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## AL8806EV4 USER GUIDE

### Performance

- 9V to 30V DC input (with 2 LEDs)
- 1.5A LED current
- Drives 1 LED or several LEDs in series
- Brightness control using DC or PWM
- Inherent open circuit LED protection
- Ambient temperature range  
-40°C to +105°C

### Ordering Information

Order Number
AL8806EV4

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

### Introduction

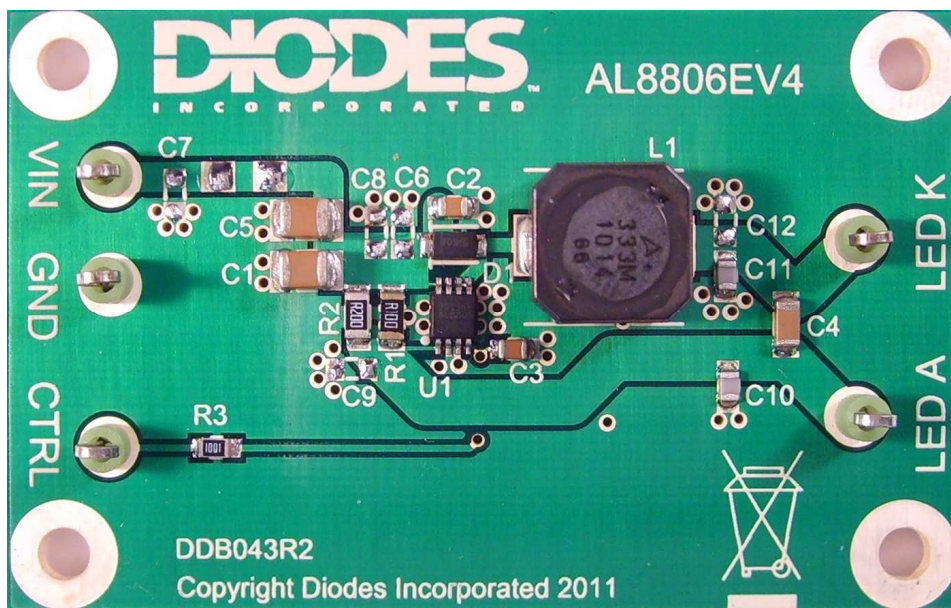
This evaluation circuit demonstrates the AL8806 High Efficiency 30V 1.5A Buck LED Driver. For detailed information on the AL8806, please see the datasheet at: <http://www.diodes.com/datasheets/AL8806.pdf>

The evaluation board is preset to drive its maximum current of 1.5A into a single LED or multiple LEDs, the maximum number of which depends on their total forward voltage drop. EMC filtering is included to meet international standards including the radiated emission requirements of EN55015 and EN55022 Class B.

The circuit operates in continuous switching mode at a frequency of approximately 170kHz when driving 2 LEDs each having a forward voltage drop of approximately 3.4V at 1.5A.

The construction uses a double-sided FR4 printed circuit board, 63 x 40 x 1.7 mm with 2oz/sq ft copper (70µm). Components are mounted on one side only.

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



## Quick Start Guide

### Suitable Test Equipment

Count	Description	Manufacturer	Part Number
1	Adjustable Power Supply, up to 30V 2A	Thurlby Thandar	CPX400A
2	Digital Multimeter	Fluke	179
1	Digital Storage Oscilloscope	Tektronix	TDS2024B
2	LED, high brightness, 2A, connected on suitable heat conducting PCB		

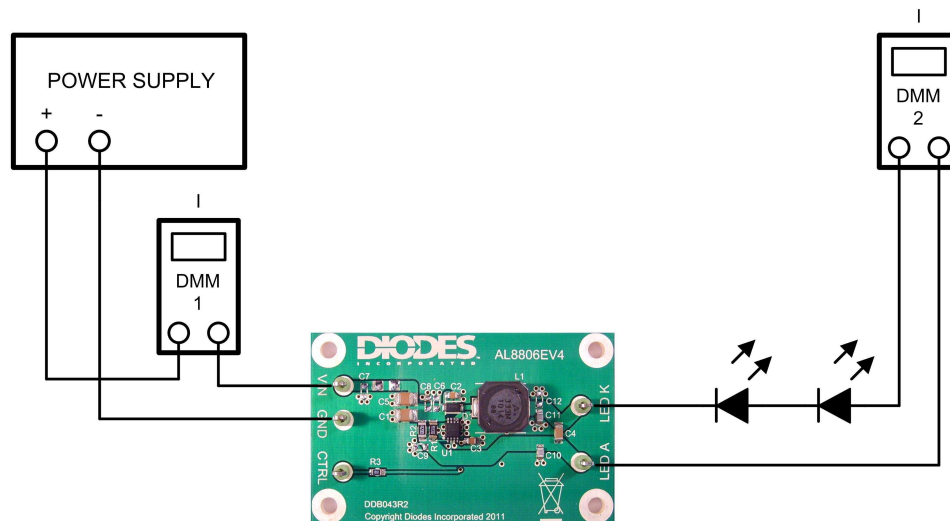
**CAUTION:** The LEDs are very bright. Ensure they are hidden from direct view, or covered with a dispersing filter. The lid from an aerosol can is convenient for this.

**Also the LEDs are very hot. Do not touch!!**

### Lamp Operation

1. Set the power supply to 12.0V but do not switch on. Set the current limit to 2.0A.
2. Connect up the AL8806EV4 board to the equipment as in **Figure 1** below. Set DMM1 and DMM2 to measure current up to 2A.

**Figure 1: Test Schematic**

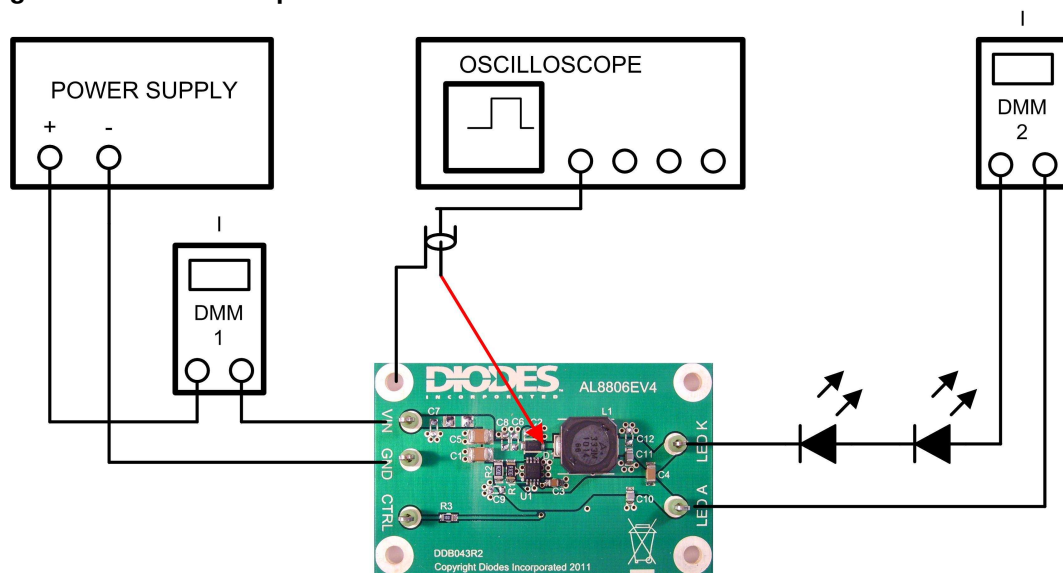


3. Cover the LEDs to avoid dazzling.
4. Switch on the power supply. This should illuminate the LEDs. Note that the input current (DMM1) depends on the LED volt drop. The input current is approximately 900mA if the total LED volt drop is about 6.9V. The output current (DMM2) is approximately 1.47A. The input voltage can be varied from approximately 8.5VDC to 30VDC and the current regulation observed is typically within  $\pm 2\%$ .

### Observe Switching Waveform

5. The switching waveform can be observed on an oscilloscope.
6. Set the oscilloscope as follows:
  - Channel 1 sensitivity: 2V/div (at probe tip)
  - Time base: 2 $\mu$ s/div
  - Trigger Source: CH1
  - Trigger Mode: Auto
7. Connect the ground lead of a 10x probe to one of the plated fixing holes of the AL8806EV4, and touch the probe tip onto the anode of D1 as in **Figure 2** below. On the oscilloscope, press RUN/STOP to capture the waveform. The cursor readout indicates a switching frequency of 170kHz approximately –see **Figure 3**. (This frequency is dependent on the LED volt drop.)

**Figure 2: Waveform Capture**

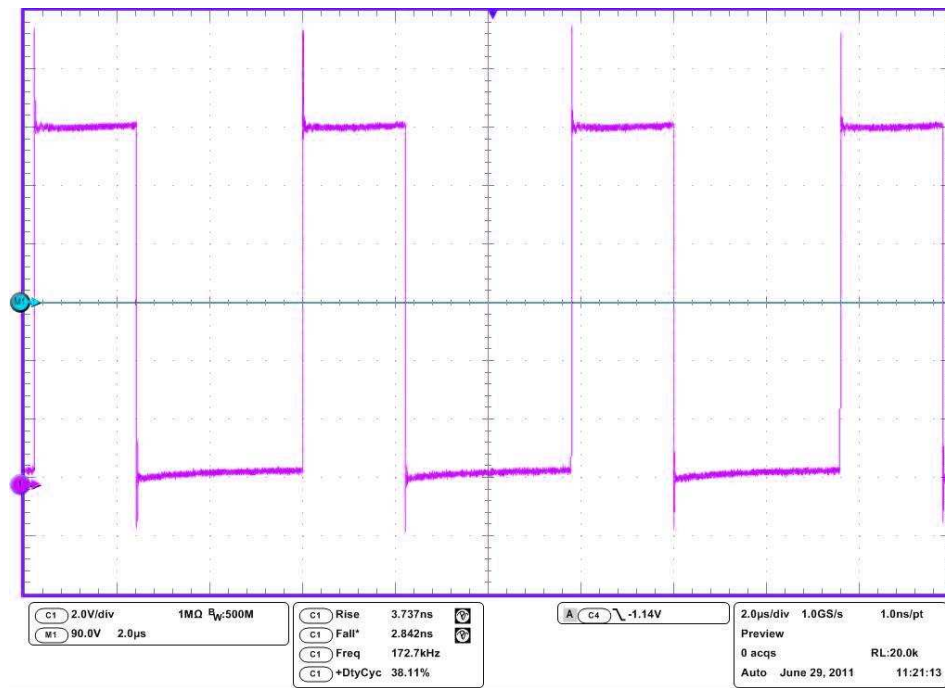


### Dimming

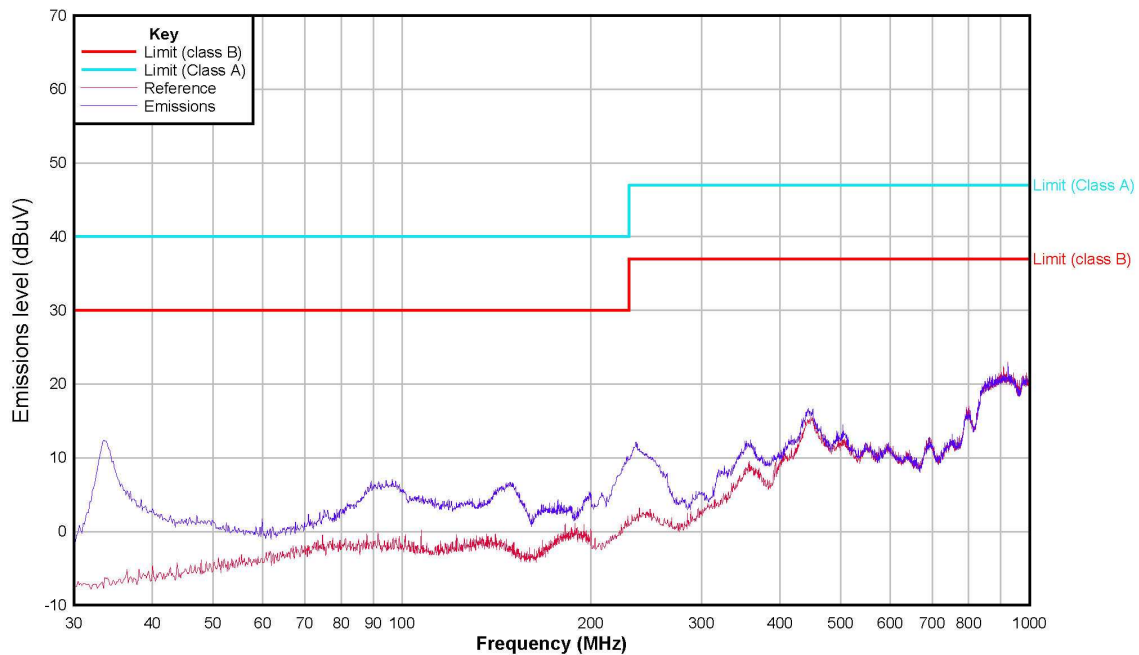
Both DC and PWM dimming can be achieved by driving the CTRL input pin. For DC dimming, the CTRL pin may be driven between 0.5V and 2.5V adjusting the output current from 25% to 100% of the maximum value of 1.5A nominal. Driving the CTRL pin below 0.4V will shut down the output current.

A PWM signal (low level  $\leq 0.4V$  and high level  $> 2.5V$ ) allows the output current to be adjusted up to 1.5A. The PWM frequency can be around 100Hz to 1kHz, providing a resolution of 10 bits. In this case, C3 should be removed or reduced from the evaluation board (see AL8806EV4 schematic below) to give a more accurate control.

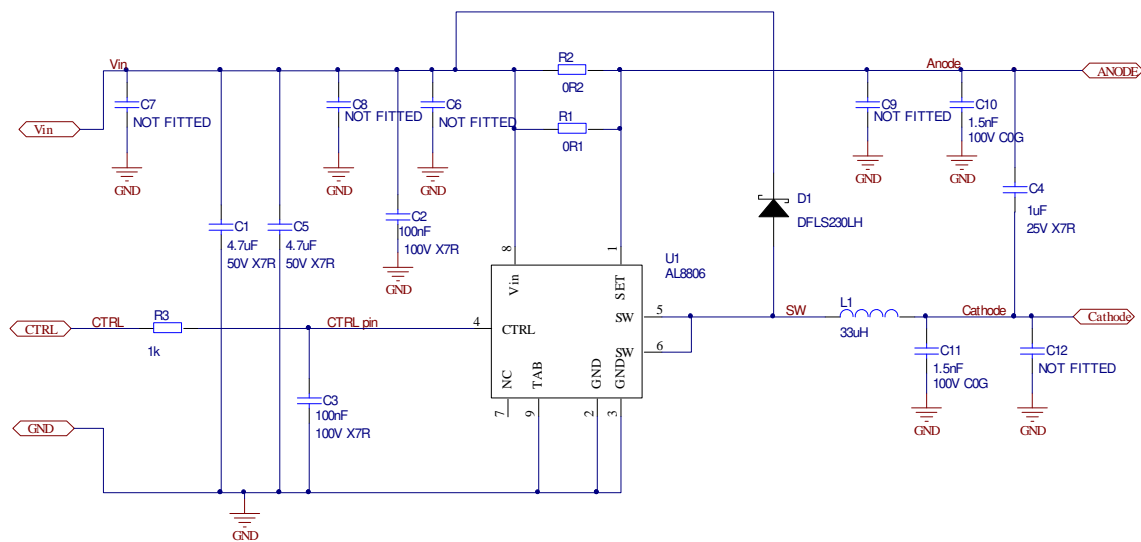
Figure 3: Oscilloscope Waveform



**Radiated EMI Performance, EN55022:**  
**Results of AL8806EV4 test at an independent EMC test facility.**  
**Input: 12VDC**  
**Load: 2 LEDs, 1.5A**

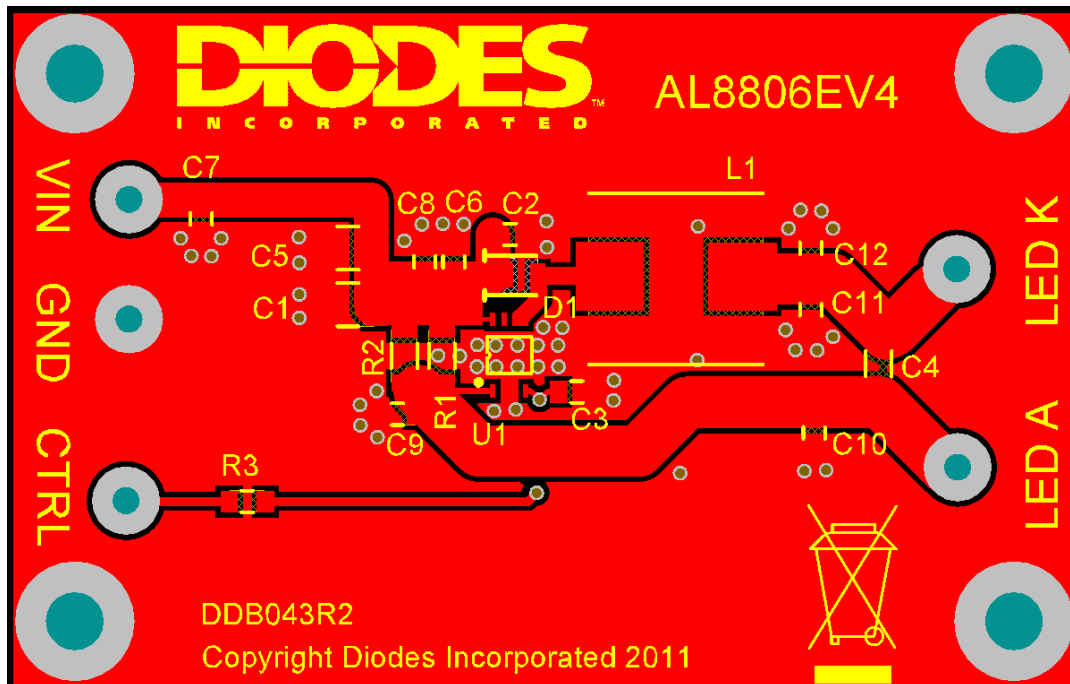


(By courtesy of Cass Industries, Limited)

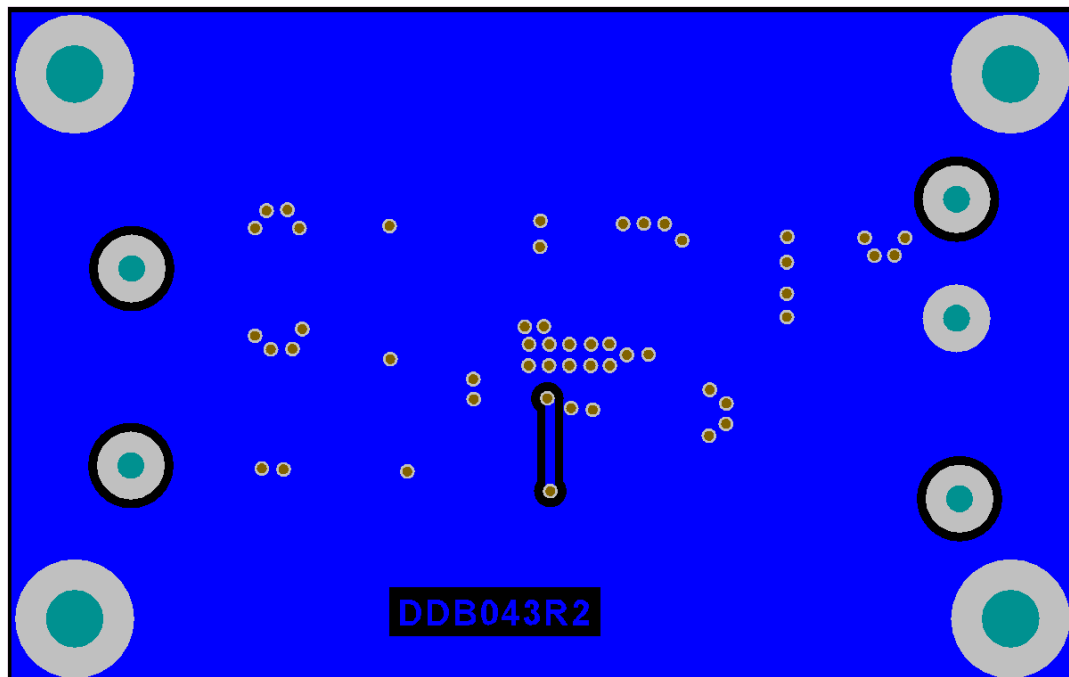


AL8806EV4 Schematic

## PCB Copper Layout &amp; Silk Screen – Top



## PCB Copper Layout &amp; Silk Screen –Bottom



## Parts List

Count	Designator	Description	Package	Manufacturer	Part Number
2	C1 C5	Capacitor, 4.7 $\mu$ F 10% 50V X7R	1210	Kemet	C1210X475K5RAC
2	C2 C3	Capacitor, 100nF 10% 100V X7R	0805	NIC Murata	NMC0805X7R104K100PF GRM21BR71H104KA01L
1	C4	Capacitor, 1 $\mu$ F 10% 100V X7R	1206	generic NIC	NMC1206X7R104K100
0	C6 – C9, C12	NOT FITTED			
2	C10 C11	Capacitor, 1.5nF 100V COG	0805	generic	
1	L1	Inductor, shielded, 33 $\mu$ H 20%		Coilcraft NIC Würth	MSS1038-333ML NPIS104F330MTRF 744-066-330
1	R1	Resistor, 0.1ohms 1%	1206	generic	
1	R2	Resistor, 0.2ohms 1%	1206	generic	
1	R3	Resistor, 1k 1%	0805	generic	
1	D1	Diode, schottky, 30V 2A DFSL230LH	PowerDi123	Diodes Inc	DFLS230LH-7
1	U1	IC, LED Driver, AL8806	MSOP-8EP	Diodes Inc	AL8806MP8-13

## I/O

Count	Designator	Description	Function	Manufacturer	Part Number
1	VIN	Loop terminal	DC Supply + Input	Hughes	100-108
1	GND	Loop terminal	DC Supply – Input	Hughes	100-108
1	CTRL	Loop terminal	Dimming Control Input	Hughes	100-108
1	LED A	Loop terminal	LED Anode Load	Hughes	100-108
1	LED K	Loop terminal	LED Cathode load	Hughes	100-108

## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Units
VDC	Input Supply Voltage, VDC	8	30	V
VOUT	Load voltage	0	VDC-1.5	V
T <sub>A</sub>	Operating Ambient Temperature	-40	+105	°C



## Current Setting

The LED current is set by the sense resistor value,  $R_{\text{SENSE}}$ . On this PCB, there are two resistors in parallel.

$$R_{\text{SENSE}} = R_1 * R_2 / (R_1 + R_2)$$

For the schematic values this gives a resistance of  $0.1 * 0.2 / (0.1 + 0.2) = 0.0667$  ohms.

The LED current flows through  $R_{\text{SENSE}}$ . The sense voltage is 100mV, so the LED current is simply

$$I_{\text{LED}} = 0.1 / R_{\text{SENSE}}$$

For the schematic values this gives an LED current of  $0.1 / 0.0667 = 1.500$  A nominally. In practice there is a slight reduction in current partly due to the resistance of the PCB copper, depending on the PCB layout. At 1.5A this reduction is typically 1 to 2% using AL8806EV4.

The following table gives commercially available resistor values for typical current requirements, allowing a current error of 3% maximum not including the effect of PCB copper. A power limit of 250mW is assumed for the 0805 size resistors with 50% de-rating.

LED Current	R1, ohms	R2, ohms
150mA	0.68	DO NOT FIT
300mA	0.33	DO NOT FIT
380mA	0.51	DO NOT FIT
500mA	0.2	DO NOT FIT
660mA	0.15	DO NOT FIT
1A	0.1	DO NOT FIT
1.1A	0.15	0.22
1.5A	0.1	0.2

## Performance

The performance of the AL8806EV4 demonstrated shows the capability to regulate LED current. The LED current of 1.5A is approximately 2% lower than the calculated value. This is partly due to copper resistance. With a load of 2 LEDs, the current changes by less than  $\pm 2\%$  over the input voltage range from 9VDC to 30VDC. With 2 LEDs and a supply of 12VDC, the circuit operates in continuous mode with a switching frequency of approximately 170kHz.

Power efficiency is approximately 95%.

The radiated emission of AL8806EV4 is approximately 18dB below the limits of EN55015 and is also well within the limit of EN55022 Class B. (In the application of AL8806, the radiation depends very much upon PCB layout and filtering.)

**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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