

# Simple NiCd Charger

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A simple NiCd charger can be built using 'junk box' components and an inexpensive LM317 or 78xx voltage regulator. Using a current limiter composed of R3 and a transistor, it can charge as many cells as desired until a 'fully charged' voltage determined by the voltage regulator is reached, and it indicates whether it is charging or has reached the fully charged state. If the storage capacitor (C1) is omitted, pulsed charging takes place. In this mode, a higher charging current can be used, with all of the control characteristics remaining the same.

The operation of the circuit is quite simple. If the cells are not fully charged, a charging current flows freely from the voltage regulator, although it is limited by resistor R3 and transistor T1. The limit is set by the formula

$$I_{max} \approx (0.6 \text{ V}) \div R3$$

For  $I_{max} = 200 \text{ mA}$ , this yields  $R3 = 3 \Omega$ . The LED is on if current limiting is active, which also means that the cells are not yet fully charged.

The potential on the reference lead of the voltage regulator is raised by approximately 2.9 V due to the voltage across the LED. This leads to a requirement for

a certain minimum number of cells. For an LM317, the voltage between the reference lead and the output is 1.25 V, which means at least three cells must be charged ( $3 \times 1.45 \text{ V} > 2.9 \text{ V} + 1.25 \text{ V}$ ). For a 78xx with a voltage drop of around 3 V (plus 2.9 V), the minimum number is four cells.

When the cells are almost fully charged, the current gradually drops, so the current limiter becomes inactive and the LED goes out. In this state, the voltage on the reference lead of the regulator depends only on voltage divider R1/R2. For a 7805 regulator, the value of R2 is selected such that the current through it is 6 mA.

Together with the current through the regulator (around 4 mA), this yields a current of around 10 mA through R1. If the voltage across R1 is 4 V ( $9 \text{ V} - 5 \text{ V}$ ), this yields a value of 390  $\Omega$ . The end-of-charge voltage can thus be set to approximately 8.9 V. As the current through the regulator depends on the device manufacturer and the load, the value of R1 must be adjusted as necessary. The value of the storage capacitor must be matched to the selected charging current. As already mentioned, it can also be omitted for pulse charging.

