# PENCELL CHARGE INDICATOR

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Small-size AA cells and button cells used in electronic devices providing a terminal voltage of 1.5V are normally rated at 500 mAh. As the cells discharge, their internal impedance increases to form a potential divider along with the load and the battery terminal voltage reduces. This, in turn, reduces the performance of the gadget and we are forced to replace the battery with a new one. But the same battery can be used again in some other application that requires less current.

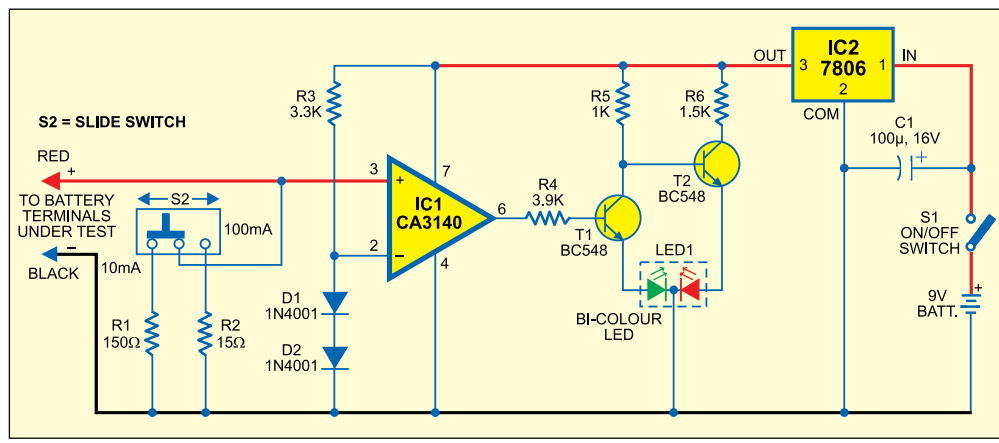
Here's a simple tester for quick checking of discharged pencells and button cells before throwing them away. The tester detects the holding charge of the battery and the terminal voltage to indicate whether the battery is suitable for a particular gadget or not.

A 9V battery can power the circuit with sufficient voltage and current. When you close switch S1, it provides stable 6V DC to the circuit.

The circuit uses op-amp CA3140 (IC1) as a voltage comparator. It can sense even a slight voltage variation between its inverting and non-inverting inputs. The non-inverting input (pin 3) of IC1 is supplied with a voltage obtained from the battery under test, while its inverting input pin 2 is provided with a reference voltage of 1.4V derived by resistor R4 and series combination of diodes D1 and D2. Resistors R1 and R2 provide a loading of 10 mA and 100 mA, respectively, for checking the charge capacity.

When a new battery is connected to the test terminals, the non-inverting input of IC1 gets 1.5V, which exceeds the voltage of the inverting input and the output of IC1 goes high. This high output provides forward bias to transistor T1 through resistor R4 and it conducts to light up the green half of the bicolour LED (LED1). Simultaneously, the base of transistor T2 is pulled down and it turns off and the red half of bicolour LED1 remains off.

When a partially discharged battery (with a terminal voltage of less than 1.4 V) is connected to the test terminals, the output of IC1 goes low to switch off transistor T1. This allows transistor T2 to forward bias by taking bias voltage through resistor R5 and the red LED within bicolour LED1 glows.




Slide switch S2 is used to check whether the battery is holding sufficient current to drive a load of 10 mA or 100 mA. If the discharged battery holds more than 100mA current, the green LED within bicolour LED1 glows, indicating that the battery can be used again in a low-drain circuit.

The circuit can be easily constructed on a perforated board using readily available components. Enclose it in a small case with probes or battery holder for testing. ●