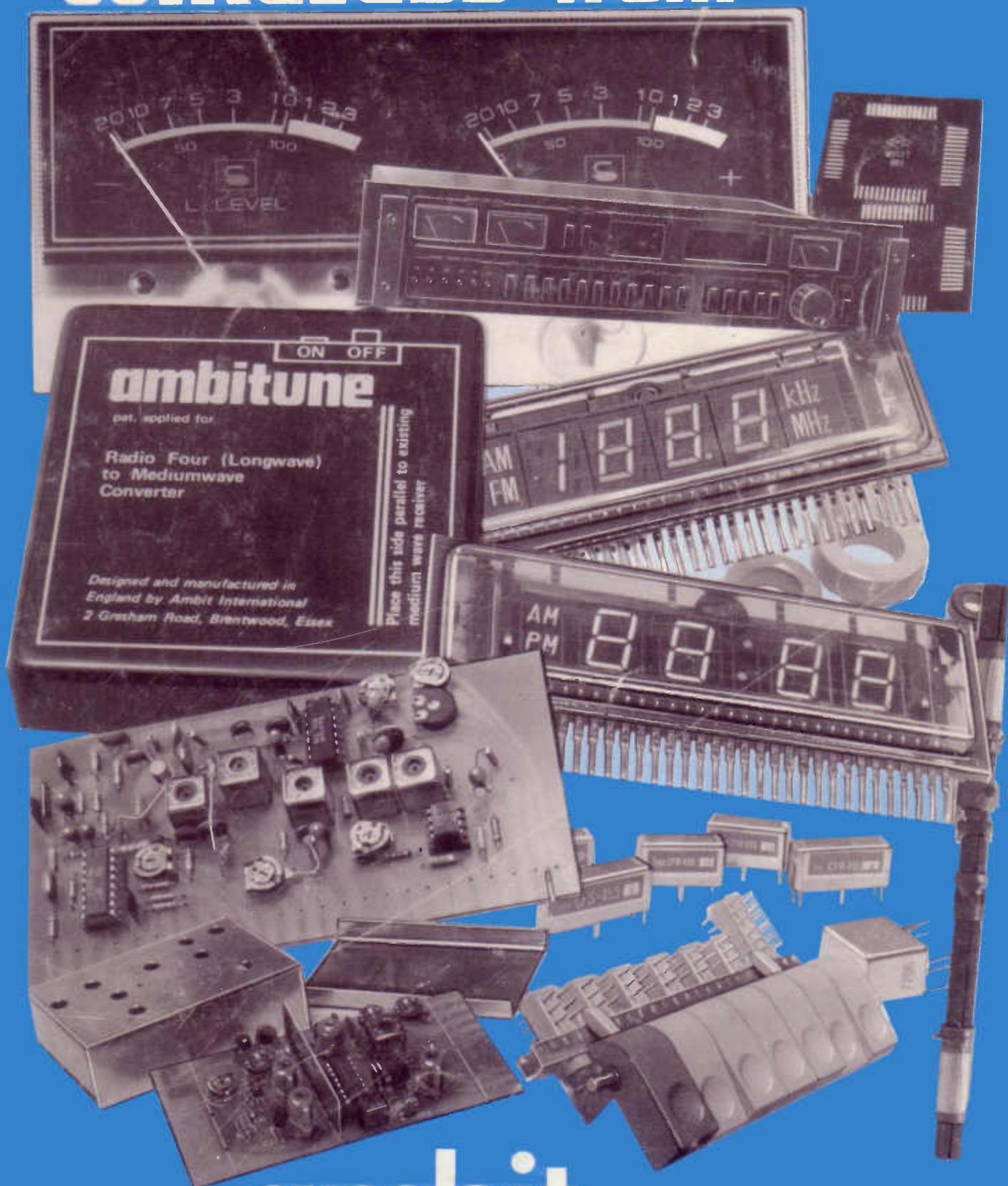


# practically all **WIRELESS** from



**ambit** international  
2 Gresham Road, Brentwood, Essex.

Tecknowledqev: number 2

**Warning: Read this once and then destroy**

It has been suggested (cruelly) to the writer of this page that the last such offering in Tecknowledgegy part one, that the 'editorial' tends to pall after the eighty-fourth time of reading. The first time - he said - the cutting and poignant observations on the matters therein drew murmurs of approval and agreement. But as time wore on, the murmurs of approval turned to gasps of despair as his eye fell across the same old rubbish!.

Well Steve, the answer is simple, rip out this page when you are sick of it, and fix it on the nail along with the copy of last week's Sun. But watch out, since the print tends not to be waterproof.

But to the many of you who actually took the trouble to write in approval of our first fully bound and tastefully presented catalogue - thank you.

Sorry about the spelling mistakes, but now we have the Concise Oxford at our elbow - so when we learn the alphabet, we will be able to make certain of the spelling of such words as: "Ipecacuanha" and "Corybantic".

#### What's on and where

Along with the binding of some of our intermediate issue data sheets, this part of the catalogue system includes many new and notable items from the world of wireless componentry - but perhaps the most interesting development is the simple fact that mechanical tuning of radio systems is now definitely on the way out. OKI electric offer the world's first versatile LSI counter/clock ICs, and Ambit has them - as you may have come to expect. The cost to a manufacturer of these devices compares very favourably with the cost of mechanical alternatives in the HiFi world. And shortly it will catch up with the cheaper end of the radio and tuner market. Words on the Ambit DFM one are presented on the page dealing with matters pending in our lab, and we see this as being the first of a family of digital tuning modules, with our first programmable frequency synthesiser already in breadboard form.

MOSFET power transistors also bow in with this issue, and another prediction is that power MOS will totally supplant bipolar power technology. Prices for the audio output devices compare more than favourably with bipolar alternates, when things like the peripheral component count, and relative specifications are all taken into account. Remember that Ambit was first to introduce Hitachi power MOSFETs to you, when power MOSFETs are commonplace as the old faithful 3055/2955.

Various communications devices are covered in this catalogue, largely in response to requests for us to expand our range in the area of amateur and professional radio devices. Crystal filters, communications grade multi-element ceramic filters, UHF MOSFETs, Micrometals dust iron cores and new ICs are all aimed to fill this gap. And once again, we think it is worth pointing out that many radio and electronics enthusiasts can now make very high performance equipment for

less than the cost of commercial equipment that costs more, and does less.

With this in mind, our presentation of things like the new Mark Three tuner is chosen to make the finished article compare more than favourably with the transitory offerings of the far east HiFi manufacturers. Furthermore, the DIY system has been adapted using an all plug-in concept, to be completely "up-dateable", as and when new modules are developed and made available. The Mark three tuner includes a few spare switch positions to take this into account, and we intend to use the switched selectivity IF button before much longer.

In communications, so much is happening in receiver technology that our lab is scattered with remains of projects that died before completion, simply because technology overtook them. Various modules are under development at present - the first of which will be a multi-channel version of the VHF FM monitor RX shortly appearing in PW, and designed by James Bryant, of Plessey. The presentation of these items is planned to follow in the footsteps of the Mark 3 tuner - namely a thoroughly well thought out mechanical design with a styling more reminiscent of professional than DIY appearances.

#### Fame at last - or nearly.

There aren't that many firms that get a product onto a well known BBC science 'preview' programme - let alone two in the space of a month. We were obliged to sign a piece of paper saying that we would not use the programme name in promotional literature - but the BBC has few science programmes, and only one with a regular peak viewing time.

Item number one was the brilliant little black box, the Ambitune, star of screen and national wireless, various national newspapers, and countless other media.

The chances are that at least half of you will have seen or heard of the unit, since the BBC have been good enough to advise owners of sets with no LW to use the Ambitune to bring back radio



four to the medium wave. Simply place alongside the radio, tune to around 800kHz, and there is an up-converted 200kHz ready to delight you with schools-broadcast-free radio 4. For a total cost, on your doormat, with battery, including PP and VAT of only £6, it is hardly worth making as a kit - and so we haven't. Battery life is about 1000+ hours with two pencells, but more than simply retrieving radio four, the

Ambitune has been acclaimed as a positive improvement for most sets that include longwave anyway. In many instances, the LW directionality of a set is far greater than the MW, and so the flexibility of the Ambitune can permit "off axis" reception with no loss of performance.

The second item shown was far removed from the ingenious simplicity of the Ambitune - and how many of you spotted our name in very small print beneath the tuning knob of the Mark3? Don't tell Auntie, since she will get upset that no-one taped us up - but we have yet to find anyone who did notice the name!

#### Electronics publications...you write:

Part one of this catalogue prompted a substantial response from the readers, and from about 1000 letters mentioning the comments made we made on the state of electronics publications, only one was in defence of "Long, tedious and generally boring technical correspondence monthly, that squeezes itself in between the adverts when space permits". The mood is thus clear, more meaty, up to the minute text, less of the outmoded and irrelevant.

Looking around recent editions of some of the other magazines, it is gratifying to note that one or two are showing distinct signs of a recovery of their original aims - for which we now commend them. But remember that these publications are generally only as good as the material available to them. So if you have the skill and time, why not write an article yourselves? Ambit will refund the costs of all parts used on publication, and will keep budding authors as fully informed as possible. In cases of exceptional valour, where a potential author wishes to try out some really new devices in a novel way, we will supply either FOC, or at reduced cost on receiving and approving outline details of the idea, and intentions.

Finally, the writer of this page would like to remind readers not in possession of part one of the catalogue, that this part does not supercede - but merely adds to the "Tecknowledgegy" series. Part three, we fervently hope and pray will be out by Autumn, but the volume of business we are presently handling is putting a strain on the schedule. By the end of year, we also anticipate a further move to a new factory/office/research centre, presently being built about ¾ mile away in Brentwood - and with four times the space at our disposal, it would be nice to employ sufficient staff to produce a quarterly catalogue (at least). Anyone interested in technical publication work, with skills in drawing, typesetting etc and living within commuting range is invited to let us know of their possible interest, and we will let you know more details nearer the proposed date.

PS. Since this page appears on the inside front cover, the use suggested in para 2 not feasible. So we have had the cover printed in ipecacuanha flavoured ink, thus enabling destruction of this page in true James Bond fashion.

Items indicated 'PL', please refer to price list and newsletter(s) for details. Items marked CO are available to callers only. Page numbers in **BOLD type**, indicate part 2 of the catalogue

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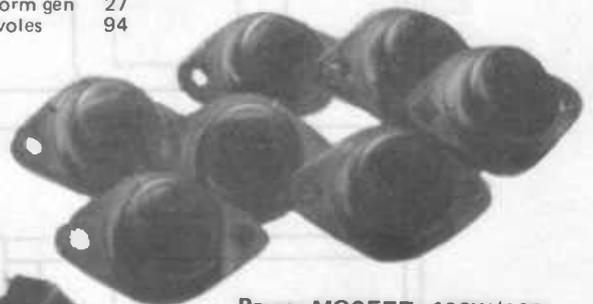
**Mains filters**



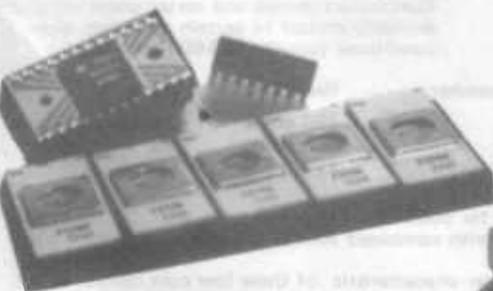
**from the OSTS**



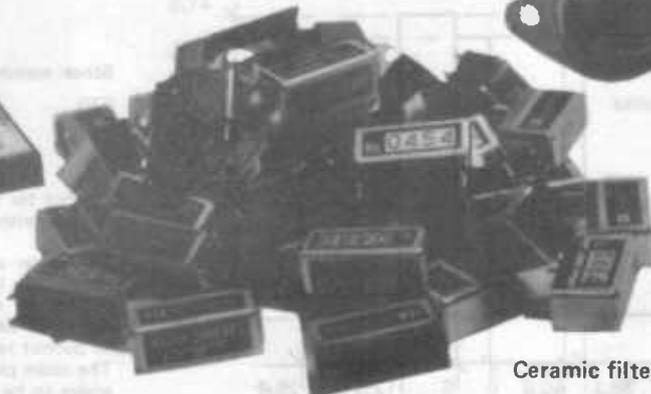
**Meters, a speciality of Ambit**



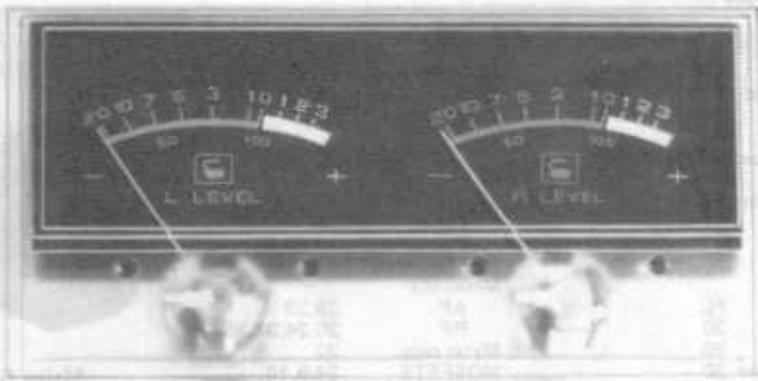
**Power MOSFETs 100W/130v**



**UV PROMs and other MPU devices from the OSTS pricelist**

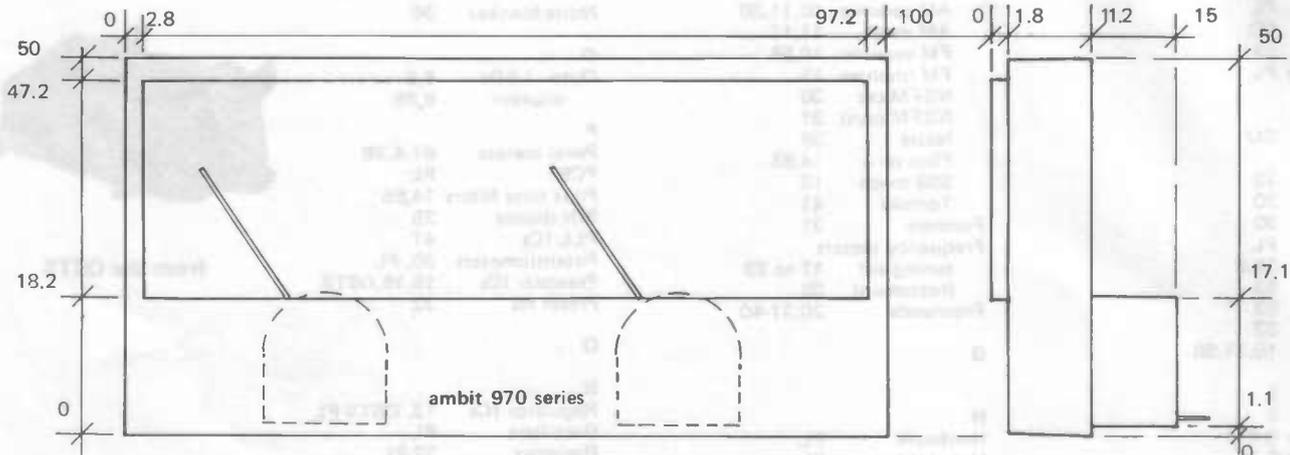


**Ceramic filters**

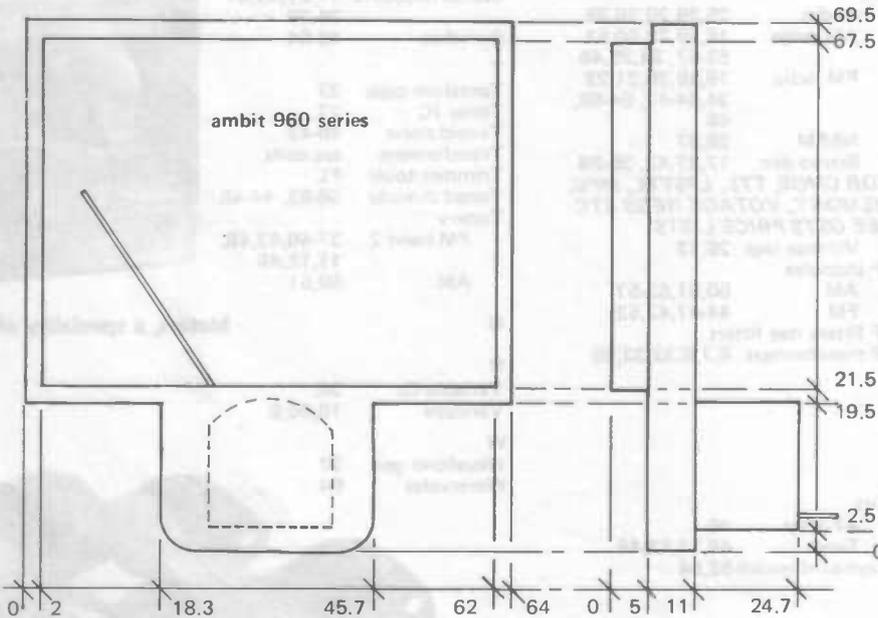


In addition to the meters described in part one of the AMBIT catalogue, these new types are offered for ex-stock delivery in quantities up to 1000 pieces. For custom requirements and larger quantities, delivery is available either by sea or air (8-12 weeks or 6-8 weeks) with a surcharge of approx 25% for airfreighting.

All types of customized scale legends are available for orders of 100 or more meters (at extra cost) - please supply a sketch, or full artwork to your requirement. Production of artwork from sketch is £10 per scale - multiple colour work +£4 per additional colour.



**NOTE:** All dimensions shown are in mm, labelled from bottom left hand corner as start point. All drawings are approx same size, but customers should satisfy themselves of dimensions from examples of the meters before proceeding with engineering work, since small adjustments may be made in these dimensions from time. Existing customers will be kept advised at all times.



**METER SPECIFICATIONS**

The following values are for standard meters. Customized meters and meter scales are also available subject to certain minimum order conditions (usually 200-500 pieces)

Stock number	Resistance	Scale	uA FSD
970	750 ohms	2xVU	200uA
960	750 ohms	VU	200uA
950	750	tuning*	100-0-100

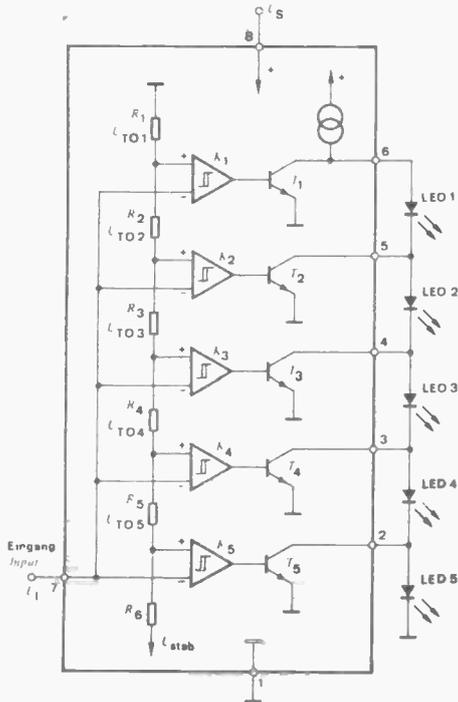
\*scaled for combined FM centre zero, and AM signal level for use with combined AMFM ICs and tuners (TDA1090)

The meter characteristic of these low cost devices is not necessarily linear. All types illustrated here conform to the deflection described on page 67 of the catalogue. All types described are provided with translucent backing to permit rear illumination.

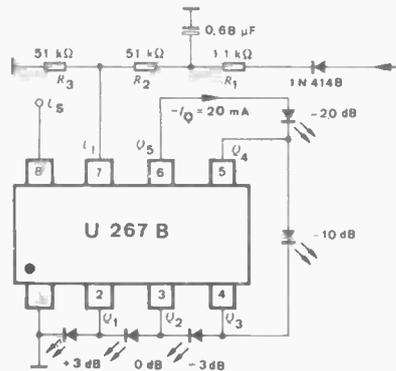
The scale plates are readily removable, to permit custom scales to be devised using the 920 series meter made scale transfers for HW13, and 930 for the HS49. The 950 series can be used in conjunction with 940 series transfers.

LED bar graph driver ICs : linear U 237/247, log U 257/267 from AEG

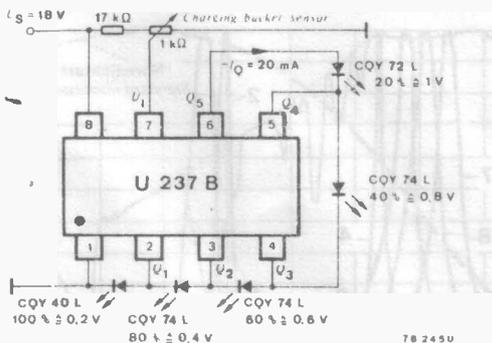
For those of you not satisfied with the slow response times of LCD DVMS, and the mechanical uncertainty of moving coil meters, we now offer you a very versatile series of bar graph drivers from AEG.



block diagram of basic bar graph driver



recording/AF level meter



linear resistance meter (liquid levels etc)

These devices operate on fixed thresholds, to provide progressively illuminated bars of LEDs, which may be multicoloured if required. The ULN237B, for example, operates with 200mV thresholds, so that no LED is lit in the range 0-200mV, the first is lit in the region 200-400, the first and second in the range 400-600, until when the input reaches 1000mV, all five are lit.

The LEDs are fed from the integrated current source, with 20mA so no limiting resistors are necessary. The internal stabilizer isolates the circuit from supply voltage changes and maintain an accurate reference point for the comparators.

A useful feature of this circuit is the fact that the progressive illumination of the LEDs does not step the supply current, since the comparators are connected in such a way that at an input voltage of less than that of the reference point  $U_{TO1}$  between  $R_1$  and  $R_2$ , transistors  $T_1$ - $T_5$  all conduct.  $T_1$  conducts the whole current from the internal current source, and the LEDs remain unlit. If the input is greater than  $U_{TO1}$  and less than  $U_{TO2}$ , then  $K_1$  changes state,  $T_1$  cuts off- but  $T_2$  conducts. Thus diverting the constant 20mA via LED1 to transistor  $T_2$ . This process simply cascaded on as the input voltage gradually increases. The switching hysteresis is typically 10mV.

The various devices fall into two basic families, with ULN237/247B for linear displays with a resolution of 100mV (when using both together) to 1000mV input. The 257 and 267 are for log displays, according to the following.

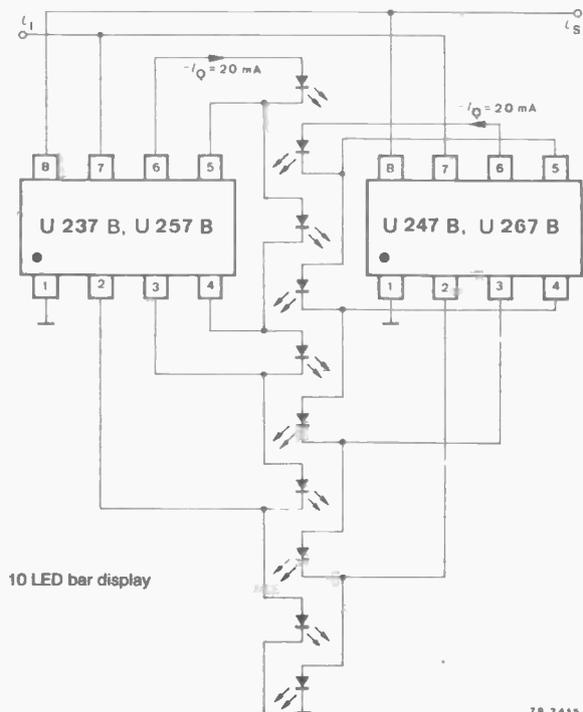
Device	step 1	2	3	4	5	
U237B	0.2	0.4	0.6	0.8	1.0	volts
U247B	0.1	0.3	0.5	0.7	0.9	volts
U257B	0.18/-15	0.5/-6	0.84/-1.5	1.19/+1.5	2.0/+6	volts/dB
U267B	0.1/-20	0.32/-10	0.71/-3	1.0/0	1.41/+3	volts/dB

Various colours are readily combined - but the forward voltage at 20mA is the factor that determines the necessary supply voltage for constant current operation. In the case of CQY40 red types, with a drop of 2v, the supply needs to be 10v. The drop in the constant current source is 2v, so the total supply requirement is 12v. The green and yellow display devices drop considerably more, so allowance must be made when using these types.

The AF recording level indicator using the U267B is biased towards peak reading, and a 1ms peak can be resolved with this circuit, which is very substantially cheaper than any form of meter movement to perform PPM measurements. The discharge time constant is approx. 70mSec - and it must be noted that although the IC input  $Z$  is about 100k, this drive circuit requires low impedance feed, either from the output of an amplifier, or via an emitter follower to lower the impedance from a preamp output.

The sensitivity is adjusted by the ratio of  $R_3$  to  $R_2$  - and with the values shown, 0 dB is reached with about 3v input. The display may be extended to 10 points with the U257B. General specifications of all four types are listed as follows:

Parameter	Symbol	min	typ	max	
Supply voltage	$V_{cc}$	8	12	25v	see above
Input voltage	$V_{in}$			5v	
Input current	$I_{in}$			0.5mA	
Maximum supply current	$I_Q$		25	30mA	
Power dissipation (at 60°C)	$P_{tot}$			690mW	
Junction temperature	$t_{stg}$	-10		+80°C	
Step tolerance		-30		+30mV	
Hysteresis			5	10mV	
Input resistance			100k		
Output saturation voltage	$V_{Q1...5}$			1v	



10 LED bar display

**OPTO ELECTRONIC DEVICES from AEG... discrete LEDs, double digit arrays for DFM's etc**

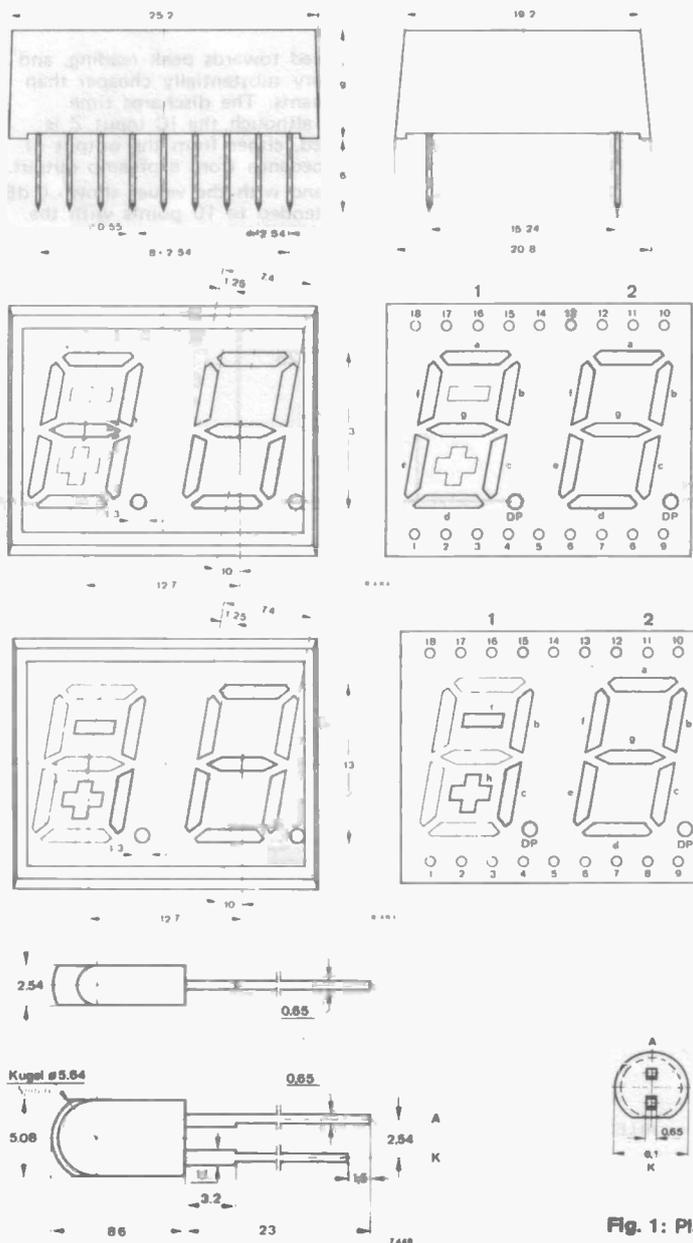
Made in Europe, these LEDs represent the finest value in the market. Not only are they low cost - but they are cosmetically perfect, reliable & repeatable.

Type	Case	Fig.no.	Characteristics				Spectral response
			$\alpha \circ$	$I_v$ mcd	$U_f$	$I_f$ mA	
<b>RED</b>							
CQY40L	5mm plastic matt red	1	60	1.6	1.6	20	4
CQX25	3mm plastic clear	2	25	2.6	1.6	20	4
V178P	3mm plastic matt red	2	60	3.0	1.6	20	4
V260P	3mm plastic matt red	2	60	1.6	1.6	20	4
CQX10	2.54x5.08mm plastic matt red	4	50	1.6	1.6	20	4
<b>ORANGERED</b>							
CQX38A	5mm plastic matt orangered	1	60	6.0	2.2	20	9
CQX39B	5mm plastic clear	1	25	40	2.2	20	9
CQX41A	3mm plastic matt orangered	2	60	6.0	2.2	20	9
CQX40	2.54x5.08mm plastic matt or	4	50	5.0	2.2	20	9
<b>GREEN</b>							
CQY72L	5mm plastic matt green	1	60	2.0	2.7	20	7
CQX26	3mm plastic clear	2	25	4.0	2.7	20	7
V179P	3mm plastic matt green	2	60	4.0	2.7	20	7
CQX11	2.54x5.08mm plastic matt gn	4	50	2.6	2.7	20	7
<b>YELLOW</b>							
CQY74L	5mm plastic matt yellow	1	60	3.0	2.7	20	8
CQX27	3mm plastic clear	2	25	5.0	2.7	20	8
V180P	3mm plastic matt yellow	2	60	5.0	2.7	20	8
CQX12	2.54x5.08mm plastic matt ye	4	50	4.2	2.7	20	8

The above table represents all types held in stock at the time of this catalogue. Sufficient quantities are usually available to cover all orders up to 1000 pieces.

Type	Specifically for use	DFM applications	High brightness	orangered types	Common anode	
CQX88A	7 segment 1/2 digit with $\pm$	3	1.5	2.7	20	9
CQX89A	7 segment, double digit	5	1.5	2.7	20	9

(A specially designed PCB for multiplexing 1xCQX88A and two CQX89A with 5 function indication LEDs is available type CQMPCB)



Pin connections CQX 86, CQX 88 CQX 90, CQX 92			Pin connections CQX 87, CQX 89 CQX 91, CQX 93		
Pin	Segment	Digit	Pin	Segment	Digit
1	i	1	1	e	1
2	h	1	2	d	1
3	c	1	3	c	1
4	DP	1	4	DP	1
5	e	2	5	e	2
6	d	2	6	d	2
7	g	2	7	g	2
8	c	2	8	c	2
9	DP	2	9	DP	2
10	b	2	10	b	2
11	a	2	11	a	2
12	f	2	12	f	2
13	Anode/Cathode	2	13	Anode/Cathode	2
14	Anode/Cathode	1	14	Anode/Cathode	1
15	b	1	15	b	1
			16	a	1
			17	g	1
			18	f	1

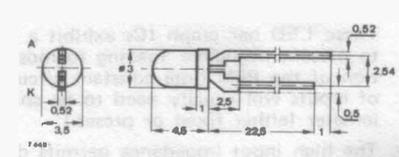
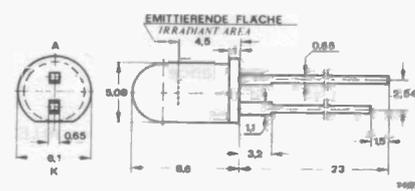
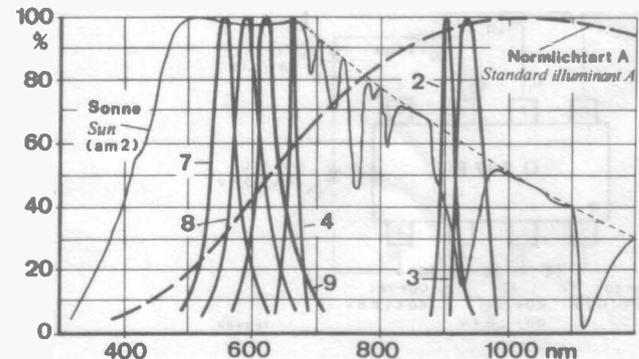


Fig. 1: Plastic case  $\phi$  5

Fig. 2: Plastic case  $\phi$  3

# FLUORESCENT DISPLAY ARRAYS from FUTABA

Most of you will have seen the characteristic green glow of the Futaba fluorescent display - now the most popular type of digital readout device in use in high ambient light conditions - and now Ambit offers you a selected few for applications in connection with frequency displays, clocks etc.

Fluorescent display tubes are not to be confused with planar gas discharge, or neon arrays. (Nixie etc) . The soft green light can be seen glowing from a wide variety of everyday apparatus, ranging from cash registers, weighing machines and clocks, to DFM's, DVM's etc. , frequently in situations that have to contend with daylight illumination. The main advantage of this type of display is thus brightness and contrast - coupled with long lifetimes of 100,000 hours typically.

The display requires approx. the same power as high efficiency LED displays, but there is one drawback for many applications - namely the need for multiple rail voltages to provide for anode, cathode and filament supplies. The filament voltage can be either AC or DC in many applications, though certain units are DC only operation.

Many types of LSI clock, timer and frequency display will drive Futaba displays directly (MSM5524 and MSM5525 for example) - and in many types of application using static displays, a fluorescent display is the best solution to avoid RFI, avoiding the backplane scan frequency of LCDs. However, the pro's and con's of these types of display versus LCD and LED alternatives are influenced very much by the individual circumstances of a given application.

The full range of Futaba displays encompasses applications from multi-digit dot matrix arrays to bar graph and calculator arrays, and the list here is very much curtailed to complement the LSI on offer elsewhere in this catalogue. Industrial and commercial users are invited to contact us with their requirements for types not seen here - and we will endeavour to supply information on the type of display you require.

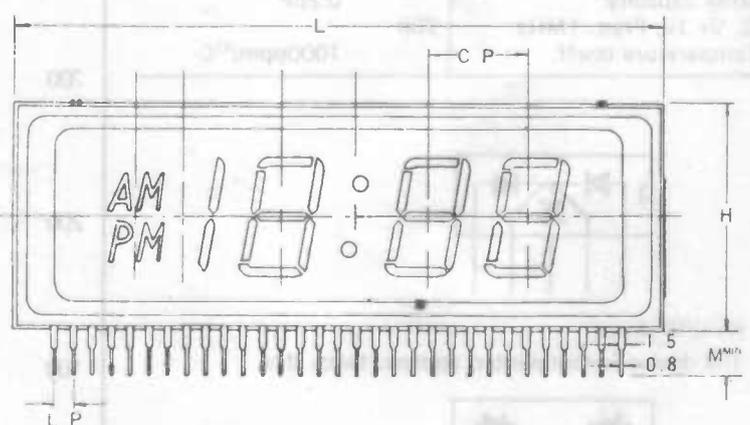
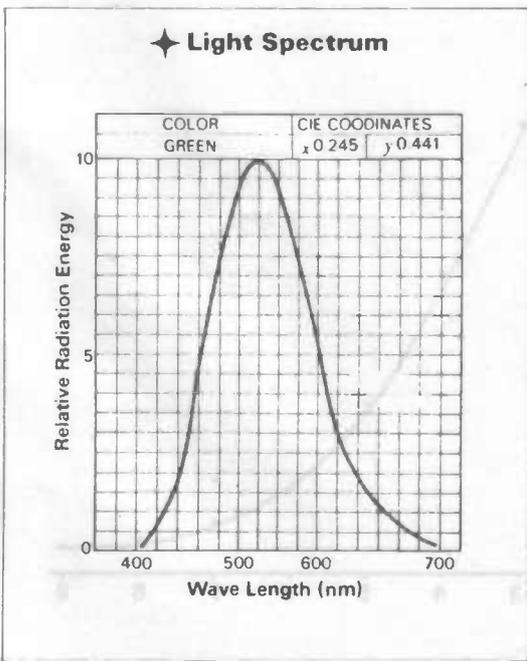
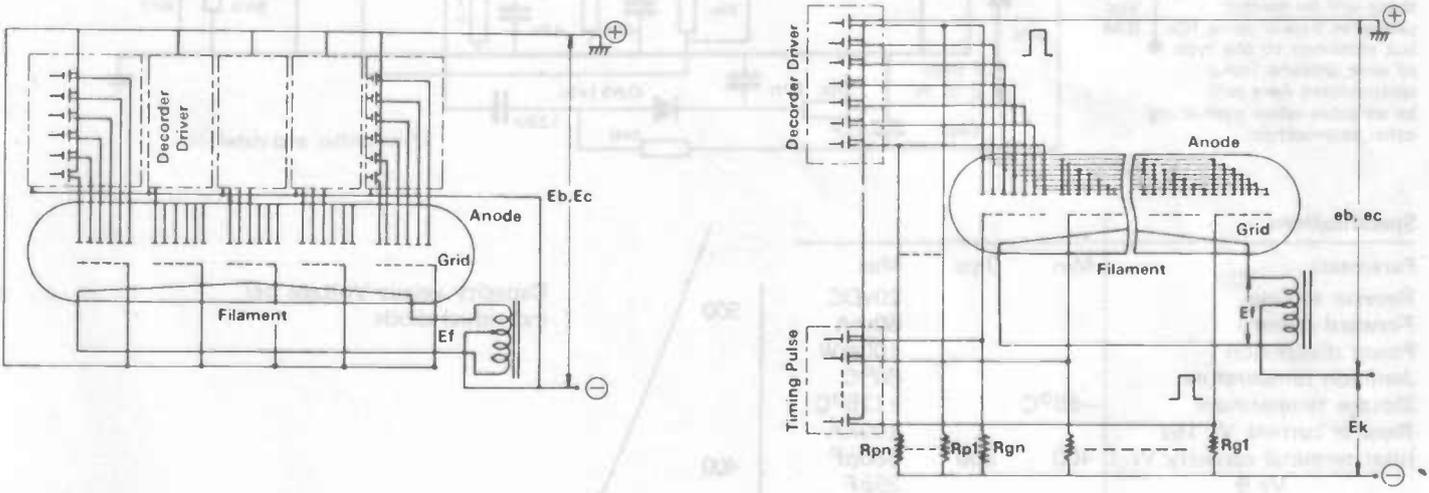
### Terms used in describing Futaba displays

- H : Character height
- CP : Character pitch
- DY : Dynamic drive
- Ek : Grid cutoff bias voltage
- L : Brightness in foot lambert
- W : Character width
- LP : Lead spacing
- ST : Static drive type
- Duty : MPX duty cycle
- L : overall length of package
- M : length of narrow pin section
- Ef : Filament voltage (AC or DC)
- eb/ec (Vp-p) : Max anode/grid voltage
- H' : Overall height of package
- SIL or DIL : package type
- If : Filament current
- ib/dig(mA) : Peak anode current per digit

Type	fig.no	H	W	L	H'	C.P.	L.P.	M	Ef V	If mA	eb/ec Vdc	Ek Vdc	Duty	ib/dig mA	ic/dig mA	L ftL	SIL or DIL	DY or ST	Power mw/digit
5LT02	L3 clock	12.5	9	98	33	13.5	2.54	10.5	3 ac	50	20*			0.8	9.5	200	S	ST	
5LT03	L3b DFM	12.3	9	98	33	13.5	2.54	10.0	3 ac	50	36	4	1/7.5	2.2	4.8	180	S	DY	63.6
6LT06	L3c DFM	12.5	9	98	33	12.0	2.54	10.0	3 ac	75	13.5			1.0	1.3	180	S	ST	

5LT02 is suitable for use with the OKI, TOKO, Fairchild, Mostek clock LSI with static drive. (Also replaces many imported clock displays)  
 5LT03 is suitable for use with the MSM5524, and other multiplexed 5 digit drive systems  
 6LT06 is suitable for use with the MSM5525, and similar DFM display LSI. (This type is found on most Japanese digital tuners)

The pinout plan is visible on the reverse of the display package



### Display formats

- L3 clock: 12 or 24 hour with am/pm indicators
- L3b DFM 5 full digits with RH points
- L3c DFM 3½ digit with RH point, AM/FM and kHz MHz

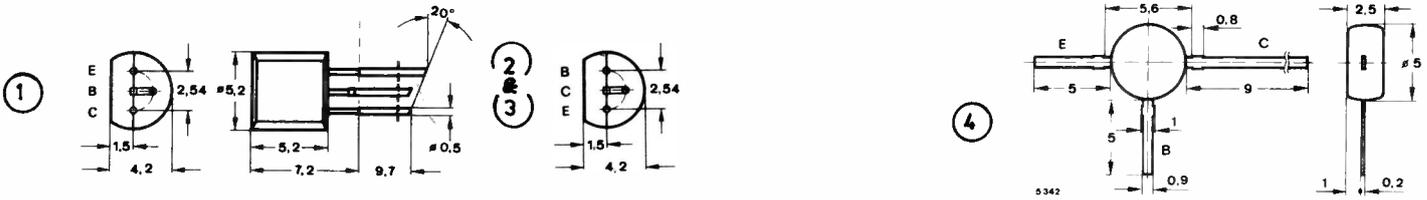


**Small Signal bipolar Transistors for Audio ; 3rd Generation MOSFETs**

Since part one of the catalogue, efforts have been made to standardize on the source and types of all our semiconductor devices. The range here is selected from the AEG Telefunken listings, with over 1000 items of each type held in stock for immediate delivery. Also included are the Hitachi high voltage audio drivers, especially characterized to suit VMOS amplifiers - and new MOSFETs from AEG/Siemens.

Type	Similar to	Comp.	Structure	Fig.no.	P <sub>tot</sub> :mW	I <sub>c</sub> :mA	V <sub>ceo</sub>	f <sub>t</sub> : MHz	h <sub>fe</sub> at I <sub>c</sub> and V <sub>ce</sub>	NF:dB	at f Hz
BC237B	BC107/ZTX107/ etc	BC307B	NPN	1	260	100	45	300	200 2 5	<10	200
BC238B	BC108/ZTX108/ etc	BC308B	NPN	1	260	100	20	300	200 2 5	<10	200
BC239C	BC109/ZTX109/ etc	BC309B	NPN	1	260	100	20	300	420 2 5	<4	30-15kHz
BC307B	BC177 etc	BC237B	PNP	1	260	100	45	130	200 2 5	<10	200
BC308B	BC178 etc	BC238B	PNP	1	260	100	25	130	200 2 5	<10	200
BC309C	BC179 etc	BC239C	PNP	1	260	100	20	130	420 2 5	<4	30-15kHz
BC413C	lo noise 109	BC415	NPN	1	250	100	30	250	380 2 5	<3	30-15kHz
BC414C	lo noise 107	BC416	NPN	1	250	100	45	250	380 2 5	<3	30-15kHz
BC415C	lo noise 179	BC413	PNP	1	250	100	35	200	380 2 5	<2	30-15kHz
BC416C	lo noise 177	BC414	PNP	1	250	100	45	200	380 2 5	<2	30-15kHz
BC546B	med power/volts	BC556B	NPN	1	500	100	65	300	220 2 5	<10	200
BC556B	med power/volts	BC546B	PNP	1	500	100	65	150	110 2 5	<10	200
BC550C	med power, lo noise	BC560C	NPN	1	500	100	45	300	420 2 5	<3	30-15kHz
BC560C	med power, lo noise	BC550C	PNP	1	500	100	45	150	420 2 5	<3	30-15kHz
BC639	high volts/med power	BC640	NPN	2	1000	1000	80	50	40 150 2	-	
BC640	high volts/med power	BC639	PNP	2	1000	1000	80	50	40 150 2	-	
2SC1775	A type	2SA872A	NPN	3	300	50	120	200	400 2 12	<5	10
2SA872	A type	2SC1775A	PNP	3	300	50	120	120	400 2 12	<5	10
2SD666	A type	2SB646A	NPN	3	900	50	100	140	100 10 5	-	
2SB646	A type	2SD666A	PNP	3	900	50	100	140	100 10 5	-	
BFT95			PNP	4	200	25	15	5000	60 10 5	2	1000MHz

All h<sub>fe</sub> 's quoted are minimum only



BFT95-AN : An AEG application note for the BFT95, giving details of a wideband (1 to 800MHz) 23dB gain, 4dB NF preamp 6 pages

**MOSFETs**

Type	Structure	Fig.no.	P <sub>tot</sub>	V <sub>ds</sub>	I <sub>d</sub> :mA	I <sub>G1&amp;G2</sub> mA	V <sub>ds</sub> =15v/v <sub>gs</sub> =0 I <sub>dss</sub>	GM mS	CG1S pF	CdG1 pF	CdS pF	G <sub>ps</sub> dB	F at freq. dB MHz	Notes
BF960	N	5	0.2W	20	30	10	2....25mA	12	1.8	25	2	23	1.6 200	
BF960	N	5	0.2W	20	30	10	2....25mA	12	1.8	25	2	18	2.8 800	
BF961	N	5	0.2W	20	20	10	2....25mA	14	3.7	25	2	20	1.8 200	
3SK51	N	6	0.3W	15	33	5	7....25mA	17		20		20	2.0 200	

**Notes**

These new MOSFETs are suitable for RF and mixer applications (use 800mV of osc. on gate 2 when used as a mixer). Being depletion types, the G2 voltage should be taken below V<sub>s</sub> for maximum AGC action - in the case of the BF960, 30dB of attenuation is available with V<sub>g2s</sub> = -1v. The BF960 is suited to applications in UHF TV tuners, UHF communications etc, where enhancement type DMOS was previously the only viable MOSFET type. The lower cost of the 960, coupled with the ease of use of depletion types supercedes most DMOS applications up to 1000MHz.

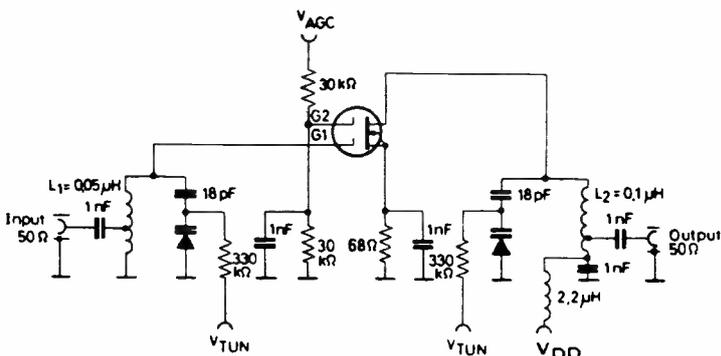
When using this type of high gain MOSFET, a drain stopper resistor of around 30 ohms is a useful feature - especially at lower frequencies where gain can be excessive. The input/output screening must be perfect for best stability - and the earthing of the screen and the decoupling capacitors must be carefully chosen to avoid interaction.

The above MOSFETs are recommended for all new design work in VHF/UHF. The capstan style package uses the same lead configuration as the standard TO72. All types are protected gate versions. The 3SK51 is frequently encountered in imported Japanese transceivers and receivers and offers some performance advantages over the 40673, which it may replace directly.

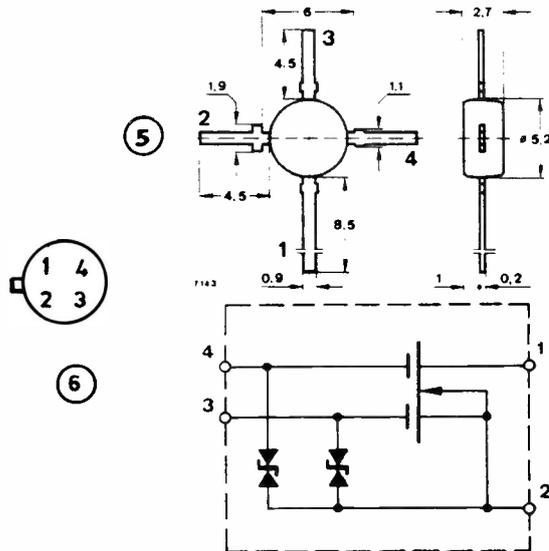
In many applications where current drain is not critical, operation without a source resistor - ie with the source earthed directly - can contribute to stability and performance. A 100 ohm resistor placed after the tuned load in the drain circuit will limit the maximum current flow. MOSFETs are not generally suited to battery operated applications, since the current consumed, and the voltage required for optimum performance is far better employed with modern bipolar devices. Such applications do not usually make severe demands on overload and AGC performance - and a bipolar alternative can be designed to consume as little as 1mA at 3v.

To achieve the best noise performance from a MOSFET input circuit, the G1 connection should be made adjustable. This may be done either by capacitive divider techniques, or shifting the tap position along a coil. At frequencies of about 100-200MHz, the tap position is usually about 80% from the earthy end of the coil - although in relatively low impedance circuits (such a varicap tuned Band 2 stage, using BB104/204) there is not much advantage from this additional effort.

**A masthead pre-amp using the BF960/961 MOSFET**



200 MHz AMPLIFIER



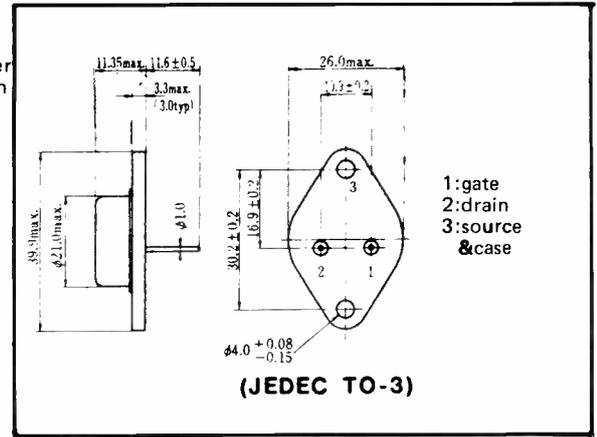
# MOSFET POWER - Hitachi's revolutionary complementary 100W MOSFETs

## Why power MOSFETs ?

Power MOSFETs offer answers to virtually every one of the classical bipolar power device drawbacks. There is little doubt that this technology will rapidly overtake most bipolar power applications in the course of the next year or so. Prices are presently quite high, but taken in context of the advantages of the MOSFET, and the fact that prices are already falling, the 100W power MOSFET stage is reasonably cost effective. Certainly to produce the same type of performance in audio applications with a bipolar stage, would probably end up at about the same overall cost - with a great deal more difficulty and number of adjustments.

- \* Much faster operation
- \* Self limiting, with a negative thermal coefficient
- \* Manufactured to exceptionally tight specifications for complementary use
- \* Hardly any drive power required compared to bipolar designs
- \* No secondary breakdown problems

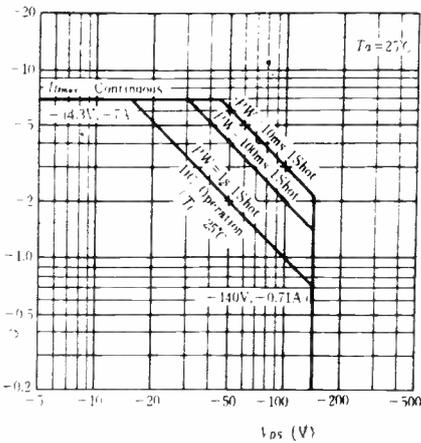
The main stock types held by Ambit are the 2SK133 and 2SJ48, since these fulfill the great majority of the types of application required by audio engineers and enthusiasts. 160v types are also available if required - although stocks of these are somewhat smaller.



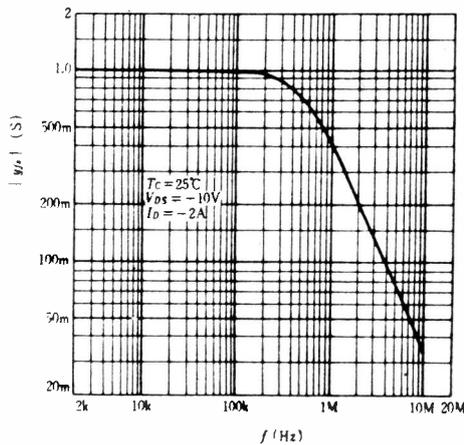
## ELECTRICAL CHARACTERISTICS AND RATINGS

Item	Symbol	Conditions	min	typ	max	units
Drain to source voltage	$V_{DSX}$	2SK133 2SK134 2SK135			120 140 160	volts volts volts
		2SJ48 2SJ49 2SJ50			-120 -140 -160	volts volts volts
Gate to source voltage	$V_{GSS}$	all types			±14	volts
Drain current	$I_D$	all types			7	amps
Channel dissipation	Pch	all types at case 25°C			100	watts
Storage temperature	Tstg	all types	-55		+150	°C
Gate source cutoff voltage	$V_{GS(off)}$	n channel types p channel types	0 0	1 -0.8	1.5 -1.5	volts volts
Drain to source saturation voltage	$V_{DS(sat)}$	all types			12	volts
Forward transfer admittance	yfs	all types $V_{DS}=10v, I_D=3A$	0.6	1	1.3	S
Input capacitance	$C_{iss}$	$V_{GS}=5v, f=1MHz$ n channel $V_{GS}=-5v, ..$ p channel		600 900		pF pF
Output capacitance	$C_{oss}$	$V_{GS}=-5v, V_{DS}=5v, f=1MHz$ -n $V_{GS}=5v, V_{DS}=-5v, f=1MHz$ -p		350 400		pF pF
Reverse transfer capacitance	$C_{rss}$	$V_{GS}=-5v, f=1MHz$ - n channel $V_{GS}=5v, f=1MHz$ - p channel		10 40		pF pF
Turn on time	$t_{on}$	$V_{DD}=20v, I_D=2A$ - n channel		18		nsec
off	$t_{off}$	..		7		nsec
Storage time	$t_{stg}$	..		7		nsec
Turn on time	$t_{on}$	.. - p channel		25		nsec
off	$t_{off}$	..		15		nsec
Storage time	$t_{stg}$	..		9		nsec

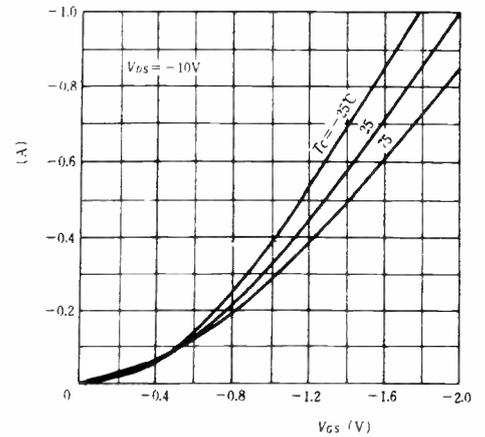
## AREA OF SAFE OPERATION



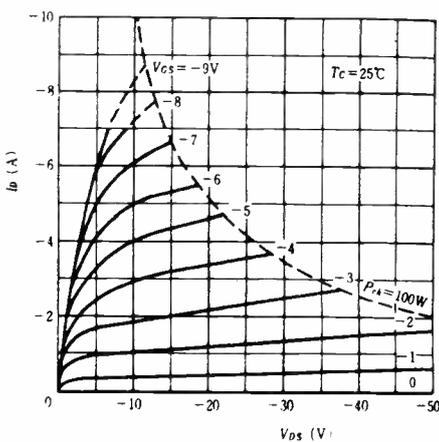
## FORWARD TRANSFER ADMITTANCE VS. FREQUENCY



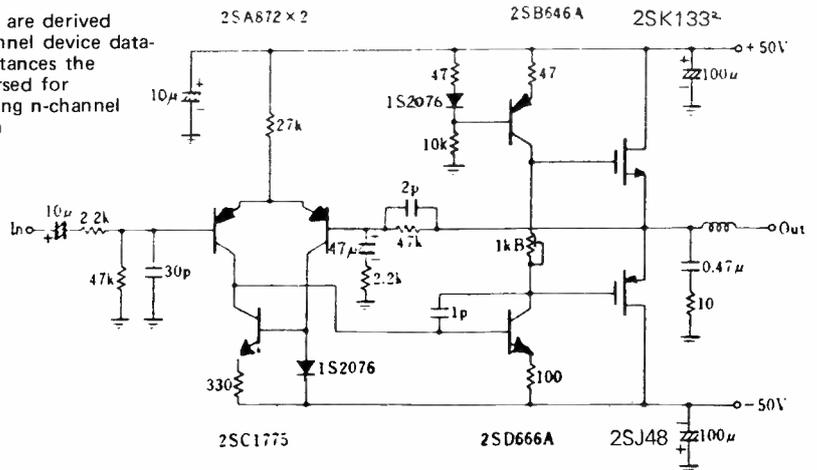
## TYPICAL TRANSFER CHARACTERISTICS



## TYPICAL OUTPUT CHARACTERISTICS

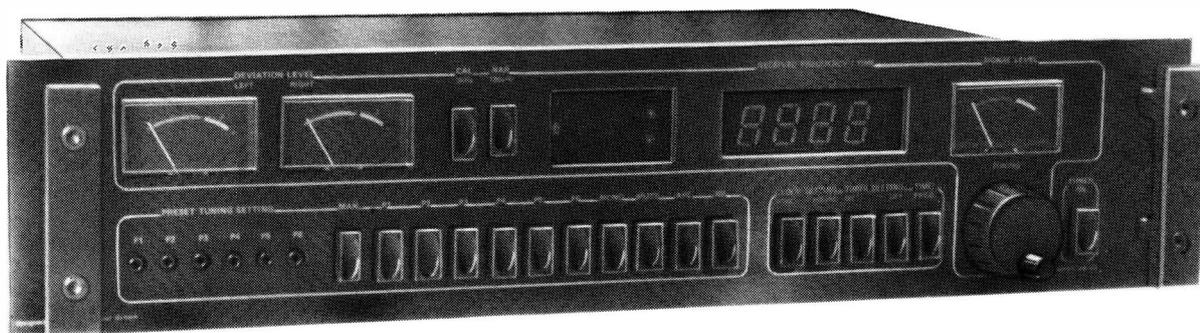


graphs here are derived from p-channel device data - in some instances the sign is reversed for corresponding n-channel information



80W amplifier configuration (THD 0.01%)

# mk 3 FM TUNER



## The International Mark III FM tuner system

Those of you who have been followers of the daring exploits of Ambit in the field of FM tuner design and development over the past five years or so will be forgiven for thinking that our hardware packages for wrapping up the tuner modules we supply have been intended for the more experienced constructor. The articles that have appeared in ETI and Popular HiFi at the end of 1978 have described a development we have carried out to produce an FM tuner that provides just about as much performance as the broadcast medium can cope with - but the use of a Swiftcase for the prototype should not be confused with the final version (pictured above) that evolved from months of painstaking mechanical and electrical design.

The Mark III tuner system is designed with the opposite of "built in obsolescence" in mind. There are spare switch positions provided for coming attractions - and the whole construction is based around modular components that will be as interchangeable as possible with any future advances that may be offered. The connector system permits straightforward construction by most levels of experience - since the units plug into "Motherboards" to take the chance out of the interwiring and earthing of FM tuner modules from our reference and new "Hyperfi" series.

Two basic approaches are offered in the Mark III system, although the hardware and assembly kit is available for those of you already in possession of the relevant modules - but without a respectable home for them.

A) Reference series, based on the ETI, and Popular HiFi articles

EF5803 tunerhead with LO output  
7130 IF with 2 linear phase filters, the CA3189E and trimmings  
91196B decoder, but without the monitor amplifier stages connected

B) Hyperfi series

EF5803S tunerhead  
7230 IF with electronically switched linear phase ceramic filters, variable slope AFC, the CA3189E and trimmings  
944378 decoder with pilot cancel, post decoder muting, remote VCO kill, flat frequency response to 15kHz

All kits are supplied with digital frequency/time display module, toroidal PSU, highest quality 10 turn tuning pot, function and preset selection switches with the new SUF series ultra light action, mains input filter, AC and DC fusing, twin VU style audio level meters, and a calibration oscillator, signal level meter.

A lower cost option is available that excludes the DFM and audio level meters/calibration oscillator - but of course this can be brought up to full spec by the addition of these parts. (The Mark III C) otherwise as Mark III A

## Performance

In the words of the famous motor car, performance is "adequate" - with the absolute levels of performance being limited by the broadcast medium.

	Mark III A & C	Mark III B
Frequency coverage	87.5 - 104 MHz use of the EF5401 strong signal handling frontend will extend coverage to 108MHz by virtue of the reduced tuning voltage requirement.	87.5 - 104MHz
Input sensitivity 75 ohms PD 30% modulation	0.8uV for 30dB S/N mono 210kHz IF BW 10uV for 55dB 100uV for 65dB	0.7uV for 30dB S/N mono in 240kHz 8uV for 55dB 100uV for 65dB
Ultimate S/N	67dB	68dB
Please note these figures are achieved with 30% modulation levels, as opposed to the more usually quoted 100% modulation. This is because most broadcasting averages to around 30% modulation, and consequently, the design of the mark 3 system has been optimized for such applications. To compare with 100% modulation levels, please remember to add approx. 10dB to the above S/N figures.		
Harmonic distortion	-65dB over 25kHz BW	-65dB over 100kHz BW
Ultrasonic content	<65dB	<65dB Note the IF bandwidth of this system may be switched electronically to 210kHz (separation reduced by 5-8dB)
Stereo separation	100Hz to 12kHz better than 30dB	50Hz to 15kHz better than 38dB
Capture ratio	1.1dB	1.1dB

For other information, see data relating to individual modules/components. Much of the specification will depend on settings made to suit individual taste and location - eg compromises between signal handling and sensitivity with AGC action etc.

The signal level meter will respond to antenna signals of as little as 0.4uV, with a dynamic range of some 60-80dB, depending on the AGC threshold settings and the tunerhead in use. This means that once full S/N ratio has been achieved, the reading tends to level off - and whilst some reviews seem to be impressed by a meter that reads from 1uV to 1V input, this has little bearing on the sound quality achieved.

Owners of Mark III systems will be kept up to date with the latest developments, modifications and improvements that are likely to evolve, and the flexible approach used throughout will permit easy incorporation of such amendments.

AC and DC fuse protection

Integral mains filter

Plug-in wire interconnections

'Motherboard system' for ease of assembly

Temperature compensation board

Calibration oscillator for system checking

Twin regulated supply

VU meter drive preset pots

SUF light-action switches used throughout

LED function indicator board

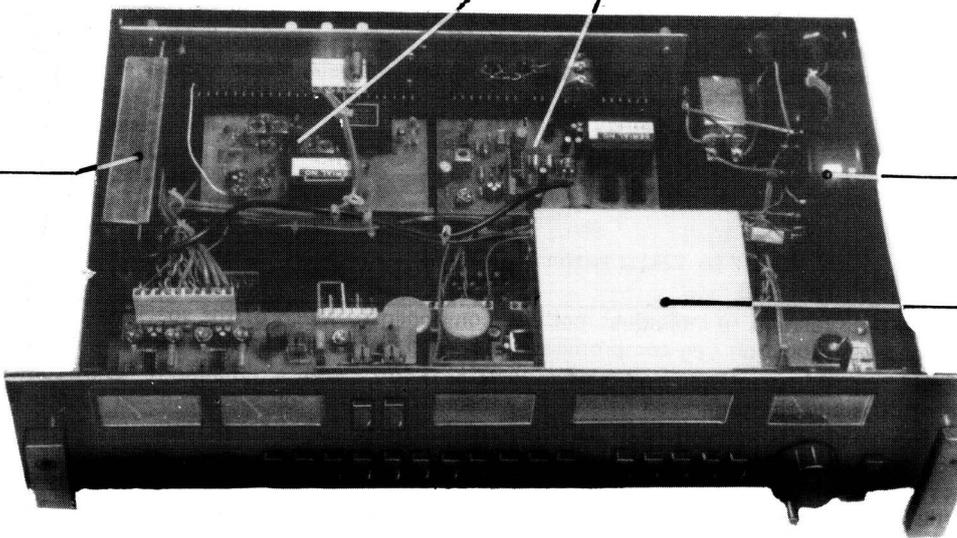
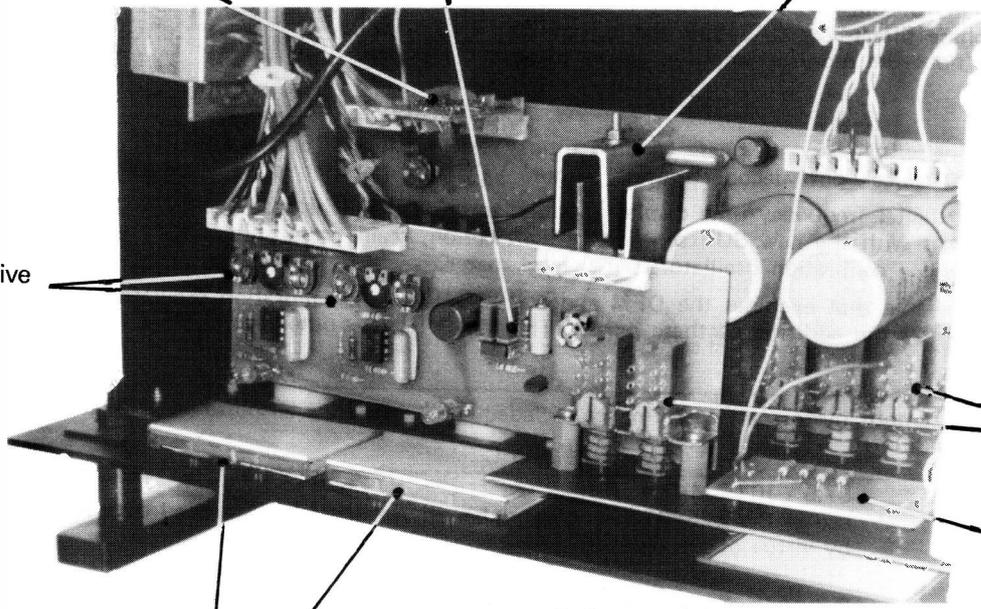
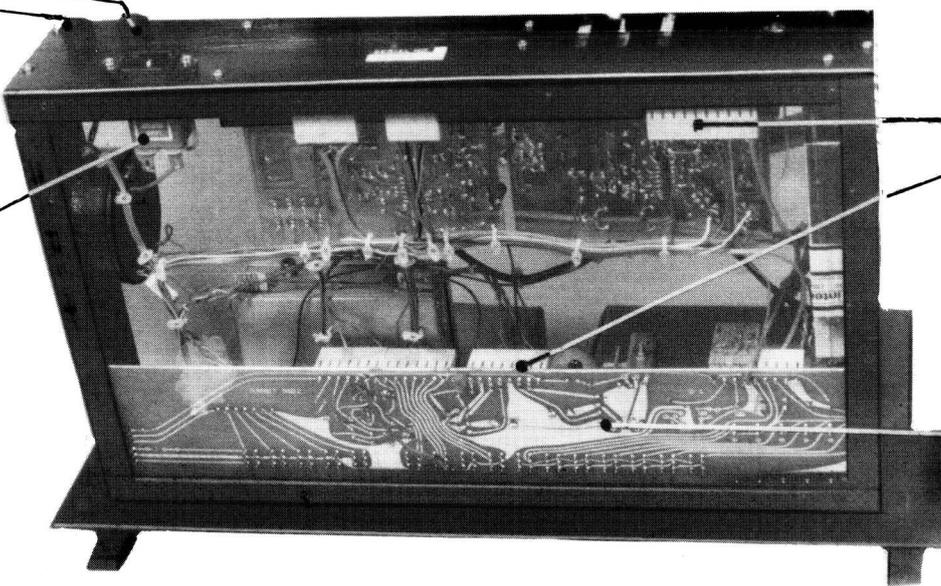
Left/Right channel VU meters

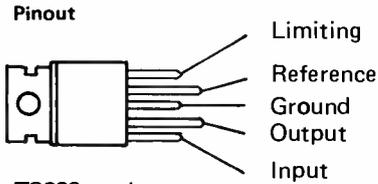
Reference Series IF and MPX

EF5800 series front-end

Low field transformer

Digital frequency read-out unit and clock

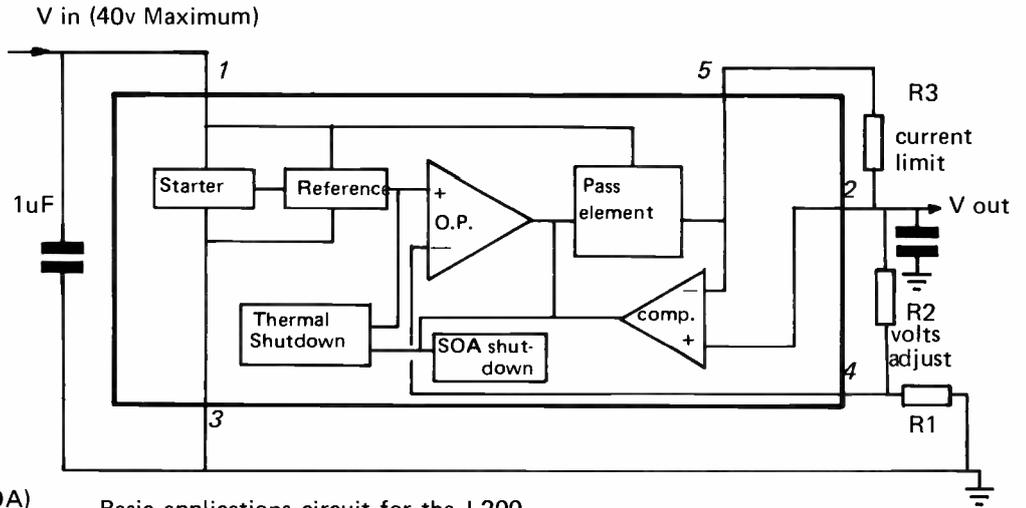




TO220 package viewed from top 'Pentawatt' leadout

**Features of the L200**

- Over 1.8A current available
- Adjustable V and I
- Thermal shutdown
- Short circuit protection
- Pass transistor safe area of operation (SOA) shutdown protection
- Ripple rejection 75dB
- Versatile pentawatt package
- Up to 60v momentary overvoltage protection
- May be used in switching configuration
- Single 'R' voltage adjustment permits remote/digital output voltage programming



Basic applications circuit for the L200

Output voltage (Vo) is given by:  $V_o = 2.75 (1 + \frac{R_2}{R_1})$  volts

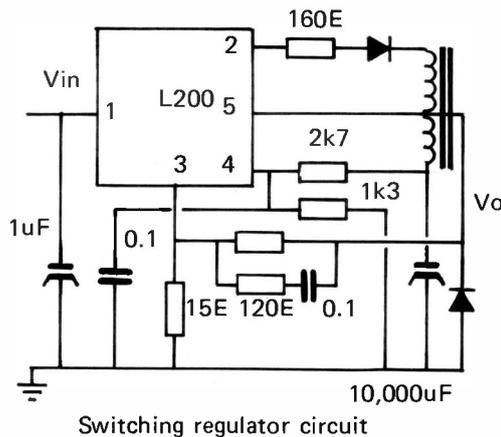
Current:  $I_o = \frac{0.6}{R_3}$  amps

Suggested values: R1 6k8, R2 100k potentiometer, R3 30ohm WW pot., for a fully adjustable 3 to 30V PSU with maximum current output 1.8A. Maximum current available will depend on device dissipation according to the Vin/Vout differential. Vin should be 35v DC smoothed with approx 2000uF

The L200 is a one-chip PSU regulator element, and combines the essential features of a 723/pass transistor combination - and includes some more besides. After the 78series, the L200 represents the most recent advance in regulator IC technology, and as usual, Ambit are first to bring the advantages to the engineer and home constructor.

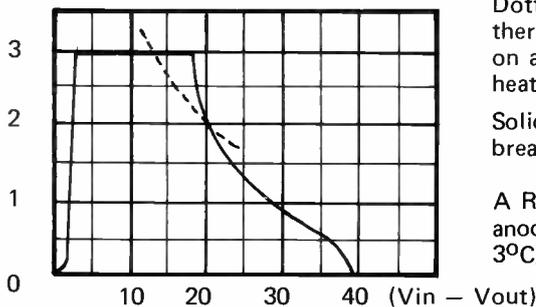
**RATINGS**

Symbol	definition	min	typ	max	Notes
Vin	Input voltage	3	35	40	general PSU use
Ptot	Total power dissipation	internally limited			use sufficient h/sink
Tj	Junction temperature	-55°	20°	+150° C	..
Tstg	Storage temperature range	-65°		+150° C	
Rth jc	Thermal resistance junction/case		3°C/W		
Rth ja	Thermal resistance junction/ambient		50°C/W		
	Output voltage spread $\Delta V_{in}$ 10v, $\Delta I_{out}$ 1 amp			±5%	Vout
	Line regulation $\Delta V_{in}$ 10v, Iout 5mA		0.1%		Vout
	Voltage load reg. $\Delta I_{out}$ 1.5A		0.1%		Vout
	Current load reg. $\Delta V_{out}$ 5v		1.5%		I out
	Quiescent current V in 20v		5mA		no load condition
	Ripple rejection $\Delta V$ in 10v, f 100Hz		75dB		
Vn	Output noise voltage Vout 5v		40uV		10Hz to 100kHz
Vdo	Dropout voltage I out 1.8 amps		2.2v		
Ip	Peak output current		3amps		
TC	Ave. temp. coeff. of Vo V out 5v, I out 5mA		1mV/°C		
Vref	Pin 4 voltage reference		2.75v		
	Shutdown voltage pins 5-2		0.6v		current limiting



Switching regulator circuit

amps



Internal safe operating area

Dotted line indicates thermal shutdown point on a perfect (infinite) heatsink.

Solid line indicates second breakdown area.

A Redpoint extruded black anodized heatsink with approx 3°C/W is available at 85p

## Printed Circuit Drafting System : Chartpak

Although this page is aimed primarily at professional electronics users, it is becoming apparent that the more enthusiastic amateurs are finding a need for this type PCB drafting facility. Just about every new component is designed for use with PCB wiring, so we now offer a service for the supply of the full range of Chartpak circuit drafting products, and a series of low cost precision grids for either metric or imperial standards. The full range catalogue costs 25p inc., and includes a separate price list to the usual Ambit electronic component lists.

### About the system

All the symbols, tapes etc are manufactured to a very high quality - with guaranteed precision for the highest professional quality. Although primarily intended for use in 2:1 art masters, various scales ranging from 1:1 to 4:1 are available for different types of work. The 1:1 scale permits direct etching of the prototype PCB in Ferric Chloride - providing a more secure medium of etch resist than the popular Dalo type pen, since the lines and symbols (not IC pads which are printed on a film carrier) are die cut from tough black crepe tape, with a resettable adhesive backing.

The 2:1 system is the most widely used means of generating artwork masters for photographic reduction to provide the necessary negatives (or positives) for the PCB manufacturing process.

Basically, the only parts specific to any given scale are the IC pads, and other printed symbols, with tapes, pads etc being interchangeable.

### The Prototype PCB services:

A quick glance in the local yellow pages will reveal several PCB manufacturers in most parts of the country. The type of service offered, the costs and the quality all vary quite enormously. For fast prototype work, Ambit has arranged with our own supplier to provide a 7 day (average) turnaround service, for approx. £5 photographic charge, plus £8 per one prototype board up to 15cm square. These are strictly guide prices, since prices fall rapidly depending on quantity (over 10), when board area and hole numbers will be the prime determining factors.

These prototypes are produced on a consolidation basis, and all artwork should be sent in a suitable packing tube etc. to reach us by Friday, to catch the weekly batch to be delivered the following Friday. For quantity quotations, please state number required and what schedule of delivery.

All prototypes for the consignment service will be made on 1/16th thickness fibreglass PCB, with only 1mm holes drilled. Other size holes/slots etc cannot be catered for in the consignment system - but may be separately handled at extra cost and time.

### To order:

- 1 Supply 1:1 negative by Friday of week preceding delivery requirement -or-
- 2 Supply any true scale artwork, stating scale £5.00 charge up to 12" square
- 3 Mark which side is copper track
- 4 Prepayment required on the basis of £8 per single board up to 15cm square  
additional boards up to 10 max for proto service £4  
more than 200 holes per board may be surcharged, please allow 1p per additional hole

Regular users of this service may be permitted volume discounts, please ask for details.

If you require hole sizes other than 1mm, and are prepared to chance waiting an extra week for delivery (though at present, different hole sizes may be accommodated under the standard service) - then please supply an accurate drilling plan (a marked photocopy etc).

Double sided boards allow 50% extra, overpayment will be credited.

Sizes above 15cm square, allow 3p per square centimetre extra - remembering additional holes.

In cases of doubt, please allow extra in costs, and overpayment will be refunded as credit.

**Plated through holes** are available, but will be individually assessed. Prices usually 3-7 times standard charges for production, but about 2x - 3x for prototypes.

**Production quantities** from our service will be exceptionally competitively priced, and take about 2-3 weeks to supply. To ensure accuracy, please supply a correctly drilled prototype PCB, plus drilling detail etc.

### Examples of the system

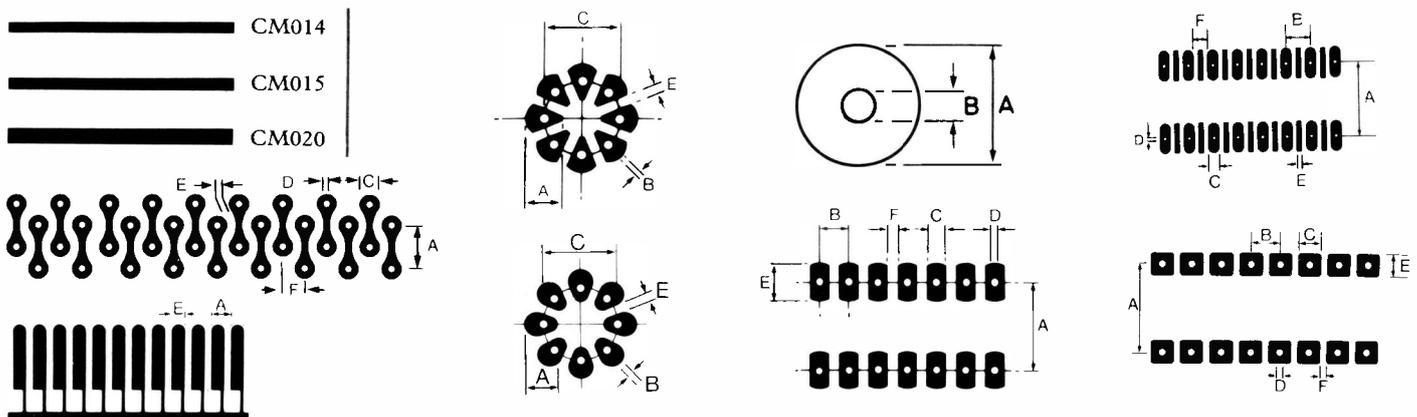
#### Precision drafting grids

Various sizes of precision drafting grid are available, with a variety of rulings:

Size	30x20"	A1	40x30"	A0
Rulings	1mm (with 1cm bold)		preferred type	
	0.1" (with 1" bold)		preferred type	
	0.1x0.2x1.0"			
	2mm (with 1cm bold)			



These grids are precision made on polycarbonate film, and range in cost from £9 to £15 approx, representing excellent value.



**REMEMBER:** Original projects, carried out under our 'sponsorship' offer will be eligible to reclaim PCB drafting costs as well. All Chartpak items are supplied at current list prices, so if you already possess the catalogue and price list, then you may order on this basis. Until announced in our price list/bulletin, Chartpak is available only on a mail-order basis for the time being - and please note that the prices for the PCB service are offered as guide, and may be revised at any time. (Accurate as at January 1979.)

Low power divide by 100 , 200MHz (typ) prescaler : Plessey/National SP/DM 8629

For use with synthesiser, DFM circuits requiring conversion of VHF to CMOS compatible frequencies

The 8629 is suitable for most types of DFM prescaler, especially since it operates from sinewave inputs of 0.2 to 1v p-p. The low power of the IC reflects in the relatively low level of spurious switching products - especially with the countdown sequence that has been carefully chosen to avoid harmonics in Band 2. (divide by 5, divide by 5, divide by four). ECL logic is used to further reduce switching transients.

A simple wideband transistor amplifier can be used to boost sensitivity to 10mV at 100MHz, enabling operation with most types of Band two tunerhead local oscillator outputs. The output will drive any of the OKI range of frequency counter LSI.

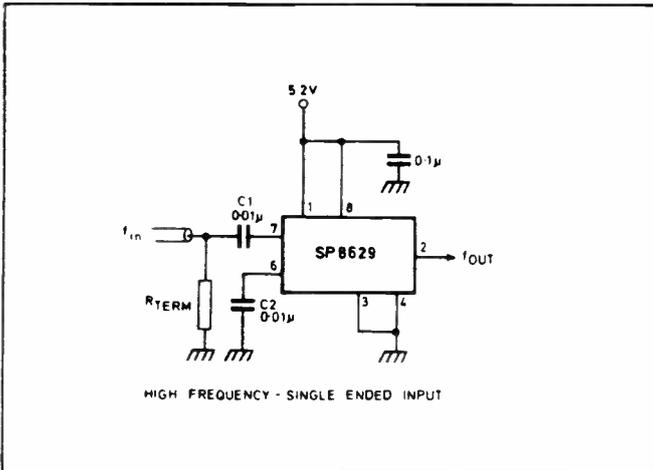
The signal source is usually capacitively coupled to the input of the IC - and in the usual single ended operation, the unused input should be taken to ground via a low inductance 0.01uF ceramic capacitor. When used as a DFM prescaler, the input should be tied to ground with a 100k resistor to prevent stray operation under "no signal" conditions.

For operation below 10MHz, the slew rate of the incoming signal must exceed 50v/uS. A TTL drive is suitable for this type of operation - but in many instances, it is simpler to switch out the prescaler for such LF measurements. The use of a prescaler will inevitably increase the DFM gate time for a given resolution, and this may be cumbersome at LF where 10Hz resolution or better, is required.

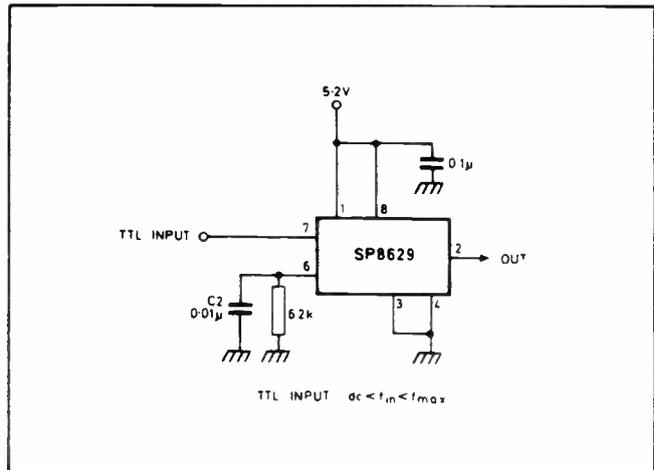
The MSL2318 programmable 10/100 divider data includes further details concerning PSU decoupling - and these may be usefully incorporated in designs using the SP8629.

ELECTRICAL CHARACTERISTICS

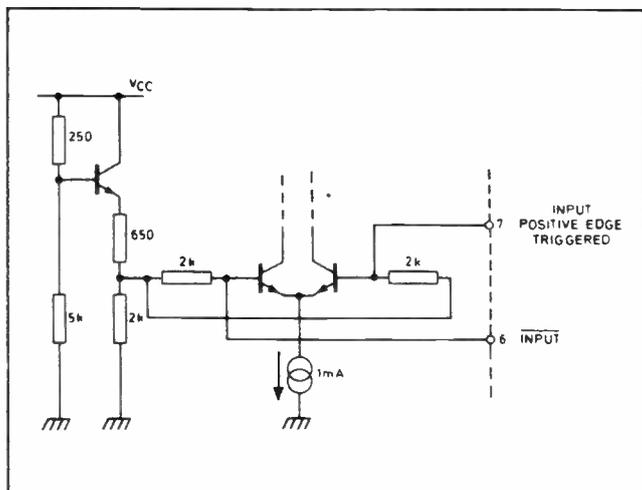
Item	symbol	min.	typ	max.	units	comments
Supply voltage	Vcc-Vee	4.7	5.2	8	v	may be adjusted for best fmax
Input voltage	Vin DC			Vcc-Vee	v	
Output voltage	Vout			5.5	v	
Output current	Iout			40	mA	
Zener current	Iz			20	mA	6.3v zener supplied at pin 5
Operating temp range	Top	-30		+70	oC	
Storage temp range	Tstg	-55		+150	oC	
Max input frequency	fmax	150	200		MHz	Vcc=5.2v, Vin 600mV p-p single ended
Input voltage	Vin 1 (p-p)	200		1000	mV	Vcc=5.2v, single ended
	Vin 2 (p-p)	100		1000	mV	Vcc=5.2v, differential
Min input frequency sinewave	fsine	10			MHz	Vcc=5.2v, Vin 600mV p-p
Min slew rate for square wave in	dv/dt			50	V/uS	Vcc=5.2v, Vin 600mV p-p
Logic 1 output voltage	Voh	2.4			v	Vcc=min, Ioh= -400 uA
Output short circuit current	Ios	-10		-40	mA	Vcc=max
Logic 0 output voltage				0.5	v	Vcc=min, Iol = 8mA
Supply current	Icc		33	45	mA	Vcc=max
Zener voltage	Vz		6.3		v	Iz=5mA



High frequency, single-ended input



TTL input (DC < f\_in < f\_max)



Input circuit diagram

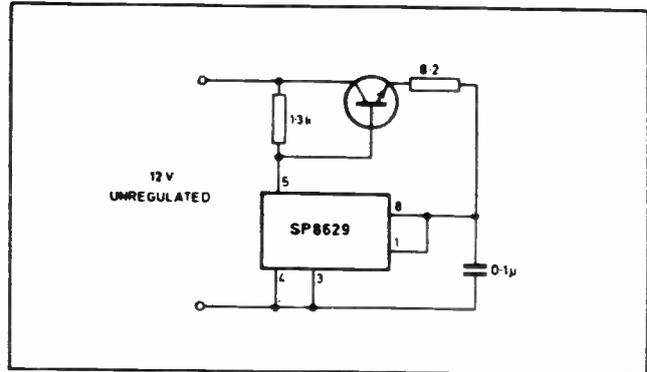
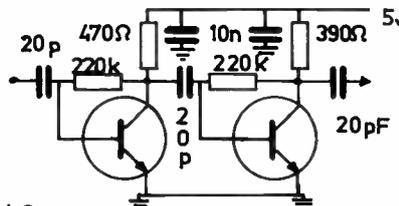
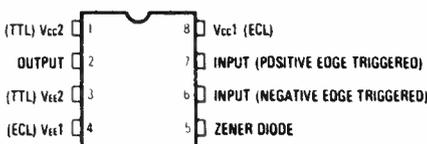


Fig. 5 Voltage regulator



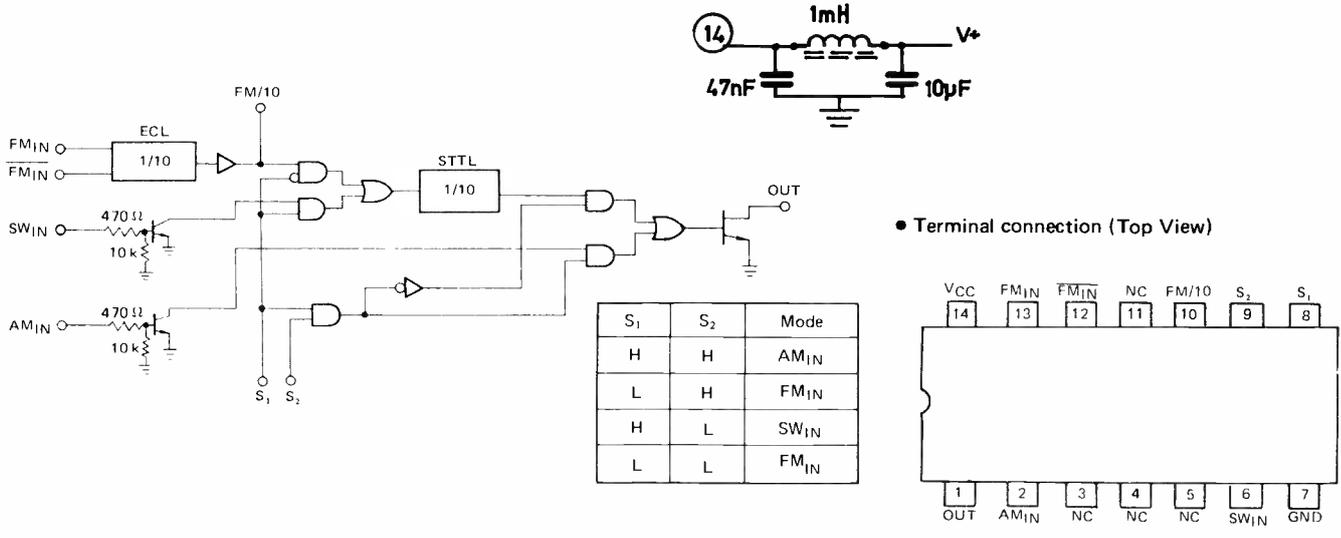
input preamp for Band 2

...using BF273 or similar high ft npn small signal RF transistors. Care is essential to avoid oscillation - but such a circuit will improve the sensitivity to approx. 10mV rms at 100MHz. Ferrite beads placed on the collector leads will assist in improving gain (between signal coupling capacitor, and collector load resistor)



# OKI electric programmable prescaler: divide-by-100 for VHF, divide-by- 10 for SW, and direct input interface for LF bands the MSL2318

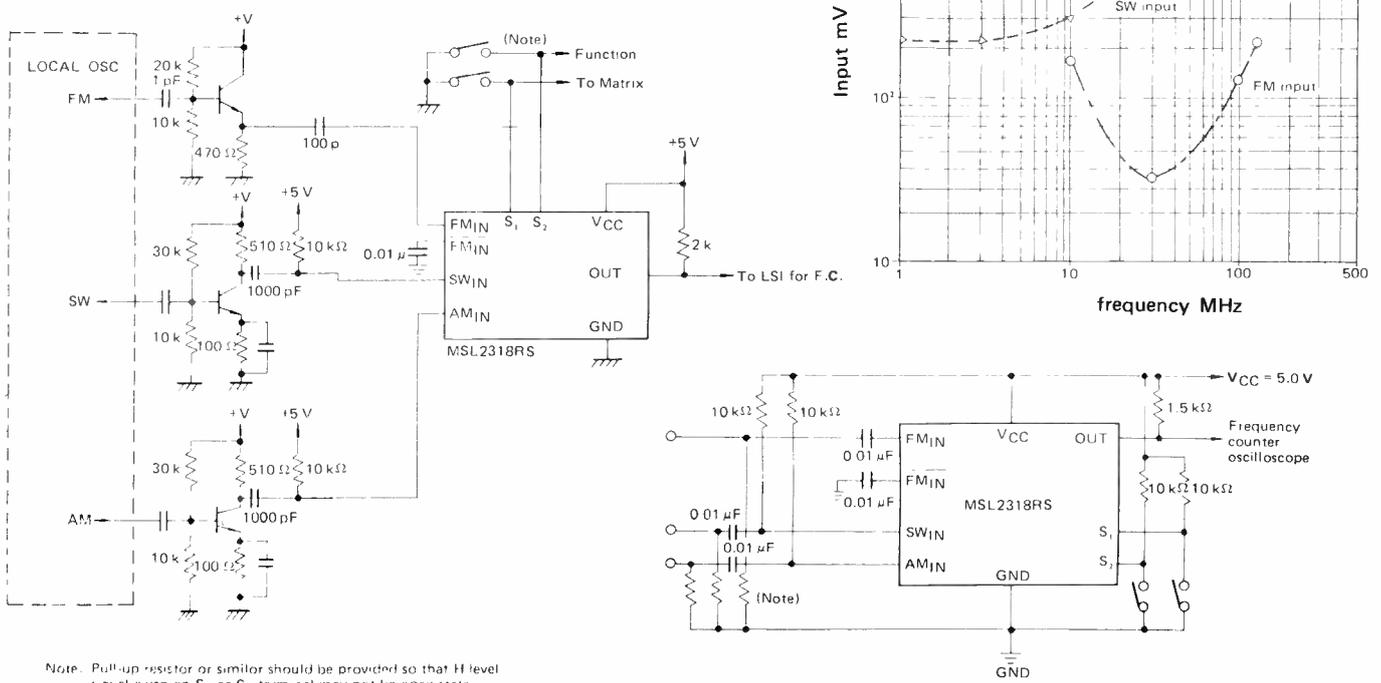
This versatile prescaler is designed for use with sinewave inputs in frequency counters for instrumentation and consumer frequency readout displays. It employs a combination of ECL (VHF input), LPS (SW), and TTL techniques to provide 100 times division up to 200MHz, as typically found in our tests. The intermediate decade output is also available - eg FM input frequency 110MHz, intermediate 11MHz. This feature permits faster operation with LSI such as the ICM2716 series when the input frequency is less than ten times the LSI speed capability. The ceramic package is designed to operate warm to touch - and the current consumption makes this type device unsuited to battery operation. In any frequency counter used in conjunction with RF sensitive environments, great care must be taken to decouple the supply of the 2318 to prevent reradiation of switching transients. The S1 and S2 lines must also be decoupled with .01uF close by the IC - and the output track should be kept as short as possible, where design scope permits, a lowpass filter can be used.



**Electrical characteristics and rating**

Item	Symbol	Conditions	Minimum	Typical	Maximum	Units	Notes
Supply voltage	V <sub>cc</sub>	at 25°C	4.75	5	7	V	Use TTL techniques See graphs Uncommitted collector Runs quite warm
Input voltage	V <sub>i</sub>	..	0.8	1	5.5	p-p V	
Output voltage	V <sub>o</sub>	..		V <sub>cc</sub> -0.6		V	
Power dissipation	P <sub>d</sub>	..			800	mW	
Supply Current	I <sub>cc</sub>	V <sub>cc</sub> =5v		100	125	mA	
Operational temp	T <sub>a</sub>		-20		+70	°C	
Storage temp	T <sub>stg</sub>		-55		+125	°C	
S1/S2 switching							
High level			2.0			V	
Low level					0.6	V	
Input current S1/S2							
High level		2.4V			40	uA	
Low level		0.4V			-4.8	mA	
FM/10 output levels			0.4		2.4	V	Range of output swing (Ambit tests show 200MHz)
Input freq. FM	f	400mV p-p	20	120	150	MHz	
SW	f	1V p-p		30	50	MHz	
AM	f	1V p-p		3	8	MHz	

(5) Connection diagram for input circuit (example for frequency counter display)



# OKI electric CO.

## FREQUENCY DISPLAY LSI

# MSM · 5523 & 5524

from OKI's uniquely comprehensive series of consumer and communications LSI

- Direct frequency readout for consumer and communications receivers with a wide choice of IF offsets for AM and FM
- 4½ digit resolution:
  - 'AM' up to 3.999MHz
  - 'SW' up to 39.999MHz
  - 'FM' up to 399.9MHz

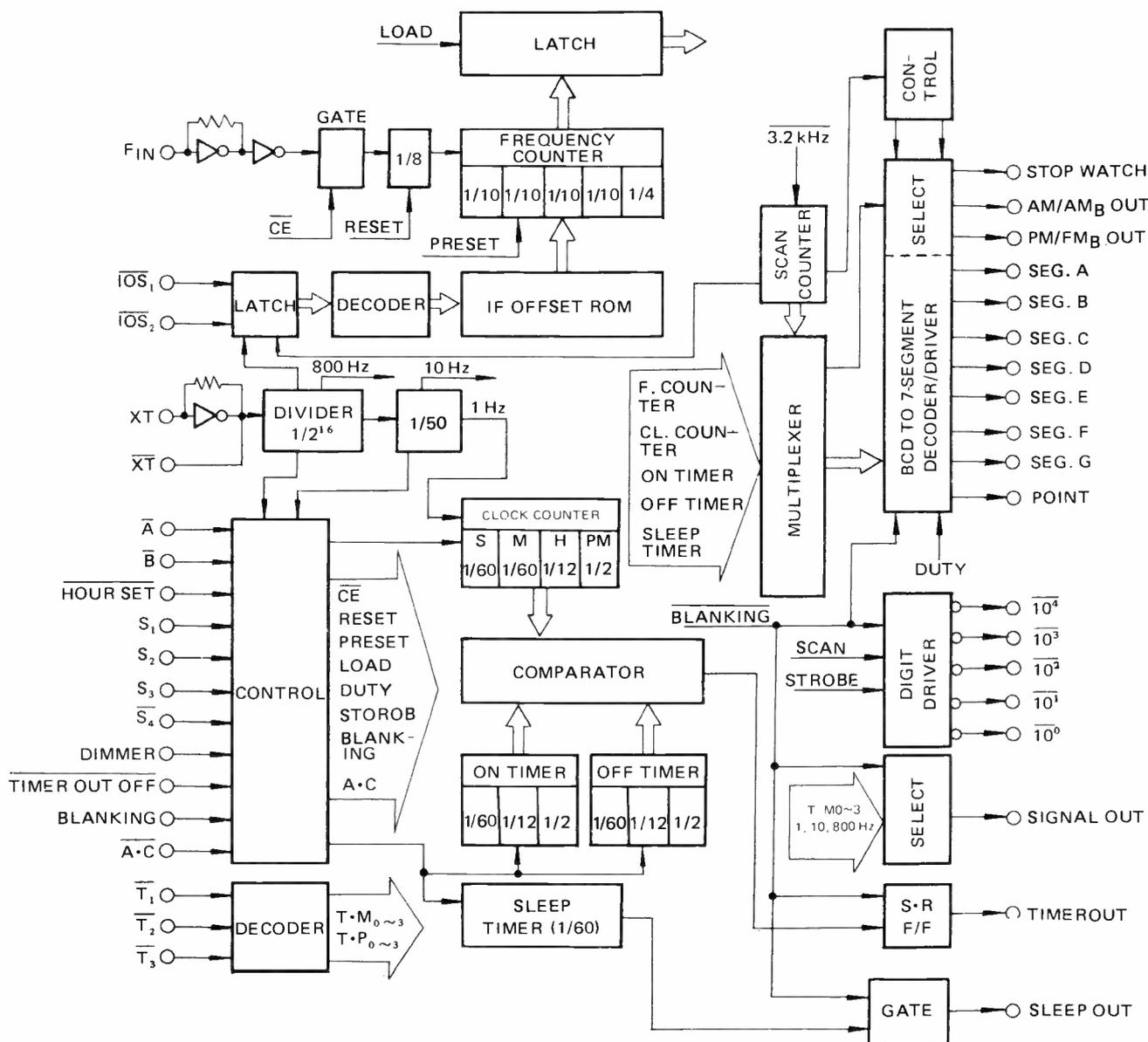
with 'AM' and 'FM' identification

- 12 hour format clock, with 24 hour cycle timer and alarm functions
- Elapsed time stop-watch function up to 12hrs - 59mins - 59secs
- MSM5523 for LED displays, MSM5524 for fluorescent display tubes
- Standard frequency timebase crystal: 3.2768 MHz
- Direct count capability with no offset

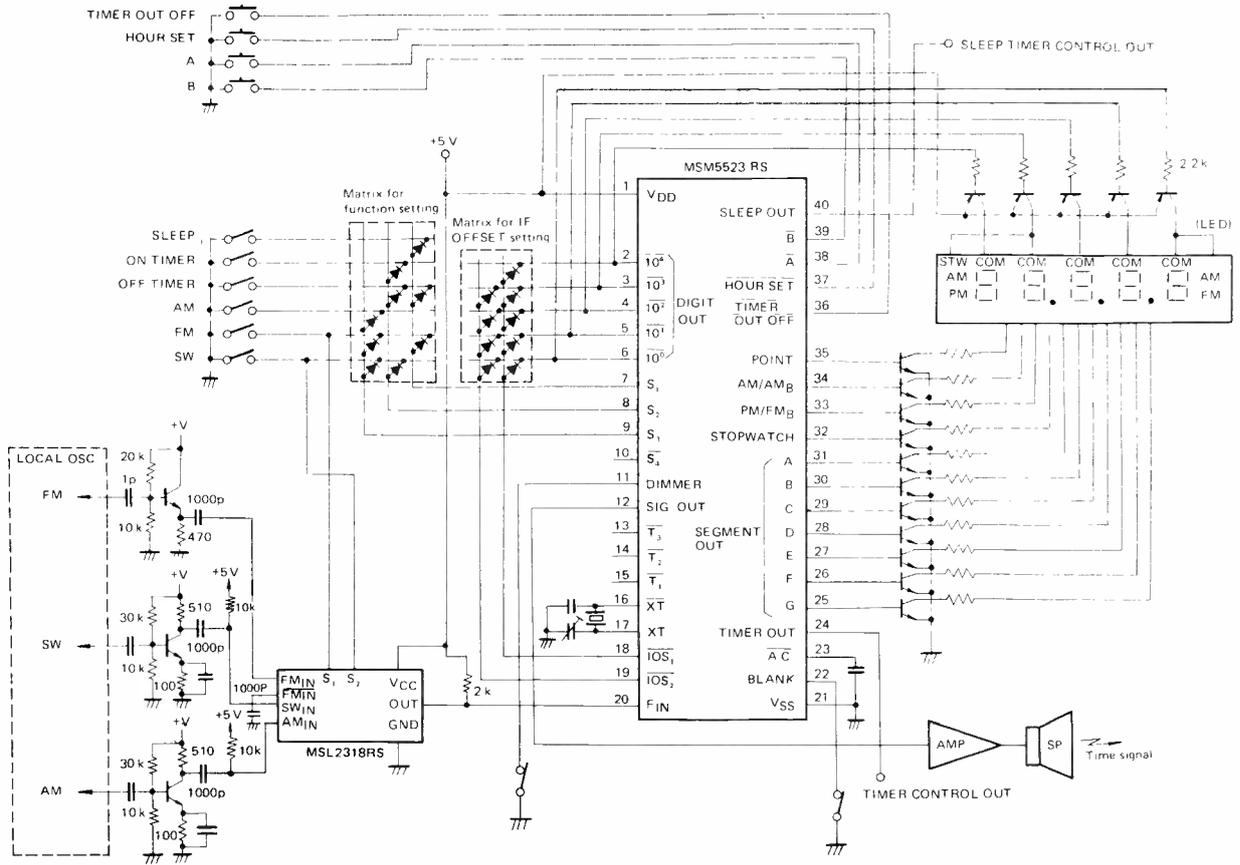
This CMOS device dramatically simplifies the design and construction of the frequency readout sections of modern radio receiver circuitry, whilst maintaining a host of features that are now almost obligatory in new receiver design practise. The various IF offset frequencies cater for all world zone preferences in both AM and FM operation - and the versatile supply requirements permit this device to be incorporated into car radio systems with ease. The companion MSL2318 prescaler/input interface provides all the necessary buffering to drive the IC from sinewave sources.

Other LSI in this series is available with frequency count only, for direct segment and digit drive using fluorescent or LCD displays.

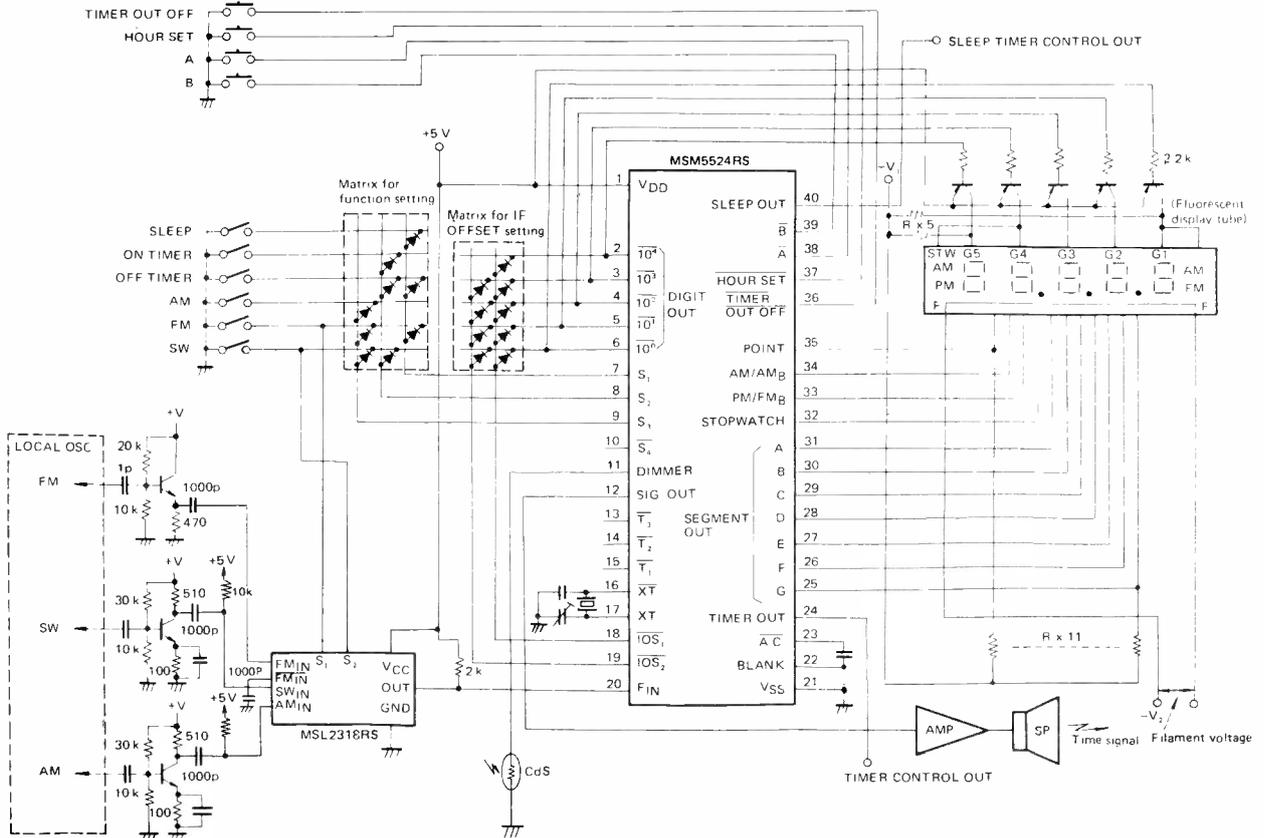
circuit design detail



Application example of MSM5523RS



Application example of MSM5524



**Operation**

**Function details**

**S1, S2, S3 :**

Selection of display mode is accomplished by setting these pins as follows:

Select input	Display selected	Remarks
S1 S2 S3		
H H H	Clock	Clock/Timer functions
L H H	Sleep timer	
H L H	ON timer	
L L H	OFF timer	
H H L	AM band (MW&LW)	Frequency counter
H L L	SW	
L H L	FM (VHF)	
L L L	direct frequency	

"H" is open (or Vdd) "L" is ground (internal pullup resistors)

**S4 :**

Selects least sig. digit displayed in counter mode

L :	on AM LSD is always "0" on FM LSD is rounded up to 1, 3, 5, 7, 9 in accordance with US channelling practise
H :	Displays to full resolution capability

**Display examples**

Frequency 4 digits 399.9 5 digits 39.999

Display selected	Display	Units
AM	AM 0 - 3999	kHz
FM	FM 0 - 399.9	MHz
SW	0.000 - 39.999	MHz
direct	0 - 3999	kHz

**Clock, timer and stopwatch**

Display selected	Display
Clock	AM/PM 1.00 - 12.59
Timer ON	AM 0.00 - AM or PM 1.00 - 12.59
Timer OFF	AM 0.00 - AM or PM 1.00 - 12.59
Sleep timer	00 - 59 - 00 (mins)
Stop watch ON	0.00 - 12.59 (hours - mins)
Timer OFF	0.00 - 59.59 (mins -secs)

The on and off timers display "AM 0.00" when reset

**Colon (point output)**

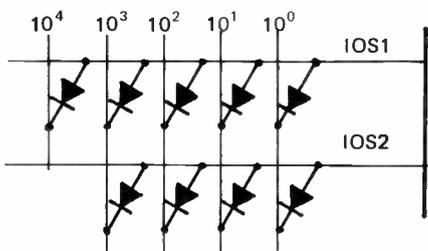
Display selected	Display
FM/SW	Constantly lit
Clock	Pulsed at 1Hz
Timer ON	Constant
Timer OFF	Constant
Stp watch mode	
Timer ON	Lit when counter stopped
Timer OFF	and pulsed when counter operating

**Selection of IF offset**

The digit out lines are programmed from  $\overline{IOS1}$  and  $\overline{IOS2}$  through a diode matrix according to the following table.

IF OFFSET SELECT	Band select	DIGIT OUT					Offset
		$10^4$	$10^3$	$10^2$	10	$10^0$	
$\overline{IOS1}$	AM				X	X	-262
					X	X	-452.5
				X	X	X	-454.5
				X	X	X	-456.5
$\overline{IOS1}$	SW	X	X				-467.5
		X	X				-455
		X	X				-465
		X	X				-468
$\overline{IOS2}$	FM				X	X	+10.68
					X	X	+10.71
					X	X	+10.79
				X	X	X	+10.82
				X	X	X	+10.75
				X	X	X	-10.58
				X	X	X	-10.60
				X	X	X	-10.61
				X	X	X	-10.62
				X	X	X	-10.63
				X	X	X	-10.65
				X	X	X	-10.66
		X	X	X	-10.69		
		X	X	X	-10.70		
		X	X	X	-10.72		
		X	X	X	-10.73		

**Example of diode programming**



(Use only diodes that are required by reference to the above table)

**XT inputs:**

The crystal on these pins is trimmed with a 60pF trimmer and the fixed value is approx 47pF

**Fin input :**

The built in CMOS amplifier stage permits operation when the input exceeds 1v p-p. When Vin is less than 3.6v with a 5v supply, connect via a capacitor of 1nF)

The AM (MW&LW) bands are read directly, but a divide by ten pre-scaler is required for SW operation, and divide by 100 for FM.

The MSL2318 fulfills all requirements for this interface function - though where the SW feature is not required the SP/DM8629 may be used for FM prescaling .

**Time adjustment and setting functions:**

Using terminals A and B (with internal pull-up) as follows :

Display select	A	B	Operation
CLOCK	L	L	Reset clock counter : AM 1.00.00 Hrs Mins Secs
	H	L	Setting minutes (Hours held) seconds counting, but minute carryover inhibited in this period
	L	H	Setting Hours (minutes held)
	H	H	normal operation
ON TIMER	L	L	Reset on-timer AM 0.00 Hrs.Mins
	H	L	Set minutes (hour held)
	L	H	Set hours (minutes held)
	H	H	Retain setting time
OFF TIMER	L	L	Reset off-timer AM 0.00 Hrs.Mins
	H	L	Set minutes (hour held)
	L	H	Set hours (minutes held)
	H	H	Retain setting time
SLEEP TIMER	L	L	Reset sleep timer counter 00 mins
	H	L	Countdown 00 - 59 - 00
	L	H	Hold setting time
	H	H	Normal operation with display counting down

Operating notes: If A or B are held low for between 0.1 and 1.6 sec., a single digit will be counted. If held for longer, the count rate increases at 10Hz thereafter.

**Stopwatch Functions**

Used in connection with the "Hours set" terminal, A and B

A	B	Hour Set	Display selected	Result
H	H	H to L 1	On timer	Stopwatch display 0.00 - 12.59 Hrs.Mins.
H	H	H to L 1	Off timer	Stopwatch display 00.00 - 59.59
L	H	H to L'	(Stopwatch mode)	Return to timer selected
L	H	(H)	(Stopwatch mode)	Start count
L'	H	(H)	(Stopwatch mode)	Stop count
H	L	(H)	(Stopwatch mode)	Reset

**Timer Out**

This pin is taken to "L" when the OFF time is reached and to "H" as the clock display reaches the preset "ON" timer value

**Timer Out Off (built in pullup)**

This pin resets the Timer out, and returns the sleep counter to "00" when taken "L"

**Blanking (built in pullup)**

Normal display operation occurs when this pin is held to "L" the display is blanked when left oc or taken "H"

**Dimmer (built in pullup)**

This is "L" under normal conditions, and taken to "H" to reduce display on strobe pulses by 75% thus dimming the readout

**T1, T2, T3 (built in pullup)**

These pins determine the nature of the signal out function. T3 should be connected to Vdd to reduce noise.

T1	T2	Signal Out content
L	L	1Hz continuous
H	L	10Hz continuous
L	H	800Hz continuous
H	H	500mSec of 800Hz at hour transitions

**Output system**

MSM5523 (LED) all CMOS levels

MSM5524 (Fluorescent displays) Pch open drain

with display line "on", the FET is on

Segments are driven via transistors for LED displays (5523)

or directly with fluorescent displays (5524)

Digits are transistor driven in all cases

**Point**

The point is driven as described in the colon function, being synchronized with the  $10^2$  digit for time displays,  $10^1$  digit for FM and  $10^3$  for SW.

**Stopwatch**

This terminal drives the function indicator during stopwatch mode

**AM/AMB OUT**

This drives the (clock) AM indicator, synchronized to  $10^3$ , and the AM band indicator, synchronized to  $10^0$

**A̅C**

Grounding this terminal resets all counters. A 10nF capacitor to earth ensures full switchon reset operation.

**PM/FM<sub>B</sub> OUT**

This drives the (clock) PM indicator, synchronized to 10<sup>3</sup> digit line, and the FM band indicator, synchronized to 10<sup>0</sup>.

**SIGNAL OUT** : see T1, T2, T3

**SLEEP OUT**

This output remains high as long as the sleep timer is counting towards zero, whereon it goes low until reactivated.

**Static and Dynamic Electrical Characteristics**

Function/Parameter	Symbol	Conditions	Min	Typ	Max	Units	Comments
Supply voltage	V <sub>DD</sub>	Counter Clock	4.75	5	7	V DC	
Crystal frequency			4	5	7	V DC	
Operating temperature	Top		-35	3.2768		MHz	
Count frequency in	fin	V <sub>DD</sub> 4.75V Vin 1V p-p	3	20	+80	°C	
						MHz	

**ABSOLUTE RATINGS**

Supply voltage	V <sub>DD</sub>		-0.3		+7	V	
Input voltage	V <sub>in</sub>		-0.3		V <sub>DD</sub>	V	
Storage temperature	T <sub>stg</sub>		-55		+125	°C	

**OUTPUT DRIVE CAPABILITIES**

**MSM5523 : LED**

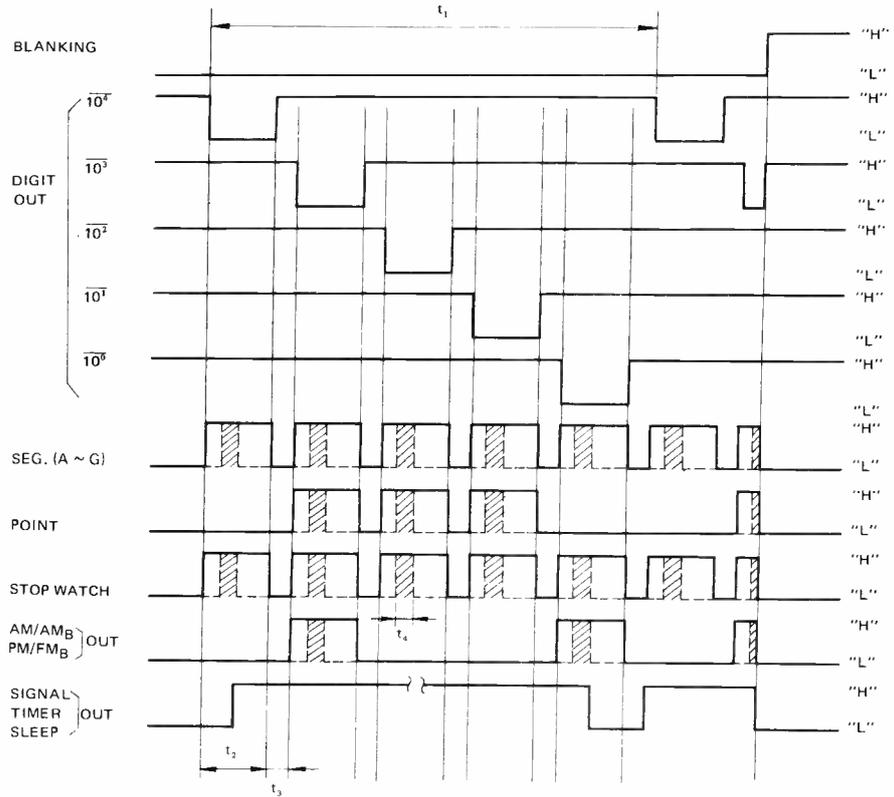
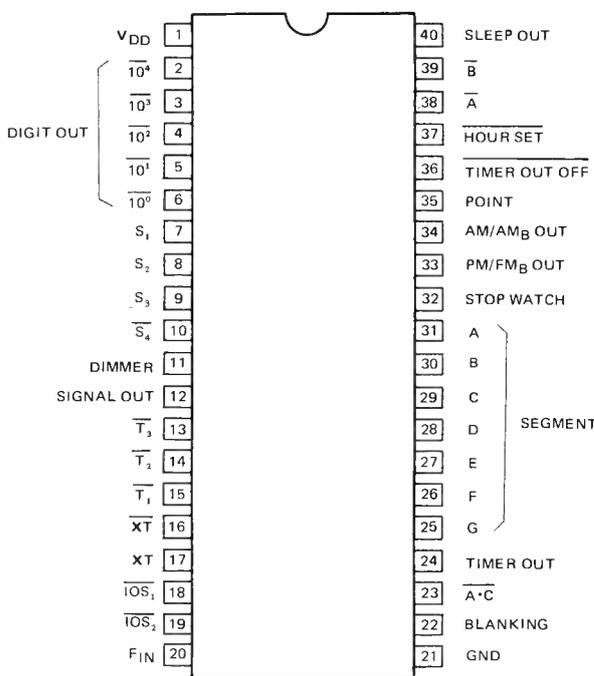
**MSM5524 : Fluorescent**

Output	MSM5523 : LED	MSM5524 : Fluorescent
AM/AM <sub>B</sub> , Stopwatch	output high	low
PM/FM <sub>B</sub> , Segments A to G	> -1mA (V <sub>DD</sub> -2v)	0.1mA (0.4v)
POINT	> -0.1mA (V <sub>DD</sub> -2v)	> 2mA (0.4v)
10 <sup>0</sup> to 10 <sup>4</sup>	> -0.1mA (V <sub>DD</sub> -2v)	> 0.1mA (0.4v)
Signal, Timer, Sleep	> -0.1mA (V <sub>DD</sub> -2v)	> 0.1mA (0.4v)
		output high
		> -1mA (V <sub>DD</sub> -2v)
		> -0.1mA
		> 0.1mA (V <sub>DD</sub> -2v)
		low
		< 1uA (V <sub>DD</sub> -30v)
		> 2mA(0.4v)
		> 0.1mA (0.4v)

> indicates in this instance, "greater than or equal to"

All information supplied herein is believed to be accurate and correct. However, no responsibility or liability can be accepted for errors or omissions. OKI reserve the right to amend and/or improve any specification. Such amendments requiring alterations to the applications circuitry will be accompanied by a change of device type number, and appropriate notice will be given.

(Top view) 40-lead plastic DIP



- Note: 1)  $t_1 \approx 1.5 \text{ ms}$ ,  $t_2 \approx 0.29 \text{ ms}$ ,  $t_3 \approx 0.019 \text{ ms}$ ,  $t_4 \approx 0.078 \text{ ms}$
- 2) For MSM5524, the level "L" of each output signal of SEGMENT OUT (A ~ G), POINT, AM/AM<sub>B</sub> OUT, PM/FM<sub>B</sub> OUT and STOP WATCH is floated.
- 3) The POINT output is synchronized to the digit signal of 10<sup>2</sup> for lock display, to the digit signal of 10<sup>1</sup> for FM band display and to the digit signal of 10<sup>3</sup> for SW band display.
- 4) The AM/PM output in clock display is synchronized to the digit signal of 10<sup>3</sup>.
- 5) The AM<sub>B</sub>/FM<sub>B</sub> output in received frequency display is synchronized to the digit signal of 10<sup>0</sup>.
- 6) The output signals of SIGNAL, TIMER and SLEEP OUT are output irrespective of the digit signals.
- 7) "▨" denotes the case of DIMMER.

from OKI's uniquely comprehensive series of consumer and communications LSI

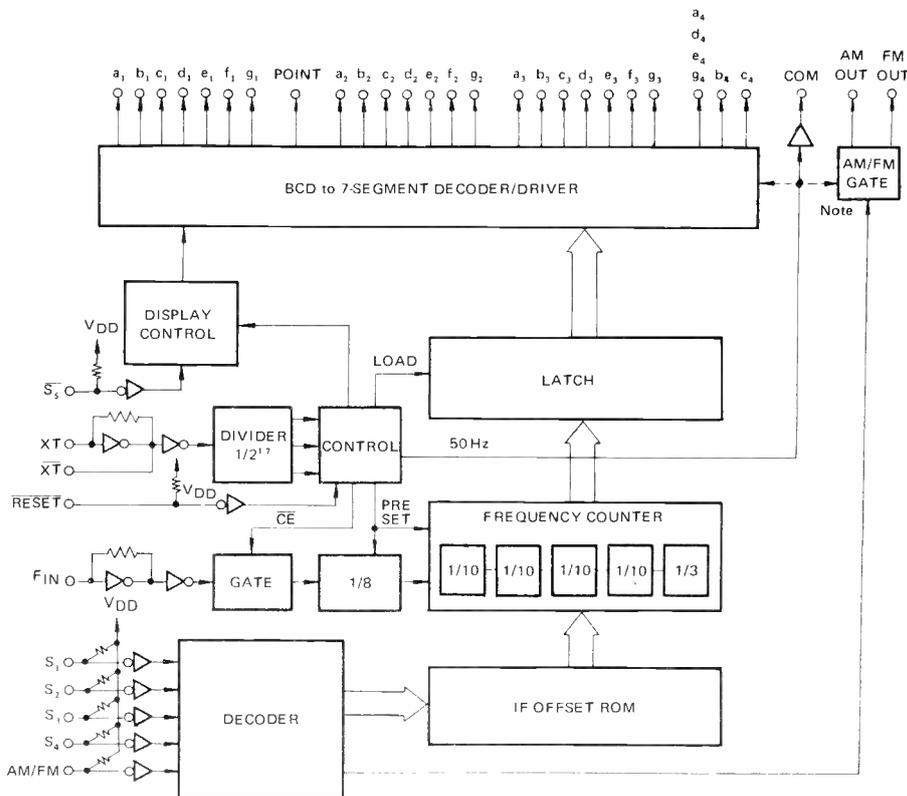
- Direct frequency readout for broadcast AM/FM radio
- 3½ digit resolution:
  - 'AM' up to 2999kHz
  - 'FM' up to 299.9MHz
- AM/FM indicator drive, with a choice of either Fluorescent display (Futaba 6LT06), or LCD display (Ambit LC920)
- Static (non-multiplexed) display, with direct drive of digits and segments for LCD or fluorescent display
- All common IF offsets programmable for both AM and FM operation
- Direct frequency count option, with event count if required

Use MSM5525 for fluorescent (and LED, via drivers) and the MSM5526 for LCD operation

The MSM5525/5 series of CMOS represent the breakthrough in digital frequency display LSI, that marks the boundary between old fashioned mechanical methods of radio tuning, and impeccably accurate "no moving parts" digital technology. The digital frequency display requires no tiresome alignment of pointer to slide rule, or rotary scale, and assists in the manufacturing process by providing its own test facility. The use of varicap diode tuning has been held back by the mechanical constraints of matching diode law to mechanical scale, and now the MSM5525/6 have put all these problems into the past.

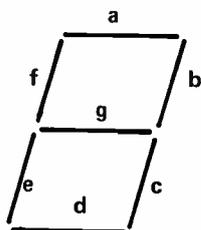
Other LSI in this series are available for combined frequency counter/clock/timer/stopwatch functions (MSM5523/4), and with AM/FM/SW operation, with an additional decade of resolution, plus static display latching for power conservation. (MSM5527 - but this is supplied in 54 lead package not suitable for standard manufacturing techniques.)

The Fluorescent display version (MSM5525) can also drive LED displays, by using driver transistor stages, as per the MSM5523 application details. The static nature of the display requires that current limiting to the diodes is considerably increased.



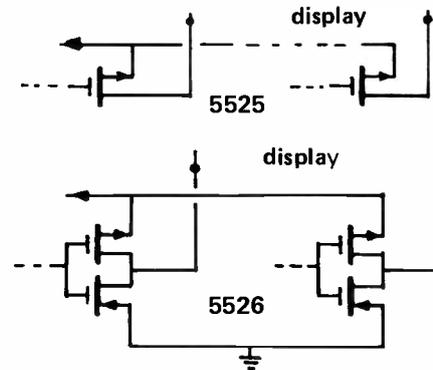
Note: "—" denotes the case of MSM5526RS

### segment identification

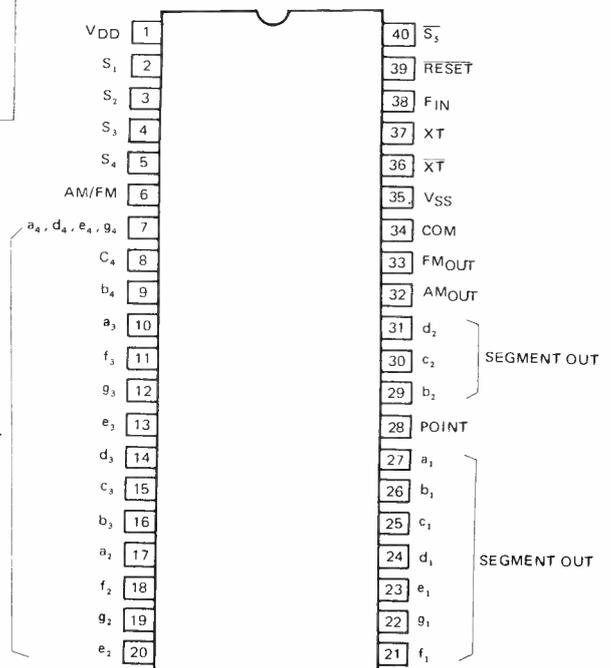


SEGMENT OUT

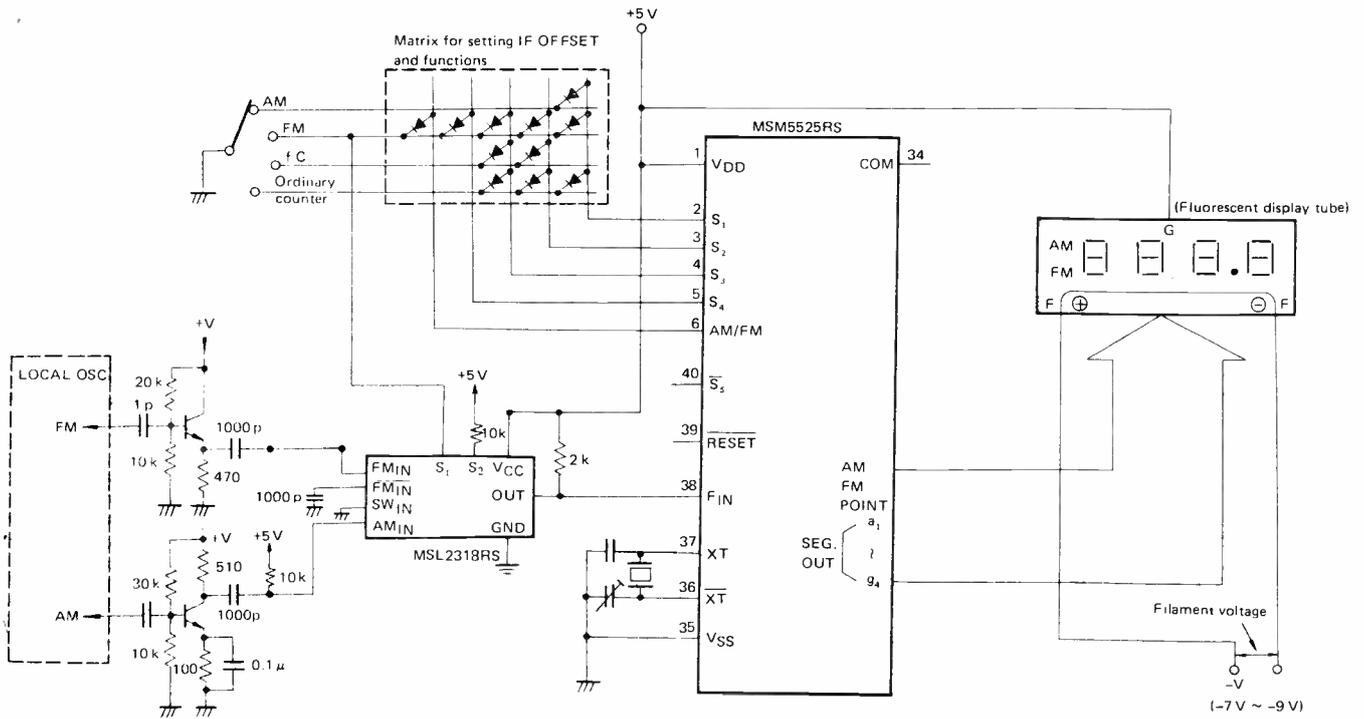
### Output configurations



The fluorescent display driver is an open drain P-MOS configuration. The FET is switched on to light the display, and off to float the output during no display. The LCD driver uses CMOS with 50% duty cycle 50Hz, in antiphase to the common - or backplane terminals, to display the segment. Under no display conditions, the segment and backplane are in phase.

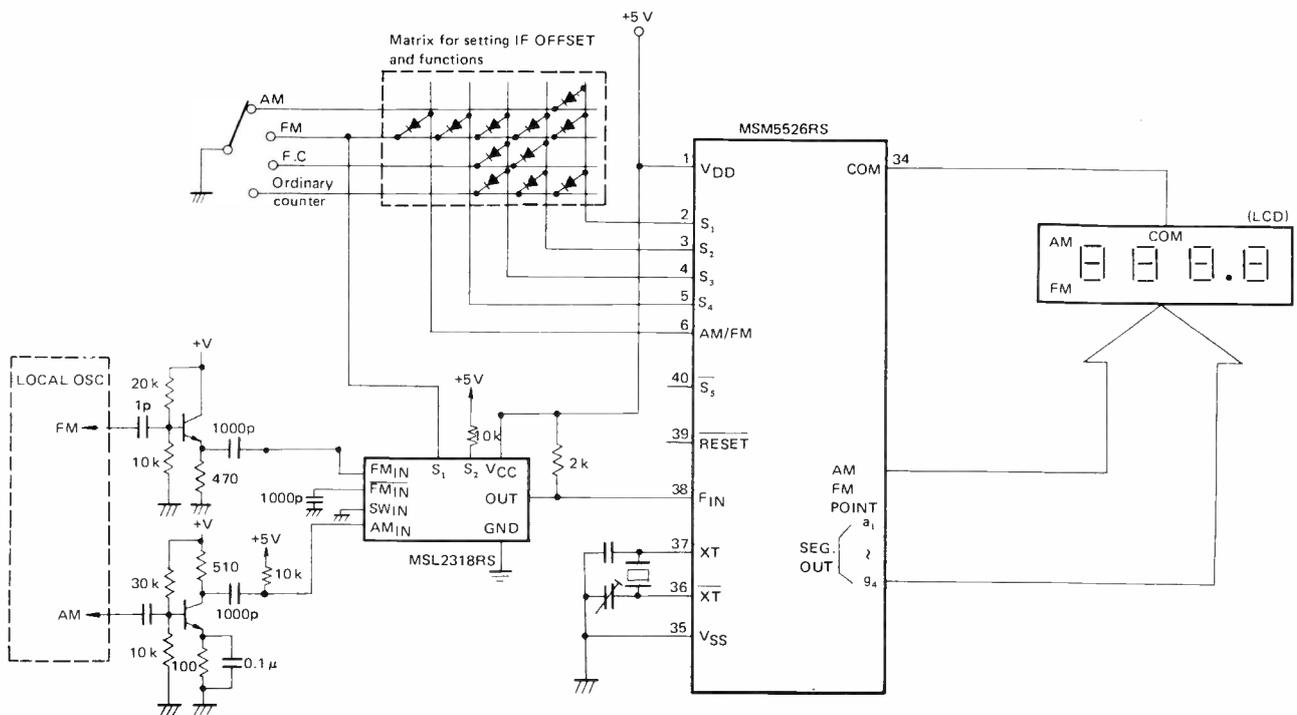


Application example of MSM5525RS



Note: No pull-down resistor for each segment is required.

Application example of MSM5526RS

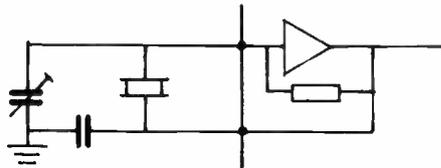


**Operational details**

Terminal analysis

**Crystal oscillator**

A standard frequency 6.5536MHz crystal is connected across a standard CMOS inverter, with capacitors C1 and C2 in the region of 20-60pF.



F in

Operation at this terminal starts with input exceeding 1v p-p, by virtue of an internal CMOS amplifier. When Vin is less than 3.6v, with a Vdd of 5v, use a coupling capacitor, to avoid disturbing the internal biasing arrangements.

**Reset (with internal pull-up resistor)**

Grounding the reset terminal clears all functions to zero. For normal operation, this terminal should be left OC

(1) If the RESET terminal is taken to ground while the IC is in the AM or FM mode, the contents of the IF offset ROM are loaded to the display during the period when the pin is held low - thus the ROM contents can be checked.

(2) If the pin is taken low while in the direct frequency counter mode, or event counter mode, the contents of the IF offset ROM are immediately loaded to the 14 bit latch.

**AM/FM S1 to S4**

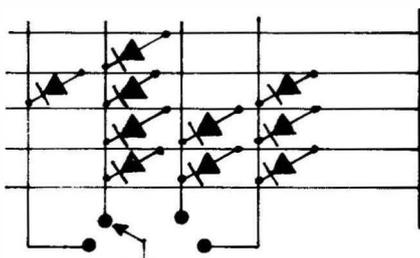
These terminals are used to determine the display selection, and the IF offsets for both AM and FM operation

Display Select	Input conditions					IF offset value
	AM/FM	S1	S2	S3	S4	
AM	H	H	H	H	X	-452.5kHz
	H	L	H	H	X	-454.5
	H	H	L	H	X	-456.5
	H	L	L	H	X	-465.5
	H	H	H	L	X	-467.5
	H	L	H	L	X	-469.5
FM	L	H	H	H	H	+10.68
	L	L	H	H	H	+10.71
	L	H	L	H	H	+10.75
	L	L	L	H	H	+10.79
	L	H	H	L	H	+10.82
	L	L	H	L	H	-10.58
	L	H	L	L	H	-10.60
	L	L	L	L	H	-10.61
	L	H	H	H	L	-10.62
	L	L	H	H	L	-10.63
	L	H	L	H	L	-10.65
	L	L	L	H	L	-10.66
	L	H	H	L	L	-10.69
	L	L	H	L	L	-10.70
L	H	L	L	L	-10.72	
L	L	L	L	L	-10.73	
direct	H	H	L	L	X	none
event counter	H	L	L	L	X	impulses

"H" = open (or Vdd)

"L" = ground (Vss)

"X" = either



Example of selection:

**S5 (with internal pull up)**

In the AM or FM modes, the setting of S5 determines the lowest digit displayed:

- a) open, or Vdd - displays full resolution
- b) grounded in AM mode, last digit always "0"
- c) grounded in FM mode, last digit is 1,3,5,7 or 9 (in accordance with US alternate channelling practise)

**Display**

AM	0 - 2999	kHz
FM	0.0 - 299.9	MHz
Direct count	0 - 2999	kHz
Event	0 - 2999	events

**Segment out (a1 to g4)**

Connect directly to appropriate display

**AM/FM out**

Where AM/FM indication is available, connect to display terminals

**Point**

The decimal point terminal is only active in the FM mode.

**Common**

The common terminal provides the backplane of 50% duty cycle 50Hz for LCD displays. The crystal derived reference may also be used to provide timebase functions for digital clocks and timers.

**Electrical specifications**

Absolute maximum ratings		
Power supply voltage	Vdd	-0.3 to 7 volts
Input voltage	Vin	-0.3 to Vdd volts
Storage temperature	Tstg	-55 to +150°C
Operational range		
Power supply voltage	Vdd	4.75 to 7 volts
Crystal frequency	fC	6.5536 MHz
Operation temperatures	Top	-35 to +85°C
Max count frequency	F	3MHz min (Vdd 4.75v)
with 1v p-p capacitor coupled		
DC characteristics	Output current	
MSM5525	Ioh	>0.2mA (Vo = Vdd - 1vnt)
	Iol	<1µA (Vo = Vdd - 16volts)
MSM5526	Ioh	>10µA (Vo = Vdd - 0.5volts)
	Iol	>10µA (Vo = Vss + 0.5volts)

**Further notes on the applications of MSM5525/6**

The static nature of the display drastically cuts down the interference from this DFM chip, but it must be remembered that the crystal clock will provide a potential source of interference unless the device is carefully decoupled at the supply pin

The 50Hz backplane frequency for the LCD version may also cause RFI when receiving low frequencies, so leads to the display should be to the minimum necessary. Nevertheless, it is possible to operate the circuit less screening in close proximity to a receiver - a feature not possible with multiplexed display systems.

The prescaler for FM operation (the SP/DM8629 is applicable here, since the SW facilities of the MSL2318 are not used) will be a source of RFI - and the supply to this IC must be very carefully decoupled with both ceramic and tantalum capacitors, with 1mH in series to form a full low pass filter configuration. Operation in conjunction with FM equipment may not necessarily be impaired however, since the content at band II is generally insignificant, provided these precautions are observed.

The MSM5525 version operates without individual segment pull-down resistors.

Usual CMOS precautions should be observed when handling these LSI devices, although modern techniques ensure a far more rugged fabrication technique.

**Connections to standard 4 digit LCD LC302**

MSM5526 pin	LCD pin
7	5,6,35,37
8	7
9	34
10	30
11	31
12	32
13	9
14	10
15	11
16	29
17	25
18	26
19	27
20	13
21	22
22	23
23	17
24	18
25	19
26	20
27	21
28	16
29	24
30	15
31	14
34	1 & 40
32	AM ind (na)
33	FM ind (na)



# 20W (RMS) audio power amplifier IC - HA1370

Audio power amplifier ICs have enjoyed a rather notorious career since the early Texas electronic fuses burst upon the scene - many of you will have heard about the more recent types, including the TDA2020 from SGS. The HA1370 is similarly specified, but much easier to use due to the SIL type of construction - and more rugged in operation.

## ELECTRICAL CHARACTERISTICS

Supply voltage +/- 25v, 8 ohm load		min	typ	max		comments
Quiescent current	I <sub>q</sub>		60	120	mA	between + and pin 3
Quiescent current of driver stage	I <sub>q'</sub>			22	mA	between + and pin 4
Output offset voltage	ΔV <sub>o</sub>		0	±0.1	V	between pin 1 and ground
Input resistance	R <sub>in</sub>	f = 1kHz	55		kohms	
Voltage gain in closed loop	G <sub>v</sub>	f = 1kHz	38		dB	R103:680E, R104:56k
Voltage gain in open loop	G <sub>v(ol)</sub>	f = 1kHz	88		dB	
Output power	P <sub>out</sub>	f = 1kHz	20		W	with 1% THD
		f = 20Hz to 20kHz	18		W	with 0.5% THD
		f = 20Hz to 20kHz	15		W	with 0.1% THD
THD	THD	f = 20kHz	0.06		%	at 2W output
Output noise voltage	V <sub>n</sub>	20Hz to 100kHz	0.35		mV	5k source
Supply rejection	SVR	100Hz	52	60	dB	5k source

## Using the HA1370

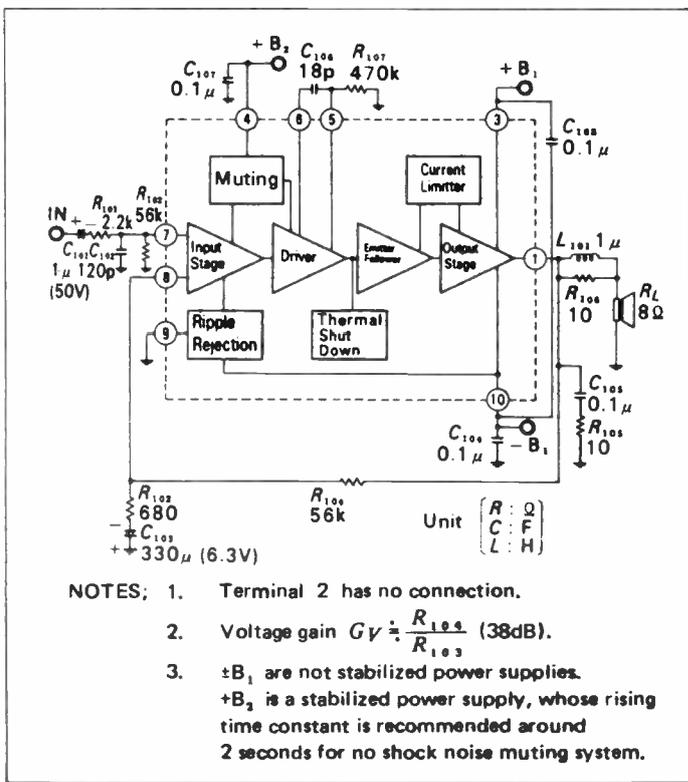
The SIL package may be fixed to the same heatsink as supplied for the TDA2020, since the fixing hole spacings are similar. The heatsink plate should be electrically isolated from all pins and ground.

The HA1370 includes both current and thermal shutdown limiting, though extended operation with the output shorted may lead to deterioration in performance, and eventual destruction. The safety margin of this IC (and all other Hitachi) devices is sufficiently generous to permit a substantial degree of mishandling before damage occurs. In this respect, the HA1370 is far more reliable than its predecessors in the high power AF IC world, and compares favourably with protected discrete designs.

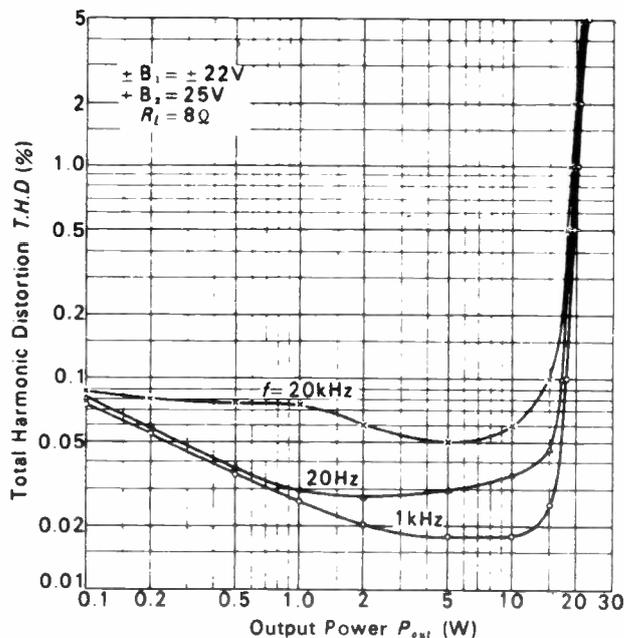
With a -1dB frequency response of 5Hz to 120kHz, the HA1370 complies with current thinking in terms of desirability of fast slew rates - but this also means that much care in layout and earthing is absolutely essential to ensure stable operation and freedom from ultrasonic spuri.

The two separate voltages for the driver and output sections may be combined into one - but for best immunity from shock, the B2 supply should be a stabilized system with slugged risetime. In view of the DC speaker, correct fusing of supplies and speaker are strongly recommended to avoid any possible hazard from incorrectly wired units destroying the speaker voice coil.

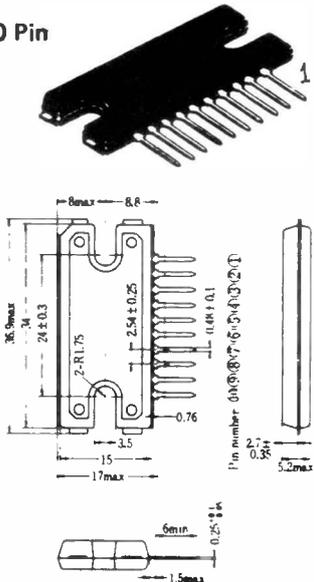
The HA1370 is well suited to applications in active crossover loudspeaker systems, and various amplification systems requiring "medium power".



## TOTAL HARMONIC DISTORTION VS. OUTPUT POWER



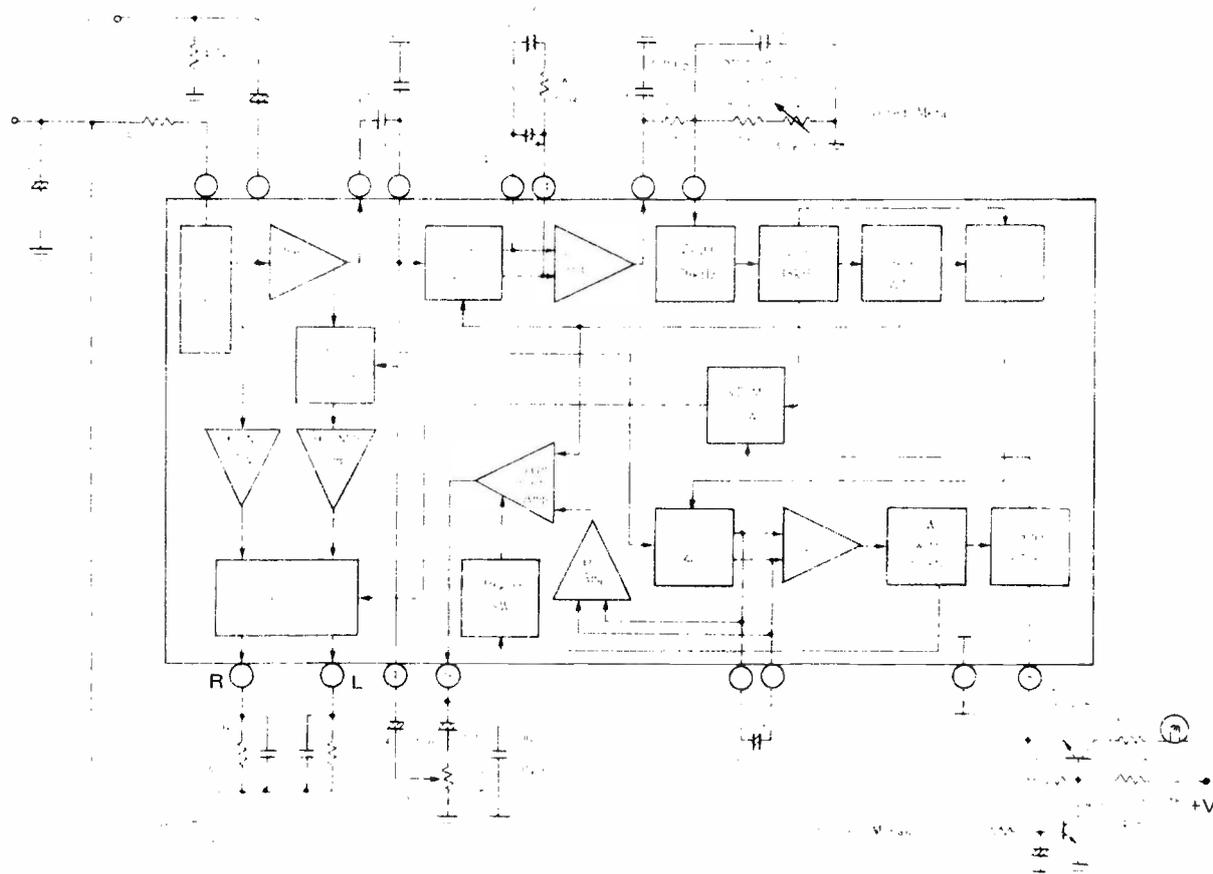
## 10 Pin



## ABSOLUTE MAXIMUM RATINGS (T<sub>o</sub> = 25°C)

Item	Symbol	Rating	Unit	Notes
Positive Supply Voltage	$+B_1, +B_2$	30	V	1
Negative Supply Voltage	$-B_1$	-30	V	
Output Current	$I_{o, peak}$	7.5	A	
Input Voltage	$V_{i, peak}$	±10	V	
Power Dissipation	$P_T$	30	W	2
Junction Temperature	$T_j$	150	°C	
Thermal Resistance	$\theta_{j-c}$	3	°C/W	
Operating Temperature Range	$T_{op}$	-20 to +70	°C	
Storage Temperature Range	$T_{stg}$	-55 to +125	°C	

Notes: 1. Standard operating voltages are as follows:  $\pm B_2 = 25V, \pm B_1 = 22V$   
 2. The value when  $T_{amb} = 60°C$   
 3. Tab should be isolated electrically from every point including GND.



**Block diagram** The pilot cancel system of stereo decoding, as used in the HA11223

#### Pilot Cancel: whys and wherefores

Hitachi's HA11223 and TOKO's KB4437 both employ a new technique to be used in phase locked loop stereo decoders - the name of which has already been given a good airing in the HiFi press as one of the new trade buzzwords for high quality FM tuners. The use of this technique probably has more actual benefit than many "gimmicks" in HiFi, since primarily it improves the audio response of FM tuner to something like 1dB flatness across the entire broadcast spectrum - whilst maintaining pilot tone (ultrasonic) rejection at 60dB or so. Previous techniques have relied on notch filters at 19kHz and the difference channel of 38kHz to provide this rejection, and in the process (since no filter is ideal) caused rolloff from about 13kHz.

Attenuation of 19kHz at 15kHz can vary from 1.2dB to 4dB, depending on the depth of 19kHz notch required - although various corrective measures can be made to straighten out the response. Nevertheless, such measures inevitably contribute to scrambling the purity of the HF audio signal, by the various phase errors created - and the solution is simply to use the pilot signal out of phase, to cancel out at the decoder output.

The notch filters in the pilot cancel system can be of two types - one simply to remove the residual 38kHz (single pole), or one with two notches, but in place of the 19kHz notch, a 26kHz notch is used instead. This frequency is sufficiently far removed from 15kHz to cause only a nominal 0.6 dB loss at 15kHz - in this way, however, the 38kHz notch is considerably steepened, and the primary notch has a side effect of helping take out some of the signalling frequencies sometimes encountered on FM transmissions that are used to control repeaters.

As well as the pilot cancel features, the new generation of decoders have improved THD (typically 0.01% at 1kHz), better S/N - to the extent that with a properly designed IF, the difference in absolute S+N/N for mono and stereo is barely audible. The use of 100% negative feedback amplifiers within the IC contribute greatly to these improvements, which make the use of earlier types of stereo decoder in new designs a positively retrograde step! For manufacturing purposes, the new pilot cancel decoders are still 'single sourced', since the TOKO and Hitachi types are almost - but not completely - interchangeable. Furthermore, unless the rest of the set deserves it, there may not be any real advantage, and there are very few basic designs around that can match the performance required to get the most from the pilot cancel system.

It must be noted that the supply voltage is 13v, 12v will lead to clipping on output signal levels of 1v p-p unless the supply is adequate.

In completely DC designs, the input and output of the decoder may be directly coupled as well, although careful experimentation is required to achieve the best results. Considering the weakest link in the chain is probably somewhere from studio to transmitter, such a feature is almost certainly likely to be wasted.

#### Drive level considerations

In order to achieve the best S/N, a reasonably high level of drive is required. 300mV (rms) is usually quoted as the reference point, although the device data sheets for the HA11223 go into great detail concerning the correlation of various dynamic parameters. With the CA3189E type of IF system, this type of input drive is easily achieved. Drive level is primarily a compromise between S/N and THD.

#### Practical applications

Elsewhere in this catalogue systems using both the HA11223 and the KB4437 are described in detail. In the case of the KB4437 a muting stereo preamplifier - the KB4437 is used to provide preamplification to usual "standards", combined with a totally silent muting system that is driven either from the IF muting voltage, or from the mono/stereo indication. The pilot cancel decoder can be used without modification in many existing tuners, where the audible improvement over first generation PLL decoders, such as the MC1310P, uA758 etc., can be quite dramatic. The IF bandwidth of the preceding sections should be approx 210kHz min to achieve best separation - since although a degree of correction can be applied in the composite path by phase advance circuitry, there is no substitute for a good linear phase IF of the correct bandwidth.

Most aspects of use of the new decoder ICs are common to all types of multiplex decoder, and that includes the need for a very pure supply voltage, with plenty of decoupling to prevent the reradiation of the various switching frequencies, and their harmonics, around the rest of the circuit.

#### Comparative measurements

In so much of HiFi and Audio, the figures tend to mean very little. The two pilot cancel decoders discussed here are unquestionably superior to all the previous IC designs - and also the various discrete decoders that have found their way into WW and other magazines. Moreover, the superiority is very distinctly audible from a subjective judgement, and not one listener has yet been in disagreement with this opinion. The reasons for this may be found by reference to test statistics, but perhaps they also owe something to the subtle reactions of the human ear to apparently supersonic sounds by virtue of intermodulation products (of a desirable nature) being recreated with the additional AF bandwidth available.

With this advance, it is hard to imagine what to expect next - since the broadcasters haven't quite caught up with the standards of the HA1196 yet. As far as it is possible to predict, the only likely innovation left is to include a form of variable high frequency blending, driven from the signal level metering circuit. The TCA4500 does this quite nicely, but in most other respects, the TCA4500 is not in the same league of HiFi reproduction, albeit a useful device for car radio.

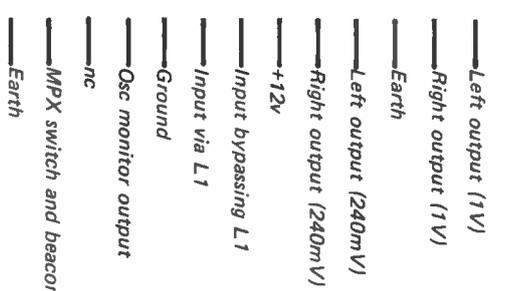
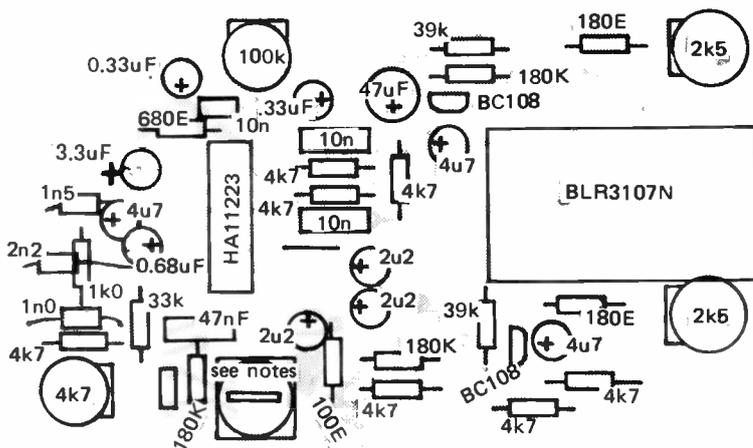
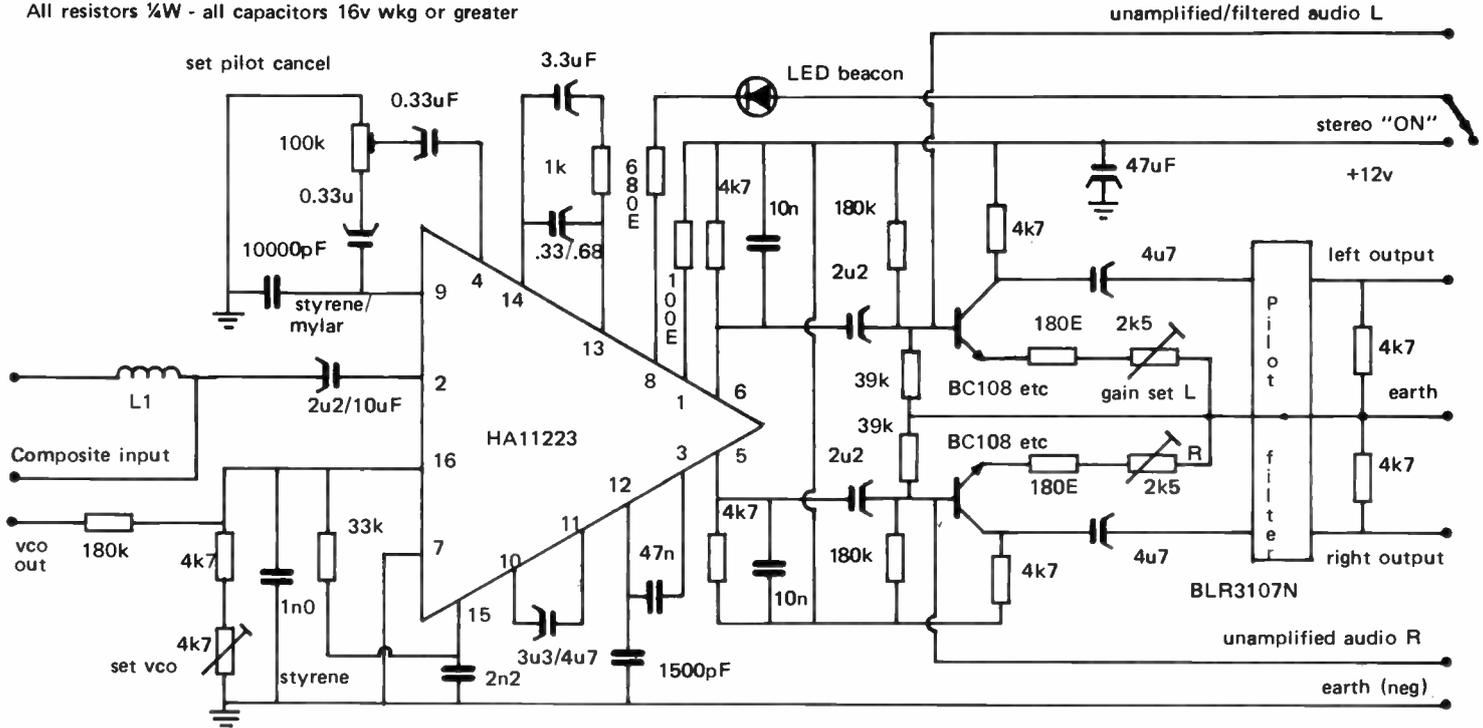
# PILOT CANCEL STEREO DECODER - HA11223

HA11223  
HA11223  
HA11223  
HA11223

The HA11223 pilot cancel stereo decoder

**Application circuit**

All resistors 1/4W - all capacitors 16v wkg or greater



**Description**

The HA11223 employs a pilot cancel facility to enable typ. 60dB of 19kHz suppression to be achieved without recourse to external filtering - this feature enables a totally flat frequency response to 15kHz, and greater freedom from HF intermodulation products.

The HA11223 also features ultra low distortion by the use of 100% negative feedback in susceptible sections of the circuits permitting 0.01% mono THD and a very wide dynamic range of operation.

The loop filter also includes an additional element to reduce HF intermodulation products to a minimum of approx. 0.06% (Main 10kHz/ IM 1kHz)

The practical application module described here is available ready made or in parts form from Ambit, and includes facilities for an input notch in conjunction with L1, for use in areas where 100kHz/200kHz alternate channel interference is obtrusive on stereo signals. The notch should be set for approx. 100kHz with appropriately selected values of L1 and parallel capacitor.

The output preamplifiers boost the recovered audio level to typically 1 v where required, and provide the correct isolation for driving the LC 19/38kHz notch filter. Deemphasis is nominally 50uSec.

**Specifications 300mV input**

Parameter	300mV input	
Input impedance		75k ohms
Channel separation	100Hz - 10kHz	40dB
Stereo THD	1000Hz	0.02%
	10kHz	0.05%
Mono THD		0.01%
Pilot level to switch	19kHz	12mV
Output voltage	from IC only	240mV
19kHz output	..	-60dB
38kHz	..	-35dB
67kHz rejection		-80dB
S/N ratio	4k7 source	86dB
Maximum input	for 0.5% THD	1200mV
Supply range		12-14v
Supply current		17mA
Lamp drive	Continuous	75mA
	Surge max	100mA

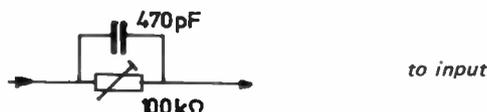
**Further user notes:**

The pilot cancel may only effectively be aligned in conjunction with an oscilloscope or spectrum analyzer - or tuned audio millivoltmeter. The output level after transistor preamplification stages should be set for balance on a mono transmission /test signal.

A single pole (38kHz) output filter may be used in preference to the dual type described here.

The channel separation depends very largely on the preceding IF bandwidth. Compensation for narrow IF systems may be made using the circuit shown alongside.

Phase advance circuit for narrow IFs preceding the decoder:



(Use with 7030/7130 IF systems from Ambit)

**The 44378 decoder unit features the very latest pilot cancel decoder IC - the KB4437 from TOKO, together with the low distortion muting preamplifier, the KB4438:**

- Ultra low distortion: 0.03% typ overall at 1kHz  
0.08% 10kHz
- Pilot cancel method, for flat response to 15kHz
- 26kHz, and 38kHz notch filters for residual switching interference suppression
- 55kHz input low pass filter ("Birdy Filter")
- Excellent S/N and separation
- Suitable for DC coupling to preceding IF system output
- Muting facility *after* the IF and decoder, driven from the muting signal from the CA3089/3189, HA1137 or KB4402/4420A families of IF systems
- Auto stereo switching + VCO kill option
- Power on mute delay facility
- Phase delay compensation on decoder input
- Adjustable output levels

**Outperforms all known broadcast standards - and all previous stereo decoder systems under £100**

**Operation of the system**

The input circuit, including the 55kHz LPF stage, closely resembles that of the 91196B decoder system, enabling direct coupling to the preceding IF stage, via a 4k7 resistor to the audio output pin. R1 and R2 must be removed for correct DC operation. This facility enables fast response tuning to take place, without the delays associated with coupling capacitor charge times etc. The input stage also provides a small amount of gain, to permit the input levels to the decoder IC to be optimized in any given application.

The internal arrangement of the decoder, IC1, is similar to most PLL arrangements to be found in the MC1310/HA1196 etc., but with the addition of 19kHz phase cancel circuit, that suppresses pilot tone in the output by some 60dB. This permits the filter stage to be completely flat throughout the entire AF spectrum, with the first pole at 26kHz, instead of 19kHz.

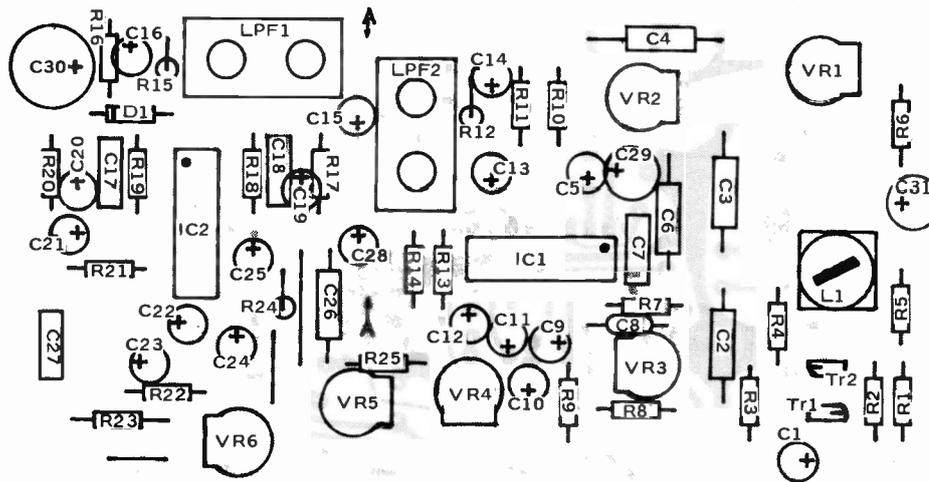
LPF1 & 2 are essential for the removal of remaining harmonics of the 19kHz tone, as well as providing a general low pass type of characteristic for any supersonic SCA or intermodulation products before the stereo preamplifier, IC2 is used. VR4 is the adjustment of pilot phase, and should be set for minimum 19kHz at the output with a multiplex signal present at the input. IC2 provides audio gain, and also the required de-emphasis by virtue of R19/C17 and R18/C18.

Minimum THD in IC2 occurs with 1v rms output - the IC itself proding 23-24dB of voltage gain. The muting circuit on the IC can operate in conjunction with the mute signal from the IF strip, since the mute is brought into function when pin 8 of the IC is raised above a nom. 1.5v., with C24 and C28 controlling the speed of the action of this function. However, post IF muting also enables other forms of mute

control to be used - such as the presence of a stereo pilot tone on the transmission. In cases where exceptionally high gain tuners lead to false operation of the basic IF muting, a separate noise mute may be used (but still in conjunction with deviation mute from the IF IC) to provide muting that is adjustable in operating point, with regard to varying S/N ratios.

The auto stereo defeat control on pin 8 of IC1 may similarly be operated from the mute control voltage, to disable stereo reception on weak signals - where the main signal muting is not used. Where the muting of the IC2 stage is used at the same time, it is implied that stereo will be enabled at the same instant as the main signal path.

The beacon lamp/LED is taken to the +ve supply rail - taking care that the operation of the beacon does not affect any supply voltages to cause motorboating effects.



**Connections:**

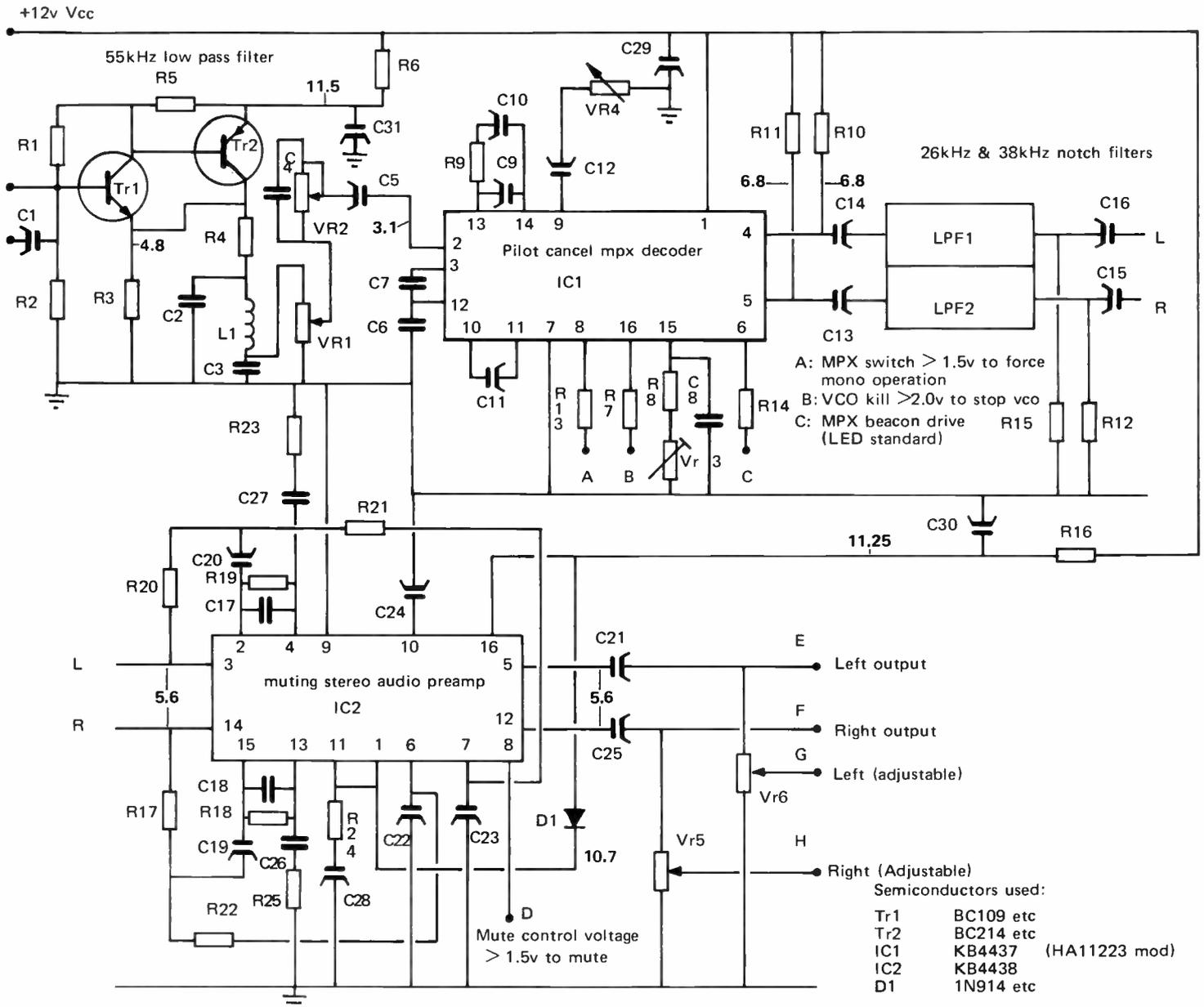
- 1 Earth
- 2 +Vcc 12v
- 3 Left output (E)
- 4 Mute control voltage for IC2
- 5 Earth
- 6 Left output (G)
- 7 Right output (H)
- 8 Right output (F)
- 9 Vcc +12v (alternative)
- 10 Earth
- 11 MPX beacon (C)
- 12 auto mpX switch (A)
- 13 VCO kill (B)
- 14 Input
- 15 DC input
- 16 Earth

Brackets ( ) indicate reference on cct diagram  
Certain connections are apparently duplicated to maintain compatibility with 91196B edge terminations as far as possible.

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16

**Specifications of the 44378 Vcc +12v**

Parameter	Symbol	min	typ	max	unit	comments
Current drain	I		33	45	mA	without mpX beacon
Input impedance	Zin		50		k ohm	
Input voltage range	Vin	150	300	3000	mV	set into IC1 via Vr1
Output voltage	Vout		900		mV	input to IC1 150mV
Channel separation	Sep		45		dB	at 100Hz
			45		dB	at 1kHz
			40		dB	at 10kHz
Distortion -mono	THD		0.02	0.08	%	Vin 400mV to IC1
Distortion -stereo	THD		0.04		%	at 100Hz
			0.02		%	at 1kHz
			0.05		%	at 10kHz
Signal to noise ratio			86dB			
Stereo lamp on level to IC1			13	20	mV	at 19kHz
SCA rejection ratio of IC1			80		dB	
Pilot tone at output			-65		dB	at 19kHz
			-80		dB	at 38kHz
VCO stop level (B)				2	v	
Auto stereo switch level (A)			1.33		v	
Muting attenuation	M att	72	80		dB	
Muting time from on to off	Mt(1)		0.15		sec	
Muting time from power on	Mt(2)	1	1.6	2.5	sec	switchon delay
Transient level at power on/off			30	100	mV	
S/N under muted conditions		96	109		dB	
Mute on DC level	V8	1.2	1.35	1.5	V	



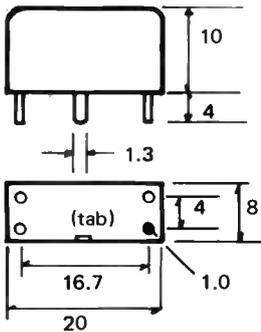
Complete circuit of the 44378 Test voltages are shown in bold type

Table of component values

Resistors: all .25W / 10% or better (* indicates 5% min)				Capacitors and misc			
R number	nominal	permissible range	function	C number	nominal	permissible range	function
1	470k	330k-560k	birdy filter input biasing	1	2u2	1-10uF	input coupling
2	as R1			2	1500pF	1200-1800pF	filter tuning
3	2k2	1k8-2k7	input load to filter network	3	680pF	560-820pF	filter tuning
4	1k2	1k0-1k5	drive load to filter	4	470pF	390-560pF	mpx phase balance
5	47k	39k-56k	biasing	5	2u2	1-10uF	IC1 input coupling
6	56E	47E-100E	Birdy filter Vcc decoupling	6	820pF	680-1000pF	PLL phase correction
7	47k	39k-56k	VCO killer coupling R	7	47n	39-56n	phase det. coupling
8*	15k	12k-18k	VCO timing	8	470pF	390-560pF	vco tuning C
9	820E	680E-1k	Loop filter	9	1u	1-2.2uF	loop filter
10	4k7		MPX filter termination load	10	6u8	4.7-10uF	loop filter
11	as R10			11	1u	1-2.2uF	switch filter
12	as R10			12	1u	1-2.2uF	pilot cancel phasing
13	10k	10k-47k	MPX switchover coupling R	13	2u2	1-10uF	RH output
14	680E	680E-1k	LED beacon current limiter	14	as C13		LH ..
15	as R10			15	2u2	1-10uF	RH input to IC2
16	33E	27E-47E	Stereo preamp Vcc decoupling	16	as C15		LH ..
17*	30k	27k-33k	preamp biasing	17	1n5	50uS	Deemphasis LH
18	as R17		neg. feedback loop		2n5	75uS	
19	as R17		preamp biasing	C18	as C17		Deemphasis RH
20	as R17		preamp biasing	C19	4u7	2.2-10uF	feedback coupling
21	1k8	1k5-2k2	..	C20	as C19		
22	as R21			C21	4u7	2.2-10uF	LH output coupling
23	680E	620E-750E	neg. feedback frequency res.	C22	47u	33-100uF	RH bias decoupling
24	560E	470E-680E	mute "off" time constant	C23	as C22		LH ..
25	as R23			C24	33u	22-47uF	"on" delay control
VR1	25k		IC1 input level set	C25	as C21		RH output coupling
VR2	47k	47k-100k	phase balance adjustment	C26	180pF	150-220pF	RH feedback rolloff
VR3	4k7	4k7-10k	VCO timing set	C27	as C26		LH ..
VR4	25k	25k-47k	19kHz pilot cancel set	C28	100uF	100uF-330uF	"off" delay control
VR5	4k7	4k7-10k	Right output level	C29	47uF	33-100uF	IC1 supply decouple
VR6	as VR5		Left output level	C30	100uF	47-330uF	IC2 ..
				C31	as C29		Birdy filter ..
				L1	CAN1980	6-10mH	Birdy filter tune
				LPF1&2	208BLRC3155/2		26/38kHz filter

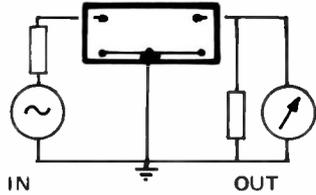
## Dimensions in mm

approx actual size



## Test circuit

Impedances selected from table to suit filter used



The CFM is a suitable filter to provide switched bandwidth capability in receivers such as the FRG7, to provide NBFM, AM and SSB facilities with the MFL455 series mechanical.

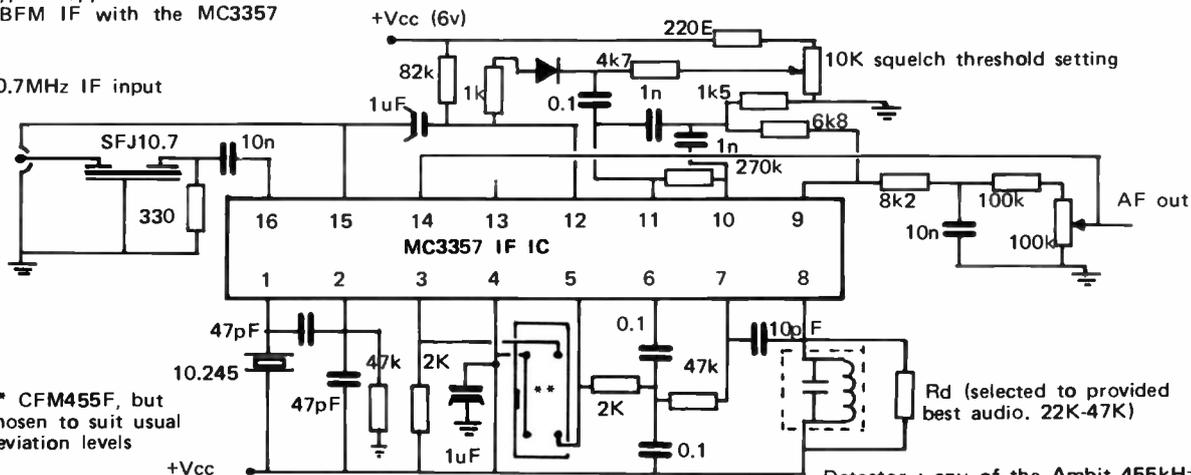
Correct termination is essential for minimum ripple bandpass characteristics (better than 3dB)-

an 18 page application note is available for the CFM series, with details of bandpass, phase and various mismatch effects.

It is advisable to precede the CFM (and any ceramic/crystal filter) with at least one LC tuned stage to provide best spurious rejection when using it for HF purposes.

Typical application:  
NBFM IF with the MC3357

10.7MHz IF input



\*\* CFM455F, but chosen to suit usual deviation levels

Detector: any of the Ambit 455kHz range will do suggested use LMC4200, leave 2ndary OC.

The choice of filter will depend largely on the nature of deviation. For all commercial (PMR) deviation, the CFM455H is recommended, though for amateur use, the G and F are perhaps better suited to cope with the broader deviation and less accurate channelling frequently encountered.

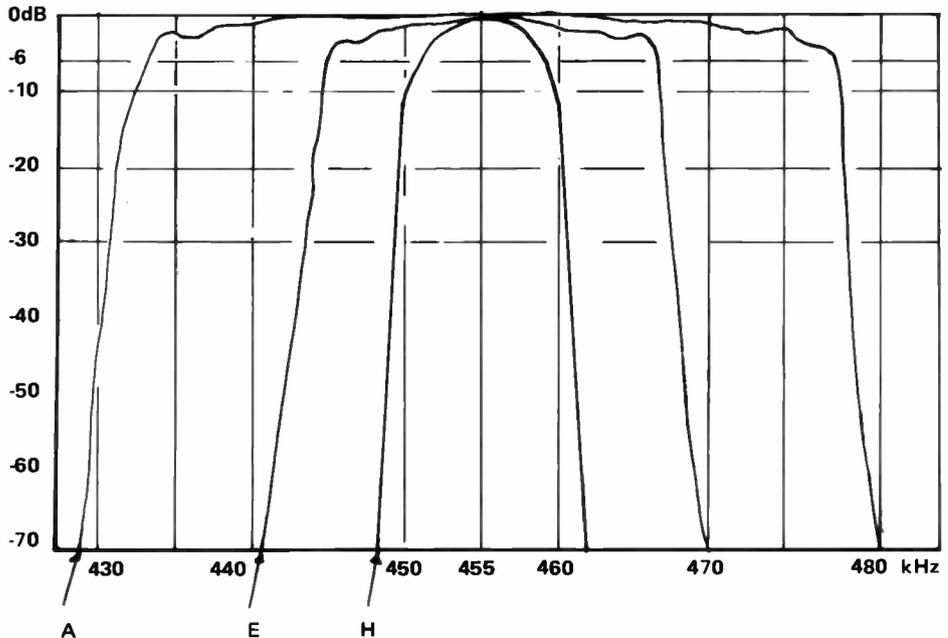
## General information:

The CFM series ceramic filter is selected from the range of Murata filters frequently found in imported equipment. It is a suitable replacement for re-channelling many types of HF/VHF receiver equipment, as well as being applicable to new designs. Various bandwidths are held in stock to suit applications in NBFM and AM

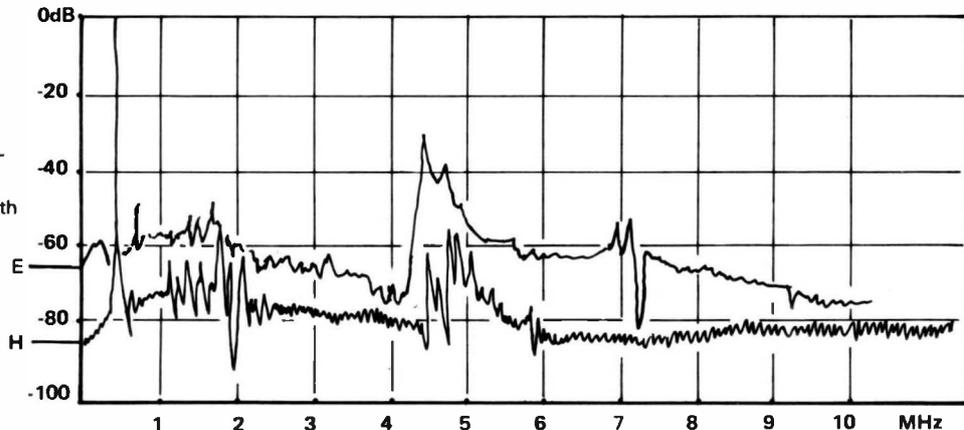
Stock type	Centre frequency	-3dB	-6dB	-60dB	Spurii $\pm 100$ kHz	loss	in/out imp.
CFM455D	455kHz	$\pm 7$	$\pm 10$	$\pm 20$	50dB	3dB	1K5 ohms
CFM455E	..	$\pm 5.5$	$\pm 8$	$\pm 16$	45dB	5dB	1K5 ohms
CFM455F	..	$\pm 4.2$	$\pm 6$	$\pm 12$	45dB	6dB	2K0 ohms
CFM455G	..	..	$\pm 4$	$\pm 10$	45dB	6dB	2K0 ohms
CFM455H	..	..	$\pm 3$	$\pm 7.5$	45dB	6dB	2K0 ohms

The above specifications are minimum performance only, typical examples are used in the diagram details

## BANDPASS CHARACTERISTICS for CFM455A, E and H



## SPURIOUS RESPONSES for CFM455E and H



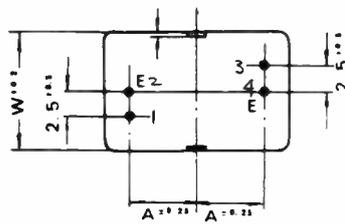
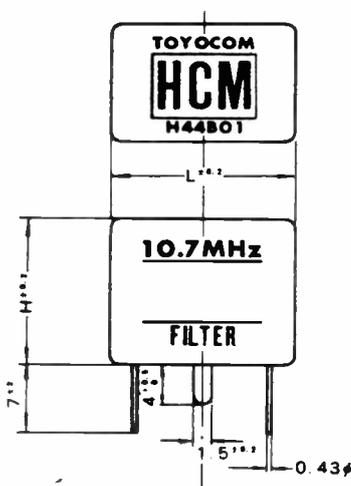
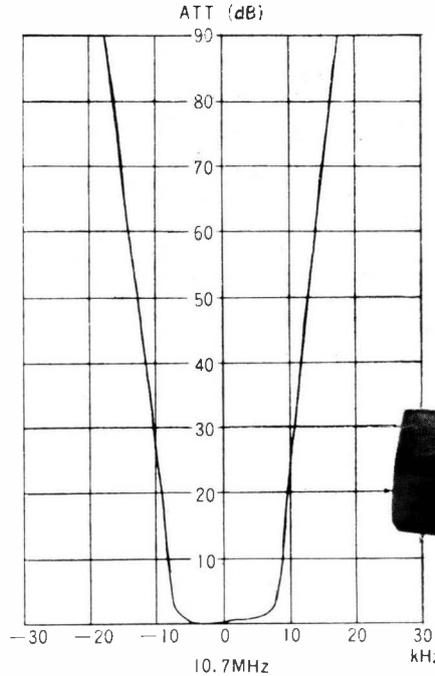
This is a full specification crystal filter for 10.7MHz IF channelling, with better than 90dB adjacent channel rejection. The small size enables the device to be used in base, mobile and portable applications. No additional selectivity is required in circuits employing such a filter, but it is useful to include some form tuned coupling to prevent SW pickup and general IF breakthrough in wideband untuned stages.

When correctly matched, the filter exhibits less than 1.5dB passband ripple, and as a result of various dynamic tests, a suggested range of matching transformers has been devised as follows:

Required input impedance	IFT	Required output impedance	IFT
1k	KAC8448PJQ	10k	KAC8448PJQ
100ohms	119LC30099	2k	119LC30099
10ohms	85FCS4402SEJ	100ohms	85FCS4402SEJ

In all instances, the tuned winding is to be connected across filter input (or output), as shown. All 10.7MHz IFTs so far examined in conjunction with this filter have proven to be suitable - but the input matching is certainly far more critical than the output matching, where any impedance in excess of the stated value will match without trouble (up to about 50k). The ideal match is a resistive 3k load, and for the pedantic, a source follower driver with 3k source resistor makes a perfect match from a wide range of misc. inputs. Where in the input impedance is not known, usually this will be larger than the ideal value to match the IFT. In this case, a 5k preset can be connected across the input transformer on the coupling winding side, and trimmed to provide best results. (Least passband ripple.)

Center Frequency	10.7 MHz
Pass Band Width	more than $\pm 7.5$ KHz (6 dB)
Ripple	less than 2 dB
Stop Band Discrimination	less than $\pm 15$ KHz (60 dB) less than $\pm 20$ KHz (80 dB)
Insertion Loss	less than 4 dB
Attenuation Guaranteed	more than 80 dB
Operating Temperature Range	-40°C ~ +80°C
Nominal Impedances	3 k $\Omega$
Maximum Input Level	+10 dBm
Case Code	H-4
Weight	8 gr. approx.
Remarks	Matching transformers are not included.



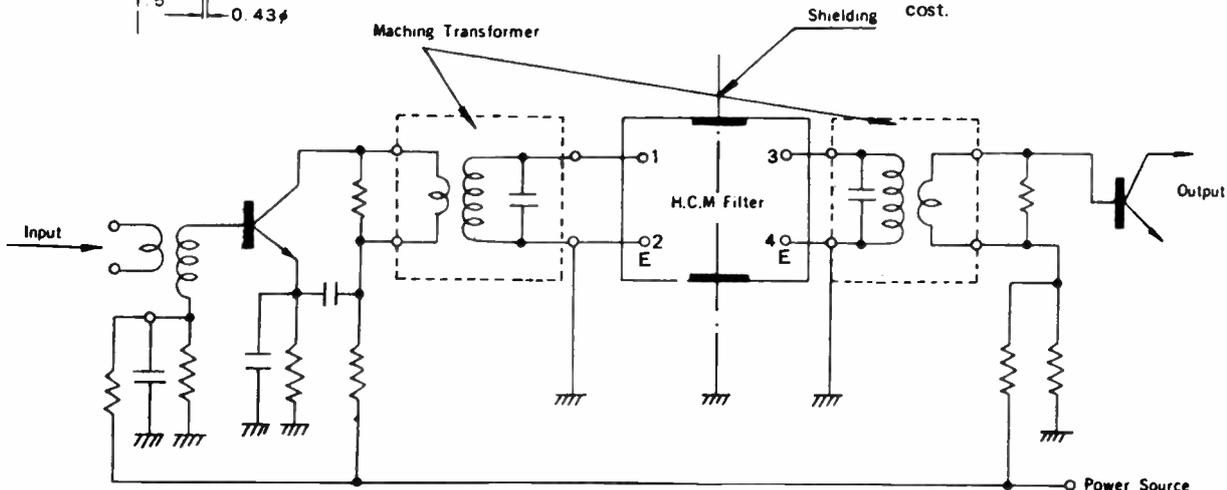
Dimension of Filter

Case Code	L	H	W	A
H-3	15	15	12	4.5
H-4	18.5	15	12	6.7

**General information and comments**

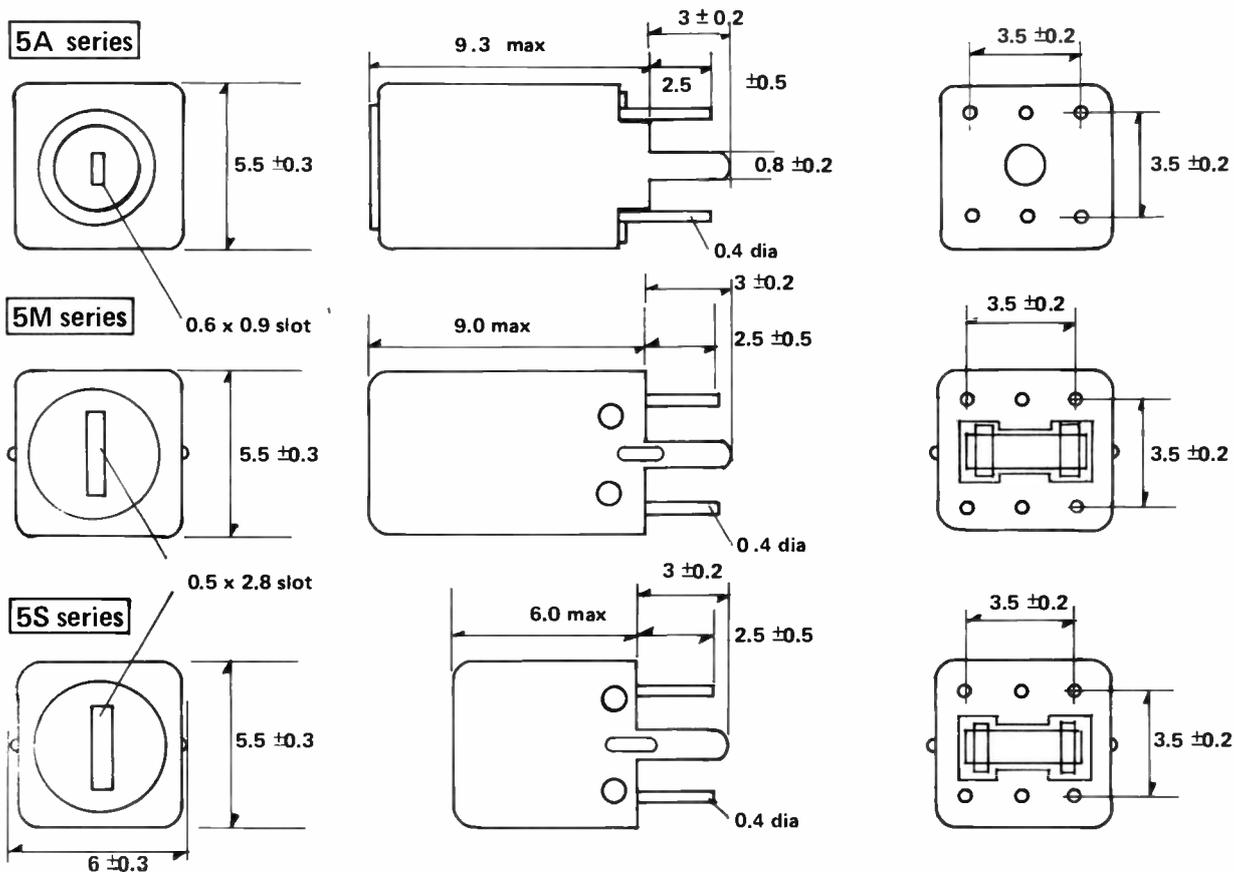
With so much emphasis placed on the selectivity at the crystal filter - many amateur designs overlook the importance of good input/output screening if the stopband of the filter is to meet specification. 90dB is a lot of isolation, and the layout practice must reflect this for best results.

Now that double conversion is enjoying a revival, it is quite possible to use the 10M4B1 in conjunction with a 455kHz type of filter - but check the accuracy of the second conversion oscillator. Otherwise, a small shift will completely offset the two filter responses - and in many VHF RX designs, it is becoming desirable to switch the bandwidth for 12.5/25kHz spacing. The second IF filter may be switched more easily than at 10.7MHz, and at far lower cost.



A COMPLETELY NEW RANGE OF SUB-MINIATURE TUNEABLE COILS FOR IF, RF and oscillator

ALL DIMENSIONS SHOWN IN MM



## TOKO's new miniature coils series, in 5mm format

This series supercedes the previous range of 5E coils, and offers many distinct advantages:

- ◆ A complete range from 100kHz to 175MHz
- ◆ 5A and 5M types may incorporate tuning capacitors if required
- ◆ Large adjustment aperture, with redesigned core support system to minimize breakages in alignment
- ◆ Improved packing density

### The 5A - for 30 -175MHz

These miniature shielded coils are well suited to all types of VHF application, up to a maximum inductance of 0.3uH. The 5A is recommended for many types of communication application, including oscillators, multipliers and rejectors - however, the relatively lower 'Q' of such a compact design may make one TOKO's larger format coils better in RF and mixer applications.

In many paging applications and remote control systems at VHF, the 5A is the smallest tuneable inductor you can obtain in the world - where necessary or advantageous, the 5A is available without a screening can for improved circuit Q.

### The 5M - for 100kHz to 15MHz

The 5M series are approximately the same size as the 5A types - and in the same dimensions, an internal capacitor of up to 1500pF may be accommodated. The 5M types are well suited AM and FM IF applications, RF and oscillator stages. Despite its diminutive appearance, the 5M possesses an environmental specification that enables its use in professional and communications equipment destined for use in vigorous climatic conditions.

### The 5S - for 100kHz to 15MHz

The 5S range cover basically the same applications as the 5M - except with approx. 30% less height. The smaller overall size means that Q is slightly lower, and the maximum inductance available slightly lower - but for miniature radio equipment, there is no better suited component. Using the KV1210 varicap tuning diode - a complete AM/FM radio can be constructed using TDA1083 ICs, that is less than 9mm thick overall.

## GENERAL INFORMATION

The introduction of the 5A, 5M and 5S coils realizes new standards in miniature RF/IF transformer design. The original 5mm series - TOKO's famous 5E range - is now discontinued, and types originally designed for 5E are being provided in 5S or 5M styles. Sample types of the three ranges are being held for customer evaluation - mainly based on the existing 5E range, and versions that have been scaled down from popular 10mm and 7mm styles.

All three types fit into the same basic PC pattern.

## Design Data for the 5A, 5M and 5S

Type	Prefix	Frequency range	Inductance range	Adjustment range	Qu±20% at MHz	Temperature coeff.: ppm/°C
5A		30 - 175MHz	0.03 to 0.3uH	Lo±6%	70-100 @ 100	(-10 to +60) 0 - 150
5M	5MMC	0.2 - 1.0MHz	20 to 1000uH	Fo±2%	110 @ .455	.. 0±150
	5MMN			Lo±4%		
	5MNR	0.5 - 3.0MHz	20 to 560 uH	Lo±6%	90 @ 1.4	.. 0±150
	5MAC	2.0 - 15MHz	1.0 to 30 uH	Fo±2%	100 @ 10.7	.. 0±60
	5MAN	2.0 - 15MHz	1.0 to 30uH	Lo±4%	100 @ 10.7	.. 220±60
	5MFC	2.0 - 15MHz	1.0 to 15 uH	Fo±2%	110 @ 10.7	.. 0±60
5MFN	Lo±4%			220±60		
5S	5SLC	0.2 - 1.0MHz	20 to 680uH		Fo±2%	70 @ .455
	5SLN			Lo±4%	750±250	
	5SNR	0.5 - 3.0MHz	20 to 360uH	Lo±6%		70 @ 1.4
	5SPC	2.0 - 15MHz	1.0 to 28 uH	Fo±2%	70 @ 10.7	.. 0±120
	5SPN			Lo±4%		
	5SFC	2.0 - 15MHz	1.0 to 15 uH	Fo±2%	70 @ 10.7	.. 0±120
5SFN	Lo±4%			220±120		

## General Specifications

5A	
Core torque:	10 to 150 gm.cm
Dielectric strength:	No abnormality when applying 100v DC between case and pins, or between primary and secondary for a period of one minute
Insulation resistance:	Greater than 100MΩ at 100v DC between case and pins, and primary and secondary windings
Solder dipping:	No apparent defect when the pins are dipped up to 2mm from the base surface in molten solder at 270°C for a period of 5 seconds
Vibration testing:	Applying a 1.5mm amplitude vibration for two hours along each of three axes, and cycling the frequency from 10Hz to 55Hz in 60 seconds the change in inductance will be within ±1% of the initial value, and the change in Q within ±20%
Shock testing:	After the application of a 100G shock for 0.01 seconds, along each of three axes - the shift from initial values of L and Q will be ±1% and ±20% respectively
Humidity testing:	After exposure to 90/95% relative humidity for a period of 96 hours, at 40°C - the shift from initial values of L and Q will be ±1% and ±20% respectively

5M and 5S as 5A, except 20-300gm.cm core torque

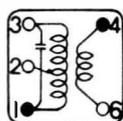
## Internal Capacitors - 5M and 5S types only

The following internal capacitors are available for either 5M or 5S coils

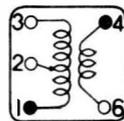
18, 22, 27, 33, 39, 47 pF	T.C. - 220 ppm/°C
180, 1500 pF	T.C. - 750 ppm/°C

## Base connections

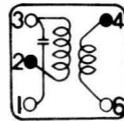
For 5M and 5S types, the internal capacitor may only be fitted between pins 1-3, 4-6, 3-6, 1-4  
These base connections are in accordance with standard practise in 7 and 10mm series coils



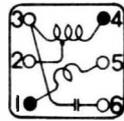
N:1)



N:2)



M



L

● Black dot indicates start of winding.

## When ordering:

Please specify by:

- coil type
- inductance, or centre frequency if IFT
- capacitor value if IFT
- operational frequency range
- Q required
- temperature range (coefficient)
- base connections from above table
- if you require a type scaled from any other TOKO range, please specify original part number
- please try to use coils from the list of standard parts which is published and updated from time to time

## General Application Information

Do not use ferrous tools for adjustment of cores, the high density of the coil structure makes the effect of ferrous trimming tools particularly severe. Locate all coils away from magnetic fields, such as high density speaker magnets etc.  
For best RF performance, always use the largest possible format of coil permissible in a given design brief.

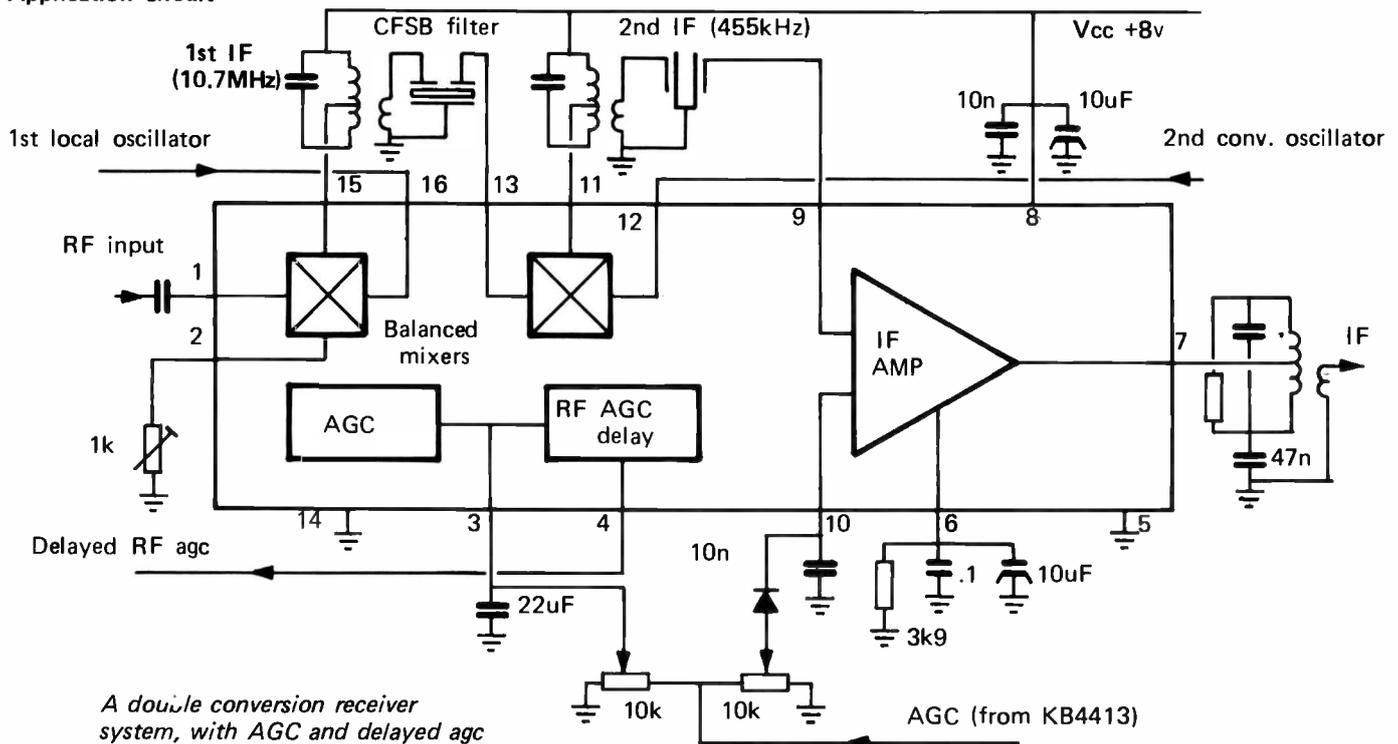
TOKO (UK) Ltd., Ward Royal Parade, Alma Road, Windsor, Berkshire.

Distributed and stocked by Ambit International, 2 Gresham Road, Brentwood, Essex. CM14 4HN tel (0277) 227050

## Two new communications ICs from TOKO KB4412 - two mixers/IF amp, KB4413 detector system

"Accessible" communications ICs are scarce things, but these devices offer much for the AM/SSB designer with most of the features programmable by external coupling and values choices. Supplied in plastic DIP

### Application circuit

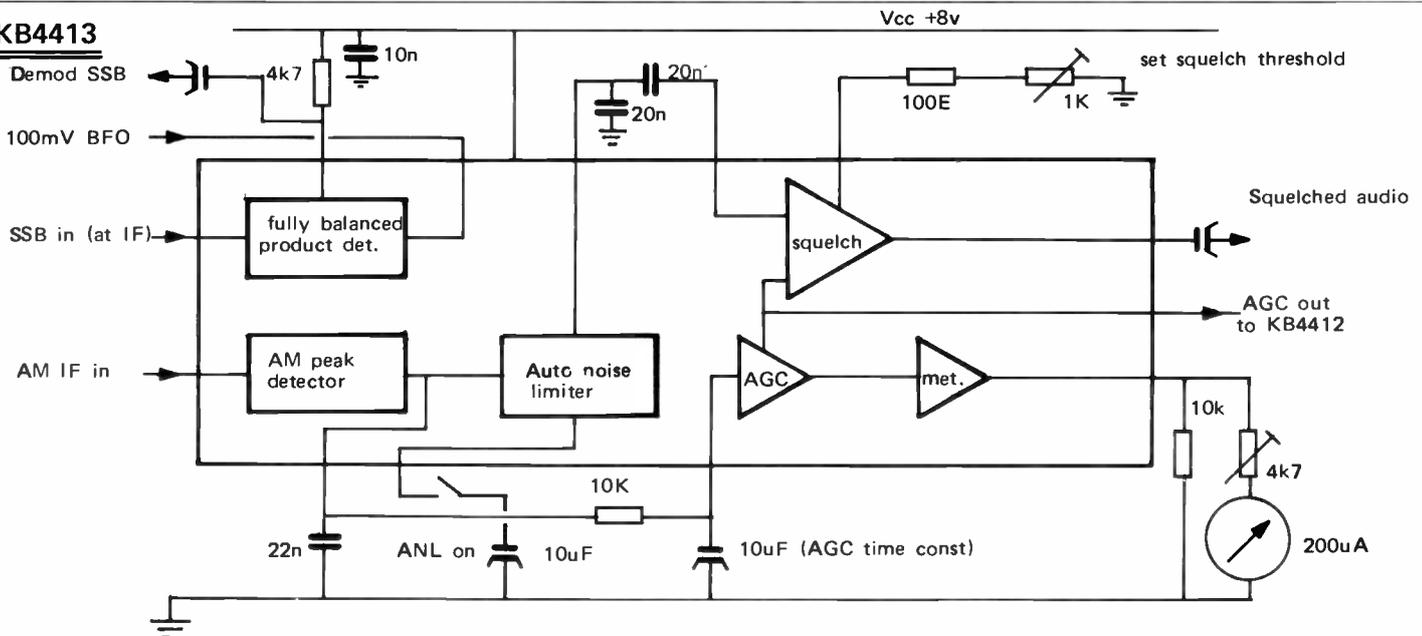


### General

The KB4412 is a high performance communications system, utilizing two double balanced mixers for exceptional overload capability. The local oscillator injection levels are only 100 mV at full gain.

The system is primarily designed for applications in CB type transceiver applications - although it is well suited to a large number of other communications applications in AM, FM and SSB modes. A complementary device, the KB4413, is available to perform all detection, noise limiting and squelch functions, to provide a complete double conversion receiver system in just two main signal processing devices.

### KB4413



### General

The KB4413 is multifunction AM and SSB demodulator, AGC amplifier, meter driver, switched ANL and carrier operated squelch. The internal blocks are largely separately externally accessible, and programmed by values that may be chosen to suit the nature of the application. The KB4413 is ideally suited to applications in CB, aircraft band, broadcast and general communications receivers - and may be added to existing designs to provide extended facilities (eg FRG7 etc).

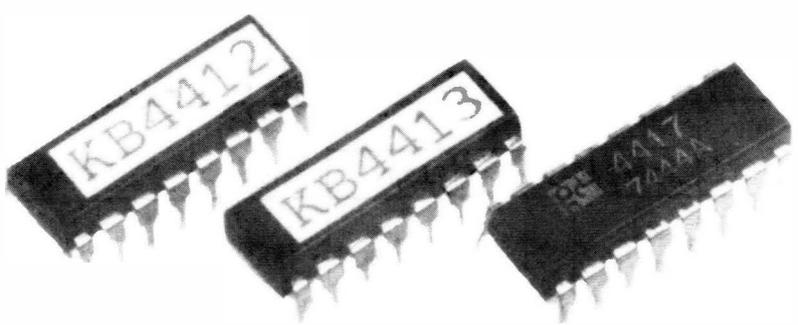
When used with the KB4412, the AGC voltage is directly compatible, and with certain devices in the SL600 range. Since this AGC is positive going, a simple transistor inverter will be required to drive AGC for MOSFETs, although PIN diode attenuators may be driven directly through emitter follower buffers.

The product detector is designed in the form of a fully balanced mixer (as those in the KB4412), and may be used to 50MHz - enabling use of the KB4412 at higher IFs than the 455kHz described above. The AM input detector is suitable to over 80MHz - the remainder of the functions being largely determined by DC characteristics only.

**MAXIMUM RATINGS**

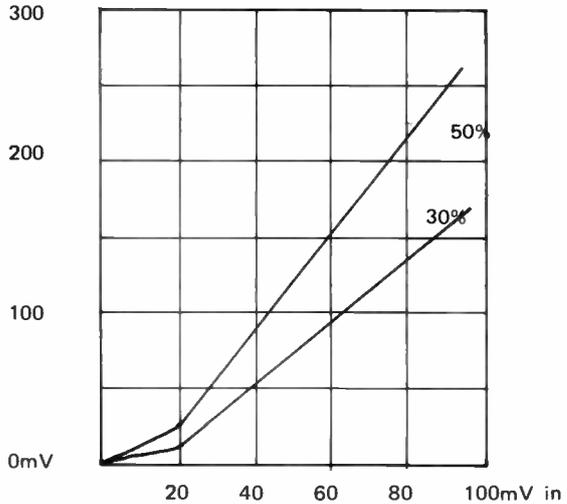
Supply voltage	16v	operating voltage 8v DC				
Power dissipation	500mW	120-130 mW in practise				
Operating temperature	-25° - +60°C	designed to operate under portable and mobile extremes				
Storage temperature	-30° - +125°C					
<b>KB4412</b>	<b>symbol</b>	<b>min</b>	<b>typ</b>	<b>max</b>	<b>unit</b>	<b>conditions</b>
Current drain	Iq		15	22	mA	no signal, Vcc 8v at 25°C
Gain of 1st mixer	G1	15	20		dB	30MHz input, 100mV p-p LO at 16MHz
Gain of second mixer	G2	15	20		dB	11MHz input, 100mV p-p LO at 10.5MHz
IF amplifier gain	G3	50	55		dB	455kHz input, at full gain
AGC voltage for max G			1.2		V	
RF AGC range		0.7		4.5	V	suits most bipolar/MOSFET stages
<b>KB4413</b>						
Current drain	Iq		15	22	mA	no signal, Vcc 8v at 25°C
AM detector output	Vo		30		mV	100dBu input, 30% mod. (100mV)
			110		mV	110dBu input, 30% mod. (310mV)
Signal/noise ratio	S/N	50			dB	100dBu input, 30% mod.
THD			0.5%			110dBu input, 30% mod.
			1.0%			110dBu input, 80% mod.
Product detector output	Vpd		200		mV	80dBu input (pin 10), 100mV into pin 9
			1500		mV	100dBu input ..

The above detector outputs applicable from 100kHz to 50MHz min.

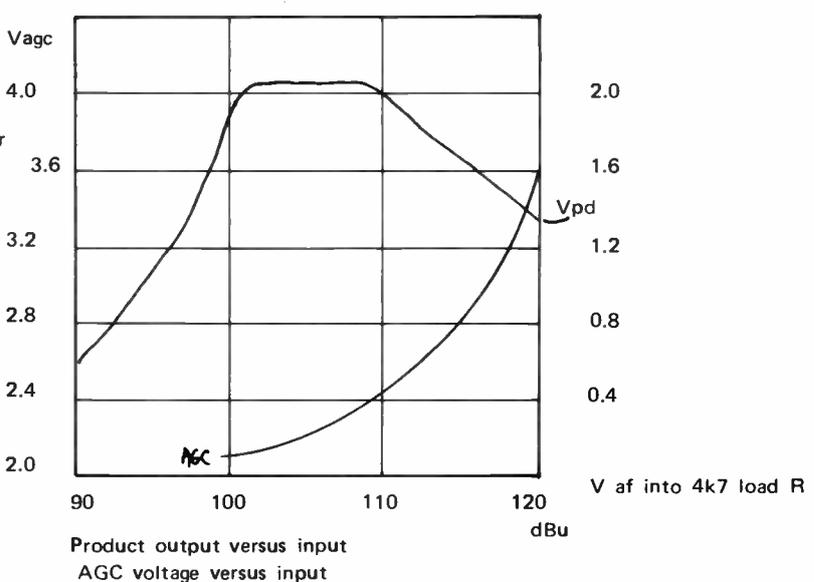
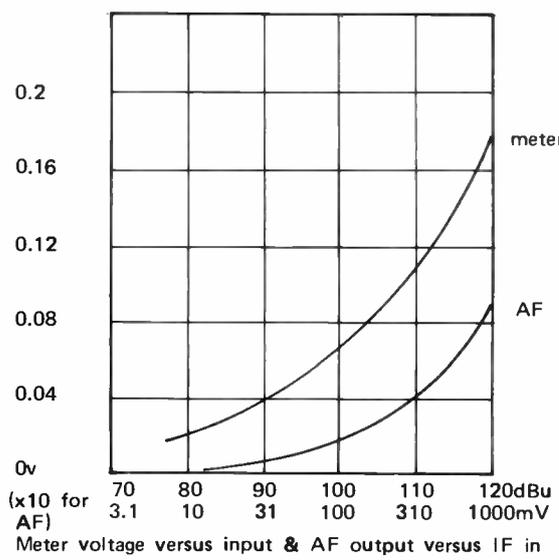
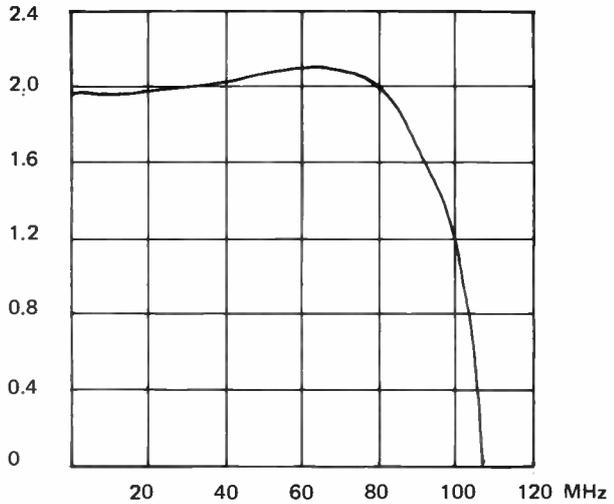


**KB4413 Characteristics**

AF out v IF input 30% and 50% mod :



Relative detector output (4k7 load) 100mV .LO





# Motorola MC3357: Low Power NBFM IF, detector, squelch, mixer, oscillator

**Features:** 2mA current drain from 6V supply with squelched output - 3mA un-squelched  
 Balanced mixer input stage, driven from on-board 2nd conversion oscillator  
 Apart from uses in FM equipment, the MC3357 can be used as a low power limited SSB receiver, taking advantage of the features to provide a tuneable input stage, clipped IF amplifier and product detector.

### Introducing the MC3357

The MC3357 is probably one of the most useful RF/IF ICs to have appeared since the SL600 series - and in fact, the MC3357 offers rather more in the way of price/performance ratio than the illustrious SL1600 devices. The input stage is a double balanced mixer, fed from the on-board crystal - which in the case of the 2nd conversion IF system, is usually 10.245 (or 11.115) MHz. The oscillator is an internally biased Colpitts configuration, which then permits use of the oscillator with an ordinary parallel resonant circuit - the base of the transistor appearing at pin 1, and the emitter at pin 2.

In this way, the second conversion may be made tuneable to provide continuous coverage of a section of the VHF band, using the unique OKI DFM device to provide resolution to the nearest 1kHz. For example, to tune 144-146MHz, the second conversion can be made to tune 4-6MHz by using the appropriate first oscillator at 140MHz. The DFM, driven from the MC3357 oscillator then reads 4-6MHz, with a 1kHz resolution (in SW mode) - corresponding to a range of 144.000 to 146.000 MHz.

For use in HF SSB applications, the signal from the mixer may be fed through one of the TOKO MFL series filters to the IF - and then the technique of limited SSB may be used, with the quadrature detector being fed with BFO to act as a product detector. The sound quality of such SSB may seem a little strange at first, but it is very well suited to communications applications. With an input sensitivity of a couple of microvolts, a very useful RX can be made for a few pounds.

And of course, the MC3357 is likely to find widespread use in 27MHz radio control systems, now that the followers of the hobby have at last come to appreciate the many advantages of NBFM. The operation of the Colpitts oscillator on third overtone crystals is not possible in the basic configuration, although the use of parallel tuned circuit from pin2 has worked with most crystals tried. This is a matter for some experimentation, and since the device has already been put to various uses above and beyond its prime purpose - we invite you to have a go and let us know your findings. The full data includes an internal diagram.

### Notes on operation

The IC includes a muting function, which is essentially a separately accessed op-amp, tuned to ultra sonic noise - and then detected to provide the drive signal for the squelch trigger and scan driver. The scan output at pin 13 sits at approx (Vcc - 0.5) v when pin 12 is pulled down to 0.7v by the mute signal detector - the mute signal pin (14) is internally short circuited to ground, thereby bypassing the audio path at the level pot. Under signal received conditions, the scan output remains low (at around 60k ohms) and the mute (pin 14) stay oc to permit audio to pass.

The quadrature coil determines the level of recovered audio for a given deviation, and once "on tune" this AF level may be adjusted by varying the value of the damping resistor. AF levels in excess of 300mV rms should be avoided to keep distortion to a minimum. Most parallel resonant tuned circuits are suitable.

The filter most widely used for IF shaping is a ceramic ladder type (Murata CFM, TOKO LFY, CFM2 etc) although other types may be used with the appropriate choice of matching. Pure wideband coupling is not recommended, since the crystal oscillator feedthrough will cause the IF to limit and become unstable.

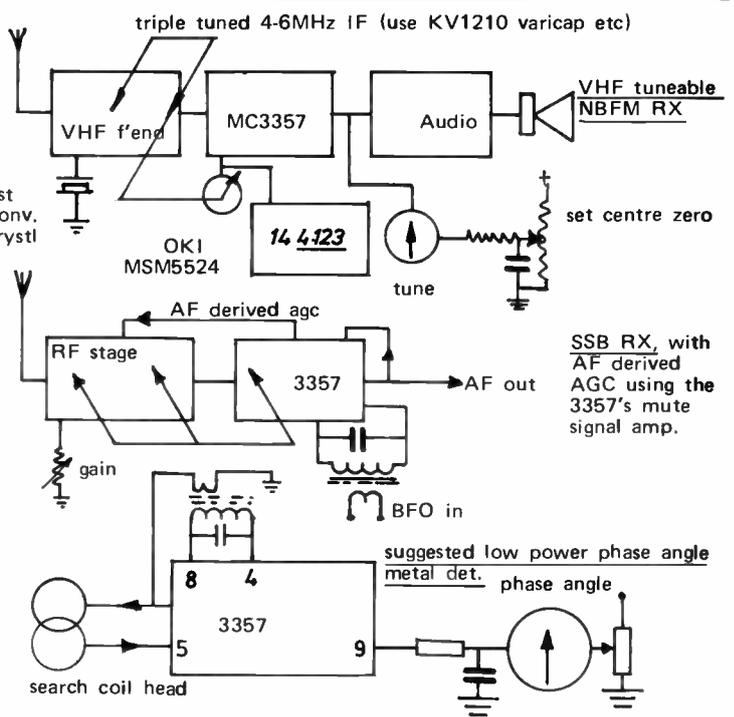
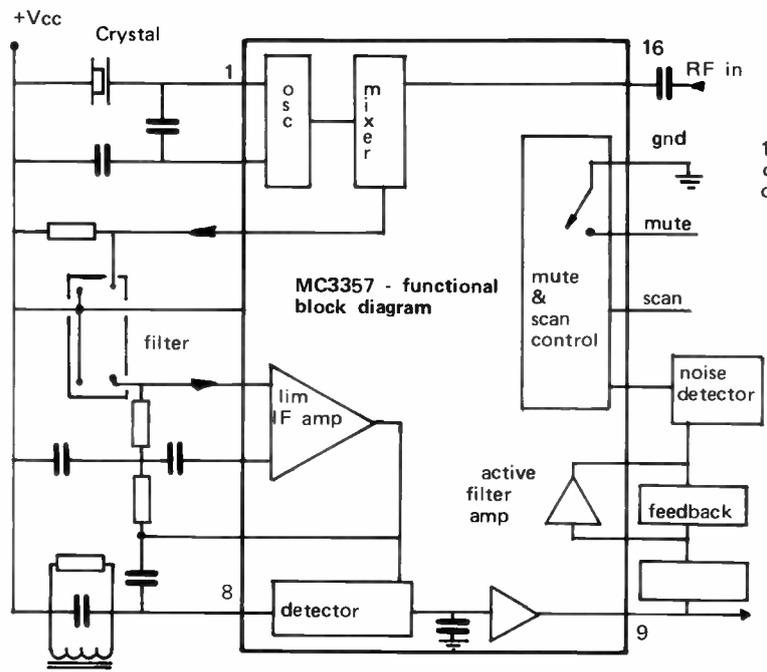
As with any wideband, high gain device, good layout is crucial. The exceptional input sensitivity of the MC3357 means that even 2cm of track to pin 16 from the preceding stage may lead to unacceptable HF breakthrough, since this pin sits at a nominal 3k impedance. If any length of track is found to be essential, then the input impedance must be lowered as close to the pin as possible - and the lead in be screened. The breakthrough effect can be masked to a great extent by high gain and noisy front ends - but this tends to waste the sensitivity of the IC.

Ceramic decoupling capacitors, and tantalum electrolytics are essential for reliable operation.

### ELECTRICAL CHARACTERISTICS AND SPECIFICATIONS

Item	pin	minimum	typical	maximum	units	comments
Supply voltage range	4	4	6	8	volts	I <sup>2</sup> L construction
Input voltage	16			1	volt rms	
operational temp range		0		+70	°C	
Storage temp range		-65		+150	°C	
Current drain	4		2		mA	muted
			3		mA	unmuted
-3dB input limiting voltage			5		uV	from 50 ohm source
Detector output voltage range			1/2 Vcc		V	
Squelch filter gain			46		dB	at 10kHz
Filter output voltage			2.0		V	
Trigger hysteresis			100		mV	prevents mute chatter to ground
Mute function low	14		15		ohms	
Mute function high	14		10		Mohms	
Scan low (mute off)	13		0		V	
Scan high (mute on)	13		Vcc - 0.5		V	

See CFM ceramic filter data for NBFM circuit details



The above circuit configurations have been briefly tried at Ambit, and found to provide the basis of feasible systems. We do not propose to spend time on refining the development for the foreseeable future, but we invite you to try one or two for yourself, and submit any final ideas to our free components sponsorship scheme.

# THE ONE STOP TECHNOLOGY SHOP from ambit

## The OSTs; aims and objects

Many of you, we hope, will have seen our adverts including the OSTs section. (OSTs appeared about last August time). If you read some of the opening paragraphs, you will have noticed that we set ourselves several specific aims, since we did not wish to get too embroiled in the ins and outs of BC107s, resistors and capacitors - the 'general' component service of Ambit will specialize in the latest technology from a broad range of sources. Furthermore, the OSTs stocks are all drawn from sources that comply with BS9000 approval, since in the general TTI/CMOS market, there is a lot of not quite 100% product about. Professional users simply cannot take a chance on the parts they buy, and increasingly the enthusiast appreciates that modern circuit complexity means that less than perfect devices can create trouble that far outweighs the cost savings of 'job lot' and surplus componentry.

OSTs stocks generally permit ex-stock delivery for over 99% of parts. Certain items occasionally suffer the 'world shortage' syndrome, and our stocks are greedily consumed once a major commercial customer finds out that we still have some on the shelf. However, we think that you will be generally impressed by our ability to supply ex-stock.

All product is first grade commercial specification types, from major manufacturers, such as Motorola (Mostly for CMOS/LPSTTL), Texas, RCA and Fairchild, NEC and Intersil.

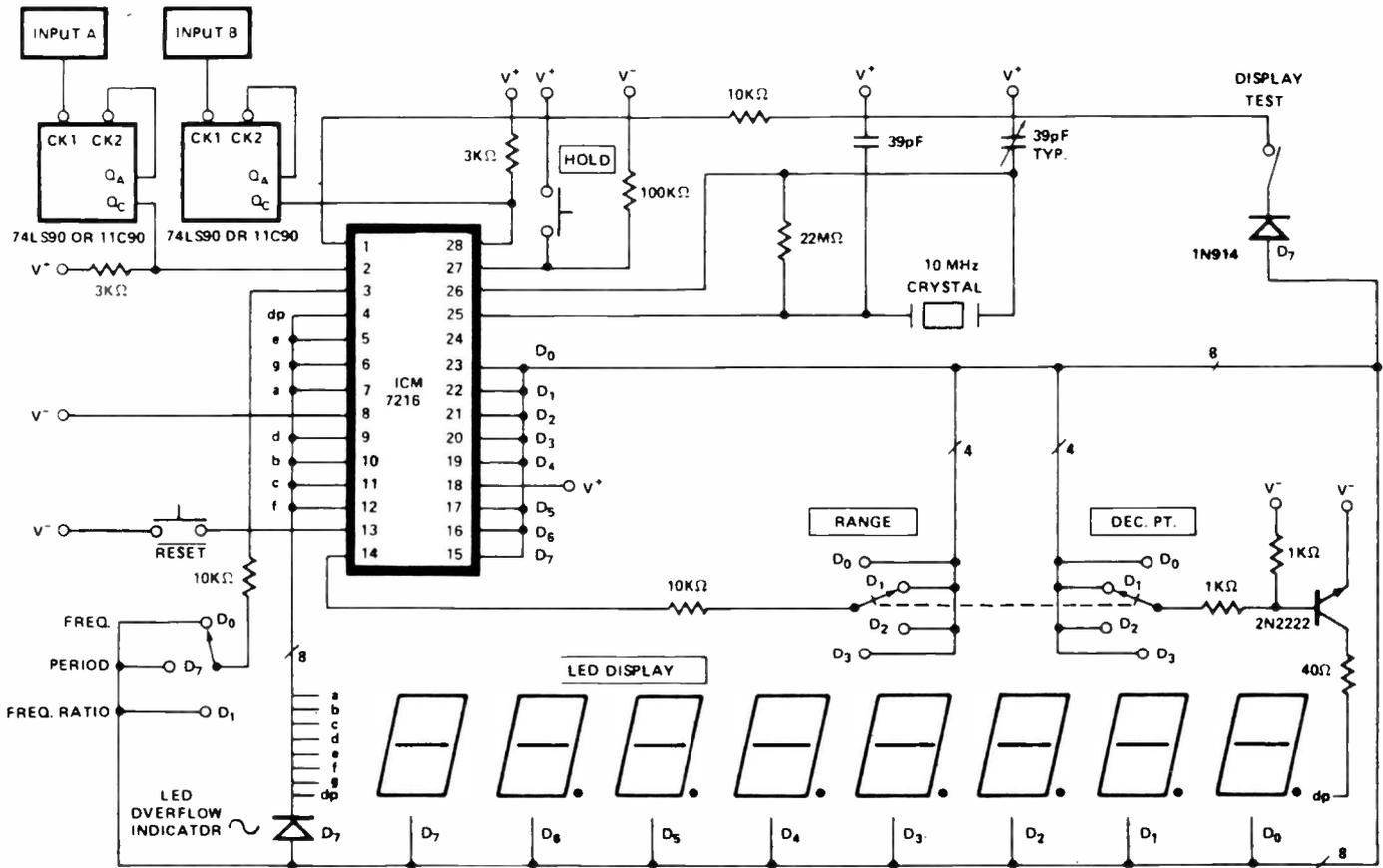
## Intersil LSI: The revolution in one-chip DFM's and DVM's

This may sound a little extravagant, but Intersil's ICM7216 series has made all previous DFM circuitry of this type of specification completely redundant. This one IC features:

- Operation as a frequency, period and unit counter.
- Frequency ratio and time interval counter.
- Four internal gate times 0.01, 0.1, 1.0 and 10 seconds in counter mode
- 1, 10, 100 and 1000 cycles in period, frequency ratio and time interval modes.
- Measures frequencies from DC to 10MHz (typ 14MHz)
- Measures period from 0.5µs to 10 seconds.
- Eight digit multiplexed LED drive (use HP high efficiency CC red, type 5082-7653 or sim)

- Single 5v supply rail only
- On chip stable 10 or 1MHz Xtal oscillator
- Interdigit blanking, leading zero blanking
- Overflow indication
- Display 'off' mode to conserve power
- All terminal protected against static discharge

The version supplied by OSTs is the ICM7216BIPI (timer/counter for common cathode displays in plastic DIL)

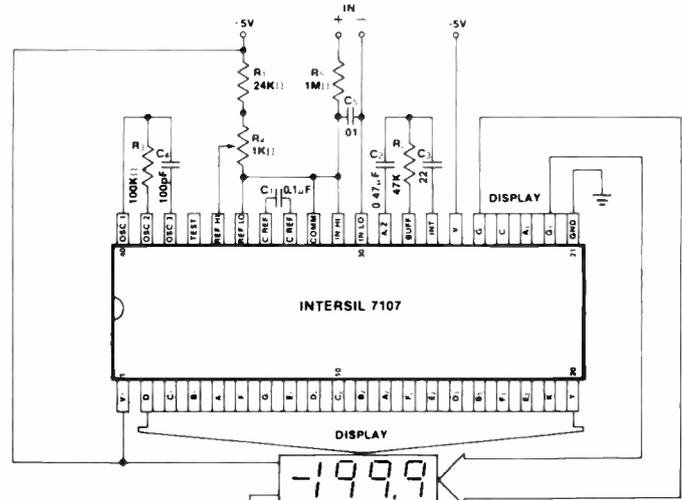
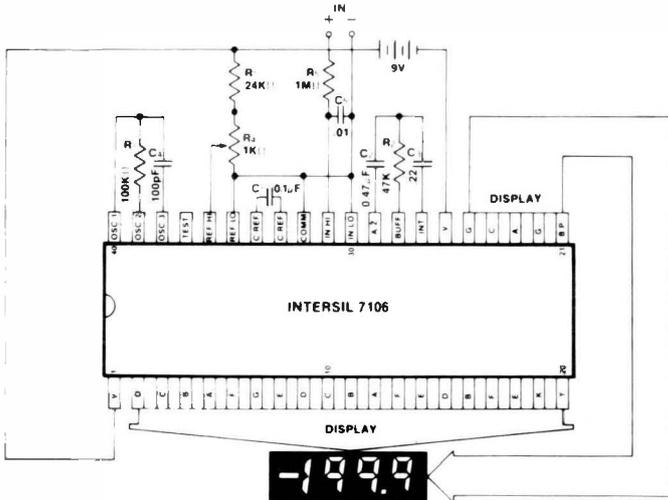


100MHz Multifunction Counter

## DVM's : 3½ digit A/D converters with direct display drive

7106 for LCD, 7107 for LED displays.

These devices are available complete with all components in the form of an evaluation kit to make a complete DVM, with details of the various shunts and multipliers necessary to turn it into a full multimeter. How about an industrious reader using our Dialstat switch system to produce a really elegant design under our component sponsorship scheme? If the design justifies, we will also arrange for customized computer manufactured hardware to complete the project. (LCD types for such applications - low power consumption, single rail.)



# OSTS: Hewlett Packard LED displays

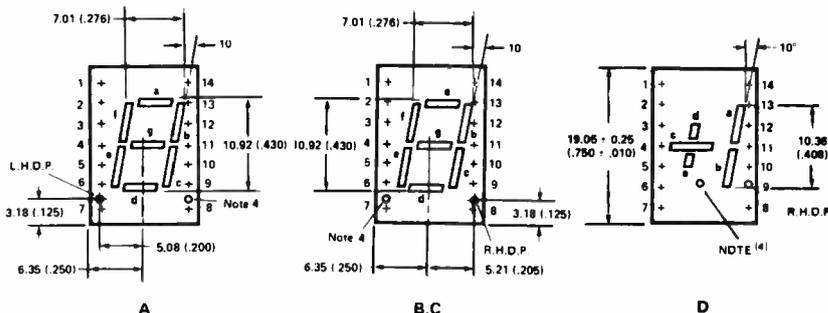
OSTS offers two standard lines of HP LED displays, acknowledged brand leaders in opto electronic displays. The 0.43 inch 7650 series is available in high brightness red, yellow and green. The 0.3 inch 7730/7740 type is available in red only.

All HP displays feature excellent contrast, reliable matching and even illumination of segments - and both these types are suitable for mounting in 14pin DIL sockets, with pinouts that lend themselves to relative simple multiplexing.

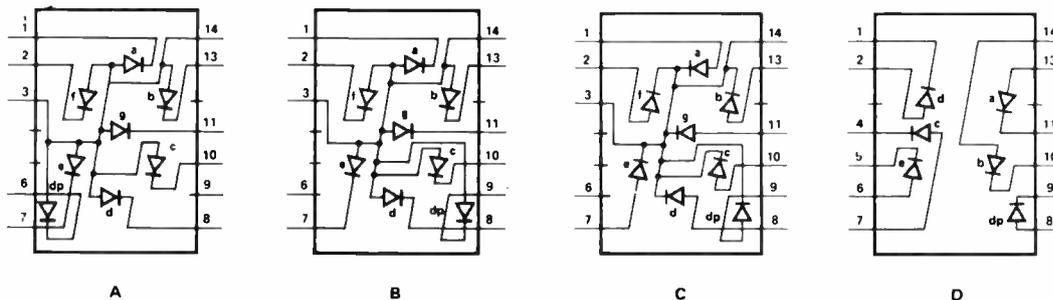
Device range (for current stock types, see price list)

-7650	high efficiency red	Com anode LH dp
-7651	..	Com anode RH dp
-7653	..	Com cathode RH dp
-7656	..	Univ overflow ± 1 RH dp
7660 series	as above numbering, yellow colour	
7670 series	as above numbering, green colour	
-7730	red	Com anode LH dp
-7731	red	Com anode RH dp
-7736	red	Univ overflow ± 1 RH dp
-7740	red	Com cathode RH dp

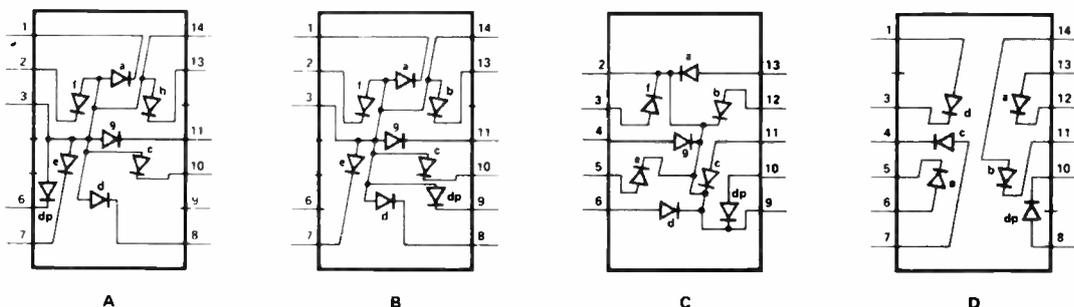
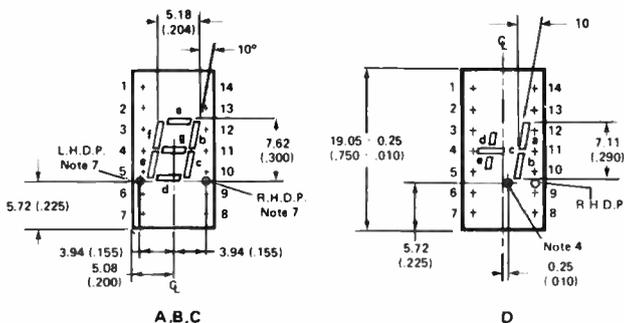
PIN	ELECTRICAL CONNECTIONS			
	A 7650R, 7660Y 7670G,	B 7651R, 7661Y 7671G,	C 7653R, 7663Y 7673R,	D 7656R, 7666Y 7676G,
1	CATHODE-a	CATHODE-a	ANODE-a	CATHODE-d
2	CATHODE-f	CATHODE-f	ANODE-f	ANODE-d
3	ANODE{3}	ANODE{3}	CATHODE{6}	NO PIN
4	NO PIN	NO PIN	NO PIN	CATHODE-c
5	NO PIN	NO PIN	NO PIN	CATHODE-e
6	CATHODE-dp	NO CONN. {5}	NO CONN. {5}	ANODE-e
7	CATHODE-a	CATHODE-a	ANODE-a	ANODE-c
8	CATHODE-d	CATHODE-d	ANODE-d	ANODE-dp
9	NO CONN. {5}	CATHODE-dp	ANODE-dp	CATHODE-dp
10	CATHODE-c	CATHODE-c	ANODE-c	CATHODE-b
11	CATHODE-g	CATHODE-g	ANODE-g	CATHODE-a
12	NO PIN	NO PIN	NO PIN	NO PIN
13	CATHODE-b	CATHODE-b	ANODE-b	ANODE-a
14	ANODE{3}	ANODE{3}	CATHODE{6}	ANODE-b



**INTERNAL CIRCUIT DIAGRAM**



Similar to RS display type 586-526 and various Monsanto, Litronix etc



PIN	ELECTRICAL CONNECTIONS			
	A 7610R, 7620Y 7630G, 7730R	B 7611R, 7621Y 7631G, 7731R	C 7613R, 7623Y 7633G, 7740R	D 7616R, 7626Y 7636G, 7736R
1	CATHODE-a	CATHODE-a	NO PIN	ANODE-d
2	CATHODE-f	CATHODE-f	CATHODE{6}	NO PIN
3	ANODE{3}	ANODE{3}	ANODE-f	CATHODE-d
4	NO PIN	NO PIN	ANODE-g	CATHODE-c
5	NO PIN	NO PIN	ANODE-a	CATHODE-a
6	CATHODE-dp	NO CONN. {5}	ANODE-d	ANODE-e
7	CATHODE-a	CATHODE-a	NO PIN	ANODE-c
8	CATHODE-d	CATHODE-d	NO PIN	ANODE-dp
9	NO CONN. {5}	CATHODE-dp	CATHODE{6}	NO PIN
10	CATHODE-c	CATHODE-c	ANODE-dp	CATHODE-dp
11	CATHODE-g	CATHODE-g	ANODE-c	CATHODE-b
12	NO PIN	NO PIN	ANODE-b	CATHODE-a
13	CATHODE-b	CATHODE-b	ANODE-e	ANODE-a
14	ANODE{3}	ANODE{3}	NO PIN	ANODE-b

**MICROMETALS TOROID CORES for EMI filters, resonant circuits, broadband transformers etc.**

**General information**

Micrometals dust iron cores are frequently found in US publications, and increasingly in UK and European articles, since the toroid form of coil construction is ideally suited to the wideband techniques now available to a much wider audience, by virtue of the lower cost and better availability of all types of high Ft semiconductor device. The closed field of the toroid avoids many problems of radiation and stray coupling, and together with the excellent characteristic control of the Micrometals range, inductances may be very closely designed to suit given sets of performance parameters.

In EMI filter applications (electro magnetic interference), the ideal permeability characteristics provide a uniquely effective means of controlling EMI sources - SCR controllers, triacs, switched mode PSUs etc. The use of this type of core in all types of DC/DC converter, power filter and pulse transformer can represent significant savings over other types of material.

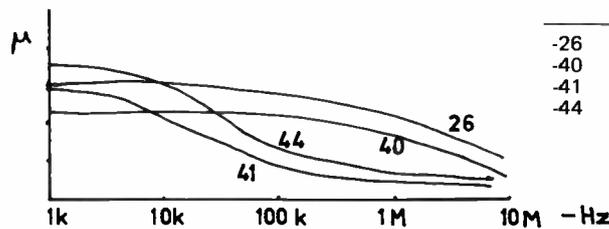
Micrometals range is also offered under the Amidon brand - although all parts are manufactured by Micrometals themselves.

**STOCK and ORDER POLICY:**

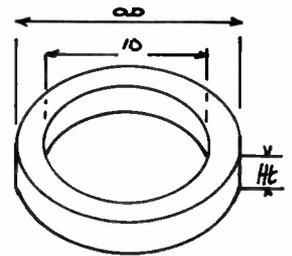
With such a massive range of parts, it is not feasible for stocks to be held covering all ranges. An initial range covering popular parts for a wide variety of applications has been covered in this catalogue - and with future issues, we expect to expand all stock ranges very considerably. Not described here, though available subject to certain minimum order conditions, are dust iron tuning slugs, beads, coil former assemblies and toroid mounts. Since Ambient is the officially appointed Micrometals distributor and agent, we are pleased to deal with any enquiries for this type of product, although details may not appear here or in the price list yet. Enquiries for these parts will naturally tend to influence stock policies - so if you don't see the part you need, please ask for further details. For the time being, we regret we are unable to handle orders for less than 100 pieces of non-stock items without a fairly large freight surcharges. However, in many instances even these prices are highly competitive with alternative sources - and coupled with the very large stocks of parts held at Micrometals, deliveries are frequently only 2-4 weeks. All prices quoted herein are based on 1.95 US dollars to the £, and are offered as an introductory guide. Typical OEM 10K pricing is 30% off published 1K prices. In certain instances, mix pricing may apply.

**EMI filter series**

High permeability cores for LF noise suppression

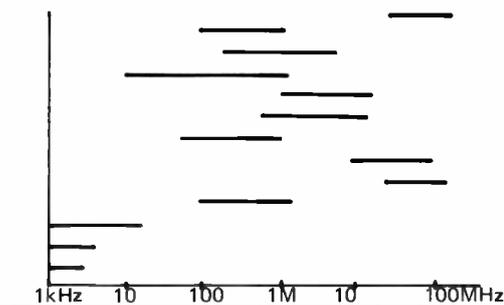


	colour code	test f	permeability
-26	Yellow/white	130kHz	75
-40	Green/yellow	130kHz	60
-41	Green	1kHz	75
-44	Black/white	1kHz	90



**Resonant circuit series**

A broad range of materials covering the range 1kHz to 200MHz



	Temp.coef.	Colour code	Permeability
-0	Phenolic		
-1	Carbonyl C	280ppm/°C	Blue 20
-2	E	95	Red 10
-3	HP	370	Gray 35
-6	SF	35	Yellow 8.5
-7	TH	30	White 9.0
-8	GQ4	255	Orange 35
-10	W	150	Black 6
-12	Synthetic Oxide	170*	Green/white 4
-15	Carbonyl GS6	190	Red/white 25
-40	Hydrogen reduced	950	Green/yellow 60
-41	Hydrogen reduced	975	Green 75
-44	Electrolytic	1025	Black/white 90

**EMI filter cores**

j= mean magnetic path (cm)  
A= cross sectional area (cm<sup>2</sup>) [no radius correction]

Type no.	OD	ID	Ht	LuH	j	A	Type no.	OD	ID	Ht	LuH	j	A
T25-40	6.48	3.05	2.44	180	1.5	.042	T94-40	23.9	14.2	7.42	473	6	.385
-41/26				225			-41/26				590		
-44				270			-41A/26A			6.35	432		.308
-44C			4.06	480		.070	-44			7.42	680		.385
T26-40	6.73	2.67	4.83	560	1.48	.098	T106-40	26.9	14.2	11.1	785	6.47	.706
-41/26				700			-41(26)			11.1	900		.706
-44				840			-41B/26B			14.6	1200		.930
T27-40	7.12	3.84	3.25	230	1.72	.053	-44			11.1	1100		.706
-41/26				285			T130-40	33.0	19.8	11.1	665	8.29	.733
-44				350			-41/26				785		
T30-40	7.80	3.84	3.25	300	1.83	.065	T157-40	39.9	24.1	14.5	830	10.05	1.14
-41/26				375			-41/26				970		
-44				460			-44				1150		
T37-40	9.53	5.21	3.25	248	2.32	.070	T184-40	46.7	24.1	18.0	1390	11.12	2.04
-41/26				308			-41/26				1640		
-41B/26B			4.04	380		.085	T200-40	50.8	31.8	14.0	755	12.97	1.33
-44				380		.070	-40B			25.4	1380		2.42
T44-40	11.2	5.82	4.04	270	2.67	.107	-41/26			14.0	895		1.33
-40S		6.35	3.25	220	2.75	.116	-41B/26B			25.4	1550		2.42
-41/26		5.82	4.04	310	2.67	.107							
-41A/26A		5.82	3.25	250	2.67	.087							
-44		5.82	4.04	340	2.67	.107							
T50-40	12.7	7.70	4.83	285	3.20	.121							
-41/26			4.83	320									
-41A/26A			6.35	420		.159							
-44			4.83	400		.121							
T68-40	17.5	9.40	4.83	336	4.24	.196							
-40A			6.35	450		.259							
-41/26			4.83	420		.196							
-41A/26A			6.35	560		.259							
-44			4.83	525		.196							
T80-40	20.2	12.6	6.35	383	5.15	.242							
-41/26			6.35	450		.242							
-41B/26B			9.53	700		.370							
-44			6.35	540		.242							

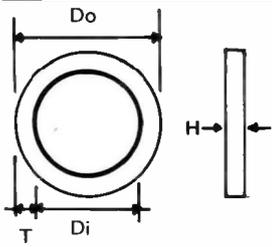
Prices offered as a guide only here  
 T25 - T37 types inc. 1/24:0.15 25/99:0.10 100/999:0.08  
 T44 - T94 types inc. 1/24:0.26 25/99:0.18 100/999:0.14  
 T106 0.39 0.30 0.22  
 T130 0.48 0.36 0.28  
 T157 0.55 0.45 0.38  
 T184 0.95 0.65 0.55  
 T200 1.35 0.85 0.75

type 26 and 44 material subject to +5%

**Stock types of EMI CORES (Jan 79)**

T68-40 T106-26  
 T80-26 T94-40

Micrometals dust iron torroid cores for tuned circuits, baluns, EMI filters etc.



The world famous Micrometals range of dust iron components is now being distributed in the UK by ambit. With our existing ranges of TOKO coils, and custom coil facilities in general, this range makes an excellent complement in areas where we are very frequently asked for this type of product. The entire standard range is included here, although only those types indicated will be held in the initial stock range for the UK. Please advise your requirements so that we can judge in which areas to expand the types available "off the shelf".

Core type	Do	Di	H	LuH/100t	Q test freq	Colour code	1-24	25-99	100-999	1K	Notes
T5- 6 10 12 0	1.27	0.64	0.64	10 7 5 1.6	35 MHz 70 120 160		0.15 as T5-6 as T5-6 0.13	0.09 0.08	0.07 0.06	0.05 0.045	
T7- 1 2 6 10 12 0	1.78	0.89	0.76	35 18 13 9 6 3	4 20 30 50 100 160		0.15 as T7-1 as T7-1 as T7-1 as T7-1 as T5-0	0.09	0.07	0.05	
T10- 1 2 6 10 12 0 2B 10B	2.46	1.12	0.76	32 16 11.5 8 5 2.4 20.8 12.5	3 20 30 40 80 160 20 40	blue red yellow black green/white tan red black	0.15 as T10-1 as T10-1 as T10-1 as T10-1 as T5-0 as T10-1 as T10-1	0.09	0.07	0.05	
T12- 1 2 3 6 7 10 12 0 2B 6B 10B	3.18	1.57	1.27	48 22.5 60 17 20 12 7.5 3 18.5 13.5 10	2 8 1 16 14 40 90 150 12 20 35	blue red gray yellow white black green/white tan red yellow black	0.15 as T12-1 as T12-1 as T12-1 as T12-1 as T12-1 as T12-1 as T5-0 as T12-1 as T12-1 as T12-1	0.09	0.07	0.05	
T16- 1 2 3 6 10 12 0	4.06	1.98	1.52	44 22 61 19 13 8 3	1 9 1 12 30 80 120	blue red gray yellow black green/white tan	0.16 as T16-1 as T16-1 as T16-1 as T16-1 as T16-1 as T5-0	0.10	0.07	0.055	
T20- 1 2 3 6 7 10 12 15 22 0	5.08	2.24	1.70	52 27 90 22 24 16 10 65 9 3.5	1 8 1 11 9 30 80 1 90 120	blue red gray yellow white black green/white red/white green/orange tan	0.16 as T20-1 as T20-1 as T20-1 as T20-1 as T20-1 as T20-1 as T20-1 as T20-1 as T5-0	0.10	0.07	0.055	
T25- 1 2 3 6 7 10 12 15 0 2A 3A 6A 7A 2B 3B 6B	6.48	3.05	2.44	70 34 100 27 29 16 12 85 4.5 23 77 18 19.5 28 84 23	0.9 6 0.6 11 9 30 60 1 120 8 0.85 12 10 8 0.85 12	blue red gray yellow white black green/white red/white tan red gray yellow white red gray yellow	0.16 as T25-1 as T25-1	0.10	0.07	0.055	
T27- 2 6 10 12 0	7.11	3.84	3.25	33 27 19 12 4.5	5.5 10 20 60 120	red yellow black green/white tan	0.16 0.17 0.18 0.16 as T25-0	0.10 0.11 0.12	0.07 0.075 0.08 0.07	0.055 0.06 0.065 0.055	
T30- 1 2 3 6 7 8 10 12 15 0 2B	7.80	3.84	3.25	85 43 110 36 37 123 25 16 93 6 27	0.65 5 0.5 10 6.0 0.6 20 60 0.8 120 5	blue red gray yellow white orange black green/white red/white tan red	0.17 as T30-1 as T30-1 0.18 as T30-1 as T30-6 0.19 as T30-1 as T30-6 as T27-0 as T30-1	0.11	0.08 0.09	0.06 0.07 0.08	

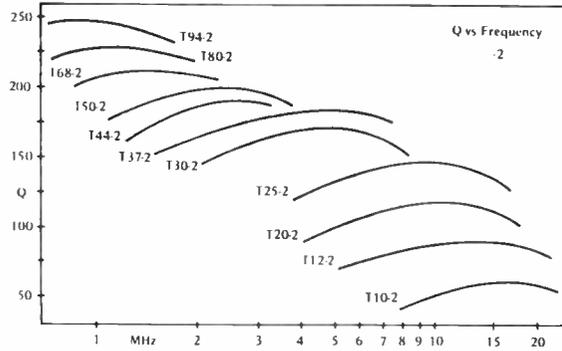
Core type	Do	Di	H	LuH/100t	Q test freq	Colour code	1-24	25-99	100-999	1K	Notes
T37- 1 2 3 6 7 8 10 12 15 0	9.53	5.21	3.25	80 40 110 30 32 125 25 15 90 4.9	0.7MHz 3.0 0.6 10.0 5.0 0.6 25.0 60.0 0.8 120	blue red gray yellow white orange black gn/white red/white tan	0.17 as T37-1 0.18 as T37-1 0.19 as T37-1 0.19 as T37-1 as T25-0	0.11 0.12 0.13	0.08 0.09 0.095	0.06 0.07 0.075	preferred type —  preferred type —
T44- 1 2 3 6 7 8 10 12 15 0	11.18	5.82	4.04	105 57 180 42 48 204 33 15 160 6.5	0.6 2.0 0.5 10.0 5.0 0.6 18 60 0.7 100	blue red gray yellow white orange black gn/white red/white tan	0.21 as T44-1 as T44-1 as T44-1 as T44-1 as T44-1 0.23 as T44-1 as T44-1 0.15	0.14 0.16	0.10 0.12 0.08	0.08 0.10	
T50- 1 2 3 6 7 8 10 12 15 0	12.7	7.7	4.84	100 51 175 40 45 190 31 18 135 6.4	5.0 2.0 0.4 10.0 5.0 0.4 16.0 50.0 0.6 100	blue red gray yellow white orange black gn/white red/white tan	0.23 as T50-1 as T50-1 as T50-1 as T50-1 0.24 0.26 as T50-1 as T50-1 as T44-0	0.16 0.17	0.12 0.125 0.14	0.10 0.105 0.12	preferred type —  preferred type —  preferred type — preferred type —
T51- 2B 6B	12.7	5.08	7.92	138 102	2.0 8.0	red yellow	as T50-1 0.30	0.23	0.17	0.15	
T68- 1 2 3 6 7 8 10 12 15 0	17.53	9.40	4.83	115 57 195 47 52 205 32 21 180 7.5	0.45 2.0 0.35 10 5 0.4 20 30 0.55 100	blue red gray yellow white orange black green/white red/white tan	0.27 0.25 as T68-1 0.30 as T68-1 as T68-1 0.40 as T68-1 as T68-6 as T44-0	0.20 0.18 0.23	0.145 0.135 0.17	0.125 0.115 0.15	preferred type  preferred type —
T72- 2 7	18.29	7.11	6.60	128 95	2 5	red white	0.27 as T72-1	0.20	0.17	0.15	
T80- 1 2 3 6 7 8 10 12 15 0	20.19	12.57	6.35	115 55 180 45 50 190 32 22 170 8.5	0.45 2.0 0.35 10.0 5 0.4 20.0 50.0 0.55 70	blue red gray yellow white orange black gn/white red/white tan	0.30 as T80-1 0.35 as T80-3 as T80-1 as T80-3 0.50 as T80-1 as T80-3 as T44-0	0.23 0.28	0.17 0.22	0.15 0.19	
T80- 1 2 3 6 7 8 10 12 15 0	20.19	12.57	6.35	115 55 180 45 50 190 32 22 170 8.5	0.45 2.0 0.35 10.0 5 0.4 20.0 50.0 0.55 70	blue red gray yellow white orange black gn/white red/white tan	0.30 as T80-1 0.35 as T80-3 as T80-1 as T80-3 0.50 as T80-1 as T80-3 as T44-0	0.23 0.28	0.17 0.22	0.15 0.19	
T94- 1 2 3 6 10 0	23.93	14.22	7.92	160 84 248 70 58 10.6	0.4 2.0 0.3 10 20 60	blue red gray yellow black tan	0.36 as T94-1 as T94-1 0.39 0.60 0.16	0.29 0.29	0.23 0.38 0.09	0.20 0.26 0.07	
T106- 1 2 3 6 7 15 0	26.92	14.22	11.10	280 135 405 116 133 330 19.2	0.3 2.0 0.2 10.0 5.0 0.3 60.0	blue red gray yellow white red/white tan	0.50 as T106-1 0.60 0.75 as T106-1 as T106-6 0.18	0.40 0.48 0.59	0.33 0.38 0.45	0.27 0.30 0.38	
T130- 1 2 3 6 7 15 0	33.02	19.81	11.10	200 110 330 96 103 215 15	0.3 2.0 0.2 10.0 5.0 0.3 50	blue red gray yellow white red/white tan	0.70 0.55 0.80 0.90 as T130-1 as T130-6 as T106-0	0.60 0.42 0.70 0.80	0.52 0.37 0.60 0.69	0.41 0.32 0.46 0.54	
T157- 2 3 6	34.88	24.13	14.48	140 420 115	2.0 0.2 10.0	red gray yellow	0.95 1.35 1.50	0.85 1.00 1.05	0.64 0.59 1.00	0.54 0.46 0.92	preferred type —
T184- 1 2 3 6	46.74	24.13	18.03	580 240 720 195	0.2 2.0 0.2 10.0	blue red gray yellow	2.20 1.70 2.55 2.95	2.00 1.50 2.20 2.40	1.60 1.15 1.85 2.10	1.27 0.95 1.48 1.90	
T200- 2 3 6 7	50.8	31.75	13.97	120 360 100 105	2.0 0.2 10 5.0	red gray yellow white	1.50 2.10 2.40 1.80	1.20 1.80 2.00 1.50	1.02 1.65 1.75 1.20	0.95 1.20 1.50 1.02	preferred type —

The above table includes all standard micrometals dust iron cores. Specials are available to order, where a minimum quantity will be charged to cover costs of tooling etc.

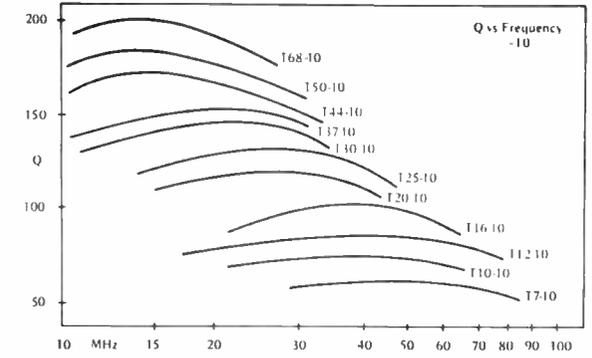
Since the range is so broad, please adhere to standard preferred types where possible, since these are stocked in volume; non-preferred types are subject to a minimum order of 100 pieces per value.

Catalogue of complete dustiron torroid ranges, including all EMI, pulse and resonant circuit types, together with characteristics is 35 p

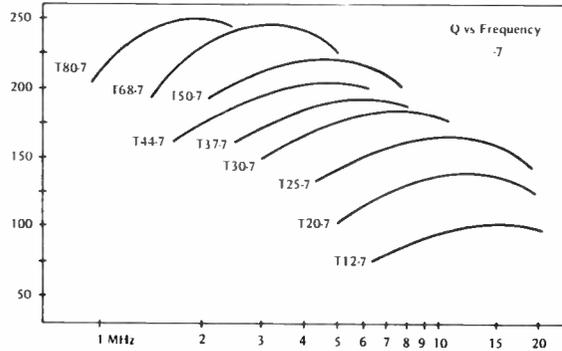
	Turns	Wire	L (uh)
T 94-2	100	#28	84
T 80-2	100	#28	55
T 68-2	100	#30	57
T 50-2	77	#30	32
T 44-2	66	#30	25
T 37-2	53	#30	11.5
T 30-2	47	#32	9.3
T 25-2	30	#30	3.0
T 20-2	30	#33	2.4
T 12-2	25	#36	1.5
T 10-2	25	#40	.9



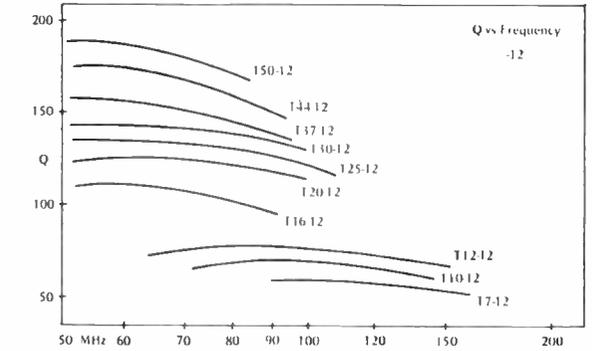
	Turns	Wire	L (uh)
T 68-10	15	#20	.80
T 50-10	14	#20	.70
T 44-10	13	#20	.65
T 37-10	12	#20	.40
T 30-10	14	#24	.55
T 25-10	14	#26	.45
T 20-10	13	#27	.30
T 16-10	11	#27	.20
T 12-10	10	#29	.15
T 10-10	10	#32	.10
T 7-10	30	#36	.10



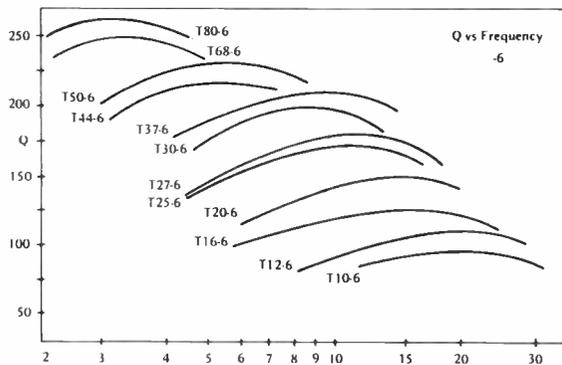
	Turns	Wire	L (uh)
T 80-7	100	#28	50
T 68-7	66	#27	23
T 50-7	60	#28	16
T 44-7	50	#28	12
T 37-7	50	#30	8
T 30-7	37	#30	5.2
T 25-7	30	#30	2.6
T 20-7	30	#33	2.1
T 12-7	25	#36	1.1



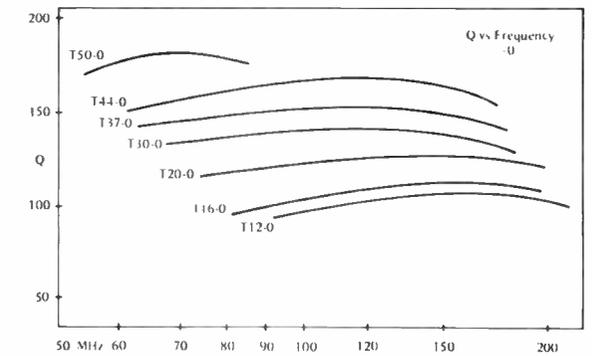
	Turns	Wire	L (uh)
T 50-12	9	#20	.14
T 44-12	7	#20	.13
T 37-12	8	#20	.12
T 30-12	8	#22	.13
T 27-12	8	#22	.12
T 25-12	9	#24	.12
T 20-12	9	#26	.10
T 16-12	9	#28	.08
T 12-12	9	#30	.08
T 10-12	7	#32	.07
T 7-12	7	#35	.05



	Turns	Wire	L (uh)
T 80-6	70	#26	22
T 68-6	60	#27	17
T 50-6	50	#27	10
T 44-6	47	#28	9.3
T 37-6	40	#28	4.8
T 30-6	37	#30	4.9
T 27-6	32	#30	2.8
T 25-6	30	#30	2.5
T 20-6	30	#33	2.0
T 16-6	25	#33	1.2
T 12-6	22	#34	.7
T 10-6	17	#36	.3



	Turns	Wire	L (uh)
T 50-0	10	#20	.12
T 44-0	8	#20	.08
T 37-0	8	#22	.07
T 30-0	8	#22	.07
T 20-0	8	#24	.06
T 16-0	7	#26	.04
T 12-0	7	#26	.03



The above table of Q versus frequency for various torroid windings (single layer magnet wire) represent typical values - not necessarily optimized. The left hand tables relate to low frequency applications (up to 30MHz) - whereas on the right hand side, applications to 200MHz are covered. Fuller details of the Q curves for various applications are covered in separate data sheets that are characterized in the following frequency bands:

20 - 200kHz, 40 - 400kHz, 100-1000kHz, 200kHz - 2MHz, 500kHz - 5MHz, 1 - 10MHz, 2 - 20MHz, 3 - 30MHz, 5-50MHz, 10 - 100MHz, 20- 200MHz, 40 - 400MHz, EMI/pulse cores

Copies of these data sheets are available on application at 10p per band (2-20MHz, and 1-10MHz bands are 20p each)

Copies of micrometals former and core catalogues, which have not been reproduced here for lack of space, 25p each.

## Ferrite rods and capacitive antennas explained

The following is largely drawn from the NS audio handbook and sets out to explain the theory and practical considerations associated with ferrite rod and capacitive (car radio) types of antenna - used for receiving purposes

### 1 Conversion of field strength to circuit input voltage

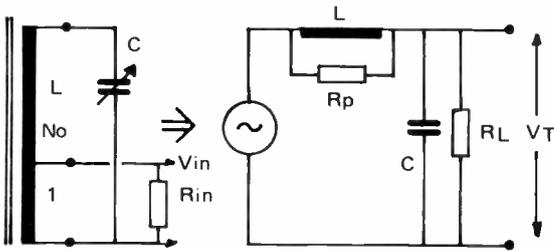


Fig 1 Equivalent circuit of ferrite rod antenna

#### Definition of terms

- L = Antenna inductance
- C = Tuning capacitor + strays
- No = Primary/secondary turns ratio
- Rin = Circuit input impedance
- Rp = equivalent parallel loss resistance
- RL = equivalent loading resistance
- Vin = voltage applied to circuit
- Vid = voltage induced in antenna
- VT = voltage transferred across tank
- Qu = unloaded antenna coil Q
- QL = loaded antenna coil Q
- Heff = effective height of antenna (m)
- E = field strength in volts/metre

#### Formulae:

- Qu =  $\frac{R_p}{X_L}$  (a)
- QL =  $\frac{R_p || R_L}{X_L} = \frac{R_T}{X_L}$  (b)
- RL =  $No^2 R_{in}$  (c)
- VT =  $Q_L V_{id}$  (d)
- Vid =  $Heff \cdot E$  (e)
- Vin =  $\frac{V_T}{No}$  (f)
- Heff approximates to  $\frac{2\pi \mu_r N_1 A}{\lambda}$  (g)

- where
- N1 = Total number of turns
  - $\mu_r$  = relative permeability of antenna rod (function of length)
  - A = cross sectional area of antenna rod
  - $\lambda$  = wavelength of received signal ( $3 \times 10^8 / \text{freq in Hz}$ )

- Noise voltage, calculated from the total Thevenin equivalent loading resistance,  $R_T = R_p || R_L$
- $$e_n = \sqrt{4KT\Delta f R_T}$$
- (h)

- where
- $\Delta f$  = 3dB bandwidth of the IF
  - T = temperature in °K
  - K = Boltzmanns constant =  $1.38 \times 10^{-23}$  joules /°K

Thus the signal to noise ratio at the antenna may be expressed as:

$$S/N = \frac{V_T m}{e_n} = \frac{Q_L Heff E m}{\sqrt{4KT\Delta f R_T}}$$
 (i)

- where
- m = modulation index (usually 30% for AM broadcasts)

### WORKED EXAMPLE

Specify the turns ratio No, total turns N1, effective height Heff, and inductance required for an antenna wound onto a rod with the characteristics specified below, designed to match an input impedance of 1k. Calculate the circuit input voltage resulting from a field strength of 100uV/m with 20dB S/N in the antenna circuit. Assume a 15-365pF tuning capacitor set at 100pF for an input of 1MHz.

- Rin = 1k
- E = 100uV/m
- S/N = 20dB
- C = 100pF
- Qu = 200
- fo = 1MHz
- rod dia = 1.5cm
- $\mu_r$  = 65 (rod length 19cm)
- m = 0.3
- $\Delta f$  = 10kHz

Calculate L, No, Heff, N1, Vin

At resonance, a tuned circuit  $X_L = X_C$  or

$$L = \frac{1}{C(2\pi f_o)^2} = \frac{1}{100pF (2\pi \cdot 1.10^6)^2}$$

$$= 2.53 \cdot 10^{-4} \text{ H} \quad L \text{ is approx. } 250\mu\text{H}$$

$$R_p = \frac{Q_u X_L}{\text{approx } 314k} = 200 \cdot \pi \cdot 1\text{MHz} \cdot 250\mu\text{H} \quad \text{from a}$$

Under matched conditions

$$R_p = \frac{R_L}{No^2} = No^2 \cdot R_{in}$$

$$No = \sqrt{\frac{R_p}{R_{in}}} = \sqrt{\frac{314k}{1k}} = 17.7$$

No is approx 18:1

$$Q_L = \frac{R_p || R_L}{X_L} = \frac{R_p}{2X_L} \cdot \frac{Q_u}{2} \text{ since } R_p = R_L \quad \text{from a \& b}$$

$$Q_L = 100$$

$$Heff = \frac{S/N \sqrt{4KT \Delta f R_T}}{Q_L E \cdot m}$$

$$= \frac{10 \sqrt{(4) (1.38 \times 10^{-23}) (300) (10\text{kHz}) (157k)}}{(100) (100\mu\text{V/m}) (0.3)} \quad \text{rearranging (i)}$$

$$= 1.7\text{cm}$$

$$N_1 = \frac{Heff \lambda}{2\pi \cdot \mu_r \cdot A} \quad \text{from (g)}$$

$$= \frac{(0.017\text{m}) (3 \cdot 10^8 \text{m/sec})}{(2\pi) (65) (1 \cdot 10^6 \text{Hz}) (\pi) (7.5 \times 10^{-3} \text{m})^2} = 70.7$$

N1 = 71 turns approx

$$V_{id} = Heff \cdot E \quad \text{from (e)}$$

$$= 0.017\text{m} \cdot 100\mu\text{V/m}$$

$$= 1.7\mu\text{V}$$

$$V_T = Q_L \cdot V_{id} \quad \text{from (d)}$$

$$= 100 \cdot 1.7\mu\text{V}$$

$$= 170\mu\text{V}$$

$$V_{in} = \frac{V_T}{No} = \frac{170\mu\text{V}}{18} \quad \text{from (f)}$$

$$= 9.4\mu\text{V}$$

Thus the ferrite rod antenna can be tailored to suit an exact set of field strength conditions - with predictable performance. The rod is assumed to be orientated in the best direction for maximum pickup.

The type of material used in the construction of the ferrite rod, and the nature of the wire used in the winding are crucial factors in determining the Q at a given frequency, hence the circuit impedance. Various types of ferrite exist for different basic applications, usually referred to with a number derived from Neosid's classification:

Material	Initial permeability	Application
F5	1600	AF/VLF
F6	1200	..
F7	1800	..
F8	1200	..
F9	3500	..
F11	500	LF (LW/Marine beacons)
F13	650	..
F14	220	LW/MW
F16	125	SW to 10MHz
F25	50	SW to 20MHz
F22	19	SW to 30MHz
F29	12	VHF to 200MHz

F14 Material is the most widely used type for ferrite rod LW/MW antennas - and it is important to note the frequency limitations of the various types of ferrite. F14 material at 5MHz is more lossy than F16 - though still just useable. F16 is a better choice, though with a lower permeability - more turns will be required to result in the same inductance.

The core loss factor,  $\tan \delta / \mu_i$  relates to specific materials and is the factor determining the frequency range of a given material. It is beyond the scope of this brief explanation - but further reference may be found in many ferrite manufacturers data books and application notes.

Ferrite rod antennas are never suited to transmission applications when wound in the manner described here - although certain techniques for winding rods to suit both receiver and transmitter applications are appearing now in the technical press. At the moment, though, it would appear that these techniques are the subject of trial and error experimentation, without a substantial grounding in theory.

Further experimental evidence shows that windings spaced some 20% of the rod diameter from the core show appreciable increases in the resonant Q of a given inductor.

Ferrite temperature coefficients are not linear - and probably represent the single biggest headache to the coil designer working with wide spans of temperature. Over the more restricted "domestic" range of 23-70°C, a factor can be approximated for general purposes. Again, this factor is dependent on the grade of ferrite being used and varies from 2 to 40 ppm /°C

The use of ferrite rods at VHF is another subject which appears from time to time, only to disappear just as quickly. The main motivating force stems from a desire to conceal the antenna of VHF portables and various pagers. In some pager applications, it is virtually obligatory from the point of view of both practicality and appearance - but it is invariably a compromise over a rod antenna. Ferrite antennas of this type are usually described in connection with tuned preamps, and a little experimentation shows that a very short piece of wire with the same preamp offers rather similar performance - albeit more subject to the capacitive effects of the body that prompt the use of the ferrite alternative in pager-type applications.

F29 material is not cost effective in all but commercial/industrial applications where there is little alternative. For radio reception the rod antenna is always a better solution if available.

At lower frequencies, the electrostatic field effects, versus the electro-magnetic field effects make the use of ferrite a very much more desirable feature - especially where the antenna is subject to normal environmental noise that besets domestic reception.

**Capacitive antennas**

The capacitive antenna as described here, is a very high impedance type of receiver antenna - as implied by its position at the top of the tuned circuit. It is the type of antenna almost exclusively used in connection with car radio design - and should not be confused a loaded whip or similar electrically short type of antenna, which is basically matched to a low impedance load at the receiver input.

The circuit described here is not particularly practical as a car radio antenna - since the not inconsiderable capacity of the feeder is rather underestimated. A typical input circuit adopts the pi configuration to provide matching.

With this in mind, the analysis of the capacitive rod antenna is very similar to the ferrite rod, with many of the terms being the same.

**Analysis**

$C_1$  is the capacitance of the vertical rod to the horizontal ground plane, while  $C_2$  is the capacitance of the feeder cable. The capacitance  $C_2$  is tuned out with an inductor  $L$  (part of the usual permeability tuning arrangement). The losses of the inductor and input resistance form the load  $R_L$ .

The signal then appearing at the input of the radio is related to field strength according to:

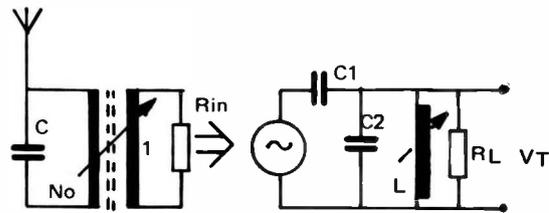
$$V_T = V_{id} \cdot Q_L \cdot \frac{C_1}{C_T} \quad (j)$$

where  $V_{id}$  is derived from (e) and  $Q_L$  from (b)

$$C_T = C_1 + C_2$$

$$S/N = \frac{H_{eff} \cdot E \cdot m \cdot Q_L \cdot (C_1/C_2)}{\sqrt{4KT \Delta f \cdot Q_L \cdot X_{CT}}} \quad (k)$$

It can be shown that the effect height of such a whip antenna approximates to (height in metres)/2 (m)



Using the same parameters as for the example with the ferrite rod,

$$\begin{aligned} R_{in} &= 1k \Omega & \Delta f &= 10kHz & h &= 1m \\ E &= 100\mu V/m & C_1 &= 10pF \\ Q_L &= 80 & C_T &= 90pF \\ f_0 &= 1MHz & m &= 0.3 \end{aligned}$$

Calculate  $S/N$ ,  $N_0$ ,  $V_{in}$

$$H_{eff} = 0.5m$$

solving for  $X_{CT}$

$$= \frac{1}{2\pi \cdot f \cdot C_T} = \frac{1}{2\pi \cdot 1MHz \cdot 90pF}$$

$$X_{CT} = 1768 \Omega$$

from (k)

$$S/N = H_{eff} \cdot E \cdot m \cdot \frac{C_1}{C_2} \cdot Q_L$$

$$4 \cdot K \cdot T \cdot \Delta f \cdot X_{CT}$$

$$= \frac{90.5 (100\mu V/m) (0.3) (10pF/90pF) \sqrt{80}}{\sqrt{4 (1.38 \times 10^{-23}) (300 (10k) (1768))}}$$

$$= 27.55 \text{ dB}$$

from (j) and (e)

$$V_T = H_{eff} \cdot E \cdot Q_L \cdot (C_1/C_T)$$

$$= 0.5m \cdot 100\mu V/m \cdot 80 \cdot (10/90pF)$$

$$= 444\mu V$$

Under matched conditions,  $R_p = R_L$ , and  $X_{CT} = X_L$  (at resonance) so from (b)

$$R_p/2 = Q_L X_{CT}$$

$$R_p = 2.80 \cdot \frac{1}{2\pi \cdot (1MHz) (90pF)} = 283k = R_L$$

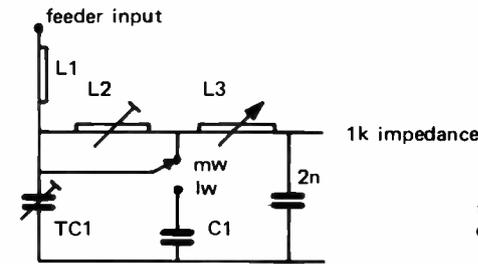
So from (c)

$$N_0 = \sqrt{\frac{R_L}{R_{in}}} = \sqrt{283k/1} = 16.8$$

use  $N_0 = 17:1$

$$\text{From (a) } Q_u = \frac{R_p}{X_{CT}} = 283k \cdot 2\pi \cdot 1MHz \cdot 90pF = 160$$

Thus to summarize the effect of the capacitive rod antenna is to provide approx. three times as much voltage to the input of the circuit - leading to the improved signal to noise ratio of 27.55dB.

**A practical input stage for car radio**

TC1 is the antenna trimmer - effective on mw only.

It is more common to use a single wound type of coil in the permeability (variable inductance / variometer) tuners of car radio. So the  $N_0:N_1$  transformation is performed via a pi-network circuit as shown. In European radios incorporating longwave, the use of this type of circuit permits easy conversion to longwave, by simply switching in a preset tuning coil ( $L_2$ ) in series - and adding  $C_1$  to the input matching of the pi circuit. (about 900uH).

The trend towards varicap tuned car radio (in conjunction with digital displays, synthesis etc.) will inevitably cause a rethink, but since most such sets are aimed at markets where LW is not a problem, it is quite possible that manufacturers may avoid the question for the time being.

**Modern receiver trends**

A brief word on the subject of the way things are heading in the realm of 'consumer' and broadcast radio - since it is very apparent that the digital revolution is about to take over from the old established mechanical tuning means. The technology to do this has been about for some time, with hyperabrupt tuning diodes (KV1210/1211, MVAM series, BB113 etc), but the practical manufacturing problems of getting to grips with the broad end point tolerances of varicap diodes has kept varicap AM tuning out of all but the most adventurous equipment.

However, the revolution has been spurred on by the emergence of the new families of LSI for direct count and display of received frequency, such as the OKI types described elsewhere in this catalogue.

Scale alignment problems no longer exist, and so varicap tuning has come into its own. From now onwards, most new HiFi, and increasing amounts of 'ordinary' radio equipment will be sprouting digital readouts. The choice of display is still unresolved, but LED seems to be the current favourite, although LCD and Futaba type fluorescent arrays are found in many high ambient light applications. LED is certainly the simplest to drive, with best life and environmental characteristics.

But apart from DFMs, the synthesiser is beginning to proliferate in conjunction with various forms of MPU control. Mullard have recently announced a two chip system that cost us £50 for a sample pair. It uses a double phase detector in a manner that gets around many of the objections to synthesised LOs for HiFi FM. Firstly, a digital phase detector is used for fast capture, and then an analogue system switches in once lock is achieved, resulting in a very pure output, but with fast lockup. We understand that Plessey are close on the heels of this with their own system - and by the next catalogue, we expect to be offering a building block system using one or other manufacturers' devices.

As cheap solutions to digital display of frequency have catalyzed the use of varicap tuning, so the synthesiser will encourage the use of MPU control. Various systems are going around in prototype form at the moment, but most still bear the marks of haste, and do not offer everything that is possible and desirable.

The synthesiser also makes the use of up conversion a very simple matter. Part one of this catalogue describes the basic approach using an IF of around 100MHz, but a simpler version for 100kHz to 5MHz, with a 10.7MHz IF is possible, using the TDA1062 - or even the TDA1083 for the whole lot. Work needs to be done on lowering the cost of the basic synthesiser, but it is obvious from the experience of other LSI that a dramatic price cut is imminent, and when it happens, we trust you will be prepared to throw away the cherished ideas of bandswitching, tracking, multiple tuned circuits - and all the bother they entail.

Our own research using the TDA1062/1220/1083 type of devices shows that a very sophisticated performance can be extracted from a humble piece of silicon. A preview of a Japanese MW/FM portable with synthesiser and digital readout that was approx. 8mm thick, with an area of twice the average credit card leads us to suspect that the consumer market is about to be shaken up in a big way.

The MC3357 has also shown itself as an intriguing SSB receiver for HF, which with the addition of a CMOS synthesiser and LCD display would make an ideal project for any electronics magazine. If any reader would like to pursue experimental work in this type of advanced receiver design, we are happy to consider the sponsorship of such projects for publication - even with fairly humble test equipment, it is surprising how much original work is available with the latest radio ICs when using them outside their originally intended applications.

Perhaps with the sophistication of modern receiver design, broadcasters and amateurs might be persuaded to cut down pollution of the airwaves with multikilowatt transmissions. The fact that low power can span oceans is demonstrated daily - so maybe there's hope.

# THE TDA1090 (ULN2242) AM/FM HiFi tuner IC

This device combines the qualities and performance of the CA3089E for FM, with the exceptional AM performance afforded by a fully balanced mixer input stage, low level oscillator - and low level detection. In some respects it resembles the TDA1083/ULN2204 AM/FM portable radio IC (described in part one) although generally, the TDA1090 has been designed with HiFi tuners in mind, with features such as muting, meter drive facilities and AGC.

The device itself is fully used in the PW Dorchester (Dec'78, Jan & Feb'79), wherein is described a LW/MW/3xSW and FM stereo tuner - for which Ambit is producing a full kit. The kit has been slightly revised in the light of OKI DFM ICs, and now includes provision for using either our DFM 1 frequency display/time module, or the low cost MA1012 digital clock module.

The TDA1090 also lends itself to less ambitious applications, and provides a very simple and high quality AM/FM tuner for low cost in terms of both expense and effort. Early attempts at this type of linear function have been notoriously unsatisfactory, but provided care is taken with layout and choice of components, the TDA1090 is no more difficult to use than the CA3089E.

Electrical characteristics	Symbol	Pin	Conditions	Min	Typ	Max	Units
Operating voltage range	Vcc	10		10	12.8	16	V dc
Differential audio output	Vout	6	(difference between AM/FM volume	-3	0	+3	dB
Audio output voltage	V6	6	DC voltage under no signal conditions		5.8		V
Regulator output voltage	Vreg	13	"		6.4		V
Regulator output current	Ireg	13	"	2.0			mA
<b>FM MODE</b>							
fin = 10.7MHz, mod 400hz/75kHz deviation Vin = 10mV (unless otherwise stated)							
Input limiting threshold	Vth	2			12	25	uV
Recovered audio	Vout	6		350	425	600	mV
Output distortion	THD	6			0.3	0.7	%
AM rejection	AMR	12		45	55		dB
AFC output voltage	AFC	7		280		480	mV
IF input voltage	V2dc	2	No signal		3.5		V
Supply current	Icc		No signal		23	25	mA
<b>AM MODE</b>							
fo = 1MHz, Fif = 455kHz, Fmod=400Hz, 30% AM, Vin 1mVrms							
Sensitivity	Vin	18	Vout 50mV rms		5	8.5	uV
Recovered audio	Vout	6		250	325	500	mV
Input overload	Vin	18	80% mod, 10% THD		50		mV
Supply current	Icc		No signal		16	30	mA

A very comprehensive data sheet is available for the TDA1090 - see price list for details

## The kit for the PW Dorchester

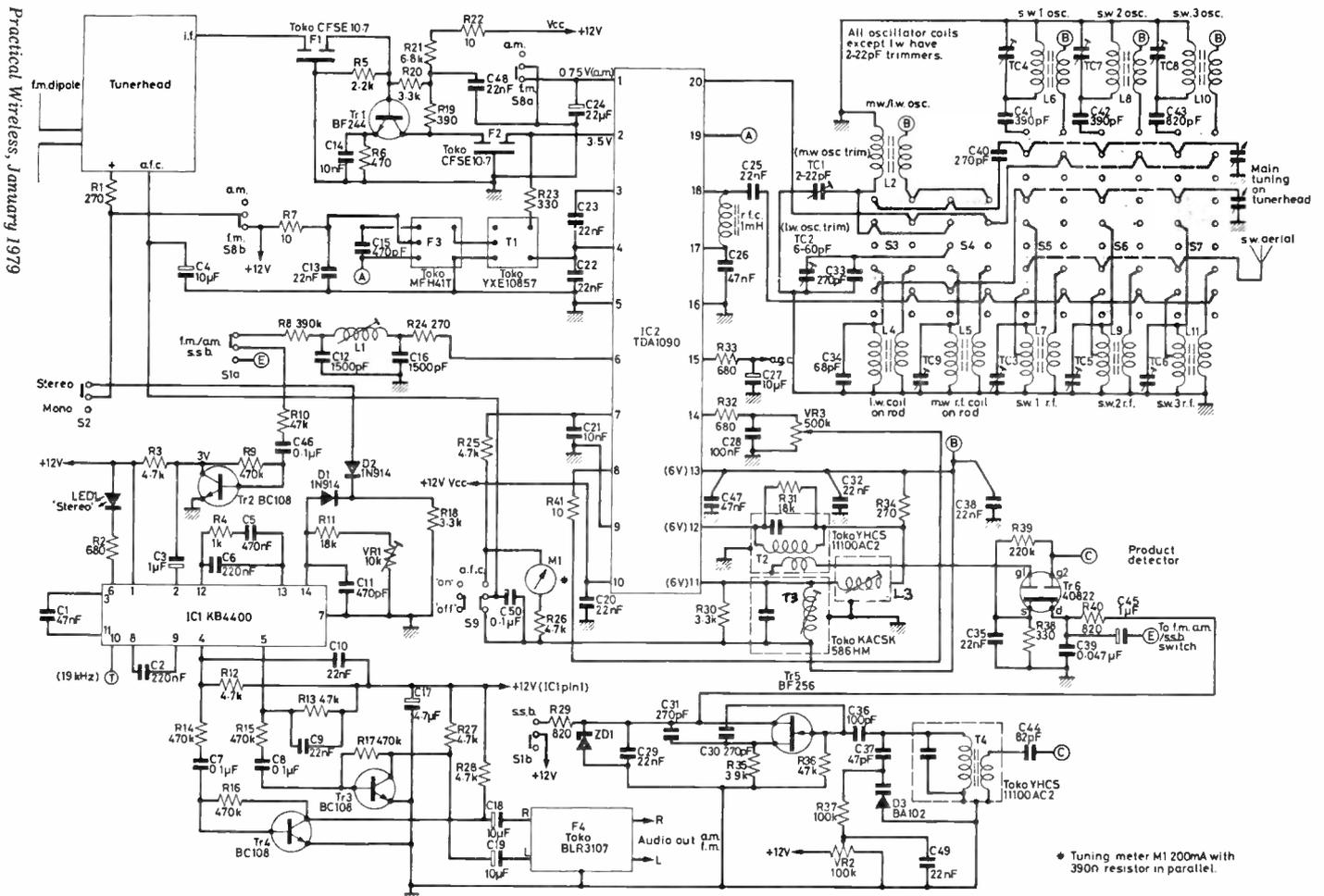
Ambit is supplying the kit in two basic parts. The electronics to make the circuit shown below, complete with all PCB switching and all the components thereon - and a separate package comprising the hardware, meter, PSU and cabinet styled to match the Mark Three FM only tuner. The originally published design could not readily accommodate the digital frequency option, using the Ambit DFM1 based on the MSMS5524 and high brightness AEG 1/2" LED displays.

Frequency coverage is in six bands: (with easy on-board switching)

LW	150-275kHz	With internal rod antenna	SW1	1.6 - 4.0MHz	With external antenna
MW	525-1605kHz	"	SW2	4.0 - 12.0MHz	"
FM	88-108MHz	Ext. antenna. Inc MPX decoder	SW3	12.0 - 22.0MHz	"

Coverage of up to 30MHz is possible with SW3, by simple adjustment of L/C, but an RF tuned preselector is really necessary to maintain good image rejection at these frequencies.

The Dorchester kit is supplied with our instructions, detailing one or two errors and omissions from the original text, and makes a very comprehensive "All Broadcast Band" AM/FM tuner. It also includes a BFO and MOSFET product detector, but remember this is specifically a broadcast receiver, not to be confused with the type of performance anticipated with our full communications receiver system.





## Thoughts on Metal locator techniques: The radiometer Ferret

In addition to supplying a kit based on the PW Sandbanks Pulse induction metal locator design, the following thoughts are offered on another type of metal locator technique, which has so far remained undiscovered - since so many of the detector manufacturers simply do not have a thorough understanding of the underlying principles of discrimination techniques.

Of all the articles that appear in the various magazines, nothing is quite so popular as a form of metal locator. But despite that, the level of technical understanding that seems to appear in print, is distinctly on the low side. Maybe those who know what it's all about wish to keep it to themselves, or maybe the basics of discrimination are not fully understood by even those who set out to describe discriminating designs.

A discriminator, in the currently accepted meaning of the word, is a detector that can be set to ignore the responses of junk and ferrous metals. The description of the technique as offered here, is presented in a question and answer form, since this is one of the most effective means of clarifying a nebulous topic such as this.

Q What property of a metal enables an arrangement of two coils to determine which target metal is ferrous, and which is non-ferrous?

A Simple, the ferromagnetic effect of the material where it exhibit high permeability.

Q The why do so many apparently ferromagnetic objects react on metal detectors as if they are non ferrous?

A Not so easy this time, but such reactions usually occur with objects that are solid or sheet in form, particle ferrous materials, and laminated stacks still appear ferrous.

The answer is due to the eddy currents that circulate in the larger continuous lumps, tending to flow in such a manner as to oppose the force that is producing them. (basic physical laws).

A classic demonstration of this effect can be seen when bringing a short circuited turn along a ferrite rod antenna, apparently causing a dramatic decrease in inductance. The turn can be made from pure iron, but the effect is still apparently strongly anti-ferromagnetic.

Q How is this effect reduced to enable a better identification between Fe and Non Fe?

A Eddy current effects tend to increase with frequency, - viz the transition from iron to ferrite cores in inductors, as the frequency increases. So reducing the frequency of the detection circuits is one way.

Q But even so, this does not account for the discrimination against objects such as silver paper, since that is strictly non-ferrous itself?

A The a second characteristic of the metal must be sought that affects the performance of an electric/magnetic field.

Conductivity is one of the most readily assessed properties of a metal, and as it happens - discrimination between solid aluminium and foil is due to the different conductivities.

Note how a relatively poor conductor, such as the copper/nickel of a 10p coin can be rejected by a discriminating metal detector - whereas the highly conductive copper and gold coins of similar size and weight are readily identifiable.

Q How is discrimination made variable, when the conductivity is a constant?

A The effect of variable discrimination against poor conductivity targets is enhanced by separating the induction balance coil arrangement just past the point of the optimum signal null. This has the effect of increasing the residual signal - but the field itself should not be considered the medium of measurement. For whilst the search head traverses a target, the phase of the signal in the receive coil will change by 180°. At the point of perfect null, with the two coils perfectly balanced, the residual signal in the receive coil is 90° different. Increasing the coupling of the coils will thus increase the phase, and the residual signal since this is now past the null.

With the coils slightly under coupled, the phase varies as before - but now the Fe presence in the detection area coupling the two coils causing an increase in the field, whereas the non-Fe causes a decrease.

Discrimination occurs in the phase readings,

which is progressively increased in the presence of low conductivity metals, as the residual field in the detection area is absorbed - thereby distorting the field by 'drawing it in', leading to an apparently ferrous effect.

At the condition of perfect null, the absence of any residual - or stray - field from the detection area, means that a non-ferrous foil will react in the usual manner of non-ferrous metals, by reflecting the induced eddy currents. The phase readings remain essentially constant at this point, but the field or residual level readings will increase either side of the null condition.

To vary the discrimination by electronic means, the coils are set to best null points, (at resonance), and a small amount of the transmitted signal is then force fed to the receive coil.

This produces an effect at the detection area that corresponds to the undercoupled effect of slightly separating the two coils. Varying the amount of injection will vary the apparent phase error, and hence the discrimination.

A practical circuit is offered here, and since it only costs a few pounds to make and experiment with, it is hoped that these ideas may be taken further by experimentation, so that we can report on any progress with the next issue.

### A practical Field/phase metal locator

This circuit uses the two effects described, to provide a fully discriminating metal locator (operating at VLF), which uses two meters to provide the field/phase information so that discrimination can be used whilst maintaining full sensitivity.

The block diagram includes details of a method of autotuning - bearing in mind that phase angle in a tuned circuit at resonance can be readily adjusted by altering the frequency. An experimental circuit with a CMOS monostable has been breadboarded, and found to work surprisingly well.

The actual circuit diagram omits this refinement however - and it should be noted that unbuffered 4011s are essential, since the buffered versions do not exhibit the same characteristics in the "Linear" mode of operation.

The reference oscillator is tuned to match the resonant frequency of the coil used - and the circuit is set up by switching on, and adjusting the search coil overlap so that the reading on the field meter just backs off a little. Set the oscillator tuning to maximize this reading, progressively adjusting the coil alignment to keep the range on the scale. The FSD of the field meter should be set so that the needle doesn't rattle against the end stop.

When a peak has been achieved, then set the coil so that the best possible null is found, so that when the coil is pulled very slightly apart, the phase meter reacts violently.

At this point, experimentation with various head settings and different types of target material will help familiarize yourself with the characteristics of this type of system. When correctly set, a 2p coin can be detected at a distance of 10" - whilst maintaining full discrimination. By force feeding the receive circuits to discriminate, the absolute detection range tends to suffer in proportion to the degree of junk rejection.

The FET audio gate is not ideal, and some recent tests with the CD4016 quad analogue gate have shown better results in the audio definition. Two sections of the gate should be cascaded - leaving the other section to be driven from field meter signal, which could itself be used to pass a second audio tone, so that stereo headphones could provide the field reaction in Left, and the phase reaction in right. The possibilities of this approach are very largely unexplored as yet, and we invite experimenters to let us know their findings.

## IN THE NEXT ISSUE

As this edition goes to press, a little late - like its predecessor, we have many plans laid down already for part 3. Whether or not pressure of work will prevent us from meeting an Autumn deadline, we don't know, but efforts will be made from now to stay up on schedule.

### Mullard comes to Ambit:

The new families of HiFi spec DC tone and volume controls. Hopefully, accompanied with the details of the VMOS amplifier and pre-amp system designed to match in with the mark three tuner. All DC control, with a full interface to remote control.

The LN1231 and 1241 synthesiser IC pair. Work in the lab is going on with these ICs at present - and we hope to report on our findings shortly. This system will be a central part of our 100kHz to 30MHz synthesised receiver - but we doubt if that will be ready in time. Nevertheless, a progress report will be issued.

We also hope to detail rather more Mullard parts, with applications, including some new AM radio devices and communications devices.

### TOKO go to town on ICs

A recently received list of new products from TOKO's expanding IC division includes the following exciting looking parts:

KB4428/9 - single channel radio control sender/receiver pair

KB4445/6/7 - multi channel radio control sender/receiver/servo controllers

KB4436 - a more comprehensive version of the KB4423 noise canceller IC

DC tone and volume controllers, more ICs for AM/FM radio

Details are still being prepared for these, but the radio control devices look potentially very significant advances indeed.

### More from Plessey

Full details on our multichannel monitor RX based on the SL6640, and hopefully, the full range of Plessey communications ICs as well.

### A tuneable 2m receiver

A lab prototype panoramic receiver for VHF is well under way, and with various plug in modules, this will cover from 40 to 200MHz. Using standard modules and simple logic, the panoramic system has some 70dB dynamic range, showing signals of less than 1uV.

A small, low cost 2m receiver around the MC3357 is also planned, with options for other VHF frequencies easily accommodated.

### More on OKI

The DFM1 only just missed this issue, and will certainly be included in the next edition. An LCD version with the MSM5525 is planned to be ready as well - and this unit should be ideal for converting existing equipment, with its minimal size and power requirements.

We may even have the first details of a new communications resolution device, but that is still under some secrecy at present.

### More from AEG

Depending on licencing arrangements, we hope to offer the first HiCom companders for use in enthusiast equipment. The HiCom is basically a very accurate 20dB compander for improving S/N, but unlike the other similar system, HiCom offers immunity from level effects and better HiFi qualities, since it is a broadband system.

If you think you might find any of the above interesting (plus all the usual product updates) then order for part three are taken now, and will be held pending publication. 50p only. Some of the items will be released with notices in our general adverts and pricelists - so keep an eye open, or leave us an SAE for details when ready.

# DIALISTAT: the professional miniature switch system

The "Dialistat" series of push-button switches from Lipa & Isostat are amongst the most versatile and widely applicable ranges of high quality, low cost switch methods in the electronics industry.

The range supplied by Ambit "as shelf standards" includes parts for the 5mm centre pitch system, which is available in either piece-part form for DIY assembly, or as preassembled units in small volume (less than 100 units). The bracket and latch-bar units provided may be sub-divided quite readily, provided care is taken to ensure that all burrs and abrasive surfaces are carefully removed before assembly.

The general range extends from "zero" pole units (used for latch release functions) to 8 pole changeover blocks, for either latched, (self cancelling) push on/ push off, or momentary contact applications. The unique design of Dialistat permits any or all of the separate functions to be placed at any position on a given bracket - with push on/push off functions, or momentary functions placed in the midst of an array of latching units.

The 5mm pitch supplied as standard may be considered as applicable to either 10mm, 15mm, 20mm, 25mm etc. A maximum of 30 switch positions is possible on the stock range - with up to 50 on special order.

**The technical suitability of Dialistat to exacting professional applications is without parallel for such a flexible, low cost and readily available switch systems.**

## Specifications

Bracket material	Aluminium Alloy AG4MC	
Latch bar material	Stainless steel	
Plastics	SE thermoplastic UL94VEO	
Fixed contacts	AgCu wire cold drawn to .8mm	
Moving contacts	Cold rolled silver coated nickel silver. Self cleaning	
Contact resistance	less than 8 mohms less than 10 mohms less than 10 mohms	at 20mV/10mA 50Hz after 20,000 operations without load after 100,000 operations without load
Insulation resistance	3,000,000 Mohms	at 500v continuous
Dielectric strength	greater than 2000v	
HF resistance	greater than 4 Mohms	measured at 1MHz
Inter contact capacity	less than 0.9pF	measured at 1MHz
Operation temperature range	-40°C to +85°C	

## Reaction to humidity.

4 days continuous	
Contact resistance	less than 10mohms
Insulation resistance	greater than 1,000,000 Mohms
Dielectric strength	greater than 2000v
21 days continuous	
Contact resistance	less than 15 mohms
Insulation resistance	greater than 400,000 Mohms
Dielectric strength	greater than 2000v

## Corrosive atmosphere

48 hours in H <sub>2</sub> S	
Contact resistance	less than 15mohms

Mechanical endurance	greater than 100,000 operations
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## Operating force:

2 pole	less than 3.5N
4 pole	.. 4N
6 pole	.. 4.5N
8 pole	.. 5N

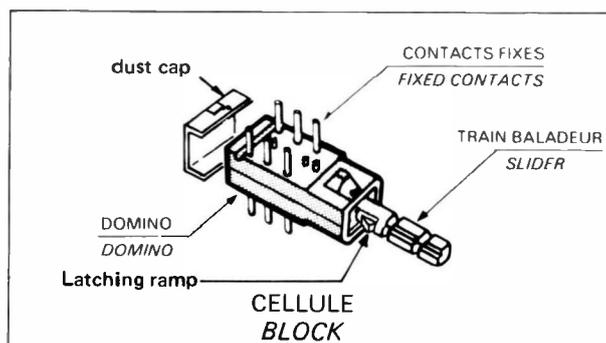
## Mechanical strength according to IEC 65

	greater than 100N
--	-------------------

Solderability	wave or hand soldering	to IEC 68
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Traction on fixed contacts	greater than 15N	to IEC 68
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**NB The Dialistat switch is lubricated for life - switches must never be washed in solvent baths before or after soldering**



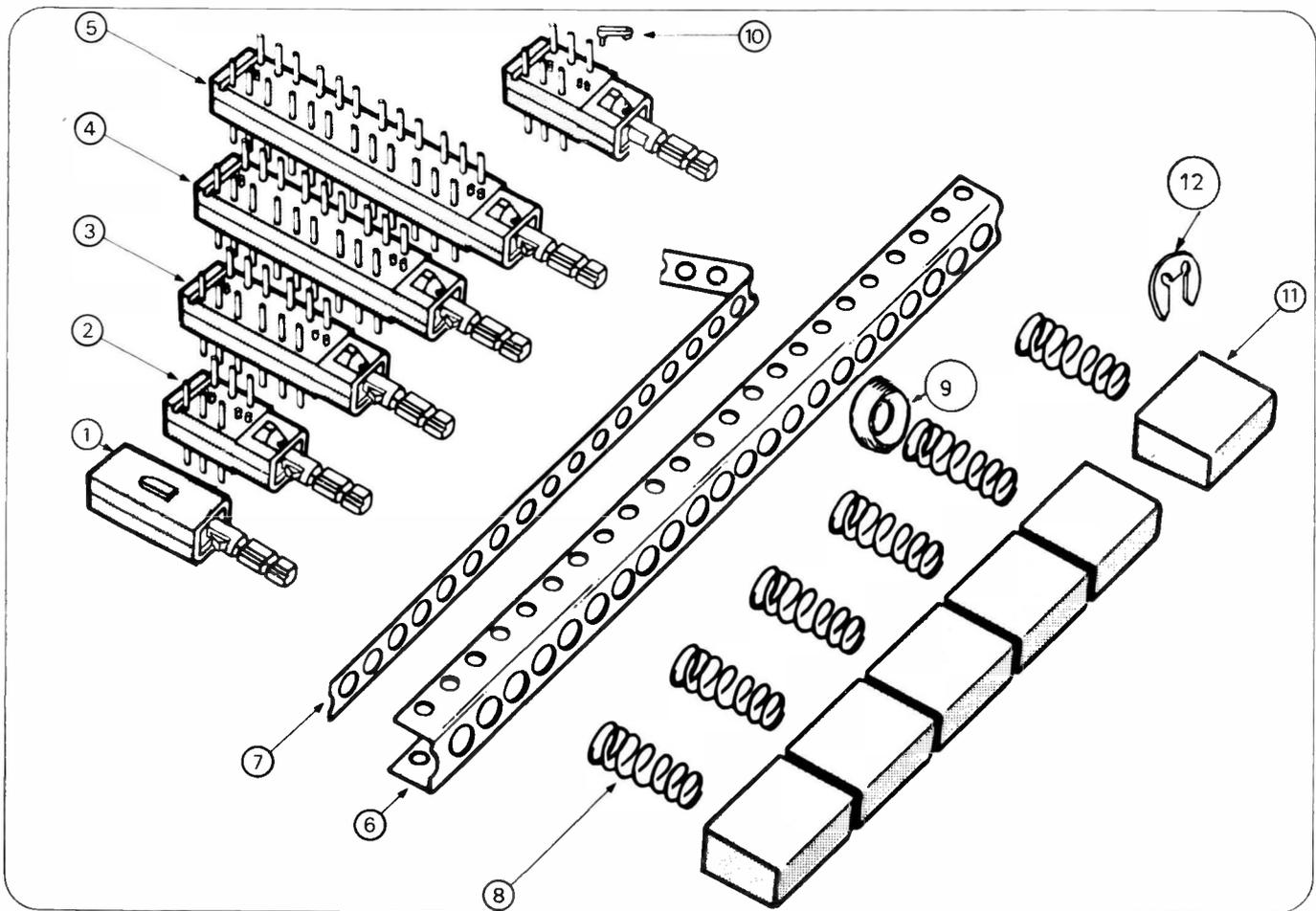
## Major features of "Dialistat" block construction

The basic block (illustrated here is a 2 pole unit) is supplied in two distinctly different types, depending on the nature of the operation of a given position. ie EITHER latching style, OR Push on- push off. Superficially these blocks look the same but the key to identification is the latching ramp (as shown) which must be present for latching operation. The latching ramp on the slider always faces away from the folded back end of the latch bar, which is formed in such a way as to provide its own integral spring return facility.

Push on -push off switches do not have the latch ramp on the slider - but in the top side of the slider molding, the ratchet mechanism molding is visible. It is in this opening that the cam follower is inserted, before the switch is pressed into its location on the bracket.

The cam follower should be inserted with a light grease, or vaseline - this makes accidental loss unlikely, and lubricates the action of the push/push mechanism.

A snap-on clear plastic dust cap is available to cover the rear of the block. This also prevents accidental dismantling of block and slider by pushing the slider section through the back of the switch, causing contacts to drop out accidentally.



#### Block details

- 1 Zero blocks (without contacts)
- 2 2 pole changeover block
- 3 4 pole changeover block
- 4 6 pole changeover block
- 5 8 pole changeover block

#### Fittings

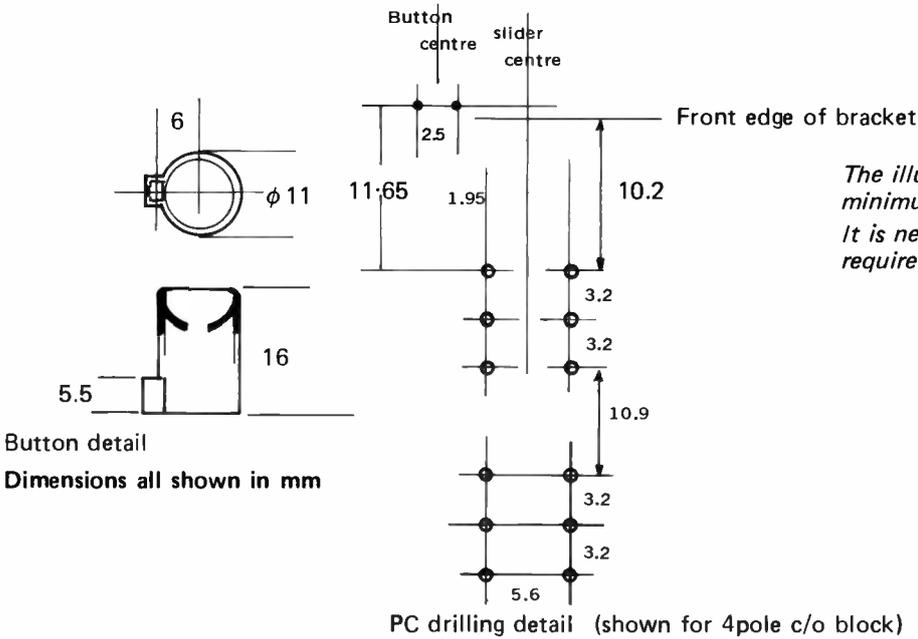
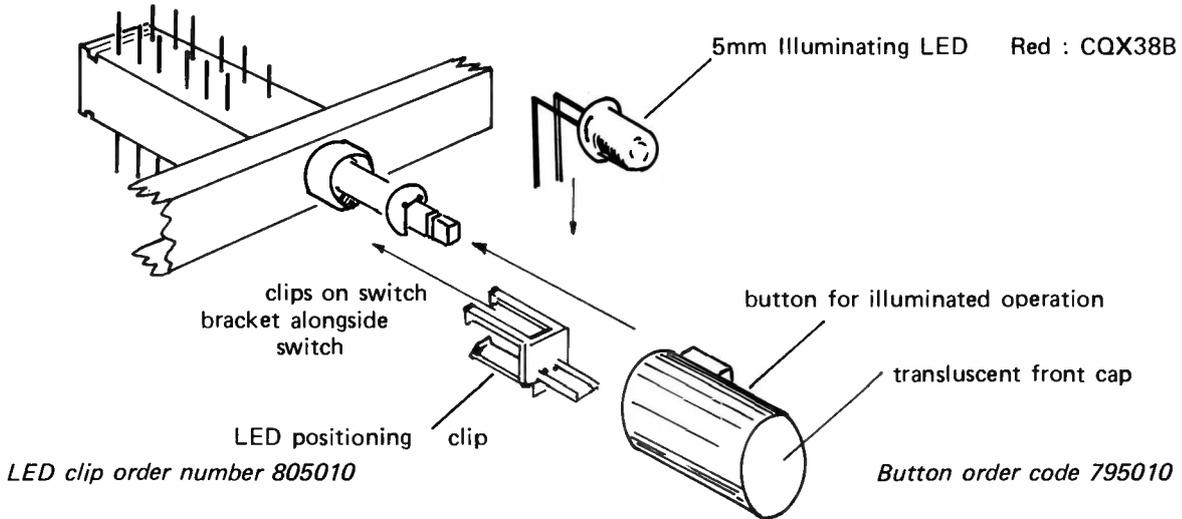
- 6 Bracket
- 7 Latch bar with integral return spring
- 8 Block return spring
- 9 Plastic spring location cup/slider stopper
- 10 Cam follower for push on -push off functions
- 11 Button
- 12 Slider spring retainer

#### Assembly of basic Dialistat system switches

The exploded drawing indicates all the features and fittings of Dialistat switches. When assembling a switch, observe the following procedures to ensure easy fitting:

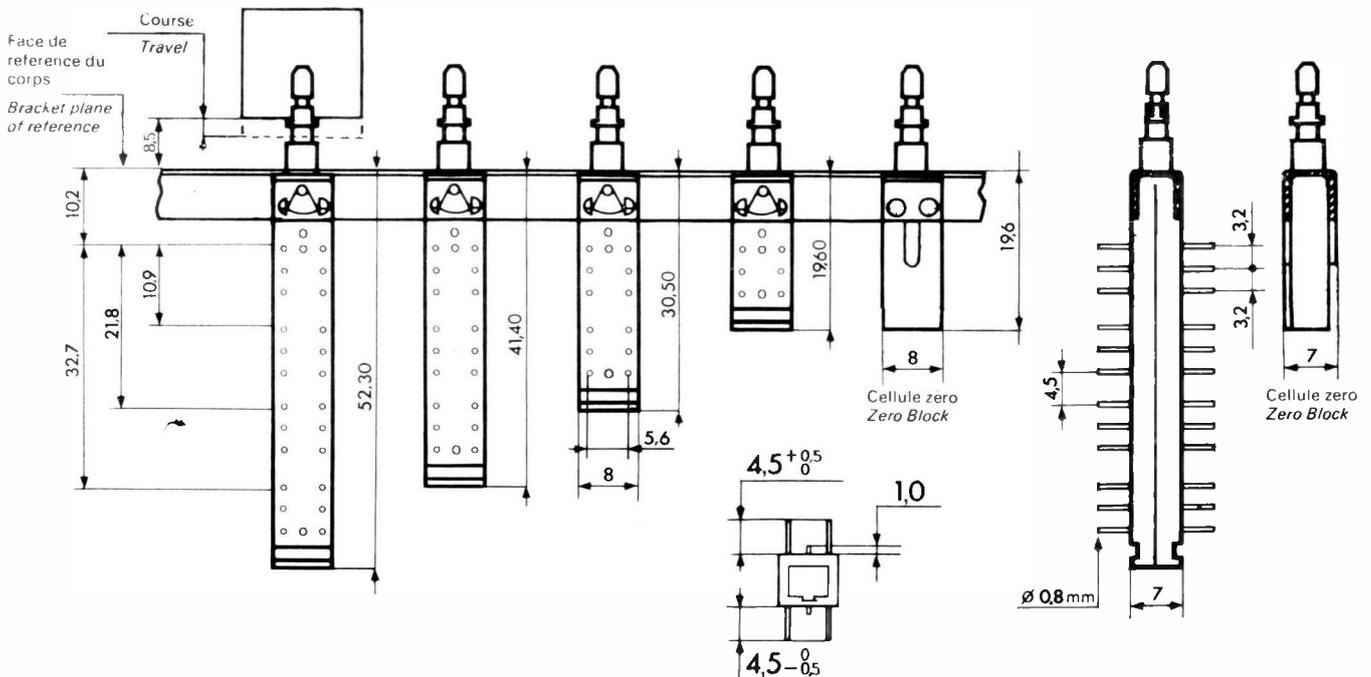
- 1 Cut the bracket and latch bar to suit your application. Take care to remove burrs, nicks etc., and do not use a latch bar if it has been accidentally "kinked".
- 2 Have a clear idea of the layout of the switch you require - sketch out a plan on paper if necessary.
- 3 Fit rear dust caps to the blocks you wish to assemble
- 4 Make certain you have selected the appropriate function blocks
- 5 Place the latch-bar in the bracket, and fit the module immediately alongside the folded back spring return into the bracket, thereby retaining the latch-bar. The block is fitted by simply locating the slider in the appropriate hole, and pressing home until the molded retainers snap into location holes along the top and bottom of the bracket.
- 6 Fit the remaining switches in the latched section
- 7 Fit the cam follower (10) into the tops of the push-push operation switches, using a SMALL blob of grease to both retain and lubricate
- 8 Snap push-push blocks into the desired positions on the bracket
- 9 Fit a spring location cup over each slider (9), and then fit the spring, fixing its location by clipping the spring retainer (12) into the forward groove in the slider molding. To do this, the spring must be slightly compressed - a piece of the latch bar material can be used for this operation, since it slides neatly over the slider molding, without permitting the spring to pass through
- 10 With all springs and spring stoppers fitted, check the operation of the switchbank to see that all positions function as desired.
- 11 Momentary push on (or push off) switch functions are provided by assembling the switch with neither latch - bar or cam follower present.
- 12 Please note that this system permits push-push functions to be placed in the midst of an array of latched units, without disturbing the continuity of the latching blocks.

Should it be necessary to dismantle an incorrectly assembled row of switches, simply prise apart the bracket and the blocks may be taken out for re-assembly. It is best to dismantle the entire bracket array - and then pinch the bracket back slightly, since a partial removal may leave a section of the bracket slightly too wide, causing the switches fitted therein to work loose.

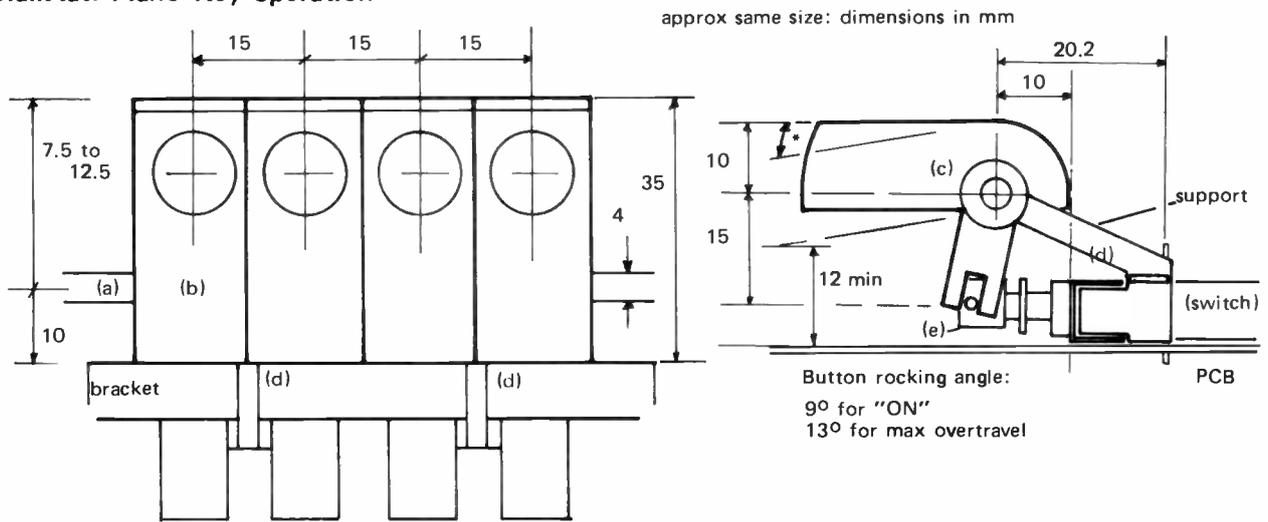


The illuminated Dialistat series may be made with a minimum switch pitch of 15mm. It is necessary to remember that the LED itself will require one of the switch contacts.

Block Dimensions



## Dialstat: Piano Key operation



The piano key system is available to fit 15mm pitch Dialstat switch assemblies, it comprises the following parts:

4mm dia pivot rod	(a)	
button	(b)	standard colour black
pivot retaining clip	(c)	a small grommet, or tight fitting PVC sleeving may be used alternatively
support bracket	(d)	this clips into the bracket alongside the switch modules, and supports (a)
slider cap adapter	(e)	this fits over the front of the slider, and incorporates the peg to locate the lower part of the button (b)

### PRICE LIST for DIALISTAT

Switch blocks	1-9	10-49	100+
2pole C/O			
Latching	23	19	12.5
Push/push	24	20	13
4pole C/O			
Latching	32	27	17.5
Push/push	33	28	18
6pole C/O			
Latching	42	36	24
Push/push	43	37	24.5
8pole C/O			
Latching	52	46	33
Push/push	53	47	33.5

Brackets and latchbars	1-9	10-49	100+
(may be cut to exact length by user)			
Brackets (Latchbars)			
10 way	10	8	6
	(8)	(7.5)	(5)
20 way	14	12	9
	(10)	(8)	(6)
30 way	18	16	12
	(12)	(10)	(8)
50 way	22	20	15
	(14)	(12)	(10)

### Illuminated system

This is simply a special button and LED holder used in connection with the standard switch. Remember to allow an extra switch pole to light the LED

	1-9	10-49	100+
LED holder	6	5	3.5
Button	16	12	9

See standard PL for details of various coloured LEDs

Block prices include: block, spring, retaining clip, location cup, dust cap, (cam)

### Piano Key Conversions & push buttons

A pivot bar for up to 10 button positions is supplied as standard, which must be cut to suit your exact requirement

	1-9	10-49	100+
Pivot shaft	42	34	28
Shaft holder	9	7	5
Slider cap	8	7	6
Piano key button	19	16	12

Buttons:	1-9	10-49	100+
Black, round 7.6mm dia/11.5mm long	8	6	4
Chrome outer, 11mm dia/15mm long	12	10	9
Chrome outer, 10mm dia/13mm long	12	10	9
9.8x5.5 tapered, black or red	8	6	5
14.7x7.4 rectangular black	9	7	6

### Ready made switch examples

Add 33% to the cost of the component parts. Max 5 switches - larger quantities quoted on application

### To order:

Where you have a specific switch design in mind, then please order by describing the entire switch assembly, as well as listing the parts required, eg:

On 15mm slider centres, a 4 way switch, with 3 interlocking 2pole C/O blocks, and a 6pole push-push on the extreme right will require a 10 hole bracket - with 10 hole latchbar cut to suit the three interlocked positions. The description is then:

4 way / 15mm centres	Parts:	3x2p C/O latching blocks	
		1x6p C/O push/push block	
2p 2p 2p 6p		1x10hole bracket	
latched P/P		1x10hole latchbar	plus knobs etc

If piano key parts are required:	4x piano key button
	1x pivot shaft *
	4x slider cap
	2x shaft holder
	(* to be cut to size by user)

### In General

The dialstat switch system is exceptionally versatile - and easy to assemble with a little practise. If you have not seen a fully assembled unit, then we suggest that your first purchase should be of a ready assembled unit - since example is one the best and quickest ways to familiarize yourself with the steps required in assembly.

Parts are generally available ex-stock, though please allow 7 days for ready assembled switches.

**D6 'key switches'** Ambit also carries stocks of the D6 keyboard pushbutton switch, for PCB mounting. Applications include all types of keyboard (including cross matrixed types), remote controllers, clock setting etc.

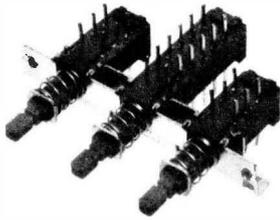
11.5 dia by 11 tall (from PCB surface) with silver contact material 1-9 : 14p 10-49 : 10p

Interlocking, high quality push button switch system

Alps SUB series

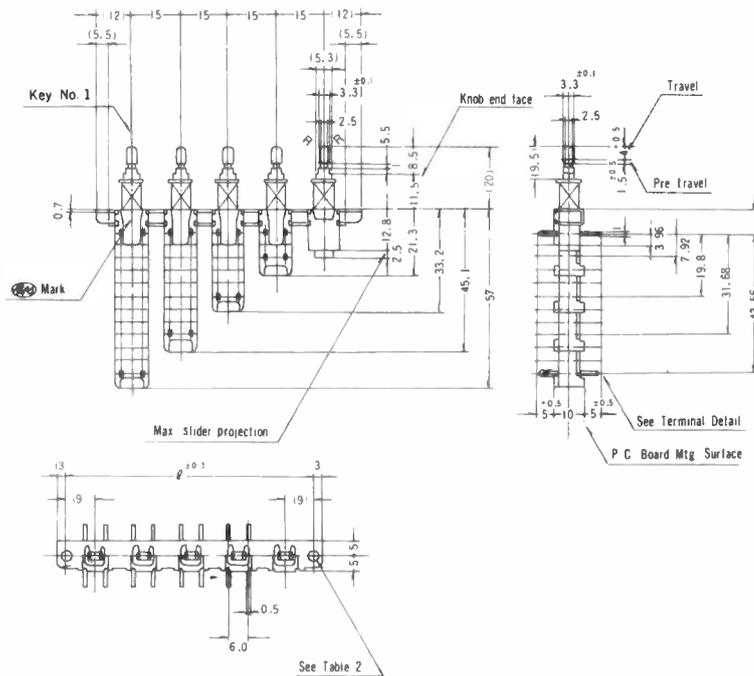
\* Professional quality switches, at low cost - with many possible permutations of assembly to suit a very wide range of applications in audio and radio, test equipment, etc.

The Alps switch range is one the most widely used and highly regarded in the electronics industry, and here we offer either ready assembled, or DIY sets of parts based on the widely used SUB system, which is interchangeable with Lipa/Isostat, Schadow, AB, Petrik and others. (In terms of configuration dimensions) Materials used are silver plated, giving a life of some 25,000 to 40,000 operations.



<b>Ratings:</b>			
Maximum voltage	125v RMS AC	45V DC	
Maximum current	125v AC/125mA	45V DC/300mA	
Test voltage	1000v RMS for 60 seconds		
Insulation resistance	100MΩ at 500V DC		
Types of action	Push/Push (Push for on - push again to reset)		
	Interlock (Selection releases other buttons in the interlock section)		
	Momentary (Push on - release off)		
	<b>All poles are changeover types 2pole to 8pole available in a single switch module</b>		

Dimensions - illustrated on a 15mm centre line pitch standard. Pitches available 10mm - 15mm - 20mm as standard (dimensions other than centre line pitch similar to all basic pitch units)



Mounting hole type

Button pitch	For screw	hole diameter
10mm	M2	2.4mm
15mm	M2/M3 st	2.4mm threaded
20mm	M2.6	2.8mm

Number of positions available per bracket 2 to 10  
 Number of poles per position 0,2,4,6, or 8  
 Contacts Non-shorting types

Interlocking:

Switches that are required to be interlocking in action must be placed together. Two groups of switches with independent interlocking action cannot overlap.

A bracket mounting mains switch approved to BS415 is available in this system. Buttons used in the SUB system are interchangeable with those used in other switch systems having the standard 3.3mm square end to the slider molding.

Ordering system: Please tick or indicate with a number as appropriate

Position function	1	2	3	4	5	6	7	8	9	10
Momentary										
Push/push										
Interlock										
Number of poles										

Pitch \_\_\_\_\_

Self assembly? \_\_\_\_\_

Quantity required \_\_\_\_\_

Please indicate the switches required to interlock by bracketing the appropriate modules

Prices	Switch modules	
	1-5	6-24
Poles	1-5	6-24
2	22p	18p
4	26p	21p
6	37p	34p
8	51p	46p

Brackets/Latch bars - any centre pitch dimensions			
Number of modules	1-5	No. of modules	1-5
1	8p/3p	5	28p/5p
2	18p/4p	6	30p/6p
3	23p/4p	7	32p/7p
4	26p/5p	8	35p/8p
		9	37p/8p
		10	40p/8p

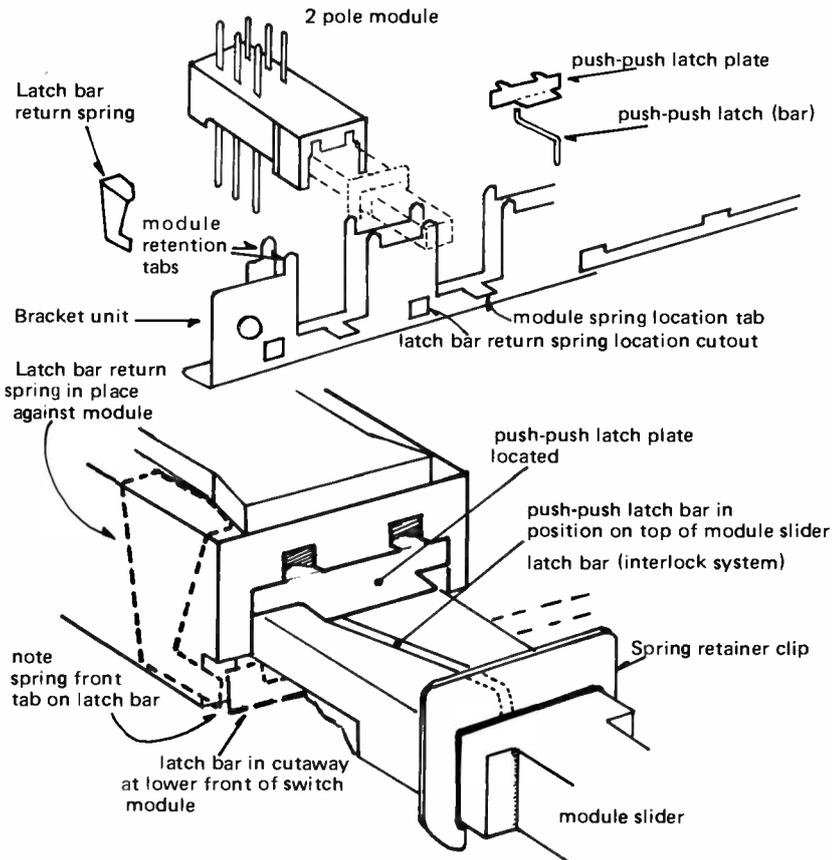
<b>Misc.</b>	
Latch bar spring	1p
Momentary stopper	2p
Push-push latch	15p
Push-push plate	15p
Mainswitch	62p
Zero module (latch release functions)	12p

The basic switch modules will be supplied with spring, and spring retainer clip ready fitted.

#### Assembly of switch units:

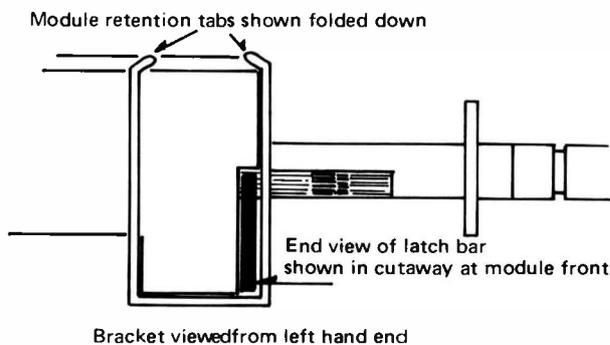
- 1 Remember to fit the modules into the correct side of the bracket, with the latch bar return spring location cutouts facing the button side
- 2 When locating the module in the bracket, pull the spring slightly forward, so that it fits over the spring location tab, and the lower face of the slider should then fit close against the upper surface of this tab.
3. When fitting adjacent latching switches, first fit the unit on the left of the switches to be coupled together, and remember to slot in the latch bar itself before folding down the module retention tabs. It cannot be fitted after the switch module has been secured.
4. The extreme left latching switch module is also fitted in conjunction with the latch bar return spring. The lower front tab of this return spring is allowed to protrude through the location cutout.

If you have not already seen an assembled unit based on the ALPS SUB series, we recommend that you do so before attempting a self assembly switch kit. Self assembly is quite straightforward, and a little practise will rapidly perfect your technique. Nevertheless, reference to a working example is an invaluable aid.



The Spring is not illustrated in any of these drawings- though obviously it must be fitted between the module body and the spring retainer tab.

#### End view



#### Knobs

It is anticipated that a broader selection will be made available shortly, the current range includes:

All chrome capping:	13mm long x 10mm dia
	Price 12p ea 10/80p
	15mm long x 11mm dia
	Price 14p 10/88p
Black barrel/chrome cap:	15mm long x 10mm dia
	Price 13p 10/85p

Remember that knobs from other switch standards may fit

#### TOKO KS series momentary action push button + rectangular knob.

##### Actual size with knob



##### Front view with knob



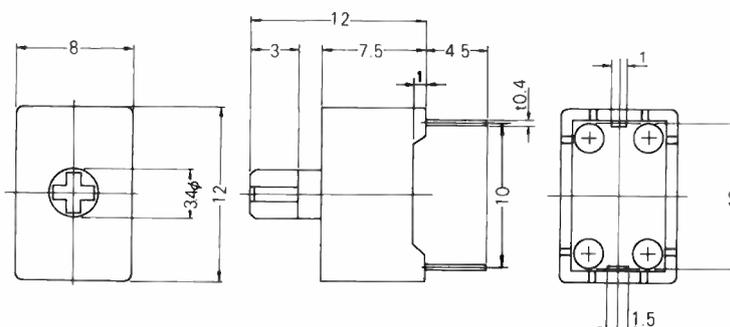
(The knob is detachable)

Current rating:  
10mA at 6v  
Insulation:  
100MΩ at 100V DC  
Life:  
More than 20,000 operations

Switches are one of TOKO's lesser known activities - and to start to introduce them to the UK, we offer the KS series light touch/positive action keyboard switch. These are high quality microswitch units, ideal for applications such as clock module programming, synthesizer setting etc. The KS series is ideally suited to PCB mounting for matrix arrays etc.

All TOKO switches are manufactured to the same exacting standards that have kept TOKO wound components foremost throughout the world

Dimensions in mm (Shown less knob, twice full size)



#### Prices:

1-9	22p
10-99	18p
100-999	14.8p

# Electromagnetic Interference Filters (EMI Filters)

With the sensitive wideband nature of most modern semiconductor products, susceptibility to mains and supply borne interference is a considerable nuisance - these EMI filters are designed to allow equipment to operate compatibly on a common power supply source, by limiting the amplitude of interfering voltages on AC power lines, and prevent them from propagating into, or out of, filtered equipment.

EMI filters work by creating a mismatch condition between the source and load impedances at high frequencies. This is caused by series inductance and shunt capacitive elements in various common filter configurations. Since the filter usually works with unknown terminating impedances, it is not possible to use the insertion loss data obtained with standard 50 ohm terminations - but as a general rule, power line impedance is low, whilst the equipment may be either low or high; Switching regulators (a prime source of EMI) are to be regarded as low impedance loads, whereas linear power regulators may be high. To achieve maximum mismatch, the filter must present a high series impedance or inductance to the power source, and a low shunt impedance or high capacitance to a high impedance load. If the equipment impedance is low, the filter must also present a high series inductance between source and load.

Common mode interference is the most frequently encountered type of EMI, since these signals are readily propagated in power systems and equipment which are generally less prone to interference from differential mode sources such as SCRs and switching PSUs. (Differential mode interference is rapidly attenuated in most wiring systems, but is propagated in free space causing RFI at high frequencies)

## Stanford Applied Engineering Filters

The filters offered by Ambit are manufactured by SAE, and meet various BS and world safety approval standards.

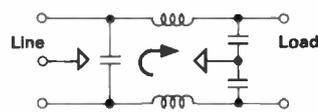
## General Application Filters

SAE's general application filters are available in two basic circuit configurations, to provide an economical solution to the majority of interference problems.

### Circuit A:

General application filters offering lowest cost and smallest size, for effective control of all common mode (line to ground) interference. The full range is very comprehensive - but please refer to current OSTs price list for details of current stock types. Many applications will tend to overlap, and in low volume, the price differential does not warrant stocking low current types where a higher rated device costs almost the same.

## Electrical Schematics

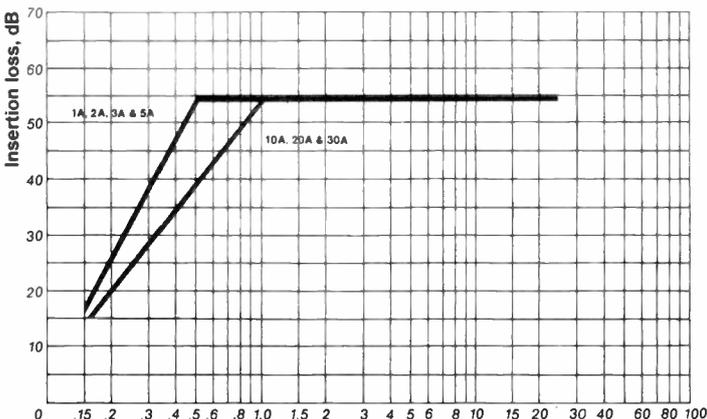
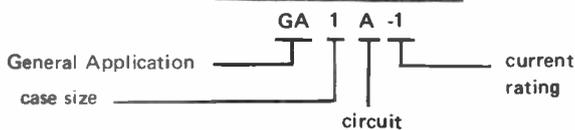


Circuit A

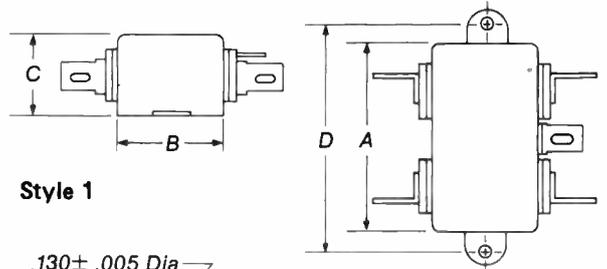
- Voltage Rating • 115-250 VAC**
- Line frequency • DC-400 Hz**
- Leakage current • Line to ground**
  - @ 115 V, 60 Hz - 0.5 mA max.
  - @ 250 V, 50 Hz - 1.0 mA max.
- Test voltage • 2250 VDC**
- Current overload test • 6 X rated for 8 sec.**
- Insulation resistance • 6000 Megohms @ 100 VDC**

Part No.	5 AMP	10 AMP	20 AMP	30 AMP
1 AMP GA 1A-1	GA 1A-5	GA 1A-10	GA 1A-20	GA 5A-30
GA 2A-1	GA 2A-5	GA 2A-10	GA 4A-20	
GA 3A-1	GA 3A-5	GA 3A-10		
2 AMP GA 1A-2		GA 4A-10		
GA 2A-2				
GA 3A-2				
3 AMP GA 1A-3				
GA 2A-3				
GA 3A-3				

### PART NO BREAKDOWN

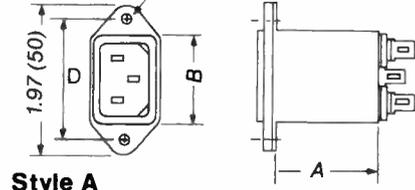


Insertion Loss in 50 OHM System



Style 1

.130 ± .005 Dia.  
(3.3) ± (.13)  
2 Holes



Style A

## Connector and medical filters

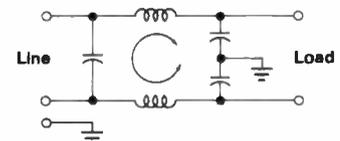
These filters are built into standard types of mains connectors, including the universal IEC type. Medical connectors have a reduced HF attenuation, since the requirements made in the standards for leakage current are exceptionally severe, thereby restricting the types and size of components used.

- Voltage rating • 115 to 250 VAC All units**
- Line frequency • DC to 400 Hz All units**
- Test voltage • Line to ground 2250 VDC**
- Line to line 1450 VDC**
- Leakage current • Line to ground**

- @ 115 VAC, 60 Hz (Schematic 1) - 0.5 mA
- @ 115 VAC, 60 Hz (Schematic 2) - 0.25 mA
- @ 115 VAC, 60 Hz (Schematic 3) - 2.0 μA
- @ 250 VAC, 50 Hz (Schematics 1 and 2) - 1.25 mA
- @ 250 VAC, 50 Hz (Schematic 3) - 5.0 μA

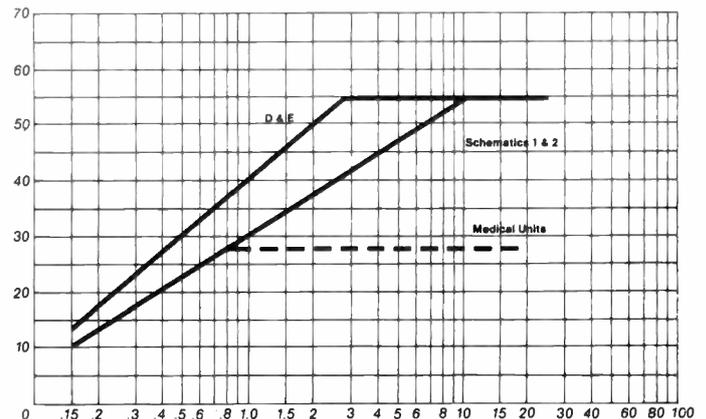
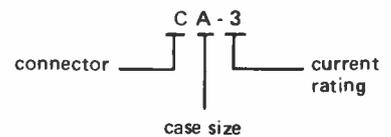
### Part No

1 AMP	CA-1
	CB-1
	CD-1
	CE-1
3 AMP	CA-3
	CB-3
	CD-3
	CE-3
6 AMP	CA-6
	CB-6
	CD-6
	CE-6
	C110
10 AMP	CD-10
	CE-10
	C110
15 AMP	C115



Schematic 2

### PART NO BREAKDOWN



The list here contains data relating to mainly stock types - a separate catalogue of all SAE EMI filters is available for 35p. Stock types GA1A5, CA-1 and CA-6 see OSTs PL for full details of types currently available from stock.

# Low power 1W audio - with very low standby current for 3 to 16v TBA820M

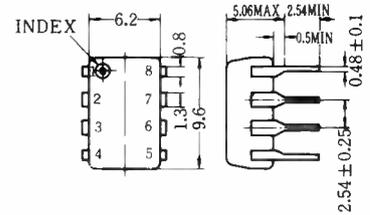
The TBA820M is derived from the standard TBA820 family, although the actual chip size is shrunk whilst retaining the same basic circuit. The power rating is correspondingly lower, but in all respects, the TBA820M resembles the larger versions of the family.

The standby power consumption is exceptionally low - and coupled with the very wide range of working voltages, the TBA820M is ideally suited to applications in hand held and portable equipment. In most hand held equipment, it is more economical to operate the IC with as low a supply voltage as necessary for the desired level of audio, since as seen on the graph of supply versus drain, a good working voltage for best efficiency is about 4v (but don't simply loose the excess voltage in a zener circuit !)

The supply voltage can be fed from the set's squelch circuit, thereby performing a dual role of switch and regulator.

These features make the TBA820M ideal for:

- Portable radios
- Metal locators
- Line powered intercoms



## ELECTRICAL CHARACTERISTICS

(T<sub>a</sub> = 25 °C unless otherwise specified)

Parameter	Test conditions	Min.	Typ.	Max.	Unit	Fig.		
V	Supply voltage	3		16	V	—		
V	Quiescent output voltage (pin 12)	4	4.5	5	V	—		
I	Quiescent drain current		4	12	mA	—		
I	Bias current (pin 7)		0.1	0.7	µA	—		
P	Output power	$d = 10^{10}$ $f = 1 \text{ kHz}$ $R_L = 120 \Omega$ $V_s = 12 \text{ V}$ $R_L = 8 \Omega$ $V_s = 9 \text{ V}$ $R_L = 4 \Omega$ $V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $V_s = 6 \text{ V}$ $R_L = 4 \Omega$ $V_s = 3.5 \text{ V}$ $R_L = 4 \Omega$		0.9	2	W	1	
V	Input sensitivity	$P_o = 1.2 \text{ W}$ $V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f = 1 \text{ kHz}$ $R_i = 33 \Omega$ $R_L = 120 \Omega$		16	60	mV	1	
V	Input sensitivity	$P_o = 50 \text{ mW}$ $V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f = 1 \text{ kHz}$ $R_i = 33 \Omega$ $R_L = 120 \Omega$		3.5	12	mV	1	
R	Input resistance		5		MΩ	—		
B	Frequency response (-3 dB)	$V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $R_i = 120 \Omega$ $C_B = 680 \text{ pF}$ $C_S = 220 \text{ pF}$		25 to 7000	25 to 20000	Hz	1	
d	Distortion	$P_o = 500 \text{ mW}$ $V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f = 1 \text{ kHz}$ $R_i = 33 \Omega$ $R_L = 120 \Omega$		0.8	0.4	%	1	
G <sub>v</sub>	Voltage gain (open loop)	$V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f = 1 \text{ kHz}$		75		dB	—	
G <sub>v</sub>	Voltage gain (closed loop)	$V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f = 1 \text{ kHz}$ $R_i = 33 \Omega$ $R_L = 120 \Omega$		31	45	37	dB	—
e <sub>N</sub>	Input noise voltage	$V_s = 9 \text{ V}$ $B (-3 \text{ dB}) = 25 \text{ to } 20000 \text{ Hz}$		3		µV	—	
i <sub>N</sub>	Input noise current	$V_s = 9 \text{ V}$ $B (-3 \text{ dB}) = 25 \text{ to } 20000 \text{ Hz}$		0.4		nA	—	
S+N	Signal and noise to noise ratio	$V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $R_i = 120 \Omega$ $B (-3 \text{ dB}) = 25 \text{ to } 20000 \text{ Hz}$ $R_1 = 100 \text{ k}\Omega$ $P = 1.2 \text{ W}$		70		dB	—	
SVR	Supply voltage rejection	$V_s = 9 \text{ V}$ $R_L = 8 \Omega$ $f (\text{ripple}) = 100 \text{ Hz}$ $C_6 = 50 \text{ }\mu\text{F}$ $R_i = 120 \Omega$		42		dB	2	

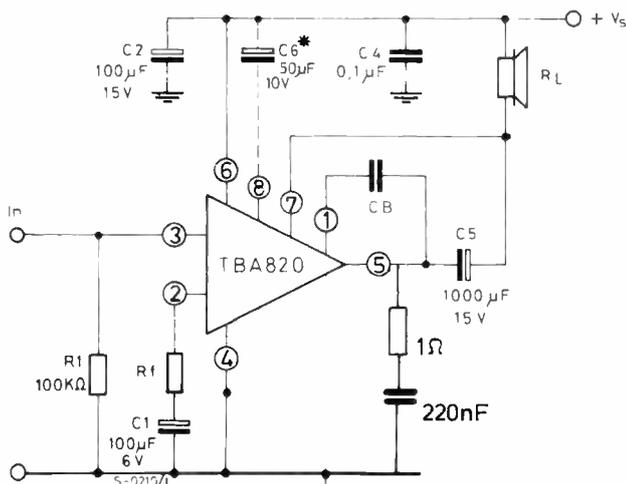
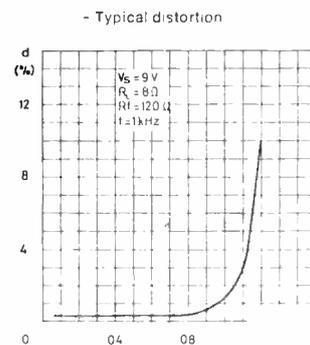
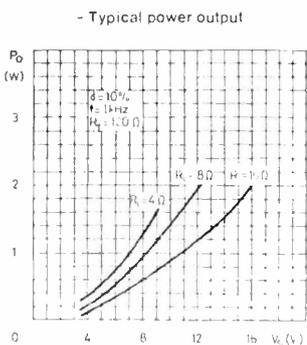
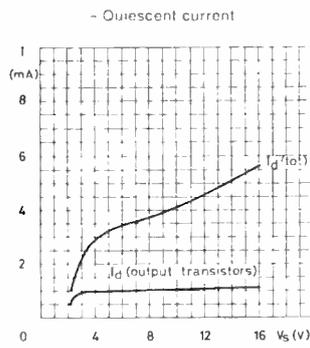
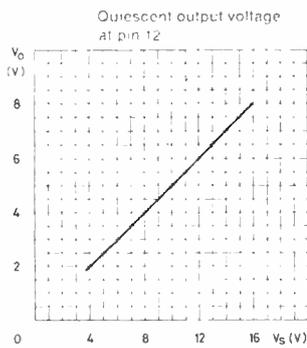
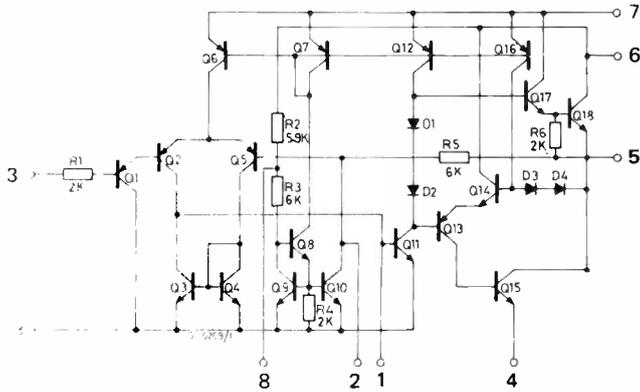


Fig one - load connected to supply

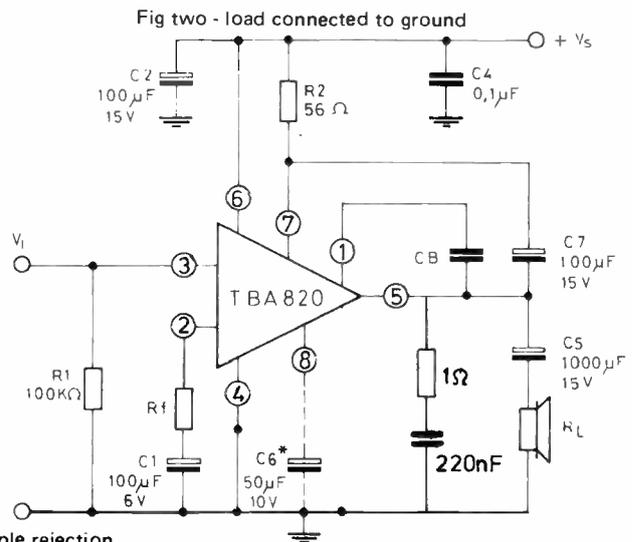


Fig two - load connected to ground

use C6 for best supply ripple rejection

# SAS6610 - SAS 6710 Multi-channel touch selector system, with automatic switch on priority

## AEG's versatile touch selection system

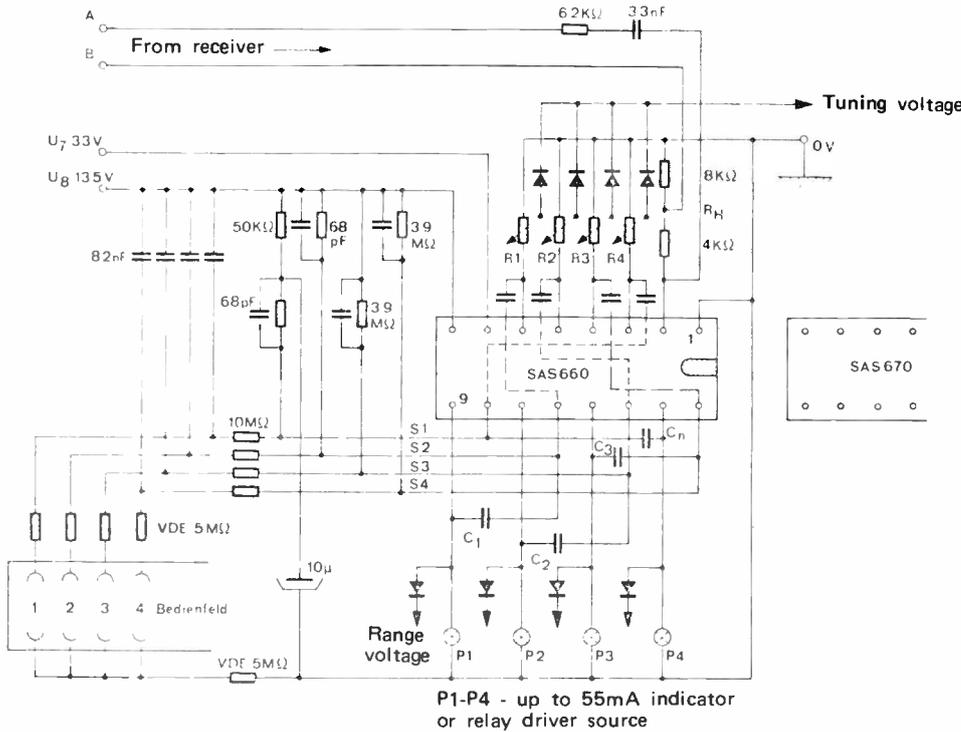
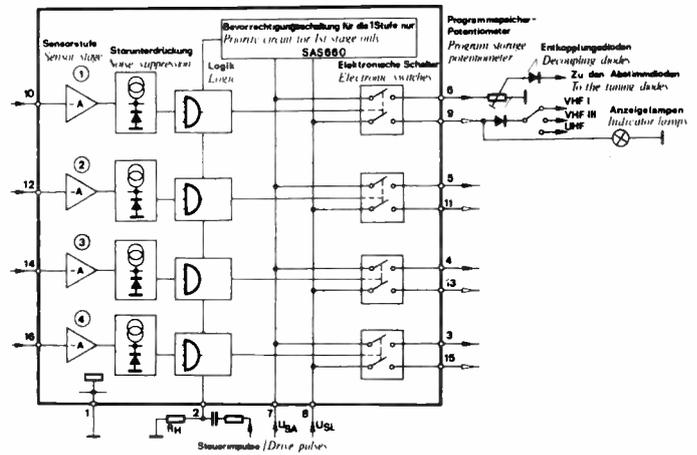
Most of you will have seen the SAS660 system, and to most intents and purposes, these devices are fully compatible in all types of application. However, the 6610 and 6710 incorporate additional features including:

- High sensitivity
- High noise immunity
- Low  $V_{sat}$  and temp drift of the switching transistors
- Selected programme maintained in standby mode
- Sensor inputs with protection diodes for mains/static

The SAS6610 is the basic device, which resets to the first chosen position on switch on. To extend the system in blocks of four, the SAS6710 is simply cascaded as shown in the diagram. The SAS6610 will maintain switchon priority.

The system may also be used as a ring counter, whereby any number of 6610/6710s may be operated from a simple impulse source - such a single push to make switch, remote control output etc. A parallel output remote control device may also be readily connected to the sensor input via limiting resistors.

A very comprehensive application note of 8 pages is available in accordance with our usual datacopying service.



### General application with serial pulse drive

In this application, the channel switching is provided from either the touch plate contacts - or a serial input from some form of pulse drive. The input 'B' is from a voltage, integrated from the drive pulse train to prevent false triggering.

This circuit is fully detailed in the application note for the SAS660/670, which is fully applicable to the 6610 and 6710

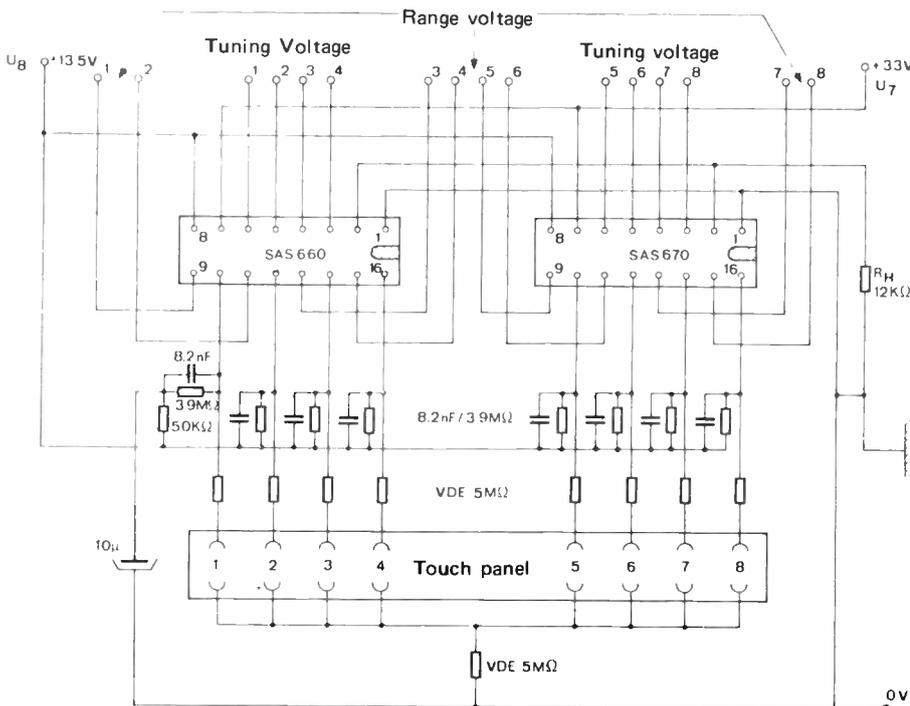
Note the indicator drives P1 to P4 - these sources are suitable for driving range indicator LEDs/lamps - but this feature also enables the circuit to provide switching of various other forms, such as the Mullard TDA1028/1029 DC input selector system. Alternatively, the drive may be used to provide band (range) switching in MW/LW/FM tuners, where individual presets are required to operate in conjunction with specific bands. Provided U7 is maintained, the IC will retain the last signal selected in its 'standby' mode. A quiescent current of 5mA is the only current drawn during standby.

### Cascaded operation of the SAS6610/6710

In this application, a further 4 ststions have been added, with a priority return on switchon to position 1.

Additional stages may be cascaded on the end in a similar manner.

In this instance, the range indicators are omitted, but may be included as above, if required.



# An on-going, meaningful scenario situation of new devices at this point in time : Misc. Stop Press

## TOKO coil additions

Style	Type no	Colour	Q	Int CpF	Turns:	1-2	2-3	1-3	4-6	other	Base type (see part one of cat) & notes
10KC	MKXCSK3464BM	black	100	27							3 - 27MHz HiQ RF coil for RC etc
10E	YWOS6A356EK	blue	70+	156uH nom		2	64	66	7		6 - low self capacity MW osc coil
10EZ	RWO6A775EK	green	80+	630uH nom		9	114	123	13		6 - LW and RDF band oscillator coil
10EZ	154FN8A6438EK	violet	100+	45uH		10	30	40	8		6 - SW1 RF / ANT, HiZ, HiQ
10EZ	154FN8A6439EK	yellow	110+	5.5uH		4	10	14	6		6 - SW2 RF / ANT, HiZ, HiQ
10K	KXNK3767EK	black	80+	1.2uH		2	6	8	5		6 - SW3 RF / ANT, HiZ, HiQ
10EZ	154AN7A6440EK	white	90+	38uH		10	31	41	9		6 - SW1 OSC HiZ
10EZ	154AN7A6441EK	green	70+	5uH		4	11	15	7		6 - SW2 OSC HiZ
10K	KXNK3766EK	blue	80+	1.1uH		2	6	8	5		6 - SW3 OSC HiZ

208BLR3152N - a 19/38kHz mono mpx pilot tone filter (smaller sized version of 190BLR3152N)

208BLR3155N - a 26/38kHz mono filter for pilot cancel stereo decoder applications

5S coils: Certain stock types are now available, being based on scaled down values from 10mm types:

			1-2	2-3	1-3	4-6	Q
5SNR-0188N	from RWR331208	for MW antenna/RF and osc applications.	13	127	140	52	57+
5SNR-0187N	from YMRS80046N	for MW/LW osc applications	2	93	95	14	75+
5SNR-0332N	from YWOS6A356EK	for MW/LW osc applications	2	92	94	10	70+
5SPN-0186N	from 94AES-30466N	for 10.7/9MHz IF filter matching etc	7	3	10	2	67+
5SPC-0185A	from KALS4520A	for 10.7/9MHz IF and filter matching	7	8	15	1	78+
5SPC-0210Z	from KACSK586HM	for 10.7MHz quadrature detection			15		95+
5SLC-0184AC	from YHCS11100AC2	for 455-470kHz IF and detector applications	137	43	180	27	77+
5SLC-0333R	from YRCS12374AC2	for 455-470kHz IF applications	142	43	185	7	80+
5SLC-0190N	from YLE4A888EK	for 455-470 IF and detector applications	58	58	116	16	85+
5SLC-0331R	from YHCS1A590R	for 455-470kHz IF/detector and filter matching	104	76	180	20	80+

## Monolithic ceramic capacitors

These small, low inductance 50v capacitors are well suited to RF decoupling applications - where the inductance of other types of capacitor construction can cause problems. Depending on popularity, we propose to stock a full range in time - but for the time being, only miniature 100n and 10n will be stocked.

Good decoupling of high gain ICs such as the MC3357 and SL6640 can permit a much more flexible layout design, and one or two projects that are proposed around these types of ICs will be requiring the use of monolithic types. (Eirre redcap types, ITT, AEG etc.)

The cost of these capacitors is considerably more than cheap ceramic types, but the stability and loss factors are far better, making them the most widely used type of capacitor in many communications and similar professional applications.

## New linear phase ceramic filters from Murata

A recent addition to the range of ceramic filters from Murata is the SFE10.7ML, which resembles existing types of 10.7MHz filter, except for its very characteristic blue colouring. Input/output impedances are the standard 330 ohm, but the most important feature is the phase linearity, which is within 0.25uS group delay over a 140kHz bandwidth, the centre of which is colour coded in the usual way.

Part number	3dB bandwidth	20dB bandwidth	Insertion loss	Spurious responses (9-12MHz)	Group delay 0.25uS BW
SFE10.7ML	280kHz ± 50kHz	650kHz max	9dB max	better than -25dB	fcentre ± 70kHz min

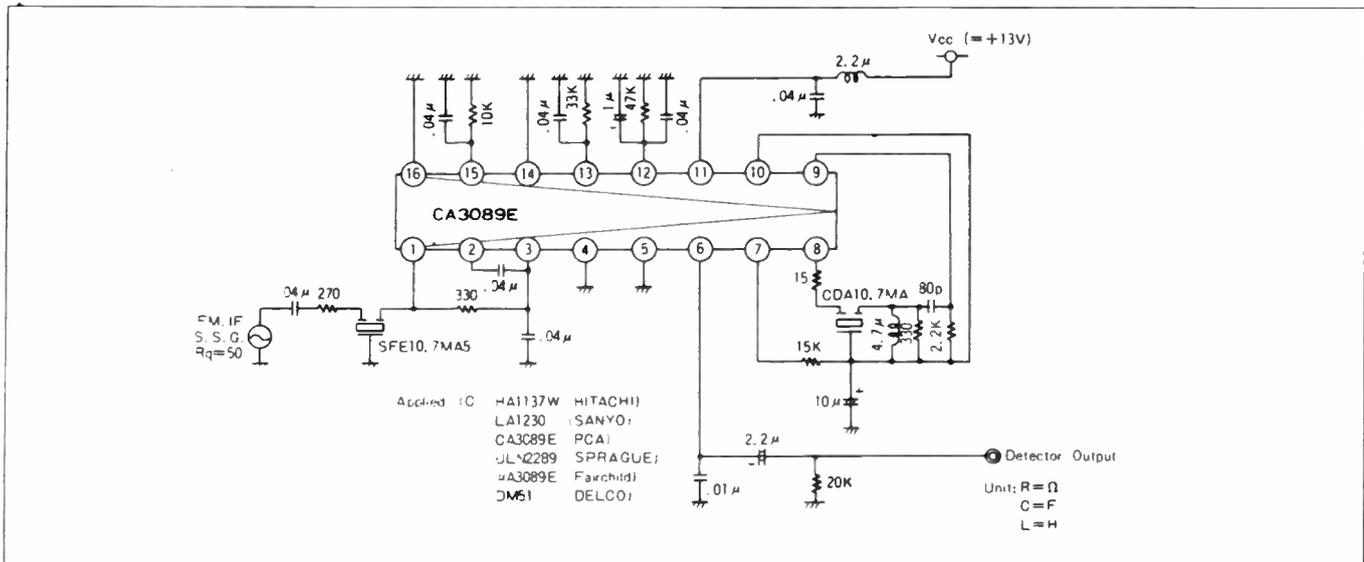
These filters may be used to good effect in any existing design (which is correctly terminated with 330 ohms resistive) - but since the nature of linear phase filters is generally broader, with slightly lower spurious rejection than the regular types, certain factors must be taken into account to suit a given set of listening conditions.

A new hyperfi series IF is currently under development, using 2x SFE10.7ML filters, together with a diode switched narrow filter to cope with all types of band 2 conditions, details of which will be ready by about September 1979. Meantime, the filters are available from standard stocks.

## Ceramic discriminator for 10.7MHz

For small size, and freedom from adjustment, we now offer the CDA10.7MA ceramic discriminator device. The test circuit and details below apply to the most widely used family of devices - and is applicable to the CA3189E and KB4402/4420 and the new Hitachi 12411.

## [CA3089E] Type IC Test Circuit



Some brief work has been carried to determine the use of this type of detector for NBFM at 10.7MHz, and whilst this work is still at an early stage, it seems that the CDA10.7MA will provide a useable output with 5kHz deviation (approx. 150mV of AF) when increasing the resistance between pins 9 and 10 to approx. 5k6, and using a 4-65pF trimmer across the 4.7uH choke to trim for best results. We would be interested to report on the experiences of any others with this application.

## "Doing up the FRG7"

A fuller feature has been held over from this issue, on the subject of upgrading the popular FRG7 receiver. The modifications include a two stage, or three stage diode switched IF filter, for AM, FM and SSB applications, an NBFM adapter based on the MC3357 - and the reason for the delay, our new DFM 1 digital frequency display with the OKI MSM5524 chip, to provide clock and digital readout accuracy. The DFM1 is delayed due to shortage of OKI parts at the end of 1978 (for a strike in Japan of all things) but at the time of writing, parts are in stock, and work is once again going ahead, and should appear in our next issue. Sorry for the omission here.

Photocopies of an article draft for conversion using the MFL and MFH41T filters is available for 40p - this being rather more comprehensive than the feature in August 78 Radcom for MFL filter conversion of the FRG7.

## Metal film resistors

With modern ICs doing away with so many discrete components, it seems only fair to make the last few remaining discrettes as professional as possible. With this in mind, Ambit is stocking 2% metal film resistors from March 79 - to be sold by the ten only - see future PL for details.

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