100V INPUT, 5V 30mA REGULATOR TRANSISTOR

Description

The ZXTR2005ZQ monolithically integrates a transistor, Zener diode and resistor to function as a high voltage linear regulator. The device regulates with a 5V 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 SOT89 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)

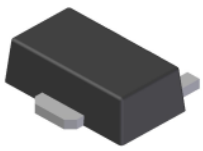
Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10V to 100V (For Regulated Output Voltage)
- Output Voltage = 5V ± 10%
- 150kΩ Resistor to Limit Quiescent Current
- Fully Integrated Into a SOT89 Package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **The ZXTR2005ZQ is suitable for automotive applications requiring specific change control; this part is AEC-Q101 qualified, PPAP capable, and manufactured in IATF 16949 certified facilities.**
  https://www.diodes.com/quality/product-definitions/

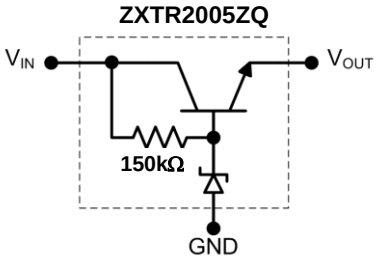
Mechanical Data

- Case: SOT89
- 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 e3
- Weight: 0.052 grams (Approximate)

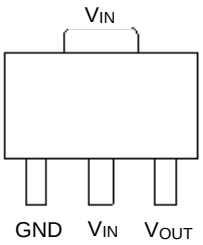
SOT89



Top View



Internal Device Schematic



Top View Pin-Out

Pin Name	Pin Function
V_{IN}	Input Supply
GND	Power Ground
V_{OUT}	Voltage Output

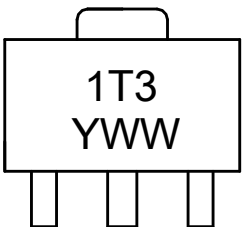
Ordering Information (Note 4)

Part Number	Package	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXTR2005ZQ-13	SOT89	1T3	13	12	2,500

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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 https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

SOT89



1T3 = Product Type Marking Code
YWW = Date Code Marking
Y = Last Digit of Year (ex: 1 = 2021)
WW = Week Code (01 to 53)

Absolute Maximum Ratings (Voltage relative to GND, @T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Input Voltage	V_{IN}	-0.3 to 100	V
Continuous Input & Output Current	I_{IN}, I_{OUT}	350	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}+5V or 11V	V

Maximum Current at V_{IN} = 48V (@T_A = +25°C, unless otherwise specified.)

Characteristic		Symbol	Value	Unit
Continuous Output Current	(Note 7)	I_{OUT}	38	mA
Pulsed Output Current	(Note 8)	I_{OM}	740	mA
	(Note 9)		150	

Thermal Characteristics

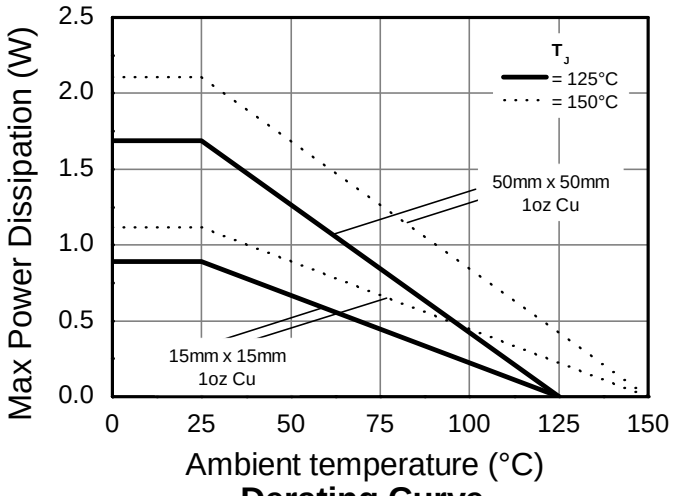
Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 5)	P_D	1.7	W
	(Note 6)		0.89	
Thermal Resistance, Junction to Ambient	(Note 5)	$R_{\theta JA}$	59	°C/W
	(Note 6)		112	
Thermal Resistance, Junction to Lead	(Note 10)	$R_{\theta JL}$	20	
Thermal Resistance, Junction to Case	(Note 10)	$R_{\theta JC}$	15.7	
Recommended Operating Junction Temperature Range		T_J	-40 to +125	°C
Maximum Operating Junction and Storage Temperature Range		T_J, T_{STG}	-65 to +150	°C

ESD Ratings (Note 11)

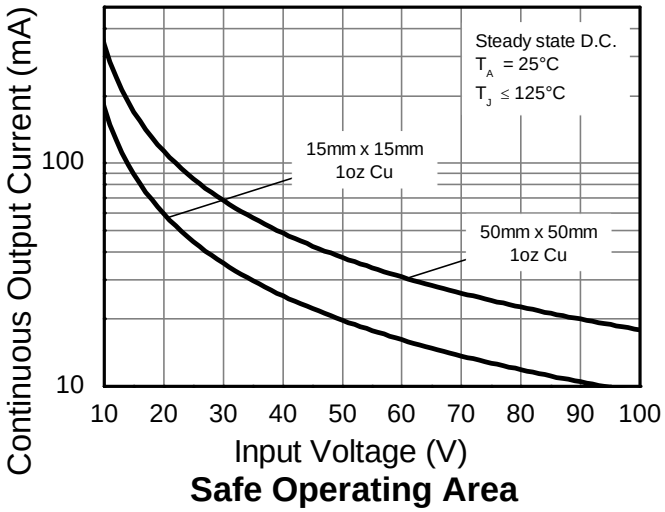
Characteristics	Symbol	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

Notes:
5. 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.
6. Same as note 5, except mounted on 15mm x 15mm 1oz copper.
7. Same as note 5, whilst operating at V_{IN} = 48V. Refer to Safe Operating Area for other Input Voltages.
8. Same as note 5, except measured with a single pulse width = 100µs and V_{IN} = 48V.
9. Same as note 5, except measured with a single pulse width = 10ms and V_{IN} = 48V.
10. $R_{\theta JL}$ = 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.
11. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

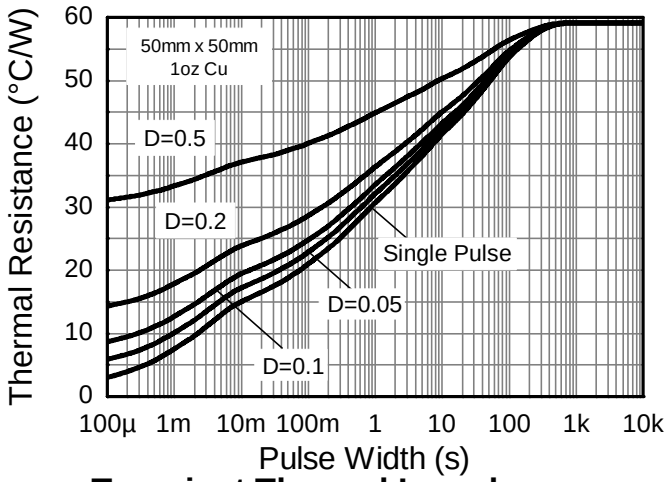
Thermal Characteristics and Derating Information



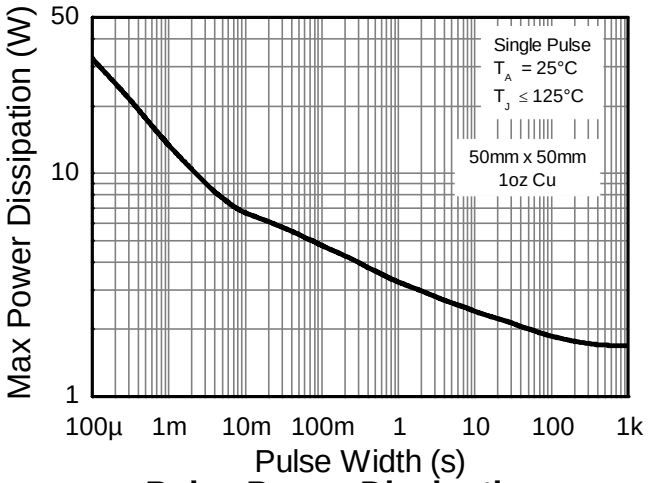
Derating Curve



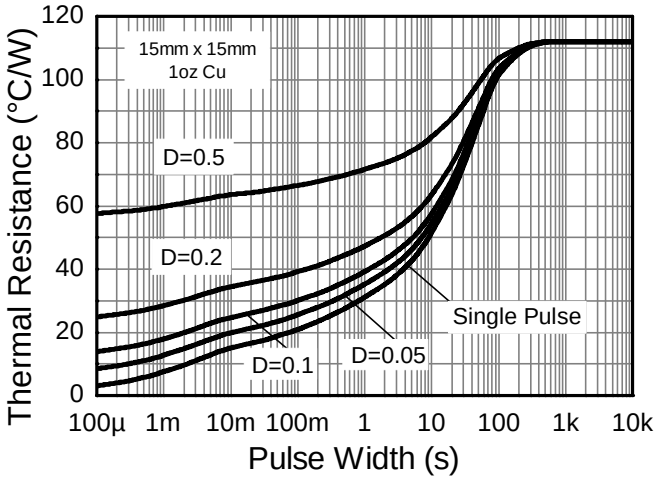
Safe Operating Area



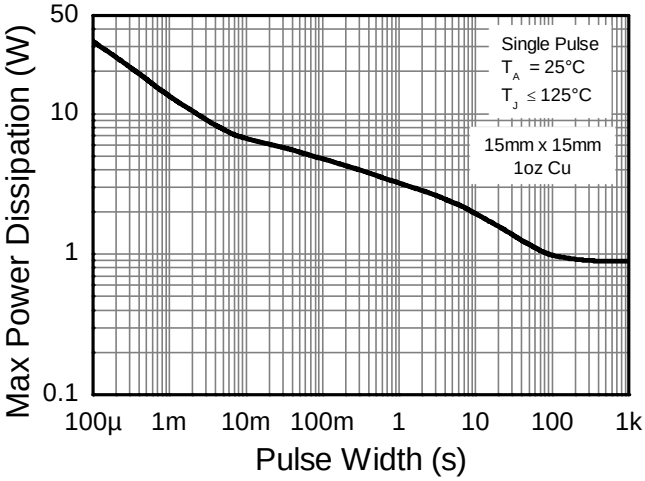
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



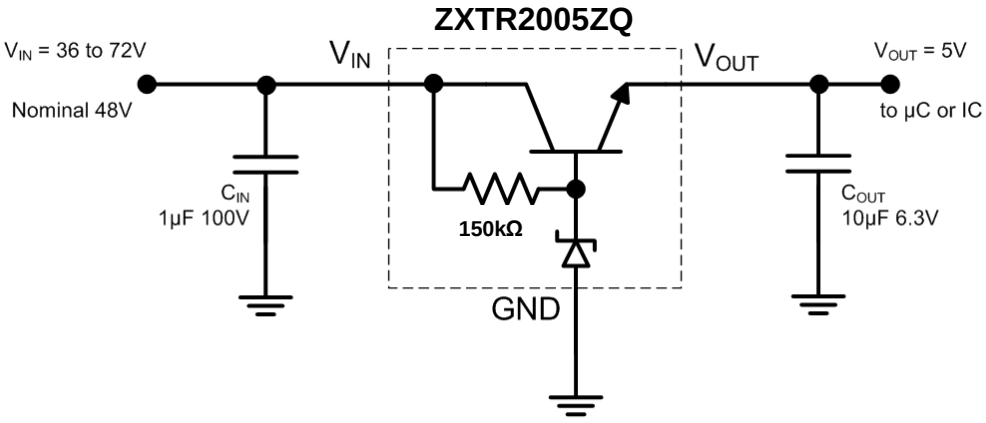
Pulse Power Dissipation

Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	V_{OUT}	4.5	5.0	5.5	V	V_{IN} = 48V, I_{OUT} = 15mA
Line Regulation (Notes 12 & 13)	ΔV_{OUT}	—	195	300	mV	V_{IN} = 10V to 72V, I_{OUT} = 15mA
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	7.0	—	mV/°C	T_J = -40°C to +125°C V_{IN} = 48V, I_{OUT} = 15mA
Load Regulation (Notes 12 & 14)	ΔV_{OUT}	— —	-185 -205	-350 -400	mV	I_{OUT} = 0.1 to 30mA, V_{IN} = 48V I_{OUT} = 0.1 to 100mA, V_{IN} = 48V
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	10	—	—	V	—
Quiescent Current	I_Q	— —	260 550	500 900	µA	V_{IN} = 48V, I_{OUT} = 10µA V_{IN} = 100V, I_{OUT} = 10µA
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	45	—	dB	C_{OUT} = 100nF, I_{OUT} = 15mA, V_{OUT} = 5V, V_{IN} = 10V to 100V, f = 100Hz

Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.
13. Line regulation $\Delta V_{OUT} = V_{OUT}(@\ V_{IN} = 72V) – V_{OUT}(@\ V_{IN} = 10V)$
14. Load regulation $\Delta V_{OUT} = V_{OUT}(@\ I_{OUT} = 30mA) – V_{OUT}(@\ I_{OUT} = 0.1mA)$
$\Delta V_{OUT} = V_{OUT}(@\ I_{OUT} = 100mA) – V_{OUT}(@\ I_{OUT} = 0.1mA)$

Typical Application Circuit

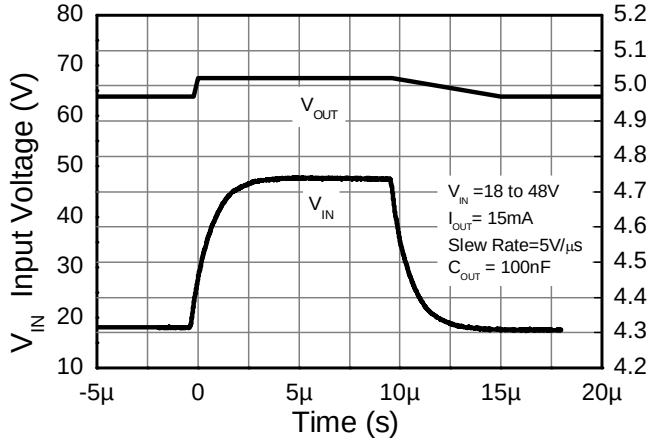


Example of a 5V regulated supply from a nominal 48V for powering a Controller IC.

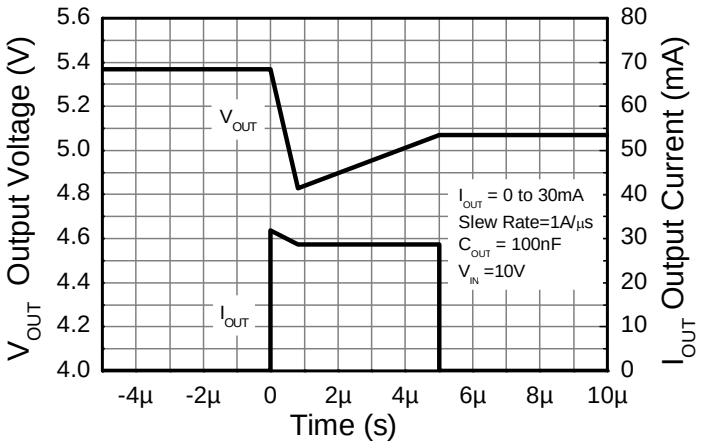
Pin Functions

Pin Name	Pin Function	Notes
V_{IN}	Input Supply	Input voltage can vary from -0.3V to 100V with respect to GND; for V_{OUT} regulated then 10V ≤ V_{IN} ≤ 100V. It is recommended to connect a 1µF capacitor to GND.
GND	Power Ground	This pin should be tied to the system ground.
V_{OUT}	Voltage Output	Outputs a regulated 5V when 10V ≤ V_{IN} ≤ 100V. When V_{IN} < 10V, then V_{OUT} maximum = V_{IN} – 1.5V. This pin can be pulled high to a maximum of +11V with respect to GND, or +5V with respect to V_{IN}, whichever is lower. It is recommended to connect a 10µF capacitor to GND and a minimum of 10µA to be drawn from V_{OUT} to maintain regulation.

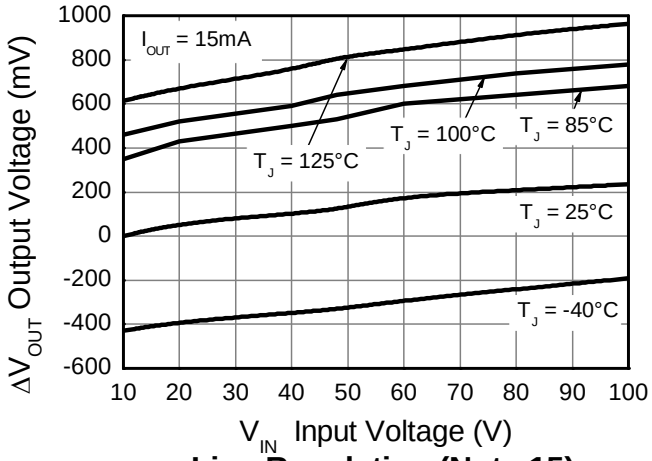
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



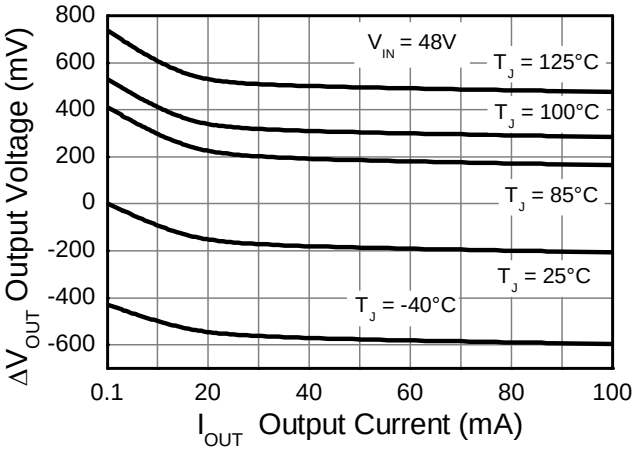
Line transient response



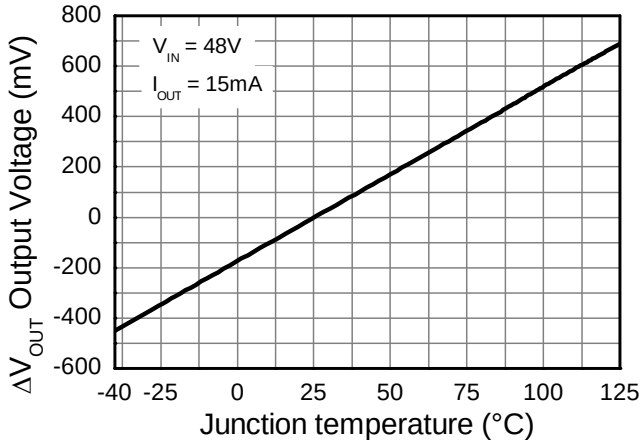
Load transient response



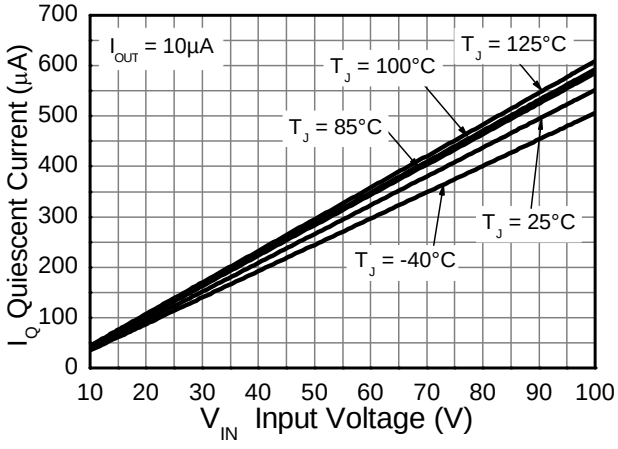
Line Regulation (Note 15)



Load Regulation (Note 16)



Temperature Coefficient (Note 17)



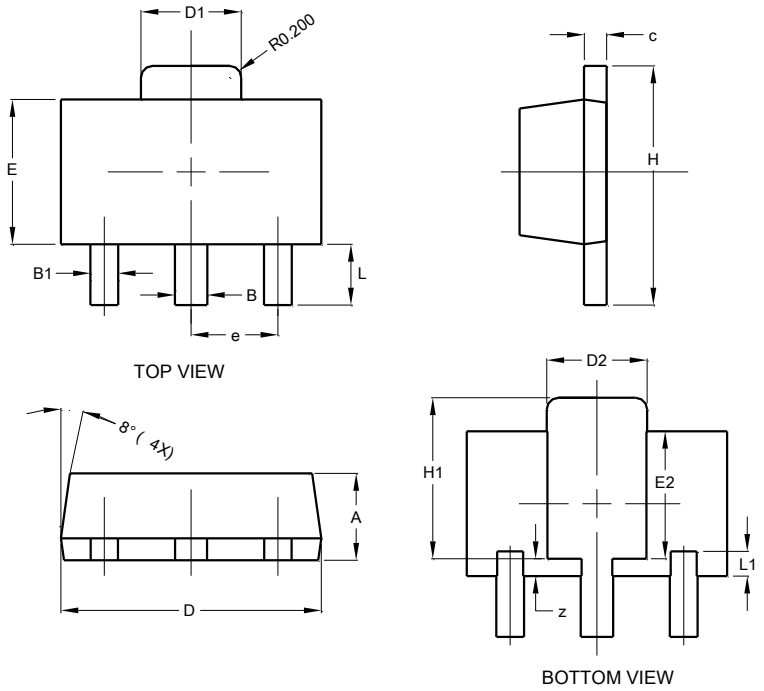
Quiescent Current

Notes: 15. Line regulation $\Delta V_{OUT} = V_{OUT} – V_{OUT}$ (@ V_{IN} = 10V, I_{OUT} = 15mA, T_J = +25°C)
16. Load regulation $\Delta V_{OUT} = V_{OUT} – V_{OUT}$ (@ V_{IN} = 48V, I_{OUT} = 0.1mA, T_J = +25°C)
17. Temperature Coefficient $\Delta V_{OUT} = V_{OUT} – V_{OUT}$ (@ V_{IN} = 48V, I_{OUT} = 15mA, T_J = +25°C)

Package Outline Dimensions

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

SOT89

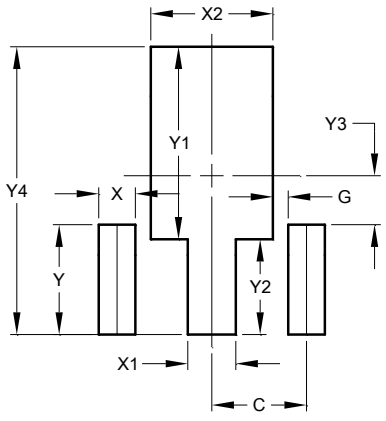


SOT89			
Dim	**Min**	**Max**	**Typ**
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.42	0.54	0.48
c	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
D2	1.61	1.81	1.71
E	2.40	2.60	2.50
E2	2.05	2.35	2.20
e	-	-	1.50
H	3.95	4.25	4.10
H1	2.63	2.93	2.78
L	0.90	1.20	1.05
L1	0.327	0.527	0.427
z	0.20	0.40	0.30
All Dimensions in mm			

Suggested Pad Layout

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

SOT89



Dimensions	Value (in mm)
C	1.500
G	0.244
X	0.580
X1	0.760
X2	1.933
Y	1.730
Y1	3.030
Y2	1.500
Y3	0.770
Y4	4.530

IMPORTANT NOTICE

1. DIODES INCORPORATED AND ITS SUBSIDIARIES ("DIODES") MAKE NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, WITH REGARDS TO ANY INFORMATION CONTAINED IN THIS DOCUMENT, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR NON-INFRINGEMENT OF THIRD PARTY INTELLECTUAL PROPERTY RIGHTS (AND THEIR EQUIVALENTS UNDER THE LAWS OF ANY JURISDICTION).

2. The Information contained herein is for informational purpose only and is provided only to illustrate the operation of Diodes products described herein and application examples. Diodes does not assume any liability arising out of the application or use of this document or any product described herein. This document is intended for skilled and technically trained engineering customers and users who design with Diodes products. Diodes products may be used to facilitate safety-related applications; however, in all instances customers and users are responsible for (a) selecting the appropriate Diodes products for their applications, (b) evaluating the suitability of the Diodes products for their intended applications, (c) ensuring their applications, which incorporate Diodes products, comply the applicable legal and regulatory requirements as well as safety and functional-safety related standards, and (d) ensuring they design with appropriate safeguards (including testing, validation, quality control techniques, redundancy, malfunction prevention, and appropriate treatment for aging degradation) to minimize the risks associated with their applications.

3. Diodes assumes no liability for any application-related information, support, assistance or feedback that may be provided by Diodes from time to time. Any customer or user of this document or products described herein will assume all risks and liabilities associated with such use, and will hold Diodes and all companies whose products are represented herein or on Diodes' websites, harmless against all damages and liabilities.

4. Products described herein may be covered by one or more United States, international or foreign patents and pending patent applications. Product names and markings noted herein may also be covered by one or more United States, international or foreign trademarks and trademark applications. Diodes does not convey any license under any of its intellectual property rights or the rights of any third parties (including third parties whose products and services may be described in this document or on Diodes' website) under this document.

5. Diodes products are provided subject to Diodes' Standard Terms and Conditions of Sale (https://www.diodes.com/about/company/terms-and-conditions/terms-and-conditions-of-sales/) or other applicable terms. This document does not alter or expand the applicable warranties provided by Diodes. Diodes does not warrant or accept any liability whatsoever in respect of any products purchased through unauthorized sales channel.

6. Diodes products and technology may not be used for or incorporated into any products or systems whose manufacture, use or sale is prohibited under any applicable laws and regulations. Should customers or users use Diodes products in contravention of any applicable laws or regulations, or for any unintended or unauthorized application, customers and users will (a) be solely responsible for any damages, losses or penalties arising in connection therewith or as a result thereof, and (b) indemnify and hold Diodes and its representatives and agents harmless against any and all claims, damages, expenses, and attorney fees arising out of, directly or indirectly, any claim relating to any noncompliance with the applicable laws and regulations, as well as any unintended or unauthorized application.

7. While efforts have been made to ensure the information contained in this document is accurate, complete and current, it may contain technical inaccuracies, omissions and typographical errors. Diodes does not warrant that information contained in this document is error-free and Diodes is under no obligation to update or otherwise correct this information. Notwithstanding the foregoing, Diodes reserves the right to make modifications, enhancements, improvements, corrections or other changes without further notice to this document and any product described herein. This document is written in English but may be translated into multiple languages for reference. Only the English version of this document is the final and determinative format released by Diodes.

8. Any unauthorized copying, modification, distribution, transmission, display or other use of this document (or any portion hereof) is prohibited. Diodes assumes no responsibility for any losses incurred by the customers or users or any third parties arising from any such unauthorized use.

www.diodes.com