

DESIGN NOTES

Triple Output DC/DC μ Module[®] Regulator in 15mm \times 15mm \times 2.8mm Surface Mount Package Replaces Up to 30 Discrete Components Design Note 469

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Introduction

When space and design-time are tight in multivoltage systems, the solution is a multioutput DC/DC regulator IC. For more space and time constraint systems, a better solution is an already-fabricated compact multioutput DC/DC system that includes not only the regulator ICs but the supporting components such as the inductors, compensation circuits, capacitors and resistors.

Dual Switching 4A and 1.5A VLDO[™] Regulators

The LTM[®]4615 offers three separate power supply regulators in a 15mm \times 15mm \times 2.8mm LGA surface mount package: two switching DC/DC regulators and one very low dropout VLDO linear regulator (Figure 1). MOSFETs, inductors, and other support components are all built in. Each power supply can be powered individually or together, to form a single input, three output design. Moreover, for an otherwise complex triple output circuit design, the task is eased to designing with only one device while the layout is as simple as copying and pasting the LTM4615's package layout. One LTM4615 replaces up to 30 discrete components when compared to a triple-output high efficiency DC/DC circuit.

The two switching regulators, operating at a 1.25MHz switching frequency, accept input voltages between 2.35V

to 5.5V and each delivers a resistor-set output voltage of 0.8V to 5V at 4A of continuous current (5A peak). The output voltages can track each other or another voltage source. Other features include, low output voltage ripple and low thermal dissipation.

The VLDO regulator input voltage (1.14V to 3.5V) is capable of up to 1.5A of output current with an adjustable output range of 0.4V to 2.6V, also via a resistor. The VLDO regulator has a low voltage dropout of 200mV at maximum load. The regulator can be used independently, or in conjunction with either of the two switching regulators to create a high efficiency, low noise, large-ratio step-down supply—simply tie one of the switching regulator's outputs to the input of the VLDO regulator.

Multiple Low Noise Outputs

The LTM4615 is capable of operating with all three regulators at full load while maintaining optimum efficiency. A typical LTM4615 design (Figure 2) for a 3.3V input to three outputs has the VLDO input driven by V_{OUT2}. The efficiency of this design is shown in Figure 3.

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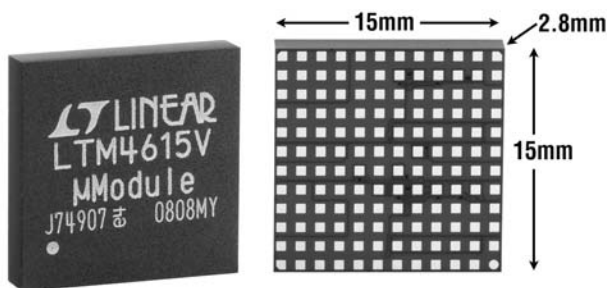


Figure 1. Three DC/DC Circuits in One Package

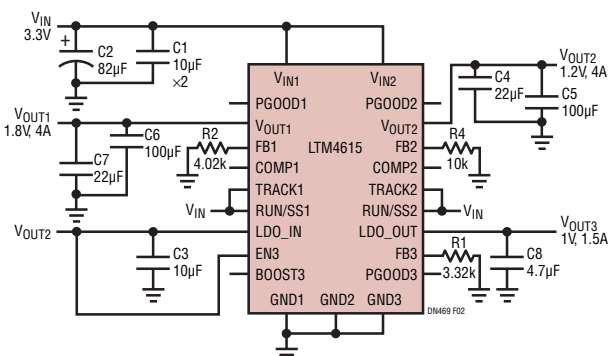


Figure 2. Triple Output LTM4615: 3.3V Input, 1.8V (4A), 1.2V (4A), 1.0V (1.5A)

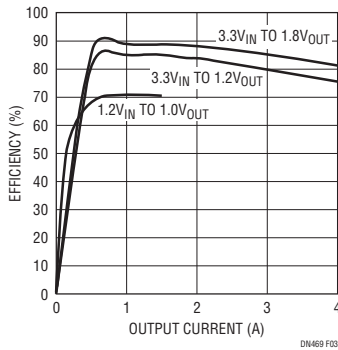


Figure 3. Efficiency of the Circuit in Figure 2, 1.8V, 1.2V and 1.0V (VLDO)

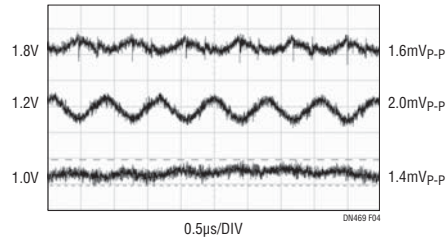


Figure 4. Low Output Voltage Ripple (3.3V Input)

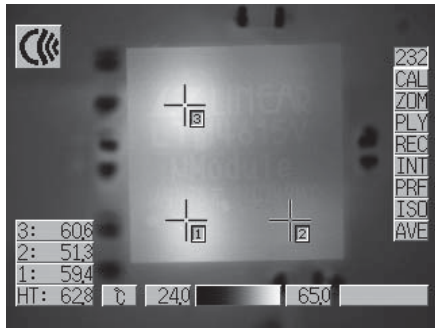


Figure 5. Top View Thermal Imaging of the Unit at Full Load in Ambient Temperature with No Airflow. Even Temperatures (Cursors 1 and 3) Indicate Balanced Thermal Conductivity Between the Two Switching Regulators. 3.3V Input, 1.8V (4A) and 1.2V (4A).

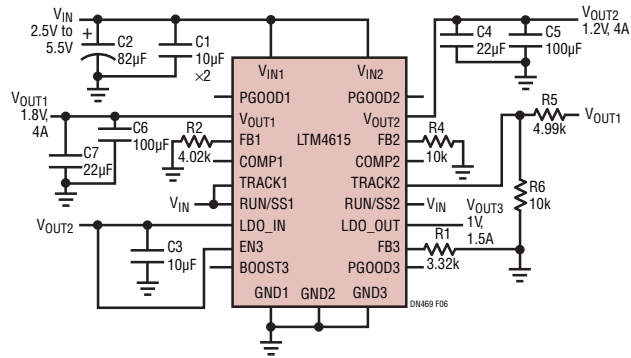


Figure 6. Output Voltage Tracking Design V_{OUT2} (1.2V) Tracks V_{OUT1} (1.8V)

The LTM4615 comes prepackaged with ceramic capacitors and additional output capacitors are only needed under full 4A load and if the input source impedance is compromised by long inductive leads or traces.

The VLDO regulator provides a particularly low noise 1.0V supply as it is driven by the output of the 1.2V switching regulator (V_{OUT2}). The low output voltage ripple for all three outputs is shown in Figure 4.

Thermally Enhanced Packaging

The LGA packaging allows heatsinking from both the top and bottom. This design utilizes the PCB copper layout to draw heat away from the part and into the board. Additionally, a heat sink can be placed on top of the device, such as a metal chassis, to promote thermal conductivity. Thermal dissipation is well balanced between the two switching regulators (Figure 5).

Output Voltage Tracking

A tracking design (Figure 6) and output (Figure 7) can be programmed using the TRACK1 and TRACK2 pins. Divide down the master regulator's output with an external resistor divider that is the same as the slave regulator's feedback divider on the slave's TRACK pin for coincident tracking.

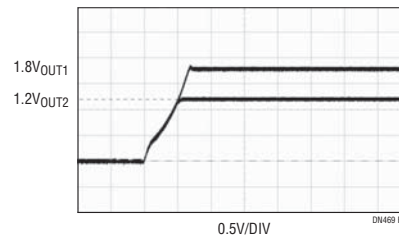


Figure 7. Start-Up Voltage for Figure 5 Circuit V_{OUT1} (1.8V) Coincidentally Tracks V_{OUT2} (1.2V) for Coincident Tracking

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