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AL8805EV1 EVALUATION BOARD USER GUIDE

DESCRIPTION

The AL8805EV1, Figure 1, is a double sided evaluation board for the AL8805 LED driver with internal switch. The evaluation board is preset to drive 680mA into a single LED, or multiple LEDs, the maximum number of which depends on their total forward voltage drop. (The maximum drive current of the AL8805 is 1000mA)

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 nominal voltage must be connected across the +Vin and GND pins.

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

The nominal current, 680mA, is set with the 0R15 sense resistor, R1.

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

Warning: At 30V nominal operation with 680mA output, the LED will be hot and very bright

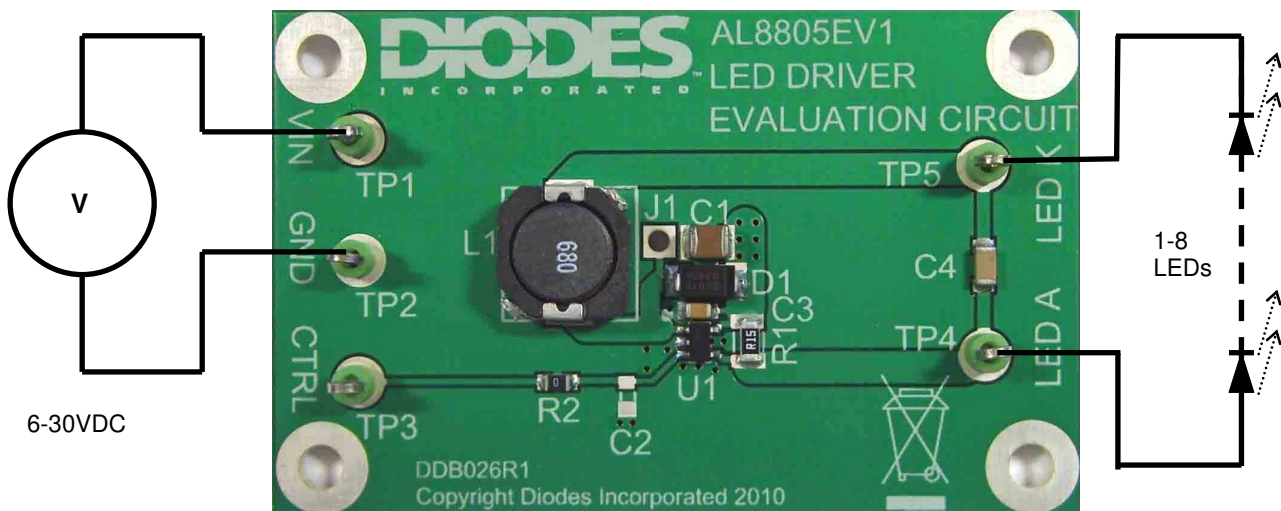


Figure 1: AL8805EV1 evaluation board and connection diagram

| AL8805EV1 Connection Point Definition | |
|---------------------------------------|--|
| Name | Description |
| Vin | Positive supply voltage. 6 to 30V |
| 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 |

AL8805 DEVICE DESCRIPTION

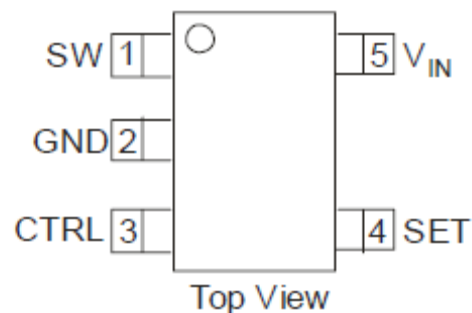
The AL8805 is a continuous mode inductive driver in a SOT25 package, for driving one or more series-connected LEDs efficiently from a voltage source higher than the LED voltage. The device includes the output switch and a current sense circuit, which requires an external sense resistor to set the nominal current up to 1000mA.

AL8805 DEVICE FEATURES

- Drives one or more series-connected LEDs
- LEDs up to 1000mA.
- Internal 30V switch.
- Wide input voltage: 6V to 30V.
- 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.

AL8805 Device Packages, Pin and Definitions**SOT25 pack****AL8805 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 (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 30V. Decouple to ground with a 2.2uF or higher ceramic capacitor. |

ORDERING INFORMATION

| EVALBOARD ORDER NUMBER |
|------------------------|
| AL8805EV1 |

| DEVICE ORDER NUMBER |
|---------------------|
| AL8805E5TA |

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

AL8805EV1 EVALUATION BOARD REFERENCE DESIGN

The AL8805EV1 is configured to the reference design in Figure 2.

The operating voltage is a nominal 30V. The nominal current is set at 680mA with a 0R15 sense resistor R1. The circuit operates in continuous mode at approximately 188kHz, with a 68uH inductor and one LED.

An accurate way of determining the current is to measure the voltage on the sense resistor. A 10K resistor and a 1uF capacitor can be used to form a low pass filter; the voltage across the capacitor representing a more stable DC reading of current. 100mV represents 1 Amp when using a 0R1 sense resistor.

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 $\leq 0.4V$ and high level $> 2.5V$) 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 AL8805 datasheet.

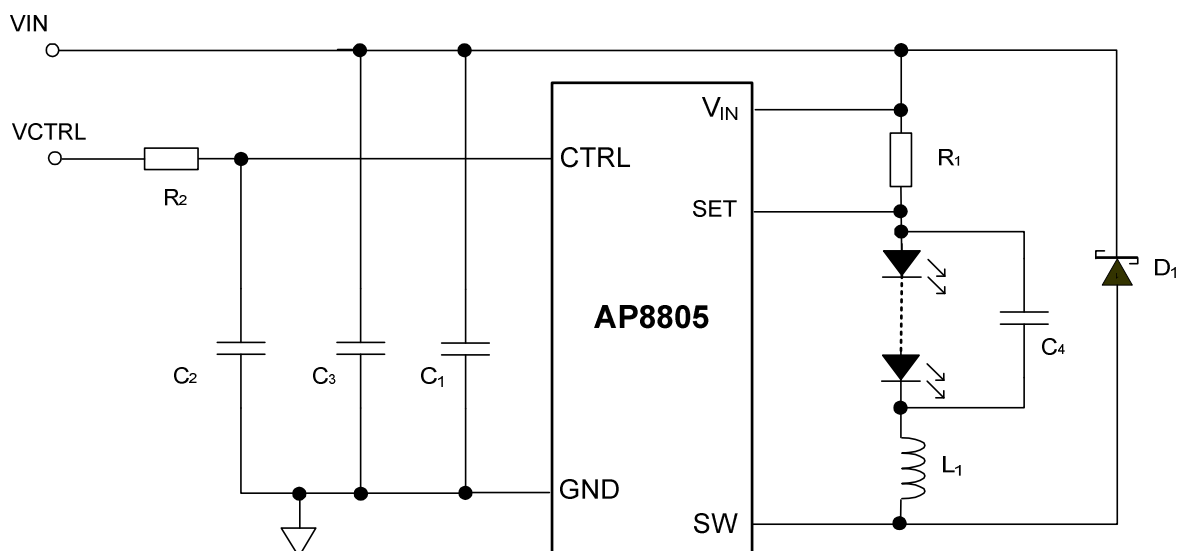


Figure 2: Schematic diagram

AL8805 Operation

In normal operation, when voltage is applied at +Vin, the AL8805 internal NDMOS switch is turned on. Current starts to flow through sense resistor R1, 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 R1. The internal circuit of the AL8805 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 AL8805. 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, AL8805 internal circuits, electrical characteristics and parameters.

AL8805EV1 Component list

| Ref | Value | Package | Part Number | Manufacturer | Notes |
|-----|-------------|---------|--|--------------------------------|-------------------------------|
| U1 | AL8805 | SOT25 | AL8805E5TA | Diodes Zetex | DC-DC converter |
| D1 | 40V, 3A | | B240A | Diodes Zetex | Schottky diode |
| R1 | 0R15 | 0805 | | Generic | 5% |
| R2, | 1K | 0805 | | Generic | 1% |
| C1 | 4.7uF 50V | 1210 | C1210X475K5RAC | Generic KEMET | X7R |
| C2 | Not Fitted | | | | Optional soft start capacitor |
| C3 | 100nF, 100V | 0805 | NMC0805X7R104K100 PF GRM21BR71H104KA01L | Generic NIC Comps MURATA | X7R |
| C4 | 100nF 100V | 1206 | NMC1206X7R104K100 | Generic NIC Comps | X7R |
| L1 | 68uH | | MSS1038-683ML NPIS24H680MTRF | 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.

AL8805EV1 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 :

$$R1 = 0.1V/I_{OUT}$$

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 30V supply and one LED, the switching frequency is typically 188kHz.

The efficiency level is >85% .

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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