AL8807EV4 USER GUIDE

Performance

- **12VDC and 12VAC input**
- **1.1A LED current**
- **Drives 1 to 3 LEDs in series**
- **2% current regulation 9V to 30VDC (with 2 LEDs)**
- **Ambient temperature range -40℃ to +105℃**

Ordering Information

Order Number
AL8807EV4

Introduction

This evaluation circuit demonstrates the AL8807 High Efficiency 30V 1.5A Buck LED Driver operating in a circuit providing 1.1A LED current in MR16 form intended to drive 1 to 3 high brightness LEDs in series with a total load voltage drop up to 10V. The circuit includes a 470µF reservoir capacitor to prevent flicker for 50Hz or 60Hz AC input power. EMC filtering is included to meet international standards including the radiated emission requirements of EN55015 and EN55022 Class B.

The switching frequency is approximately 440kHz when driving 2 Osram Dragon Diamond LEDs.

The construction uses a double-sided FR4 printed circuit board, 17 x 20 x 0.8 mm with 2oz/sq ft copper (70µm). Components are mounted on both sides.

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Quick Start Guide

Suitable Test Equipment

Count	Description	Manufacturer	Part Number
1	Adjustable Power Supply, 12V 2A	Thurlby Thandar	CPX400A
2	Digital Multimeter	Fluke	179
1	Digital Storage Oscilloscope	Tektronix	TDS2024B
2	LED, high brightness, "Dragon Diamond", series connected on suitable heat conducting PCB	Osram	

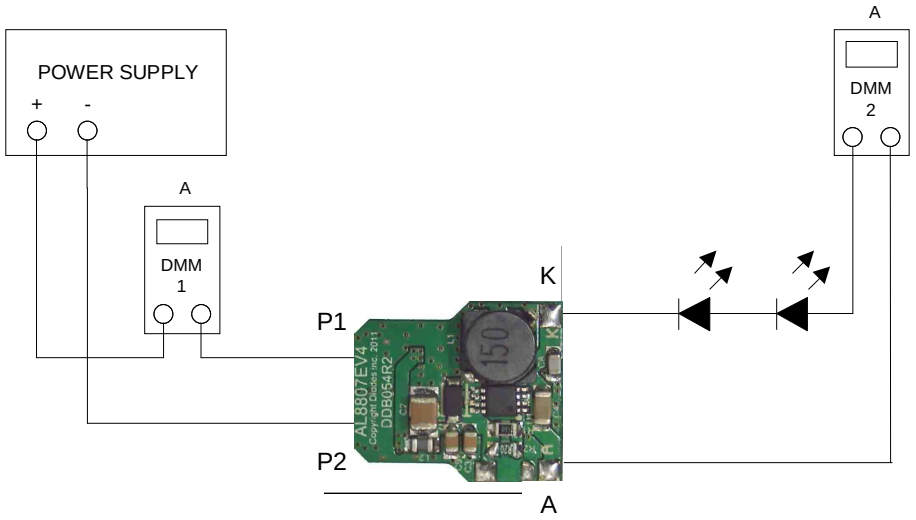
CAUTION: The LEDs are very bright. Ensure they are hidden from direct view, or covered with a dispersing filter. The lid from an aerosol can is convenient for this.

Also the LEDs are very hot. Do not touch!!

Lamp Operation

1. Set the power supply to 12.0V but do not switch on. Set the current limit to 2.0A.
2. Connect up the AL8807EV4 board to the equipment as in **Figure 1** below. Set DMM1 and DMM2 to measure current up to 2A.

Figure 1: Test Schematic using VDC Input



3. Cover the LEDs to avoid dazzling.
4. Switch on the power supply. This should illuminate the LEDs. Note that the input current (DMM1) is approximately 690mA. The output current (DMM2) is approximately 1.12A. The input voltage can be varied from approximately 9VDC to 30VDC and the current regulation observed is typically within ±2%.

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Observe Switching Waveform

5. The switching waveform can be observed on an oscilloscope.
6. Set the oscilloscope as follows:

   Channel 1 sensitivity: 2V/div (at probe tip)
   Time base: 1µs/div
   Trigger Source: CH1
   Trigger Mode: Auto

7. Connect the ground lead of a 10x probe to the supply negative terminal near P2 of the AL8807EV4, and touch the probe tip onto the anode of D1 as in **Figure 2** below. On the oscilloscope, press RUN/STOP to capture the waveform. The cursor readout indicates a switching frequency of 440kHz approximately.

Figure 2:

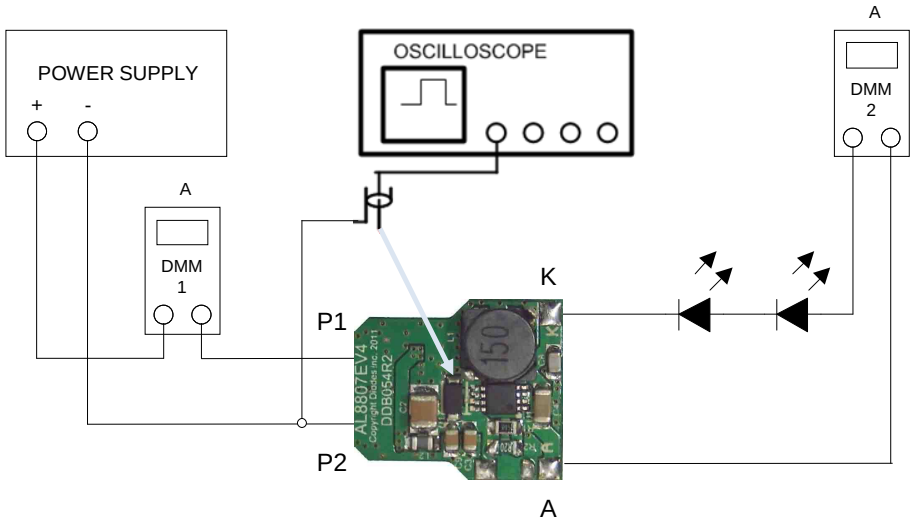
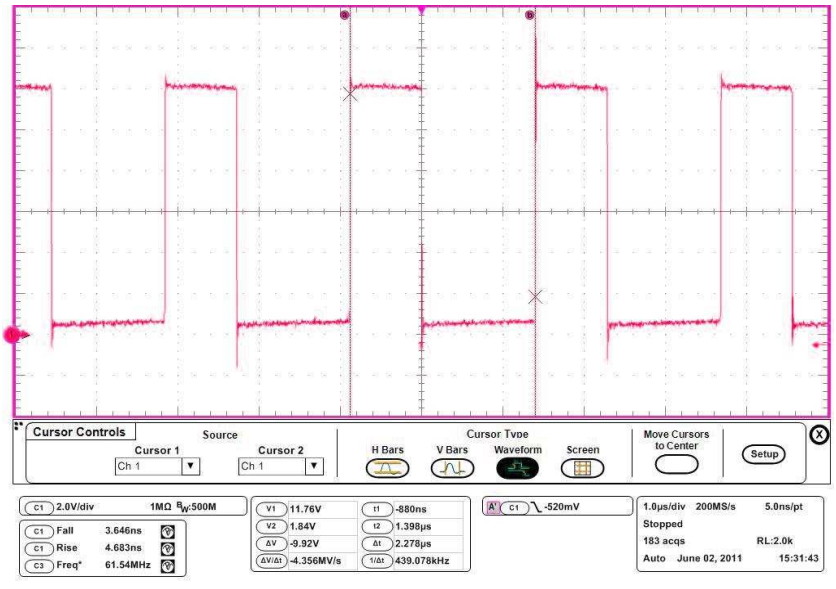


Figure 3: Oscilloscope Waveform



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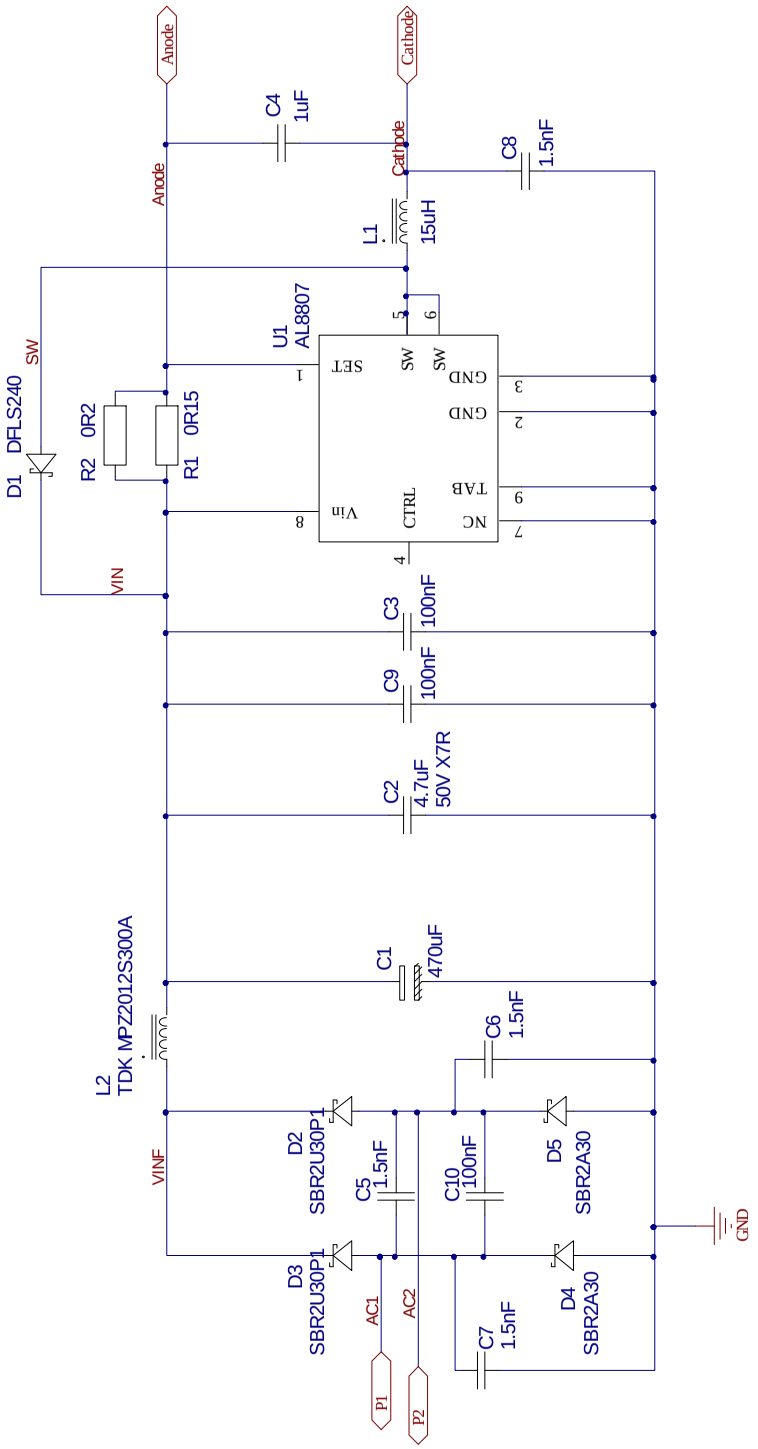
AL8807EV4 Schematic



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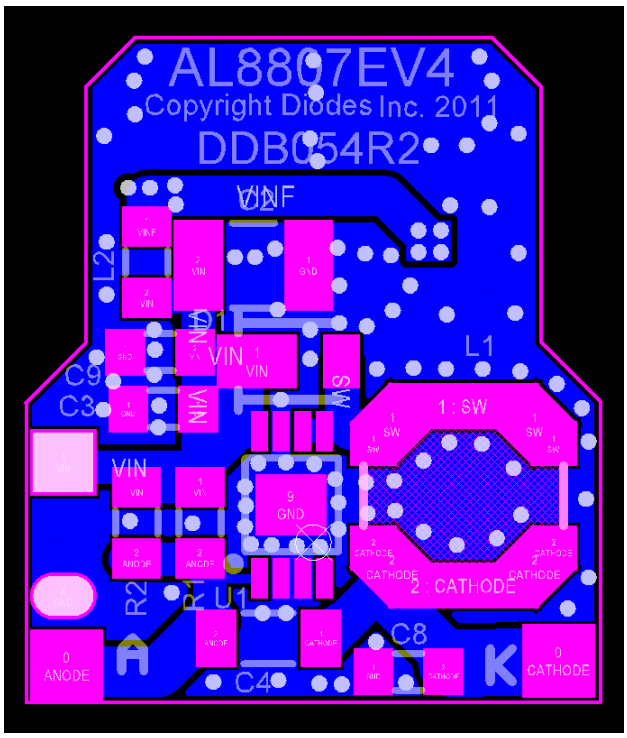
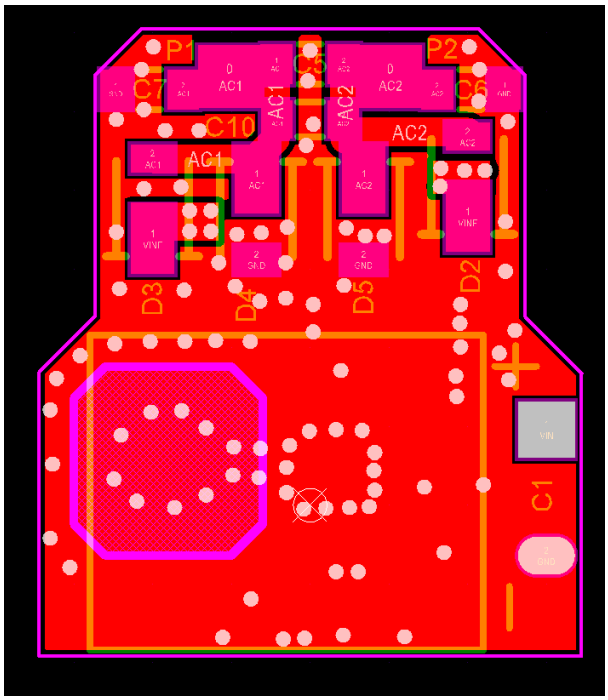
PCB Copper Layout & Silk Screen – Top



PCB Copper Layout & Silk Screen –Bottom



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Parts List

Count	Designator	Description	Package	Manufacturer	Part Number
1	C1	Capacitor, 470uF, 25V Aluminium Electrolytic	Radial, 10 x 12.5mm	Rubycon	25ZLH470M
1	C2	Capacitor, 4.7µF 10% 50V X7R	1210	Kemet	C1210X475K5RAC
3	C3 C9 C10	Capacitor, 100nF 10% 50V X7R	0805	Kemet NIC	C1210X475K5RAC NMC0805X7R104K50TRPF
1	C4	Capacitor, 100nF 10% 50V X7R	1206	Kemet NIC	C1206104K5RAC7800 NMC1206X7R104K50TRPF
4	C5 - C8	Capacitor, 1.5nF 10% 50V or 100V, COG	0805	generic	
1	L1	Inductor, shielded, 15µH 20%	6.6 x 6.6mm	Coilcraft NIC Würth	MSS7341-153ML NPIS64D150MTRF 744777115
1	L2	Inductor, ferrite bead, 6A, 30ohms @100MHz	0805	TDK	MPZ2012S300A
1	R1	Resistor, 0.15ohms 1% 250ppm 125mW	0805	generic	
1	R2	Resistor, 0.2ohms 1% 250ppm 125mW	0805	generic	
1	D1	Diode, schottky, 30V 2A DFLS230 (alternatives: DFLS230L or LH)	PowerDi123	Diodes Inc	DFLS230-7
4	D2 - D5	Diode, Super Barrier Rectifier, 30V 2A SBR2U30	PowerDi123	Diodes Inc	SBR2U30P1-7
1	U1	IC, LED Driver, AL8807	MSOP-8EP	Diodes Inc	AL8807MP8-13

I/O

Count	Designator	Description	Function	Manufacturer	Part Number
1	P1	Solder pad	VDC, VAC Input		
1	P2	Solder pad	VDC, VAC Input		
1	A	Solder pad	LED Anode load		
1	K	Solder pad	LED Cathode load		

Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units
VDC	**Input Supply Voltage, VDC**	**8**	**30**	**V**
VAC	**Input Supply Voltage, VAC**	**8**	**20**	**Vrms**
VOUT	**Load voltage (1 to 3 LEDs)**	**0**	**10**	**V**
T_A	**Operating Ambient Temperature**	**-40**	**+105**	**℃**

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Current Setting

The LED current is set by the sense resistor value, R_{SENSE}. On this PCB, there are two resistors in parallel.

$$R_{SENSE} = R_1 * R_2 / (R_1 + R_2)$$

For the schematic values this gives a resistance of 0.15 * 0.2 (0.15 + 0.2) = 0.0857 ohms.

The LED current flows through R_{SENSE}. The sense voltage is 100mV, so the LED current is simply

$$I_{LED} = 0.1/ R_{SENSE}$$

For the schematic values this gives an LED current of 0.1/0.0857 = 1.167 A nominally. In practice there is a slight reduction in current partly due to the resistance of the PCB copper, depending on the PCB layout. At 1.1A this reduction is typically about 5% using AL8807EV4.

The following table gives commercially available resistor values for typical current requirements, allowing a current error of 3% maximum not including the effect of PCB copper. A power limit of 125mW is assumed for the 0805 size resistors with 50% de-rating.

LED Current	R1, ohms	R2, ohms
150mA	0.68	DO NOT FIT
300mA	0.33	DO NOT FIT
380mA	0.51	DO NOT FIT
500mA	0.2	DO NOT FIT
660mA	0.15	DO NOT FIT
1A	0.2	0.2
1.1A	0.15	0.2

Performance

The performance of the AL8807EV4 demonstrated shows the capability to regulate LED current. The LED current of 1.1A is approximately 5% lower than the calculated value. This is partly due to copper resistance. With a load of 2 LEDs, the current changes by less than ±2% over the input voltage range from 9VDC to 30VDC. With 2 LEDs and a supply of 12VDC, the switching frequency is approximately 440kHz.

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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