Logic Pulser

A simple, inexpensive companion for your logic probe

By Mike Tooley

This instrument is designed for use in conjunction with a logic probe but it can also be used in its own right as a means of changing the logical state of a digital circuit without the need to make any soldered connections. The pulser is fully compatible with both CMOS and TTL devices.

Circuit Description

The complete circuit diagram of the Logic Pulser is shown in Fig. 1. A 555 timer, IC1, is connected as a monostable pulse generator.

The output of IC1 (at pin 3) will go high for a period determined by the time constant, R2 x C2, whenever the pulse button, S2, is depressed. With the values specified, the pulse duration is approximately 5ms.

The polarity of the output pulse is switched by means of S1. Transistor TR1 acts as an inverter while TR2 and TR3 operate as saturated switches (providing positive and negative output drive respectively). The output current is limited by resistors R7 and R8. With the component values shown and assuming a standard TTL 5V supply, the peak current sourced or sunk into a short circuit will be limited to several hundred milliamps.

When no output pulse is being produced, TR1 conducts but both TR2 and TR3 are in a non-conducting (switched off) state. The output at the probe tip thus floats in a high- impedance state.

Diode, D1, is incorporated in order to provide protection against inadvertent reversal of the supply leads.

Construction

All components for the logic probe are mounted on a 0.1 in matrix board comprising 9 strips of 37 holes.

The component layout of the Logic Pulser is shown in Fig. 2. The following sequence of component assembly is recommended; button switch, IC socket, terminal pins, links, transistors, resistors, diode, and capacitors.

The probe tip boss and supply lead should be connected last. In the latter case, care should be taken to ensure the correct polarity (red crocodile clip/striped lead to positive).

Constructors should note that a total of 18 track breaks are required and these should be made using a spot face cutter. If such a tool is unavailable, a sharp drill bit of appropriate size may be substituted. Three links should also be made under the board, shown dotted on the topside view in Fig. 2.

Before inserting the IC into its holder and mounting the circuit board in its final position, carefully check the components, links, and track breaks. Furthermore, it is worth checking that all of the polarized components (including transistors, diode and electrolytic
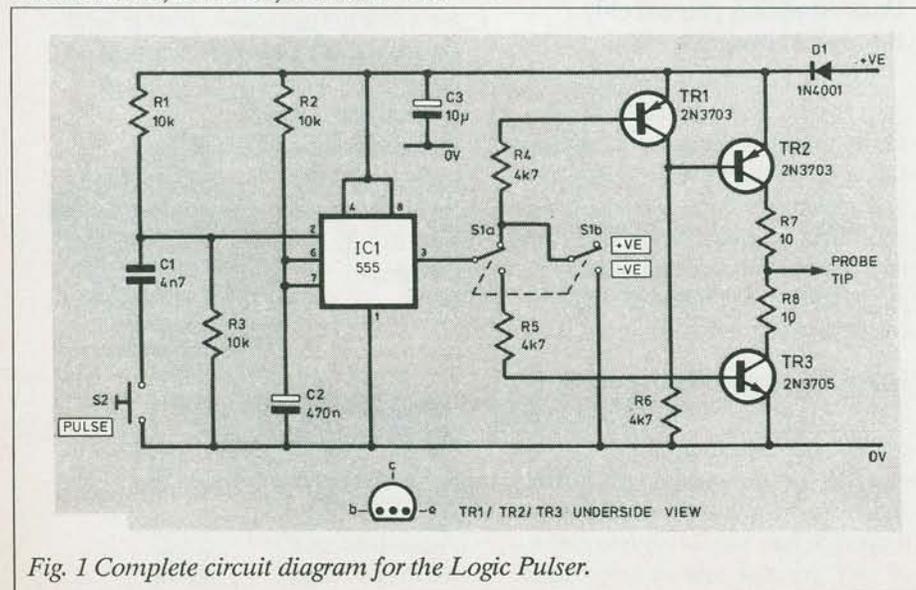

Fig. 1 Complete circuit diagram for the Logic Pulser.

capacitors) have been correctly oriented. Also, carefully examine the underside of the stripboard for dry joints, solder splashes, and bridges between adjacent tracks.

Probe Case

When the board has been thoroughly checked, the integrated circuit should be inserted into its holder. The circuit board should then be temporarily placed in the base of a suitable probe case (approx. 140mm x 30mm x 20mm). Depending on the case used, it may be necessary to fasten the board with screws; some cases may allow friction fitting within the two halves.

The upper half of the probe case should then be marked for drilling and cutting the apertures that will be necessary in order to permit access to switches S1 and S2. Switch S1 will require a rectangular hole measuring approximately 8mm x 3mm, while S2 will require a square aperture measuring 12mm x 12mm. In both cases it will be necessary to drill several small round holes and then apply a small square or rectangular section file.

When complete, the two case halves should be screwed together (using the countersunk screws supplied with the case) and the probe tip should then be fitted.

Testing

The probe should be tested using a current limited 5V supply of the type normally employed with TTL and CMOS circuits together with a logic probe. Connect the pulser and logic probe supply leads together and to the power supply (taking care to observe correct polarity). Then link the two probe tips together using a short length of insulated wire fitted with two crocodile clips.

Switch S1 should first be set to produce a positive pulse. Do not, at this stage, operate the pulse button, S2, but check that the output of the pulser is in a tri-state condition (none of the logic probe's LEDs should be illuminated). If this is not the case, disconnect the pulser, dismantle and check the pulser's circuit board again.

Having verified that the pulser operates in the quiescent state, a pulse

should be generated by depressing S2. At the same time the state of the logic probe's LEDs should be examined. Hopefully, these should confirm that a positive pulse is produced. If no pulse is produced or if the logic pulser generates a continuous low or high state output, the pulser should be dismantled and the circuit layout should be carefully checked again. Finally, the foregoing procedure should be repeated with S1 switched to produce a negative going output pulse.

Parts List

Resistors
All Resistors are 0.25W 5%
R1,2,3 .... 10k
R4,5,6 .... 10k
R7,8 .... 10R

Capacitors
C1 .... 4n7
C2 .... 470n tant. 35V
C3 .... 10m tant. 16V

Semiconductors
IC1 .... 555 Timer
D1 .... 1N4001
TR1,2 .... 2N3703 pnp
TR3 .... 2N3705 npn

Miscellaneous
S1 .... Low profile PCB mounting keyboard sw.
S2 .... Ultra-min. DPDT vertical slide sw. 8-pin low-profile IC socket; probe case (140mm x 30mm x 20mm); single-sided 1mm terminal pins (3); stripboard, 0.1 inch matrix, see text.

Specifications

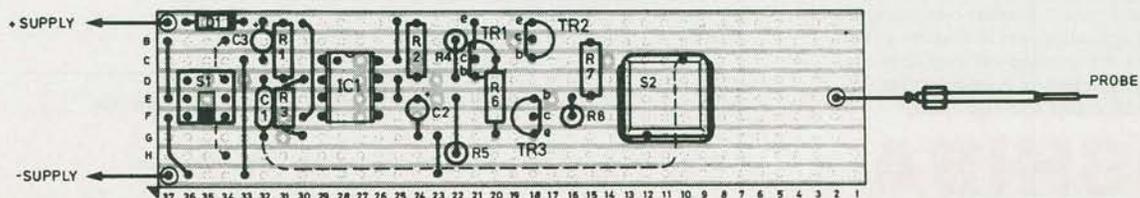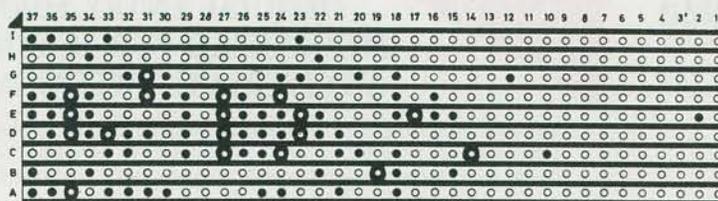|	
Output Pulse Duration:	5.2ms
Pulse Polarity:	Switched positive or negative
Peak Output Current (short circuit):	200mA (approx.)
Quiescent Resistance at Probe Tip:	Greater than 200k
Power Supply Requirements:	4.5V to 15V at less than 15mA quiescent

Fig. 2 Component layout and wiring for the Pulser. The link wires shown dotted must be soldered to the underside of the board. The breaks to be made in the underside copper tracks are shown left.