COVER STORY

Build an IC 'Testone'

UTILITY SQUARE-WAVE GENERATOR FEATURES HIGH OUTPUT AND LOW COST

BY DON LANCASTER

HERE'S A LOW-COST IC audio signal source powerful enough to directly drive a speaker, yet so tiny it fits easily into the palm of your hand. The "Testone" puts out a 1-kHz square wave of 2.5 volts amplitude, runs on two internal AA penlight cells for 50 hours or more, and has a special buffered output stage that can drive any impedance load—and even be short-circuited—without stalling.

The "Testone" is handy for audio, p.a., and hi-fi service work, particularly in checking out cables, speaker lines, and anywhere else where a physically larger audio oscillator unit would become an awkward burden. It tucks away in the smallest tool kit or tube caddy. In conjunction with an oscilloscope, the "Testone" will help you obtain approximate quality checks on a hi-fi system—frequency response, distortion, etc. The sharp-rise output square wave has harmonics well out into the MHz region, making the "Testone" an ideal signal injector whose thousands of harmonics can be most useful for AM radio and other high-frequency service work. Add a key and a speaker, and you have a low-cost CPO or signaling system.

A breadboard version of this circuit could cost you less than $2 (the price tag on *IC1* is only $1.08), while a fancier, boxed version will go from $3 to $5, depending upon your taste in enclosures. A professional dialplate is available, and all parts are easy to get.

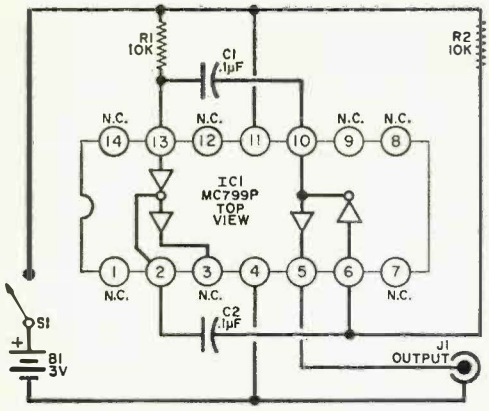


Fig. 1. Although the IC contains two sets of inverting buffers, not all of the internal circuits are used. The output can drive any load impedance—even down to a short circuit.

PARTS LIST

B1—"AA" penlight cell, 1.5 volts (2 needed)
C1, C2—0.1-μF, 10-volt miniature ceramic capacitor (Centralab UK-10-104 or similar)
IC1—Motorola MC799 dual buffer (Allied Radio #50-E-26-MC799P-MOT)
R1, R2—10,000-ohm, ¼-watt resistor
S1—S.p.s.t. slide switch
J1—RCA phono jack
1—Small enclosure (Bud CU-2100A, Davies #220 plastic case, Zero Z-32-40A-24 box, or similar)
1—1/16" x 1" x 1¾" single-sided printed circuit board
*1—Dialplate (optional)**
Misc.—Holder for 2 "AA" penlight cells (Keystone #140); chassis (optional—see text); pop rivets (4) optional; threaded rivet-type spacers (5) optional; #6 x ¼ binder-head plastic screws, optional; wire, solder, etc.

*Metalphoto hard anodized aluminum dialplate is available from Reill's Photo Finishing, 4627 N. 11 St., Phoenix, Arizona 85014, in black and white for $1, red or copper for $1.25, postpaid in U.S.A.

HOW IT WORKS

The heart of the "Testone" is an integrated circuit *(IC1)* containing two inverting buffers, each having a high- and low-power output. The low-level outputs are coupled to the opposite inputs by *C1* and *C2*, thus forming an astable multivibrator. Recharging resistors *R1* and *R2*, together with the capacitors, determine the waveform symmetry and operating frequency. Values of the resistors and capacitors have been selected to produce an approximate 1-kHz operating frequency. The signal output is taken from one high-level output (at pin 5), and routed to the output jack.

The IC contains 6 transistors and 12 resistors, divided equally into two identical circuits. Transistors *Q1* and *Q4* form the active part of the astable multivibrator, while *Q5* and *Q6* provide a push-pull output stage for load drive and isolation. Transistors *Q2* and *Q3*, and a pair of 1000-ohm resistors (all within the IC), are not used.

Construction. Figure 1 is the schematic for the "Testone" and Fig. 2 shows the equivalent circuit of the IC. An actual-size printed circuit board appears in Fig. 3, while Fig. 4 gives you the layout and drilling details. You can make the PC board from a 1¾" x 1" x 1/16" scrap of printed circuit material.

Component layout is shown in Fig. 5. Note that *IC1* is identified by a dot and code notch and that all pin connections are shown from the top. Use a small soldering iron and fine solder to mount the components. While not required, three PC terminals (one for each lead coming off the PC board) add a professional touch and aid in making circuit interconnections.

You can use any enclosure you wish—

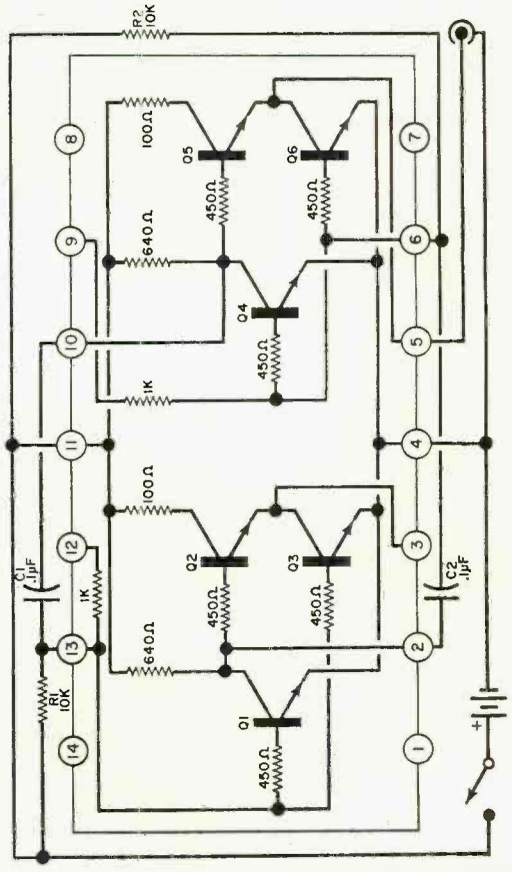


Fig. 2. The IC contains six transistors and 12 resistors, all diffused on a tiny piece of silicon, and packaged in a dual in-line, injection-molded 0.75" x 0.3" plastic case.

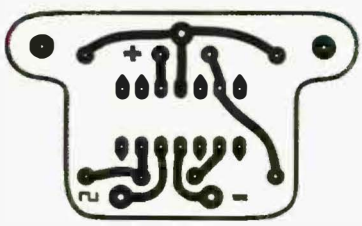


Fig. 3. Use this actual-size printed board if you want to make the "Testone" as small as possible.

a small metal box, a small plastic instrument case, or a deep-drawn aluminum box. Inside case dimensions should be greater than $1\frac{3}{8}$" × $1\frac{7}{8}$" × $2\frac{3}{8}$" to allow enough room for the battery holder and the IC. Some enclosures may call for a small aluminum chassis, particularly if a dialplate is being used.

In the prototype "Testone," rivet-type standoffs secure the PC board to the chassis, while *S1* and the battery holder are pop-riveted in place. If you're using a dialplate, be sure to dimple the chassis or case so the dialplate will lie flush and hide the switch hardware. The dialplate is secured with the hardware on *S1*. If #6 plastic binder head screws are used, their heads can double as no-mar cabinet feet for the complete instrument. Be sure to observe polarity when you install the penlight cells.

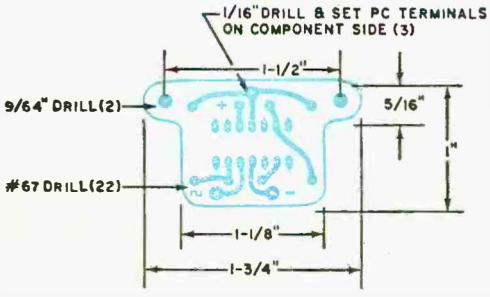


Fig. 4. Drilling information for the PC board. Use of PC terminals makes a professional-looking job.

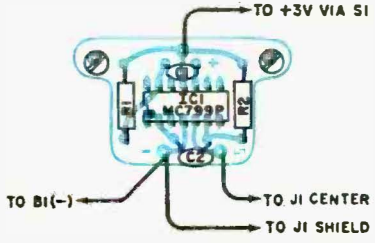
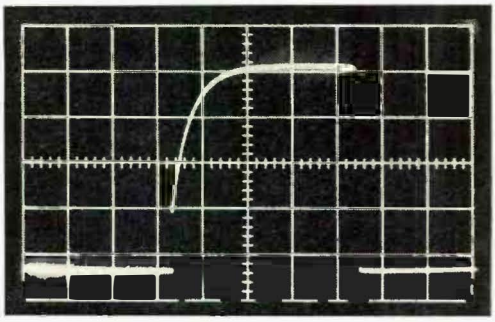


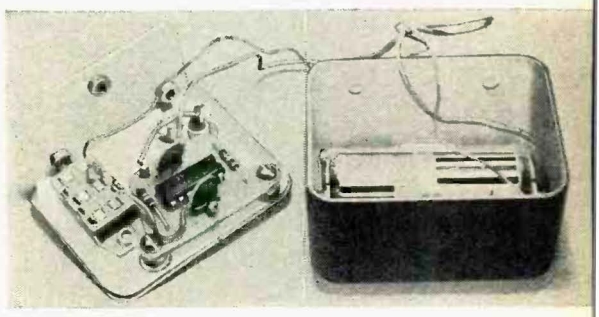
Fig. 5. Component layout. Note that the IC carries both a coding dot and notch for proper positioning.

Operating Hints. To use the "Testone," just connect it to a speaker or an amplifier input, switch to ON—and away you go. Although the "Testone" has a small d.c. output offset current, its value is safely within that of even the smallest speaker, and no harm will be done.



Abrupt trailing edge of the output waveform of the Testone produces harmonics out to the MHz region.

DO NOT apply any voltage to the "Testone" output terminal or use the "Testone" on any live circuit carrying d.c. without adding a coupling capacitor. For AM radio service and signal injecting, use a 500-pF mica coupling capacitor which will permit only the high frequency leading and trailing edges of the "Testone's" output waveform to be injected into the circuit under test. -30-



Author's prototype shows PC board mounting, location of on/off switch, batteries, and output jack.