Dual Output High Efficiency Converter Produces 3.3V and 8.5V Outputs from a 9V to 60V Rail

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The LTC3890 dual output DC/DC controller brings a unique combination of high performance features to applications that require low voltage outputs from high voltage inputs. It can produce two output voltages ranging from 0.8V to 24V from an input voltage of 4V to 60V. It is also very efficient, with a no-load quiescent current of only 50µA.

Many high-input-voltage step-down DC/DC converter designs use a transformer-based topology or external high side drivers to operate from up to $60V_{IN}$. Others use an intermediate bus converter requiring an additional power stage. However, the LTC3890 simplifies design, with its smaller solution size, reduced cost and shorter development time compared to other design alternatives.

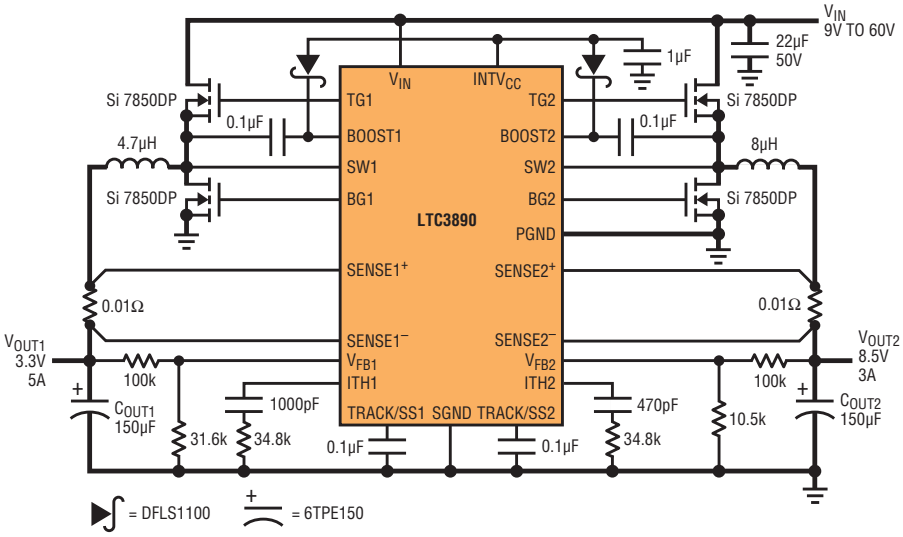

Figure 1. High efficiency dual 8.5V/3.3V output step-down converter

FEATURE RICH

The LTC3890 is a high performance synchronous buck DC/DC controller with integrated N-channel MOSFET drivers. It uses a current mode architecture and operates from a phase-lockable fixed frequency from 50kHz to 900kHz. The device features up to 99% duty cycle capability for low voltage dropout applications, adjustable soft-start or voltage tracking and selectable continuous, pulse-skipping or Burst Mode operation with a no-load quiescent current of only 50µA. These features, combined with a minimum on-time of just 95ns, make this controller an ideal choice for high step-down ratio applications. Power loss and

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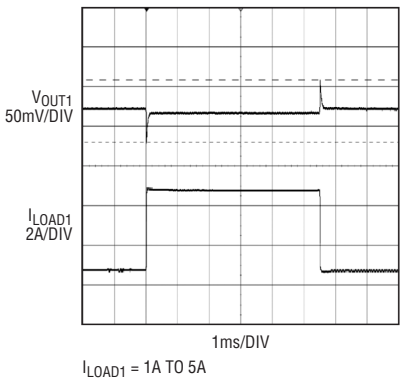

Figure 2. Transient response of 3.3V channel

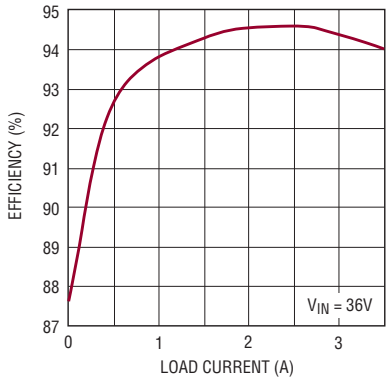

Figure 3. Efficiency of the converter in Figure 1 for the V_{OUT2} 8.5V channel

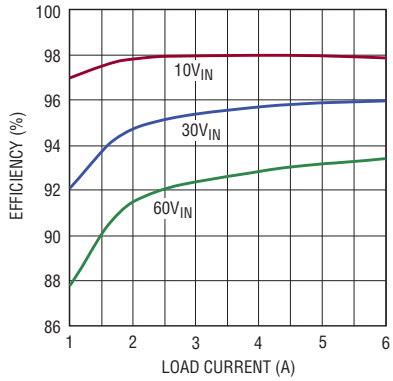

Figure 4. Efficiency of the LTC3890 configured as a 2-phase single output of 8.5V at up to 6A

The LTC4361 overvoltage and overcurrent protection controller utilizes a 2% accurate 5.8V overvoltage threshold to detect an overvoltage event and responds quickly within 1µs (max) to isolate the downstream components from the input.

The LTC4361 controls a low cost external N-channel MOSFET so that under normal operation it provides a low loss path from the input to the load. Inrush current limiting is achieved by controlling the voltage slew rate of the gate. If the voltage at the input exceeds the overvoltage threshold of 5.8V, the GATE is pulled low within 1µs to protect the load. While the IC operates from supplies between 2.5V and 5.5V, the input pins can withstand 80V transients or DC overvoltages. The LTC4361 features a soft shutdown controlled by the ON pin and provides a gate drive output for an optional external P-channel MOSFET for reverse voltage protection. A power good output pin indicates gate turn-on. Following an overvoltage condition, the LTC4361 automatically restarts with a start-up delay. The LTC4361 is available in two options; the LTC4361-1 latches off after an overcurrent event, where as the LTC4361-2 performs an auto-retry following a 130ms delay.

The new LTC4360 overvoltage protection controller is recommended for applications that do not require overcurrent protection. While offering many of the same features as the LTC4361, the two LTC4360 versions are differentiated by pin functions. The LTC4360-1 features soft shutdown control with low shutdown current of 1.5µA, while the LTC4360-2 can drive an optional external P-channel MOSFET for negative voltage protection.

The LTC4361 is offered in 8-lead (2mm × 2mm) DFN and SOT-23 packages, and the LTC4360 is offered in a tiny 8-lead SC70 package.

180MHZ, 1mA POWER EFFICIENT RAIL-TO-RAIL I/O OP AMPS

The LTC6246/LTC6247/LTC6248 are single/dual/quad low power, high speed unity gain stable rail-to-rail input/output operational amplifiers. On only 1mA of supply current, they feature an impressive 180MHz gain-bandwidth product, 90V/µs slew rate and a low 4.2nV/$\sqrt{\text{Hz}}$ of input-referred noise. The combination of high bandwidth, high slew rate, low power consumption and low broadband noise makes these amplifiers unique among rail-to-rail input/output op amps with similar supply currents. They are ideal for lower supply voltage high speed signal conditioning systems. The LTC6246 family maintains high efficiency performance from supply voltage levels of 2.5V to 5.25V and is fully specified at supplies of 2.7V and 5.0V. For applications that require power-down, the LTC6246 and the LTC6247 in MS10 offer a shutdown pin, which disables the amplifier and reduces current consumption to 42µA. The LTC6246 family can be used as a plug-in replacement for many commercially available op amps. ■

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supply noise are minimized by operating the two output stages out-of-phase.

DUAL OUTPUT APPLICATION

Figure 1 shows the LTC3890 operating in an application that converts a 9V to 60V input into 3.5V/5A and 8.5V/3A outputs. The transient response for the 3.3V output with a 4A load step is less than 50mV (as shown in Figure 2).

Figure 3 shows the efficiency of the 8.5V channel with a 36V input voltage.

SINGLE OUTPUT APPLICATION

The LTC3890 can also be configured as a 2-phase single output converter by simply connecting the two channels together. For example, a 9V to 60V input can be converted to an 8.5V output at 6A. Figure 4 shows the efficiency of this configuration at input voltages of 10V, 30V and 60V.

Current mode control provides good current balance between the phases. Less than 10% mismatch can be achieved, as shown in Figure 5.

CONCLUSION

Although there are many choices in dual-output controllers, the LTC3890 brings a new level of performance with its high voltage operation, high efficiency conversion and ease of design. ■

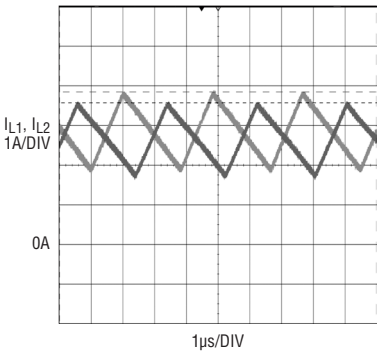

Figure 5. The inductor current in a 2-phase single output converter. Currents in both inductors shown with a 24V Input and 8.5V at 6A output.