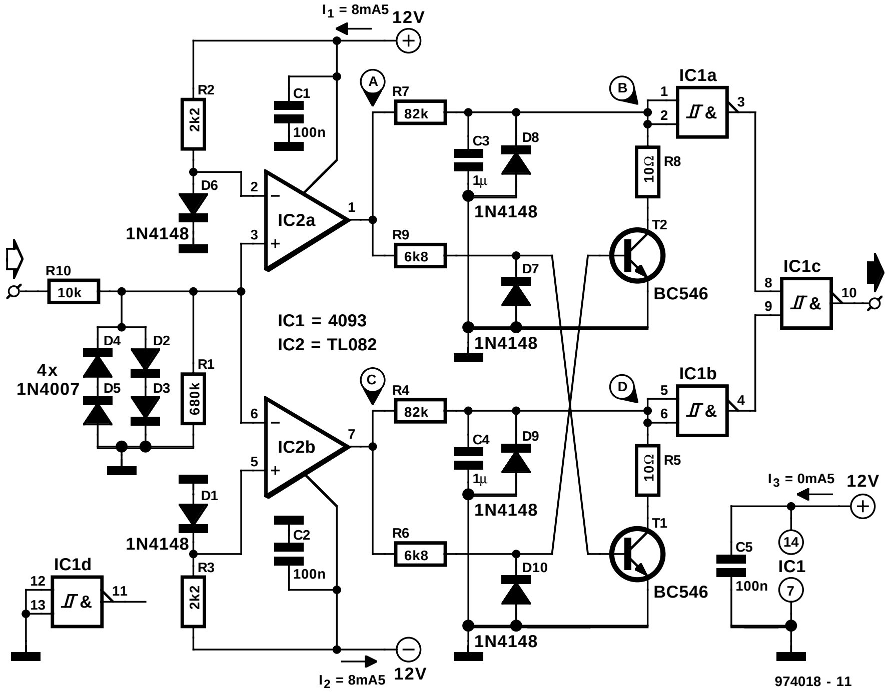
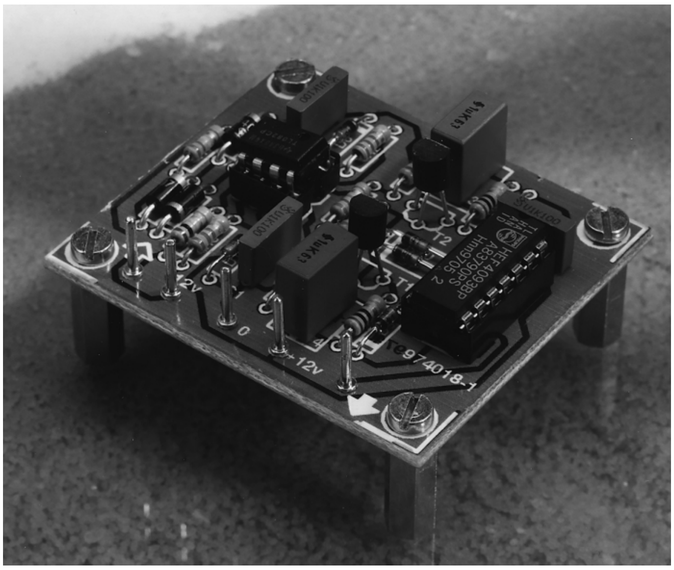
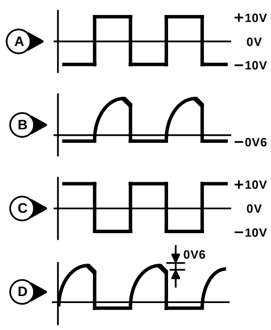
d.c. detector

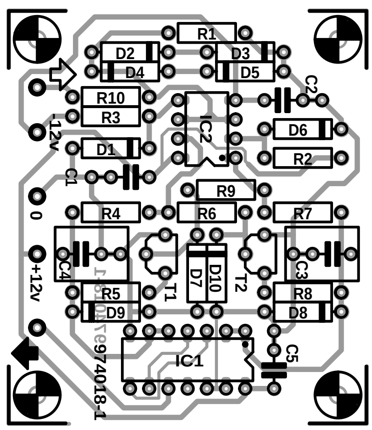


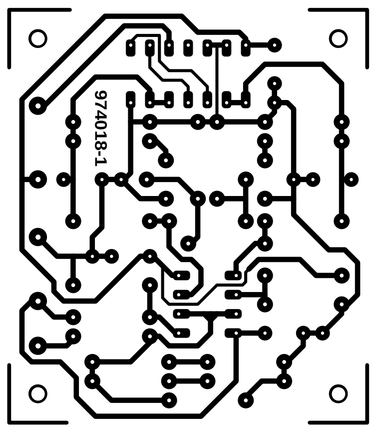
The detector is intended primarily to sense direct voltages at the output of power amplifiers. The signal so detected may be used to enable a protection circuit that, for instance, disconnects the loudspeakers from the amplifier. The circuit has the advantage of reacting at whatever level of direct voltage: always within 75 ms. It also reacts to signals >600 mV at very low frequencies below about 4 Hz, which are likely to damage the loudspeakers.

The circuit is configured symmetrically and may therefore be split into two. The upper part in the diagram processes positive input signals, and the lower part, negative signals.









The signal from the amplifier is applied to the sensor via R_{10}. Its level is limited by diodes D_2–D_5. The trip levels of comparators IC_{2a}–IC_{2b} are set to +600 mV and –600 mV by R_2-D_6 and R_3-D_1 respectively. This means that the output of IC_{2a} goes high when the input voltage is higher than +600 mV and that of IC_{2b} when the input voltage is lower than –600 mV.

It follows that the signals at the outputs of the comparators together form a square wave. This is used to charge C_3 and C_4 alternately to a potential that does not exceed the trip levels of the comparators. This situation changes, however, if, for instance because of a positive offset, the output of IC_{2a} remains high longer than usual. This causes C_3 to be charged to a higher potential, while at the same time T_1 is switched on via R_9 and C_4 is short-circuited. This causes T_2 to be blocked via R_6, so that the potential building up across C_3 cannot be removed via this transistor. This means that the trip level of IC_3 will be exceeded so that the output of the circuit changes from low to high.

The same kind of action occurs if because of a negative offset the output of IC_{2b} remains high longer than usual. It is then C_4, however, that is charged, while IC_{1b} functions as the trigger.

Diodes D_7 and D_{10} protect T_1 and T_2 by preventing their base voltage dropping below –700 mV.

Clearly, the response time of the sensor depends not only on the trigger level of IC_{1a} and IC_{1b}, but also on the time constants R_4-C_4 and R_7-C_3. The HEF4093 used in the prototype triggered at 7.5 V (V_{DD} = 15 V), which resulted in a response time of 57 ms. However, the spread of trigger voltages in the 4093 series is appreciable and it may, therefore, be necessary to lower the values of R_4 and R_7.

Parts list

Resistors:
R_1 = 680 kΩ
R_2, R_3 = 2.2 kΩ
R_4, R_7 = 82 kΩ
R_5, R_8 = 10 Ω
R_6, R_9 = 6.8 kΩ
R_{10} = 10 kΩ

Capacitors:
C_1, C_2, C_5 = 0.001 µF
C_3, C_4 = 1 µF, MKT (metallized polyester)

Semiconductors:
D_1, D_6–D_{10} = 1N4148
D_2–D_5 = 1N4007
T_1, T_2 = BC546

Integrated circuits:
IC_1 = 4093
IC_2 = TL082CP

Miscellaneous:
5 off board pins

The detector is best built in the printed-circuit board shown, but this is not available ready made.

The symmetrical power supply may have an output between ±10 V and ±18 V. The prototype draws a current not exceeding 10 mA.

[Wolff – 974018]