

DESIGN NOTES

High Voltage Buck Converters Drive High Power LEDs

Design Note 392

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Introduction

High power LEDs continue to replace traditional bulbs in new automotive, industrial, backlight display and architectural detail lighting systems. LEDs excel in a wide range of performance and cost parameters, including excellent spectral performance, long life, robustness, falling manufacturing cost and relatively safe materials. Linear Technology offers a large and growing family of high voltage DC/DC converters tailored specifically to drive high-powered LEDs.

The LT[®]3474 and LT3475, for example, are high voltage, high current, single- and dual-channel buck LED converters with wide PWM dimming ratios that can drive one or more LEDs up to 1A and 1.5A for 80 lumens to 120 lumens per LED (or more as higher output LEDs become available). These dedicated LED drivers have onboard high voltage NPN power switches and internal sense resistors to minimize board space, reduce component count and simplify design.

With their high side sense resistors, the LT3474 and LT3475 can drive LEDs tied to ground, an important advantage in many systems. Current-mode control and a precise reference voltage optimize loop dynamics for a well regulated, low ripple constant LED current. Thermally enhanced exposed pad packages keep the junction temperature low during high power operation in stressful environments. A PWM pin uses the dimming MOSFET

gate signal to extend the dimming ratio of the converter by maintaining constant output capacitor voltage and control loop state during PWM dimming off-time. Shutdown and external analog current adjust pins provide simple interface for further LED light and current control flexibility in any system.

Single Buck 1A LED Driver

The LT3474 buck converter 1A LED driver shown in Figure 1 has features that suit it to automotive applications (and other battery-powered applications) or to industrial applications with limited board space, high voltage and high ambient temperature. This scheme uses a high side integrated 100mΩ sense resistor for true LED current sensing and regulation, superior to the common and less efficient method of biasing LEDs with a constant voltage and a power wasting bias resistor.

The 4V to 36V input voltage range makes it ideal to use with little-to-no input transient protection circuitry in automotive, industrial and avionic applications where long cables from the battery result in very high input spikes.

The boosted NPN power switch results in high efficiency for both 1- and 2-LED applications (Figure 2). The boost diode is integrated to further reduce component count. Driving the shutdown pin to ground turns off the LEDs and reduces the input current to less than 2μA for battery longevity.

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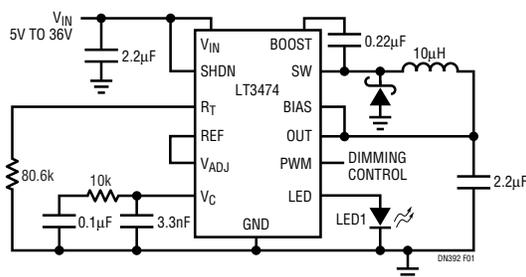


Figure 1. LT3474 High Voltage Buck LED Driver Regulates 1A

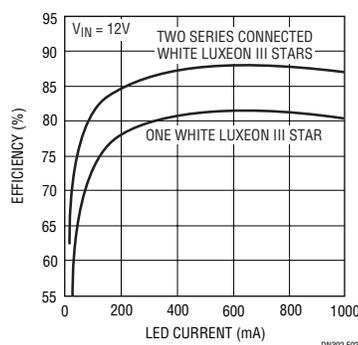


Figure 2. LT3474 Buck Drives Single or Multiple LEDs with High Efficiency

