µModule Regulators Shrink Power Supply Size *and* Design Effort

by David Ng

Introduction

When it comes to high density, efficient power supplies, switching regulators are a top choice, but what if a project lacks sufficient design resources to properly layout and test a switching power supply circuit? Like any other system, switching power supplies require component selection, derating, simulation, prototyping, board layout, analysis and design verification testing. Design engineers should focus on the guts of the new whiz-bang gadget, not the power supply to run it.

The LTM8020, LTM8022 and LTM8023 are three µModule regulators that require minimal design effort and only a few inexpensive passive components to make a complete power supply. The modules are small, accept a wide input operating range and can produce 0.2A, 1A and 2A, respectively.

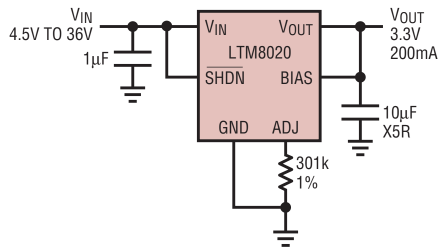

Figure 1. Generate 3.3V at 200mA with the LTM8020, two caps and a resistor

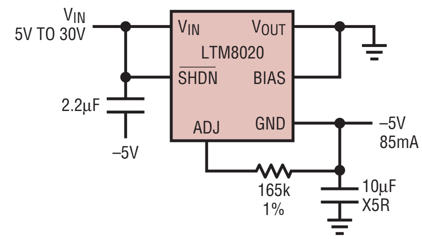

Figure 2. A simple reconfiguration of the µModule generates a negative output

The LTM8020, LTM8022 and LTM8023 are three µModule regulators that require minimal design effort and only a few inexpensive passive components to make a complete power supply.

Tiny, Self-Contained, 200mA Power Supply

The LTM8020 is small, with a package measuring only 6.25mm × 6.25mm × 2.32mm, but it accepts a wide 4V to 36V input voltage range, and can produce up to 1W for output voltages between 1.25V and 5V at 200mA. At light loads, Burst Mode operation keeps quiescent current to 50µA at no load. The current draw is less than 1µA when shut down. As seen in Figure 1, a complete LTM8020 power supply requires only an input capacitor, output capacitor and a single resistor to set the output voltage.

Negative Power Supply with Few Components

Being a self-contained design, the LTM8020 can be easily configured to generate a negative voltage. Figure 2 shows is an example of how to use the LTM8020 to generate –5V at 85mA from an input range of 4.5V to 30V. The part does not operate as a true buck converter in this configuration, so the maximum output current is less than that achievable in the buck configuration.

If You Need More Power…

The LTM8022 comes in a larger 11.25mm × 9mm × 2.82mm package than the LTM8020, but boasts a wider input range, 3.6V–36V, and output range, 0.8V–10V, for loads up to 1A. It also includes more control features, including a RUN/SS pin,

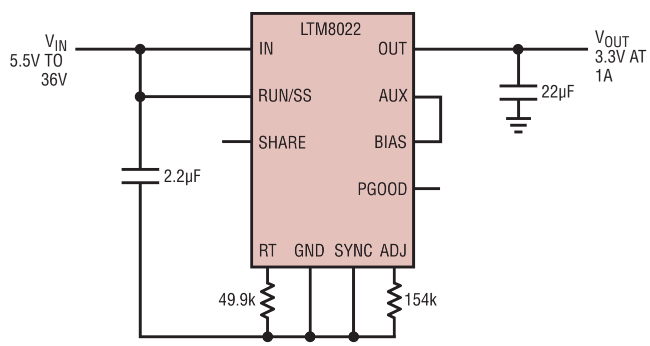

Figure 3. Produce 3.3V at 1A with LTM8022 and just four passive components

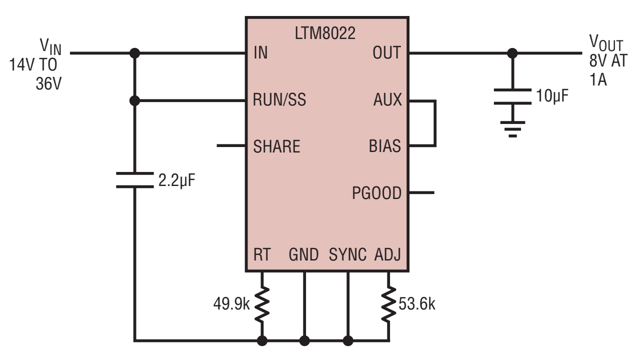

Figure 4. The LTM8022 can produce 8V, too

synchronization, user adjustable switching frequency and a SHARE pin for paralleling modules. The LTM8022 also employs Burst Mode operation, drawing only 50µA quiescent current at no load while maintaining only 30mV of output voltage ripple. Like the LTM8020, the quiescent current when shut down is less than 1µA. The schematic is very simple, with examples of 3.3V and 8V output designs shown in Figures 3 and 4, respectively.

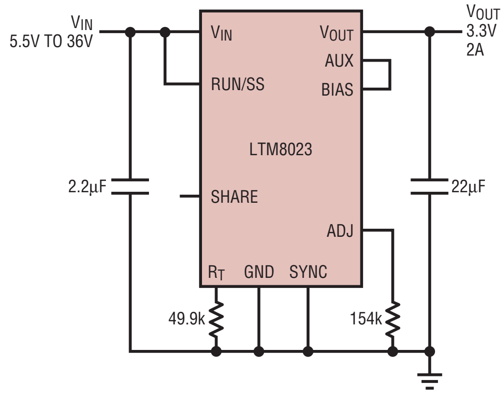

Figure 5. The LTM8023 produces 3.3V at 2A with the same footprint and components required for the LTM8022 producing 1A.

…Or, Even More Power…

The LTM8023 is the big brother of the LTM8022, capable of producing up to 2A of output current. The LTM8023 has the same input, output voltage range, and control features as the LTM8022. It also features Burst Mode operation and low quiescent current. The LTM8022 and LTM8023 share the same footprint and pin pattern, so even if you start a design with the LTM8022 but later find that you need more current, you can simply drop in the LTM8023. In most cases, the design will use identical passive components as the LTM8022, as seen in the 3.3V example in Figure 5.

Table 1. Summary of LTM8000 series µModule regulators

Part Number	V_{IN} Range	Max Load	V_{OUT} Range	Size
LTM8020EV	4V to 36V	200mA	1.25V to 5V	6.25 × 6.25 × 2.32mm
LTM8022EV	3.6V to 36V	1A	0.8V to 10V	11.25 × 9 × 2.82mm
LMT8023EV	3.6V to 36V	2A	0.8V to 10V	11.25 × 9 × 2.82mm

Conclusion

The LTM8020, LTM8022 and LTM8023 µModule regulators make power supply development fast and easy. Their broad input and output voltage ranges, load capabilities and small size (see Table 1) make them readily fit into a wide variety of applications.

LTC3562, continued from page 35

Mode operation to maximize power efficiency at light loads. Under no-load conditions, the regulators can also be programmed into LDO mode, which provides the lowest quiescent current (all four regulators in LDO mode only draw a combined 80µA for the entire chip).

To save even more power, the LTC3562 can be programmed to reduce the regulators' output voltages in Burst Mode operation or forced Burst Mode operation during light load conditions. Since power dissipation is directly proportional to the supply voltage multiplied by the load current, dropping the supply voltage effectively reduces the circuit's total power dissipation. If the output load is resistive in nature, reducing the supply voltages has an even greater effect, since power dissipation in the load is proportional to the supply voltage squared.

Conclusion

The LTC3562 is a highly flexible I^2C quad step-down converter composed of two 600mA and two 400mA buck regulators in a 3mm × 3mm QFN package. The output voltages of the regulators can be switched on the fly using servo control or I^2C control. Each regulator can also be switched on the fly into four possible high efficiency or low-noise operating modes. This is a perfect device for high performance applications that require constant control of the power supply. It can also be used to simplify design, build and test cycles, since output voltages can easily be changed without changing components.

LTC3813 and LTC3814-5, continued from page 21

the output is drawing full load. Its efficiency is shown in Figure 7.

Conclusion

The LTC3813 and LTC3814-5's synchronous architecture and high voltage capability make them ideally suited for high voltage high power boost converters. They decrease complexity by eliminating the requirement for a large diode package and heat sink to dissipate its high power loss. Programmable frequency and current limit, wide output voltage range, and ability to drive logic-level or higher threshold MOSFETs provide maximum flexibility in using them for a variety of boost applications. Other features such as such as strong gate drivers to minimize transition losses, an accurate voltage reference, accurate cycle-by-cycle current limit, and an on-chip bias supply controller make the LTC3813 and LTC3814-5 the obvious choice for high performance, high power boost converters.