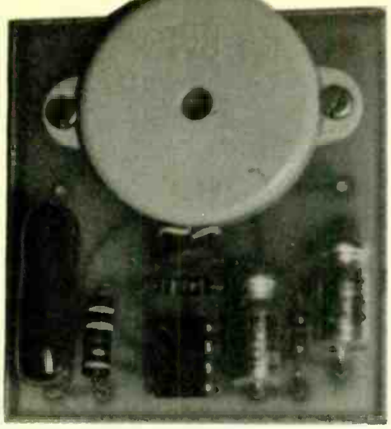

TONE-RINGER

Eliminate that spine-chilling, ear-grating Ma Bell ringer by replacing it with our pleasing two-tone warble caller!

By Gary Kloesz*

□EVER WISH YOU HAD A TELEPHONE RINGER IN YOUR BACK yard, or one that sounded different than your neighbors? Here is an electronic ringer project that is centered around a Motorola MC34012 telephone, tone-ringer, integrated circuit. The MC34012 chip, along with a piezo-electric sound transducer, produces a pleasing two-tone warble (some say it's a *turkey* call) whose frequency may be adjusted to suit anyone's listening taste.

Circuit Description

The MC34012 tone-ringer chip (Fig. 1) derives it's power by rectifying the AC ringing signal. That signal is normally at 20 Hz and measures between 70 and 130-volts *rms*. It uses that *stolen* power for the tone generator and to drive the piezo-electric transducer.

The sound that is produced is a warble that varies between two frequencies, $f_0/4$ ($f_0 \div 4$) and $f_0/5$. The clock, or fundamental, frequency, f_0, is generated by a relaxation oscillator. That oscillator has R2 and C2 as its frequency setting components providing a selectable range of 1 kHz to 10 kHz. Selecting different values for R2 and/or C2 changes the clock frequency, which in turn varies the warble frequencies.

The MC34012 chip comes in three different warble rates at which the warble frequencies ($f_0/4$, $f_0/5$) are varied. These warble rates are $f_0/320$, $f_0/640$, or $f_0/160$ and the different chips are designated as MC34012-1, -2, and -3, respectively. For example: with a 4.0-kHz oscillator frequency, the MC34012-1 produces 800-Hz and 1000-Hz tones with a 12.5-Hz warble rate. The MC34012-2 generates 1600-Hz and 2000-Hz tones with a similar 12.5-Hz warble frequency from a 8.0 kHz oscillator frequency. MC34012-3 will produce 400-Hz and 500-Hz tones with a 12.5-warble rate from a 2.0-kHz oscillator frequency.

The Tone-Ringer output circuit can source or sink 20 mA with a voltage swing of 20-volt peak-to-peak. A volume control may be installed by adding a potentiometer in series with the piezoelectric sound transducer, PZ1.

The input-signal, detection circuit activates the Tone-Ringer output when the AC-line voltage exceeds the pro-

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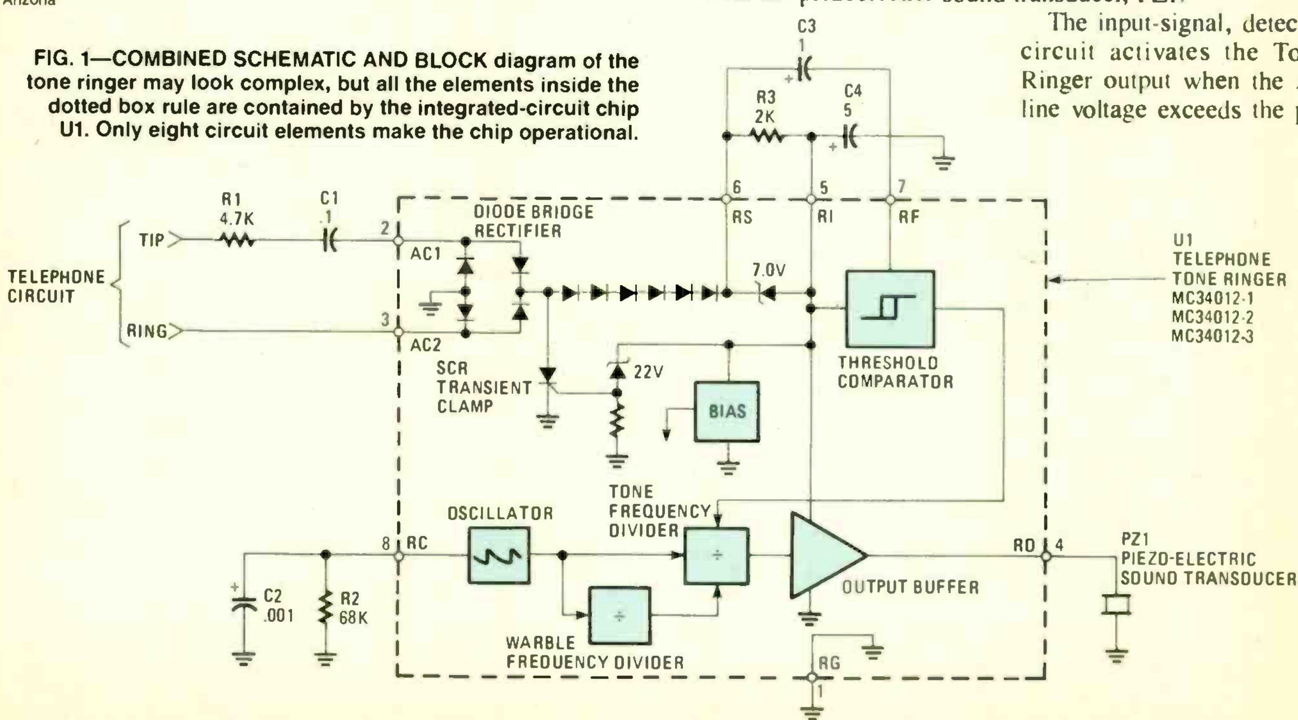
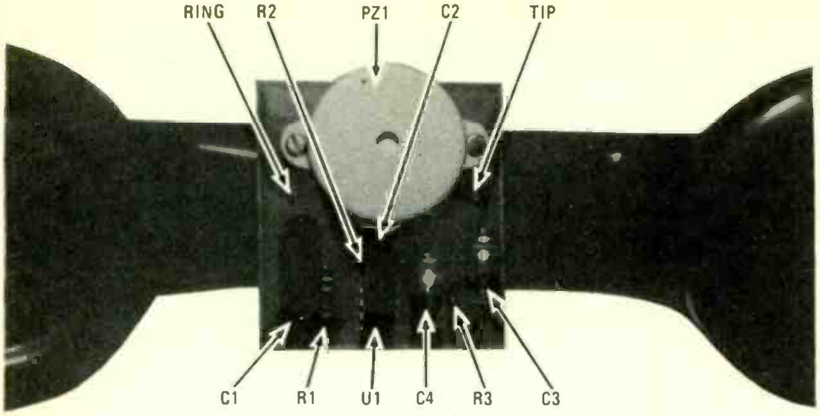
FIG. 1—COMBINED SCHEMATIC AND BLOCK diagram of the tone ringer may look complex, but all the elements inside the dotted box rule are contained by the integrated-circuit chip U1. Only eight circuit elements make the chip operational.





THE COMPLETED Tone-Ringer is smaller than the mouthpiece of a telephone handset. Connect the telephone line to the ring and tip terminals, and the project is ready for its first call. Install the Tone-Ringer inside your telephone, provided that you own it and there is ample space to house it.

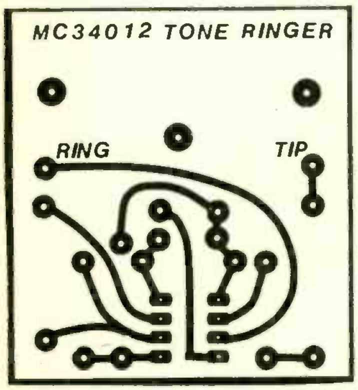


FIG. 2—PRINTED-CIRCUIT board layout is shown here same size. Should you plan to make one, then make ten or more for almost the same price and time. Your friends are sure to want a few.

grammed threshold level. The threshold is set to keep the ringer from sounding during dial pulse transients.

The MC34012 chip also contains transient protection to protect it from high-voltage spikes that can occur on telephone lines, and incorporates a bridge rectifier (polarity guard) on the input which allows the chip's tip and ring connections be reversed.

Ringer equivalence is a measurement that compares the electronic ringer's AC load impedance to a standard 500-series Bell telephone. The standard is 7000-ohms at 20 to 30 Hz. The Tone-Ringer's AC impedance, using input values of 4,700 ohms and 1 μF, is greater than 10,000 ohms. That results in a ringer equivalence of approximately 0.7A, and should be reported to the telephone company.

Parts Value Ranges

Listed below are circuit-function descriptions of the external components connected to the MC34012 chip and the normal ranges they may fall into:

R1—Line input resistor—controls the Tone-Ringer input impedance. It also influences the ringing threshold voltage and limits excessive currents due to line transients. Range: 2000-10,000 ohms;

C1—Line input capacitor—couples the line's AC-ringing signal to the Tone-Ringer's MC34012 chip and determines the ringer-input impedance at low frequencies (5 Hz)—range: 0.4—2.0 μF (use 200-WVDC, non-polarized type);

R2—Oscillator resistor—range: 50,000-300,000 ohms;

C2—Oscillator capacitor—range: 400-2000 pF;

R3—Input-current, sense resistor—controls the ringing threshold voltage. Increasing R3 decreases the ring-start voltage. Range: 800-2000 ohms;

C3—Ringing threshold capacitor—filters the rectified supply voltage across R3 at the input of the ringing threshold comparator. It also provides dialer transient rejection. Range: 0.5-5.0 μF; and,

C4—Ringer supply capacitor—filters the rectified supply voltage for the tone generating circuits. It also provides an AC path for the 10-volt *rms* ringer signature impedance. Range: 1.0 to 1 μF.

Construction

The Tone-Ringer may be constructed on a perfboard or

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PARTS LIST FOR TONE-RINGER

SEMICONDUCTOR
PZ1—Toko PB-2720 sound transducer (Radio Shack 273-064, or equivalent)
U1—MC34012 tone-ringer, integrated circuit

RESISTORS
(All resistors are ½-watt. Refer to text for value ranges)
R1—4700-ohm
R2-68,000-ohm
R3—2000-ohm

CAPACITORS
(Refer to text for value ranges)
C1—1.0-μF, 200-WVDC, non-polarized
C2—0.001-μF
C3—1.0-μF, 10-WVDC, electrolytic
C4—5.0-μF, 25-WVDC, electrolytic

ADDITIONAL PARTS AND MATERIALS
Printed-circuit material, telephone cable, required plugs and jacks to tie into your phone line, plastic housing to contain project, wire, solder, hardware, etc.

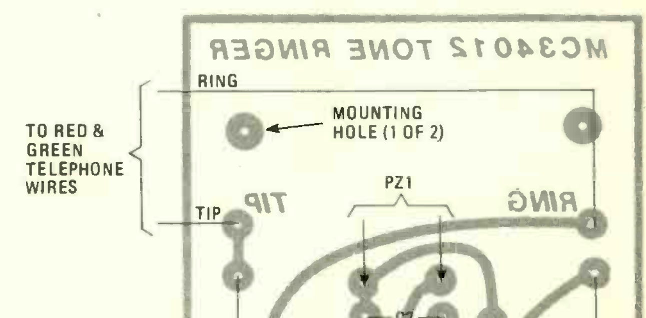

FIG. 3—X-RAY VIEW of printed-circuit board showing circuit parts location and external circuit connection.

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printed-circuit board. The foil diagram is given in Fig. 2 and the parts location on the reverse side of the foil pattern is given in Fig. 3. You may have to vary the mounting and connection details on the foil pattern to accommodate the PZ1 transducer you obtain for the project. Part values are not critical so long as capacitor minimum working-voltages are respected. Location of parts in a hand-wired or wire-wrap construction project is are not critical. Just remember that neatness counts!

When selecting the piezo-sound transducer, PZ1, a rule of thumb is—the larger the better. As the physical size increases, the sound producing diaphragm gets bigger which produces more sound. Also, the transducers resonant frequency drops which better matches the output frequency of the Tone-Ringer. There are two types of piezo transducers, self-drive (like a Sonalert) and external drive. That application requires the external drive type.

Connection to the phone line is very simple. There are usually two wires (denoted Tip and Ring) coming into the subscriber's location. The Tone-Ringer's input is connected to those wires. Depending on your location, the phone may connect to the lines via a four-prong connector or a modular plug. Either of those connectors is available at your local electronics or telephone store. Inside there are four wires. Connect the Tone-Ringer to the red and green wires, and fasten the connector to the back of the ringer circuit board.

Now sit back, and wait for your first call. ■