AL8807BQEV1 User Guide

General Description

The AL8807BQEV1, Figure 1, is a double sided evaluation board for the AL8807BQ step-down, or 'buck', LED driver with internal switch. The evaluation board is preset to drive 1A into a single LED, or multiple LEDs, the maximum number of which depends on their total forward voltage drop and the supply voltage.

The operating voltage is nominally 30 volts, but it can be reduced to a minimum of 6 volts. The 68uH inductor used in the circuit is based on this nominal supply. The evaluation board should be connected as in Figure 1 below.

Terminal CTRL provides a connection point for PWM dimming and shutdown.

Key Features

- Automotive Grade with AEC-Q100 Qualification
- 6V to 30V DC input (with 2 LEDs)
- 1A LED current
- Drives 1 LED or several LEDs in series
- Brightness control using PWM
- Inherent open circuit LED protection
- Ambient temperature range -40°C to +125°C

Applications

- Automotive LED Lamps
- Illuminated signs
- High Power LED driving

AL8807BQEV1 Specifications

Parameter	Value
Input Voltage	6VDC to 30VDC
LED Current	1A (Adjustable)
LED Current Accuracy	±3%
Switching Frequency	100kHz
Efficiency	95%
Number of LEDs	2 LEDs in series (Under Tested)
XY Dimension	2.48 " x 1.57"

EVB (Rev 1.0)

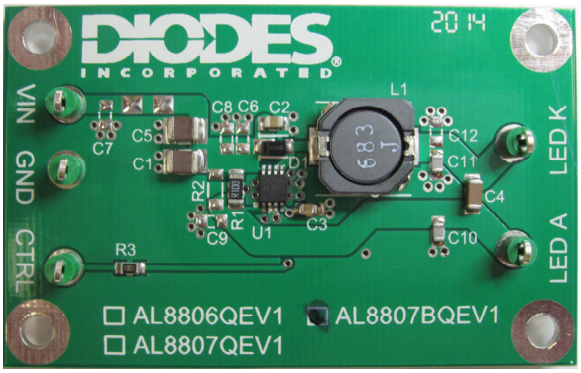

Figure 1: Top View (Single Side Board)

Connection Instructions

Input Voltage: 6VDC to 30VDC (VIN, GND)
LED Outputs: LED A (+), LED K (-)

Evaluation Board Schematic

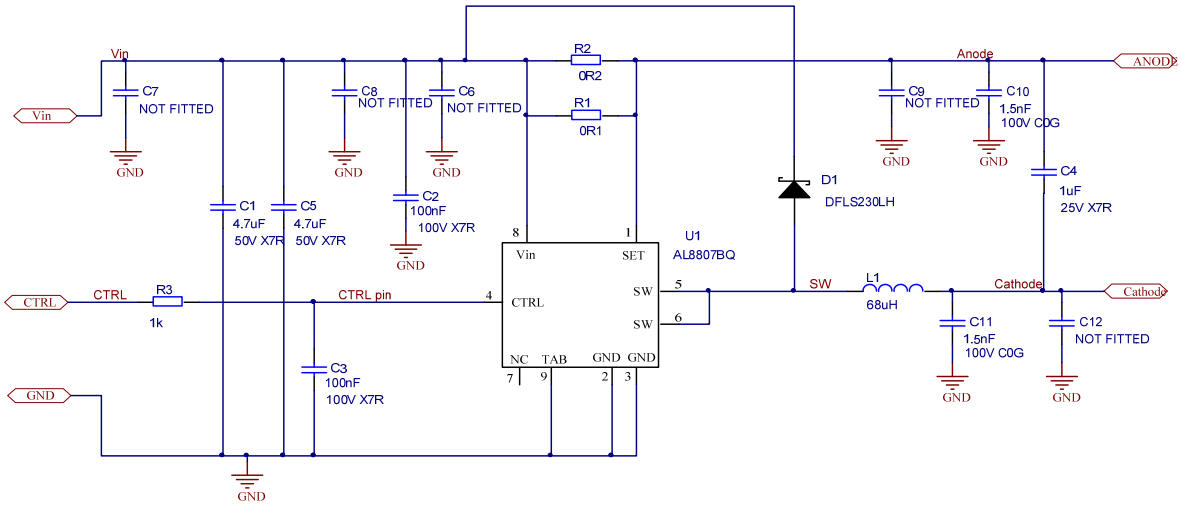

Figure 2: Evaluation Board Schematic

Evaluation Board Layout

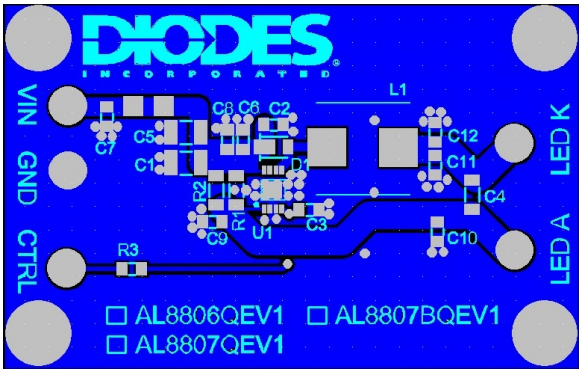

Figure 3: Top View

Figure 4: Bottom View

Bill of Material

#	Name	Quantity	Part number	Manufacturer	Description
1	U1	1	AL8807BQMP-13	Diodes Inc	IC, LED Driver (MSOP-8EP)
2	D1	1	DFLS260	Diodes Inc	Schottky diode, 60V/2A
3	L1	1	MSS1038-683ML	Coilcraft	Inductor, shielded, 68µH 20%
4	R1	1	-	generic	0.1Ω Resistor 1/8W 1% 1206 SMD
5	R2	1	-		NOT FITTED
6	R3	1	-	generic	1kΩ Resistor 1/8W 1% 0805 SMD
7	C1, C5	2	C1210X475K5RAC	Kemet	4.7µF Cap 50V 10% X7R 1210
8	C2, C3	2	NMC0805X7R104K100PF	NIC	100nF Cap 100V 10% X7R 0805
9	C4	1	NMC1206X7R104K100	NIC	1µF Cap 100V 10% X7R 1206
10	C6, C7, C8, C9, C12	0	-	-	NOT FITTED
11	C10, C11	2	-	generic	1.5nF Cer Cap 100V COG 0805
12	VIN, GND, CTRL, LEDA, LEDK	5	100-108	Hughes	2.15mm Test Loop Terminal

Quick Start Guide

Basic Operation at full voltage

1. Connect Vin and GND

   Warning: The board does not feature reverse battery/supply protection.

2. Set the PSU to 30V
3. Turn on the PSU and the LED will illuminate and the current should be approximately 680mA.

   Warning: Do not stare at the LED directly.

Switching the output current off

Shorting the CTRL pin to GND will cause the LED current to go to zero.

Soft start

Adding a C2 capacitor will create a soft-start power-up sequence (0.1ms/nF). This delay will reduce the PWM dimming performance.

Changing the LED current

1. Remove R1.
2. Calculate and replace sense resistor, R1, the value of which is based on the required LED current without dimming. R1 can be calculated using following equation:

R1 = 0.1V/IOUT

where IOUT = the LED current.

R1 = the sense resistor value in ohms.

0.1V is the nominal sense voltage with 'CTRL' open circuit or set to 2.5V.

The device calculator at the address below can be used to speed up the redesign phase:

http://www.diodes.com/destools/calculators.html

Performance

The system efficiency depends on the sense resistor, supply voltage, switching frequency and the number of LEDs.

With a 12V supply and two LEDs, the switching frequency is typically 102kHz, and the efficiency level is 88%.

AL8807BQ Operation

In normal operation, when a voltage is applied at +Vin, the AL8807BQ internal NDMOS switch is turned on. Current starts to flow through sense resistor R1, inductor L1, and the LED. The current ramps up linearly, the ramp rate being determined by the input voltage +Vin and the inductor L1. This rising current produces a voltage ramp across R1. The internal circuit of the AL8807BQ senses the voltage across R1 and applies a proportional voltage to the input of the internal comparator. When this voltage reaches an internally set upper threshold, the NDMOS switch is turned off. The inductor current continues to flow through R1, L1, the LED and the Schottky diode D1, and back to the supply rail, but it decays, with the rate of decay determined by the forward voltage drop of the LEDs and the Schottky diode. This decaying current produces

a falling voltage at R1, which is sensed by the AL8807BQ. A voltage proportional to the sense voltage across R1 is applied at the input of the internal comparator. When this voltage falls to the internally set lower threshold, the NDMOS switch is turned on again. This switch-on-and-off cycle continues to provide the average LED current set by the sense resistor R1. Please refer to the datasheets for the threshold limits, AL8807BQ internal circuits, electrical characteristics and parameters.

AL8807BQEV1 Evaluation Board Reference Design

The AL8807BQEV1 is configured to the reference design in Figure 2.

The operating voltage is up to 30V. The nominal current is set at 1A with a 0R1 sense resistor R1. The circuit operates in continuous mode between approximately 40kHz and 130kHz, depending on the input voltage, and with a 68uH inductor and one LED.

PWM dimming can be achieved by driving the CTRL pin.

Driving the CTRL pin below 0.4V will shut down the output current.
A PWM signal (low level ≤ 0.4V and high level > 2.5) allows the output current to be adjusted above or below the level set by the resistor connected to SET input pin. The PWM frequency can be around 100Hz to 1kHz, providing a resolution of 10 bits.

For low frequency PWM, C2 should be removed from the evaluation board, to give a more accurate duty cycle.
Shorting R2 will connect the test pin CTRL to device pin CTRL, if required.

For further advice, please contact your local Diodes Field Applications Engineer.

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