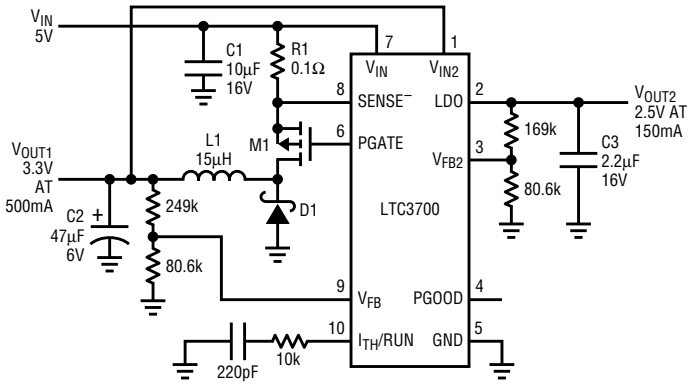
Replace Two ICs with a Combination High Efficiency Buck Controller Plus Low Noise LDO

by Mark Vitunic



C1: TAIYO YUDEN EMK325BJ106MNT (408) 573-4150
C2: SANYO POSCAP 6TPA47M (619) 661-6835
C3: MURATA GRM42-6X7R225K016AL (770) 436-1300
D1: MOTOROLA MBRS130LT3 (800) 441-2447
L1: COILTRONICS UP1B150 (561) 752-5000
M1: SILICONIX Si3443DV (800) 554-5565
R1: DALE 0.25W (605) 665-9301

Figure 1. 5V input to dual output: a 3.3V/500mA high efficiency output and a 2.5V/150mA low noise output

Need a second low-noise voltage output alongside your DC/DC converter, but don't have the room for another IC? The LTC3700 offers a simple solution by combining a constant frequency current mode step-down DC/DC controller with a 150mA low dropout (LDO) regulator in a tiny 10-pin MSOP.

The buck controller section of the LTC3700 offers many of the features expected in a high-performance switcher: high efficiency (up to 94%), wide V_{IN} range (2.65V to 9.8V), high constant frequency operation (550kHz), and current mode control for excellent AC and DC load and line regulation. The buck is configured for Burst Mode® operation, which reduces switching losses at light load, thereby enhancing efficiency. In dropout, the external P-channel MOSFET is turned on continuously (100% duty cycle), extending the usable voltage range of a battery source.

The LDO output is powered by an internal P-channel MOSFET pass device with an on resistance of approximately 1.5Ω (with V_{IN2} = 4.2V). The LDO has a separate input supply pin, which offers the versatility of powering the LDO from the buck regulator's input supply, its own independent input supply or the buck controller's output. The LDO is protected by both current limit and thermal shutdown circuits.

The LTC3700 provides ±2.5% output voltage accuracy for both the buck and LDO. The buck consumes only 210µA of quiescent current in normal operation with the LDO consuming an additional 50µA. In shutdown, a mere 10µA (combined) is consumed. A common "Power Good" output monitors both supplies.

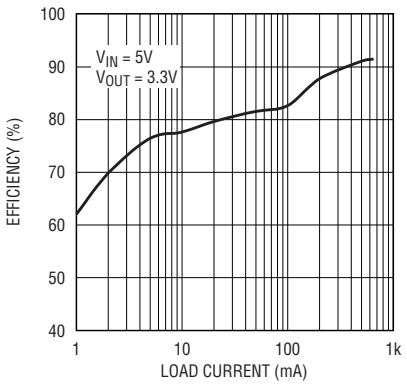


Figure 2. Efficiency of the 3.3V output for the circuit in Figure 1

5V Input Supply to 3.3V/500mA High Efficiency Output and 2.5V/150mA Low Noise Output

Figure 1 shows a dual regulated output voltage design running off of a single 5V input supply. The input to the LDO, V_{IN2}, could connect directly to V_{IN}, but better efficiency is obtained by running if off the 3.3V buck output.

Figure 2 shows the buck efficiency vs load current. Since the LDO's input supply is connected to the buck output, input current to the LDO adds to the load current seen by the buck. With both outputs running at maximum current, 500mA (buck) and 150mA (LDO) for 650mA total, the measured buck efficiency was 91.4%.