

Complete 20V, 20A High Performance μ Module DC/DC Regulator in 15mm \times 15mm \times 4.32mm Package

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The LTM4637 is a complete 20A high efficiency switch mode power supply in a compact 15mm \times 15mm \times 4.32mm LGA package. The controller, power MOSFETs, inductor and compensation circuitry are all integrated within its low profile package, allowing use on the bottom side of the PCB. The LTM4637 has an input voltage range of 4.5V to 20V and supports an output voltage range of 0.6V to 1.8V. It has an operating frequency range of 440kHz–770kHz where it can provide up to 20A with just a few additional external components.

VERSATILITY

The LTM4637 features a programmable soft-start to limit inrush currents as well as output voltage tracking for sequencing requirements. Also included are an output voltage power good indicator, an external V_{CC} pin allowing for bypassing of the internal LDO for an extra efficiency benefit, selectable pulse-skipping mode and Burst Mode operation for increased light load efficiency, as well as internal temperature monitoring.

EASY COMPENSATION; EASY PARALLEL OPERATION

The LTM4637's constant-frequency current mode control and internal feedback loop compensation provide excellent stability and transient performance for a wide range of output capacitors. The LTM4637 also includes an internal differential remote sense amplifier, as well as a phase locked loop and voltage controlled oscillator for synchronization to an external clock. These features make the LTM4637 ideal for paralleling modules to satisfy even higher load current demands. The current mode control architecture of the LTM4637 ensures balanced load current sharing to maximize efficiency and thermal benefits. The differential remote sense

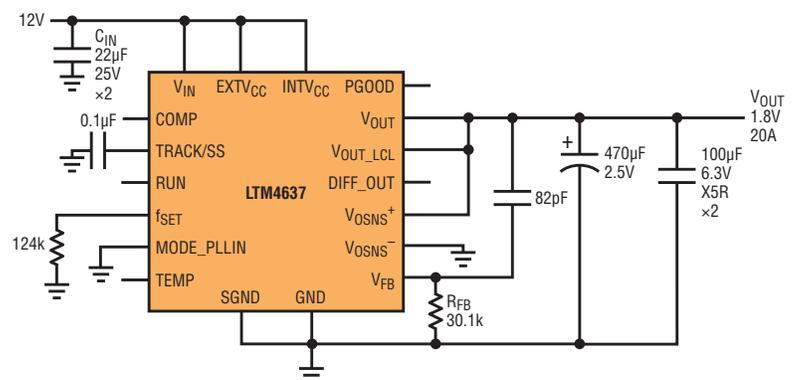
amplifier allows for paralleled LTM4637s to regulate a precise output voltage $\pm 1.5\%$ at the point-of-load, compensating for error caused by PCB IR voltage drops. The internal phase locked loop allows synchronization and interleaving of paralleled phases, minimizing voltage and current ripple in the system.

PROTECTION

The LTM4637 features overvoltage protection, foldback current protection and overtemperature protection. In the event of an overvoltage condition where the output voltage exceeds 10% of the programmed value, the top MOSFET is forced off and bottom MOSFET is turned on until

the overvoltage condition is cleared. In the event of an output short-circuit, if the output voltage falls 50% below its nominal output level, the maximum output current is progressively lowered to one-third of the original value, limiting the current dumped into the short. The overtemperature protection shuts down the internal controller at $\sim 130^{\circ}\text{C}$ – 137°C , restarting the controller again when the temperature cools. These protection features help ensure a low risk design. Furthermore, the LTM4637's dependability can be assured by rigorous electrical and reliability testing performed on each module.

Figure 1. Complete 1.8V, 20A regulator requires only a few components



The LTM4637 is a complete POL power supply solution for applications that require top-notch performance in a small footprint with minimal design effort and user-adjustable feature versatility. Its low power loss and thermal resistance allow for up to 20A of load current per phase, while its current mode structure allows the load current to be scaled up via parallel configurations.

Figure 2. Efficiency of the 1.8V regulator in Figure 1

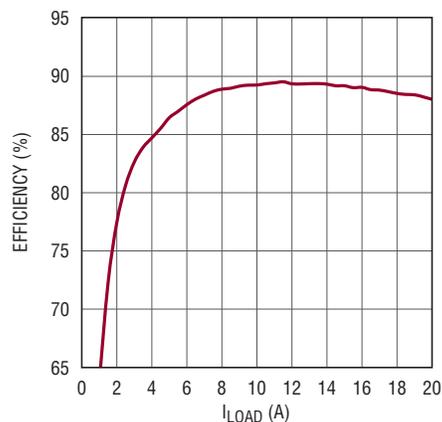
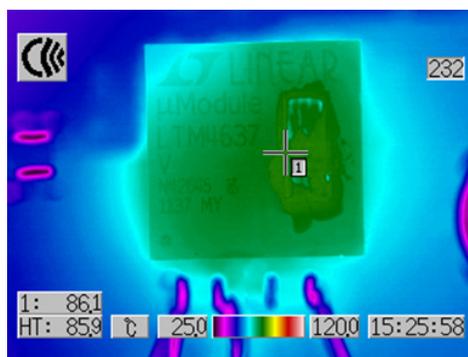


Figure 3. Thermal scan of the LTM4637 under full load for the solution in Figure 1.



$T_A = 25^\circ\text{C}$, NO AIR, NO HEAT SINK
 $I_{\text{LOAD}} = 20\text{A}$, $V_{\text{IN}} = 12\text{V}$, $V_{\text{OUT}} = 1.8\text{V}$

MINIMAL DESIGN EFFORT

Little effort is required to create a high performance design because a complete power supply solution is integrated into the LTM4637. Just a few external components are required to conclude an application's design, simplifying the schematic and PCB layout.

For example, set the output voltage and switching frequency each with a single resistor from their respective programming pins to ground, then select input and output capacitors to satisfy voltage and current ripple requirements and the base design is complete. The LTM4637 minimizes total design effort, an important factor when time to market is important or limited power design resources are available. Figures 1 and 2 show a typical 12V input to 1.8V, 20A output application circuit and its efficiency, exemplifying the simplicity and high performance benefits of designing with the LTM4637.

EXCEPTIONAL THERMAL PERFORMANCE

Exceptional thermal performance allows for increased current capability, which translates to a reduced total solution cost and increased reliability in high current density applications. The LTM4637 can provide up to 20A while remaining cool due to low power dissipation and thermal resistances. Figure 3 shows the μModule regulator's outstanding thermal performance for the setup in Figure 1. Even while providing a hefty 20A of load current, with no forced air cooling, the LTM4637 easily provides 36W of high current output power all from a footprint of less than 0.35in^2 without risking thermal overload. Attach a heat sink to the exposed metal on the top of the package and add forced airflow conditions for further reduction of internal temperatures.

CONCLUSION

The LTM4637 is a complete POL power supply solution for applications that require top-notch performance in a small footprint with minimal design effort and user-adjustable feature versatility. Its low power loss and thermal resistance allow for up to 20A of load current per phase, while its current mode structure allows the load current to be scaled up via parallel configurations. Its built-in protection features and rigorous factory electrical testing ensure a reliable, low risk solution. ■