calibrate the circuit as suggested, then the reading is 10Ω/V on the 100-mA range and 100Ω/V on the 10-mA range.

To track down pc-board short circuits, attach the unit with test points A and B across the suspected shorted signals. Attach one DVM probe to test point A and use the other to probe the circuit. Constant voltage along a trace indicates that no current is flowing and that the trace is not the source of the short circuit. Look for high readings on the trace with the low reading and low readings on the trace with the high reading, to locate the source of the short circuit.□

Quasiresonant converter uses a simple CMOS IC

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FIGURE 1 SHOWS a flyback power supply that has low noise and uses a simple CMOS 4093 IC for its control. The electrical noise of a converter arises mainly when current switches on. Diode recovery and charging parasitic capacitances create high di/dt, which is the main cause of noise. The converter in **Figure 1** has a low noise level, because it slowly switches current on at nearly zero voltage. The converter works in the boundary between discontinuous and continuous mode and switches on when the drain voltage is at its lowest value. To avoid working with low gate voltages, which would cause excessive MOSFET losses, ZD_1 conducts and enables the input gate of the 4093 when the voltage is high enough. When the supply starts, the auxiliary nonisolated winding through D_3 keeps the gate input high. When the MOSFET is on, current increases linearly until the base of Q_5 starts to conduct, and this transistor turns the MOSFET off. The flyback operation then starts, and the primary energy charges the output capacitors. During this phase of operation, D_5 and R_6 keep Q_5 conducting and the MOSFET off. When the energy has discharged, D_5 stops conducting, as do the secondary diodes, so no recovery problems exist.

The time constant of R_3 and C_5 keeps the MOSFET off for a while. The output capacitance of the MOSFET plus the parasitic capacitance of the primary resonate with the primary inductance and the voltage decreases. R_5 and C_5 allow the MOSFET to turn on when the voltage has reached the minimum value.

The values are valid only for this case. The circuit of **Figure 1** not only minimizes turn-on losses, but also reduces electrical noise. Voltage regulation uses traditional techniques, using a TL431. The optocoupler current adds to the shunt current. Because the MOSFET turns on when current is zero, the gate resistor may be high, so parasitic capacitances charge slowly, further reducing switching noise. The circuit around Q_4 is optional; you can use it in most power supplies. It kills the current glitch when Q_3 turns on. It is more effective than the usual RC circuit, and it allows a low duty cycle at low loads. Note that many of the component values in **Figure 1** are undesignated; you should determine these values to fit the application.□
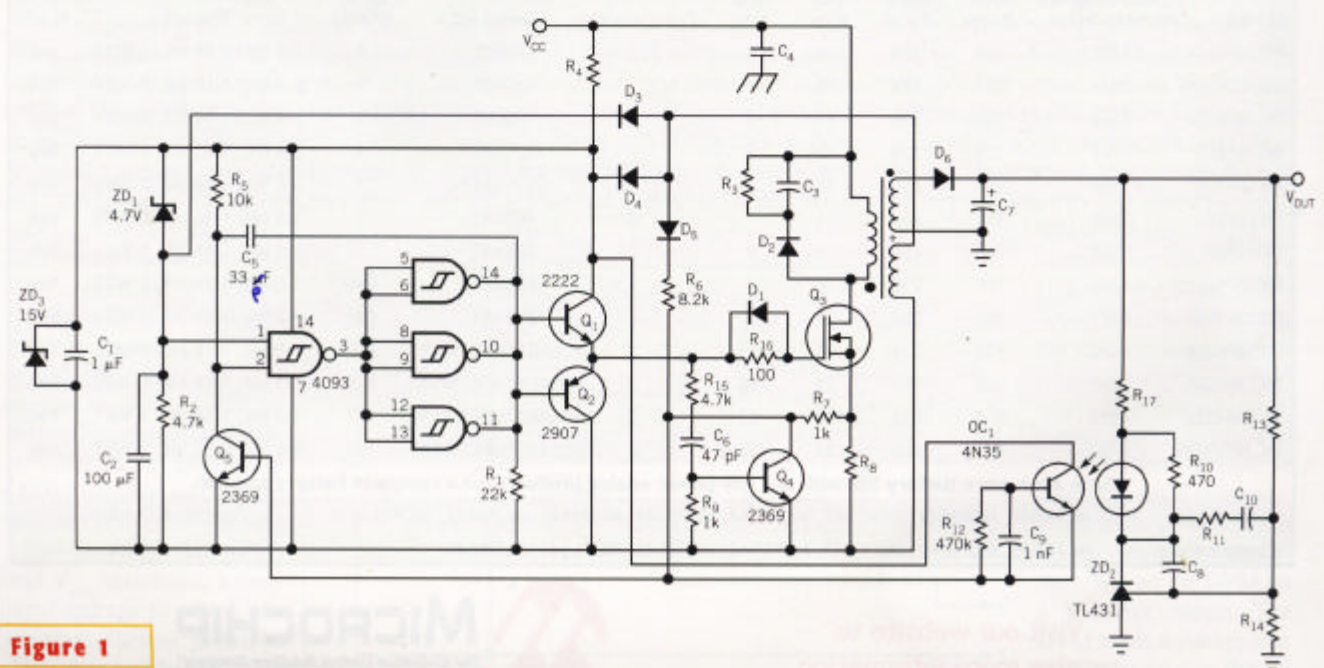

Figure 1

Using a simple CMOS IC, this flyback power-supply circuit exhibits extremely low noise.