



Applications Report

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Issue: 1

Project number: AL8806 User guide

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Title: AL8806 preliminary Evaluation Board for MR16 user guide

AL8806 DESCRIPTION

AL8806EV2 is an evaluation board showing the application of the Diodes Incorporated AL8806 LED driver device on a board suitable for use in an MR16 lamp.

The board has four main connections: two power inputs P1 and P2, and two LED connections Anode (A) and Cathode (C). The evaluation board is preset to drive 1300mA into two LEDs.

The operating voltage is nominally 12VAC or DC. The 10uH inductor used in the circuit is based on this nominal supply, which should be connected across the P1 and P2 pins.

Note: The input bridge rectifier provides the board with reverse battery protection.

The nominal current, 1300mA, is set with the 0R075 sense resistors, R1 and R2 in parallel.

The CTRL Terminal is not used in this application.

Warning: At 12V nominal operation with 1300mA output, the LED will be hot and very bright

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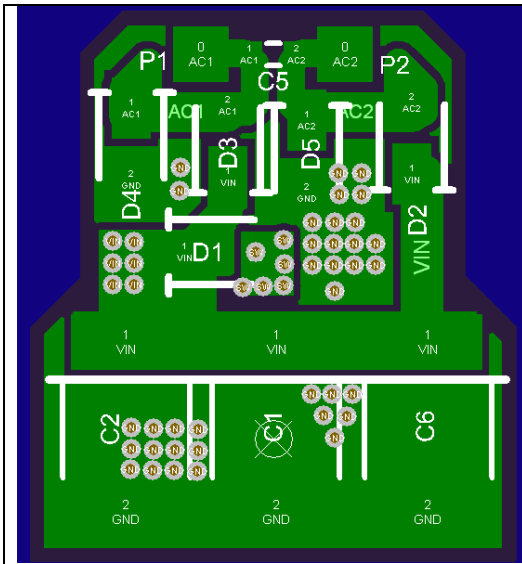


Figure 1: Top Layer

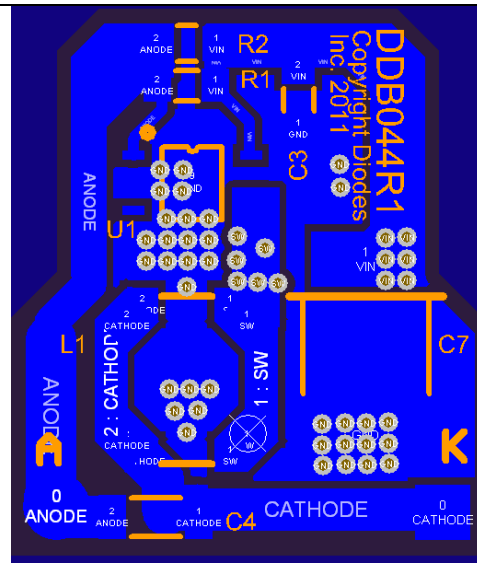


Figure 2: Bottom Layer

AL8806 DEVICE DESCRIPTION

The AL8806 is a continuous mode inductive driver in a MSOP8 EP 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 1500mA.

AL8806 DEVICE FEATURES

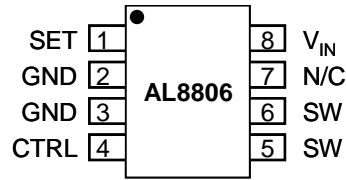
- Drives one or more series-connected LEDs
- LEDs up to 1500mA.
- Internal 30V switch.
- Wide input voltage: 6V to 30V.
- Inherent open circuit LED protection.
- Brightness control using DC or PWM.

DEVICE APPLICATIONS

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

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AL8806 Device Packages, Pin and Definitions



MSOP8 EP

AL8806 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) : <ul style="list-style-type: none"> • 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 signal to Adjust output current
SET	4	Connect a sense resistor, R_s , from the SET pin to V_{IN} to sense the nominal output current. Nominal $I_{out} = 0.1 / R_1$
VIN	5	Input voltage: 6V to 30V. Decouple to ground with a 4.7uF or higher ceramic capacitor.

ORDERING INFORMATION

EVALBOARD ORDER NUMBER
AL8806EV2

DEVICE ORDER NUMBER
AL8806E5TA

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

AL8806EV2 Circuit description

P1 and P2 are the power input pads, feeding into the bridge rectifier, comprising of D2, D3, D4 and D5. C5 offers an optional EMI filtering at the input pads.

C1 and C2 form the bulk reservoir capacitance, used to sustain operation of the device during the low part of the AC wave. In the case of a system driving two LED, four capacitors of 150uF is needed.

C3 provides local decoupling for the AL8806 device U1. It is important that this is as close as possible to U1, as reflected in the layout.

R1 and R2 set the LED current, in this case to 1300mA.

C4 decouples the LED connections, again to minimise EMI, as well as smoothing the current.

L1 smoothes the switching at LX into a DC current for the LED string. D1 operates as the freewheeling diode, preventing large voltage spikes at LX.

AL8806 Operation

In normal operation, when voltage is applied at +Vin, the AL8806 internal NDMOS switch is turned on. Current starts to flow through sense resistor, inductor L1, and the LED. The current ramps up linearly, and the ramp rate is determined by the input voltage +Vin and the inductor L1. This rising current produces a voltage ramp across the sense resistor. The internal circuit of the AL8806 senses the voltage across R1||R2 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||R2, 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||R2, which is sensed by the AL8806. A voltage proportional to the sense voltage across R1||R2 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||R2. Please refer to the datasheets for the threshold limits, AL8806 internal circuits, electrical characteristics and parameters.

AL8806EV2 Component list

<u>QUANTITY</u>	<u>PCB IDENT</u>	<u>VALUE</u>	<u>DESCRIPTION</u>
1	U1	AL8806	Diodes Zetex LED Driver IC
5	D1, D2, D3, D4, D5	DFLS230HL	Diodes Zetex freewheeling diode and bridge
2	R1, R2	0R15	Resistor, 0805, +/-1% <+/-300ppm Generic KOA SR732ATTDR150F
4	C1, C2, C6, C7	150uF 20v	SMD tantalum Kemet D case, T491X157K020AT
1	C3	100nF >=25v	X7R 0805 Generic Kemet C0805C104K5RAC (50v) NIC NMC0805X7R104K50TRPF (50v)
1	C4	100nF >=25v	X7R 1206 Generic
1	C5	100nF >=25v	X7R 0603 Generic
0	C6		NOT FITTED
1	L1	10uH	MSS7341- 103ML

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.

AL8806EV2 Basic operation at full voltage

1. Connect P1 and P2 to the power supply
2. Set the PSU to 12VAC or 12VDC

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3. Turn on the PSU and the LED will illuminate and the current should be approximately 1300mA.
Warning: Do not stare at the LED directly.

Changing the LED current

1. Remove R1||R2.
2. Calculate and fit a new 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.

An on-line Calculator is available to speed up the design process at:

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

PERFORMANCE

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

With a 12VDC supply, the switching frequency is typically 600kHz, and the efficiency level is >80% .

For further advice, please contact our local FAE or contact our local sales offices as listed below.

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Performances

VIN	Power IN	VLED	ILED	Temp AL8806	Temp Inductor	T Bridge	Efficiency	PFC
12 DC	9.84W	6.69	1.27A	82.3	77.8	86C	86.3%	NA
12 Ac	10.2W	6.7V	1.26A	89.5C	78C	91.5C	82%	0.614

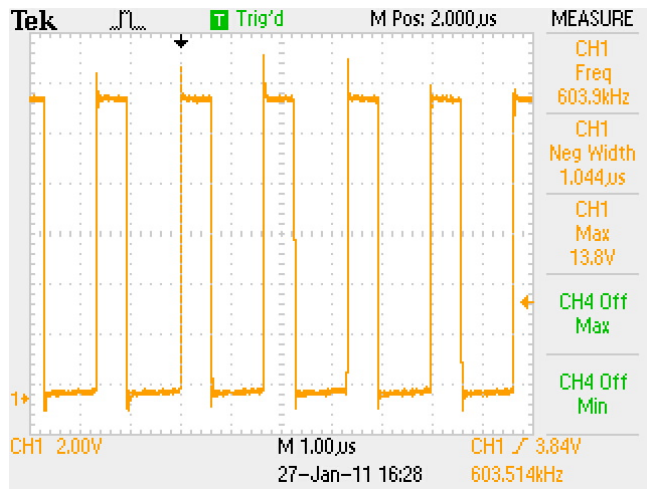


Figure 4: Switching waveform with VIN=12V DC

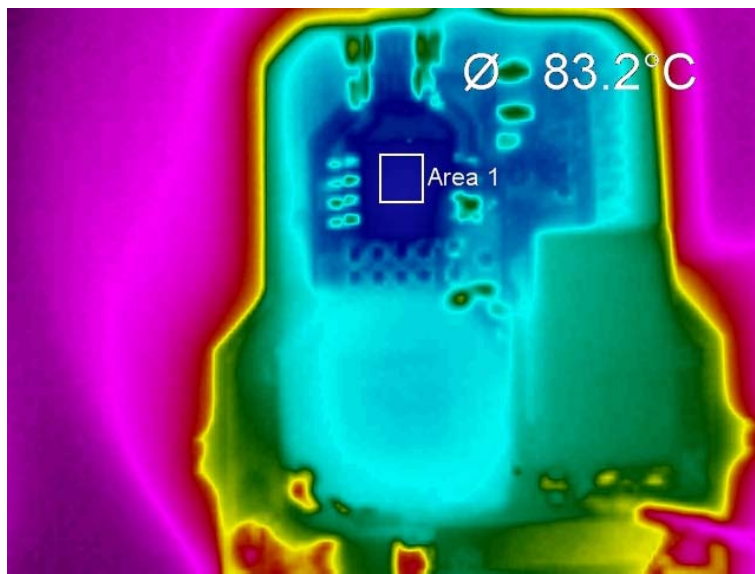


Figure 5: AL8806 surface temperature with VIN=12VDC

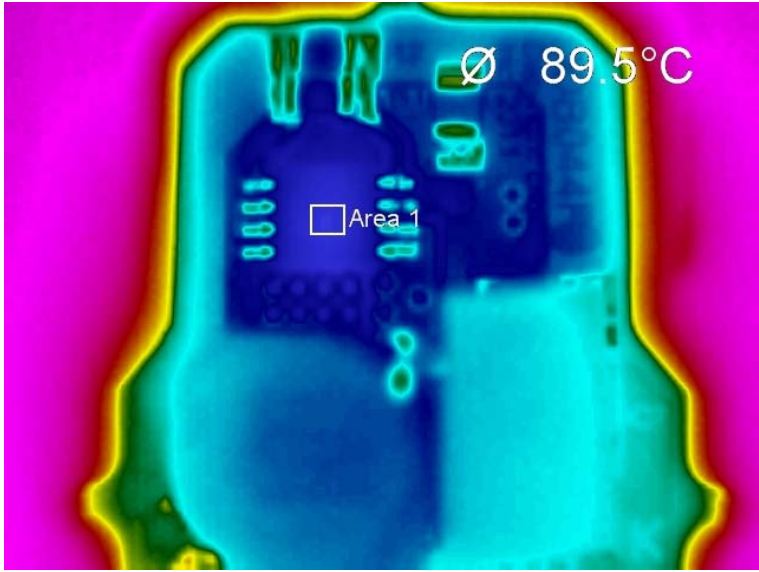


Figure 6: AL8806 surface temperature with VIN=12VAc

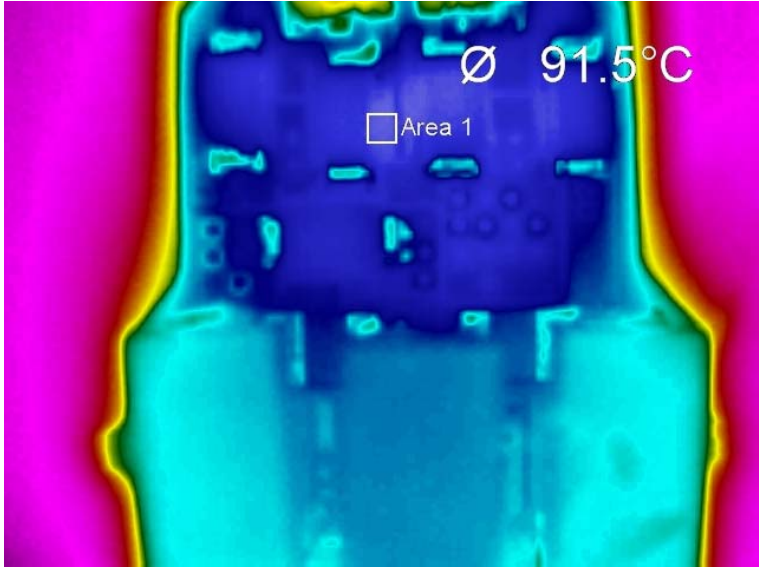


Figure 7: Bridge rectifier and freewheeling diode surface temperature with VIN=12VDAC

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