Battery-Powered Buck-Boost Converter Requires No Magnetics

by John Seago

One of the problems that designers of portable equipment face is generating a regulated voltage that is between the charged and discharged voltage of a battery pack. As an example, when generating a 3.3V output from a 3-cell battery pack, the regulator input voltage changes from about 4.5V at full charge to about 2.7V when discharged. At full charge, the regulator must step down the input voltage, and when the battery voltage drops below 3.3V, the regulator must step up the voltage. The same problem occurs when a 5V output is required from a four-cell input voltage that varies from about 3.6V to 6V. Ordinarily, a flyback or SEPIC configuration is required to solve this problem.

The LTC1515 switched capacitor DC/DC converter, can provide this buck-boost function for load currents up to 50mA with only three external capacitors. The circuit shown in Figure 1 will provide a regulated 3.3V output from a three-cell input or a 5V output from a four-cell input. Connecting the 5/3 pin to V_{IN} will program the output to 5V, whereas grounding the 5/3 pin programs the output to 3.3V.

The absence of bulky magnetics provides another benefit: this circuit requires only 0.07 square inches of board space in those applications where components can be mounted on both sides of the board. The addition of R1 provides a power-on-reset flag that goes high 200ms after the output reaches 93.5% of its programmed value. The $\overline{SHDN}$ pin allows the output to be turned on or off with a 3V logic signal.

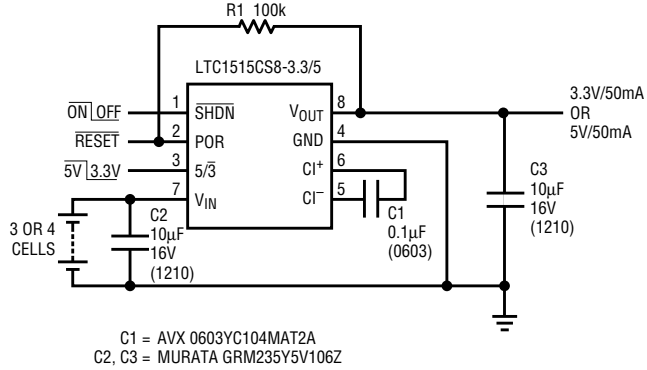

Figure 1. Battery-powered buck-boost converter