

60V Low I_Q , Dual Output Synchronous Step-Down Controller with Adjustable Gate Drive

Design Note 562

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Introduction

The **LTC[®]3892** is a dual output synchronous buck controller featuring a wide input voltage range of 4.5V to 60V and an output voltage of 0.8V to 99% of V_{IN} . The combination of the LTC3892's built-in FET drivers and external FETs yield high efficiency and high power capability, up to 97% efficiency and over 60A output current². Its robust design—an IC operating junction temperature range of -55°C to 150°C —meets the needs of industrial, automotive, telecom, military, aerospace and distributed systems.

The LTC3892's low I_Q is indispensable in battery-powered applications where idle current must be kept low. It features 29 μA no-load quiescent current

and 3.9 μA shutdown current, maintaining battery charge as long as possible. The LTC3892's wide input voltage range satisfies the demanding requirements of industrial and automotive applications, which are distinguished by their lack of stable, high quality voltage sources. For example, in automotive environments, a 12V nominal voltage rail can range from a low 5V to above 50V during cold starts and load dumps. The LTC3892's ability to sustain the output in the face of high voltage inputs eliminates costly voltage suppressors; its low minimum input

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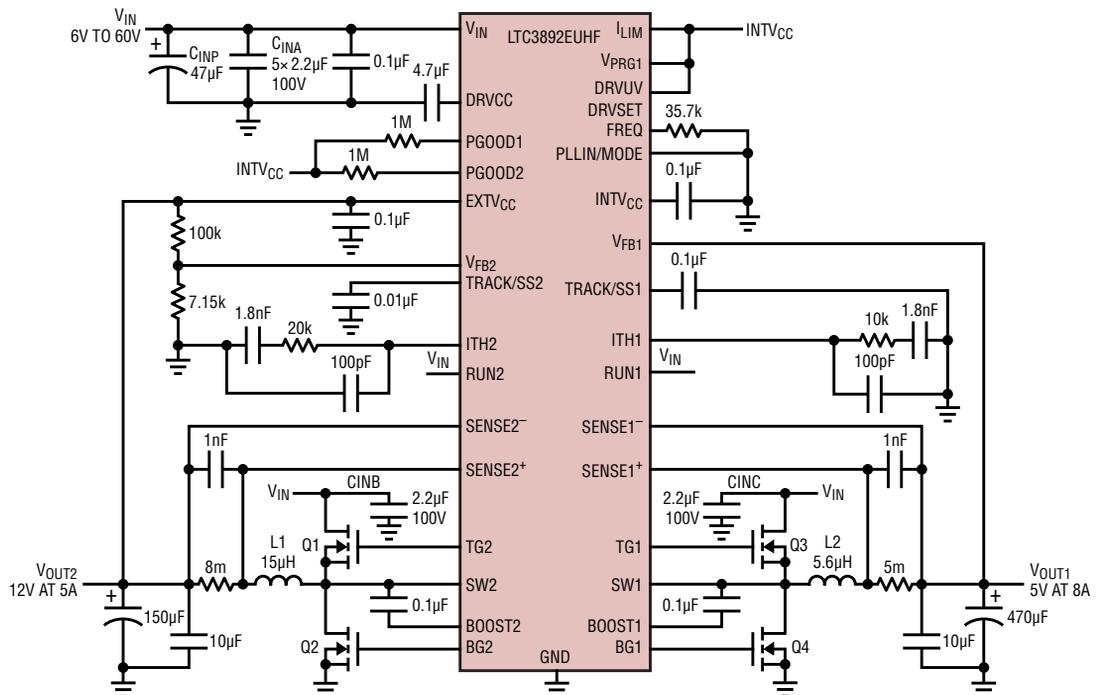


Figure 1. LTC3892, Dual Output DC/DC Converter Schematic

maintains an uninterrupted logic supply when the input voltage dips far below nominal.

Another key feature of the LTC3892 is its programmable gate voltage that can be set from 5V to 10V. This is important for many reasons. A designer can choose a standard (10V) gate drive level and select switching devices from the wide variety of MOSFETs offered by multiple vendors, optimizing the supply efficiency and reducing overall cost. However, if gate driver loss is important, then logic level (5V) FETs can be used. As a compromise, the gate voltage can be programmed to any intermediate value, providing acceptable gate and minimum conduction losses¹. The LTC3892 features programmable undervoltage lockout (UVLO) and programmable $EXTV_{CC}$ via the $DRVUV$ pin.

Circuit Description

Figure 1 shows a single LTC3892, dual-output solution: 12V out at 5A and 5V out at 8A. The LTC3892 controls two power trains, each with a pair of switching MOSFETs, inductor and output filter. This circuit demonstrates the ability for V_{OUT1} to be set to a fixed level by programming the V_{PRG1} pin. In this schematic it's set to 5V¹; consequently V_{OUT1} is connected directly to the FB1 pin. The standard gate drive level is selected by tying the $DRVSET$ pin to the $INTV_{CC}$ pin.

In the solution of Figure 1, the V_{IN} pin and the drains of the top MOSFETs of both outputs are connected to the same input voltage V_{IN} . However, these three

ports can be connected to different voltages or power supplies if needed. Designers can bias the LTC3892 through the V_{IN} pin and apply a voltage from different sources to the drains of Q1 or Q3. Figures 2 and 3 illustrate the efficiency of the converter in Figure 1 at various input voltages.

Demonstration circuits² are available from the factory, designed to display a variety of load capabilities. Incorporating current mode control, a LTC3892 supply can be wired as a dual output supply as on the DC1998A demo board, as a 2-phase single output supply delivering 12V at 30A (DC2190A-B), or as a 4-phase single output supply generating 12V at 60A (DC2190A-A).

Conclusion

The LTC3892 is a versatile 60V input, dual output buck controller, optimized for high efficiency DC/DC solutions in automotive, industrial and telecom fields. Other salient features include programmable gate voltage, extremely low no-load and shutdown quiescent current, programmable frequency, internal bootstrap diodes and easy current sharing for high current designs.

References

1. <http://cds.linear.com/docs/en/datasheet/38921fb.pdf>, LTC3892 Family Data Sheet
2. <http://www.linear.com/product/LTC3892#demoboards>, LTC3892 Family Demo Circuits

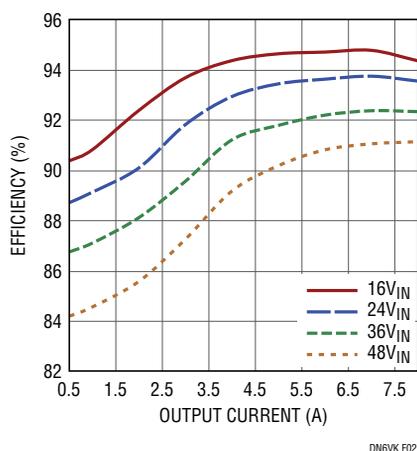


Figure 2. LTC3892, V_{OUT1} , 5V Efficiency Curves

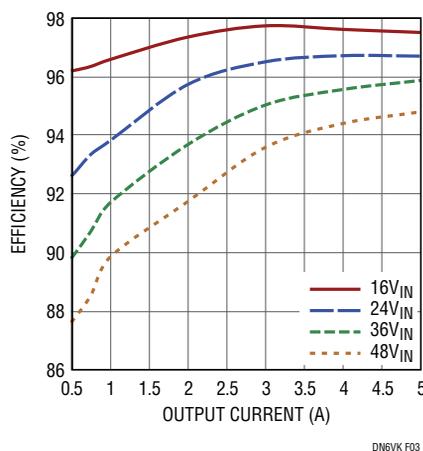


Figure 3. LTC3892, V_{OUT2} , 12V Efficiency Curves

Data Sheet Download

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