50 Simple L.E.D. Circuits Book 2

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INTRODUCTION

This book is the result of further experiments and tests carried out after the publication of my book No. BP42 "50 Simple LED Circuits" by Bernard Babani (publishing) Ltd. in 1977. As a result certain ideas have had to be modified.

It was stated in my first book that the longer lead of the LED is the cathode, this was the case with every LED tested. However, since the publication of that book, LEDs appeared which have the longer lead connected to the *Anode*, this is against the usual convention that the cathode of a diode is identified, but it seems that at least one major manufacturer produces LEDs with a longer anode lead.

This means that LEDs must always be checked for polarity before being soldered into circuit (see Circuit 1).

Red LEDs seem to be much more robust than green or yellow ones. Several of the original green LEDs used failed after several months for no apparent reason. LEDs can be destroyed by excessive current or a relatively low reverse voltage but the green LEDs failed in circuits where neither cause was possible. The reason for this sudden failure remains unknown. The lifetime of a LED is predicted as many years with a very gradual reduction in light output over the period. No red LED has failed in this way. LEDs can be used on low voltage A C but there is a possibility that the LED could be destroyed by the reverse voltage, a silicon rectifier should be connected to protect the LED, as described later.

Many of the circuits are shown as powered by 3 volt or 9 volt batteries, batteries are expensive, but at least this means that the circuits are perfectly safe for anyone to experiment with. However, one or two circuits are clearly marked as being not suitable for beginners.

ABBREVIATIONS USED

A	Anode
A C	Alternating Current
C A	Common Anode
C C	Common Cathode
D C	Direct Current
D P D T	Double Pole Double Throw Switch (Two circuit changeover switch)
G	Gate
K	Cathode
LED	Light Emitting Diode
S C R	Silicon Controlled Rectifier (Thyristor)
S P S T	Single Pole Single Throw Switch (ON/OFF)

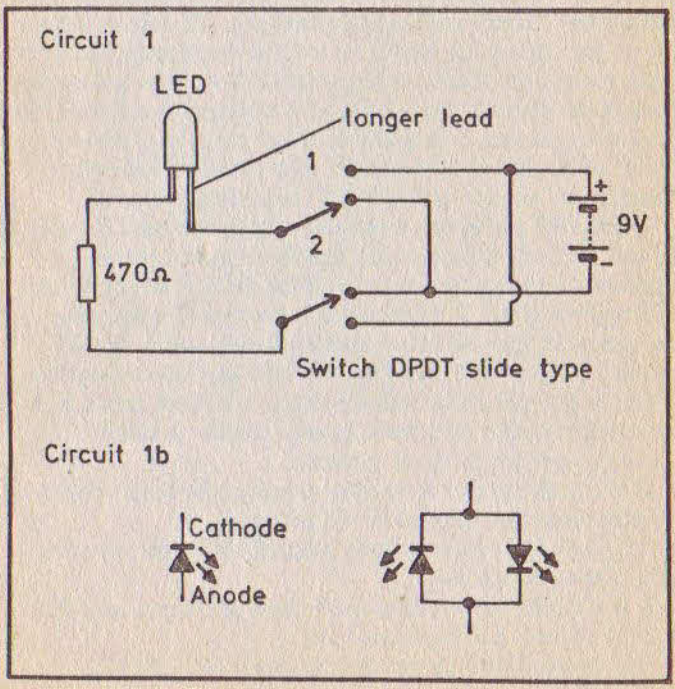
CIRCUIT 1
LED Test Circuit

This is a simple circuit to determine the polarity of a LED.

The longer lead of the LED should always be connected as shown. At switch position 1, if the LED glows the longer lead is the ANODE. At switch position 2, if the LED glows the longer lead is the CATHODE. See Circuit 1.

If the LED does not glow in position 1 or 2 it is faulty but check carefully that the two LED leads are not touching and causing a short circuit.

If you are testing a large number of surplus or "bargain price" LED's you may get weird results. One Green LED was found which glowed brightly in one direction (anode positive) but also glowed dimly but distinctly in *reverse*. You might come across a LED which glows equally brightly in either



direction, this is a "twin" LED as shown in Circuit 1b, i.e. two LEDs connected in Inverse Parallel, or a LED which glows Red in one direction and Green in the other (see later Circuits).

The resistor value shown is 470Ω this makes the tester suitable for any colour LED, if Red LEDs only are tested the value can be 1kΩ or 2.2kΩ this will still give quite a bright glow but will reduce the current drawn from the battery.

The switch is a miniature D P D T slide type details of the several ways in which the D P D T slide switch can be used are given later.

CIRCUIT 2
Diode Tester

Power rectifiers can be tested easily with a LED and a 3 volt battery but signal diodes such as the 0A91 are intended to pass only a small current and might be damaged. This circuit uses a low current to test the diode, the test current is amplified by a transistor and the transistor turns the LED on. The test current through the diode is about 1mA. The transistor is a 2N697, this is a general purpose type available at low cost and is used in several other circuits in the book. Any transistor which is described as "similar to the 2N697" is perfectly suitable.

If the diode under test is connected as shown the LED will glow if the diode is functional. The diode should also be tested in the reverse direction and if the diode is functional the LED will not glow. A diode which is functional conducts in one direction, forward bias – anode positive, and does *not* conduct in the reverse direction, reverse bias – anode negative. If the diode conducts in both directions it is short circuit, if it conducts in neither direction it is open circuit. A short circuit or open circuit diode is useless.

If the diode appears to be open circuit make certain that it is actually connected into the circuit properly.

The cathode of a signal diode is usually indicated by a ring next to the cathode lead.

If you remove diodes from old broken radios you may find that the cathode end is coloured red.

Germanium signal diodes are numbered 0A91, 0A90,

0A81 etc. diodes of American or Japanese origin have type numbers 1N60 etc. For further details on signal diodes and their uses see Book No. BP36 50 Circuits using Germanium, Silicon and Zener Diodes, published by Bernard Babani (publishing) Ltd. Tr1 the 2N697 is functioning as a current amplifier.

Germanium diodes are not perfect rectifiers they do pass a small current in the reverse direction, this reverse current when amplified may be sufficient to cause the LED to glow very dimly, this does not mean that the diode is faulty it is quite normal.

Sometimes the anode and cathode of a diode are indicated as A and K.