Telephone-ring detector eliminates relay

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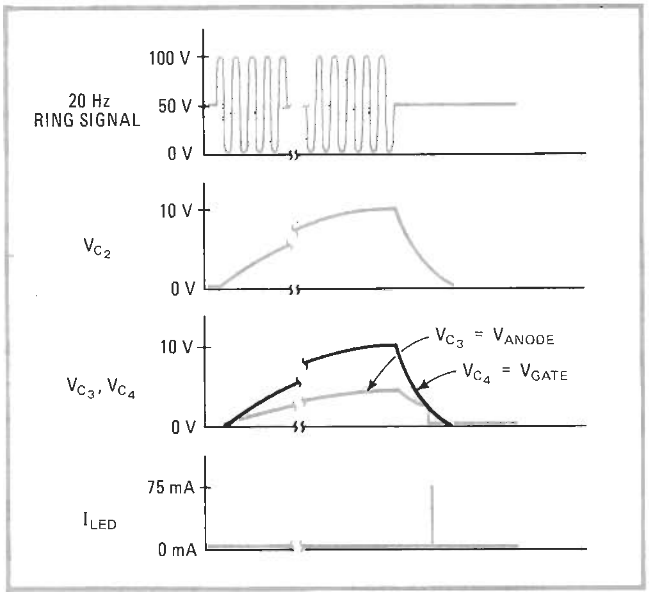
A dial-up telephone-line interface to a computer can detect telephone ringing signals with a circuit that includes a varistor, a programable unijunction transistor, and a photon coupler. This circuit replaces the more conventional ring detector that consists of a capacitor-isolated full-wave bridge driving the coil of a small relay.

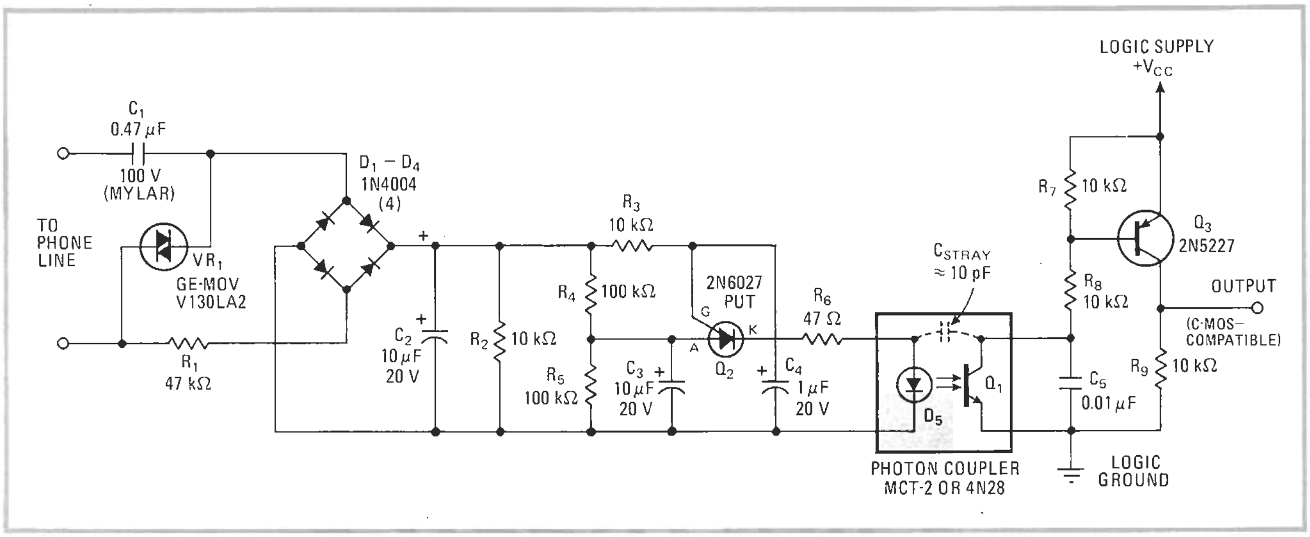
Like the relay, the arrangement described here isolates the phone line from the computer logic and is immune to noise interference. Nor does it suffer from the inherent mechanical disadvantages of relays. Indeed, this circuit has advantages of its own. It emits one and only one pulse per ring —it cannot be teased. Its line side is powered entirely by the ring, yet it loads neither the ring nor the line. By telephone-company standards, an ac impedance of 47 kilohms bridging a line is an open circuit; however, check your local phone company's rulings on connecting to the line.

As the circuit diagram in Fig. 1 shows, the incoming ac signal is rectified by bridge diodes D_1-D_4, charging capacitor C_2 to about 10 volts during the ring. The time constant of R_2C_2 is chosen to smooth out the 20-hertz ripple, leaving a roughly rectangular pulse. Capacitor C_1 blocks the 48 v dc normally found on an idle phone line. Resistor R_1 limits the charging current to C_2 and with R_2 forms a divider that controls the voltage to which C_2 charges. Varistor VR_1 clamps transients.

The programable unijunction transistor, Q_2, fires when its anode voltage exceeds its gate voltage by about 600 millivolts. The anode voltage is controlled by C_3 and the divider formed by R_4 and R_5. C_3 slowly charges to half the voltage across C_2 and reaches 4 v or so by the end of the ring. The gate voltage is controlled by R_3C_4 and follows the voltage on C_2 closely. When the ring ends, the anode voltage is 4 v and decaying slowly, while the gate voltage is 10 v and decaying quickly (Fig. 2). In about 100 milliseconds, the gate voltage catches up with



2. One pulse per ring. Waveforms of circuit in Fig. 1 show programable unijunction transistor firing when gate voltage drops below anode voltage, dumping C_3's charge into LED.



1. Relayless phone-ring detector. This circuit produces a single output pulse when a ringing signal comes in on the telephone line. It is useful in a computer-to-phone-line interface because it provides isolation, is immune to line noise, and is reliable. The programable unijunction transistor, fired as capacitors discharge after ringing stops, pulses the photon coupler to produce output.

the anode voltage; Q_2 then fires, dumping C_3's charge through current-limiting resistor R_6 and the light-emitting diode of the photon coupler.

When the LED conducts the current pulse from C_3's discharge, it turns on transistor Q_1 in the photon coupler. Transistor Q_3 is then turned on, producing an output voltage pulse that is adequate to drive C-MOS circuitry. If transistor-transistor logic is to be driven, the pulse will require some sharpening by a buffer transistor and a Schmitt trigger such as the 7413.

Capacitor C_5 is included to provide noise immunity. There is enough common-mode noise on telephone lines to falsely switch Q_3 even after it has passed through the stray capacitance of the coupler. C_5 forms a voltage divider with the stray capacitance, reducing the noise to insignificance. □