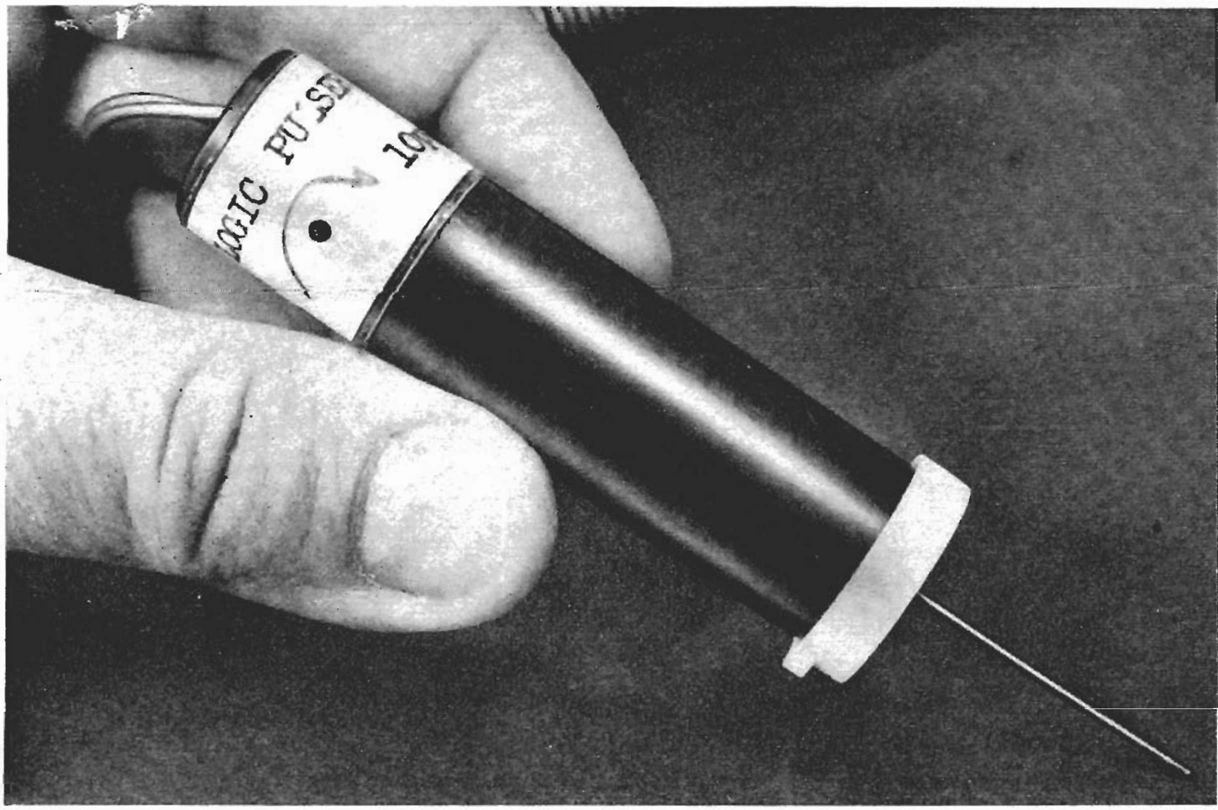


POLA-Testers

SURPLUS CONTAINERS MAKE HANDY PROBES

BY E. B. BEACH

ONE OF the more vexing problems facing the electronics experimenter is finding a way to house small, odd-sized projects. The author, for example, designed a series of very useful, low-cost test instruments that occupy very little space and must be held in the hand during use. The novel packaging scheme he devised can be seen in the photographs. All three of the devices shown are packaged in discarded Polaroid® print coat containers. The containers are of generous proportions and fit well in the hand when used as probes. If you don't happen to have a Polaroid camera, you certainly know someone who would save you a couple of the containers since they are normally discarded. If that source is dry, you can use any small plastic container of the type used for pills.

If you are using the coater containers, remove and discard the used spreader and leave the cap off the container for a few days to allow the chemical to dry thoroughly. If this is not done, the chemicals in the coating compound will corrode soldered connections and leads, which may eventually lead to trouble.

After the container and cap have dried out, scrape the dried material from inside the container and the lip of the cap. Make sure that both are clean, inside and out.

The three test instruments which employ this unique packaging scheme are used with the many RTL digital IC projects recently published in this magazine. Several other, non-digital instruments are presently being designed and will appear in future issues. To use these instruments, connect the +3.6-volt lead to the power supply of the circuit being tested and the ground lead to the board ground.

Logic Probe

Connect the power leads to the respective terminals on the digital board being tested, then follow digital signal around the board, observing the lamp. Each time trace signal goes positive, the small lamp glows.

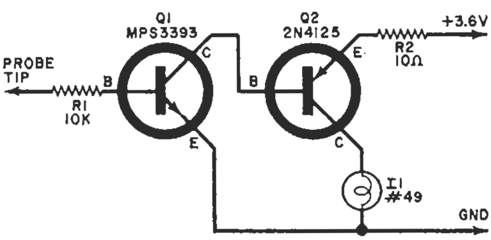
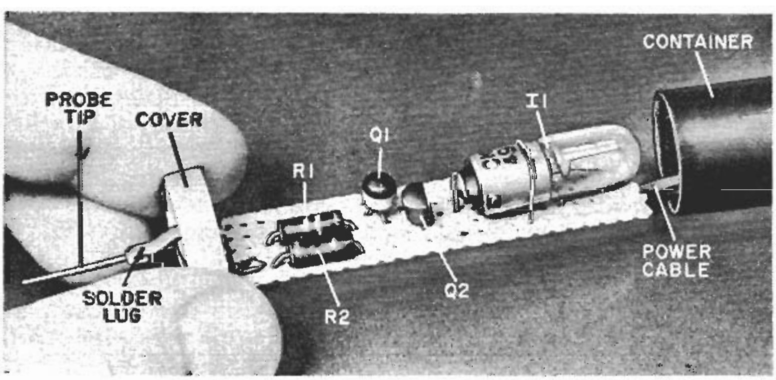


Fig. 1. In this simple electronic switch, resistor R1 isolates the probe from the circuit under test.

Fig. 2. Lamp is strapped down with a small piece of wire while other components are lead mounted.

Logic Probe. The purpose of a logic probe is to detect the presence of the discrete voltage outputs (1 and 0) in a digital circuit without having to disassemble the device. Place the tip of the logic probe on the proper point in the circuit and, when the voltage switches up and down according to the logic, a small lamp within the probe will blink on and off. A positive voltage lights the lamp.

The circuit for this simple probe is shown in Fig. 1. Any low-cost *npn* silicon transistor can be used for *Q1*, while any low-cost *pnp* transistor can be used for *Q2*. Using the specified value for *R1*



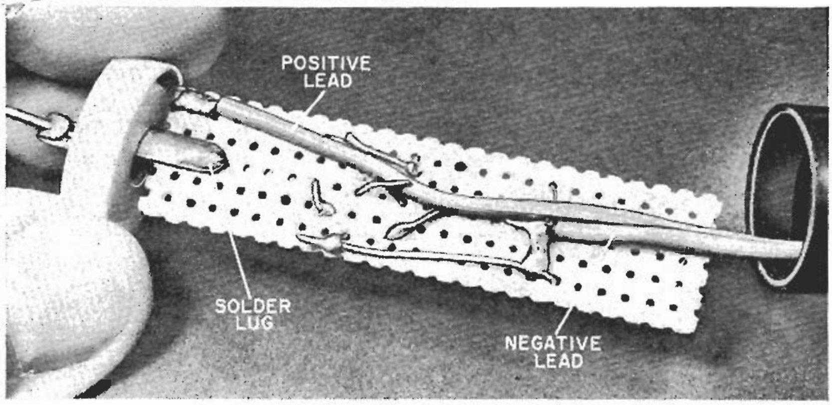


Fig. 3. The underside of the probe board showing the two power connections, and the solder lug that connects to the probe through cover mounted hardware.

gives an input sensitivity of about 0.8 volt. Resistor *R2* limits the current flow and gives degenerative stability to the circuit.

The circuit is assembled on a 2⅜" × 9/16" piece of perforated phenolic board having a 0.1" grid of 0.042" holes. The lamp is strapped down at one end using a small piece of bare wire. The other components are installed as shown in Fig. 2. Connections are made using component leads protruding through the board. The underside of the board is shown in Fig. 3. Two small holes must be made in the closed end of the plastic case—one for the two color-coded power leads and one through which the lamp can be easily seen.

The probe tip is made from a piece of a paper clip soldered to a lug which is secured to the cap with a 4-40 screw and nut. A second solder lug on the inside of the cap is connected to *R1*. The board assembly is rotated and slipped into the plastic case so that the lamp is opposite its viewing hole. The cap then fits snugly on the container.

As a finishing touch, make up a typewritten label describing the device, identifying the color code on the power leads, and telling what the lamp does. Attach the label to the container with transparent tape.

Logic Pulser

Logic Pulser. This is an astable multivibrator made from a dual-buffer IC which is adjustable from about one pulse per second to about 10 pulses per second. It is capable of driving as many as 80 milliwatt RTL gates or 26 medium-power IC gates for testing purposes. It receives its primary power from the circuit being tested.

The circuit for the pulser is shown in Fig. 4. It is also built on a 2⅜" × 9/16" piece of perforated phenolic board having a 0.1" grid of 0.042" holes. The integrated circuit (*IC1*) fits directly into

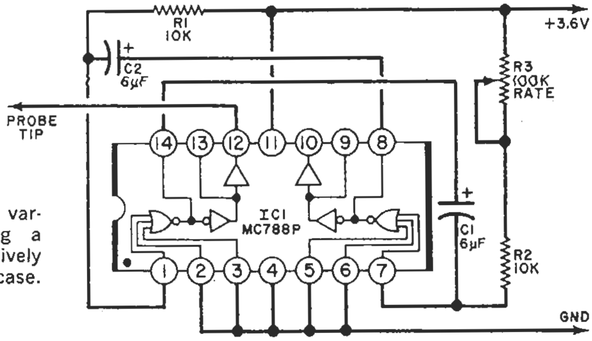


Fig. 4. IC1 is coupled up as a variable-frequency oscillator having a buffer output. Even this relatively complex circuit fits the small case.

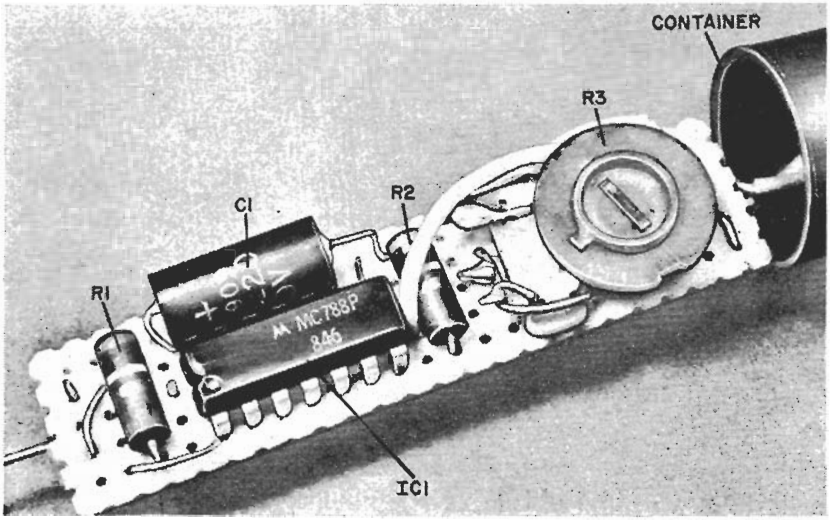
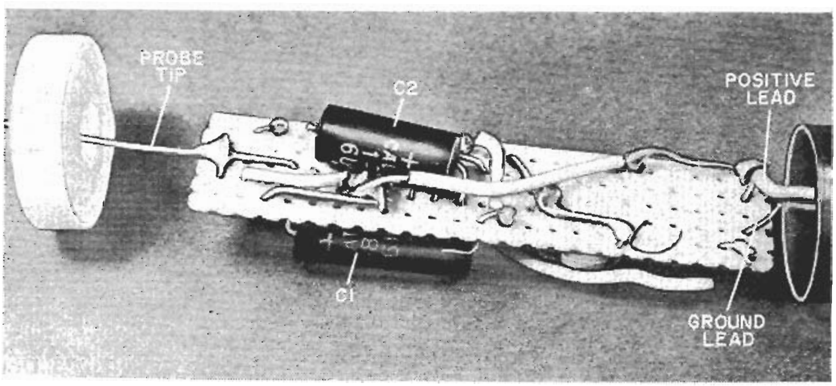


Fig. 5. The parts fit the small board easily if you follow the layout shown here. Make sure you have a small hole in the container to make screwdriver adjustments of R3 as required during operation.

the board holes and is positioned as shown in Fig. 5. Bend a couple of leads over to keep the IC in place while assembling the other components. Mount *C1* beside the IC and mount *C2* on the other side of the board as shown in Fig. 6. Be sure that these two capacitors are not larger than 5⁄16″ in diameter or the completed circuit will not fit into the container. Potentiometer *R3* is held on the board by the wiring to its three terminals.

The probe tip for this instrument is made from a length of paper clip. Make a hook in one end of the probe to fit through a hole in the board. A small piece of bare wire soldered to the hook of the paper clip will hold the probe in place while it is connected to pin 12 of *IC1*. Make a small hole in the center of the plastic cap for the probe tip to pass through. Make one small hole in the end of the container for the power leads and another small hole in such a position that *R3* can be adjusted with a screwdriver when the circuit is mounted.

Fig. 6. Underside view showing placement of C2. When selecting both C1 and C2, make sure that they are no larger than 5⁄16″ diameter so that they will fit the container. Note how the probe is supported.



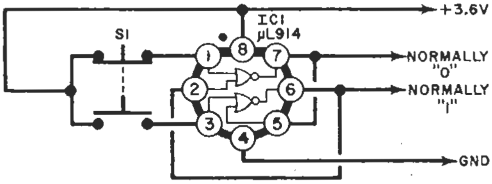


Fig. 7. The circuit is a basic "bounceless switch" made up of one small IC. It produces a clean pulse.

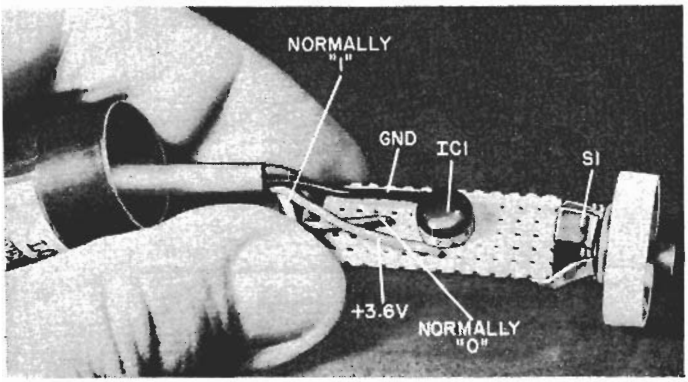
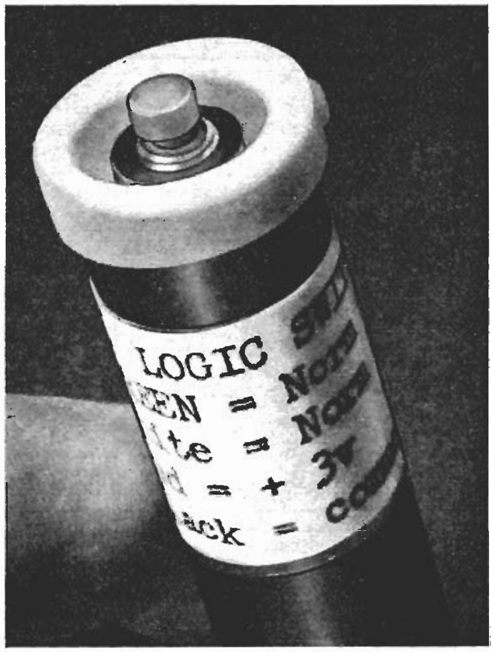
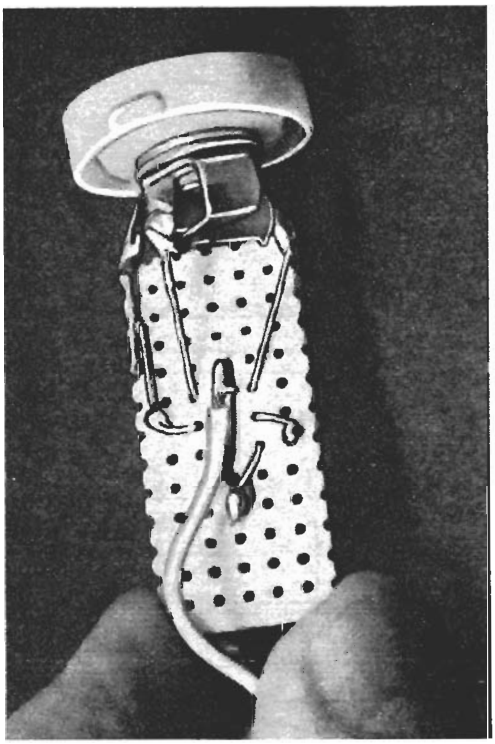


Fig. 8. All that's in the circuit is the IC and a switch. Four-lead flexible cable couples to board.



The pushbutton switch fits in a hole drilled in container cover. Like other testers, a typewritten label identifies leads and explains operation.

Fig. 9. Underside of the board showing method of mounting the switch using its circuit connections.



Logic Switch. One difficulty encountered in triggering an RTL circuit with low noise immunity is the erratic count that occurs when a conventional noisy mechanical switch generates the trigger. This noise can be eliminated by using a mechanical single-pole double-throw pushbutton switch to operate a set-reset flip-flop. This insures that a clean, noise-free, single pulse is generated each time the pushbutton is operated.

The circuit for the logic switch is shown in Fig. 7. It is built on a $1\frac{1}{4}'' \times \frac{9}{16}''$ piece of perforated phenolic board. Mount the s.p.d.t. pushbutton switch in a hole centered in the plastic cover. Drill a hole in the closed end of the container for a four-wire cable. The circuit is wired (Fig. 8) so that it holds the switch at the end of the board. Another view is shown in Fig. 9. –30–