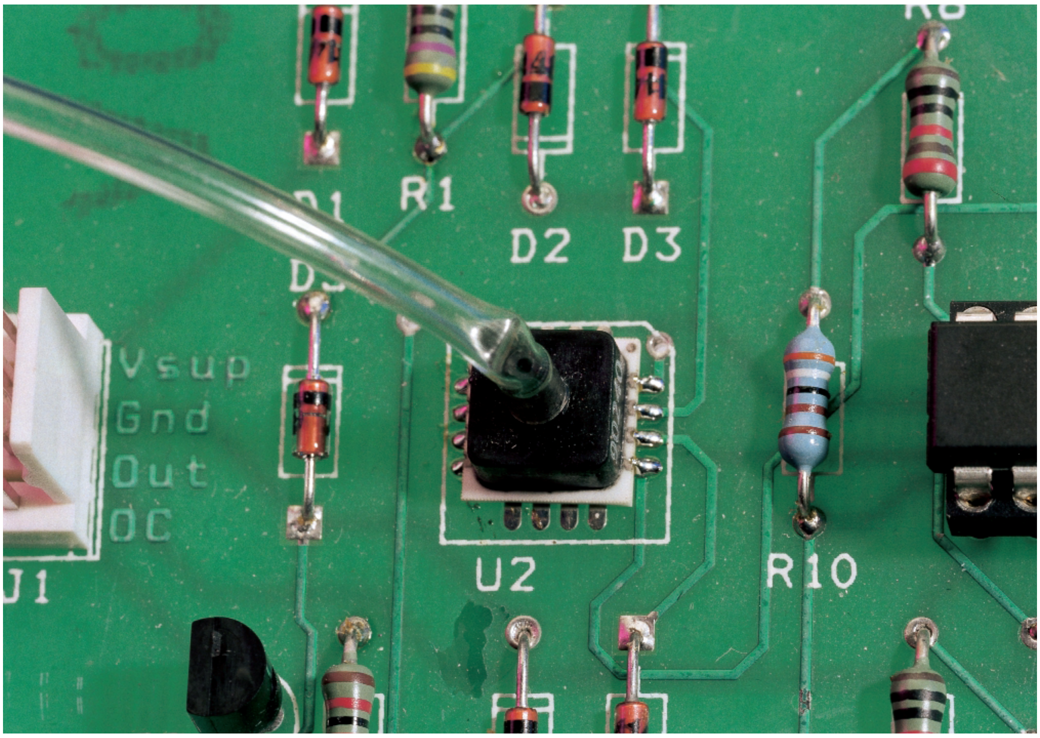
060 Pressure Switch



J. Schuurmans

A simple pressure switch with a range of 50 to 350 mbar can be made using a pressure sensor. If you can accept somewhat reduced linearity, the sensor can even be used up to 500 mbar. As shown in the schematic diagram, the circuit contains very few components other than the sensor. D1, R1, C1 and D5 form a simple voltage stabiliser that holds the supply voltage for the sensor and opamps at 5 V. The three diodes in series with the sensor provide temperature compensation (more on this later). The differential output signal from the sensor is amplified 30× by an instrumentation amplifier composed of opamps IC1a, IC1b and IC1c. The amplification factor can be adjusted if necessary by modifying the value of R10. The amplified output signal is compared to the voltage on the wiper of P1. If the voltage that results from the pressure being measured is less than the value set by P1, the output of comparator IC1d is High and LED D4 is on. An external load can be switched via the open-collector output of T2.

We used a Melexis MLX90240 sensor (*www.melexis.com*), but unless you work in the automotive industry, you won't be able to obtain this sensor. An Exar sensor (such as the SM5310-005-G-P; see *www.exar.com*) or a Motorola type can be used instead. If necessary, the circuit can be modified as described below.

Start with the sensor sensitivity specification from the data sheet (approximately 60 mV/bar/volt in our case). Since the supply voltage of the sensor is 5 V minus 3 diode drops, or around 3 V, the net sensitivity is thus 180 mV/bar. The range of the sensor is 0 to 350 mbar, so the maximum output voltage is 63 mV. The following amplifier has a gain of approximately 30, so the output signal ranges between 0 and 1.89 V. This voltage is compared to the voltage on the wiper of P1, which can be varied between 0 and 2.5 V. If the sensitivity differs from the nominal value, the amplification can be adjusted as necessary using R10.

Finally, a remark on the temperature compensation. The sensor used here has a temperature coefficient of 2100 ppm/degree. Other types of sensor will have somewhat different values (consult the data sheet). The supply voltage should thus increase by 2100 ppm of 3 V for every degree, which is 6.3 mV per degree. The voltage across a silicon diode drops approximately 2 mV per degree, so the supply voltage of the sensor increases as the temperature increases. This compensates for its decreased sensitivity. With the indicated sensor, three diodes in series are needed to just about fully compensate for its temperature coefficient. Two diodes are sufficient for the previously mentioned Exar sensor.

(004070-1)