

Triple Output LED Driver Works with Inputs to 60V and Delivers 3000:1 PWM Dimming

by Hua (Walker) Bai

Introduction

The LT3492 is a 60V triple output LED driver for high input and/or high output voltage backlighting or direct lighting applications. A single 4mm x 5mm IC can drive a large number of LEDs, reducing overall solution cost when compared to less capable drivers. A built-in gate driver for a disconnect PMOS in series with the LED string, along with other techniques, enables a 3000:1 PWM dimming ratio. When coupled with the part's analog dimming functions, the overall dimming ratio can be as high as 30,000:1. The LT3492 can be configured into buck-mode, boost-mode or buck-boost mode, depending on the available input voltage source and the number and configuration of LEDs to be driven.

High Input Voltage Triple Buck Mode LED Driver

Many "regulated" supplies actually have fairly loose tolerances. For ex-

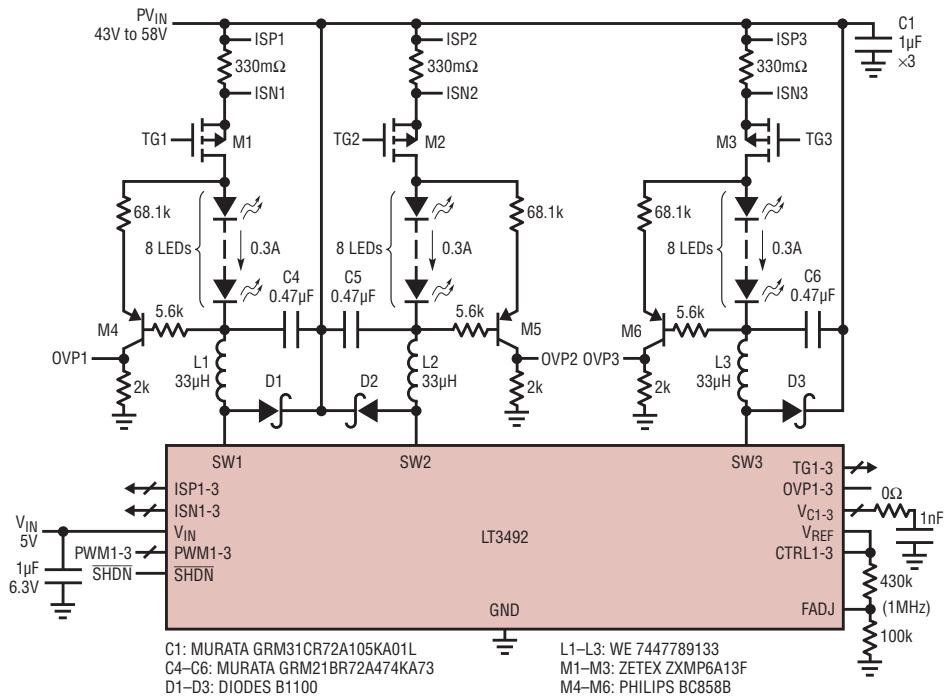


Figure 1. Triple buck mode LED driver with open LED protection

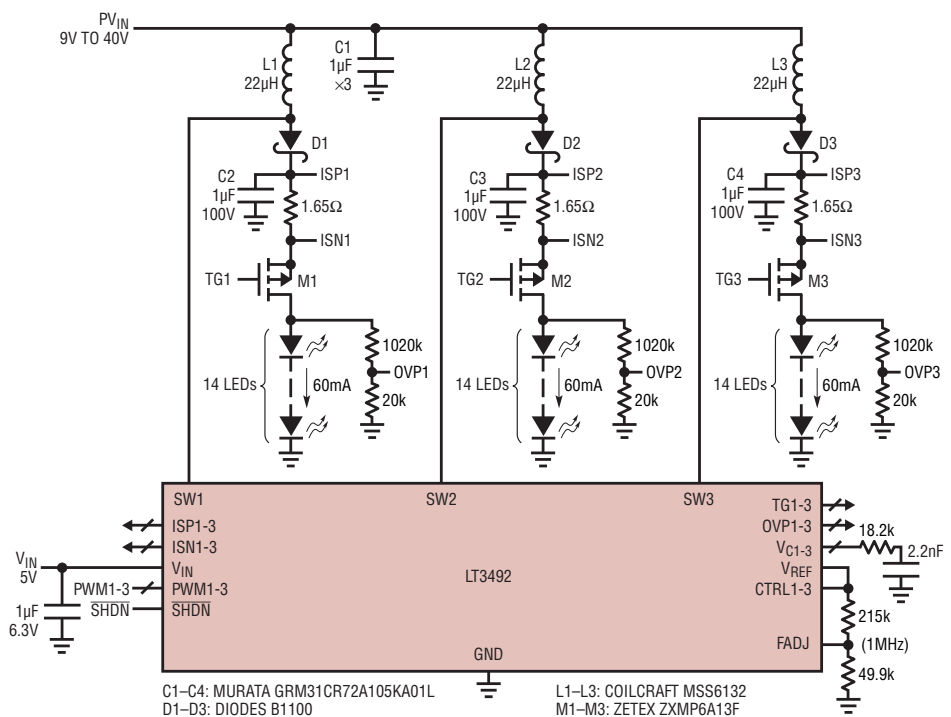


Figure 2. Triple boost mode 60mA x 14 LED driver

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ample, a 48V supply can range between 43V and 58V, well above most LED drivers' safe operating voltage ratings. The LT3492's 60V input voltage rating makes it an easy fit in such volatile voltage environments.

Figure 1 shows a triple buck-mode LED driver for high voltage inputs. Each channel can drive up to eight 300mA white LEDs in series, a limit set by assuming 4V maximum forward voltage and a 43V minimum input voltage. Red LEDs or infrared LEDs have much lower forward voltage, therefore each output can drive as many as 20 infrared LEDs. The V_{IN} pin in Figure 1 is tied to a 5V supply, as opposed to PV_{IN} , to improve circuit efficiency.

Triple Boost Mode Driver Supports 14 LEDs per Output from a 9V–40V Input

Figure 2 shows a triple boost mode LED driver that delivers 60mA to each LED string. Due to the LT3492's 60V switch rating, each output can support up to 14 LEDs. The 9V-to-40V input range covers a diverse range of applications, including regulated 12V, 24V, 32V to 36V, etc. Unlike in a buck mode regulator, where the output current capability is determined by the switch current limit, the current driving capability of a boost regulator

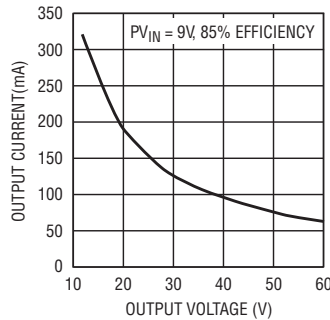


Figure 3. Maximum output current capability of an LT3492 boost circuit


is a function of the ratio of output voltage to minimum input voltage. Figure 3 shows the maximum output current vs output voltage for a 9V minimum input (assuming 85% efficiency at 1MHz). For applications that require less than 40V output, the LT3496 should be considered instead.

Triple Buck-Boost Mode LED Driver Regulates During Load Dump Events

Buck-boost mode is used when the LED string voltage falls within the input voltage range. Figure 4 shows a buck-boost application that uses one inductor per driver. The LED string is returned to the input—returning all LED strings to the same potential allows easy heat sinking. To prevent body diode conduction, the drain of the disconnect PMOS is tied to the

anode of the LED string. The high input voltage of the circuits in Figure 2 and Figure 4 is a real benefit in automotive applications, where the ability to ride through 40V load dump events while maintaining LED current regulation is required. Figure 5 shows the greater than 3000:1 PWM dimming ratio achievable with the LT3492. This high PWM dimming ratio helps improve the picture quality of an LCD display under various dynamic conditions.

Conclusion

The LT3492 is a high voltage triple output LED driver with 60V rated switches, allowing high input voltage and/or high output voltage operations with accurate LED current. It can run in buck mode, boost mode or buck-boost mode with 3000:1 PWM dimming capability. 

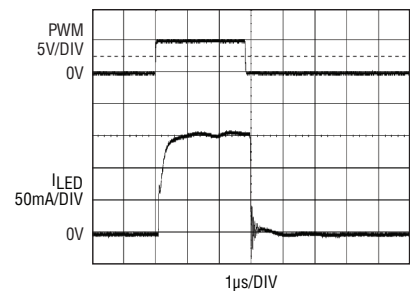


Figure 5. High dimming ratio (>3000:1) improves quality of an LCD display

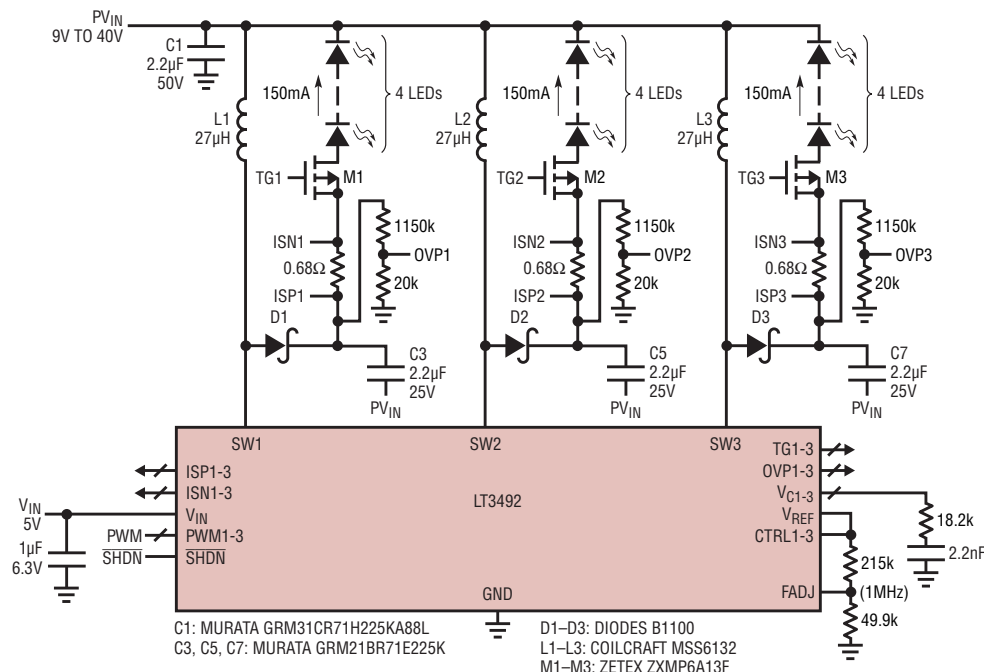


Figure 4. Triple buck-boost mode 150mA x 4 LED driver