Isolated indicator signals telephone line's status

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Part 68 of the FCC's (Federal Communications Commission, www.fcc.gov) telecommunications regulations requires that certain signaling equipment connecting directly to the public-telephone network must present a line-to-line resistance of at least 5 MΩ. In addition, status signals that equipment derives from the phone lines must include electrical isolation to prevent interaction between earth grounds from the telephone network and attached control or communications equipment. Although a transformer can provide isolation for voice-frequency signals, the telephone-line-status-indicator circuit in **Figure 1** meets FCC isolation requirements without incorporating a transformer (**Reference 1**). A diode bridge, D_1 through D_4, and R_1, a 5.6-MΩ resistor, supply a small amount of dc power from the phone line to a nanopowered combination comparator and a 1.2V voltage reference, IC_1. The Maxim (www.maxim-ic.com) MAX917 IC draws only 0.75 μA at $1.8V_{CC}$.

Resistors R_2 and R_3 form the detection-voltage divider, and R_4 provides hysteresis. When IC_1's output goes low, R_4 and R_3 form a parallel combination of 3.26-MΩ resistance. To reach the comparator's reference voltage of 1.245V, the voltage across C_1 must reach at least 5.06V. Once IC_1's output

goes high, R_4 and R_2 form a parallel resistance of 6.67 MΩ, and the voltage across C_1 must reach 3.37V to deliver a 1.245V input to the comparator. IC_1's output drives a photocoupler, IC_2, a Toshiba (www.semicon.toshiba.co.jp) TLP190B. Unlike other photocouplers, IC_2 includes an array of photodiodes that, when illuminated, delivers a voltage output. Although weak by power-conversion standards, the photocoupler's output can deliver several microamperes at an open-circuit voltage that exceeds 7V, or enough to drive a MOSFET's gate or a microprocessor's input pin. In addition, the TLP190B carries a 2500V-rms emitter-to-detector isolation-voltage rating.

When a telephone is not in use, the on-hook voltage across its line of approximately −48V produces a current of 7 to 8 µA through R_1, which imposes a low-leakage requirement on C_1. The prototype version of the circuit uses an X5R-characteristic ceramic capacitor. When the voltage across C_1 exceeds 5.06V, IC_1's output goes high and drives IC_2 through R_5, discharging C_1. When the voltage across C_1 decreases to 3.37V, IC_1's output goes low, and C_1 recharges. The output from IC_2 comprises a 1.4-msec-wide voltage pulse with a repetition period of approximately 240 msec. When the phone is off the hook, the voltage across its lines drops to a few volts, which don't sustain pulse generation. EDN

REFERENCE

1 www.fcc.gov/wcb/iatd/part_68.html.

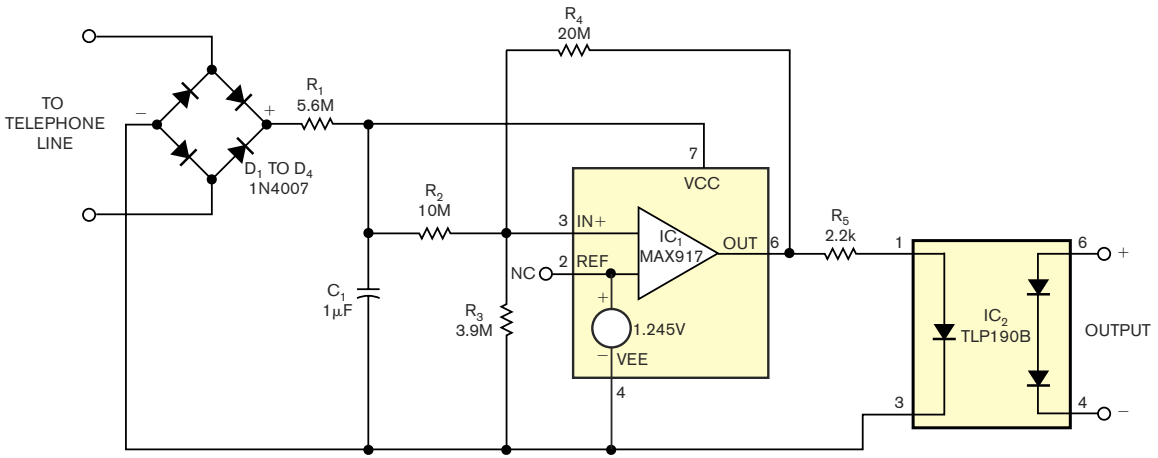

Figure 1 Drawing minuscule amounts of power from a telephone line, this isolated-output circuit indicates whether the line is in use.