

# DESIGN NOTES

## Tiny and Efficient Boost Converter Generates 5V at 3A from 3.3V Bus – Design Note 280

Dongyan Zhou

### Introduction

Circuits that require 5V remain popular despite the fact that modern systems commonly supply a 3.3V power bus, not 5V. The tiny LTC<sup>®</sup>1700 is optimized to deliver 5V from the 3.3V bus at very high efficiency, though it can also efficiently boost other voltages. The small MSOP package and 530kHz operation promote small surface mount circuits requiring minimal board space, perfect for the latest portable devices. By taking advantage of the synchronous rectifier driver, the LTC1700 provides up to 95% efficiency. To keep light load efficiency high in portable applications, the LTC1700 draws only 180 $\mu$ A in sleep mode. The LTC1700 features a start-up voltage as low as 0.9V, adding to its versatility.

The LTC1700 uses a constant frequency, current mode PWM control scheme. Its No R<sub>SENSE</sub><sup>™</sup> feature means the current is sensed at the main MOSFET, eliminating the need for a sense resistor. This saves cost, space and improves efficiency at heavy loads. For noise-sensitive

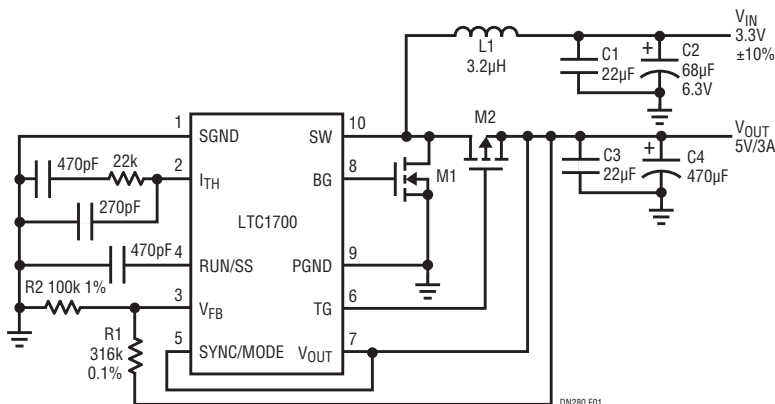
applications, Burst Mode<sup>®</sup> operation can be disabled when the SYNC/MODE pin is pulled low or driven by an external clock. The LTC1700 can be synchronized to an external clock ranging from 400kHz to 750kHz.

### 3.3V Input, 5V/3A Output Boost Regulator

Figure 1 shows a 3.3V input to 5V output boost regulator which can supply up to 3A load current. Figure 2 shows that the efficiency is greater than 90% for a load current range of 200mA to 3A and stays above 80% all the way down to a 3mA load.

C2 is a tantalum capacitor providing bulk capacitance to compensate for possible long wire connections to the input supply. In applications where the regulator's input is connected very close to a low impedance supply, this capacitor is not needed.

LT, LTC, LTM, Linear Technology, the Linear logo and Burst Mode are registered trademarks and No R<sub>SENSE</sub> is a trademark of Linear Technology Corporation. All other trademarks are the property of their respective owners.



C1, C3: TAIYO YUDEN CERAMIC JMK325BJ226M  
 C2: AVX TAJB686K006R  
 C4: SANYO POSCAP 6TPB470M  
 L1: SUMIDA CEP1233R2  
 M1: INTERNATIONAL RECTIFIER IR7811W  
 M2: SILICONIX Si9803

Figure 1. 3.3V to 5V, 3A Boost Regulator

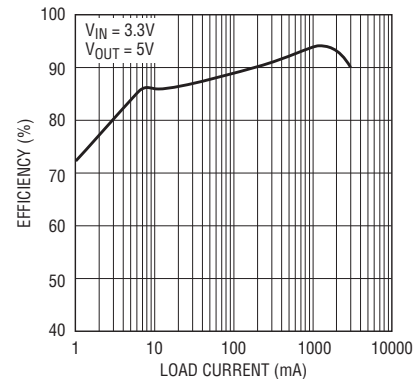


Figure 2. Efficiency of the Figure 1 Circuit

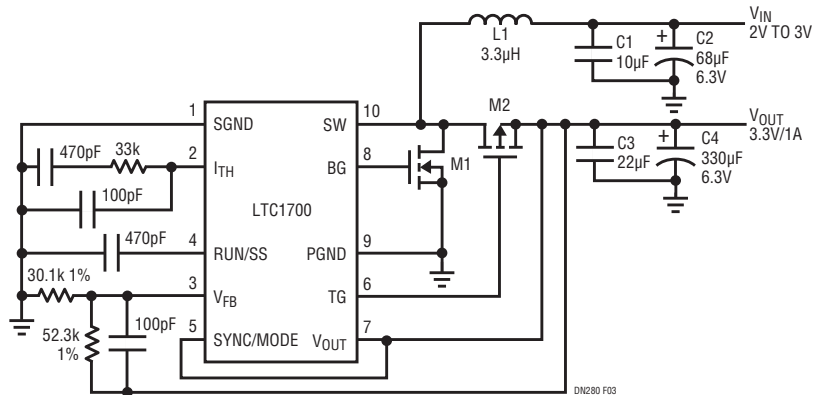
## 2-Cell Input, 3.3V/1A Output Regulator

In digital cameras and other battery-powered devices, the LTC1700 makes for a high efficiency boost regulator in a small package. Figure 3 shows a 2-alkaline cell to 3.3V output circuit. This circuit can supply 1A maximum output current. Figure 4 shows the efficiency at different battery voltages. Efficiency of this circuit peaks at 93%. If a lower  $R_{DS(ON)}$  MOSFET (such as Si6466) is used for M1, the maximum output current can be increased to 1.4A with about a 2% reduction in efficiency due to

the increased gate capacitance. MOSFETs with lower than 2.5V gate threshold voltages are recommended. The LTC1700 is also an ideal device for single cell Li-Ion battery to 5V applications.

### Conclusion

The LTC1700 boost controller brings high efficiency and small size to low voltage applications. Its features are ideally suited to both battery-powered and line-powered applications.



C1: TAIYO YUDEN CERAMIC JMK316BJ106ML  
 C2: AVX TAJB686K006R  
 C3: TAIYO YUDEN CERAMIC JMK325BJ226M  
 C4: SANYO POSCAP 6TPB330M  
 L1: MURATA LQN6C  
 M1: SILICONIX Si9804  
 M2: SILICONIX Si9803

Figure 3. 2-Cell to 3.3V, 1A Boost Regulator

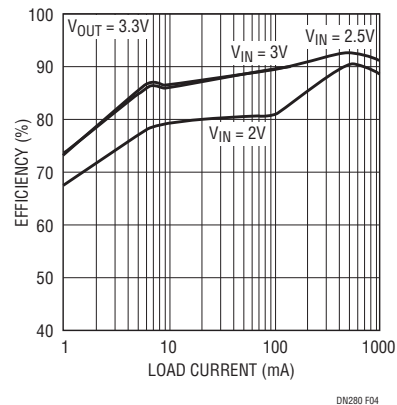


Figure 4. Efficiency of the Figure 3 Circuit

Data Sheet Download

[www.linear.com](http://www.linear.com)

For applications help,  
 call (408) 432-1900

Linear Technology Corporation  
 1630 McCarthy Blvd., Milpitas, CA 95035-7417  
 (408) 432-1900 • FAX: (408) 434-0507 • [www.linear.com](http://www.linear.com)

dn280f\_conv LT/TP 0302 341.5K • PRINTED IN THE USA

  
 © LINEAR TECHNOLOGY CORPORATION 2002