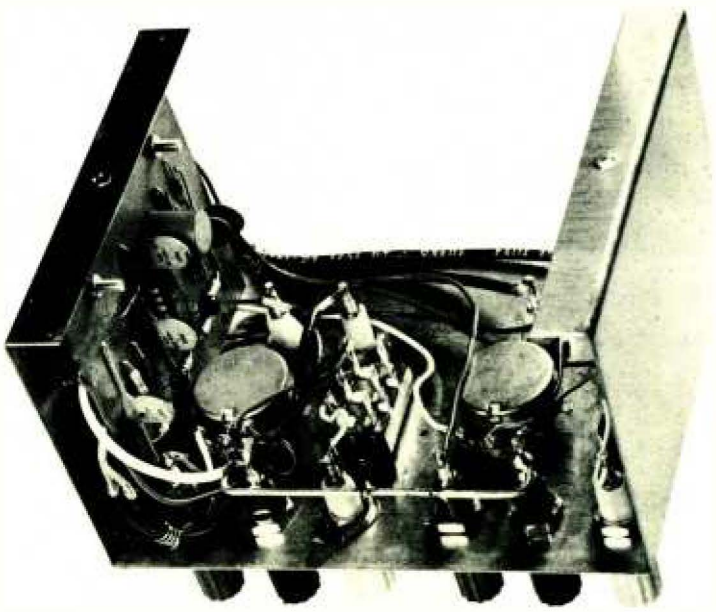
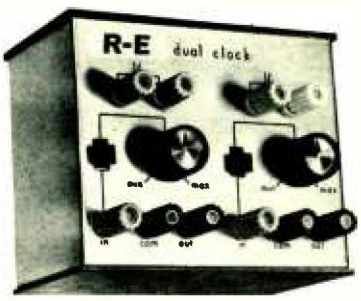
*Universal dual signal source for audio testing, digital logic, electronic music synthesis, SWL and ham BFO'S, panic alarms, sirens, birdcalls, calibrators, signal generators, squawkers, etc. . . .*






# Solid-State Dual-Clock Generator

by DON LANCASTER

HERE'S A UNIVERSAL SHORTPROOF DUAL oscillator that virtually anyone in electronics can use and easily afford. Snap on a capacitor and out comes a stable, buffered, 3-volt high symmetrical square wave of any frequency you want from once every ten seconds up to 30 MHz. If you want, you can knob tune the frequency over a 3.5 to 1 range with a single capacitor, or voltage control the thing with an external 3- to 5-volt dc control voltage.

The output directly drives TTL, RTL, DTL, or low-threshold MOS integrated circuits, and with a good power supply, the frequency is stable enough for music synthesis and metronome work. A speaker can be driven directly by the output to useful volume levels. If you need more stability, just replace the capacitor with a crystal from 3 to 30 MHz and you have a crystal-controlled source.

You can use just one of the clocks, use both clocks separately, or you can let the one clock control the other one, useful for sirens, two-tone alarms, tone-burst testing, etc. Hams and SWL's might like to put a crystal calibrator on one half and a bfo on the other.

Cost and complexity? A single $2.40 integrated circuit does the whole job, helped along with two optional 25¢ transistors. You provide the power supply—either 5 volts from a regulated bench source or 4.5 to 6 volts worth of D cells.

## Construction hints

The schematic is in Fig. 1. The heart of the circuit is IC1, a dual buffered TTL astable multivibrator. The multi's frequency is controlled by an external capacitor along with a control voltage input. For no frequency adjustment, you clamp the control voltage to +5. For pot control, you run it to a pot that lets the voltage run from +2.5 to +5. Or for external use, you bring out the voltage control directly.

Note that there are three supply voltages and three ground connections that must be made to the IC. B+ to the oscillators must be R-C decoupled to prevent interaction between both circuit halves. The oscillators *cannot* be gated by applying and removing B+ because of a sneak path through from the voltage control input. Thus, to electronically gate (or turn on and off) the oscillator, you break the ground side to the oscillator. This is done optionally by transistors Q1 and Q2. If you don't need gating, just replace these transistors with a solid ground connection. +2 to +5 volts at the GATE terminal turns ON the clock. Ground shuts it off.

A small printed circuit simplifies assembly. You can make your own using the layout guide of Fig. 2, along with the mechanical and layout guides of Figs. 3 and 4. Be sure to observe the code notch and dot when inserting the IC and use a low-wattage iron and fine solder during assembly.

The printed circuit mounts on the side of a small case, with each clock's input, output, and capacitor binding posts going on the top, along with a frequency-adjust pot. Since this is a 30-MHz device and circuit, lead routing can be critical and cause noise and interaction problems. To solve these problems, use short pieces of coax (miniature 50-ohm RG-174 is ideal) to reach the capacitor binding posts. Use one piece of coax for each binding post and ground the coax only at the printed-circuit end. Also, use a sturdy No. 12 or

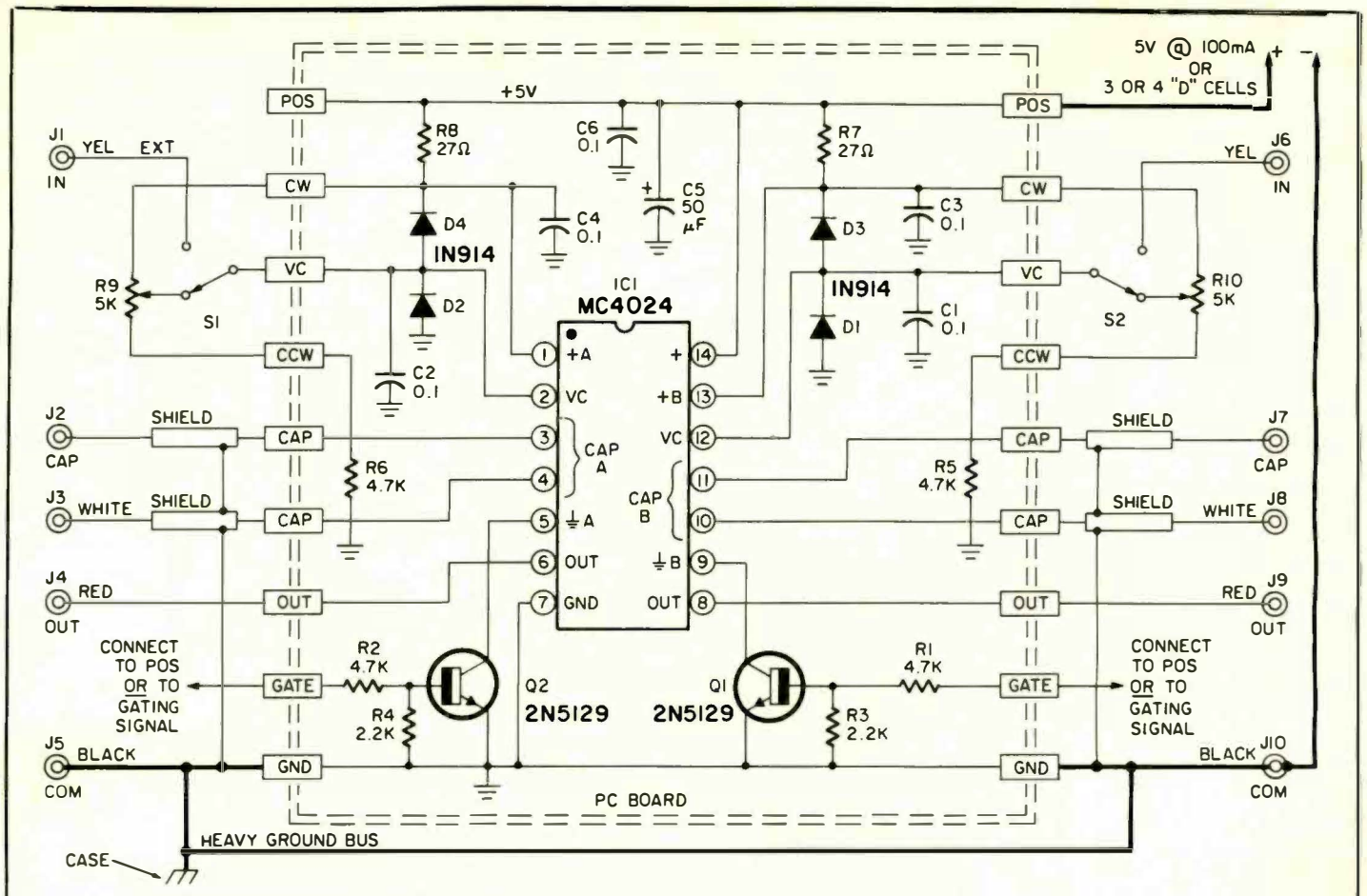



**FIG. 1—COMPLETE SCHEMATIC** of the dual clock. It's a versatile dual-output signal generator that has a thousand and one uses around the shop. And you can build it around a single IC and a pair of low-cost diodes.

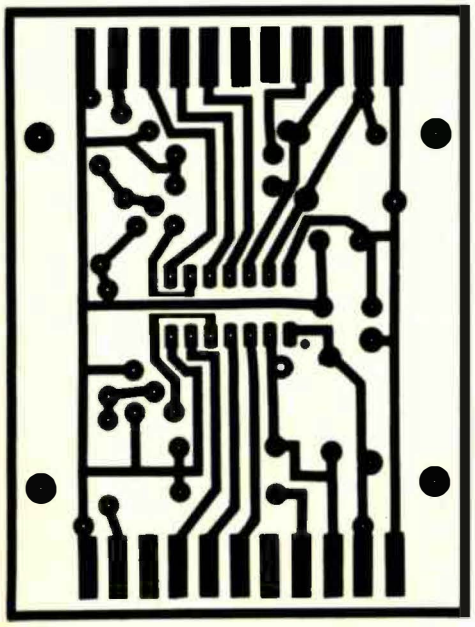
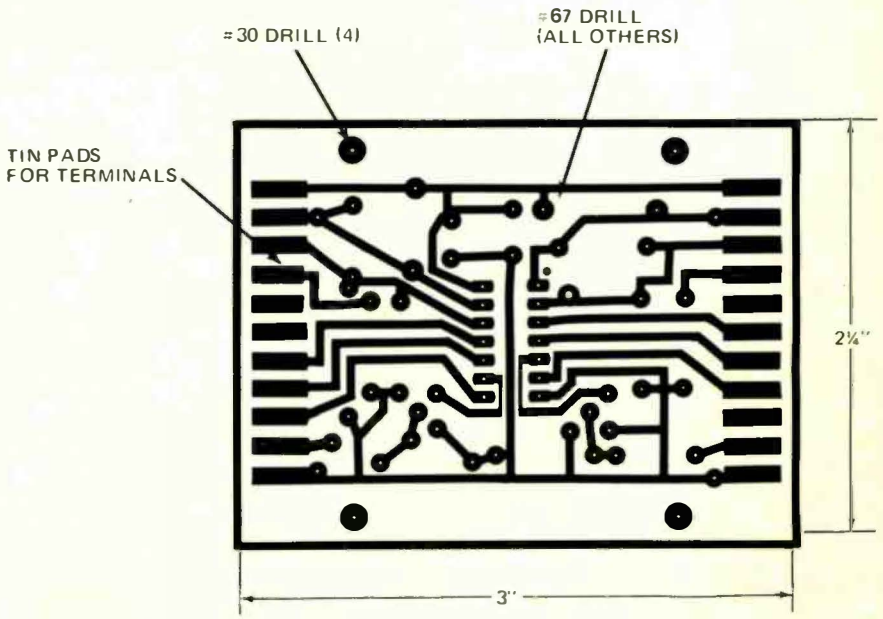


**FIG. 2—FULL SIZE PATTERN** for the dual-clock circuit board.




1 REQ'D - MAKE
FROM 1/16" G-10
PC MAT'L

**FIG. 3—DRILLING GUIDE** shows proper hole sizes for board.

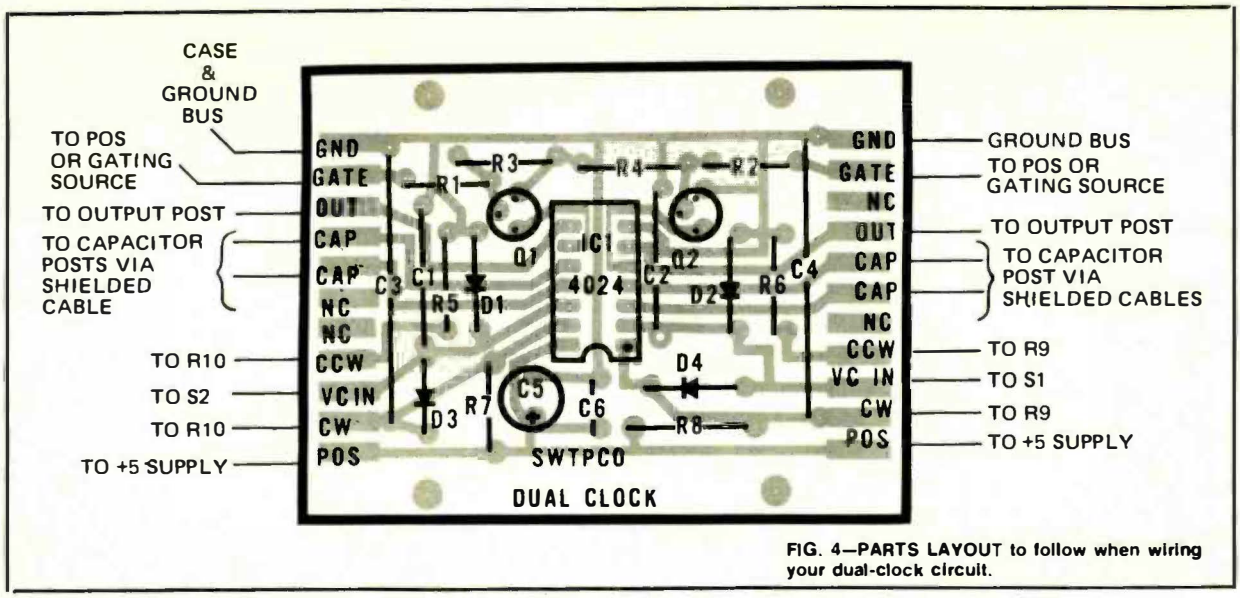



**FIG. 4—PARTS LAYOUT to follow when wiring your dual-clock circuit.**

R1, R2, R5, R6—4700 ohms, ¼ watt
R3, R4—2200 ohms, ¼ watt
R7, R8—27 ohms, ¼ watt
R9, R10—5000 ohms, linear pot
C1, C2, C3, C4, C6—0.1 μF, 10 volts, disc ceramic
C5—50 μF, 6 volts, electrolytic
D1, D2, D3, D4—1N914 silicon diode
IC1—MC4024 or MC4324
Q1, Q2—2N5129
S1, S2 spdt slide switch
J1 thru J10—5 way binding posts, 4 white, 2 each red, yellow, and black
MISC: PC Board, 2¼" x 3"; case; mounting feet (4); push-on knobs (2); RG-174 or other miniature shielded wire, 2 feet; hookup wire; PC board mounting hardware; ground bus; solder, ground lug to fit J5.

**NOTE: The following items are available from Southwest Technical Products, 219 West Rhapsody, San Antonio, Texas, 78216:**
**Integrated Circuit IC1 MC4024, $2.40.**
**Etched and Drilled PC Board No. 176B, $1.80.**
**Complete kit of all parts including prepunched and prefinished case and complete assembly instructions No. 176-C, $8.30.**

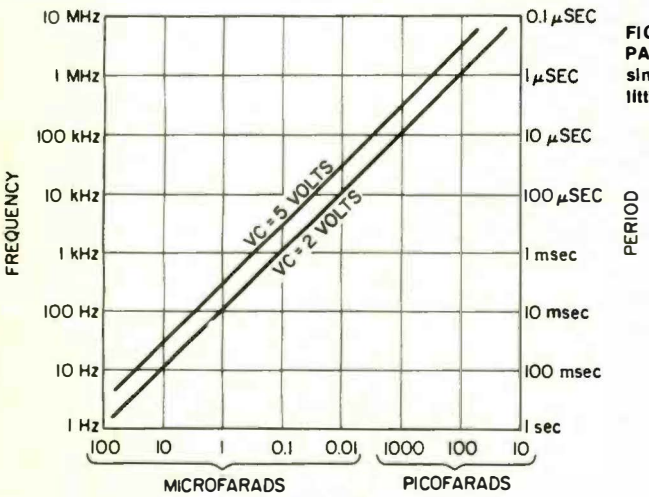



**FIG. 5—OUTPUT CAPACITOR selection is simplified by using this little chart.**

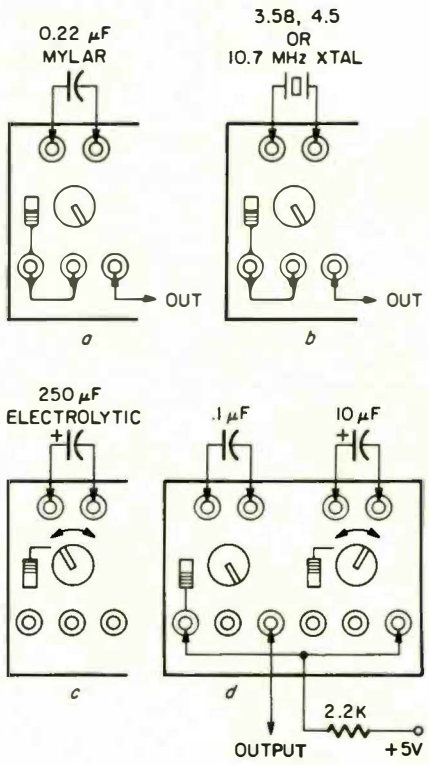



**FIG. 6—FOUR APPLICATIONS for the dual clock, a—1 kHz test oscillator, b—crystal clock or marker generator. c—1 pps metronome or clock source. d—two-tone alarm.**

No. 14 ground bus, made from a piece of house wiring. When lead dress is right, both oscillators should run over their entire range without any interaction, pulling, or noise problems.

If desired, a small 5-volt power supply may be added to the bottom of the case. It should be regulated if extreme frequency stability is needed.

## Operation

To use one of the clocks, apply 5 volts, make the gate input positive by 2.5 to 5 volts, use the internal pot, and snap a capacitor in place. The frequency is determined by the graph of Fig. 5. For instance, a 0.1-μF Mylar capacitor should give you a range of 1200 Hz to 4500 Hz.

Some practical circuits are shown in Fig. 6. A 1-kHz square wave generator (Fig. 6-a). A 3.58, 4.5, or 10.7-Mhz crystal oscillator for color, sound TV or FM work (Fig. 6-b). Crystals below 3 MHz may be used, but some capacitive padding is sometimes needed for stable operation. You can go down to 100 kHz if you custom-fit the padding to the particular crystal in use. A one pulse-per-second timer or metronome (Fig. 6-c). A two-tone audio alarm that puts out a commanding TWEEE-DELLL TWEEE-DELLL note (Fig. 6-d). To allow one clock to control the other, or anytime you want a full five volts output, add a 2,200- or a 470-ohm resistor between the driving output and +5 volts. You might like to do this internally.

To gate one clock with the other, remove the gate input from POS and connect it to the other output. This gives you a gated oscillator or a tone burst generator. Or, add a big electrolytic and a charging resistor to the VC INPUT to get a siren or FM signal source.

There are many options available to you. If you want, bring the GATE inputs out to binding posts and add permanent output pull-up resistors. Or to cut costs, if you're never going to use an outside world signal, leave off protecting diodes D1 thru D4. You'll find lots of ways to customize this **Radio-Electronics** dual clock to your own uses. **R-E**