



**THE DATASHEET OF  
ZXTR2012Z-7**



**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:

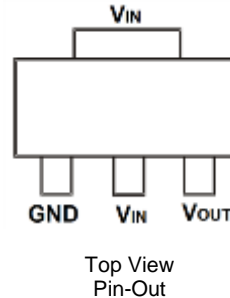
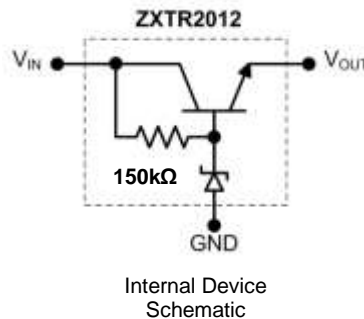
- Startup Switch in DC-DC Converters
- Networking
- Telecommunications
- Power over Ethernet (PoE)

**Features**

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 15V to 100V (For Regulated Output Voltage)
- Output Voltage = 12V  $\pm$  10%
- 150k $\Omega$  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 <sup>(e3)</sup>
- Weight: 0.052 grams (Approximate)

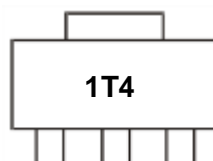


Pin Name	Pin Function
V <sub>IN</sub>	Input Supply
GND	Power Ground
V <sub>OUT</sub>	Voltage Output

**Ordering Information** (Note 4)

Product	Package	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
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<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Input Supply Voltage	V <sub>IN</sub>	-0.3 to 100	V
Continuous Input & Output Current	I <sub>IN</sub> , I <sub>OUT</sub>	550	mA
Peak Pulsed Input & Output Current	I <sub>IM</sub> , I <sub>OM</sub>	2	A
Maximum Voltage applied to V <sub>OUT</sub>	V <sub>OUT(MAX)</sub>	Smaller of V <sub>IN</sub> +12V or 18V	V

**Maximum Current at V<sub>IN</sub> = 48V** (@T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Continuous Output Current (Note 7)	I <sub>OUT</sub>	47	mA
Pulsed Output Current (Note 8)	I <sub>OM</sub>	880	mA
		(Note 9)	

**Thermal Characteristics**

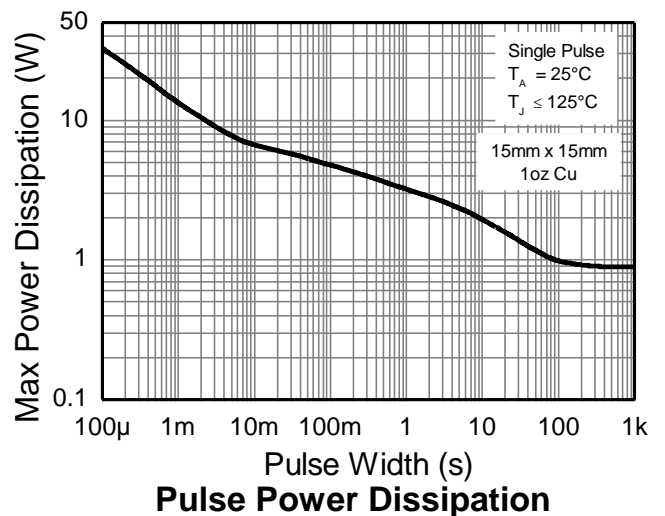
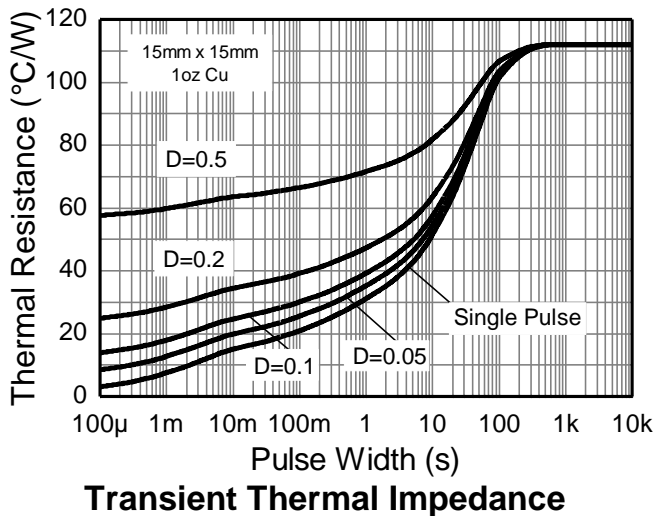
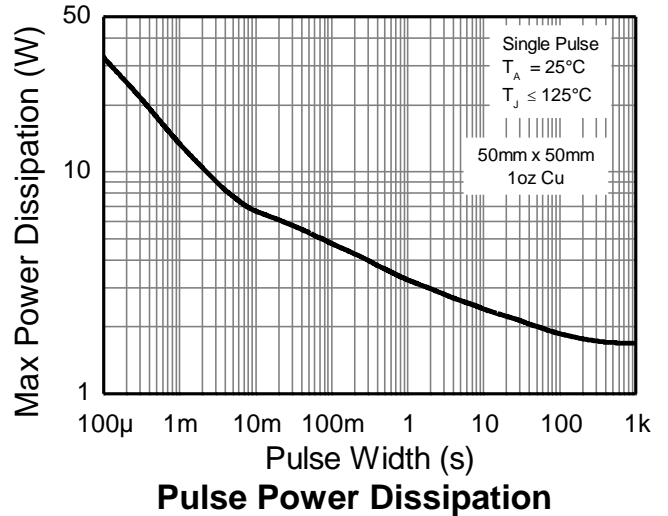
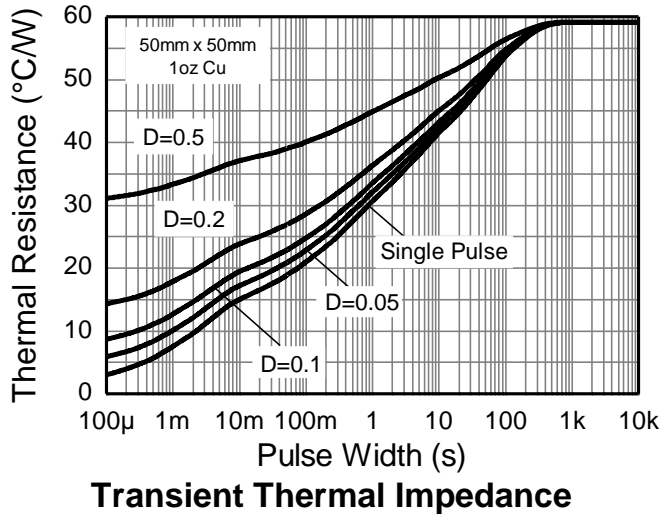
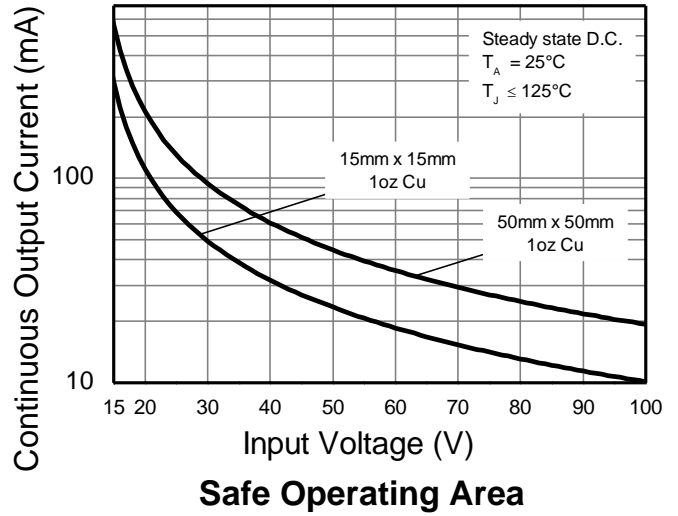
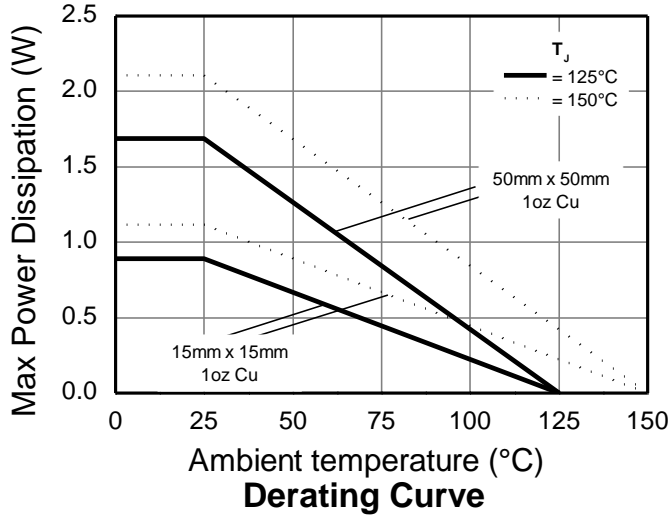
Characteristic	Symbol	Value	Unit
Power Dissipation (Note 5)	P <sub>D</sub>	1.7	W
		(Note 6)	
Thermal Resistance, Junction to Ambient (Note 5)	R <sub>θJA</sub>	59	°C/W
		(Note 6)	
Thermal Resistance, Junction to Lead (Note 10)	R <sub>θJL</sub>	20	
Thermal Resistance, Junction to Case (Note 10)	R <sub>θJC</sub>	15.7	
Recommended Operating Junction Temperature Range	T <sub>J</sub>	-40 to +125	°C
Maximum Operating Junction and Storage Temperature Range	T <sub>J</sub> , T <sub>STG</sub>	-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<sub>IN</sub> 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<sub>IN</sub> = 48V. Refer to Safe Operating Area for other Input Voltages.
  - Same as note 5, except measured with a single pulse width = 100µs and V<sub>IN</sub> = 48V.
  - Same as note 5, except measured with a single pulse width = 10ms and V<sub>IN</sub> = 48V.
  - R<sub>θJL</sub> = Thermal resistance from junction to solder-point (on the exposed V<sub>IN</sub> pad).
  - R<sub>θJC</sub> = Thermal resistance from junction to the top of case.
  - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

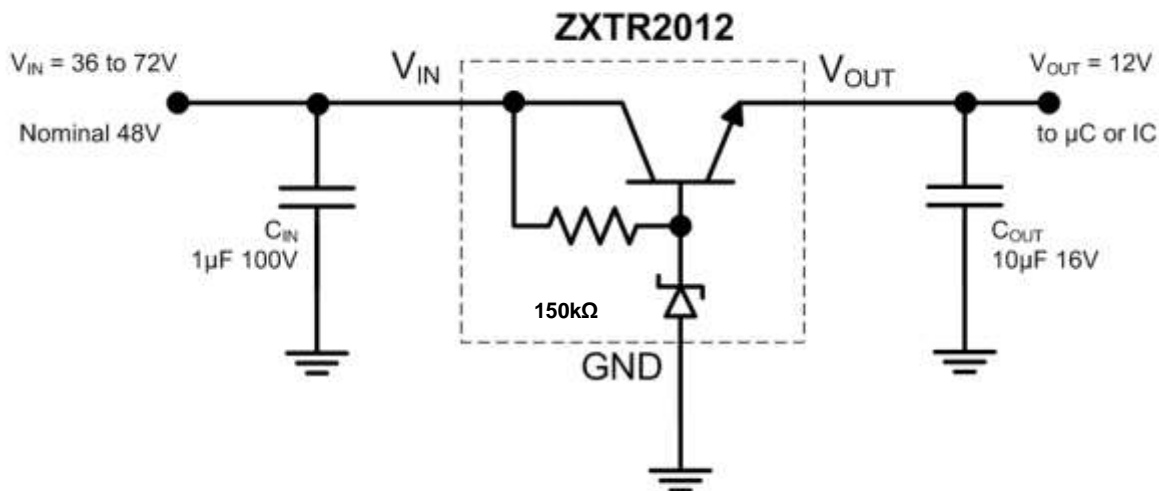
**Thermal Characteristics and Derating Information**



**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)	$\Delta V_{OUT}$	—	240	750	mV	$V_{IN} = 15$ to $72\text{V}$ , $I_{OUT} = 15\text{mA}$
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)	$\Delta V_{OUT}$	—	-450 -600	-600 -750	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	$V_{IN(MIN)}$	15	—	—	V	—
Quiescent Current	$I_Q$	—	240 590	400 900	$\mu\text{A}$	$V_{IN} = 48\text{V}$ , $I_{OUT} = 10\mu\text{A}$ $V_{IN} = 100\text{V}$ , $I_{OUT} = 10\mu\text{A}$
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	45	—	dB	$C_{OUT} = 100\text{nF}$ , $I_{OUT} = 15\text{mA}$ , $V_{OUT} = 12\text{V}$ , $V_{IN} = 15$ 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  $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 30\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$   
 $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 100\text{mA}) - V_{OUT}(@ I_{OUT} = 0.1\text{mA})$

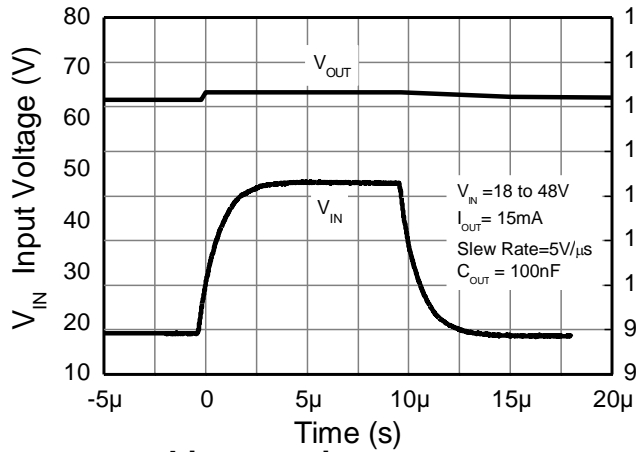
**Typical Application Circuit**


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

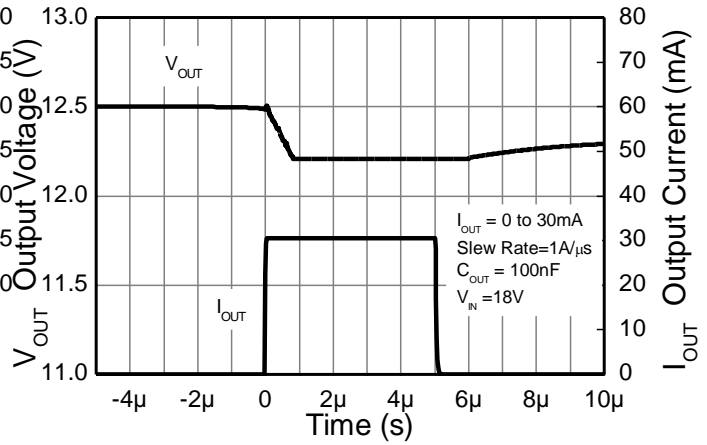
**Pin Functions**

Pin Name	Pin Function	Notes
$V_{IN}$	Input Supply	Input voltage can vary from $-0.3\text{V}$ to $100\text{V}$ 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 $12\text{V}$ 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.

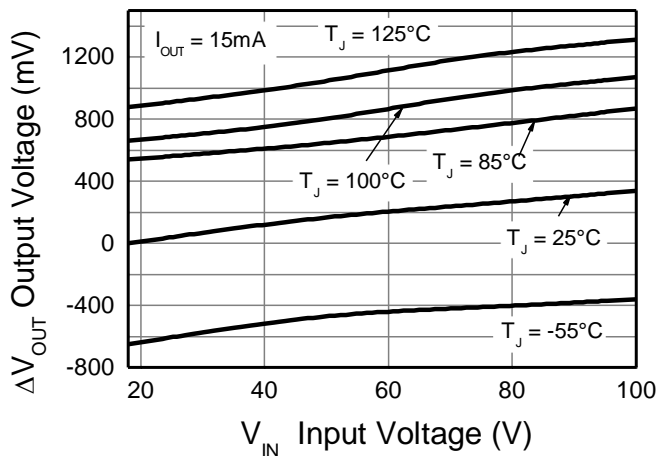
**Typical Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



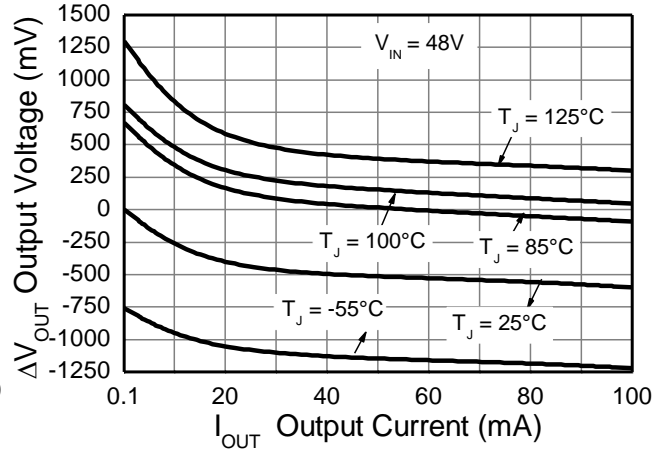
**Line transient response**



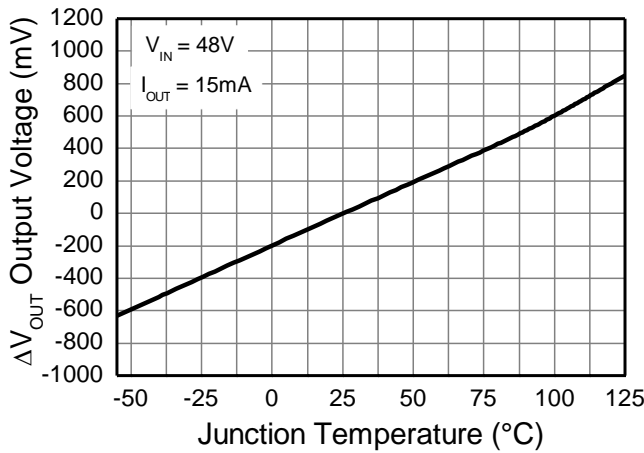
**Load transient response**



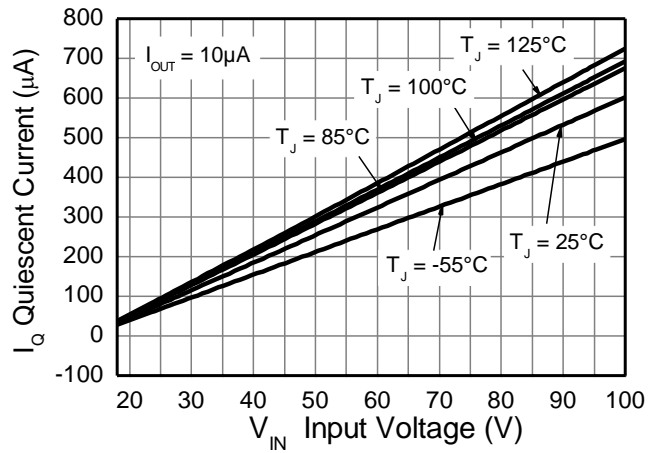
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



**Temperature Coefficient (Note 17)**

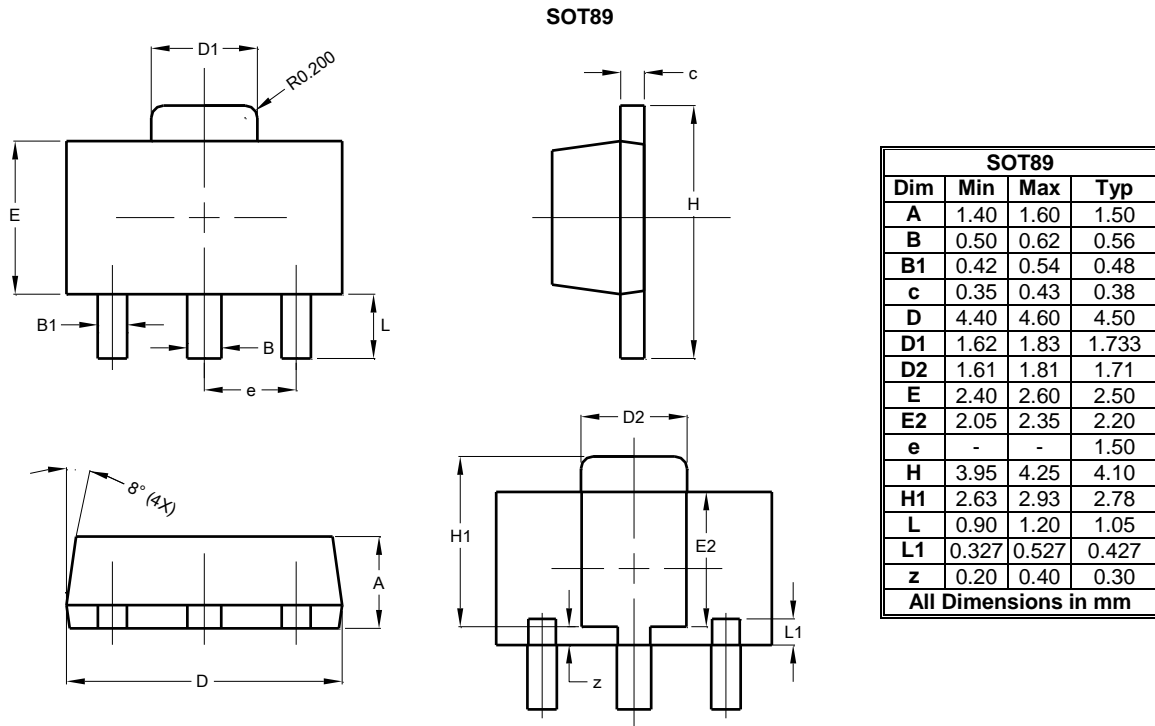


**Quiescent Current**

- 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  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48V, I_{OUT} = 15mA, T_J = +25^\circ C)$

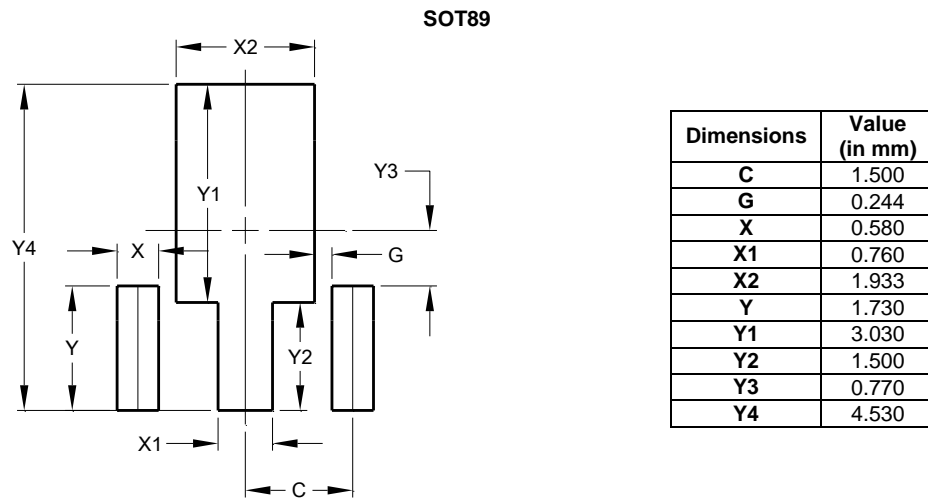
## Package Outline Dimensions

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



## Suggested Pad Layout

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



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