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Monitor circuit conserves battery energy

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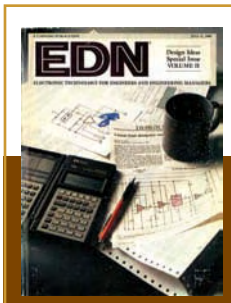
Many battery-powered systems require a visual indication when the battery needs replacement. LEDs often serve as the indicator, but they can draw as much as 10 mA of current. This excessive current drain unduly accelerates the battery's discharging and curtails the battery's useful life. **Figure 1** uses a sampled-data technique to lower the monitor circuit's average power consumption. The circuit draws 5 µA of standby current and 30 µA during low-battery indication.

During a sampling cycle, the LTC1041 bang-bang controller applies power to both of its internal comparators; samples the V_{IN}, SET POINT, and DELTA inputs; stores the results of the comparisons in an output latch; and turns off power. This process takes approximately 80 µsec. An external RC network consisting of R_1 and C_1 sets the sampling rate.

The controller's V_{PP} output switches to V_{CC} during the controller's active 80-µsec on time and switches to a high impedance during off time. A fast-settling reference sets the trip points. R_2 must be small enough to supply the LT1009's minimum required current. R_3, R_4, and R_5 divide the battery voltage and feed it into a comparator input. The resistors provide a lower trip point of 5.5V and an upper trip point of 5.95V. The internal comparators' low-current bias point permits using high-valued resistors for the divider. R_5 sets the comparator's hysteresis. The comparators drive an internal RS flip-flop; the flip-flop is set (ON/OFF=V_{CC}) when V_{IN}<SET POINT–DELTA. The flip-flop is reset (ON/OFF=ground) when V_{IN}>SET POINT+DELTA.

When the controller reaches the lower trip point, the flip-flop latches, turning on Q_1. Once latched, the V_{PP} output drives Q_2, causing the LED to flash at each sampling cycle. The circuit drives the LED with 75 mA for 80 µsec every 220 msec. This operation results in an average current drain of 27 µA. The LED may flash once during power up because the latch output is temporarily indeterminate. A bypass capacitor, C_2, ensures low-supply impedance under transient loads. EDN



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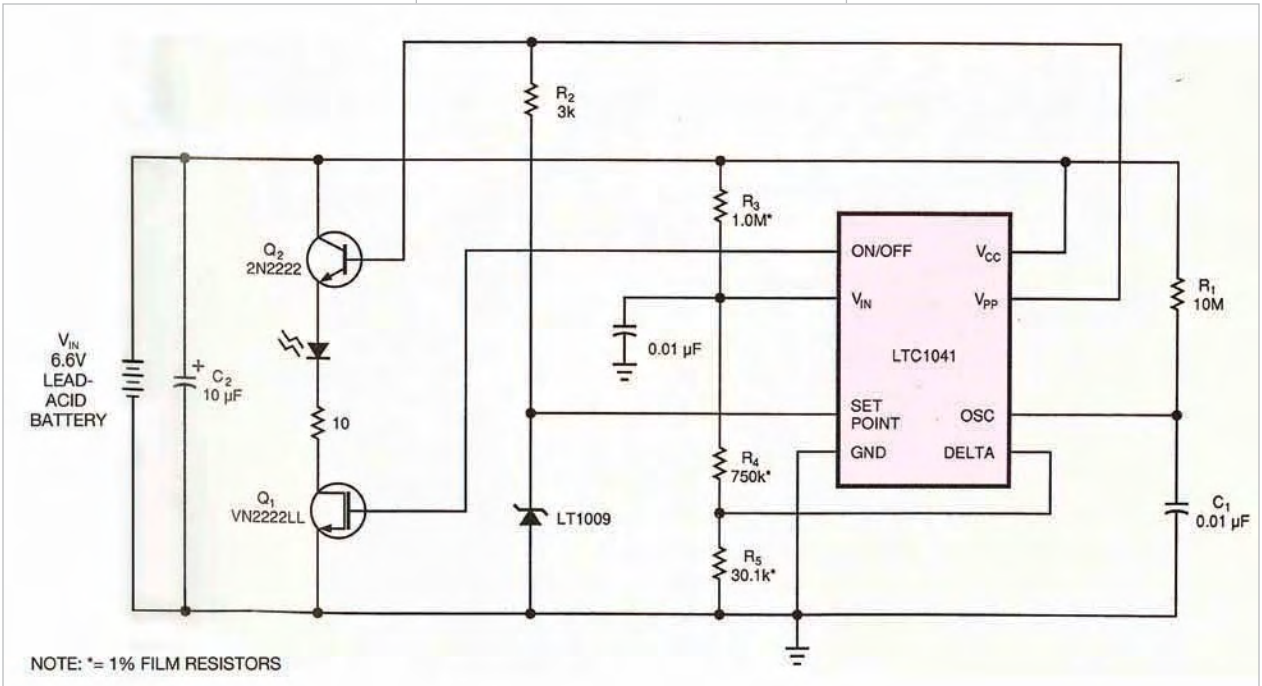

Figure 1 Instead of continuously draining the battery, this monitor circuit samples the inputs to achieve power consumption of 5 µA in standby and 30 µA during low-battery indication.