Inductive proximity detector uses little power

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A contactless limit switch and a tachometer pickup are two possible applications for the inductive proximity detector described here. This detector changes its output level from high (9 volts) to low (0 V) whenever a conducting object is close by. It uses less power than a photocell pickup and is immune to environmental dust and dirt.

The sensing element is an unshielded high-Q inductor coil wound on a ferrite core. When a metallic object is brought close to the inductor, eddy currents that are induced in the metal absorb energy from the rf field of the coil and thus reduce its Q.

The active elements in the detector circuit are four of the C-MOS MOSFETs in a CD4007A package, and two 1N3604 diodes are included. FET Q_1 and its associated components, together with the inductor, constitute an oscillator that operates at about 100 kilohertz. The two diodes develop a dc voltage proportional to the peak-to-peak value of the oscillator signal. This voltage is applied to a Schmitt trigger composed of Q_2, Q_3, and Q_4 and holds this circuit in the "on" state.

A conductive object near the coil absorbs energy from the magnetic field of the coil, so that the oscillator amplitude drops. The rectified voltage therefore drops, and the Schmitt trigger turns off. The variable resistor adjusts the oscillator's operating level and hence its sensitivity to metal objects.

The inductor used in this circuit consists of 150 turns of #34 enameled wire inside half of a Ferroxcube 1811-PL00-3B7 pot core set, as shown in the figure. The inductance is approximately 2 millihenries. The circuit can detect the presence of metal objects at distances up to a centimeter from the open end of the coil.

This circuit draws about 250 microamperes at 9 V. It may be used to drive C-MOS logic directly or to drive a buffer that in turn drives TTL. □

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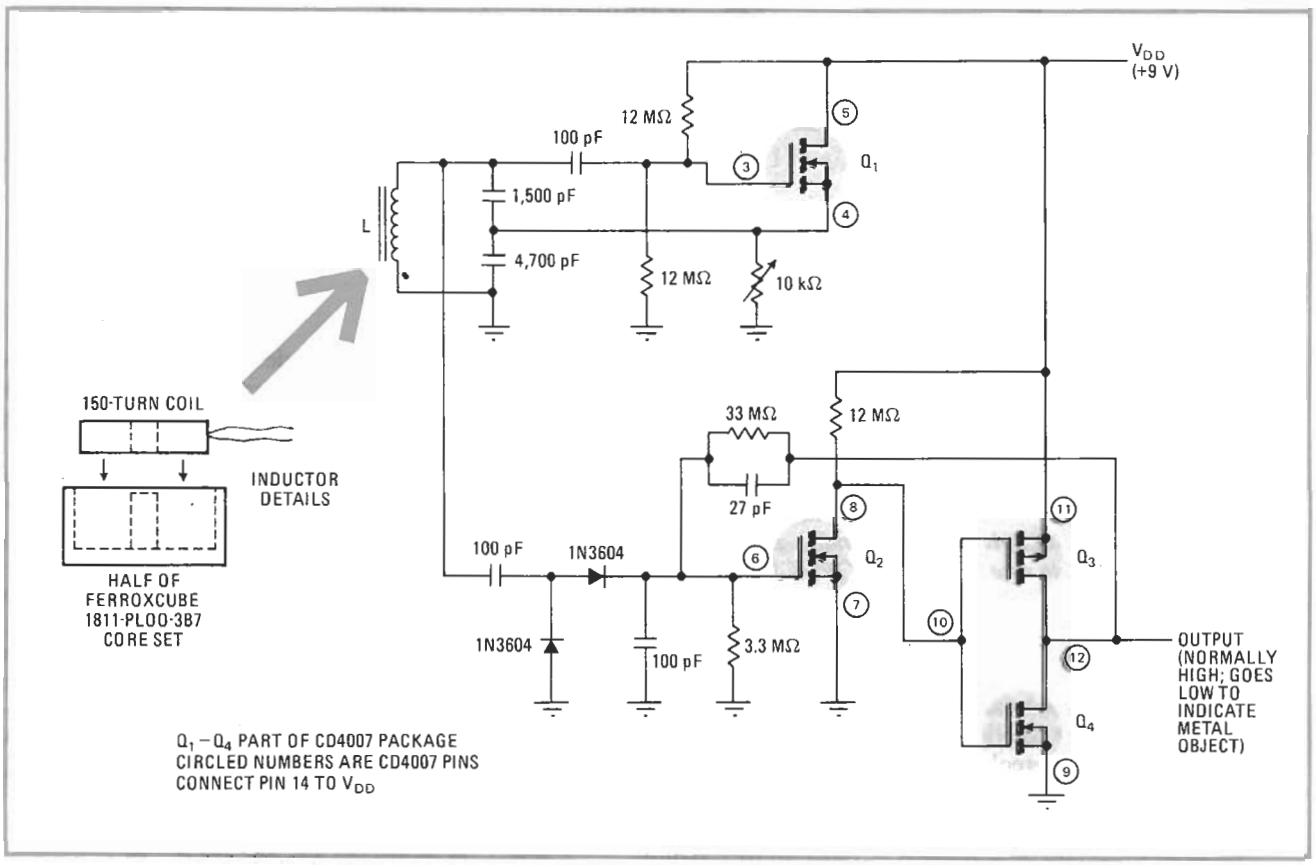

Detects metal. Proximity detector consists of modified Colpitts oscillator, amplitude detector, and Schmitt trigger. Output signal is normally high; but when oscillator coil is loaded by presence of metal object, amplitude decreases and output from Schmitt trigger goes low. Detail drawing shows construction of the oscillator coil in a proximity detector that serves as the noncontacting pickup for a tachometer.