ZXLD1370EV2 BUCK/BOOST LED DRIVER USER GUIDE

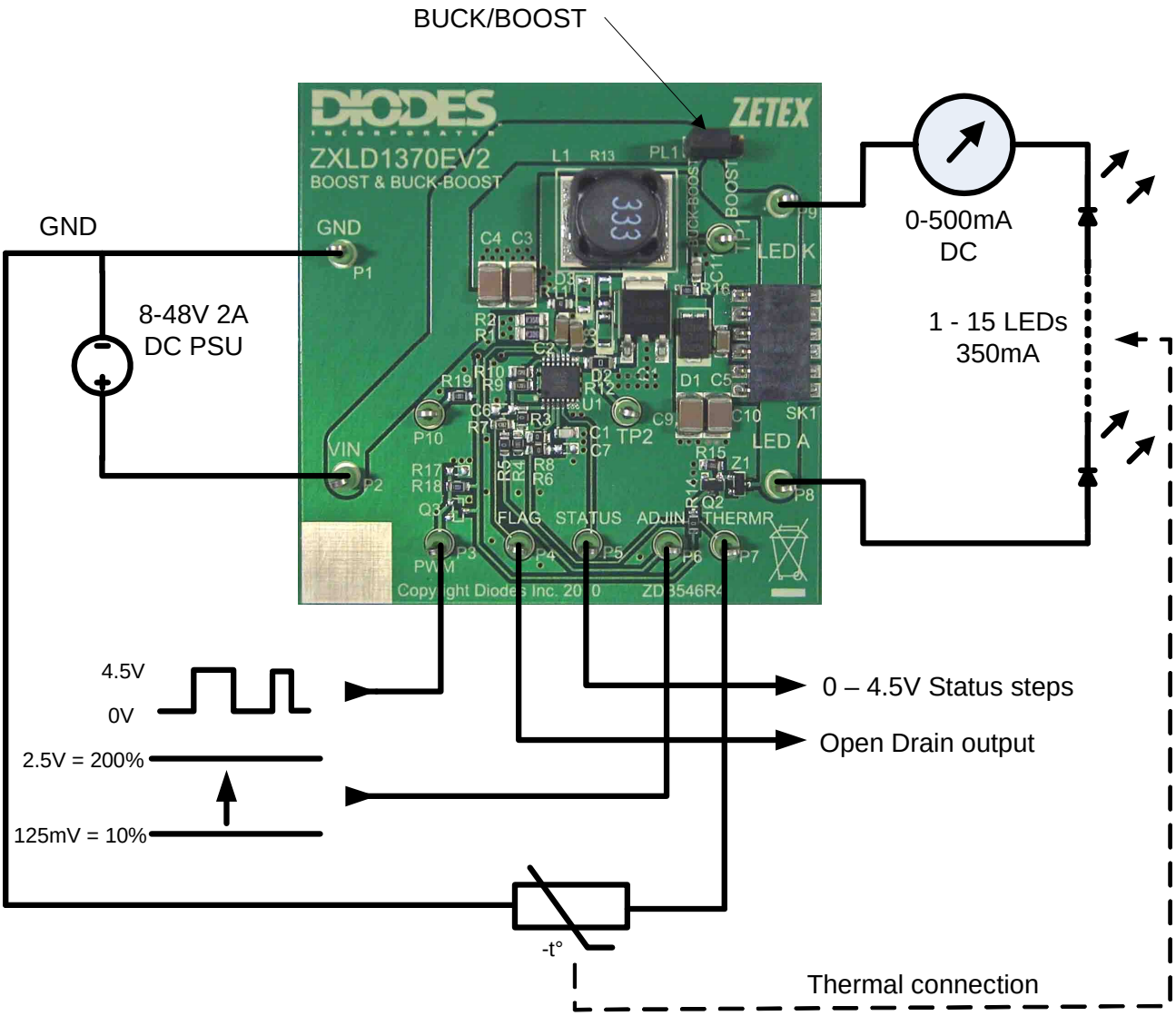


Fig.1 ZXLD1370EV2 Evaluation board connection diagram

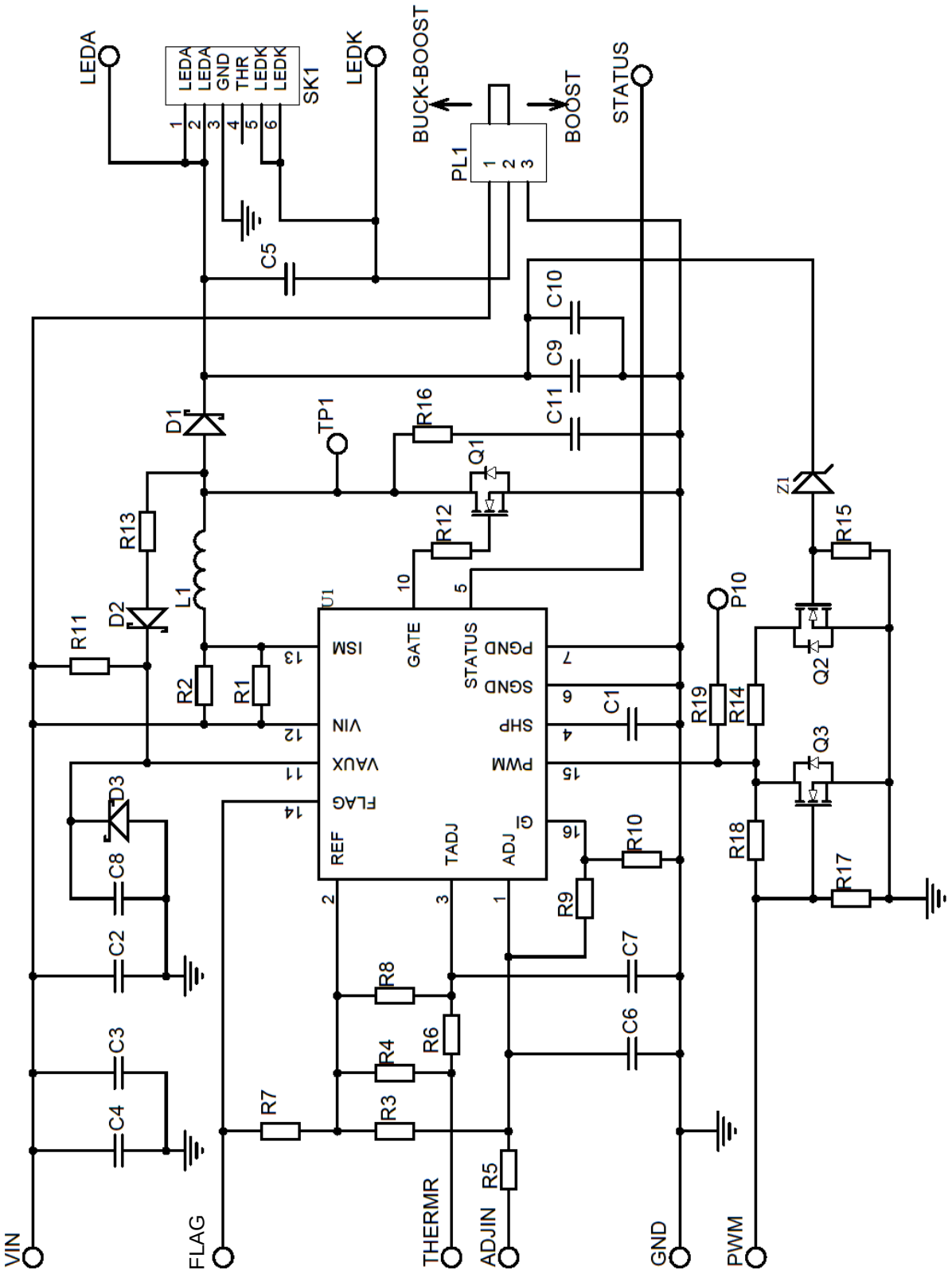


Fig2. Schematic diagram

PARTS LIST

Ref	Value	Package	Part Number	Manufacturer	Contact Details
U1	LED Driver Controller	TSSOP16L	ZXLD1370	Diodes Zetex	www.diodes.com
Q1	60V N-ch MOSFET	DPAK	DMN6068LK3	Diodes Zetex	www.diodes.com
Q2 Q3	60V General Purpose Mosfet	SOT23	2N7002	Diodes	www.diodes.com
D1	Freewheeling diode 3A 100V	PowerDI5	PDS3100	Diodes	www.diodes.com
D2	51V 200mW Zener Diodes	SOD323	BZT52C51	Diodes	www.diodes.com
D3	Freewheeling diode 3A 100V	PowerDI5	PDS3100	Diodes	www.diodes.com
Z1	47V 300mW Zener Diode	SOT23	BZX84C47	Diodes	www.diodes.com
L1	33uH 2.3A		MS1246-333MLB NPIS24H330MTRF 744-7715330	Coilcraft NIC Comps. Wurth	www.coilcraft.com www.niccomp.com www.we-online.com
C1	100pF 10V	0805		Generic	
C2 C5 C8	1uF 100V X7R	1206	GRM31CR72A105KA01L	Murata	www.murata.com
C3 C4 C9 C10	2.2uF 100V X7R	1812	GRM43ER72A225KA01L	Murata	www.murata.com
C6 C7	Not fitted				
C11	10nF 100V X7R	0805		Generic	
R1 R2	0R3	1206		Generic	
R4	1K3	0805		Generic	
R7	47K	0805		Generic	
R9	120K 1%	0805		Generic	
R10	36K 1%	0805		Generic	
R3 R5 R6 R8 R11 R12 R14	0R	0805		Generic	
R15	2K	0805		Generic	
R13 R18	Not fitted				
R16 R17 R19	1K	0805		Generic	

NOTES

The PCB is supplied with R3 and R8 0R0 resistors fitted.
The 'ADJ' pin and the 'TADG' pin are disabled.
Boost-only mode is selected by changing PL1

In boost mode, the total LED output voltage is <=47V.
The supply voltage for the ZXLD1370EV2 is >=6V, <= (total LED voltage).

In buck-boost operation, the input voltage range is limited by the overvoltage threshold voltage and the LED voltage. >=6V, <=(47V – VLED).

For other reference designs or further applications information, please refer to the ZXLD1370 datasheet.

Q2 and Z1 protect the circuit from open-circuit LEDs.

The overvoltage threshold of the evaluation board is 47V. (Set by the 47V Zener diode Z1)
The overvoltage threshold can be increased by using a Zener diode with a higher voltage (56V)
Do not use a Zener diode of higher voltage than the MosFet or ZXLD1370.

Boost and Buck-boost modes, average I_{LED}= average $I_{INDUCTOR}$ x R10/(R9+R10)

The nominal current, I_{LED} for the evaluation board is set to 350mA.

OPERATION

In Boost and Buck-boost mode the LED current is sensed by the series resistor (R1 // R2). An output from the control loop drives the input of a comparator. The comparator drives the gate of the external NMOS switch transistor via 'GATE' pin. When the NMOS switch is on, current flows from VIN, via (R1 // R2), inductor and 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 inductor, D1 and the LED, to 'VIN' (Buck-boost mode), or 'GND' (Boost mode). When the inductor current has gone low, 'GATE' goes high, and the cycle of events repeats. The circuit oscillates. The average current in the LEDs is equal to the average of the maximum and minimum threshold currents. The ripple current (hysteresis) is equal to the difference between the thresholds. The average current in the LED is always less than the average current in the inductor and the ratio between these currents is set by the values of resistors R9 and R10. The peak current in the LED is equal to the peak current in the inductor. 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.

Bootstrap Circuit

The ZXLD1370 works normally between 8-60V. For input voltages between 6-8V and high switch currents that require a fully enhanced MOSFET, it is recommended to use the bootstrap network D2-R13 and remove R11.

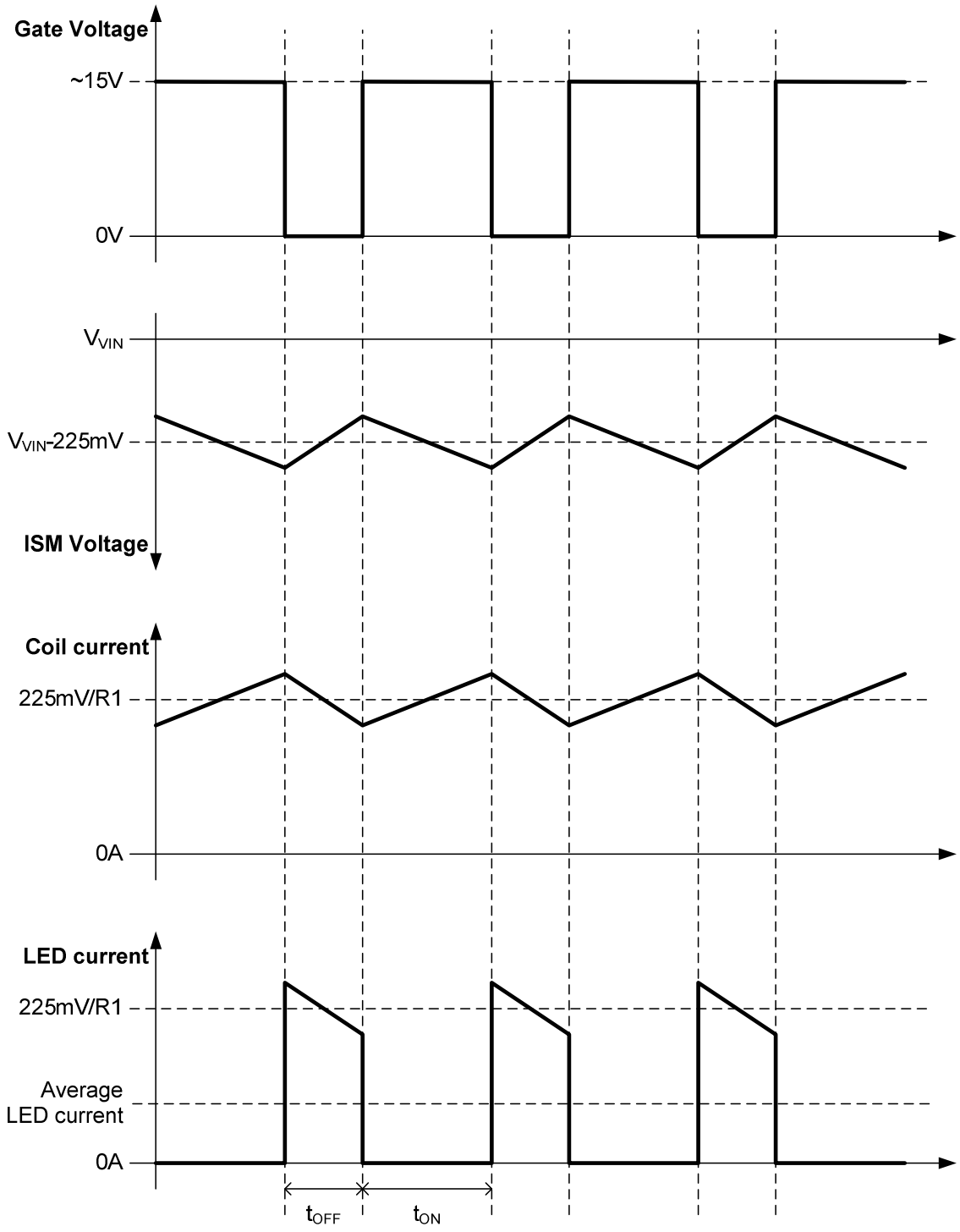


Fig. 3 Waveforms for Boost and Buck-boost modes

ADJ Terminal (DC output current adjustment)

On the ZXLD1370EV2, the 'ADJ' pin R3 connects the internal 1.25V reference (V_{REF}) give 100% LED current.

The ADJ pin can also be driven with an external DC voltage >=125mV and <= 2.5V to adjust the LED current to >= 10% and <=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 high impedance within its normal operating voltage range. An internal 2.6V clamp protects the device against excessive input voltage and limits the maximum output current to approximately 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 switch is switched by the control signal.

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

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' < 625mV. 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% above it as shown in the graph. The temperature threshold can be changed by adjusting the value of Rth and/or the thermistor to suit the LED used.

On the ZXLD1370EV2, Rth is 1K3 (R4). In order 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 ~ 90ºC.

Thermal control by LED current reduction

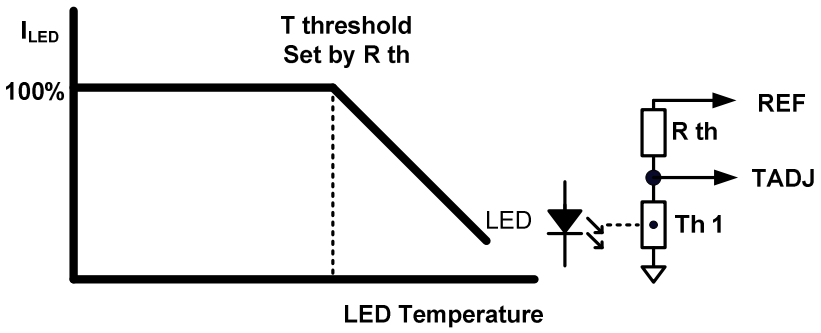
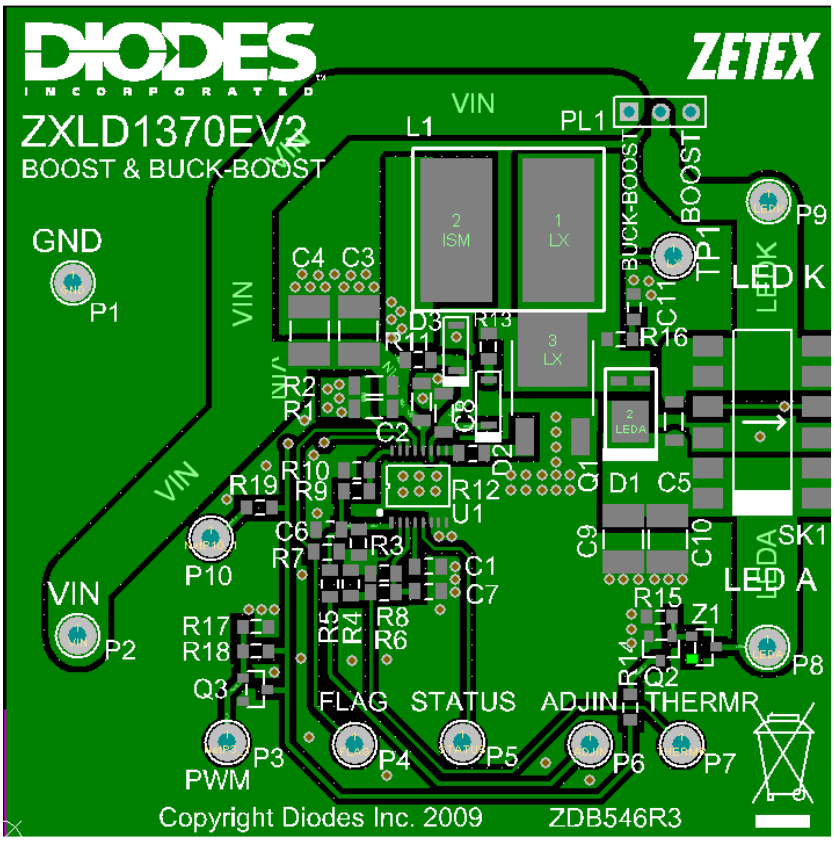
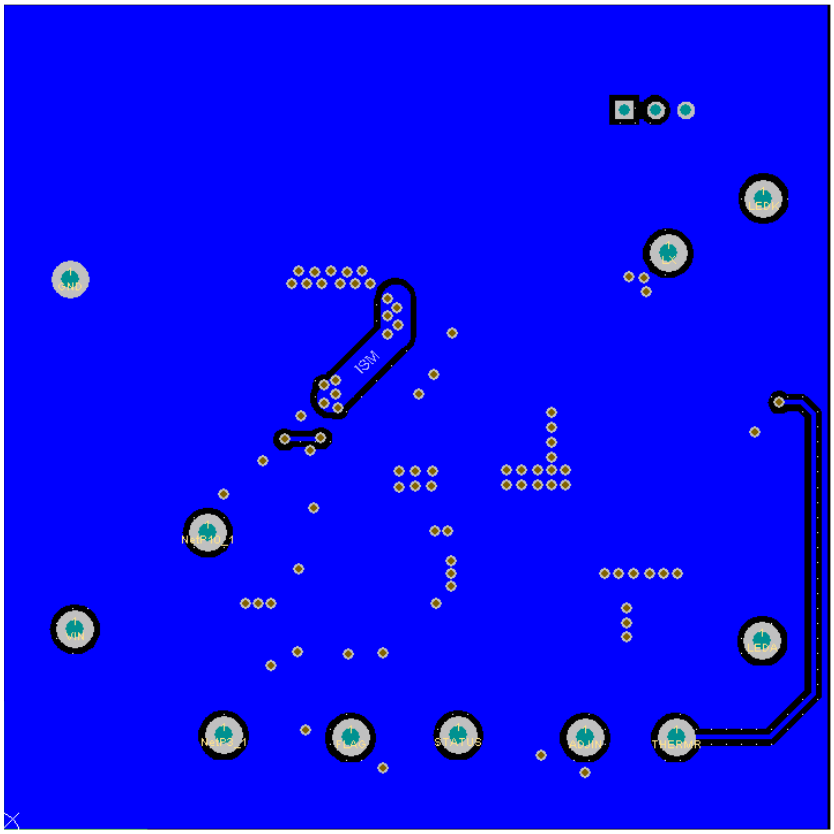


Fig. 4 Thermal control

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

BOARD LAYOUT





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