



## CMOS logic probe

A LOGIC PROBE is a device which is used when testing digital circuits, and it shows the logic state at the selected test point. In common with most designs, this one can indicate four input states, as follows:

1. Input high (logic 1).
2. Input low (logic 0).
3. Input pulsing.
4. Input floating.

The circuit uses the four two-input NOR gates contained within the 4001 CMOS device and is primarily intended for testing CMOS circuits. The probe derives its power from the supply of the circuit being tested. The first gate has its inputs tied together so that it operates as an inverter, and it is biased by R1 so that roughly half the supply potential appears at its output. A similar voltage appears at the junction of R4 and R5, and so no significant voltage

will be developed across D1 and D2, which are connected between this junction and gate 1 output. Thus under quiescent conditions, or if the probe is connected to a floating test point, neither D1a or D2 will light up. If the input is taken to a high logic point, gate 1 output will go low and switch on D1, giving a 'high' indication. If the input is taken to a low test point, gate 1 output will go high and D2 will be switched on to indicate the 'low' input state.

A pulsed input will contain both logic states, causing both D1 and D2 to switch on alternately. However, if the mark to space ratio of the input signal is very high, this may result in one indicator lighting up very brightly while the other does not visibly glow at all. In order to give a more reliable indication of a pulsed input, gates 2 to 4 are connected as a buffered output monostable multivibrator. The purpose of

this circuit is to produce an output pulse of predetermined length (about half a second in this case) whenever it receives a positive-going input pulse.

The length of the input pulse has no significant effect on the output pulse. D3 is connected at the output of the monostable, and is switched on for about half a second whenever the monostable is triggered, regardless of how brief the triggering input pulse happens to be. Therefore a pulsing input will be clearly indicated by D3 switching on.

The various outputs will be:

- Floating input — all LEDs off.
- Logic 0 input — D2 switched on (D3 will briefly flash on).
- Logic 1 input — D1 switched on.
- Pulsing input — D3 switched on, or pulsing in the case of a low frequency input signal (one or both of the other indicators will switch on, showing if one input state predominates).