Li ion battery schematic

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Lithium batteries have the advantage of high energy density. However, they require careful handling. This article discusses important safety and protection considerations when using a lithium battery, introduces some common battery protection ICs, and briefly outlines selection of important components in battery protection circuits.

Lithium batteries can be safely charged to 4.1 V or 4.2 V/cell, but no higher. Overcharging causes damage to the battery and creates a safety hazard, including fire danger. A battery protection circuit should be used to prevent this.

Lithium batteries are completely empty when discharged to 2.5 V/cell. Discharging a lithium cell this low is stressful to the cell and reduces cell lifetime. A good battery protection circuit will also provide over-discharge protection.

Battery protection ICs typically use MOSFETs to switch lithium cells in and out of circuit. Lithium cells of the same age and part number can be paralleled and share one protection circuit.

Figure 1 is a typical application schematic for a Texas Instruments BQ29700. It shows a BQ29700 connected to two MOSFETs, labeled CHG and DSG, and the cell terminals. The CHG MOSFET will turn off if the voltage at the cell terminals is too high. The cell can still discharge through CHG’s body diode and through DSG, so long as DSG is turned on. If the cell is discharging too quickly, or the cell voltage is going too low, then DSG will turn off, preventing further discharge. The cell can still be charged through DSG’s body diode, and the CHG MOSFET, so long as CHG is turned on.

Battery protection ICs are available from many manufacturers. Figure 2 shows the application schematics for Seiko’s S-8200A Series lithium cell protection ICs. Seiko has several lithium cell protection IC product families. Figure 3 shows the application schematic for another lithium cell protection IC, the DW01-P. Notice that the application schematics for all three circuits are very similar.

Figure 1: Typical application schematic for Texas Instruments BQ29700D

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