

Wide input range 1A LED driver powers high brightness LEDs with automotive and 12V_{AC} supplies

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Introduction

Today's ultrabright LEDs far exceed the performance of incandescent bulbs in both efficiency and lifetime. Taking full advantage of these features requires a correspondingly efficient and reliable LED driver, such as the LT3474. The LT3474 is a step-down 1A LED driver that supports a variety of power sources, has a wide 4V to 36V input voltage range and is programmable to deliver LED current from 35mA to 1A at up to 88% efficiency. It requires minimal external circuitry and is available in a space saving 16-lead TSSOP package.

Automotive LED driver

Figure 294.1 shows the configuration of the LT3474 operating from a 12V automotive battery input. As shown, the circuit can tolerate voltage swings from 4V to 36V, common in an automotive environment. With an integrated NPN switch, boost diode and sense resistor, the LT3474 cuts the external component count to a minimum. The high side sense allows a

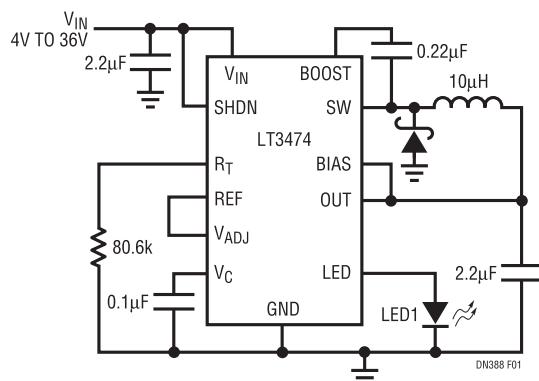


Figure 294.1 • 4V–36V Input Voltage 1A LED Driver Requires Few Components

grounded cathode connection, easing wiring constraints. Both PWM and analog dimming are available with minor circuit modification; see the LT3474 data sheet for details.

Driving LEDs from 12V_{AC} input

The LT3474 directly regulates LED current, maintaining constant LED current over changing V_{IN} . The wide input range of the LT3474 allows direct connection to a rectified 12V_{AC} input. Using a small input capacitor, as shown in Figure 294.2,

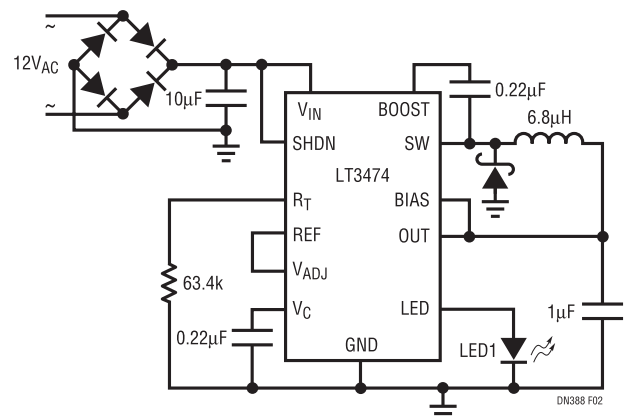


Figure 294.2 • Using a Diode Bridge Allows the LT3474 to Drive an LED from a 12V_{AC} Input

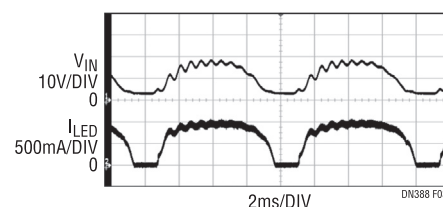


Figure 294.3 • Using a 10µF Input Capacitance, the LT3474 Delivers Nearly 1A of LED Current with Smallest Board Size

minimizes size. In this case, the LT3474 delivers nearly 1A of LED current as shown in Figure 294.3. Adding more capacitance to the input, as shown in Figure 294.4, holds the input voltage above the LED voltage. In this case, the LT3474 can deliver a constant LED current even with significant 120Hz ripple on the input as shown in Figure 294.5.

Thermal regulation

The issue of heat management is at the core of many LED applications. A reliable solution maintains the longevity of the LED by keeping the LED junction temperature below the recommended limit. One answer to this problem is to mount massive heat sinks, wasting space and money. Figure 294.6 shows a better solution. The temperature of the LED is sensed by the thermistor mounted near the LED and is

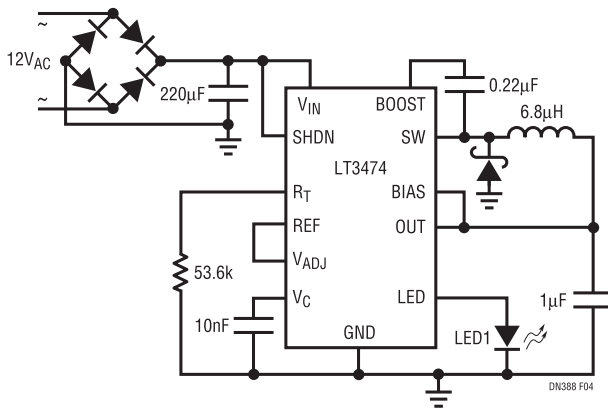


Figure 294.4 • With a 220µF Input Capacitor, the LT3474 Supplies a Constant 1A Current to the LED

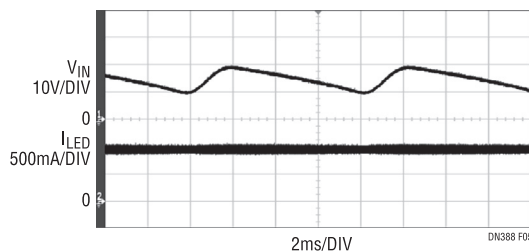


Figure 294.5 • With a 220µF Input Capacitor, the LT3474 Delivers Constant 1A LED Current with Changing Input Voltage

translated into a voltage signal to the VADJ pin. The VADJ pin reduces the current through the LED appropriately to meet the power derating specified by the Luxeon III Star manufacturer. Only slight modifications to the resistor values are required to adjust the circuit for use with other high brightness LEDs (see Figure 294.7).

Conclusion

High power white LEDs are fast becoming the lighting of choice in architectural, automotive, museum and avionic systems due to their efficiency, high quality light and long lifetimes. The LT3474 makes it easy to create compact, efficient, robust and versatile LED drivers from a variety of power supplies. Designers can now focus their time on creating imaginative new LED applications, instead of on LED drivers.

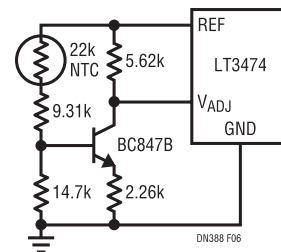


Figure 294.6 • Compact, Economical Thermo-Regulating Circuit. The NTC and NPN, Mounted Close to the LED, Monitor the LED's Temperature

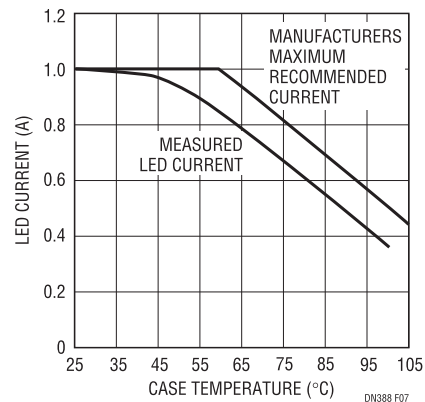


Figure 294.7 • LED Current Safely Lies within Specified Limits for the Luxeon III Star Power