ZXLD1360EV2

ZXLD1360EV2 EVALUATION BOARD USER GUIDE

DESCRIPTION

The ZXLD1360EV2, Figure 1, is an evaluation board for evaluating the ZXLD1360 1000mA LED driver with internal switch. The evaluation board can be used to drive a 1 amp LED, or an external choice of LEDs. The number of external connected LEDs depends on the forward voltage of the LEDs connected. A 6 way connector is provided, to allow an external 0.1 inch connecter to be inserted.
The LED fitted on this evaluation board is the Ostar range produced by Osram.

The operating voltage is nominally 30V for the 6 led Ostar, but can be reduced for the 4 led version. The 33uH inductor used in the circuit is based on this nominal supply, which should be connected across +VIN and GND pins. Note: The evaluation board does not have reverse battery protection. The nominal current for the evaluation board is set at 1000mA with a 0.1Ω sense resistor, R1.

Alternative LEDs can be connected using the terminal marked LEDA and LEDK but the onboard led should be disconnected first by clipping the wires to the heatsink mounted Ostar.

Test point ADJ provides a connection point for DC or PWM dimming and shutdown.

Warning: At 30V nominal operation with 1000mA output, the LED will be hot and very bright

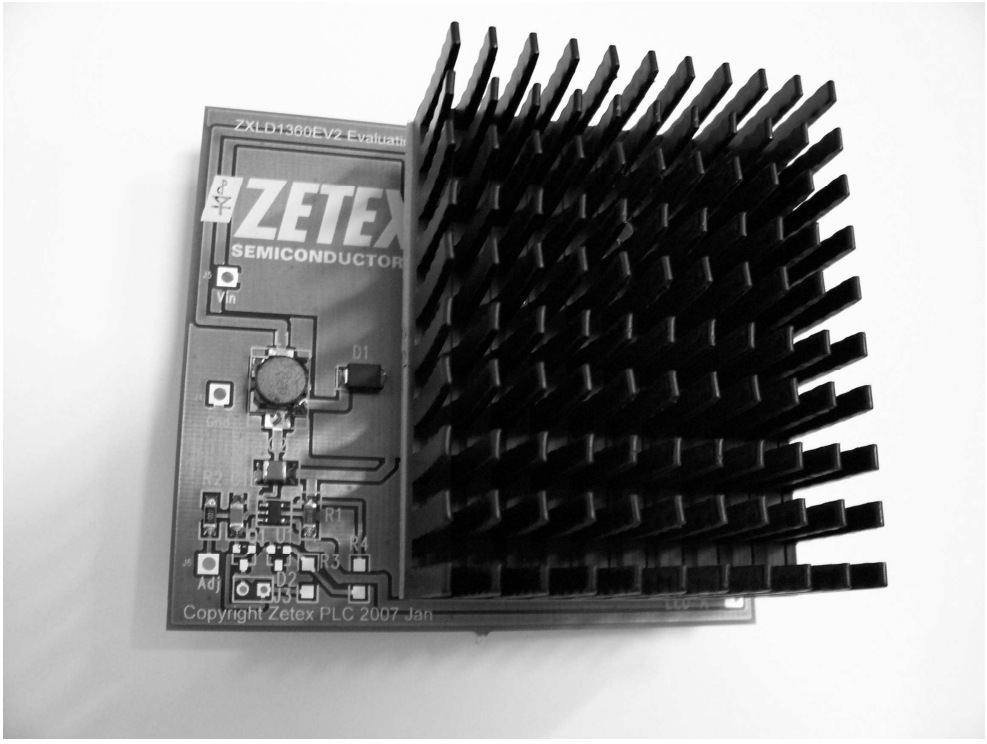


Figure 1: ZXLD1360EV2 evaluation board

ZXLD1360EV2

ZXLD1360 DEVICE DESCRIPTION

The ZXLD1360 is a continuous mode inductive driver in a TSOT23-5 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.

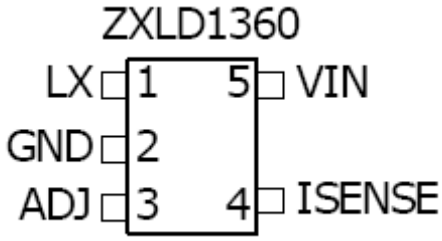
ZXLD1360 DEVICE FEATURES

- Drives one or more series-connected LEDs
- LEDs up to 1000mA.
- Internal 30V switch.
- Wide input voltage: 7V to 30V.
- Inherent open circuit LED protection.
- Brightness control using DC or PWM.
- Internal PWM filter.

DEVICE APPLICATIONS

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

ZXLD1360 Device Packages, Pin and Definitions



TSOT23-5 pack

ZXLD1360 Device Pin Definition

Name	Pin No	Description
LX	1	Drain of NDMOS switch.
GND	2	Ground (0V).
ADJ	3	Internal voltage ref. pin (1.25V) : • Leave floating for normal operation. • Connect to GND to turn off output current. • Drive with DC voltage (0.3V to 1.25V) or with PWM signal to adjust output current or.... • Connect a capacitor from this pin to ground to set soft-start time.
ISENSE	4	Connect a sense resistor, Rs, from the ADJ pin to VIN to sense the nominal output current. Nominal I_{out} = 0.1/ R1
VIN	5	Input voltage: 7V to 30V. Decouple to ground with a 4U7F or higher ceramic capacitor.

ORDERING INFORMATION

EVALBOARD ORDER NUMBER
ZXLD1360EV2

DEVICE ORDER NUMBER
ZXLD1360E5TA

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

ZXLD1360EV2 EVALUATION BOARD
REFERENCE DESIGN

The ZXLD1360EV2 is configured to the reference design in Figure 2. The target application is a driver for one Ostar series-connected 24W white LEDs for torches and other high powered LEDs .

The operating voltage is a nominal 30V The nominal current is set at 1000mA with a 0.1Ω sense resistor, R1 and the operates in continuous mode at 200kHz approximately , with a 33uH inductor.

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 and the voltage across the capacitor represents a more stable dc reading of current . 100mV represents 1 Amp when using a 0.1Ω sense resistor.

The ADJ pin has a low pass filter within the 1360 chip to provide some decoupling and soft a start but the external capacitor C1 (100nF) is used to provide additional decoupling to reduce any high frequency noise as well as providing an extra amount of soft start .
Both DC and PWM dimming can be achieved by driving the ADJ pin. For DC dimming, the ADJ pin may be driven between 0.3V and 1.25V. Driving the ADJ pin below 0.2V will shutdown the output current. For PWM dimming, an external open-collector NPN transistor or open-drain N-channel MOSFET can be used to drive the ADJ pin. The PWM frequency can be low, around 100Hz to 1kHz, or high between 10kHz to 50kHz.
For low frequency PWM C1 should be removed on the evaluation board to give a more accurate duty cycle .
Shorting R2 will connect the test pin ADJ to device pin ADJ if needed.
The soft-start time will be nominally 0.5ms without capacitor C1. Adding C1 will increase the soft start time by approximately 0.5ms/nF

For other reference designs or further applications information, please refer to the ZXLD1360 datasheet.

Schematic Diagram

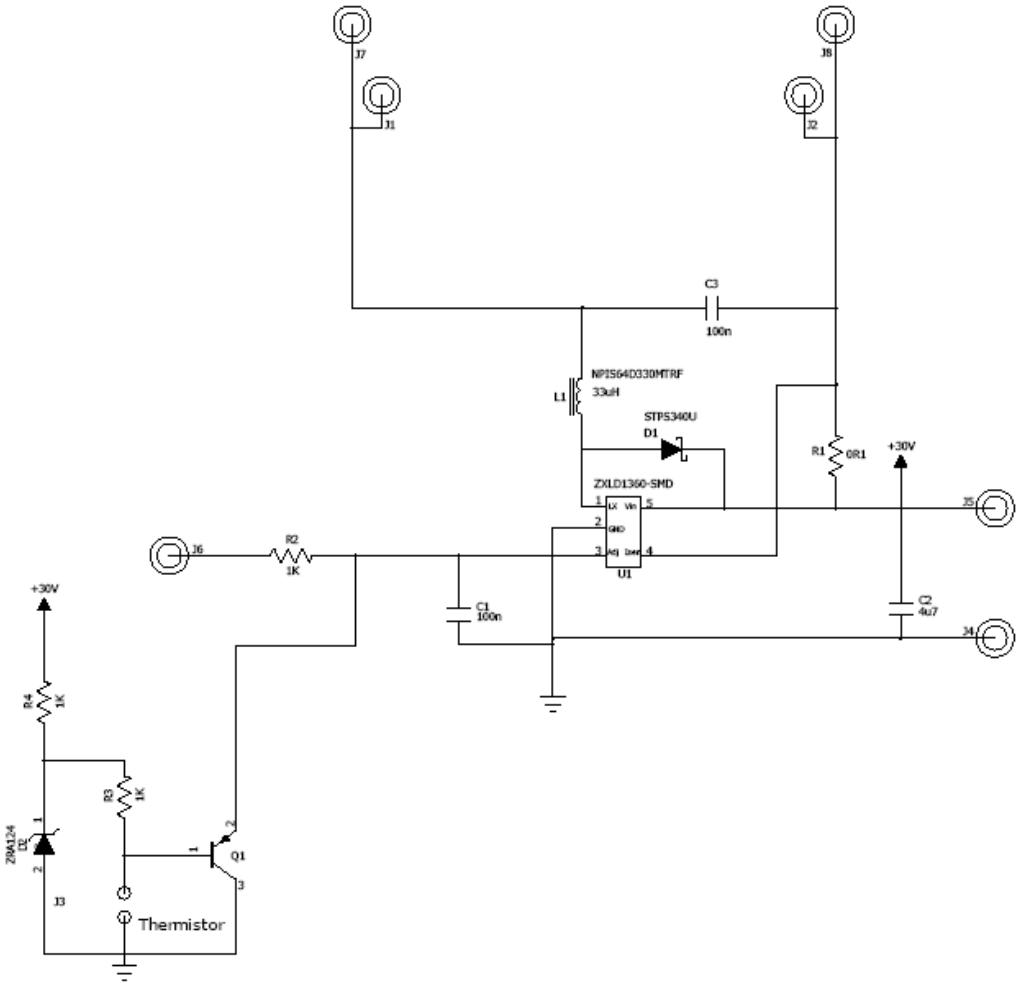


Figure 2: Schematic for the evaluation board ZXLD1360EV2

ZXLD1360 Operation

In normal operation, when voltage is applied at +VIN, the ZXLD1360 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 ZXLD1360 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 ZXLD1360. 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, ZXLD1360 internal circuits, electrical characteristics and parameters.

ZXLD1360EV2 Evaluation Board.

Ref	Value	Package	Part Number	Manufacturer	Notes
R1	0.1R	1206	LR12060R1F	WELWYN	1%,200ppm
C2	4u7F 50V	1210	GRM32ER71H475KA88B	MURATA	
C1	100nF, 50V	1206	C1206C104K5RAC	KEMET	
C3	100nF,50V	1206	C1206C104K5RAC	KEMET	
L1	33uH		NPIS64D330MTRF	NIC	33uH/1.1A rms
D1	40V, 3A	DO-214	STPS340U	ST	Schottky diode
U1	ZXLD1360	TSOT23-5	ZXLD1360E5TA	Zetex	DC-DC converter
LED1	LED		Ostar	Osram	power LED
	6 way 0.1		M20-7890646	Harwin	

The metal underside of the LED is connected to isolated copper plane the top and bottom layers with thermal inter-connection between the layers. This metal is electrically isolated from other circuits and pads on the evaluation board. **Warning: At 30V operation with 1000mA output, the heatsink temperature rises to 80℃ from ambient after 30 minutes of operation.**

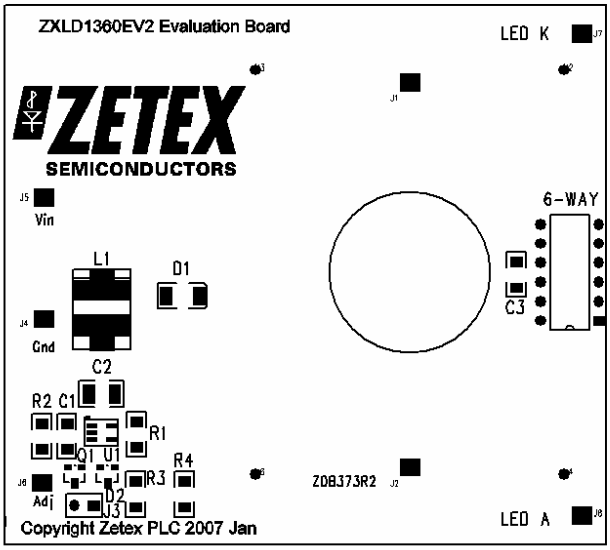


Figure 3: Component layout

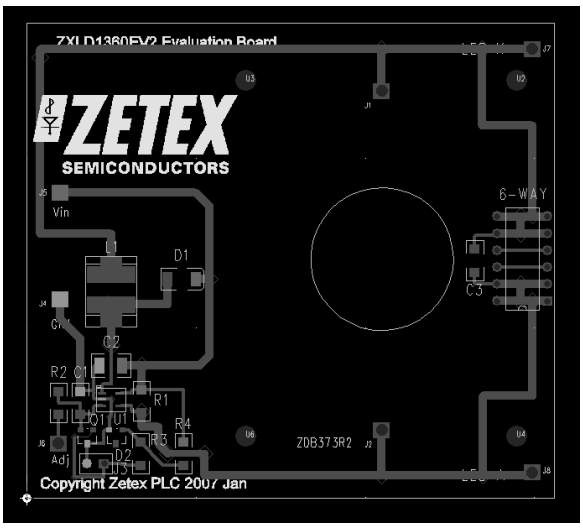


Figure 4: Top View

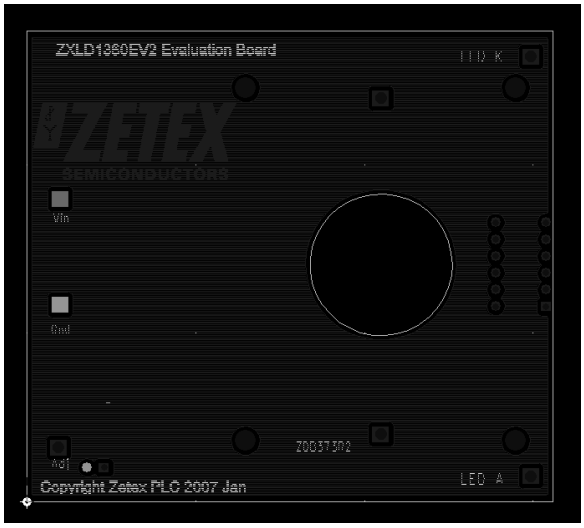


Figure 5: Bottom View

ZXLD1360EV2 Connection Point Definition	
Name	**Description**
+VIN	Positive supply voltage.
GND	Supply Ground (0V).
ADJ	Internal voltage ref. pin (1.25). This pin can be used to achieve dimming and soft-start, and for switching the output current off. • Leave floating for normal operation. • See 'Other Features' section to achieve dimming, and soft-start and for switching the output current off.
LED a	LED a connects to the ANODE of LED1, and is the external LED anode connection point. Disconnect the jumper JP1 when driving an external load.
LED k	LED k connects to the CATHODE of LED1, and is the external LED cathode

ZXDL1360EV2 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 1000mA.
   Warning: Do not stare at the LED directly.

Circuit features (remember to remove power whilst changing components)
Soft-start

1. Fit a capacitor at C1to alter the risetime of the adjust pin at startup. The output impedance is 200K so CxR is the time constant to reach 66% of output current

Switching the output current off

1. Short the ADJ pin to GND and the LED current will go to zero. Releasing this pin will create a softstart powerup sequence.

Changing the LED current

1. Remove R1.
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 ADJ open circuit or set to 1.25V.

Using external LEDs or loads

1. Switch off the power supply.
2. Connect external LEDs across test pins ‘LED a’ and ‘LED k’. ‘LED a’ is the LEDs' anode connection point and ‘LED k’ is the LEDs' cathode connection point. The number of external LEDs that can be connected depends on their operating power and forward voltage drop. For an external load other than LEDs, the positive terminal of the load should be connected to test pin ‘LED a’ and the negative terminal of the load should be connected to test pin ‘LED k’.

PERFORMANCE

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

With a 30V supply and a single LED , the switching frequency is typically 200kHz and efficiency levels >85% are typical.

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