



APPLICATION NOTE 2046

Using the DS2751 Battery Fuel Gauge in Multiple-Cell Battery Pack Applications

Abstract: The DS2751 Li+/NiMH battery Fuel Gauge IC is designed to monitor single-cell Lithium-ion (Li-ion) or 3-cell NiMH battery packs. However, with the appropriate circuit modifications, the DS2751 fuel gauge can also be used to monitor a 2-cell Li-ion battery pack. This application note presents a reference circuit that can be used to implement the use of the DS2751 battery fuel gauge to measure the remaining capacity of a 2-cell Li-ion battery pack. Detailed descriptions of the key components of the circuit are discussed, including configuration issues for the DS2751 itself.

Introduction

The DS2751 multichemistry battery fuel gauge has an operating range such that it can be used in singlecell Lithium Ion/Polymer packs or 3-cell Nickel packs. However, many applications necessitate more cells in a series stack. The DS2751 can still be used as a fuel gauging IC in those applications by dividing the multiple cell voltage down to an acceptable level. This method allows the use of all the features of the DS2751 including integrated 25mΩ sense resistor, temperature/voltage/current measurement, current accumulation (coulomb counting), 32-bytes of EEPROM, and a single wire communication interface.

Overview

The schematic in **Figure 1** illustrates a possible solution for using the DS2751 in a two cell application. Although not required for basic fuel gauging as described in AN131, this circuit presents a method to measure the dual cell voltage. In this application, PIO is used to switch the comparator output to drive one of its supply rails across the resistor dividing network. With PIO low, the voltage at V_{IN} is half of the dual cell voltage, and with PIO high, V_{IN} is 0V. To provide constant power to the DS2751, a low dropout voltage regulator (LDO) is required to step down the dual cell voltage to an acceptable level. A dual cell protector is also necessary to protect the cells from fault conditions. As shown in the schematic, all components for this circuit must reside on the contact side (as opposed to the cell side) of the protector.

2. Experimental results showed that adding an additional 0.1V to the doubled voltage register value produced a cell stack voltage accurate to 99%. The additional 0.1V is needed to account for the voltage drop from the comparator positive rail to the comparator output.

For protection of the cell stack, any multiple-cell standalone protector supporting NMOS or PMOS FETs can be used. The standalone protector is placed on the cell side of the DS2751, as illustrated in Figure 1. With this configuration, power to all external components will be disconnected via the protection FETs if a fault condition occurs. When the fault condition is corrected, the discharge FET will again be turned on, and all components will be powered up. As long as the UVEN function is disabled, the DS2751 can go to sleep in only one condition: If the PMOD bit is set to 1 (recommended), and DQ is a logic low for > 2s (pack disconnect). This causes the DS2751 to revert to a low power sleep mode and cease temperature, voltage, current, and accumulated current measurements. Reconnecting the pack and pulling DQ high causes the DS2751 to return to active mode.

The configuration shown in Figure 1 assumes an internal 25mΩ sense resistor. Please refer to the DS2751 data sheet for help choosing an appropriate external sense resistor for your application. All other passive components shown in Figure 1 are included for filtering and ESD protection as shown in the DS2751 data sheet.

Summary

Although the DS2751 is specifically designed for single-cell Lithium Ion/Polymer packs or 3-cell Nickel packs, it can be used as a monitoring and fuel-gauging device in applications that require more cells in the series stack. A comparator and LDO must be added to the complete solution, but the proposed components only add 2.6μA of supply current. With the UVEN function disabled, the numerous benefits of the DS2751 can be utilized in multiple cell applications. The benefits include high-precision coulomb counting with an integrated current sense resistor, 32 bytes of lockable user EEPROM, temperature, voltage and current measurements, a unique 64-bit ROM address, and a single wire serial communication interface.

Application Note 2046: <http://www.maxim-ic.com/an2046>

More Information

For technical questions and support: <http://www.maxim-ic.com/support>

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Related Parts

DS2751: [QuickView](#) -- [Full \(PDF\) Data Sheet](#)

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