Failed Fuse Indicator

By **Hans-Norbert Gerbig** (Germany)

You switch it on and... ping! Or perhaps a gentle 'pffft' or just silence, but nothing more after that. Who hasn't had this experience at some time? The usual suspect is the fuse. In the same way the normal 'quick fix' is to change the fuse for another one, even though this is not really advisable without knowing the precise cause of failure. But what else can you do when you're far away from the electronics lab? Well, try some simple checks. Is the fuse really defective — and if there are several, which one? Not easy to determine without testgear. Unless you have a built-in failure indicator...

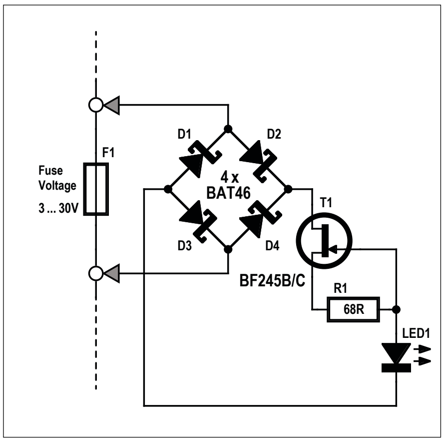

Figure 1. The circuit of the failed fuse indicator uses only seven components.

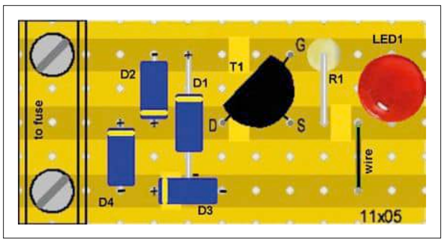

Figure 2. Here's how the circuit in Figure 1 can be built.

If the device went bang, fizzed or simply did nothing when turned on, you could assume that it has cost you a fuse (or several). If, with it still plugged in, the main circuit breaker has not cut out and there is no overall power failure, the other items connected to the same wiring circuit will at least still work.

Some instrument fuses are filled with silica sand, however, in order to extinguish any arcs arising when the fuse element (a length of fine wire) blows and cuts the current flow of any short circuit as rapidly as possible. This is good for the appliance we want to be protected but has the disadvantage that it's hard to see whether the fuse has actually blown or not. An optical indication would be no bad thing, particularly for devices with which this happens more often or not. This is easy at mains (line) voltage: a small bulb can be wired in parallel with the fuse. However, the failure indicator described here uses an LED to light up when the fuse blows and will also work at lower voltages.

Failure indication

A failed fuse indicator needs to be simple, cheap, reliable and small. Ergo it should also require not many components. The circuit in **Figure 1** fulfills all of these criteria. Its operation is supremely simple: an LED is wired in parallel with the fuse along with a little electronic wizardry. Under normal conditions the LED is shunted by the intact fuse and remains unlit. If the fuse blows, the operating voltage is available via the load connected to the defective fuse. The parallel LED can avail itself of this and light up.

The electronics needed can remain straightforward. The first consideration is that the failure indication should operate regardless of DC polarity and on AC as well. This means having the LED plus current limiting circuitry driven by a bridge rectifier. To avoid too much voltage drop and maintain operation at low supply voltages, Schottky diodes are employed for D1 to D4.

The only other thing we need to ensure now is that the current through the LED is not only limited but also maintained unaltered across a broad voltage range. This works best using a constant current source. The simplest option is an N-channel barrier layer FET with a resistor between the Gate and Source. The current flowing is dependent mainly on the slope of the FET or its DC voltage at a particular current across the resistor. However, one has to keep in mind the maximum voltage between Drain and Source and the maximum power dissipation. With the BF245 FET you can reach 30 V. The failure indication can therefore be used with fused voltages of between 3 and 30 V.

Performance considerations now: according to the datasheet [1] a BF245 can tolerate ambient temperatures up to 75 ºC 300 mW, getting significantly hot and bothered nevertheless. Better to keep it below half of that. The subtype BF245A produces a current of 4 mA when R1 = 0Ω. This way any LED will light up clearly and total power dissipation for T1 remains in the region of 100 mW even at 30 V. With the BF245B the figure is around 10 mA and finally around 18 mA with the BF245C. This makes things brighter. With R1 you can reduce the current through the LED at will. For the BF245B, a current of approximately 7 mA is obtained with a value of 68Ω for R1.

Construction

The circuit is so simple that you should have no problem using perf board for the seven components. The placement plan in **Figure 2** will assist you. For convenient connection in parallel with the fuse a 3-way screw terminal connector (5 mm pitch) is provided. One more tip: for especially low voltage a red LED is recommended, as these exhibit the lowest voltage drop. To make this particularly noticeable use a flashing LED for LED1.

(160449)

Web Link

[1] www.nxp.com/documents/data_sheet/BF245A-B-C.pdf

About the Author

Hans-Norbert Gehrig was employed as a teacher at the Kreuzburg Franciscan High School near Frankfurt am Main, where he also supervised various electronics student groups. Radio and electronics have fascinated him ever since his school days and now in retirement, he can devote himself to his technical hobby with all his heart.