

Designed and produced by Diodes Zetex Applications team, Oldham, UK

ZXLD1370EV3 EVALUATION BOARD USER GUIDE

9 AMP HIGH CURRENT BUCK LED DRIVER APPLICATION

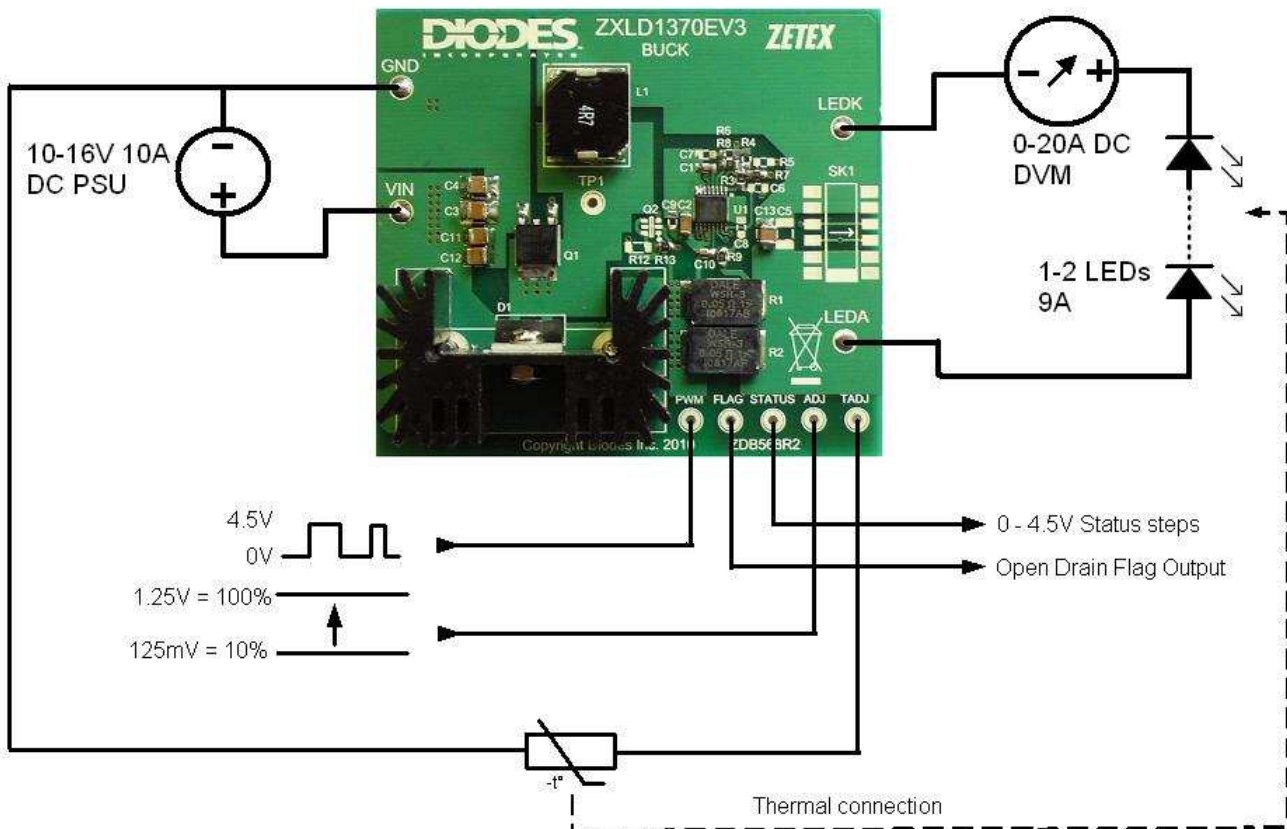


Fig. 1 ZXLD1370EV3 Evaluation board connection diagram

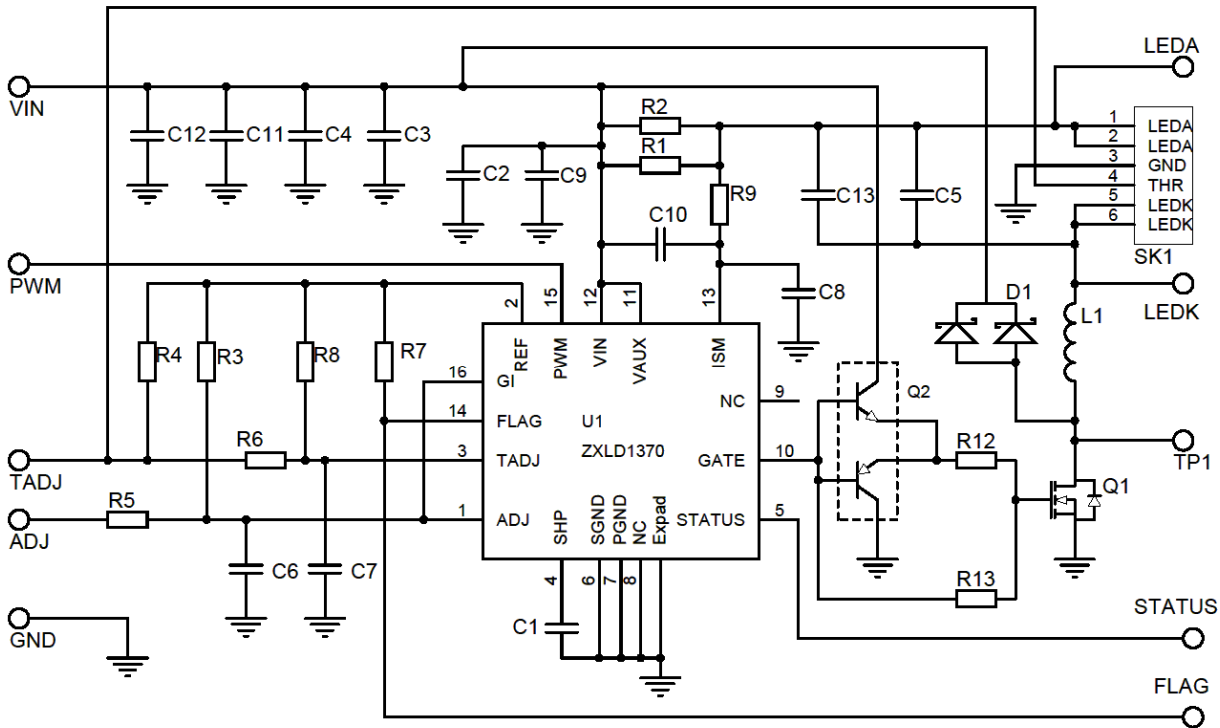


Fig. 2 ZXLD1370EV3 Schematic Diagram

PARTS LIST

| Ref | Value | Package | Part Number | Manufacturer | Contact Details |
|----------------------|-------------------------------|---------------|------------------------------|---------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| U1 | LED Driver Controller | TSSOP16L - EP | ZXLD1370 | Diodes | www.diodes.com |
| Q1 | 30V Nch 20A MOSFET | DPAK | DMN3020LK3 | Diodes | www.diodes.com |
| Q2 | NOT FITTED | | | | |
| D1 | Freewheeling diode 20A X2 45V | TO220 | MBR2045CTP | Diodes | www.diodes.com |
| L1 | 4.7uH 15A | | SRP1270-4R7M 7443551470 | Bourns Würth | www.bourns.com www.we-online.com www.murata.com |
| C1 | 100pF 50V X7R | 0805 | Generic | | www.murata.com |
| C2 | 4.7uF 25V X7R | 1206 | GRM31CR71E475K A88L | Murata | www.murata.com |
| C3 C4 C11 C12 C13 | 10uF 25V X7R | 1210 | GCM32ER71E106K A57L | Murata | www.murata.com |
| C5 C6 C7 C8 C9 | NOT FITTED | | | | |
| C10 | 10nF 50V X7R | 0805 | Generic | | www.murata.com |
| R1 R2 | 0R05 1% | 4527 | WSR3R0500FEA WSR2R0500FEA | Vishay Vishay | www.vishay.com www.vishay.com |
| R3 R8 | 0R | 0805 | Generic | | |
| R7 | 47K 1% | 0805 | Generic | | |
| R9 | 33R 1% | 0805 | Generic | | |
| R4 R5 R6 R12 | NOT FITTED | 1206 | | | |
| R13 | 5R6 1% | 0805 | Generic | | |
| HS1 | Heatsnk for D1 | | 6396BG | AVVID Thermalloy | |

NOTES

The PCB is supplied with R3 and R8 0R0 resistors fitted.

The 'ADJ' pin and the 'TADJ' pin are disabled.

The LED current of the ZXLD1370EV3 boards = 9A with $2x // 0R05 = 0R025$ (R1 & R2)

For other reference designs or more applications information, please see the ZXLD1370 datasheet.

DESCRIPTION

ZXLD1370EV3 is designed for LED Lighting applications which require a very high LED current such as LED projectors, entertainment lighting, emergency vehicle lighting etc. The LED current of this evaluation board is set at 9A with the input voltage ranging from 10V up to 18V.

OPERATION

In buck mode, the LED current is sensed by the resistor (R1 // R2). The 'GI' output drives the input of a comparator, and the 'ADJ'. 'GATE' drives the gate of the external NMOS switch transistor through the chip. When the NMOS switch is on, current flows from 'VIN', through (R1 // R2), the LED, the inductor and the switch to ground, and increases until a high value is reached. Then, 'GATE' goes low, the switch turns off and the current flows through (R1 // R2), the LED, the inductor and D1, back to 'VIN'. When the inductor current has gone low, 'GATE' goes high, the switch turns on, and the cycle repeats. The circuit oscillates. The average current in the LED equals the average of the maximum and minimum threshold currents. The ripple current (hysteresis) is equal to the difference between the thresholds. The control loop keeps the average LED current at the level set by the voltage on the 'ADJ' pin. Loop compensation is achieved by C1.

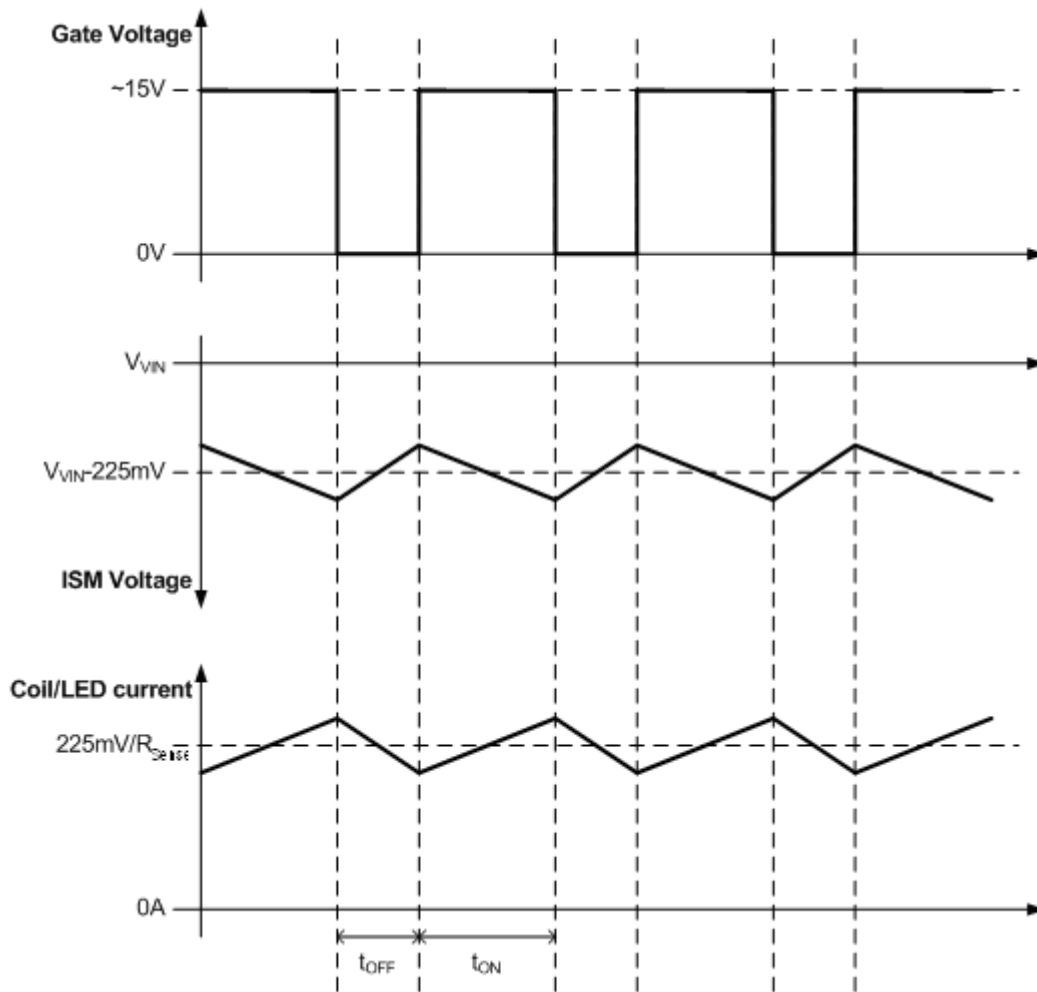


Fig. 3 Waveforms

ADJ Terminal (DC output current adjustment)

On the ZXLD1370EV3, R3 connects the 'ADJ' pin to 'V_{REF}' to give 100% LED current. The 'ADJ' pin can be driven with an external DC voltage $\geq 125\text{mV}$ and $\leq 2.5\text{V}$ to adjust the LED current to $\geq 10\%$ and $\leq 200\%$ of the nominal value. To do this, remove R3, fit R5 and apply an external DC voltage between 'ADJIN' and 'GND'.

The voltage 'V_{ADJ}' can be derived from a resistor-divider connected between 'REF' and 'GND'.

'ADJ' has a high impedance within its normal operating voltage range. An internal 2.6V clamp protects the device against high input voltages and limits the maximum output current to about 4% above the maximum current set by 'V_{ADJ}' if the maximum input voltage is exceeded.

PWM Terminal (PWM output current control/dimming)

The LED current can be adjusted digitally, by applying a low frequency PWM logic signal to the 'PWM' pin to turn the controller on and off. This will produce an average output current proportional to the duty cycle of the control signal. During PWM operation, the device remains powered-up and only the output is switched by the control signal.

The device can be shut down by taking the 'PWM' pin to $< 0.4\text{V}$ with a short to 0V or via a suitable open collector NPN, or open drain NMOS transistor, for $> 15\text{ms}$. In shutdown, most of the circuitry inside the device is off and the quiescent current will be typically $90\mu\text{A}$.

TADJ Terminal (Thermal control of LED current)

The Thermal control circuit monitors the voltage on the 'TADJ' pin and reduces the output current linearly if the voltage on 'TADJ' $< 625\text{mV}$. An NTC thermistor and resistor can be connected to set the voltage on the 'TADJ' pin = 625mV at the required threshold temperature. This will give 100% LED current below the threshold temperature and $< 100\%$ current above it as shown in the graph. The temperature threshold can be changed by adjusting the value of R_{th} and/or the thermistor to suit the LED used.

On the ZXLD1370EV3, R_{th} is 1K3 (R4). To use Thermal control, remove R8, fit R6, and fit a 10K NTC (Negative Temperature Coefficient) type thermistor between 'TADJ' and 'GND'. This will set the threshold temperature to $\sim 90^\circ\text{C}$.

Thermal control by LED current reduction

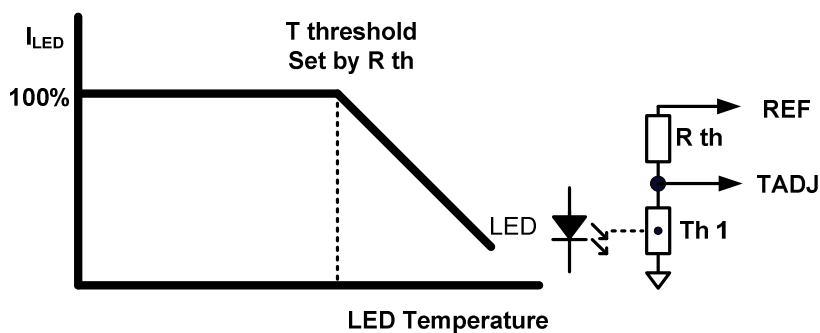
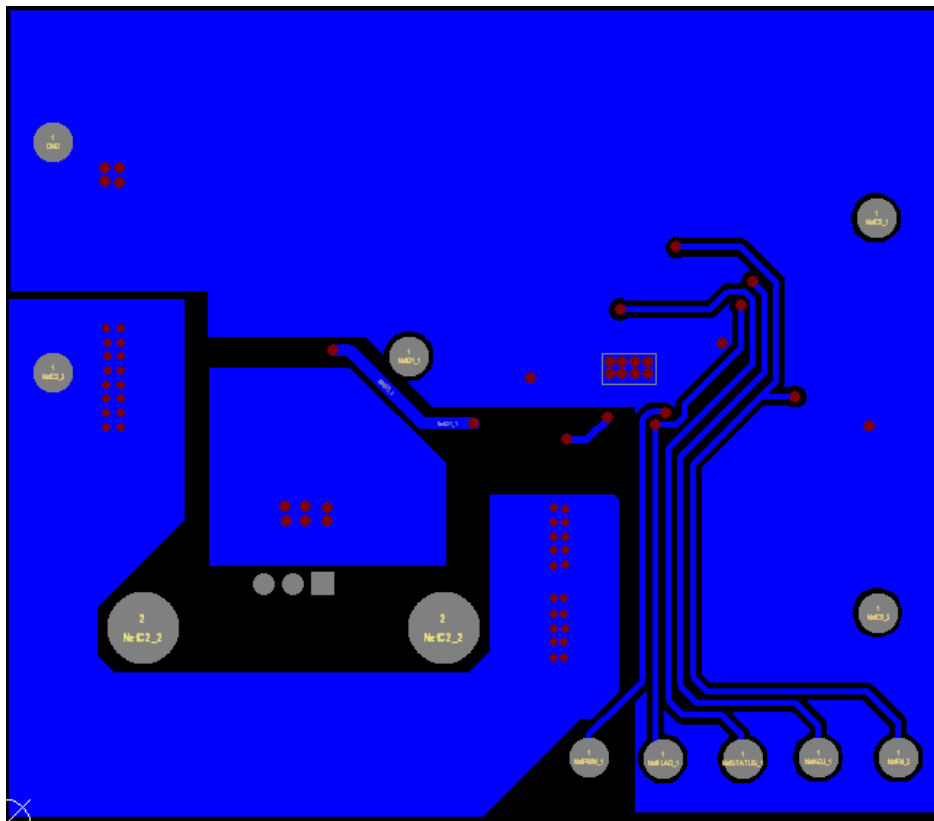
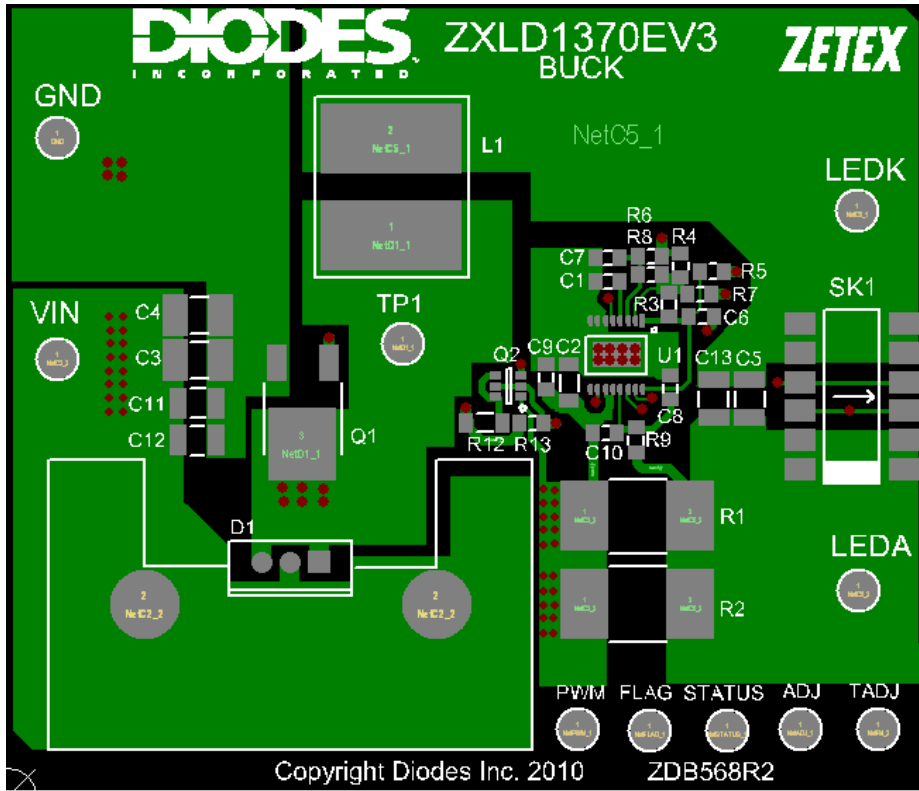


Fig. 4 Thermal control

The Thermal Control feature can be disabled by connecting 'TADJ' to 'REF' through the jumper resistor R8.

BOARD LAYOUT



INTENTIONALLY BLANK

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