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APPLICATION NOTE 4234

AC-Based Continuity Tester Finds Single-Ended Faults

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Abstract: This article presents an AC-based continuity tester designed for frontline test and repair jobs. The circuit provides a simple GO/NO-GO test for localizing faults in multicore cables, allowing one to open and repair the correct cable end while avoiding the risk of damaging a good connector by opening it up.

A similar version of this article was featured in Maxim's Engineering Journal, vol. 63 (PDF, 1.3MB).

Overview

This article details an AC-based continuity tester designed for frontline test and repair jobs. The circuit provides a simple GO/NO-GO test for localizing faults in multicore cables.

Open circuits are more likely at connector ends. By identifying the faulty end, the AC continuity tester allows you to open and repair the correct cable end and avoids the risk of damaging a good connector by opening it up. This approach is also useful for testing an installed cable with ends at different locations.

Circuit Description

Figure 1 illustrates a circuit for a continuity tester that injects an AC signal on one cable wire and then looks for the absence of capacitive coupling on the other wires. One end of a bad cable typically shows good AC continuity, while the other end typically has one or more connector pins with no AC continuity. Because a short in the cable appears as a good connection, the operator can easily confirm that the tester is operating correctly by simply shorting its test leads together.
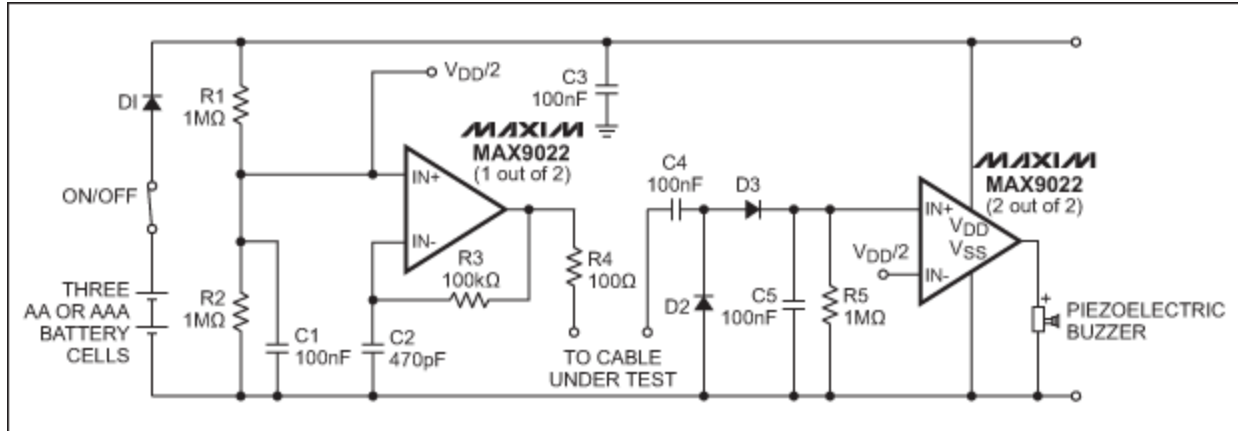
Figure 1. Based on a low-power dual comparator (MAX9022), this AC-based continuity tester locates open-circuit pins in a cable.

The left side of the circuit uses a low-power dual comparator (MAX9022) to form a relaxation oscillator operating at approximately 155kHz. It produces a peak-to-peak output signal approximately equal to the supply voltage, which is fed to a connector of the cable under test. The right side of the circuit processes any AC signal picked up by the inter-lead capacitance. That AC signal is first rectified by a pair of silicon diodes, and then integrated on storage capacitor C5. The bleed resistor (R5) provides some noise immunity and helps to reset the capacitor between tests.

The output resistor (R4) and input capacitor (C4) provide limited circuit protection. The circuit indicates OPEN for any test-cable capacitance below 100pF. (Thus, a standard 2m IEC mains test lead, whose typical lead-to-lead capacitance is 200pF, would test OK.) The circuit is also immune to false triggers caused by the 60Hz pickup from power lines. Because the typical current draw of this low-power circuit is less than 40µA most of the time, the circuit can be powered by three AA or AAA 1.5V pencil batteries.

Many low-cost alternatives are available for the output device (a DC-activated piezoelectric buzzer in Figure 1), and most alternatives feature a suitably wide operating-voltage range. The 100nF capacitors are standard ceramic decoupling capacitors, and the circuit contains no critical passive components. The comparator's high-side drive is better than its low-side drive, so it should be used to source (rather than sink) current to the indicator device. Diodes D1 through D3 are silicon diodes.

A similar design idea appeared in the February 21, 2008 issue of *EDN*.

Related Parts		
MAX9022	Micropower, Ultra-Small, Single/Dual/Quad Single-Supply Comparators	Free Samples

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