

100V INPUT, 12V 30mA REGULATOR TRANSISTOR
Description

The ZXTR2012Z monolithically integrates a transistor, Zener diode and resistor to function as a high voltage linear regulator. The device regulates with a 12V 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:

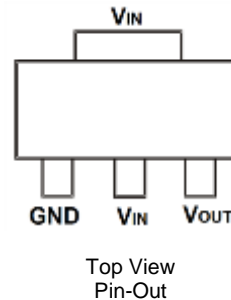
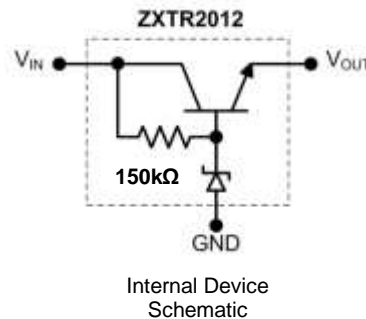
- Startup Switch in DC-DC Converters
- Networking
- Telecommunications
- Power over Ethernet (PoE)

Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 15V to 100V (For Regulated Output Voltage)
- Output Voltage = 12V \pm 10%
- 150k Ω 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)**
- **Qualified to AEC-Q101 for High Reliability**

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)

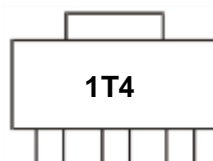


Pin Name	Pin Function
V _{IN}	Input Supply
GND	Power Ground
V _{OUT}	Voltage Output

Ordering Information (Note 4)

Product	Package	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXTR2012Z-7	SOT89	1T4	7	12	1,000
ZXTR2012Z-13	SOT89	1T4	13	12	2,500

- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) 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


1T4 = Product Type Marking Code

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}	550	mA
Peak Pulsed Input & Output Current	I_{IM}, I_{OM}	2	A
Maximum Voltage applied to V_{OUT}	$V_{OUT(MAX)}$	Smaller of $V_{IN}+12\text{V}$ or 18V	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 (Note 7)	I_{OUT}	47	mA
Pulsed Output Current (Note 8)	I_{OM}	880	mA
		180 (Note 9)	

Thermal Characteristics

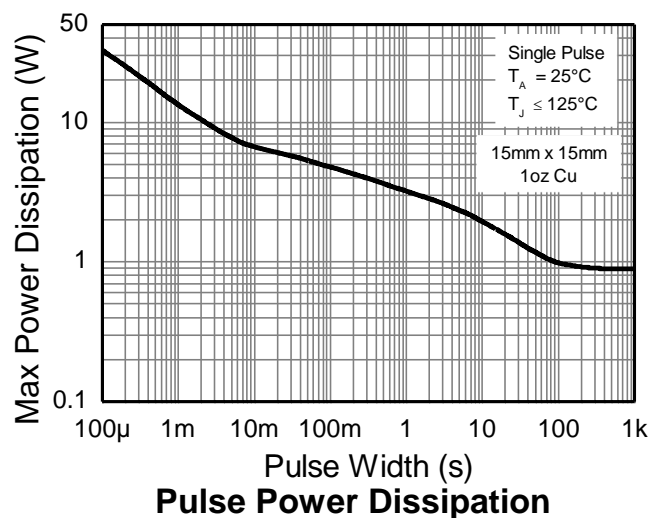
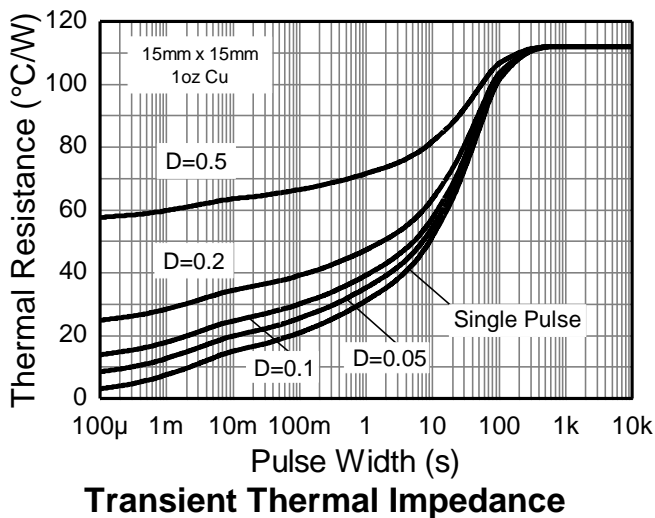
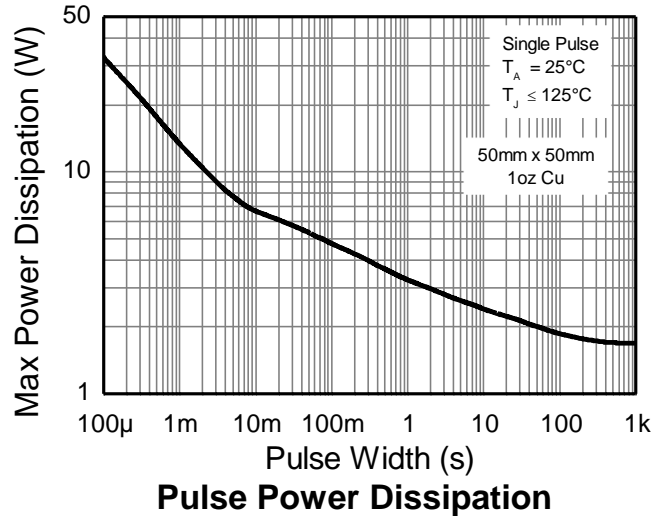
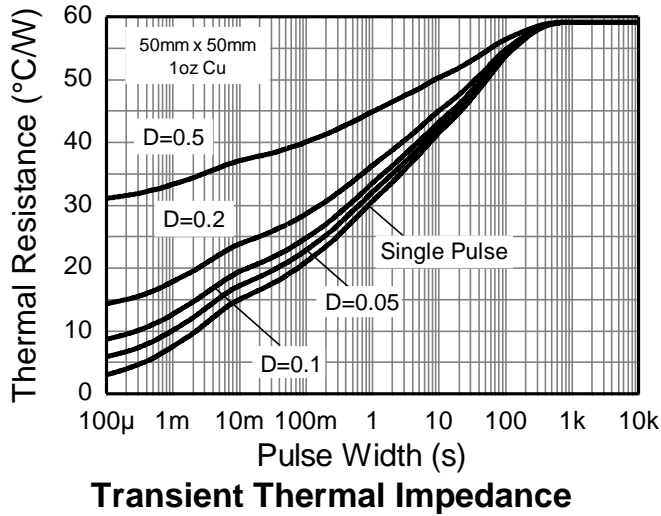
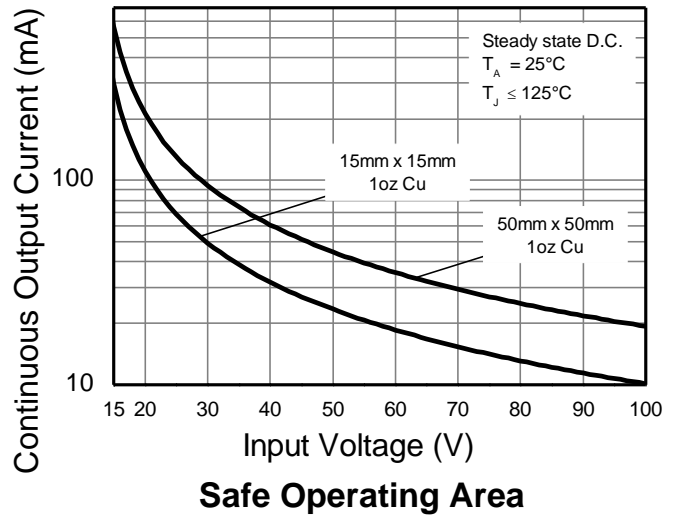
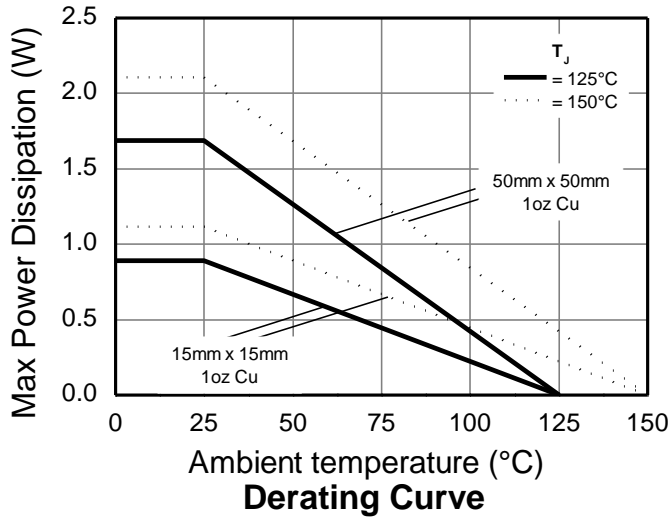
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P_D	1.7	W
		0.89 (Note 6)	
Thermal Resistance, Junction to Ambient (Note 5)	$R_{\theta JA}$	59	$^\circ\text{C/W}$
		112 (Note 6)	
Thermal Resistance, Junction to Lead (Note 10)	$R_{\theta JL}$	20	
Thermal Resistance, Junction to Case (Note 10)	$R_{\theta JC}$	15.7	
Recommended Operating Junction Temperature Range	T_J	-40 to +125	$^\circ\text{C}$
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	4,000	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, whilst 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 μs 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.

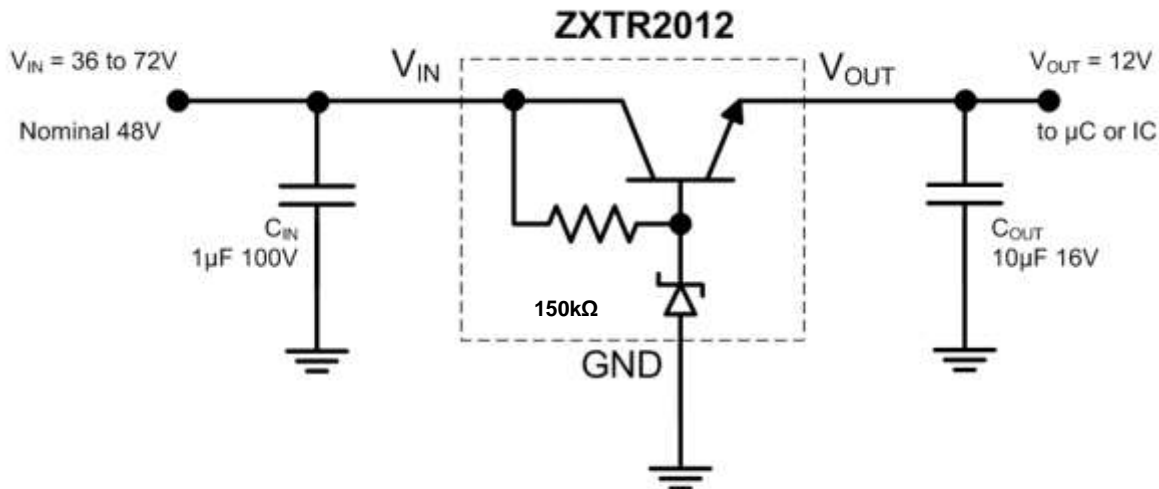
Thermal Characteristics and Derating Information



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}	10.8	12	13.2	V	$V_{IN} = 48\text{V}$, $I_{OUT} = 15\text{mA}$
Line Regulation (Notes 12 & 13)	ΔV_{OUT}	—	240	750	mV	$V_{IN} = 15$ to 72V , $I_{OUT} = 15\text{mA}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	8.0	—	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)	ΔV_{OUT}	—	-450 -600	-600 -750	mV	$I_{OUT} = 0.1$ to 30mA , $V_{IN} = 48\text{V}$ $I_{OUT} = 0.1$ to 100mA , $V_{IN} = 48\text{V}$
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	15	—	—	V	—
Quiescent Current	I_Q	—	240 590	400 900	μA	$V_{IN} = 48\text{V}$, $I_{OUT} = 10\mu\text{A}$ $V_{IN} = 100\text{V}$, $I_{OUT} = 10\mu\text{A}$
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	45	—	dB	$C_{OUT} = 100\text{nF}$, $I_{OUT} = 15\text{mA}$, $V_{OUT} = 12\text{V}$, $V_{IN} = 15$ to 100V , $f = 100\text{Hz}$

- 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 $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 30\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$
 $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 100\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$

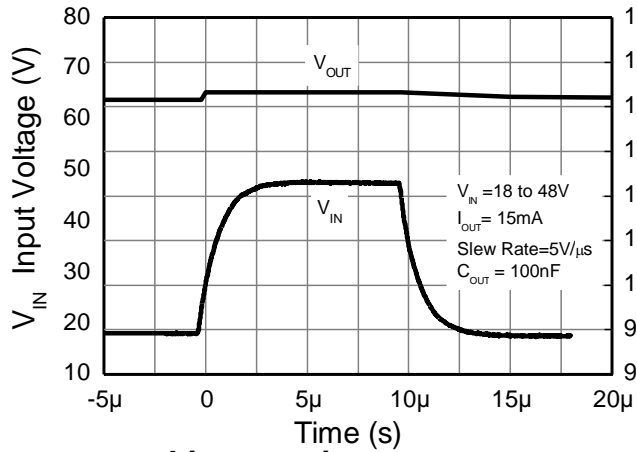
Typical Application Circuit


Example of an 12V regulated supply from a nominal 48V for powering a Controller IC.

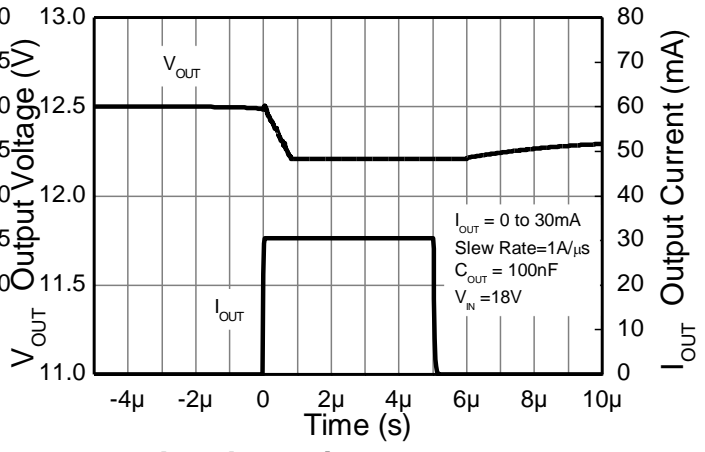
Pin Functions

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 $15\text{V} \leq V_{IN} \leq 100\text{V}$. It is recommended to connect a $1\mu\text{F}$ capacitor to GND.
GND	Power Ground	This pin should be tied to the system ground.
V_{OUT}	Voltage Output	Outputs a regulated 12V when $15\text{V} \leq V_{IN} \leq 100\text{V}$. When $V_{IN} < 15\text{V}$, then V_{OUT} maximum = $V_{IN} - 1.5\text{V}$. The pin can be pulled high to a maximum of $+18\text{V}$ with respect to GND, or $+12\text{V}$ with respect to V_{IN} , 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 V_{OUT} to maintain regulation.

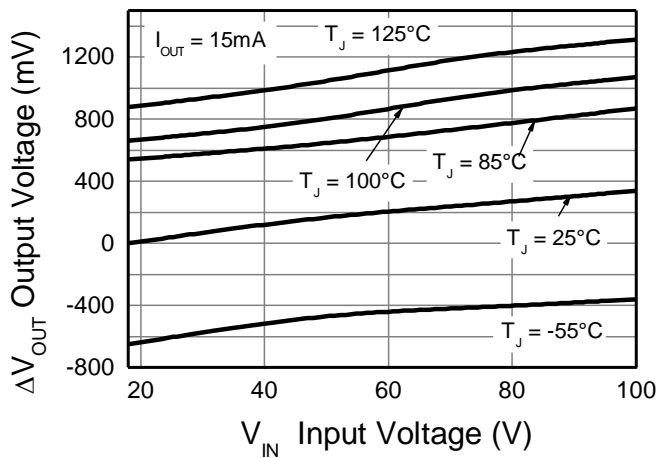
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



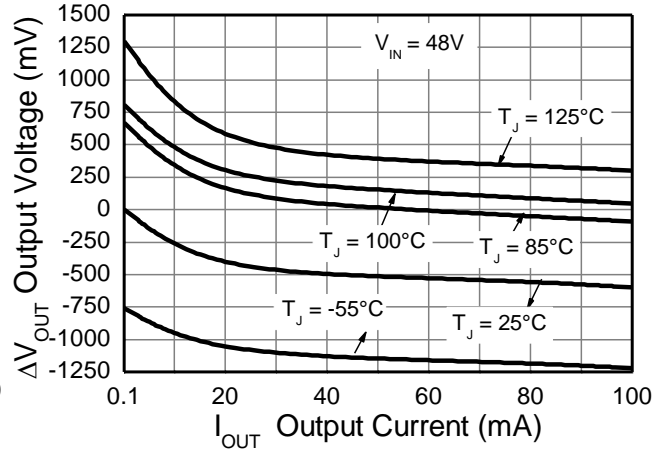
Line transient response



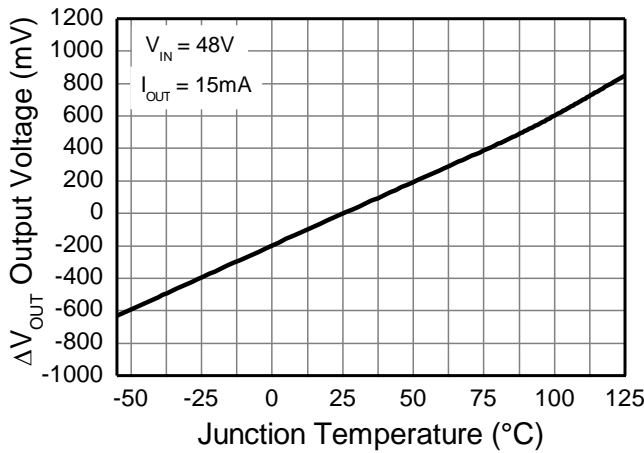
Load transient response



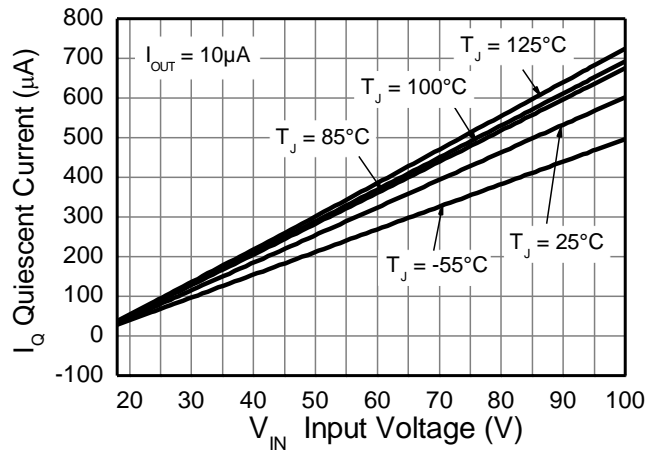
Line Regulation (Note 15)



Load Regulation (Note 16)



Temperature Coefficient (Note 17)



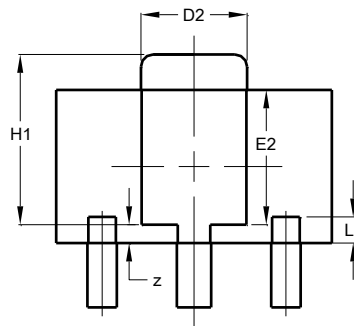
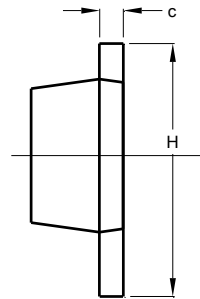
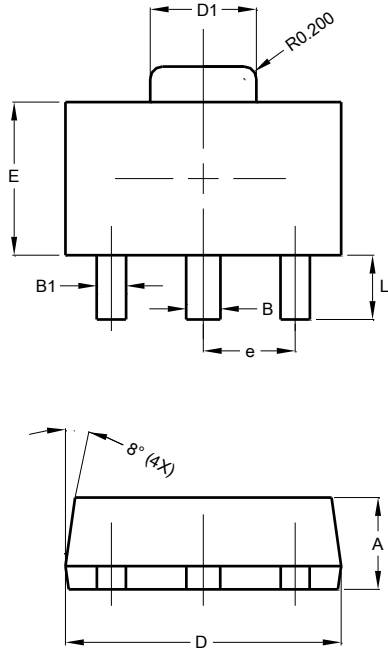
Quiescent Current

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

Package Outline Dimensions

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

SOT89

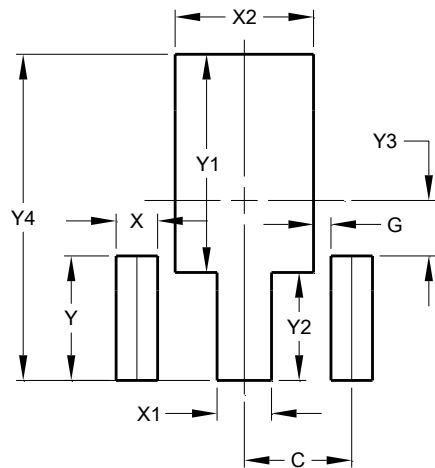


SOT89			
Dim	Min	Max	Typ
A	1.40	1.60	1.50
B	0.50	0.62	0.56
B1	0.42	0.54	0.48
c	0.35	0.43	0.38
D	4.40	4.60	4.50
D1	1.62	1.83	1.733
D2	1.61	1.81	1.71
E	2.40	2.60	2.50
E2	2.05	2.35	2.20
e	-	-	1.50
H	3.95	4.25	4.10
H1	2.63	2.93	2.78
L	0.90	1.20	1.05
L1	0.327	0.527	0.427
z	0.20	0.40	0.30
All Dimensions in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

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