

Description

The ZXTR2005Z 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

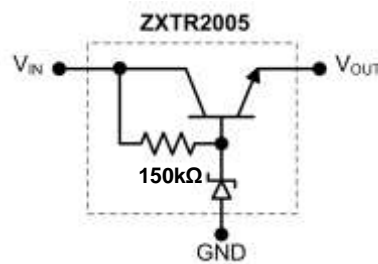
Supply Voltage Regulation in:

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

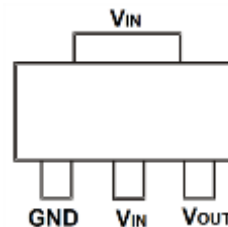
SOT89



Top View



Internal Device Schematic



Top View
Pin-Out

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

Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10 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)**
- **Qualified to AEC-Q101 for High Reliability**

Mechanical Data

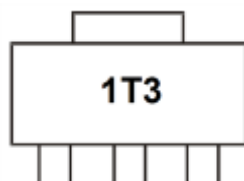
- Case: SOT89
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.052 grams (Approximate)

Ordering Information (Note 4)

| Product | Package | Marking | Reel Size (inches) | Tape Width (mm) | Quantity per Reel |
|--------------|---------|---------|--------------------|-----------------|-------------------|
| ZXTR2005Z-7 | SOT89 | 1T3 | 7 | 12 | 1,000 |
| ZXTR2005Z-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) 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



1T3 = 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 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 $V_{IN}+5\text{V}$ or 11V | 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} | 38 | mA |
| Pulsed Output Current (Notes 8, 9) | I_{OM} | 740 | mA |
| | | 150 | |

Thermal Characteristics

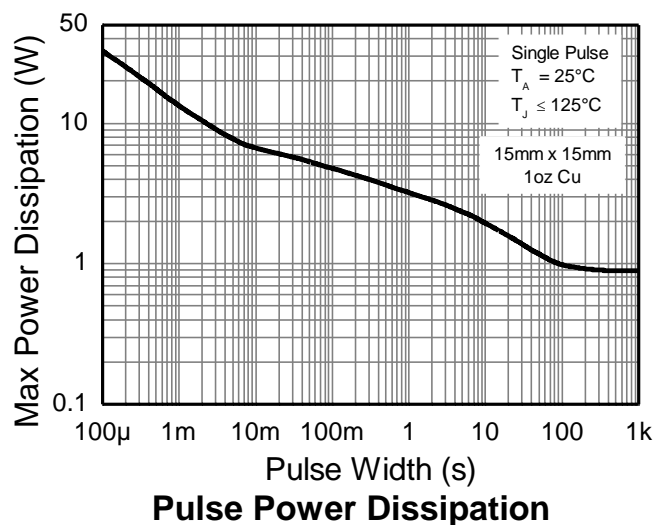
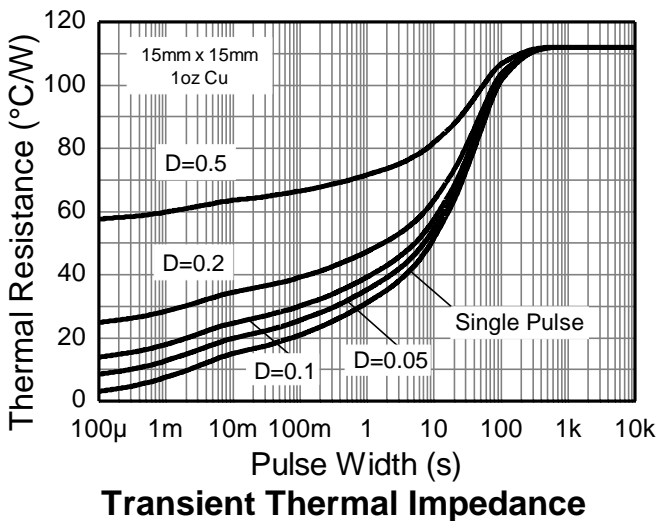
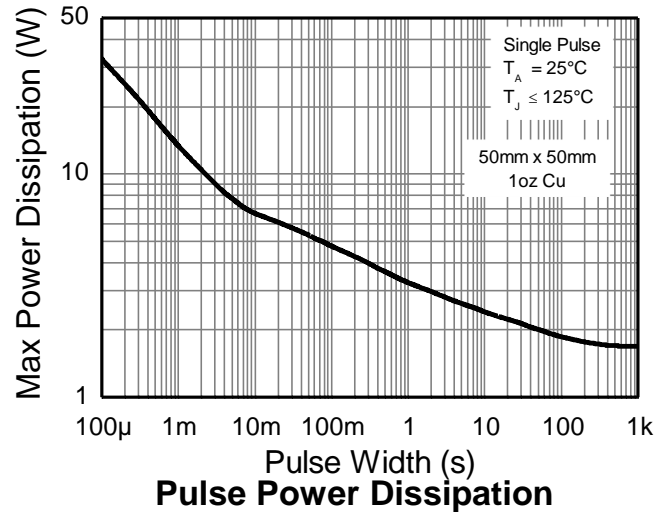
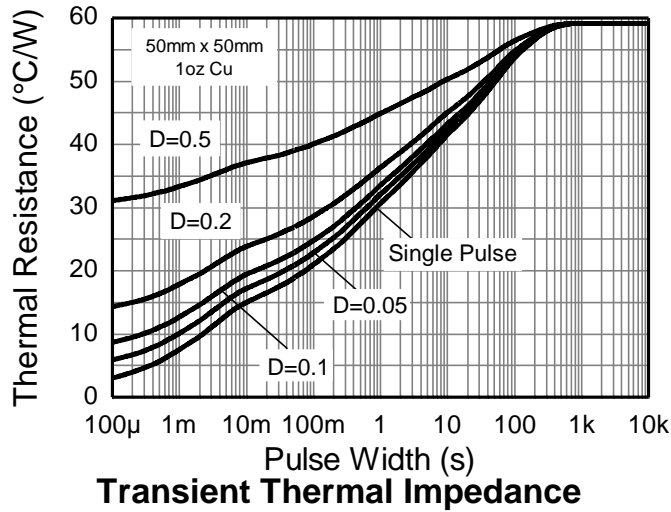
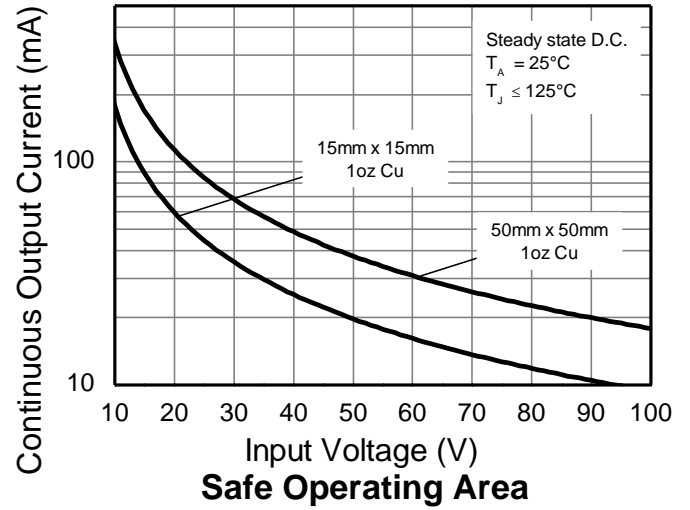
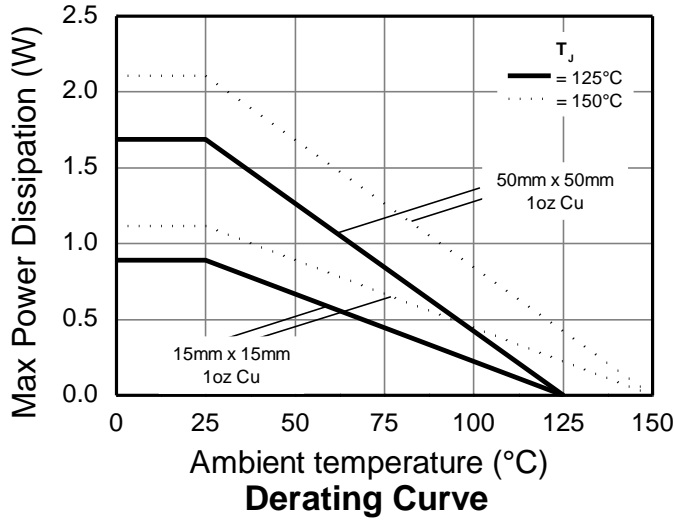
| Characteristic | Symbol | Value | Unit |
|----------------------------------------------------------|-----------------|-------------|--------------------|
| Power Dissipation (Notes 5, 6) | P_D | 1.7 | W |
| | | 0.89 | |
| Thermal Resistance, Junction to Ambient (Notes 5, 6) | $R_{\theta JA}$ | 59 | $^\circ\text{C/W}$ |
| | | 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 | |
| Maximum Operating Junction and Storage Temperature Range | T_J, T_{STG} | -65 to +150 | $^\circ\text{C}$ |

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.

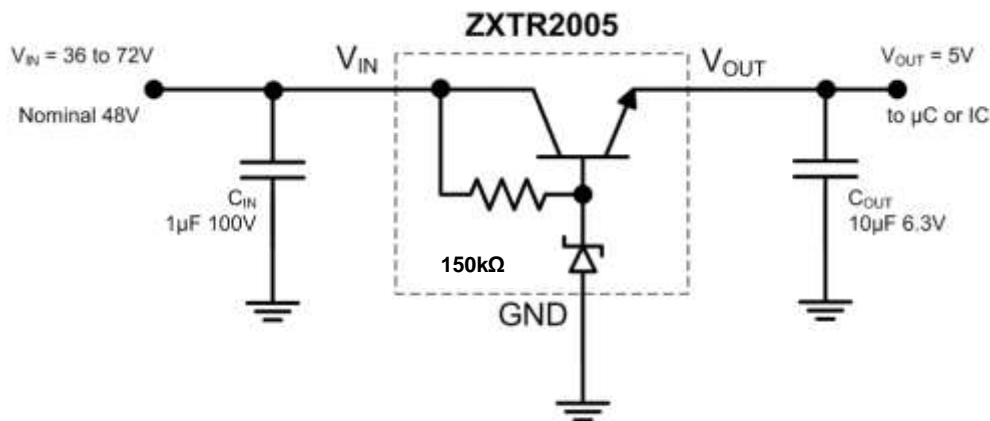
Thermal Characteristics and Derating Information



Electrical Characteristics (@T_A = +25°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} = 10 to 72V, I _{OUT} = 15mA |
| Temperature Coefficient | ΔV _{OUT} /ΔT | — | 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 | ΔV _{IN} /ΔV _{OUT} | — | 45 | — | dB | C _{OUT} = 100nF, I _{OUT} = 15mA, V _{OUT} = 5V, V _{IN} = 10 to 100V, f = 100Hz |

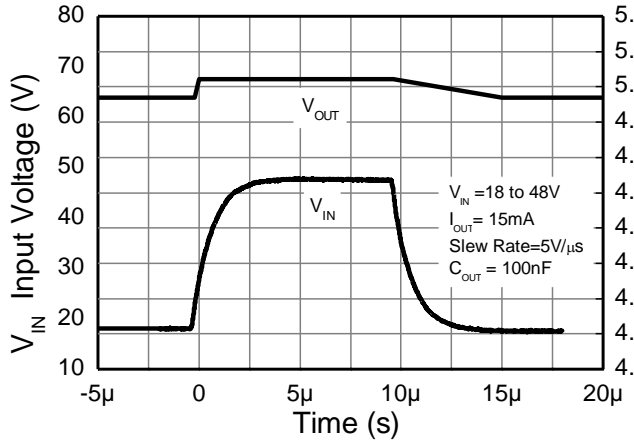
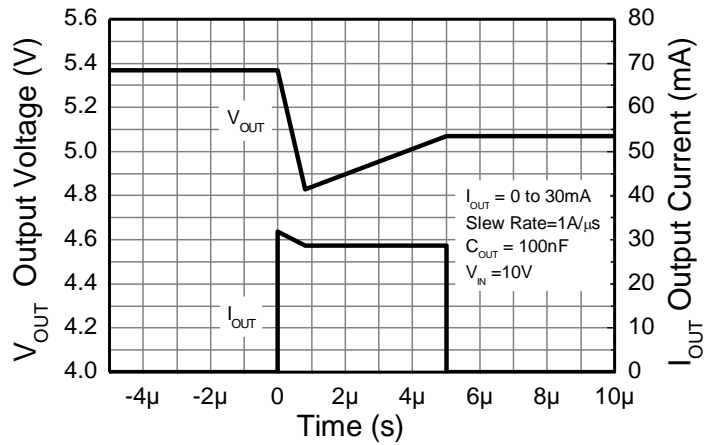
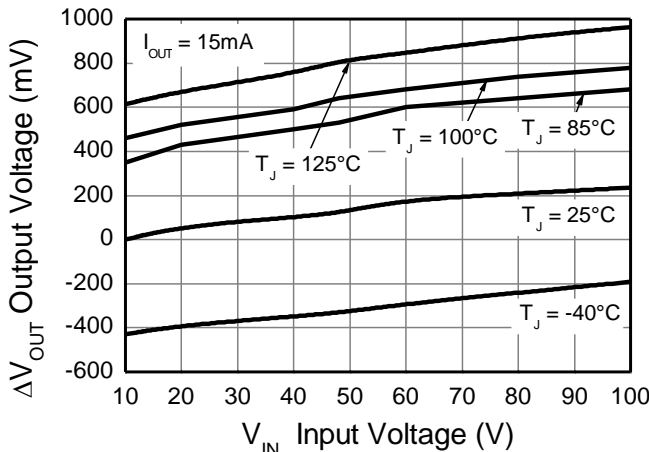
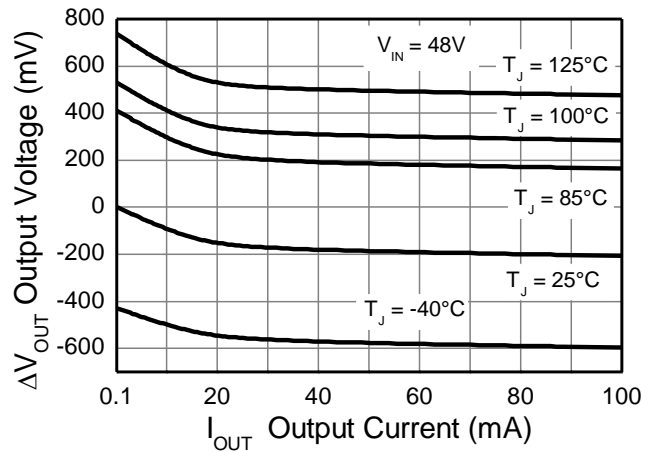
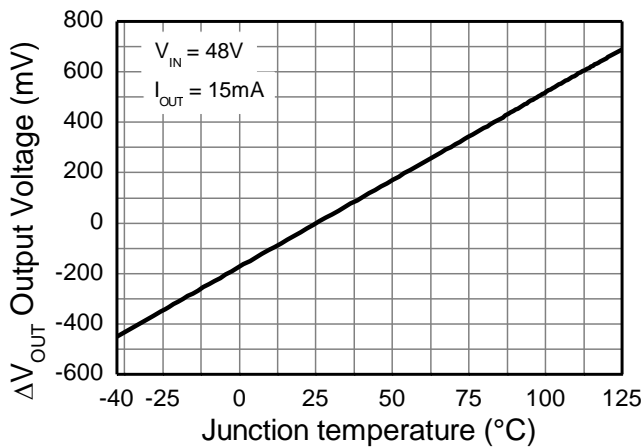
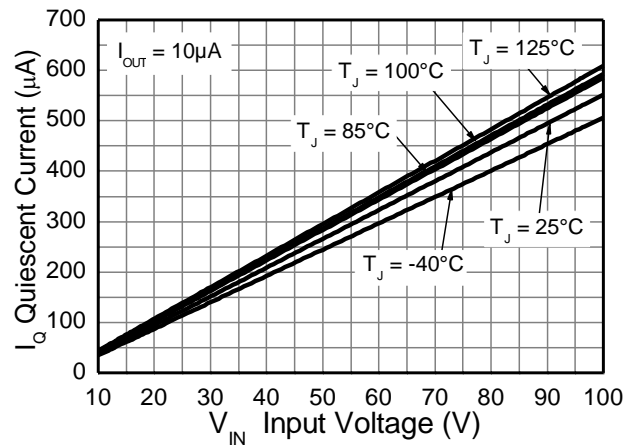
- Notes:
- 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.
 - 13. Line regulation $\Delta V_{OUT} = V_{OUT}(@ V_{IN} = 72V) - V_{OUT}(@ V_{IN} = 10V)$
 - 14. Load regulation $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 30mA) - V_{OUT}(@ I_{OUT} = 0.1mA)$
 $\Delta V_{OUT} = V_{OUT}(@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

Typical Application Circuit


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

Pin Functions

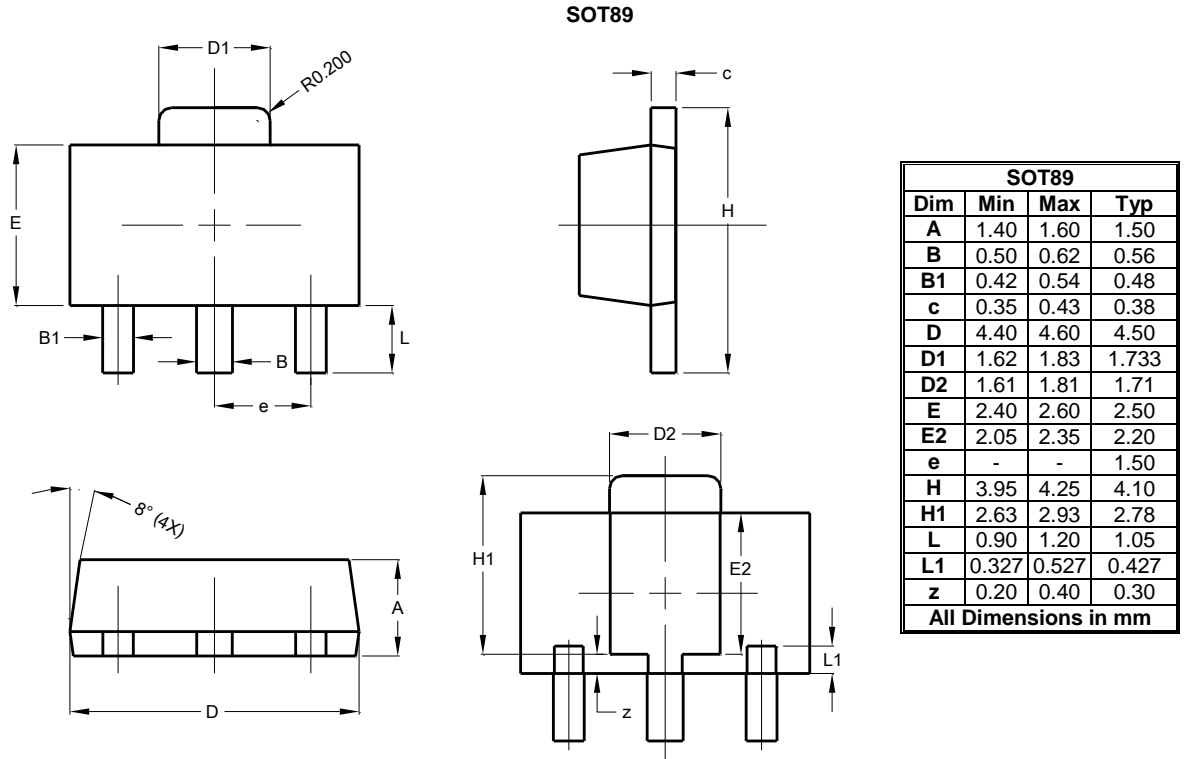
| Pin Name | Pin Function | Notes |
|------------------|----------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 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. The 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 (@ $T_A = +25^\circ\text{C}$, 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 $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 10\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$
 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 $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 48\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$

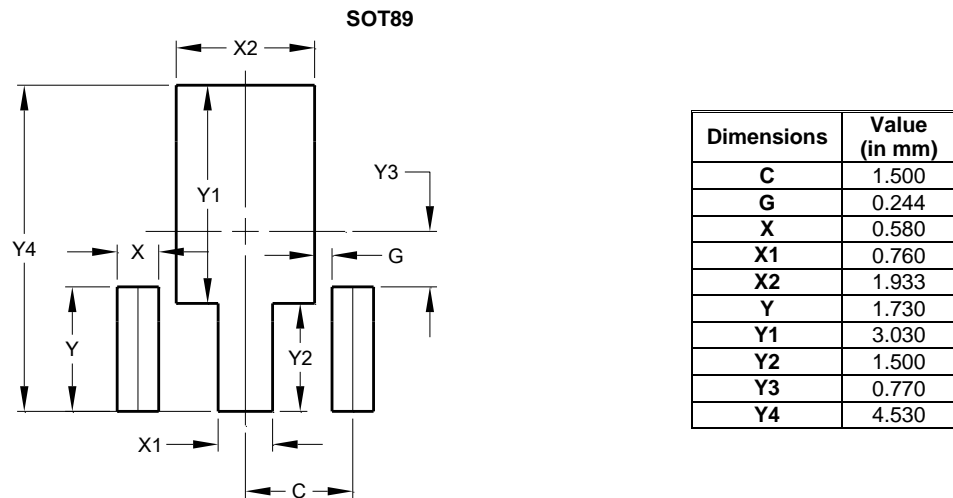
Package Outline Dimensions

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



Suggested Pad Layout

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



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