Transistor CHECKER

COVER PROJECT

P. D. MADDISON

THIS device indicates the polarity, *npn* or *pnp* of transistors and of diodes, and can give an indication of "open" or "short" defects. Fig. 1 shows a standard Astable oscillator running at several kHz, Tr1 and Tr2, with buffer transistors Tr3 and Tr4, and drivers Tr5 and Tr6 for the two LED displays. The buffer transistors isolate the oscillator and provide an AC signal to the component under test. The buffers are essential, as a short across the oscillator would stop it functioning. The 10kΩ load resistors limit currents, during normal short conditions, to a safe value.

The collector of Tr3 provides drive to the emitter of the transistor under test. The collector of Tr4 drives the collector and the base, via a current limiting resistor R7, of the transistor under test, ensuring that they are of the same polarity and opposite to that of the emitter.

Operation

Assume an *npn* transistor is connected to EBC so when E is high and C is low the transistor is reverse biased and cut off. The high state is amplified by Tr6 and the LED, D4, lights up. When, on the opposite half cycle, E is low and C goes high the transistor is forward biased and switches on. This forces C to go low also and hence neither LED is lit.

The high speed of the oscillator makes it appear as if a single LED is on, thus giving indication of *npn*. The converse happens for a *pnp* transistor and the other LED stays on. A diode can also be tested by connecting between E and B or C. The *npn* LED then indicates that the cathode is at E.

It can be seen that in the open circuit, no component connected, both LEDs are alternatively switched and appear on. For a short circuit condition the high state is pulled to low and hence both LEDs go out. See summary table.

The diodes, D1 and D2, provide an extra 0·6V voltage drop to ensure that a low condition (approx 1V)

Summary of operation

Both LEDs ON: normal state, open circuit condition

One LED ON: indicates the required polarity

Both LEDs OFF: Short circuit condition

One or both LEDs partly on: partial short circuit, high leakage component, LED drivers not fully off (see text). **Note:** some transistors readily display this fault, especially germanium and 'self-oscillating' HF types. They may not necessarily be faulty so it is wise to check further, in the normal way, with a meter.

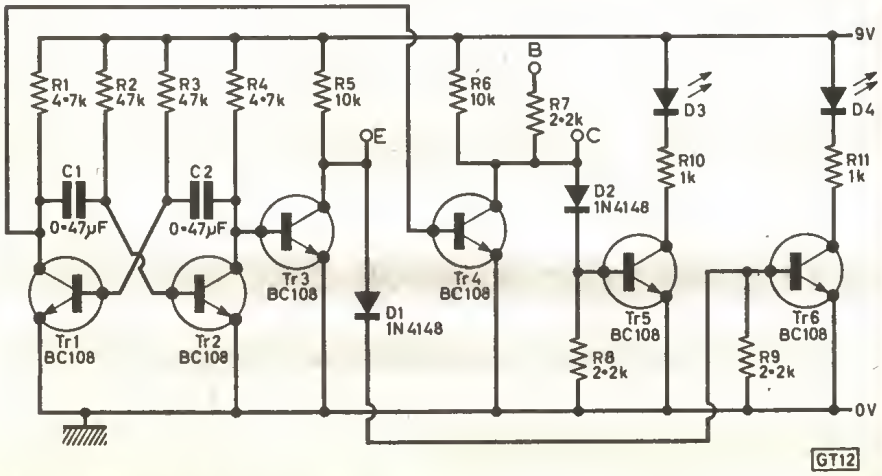


Fig. 1: Circuit of the Transistor Checker. The LED D4 corresponds to an 'NPN' indication and D3 to 'PNP'. A 9V PP3 battery can be located inside the box or two terminals fitted to the box for an external supply.

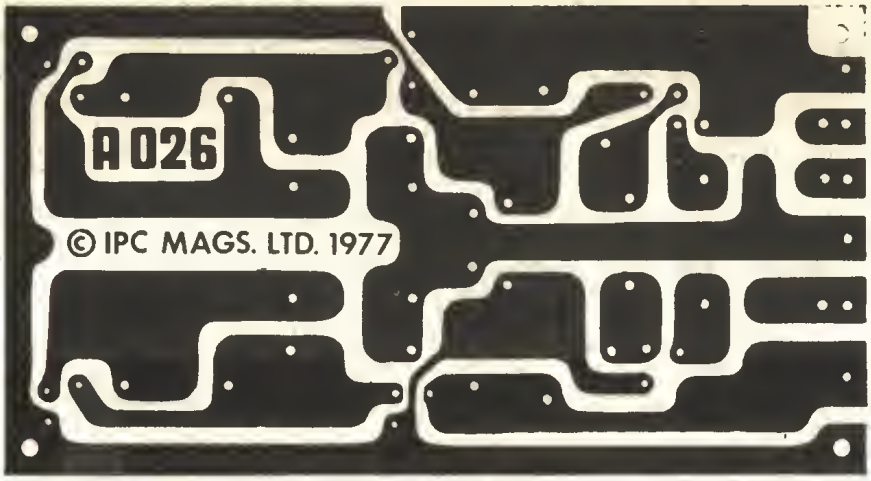
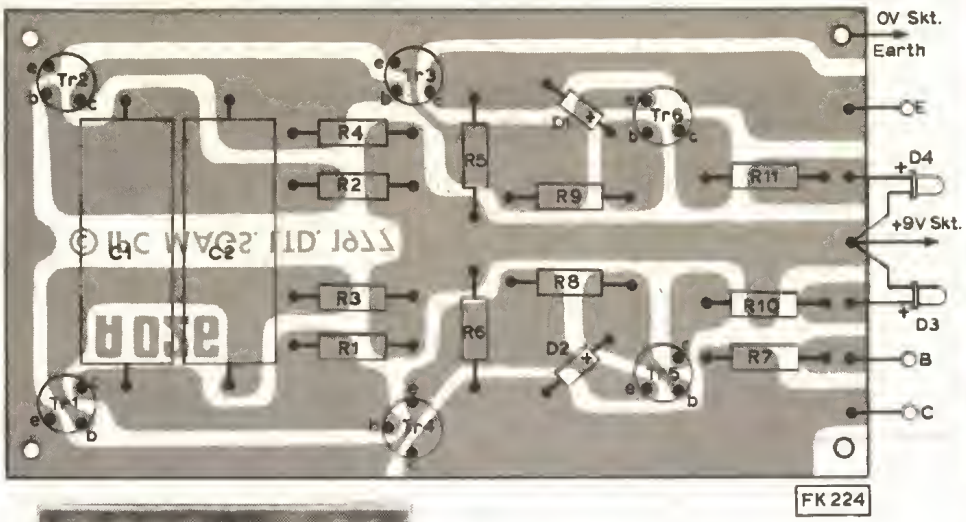
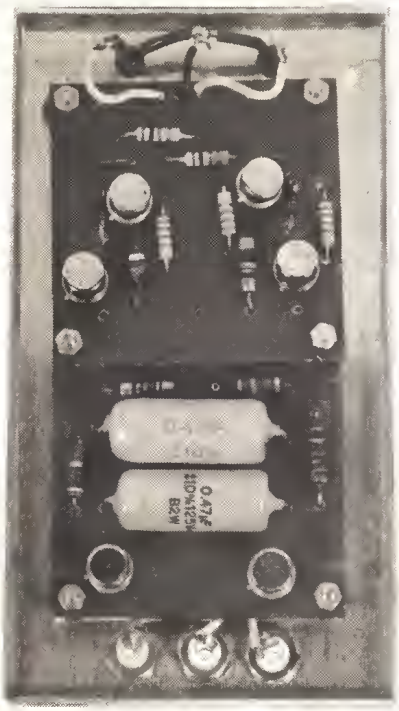


Fig. 2: above, is the printed circuit board, copper side, shown full size. Fig. 3: below, is the layout of the components on the PCB.





View of the first model of the Transistor Checker in which two boards were bolted together. The test sockets are at the bottom and the LED's at the top.

★ components list

Resistors

R1	4·7kΩ	R5	10kΩ	R9	2·2kΩ
R2	47kΩ	R6	10kΩ	R10	1kΩ
R3	47kΩ	R7	2·2kΩ	R11	1kΩ
R4	4·7kΩ	R8	2·2kΩ		

Capacitors

C1 470nF C2 470nF

Semiconductors

Tr1 to Tr6 inc BC108 D1 and D2 1N4148 or similar
D3 and D4 LED general purpose

Miscelianeous

Aluminium box 5¼ x 2¾ x 1½in. or similar
Sockets 5 off. PCB from PW Readers PCB Service, see ad.

turns the LEDs fully off, in conjunction with R8 and R9. If necessary, further resistance may be added in series with the diodes. In the prototype it was found that with a "good" transistor one LED remained partly lit due to this fault, normally indicative of a leaky transistor, especially germanium.

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Construction

Construction should present no problems due to the simplicity of the circuit. A home-made printed circuit board was used, Figs. 2 and 3, but veroboard could easily be substituted. Small sockets were used for external battery and transistor connections. This saved on the expense of a transistor socket and battery holder. Most constructors have an S-dec or T-dec breadboard which provides an ideal holder for components under test. Crocodile clips are also useful, especially for TO3 power transistors which cannot easily be plugged into some holders. The LEDs were panel mounting types fitted to the front of the box.

Notes

The unit will work over a wide range of voltages limited at the low end by the oscillator functioning and the dimming of the LEDs. It is not recommended for use over 15V since some components can be damaged by the reverse voltage, (current limited) that may result.

The oscillator outputs are available, buffered, at E, B and C, if required, for example as a signal generator.

Finally, note that when testing transistors the collector should be firmly connected. The unit will give an indication across the base-emitter junction, and, if the collector is unconnected, will fail to reveal a collector-base/collector-emitter short circuit. PW