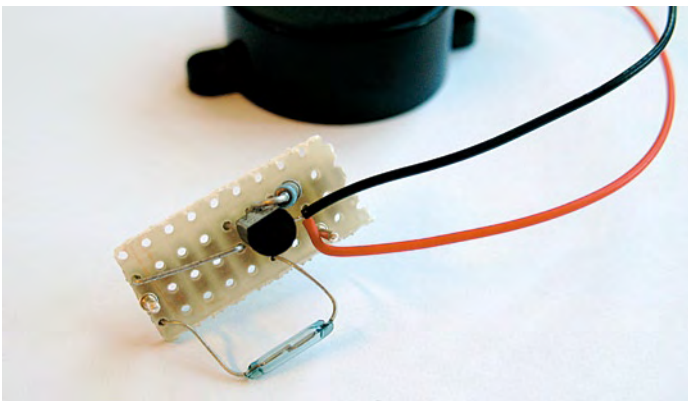
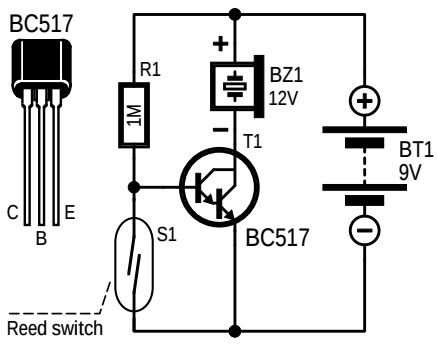
Back door alarm

By Ton Giesberts (Elektor Labs)

Although common sense repeatedly tells us that inanimate objects can't move by themselves, it sometimes sure seems like they do. No matter how sure you are that you closed the back door, it will always find a way to sneak back open and let the cold air in, which is unacceptable in winter time considering the low temperatures outside and



energy prices. Not to mention the lengthy discussions arising from a simple question like “Honey? Did you close the back door?” Both reasons, and others, prompted the Elektor lab to find a solution. This simple yet effective circuit solves all these problems with a mere four components (well five if you count the battery), as shown in the diagram.
The circuit can be fitted in a small ABS casing, which would ideally contain a space for a 9 V battery, and should be located on the door frame. Next, you will need to attach a small but strong magnet to the door itself.
The sensor of this circuit is based on a reed switch. That’s basically a switch which only conducts when placed within a sufficiently strong magnetic field. The presence of the magnetic field caused by the magnet on the door is detected by the circuit, causing it to buzz or to remain silent. Although it will probably take some experimentation to get the magnet at the correct distance from the reed switch so that the alarm will go off if the door is even the slightest bit ajar, this is always possible.
We selected a reed switch instead of a micro switch because the latter requires physical contact to influence current, while a reed switch doesn’t. As long as the door is closed, the magnetic field will cause the reed switch to conduct, which causes the base of the transistor to be connected to the negative pole of the battery. Consequently the Darlington transistor blocks all current through the buzzer causing it to remain totally silent.
As soon as the door opens, the distance between the magnet and the reed switch becomes so large that the reed switch stops conducting, causing the base of the Darlington transistor to be effectively disconnected from the negative pole. Even though R1 has a very high resistance, it nonetheless conducts enough current to activate T1, causing it to conduct, which in turn causes the buzzer to emit sound.
A Darlington transistor was selected for this circuit because of its ability to considerably amplify currents and because of the very small current it needs to start conducting. This allows R1 to have a



very large resistance so only a small amount of current is used when the door is closed (which means that S1 conducts current). This can be proven using Ohm's law: I = U / R = 9 V / 1 MΩ = 9 μA. The upshot is that a simple 9 V battery will last for months!

We decided to use a 12 V piezo buzzer in this circuit (and, to be more precise, a CEP-2260a in our prototype), which emits a loud tone and seems to work fine at 9 V and below. You can basically use any buzzer which works at 9 V, provided it doesn't consume too much current. Do not attempt to use a buzzer that draws more than a few milliamps. When the buzzer is activated, the current rises from 9 μA to approximately 4 mA.

Due to the simplicity of this design, you could easily omit the prototype board altogether and just solder the components directly — although having a circuit board does look more professional. Technically speaking it doesn't change the fact that this circuit will work like a charm.

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