Fig. 1. Circuit of the ETI Reaction Tester Game.

NOTE:
IC1 IS 4017
IC2 IS 555
SCR1 IS C103YY
LEDS1–4 ARE 0.2" GREEN LEDS
LED5 IS 0.2" ORANGE LED
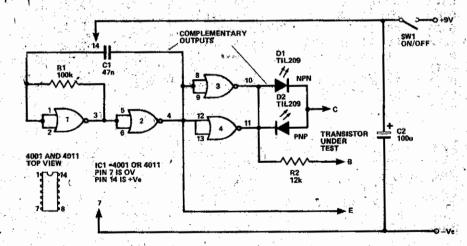LEDS6–9 ARE 0.2" YELLOW LEDS
LED10 IS 0.2" RED LED

Designer Circuits

QUICK TRANSISTOR CHECKER

This very simple and inexpensive circuit is not designed to measure any transistor performance figures, but is intended for quick testing to show whether or not the test device is functional. The basic method of testing a transistor is to first connect a supply to its emitter and collector terminals and check that no significant current flows. If the base terminal is then given a small forward bias, this will be amplified in the form of a large collector-emitter current.

This circuit is based on a CMOS quad 2 input NAND or NOR gate IC. Either type is suitable as each gate has its two inputs connected together so that it acts as an inverter. The first two inverters are used in conjunction with R1 and C1 as a conventional CMOS oscillator operating at a frequency of a few hundred Hz. The other two inverters are connected in parallel, and fed from the output of the oscillator so that they provide a complementary output. In other words, one output will be positive and the other will be negative except during the brief periods when the outputs change state.

The collector and emitter of the transistor are fed from the outputs via D1 and D2, and the base is fed from one output via R2. If we assume that an NPN device is being tested, when gate 2 output is positive and the other output is negative, the transistor will not be forward biased by R2 (it will be reverse biased in fact) and it should pass no significant collector current. If it is a short circuit device and does pass such a current, this will pass through D2 which will light up and indicate the fault. When the outputs are in the opposite states, the transistor will be forward biased by R2 and should conduct heavily, causing D1 to pass a current and light up. Failure of D1 to come on indicates an open circuit or very low gain device. PNP devices operate with the opposite polarity, and so when testing one of these it is D2 that should switch on, and D1 which should remain off.

Summary

One LED on = functional device, type (ie PNP/NPN) as indicated.
Both LEDs on = short circuited device.
No LEDs on = open circuit or very low gain device.
Diode or rectifier testing (anode to collector, cathode to emitter).
D1 on = functional device.
D2 on = connected with wrong polarity.
Both LEDs on = short circuited device.
No LEDs on = open circuit device.