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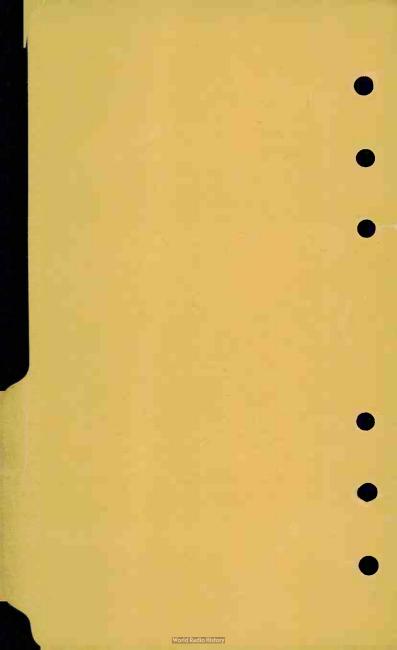
SEMICONDUCTOR DEVICE SECTION

This Section contains data on semiconductor devices such as transistors and diodes.

For Further Technical Information, write to Commercial Engineering. Semiconductor Division, Radio Corporation of America, Somerville, N. J.

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SEPARATOR



Sheets in the RCA Semiconductor Products Handbook are arranged in the Table of Contents in order of appearance in each section. The Index of Types, which follows the Table of Contents, lists type numbers in numerical-alphabeticalnumerical sequence.

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2N247		TENT. DATA 1, 12-56			RANGEMENT CE-10053
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	S	CURVE 92CM-8576R1			TENT. DATA 3, 6-59
	S	CURVE 92CM-8573R1		s	SUGGESTED MOUNTING AR-
2N247	S	TENT. DATA 1, 12-56			RANGEMENT CE-10053
	S	TENT. DATA 2, 12-56		s	RATING CHART III 92CM-
	S	CURVES 92CM-9106R1		-	9835
2N331	S	TENT. DATA 1, 6-59			CURVE 92CM-9826R1
	S S	TENT. DATA 2, 6-59			CURVE 92CM-9828
	S	CURVE 92CS-9596 CURVES 92CS-9622 &		5	CURVES 92CS-9834 &
	5	92CS-9622 &		~	92CS-9830R1
2N456	s	TENT. DATA 1, 8-59	2N640		
21430	S	TENT. DATA 1, 8-59		S	TENT. DATA 2, 6-59
2N457	S	TENT, DATA 1, 8-59		S	CURVE 92CM-9107
211931	s	TENT, DATA 2, 8-59	2N641	S	CURVE 92CM-9758 TENT. DATA 1, 6-59
	s	OUTLINE CE-9993	211041	S	TENT. DATA 1, 6-59
	š	CURVE 92CM-9826R1		s	CURVE 92CM-9107
	s	CURVE 92CM-9828	2N641	-	CURVE 92CM-9788
	š	CURVES 92CS-9837 &	2N642	s	
	~	92CS-9834		s	TENT. DATA 2, 6-59
2N544	S	TENT. DATA, 4-58		s	
	š	OUTLINE & NOTE CE-		s	CURVE 92CS-9784
	~	9122R3	2N1014	s	
		7122110		5	Unith, 0-33

DISCONTINUED TYPES

The following types have been discontinued. To indicate this fact for your future reference please place a large dot (\bullet) after each of the types in the "Type" column of the Index-of-Types sheets.

2N105	2N457	2N641
2N 247	2N544	2N642
2N 3 3 1	2N561	2N1014
2N456	2N640	3746



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Supplement

•		ADDITIONS AI	ND REVIS	SIONS
	For	key to symbols, see	sheet In	dex of Types 1
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1N 1 18 3R		DATA 3, 2-62 See 1N1183A, 1N1183RA sheet	2N398A	sheet S DATA 1, 2-62 S DATA 2, 2-62
1N1184R	RA S	DATA, 2-62 See !NII84A, INII84RA sheet	21955	S DATA 1, 2-62 S DATA 2, 2-62 S DATA 3, 2-62 S DATA 4, 2-62
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1N1189, 1N1189 1N1189 1N1189.		DATA, 2-62 See lWI189, lW1189R sheet		S DATA 6, 2-62 S DATA 7, 2-62



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Supplement

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				symbo	ls, see	sheet Ind	lex	of Types 1	
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	1N3756		DATA 1,					DATA 4, 8-62	
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	1N3850		DATA, 8					DATA 4, 8-62	
	1N3851		DATA, 8		1	2N2477		DATA 1, 8-62	
	1N3852		DATA, 8			2112411		DATA 2, 8-62	
	1N3853		DATA, 8			2N2 482		DATA 1, 8-62	
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	1N3859		DATA, 8			CR101		DATA 1, 8-62	
	1N3860		DATA, 8			0.110 111 11		DATA 2, 8-62	
	IN3861	5	DATA 1,	8-62				DATA 3, 8-62	
	1113001	5	DATA 2,	8-62				DATA 4, 8-62	
	1N3862		DATA, 8			CR102		DATA, 8-62	
	1N3863		DATA, 8			CR103		DATA, 8-62	
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	2N398A		DATA 1,					DATA 2, 8-62	
	2110701111		DATA 2			CR105		DATA 1, 8-62	
	2N398B		DATA 1					DATA 2, 8-62	
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	2N709		DATA 1			CR107	s	DATA 1, 8-62	
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	2N955	S	DATA 1,	8-62		CR108		DATA 1, 8-62	
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	2N955A	S	DATA 1,	8-62		CR109		DATA 1, 8-62	
			DATA 2	8-62			s		
		S	DATA 3	8 - 62		CR110		DATA 1, 8-62	
			DATA 4			1		DATA 2, 8-62	
		S	DATA 5			CR201		DATA 1, 8-62	
		S	DATA 6					DATA 2, 8-62	
	2N1853		DATA 1					DATA 3, 8-62	
		S	DATA 2			CR203		DATA, 8-62	
		S		8-62		CR204		DATA, 8-62	
	2N1854		DATA 1			CR206		DATA, 8-62	
			DATA 2			CR208		DATA, 8-62	
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		s	DATA 2	, 8-62		CR212	s	DATA, 8-62	
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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. INDEX SUPPLEMENT 8-62

World Radio History

•

AUDIO-FREQUENCY APPLICATIONS

SMALL SIGN	AL-Class A			VHF
2N104	2N 2 1 5	2N 2 2 0	2N1010	2
2N175				2
0011150				2
DRIVER				ис
2N 40 5	2N406	2N 5 9 1		HF
LARGE SIGN	AL-Classes	And B		2
2N109	2N 27 0	2N 408	2N649	2
2N217	2N407	2N647	2110 19	•2
		DITOPT		2
POWER AMPL				2
Diss	sipations—Up	to 4.9 Was	tts	MIX
•2N497	•2N699	• 2N 10 9 2	•2N1613	2
•2N656				2
Die	sipations—5	to 110 0 Way	***	2
2N176	'			OSC
2N 30 1	2N1183 2N1183A	●2N1480 ●2N1481		
2N 30 1 2N 30 1A	2N1183A 2N1183B	$\bullet 2N1481$ $\bullet 2N1482$	•2N1701 •2N1768	2
2N 35 1	2N1183B	$\bullet 2N1482$ $\bullet 2N1483$	•2N1768	2
2N 376				2
•2N 1067			•2N2270	CON
•2N1068		•2N1486	•21(2210	2
- 2111000	- 21(1-1)	- 2111400		2
Dissi	bations—50 W	atts and H	igher	2
2N 17 3	●2N1069	•2N1488	•2N1702	2
2N 174	•2N1070	●2N1489	•2N1703	2
2N 277	2N1099	•2N1490	2N1905	2
2N278	2N1100	• 2N 15 11	2N1906	15
2N441	2N1358	$\bullet 2N1512$	•2N2015	IF
2N442	2N1412	$\bullet 2N1513$	•2N2016	2
2N443	$\bullet 2N1487$	$\bullet 2N1514$		2
				2
				2
				2

RADIO-FREQUENCY APPLICATIONS

VHF AMPLIF	ER		
2N384	2N1177	2N1396	•2N1491
2N1023	2N 1225	2N1397	•2N1492
2N1066			•2N1493
HE AMPLIFIE	P		
	2N 1066	011205	•2N1492
2N 27 4 2N 37 0	2N 1000	2N1395 2N1396	$\bullet 2N1492$ $\bullet 2N1493$
2N 37 0	2N 1224 2N 1225	2N 1398 2N 1397	2N1493 2N1631
●2N708	2N1225 2N1226	•2N1397	2N1631 2N1632
2N1023	201220	•2111471	2N1632 2N1637
			2111051
MIXER			
2N 27 4	2N1023	2N1224	2N 1395
2N 37 2	2N 1066	2N1225	2N1396
2N 38 4	2N1179	2N1226	2N1397
OSCILLATOR			
2N274	2N 10 2 3	2N1224	2N1395
2N 37 1	2N1066	2N1225	2N1396
2N 38 4	2N1178	2N1226	2N1397
CONVERTER			
2N140	2N412	2N1226	2N1526
2N 219	2N 10 2 3	2N1395	2N1527
2N 27 4	2N 1066	2N1396	2N1635
2N 37 4	2N1224	2N 1 3 9 7	2N1636
2N 38 4	2N 1 2 2 5	2N1426	2N1639
2N 4 1 1			
IF AMPLIFIE	ER		
2N139	2N 4 10	2N1225	2N1425
2N218	2N 10 2 3	2N1226	2N1524
2N 27 4	2N1066	2N 1 3 9 5	2N1525
2N 37 3	2N1180	2N1396	2N1633
2N 38 4	2N1224	2N1397	2N1634
2N 40 9			2N1638
• Silicon ty	pe.		

COMPUTER SWITCHING APPLICATIONS

					а
S	tage Del	ays Greate	er than 3	00 Nano	seconds
	2N398	2N 398 A	2N 58 6		
	Stage D	elays of i	100 to 300	Nanose	conds ^a
	2N 269	2N580	2N109		2N1306
	2N388	2N581	2N116		2N1307
	2N 388 A	2N582	2N117	0 b	2N1308
	2N404	2N583	2N130	2	2N1309
	2N 40 4 A	2N584	2N130	3	2N1319 b
	2N414	2N585	2N130	4	2N1605
	2N578	2N 1090	2N130	5	2N1605A
	2N579			39	07/2N404
	Stage D	elays of 3	30 to 100	Nanose	conds ^a
	•2N696	2N796	2N121		2N1301
	•2N697	2N1213			2N1384
	2N794	2N1214	c 2N130	0	2N1683
	2N795				
	Stage	Delays of	10 to 30	Nanosec	onds ^a
	2N643	•2N706	2N710		2N1450
	2N6 44	•2N706A			•2N1708
	2N645	●2N708	2N8 28		•2N2205
	2N705				•2N2206
	Stage	Delays of	5 to 10	Nanosec	andsa
	2N955		0 00 10	10,00000	01123
	210955				
é	Maagura	d in resis	ton-conor	itor-tr	anciston
	logic c	ircuit exc	corcapac ept for c	frift-ti	ansistor
	types 21	1643, 2N644	1, 2N645,	and 2N1	450 which
	are meas	ircuit exc 1643, 2N644 sured in tr rcuit. Na	ransistor-	= 10-9	-steering
ł		ional type		- 10	seconus.

- ^D Bidirectional type.
- c Thyristor type.
- Silicon type.

TRANSISTORS

• Silicon type.



POWER SWITCHING APPLICATIONS

Diss	ipations—Uf	5 to 4.9 Wat	ts
•2N497	•2N699	• 2N 10 9 2	•2N1613
•2N656			
Diss	ipations-5	to 49.9 Wat	ts
• 2N1067	2N1184A	$\bullet 2N1482$	-2N1700
•2N1068	2N1184B	•2N1483	•2N1701
2N 1 18 3	●2N1479	• 2N 1 4 8 4	•2N1768
2N1183A	•2N1480	• 2N1485	•2N1769
2N1183B	•2N1481	•2N1486	•2N 2 10 2
2N1184			•2N2270
Dissip	ations—50 k	Vatts and Hi	gher
2N173	●2N1069	•2N1488	•2N1702
2N174	•2N1070	•2N1489	• 2N1703
2N 277	2N 1099	•2N1490	2N1905
2N278	2N1100	• 2N1511	2N1906
2N441	2N1358	•2N1512	•2N2015
2N442	2N1412	•2N1513	•2N2016
2N443	●2N1487	•2N1514	

MILITARY-SPECIFICATION TYPES

JAN - 2N220	Meets MIL-T-19500/1	
	dated Jan.14, 19	957
USA- 2N27 4	Meets MIL-T-19500/26 (Sig (dated Oct.3, 19	
USA- 2N38 4	Meets MIL-T-19500/27 (Sig (dated Oct.14, 19	C)
USA-2N706	Meets MIL-S-19500/120 (Sig dated June 2, 19	
USA-2N1183 USA-2N1183A USA-2N1183B USA-2N1184 USA-2N1184A USA-2N1184B	Meet MIL-S-19500/143 (Sig (dated Oct.10, 19	
USA-2N1358	Meets MIL-S-19500 (Sig C) dated June 9, 19	961
USAF- 2N404	Meets MIL-T-19500/20 USAF dated July 23, 19	

• Silicon type.



AUDIO-FREQUENCY APPLICATIONS SMALL SIGNAL-Class A 2N104 2N215 2N220 2N1010 2N175 DRIVER 2N405 2N406 2N591 LARGE SIGNAL-Classes A and B 2N109 2N 27 0 2N408 2N649 2N217 2N407 2N647 POWER AMPLIFIER Dissipations-Up to 4.9 Watts ●2N497 •2N656 •2N1092 Dissipations-5 to 49.9 Watts 2N176 2N1183 •2N1479 •2N1485 ●2N1480 2N 30 1 2N1183A •2N1486 2N 30 1 A 2N1183B •2N1481 2N1700 2N351 2N1184 • 2N1482 •2N1701 2N376 2N1184A • 2N1483 2N1768 •2N1067 2N1184B • 2N1484 •2N1769 2N1068 Dissipations-50 Watts and Higher 2N173 •2N1069 •2N1488 • 2N1702 2N174 •2N1070 •2N1489 •2N1703 2N 277 2N1099 •2N1490 2N1905 2N 278 2N1100 • 2N1511 2N1906 2N441 2N1358 •2N1512 •2N2015 •2N2016 2N442 2N1412 •2N1513 2N443 •2N1487 •2N1514

RADIO-FREQUENCY APPLICATIONS

VHF AMPL	IFIER			
2N384	2N 1	177	2N1396	•2N1491
2N1023	3 2N 1	1225	2N1397	•2N1492
2N1066	ó			•2N1493
HE AMPL	FIER			
2N274	2N 1	224	2N1396	•2N1493
2N370		1225	2N1397	2N1631
2N 38 4		-	2N1491	2N1632
2N102			2N1492	2N1637
2N106		2070		2111001
	•			
MIXER				
2N 27 4		1023	2N1224	2N1395
2N 37 2		1066	2N1225	2N1396
2N384	2N .	1179	2N1226	2N1397
OSCILLA	TOR			
2N274	2N.	1023	2N1224	2N1395
2N 37 1	2N	1066	2N1225	2N1396
2N 38 4	2N	1178	2N1226	2N1397
CONVERTI	ER			
2N140	2N 4	412	2N1226	2N 1 5 26
2N219	2N.	1023	2N 1 39 5	2N1527
2N 27 4	2N.	1066	2N1396	2N1635
2N374	2N.	1224	2N1397	2N1636
2N 38 4	2N	1225	2N1426	2N1639
2N411				
IF AMPL	FIER			
2N139	2N	410	2N1225	2N1425
2N218	2N.	1023	2N1226	2N1524
2N274	2N.	1066	2N1395	2N1525
2N 37 3	2N.	1180	2N1396	2N1633
2N 384	2N.	1224	2N1397	2N 1634
2N409				2N1638

• Silicon type.

World Radio History

COMPUTER SWITCHING APPLICATIONS

Stage D	elays Greater	than 300 Nat	noseconds ^a
2N398	2N586		
Stage	Delays of 100	to 300 Nan	oseconds ^a
2N269	2N 57 9	2N 58 3	2N1091
2N404	2N580	2N 58 4	2N1169 ^b
2N404A	2N 58 1	2N585	2N1170b
2N414	2N582	2N1090	2N1319 ^b
2N578		390	07/2N404
Stage	Delays of 30	to 100 Nanos	seconds ^a
2N794	2N934	2N1215 ^C	2N 1 30 1
2N795	2N1213 ^C	2N1216 ^C	2N 1 38 4
2N796	2N1214 ^C	2N1300	2N 168 3
Stage	Delays of 10	to 30 Nanos	seconds ^a
2N643	2N705	•2N706A	2N711
2N644 2N645	•2N706	2N710	2N1450
2110 45			

- a Measured in resistor-capacitor-transistor logic circuit except for very high speed drift-transistor types 2N643, 2N644, 2N645, and 2N1450 which are measured in transistor current steering logic circuit. Nanoseconds = 10-9 seconds.
- ^b Bidirectional type.
- ^C Thyristor type.
- Silicon type.

POWER SWITCHING APPLICATIONS

Diss	ipations-04	b to 4.9 Wat	ts
●2N497	●2N656	•2N1092	
Diss	ipations-5	to 49.9 Wat	ts
●2N1067	2N1184	•2N1481	●2N1486
•2N1068	2N1184A	•2N1482	●2N1700
2N1183	2N1184B	•2N 1 48 3	●2N1701
2N1183A	●2N1479	•2N1484	●2N1768
2N1 18 3B	•2N1480	•2N1485	•2N1769
Dissiț	ations—50 k	Watts and Hi	gher
2N173	●2N1069	•2N1488	•2N1702
2N174	•2N1070	•2N1489	•2N1703
2N 27 7	2N1099	●2N1490	2N 1905
2N 27 8	2N1100	•2N1511	2N1906
2N441	2N1358	•2N1512	•2N2015
2N442	2N1412	•2N1513	•2N 20 16
2N443	•2N1487	•2N1514	

MILITARY-SPECIFICATION TYPES

JAN - 2N 2 20	Meets	MIL-T-19500/1
		dated Jan.14, 1957
USA- 2N 27 4	Meets	MIL-T-19500/26 (Sig C)
	•	dated Oct.3, 1957
USA-2N384	Meets	MIL-T-19500/27 (Sig C)
		dated Oct.14, 1957
USAF-2N404	Meets	MIL-T-19500/20 USAF
		dated July 23, 1957
USA-2N706	Meets	MIL-S-19500/120 (Sig C)
		dated June 2, 1960

Application Guide for RCA SILICON RECTIFIERS

RECTIFIER APPLICATIONS

FORWARD	dicate	ES ^a d	MAXIMUM PEAK Inverse Volts	RCA TYPE	
For	nvard (Curren	nts—Up t	о 0.750 Атре	re
0.500c	≦75	TA	400	100 TA	1N1763
0.500°	≦75	TA	500	100 T _A	1N1764
0.500 0.400°	≦75	TA	800	100 T _A	1N3196 1N3256
0.750 0.500°	_≦75	T _A	50	125 T _A	1N2858
0.750 0.500 ^c	≦75	T _A	100	125 T _A	1N2859
0.750 0.500 ^c	≦75	T _A	200	125 T _A	1N2860
0.750 0.500 ^c	≦75	TA	300	125 T _A	1N2861
0.750 0.500 ^c	≦75	T _A	400	125 T _A	1N2862
0.750 0.500 ^c	≦75	TA	500	125 T _A	1N2863
0.750 0.500 ^c	≦75	T _A	600	125 T _A	1N2864
0.750 0.500°	≦75	T _A	200	100 T _A	1N3193 1N3253
0.750 0.500 ^c	≦75	T _A	400	100 T _A	1N3194 1N3254
0.750 0.500 ^c	≦75	T _A	600	100 T _A	1N3195 1N3255
0.750	≦50	TA	100	165 T _A	1N440B
0.750	≦50	TA	200	165 T _A	1N441B
0.750	≦50	TA	300	165 TA	1N442B
0.750	≦50	TA	400	165 TA	1N443B
0.750	≦35	TA	500	150 T _A	1N444B

RECTIFIER APPLICATIONS

FORWAR	IMUM DC) AMPER ndicate ture ^b (d	MAXIMUM PEAK Inverse Volts	PEAK OPERATING INVERSE TEMPERA-			
0.750	≤35	TA	600	150 T _A	1N445B		
0.750	≤50	TA	50	165 TA	1N536		
0.750	≦50	TA	100	165 TA	1N537		
0.750	≦50	TA	200	165 TA	1N538		
0.750	≦50	TA	300	165 TA	1N539		
0.750	≦50	TA	400	165 T _A	1N540		
0.750	≦50	TA	600	165 TA	1N547		
0.750	≦50	TA	500	165 Ta	1N1095		
	es						
5	135	T _C	50	175 T _C	1N1612, 1N1612R		
5	135	TC	100	175 T _C	1N1613, 1N1613R		
5	135	TC	200	175 T _C	1N1614, 1N1614R		
5	135	T _C	400	175 T _C	1N1615, 1N1615R		
5	135	T _C	600	175 T _C	1N1616, 1N1616R		
12	150	T _C	50 100 ^d	200 T _C	1N1199A, 1N1199RA		
12	150	T _C	100 200d	200 T _C	1N1200A, 1N1200RA		
12	150	T _C	200 350 d	200 T _C	1N1202A, 1N1202RA		
12	150	T _C	300 450 ^d	200 T _C	1N1203A, 1N1203RA		
12	150	T _C	400 600d	200 T _C	1N1204A, 1N1204RA		

RECTIFIER APPLICATIONS

MA) FORWAR at i temper	MAXIMUM PEAK INVERSE VOLTS	OPERATING E TEMPERA-			RCA TYPE		
12	150	T _C	500 700 d		200	T _C	1N1205A, 1N1205RA
12	150	T _C	600 800 ^d		200	TC	1N1206A, 1N1206RA
20	150	T _C	55		175	T _C	1N248C, 1N248RC
20	150	TC	110		175	T _C	1N249C, 1N249RC
20	150	T _C	220		175	T _C	1N250C, 1N250RC
20	150	T _C	300		175	T _C	1N1195A, 1N1195RA
20	150	Tc	400		175	T _C	1N1196A, 1N1196RA
20	150	TĊ	500		175	T _C	1N1197A, 1N1197RA
20	150	T _C	600		175	T _C	1N1198A, 1N1198RA
35	140	T _C	300		175	T _C	1N1187, 1N1187R
35	140	T _C	400		175	T _C	1N1188, 1N1188R
35	140	T _C	500		175	T _C	1N1189, 1N1189R
35	140	T _C	600		175	T _C	1N1190, 1N1190R

^a With resistive or inductive load except as noted. b_{TA} = ambient temperature, TC = case temperature. C With capacitive load. d Transient voltage rating.

APPLICATION GUIDE **RECTIFIERS & DIODES** 3-62



RECTIFIERS & DIODES

SILICON RECTIFIERS

DIODES

RECTIFIER APPLICATIONS

	FORWARI	IMUM DC D AMPER ndicate ture ^b (d	MAXIMUM PEAK Inverse Volts	MAXIMUM OPERATING TEMPERA- TURE ^b (^o C)	RCA TYPE			
Forward Currents—1 to 40 Amperes									
	40	150	T _C	50	200 T _C	1N1183A, 1N1183RA			
	40	150	T _C	100	200 T _C	1N1184A, 1N1184RA			
	40	150	50 T _C 200 20		200 T _C	1N1186A, 1N1186RA			
	Peak	Invers	e Vo	ltages-l	Ip to 10000	Volts			
	0.825	60	TA	1200	125 T _A	CR101			
	0.825	60	TA	2000	125 T _A	CR102			
	0.715	60	TA	3000	125 T _A	CR103			
	0.605	60	TA	4000	125 T _A	CR104			
	0.605	60	TA	5000	125 Ta	CR105			
	0.550	60	TA	6000	125 T _A	CR106			
	0.550	60	TA	7000	125 TA	CR107			
	0.550	60	TA	8000	125 T _A	CR108			
	0.550	60	TA	9000	125 T _A	CR109			
	0.550	60	TA	10000	125 T _A	CR110			

MILITARY-SPECIFICATION TYPES

JAN-1N538	Meets MIL-E-1/1084A
	dated Jan.28, 1958
JAN-1N540	Meets MIL-E-1/1085A
	dated Jan.28, 1958
JAN-1N547	Meets MIL-E-1/1083A
	dated Jan.28, 1958
USA-1N249B	
USA- 1N250B	Meet MIL-S-19500/134 (Sig C)
USA- 1N2135A	dated Aug.9, 1960
i i i i i i i i i i i i i i i i i i i	

TEMPERATURE- AND VOLTAGE-COMPENSATION APPLICATIONS

1N2326

COMPUTER APPLICATIONS

GERMANIUM TUNNEL DIODES 1N3128 1N3129 1N3130

GALLIUM-ARSENIDE TUNNEL DIODE 1N3138

GERMANIUM MULTIPLE DIODES 2DG001 (Twin) 3DG001 (Triple)

^a With resistive or inductive load except as noted. ^b T_A = ambient temperature, T_C = case temperature.

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



RCA TRANSISTORS

Application Guide

AUDIO-FREQUENCY APPLICATIONS

RADIO-FREQUENCY APPLICATIONS

COMPUTER	IO ALLE	ICALORS.

SMALL SIGN	AL-Class A			VHF AMPLIFIEF	2)elays Greater	than 300 Nan	oseconds ^a
2N104	2N215	2N220	2N1010	2N384	2N1177	2N1396	•2N1491	2N398	2N586		
2N175	211210	211220	2111010	2N1023	2N1225	2N1397	•2N1492	0.	D 1 ((00	200 1	
				2N1066			•2N1493		Delays of 100		
DRIVER								2N269	2N580	2N584	2N1169
	011107	-		HF AMPLIFIER				2N404 2N414	2N 5 8 1 2N 5 8 2	2N585 2N1090	2N1170 ^b 2N1319 ^b
2N405	2N406	2N591			011004	011206	-081402	2N578	2N583	2N1091	3907/2N404
				2N274 2N370	2N1224 2N1225	2N1396 2N1397	2N1493 2N1631	2N579		2	ovor) prove
LARGE SIGN	AL-Classes A a	and B		2N384	2N1225	■2N1491	2N1632				
2N109	2N270	2N408	2N649	2N1023	2N1395	•2N1492	2N1637	Stage	Delays of 30	to 100 Nanos	econds ^a
2N217	2N407	2N647		2N1066				2N794	2N934	2N1215 ^c	2N1301
								2N795	2N1213 ^c	2N1216 °	2N1384
POWER AMPL	IFIER			MIXER				2N796	2N1214 ^c	2N1300	2N1683
				2N274	2N1023	2N1224	2N1395	Star	Delays of 10	4. 20 Nores	a
		Up to 4.9 Watts		2N372	2N1023 2N1066	2N1224 2N1225	2N1395 2N1396				
•2N497	•2N1092	•2N1480	•2N1482	2N384	2N1179	2N1226	2N1397	2N643 2N644	2N705 •2N706	•2N706-A 2N710	2N711
•2N656	•2N1479	•2N1481						2N644 2N645	•2N700	211/10	2N1450
	Dissingtions	5 to 49.9 Watts		OSCILLATOR				211045			
	•							Stage	Delays Less	than 10 Nanos	econds ^a
2N176 2N301	•2N1068 2N1183	2N1184-A 2N1184-B	•2N1486 •2N1700	2N274	2N1023	2N1224	2N1395	2N931	2N932		
2N301-A	2N1183-A	•2N1483	●2N1701	2N371 2N384	2N1066 2N1178	2N1225 2N1226	2N1396 2N1397				
2N351	2N1183-B	•2N1484	•2N1768	211004	201110	2111220	2111377				ONIC
2N376	2N1184	•2N1485	•2N1769					PC	WER SWITCHIN	NG APPLICATIO	UNS
●2N1067				CONVERTER				n)issipations —	In to / 9 Wa	* * *
				2N140	2N412	2N1226	2N1526	•2N497	•2N1092	•2N1480	•2N1482
		Watts and High	er	2N219	2N1023	2N1395	2N1527	•2N656	•2N1479	•2N1481	•2N1402
2N173	•2N1069	•2N1487	•2N1513	2N274 2N374	2N1066 2N1224	2N1396 2N1397	2N1635 2N1636	- 2110 0 0	-2014()	- 2111 40 1	
2N174 2N277	•2N1070 2N1099	•2N1488	•2N1514	2N384	2N1225	2N1397 2N1426	2N1639	D)issipations —	5 to 49.9 Wa	tts
2N278	2N1099 2N1100	●2N1489 ●2N1490	• 2N1702 • 2N1703	2N411	21.12.00	2	22007	•2N1067	2N1183-B	•2N1483	•2N1700
2N441	2N1358	•2N1511	2N1905					•2N1068	2N1184	•2N1484	•2N1701
2N442	2N1412	•2N1512	2N1906	IF AMPLIFIER				2N1183	2N1184-A	•2N1485	•2N1768
2N443					01410	011007	011405	2N1183-A	2N1184-B	•2N1486	•2N1769
				2N139 2N218	2N410 2N1023	2N1225 2N1226	2N1425 2N1524	Die		Watte and H	E LA LA
				2N274	2N1023	2N1395	2N1525		sipations - 50		
				2N 37 3	2N1180	2N1396	2N1633	2N173	•2N1069	•2N1487	•2N1513
				2N384	2N1224	2N1397	2N1634	2N174 2N277	•2N1070 2N1099	•2N1488 •2N1489	•2N1514 •2N1702
				2N409			2N1638	2N278	2N11099	•2N1490	•2N1702
								2N441	2N1358	•2N1511	2N1905
								2N442	2N1412	•2N1512	2N1906
								2N443			
						•		a Measured in r	esistorecanaciter	transistor losic	incuit except for
								very high speed	esistor-capacitor- d drift-transistor t sured in transisto	ypes 2N643, 2N644,	2N645, and 2N1450
										or current steeri	ng logic circuit.
								b Bidirectional	type		

^b Bidirectional type. C Thyristor type.

• Silicon type.

RCA

SILICON RECTIFIERS

DIODES

MILITARY-SPECIFICATION TYPES

RECTIFIER APPLICATIONS

FORWARD at in	MUM DC AMPERES ^a dicated ture ^b (^o C)	MAX IMUM PEAK Inverse Volts	MAXIMUM OPERATING TEMPERA- TURE ^b (°C)	ТҮРЕ
20	150 T _c	55	175 T _c	1N248-C, 1N248-RC
20	120 10	110	1/5 IC	1N249-C, 1N249-RC
20	150 T ^c ≦50 T _A	220	175 T _c	1N250-C, 1N250-RC
0.750 0.750		100 200	165 T 165 T	1N440-В 1N441-В
0.750		300	165 T	1N441-B
0.750	≥50 T.	400	105 T	1N443-B
0.750	≧35 T,	500	150 T	1N444-B
0.750		600	150 T	1N445-B
0.750	≦50 T ^A ≦50 T ^A	50	165 T ^A 165 T ^A	1N536
0.750 0.750	≦50 T ≦50 T	100 200	165 T 165 T	1N537 1N538
0.750	≤50 T	300	165 T ^A	1N539
0.750	≤50 TA	400	165 T ^A 165 T ^A	1N540
0.750	≦50 TÅ	600	165 T	1N547
0.750	≥50 T,	500	165 T ^A 175 T ^C 175 T ^C	1N1095
20 20	150 T [°] 150 T [°]	300 400	175 T _c 175 T _c	1N1195-A, 1N1195-RA 1N1196-A, 1N1196-RA
20		500	175 Tc	1N1197-A, 1N1197-RA
20	150 T	600	175 T _c	1N1198-A, 1N1198-RA
0.500°	275 T	400	100 1	1N1763
0.500°	≦75 T _A	500	100 T _A	1N1764
0.750 0.500°	≦75 T _A	50	125 T	1N2858
0.750				
0.500°	· ≦75 T _▲	100	125 T	1N2859
0.750		200	405 T	1310070
0.500°	. ≦75 T _A	200	125 T _A	1N2860
0.750 0.500°	≦75 T.	300	125 T_	1N2861
0.750	Ŷ			
0.500°	· ≦75 T _A	400	125 T _A	1N2862
0.750		500	4.05 T	13100 (2
0.500°	. ≦75 T _A	500	125 T _A	1N2863
0.750	≦75 T.	600	125 T_	1N2864
0.500°) 0.750	î			
0.500°	' ≦75 T _a	200	100 T _a	1N3193
0.750		400	100 T	180104
0.500°	• ≦75 T _A	400	100 T _a	1N3194
0:750 0.500°	≦75 T.	600	100 T_	1N3195
0.500	<u>^</u>			
0.400°)	≦75 T _A	800	100 T _a	1N3,196

^a With resistive or inductive load except as noted.

b T_A = ambient temperature, T_C = case temperature.

C With capacitive load.

TEMPERATURE- AND VOLTAGE-COMPENSATION APPLICATIONS

1N2326

COMPUTER APPLICATIONS

ERMANIUM	TUNNEL	DIODES
1N3128		
1N3129		
1N3130		

GALLIUM-ARSENIDE TUNNEL DIODE 1N3138

TRANSISTORS

 JAN-2N220
 Meets MIL-T-19500/1 dated Jan.14, 1957

 USA-2N274
 Meets MIL-T-19500/26 (Sig C) dated Oct.3, 1957

 USA-2N384
 Meets MIL-T-19500/27 (Sig C) dated Oct.14, 1957

 USAF-2N404
 Meets MIL-T-19500/20 USAF dated July 23, 1957

 USA-2N706
 Meets MIL-T-19500/120 (Sig C) dated Jan.4, 1961

SILICON RECTIFIERS

JAN-1N538 Meets MIL-E-1/1084A dated Jan-28, 1958 JAN-1N540 Meets MIL-E-1/1085A dated Jan-28, 1958



Information on Prices

Information on prices of RCA semiconductor devices described in this Handbook may be obtained from your local RCA Semiconductor Distributor or from your RCA Equipment Sales Representative, who may be reached at the following RCA Equipment Sales Offices:

> (East) 744 Broad Street Newark 2, New Jersey HUmboldt 5-3900

> > 605 Marlton Pike Erlton, New Jersey HAzel 8-4802

731 James Street Room 402 Syracuse 3, New York GRanite 4-5591

Greater Baltimore Area ENterprise 9-1850

(Northeast) 64 "A" Street Needham Heights 94, Massachusetts Hillcrest 4-7200

- (Southeast) Suite 1 1520 Edgewater Drive Orlando, Florida GArden 4-4768
- (East Central) 714 New Center Building Detroit 2, Michigan TRinity 5-5600
 - (Central) Suite 1154 Merchandise Mart Plaza Chicago 54, Illinois WHitehall 4-2900

2132 East 52nd Street Indianapolis 5, Indiana CLifford 1-1405

5805 Excelsior Boulevard Minneapolis 16, Minnesota WEst 9-0676

(West) 6801 East Washington Boulevard Los Angeles 22, California RAymond 3-8361

> 1838 El Camino Real Burlingame, California OXford 7-1620

(Southwest) 7905 Carpenter Freeway Dallas 7, Texas MElrose 1-9720



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. INFORMATION ON PRICES 8-61 (Government) Route 202 Somerville, New Jersey RAndolph 2-3200

> 1725 "K" Street, Northwest Washington 6, D.C. FEderal 7-8500

> 224 North Wilkinson Street Dayton 2, Ohio BAldwin 6-2366

EXPORT

(International) Radio Corporation of America RCA International Division Electronic-Components Marketing Operations 30 Rockefeller Plaza New York 20, New York (U.S.A.)



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Transistor-Dissipation Rating Chart

Pulse or Switching Service

From Table I: $T_{IMAX} = 175^{\circ} \text{ C}$ $\tau_{I} = 8 \text{ milliseconds} = 8 \times 10^{-3} \text{ second}$ $R_{TMAX} = 75^{\circ} \text{ C/watt}$ Then: $t_{o}/\tau_{I} = 10^{-3}/8 \times 10^{-3} = 1.25 \times 10^{-1}$ $d = t_{o} \times \text{PRR} = (10^{-3})(10^{1}) = 10^{-2} = 0.01$ Entering the Chart with $t_{o}/\tau_{I} = 1.25 \times 10^{-1}$ and d = 0.01, read Y = 2.5 x 10^{-1}. Solving for T_{o} in the equation: $T_{o} = T_{JMAX} - P_{MAX} Y R_{TMAX}$ $T_{o} = 175 - (3)(2.5 \times 10^{-1})(75) = 119^{\circ} \text{ C}$ Solving for ΔT_{JMAX} in the equation:

$$\Delta T_{J_{MAX}} = T_{J_{MAX}} - T_{o}$$

 $\Delta T_{JMAX} = 175 - 119 = 56^{\circ} C$

TABLE I

-	RCA	MAXIMUM JUNCTION OR STORAGE TEMPERATURE	THERMAL TIME CONSTANT	MAXIMUM THERMAL RESISTANCE R _{TMAX} (°C/WATT) COLLECTOR JUNCTION TO: FREE		
	TRANSISTOR Type	TJMAX (°C)	τι (msec)	AMBIENT	CASE	MOUNTING FLANGE
	2N109	85	12	400	_	
	2N139	85	10	750	-	-
	2N140	85	10	750	-	-
	2N217	85	12	400	-	-
	2N218	85	10	750	-	-
	2N219	85	10	750	-	-
	2N269	85	10	500	-	-
	2N270	85	12	320	-	-
	2N274	100	12	620	310	-
	2N 584	100	10	620	310	-
	2N398	85	12	750	-	-
	2N4O4	85	10	500	-	-
	2N578	85	15	500		-
	2№579	85	15	500	-	-

RADIO CORPORATION OF AMERICA RATING Semiconductor & Materials Division Somerville, N. J

RATING CHART 2 6-6

Transistor-Dissipation Rating Chart

Pulse or Switching Service

RCA	MAXIMUM JUNCTION OR STORAGE TEMPERATURE	THERMAL TIME CONSTANT Ti (msec)	MAXIMUM THERMAL RESISTANCE R _{TMAX} (^o c/watt) Collector Junction to: FREE		
TRANSISTOR TYPE	т _{амах} (°С)		AMBIENT AIR	CASE	MOUNTING Flange
2N580	85	15	500	_	_
2N581	85	10	500	~	-
2N582	85	10	500	-	-
2N583	85	10	500	-	
2N584	85	10	500	-	-
2N585	85	12	500	-	-
2N586	85	12	240	-	-
2N643	85	10	500		-
2N644 2N645	85	10	500	-	-
2N045 2N1023	85 100	10	500 620	310	-
2N1025	100	10	620	310	-
2N1067	175	8	100	30	-
2N1068	175	8	100	15	-
2N1069	175	10	-	19	-
2N1070	175	10	_	-	3 3
2N 1090	85	12	500	_	-
2N1091	85	12	500	-	_
2N1092	175	8	225	75	_
2N1183	100	8	75	10	_
2N 1 1 83-A	100	8	75	10	_
2N1183-8	100	8	75	10	-
2N1184	100	8	75	10	-
2N1184-A	100	8	75	10	-
2N1184-8	100	8	75	10	-
2N 224	100	10	620	310	-
2N1225	100	10	620	310	-
2N 226	100	10	620	310	-
2N1300	85	10	400	-	-
2N 30	85	10	400	-	-
2N 395	100	10	620	310	-
2N 396	100	10	620	310	-
2N 397	100	10	620	310	-

For transistor types not listed in Table I above, refer to the data sheets for the specific type for the required values.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Padio History



CLASSIFICATION CHART FOR TYPES IN SEMICONDUCTOR DEVICE SECTION

JUNCTION TRANSISTORS

Germanium P-N-P Alloy Types

For small-signal af applications 21177 2N104 2№105 2№175▲ 21205 2N215 24220 For af driver-amplifier applications 2N405 2N406 For large-signal af applications 2N109 2N217 2N270 2N407 2N408 For af power applications 2N301 2N301-A For 455-kc if applications 2N139 2N218 2N409 2N410 For 540- to 1600-kc converter applications 2N140 2N219* 2N411 2N412 For rf amplifier applications 2N247* 2N274 2N370

For rf oscillator applications 2N371 For rf mixer applications 2N372

■,▲: See next page.

2N384 2N544

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CLASSIFICATION CHART FOR TYPES IN SEMICONDUCTOR DEVICE SECTION

JUNCTION TRANSISTORS (Cont'd)

For "on-off" control applications 2N269 2N398 2N404

SEMICONDUCTOR DIODES

Germanium Point-Contact Types For low-power-rectification applications 1N34-A For large-signal applications 1N38-A 1N58-A For applications requiring high back resistance 1N54-A

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Flexible-lead type.
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▲ Low-Noise type.



RCA TRANSISTORS NOT RECOMMENDED For New Equipment Design

Certain transistors should be avoided in the design of new squipment because they are approaching obsolescence or have limited or dwindling demand. Such RCA types are listed below for the benefit of equipment designers.

JUNCTION TRANSISTORS

2N77

World Radio History



TENTATIVE DEFINITIONS OF SEMICONDUCTOR DEVICE TERMS

Current Transfer Ratio. The quotient of the change of output current with ac output circuit shorted divided by the change in input current producing the change in output current. The current components are understood to be small enough so that linear relations hold between them.

Large-Signal DC Current Transfer Ratio. The quotient of the dc output current with the dc output circuit shorted divided by the dc input current producing the dc output current.

Circuit Stability Factor. The quotient of the change of dc collector current divided by the change in collector saturation current producing the change in dc collector current.

Collector Saturation Current. The temperature-sensitive dc collector current that flows when a dc collector-to-base voltage greater than -0.2 volt is applied with emitter circuit open.

Class A Amplifier. An amplifier in which the bias of the input electrode and the alternating input signal are such that output current flows at all times.

Class B Amplifier. An amplifier in which the bias of the input electrode is such that the output current is approximately zero when no alternating input signal is applied, and such that when an alternating input signal is applied, the output current flows approximately one-half cycle.

Collector Transition Capacitance. The capacitance across the collector-to-base transition region. (A transition region is a region between two homogeneous semiconductor regions, in which the impurity concentration changes).

Unilateralization. Unilateralization is a special case of neutralization in that the feedback parameters are completely balanced out. In the case of transistors, these feedback parameters include a resistive component in addition to a capacitive component. Unilateralization changes a bilateral network into a unilateral network.

World Radio History

RCA TRANSISTORS

Transistors are a new form of electron device. They can perform many of the functions of an electron tube and, in addition, can do some things better and more efficiently than electron tubes. Unlike electron tubes which depend for their functioning on the flow of electrons through a vacuum, a gas, or a vapor, transistors make use of the flow of electrons in a solid — a semiconductor.

A semiconductor is a material having a conductivity lower than that of metals but higher than that of insulators. There are many varieties of semiconductors, but the one employed for the transistors described in this section is germanium. Germanium in its very purest state behaves like an insulator, but its conductivity can be increased by the addition of exact but almost infinitesimal amounts of certain impurities. Peculiarly, the manner in which a germanium crystal conducts can be changed by the choice of the impurity. Thus, by the addition of the proper amount of certain impurities to pure germanium, its conductivity is increased because a surplus of electrons which can migrate freely through the crystal is provided. A conducting germanium crystal so made is identified as n-type because it depends on negative particles of electricity, electrons, for conduction.

On the other hand, the addition of other impurities provides a deficiency of electrons which effectively behave like positive particles of electricity. This deficiency of electrons leaves vacancies or holes in the crystal structure. These holes which are free to migrate can carry current but in a direction opposite to that of the n-type crystal. Because these carriers of the conduction current are positive in nature, a germanium crystal of this type is identified as p-type.

It should be noted that whereas electron tubes depend ordinarily on electrons for conduction, transistors not only make use of electrons but also of holes for obtaining conduction.

The transistors described in this section make use of both kinds of conduction and employ two different types of structures. These two types of structures are identified as "point-contact" and "junction".

Fig. 1 shows the structure of a point-contact transistor. It consists of a crystal of *n*-type germanium having three electrical contacts. Two of these are point contacts and are known as the emitter and collector. A third, the



TRANSISTORS

base, makes area contact with the germanium crystal. The complete assembly is encased in plastic to provide ruggedness and freedom from atmospheric contaminants.

Fig.1 also shows the point-contact transistor connected in a simple circuit in which the base connection serves as the common return for the input circuit and the output circuit. The input circuit on the left is completed through the battery, the emitter, and the germanium crystal to the base connection. When a positive voltage is applied to the emitter, electrons will be drawn from the crystal into the emitter and thus leave holes in the crystal structure. Under the influence of the negative field of the collector, these holes flow to the collector and thereby increase the collector current appreciably. Or as is sometimes stated, the emitter electrode injects holes into the germanium crystal. Holes near the collector allow electrons to pass into the crystal. Some of these electrons neutralize the holes; others flow to the base connection and shus complete the circuit.

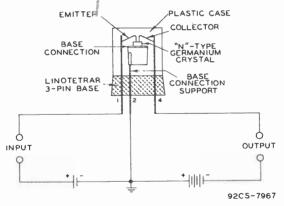


Fig. 1 - Diagrammatic Sketch Showing Structural Arrangement of Type 2N32 or Type 2N33 with Associated Simple Circuit.

If the assumption is made that every unit of hole current which leaves the emitter reaches the collector, it follows that a small change in emitter current will result in an equivalent change in collector current, and consequently produce a current amplification factor of one. The current

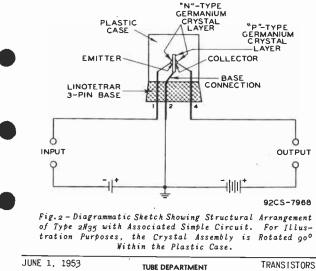


TRANSISTORS

amplification factor or "alpha" of a transistor is defined as the ratio of change in collector current to a change in emitter current when collector voltage is maintained constant. In point-contact transistors "alpha" is greater than unity; in junction-type transistors, it is less than but approaches unity.

If the germanium crystal employed in Fig.1 is of the p-type, a negative voltage is applied to the emitter and holes will be drawn from the crystal into the emitter and thus leave an excess of electrons in the crystal structure. Under the influence of the positive field of the collector, these electrons flow through the crystal to the collector. In general, the p-type germanium crystal has characteristics similar to the n-type except that in operation all battery polarities are reversed.

Fig.2 shows the structure of a junction transistor of the n-p-n type. It is composed of a wafer of p-type germanium between two smaller layers of n-type germanium. Lowresistance connections are made to the n-layers, one of which serves as the emitter and the other as the collector. A third low-resistance connection to the p-layer is the base connection. The complete assembly is encased in plastic to provide ruggedness and freedom from atmospheric contaminants.



TRANSISTORS 2

RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



TRANSISTORS

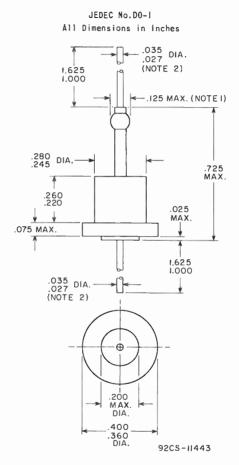
The principle of operation of the junction transistor is somewhat different from that of the point-contact transistor. In the n-p-n junction transistor, electrons from the n-layer diffuse through the p-layer and are attracted to the collector. The p-layer has a surplus of holes. Because the p_{-} layer is very thin, most of the electrons entering the base region from the emitter will reach the collector region without recombining (neutralizing) the holes. Practically all of the electrons leaving the emitter reach the collector, thus resulting in a current amplification factor approaching unity.

The action of the p-n-p type of junction transistor is similar to that of the n-p-n type except that the polarities of the battery voltages are reversed and conduction is caused by holes instead of electrons.

Transistors are essentially low-impedance devices, that is, they deal with current changes rather than voltage changes. They are small in size and the power requirements for their operation are extremely small. In addition, they operate instantaneously on application of voltages to the electrodes.

The point-contact transistor has a current amplification factor greater than unity. This feature contributes to its usefulness in oscillator and triggering applications. In addition, the point-contact transistor can be operated at relatively high frequencies. Because of this feature, it has considerable application in switching circuits and in radio circuits such as intermediate-frequency amplifiers, radio-frequency amplifiers, and radio-frequency oscillators.

The junction transistor has a current amplification factor approaching unity. This characteristic contributes to the stability of the junction transistor even under short-circuit conditions. It has a high operating power gain and can operate with extremely low values of input power — features which are of primary importance in oscillator and amplifier applications in the audiofrequency and low-frequency ranges.

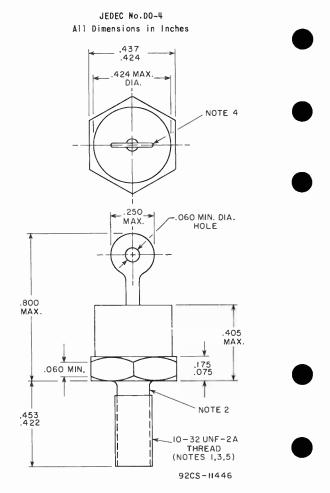


NOTE I: DIMENSION TO ALLOW FOR PINCH OR SEAL DEFORMATION ANYWHERE ALONG TABULATION (OPTIONAL).

NGTE 2: DIVENSION TO BE CONTROLLED FROM FREE END OF LEAD TC W'THIN 0.188 INCH FROM THE POINT OF ATTACHMENT TO THE BCDY. WITHIN THE 0.188 INCH DIMENSION, THE DIAVETER MAY VARY TO ALLOW FOR LEAD FINISHES AND IRREGULARITIES.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OUTLINE DO-1 2-62



NOTE 1: UNIT MUST NOT BE DAMAGED BY TORQUE OF 15 INCH-POUNDS APPLIED TO ID-32 UNF-28 NUT ASSEMBLED ON THREAD. NOTE 2: DIAMETER OF UNTHREADED PORTION D.189 INCH MAXIMUM, D.163 INCH MINIMUM.

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



NOTE 3: COMPLETE THREADS TO EXTEND TO WITHIN 2-1/2 THREADS OF HEAD.

NOTE 4: ANGULAR CRIENTATION OF THIS TERMINAL IS UNDEFINED.

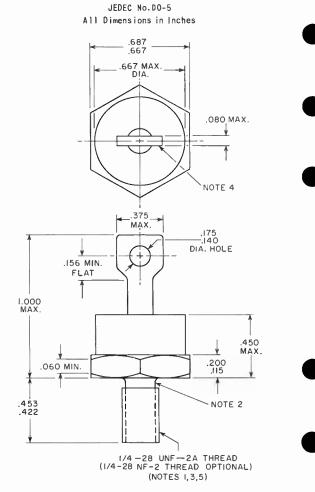
NOTE 5: MAXIMUM PITCH DIAMETER OF PLATED THREADS SHALL BE BASIC PITCH DIAMETER (0.1697 INCH) REFERENCE (SCREW THREAD STANDARDS FOR FEDERAL SERVICES, 1957) HANDPOOK H28 1957 PL.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division rld Radi

Somerville, N. J.

OUTLINE DO-4 2-62



92CS-11448

NOTE I: UNIT MUST NOT BE DAMAGED BY TORQUE OF 30 INCH-POUNDS APPLIED TO 1/4-28 UNF-28 NUT ASSEMBLED ON THREAD.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Parine History NOTE 2: DIAMETER OF UNTHREADED PORTION 0.249 INCH MAXIMUM, 0.120 INCH MINIMUM.

NOTE 3: COMPLETE THREADS TO EXTEND TO WITHIN 2-1/2 THREADS OF HEAD.

NOTE 4: ANGULAR ORIENTATION OF THIS TERMINAL IS UNDEFINED.

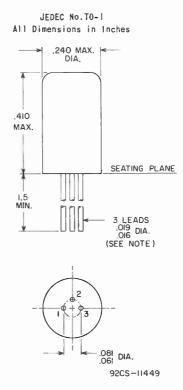
NOTE 5: MAXIMUM PITCH DIAMFTER OF PLATED THRIADS SHALL BE BASIC PITCH DIAMETER (0.2268 INCH) REFERENCE (SCREW THREAD STANFARDS FOR FEDERAL SERVICES, 1957) HANDBOOK H28 1957 PL.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OUTLINE DO-5 2-62

World Radio History

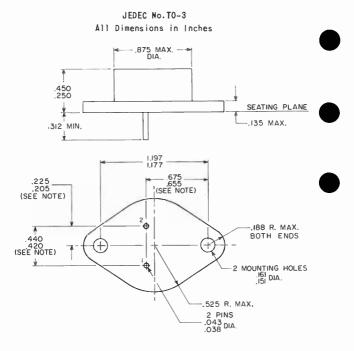
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NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN ZONE BETWEEN 0.05D INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND I.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History OUTLINE TO-F 2-62

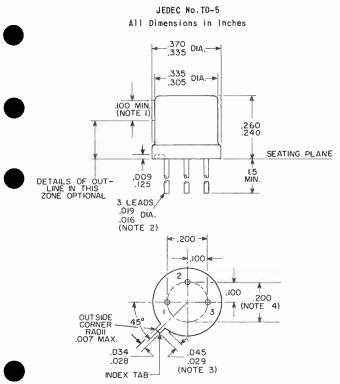


92CS-11455

NOTE: THESE DIMENSIONS SHOULD BE MEASURED AT POINTS 0.050 INCH TO 0.055 INCH BELOW SEATING PLANE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World redicibilistory



92CS-11444

TRIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN OOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFICO LEAO DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM OIAMETER OF C.021 INCH IS HELO. OUTSIOE OF THESE ZONES, THE LEAO DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

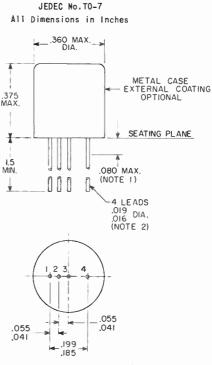
OUTLINE TO-5 2-62 NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH +0.001 INCH -0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. World Padio History





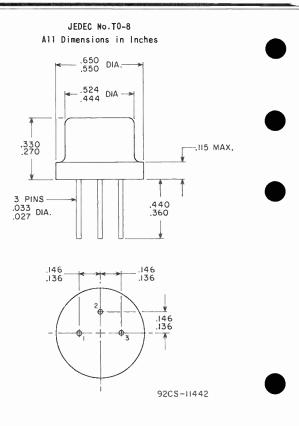
92CS-11447

NOTE 1: EXTERNALLY COATED DEVICES SHALL NOT HAVE COATING ON THE LEADS BEYOND THIS ZONE.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. SETWEEN 0.250 INCH AND I.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

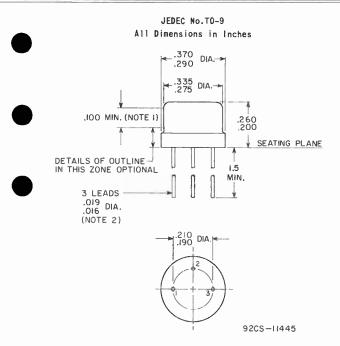


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OUTLINE TO-7 2-62









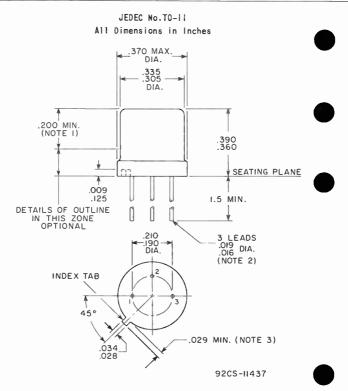
"HIS DEVICE IS FOR SOCKFIED, SINGLE-SIDED-CIRCUIT BOARD, WIPE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SICED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR DTHER STAND-OFF DEVICE MAY HE NECESSARY.

NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, AMAXIMUM DIAMETER OF 0.221 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OUTLINE TO-9 2-62



THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN_AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

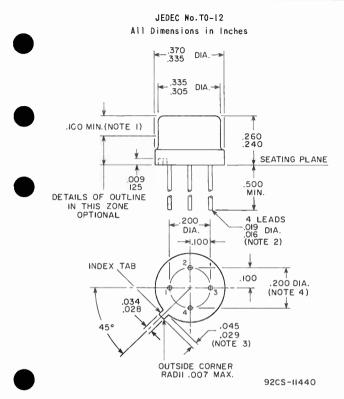
NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. RETWEEN 0.250 INCH AND 0.500 INCH, AMAXIMUM DIAMETER OF G.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD CHAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

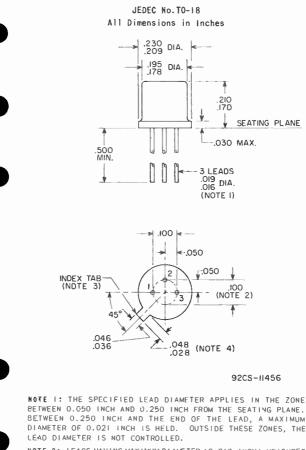


RADIO CORPORATION OF AMERICA OUTLINE TO-12 Semiconductor & Materials Division Somerville, N. J. 2-62 NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITH-IN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXI-MUM-WIDTH TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



BETWEEN 0.250 INCH AND THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE THESE ZONES, THE

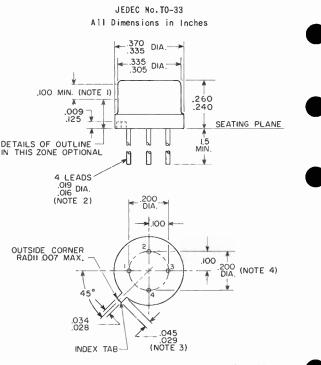
NOTE 2: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BE-LCW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.230 INCH DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: MEASURED FROM MAXIMUM DIAMETER OF ACTUAL DEVICE.



RADIO CORPORATION OF AMERICA OUTLINE TO-IB Semiconductor & Materials Division 2-62 Somerville, N. J.



92CS-11457

THIS DEVICE IS FOR SOCKETED, SINGLE-SIDED-CIRCUIT BOARD, WIRE-IN AND SIMILAR APPLICATIONS. WHERE USED IN DOUBLE-SIDED OR EYELETED-CIRCUIT BOARD, OR SIMILAR APPLICATIONS WHERE SOLDER BRIDGING MAY OCCUR, A DIELECTRIC WASHER OR OTHER STAND-OFF DEVICE MAY BE NECESSARY.

NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010 INCH.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND 1.5 INCHES, A MAXIMUM DIAMETER OF 0.021 INCH ISHELD. OUTSIDE THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

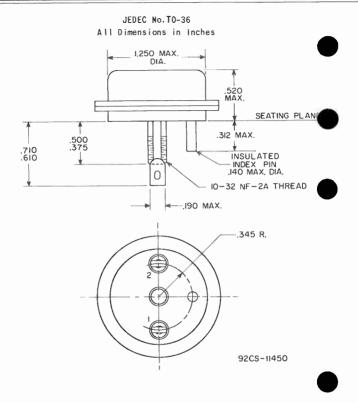


NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BE-LOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDT TAB.

NOTE 5: THE DEVICE MAY BE MEASURED BY DIRECT METHODS OR BY THE GAUGE AND GAUGING PROCEDURE DESCRIBED ON THE SHEET "GAUGE GS-1."

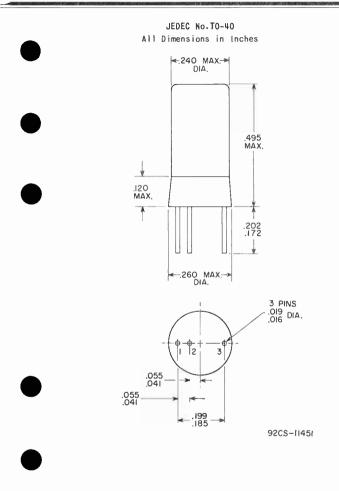


RADIO CORPORATION OF AMERICA OUTLINE TO-33 Semiconductor & Materials Division Somerville, N. J. 2-62



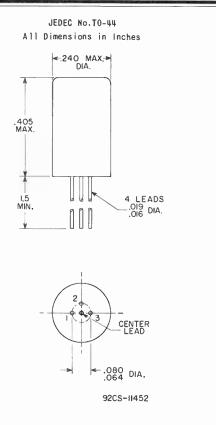






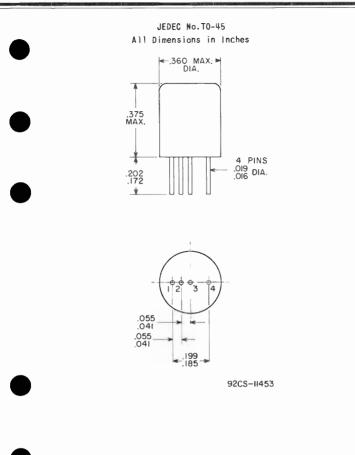


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OUTLINE TO-40 2-62



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

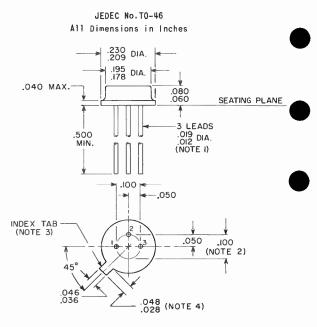






RADIO CORPORATION OF AMERICA OL Semiconductor & Materials Division World References

OUTLINE TO-45 2-62



92CS-11438

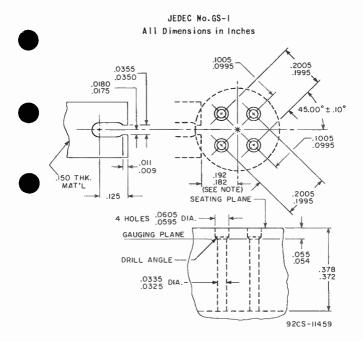
NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050 INCH AND 0.250 INCH FROM THE SEATING PLANE. BETWEEN 0.250 INCH AND THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021 INCH IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: LEADS HAVING MAXIMUM DIAMETER (0.019 INCH) MEASURED IN GAUGING PLANE 0.054 INCH + 0.001 INCH - 0.000 INCH BELOW THE SEATING PLANE OF THEDEVICE SHALL BE WITHIN 0.007 INCH OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB AND TO THE MAXIMUM 0.230 INCH DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: MEASURED FROM MAXIMUM DIAMETER OF ACTUAL DEVICE.





NOTE: THE LOCATION OF THE TAB LOCATOR WITHIN THE LIMITS INDICATED WILL BE DETERMINED BY THE TAB AND FLANGE DIMENSION OF THE DEVICE BEING CHECKED.

THE FOLLOWING GAUGING PROCEDURE SHALL BE USED:

THE DEVICE BEING MEASURED SHALL BE INSERTED UNTIL ITS SEATING PLANE IS 0.125 INCH ± 0.010 INCH FROM THE SEATING SUFFACE OF THE GAUGE. A FORCE OF 8.0±0.5 OZ. SHALL THEN BE AFPLIED PARALLEL AND SYMMETRICAL TO THE DEVICE'S CYLIN-DFICAL AXIS. WHEN EXAMINED VISUALLY AFTER THE FORCE AFPL.CATIONI(THE FORCE NEED NOT BE REMOVED) THE SEATING PLANE OF THE DEVICE SHALL BE SEATED AGAINST THE GAUGE.

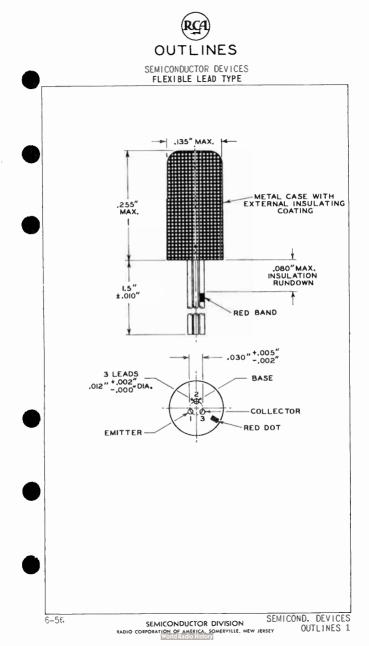
THE USE OF A PIN STRAIGHTENER PRIOR TO INSERTION IN THE CAUGE IS PERMISSIBLE.

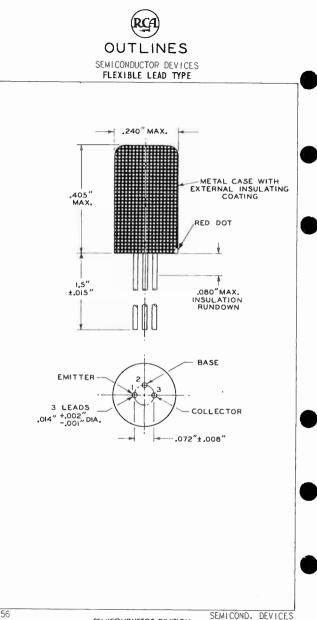
P SPACER MAY BE USED TO DBTAIN THE 0.125 INCH DISTANCE FROM THE GAUGE SEAT PRIOR TO FORCE APPLICATION.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division WorkExedicities ory GAUGE GS-I 2-62

World Radio History

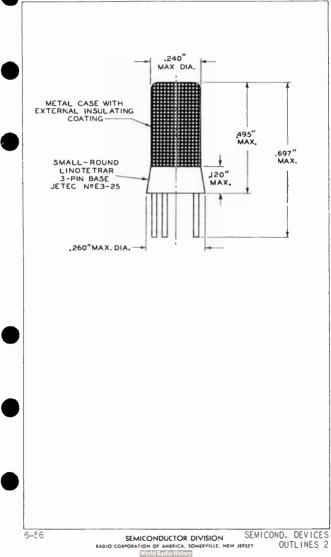




OUTLINES 1

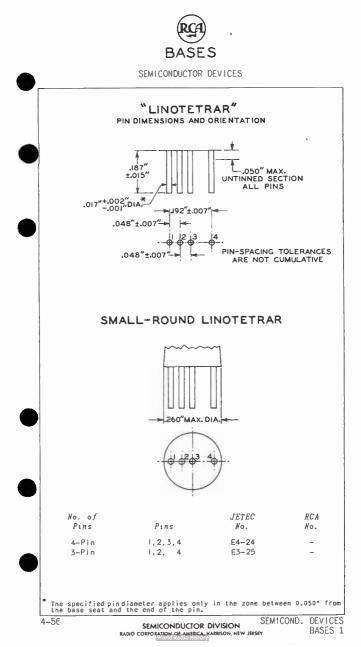






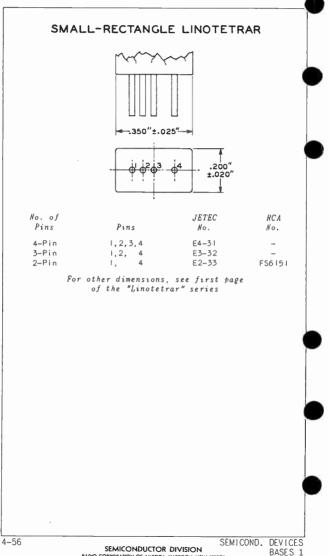
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SEMICONDUCTOR DEVICES



RADIO CORPORATION OF AMERICA, MARRISON, NEW JERSEY



GERMANIUM POINT-CONTACT TYPE

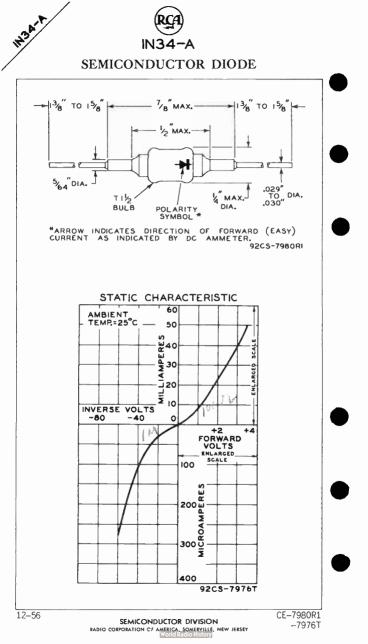
A general-purpose type intended for low-power rectification in applications such as isolating, clipping, and switching circuits, as well as in certain meter circuits

DAT	Α.
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DATA
General:
Maximum Envelope Length (Including studs)
(Including flexible leads)
Length
Operating Position
RECTIFIER SERVICE
For power-supply frequency of 25 cps and above
Maximum Ratings, Absolute Values:
PEAK INVERSE VOLTAGE
Peak
Average*
AMBIENT-TEMPERATURE RANGE55 to +75
Characteristics, At Ambient Temperature of 25°C:
Minimum Forward Current at dc volts = 1 . 5 ma Maximum Average Inverse Current:
At dc volts = -10
At dc volts = -50 , 500 μamp Minimum Peak Inverse Voltage for
zero dynamic resistance
(Approx.)
* Averaged over one conduction cycle.

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GERMANIUM POINT-CONTACT TYPE

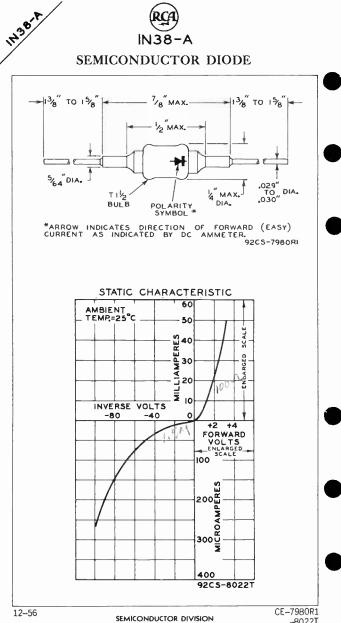
A large-signal type having a high peak inverse voltage rating and intended for use in electronic computers and clamping circuits

DATA

General:		
Maximum Envelope Length (Including studs). Maximum Envelope Diameter		
(Including flexible leads)		4-1/8"
Leads, Flexible		2
Length		
Envelope, Glass.		
Operating Position		. Any
RECTIFIER SERVICE		
For power-supply frequency of 25 cp.	s and above	
Maximum Ratings, Absolute Values:		
FORWARD CURRENT:	100 max.	volts
Peak	150 max. 50 max.	ma mai
Average*	500 max.	ma
AMBIENT-TEMPERATURE RANGE	-50 to +75	°C
Characteristics, At Ambient Temperature of	25°C:	
Minimum Forward Current at dc volts = 1 .	4	ma
Maximum Average Inverse Current; At dc volts = -3	5	µamp
At dc volts = -100	500	µamp
Minimum Peak Inverse Voltage for zero dynamic resistance	120	volts
Capacitance Between Stud Tips		
(Approx.).	1	μμf
* Averaged over one conduction cycle.		



SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY A BENI



RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY



GERMANIUM POINT-CONTACT TYPE

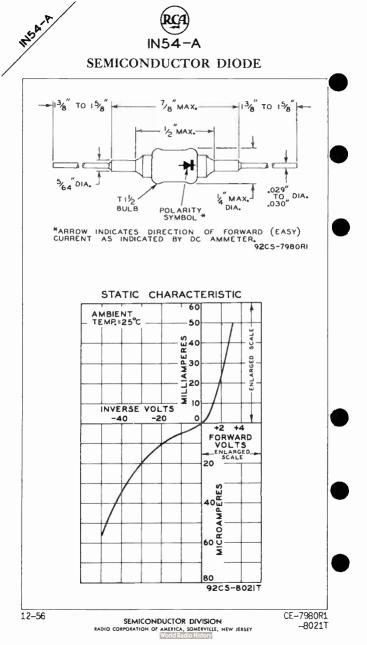
A high-back-resistance type intended for use in clipping circuits, high-impedance high-voltage probes, dc restorer circuits, and high-impedance detector circuits

DATA	
General:	
Maximum Envelope Length (Including studs)	-
Maximum Overall Length (Including flexible leads)	+
Leads, Flexible	
Diameter	-
Operating Position	
RECTIFIER SERVICE	
For power-supply frequency of 25 cps and above	
Maximum Ratings, Absolute Values:	
PEAK INVERSE VOLTAGE 50 max. volts FORWARD CURRENT:	ŀ
Peak 150 max. ma	
Average*	
AMBIENT-TEMPERATURE RANGE	
Characteristics, At Ambient Temperature of 25°C:	ĺ
Minimum Forward Current at dc volts = 1 . 5 ma Maximum Average Inverse Current:	
At dc volts = -10	Ĺ
At dc volts = -50 100 μamp Minimum Peak Inverse Voltage for	ŀ
zero dynamic resistance	
(Approx.)	
* Averaged over one conduction cycle.	ļ

+ Indicates a change.

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GERMANIUM POINT-CONTACT TYPE

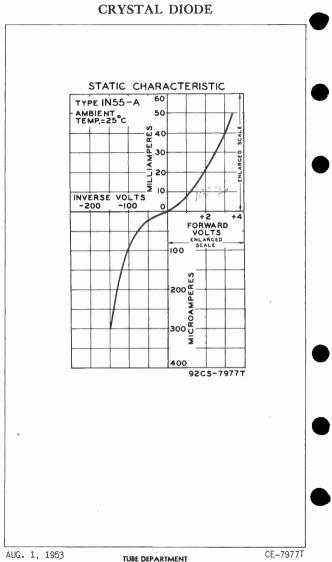
A large-signal type having a high peak inverse voltage rating and intended for use in electronic computers, clamping circuits, dc restorer circuits, and in high-voltage probes.

	DATA
,	General:
)	Maximum Envelope Length (Including studs) 15/16" Maximum Envelope Diameter 1/4" Maximum Overall Length (Including flexible leads) 4-3/16" Leads, Flexible 1.4" Diameter 0.025" Envelope, Glass 1-1-1/2 Operating Position Any
	RECTIFIER SERVICE
	For frequencies of 25 cps and above
	Maximum Ratings, Absolute Values:
	PEAK INVERSE VOLTAGE 150 max. volts FORWARD CURRENT:
	Peak
	FAULT CURRENT (For duration of i sec. max.) 500 max. ma
	AMBIENT TEMPERATURE RANGE
	Characteristics at Ambient Temperature of 25 ^o C:
	Minimum Forward Current at dc volts = 1 4 ma Maximum Average Inverse Current:
)	Maximum Average Inverse Current: At dc volts = -150
)	Maximum Average Inverse Current: At dc volts = -150
	Maximum Average Inverse Current: At dc volts = -150
)	Maximum Average Inverse Current: At dc volts = -150
)	Maximum Average Inverse Current: At dc volts = -150 500 μamp Minimum Peak Inverse Voltage for zero dynamic resistance
	Maximum Average Inverse Current: At dc volts = -150
	Maximum Average Inverse Current: At dc volts = -150
	Maximum Average Inverse Current: At dc volts = -150

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TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY World Radio History





IN55-A



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CRYSTAL DIODE

GERMANIUM POINT-CONTACT TYPE

A high-conduction type featuring exceptionally low

dynamic impedance and intended for limiter service

in FM receivers.

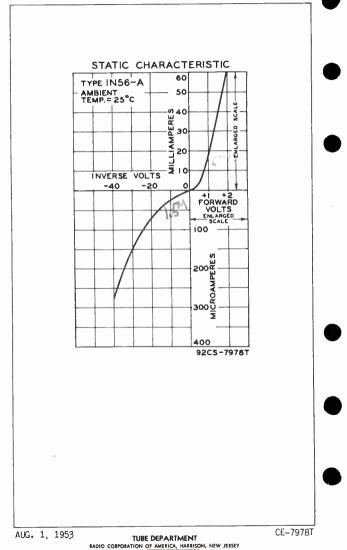
DATA
eneral:
Aaximum Envelope Length (Including studs)
RECTIFIER SERVICE
For frequencies of 25 cps and above
aximum Ratings, Absolute Values:
EAK INVERSE VOLTAGE 40 max. vol ORWARD CURRENT:
Peak
AULT CURRENT▲ For duration of I sec. max.) . 1000 max. MBIENT TEMPERATURE RANGE
haracteristics at Ambient Temperature of 25°C:
inimum Forward Current at dc volts = 1 . 15 eximum Average Inverse Current: At dc volts = -30
linimum Peak Inverse Voltage for zero dynamic resistance . 50 vol inunt Capacitance (Approx.) -
Measured Between Studs) 1 μ
Averaged over one conduction cycle.
Maximum fault current is the highest value of current that should be pe mitted to flow through the diode under a fault condition such as ic short circuit.
DIMENSIONAL OUTLINE for Type 1N56—A is the same as that shown for Type 1N34—A

TENTATIVE DATA

TUBE DEPARTMENT RADIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY



1456-4





GERMANIUM POINT-CONTACT TYPE

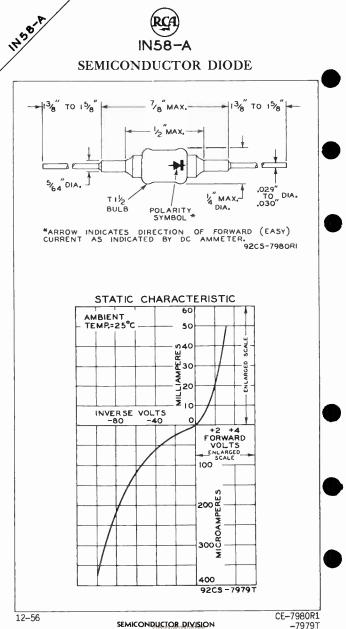
A large-signal type having a high peak inverse voltage rating and intended for use in electronic computers and clamping circuits

DATA

2010	L
General:	
Maximum Envelope Length (Including studs)	8" - 4" -
(Including flexible leads)	
Leads, Flexible	2
Diameter	2" +
Envelope, Glass	12
Operating Position	^{ny}
RECTIFIER SERVICE	
For power-supply frequency of 25 cps and above	
Maximum Ratings, Absolute Values:	
PEAK INVERSE VOLTAGE 100 max. vol FORWARD CURRENT:	
Teak	ma ma
Fault for duration of 0.1 second max. 500 max.	тa
AMBIENT-TEMPERATURE RANGE	°C
Characteristics, At Ambient Temperature of 25°C:	
Maximum Average Inverse Current	ma
at dc volts = -100 600 μa Minimum Peak Inverse Voltage for	
zero dynamic resistance 120 vol Capacitance Between Stud Tips	
(Арргох.) 1 н	μf
* Averaged over one conduction cycle.	



IN58 F



RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.											Any
Dimensions											
Dimensional Outline	•										JEDEC No.DO-5
Case											Metal
											Hermetic
Terminal Diagrams (See	e 1	D 1 11	ne n	151	101	14	1 (Jui	tlin	e):



Type 1N248RC



The arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase	
operation, and with resistive or inductive load	
RMS SUPPLY VOLTAGE	olts olts olts
At case temperature of 150° C 20 max. At other case temperatures See Average-Forward-Cur	amp rent
Rating C	
PEAK RECURRENT CURRENT	amp
For one-half cycle, sine wave	amp hart
Operating and storage65 to +175	°C
Characteristics:	
At case temperature of 150° C and maximum-	
rated voltage and average forward current	
Maximum Forward Voltage Drop 0.6 Maximum Reverse Current 3.8	volt ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 6-61

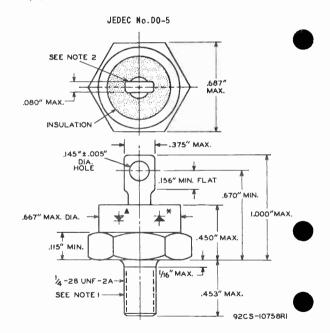
^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS

Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 26 to 36 inchpounds applied to a 1/4-28 UNF-28 hex nut assembled on stud thread.

The applied torque during installation should not exceed 75 inch-pounds.



NOTE 1: MUST WITHSTAND TOROUE OF 30 INCH-POUNDS APPLIED TO 1/4-28 UNF-28 NUT ASSEMBLED ON STUD THREAD.

- ANGULAR ORIENTATION OF THIS TERMINAL UNDEFINED. NOTE 2:
- Polarity symbol for types 1N2N8C, 1N2N9C, 1N2SOC, 1N1195A, 1N1196A, 1N1197A, and 1N1198A.
- Polarity symbol for types 1N248RC, 1N249RC, 1N250RC, 1N1195RA, 1N1196RA, 1N1197RA, and 1N1198RA.

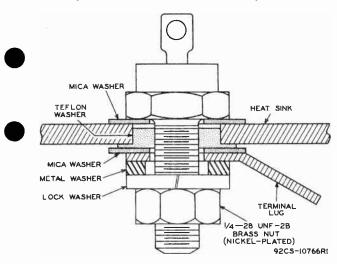
Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA Somerville, N. J.



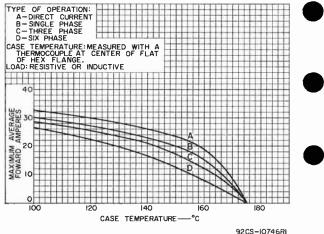
SUGGESTED MOUNTING ARRANGEMENT

Mounting components of the type shown are furnished with each silicon rectifier

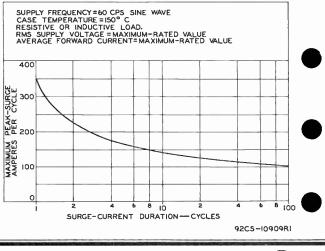




AVERAGE-FORWARD-CURRENT RATING CHART



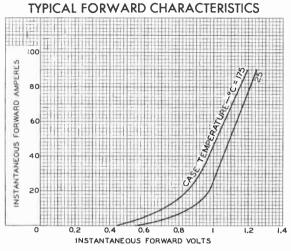
PEAK-SURGE-CURRENT RATING CHART



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

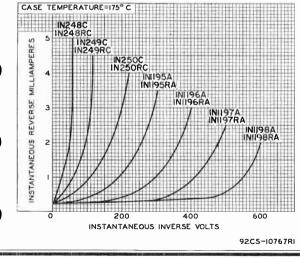
Somerville, N. J.





92CS-10768







RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 3 6-61

World Radio History

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

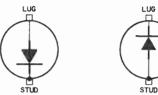
GENERAL DATA

Mechanical.

Operating Position.		Any
	See Dimensiona	
	•••••JEDE	
		Hermetic
leminal blagrams (ee Dimensional Outline):	



Type 1N249RC



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values: _

	For power-supply frequency of 60 cps, single-phase
	operation, and with resistive or inductive load
	PEAK INVERSE VOLTAGE. 110 max. volts RMS SUPPLY VOLTAGE. 77 max. volts DC BLOCKING VOLTAGE. 100 max. volts AVERAGE FORWARD CURRENT: 100 max. volts
-	At case temperature of 150° C 20 max. amp
	At other case temperatures See Average-Forward-Current
	Rating Chart
	PEAK RECURRENT CURRENT 90 max, amp PEAK SURGE CURRENT: ^a
	For one-half cycle, sine wave 350 max. amp
	For one or more cycles See Peak-Surge-Current
,	Rating Chart
	CASE-TEMPERATURE RANGE:
	Operating and storage65 to +175 ^O C
	Characteristics:
	At case temperature of 150° Cand maximum-
	rated voltage and average forward current
	Maximum Forward Voltage Drop 0.6 volt Maximum Reverse Current 3.6 ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

1N249C, 1N249RC

a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types IN248C and IN248RC also apply to the IN249C and IN249RC



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.								Any
Dimensions								
Dimensional Outline								
Case								
Seals								
Terminal Diagrams (S	ee	Dim	en s 1	on	al	0u1	tline	2):

Type 1N250C

Type 1N250RC



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase	
operation, and with resistive or inductive load	
The fittende formation of the fittende forma	/olts /olts
TIMO DOT ET TOET OCT	
DC BLOCKING VOLTAGE 200 max. v AVERAGE FORWARD CURRENT:	voits
At case temperature of 150° C 20 max.	amp
At other case temperatures See Average-Forward-Cur	rent
Rating (
PEAK RECURRENT CURRENT	amp
For one-half cycle, sine wave 350 max.	amp
For one or more cycles See Peak-Surge-Cur	rent
Rating (
CASE-TEMPERATURE RANGE:	
Operating and storage65 to +175	oC
Characteristics:	
At case temperature of 150° C and maximum-	
rated voltage and average forward current	
Maximum Forward Voltage Drop 0.6	volt
Maximum Reverse Current	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

1N250C, 1N250RC

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal~equilibrium conditions.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types IN248C and IN248RC also apply to the IN250C and IN250RC





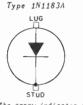
Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See	Dimensional Outline
Dimensional Outline	
Case	
Seals	· · · · . Hermetic
Termina! Diagrams (See Dimensional Outlin	e):



Type 1N1183RA



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

	For power-supply frequency of 60 cps, single-phase uperation, and with resistive or inductive load
	PEAK REYERSE VOLTAGE
	At case temperature of 150° C 40 max. amp At other case temperatures. See Average-Forward-Current Rating Chart
	PEAK RECURRENT CURRENT
)	For one-half cycle, sine wave 800 max. amp For one or more cycles See Peak-Surge-Current Rating Chart
	CASE-TE:/PERATURE RANGE: Operating and storage
	Characteristics: Maximum Forward Voltage Drop ^b 0.65 volt Maximum Reverse Current: Dynamic (Averaged over one complete
	cycle for maximum peak-reverse volts = 50, dc forward amperes = 40, case temperature (°C) = 150) 2.5 ma



RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

Somerville, N. J.

Static (DC value for maximum peak-reverse			
volts = 50, case temperature (°C) = 25).	0.025	ma	
Maximum Thermal Resistance:			4
Junction-to-case	1	OC/watt	

- a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
- b Average value for one complete cycle, for maximum peak-reverse volts = 50, dc forward amperes = 40, case temperature ($^{\circ}C$) = 150.

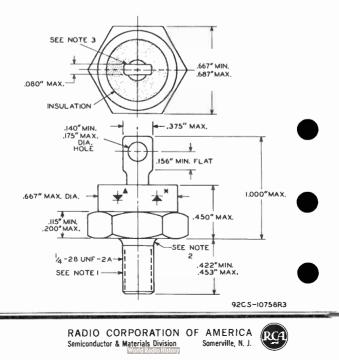
OPERATING CONSIDERATIONS

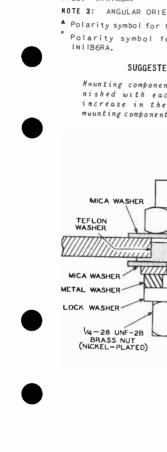
Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 26 to 36 inch-pounds applied to a $1/4{-}28\ {\rm UNF}{-}2B$ hex nut assembled on stud thread.

The applied torque during installation should not exceed 50 inch-pounds.

JEOEC No.00-5





NOTE I: MUST WITHSTAND TORQUE OF 30 INCH-POUNDS APPLIED TO 1/4-28 UNF-28 NUT ASSEMBLED ON STUD THREAD.

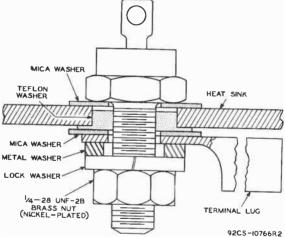
NOTE 2: DIAMETER OF UNTHREADED PORTION: 0.249" MAXIMUM, 0.220" MINIMUM.

NOTE 3: ANGULAR ORIENTATION OF THIS TERMINAL UNDEFINED.

- Polarity symbol for types IN1183A, IN1184A, and IN1186A.
- * Polarity symbol for types INI183RA, INI184RA, and INI186RA.

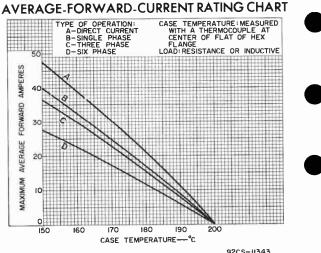
SUGGESTED MOUNTING ARRANGEMENT

Hmunting components of the type shown are furnished with each silicon rectifier. The increase in thermal resistance with these muunting components is approximately 1.5% (Duatt.



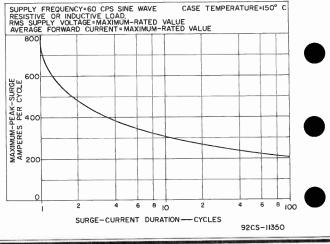
RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division Somerville, N. J.



92CS-11343

PEAK-SURGE-CURRENT RATING CHART

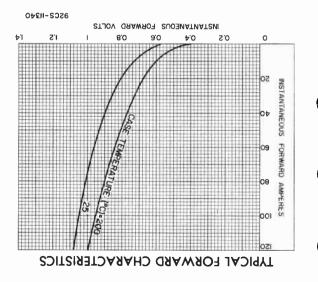


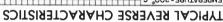
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

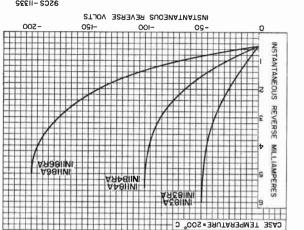
Somerville, N. J.



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92C2 - 11332



World Radio History

1N1184A, 1N1184RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	
Dimensions See Dimensional Outline	
Dimensional Outline JEDEC No.DO-5	
Case	
Seals	
erinital Diagrams (See Dimensional Untline).	

Type 1N1184A

Type 1N1184RA





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load
PEAK REVERSE VOLTAGE. 100 max. volts RMS SUPPLY VOLTAGE. 70 max. volts DC BLOCKING VOLTAGE. 100 max. volts AVERAGE FORWARD CURRENT: 100 max. amp
At other case temperatures See Average-Forward-Current
PEAK RECURRENT CURRENT
For one-half cycle, sine wave 800 max. amp For one or more cycles See Peak-Surge-Current Rating Chart
CASE-TEMPERATURE RANGE: Operating and storage
Characteristics:
Maximum Forward Voltage Drop ^b 0.65 volt Maximum Reverse Current: Dynamic (Averaged over one complete cycle
for maximum peak-reverse volts = 100, dc
forward amperes = 40, case temperature (°C) = 150) 2.5 ma

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Interville, N. J. DATA 2-62

1N1184A, 1N1184RA

Static (DC value for maximum peak-reverse volts = 100, case temperature (°C) = 25). Maximum Thermal Resistance: 0.025 ma °C/watt 1 Junction-to-case . .

- ^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions
- **b** Average value for one complete cycle, for maximum peak reverse volts = 100, dc forward amperes = 40, case temperature ($^{\circ}C$) = 150.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS. and CURVES shown under Types IN1183A and IN1183RA also apply to the INII84A and INII84RA



1N1186A, 1N1186RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.										Any
Dimensions	•								See	Dimensional Outline
Dimensional Outline	•	•	•	•	•		٠			JEDEC No.DO-5
Case	·	• •	•	٠	٠	•	٠	٠	• •	••••••••••••••••••••••••••••••••••••••
Seals	•	• _ •	•	·	•	•	÷.	•	• •	· · · · · . Hermetic
Terminal Diagrams (S	ee	D_1	men	151	101	na i	. (Jul	tlini	e) :

Type 1N1186A

Type 1N1186RA





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	
PEAK REVERSE VOLTAGE. 200 max. vol RMS SUPPLY VOLTAGE. 140 max. vol DC BLOCKING VOLTAGE. 200 max. vol AVERAGE FORWARD CURRENT: 200 max. vol	ts
At other case temperatures See Average-Forward-Curren	
Reating Chai PEAN RECURRENT CURRENT	rt np
For one-half cycle, sine wave 800 max. an For one or more cycles See Peak Surge-Current Rating Char CASE-TEMPERATURE RANGE:	np rt
	C
Characteristics: Maximum Forward Voltage Drop ^b 0.65 vol Maximum Reverse Current:	t
Dynamic (Averaged over one complete cycle for maximum peak-reverse volts= 200, dc forward amoeres = 40, case tempera-	
$t_{\rm WFO} (90) = 1501$	na



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

DATA 2-62

1N1186A, 1N1186RA

Static (DC value for maximum peak-		
reverse volts = 200, case tempera-		
ture (°C) = 25) 0.	025	ma
Maximum Thermal Resistance:		
Junction-to-case	1	°C/watt

a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

b Average value for one complete cycle, for maximum poak-reverse volts = 200, dc forward amperes = 40, case temperature (°C) = 150.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INII83A and INII83RA also apply to the INII86A and INII86RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

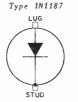
Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.				Any
Dimensions			S	ee Dimensional Outline
				JEDEC No.DO-5
				· · · · · · · · rlermetic
Terminai Diagrams (S	iee D)imensi	ional Outl	ine):



Type IN1187R LUG



The arrow indicates direction of forwarl (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	Forpower-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load
1	PFAK RFVERSE VOLTAGE. 300 max. volts RMS SUPPLY VOLTAGE. 212 max. volts DC 3LOCKING VOLTAGE. 240 max. volts AVERAGE FORWARD CURRENT: At case temperature of 140° C. 35 max. amp
	At other case temperatures See Average-Forward-Current Rating Chart
	PEAK @ECURRENT CURRENT 130 max. amp PEAK SURGE CURRENT: ª
	For one-half cycle, sine wave 500 max. amp For one or more cycles See Peak-Surge-Current Rating Chart
'	CASE-TEMPERATURE RANGE: Uperating and storage
	Characteristics:
	Makimum Forward Voltage Drop ^b 1.7 volts Makimum Reverse Current:
I	Dynamic (Averaged over one complete cycle for maximum peak-reverse volts = 300, dc forward amperes = 35, case
	temperature (°C) = 140) 10 ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA I 2-62



Static (DC value for maximum peak-	
reverse volts = 300, case	
temperature (°C) = 25) 0.	025 ma
Maximum Thermal Resistance:	
Junction-to-case	1 ^o C/watt

 Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient lime has elapsed for the device to return to the presurge thermal-equilibrium conditions.
 Peak value for maximum average forward amperes = 35, case temperature {°C} = 140.

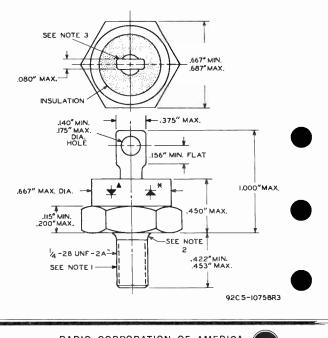
OPERATING CONSIDERATIONS

Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 26 to 36 inch-pounds applied to a 1/4-28 UNF-28 hex nut assembled on stud thread.

The applied torque during installation should not exceed 50 inch-pounds.

JEDEC No.D0-5



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Datio History Somerville, N. J.



NOTE 1: MUST WITHSTAND TORQUE OF 30 INCH-POUNDS APPLIED TO 1/4-28 UNF-28 NUT ASSEMBLED ON STUD THREAD.

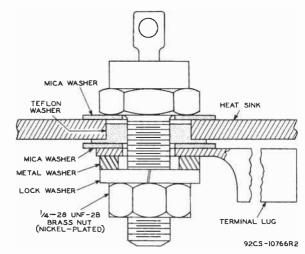
NOTE 2: DIAMETER OF UNTHREADED PORTION: 0.249" MAXIMUM, 0.220" MINIMUM.

NOTE 3: ANGULAR ORIENTATION OF THIS TERMINAL UNDEFINED.

- Polarity symbol for types 1N1187, 1N1188, 1N1189, and 1N1190.
- * Polarity symbol for types 1N1187R, 1N1188R, 1N1189R, and 1N1190R.

SUGGESTED MOUNTING ARRANGEMENT

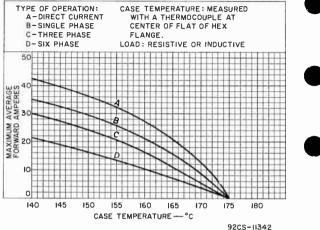
Hounting components of the type shown are furnished with each silicon rectifier. The increase in thermal resistance with these mounting components is approximately 1.5 °C/watt.



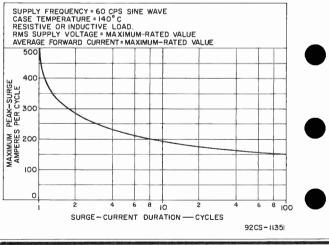


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Somerville, N. J.





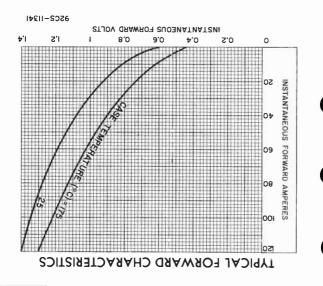
PEAK-SURGE-CURRENT RATING CHART

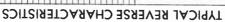


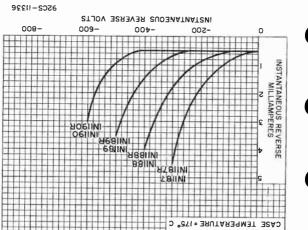
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Somerville, N. J.



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₹ A1AQ 28-5 RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



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World Radio History

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1N1188, 1N1188R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.											Any
Dimensions										See	Dimensional Outline
Dimensional Outline											JEDEC No.DO-5
Case											Metal
Seals											Hermetic
Terminal Diagrams (Se	e ,	Dir	nei	15	101	na.	l I) u i	tline	e):

Type 1N1188

Type 1N1188R



The arrow indicates direction of forward (easy) current flow as indicated by dc armeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	
PEAK REVERSE VOLTAGE	
DC BLOCKING VGLTAGE	
At case temperature of 140° C	
At other case temperatures See Average-Forward-Current Rating Chart	
PEAk RECURRENT CURRENT 130 max. amp PEAK SURGE CURRENT: *	
For one-half cycle, sine wave 500 max. amp For one or more cycles See Peak-Surge-Current	
CASE-TEMPERATURE RANGE: Rating Chart	
Operating and storage	,
Characteristics:	
Maximum Forward Voltage Drop ^b 1.7 volts Maximum Reverse Current:	\$
Cynamic (Averaged over one complete cycle for maximum peak-reverse volts = 400, dc	
forward amperes = 35, case temperature	
(°C) = 140	1



RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

DATA 2-62

World Radio History

Somerville, N. J.

1N1188, 1N1188R

Static (DC value for maximum peak-reverse		
volts = 400, case temperature (°C) = 25).	0.025	ma
Maximum Thermal Resistance:		
Junction-to-case	1 °C	/watt

- ^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to returr to the presurge thermal-equilibrium conditions.
- b Peak value for maximum average forward amperes = 35, case temperature (°C) = 140.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types IN1187 and IN1187R also apply to the IN1188 and IN1188R





World Padio History

1N1189, 1N1189R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.											Any
Dimensions										See	Dimensional Autiens
Case.	·	·	·	·	·	٠	·	•	·	• •	JEDEC No.DO-5
Seals											Hormotic
Terminal Diagrams (See	e l)ım	ie n	51	on	ia l	C)u t	line	:):

Type 1N1189





LUG

รรับอ

The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	For power-supply frequency of 60 cps, single-phase	
	operation, and with resistive or inductive load	
	PEAK REVERSE VOLTAGE	s
,	At case temperature of 140° C	D
	At other case temperatures See Average-Forward-Curren	t
	PEAK RECURRENT CURRENT	t p
	For one-half cycle, sine wave	p t
	CASE-TEMPERATURE RANGE: Rating Chart	Ł
	Operating and storage65 to +175 9	С
	Characteristics:	
	Maximum Forward Voltage Drop ^b 1.7 volts Maximum Reverse Current:	5
)	Dynamic (Averaged over one complete cycle for maximum peak-reverse volts = 500, dc forward amperes = 35, case tempera-	
_	ture $(^{\circ}C) = 140$)	à
1		_



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

DATA 2 - 62

World Radio History

Somerville, N. J.

1N1189, 1N1189R

Static (DC value for maximum peak-reverse		
volts = 500, case temperature (°C)		
= 25) 0.025	ma	
Maximum Thermal Resistance:		
Junction-to-case 1	^O C/watt	

a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

b Peak value for maximum average forward amperes = 35, case temperature (^{O}C) = 140.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INI187 and INI187R also apply to the INI189 and INI189R



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World References

1N1190, 1N1190R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanicai:

Operating Position	Any
Dimensions See Dimensional Outl	1 11 10
Dimensional Outline JEDEC No.D	0-5
Case	tal
Seals	tic
Terminal Diagrams (See Dimensional Outline):	

Type 1N1190

Type 1N1190R



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	For power-supply frequency of 60 cps, single-phase
	operation, and with resistive or inductive load
	PE4K REVERSE VOLTAGE. 600 max. volts RMS SUPPLY VOLTAGE. 424 max. volts DC BLOCKING VOLTAGE. 480 max. volts AVERAGE FORWARD CURRENT: 480 max. volts
	At case temperature of 140° C 35 max. amp
	At other case temperatures See Average-Forward-Current
	PEAK RECURRENT CURRENT
	For one-half cycle, sine wave 500 max. amp For one or more cycles See <i>Peak-Surge-Current</i>
)	CASE_TEMPERATURE RANGE: Operating and storage
	Characteristics:
	M⇒ximum Forward Voltage Drop ^b 1.7 volts Maximum Reverse Current: Dynamic (Averaged over one complete cycle
,	for maximum peak-reverse volts = 600, dc forward amperes = 35, case tempera-
	ture (°C) = 140) 10 ma





RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

Somerville, N. J.

1N1190, 1N1190R

Static (DC value for maximum peak-reverse volts = 600, case temperature (°C)	
= 25) 0.025	ma
Maximum Thermal Resistance:	OC (weat t
Junction-to-case 1	°C/watt

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions. b Peak value for maximum average forward amperes = 35, case temperature (^OC)

P Peak value for maximum average forward amperes = 35, case temperature (°C) = 140.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTEO MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INII87 and INII87R also apply to the INII90 and INII90R



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Rector History Somerville, N. J.

1N1195A, 1N1195RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See	
Dimensional Outline	JEDEC No.DO-5
Case	Metal
Seals	Hermetic
Terminal Diagrams (See Dimensional Outline):



Type 1N1195RA

STUD

the arrow indicates direction of forward (easy) current flow as indicated by ac anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	
PEAK INVERSE VOLTAGE 300 max. RWS SUPPLY VOLTAGE 212 max. DC BLOCKING VOLTAGE 300 max. AVERAGE FORWARD CURRENT: 300 max.	volts volts volts
At case temperature of 150 ⁰ C 20 max.	amp
At other case temperatures See Average-Forward-Cu	irrent
Rating	
PEAK RECURRENT CURRENT	атр
For one-half cycle, sine wave	amp
For one or more cycles See Peak-Surge-Cu	irrent
Rating	Chart
CASE-TEMPERATURE RANGE: Operating and storage	٥C
Characteristics:	
At case temperature of 150° Cand maximum- rated voltage and average forward current	
Maximum Forward Voltage Drop 0.6	volt
Maximum Reverse Current	ma
	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

DATA 6-61

1N1195A, 1N1195RA

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Type IN248C and IN248RC also apply to the INI195A and IN195RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Votici Portici Istory

1N1196A, 1N1196RA

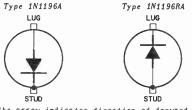
Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position
Dimensions See Dimensional Outline
Dimensional Outline JEDEC No.DO-5
Case
Seals
Terminal Diagrams (See Dimensional Outline):



The arrow indicates direction of forward (easy) current flow as indicated by ac ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load
PEAK INVERSE VOLTAGE 400 max. volts RMWS SUPPLY VOLTAGE
At case temperature of 150° C 20 max. amp At other case temperatures. See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT
For one-half cycle, sine wave
For one or more cycles See Peak-Surge-Current Rating Chart
CASE-TEMPERATURE RANGE: Operating and storage
Characteristics:
At case temperature of 150 ⁰ C and maximum- rated voltage and average forward current
Maximum Forward Voltage Drop 0.6 volt Maximum Reverse Current 2.5 ma



1N1196A, 1N1196RA

Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types IN248C and IN248RC also apply to the INII96A and INII96RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

1N1197A, 1N1197RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions, See	Dimensional Outline
Dimensional Outline	JEDEC No.DO-5
Case	Metal
Seals	Hermetic
Terminal Diagrams (See Dimensional Outlin	e):







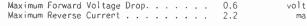


The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load
PEAK INVERSE VOLTAGE
DC BLOCKING VOLTAGE
At case temperature of 150° C 20 max. amp
At other case temperatures See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT
For one-half cycle, sine wave 350 max. amp
For one or more cyclesSee Peak-Surge-Current Rating Chart
CASE-TEMPERATURE RANGE:
Operating and storage65 to +175 ^O C
Characteristics:
At case temperature of 150° C and maximum- rated voltage and average forward current
Maximum Forward Voltage Drop 0.6 volt





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division* Somerville, N. J. World Radio History

DATA 6-61

1N1197A, 1N1197RA

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equiliprium conditions.

> OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES

shown under Type IN248C and IN248RC also apply to the INII97A and IN1197RA





1N1198A, 1N1198RA

Silicon Rectifiers

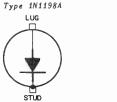
DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	У
Dimensions See Dimensional Outline	
Dimensional Outline JEDEC No.DO-	õ
Case	1
Seals	с
[ermina] Diagrams (See Dimensional Outline):	



Type 1N1198RA



The arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	
PEAK INVERSE VOLTAGE 600 max. volts RMS_SUPPLY_VOLTAGE	5
DC BLOCKING VOLTAGE 600 max. volts AVERAGE FORWARD CURRENT:	,
At case temperature of 150° C 20 max. amp	1
At other case temperatures See Average-Forward-Current	
Rating Chart FEAK RECURRENT CURRENT	
PEAK SURGE CURRENT: *	•
For one-half cycle, sine wave 350 max. amp)
For one or more cyclesSee Peak-Surge-Current Rating Chart CASE-TEMPERATURE RANGE:	
Operating and storage	
Characteristics:	
At case temperature of 150° Candmaximum-	
rated voltage and average forward current	
Maximum Forward Voltage Drop 0.6 volt Maximum Reverse Current 1.5 ma	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 6-61

World Radio History

1N1198A, 1N1198RA

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

> OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS,

and

CURVES shown under Types IN248C and IN248RC also apply to the IN1198A and IN1198RA





Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

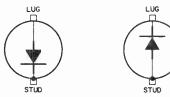
GENERAL DATA

Mechanical:

					Any
					Dimensional Outline
					JEDEC No.DO-4
Case					
					Hermetic
Terminal Diagrams	(See	Dımen	sional	Outline	e):

Type 1N1199A

Type 1N1199RA



The arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single- operation, and with resistive or inductive	
PEAK INVERSE VOLTAGE	max. volts
	max. volts max. volts
DC BLOCKING VOLTAGE	max. volts
At other case temperatures See Average-For	
	Rating Chart max. amp
For one-half cycle, sine wave	urge-Current
CASE-TEMPERATURE RANGE: Operating and storage65 to	Rating Chart 0+200 ^O C
Characteristics: Maximum Forward Voltage Drop ^b 0.55 Maximum Reverse Current ^b	volt ma
Maximum Neverse Current	Ind



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 6-61

Maximum Thermal Resistance: 2 °C/watt Junction-to-case.

- Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
- At case temperature of 150° C and maximum-rated voltage and average forward current.

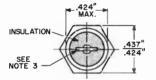
OPERATING CONSIDERATIONS

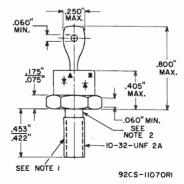
Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 15 to 20 inchpounds applied to a 10-32 UNF-28 hex nut assembled on stud thread.

The applied torque during installation should not exceed 25 inch-pounds.

JEDEC No. DO-4







Somerville, N. J.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division



NOTE 1: NORMAL INSTALLATION TORQUE IS 15 to 20 INCH-POUNDS APPLIED TO A 10-32 UNF-28 HEX NUT ASSEMBLED ON STUE THREADS. UNDER NO CIRCUMSTANCES SHOULD THIS VALUE EXCEED 25 INCH-POUNDS.

NOTE 2: DIAMETER OF UNTHREADED PORTION: 0.189" MAXIMUM, 0.169" M:NIMUM.

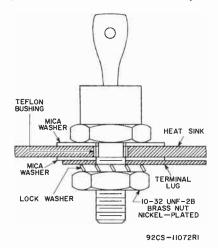
NOTE 3: ANGULAR ORIENTATION OF THIS TERMINAL UNDEFINED.

Polarity symbol for Lypes 1N1199A, IN1200A, 1N1202A, 1N1203A, 1N1204A, 1N1205A, and 1N1206A.

Polirity symbol for types 1N1199RA, 1N120GRA, 1N1202RA, 1N1203RA, 1N1204RA, 1N1205RA, and 1N1206RA,

SUGGESTED MOUNTING ARRANGEMENT

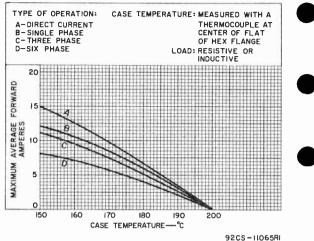
Mounting components of the type shown are furnished with each silicon rectifier



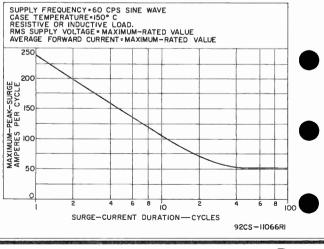


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Pation Istory DATA 2 6-61

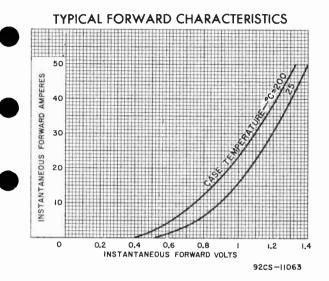
AVERAGE-FORWARD-CURRENT RATING CHART



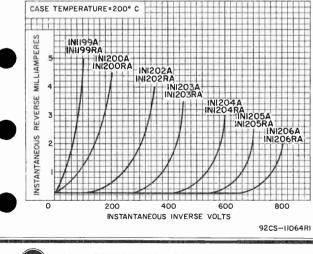
PEAK-SURGE-CURRENT RATING CHART



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Colligion









RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 3 6-61

World Radio History

1N1200A, 1N1200RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position		Any					
Dimensions.		. See Dimensional Outline					
Dimensional Outline .		JEDEC No.DO-4					
Case		Metal					
Seals							
Terminal Diagrams (See Dimensional Outline):							

Type IN1200A

Type 1N1200RA



LUG

STUD

the arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase
operation, and with resistive or inductive load
PEAK INVERSE VOLTAGE 100 max. volts
TEANSIENT INVERSE VOLTAGE: Non-repetitive, for duration of
5-milliseconds maximum 200 max. volts
RMS SUPPLY VOLTAGE
DC BLOCKING VOLTAGE 100 max. volts
AVERAGE FORWARD CURRENT:
At case temperature of 150° C 12 max. amp
At other case temperatures See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT
PEAK SURGE CURRENT: *
For one-half cycle, sine wave 240 max. amp
For one or more cycles See Peak-Surge-Current
Rating Chart
CASE-TEMPERATURE RANGE:
Operating and storage65 to +200 ^O C



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Reficielision

1N1200A, 1N1200RA

Characteristics:

Maximum Forward	Voltage Drop ^b				0.55	volt
Maximum Reverse	Current ^b				2.5	ma
Maximum Thermal						
Junction-to-c	ase				2	OC/watt

^a Superimposed on device operaling within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

b At case temperature of 150° C and maximum-rated voltage and average forward current.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INI199A and INI199RA also apply to the INI200A and INI200RA





1N1202A, 1N1202RA

Silicon Rectifiers

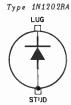
DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.											Any
Dimensions											
Dimensional Outline											
Case											
Seals											
Terminal Diagrams (S	ee	e D	1 7	еn	151	or	ıa l	. () u i	tline	e):





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	
PEAK INVERSE VOLTAGE	volts
Non-repetitive, for duration of 5-milliseconds maximum	volts volts volts amp
At other case temperatures See Average-Forward-C Rating	
PEAK RECURRENT CURRENT 50 max. PEAK SURGE CURRENT: *	amp
For one-half cycle, sine wave 240 max. For one or more cyclesSee Peak-Surge-Current Rating CASE-TEMPERATURE RANGE: Operating and storage65 to +200	amp <i>chart</i> oc
Characteristics:	
Maximum Forward Voltage Drop ^b 0.55 Maximum Reverse Current ^b	volt ma

1N1202A, 1N1202RA

- ^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
- $^{\rm b}$ At case temperature of 150 $^{\rm O}$ C and maximum-rated voltage and average forward current.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INI1998 and INI199RA also apply to the INI202A and INI202RA



1N1203A, 1N1203RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position
Dimensions See Dimensional Outline
Dimensional Outline JEDEC No.DO-4
Case
Seals
Terminal Diagrams (See Dimensional Outline):

Type 1N1203A

Type 1N1203RA



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase		
	operation, and with resistive or inductive load	
	PEAK INVERSE VOLTAGE	ts
	Non-repetitive, for duration of 5-milliseconds maximum	ts
	RMS SUPPLY VOLTAGE	
	D€ BLOCKING VOLTAGE	ts
	At case temperature of 150° C 12 max. a	
	At other case temperatures See Average-Forward-Curre Rating Cha	
)	ETAL DEGUODEUT GUODEUT	amp
	For one-half cycle, sine wave	
	For one or more cycles	
	CASE-TEMPERATURE RANGE: Operating and storage65 to +200	oC
)	Characteristics:	
	D	na ma

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 6-61

1N1203A, 1N1203RA

- a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilbrium conditions.
- b At case temperature of 150° C and maximum-rated voltage and average forward current.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INI199A and INI199RA also apply to the INI203A and INI203RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio listory Somerville, N. J.

1N1204A, 1N1204RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See Dimen	isional Outline
Dimensional Outline	. JEDEC No.DO-4
Case	Metal
Seals	Hermetic
Terminal Diagrams (See Dimensional Outline):	

Type 1N1204A

Type 1N1204RA





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, so operation, and with resistive or inc	
PEAK INVERSE VOLTAGE	400 max. volts
Non-repetitive, for duration of	
5-milliseconds maximum	600 max. volts
RMS SUPPLY VOLTAGE	284 max. volts
DC BLOCKING VOLTAGE	400 max, volts
AVERAGE FORWARD CURRENT:	
At case temperature of 150° C	12 max. amp
At other case temperatures See Avera	
	Rating Chart
PEAK RECURRENT CURRENT	50 max. amp
For one-half cycle, sine wave	240 max. amp
For one or more cycles See	
	Rating Chart
CASE-TEMPERATURE RANGE:	nating churt
Operating and storage	-65 to +200 °C
Characteristics:	
Maximum Forward Voltage Drop ^b	0.55 volt
Maximum Reverse Current ^b	1.5 ma

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

DATA 6-ő I

World Radio History

Somerville, N. J.

1N1204A, 1N1204RA

Maximum Thermal Resistance: Junction-to-case. °C/watt 2

a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

At case temperature of 150° C and maximum-rated voltage and average forь ward current.

OPERATING CONSIDERATIONS. DIMENSIONAL OUTLINE. SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS. and CURVES shown under Types INII99A and INII99RA also apply to the IN1204A and IN1204RA



Semiconductor & Materials Division

World Radio History



1N1205A, 1N1205RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See	Dimensional Outline
Dimensional Outline	
Case	
Seals	Hermetic
Terminal Diagrams (See Dimensional Outlin	e):

Type 1N1205A





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load
	PEAK INVERSE VOLTAGE:
)	5-milliseconds maximum
	At case temperature of 150° C 12 max. amp At other case temperatures See Average-Forward-Current Rating Chart
)	PEAK RECURRENT CURRENT 50 max. amp PEAK SURGE CURRENT: a For one-half cycle, sine wave
	For one or more cycles See Peak-Surge-Current Rating Chart CASE-TEMPERATURE RANGE: Operating and storage



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Work Data Division Somerville, N. J. 0ATA 6-61

1N1205A, 1N1205RA

Characteristics:

Maximum Forward	Voltage Drop ^b	,			0.55	volt
Maximum Reverse	Current ^b				1.25	ma
Maximum Thermal	Resistance:					
Junction-to-ca	ase				2	°C/watt

^a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

b At case temperature of 150 $^{\circ}$ C and maximum-rated voltage and average forward current.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types IN1199A and IN1199RA also apply to the IN1205A and IN1205RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

1N1206A, 1N1206RA

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

		Any
		ee Dimensional Outline
		JEDEC No.DO-4
		Metal
Terminal Diagrams {		
rennina Draurans (see Dimensional Oull	ine).

Type 1N1206A

Type 1N1206RA





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALE-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load
PEAK INVERSE VOLTAGE 600 max. volts TRANSIENT INVERSE VOLTAGE:
Non-repetitive, for duration of
5-milliseconds maximum 800 max. volts
RMS SUPPLY VOLTAGE
DC BLOCKING VOLTAGE 600 max. volts AVERAGE FORWARD CURRENT:
At case temperature of 150° C
At other case temperatures See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT 50 max. amp PEAK SURGE CURRENT: ª
For one-half cycle, sine wave
For one or more cycles See Peak-Surge-Current
Rating Chart
CASE-TEMPERATURE RANGE:
Operating and storage
Characteristics:
Maximum Forward Voltage Drop ^b 0.55 volt Maximum Reverse Current ^b 1 ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA 6-61

1N1206A, 1N1206RA

Maximum Thermal Resistance: Junction-to-case..., C. ... 2 ^oC/watt

- a Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
- Al case lemperature of 150° C and maximum-rated voltage and average forward current.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHARTS, and CURVES shown under Types INI199A and INI199RA also apply to the INI206A and INI206RA



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

1N1612, 1N1612R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position
Dimensions See Dimensional Outline
Dimensional Outline JEDEC No.DO-4
Case
Seals
Terminal Diagrams (See Dimensional Outline):



STUD



Type 1N1612R LUG

STUD

The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

	For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load
	PEAK INVERSE VOLTAGE
)	At case temperature of 135° C 5 max. amp At other case temperatures See Average-Forward-Current
	Rating Chart PEAK RECURRENT CURRENT. 15 max. amp CASE-TEMPERATURE RANGE: -65 to +175 90 Operating and storage -65 to +175 90
	Operating and storage65 to +175 °C Characteristics:
,	Maximum Forward Voltage Drop for dc forward amperes = 10, case temperature (^O C) = 25 . 1.5 volts Maximum Reverse Current: Dynamic (Averaged over one complete cycle for maximum peak-reverse volts = 50, dc
)	forward amperes = 5, case temperature (°C) = 150) ma Static (DC value for maximum peak-reverse
	volts = 50, case temperature ($^{\circ}$ C) = 25) . 0.01 ma



RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

DATA I 8-61

Somerville, N. J.

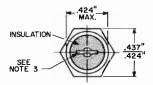
OPERATING CONSIDERATIONS

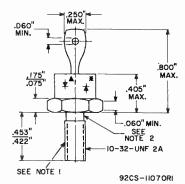
Because these rectifiers may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier.

The recommended installation torque is 15 to 2D inch-pounds applied to a 1D-32 UNF-2B hex nut assembled on stud thread.

The applied torque during installation should not exceed 25 inch-pounds.

JEDEC No.DO-4





NOTE I: NORMAL INSTALLATION TORQUE IS 15 TO 2D INCH-POUNDS APPLIED TO A 1D-32 UNF-28 HEX NUT ASSEMBLED ON STUD THREADS. UNDER NO CIRCUMSTANCES SHOULD THIS VALUE EXCEED 25 INCH-POUNDS.

NOTE 2: DIAMETER OF UNTHREADED PORTION: D.189" MAXIMUM, D.163" MINIMUM.

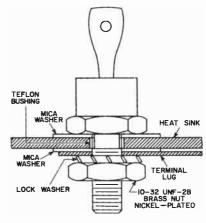
NOTE 3: ANGULAR ORIENTATION OF THIS TERMINAL UNDEFINED.

- Polarity symbol for types 1N1612, 1N1613, 1N1614, 1N1615, and 1N1616.
- * Polarity symbol for types 1N1612R, 1N1613R, 1N1614R, 1N1615R, and 1N1616R.



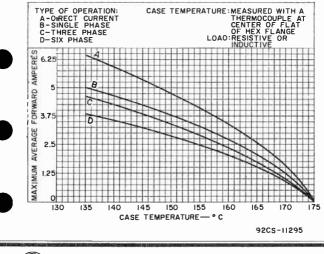
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Performance

SUGGESTED MOUNTING ARRANGEMENT



92CS-11072RI

AVERAGE-FORWARD-CURRENT RATING CHART

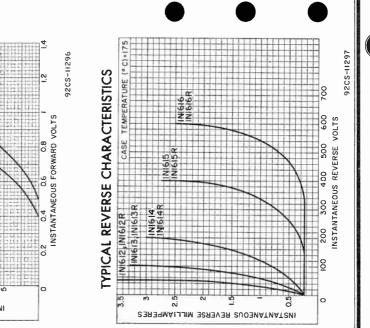


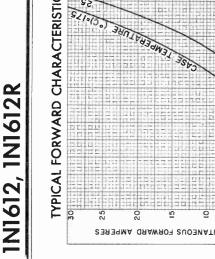


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INSTRUTANEOUS FORWARD AMPERES

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14 4 4 4 5 4 5 4 4 5 4 6 4 5 1 5 5 5 5 1 1 1 1 1 1

1N1613, 1N1613R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

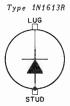
GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See	Dimensional Outline
Dimensional Outline	JEDEC No.DO-4
Case	Metal
Seals	Hermetic
Terminal Diagrams (See Dimensional Outlin	e):







The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load
	PEAK INVERSE VOLTAGE 100 max. volts RMS SUPPLY VOLTAGE
	DC BLOCKING VOLTAGE 100 max. volts AVERAGE FORWARD CURRENT:
)	At case temperature of 135 ^o C 5 max. amp At other case temperatures See Average-Forward-Current
	Rating Chart
	PEAK RECURRENT CURRENT
	Operating and storage
)	Characteristics: Maximum Forward Voltage Drop for dc forward amperes = 10, case temperature (°C) = 25. 1.5 volts Maximum Reverse Current:
	Dynamic (Averaged over one complete cycle for maximum peak-reverse volts = 100,
)	dc forward amperes = 5, case temperature (°C) = 150)
	volts = 100, case temperature (°C) = 25)



RADIO CORPORATION OF AMERICA

Somerville, N. J.

Semiconductor & Materials Division

DATA 8-61 OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES shown under Types INI612 and INI612R also apply to the INI613 and INI613R



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1N1614, 1N1614R

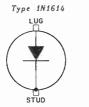
Silicon Rectifiers

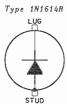
DIFFUSED-JUNCTION TYPES For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position.			Any
Dimensions		See	Dimensional Outline
Dimensional Outline			
Case			
Seals			
Terminal Diagrams (e Dime	ensional Outline):





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load						
FMS SUPPLY VOLTAGE. 140 DC BLOCKING VOLTAGE. 200	max. volts max. volts max. volts					
At other case temperatures See Average-For	max. amp ward-Current Rating Chart					
	max. amp					
Characteristics:						
Maximum Forward Voltage Drop for dc forward amperes = 10, case temperature (°C) = 25 . 1.5 Maximum Reverse Current: Dynamic (Averaged over one complete cycle	volts					
for maximum peak-reverse volts = 200, dc forward amperes = 5, case temperature (°C) = 150)	ma					
peak-reverse volts = 200, case temperature (°C) = 25)0.01	ma					



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES shown under Types INIGI2 and INIGI2R also apply to the INIG14 and INIG14R



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

1N1615, 1N1615R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position								
Dimensions See Dimensional Outline								
Dimensional Outline JEDEC No.DO-4								
Case								
Seals								
Terminal Diagrams (See Dimensional Outline):								





Type 1N1615R



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

Fur power-supply frequency of 60 cps, si operation, and with resistive or indi	
PEAK INVERSE VOLTAGE	400 max. volts 280 max. volts
DC BLOCKING VOLTAGE	400 max. volts
At case temperature of 135 ^o C	5 max. amp
At other case temperatures See Averag	
	Rating Chart
PEAK RECURRENT CURRENT	15 max. amp
Operating and storage	-65 to +175 °C
Characteristics:	
Maximum Forward Voltage Drop for dc forward amperes = 10, case temperature (°C) = 25.	1.5 volts
Maximum Reverse Current: Dynamic (Averaged over one complete cycle	
for maximum peak-reverse volts = 400,	
dc forward amperes = 5, case temperature $\binom{OC}{2}$ = 150)	1 ma
Static (DC value for maximum peak-reverse	
volts = 400, case temperature (^o C) = 25)	0.01 ma
- 201	0.01 110



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-61 OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES shown under Types INIG12 and INIG12R also apply to the INIG15 and INIG15R



1N1616, 1N1616R

Silicon Rectifiers

DIFFUSED-JUNCTION TYPES

For Industrial and Military Power Supplies

GENERAL DATA

Mechanical:

Operating Position	Any
Dimensions See	Dimensional Outline
Dimensional Outline	JEDEC No.DO-4
Case	
Seals	
Terminal Diagrams (See Dimensional Outline	e):

Type 1N1616 LUG

STUD



STUD

The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

For power-supply frequency of 60 cps, single-phase operation, and with resistive or inductive load	~.*
PEAK INVERSE VOLTAGE. 600 max. RMS SUPPLY VOLTAGE. 420 max. DC BLOCKING VOLTAGE 600 max. AVERAGE FORWARD CURRENT: 600 max.	volts volts volts
At case temperature of 135 ⁰ C 5 max. At other case temperatures See Average-Forward-Cu	amp rrent
Rating (PEAK RECURRENT CURRENT	Chart amp
Operating and storage65 to +175	oC
Maximum Reverse Current: Dynamic (Averaged over one complete cycle for maximum peak-reverse volts = 600,	volts
dc forward amperes = 5, case temperature (°C) = 150)	ma
volts = 600, case temperature ($^{\circ}$ C) = 25) . 0.01	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. World Radio History

DATA 8-61



OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES shown under Types INIGI2 and INIGI2R also apply to the INIGI6 and INIGI6R



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redict listory

Tunnel Diode

GERMANIUM TYPE

A Low-Current Type for Applications Employing Clock (Pulse-Repetition) Rates up to 100 Mc with Typical Switching Times of 2 Millimicroseconds or Less

GENERAL DATA

Mechanical:

Operating Position												Any
Maximun Överall Length.						•	•	•		•	• •	0.265"
Maximum Width												
Maximum Height												
Case.						•		•	Meta	1	and	Ceramic
Colored Dots for Device	de	ent	i fi	ca	-							

tion (See Dimensional Outline) Red and Gray Terminal Diagram (See Dimensional Outline):



the arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values;

INSTANTANEOUS FORWARD CURRENT	ma						
INSTANTANEOUS REVERSE CUFRENT	ma						
A: ambient temperature of 25° C 40 max. AMB:ENT-TEMPERATURE RANGE:	mw						
Operating	°C						
Storage	°C						
CASE TEMPERATURE: For immersion in molten solder for 10 seconds maximum	°C						
Electrical Characteristics:							
At ambient temperature of 25° C							
Min. Typical Max.							
Static: •							
Peak-Point Current p 4.75 5 5.25 Valley-Point Current v - 0.45 0.6	n i m~i						

Peak-Point-to-Valley-	. V		0.10	0.0	
Point Current Ratio	$ _{P}/ _{V}$	8/1	11/1	-	
Peak-Point Voltage	V _P	45	-	65	ΠV
Valley-Point Voltage	V'v	280	-	330	Γ·V
Positive Voltage at peak-	*				
point ma. = 5.25	Vci	445	-	485	nv



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA I 2-61 Total Series In

Total Series Re

Negative Resist

measured at inflection

Dynamic:* Terminal Valley Capacitance.

		Min.	Typical	Max.	
ynamıc:*					
erminal Valley-Point					
Capacitance	С	-	7	15	μµf
otal Series Inductance .	Lc		-	0.6	muh
otal Series Resistance .	Ls Rs	-	-	1.5	ohms
egative Resistance (-R _D)	2				
of Intrinsic Diode					

point of negative-				
resistance charac-				
teristicR _{Dm}	-	22	-	ohms
Dissipation with diode				
switched to its high-				
voltage state $(V = V_{F})$				
and I = Ip _{max}) P _{OPR} Rise Time	-	2.5		mw
Rise Time.	-	-	5	mµsec
Figure of Merit	-	0.33	-	ma/μμf

Derate linearly to 0 milliwatts at 150° C.

See accompanying Static-Porward-Characteristic diagram.

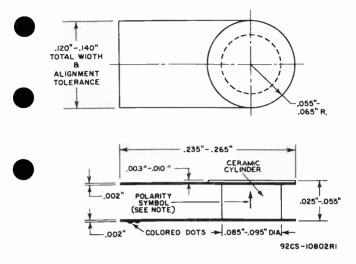
See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

At measured $\mathbf{I}_{\mathbf{V}}$ for individual diode and includes case capacitance of 0.3 µµ1.

The time required for the forward voltage to rise from vp + 0.1 (vr - vp) to vp + 0.9 (vr - vp). For 20 per cent overdrive (dc forward voltage and driving pulse provided by constant-current sources).



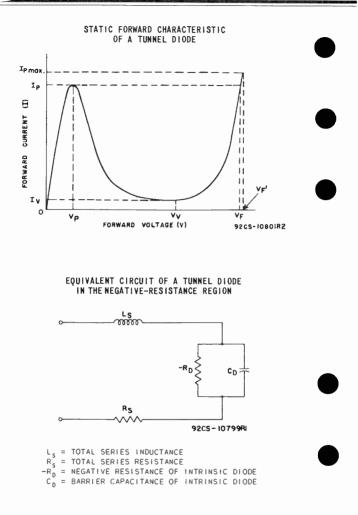




NOTE: ARROW INDICATES DIRECTION OF FORWARD CURRENT FLOW AS INDICATED BY DC AMMETER,



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Racio History DATA 2 2-61



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



Tunnel Diode

GERMANIUM TYPE

An Intermediate-Speed Type for Applications Employing Clock (Pulse-Repetition) Rates up to 500 Mc with Typical Switching Times of 1/2 Millimicrosecond or Less

GENERAL DATA

M	echanical:	
	perating Position	
N	aximum Överall Length 0.265"	
	aximum Width 0.140"	
N	aximum Height	
	ase	
	blored Dots for Device Identifica-	
	tion (See Dimensional Outline)	
) 1	errinal Diagram (See Dimensional Outline):	



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

interinger, need		i de la entre de		
INSTANTANEOUS FORWARD CURRENT	• • • •	• • •	100 max.	ma
INSTANTANEOUS REVERSE CURRENT DISSIPATION: *	• • •	• • •	200 max.	mЭ
At ambient temperature of 25° (AMBLENT-TEMPERATURE RANGE:	· · ·	• • •	40 max.	m₩
Operating				°C
Storage	•••	6	5 to +175	°C
For immersion in molten solder for 10 seconds maximum .			275 max.	°C
Electrical Characteristics:				
At ambient tempero	iture o	of 25° C		
	Min.	Typical	Max.	
Static: •				
Peak-Point Current IP	19	20	21	ma
Valley-Point Current		1.8	2.4	ма
Point Current Ratio 1p/ly	8/1	11/1	_	
Peak-Point Voltage Vp	65	-	90	m∀
Valley-Point Voltage V _V Positive Voltage at peak-	300	-	360	mv

valley-Fornt Current	1V		1.8	2.4
Peak-Point-to-Valley-				
Point Current Ratio	p/ly	8/1	11/1	
Peak-Point Voltage	Vp	65	-	90
Valley-Point Voltage	Vv	300	_	360
Positive Voltage at peak-	*			-
point ma. = Ž1	Vc'	500	_	550

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2- E- I

m.

	Min.	Typical	Max.	
Dynamic:*				
Terminal Valley-Point				
Capacitance		10	20	μμ f
Total Series Inductance . Ls	-		0.6	muh
Total Series Resistance . Rs	-	-	1.5	ohms
Negative Resistance (-R _D)				
of Intrinsic Diode				
measured at inflection				
point of negative-re-				
sistance characteristic -RDm		6	-	ohms
Dissipation with diode		0		•••••
switched to its high-				
voltage state (V = V_{F1}				
	_	12	_	mw
and I = IPmax)Popr Rise Timetr	_		2	mµsec
Figure of Merit	_	1	2	ma/μμf
rigure of merit P'Cmax	<	L	_	та и др

Derate linearly to 0 milliwatts at 150⁰ C.

See accompanying Static-Forward-Characteristic diagram.

See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

At measured by for individual diode and includes case capacitance of 0.3 $\mu\mu f.$

The time required for the forward voltage to rise from $V_P + 0.1(V_F - V_P)$ to $V_P + 0.9(V_F - V_P)$. For 20 per cent overdrive (dc forward voltage and driving pulse proviaed by constant-current sources).

DIMENSIONAL OUTLINE,

STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE,

and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type IN3128 also apply to the IN3129



Tunnel Diode

GERMANIUM TYPE

An Ultra-High-Speed Type for Applications Employing Clock (Pulse-Repetition) Rates up to 1000 Mc with Typical Switching Times of 1/5 Millimicrosecond or Less

GENERAL DATA

Operating Position		 	Any
Maximum Overall Length.		 	0.265"
Maximum Width			
Maximum height			
Case		Metal	and Ceramic
Colored Dots for Device	ldentifica-		

tion (See Dimensional Outline). Orange and Green Terminal Dingram (See Dimensional Outline):



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Naximum Values:

	max. m max. m	na Na
	m 1X. m	NW
Operating)С С
For immersion in molten solder	max. O	С

Electrical Characteristics:

Mechanical:

At ambient temperature of 25° C

Min.	Tubecal	Max.
<u>.</u>	Typical	лих.

Static:						
Peak-Point Current		IP	47.5	50	52.5	ma
Vailey-Point Current.		L _V	-	4.5	6	ma
Peak-Point-to-Valley-						
Point Current Ratio.	• •	$ _{P}/ _{V}$	8/1	11/1	-	
Peak-Point Voltage	• .	V _P	90	-	120	mv
Valley-Point Voltage.		V _v	350	-	430	mv-
Positive Voltage at pea	ak-					
point ma. = 52.5.		VE	540	_	600	m,

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA 2-61

Min. Typical Max.

Ċ		12	25	μµ f
L.s	-	-	0.6	πµh
	-	-	1.2	ohms
0				
-Rom	-	2.4		ohms
POPR	-	32		mw
tr	-	-	0.5	mµsec
lp/Cmax	-	2	-	ma/µµf
	L _S R _S -R _{Dm} POPR tr	L _S – R _S – -R _{Dm} – Popr – tr –	$\frac{L_{S}}{R_{S}} = \frac{1}{-}$ $-R_{Dm} = 2.4$ $\frac{P_{OPR}}{t_{r}} = \frac{32}{-}$	$L_{S} = - 0.6$ $R_{S} = - 1.2$ $-R_{D_{m}} = 2.4$ - $P_{OPR} = - 32$ - $t_{r} = - 0.5$

Derate linearly to 0 milliwatts at 150° C.

See accompanying Static-Porward-Characteristic diagram.

Sec accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

At measured by for individual diode and includes case capacitance of 0.3 $\mu\mu$ f.

The time required for the forward voltage to rise from VP + 0.1 (VF-VP) to VP + 0.9 (VF-VP). For 20 per cent overdrive (dc forward voltage and driving pulse provided by constant-current sources).

DIMENSIONAL OUTLINE,

STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE,

and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type IN3128 also apply to the IN3130



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Tunnel Diode

GALLIUM-ARSENIDE TYPE

A High-Speed Type for Use as a Switching Device in Digital-Pulse Circuits and Memory Matrices, and in Other Applica-tions Requiring Switching Times of 1/2 Millimicrosecond or Less and Clock (Pulse-Repetition) Rates up to 1000 Mc

GENERAL DATA

Mechanical:

Operating Position											Any
Maximum Överall Length.											
Maximum Width											0.140"
Maximum deight											0.055"
Case								Met	al	and	Ceramic
Colored Dots for Device	Ide	nt	i f	ica	(

tion (See Dimensional Outline). . . .

. Yellow and Black Terminal Diagram (See Dimensional Outline):



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

INSTANTANEOUS FORWARD CURRENT .					100 max.	ma
INSTANTANEOUS REVERSE CURRENT .					200 max.	ma
DISSIPATION: A						
At ambient temperature of 25 ⁰	'С				75 max.	mw
AMBIENT-TEMPERATURE RANGE:						
Operating					-65 to +150	°C
Storage					-65 to +175	°C
CASE TEMPERATURE :						
For immersion in molten						
solder for 10 seconds maximum	1.				275 max.	0C
Electrical Characteristics						

Electrical Characteristics:

At ambient temperature of 25° C

Min. Typical Nax.

Static:							
Peak-Point Current			Ιp	47.5	50	52.5	ma
Valley-Point Current.			1	-	2.5	3.5	ma
Peak-Point-to-Valley-			,				
Point Current Ratio			I _P /I _V	13/1	20/1		
Peak-Point Voltage.			VP	120	-	260	mγ
Valley-Point Voltage.			Vv	510	-	620	mγ

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

1N3138

	Mın.	Typical	Max.		
Positive Voltage at peak- point ma. = 52.5 V _F ,	1100	-	1400	m∨	
Dynamic:*					· ·
Terminal Valley-Point Capacitance♥C Total Series Inductance L _S Total Series Resistance R _S Negative Resistance (-R _D) of Intrinsic Diode	- - -	10 	30 0.6 2.6	μμf mµh ohms	
measured at inflection point of negative-re- sistance characteristic -R _{Dm} Dissipation with diode switched to its high-		2.6	-	ohms	
voltage state (V = V _F , and I = _{Pmax})P _{OPR} Rise Timet _r Figure of MeritI _P /2C _{max}	-	73 	2	mw mµsec ma/µµf	

▲ Derate linearly to D milliwatts at 150⁰ C.

See accompanying Static-Porward-Characteristic diagram.

See accompanying Equivalent Circuit of a Tunnel Diode in the Negative-Resistance Region.

At measured by for individual diode and includes case capacitance of 0.3 $\mu\mu f$.

The time required for the forward voltage to rise from v_P + 0.1(v_F – v_P) to v_P + 0.9(v_F – v_P). For 20 per cent overarive (ac forward voltage and driving pulse provided by constant-current sources).

DIMENSIONAL OUTLINE,

STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE,

and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type IN3128 also apply to the IN3138



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Silicon Rectifier

DIFFUSED-JUNCTION TYPE For Industrial and Consumer-Product Applications See also insulated-Version Type IN3253

GENERAL DATA

Mechanical:

Operating Position		
Maximum Length (Excluding	flexible leads)	0.405"
Maximum Diameter		0.240"
Case		Metal
Seals		Hermetic
Leads, Elexible		2
Minimum length		1.4"
Diameter		
Orientation	See	Dimensional Outline
Terminal Diagram:		



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

	For resistive or inductive load		acitıve- filter	
PEAK INVERSE VOLTAGE. RMS SUPPLY VOLTAGE . FORWARD CURRENT: *	200 max. 140 max.		max. max.	volts volts
DC Peak recurrent Surge, for "turn- on" time of	750 max. -	* · ·	max. max.	ma amp
2 milliseconds . AMB!ENT_TEMPERATURE RANGE:	_	35	max.	amp
Operating Storage	-65 to -65 to			°င



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

LEAD TEMPERATURE: For 10 seconds maximum	oC
Characteristics:	
At ambient temperature of 25° C	
Minimum Instantaneous Forward Voltage Drop at dc forward amperes = 0.5 1.2 Maximum Reverse Current at maximum	volts
peak inverse voltage 10	<i>µ</i> а
^a At ambient temperatures up to 75 ^o C. At ambient temperatures about the contract of th	ove 75° C

see Rating Chart.

OPERATING CONSIDERATIONS

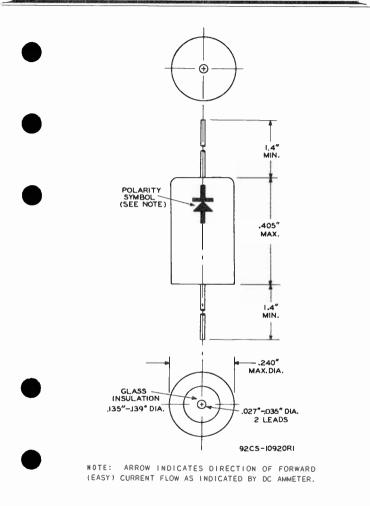
A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the powertransformer windings, or by an external resistor or choke.

The flexible leads of this rectifier are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifier between the case and the soldering point with a pair of pliers.

When dip soldering is employed in the assembly of printed circuitry using this rectifier, the leads should not be dip soldered within 0.5" of the metal case.

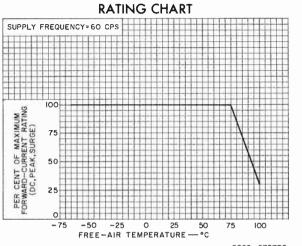
Because the case of this rectifier may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier. It is recommended that this rectifier be mounted on the underside of the chassis.





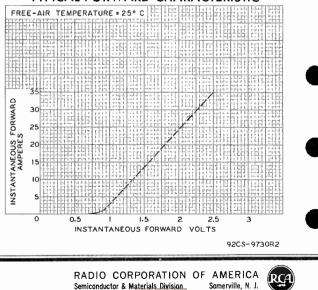


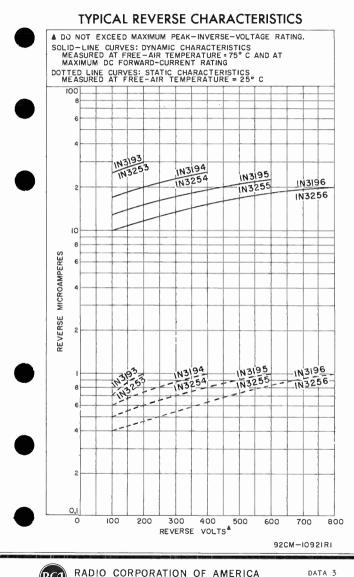
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Padlo History DATA 2 8-6!



92CS-9727R2







Semiconductor & Materials Division

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Somerville, N. J.

DATA 3 8-61

World Radio History

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

Mechanical:

. Any 0.405"
0.240"
Metal
rmetic
2
1.4"
0.035"
utline
(



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

	For resistive or inductive load		acitıve- filter	
PEAK INVERSE VOLTAGE.	200 max.	200	max.	volts
RMS SUPPLY VOLTAGE . FORWARD CURRENT: ^a	140 max.	70	max.	volts
DC	750 max.	500	max.	ma
Peak recurrent	-	6	max.	amp
Sarge, for "turn- on" time of				
2 milliseconds .	-	35	max.	атр
AMBIENT-TEMPERATURE RANGE:				
Cperating	-65 to	+100		00
Storage	-65 to	+175		°C
For 10 seconds maximum	255 r	max.		°C

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Characteristics:

At ambient temperature of 25° C

Mi	nimum Instantaneous Forward Voltage	
	Drop at dc forward amperes = 0.5	volts
	iximum Reverse Current at maximum	
	peak inverse voltage 10	μa
а	At ambient temperatures up to 75° C. At ambient temperatures above see Rating Chart.	75 ⁰ C

OPERATING CONSIDERATIONS

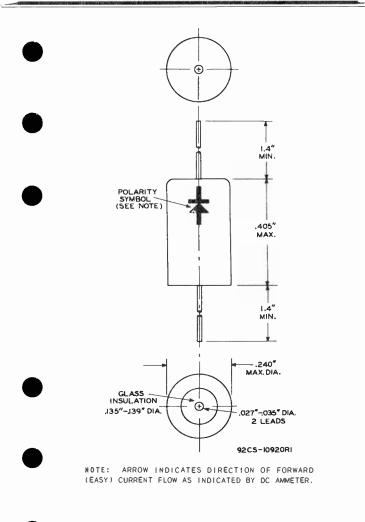
A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the powertransformer windings, or by an external resistor or choke.

The flexible leads of this rectifier are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifier between the case and the soldering point with a pair of pliers.

When dip soldering is employed in the assembly of printed circuitry using this rectifier, the leads should not be dip soldered within 0.5" of the metal case.

Because the case of this rectifier may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier. It is recommended that this rectifier be mounted on the underside of the chassis.





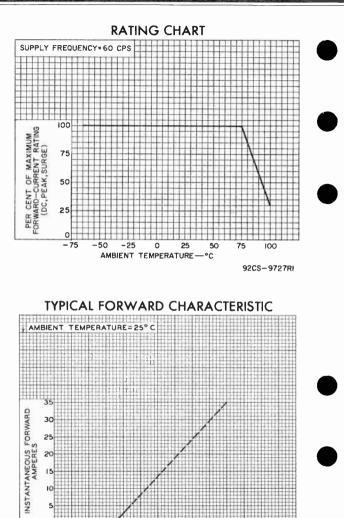


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 6-61

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з INSTANTANEOUS FORWARD VOLTS 92CS-9730

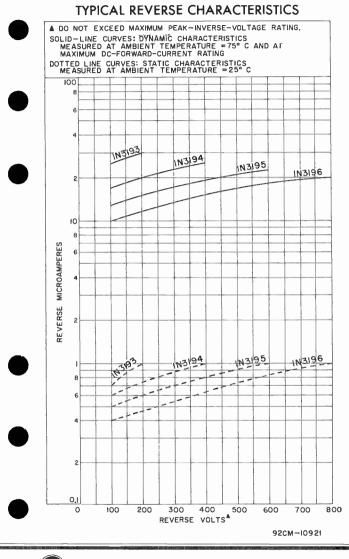
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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

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Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA Somerville, N. J. World Radio History

DATA 3 6-61

World Radio History

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications See also Insulated-Version Type 1N3254

GENERAL DATA

Mechanical:

Maximum Length (E>	۲C	uc	lin	g	fl	e>	cit))	e 1	lea	ads	;)	
Maximum Diameter.													0.240"
Case													Metal
Seals													Hermetic
Leads, Flexible .													2
Minimum length.													1.4"
Diameter													. 0.027" to 0.035"
Orientation											Se	e	Dimensional Outline
Terminal Diagram:													



The arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

	For resi inducti	stive or ve load		acitive- filter	
PEAK INVERSE VOLTAGE. RMS SUPPLY VOLTAGE.		max. max.		max. max.	volts volts
FORWARD CURRENT: ^a DC		max.		max. max.	ma amp
Surge, for "turn- on" time of 2					Camp
milliseconds AMBIENT-TEMPERATURE RANGE:		-	35	max.	amp
Operating Storage			o +100 o +175		°C



RADIO CORPORATION OF AMERICA Semiconductor & Materials, <u>Division</u>, Somerville, N. J. DATA I 8-61

LEAD TEMPERATURE: For 10 seconds maximum	°C
Characteristics:	
At ambient temperature of 25°C	•
Minimum Instantaneous Forward Voltage Drop at dc forward amperes = 0.5 1.2 Maximum Reverse Current at maximum	volts
peak inverse voltage 10	μа
${\bf a}$ At ambient temperatures up to 75° C. At ambient Lemperatures abo see Rating Chart.	ve 750 C

OPERATING CONSIDERATIONS

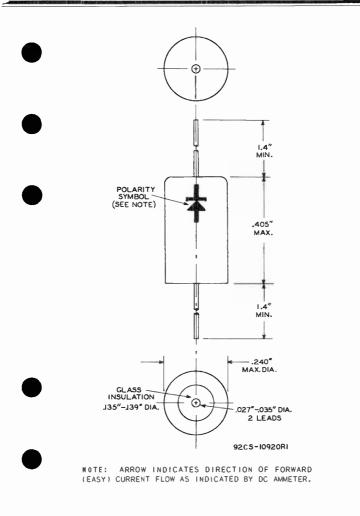
A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the powertransformer windings, or by an external resistor or choke.

The flexible leads of this transistor are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifier between the case and the soldering point with a pair of pliers.

When dip soldering is employed in the assembly of printed circuitry using this rectifier, the leads should not be dip soldered within 0.5" of the metal case.

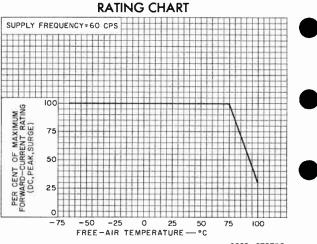
Because the case of this rectifier may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier. It is recommended that this rectifier be mounted on the underside of the chassis.





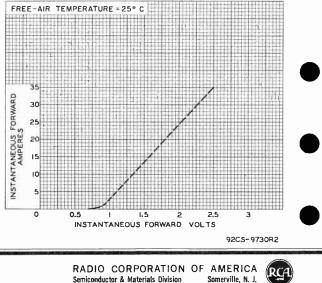


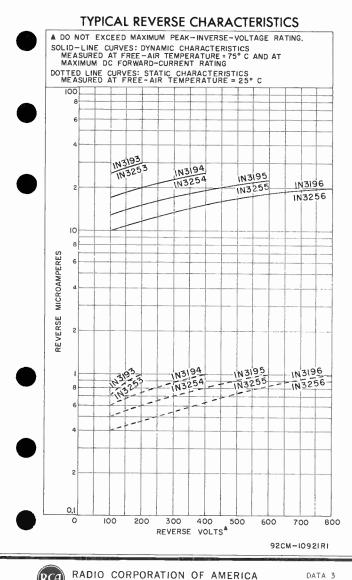
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Recto History CATA 2 8-61



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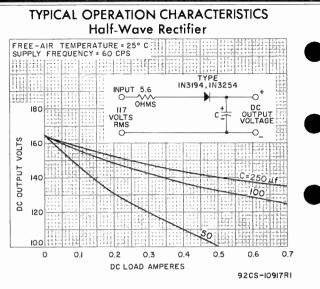




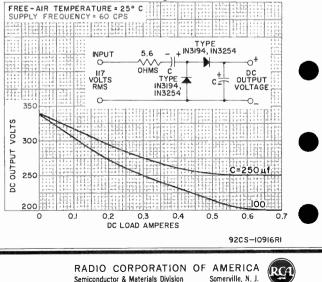
Semiconductor & Materials Division

World Radio History

Somerville, N. J.

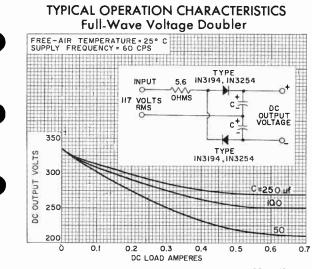




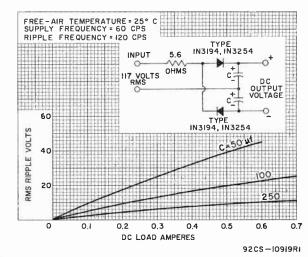


Vorld Radio History

1N3194



⁹²CS-10918R1





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

World Radio History

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

Mechanical:

Maximum Length (Excluding flex	Any xible leads) 0.405"
	0.240"
Case	Metal
Seals	
	1.4"
	••••••••••••••••••••••••••••••••••••••
Orientation	See Dimensional Outline



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

		For resistive or inductive load		acıtive- filter	
	PEAK INVERSE VOLTAGE.	400 max.	400	max.	volts
	RMS SUPPLY VOLTAGE FORWARD CURRENT: ^a	280 max.	140	max.	volts
	DC	750 max.	500	max.	ma
	Peak recurrent	-	6	max.	атр
	Surge, for "turn- on" time of 2 milliseconds AMBIENT-TEMPERATURE RANGE:	-	35	max.	amp
	Operating	-65 to -	+100		°C
-	Storage LEAD TEMPERATURE: For 10 seconds	-65 to -			٥Č
	maximum	255 ma	ax.		°C

a At ambient temperatures up to 75° C. At ambient temperatures above 75° C see Rating Chart.

Characteristics:

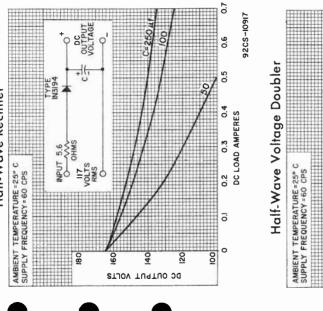
At ambient temperature of 25°C		
Maximum Instantaneous Forward Voltage		
Drop at dc forward amperes = 0.5,	1.2	volts
Maximum Reverse Current at maximum		
peak inverse voltage	10	μa

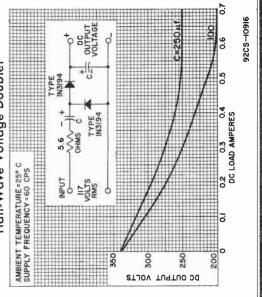
OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE. RATING CHART, TYPICAL-FORWARD-CHARACTERISTIC CURVE, and TYPICAL-REVERSE-CHARACTERISTICS CURVE (Given on multitype curve sheet) shown under Type 183193 also apply to the 183194











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CORPORATION

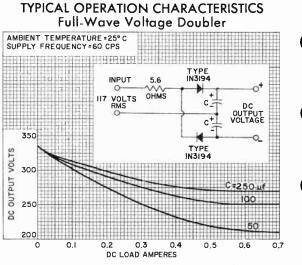
RADIO

RGA

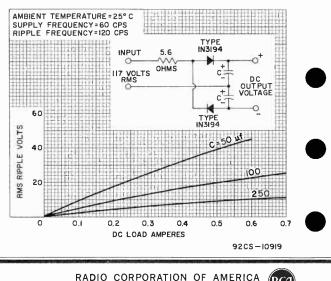
Semiconductor & Materials Division

Somerville, N.

DATA



92CS-10918



Semiconductor & Materials Division

Somerville, N. J.

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications See also Insulated-Version Type IN3255

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding fl	lexible leads)	0.405"
Maximum Diameter		0.240"
Case		Metal
Seals		Hermetic
Leads, Flexible		
Minimum length		1.4"
Diameter		. 0.027" to 0.035"
Orientation ,	See	Dimensional Outline



the arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

For power-supply frequency of 60 cps

		For resistive or inductive load	For capac input f	
	PEAK INVERSE VOLTAGE. RMS SUPPLY VOLTAGE . FORWARD CURRENT: ^a	600 max. 420 max.	600 m 210 m	
_	DC	750 max.	500 m 6 m	
	Surge, for "turn- on" time of 2 milliseconds . AMBIENT-TEMPERATURE	-	35 m	ax. amp
	RANGE: Operating Storage	-65 to -65 to		°C



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J.

1N3195

LEAD TEMPERATURE: For 10 seconds maximum	
Characteristics:	
At ambient temperature of 25°C	
Minimum Instantaneous Forward Voltage Drop at dc forward amperes = 0.5 1.2 volts Maximum Reverse Current at maximum peak inverse voltage 10 μa	
^a At ambient temperatures up to 75° C. At ambient temperatures above 75° C see Rating Chart.	

OPERATING CONSIDERATIONS

A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the powertransformer windings, or by an external resistor or choke.

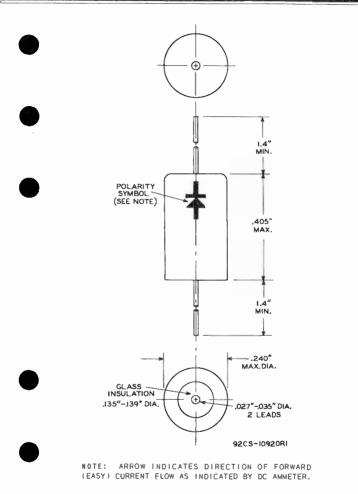
The flexible leads of this transistor are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifier between the case and the soldering point with a pair of pliers.

When dip soldering is employed in the assembly of printed circuitry using this rectifier, the leads should not be dip soldered within $0.5^{\prime\prime}$ of the metal case.

Because the case of this rectifier may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier. It is recommended that this rectifier be mounted on the underside of the chassis.

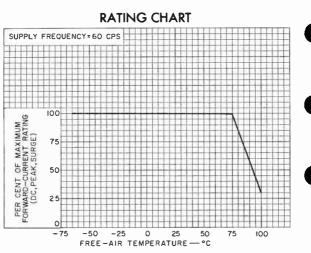








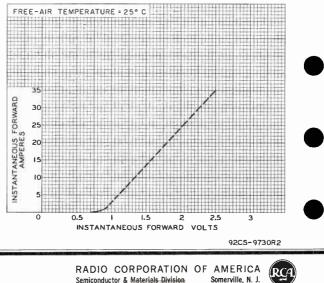
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J.

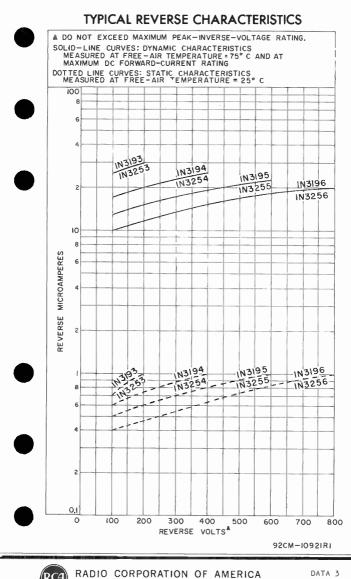


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Semiconductor & Materials Division

DATA 3 8-61

Somerville, N. J.

World Radio History

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

Mechanical:

	Operating Position Maximum Length (Excluding	fl€	exible	e leads)	0.405"
	Maximum Diameter				0.240"
1	Case				Metal
	Seals				Hermetic
	Leads, Flexible				2
	Minimum length				1.4"
	Diameter				. 0.027" to 0.035"
	Orientation			See	Dimensional Outline



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

			stive or ve load	r Forcap input	acitive- filter	
📃 РЕАК	INVERSE VOLTAGE	. 600	max.	600	max.	volts
	SUPPLY VOLTAGE. ARD CURRENT: ^a	. 420	max.	210	max.	volts
DC		. 750	max.	500	max.	ma
Su	ak recurrent rge, for "turn-on		-	6	max.	amp
AMB1	time of 2 milli- seconds ENT-TEMPERATURE		-	35	max.	amp
0p St	NGE: erating orage			to +100 to +175		°C °C
Fo	TEMPERATURE: r 10 seconds ximum	•	255	max.		°C

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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History DATA 6-6 J

1N3195

Characteristics:

At ambient temperature of 25° C Maximum Instantaneous Forward Voltage Drop at dc forward amperes = 0.5. . 1.2 volts Maximum Reverse Current at maximum peak inverse voltage. 10 μa

 ${\bf a}$ At ambient temperatures up to 75 $^{\rm O}$ C. At ambient temperatures above 75 $^{\rm O}$ C see Rating Chart.

OPERATING CONSIDERATIONS. DIMENSIONAL OUTLINE. RATING CHART. TYPICAL-FORWARD-CHARACTERISTIC CURVE. and TYPICAL-REVERSE-CHARACTERISTICS CURVE (Given on multitype curve sheet) shown under Type IN3193 also apply to the IN3195



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DIFFUSED-JUNCTION TYPE For Industrial and Consumer-Product Applications See also Insulated-Version Type 1N3256

GENERAL DATA

Mechanical:

Operating Position		Any
Maximum Length (Excluding	flexible leads)	0.405"
Maximum Diameter		0.240"
Case		Metal
Seals		Hermetic
Leads, Flexible		2
Minimum length		1.4"
Diameter		. 0.027" to 0.035"
Orientation	See	Dimensional Outline
Terminal Diagram:		



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.



Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps

			tive o e load		acitive- filter	
)	PEAK INVERSE VOLTAGE. RMS SUPPLY VOLTAGE. FORWARD CURRENT: ª	800 m 560 m		4	max. ™ax.	volts volts
•	DC	500 m -	ax.		max. max.	em qms
	on" time of 2 milliseconds AMBIENT-TEMPERATURE RANGE:			35	max.	amp
,	Operating Storage			+100 +175		°C °C



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

CAD TOUDOOUTUOO

For 10 seconds	. 255	max.	°C
Characteristics:			
At a	mbient temperature	of 25° C	
Minimum Instantaneo	LE Forward Voltage		

	Drop at dc forward amperes = 0.5. aximum Reverse Current at maximum						1.2	volts
	peak inverse voltage						10	μa
a	At ambient temperatures up to 75 ⁰ C. At am see Rating Chart.	bien	t ter	npe	rat	ures	above	75 ⁰ C

OPERATING CONSIDERATIONS

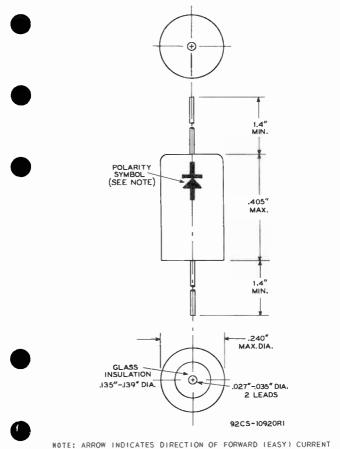
A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the power transformer windings, or by an external resistor or choke.

The flexible leads of this rectifier are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifiers. between the case and the soldering point with a pair of pliers.

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Because the case of this rectifier may operate at voltages which are dangerous, care should be taken in the design of equipment to prevent the operator from coming in contact with the rectifier. It is recommended that this rectifier be mounted on the underside of the chassis.

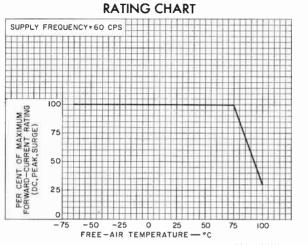




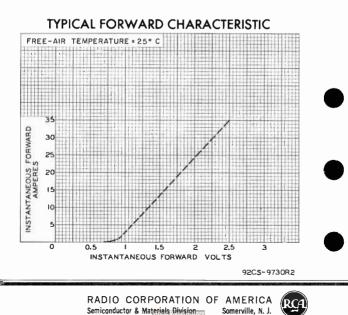
FLOW AS INDICATED BY DC AMMETER.

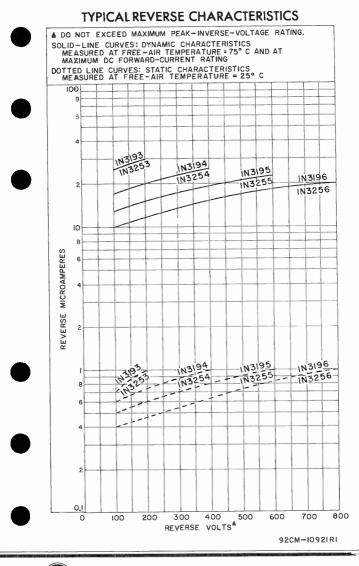


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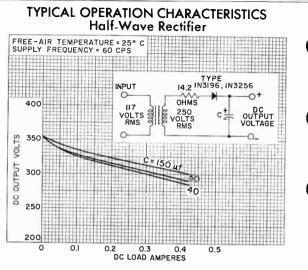






Somerville, N. J.

DATA 3 8-61



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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redicivition

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

Mechanical:

Operating Position	 		 	Any
- Maximum Length (Exclud				
Maximum Diameter	 		 	0.240"
Case	 		 	Metal
Seals				
Leads, Flexible	 		 	2
Minimum length	 		 	1.4"
Diameter				
Orientation	 	• •	 See	Dimensional Outline
Terminal Diagram:				



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

For tower-supply frequency of 60 cbs

	For resistive or inductive load		acıtive- filter	
PEAK INVERSE VOLTAGE		800	max.	volts
RMS SUPPLY VOLTAGE. FORWARD CURRENT: *	. 560 max.	280	max.	volts
DC		400	max.	ma
Peak recurrent	. –	5	max.	amp
Surge, for "turn- on" time of 2				
milliseconds	. –	35	max.	amp
RANGE:				
Operating	65 to	+100		°C
Storage	. –65 to	+175		oC
For 10 seconds				
maximum	. 255 n	nax.		оС

 $^{\rm a}$ At ambient temperatures up to $75^{\rm O}$ C. At ambient lemperatures above $75^{\rm O}$ C see Rating Chart.



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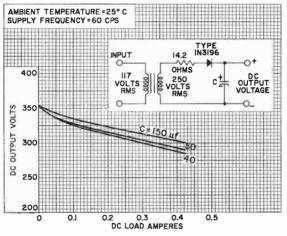
1N3196

Characteristics:

At ambient temperature of 250	С			_
Maximum Instantaneous Forward Voltage Drop				
at dc forward amperes = 0.4		1.2	volts	•
Maximum Reverse Current at maximum				
peak inverse voltage	• •	10	μa	

OPERATING CONSIDERATIONS. DIMENSIONAL OUTLINE, RATING CHART, TYPICAL-FORWARD-CHARACTERISTIC CURVE. and TYPICAL-REVERSE-CHARACTERISTICS CURVE (Given on multitype curve sheet) shown under Type IN3193 also apply to the IN3196

TYPICAL OPERATION CHARACTERISTICS Half-Wave Rectifier



92CS-10915

Somerville, N. J.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications See also Uninsulated-Version Type 1N3193

The 1N3253 is the same as the 1N3103 except for the following items: Mechanical:

Case. Metal with Insulating Sleeve^a

1N3254

Silicon Rectifier

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications See also Uninsulated-Version Type 1N3194

The 1N3254 is the same as the 1N3194 except for the following items:

Mechanical:

Case. Metal with Insulating Sleeve^a

1N3255

Silicon Rectifier

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

See also Uninsulated-Version Type IN3195

The 1N3255 is the same as the 1N3195 except for the following items: Mechanica!:

Case. Metal with Insulating Sleeve*

The maximum diameter of the metal case with insulating sleeve is 0.240*. The specifications of the insulating sleeve are: material, plastic; wall thickness, 0.002°; dielectric strength, 4500 volts/mil at 250 C, 3150 volts/mil at 150° C; moisture absorption, 0.3% (surface resistivity is not affected by moisture); degree of transparency, optically clear.



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DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications See also Uninsulated-Version Type 1N3196

The 1N3256 is the same as the 1N3196 except for the following items:

Mechanical:

Case. Metal with Insulating Sleeve^a

a The maximum diameter of the metal case with insulating sleeve is 0.240*. The specifications of the insulating sleeve are; material, plastic; wall thickness, 0.002*; dielectric strength, 4500 volts/mil at 25° C, 3150 volts/mil at 150° C; moisture absorption, 0.3¥ (surface resistivity is not affected by moisture); degree of transparency, optically clear.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Silicon Rectifier

DIFFUSED-JUNCTION TYPE For Industrial and Consumer-Product Applications

GENERAL DATA

Mechanical:

Dimensions. Similar to Outline TO-1 in General Section except that lead 3 is omitted Terminal Diagram: BOTTOM VIEW

Lead 1 - Cathode



Lead 2 - Anode

The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALE-WAVE RECTIFIER

Maximum and Minimum Ratings. Absolute-Maximum Values:

For power-supply frequency of 60 cps and for capacitor-input filter 100 max. volts RMS SUPPLY VOLTAGE. 35 max. volts . FORWARD CURRENT: DC. 125 max. ma Peak recurrent. . . . 1.3 max. amp Surge, for "turn-on" time of 2 milliseconds . . . 30 max. amp FREE-AIR TEMPERATURE RANGE: °C Operating -65 to +100 . ٥ř -65 to +175 Storage LEAD TEMPERATURE : 00 Characteristics: At free-air temperature of 25° C unless otherwise specified Maximum Instantaneous Forward Voltage Drop at dc forward ma. = 125. . . . 1 volt Maximum Reverse Current: Static value at maximum-rated peak reverse voltage, forward ma. = 0, free-air temperature of 25° C. 0.005 ma Dynamic value at maximum-rated peak reverse voltage, maximum-rated dc forward current, free-air temperature of 65° C 0.3 ma At free-air temperatures up to 65 $^{\rm O}$ C. At free-air temperatures above 65 $^{\rm O}$ C, see Rating Chart.





OPERATING CONSIDERATIONS

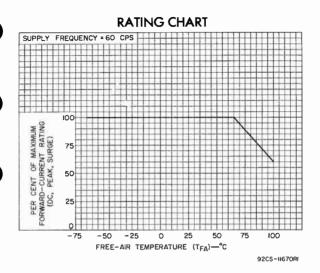
A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the powertransformer windings, or by an external resistor or choke.

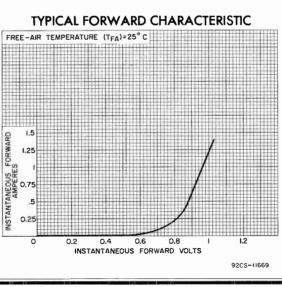
The flexible leads of this transistor are usually soldered to the circuit elements. It is desirable in all soldering operations to provide some slack or an expansion elbow in the leads to prevent excessive tension on the leads. It is important during the soldering operation to avoid excessive heat in order to prevent possible damage to the rectifier. To absorb some of the heat, grip the flexible lead of the rectifier between the case and the soldering point with a pair of pliers.

When dip soldering is employed in the assembly of printed circuitry using this rectifier, the leads should not be dip soldered within 0.25" of the metal case.



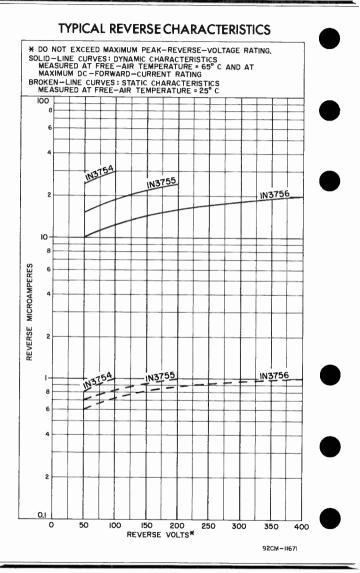








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Silicon Rectifier

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

The 1H3755 is the same as the 1H3754 except for the following items:

HALF-WAVE RECTIFIER

Maximum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps and for capacitor-input filter

PEAK REVERSE VOLTAGE.							ax. vo	
RMS SUPPLY VOLTAGE							ax. vo	olts





World Radio History

Silicon Rectifier

DIFFUSED-JUNCTION TYPE

For Industrial and Consumer-Product Applications

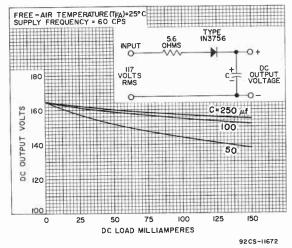
The 1N3756 is the same as the 1N3754 except for the following items:

HALF-WAVE RECTIFIER

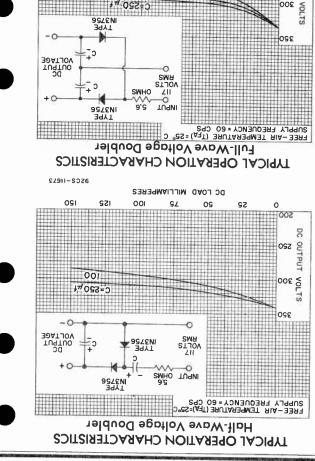
Maximum Ratings, Absolute-Maximum Values:

		power for														
PEAK REVERSE RMS SUPPLY V	VOLT	AGE.	•	:	:	:	:	•	:	•	•	:	•	400 140	max. max.	volts volt s

TYPICAL OPERATION CHARACTERISTICS Half-Wave Rectifier







92CS-11674



200

osz

DC LOAD MILLIAMPERES

OGI

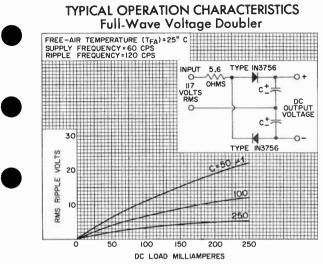
001

09

500

200

8 520 OUTPUT



92CS-11675



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

World Radio History

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±10%) of Peak-Point Current and Switching Times Greater than 1800 Picoseconds

GENERAL DATA

Mec	haniq	al:																					
Ope	ratir	ng Pos	iti	on																			Any
																							0.270"
																							0.130"
																							0.055"
																		Me	eta	ı l	ar	١d	Ceramic
Ter	mīnal	Diag	ran	ı (Se	e	Dı	i me	en:	sic	no	i l	01	it l	in	1 e]	:						



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum	Ratings,	Absolute-Maximu	m Values:
DC CURRENT:			
Forward			10 max. ma
Reverse		I _R	15 max. ma
DISSIPATION:		P	
At free-air tempe			
		Derate linearly	to o mw at 100°C
FREE-AIR TEMPERATUR		_	
Operating			
Storage		T _{STG}	-35 to 100 °C
TAB TEMPERATURE: 4		_	
For 3 seconds max	imum	I _T	175 max. ^о С
Electrical Characte	ristics:		

At	free-air	temperature	=	250	С	
----	----------	-------------	---	-----	---	--

	<i>g</i> ın.	Iypical	max.	
Static: ^b Peak-Point Current I _P Valley-Point Current I _V Peak-Point-to-Valley-	4.5	-	5.5 0.75	ma ma
Point Current Ratio Ip/Iv	6/1	-	-	
Positive Voltage at peak- point ma. = 5.5	430	_	590	mγ

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inal

fin. Typical	Max.
--------------	------

Dynamic: C						
Terminal Valley-Point						
Capacitance ^d	С	_	-	25	pf	
Total Series Resistance	R _c	-	-	3	ohms	
Switching Time:	5					
Rise time ^e	t_	-	1800	_	psec	
a See Soldering Considerations.	ľ					

J

^b See accompanying Static-Forward-Characteristic graph.

^C See accompanying Bauivalent Circuit of a Tunnel Diode in the Wegative-Resistance Region.

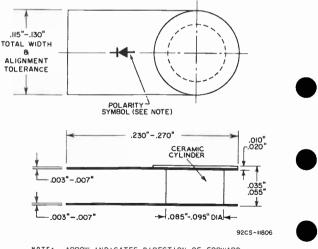
d Includes case capacitance of 0.8 pf.

 $^{\rm C}$ Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to VF at a constant value of Lp.



SOLDERING CONSIDERATIONS

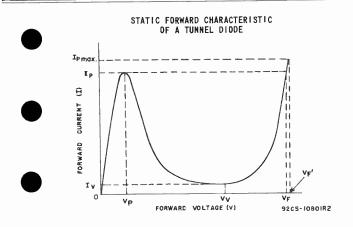
A low-temperature solder, (such as Alpha #111 alloy, rosinfilled, or equivalent) should be used. To minimize soldering time, a pre-tinned circuit board should be used. To protect the junction against overheating, the tunnel diode should be held with long-nose pliers.



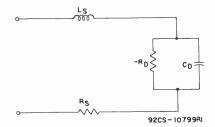
NOTE: ARROW INDICATES DIRECTION OF FORWARD CURRENT FLOW AS INDICATED BY DC AMMETER.







EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION





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World Radio History

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (± 10%) of Peak-Point Current and Switching Times Greater than 900 Picoseconds

GENERAL DATA

	Mechanical:
)	Operating Position
	Maximum Överall Length 0.270"
	Maximum Width 0.130"
	Maximum Height
	Case
	Terminal Diagram (See Dimensional Outline):



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum	Ratings, Absolut	e-Naximum Values:
DC CURRENT:		
Forward		l _F 18 max. ma
Reverse		I _R 25 max. ma
DISSIPATION:		P
At free-air tempe		
From -35° to 25	°C	10 max. mw
		linearly too mwat 100° C
FREE-AIR TEMPERATUR	E RANGE:	.
Operating		
		T _{STG} -35 to 100 °C
TAB TEMPERATURE: ^a		<u></u>
For 3 seconds max	imum	T _T 175 max. ^O C

Electrical Characteristics:

At free-air temperature = 25° C

Nin. Typical Max.

Static: "				
Peak-Point Current	9	-	11	ma
Valley-Point Current Iv	-	-	1.5	ma
Peak-Point-to-Valley-Point				
Current Ratio	6/1	-	-	
Positive Voltage at peak-point				
ma. = 11 V _F '	440	-	600	mν

Min. Typical Max.

Dy			

Terminal Valley-Point									1
Capacitance ^d				С	_		25	pf	
Total Series Resistance				Rs	_	-	2.5	ohms	
Switching Time:				-					
Rise time ^e				tr	-	900	-	psec	
a See Soldering Consideration	ons.								
b See accompanying Static-Po	07 WG9	d-1	Cha	racter	istic gr	aph.			

- See accompanying Equivalent Circuit of a Funnel Diode in the Wegative-Resistance Region. d
- includes case capacitance of 0.8 pf. e
- Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to Vr at a constant value of Ip.

$$t_{\Gamma} \simeq \frac{C(V_{\Gamma} \sim V_{P})}{(I_{P} - I_{V})} \simeq \frac{C}{2 I_{P}}$$

SOLDERING CONSIDERATIONS. DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE,

and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type 1N3847 also apply to the 1N3848



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±10%) of Peak-Point Current and Switching Times Greater than 600 Picoseconds

GENERAL DATA

	Mechanical:
,	Operating Position
	Maximum Överall Length 0.270"
	Maximum Width
	Maximum Height
	Case
	Terminal Diagram (See Dimensional Outline):



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Naximum Values:	
Reverse I _R 50 max. DISSIPATION:	ma ma
At free-air temperatures: From -35° to 25° C	mw C
Operating \dots Toperating \dots Toperating -35 to 100 Storage \dots Toperation Toperation T_{STG} and -35 to 100 TAB TEMPERATURE: ^a	°C °C
For 3 seconds maximum T _T 175 max.	°C
Electrical Characteristics:	
At free-air temperature = 25° C	
Min. Typical Max.	
Static: b	
Peak-Point Current I_P 18 - 22 Valley-Point Current I_V 3	та та
Peak-Point-to-Valley- Point Current Ratio Ip/ly 6/1 Positive Voltage at peak-	
point ma. = 22 V _E , 460 - 620	mν

	min.	lypical	Max.	
Dynamic: ^C				
Terminal Valley-Point				
Capacitance ^d C	_	-	30	pf
Total Series Resistance . Rs	-	-	2	ohms
Switching Time:				
Rise time ^e t _r	-	600	-	psec
a see Soldering Considerations.				
b See accompanying Static-Porward-Charact	eristic	oranh		

^C See accompanying Bquivalent Circuit of a Tunnel Diode in the Negative-Resistance Region.

Includes case capacitance of 0.8 pf.

Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to VF at a constant value of Ip.



SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3849



GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±10%) of Peak-Point Current and Switching Times Greater than 350 Picoseconds

GENERAL DATA

Mechanical:	
Operating Position	
Maximum Överal) Length 0.270"	
Maximum Width	
Maximum Height	
Case	
Terminal Diagram (See Dimensional Outline):	



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values: DC CURRENT: Forward . . . ۱_F 85 max. ma Reverse R 125 max. ma DISSIPATION: At free-air temperatures: From -35° to 25° C. . . 50 max. mw Above 25° C Derate linearly to o mw at 100° C FREE-AIR TEMPERATURE RANGE: °C T_{OPR} -35 to 100 Operating °C Storage . . . TSTG -35 to 100 TAB TEMPERATURE: * ٥С For 3 seconds maximum . T_T 175 max. . Electrical Characteristics:

At free-air temperature = 25° C

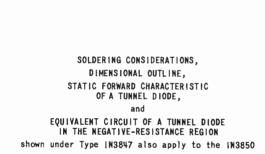
Min. Typical Max.

Static: b					
Peak-Point Current	l _P	45	-	55	ma
Valley-Point Current		-	-	7.5	ma
Peak-Point-to-Valley-					
Point Current Ratio	I _P /I _V	6/1	-	-	
Positive Voltage at peak-		500		6.40	
point ma. = 55	V _E '	530	-	640	μiλ

Min. Typical Max. Dynamic: C Terminal Valley-Point Capacitance^d.... С 40 рf Total Series Resistance . . R_c 1.5 ohms Switching Time: Rise time^e. . . 350 t. ---psec a See Soldering Considerations. b See accompanying Static-Porward-Characteristic graph. с

- c See accompanying Equivalent Circuit of a Tunnel Diode in the Negative-Resistance Region.
- d includes case capacitance of 0.8 pf.

e calculated rise time (approximate) for a germanium tunnel diode when switching from V_P to V_F at a constant value of I_P. $t_{r} \simeq \frac{C(V_{F} - V_{P})}{(I_{P} - I_{V})} \simeq \frac{C}{2} \frac{C}{I_{P}}$





GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±10%) of Peak-Point Current and Switching Times Greater than 125 Picoseconds

GENERAL DATA

	Mechanical:	
,	Operating Position	
	Maximum Overall Length 0.270"	
	Maximum Width	
	Maximum Height	
	Case Metal and Ceramic	
	Terminal Diagram (See Dimensional Outline):	



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum	values:	
DC CURRENT: Forward	170 max 250 max	
At free-air temperatures: From -35° to 25° C Above 25° C Derate linearly t FREE-AIR TEMPERATURE RANGE:	100 max to o ກາພ ຜ	
Operating T _{OPR} Storage T _{STG}	-35 to 1 -35 to 1	00 °C
TAB TEMPERATURE: For 3 seconds maximum T _T	175 max	۰. °C
Electrical Characteristics:		
At free-air temperature = 25°	С	
Min. Ty	pical Ma	IX.
Static: b		
Peak-Point Current I _P 90		10 ma
Valley-Point Current I'v - Peak-Point-to-Valley-	-	15 ma
Point Current Ratio Ip/Iv 6/1 Positive Voltage at peak-	-	-
point ma. = $110 \dots V_F$, 540	- 6	50 mv

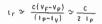
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-62

Min. Typical Max. Dynamic: C Terminal Valley-Point Capacitance^d... С 40 pf Total Series Resistance . R_c 1 obm Switching Time: Rise time[®]. t, 125 psec See Soldering Considerations. ь See accompanying Static-Porward-Characteristic graph. c

C See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

d includes case capacitance of 0.8 pf.

 e Calculated rise time (approximate) for a germanium tunnel diode when switching from V_p to V_p at a constant value of 1_p.



SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3851



RADIO CORPORATION OF AMERICA Electron Tube Division Horid Radio History Harrison, N. J.

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 1200 Picoseconds

GENERAL DATA

Mechanic	al:																					
Operatio	ng Posi	ti	on													•		•				Any
Maximum	Överal	1	Le	ng	th	•				•	•		•	٠	٠	•	٠	•	·		•	0.270"
Maximum	Width																					0.130"
Mavimum	Height																					0.055"
Case		·	٠.	•	·	·	٠	÷	•	٠	·	•	٠		٠.	•	M	eta	aı	ar	na	Ceramic
Termina	l Diagr	an	n (Se	e	Di	me	: n :	510	0110	ıl	01	it i	lin	ie,):						
											_											



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

	DC CURRENT: Forward			max. max.	ma ma
	At free-air temperatures: From -35° to 25° C	 linearly		max. watio	mw o ^o C
)	Storage	T _{OPR} T _{STG}	-35 t -35 t	o 100 o 100	оС оС
	For 3 seconds maximum	T _T	175	max.	°C
	Electrical Characteristics:		•		
	At free-air temperat	-			
		Min. 1	ypical	Max.	
	Static:	4 75		5.25	ma
	Peak-Point Current IP Valley-Point Current Iv	4.75	_	0.6	ma
	Peak-Point-to-Valley- Point Current Ratio Ip/ly	8/1		_	
	Peak-Point Voltage.	50	_	90	۳v
,	Valley-Point Voltage Vv	330	-	-	mv
	Positive Voltage at peak- point ma. = 5.25 V _F '	490	-	560	ΜV

	Min.	Typical	Max.	
Dynamic: C				
Terminal Valley-Point				
Capacitance ^d C	-	_	15	pf
Total Series Resistance Rs	-	-	3	ohms
Switching Time:			-	
Rise time ^e t _r	-	1200	-	psec
See Soldering Considerations.				
^b See accompanying Static-Porward-Characy	teristic	c oraoh.		
C See accompanying Equivalent Circuit of Resistance Region.	a Tunne	el Diode in	the leg	ative-

d includes case capacitance of 0.8 pf.

 6 Calculated rise time (approximate) for a germanium tunnel diode when switching from v_{p} to v_{p} at a constant value of $i_{p},$

$$t_{\Gamma} \simeq \frac{C(v_{F} - v_{P})}{(1_{P} - 1_{V})} \simeq \frac{C}{2 - L_{P}}$$

SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3852



RADIO CORPORATION OF AMERICA Electron Tube Division ord Radio History Harrison, N. J.

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 600 Picoseconds

GENERAL DATA

schanical:	
aximum Width	
aximum Height	
ase	
erminal Diagram (See Dimensional Outline):	
Or Ma Ma Ma Ca	Mechanical: Operating Position



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

	Maximum and Minimum Ratings, Absolu	ıte-Max	imum Valu	es:	
	DC CURFENT: Forward			max. max.	ma ma
	At free-air temperatures: From -35° to 25° C			max. w at	mw 100° C
)	FREE-AIR TEMPERATURE RANGE: Operating	T _{op}	PR −35 to rg −35 to		°C °C
	TAB TEMPERATURE: For 3 seconds maximum	т ₁	r 175	max.	oC
	Electrical Characteristics:				
	At free-air tempera	ture =	25° C		
)			25°C Typical	Max.	
)	At free-air tempera: Static:b			<i>Max.</i>	ma
)	At free-air tempera: Static: ^b	Nin.			ma ma
)	At free-air tempera Static: ^b Peak-Point Current I _P Valley-Point Current I _V	Min. 9.5 - 8/1		10.5	
)	At free-air tempera: Static: ^b Peak-Point Current I _p Valley-Point Current I _V Peak-Point-to-Valley- Point Current Ratio I _p /I _V Peak-Point Voltage V _p	Hin. 9.5 - 8/1 55		10.5	
)	At free-air tempera: Static: ^b Peak-Point Current I _p Valley-Point Current I _V Peak-Point-to-Valley- Point Current Ratio I _p /I _V	Min. 9.5 - 8/1		10.5 1.2	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA 8-62

Dynamic: C	Min.	Typical	Max.		_
Terminal Valley-Point					
Capacitance ^d ,	-	-	15	pf	$\mathbf{-}$
Total Series Resistance R _s	-	-	2.5	ohms	
Switching Time:					
Rise time ^e t _r	-	600	-	psec	
a See Soldering Considerations.					
b See accompanying Static-Forward-Charac	teristi	c graph.			

^C See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

d includes case capacitance of 0.8 pf.

 $^{\rm e}$ Calculated rise time (approximate) for a germanium tunnel diode when switching from V_{\rm P} to V_{\rm F} at a constant value of I_{\rm P}.



SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE

IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3853



GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 400 Picoseconds

GENERAL DATA

Operating Position						
Maximum Overall Length						0.270"
Maximum Width						0.130"
Maximum Height						0.055"
Case					.Metal	and Ceramic
Terminal Diagram (See D	imen	sion	al Out	tline):	:	



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

	Maximum and Minimum Ratings, Abso	lute-Maximum Vai	ues:	
	DC CURRENT: Forward) max.) max.	ma ma
	At free-air temperatures: From -35° to 25° C Above 25° C Derat FREE-AIR TEMPERATURE RANGE:) max. <i>mw at 100⁰</i>	mw C
'	Operating	. T _{STG} -35	to 100 to 100	°C °C
	For 3 seconds maximum Electrical Characteristics:	T _T 175	ō max.	оC
	At free-air temper	ature = 25° C		
	Static: b	Hin. Typical	Max.	
	Peak-Point Current I _P Valley-Point Current I _V Peak-Point-to-Valley-	19 – – –	21 2.4	ma ma
I	Point Current Ratio Ip/Iv Peak-Point Voltage Vp Valley-Point Voltage Vv	8/1 – 65 – 365 –	105	mv m∨
	Positive Voltage at peak- point ma. = 21 V _F ,	530 -	600	m∨

Mechanical:

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Dynamic: ^c	Min.	Typical	Nax.		
Terminal Valley-Point					
Capacitance ^d C	-	_	20	pf	
Total Series Resistance R _S Switching Time:	-	-	2	ohms	
Rise time ^e t _r	-	400	-	psec	
a see Soldering Considerations.					_
b see accompanying Static-Forward-Charac	teristi	c graph.			
^C See accompanying Equivalent Circuit of Resistance Region.	a Iunn	el Diode in	the Ne	gative-	

d Includes case capacitance of 0.8 pf.

 $^{\rm C}$ Calculated rise time (approximate) for a germanium tunnel diode when switching from V_p to V_f at a constant value of I_p.



SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3854



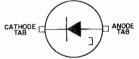
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World David Pario History

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (± 5%) of Peak-Point Current and Switching Times Greater than 200 Picoseconds

GENERAL DATA

Any
0.270"
0.130"
0.055"
Ceramic



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC CURRENT: Forward		na na
	50 max. m Derate linearly too mw at 100°	nw C
Operating		ос Ос
For 3 seconds maximum	T _T 175 max. (οС

Electrical Characteristics:

At free-air temperature = 25° C

Min. Typical Max.

та
ma
۳v
۳v
m∨

RADIO CORPORATION OF AMERICA Semiconductor & Materiais Division Somerville, N. J. DATA 8-62

1N3855

Min. Typical Max. Dynamic: C Terminal Valley-Point Capacitance^d C 25 рf Total Series Resistance Rs 1.5 ohms Switching Time: Rise time^e. . • • • • tr psec a See Soldering Considerations. b See accompanying Static-Porward-Characteristic graph. с See accompanying Bquivalent Circuit of a Tunnel Diode in the Hegative-Resistance Region.

d Includes case capacitance of 0.8 pf.

e Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to Vp at a constant value of Ip.

 $t_{r} \simeq \frac{C(V_{F}-V_{P})}{(1P-1V)} \simeq \frac{C}{21P}$

SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3855



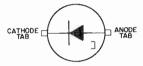
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Note Participation Somerville, N. J.

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 75 Picoseconds

GENERAL DATA

Mechanical:	
Operating Position	
Maximum Överall Length 0.270"	
Maximum Width	
Maximum Height	
Case	
Termina) Diagram (See Dimensional Outline):	



the arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum	values:
DC CURPENT: Forward IF Reverse IR DISSIPATION: P	170 max. ma 250 max. ma
At free-air temperatures: From -35° to 25° C	
FREE-AIR TEMPERATURE RANGE: Operating T _{OPR} Storage T _{STG} TAB TEMPERATURE: ^a	-35 to 100 °C -35 to 100 °C
For 3 seconds maximum T _T	175 max. ^o C
Electrical Characteristics:	
At free-air temperature = 25°	С
Min. Ty	pical Max.
Static: b	
Peak-Foint Current Ip 95	– 105 ma
Valley-Point Current Iv -	– 12 ma
Peak-Foint-to-Valley- Point Current Ratio Ip/Iv 8/1 Peak-Point Voltage Vp 90	 - 140 m∨

Vv

۰٦۷

390

560

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Valley-Point Voltage. . .

Positive Voltage at peak-

point ma. = 105

DATA 8-62

630

mν

mv

	Min.	Typical	Max.		
Dynamic: ^c					
Terminal Valley-Point					
Capacitance ^d	-	-	25	pf	
Total Series Resistance R _S	-	-	1	ohm	
Switching Time:					
Rise time ^e t _r	-	75		psec	
^a See Soldering Considerations.					_
b See accompanying Static-Porward-Charac	teristic	graph.			
See accompanying Equivalent Circuit of	a lunne	l Diode in	the Neg	ative-	
iesistance Region.					
Includes case capacitance of 0.8 pf.					

Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to Vp at a constant value of (p.



SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type 1N3847 also apply to the 1N3856



GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 600 Picoseconds

GENERAL DATA

	Mechanical:
,	Operating Position
	Maximum Överall Length 0.270"
	Maximum Width
	Maximum Height 0.055"
	Case
	Terminal Diagram (See Dimensional Outline):



the arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

	Maximum and Minimum Ratings, Absolu	te-Maximu	n Value	25:	
	DC CURRENT: Forward			max. max.	ma ma
	At free-air temperatures: From -35° to 25° C		~	max. w at 10	mw o⁰C
)	Operating	. T _{opr} . T _{stg}	-35 t -35 t	o 100 o 100	оС 0
	TAB TEMPERATURE: ^a For 3 seconds maximum	. Т _т	175	max.	oC
	Electrical Characteristics:				
	At free-air temperat	ure = 25 ⁰	С		
		Min. Ty	pical	Nax.	
	Static: b				
	Peak-Point Current	4.75	-	5.25	та
	Valley-Point Current	-	-	0.6	ma
	Peak-Point-to-Valley- Point Current Ratio	8/1	_	_	
	Peak-Point Voltage Vp	50	-	90	mv
	Valley-Point Voltage Vy	330	-	-	mv
	Positive Voltage at peak- point ma. = 5.25 V _F ,	490	-	560	mv

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-62

	Min.	Typical	Max.		
Dynamic: C					4
Terminal Valley-Point					
Capacitance ^d	-	-	8	pf	
Total Series Resistance R _s	-	-	3	ohms	
Switching Time:					
Rise time ^e t _r	-	600	-	psec	
a see Soldering Considerations.					
b See accompanying Static-Porward-Charact					
C See accompanying Static-Forthard-Charact	eristic	graph.			
^C See accompanying Equivalent Circuit of Resistance Region.	a Iunne	i Viode in	the Nego	1 <i>t t ve</i> -	

d Includes case capacitance of 0.8 pf.

 $^{\rm e}$ Calculated rise time (approximate) for a germanium tunne) diode when switching from V_p to V_F at a constant value of 1_p.

$$t_{r} \simeq \frac{C(v_{F}-v_{P})}{(1_{P}-1_{V})} \simeq \frac{C}{2-1_{P}}$$

SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type IN3847 also apply to the IN3857



GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Reguiring Control (15%) of Peak-Point Current and Switching Times Greater than 300 Picoseconds

GENERAL DATA

Mechanical:
Operating Position
Maximum Överall Length 0.270"
Maximum Width
Maximum Height 0.055"
Case Metal and Ceramic
Terminal Diagram (See Dimensional Outline);



The arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolu	te-Max	ımum Valu	es:	
DC CURRENT: Forward		1	max. max.	ma ma
At free-air temperatures: From -35° to 25° C			max. nv at 10	mw oo°C
Derating	. T ₀ . T _S	PR -35 t TG -35 t	o 100 o 100	°C
Fo: 3 seconds maximum	. т	т 175	max.	°C
Electrical Characteristics:				
Electrical Characteristics: At free-air temperat	ure =	25° C		
		25°C Typical	Max.	
		-	Max.	
At free-air temperat		-	<i>Max.</i> 10.5	ma
At free-air temperat Stat:c: ^b	Mın.	Typıcal		ma ma
At free-air temperat Stat:c: ^b Peak-Point Current Ip Valley-Point Current Iv Peak-Point-to-Valley-	₩1n. 9.5 -	Typıcal _ _	10.5 1.2	
At free-air temperat Stat:c: ^b Peak-Point Current p Valley-Point Current v Peak-Point-to-Valley- Paint Current Ratio p/ v	Hın. 9.5 − 8/1	Typıcal	10.5 1.2 -	та
At free-air temperat Stat:c: ^b Peak-Point Current p Valley-Point Current v Peak-Point-to-Valley- Paint Current Ratio p/ v	₩1n. 9.5 -	Typıcal _ _	10.5 1.2	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

Min. Typical Max. Dynamic: ^c Terminal Valley-Point Capacitanced. С 8 pf Total Series Resistance . . 2.5 Rs ohms Switching Time: Rise time". . 300 tr Dsec ^a See Soldering Considerations. b See accompanying Static-Porward-Characteristic graph. C See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region. d

Includes case capacitance of 0.8 pf.

Calculated rise time (approximate) for a germanium tunnel diode when switching from Vp to V $_{\rm F}$ at a constant value of 1p.



SOLDERING CONSIDERATIONS. DIMENSIONAL OUTLINE. STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3858



RADIO CORPORATION OF AMERICA Electron Tube Division Harrison, N. J. Radio History

Tunnel Diode

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (±5%) of Peak-Point Current and Switching Times Greater than 200 Picoseconds

GENERAL DATA

	Mechanical:	
,	Operating Position	
	Maximum Overall Length 0.270"	
	Maximum Width	
	Maximum Height	
	Case	
	Terminal Diagram (See Dimensional Outline):	



the arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratir	ngs, A	bsolu	te-Maxı	mum Valu	es:	
DC CURRENT: Forward Reverse DISSIPATION:	• • •				max. max.	ma ma
At free-air temperature From -35° to 25° C. Above 25° C.	 De			20 Sytoom		mw oo°C
FREE-AIR TEMPERATURE RANG Operating						°C
For 3 seconds maximum .			. T ₁	í 175	max.	°C
Electrical Characteristic						
LIECTICAL GUALACTERISTIC						
At free-as		perat	ure = a	25° C		
		perat		25°C Typical	Max.	
		iperat		-	Max.	
At free-at	ir ten	iperat Ip		-	<i>Max.</i> 21	ma
At free-an Static: ^b	ir ten		∦ın.	-		ma ma
At free-an Static: ^b Peak-Point Current Valley-Point Current	ir ten 	lp	₩1n. 19 - 8/1	-	21 2.4 -	
At free-an Static: ^b Peak-Point Current Valley-Point Current Peak-Point Current Ratio . Peak-Point Voltage	ir ten 	lp ly P/ly Vp	₩1n. 19 - 8/1 65	-	21 2.4	ma mv
At free-an Static: ^b Peak-Point Current Valley-Point Current Peak-Point-to-Valley- Point Current Ratio .	ir ten 	lp lv p/lv	₩1n. 19 - 8/1	-	21 2.4 -	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

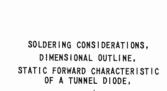
Somerville, N. J.

DATA 8-62

Min. Typical Max. Dynamic: C Terminal Valley-Point Capacitance^d.... С of Total Series Resistance . . Re 2 ohms Switching Time: Rise time^e. . t. 200 psec a See Soldering Considerations. h See accompanying Static-Forward-Characteristic graph. с See accompanying Equivalent Circuit of a funnel Diode in the Negative-Resistance Region.

d Includes case capacitance of 0.8 pf.

^e Calculated rise time (approximate) for a germanium tunnel diode when switching from V_P to V_F at a constant value of I_P. $\iota_r \simeq \frac{C(V_F - V_P)}{(I_P - I_V)} \simeq \frac{C}{2 \cdot I_P}$



and

EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION shown under Type IN3847 also apply to the IN3859



Tunnel Diode

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For Switching and Small-Signal Applications Requiring Control (± 5%) of Peak-Point Current amd Switching Times Greater than 150 Picoseconds

GENERAL DATA

	Mechanical:
,	Operating Position
	Maximum Överall Length 0.270"
	Maximum Width
	Maximum Height
	Case
	Termina' Diagram (See Dimensional Outline):



The arrow indicates direction of forward current flow as indicated by dr ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC CURRENT: Forward		_F _R	85 max. 125 max.	ma ma
DISSIPATION:		Ρ		
At free-air temperatures: Frem -35° to 25° C Above 25° C FREE-AIR TEMPERATURE RANGE:			50 max. ytoo mwatic	mw co c
Operating			-35 to 100 -35 to 100	°C
For 3 seconds maximum		ΤŢ	175 max.	°C
Electrical Characteristics: At free-air te	mperatu	re = 25°	° с	
		Min.	Typical Max.	
Static: b				

Peak-Point Current		52.5 ma 6 ma
Current Ratio	80 -	130 mv - mv
Positive Voltage at peak-point ma. = 52.5 V _F	, 550 –	620 mv

		Min.	Typical	Max.		
Dy	namic: C					
Te	erminal Valley-Point Capacitance ^d . C	-	-	12	pf	
To	otal Series ResistanceR _s	-	-	1.5	ohms	
Sv	vitching Time: Rise time ^e t,		150			
	Alse time	-	150	-	psec	
a	See Soldering Considerations.					
b	See accompanying Static-Porward-Characteri					
c	See accompanying Equivalent Circuit of a 1 Resistance Region.	unne l	Diode in	the ∦eg	ative-	
<u>ن</u>	Includes case capacitance of 0.8 pf.					
e	Calculated rise time (approximate) for a switching from Vp to $V_{\rm F}$ at a constant value	german e of t	nium tunne 'p•	el diod	e when	
	$t_{\Gamma} \stackrel{\sim}{\simeq} \frac{C(V_{\Gamma}-V_{\Gamma})}{(I_{\Gamma}-I_{V})} \stackrel{\sim}{\simeq} \frac{C}{2}$	1 _P				_

SOLDERING CONSIDERATIONS, DIMENSIONAL OUTLINE, STATIC FORWARD CHARACTERISTIC OF A TUNNEL DIODE, and EQUIVALENT CIRCUIT OF A TUNNEL DIODE IN THE NEGATIVE-RESISTANCE REGION

shown under Type IN3847 also apply to the IN3860



Tunnel Rectifier

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For use as Coupling Device in Memory Systems and other Switching Applications

GENERAL DATA

Mechanical:

Operating Position				Any
Maximum Överall Length				
Maximum Width				0.130"
Maximum Height				0.075"
Case			Metal	and Ceramic
Terminal Diagram (See Dimens	ional	Outline):		



the arrow indicates direction of forward current flow as indicated by dc ammeter.

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC CURRENT: IF 10 max. Forward	ma ma
At free-air temperatures: From -35° to 25° C 10 max. Above 25° C Derate linearly to o mw at FREE-AIR TEMPERATURE RANGE:	mw 100°C
Operating	°င ဝ
TAB TEMPERATURE: ^a For 3 seconds maximum T _C 175 max.	°C

Electrical Characteristics:

At free-air temperature = 25° C

	Min.	Max.	
Peak-Point Current	0.1	1	ma
Reverse Voltage ^b for dc reverse ma. = 10 V _R Positive Voltage at peak-point	-	170	mv
ma.= 1 V _F Terminal Valley-Point Capacitance ^c . C	400	6	m∨ pf

^a See Soldering Considerations.

^b See accompanying Static Characteristic of funnel Rectifier graph.

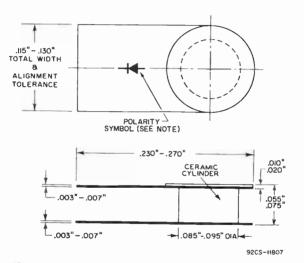
C includes case capacitance of 0.4 pf.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History DATA I 8-62

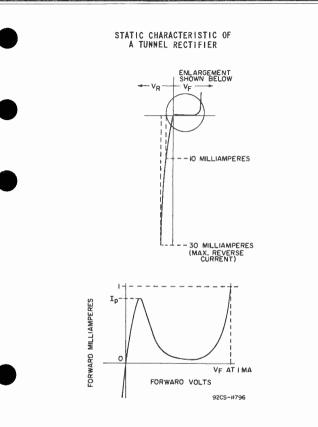
SOLDERING CONSIDERATIONS

A low-temperature solder, (such as Alpha #III alloy, rosinfilled, or equivalent) should be used. To minimize soldering time, a pre-tinned circuit board should be used. To protect the junction against overheating, the tunnel rectifier should be held with long-nose piliers.



NOTE: ARROW INDICATES DIRECTION OF FORWARD CURRENT FLOW AS INDICATED BY DC AMMETER.







World Radio History

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Tunnel Rectifier

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE For use as Coupling Device in Memory Systems and other Switching Applications

The 1N3862 is the same as the 1N3861 except for the following items:

Electrical Characteristics:

At free-air temperature = 25° C

Min. Max.

Reverse Voltage: ^b V _R	2		
With dc reverse ma. = 10	-	150	₩v
With dc reverse ma. = 30	-	300	m∨
Positive Voltage at peak point ma. = 1 V _F	420	-	mv
Terminal Valley-Point Capacitance ^c C	-	4	pf

b see accompanying Static Characteristic of funnel Rectifier graph. C Includes case capacitance of 0.4 pf.



World Radio History

Tunnel Rectifier

GERMANIUM P-ON-N REGION, EPITAXIAL TYPE

For use as Coupling Device in Memory Systems and other Switching Applications

The 1N3863 is the same as the 1N3861 except for the following items:

Electrical Characteristics:

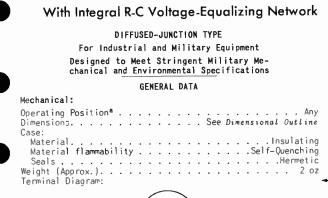
At free-air temperature = 25° C

	Mın.	Max.	
Peak-Point Current	p 0.1	0.5	ma
Reverse Voltage: ^b V	Ŕ		
With dc reverse ma. = 10	-	150	mν
With dc reverse ma. = 30	-	300	mν
Positive Voltage at peak point ma. = 1 . V	F 435	-	mv
Terminal Valley-Point Capacitance ^c (- (4	pf

^b see accompanying Static Characteristic of funnel Rectifier graph. ^c Includes case capacitance of 0.4 pf.



World Radio History





The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet

PEAK REVERSE VOLTAGE (Repetitive) . . . 1200 max. volts PEAK-TRANSIENT REVERSE VOLTAGE (Non-repetitive, for duration of 5-milliseconds maximum):

At free-air temperature of

+60 ⁰ to +125 ⁰ C	volts
At other free-air temperatures See Peak-Tran	sient
Reverse-Voltage Rating	
RMS SUPPLY VOLTAGE	
DC BLOCKING VOLTAGE	volts
AVERAGE FORWARD CURRENT:	+
At free-air temperature of 60 ⁰ C 850 max.	ma
At free-air temperature of 100° C 350 max.	ma
At other free-air temperatures See Average-For	ward-
Current Rating	Chart
PEAK RECURRENT CURRENT	amp





PEAK SURGE CURRENT: ^b For one-half cycle, sine wave	
Rating Chart FREE-AIR TEMPERATURE RANGE: 0perating and storage	
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum-rated operating conditions 1.2 volts Instantaneous Forward Voltage Drop. See Instantaneous Forward	
Maximum Reverse Current: Characteristics Curve	
Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 ma DC (At maximum rated dc blocking voltage and any temperature within the operating	
temperature range) 0.6 ma	
Shunt Capacitance: Maximum 600 pf Minimum	
a	

See Operating Considerations.

Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

 $^{\rm C}$ Example: For type CR101 at 60 $^{\rm O}$ C free-air temperature, average forward ma. = 850, peak reverse volts = 1200.

OPERATING CONSIDERATIONS

This high-voltage silicon rectifier can be mounted in any position. It is recommended that wherever possible this rectifier be mounted on a vertical surface to prevent an accumulation of dust on the surface between the rectifier terminals.

A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the power transformer windings, or by an external resistor or choke.

This rectifier is designed to operate at full ratings at altitudes up to 30,000 feet. For operation at altitudes above 10,000 feet, it is recommended that adequate spacing be provided between rectifiers and between rectifiers and other components (including the chassis and enclosure) to help prevent corona. If the applied voltage exceeds 5500 volts peak, the rectifiers should be mounted on I-1/2-inch standoff insulators.

When several rectifiers are to be operated in series across a supply voltage of 20,000 volts peak or more, the protection afforded by the integral voltage-equalizing networks may not be adequate, depending on the circuit arrangement and the physical layout of the components. Consequently, additional protection against high transient voltages may be required in the design



of the equipment. For additional information on this subject, write to RCA, Commercial Engineering, Somerville, New Jersey.

Because this rectifier operates at voltages which are dangerous, care should be taken in the design and operation of the equipment to prevent personnel from coming in contact with the rectifier.

Connections to the solder lugs of this rectifier should be made with 16-gauge (or smaller diameter) wire. Careshould be exercised during the soldering operation to prevent overheating of the rectifier terminals. A clean, well-tinned iron is recommended to keep soldering time to a minimum.

During a period of prolonged heating, for example, during lead unwrapping, a heat sink such as the jaws of a pair of long-nose pliers should be used between the tip of the soldering iron and the rectifier case.

MECHANICAL AND ENVIRONMENTAL TESTS

This silicon rectifier is designed to meet the following rigorous mechanical and environmental tests:

Shock:

MIL-STD-202B, method 202A

MIL-S-19500B, paragraph 40.10

The device is subjected to 5 blows in each of the orientations $\{X_1, Y_1, and Z_1\}$ with an acceleration of 50 g and a duration of approximately II milliseconds.

Vibration Fatigue:

MIL-S-19500B, paragraph 40.1B

The device is subjected to a simple harmonic motion at any single frequency between 40 and 100 cycles per second with a constant peak acceleration of 20 g. The vibration shall be applied for 32 hours minimum in each of the orientations $X_1, Y_1, \text{ and } Z_1$ (a total of 96 hours minimum).

Vibration, Variable Frequency:

MIL-S-19500B, paragraph 40.20

Barometric Pressure:

MIL-STD-202B, method 105B, Condition A (Operation at altitude of 30,000 feet) MIL-S-19500B, paragraph 40.1

Moisture Resistance:

Mil-STD-202B, method 106A Mil-S-19500B, paragraph 40.6

Salt Spray (Corrosion):

MIL-STD-202B, method IOIA, Condition A (Length of test—96 hours) MIL-S-19500B, paragraph 40.9

Temperature Cycling:

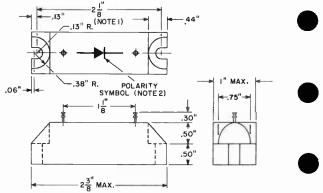
MIL-STD-202B, method 102A, Condition C MIL-S-19500B, paragraph 40.14



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 8-62



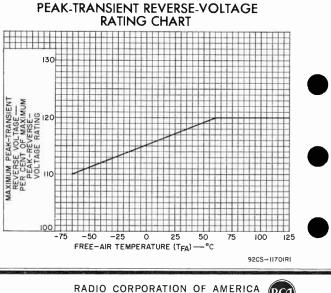




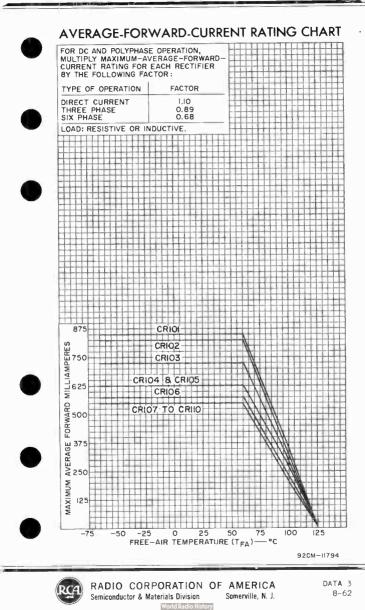
92CS-(125)RI

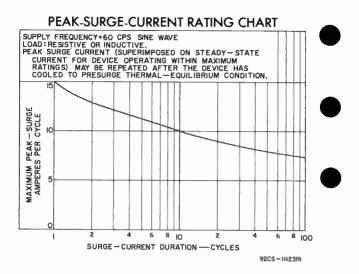
NOTE I: OISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-OIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CUR-RENT FLOW AS INDICATED BY DC AMMETER.



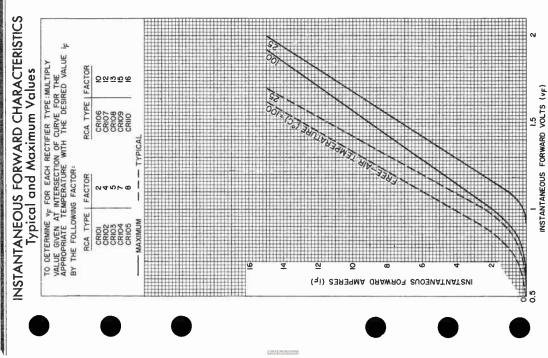
Semiconductor & Materials Division Somerville, N. J.





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Somerville, N. J.





DATA 4 8-62

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AMERICA Somerville, N. J. Ч CORPORATION Materials Division Semiconductor & RADIO



World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions	•	•	•	•	•	•		 See	Dimensional Outline
Case:	•	·	•	·	•		•	000	Dimensional Calibra
Material									Insulating
Material flammability									Self-Quenching
Seals									
Weight (Approx.) Terminal Diagram:	٠	•	·	·	·	·	·	•••	2 oz



The arrow indicates direction of forward (easy) current flow as indicated by 2c ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, si phase operation, with resistive or indu	
load, and at altitudes up to 30,000	
PEAK INVERSE VOLTAGE	max. volts
	max. volts
DC BLOCKING VOLTAGE	max. volts
AVERAGE FORWARD CURRENT:	
At ambient temperature of 60 ⁰ C 825	max. ma
At ambient temperature of 100° C 320	max. ma
At other ambient temperatures . See Average-Fo	
	Rating Chart
PEAK RECURRENT CURRENT	max. amp
PEAK SLRGE CURRENT: b	
For one-half cycle, sine wave	max. amp
For one or more cycles See Peak-	Surge-Current
	Rating Chart
AMBIENT-TEMPERATURE RANGE:	nuting churt
	a 1125 00
Operating and storage65 t	o +125 °C



Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum-rated operating conditions	5
Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curv	d
Maximum Reverse Current:	e
Dynamic (averaged over one complete cycle at maximum ratings) ^c 00.3 ma DC at maximum rated dc blocking voltage and any temperature within the operating temper-	a
ature range 0.6 ma	3
Shunt Capacitance:	
Maximum	f
Minimum	
a	

See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR101 at 60° C ambient temperature, average forward ma. = 825, peak inverse volts = 1200.

OPERATING CONSIDERATIONS

This high-voltage silicon rectifier can be mounted in any position. It is recommended that wherever possible this rectifier be mounted on a vertical surface to prevent an accumulation of dust on the surface between the rectifier terminals.

A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the power transformer windings, or by an external resistor or choke.

This rectifier is designed to operate at full ratings at altitudes up to 30,000 feet. For operation at altitudes above 10,000 feet, it is recommended that adenuate spacing be provided between rectifiers and between rectifiers and other components (including the chassis and enclosure) to help prevent corona. If the applied voltage exceeds 5500 volts peak, the rectifiers should be mounted on 1-1/2-inch standoff insulators.

When several rectifiers are to be operated in series across a supply voltage of 20,000 volts peak or more, the protection afforded by the integral voltage-equalizing networks may not be adequate, depending on the circuit arrangement and the physical layout of the components. Consequently, additional protection against high transient voltages may be required in the design of the equipment. For additional information on this subject, write to RCA, Commercial Engineering, Somerville, New Jersey.



Because this rectifier operates at voltages which are dangerous, care should be taken in the design and operation of the equipment to prevent personnel from coming in contact with the rectifier.

Connections to the solder lugs of this rectifier should be made with 16-gauge (or smaller diameter) wire. Care should be exercised during the soldering operation to prevent overheating of the rectifier terminals. A clean, well-tinned iron is recommended to keep soldering time to a minimum.

During a period of prolonged heating, for example, during lead unwrapping, a heat sink such as the jaws of a pair of long-ncse pliers should be used between the tip of the soldering iron and the rectifier case.

MECHANICAL AND ENVIRONMENTAL TESTS

This silicon rectifier is designed to meet the following rigorous mechanical and environmental tests:

Shock:

- MIL-STD-202B, method 202A
- MIL-S-19500B, paragraph 40.10

The device is subjected to 5 blows in each of the orientations $(X_1, Y_1, \text{ and } Z_1)$ with an acceleration of 50 g and a duration of approximately II milliseconds.

Vibration Fatigue:

MIL-S-19500B, paragraph 40.18

The device is subjected to a simple harmonic motion at any single frequency between 40 and 100 cycles per second with a constant peak acceleration of 20 g. The vibration shall be applied for 32 hours minimum in each of the orientations X1, Y1, and Z1 (a total of 96 hours minimum).

Vibration, Variable Frequency: MIL-S-19500B, paragraph 40.20

Barometric Pressure:

MIL-STD-202B, method 105B, Condition A (Operation at altitude of 30,000 feet) MIL-S-19500B, paragraph 40.1

Moisture Resistance:

MIL-STD-202B, method 106A MIL-S-19500B, paragraph 40.6

Salt Spray (Corrosion):

MIL-STD-202B, method IOIA, Condition A

[Length of test-96 hours] MIL-S-19500B, paragraph 40.9

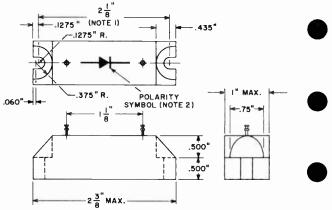
Temperature Cycling:

MIL-STD-2023, method 102A, Condition C MIL-S-195003, paragraph 40.14



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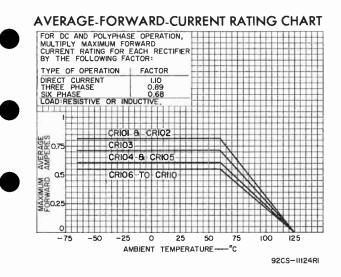
92CS-11251

NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR I/4"-DIAMETER BOLTS.

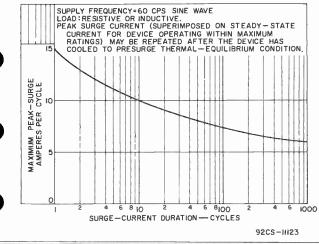
NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CUR-RENT FLOW AS INDICATED BY DC AMMFTED







PEAK-SURGE-CURRENT RATING CHART





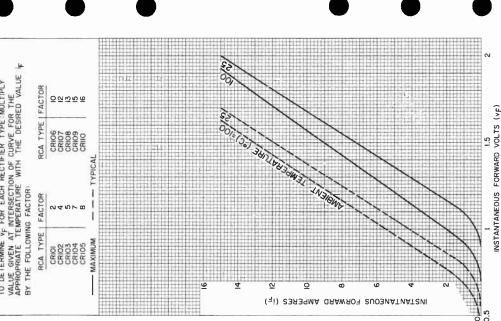
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Somerville, N. J.

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CURVE FOR THE THE DESIRED VALUE TO DETERMINE VF FOR EACH RECTIFIER TYPE: MULTIPLY WITH WITH TEMPERATURE W AT VALUE GIVEN APPROPRIATE



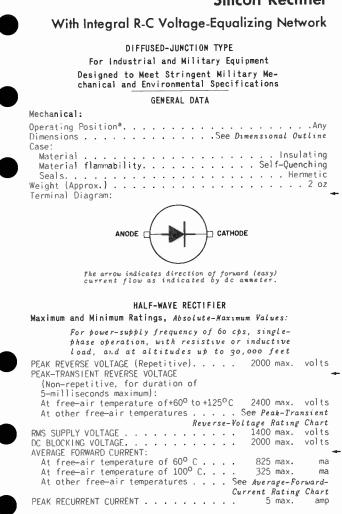
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PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 15 max. amp For one or more cycles, sine waveSee <i>Peak-Surge-Current</i>	
Rating Chart FREE-AIR TEMPERATURE RANGE: 0perating and storage	
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions	
Maximum Reverse Current: Characteristics Curve	
Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 ma DC (At maximum rated dc blocking voltage and any temperature within the operating	
temperature range) 0.6 ma	
Shunt Capacitance: Maximum 320 pf Minimum 175 pf	
a See Operating Considerations.	

 Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
 Example: For type CR102 at 60° c free-air temperature, average forward ma. = 825, peak reverse volts = 2000.

> OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, DIMENSIONAL OUTLINE, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIO2



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Reficiencia

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:	:																			
Operating F	Posit	iona																		. Any
Dimensions					•	•					.:	See	e L)in	ie r	isid	ona	1 0)uti	line
Case:																				
Material																				
Material	flan	nmabi	łi	ty	•							•		•		Se	l f-	-Que	encl	ning
Seals																				
Weight (App	prox.).	•	•	•						•			•					. 2	2 oz
Terminal D	iagra	im:																		
					-	_	_	_	_	 _	-									



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-
phase operation, with resistive or inductive
load, and at altitudes up to 30,000 feet
PEAK INVERSE VOLTAGE
RMS SUPPLY VOLTAGE
DC BLOCKING VOLTAGE
AVERAGE FORWARD CURRENT:
At ambient temperature of 60° C 825 max. ma
At ambient temperature of 100° C 320 max. ma
At other ambient temperatures . See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT 5 max. amp
PEAK SURGE CURRENT: b
For one-half cycle, sine wave 15 max. amp
For one or more cyclesSee Peak-Surge-Current Rating Chart
AMBIENT-TEMPERATURE RANGE:
Operating and storage



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-61

World Radio History

Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions. . . 2.4 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve Maximum Reverse Current: 0.3 ma DC at maximum rated dc blocking voltage and any temperature within the operating temperature range . . . 0.6 ma Shunt Capacitance: Maximum , 320 μµf 175 Minimum , . . . μµf

^a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
C Rample: For type CR102 at 60° C ambient temperature, average forward ma. = 825, peak inverse volts = 2000.

> OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, DIMENSIONAL OUTLINE, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO2





DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions Case:	•	:		•	:	 See	Dimensional Outline
Material Material flammability							Self-Quenching
Seals							



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet volts PEAK-TRANSIENT REVERSE VOLTAGE [Non-repetitive, for duration of 5-milliseconds maximum): At free-air temperatures of +60° to +125° C. 3600 max. volts At other free-air temperatures. See Peak-Transient Reverse-Voltage Rating Chart RMS SUPPLY VOLTAGE. 2100 max. volts . . DC BLOCKING VOLTAGE 3000 max. volts AVERAGE FORWARD CURRENT: At free-air temperature of 60° C. 725 max. ma At free-air temperature of 100° C 300 max. ma At other free-air temperatures. See Average-Forward-Current Rating Chart PEAK RECURRENT CURRENT. . . 5 max. amp



- Indicates a change.

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PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 1: For one or more cycles, sine wave See Peak-	Surge-C		
FREE-AIR TEMPERATURE RANGE:	Rating	Chart	-
Operating and storage65 t	o +125	°C	
Characteristics:			
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating			
conditions		volts	
Instantaneous Forward Voltage Drop . See Instanta Characte			
Maximum Reverse Current:	1 + 3 + + + 5	C470E	
Dynamic (Averaged over one complete	•		
cycle at maximum ratings) ^c	0.3	ma	_
DC (At maximum rated dc blocking voltage and any temperature within			
the operating temperature range)	0.6	ma	$\mathbf{}$
Shunt Capacitance:			
Maximum	250	pf	
Minimum	140	pf	
a see Oberating Considerations			

^a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR103 at 60° C free-air temperature, average forward ma. = 725, peak reverse volts = 3000.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, DIMENSIONAL OUTLINE, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIO3



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment

Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions Case:	
Material	Insulating Self-Quenching
Seals	Hermetic
Terminal Diagram:	



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-
phase operation, with resistive or inductive
load, and at altitudes up to 30,000 feet
PEAK INVERSE VOLTAGE
RMS SUPPLY VOLTAGE
DC BLOCKING VOLTAGE
At ambient temperature of 60° C 715 max. ma
At ambient temperature of 100° C 275 max. ma
At other ambient temperatures . See Average-Forward-Current
Rating Chart
PEAK RECURRENT CURRENT
PEAK SURGE CURRENT:
For one-half cycle, sine wave 15 max. amp
For one or more cyclesSee Peak-Surge-Current Rating Chart
AMBIENT-TEMPERATURE RANGE:
Operating and storage



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-61

World Radio History

Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions. . . 3 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve Maximum Reverse Current: Dynamic (averaged over one complete cycle at maximum ratings)^c. 0.3 ma DC at maximum rated dc blocking voltage and any temperature within 0.6 the operating temperature range . . ma Shunt Capacitance: Maximum 250 шí 140 μµf Minimum

^a See Operating Considerations.

be operating void terms of the second sec

Example: For type CR103 at 60° C ambient temperature, average forward ma. = 715, peak inverse volts = 3000. c Example:

> OPERATING CONSIDERATIONS. MECHANICAL AND ENVIRONMENTAL TESTS. DIMENSIONAL OUTLINE. RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO3



With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

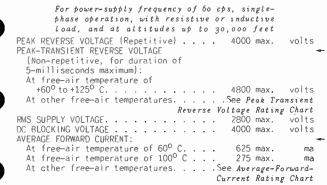
Operating Position ^a Dimensions					
Case:					
Material					
Material flammability					
Seals					
Weight (Approx.)					3 oz 🖛
Terminal Diagram:					-



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:



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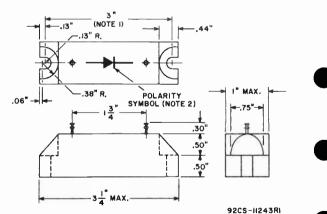


PEAK RECURRENT CURRENT	amp
For one or more cycles, sine wave See Peak-Surge-Curr	
Rating Ch FREE-AIR TEMPERATURE RANGE: Operating and storage Operating and storage	о _С
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated	
operating conditions 4.2 vo instantaneous Forward Voltage DropSee Instantaneous Forw	lts
Characteristics Cu	
Maximum Reverse Current:	
Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 DC (At maximum rated dc blocking	ma
voltage and any temperature within	
the operating temperature range) 0.6 Shunt Capacitance:	ma
Maximum	pf pf
	P (

a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR104 at 60° Cfree-air temperature, average forward ma. = 625, peak reverse volts = 4000.



NOTE 1: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIO4



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World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions	•							 See	Any Dimensional Outline
Case:									
Material									Insulating
Material flammability					•				Self-Quenching
Seals	•	·	٠	•		•	•		Hermetic
Weight (Approx.) Terminal Diagram:	·	·	•	•	•	•	·	•••	2.9 oz



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single-	
phase operation, with resistive or inductive	
load, and at altitudes up to 30,000 feet	
PEAK INVERSE VOLTAGE 4000 max. vol	ts
RMS SJPPLY VOLTAGE	
	ts
AVERAGE FORWARD CURRENT:	ιs
At ambient temperature of 60° C 605 max.	ma
At ambient temperature of 100° C 235 max.	ma
At other ambient temperatures See Average-Forwar	
Current Rating Cha	rt
	amp
PEAK SURGE CURRENT: b	
For one-half cycle, sine wave 15 max.	amp
For one or more cycles See Peak-Surge-Curre	nt
Rating Cha	
AMBIENT-TEMPERATURE RANGE:	16
Operating and storage65 to +125	oC





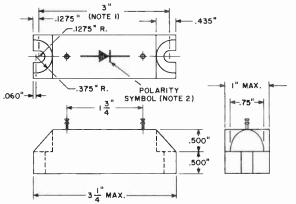
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 4.2 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward	
Characteristics Curve	
Maximum Reverse Current:	
Dynamic (averaged over one complete cycle at maximum ratings) ^c	
operating temperature range 0.6 ma	
Shunt Capacitance:	
Maximum	

a See Operating Conside ations.

Superimposed on device operating within the maximum voltage, current, and temperature ratings and may * repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

^C Example: For type CR104 at 60° C ambient temperature, average forward ma. = 605, peak inverse volts = 4000.



92CS-11243

NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to type CRIO4



With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

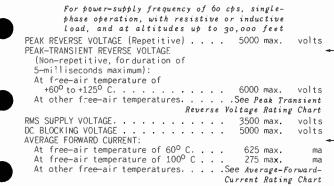
Operating Position ^a Dimensions					
Case: Material Material flammability					Self-Quenching
Seals					



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:



Indicates a change.



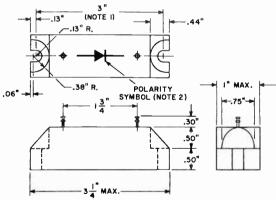
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PEAK SURGE CURRENT: 5	
FREE-AIR TEMPERATURE RANGE:	°C
Characteristics: Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 4.8 vol Instantaneous Forward Voltage DropSee Instantaneous Forwa Characteristics Cur	rd
Maximum Reverse Current: Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 DC (At maximum rated dc blocking voltage and any temperature within	ma
the operating temperature range) 0.6 Shunt Capacitance: Maximum	ma pf pf

a See Operating Considerations.

^b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient lime has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR105 at 60⁰ C free-air temperature, average forward ma. = 625, peak reverse volts = 5000.



92CS-11243RI

NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIO5



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World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions Case:		•				:		 See	Any Dimensional Outline
Material									Self-Quenching
Weight (Approx.) Terminal Diagram:	•	•	•	•	•	•	•	•••	· · · · · · 2.9 oz



The arrow indicates direction of forward (easy) current flow as indicated by dc anneter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

	For power-supply frequency of 60 cps, single- phase operation, with resistive or inductive load, and at altitudes up to 30,000 feet	
	RMS_SUPPLY_VOLTAGE. 3500 max. vc DC_BLOCKING_VOLTAGE. 5000 max. vc	olts olts
	AVERAGE FORWARD CURRENT: At ambient temperature of 60° C 605 max. At ambient temperature of 100° C 235 max.	ma ma
	At other ambient temperatures	
	PEAK RECURRENT CURRENT	атр
-	For one-half cycle, sine-wave	
	AMBIENT-TEMPERATURE RANGE: Rating Ch	art
	Operating and storage65 to +125	oC



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DATA 8-61

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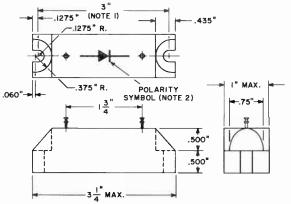
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 4.8 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward								
0	Charl	act	erı	stics	Curve			
Maximum Reverse Current:								
Dynamic (averaged over one complete cycle at maximum ratings) ^c DC at maximum rated dc blocking	• •			0.3	ma			
the operating temperature range				0.6	ma			
Shunt Capacitance:						· ·		
Maximum				160 85	μμf μμf			
Instantaneous Forward Voltage Drop .See j Maximum Reverse Current: Dynamic (averaged over one complete cycle at maximum ratings) ^c DC at maximum rated dc blocking voltage and any temperature within the operating temperature range Shunt Capacitance: Maximum	Inst Char · · ·	ant act 	ane eri	ous Fo stics 0.3 0.6 160	rward Curve ma ma μμf			

^a See Operating Considerations.

^b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient lime has elapsed for the device to return to the presurge thermal-equilbrium conditions.

C Example: For type CR105 at 60° C ambient temperature, average forward ma, = 605, peak inverse volts = 5000.



92CS-11243

NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

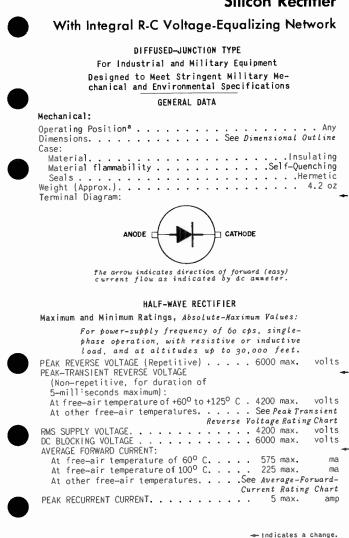
NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO5

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History









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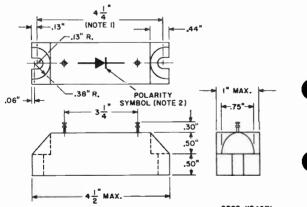
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PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 15 max. amp For one or more cycles, sine waveSee Peak-Surge-Current Rating Chart	
FREE-AIR TEMPERATURE RANGE: Operating and Storage	
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 6 volts Instantaneous Forward Voltage DropSee Instantaneous Forward Characteristics Curve	
Maximum Reverse Current: Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 ma DC (At maximum rated dc blocking voltage and any temperature within the	
operating temperature range)	
Shunt Capacitance: Maximum 125 Minimum 70 pf	

See Operating Considerations,

Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions. b

C Example: For type CR106 at 60° C free-air temperature, average forward ma. = 575, peak reverse volts = 6000.



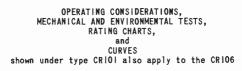
92CS-11249R1

NOTE 1: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



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World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

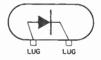
For Industrial and Military Equipment

Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a . Dimensions Case:	 			•	:	:		 See	Any Dimensional Outline
Material Material flammability Seals Weight (Approx.) Terminal Diagram:	у. 	•	÷	•	÷	÷	:	•••	Self-Quenching



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet.

F C	PEAK INVERSE VOLTAGE.	. 4200 max. volts
Д	AVERAGE FORWARD CURRENT:	
	At ambient temperature of 60° C	
	At ambient temperature of 100° C	. 210 max. ma
	At other ambient temperatures . See Aver	age-Forward-Current
		Rating Chart
	PEAK FECURRENT CURRENT	. 5 max. amp
r		
	For ore-half cycle, sine wave	. 15 max. атр
۵	For one or more cycles. See <i>Peak-Surge-C</i> AMBIENT-TEMPERATURE RANGE:	urrent Rating Chart
	Operating and storage	. −65 to +125 °C



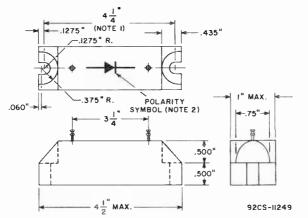
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions. . . 6 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve Maximum Reverse Current: Dynamic (averaged over one complete cycle at maximum ratings)^c. . . 0.3 ma DC at maximum rated dc blocking voltage and any temperature within the 0.6 operating temperature range . ma Shunt Capacitance: Maximum 125 μµf Minimum . µџf

a See Operating Considerations.

^b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

 $^{\rm C}$ Example: For type CR106 at 60 $^{\rm O}$ C ambient temperature, average forward ma. = 550, peak inverse volts = 6000.



NOTE 1: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

> OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO6





With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions Case:					
Material Material flammability					Self-Quenching
Seals					



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet PEAK REVERSE VOLTAGE (Repetitive) . . . 7000 max. volts PEAK-TRANSIENT REVERSE VOLTAGE (Non-repetitive, for duration of 5-milliseconds maximum): At free-air temperature of +60° to +125° C. 8400 max. volts At other free-air temperatures. .See Peak Transient Reverse Voltage Rating Chart 4900 max. RMS SUPPLY VOLTAGE. . . volts DC BLOCKING VOLTAGE . 7000 max. volts AVERAGE FORWARD CURRENT: At free-air temperature of $60^{\rm O}$ C. . 550 max. ma At free-air temperature of 100° C . 210 max. ma Current Rating Chart

-Indicates a change.

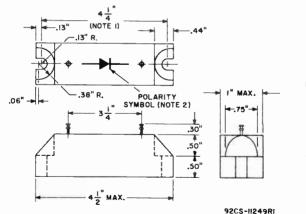
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation DATA 1 8-62

PEAK RECURRENT CURRENT 5 max. an PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 15 max. an For one or more cycles, sine waveSee Peak-Surge-Curren	np
FREE-AIR TEMPERATURE RANGE: Rating Char	rt
	С
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions	rd.
Maximum Reverse Current:)e
DC (At maximum rated dc blocking	na
voltage and any temperature within the operating temperature range) 0.6 m	na
Shunt Capacitance:	1.04
Ni - i	òf of

a See Operating Considerations.

b Superimposed on device operaling within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR107 at 60⁰ C free-air temperature, average forward ma. = 550, peak reverse volts = 7000.



NOTE 1: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Profession OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES shown under type CRIO1 also apply to the CRIO7



World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment

Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions	÷	 	:	:	:	:	 See	Dimensional Outline
Case:								
Material								Insulating
Material flammability								Self-Quenching
Seals								Hermetic
Weight (Approx.) Terminal Diagram:	•	• •	·	·	·	•	•••	4.2 oz



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet.

PEAK INVERSE VOLTAGE	
At ambient temperature of 60° C 550 max. ma At ambient temperature of 100° C 210 max. ma	
At other ambient temperatures . See Average-Forward-Current	
PEAK RECURRENT CURRENT	
For one-half cycle, sine wave 15 max. amp For one or more cycles. See Peak-Surge-Current Rating Chart	
AMBIENT-TEMPERATURE RANGE: Operating and storage	



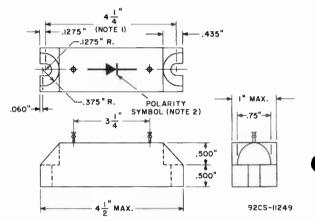
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 7.2 volts Instantaneous Forward Voltage Drop .See Instantaneous Forwara Characteristics Curve								
Maximum Reverse Current:								
Dynamic (averaged over one complete cycle at maximum ratings) ^c 0.3 ma DC at maximum rated dc blocking voltage								
and any temperature within the operating temperature range 0.6 ma Shunt Capacitance:								
Maximum								

a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

c Example: For type CR107 at 60° C ambient temperature, average forward ma. = 550, peak inverse volts = 7000.



NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO7



Silicon	Rectifier
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With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

	Operating Position ^a Dimensions								
)	Case: Material Material flammability	•	:	•	:	•	:	:	 Insulating Self-Quenching
	Seals								



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet

PEAK REVERSE VOLTAGE (Repetitive) . . . 8000 max. volts PEAK-TRANSIENT REVERSE VOLTAGE (Non-repetitive, for duration of

5-milliseconds maximum):

At free-air temperature of

	+60° to +125° C	
	At other free-air temperatures See Peak Transient	
)	Reverse Voltage Rating Chart	
	RMS SUPPLY VOLTAGE	
	DC BLOCKING VOLTAGE 8000 max. volts	
	AVERAGE FORWARD CURRENT:	
	At ambient temperature of 60° C 550 max. ma	l
	At ambient temperature of 100° C 210 max. ma	L
	At other ambient temperatures See Average-Forward-	
۱	Current Rating Chart	
	PEAK RECURRENT CURRENT	

- Indicates a change.

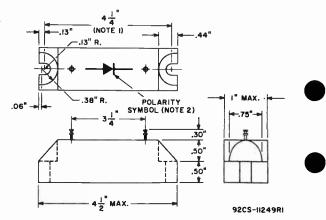


PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 15 max. amp For one or more cycles, sine waveSee Peak-Surge-Current Rating Chart FREE-AIR TEMPERATURE RANGE:	•
Operating and storage65 to +125 °C	
Characteristics:	
Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 7.8 volts Instantaneous Forward Voltage Drop. See Instantaneous Forward Characteristics Curve	
Maximum Reverse Current: Dynamic (Averaged over one complete cycle at maximum ratings) ^c 0.3 ma DC (At maximum rated dc blocking voltage and any temperature within	
the operating temperature range) 0.6 ma	
Shunt Capacitance: Maximum 100 pf Minimum 55 pf	

See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

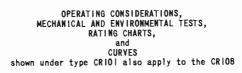
c Example: For type CR10B at 60° C free-air temperature, average forward ma. = 550, peak reverse volts = 8000.



NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CUR-RENT FLOW AS INDICATED BY DC AMMETER.







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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 8-62

World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment

Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a . Dimensions Case:	• •					•		.Se	e.	Dii	ne i	151	 ona	10	/ utli	ne
Material Material flammabil Seals Weight (Approx.)	ity.	:	:	:	:	:	:	•••	•	•	:	Se	lf- 	Que He	nch rmei	ng
Terminal Diagram:																



the arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, single- phase operation, with resistive or inductive load, and at altitudes up to 30,000 feet	
PEAK INVERSE VOLTAGE. 8000 max. RMS SUPPLY VOLTAGE. 5600 max.	volts volts volts
At ambient temperature of 60° C	
PEAK RECURRENT CURRENT. 5 max. PEAK SURGE CURRENT: ^b 5 max. For one-half cycle, sine wave 15 max.	
For one or more cyclesSee Peak-Surge-Current Rating C AMBIENT-TEMPERATURE RANGE:	chart
Operating and storage	°C



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation Somerville, N. J.

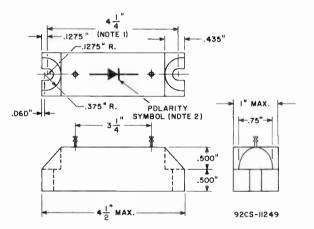
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 7.8 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve							
Maximum Reverse Current:							
Dynamic (averaged over one complete cycle at maximum ratings)? 0.3 ma DC at maximum rated dc blocking voltage and							
any temperature within the operating							
temperature range							
Shunt Capacitance:							
Махімия							

a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

^C Example: For type CR108 at 60^o C ambient temperature, average forward ma. = 550, peak inverse volts = 8000.



NOTE 1: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO8

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

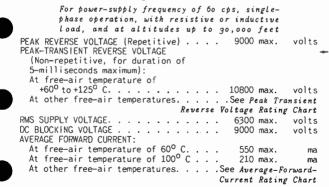
Operating Position ^a Dimensions	:	:	:	:	:	:	•	 See	Any Dimensional Outline
Case:									
Material									
Material flammability									Self-Quenching
Seals									
Weight (Approx.)									5.4 oz 🖛
Terminal Diagram:									



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:



-Indicates a change.

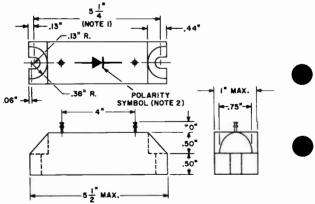


PEAK RECURRENT CURRENT 5 max. am PEAK SURGE CURRENT. ^b For one-half cycle, sine wave 15 max. am For one or more cycles, sine wave See Peak-Surge-Curren	
Rating Char FREE-AIR TEMPERATURE RANGE: Operating and storage Operating and storage	
Characteristics: Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions	d
Maximum Reverse Current: Dynamic (Averaged over one complete cycle at maximum ratings) ^e 0.3 m DC (At maximum rated dc blocking voltage and any temperature within the operating temperature range) 0.6 m	
Shunt Capacitance:	f f

^a See Operating Considerations.

^b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient lime has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR109 at 60° C free-air temperature, average forward ma. = 550, peak reverse volts = 9000.



92CS-11250RI

NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR I/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIO9



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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History DATA 2 8-62

World Radio History

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a
Material
Material flammability Self-Quenching
Seals
Weight (Approx.)



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet

	PEAK INVERSE VOLTAGE	;
,	RMS SUPPLY VOLTAGE 6300 max. volts	;
	DC BLGCKING VOLTAGE	;
	AVERAGE FORWARD CURRENT:	
	At ambient temperature of 60° C 550 max. ma	
	At ambient temperature of 100° C 210 max. ma	1
	At other ambient temperatures See Average-Forward-Current	
	Rating Chart	
	PEAK RECURRENT CURRENT 5 max. amp PEAK SURGE CURRENT: ^b	
	For ore-half cycle, sine wave 15 max. amp	,
	For one or more cyclesSee Peak-Surge-Current Rating Chart	
	AMBIENT-TEMPERATURE RANGE:	
	Operating and storage	



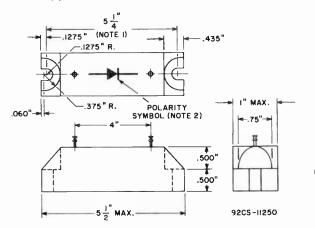
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions 9 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve	
Maximum Reverse Current:	
Dynamic (averaged over one complete cycle at maximum ratings) ^c	
any temperature within the operating	
cemperature range	
Shunt Capacitance: Maximum	
Maximum	
minimum $\dots \dots \dots$	

a See Operating Considerations.

^b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR109 at 60° C ambient experiation constructs, ma. = 550, peak inverse volts = 9000.



NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIO9



With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment

Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanicai:

Operating Position ^a	•		•	•		•	· ·	Any
Dimensions	•	٠	•	•	•	٠	See	Dimensional Outline
Case:								
Material	•		•			•	• •	Insulating
Material flammability			•			•		Self—Quenching
Seals								Hermetic
Weight (Approx.)						•		••••• 5.5 oz 🖛
Terminal Diagram:								
ronnar = · J								



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30.000 feet.

PEAK REVERSE VOLTAGE (Repetitive) 10000 max. volts PEAK-TRANSIENT REVERSE VOLTAGE (Non-repetitive, for duration of 5-milliseconds maximum): At free-air temperature of +60° to +125° C. 12000 max. volts At other free-air temperatures. . See Peak Transient Reverse Voltage Rating Chart 7000 max. volts RMS SUPPLY VOLTAGE. . . volts DC BLOCKING VOLTAGE . . 10000 max. AVERAGE FORWARD CURRENT: At free-air temperature of 60° C. . . . 550 max. ma At free-air temperature of 100° C . . . 210 max. ma . .See Average-Forward-At other free-air temperatures. . Current Rating Chart 5 max. amp PEAK RECURRENT CURRENT, .

---- Indicates a change.



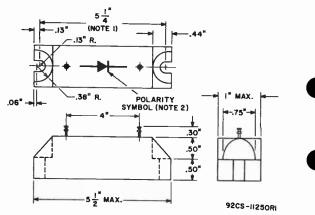
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PEAK SURGE CURRENT: ^b For one-half cycle, sine wave 15 max. amp For one or more cycles, sine waveSee Peak-Surge-Current Rating Chart FREE-AIR TEMPERATURE RANGE: Operating and storage	
Characteristics:	
Maximum Full-Cycle Average Forward Voltage	
Drop at maximum rated operating conditions 9.6 volts	
Instantaneous Forward Voltage Drop . See Instantaneous Forward	
Characteristics Curve	- -
Maximum Reverse Current:	
Dynamic (Averaged over one complete	
DC (At maximum ratings)*	
DC (At maximum rated dc blocking voltage	-
and any temperature within the	
operating temperature range) 0.6 ma	
Shunt Capacitance:	-
Maximum	
Minimum	

See Operating Considerations.

Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR110 at 60⁰ C free-air temperature, average forward ma. = 550, peak reverse volts = 1000.



NOTE I: DISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 1/4"-DIAMETER BOLTS.

#OTE 2: ARROW INDICATES DIRECTION OF FORWARD {EASY}
CURRENT FLOW AS INDICATED BY DC AMMETER.



OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES shown under type CRIOI also apply to the CRIIO



DATA 2 8-62

With Integral R-C Voltage-Equalizing Network

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Military Mechanical and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position ^a Dimensions Case:		:	•	:			 See	Dimensional Outline
Material Material flammability Seals								Self-Quenching
Weight (Approx.) Terminal Diagram:	:	:	:	•	•	:	•••	5.3 oz



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load, and at altitudes up to 30,000 feet.

	olts
	olts
AVERAGE FORWARD CURRENT:	
At ambient temperature of 60° C	ma
At ambient temperature of 100 ⁰ C 210 max.	та
At other ambient temperatures . See Average-Forward-Cur	rent
Rating C.	hart
PEAK RECURRENT CURRENT	amp
PEAK SURGE CURRENT: D	
For one-half cycle, sine wave 15 max.	amp
For one or more cycles. See Peak-Surge-Current Rating C.	hart
AMBIENT-TEMPERATURE RANGE:	
Operating and storage	oC



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-61

CR110

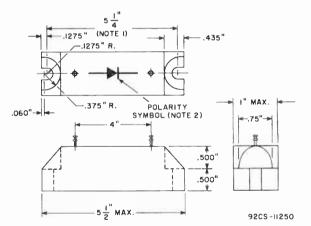
Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum rated operating conditions. . . 9.6 volts Instantaneous Forward Voltage Drop .See Instantaneous Forward Characteristics Curve Maximum Reverse Current: Dynamic (averaged over one complete cycle at maximum ratinos)^c. . . 0.3 ma DC at maximum rated dc blocking voltage and any temperature within the operating temperature range . 0.6 ma Shunt Capacitance: Maximum 80 μµf Minimum 40 μµf

^a See Operating Considerations.

b Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.

C Example: For type CR110 at 60^o C ambient temperature, average forward ma. = 550, peak inverse volts = 10000.



NOTE 1: LISTANCE BETWEEN CENTERS OF MOUNTING HOLES FOR 174"-DIAMETER BOLTS.

NOTE 2: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

OPERATING CONSIDERATIONS, MECHANICAL AND ENVIRONMENTAL TESTS, RATING CHARTS, and CURVES Shown under Type CRIOI also apply to the CRIIO



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History

With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

GENERAL DATA

Mechanical:

Operating Position		•	•		•	•			Any
Dimensions		٠		•	•	٠		See	Dimensional Outline
Case:									
Material		•			•				Insulating
Material flammability									Self-Quenching
Seals									Hermetic
Weight (Approx.) Terminal Diagram:	•	•	•	•	•	•	•		0.32 oz



The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

For power-supply frequency of 60 c	
phase operation, with resistive or in	ductive load
PEAK REVERSE VOLTAGE.	
RMS SUPPLY VOLTAGE	1060 max. volts
DC BLOCKING VOLTAGE	
AVERAGE FORWARD CURRENT:	
At free-air temperature of 60° C	300 max. ma
At free-air temperature of 100° C	
At other free-air temperatures Se	
<u>^</u>	reant Pating Chart
Cu	rrent Rating Chart
PEAK RECURRENT CURRENT	rrent Rating Chart
C₂ PEAK RECURRENT CURRENT	rrent Rating Chart
Cu PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp
CL PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp 9 max. amp
CL PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp 9 max. amp . See Peak-Surge-
CL PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp 9 max. amp
CL PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp 9 max. amp . See Peak-Surge-
CL PEAK RECURRENT CURRENT	rrent Rating Chart 3 max. amp 9 max. amp . See Peak-Surge- rrent Rating Chart

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Characteristics:

Maximum Full-Cycle Average Forward Voltage Drop at maximum-rated operating conditions 1.8 volts Instantaneous Forward Voltage Drop . See Instantaneous Forward Characteristics Curve	
Maximum-Reverse Current:	
Dynamic (Averaged over one complete cycle at maximum ratings) ^b 0.1 ma DC (At maximum rated dc blocking voltage and any temperature within the operating temperature range) free-air temperature =	
25° C	

- Superimposed on device operating within the maximum voltage, current, and temperature ratings and may be repeated after sufficient time has elapsed for the device to return to the presurge thermal-equilibrium conditions.
- Example: For type CR201 at 60⁰ C free-air temperature, average forward ma. = 300, peak reverse volts = 1500.

OPERATING CONSIDERATIONS

A surge-limiting impedance should always be used in series with the rectifier. The impedance value must be sufficient to limit the surge current to the value specified under the maximum ratings. This impedance may be provided by the power transformer windings, or by an external resistor or choke.

Because this rectifier operates atvoltages which are dangerous, care should be taken in the design and operation of the equipment to prevent personnel from coming in contact with the rectifier.

Care should be exercised during the soldering operation to prevent overheating of the rectifier terminals. A clean, well-tinned iron is recommended to keep soldering time to a minimum.

During a period of prolonged heating, for example, during lead unwrapping, a heat sink such as the jaws of a pair of long-nose pliers should be used between the tip of the soldering iron and the rectifier case.

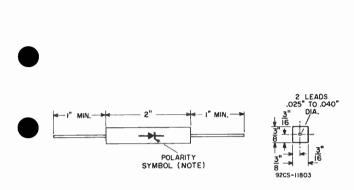
This rectifier should not be used in series arrangements to obtain dc output voltages higher than those obtained from a single unit. For information on special precision-matched units for use in such series arrangements, write to RCA, Commercial Engineering, Somerville, New Jersey.





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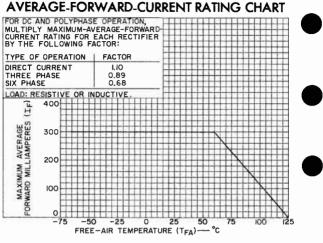




NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.

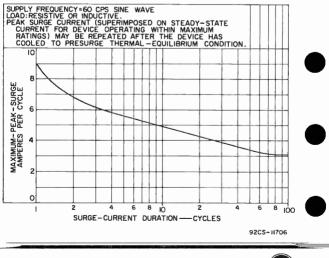


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History DATA 2 8-62



92CS-11704

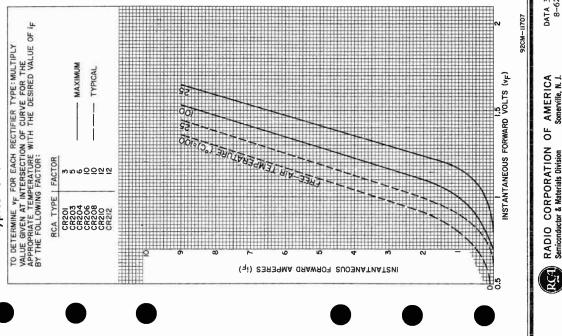
PEAK-SURGE-CURRENT RATING CHART



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Profession







DATA 3 8-62

Somerville, N.

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CORPORATION

Materials Division

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Semiconductor

RADIO

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With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR203 is the same as the CR201 except for the following items:

Mechanical:

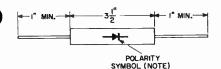
HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values:

For power-supply frequency of 60 cps, singlephase operation, with resistive or inductive load

PEAK REVERSE VOLTAGE.										1500 max. volts
RMS SUPPLY VOLTAGE					•				•	
DC BLOCKING VOLTAGE .	•	•	•	•	•	•	•	•	•	1500 max. volts

Characteristics:





NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History Somerville, N. J. DAT A 8-62

With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR204 is the same as the CR201 except for the following items:

Mechanical:

Dimensions									See	Dimensional	Outline
Weight (Approx.).		•	•	•	•	•	•	•			0.73 oz

HALF-WAYE RECTIFIER

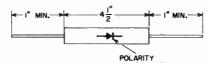
Maximum and Minimum Ratings, Absolute-Haximum Values:

For power-suppl phase operation,								
PEAK REVERSE VOLTAGE.								volts
RMS SUPPLY VOLTAGE							2120 max.	volts
DC BLOCKING VOLTAGE .	 •	•		•	•	•	3000 max.	volts

Characteristics:

Maximum Full-Cycle Average Forward	
Voltage Drop at maximum-rated	
operating conditions	3.6

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SYMBOL (NOTE)





NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redo History DATA 8-62

With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR206 is the same as the CR201 except for the following items:

Mechanical:

Dimensions						See	D	imens	onal	Outline
Weight (Approx.).										1.20 oz

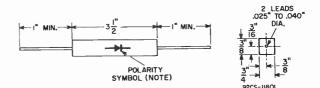
HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-suppl phase operation,	у w	fre ith	equ re	en si	st	i v	o f e	60 0 r	cps, single- inductive load	
PEAK REVERSE VOLTAGE.									6000 max.	volts
RMS SUPPLY VOLTAGE DC BLOCKING VOLTAGE .										volts volts

Characteristics:

Maximum Full-Cycle Average Forward		
Voltage Drop at maximum-rated		
operating conditions	6	volts



NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



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With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR208 is the same as the CR201 except for the following items: Mechanical:

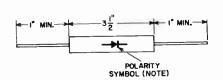
Dimensions						See	D	ime	:ns	5 i 0	nal O	utline
Weight (Approx.).											1.20	oz

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

For power-supply fre phase operation, with	equency of 60 cps, single- h resistive or inductive load	
PEAK REVERSE VOLTAGE		volts
DC BLOCKING VOLTAGE		olts

Characteristics:





NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For Industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR210 is the same as the CR201 except for the following items: Mechanical:

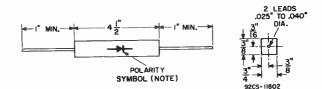
Dimensions						See	Dimens	sional	Outline
Weight (Approx.).									1.60 oz

HALF-WAVE RECTIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values;

For power-sup phase operatio														
PEAK REVERSE VOLTAGE													10000 max.	volts
RMS SUPPLY VOLTAGE. DC BLOCKING VOLTAGE	:	:	:	:	:	:	1	:	:	:	:	:	10000 max.	volts

Characteristics:



NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



With Precisely-Matched Cells for Internal Voltage Equalization

DIFFUSED-JUNCTION TYPE

For industrial and Military Equipment Designed to Meet Stringent Electrical, Mechanical, and Environmental Specifications

The CR212 is the same as the CR201 except for the following items:

Mechanical:

Dimensions						See	Dimensional	
Weight (Approx.).				•				1.60 oz

HALF-WAVE RECTIFIER

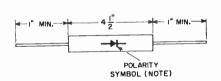
Maximum and Minimum Ratings, Absolute-Naximum Values:

For power-supply frequency of 60 cps, single	•
phase operation, with resistive or inductive loa	
PEAK REVERSE VOLTAGE	volts

RMS SUPPLY VOLTAGE.												8480 max.	volts
DC BLOCKING VOLTAGE	·	·	•	•	·	·	•	•	•	•	٠	12000 max.	volts

Characteristics:

Maximum Full-Cycle Average Forward		
Voltage Drop at maximum-rated		
operating conditions	7:2 max.	volts





NOTE: ARROW INDICATES DIRECTION OF FORWARD (EASY) CURRENT FLOW AS INDICATED BY DC AMMETER.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Recto History DATA 8-62

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2DG001

No.2

Twin Semiconductor Diode

GERMANIUM DIFFUSED-JUNCTION TYPE For Switching Applications in Electronic Data-Processing Systems

GENERAL DATA

Mechanical:

No.2

Operating Position Maximum Length (Excluding Maximum Diameter Dimensional Outline	flexible leads) . 	0.260" 0.370"
Case		Welded, Metal
Seals		
Leads, Flexible		3
Minimum length		1.5"
Orientation and diameter.	See Di	imensional Outline
Terminal Diagram: B	OTTOM VIEW	
Lead 1-Diode Unit No.1 Lead 3-Diode Unit	3	ead 4-Common Lead for Diode Units No.1 &

The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.

SWITCHING SERVICE

Values are for Each Unit

Maximum and Minimum Ratings, Absolute-Haximum Values:

At free-air temperature of	2	5°	С	uı	nl	e s	s	ot	herwise speci	fied
DC REVERSE VOLTAGE										
DC FORWARD CURRENT ^a						•			40 max.	ma
FREE-AIR TEMPERATURE RANGE:										0.0
Operating and storage		•	·	·	·	٠	·	÷	-65 to +85	°C
LEAD TEMPERATURE:										00
For 10 seconds maximum					•	٠			230 max.	°C

ELECTRICAL CHARACTERISTICS

Values are for each unit and at free-air temperature of 25° C unless otherwise specified

	Min.	Max.
a contract a contrago con	F	
dc forward ma. =		
5	_	0.4 volt
9	-	0.55 volt
^a See accompanying Rating Chart.		



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 8-61

2DG001

Reverse Breakdown Voltage for dc reverse $\mu a = -200$ DC Forward Current for dc	BV _R	-20	-	volts
forward volts = 1	I _F I _R	40	-	ma
dc reverse volts = -210 Reverse Recovery Time ^b for dc reverse volts = -6, dc forward ma. = 20, recovery to a	trr	-	-15 -75	μа μа
reverse impedance (ohms) = 35000		_	0.25 0.3	µsec µsec

b See accompanying Reverse-Recovery-Fime Measurement Circuit.

OPERATING CONSIDERATIONS

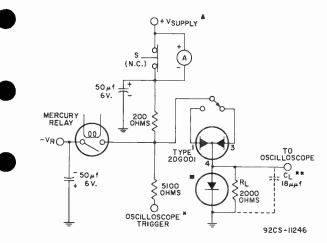
It is recommended that this device not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the device or its associated circuitry.

The *flexible leads* of this device are usually soldered to the circuit elements. Soldering of the leads may be made close to the stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the device.

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Somerville, N. J.



REVERSE-RECOVERY-TIME MEASUREMENT CIRCUIT

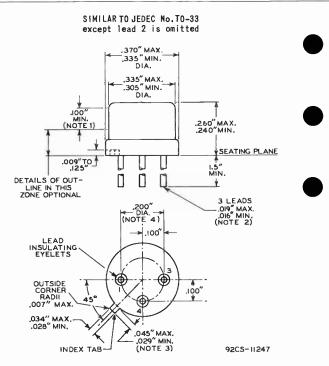


NOTE: THE STRAY CAPACITANCE ACROSS THE SOCKET FOR THE TWIN DIODE UNIT UNDER TEST MUST BE LESS THAN 2 $\mu\mu$ f.

- * TEKTRONIX TYPE 545 OSCILLOSCOPE WITH TYPE H PLUG-IN VERTICAL AMPLIFIER AND TYPE P6000 PROBE, OR EQUIVALENT.
- ** CL REPRESENTS THE TOTAL CAPACITANCE ACROSS RL --- THAT IS, THE SUM OF THE OSCILLOSCOPE-PROBE CAPACITANCE AND THE STRAY CAPACITANCE. THE STRAY CAPACITANCE ACROSS RL MUST BE LESS THAN 6 μμf.
- SILICON ULTRA-FAST SWITCHING DIODE WITH 0.5-mµlsec MAXIMUM REVERSE RECOVERY TIME WHEN SWITCHING FROM IO MA. FORWARD CURRENT TO -6 VOLTS REVERSE VOLTAGE.
- WITH RELAY OUT AND SWITCH (S) OPEN, ADJUST VSUPPLY TO OBTAIN SPECIFIED FORWARD CURRENT (IE).



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Word Radio History Somerville, N. J.



NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

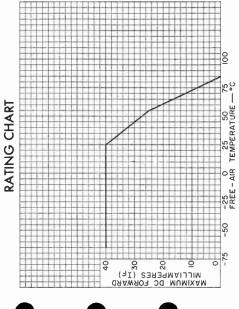
NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM OIAMETER OF 0.021" IS HELO. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL OEVICE.

NOTE 4: LEAOS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.



2DG001



92CS-11198

World Radio History



AMERICA Somerville, N. J. Я CORPORATION RADIO CORPORATION Semiconductor & Materiats Division



POINT-CONTACT TRANSISTOR

GERMANIUM TYPE FOR PULSE OR SWITCHING APPLICATIONS

DATA

Maximum Depth	0.660" 0.445" ±.020" 0.240" Plastic r 3-Pin . Any
PULSE or SWITCHING SERVICE	
Voltage values are given with respect to base conne	ction
Maximum Ratings, Absolute Values:	1
COLLECTOR: -40 max. DC Voltage -8 max. Dissipation 50 max. EMITTER: -40 max. DC Voltage -40 max. DC Voltage 3 max. AMBIENT TEMPERATURE 40 max.	volts ma mw volts ma oC
Characteristics at Ambient Temperature of 25°C:	
With input circuit between emitter and base connect and output circuit between collector and base connec	
DC Collector Voltage	volts ma ohms
Open-Circuit Output 31000 Feedback 140 Power Gain# 21 Frequency: 140	ohms ohms db
For Voltage-gain cutofft 0.9	MC
For alpha cutoff†† 2.7	Mc
Minimum Circuit Values:	.
Emitter-Circuit Resistance 1000 min.	ohms
O obtained by adjusting a variable resistor in series with power to give the desired current.	er supply
* with collector load resistance of 10000 ohms, signal-source imp 500 ohms, and signal frequency of 5000 cycles per second. Measured at a point 3 decibels down from the low-frequency value and with collector load resistance of 20000 ohms, signal-source of 300 ohms, and signal voltage of 25 millivolts rms. The cu quency is defined as the frequency at which the output voltage ha to 0.7 of its low-frequency value.	edance of (100 KC) impedance toff fre- is dropped
tt, see next page.	

JUNE 1, 1953

SC-19



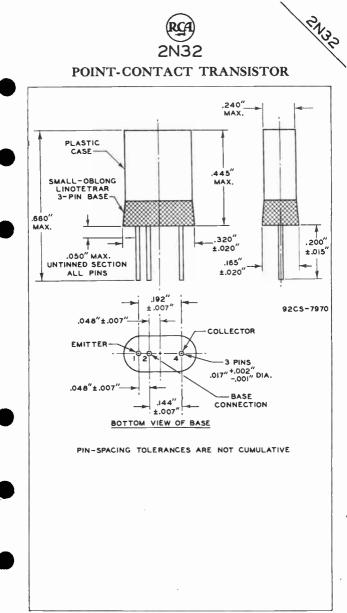


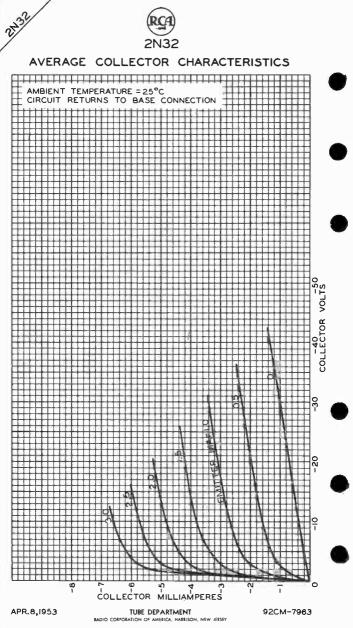
POINT-CONTACT TRANSISTOR

the weasured at a point 3 decibels down from its low-frequency value (100 kc). The cutoff frequency is defined as the frequency at which the current amplification factor has dropped to 0.7 of its lowfrequency value.

The $2Nq_2$ should not be inserted into or withdrawn from its socket with the power "on" because high transient currents may cause permonent damage to the transistor.

TENTATIVE DATA





World Radio History



POINT-CONTACT TRANSISTOR

GERMANIUM TYPE FOR OSCILLATOR APPLICATIONS UP TO 50 Mc

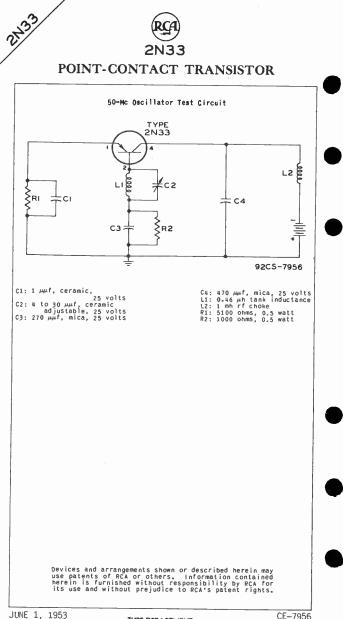
DATA

General:	۰ ۵
Maximum Overall Lengtn 0.66	15 "
Maximum Seated Length	20"
Width	10
Maximum Depth	tic
Case	Pin
Base	Any
Mounting Position	,
VHF OSCILLATOR SERVICE	
Voltage values are given with respect to base connection	1
Maximum Ratings, Absolute Values:	
COLLECTOR:	۱
DC Voltage	113
DC Current	
Dissipation	ШМ
EMITTER:	ma
DC Current	00
AMBIENT TEMPERATURE	-(
Typical Operation in Accompanying 50-Mc Oscillator Test Circuit:	
COLLECTOR:	۰.
DC Supply Voltage	lts
DC Current	ma
DC Emitter Current	ma
Useful Power Output (Approx.) 1.0	m
The 2N33 should not be inserted into or withdrawn from	
its socket with the power "on" because high transient	
currents may cause permanent damage to the transistor.	
currents muy cause permanent aumore por the provident	

OUTLINE DIMENSIONS and TERMINAL CONNECTIONS for Type 2N33 are the same as those shown for Type 2N32

JUNE 1, 1953

CCV23





JUNCTION TRANSISTOR

P-N-P GERMANIUM TYPE

FOR LOW-POWER, LOW-FREQUENCY APPLICATIONS

DATA

General:																		
Maximum Overa	alt Lei	ng t	h.													0.	885	5"
Maximum Seate	ed Leng	gth														0.	670)"
Width																		
Depth							•	•	•			•	0.	. 16	55"	± 0.	.020)"
Case								•			•					Pla	asti	С
Base					5	sma	11	-0	ЬI	or	١g	L	inc	ote	etr	ar 🤅	3-Pi	n
Mounting Pos	ition									•							Ar	עי
-																		

AUDIO-FREQUENCY AMPLIFIER SERVICE

Voltages are given with respect to base connection

Maximum Ratings, Absolute Values:

COLLECTOR:

DC Voltage	•						-25	max.	volts
DC Current							8	max.	ma
Dissipation							50	max.	mw
EMITTER:									
DC Current					•			max.	ma
AMBIENT TEMPERATURE							50	max.	°C

Characteristics at Ambient Temperature of 25°C:

With input circuit between base connection and emitter, and output circuit between collector and emitter

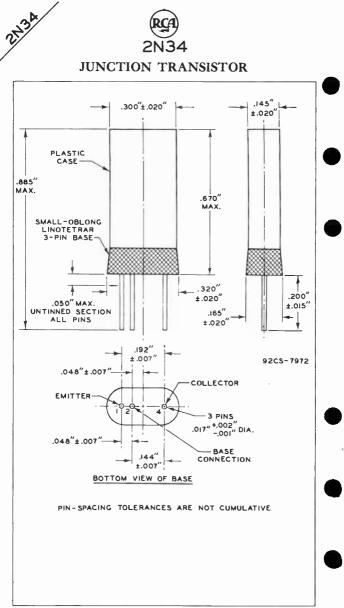
Collector:

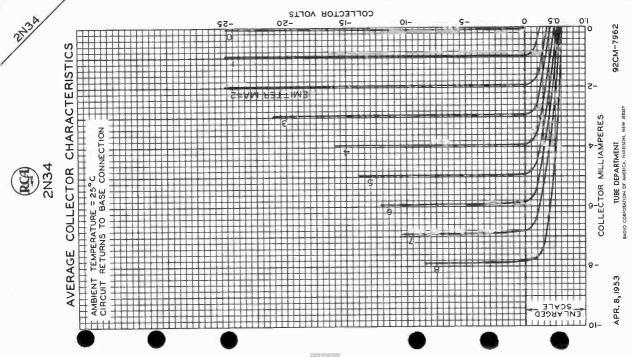
DC Voltage6	volts
DC Current	μamp
DC Emitter Current [®] 1	ma
DC Base-Connection Current25	μamp
Current Amolification Factor (Approx.):	
Between Emitter and Collector 0.98	
Between Base Connection and Collector 40	
Power Gain#	db
	1

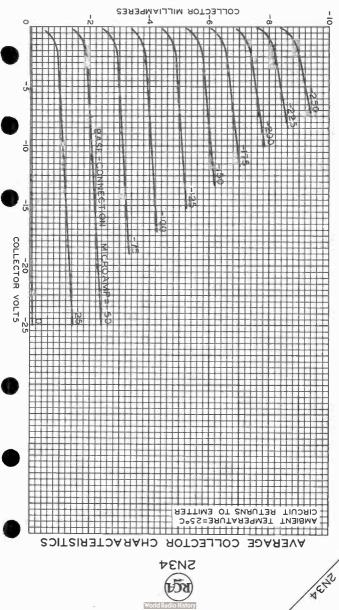
- With collector voltage of -12 volts and emitter current of 0 milliamperes. Øbtained by adjusting a variable resistor in series with the power supply
- to give the desired current.
 - With collector load resistance of 30000 ohms, signal-source impedance of 500 ohms, and signal frequency of 5000 cycles per second.

The 2N34 should not be inserted into or withdrawm from its socket with the power "on" because high transient currents may cause permanent damage to the transistor.

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REDIO CORPORATION OF AMERICA, HARRISON, NEW JERSEY

92CM-7961

£261,8.99A



2535

JUNCTION TRANSISTOR

N-P-N GERMANIUM TYPE

FOR LOW-POWER, LOW-FREQUENCY APPLICATIONS

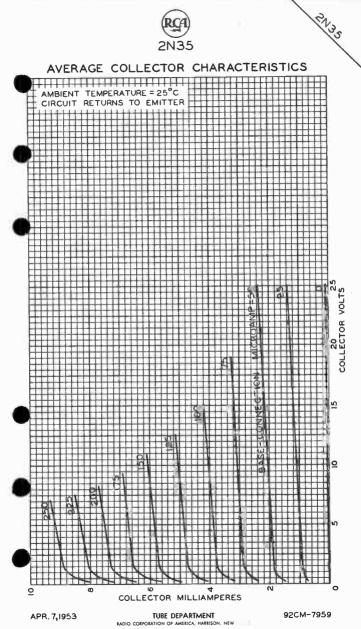
DATA

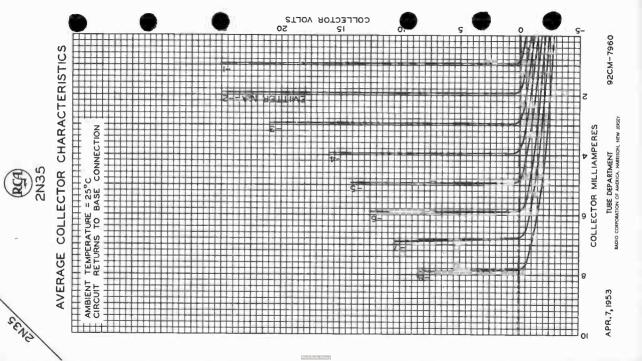
	General:
I	Maximum Overall Length 0.885" Maximum Seated Length 0.670" Width 0.020" Depth 0.165" ± 0.020" Case Plastic Base Small-Oblong Linotetrar 3-Pin Mounting Position Any
	AUDIO-FREQUENCY AMPLIFIER SERVICE
	Voltages are given with respect to base connection
	Maximum Ratings, Absolute Values:
	COLLECTOR: 25 max. volts DC Voltage 8 max. ma DC Current 8 max. ma Dissipation 50 max. mw EMITTER: -8 max. ma DC Current 50 max. ma
	Characteristics at Ambient Temperature of 25°C:
	With input circuit between base connection and emitter, and output circuit between collector and emitter Collector:
	DC Voltage 6 volts DC Current
	 With collector voltage of 12 volts and emitter current of 0 milli- amperes. Obtained by adjusting a variable resistor in series with the power supply to give the desired current. With collector load resistance of 30000 ohms, signal-source impedance of 500 ohms, and signal frequency of 5000 cycles per second.
	The 2N35 should not be inserted into or withdrawn from its socket with the power "on" because high transient currents may cause permanent damage to the transistor.
	OUTLINE DIMENSIONS and TERMINAL CONNECTIONS for Type 2N35 are the same as those shown for Type 2N34 $$

World Radio History

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PAI

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For small-signal audio-frequency applications

GENERAL DATA

Electrical:

Electrical:
Minimum DC Collector-to-Base Voltage for dc collector current of -20 μamp with emitter open, and at am- tiert temperature of 25°C30 volts Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25°C10 μamp
Mechanical:
Wounting Position Any Maximum Length (Excluding flexible leads) 0.405" Maximum Diameter 0.240" Case Maximum Diameter Envelope Seals Metal, Insulated Envelope Seals Hermetic Leads, Flexible 3 Length 1.5" ± 0.015" Orientation and diameter See Dimensional Outline at front of this Section BOTTOM VIEW
Leac 1 - Emitter (Adjacent to red dot on side of
AUDIO-FREQUENCY AMPLIFIER Class A
Maximum Ratings, Absolute Values:
DC COLLECTOR-TO-BASE VOLTAGE25 max. volts
DC COLLECTOR CURRENT

Characteristics, At Ambient Temperature of 25°C:

Common-Emitter Circuit, Base Input

	DC Collector-to-Emitter Voltage4 DC Collector Current0.7	volts ma
	Power Bain: With load resistance = 0.1 megohm,	
1	and input resistance = 1980 ohms 44.1	db
	With load resistance = 2670 ohms, and input resistance = 2670 ohms 34.5	db

TENTATIVE DATA 1





Measured with a noise diode and thermo- couple voltmeter with load resistance = 20,000 ohms, generator resistance = 1000 ohms, and equivalent noise band- width = 12.3 kc with geometric mean of 300 cps. Small-Signal T Parameters:* DC Collector-to-Emitter Voltage (VCE). -4 volts DC Collector-to-Emitter Voltage (VCE). -4 volts DC Collector Current (I _C). 0.7 ma Emitter Resistance (r _b). 3.86 megohms Collector Resistance (r _b). 3.93 megohms Current Transfer Ratio (a _f)* -55 Small-Signal Hybrid-# Parameters:* DC Collector Current (I _C). 407 µmhos Conductance gb'e. 407 µmhos Conductance gb'e. 40 µµf Intrinsic Transconductance (gm). wolts CC Collector-to-Emitter Voltage (VCE).			
DC Collector-to-Emitter Voltage (V _{CE})4 volts DC Collector Current ($ _{C}$)	couple voltmeter with load resistance = 20,000 ohms, generator resistance = 1000 ohms, and equivalent noise band- width = 12.3 kc with geometric mean	6.5	db
DC Collector Current $(_{C})$	Small-Signal T Parameters:*		
DC Collector-to-Emitter Voltage (V_{CE})4 volts DC Collector Current (I_C)	DC Collector-to-Emitter Voltage {V _{CE} } DC Collector Current { $ _C$ } Emitter Resistance { r_e } Base Resistance { r_b } Mutual Resistance { r_m } Collector Resistance { r_c } Current Transfer Ratio { α_f }	-0.7 23 1430 3.86 3.93	ma ohms ohms megohms
DC Collector-to-Emitter Voltage (V_{CE})4 volts DC Collector Current (I_C)	Small-Signal Hybrid-17 Parameters:*		
DC Collector-to-Emitter Voltage (V_{CE})4 volts DC Collector Current (I_C)0.7 ma Input Resistance, output circuit shorted (h_i)	DC Collector-to-Emitter Voltage (V _{CE}). DC Collector Current (I _C). Resistance r _{bb} . Conductance g _b . Conductance g _b . Conductance g _b . Conductance g _b . Capacitance C _b .	-0.7 240 407 6.8 0.13 5000 40 22300	ma ohms μmhos μmhos μμho μμιf μμιf μmhos
DC Collector-to-Emitter Voltage (V_{CE})4 volts DC Collector Current (I_C)0.7 ma Input Resistance, output circuit shorted (h_i)	Small-Signal H Parameters:*		
shorted (h_i)	DC Collector-to-Emitter Voltage (V _{CE}) DC Collector Current (I _C) Input Resistance, output circuit		
Forward Current Transfer Ratio, output circuit shorted (h _f)55 Output Conductance, input circuit open (h ₀)14 µmhus Common-Base Circuit, Emitter Input DC Collector-to-Base Voltage4 volts DC Collector Current0.7 ma Power Gain: With load resistance = 0.5 megohm, and input resistance = 215 ohms32.5 db Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc700 kc Measured at 1 kc. *,*: see next page. 6-56 TENTATIVE DATA 1	shorted (h;)		
output circuit shorted (h _f)	Forward Current Transfer Ratio	25 X 10	
open (h ₀)		55	
DC Collector-to-Base Voltage4 volts DC Collector Current0.7 ma Power Gain: With load resistance = 0.5 megohm, and input resistance = 215 ohms 32.5 db Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc 700 kc Measured at 1 kc. *,•: see next page. 6-56 TENTATIVE DATA 1		14	µmhos
DC Collector-to-Base Voltage4 volts DC Collector Current0.7 ma Power Gain: With load resistance = 0.5 megohm, and input resistance = 215 ohms 32.5 db Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc 700 kc Measured at 1 kc. *,•: see next page. 6-56 TENTATIVE DATA 1	Common-Base Circuit, Emitter Inp	ut	
With load resistance = 0.5 megohm, and input resistance = 215 ohms 32.5 db Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc 700 kc Measured at 1 kc. *,*: see next page. 6-56 TENTATIVE DATA 1	DC Collector Current		
ratio drops to one-half the square root of two times its value at 1 kc 700 kc Measured at 1 kc. *,*: See next page. 6-56 TENTATIVE DATA 1	With load resistance = 0.5 megohm, and input resistance = 215 ohms Frequency at which the current transfer	32.5	db
*,•: See next page.	ratio drops to one-half the square	700	kc
6-56 TENTATIVE DATA 1	Measured at 1 kc.		
6-56 TENTATIVE DATA 1	*,•: See next page.		
	6-56 SEMICONDUCTOR DIVISION	TENTATIN	E DATA 1



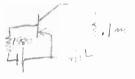
Common-Collector Circuit, Bas	se Input
DC Emitter-to-Collector Voltage	. 4 volts
DC Emitter Current	. 0.7 ma
Power Gain:	
With load resistance = 10,000 ohms, and input resistance = 0.5 megohm	. 17 db
* As Gerived from corresponding equivalent circuit	shown under type 2N104.
This frequency (figure of merit) may be calcul	ated from the equation

	_	1	9m			
1	=	4πV	r bb'	Cp.c	Cp,e	

OPERATING CONSIDERATIONS

The 2N77 should not be connected into ordisconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N77 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.



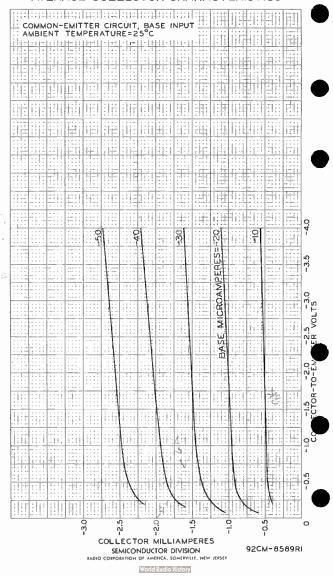


SEMICONDUCTOR DIVISION



2141

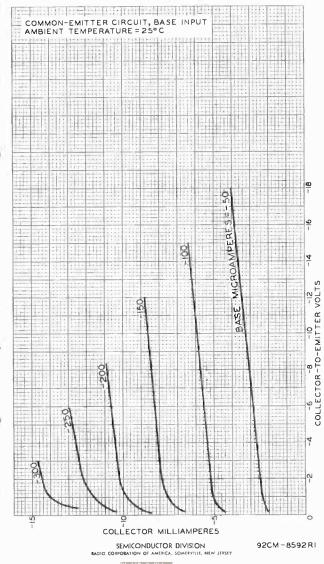
AVERAGE COLLECTOR CHARACTERISTICS

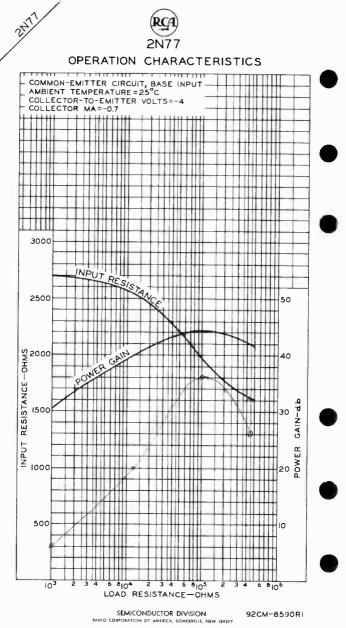




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AVERAGE COLLECTOR CHARACTERISTICS





World Radio History



-~ PIC P NOISE CHARAC TERIS STICS

IOr MEASURED METER NOISE B AMBIENT TEMPER CURVE 0 × GENERATOR RESISTANCE (OHMS) D WITH A NOISE DIODE AND THERMOCOUPLE WITH LOAD RESISTANCE=20000 OHMS AND BANDWIDTH=12.3 KC WITH GEOMETRIC MEAN EMITTER CIRCUIT, BASE 1000 1000 0 COLI ECTOR TO EM ITTER NOISE VO TS COLLECTOR-TO FAC INPUT TOR 1 1 4 ھ ģ EMITTER COLLECTOR EQUIVALENT OF 300 CPS 1000 1200 600 800 200 400 -0.7 GENERATOR RESISTANCE -OHMS 0.7 -30 -15 -20 -25 -5 -10 COLLECTOR-TO-EMITTER VOLTS -1.2 -0.4 0.4 -0.6 -0 COLLECTOR MILLIAMPERES -0.8 -1.0 -0.2

SEMICONDUCTOR

SOMERVILLE, P

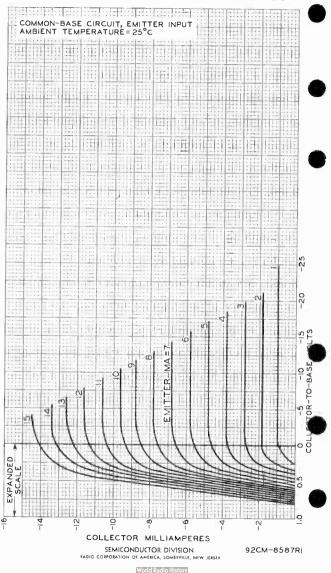
92CM-

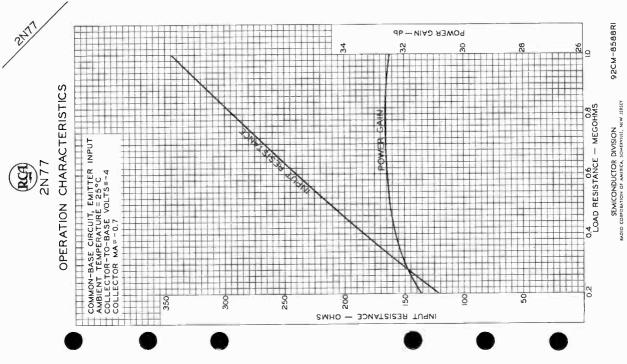
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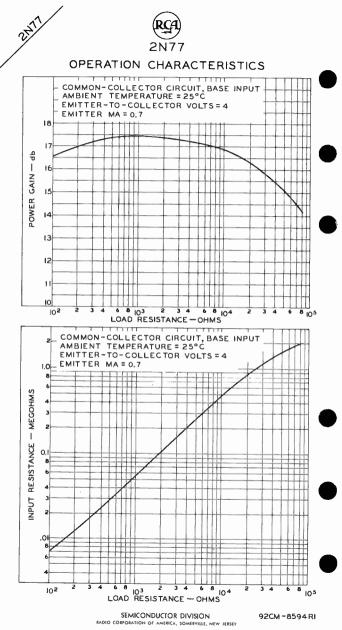


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AVERAGE COLLECTOR CHARACTERISTICS









PNIO*

2NI04

JUNCTION TRANSISTOR

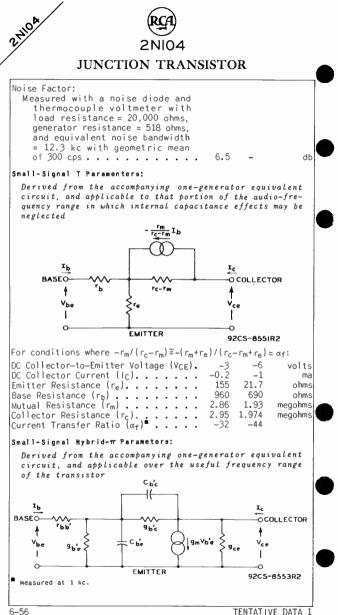
GERMANIUM P-N-P ALLOY TYPE

For small-signal audio-frequency applications

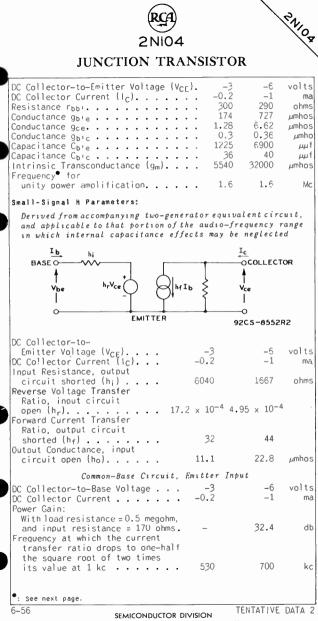
	GENERAL DATA
	Electrical:
	Minimum DC Collector-to-Base Voltage fordc collector current of -20 µamp with emitter open, and at am- bient temperature of 25°C30 volts Maximum DC Collector Current for dc collector-to-base voltage of -12
	volts with emitter open, and at am- bient temperature of 25°C10 µamp Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts with collector open, and at ambient temperature of 25°C10 µamp Junction Temperature Rise (In free air). 0.4 °C/mw
	Mechanical:
	Mounting Position
	Pin 1 - Emitter Pin 2 - Base
	AUDIO-FREQUENCY AMPLIFIER Class A
,	Maximum Ratings, Absolute Values:
	DC COLLECTOR-TO-BASE VOLTAGE. -30 max. volts DC COLLECTOR CURRENT. -50 max. ma DC EMITTER CURRENT. 50 max. ma TRANSISTOR DISSIPATION. See Rating Chart AMBIENT TEMPERATURE (During operation). 70 max. °C STORAGE-TEMPERATURE RANGE -55 to +85 °C
	Characteristics, At Ambient Temperature of 25°C:
	Common-Emitter Circuit, Base Input DC Collector-to-Emitter Voltage -4 -6 volts DC Collector Current -0.7 -1 ma Power Gain: With load resistance = 20,000 ohms, and input resistance = 1400 ohms. -4 41 db

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SEMICONDUCTOR DIVISION



RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY



	Common-Collector Circuit, Base Input	
	Emitter-to-Collector Voltage 3	volts
	Emitter Current 0.2	ma
	wer Gain:	
	With load resistance = 18,000 ohms, and input resistance = 0.5 megohm 14.3	ما أد
	and input resistance = 0.5 megonin, 14.5	db
• т	his frequency (figure of merit) may be calculated from the	equation

 $f = \frac{1}{4\pi} \sqrt{\frac{g_m}{r_{bb} \cdot c_{b} \cdot c_{b} \cdot c_{b} \cdot e}}$

OPERATING CONSIDERATIONS

The 2NIO4 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

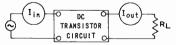
TRANSISTOR DISSIPATION RATING CHART

The Transistor Dissipation Rating Chart may be used to determine, for a particular circuit application, the maximum allowable transistor dissipation. On this chart, solid boundary lines ABC, DEF, and GHI are the loci of the maximum allowable dissipation for operating ambient temperatures of 25° C, 50° C, and 70° C, respectively. The dashed curves for the various values of circuit stability factor represent conditions where the maximum allowable dissipation is current limited by the maximum dc collector current rating of -50 milliamperes.

It is recommended that the $50^{\circ}\text{C-ambient-temperature curve}$ be used in commercial applications, and the 70°C curve for industrial applications. The 25°C curve should not be used unless the equipment is operated under closely controlled ambient-temperature conditions.

To use this chart it is only necessary to know the dc collector-to-emitter voltage, dc collector current, ambient temperature after equipment warm-up, and the circuit stability factor, $S_{\rm F}.$

The circuit stability factor is equal to the dc-circuit current gain of the transistor (between collector and base) plus one. It may be measured empirically from the arrange-

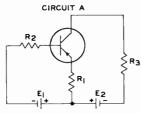


where $I_{in} = input$ current $I_{out} = output$ current and $R_L = load$ resistance ment shown at left. If a current, I_{in} , of 1 microampere dc is passed through the transistor circuit, the value of I_{out} in microamperes measured plus one is equal to the circuit stability factor.

214104



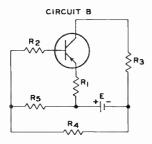
For conditions where the base spreading resistance, rbbi, is much less than the external emitter- or base-circuit resistance, and where the forward current transfer ratio, α_{f} , is much greater than 1, the circuit stability factor may also be calculated for three commonly-used dc circuit configurations from the formulas below:



 $S_{F} = \frac{\left|\alpha_{f}\right| \left(R_{1} + R_{2}\right)}{R_{2} + \left|\alpha_{f}\right| R_{1}}$

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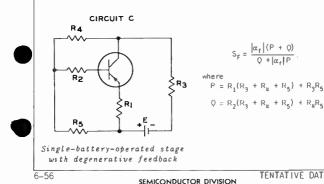
Two-battery-operated stage



 $S_{F} = \frac{|\alpha_{f}|(R_{1} + R_{eq})}{R_{eq} + |\alpha_{f}|R_{1}}$

where
$$R_{eq} = R_2 + \frac{R_4 R_5}{R_4 + R_5}$$

Single-battery-operated stuge

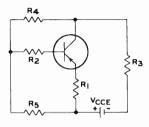


TENTATIVE DATA 3

RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY



For example, in the following dc equivalent circuit for a typical commercial application employing common-emitter circuit, base input, it is desired to determine if the transistor will be operating within dissipation rating if the dc collector-to-emitter voltage is -6 volts, the dc collector current is -1 milliampere, and the ambient temperature after equipment warm-up is 50° C. Under these conditions, the transistor dissipation is approximately equal to the collector dissipation V_{CE} x I_C, or 6 milliwatts.



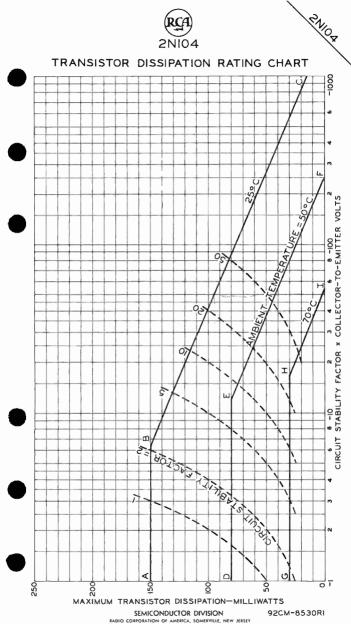
214104

Circuit components: $R_1 = 270 \text{ ohms}$ $R_2 = 1000 \text{ ohms}$ $R_3 = 9000 \text{ ohms}$ $R_4 = 43000 \text{ ohms}$ $R_5 = 3900 \text{ ohms}$

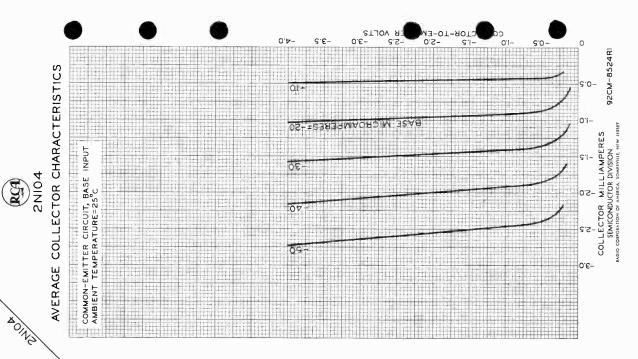
(1) By use of the curve showing the variation of the forward current transfer ratio, α_f , with ambient temperature, for an ambient temperature of 50° C, a value of α_f equal to -56 is obtained.

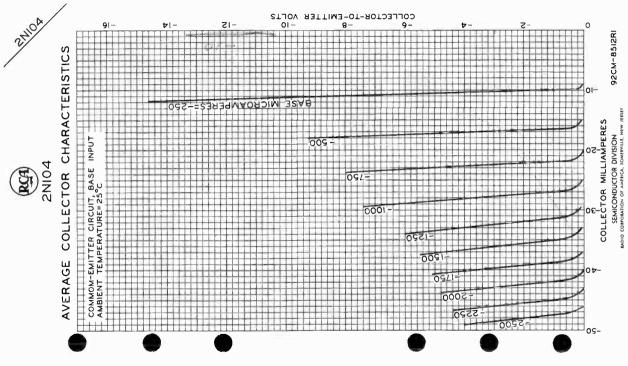
(2) Using formulas shown for circuit C, P = 270(9000 + 43000 + 3900) + (9000)(3900) P = 5.02 × 10⁷ ohms² Q = 1000(9000 + 43000 + 3900) + (43000)(3900) Q = 22.4 × 10⁷ ohms² S_F = <u>56 [(5.02 × 10⁷) + (22.4 × 10⁷)]</u> (22.4 × 10⁷) + <u>56 (5.02 × 10⁷)</u> S_F = 5.06

(3) Referring to the dissipation chart, for an abscissa $(S_F \times V_{CE} = 5.06 \times -6)$ of -30.4 and an ambient temperature of $50^{\circ}C$, the maximum dissipation rating is 55 milliwatts. Since the actual transistor dissipation of 6 milliwatts is well within the maximum dissipation, the transistor is being operated with a considerable degree of safety.



⁻⁻⁻⁻⁻



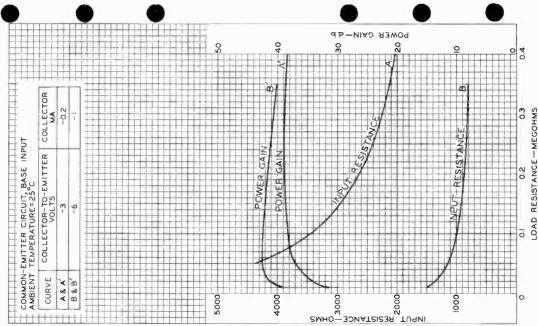




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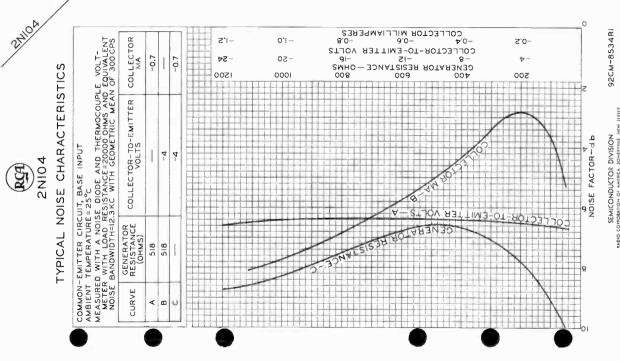


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SEMICONDUCTOR

ROBAT

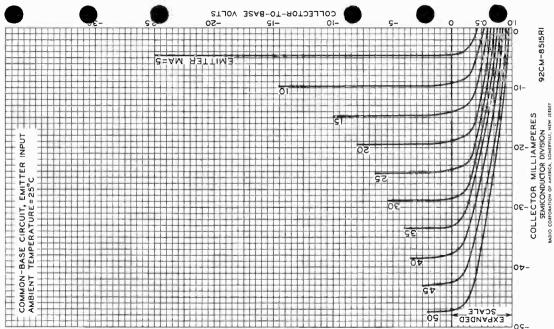




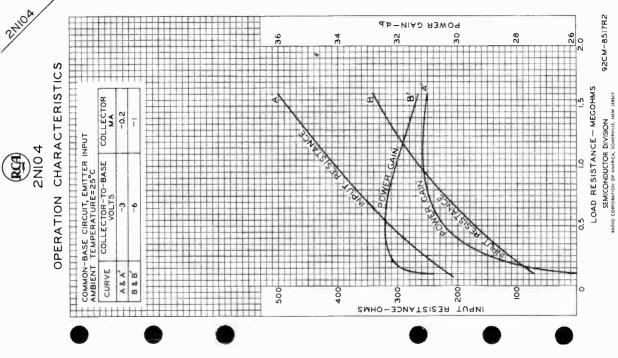
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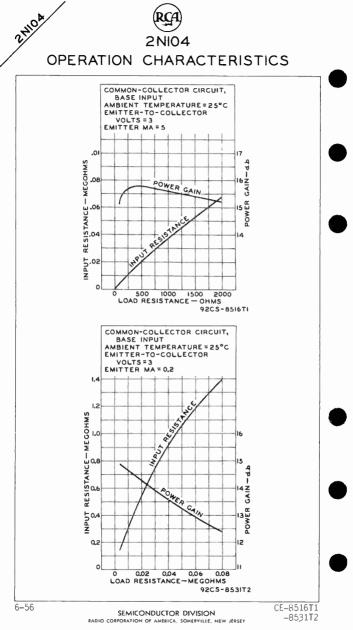
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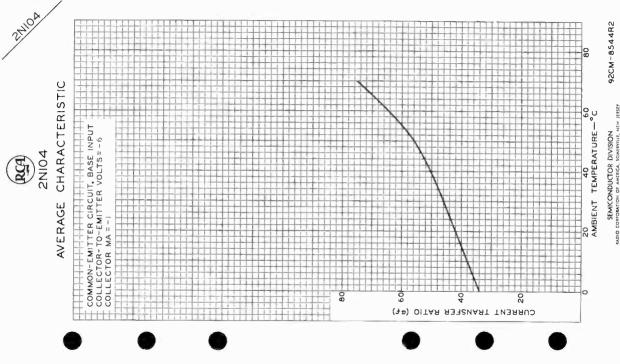
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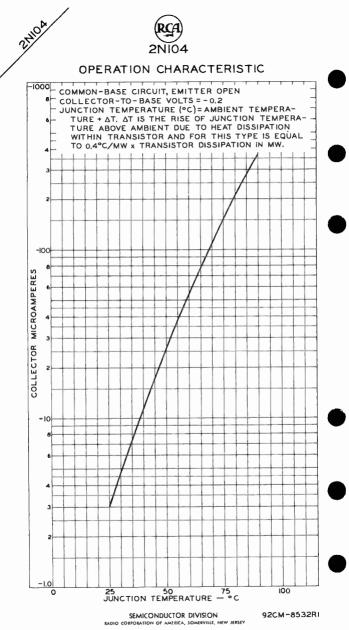


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2N105

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For small-signal audio-frequency applications

GENERAL DATA

GENERAL DATA
Electrical:
Minimum DC Collector-to-Base Voltage for dc collector current of -10 μamp with emitter open, and at am- bient temperature of 25°C35 volt: Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with collector open, and at ambient temperature of 25°C5 μam
Mechanical:
Mounting Position An Maximum Length (Excluding flexible leads) 0.255 Maximum Diameter. 0.135 Case Metal, Insulate Envelope Seals Hermeti Leads, Flexible 1.5" ± 0.015 Orientation and diameter. See Dimensional Outlin at front of this Section BOTTOM VIEW @
Lead 1 - Emitter Lead 2 - Base
AUDIO-FREQUENCY AMPLIFIER Class A
Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE. -25 max. volt DC CCLLECTOR CURRENT. -15 max. m DC ENITTER CURRENT. 15 max. m COLLECTOR DISSIPATION 35 max. m AMBIENT TEMPERATURE (During operation). 50 max. o STORAGE-TEMPERATURE RANGE -55 to +70
Characteristics, At Ambient Temperature of 25°C:
Common-Emitter Circuit, Base Input
DC Collector-to-Emitter Voltage1.3 -4 volt DC Collector Current0.3 -0.7 m Power Gain: With load resistance = 4700 ohms.
With load resistance = 4700 ohms. 32.5 - d With load resistance = 20,000 ohms. 42 dd
= and input resistance = 200 00005 $=$ 42 0
6-56 SEMICONDUCTOR DIVISION TENTATIVE DATA

2NI05

JUNCTION TRANSISTOR

Noise Factor: Measured with a noise diode and thermocouple voltmeter with load resistance = 20,000 ohms, gen- crator resistance = 1000 ohms, and equivalent noise bandwidth = 12.3 kc with geometric mean of 300 cps Maximum value. Typical value.	16.5 7.5	-	db. db
Small-Signal T Parameters:*			
DC Collector-to-Emitter Voltage (V _{CE}) DC Collector Current (I _C) Emitter Resistance (r_e). Base Resistance (r_b) Mutual Resistance (r_m). Collector Resistance (r_c) Current Transfer Ratio (α_f) ⁼	-1.3 -0.3 . 73 . 1400 . 3.66 . 3.74 45	-4 -0.7 34 976 3.39 3.45 -55	volts ma ohms ohms megohms megohms
` Small-Signal Hybrid-π Parameters:*			
DC Collector-to-Emitter Voltage (V _{CE}) DC Collector Current (I _C) Resistance r _{bb'} . Conductance g _{b'e} . Conductance g _{b'e} . Conductance g _{b'c} . Capacitance C _{b'e} Capacitance C _{b'e} Capacitance C _{b'c} . Intrinsic Transconductance (g _m). Freouency [®] for unity power amplification.	-0.3 260 220 3.1 0.20 2500 27 10000	$\begin{array}{r} -4 \\ -0.7 \\ 250 \\ 380 \\ 4.5 \\ 0.21 \\ 4500 \\ 17 \\ 21000 \\ 2.6 \end{array}$	volts ma ohms µmhos µmhos µmhos µµµf µµf µmhos Mc
Small-Signal H Parameters:*			1
DC Collector-to- Emitter Voltage (V _{CE}) DC Collector Current (I _C) Input Resistance, output	-1.3 -0.3	- 4 -0.7	
circuit shorted (h _i) Reverse Voltage Transfer	4800	2880) ohms
Ratio, input circuit open (h _r)9. Forward Current Transfer Ratio, output circuit	1×10^{-4}	5.5×10	-4
shorted (h _f)	45	55	
Output Conductance, input circuit open (h _o)	12.4	16.3	β µmhos
As derived from corresponding equivalen 2x104. Measured at 1 kc.		-	·
•: See next page.			
6-56		TENTATIVE	DATA 1

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TENTATIVE DATA 1



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JUNCTION TRANSISTOR

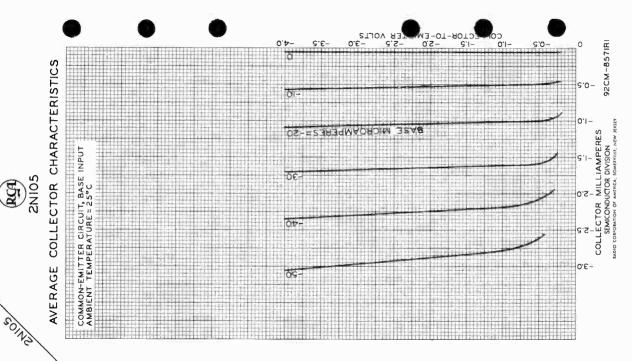
	Common-Base Circuit, Emitter Input	
	DC Collector-to-Base Voltage	· I -
	With load resistance = 0.5 megohm, and input resistance = 180 ohms 33.2 dl Freouency at which the current transfer	
	ratio drops to one-half the square root of two times its value at 1 kc 700 kg	
	Common-Collector Circuit, Base Input	
	DC Emitter-to-Collector Voltage 1.3 volt DC Emitter Current 0.3 mm	11
)	Power Gain: With load resistance = 13,000 ohms, and input resistance = 0.5 megohm 16 d	
	• This frequency (figure of merit) may be calculated from the equation $1 \sqrt{\frac{9m}{2}}$	2

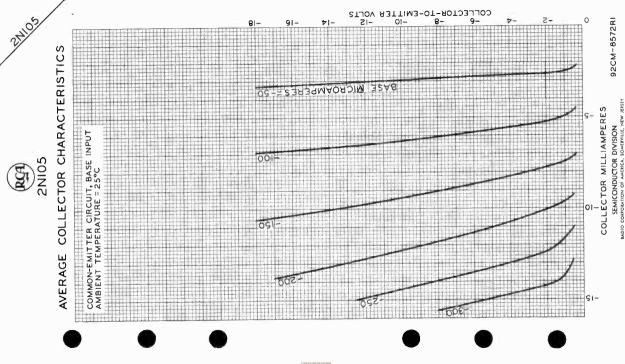
$$= \frac{1}{4\pi} \sqrt{r_{\rm DD} \cdot c_{\rm D'c} c_{\rm C'e}}$$

OPERATING CONSIDERATIONS

The $2\hbar$ 105 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N105 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.



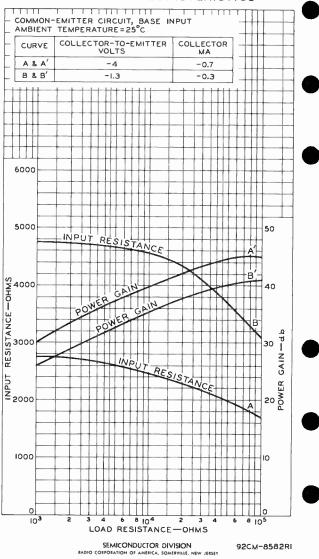


World Radio Histor





OPERATION CHARACTERISTICS



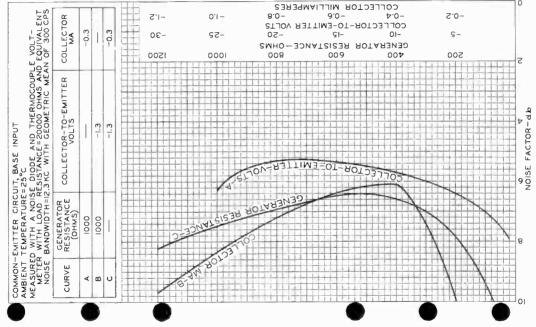
World Radio History



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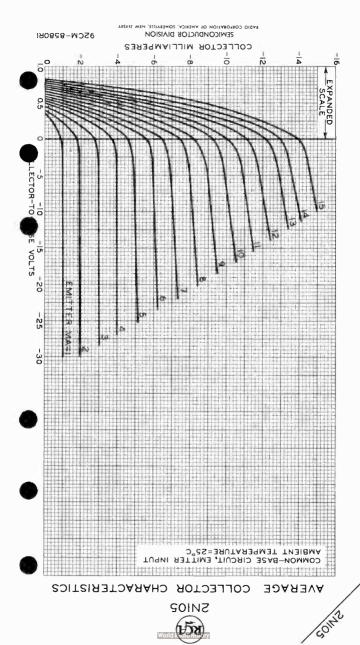


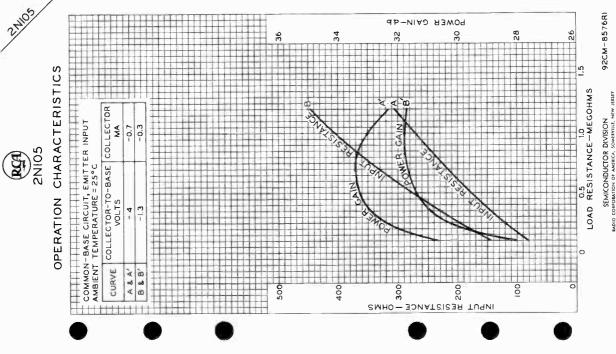
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DIVISION SOMERVILLE, N

SEMICONDUCTOR FORATION OF AMERICA,

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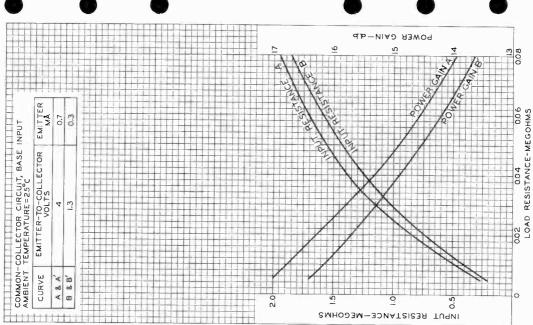




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S CHARACTERISTIC OPERATION



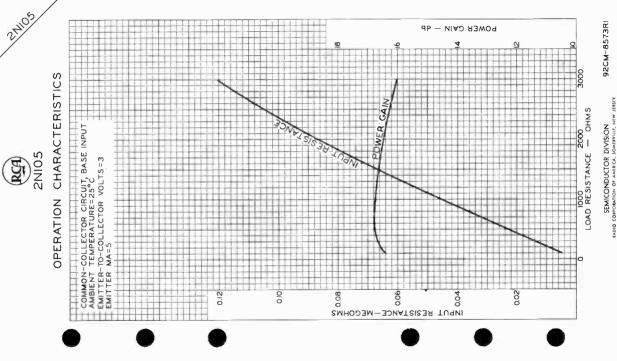
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World Radio History



JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For large-signal audio-frequency applications

GENERAL DATA

Electrical:

	Electrical:	
	Maximum DC Collector Current for dc collector-to-base voltage of -25 volts with emitter open, and at ambient temperature of 25°C	
	Mechanical:	
	Mounting Position. An Maximum Overall Length 0.69 Maximum Seated Length 0.49 Maximum Diameter 0.26 Dimensional Outline. 0.26 Case Metal, Insulate Envelope Seals Hermet Base	7" 5" 0" ed ic 5)
	Pin 1-Emitter Pin 2-Base D@@	
	AUDIO-FREQUENCY AMPLIFIER Class B	
	Maximum Ratings, Absolute Values:	
	PEAK COLLECTOR-TO-BASE VOLTAGE25 max. vol DC COLLECTOR-TO-BASE VOLTAGE (For	
	inductive load)	ts. ma
,	AVERAGE COLLECTOR CURRENT.	ma
	PEAK EMITTER CURRENT	ma
	AVERAGE EMITTER CURRENT	ma
		mw MW
		oC
	Characteristics, At Ambient Temperature of 25°C:	
	Common-Emitter Circuit. Base Input	
	DC Collector-to-Emitter Voltage1 vo	1+
	be confidered to Emilie to reage, i i i i i i i	ma
		1

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JUNCTION TRANSISTOR

	Typical Push-Pull Operation, At Ambient Temperature of 25°C:
	Common-Emitter Circuit, Base Input
	Unless otherwise specified, values are for 2 transistors
	DC Collector-to-Emitter Supply Voltage4.5 -9 volts
	DC Ease-to-Emitter Voltage0.15 -0.15 volt
1	Peak Collector Current (Per transistor)35 -40 ma
	Zero-Signal DC Collector Current (Per
	transistor)
	MaxSignal DC Collector Current {Per
	transistor)
	Signal-Source Impedance (Base
ļ	to base) 1500 1500
	Load Impedance (Collector to
ł	collector)
Ì	Signal Frequency
	Circuit Efficiency 60 69 %
ļ	Power Gain
	Total Harmonic Distortion
	MaxSignal Power Output

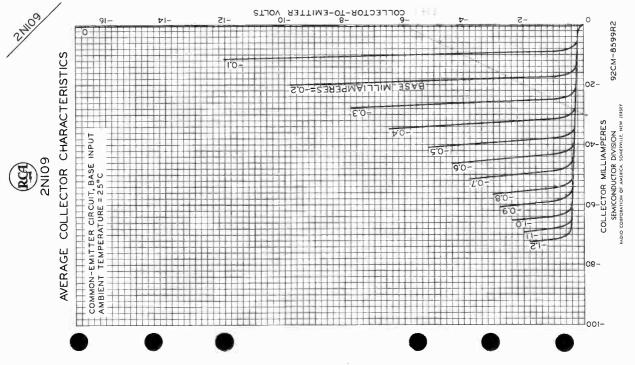
OPERATING CONSIDERATIONS

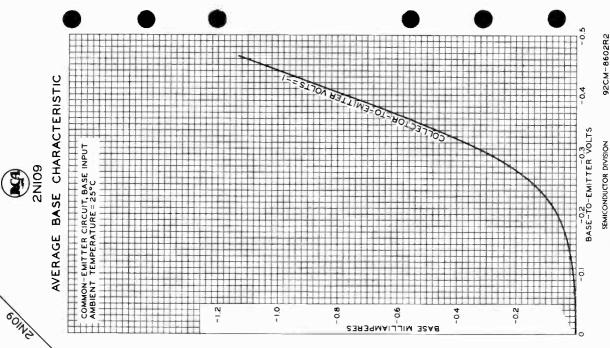
The 2N109 should not be connected into or disconnected from circuits with the power On because high transient currents may cause permanent damage to the transistor.

In class B service, when the 2N109 is operated at ambient temperatures other than 25° C, the base-to-emitter voltage should be reduced or increased by approximately 0.002 volt for each degree the ambient temperature is above or below 25° C, respectively. When this transistor is operated under varying ambient temperatures, some form of temperature compensation may be used in the base-to-emitter circuit to hold the operating point constant.

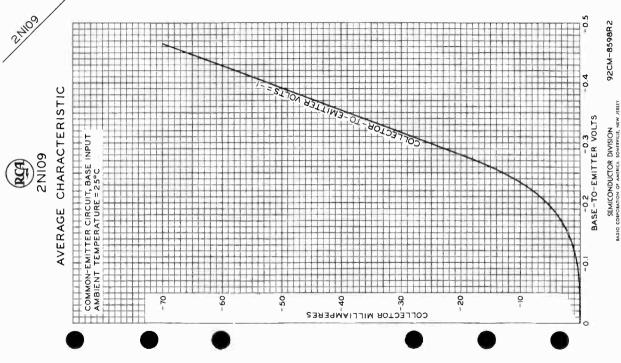
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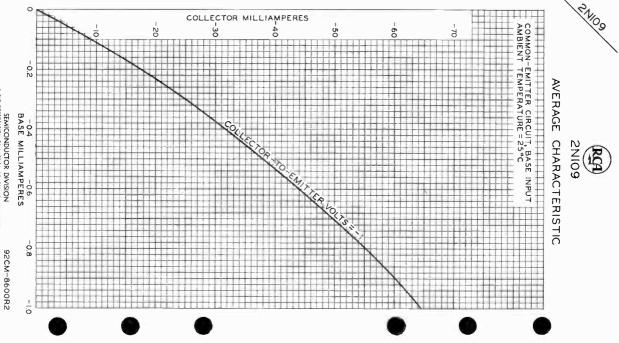
TENTATIVE DATA





SEMICONDUCTOR DIVISION CORPORATION OF AMERICA, SOMERVILLE, P õ





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JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

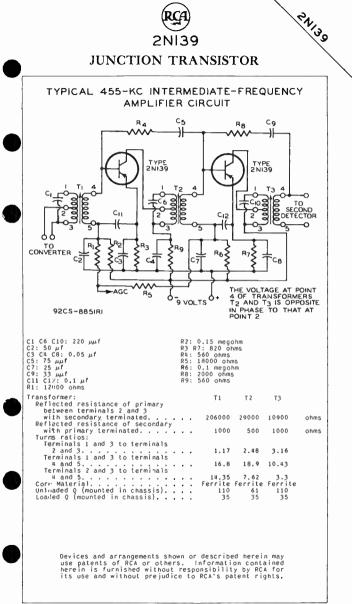
For 455-kc intermediate-frequency applications

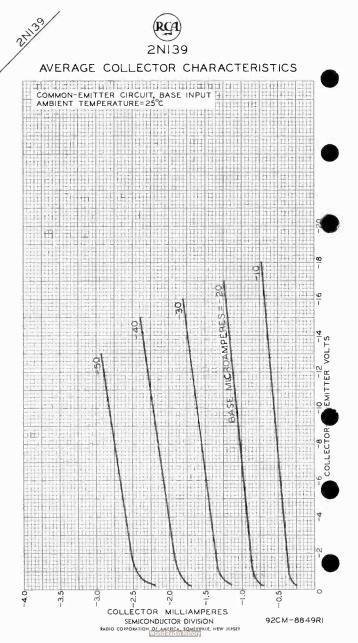
	GENERAL DATA	
	Electrical:	
	Minimum DC Collector-to-Base Voltage fords collector surrent of -10 μamp with emitter open, and at am- bient temperature of 25°C16 volts Maximum DC Collector Current for	
ł	dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25 ⁹ C6 μamp Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts with collector open, and at ambient temperature of 25 ⁹ C40 μamp	
	Mechanical:	
	Mounting Position	
	Pin 1 - Emitter Pin 4 - Collector	
	INTERMEDIATE-FREQUENCY AMPLIFIER SERVICE	
	Maximum Ratings, Absolute Values:	
)	DC COLLECTOR-TO-BASE VOLTAGE. -16 max. volts DC EMITTER-TO-BASE VOLTAGE. -12 max. volts DC COLLECTOR CURRENT. -15 max. max DC EMITTER CURRENT. 15 max. max COLLECTOR DISSIPATION 35 max. max AMBIENT TEMPERATURE (During operation). 70 max. 00 STORAGE-TEMPERATURE RANGE -55 to +85	
	Characteristics, At Ambient Temperature of 25°C:	
	Common-Emitter Circuit, Base Input	_
I	DC Collector-to-Emitter Voltage9 -9 volts DC Collector Current0.5 -1 ma Current Transfer Ratio (α_f) [•] 45 -48	- 1
	_	
	•: see next page. 6-56 TENTATIVE DATA	
	6-56 SEMICONDUCTOR DIVISION TENTATIVE DATA	-

(RCA) 2NI39

JUNCTION TRANSISTOR

		. 1
	Small-Signal Hybrid-17 Parameters;*	
	$\begin{array}{cccc} \text{DC Collector-to-Emitter Voltage } (V_{\text{CE}}) & -9 & -9 & \text{volts}\\ \text{DC Collector Current } (I_{\text{C}}) & & -0.5 & -1 & \text{ma}\\ \text{Resistance } r_{\text{bb}^{1}} & & & 85 & 75 & \text{ohms}\\ \text{Conductance } g_{\text{b}^{1}} & & & 425 & 800 & \mu\text{mhos}\\ \text{Conductance } g_{\text{c}e} & & & 4.6 & 8.6 & \mu\text{mhos}\\ \text{Conductance } g_{\text{b}^{1}} & & & 0.22 & 0.25 & \mu\text{mho}\\ \text{Capacitance } C_{\text{b}^{1}e} & & & 900 & 1560 & \mu\mu\text{f}\\ \text{Capacitance } C_{\text{b}^{1}e} & & & 9.5 & 9.5 & \mu\mu\text{f}\\ \text{Intrinsic Transconductance } (g_{\text{m}}) & & 19300 & 38600 & \mu\text{mhos}\\ \text{Frequency}^{\bullet} & \text{for} & & & & & & & & & & & & \\ \end{array}$	
	unity power amplification 13 14 Mc	
	Common-Base Circuit, Emitter Input	
	DC Collector-to-Base Voltage9 -9 volts DC Collector Current	
	Typical Operation, At Ambient Temperature of 25°C:	
1	Common-Emitter Circuit, Base Input	
	DC Collector-to-Emitter Voltage -9 -9 volts DC Collector Current -0.5 -1 ma Input Resistance 1000 500 ohms Output Resistance 76000 30000 ohms Spot Noise Factor 4.5 4.5 db Maximum Power Gain 38 37 db	
	As derived from corresponding equivalent circuit shown under type 20104. This frequency (figure of merit) may be calculated from the equation	
	$f = \frac{1}{4\pi} \sqrt{\frac{9_m}{r_{DD} \cdot c_{D} \cdot c_{D} \cdot c_{D}}}$ Measured at 1 kc.	
	 Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. (Unilateralization is a special case of neutralization in which the resistive as well as the reactive feedback parameters are balanced out. Unilateralization changes a bilateral network into a unilateral network). A transformer insertion loss of 10.4 db is included in this figure. A transformer insertion loss of 6.6 db is included in the figure. 	1
	OPERATING CONSIDERATIONS	
	The 2N139 should not be connected into or disconnected from circuits with the power are because high transient currents may cause permanent damage to the transistor.	







JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For 540 to 1600 kc converter applications

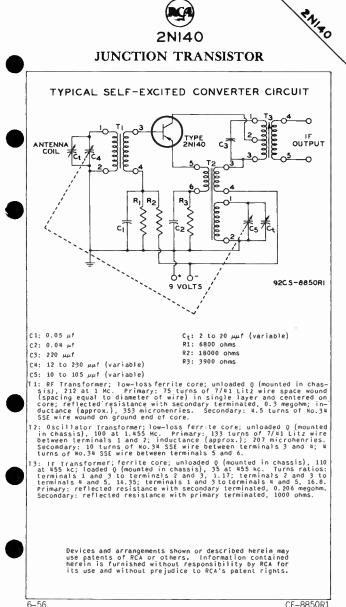
For 540 to 1600 kc converter applications
GENERAL DATA
Electrical:
Minimum DC Collector-to-Base Voltage for dc collector current of -10 μamp with emitter open, and at ambient temperature of 25°C16 volts Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25°C6 μamp Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts
with collector open, and at ambient temperature of 25°C
Mechanical:
Mounting Position
Pin 2 - Base
CONVERTER SERVICE
Maximum Ratings, Absolute Values:
DC COLLECTOR-TO-BASE VOLTAGE16 max. volts DC EMITTER-TO-BASE VOLTAGE12 max. volts DC COLLECTOR CURRENT15 max. mm DC EMITTER CURRENT15 max. mm COLLECTOR DISSIPATION .35 max. mm AMBIENT TEMPERATURE (During operation).70 max. 90 STORAGE-TEMPERATURE RANGE
Characteristics, At Ambient Temperature of 25°C:
Common-Emitter Circuit, Base Input
DC Collector-to-Emitter Voltage9 volta DC Collector Current
"; See next page.
6-56 SEMICONDUCTOR DIVISION TENTATIVE DAT

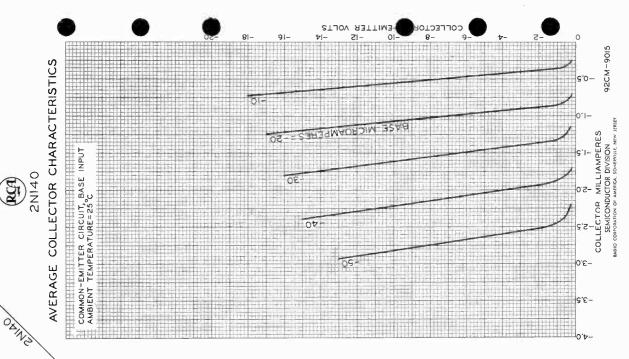
2NIRO

2NI40

JUNCTION TRANSISTOR

Small-Signal Hybrid- π Parameters: DC Collector-to-Emitter Voltage (V _{CE})9 volts DC Collector Current (I _C)	
DC Collector Current (I _C)	Small-Signal Hybrid-77 Parameters:*
Current Transfer Ratio Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc 7 Mc Typical Operation, At Ambient Temperature of $25^{\circ}C$: Common-Emitter Circuit, Base Input DC Collector-to-Emitter Voltage9 volts DC Collector Current	DC Collector-to-Emitter Voltage (V _{CE})9 volts DC Collector Current (I _C)0.6 ma Resistance r _{bb}
Common-Emitter Circuit, Base InputDC Collector-to-Emitter Voltage9voltsDC Collector Current-0.6maInput Resistance600ohmsOutput Resistance.75000ohmsRMS Base-to-Emitter Oscillator100mvSignal Frequency1McUseful Conversion Power Gain30db* As derived from corresponding equivalent circuit shown under type2x104.* Measured at 1 kc.This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{bb} \cdot C_{b'c} \cdot C_{b'c}}}$ OPERATING CONSIDERATIONSThe 2N140 should not be connected into or disconnected from circuits with the power on because high transient	Current Transfer Ratio 0.980 Frequency at which the current transfer ratio drops to one-half the square root
DC Collector-to-Emitter Voltage9 volts DC Collector Current	Typical Operation, At Ambient Temperature of 25°C:
DC Collector Current	Common-Emitter Circuit, Base Input
2N104. Measured at 1 kc. This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{u_{\pi}} \sqrt{\frac{g_m}{r_{bb} \cdot c_b \cdot c_b \cdot e}}$ OPERATING CONSIDERATIONS The 2N140 should not be connected into or disconnected from circuits with the power on because high transient	DC Collector Current -0.6 ma Input Resistance 600 ohms Output Resistance 75000 ohms RMS Base-to-Emitter Oscillator Injection Voltage 100 mv Signal Frequency 1 Mc
• This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{bb} \cdot c_{b} \cdot c_{b} \cdot c_{b} \cdot e}}$ OPERATING CONSIDERATIONS The 2NI40 should not be connected into or disconnected from circuits with the power on because high transient	
$f = \frac{1}{u_{\pi}} \sqrt{\frac{g_m}{f_{bb} \cdot c_b \cdot c_b \cdot c_b}}$ OPERATING CONSIDERATIONS The 2NI40 should not be connected into or disconnected from circuits with the power on because high transient	
The 2NI4O should not be connected into or disconnected from circuits with the power on because high transient	
from circuits with the power on because high transient	OPERATING CONSIDERATIONS
	from circuits with the power on because high transient





Power Transistor

GERMANIUM P-N-P ALLOY TYPE

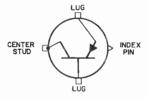
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position						Any
Maximum Seated Length .						
Maximum Diameter						
Dimensional Outline					• •	JEDEC No.TO-36
Case						
Seals						Hermetic
Terminal Diagram (See D)ıme	ns10	onal	Outline):		





INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse blased

	(DC emitter-to-base volts = 1.5)60 max.	volts
)	EMITTER-TO-BASE VOLTAGE	volts
	COLLECTOR CURRENT	атр
	EMITTER CURRENT	атр
	BASE CURRENT	атр
	TRANSISTOR DISSIPATION: *	· · · ·
	At case temperatures ^b of 25 ⁰ C or below . 150 max.	watts
	CASE TEMPERATURE RANGE:	-
)	Operating and storage	°C
	Typical Operation:	
	In a common-emitter, base-input, power-switch-	
	ing circuit at case temperatureb of 25°C	
	DC Supply Voltage	
	DC Base-Bias Voltage 6	volts
١.	"On" DC Collector Current12	200



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Switching Time: Rise time	•••	•••		. 15 . 15		
^a See accompanying Rating Chartan in General Section. ^b Measured at any point on sealing			r-Dissipan	tion Rati	ing Chart	
- ELECTRICA	L CHARAG	TERIS	TICS			
Voltage values are give	en with	respe	ct to ba	ise and	at	
case temperature ^b of 2	5° C un l i		nerwise Typical		1 e a	
DC Collector-to Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes = -0.3.	BVCES	-50	-	-	volts	
With base open: For dc collector amperes = -0.3	BVCEO	_	-50	_	volts	
For dc collector amperes = -1 ^c DC Base-to-Emitter Voltage for dc collector-to-		45	-	-	volts	
emitter volts = -2, dc collector amperes = -5 DC Collector-to-Emitter Saturation Voltage for dc collector amperes =	V _{BE}	-	-0.65	•==	volt	
<pre>-12, dc base amperes = -2</pre>	V _{CE} (sat)	-	-0.3	-0.7	volt	
<pre>dc emitter current = 0 DC Punch-Through Voltage DC Emitter-Cutoff Current for dc emitter volts =</pre>	VPT	-60	-0.15	1 _	volt volts	
-40, dc collector current = 0		-	-1	-4	ma	Ū
= -2, dc emitter current = 0 With dc collector volts		-	-100	-	μa	
= -60, dc emitter current = 0 With dc collector volts = -60, dc emitter		-	-2	-4	μa	
current = 0, case temperature ^b = 71 ⁰ C		-	-	-15	ma	

--- Indicates a change.

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DC Current Transfer Ratio for dc collector-to- emitter volts = -2, dc collector amperes = -5 -12 Beta-Cutoff Frequency for dc collector-to-emitter volts = -6, dc collector	h _{FE}	35 -	- 25	70 _	
amperes = -5	f _{ae}	-	10	-	kc
	RT	-	0.35	0.5	^o C/watt
milliseconds		-	0.075	-	watt- sec/ ^o C
Thermal Time Constant	\mathcal{T}_{1}	_	26.25		msec

b Measured at any point on seating surface.

C Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS

This transistor type is designed to pass the environmental tests specified in Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter lugs by means of clips or by soldering directly to the lugs. When soldering connections are made to the lugs, care should be taken to conduct excessive heat away from the lug seals, otherwise the heat of the soldering operation will crack the glass seals of the lugs and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective lugs.

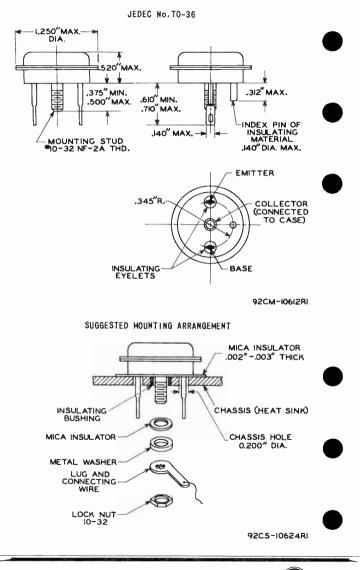
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

The maximum torque on mounting stud should not exceed 12 inch-pounds.

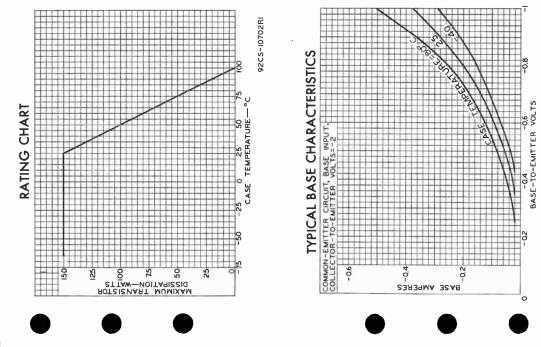


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Indicates a change.



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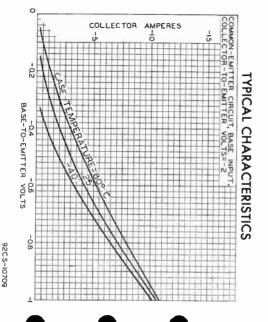
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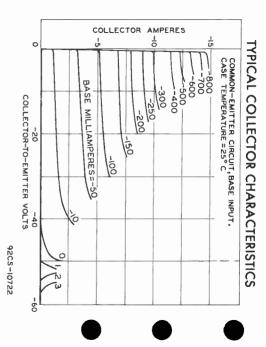
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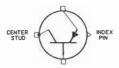
Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position														. Any
Maximum Överall Length.														1.230"
Maximum Seated Length .					•		•							0.520"
Maximum Diameter														
Dimensional Outline														
Case														
Seals										•	·	·	.He	rmetic
Terminal Diagram (See D:									:					
BOTTOM VIEW														



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator. dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:	
With emitter-to-base reverse biased	
(DC emitter-to-base volts = 1.5)60 max.	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR CURRENT	amp
EMITTER CURRENT	amp
BASE CURRENT	amp
TRANSISTOR DISSIPATION: *	
At case temperature of 25 ⁰ C 70 max.	watts
CASE - TEMPERATURE RANGE :	
Continuous operation	oC
Intermittent operation	°C
Storage	oC
T : 10 11	

Typical Operation:

in a common-emitter, base-input	, P	ower-	
switching circuit at case temperature	e of	25° C	
DC Supply Voltage			volts
DC Base-Bias Voltage		-	volts
"On" DC Collector Current			amp
"Turn-On" Base Current			amp amp
"Turn-Off" Base Current	• •	0	amp



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Switching Time: Rise time	•••	 	15 15	µsec µsec		
See accompanying Rating Chart and als Chart in General Section.	so Trans	istor-Dis:	sipatio	n Rating		
ELECTRICAL CHARACTERISTICS						
			and			
Voltage values are given with respect to base and case temperature of 25° C unless otherwise specified						
DC Callester to Exitter Recal	Min.	Typıcal	Max.			
DC Collector-to-Emitter Break- down Voltage:						
With base connected to						
emitter, dc collector amperes = -0.3BVce				volts		
With base open: BVCE		-	-	VOLUS		
For dc collector amperes						
= -0.3	-	-50	-	volts		
$= -1^{\bullet}$	-45	-	-	volts		
DC Base-to-Emitter Voltage* for dc collector-to-emitter						
volts = -2 , dc collector						
amperes = -5 V _{BE}	- :	-0.65	-	volt		
DC Collector-to-Emitter Saturation Voltage* for dc						
collector amperes = -12 ,						
base amperes = -2 V _{CE}		-0.3	1	volt		
DC Emitter Voltage for dc collector volts = -60,						
emitter_amperes = 0 V _{EE}		-0.15	-1	volt		
DC Punch-Through Voltage V _P	-60	-		volts		
DC Emitter-Cutoff Current for dc emitter volts = -40,						
dc collector amperes = 0 IEB	0 -	-1	8	ma		
DC Collector-Cutoff Current: ICB						
With dc collector volts = -2, dc emitter amperes =0.	_	-100				
With dc collector volts	_	-100	-	μа		
= -60, dc emitter						
amperes = 0		-2	-8	μa		
= -60, dc emitter amperes						
= 0, case temperature			4.5			
= 71 ^o C	_	-	-15	ma		
for dc collector-to-emitter						
valts = -2, dc collector						
amperes = -5	35	_	70		-	
-12	-	25	-			

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coll	utoff Frequency* for dc ector-to-emitter volts , dc collector amperes					
=5		f_{ae}		10	-	kc
Junc Therma	l Resistance: tion-to-case l Capacity for pulse tion of 1 to 10	۳T	-	0.7	1	°C∕watt
	iseconds		-	0.075	-	watt-
Therma	Time Constant	\mathcal{T}_{\parallel}	-	52.5	-	sec/OC msec

Sweep voltage used to perform test.

★ Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

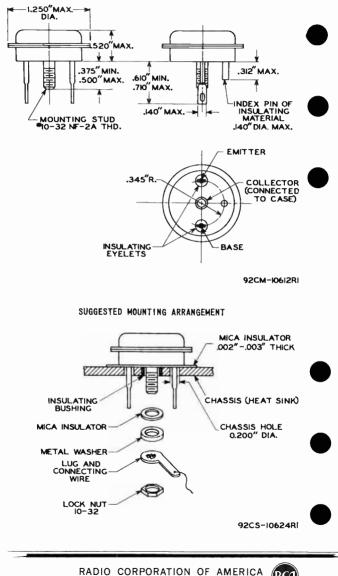
This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taker.

The maximum torque on mounting stud should not exceed 12 inch-pounds.



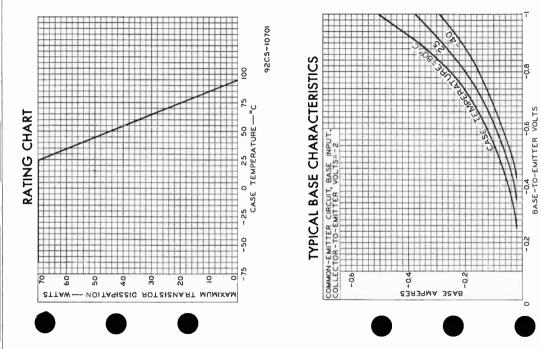
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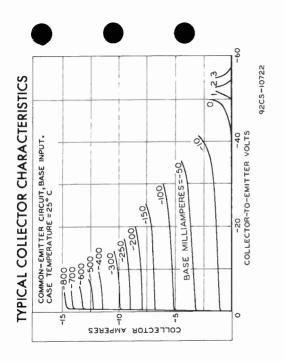
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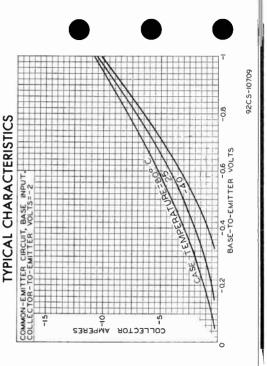
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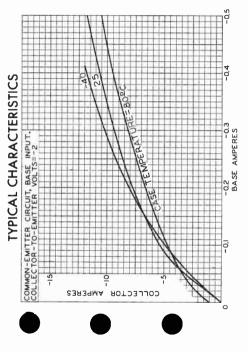


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Power Transistor

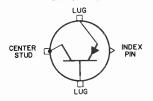
GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position.													Any
Maximum Seated Length													0.520"
Maximum Diameter					•					•	•		1.250"
Dimensional Outline .	•	•	•	•	•	•	•	•	•	•	·	٠	JEDEC No. TO-36
Case	•	•	•	•	·	•	•	•	•	٠	•	·	. Welded, Metal
Seals												•	Hermetic
Terminal Diagram (See											•		



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator. dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased		
(DC emitter-to-base volts = 1.5)	-80 max.	volts
FMITTER-TO-BASE VOLTAGE	-60 max.	volts

EMITTER-TO-BASE VOLTAGE	-60 max. -15 max. 15 max. -4 max.	amp amp
CASE-TEMPERATURE ^b RANGE: Operating and storage		°C
Typical Operation: In a common-emitter, base-input switching circuit at case temperatur	e ^b of 25 [°] C	
DC Supply Voltage	6 12 2	volts amp amp amo



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2N174

Switching Time: Rise time	•••	••••	. 19						
 Bee accompanying Rating Chart and a Chart in General Section. Measured at any point on seating sur- 		ansistor-D	issipati	on Rating					
- ELECTRICAL CHAR.	ACTER	ISTICS							
Voltage values are given wit	Voltage values are given with respect to base and at								
case temperature ^b of 25°C un				ied					
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes	Min.	Typical	Max.						
= -0.3 BV With base open: BV For dc collector	-70	-	-	volts					
<pre>amperes = -1^c DC Base-to-Emitter Voltage for dc collector-to- emitter volts = -2, dc</pre>	-55	-	-	volts					
collector amperes = -5. V _{BE} DC Collector-to-Emitter Saturation Voltage for dc collector amperes = -12	-	-0.65	-0.9	volt					
<pre>dc base amperes = -2 V_{CE} DC Emitter Voltage for dc (sat) collector volts = -80,</pre>	-	-0.3	-0.7	volt					
dc emitter current = 0. • V _{EB} DC Punch-Through Voltage. • V _{PT} DC Emitter-Cutoff Current for dc emitter volts = -60, dc collector	-80	-	1 -	volt volts					
current = 0	-	-1	-4	ma					
current = 0 With dc collector volts = -80, dc emitter	~	-100	-	μа					
current = 0 With dc collector volts = -80, dc emitter current = 0, case	-	-2	-4	ma					
temperature ^b = 71° C DC Current Transfer Ratio h _{FE} for dc collector-to- emitter volts = -2, dc collector amperes =	-	_	-15	ma					
-5	25 _	20	50						
		- - 1nd	iicates a	change.					

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

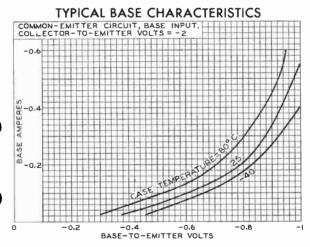


Beta-Cutoff Frequency for dc ccllector-to-emitter volts = -6, dc collector amperes = -5. 10 kc fae Thermal Resistance: Junction-to-case. . . . R_T 0.35 C.5 ^OC/watt Thermal Capacity for pulse duration of 1 to 10 milliseconds. . . 0.075 wattsec/°C Thermai Time Constant . . . τ_1 26.25 msec

^b Measured at any point on sealing surface.

C Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, and RATING CHART shown under Type 2N173 also apply to the 2N174 - indicates a change.

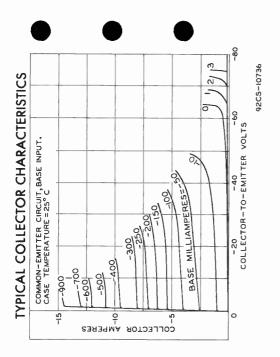


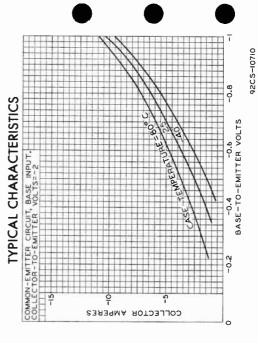
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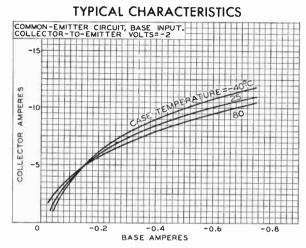


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Power Transistor

GERMANIUM P-N-P ALLOY TYPE

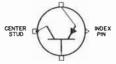
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Diameter
Dimensional Outline JEDEC No.TO-36
Case
Seals
Terminal Diagram (See Dimensional Outline):





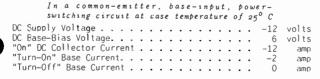
INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:	
With emitter-to-base reverse biased	
(DC emitter-to-base volts = 1.5)80 max.	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR CURRENT	amp
EMITTER CURRENT	amp
BASE CURRENT	amp
TRANSISTOR DISSIPATION:	
At case temperature of 25 ⁰ C	watts
CASE-TEMPERATURE RANGE:	
Continuous operation	°C
Intermittent operation65 to +100	°C
Storage65 to +100	°C

Typical Operation:





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Switching Time: Rise time	•••		· 15 · 15	μsec μsec				
See accompanying Rating Chart and al Chart in General Section.	150 <i>Tr</i>	ansistor-D	issipatio	n Rating				
ELECTRICAL CHAR	ELECTRICAL CHARACTERISTICS							
Voltage values are given wi case temperature of 25° Cunl								
	∀ın.	Typical	Max.					
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amneres = -0.3 BV _{CES}	-70		_	vo ¹ ts				
With base onen: BV _{CEO} For dc collector amperes = -1•	-55	_	_	volts				
DC Base-to-Emitter Voltage* for dc collector-to- emitter volts = -2, dc collector amperes = -5. V _{BE} DC Collector-to-Emitter Saturation Voltage* for dc collector amperes	-	-0.65	-0.9	volt				
= -12, base amperes = -2. V_{CE} DC Emitter Voltage for dc collector volts = -80.	-	-0.3	-0.9	volt				
contector voits = -dd, emitter anneres = 0 V _{EB} DC Punch-Through Voltine V _P DC Emitter-Cutoff Current for dc emitter volts = -60, dc collector	-80	-	-1 -	volt volts				
amperes = 0	-	-1	-8	ma				

= 2, dc emitter -100= -80, dc emitter amperes = 0 . . . -2 -8 With dc collector volts = -80, dc emitter amperes = 0, case temperature = 71° C . -15 DC Current Transfer Ratio* h_{FF} for dc collector-toemitter volts = -2, dc collector ammeres = 25 50 -5. 20 -12

With dc collector volts

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Beta-Cutoff Frequency* for dc_collector-to-emitter volts = -6, dc collector ammeres = -5. f_{ae} 10 kc Thermal Resistance: Junction-to-case. . . . R_T 0.8 °C/watt 0.5 Thermal Capacity for pulse duration of 1 to 10 milliseconds. 0.075 wattsec/°C Thermal Time Constant . . . au_1 msec

Sweep voltage used to perform test.

* Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

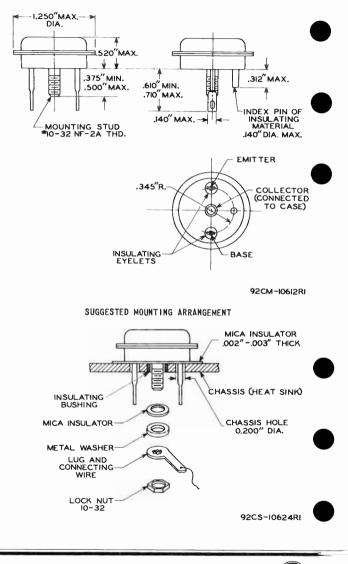
This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

It is to be noted that the case of this transistor operates at the collector voltage. Hecause of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

The maximum torque on mounting stud should not exceed 12 inch-pounds.

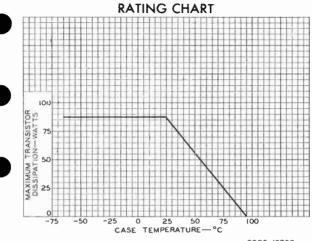


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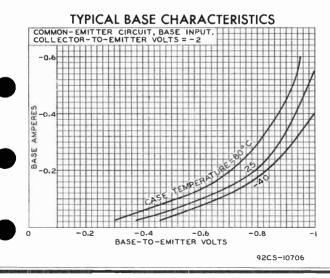


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2N174



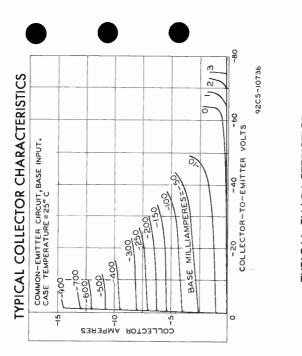
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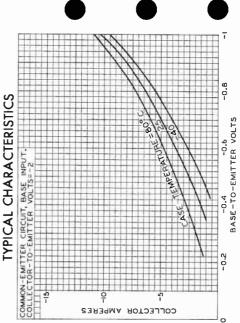




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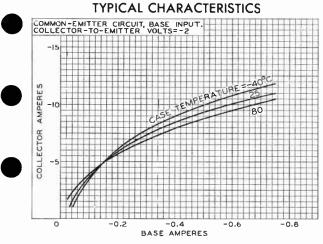
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Semiconductor & Materials Division



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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Recipy Somerville, N. J.

DATA 4 2-61

World Radio History



GERMANIUM P-N-P ALLOY TYPE

For low-noise audio-frequency applications

GENERAL DATA	
Electrical:	
Maximum DC Collector Current for dc collector-to-base voltage of -25 volts with emitter open, and at ambient temperature of 25°C12 Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts with collector open, and at ambient temperature of 25°C12	µam; µam;
Mechanical:	
Mounting Position. Maximum Overall Length	.495 .260 ction lated metic 3-25)
Pin 1 - Emitter Pin 2 - Base	tor
AUDIO-FREQUENCY AMPLIFIER Class A	
Maximum Ratings, Absolute Values:	
DC CCLLECTOR-TO-EASE VOLTAGE10 max. DC EMITTER-TO-EASE VOLTAGE10 max. DC COLLECTOR CURRENT	volts volts ma ma o(o(
Characteristics, At Ambient Temperature of 25°C:	
Common-Emitter Circuit, Base Input	
DC Collector Current	volt: m
With load resistance = 0.07 megohm, and input resistance = 2000 ohms 43 Noise Factor:	d
Measured with a noise diode and thermo- couple voltmeter with load resistance = 20,000 ohms, generator resistance = 1000 ohms, and equivalent noise band-	
width = 12.3 kc with geometric mean of 300 cps:	

World Radio History

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2NI75

JUNCTION TRANSISTOR

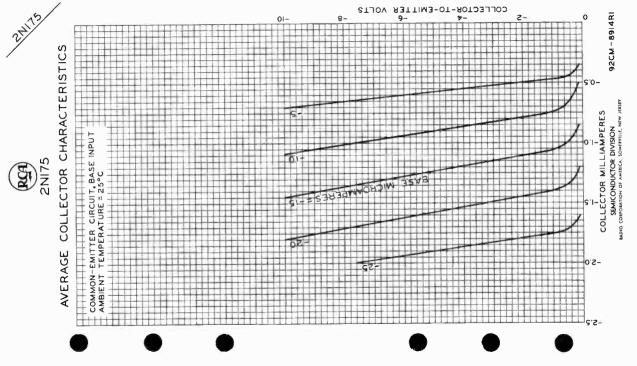
Small-Signal T Parameters:*		
$\begin{array}{c} \text{DC Collector-to-Emitter Voltage (V_{CE})}.\\ \text{DC Collector Current (l_C)}.\\ \text{Emitter Resistance (}r_{e}).\\ \text{Base Resistance (}r_{b}).\\ \text{Mutual Resistance (}r_{m}).\\ \text{Collector Resistance (}r_{c}).\\ \text{Current Transfer Ratio (}\alpha_{f})^{\bullet}.\\ \end{array}$	-4 -0.5 37.7 1085 2.82 2.86 -65	volts ma ohms ohms megohms megohms
Small-Signal Hybrid-77 Parameters;*		1
DC Collector-to-Emitter Voltage (V _{CE}). DC Collector Current (I _C). Resistance r _{bb'} . Conductance g _{b'e} . Conductance g _{b'e} . Conductance g _{b'c} . Capacitance C _{b'c} . Intrinsic Transconductance (g _m). Frequency [®] for unity power amplification	-4 -0.5 190 296 6.6 0.279 3900 36 19200 2.06	volts ma ohms μmhos μmhos μμή μμf μμf μmhos Mc
Small-Signal H Parameters:*		
DC Collector-to-Emitter Voltage (V _{CE}). DC Collector Current (I _C) Input Resistance, output circuit	-4 -0.5	volts ma
shorted (h _i)	3570 9.44 × 10 ⁻⁴	ohms
Forward Current Transfer Ratio, output circuit shorted (h _f) Output Conductance, input circuit open (h _o)	65 25	µm hos
		μ
Common-Base Circuit, Emitt	er Input -4	
DC Collector-to-Base Voltage DC Collector Current	-0.5	volts ma
ratio drops to one-half the square root of two times its value at 1 kc.	0.85	Мс
OPERATING CONSIDERATI	ONS	
The 2N175 should not beconnected into c circuits with the power on because high may cause permanent damage to the tran	transient o	
As derived from corresponding equivalent ci 2N104.	ircuit shown	under type
Measured at 1 kc. This frequency (figure of merit) may be calcu	lated from the	eequation
$f = \frac{1}{4\pi} \sqrt{\frac{g_m}{r_{bb} \cdot c_b \cdot c_b \cdot c_b \cdot e}}$		
C 56	TENT	ATIVE DATA

TENTATIVE DATA

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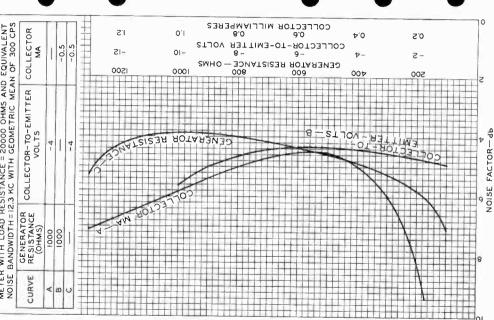


S TERISTIC CHARAC NOISE TYPICAL

INPUT CIRCUIT, BASE TURE = 25°C ۲ μ EMIT COMMON-AMBIENT

EMPERATURE ⊢

Ē EQUIVAL 300 Ś AND THERMOCOUPLE = 20000 OHMS AND EQ 1 GEOMETRIC MEAN OI I NOISE DIODE D RESISTANCE WITI Ϋ́ 12.3 П LOAD BANDWIDTH < WITH WITH MEASURED METER W NOISE



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27200

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For small-signal audio-frequency applications

GENERAL DATA

	GENERAL DATA				
	Electrical, At Ambient Temperature of 25°C:				
	Maximum DC Collector Current for dc collector-to-base voltage of -30 volts with emitter open10 μamp Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts with collector oper10 μamp Junction Temperature Rise (In free air)0.3 °C/mw				
1	Mechanical:				
	Mounting Position				
	Lead 1 - Emitter (2) Lead 3 - Collector				
	Lead 2 – Base (Adjacent to red dot on side of envelope)				
	AUDIO-FREQUENCY AMPLIFIER Class A				
	taximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE DC EMITTER-TO-BASE VOLTAGE DC EMITTER-TO-BASE VOLTAGE DC EMITTER-TO-BASE VOLTAGE DC COLLECTOR CURRENT DC COLLECTOR CURRENT DC EMITTER CURRENT DC EMITTER CURRENT SO max. Max DULECTOR DISSIPATION (At ambient temperature of 25°C) MBIENT TEMPERATURE (During operation) T1 max. °C OTORAGE-TEMPERATURE RANGE				
c	haracteristics, At Ambient Temperature of 25°C:				
	Common-Emitter Circuit, Base Input				
) F	C Collector-to-Emitter Voltage5 volts C Collector Current				
N	loise Factor: Measured with a noise diode and thermo- couple voltmeter with load resistance				

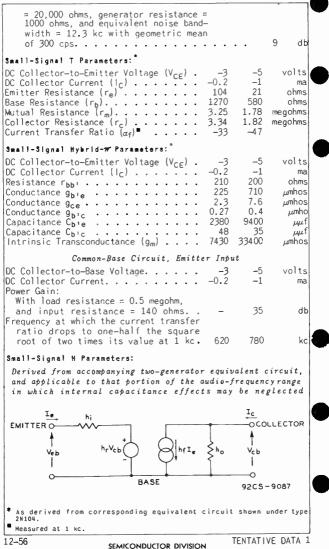


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RCA 2N206

211200

JUNCTION TRANSISTOR



RADIO CORPORATION OF AMERICA, SCIMERYILLE, NEW JERSEY



D	C Collector-to- Base Voltage (VCB)3 C Collector Current (IC)0.2	-5 -1	volts ma
11	nput Resistance, output circuit shorted (hj)	33	ohms
	everse Voltage Transfer Ratio, input circuit open (hr)	2 × 10-	-4
	utput Conductance, input	-0.980	µmhos
	circuit open (h ₀)0.3 Common-Collector Circuit, Base Inpu		<i>p</i>
D	C Emitter Current 0. ower Gain:	3	volts ma
ľ	With load resistance = 18,000 ohms, and input resistance = 0.56 megohm	30	db

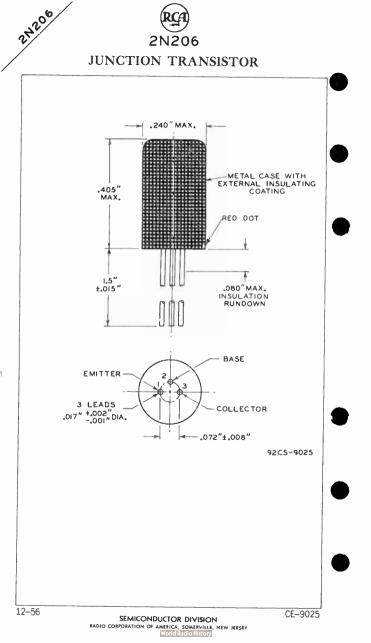
OPERATING CONSIDERATIONS

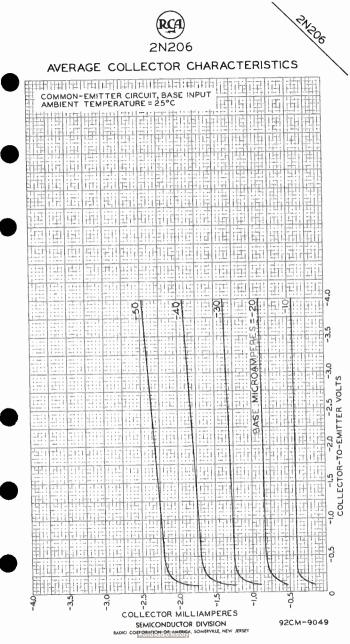
The 2N2O6 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

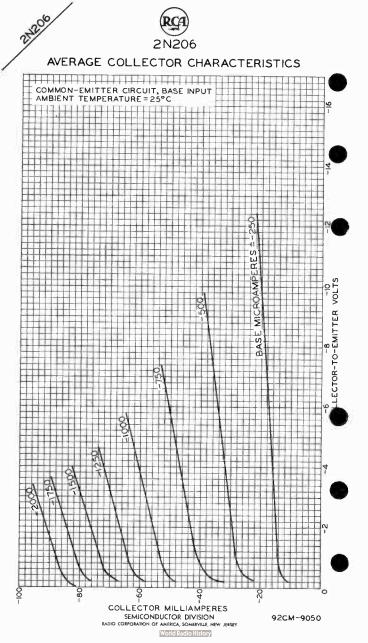
The *flexible leads* of the 2N206 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

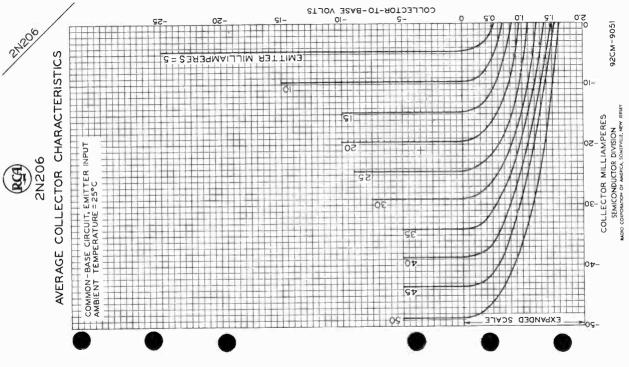
When dip soldering is employed in the assembly of printed circuitry using the 2N206, the temperature of the solder should not exceed $230^{\circ}C$ for a maximum immersion period of 10 seconds.

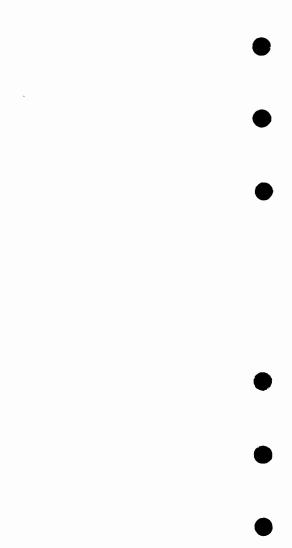
21200











World Radio History



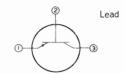
GERMANIUM P-N-P ALLOY TYPE

For small-signal audio-frequency applications

The 2N215 is the same as the 2N104 except for the following items:

Mechanical:

Lead 1 - Emitter



Lead 3-Collector (Adjacent to red dot on side of envelope)

21215

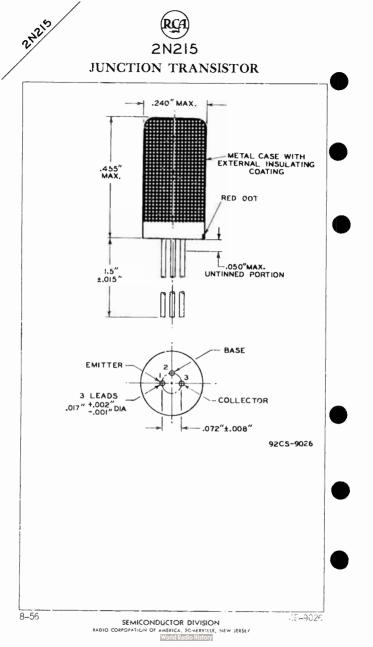
Lead 2 - Base

OPERATING CONSIDERATIONS

The 2N215 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N215 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the $2N \gtrsim 15$, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.





GERMANIUM P-N-P ALLOY TYPE

For large-signal audio-frequency applications

The 2N217 is the same as the 2N109 except for the foliowing items:

Mechanical:

Lead 1 - Emitter



Lead 3 - Collector (Adjacent to red dot or side of envelope)

PARIA

Lead 2 - Base

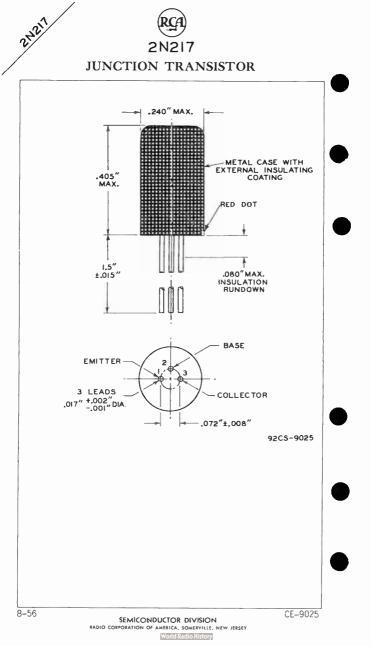
OPERATING CONSIDERATIONS

The 2N217 should not be connected into ordisconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of the 2N21? are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N217, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.

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GERMANIUM P-N-P ALLOY TYPE

For 455-kc intermediate-frequency applications

The $2\sqrt[n]{218}$ is the same as the $2\sqrt[n]{139}$ except for the following items:

Mechanical:

Lead 1 - Emitter

er	2 Lead 3	3 -	Collector
			(Adjacent to red dot on side of
			envelope)

Lead 2 - Base

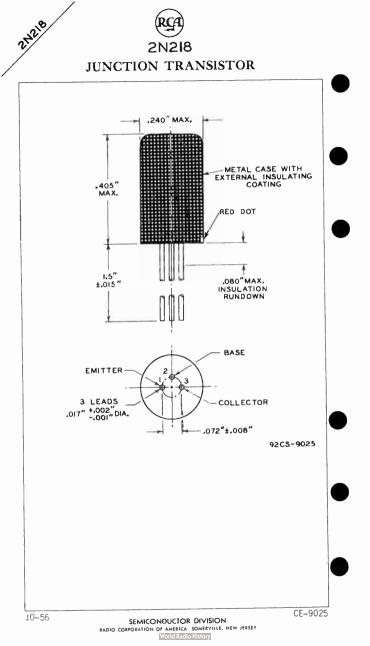
OPERATING CONSIDERATIONS

The 2N218 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N218 are usually soldered to the circuit elements. Soldering of the leads may be made clese to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

Wh∺n dip soldering is employed in the assembly of printed circuitry using the 2N218, the temperature of the solder shou'd not exceed 230°C for a maximum immersion period of 10 seconds.

21218





GERMANIUM P-N-P ALLOY TYPE

For 540 to 1600 kc converter applications

The 2N219 is the same as the 2N140 except for the following items:

Mechanical:

Maximum Length (Excluding flexible leads) 0.405" Leads, Flexible Length. 1.5 " ± 0.015" Orientation and diameter. See Dimensional Outline BOTTOM VIEW

Lead 1 - Emitter



Lead 2 - Base

OPERATING CONSIDERATIONS

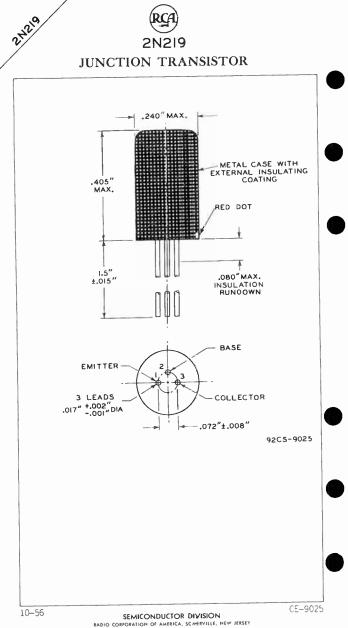
The 2N219 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of the 2N219 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N219, the temperature of the solder should not exceed 230°C for a maximum immersion period of 10 seconds.

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(Adjacent to red dot on side of envelopel





GERMANIUM P-N-P ALLOY TYPE

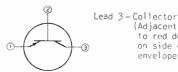
For low-noise audio-frequency applications

The 2N220 is the same as the 2N175 except for the following items:

Mechanical:

Maximum Length (Excluding flexible leads). . . 0.405" Leads, Flexible. . . . 015" Length + (). Orientation and diameter . See Dimensional Outline BOTTOM VIEW

Lead 1 - Emitter



Lead 2 - Base

OPERATING CONSIDERATIONS

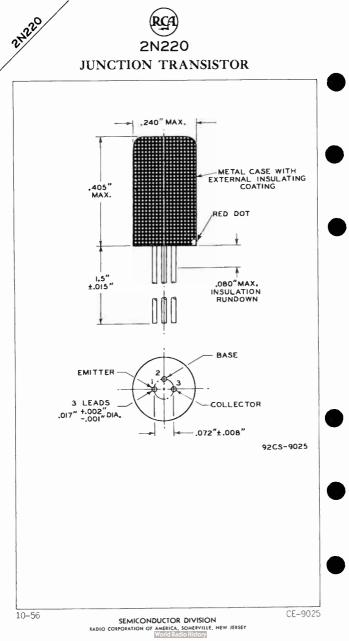
The 2N220 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

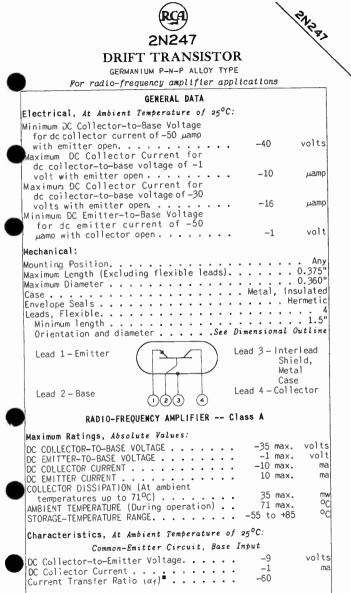
The flexible leads of the 2N220 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N220, the temperature of the solder should not exceed 230°C for a maximum immersion period of 10 seconds.

27220

(Adjacent to red dot on side of envelope)





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World Radio History

See next page.

12-56



RCA 2N247

DRIFT TRANSISTOR

Small-Signal Hybrid-T Parameters:"DC Collector-to-Emitter Voltage (VCE)9voltsDC Collector Current (_c)1maResistance Fub:			-
DC Collector Current (c)			
DC Collector Current (c)	DC Collector-to-Emitter Voltage (VCE)	-9	volts
Resistance r_{bb}	DC Collector Current ()	-1	
Conductance gbre	Resistance r _{bb}	40	ohms
Conductance gbic (Approx.)	Conductance g _{bie}		µm hos
Capacitance Cbre	Lonductance gce (Approx.).		
Capacitance C_{b1c}	Conductance gbic (Approx.)	-	
Interlead Capacitance between collector and base leads with interlead shield connected to ground and all leads cut to 5/16"			
Frequency for unity power amplification. 132 Mathematical formula and the power amplification. 132 Mathematical formula and the power amplification. 132 Mathematical formula and the power amplification. 132 Mathematical formula f	Interlead Capacitance between collector and base leads with interlead shield connected to ground and all leads cut to 5/16"	0.003	μμf
Common-Base Circuit, Emitter InputDC Collector-to-Base Voltage9voltsDC Collector Current11Current Transfer Ratio $(a_f)^{\bullet}$ 0.984Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc.30McTypical Operation, At Ambient Temperature of 25°C: Common-Emitter Circuit, Base InputAt frequency of1.5DC Collector-to-Emitter Voltage9OC Collector Current-1CDC Base-to-Emitter Voltage-0.2Collector Current.1350Dutput Resistance, output circuit shorted.70000Circuit shorted.45Cata drived from corresponding equivalent circuit shown under type 2*104.This frequency (figure of merit) may be calculated from the equation $t = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{0b} \cdot C_{b'c}}}$ Measured at 1 kc.DPERATING CONSIDERATIONSThe 2N247 should not be connected into or disconnected from circuits with the power on because high transient	Frequency for unity power amplification.		
DC Collector Current		but	
Current Transfer Ratio $\{\alpha_f\}^m$ 0.984 Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc. 30 Mc Typical Operation, At Ambient Temperature of 25°C: Common-Emitter Circuit, Base Input At frequency of 1.5 10.7 Mc DC Collector-to-Emitter Voltage. 9 -9 volts DC Collector Current1 -1 ma DC Base-to-Emitter Voltage0.2 -0.2 volt Input Resistance, output circuit shorted		-9	volts
Frequency at which the current transfer ratio drops to one-half the square root of two times its value at 1 kc. 30 Mc Typical Operation, At Ambient Temperature of $25^{\circ}C$: Common-Emitter Circuit, Base Input At frequency of 1.5 10.7 Nc DC Collector-to-Emitter Voltage. 9 -9 volts DC Collector Current. 9 -9 volts DC Collector Current. 9 -0.2 volt Input Resistance, output circuit shorted. 1350 170 ohms Output Resistance, input circuit shorted. 1350 170 ohms Power Gain ^A . 45 24 db * As derived from corresponding equivalent circuit shown under type 20100. This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{\Gamma_{bb} \cdot C_{b'c}}}$ Measured at 1 kc. DPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient			ma
Typical Operation, At Ambient Temperature of 25°C: Common-Emitter Circuit, Base Input At frequency of 1.5 10.7 Nc DC Collector-to-Emitter Voltage	Frequency at which the current transfer ratio drops to one-half the square		
Common-Emitter Circuit, Base InputAt frequency of1.510.7NcDC Collector-to-Emitter Voltage9-9voltsDC Collector Current-1-1maDC Base-to-Emitter Voltage0.2-0.2voltInput Resistance, output-0.2-0.2voltcircuit shorted.1350170ohmsDutput Resistance, input700004500ohmsPower Gain ^A .4524db* As derived from corresponding equivalent circuit shown under type2×10a.This frequency (figure of merit) may be calculated from the equation $t = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{Db} \cdot C_{b'c} \cdot C_{b'e}}}$ Measured in a single-tuned unilateralized circuit matched to the generatorand load impedances for maximum transfer of power.The 2N247 should not be connected into or disconnectedfrom circuits with the power on because high transient			Mc
At frequency of At frequency of 1.5 10.7 Nc CC Collector-to-Emitter Voltage			
DC Collector-to-Emitter Voltage9 -9 volts DC Collector Current		þut	
CC Collector Current		- ,	Nc
DC Base-to-Emitter Voltage0.2 -0.2 volt Input Resistance, output circuit shorted	DC Collector-to-Emitter Voltage		
circuit shorted	DC Base-to-Emitter Voltage		
circuit shorted	circuit shorted	50 170	ohms
As derived from corresponding equivalent circuit shown under type 2N10A, This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{\Gamma_{Db} \cdot \Gamma_{Db} \cdot C_{Dc}}}$ Measured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	circuit shorted 700	00 4500	ohms
20100. This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{bb}, c_{b'c} c_{b'e}}}$ Heasured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	Power Gain [▲]	45 24	db
This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{9m}{r_{bb}, C_{b'c} C_{b'e}}}$ Measured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	As derived from corresponding equivalent circui 2N104.	t shown und	ler type
Measured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	•	d from the o	equation
Measured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	1 / 0m		
Measured at 1 kc. Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	$f = \frac{3}{4\pi} \sqrt{r_{bb}} \frac{3}{c_{b'c}} \frac{5}{c_{b'c}}$		
and load impedances for maximum transfer of power. Transformer insertion losses not included. OPERATING CONSIDERATIONS The 2N247 should not be connected into or disconnected from circuits with the power on because high transient			
The 2N247 should not be connected into or disconnected from circuits with the power on because high transient	and load impedances for maximum transfer of power. Th	ched to the g ransformer i	enerator nsertion
from circuits with the power on because high transient	OPERATING CONSIDERATIONS		
currents may cause permanent damage to the transistor.	currents may cause permanent damage to the	transistor	•
2-56 TENTATIVE DATA 1		TENTATIVE	DATA 1

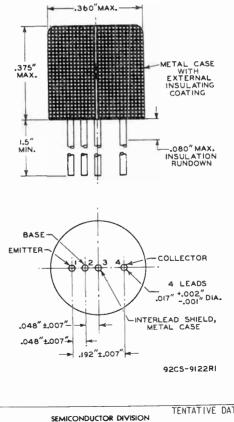
SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY World Radio History



DRIFT TRANSISTOR

The flexible leads of the 2N247 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N247, the temperature of the solder should not exceed 230°C for a maximum immersion period of 10 seconds.

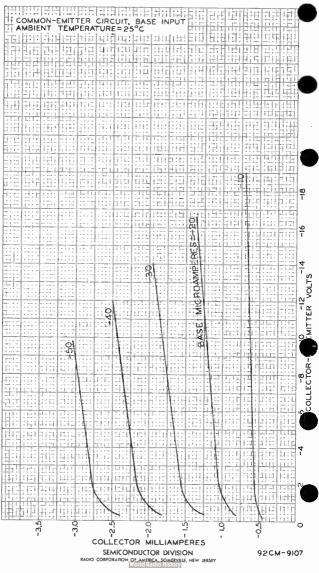


PARA.

RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

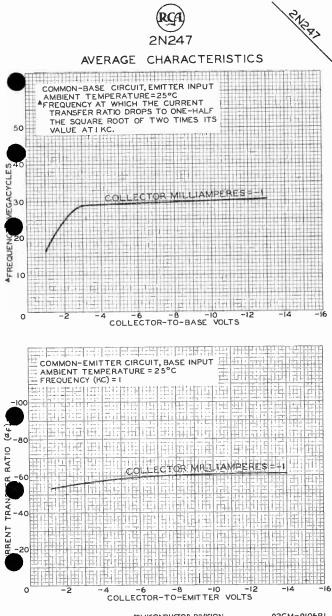


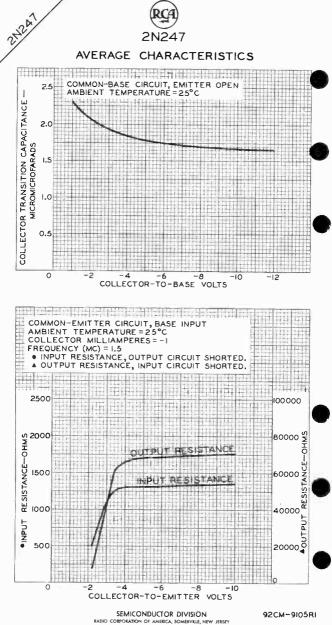
AVERAGE COLLECTOR CHARACTERISTICS





92CM-9106RI





World Radio History

2N269

Transistor

Lead 3-Collector

(Adjacent to red dot

case)

on side of

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position. Maximum Length (Excluding	flexible leads)	0.410"
Maximum Diameter		0.240"
Dimensional Outline		JEDEC No.TO-1
Case		Metal
Seals		Hermetic
Leads, Flexible		3
Minimum length		1.5"
Orientation and diamete		Dimensional Outline
Terminal Diagram:	BOTTOM VIEW	

2

G

Lead 1 - Emitter

Lead 2 - Base



Maximum and Minimum Ratings, Absolute-Maximum Values:	+
COLLECTOR-TO-BASE VOLTAGE	volts
COLLECTOR-TO-EMITTER VOLTAGE:	
With dc emitter-to-base volts = -1 -24 max.	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR CURRENT	ma
	ma
TRANSISTOR DISSIPATION: *	
At ambient temperature of 25° C or below . 120 max.	mw
At ambient temperature of 55° C	шM
At ambient temperature of 71 ^o C 10 max.	шw
AMBIENT-TEMPERATURE RANGE:	
Operating and storage	°C
LEAD TEMPERATURE:	0.0
For 10 seconds maximum	°C

ELECTRICAL CHARACTERISTICS and OPERATING CONSIDERATIONS shown under Type 2N404 also apply to the 2N269

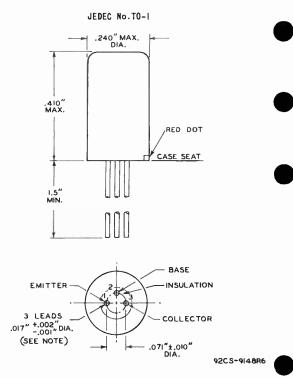
^a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.







DATA I 6-61

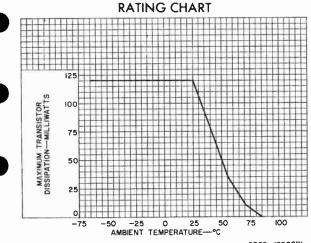


NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



Harrison, N. J.

RADIO CORPORATION OF AMERICA Electron Tube Division



92CS-10908RI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division (Inform DATA 2 6-61

World Radio History



JUNCTION TRANSISTOR

27269

GERMANIUM P-N-P ALLOY TYPE

For "on-off" control applications

GENERAL DATA

Maximum Diameter	•	•		0.405"
Mourting Position Maximum Length (Excluding flexible leads)	•	•		Any
Mechanical:				
for dc collector-to-base voltage of -6 volts with emitter open, and at ambient temperature of 25 °C			20	μµf
todouble with dc collector-to-base valtage equal to or greater than -2.5 volts with emitter open. MaximumCollector-to-Base Capacitance			10	°C
(With transistor in free air) Minimum Junction-Temperature Change which will cause collector current	•	•	0.35	°C/mw
volts with collector open, and at ambient temperature of: 25 °C 80 °C Maximum Junction-Temperature Rise		•	-2.5 -50	μа μа
ambient temperature of: 25 °C. 80 °C. Maximum DC Emitter Current for dc emitter-to-base voltage of -2.5			-4 -60	µ а µа
25 °C 80 °C Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at	•	•	-2.5 -50	µа µa
volts, and at ambient temper- ature of 25 °C. Maximum DC Collector Current for dc collector-to-base voltage of -2.5 volts with emitter open, and at ambient temperature of:			-1	volt
with collector open, and at am- biert temperature of 25 °C Maximum DC Emitter-to-Base Voltage for dc collector-to-base voltage of -20 volts, emitter load re- sistance of 11 megohms, emitter- to-base supply voltage of 0			-12	volts
Minimum DC Collector-to-Base Voltage for dc collector current of -20 μa with emitter open, and at am- bient temperature of 25 °C Minimum DC Emitter-to-Base Voltage for dc emitter current of -20 μa	•		25	volts
Electrical:				

SEMICONDUCTOR DIVISION

RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

2N269

21209

JUNCTION TRANSISTOR

Metal, Insulated Case . . Envelope Seals . . Hermetic 3 Leads, Flexible. . . 1.5 Minimum length . .See Dimensional Outline Orientation and diameter BOTTOM VIEW 2) Lead 1 - Emitter Lead 3-Collector (Adjacent to red dot on side of Э Lead 2 - Base envelopel LOW-LEVEL SWITCHING SERVICE Maximum Ratings. Absolute Values: PFAK COLLECTOR-TO-BASE VOLTAGE . . -25 max. volts DC COLLECTOR-TO-BASE VOLTAGE . . -20 max. volts PEAK EMITTER-TO-BASE VOLTAGE . -12 max. volts DC EMITTER-TO-BASE VOLTAGE . . -9 max. volts COLLECTOR CURRENT (DC or Peak) -100 max. ma EMITTER CURRENT (DC or Peak) . TRANSISTOR DISSIPATION:* 100 max. ma At ambient temperatures up to 55 °C. 35 max. mw At ambient temperature of 71 °C. . . 10 max. mw oc AMBIENT TEMPERATURE (During operation) 71 max. -65 to +85 0r STORAGE-TEMPERATURE RANGE. Characteristics, At Ambient Temperature of 25 °C: Common-Emitter Circuit, Base Input -12-24 DC Collector Current ma -0.342-0.858 DC Base Current. ma Maximum DC Collector--0.2 to-Emitter Voltage . . -0.15volt Maximum DC Baseto-Emitter Voltage . . . -0.35-0.4 volt Common-Base Circuit. Emitter Input DC Collector-to-Base Voltage . . . -6 volts 1 ma transfer ratio is 0.707 (or $1\sqrt{2}$) of its value at 1 kc. 4 Mc The maximum transistor-dissipation rating is reduced 1.56 milliwatts for each degree centigrade the ambient temperature is increased above 55 °C. TENTATIVE DATA 1 4-57 SEMICONDUCTOR DIVISION



JUNCTION TRANSISTOR

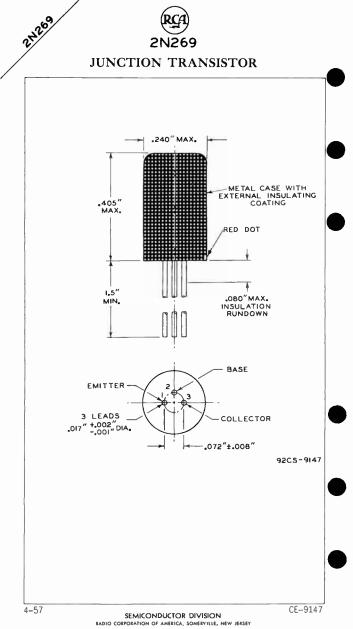
OPERATING CONSIDERATIONS

The 2N269 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

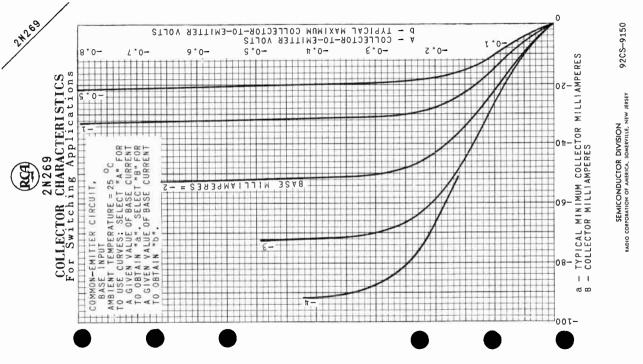
The *flexible leads* of the 2N269 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead sea!. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

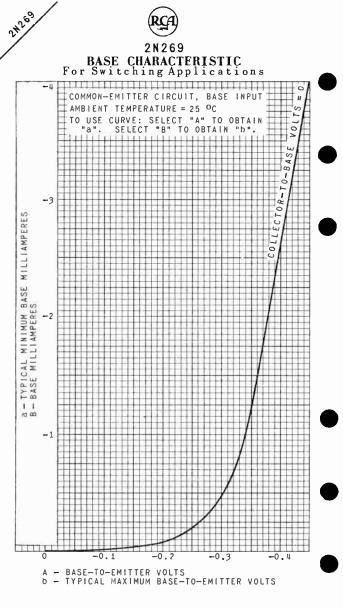
When dip soldering is employed in the assembly of printed circuitry using the 2N269, the temperature of the solder should not exceed 230 $^{\rm OC}$ for a maximum immersion period of 10 seconds.

The accompanying curves may be used to determine the typical maximum (or minimum) value of one transistor parameter when two other transistor parameters are known. For example, using the BASE CHARACTERISTIC curve, if a base-to-emitter voltage of -0.35 volt (A) is applied to the 2N269 with the collector-to-base voltage equal to 0, a typical minimum base-current value of -1.25 milliamperes (B) flowing through the base circuit with the collector-to-base voltage equal to 0, a typical maximum base-current value of -0.45 (b) will be obtained.



World Radio His

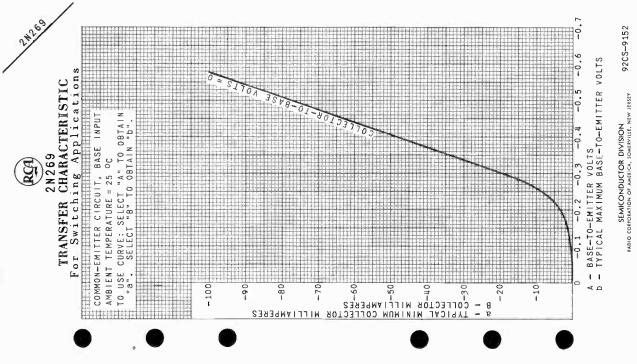




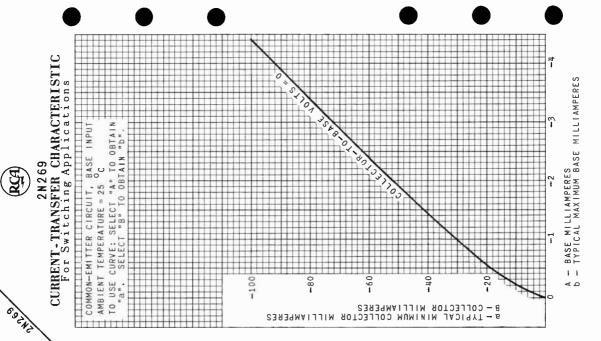
SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA. SOMERVILLE, NEW JERSEY

92CS-9151

World Radio History



World Radio Histor



92CS-9153R1 JERSEY NEW SEMICONDUCTOR DIVISION ADIO CORPORATION OF AMERICA, SOMERVILLE, P



JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For large-signal audio-frequency applications

GENERAL DATA

Electrical:

	Maximum DC Collector Current for dc collector-to-base voltage of -25 volts with emitter open, and at ambient temperature of 25 °C10 μ Maximum DC Emitter Current for dc emitter-to-base voltage of -12 volts with collector open, and at ambient temperature of 25 °C10 μ Maximum Junction-Temperature Rise (With transistor in free air) 0.24 °C/m	a
,	Mechanical:	
	Mounting Position	
	Lead 1 - Emitter Lead 2 - Base	
	AUDIO-FREQUENCY AMPLIFIER Class A	
		s ia ia
		č
)	Characteristics, At Ambient Temperature of 25 °C: Common-Emitter Circuit, Base Input DC Collector-to-Emitter Voltage	t
	Large-Signal DC Current Transfer Ratio 70	

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

TENTATIVE DATA 1

World Radio History

2N270

21270

JUNCTION TRANSISTOR

ypical Operation, At Ambient Temperature of 25 °C:	
Common-Emitter Circuit, Base Input	
	o!ts
	hms
mitter Bypass Capacitor	μf
OC Collector Current	na /o ¹ t
	ohers
	shms
Signal Frequency	20
Power Gaint	db
otal Harmonic Distortion	%
laxSignal Power Output≬60	mw
AUDIO-FREQUENCY AMPLIFIER Class 6	
laximum Ratings, Absolute Values	
PEAK COLLECTOR-TO-BASE VOLTAGE	olts
	dits -
PEAK COLLECTOR CUPRENT	шŞ
DC COLLECTOR CURRENT	na
PEAK EMITTER CURRENT	10.3
C EMITTER CURRENT	nva
temperatures up to 50 °C)	mw
WBIENT TEMPERATURE (During operation). 50 max.	('C
STORAGE-TEMPERATURE RANGE	°Č
Characteristics, At Ambient Temperature of 25 °C:	
Common-Emitter Circuit, Base Input	
OC Collector-to-Emitter Voltage1	voit 🖌
DC Collector Current150	ma
arge-Signal DC Current Transfer Ratio 70	
Typical Push-Pull Operation, At Ambient Temperature of 25	°C:
Common-Emitter Circuit, Base Input	
Unless otherwise specified, values are for 2 transistor	
	olts
	ohms volt
Peak Collector Current (Per transistor)110	mal
ero-Signal DC Collector Current (Per	THCA
transistor)2 MaxSignal DC Collector Current (Per	ma
transistor)	ma
Signal-Source Impedance (Base to	
base)	ohms 📑
base)	1
This value is 4 per cent maximum at max.~sional power output	1

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEV World Radio History



PNRIO

JUNCTION TRANSISTOR

Load Impedance (Collector to

	collector)	0 ohms
	Signal Frequency	1 kc
	Circuit Efficiency 7	75 %
	Power Gain	
		.0¶ max. %
Ì.	MaxSignal Power Output≬50	wm 0(
	1	

Measured at the primary of the output transformer.

This value is 5 per cent maximum at max.-signal power output of 10 milliwatts.

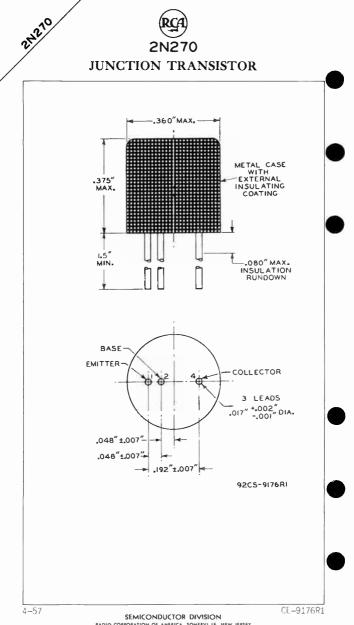
OPERATING CONSIDERATIONS

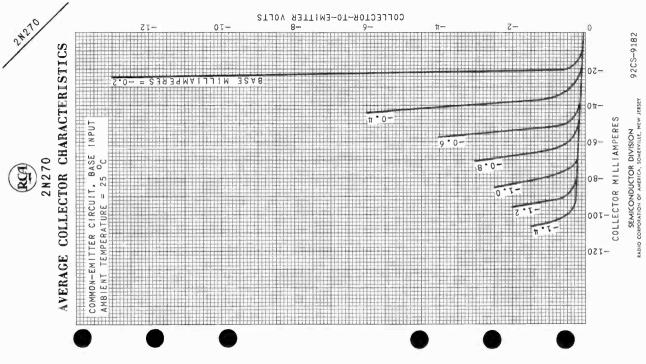
The 2N270 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

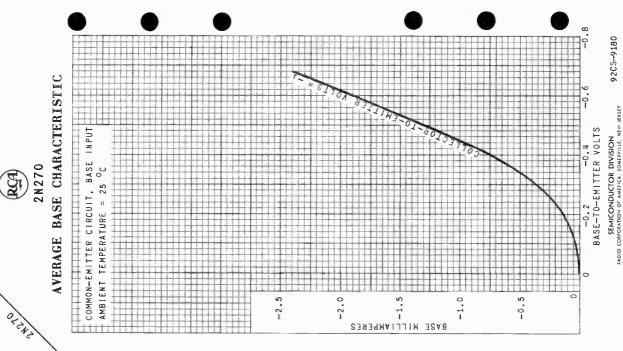
The *flexible leads* of the 2N270 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

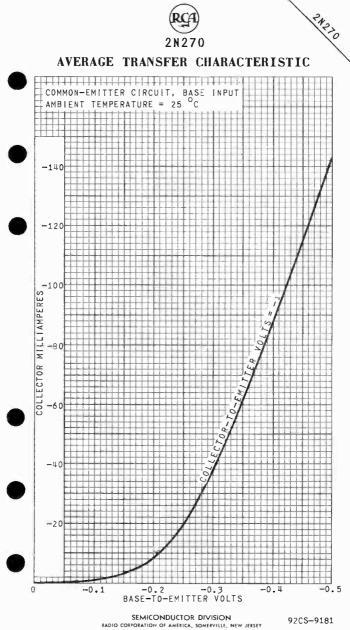
When dip soldering is employed in the assembly of printed circuitry using the 2N270, the temperature of the solder should not exceed 230 $^{\rm OC}$ for a maximum immersion period of 10 seconds.

In class B service, when the 2N270 is operated at ambient temperatures other than 25 $^{\circ}$ C, the base-to-emitter voltage should be reduced or increased by approximately 0.002 volt for each degree the ambient temperature is above or below 25 $^{\circ}$ C, respectively. When this transistor is operated under varying ambient temperatures, some form of temperature compensation may be used in the base-to-emitter circuit to hold the operating point constant.

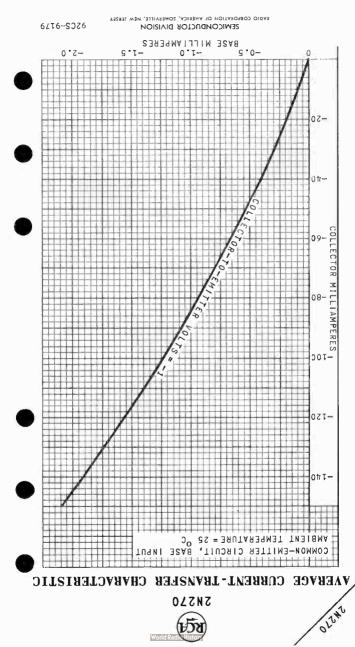








World Padio History





DRIFT TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For radio-frequency amplifier applications

GENERAL DATA

GENERAL DATA	
Electrical, At Ambient Temperature of 25° C:	
Minimum DC Collector-to-Base Voltage for dc collector current of -50 μa	
with emitter open	٤S
volt with emitter open10 Maximum DC Collector Current for dc collector-to-base voltage of -12	μη
volts with emitter open16 Minimum DC Emitter-to-Base Voltage for dc emitter current of -50 μa with collector open0.5 vo	µa. It
Mechanical:	
Operating Position	5" 0" al ic 4 5"
Lead 1 - Emitter CENTER C Lead 2 - Base Center Lead - Interlead Shield, Metal Case C Lead 2 - Base Lead 3 - Collector (Adjacent to red dot on side of case)	
RÁDIO-FREQUENCY ÁMPLIFIER — Class A	
Maximum Ratings, Absolute Values:	
temperatures up to 71 ^o C)	°C °C
Characteristics, At Ambient Temperature of 25° C:	
Common-Emitter Circuit, Base Input	
DC Collector-to-Emitter Voltage	ts ma
	1
STORE SEMICONDUCTOR DIVISION LENTATIVE. UATA RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY WORK RACIO LINGOY	ĩ

RCA 2N274

DRIFT TRANSISTOR

Small-Signal Hybrid-17 Parameters:*		
DC Collector-to-Emitter Voltage (V _{CE})	9	volts
DC Emitter Current (I _F)	1	ma
Resistance robbe	40	ohms
Conductance g _{bte}	640	µmhos
Conductance g _{ble}	0	µmhos
Conductance g _{bic} (Approx.)	0	µmhos
Capacitance C _{bie}	200	μµf
Capacitance Chic Interlead Capacitance between collector and base leads with interlead shield connected to ground and all leads	1.7	μι f
cut to 5/16"	0.094	µµt
Intrinsic Transconductance (gm).	37000	µmhos
Frequency• for unity power amplification .	132	Mc
Common-Base Circuit, Emitter Input		
DC Collector-to-Base Voltage	-9	volts
DC Emitter Current Forward Current Transfer Ratio Frequency at which the forward current transfer ratio drops to 0.707 times	1 0.984	ma'
its value at 1 kc	30	Mc
Typical Operation, At Ambient Temperature of 25	5° C:	
Common-Emitter Circuit, Base Input	t	
At frequency of 1.5	10.7	Мc
DC Collector-to-Emitter Voltage9	-9	volts
DC Emitter Current	1	ma
DC Base-to-Emitter Voltage0.2 Input Resistance, AC output	-0.2	volt
circuit shorted	170	ohms
Dutput Resistance, AC input		
circuit shorted	4500	ohms
Power Gain▲	24	db
Measured at 1 kc.		
* As derived from corresponding equivalent circuit s 2N104.	shown und	ler type
 This frequency (figure of merit) may be calculated f 	rom the	equation
$f = \frac{1}{u\pi}\sqrt{\frac{g_m}{r_{bb} \cdot c_{b} \cdot c_{b} \cdot e}}$		
Measured in a single-tuned unilateralized circuit matche and load impedances for maximum transfer of power. Tran losses not included.	d to the g sformer i	enerator nsertion
OPERATING CONSIDERATIONS		
The 2N274 should not be connected into or of from circuits with the power on because his currents may cause permanent damage to the t	gh trans	sient

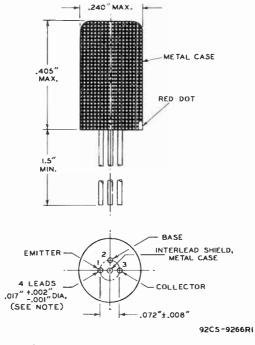
TENTATIVE DATA 1



DRIFT TRANSISTOR

The *flexible leads* of the 2N274 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N274, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.

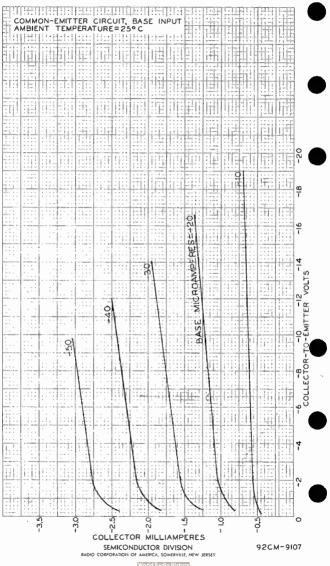


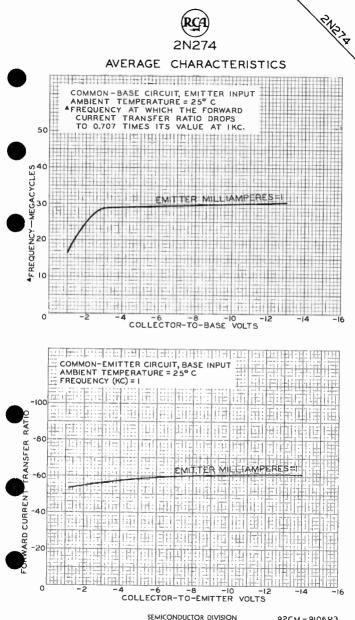
NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050" AND 0.250" FROM THE PLANE OF THE AC-TUAL BOTTOM OF THE BASE. BETWEEN 0.250" AND 1.50", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

SEMICONDUCTOR DIVISION TENTATIVE DATA 2 RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY



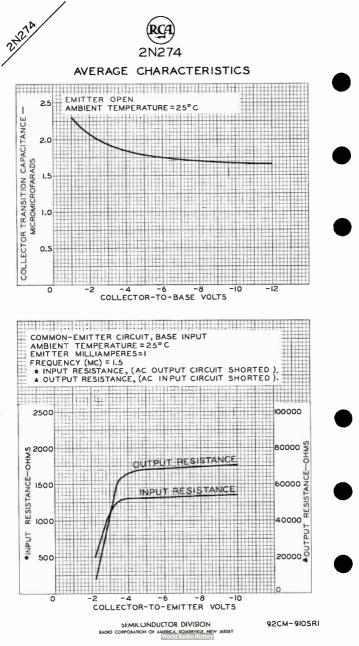
AVERAGE COLLECTOR CHARACTERISTICS





RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY d Rac

92CM - 9106 R3



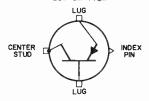
Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechan	i	cal	:
Ocorat	:	~~	ο,

Operating Position	An	у
Maximum Seated Length	0.520	й.
	1.250	
	JEDEC No.TO-3	
	••••• Welded, Meta	
		С
Terminal Diagram (See Dimen		
B	BOTTOM VIEW	



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased

	(D€ emitter-to-base volts = 1.5) −40	max.	volts
,	EMITTER-TO-BASE VOLTAGE	max.	volts
	COLLECTOR CURRENT	max.	amp
	EMITTER CURRENT	max.	amp
	BASE CURRENT	max.	amp
	TRANSISTOR DISSIPATION: *		·
	At case temperatures ^b of 25 ^o C or below . 150	max.	watts
	CASE-TEMPERATURE [®] RANGE:		-
١	Operating and storage65 to	+100	°C
	Typical Operation:		
-	•••	e r -	
-	Typical Operation: In a common-emitter, base-input, pow switching circuit at case temperature ^b of 25	er- °C	
	In a common-emitter, base-input, pow switching circuit at case temperature ^b of 25		volts
	In a common-emitter, base-input, pow switching circuit at case temperature of 25 DC Supply Voltage	-12	volts volts
	In a common-emitter, base-input, pow switching circuit at case temperature of 25 DC Supply Voltage	-12 6	volts
)	In a common-emitter, base-input, pow switching circuit at case temperature of 25 DC Supply Voltage	-12 6 -12	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Indicates a change.

2N277

Switching Time: Rise time	 		. 19	5 μsec					
 a See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section. b Measured at any point on sealing surface. 									
ELECTRICAL CHARACTERISTICS									
Voltage values are given with respect to base and at case temperatureb of 25° C unless otherwise specified									
case temperature of 25 C un	Min.			* 5 6					
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector		.,,			-				
amperes = -0.3 BV _{CES} With base open: BV _{CEO} For dc collector	-40	-	-	volts					
amperes = -0.3 For dc collector	-	-40	-	volts	_				
amperes = -1° DC Base-to-Emitter Voltage for dc collector-to-	-25	-	-	volts					
emitter volts = -2, dc collector amperes = -5. V _{BE} DC Collector-to-Emitter Saturation Voltage for	-	-0.65	-	volt					
dc collector amperes = -12, dc base amperes = -2 · V _{CE} DC Emitter Voltage for dc (sat)	-	-0.3	-	volt					
collector volts = -40, dc emitter current = 0. V _{EB} DC Punch-Through Voltage. V _{PT} DC Emitter-Cutoff Current for dc emitter volts =	_ -40	_	-1 -	volt volts					
-20, dc collector current = 0 EBO DC Collector-Cutoff Current: CBO With dc collector volts	-	-1	-4	ma					
= -2, dc emitter current = 0 With dc collector volts		-100	-	μa					
= -40, dc emitter current = 0 With dc collector volts = -40, dc emitter	-	-2	-4	ma					
current = 0, case temperature ^b = 71° C DC Current Transfer Ratio h _{FE} for dc collector-to- emitter volts = -2, dc collector process -	-	-	-15	ma					
collector amperes = -5	35	-	70						
-12	-	25 	ndicales	a change.					

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<pre>Beta-Cutoff Frequency for</pre>				
amperes = -5	f _{ae} -	10		kc
Thermal Resistance: Junction-to-case Thermal Capacity for pulse duration of 1 to 10	R _T -	0.35	0.5	^O C/watt
milliseconds	-	0.075	-	watt-
Thermal Time Constant	<i>τ</i> ₁ -	26,25	-	sec/ ^O C msec

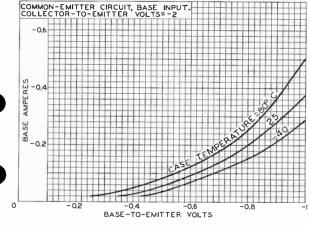
b Measured at any point on seating surface.

C Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, and RATING CHART shown under Type 2N173 also apply to the 2N277

🖛 Indicates a change.

TYPICAL BASE CHARACTERISTICS



92CS-10703

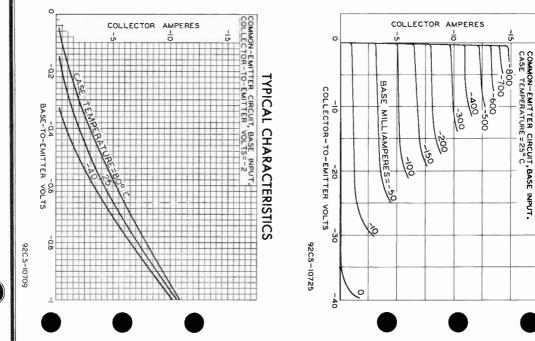


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Work Deviation Listory Somerville, N. J.

DATA 2 8-61

OF AMERICA Somerville, N. J.

RADIO CORPORATION OF Semiconductor & Materials Division



Radio History

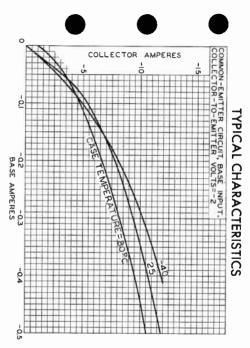
2N277

TYPICAL COLLECTOR

CHARACTERISTICS







2N277



World Radio History

Power Transistor

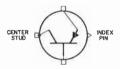
GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service

in Industrial and Military Applications

GENERAL DATA

Mechanical:

Maximum Överall Length.	Any	1
Maximum Seated Length .	0.520'	1
Maximum Diameter	1.250'	
Dimensional Outline	JEDEC No. TO-36	3
	Welded, Metal	
Seals		2
Terminal Diagram (See D	Dimensional Outline):	
	BOTTOM VIEW	



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter-to-base reverse biased (DC emitter-to-base volts = 1.5)40 max. EMITTER-TO-BASE VOLTAGE -20 max. COLLECTOR CURRENT -15 max. BASE CURRENT -15 max. BASE CURRENT -4 max. TRANSISTOR DISSIPATION:	volts amp amp
At case temperature of 25° C. 70 max. CASE-TEMPERATURE RANGE: -65 to +95 Continuous operation. -65 to +95 Intermittent operation. -65 to +100 Storage -65 to +100	°C 0°
Typical Operation:	
In a common-emitter. base-input, power- switching circuit at case temperature of 25° C DC Supply Voltage	volts amp amo



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. Switching Time:

Rise time		••••		.5 μsec .5 μsec				
See accompanying Rating Chart and al Chart in General Section.	50 Î70	nsistor-Di	ssipati	on Rating				
ELECTRICAL CHARACTERISTICS Voltage values are given with respect to base and								
case temperature of 25° C unless otherwise specified								
	Mın.	Typical	Nax.					
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector								
amperes = -0.3. BV With base open: BV For dc collector	-40	-	-	volts				
amperes = -0.3 For dc collector	~	-40	-	volts				
amperes = −1• DC Base-to-Emitter Voltage* for dc collector-to- emitter volts = -2, dc	-25	-	-	volts				
collector amperes = -5. V _{BE} DC Collector-to-Emitter Saturation Voltage* for dc collector amperes =	-	-0.65	-	volt				
-12, base amperes = $-2. \cdot V_{CE}$ DC Emitter Voltage for dc	-	-0.3	-	volt				
collector volts = -40, emitter amperes = 0 V _{EB} DC Punch-Through Voltage V _P DC Emitter-Cutoff Current for dc emitter volts = -20, dc collector	-40	-	-1 -	volt volts				
amperes = 0	-	-1	-8	ma				
amperes = $0 \cdot \cdot \cdot \cdot$ With dc collector volts = -40, dc emitter	-	-100		μа	_			
amperes = 0 With dc collector volts = -40, dc emitter amperes = 0, case	-	-2	-8	ma				
temperature = 71° C DC Current Transfer Ratio* h _{FE} for dc collector-to- emitter volts = -2, dc collector amperes =	-	-	-15	ma				
-5	35 -	25	70 _		•			

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.



•	Beta-Cutoff Frequency for dc collector-to-emitter volts = -6, dc collector					
	amperes = -5	fae	-	10	-	kс
	Thermal Resistance: Junction-to-case	RT	-	0.7	1	°C/watt
	Thermal Capacity for pulse duration of 1 to 10					
	milliseconds		-	0.075	-	watt- sec/ ^o C
	Thermal Time Constant	τ_1		52.5	-	msec

Sweep voltage used to perform test.

★ Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

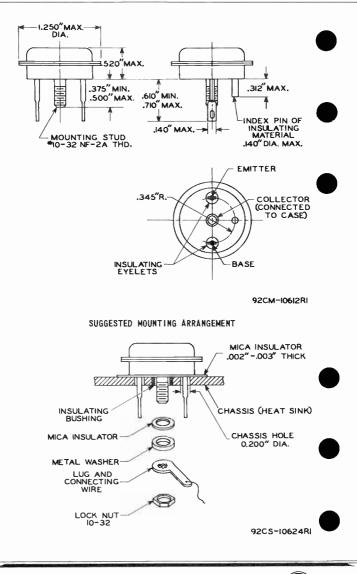
This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Hounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

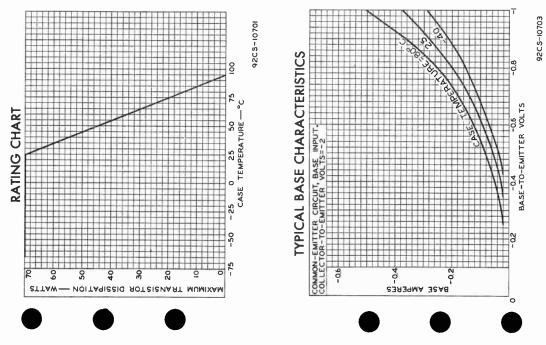
The maximum torque on mounting stud should not exceed 12 inch-pounds.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



2N277



DATA 3 2-61

AMERICA Somervitle, N. J.

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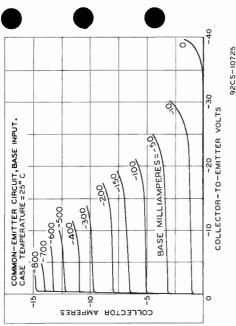
CORPORATION or & Materials Division

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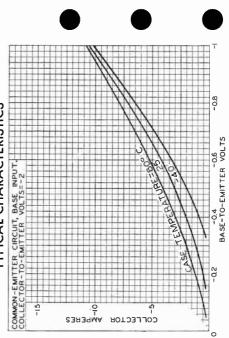
World Radio Histor



CHARACTERISTICS **LYPICAL COLLECTOR**







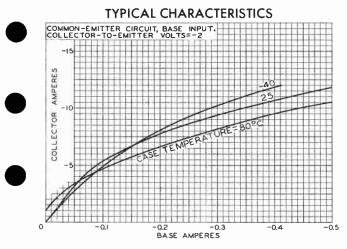
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AMERICA Somerville, N. J.

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CORPORATION RADIO CORPORATION Semiconductor & Materials Division

92C S-10709



92CS-10712



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 4 2-61

World Radio History

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2N278

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

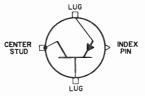
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position												Any
Maximum Seated Length												0.520"
Maximum Diameter												1.250"
Dimensional Outline .												.JEDEC No.TO-36
Case												. Welded, Metal
Seals												Hermetic
Terninal Diagram (See	D	1 11 0	en:	510	on	ıl	01	ı t i	lıı	ne)	:	

BOTTOM VIEW



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased

(DC emitter-to-base volts = 1.5)50 max. volts	
EMITTER-TO-BASE VOLTAGE	
COLLECTOR CURRENT	
EMITTER CURRENT	
BASE CURRENT	
TRANSISTOR DISSIPATION: *	-
At case temperatures ^b of 25 ⁰ C or below . 150 max, watts	
CASE-TEMPERATURE RANGE :	-
Operating and storage	
Typical Operation:	
In a common-emitter, base-input, power-switch-	

In a common-emitter, base-input, power-switch-	
ing circuit at case temperature ^b of 25°C	
DC Supply Voltage	volts
DC Base-Bias Voltage 6	volts
"On" DC Collector Current	amp
"Turn-On" Base Current	amp
"Turn-Off" Base Current 0	amp
- Indicates a	change



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA 1 8-61

2N278

	Switching Time: Rise time 15 μsec Fall time
	 a See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section. b Measured at any point on seating surface.
•	ELECTRICAL CHARACTERISTICS
	Voltage values are given with respect to base and at case temperature ^b of 25°C unless otherwise specified
	Hin. Typical Max. DC Collector-to-Emitter

Breakdown Voltage: With base connected to					
emitter, dc collector amperes.= -0.3 · · · .BV _{CES} With base open: BV _{CES}	-45	-	_	volts	
For dc collector amperes = -0.3 For dc collector	-	-45	-	volts	
amperes = -1° DC Base-to-Emitter	-30	-	-	volts	
Voltage for dc col- lector-to-emitter volts = -2, dc collector					
amperes = -5 V _{BE} DC Collector-to-Emitter Saturation Voltage for dc collector amperes	-	-0.65	-	volt	
= -12, dc base amperes = -2 V _{CE} DC Emitter Voltage for dc collector volts = -50, dc emitter current	-	-0.3	-0.7	volt	
= 0 V _{EB} DC Punch-Through Voltage . V _{PT} DC Emitter-Cutoff Current for dc emitter volts = -30, dc collector	-50	-	-1 -	volt volts	
current = 0 I _{EBO} DC Collector-Cutoff Current: I _{CBO} With dc collector volts = -2, dc emitter	-	-1	-4	ma	
current = 0 With dc collectorvolts = -50, dc emitter	-	-100	-	μа	
current = 0 With dc collectorvolts = -50, dc emitter current = 0, case	-	-2	-4	ma	
temperature ^b = 71 ⁰ C .	-	-	-15	ma	
		🔶 ine	dicates a	change.	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Recipition



DC Current Transfer Ratio h _p for dc collector-to- emitter volts = -2, dc collector amperes =	Ē			
-5	35	-	70	
-12	-	25	-	
Beta-Cutoff Frequency				
for dc collector-to-				
emitter volts =-6, dc				
collector amperes = -5 for the second	2e -	10	-	kc
Thermal Resistance:		0.25	0.5	^o C/watt
Junction-to-case R Thermal Capacity for pulse	т —	0.35	0.5	-C/Wall
duration of 1 to 10				
milliseconds	_	0.075	***	watt-
		0.070		sec/°C
Thermal Time Constant $_{\mathcal{T}}$	í –	52.5	_	msec

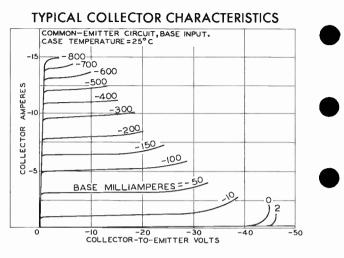
b Measured at any point on seating surface.

C Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES shown under Type 2N173 also apply to the 2N278



🛥 Indicates a change.



9205-10738

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position		Any					
Maximum Överall Length	1.1	230"					
Maximum Seated Length	0.!	520"					
Maximum Diameter	1.3	250"					
Dimensional Outline	JEDEC No.T	0-36					
Case	Welded, M	etal					
		etic					
Terminal Diagram (See Dimensional Outline):							
BOTTOM VIEW							



INDUSTRIAL SERVICE

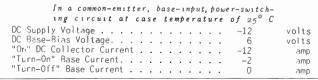
Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, *Absolute-Haximum Values*: COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased

(DC emitter-to-base volts = 1.5)50 max.	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR CURRENT	amp
EMITTER CURRENT	amp
BASE CURRENT	amp
TRANSISTOR DISSIPATION: A	
AI case temperature of 25° C 70 max.	watts
CASE-TEMPERATURE RANGE:	
Continuous operation	
Intermittent operation	0°C
Storage	0 °C

Typical Operation:





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. Switching Time:

Rise time	· · · ·	•••		15 15	μsec μsec	
See accompanying Rating Cha Chart in General Section.	rt and a	150 770	ansistor-D	issiþati	on Rating	
ELECTRIC	AL CHAR	ACTERI	STICS			
Voltage values are g						
case temperature of 2	5º Cun				e d	
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector		Mın.	Typıcal	Max.		Ū
amperes = -0.3 With base open: For dc collector	^{RV} CES RV _{CEO}	-45	-	-	volts	
amperes = $-0.3.$. For dc collector		-	-45	-	volts	
amperes = -1 [•] DC Base-to-Fmitter Voltage* for dc col		-30	-	-	volts	
<pre>lector-to-emitter volts = -2, dc collector amperes = -5 DC Collector-to-Emitter Saturation Voltage* for dc collector</pre>	V _{BE}	-	-0.65	-	volts	
<pre>amperes = -12, base amperes = -2. DC Emitter Voltage for dc collector volts = -50, emitter amperes</pre>	V _{CE}	-	-0.3	-1	volt	
= 0 DC Punch-Through Voltage. DC Emitter-Cutoff Current for dc emitter volts = -30, dc collector	V _{EB} V _P	-50	-	-1 -	volt volts	
<pre>amperes = 0 DC Collector-Cutoff Current: With dc collector volts</pre>	I _{EBO} I _{CBO}	-	-1	-8	ma	
= -2, dc emitter amperes = 0 With dc collector volts = -50, dc emitter		-	-100	-	μα	
amperes = 0 With dc collector volts = -50, dc emitter		-	-2	-8	ጠа	-
amperes = 0, case temperature = 71 ⁰ C .		-	-	-15	та	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



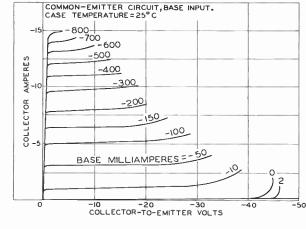
)	DC Current Transfer Ratio* h _F for dc collector-to- emitter volts = -2, dc collector amperes = -5 -12 Reta-Cutoff Frequency* for dc collector-to-	e 35 -	- 25	70 -	
	emitter volts = -6, dc collector amperes = -5 t _a Thermai Resistance: Junction-to-case R _T	C	10 0.7		kc ©C/watt
	Thermal Capacity for pulse duration of 1 to 10 milliseconds	_	0.075	_	watt-
	Thermal Time Constant τ_1	-	52.5	_	sec/ ^O C msec

Sweep voltage used to perform test.

Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES, shown under Type 2N277 also apply to the 2N278

TYPICAL COLLECTOR CHARACTERISTICS



92CS-10738



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation DATA 2 2-61

World Radio History



10EVA

POWER TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For audio-frequency power applications

GENERAL DATA

	Electrical, For Mounting-Flange Temperature of 25 °C:
	Minimum DC Collector-to-Base Voltage for dc collector current of -1 milli- ampere with emitter open40 volts Minimum DC Emitter-to-Base Voltage for dc emitter current of -1 milli- ampere with collector open12 volts Maximum DC Collector Current for
	dc collector-to-base voltage of -12 volts with emitter open220 μa Maximum DC Collector Current for dc collector-to-base voltage of -0.5 volt with emitter open
	Mechanical:
	Mounting Position Any Maximum Overall Length 0.875' Maximum Seated Length 0.475' Maximum Length of Mounting Flange 1.562' Maximum Width of Mounting Flange 1.031' Case 1.031' Case Copper Mounting Flange Copper Envelope Seals Hermetic Term.nal Connections (See Dimensional Outline): Hermetic
	E-Emitter MOUNTING FLANGE -
	B - Base MOUNTING FLANGE - Collector
	E ⊂ ⊂B
- 1	AUDIO EDEOUENCY DOWED ANDLIELED CLOOP A
	AUDIO-FREQUENCY POWER AMPLIFIER Class A
	Maximum Ratings, <i>Absolute Values:</i> РЕАК COLLECTOR-TO-BASE VOLTAGE
	Maximum Ratings, Absolute Values: PEAK COLLECTOR-TO-BASE VOLTAGE -40 max. volts DC CDLLECTOR-TO-BASE VOLTAGE (For inductive load) -20 max. volts DC EMITTER-TO-BASE VOLTAGE -12 max. volts PEAK COLLECTOR CURRENT -2 max. amp DC COLLECTOR CURRENT -1 max. amp PEAK EMITTER CURRENT 2 max. amp DC EMITTER CURRENT 1 max. amp TRANSISTOR DISSIPATION: 1 max. amp
	Maximum Ratings, Absolute Values: PEAK COLLECTOR-TO-BASE VOLTAGE. -40 max. volts DC CDLLECTOR-TO-BASE VOLTAGE (For inductive load) -20 max. volts DC EMITTER-TO-BASE VOLTAGE. -12 max. volts PEAK COLLECTOR CURRENT. -2 max. amp DC CDLLECTOR CURRENT. -1 max. amp PEAK EMITTER CURRENT. 2 max. amp DC EMITTER CURRENT. 1 max. amp DC EMITTER CURRENT. 1 max. amp
	Maximum Ratings, Absolute Values: PEAK COLLECTOR-TO-BASE VOLTAGE. -40 max. volts DC COLLECTOR-TO-BASE VOLTAGE (For -20 max. volts inductive load) -20 max. volts DC EMITTER-TO-BASE VOLTAGE. -12 max. volts PEAK COLLECTOR CURRENT. -20 max. amp DC COLLECTOR CURRENT. -1 max. amp DC COLLECTOR CURRENT. 2 max. amp DC CALLECTOR CURRENT. 1 max. amp PEAK COLLECTOR CURRENT. 1 max. amp PEAK EMITTER CURRENT. 1 max. amp C EMITTER CURRENT. 1 max. amp For continuous operation: * For continuous operation: * For mounting-flange temperatures 12 max. watts For mounting-flange temperature *

RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

(RCA) 2N301

211301

POWER TRANSISTOR

For intermittent operation:		
For mounting-flange temperature of 80 °C	7.5 max.	watts
MOUNTING-FLANGE TEMPERATURE (During		0.0
operation). STORAGE-TEMPERATURE RANGE	85 max. -65 to +85	°C °C
Characteristics, For Mounting-Flange Tempera		°C:
Common-Emitter Circuit, Base In;		
DC Collector-to-Emitter Voltage1 DC Collector Current0		volts amo
	1 -	ke
nput Resistance	23 37	otas
Current Transfer Ratio	75	1
arge-Signal DC Current Trans-	. 70	
ypical Operation [*] , At Ambient Temperature o		
Common-Emitter Circuit, Base In;		
C Supply Voltage	14.4 -13.6	volts volts
mitter Resistor (Unbypassed)	1	onn
	-C.24	vol t
C Collector Current:		ļ
Peak.	-0.8 -0.4	ar oj arroj
Zero-signal	-0.4	chest
oad Impedance.	34	ohms
ignal Frequency	400	cps
ircuit Efficiency♥	47	%
Power Gaint	32.5 10 max.	db %
MaxSignal Power Output	2.7	watts
AUDIO-FREQUENCY POWER AMPLIFIER	Class B	
aximum Ratings, Absolute Values:		
PEAK COLLECTOR-TO-BASE VOLTAGE. ,	-40 max.	volts
inductive load)	-20 max.	volts
C EMITTER-TO-BASE VOLTAGE	-12 max.	volts
EAK COLLECTOR CURRENT.	-2 max. -1 max.	amp amp
EAK EMITTER CURRENT.	2 max.	amp
C EMITTER CURRENT.	1 max.	amp
An aluminum chassis 7° \times 11° \times 1/16° mounted horizo used as a heat sink.	ntally in free	eir is
•		
. See next page.	TONTATIVE	
1-57 SEMICONDUCTOR DIVISION	TENTATIVE	UATA 1

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2N301

POWER TRANSISTOR

TRANSISTOR DISSIPATION: For continuous operation: * For mounting-flange temperatures up to 55 °C 12 max. watts For mounting-flange temperature of 71 °C.... For intermittent operation: 5.5 max. watts For mounting-flange temperature of 80 °C. 7.5 max. watts MOUNTING-FLANGE TEMPERATURE (During oC operation). . . 85 max. STORAGE-TEMPERATURE RANGE . . -65 to +85 00 Characteristics, For Mounting-Flange Temperature of 25 °C: Common-Emitter Circuit, Base Input volts DC Collector-to-Emitter Voltage . -1.5 -1.5 DC Collector Current. -0.5 amp -11 kc Signal Frequency. . . . Input Resistance. 23 37 ohms -75 Current Transfer Ratio. ---Large-Signal DC Current Trans-70 fer Ratio Typical Push-Pull Operation[®], At Ambient Temperature of 55 °C: Common-Emitter Circuit, Base Input Unless otherwise specified, values are for 2 transistors DC Supply Voltage 14.4 volts . . . DC Base-to-Emitter Voltage (Zero signal) volt . . . -0.13 Peak Collector Current (Per transistor) . . amp Zero-Signal DC Collector Current (Per amp Max.-Signal DC Collector Current (Per transistor) -0.64 amp Signal-Source Impedance (Base to base) ohms Load Impedance (Collector to collector). . . . 24 ohms . . . Signal Frequency. . . . 400 . Circuit Efficiency 67 % . 30 Power Gaine db 10 max. 7 Total Harmonic Distortion . . Max.-Signal Power Outputt . . 41220 The term "intermittent" is used to identify existing condities in which no operating or "on" perior excess true an existing rind is followed by an "off" period or at least the new spheric conduct values. * The maximum transistor-dissipation offing is re-gree centigrade the mounting-flange - emperator - is . ": See next page.

4-57

SEMICONDUCTOR DIVISION RADIO CORPORATION OF JUNERICA, SOMERVILLE, NEW JERSEY

TENTATIVE DATA 2



Measured at the primary of the output transformer.

21301

An aluminum chassis 7" x 11" x 1/16" mounted horizontally in free air is used as a heat sink. A 1/8" anodized-alumirum insulator is mounted between the mounting flange of each transistor and the chassis.

OPERATING CONSIDERATIONS

The base and emitter pins of the 2N3Ol fit the Loranger Mfg. Corp. Socket No.2149, or equivalent. When a socket is not used, connections can be soldered directly to the base and emitter pins. Soldering of the connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seals. Otherwise, the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

Depending upon application, electrical connection to the collector is made either directly to the chassis or to the mounting lug (See Suggested Nounting Arrangement). Under no circumstances should a connection be soldered to the mounting flange because the heat of the soldering operation will permanently damage the transistor.

In most applications, the metal chassis may be used as a heat sink. Depending upon the application, the chassis (heat sink) may be connected either to the positive or negative terminal of the voltage supply. In applications where the chassis is connected to the positive terminal of the voltage supply, it will be necessary to use a 1/8" anodized-aluminum insulator having high thermal conductivity or a 0.002" mica insulator between the mounting flange and the chassis. An aluminum washer should be drilled or punched to provide the two mounting holes and the clearance holes for the emitter and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that a fiber washer be used between the bolt and the chassis. (See Suggested Mounting Arrangement).

The 2N301 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

In class A service when the chassis is connected to the negative terminal of the voltage supply, the mounting flange may be directly fastened to the chassis. In this class of service, degeneration in the biasing circuit may cause reduced power gain. To minimize degeneration, it is necessary to provide positive feedback in the input circuit. To insure stable operation and low distortion, it



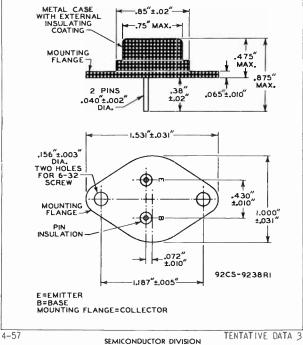
EN301

POWER TRANSISTOR

is recessary to provide some degeneration in the emitter circuit. This degeneration may be provided by the use of an unbypassed I-ohm resistor in the emitter circuit.

In class B service, when the 2N3OI is operated at mounting-flange temperatures other than 25 $^{\circ}$ C, the base-toemitter voltage should be reduced or increased by approximately 0.002 volt for each degree the mounting-flange temperature is above or below 25 $^{\circ}$ C, respectively. When this transistor is operated under varying mounting-flange temperatures, some form of temperature compensation may be used in the base-to-emitter circuit to hold the operating point constant.

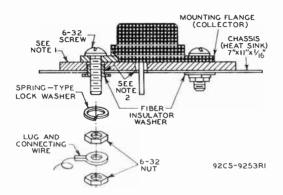
In class B push-pull service, it is necessary to insulate the mounting flange (collector terminal) of each transistor from the chassis and from the mounting flange of the other in order to prevent short circuiting the collector load. The Suggested Mounting Arrangement will insure good electrical contact and maximum transfer of heat.



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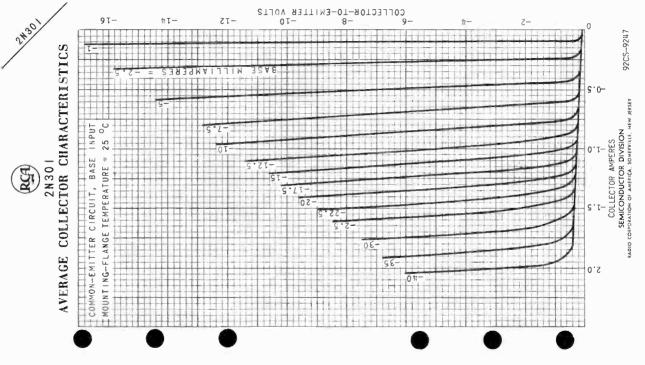
SUGGESTED MOUNTING ARRANGEMENT



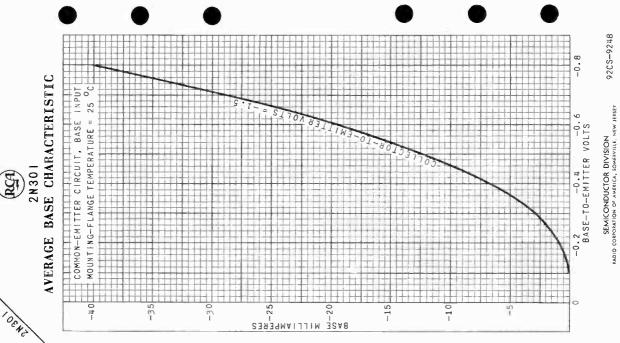
NOTE 1: 0.062" MICA INSULATOR OR ALUMINUM INSULATOR 1/8" THICK, DRILLED OR PUNCHED WITH BURRS REMOVED, AND THEN ANODIZED.

NOTE 2: REMOVE BURRS FROM CHASSIS HOLES.

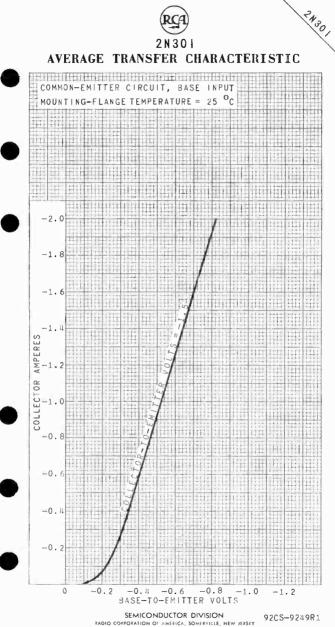
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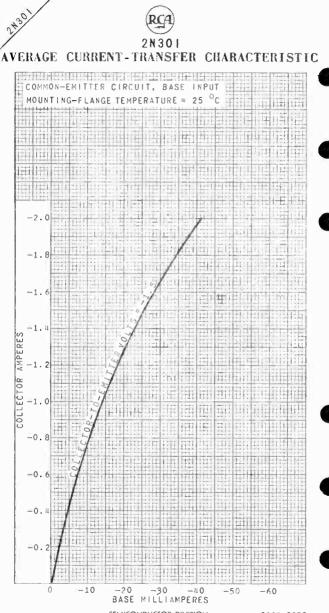
World Radio Histo



RGA



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SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY World Radio History 92CS-9250



2N30I-A

POWER TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For audio-frequency power applications

The $2N_3O_1-A$ is the same as the $2N_3O_1$ except for the following items:

AUDIO-FREQUENCY POWER AMPLIFIER -- Class A and Class B

Maximum Ratings, Absolute Values:

PEAK COLLECTOR-TO-BASE VOLTAGE	-60 max.	volts
DC COLLECTOR-TO-BASE VOLTAGE (For		
inductive load)	-30 max.	volts

A TOCKAR

World Radio History



PL 310

GERMANIUM P-N-P ALLOY TYPE

For radio-frequency amplifier applications

GENERAL DATA

Electrical:	1
Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25° C. Maximum DC Emitter Current for dc emitter-to-base voltage of -1.5 volts with collector open, and at ambient temperature of 25° C. Interlead Capacitance between collector and base 'eads with interlead shield connected to	–20 µа –50 µа
ground and all leads cut to	
	003 μμf
Mechanical:	
	A
Operating Position. Maximum Length (Excluding flexible leads) Maximum Diameter	0.375" 0.360" . Metai .Hermetic . 4
	nterlead Shield, Metal Case
Lead 2 - Base	
RADIO-FREQUENCY AMPLIFIER - Class A	
Maximum Ratings, Absolute Values:	
DC COLLECTOR-TO-BASE VOLTAGE20 ma DC EMITTER-TO-BASE VOLTAGE1.5 ma DC COLLECTOR CURRENT10 ma DC EMITTER CURRENT10 ma DC EMITTER CURRENT10 ma COLLECTOR DISSIPATION: At ambient temperature of 25° C 80 ma At ambient temperature of 55° C 40 ma At ambient temperature of 71° C 20 ma At ambient TEMPERATURE (During operation).71 ma STORAGE-TEMPERATURE RANGE65 to 4	x. volts ix. ma ix. ma ix. mw ix. mw ix. mw ix. inw ix. oc

SEMICONDUCTOR DIVISION

E7

DRIFT TRANSISTOR

rature oj	25° C.	;			
it, Base	Input				
 		-12 1 -60 132	volts ma Mc		
Emitter	Input				
ansfer		1 0.984	volts ma Mc		
Typical Operation, At Ambient Temperature of 25° C:					
-			Mc		
1 1750 180000 50.5	1 200 18000 26.2	1 100 11000 17	ma ohms ohms db		
	iit, Base iit, Base iit, Base ansfer value iit, Base i.5 -12 1750 180000 50.5	ait, Base Input 			

Measured at 1 kc.

21370

A Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included.

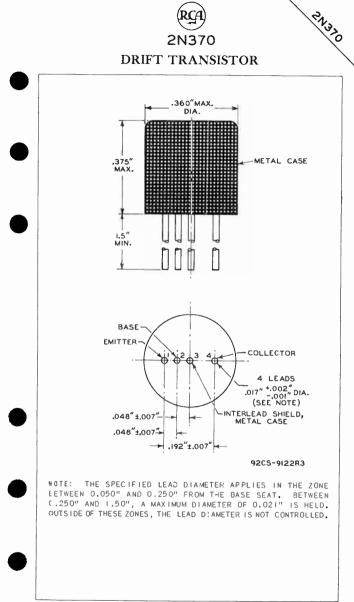
OPERATING CONSIDERATIONS

The 2N370 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of the 2N370 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N370, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.

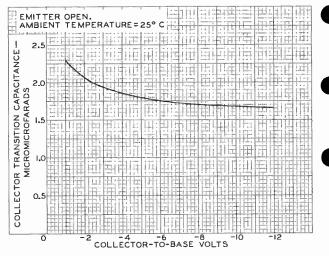
World Radio History





211370

AVERAGE CHARACTERISTIC



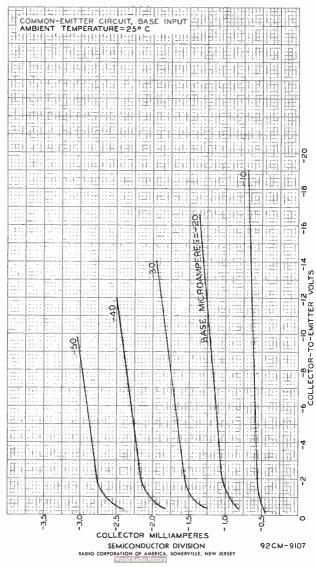
9205-9527

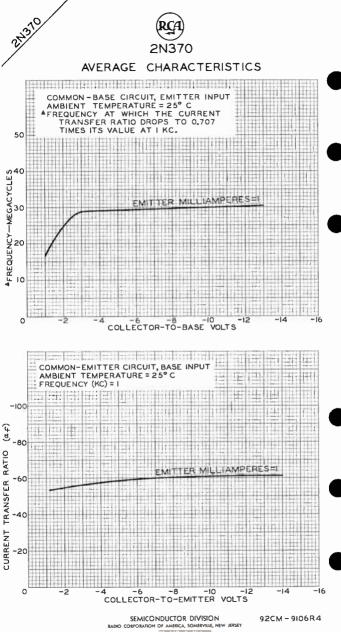
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AVERAGE COLLECTOR CHARACTERISTICS





World Radio History



EN31

DRIFT TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For radio-frequency oscillator applications

GENERAL DATA

Electrical:	
Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25° C Maximum DC Emitter Current for dc emitter-to-base voltage of -0.5 volt with collector open,	ھىر 20 –
and at ambient temperature of 25 ⁰ C	50 μa
ground and all leads cut to 5/16"	0.003 μμf
Mechanical:	
Operating Position Maximum Length (Excluding flexible leads) Maximum Diameter. Case. Envelope Seals. Leads, Flexible Minimum length. Orientation and diameterSee	0.360"
Lead 1 - Emitter	Lead 3 - Interlead Shield, Metal
Lead 2 - Base	Case Lead 4 - Collector
RADIO-FREQUENCY OSCILLA	TOR
Maximum Ratings, Absolute Values:	
DC COLLECTOR-TO-BASE VOLTAGE. DC EMITTER-TO-BASE VOLTAGE. DC EMITTER CURRENT. DC EMITTER CURRENT. COLLECTOR DISSIPATION: At ambient temperature of 25° C. At ambient temperature of 71° C. AT AMBIENT TEMPERATURE (During operation). STORAGE-TEMPERATURE RANGE.	-20 max. volts -0.5 max. volt -10 max. ma 10 max ma 80 max. mw 40 max. mw 20 max. mw 71 max. ^O C -65 to +85 ^O C

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY



DRIFT TRANSISTOR

Characteristics, At Ambient Temperature of 25° C:

Common-Base Circuit, Emitter Input

DC Collector-to-Base Voltage	volts
DC Emitter Current	ma
Current Transfer Ratio (α_f) 0.984	
Frequency at which the current transfer	
ratio drops to 0.707 times it value	- 1
at 1 kc	Mc

Typical Operation:

24371

The 2N371 can produce an oscillator-injection voltage which will provide optimum mixing in a typical rf tuner circuit.

In an oscillator stage utilizing the 2N371 and operating at 22 Mc, if the collector-supply voltage drops from -12 to -8 volts, the frequency provided by this stage will deviate from 22 Mc by less than 7 kc.

Measured at 1 kc.

OPERATING CONSIDERATIONS

The 2N371 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N371 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N371, the temperature of the solder should not exceed 230°C for a maximum immersion period of 10 seconds.

> DIMENSIONAL OUTLINE and CURVES shown for Type 2N370 also apply to the 2N371



alexa

DRIFT TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For radio-frequency mixer applications

For radio-frequency mixer applications
GENERAL DATA
Electrical:
Maximum DC Collector Current for dc collector-to-base voltage of -12 volts with emitter open, and at ambient temperature of 25° C20 μa Maximum DC Emitter Current for dc emitter-to-base voltage of -0.5 volt with collector open, and at ambient temperature of
25 ^o C50 μa Interlead Capacitance between collector and base leads with interlead shield connected to ground and all leads cut to 5/16" 0.003 μμf
Mechanical:
Operating Position
Leac 1 - Emitter Lead 2 - Base Lead 2 - Base Lead 2 - Base Lead 4 - Collector
RADIO-FREQUENCY MIXER
Maximum Ratings, <i>Absolute Values:</i>
DC COLLECTOR-TO-BASE VOLTAGE -20 max. volts DC EMITTER-TO-BASE VOLTAGE -0.5 max. volt DC EMITTER-TO-BASE VOLTAGE -0.5 max. volt DC COLLECTOR CURRENT -10 max. ma DC EMITTER CURRENT 10 max. ma COLLECTOR DISSIPATION: At ambient temperature of 25° C. 80 max. mw At ambient temperature of 71° C. 20 max. mw At ambient temperature of 71° C. 20 max. mw AMBIENT TEMPERATURE (During operation) 71 max. °C STORAGE-TEMPERATURE RANGE. -65 to +85

TENTATIVE DATA

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY World Radio History 2N372

DRIFT TRANSISTOR

Characteristics, At Ambient Tempe	rature o	f 25° C	:	
Common-Emitter Circu	st, Base	Input		
DC Collector-to-Emitter Voltage. DC Emitter Current Current Transfer Ratio $\{\alpha_f\}^{\bullet}$. Frequency for unity power amplifi		6	1 0	volts ma Mc
Common-Base Circuit,	Emitter	Input		
DC Collector-to-Base Voltage . DC Emitter Current Current Transfer Ratio (α_f) . Frequency at which the current tr ratio drops to 0.707 times its	ansfer	•	2 1 4	volts ma
at 1 kc			0	Mc
Typical Operation, At Ambient Tem			6.	
Common-Emitter Circu				
At frequency of		10		Mc
DC Collector-to-Emitter Voltage. DC Emitter Current	1 1750 180000 50.5 31	1 200 18000 26.2 17.6	17 12.5	ma ohms ohms db db
Collector Transition Capacitance.		1.7		μµf
Measured at 1 kc.				

Measured at 1 kc.

214372

Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included.

OPERATING CONSIDERATIONS

The 2N372 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of the 2N372 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N372, the temperature of the solder should not exceed 230⁰ C for a maximum immersion period of 10 seconds.

DIMENSIONAL OUTLINE and CURVES shown for Type 2N370 also apply to the 2N372

TENTATIVE DATA

Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE For Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position															Any
Maximum Length (Ex															
Maximum Diameter.															0.240"
Dimensional Outlin															
Case															. Metal
Seals														. ł	lermetic
Leads, Flexible .															4
Minimum length.															
Orientation and	dia	net	er.				. Se	ee	Dı	ime	en s	sic	na	l	Outline
Terminal Diagram:			BO	TT0	ΜV	₩.3 I									
					\sim										

d 1 — Emitter ter Lead —		(2)	2 - Base 3 - Collector
Interlead Shield, Case	0	3	(Adjacent to red dot on side of case)

INDUSTRIAL SERVICE

Such as in rf, if, oscillator, mixer, converter, and low-level video-amplifier circuits

Maxi	mum	and	Mini	mum	Rati	ngs,	Absolute-Maximum	Values:
------	-----	-----	------	-----	------	------	------------------	---------

COLLECTOR-TO-BASE VOLTAGE (Emitter open)40 max. COLLECTOR-TO-EMITTER VOLTAGE	volts							
(Base-to-emitter volts = 0.5)40 max.	volts							
EMITTER-TO-BASE VOLTAGE	volt							
COLLECTOR CURRENT	ma							
EMITTER CURRENT 10 max.	ma							
TRANSISTOR DISSIPATION: *								
At ambient temperature of 25 ⁰ C								
for operation in free air	mw							
At case temperature of 25 ⁰ C								
for operation with heat sink	mw							
AMBIENT-TEMPERATURE RANGE:								
Operating and storage	°C							
Typical Operation:								
In accompanying video-amplifier circuit with ambient temperature range of -65 to +85° C								

	•	-		~ ~ ~	
					-12 volts
					5.8 ma
	• •	۰.			150 ohms
\cdot \cdot \cdot	•••	• •	• •	• •	16 <i>μ</i> μf
			· · · · · · · · · ·		Voltage



M

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 6-61 2N384

	Frequency-Response Range: Minimum,	 e		20 10 0.035 26 20 <i>ipation</i>	cps Mc db volts Rating	•
	CHARACTERISTICS RANGE VALUES	FOR E	QUIPMENT	DESIGN		
	Voltage values are given with otherwise specified. Ambient	respec tempe	t to base rature =	unless 25°C.		
		Min.	Typical	Max.		
	DC Collector Breakdown Voltage for dc collector μa = -50, dc emitter					
	ma. = 0	-40	-80	-	volts	
	dc emitter volts = -0.5Vp DC Collector-Cutoff Current for dc collector volts =	40	-80	-	volts	
	-12, dc emitter ma. = 0 I _{CBO} DC Emitter-Cutoff Current for dc emitter volts =	-	4	-12	μа	
	-0.5, collector open I _{EBO} Small-Signal Current Trans- fer Ratio for dc collec- tor-to-emitter volts = -12, dc emitter ma. = 1.5,	-	-1	-12	μа	
+	signal frequency of 1 kc .h _{fe} Alpha-Cutoff Frequency for dc collector volts = -12,	20	60	175		
	dc emitter ma. = 1.5 f _{αb} Input Resistance: ^b R _{in} With dc collector volts = -12, dc emitter ma. = 1.5, signal frequency	-	100	-	Мс	
	of 50 MC	-	30	-	ohms	-
	nal frequency of 30 Mc ² . With dc collector-to- emitter volts = -12, dc emitter ma. = 1.5, sig-	-	50	-	ohms	
	nal frequency of 12.5 Mc. Output Resistance: ^c R _{out} With dc collector volts = -12, dc emitter ma. = 1.5, signal fre-		250	-	ohms	-
	quency of 50 Mc		5000	-	ohms	

--- Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

Somerville, N. J.



With dc collector-to-				
<pre>emitter volts = -12, dc emitter ma. = 1.5, signal frequency of 30 Mc With dc collector-to- emitter volts = -12, dc emitter ma. = 1.5,</pre>	-	5000	-	ohms
signal frequency of 12.5 Mc Collector-to-Base Capaci- tance for dc collector		16000	-	ohms
volts = -12, dc emitter ma. = 0		2	3	μµf
= -12, dc emitter ma. = 1.5, signal fre- quency of 50 Mc With dc collector-to- emitter volts = -12,	15	18	21	db
dc emitter worts = -12, signal frequency of 30 Mc With dc collector-to- emitter volts = -12.	16	20	24	db
dc emitter ma. = 1.5, signal frequency of 12.5 Mc Thermal Resistance: R _T Between junction and	24	28	32	db
case	-	-	0.31	^o C∕watt
Between junction and free air	_	-	0.62	^o C/watt
b AC output-circuit shorted.				



d

AC output-circuit shorted.

AC input-circuit shorted.

Measured in a single-tuned unilateralized circuit matched to the generator and load impedance for maximum transfer of power (transformerinsertion losses not included).

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

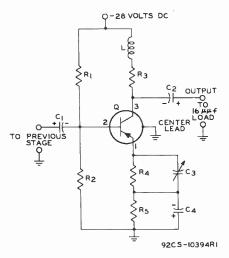
The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. 2N384

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

This transistor utilizes shielding to minimize interlead capacitance and coupling to adjacent circuit components. This shielding is provided by a fourth lead which is internally connected to the case. For optimum performance, it is recommended that this lead be connected to the chassis ground.



VIDEO-AMPLIFIER CIRCUIT

C₁: C₂: C₃: C₄: 25 µf, 12 volts 25 µf, 25 volts 100 to 300 µµf (variable) 100 µf, 12 volts ĩ: 30 µh Transistor type 2N384 0: R1: 20,000 ohms, 0.25 watt R2: 3600 ohms, 0.25 watt R3: 2000 ohms, 0.25 watt R': 62 ohms, 0.25 watt R.: 620 ohms, 0.25 watt

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Semiconductor & Materials Division

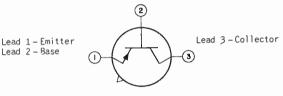
Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For "On-Off" Control Applications in Industrial and Military Equipment The 2N398B is a Direct Replacement for Type 2N398

GENERAL DATA

Mechanical:

. See Outline TO-5 in General Section Dimensions. . . BOTTOM VIEW Terminal Diagram:



SWITCHING SERVICE

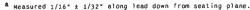
For direct "on-off" control of high-voltage, low-power devices such as neon indicators, relays, incandescent-lamp indicators, and indicating counters of electronic computers

Maximum and Minimum Ratings, Absolute-Naximum Values:

COL	LEC	TOR.	-TO-	-BASE	VOU	TAGE :

Lead 2 - Base

COLLECTOR-TO-BASE VOLTAGE: With emitter open VCBO COLLECTOR-TO-EMITTER VOLTAGE: With base short-circuited	-105 max.	volts
to emitter V _{CES}	-105 max.	volts
With collector open V _{EBO}	-50 max.	
COLLECTOR CURRENT	-100 max.	
COLLECTOR CURRENT IC IC EMITTER CURRENT IE IE TRANSISTOR DISSIPATION: PT	100 max.	ma
At free-air temperatures:	50	
From -65° to 25° C	50 max.	mw
At 55 ⁰ C	10 max.	mw
TEMPERATURE RANGE:		0.0
Operating	-65 to 55	၀င ၀င
Storage TSTG	-65 to 85	°C
LEAD TEMPERATURE: *		
For 10 seconds maximum T _i	230 max.	°C



- Indicates a change.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N, J.

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

	-)	-			
		Min.	Max.		
DC Collector-to-Emitter Reach-Through Voltage ^b DC Collector-to-Base Breakdown Voltage for de sellect	V _{RT}	-105	-	volts	
Voltage for dc collector ma. = -0.05, emitter current = 0. DC Emitter-to-Base Breakdown Voltage for dc emitter ma. =	BVCBO	-105	_	volts	
-0.05, collector current = 0. DC Base-to-Emitter Saturation Voltage for dc collector ma.	BVEBO	-50	-	volts	
= -5, dc base ma. = -0.25 DC Collector-to-Emitter Saturation Voltage for dc	V _{BE} (sat)	-	-0.4	volt	
collector ma. = -5, dc base ma. = -0.25 DC Collector-Cutoff Current: For emitter current = 0, dc collector-to-base volts =	V _{CE} (sat) CBO	-	-0.35	volt	
-2.5. -150. DC Collector Current for dc collector-to-emitter voltage = -105, base short-circuited		-	-14 -50	μа µа	
to emitter	CES	-	-600	μa	
<pre>for dc emitter-to-base volts = -50, collector current = 0. DC Forward-Current Transfer Ratio for dc collector-to-emitter volts = -0.35, dc collector</pre>	I _{EBO}	-	-50	μa	
ma. = -5	h _{FE}	20	_		

The dc collector-to-emitter reach-through voltage is determined by con-necting a high-impedance voltmeter (11 megohms or greater) between the emitter and base, and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

-- Indicates a change.





BOENT

Lead 3-Collector

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For high-voltage "on-off" control applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Length (Excluding flexible leads) 0.250"
Maximum Diameter
Case
Envelope Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



SWITCHING SERVICE

Maximum Ratings, Absolute Values:

COLLECTOR-TO-BASE VOLTAGE	volts	
COLLECTOR-TO-EMITTER VOLTAGE	volts	
EMITTER-TO-BASE VOLTAGE	volts	
COLLECTOR CURRENT	ma	
EMITTER CURRENT	mа	
TRANSISTOR DISSIPATION:		
At ambient temperature of 25° C 50 max.	mw	
At ambient temperature of 55° C 10 max.	тw	
AMBIENT TEMPERATURE (During operation) . 55 max.	°C	
STORAGE-TEMPERATURE RANGE	oC	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to the base unless otherwise specified. Ambient temperature = 25° C.

	Typical Values		Values Max.	
DC Collector Breakdown Voltage (BV _{CBO}) with dc collector current (lc) = $-50 \mu a$, dc emitter current (l _E) = 0 DC Collector Cutoff Current (l _{CBO}) with dc collector voltage (V _C) = -2.5 volts,	-150	-105	-	volts
dc emitter current $(I_E) = 0$.	-6	- 1	-14	μa



JUNCTION TRANSISTOR

	Typical Values	Range Nin.	Values Max.	
DC Emitter Breakdown Voltage (BV _{FBO}) with dc emitter				
current $(I_E) = -50 \ \mu a$, dc collector current $(I_C) = 0$.	-75	-50	-	volts
DC Collector-to-Emitter (Punch-Through) Voltage* DC Collector-to-Emitter	-150	-105	-	volts
Saturation Voltage (V _{CE}) with dc collector current ($ _{C}$) = -5 ma., dc base current ($ _{B}$) = 0.25 ma DC Base-to-Emitter Saturation	-0.20	-	-0.35	volt
Voltage (V_{BE}) with dc collector current $(I_C) =$ -5 ma., dc base current $(I_B) = -0.25$ ma Large-Signal DC Current Transfer Patie (c) with	-0.30		-0.40	volt
Transfer Ratio (α _{fe}) with dc collector current (I _C) = -5 ma.,dc collector-to emitter voltage (V _{CE}) = -0.35 volt	60	20	_	

* The dc collector-to-emitter (punch-through) voltage is determined by connecting a high-impedance voltmeter (11 megohms or greater) between the emitter and base and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt.

OPERATING CONSIDERATIONS

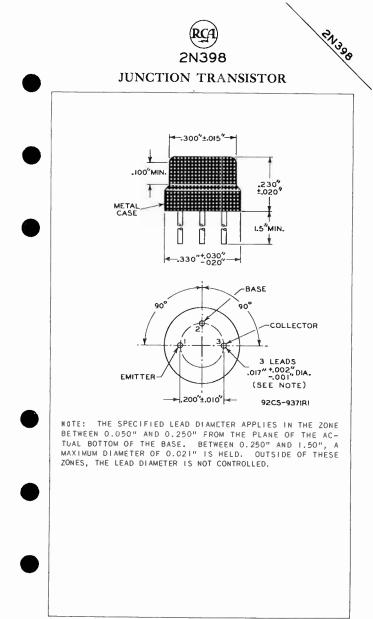
The 2N398 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

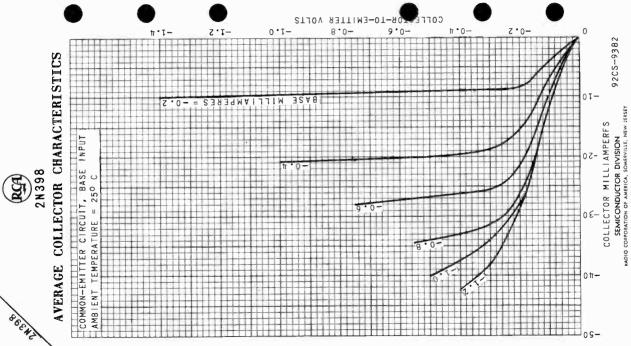
The *flexible leads* of the 2N398 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N398, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.

TENTATIVE DATA

211398





Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For "On-Off" Control Applications in Industrial and Military Equipment The 2N398B is a Direct Replacement for Type 2N398A

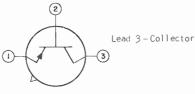
GENERAL DATA



Mechanical:

Lead 1 - Emitter Lead 2 - Base

Dimensions. See Outline TO-5 in General Section Terminal Diagram: BOTTOM VIEW



SWITCHING SERVICE

For direct "on-off" control of high-voltage, low-power devices such as neon indicators, relays, incandescent-lamp indicators, and indicating counters of electronic computers

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open V _{CBO} -105 COLLECTOR-TO-EMITTER VOLTAGE:	max. volts
	max. volts ~
EMITTER-TO-BASE VOLTAGE: With collector open VEBO -50	max. volts
COLLECTOR CURRENT	max. ma
	max. ma
TRANSISTOR DISSIPATION: PT	
At free-air temperatures:	
	max. mw
Above 25° C Derate lin	early 2 mw/°C
TEMPERATURE RANGE:	
Operating Tops -65	to 100 °C
	to 100 °C
LEAD TEMPERATURE : ª	
	max. ^o C







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ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARAC	TERISTIC	5			
Free-air temperatu	re = 250	С			
	-	Min.	Nax.		
DC Collector-to-Emitter Reach-Through Voltage ^b DC Collector-to-Base Breakdown	V _{RT}	-105	_	volts	-
Voltage for dc collector ma. = -0.05, emitter current = 0 DC Emitter-to-Base Breakdown Voltage for dc emitter ma. =	BV _{CBO}	-105		volts	
-0.05, collector current = 0. DC Base-to-Emitter Saturation Voltage for dc collector ma.	BVEBO	-50	-	volts	
= ~5, dc base ma. = -0.25 DC Collector-to-Emitter Saturation Voltage for dc	V _{BE} (sat)	-	-0.4	volt	
collector ma. = -5, dc base ma. = -0.25 DC Collector-Cutoff Current for emitter current = 0, dc	V _{CE} (sat) I _{CBO}	-	-0.35	volt	
<pre>collector-to-base volts = -2.5</pre>		-	-14 -50	µа µа	
= -105, base short-circuited to emitter DC Emitter-Cutoff Current for dc emitter-to-base volts	CES	-	-600	μa	
 = -50, collector current = 0. DC Forward-Current Transfer Ratio for dc collector-to-emitter 	I _{EBO}	-	-50	μa	
volts = -0.35, dc collector ma. = -5	hfe	20	-		
<pre>for dc collector-to-emitter volts = -6, dc collector ma. = -1, frequency (kc) = 1 Thermal Resistance:</pre>	h _{fe}	20	_		
Junction-to-free air	θ_{JFA}	-	0.5	°C/mw	

b The dc collector-to-emitter reach-through voltage is determined by connecting a high-impedance voltmeter (11 megohms or greater) between the emitter and base, and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt.

--- Indicates a change.



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OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.



World Radio History

Transistor

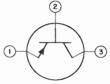
GERMANIUM P-N-P ALLOY-JUNCTION TYPE For "On-Off" Control Applications

GENERAL DATA

Mechanical:

Operating Position													. Any
Maximum Length (Ex													
Maximum Diameter.												().370"
Dimensional Outlin	е.									JE	DEC	No	.T0-5
Case													
Seals													
Leads, Flexible .													
Minimum length.													
Orientation and						See	Dı	те	n s	10	nal	0ı	itline
Terminal Diagram:		BOL	TOM	VIEI	W								

Lead 1 - Emitter Lend 2 - Base



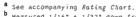
Lead 3 - Collector

SWITCHING SERVICE

For direct high-voltage control of "on-off" devices such as neon indicators, relays, incandescent-lamp indicators, and indicating counters of electronic computers

Maximum and Minimum Ratings, Absolute-Maximum Values: ------

COLLECTOR-TO-BASE VOLTAGE:						
With emitter open					-105 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:						
With base open					-105 max.	volts
EMITTER-TO-BASE VOLTAGE:						
With collector open	•				-50 max.	volts
COLLECTOR CURRENT						
EMITTER CURRENT			•		200 max.	ma
TRANSISTOR DISSIPATION: *						
At_free-air temperature of						
25 ^D C or below					150 max.	mw
FREE-AIR TEMPERATURE RANGE:						
Operating and storage	•	•			-65 to +100	°C
LEAD TEMPERATURE:						
Four 3 seconds maximum ^b					250 max.	°C



Measured 1/16" ± 1/32" down from seating plane.

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ELECTRICAL CHARACTERISTICS

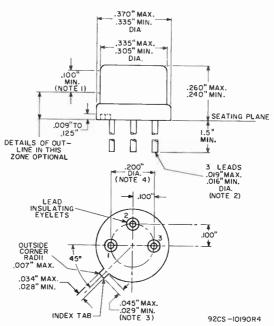
Voltage values are given with respect otherwise specified. Free-air temper			
	Min.	Max.	
DC Collector-to-Emitter Reach-Through Voltage ^c V _{RT} DC Base-to-Emitter Saturation	-105	-	volts
Voltage for dc collector ma. = -5, dc base ma. = 0.25V _{BE} (sat) DC Collector-to-Emitter Saturation Voltage for dc	-	-0.4	volt
collector ma. = -5, dc base ma. = -0.25V _{CE} (sat) DC Collector-Cutoff Current for dc emitter ma. = 0, dc	-	-0.35	volt
collector-to-base vo!ts = -2.5	-	-14 -50	µа µа
dc emitter volts = -50, dc collector ma. = 0 I _{EBO} DC Current Transfer Ratio for dc collector-to-emitter	-	-50	μa
volts = -0.35, dc collector ma. = -5 h _{FE} Small-Signal Current Transfer Ratio for dc collector-to-	20		
emitter volts = -6, dc collector ma. = -1 h _{fe} Thermal Resistance:	20	-8	
Junction-to-free air θ_{J-FA}	-	0.5	oC\umber ww

C The dc collector-to-emitter reach-through voltage is determined by connecting a high-impedance voltmeter (11 megohms or greater) between the emitter and base, and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt.



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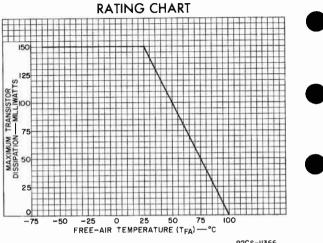
NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE OF 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.





92CS-11366



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For "On-Off" Control Applications in Industrial and Military Equipment The 2N398B is Unilaterally Interchangeable with Types 2N398 and 2N398A

GENERAL DATA

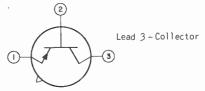
Mechanical:

Dimensions. See Outline TO-5 in General Section Terminal Diagram: BOTTOM VIEW



Lead 1 - Emitter

Lead 2 - Base



SWITCHING SERVICE

For direct "on-off" control of high-voltage. low-power devices such as neon indicators, relays, incandescent-lamp indicators, and indicating counters of electronic computers

	Maximum and Minimum Ratings, Absolute-Maximum Values:	
	COLLECTOR-TO-BASE VOLTAGE: With emitter open V _{CBO} -105 max. volts COLLECTOR-TO-EMITTER VOLTAGE:	
	With base short-circuited to emitterV _{CES} -105 max. volts FMITTER-TO-BASE VOLTAGE:	
)	With collector open VEBO -75 max. volts COLLECTOR CURRENT Ic -200 max. ma EMITTER CURRENT Ic 200 max. ma TRANSISTOR DISSIPATION: PT	
	At free-air temperatures: From -65 ^o to 25 ^o C	
)	Operating Operating <t< td=""><td></td></t<>	
	For 10 seconds maximum T _L 250 max. ^O C	



Measured 1/16" ± 1/32" along lead down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

ELECTRICAL CHARACTERISTICS

ELECTRICAL OF						
Unless otherwise specified, free-air temperature = 25° C						
DC Collector to Emitter			Nin.	Max.		
DC Collector-to-Emitter Reach-Through Voltage ^b DC Collector-to-Base Breakdown	•	V _{RT}	-105	-	volts	
Voltage for dc collector ma. = -0.025, emitter current = 0 DC Emitter-to-Base Breakdown Voltage for dc emitter ma. =	•	BVCBO	-105		volts	
-0.05, collector current =0. DC Base-to-Emitter Saturation Voltage for dc collector ma.	•	BVEBO	-75	-	volts	
= -5, dc base ma. = -0.25 . DC Collector-to-Emitter Saturation Voltage for dc	•	V _{BE} (sat)	-	-0.3	volt	
collector ma. = -5, dc base ma. = -0.25		V _{CE} (sat) I _{CBO}	-	-0.25	volt	
current = 0 With dc collector-to-base volts = -105, emitter current = 0, free-air	•		-	-6	μa	
temperature = 25° C			_	-25 -300	<i>µ</i> а µа	
= -105, base short-circuited to emitter DC Collector Current for dc collector-to-emitter volts	•	ICES	-	-300	μa	
<pre>= -55, base-to-emitter resistance (ohms) = 10000 DC Emitter-Cutoff Current for collector current = 0, dc emitter-to-base volts =</pre>	•	I CER I EBO	-	-300	μa	
-2.5			-	-6 -50	<i>µ</i> а µа	
emitter volts = -0.25, dc collector ma. = -5 Small-Signal Short-Circuit Forward-Current Transfer Rati for dc collector-to-emitter	io	hfe	20	-1		•
volts = -6, dc collector ma. -1, frequency (kc) = 1	=	h _{fe}	40	-		

The dc collector-to-emitter reach-through voltage is determined by con-necting a high-impedance voltmeter (11 megohns or greater) between the emitter and base, and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt. b





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	Nin.	Max.	
Small-Signal Short-Circuit Forward-			
Current Transfer Ratio Cutoff			
Frequency for dc collector-to-			
base volts = -6 , dc emitter			
ma, = 1 f _{hfh}	1	-	Mc
Thermal Resistance:			~
Junction-to-free air θ_{JFA}	-	0.3	°C/mw

PERFORMANCE TESTS AND SPECIAL RATINGS

This transistor type is tested in strict accordance with rigid procedures conforming to the environmental, life, and mechanical requirements of Military Specification MIL-S-195008.

Moisture Resistance:

This test is performed on a sample lot of transistors from each production run. The transistors are subjected to temperature cycling during this moisture-resistance test to provide alternate periods of condensation and drying. Increased effectiveness is also obtained by the use of a high temperature which intensifies the effects of humidity. At the end of the test, the transistors in the sample lot are required to meet the limits for BV_{CBO}, and h_{FE} as shown under *Characteristics Endpoint Values*.

Salt Atmosphere:

This test is performed on a sample lot of transistors from each production run. The transistors are placed in a test chamber through which asalt atmosphere fog (at a temperature of 35° C) is passed for 24 + 2 - 0 hours. The fog concentration and velocity are adjusted so that the rate of salt deposition in the test area is 10000 to 50000 mg/meter²/day. At the end of the test, the transistors in the sample lot are required to meet the limits for BV_{CB0}, BV_{EB0}, and h_{FE} as shown under *Characteristics Endpoint Values*.

Temperature Cycling:

Cycles of Intermittent Operation. . . . 10 min. cycles This test is performed on a sample lot of transistors from each production run. The transistors undergo IO temperature cycles from -65 \pm 3° C to + 100 \pm 3° C. At the end of the test, the transistors in the sample lot are required to meet the established limits for I_{CBO} and h_{FE} as shown under Characteristics Endpoint Values.

Thermal Shock:



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Operating Life Performance:

This test is performed on a sample lot of transistors from each production run. The transistors are operated at a transistor dissipation of 150 mw (with $V_{CC} = -100 \text{ v}$) in the accompanying *Operating-Life Test Circuit*, and at a free-air temperature of 25 ± 3⁰ C. At the end of 1000 hours, the transistors in the sample lot are required to meet the limits for I_{CB0}, hFE, BV_{CB0}, and BV_{EB0} as shown under *Characteristics* Endpoint Values.

Storage Life Performance (High Temperature):

This test is performed on a sample lot of transistors from each production run. The transistors are placed in a chamber at a temperature of 100 $\pm 3^{0}$ C for a period of 1000 hours. At the end of 1000 hours, the transistors in the sample lot are required to meet the limits for 1_{CB0}, h_{FE}, BV_{CB0}, and BV_{EB0} as shown under *Characteristics Endpoint Values*.

Constant Acceleration:

Centrifugal Acceleration. 10000 max.

This test is performed on a sample lot of transistors from each production run. The transistors are rigidly mounted with suitable protection for the leads. A centrifugal acceleration of 10000 g is applied to the transistors for one minute in each of the orientations X_1 , Y_1 , and Z_1 . The acceleration is increased to 10000 g in not less than 20 seconds and then decreased gradually to zero in not less than 20 seconds. At the end of the test, the transistors in the sample lot are required to meet the limits for BVCB0, BVCB0, and hFE as shown under *Characteristics Endpoint Values*.

Lead Fatigue:

Two leads of each transistor in the sample lot are subjected to a pull of 16 ± 1 ounces for three 90° arcs of the case (movement of the case, without torsion, to a position perpendicular to the pull axis and return to normal). All arcs on a single lead are in the same direction and in the same plane. The lead under test is restricted so that the bend starts $3/32 \pm 1/32$ inch from the case. Breakage of one or more of the leads under these test conditions constitutes failure.

Shock:

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Solderability:

This test is performed on a sample lot of transistors from each production run. The transistor leads are immersed in a flux composed of 25% (by weight) water-white resin and 75% isopropyl alcohol (90%) for a minimum of 5 seconds and then are dipped into molten solder (60% tin, and 40% lead, at 230 \pm 5° C) for 5 \pm 1/2 seconds. At the end of the test, the transistors in the sample lot are required to meet the limits for BV_{EBO} , BV_{EBO} , and h_{FE} as shown under *Characteristics Endpoint Values*.

Variable-Frequency Vibration Performance:

100 to 2000 cps at a Constant Peak Acceleration of 20 g This test is performed on a sample lot of transistors from each production run. The transistors are rigidly mounted on a vibration platform and subjected to vibration in each of the orientations X_1 , Y_1 , and Z_1 over a frequency range of 100 to 2000 cycles per second with approximately logarithmic variation of frequency and a constant peak acceleration of 20 g. The entire frequency range from 100 to 2000 cycles per second is covered in not less than four minutes. At the end of the test, the transistors in the sample lot are required to meet the limits for BV_{EB0} , BV_{EB0} , and h_{FE} as shown under Characteristics Endpoint Values.

Vibration Fatigue:

Vibrational Acceleration 20 max. g This test is performed on a sample lot of transistors from each production run. The transistors are supplied with the required test voltages while rigidly mounted on a vibration platform. The transistors are then subjected to a simple harmonic motion at any single frequency between 40 and 100 cycles per second with a constant peak acceleration of 20 g. The vibration is applied for 32 hours minimum in each of the orientations X_1 , Y_1 , and Z_1 (for a total time of 96 hours minimum). At the end of the test, the transistors are required to meet the limits for I_{CB0} and h_{FE} as shown under Characteristics Endpoint Values.

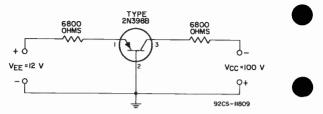
	Test	LIN		
Characteristic	Conditions	Min.	Max.	Units
¢сво	$V_{CB} = -2.5 \text{ volts}$ $I_E = 0$	-	-10	μa
h _{FE}	V _{CE} = -0.25 volt I _C = -5 ma	15.5		
BVCBO	$I_{\rm E} = -25 \ \mu a$ $I_{\rm E} = 0$	-90	-	volts
BVEBO	$I_{\rm E} = -50 \ \mu a$ $I_{\rm C} = 0$	-60	-	volts

CHARACTERISTICS ENDPOINT VALUES



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OPERATING-LIFE TEST CIRCUIT



OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

2N404

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding		
Maximum Diameter		0.370"
Dimensional Outline		JEDEC No.TO-5
Case		Welded, Metal
Seals		Hermetic
Leads, Flexible		3
Minimum length		1.5"
Orientation and diameter	r See	Dimensional Outline
Terminal Diagram:		

Lead 1 - Emitter Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum	Values:	
COLLECTOR-TO-BASE VOLTAGE	-25 max.	volts
With dc emitter-to-base volts = -1	-24 max.	volts
EMITTER-TO-BASE VOLTAGE	-12 max.	volts
COLLECTOR CURRENT	-100 max.	ma
EMITTER CURRENT	100 max.	ma
TRANSISTOR DISSIPATION: *		
At ambient temperature of 25 ⁰ C or below.	150 max.	mw
At ambient temperature of 55 ⁰ C	75 max.	mw
At ambient temperature of 71 ⁰ C	35 max.	mw
AMBIENT TEMPERATURE RANGE:		
Operating	-65 to +85	°C
Storage		°C
LEAC TEMPERATURE:		
For 10 seconds maximum	255 max.	°C

See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

- Indicates a change.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History DATA | 6-6!

Voltage values are	given u	vith r	espect	to base	and at				
ambient temperature	of 250	C unle	ss othe	rwise st	ecified				
			Typical						
DC Collector Break- down Voltage for dc collector ma. =			1 yp i cui	nux.		-			
-0.02, dc emitter ma. = 0 DC Punch-Through Voltage for dc	BVCBO	-25	-40	-	volts				
emitter volts = -1. DC Emitter Breakdown Voltage for dc	Vp	-24	-40	-	volts	-			
emitter ma. = -0.02,	BV _{EBO}	-12	-35	-	volts				
Voltage: With dc collector ma. = -12, dc	VCE(sat)					-			
base ma. = -0.4. With dc collector ma. = -24, dc		-	-0.1	-0.15	volt				
base ma. = -1 DC Base-to-Emitter Saturation Voltage: With dc collector ma. = -12, dc	VBE(sat)	-	-0.12	-0.2	volt				
base ma. = -0.4 . With dc collector ma. = -24, dc		-	-0.25	-0.35	volt				
base ma. = -1 DC Collector-Cutoff Current for dc col- lector volts = -12, dc emitter ma. = 0, ambient temperature =	I _{CBO}	-	-0.32	-0.4	vol t	•			
25° C 80° C DC Emitter-Cutoff Current for dc emit- ter volts = -2.5,		_	-2 -45	-5 -90	<i>µ</i> а <i>µ</i> а				
dc collector ma. = 0. Collector-to-Base Capacitance for dc collector volts = -6, dc collector	I _{EBO}	-	-1	-	μа				
-0, 00 confector	Cob	-	12	20	µµf				

ELECTRICAL CHARACTERISTICS





Somerville, N. J.



	DC Current Transfer Ratio: h Nith dc collector-to- emitter volts = -0.2, dc	FE				
ł	collector ma. = -24		24	40	-	
	With dc collector-to- emitter volts = -0.15. dc					
	collector ma. = -12		30	50	-	
	Alpha-Cutoff Frequency for dc collector volts = -6.					
	dc collector ma. = -1 f	ab	4	13	-	Мс
	Stored Base Charge for dc collector ma. = -10, dc base					
	ma. = -1					μμcoulombs
	Thermal Time Constant ; Thermal Resistance:	τ_1	-	10	-	msec
	Junction-to-free air I	RT	_	_	500	^o C/watt

PERFORMANCE TESTS

This transistor type is tested in accordance with Military Specification $\mbox{MIL-S-19500B}.$

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into cr disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

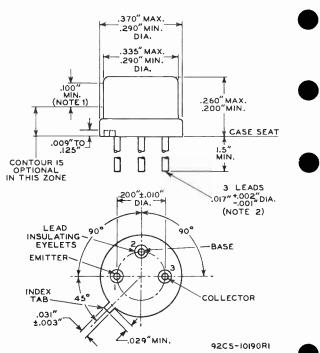
The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.



🛶 Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 6-61

JEDEC No.TO-5

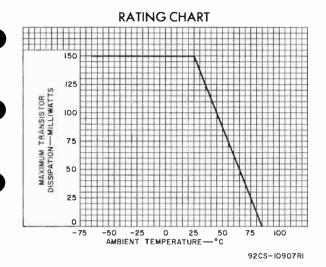


NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010¹⁰.

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





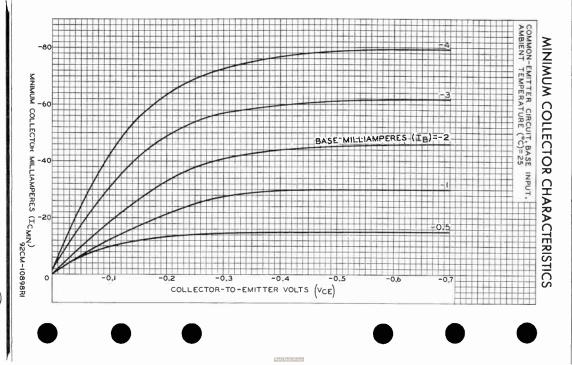


The following curves give the maximum and/or minimum characteristics values for this transistor. These curves were obtained from transistors at the extremes of the characteristics range in a 25-unit sample taken from a large number of production runs.



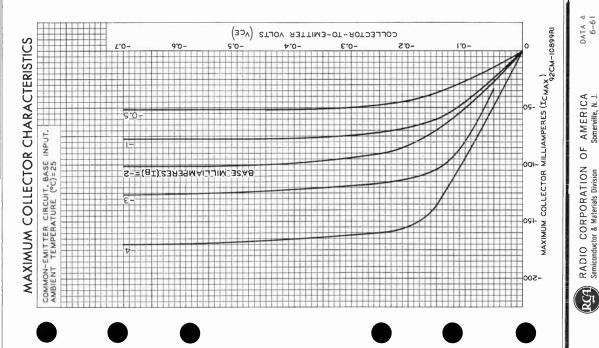
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 3 6-61

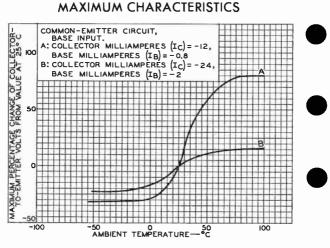




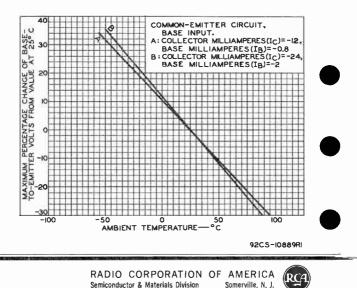
2N404

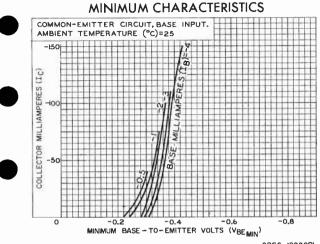
2N404





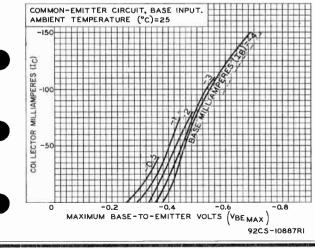
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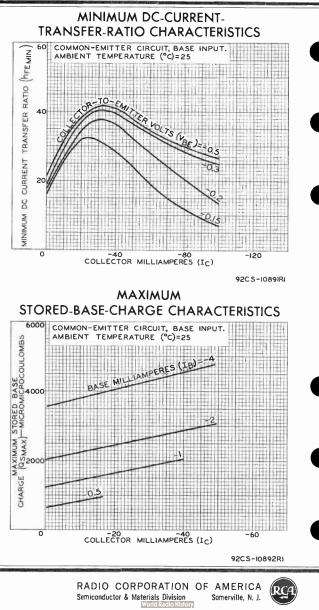
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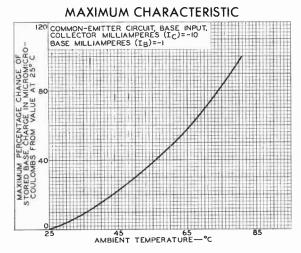
MAXIMUM CHARACTERISTICS





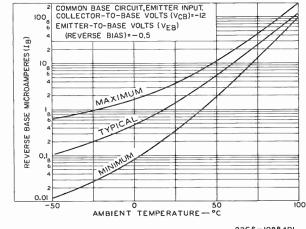
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.





92CS-10893RI

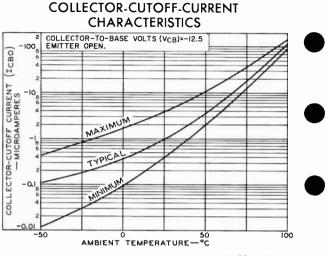
REVERSE-BASE-CURRENT CHARACTERISTICS







RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



92CS-10885RI





2N404A

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Maximum Length (Excluding	flexible leads) 0.26	60"
Maximum Diameter	0.31	70"
Dimensional Outline	JEDEC No. TO)–5
Case	Welded, Met	tal
Seals		tic
Minimum length	1.	. 5"
Orientation and diameter	" See Dimensional Outly	ine
Terminal Diagram: 8	BOTTOM VIEW	

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	. volts
With dc emitter-to-base volts = -135 max	. volts
EMITTER-TO-BASE VOLTAGE	c. volts
COLLECTOR CURRENT	k. ma
EMITTER CURRENT	k. ma
TRANSISTOR DISSIPATION: *	
At ambient temperature of 25° C 150 max	c. mw
At ambient temperature of 55° C 90 max	<. mw
At ambient temperature of 71° C 60 may	<. mw
AMBIENT-TEMPERATURE RANGE: Operating and storage	00 °C
For immersion in molten solder for 10 seconds maximum	к. °С

^a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.



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ELECTRICAL CHARACTERISTICS

LELVINI		NAU PL	101100			
Voltage values are give	ven wil	th res	pect to	base a	ind am-	
bient temperature of :	25°C i	inless	otherw	ise spe	cified	
		Min.	Typical	Max.		
DC Collector Breakdown Voltage for dc col- lector ma. = -0.02, dc emitter current = 0. DC Emitter Breakdown Voltage for dc emitter	8V _{CBO}	-40	-	_	volts	
ma. = -0.02, dc col- lector current = 0 DC Punch-Through Voltage for dc emitter volts		-25		-	volts	
= -1 DC Base-to-Emitter Sat- uration Voltage: For dc collector ma. =	V _{PT} V _{BE (sa}	-35 it)	-	-	volts	
-12, dc base ma. = -0.4 For dc collector ma. = -24, dc base ma. =		-	-	-0.35	volt	•
-1		-	-	-0.4	volt	
Saturation Voltage: For dc collector ma. = -12, dc base ma. =	V _{CE(sa}	it)				
-0.4		_	-	-0.15	volt	
-1		414	-	0.2	volt	
DC Collector-Cutoff Cur- 1 rent for dc collector volts = -12, dc emit- ter current = 0, am-) _S СВО		-	1400	μμcoulombs	
bient temperature of: 25° C 80° C		-		-5 -90	µа µа	•
for dc collector volts = -6, dc collector ma. = -1	f _{ab} h _{FE}	4	-	-	Мс	
emitter volts = -0.15, dc collector ma. = -12 For dc collector-to- emitter volts =		30	-	_		
-0.2, dc collector ma. = -24		24		-		

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Collector-to-Base Capac- itance for dc collector volts = -6, dc emitter current = -1, frequency				
(Mc) = 2 C _{op} Thermal Time Constant τ_1	-	10	20	µµ f
Thermal Resistance:	-	10	-	msec
Collector junction to free ambient air R _T	-	_	500	0C/watt
			500	C/Wall

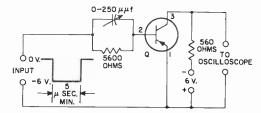
OPERATING CONSIDERATIONS

!t is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for use in single-side printed circLit boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in orinted-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.

STORED-BASE-CHARGE TEST CIRCUIT



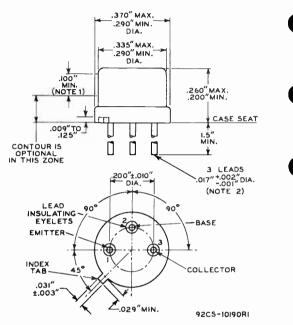
92CS-11042RI

Q: Transistor type 2N4O4A



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 6-61

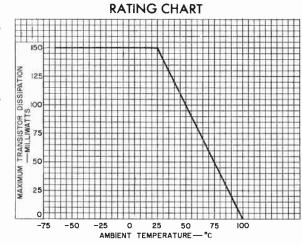




NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





92CS-11044RI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History DATA 3 6-61



L'ANDOR

JUNCTION TRANSISTOR

GERMANIUM F-N-P ALLOY TYPE

For "on-off" control applications

GENERAL DATA

Mec	h 2 n	100	
FICL	12011	i Ca	

Mechanical:	
Operating Position. Maximum Length (Excluding flexible Maximum Diameter. Case. Ervelope Seals. Leacs, Flexible. Winimum length. Orientation and diameter. BOTTOM VI Leas 1 - Emitter	
Lean 2 - Base	
SWITCHING SE	ERVICE
Maximum Ratings, Absolute Values:	
COLLECTOR-TO-BASE VOLTAGE COLLECTOR-TO-EMITTER VOLTAGE EMITTER-TO-BASE VOLTAGE COLLECTOR CURRENT EMITTER CURRENT	
CHARACTERISTICS RANGE VALUES	FOR EQUIPMENT DESIGN
Voltage values are given with ambient temperature = 25° C, un	respect to the base and
	Range Values
Values	
DC Collector Breakdown Voltage with dc collector current = -20 μa, dc emitter current = 040 DC Collector Cutoff Current with dc collector voltage = -12 volts, dc emitter current = 02	-25 - volts 5 μα
	μα

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

TENTATIVE DATA 1

2N404

JUNCTION TRANSISTOR

DC Emitter Breakdown No Voltage with dc emitter current = -20 μa, dc col- -35 lector current = 0 -35 DC Emitter Cutoff Current = 0 Current with dc emitter voltage = -2.5 volts, dc collector current = 0 -1 -2.5 Emitter (Punch- -1 -2.5 Through) Voltage* -40 -24 - DC Collector-to- Emitter Saturation Voltage with dc -24 - Collector-to- Emitter Saturation Voltage with dc -0.10 - -0.15 volts DC Base-to-Emitter Saturation Voltage -0.10 - -0.15 volt DC Base-to-Emitter -0.25 - -0.35 volt DC Collector-to- Emitter Saturation -0.25 - -0.35 volt DC Callector-to- Emitter Saturation -0.2 - - - E = -0.4 ma. -0.12 - - - - - E = -24 ma., dc base - - - <td< th=""><th></th><th>Typical Values</th><th>Range Min.</th><th>Values Max.</th><th></th></td<>		Typical Values	Range Min.	Values Max.	
temperature = 80° C4590 μ a C Emitter Breakdown Voltage with dc emitter current = -20 μ a, dc col- lector current = 0 -35 -12 - volts C Emitter Cutoff Current with dc emitter voltage = -2.5 volts, dc collector current = 012.5 μ a C Collector-to- Emitter (Punch- Through) Voltage40 -24 - volts C Collector-to- Emitter Saturation Voltage with dc collector current = -12 ma, dc base current = 0.4 ma - 0.100.15 volt C Base-to-Emitter Saturation Voltage with dc collector current = -12 ma, dc base current = -0.4 ma - 0.120.25 volt C Base-to-Emitter Saturation Voltage with dc collector collector current = -24 ma, dc base current = 2 ma, dc base current = -24 ma, dc base current =	Current with dc collector voltage = -12 volts, dc emitter current				
lector current = 035 C Emitter Cutoff Current with dc emitter voltage = -2.5 volts, dc collector current = 01 C Collector-to- Emitter (Punch- Through) Voltage40 C Collector-to- Emitter Saturation Voltage with dc collector current = -12 ma., dc base current = 0.4 ma0.10 C Base-to-Emitter Saturation Voltage with dc collector current = -12 ma., dc base current = -24 ma., dc base current = 1 ma0.12 C Base-to-Emitter Saturation Voltage with dc collector volts C Collector-to- Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = 1 ma0.12 C Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = -24 m	temperature = 80 ^o C C Emitter Breakdown Voltage with dc emitter current	-45	-	-90	μα
<pre>= 012.5 μa C Collector-to- Emitter (Punch- Through) Voltage*40 -24 - volts C Collector-to- Emitter Saturation Voltage with dc collector current = -12 ma., dc base current = 0.4 ma0.100.15 volt C Base-to-Emitter Saturation Voltage with dc collector current = -12 ma., dc base current = -0.4 ma0.250.35 volt C Collector-to- Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = 1 ma0.120.2 volt C Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = -24 ma., dc base cu</pre>	lector current = 0 C Emitter Cutoff Current with dc emitter voltage = -2.5 volts, dc	-35	-12	-	volts
Through) Voltage-40-24- voltsDC Collector-to- Emitter Saturation-24- voltsSaturationVoltage with dc collector current-21- volts= -12 ma., dc base current = 0.4 ma0.100.15voltDC Base-to-Emitter Saturation Voltage with dc collector current = -12 ma., dc base current-0.15voltDC Collector-to- Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = 1 ma0.250.35voltDC Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = -24 ma., dc base-0.120.2volt	= 0	-1	-	-2.5	μa
current = 0.4 ma0.10 DC Base-to-Emitter Saturation Voltage with dc collector current = -12 ma., dc base current = -0.4 ma0.250.35 volt DC Collector-to- Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = 1 ma0.12 DC Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current	Through) Voltage*. DC Collector-to- Emitter Saturation Voltage with dc collector current	-40	-24	-	volts
= -0.4 ma0.250.35 volt CC Collector-to- Emitter Saturation Voltage with dc collector current = -24 ma., dc base current = 1 ma0.120.2 volt CC Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current	current = 0.4 ma C Base-to-Emitter Saturation Voltage with dc collector current = -12 ma.,	-0.10	_	-0.15	volt
current = 1 ma0.120.2 volt DC Base-to-Emitter Saturation Voltage with dc collector current = -24 ma., dc base current	= -0.4 ma CC Collector-to- Emitter Saturation Voltage with dc collector current	-0.25	-	-0.35	volt
	current = 1 ma DC Base-to-Emitter Saturation Voltage with dc collector current = -24 ma.,	0.12	-	-0.2	volt
		-0.32	-	-0.4	vol t

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PAROP



	Typical Values	Range Min.	Values Max.	
Stored Base Charge with dc collector current = -10 ma. dc base current = 1 ma. Alpha-Cutoff Fre- quency with dc collector voltage	800	-	1400	μμcoulombs
= -6 volts, dc emitter current = 1 ma Collector Capaci- tance with dc col- lector voltage = -6 volts, dc	12	4	-	Mc
emitter current = 0. Junction Temperature	12	-	20	µµf
Rise (In free air) .	0.28	-	0.35	°C/mw

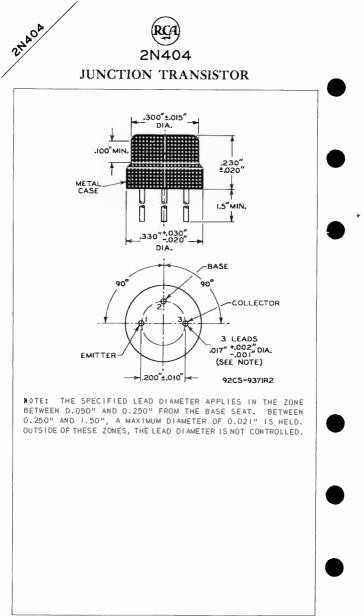
The dc collector-to-emitter (punch-through) voltage may be determined by connecting a high-impedance voltmeter (11 megohms or greater) between the emitter and base and measuring the collector-to-base voltage which causes the emitter to assume an emitter-to-base floating voltage of -1 volt. In making this test, care must be taken not to exceed the maximum collector-to-base voltage rating.

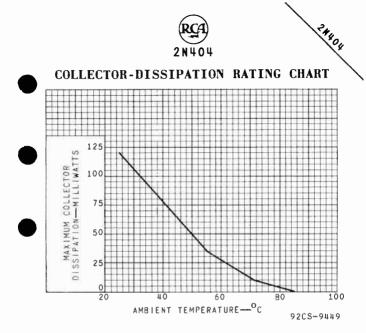
OPERATING CONSIDERATIONS

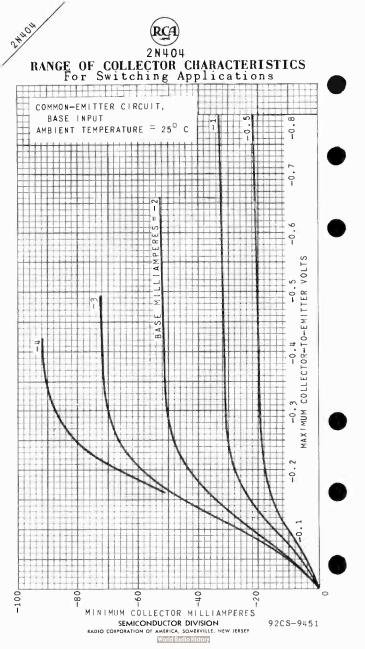
The 2N404 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of the 2N404 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation wil' crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N404, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.









2N405

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

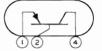
For audio-frequency driver-amplifier applications

The $2N_{405}$ is the same as the $2N_{406}$ except for the following items:

Mechanical:

Pin 1 - Emitter

Pin 2-Base

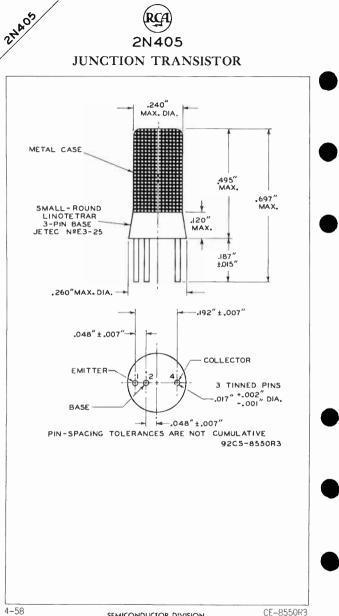


Pin 4 - Collector

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OPERATING CONSIDERATIONS

The 2N405 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.



SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SGMERVILLE, NEW JERSEY



PNR06

2N406

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For audio-frequency driver-amplifier applications

		GENERAL [
Electrical, At	Ambient T	emperatur	e of 25	° C:		
Yaxirum DC Coll dc collector- -12 volts wit Maximum DC Emit dc emitter-to- -2.5 volts wit	-to-base-vo ch emitter ter Curre -base-volta	oltage of onen nt for age of		· · ·	· -14	
Mechanical:						
Operating Posit Maximum Length Maximum Diamete Dimensional Out Case Envelope Seals Lerds, Fiexible Sinimum lengt Orientation a	line	· · · · ·		· · · ·	JETEC M	0.240 No.TO Meta ermeti
Linad 1-Emitt	۴۰r) -		Collect (Adjace	ent
Lead 2 – Base	0		}]- 3		to rec on sic case)	
A UD I 0-	FREQUENCY	DRIVER-AN	PLIFIE	R — Cla	ass A	
Maximum Ratings	, Absolute	e Values:				
COLLECTOR-TO-BA: CCLLECTOR-TO-EM EMITTER-TO-BASE DC CCLLECTOR CU DC EMITTER CURRI COLLECTOR DISSI	ITTER VOLT. VOLTAGE (RRENT ENT PAT LON	AGE (DC + F (DC + Peal	Peak AC AC)). –1 . –2 . –2	20 max. 18 max. 5 max. 35 max. 35 max.	volt volt volt m
At ambient ter At ambient ter At ambient ter AMBIENT TEMPERA SICRAGE-TEMPERA	mperature TURE (Duri	of 71 ⁰ C ind operat	ion).	•	00 max. 00 max. 20 max. 71 max. to +85	m, m, O(
At ambient te AMBIENT TEMPERA STORAGE-TEMPERA	mperature TURE (Duri TURE RANGE	of 71°C ng onerat	ion)	65	0 max. 20 max. 71 max. to +85	mi mi O(
At ambient ter AMBIENT TEMPERA STCRAGE-TEMPERA Characteristics Co	mperature TURE (Duri TURE RANGE , At Ambie ummon-Emiti	of 71° C ng operat ent Temper ter Circu	ion) ature it. Bas	-65 of 25° (e Input	0 max. 20 max. 71 max. to +85	m, m, O(
At ambient ter AMBIENT TEMPERA STORAGE-TEMPERA Characteristics	mperature TURE (Duri TURE RANGE , At Ambie mmon-Emit -Emitter V	of 71° C ing onerat ent Temper ter Circu	ion) ature it, Bas	-65 of 25° (e Input	0 max. 20 max. 71 mix. to +85	m m o(o(volts ma

RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

2N406

JUNCTION TRANSISTOR

Power Gain: With load resistance = 8500 ohms, and input resistance = 750 ohms 43	db
$\begin{array}{l lllllllllllllllllllllllllllllllllll$	ma ms ms ms
Small-Signal Hybrid-77 Parameters:*	
	ma ms ics ios iho μf μf
Small-Signal H Parameters:*	
DC Collector-to-Emitter Voltage (V _{CE})6 vol DC Emitter Current (I _F) 1	ts ma
Reverse Voltage Transfer Ratio.	ms
input circuit open (h_r) 2.93 × 10 ⁻⁴ Forward Current Transfer Ratio, ac outout circuit shorted (h_f)	
Output Conductance, input circuit open (h _o)	105
Common-Base Circuit, Emitter Input	
DC Collector-to-Base Voltage6 vo DC Emitter Current	lts ma
ratio drons to 0.707 times its value	Mc
at 1 kc 650	
 at 1 kc	104
 As derived from corresponding equivalent circuit shown under type 2N 	104
 As derived from corresponding equivalent circuit shown under type 2N Measured at 1 kc. OPERATING CONSIDERATIONS The 2N406 should not be connected into or disconnected into or disconnected incluits with the power on because high transient curre 	ted
 As derived from corresponding equivalent circuit shown under type 2N Measured at 1 kc. OPERATING CONSIDERATIONS The 2N406 should not be connected into or disconnec 	ted nts to

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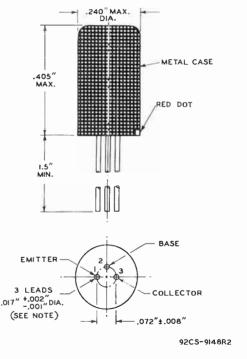


EN ROS

JUNCTION TRANSISTOR

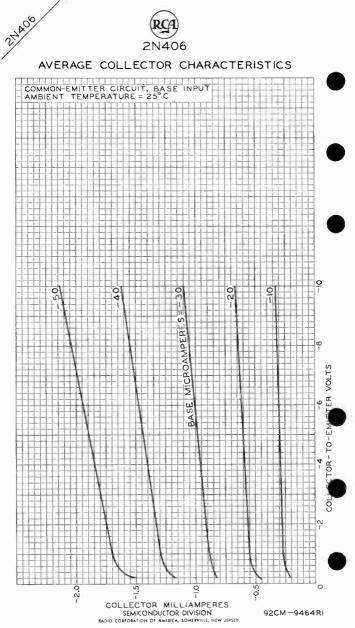
close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N406, the temperature of the solder should not exceed 230° C fora maximum immersion period of 10 seconds.



NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.050" AND 0.250" FROM THE BASE SEAT. BETWEEN 0.250" AND 1.50", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

SEMICONDUCTOR DIVISION



World Radio History



2N407

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For large-signal audio-frequency applications

The 2N407 is the same as the 2N408 except for the following items:

Mechanical:

Pin 1-Emitter

Fin 2-Base



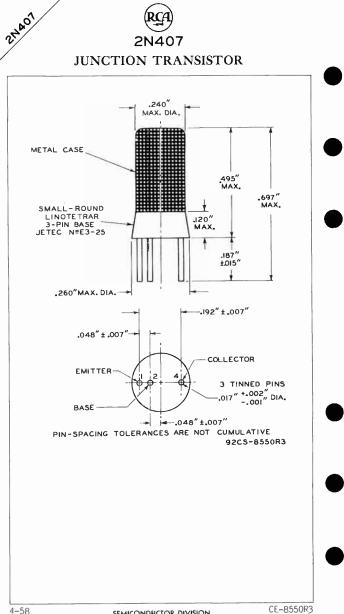
Pir 4 - Collector

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OPERATING CONSIDERATIONS

The 2N4C7 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

In class B service, when the 2N407 is operated at ambient temperatures other than 25° C, the base-to-emitter voltage should be reduced or increased by approximately 0.002 volt for each degree the ambient temperature is above or below 25° C, respectively. When this transistor is operated under varying ambient temperatures, some form of temperature compensation may be used in the base-to-emitter circuit to hold the operating point constant.





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2N408

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For large-signal audio-frequency applications

	GENERAL DATA	
	ent Temperature of 25°C:	
Maximum DC Emitter (dc emitter-to-base	ase voltage of itter open Current for a voltage of	14 μi 14 μi
Mechanical:		
Maximum Diameter Dimensional Outline Case Envelope Seals Leads, Flexible Minimum length	uding flexible leads)	0.204 C No.TO- Meta Hermetic
Lead 1 - Emitter Lead 2 - Base		acent red dot side of
	0	
A UD 10-F	REQUENCY AMPLIFIER — Class B	
AUDIO-F Maximum Ratings, <i>Abs</i>	•	
Maximum Ratings, Abs COLLECTOR-TO-BASE VC COLLECTOR-TO-EMITTER EMITTER-TO-BASE VOLT COLLECTOR CURRENT. EMITTER CURRENT.	Solute Values: DLTAGE. -20 ma: R VOLTAGE -18 ma: TAGE. -2.5 ma: -70 ma: -70 ma:	x. volt x. volt x. ma
Maximum Ratings, Abs COLLECTOR-TO-BASE VC COLLECTOR-TO-EMITTER EMITTER-TO-BASE VOLT COLLECTOR CURRENT. EMITTER CURRENT. CCLLECTOR DISSIPATIC At ambient tempera At ambient tempera At ambient tempera At BIENT TEMPERATURE	Solute Values: DLTAGE. -20 ma: R VOLTAGE -18 ma: FAGE. -2.5 ma:	x. volts x. volts x. ma x. ma x. ma x. ma x. ma x. ma
Maximum Ratings, Abs COLLECTOR-TO-BASE VC COLLECTOR-TO-EMITTER EMITTER-TO-BASE VOLT COLLECTOR CURRENT. EMITTER CURRENT. CCLLECTOR DISSIPATIC At ambient tempera At ambient tempera At ambient tempera At ambient tempera STORAGE-TEMPERATURE	Solute Values: DLTAGE. -20 ma: R VOLTAGE -18 ma: TAGE. -2.5 ma: TAGE. -70 ma: TAGE. 70 ma: TAGE. 50 ma: Toture of 25° D 150 ma: Sture of 55° D 50 ma: Uture of 71° D 20 ma: (During operation) 71 ma: RANGE. -65 to +6	x. volt: x. volt: x. m x. m x. m x. m x. m
Maximum Ratings, Abs COLLECTOR-TO-BASE VC COLLECTOR-TO-EMITTER EMITTER-TO-BASE VOLT COLLECTOR CURRENT. EMITTER CURRENT. CCLLECTOR DISSIPATIC At ambient tempera At ambient tempera At ambient tempera At Ambient tempera At Ambient tempera CALECTOR DISSIPATICE At Ambient tempera At Ambient tempera At Ambient tempera At Ambient TEMPERATURE STORAGE-TEMPERATURE Characteristics, At	Solute Values: DLTAGE. -20 ma: AVDITAGE. -18 ma: TAGE. -2.5 ma: TAGE. -70 ma: TAGE. 70 ma: TAGE. 50 DLTAGE TAGE. -2.5 ma: TAGE. 70 ma: To ma: 70 ma: Thure of 25° D 150 ma: Sture of 55° D 50 ma: Sture of 71° D 20 ma: Our ing operation) 71 ma:	x. volt: x. volt: x. m x. m x. m x. m x. m

SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

2N408

JUNCTION TRANSISTOR

Typical Push-Pull Operation, At Ambient Temperature of 25°C: Common-Emitter Circuit, Base Input Unless otherwise specified, values are for 2 transistors DC Collector-to-Emitter Supply volts Voltage. -4.5 -9 DC Base-to-Emitter Voltage . . volt -0.15 -0.15Peak Collector Current (Per transistor). -40 -35 ma Zero-Signal DC Collector Current (Per transistor).... Max.-Signal DC Collector Cur--2 -2 ma rent (Per transistor). . . . -11.5-13 mi Signal-Source Impedance (Base to base) 1500 1500 ohms Load Impedance (Collector to collector) 400 800 ohms Signal Frequency 1 kc Circuit Efficiency 60 69 % Power Gain 30 33 db Total Harmonic Distortion. . . 10 max. 10 max. 16 Max.-Signal Power Output . . . 75 160 mw

OPERATING CONSIDERATIONS

The 2N408 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

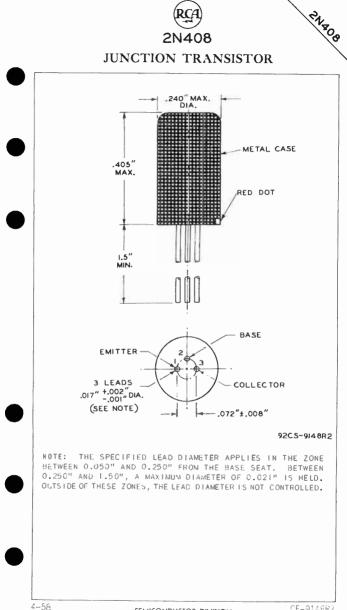
In class B service, when the 2N408 is operated at ambient temperatures other than 25° C, the base-to-emitter voltage should be reduced or increased by approximately 0.002 volt for each degree the ambient temperature is above or below 25° C, respectively. When this transistor is operated under varying ambient temperatures, some form of temperature compensation may be used in the base-to-emitter circuit to hold the operating point constant.

The flexible leads of the 2N408 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N408, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.

Curves shown under Type 2N109 also apply to the 2N408

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World Radio History

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JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For 455-kc intermediate-frequency applications

The $2N_{409}$ is the same as the $2N_{410}$ except for the following items:

Mechanical:

Maximum Overall Length. 0.697" Maximum Seated Length . 0.495" Maximum Diameter. 0.260" Base. . . Small-Round Linotetrar 3-Pin (JETEC No.E3-25)

Pin 1 - Emitter



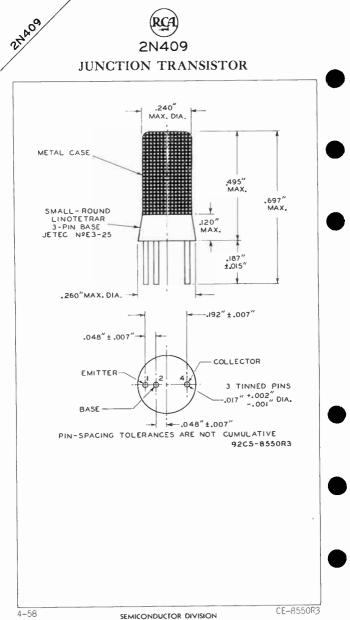
Pin 2-Base

OPERATING CONSIDERATIONS

The 2N409 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

EN ROS

Pin 4-Collector





ENRIO

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For 455-kc intermediate-frequency applications

GENERAL DATA

Electrical, At Ambient Temperature of 25° C: Minimum DC Collector-to-Base Voltage for dc collector current of -10 µa with emitter open		GENERAL DATA	
for dc collector current of -10 µa with emitter open		Electrical, At Ambient Temperature of 25°C:	L
<pre>with emitter open</pre>		Minimum DC Collector-to-Base Voltage	
Maximum DC Collector Current for dc collector-to-base voltage of -13 volts with emitter open10 Maximum DC Emitter Current for dc emitter-to-base voltage of -0.5 volt with collector open12 Mechanical: Operating Position			İ.
dc collector-to-base voltage of -13 volts with emitter open		with emitter open	
volts with emitter open			Ł
Maximum DC Emitter Current for dc emitter-to-base voltage of -0.5 volt with collector open		dc collector-to-base voltage of -13	
dc emitter-to-base voltage of -0.5 volt with collector open		Volts with emitter open $-10 \mu a$	
volt with collector open			
Mechanical: Operating Position			
Operating Position			
Maximum Length (Excluding flexible leads). 0.405" Maximum Diameter 0.240" Dimensional Outline JETEC No.TO-1 Case . Enveloce Seals . Minimum length . Orientation and diameter . Softenation . Minimum length . Orientation and diameter . Softenation . Maximum Ratings, Absolute Values: . DC COLLECTOR-TO-BASE VOLTAGE . DC EMITTER CURRENT . DC EMITTER CURRENT . DC EMITTER CURRENT . At ambient temperature of 25° C. . At ambient temperature of 55° C. . At ambient temperature of 71° C. . At ambient temperature of 71° C. . STORAGE-TEMPERATURE RANGE. .		Mechanical:	
Maximum Diameter 0.240" Dimensional Outline			
Dimensional Outline		Maximum Length (Excluding flexible leads) 0.405"	
Case			
Envelooe Seals			
Leads, Flexible			
Minimum length		Enverope Sears	
Orientation and diameter			
BOTTOM VIEW Lead 1 - Emitter Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT			Ł
Lead 1 - Emitter Lead 1 - Emitter Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE			
Lead 1 - Emitter Lead 1 - Emitter Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT		٢	
to red dot on side of case) INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT		Lead 1 - Emitter Y Lead 3 - Collector	L
on side of case) Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE			L
Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT			
Lead 2 - Base INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT			
INTERMEDIATE-FREQUENCY AMPLIFIER Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE			
Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE DC EMITTER-TO-BASE VOLTAGE DC COLLECTOR CURRENT DC EMITTER CURRENT ID COLLECTOR DISSIPATION: At ambient temperature of 25° C. At ambient temperature of 55° C. At ambient temperature of 71° C. At ambient temperature of 71° C. ID max. AMBIENT TEMPERATURE (During operation) STORAGE-TEMPERATURE RANGE.			
Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE DC EMITTER-TO-BASE VOLTAGE DC COLLECTOR CURRENT DC EMITTER CURRENT ID COLLECTOR DISSIPATION: At ambient temperature of 25° C. At ambient temperature of 55° C. At ambient temperature of 71° C. At ambient temperature of 71° C. ID max. AMBIENT TEMPERATURE (During operation) STORAGE-TEMPERATURE RANGE.		INTERMEDIATE-ERECHENCY AMPLIFIER	
DC COLLECTOR-TO-BASE VOLTAGE13 max. volts DC EMITTER-TO-BASE VOLTAGE0.5 max. volt DC COLLECTOR CURRENT			ł
DC EMITTER-TO-BASE VOLTAGE			
DC COLLECTOR CURRENT			
DC EMITTER CURRENT			Ł
COLLECTOR DISSIPATION: At ambient temperature of 25° C 80 max. mw At ambient temperature of 55° C 35 max. mw At ambient temperature of 71° C 10 max. mw AMBIENT TEMPERATURE (During operation) . 71 max. °C STORAGE-TEMPERATURE RANGE			1
At ambient temperature of 25° C 80 max. mw At ambient temperature of 55° C			
At ambient temperature of 55° C 35 max. mw At ambient temperature of 71° C 10 max. mw AMBIENT TEMPERATURE (During operation) . 71 max. °C STORAGE-TEMPERATURE RANGE			
At ambient temperature of 71° C 10 max. mw AMBIENT TEMPERATURE (During operation) 71 max. °C STORAGE-TEMPERATURE RANGE			
AMBIENT TEMPERATURE (During operation) . 71 max. ^{OC} STORAGE-TEMPERATURE RANGE65 to +85 ^{OC}			1
STORAGE-TEMPERATURE RANGE65 to +85 °C			
4.50			l
4.50			
4.50			ł
4.50			
4.50			Ł
4.50 TOUTATING OUT A			ŀ
	l		ļ



JUNCTION TRANSISTOR

Characteristics, At Ambient Temperature of 25°C:
Common-Emitter Circuit, Base Input
DC Collector-to-Emitter Voltage9 -9 volts
DC Emitter Current 0.5 1 ma Current Transfer Ratio
Small-Signal Hybrid-π Parameters:*
DC Collector-to-Emitter Voltage (V _{CE})9 -9 volts
DC Emitter Current (IE)
Resistance r _{bb}
orprovide object a statistic statistic statistic statistics and st
Frequency for unity power
amplification
Common-Base Circuit, Emitter Input
DC Collector-to-Base Voltage9 -9 volts
DC Emitter Current 0.5 1 ma
Current Transfer Ratio
Frequency at which the current transfer
ratio drops to 0.707 times its value
at 1 kc 6.8 6.7 Mc
Typical Operation, At Ambient Temperature of 25°C:
Common-Emitter Circuit. Base Input
De corrector-to-timetter vortage.
De Emilieur obritante i anno anno anno
The for the state of the state
ourput hesistanees .
Useful Power Gain
* As derived from corresponding equivalent circuit shown under type 2N104.
 This frequency (figure of merit) may be calculated from the equation
$f = \frac{1}{4\pi} \sqrt{r_{DD} \cdot c_{D} \cdot c_{D} \cdot c_{D}}$
-
Measured at 1 kc.
Measured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transforme:
insertion losses not included. (unilateralization is a special case of neutralization in which the resistive as well as the reactive feed
back parameters are balanced out. Unilateralization changes a bilatera
network into a unilateral network).
\S A transformer insertion loss of 10.4 db is included in this figure.
A transformer insertion loss of 6.6 db is included in the figure.

21410



2N RIO

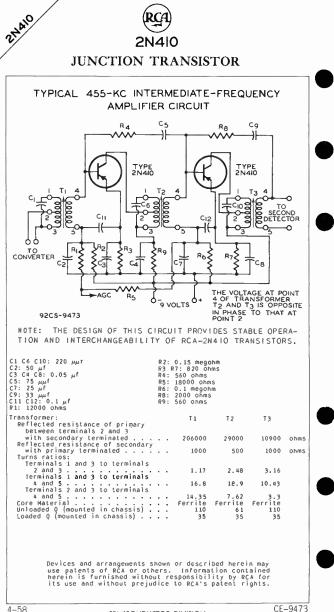


OPERATING CONSIDERATIONS

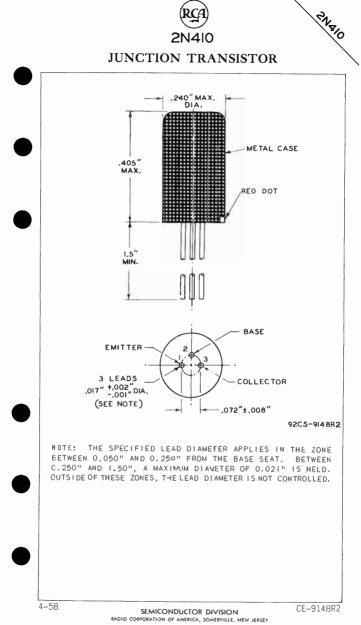
The 2N410 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N410 are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using the 2N410, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.



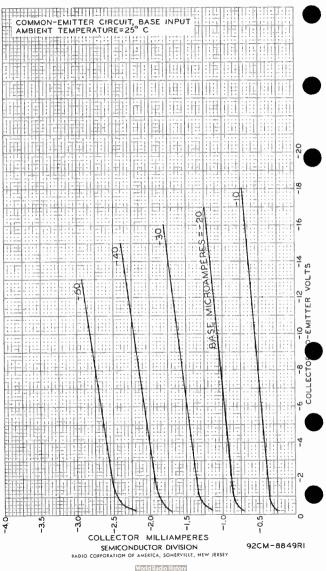
SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY





214410

AVERAGE COLLECTOR CHARACTERISTICS





JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For 540-to 1600-kc converter applications

The 2N411 is the same as the 2N412 except for the following items:

Mechanical:

Pin 1-Emitter

Pin 2 - Base

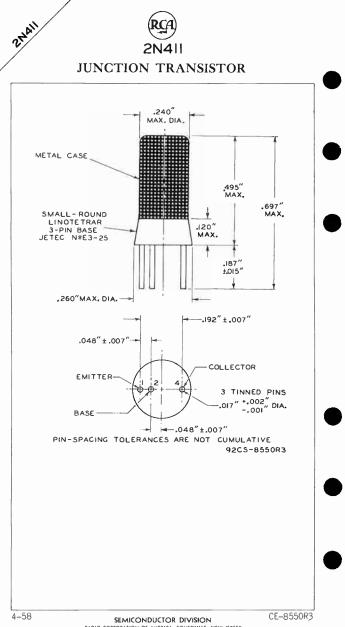


OPERATING CONSIDERATIONS

The 2N411 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

ENAL

Pin 4 - Collector



RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY World Radio History



P.N. BID

JUNCTION TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For 540-to 1600-kc converter applications

	For 540-10 1000-RC conserver apprications
	GENERAL DATA
	Electrical, At Ambient Temperature of 25°C:
)	Minimum DC Collector-to-Base Voltage for dc collector current of -10 μa with emitter open13 volts Vaximum DC Collector Current for dc collector-to-base voltage of -13 volts with emitter open10 μa
	volts with emitter open10 μa Maximum DC Emitter Current for dc emitter-to-base voltage of -0.5 volt with collector open12 μa
	Mechanical:
	Operating Position
	Lead 1 - Emitter Lead 1 - Emitter Lead 3 - Collector (Adjacent to red dot on side of case)
	CONVERTER SERVICE
	Maximum Ratings, Absolute Values: DC COLLECTOR-TO-BASE VOLTAGE -0.5 max. volts DC EMITTER-TO-BASE VOLTAGE -0.5 max. volt DC COLLECTOR CURRENT -15 max. ma DC EMITTER CURRENT 15 max. ma COLLECTOR DISSIPATION: 15 max. mw At ambient temperature of 25° C. 35 max. mw At ambient temperature of 71° C. 10 max. mw AMBIENT TEMPERATURE (During operation) 71 max. °C STORAGE-TEMPERATURE RANGE. -65 to +85 °C



JUNCTION TRANSISTOR

Characteristics, At Ambient Temperature of 25° C:
Common-Emitter Circuit, Base Input
DC Collector-to-Emitter Voltage
Small-Signal Hybrid-17 Parameters:*
DC Collector-to-Emitter Voltage (V _{CE})9 volt DC Emitter Current (I _E)
Common-Base Circuit, Emitter Input
DC Collector-to-Base Voltage 9 volt DC Emitter Current 0.6 m Current Transfer Ratio [®] 0.987 Frequency at which the current transfer ratio drops to 0.707 times its value at 1 kc
Typical Operation, At Ambient Temperature of 25° C:
Common-Emitter Circuit, Base Input
DC Collector-to-Emitter Voltage. -9 volt DC Emitter Current 0.6 m Input Resistance 700 ohm Output Resistance. 75000 ohm RMS Base-to-Emitter Oscillator 100 m Signal Frequency 1 M Useful Conversion Power Gain 32 of
Measured at 1 kc. • As derived from corresponding equivalent circuit shown under type 2010 • This frequency (figure of merit) may be calculated from the equation $f = \frac{1}{4\pi} \sqrt{\frac{g_m}{\Gamma_b b^* \ Cb^* C \ Cb^* e}}$
OPERATING CONSIDERATIONS

The 2N412 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of the 2N412 are usually soldered to the circuit elements. Soldering of the leads may be made

211412

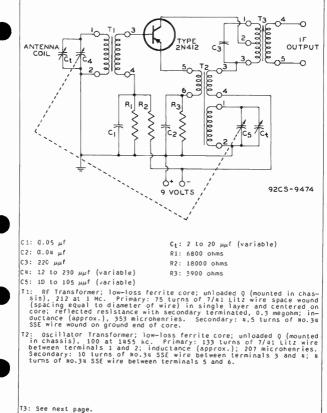


PNAID

JUNCTION TRANSISTOR

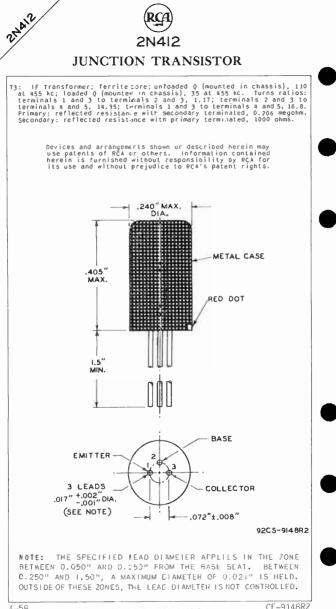
close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

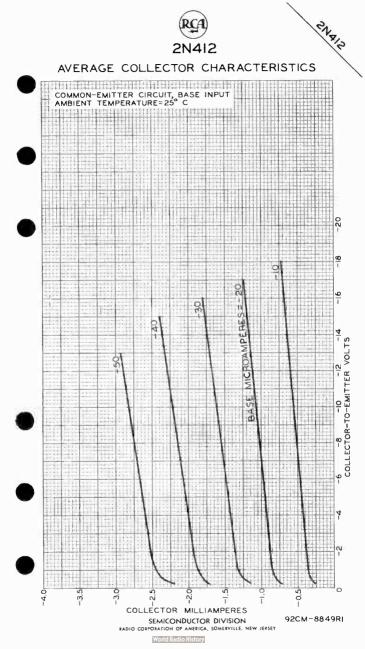
When dip soldering is employed in the assembly of printed circuitry using the 2N412, the temperature of the solder should not exceed 230° C for a maximum immersion period of 10 seconds.



TYPICAL SELF-EXCITED CONVERTER CIRCUIT

4-58





World Radio History

Junction Transistor

GERMANIUM P-N-P ALLOY TYPE

For Medium-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position																			. Any
-Maximum Length (Ex	clu	dir	цġ	fl	ex	it)le	- 1	e'	ids	.)							().260"
Maximum Diameter.	• •																	().370"
Cimensional Outline																			
Case																			
Seals																			
Leads, Elexible .			•		•		•	•				•							3
Minimum length.																			
Orientation and										Se	e	Dı	тe	n:	520	on c	ıl	01	itline
Terminal Dingram:			B	301	10	P.4	VI	El	1										

Lead 1 - Emitter

Lead 2 ~ Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR-TO-EMITTER VOLTAGE:	
Base-to-emitter volts = 1	volts
Base open	volts
PEAK COLLECTOR CURRENT	ma
DC COLLECTOR CURRENT	ma
TRANSISTOR DISSIPATION: *	
At ambient temperature of 25° C 150 max.	mw
At ambient temperature of 55° C	ΠW
AMB. ENT-TEMPERATURE RANGE :	
Operating and storage	°C
LEAG TEMPERATURE :	Ű.
For immersion in molten	
solder for 10 seconds maximum	00
	Ŭ

^a See accompanying Rating Chart.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 4-61

ELECTRICAL CHARACTERISTICS

Voltage values are given wit less otherwise specified. Am					
	Min.	Typical	Max.		
DC Collector-Cutoff Current for dc collector volts = -12, emitter open I _{CBO} DC Emitter-Cutoff Current for dc emitter volts =	-	-2	-5	μA	-
-12, collector open I _{EBO} Small-Signal Current Transfer Ratio for dc collector-to-emitter volts = -6, dc emitter ma. = 1, frequency of	-	-2	-5	μλ	
1 kc h _{fe} Small-Signal Ocen-Circuit Reverse-Voltage Transfer Ratio for dc collector volts = -6, dc emitter ma. = 1, frequency of	-	80	-		•
1 kc h _{rb} Alpha-Cutoff Frequency for dc collector volts = -6,	-	0.5×10^{-3}	-		
dc emitter ma. = 1 f _{ab} Small-Signal Short-Circuit Input Impedance for dc collector volts = -6, dc emitter ma. = 1, frequen-	-	8	-	Мс	
cy of 1 kc h _{ib} Extrinsic Base Resistance for dc collector-to- emitter volts = -6, dc emitter ma. = 1, fre-	-	30	-	ohms	
auency of 6 Mc r _{bb} ; Collector-to-Base Capaci- tance for dc collector volts = -6, dc emitter	-	120	-	ohms	
<pre>ma. = 1 Cob Power Gain fordc collector- to-emitter volts = -6, dc emitter ma. = 1, frequen-</pre>	-	11	-	μμ f	-
cy of 1.5 Mc PG Noise Factor for dc collec- tor-to-emitter voltage = -6, dc emitter ma. = 1,		16	-	db	
frequency of 1.5 Mc NF	-	6	-	db	

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.



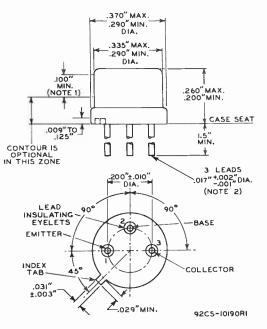
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



2N414

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

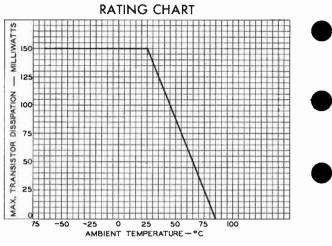
JEDEC No.TO-5



NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE RETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





92CS-10232RI





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division d Radio

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

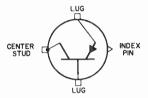
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position													Any
Maximum Seated Length													0.520"
Maximum Diameter													
Dimensional Outline .													
Case													
Seals												٠	Hermetic
Terminal Diagram (See	D	1 177 (e n	\$10	n	ıl	01	ıt l	111	ne)	:		

BOTTOM VIEW



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

	COLLECTOR-TO-BASE VOLTAGE:	
	With emitter-to-base reverse biased	
	(DC emitter-to-base volts = -1.5)40 max.	volts
	EMITTER-TO-BASE VOLTAGE	volts
	COLLECTOR CURRENT	amp
	EMITTER CURRENT	атр
	BASE CURRENT	amp
	TRANSISTOR DISSIPATION: *	· · ·
		watts
	CASE-TEMPERATURE ^b RANGE:	+
	Operating and storage65 to +100	°C
	operating and storage	-
5	Typical Operation:	
	In a common-emitter, base-input, power-	
	switching circuit at case temperature ^b of 25°C	
	DC Supply Voltage	volts
	DC Base-Bias Voltage 6	volts
	"Or" DC Collector Current	amp
1	"Turn-On" Base Current	amp
	"Turn-Off" Base Currert 0	amp
	fulleoff base outforce to the test of the	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 8-61

2N441

Switching Time: Rise time Fall time	 	•••	••••	· 15		
a See accompanying <i>Rating Chart Chart</i> In General Section. ^b Measured at any point on seati			sistor-Dis	sipatio	on Rating	
ELECTRIC/	AL CHAR	ACTER	ISTICS			
Voltage values are give case temperature ^b of 25	n with °Cunle	respe ess ot	ct to ba herwise	se and specif	at ied	
		Min.	Typical	Max.		· ·
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes						
= -0.3	BV _{CES} BV _{CEO}	-40	~	-	volts	
amperes = -0.3 For dc collector		-	-40	-	volts	
amperes = -1 ^c DC Base-to-Emitter Voltage for dc collector-to-		-25	-	-	volts	
emitter volts = -2, dc collector amperes = -5 DC Collector-to-Emitter Saturation Voltage	V _{BE}	-	-0.65	-	volt	
<pre>for dc collector amperes = -12, dc base amperes = -2. DC Emitter Voltage for dc collector volts = -40,</pre>	V _{CE} (sat)	-	-0.3	-	volt	
dc emitter current'= 0 DC Punch-Through Voltage DC Emitter-Cutoff Current for dc emitter volts = -20, dc collector	V _{EB} V _{PT}	-40	-	-1 -	volt volts	
current = 0 DC Collector-Cutoff Current: With dc collector volts = -2, dc emitter	_{ЕВО} _{СВО}	-	-1	-4	ma	
current = 0 With dc collector volts = -40, dc emitter		-	-100	-	μа	
current = 0 With dc collector volts = -40, dc emitter current = 0, case		-	-2	-4	ma	
temperature ^b = 71° C .		-	-	-15	ma	

- Indicates a change.

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DC Current Transfer Ratio for dc collector-to- emitter volts = -2, dc collector amperes = -5 -12 Beta-Cutoff Frequency for dc collector-to- emitter volts = -6, dc collector amperes	h _{FE}	20	20	40	
= -5	fae	-	10	-	kc
Thermal Resistance: Junction-to-case Thermal Capacity for pulse duration of 1 to 10	RT	-	0.35	0.5	^o C/watt
milliseconds		-	0.075		watt- sec/ ^o C
Thermal Time Constant	\mathcal{T}_{I}	-	26.25	-	msec

^b Measured at any point on seating surface.

^C Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS

This transistor type is designed to pass the environmental tests specified in Military Specification MIL-S-195008.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter lugs by means of clips or by soldering directly to the lugs. When soldering connections are made to the lugs, care should be taken to conduct excessive heat away from the lug seals, otherwise the heat of the soldering operation will crack the glass seals of the lugs and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective lugs.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

The maximum torque on mounting stud should not exceed 12 inch-pounds.

Somerville, N. J.

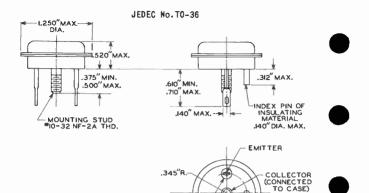
RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

-Indicates a change.

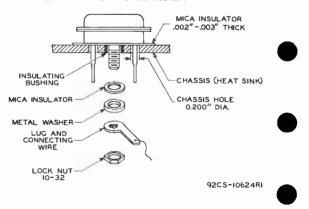


DATA 2 8-61





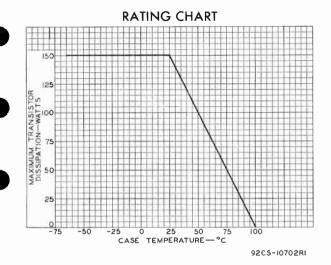
INSULATING EYELETS



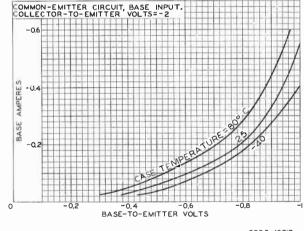
BASE

92CM-10612RI

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TYPICAL BASE CHARACTERISTICS



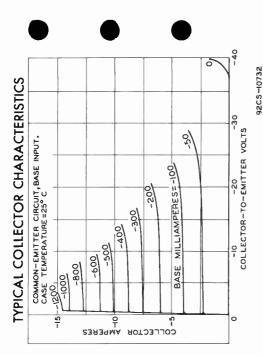




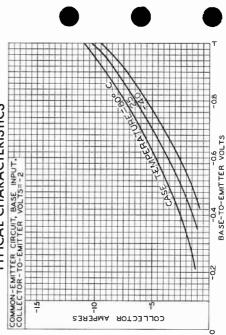
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DATA 3 8-61









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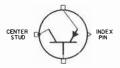
Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position											
Maximum Overall Length											
Maximum Seated Length 0.520"											
Max'mum Diameter											
Dimensional Outline JEDEC No.TO-36											
CaseWelded, Metal											
Seals											
Terminal Diagram (See Dimensional Outline):											
BOTTOM VIEW											



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter-to-base reverse biased		
(DC emitter-to-base volts = -1.5)	-40 max.	volts
EMITTER-TO-BASE VOLTAGE	-20 max.	volts
COLLECTOR CURRENT	-15 max.	amp
EMITTER CURRENT	15 max.	amp
BASE CURRENT.	-4 max.	amp
TRANSISTOR DISSIPATION:		
At case temperature of 25 ⁰ C	70 max.	watts
CASE-TEMPERATURE RANGE:		
Continuous operation	-65 to +95	°C
Intermittent operation	65 to +100	°C
Storage	65 to +100	°C
Typical Operation:		

In a common-emitter, base-input, powerswitching circuit at case temperature of 25°C

DC Supply Voltage														
DC Base-Bias Voltage								•			•		6	volts
"On" DC Collector Current													-12	amp
"Turn-On" Base Current													-2	amp
"Turn-Off" Base Current .	•	•	·	•	•	•	•	·	•	•		•	0	amp
 		_	_	_		_	_					_		



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redicitistory DATA | 2-61

2N441

Switching Time: Rise time	••••	 		. 15 . 15	μsec μsec
▲ See accompanying Rating Chart Chart in General Section.	and als	o îran	sistor-Dis	sipation	Rating
ELECTRICA	L CHAR	ACTER	STICS		
Voltage values are giv case temperature of 25					
ouse temperature of 25	Cunte	Min.		-	
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes		,,	1) p = 0 = 0	N 02.	
= -0.3	BV _{CES} BV _{CEO}	-40	-		volts
amperes = -0.3 For dc collector		-	-40	-	volts
amperes = -1° DC Base-to-Emitter Voltage*		-25	-	-	volts
for dc collector-to- emitter volts = -2, dc collector amoeres = -5 DC Collector-to-Emitter Saturation Voltage* for dc collector amperes	V _{BE}	_	-0.65	-	volt
= -12 , base amperes = -2 . DC Emitter Voltage for dc collector volts = -40 ,	V _{CE}	-	-0.3	-	volt
dc emitter amperes = 0. DC Punch-Through Voltage. DC Emitter-Cutoff Current for dc emitter volts = -20, dc collector	V _{EB} V _P	_ -40	-	-1 -	volt vclts
<pre>amperes = 0 DC Collector-Cutoff Current: With dc collector volts = -2, dc emitter</pre>	I _{EBO} I _{CBO}	-	-1	-8	ma
amperes = 0		-	-100	-	μа
amoeres = 0 With dc collector volts = -40, dc emitter amperes = 0, case		-	-2	-8	ma
temperature = 71° C		-	-	-15	ma





)	DC Current Transfer Ratio* for dc collector-to- emitter volts = -2, dc collector amperes = -5	h _{FE}	20	20	40	
	dc collector amperes = -5	fae	-	10	_	kc
	Junction-to-case Thermal Capacity for pulse	₽r	-	0.7	1	°C∕watt
	duration of 1 to 10 milliseconds.		-	0.075		watt- sec/ ⁰ C
	Thermal lime Constant	\mathcal{T}_{1}	-	52.5	-	msec

Sweep voltage used to perform test.

* Measured in a common-emitter. base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the co:lector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

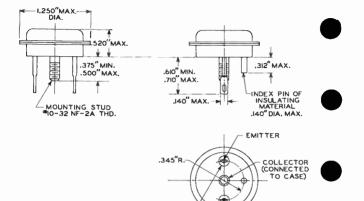
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

The maximum torque on mounting stud should not exceed 12 inch-pounds.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

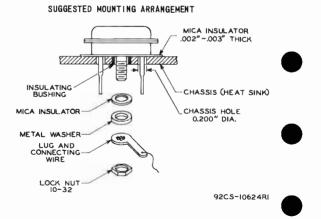




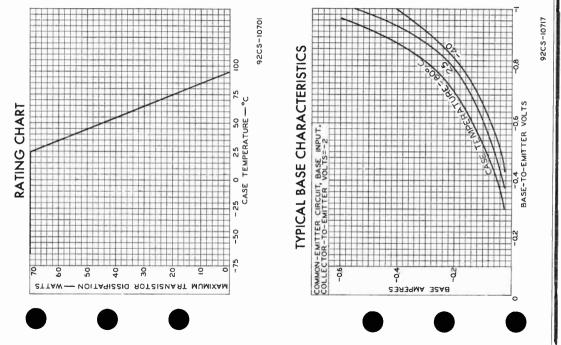
INSULATING EYELETS

92CM-10612RI

BASE



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Part History Somerville, N. J. 2N441



DATA 3 2-61

AMERICA j

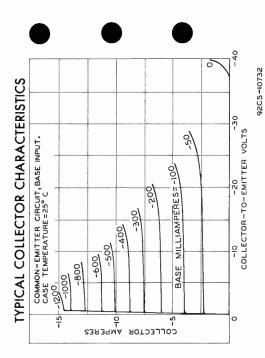
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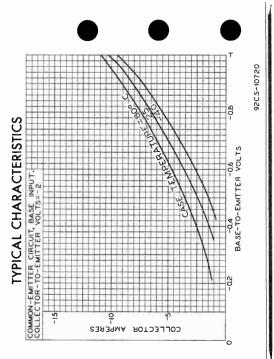
CORPORATION

RADIO CORPORATION Semiconductor & Materials Division

Somerville, N.







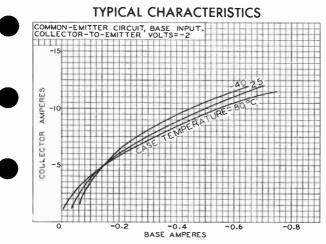
AMERICA Somerville, N. J.

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92CS-10721



World Radio History

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

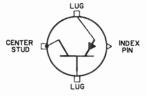
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Coerating Position													Any
Maximum Seated Length													0.520"
Maximum Diameter													
Dimensional Outline .													
Case													
Seals	:	٠	٠	٠	٠	÷	•	٠	٠	۰.	•	•	Hermetic
Terminal Diagram (See	U	t Me	: n :	510) n (ı l	01	it i	117	ie)	:		





INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper. voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base re

	With emiller-to-base reverse blased	
	(DC emitter-to-base volts = -1.5)50 max. volts	
	EMITTER-TO-BASE VOLTAGE	
	COLLECTOR CURRENT	
	EMITTER CURRENT 15 max. amp	
	BASE CURRENT	
	At case temperatures ^b of 25 ^o C or below 150 max. watts CASE-TEMPERATURE ^b RANGE:	
	Operating and storage65 to +100 °C	
	Typical Operation:	
	In a common-emitter, base-input, power-switch-	
	ing circuit at case temperature ^b of 25°C	
	DC Supply Voltage12 volts	
	DC Base-Bias Voltage	
	"Un" DC Collector Current12 amp	
,	"lurn-On" Base Current	
	"Turn-Off" Base Current 0 amp	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

Switching Time: Rise time	• • •	nsistor	-Dissipatic	15 15 on Ratin	µSec µSec g Chart	
b Measured at any point on seating :	surface	в.				
ELECTRICAL C						
Voltage values are given case temperature ^b of 25°C	with unle	respec ss oth	t to base erwise sp	and a ecifie	t d	
			Typical			
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amoeres = -0.3BN	1	-45		_	volts	
With base open: BN	CES	-40			00103	
For dc collector amperes = -0.3 For dc collector		-	-45	-	volts	
amperes = -1^{c}		-30	-	-	volts	
DC Base-to-Emitter Voltage for dc col- lector-to-emitter volts = -2, dc collector ampores = -5 N	1	_	-0.65	_	volt	
DC Collector-to-Emitter Saturation Voltage for dc collector amperes = -12, dc base	[/] BE		0.00		ione	
amperes = -2	CE	-	-0.3		volt	
= 0 DC Punch-Through Voltage.	,ев	-50	-	-1	volt volts	
DC Emitter-Cutoff Current for dc emitter volts = -30, dc collector	PT	-50	_			
current = 0 I DC Collector-Cutoff	EBO	-	-1	-4	ma	
Current: I With dc collector volts	СВО					
= -2, dc emitter current = 0 With dc collectorvolts		-	-100	-	μa	
= -50, dc emitter			-2	-4	ma	
current = 0 With dc collector volts = -50, dc emitter current = 0, case		-	-2	-4	IIId	
temperature ^b = 71 ⁰ C.		-	-	-15	ma	
			🕂 India	ates a	change.	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

Somerville, N. J.



DC Current Transfer Ratio for dc collector-to- emitter volts = -2, dc ccllector amperes =		h _{FE}				
-5			20	-	40	
-12				20	-	
Beta-Cutoff Frequency						
for dc collector-to-						
emitter volts = -6, dc						
collector amperes = -5.		.fae	-	10	-	kc
Thermal Resistance:		u.e				
Junction-to-case		.R _T	-	0.35	0.5	°C/watt
Thermal Capacity for pulse duration of 1 to 10						
milliseconds			_	0.075	_	watt-
	•					sec/°C
Thermal Time Constant	•	$\cdot \mathcal{T}_{I}$	-	26.25	-	msec
b Her sured at sour point on sould						

Me⊾sured at any point on seating surface.

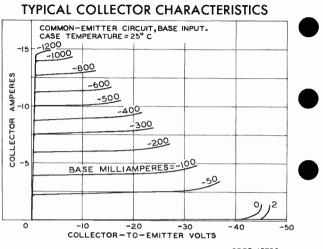
C Texted by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS. OPERATING CONSIDERATIONS. DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES. and TYPICAL CHARACTERISTICS CURVES shown under Type 2N441 also apply to the 2N442



Semiconductor & Materials Division

- Indicates a change.



9205-10739



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position
<pre>Max mum Overall Length</pre>
Max mum Seated Length 0.520"
Max'mum Diameter
Dimensional Outline JEDEC No. TO-36
Case
Seals
Terninal Diagram (See Dimensional Outline);
BOTTOM VIEW



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper. voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values: COLLECTOR TO PASE VOLTACE.

LULLEUTOR-TU-BASE VULTAGE:	
With emitter-to-base reverse biased	
(DC emitter-to-base volts = -1.5)50 max.	volts
EMITTER-TO-BASE VOLTAGE	volts
COLLECTOR CURRENT	amp
EMITTER CURRENT	атр
BASE CURRENT	amp
TRANSISTOR DISSIPATION: *	
At case temperature of 25 ⁰ C 70 max.	watts
CASE-TEMPERATURE RANGE:	
Continuous operation	°C
Intermittent operation	°C
Storage	°C

Typical Operation:

switching circu											
DC Supply Voltage DC Base-Bias Voltage "On" DC Collector Currer "Turn-On" Base Current.	nt						•		• • •	-12 6 -12 -2	volts volts amp amp
"Turn-Off" Base Current		٠	٠	•	·	•	·	٠	•	0	amp

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. World Radio H

DATA I 2-61

2N442

Switching Time:					
Rise time	• • • •	 	15 15	μsec μsec	
See accompanying Rating Chart and a Chart in General Section.	1so <i>îra</i>	nsistor-D	issiþatio	n Rating	
ELECTRICAL CHAR	ACTERI	STICS			
Voltage values are given wi case temperature of 25°C uni	th re less ot	spect to herwise s	base an specifie	d d	
	Nın.	Typical	Max.		
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes = -0.3 BV _{CES} With base open: BV _{CES}	-45	-	_	volts	
For dc collector amperes = -0.3	-	-45	_	volts	
For dc collector amperes = -1 [•] DC Base-to-Emitter	-30	-	-	volts	
Voltage [®] for dc col- lector-to-emitter volts = -2, dc collector amperes = -5 V _{BE} DC Collector-to-Emitter Saturation Voltage [®] for dc collector	-	-0.65	_	volt	
amperes = -12, base amperes = -2 V _{CE} DC Emitter Voltage for dc collector volts =	-	-0.3	-	volt	
-50, dc emitter amperes = 0 V _{EB} DC Punch-Through Voltage. V_p DC Emitter-Cutoff Current for dc emitter volts =	-50	-	-1 -	volt volts	D
-30, dc collector amperes = 0	-	-1	-8	ma	
With dc collector volts = -2, dc emitter amperes = 0	_	-100	_	μa	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

With dc collector volts = -50, dc emitter

amperes = 0

With dc collector volts = -50, dc emitter amperes = 0, case temperature = 71° C .

> A J.

ma

ma

-2 -8

-15

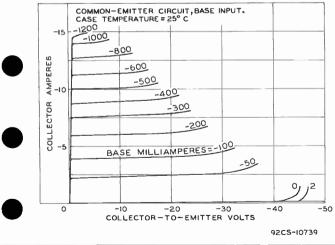
DC Current Transfer Ratio* for dc collector-to- emitter volts = -2, dc collector amperes =	h _{FE}				
-5		20	-	40	
-12		-	20	-	
Beta-Cutoff Frequency*					
for dc collector-to-					
emitter volts = -6. dc					
collector amperes = -5 .	fae		10	-	kc
Thermal Resistance:	ue				
Junction-to-case	R _r	_	0.7	1	^o C/watt
Thermal Capacity for pulse					
duration of 1 to 10					
milliseconds		_	0.075	_	watt-
MPT1136C0103			0.075		sec/°C
Thormal Time Constant	~		52.5		msec
Thermal Time Constant	1		J2. J	_	IISEC
• • •					

Sweep voltage used to perform test.

Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES shown under Type 2N441 also apply to the 2N442

TYPICAL COLLECTOR CHARACTERISTICS





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 2-61

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World Radio History

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

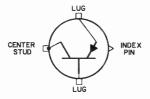
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position	
Maximum Seated Length	0.520"
Maximum Diameter	1.250"
Dimensional Outline .	JEDEC No.TO-36
Case	Welded, Metal
Terminal Diagram (See	Dimensional Outline):

BOTTOM VIEW



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter-to-base reverse biased (DC emitter-to-base volts = -1.5) . . -60 max. volts EMITTER-TO-BASE VOLTAGE -40 max. volts COLLECTOP CURRENT -15 max. атр 15 max. amp BASE CLRRENT. . . . -4 max. amp TRANSISTOR DISSIPATION: * At case temperatures^b of 25⁰Cor below. 150 max. watts CASE-TEMPERATURE^b RANGE : Operating and storage . . °C -65 to +100 Typical Operation: In a common-emitter, base-input, bowerswitching circuit at case temperature^b of 25° C DC Supply Voltage -12 volts DC Base-Bias Voltage. . . . 6 volts "On" DC Collector Current -12amp "Turn-On" Base Current. . . -2 amp "Turn-Off" Base Current . amp

-Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 8-61

2N443

Switching Time: Rise time Fall time ^a See accompanying Rating Cha Chart in General Section. ^b Measured at any point on sea			sistor-Dis	15 15 sipatio	μsec μsec m Rating
- ELECTRICAL CHARACTERISTICS					
Voltage values are given with respect to base and at case temperature ^b of 25° Cunless otherwise specified					
case temperature of	25° C uni	Nin.	nerwise s Typical	peciji Max.	
<pre>DC Collector-to-Fmitter</pre>	RVCES	-50		-	volts
With base open: For dc collector	BVCEO	00			
amperes = -0.3 For dc collector		-	-55	-	volts
<pre>amperes = -1^c DC Base-to-Emitter Voltage for dc col- lector-to-emitter volts = -2, dc col- lector amperes = -5 . DC Collector-to-Emitter Saturation Voltage for dc collector</pre>		-45	-	-	volts
	V _{BE}		-0.65	-0.9	volt
amperes = -12, dc base amperes = -2 DC Emitter Voltage fordc collector volts = -60.	V _{CE} (sat)	-	-0.3	-1	volt
<pre>dc emitter current = 0. DC Punch-Through Voltage. DC Emitter-Cutoff Current for dc emitter volts = -40, dc collector current = 0 DC Collector-Cutoff Current: With dc collector volts = -2, dc emitter current = 0 With dc collector volts = -60, dc emitter current = 0 With dc collector volts = -60, dc emitter current = 0</pre>	V _{EB} V _{PT}	-60	-	-1 -	volt volts
	I _{ЕВО} ¹ сво	-	1	-4	ma
		-	-100	-	μа
		-	-2	-4	ma
current = 0, case temperature ^b = 71 ⁰ C .		-	-	-15	та

--Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

Somerville, N. J.



DC Current Transfer Ratio for dc col- lector-to-emitter volts = -2, dc collector amoeres =	h _{FE}				
-5		20	-	40	
-12		-	20	-	
Beta-Cutoff Frequency					
for dc collector-to-					
emitter volts = -6,					
dc collector amperes			1.0		
= -5,	tae		10	-	kc
Thermal Resistance:	0		0.05	0.5	00/
Junction-to-case	КТ	-	0.35	0.5	°C/watt
Thermal Capacity for					
pulse duration of 1 to 10 milliseconds			0.075		
TA millinseconds • • • •		_	0.075	-	watt- sec/°C
Thermal Time Constant	~	_	26.25		msec
merman nime constant	21	_	20.20	-	msec

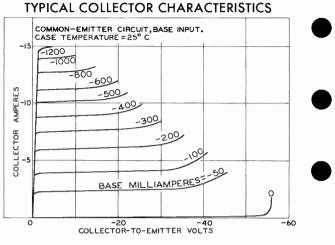
^b Measured at any point on seating surface.

c Tested by sweep method to prevent excessive healing of collector junction.

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES shown under Type 2N441 also apply to the 2N443



Indicates a change.



92CS-10729



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

Power Transistor

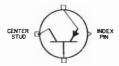
GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position															Any
Maximum Overall Length															1.230"
Maximum Seated Length		•													0.520"
Maximum Diameter															1.250"
Dimensional Outline .												JEC)E(C	lo.T0-36
Case												We	elo	lec	l, Metal
Seals														.1	lermetic
Terminal Diagram (See	Dir	пел	\$10	ο πα	ıl	0 u	itl	17	ie)	:					
BOTTOM VIEW															



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute Maximum Values: COLLECTOR TO PASE VOLTACE.

	CULTECIOK-IO-RASE AOFIARE										
With emitter-to-base reverse biased											
	(DC emitter-to-base vol									-60 max.	volts
	EMITTER-TO-BASE VOLTAGE.									-40 max.	volts
	COLLECTOR CURRENT									-15 max.	amp
	EMITTER CURRENT									15 max.	amp
	BASE CURRENT									-4 max.	amp
	TRANSISTOR DISSIPATION:										
	At case temperature of	25 ^c	' C							70 max.	watts
	CASE-TEMPERATURE RANGE:										
	Continuous operation .									-65 to +95	°C
	Intermittent operation									-65 to +100	oC
,	Storage,			•	•	•		•		-65 to +100	°C
	Tuninal Anaratiant										

In a common-emitter, base-input, power-switch-

Typical Operation:

	ing circuit	at	case	e	t e	m þ e	r a	tı	ire	of 25°	С
_	DC Supply Voltage									-12	
	DC Base-Bias Voltage .									6	
	"On" DC Collector Čurr	rent		٠	•		٠	٠		-12	
	"Turn-On" Base Current									-2	
	"Turn-Off" Base Curren	it.								0	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 2-61

volts

volts

amp

amp

amp

0

Switching Time:

Rise time	• • • • • • • •		•••	15 15	μsec μsec				
See accompanying Rating Cha Chart in General Section.	τt and al	so îra	nsistor-Di	ssipatio	n Rating				
ELECTRIC									
Voltage values are given with respect to base and case temperature of 25°C unless otherwise specified									
) 0 4.10	M1n.			eu				
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector			.,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,						
amperes = -0.3 With base open: For dc collector	BVCES BVCEO	-50	-	-	volts				
amperes = $-0.3.$		-	-55	-	volts				
For dc collector amperes = -1● DC Base-to-Emitter		-45	-	-	volts				
Voltage* for dc col- lector-to-emitter volts = -2, dc col- lector amperes = -5. DC Collector-to-Emitter Saturation Voltage* for dc collector	V _{BE}	-	-0.65	-0.9	volt				
<pre>amperes = -12, base amperes = -2, DC Emitter Voltage fordc collector volts = -60,</pre>	V _{CE}	-	-0.3	-1	volt				
dc emitter amperes = 00, DC Punch-Through Voltage. DC Emitter-Cutoff Current for dc emitter volts = -40, dc collector	V _{EB} V _P	-60	-	1 _	volt volts	•			
<pre>amperes = 0 DC Collector-Cutoff Current:</pre>	I _{ЕВО}	-	-1	-8	ma				
With dc collector volts = -2, dc emitter amperes = 0 With dc collector volts		-	-100	-	μa				
= -60, dc emitter amperes = 0 With dc collector volts = -60, dc emitter		-	-2	-8	ma				
amperes = 0, case temperature = 71° C .		-	-	-15	ma				

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DC Current Transfer Ratio* for dc col- lector-to-emitter volts = -2, dc collector amperes =	h _{FE}				
-5		20	-	40	
-12		-	20	-	
Beta-Cutoff Frequency* for dc collector-to-					
emitter volts = -6,					
dc collector amperes					
= -5	fae	-	10	-	kc
Thermal Resistance:					0.0
Junction-to-case	RT	-	0.7	1	°C∕watt
Thermal Capacity for pulse duration of 1 to					
10 milliseconds		_	0.075	_	watt-
10 101113000103		_	0.075	_	sec / °C
Thermal Time Constant	\mathcal{T}_{1}	-	52.5	-	msec

Sweep voltage used to perform test.

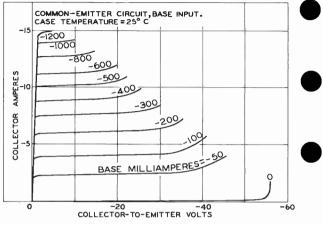
* Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES shown under Type 2N441 also apply to the 2N443



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Reference Somerville, N. J. DATA 2 2~6!





92CS-10729



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation Somerville, N. J.

Power Transistor

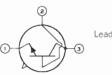
SILICON N-P-N DIFFUSED-JUNCTION TYPE For Medium-Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position				
Maximum Length (Excluding	flex	cible	leads)	 0.260"
Maximum Diameter				 0.370"
Dimensional Outline				 JEDEC No.10-5
Case				 Metal
Seals				 Hermetic
Leads, Flexible				 3
Minimum length				 · · · · 1.5"
Orientation and diameter				
Terminal Diagram:				
v				

Lead 1 - Emitter



Lead 3-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	60 max.	volts
With base open	60 max.	volts
EMITTER-TO-BASE VOLTAGE	8 max.	volts
TRANSISTOR DISSIPATION: a		
At case temperature of 25° C		
At case temperature of 100° C	2.28 max.	watts
CASE-TEMPERATURE RANGE:		
Operating and storage	-65 to +200	°C

a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base unless otherwise specified. Ambient temperature of 25° C.

Min. Typical Max.



DC Collector Breakdown Voltage fordcollector ma. =0.1, dcemitter ma. = 0. BV_{CBO} 60 - - volts



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	Min.	Typical	Max.	
DC Collector-to-Emitter Breakdown Voltage for dc collector ma. = 0.25,				
dc base ma. = 0 BV _{CEO} DC Emitter Breakdown Voltage for dc emitter ma. = 0.25. dc	60	-	-	volts
collector ma. = 0 BV _{EBO} DC Collector-Cutoff Current for dc col- lector volts = 30, dc	8	-	-	volts
emitter ma. = 0 I _{CBO} DC Current Transfer Ratio fordc collector- to-emitter volts = 10.	-	-	10	μа
dc collector ma. = 200 . h _{FE} Input Resistance for dc collector-to-emitter	12	-	36	
volts = 10, dc col- lector ma. = 200 h _{IE} DC Collector-to-Emitter Saturation Resistance	-	-	500	ohms
for dc collector ma.= 200, dc base ma.=20R _S Thermal Resistance: R _T Between junction and	-	-	25	ohms
case	-	-	43.75	°C/watt
free air	_	10	200 -	^O C/watt msec

Typical Ma

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

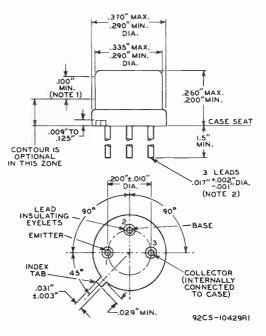
The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



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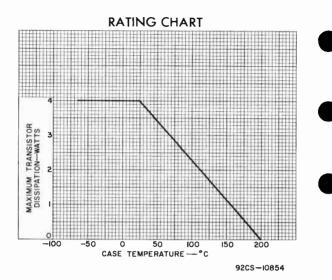
JEDEC No.TO-5



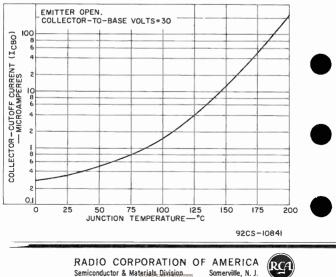
NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE CG* THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





TYPICAL OPERATION CHARACTERISTIC





DRIFT TRANSISTOR

GERMANIUM P-N-P ALLOY TYPE

For radio-frequency amplifier applications

GENERAL DATA

	GENERAL DATA	
	Electrical, At Ambient Temperature of 25°C:	
	Minimum DC Collector-to-Base Voltage	
	for dc collector current of -50 μa with emitter open18 volts	
	with emitter open	
	dc collector-to-base voltage of -12	l
	volts with emitter open4 μa	
	Maximum DC Emitter Current for dc emitter-to-base voltage of -1	
	volt with collector open	
1	Interlead Capacitance between col-	
	lector and base leads with inter-	
	lead shield connected to ground and all leads cut to 5/16"	
	Mechanical:	
	Operating Position	
	Maximum Diameter	
	Case	
	Envelope Seals	
	Leads, Flexible	
	Orientation and diameter See Dimensional Outline	
	Lead 1 - Emitter (
	Shield,	
	Metal Case	
	Lead 2 - Base Lead 4 - Collector	
	()23 (4)	
	RADIO-FREQUENCY AMPLIFIER — Class A	
	Maximum Ratings, Absolute Values:	
	COLLECTOR-TO-BASE VOLTAGE (DC + Peak AC)18 max. volts	
	EMITTER-TO-BASE VOLTAGE (DC + Peak AC) -1 max. volt DC COLLECTOR CURRENT -10 max. ma	1
	DC EMITTER CURRENT	
	COLLECTOR DISSIPATION:	
	At ambient temperature of 25° C 80 max. mw At ambient temperature of 55° C 50 max. mw	1
	At ambient temperature of 55 ^o C 50 max. mw At ambient temperature of 71 ^o C 35 max. mw	1
	AMBIENT TEMPERATURE (During operation) 71 max. OC	
	STORAGE-TEMPERATURE RANGE	-

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SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

DRIFT TRANSISTOR

Characteristics, At Ambient Tempe	rature	of 25°	C:	
Common-Emitter Circu	uit, Bas	e Input		
DC Collector-to-Emitter Voltage. DC Emitter Current			-12 1 ~60	volts ma
Common-Base Circuit,				
DC Collector-to-Base Voltage DC Emitter Current Current Transfer Ratio (α _f) . Alpha-Cutoff Frequency	· · · · ·	· · · ·	-12 1 0.984 30	ma
Typical Operation, At Ambient Tem	nperatur	e of 25	° C:	
At frequency of	1.5	1.5	1.5	Nc
DC Collector-to-Emitter Voltage.	~6	-9	-12	volts
DC Emitter Current		0.5		ma
circuit shorted Output Resistance, ac input	1300	1700	2100	ohms
circuit shorted	0.11	0.18	0.28	megohm
Intrinsic Transconductance	18900	18900	18900	µmhos
Collector-to-Base Capacitance	1.85	1.65	1.55	μµf
Maximum Power Gain≜ Useful Power Gain:	41.1	44.4		db
In neutralized circuit	30.4	30.4	30.4	db
	30.4 25.1	30.4 25.1	30.4 25.1	db db

Measured at 1 kc.

214544

Heasured in a single-tuned unilateralized circuit matched to the generator and load impedances for maximum transfer of power. Transformer insertion losses not included.

OPERATING CONSIDERATIONS

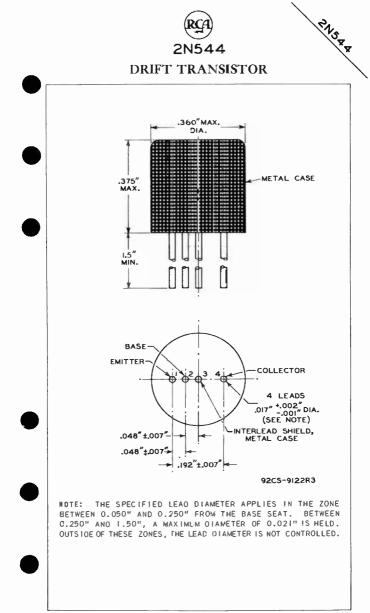
The 2N544 should not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

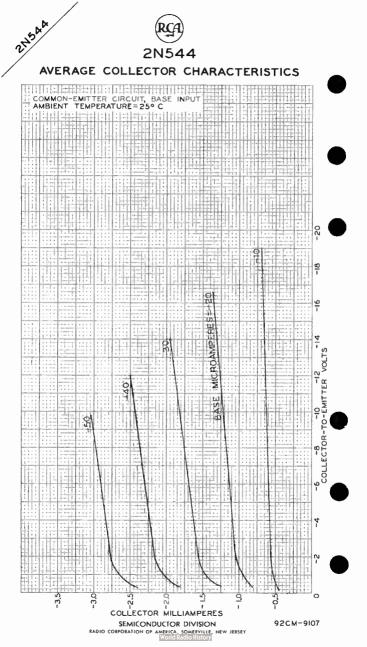
The flexible leads of the 2N544 are usually soldered to the circuits elements. Soldering of the leads may be made close to the glass stem provided care is takento conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

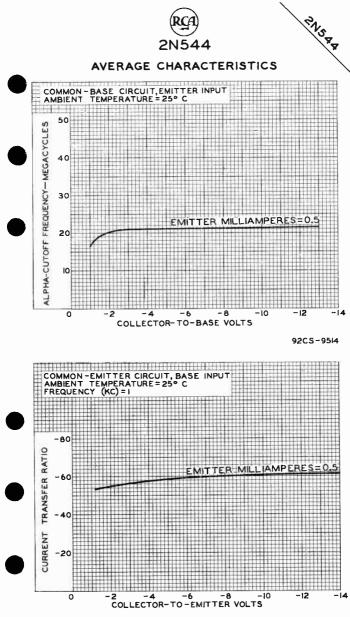
The 2N544 utilizes shielding to minimize interlead capacitance and to minimize coupling to adjacent circuit components. This shielding is provided by lead 3 (center lead) situated between the collector lead and the base lead and internally connected to the metal case. For optimum performance, it is recommended that lead 3 be connected to the circuit ground.

When dip soldering is employed in the assembly of printed circuitry using the 2N544, the temperature of the solder should not exceed 230⁰ C fora maximum immersion.period of 10 seconds.

TENTATIVE DATA



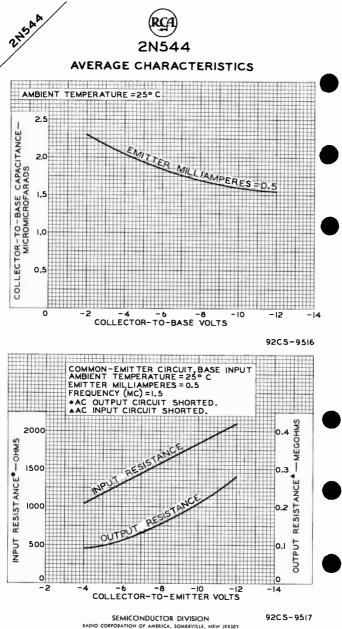




SEMICONDUCTOR DIVISION RADIO CORPORATION OF AMERICA, SOMERVILLE, NEW JERSEY

9205-9515

World Radio History



Junction Transistor

GERMANIUM P-N-P ALLOY TYPE

For Medium-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding	lexible leads)	0.260"
Maximum Diameter		0.370"
Dimensional Outline	JI	EDEC No.TO-9
Case		
Seals		
Leads, Flexible		
Minimum length		1.5"
Drientation and diameter	See Dimensi	onal Outline
Terminal Diagram: B	TTOM VIEW	
	Ô	

Lead 1 - Emitter

Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:	
CGLLECTOR-TO-BASE VOLTAGE	
COLLECTOR-TO-EMITTER VOLTAGE:	+
With emitter-to-base reverse biased	
(DC emitter-to-base volts = 1)14 max. volts	
EMITTER-TO-BASE VOLTAGE	
COLLECTOR CURRENT	
EMITTER CURRENT 400 max. ma	
TRANSISTOR DISSIPATION: "	
At ambient temperature of 25° C 120 max. mw	1
At ambient temperature of 55° C 35 max. mw	1
At ambient temperature of 71° C 10 max. mw	
AMBIENT TEMPERATURE (During operation) 71 max. OC	
STORAGE-TEMPERATURE RANGE	
LEAD TEMPERATURE:	+
For immersion in molten solder	
for 10 seconds maximum	
Typical Operation:	
In typical inverter circuit at ambient temperature of 25°C	
"On" Collector Current200 ma	-
"Turn-On" Base Current (IB,)	-
"Turn-Off" Base Current (I ₈₂) 20 ma	3
4	

- Indicates a change.



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otherwise specified. Ambient temperature of 25° C. 4'in. Typical Max. DC Collector Breakdown Voltage for dc collector ma. = 02, dc emitter ma. = 0	
Voltage for dc collector ma. = -0.02, dc emitter	
$ma. = 0$, $BV_{CRO} = 20$ -30 -30	
DC Emitter Breakdown Voltage for emitter ma. = 0.02. dc collec-	olts
tor ma, = 0	olts
DC Collector-to-Emitter Saturation Voltage for dc collector ma. =	olts
DC Base-to-Emitter Voltage for dc collec- tor ma. = -400, dc	volt
base ma. = -40 V $_{\rm BE}$ 0.65 -1.2 vd DC Collector-Cutoff Current for dc collec-tor volts = -12, dc	olts
emitter ma. = 0 ⁻ I _{CBO} 3 -5 DC Emitter-Cutoff Current for dc emitter volts = -6, dc collector ma.	μа
= 0	μа
-0.3, dc collector ma. = -400h _{FE} 10 15 - Alpha-Cutoff Frequency for dc collector volts = -6, dc emitter ma.	
=	Мc
	vatt

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



World Radio History

The flexible leads of this transistor are usually solvered to the circuit elements. Solvering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the solvering operation may crack the glass seals of the leads and damage the transistor.

.370" MAX. .290" MIN. DIA. .335" MAX. .275" MIN DIA. 100 MIN .260" MAX. INOTE CASE SEAT 1.5" MIN. Π Γ CONTOUR IS ŧ OPTIONAL IN THIS ZONE 3 1 EADS 200"±.010 .017" +.002" DIA, DIA. (NOTE 2) LEAD 90° 90 EYELETS BASE EMITTER-COLLECTOR

JEDEC No.TO-9

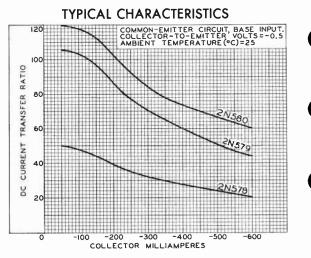
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NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED D.010".

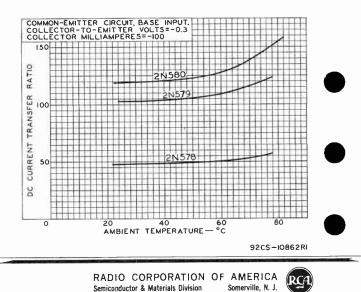
NOTE 2: THE SPECIFIEO LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD OIAMETER IS NOT CONTROLLEO.



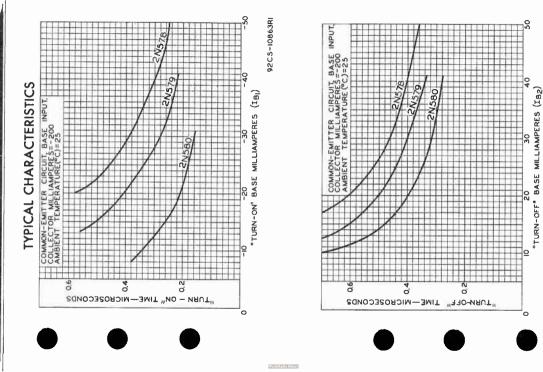
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DATA 3 4-61

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World Radio History

Junction Transistor

GERMANIUM P-N-P ALLOY TYPE

For Medium-Speed Switching Service in Commercial and Military Data-Processing Systems

The 2N579 is the same as the 2N578 except for the following items:

Typical Operation:

In typical inverter circuit at ambient	
"On" Collector Current	 -200 ma
"lurn-On" Base Current (I _{B1})	 -20 ma
"lurn-Off" Base Current (I _{B2})	 20 та
"lurn-On" lime	 0.4 µsec
"Turn-Off" Time	 0.5 µsec

ELECTRICAL CHARACTERISTICS

Voltage values are given with otherwise specified. Ambient				
	Mın.	Typical	Nax.	
DC Collector-to-Emitter				
Saturation Voltage for dc				
collector ma. = -400, dc base				
ma. = -20	-	-0.2	-0.3	volt
DC Base-to-Emitter Voltage for				
dc collector ma. = -400, dc				
base ma. = $-20.$	-	-0.63	-1.1	volts
dc_collector-to-emitter				
volts = -0.3, dc collector				
h_{FE} Alpha-Cutoff Frequency for dc	20	30	_	
Alpha-Cutoff Frequency for dc				
collector volts = -6, dc				
emitter ma. = 1	5	8		Mc

CURVES for the 2N579 are given on the multitype curve sheet under Type 2N578



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World Radio History

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Junction Transistor

GERMANIUM P-N-P ALLOY TYPE

For Medium-Speed Switching Service in Commercial and Military Data-Processing Systems

The 2N580 is the same as the 2N578 except for the following items: Typical Operation:

In typical inverter circuit at ambien	1 t	tem	<i>pe</i>	ra	ture	of a	25° C
"On" Collector Current	•		•			-200	ma
"Turn-On" Base Current (IBI).	•	• •	·	•	•	-20	ma
"Turn-Off" Base Current (1 _{B1}) "Turn-On" Time. "Turn-Off" Time	•	• •	*	•	•	20	ma
"Turn-Off" Time							
	٠	• •	•	•	•	0.4	µsec

ELECTRICAL CHARACTERISTICS

	LICKIOII			
Voltage values are given with r otherwise specified. Ambient	respect tempera	to base ature of	unless 25°C.	
	Min.	Typical	Max.	
DC Collector-to-Emitter Saturation Voltage for dc collector ma. = -400, dc		-,,		
base ma. = -13.3V _{CE} DC Base-to-Emitter Voltage for dc collector ma. =		-0.2	~0.3	volt
-4D0, dc base ma. = -13.3 · ·V _{BE} DC Current Transfer Ratio for dc collector-to- emitter volts = -0.3,	-	-0.6	-1	volt
dc collector ma. = -400 h Alpha-Cutoff Frequency for dc collector volts = -6.	30	45	-	
dc emitter ma. = 1 $f_{\alpha b}$	10	15	-	Мc

CURVES

for the 2N580 are given on the multitype curve sheet under Type 2N578



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World Radio History

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excludin	ng flexible leads)	0.260"
Maximum Diameter		0.370"
Dimensional Outline		• • • JEDEC No.TO-5
Case		Welded, Metal
Sea's		Hermetic
Leads, Flexible		3
Minimum length		1.5"
Orientation and diamet	ter See	Dimensional Outline
Terminal Diagram:	BOTTOM VIEW	
5		

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector

SWITCHING SERVICE

Maximum and M	Minimum	Rating	s, i	4 <i>b</i> s	ol	ute	:-M	axi	mum Val	ues:		-
COLLECTOR-TO- COLLECTOR-TO-	-EMITTER	VOLT/		•	•	•	•	·	-18	max.	volts	
With dc em												
volts = -1										max.	volts	
EMITTER-TO-B	ASE VOLT	AGE .							-10	max.	volts	
COLLECTOR CUI	RRENT .					•			-100	max.	ma	
EMITTER CURRI	ENT								100	max.	ma	
TRANSISTOR D	ISSIPATI	ON: ^a										
At ambient	temperat	ureof	25°	С	or	be	elo	w.	150	max.	mw	
At ambient	temperat	ureof	55°	С					75	max.	mw	
At ambient	temperat	ureof	71 ⁰	С					35	max.	mw	
AMBIENT-TEMP	ERATURE	RANGE :							-			
Operating									-65 t	o +85	°C	
Storage .											°C	
LEAD TEMPERA											-	
For 10 sec		imum.							255	max.	oC	
					-							

a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History Somerville, N. J.

ELECTRICAL CHARACTERISTICS

		ERISIIUS		
Voltage values are given otherwise specified. An				
otherwise specified. An		Typical		25 0.
DC Collector Breakdown Voltage for dc col- lector ma. = -0.02, dc emitter ma. = 0 BV _{CB} DC Punch-Through Voltage			-	volts
for dc emitter volts = -1 V _P DC Emitter Breakdown	-15	-25	_	volts
Voltage for dc emitter ma. = -0.02, dc collector ma. = 0. BV _{EB} DC Collector-to-Emitter Saturation Voltage for dc collector ma.	0 -10	-25	-	volts
= -20, dc base ma. = -1 V _{CEIs} DC Base-to-Emitter Saturation Voltage	_{at)} -0.2	-0.3	-	volt
for dc collector ma. = -20, dc base ma. = -1V _{BE(s:} DC Collector-Cutoff Current for dc col-	at) —	-0.35	-0.5	volt
lector volts = -12, dc emitter ma. = 0 I _{CBU} DC Emitter-Cutoff	o –	-3	-10	μa
Current for dc emitter volts = -2.5, dc collector ma. = 0. I Collector-to-Base Capacitance for dc	o –	-1	-	μа
collector volts = -6, dc collector ma. = 0 . C _{ob} DC Current Transfer Ratio for dc col-	-	12	20	µµ⊥f
lector-to-emitter volts = -0.3, dc collector ma. = -20 . h _{FE} Alpha-Cutoff Frequency for dc collector	20	30	-	
volts = -6 , dc col- lector ma. = -1 $f_{\alpha t}$ Stored Base Charge	, 4	8	-	Мс
for de collector ma				
for dc collector ma. = -20, dc base ma. = -2 Q_S Thermal Time Constant . T_1		1700 10		coulombs شہر msec
= -20, dc base ma. = -2, Q _S	-			msec

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Somerville, N. J.



PERFORMANCE TESTS



This transistor type is tested in accordance with Military Specification $\mbox{MIL-S-19500B}.$

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

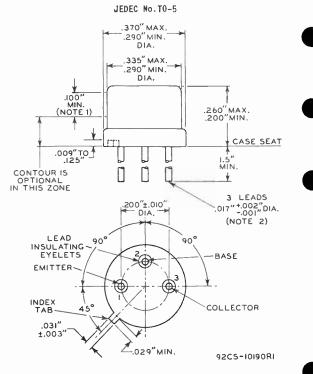
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.



🛶 Indicates a change.

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DATA 2 6~61

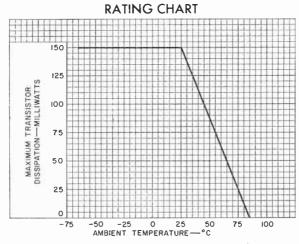


NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.







92CS-10907RI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redict History DATA 3 6-61

World Radio History

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Diameter
Dimensional Outline JEDEC No.TO-5
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOTTOM VIEW
v

Lead 1 - Emitter Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:	-
COLLECTOR-TO-BASE VOLTAGE	volts
	volts
	volts
COLLECTOR CURRENT	ma
EMITTER CURRENT 100 max.	ma
TRANSISTOR DISSIPATION: ª	
At ambient temperature of 25° C or below. 150 max.	mw
At ambient temperature of 55°C 75 max.	mw
At ambient temperature of 71 ⁰ C	ШM
AMBIENT-TEMPERATURE RANGE:	
Operating65 to +85	°C
Storage	°C
LEAD TEMPERATURE:	
For 10 seconds maximum	°C

a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

🛥 Indicates a change.



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ELECTRICAL CHARACTERISTICS

Voltage values are g ambient temperature	riven wi	th re	spect to	base	and at	
wholeno cemperadare	0, <i>≥</i> 9 c				cijiea	
DC Collector Breakdown Voltage for dc col- lector ma. = -0.02,			Typical	Max.		
dc emitter ma. = 0. DC Punch-Through Volt- age for dc emitter		-25	-30	_	volts	
volts = -1. DC Emitter Breakdown Voltage for dc emit- ter ma. = -0.02, dc	·	-14	-30	-	volts	
collector ma. = 0 DC Collector-to-Emitter Saturation Voltage: With dc collector ma. = -24, dc base ma.	.BV _{EBO} V _{CE} (sat)	-12	-30	-	volts	
= -0.6		-	-0.12	-0.2	volt	
= -5. DC Base-to-Emitter Saturation Voltage: With dc collector ma. = -24, dc base ma.	V _{RC}	-	-0.2	-0.3	volt	
= -0.6	•	-	-0.3	-0.4	volt	
= -5. DC Collector-Cutoff Cur- rent for dc collector volts = -12, dc emitte ma. = 0, ambient temperature =	I _{СВО} r	pro-	-0.6	-0.8	volt	
25° C 80° C DC Emitter-Cutoff Curren for dc emitter volts = -2.5, dc collector ma.	t	-	-2 -45	-5 -90	µа µа	
= 0			-1	-	μa	
DC Current Transfer Ratio: With dc collector-to- emitter volts = -0.2 dc collector ma. =	h _{FE}	_	12	20	μµf	
-24		40	60	-		

- Indicates a change.

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)	With dc collector-to- emitter volts = -0.3, dc collector ma. = -100		20	25	-	
	= -1	fab	14	18		Mc
)	coliector ma. = -24, dc base ma. = -1.2 Thermal Time Constant . Thermai Resistance:	Q _S TI	-	800 10	1200	µµcoulombs msec
	Junction-to-free air	R _T	-	-	500	°C/watt

PERFORMANCE TESTS

This transistor type is tested in accordance with Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

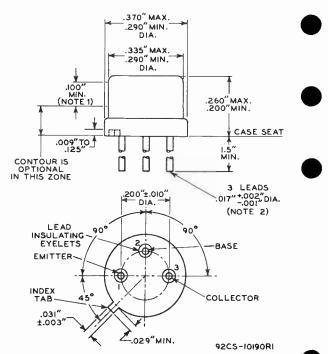
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.





RADIO CORPORATION OF AMERICA Semicenductor & Materials Division World Redio History

JEDEC No. TO-5

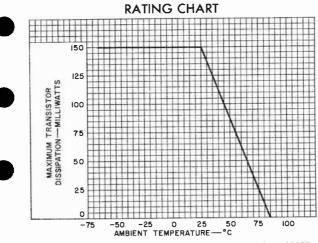


NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.







92CS-10907RI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Particip History DATA 3 5-61

World Radio History

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

	Operating Position
	Maximum Length (Excluding flexible leads) 0.410"
)	Maximum Diameter
	Dimensional Outline JEDEC No.TO-1
	Case
	Seals
	Leads, Flexible
	Minimum length
	Orientation and diameter See Dimensional Outline
	Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



Lead 3-Collector (Adjacent to red dot on side of case)

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Value	s: 🗕
CCLLECTOR-TO-BASE VOLTAGE18 m COLLECTOR-TO-EMITTER VOLTAGE:	max. volts
With dc emitter-to-base volts = -115 m	
EMITTER-TO-BASE VOLTAGE	max. volts
COLLECTOR CURRENT	nax. ma
EMITTER CURRENT	nax. ma
TRANSISTOR DISSIPATION: *	
At ambient temperature of 25° C or below. 120 m	nax. mw
At ambient temperature of 55° C 35 m	nax. mw
At ambient temperature of 71° C 10 m AMBIENT-TEMPERATURE RANGE:	nax. mw
Operating and storage65 to LEAD TEMPERATURE:	+85 °C
For 10 seconds maximum	nax. ^o C

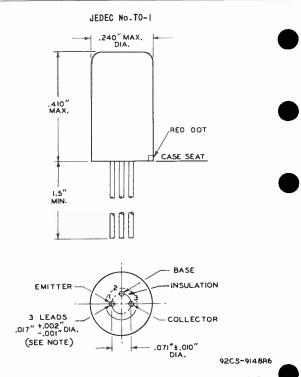
ELECTRICAL CHARACTERISTICS and OPERATING CONSIDERATIONS shown under Type 2N581 also apply to the 2N583

a See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

+ Indicates a change.



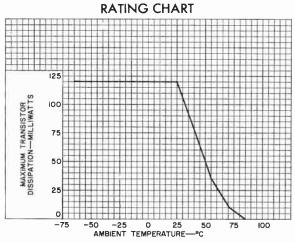
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J.



NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.







92CS-10908RI



World Radio History

Transistor

GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Computer Switching Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Diameter
Dimensional Outline JEDEC No.TO-1
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



Lead 3-Collector (Adjacent to red dot on side of case)

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Haximum Values:	-
COLLECTOR-TO-BASE VOLTAGE	<. volts
With dc emitter-to-base volts = -114 max	
EM!TTER-TO-BASE VOLTAGE -12 max COLLECTOR CURRENT -100 max	
	(, ma. (, ma.
TRANSISTOR DISSIPATION: *	
At ambient temperature of 25° C or below. 120 max	
At ambient temperature of 55° C	
At ambient temperature of 71° C 10 max AMBIENT-TEMPERATURE RANGE:	
Operating and storage65 to +8 LEAD TEMPERATURE:	35 °C
For 10 seconds maximum	«. °С

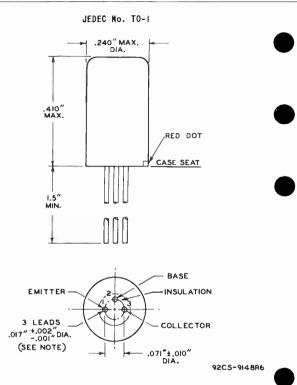
ELECTRICAL CHARACTERISTICS and OPERATING CONSIDERATIONS shown under Type 2N582 also apply to the 2N584

See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

- Indicates a change.

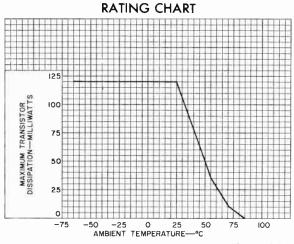


RADIO CORPORATION OF AMERICA Semiconductor & Materiats Division listory Somerville, N. J.



NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





92CS-10908RI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Valido History DATA 2 6-61

World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Medium-Power Switching and Amplifier Service in Industrial and Military Applications

The 2N656 is the same as the 2N497 except for the following item:

ELECTRICAL CHARACTERISTICS

Min. Typical Max.

DC Current Transfer Ratio for dc collector-to-emitter volts = 10, dc collector ra. = 200....h_{FE} 30 - 90



World Radio History

2N696

Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION TYPE For Switching Service in Commercial and Military Data-Processing Systems

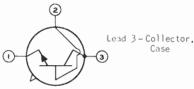
GENERAL DATA

Mechanical:

Operating Position.				•				•	•		•		•				•	. An	y
Maximum Length (Exc	i Ga	1116	11	1 ex) [6	3	lec	105		٠	٠	٠	٠	٠	٠	C.	.200	
Maximum Diameter			•														0	.370	11
Dimensional Outline														JE	EDa	C	No	. TO-9	5
Case																			
Seals																			
Leads, Flexible																		3	3
Minimum length			•															1.5	л
Orientation and d	iam	ete	er.						Se	e	Dı	me	: n :	sic	na	ıl	0 u	tline	e
Terminal Diagram:			BO	TTC	M	٧I	EW	¥.											

Lead 1 - Emitter

_ead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE with emitter open. COLLECTOR-TO-EMITTER VOLTAGE:	60 max.	volts
<pre>with external base-to-emitter resistor (ohms) ≤ 10</pre>	40 max. 5 max.	
TRANSISTOR DISSIPATION: *	500 max.	ma
At case temperature ^b of 25 ^o C or below At free-air temperature of 25 ^o C or below . OPERATING TEMPERATURE RANGE:		watts watt
Case ^b or free air.	-65 to +175	°C
For 10 seconds maximum	255 max.	°C
a see accompanying Rating Chart.		

b Measured at center of seating surface.

C Measured 1/16" ± 1/32" down from seating surface.



ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and free- air temperature of 25°C unless otherwise specified	
Here Television Here	
Min. Typical Max.	
DC Collector Breakdown Voltage for dc collector	olts
to-emitter resistor (ohms) = 10 V _{CER} 40 50 - vo DC Emitter Breakdown Voltage	olts
DC Base-to-Emitter Satu- ration Voltage for dc	olts
collector ma. = 150, dc base ma. = 15VBE _(sat) - 1 1.3 vc DC Collector-to-Emitter Saturation Voltage for	olts
dc collector ma. = 150, dc base ma. = 15VcE _(sat) - 0.9 1.5 vc DC Collector Cutoff Current I _{CBO} for dc collector volts = 30, dc emitter ma. = 0, free-air temperature =	olts
25° C	µа µа
volts = 10, dc emitter ma. = 0 C _{ob} - 20 35 DC-Pulse Forward-Current Transfer Ratio for dc col- lector-to-emitter volts = 10, dc collector ma. = 150,	μµf
pulse duration (msec) ≤ 12, duty factor ≤ 0.02 h _{FE} 20 40 60 Small-Signal Forward-Current Transfer Ratio for dc collector-to-emitter volts = 10, dc collector ma.	
= 10, de corrector ma. = 50, frequency of 20 Mc. h_{fe} 2 4 - Gain-Bandwidth Producte. f_T - 80 -	Мс

d Pulsed to prevent excessive heating of collector junction.

e Frequency at which small-signal forward current transfer ratio is equal to 1.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.



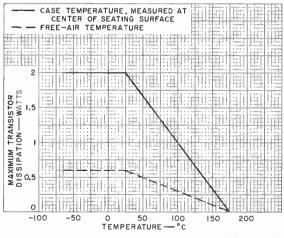
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

RCA

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

This transistor is intended for use in socketed, singleside printed-circuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side printedcircuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the boards, and to prevent the collector from shorting to ground.



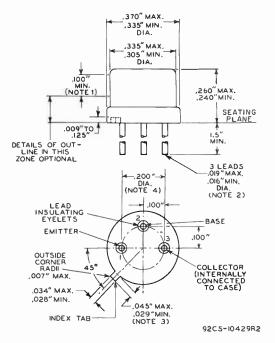
RATING CHART

92CS-1116IRI



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 8-61

JEDEC No.TO-5



NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEAOS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" \pm 0.001" - 0.000" BELOW THE SEATING PLANE OF THE OEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.



2N697

Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION TYPE

For Switching Service in Commercial

and Military Data-Processing Systems

The 2N697 is the same as the 2N696 except for the following items:

ELECTRICAL CHARACTERISTICS

		Mın.	Typical	Max.	
)	DC Collector-to-Emitter Saturation Voltage for dc collectorma. = 150, dc base ma. = 15V _{CE} (sat) DC-Fulse Forward-Current Transfer Ratio for dc ccllector-to-emitter	-	0.8	1.5	volts
	velts = 10, dc collec- tcr ma. = 150, pulse duration (msec) ≤ 12, duty factor ≤ 0.02 h _{FE} Small-Signal Forward Current Transfer Ratio for dc collector-to-	40	75	120	
	emitter volts = 10, dc collector ma. = 150, frequency of 20 Mc h _{fe} Gain Bandwidth Product ^e . f _T	2.5	5 100	-	Мс

Frequency at which small—signal forward current transfer ratio is equal to 1.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Red of History

World Radio History

2N705

Mesa Transistor

GERMANIUM P-N-P DIFFUSED-BASE TYPE

For Logic-Circuit Applications in Commercial and Military Data-Processing Equipment

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding	flexit	ole lea	ads)			0.210"
Maximum Diameter						0.230"
Dimensional Outline					JEDEC	No.T0-18
Case						
Seals						Hermetic
Leads, Flexible						3
Minimum length						0.500"
Orientation and diameter	r	· · .	See	Dimen	sional	Outline
Terminal Diagram: 6	BOTTOM	AIF%.				
	-					

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector, Case

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-10-BASE VOLTAGE	-15 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE	-15 max.	volts
EMITTER-TO-BASE VOLTAGE	-3.5 max.	volts
COLLECTOR CURRENT.	-50 max.	ma
EMITTER CURRENT.	50 max.	ma
TRANSISTOR DISSIPATION:		
Coeration in free air (See Ruting Chart):		
At ambient temperature of 25° C	150 max.	mw
At ambient temperature of 55° C.	90 max.	mw
At ambient temperature of 71 ^o C	58 max.	mw
Operation with heat sink:		
At case temperature of 25° Ca	300 max.	mw
AMELENT-TEMPERATURE RANGE:		
Operating and storage	–65 to +100	°C
LEAD TEMPERATURE:		
For immersion in molten solder		
for 10 seconds maximum	230 max.	°C

a For case temperatures above 25⁰ C, reduce the dissipation by a milliwatts/⁰C.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 1 6-61

ELECTRICAL CHARACTERISTICS

	TOAL ONA					
Voltage values are g otherwise specified	iven wit 1. Ambie	n respect nt tempe	t to bas rature o	eunles f25 ⁰ C	s	
		Hin.	Typical	Max.		
UC Collector Breakdown Voltage for dc collec- torma. = -0.1, emitter current = 0 UC Emitter Breakdown Voltage fordc emitter		-15	_	-	volts	
<pre>ma. = -0.1, collector current = 0. DC Collector-to-Emitter Breakdown Voltage for dc emitter volts = 0, dc collector ma.</pre>	8V _{EBO}	-3.5		-	volts	
= -0.1	BVces	-15	-	-	volts	
base ma. = -0.4 UC Collector-to-Emitter Saturation Voltage for dc collector ma. = -10, dc base ma.	V _{BE}	-0.34	-	-0.44	volt	
= -0.4 DC Collector-Cutoff Current for dc col- lector volts = -5,	CE(sat)	-	-	-0.3	volt	
emitter current = 0 . Small-Signal Current Transfer Ratio for dc collector-to- emitter volts = -5, dc collector ma. = -10, frequency (Mc)	Гсво	-	-	-3	<i>µ</i> а	
= 100	h _{fe}	-	3	-		
collector ma. = -10 Collector Transition Capacitance for dc collector volts = -10, emitter current	h _{FE}	25	-	-		
= 0, frequency (Mc) = 1	C _{TC}	-	5	-	μμf	
= 1	Сте	-	3.5	-	<i>µµ</i> f	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



"Turn-On" Time (Delay time + rise time) for dc col- lector-to-emitter supply volts = -3.5, "turn-on" base ma. = -1, collector resistor (ohms) = 300,				
dc "off" base-to-emitter volts = 0.5. · · · · · · · · · · · · · · · · · ·		-	75	mµsec
Storage Time for dc collec- tor-to-emitter supply				
volts = -3.5, "turn-on"				
base ma. = -1, "turn-off" base ma. = 0.25, collec-				
tor resistor (ohms) = 300 ts	-	-	100	mµsec
Fall Time for dc collector- to-emitter supply volts =				
-3.5, "turn-on" base ma. =				
-1, "turn-off" base ma. = 0.25, collector resistor				
$(\text{ohms}) = 300 \dots \text{t}_{f}$	-	-	100	mµsec

PERFORMANCE TESTS

This transistor type is tested in accordance with Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

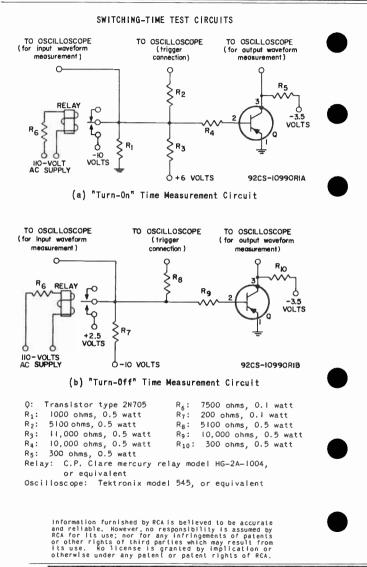
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

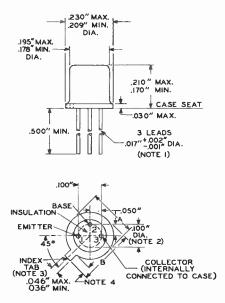




RADIO CORPORATION OF AMERICA Semiconductor & Materials Division or Somerville, N. J.



JEDEC No.TO-18



92CS-10605RI

NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" TD THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NDTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW CASE.SEAT TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT CASE SEAT.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXI-MUM, ANO WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".

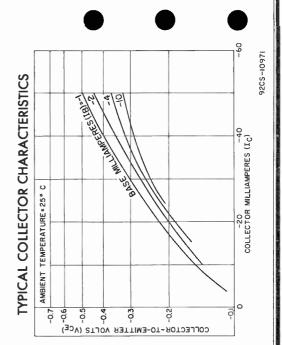


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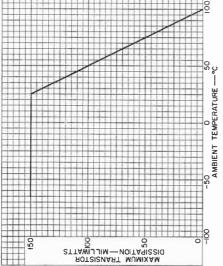
2N705



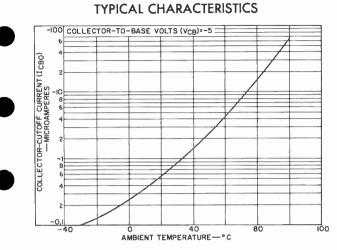
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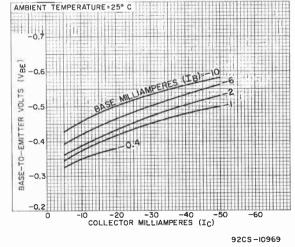
RATING CHART



92CS-10968



92CS-10976

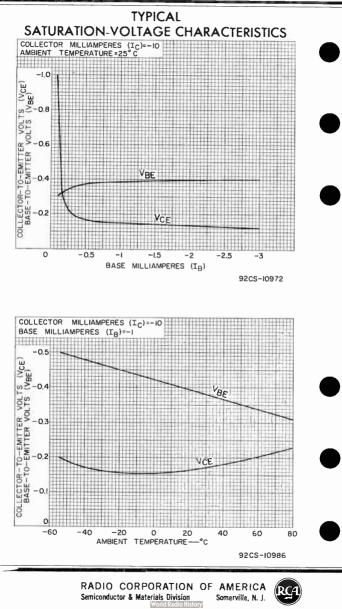


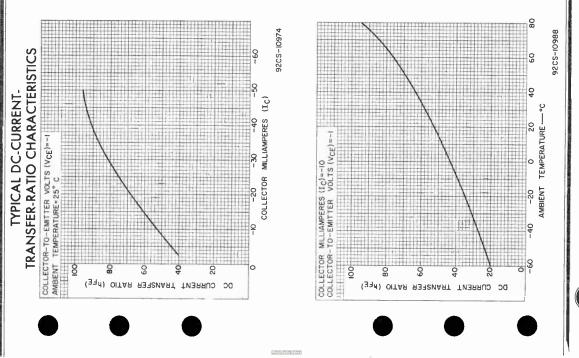
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Semiconductor & Materials Division



Somerville, N. J.





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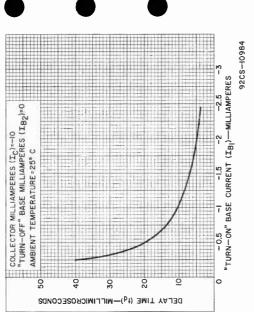
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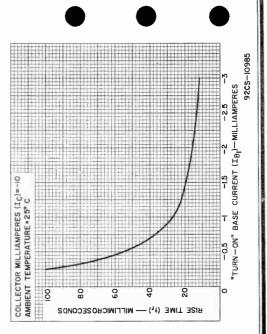
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Materials Division







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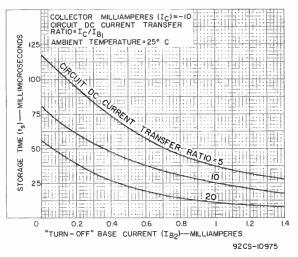
CORPORATION Materials Division

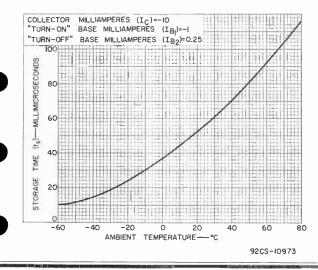
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RADIO CC Semiconductor 8

Somerville, N.

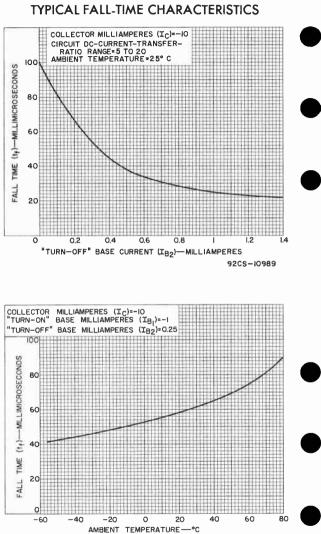








RADIO CORPORATION OF AMERICA Semiconductor & Materiats Division World Reddo History Somerville, N. J. DATA 6 6-61



Semiconductor & Materials Division

92CS-10987



Mesa Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Switching Applications

GENERAL DATA

Mechanical:

	Operating Position
	Maximum Diameter
	Dimensional Outline JEDEC No. TO-18
	Case
	Seals
	Leads, Flexible
	Minimum length
	Orientation and diameter See Dimensional Outline
)	Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector, Case

SWITCHING SERVICE

Maximum Ratings, Absolute-Maximum Values:		
COLLECTOR-TO-BASE VOLTAGE	25 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With external resistor (ohms) = 10		
between base and emitter	20 max.	volts
EMITTER-TO-BASE VOLTAGE	3 max.	volts
TRANSISTOR DISSIPATION (See Rating Chart):		
Operation in free air:		
At ambient temperature of 25° C	0.3 max.	watt
Operation with heat sink:		
At case temperature of 25° C	1 max.	watt
At case temperature of 100° C	0.5 max.	watt
JUNCTION TEMPERATURE	175 max.	°C

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and ambient temperature of 25° C unless otherwise specified Nin. Typical Max. DC Base-to-Emitter Saturation Voltage for dc collector ma. = 10, dc base ma. = 1. V_{BE} - 0.75 0.9 volt (sat)



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 2-61

2N706

DC Collector-to-Emitter Saturation Voltage for dc collector ma. = 10, dc base ma. = 1 DC Collector-Cutoff Current for dc collector volts = 15, emitter open, ambient temperature =	V _{CE} I _{CBO}	-	0.3	0.6	volt	•
25° C		_	0.005	0.5	μа	
150 ⁰ C		-	3.5	30	μа	
tance for dc collector						
volts = 10, emitter open.	Cob		5	6	<i>µµ</i> f	
DC-Pulse Current Transfer Ratio for dc collector- to-emitter volts = 1, dc collector ma. = 10, pulse duration (msec) \$\le 12, duty factor \$\le 0.02.	h _{FE}	20	_	_		
Small-Signal Current Transfer Ratio for dc collector-to-emitter volts = 15, dc collec- tor ma. = 10, fre-						
quency of 100 Mc	h _{fe}	2	4	-		
<pre>Gain-Bandwith Product Storage Time for dc collec- tor ma. = 10, "turn-on" base ma. (IB1) = 10,</pre>	GBŴ	-	400	-	Mc	
"turn-off" base ma. (I _{B2}) = -10	t.	_	16	60	mµsec	
	- 5				1	

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

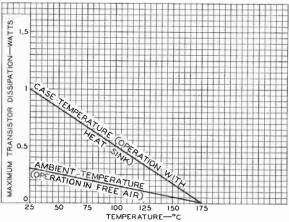
This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use as insulating washer or similar standoff device made of good dielectric material to prevent the solder





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Word Radio History from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

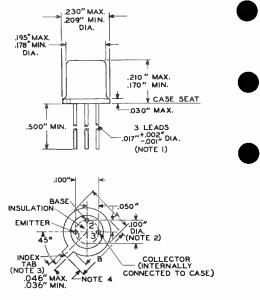


RATING CHART

9205-10602



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Official Somerville, N. J.



92CS-10605R1

NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW CASE SEAT TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB ANO TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT CASE SEAT.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".

2N706-A

Mesa Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Switching Applications

GENERAL DATA

Mechanical:

Operating Position	Any
Maximum Length (Excluding flexible lea	ads)0.210"
Maximum Diameter	
Dimensional Outline	
Case	
Seals	
Leads, Flexible	
Minimum length	
Orientation and diameter	See Dimensional Outline
Term.nal Diagram: BOTTOM VIEW	

lead 1-Emitter Lead 2 - Base



Lead 3 - Collector, Case

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Haximum Values:

COLLECTOR-TO-BASE VOLTAGE	. volts
With external resistor (ohms) = 10	
between base and emitter	. volts
	. volts
COLLECTOR DISSIPATION:	
Operation in free air:	
At ambient temperature of 25 ⁰ C 0.3 max	. watt
Operation with heat sink:	
At case temperature of 100 ⁰ C 1 max	. watt
JUNCTION TEMPERATURE	. °C
AMBIENT-TEMPERATURE RANGE:	
Storage	75 ^o C

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and ambient temperature of 25° C unless otherwise specified Min. Typical Max.



DC Base-to-Emitter Satura- tion Voltage for dc collector ma. = 10. dc				
base ma. = 1 V _B	4	-	0.9	volt



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

2N706-A

DC Collector-to-Emitter Saturation Voltage for dc collector ma. = 10, dc base ma. = 1 DC Collector-Cutoff Current for dc collector volts = 15, emitter open, ambient temperature =	V _{CE} ICBO	-	-	0.6	volt
25° C		_	_	0.5	μa
150° C		-	-	30	µа
DC Current Transfer Ratio for collector-to-emitter volts = 1, dc collector					
ma. = 10	h _{FE}	20	-	60	
Small-Signal Current Trans- fer Ratio for dc collec- tor-to-emitter volts = 10, dc collector ma. =	-	2			
10, frequency of 100 Mc . "Turn-On" Time for dc collector supply volts = 3, "turn-on" base ma. (1 ₆₁) = 3, "turn-off"	h _{fe}	2	-	-	
base ma. (182) = -1 "Turn-Off" Time for dc collector supply volts = 3, "turn-on" base ma. (18.) = 3. "turn-off"		-	-	40	mμsec
base ma. $(I_{\beta_2}) = -1$. Storage Time for dc collector ma. = 10, "turn-on" base ma. $(I_{\beta_1}) = 10$, "turn-off" base ma. (I_{β_2})		-	-	75	mµ∠sec
= 10	ts	-	r –	25	mµsec

OPERATING CONSIDERATIONS and DIMENSIONAL OUTLINE shown under Type 2N706 also apply to the 2N706-A

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



2N708

Transistor



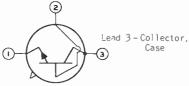
SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION PLANAR TYPE For Switching and Amplifier Applications in Industrial and Military Equipment

GENERAL DATA

Mechanical:

Operating Position
Maximum Length (Excluding flexible leads) 0.210"
Maximum Diameter
Dimensional Outline JEDEC No.TO-18
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

	Maximum Ratings, Absolute-Maximum 1	Values:			
	COLLECTOR-TO-BASE VOLTAGE:				
	With emitter open			40 hax.	volts
	COLLECTOR-TO-EMITTER VOLTAGE:				
	With external resistor (chms) ≤ 1				
	between base and emitter			20 max.	
,	With base open.		٠	15 max.	volts
	EMITTER-TO-BASE VOLTAGE:			<i>p.</i>	
	With collector open		·	5 max.	volts
		F - 1		1.2	
	At case temperature ^b of 25 ^o C or				watts
	At case temperature ^b of 100 ^o C.				
	At free-air temperature of 25° C or TEMPERATURE RANGE:	below.	·	0.36 max.	watt
)				CE + + 200	00
	Storage				°C
	Operating (Junction)	• • • •	٠	200 max.	oC
				200	°C
	For 10 seconds maximum	• • • •	•	300 max.	υ

- ^a See accompanying Rating Chart.
- b Measured at center of seating plane.
- C Measured 1/16" ± 1/32" down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History Somerville, N. J.

DATA I 8-61

ELECTRICAL CHARACTERISTICS

	100			
Voltage values are given with respect				_
air temperature of 25°C unless othe	e rwise	specifi	ed.	
	Min.	Max.		
DC Collector Breakdown Voltage for dc collector ma. = 0.001, emitter ma. = 0 BV _{CBO} DC Emitter Breakdown Voltage	40	-	volts	
for dc emitter ma. = 0.1, collector ma. = 0 BV _{EBO} DC Collector-to-Emitter Sustaining Voltage: With dc collector pulsed ma. = 30, external base-	5	-	volts	
to-emitter resistor (ohms) ≤ 10 V _{CER} (sus) With dc collector pulsed	20	-	volts	
ma. = 30, base openV _{CEO} (sus) DC Base-to-Emitter	15	-	volts	
Saturation Voltage: V _{BE} (sat) With dc collector ma. = 10, dc base ma. = 1, free-				
air temperature = 25 ⁰ C With dc collector ma. = 7.	0.72	0.8	volt	
dc base ma. = 0.7, free- air temperature = -55° C . DC Collector-to-Emitter	-	0.9	volt	
Saturation Voltage: V _{CE} (sat) With dc collector ma. = 10, dc base ma. = 1, free- air temperature = 25 ⁰ C. With dc collector ma. = 7, dc base ma. = 0.7, free-	_	0.4	volt	
air temperature range = -55 to *125° C DC Collector-Cutoff Current I _{CBO} for dc collector volts = 20, dc emitter ma. = 0, for dc collector volts =	-	0.4	volt	
free-air temperature = 25° C	_	0.025 15	μa μa	
collector volts = 20, free- air temperature = 125° C I _{CEX} DC Emitter-Cutoff Current for dc base-to-emitter	-	10	μα	
volts = 4, dc collector ma. = 0 ¹ EBO	-	0.08	μa	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



)	Base-Spreading Resistance ^d for dc collector-to- emitter volts = 10, dc				
	collector ma. = 10, frequency (Mc) = 300 Collector-to-Base Capacitance for dc collector volts =	r _{b'}	-	50	ohms
)	10, dc emitter ma. = 9 Small-Signal Current Transfer Ratio for dc collector-to- emitter volts = 10, dc collector ma. = 10.	C _{ob}	-	6	μµf
)	frequency (Mc) = 100 DC Current Transfer Ratio: With dc collector-to- emitter volts = 1, frea- air temperature = 25°C, dc collector ma. =	h fe h _{FE}	3	-	
	10 0.5. With dc collector-to- emitter volts = 1, dc collector ma. = 10, free-		30 15	120 -	
	air temperature = -55° C. Storage Time ^e for dc collec- tor supply volts = 10, collector resistor (ohms) = 1000, "turn-on" and "turn- off" base ma. = 10 each, dc		15	-	
	collector ma. = 10	ts		25	mµsec
	Thermal Resistance: Junction-to-case Junction-to-free air	RT	_	1 45 480	^o C/watt ^o C/watt

- d Base-Spreading Resistance (rb') is the product of Re and hie (small-signal value of the short-circuit input impedance).
- ^e See accompanying Storage-Time-Neasurement Circuit.

OPERATING CONSIDERATIONS

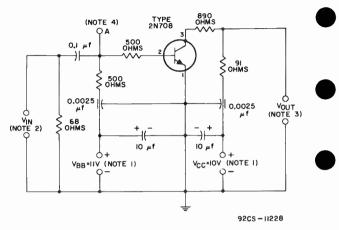
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



RADIO CORPORATION OF AMERICA Semiconductor & Materials: Division History Somerville, N. J.



STORAGE-TIME-MEASUREMENT CIRCUIT

NOTE I: WITH CERTAIN TYPES DF PDWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 5D OHMS.

NOTE 3: THE ASSOCIATED INPUT AND OUTPUT WAVEFORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING AN INPUT IMPEDANCE OF 5D OHMS.

NOTE 4: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (V_A).

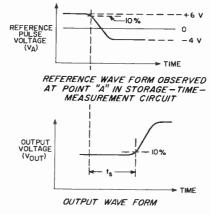
ASSOCIATED WAVE FORMS



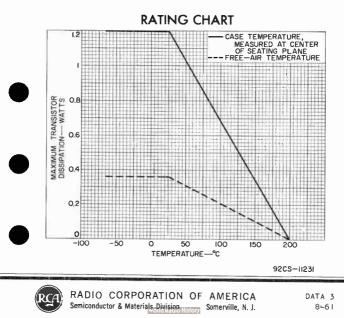
RISE TIME < Im_{μ} SEC PULSE DURATION $\geq 300m_{\mu}$ SEC DUTY FACTOR < 0.02

INPUT WAVE FORM





92CS-11224



.230" MAX. 209" MIN. DIA. .195" MAX. .178" MIN. DIA. 210" MAX. 170" MIN. SEATING PLANE .030" MAX. .500" MIN. 3 LEADS .017"+.002" DIA. (NOTE I) .100"≥ .050" INSULATION 100 DIA (NOTE 2) A-59 INDEX-TAB (NOTE 3)

JEDEC No.TO-18

92CS-10605R1

NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 4

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

.046" MÄX. .036" MIN.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".

Transistor

SILICON N-P-N EPITAXIAL-PLANAR TYPE

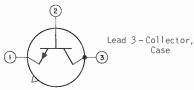
For Ultra-High-Speed Logic-Circuit Switching Applications in Commercial and Military Data-Processing Systems. The 2N2475 is a Direct Replacement for Type 2N709.

GENERAL DATA



Lead 1 - Emitter Lead 2 - Base

Mechanical:



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Naximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open V _{CBO} COLLECTOR-TO-EMITTER VOLTAGE:	15 max.	volts
With base open V _{CEO}	6 max.	volts
With collector open VEBO COLLECTOR CURRENT I _C	4 max. Limited by dissip	power
TRANSISTOR DISSIPATION: a P At case temperature ^b of		
100° C or below	500 max.	ΠW
25° C or below	300 max.	mw
Junction (Operating) T _J Storage T _{STG} LEAD TEMPERATURE: ^c	-65 to +200 -65 to +300	°C
For 10 seconds maximum T _L	300 max.	°C

ELECTRICAL CHARACTERISTICS

	Unless	otherwise	specified,	free-	aır	temper	ature	= 25	°C
					Mın.	Typic	al h	lax.	
	for dc c	orBreakdo collector m er current		ВV _{сво}	15	30		_	volts
a b c	See accomp Measured a Measured 1	anying Rational Conter of 1/16" ± 1/32	ng Chart. seating plan " along lead,	ne. down	from	sealing	plane		

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J.

	Nin.	Typıcal	Max.		
DC Emitter Breakdown Voltage for dc collector current=0, dc emitter ma.=0.01BV _{EBO} DC Collector-to-Emitter Sustaining Voltage ^d for dc pulsed collector	4	7	-	volts	
ma. = 10, dc base cur- rent = 0V _{CEO} (sus DC Base-to-Emitter Satu- ration Voltage for dc) 6	10	-	volts	
collector ma. = 3, dc base ma. = 0.15 V _{BE} (sat) DC Collector-to-Emitter Saturation Voltage for	0.7	0.77	0.85	volt	
dc collector ma. = 3, dc base ma. = 0.15 V _{CE} (sat) DC Collector-Cutoff Current for dc col-	-	0.26	0.3	volt	
lector-to-base volts = 5, dc emitter current = 0, free-air tempera- ture = 25° C 150° C Emitter-to-Base Capaci- tance for dc emitter-to-	1 1	0.002	0.05	μа μа	
<pre>base volts = -0.5, dc collector current = 0, frequency (kc) = 140 (Approx.) C_{ib} Collector-to-Base Capaci- tance for dc collector- to-base volts = 5, dc</pre>	-	1.8	2	pf	
emitter current = 0, frequency (kc) = 140 (Approx.)C _{ob} DC Forward-Current Transfer Ratio: h _{FE} With dc collector-to-	-	2.1	3	pf	•
emitter volts = 1, dc pulsed collector ma. = 30 With dc collector-to- emitter volts = 0.5,	15	43	_		
dc pulsed collector ma. = 10 With dc collector-to- emitter volts = 0.5,	20	53	120		
dc pulsed collector ma. = 10, free-air temperature = -55° C .	10	29	_		

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

A RCA

Small-Signal Short-Circuit Forward-Current Transfer Ratio for dc collectorto-emitter volts = 4. dc collector ma. = 5. signal frequency (Mc) = 100. 6 8 hee Switching Time: Storage time^e for do collector ma. = 5. turn-on dc base ma. = 5, turn-off dc base ma. = -5 Turn-On time^f (Delay 4.1 6 nsec t. time + rise time) for dc collector ma. = 10, turn-on dc base ma. = 2, turn-off dc base 15 ma. = -1 ton 6.4 nsec Turn-Off time^f (Storage time + fall time) for dc collector ma. = 10. turn-on dc base ma. = 1. turn-off dc base ma. = -1 8.3 15 nsec toff

d The Collector-to-Emitter Sustaining Voltage [vcc0(sus)] with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (vam = 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

- e See accompanying Storage-fime-Neasurement Circuit.
- f See accompanying furn-On-fime and furn-Off-fime Heasurement Circuit.

OPERATING CONSIDERATIONS, RATING CHART, STORAGE-TIME MEASUREMENT CIRCUIT, TURN-ON-TIME AND TURN-OFF-TIME MEASUREMENT CIRCUIT, and ASSOCIATED WAVE FORMS shown under type 2N2475 also apply to the 2N709



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Information Somerville, N. J.

World Radio History

Mesa Transistor

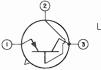
GERMANIUM P-N-P DIFFUSED-BASE TYPE For Logic-Circuit Applications in Commercial and Military Data-Processing Equipment

GENERAL DATA

Mechanical:

Maximum Length (Excluding	g flexible leads) 0.210"
Maximum Diameter	0.230"
Dimensional Outline	JEDEC No. T0-18
Case	
Seals	
Leads, Flexible	
Minimum length	0.500"
Orientation and diamete	er See Dimensional Outline
Termina ¹ Diagram:	BCTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector, Case

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	-15 max.	volts volts volts
COLLECTOR CURRENT	-50 max.	ma
EMITTER CURRENT	50 max.	та
TRANSISTOR DISSIPATION:		
Operation in free air (See Rating Chart):		
At ambient temperature of 25° C	150 max.	mw
At ambient temperature of 55°C	90 max.	mw
At ambient temperature of 71 ⁰ C	58 max.	mw
Operation with heat sink:		
At case temperature of 25 ⁰ C ^a	300 max.	mw
AMBIENT TEMPERATURE RANGE:		
Operating and storage	-65 to +100	°C
LEAD TEMPERATURE:		
For immersion in molten solder		
for 10 seconds maximum	230 max.	oC



 $^{\rm a}$ For case temperatures above 25 $^{\rm O}$ C, reduce the dissipation by 4 milliwatts/ $^{\rm O}$ C.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Listory Somerville, N. J.

ELECTRICAL CHARACTERISTICS

LLEUTATOAL CHAN	ACIERIALI	103			
Voltage values are given wit otherwise specified. Ambien					
		Typical			
DC Collector Breakdown Voltage for dc col- lector ma. = -0.1, emitter current = 0 BV _{CB}				uelte	
DC Emitter Breakdown Voltage for dc emit- ter ma. = -0.1, col- lector current = 0 BV _{EB}				volts	
DC Collector-to-Emitter Breakdown Voltage for dc emitter volts = 0, dc collector ma.					
= -0.1 BV _{CE} DC Base-to-Emitter Voltage for dc col- lector ma. = -10, dc	-			volts	
base ma. = -0.4 V _{BE} DC Collector-to-Emitter Saturation Voltage for dc collector ma. = -10, dc base ma.				volt	
= -0.4 V _{CE(st} DC Collector-Cutoff Current for dc collector volts = -5, emitter current		-		volt	
= 0 I _{CBC} Small-Signal Current Transfer Ratio for dc collector-to-emitter volts = -5, dc collector ma. = -10, frequency		_	-3	μа	_
(Mc) = 100		3	_		
dc collector ma. = -10. h _{FE} Collector Transition Capaci- tance for dc collector volts = -10, emitter current = 0, fre-			-		
quency (Mc) = 1 C _{TC} Emitter Transition Capaci- tance for dc emitter volts = -2, collector &urrent = 0, fre-		5	-	<i>µµ</i> f	•
quency (Mc) = $1 \cdot \cdot \cdot \cdot C_{TE}$	-	3.5	-	μµ f	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



2N710

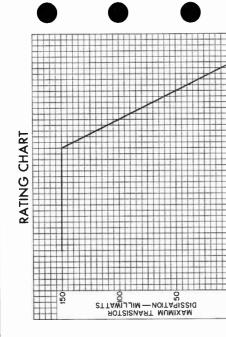
"Turn-On" Time (Delay time + rise time) for dc collector-to-emit- ter supply volts = -3.5, "turn-on" base ma. = -1, collector resistor (ohms) = 300, dc "off" base-to-emit-					
ter volts = 0.5 Storage Time for dc col-	t _d + t _r	-	-	75	mµsec
<pre>lector-to-emitter supply volts = -3.5, "turn-on" base ma. = -1, "turn-off" base ma. = 0.25, col- lector resistor (ohms)</pre>					
= 300	ts	-	-	100	mµsec
<pre>lector-to-emitter supply volts = -3.5, "turn-on" base ma. = -1, "turn-off" base ma. = 0.25, col- lector resistor (ohms)</pre>					
= 300	tf	-	-	100	mµsec

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, SWITCHING-TIME TEST CIRCUITS, and DIMENSIONAL OUTLINE shown under Type 2N705 also apply to the 2N710



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 6-61







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TEMPERATURE

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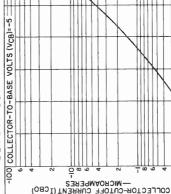


















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TEMPERATURE

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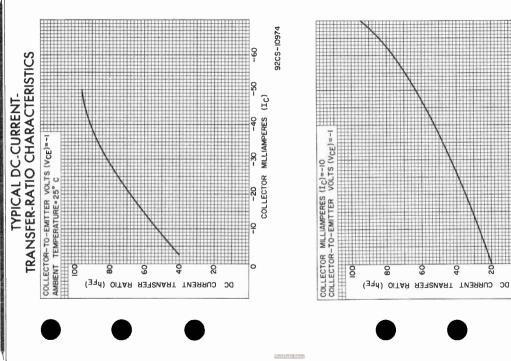
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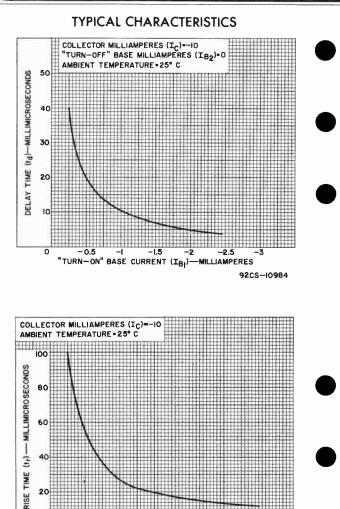
TEMPERATURE

-20 AMBiENT AMERICA Somerville, N. J. Ч CORPORATION RADIO CORPORATION Semiconductor & Materiats Division



0

-0.5





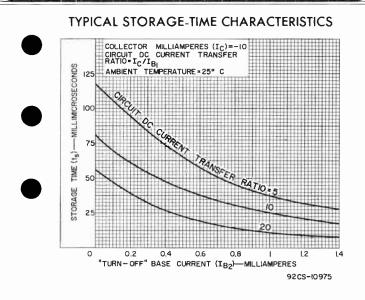
-2

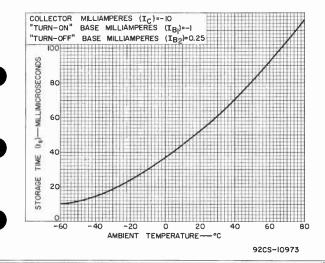
-2.5

-3

-1.5

"TURN-ON" BASE CURRENT (IBI)-MILLIAMPERES



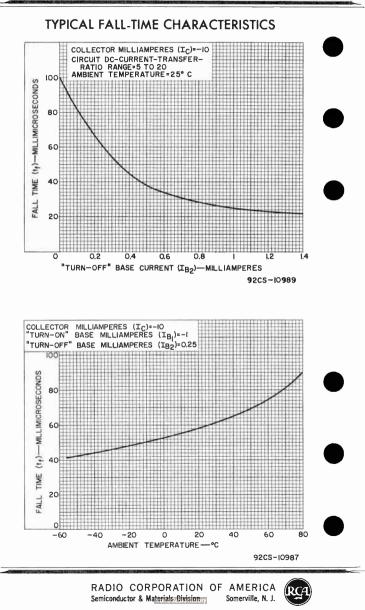




RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA 4 6-61



Mesa Transistor

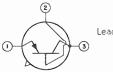
GERMANIUM P-N-P DIFFUSED-BASE TYPE For Logic-Circuit Applications in Commercial and Military Data-Processing Equipment

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding	
Maximum Diameter	 0.230"
Dimensional Outline	 JEDEC No.TO-18
Case	
Seals	 Hermetic
Leads, Flexible	 3
Minimum length	 0.500"
Orientation and diameter Terminal Diagram: B	èee Dimensional Outline

Lead 1 - Emitter Lead 2 - Base

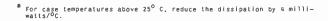


Lead 3-Collector, Case

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	s
EMITTER-TO-BASE VOLTAGE	
	ŧ.
	· ·
COLLECTOR CURRENT	а
EMITTER CURRENT	а
TRANSISTOR DISSIPATION:	
Operation in free air (See Rating Chart):	
At ambient temperature of 25°C 150 max. m	W
At ambient temperature of 55°C 90 max. m	W
At ambient temperature of 71°C 58 max. m	W
Operation with heat sink:	
At case temperature of 25º Cª	W
AMBIENT-TEMPERATURE RANGE:	
Operating and storage65 to +100 O	С
LEAD TEMPERATURE:	
For immersion in molten solder	
for 10 seconds maximum	Ç





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 6-61

ELECTRICAL CHARACTERISTICS

	ELLOTATO			1100			
	Voltage values are gi otherwise specified.						
			Min.	Typical	Mar		
Vol [.] tor	llector Breakdown tage fordc collec- ma. = -0.1, emitter		,, , , , , , , , , , , , , , , , , , , ,	1),,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
DC Em Vol	rent = 0	.BV _{CBO}	-12	-	-	volts	
cur DC Co Brea	rent = 0 llector-to-Emitter akdown Voltage for emitter volts = 0,	. ^{ВV} ЕВО	-1	-	_	volt	
dc d DC Bas Volt	collector ma. = -0.1 se-to-Emitter tage for dc collec-	.BV _{CES}	-12	-	_	volts	
ma. DC Co Satu	ma. = -10, dc base = -0.4	. V _{BE}	-0.34	-	-0.5	volt	
dc l DC Col rent	collector ma. = -10, base ma. = -0.5 llector-Cutoff Cur- for dc collector is = -5, emitter	.V _{CE(sat}	, –	-	-0.5	volt	
curi Small- Tran coll volt	-Signal Current -Signal Current Isfer Ratio for dc Lector-to-emitter -S = -5, dc collector = -10, frequency		-	-	-3	μð	
(Mc) DC Cui Rati	= 100	• ^h fe	-	2	-		
Collec tanc volt	collector ma. = -10. tor Transition Capaci e for dc collector s = -10, emitter	. h _{FE} -	20	-	-		•
(Mc) Emitte tanc volt	rent = 0, frequency = 1er Transition Capaci- ce for dc emitter .s = -2, collector rent = 0, frequency	. C _{TC}	-	5	-	μμf	
(Mc)	$= 1. \dots \dots \dots$. C _{te}	-	4	-	μµuf	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



	"Turn-On" Time (Delay time + rise time) for dc collector-to-emitter supply volts = -3.5, "turn-on" base ma. = -1, collector resistor (ohms)					
D	= 300, dc "off" base-to- emitter volts = 0.5 Storage Time for dc col- iector-to-emitter supply volts = -3.5, "turn-on"	t _d + t _r	-	-	100	mµsec
	base ma. = -1, "turn-off" base ma. = 0.25, col- lector resistor (ohms) = 300 Fall Time for dc col- lector-to-emitter supply volts = -3.5, "turn-on" base ma. = -1, "turn-off"	ts	-	-	200	mμsec
	base ma. = 0.25, col- lector resistor (ohms) = 300	t f	_	-	150	mµsec

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, SWITCHING-TIME TEST CIRCUITS, and DIMENSIONAL OUTLINE shown under Type 2N705 also apply to the 2N711





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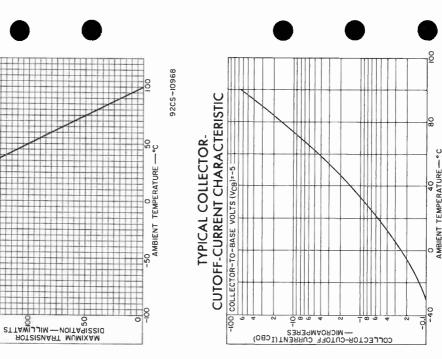
Ð

RATING

150



92CS-10976



forld Radio History

Mesa Transistor

GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE For High-Speed Switching Service in Commercial and Military Data-Processing Systems

The 2N764 is the same as the 2N1300 except for the following items:

Mechanical:

Operating Position							
Maximum Length (Exclud	ling	flex	ible	lea	ads)		0.210"
Maximum Diameter							0.230"
Dimensional Outline .						JEDEC I	Vo.T0-18
Case					• •		. Metal
Seals							
Leads, Flexible							3
Minimum length	• •						0.500"
Orientation and diam	nete	r			See	Dimensional	Outline
Terminal Diagram:	1	30 T T0	M VI	EW			

Lead 1 - Emitter Lead 2 - Base



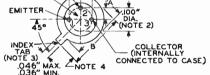
Lead 3 - Collector, Case

OPERATING CONSIDERATIONS

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



JEDEC No.TO-18 .230" MAX. 209" MIN. DIA. .195" MAX. .178" MIN. -DIA. .210 " MAX. .170" MIN. CASE SEAT .030" MAX. .500" MIN. 3 LEADS .017"+.002" DIA. (NOTE 1) .100"> BASE -.050" INSULATION EMITTER



92CS-10605R1

NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW CASE SEAT TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT CASE SEAT. NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.02B" MINIMUM AND 0.04B" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Mesa Transistor



GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE

For High-Speed Switching Service in Commercial and Military Data-Processing Systems

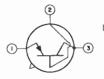
The 2N795 is the same as the 2N1301 except for the following items:

Mechanical:

Operating Position
Maximum Diameter 0.230"
Dimensional Outline JEDEC No.TO-18
Case
Sea's
Leads, Flexible
Minimum length 0.500"
Orientation and diameter See Dimensional Outline Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



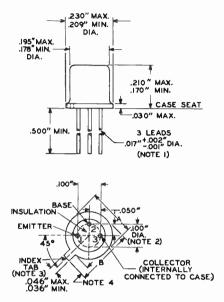
Lead 3-Collector, Case

OPERATING CONSIDERATIONS

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



JEDEC No.TO-18



92CS-10605R1

NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW CASE SEAT TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT CASE SEAT.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".



Mesa Transistor

GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE

For High-Speed Switching Service in Commercial and Military Data-Processing Systems

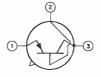
The 2N796 is the same as the 2N1683 except for the following items:

Mechanical:

Operating Position	
Maximum Diameter	0.230"
Dimensional Outline	JEDEC No.TO-18
Case	Metal
Seals	
Leads, Flexible	3
Minimum length	0.500"
Orientation and diameter S Terminal Diagram: BOTTOM VIEW	ee Dimensional Outline

Lead 1 - Emitter





Lead 3-Collector, Case

OPERATING CONSIDERATIONS

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



230" MAX. 209" MIN. DIA. .195" MAX. .178" MIN. DIA. .210 " MAX. 170" MIN. CASE SEAT 030" MAX. .500" MIN. 3 LEADS .017"+.002" DIA. (NOTE I) .100"> BASE .050" INSULATION EMITTER 100* DIA A.,. (NÖTE 2) INDEX COLLECTOR TAB (NOTE 3) (INTERNALLY

JEDEC No.TO-18

92CS-10605R1

CONNECTED TO CASE)

NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZDNE BETWEEN D.D5" AND D.25" FROM THE CASE SEAT. BETWEEN D.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF D.D21" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 4

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE D.D54" + D.DD?" - D.ODD" BELOW CASE SEAT TO BE WITHIN D.DD7" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM D.23D" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT CASE SEAT.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

.046" MAX 036" MIN. MAY

NOTE 4: TAB LENGTH TO BE 0.D2B" MINIMUM AND 0.04B" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".

Semiconductor & Materials Division



Transistor



GERMANIUM P-N-P DIFFUSED-JUNCTION EPITAXIAL-MESA TYPE

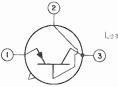
For Switching Applications in Industrial and Military Equipment

GENERAL DATA

Mechanical:

Operating Position							Anv
Maximum Length (Exclud	ling	fle	exit	ble le	eads		0.210"
Maximum Diameter							0.230"
Dimensional Outline .							. JED: C No. TO-18
Case	• ••			• • •			Metal
Seals							Hermetic
Leads, flexible		• •		• • •			· · · · · · · 3
Minimum length	• •				• •		0.500"
Orientation and diam Terminal Diagram:	netei E	г ЗОТГ	0M		See	e Dime	nsional Outline

Lead 1 - Emitter Lead 2 - Base



Lead 3 - Collector, Case

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Vali	ues:
COLLECTOR-TO-BASE VOLTAGE:	
With emitter open	max. volts
COLLECTOR-TO-EMITTER:	
With external resistor (ohms) ≤ 10	
between base and emitter15	max. volts
EMITTER-TO-BASE:	
	max. volts
	max. ma
TRANSISTOR DISSIPATION:	
	max. mw
	max. mw
TEMPERATURE RANGE:	
Storage	+100 °C
Operating (Junction) 100	max. oc
LEAD TEMPERATURE:	0.0
For 10 seconds maximum ^c 240	max. ^o C

- a Sec accompanying Rating Chart.
- b Measured at center of seating plane.
- C Measured 1/16" ± 1/32" down from seating plane.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

ELECTRICAL CHARACTERISTICS

LELOTATORE OTRA	ROTERIOT				
Voltage values are given wit: otherwise specified. Free-a	h respect ir temper	to bas ature o	e unles f 25° (s s 2.	
		Min.			$\mathbf{\bullet}$
<pre>DC Collector Breakdown Voltage for dc collector ma. = -0.1, emitter ma. = 0 DC Collector-to-Emitter Break- down Voltage for dc base-to- emitter volts = 0, dc collector</pre>	BV _{CBO}	-15	-	volts	•
ma. = -0.1, external base-to- emitter resistance (ohms) = 0 . DC Emitter Breakdown Voltage for	BV _{CES}	-15	-	volts	_
dc collector ma. = 0, dc emitter ma. = -0.1 DC Base-to-Emitter Saturation	BVEBO	-2.5	-	volts	
Voltage for dc collector ma. = -10, dc base ma. = -1 DC Collector-to-Emitter Satu-		0.34	0.44	volt	
	V _{CE} (sat)				
With dc collector ma. = -10 , dc base ma. = -1		-	-0.2	volt	
With dc collector ma. = -50, dc base ma. = -5 DC Collector-Cutoff Current for		-	-0.25	volt	
dc collector volts = -6, dc emitter ma. = 0 Collector-to-Base Capacitance for dc collector volts = -6,	Сво	-	-3	μa	
dc emitter ma. = 0, frequency (kc) = 100 DC Current Transfer Ratio for dc	C _{ob}	-	6	<i>μμ</i> f	
collector-to-emitter volts = -0.3, dc collector ma. = -10. Small-Signal Current Transfer Ratio for dc collector-to- emitter volts = -1, dc col-	h _{FE}	25	-		
lector ma. = -10, frequency (Mc) = 100	h _{fe}	3	_		•
collector-to-emitter volts = -1, dc collector ma. = -10 Switching Time ^d for the	f _T	300	-	Мс	
following conditions unless otherwise specified, with dc collector-to-emitter supply volts = -3, dc collector ma. ^e = -10, "turn-on" base ma. = -1, "turn-off" base ma. = 0.25, external collector resistance (including "sampling" resistor of 20 ohms) of 300 ohms:					•



ı	Storage Time	td+tr ts	-	70 50	mµ⊥sec mµ⊥sec
	Fall Time	tf	-	50	mµsec
	Constant ^f for dc collector-to-				
	emitter supply volts = -10, dc				
	collector ma. ^e = -10, "turn-on"				
	base ma. = -10, "turn-off" base				
	ma. = 10, external collector				
	resistance (including "sampling" resistor of 20 ohms) of				
	1000 ohms	\mathcal{T}_{S}	_	25	musec
		15			,

d See accompanying Switching-fime Neasurement Circuit.

^e The dc collector-to-emitter supply volts adjusted to give dc collector milliamperes of -10.

^f See accompanying Saturation Stored-Charge Time Constant Neasurement Circuit.

PERFORMANCE TESTS

This transistor type meets mechanical and environmental requirements of Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

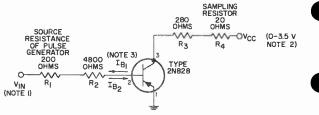
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



SWITCHING-TIME MEASUREMENT CIRCUIT



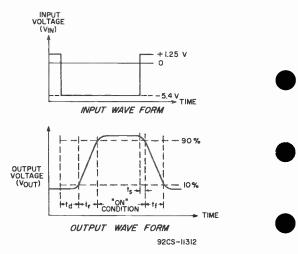
92CS-11308

NOTE I: TEST CIRCUIT PROVIDED BY THE TEKTRONIX TYPE R PLUG-IN UNIT (FOR TEKTRONIX MODEL 541 OSCILLOSCOPE) FOR THE MEASUREMENT OF SWITCHING TIME. THE TYPE R UNIT PROVIDES THE INPUT VOLTAGE (VIN) AND THE COLLECTOR-SUPPLY VOLTAGE (V_{CC}). RESISTORS R1 AND R4 ARE INCLUDED IN THE TYPE R UNIT; RESISTORS R2 AND R3 ARE WIRED TO THE ASSOCIATED WIRING BOARD.

NOTE 2: V_{CC} is adjusted for $i_C = -10$ MA.

NOTE 3: IB1 = "TURN-ON" BASE CURRENT = -I MA. B2 = "TURN-OFF" BASE CURRENT = 0.25 MA.

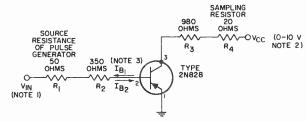
ASSOCIATED WAVE FORMS







SATURATION STORED-CHARGE TIME CONSTANT MEASUREMENT CIRCUIT

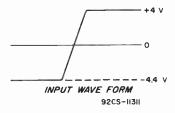


9205-11309

NOTE 1: TEST CIRCUIT PROVIDED BY THE TEKTRONIX TYPE R PLUG-IN UNIT (FOR TEKTRONIX MODEL 541 OSCILLOSCOPE) FOR THE MEASUREMENT OF $\tau_{\rm S}$. THE TYPE R UNIT PROVIDES THE INPUT VOLTAGE (V_{IN}) AND THE COLLECTOR-SUPPLY VOLTAGE (V_{CC}). RESISTORS R₁ AND P₄ ARE INCLUDED IN THE TYPE R UNIT; RESISTORS R₂ AND R₃ ARE WIRED TO THE ASSOCIATED WIRING BOARD.

NOTE	2:	V_{CC} is adjusted for $I_C = -10$ MA.	
NOTE	3:	IB1 = "TURN-ON" BASE CURRENT = -10 MA	٩.
		182 = "TURN-OFF" BASE CURRENT = 10 MA	١.

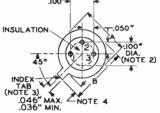
ASSOCIATED WAVE FORM





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

JEDEC No. TO-18 230" MAX. 209" MIN. DIA. .195" MAX. .178" MIN. -DIA. .210 " MAX. .170" MIN. SEATING PLANE -030" MAX. .500" MIN 3 LEADS .017"+.002" DIA. (NOTE I) .100" -.050" 100



92CS-10605R2

NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZDNE BETWEEN 0.D5" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.D21" IS NELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE D.D54" + D.DD1" - D.DDD" BELOW SEATING PLANE TO BE WITHIN D.DD7" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM D.23D" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

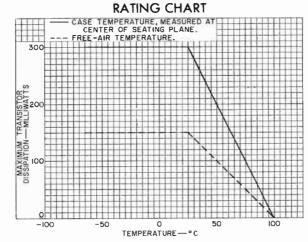
NOTE 4: TAB LENGTH TO BE D.028" MINIMUM AND D.D48" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".

Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA



Somerville, N. J.



92CS-11307RI



World Radio History

Transistor

GERMANIUM P-N-P DOUBLE-DIFFUSED-JUNCTION TYPE For High-Speed Logic-Circuit Switching Applications in Commercial and Military Data-Processing Systems. The 2N955A is a Direct Replacement for Type 2N955.

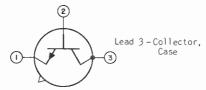
GENERAL DATA

Mechanical:

Dimensions See Outline TO-18 in General Section Terminal Diagram: BOTTOM VIEW



Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values: COLLECTOR-TO-BASE VOLTAGE: With emitter open. . . 12 max. volts . . V_{CBO} COLLECTOR-TO-EMITTER VOLTAGE: With base open . 8 max. VCEO volts 🖛 . . . EMITTER-TC-BASE VOLTAGE: With collector open. 2 max. volts F80 COLLECTOR CURRENT. 100 max. P ma TRANSISTOR DISSIPATION: * At free-air temperature of 25⁰ C or below 150 max. mw TEMPERATURE RANGE: Junction (Operating) Tj -65 to +100 00 Storage. . . . T_{STG} -65 to +100 oC . . . LEAD TEMPERATURE: 6 For 10 seconds maximum . . T 230 max. 00

ELECTRICAL CHARACTERISTICS

Free-air temperature = 25° C

8V C.80

12

Min. Typical Max.

25

EC Collector-to-Base Breakdown Voltage for dc collector ma. = 0.1, dc emitter current = 0...

a See accompanying Rating Chart.

b Measured 1/16" ± 1/32" along lead, down from seating plane.

- Indicates a change.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J.

DATA I 8-62

volts

		Min.	Typical	Max.		
DC Collector-to-Emitter Breakdown Voltage for dc collector ma. = 5, dc emitter current = 0. DC Emitter-to-Base Breakdown Voltage for dc collector current	BVCEO	8	15	_	volts	•
= 0, dc emitter ma. = 0.1DC Collector-to-Emitter Reach-Through Voltage for dc collector-to- base volts = 12, dc	BVEBO	2	6	-	volts	
<pre>emitter-to-base float- ing potential (volts) = 1 DC Collector-to-Emitter Latching Voltage for dc collector ma. = 100,</pre>	V _{RT}	11	-	-	volts	•
external base-to- emitter_resistance (ohms) = 1000 DC Base-to-Emitter Saturation Voltage for	V _{CERL} ℃	9	-	-	volts	
dc collector ma. = 30, dc base ma. = 1 DC Collector-to-Emitter Saturation Voltage for	V _{BE} (sat)	0.3	0.45	0.6	volt	
dc collector ma. = 30, dc base ma. = 1 DC Collector-Cutoff Current for dc collec-	V _{CE} {sat)	-	0.35	0.5	volt	
tor volts = 5, dc emitter current = 0 Input Capacitance for dc emitter-to-base	СВО	-	0.6	5	μa	
<pre>volts = -0.5, dc col- lector current = 0, signal frequency (kc) = 100 Output Capacitance for dc collector-to-base volts = 5, dc emitter</pre>	С _{іЬ}	-	6	10	pf	
current = 0, frequency (kc) = 100 DC Forward-Current Transfer Ratio for dc	C _{ob}	-	4	6	pf	
collector-to-base volts = 0.5, dc col- lector ma. = 30	h _{FE}	30	50	-		



Small-Signal Short-Circuit Forward Current Transfer Ratio for dc collector- to-emitter volts = 5, dc collector ma. = 20,					
signal frequency (Mc) = 100	h _{fe}	-	10	-	
<pre>dc collector ma. = 30, dc base ma. = 1.5 Switching Time for dc collector supply volts = 5, dc collector ma. = 30:</pre>	Q _s d	-	90	-	pc
Delay time for dc base supply volts = -0.5, dc base-to-emitter volts = -0.5, turn-on dc base ma. = 4 Rise time for dc base supply volts = -0.5,	t d ^e	-	4.5	-	nsec
dc base-to-emitter volts = -0.5, turn-on dc base ma. = 4 Storage time for dc base supply volts = 5,	t _r e	-	6.5	10	nsec
<pre>turn-on dc base ma. = 1.5, turn-off dc base ma. = -3 Fall time for dc base supply volts = 5,</pre>	tsf	-	18	-	nsec
turn-on dc base ma. = 1.5, turn-off dc base ma. = -3 Total turn-off time for dc base supply volts = 5, turn-on dc base	t _f f	-	8	-	nsec
ma. = 1.5, total stored charge (pf) = 125	t _{Qs} ď	-	9	15	nsec
c See accompanying DC Collect Neasurement Circuit.	07-to-E1	itter L	atching-Vo	oltage (VCERL)

a

 $^{\rm d}$ See accompanying fotal-Stored-Charge (Q_s) and fotal furn-Off fime (tQ_s) Measurement Circuit.

e See accompanying Delay-fime (t_d) and Rise-fime (t_τ) Neasurement Circuit. f See accompanying Storage-fime (t_g) and Pull-fime (t_f) Neasurement Circuit.



 $\label{eq:construction} OPERATING CONSIDERATIONS, \\ DC COLLECTOR-TO-EMITTER LATCHING VOLTAGE (V_{CERL}) \\ MEASUREMENT CIRCUIT, \\ TOTAL-STORED-CHARGE (Q_s) and TOTAL TURN-OFF TIME (t_{Qs}) \\ MEASUREMENT CIRCUIT, \\ DELAY-TIME (t_d) and RISE-TIME (t_r) MEASUREMENT CIRCUIT, \\ STORAGE-TIME (t_s) and FALL-TIME (t_f) MEASUREMENT CIRCUIT, \\ and \\ RATING CHART \\ \end{array}$

shown under type 2N955A also apply to the 2N955



Transistor



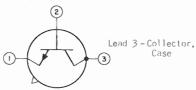
GERMANIUM N-P-N DOUBLE-DIFFUSED-JUNCTIDN MESA TYPE For Logic-Circuit Applications in Commercial and Military Data-Processing Equipment

GENERAL DATA

Mechanical:

Operating Position			Any
Maximum Length (Exclu	uding flexi	bleleads).	0.210"
Maximum Diameter			0.230"
Dimensional Outline .			JEDEC No. 70-18
Case			
Seals			Hermetic
Leads, Flexible			3
Minimum length			0.500"
Orientation and dia	ameter	See	Dimensional Outline
Terminal Diagram:	BOTTOM	I VIEW	

Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:		
With emitter open	12 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With base open	11 max.	volts
EMITTIR-TO-BASE VOLTAGE:		
With collector open	2 max.	volts
COLLICTOR CURRENT	100 max.	ma
TRANSISTOR DISSIPATION: ⁴		
At free-air temperature of 25 ⁰ Corbelow.	150 max.	mw
FREE-AIR TEMPERATURE RANGE:		
Operating and storage	65 to +100	oC
LEAD TEMPERATURE:		
For 10 seconds maximum ^b	230 max.	°C



b Measured 1/16" ± 1/32" down from seating plane.



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ELECTRICAL CHARACTERISTICS

LEUTATO	AL CHARA	TERIO	1100			
Voltage values are give	ven with	respec	t to base	unle	55	
otherwise specified.	Free-ai	r tempe	erature of	250	С.	
		Yin.	Typical	Nax.		-
DC Collector Breakdown Voltage for dc collector ma. = 0.1. dc emitter ma. = 0. DC Emitter Breakdown Voltage for dc collector		12	25	-	volts	
ma. = 0, dc emitter ma. = 0.1	BVEBO	2	5	-	volts	
DC Collector-to-Emitter Reach-Through Voltage . DC Collector-to-Emitter Latching Voltage for	V _{RT}	11	-	-	volts	
dc collector ma. = 100, external base-to- emitter resistance (ohms) = 1000 DC Base-to-Emitter	V _{CERL} °	9	-	_	volts	•
Saturation Voltage for dc collector ma. = 30, dc base ma. = 1 V DC Collector-to-Emitter Saturation Voltage for	BE ^(sat)	0.3	0.45	0.6	volt	
dc collector ma. = 30, dc base ma. = 1 V DC Collector-Cutoff Current for dc collec-	CE ^(sat)	-	0.35	0.5	volt	
tor volts = 5, dc emitter ma. = 0 Input Canacitance for dc	I _{CBO}	-	2	5	μa	
emitter volts = 0.5, dc collector ma. = 0 Output Capacitance for	C _{ib}	-	7	10	pf	
dc collector volts = 5, dc emitterma. = 0 Small-Signal Current Transfer Ratio for dc	C _{ob}	-	4	6	pf	
collector-to-emitter volts = 5, dc collector ma = 20, frequency (Mc) = 100 DC Current Transfer Ratio for dc collector-to-	h _{fe}	_	10	-		
emitter volts = 0.5, dccollectorma. = 30 Total Stored Charge for	h _{FE}	30	60	-		
dc collector ma. = 30, dc base ma. = 1.5	Qs ^d	-	90	125	рс	

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= -0.5, ' base-to-e	olts = 5, supply volts "off" dc emitter volts	ţ				
ma. = 30, base ma. fWith dc coc supply v dc base s = -6, "of	= 4		-	4.5	-	nsec
-0.5, dc ma. = 10, base ma. Rise Time: *With dc cc supply vo base supp	collector , "on" dc = 1	t _r		11	-	nsec
-0.5, dc ma. = 30, base ma. fWith dc cc supply vo dc base s = -6, "ol	= 4 pllector plts = 3.5, supply volts ff" dc base-		-	6.5	10	nsec
-0.5, dc ma. = 10 base ma. Storage Time: With dc co supply vo	= 1	t _s	_	20	-	nsec
5, dc col = 30, "or ma. = 1.5 base ma. With dc co supply vo dc base s	llector ma. n" dc base 5, "off" dc = -3 ,		-	18	-	nsec
ma. = 10. base ma.			-	45	_	nsec



RADIO CORPORATION OF AMERICA Semiconductor & Materials, Division Montel Action History Somerville, N. J. DATA 2 2-62

		Min.	Typical	Max.		
<pre>Fall Time: 9With dc collector supply volts = 5, dc base supply volts = 5, dc collector ma. = 30, "on" dc base definition dc base</pre>	tf					•
<pre>ma. = 1.5, "off" dc base ma. = -3 "With dc collector supply volts = 3.5, dc base supply volts = 10, dc collectorma. = 10, "on" dc base ma. = 1, "off" dc</pre>		_	8	_	nsec	•
ha 1, orr base ma. = -0.25 Total Turn-Off Time for total stored charge (pc) = 125, dc collec- tor supply volts = 5, dc base supply volts = 5, dc collector ma. = 30, "on" dc base ma.			50	-	nsec	•
= 1.5	t _{Qs} ď	-	9	15	nsec	

^C See accompanying DC Collector-to-Smitter Latching-Voltage (V_{CBRL}) Neasurement Circuit.

 ${\bf d}$ See accompanying fotal-Stored-Charge (Q_S) and fotal furn-Off fime (t_{Q_S}) Neasurement Circuit.

e See accompanying Delay-fine (td) and Rise-fine (tr) Neasurement Circuit.

f See accompanying Alternate-De lay-fime and Rise-fime Measurement Circuit.

9 See accompanying Storage-fime (t_s) and Pall-fime (t_f) Neasurement Circuit.

h See accompanying Alternate-Storage-Time and Pall-Time Neasurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standof device made of good dielectric material to prevent the solder







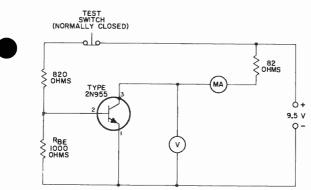
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

DC COLLECTOR-TO-EMITTER LATCHING-VOLTAGE (V_{CERL}) MEASUREMENT CIRCUIT

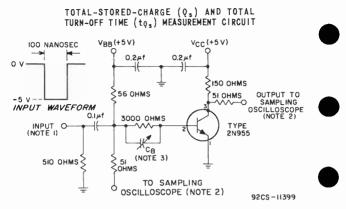


92CS-11398



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Wold Redio History

DATA 3 2-62

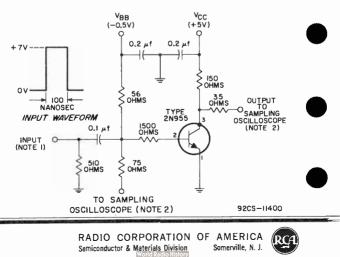


NOTE I: FROM TEKTRONIX TYPE IIO MERCURY PULSER, OR EQUIVALENT.

NOTE 2: HEWLETT-PACKARD TYPE 185A, OR EQUIVALENT.

NOTE 3: FOR MEASUREMENT OF O_S , C_B IS A CALIBRATED VARIABLE CAPACITOR HAVING A RANGE OF APPROXIMATELY 3.5 TO 35 MICRO-MICROFARADS. FOR MEASUREMENT OF t_{O_S} , C_B IS A FIXED CAPACITOR HAVING A VALUE OF 27 MICROMICROFARADS ± 2 PER CENT.

DELAY-TIME (td) AND RISE-TIME (tr) MEASUREMENT CIRCUIT



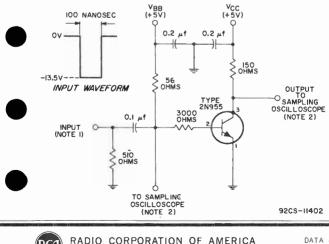
EQUIVALENT. HEWLETT-PACKARD TYPE 1854, OR EQUIVALENT. NOTE 2: ALTERNATE-DELAY-TIME AND RISE-TIME MEASUREMENT CIRCUIT NOTE: Except for supply-voltage polarities, this circuit is identical with that used to measure "Turn-On" Time (Delay time + rise time) for Type 2N705. TO OSCILLOSCOPE TO OSCILLOSCOPE TO OSCILLOSCOPE (for input-waveform (for output-waveform measurement) measurement) (trigger connection) (NOTE I) (NOTE I) (NOTE I) 0 100 TYPE 5100 OHMS 2N955 RELAY (NOTE 2) OHMS 3 iw 0.5 W 0 \sim IOOOO OHMS c 300 7500 0.5 W OHMS 0.5 W OHMS 1100 0HMS 0.5 W IW 6 ć IIO V +10 V VBB Vcc (+3.5 V) AC SUPPLY (-6V) 92CS-11403

NOTE I:

FROM TEKTRONIX TYPE IIO MERCURY PULSER, OR

NOTE I: TEKTRONIX TYPE 545, OR EQUIVALENT. NOTE 2: C.P. CLARE MERCURY RELAY TYPE HG-2A-1004, OR EQUIVALENT.

STORAGE-TIME (ts) AND FALL-TIME (tf) MEASUREMENT CIRCUIT



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Semiconductor & Materials Division

DATA 4 2-62 NOTE I: FROM TEKTRONIX TYPE IIO MERCURY PULSER, OR EQUIVALENT.

NOTE 2: HEWLETT-PACKARD TYPE 185A, OR EQUIVALENT.

ALTERNATE-STORAGE-TIME AND FALL-TIME MEASUREMENT CIRCUIT NOTE: Except for supply-voltage polarities, this circuit is identical with that used to measure "Turn-Off" Storage Time and "Turn-Off" Fall Time for Type 2N705. TO OSCILLOSCOPE (for input-waveform measurement) TO OSCILLOSCOPE TO OSCILLOSCOPE (for output-woveform measurement) (trigger connection) (NOTE I) (NOTE I) (NOTE I) 0 5100 TYPE RELAY OHMS 0.5W 2N955 F (NOTE 2) -0 -0 2 10000 OHMS 0.5W 7500 100 300 0HMS 0.5₩ OHMS OHMS IW -2.5 vo AC SUPPLY V_{BB} (+IOV) Vcc (+3.5V)

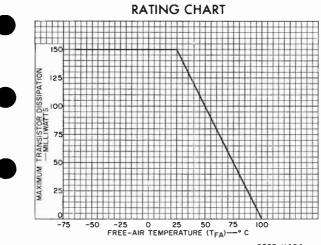
92CS-11401

NOTE I: TEKTRONIX TYPE 545, OR EQUIVALENT.

NOTE 2: C.P. CLARE MERCURY RELAY TYPE HG-2A-1004, OR EQUIVALENT.



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9205-11404



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World References DATA 5 2-62

JEDEC No.TO-18 .230" MAX. 209" MIN. DIA. .195" MAX. .178" MIN. DIA. .210 " MAX. .170" MIN. SEATING PLANE à -.030" MAX. .500" MIN. 3 LEADS .017"+.002" DIA. (NOTE I) .100"≥ -.050" INSULATION .100" DIA 450 (NOTE 2) INDEX-(NOTE 3) .046" MAX. .036" MIN. MÄX. -NOTE 4

92CS-10605R2

NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE C.028" MINIMUM AND O.048" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".



Transistor

GERMANIUM P-N-P DOUBLE-DIFFUSED-JUNCTION TYPE

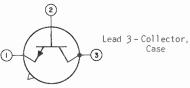
For High-Speed Logic-Circuit Switching Applications in Commercial and Military Data-Processing Systems. The 2N955A is Unilaterally Interchangeable with Type 2N955.

GENERAL DATA

Mechanical: Dimensions....

Dimensions..... See Outline TO-18 in General Section Terminal Diagram: BOTTOM VIEW

Lead 1-Emitter Lead 2-Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open	ts
CBD	
COL_ECTOR-TO-EMITTER VOLTAGE: With base open	ts
With collector open VEBO 2 max. vol COLLECTOR CURRENT Ic 100 max.	
TRANSISTOR DISSIPATION: P At free-air temperature	
of 25°C or below	mw
Groudge	ос ОС
LEAD TEMPERATURE: ^b For 10 seconds maximum T _L 230 max.	оC

a See accompanying Rating Chart.

b Measured 1/16" ± 1/32" along lead, down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials, Division Somerville, N. J. DATA I 8-62

ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS					
Free-air tempera	ture = 2	5° C			
	Min.	Typical	Max.		
DC Collector-to-Base Breakdown Voltage for dc collector ma. = 0.1, dc emitter current = 0. BV _{CBO} DC Collector-to-Emitter Breakdown Voltage for	12	25	-	volts	
dc collector ma. = 5, dc emitter current = 0. BV _{CEO} DC Emitter-to-Base Breakdown Voltage for dc collector current	8	15	-	volts	
= 0, dc emitter ma. = 0.1BV _{EBO} DC Collector-to-Emitter Reach-Through Voltage for dc collector-to- base volts = 12, dc emitter-to-base float-	2	6	-	volts	•
ing potential (volts) = 1 V _{RT} DC Collector-to-Emitter Latching Voltage for dc collector ma. = 100, external base-to- emitter resistance	11	-	-	volts	
(ohms) = 1000 V _{CERL} ^c DC Base-to-Emitter Sat- uration Voltage for dc collector ma. = 30,	9	-	-	volts	
dc base ma. = 1 V _{BE} (sat DC Collector-to-Emitter Saturation Voltage: V _{CE} (sat With dc collector ma.		0.45	0.6	volt	
= 30, dc base ma. = 1	-	0.22	0.3	volt	•
= 100, dc base ma. = 5 DC Collector-Cutoff Current for dc col-	-	0.45	0.6	volt	
<pre>lector volts = 5, dc emitter current = 0 CBO Input Capacitance for dc emitter-to-base volts = -0.5, dc col- lector current = 0, signal frequency (kc)</pre>	-	0.6	5	μa	
= 100 C _{ib}	-	6	10	pf	

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Semiconductor & Materials Division

2N955A

•	Output Capacitance for dc collector-to-base volts = 5, dc emitter current = 0, frequency {kc} = 100 DC Forward-Current Transfer Ratio for dc collector-to-base	C _{ob}	-	4	6	pf
•	<pre>volts = 0.3, dc col- lector ma. = 30 . Small-Signal Short-Cir- cuit Forward Current Transfer Ratio for dc collector-to-emitter volts = 5, dc collector</pre>	h _{FE}	30	50	-	
	ma. = 20, signal fre- quency (Mc) = 100 Total Stored Charge for	h _{fe}	-	10	-	
	dc collector ma. = 30, dc base ma. = 1.5	Q _s d	_	45	65	pc
	Collector-to-Base Time Constant for dc col- lector supply volts = 3.5, dc collector- to-base volts = 3, dc emitter ma. = 10, fre- quency (Mc) = 31.9 Switching Time for dc collector supply volts = 5, dc collector ma. = 30: Delay time for dc base supply volts = -0.5, dc base-	r _b ,C _c e	-	150	250	psec
	to-emitter volts = -0.5, turn-on dc base ma. = 4 Rise time for dc base supply volts = -0.5, dc base-	t _d f	-	4.5	-	nsec
	to-emitter volts = -0.5, turn-on dc base ma. = 4 Storage time for dc base supply volts = 5, turn-on dc	t _r f	_	6.5	10	nsec
	base ma. = 1.5, turn-off dc base ma. = -3 Fall time for dc base supply volts = 5, turn-on dc	t s ^g	-	5	-	nsec
	base ma. = 1.5, turn-off dc base ma. = -3	t _f g	-	8	_	nsec



RADIO CORPORATION OF AMERICA

Somerville, N. J.

DATA 2 8-62

Semiconductor & Materials Division World Radio Histo

- Total turn-off time for dc base supply volts = 5, turn-on dc base ma. = 1.5, total stored charge (pf) = 65.....
 - . t_{Qs}^d 6 10 nsec
- C See accompanying DC Collector-to-Bmitter Latching-Voltage (VCBRL) Neasurement Circuit
- d See accompanying fotal-Stored-Charge (Q_S) and fotal furn-Off fime (tQ_S) Measurement Circuit.
- ^e See accompanying Collector-to-Base fime-Constant Neasurement Circuit.
- † see accompanying Delay-fime (td) and Rise-Time (tr) Measurement Circuit. See accompanying Storage-Fime (ts) and Pall-fime (tf) Measurement Circuit.

OPERATING CONSIDERATIONS

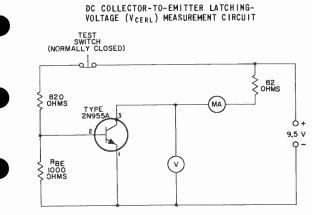
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Ctherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

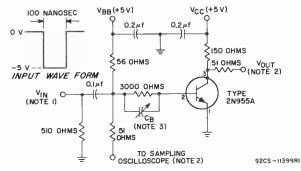






92CS-1/398RI

TOTAL-STORED-CHARGE (0.) AND TOTAL TURN-OFF TIME (to,) MEASUREMENT CIRCUIT



FROM A PULSE GENERATOR HAVING Rg = 50 OHMS AND NOTE 1: tr < 1 NANOSECOND.

NOTE 2: SAMPLING OSCILLOSCOPE INPUT IMPEDANCE = I MEGOHM SHUNTED WITH 3 PICOFARADS, tr = 0.35 NANOSECOND.

NOTE 3: FOR MEASUREMENT OF Qs, C8 IS A CALIBRATED VARI-ABLE CAPACITOR HAVING A RANGE OF APPROXIMATELY 3.5 TO 35 PICOFARADS. FOR MEASUREMENT OF tos, CB IS A FIXED CA-PACITOR HAVING A VALUE OF:

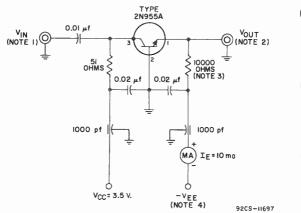
FOR 2N955A, 14 pf ± 2 PER CENT FOR 2N955, 27 pf ± 2 PER CENT

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COLLECTOR-TO-BASE TIME-CONSTANT (rb.Cc) MEASUREMENT CIRCUIT

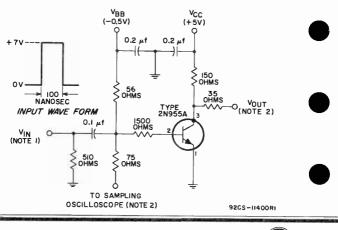


NOTE 1: VIN = 0.5 RMS VOLTS, FREQUENCY = 31.9 Mc, SIGNAL GENERATOR IMPEDANCE = 50 OHMS.

NOTE 2: $v_{0.0T}$ MEASURED WITH RF VOLTMETER, $r_b{}^{1}C_c = 10 \ v_{0.0T}$, where $r_b{}^{1}C_c$ is in picoseconds and $v_{0.0T}$ is in millivolts. NOTE 3: HIGH-FREQUENCY TYPE.

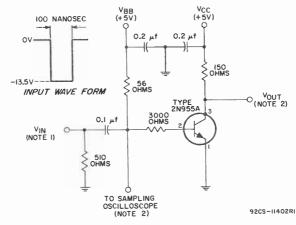
NOTE 4: ADJUSTED FOR AN EMITTER CURRENT OF IO MILLI-AMPERES.

DELAY-TIME (td) AND RISE-TIME (tr) MEASUREMENT CIRCUIT



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division NOTE 1: FROM A PULSE GENERATOR HAVING R_g = 50 OHMS AND $t_{\,\rm f}$ < 1 NANOSECOND.

NOTE 2: SAMPLING OSCILLOSCOPE INPUT IMPEDANCE = 1 MEGOHM SHUNTED WITH 3 PICOFARADS, tr = 0.35 NANOSECOND.



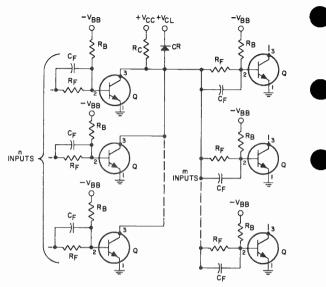
STORAGE-TIME (ts) AND FALL-TIME (tr) MEASUREMENT CIRCUIT

NOTE I: FROM A PULSE GENERATOR HAVING $R_g = 50$ OHMS AND $t_r \le 1$ NANOSECOND.

NOTE 2: SAMPLING OSCILLOSCOPE INPUT IMPEDANCE = 1 MEGOHM SHUNTED WITH 3 PICOFARADS, tr = 0.35 NANOSECOND.



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RCTL CIRCUIT FOR MEASUREMENT OF PROPAGATION DELAY PER STAGE

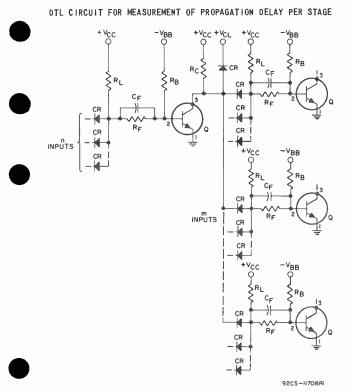
92CS-11709RI

m = n = 5

NOTE: ALL CAPACITANCE, RESISTANCE, AND VOLTAGE VALUES HAVE ± 5 PER CENT TOLERANCE. OPERATING TEMPERATURE RANGE = 0° to 55° C.



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m = n = 4

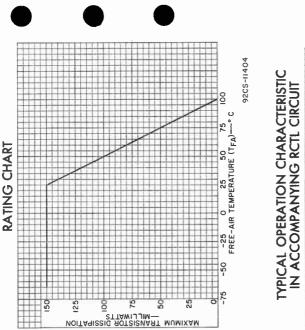
C _F = 30 pf	$R_{B} = 24000 \text{ ohms}$	V _{BB} = 15 volts
Cg = Type IN955	$R_{C} \approx R_{L} = 2000 \text{ ohms}$	V _{CC} = 15 volts
Q = Type 2N955A	R _F = 1800 ohms	V _{CL} = 5 volts

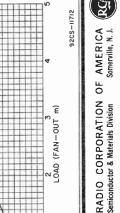
NOTE: ALL CAPACITANCE, RESISTANCE, AND VOLTAGE VALUES HAVE ± 5 PER CENT TOLERANCE. OPERATING TEMPERATURE RANGE = 0° to 55° C.

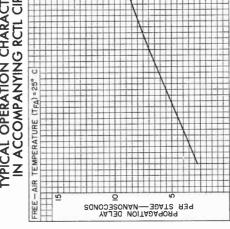


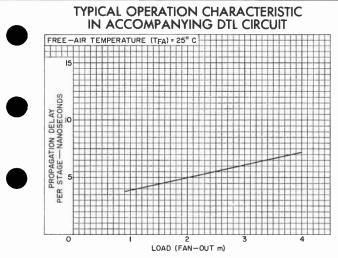
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92CS-11711



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 6 8-62

World Radio History

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

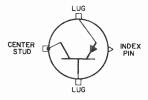
For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position		 		Any
Maximum Seated Length	• •	 		0.520"
Maximum Diameter				
Dimensional Outline				
Case				
Seals	• •	 · · ·		Hermetic
Terminal Diagram (See Dime			:	

BOTTOM VIEN



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute Naximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased

	with emitter-to-base reverse bridged	
	(DC emitter-to-base volts = -1.5)80 max.	volts
,	EMITTER-TO-BASE VOLTAGE	volts
	COLLECTOR CURRENT	amp
	EMITTER CURRENT	amp
	BASE CURRENT	amp
	TRANSISTOR DISSIPATION: *	+-
	At case temperatures ^b of 25 ^o C or below . 150 max.	watts
	CASE-TEMPERATURE RANGE:	
,	Operating and storage65 to +100	°C
	Typical Operation:	
	In a common emitter, base-input, power-switch-	
	ing circuit at case temperature b of 25° C	
	DC Supply Voltage	volts
	DC Base-Bias Voltage 6	volts
	"On" DC Collector Current	amp
	"Turn-On" Base Current2	amp
	"Turn-Off" Base Current 0	amp
	Indicates a	change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History DATA 1 8-61





Switching Time: Rise time Fall time	· · · ·	••••	· · · · ·	15 15	μsec μsec	
a <ee accompanying="" c<br="" rating="">Chart in General Section. b Measured at any point on se</ee>	hart and eating su	also <i>fr</i> rface.	ansistor-D	issipati	on Rating	
+ ELECTR	ICAL CHA	RACTER	ISTICS			
Voltage values are g	iven wi	th resp	bect to b	ase and	at	
case temperatureb of	25° C ui	nless (Min.	Typical		ied	
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc col- lector amperes =		<i></i>	<i>Typicat</i>	<i>пц</i> л.		
-0.3 With base open: For dc collector	BV _{CES} BV _{CEO}	-70	-	-	volts	
amperes = -0.3 For dc collector		-	-60	-	volts	
amperes = -1 ^c DC Base-to-Emitter		-55	-	-	volts	
Voltage for dc col- lector-to-emitter volts = -2, dc col- lector amperes = -5. DC Collector-to-Emitter Saturation Voltage for dc collector	V _{BE}	-	-0.65	-0.9	volt	
<pre>amperes = -12, dc base amperes = -2 DC Emitter Voltage for dc collector volts = -80, dc emitter</pre>	V _{CE} (sat)	-	-0.3	-0.7	volt	
current = 0 DC Punch-Through	V _{EB}	-	-0.15	-1	vo)t	
Voltage DC Emitter-Cutoff	V _{PT}	-80	-	-	volts	
Current for dc emitter volts = -40, dc col- lector current = 0 DC Collector-Cutoff Current: With dc collector volts = -2, dc	I _{EBO}	-	-1	-4	ma	
witter current = 0		-	100	-	μa	
emitter current = 0		-	-2	-4	ma	۲

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+ indicates a change.

With dc collector volts = -80, dc emitter current = 0, case temperature ^b = 71 ^o C DC Current Transfer Ratio for dc col- lector-to-emitter volts = -2, dc collector amperes = -5 Heta-Cutoff Frequency for dc collector-to- emitter volts = -6.	h _{FE}	- 35 -	- 25	-15 70	ma
dc collector amperes = -5 Thermal Resistance:	fae	-	10	_	kc
Junction-to-case Thermal Capacity for	RT	-	0.35	0.5	^o C/watt
pulse duration of 1 to 10 milliseconds		-	0.075	_	watt- sec/ ^O C
Thermal Time Constant	\mathcal{T}_{\parallel}	-	26.25	-	msec

^b Measured at any point on seating surface.

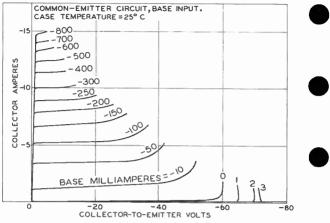
c Tested by sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS, OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, TYPICAL BASE-CHARACTERISTICS CURVES, and TYPICAL CHARACTERISTICS CURVES shown under Type 2N173 also apply to the 2N1099



- Indicates a change.

TYPICAL COLLECTOR CHARACTERISTICS



92CS-10733





Power Transistor

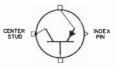
GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position											Any
Maximum Overall Length.											1.230"
Maximum Seated Length .											0.520"
Maximum Diameter											1.250"
Dimensional Outline											JEDEC No. TO-36
Case											. Welded, Metal
Seals											Hermetic
Terminal Diagram (See Dimensional Outline):											
BOTTOM VIEW											



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute Haximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased	
(DC emitter-to-base volts = -1.5)80	max. volts
EMITTER-TO-BASE VOLTAGE	max. volts
CULLECTOR CURRENT15	max amo
EMITTER CURRENT	max. amp
BASE CURRENT	max. amp
TRANSISTOR DISSIPATION:	
At case temperature of 25° C	max. watts
CASE-TEMPERATURE RANGE:	
Continuous operation	> +95 ℃
Intermittent operation	+100 °C
Storage	+100 °C

Typical Operation:



In a common emitter, base-input, power-switch-	
ing circuit at case temperature of 25° C	
DC Supply Voltage	volts
DC Base-Blas Voltage.	volts
"On" DC Collector Current	amp
"Turn-On" Base Current	amp
"Turn-Off" Base Current 0	amp



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Switching Time:											
Rise time									15	μsec	
Fall time											

See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

	0.00					
Voltage values are	given	with re	spect to	base	and	
case temperature of	25° C 1	unless o	otherwise	specij	fied	
		Min.	Typical	Max.		
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc col-						_
lector amperes = -0.3 With base open: For dc collector	BVces BV _{ceo}		-	-	volts	D
amperes = -0.3 .		-	-60	-	volts	
For dc collector amperes = -1^{\bullet} .		-55	-	-	volts	
DC Base-to-Emitter Voltage* for dc col- lector-to-emitter volts = -2, dc col-						
<pre>lector amperes = -5 DC Collector-to-Emitter Saturation Voltage* for dc collector amperes = -12, base</pre>	V _{BE}	-	-0.65	-0.9	volt	
amperes = -2 DC Emitter Voltage for dc collector volts = -80, dc emitter	V _{CE}	-	-0.3	-0.7	volt	
amperes = 0	V _{EB}	-	-0.15	-1	volt	
Voltage DC Emitter-Cutoff	۷ _P	-80	-	-	volts	
Current for dc emitter volts = -40, dc col- lector amperes = 0 DC Collector-Cutoff	I _{EBO}	-	-1	-8	та	
Current: With dc collector volts = -2, dc emitter amperes = 0	I _{СВО}	_	100	_	μα	
With dc collector volts = -80, dc emitter amperes = 0		_	-2	-8	ma	

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CA RC

With dc collector volts = -80, dc emitter amperes = 0, case temperature = 71° C DC Current Transfer Ratio* for dc col- lector-to-emitter volts = -2, dc	h _{FE}	-	-	-15	ma
Collector amperes = -5		35	_25	70 _	
= -5	$f_{\alpha e}$	-	10	-	kc
Junction-to-case Thermal Capacity for pulse duration of 1 to	R _T	-	0.5	0.8	^o C/watt
10 milliseconds		-	0.075	-	watt- sec/ ^o C
Thermal Time Constant	$\mathcal{T}_{ }$	-	37.5	-	msec

Sweep voltage used to perform test.

* Measured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying *Suggested Mounting Arrangement*). Electrical connection to the base and to the emitter is made to their respective terminals.

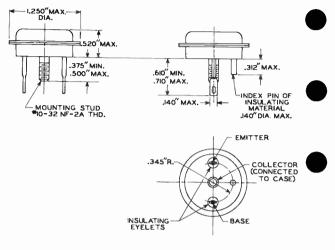
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



The maximum torque on mounting stud should not exceed 12 inch-pounds.

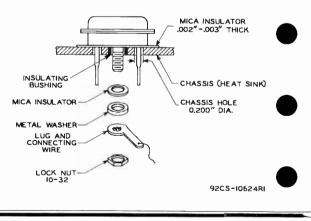


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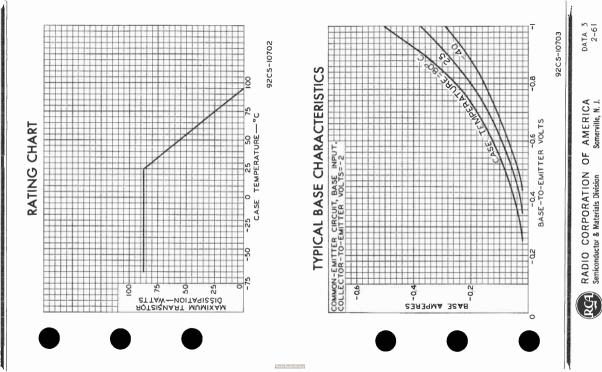
92CM-10612RI

SUGGESTED MOUNTING ARRANGEMENT



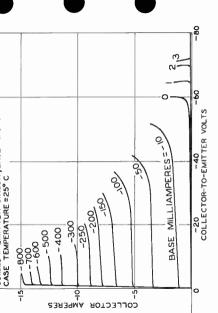
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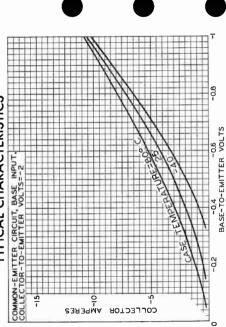








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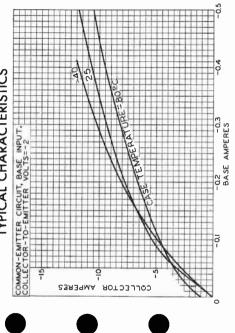


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World Radio History

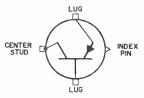
Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position																	Any
Maximum Seated Length																	0.520"
Maximum Diameter																	1.250"
Dimensional Outline .	•	٠	٠	•	•	•							• •	JEI)E(C N	lo.T0-36
Case	•	٠	٠	٠	·	·	•	·	٠	•	٠			We	elo	led	I, Metal
Seals	•	٠	·	٠	٠	÷	·	·	·	٠	·	•	·	·	·	.н	lermetic
Terninal Diagram (See		1 TR 6							11	10	:						



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:

With emitter-to-base reverse biased

	With emitter-to-base reverse blased	
	(DC emitter-to-base volts = -1.5)100 max.	volts
'	EMITTER-TO-BASE VOLTAGE	volts
	COLLECTOR CURRENT	amp
	EMILTER CURRENT	amp
	BASE CURRENT	amp
	TRANSISTOR DISSIPATION: *	· · ·
	At case temperatures ^b of 25 ^o C or below. 150 max. CASE-TEMPERATURE ^b RANGE:	watts
)	Operating and storage65 to +100	°C
	Typical Operation:	
	In a common-emitter, base-input, power-switch-	
	ing circuit at case temperature ^b of 25°C	
	DC Supply Voltage	volts
	DC Base-Bias Voltage	volts
)	"Un" DC Collector Current	amp
	"lurn-Cn" Base Current	amp
	"Turn-Off" Base Current 0	amp
	-Indicates a	



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DATA 1 8-61

Switching Time: Rise time Fall time	•••	• • • •	 	. 15 . 15	μsec μsec						
 a See accompanying Rating Charts in General Section. b Measured at any point on sea 			or-Dissipa	tion Rati	ng Chart	•					
ELECTRICAL CHARACTERISTICS											
Voltage values are given with respect to base and at case temperature ^b of 25°C unless otherwise specified											
		Nin.				-					
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector amperes = -0.3	BVCES	-80	_	_	volts						
With base open: For dc collector amperes = -1° DC Base-to-Emitter Voltage for dc col-	8V _{CEO}	-65	-	-	volts	•					
lector-to-emitter volts = -2, dc collector amperes = -5 DC Collector-to-Emitter Saturation Voltage for	V _{BE}	_	-0.65	-0.9	volt						
dc collector amperes = -12, dc base amperes=-2. DC Emitter Voltage for dc collector volts =	V _{CE} (sat)	-	-0.3	-0.7	volt						
-100, dc emitter current = 0 DC Punch-Through Voltage . DC Emitter-Cutoff Current for dc emitter volts	V _{EB} V _{PT}	-100	-	_1 _	volt volts						
= -80, dc collector current = 0 DC Collector-Cutoff Current: With dc collector volts	I _{EBO} I _{CBO}	-	-1	-4	ma	•					
= -2, dc emitter current = 0 With dc collectorvolts		-	100	-	μa						
= -100, dc emitter current = 0 With dc collectorvolts = -100, dc emitter		-	-2	-4	ma						
current = 0, case temperature ^b = 71 ^o C.		-	-	-15	ma						

-Indicates a change.

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DC Current Transfer Ratio for dc collector-to- emitter volts = -2, dc collector amperes =	h _{FE}	Ē			
-5		25	-	50	
-12		-	20	-	
Beta-Cutoff Frequency for					
dc collector-to-emitter					
volts = -6, dc collector	£		10		1
amperes = -5	lae		10	-	kc
Junction-to-case.	R_	_	0.35	0.5	⁰C/watt
Thermal Capacity for pulse	ΥT		0.70	0.0	0/ 4011
duration of 1 to 10					
milliseconds		-	0.075	-	watt-
The second The Constant			00.05		sec/ºC
Thermal Time Constant	\mathcal{T}_{1}	-	26.25	-	msec

b Measured at any point on seating surface.

c Tested be sweep method to prevent excessive heating of collector junction.

PERFORMANCE TESTS

This transistor type is designed to pass the environmental tests specified in Military Specification MIL-S-19500B.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter lugs by means of clips or by soldering directly to the lugs. When soldering connections are made to the lugs, care should be taken to conduct excessive heat away from the lug seals, otherwise the heat of the soldering operation will crack the glass seals of the lugs and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Hounting Arrangement). Electrical connection to the base and to the emitter is made to their respective lugs.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

The maximum torque on mounting stud should not exceed 12 inch-pounds.

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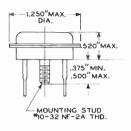
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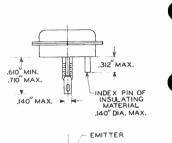


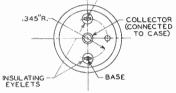




JEDEC No.TO-36

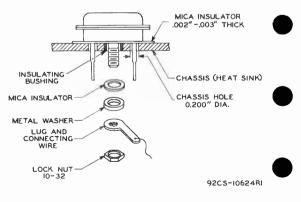






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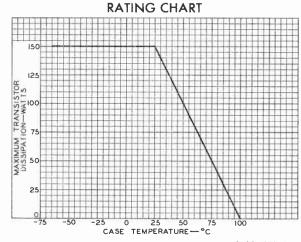
SUGGESTED MOUNTING ARRANGEMENT



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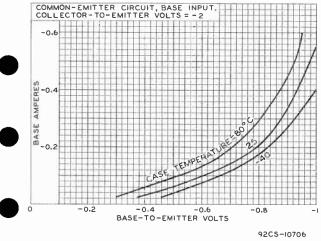
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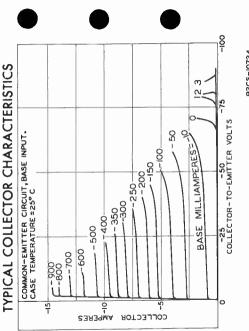




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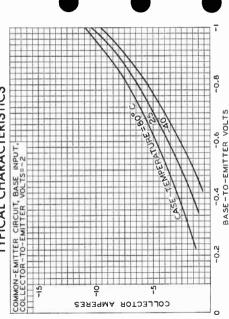


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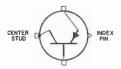
Power Transistor

GERMANIUM P-N-P ALLOY TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position					Any			
Maximum Överall Length					1.230"			
Maximum Seated Length					0.520"			
Maximum Diameter								
Dimensional Outline					JEDEC No.TO-36			
Case					Welded, Metal			
Seals					Hermetic			
Terminal Diagram (See Dimensional Outline):								
BOTTOM VIEW								



INDUSTRIAL SERVICE

Such as in dc-to-dc converter. inverter, chopper, voltage- and current-regulator, dc- and audio amplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter-to-base reverse biased	
(DC emitter-to-base volts = -1.5)100) max. volts
EMITTER-TO-BASE VOLTAGE) max. volts
	j max. amp
	5 max. amp
	1 max. amp
TRANSISTOR DISSIPATION: *	
At case temperature of 25° C 87.5	5 max. watts
CASE-TEMPERATURE RANGE:	
	to +95 °C
Intermittent operation65 t	o +100 °C
Storage	o +100 °C
Typical Operation:	

In a common switching cir						
DC Supply Voltage DC Base-Bias Voltage. "On" DC Collector Cur "Turn-On" Base Currer "Turn-Off" Base Currer	rent		 •	 • •	-12 6 -12 -2 0	volts volts amp amp

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Switching Time: Rise time			· •	15 15	μsec μsec					
See accompanying Rating Cha Chart in General Section.	rtancia	ilso Tra	nsistor-D	issipatio	n Rating					
ELECTRIC	ELECTRICAL CHARACTERISTICS									
	Voltage values are given with respect to base and case temperature of 25°C unless otherwise specified									
		Min.	Typical	Max.						
DC Collector-to-Emitter Breakdown Voltage: With base connected to emitter, dc collector			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	,,		-				
amperes = -0.3 With base open: For dc collector	BVCES	-80	-	-	volts					
amperes = -1• DC Base-to-Emitter Voltage* for dc col- lector-to-emitter volts = -2, dc collector	BV _{CEO}	-65	-	-	volts	_				
amperes = -5 DC Collector-to-Emitter Saturation Voltage* for dc collector amperes =	V _{BE}	-	-0.65	-0.9	volt					
-12, base amperes = -2. DC Emitter Voltage for dc collector volts = -100, dc emitter	V _{CE}	-	-0.3	-0.7	volt					
<pre>amperes = 0 DC Punch-Through Voltage. DC Emitter-Cutoff Current for dc emitter volts = -80, dc collector</pre>	V _{EB} V _P	-100	-	-1 -	volt volts	_				
amperes = 0 DC Collector-Cutoff Current: With dc collector volts = -2, dc emitter	^I _{ЕВО} ^I _{СВО}	-	-1	-8	ma					
amperes = 0 With dc collector volts = -100, dc emitter		-	100	-	μа					
amperes = 0 With dc collector volts = -100, dc emitter amperes = 0, case		-	-2	-8	ma					
temperature = 71° C .		-	-	-15	ma					

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DC Current Transfer Ratio* for dc collector-to- emitter volts = -2, dc collector amperes =	h _{fe}			
-5	25	_	50	
-12	2.0	20		
Beta-Cutoff Frequency* for		20		
dc collector-to emitter				
volts = -6 , ac col-				
lector amperes = -5	f –	10	_	kc
Thermal Resistance:	ae	10		
Junction-to-case	R	0.5	0.8	°C/watt
Thermal Capacity for pulse		010		
duration of 1 to 10				
milliseconds	_	0.075	_	watt-
				sec/OC
Thermal Time Constant ;	Τ	37.5	_	msec
	·			

Sweep voltage used to perform test.

Keasured in a common-emitter, base-input circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

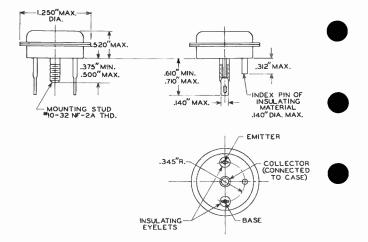
Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying *Suggested Mounting Arrangement*). Electrical connection to the base and to the emitter is made to their respective terminals.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock nazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

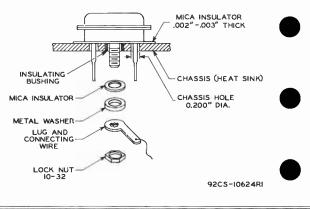
The maximum torque on mounting stud should not exceed 12 inch-pounds.





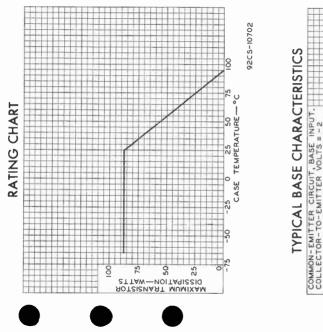
92CM-10612RI

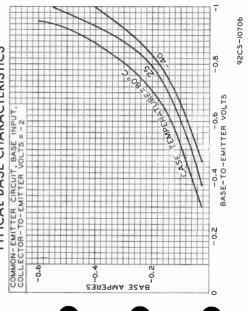
SUGGESTED MOUNTING ARRANGEMENT



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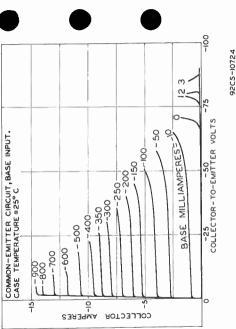
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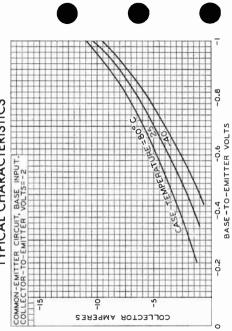








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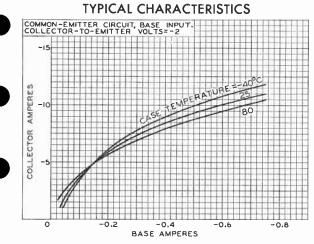
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World Radio History

Bidirectional Transistor

GERMANIUM N-P-N ALLOY TYPE

For Medium-Speed Switching Service in Industrial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position	
Max'mum Diameter	
Dimensional Outline JEDEC No. TO-5	5
Case	
Seals	
Leads, Flexible	3
Minimum length	1
Orientation and diameter See Dimensional Outline	
Terminal Diagram: BOTTOM VIEW	

Lead 1 -Emitter (Or Col- lector) Lead 2-Base	Lead 3-Collector (Or Emitter)
	\sim

SWITCHING SERVICE

Such as in bidirectional switching, coredriver, and ac-signal-relay circuits

Maximum and Minimum Ratings, Absolute-Maximum Values;

COLLECTOR-TO-BASE VOLTAGE	
Base-to-emitter volts = -1 20 max.	volts
Base open	volts
COLLECTOR CURRENT ±400 max.	ma
EMITTER CURRENT	ma
TRANSISTOR DISSIPATION:	
At ambient temperature of 25° C	mw
At ambient temperature of 55° C	mw
At ambient temperature of 71° C 10 max.	m₩
AMBIENT TEMPERATURE (During operation) 71 max.	°C
STORAGE-TEMPERATURE RANGE	°C

Typical Operation:

In accompanying typical inverter circuit at ambient temperature of 25° C

"On" Collector Current								200	та
"Turn-On" Base Current (IB.).								20	та
"Turn-Off" Base Current (1 _{B2})	•	•	·	٠	·	٠	٠	-20	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

DATA I 9-60

Switching Time: Delay time (t _d) Rise time (t _r) Storage time (t _s) Fall time (t _f)	· · · · · ·	• • • • • •	· · 0. · · 0.	45	μsec μsec μsec μsec	
See accompanying Rating Cha Chart in General Section.	rt and	also fr	ansistor-D	issipati	on Rating	
CHARACTERISTICS RANG	E VALU	ES FOR	EQUIPMEN	T DESI	GN	
Voltage values are giv less otherwise specifie	en witi d. Amb	h resp ient t	ect to th emperatur	e oase e of 25 ⁶	^{un~} C.	
00 Callester Breakdowe		Mın.	Typical	Max.		
DC Collector Breakdown Voltage for dc collector µa = -50, emitter open	BV en e	25	35	_	volts	
DC Punch-Through Voltage for dc	· O CBO	20)5		00113	
emitter volts = 1 DC Base-to-Emitter Voltage for dc	.V _P	20	35		volts	
collector ma. = 200, dc base ma. = 10 DC Collector-to-Emitter Saturation Voltage for dc collector ma.	.V _{BE}		1	1.5	volts	
= 200, dc base ma. = 10	.V _{CE}	-	0.1	0.3	volt	
collector volts = 12, emitter open	. I _{CBO}	-	3	10	μa	
= 0.3, dc collector ma. = 200 Alpha-Cutoff Frequency for dc collector volts = 6, dc collector ma.	• ^h fE	20	40	-		
	.f _{αb}	4.5	7	-	Мс	
lector ma. = 0 Thermal Time Constant Thermal Resistance between collector		_	19 12		μµf msec	
junction and free air .	.R _T	-	-	500	^o C/watt	-





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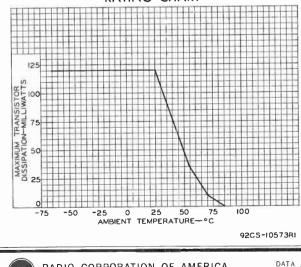
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

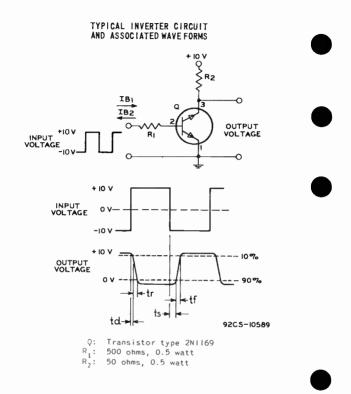
This transistor is intended for use in single-side printed circu't boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.



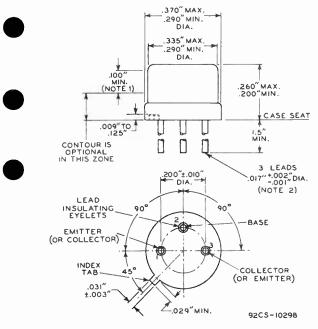
RATING CHART



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2 9-60





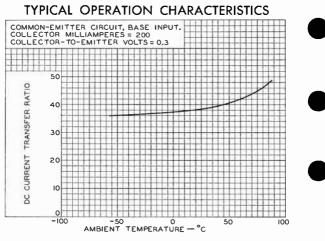


NOTE 1: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

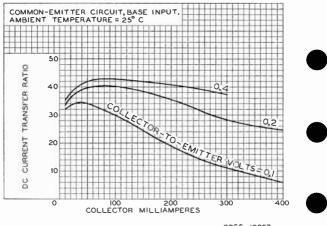
NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



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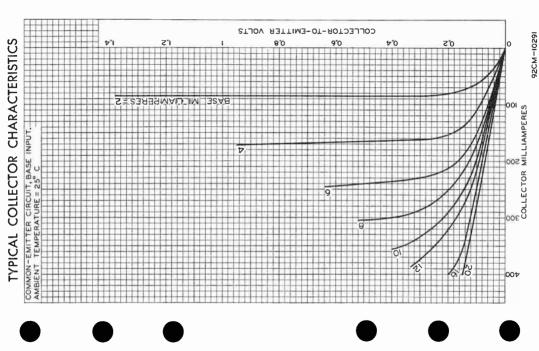
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92CS-10287

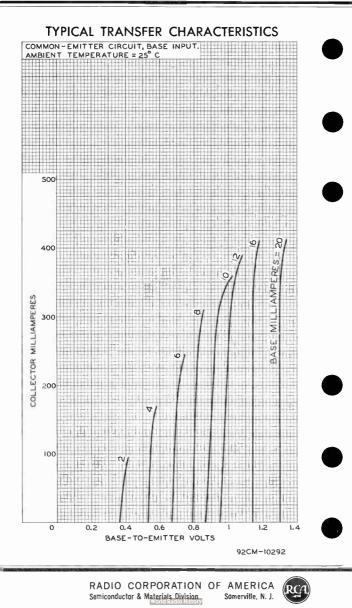




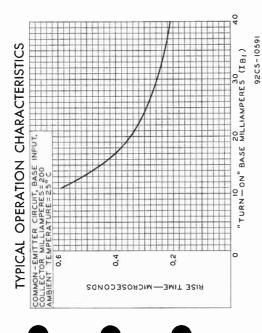


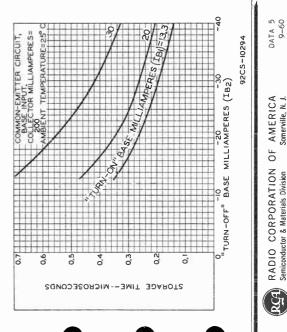
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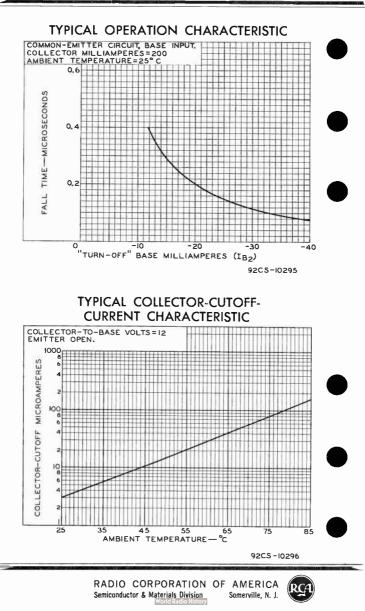
Somerville, N.

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CORPORATION & Materials Division

RADIO

Semiconductor



Bidirectional Transistor

GERMANIUM N-P-N ALLOY TYPE

For Medium-Speed SwitchingService in Industrial and Military Data-Processing Systems

The 2N1170 is the same as the 2N1169 except for the following stems:

SWITCHING SERVICE

Such as in bidirectional switching, coredriver, and ac-signal-relay circuits

Maximum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE					40 max.	volts
EMITTER-TO-BASE VOLTAGE			٠		40 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:						
Base-to-emitter volts = -1 .						
Base open	• •	• •	·	۰. ۱	20 max.	volts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

...

	Min.	Typical	Max.	
DC Collector Breakdown				
Voltage for dc collector $\mu a = -50$, emitter openBV _{CBO} DC Punch-Through Voltage	40	50	-	volts
for dc emitter volts = 1Vp DC Collector-Cutoff Cur- rent for dc collector	39	50	-	volts
volts = 12, emitter open	_	3	8	μa



World Radio History

Mesa Transistor

GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE For High-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position								 4	- ny
Maximum Lenoth (Excluding	fle	xit	le	le.	ads)			 0.26	50"
Maximum Diameter								 0.37	70"
Dimensional Outline									
Case									
Seals								 Hermet	tic
Leads, Flexible								 	3
Minimum length								 . 1.	.5"
Orientation and diameter									
Terminal Diagram:									
2		-							

Lead 1 - Emitter

Lead 2-Base



Lead 3-Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE		–13 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE		-12 max.	volts
EMITTER-TO- BASE VOLTAGE*.		-1 max.	volt
COLLECTOR CURRENT	•••	100 max.	ма
EMITTER CURRENT	• •	100 max.	ma
TRANSISTOR DISSIPATION: •	•••	100 max.	Incl
At ambient temperature of 25° C		150 max.	шw
At ambient temperature of 55° C		75 max.	mw
At ambient temperature of 71° C		35 max.	mw
AMBIENT-TEMPERATURE RANGE:	• • •	<i>))</i> max.	11.84
Operating and storage		65 to +85	°C
LEAD TEMPERATURE :			
For immersion in molten solder			-
for 10 seconds maximum		255 max.	°C
Typical Operation:			-
In an inverter circ		at	
ambient temperature o			
Collector-to-Emitter Voltage	• • •	-5	volts
Base Resistor	• • •	5000	ohms
Coliector Resistor		500	ohms
"iurn-Un" Base Voltage.		-5	volts
"Turn-Off" Base Voltage		5	volts
5			
		-≪—indicates a	cnange.



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"On" Collector Current. "Turn-On" Base Current. "Turn-Off" Base Current Switching Time:	:	:			•	:	:	:			-0.66 0.66	ma ma	4
Delay time (t _d) Rise time (t _r) Storage time (t _s) Fall time (t _f)	•	:	•	:	÷	÷	÷	÷	÷	÷	0.16	µsec µsec µsec µsec	

This rating may be exceeded and the emitter-to-base junction operated in the breakdown condition provided the emitter dissipation is limited to 30 millimetts at 25° C. For amblent temperatures above 25° C, the dissipation should be reduced by 0.5 milliwatt/°C.

Ь See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base unless otherwise specified. Ambient temperature of 25° C.

Min. Typical Max.

(OC Collector Breakdown Voltage for dc collec- tor ma. = -0.02.		.,,,			
(emitter openBV _{CE} DC Collector-to-Emitter	-13	-30	-	volts	
	Breakdown Voltage BV _{CEI} C Emitter Breakdown Voltage for dc emitter ma. = -0.1,	RL -12	-25	-	volts	
(Collector openBV _{EE} C Punch-Through Voltage. Vp C Base-to-Emitter Voltage for dc collec-	-1 -12	-3 -30	-	volts volts	
(tor ma. = -40, dc base ma. = -1 V _{BE} DC Collector-Cutoff Current for collec-	-	-0.3	-0.4	volt	
- (tor volts = -6, emitter open I _{CB} collector Capacitance for	0 -	-1	-3	μa	
(dc collector volts = -6, emitter open C _C C Current Transfer Ratio for dc collector-to-	-	8	12	<i>μμ</i> f	
C	emitter volts = -0.3, dc collector ma. = -10 h _{FE} main-Bandwidth Product ^e for collector-to-	30	50	-		
	emitter volts = -3, collector ma. = -10 GBW	25	40	_	Мс	

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- indicates a change.





Thermal Resistance: Junction-to-free air Total Stored Charge for	R _T	-	- ent	400	^o C/watt
dc collector ma. = -10,					
dc base ma. = -1	Qs	-	250	400	μμcoulombs
Thermal Time Constant	τ_1	-	10	-	msec

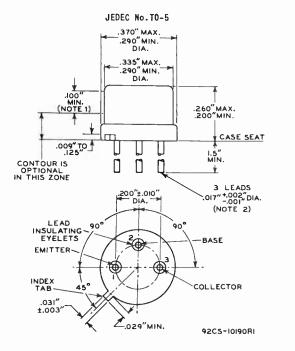
 $^{f c}$ Frequency at which the current transfer ratio is equal to 1.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

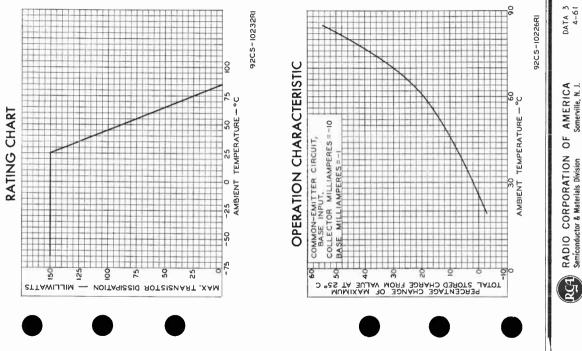




MOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

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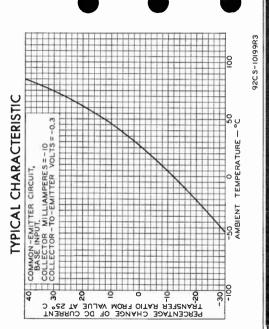
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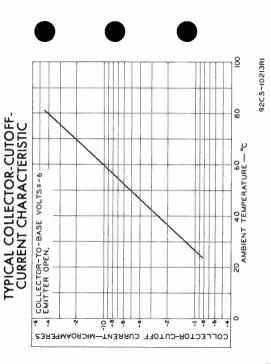
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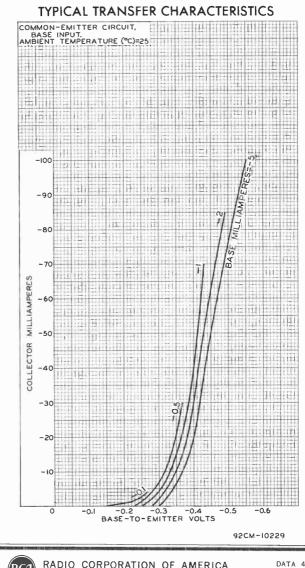
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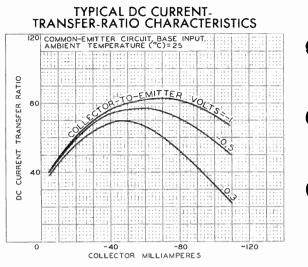


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World Radio History

Semiconductor & Materials Division

Somerville, N. J.



92CS-10829



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History

Mesa Transistor

GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE

For High-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Exclu					
Maximum Diameter					
Dimensional Outline .				 	JEDEC No. TO-5
Case				 	Welded, Metal
Seals				 	Hermetic
Leads, Flexible				 	3
Minimum length				 	1.5"
Orientation and dia				Dimen	sional Outline
^r erminal Diagram:	1	BOTTON	/ VIEW		

Lead 1 - Emitter

Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

🛶 Indicates a change.	
In an inverter circuit at ambient temperature of 25° C Collector-to-Emitter Voltage	
Typical Operation:	-
LEAC TEMPERATURE: For immersion in molten solder for 10 seconds maximum	1
AMB:ENT-TEMPERATURE RANGE: Operating and storage	
At ambient temperature of 71° C 35 max. mw	
TRANSISTOR DISSIPATION: ^b At ambient temperature of 25 ^o C 150 max. mw At ambient temperature of 55 ^o C 75 max. mw	
COLLECTOR CURRENT	
COLLECTOR-TO-EMITTER VOLTAGE	
COLLECTOR-TO-BASE VOLTAGE	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 4-6!

World Radio History

"Turn-Off" Base Voltage.					5	volts
"On" Collector Current					-40	ma
"Turn-On" Base Current					-2	ma
"Turn-Off" Base Current.					2	ma
Switching Time:						
Delay time (t _d).					0.08	μsec
Rise time (t _r)					0.07	μsec
Storage time (t _s)					0.12	μsec
Fall time (t _f)					0.07	μsec

^a This rating may be exceeded and the emitter-to-base junction operated in the breakdown condition provided the emitter dissipation is limited to 30 milliwatts at 25° C. For ambient temperatures above 25° C, the dissipation should be reduced by 0.5 milliwatt/°C.

b See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base unless otherwise specified. Ambient temperature of 25° C.

Min. Typical Max.

-0.02, emitter open. BV_{CBO} -13 -30 - volts DC Collector-to- Emitter Breakdown Voltage BV_{CERL} -12 -25 - volts DC Emitter Breakdown Voltage for dc emitter ma. = -0.1. collector open BV_{EBO} -4 -6 - volts DC Punch-Through Voltage VP -12 -30 - volts DC Rase-to-Emitter Voltage for dc collector ma. = -40. dc base ma. = -1 V_{BE} 0.4 -0.6 volt DC Collector-Cutoff Current for collec- tor volts = -6, emitter open CBO1 -3 μa + Collector Capacitance for dc collector volts = -6, emitter open Cc - 8 12 $\mu \mu f$ DC Current Transfer Ratio: hFE With dc collector-to- emitter volts = -0.3, dc collec- tor ma. = -10 30 50 -	DC Collector Breakdown Voltage for dc collector ma. =					
Voltage	-0.02, emitter open. BV _{CBO} DC Collector-to-	-13	-30	-	volts	
collector open BV_{EBO} -4 -6 - volts DC Punch-Through Voltage VP -12 -30 - volts DC Base-to-Emitter Voltage for dc collector ma. = -40. dc base ma. = -1 . V _{BE} 0.4 -0.6 volt DC Collector-Cutoff Current for collec- tor volts = -6, emitter open CBO1 -3 μa Collector Capacitance for dc collector volts = -6, emitter open Cc - 8 12 $\mu \mu f$ DC Current Transfer Ratio: h_{FE} With dc collector-to- emitter volts = -0.3, dc collec-	VoltageBV _{CERL} DC Emitter Breakdown	-12	-25	-	volts	
Voltage VP -12 -30 - volts \rightarrow DC Rase-to-Emitter Voltage for dc collector ma. = -40. dc base ma. = -1 . V _{BE} 0.4 -0.6 volt DC Collector-Cutoff Current for collec- tor volts = -6, emitter open CB01 -3 μa \Rightarrow Collector Capacitance for dc collector volts = -6, emitter open Cc - 8 12 $\mu \mu$ f CCurrent Transfer Ratio: With dc collector-to- emitter volts = -0.3, dc collec-	collector open BV _{EBO}	-4	-6	-	volts	
collector ma. = -40. dc base ma. = -1 V_{BE} 0.4 -0.6 volt DC Collector-Cutoff Current for collec- tor volts = -6, emitter open CB01 -3 μa Collector Capacitance for dc collector volts = -6, emitter open C _C - 8 12 $\mu \mu$ f DC Current Transfer Ratio: hFE With dc collector-to- emitter volts = -0.3, dc collec-	Voltage Vp	-12	-30	-	volts	
emitter open $ _{CBO}$ 1 -3 μa \Rightarrow Collector Capacitance for dc collector volts = -6, emitter open C _C - 8 12 $\mu \mu f$ DC Current Transfer Ratio: hFE With dc collector-to- emitter volts = -0.3, dc collec-	collector ma. = -40. dc base ma. = -1 V _{BE} DC Collector-Cutoff	-	-0.4	-0.6	volt	
emitter open C_C – 8 12 $\mu\mu$ f DC Current Transfer Ratio: h_{FE} With dc collector-to- emitter volts = -0.3, dc collec-	emitter open ICBO - Collector Capacitance for dc collector	-	-1	-3	μα	
-0.3, dc collec-	emitter open C _C DC Current Transfer Ratio: h _{FE} With dc collector-to-	-	8	12	μμ f	
	-0.3, dc collec-	30	50	_		

--- Indicates a change.

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World Radio Histor

With dc collector-to- emitter volts = -0.5, dc collector ma. = -40. Gain-Bandwidth Product ^c for dc collector-to-	40	75	-	
emilter volts = -3, dc collector ma. = -10GRW Thermal Resistance:	35	60	-	Mc
Junction-to-free air R _T Total Stored Charge:	-		400	^o C/watt
With dc collector $ma. = -10, dc$				
base ma. = -0.4 With dc collector	-	225	325	μμcoulombs
ma. = -40, dc base ma. = -1.6 Thermal Time Constant	-	600 10	800	µµcoulombs msec

C Frequency at which the current transfer ratio is equal to 1.

OPERATING CONSIDERATIONS

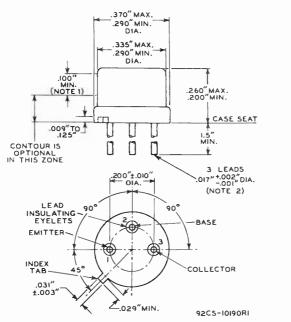
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.



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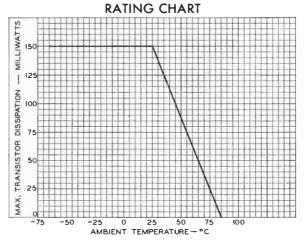
JEDEC No. TO-5



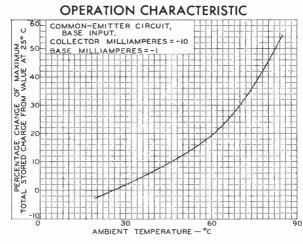
NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

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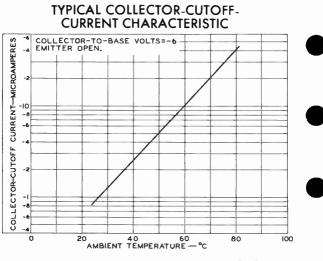
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92C S-10226RI

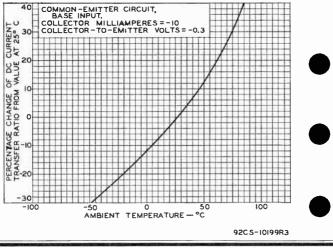


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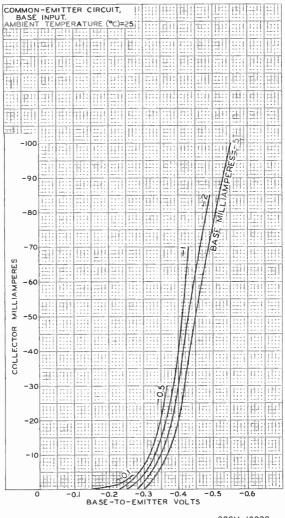
TYPICAL CHARACTERISTIC



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RADIO CORPORATION OF AMERICA

Semiconductor & Materials Division

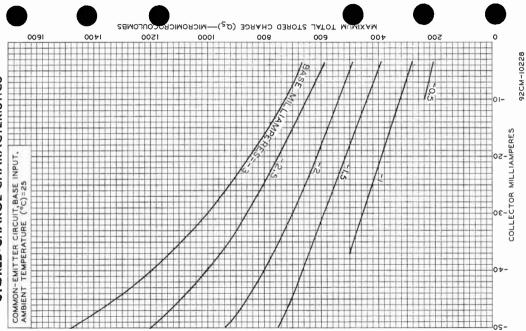


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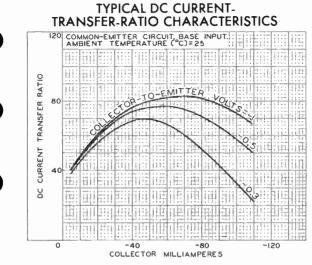
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CORPORATION **Materials Division**

RADIO COF Semiconductor & I



9205-10829



World Radio History

Bidirectional Transistor

GERMANIUM P-N-P ALLOY TYPE

For Medium-Speed Switching Service in Industrial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position	0.260"
Maximum Diameter	0.370"
Dimensional Outline	
Case	
Seals	Hermetic
Leads, Flexible	3
Minimum length	1.5"
Orientation and diameter See Dimen	sional Outline
Terminal Diagram: BOTTOM VIEW	
\sim	

Lead 1 - Emitter (Or Col- lector) Lead 2 - Base	Lead 3-Collector (Or Emitter)

SWITCHING SERVICE

Such as in bidirectional switching, coredriver, and ac-signal-relay circuits

Maximum and	Minimum	Ratings,	Absolute-Maximum	Values:
-------------	---------	----------	------------------	---------

COLLECTOR-TO-BASE VOLTAGE	max.	volts
EMITTER-TO-BASE VOLTAGE	max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
Base-to-emitter volts = 120	max.	volts
COLLECTOR CURRENT	max.	ma
EMITTER CURRENT	max.	ma
TRANSISTOR DISSIPATION: *		
At ambient temperature of 25° C 120	max.	mw
At ambient temperature of 55° C	max.	ШM
At ambient temperature of 71° C 10	max.	ШM
AMBIENT TEMPERATURE (During operation) 71	max.	°C
STORAGE-TEMPERATURE RANGE	o +85	oC

Typical Operation:

In accompanying typical inverter circuit at ambient temperature of 25°C

"On" Collector Current									ma
"Turn-On" Base Current (IBI).	•	•					•	-20	ma
"Turn-Off" Base Current (182)	•	•	٠	•	٠	•	•	20	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 4-61

Switching Time: Delay time (t _d) Rise time (t _r) Storage time (t _s) Fall time (t _f)	· · · ·	0.	55 .7	μsec μsec μsec μsec	
a See accompanying <i>Rating Chart</i> and <i>Chart</i> in General Section,	also Ira	nsistor-Di	ssipati	on Rating	
ELECTRICAL CH	RACTERI	STICS			
Voltage values are given wi less otherwise specified. An	th respe	ct to th	e base	un-	
tess otherwise specified. An	Nin.			- ι.	
DC Collector Breakdown	Ain.	Typical	нах.		
Voltage for dc collector $\mu a = -50$, emitter open	0 -21	-35	-	volts	
Voltage for dc emitter volts = -1 V _p DC Base-to-Emitter Voltage for de	-20	-35	-	volts	•
Voltage for dc collector ma. = -400, dc base ma. = -26.7V _{BE} DC Collector-to-Emitter Saturation Voltage for dc collector ma.	-	-1	-1.5	volts	
= -400, dc base ma. = -26.7 V _{CE} DC Collector-Cutoff Current for dc	-	-0.2	-0.3	volt	
collector volts = -12, emitter open	-	-2.5	-6	μa	
= -0.3, dc collector ma. = -400	15	30	-		
 = -6, dc emitter ma. = 1	3	6	-	Мс	
volts = 6, dc emitter ma. = 0C _{ob} Thermal Time Constant	-	20 12	30	μμf msec	
between collector junction and free airR _T	-	-	500	^o C/watt	





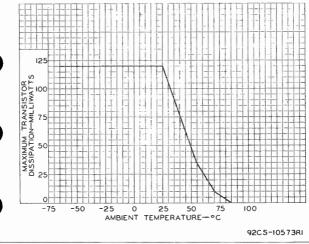
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

This transistor is intended for use in single-side printed circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit bcards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.



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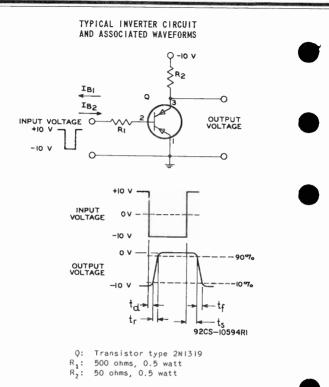
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RATING CHART

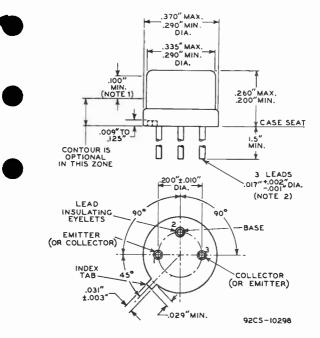


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JEDEC No.TO-5



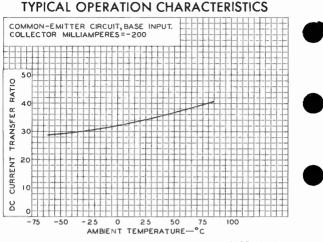
NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD D'AMETER IS NOT CONTROLLED.

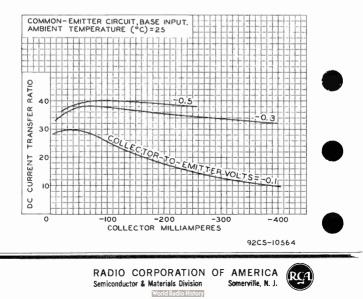


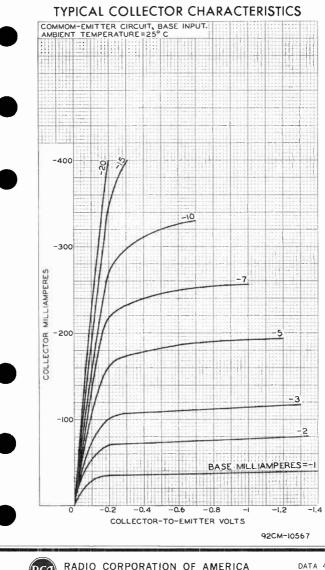
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 3 4-61

World Radio History



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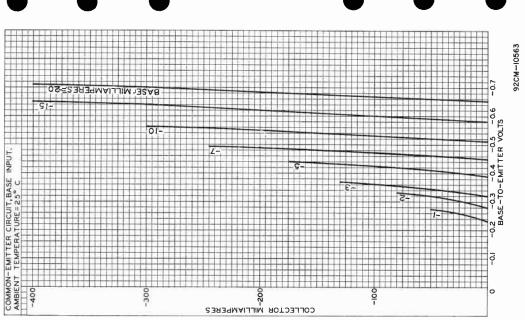
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World Radio History

Semiconductor & Materials Division

S CHARACTERISTIC TRANSFER TYPICAL

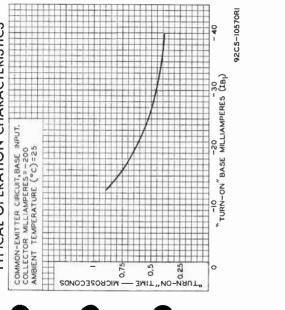


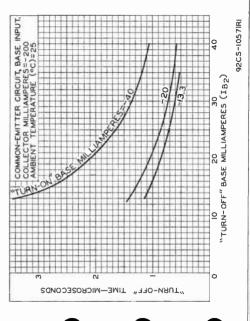
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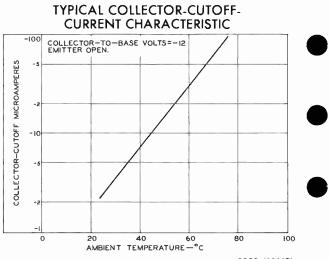
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Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

The 2N1358 is the same as the 2N174 except for the following items:

ELECTRICAL CHARACTERISTICS -								
Voltage values are given with r								
case temperature ^a of 25°C unies	s oth	erwise s	specifi	ed				
	Min.	Typical	Max.					
DC Collector-to-Emitter Break- down Voltage: With base connected to emitter, dc collector								
amperes = -0.3 BV _{CES} With base open, dc collector	-70	-	-	volts				
amperes = -0.3 BV _{CEO} DC Base-to-Emitter Voltage: V _{gE} With dc collector volts = -2, dc collector amperes	-40	-	-	volts				
= -1.2	-	0.35	0.5	volt				
emitter volts = -2, dc collector amperes = -5, . DC Collector-to-Emitter Saturation Voltage for dc	-	-0.65	-0.9	volt				
collector amperes = -12, dc base amperes = -2 V _{CE} DC Emitter Voltage for dc (sat) collector volts = -80, dc	-	-0.3	-0.7	volt				
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	-80	-0.15	-1 -	volt volts				
dc collector current = 0, casetemperature ^a = 71 ⁰ C. With dc emitter volts = -60,	-	-4	-6	ma				
dc collector current = 0. DC Collector-Cutoff Current: I _{CBO}	-	-1	-4	та				
With dc collector volts = -2, dc emitter current =0 With dc collector volts = -30, dc emitter current =	-	-100	-200	μa				
0, case temperature ^a = 71°C With dc collector volts = -80, dc emitter current	-	-4	-6	та				

Indicates a change.

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With dc collector volts = -80, dc emitter current = 0, case temperature ^a = 71° C	•••	-	-15	ma	
-5	25 40	35 55	_ 80		
Beta-Cutoff Frequency for dc collector volts = -12,					
dc collector amperes = -1 . f _{ae} Thermal Resistance:	100	-	-	kc	
Junction-to-case R _T Thermal Capacity for pulse		0.35	0.5	^o C/watt	
duration of 1 to 10					-
milliseconds	-	0.075	-	watt- sec/ ^o C	
Thermal Time Constant \mathcal{T}_1		26.25	-	msec	-
⁶ Measured at any point on coating such					

^a Measured at any point on seating surface.





Power Transistor

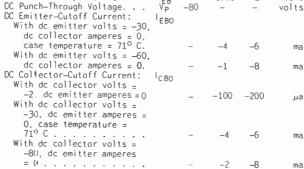
GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

The 2N1358 is the same as the 2N17d except for the following items:

ELECTRICAL CHARACTERISTICS

Foltage values are given with case temperature of 25°C unles				
	Min.	Typical	Max.	
DC Collector-to-Emitter Break- down Voltage:				
With base connected to				
emitter, dc collector				
amperes = -0.3 BV _{CES} With base open, dc collector	-70	-	-	volts
amperes = -0.3 BV _{CEO} DC Base-to-Emitter Voltage:* V _{BE}	-40			volts
With dc collector volts =				
-2, dc collector amperes = -1.2	-	0.35	0.5	volt
With dc collector-to- enitter volts = -2, dc				
collector amperes = -5 DC Collector-to-Emitter	-	-0.65	-0.9	volt
Saturation Voltage* for dc				
collector amperes = -12, base amperes = -2 V _{CE}	_	-0.3	-0.7	volt
DC Emitter Voltage for dc collector volts = -80, dc				
	_	-0.15	-1	volt
collector amperes = 0 V _{EB} CC Punch-Through Voltage V _P DC Emitter-Cutoff Current: I _{EBO}	-80	-		volts



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With dc collector volts = -80, dc emitter amoeres = 0, case temperature = 71° C DC Current Transfer Ratio* for dc collector-to- emitter volts = -2, dc collector amperes =	h _{FE}	-	_	-15	ma	
-5		25	35	-		
-1.2		40	55	80		
Beta-Cutoff Frequency* for dc collector volts = -12.						
dc collector amperes = -1 .	fae	100	-	-	kc	
Thermal Resistance:					0.0	
Junction-to-case	RL	-	0.5	0,8	^o C/watt	
duration of 1 to 10						
milliseconds		-	0,075	-	watt-	
Thermal Time Constant	\mathcal{T}_{I}	-	37.5	-	msec	

★ Measured in a common-emitter, base-input circuit.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

For High-Speed Switching Circuits in Industrial and Military Electronic Computers

GENERAL DATA

Mechanical:

Operating Position Maximum Length (E																		
Maximum Diameter.																	0	.370"
Dimensional Outlin	ne .												•••)EC)E (1 1	١o.	T0-11
Case								•	÷			•		₩e	elo	lec	١,	Metal
Seals										•		•				. F	ler	metic
Leads, Flexible .										•								3
Minimum length.																٠		1.5"
Orientation and	dia	met	er					•	Se	e	Dı	me	ns		na	ı l	0u	tline
Terminal Diagram:			В	0TT	ОM	V	I EM	1										

Lead 1 - Emitter Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Such as in memory-core-driver, pulse-amplifier, inverter, flip-flop, and logic-gate circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	volts								
COLLECTOR-TO-EMITTER VOLTAGE	volts								
EMITTER-TO-BASE VOLTAGE ^a	volt								
COLLECTOR CURRENT	ma								
EMITTER CURRENT	ma								
TRANSISTOR DISSIPATION:									
At ambient temperature of 25° C 240 max.	ШM								
At ambient temperature of 55° C 120 max.	(DW)								
At ambient temperature of 71°C 56 max.	mw								
AMBIENT-TEMPERATURE RANGE:									
Operating and storage	°C								
Typical Operation:									
In an inverter circuit at ambient temperature of 25°	С								
"On" Collector Current	fild								

"On" Collector Current.												fild
"Turn-On" Base Current.												ma
"Turn-Off" Base Current				•							20	ma
Switching Time:												
Delay time (t _d)											0.02	µsec
Rise time (t _r)	٠	•	•	•	•	•	•	•	•	•	0.08	µsec

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0.25 Storage time (t_s) *µ*sec Fall time (tf). . . 0.1 µsec

- This rating may be exceeded and the emitter-to-base junction operated in the breakdown condition provided the emitter dissipation is limited to 30 millimatts at 25° C. For ambient temperatures above 25° C, reduce the dissipation by 0.5 milliwatt/ $^{\circ}$ C. а
- ь See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

ELECTRICAL				
Voltage values are given less otherwise specified.				
	Min.	Typical	Max.	
DC Collector Breakdown Voltage for dc collector $\mu a = -100$				
with emitter openBV _{CBO} DC Collector-to- Emitter Breakdown	-30	-55	-	volts
Voltage DC Emitter Breakdown Voltage for dc emitter μa = -100	-30	-40	-	volts
with collector openBV _{EBO} DC Punch-Through Voltage for dc	-1	-3	-	volts
emitter volts = −1V _p → DC Base-to-Emitter Voltage for dc collector ma. = -200,	-30	-50	-	volts
<pre>dc base ma. = -10V_{BE} DC Collector-Cutoff Current for dc collector volts = -3</pre>	-	-0.6	-0.9	volt
with emitter open . I _{CBO} DC Current Transfer Ratio for dc collec- tor-to-emitter volts = -0.5, dc collector	-	_4	-8	μα
<pre>ma. = -200 h_{FE} Gain-Bandwidth Product^c for collector-to- emitter volts = -3,</pre>	20	50	_	
collector ma. = -10 .GBW	20	35	-	Mc
Thermal Time Constant71 Thermal Resistance between collector	-	14	-	msec
junction and freeair.R _T Stored Base Charge for dc collector ma. = -10, dc base	-	-	250	°C/watt
ma. <i>= −</i> 1 Q _S	-	600	B00	μμcoulombs
C Frequency at which the current t	ransfer	ratio is o	equal to	1.

--- Indicates a change.

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OPERATING CONSIDERATIONS

It is recommended that this transistor not beconnected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

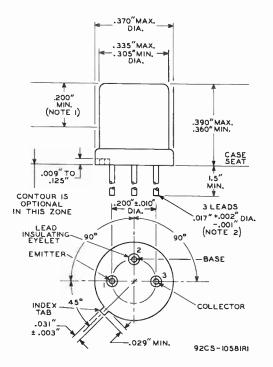
The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

This transistor is intended for use in single-side printed circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. 0ATA 2 9-60



NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTOLLED.

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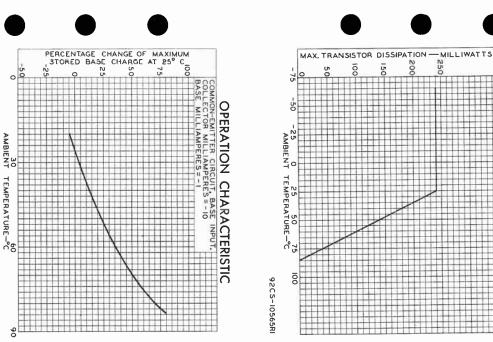
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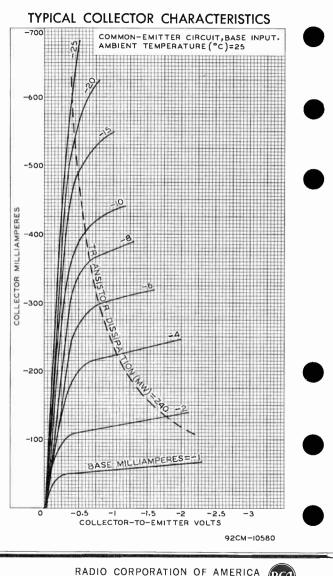
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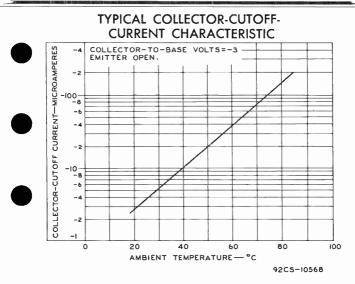
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EMPERATURE

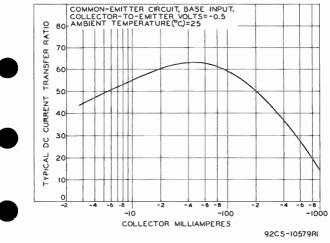


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TYPICAL DC CURRENT-TRANSFER-RATIO CHARACTERISTIC

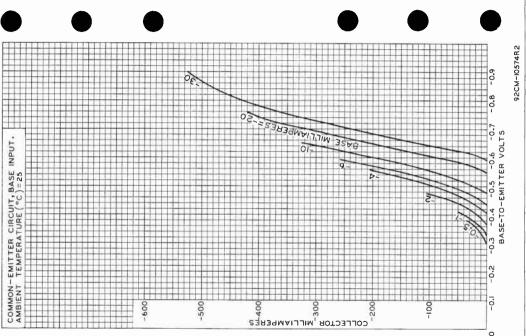




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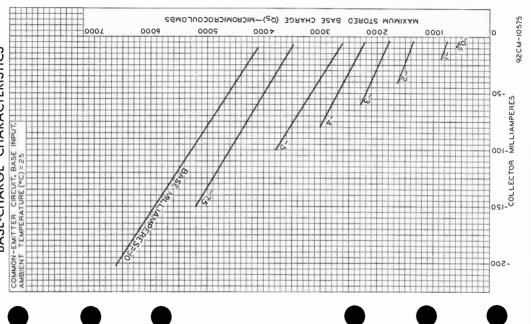


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World Radio History

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

The 2N1412 is the same as the 2N1100 except for the following items:

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and at case temperature $^{\rm a}$ of 25° C unless otherwise specified

	Min.	Typical	Max.	
DC Base-to-Emitter Voltage for dc collector-to-emitter				
volts = -2, dc collector amperes = -5 DC Emitter-Cutoff Current for	V _{BE} -	-0.65	-0.8	volt
d∉ emitter volts = −60, dc c∞llector current = 0	I _{EBO} -	-1	-4	та

a Measured at any point on seating surface.

🖛 Indicates a change.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

World Radio History

Power Transistor

GERMANIUM P-N-P ALLOY TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

The $2N_{1412}$ is the same as the $2N_{1100}$ except for the following items:

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and audioamplifier, relay- and solenoid-actuating circuits

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and case temperature of 25° C unless otherwise specified

	Nin.	Typical	Nax.	
DC Base-to-Emitter Voltage*				
far da collector-to-emitter				
volts = -2, dc collector				
amperes = -5	Vec -	-0.65	-0.8	volt
DC Emitter-Cutoff Current for	DE			
dc emitter volts = -60, dc				
collector amperes = 0	1	1	-8	ma
cerrector amperes - o	'EBO	+	. 0	ma

★ Memasured in a common-emitter, base-input circuit.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 2-61

World Radio History

Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

For High-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Position. Max.mum Length (Exc	luc	s in	9	fl	exi	b1	e l	lea	ad s)							0.260"
Max mum Diameter																	0.370"
Dimensional Outline														JE	DE	C	No.T0-9
Case														We	ld	iec	J, Metal
Seals			•													. ۲	lermet ic
Leacs, Flexible				•													3
Minimum length																	. 1.5"
Orientation and d Terminal Diagram:	ian	net	er						See	ġ	Dıı	nei	15	10	na	l	Outline

Lead 1 - Emitter Lead 2 - Base



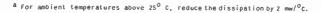
Lead 3-Collector

SWITCHING SERVICE

Such as in inverter, flip-flop, and logic-gate circuits

					ana logic-	
Maximum	and	Minimum	Ratings	, Absol	ute-Maxımum	Values:

COLLECTOR-TO-BASE VOLTAGE	-30 max.	volts
EMITTER-TO-BASE VOLTAGE	-1 max.	volt
COLLECTOR CURRENT	-100 max.	ma
EMITTER CURRENT	100 max.	ma
TRANSISTOR DISSIPATION: *		
At ambient temperature of 25° C	120 max.	ШM
At ambient temperature of 55° C	60 max.	mw
At ambient temperature of 71° C	28 max.	mw
AMBIENT-TEMPERATURE RANGE:		
Operating and storage	-65 to +85	°C
LEAD TEMPERATURE:		
For immersion in molten solder for		
10 seconds maximum	255 max.	°C





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

ELECTRICAL CHARACTERISTICS

Voltage values are given wit. otherwise specified. Ambie:					
		Hin.	Max.		
DC Collector Breakdown Voltage for dc collector ma. = -0.1, emitter open	BVCBO	-30	-	volts	_
down Voltage for dc emitter ma. = -1, base open	BVCEO	-20	-	volts	
Reach-Through Voltage for dc emitter ma. = -0.025 DC Emitter Breakdown Voltage	V _{RT}	-20	-	volts	
for dc emitter ma. = -0.05, collector open DC Base-to-Emitter Voltage for	BVEBO	-1	-	volt	_
dc collector ma. = -10, dc base ma. = -0.5 DC Collector-to-Emitter Saturation Voltage for dc	V _{BE}	-	-0.6	volt	
collector ma. = -10, dc base ma. = -1	V _{CE} (sat)	-	-0.25	volt	
emitter open	I _{C80}	-	-10	μа	
dc collector-to-emitter volts = -1, dc collector ma. = -10 . "Turn-On" Time ^b (Rise time	h _{FE}	20	-		
plus delay time)	ton	-	100	mµ∠sec	
plus fall time)	t _{off}		85	mµsec	

^b See accompanying Switching-Time Test Circuit and Associated Wave Porms.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.

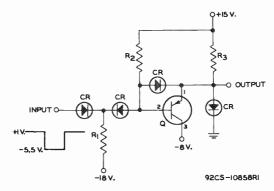




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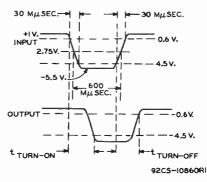


SWITCHING-TIME TEST CIRCUIT



CR: Semiconductor diode type IN198-8 (NOTE 2) Q: Transistor type 2N1450 R₁: 22,600 ohms ± 1%, 0.5 watt R₂: 82,500 ohms ± 1%, 0.5 watt R₃: 10,000 ohms ± 1%, 0.5 watt

ASSOCIATED WAVE FORMS



NOTE I: TOLERANCE FOR SUPPLY VOLTAGES IS ± 1%. ALL RESISTORS ARE CARBON-COMPOSITION TYPES.

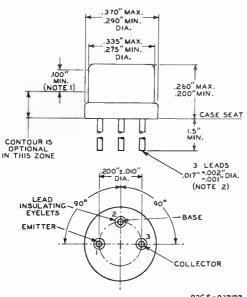
NOTE 2: THE IN198-8 SEMICONDUCTOR DIODES USED IN THIS CIRCUIT MUST SATISFY THE FOLLOWING REVERSE-RECOVERY CRITERIA AS SPECIFIED IN JAN-256 TEST CIRCUIT 14.5-2 EIA STANDARD RS-231, J14-F3, DECEMBER, 1959.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. THE MAXIMUM TRANSIENT VOLTAGE DEVELOPED BY THE DIODE ACROSS A 2000-OHM LOAD RESISTANCE MUST BE LESS THAN 0.3 VOLT. UNDER THESE CONDITIONS, THE PEAK REVERSE CURRENT SHALL NOT EXCEED 0.15 MILLIAMPERE AND THE REVERSE RESISTANCE SHALL NOT BE LESS THAN 40,000 OHMS.

AT 0.3 MICROSECONO AFTER THE DIDDE HAS BEEN SWITCHED AS DISCUSSED IN NOTE 2, THE REVERSE RESISTANCE OF THE DIDDE SHALL NOT BE LESS THAN 100,000 OHMS AND THE REVERSE CURRENT NOT MORE THAN 0.06 MA.

NOTE 3: IN THIS CIRCUIT, THE MAXIMUM LENGTH OF THE BASE LEAD OF THE TRANSISTOR SHALL BE I INCH, THE EMITTER LEAD 2 INCHES.



JEDEC No.TO-9

92CS-937IR7

NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANOLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, OUE TO TAPER AND OUT OF ROUNO WITHIN THIS ZONE WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD OIAMETER IS NOT CONTROLLED.



Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

)	Operating Position
	Maximum Diameter
	Dimensional Outline JEDEC No.TO-5
	Case
	Leads, Flexible
	Minimum length
	Orientation and diameter See Dimensional Outline
	Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



Lead 3 - Collector. Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper. voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Haximum Values:						
COLLECTOR-TO-BASE VOLTAGE 60 max.	volts					
COLLECTOR-TO-EMITTER VOLTAGE:						
With emitter-to-base reverse biased						
(DC emitter-to-base volts = 1.5) 60 max.	volts					
With base open (Sustaining voltage) ^a 40 max.	volts					
EMITTER-TO-BASE VOLTAGE	volts					
COLLECTOR CURRENT	amp					
EMITTER CURRENT	amp					
BASE CURRENT. 1 max.	amp					
TRANSISTOR DISSIPATION:						
At case temperature of 25° C 5 max.	watts					
At case temperature of 100° C 2.86 max.	watts					
CASE-TEMPERATURE RANGE: C						
Operating and storage65 to +200	°C					
Characteristics:						
At case temperature of 25° C ^C						
Small-Signal Current Transfer Patio (b.)						

mall-Signal Current Transfer Ratio (hfe) with dc collector-to-emitter volts =

4. dc collector ma. = 5 . .

50 - Indicates a change.

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Somerville, N. J.

DATA I 6-61

Alpha-Cutoff Frequency (f_{ab}) with dc collector-to-base volts = 28, dc collector ma. = 5 1.5 Mc Collector-to-Base Capacitance (Cob) with dc collector-to-base volts = 40 150 $\mu\mu$ f Thermal Time Constant (τ_1) 10 msec	
Typical Operation:	
In accompanying typical power-switching circuit at case temperature ^c of 25°C DC Supply Voltage (B ₂)	
$ \begin{array}{llllllllllllllllllllllllllllllllllll$	

a The Collector-to-Emitter Sustaining Voltage ($v_{CEO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

^b See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

C Measured at center of seating surface.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base and case temperature^C of 25⁰ C unless otherwise specified

		Min.	Max.		
Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector				(
<pre>ma. = 0.25</pre>	VCEX	60	-	volts	
ma. = 50, dc base ma. = 0.	V _{CEO} a (sus)	40	-	volts	
Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector				(
<pre>ma. = 200</pre>	V _{BE} Icbo	-	3	volts	
case temperature =		_	10 500	µа µа	
		-+	indicates	a change.	

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RCA

<pre>Emitter-Cutoff Current for dc emitter volts = 12, dc collector ma. = 0 DC Current Transfer Ratio for dc collector-to-emitter</pre>	l _{EBO}	_	10	µa ★
volts = 4, dc collector ma. = 200 DC collector-to-Emitter Saturation Resistance for	h _{Fε}	20	60	
dc collector ma. = 200, dc base ma. = 20 Thermal Resistance:	R _S RT	-	7	ohms 🔶
Junction-to-case Junction-to-free air		_	35 200	^o C/watt ^o C/watt

The Cullector-to-Emitter Sustaining Voltage (VCE0(Sus)) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{\rm CM}$ * 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

C Measured at center of sealing surface.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should rot exceed 255° C for a maximum immersion period of 10 seconds.

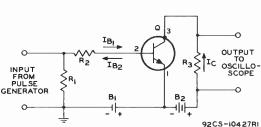
This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in-type circuits. If this transistor is used in double-side'printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device mide of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

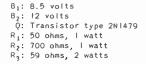
- Indicates a change.



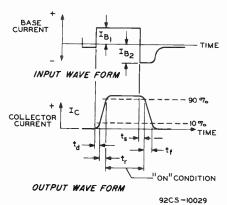




TYPICAL POWER-SWITCHING CIRCUIT



ASSOCIATED WAVE FORMS

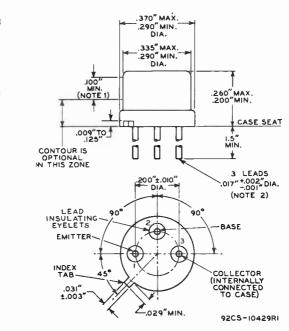


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JEDEC No.TO-5



NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

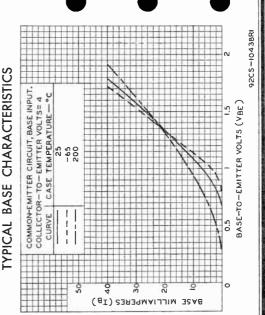
NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN C.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUT-SIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



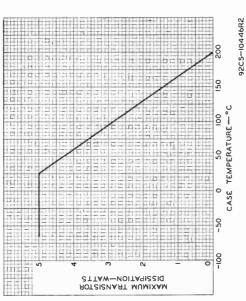
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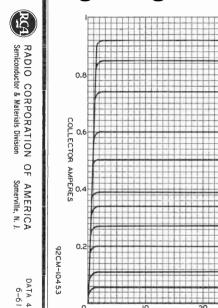


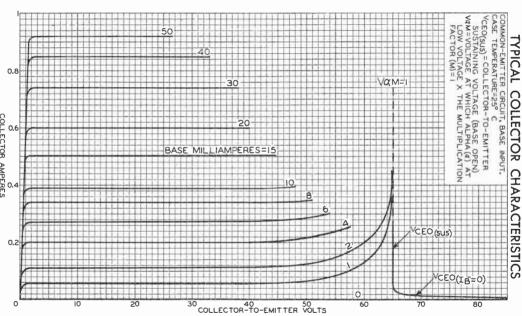




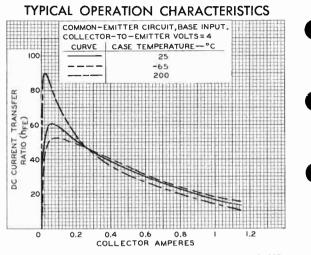
RATING CHART



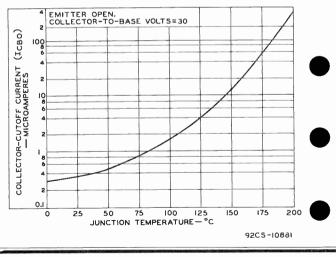




2N1479



92CS-10450RI



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Power Transistor

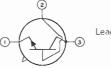
SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding					
Maximum Diameter					. 0.370"
Dimensional Outline				JED	EC No. TO-5
Case					Metal
Seals					.Hermetic
Leads, Flexible					
Minimum length					1.5"
Orientation and diamete	r		See D	ımension	al Outline
Terminal Diagram:	BOTTOM	VIEW			

Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

	COLLECTOR-TO-BASE VOLTAGE 60 COLLECTOR-TO-EMITTER VOLTAGE:	max.	volts
)			volts
			volts
		max.	volts
		max.	amp
	EMITTER CURRENT	max.	amp
	BASE CHRRENT	max.	amp 🛖
	At case temperature of 25 ⁰ C 5		watts
	At case temperature of 100° C 2.86 CASE-TEMPERATURE RANGE: ^c	max.	watts 🛖
	Operating and storage65 to	+200	°C
	Characteristics:		

At case temperature of 25° C



Small-Signal Current Transfer Ratio (hfe) with dc collector-to-emitter volts = 4, dc collector ma. = 5 . . . 50 Indicates a change.



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Somerville, N. J.

DATA I 6-61



2N1481

Alpha-Cutoff Frequency $(f_{a,b})$ with dc collector-to-base volts = 28. dc collector ma. = 5 1.5 Mc Collector-to-Base Capacitance $(C_{o,b})$ with dc collector-to-base volts = 40 150 $\mu\mu$ f Thermal Time Constant (τ_1) 10 msec	
Typical Operation:	
In accompanying typical bower-switching circuit at case temperature of 25°C DC Supply Voltage (B ₂)	
$ \begin{array}{cccccccccccccccccccccccccccccccccccc$	

The Collector-to-Emitter Sustaining Voltage $\{V_{CEO}(s_{MS})\}$ with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity $\{V_{\Delta M}=1;$ voltage at which the product of alpha $\{\alpha\}$, at low voltage, times the multiplication factor (M) equals unity).

h See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section. с

Measured at center of seating surface.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base and case temperature of 250 C unless otherwise specified

Min. Max.

Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector					
ma. = 0.25	V _{CEX}	60	-	volts	
ma. = 50, dc base ma. = 0 .	V _{CEO} ® (sus)	40	-	vo!ts	
Base-to-Emitter Voltage for dc collector-to-emitter volts					
<pre>= 4, dc collector ma. = 200 . Collector-Cutoff Current tor dc collector volts = 30, dc emitter ma. = 0, case</pre>	V _{BE} ICBO	-	3	volts	
temperature =					
25° C		-	10	μa	
150° C		-	500	μa	
Emitter-Cutoff Current for dc emitter volts = 12, dc					
collector ma. = 0	I E BO	-	10	μa	
		(nd	icates a	change.	

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Somerville, N. J.



DC Current Transfer Ratio for dc collector-to-emitter vclts = 4, dc collector		100	
ma. = 200 h DC Collector-to-Emitter	FE 25	100	
Saturation Resistance for dc collector ma. = 200, dc			
base ma. = 10 R	s –	7	ohms
Thermal Resistance: R	, T		
Junction-to-case		35	^o C/watt
Junction-to-free air		200	^o C/watt

^a The Collector-to-Emitter Sustaining Voltage ($v_{CEQ}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector veltage at which the effective alpha of the device is equal to unity ($v_{QM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (H) equals unity).

> OPERATING CONSIDERATIONS, TYPICAL POWER-SWITCHING CIRCUIT, DIMENSIONAL OUTLINE, RATING CHART, and CURVES shown under Type 2N1479 also apply to the 2N1481



- Indicates a change.

World Radio History

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Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE

For Power Switching and Amplifier Service

GENERAL DATA

Mechanical:

Operating Position														Any
Maximum Överall Length.														0.770"
Maximum Seated Length .														0.330"
Maximum Diameter														0.650"
Dimensional Outline											J	ED	EC	No.TO-8
Case														. Metal
Seals														Hermetic
Terminal Diagram:														

BOTTOM VIEW

Pin 1 - Emitter Pin 2 - Base



Pin 3-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Naximum Values:

COLLECTOR-TO-BASE VOLTAGE	60	max.	volts
With emitter-to-base reverse biased			
(DC emitter-to-base volts = 1.5)	60	max.	volts
With base open (Sustaining voltage) ^a		max.	volts
EMITTER-TO-BASE VOLTAGE	12	max.	volts
COLLECTOR CURRENT	3	max.	amp
EMITTER CURRENT	3.5	max.	атр
		max.	алр
TRANSISTOR DISSIPATION:	1.0		
	25		
At case temperature of 25 ⁰ C		max.	watts
At case temperature of 100°C 1	4.1	max.	watts
CASE-TEMPERATURE RANGE:			-
Operating and storage6	i5 to	+200	°C
operating and etchage in the three e	0 10		Ŭ
Characteristics:			
At case temperature of 25° C	c		
Alpha-Cutoff Frequency $(f_{\alpha b})$ with dc cpllector-to-base volts = 28, dc			
collector ma. = 5	•	1.25	Mc
-	⊢ tnd	icates a d	change.
			-



RADIO CORPORATION OF AMERICA Semiconductor & Materiats Division

2N1483

Typical Operation:	
In accompanying typical power-switching circuit at case temperature ^c of 25 ⁰ C	
DC Supply Voltage (B ₂)	
DC Base-Bias Voltage (B1)	-
"On" DC Collector Current	
"Turn-On" Base Current (IB;)	•
"Turn-Off" Base Current (I _{B2})	
Generator Resistance	
Switching Time:	
Delay time (t _d) 0.2 μsec	
Rise time (t_r)	
Storage time (t _s) 0.8 µsec	
Fall time (t_f)	
a The Collector-to-Emilter Sustaining Voltage (VCFn(sus)) with the base	

The corrector-constructor sustaining vortage (vccolsus) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (V_{CM} = 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

Bee accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.
 Measured al center of sealing surface.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base and case temperature^c of 25°C unless otherwise specified

> Min. Max.

Collector-to-Emitter Voltage:				
With emitter reverse bias				
volts = 1.5, dc collector				
	Varu	60	-	volts
ma. = 0.25	CEX	00		10.15
voltage), dc collector				
	v a	40		volts
ma. = 100, dc base ma. = 0. Base-to-Emitter Voltage for	(SUS)	40		VUILS
	1.50.51			
dc collector-to-emitter				
volts = 4, dc collector				
ma. = 750	V BE	-	3.5	volts
+ Collector-Lutott Current	1080			-
for dc collector volts = 30,				
dc emitter ma. = 0, case				
temperature =				
25° C		-	15	μa
150° C		-	750	μa
Emitter-Cutoff Current for				
dc_emitter_volts = 12, dc				
emitter ma. = 0	FRO	-	15	да 🌑
+DC Current Fransfer Ratio for	200			
dc collector-to-emittervolts				
= 4,dccollectorma.= 750	h _{FE}	20	60	
		👄 l nd	icates a c	hange.

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ohms
-
°C/watt
°C/watt

a The collector-to-Emitter Sustaining Voltage ($v_{CEQ}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

C Measured at center of seating surface.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the collector, base, and emitter pins by means of clips or by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal, otherwise the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 235° C for a maximum immersion period of 1C seconds. Furthermore, the pins should not be dip soldered closer than 1/32" from the transistor case.

Under no circumstances should the case be soldered to the heat sink because the heat of the soldering operation will permanently damage the transistor.

It is important that this transistor be securely fastened to a heat sink. Amounting clamp is provided for this purpose.

The chassis (heat sink) may be connected either to the positive or negative terminal of the voltage supply. In applications where the chassis is connected to the negative terminal of the voltage supply, it will be necessary to use an anodized aluminum insulator having high thermal conductivity, or a 0.002" mica insulator between the transistor case and the chassis. The insulator should extend beyond the mounting clamp (See Suggested Hounting Arrangement). An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the collector, emitter, and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting.

🛥 Indicates a change.

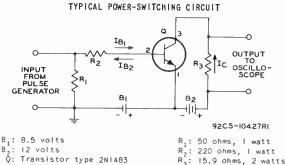


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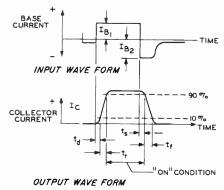
2N1483

it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that an insulating washer be used between the bolt and the chassis.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration therefore, should be given to the possibility of shock hazard if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



ASSOCIATED WAVE FORMS

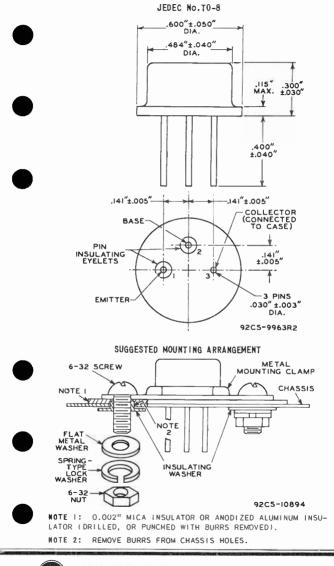


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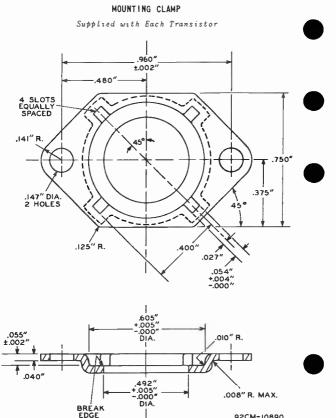
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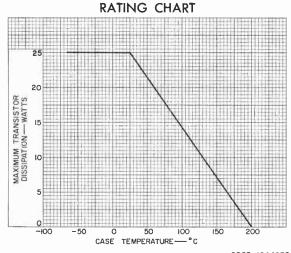
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92CM-10890

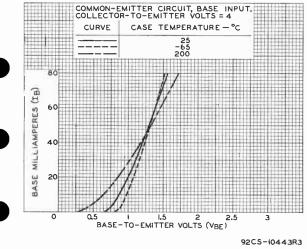
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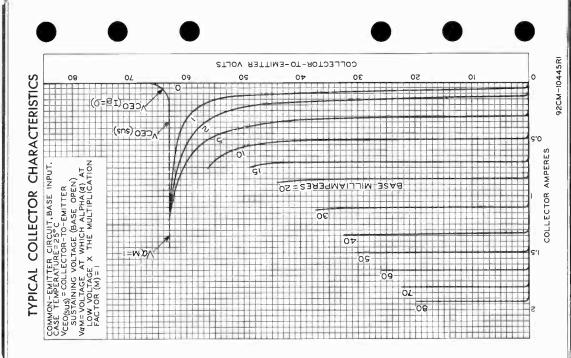
92CS-10442R2

TYPICAL BASE CHARACTERISTICS





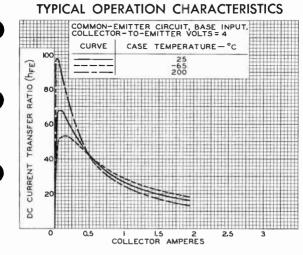
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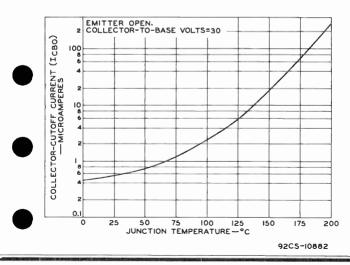
AMERICA Somerville, N. J.

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92C5-10444R2





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World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position										Any
Maximum Overall Length.										.0.770"
Maximum Seated Length .										
Maximum Diameter										.0.650"
Dimensional Outline							JI	EDE	EC	No.T0-8
Case										. Metal
Seals									. 1	lermetic
Terminal Diagram:										

BOTTOM VIEW

Piπ 1 - Emitter Pir 2 - Base



Pin 3-Collector, Case

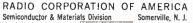
INDUSTRIAL SERVICE

Such as dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Naximum Values:

		+Indic	ates a (change.
	collector-to-base volts = 28, dc collector ma. = 5		1.25	Мс
	Alpha-Cutoff Frenquency (fab) with dc			
	At case temperature of 25° (с -		
		с		
	Characteristics:			
	Operating and storage	65 to	+200	°C
,	CASE TEMPERATURE RANGE:	14.1	max.	watts
	At case temperature of 100° C.	1/ 1	max.	watts
	At case temperature of 25° C	25		
	BASE CURRENT,	1.5	max.	amp
	EMITTER CURRENT			amp
	COLLECTOR CURRENT	3	max.	amp
	EMITTER-TO-BASE VOLTAGE		max.	volts
	With base open (Sustaining voltage)*		max.	volts
_	(DC emitter-to-base volts = 1.5).	60	max.	volts
	With emitter-to-base reverse biased			
	COLLECTOR-TO-BASE VOLTAGE	. 60	max.	volts





DATA ! 6-61

Collector-to-Base Capacitance with dc collector-to-base vo Thermal Time Constant $\{\tau_1\}$.	ts = 40.		175 10	μµf msec						
Typical Operation:										
In accompanying typical power-switching circuit at case temperature of 25° C										
DC Supply Voltage (B ₂) DC Base-Bias Voltage (B ₁) "On" DC Collector Current	· · · · · · · ·		12 8.5 750 65 -35 50	volts volts ma ma ohms						
Delay time (t_d) Rise time (t_r) Storage time (t_s) Fall time (t_f)	 	· · · · ·	0.2 1 0.8 1.1	μsec μsec μsec μsec						
^a The Collector-to-Emilter Sustaini open is that value of voltage whi a wide range of collector currer voltage at which the effective ai $(V_{QM} = 1; voltage at which the prtimes the multiplication factor (M$	ng Voltage () Ich remains r Its, and appr Ipha of the d Toduct of alp) equals unit	CED(sus)) elatively oximates evice is ha (a), a y).	with t consta the co equal t t low v	he base nt over llector o unity oltage.						
 b See accompanying Rating Chart and Chart in General Section. c Measured at center of seating sur 		stor-Diss	ipation	Rating						
CHARACTERISTICS RANGE VA	LUES FOR EQ	UIPMENT	DESIGN							
Voltage values are given	with respe	ct to ba	se and							
case temperature ^c of 25°C	unless other									
Collector-to-Emitter Voltage:		Min.	Nax.							
With emitter reverse bias volts = 1.5, dc collector ma. = 0.25 With base open (Sustaining voltage), dc collector ma. = 100, dc base	V _{CEX}	60	-	volts						
ma. = 0	V _{CEO} ^a (sus)	40	-	volts						
Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector ma. = 750	V _{BE}	-	2.5	volts						
 Collector-Cutoff Current for dc collector volts = 30, dc emitter ma. = 0, case temperature = 	1CB0		2.0							
25° C 150° C Emitter-Cutoff Current for dc emitter volts = 12.		-	15 750	μа μа						
dc emitter wa. = 0	IEBO	- + Indi	15 cates a	μa change.						

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)	DC Current Transfer Ratio for dc collector-to-emitter volts = 4, dc collector ma. = 750DC Collector-to-Emitter Saturation Resistance for dc collector ma. = 750, dc	h _{FE}	35	100	
	base ma. = 40	Rs	-	1	ohm
	Thermal Resistance:	RT		-	
	Junction-to-case		-	/	°C/watt
	Junction-to-free air			100	°C/watt

^a The Collector-to-Emitter Sustaining Voltage ($Y_{CFO(SUS)}$) with the base open: is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector yoltage at which the effective alpha of the device is equal to unity ($Y_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

c Measured at center of seating surface.

OPERATING CONSIDERATIONS, TYPICAL POWER-SWITCHING CIRCUIT, DIMENSIONAL OUTLINE, RATING CHART, and CURVES shown under Type 2N1483 also apply to the 2N1485



-Indicates a change.

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World Radio History

Power Transistor

SILLCON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

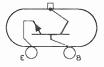
GENERAL DATA

Mechanical:

Operating Position		Any
Maximum Overall Length		
Mazimum Seated Length		• 0. 390"
Maximum Length of Mounting Flange		. 1.550"
Mazimum Width of Mounting Flange		. 1.015"
Case		Metal
Mounting Flange		Metal
Seals		
Socket Loranger Mfg. Corp. No.2149, (or e	equivalent
Terminal Diagram (See Dimensional Outline):		

E-Emitter

8 - Base



MOUNTING FLANGE-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator. dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

	COLLECTOR-TO-BASE VOLTAGE	60 max.	volts
-	With emitter-to-base reverse biased		
	(DC emitter-to-base volts = 1.5)	60 max.	volts
	With base open (Sustaining voltage)*	40 max.	volts
	EMITTER-TO-BASE VOLTAGE	10 max.	volts
	COLLECTOR CURRENT	6 max.	amp
	EMITTER CURRENT.	-8 max.	amp
	BASE CURRENT	3 max.	amp
-	TRANSISTOR DISSIPATION: •		-
	At mounting-flange temperature of 25° C.	75 max.	watts
	At mounting-flange temperature of 100° C.	43 max.	watts
	MOUNTING-FLANGE TEMPERATURE RANGE:	05 4 000	-
	Operating and storage	-65 to +200	oC
	Characteristics:		
	At mounting-flange temperature o	f 25° C°	
	Alpha-Cutoff Frequency (fah)		
	with dc collector-to-base volts		
	= 12, dc collector ma. = 100	1	Мс
		🛥 Indicates a	change.



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Collector-to-Base Capacitance (C_{ob}) with dc collector-to-base volts = 40 Thermal Time Constant (τ_1)	••••	· · 200	μμf msec	
Typical Operation:				
In accompanying typical power- cuit at mounting-flange tempera				
DC Supply Voltage (B ₂) DC Base-Bias Voltage (B ₁) "On" DC Collector Current. "Turn-On" Base Current (IB ₁) "Turn-Off" Base Current (IB ₂) Generator Resistance Switching Time:	· · · · · · · · · · · ·	. 12 8.5 . 1.5 . 0.3 0.15 . 50	volts volts amp amp ohms	
Delay Ťime (t _d) Rise Time (t _r) Storage Time (t _s) Fall Time (t _f)	· · · ·	. 0.2 . 1 . 1 . 1.2	μsec μsec μsec μsec	
 The Collector-to-Emitter Sustaining voltage open is that value of voltage which remains wide range of collector currents, and approx at which the effective alpha of the device voltage at which the product of alpha (a), multiplication factor (M) equals unity). See accompanying Rating Chart and also fra Chart in General Section. 	e (VCEQ(relativ imatestl is equal at low nsistor	sus)) with ely constan he collector to unity f voltage, t -Dissipatio	the base nt over a r voltage (V _{GM} = 1; imes the on Rating	
Measured at center of seating surface.				
CHARACTERISTICS RANGE VALUES FOR	•			
Voltage values are given with respect flange temperature ^c of 25°C unless	to base	and mount	ing-	
junge temperature of 25° Cuntess	ouneru	JISE SDECI		
			.)	
Collector to Emitter Voltages	Min.	Max.	.,	
Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open {Sustaining			volts	
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0V _{CEO} ^a Base-to-Emitter Voltage for	Min.			
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	Min. 60		volts	
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	Min. 60	<i>Нах.</i> - 3.5 25	volts volts volts μa	•
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	Min. 60	Нах. - 3.5	volts volts volts	•
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	Min. 60	<i>Нах.</i> - 3.5 25	volts volts volts μa	•
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	Min. 60	<i>Нах.</i> - 3.5 25 1000	volts volts volts µa µa	•
With emitter reverse bias volts = 1.5, dc collector ma. = 0.5	<i>Hin</i> . 60 40 - - 15	<i>Нах</i> . - 3.5 25 1000 25	volts volts volts µa µa	•

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Somerville, N. J.



DC Collector-to-Emitter				
Saturation Resistance for				
dc col'ector amperes = 1.5,				
dc base ma. = 300	.Rs	**	2	ohms
Thermal Resistance:	0			
Junction-to-mounting-flange.	•RT	-	2.33	^o C/watt

The collector-to-Emitter Sustaining Voltage ($v_{CFO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{AM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

^c Measured at center of seating surface.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

This transistor utilizes the Loranger Mfg. Corp. socket No.2149, or equivalent. Electrical connection can also be made to the base and emitter pins by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal, otherwise the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

Under no circumstances should the mounting flange be soldered to the heat sink because the heat of the soldering operation will permanently damage the transistor.

It is important that the mounting flange which serves as the collector terminal be securely fastened to a heat sink. Depending on the application, the chassis (heat sink) may be connected either to the positive or negative terminal of the voltage supply.

In applications where the chassis is connected to the negative terminal of the voltage supply, it will be necessary to use an anodized-alumium insulator having high thermal conductivity, or a 0.002" mica insulator between the mounting flange and the chassis. An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the emitter and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that an insulating washer be used between the bolt and the chassis (See Suggested Mounting Arrangement).

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

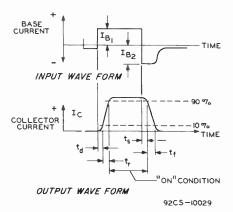
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Q FLANGE IBI 0 0 OUTPUT Ř2 в TO R₃ IB2 Ic OSCILLO-INPUT SCOPE F FROM R PULSE GENERATOR -0 Bį 82 ┥┝_╈ 0 -{ | t | 92CS-10604RI $B_1 = 8.5$ volts $B_2 = 12$ volts = Transistor type 2N1487 $R_1 = 50$ ohms, I watt $R_2 = 30$ ohms, i watt $R_3 = 7.8$ ohms, 2 watts

TYPICAL POWER-SWITCHING CIRCUIT

ASSOCIATED WAVE FORMS

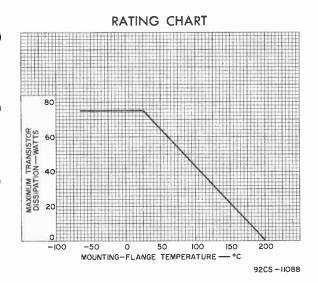


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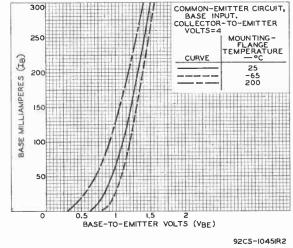
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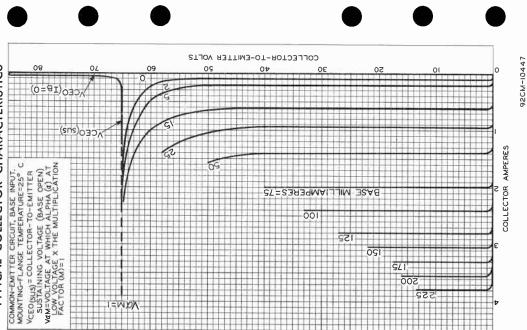




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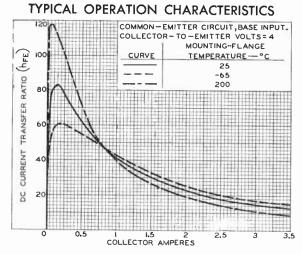




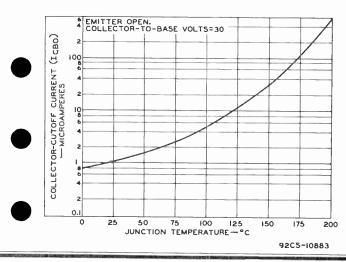
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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division History Somerville, N. J. DATA 5 6-61

World Radio History

Power Transistor

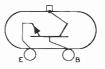
SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Överall Length
Maximum Seated Length
Maximum Length of Mounting Flange
Maximum Width of Mounting Flange
Case
Mounting Flange
Seals
Socket Loranger Mfg. Corp. No.2149, or equivalent
Terminal Diagram (See Dimensional Outline):

€-Emitter B-Base



MOUNTING FLANGE-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter. inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

	COLLECTOR-TO-BASE VOLTAGE	60	max.	volts	
	(DC emitter-to-base volts = 1.5)	60	max.	volts	
	With base open (Sustaining voltage) ^a	40	max.	volts	
	EMITTER-TO-BASE VOLTAGE	10	max.	volts	
	COLLECTOR CURRENT	6	max.	amp	
	EMITTER CURRENT	-8	max.	amp	
	BASE CURRENT	3	max.	amp	
	TRANSISTOR DISSIPATION:"				
	At mounting-flange temperature of 25° C .		max.	watts	
	At mounting-flange temperature of 100° C	43	max.	watts	
	MOUNTING-FLANGE TEMPERATURE RANGE:				
	Operating and storage	to	+200	٥Ç	
	Characteristics:				
	At mounting-flange temperature of a	250	С°		
)	Alpna-Cutoff Frequency (fab) with dc collector-to-base volts = 12, dc				
	collector ma. = 100		1	Mc	
	🖛 (n	dica	ites a d	change.	



2N1489

$\begin{array}{llllllllllllllllllllllllllllllllllll$	
Typical Operation:	
In accompanying typical power-switching cir- cuit at mounting-flange temperature of 25°C	
DC Supply Voltage (B2). 12 volts DC Base-Bias Voltage (B1). -8.5 volts "On" DC Collector Current 1.5 amp "Turn-On" Base Current (IB1). 0.3 amp "Turn-Off" Base Current (IB2). -0.15 amp Generator Resistance. 50 ohms Switching Time: 50 ohms	
Delay Time (t _d) 0.2 μsec Rise Time (t _r) 1 μsec Storage Time (t _s) 1 μsec Fall Time (t _f) 1.2 μsec	_

- The Collector-to-Emitter Sustaining Voltage ($v_{CFO(SUS)}$) with the base open is that value of voltage which remains relatively constaint over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity $v_{QM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).
- b See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.
- **c** Measured at center of seating surface.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with r ing-flange temperature ^c of 25°C.				
	Min.	Max.		
Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector				
<pre>ma. = 0.5 V_{Cf} With base open (Sustaining voltage), dc collector ma. = 100, dc base</pre>	x 60	-	volts	•
ma. = 0 Vcf (si		-	volts	
Base-to-Emitter Voltage for dc collector-to- emitter volts = 4, dc				
collector amperes = 1.5 V _{BF} Collector-Cutoff Current cf for dc collector volts = 30, dc emitter ma. = 0,		2.5	volts	•
mounting-flangetemperature = 25° C	-	25	μa	-
150° C	-	1000	µа	
dc collector ma. = 0 I _{Ef}		25	μa	
		Indicates	a change.	



DC Current Transfer Ratio for dc collector-to-emitter volts = 4, dc collector amperes			
= 1.5 h _{FE} DC Collector-to-Emitter	25	75	
Saturation Resistance for dc collector amperes = 1.5.			
dc base ma. = 100 R _S Thermal Resistance:	-	0.67	ohms
Junction-to-mounting-flange RT	-	2.33	°C/watt

^a The Collector-to-Emitter Sustaining voltage ($v_{CED}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{CAH} = 1$: voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

C Measured at center of seating surface.

OPERATING CONSIDERATIONS, TYPICAL POWER SWITCHING CIRCUIT, RATING CHART, and CURVES shown under Type 2N1487 also apply to the 2N1489



-indicates a change.

World Radio History

Mesa Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION TYPE For VeryHigh Frequency Amplifier and Oscillator Service in Industrial and Military Applications

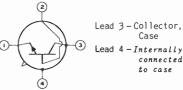
GENERAL DATA

Mechanical:

Operating Position Maximum Length (Excluding					
Maximum Diameter					
Dimensional Outline				JEDEC	No. TO-12
Case				Welde	d, Metal
Seals					Hermetic
Leads, Flexible					
Minimum length					0.500"
Orientation and diameter			See	Dimensional	Outline
Terminal Diagram:	BOTTOM	VIEW			

Lead 1 - Emitter

Lead 2 - Base



INDUSTRIAL SERVICE

Such as large-signal power-amplifier, video-amplifier, and oscillator circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	30	max. volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With emitter-to-base reverse biased	30	max. volts
EMITTER-TO-BASE VOLTAGE	1	max. volt
COLLECTOR CURRENT.	50	max. ma
EMITTER CURRENT	-50	max, ma
TRANSISTOR DISSIPATION (See Rating Chart):		
Operation in free air:		
At ambient temperature of 25° C	0.5	max. watt
At ambient temperature of 100° C	0.25	max. watt
Operation with heat sink:		
At case temperature of 25° C	3	max. watts
At case temperature of 100° C		max, watts
AMBIENT-TEMPERATURE RANGE:	2.0	
Operating and storage	-65 to	+175 °C
operating and beer ages s s s s s s s s	00 10	





ELECTRICAL CHARACTERISTICS

Voltage values are given otherwise specified.					
		Min.	Typical	Max.	
DC Collector Breakdown Voltage for dc collector ma.=0.1, dc emitter					
current = 0 DC Emitter-Cutoff Current for dc emitter volts = 0.5.	BVCBO	30	-	-	volts
<pre>dc collector current = 0 DC Collector-Cutoff Current for dc collector volts = 12,</pre>	I _{E80}	•••	-	100	μа
dc emitter current = 0 . Collector-to-Base and Stem Capacitance for dc col-	Сво	-	-	10	μа
lector volts = 30, dc emitter current = 0 Small-Signal Current Transfer Ratio:	hfe	-	-	5	<i>µµ</i>
<pre>For dc collector-to- emitter volts = 20, dc collector ma. = 15, signal frequency of 1 kc</pre>	· Ie	15	50	200	
of 100 Mc		-	1.8	-	
dc collector ma. = 15 Power Gain at 70 Mc for dc collector volts = 20, dc	f _{ab}	-	250	-	Мс
emitter ma. = -15, power output (mw) = 10 Thermal Resistance:	PG	13	15	-	db
Junction-to-case	RT	-	-	50 ⁰ (C/watt

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

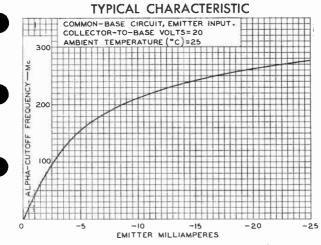
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder

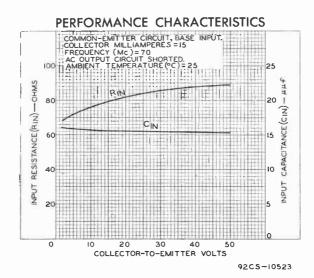
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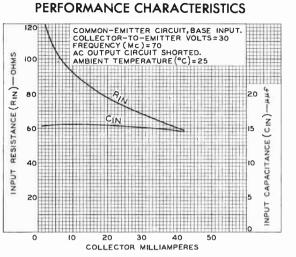




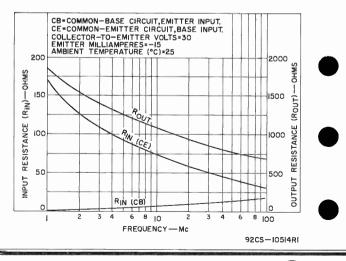
92C\$-10510



RCA

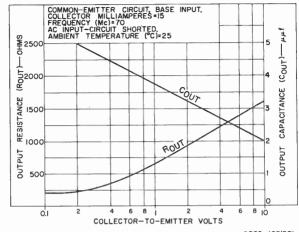


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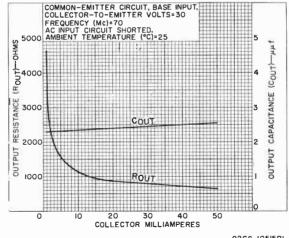






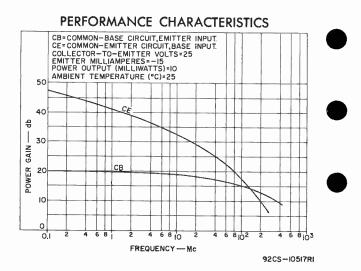


92CS-105I3RI



92CS-10515RI







Mesa Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION TYPE For Very High Frequency Amplifier and Oscillator Service in Industrial and Military Applications

The $2N_{14}q_2$ is the same as the $2N_{14}q_1$ except for the following items:

INDUSTRIAL SERVICE

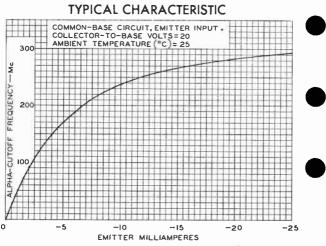
Such as large-signal power-amplifier, video-amplifier, and oscillator circuits

Maximum Ratings, Absolute-Maximum Values:		
COLLECTOR-TO-BASE VOLTAGE	60 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With emitter-to-base reverse biased	60 max.	
EMITTER-TO-BASE VOLTAGE	2 max.	volts

ELECTRICAL CHARACTERISTICS

		Nın.	Typical	Max,	
DC Collector Breakdown Voltage for dc collector ma. = 0.1, dc emitter current = 0 Alpha-Cutoff Frequency for dc collector volts	.BV _{CBO}	60	-	_	volts
= 30, dc collector ma. = 15	. f _{ab}	-	275	_	Мс
dc emitter ma. = -15, power output (mw) = 100.	. PG	13	15	-	db





92CS-10512





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Mesa Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION TYPE

For Very High Frequency Amplifier and Oscillator Service in Industrial and Military Applications

The $2N_{1493}$ is the same as the $2N_{1491}$ except for the following items:

INDUSTRIAL SERVICE

Such as large-signal power-amplifier, video-amplifier, and oscillator circuits

Maximum Ratings, Absolute-Maximum Values:

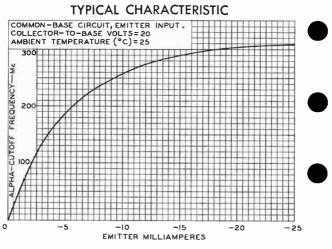
COLLECTOR-TO-BASE VOLTAGE			100 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE				
With emitter-to-base reverse	biased.		100 max.	volts
EMITTER-TO-BASE VOLTAGE			4.5 max.	volts

ELECTRICAL CHARACTERISTICS

		Min.	Typical	Max.	
DC Collector Breakdown Voltage for dc collector ma. = 0.1, dc emitter current = 0 Alpha-Cutoff Frequency for dc collector volts	ВV _{СВО}	100	~	_	volts
= 30, dc collector ma. = 15 Power Gain at 70 Mc: For dc collector volts = 20, dc emitter ma.	f _{ab} PG	-	300	-	Мс
= -15 , power output (rw) = 10 For dc collector volts = 30, dc emitter ma.		-	16	-	db
= -15, power output (mw) = 100 For dc collector volts = 50, dc emitter ma. = -25, power output		-	16	-	db
(mw) = 500		10	12	-	db



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 8-61



92CS-10511





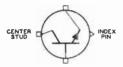
Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position																Any
Maximum Överall Length.																1.230"
Maximum Seated Length .			•			•					•					0.520"
Maximum Diameter		•	•				•	•	•	•	•	•	. . .	•	•	1.250"
Dimensional Outline				•	•	•				•	•	• •	JEL)EC	; N	lo.10-36
Case								•					We	eld	lec	I, Metal
Seals														•	.ŀ	lermetic
Terminal Diagram (See Dimensional Outline):																
-	F	201	CTC	M	VI	FW	1									



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inver	ter, chopper.
voltage- and current-regulator, de	
amplifier, relay- and solenoid-actua	
Maximum and Minimum Ratings, Absolute-Maxi	-
COLLECTOR-TO-BASE VOLTAGE	. 60 max. volts
With emitter-to-base reverse biased	. 60 max. volts
(DC emitter-to-base volts = 1.5)	
With base open (Sustaining voltage) ^a	
EMITTER-TO-BASE VOLTAGE	
COLLECTOR CURRENT	
EMITTER CURRENT	
BASE CURRENT.	. 3 max. amp
TRANSISTOR DISSIPATION:	
At case temperature of 25° C	
At case temperature of 100° C CASE-TEMPERATURE RANGE:	. 43 max. watts
Operating and storage	65 to +200 °C
Characteristics:	
At case temperature of 25 ⁶	° C°
Alpha-Cutoff Frequency (f _{αb}) with dc collector-to-base volts = 12, dc collector ma. = 100	. 1 Mc
	🛥 Indicates a change.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 6-61

2N1511

Collector-to-Base Capacitance (C_{ob}) with dc collector-to-base volts = 40. Thermal Time Constant $\{r_1\}, \ldots, \ldots$ Typical Operation:	•••	. 200 . 12		
In accompanying typical power				
circuit at case temperature ^C DC Supply Voltage (B ₂) DC Base-Bias Voltage (B ₁) "On" DC Collector Current "Turn-On" Base Current (I _{B1}) "Turn-Off" Base Current (I _{B2}) Generator Resistance Switching Time:	of 25	e° C . 12 8.5 . 1.5 . 0.3 0.15 . 50	volts amp amp amp amp	٠
Delay time (t _d)	• • • • ·	. 0.2 . 1 . 1.2	μsec μsec	
 The Collector-to-Emitter Sustaining Voltage (open is that value of voltage which remains re wide range of collector currents, and approximat at which the effective alpha of the device is voltage at which the product of alpha (a), a multiplication factor (M) equals unity. See accompanying Rating Chart and also frans Chart in General Section. C Measured at intersection of seating surface with 	istor-D	issipatio	the base it over a voltage $V_{AM} = 1;$ times the on Rating	
CHARACTERISTICS RANGE VALUES FOR EC		T DESIG	N	
Voltage values are given with respe	ect to	hase an	d	
	ect to	hase an	d	
Voltage values are given with respective case temperature ^C of 25°Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector	ect to rwises Min.	base an pecifie	d d	
Voltage values are given with respective case temperature ^C of 25 ^o Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open (Sustaining voltage), dc collector ma.	ect to rwises	base an pecifie	d	
Voltage values are given with respectate temperature ^C of 25 ^o Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0 V _{CEO} (sus) Base-to-Emitter Voltage for	ect to rwises Min. 60 40	base an pecifie	d d	•
Voltage values are given with respectate temperature ^C of 25°Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0 V _{CEX} Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector amperes = 1.5 . V _{BE} Collector-Cutoff Current for dc collector volts = 30, I _{CBO}	ect to rwises Min. 60 40	base an pecifie	d volts	•
Voltage values are given with respectate temperature ^C of 25°Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 V _{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0 V _{CEX} Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector amperes = 1.5 . V _{BE} Collector-Cutoff Current for dc collector volts = 30, I _{CBO} dc emitter ma. = 0, case temperature = 25°C	ect to rwises Min. 60 40	base an specifie Hax. - -	d volts volts	•
<pre>Voltage values are given with respectate temperature C of 25°Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 V_{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0 V_{CEX} Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector amperes = 1.5 . V_{BE} Collector-Cutoff Current for dc collector volts = 30, I_{CB0} dc emitter ma. = 0, case temperature = 25°C</pre>	ect to rwises Min. 60 40	base ann specifie Max. - 3.5 25	d volts volts volts μa	•
Voltage values are given with respectate temperature ^C of 25°Cunless othe Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5V _{CEX} With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0V _{CEX} (sus) Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector amperes = 1.5. V _{BE} Collector-Cutoff Current for dc collector volts = 30, I _{CBO} dc.emitter ma. = 0, case temperature = 25°C 150°C Emitter-Cutoff Current for dc emitter volts = 10, dc collector ma. = 0	ect to rwises Min. 60 40 - - - - 15	base an specifie Nax. - 3.5 25 1000	d volts volts volts μa μa	•

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Somerville, N. J.

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DC Collector-to-Emitter			
Saturation Resistance for			
dc collector amperes = 1.5, dc base ma. = 300 R _S	-	2	ohms
Thermal Resistance: Junction-to-caseR _T	-	2.33	°C/watt

^a The Collector-to-Emitter Sustaining Voltage (V_{CE0}(sus)) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (v_{QM} = 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

C Measured at intersection of seating surface with the stud.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and danage the transistor.

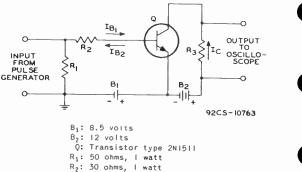
This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Nounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



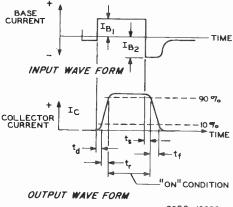
-Indicates a change.

TYPICAL POWER-SWITCHING CIRCUIT



R3: 7.8 ohms, 2 watts

ASSOCIATED WAVE FORMS



92CS-10029

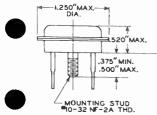
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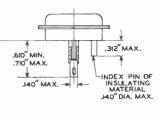
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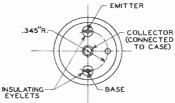
Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA

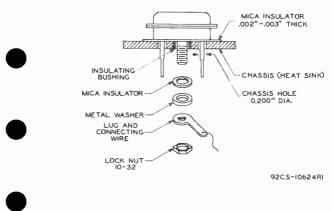
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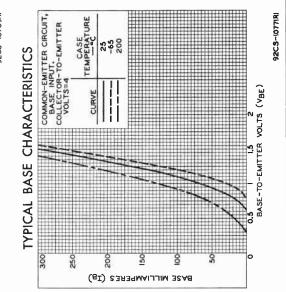
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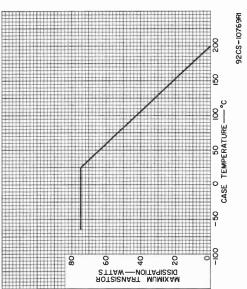
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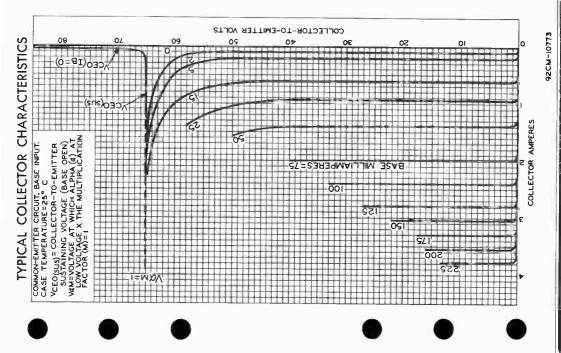








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AMERICA Somerville, N. J. 9

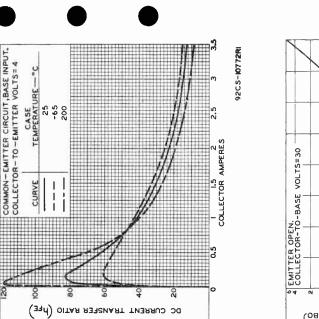
CORPORATION Semiconductor & Materials Division

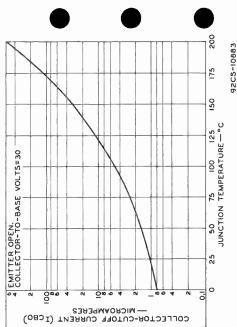
RADIO

CHARACTERISTICS

OPERATION

TYPICAL





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AMERICA Somerville, N. J.

Power Transistor

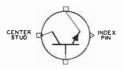


SILICON N-P-N DIFFUSED-JUNCTION TYPE For High-Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position,									
Maximum Överall Length									
Maximum Seated Length 0.520"									
Maximum Diameter									
Dimensional Outline JEDEC No.TO-36									
Case									
Seals									
Terminal Diagram (See Dimensional Outline):									
BOTTOM VIEW									



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

	COLLECTOR-TO-BASE VOLTAGE 60 max. COLLECTOR-TO-EMITTER VOLTAGE:	volts
	With emitter-to-base reverse biased	
	(DC emitter-to-base volts = 1.5) 60 max.	volts
	With base open (Sustaining voltage)≜ 40 max.	volts
7	EMITTER-TO-BASE VOLTAGE 10 max.	volts
	COLLECTOR CURRENT	amp
	EMITTER CURRENT	amp
	BASE CURRENT	amp
	TRANSISTOR DISSIPATION:	
	At case temperature of 25° C 60 max.	watts
	At case temperature of 100° C	watts
,	CASE-TEMPERATURE RANGE:	
	Operating and storage	°C
	Characteristics:	
	At case temperature of 25°C	
	Alpha-Cutoff Frequency (fab)	
1	with dc collector-to-base volts	

= 12. dc collector ma. = 100. . Mc 1



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA I 9-60

2N1511

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Typical Operation:	
In accompanying typical power-switching circuit at case temperature of 25°C	
DC Supply Voltage (B_2)	s
DC Base-Bias Voltage (B)	s
"On" DC Collector Current 1.5 am	p 🧖
"Turn-On" Base Current (I _{B1}) 0.3 am	p
"Turn-Off" Base Current (I _{B2})0.15 am	p
Generator Resistance	S

Switching Time:											
Delay time (t _d) .											μsec
Rise time (t_r) .				٠						1	μsec
Storage time (t _s)											
Fall time (t _f)	•	٠	٠		•		٠			1.2	μsec

- The Collector-to-Emitter Sustaining Voltage $(V_{CCQ}(s_{US}))$ with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity $(V_{CQH} = 1; voltage at which the product of alpha (<math>\Omega$), at low voltage, times the multiplication factor (M) equals unity.
- See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base and case temperature of 25° Cunless otherwise specified

> Min. Max.

Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector						
<pre>ma. = 0.5</pre>	·	V _{CEX}	60	-	volts	
= 100, dc base ma. = 0	·	V _{CEO} (sus)	40		volts	
Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector amperes = 1.5 Collector-Cutoff Current		V _{BE}	-	3.5	volts	
for dc collector volts = 30, dc emitter ma. = 0, case temperature =		I _{CBO}				
25° C	:		_	25 1000	<i>µ</i> а µа	
Emitter-Cutoff Current for dc emitter volts = 10, dc collector ma. = 0 DC Current Transfer Ratio for dc	•	I _{EBO}	-	25	μa	
collector-to-emitter volts = 4, dc collector amperes = 1.5		h _{FE}	10	50		

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Somerville, N. J.



DC Collector-to-Emitter Saturation Resistance for dc collector amperes = 1.5, dc base ma. = 300 R_S - 2 ohms Thermal Resistance: Junction-to-case. R_T - 2.5 ^oC/watt

• The collector-to-Emitter Sustaining Voltage ($V_{CEO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{OM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

OPERATING CONSIDERATIONS

't is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

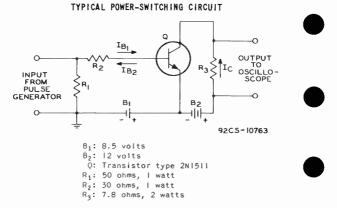
Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Mounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

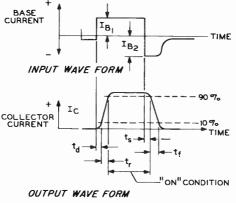
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



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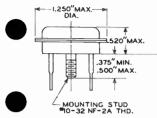
ASSOCIATED WAVE FORMS

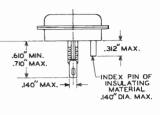


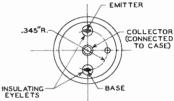
92CS-10029

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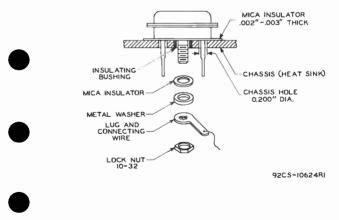






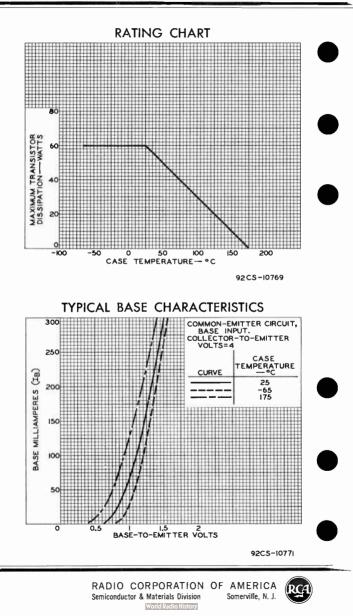
92CM-10612RI



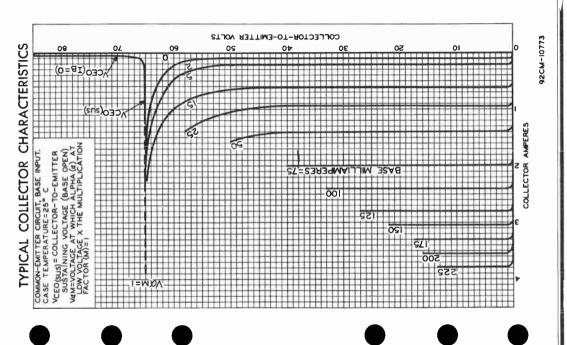




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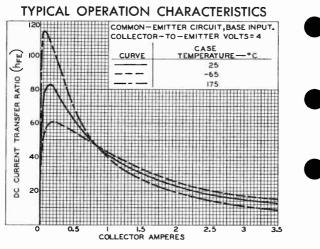
2N1511



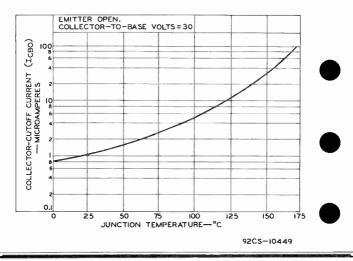
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RADIO



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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.



volts

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE

For High-Power Switching and Amplifier Service in Industrial and Military Applications

The $2N_{1512}$ is the same as the $2N_{1511}$ except for the following items:

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE 100 max. volts COLLECTOR-TO-EMITTER VOLTAGE:

With emitter-to-base reverse biased (DC emitter-to-base volts = 1.5). . . . 100 max.

With base open (Sustaining voltage)≜... 55 max. volts

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

		Mın.	Max.	
Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 With base open {Sustaining	V _{CEX}	100	-	volts
woltage), dc collector ma. = 100, dc base ma. = 0	V _{CEO} ^A	55	_	volts

The collector-to-Emitter Sustaining Voltage ($V_{CEQ}(SUS)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($\underline{V}_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).



World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Overall Length
Maximum Seated Length 0.520"
Maximum Diameter
Dimensional Outline JEDEC No.TO-36
Case
Seals Hermetic
Terminal Diagram (See Dimensional Outline):





INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum and Minimum Ratings, Absolute Maximum Values:

in the second seco	/		
COLLECTOR-TO-BASE VOLTAGE	60 max.	volts	
(DC emitter-to-base reverse blased (DC emitter-to-base volts = 1.5). With base open (Sustaining voltage) EMITTER-TO-BASE VOLTAGE COLLECTOR CURRENT EMITTER CURRENT BASE CURRENT. TRANSISTOR DISSIPATION: ^b	60 max. 40 max. 10 max. 6 max. -8 max. 3 max.	volts amp	-
At case temperature of 25° C At case temperature of 100° C CASE-TEMPERATURE RANGE:° Operating and storage	75 max. 43 max. to +200	watts	•
Characteristics:			
At case temperature of 25° C^{c}			
Alpha-Cutoff Frequency $(f_{\alpha b})$ with dc collector-to-base voits = 12, dc collector ma. = 100	1 200 12	Mc µµf msec	
+	ndicates a	cnange.	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Typical Operation:

In accompanying typical power switching circuit at case temperature ^c of 25 ⁰ C								
DC Supply Voltage (B2)				•	•		12	volts
DC Base-Bias Voltage ² (B ₁)					•	• •	-8.5	volts
"On" DC Collector Current							1.5	amp
"Turn-On" Base Current (1 _{B1}).							0.3	атр
"Turn-On" Base Current (I _{B1}). "Turn-Off" Base Current (I _{B2})							-0.15	amp
Generator Resistance					•		50	ohms
Switching Time:								
Delay time (t _d)							0.2	µsec
Rise time (t _r)					•		1	µsec
Storage time (t _s)					•		1	μsec
Fall time (t _f)	• •	•••	•	·	•		1.2	μsec

The Collector-to-Emitter Sustaining Voltage ($V_{CEO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{CM} = 1$; voltage at which the product of alpha (α), at low voltage times the multiplication factor (M) equals unity).

b See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

c Measured at intersection of sealing surface with the stud.

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Voltage values are given with respect to base and case temperature^C of 25° C unless otherwise specified Max.

Min.

Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5V _{CEX} With base open (Sustaining voltage), dc collector	60	-	volts	
ma. = 100, dc base ma. = 0 V _{CEO} (sus)	40	-	volts	_
Base-to-Emitter Voltage for dc collector-to- emitter volts = 4, dc collector amperes = 1.5 V _{BE} Collector-Cutoff Current I _{CBO} for dc collector volts = 30, dc emitter ma. = 0,	-	2.5	volts	
case temperature = 25° C	-	25	μa	
150° C	-	1000	μa	
dc emitter volts = 10, dc collecter ma. = 0 _{EBO} DC Current Transfer Ratio for dc collector-to-emitter	-	25	μa	
volts = 4, dc collector amperes = 1.5 h _{FE}	25	75	(

-- Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.





DC Collector-to-Emitter Saturation Resistance for dc collector amperes = 1.5, dc base ma. = 100. . . . R_S - 0.67 ohms Thermal Resistance: Junction-to-case R_T - 2.33 ^OC/watt

^a The collector-to-Emitter Sustaining Voltage ($v_{CEO}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{QM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (W) equals unity).

C Measured at intersection of seating surface with the stud.

OPERATING CONSIDERATIONS, TYPICAL POWER SWITCHING CIRCUIT, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES, shown under Type 2NI5II also apply to the 2NI5I3



-Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

World Radio History

2N1513

Power Transistor



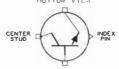
SILICON N-P-N DIFFUSED-JUNCTION TYPE

For High-Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

Operating Position								Any		
Maximum Overall Length.								1.230"		
Maximum Seated Length .								0.520"		
Maximum Diameter										
Dimensional Outline								JEDEC No.TO-36		
Case										
Seals								Hermetic		
Terminal Diagram (See Dimensional Outline):										
BOTTOM VIEW										



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servo-

amplifier, relay- and solenoid-actuating circuits	
Maximum and Minimum Ratings, Absolute Maximum Values:	
COLLECTOR-TO-BASE VOLTAGE 60 max. v	volts
COLLECTOR-TO-EMITTER VOLTAGE:	
With emitter-to-base reverse biased	
	volts
With base open (Sustaining voltage) 40 max. v	volts
EMITTER-TO-BASE VOLTAGE 10 max. N	volts
COLLECTOR CURRENT 6 max.	amp
EMITTER CURRENT	amp
BASE CURRENT	amp
TRANSISTOR DISSIPATION:	
At case temperature of 25 ⁰ C 60 max. v	watts
At case temperature of 100° C	watts
CASE-TEMPERATURE RANGE:	
Operating and storage	°C
, 5 5	
Characteristics:	

At case temperature of 25° C

Alpha-Cutoff Frequency (f _{ab}) with dc collector-to-base volts = 12, dc		
collector ma. = 100	1	Mc
Collector-to-Base Capacitance (Coh)		
with dc collector-to-base volts = 40	200	
Thermal Time Constant (₇₁)	12	msec



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

DATA I 9-60

Typical Operation:

In accompanying ty ing circuit at case											
DC Supply Voltage (82) DC Base-Bias Voltage (81) "On" DC Collector Current	:	:	:	:	:	:	:	:	•	12 -8.5 1.5	volts volts amp
"Turn-On" Base Current $(_{B_1})$. "Turn-Off" Base Current $(_{B_2})$ Generator Resistance Switching Time:										0.3 -0.15 50	amp amp ohms
$\begin{array}{l} \text{Oelay time} \left\{ t_{d} \right\} \dots \dots \\ \text{Rise time} \left\{ t_{r} \right\} \dots \dots \\ \text{Storage time} \left\{ t_{s} \right\} \dots \dots \\ \text{Fall time} \left\{ t_{q} \right\} \dots \dots \end{array}$:	•	:		:	:	:	:	:	0.2 1 1 1.2	µsec µsec µsec µsec

A The Collector-to-Emitter Sustaining voltage $(v_{CEO}(sus))$ with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity $(v_{QM} = 1;$ voltage at which the product of alpha (α), at low voltage times the multiplication factor (M) equals unity).

 See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

CHARGE ENTOTION RANGE TAEGE		II DEGIGIN	
Voltage values are given with case temperature of 25°C unle			
,, .	Nin.	Max.	
Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector			
<pre>ma. = 0.5 V With base open (Sustaining voltage), dc collector ma. = 100, dc base</pre>		-	volts
ma. = 100, dc base ma. = 0 V _c	EO 40 Sus)	-	volts
30, dc emitter ma. = 0,	е — 80	2.5	volts
case temperature = 25° C	- -	25 1000	<i>µ</i> а µа
<pre>dc emitter volts = 10, dc collecter ma. = 0 I_E DC Current Transfer Ratio for dc collector-to-emitter volts = 4, dc collector</pre>	BO [—]	25	µа
amperes = 1.5 ,	e 25	75	

CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

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DC Collector-to-Emitter Saturation Resistance for dc collector amperes = 1.5. dc base ma. = 100. . . . R_S - 0.67 ohms Thermai Resistance: Junction-to-case R_T - 2.5 ^OC/watt

A The collector-to-Emitter Sustaining Voltage ($V_{CEO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{QM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

> OPERATING CONSIDERATIONS, TYPICAL POWER SWITCHING CIRCUIT, DIMENSIONAL OUTLINE, SUGGESTED MOUNTING ARRANGEMENT, RATING CHART, and CURVES, shown under Type 2N1511 also apply to the 2N1513



World Radio History

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volts

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE

For High-Power Switching and Amplifier Service in Industrial and Military Applications

The $2N_{1514}$ is the same as the $2N_{1513}$ except for the following items:

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, relay- and solenoid-actuating circuits

Maximum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE. 100 max. volts COLLECTOR-TO-EMITTER VOLTAGE:

With emitter-to-base reverse biased (DC emitter-to-base volts = 1.5) . . . 100 max.

With base open (Sustaining voltage)≜ . . . 55 max. volts

CHARACTERISTICS RANGE VA	LUES FOR	EQUIPMENT Min.	DESIGN Max.	
Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector ma. = 0.5 With base open (Sustaining voltage), dc collector ma. = 100, dc base	V _{CEX}	100	-	volts
ma. = 0	V _{CEO}	55		volts

The Collector-to-Emilter Sustaining Voltage ($V_{CEO}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($Y_{QM} = 1$; voltage at which the product of alpha (Ω), at low voltage, times the multiplication factor (M) equals unity).



World Radio History

Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

For Intermediate-Frequency-Amplifier Applications in Battery-Operated AM Radio Receivers

GENERAL DATA

Electrical:

Minimum DC Collector-to-Base Voltage for dc emitter-to-base volts = -0.5, dc collector μ a = -50, ambient temperature = 25° C24 volts Maximum DC Collector-Cutoff Current (I _{CBO}) for dc collector-to-base volts = -12, emitter open, ambient temperature = 25° C16 μ a Maximum DC Emitter-Cutoff Current (I _{EBO}) for dc emitter-to-base volts = -0.5, collector open, ambient temperature = 25° C16 μ a Junction-Temperature Rise (In free air) 0.4 °C/mw
Mechanical:
Operating Position

Lead 1 - Emitter

Lead 2 - Base

Leads, Flexible. .



Lead 3 - Collector (Adjacent to red dot on side of case)

INTERMEDIATE-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC COLLECTOR-TO-BASE VOLTAGE	Ξ.						-24 max.	volts
DC EMITTER-TO-BASE VOLTAGE.							-0.5 max.	volt
DC COLLECTOR CURRENT							-10 max.	ma
DC EMITTER CURRENT			•				10 max.	ma
TRANSISTOR DISSIPATION:								
At ambient temperature of							80 max.	mw
At ambient temperature of	55	C C			•	•	50 max.	mw
At ambient temperature of	71	٦ C				•	35 max.	mw
AMBIENT TEMPERATURE (During	ope	era	tic	on)			71 max.	oC
STORAGE-TEMPERATURE RANGE .							-65 to +85	°Č



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 9--6D

Characteristics, At Ambient Temperature of 25 $^\circ$ C:													
Common-Emitter Circuit, Base Input													
DC Collector-to-Emitter Voltage	volts ma												
Common-Base Circuit, Emitter Input													
DC Collector-to-Base Voltage	volts ma Mc												
Typical Operation: At Ambient Temperature of 25° C:													
In a common-emitter, base input, single-stage,													
455-kcintermediate-frequency amplifier circuit													
DC Supply Voltage. -6 -9 -12 DC Collector-to-Emitter Voltage. -5.7 -8.5 -11 DC Emitter Current 1 1 1	volts volts ma												
Input Resistance	ohms												
Output Resistance 0.31 0.415 0.525													
Collector-to-Base Capacitance	Ŭ												
(C _{ob})2.2 ⁻ 2.1 ⁻ 2 ⁻	μµf												
Maximum Power Gain", 51 52.4 54.4	db												
Useful Power Gain: In neutralized circuit 33 33 33	db												
In neutralized circuit 33 33 33 In unneutralized circuit 29.7 30 30.2	db												
In a common-emitter, base input, two-stage,	00												
455-kc intermediate-frequency amplifier circuit													
DC Supply													
Voltage6 -6 -9 -9 -12 -12 DC Collector-	volts												
to-Emitter													
Voltage5.7 -5.7 -8.5 -8.5 -11 -11	volts												
DC Emitter Current 1 0.65 1 0.65 1 0.65	ma												
Input Re- sistance 1300 2100 1350 2200 1550 2500	ohms												
Output Re-													
sistance 0.31 0.49 0.415 0.65 0.525 0.82 Collector-to-	megohm												
Base Capaci- tance (C _{ob}). 2.2 ^A 2.2 ^A 2.1 ^A 2.1 ^A 2 ^A 2 ^A													
tance (Cob) 2.2 2.2 2.1 2.1 2 2 Maximum Power	μμf												
Gain [®] 50.9 51.3 52.4 52.8 54 54.3	db												
Useful Power													
Gain:													
In neutral- ized circuit. 31.2 30 31.2 30 31.2 30	db												
in unneutral-	00												
ized circuit. 28.1 26.6 28.2 26.7 28.3 26.8	db												
A Martin a constant of the Assessment of the Ass													

Maximum variation from this value is 1.4 μμf.

 Measured in a single-tuned unilateralized circuit matched to the generator and load impedance for maximum transfer of power (transformerinsertion losses not included).

> RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

RCA

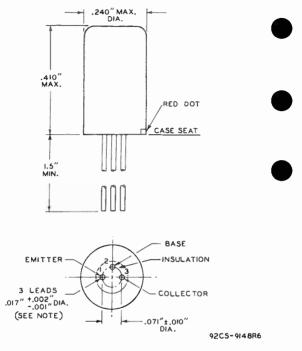
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and danage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.



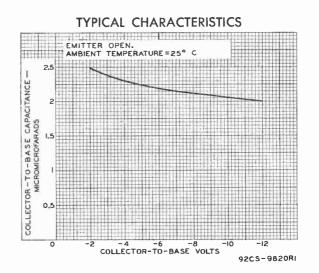


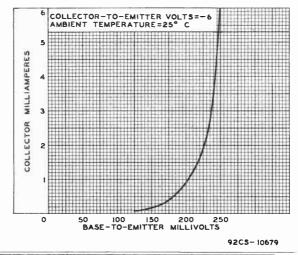
NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND D.25" FROM THE CASE SEAT. BETWEEN D.25" AND 1.5", A MAXIMUM DIAMETER OF D.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



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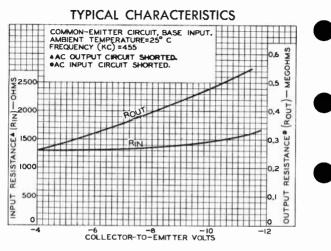
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92CS-10770



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Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

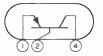
For Intermediate-Frequency-Amplifier Applications in Battery-Operated AM Radio Receivers

The $2N_{15,25}$ is the same as the $2N_{15,24}$ except for the following stems:

Mechanical:

Maximum Overall Length.											0.697"
Maximum Seated Length .											
Maximum Diameter											
Dimensional Outline											
Chse	•	•	·	•	·	•	•	·	٠	·	Metal and Plastic

Pin 1-Emitter Pin 2-Base

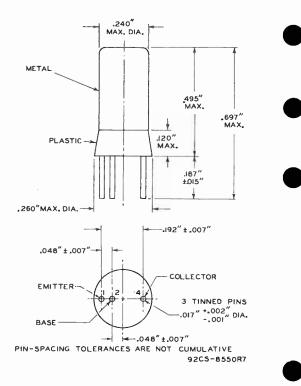


Pin 4-Collector

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transjent currents may cause permanent damage to the transistor.







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Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE For Converter Applications in Battery-Operated AM Radio Receivers

GENERAL DATA

Electrical:

•	Minimum DC Collector-to-Base Voltage for dc emitter-to- base volts = -0.5, dc col- lector $\mu a = -50$, ambient temperature = 25° C	5
	lector-to-base volts = -12, emitter open, ambient temper- ature = 25° C	а
	ature = 25° C	а
	Junction-Temperature Rise (In free air)	v
	Mechanical:	
	Operating Position	D.

BOTTOM VIEW



.ead 1 - Emitte	e		
-----------------	---	--	--

Terminal Diagram:

Lead 3-Collector (Adjacent to red dot on side of case)

Lead 2-Base

CONVERTER

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC	COLLECTOR-TO-BASE VOLTAGE.					-24	max.	volts
	EMITTER-TO-BASE VOLTAGE							
	COLLECTOR CURRENT						max.	ma
ĐC	EMITTER CURRENT	•	•	·	•	10	max.	ma



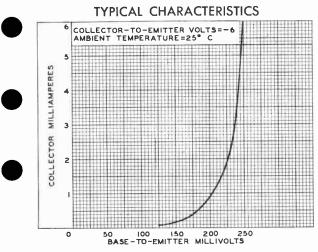
vid Dadio Hist

TRANSISTOR DISSIPATION: At ambient temperature of 25° C At ambient temperature of 55° C At ambient temperature of 71° C AMBIENT TEMPERATURE (During opera STORAGE-TEMPERATURE RANGE.	 tion) .	•••	80 max. 50 max. 35 max. 71 max. 5 to +85	o C ww	
Characteristics, At Ambient Tempe	rature (of 25°	C:		
Common-Emitter Circu			t		
DC Collector-to-Emitter Voltage. DC Emitter Current			-12 1 130	volts ma	
Common-Base Circuit,	Emitte	r Input	t		
DC Collector-to-Base Voltage DC Emitter Current Small-Signal Current Transfer Rat Alpha-Cutoff Freouency	 io at 1	kc.	-12 1 0.992 33	та	
Typical Operation, At Ambient Temp	beratur	e of 25	° C:		
In a common-emitter, b					
excited, 1.5 Mc-con	verter	cırcu	ı ı t		
DC Supply Voltage DC Collector-to-Emitter	-6	-9	-12	volts	
Voltage	-5	-8	-11	volts	
DC Emitter Current	0.65	0.65	0.65	ma	
Input Resistance	1850		2150	ohms	
Output Resistance	0.19	0.28	0.48	megohm	
Oscillator-Injection Voltage Conversion Power Gain:	100	100	100	mv	
Maximum available	44.2	46.1	48.9	db	
Useful	34.2	34.5	35.8	db	

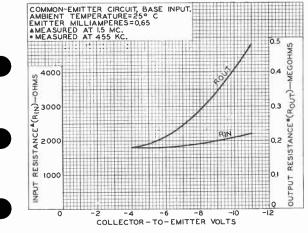
OPERATING CONSIDERATIONS and DIMENSIONAL OUTLINE shown under Type 2N1524 also apply to the 2N1526



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92CS-10679



92CS-10583RI



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World Radio History

Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

For Converter Applications in Battery-Operated AM Radio Receivers

The 2N1527 is the same as the 2N1526 except for the following items:

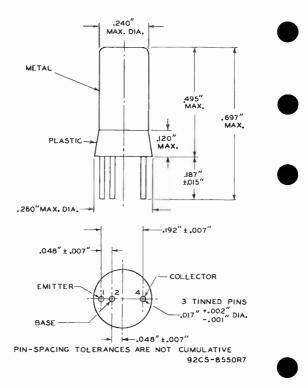
Mechanical:

Vaximum Length Maximum Seated Length Maximum Diameter, . Dimensional Outline	•	•	•	•	•	•	• •		•	0.495"
Dimensional Outline .	•	•	•	•	٠.	٠.	•	• •		JEDEC NO. 10-40
Case										. Metal and Plastic
Terminal Diagram;										
Pin 1-Emitter Pin 2-Base				1	7	/	-	\leq)	Pin 4-Collector

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.







Somerville, N. J.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

2N1613

Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION PLANAR TYPE For Industrial and Military Applications The 2N2102, having Higher Ratings, is a Direct Replacement for Type 2N1613

GENERAL DATA

	Mechanical:
	Operating Position
	Maximum Length (Excluding flexible leads) 0.260"
	Maximum Diameter 0.370"
	Dimensional Outline JEDEC No.TO-5
	Case
	Seals
	Leads, Flexible
)	Minimum length
	Orientation and diameter See Dimensional Outline
	Terminal Diagram: BOTTOM VIEW
	(2)
	Ĭ
	Lead 1-Emitter

Lead 2 - Base



Case

INDUSTRIAL SERVICE

Maximum and Minimum Ratings, Absolute-Haximum	m Values:	
COLLECTOR-TO-BASE VOLTAGE: With emitter open COLLECTOR-TO-EMITTER VOLTAGE:	75 max.	volts
With external resistance (ohms)≤10 between base and emitter	50 max.	volts
With collector open COLLECTOR CURRENT TRANSISTOR DISSIPATION: @	7 max. 1 max.	volts amp
At case temperature ^b of 25°C or below At free-air temperature of 25°C or below. TEMPERATURE RANGE:	3 max. 0.8 max.	
Storage		၀င ဝင
For 10 seconds maximum	255 max.	oC

- a See accompanying Rating Chart.
- b Measured at center of seating plane.

C Measured 1/16" ± 1/32" down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA J 8-61

ELECTRICAL CHARACTERISTICS

ELECTRICAL CHAR		•			
Voltage values are given wit case temperature ^b of 25°C un					
		Hin.	Max.		
DC Collector Breakdown Voltage for dc collector ma. = 0.1, dc emitter ma. = 0, DC Emitter Breakdown Voltage for dc collector ma. = 0, dc	ВУсво	75	-	volts	
emitter ma. = 0.25 DC Collector-to-Emitter Reach- Through Voltage for dc emitter volts = 1.5, dc collector	BVEBO	7	-	volts	
ma. = 0.1	V _{RT}	75	-	volts	
resistance (ohms) ≤ 10 DC Base-to-Emitter Saturation Voltage for dc collector ma.	VCER(sus)	50	-	volts	
= 150, dc base ma. = 15 DC Collector-to-Emitter Satu- ration Voltage for dc col- lector ma. = 150. dc	-	-	1.3	volts	
base ma. = 15 DC Collector-Cutoff Current for dc collector volts = 60, dc emitter ma. = 0, case temperature ^b =	V _{CE} (sat) CBO		1.5	volts	
25° C. 150° C. DC Emitter-Cutoff Current for dc base volts = 5, dc collector		_	0.01 10	μа μа	
ma. = 0	IЕВО hib	-	0.01	μа	
<pre>volts = 5, dc collector ma. = 1</pre>		24	34	ohms	
ma. = 5		4	8	ohms	
ma. = 10	Cib	-	80	μµf	
emitter ma. = 0	C _{ob}	-	25	μµf	





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

2N1613

	Output Conductance at fre- quency of 1 kc: With dc collector-to-emitter	h _{ob}			
	volts = 5, dc collector ma. = 1 With dc collector-to-		0.1	0.5	μmho
	emitter volts = 10, dc collector ma. = 5 Small-Signal Forward Current Transfer Ratio:	h _{fe}	0.1	1	<i>µ</i> mho
	With dc collector-to- emitter volts = 5, dc collector ma. = 1, fre- quency (kc) = 1 With dc collector-to-		30	100	
	emitter volts = 10, dc collector ma. = 5, fre- quency (kc) = 1 With dc collector-to-		35	150	
	emitter volts = 10, dc collector ma. = 50, fre- quency (Mc) = 20 DC-Pulse Forward-Current Transfer Ratio for dc col- lector-to-emitter volts =	h _{FE}	3	-	
	10, pulse width (μsec) = 300, duty factor of 0.018, dc collector ma. = 150······ 500	hfe	40 20	_120	
	Transfer Ratio: With dc collector-to- emitter volts = 10, dc collector ma. =	"FE			
	0.1		20 35	-	
_	collector ma. = 10, case temperature ^b of -55° C	hrb	20	-	
	With dc collector-to- emitter volts = 5, dc collector ma. = 1 With dc collector-to-		-	3 × 10 ⁻⁴	
	emitter volts = 10, dc collector ma. = 5		-	3×10^{-4}	



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. World Radio History

DATA 2 8-61

2N1613

Noise Figure for signal fre- quency of 1 kc, circuit bandwidth of 15 kc, gener- ator resistance (ohms) = 1000, dc collector-to- emitter volts = 10, dc col-					
lector ma. = 0.3 Total Switching Time ^d (Delay	NF	-	12	db	
time + rise time + fall time) Thermal Resistance:	td+tr+tf Rt	-	30	mµsec	
Junction-to-case Junction-to-free air	n I			^o C/watt ^o C/watt	

b Measured at center of seating plane.

^d See accompanying fotal-Switching-fime Neasurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

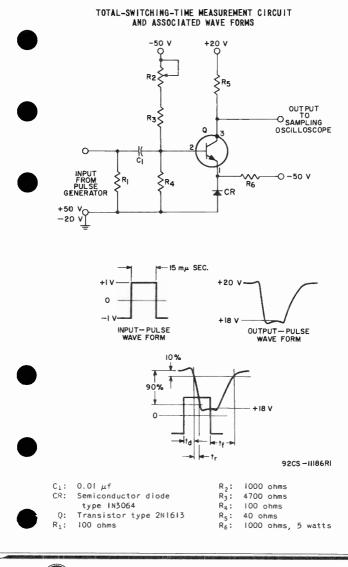
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for socketed, single-side printed-circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printedcircuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



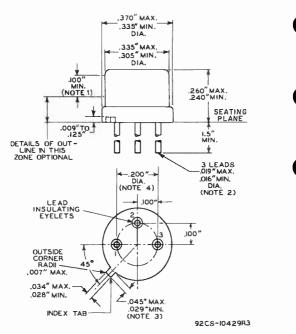




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DATA 3 8-61

JEDEC No.TO-5



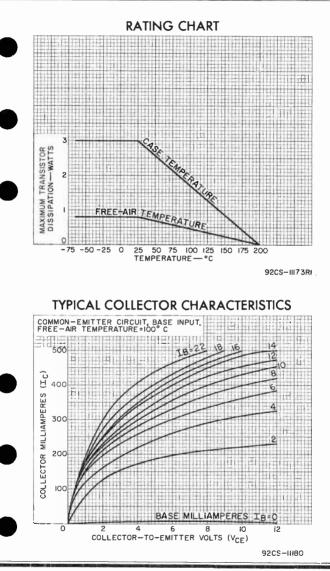
NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANOLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE OEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.

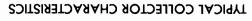


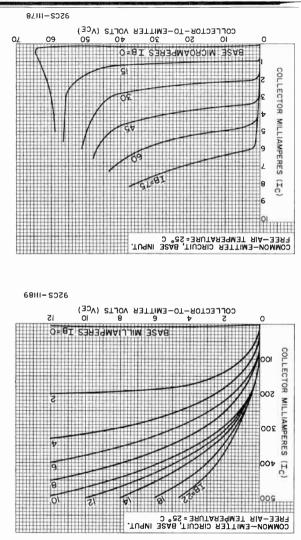




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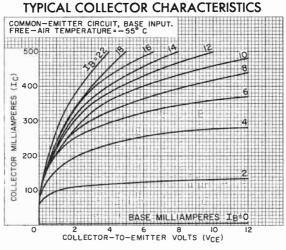






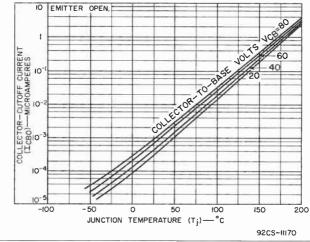


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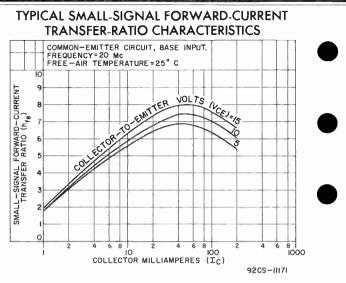
92CS-11191

TYPICAL COLLECTOR-CUTOFF-CURRENT CHARACTERISTICS

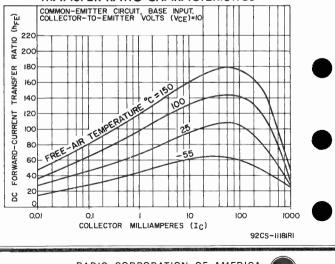




RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 5 8-61

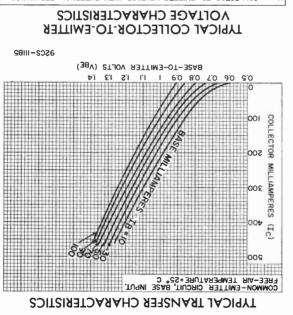


TYPICAL DC FORWARD-CURRENT TRANSFER-RATIO CHARACTERISTICS

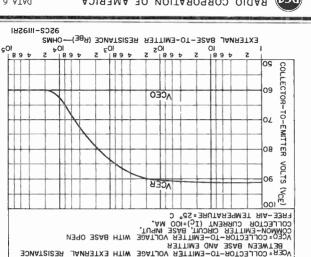


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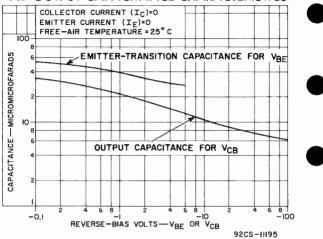




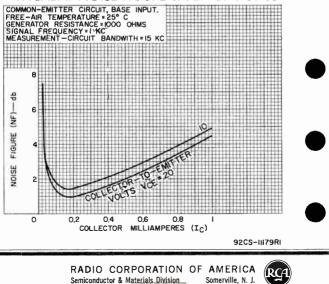




TYPICAL EMITTER-TRANSITION-CAPACITANCE AND OUTPUT-CAPACITANCE CHARACTERISTICS



TYPICAL AF NOISE-FIGURE CHARACTERISTICS



GERMANIUM P-N-P ALLOY TYPE

For Radio-Frequency-Amplifier Applications in Battery-Operated AM Radio Receivers

GENERAL DATA

Minimum DC Collector-to-Base Breakdown Voltage (BV_{CBO}) for dc collector $\mu a = -50$, emitter open, ambient
temperature = 25° C
Maximum DC Collector-Cutoff Current (I _{CBO}) for dc
collector-to-base volts
= -12, emitter open, ambient temperature = 25 ⁰ C
Maximum DC Emitter-Cutoff
Current (I _{EBO}) for dc emitter- to-base volts = -0.5, col-
lector open, ambient tem- perature = 25 ⁰ C
Maximum Junction-Temperature
Rise (In free air) 0.4 °C/mw
Mechanical:
Operating Position
Maximum Overall Length
Maximum Diameter
Dimensional Outline JEDEC No.TO-40
Case
Seals
Terminal Diagram:
Pin 1 - Emitter Pin 2 - Base Pin 4 - Collector



RADIO-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC CC	JLLECTO	R-TO-BAS	E VOL	TAG	Ε.			•	-34	max.	volts
DC EN	AFTTER-	TO-BASE	VOLTA	GE	•••				-0.5	max.	volt
DC C(OLLECTO	R CURREN	Τ						-10	max.	ma
DC EN	AITTER (CURRENT							10	max.	ma
TRANS	SISTOR I	DISSIPAT	I ON :								
At	ambien	t tempera	ature	of	25 ⁰	γС.			80	max.	mw
At	ambien	t temper	ature	of	55 ⁰	°С.			50	max.	πw
At	ambien	t temper	ature	of	710	ΥС.			35	max.	πw



Electrical:

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Particulation DATA I 9-60

2N1631

AMBIENT TEMPERATURE (During op STORAGE-TEMPERATURE RANGE				oC ဝင			
Characteristics, At Ambient Te	mperatur	e of 250	C:				
Common-Emitter Ci	ircuit, i	Base Inpu	t		•		
DC Collector-to-Emitter Voltag DC Collector Current Small-Signal Current Transfer Ratio at 1 kc			. 1	ma			
Common-Base Circu	it, Emit	tter Inpu	t				
DC Collector-to-Base Voltage. DC Emitter Current Small-Signal Current Transfer Ratio at 1 kc Alpha-Cutoff Frequency	· · · ·	· · · · ·	. 1 . 0.987	ma			
Typical Operation, At Ambient Temperature of 25° C:							
In a Common-Emitter Circuit, Base Input at a signal frequency of 1.5 Ho							
DC Supply Voltage DC Collector-to-Emitter	-6	-9	-12	volts			
Voltage	-5.7 1	-8.5 1	-11 1	volts ma			
circuit shorted	520	750	1000	ohms			
circuit shorted Extrinsic Transconductance Collector-to-Base Capacitance	0.065 36000	0.11 36000	0.18 36000	megohm µmhos			
(C _{ob})	2.2 [▲] 40.4	2.1 [▲] 44.3	2 [▲] 47.7	μμf db			
In unneutralized circuit.	25.3	25.5	25.6	db			

Maximum variation from this value is 0.9 μμf.

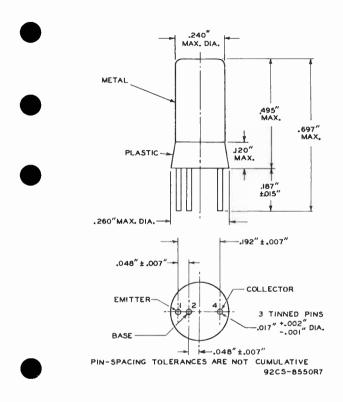
 Measured in a single-tuned unilateralized circuit matched to the generator and load impedance formaximum transfer of power (transformerinsertion losses not included).

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

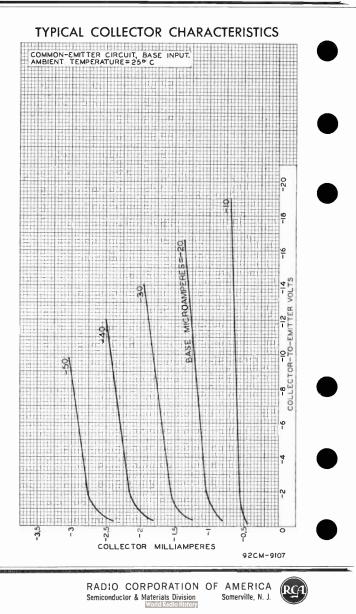


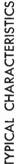


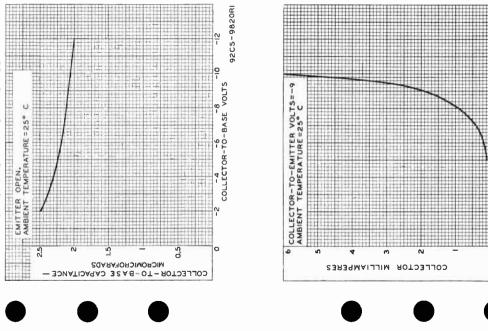




RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History Somerville, N. J.







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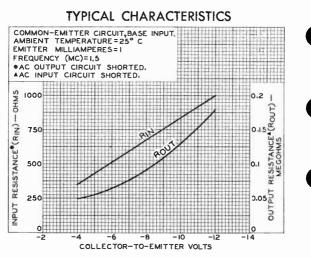
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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Rector History

GERMANIUM P-N-P ALLOY TYPE

For Radio-Frequency-Amplifier Applications in Battery-Operated Radio Receivers

The $2N_{16}$ is the same as the $2N_{16}$ except for the following items:

Mechanical:

Maximum Length (Excluding flexible leads) 0.410'	
Maximum Diameter	1
Dimensional Outline JEDEC No. TO-1	L
Case	
Leads, Flexible	3
Minimum length	1
Orientation and diameter See Dimensional Outline	
Terminal Diagram: BOTTOM VIEW	
-	

Leac 1 - Emitter

Lead 2 - Base



Lead 3 - Collector (Adjacent to red dot on side of case)

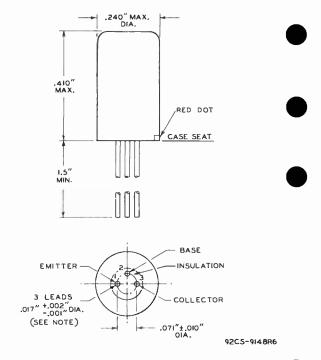
OPERATING CONSIDERATIONS

it is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.





NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



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Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE

For Intermediate-Frequency-Amplifier Applications in Battery-Operated AM Radio Receivers

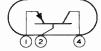
GENERAL DATA

Electrical: Minimum DC Collector-to-Base Breakdown Voltage (BVCBO) for dc collector $\mu a = -50$, emitter open, ambient temperature = 25° C. . . -34 volts Maximum DC Collector-Cutoff Current (ICBO) for dc collector-to-base volts = -12, emitter open, ambient temperature = 25° C. . -16 Maximum DC Emitter-Cutoff Current (I_{EBO}) for dc emitter-to-base volts = -0.5, collector open, ambient temperature = 25° C. . . -16 Maximum Junction-Temperature Rise (In free air). 0.4 OC/mw Mechanical: Operating Position . .Any

Max	imum O	veral	1 L	eng	th												0.6	597"
Max	cimum S	eated	l Le	ngt	h.												0.4	95"
Max	(innum D	iamet	er	÷.													0.2	260"
Din	nension	al Ou	itli	ne.									JE	EDE	C	No	5. TC	-40
Cas	e								,		.1	le1	tal	1 2	inc	11	Plas	stic
Sea	ds															He	erme	etic
Ter	minal	Diagr	am:															



Pin 1 - Emitter Pin 2 - Base



Pin 4 - Collector

INTERMEDIATE-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	DC COLLECTOR-TO-BASE VOLTAGE	max. volt	
			ι
		max. ma	а
	DC EMITTER CURRENT	max. ma	а
	TRANSISTOR DISSIPATION:		
		max. m	N
		max. m	N
		max. m	
,		max. ⁰ (
	STORAGE-TEMPERATURE RANGE	o+85 °(0

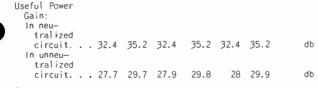
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

Characteristics, At Ambient Tem;	perature o	f 25° C:			
Common-Emitter Cir	cuit, Base	Input			-
DC Collector-to-Emitter Voltage			-12	volts	
DC Emitter Current			1	ma	
Ratio at 1 kc			75		
			15		
Common-Base Circui		Input			
DC Collector-to-Base Voltage .			-12	volts	
DC Emitter Current			1	та	
Small-Signal Current Transfer			0.000		
	• • • • •	• • • •	40	Мс	
Alpha-Cutoff Frequency		• • • •	40	MC	
Typical Operation, At Ambient T	emperature	of 250	C:		
In a common-emitter, bas	e-indut.	single-s	tage.		
455-kc intermediate-frequ					
DC Supply Voltage		-9	-12	volts	
DC Collector-to-Emitter Voltage		-8.5	-11	volts	
DC Emitter Current		1	1	ma	
Input Resistance, ac output					
circuit shorted	. 1500	1550	1800	ohms	
Output Resistance, ac input					
circuit shorted	. 0.35	0.475	0.6	megohm	
Collector-to-Base Capacitance					
(C _{ob})	. 2.2	2.1	2	μµ f	
Maximum Power Gain [®]	. 52.6	53.8	55.7	db	
Maximum Useful Power Gain:	00 7	20.7	00.7	-11-	
In neutralized circuit			36.7	db	
In unneutralized circuit	• 31.2	31.3	31.4	db	
In a common-emitter, b					
455-kc intermediate-freq	uency-ampl	ifier cı	rcuit		
DC Supply					
· · · · · · · · · · · · · · · · · · ·	-9 -9	-12	-12	volts	
DC Collector-					
to-Emitter					
Voltage5.7 -5.7 -8	.5 -8.5	-11	-11	volts	
DC Emitter	5 1	0.5	1	ma	
Current0.5 1 0 Input Resist-	.5 1	0.5	1	ma	
ance, ac out-					
put circuit					
shorted 2800 1500 30	00 1550	3400 1	800	ohms	-
Output Resist-					
ance, ac in-					
put circuit					
shorted 0.7 0.35 0	.9 0.475	1.2	0.6 m	negohms	
Collector-to-					
Base Capac-					
itance (C _{ob}) . 2.2 ⁴ 2.2 ⁴ 2	.1 2.1	2	2	<i>µµ</i> .f	
Maximum Power Gain [®] 52.2 52.6 53	2 52 0	55 6 9	5 7	db	
Gam JZ.Z JZ.O JJ	., .,	55.6 5		00	-

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Word Racio History



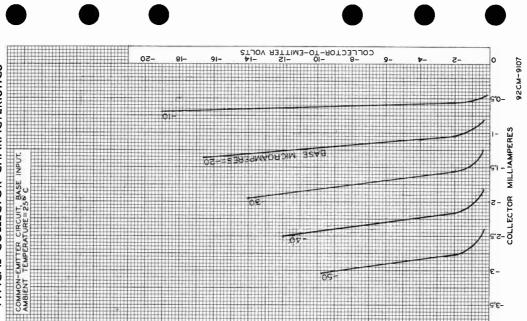


- Maximum variation from this value is 0.9 μμf.
- Measured in a single-tuned unilateralized circuit matched to the generator and load impedance for maximum transfer of power (transformerinsertion losses not included).

OPERATING CONSIDERATIONS and DIMENSIONAL OUTLINE shown under type 2N1631 also apply to the 2N1633



COLLECTOR CHARACTERISTICS **YPICAL**



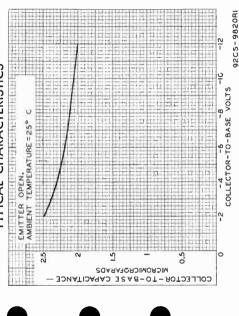
AMERICA Somerville, N. J.

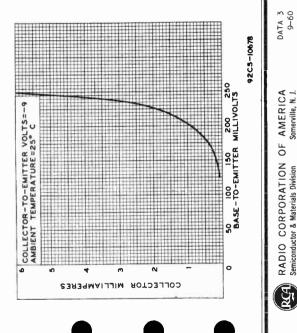
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RADIO CORPORATION Semiconductor & Materials Division







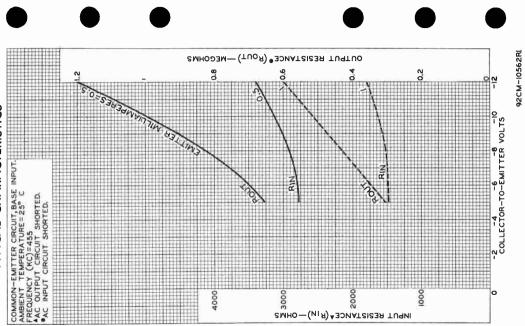
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RADIO CORPORATION Semiconductor & Materials Division

GERMANIUM P-N-P ALLOY TYPE

For Intermediate-Frequency-Amplifier Applications in Battery-Operated Radio Receivers

The 2N1634 is the same as the 2N1633 except for the following items:

Mechanical:

Maximum Length (Excluding flexible leads) 0.410"
Maximum Diameter
Dimensional Outline JEDEC No. TO-1
Case
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



Lead 3-Collector (Adjacent to red dot on side of case)

OPERATING CONSIDERATIONS

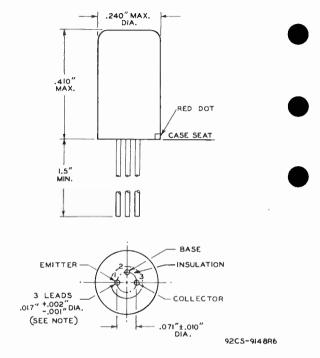
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History



NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

GERMANIUM P-N-P ALLOY TYPE

For Converter Applications in Battery-Operated AM Radio Receivers

GENERAL DATA

Minimum DC Collector-to-Base Breakdown Voltage (BVCBO) for dc collector $\mu a = -50$, emitter open, ambient temperature = 25° C. . . . -34 volts Maximum DC Collector-Cutoff Current (ICBO) for dc collector-to-base volts = -12, emitter open, ambient temper-ature = 25° C. -16 μa Maximum DC Emitter-Cutoff Current (I_{EBO}) for dc emitterto-base volts = -0.5, coilector open, ambient temperature = 25° C. -16 μa Maximum Junction-Temperature Rise (In free air) . . . 0.4 °C/mw Mechanical: Operating Position Any Maximum Överall Length 0.697" Maximum Seated Length. 0.495" . . Maximum Diameter 0.260" Dimensional Outline. . . JEDEC No. TO-40 CaseMetal and Plastic Seals. Hermetic Terminal Diagram: Pin 1-Emitter Pin 4 - Collector Pin 2 - Base



CONVERTER

Maximum and Minimum Ratings, Absolute-Maximum Values:

	4 max.	
	5 max.	volt
	0 max.	ma
	0 max.	ma
TRANSISTOR DISSIPATION:		
	0 max.	mw
	0 max.	mw
At ambient temperature of 71 ⁰ C 3	5 max.	πw



Electrical:

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Parlia History

2N1635

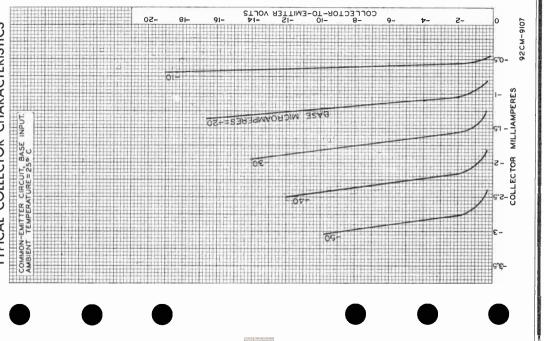
AMBIENT TEMPERATURE (During operation) 71 max. STORAGE-TEMPERATURE RANGE	°C	_
Characteristics, At Ambient Temperature of 25°C:		
Common-Emitter Circuit, Base Input		
DC Collector-to-Emitter Voltage12 DC Emitter Current	volts ma	
Ratio at 1 kc		
Common-Base Circuit, Emitter Input	(
DC Collector-to-Base Voltage12	volts	
DC Emitter Current	ma	
Alpha-Cutoff Frequency	Мс	
Typical Operation, At Ambient Temperature of 25°C:		
In a common-emitter, base-input,		
self-excited, 1-Mc converter circuit		
DC Supply Voltage	volts volts	
DC Emitter Current 0.65	ma	
Input Resistance	ohms megohm	
RMS Base-to-Emitter	megonin	
Oscillator-Injection Voltage 100	mv	
Conversion Power Gain	db	

OPERATING CONSIDERATIONS and DIMENSIONAL OUTLINE shown under Type 2N1631 also apply to the 2N1635



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

CHARACTERISTICS COLLECTOR **TYPICAL**

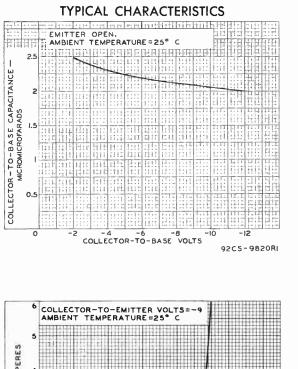


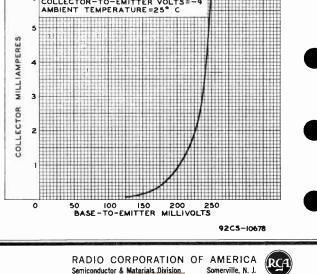
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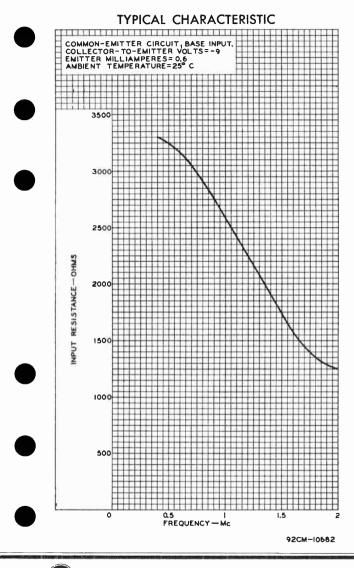
AMERICA Somerville, N. J.

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RADIO CORPORATION Semiconductor & Materials Division









RADIO CORPORATION OF AMERICA Somerville, N. J.

DATA 3 9-60

World Radio History

Lead 3-Collector (Adjacent

> to red dot on side of

case)

GERMANIUM P-N-P ALLOY TYPE

For Converter Application in Battery-Operated AM Radio Receivers

The 2N1636 is the same as the 2N1635 except for the following items:

Mechanical:

Maximum Length (Excluding flexible lea	
Maximum Diameter	0.260"
Dimensional Outline	JEDEC No. TO-1
Case	Metal
Leads, Flexible	3
Minimum length	1.5"
Orientation and diameter	See Dimensional Outline
Terminal Diagram: BOTTOM VIEW	

Lead 1 - Emitter

Lead 2 - Base

OPERATING CONSIDERATIONS

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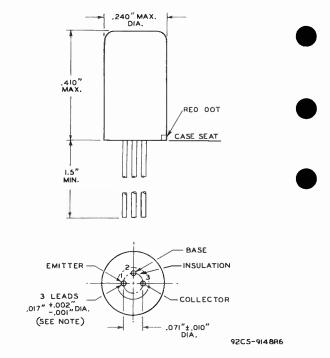
It is recommended that this transistor not be connected into or disconnected from circults with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 9-60



NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN D.D5" AND D.25" FROM THE CASE SEAT. BETWEEN D.25" AND I.5", A MAXIMUM DIAMETER OF D.D21" IS HELD. DUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Datio Henory Somerville, N. J.

GERMANIUM P-N-P ALLOY TYPE For Radio-Frequency-Amplifier Applications in AM Automobile-Radio Receivers

GENERAL DATA

Electrical:

Minimum DC Collector-to-Base Break- down Voltage (BV _{CBO}) for dc	
collector $\mu a = -50$, emitter	
open, ambient temperature of 25°C	-34 volts
Maximum DC Collector-Cutoff Current (Icao) for dc collector-to-base	
volts = -12 , emitter open,	
ambient temperature of 250 C	∽5 µа
Maximum DC Emitter-Cutoff Current (!EBD) for dc emitter-to-base	
volts = -1.5 , collector open,	
ambient temperature of 25° C	-15 μa
Maximum Junction-Temperature Rise (In free air)).4 ^o C/mw
Mechanical:	

Mechanical:

Operating Position
Maximum Diameter
Dimensional Outline JEDEC No.TO-1
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOTTOM VIEW



Lead 1 - Emitter

Lead 2 - Base



Lead 3-Collector (Adjacent to red dot on side of case)



RADIO-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

DC COLLECTOR-TO-BASE VOLTAGE.					-34	max.	volts
DC EM TTER-TO-BASE VOLTAGE						max.	volts
DC COLLECTOR CURRENT						max.	ma
DC EMITTER CURRENT			•	•	10	max.	ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 9-60

TRANSISTOR DISSIPATION: At ambient temperature of 25° C. 80 max. mw At ambient temperature of 55° C. 50 max. mw At ambient temperature of 71° C. 35 max. mw AMBIENT TEMPERATURE (During operation) 71 max. °C STORAGE-TEMPERATURE RANGE. -65 to +85 °C	
Characteristics, At Ambient Temperature of 25° C:	
Common-Emitter Circuit, Base Input	
$\begin{array}{ccc} DC \ Collector-to-Emitter \ Voltage. & & -12 \ volts \\ DC \ Collector \ Current \ . & . & . & . & . \\ Collector-to-Base \ Capacitance \ (C_{ob}) \ . & . & 2^{A} \ \mu\mu f \\ Small-Signal \ Current \ Transfer \\ Ratio \ at \ 1 \ kc. \ . & . & . & . \\ \end{array}$	
Common-Base Circuit, Emitter Input	
DC Collector-to-Base Voltage -12 volts DC Collector Current -1 ma Small-Signal Current Transfer -1 ma Ratio at 1 kc. 0.987 45 Mc	
Typical Operation, At Ambient Temperature of 25°C:	
In a common-emitter circuit, base in- put at a signal frequency of 1.5 Mc	
DC Collector-to-Emitter Voltage5.5 -11.2 volts DC Emitter Current	
circuit shorted	
Circuit shorted 0.065 0.18 megohm Maximum Power Gain 40.4 47.7 db Maximum Usful Power Gain: In unneutralized circuit 25.3 25.6 db	•
A Maximum variation from this value is a af	

Maximum variation from this value is 0.9 μμf.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

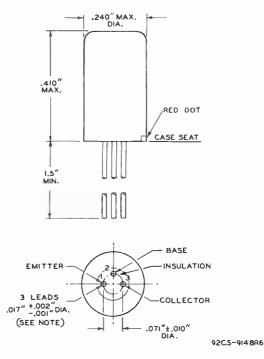
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Recipilision

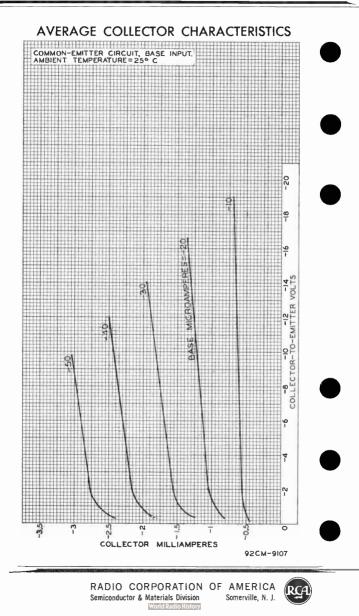


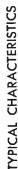


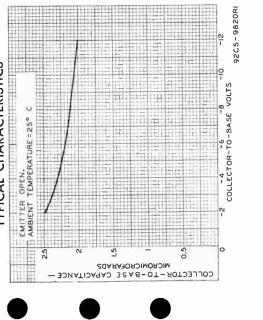


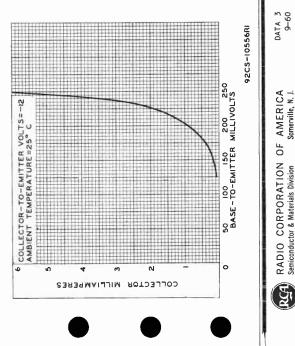
NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.







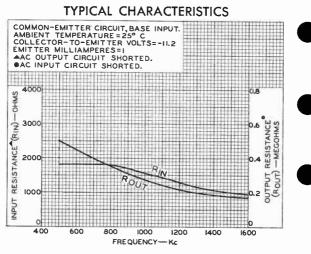




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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Reficienciation

GERMANIUM P-N-P ALLOY TYPE

For Intermediate-Frequency-Amplifier Applications in AM Automobile-Radio Receivers

GENERAL DATA

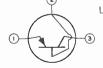
Electrical:

Minimum DC Collector-to-Base Breakdown Voltage (BV_{CBO}) for dc collector $\mu a = -50$, emitter open, ambient tem- perature = 25° C	 	-34	volts
lector-to-base volts = -12, emitter open, ambient tem- perature = 25° C	 	-7	μa
-0.5, collector open, am- bient temperature = 25 ⁰ C	 	-8	μa
Maximum Junction-Temperature Rise (In free air)		0.4	°C/mw
Mechanical:			
Operating Position			Any 0.410"

Maximum Diameter.																				
Dimensional Outli	ne														•	٦I	ED	EC	No	o. T0−1
Case																				Metal
Seals																			Her	metic
Leads, Flexible .																				3
Minimum length.																				1.5"
Orientation and	di	iar	net	ter	۰.						Se	ee	Dı	īme	271.5	ii	0710	ıl	0u	tline
Terminal Diagram:				6	301	TT(MC	V	I EV	N										

Lead 1-Emitter

Lead 2-Base



Lead 3-Collector (Adjacent to red dot on side of case)

INTERMEDIATE-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Haximum Values: DC COLLECTOR-TO-BASE VOLTAGE. -34 max. volts DC EMITTER-TO-BASE VOLTAGE. -0.5 max. volt DC COLLECTOR CURRENT. -10 max. ma DC EMITTER CURRENT. 10 max. ma



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 9-60

2N1638

$\begin{array}{llllllllllllllllllllllllllllllllllll$	mw oC oC	
Characteristics, At Ambient Temperature of 25° C:		
Common-Emitter Circuit, Base Input		
DC Collector-to-Emitter Voltage12	volts 🥒	
DC Collector Current	ma	
Collector-to-Base Capacitance (C _{ob}) 2 [*] Small-Signal Current Transfer	μµf	
Ratio at 1 kc		
Common-Base Circuit, Emitter Input		
DC Collector-to-Base Voltage12	volts	
DC Collector Current	ma	
Small-Signal Current Transfer		
Ratio at 1 kc. 0.986 Alpha-Cutoff Frequency 40	Мс	
	MC	
Typical Operation, At Ambient Temperature of 25°C:		
In a common-emitter, base-input, single-stage,		
262.5-kc intermediate-frequency-amplifier circuit		
DC Collector-to-Emitter Voltage5 -11	volts	
DC Emitter Current	ma	
Input Resistance 1400 Output Resistance 0.47	ohms negohm	
Maximum Power Gain	db	
Useful Power Gain:	<i>40</i>	
In unneutralized circuit	db	
Maximum variation from this value is 0.9 μμf.		

OPERATING CONSIDERATIONS

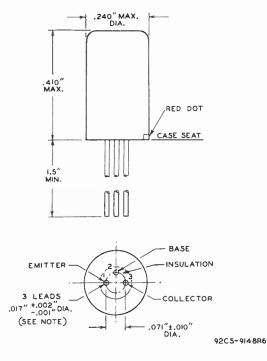
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering Of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.

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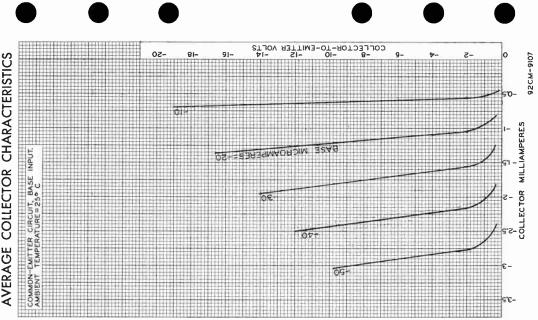


NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE RETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Refer Listory Somerville, N. J. DATA 2 9-60

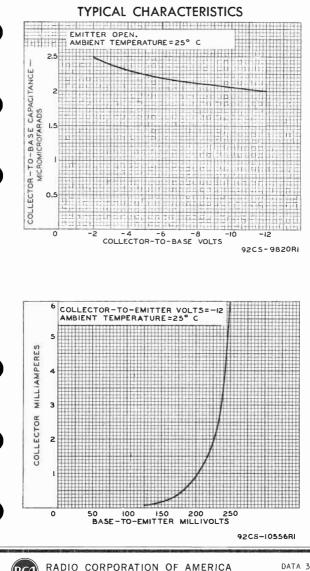




AMERICA Somerville, N. J.

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Semiconductor & Materials Division

World Radio Hi

9-60

Somerville, N. J.

World Radio History

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Drift-Field Transistor

GERMANIUM P-N-P ALLOY TYPE For Converter Applications in AM Automobile-Radio Receivers

GENERAL DATA

Minimum DC Collector-to-Base Breakdown Voltage (BV_{CBO}) for dc collector $\mu a = -50$, emitter open, ambient temperature = 25° C
Maximum DC Collector-Cutoff Current (I _{CBO}) for dc collec- tor-to-base volts = -12, emitter open, ambient temper- ature = 25° C
$= 25^{\circ}$ C
Maximum Junction-Temperature Rise (In free air) 0.4 ^O C/mw
Mechanical:
Operating Position

Lead 1- Emitter



Lead 3-Collector (Adjacent to red dot on side of case)

Lead 2 - Base

Electrical:



Maximum and Minimum Ratings,	Absolute-Maximum Values:
DC COLLECTOR-TO-BASE VOLTAGE	34 max. volts
DC EMITTER-TO-BASE VOLTAGE	0,5 max. volt
CC COLLECTOR CURRENT	ma
DC EMITTER CURRENT	ma



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DATA 9-60

Somerville, N. J.

TRANSISTOR DISSIPATION: B0 max. mw At ambient temperature of 25° C. S0 max. mw At ambient temperature of 71° C. S0 max. mw At ambient temperature of 71° C. S5 max. mw At ambient temperature of 71° C. S5 max. mw AMBIENT TEMPERATURE (During operation) 71 max. °C STORAGE-TEMPERATURE RANGE. -65 to +85 °C	•
Characteristics, At Ambient Temperature of 25°C:	
Common-Emitter Circuit, Base Input	
DC Collector-to-Emitter Voltage12 volts DC Collector Current1 ma Collector-to-Base Capacitance (Cob) 2 ^A μμf Small-Signal Current Transfer Ratio at 1 kc	•
Common-Base Circuit, Emitter Input	
DC Collector-to-Base Voltage12 volts DC Collector Current	
Ratio at 1 kc. 0.986 Alpha-Cutoff Frequency 45	
Typical Operation, At Ambient Temperature of 25° C:	
In a common-emitter, base input, 1.5-Nc converter circuit	
DC Collector-to-Emitter Voltage5 -11 volts DC Emitter Current 0.65 0.65 ma Input Resistance	
Oscillator-Injection Voltage 100 100 mv Useful Conversion Power Gain 35.4 37 db	

OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE. and CURVES shown under Type 2N1638 also apply to the 2N1639



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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Mesa Transistor

GERMANIUM P-N-P DIFFUSED-JUNCTION TYPE For High-Speed Switching Service in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Operating Positio Maximum Length (E	n. xcl	• ud	lir	•	• fl	คา	cil	i		P;	ads		•	•	•	•	•		Any
Maximum Diameter.	7.5 1			194						, Ç,	10.5	5 /	·	•	•	•	·	•	0.200
Dimensional Outli																			
Case																We	зŀ	ded	d. Metal
Seals																			
Leads, Flexible .																			
Minimum length.																			. 1.5"
Orientation and											Se	e	Dı	тe	n	510	o n a	al	Outline
Terminal Disoram:				ŀ	301	TT(¥V1	V	E7	ţ									

Lead 1 - Emitter

Lead 2 - Base



Lead 3 - Collector

SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

interinger			40	·	100.75	B 112 68 11		
COLLECTOR-TO-BASE VOLTAGE .							-13 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE							-12 max.	volts
EMITTER-TO-BASE VOLTAGE ^a							-4 max.	volts
COLLECTOR CURRENT							-100 max.	та
EMETTER CURRENT							100 max.	ma
TRANSISTOR DISSIPATION: •								
At ambient temperature of	250	С					150 max.	mw
At ambient temperature of							75 max.	
At ambient temperature of							35 max.	
AMBIENT-TEMPERATURE RANGE:			•	•	• •	•	<i>y</i> o	
Operating and storage							-65 to +85	00
LEAD TEMPERATURE :	•••	•	•	•	•••	·	00 10 00	-
For immersion in molten so	l de	r						
for 10 seconds maximum.							255 may	°C
10, 10 000000 max1mam	•••	•	•	•	•••	·	200 1107.	C
Typical Operation:								-
In an inverter circuit at	t am	616	, nt	+	e m ti	0 - 0	ture of a	0 0
Collector-to-Emitter Voltage	• •	٠	•	• •	•	• •	5	
Base Resistor								
Collector Resistor								
"Turn-Cn" Base Voltage	• •	·	•	• •	•		5	
"Turn-Off" Base Voltage	•••	·	•	• •	•	• •	5	volts
"On" Collector Current		•	•		•		40	ma
						-	Indicates a	change.

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"Turn-On" Base Current.																
"Turn-Off" Base Current	•	·	•	•	÷	•	٠	٠	٠			÷	•	1.0	ma	
Switching Time:																
Delay time (t _d)																
Rise time (tr)																
Storage time (t _s)																
Fall time (t _f)	•		•	•	•	•	•	·	•	·	٠	•	•	0.05	μsec	

a	This rating may be exceeded and the emitter-to-base junction operated	J
	in the breakdown condition provided the emitter dissipation is limited	۶.
	to 30 milliwatts at 25° C. For ambient temperatures above 25° C, the	ş
	dissipation should be reduced by 0.5 milliwalt/°C.	

See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section. Ь

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base unless otherwise specified. Ambient temperature of 25° C.

Min, Typical Max.

DC Collector Breakdown Voltage for dc					-
collector ma. = -0.02,emitteropen .BV _{CBO} DC Collector-to-	-13	-30	-	volts	
Emitter Breakdown VoltageBV _{CERL} DC Emitter Breakdown	-12	-25	-	volts	
Voltage for dc emitter ma. = -0.1, collector open BV _{EBO}	-4	-6	-	volts	
DC Punch-Through VoltageV _P DC Base-to-Emitter	-12	-30	-	volts	
Voltage for dc collector ma. = -40, dc base ma. = -1 V _{BE} DC Collector-Cutoff Current for collec-		-0.4	-0.6	volt	
tor volts = -6, emitter open I _{CBO} Collector Capacitance	-	-1	-3	μa	
for dc collector volts = -6, emitter open C _C DC Current Transfer Ratio: h _{FE}	-	В	12	<i>µ</i> µ.f	
With dc collector- to-emitter volts = -0.3, dc collec- tor ma. = -10 With dc collector- to-emitter volts	50	75	_		
= -0.5, dc collec- tor ma. = -40	50	85	_		
			Indicate	s a change,	

---Indicates a change.

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Gain-Bacdwidth Product^c for dc collector-toemitter volts = -3, dc 80 Mc Thermal Resistance: Junction-to-free air. . . . R_T °C/watt 400 Total Stored Charge: 05 With dc collector ma. = -10, dc base ma. = -0.4. 110 160 µµcoulombs With dc collector ma. = -40, dc base ma. = -1.6. 200 410 *µµ*coulombs Thermal Time Constant 10 _ _ msec

 $^{f c}$ Frequency at which the current transfer ratio is equal to 1.

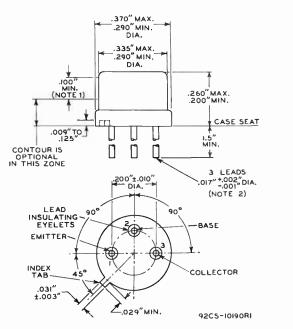
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.



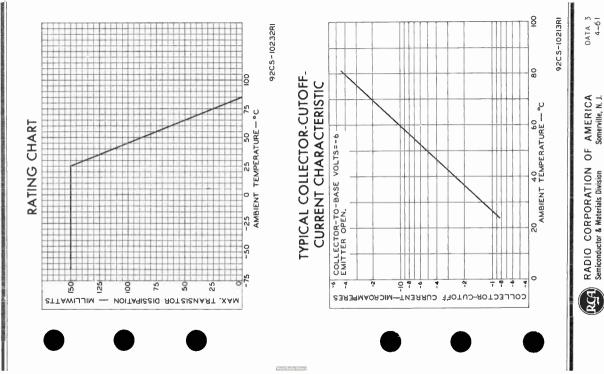
JEDEC No.TO-5



NOTE I: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTO-MATIC HANDLING. THE TOTAL VARIATION IN ACTUAL DIAMETER FROM THE TRUE DIAMETER, DUE TO TAPER AND OUT OF ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

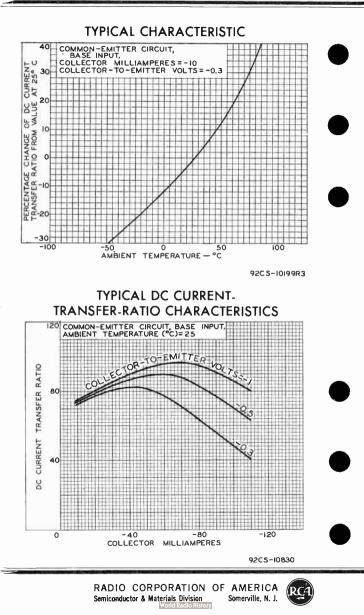




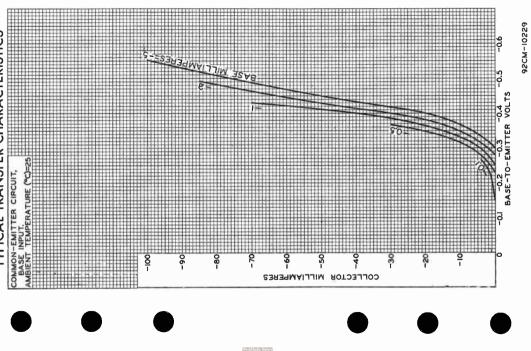
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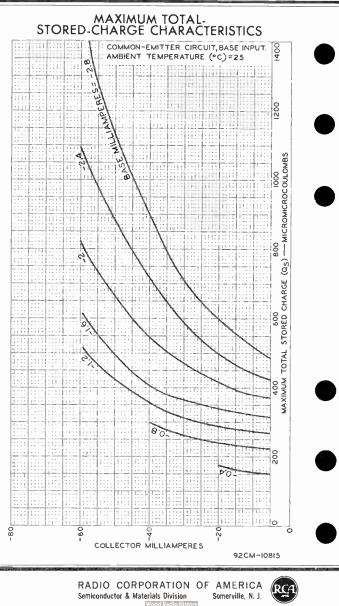
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CORPORATION

Materials Division

Semiconductor &

RADIO



Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Industrial Applications

GENERAL DATA

Mechanical:

Operating Position	Any
Maximum Length (Excluding	flexible leads) 0.260"
Maximum Diameter	0.370"
Dimensional Outline	JEDEC No. TO-5
	Metal
Seals	
Leads, Flexible	
Minimum length	•••••••••••••••••••••••••••••••••••••••
	r See Dimensional Outline
Terminal Diagram: B	BOTTOM VIEW

Lead 1 - Emitter

Lead 2 - Base



Lead 3-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dcand servo-amplifier, and relay-actuating circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

3.,		
COLLECTOR-TO-BASE VOLTAGE	max.	volts
With emitter-to-base reverse biased		
(DC emitter-to-base volts = 1.5) 60	max.	volts
With base open (Sustaining voltage)*. 40	max.	volts
EMITTER-TO-BASE VOLTAGE 6	max.	volts
COLLECTOR CURRENT	max.	атр
	max.	атр
TRANSISTOR DISSIPATION: P		•
At case temperature of 25° C or below . 5	max.	watts
CASE-TEMPERATURE RANGE:		
Operating and storage65 to	+200	°C
LEAD TEMPERATURE:		
1/16" ± 1/32" from case		
for 10 seconds maximum	max.	oC
Characteristics:		
At case temperature of 25°C		



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Alpha-Cutoff Frequency (fab) for dc		
collector-to-base volts = 28, dc		
collector ma. = 5	1.2	Mc
Collector-to-Base Capacitance(Cob)		
for dc collector-to-base volts = 40	150	μµf
Thermal Time Constant (τ_1)	10	msec

The Collector-to-Emitter Sustaining Voltage ($V_{CEQ}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{CW} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respe case temperature of 25°C unless othe	rwise	specij	
DC Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector	Min.	Max.	
ma. = 0.5	60	-	volts
ma. = 50, dc base ma. = 0V _{CEO} (sus)	40	-	volts
DC Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector ma. = 100 V _{BE}	_	2	volts
DC Collector-Cutoff Current I _{CBO} for dc collector volts = 30, dc emitter ma. = 0,		-	10110
case temperature = 25° C	-	75 1000	μa μa
DC Emitter-Cutoff Current for dc emitter volts = 6.			pro
dc collector ma. = 0 I _{EBO} DC Current Transfer Ratio for dc collector-to-emitter	-	25	μа
volts = 4, dc collector ma. = 100h _{FE} DC Collector-to-Emitter Saturation Resistance for	20	80	
dc collector ma. = 100, dc base ma. = 10 R _S Thermal Resistance: R _T	-	10	ohms
Junction-to-case Junction-to-free air	-	35 200	^o C/watt ^o C/watt

The Collector-to-Emitter Sustaining Voltage ($V_{CCO}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA Somerville, N. J.

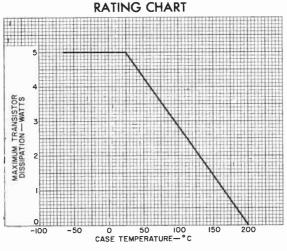


OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into ${\rm pr}$ disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

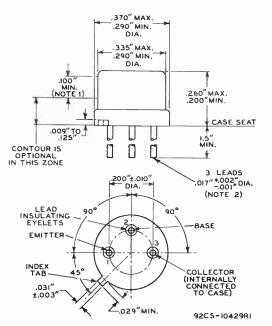
It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



9205-11019



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Partici History DATA 2 4-61 JEDEC No.TO-5



NOTE 1: THE DIAMETER IN THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE TOTAL VARIATION IN ACTUAL OIAMETER FROM THE TRUE OIAMETER, DUE TO TAPER AND OUT OR ROUND WITHIN THIS ZONE, WILL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE CASE SEAT. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUT-SIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.





World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE

For Industrial Applications

GENERAL DATA

Mechanical:

	Operating Position
	Maximum Överall Length
1	Maximum Seated Length 0.330"
	Maximum Diameter 0.650"
	Dimensional Outline JEDEC No.TO-8
	Case
	Seals
	Terminal Diagram: BOTTOM VIEW

Pin 1 - Emitter

Pin 2 - Base



Pin 3-Collector, Case

235 max.

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter. chopper, voltage- and current-regulator, dc-

and servo-amplifier, and relay-actuating circuits						
Maximum and Minimum Ratings, Absolute-Maximum Values:						
COLLECTOR-TO-BASE VOLTAGE 60 max. COLLECTOR-TO-EMITTER VOLTAGE: With emitter-to-base reverse biased	volts					
With base open (Sustaining voltage)*. 40 max. EMITTER-TO-BASE VOLTAGE 6 max. 6 max.	volts volts volts amp amo					
TRANS STOR DISSIPATION:® At rase temperature of 25°C or below						
Operating and storage	°C					

Characteristics:

for 10 seconds maximum. .

At case temperature of 25° C

Alpha-Cutoff Frequency (f _{ab}) for dc collector-to-base volts = 28, dc				
collector ma. = 5				Mc
with dc collector-to-base volts = Thermal Time Constant (r_1)	40.	:	175 10	μµf msec



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

DATA 1 4-61

°C

World Radio History

a The Collector-to-Emitter Sustaining Voltage ($v_{CEO}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{CM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

^D See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and case temperature of 25° Cunless otherwise specified Nin. Nax.

DC Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector ma. = 0.75 V _{CEX}	60	_	volts	
With base open (Sustaining voltage), dc collector ma. = 100, dc base ma. = 0 V _{CEO} ª	40	-	volts	
(sus) DC Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector				
ma. = 300 V _{BE} DC Collector-Cutoff Current I _{CBO} for dc collector volts = 30, dc emitter ma. = 0. case	_	3	volts	
temperature = 25° C. 150° C. DC Emitter-Cutoff Current for	_	100 1500	<i>ш</i> а µа	
dc emitter volts = 6, dc emitter ma. = 0 I _{EBO} DC Current Transfer Ratio	_	50	μа	
for dc collector-to-emitter volts = 4, dc collector ma. = 300h _{FE} DC Collector-to-Emitter Saturation Resistance for	20	80		
dc collector ma. = 300, dc base ma. = 30	-	5	ohms	
Junction-to-case Junction-to-free air	_	7 100	^o C/watt ^o C/watt	

^a The Collector-to-Emitter Sustaining Voltage ($Y_{CEO}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($Y_{OM} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Raciol Istory



Electrical connection can be made to the collector, base, and emitter pins by means of clips or by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal, otherwise the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

Under no circumstances should the case be soldered to the neat sink because the heat of the soldering operation will permanently damage the transistor.

It is important that this transistor be securely fastened to a heat sink. A mounting clamp is provided for this purpose.

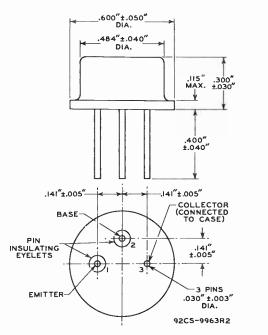
The chassis (heat sink) may be connected either to the positive or negative terminal of the voltage supply. In applications where the chassis is connected to the negative terminal of the voltage supply, it will be necessary to use an anodizedaluminum insulator having high thermal conductivity, or a 0.002" mica insulator between the transistor case and the chassis. The insulator should extend beyond the mounting clamp (See Suggested Mounting Arrangement). An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the collector, emitter, and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that an insulating washer be used between the bolt and the chassis.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration therefore, should be given to the possibility of shock hazard if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Valido History

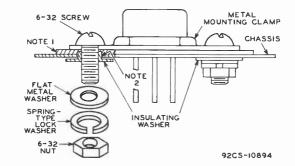
JEDEC No. TO-8



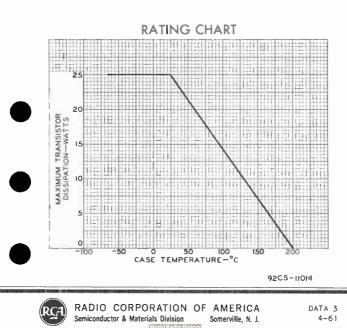
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

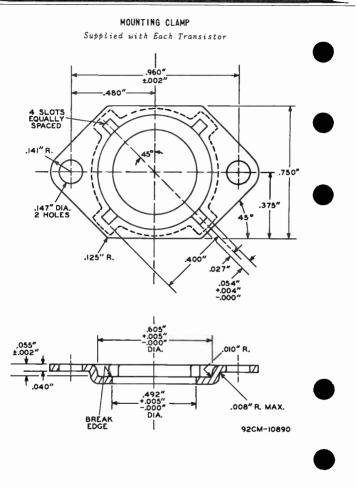


SUGGESTED MOUNTING ARRANGEMENT



NOTE I: 0.002" MICA INSULATOR OR ANODIZED ALUMINUM INSULATOR (DRILLED, OR PUNCHED WITH BURRS REMOVED). NOTE 2: REMOVE BURRS FROM CHASSIS HOLES.





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Word Radio History



Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Industrial Applications

GENERAL DATA

Mechanical:

Operating Position	пy
Maximum Överall Length 0.86	
Maximum Seated Length 0.39	
Maximum Length of Mounting Flange 1.55	
Maximum Width of Mounting Flange 1.01	5"
Case	
Mounting Flange	
Seals	
Socket Loranger Mfg. Corp. No.2149, or equivale	nt
Terminal Diagram (See Dimensional Outline):	

E-Emitter

B – Base



MOUNTING FLANGE-Collector, Case

INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dcand servo-amplifier, and relay-actuating circuits

Maximum and Minimum Ratings, Absolute-Naximum Values:

	COLLECTOR-TO-BASE VOLTAGE 60 max. COLLECTOR-TO-EMITTER VOLTAGE: With emitter-to-base reverse biased	volts
)	millernice-lobbase reverse blased (DC emitter-to-base volts = 1.5), 60 max. With base open (Sustaining voltage)*	атр
)	At mounting-frange temperature of 25°C or below	watts o _C
	Characteristics:	
	At mounting-flange temperature of 25° C	
	Alpha-Cutoff Frequency (f _{ab}) with dc collector-to-base volts	
	= 28, dc collector ma. = 5, . , 1 Collector-to-Base Capacitance (Cob)	Mc
	with dc collector-to-base volts = 40200 Thermal Time Constant $(\tau_1)12$	<i>யூ</i> f msec



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Somerville, N. J.

- The Collector-to-Emitter Sustaining Voltage ($v_{CTQ}(s_{MS})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{QN} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).
- b See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and mountingflange temperature of 25°C unless otherwise specified Min. Max.

DC Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector				
ma. = 1 V _{CEX} With base open (Sustaining voltage), dc collector ma.	60	-	volts	
= 100, dc base ma. = 0 V _{CFO} ^a DC Base-to-Emitter Voltage for	40	-	volts	
<pre>dc collector-to-emitter volts = 4, dc collector ma. = 800 V_{BE} DC Collector-Cutoff Current I_{CBO} for dc collector volts = 30, dc emitter ma. = 0,</pre>		4	volts	
mounting flange temperature = 25° C		200 2000	µа µа	
emitter volts = 6, dc collector ma. = 0 IEBO DC Current Transfer Ratio	-	100	μA	
for dc collector-to-emitter volts = 4, dc collector ma. = 800 h _{FE} DC Collector-to-Emitter Saturation Resistance for dc collector ma. = 800,	1.5	60		
dc base ma. = 80, R _S Thermal Resistance:	-	4	ohms	
Junction-to-mounting-flange R _T	-	2.33	^o C/watt	

The Collector-Lo-Emitter Sustaining Voltage ($v_{CEO(SUS)}$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{CH} = 1$; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.



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This transistor utilizes the Loranger Mfg. Corp. socket No.2149, or equivalent. Electrical connection can also be made to the base and emitter pins by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal, otherwise the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

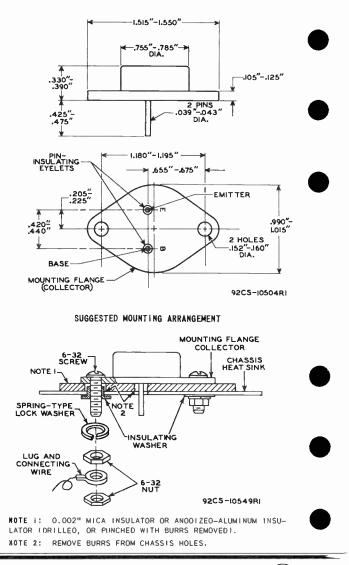
Under no circumstances should the mounting flange be soldered to the heat sink because the heat of the soldering operation will permanently damage the transistor.

It is important that the mounting flange which serves as the ccliector terminal be securely fastened to a heat sink. Depending on the application, the chassis (heat sink) may be connected either to the positive or negative terminal of the voltage supply.

In applications where the chassis is connected to the negative terminal of the voltage supply, it will be necessary to use an anodized-aluminum insulator having high thermal conductivity, or a 0.002" mica insulator between the mounting flange and the chassis. An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the emitter and base pins. The burrs should then be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that an insulating washer be used between the bolt and the chassis (See Suggested Mounting Arrangement).

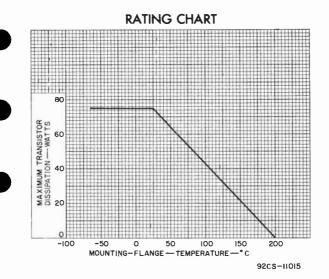
It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.







World Radio History

Power Transistor

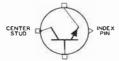
SILICON N-P-N DIFFUSED-JUNCTION TYPE For Industrial Applications

GENERAL DATA

Mechanical:

Operating Position	Any
Maximum Överall Length	1.230"
Maximum Seated Length	0.520"
Maximum Diameter	
Cimensional Outline	JEDEC No. TO-36
Case	Welded, Metal
Seals	
Terminal Diagram (See Dimensional	Outline):





INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dcand servo-amplifier, and relay-actuating circuits

Maximum and	Minimum	Ratings,	Absolute-Maximum	Values:
-------------	---------	----------	------------------	---------

2 .			
COLLECTOR-TO-BASE VOLTAGE	60	max.	volts
With emitter-to-base reverse biased			
(DC emitter-to-base volts = 1.5)	60	max.	volts
With base open (Sustaining voltage) ^a	40	max.	volts
EMITTER-TO-BASE VOLTAGE		max.	volts
COLLECTOR CURRENT			amp
BASE CURRENT.		max.	
TRANSISTOR DISSIPATION: •	2.5	max.	amp
At case temperature of 25° C or below .	75	max	watts
CASE-TEMPERATURE RANGE:	15	max.	walls
	CE + -	. 200	00
Operating and storage	-03 [0	+200	oC
Characteristics:			
At case temperature of 25°	С		
Alpha-Cutoff Frequency (f _{ab}) with dc collector-to base volts			
= 28, dc collector ma. = 5		1	Мс
Collector-to-Base Capacitance (Cob)		-	
with dc collector-to-base volts = 40, ,	20	0	μµf
	20	~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	pp -

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Thermal Time Constant $(\tau_1) \cdot \cdot \cdot \cdot \cdot$

msec

12

a The Collector-to-Emitter Sustaining Voltage ($Y_{\Gamma \Gamma \Omega}(s_{MS})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{OM} = 1$; voltage at which the product of alpha (Ω), at low voltage, times the multiplication factor (M) equals unity.

^b See accompanying Rating Chart and also fransistor-Dissipation Rating Chart in General Section.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to b case temperature of 25°C unless otherwise sp		(
DC Collector-to-Emitter Voltage: With_emitter_reverse-bias	lax.	
volts = 1.5, dc collector ma. = 1 V _{CEX} 60 With base open (Sustaining voltage), dc collector ma.	- volts	
= 100, dc base ma. = 0 \dots V _{CEO} ^a 40 (sus)	- volts	1
DC Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector ma. = 800 V _{BE} - DC Collector-Cutoff Current for dc collector volts = 30, dc emitter ma. = 0, case	4 volts	
150° C 2 DC Emitter-Cutoff Current for dc	200 µа 2000 µа	
emitter volts = 6, dc collector ma. = 0	100 μa	
collector-to-emitter volts = 4, dc collector ma. = 800 h _{FE} 15 DC Collector-to-Emitter Saturation Resistance for	60	
dc collector ma. = 800, dc base ma. = 80 R _S -	4 ohms	ļ
Thermal Resistance: Junction-to-case	2.33 °C/watt	

a The Collector-to-Emilter Sustaining Voltage ($Y_{CEO}(sus)$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (Y_{CM} , = 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

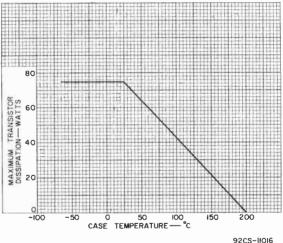


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

Electrical connection can be made to the base and emitter terminals by means of clips or by soldering directly to the terminals. When soldering connections are made to the terminals, care should be taken to conduct excessive heat away from the terminal seals, otherwise the heat of the soldering operation will crack the glass seals of the terminals and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying Suggested Hounting Arrangement). Electrical connection to the base and to the emitter is made to their respective terminals.

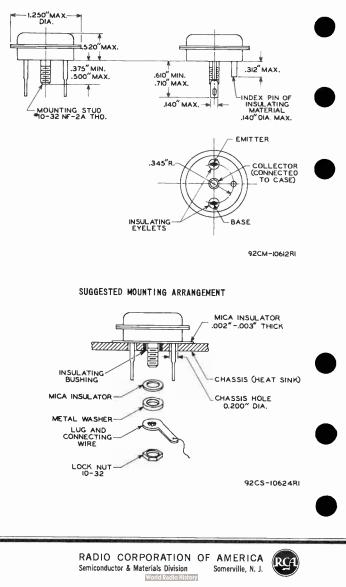
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



RATING CHART



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Work (Reference) Somerville, N. J. DATA 2 4-61 JEDEC No.TO-36



Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE

For Switching Applications in Industrial and Military Equipment

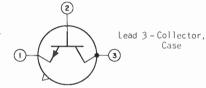
GENERAL DATA

Mechanical:

Operating Position Maximum Length (Exclu					
Maximum Diameter	• •	 	 		0.230"
Dimensional Outline .		 	 	.JEDEC	No.T0-46
Case					
Seals					
Leads, Flexible					
Minimum length					
Orientation and dia Terminal Diagram:			e Dim	ensional	Outline

Lead 1 - Emitter

Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum	Valı	ies:	
COLLECTOR-TO-BASE VOLTAGE: With emitter open VCBO COLLECTOR-TO-EMITTER VOLTAGE: With external resistance between base and emitter (ohms)	25	max.	volts
= 1000, load resistance (ohms) = 100 VCERL EMITIER-TO-BASE VOLTAGE:	20	max.	volts
With collector open VEBO COLLECTOR CURRENT IC TRANSISTOR DISSIPATION: ^a At case temperature ^b of 25° C			volts amp
or below	1	max.	watt
or below	0.3	max.	watt
Storage6		+300 +175	°C °C
For 10 seconds maximum	235	max.	оС

a See accompanying Rating Chart.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 2-62

World Radio History

b Measured at center of seating plane. c Measured 1/16" ± 1/32" down from seating plane.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and freeair temperature of 25° C unless otherwise specified

			Max.	Max.		
DC Collector Breakdown for dc collector ma. emitter ma. = 0 DC Emitter Breakdown Vo for dc emitter ma. = 6	= 0.1, Itage	ВУСВО	25	-	volts	
 → DC Collector ma. = 0. → DC Collector-to-Emitter ing Voltage^d for exte resistance between bar emitter (ohms) = 1000 load resistance (ohms) 	Latch- rnal se and	BVEBO	3	-	volts	
= 100 DC Base-to-Emitter Satu Voltage for dc collec		VCERL	20	-	volts	
= 10, dc base ma. = 1 DC Collector-to-Emitter			0.7	0.9	volt	
Saturation Voltage: With dc collector ma.	- 10	V _{C.E} (sat)				
dc base ma. = 1			-	0.22	volt	
With dc collector ma. dc base ma. = 5 DC Collector-Cutoff Cur		BCO	-	0.35	volt	
dc collector volts = emitter ma. = 0, free temperature =	15, –air	, RCO		0 025		
25° C 150° C DC Collector Current fo to-emitter forward bi = 0.35, dc collector-	 r base- as volts		-	0.025 15	µа µа	
emitter volts = 10, f temperature = 100° C → Collector-to-Base Capac for dc collector volt	ree-air itance s = 10,	ICEX	-	15	μa	•
emitter ma. = 0, freq (kc) = 140 DC Current Transfer Rat	io for dc	C _{ob}	-	6	pf	
collector to emitter 1, dc collector ma. = Small-Signal Current Tr. Ratio for dc collecto emitter volts = 10, d	10 ansfer r-to-	h _{FE}	20	-		•
collector ma. = 10, f (Mc) = 100	requency	h _{fe}	2	-		

- Indicates a change.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division



World Radio History

Somerville, N. J.

<pre>Storage Time^e for dc collector supply volts = 10, collector resistance (ohms) = 1000, turn-on and turn-off dc base ma. = 10 each, dc collector</pre>				*
ma. = 10	ts	-	25	nsec
Turn-On Time ^f (Delay time + rise	0			
time) for dc collector supply				
volts = 3, turn-on dc base ma.				
= 3, turn-off dc base ma. = 1,				
dc collector ma. = 10	td + tr	-	40	nsec
Turn-Off Timef (Storage time +				-
fall-time} for dc collector				
supply volts = 3, turn-on dc				
base ma. = 3, $turn-off dc$				
base ma. = 1, dc collector				
ma. = 10	ts + tf		75	nsec

For description of this test, write to Commercial Engineering, Semiconductor & Materials Division, RCA, Somerville, New Jersey.

^e See accompanying Storage-fime-Measurement Circuit.

f See accompanying furn-On-fime and furn-Off-fime Measurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power.on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

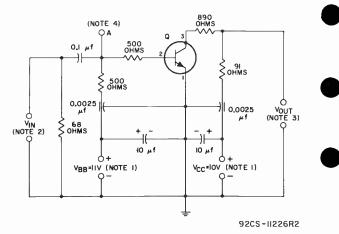
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



Semiconductor & Materials Division

- Indicates a change.

STORAGE-TIME-MEASUREMENT CIRCUIT



Q: Transistor type 2N1708

NOTE I: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY-TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS.

NOTE 3: THE ASSOCIATED INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING AN INPUT IMPEDANCE OF 50 OHMS.

NOTE 4: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (VA).



Transistor



SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE

For Switching Applications in

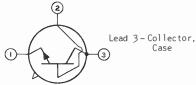
Industrial and Military Equipment

GENERAL DATA

Operating Position	Any
Maximum Length (Excluding flexible leads)	0.080"
Maximum Diameter	0.230"
Dimensional Outline	JEDEC No. TO-46
Case	Metal
Seals	Hermetic
Leads, Flexible	3
Min [:] mum length	0.500"
Orientation and diameter See	
Terminal Diagram: BCTTOM VIEW	

Lead 1 - Emitter Lead 2 - Base

Mecharical:



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum	Values:
COLLECTOR-TO-BASE VOLTAGE: With emitter open	25 max. volts
With external resistor (ohms) = 10 between base and emitter	20 max. volts
With collector open	3 max. volts 0.2 max. amp
At case temperature ^b of 25 ^o C or below. At free-air temperature of 25 ^o C or below. TEMPERATURE RANGE:	1 max. watt 0.3 max. watt
Storage	-65 to +300 °C -65 to +175 °C
For 10 seconds maximum	235 max. ^O C

^a See accompanying Rating Chart.

b Measured at center of seating plane.

C Measured 1/16" ± 1/32" down from seating plare.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 1 8-61

ELECTRICAL CHARACTERISTICS

Voltage values are given with air temperature of 25°C unl	respect t ess other	o base wise s	and fr	ee– ed.
ut, temperater, tog by t =		Min.	Max.	
DC Collector Breakdown Voltage for dc collector ma. = 0.1, emitter ma. = 0 DC Collector-to-Emitter Break- down Voltage for dc collector	BV _{CBO}	25	-	volts
<pre>ma. = 50, external base-to- emitter resistor (ohms) = 10 . DC Emitter Breakdown Voltage for do contrar man = 0.1</pre>	BVCER	20	-	volts
for dc emitter ma. = 0.1, collector ma. = 0 DC Base-to-Emitter Saturation Voltage for dc collector ma.	BVEBO	3	-	volts
= 10, dc base ma. = 1	V _{BE} (sat)	0.7	0.9	volt
DC Collector-to-Emitter Saturation Voltage: With dc collector ma. = 10,	V _{CE} (sat)			
dc base ma. = 1		-	0.22	volt
<pre>dc base ma. = 5 DC Collector-Cutoff Current for dc collector volts = 15, emitter ma. = 0, free-air</pre>	I BCO	-	0.35	volt
temperature = 25° C		-	0.025 15	<i>µ</i> а µа
emitter volts = 10, free-air temperature = 100° C Collector-to-Base Capac tance for dc collector volts = 10,	¹ CEX	-	15	μa
emitter ma. = 0, frequency (kc) = 140	Соь	-	6	μµf
collector ma. = 10, frequency (Mc) = 100	h _{fe}	2	-	
<pre>collector to emitter volts = 1, dc collector ma. = 10 Storage Time^d for dc collector supply volts = 10, collector resistor (ohms) = 1000, "turn- on" and "turn-off" base ma.</pre>	h _{FE}	20	-	
= 10 each, dc collector ma. = 10	ts	-	25	mµsec

d See accompanying Storage-Time-Measurement Circuit.

RADIO CORPORATION OF AMERICA Somerville, N. J. Semiconductor & Materials Division

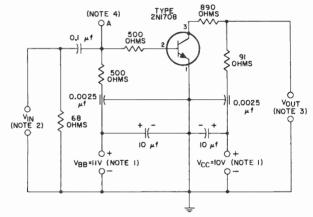


OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because nigh transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



STORAGE-TIME-MEASUREMENT CIRCUIT

92CS-1/226

NOTE I: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

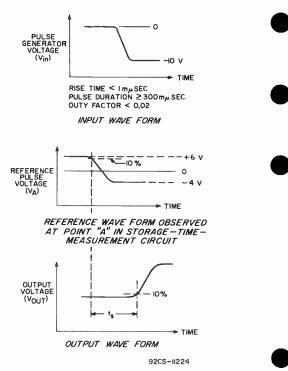
NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY-TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS.

NOTE 3: THE ASSOCIATED INPUT AND OUTPUT WAVEFORMS SHOWN BELOW SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCIL-LOSCOPE HAVING AN INPUT IMPEDANCE OF 50 OHMS.

NOTE 4: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (V_A),



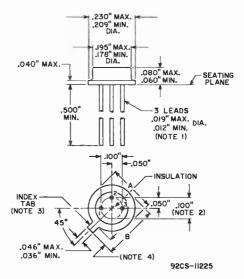








JEDEC No.TO-46



NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

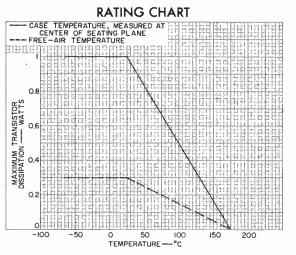
NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" QF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE 0.230" MAXIMUM DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

#OTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM - 0.048" MAXIMUM ANO WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

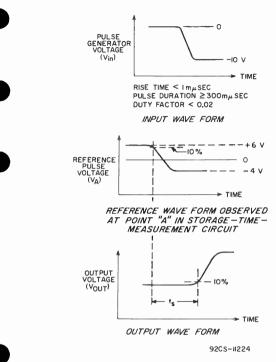


92CS-11223



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

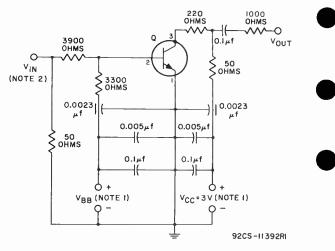






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RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 3 2-62



TURN-ON-TIME AND TURN-OFF-TIME MEASUREMENT CIRCUIT

Q: Transistor type 2N1708

NOTE I: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

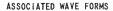
NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS.

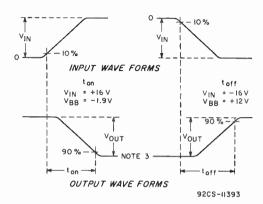
NOTE 3: INPUT AND OUTPUT WAVE FORMS, SHOWN ON NEXT PAGE, SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING AN INPUT IMPEDANCE OF 50 OHMS.

NOTE 4: ALL RESISTANCE VALUES HAVE ± 1% TOLERANCE.



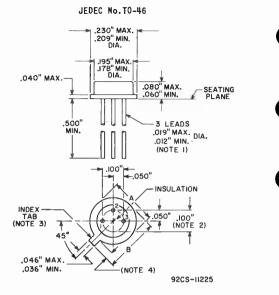
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Work Parallel History







RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Rediol Istory DATA 4 2-62



NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

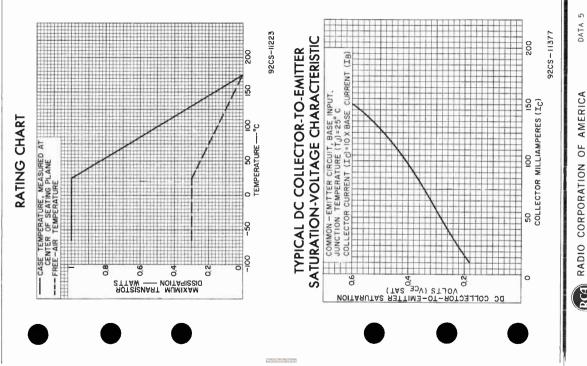
NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE 0.230" MAXIMUM DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM - 0.048" MAXIMUM AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".





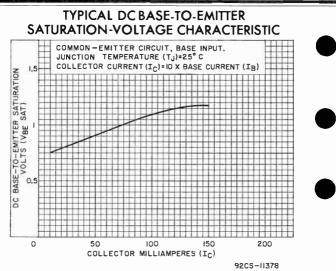


DATA 5 2-62

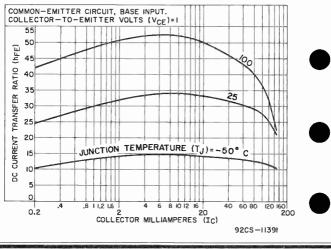
Somerville, N.

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CORPORATION Semiconductor & Materials Division



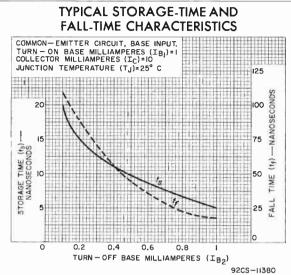
TYPICAL DC CURRENT-TRANSFER-RATIO CHARACTERISTICS

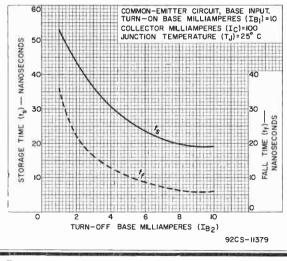


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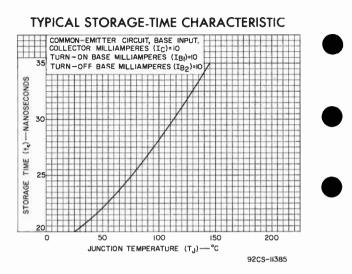




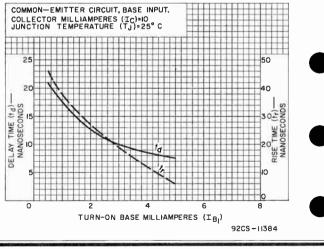




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TYPICAL DELAY-TIME AND RISE-TIME CHARACTERISTICS

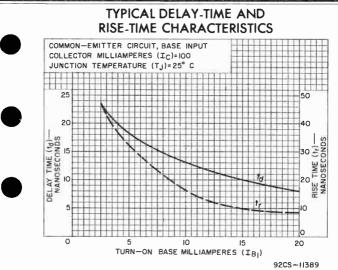


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World Radio History

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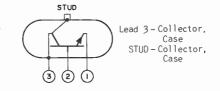
Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Industrial Applications

Mechanical:

Operating Position
Maximum Length See Dimensional Outline
Maximum Diameter
Case
Seals
Leads, Flexible
Maximum length
Orientation and diameter See Dimensional Outline
Terminal Diagram (See Dimensional Outline):

Lead 1 - Emitter Lead 2 - Base



INDUSTRIAL SERVICE

Such as in dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dcand servo-amplifier, and relay-actuating circuits

Maximum and Minimum Ratings, Absolute-Naximum Values:

With base open (Sustaining voltage) ^a . 40 max. EMITTER-TO-BASE VOLTAGE 12 max. COLLECTOR CURRENT 3 max. EMITTER CURRENT -3.5 max. BASE CURRENT 1.5 max. TRANSISTOR DISSIPATION: ^b 1.5 max. At case temperature of 25° C ^c 40 max. At case temperature of 100° C ^c 22.9 max.	volts volts amp amp watts watts
CASE-TEMPERATURE RANGE: Operating and storage65 to +200 LEAD TEMPERATURE: For 10 seconds maximum	°C
Characteristics: At case temperature of 25°C ^C	

Alpha-Cutoff Frequency (f_{ab}) with dc collector-to-base volts

= 28, dc collector ma. = 5. 1.25 Mc



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2N1768

$\begin{array}{llllllllllllllllllllllllllllllllllll$	<i>யூ</i> f msec	
Typical Operation:		
In accompanying typical power-switching circuit at case temperature ^c of 25°C		
DC Supply Voltage (B2). 12 DC Base-Bias Voltage (B1). -8.5 "On" DC Collector Current 750 "Turn-On" Base Current (181). 65 "Turn-Off" Base Current (182). -35 Generator Resistance. 50 Switching Time: 50	volts volts ma ma ohms	•
$\begin{array}{llllllllllllllllllllllllllllllllllll$	μsec μsec μsec μsec	

- a The Collector-to-Emitter Sustaining Voltage (VCCO(sus)) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (V_{CM} = 1; voltage at which the product of alpha {\alpha}, at low voltage, times the multiplication factor (M) equals unity).
- ^b See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.
- C Measured at any point on seating plane of pedestal.
- ^d Measured 1/16" ± 1/32" down from case.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and at case temperature ^c of 25° Cunless otherwise specified					
		Nin.	Max.		
Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector					
<pre>ma. = 0.25</pre>	V _{CEX}	60	-	volts	
<pre>ma. = 100, dc base ma. = 0. Base-to-Emitter Voltage for dc collector-to-emitter volts = 4, dc collector</pre>	V _{CEO} ª (sus)	40	-	volts	_
<pre>ma. = 750 . Collector-Cutoff Current for dc collector volts = 30, dc emitter ma. = 0, case temperature^c =</pre>	V _{ве} I _{Сво}	-	2.5	volts	
25° C 150° C Emitter-Cutoff Current for dc emitter volts = 12, dc		-	15 750	<i>µ</i> а µа	
emitter ma. = 0	I EBO	-	15	μa	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



ohm

DC Current Transfer Ratio for dc collector-to-emitter volts = 4, dc collector 100 ma. = 750 hee 35 DC Collector-to-Emitter Saturation Resistance for dc collector ma. = 750, dc Rs 1 base ma. = 40 Rτ Thermal Resistance: 4.375 °C/watt Junction-to-case. °C/watt 175 Junction-to-free air.

The Collector-to-Emitter Sustaining Voltage ($V_{\Gamma \in \Omega}(s_{US})$) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($V_{CM} = 1$; voltage at which the product of alpha (Ω), at low voltage, times the multiplication factor (M) equals unity).

c Measured at any point on seating plane of pedestal.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

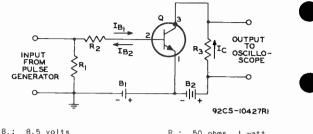
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



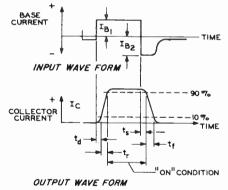
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0,1	8.5 VOITS	R ₁ : 50 ohms, 1 watt	
8.:	l2 volts	R. 220 ohms, I watt	
	Transistor type 2N1768	R3: 15.9 ohms, 2 watts	s



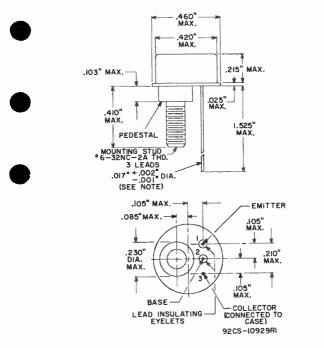


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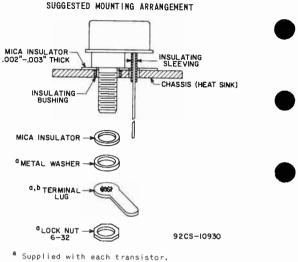
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NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE BOTTOM OF THE CASE. BETWEEN 0.25" AND THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



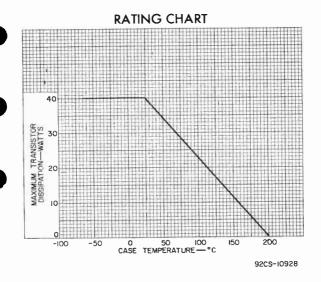
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division DATA 3 6-61



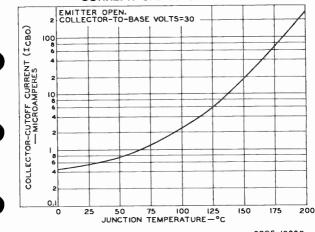
^b Shakeproof Division, Illinois Tool Works, Cat. No.2102-6.







TYPICAL COLLECTOR-CUTOFF-CURRENT CHARACTERISTIC



9205-10882



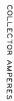
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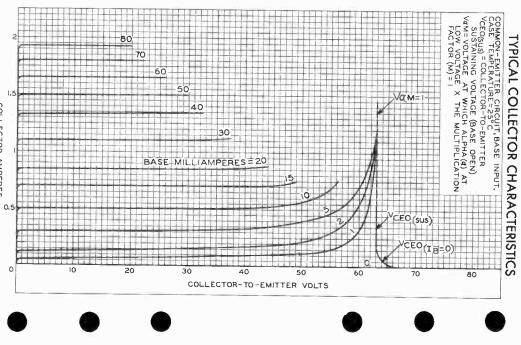
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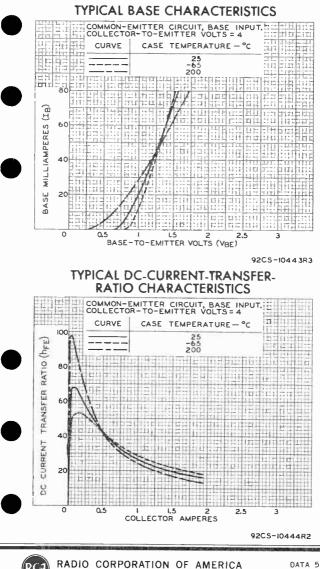
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2N1768



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DATA 5 6-61

World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Industrial Applications

The 2N1769 is the same as the 2N1768 except for the following items:

INDUSTRIAL SERVICE

Such as is dc-to-dc converter, inverter, chopper, voltage- and current-regulator, dc- and servoamplifier, and relay-actuating circuits

Maximum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	100 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With emitter-to-base reverse biased		
(DC emitter-to-base volts = 1.5)	100 max.	volts
With base open (Sustaining voltage) ^a .	55 max.	volts

ELECTRICAL CHARACTERISTICS

	Min.	Nax.	
Collector-to-Emitter Voltage: With emitter reverse bias volts = 1.5, dc collector ma. = 0.25 V _{CEX} With base open (Sustaining voltage), dc collector	100	-	volts
ma. = 100, dc base ma. = 0 V _{CEO^a(sus)}	55	_	volts

The Collector-to-Emitter Sustaining Voltage {Vctq(sus)} with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (V_{CM} = j; voltage at which the product of alpha (a), at low voltage, times the multiplication factor (W) equals unity).



World Radio History

Transistor

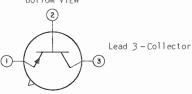
GERMANIUM P-N-P DIFFUSED-JUNCTION MESA TYPE For High-Speed Saturated Switching Applications in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Dimensions. See Outline TO-5 in General Section Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open V COLLECTOR-TO-EMITTER VOLTAGE:	сво -18	max. volts
With base open		max. volts
With collector open V COLLECTOR CURRENT	EB0 −2 C −100	max, volts max, ma
At free-air temperature of 25°C or below	P 150	max, mw
With emitter-to-base reverse bias dc volts = -2, free-air temperature		
of 25° C or below . FREE-AIR TEMPERATURE RANGE:	25	max. mw
Junction (Operating)	Т _Ј — 55 t _{STG} — 55 t	
For 10 seconds maximum	T _L 235	omax. ^o C

- $^{\rm a}$ This rating may be exceeded and the emitter-to-base junction operated in the breakdown condition provided the emitter-to-base dissipation is limited to 25 milliwatts at 250°C. For free-air temperatures above $^{25^{\rm O}}$ C, reduce the dissipation.
- D See accompanying Rating Chart and Transistor-Dissipation Rating Chart in General Section.
- ^c Measured 1/16* ± 1/32* along lead, down from seating plane.



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ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS				
Unless otherwise specified, free-air temp	eratur	re = 25	°C	
	Min.	Max.		
DC Collector-to-Base Breakdown Voltage for dc collector ma. = -0.025, dc emitter current=0. BV _{CBO} DC Collector-to-Emitter Break- down Voltage for base-to- emitter reverse bias dc volts	-18	-	volts	
= -0.15, dc collector ma. = -0.025 BV _{CEV} DC Emitter-to-Base Breakdown	-18	-	volts	
Voltage for dc emitter ma. = -0.1, dc collector current = 0 . BV _{EBO} DC Collector-to-Emitter Saturation	-2	-	volts	_
Voltage for dc collector ma. = -6, dc base ma. = -0.2 V _{CE} (sat) DC Base-to-Emitter Voltage for	-	-0.2	volt	
dc collector ma. = -6, dc base ma. = -0.2 V _{BE} DC Collector-Cutoff Current: I _{CBO}	-	-0.4	volt	
With dc collector-to-base volts = -15, dc emitter current = 0. With dc collector-to-base volts	-	-4.2	μa	
= -18, dc emitter current =0, free-air temperature = 60 DC Emitter-Cutoff Current for	_	-35	μa	
dc emitter-to-base volts = -2, dc collector current = 0 I _{EBO} DC Forward-Current Transfer Ratio: h _{FE}	-	-100	μa	
With dc collector-to-emitter volts = -1, dc base ma. = -0.2	30	400		
volts = -0.4, dc collector ma. = -6 Switching Time:	30	-		
Turn-off time ^e t _o ff Storage time ^e t _s		0.8 0.9 0.8	μsec μsec μsec	

d See accompanying furn-On-fime (ton) Neasurement Circuit.

See accompanying furn-Off-fime (toff) and Storage-fime (ts) Heasurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct

Semiconductor & Materials Division



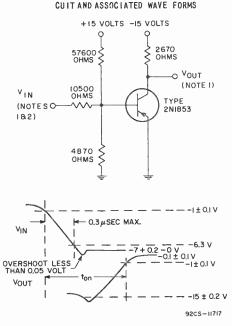
RADIO CORPORATION OF AMERICA Somerville, N. J.



excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

This transistor is intended for use in single-side printedcircuit boards and in conventional wire-in type circuits. ١f this transistor is used in double-side printed-circuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the base from shorting to ground.

TURN-ON-TIME MEASUREMENT CIR-



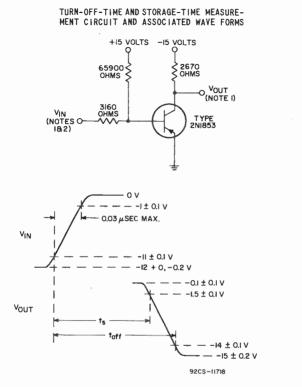
NOTE I: INPUT AND OUTPUT WAVE FORMS (VIN AND VOUT) SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME OF LESS THAN 15 NANOSECONDS, A PROBE CAPACI-TANCE OF NOT MORE THAN 12 PF, AND A SHUNT RESISTANCE OF NOT LESS THAN IO MEGOHMS.

NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM A MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 100 OHMS.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



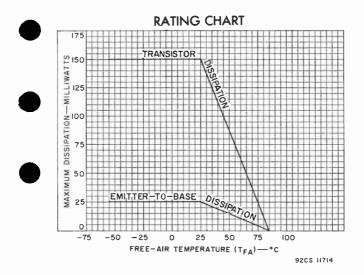


NOTE I: INPUT AND OUTPUT WAVE FORMS (VIN AND VOUT) SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME OF LESS THAN 15 NANOSECONDS, A PROBE CAPACI-TANCE OF NOT MORE THAN 12 PF, AND A SHUNT RESISTANCE OF NOT LESS THAN 10 MEGOHMS.

NOTE 2: INPUT VOLTAGE ($V_{1,N}$) OBTAINED FROM A MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 100 OHMS.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.





World Radio History

Transistor

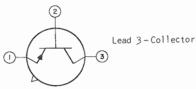
GERMANIUM P-N-P DIFFUSED-JUNCTION MESA TYPE For High-Speed Saturated Switching Applications in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Dimensions. See *Outline TO-5* in General Section Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open	√сво	-18 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE: With base open	V _{CEO}	-6 max.	volts
With collector open		-2 max. -100 max.	volts ma
At free-air temperature of 25° C or below EMITTER-TO-BASE DISSIPATION: With emitter-to-base reverse	Ρ	150 max.	mw
bias dc volts = -2, free-air temperature of 25°Cor below FREE-AIR TEMPERATURE RANGE:		25 max.	mw
Junction (Operating)	Tj Tstg	–55 to +85 –55 to +85	°C
LEAD TEMPERATURE: ^c For 10 seconds maximum	TL	235 max.	°C

- ${\bf a}$ This rating may be exceeded and the emitter-to-base junction operated in the breakdown condition provided the emitter-to-base dissipation is limited to 25 milliwatts at 25° C. For free-air temperatures above 25° c, reduce the dissipation.
- ^b See accompanying Rating Chart and Iransistor-Dissipation Rating Chart in General Section.
- C Measured 1/16" ± 1/32" along lead, down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

ELECTRICAL CHARACTERISTICS

ELEVINICAL UNA					-
Unless otherwise specified, free-air temperature = 25° C					
		Min.	Max.) 0	
DC Collector-to-Base Breakdown		<i>m</i> . <i>n</i> .	лах.		
Voltage fordc collector ma. =					
-0.025, dc emitter current = 0	DV				
DC Collector-to-Emitter Break-	BVCBO	-18	~	volts	
down Voltage for baseto-emit-					
terreverse bias dc volts = -0.2,					
dc collector ma. = -0.025	DV	40			
DC Emitter-to-Base Breakdown	BVCEV	-18	-	volts	-
Voltage for dc emitter ma. =					
-0.1, dc collector current = 0	RV/	-2			
DC Collector-to-Emitter Latching	BVEBO	-2	-	volts	
Voltage ^d for dc collector supply					_
volts = -18, emitter-to-base					
resistance (ohms) = 1000, load					
resistance (ohms) = 178	VCERL	-17	_	volts	-
DC Collector-to-Emitter Satura-	CERL	11		0113	
tion Voltage:	V _{CE} (sat)				
With dc collector ma. = -20,	CELEREN				
dc base ma. = -0.66		_	-0.25	volt	
With dc collector ma. = -20.					
dc base ma. = -0.5		-	-0.3	volt	
With dc collector ma. = -80,					
dc base ma. = -2.7, free-air					
temperature = 55°C		-	-0.7	volt	
DC Base-to-Emitter Voltage for					
dc collector ma. = -20, dc base					
ma. = -0.5	VBE	-	-0.8	volt	
DC Collector-Cutoff Current:	СВО				
With dc collector-to-base volts	000				
= -15 , dc emitter current= 0,					
free-air temperature =					
25° C		-	-4.2	μa	
65 ⁰ C		-	-40	μa	
dc emitter-to-base volts = -2,					•
dc collector current = 0	1		100		
Output Capacitance for dc collec-	EB0	-	-100	μa	
tor-to-base volts = -10, dc					
emitter current = 0	Coh		12	~ f	
DC Forward-Current Transfer	op	~	12	pf	
Ratio:	hee				
With dc collector-to-emitter					
volts = -0.5, dc collector					
ma. = −20		40	_		
With dc collector-to-emitter		10			
volts = -0.75, dc collector					
ma. = -100		25	-		
With dc collector-to-emitter					
volts = -1, dc collector					
ma. = -50		-	400		

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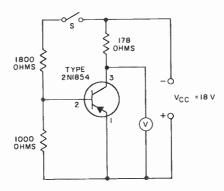


Gain-Bandwidth Product for dc collector-to-emitter volts = -1, dc collector ma. = -10, small-signal short-circuit				
forward-current transfer ratio = 5	f _T t _{Qs}	40	-	Мс
With dc collector ma. = -20 , turn-on dc base ma. = -1.5 .		-	60	nsec
With dc collector ma. = -80, turn-on dc base ma. = -4.5.		-	80	nsec

d See accompanying Collector-to-Smitzer Latching-Voltage Heasurement Circuit.

e See accompanying Charge-Storage-fime Measurement Circuit.

COLLECTOR-TO-EMITTER LATCHING-VOLTAGE MEASUREMENT CIRCUIT



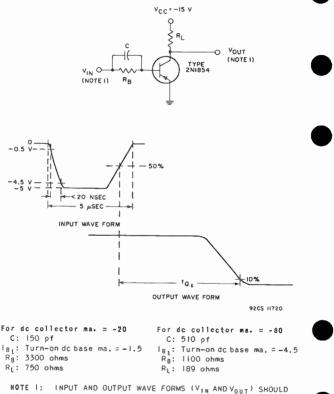
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THE TRANSISTOR IS INSERTED IN THE CIRCUIT WITH SWITCH (S) OPEN. THE SWITCH IS THEN CLOSED AND IMMEDIATELY REOPENED. THE RESULTING COLLECTOR-TO-EMITTER VOLTAGE IS THE "LATCHING" VOLTAGE, V_{CERL}.



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CHARGE-STORAGE-TIME MEASUREMENT CIRCUIT AND ASSOCIATED WAVE FORMS



NOTE I: INPUT AND OUTPUT WAVE FORMS (V_{IN} AND V_{OUT}) SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME OF LESS THAN 15 NANOSECONDS, A PROBE CAPACITANCE OF NOT MORE THAN 12 PF, AND A SHUNT RESISTANCE OF NOT LESS THAN 10 MEGOHMS.

OPERATING CONSIDERATIONS and RATING CHART shown under type 2N1853 also apply to the 2N1854



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division

Power Transistor

GERMANIUM, P-N-P, DIFFUSED-COLLEC-TOR, GRADED-BASE, DRIFT-FIELD TYPE

For Industrial and Consumer-Product Applications

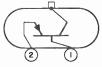
GENERAL DATA

Mechanical:

Operating Position	
Maximum Length of Mounting Flange	
Maximum Width of Mounting Flange	
Case	
Mounting Flange	
Seals	
Socket Loranger Mfg. Corp. No.2149,	, or equivalent
Terminal Diagram (See Dimensional Outline):	

Pin 1-Base

Pin 2-Emitter



MOUNTING FLANGE-Collector, Case

Maximum and Minimum Ratings, Absolute-Maximum Values:

In such applications as high-power, high-speed switches in dc-to-dc converters, inverters, and computers for data-processing equipment, as ultrasonic oscillators, and as large-signal, wide-band linear amplifiers					
COLLECTOR-TO-BASE VOLTAGE	olts				
With base open. -40 max. vo EMITTER-TO-BASE VOLTAGE -1 max. vo	olts volt				
COLLECTOR CURRENT -10 max. BASE CURRENT -3 max. TRANSISTOR DISSIPATION: -3					
For mounting-flange temperatures ^a up to 25 ^o C	atts				
above 25° C See Rating Cl MOUNTING-FLANGE TEMPERATURE® RANGE:	nart				
Operating and storage	°C				
For 10 seconds maximum	°C				

Measured at center of seating surface.

b Measured 1/16° ± 1/32" down from plane of seating surface.



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ELECTRICAL CHARACTERISTICS

ELECTRICAL CHARACTERISTICS						
Voltage values are given	with resp	ect to	o base un	less o	ther-	-
wise specified. Mount	ing-flange	tem‡	berature	a of 2	5° C.	
		Min.	Typical	Har	-	
DC Collector Breakdown Voltage for dc col- lector ma. = -10,			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,			
emitter current = 0 . DC Collector-to-Emitter Breakdown Voltage for dc collector ma. = -100,	BV _{CBO}	-60	-80	-	volts	
base current = 0 DC Emitter Breakdown Voltage for dc emitter ma. = -5, collector	BV _{CEO}	-40	-55	-	volts	
current = 0 DC Base-to-Emitter Voltage for dc collec- tor-to-emitter volts	BVEBO	-1	-2	-	volts	
= -2, dc collector ma. = -1000 DC Collector-to-Emitter Saturation Voltage for dc collector ma. =	V _{BE}	-	-0.38	-0.5	volt	
-1000, dc base ma. = -50 DC Collector-Cutoff Current for dc col-	V _{CE(sat)}	-	-0.3	-1	volt	
lector volts = -40, emitter current = 0 DC Collector-Cutoff Saturation Current for dc collector volts = -0.5, emitter current	Ісво	-	-150	-500	μa	
= 0	_{CBO(sat)}	-	-65	-100	μа	
-0.5, collector current = 0	I _{EBO}		-1	-	та	
emitter volts = -2, dc collector ma. = -1000 . Forward Current-Transfer- Ratio Cutoff Frequency	hFE	50	90	150		
<pre>for dc collector-to- emitter volts = -5, dc collector ma. = -500. Gain-Bandwidth Product for dc collector-to- emitter volts = -5,</pre>	f _{hfe}	-	75	-	kc	
dc collector ma. = -500	f _T	5	7.5		Мс	

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DC Forward Conductance (I _C /V _{BE}) for dc col- lector-to-emitter volts = -2, dc col-					
lector ma. = -1000 Thermal Resistance:	G_{FE}	2	4	-	mhos
Junction-to-mounting flange	R _T	_	-	1.5	^o C/watt
8					

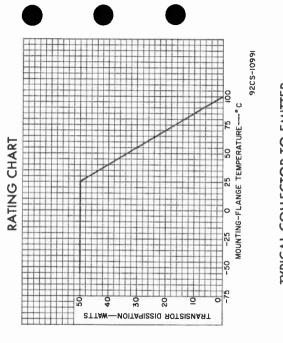
Measured at center of seating surface.

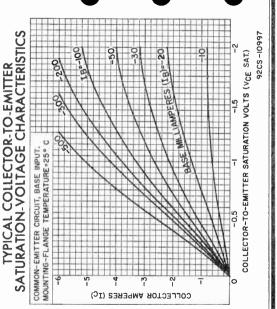
OPERATING CONSIDERATIONS, DIMENSIONAL OUTLINE, and SUGGESTED MOUNTING ARRANGEMENT shown under type 2N1906 also apply to the 2N1905



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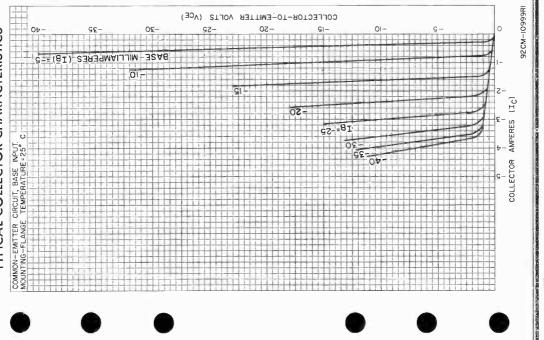


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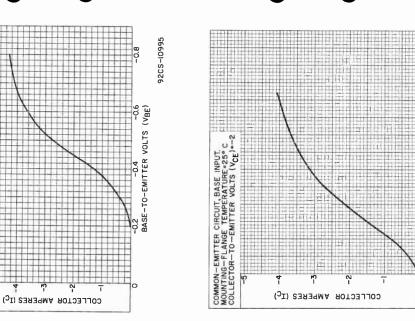
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CHARACTERISTICS TYPICAL

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COMMON-EMITTER C MOUNTING-FLANGE COLLECTOR-TO-EMI

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INPUT.

CIRCUIT, BASE IN TEMPERATURE =

Power Transistor

GERMANIUM, P-N-P, DIFFUSED-COLLECTOR, GRADED-BASE, DRIFT-FIELD TYPE For Industrial and Consumer-Product Applications

GENERAL DATA

Mechanical:

Operating Position
Maximum Seated Length
Maximum Length of Mounting Flange 1.562"
Maximum Width of Mounting Flange 1.031"
Case
Mounting Flange
Seals
Socket Loranger Mfg. Corp. No.2149, or equivalent
Terminal Diagram (See Dimensional Outline):
•

Pin 1 - Base Pin 2 - Emitter



MOUNTING FLANGE -Collector, Case

Maximum and Minimum Ratings, Absolute-Maximum Values:

In such applications as high-power, high-speed switches	
an dc-to-dc converters, inverters, and computers for	
data-processing equipment, as ultrasonic oscillators,	
and as large-signal, wide-band linear amplifiers	
COLLECTOR-TO-BASE VOLTAGE100 max. volts COLLECTOR-TO-EMITTER VOLTAGE:	5
With base open	s
EMITTER-TO-BASE VOLTAGE	
COLLECTOR CURRENT	
BASE CURRENT	
TRANSISTOR DISSIPATION:	
For mounting-flange temperatures ^a	
up to 25° C	s
For mounting-flange temperatures ^a	
above 25° C	
WOUNTING-FLANGE TEMPERATURE [®] RANGE:	
Operating and storage \ldots -55 to +100 °(~
PIN TEMPERATURE:	-
	^
For 10 seconds maximum	-
Typical Operation:	
In accompanying typical "on-off" power switching	
circuit at mounting-flange temperature ^a of 25°C	
DC Supply Voltage (V _{CC}) 5 12.5 12.5 voltage "On" Collector Current -1 -2.5 -5 amplitage "Turn-On" Base Current (IB1) - -0.25 -0.25 amplitage	p p
"Turn-Off" Base Current (182) 0.25 0.25 amp	ç



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Pulse-Generator Open- Circuit Voltage (E) Base-Bias Resistor (R "Speed-Up" Capacitor (Load Resistor (R ₂). Generator Impedance Switching Time:)	. 7 . 0.	2 – 5 5 1 – 5 5 5 5	2.5	volts ohms µf ohms ohms	•
Delay time (t _d) Rise time (t _r) Storage time (t _s) . Fall time (t _f)	• • • • • • • •	. 0. . 0.	1 0.4 1 7	0.9	μsec μsec μsec μsec	
^a Measured at center of se b Measured 1/16° ± 1/32° d			ating sur	face.		
ELEC	TRICAL CHARA	CTERI	STICS			
Voltage values are otherwise specified.	Mounting-f	lange t	emperati	ure ^a of 2		
DC Collector Breakdown		lin.	Typical	Max.		
Voltage for dc col- lector ma. = -10, emitter current = 0 DC Collector-to-Emitte Breakdown Voltage fo	. BV _{CBO} - r r	-100	-130	-	volts	
<pre>dc collector ma. = -1 base current = 0 DC Emitter Breakdown Voltage for dc emitt ma. = -5, collector</pre>	BV _{CEO}	-40	-55	-	volts	
current = 0 DC Base-to-Emitter Voltage for dc col- lector-to-emitter vo		-1	-2	-	volts	
= -2, dc collector ma. = -5000 DC Collector-to-Emitte Saturation Voltage f dc collector ma. =	r	-	-0.6	-0.9	volt	•
-5000, dc base ma. = -250. DC Collector-Cutoff Current for dc col-	V _{CE(sat)}	-	-0.75	-1	volt	
<pre>lector volts = -40, emitter current = 0 DC Collector-Cutoff Saturation Current for dc collector vol = -0.5, emitter cur-</pre>	ts	-	-150	-500	μa	•
rent = 0 DC Emitter-Cutoff Cur- rent for dc emitter volts = -0.5, collec	ICBO(sat)	-	-65	-100	μa	
tor current = 0		-	-1		ma	

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DC Current Transfer Ratio for dc col- lector-to-emitter volts = -2, dc col- lector ma. = -5000 Forward Current-Transfer- Ratio Cutoff Frequency for dc collector-to-	h _{FE}	75	125	200	
emitter volts = -5, dc collector ma. = -500. Gain-Bandwidth Product	f _{hfe}	-	75	-	kc
for dc collector-to- emitter volts = -5, dc collector ma. = -500. DC Forward Conductance (I _C /V _{BE}) for dc col- lector=to-emitter	fΤ	5	7.5	-	Мс
volts = -2, dc col- lector ma. = -5000 Thermal Resistance:	G _{FE}	5.5	8.3	-	mhos
Junction-to-mounting flange	RT	_	-	1.5	^o C/watt

A Heasured at center of seating surface.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

This transistor utilizes the Loranger Mfg. Corp. socket No.2149, or equivalent. Electrical connection can also be made to the base and emitter pins by soldering directly to the pins. Soldering of connections to the pins may be made close to the pin seals provided care is taken to conduct excessive heat away from the pin seal, otherwise the heat of the soldering operation will crack the glass seals of the pins and damage the transistor.

Under no circumstarces should the mounting flange be soldered to the heat sink because the heat of the soldering operation will permanently damage the transistor.

It is important that the mounting flange which serves as the collector terminal be securely fastened to a heat sink. Depending on the application, the chassis (heat sink) may be connected either to the positive or negative terminal of the voitage supply.

In applications where the chassis is connected to the negative terminal of the voltage supply, it will be necessary to use an anodized-aluminum insulator having high thermal conductivity, or a 0.002" mica insulator between the mounting fiange and the chassis. An aluminum washer should be drilled or punched to provide the two mounting holes, and the clearance holes for the emitter and base pins. The burrs should then



be removed from the washer and the washer finally anodized. To insure that the anodized insulating layer is not destroyed during mounting, it will also be necessary to remove the burrs from the holes in the chassis. Furthermore, to prevent a short circuit between the mounting bolt and the chassis, it is important that an insulating washer be used between the bolt and the chassis (See Suggested Nounting Arrangement).

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

To prevent damage to the transistor by thermal runaway, an external resistance may be placed in the emitter or collector circuit. The minimum value of this resistance may be obtained from the following equation:

$$R_{min} = \frac{E^2}{4\left(P_0 + \frac{25}{K}\right)}$$

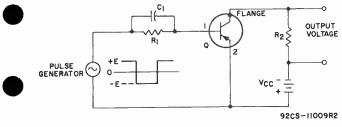
where:

E = DC collector supply voltage (Volts)

P_o = Collector-to-emitter voltage x collector current at desired operating point (Watts)

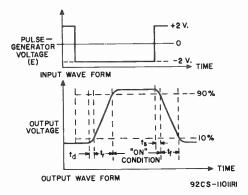
K = Thermal resistance — transistor and heat sink (^OC/watt)

TYPICAL "ON-OFF" POWER SWITCHING CIRCUIT



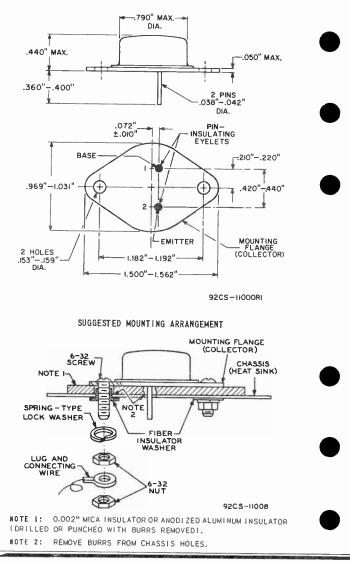
Q: Transistor type 2N1906

ASSOCIATED WAVE FORMS



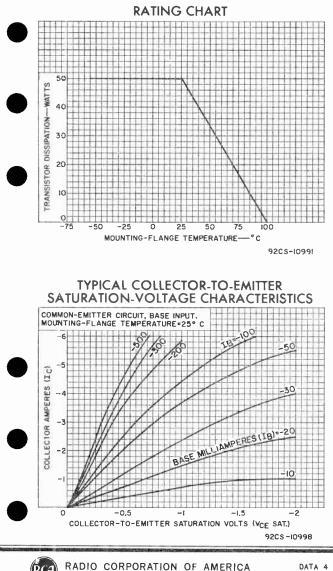


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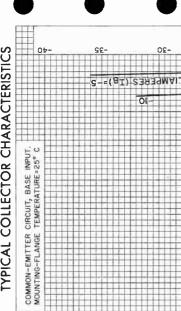




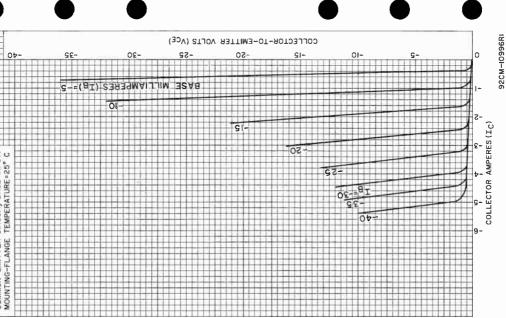
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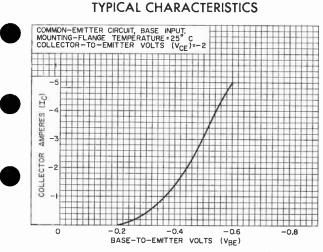
CTERISTICS CHARA TYPICAL COLLECTOR



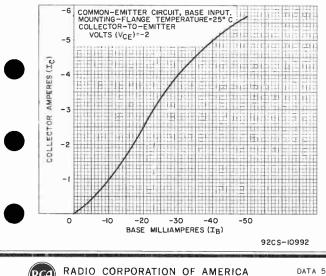
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World Radio History

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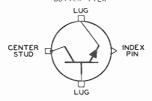
Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE For Power Switching and Amplifier Service in Industrial and Military Applications

GENERAL DATA

Mechanical:

	Operating Position	1
	Maximum Seated Length 0.520"	1
-	Maximum Diameter	J
	Dimensional Outline JEDEC No.TO-36	ò
	Case	
	Seals	;
	Terminal Diagram (See Dimensional Outline):	
	BOTTOM VIEW	



INDUSTRIAL SERVICE

Such as dc-to-dc converter, inverter, chopper, relaycontrol, oscillator, regulator, pulse-amplifier, and class A and class B push-pull-amplifier circuits

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE	100 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With base open (Sustaining voltage) ^a	50 max.	volts
EMITTER-TO-BASE VOLTAGE	10 max.	volts
COLLECTOR CURRENT	10 max.	amp
EMITTER CURRENT	–13 max.	amp
BASE CURRENT.	6 max.	amp
TRANSISTOR DISSIPATION:	450	
At case temperature ^c of 25 ^o C or below		
At case temperatures ^c above 25 ^o C	See Rating	Chart
CASE-TEMPERATURE RANGE:		0.0
Operating and storage	-65 to +200	°C
LUG TEMPERATURE:		0.0
For 10 seconds maximum	235 max.	°C
Characteristics:		
At case temperature of 25°C	6	
Forward Current-Transfer-Ratio		
Cutoff-Frequency $(f_{\alpha e})$	25	kc



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Collector-to-Base Capacitance (C_{ob}) with dc collector-to-base volts = 40 400 Thermal Time Constant (τ_1)	μμf msec
Typical Operation:	
In accompanying pulse-response test circuit at case temperature ^c of 25°C	
	volts volts amp ohms ohms ohms
"Turn-on" time [Relay time (t _d) + rise time (t _r)] 4 "Turn-off" time [Storage time (t _s) + fall time (t _f)]	μsec

The Collector-to-Emilter Sustaining Voltage (VCEO(sus)) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (Vames 1; voltage at which the product of alpha (a), at low voltage, times the multiplication factor (M) equals unity). а

See accompanying Rating Chart and also Transistor-Dissipation Rating Chart in General Section.

 ${\boldsymbol{\mathsf{c}}}$ Measured at intersection of seating surface with mounting stud. đ

Measured 1/16" ± 1/32* down from seating surface.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and at case temperature^c of 25°C unless otherwise specified

> Min. Max.

DC Collector-to-Emitter Voltage: With emitter reverse-bias volts = 1.5, dc collector			
<pre>ma. = 2 V_{CEX} With base open {Sustaining voltage}, dc collector ma.</pre>	-	100	volts
= 200, dc base ma. = 0 V _{CEO} ^a (sus) DC Base-to-Emitter Voltage for	-	50	volts
dc collector-to-emitter volts = 4, dc collector amperes = 5 · · VBE DC Collector-Cutoff Current I _{CBO} for dc collector volts = 30, dc emitter ma. = 0, case	-	2.2	volts
temperature = 25° C	-	50 2	^{µа} та
collector ma. = 0 I _{EBO}	-	50	µа

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	15 7.5	50 _	
Rc	_	0.25	ohm
5		1 17	00 (100++
	R _S	15 7.5 R _S -	15 50 7.5 - R _S - 0.25

The Collector-to-Emitter Sustaining Voltage {Y_{CEQ(SUS)}} with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (Yaw = 1; voltage at which the product of alpha (a), at low voltage, times the multiplication factor (H) equals unity).

 $^{f c}$ Measured at intersection of seating surface with mounting stud.

OPERATING CONSIDERATIONS

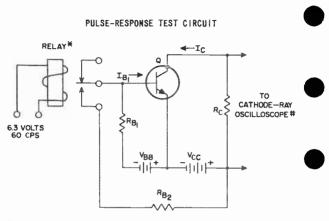
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

Electrical connection can be made to the base and emitter lugs by means of clips or by soldering directly to the lugs. When soldering connections are made to the lugs, care should be taken to conduct excessive heat away from the lug seals, otherwise the heat of the soldering operation will crack the glass seals of the lugs and damage the transistor.

This transistor is provided with a single-ended stud for mounting to a heat sink and for electrical connection to the collector. (See accompanying *Suggested Mounting Arrangement*). Electrical connection to the base and to the emitter is made to their respective lugs.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

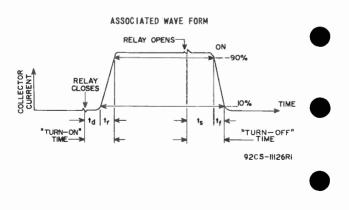




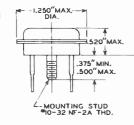
*C.P. CLARE TYPE HGP-1028 OR EQUIVALENT # TEKTRONIX TYPE 545 OR EQUIVALENT

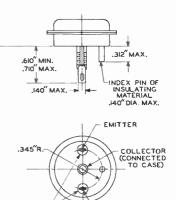
92CS-11125RI

Q: Transistor type 2N2015



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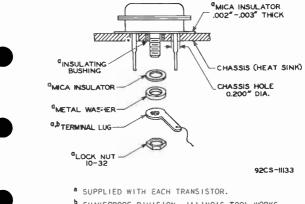
92CM-10612RI

BASE

SUGGESTED MOUNTING ARRANGEMENT

INSULATING

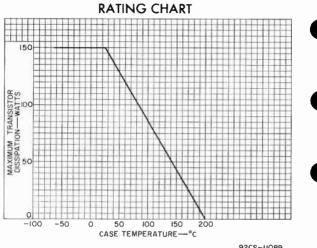
EYELETS



B SHAKEPROOF DIVISION, ILLINOIS TOOL WORKS, CATALOG NO.2102-6.

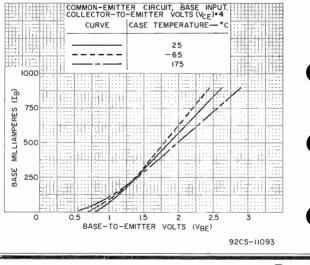


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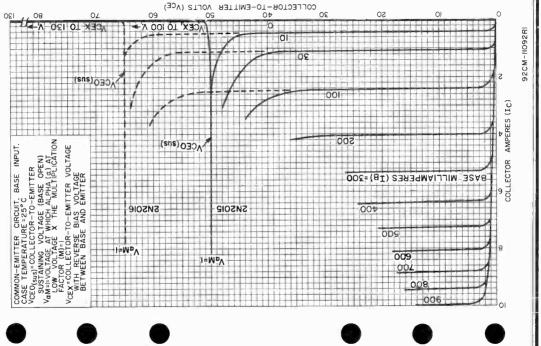
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TYPICAL BASE CHARACTERISTICS



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CTERISTICS CHARA COLLECTOR TYPICAL



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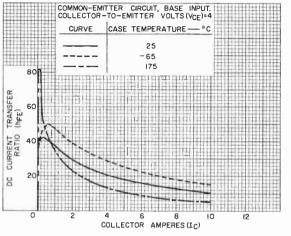
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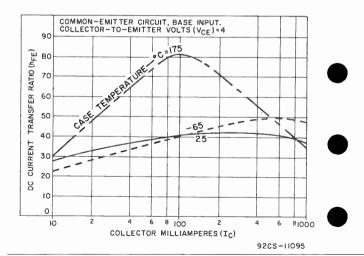
RADIO CORPORATION Semiconductor & Materials Division

Somerville, N.

TYPICAL DC-CURRENT-TRANSFER-RATIO CHARACTERISTICS

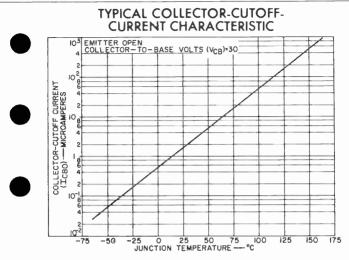


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RCA

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World Radio History

Power Transistor

SILICON N-P-N DIFFUSED-JUNCTION TYPE

For Power Switching and Amplifier Service in Industrial and Military Applications

The 2N2016 is the same as the 2N2015 except for the following items:

INDUSTRIAL SERVICE

Such as indc-to-dc converter, inverter, chopper, relaycontrol, oscillator, regulator, pulse-amplifier, and class A and class B push-pull-amplifier circuits

Maximum Ratings, Absolute-Naximum Values:

COLLECTOR-TO-BASE VOLTAGE	130 max.	volts
COLLECTOR-TO-EMITTER VOLTAGE:		
With base open (Sustaining voltage) ^a .	65 max.	volts

ELECTRICAL CHARACTERISTICS

Min. Nax.

DC Collector-to-Emitter Voitage: With emitter reverse-bias volts = 1.5, dc collector ma. = 2 V _{CEX} - With base open (Sustaining voltage), dc collector	130	volts
ma. = 200, dc base current = 0 V _{CEO} ^a (sus) ⁻	65	volts

a The Collector-to-Emitter Sustaining Voltage (VCEQ(sus)) with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity (VGM = 1; voltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).



World Radio History

Transistor

SILICON N-P-N TRIPLE-DIFFUSED-JUNCTION PLANAR TYPE For Industrial and Military Applications

The 2N2102 is Unilaterally Interchangeable with Type 2N1613

GENERAL DATA

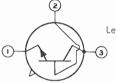
Mechanical:

Operating Position
Maximum Diameter
Dimensional Outline JEDEC No.TO-5
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter

Movimum and Minimum Datings

Lead 2 - Base



Lead 3-Collector, Case

INDUSTRIAL SERVICE

	Maximum and Minimum Katings, Absolute-Maximum	Vali	ies:	
	COLLECTOR-TO-BASE VOLTAGE: With emitter open	120	max.	volts
)	With external resistance (ohms) ≤ 10 between base and emitter With base open			volts volts
	With collector open. COLLECTOR CURRENT. TRANSISTOR DISSIPATION: ^a			volts amp
•	At case temperature ^b of 25 ^o C or below . At free-air temperature of 25 ^o C or below. TEMPERATURE RANGE:	-	max. max.	
	Storage			°C °C
		300	max.	°C



b Measured at center of seating plane.

C Measured 1/16" ± 1/32" down from seating plane.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Racio History

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and at case temperature b of 25° C unless otherwise specified							
		Nin.	Naz.				
DC Collector Breakdown Voltage for dc collector ma. = 0.1, dc emitter ma. = 0 DC Emitter Breakdown Volt-	BV _{CBO}	120	-	volts			
age for dc collector ma. = 0, dc emitter ma.= 0.1. DC Collector-to-Emitter Reach-Through Voltage for dc emitter volts = 1.5, dc collector	BV _{EBO}	7	~~	volts			
ma. = 0.1 DC Collector-to-Emitter Sustaining Voltage for dc collector ma. = 100: With external base-to- emitter resistance	V _{RT}	120	-	volts	•		
(ohms) ≤ 10 With base ma. = 0 DC Base-to-Emitter Satu- ration Voltage for dc collector ma. = 150, dc	V _{CEO} (.sus)	80 65	-	volts volts			
<pre>base ma. = 15 DC Collector-to-Emitter Saturation Voltage for dc collector ma. = 150,</pre>	V _{BE} (sat)	-	1.1	volts			
dc base ma. = 15 DC Collector-Cutoff Current for dc collector volts = 60, dc emitter ma.= 0, case temperature ^b =	VCE(sat) ICBO	-	0.5	volt	_		
25° C		-	0.002 2	<u></u> µа µа	•		
<pre>dc collector ma. = 0 Input Resistance at fre- quency of 1 kc: With dc collector-to- emitter volts = 5,</pre>	l _{EBO} h _{ib}	-	0.002	μа			
dc collector ma. = 1 . With dc collector-to- emitter volts = 10,		24	34	ohms	•		
dc collector ma. = 5 . Input Capacitance for dc emitter volts = 0.5, dc		4	8	ohms			
collector ma. = 10	C _{ib}	-	80	µµ⊥f			

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Output Capacitance for dc collector volts = 10, dc emitter ma. = 0 Cob Output Conductance at fre- hob quency of 1 kc: With dc collector-to-	-	15	<i>μμ</i> f
emitter volts = 5, dc collector ma. = 1 With dc collector-to-	0.1	0.5	µmho
emitter-volts = 10, dc collector ma. = 5 Small-Signal Forward h _{fe} Current Transfer Ratio: With dc collector-to- emitter volts = 5,	0.1	1	µmho
dc collector ma. = 1, frequency (kc) = 1 With dc collector-to- emitter volts = 10, dc	30	100	
collector ma. = 5, frequency (kc) = 1 With dc collector-to- emitter volts = 10, dc	35	150	
collector ma. = 50, frequency (Mc) = 20 DC-Pulse Forward-Current h _{FE} Transfer Ratio for dc collector-to-emitter volts = 10, pulse du- ration (μsec) = 300,	3	-	
duty factor of 0.018, dc collector ma. = 150	40 25 10	120 _ _	
<pre>emitter volts = 10, dc collector ma. = 0.01</pre>	10 20 35		
volts = 10, dc collector ma. = 10, case temperature ^b of -55 ⁰ C Voltage-Feedback Ratio at fre- h _{rb} quency of 1 kc:	20	-	
With dc collector-to-emitter volts = 5, dc collector ma. = 1 With dc collector-to-emitter	-	3 × 10-4	
volts = 10, dc collector ma. = 5	-	3 × 10 ⁻⁴	



RADIO CORPORATION OF AMERICA

Somerville, N. J.

Semiconductor & Materials Division Some

Noise Figure for signal fre- quency of 1 kc, circuit bandwidth of 15 kc, generator resistance (ohms) = 1000. dc				
collector-to-emitter volts				$\mathbf{-}$
= 10, dc collector ma. = 0.3. NF	_	6	db	
Total Switching Time ^d (Delay				
time + rise time + fall time). to+tr+tf	-	30	mµsec	
Thermal Resistance: RT				
Junction-to-case	-	35	°C/watt	
Junction-to-free air	-	175	°C/watt	

^b Measured at center of seating plane.

^d See accompanying Total-Switching-fime Neasurement Circuit.

OPERATING CONSIDERATIONS

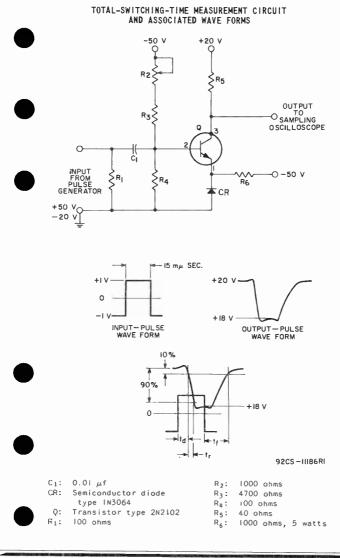
It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for socketed, single-side printed-circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printedcircuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board, and to prevent the collector from shorting to ground.

It is to be noted that the case of this transistor operates at the collector voltage. Consideration, therefore, should be given to the possibility of shock hazard, if the case of this transistor is to operate at a voltage appreciably above or below ground potential. In such cases, suitable precautionary measures should be taken.

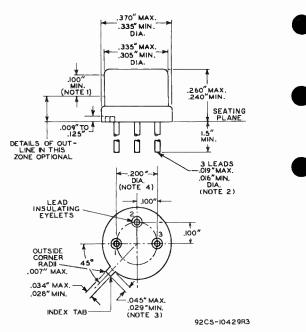






RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Reficientiation 0ATA 3 8-61

JEDEC No.TO-5



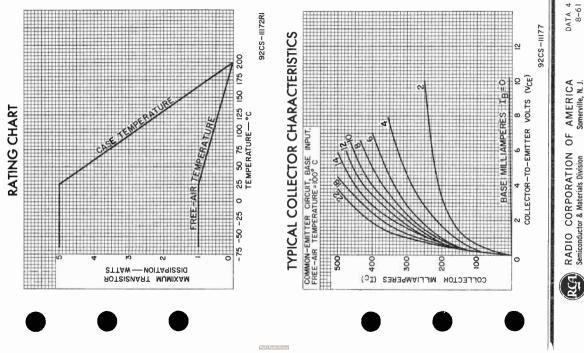
NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

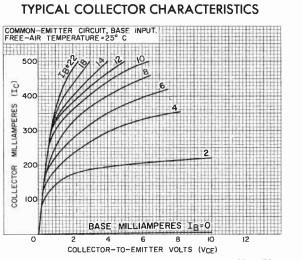
NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.



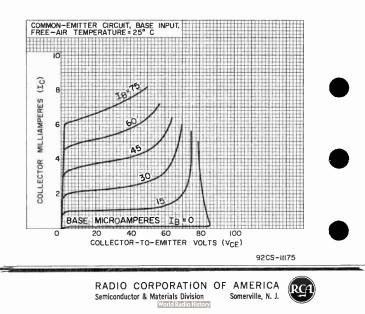


8-61 DATA

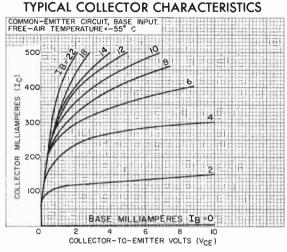
somerville, N.



92CS-11176

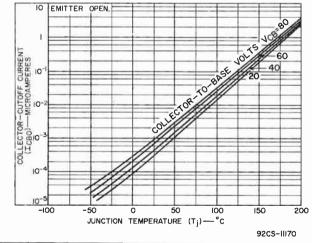


2N2102



⁹²CS-11190

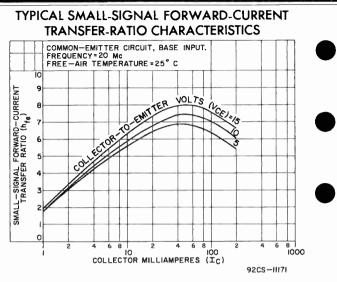
TYPICAL COLLECTOR-CUTOFF-CURRENT CHARACTERISTICS



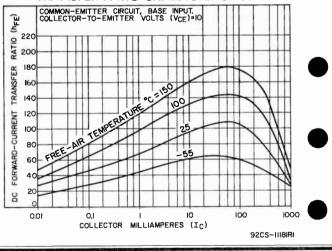


RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

DATA 5 8-61

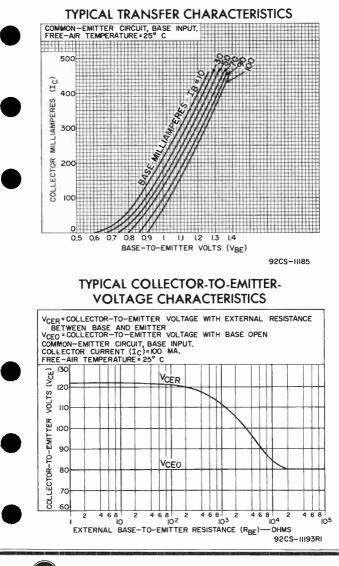


TYPICAL DC FORWARD-CURRENT TRANSFER-RATIO CHARACTERISTICS



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Work Addition Somerville, N. J.

RCA



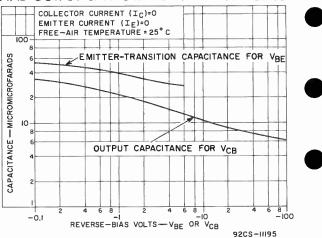
RADIO CORPORATION OF AMERICA Somerville, N. J.

Semiconductor & Materials Division

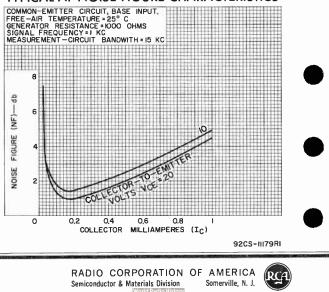
DATA 6 8-61

2N2102

TYPICAL EMITTER-TRANSITION-CAPACITANCE AND OUTPUT-CAPACITANCE CHARACTERISTICS



TYPICAL AF NOISE-FIGURE CHARACTERISTICS



Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE

For Switching Applications in Industrial and Military Equipment

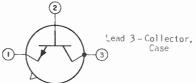
The 2N2205 is the same as the 2N1708 except for the following stems:

GENERAL DATA

Mechanical:

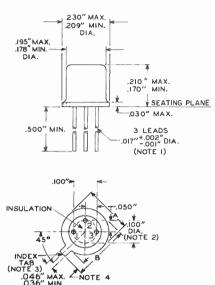
Operating Position	1
Maximum Diameter	1
Dimensional Outline JEDEC No. TO-18	3
Case	
Seals	2
Leads, Flexible	3
Minimum length	
Orientation and diameter See Dimensional Outline	2
Terminal Diagram: BOTTOM VIEW	

Lead 1 - Emitter Lead 2 - Base





JEDEC No. TO-18



92CS-10605R2

NOTE I: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXI-MUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Redio History

Transistor

SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE

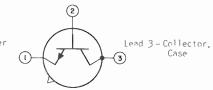
For Switching Applications in Industrial and Military Equipment

GENERAL DATA

Mechanical:

Operating Position
Maximum Length (Excluding flexible leads) 0.080"
Maximum Diameter
Dimensional Outline JEDEC No. TO-46
Case
Seals
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOTTOM VIEW

Lead 1 - Emitter Lead 2 - Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maxim	um Values:	
COLLECTOR-TO-BASE VOLTAGE: With emitter open V _{CBO} COLLECTOR-TO-EMITTER VOLTAGE: With external resistance be- tween base and emitter (ohms) = 1000, load resistance tohms)	25 max. vo	lts
= 100 V _{CERL}	20 max. vo	lts
With collector open V _{EBO} COLLECTOR CURRENT I _C	3 max. vo Limited by po	wer
TRANSISTOR DISSIPATION: a	dissipat	ion
At case temperature ^b of 25 ⁰ C		
cr below	1 max. wa	att
25° C or below. TEMPERATURE RANGE:	0.3 max. w	att
	-65 to +300	oC
Operating	-65 to +175	oC
For 10 seconds maximum	235 max.	٥C
8 Aug		

^a See accompanying Rating Chart.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 2-62

World Radio History

2N2206

b Measured at center of seating plane.

C Measured 1/16" ± 1/32" down from seating plane.

ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and free-air temperature of $25^{\rm 0}$ C unless otherwise specified

		Min.	Max.		
DC Collector Breakdown Voltage for dc collector ma. = 0.1, emitter ma. = 0 DC Emitter Breakdown Voltage for dc emitter ma. = 0.1.	BVCRO	25	-	volts	
collector ma. = 0 DC Collector-to-Emitter Latch- ing Voltage ^d for external resistance between base and	BVEBO	3	-	volts	
emitter (ohms) = 1000, load resistance (ohms) = 100 DC Base-to-Emitter Saturation Voltage for dc collector ma.	VCERL	20	-	volts	
= 10, dc base ma. = 1 DC Collector-to-Emitter	$V_{BE}(sat)$	0.7	0.9	volt	
Saturation Voltage: With dc collector ma. = 10.	V _{CE} (sat)				
dc base ma. = 1		-	0.22	volt	
dc base ma. = 5 DC Collector-Cutoff Current for dc collector volts = 15, emitter ma. = 0, free-	I BCO	-	0.35	volt	
air temperature = 25° C . 150° C . DC Collector Current for base- to-emitter forward bias volts		-	0.025 15	µд µд	
= 0.35, dc collector-to- emitter volts = 10, free-air temperature = 100° C Collector-to-Base Capacitance for dc collector volts = 10,	ICEX	-	15	μа	
emitter ma. = 0, frequency (kc) = 140	Cob	-	6	pf	
volts = 1, dc collector ma. = 10	h _{FE}	40	120		
collector ma. = 10, fre- quency (Mc) = 100	hfe	2	-		

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



World Radio History

<pre>Storage Time® for dc collector supply volts = 10, collector resistance (obms) = 1000, turn-on and turn-off dc base ma. = 10 each, dc collector ma. = 10. Turn-On Time! (Delay time + rise time) for dc collector succly volts = 3, turn-on</pre>	ts		35	μδθο
dc base ma. = 3, turn-off dc base ma. = 1, dc col- lector ma. = 10 Turn-Off Timef (Storage time + fall-time) for dc collector supply volts = 3, turn-off dc base ma. = 3, turn-off dc base ma. = 3, turn-off	td+tr	-	4 G	μSec
de base ma. = 1, de col- lector ma. : 10	$t_{\rm S}$ + $t_{\rm f}$	-	75	μsec

d For description of this test, write Commercial Engineering, Semiconductor & Materials Division. RCA, Somerville, New Jersey.

e See accompanying Storange-Time-Measurement Circuit.

f See accompanying Turn-On-fine and Turn-Off-Time Measurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

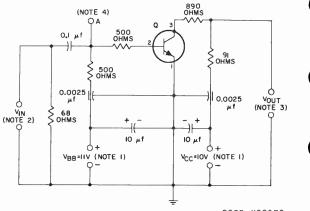
The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Radio History

STORAGE-TIME-MEASUREMENT CIRCUIT



92CS-11226R2

Q: Transistor type 2N2206

NOTE I: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25-µF DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR VCC AND VRC.

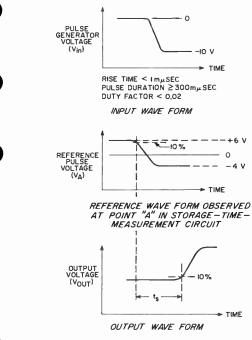
NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN DUTPUT IMPEDANCE OF 50 OPMS.

NOTE 3: THE ASSOCIATED INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING AN INPUT IMPEDANCE OF 50 OHMS.

NOTE 4: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (VA).



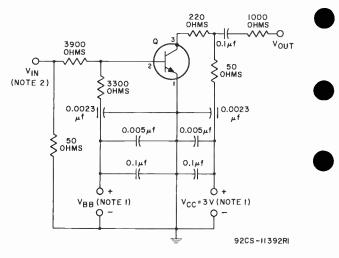
ASSOCIATED WAVE FORMS



92CS-11224



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Nortel period Vision DATA 3 2-62



TURN-ON-TIME AND TURN-OFF-TIME MEASUREMENT CIRCUIT

Q: Transistor type 2N2206

NOTE I: WITH CERTAIN TYPES OF POWER SUPPLIFS, IT WAY BE NECESSARY TO CONNECT 25-µf DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR VCC AND VBB.

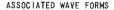
NOTE 2: INPUT VOLTAGE (VIN) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS.

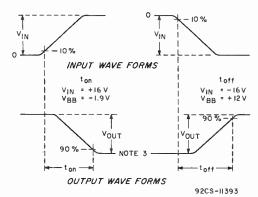
NOTE 3: INPUT AND OUTPUT WAVE FORMS, SHOWN ON NEXT PAGE, SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING AN INPUT IMPEDANCE OF 50 OHMS.

NOTE 4: ALL RESISTANCE VALUES HAVE ± 1% TOLERANCE.





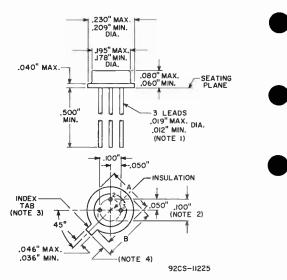






RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 4 2-62

JEDEC No. TO-46



NOTE 1: THE SPECIFIED LEAD DIAMETEP APPLIES IN THE 70NE RETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. PETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

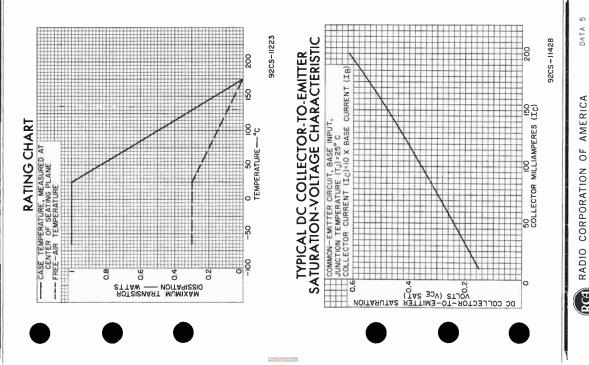
NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE AITHIN 0.007" OF THEIR TRUE LOCATION PELATIVE TO MAXIMUM WIDTH TAP AND TO THE 0.230" MAXIMUM DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS NOT USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: INDEX TAB FOR VISUAL OPIENTATION ONLY.

NOTE 4: TAB LENGTH TO BE 0.028" VINIMUM - 0.048" MAXIMUM AND WILL BE DETERMINED BY SUBTRACTING DIAVETER "A" FROM DIMENSION "B".







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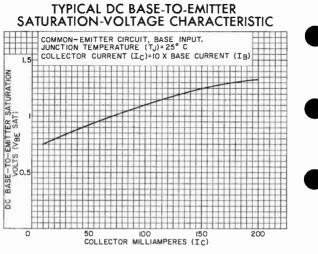
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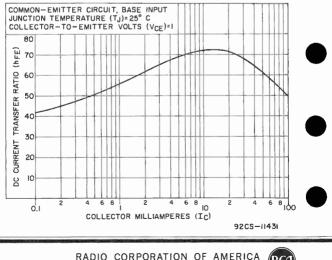
RADIO



92CS-11418

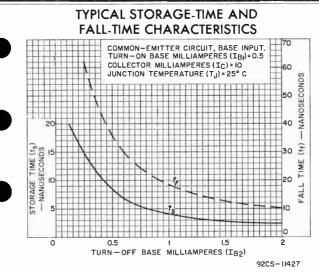
Somerville, N. J.

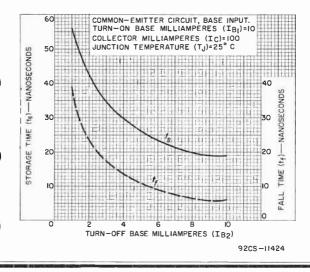
TYPICAL DC CURRENT-TRANSFER-RATIO CHARACTERISTIC



Semiconductor & Materials Division

2N2206

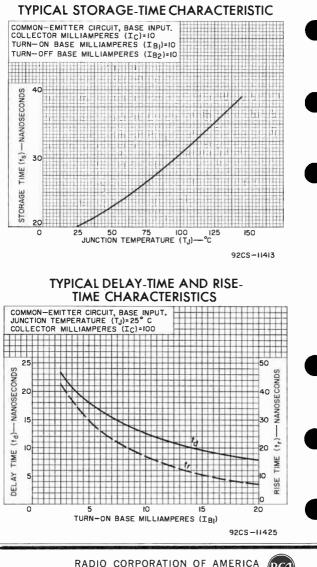






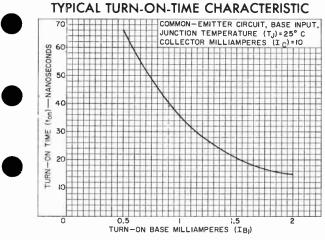
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World Radio History



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92CS-11416



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World Radio History

Transistor

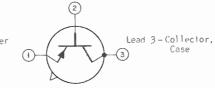
GERMANIUM P-N-P DIFFUSED-BASE MESA TYPE For 1F- and RF-Amplifier Applications in the 5-to-50 Mc Range in Industrial and Military Equipment

GENERAL DATA

Mechanical:

. . See Outline TO-18 in General Section BOTTOM VIEW





RADIO-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE:									
With emitter open						Vсво	-25 r	nax.	volts
COLLECTOR-TO-EMITTER VOLT									
With base open	·	•	·	·	·	VCEO	-15	max.	volts
EMITTER-TO-BASE VOLTAGE:									1.
With collector open	·	•	·	•	·	VEBO		nax.	
COLLECTOR CURRENT					•	1 _C	100	max.	ma
TRANSISTOR DISSIPATION:						P			
At free-air temperature									
of 25 ⁰ C or below		•					100	max.	mw
At free-air temperature									
above 25° C				. L)e 1	rate l	inearl	y 1.33	mw/°C
TEMPERATURE RANGE:									
Junction (Operating)						T,	-65 to) + 100	°C
Storage						TSTG	-65 to	+ 100	°C
LEAD TEMPERATURE: "						Q . W			
For 10 seconds maximum.						TL	235	max.	°C
101 10 0000100 1011 1						L.	-, .		



ELECTRICAL CHARACTERISTICS

Unless otherwise specified, free-air temperature = 25° C Min. Typical Max.

DC Collector-to-Base Breakdown Voltage for dc collector ma.

= -0.1, emitter cur-rent = 0. -25 volts BVCEO

a Measured 1/16" ± 1/32" along lead down from seating plane.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

		Min.	Typical	Max.		
DC Collector-to-Emitter Breakdown Voltage for dc collector ma. = -0.1, base current						
= 0	BV _{CEO}	-15	-	-	volts	
current = 0 DC Collector-Cutoff Current for dc col- lector-to-base volts = -12, emitter cur-	8V _{EBO}	-1	-	-	volt	
rent = 0	1 _{CB0}	-	-	-10	µа	•
= 250	۲ _{۵۵} ,	-	-	250	ohms	
frequency (Mc) = 250. Output Capacitance for dc collector-to-base volts = -10, emitter current = 0, fre-	h _{ie} (real)	50	-	250	ohms	
quency (kc) = 140 DC Forward-Current Transfer Ratio for ac collector-to- emitter volts = -10,	Сор	-	-	3.5	рf	
<pre>dc collector ma. = -1. Small-Signal Short- Circuit Forward-Cur- rent Transfer Ratio for dc collector-to- emitter volts = -6, dc collector ma. = -1. frequency (kc)</pre>	h _{FE}	25	-	150		•
= 1 Small-Signal Power Gain for dc collector-to- emitter volts = -9, dc collector ma. = -1,	h _{fe}	20	-	28		
frequency $(Mc) = 30$.	G _{pe}	10	-	-	db	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

RCA

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



World Radio History

Transistor

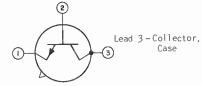
SILICON N-P-N EPITAXIAL-PLANAR TYPE

For Ultra-High-Speed Logic-Circuit Switching Applications in Commercial and Military Data-Processing Systems

GENERAL DATA

Mechanical:

Lead 1-Emitter Lead 2-Base



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open V _{CBO} 15 max. COLLECTOR-TO-EMITTER VOLTAGE:	volts
With base open V _{CEO} 6 max.	volts
EMITTER-TO-BASE VOLTAGE: With collector open V _{EBO} 4 max. COLLECTOR CURRENT I _C Limited by dissip	power
TRANSISTOR DISSIPATION: * P	atron
At case temperature ^b of 100°C or below	mw
25° C or below	mw
TEMPERATURE RANGE: Junction (Operating) T _J -65 to +200 Storage T _{STG} -65 to +300	°C °C
LEAD TEMPERATURE: ^c For 10 seconds maximum	oC

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, free-air temperature = 25° C Hin. Typical Hax. DC Collector Breakdown Voitage for dc collector ma. = 0.01, dc emitter current = 0... BV_{CBO} 15 30 - volts ^a See accompanying Rating Chart. ^b Measured at center of sealing plave.

C Measured 1/16" ± 1/32" along lead, down from seating plane.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.

		Min.	Typical	Max.		
DC Emitter Breakdown Voltage for dc collector current = 0, dc emitter ma. = 0.01 DC Collector-to-Emitter Sustaining Voltage ^d for dc	BV _{EBO}	4	7		volts	
pulsed collector ma. = 10, dc base current = 0 V DC Base-to-Emitter Saturation Voltage for dc collector	CEO ^(sus)	6	10	-	volts	
ma. = 20, dc base ma. = 0.66	8E ^(sat)	0.8	0.9	1	volt	-
<pre>dc collector ma. = 20, dc base ma. = 0.66 V DC Collector-Cutoff Current for dc collector-to-base volts = 5, dc emitter current = 0, free-air temperature =</pre>	CE (sat) ¹ CBO	-	0.28	0.4	volt	•
25° C. 150° C. Emitter-to-Base Capacitance for dc emitter-to-base volts = -0.5, dc collector		-	0.002 0.9	0.05 5	µа µа	
<pre>current = 0, frequency (kc) = 140 (Approx.) Collector-to-Base Capacitance for dc collector-to-base volts = 5, dc emitter</pre>	C _{ib}	-	2	2.5	pf	
current = 0, frequency (kc) = 140 (Approx.) DC Forward-Current Transfer Ratio: With dc collector-to-	C _{ob} h _{FE}	-	2.4	3	pf	
emitter volts = 0.3, dc collector ma. = 1 With dc collector-to-		20	40	-		
emitter volts = 0.5, dc pulsed collector ma. = 50. With dc collector-to- emitter volts = 0.4, dc		20	36	-		
pulsed collector ma. = 20. With dc collector-to- emitter volts = 0.4, dc		30	50	150		
pulsed collector ma. = 20, free-air temperature = -55° C		15	24	-		
collector ma. = 20, signal frequency (Mc) = 100	h _{fe}	6	8	_		

RADIO CORPORATION OF AMERICA Semiconductor & Materiais Division

Somerville, N. J.



Switching Time: Storage time ^e for dc collector ma. = 5, turn- on dc base ma. = 5, turn- off dc base ma. = -5 Turn-On time ^f (Delay time + rise time) for dc col-	ts	-	3.2	6	nsec
<pre>lector ma. = 20, turn-on dc base ma. = 1, turn-off dc base ma. = -1 Turn-Off time (Storage time + fall time) for dc</pre>	t _{on}	_	7.3	20	nsec
collector ma. = 20, turn- on dc base ma. = 1, turn- off dc base ma. = -1	t _{off}	_	9	15	nsec

- d The Collector-to-Emitter Sustaining Voltage [vcr0(sus)] with the base open is that value of voltage which remains relatively constant over a wide range of collector currents, and approximates the collector voltage at which the effective alpha of the device is equal to unity ($v_{DM} = 1$; vcltage at which the product of alpha (α), at low voltage, times the multiplication factor (M) equals unity).
- ^e See accompanying Storage-Fine-Neasurement Circuit.
- f See accompanying furn-On-fime and furn-Off-fime Neasurement Circuit.

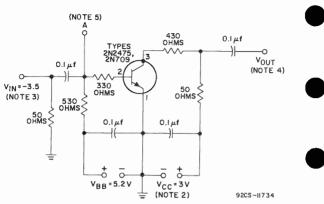
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.





STORAGE-TIME MEASUREMENT CIRCUIT

NOTE I: ALL RESISTANCE VALUES HAVE ± I PERCENT TOLERANCE. NOTE 2: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

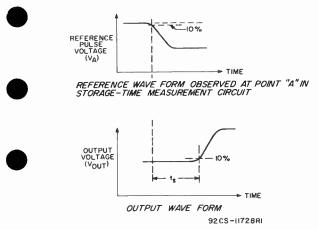
NOTE 3: INPUT VOLTAGE ($V_{1,N}$) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS. VIN RISE TIME < 1 NSEC; PULSE DURATION > 300 NSEC; AND DUTY FACTOR < 0.02.

NOTE 4: INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME < 0.5 NSEC; INPUT CAPACITANCE OF PROBE ≤ 2.5 pf with Shunt Resistance > 1000 ohms.

NOTE 5: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (V_A).

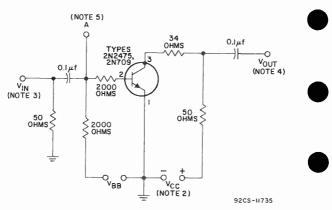


ASSOCIATED WAVE FORMS





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Padio History DATA 3 8-62



TURN-ON-TIME AND TURN-OFF-TIME MEASUREMENT CIRCUIT

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ton	toff	ton	torr
V _{BB} : -1 voit	V ₈₈ : +5 volts		V _{BB} : +5 volts
V _{IN} : +4 volts V _{CC} : +1.B volts	V _{IN} : -4 volts V _{CC} : +1.8 volts	V _{IN} : +0 volts V _{cc} : +1 volt	V _{IN} : -4 volts V _{cc} : +1 volt

NOTE I: ALL RESISTANCE VALUES HAVE ± I PER CENT TOLERANCE. NOTE 2: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

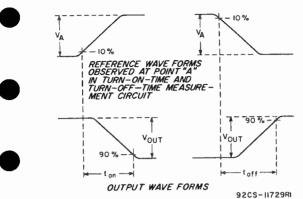
NOTE 3: INPUT VOLTAGE ($V_{1,k}$) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS. $V_{1,k}$ RISE TIME < I NSEC; PULSE DURATION > 300 NSEC; AND DUTY FACTOR < 0.02.

NOTE 4: INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME < 0.5 NSEC; INPUT CAPACITANCE OF PROBE \leq 2.5 pf with shunt resistance > 1000 ohms.

NOTE 5: TEST POINT FOR OBSERVATION OF REFERENCE PULSE VOLTAGE (v_A).

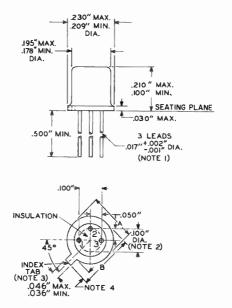








RADIO CORPORATION OF AMERICA Semiconductor & Materials Division World Participation DATA 4 8-62



SIMILAR TO JEDEC No.TO-18

92CS-11739

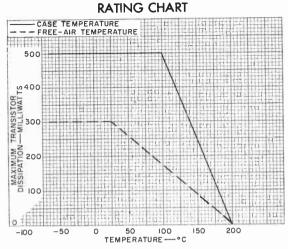
NOTE 1: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" TO THE END OF THE LEAD, A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 2: MAXIMUM DIAMETER LEADS AT A GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW SEATING PLANE TO BE WITHIN 0.007" OF THEIR TRUE LOCATION RELATIVE TO MAXIMUM WIDTH TAB AND TO THE MAXIMUM 0.230" DIAMETER MEASURED WITH A SUITABLE GAUGE. WHEN GAUGE IS USED, MEASUREMENT WILL BE MADE AT SEATING PLANE.

NOTE 3: FOR VISUAL ORIENTATION ONLY.

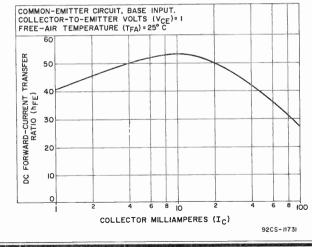
NOTE 4: TAB LENGTH TO BE 0.028" MINIMUM AND 0.048" MAXIMUM, AND WILL BE DETERMINED BY SUBTRACTING DIAMETER "A" FROM DIMENSION "B".





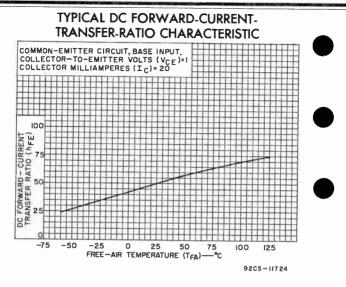
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TYPICAL DC FORWARD-CURRENT-TRANSFER-RATIO CHARACTERISTIC

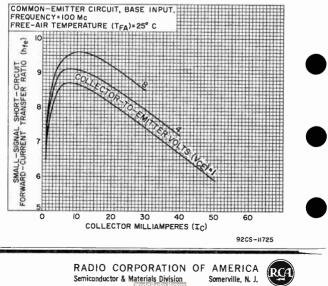


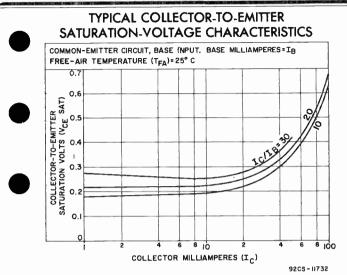


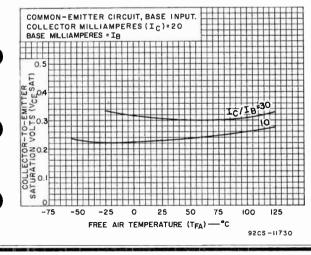
RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 5 8-62



TYPICAL SMALL-SIGNAL SHORT-CIRCUIT FORWARD-CURRENT TRANSFER-RATIO CHARACTERISTICS



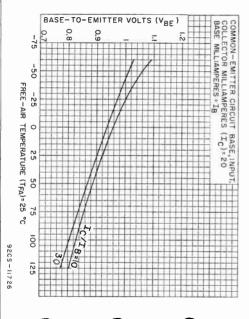






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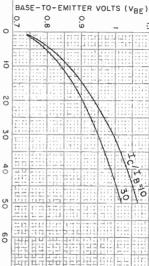






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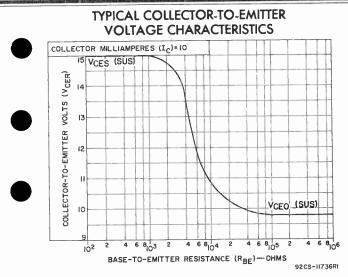
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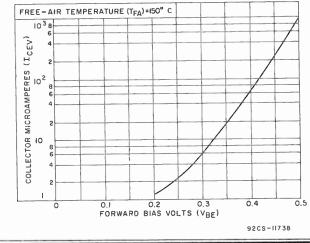
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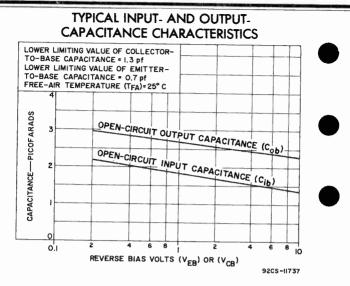


TYPICAL COLLECTOR-CURRENT CHARACTERISTIC





RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA 7 8-62



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



Transistor

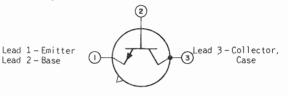


SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE For High-Speed, High-Current Switching in Core-Driving and Line-Driving Applications in Data-Processing Systems

GENERAL DATA

Mechanical:

Dimensions. See Outline TO-5 in General Section Terminal Diagram: BOTTOM VIEW



SWITCHING SERVICE

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE: With emitter open			V _{СВО}	60 max. v	olts
COLLECTOR-TO-EMITTER VOLTAGE: With base open	•		VCEO	20 max. v	olts
With collector open COLLECTOR CURRENT				5 max. v Limited by p dissipa	ower
TRANSISTOR DISSIPATION: *			Р	0,00,00	
At case temperature ^b of 25 ⁰ C or below At free-air temperature of	•			2 max. w	vatts
25° C or below	•			0.6 max.	watt
TEMPERATURE RANGE: Junction (Operating) Storage LEAD TEMPERATURE: ^c					°C °C
For 10 seconds maximum			T ₁	235 max.	°C

ELECTRICAL CHARACTERISTICS

Unless otherwise specified, free-air temperature = 25° C Nin. Nax. DC Collector-to-Base Breakdown Voltage for dc collector μa = 10, emitter current = 0... BV_{CBO} 60 - volts ^a See accompanying Rating Chart. ^b Measured at center of seating plane. ^c Measured 1/16* ± 1/32* along lead down from seating plane.

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 8-62

		Min.	Max.		
DC Collector-to-Emitter Break- down Voltage for pulse dc					
collector ma. = 50 ^d , base					
current = 0	BVCEO	20	-	volts	
Voltage fordcemitterma. = 0.1,	DV	F		1.	
collector current = 0 DC Base-to-Emitter Voltage for	BVEBO	5	-	volts	_
dc collector ma. = 150, dc base ma. = 7.5	V _{BE}		1	volt	
DC Collector-to-Emitter					
With dc collector ma. = 150,	V _{CE} (sat)				
dc base ma. = 7.5		-	0.4	volt	
dc base ma. = 50		-	0.75	volt	
DC Collector-Cutoff Current for dc collector-to-base volts	ГСВО				
= 30, emitter current = 0, free—air temperature =					
25 ⁰ C		-	0.2	μа	
150° C		-	200	μа	
emitter-to-base volts = 5, collector current = 0	I EBO	_	100	μa	
Output Capacitance for dc collec-	, EBO		200	μα	
tor-to-base volts = 10, emitter current = 0, frequency (kc) = 140.	Cob	-	10	pf	
DC Forward-Current Transfer Ratio for dc collector-to-emitter					
volts=0.4,dc collector ma.=150.	h _{FE}	20	-		
Small-Signal Short-Circuit Forward-Current Transfer Ratio					
for dc collector-to-emitter volts = 10, dc collector ma.					
= 50, frequency (Mc) = 100	h _{fe}	2.5	-		
Switching Time: Storage time [®] for dc collector					
<pre>supply volts = 6.4, collector resistance (ohms) = 40, turn-</pre>					
on dc base ma. = 15, turn-off					
dc base ma. = -15, dc collec- tor ma. = 150	't s	-	25	nsec	
Turn-on timef (Delay time + rise time) for dc collector supply	3				
volts = 6.4, turn-on dc base					
ma. = 15, dc collector ma. = 150 Turn-off time® (Storage time +	ton	_	25	nsec	
Turn-off time® (Storage time + fall_time) for dc collector					
supply volts = 6.4, turn-on dc base ma. = 15, turn-off dc					
base ma. = -15, dc collector			4.5		•
ma. = 150	t _{off}		45	nsec	

RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J.



d Pulse duration \leq 400 μ sec. duty factor = 0.03.

e See accompanying Storage-fime and furn-Off-fime Neasurement Circuit.

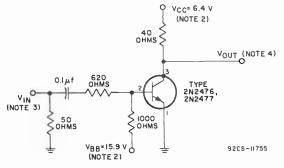
f See accompanying furn-On-fime Measurement Circuit.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.



STORAGE-TIME AND TURN-OFF-TIME MEASUREMENT CIRCUIT

NOTE 1: ALL RESISTANCE VALUES HAVE ± | PERCENT TOLERANCE.

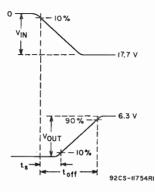
NOTE 2: WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{BB}.

NOTE 3: INPUT VOLTAGE ($V_{1,N}$) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS. $V_{1,N}$ RISE TIME < 2 NANOSECONDS; PULSE DURATION > 150 NANOSECONDS; DUTY FACTOR < 0.02.

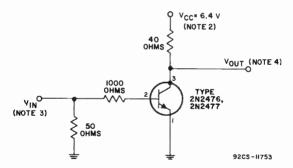
NOTE 4: THE ASSOCIATED INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME < 0.5 NANOSECOND; INPUT CAPACITANCE OF PROBE < 2.5 PICOFARADS WITH SHUNT RESISTANCE OF I MEGOHM.



ASSOCIATED WAVE FORMS



TURN-ON-TIME MEASUREMENT CIRCUIT



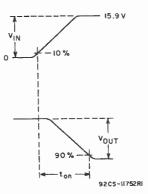
NOTE 1: ALL RESISTANCE VALUES HAVE ± 1 PERCENT TOLERANCE. **NOTE 2:** WITH CERTAIN TYPES OF POWER SUPPLIES, IT MAY BE NECESSARY TO CONNECT 25- μ f DECOUPLING CAPACITORS ACROSS THE POWER-SUPPLY TERMINALS FOR V_{CC} AND V_{B8}.

NOTE 3: INPUT VOLTAGE ($v_{1,N}$) OBTAINED FROM MERCURY-RELAY TYPE PULSE GENERATOR HAVING AN OUTPUT IMPEDANCE OF 50 OHMS. $v_{1,N}$ RISE TIME < 2 NANOSECONDS; PULSE DURATION > 150 NANOSECONDS AND DUTY FACTOR < 0.02.

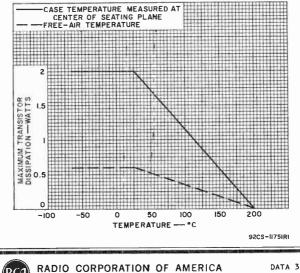
KOTE 4: THE ASSOCIATED INPUT AND OUTPUT WAVE FORMS SHOWN SHOULD BE MONITORED BY MEANS OF A SAMPLING OSCILLOSCOPE HAVING A RISE TIME < 0.5 NANOSECOND; INPUT CAPACITANCE OF PROBE < 2.5 PICOFARADS WITH SHUNT RESISTANCE OF I MEGOMM.



ASSOCIATED WAVE FORMS







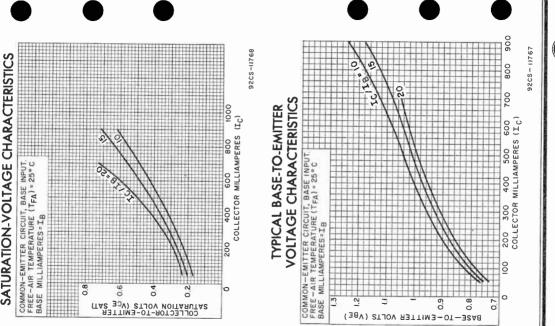
Somerville, N. J.

Semiconductor & Materials Division

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AMERICA Somervilie, N. J. ЧО CORPORATION RADIO CORPORATION Semiconductor & Materials Division



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COLLECTOR

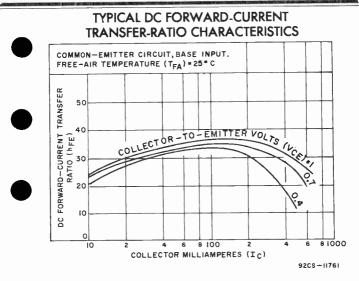
TYPICAL

2N2476

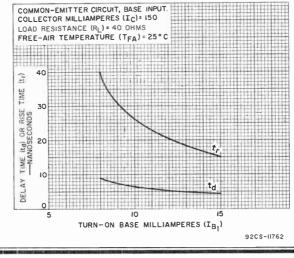
VOLTAGE

1

SATURATION

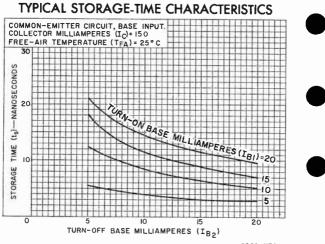


TYPICAL DELAY-TIME AND RISE-TIME CHARACTERISTICS





DATA 4 8-62



9205-11769





Transistor



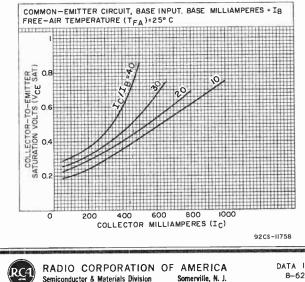
SILICON N-P-N DOUBLE-DIFFUSED-JUNCTION EPITAXIAL-PLANAR TYPE For High-Speed, High-Current Switching in Core-Driving and Line-Driving Applications in Data-Processing Systems

The 2N2477 is the same as the 2N2476 except for the following items:

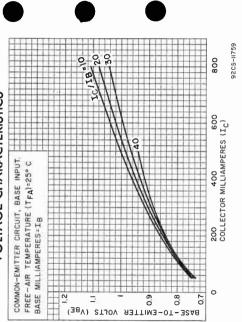
ELECTRICAL CHARACTERISTICS

	Hin.	max.	
DC Base-to-Emitter Voltage for dc collector ma. = 150, dc base ma. = 3.75 V _{BE} DC Collector-to-Emitter Saturation Voltage: V _{CE} (sat)	-	0.95	volt
With dc collector ma. = 150, dc base ma. = 3.75	-	0.4	volt
With dc collector ma. = 500, dc base ma. = 50 DC Forward-Current Transfer	-	0.65	volt
Ratio for dc collector-to- emitter volts = 0.4, dc collector ma. = 150 h _{FE}	40	_	

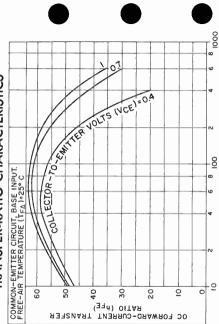
TYPICAL COLLECTOR-TO-EMITTER SATURATION-VOLTAGE CHARACTERISTICS



VOLTAGE CHARACTERISTICS **BASE-TO-EMITTER** TYPICAL



TRANSFER-RATIO CHARACTERISTICS FORWARD-CURRENT TYPICAL DC



AMERICA Somervitle, N. J. Ч CORPORATION

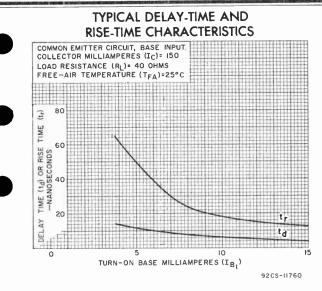
92CS-11756

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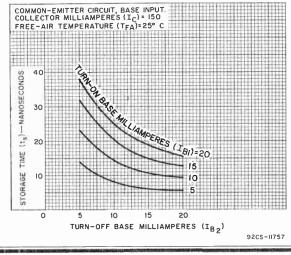
MILLIAMPERES

COLLECTOR

RADIO CORPORATION Semiconductor & Materials Division



TYPICAL STORAGE-TIME CHARACTERISTICS





Semiconductor & Materials Division

RADIO CORPORATION OF AMERICA Somerville, N. J.

World Radio History

Transistor

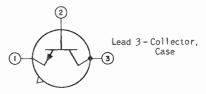
GERMANIUM N-P-N DIFFUSED-BASE MESA TYPE For Low-Power RF-Amplifier Applications in the VHF Range in Industrial and Military Equipment

GENERAL DATA

Mechanical:



Lead 1 - Emitter Lead 2 - Base



RADIO-FREQUENCY AMPLIFIER

Maximum and Minimum Ratings, Absolute-Maximum Values:

COLLECTOR-TO-BASE VOLTAGE With emitter open COLLECTOR-TO-EMITTER VOLT					•	V _{CBO}	20	max.	volts
With base open						VCEO	12	max.	volts
EMITTER-TO-BASE VOLTAGE:							~		
With collector open	•	•	•	•	•	VEBO		max.	
COLLECTOR CURRENT						I _C	100	max.	ma
TRANSISTOR DISSIPATION:						Ρ			
At free—air temperature	0	f							
25° C or below							150	max.	TW
At free—air temperature									
						. Derate	lin	early 2	mw/°C
At free-air temperature above 25° C TEMPERATURE RANGE:			•	•	•	. Derate	lin	early 2	mw/°C
above 25° C	•								
above 25 ⁰ C TEMPERATURE RANGE: Junction (Operating).	•					ТJ	-65 t	o +100	°C
above 25 ⁰ C TEMPERATURE RANGE: Junction (Operating) Storage	•					ТJ	-65 t		
above 25 ⁰ C TEMPERATURE RANGE: Junction (Operating).				•		Tj T _{stg}	-65 t -65 t	o +100	°C



ELECTRICAL CHARACTERISTICS

Unless otherwise specified, free-air temperature = 25° C Nin. Typical Max.

DC Collector-to-Base Breakdown Voltage for dc collector ma. = 0.1, emitter current = 0 . . . BV_{CBO} 20 - - volts

^a Measured 1/16* ± 1/32* along lead down from seating plane.

		Min.	Typical	Max.		
DC Collector-to-Emitter Breakdown Voltage for dc collector ma. = 2, base short-circuited			- ,,			
to emitter DC Emitter-to-Base Break- down Voltage for dc emitter ma. = 0.1,	BV _{CES}	15	-	-	volts	
<pre>collector current = 0 DC Collector-Cutoff Current for dc collector-to-base volts = 6, emitter cur- rent = 0, free air temperature =</pre>	BV _{E80} I _{CB0}	3	-	-	volts	
25 ⁰ C		-	-	5 90	µа µа	
<pre>collector ma. = 10, frequency (Mc) = 250 Output Capacitance for dc collector-to-base volts = 6, emitter current = 0,</pre>	r _{bb} ı	-	30	-	ohms	
frequency (kc) = 140 DC Forward-Current Transfer Ratio for dc collector- to-emitter volts = 6, dc	Сор	-	-	4.5	pf	
collector ma. = 2 Small-Signal Short-Circuit Forward-Current Transfer Ratio:	h _{FE}	25	-	200		
With dc collector-to- emitter volts = 6, dc collector ma. = 2,	h _{fe}					_
frequency (kc) = 1 With dc collector-to- emitter volts = 10, dc collector ma. = 10,		15	-	175		
frequency (Mc) = 100. With dc collector-to- emitter volts = 1.7, dc collector ma. = 85,		6	10	-		
frequency (Mc) = 100 Noise Figure for dc collector-to-emitter volts = 6, dc collector ma. = 2, frequency (Mc) =	NF	3	-	-		
30		_	5 6	-	db db	



With dc collector-to- emitter volts = 6, dc collector ma. = 2,	G _{pe}			
frequency (Mc) = 30 100 ^b With dc collector-to-	-	25 12	-	db db
emitter volts = 12, dc collector ma. = 10, frequency (Mc) = 200 Collector-to-Base Time	-	8	-	db
Constant for dc collec- tor-to-base volts = 6, dc collector ma. = 2, frequency (Mc) = 31.9 Power Output as class A amplifier ^c for dc col- lector-to-emitter volts	r _b ,C _c -	-	0.3	nsec
= 12, dc collector ma. = 30, signal input (mw) = 6.5, frequency (Mc) = 70	-	150	_	mw

^C See accompanying Power-Output-Neasurement Circuit.

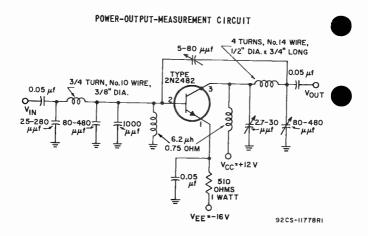
OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The *flexible leads* of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the seating plane provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the seals of the leads and damage the transistor.

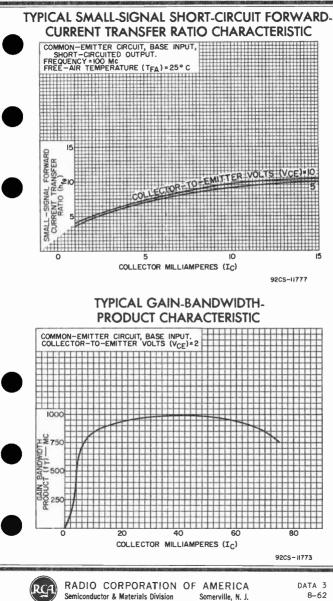
It is to be noted that the case of this transistor operates at the collector voltage. Because of the possibility of shock hazard when the case of this transistor is at a voltage appreciably above or below ground potential, suitable precautionary measures should be taken.

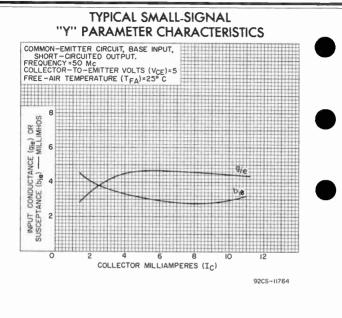


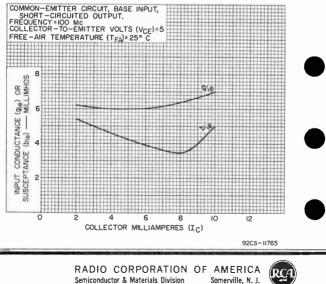


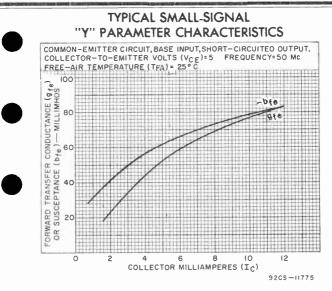


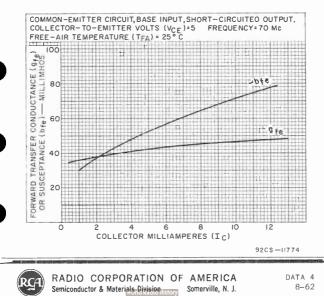


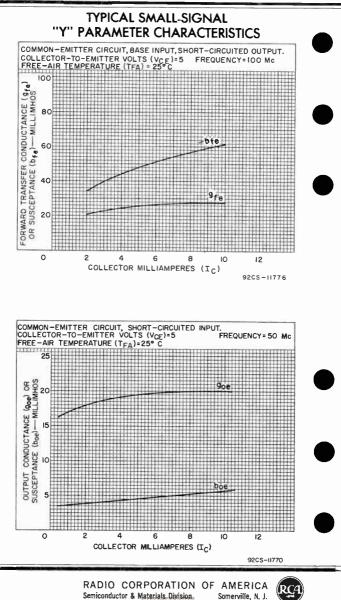


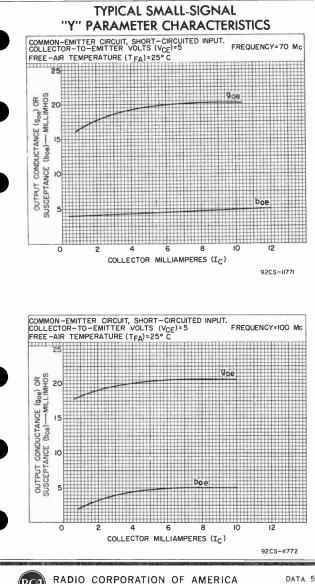










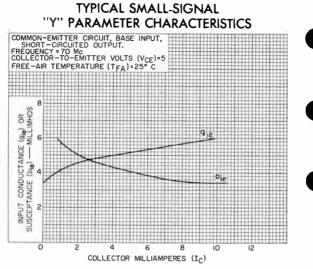


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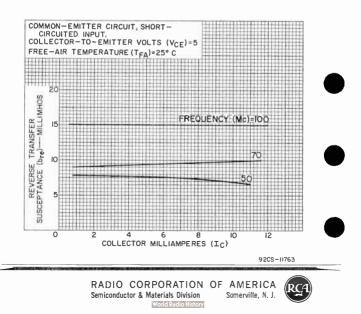
8-62

Somerville, N. J.





9205-11766



3DG001

Triple Semiconductor Diode

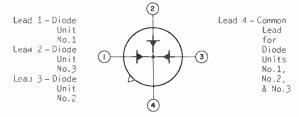
GERMANIUM DIFFUSED-JUNCTION TYPE

For Switching Applications in Electronic Data-Processing Systems

The 3DG001 is the same as the 2DG001 except for the following stems:

Mechanical:

Dimensional Outline
Leads, Flexible
Minimum length
Orientation and diameter See Dimensional Outline
Terminal Diagram: BOITOM VIEW

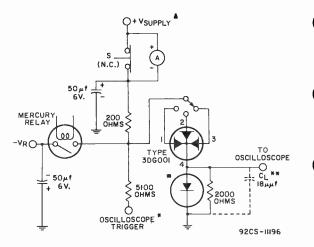


The arrow indicates direction of forward (easy) current flow as indicated by dc ammeter.



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REVERSE-RECOVERY-TIME MEASUREMENT CIRCUIT

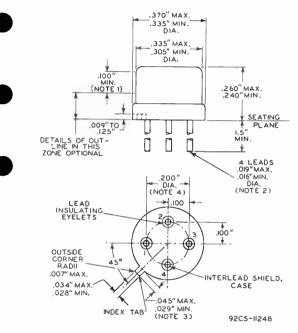


NOTE: THE STRAY CAPACITANCE ACROSS THE SOCKET FOR THE MULTIPLE-DIODE UNIT UNDER TEST MUST BE LESS THAN 2 $\mu\mu{\rm f}$.

- * TEKTRONIX TYPE 545 OSCILLOSCOPE WITH TYPE H PLUG-IN VERTICAL AMPLIFIER AND TYPE P6000 PROBE, OR EQUIVALENT.
- ** CL REPRESENTS THE TOTAL CAPACITANCE ACROSS RL --- THAT IS, THE SUM OF THE OSCILLOSCOPE-PROBE CAPACITANCE AND THE STRAY CAPACITANCE. THE STRAY CAPACITANCE ACROSS RL MUST BE LESS THAN 6 μμ1.
- SILICON ULTRA-FAST SWITCHING DIODE WITH 0.5-mµsec MAXIMUM REVERSE RECOVERY TIME WHEN SWITCHING FROM 10 MA. FORWARD CURRENT TO -6 VOLTS REVERSE VOLTAGE.
- WITH RELAY OUT AND SWITCH (S) OPEN, ADJUST VSUPPLY TO OBTAIN SPECIFIED FORWARD CURRENT (1;).







NOTE 1: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN C.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. GUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (C.019") MEASURED IN GAUGING PLANE 0.054" + 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. World PadioHistory

Drift-Field Transistor

With Two Emitters

GERMANIUM P-N-P ALLOY TYPE

For Applications Requiring Control of an Output Current by Signals from Two Sources

GENERAL DATA

Electrical:		
Maximum DC Collector-to-Base Voltage (V_{CB}) with emitter No.1 and emitter No.2 connected to- gether, for dc emitter-to-base		
volts = -0.5, dc collector µa = -50, ambient temperature = 25° C Maximum DC Collector-Cutoff Current (I _{CNO}) for dc collector-to-	34	volts
base volts = -12, emitter No.1 and emitter No.2 open, ambient temper- ature = 25° C	. –16	μa
with emitter No.1 and emitter No.2 connected together, for dc emitter- to-base volts = -0.5, collector open,	10	
ambient temperature = 25° C	16	μэ
In free air. With infinite heat sink. Intrinsic Base Resistance (r _{bb}). Collector-to-Base Capacitance (C _{ob}).	. 400 . 100 . 55 . 3.8	
Mechanical:		
Operating Position	JEDEC	. 0.240" No.TO-44 Metal Hermetic 4 1.5"
	to	acent red dot side of



RADIO CORPORATION OF AMERICA Semiconductor & Materials Division Somerville, N. J. DATA I 2-61

Maximum and Minimum Ratings, Absolute-Maximum Values:	
DC COLLECTOR-TO-BASE VOLTAGE	volts volt ma
(Emitter No.1 & Emitter No.2) 20 max. TRANSISTOR DISSIPATION:▲	ma
At ambient temperature of 25° C 80 max. At ambient temperature of 55° C 50 max. At ambient temperature of /1° C 35 max. AMBIENT TEMPERATURE (During neerstion) 71 max. STORAGE-TEMPERATURE RANGE65 to +85	mw oC oC
Characteristics, At Ambient Temperature of 25° C:	
Common-Base Circuit, Emitter Input	
DC Collector-to-Base Voltage	volts
Emitter-No.2 ma. = 0 and Emitter-No.2 ma. = 0 and Emitter-No.2 ma. = 1 0.985	
Alpha-Cutoff Frequency	Mc
Typical Operation, At Ambient Temperature of 25° C:	
In accompanying common-base, emitter-input, i-Mc, capacitor-tuned, mixer-oscillator circuit	
DC Collector-to-Base Voltage. -4.4 DC Emitter-No.1 (Signal-Emitter) Current. 1 DC Emitter-No.2 (Oscillator-Emitter) Current. 0.5 Input Impedance (Signal Emitter). 25	volts ma ohms
Oscillator Voltage at	
Oscillator Voltage at Emitter No.2	mv
Emitter No.2	mv db
Emitter No.2	db
Emitter No.2	db volts
Emitter No.2	db volts ma
Emitter No.2	db volts ma ma
Emitter No.2	db volts ma
Emitter No.2	db volts ma ma

▲ See accompanying Rating Chart.



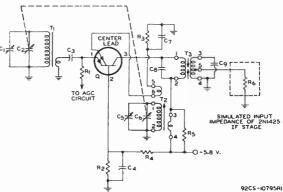
RCA

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation will crack the seals of the leads and tamage the transistor.

When dip soldering is employed in the assembly of printed circuitry using this transistor, the temperature of the solder should not exceed 255° C for a maximum immersion period of 10 seconds.



CAPACITOR-TUNED MIXER-OSCILLATOR CIRCUIT

Q: Transistor type 3746 R1: 1200 ohms, 0.5 watt R2: 4700 ohms, 0.5 watt Ra: 2200 ohms, 0.5 watt R₄: 12,000 ohms, 0.5 watt Rs: 3300 ohms, 0.5 watt R6: 1800 ohms T1: Antenna transformer T2: Oscillator transformer T₃: Intermediate-frequency transformer

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C1,

C5: Trimmer capacitors, 2-to-14 µµf

µµf, ganged with C6

 $\mu\mu f$, ganged with C₂

C.: 40 µµf, silver mica, 500 volts

C7: 0.005 µf, paper, 6 volts C_R: 36 µµf, silver mica, 500 volts

 C_3 : 0.5 μ f, paper, 6 volts

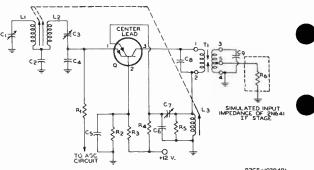
C_E: C.47 µf, paper, 6 volts

C2: Antenna tuning capacitor, 7-to-158

C6: Oscillator tuning capacitor, 7-to-78

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RADIO CORPORATION OF AMERICA Somerville, N. J.



INDUCTANCE-TUNED MIXER-OSCILLATOR CIRCUIT

 $C_1: \mbox{Trimmer capacitor, 50 $\mu\mu\mbox{f}$ approx.} \\ C_2: 0.01 $\mu\mbox{f}$ paper, 15 volts $$ C_3: \mbox{Trimmer capacitor, 110 $\mu\mbox{f}$ approx.} $$ C_4: 0.005 $\mu\mbox{f}$ paper, 15 volts $$ C_5: 0.2 $\mu\mbox{f}$ paper, 15 volts $$ C_6: 47 $\mu\mbox{f}$ paper, 500 $\mu\mbox{o}ts $$ C_5: 0.2 $\mu\mbox{f}$ paper, 15 volts $$ C_5: 0.003 $\mu\mbox{f}$ paper, 15 volts $$ C_$

L2: Antenna-transformer windings

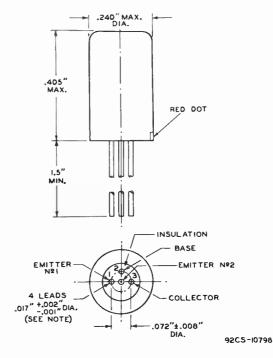
92CS-10794Ri

L3: Oscillator coil Q: Transistor type 3746 R1: 1500 ohms, 0.5 watt R2: 22000 ohms, 0.5 watt R3: 5600 ohms, 0.5 watt R4: 4700 ohms, 0.5 watt R5: 3300 ohms, 0.5 watt R6: 1400 ohms

T1: Intermediate-frequency transformer

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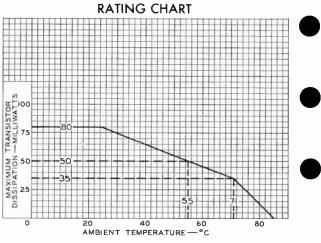




NOTE: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE PLANE OF THE ACTUAL BOTTOM OF THE CASE. BETWEEN 0.25" AND 1.5", A MAXIMUM DIAMETER OF 0.021" IS HELD. OUTSIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.



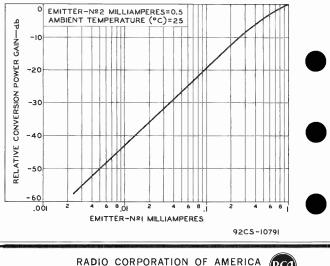
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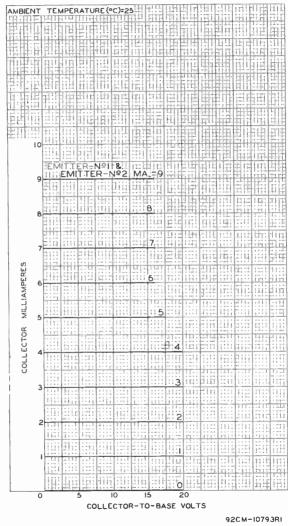
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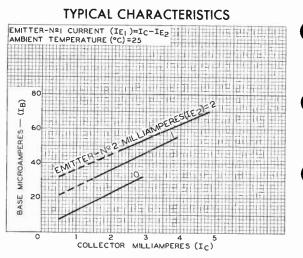
RADIO CORPORATION OF AMERICA

Somerville, N. J.

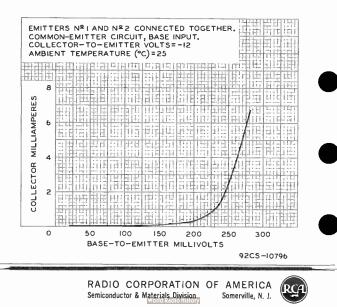
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DATA 4 2-61



92CS-10792



3907/2N404

Transistor

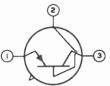
PREMIUM TYPE GERMANIUM P-N-P ALLOY-JUNCTION TYPE For Critical <u>Computer Switching</u> Applications

GENERAL DATA

Mechanical:

Operating Position		Any
Maximum Length (Excluding f	exible leads)	0.260"
Maximum Diameter		0.370"
Dimensional Outline		
Case		
Seals		Hermetic
Leads, Fiexible		3
Minimum length		. 1.5"
Orientation and diameter.	See Dimensional	Outline
Terminal Diagram: BO	TOM VIEW	

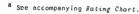
Lead 1 - Emitter Lead 2 - Base



Lead 3-Collector

SWITCHING SERVICE

	Maximum and Minimum Ratings, Absolute-Maximum Values:	
	COLLECTOR-TO-BASE VOLTAGE	volts
	With dc emitter-to-base volts = -124 max.	volts
	EMITTER-TO-BASE VOLTAGE	volts
i.	COLLECTOR CURRENT	та
	EMITTER CURRENT	ma
	TRANSISTOR DISSIPATION: *	
	At ambient temperature of 25° C 150 max.	mw
	At ambient temperature of 55° C 75 max.	mw
	At ambient temperature of 71°C 35 max.	mw
	AMBIENT-TEMPERATURE RANGE:	
	Operating	°C
	Storage	oC
	LEAD TEMPERATURE:	
	For 10 seconds maximum	°C



ELECTRICAL CHARACTERISTICS

Voltage values are given with respect to base and am- bient temperature of 25° C unless otherwise specified <i>Hin. Typical Max.</i> DC Collector Breakdown Voltage for dc col- lector μa = -20, dc emitter current = 0.BV _{CBO} -25 -45 - volts DC Emitter Breakdown Voltage for dc emit-
Win. Typical Max.DC Collector Breakdown Voltage for dc col- lector $\mu a = -20$, dc emitter current = 0 .BV CBO -25 -45 - volts DC Emitter Breakdown
DC Collector Breakdown Voltage for dc col- lector μ a = -20, dc emitter current = 0 .BV _{CBO} -25 -45 - volts DC Emitter Breakdown
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lector µa = -20, dc emitter current = 0 .BV _{CBO} -25 -45 - volts DC Emitter Breakdown
emitter current = 0 .BV _{CBO} -25 -45 - volts DC Emitter Breakdown
DC Emitter Breakdown
Vollage for dc emil-
ter $\mu a = -20$, dc col-
lector current = 0. BV _{EBO} -12 -30 - volts
DC Emitter Floating
Potential for dc
collector volts =
-25, dc emitter cur-
rent = 0 V_{EBF} 1 volt
DC Base-to-Emitter
Saturation Voltage: V _{BE(sat)} With dc collector
ma. = -12, dc base
ma. = -0.40.3 -0.35 volt With dc collector
ma. = -24 , dc base
ma. = -10.32 -0.4 volt DC Collector-to-Emitter
Saturation Voltage: V
Saturation Voltage: V _{CE(sat)} With dc collector
ma. = -12 , dc base
ma. = -0.40.1 -0.15 volt
With dc collector
ma. = -24, dc base
ma. = -10.12 -0.2 volt
DC Collector-Cutoff I _{CBO}
Current for dc col-
lector volts = -12 ,
dc emitter current
= 0, ambient tem-
perature of:
25° C
$\frac{1}{80^{\circ}}$ C -45 -90 μa
DC Emitter Cutoff Cur-
rent for emitter
volts = -2.5, dc col-
lector current = 0. I_{FBO} 1 -2.5 μa
DC Current Transfer
Ratio: h _{FE}
For dc collector-to-
emitter volts =
-0.15, dc collector
$ma. = -12 \dots 30 45 \dots$
For dc collector-to-
emitter volts =
-0.2, dc collector
ma. = -24

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Somerville, N. J.



3907/2N404

Alpha-Cutoff Frequency for dc collector volts = -6, dc col- lector ma. = -1f _{ab} Output Capacitance for	4	12	_	Мс
dc collector volts = -6, dc emitter cur- rent = 0Cob	-	15	20	μµf
dc emitter volts = -6, dc collector current = 0C _{ib} Stored Base Charge	-	10	20	μµf
for do collector ma. = 10, do base ma. = 1 Q _s	-	1000	1400	μμ c oulombs

PERFORMANCE TESTS

This transistor type is tested in strict accordance with rigid procedures conforming with the mechanical, environmental and life requirements of Military Specification MIL-S-195008.

OPERATING CONSIDERATIONS

It is recommended that this transistor not be connected into or disconnected from circuits with the power on because high transient currents may cause permanent damage to the transistor.

The flexible leads of this transistor are usually soldered to the circuit elements. Soldering of the leads may be made close to the glass stem provided care is taken to conduct excessive heat away from the lead seal. Otherwise, the heat of the soldering operation may crack the glass seals of the leads and damage the transistor.

This transistor is intended for use in socketed, singleside printed circuit boards and in conventional wire-in type circuits. If this transistor is used in double-side printedcircuit boards or in printed-circuit boards utilizing eyelets, it may be necessary to use an insulating washer or similar standoff device made of good dielectric material to prevent the solder from shorting the leads to each other or to the board.

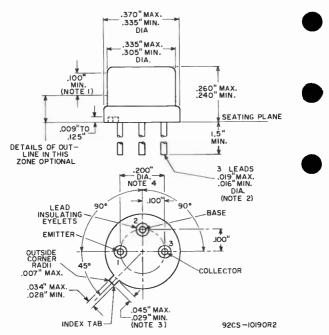
> FOR ADDITIONAL INFORMATION ON THIS TYPE, WRITE FOR TECHNICAL BULLETIN AVAILABLE FROM:

Commercial Engineering Semiconductor & Materials Division RCA Somerville, New Jersey



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JEDEC No. TO-5



NOTE I: THIS ZONE IS CONTROLLED FOR AUTOMATIC HANDLING. THE VARIATION IN ACTUAL DIAMETER WITHIN THE ZONE SHALL NOT EXCEED 0.010".

NOTE 2: THE SPECIFIED LEAD DIAMETER APPLIES IN THE ZONE BETWEEN 0.05" AND 0.25" FROM THE SEATING PLANE. BETWEEN 0.25" AND 1.5" A MAXIMUM DIAMETER OF 0.021" IS HELD. OUT-SIDE OF THESE ZONES, THE LEAD DIAMETER IS NOT CONTROLLED.

NOTE 3: MEASURED FROM MAXIMUM DIAMETER OF THE ACTUAL DEVICE.

NOTE 4: LEADS HAVING MAXIMUM DIAMETER (0.019") MEASURED IN GAUGING PLANE 0.054" \pm 0.001" - 0.000" BELOW THE SEATING PLANE OF THE DEVICE SHALL BE WITHIN 0.007" OF THEIR TRUE LOCATIONS RELATIVE TO A MAXIMUM-WIDTH TAB.





RATING CHART 150 125 MAXIMUM TRANSISTOR DISSIPATION -- MILLIWATTS 100 75 50 25 0 -75 -50 -50 -25 0 25 AMBIENT TEMPERATURE-50 75 100 -°C

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