Fast-Charge Controller Charges 22-Cell NiCd/NiMH Battery

By reducing the voltage between sensing terminals on a 16-cell fast-charge-controller IC, you can fool the device into "thinking" that fewer than the actual number of cells are present, and thereby connect more cells (22) to be charged.

Because 22-cell NiCd/NiMH batteries are common, the need for a compatible battery charger that is inexpensive, simple to use, and occupies little space is also common. You can implement such a charger by making simple modifications to the standard application circuit for a 16-cell NiCd/NiMH fast-charge controller (Figure 1).

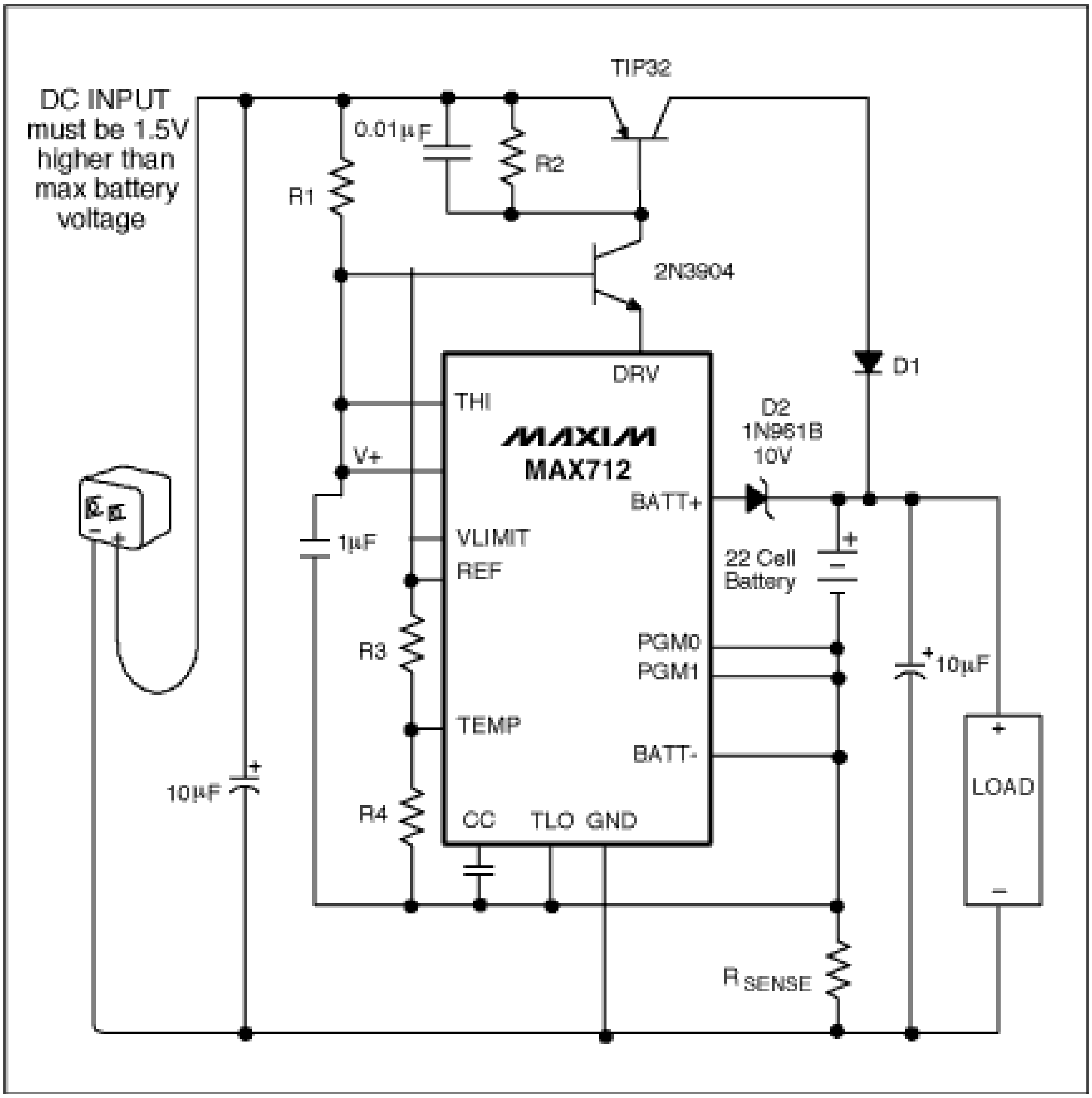

Figure 1. The circuit shown enables a charge controller for 16-cell NiCd/NiMH batteries to charge a 22-cell NiCd/NiMH battery.

The MAX712 shown in Figure 1 (or its companion, the MAX713) is designed to charge 1 to 16 NiCd/NiMH cells while maintaining power to the battery's load. The number of cells is limited by the maximum voltage allowed across battery terminals BATT+ and BATT-, which is ±2V times the programmed number of cells. But, you can fool the IC into sensing fewer cells than are actually present by reducing the voltage between BATT+ and BATT-. That is accomplished by placing a zener diode in series with the BATT+ terminal.

Thus, you can accommodate a cell number in excess of the maximum (16) by choosing a zener diode with the correct voltage. For a 22-cell battery, configure the IC for 16 cells by connecting PGM1 and PGM2 to BATT-. Reduce the voltage at BATT+ by (6x1.65V) with a 10V zener diode (D2) as shown. In general, the zener voltage V_Z should equal the number of desired cells (22 cells in this case) minus 16 cells, times 1.65V:

$V_Z = (22 \text{ cells} - 16 \text{ cells}) \times 1.65V$

The supply voltage must be at least 1.5V above the maximum battery voltage. For a 22-cell battery with a limit of 1.65V per internal cell, the supply voltage must be 22 x 1.65 +1.5 = 37.8V or greater. A medium-power pnp pass transistor (TIP32) feeds a fast-charge current into the battery and load, and a 2N3904 transistor prevents excessive power dissipation in the IC by maintaining the DRV voltage within specifications. Power dissipation in the pass transistor is:

$P = (V_{IN} - V_{BATMIN}) \times 16 \times I_{FAST}$

For fast currents greater than 250mA, the pass transistor should include a suitable heat sink.

R1 limits current into the internal shunt regulator (V+ terminal). Select an R1 value that passes at least 5mA at the minimum DC input voltage, and an R2 value that limits the current into DRV to less than 100mA. A graph (Figure 2) illustrates operation of the system. It shows a 22-cell NiMH battery being charged in fast-charge mode with a charging current of 0.5A. As the battery reaches full charge, the charger goes into trickle-charge mode. Load voltage is maintained at 36.3V (22 x 1.65V) throughout the charge cycle.

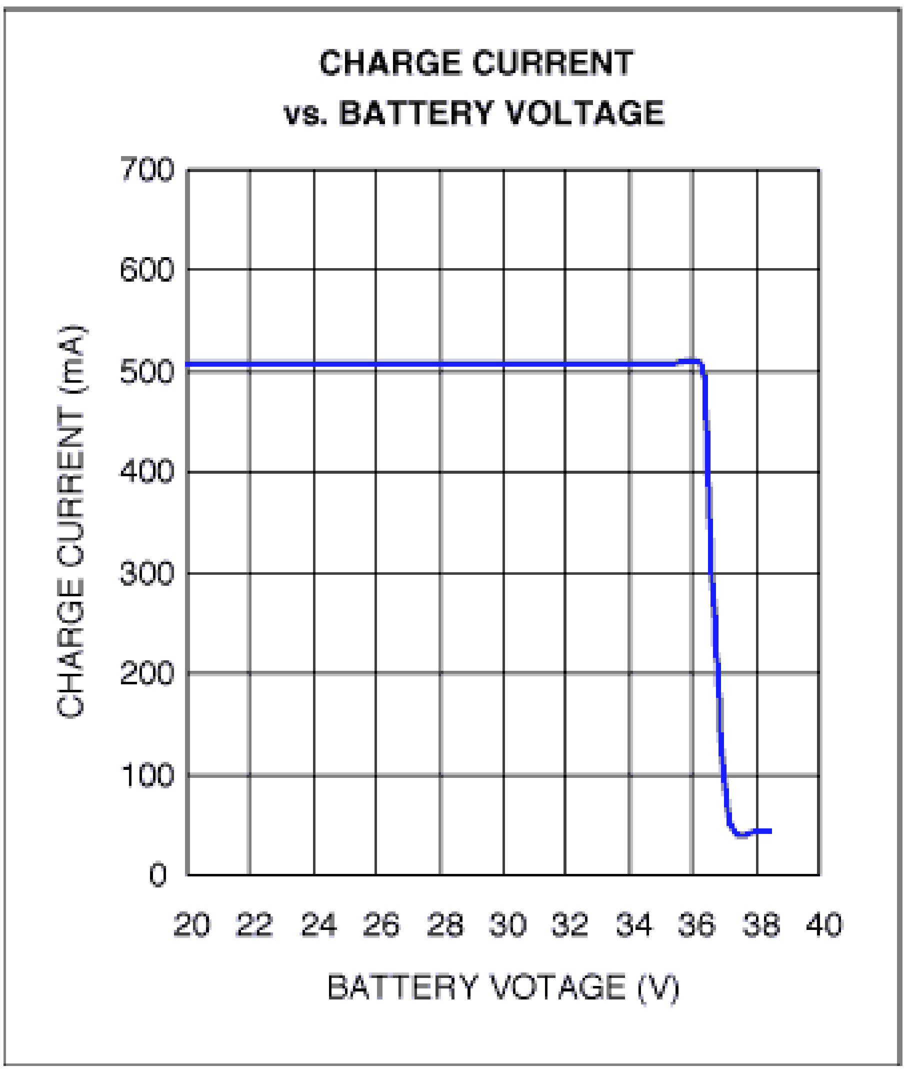

Figure 2. The circuit of Figure 1 charges a 22-cell NiCd/NiMH battery while maintaining 36.3V across the load.

This design idea appeared in the August 5, 2004 issue of *Electronic Design* magazine.

More Information

MAX712: QuickView -- Full (PDF) Data Sheet -- Free Samples