Battery Voltage LED

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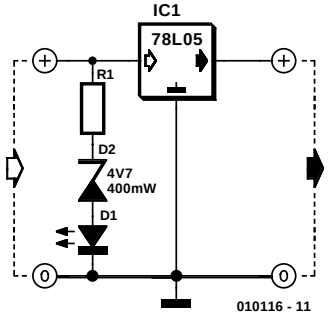
In many small battery powered apparatus it is common to have an LED act as a combined indicator for 'power-on' and 'battery state'. The most commonly seen circuit fir this is shown in Figure 1. Although it is assumed that a 78L05 is used in all circuits to be discussed, the concepts can be extended to other (low-drop) voltage regulators as well.

The 78L05 requires a minimum input voltage of 6.5 V to work properly. In Figure 1, the LED voltage will be about 1.8 V, with the zener diode dropping 4.7 V and the resistor, the excess voltage above 6.5 V. Note that a low-current LED is recommended because of its modest current requirement of just 2 mA. Once the battery voltage drops below the sum of the zener voltage and the LED voltage, the LED is turned off.

In the case of the circuit in **Figure 2**, assuming that the load current is more than a few milli-amps, the current flows through the LED-resistor combination. The value of the resistor is worked out to pass slightly less than the minimum load current. In that case, the LED will help to shunt some current past the regulator, while not wasting battery power as in Figure 1. For loads over 20 mA, work out the resistor value so as to let the regulator do more work. As the battery is drained

1



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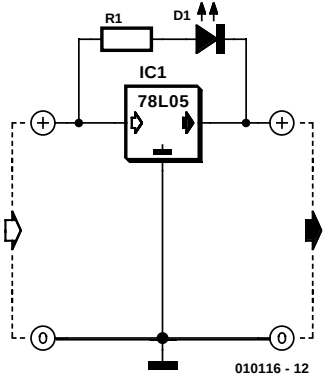

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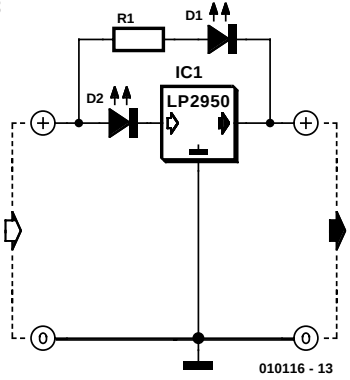

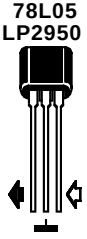

the LED will dim and eventually turn off as the battery voltage starts to approach the minimum working voltage of the regulator.

In **Figure 3**, two LEDs are used with different turn-on voltages (i.e., different colours). If the regulator used is a low-drop type with a minimum voltage drop smaller than about 0.1 V, then LED D1 is the low-battery indicator and LED D2, the power-on indicator. For this to work, D1 must have a turn-on voltage which is about 0.2 V higher than that of D2.

The LEDs in Figures 2 and 3 may be 2-mA types or the more commonly found standard 20 mA ones. Note that the maximum current through a normal LED should not exceed 50 mA or so.

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