Keywords: NMOS current switching, DS2714, NMOS charging, NiMH, NiMH charger, stand alone charger   Dec 15, 2006

APPLICATION NOTE 3959

Using an nMOS Transistor with the DS2714

Abstract: The example circuit in the data sheet for the DS2714 stand-alone NiMH charger uses pnp transistors to switch the charge current on and off. This can be problematic because the current-sink capability of the charge control pins may restrict the charge current through the pnp transistor. This application note describes how to use nMOS, instead of pnp, transistors to avoid this problem.

Introduction

The DS2714 application example in the datasheet uses pnp transistors to switch the charge current on and off. This is the most efficient configuration for component count, but it is not necessarily the best for every application. Since V_{CHG} is a current-regulated supply, the voltage drops to $\sim V_{CELL}$ when charging. Having V_{CHG} at V_{CELL} will not generate a high enough V_{GS} for a pMOS transistor to turn on. The drawback of using a pnp transistor is that the IC has to sink a current proportional to the charge current ($i_b = \beta \times i_c$). Depending on the charge rate, the base current (i_b), can be close to the limit of the DS2714. This application note provides an example that uses an inverter with nMOS transistors to avoid the problems associated with the pnp-transistor configuration.

Connection

Connect the output of your CCx pin to the input of an inverter; then, connect the output of that inverter to the gate of an nMOS transistor. The nMOS drain should be connected to V_{CHG}, and the nMOS source should be connected to the battery. Because CCx pins are open drain, a pullup resistor needs to be added from V_{CC} to CCx.
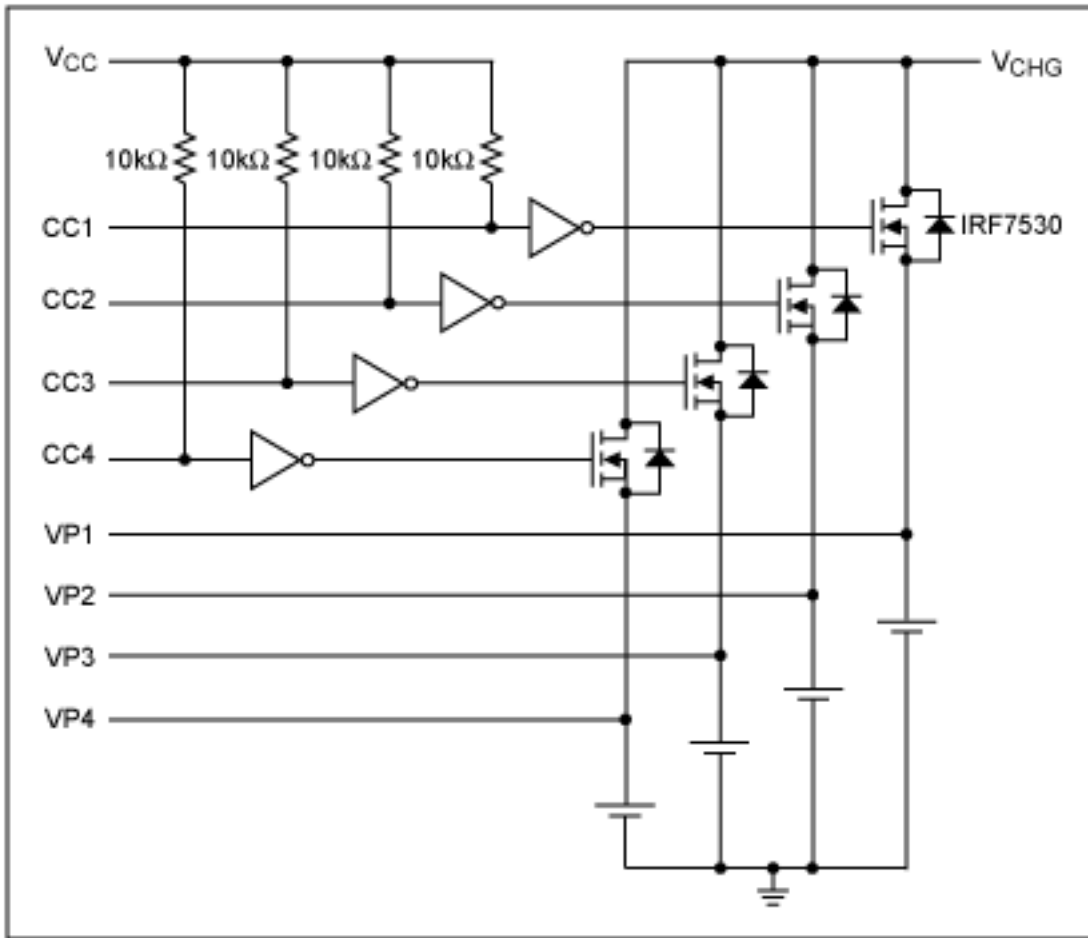
Figure 1. A diagram of an example application for the DS2714 that uses nMOS, instead of pnp, transistors.

Transistor Selection

Care must be taken when selecting an nMOS transistor to ensure that it can handle the charge current and will fully turn on within the application's voltage range. The inverter should be powered from the same supply as the DS2714, which has a minimum supply voltage of 4V. That means that the output of the inverter, ideally, should be 4V when CCx is active. The DS2714 will stop charging a cell above 1.75V. This provides a $V_{GS(ON)}$ of 2.25V (4V - 1.75V). To ensure that the transistor fully turns on, select an nMOS that has a gate threshold voltage < 2.25V. This example uses the IRF7530 because of its low V_{GS} (1.2V) and high current capability (5.4A).

Application Note 3959: www.maxim-ic.com/an3959

More Information
For technical support: www.maxim-ic.com/support
For samples: www.maxim-ic.com/samples
Other questions and comments: www.maxim-ic.com/contact

Automatic Updates
Would you like to be automatically notified when new application notes are published in your areas of interest?
Sign up for EE-Mail™.

Related Parts

DS2714: [QuickView](#) -- [Full (PDF) Data Sheet](#) -- [Free Samples](#)