Economy Timer

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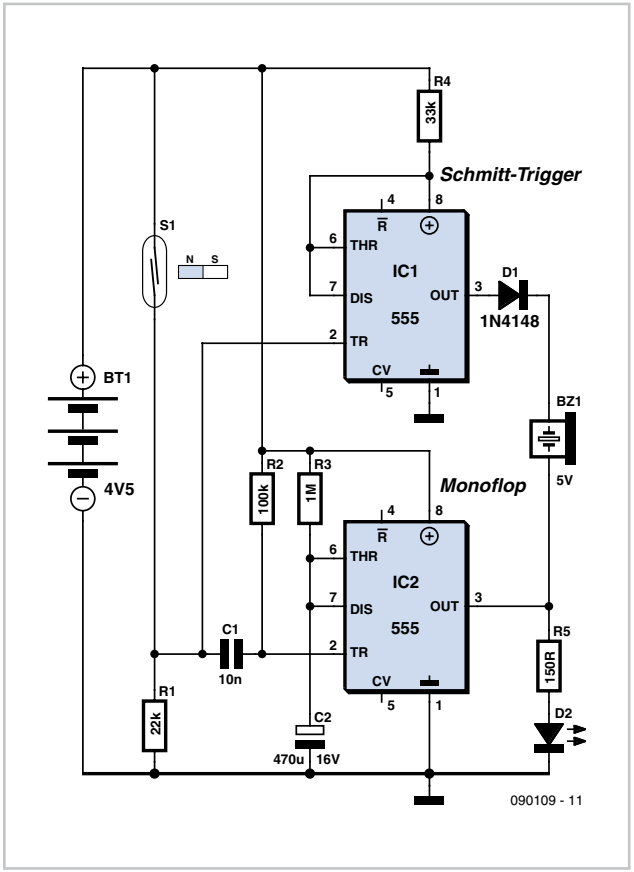
Windows should be opened only a few minutes for ventilation, and due to the risk of break-ins, you shouldn't leave windows open for hours on end or when nobody is at home.

This circuit detects when a window is open (it can also be used with a door), indicates that the window is open by means of a red LED or a blinking LED, and emits a loud acoustic signal from an intermittent electronic buzzer to remind you to close the window.

The active components consist of a pair of type 555 timer ICs. Switch S1 is a reed switch that is attached to the window frame, and when the window is closed the switch is closed by a magnet attached to the window casement.

When the window is closed, the reed switch connects resistor R1 to the 4.5-V supply voltage. If the window is opened, S1 opens as well and the voltage on R1 drops immediately to 0 V. As a result, the trigger input of IC2 is briefly pulled to ground via C1. IC2 is wired as a monostable flip-flop, and it is triggered by this pulse. After C1 charges, the supply voltage is again present at the trigger input of the monostable flip-flop (via R2). This prevents retriggering and allows the monostable to time out normally.



The red LED or blinking LED (user option; select the value of the series resistor accordingly) indicates that the timer is running (pin 3 is logic High). The output of the second 555 IC, which configured as a Schmitt trigger, also goes High when its trigger input is pulled to ground. As a result, the DC buzzer connected between the outputs of the two 555 ICs is not energised because both outputs are High.

If the window is closed within the time interval determined by the R3/C2 network, the output of the Schmitt trigger returns to the Low state. If the output of IC2 is still High, diode D1 prevents any current from flowing through the DC buzzer. After the monostable times out, the outputs of both 555 ICs are Low and the buzzer remains silent.

Things are different if the window is still open when the monostable times out. The Schmitt trigger output remains High, but the monostable output goes Low. As a result, a positive voltage is applied to the buzzer, and it generates an acoustic signal until the window is closed. As befits an intermittent buzzer, it generates an intermittent signal.

The time-out interval of the monostable can be calculated reasonably accurately with the formula

$t = 1.1 \times C2 \times R3$

With the indicated component values (1 MΩ and 470 µF), the alarm sounds after approximately nine minutes if the window is still open.
Instead of the reed switch, you can use a light-dependent resistor (LDR) to detect the light from the refrigerator lamp. If you replace R1 with a trimpot and adjust it so that the monostable is triggered when the refrigerator lamp goes on (when the refrigerator door is opened), after the monostable times out the buzzer will remind you to close the refrigerator door (which is often left open). A nice side effect here is that you can use this circuit to definitively answer the age-old question of whether that refrigerator lamp actually goes off when the fridge door is closed ;-).

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