

DESIGN NOTES

High Current Step-Down Controller Regulates to 0.6V Output from 3V Input – Design Note 322

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Introduction

The LTC[®]3832 is a voltage mode, high efficiency, high power step-down switching regulator controller that can operate from input voltages as low as 3V. It integrates a 0.6V reference voltage, two powerful MOSFET drivers and other features which make it possible to build cost effective, high efficiency, high current power supplies with output voltages as low as 0.6V.

The LTC3832 uses a synchronous switching architecture with external N-channel MOSFETs. An adjustable current limit is provided by sensing the current through the drain-source on-resistance of the top MOSFET, eliminating the need for a current sense resistor. The LTC3832 has a 300kHz free-running switching frequency that can be programmed or synchronized externally from 100kHz to 500kHz. All of these features promote a DC/DC converter solution with high efficiency and small size.

The LTC3832 also includes a thermal protection circuit which disables both gate drivers if the junction temperature reaches 150°C. The chip resumes normal operation when the temperature drops below 125°C.

Design Examples

Figure 1 shows the schematic diagram and photo of a compact 1V/7A step-down DC/DC converter that accepts

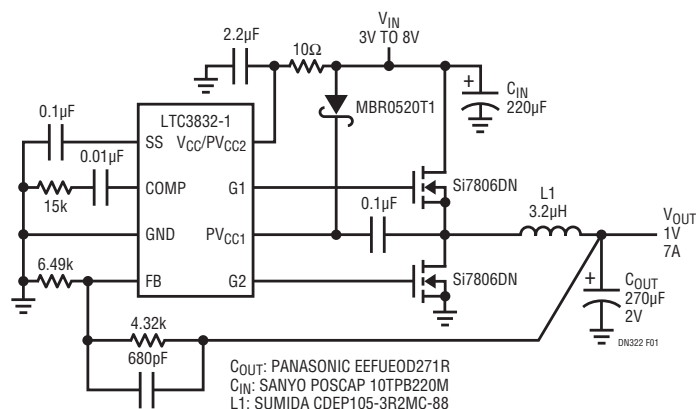


Figure 1. A Compact 5V to 1V Power Supply at 7A

an input voltage of 3V to 8V. The design is based on the LTC3832-1, an SO-8 package option. Its efficiency is shown in Figure 2.

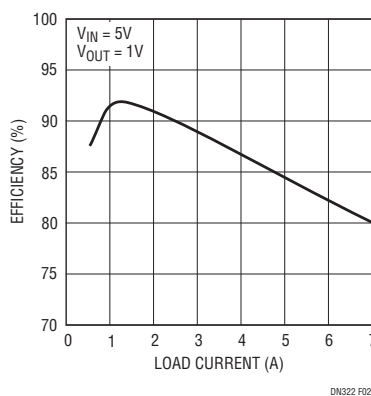
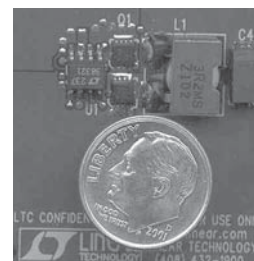


Figure 2. Efficiency for the Circuit in Figure 1

Figure 3 shows the schematic diagram of a high efficiency 3V to 8V to 1.8V/20A synchronous step-down power supply. The switching frequency is set at 360kHz by the external resistor connected to the FREQSET pin.

For normal operation, a pull-up resistor brings the voltage high at the SHDN pin. A low voltage for more

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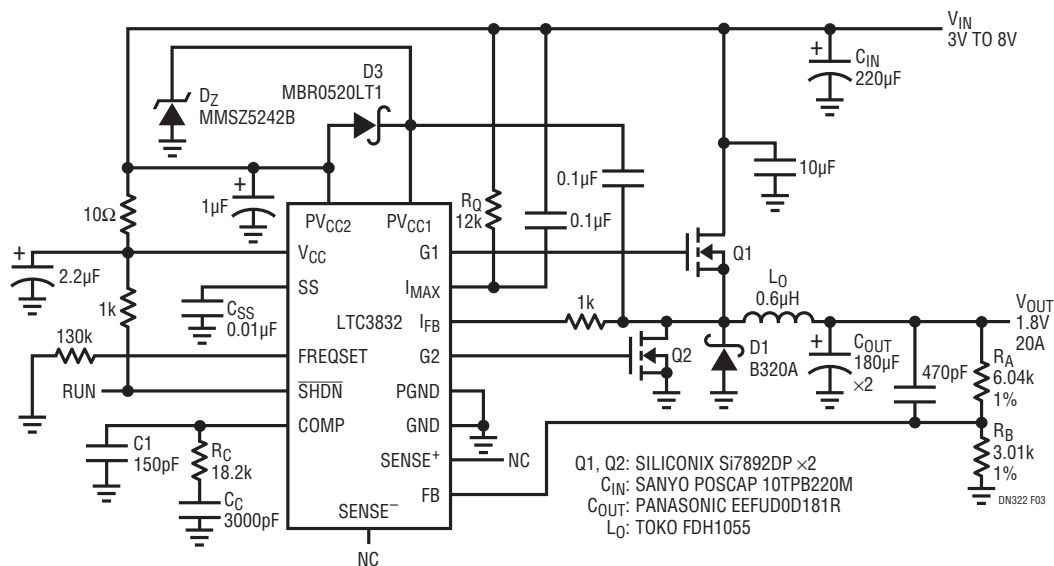


Figure 3. High Efficiency 3.3V to 1.8V at 20A Synchronous Step-Down DC/DC Converter

than 100 μ s at $\overline{\text{SHDN}}$ pin pulls the COMP and SS pins to ground and shuts Q1 and Q2 off. The current limit function is provided by connecting an external resistor R_Q from the I_{MAX} pin to the drain of the top MOSFET (Q1). The current limit threshold can be adjusted by the value of R_Q based on the $R_{\text{DS(ON)}}$ of Q1 and the load requirement. The 0.1 μ F decoupling capacitor across R_Q filters the switching noise.

The LTC3832 also includes a soft-start circuit. The soft-start voltage ramp rate in this circuit is set by C_{SS} .

Figure 4 shows the efficiency curve of the circuit. Up to 90% efficiency is obtained with a 3.3V input. For other output voltages, simply change the value of R_A . The output voltage can be as low as 0.6V (see Table 1). For higher output currents, parallel more MOSFETs and use a higher current inductor.

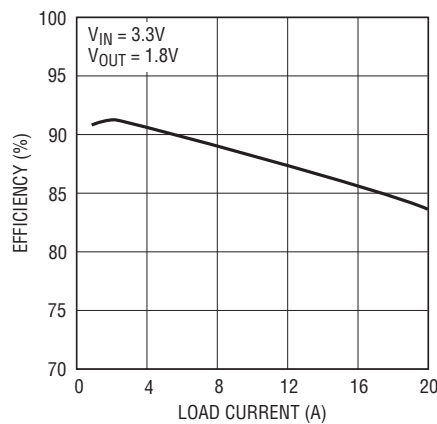


Figure 4. Efficiency for the Circuit in Figure 3 with $V_{\text{IN}} = 3.3\text{V}$

Table 1. R_A Values for Different Output Voltages

V_{OUT} (V)	R_A (Ω)
0.6	0
1.0	2.00k
1.2	3.01k
1.5	4.53k
1.8	6.04k
2.5	9.53k

Conclusion

The LTC3832 is a voltage mode controller optimized for high power, low voltage—as low as 0.6V—applications. It provides a set of features that promote high efficiency while keeping solution costs low. LTC3832 designs may be simulated with SwitcherCAD™ III which can be downloaded from www.linear.com.

Data Sheet Download

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