AL8807EV3 EVALUATION BOARD USER GUIDE

DESCRIPTION

The AL8807EV3, Figure 1, is a double sided evaluation board for the AL8807 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 36 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.

Note: The evaluation board does not have reverse supply protection.

The nominal current, 1A, is set with the 0R1 sense resistor, R1.

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

Warning: At 36V nominal operation with 1A output, the LED will be hot and very bright

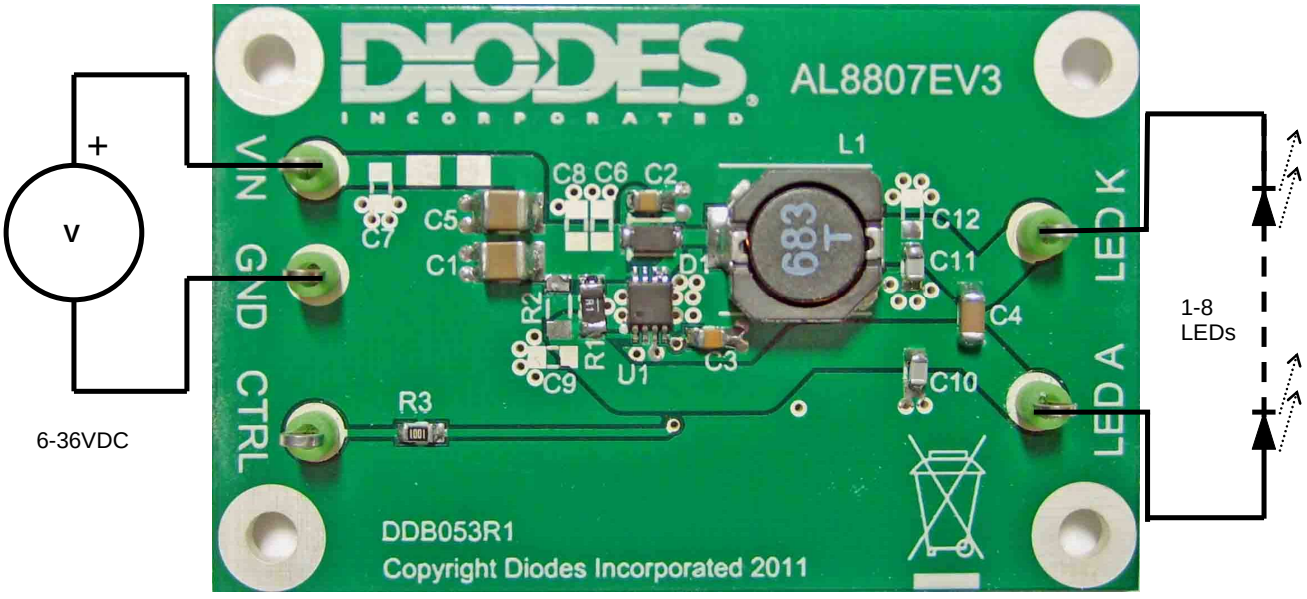


Figure 1: AL8807EV3 evaluation board and connection diagram

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AL8807EV3 Connection Point Definition	
Name	**Description**
Vin	Positive supply voltage. 6 to 36V
GND	Supply Ground (0V).
CTRL	Internal voltage ref. pin (2.5V). This pin can be used to achieve dimming and for switching the output current off. Leave floating for normal operation.
LED A	LED A connects to the external LED anode
LED K	LED K connects to the external LED cathode

AL8807 DEVICE DESCRIPTION

The AL8807 is a continuous mode inductive driver in a SOT25 package, for driving one or more series-connected LEDs efficiently from a voltage source higher than the LED voltage. The device includes the output switch and a current sense circuit, which requires an external sense resistor to set the nominal current up to 1A.

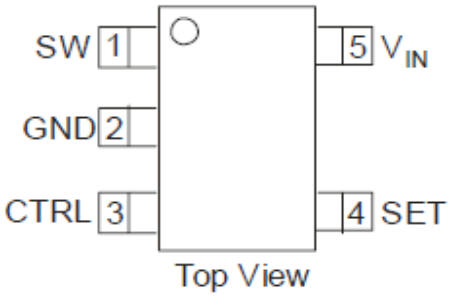
AL8807 DEVICE FEATURES

- Drives one or more series-connected LEDs
- LEDs up to 1A.
- Internal 40V switch.
- Wide input voltage: 6V to 36V.
- Inherent open circuit LED protection.
- Brightness control using DC or PWM.

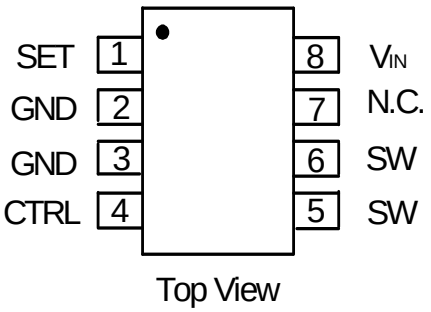
DEVICE APPLICATIONS

- LED flashlights.
- High Power LED driving.
- Low-voltage halogen replacement LEDs.
- Automotive lighting.
- Illuminated signs.

AL8807 Device Packages, Pin and Definitions



SOT25 package



MSOP8EP package

AL8807 Device Pin Definition		
Name	**Pin No**	**Description**
SW	1	Drain of NDMOS switch.
GND	2	Ground (0V).
CTRL	3	Internal voltage ref. pin (2.5V) : • Leave floating for normal operation. • Connect to GND to turn off output current. • Drive with DC voltage (0.4V to 2.5V) or with PWM (up to 5V logic level) signal to adjust output current
SET	4	Connect a sense resistor, R1, from the SET pin to VIN to sense the nominal output current. Nominal I_{out} = 0.1/ R1
VIN	5	Input voltage: 6V to 36V. Decouple to ground with a 2.2uF or higher ceramic capacitor.

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ORDERING INFORMATION

EVALBOARD ORDER NUMBER
AL8807EV3

DEVICE ORDER NUMBER
AL8807MP-13

Please note: Evaluation boards are subject to availability and qualified sales leads.

AL8807EV3 EVALUATION BOARD REFERENCE DESIGN

The AL8807EV3 is configured to the reference design in Figure 2.

The operating voltage is up to 36V. 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.

Both DC and PWM dimming can be achieved by driving the CTRL pin. For DC dimming, the CTRL pin may be driven between 0.5V and 2.5V adjusting the output current from 25% to 100% of I_{LED}.
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 other reference designs or further applications information, please refer to the AL8807 datasheet.

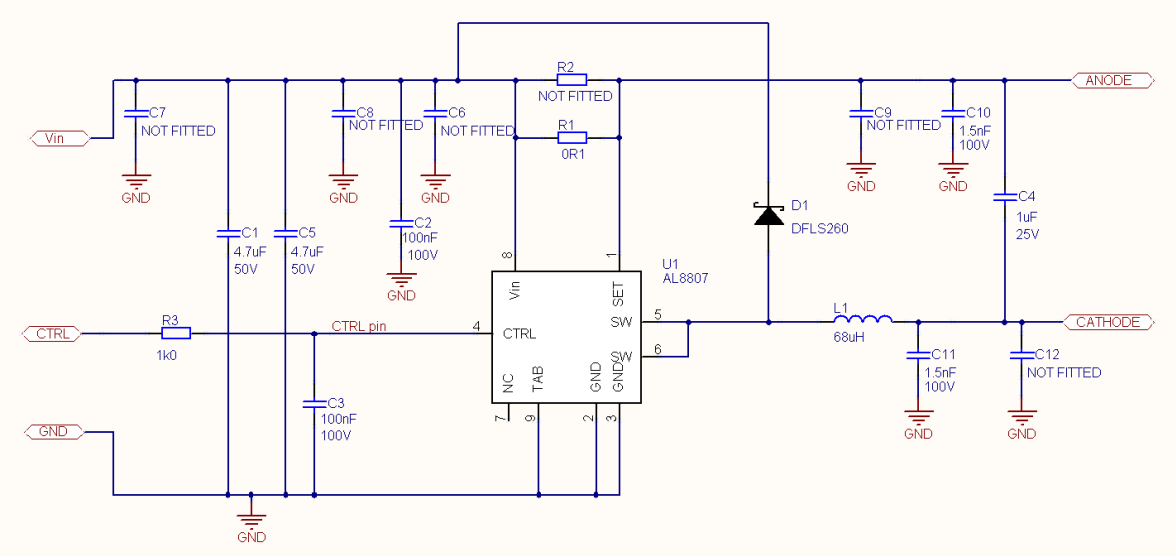


Figure 2: Schematic diagram

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AL8807 Operation

In normal operation, when a voltage is applied at +Vin, the AL8807 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 AL8807 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 AL8807. 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, AL8807 internal circuits, electrical characteristics and parameters.

AL8807EV3 Component list

Ref	Value	Package	Part Number	Manufacturer	Notes
U1	AL8807	MSOP	AL8807MP-13	Diodes Zetex	DC-DC converter
D1	60V, 2A		DFLS260	Diodes Zetex	Schottky diode
R1	0R1	1206		Generic	1% 250mW
R2			NOT FITTED		
R3	1k0	0805	generic	Generic	1% 125mW
C1, C5	4.7uF 50V	1210	C1210X475K5RAC	Generic KEMET	X7R
C2, C3	100nF, 100V	0805	NMC0805X7R104K100 PF GRM21BR71H104KA01L	Generic NIC Comps MURATA	X7R
C4	1uF 100V	1206	NMC1206X7R104K100	Generic NIC Comps	X7R
C6, C7, C8, C9 C12		0805	NOT FITTED	Generic	Fit to improve EMC performance if required
C10, C11	1n5, 100V	0805		Generic	
L1	68uH		MSS1038-683ML NPIS24H680MTRF NPIS104F680MTRF	Coilcraft NIC Comps	

Note: The component part numbers are correct at the time of publication. Diodes Inc reserves the right to substitute other parts where necessary, without further notification.

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AL8807EV3 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 36V
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 :

   $R1 = 0.1V/I_{OUT}$

   where I_{OUT} = 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% .

For further advice, please contact your local Diodes Field Applications Engineer, or one of our sales offices listed on the back page of this document.

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