# ZXTR2108F

## 60V INPUT, 8V 15mA REGULATOR TRANSISTOR

## Description

The ZXTR2108F monolithically integrates a transistor, zener diode and resistor to function as a linear regulator. The device regulates with an 8V 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 SOT23 package, minimizing PCB area and reducing the number of components when compared with a multi-chip discrete solution.

## Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10 to 60V (For regulated output voltage)
- Output Voltage = 8V ± 10%
- Fully integrated into a SOT23 package
- **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**
- **Qualified to AEC-Q101 Standards for High Reliability**

## Applications

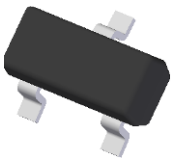
Supply voltage regulation for:

- 24V to 8V Rails
- Other Customized Input Rails

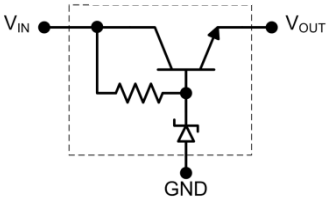
## Mechanical Data

- Case: SOT23
- 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: 0.008 grams (Approximate)

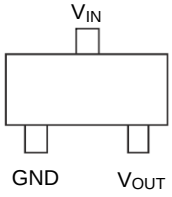
SOT23



Top View




Internal Device Schematic




Top View
Pin-Out

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

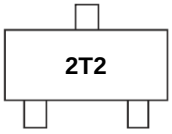
## Ordering Information (Note 4)

| Product | Compliance | Marking | Reel size (inches) | Tape width (mm) | Quantity per reel |
|---|---|---|---|---|---|
| ZXTR2108F-7 | AEC-Q101 | 2T2 | 7 | 8 | 3,000 |

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
2. See http://www.diodes.com/quality/lead_free.htmlfor 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 http://www.diodes.com/products/packages.html.

## Marking Information

SOT23




2T2 = Product Type Marking Code

## 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 60 | V |
| Continuous Input & Output Current | $I_{IN}$, $I_{OUT}$ | 320 | 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 13V | V |

## Maximum Current at $V_{IN}$ = 24V (@$T_A$ = +25°C, unless otherwise specified.)

| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Continuous Output Current | (Note 7) | $I_{OUT}$ | 40 | mA |
| Pulsed Output Current | (Note 8) | $I_{OM}$ | 2,000 | mA |
| | (Note 9) | | 375 | |

## Thermal Characteristics

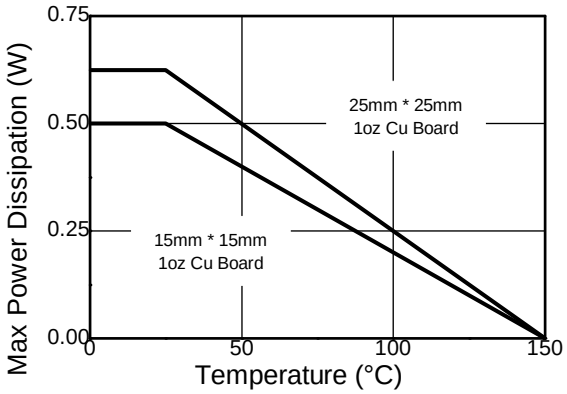
| Characteristic | | Symbol | Value | Unit |
|---|---|---|---|---|
| Power Dissipation | (Note 5) | $P_D$ | 625 | mW |
| | (Note 6) | | 500 | |
| Thermal Resistance, Junction to Ambient | (Note 5) | $R_{\theta JA}$ | 200 | °C/W |
| | (Note 6) | | 250 | |
| Thermal Resistance, Junction to Lead | (Note 10) | $R_{\theta JL}$ | 197 | |
| Thermal Resistance, Junction to Case | (Note 10) | $R_{\theta JC}$ | 17 | |
| Maximum Operating Junction and Storage Temperature Range | | $T_J$, $T_{STG}$ | -65 to +150 | °C |

## ESD Ratings (Note 11)

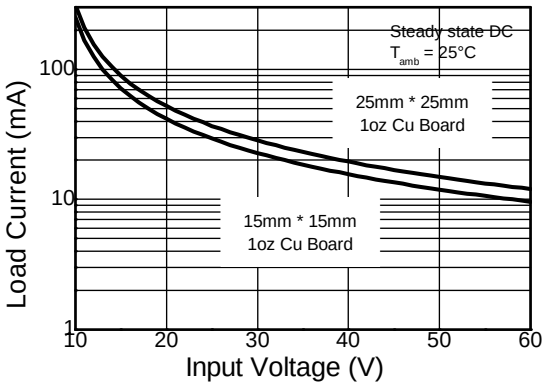
| Characteristics | Symbols | Value | Unit | JEDEC Class |
|---|---|---|---|---|
| Electrostatic Discharge – Human Body Model | ESD HBM | 4,000 | V | 3A |
| Electrostatic Discharge – Machine Model | ESD MM | 400 | V | C |

Notes:
5. For a device mounted with the $V_{IN}$ lead on 25mm x 25mm 1oz copper that is on a single-sided 1.6mm FR4 PCB; device is measured under still air conditions whilst operating in steady-state.
6. Same as note 5, except mounted on 15mm x 15mm 1oz copper.
7. Same as note 5, whilst operating at $V_{IN}$=24V. Refer to Safe Operating Area for other Input Voltages.
8. Same as note 5, except measured with a single pulse width = 100µs and $V_{IN}$=24V.
9. Same as note 5, except measured with a single pulse width = 10ms and $V_{IN}$=24V.
10. $R_{\theta JL}$ = Thermal resistance from junction to solder-point (at the end of the $V_{IN}$ lead).
    $R_{\theta JC}$ = Thermal resistance from junction to the top of case.
11. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

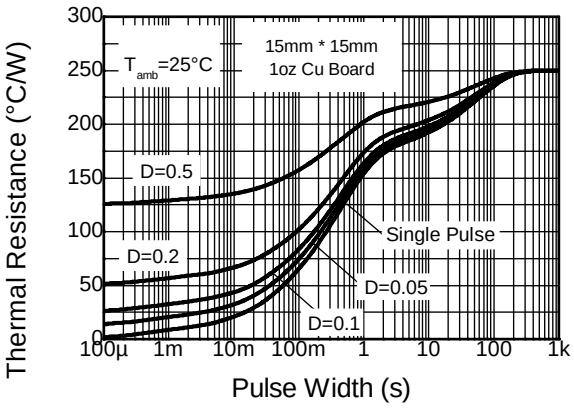
## Thermal Characteristics and Derating Information



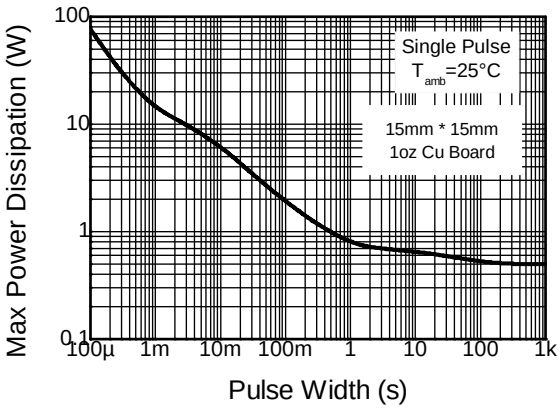

**Derating Curve**



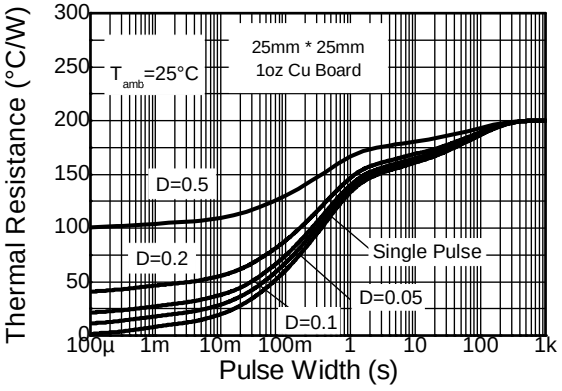

**Safe Operating Area**



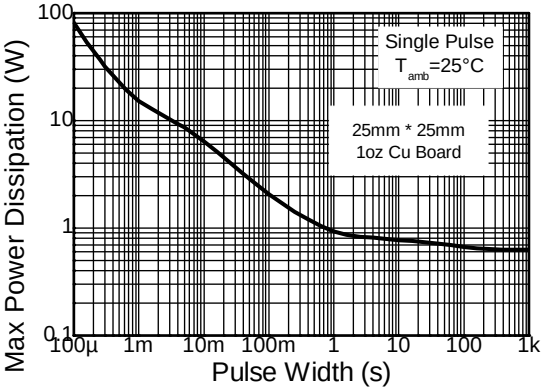

**Transient Thermal Impedance**




**Pulse Power Dissipation**




**Transient Thermal Impedance**




**Pulse Power Dissipation**

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

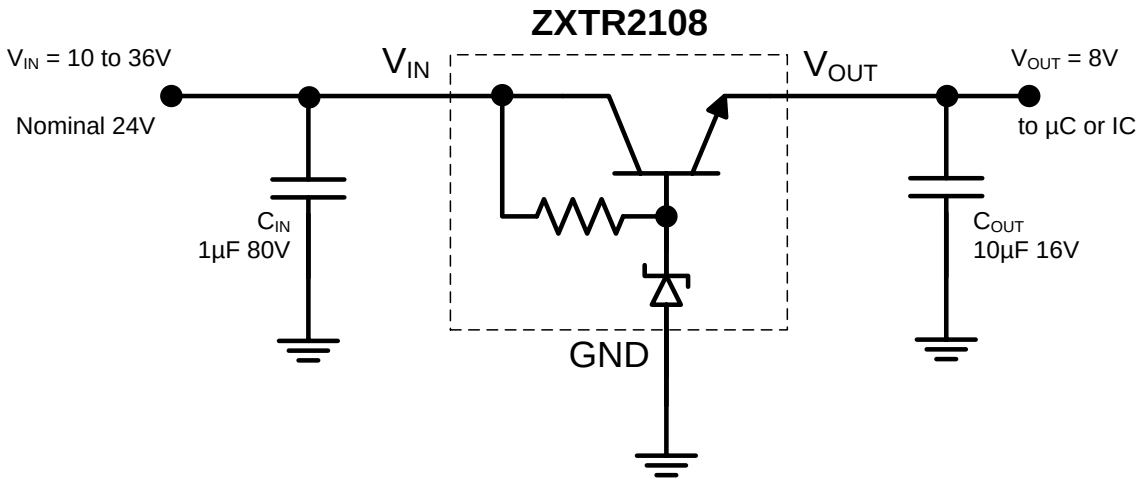
| Characteristic | Symbol | Min | Typ | Max | Unit | Test Condition |
|---|---|---|---|---|---|---|
| Output Voltage (Note 12) | $V_{OUT}$ | 7.2 | 8 | 8.8 | V | $V_{IN}$ = 24V, $I_{OUT}$ = 15mA |
| Line Regulation (Notes 12 & 13) | $\Delta V_{OUT}$ | — | 15 | 50 | mV | $V_{IN}$ = 18 to 24V, $I_{OUT}$ = 15mA |
| | | | 110 | - | | $V_{IN}$ = 12 to 60V, $I_{OUT}$ = 15mA |
| | | | 120 | - | | $V_{IN}$ = 10 to 60V, $I_{OUT}$ = 15mA |
| Temperature Coefficient | $\Delta V_{OUT}/\Delta T$ | — | 7.2 | — | mV/°C | $T_J$ = -40°C to +125°C<br>$V_{IN}$ = 24V, $I_{OUT}$ = 15mA |
| Load Regulation (Notes 12 & 14) | $\Delta V_{OUT}$ | — | -16<br>-150 | -50<br>-300 | mV | $I_{OUT}$ = 10 to 20mA, $V_{IN}$ = 24V<br>$I_{OUT}$ = 0.1 to 50mA, $V_{IN}$ = 24V |
| Minimum Value of Input Voltage Required to Maintain Line Regulation | $V_{IN(MIN)}$ | 10 | — | — | V | — |
| Quiescent Current | $I_Q$ | —<br>— | 260<br>3,700 | 500<br>6,000 | µA | $V_{IN}$ = 12V, $I_{OUT}$ = 10µA<br>$V_{IN}$ = 60V, $I_{OUT}$ = 10µA |
| Power Supply Rejection Ratio | $\Delta V_{in}/\Delta V_{out}$ | — | 45 | — | dB | $C_{OUT}$ = 100nF, $I_{OUT}$ = 15mA,<br>$V_{OUT}$ = 8V, $V_{IN}$ = 10 to 60V, f = 100Hz |

Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

13. Line regulation $\Delta V_{OUT} = V_{OUT}(@V_{IN}=24V) - V_{OUT}(@V_{IN} = 18V)$
$\Delta V_{OUT} = V_{OUT}(@V_{IN}=60V) - V_{OUT}(@V_{IN} = 10V)$
$\Delta V_{OUT} = V_{OUT}(@V_{IN}=60V) - V_{OUT}(@V_{IN} = 12V)$

14. Load regulation $\Delta V_{OUT} = V_{OUT}(@I_{OUT}= 20mA) - V_{OUT}(@I_{OUT}= 10mA)$
$\Delta V_{OUT} = V_{OUT}(@I_{OUT}= 50mA) - V_{OUT}(@I_{OUT} = 0.1mA)$

## Typical Application Circuit

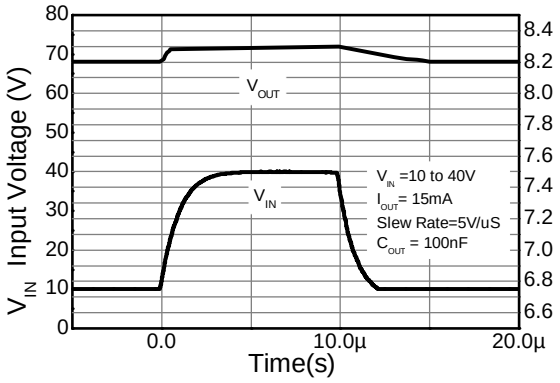



Example of a 8V regulated supply from a nominal 24V for powering a Controller IC.

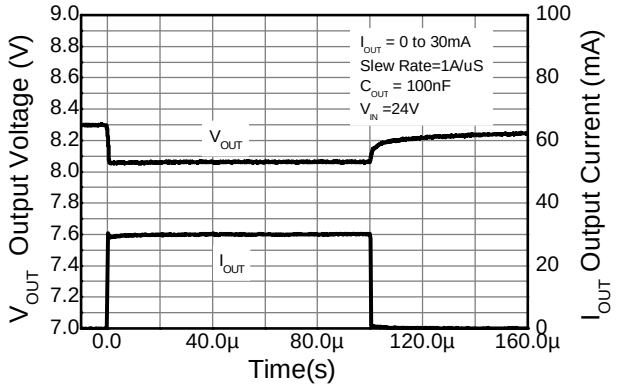
## Pin Function

| Pin Name | Pin Function | Notes |
|---|---|---|
| **$V_{IN}$** | Input Supply | Input voltage can vary from -0.3V to 60V with respect to GND; for $V_{OUT}$ regulated then 10V ≤ $V_{IN}$ ≤ 60V. 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 8V when 10V ≤ $V_{IN}$ ≤ 60V. When $V_{IN}$ < 10V, then $V_{OUT}$ maximum = $V_{IN}$ – 1V.<br>The pin can be pulled high to a maximum of +13V 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. |

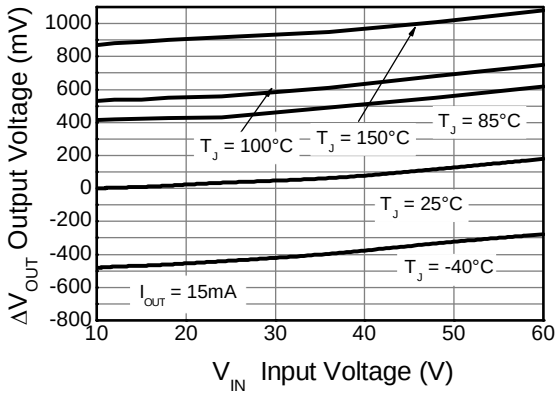
## Typical Electrical Characteristics (@$T_A$ = +25°C, unless otherwise specified.)



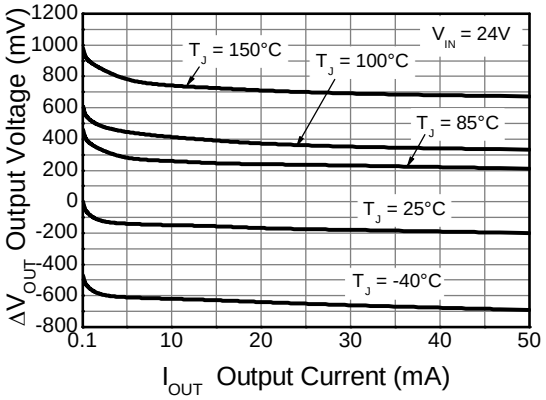

**Line transient response**



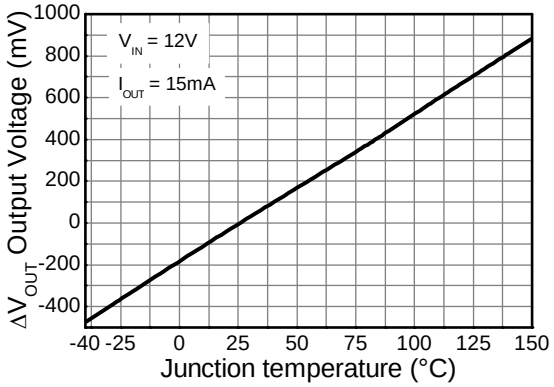

**Load transient response**



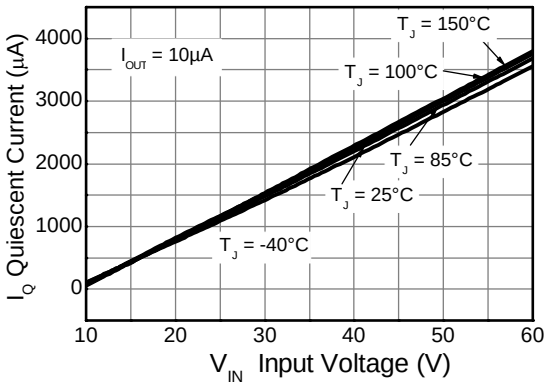

**Line Regulation (Note 15)**




**Load Regulation (Note 16)**




**Temperature Coefficient (Note 17)**

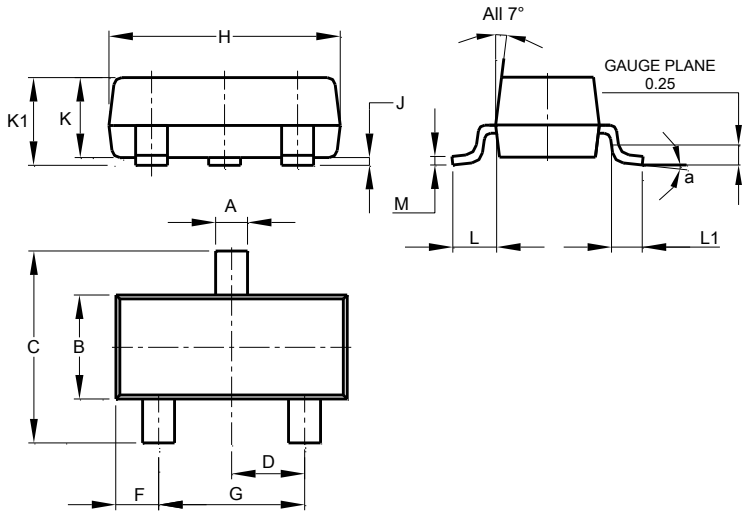



**Quiescent Current**

Notes: 15. Line Regulation ΔVOUT = VOUT – VOUT (@ VIN = 10V, IOUT = 15mA, TJ = +25°C).
16. Load Regulation ΔVOUT = VOUT – VOUT (@ VIN = 24V, IOUT = 0.1mA, TJ = +25°C).
17. Temperature Coefficient ΔVOUT = VOUT – VOUT (@ VIN = 24V, IOUT = 15mA, TJ = +25°C).

## Package Outline Dimensions

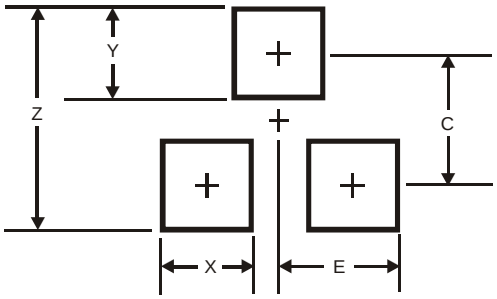
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.




| SOT23 | | | |
|---|---|---|---|
| **Dim** | **Min** | **Max** | **Typ** |
| **A** | 0.37 | 0.51 | 0.40 |
| **B** | 1.20 | 1.40 | 1.30 |
| **C** | 2.30 | 2.50 | 2.40 |
| **D** | 0.89 | 1.03 | 0.915 |
| **F** | 0.45 | 0.60 | 0.535 |
| **G** | 1.78 | 2.05 | 1.83 |
| **H** | 2.80 | 3.00 | 2.90 |
| **J** | 0.013 | 0.10 | 0.05 |
| **K** | 0.890 | 1.00 | 0.975 |
| **K1** | 0.903 | 1.10 | 1.025 |
| **L** | 0.45 | 0.61 | 0.55 |
| **L1** | 0.25 | 0.55 | 0.40 |
| **M** | 0.085 | 0.150 | 0.110 |
| **a** | 8° | | |
| **All Dimensions in mm** | | | |

## Suggested Pad Layout

Please see AP02001 at http://www.diodes.com/datasheets/ap02001.pdf for the latest version.




| Dimensions | Value (in mm) |
|---|---|
| **Z** | 2.9 |
| **X** | 0.8 |
| **Y** | 0.9 |
| **C** | 2.0 |
| **E** | 1.35 |

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