

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)

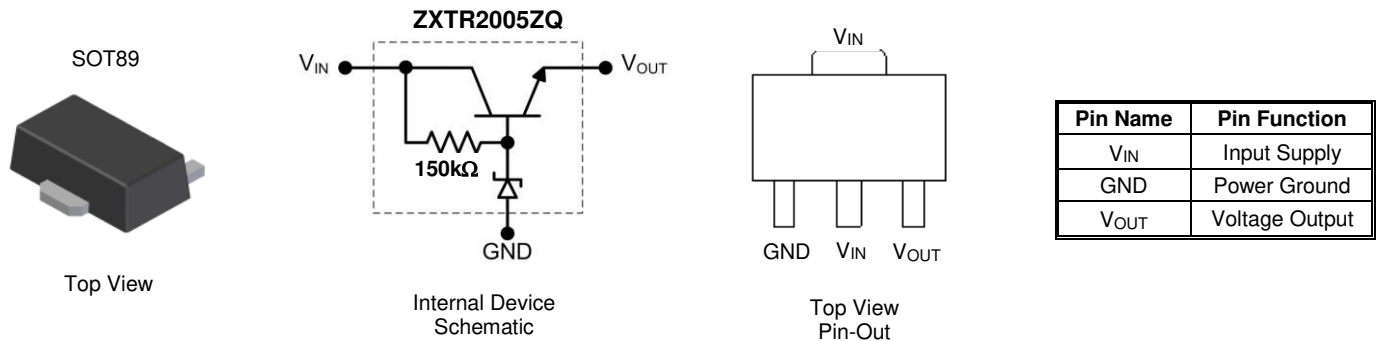
Features

- 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 [Ⓔ]3
- Weight: 0.052 grams (Approximate)

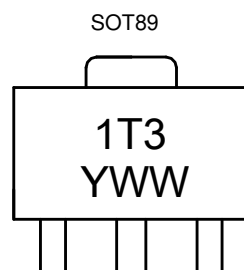


Ordering Information (Note 4)

| 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



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 | I _{OUT} | 38 | mA |
| Pulsed Output Current | I _{OM} | 740 | mA |
| | | 150 | |

Thermal Characteristics

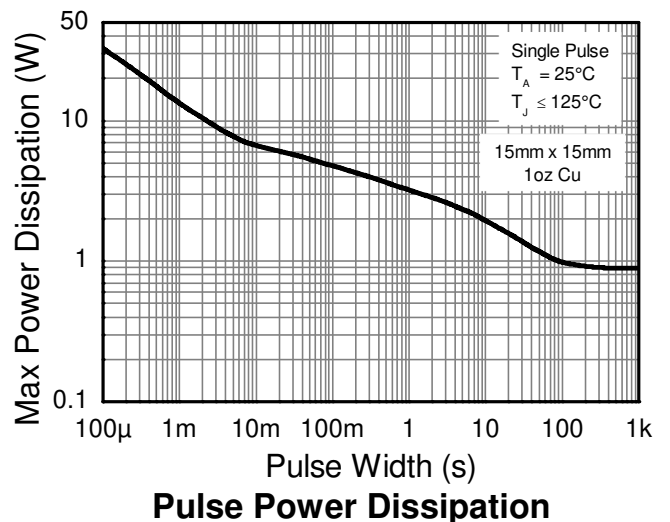
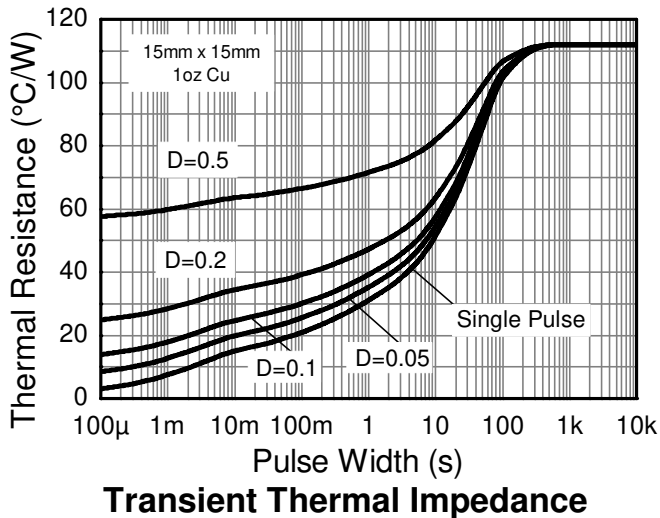
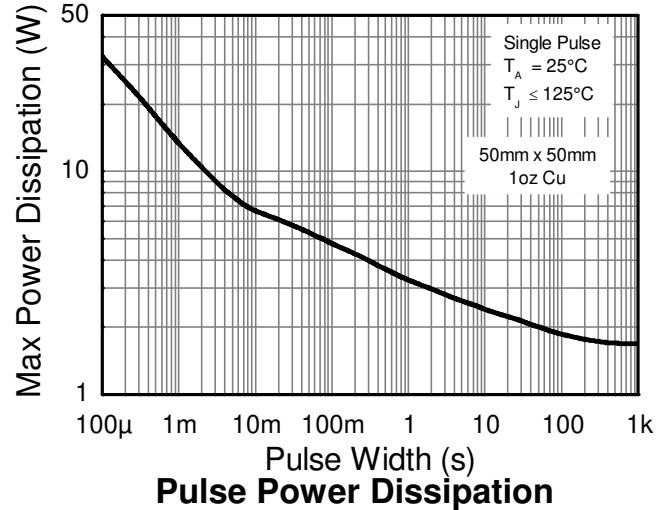
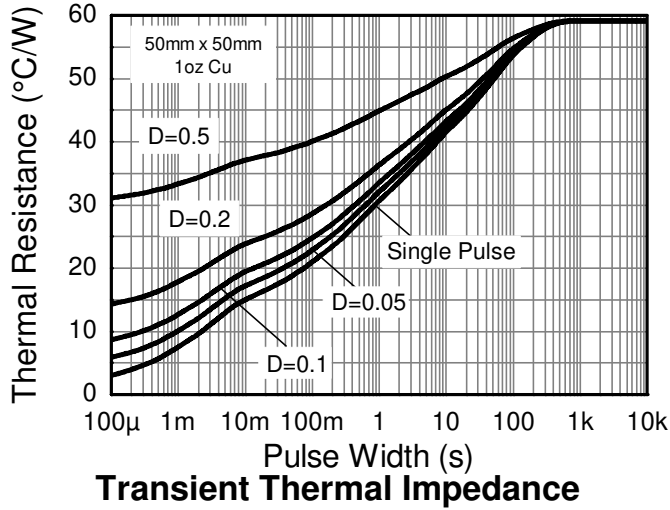
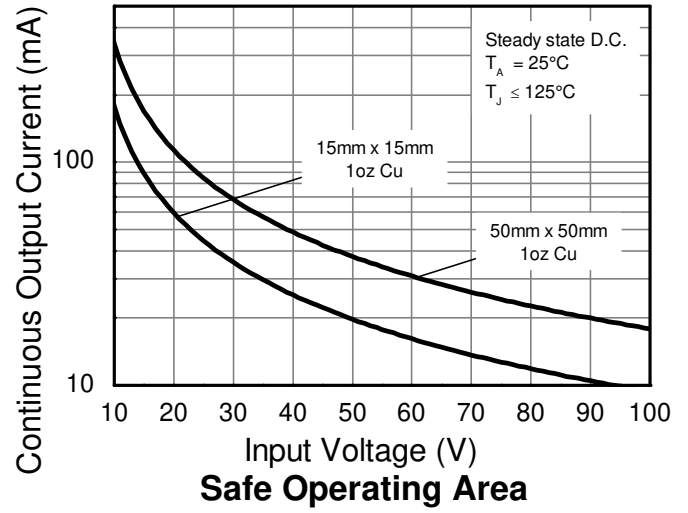
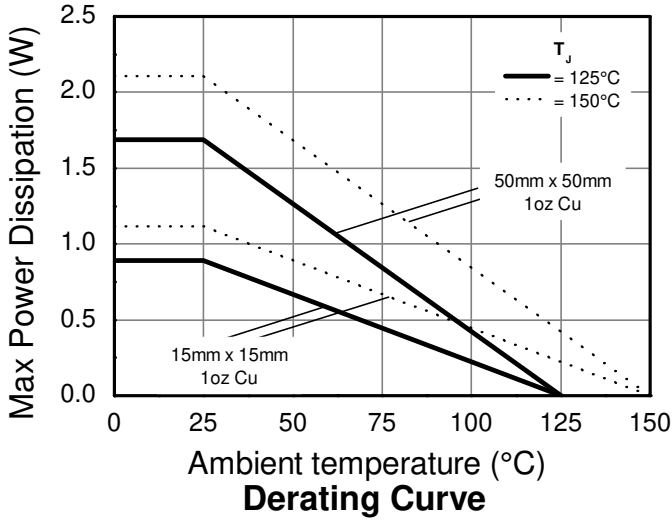
| Characteristic | Symbol | Value | Unit |
|--|-----------------------------------|-------------|------|
| Power Dissipation | P _D | 1.7 | W |
| | | 0.89 | |
| Thermal Resistance, Junction to Ambient | R _{θJA} | 59 | °C/W |
| | | 112 | |
| Thermal Resistance, Junction to Lead | R _{θJL} | 20 | |
| Thermal Resistance, Junction to Case | R _{θJC} | 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:
- 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} = 48V. Refer to Safe Operating Area for other Input Voltages.
 - Same as note 5, except measured with a single pulse width = 100μs and V_{IN} = 48V.
 - Same as note 5, except measured with a single pulse width = 10ms and V_{IN} = 48V.
 - R_{θJL} = Thermal resistance from junction to solder-point (on the exposed V_{IN} pad). R_{θJC} = Thermal resistance from junction to the top of case.
 - Refer to JEDEC specification JESD22-A114 and JESD22-A115.

Thermal Characteristics and Derating Information

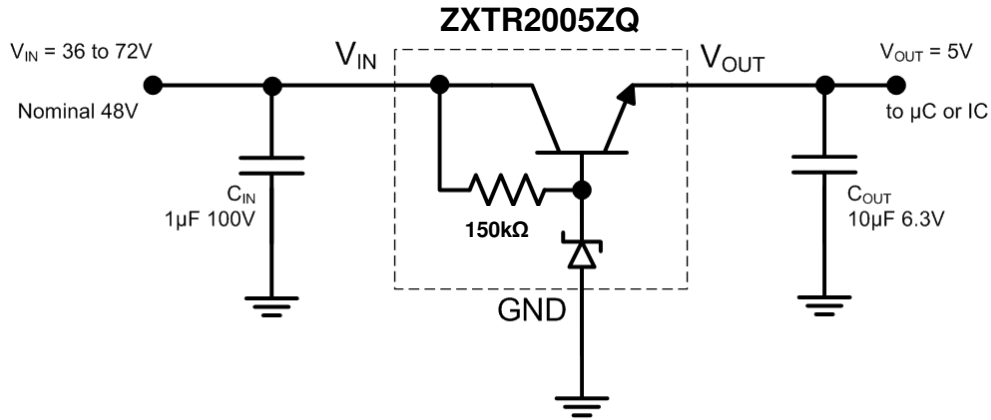


Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

| 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} = 10V 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} = 10V to 100V, f = 100Hz |

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

Typical Application Circuit

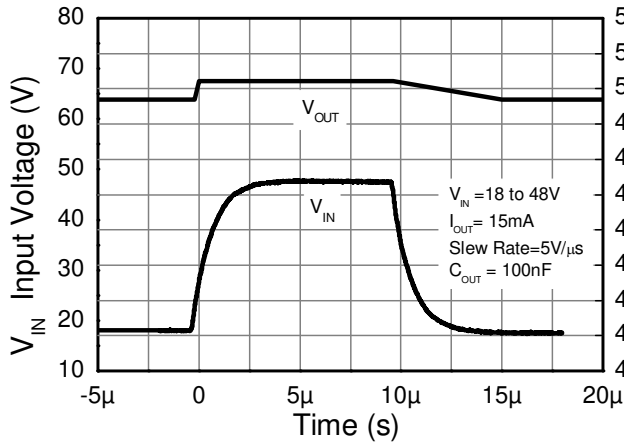


Example of a 5V regulated supply from a nominal 48V for powering a Controller IC.

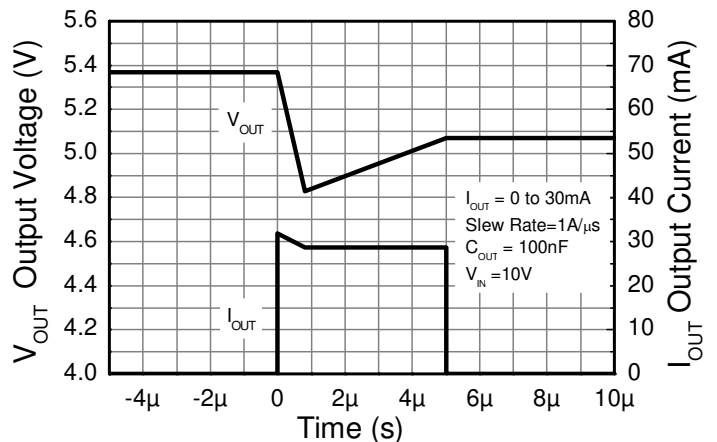
Pin Functions

| 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. |

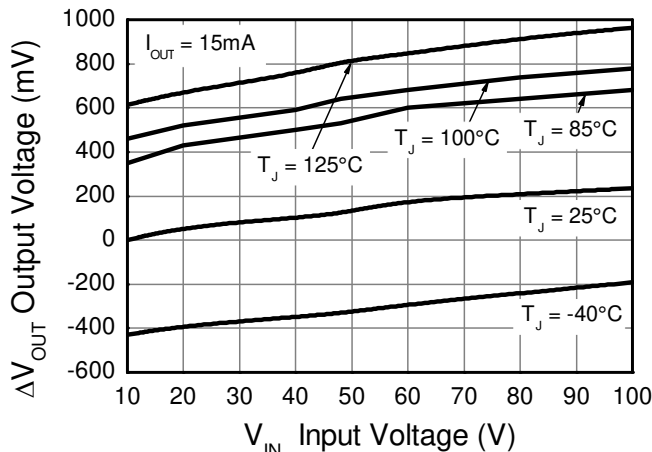
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



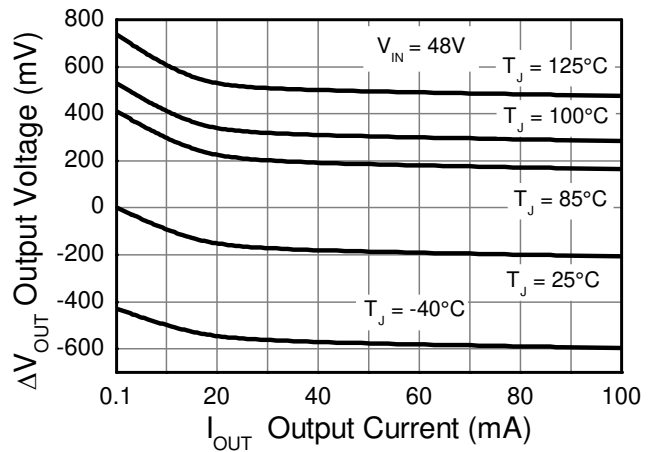
Line transient response



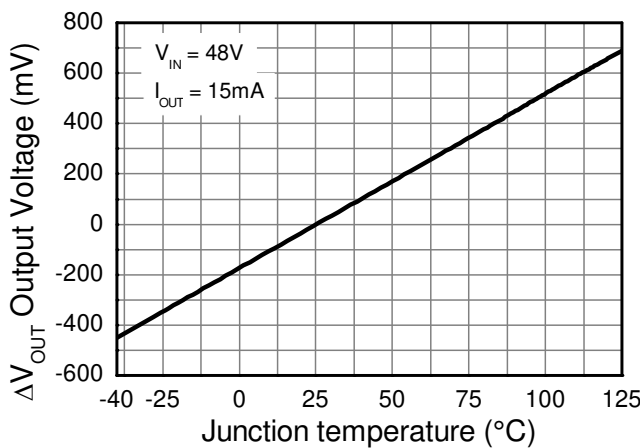
Load transient response



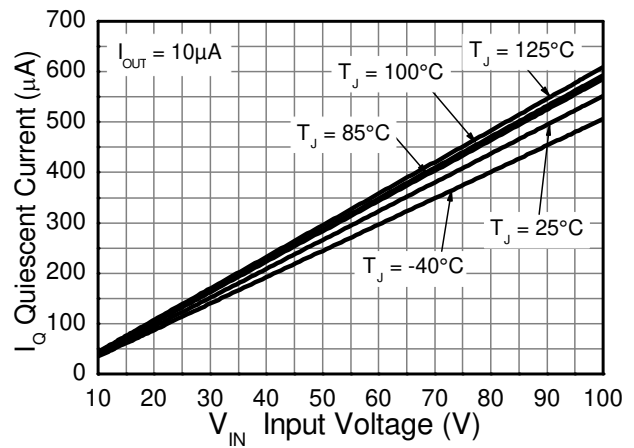
Line Regulation (Note 15)



Load Regulation (Note 16)



Temperature Coefficient (Note 17)



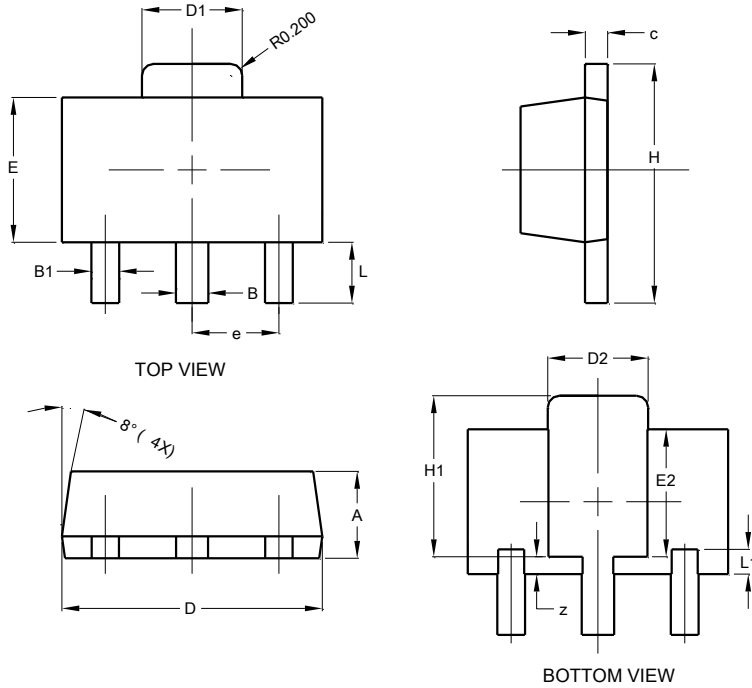
Quiescent Current

- 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

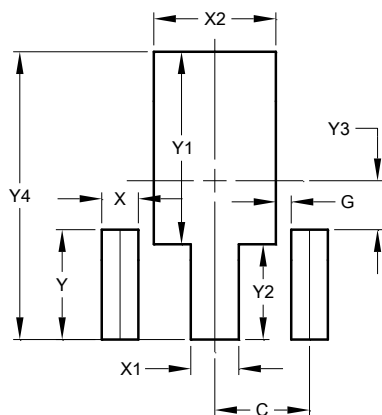


| SOT89 | | | |
|----------------------|-------|-------|-------|
| Dim | Min | Max | Typ |
| A | 1.40 | 1.60 | 1.50 |
| B | 0.50 | 0.62 | 0.56 |
| B1 | 0.42 | 0.54 | 0.48 |
| c | 0.35 | 0.43 | 0.38 |
| D | 4.40 | 4.60 | 4.50 |
| D1 | 1.62 | 1.83 | 1.733 |
| D2 | 1.61 | 1.81 | 1.71 |
| E | 2.40 | 2.60 | 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 |

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