Short-circuit finder uses few parts

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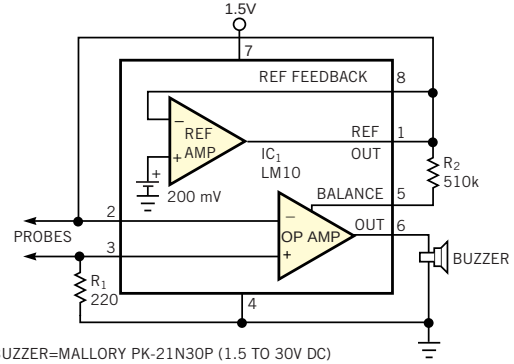
The simple tester in **Figure 1** detects short circuits on assembled pc boards and also rings out cables and harnesses. The short finder has a narrow zone of threshold uncertainty and very low "insertion" voltage and current, and it's not confused by capacitors. The circuit uses an LM10, an IC that combines a precision 200-mV reference, a reference buffer, and an independent, high-quality op amp. It can operate from supply voltages of 1.1 to 40V. The op amp in this design serves as a comparator. The voltage from the reference buffer, via R_2, creates a positive-going bias shift at the balance input and a negative-going bias shift at the comparator's inverting input.

Figure 1



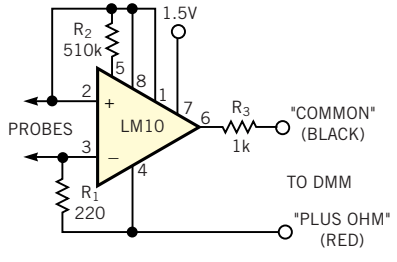
NOTES: BUZZER=MALLORY PK-21N30P (1.5 TO 30V DC) OR RADIO SHACK 273-065 (1.5 TO 15V DC).

Keep an ear open for short circuits, with this easy-to-build short-circuit tester.

When the tested circuit resistance exceeds 2V, the negative-going bias overrides the positive-going bias, and the comparator delivers 0V to the buzzer. Otherwise, the comparator delivers full output voltage to the buzzer to indicate a short circuit. R_1 limits the current to the circuit under test to less than 1 mA. The circuit's current drain is less than 300 µA with open test probes and approximately 2 mA with the probes shorted together. Open-circuit voltage is 200 mV, which is less than the turn-on voltage for pn junctions. If desired, you can set the voltage as low as 15 mV by adding 18Ω resistance between pins 2 and 3 of IC_1. However, the quiescent current increases to 1 mA.

You can change the resistance threshold by changing the value of R_2. With the values shown, the threshold is approximately 2V. The supply voltage can be within 1.1 to 30V, depending on the buzzer's voltage range. You can use any piezo buzzer with current consumption lower than 20 mA. You can easily build the short finder as an adapter for a DMM, provided that the DMM has a continuity function (**Figure 2**). Upon detection of a resistance that is less than 2V, the short finder delivers a virtual negative resistance to the DMM. By nature, this signal is lower than any DMM continuity threshold (which is always positive); therefore, the circuit works with any DMM. R_3 limits the current to the DMM's input circuitry to approximately 1 mA. (DI #2264).

Figure 2



Add a short-circuit test capability to your DMM, using this modification of the circuit in Figure 1.

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