

80V Synchronous 4-Switch Buck-Boost Controller Delivers Hundreds of Watts with 99% Efficiency – Design Note 521

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Introduction

A DC/DC converter's efficiency and component temperature are important considerations in high power applications where high current could overheat the catch diode used in an asynchronous buck or boost topology. Replacing the catch diode with a synchronous switch can significantly improve overall converter efficiency and eliminate much of the heat that would be otherwise generated in the nonsynchronous catch diode.

The advantages offered by a synchronous buck or boost topology can also be applied to a buck-boost topology, where the converter's output voltage falls within its input range. In this case, a synchronous 4-switch buck-boost converter using a single inductor offers the same advantages as a 2-switch synchronous buck or boost.

The **LT[®]8705** is a synchronous 4-switch buck-boost controller IC that can deliver hundreds of watts with high efficiency for constant voltage or constant current applications from wide-ranging inputs (up to 80V). It uses a robust synchronous switch topology and adds the versatility of four servo loops (voltage and current at input and output), making it possible to design high power battery chargers and solar panel converters with minimum component count. These are only two examples of the many high power, high current telecom, automotive and industrial solutions the LT8705 can produce.

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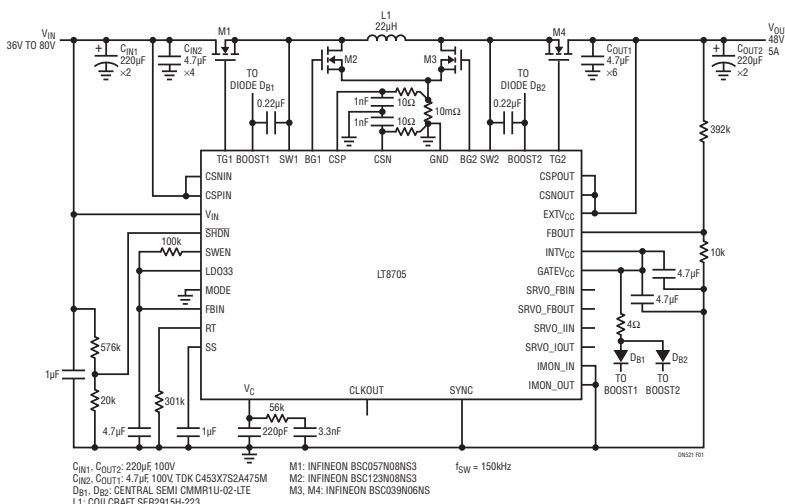


Figure 1. LT8705 240W, 48V, 5A Buck-Boost Converter for Telecom Voltage Stabilization

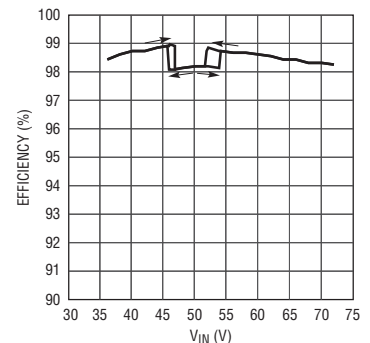


Figure 2. The Efficiency of the LT8705, 48V Converter Is as High as 99%

240W 48V 5A Telecom Power Supply

In telecom applications the input voltage has a wide (36V to 72V) range. Power converters that deliver a stabilized 48V DC voltage to the loads are commonly used. The **LT8705** can easily handle hundreds of watts at 48V output voltage, at efficiency as high as 99%. Figure 1 shows one example with 5A (240W) output.

500W Charger for 12S LiFePO4 battery

Figure 3 shows a circuit for charging a lithium iron phosphate battery from a 48V ($\pm 10\%$) input voltage. The battery has 12 cells in series, so the maximum charge voltage is 44V. This means that the circuit will operate in step-down (buck) mode most of the time, but at lowest input voltage it must operate in buck-boost mode.

At a 48V input voltage the circuit has an efficiency of 99% at full load. The efficiency is high because only the input stage (M1, M2) is switching at high duty cycle and M4 is on continuously. The efficiency drops slightly if the input voltage is reduced to the minimum input voltage (43.2V), as the LT8705 circuit then must operate in buck-boost mode when all MOSFETs are switching.

An external microcontroller can be used for the charge algorithm, and for controlling current and voltage from the LT8705 power converter.

Four Servo Loops and Wide Voltage Range

The LT8705's 2.8V to 80V input and its 1.3V to 80V output ranges, combined with its four servo loops, allow it to easily solve a number of traditionally complex problems. The four servo loops can be used to control input and output voltages and currents. For instance, the input voltage and current can be regulated along with the output voltage and current for maximum power point solar panel applications.

The IC outputs a flag for each servo loop, indicating which is in control at any given time. This is particularly useful information for microcontrollers in battery chargers and solar panel converters.

Conclusion

The LT8705 is an 80V synchronous 4-switch buck-boost controller, that can provide hundreds of watts at up to 99% efficiency with a single inductor. Its four servo-loops allow it to regulate current and/or voltage for both the input and output.

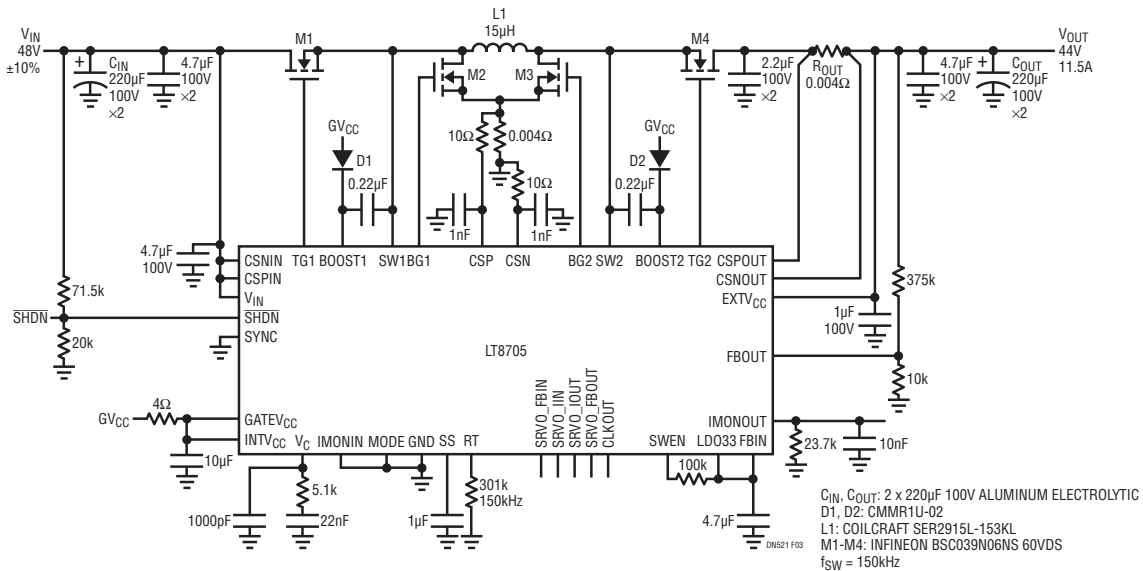


Figure 3. LT8705 500W, 44V, 11.5A Buck-Boost Converter for High Powered Battery Supply

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