35V 1A LED driver with internal switch

GENERAL DESCRIPTION
The CL6807 is a continuous mode inductive step-down converter, designed for driving single or multiple series connected LEDs efficiently from a voltage source higher than the LED voltage. The device operates from an input supply between 6V and 35V and provides an externally adjustable output current of up to 1A. Depending upon supply voltage and external components, this can provide up to 35 watts of output power.

FEATURES
- Simple low parts count
- Wide input voltage range: 6V to 35V
- Up to 1A output current
- Single pin on/off and brightness control using DC voltage or PWM
- Typical 5% output current accuracy
- Inherent open-circuit LED protection
- High efficiency (up to 95%)
- High-Side Current Sense
- Soft-start
- Available in SOT89-5 packages

APPLICATIONS
- Low voltage halogen replacement LEDs
- Automotive lighting
- Low voltage industrial lighting
- LED back-up lighting
- Illuminated signs

PIN ASSIGNMENT

TYPICAL APPLICATIONS

ABSOLUTE MAXIMUM RATINGS

RECOMMENDED OPERATING RANGE
The CL6807 are step-down, constant current, high-brightness LED (HB LED) drivers. These devices operate from a 6V to 35V input voltage range and provide up to 1A sourcing LEDs. A high-side current-sense resistor sets the output current and a dedicated PWM dimming input (ADJ) allows for a wide range of independent pulsed dimming. The high-side current-sensing scheme and on-board current-setting circuitry minimize the number of external components while delivering LED current with ±5% accuracy, using a 1% sense resistor.

When input voltage VIN is first applied, the initial current in L1 and RS is zero and there is no output from the current sense circuit. Under this condition, the output of CS comparator is high. This turns MN on and switches the LX pin low, causing current to flow from VIN to ground, via Rg, L1, and the LED(s). The current rises at a rate determined by VIN and L1 to produce a voltage ramp (VRSNS) across RS. When (VRSNS) > 115mV, the output of CS comparator switches low and MN turns off. The current flowing on the RS decreases at another rate. When (VIN-VISNS) < 85mV, the MN turns off again and the mean current on the LED is determined by ((85+ 115)/2 mV).

The CL6807 regulate the LED output current using an input comparator with hysteresis (Figure 1). As the current through the inductor ramps up and the voltage across the sense resistor reaches the upper threshold, turns off the internal MOSFET. The MOSFET turns on again when the inductor current ramps down through the freewheeling diode until the voltage across the sense resistor equals the lower threshold. Use the following equation to determine the operating frequency:

\[ f = \frac{(V_{\text{VIN}} - V_{\text{VISNS}}) \times n \times V_{\text{LED}}}{V_{\text{RS}} \times \Delta V \times L} \]

where \( n \) is the number of LEDs, \( V_{\text{LED}} \) is forward voltage drop of one LED, and \( \Delta V = (V_{\text{VISNS}} - V_{\text{IN}} + V_{\text{LX}}) \).

The CL6807 feature a programmable LED current using a resistor connected between VIN and ISNS. Use the following equation to calculate the sense resistor:

\[ R_{\text{SENSE}} = \frac{0.1 \times (V_{\text{IN}} - V_{\text{VISNS}})}{2.5 \times I_{\text{LX}}} \]

### 5V Regulator

VCC is the output of a 5V regulator capable of sourcing 10mA. VCC was bypassed to GND with internal capacitor.

**Application Description**

**Selecting RSENSE to Set the LED Current**

The CL6807 provide a wide range of independent pulsed dimming. The high-side current-sensing scheme and on-board current-setting circuitry minimize the number of external components while delivering LED current with ±5% accuracy using a 1% sense resistor. A Schottky diode is a good choice as long as the breakdown voltage is high enough to withstand the maximum operating voltage. The forward current rating of the diode must be at least equal to the maximum current rating of the LED.

**Current Regulator Operation**

The CL6807 allow dimming with a PWM signal at the ADJ input. A logic level below 0.5V at ADJ turns off the LED current. To turn the LED current on, the logic level at ADJ must be at least 2.5V.

**PCB Layout Guidelines**

Careful PCB layout is critical to achieve low switching losses and stable operation. Use a multilayer board whenever possible for better noise immunity. Minimize ground noise by connecting high-current ground returns, the input bypass capacitor ground lead, and the output filter ground lead to a single point (near ground configuration). In normal operation, there are two power loops.

**freewheeling diode**

The forward voltage of the freewheeling diode should be as low as possible for better efficiency. A Schottky diode is a good choice as long as the breakdown voltage is high enough to withstand the maximum operating voltage. The forward current rating of the diode must be at least equal to the maximum LED current.

**LED Current Ripple**

The LED current ripple is equal to the inductor current ripple. In cases when a lower LED current ripple is needed, a capacitor can be placed across the LED terminals.

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