

DESIGN NOTES

8A Low Voltage, Low Profile DC/DC μ Module Regulator in 9mm \times 15mm Package Weighs Only 1g

Design Note 430

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Introduction

In communications, industrial and other high power systems, board-mounted point-of-load (POL) DC/DC power supplies simplify thermal management and offer high performance. An ideal POL power supply module takes a minimal amount of space and mounts on the board much like other surface mount ICs without special tooling. It should also demonstrate exceptional thermal performance with excellent efficiency and low power dissipation.

8A DC/DC μ Module™ Regulator in an IC Form Factor

The LTM4608[®] μ Module regulator is a complete high density power supply in a low profile (15mm \times 9mm \times 2.8mm) LGA surface mount package (Figure 1). Its small form factor houses the switching controller, MOSFETs, inductor and all support components, and weighs only 1g. At this size, it can be mounted on the back side of a system board, taking advantage of otherwise unused space.



Figure 1. The LTM4608 Offers High Power Density in a 9mm \times 15mm \times 2.8mm LGA Package

The LTM4608 operates from an input supply range of 2.375 to 5.5V, and a single resistor is all that is needed to set the output voltage within a 0.6V to 5V output range. Its high efficiency design and low thermal impedance package delivers up to 8A continuous current.

Wealth of Features

The LTM4608's 1.5MHz switching frequency and current mode architecture allow it to react quickly to line and load transients without sacrificing stability. Cycle-by-cycle current mode control also enables excellent current sharing for parallel operation. The integrated clock enables multiphase operation and frequency synchronization,

and a frequency spread spectrum feature can also be activated to further reduce switching noise harmonics. The device supports output voltage tracking or simpler supply rail sequencing. Programmable output voltage margining is supported for $\pm 5\%$, $\pm 10\%$, and $\pm 15\%$ levels. Fault protection features include over voltage protection, over current protection, and thermal shutdown.

Quick and Easy Design

Figure 2 shows a typical 1.8V output design; its efficiency is shown in Figure 3. Because the LTM4608 includes two integrated 10 μ F ceramic capacitors, additional input capacitors are only needed for large load steps up to the full 8A level. Linear Technology provides a μ Module

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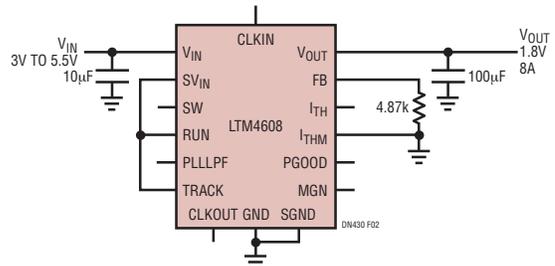


Figure 2. Few Components Are Required for a 1.8V/8A Application

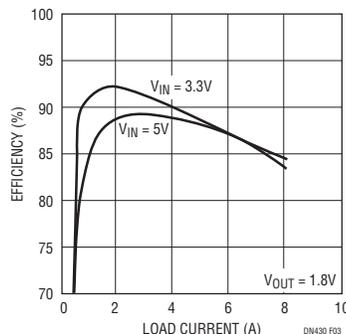


Figure 3. Efficiency of the Application in Figure 2

Power Design tool and SwitcherCAD™ simulation tool to calculate the necessary capacitance for any particular design (www.linear.com/micromodule).

For low output voltage ripple and low droop during load transients, low ESR capacitors should be used. A low ESR polymer or ceramic capacitor is sufficient. Typical ranges are 100µF to 200µF. The output voltage is set with an external resistor from the FB pin to ground.

Thermally Enhanced Packaging

The LTM4608's package has a low thermal resistance of 7°C/W junction-to-pin and 25°C/W junction-to-ambient when mounted on a four-layer board with no airflow. The device's unique packaging allows simple heat sinking from both the top and bottom, making it possible to use a metal chassis as a heat sink.

Output Voltage Tracking

Output voltage tracking is programmed via the Track pin. The slave output can be tracked up and down with another regulator's output.

Current Sharing: 8A + 8A = 16A

Two or more LTM4608 µModule regulators can be paralleled to provide multiples of 8A of load current. Because

of the LTM4608's current mode architecture, the output current and power are evenly and safely distributed across each LTM4608. Figure 4 shows a 16A design that also operates 180° out-of-phase to reduce input and output ripple current.

Fault Conditions: Overcurrent Limit and Thermal Shutdown

The LTM4608's current mode control inherently limits cycle-by-cycle inductor current, not only in steady state operation, but also in transient. The LTM4608 device has over temperature shutdown protection that inhibits switching operation above 150°C.

Conclusion

Weighing 1g, occupying 135mm², and standing only 2.8mm tall, the LTM4608 is a complete and efficient point-of-load DC/DC system that eases circuit and layout challenges by fitting in the tightest spaces even on the bottom of the PCB. With the LTM4608, the design of an 8A switchmode regulator is as simple as a linear regulator. This DC/DC µModule regulator is rich in features and provides circuit protection as well as capability to current share for applications requiring more than 8A.

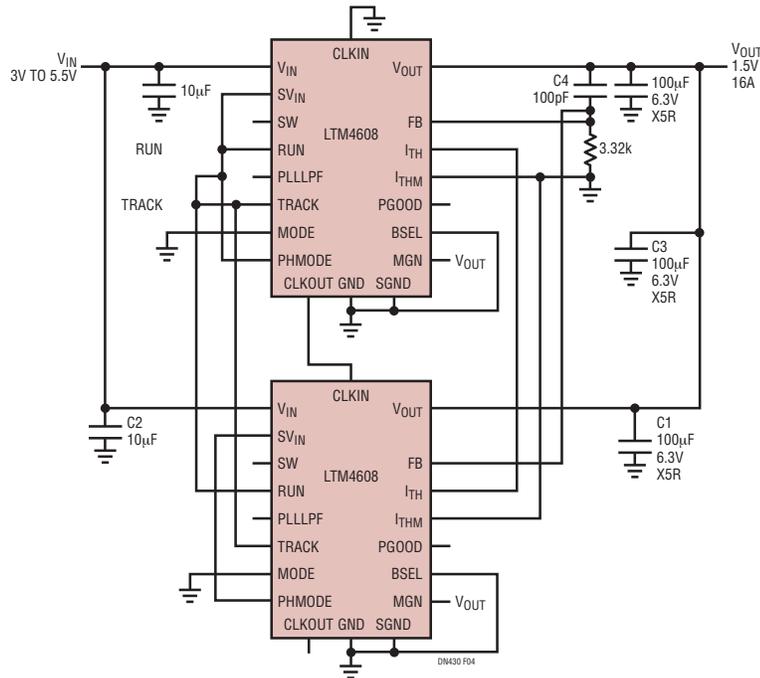


Figure 4. Two LTM4608s in Parallel, 1.5V at 16A

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