Increase Current Capability and Simplify Thermal Design of Flyback Converters with Secondary-Side Synchronous Rectifier Driver in a 5-Pin SOT-23

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In a flyback converter, current levels in high current applications are constrained by heat produced in the output rectifier diode. The clear way to lift this restriction is to replace the diode with a much lower voltage drop MOSFET, significantly reducing heat produced in the rectifier—reduced heat dissipation increases output current capability and efficiency, and simplifies thermal design. The LT8309 is a secondary-side synchronous MOSFET driver that replicates the behavior of the output diode by sensing the drain-to-source voltage of the MOSFET to determine if should be on or off, allowing it to replace a less efficient rectifier diode.

The LT8309 can be combined with any of Linear's line of no-opto boundary-mode flyback ICs (such as the LT3748 primary side controller) to produce high performance isolated power supplies with a minimal number of components.

5V, 8A ISOLATED SUPPLY

Figure 1 shows a low voltage, high current, low parts count flyback supply. The traditional output diode is replaced by an ideal diode consisting of the LT8309, a MOSFET and a few small external components.

For a MOSFET to act as a diode it must turn on as soon as the body diode starts conducting current, and turn off as soon as its current decreases to zero. The LT8309's fast comparator produces the required near instantaneous action. The current sensing comparator monitors the drain voltage of the MOSFET. When the body diode begins to conduct, the drain voltage goes well below ground, the comparator trips and turns on the MOSFET. After a minimum on-time, the LT8309 waits for the MOSFET turn-off trip point to be reached to turn off the MOSFET. The turn-off trip point can be adjusted through an external resistor connecting the part's DRAIN pin to the drain of the MOSFET. The DRAIN pin has a 150V voltage rating, making it suitable for wide input voltage design as well.

LT8309's internal LDO generates a 7V output at the $INTV_{CC}$ pin for the MOSFET gate drive. The strong gate drive with 1Ω pull-down resistance speeds up turn-on and turn-off of the MOSFET, resulting in better efficiency.

Efficiency is shown in Figure 2 with a comparison to a diode-only design. Thanks to higher efficiency, the operating temperature of a board built around an LT8309-based design remains significantly lower than a diode-only design, as shown in Figures 3 and 4.

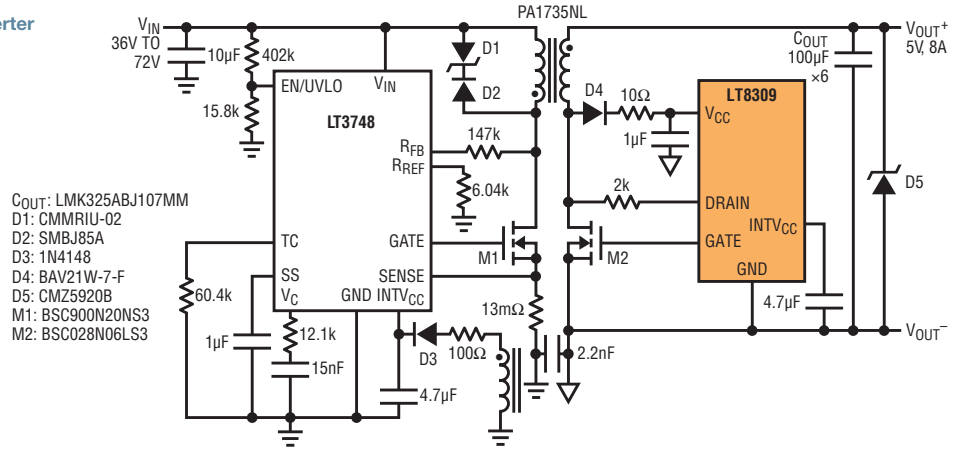

Figure 1. A low voltage high current flyback converter

The LT8309 can be combined with any of Linear's line of no-opto boundary-mode flyback ICs, such as the LT3748 primary side controller, to produce high performance isolated power supplies with minimal components.

The 40V V_{CC} pin rating allows the LT8309 to be driven from the output voltage or the rectified drain voltage of the MOSFET. If The V_{CC} pin is connected to the output of the flyback converter, during an output short-circuit condition, the LT8309 is off and the body diode of the MOSFET must handle the short-circuit condition. This puts additional thermal requirements on the MOSFET. Instead, if V_{CC} is connected to the drain voltage of the MOSFET as shown in Figure 1, V_{CC} is equal to V_{IN}/N in short-circuit, allowing the LT8309 to operate during a short. The short-circuit current flows through the MOSFET instead of the body diode.

CONCLUSION

LT8309 is an easy-to-use, fast, secondary-side synchronous flyback rectifier driver in SOT-23 package. High efficiency, high current isolated power supplies require a minimal number of components, and thermal design is simplified when the LT8309 is combined with one of Linear's line of no-opto boundary-mode flyback ICs. ■

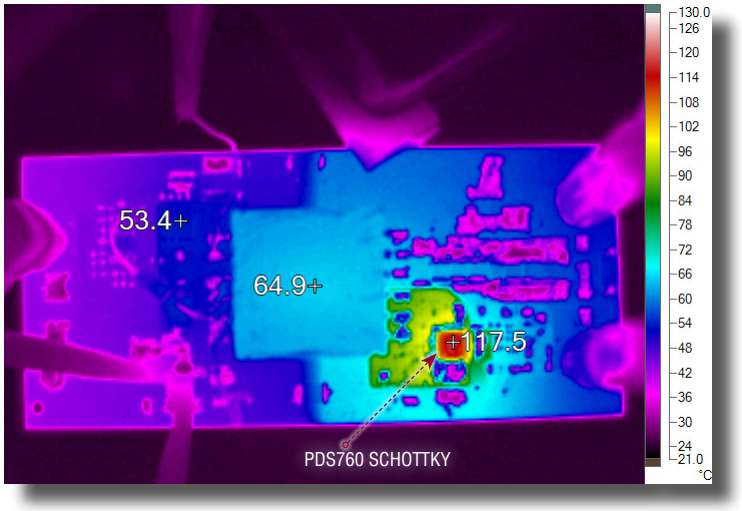

Figure 3. Thermal image at 5V/5A output with diode PDS760

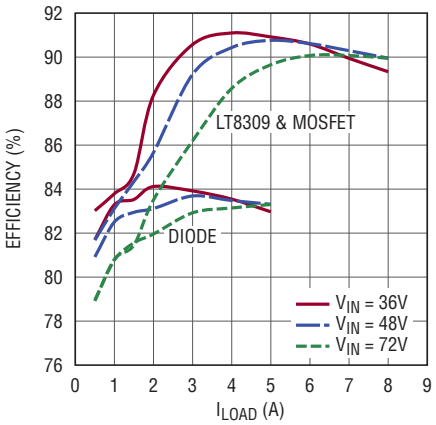

Figure 2. Efficiency of LT8309-based flyback converter compared same converter with a traditional secondary-side diode rectifier

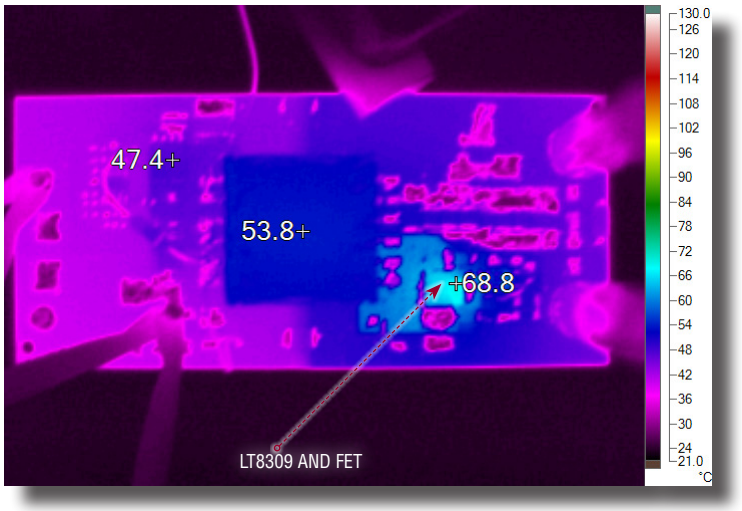

Figure 4. Thermal image shows 5V/5A output runs much cooler with the LT8309