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DESIGN NOTES

Cost Effective, Low Profile, High Efficiency 42A Supply Powers AMD Hammer Processors – Design Note 285

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Introduction

The new AMD Hammer processors require power supplies that can deliver more than 40A current at very low output voltages (0.8V to 1.55V). The LTC®3719 PolyPhase® controller meets these requirements. The LTC3719 is a current mode, 2-phase VID programmable controller that drives two synchronous buck stages 180 degrees out of phase of each other. The 2-phase architecture reduces the number of input and output capacitors without increasing the switching frequency. The relatively low switching frequency, along with integrated high current MOSFET drivers keeps efficiency high and solution size small.

Because of output current ripple cancellation, lower value inductors can be used, resulting in faster transient load responses and small inductor size. To further reduce the required input and output capacitance, the controller switching frequency can be synchronized to the external switching signal from another LTC PolyPhase controller, thus increasing the number of DC/DC converter phases. To ensure that current is equally shared among the output phases, the inductor current is sensed with current sensing resistors. Excellent current sharing eliminates the potential thermal overstress problem caused by unbalanced phase current. Therefore, the MOSFETs and inductors need not be oversized and the VRM can be operated reliably without heat sink.

An internal differential amplifier provides true remote sensing of the regulated supply's positive and negative output terminals at load point as required in high

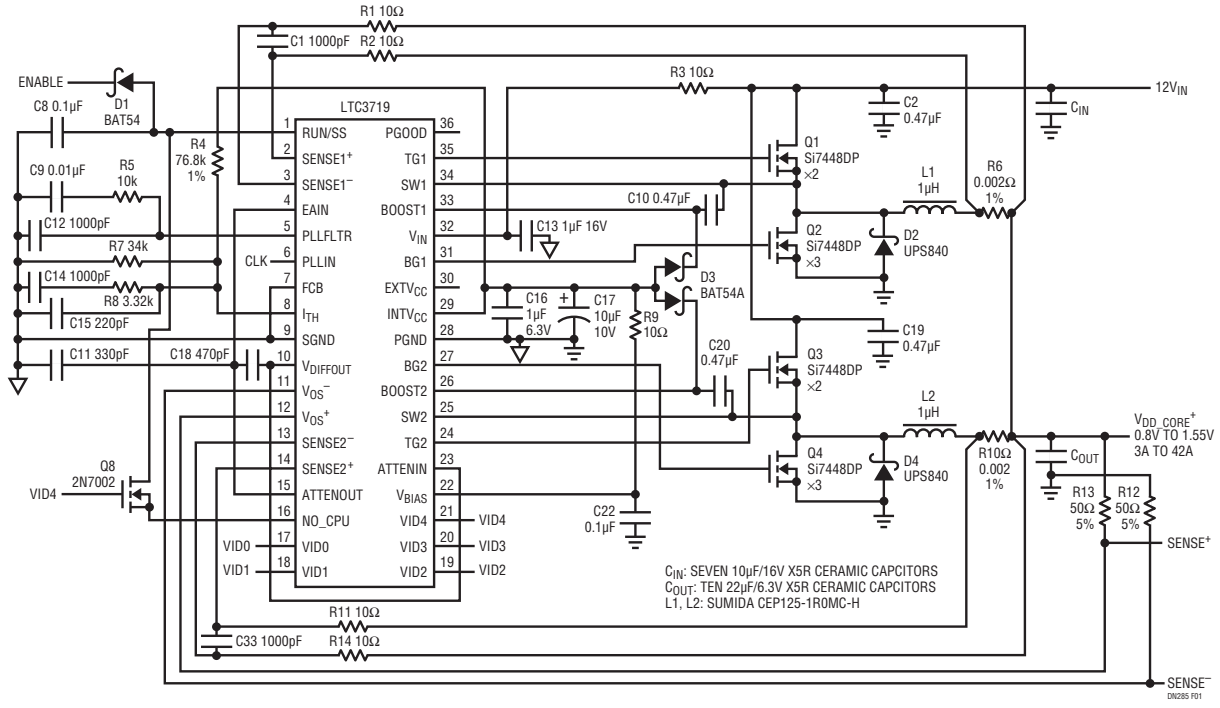

Figure 1. 42A AMD Hammer Microprocessor Power Supply Using the LTC3719

current applications. The internal 5-bit VID programmable attenuator complies with the AMD Hammer processor VID table (0.8V to 1.55V). The LTC3719 also incorporates two selectable light load operation modes: discontinuous conduction mode and Burst Mode® operation to improve the light load efficiency. Power supply designs that use the LTC3719 are efficient, low profile and low cost.

Design Example

Figure 1 shows a 2-phase 42A AMD Hammer processor power supply. With only one IC, ten tiny SO-8 size MOSFETs and two 1µH, low profile surface mount inductors, this supply is better than 86% efficient for a 12V input and a 1.55V/42A output. Figure 2 shows that efficiency remains high throughout a wide load range, from 3A to 42A. The highest component on the VRM is the output inductors which are less than 6mm high.

Figure 3 shows a measured load transient waveform. The load current step is 20A with a slew rate of 30A/µs. Output capacitor requirements are dominated by the total ESR of the output capacitor network on both the VRM and the transient load test circuit specified by the AMD Hammer Processor VRM Design Guide. Ten low profile ceramic capacitors (22µF/6.3V, X5R) are used on the VRM output. The maximum output voltage variation during the load transients is less than $100mV_{P-P}$. Active voltage positioning was employed in this design to reduce the number of output capacitors with no additional efficiency loss (refer to Design Solution 10 for more details on active voltage positioning).

Conclusion

The LTC3719, low voltage, high current power supply meets the AMD Hammer processor VRM requirement and allows low profile and high efficiency designs. The cost savings in the input and output capacitors, inductors and heat sinks help lower the cost of the overall power supply. For multiple CPU applications, several LTC1629-6s can be combined with an LTC3719 to increase the number of output phases, up to 12; the resulting supply current can be up to 200A. For more information about PolyPhase operation, see the LTC3719 data sheet and Application Note 77.

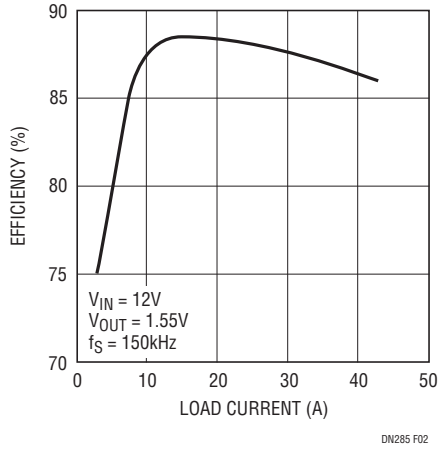

Figure 2. Efficiency vs Load Current

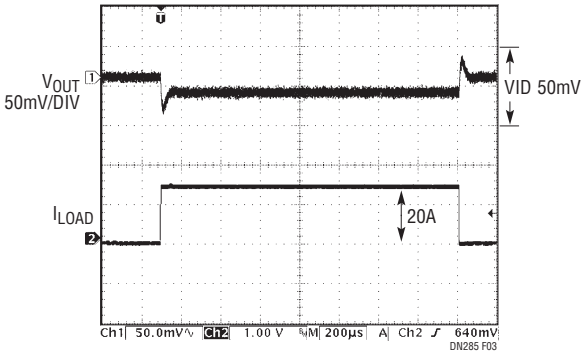

Figure 3. Load Transient Waveforms for a 20A Step with a 30A/µs Slew Rate

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