DESIGN NOTES

Dual Output Buck Regulator with Current Partitioning Optimizes Efficiency in Space-Sensitive Applications

Design Note 460

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Introduction

The LTC®3546 is a dual output current mode buck regulator with flexible output current partitioning. Beyond the advantages normally associated with dual output regulators (reduced size, cost, EMI and part count, with improved efficiency), the LTC3546's outputs can be partitioned for either 3A and 1A outputs, or two 2A outputs. This increases its application range and simplifies multiple supply rail designs. A configurable Burst Mode® clamp for each output sets the current transition level between Burst Mode operation and forced continuous conduction mode to optimize efficiency over the entire output range. An adjustable switching frequency up to 4MHz and internal power MOSFET switches allow for small and compact footprints.

The LTC3546 utilizes a constant frequency current mode architecture that operates from an input voltage range of 2.25V to 5.5V—well suited to point-of-load (POL) conversion for intermediate power bus applications—and provides dual regulated output voltages as low as 0.6V.

The adjustable switching frequency can be set from 750kHz to 4MHz by an external resistor or synchronized to an external clock, allowing for a significant reduction in overall solution size through the reduction of the output capacitors and inductors. Furthermore, the 180 degree phase shift between outputs reduces input ripple current when compared with two independent regulators, as the ripple frequency is effectively doubled, thereby lowering EMI and allowing the use of a smaller input capacitor while also improving efficiency.

Additional features such as soft-start, supply sequencing and tracking, short-circuit protection and current foldback are all included in a thermally enhanced 28-lead 4mm × 5mm QFN package. An entire converter typically consumes less than 0.6 square inches of board real estate, single-sided, and is limited to 1.2mm in height.

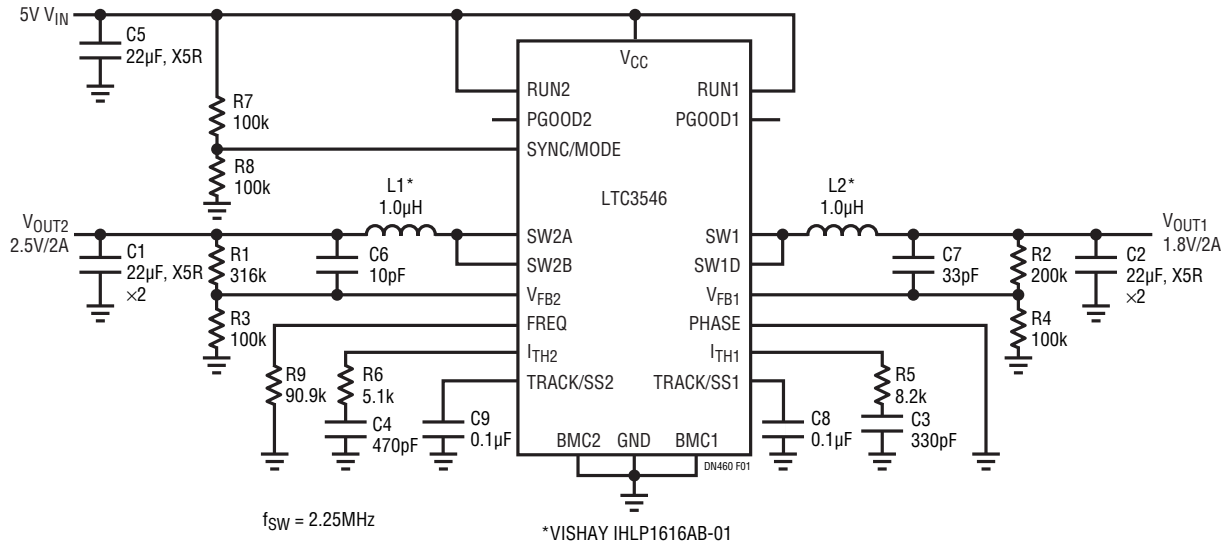

Figure 1. A Low Profile Dual Output Converter for AM Frequency Sensitive Applications—2.5V/2A and 1.8V/2A Outputs

Flexible Current Partitioning

A unique feature of the LTC3546 is its flexible current partitioning. The LTC3546 has two independently regulated outputs that can deliver up to 2A and 1A due to the 90mΩ and 180mΩ internal power MOSFET switches. An additional 1A output, with 180mΩ internal power MOSFET switches, can be paralleled to either of the outputs to produce either a 3A/1A or a 2A/2A dual output regulator. This external connection is internally detected and the dependent output is automatically gated in accordance to the connected output—nothing more is required.

Operation Modes and Efficiency

The LTC3546 can be configured for Burst Mode operation, forced continuous conduction (FCC) operation or pulse-skipping mode. In mobile applications where battery run time is of paramount importance, Burst Mode operation boosts efficiency by reducing gate charge losses at light loads, reducing supply current to just 125µA at no load. When noise control is important, forced continuous conduction operation may be preferred in order to trade efficiency for predictable, easily filtered constant frequency switching regardless of load current. Pulse-skipping mode provides a good compromise between light load efficiency and output voltage ripple. For optimum efficiency over all load conditions, the transition current between Burst Mode operation and forced continuous conduction mode can be set through the Burst Mode clamps (BMC) independently for each output.

Application Examples

Figures 1 and 2 show the versatility of the LTC3546. Figure 1 shows a low profile converter with two independent outputs. It is configured for constant frequency (2.25MHz) operation regardless of load. This design is optimized for space sensitive applications where AM band (520kHz – 1710kHz) interference could be a concern. Figure 2 shows a full featured dual POL converter with Burst Mode operation. The Burst Mode clamps are set for optimum efficiency over the entire load range of each output. This design is best suited for efficiency-sensitive applications with wide load current ranges.

Conclusion

The LTC3546 is a versatile dual output buck regulator suited for low to medium power applications. It delivers all the advantages of a dual output regulator with added flexible load current partitioning. The versatility of the LTC3546 makes it suitable for a wide range of applications that require compact, high efficiency power supplies.

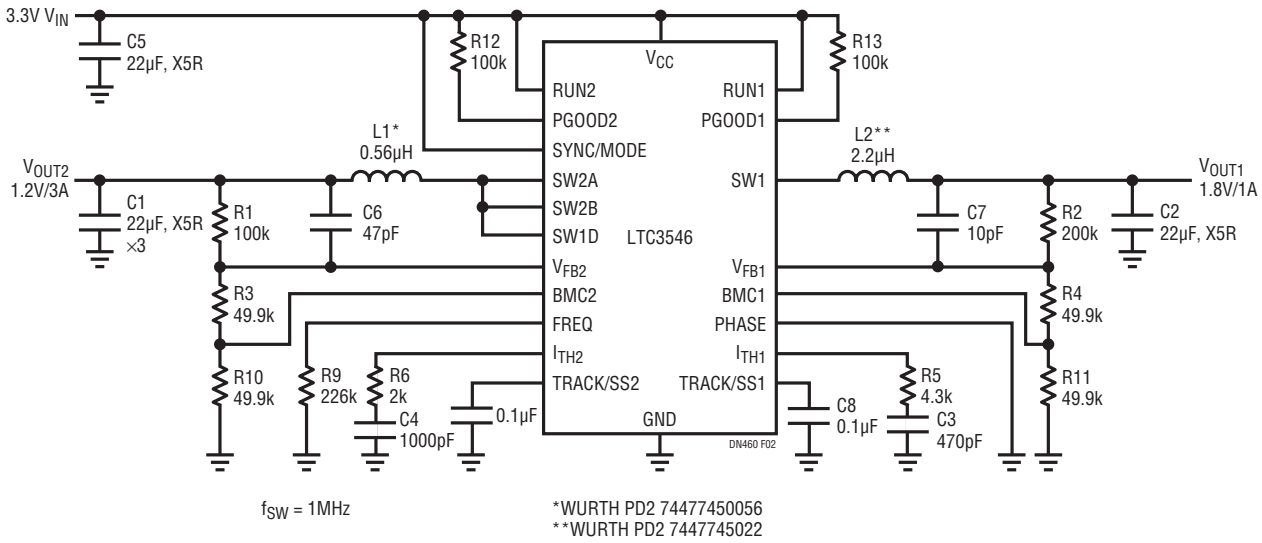

Figure 2. A Dual Output Converter with High Efficiency Over the Entire Output Range—1.8V/1A and 1.2V/3A Outputs

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