

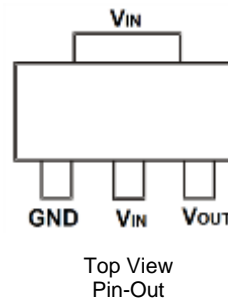
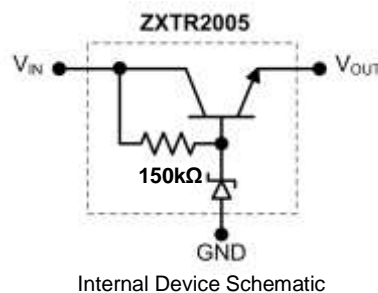
## Description

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)



| Pin Name         | Pin Function   |
|------------------|----------------|
| V <sub>IN</sub>  | Input Supply   |
| GND              | Power Ground   |
| V <sub>OUT</sub> | 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

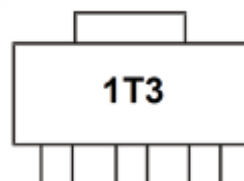
- Case: SOT89
- Case Material: Molded Plastic. "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 (e3)
- Weight: 0.052 grams (Approximate)

## 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<sub>A</sub> = +25°C, unless otherwise specified.)

| Characteristic                              | Symbol                             | Value                                 | Unit |
|---|------------------------------------|---------------------------------------|------|
| Input Voltage                               | V <sub>IN</sub>                    | -0.3 to 100                           | V    |
| Continuous Input & Output Current           | I <sub>IN</sub> , I <sub>OUT</sub> | 350                                   | 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> +5V or 11V | 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> | 38           | mA   |
| Pulsed Output Current (Note 8)     | I <sub>OM</sub>  | 740          | mA   |
|                                    |                  | 150 (Note 9) |      |

**Thermal Characteristics**

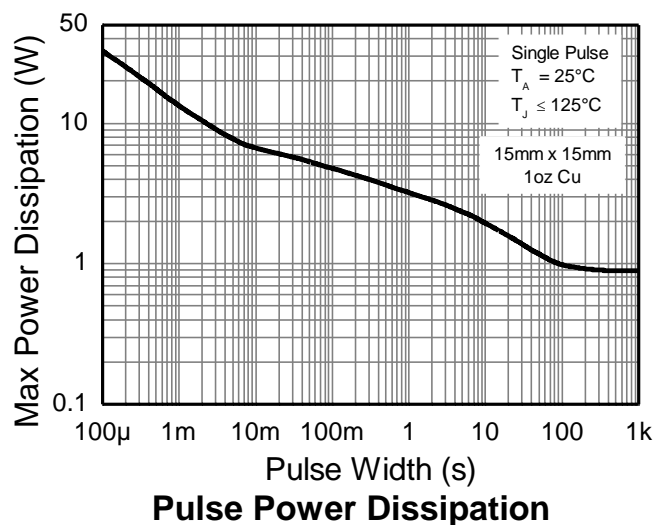
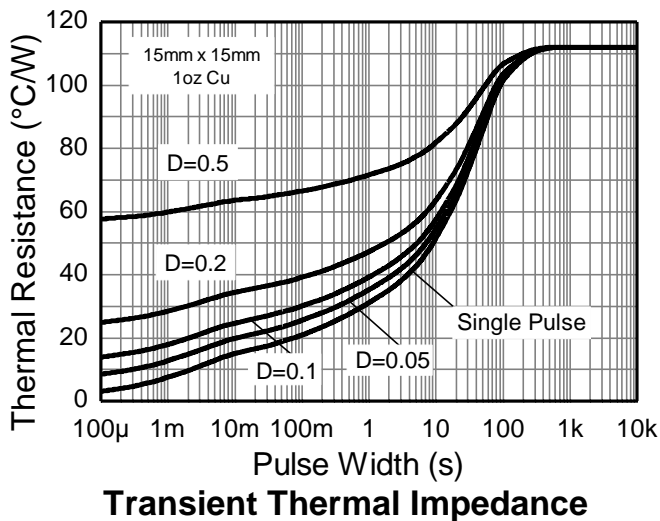
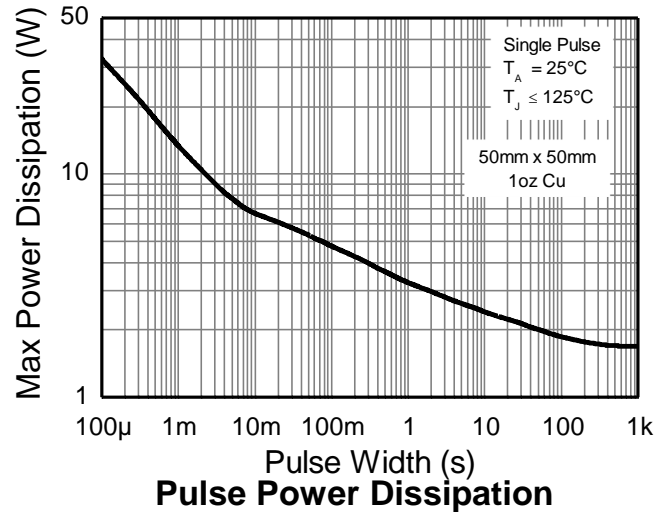
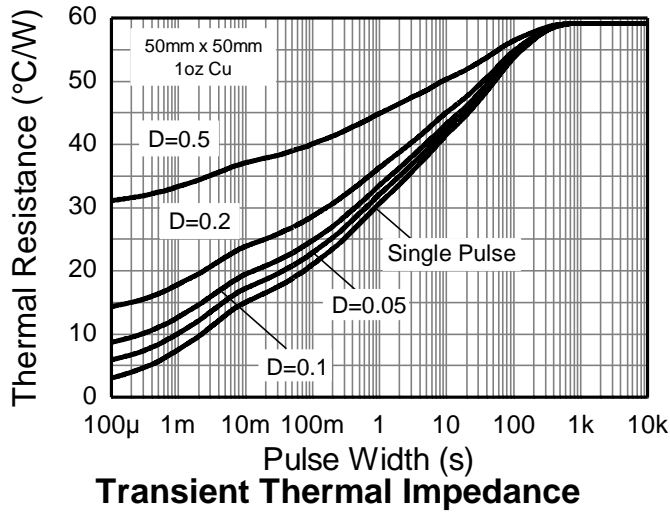
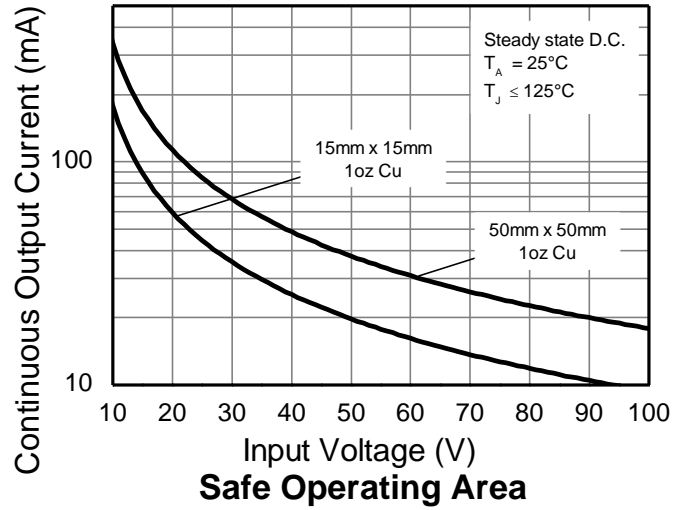
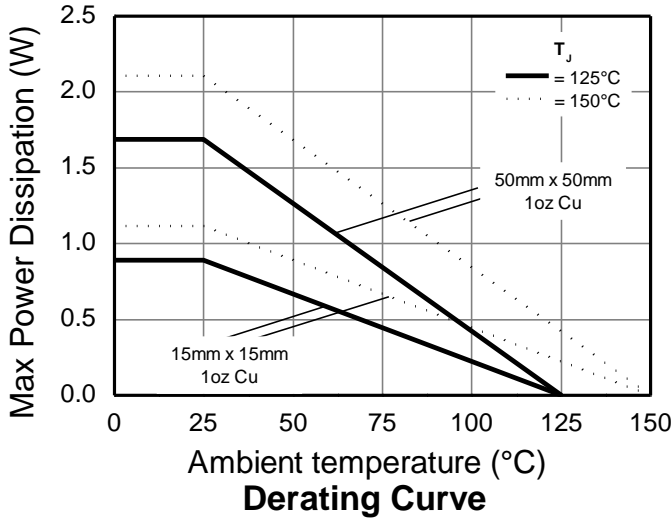
| Characteristic   | Symbol                            | Value         | Unit |
|--|-----------------------------------|---------------|------|
| Power Dissipation (Note 5)                               | P <sub>D</sub>                    | 1.7           | W    |
|  |                                   | 0.89 (Note 6) |      |
| Thermal Resistance, Junction to Ambient (Note 5)         | R <sub>θJA</sub>                  | 59            | °C/W |
|  |                                   | 112 (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   | °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<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.

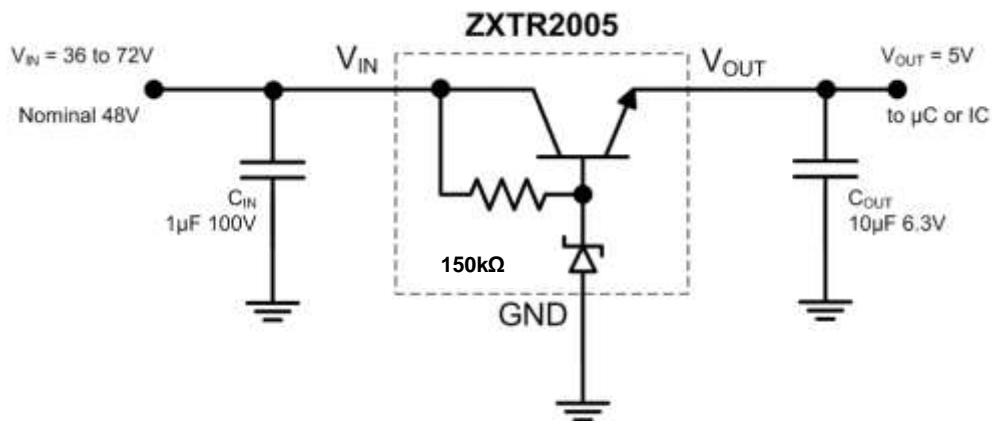
**Thermal Characteristics and Derating Information**



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

| Characteristic  | Symbol                              | Min | Typ          | Max          | Unit  | Test Condition   |
|---|-------------------------------------|-----|--------------|--------------|-------|--|
| Output Voltage (Note 12)  | V <sub>OUT</sub>                    | 4.5 | 5.0          | 5.5          | V     | V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA   |
| Line Regulation (Notes 12 & 13)                                     | ΔV <sub>OUT</sub>                   | —   | 195          | 300          | mV    | V <sub>IN</sub> = 10 to 72V, I <sub>OUT</sub> = 15mA   |
| Temperature Coefficient   | ΔV <sub>OUT</sub> /ΔT               | —   | 7.0          | —            | mV/°C | T <sub>J</sub> = -40°C to +125°C<br>V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA                                   |
| Load Regulation (Notes 12 & 14)                                     | ΔV <sub>OUT</sub>                   | —   | -185<br>-205 | -350<br>-400 | mV    | I <sub>OUT</sub> = 0.1 to 30mA, V <sub>IN</sub> = 48V<br>I <sub>OUT</sub> = 0.1 to 100mA, V <sub>IN</sub> = 48V      |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | V <sub>IN(MIN)</sub>                | 10  | —            | —            | V     | —  |
| Quiescent Current   | I <sub>Q</sub>                      | —   | 260<br>550   | 500<br>900   | μA    | V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 10μA<br>V <sub>IN</sub> = 100V, I <sub>OUT</sub> = 10μA                    |
| Power Supply Rejection Ratio  | ΔV <sub>IN</sub> /ΔV <sub>OUT</sub> | —   | 45           | —            | dB    | C <sub>OUT</sub> = 100nF, I <sub>OUT</sub> = 15mA,<br>V <sub>OUT</sub> = 5V, V <sub>IN</sub> = 10 to 100V, f = 100Hz |

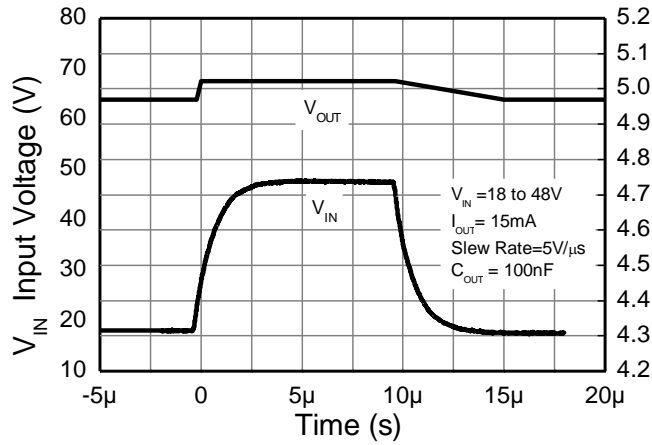
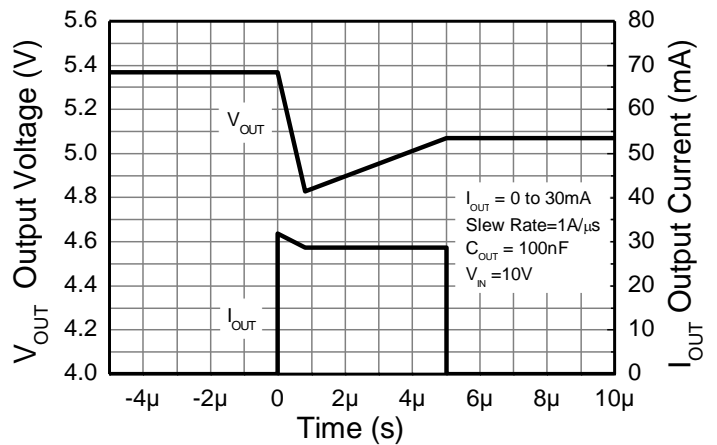
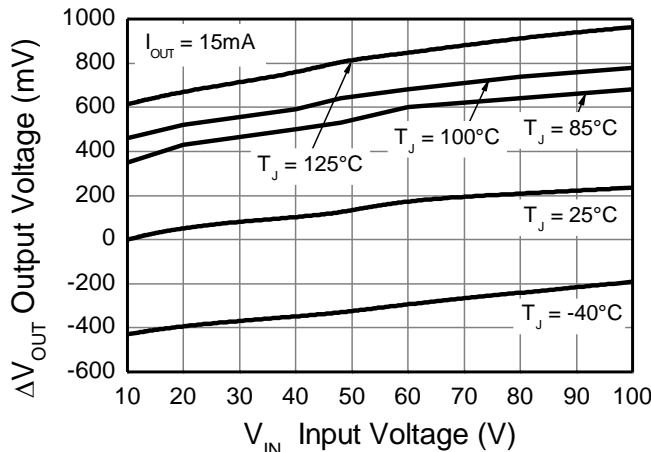
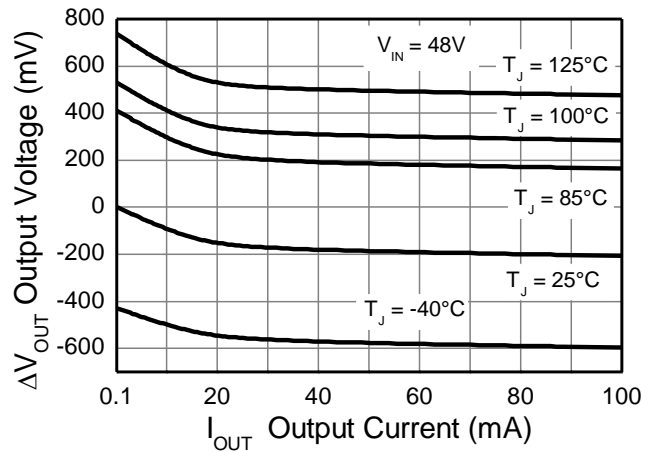
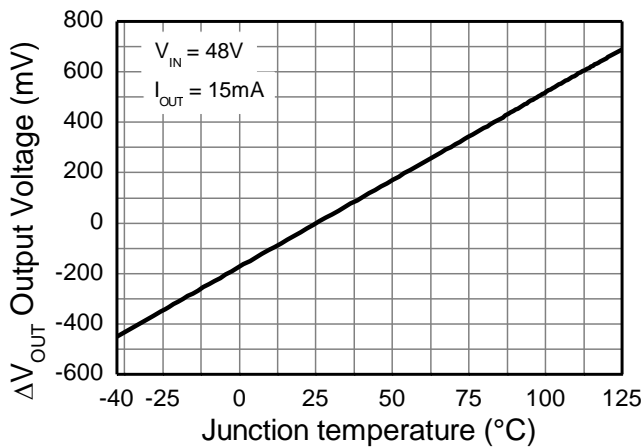
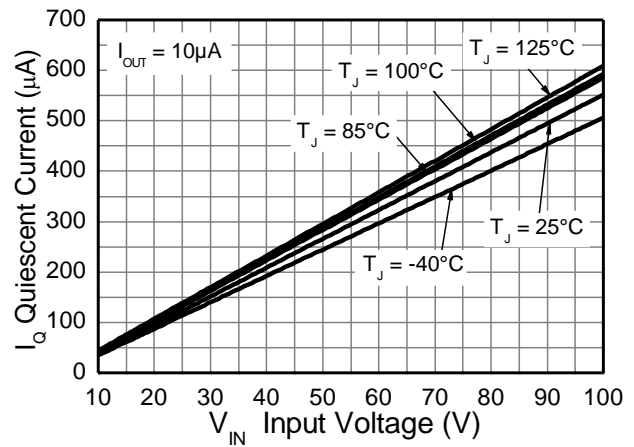
- Notes:
- 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.
  - 13. Line regulation  $\Delta V_{OUT} = V_{OUT}(@ V_{IN} = 72V) - V_{OUT}(@ V_{IN} = 10V)$
  - 14. Load regulation  $\Delta V_{OUT} = V_{OUT}(@ I_{OUT} = 30mA) - V_{OUT}(@ I_{OUT} = 0.1mA)$   
 $\Delta V_{OUT} =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

**Typical Application Circuit**


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

**Pin Functions**

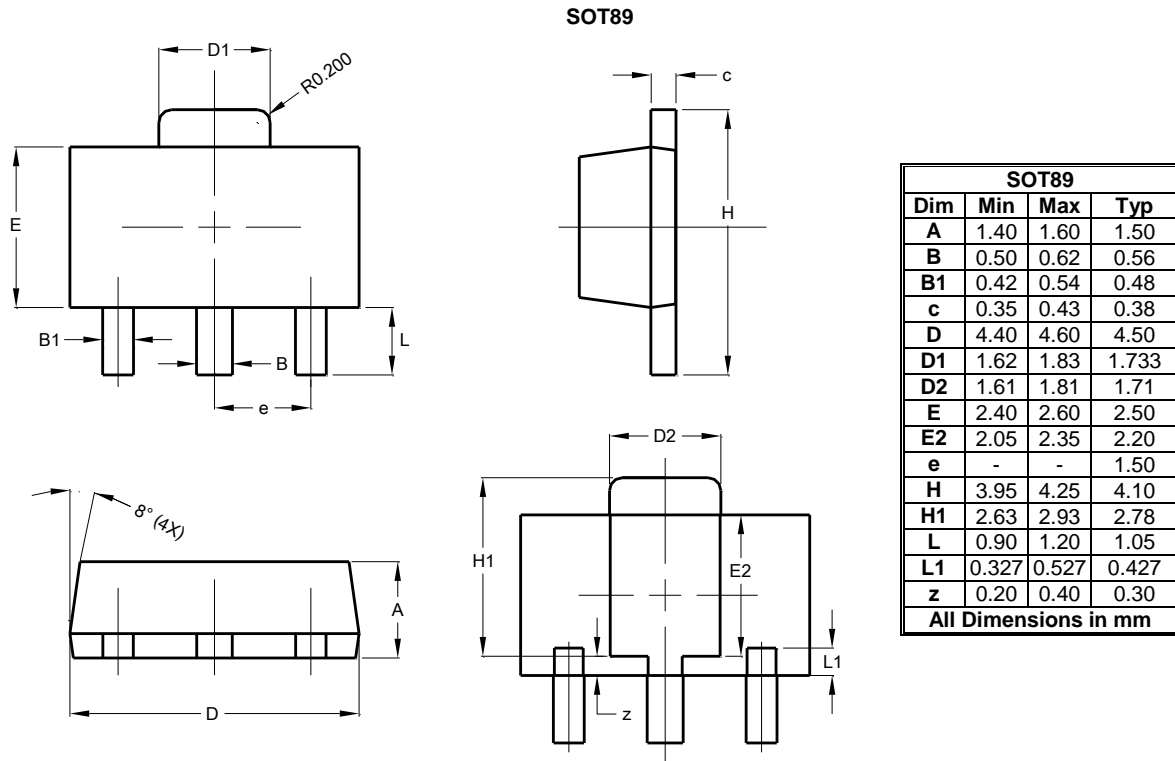
| Pin Name         | Pin Function   | Notes  |
|------------------|----------------|--|
| V <sub>IN</sub>  | Input Supply   | Input voltage can vary from -0.3V to 100V with respect to GND; for V <sub>OUT</sub> regulated then 10V ≤ V <sub>IN</sub> ≤ 100V. It is recommended to connect a 1μF capacitor to GND.  |
| GND              | Power Ground   | This pin should be tied to the system ground.  |
| V <sub>OUT</sub> | Voltage Output | Outputs a regulated 5V when 10V ≤ V <sub>IN</sub> ≤ 100V. When V <sub>IN</sub> < 10V, then V <sub>OUT</sub> maximum = V <sub>IN</sub> - 1.5V. The pin can be pulled high to a maximum of +11V with respect to GND, or +5V with respect to V <sub>IN</sub> , whichever is lower. It is recommended to connect a 10μF capacitor to GND and a minimum of 10μA to be drawn from V <sub>OUT</sub> 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  $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 48\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$

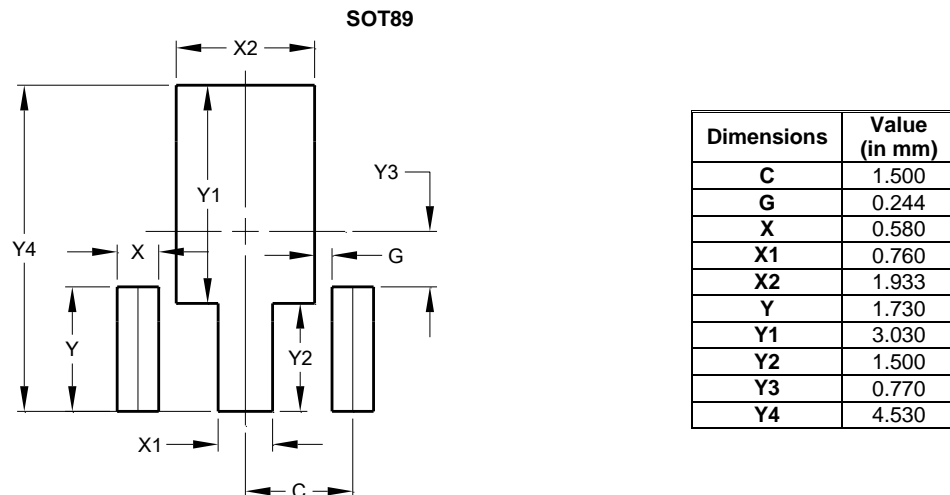
## Package Outline Dimensions

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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