Monolithic Buck-Boost Converter Provides 1A at 3.3V without Schottky Diodes

by Mark Jordan

Introduction

The power density and small form factor of lithium-Ion batteries makes them the power source of choice for many portable devices. A SEPIC converter topology is a popular way to provide a regulated bus voltage that falls within the 2.7V to 4.2V battery range, but a SEPIC converter has some flaws. It offers mediocre efficiency and requires coupled inductors and a high current flyback capacitor. The LTC3441 1A buck-boost converter offers a compact and efficient alternative that requires only a single inductor and very few external components.

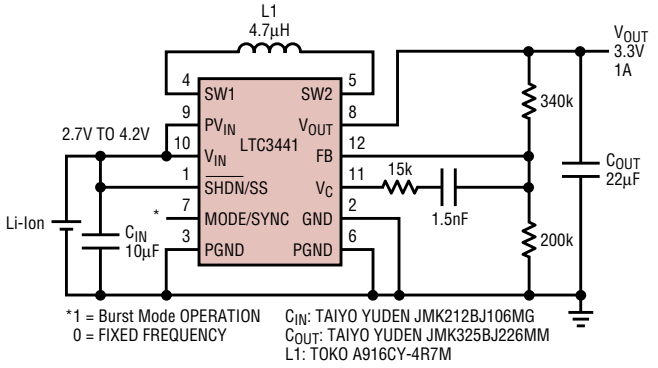

Figure 1. Li-Ion to 3.3V at 1A boost converter

Inside the LTC3441

The LTC3441 patented control technique provides smooth and continuous transfer from buck, buck-boost and boost modes while maintaining a constant frequency at no load. The operating frequency is factory set to 1MHz and can be synchronized up to 1.7MHz. For light loads, the part offers user controlled Burst Mode operation to maximize battery life, drawing only 25µA of quiescent current. To limit inrush current at start-up, an external RC network can be connected to the SHDN/SS pin to control output voltage rise time.

The LTC3441 is available in a small 3mm by 4mm low thermal resistance 12-lead DFN package.

Single Inductor Li-Ion to 3.3V/1A Converter

Figure 1 shows a 3.3W converter powered from a single Lithium-Ion battery. The single inductor topology of the LTC3441, along with all ceramic capacitors, minimizes critical board real estate. Dominant pole compensation is shown as a simple means to compensate the converter's transient response. For applications requiring optimum transient response an additional pole/zero pair to broaden the loop will achieve the desired results. Figure 2 shows that the converter can achieve 95% peak efficiency without the use of Schottky diodes.

Not Just a Buck-Boost

The LTC3441 can also be configured as a boost converter with output disconnect as shown in Figure 3. The 5V at 600mA converter from a Lithium-Ion battery demonstrates peak efficiencies of over 94%. Input current at start-up is also controlled by the LTC3441, reducing the load burden on the battery.

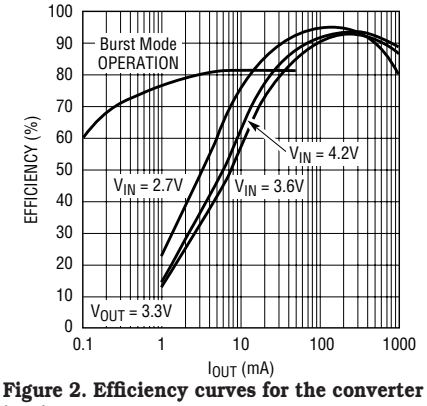

Figure 2. Efficiency curves for the converter in Figure 1

The Schottky diode limits the voltage spikes on the SW2 pin.

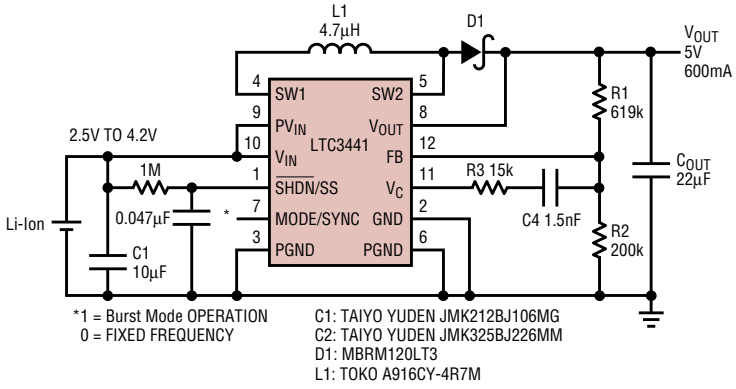

Figure 3. Li-Ion to 5V at 600mA boost converter with output disconnect