



**THE DATASHEET OF  
ZXTR2008P5-13**



## Description

The ZXTR2008P5 monolithically integrates a transistor, zener diode and resistor to function as a high-voltage linear regulator. The device regulates with an 8.2V nominal output at 15mA. It is designed for use in high-voltage applications where standard linear regulators cannot be used. This function is fully integrated into a PowerDI<sup>®</sup>5 package, minimizing PCB area and reducing number of components when compared with a multi-chip discrete solution.

## Applications

Supply voltage regulation in:

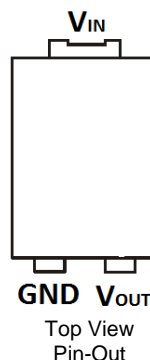
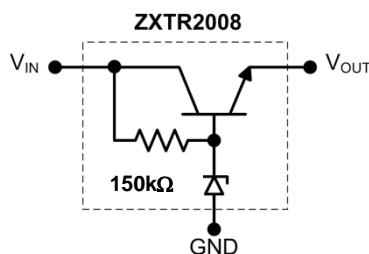
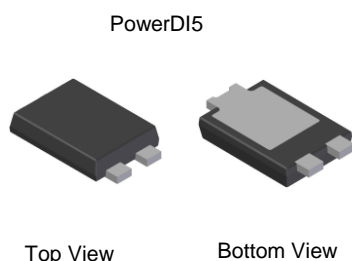
- Startup switch in DC-DC converters
- Networking
- Telecommunications
- Power over Ethernet (PoE)

## Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 12V to 100V (For regulated output voltage)
- Output Voltage = 8.2V ± 10%
- 150kΩ resistor to limit quiescent current
- Fully integrated into a PowerDI5 package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 for High Reliability**

## Mechanical Data

- Case: PowerDI5
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 <sup>(e3)</sup>
- Weight: 0.100 grams (Approximate)



Pin Name	Pin Function
V <sub>IN</sub>	Input Supply
GND	Power Ground
V <sub>OUT</sub>	Voltage Output

## Ordering Information (Note 4)

Product	Package	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXTR2008P5-13	PowerDI-5	ZXTR2008	13	16	5,000

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen and Antimony free, "Green" and Lead-Free.
  3. Halogen and Antimony free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.
  4. For packaging details, go to our website at <http://www.diodes.com/products/packages.html>.

## Marking Information



ZXTR2008 = Product Type Marking Code  
 ⌋⌋ = Manufacturers' Code Marking  
 K = Factory Designator  
 YYWW = Date Code Marking  
 YY = Last Two Digits of Year (ex: 17 for 2017)  
 WW = Week code (01 to 53)

**Absolute Maximum Ratings** (Voltage relative to GND, @ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Input Supply Voltage	$V_{IN}$	-0.3 to 100	V
Continuous Input & Output Current	$I_{IN}, I_{OUT}$	450	mA
Peak Pulsed Input & Output Current	$I_{IM}, I_{OM}$	2	A
Maximum Voltage applied to $V_{OUT}$	$V_{OUT(max)}$	Smaller of $V_{IN}+8.2\text{V}$ or 14.5V	V

**Maximum Current at  $V_{IN} = 48\text{V}$**  (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Continuous Output Current	$I_{OUT}$	45	mA
Pulsed Output Current	$I_{OM}$	800	mA
		160	

**Thermal Characteristics**

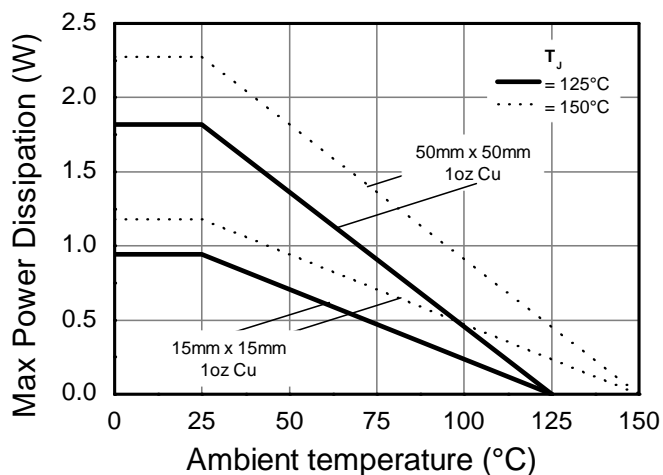
Characteristic	Symbol	Value	Unit
Power Dissipation	$P_D$	1.82	W
		0.94	
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	55	$^\circ\text{C/W}$
		107	
Thermal Resistance, Junction to Lead	$R_{\theta JL}$	20	
Thermal Resistance, Junction to Case	$R_{\theta JC}$	17.8	
Recommended Operating Junction Temperature Range	$T_J$	-40 to +125	$^\circ\text{C}$
Maximum Operating Junction and Storage Temperature Range	$T_J, T_{STG}$	-65 to +150	

**ESD Ratings** (Note 11)

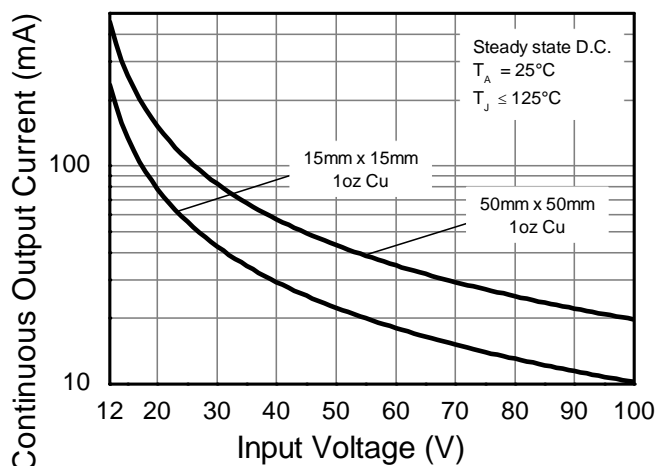
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

- Notes:
- For a device mounted with the exposed  $V_{IN}$  pad on 50mm x 50mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady-state.
  - Same as Note 5, except mounted on 15mm x 15mm 1oz copper.
  - Same as Note 5, while operating at  $V_{IN} = 48\text{V}$ . Refer to Safe Operating Area for other Input Voltages.
  - Same as Note 5, except measured with a single pulse width = 100 $\mu\text{s}$  and  $V_{IN} = 48\text{V}$ .
  - Same as Note 5, except measured with a single pulse width = 10ms and  $V_{IN} = 48\text{V}$ .
  - $R_{\theta JL}$  = Thermal resistance from junction to solder-point (on the exposed  $V_{IN}$  pad).
  - $R_{\theta JC}$  = Thermal resistance from junction to the top of case.
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

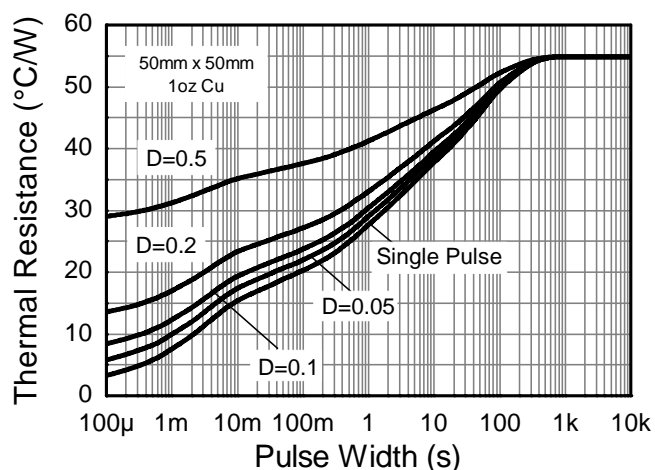
**Thermal Characteristics and Derating Information**



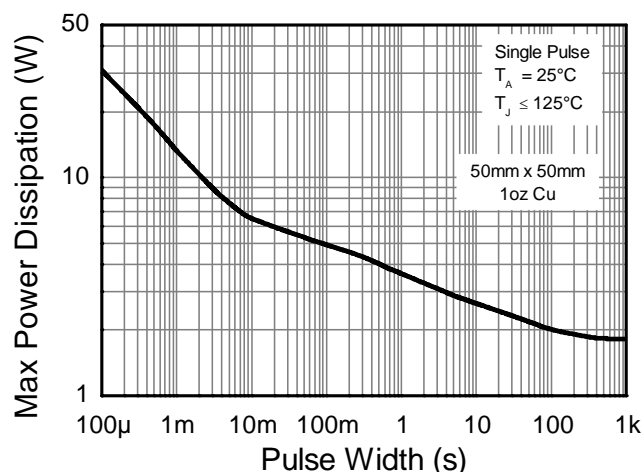
**Derating Curve**



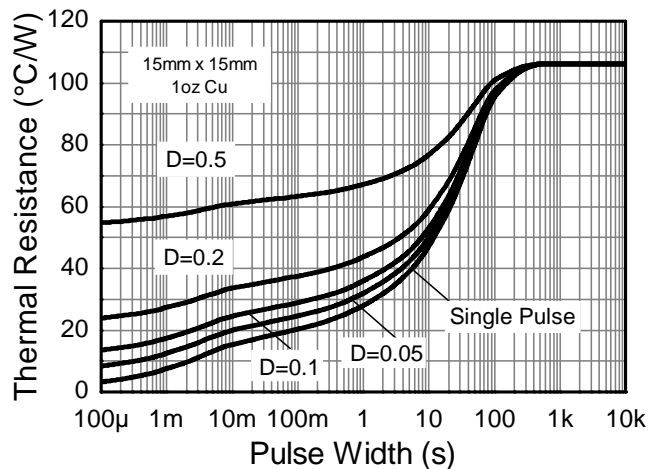
**Safe Operating Area**



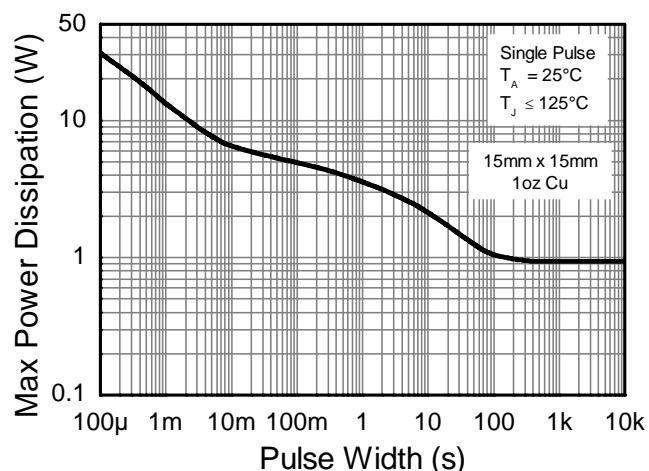
**Transient Thermal Impedance**



**Pulse Power Dissipation**



**Transient Thermal Impedance**

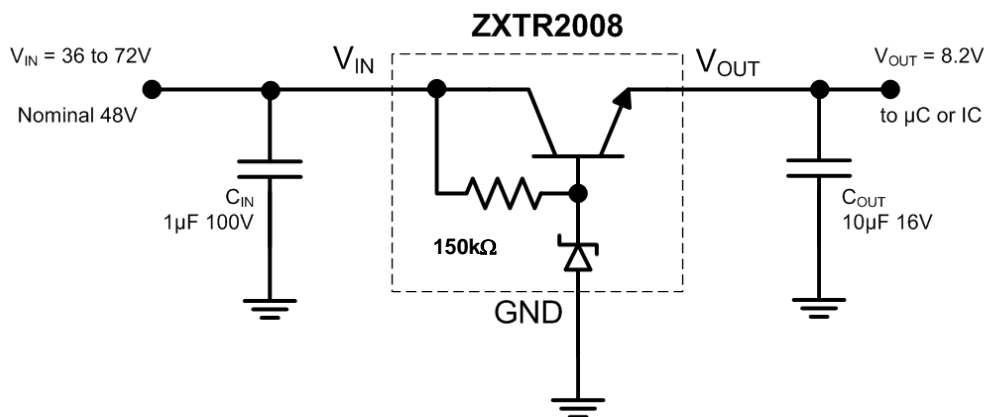


**Pulse Power Dissipation**

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	$V_{OUT}$	7.38	8.2	9.02	V	$V_{IN} = 48\text{V}$ , $I_{OUT} = 15\text{mA}$
Line Regulation (Notes 12 & 13)	$\Delta V_{OUT}$	—	10	300	mV	$V_{IN} = 12$ to $100\text{V}$ , $I_{OUT} = 15\text{mA}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	10	—	mV/ $^\circ\text{C}$	$T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$ $V_{IN} = 48\text{V}$ , $I_{OUT} = 15\text{mA}$
Load Regulation (Notes 12 & 14)	$\Delta V_{OUT}$	—	-180 -250	-400 -500	mV	$I_{OUT} = 0.1$ to $30\text{mA}$ , $V_{IN} = 48\text{V}$ $I_{OUT} = 0.1$ to $100\text{mA}$ , $V_{IN} = 48\text{V}$
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	12	—	—	V	—
Quiescent Current	$I_Q$	—	275 650	500 900	$\mu\text{A}$	$V_{IN} = 48\text{V}$ , $I_{OUT} = 10\mu\text{A}$ $V_{IN} = 100\text{V}$ , $I_{OUT} = 10\mu\text{A}$
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	38	—	dB	$C_{OUT} = 100\text{nF}$ , $I_{OUT} = 15\text{mA}$ , $V_{OUT} = 8.2\text{V}$ , $V_{IN} = 12$ to $100\text{V}$ , $f = 100\text{Hz}$

Notes: 12. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$   
 13. Line regulation  $\Delta V_{OUT} = V_{OUT}(@ V_{IN} = 72\text{V}) - V_{OUT}(@ V_{IN} = 15\text{V})$   
 14. Load regulation  $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 30\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$   
 $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 100\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$

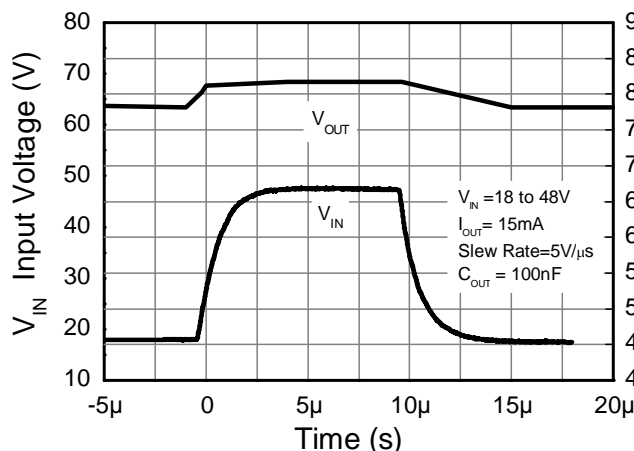
**Typical Application Circuit**


Example of an 8.2V regulated supply from a nominal 48V for powering a Controller IC.

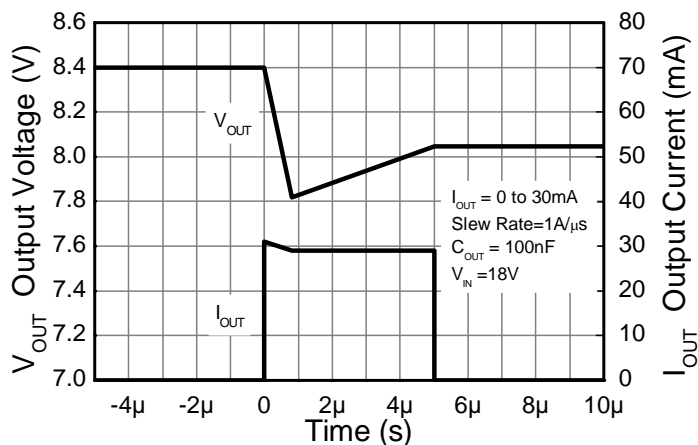
**Pin Functions**

Pin Name	Pin Function	Notes
<b>VIN</b>	Input Supply	Input voltage can vary from -0.3V to 100V with respect to GND; for VOUT regulated then $12\text{V} \leq V_{IN} \leq 100\text{V}$ . It is recommended to connect a $1\mu\text{F}$ capacitor to GND.
<b>GND</b>	Power Ground	
<b>VOUT</b>	Voltage Output	Outputs a regulated 8V when $12\text{V} \leq V_{IN} \leq 100\text{V}$ . When $V_{IN} < 12\text{V}$ , then $V_{OUT}$ maximum = $V_{IN} - 1.5\text{V}$ . The pin can be pulled high to a maximum of +14V with respect to GND, or +8V with respect to VIN, whichever is lower. It is recommended to connect a $10\mu\text{F}$ capacitor to GND and a minimum of $10\mu\text{A}$ to be drawn from VOUT to maintain regulation.

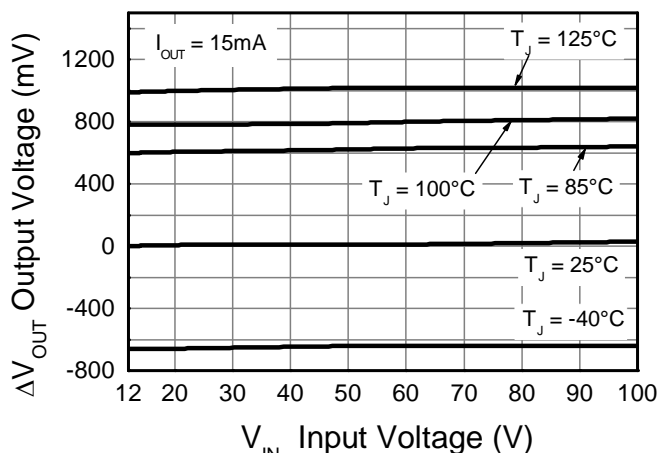
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



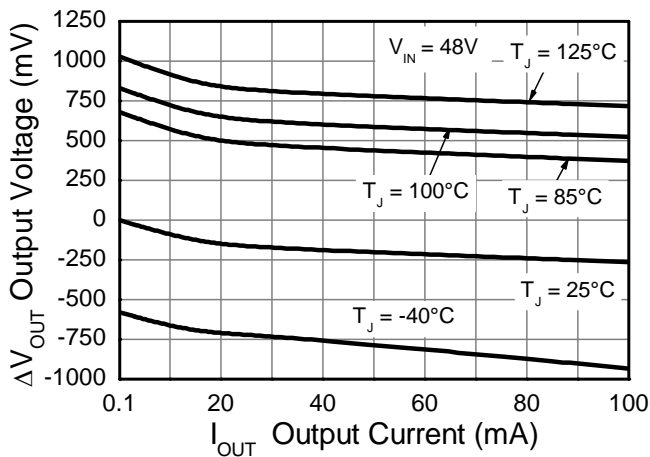
**Line transient response**



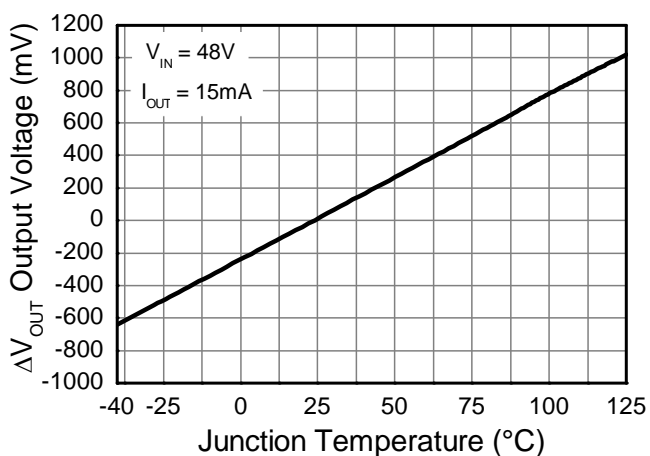
**Load transient response**



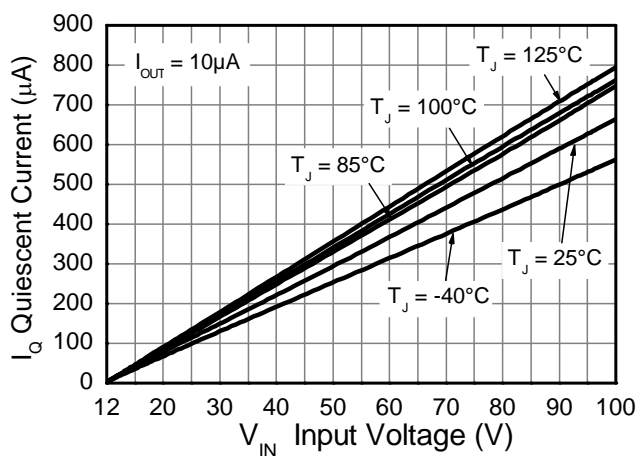
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



**Temperature Coefficient (Note 17)**

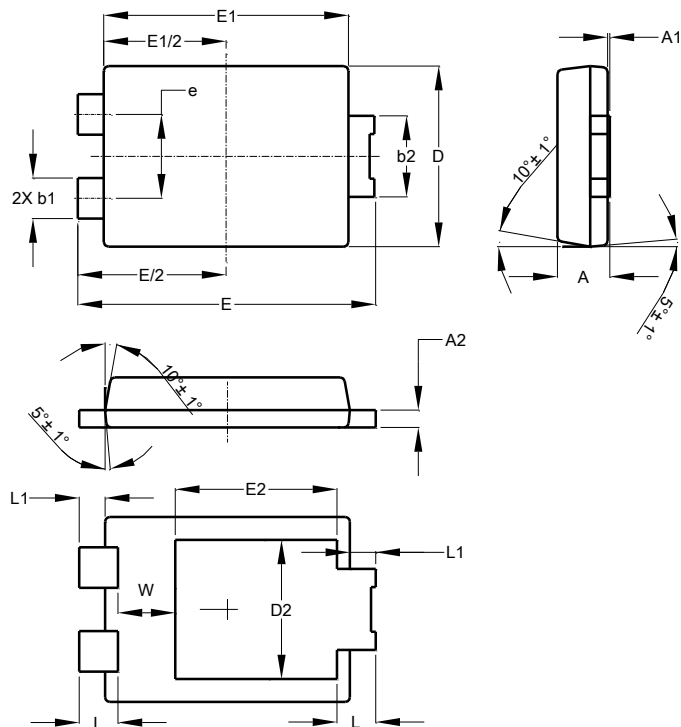


**Quiescent Current**

- Notes:
- 15. Line regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 15\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$
  - 16. Load regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48\text{V}, I_{OUT} = 0.1\text{mA}, T_J = +25^\circ\text{C})$
  - 17. Temperature Coefficient  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$

**Package Outline Dimensions**

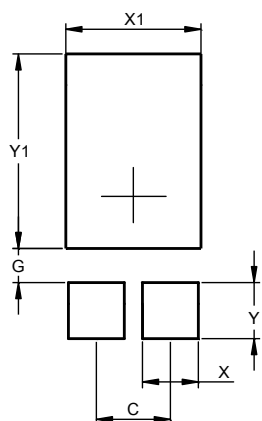
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



PowerDI5			
Dim	Min	Max	Typ
A	1.05	1.15	1.10
A1	0.00	0.05	--
A2	0.33	0.43	0.381
b1	0.80	0.99	0.89
b2	1.70	1.88	1.78
D	3.90	4.05	3.966
D2	--	--	3.054
E	6.40	6.60	6.504
e	--	--	1.84
E1	5.30	5.45	5.37
E2	--	--	3.549
L	0.75	0.95	0.85
L1	0.50	0.65	0.57
W	1.10	1.41	1.255
All Dimensions in mm			

**Suggested Pad Layout**

Please see <http://www.diodes.com/package-outlines.html> for the latest version.



Dimensions	Value (in mm)
C	1.840
G	0.852
X	1.390
X1	3.360
Y	1.400
Y1	4.860

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