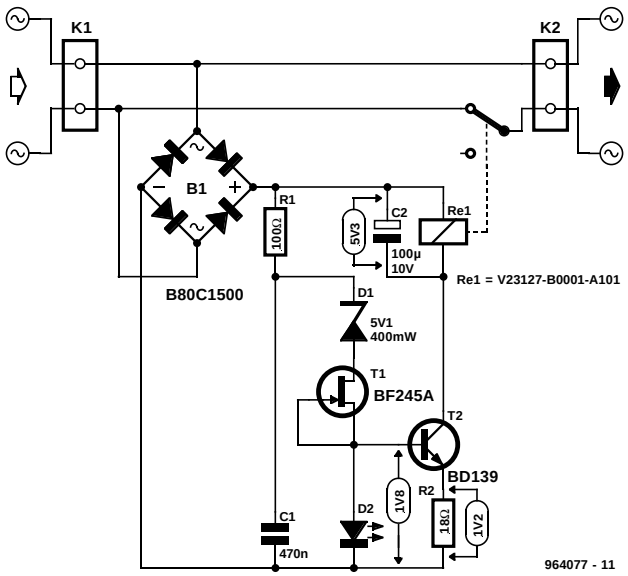
loudspeaker protector

This circuit automatically disconnects a mid-range loudspeaker or a tweeter from the output of an amplifier when too much power is applied. A relay with a normally closed (n/c) contact is used as the switching device.

The relay coil voltage is derived from the loudspeaker signal with the aid of bridge rectifier, B1. A current source, T2, is used to ensure a reasonably constant coil current. To ensure that the maximum coil current does not depend too much on level of the loudspeaker signal, the voltage across R2 is limited to about 1.2 V by an LED, D2. The maximum energizing current is then about 66 mA. The 6-V Siemens relay used here has a coil resistance of about 80 Ω. To keep the extra load on the amplifier to a minimum, the relay receives a coil voltage which is a little below the nominal value. Remember, the circuit draws current even when the relay is not energized! Fortunately, the current consumption is negligible at signal levels up to 5 V_{peak}.

The saturation current which flows through the J-FET current source, T1, is about 4 mA, enabling a low-current LED to act as a visual 'overload' indicator. Turn the volume down when the LED lights! A zener diode is connected in series with the current source and the LED to define the threshold at which the relay toggles. The zener value shown here results in an actuation level of about 7.5 V, or about 8.5 W into 8 Ω. The loudspeaker is connected again at a power level of about 3.5 W. Note that these are average power levels, so you may get quite different results when testing with music or white noise (13 W off, 5 W on). Network R1-C1 is a rudimentary peak detector which helps to improve the response of the circuit to noise.



The circuit works fine from a frequency of about 60 Hz. At lower frequencies, the relay may chatter. The protection is, therefore, mainly suitable for mid-range drive units and tweeters.

If you want to use the protection for higher signal levels, it is recommended to use a 12-V relay, and change the value of R2 according to

$R2 = 1.2V / I_{(nom)}$

where I_{nom} is the nominal coil current of the relay. The calculated value of R2 is then rounded off to the nearest (higher) E12 value.

FET T1 limits the maximum permissible input voltage to about 38 V. Current consumption of the protector is about 70 mA when actuated. The indicated test voltages apply to that state.

[Design by T. Giesberts - 964077]