60V INPUT, 8V 15mA REGULATOR TRANSISTOR

Description

The ZXTR2108FQ 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.

This linear regulator is designed to meet the stringent requirements of automotive applications.

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**
- **PPAP Capable (Note 4)**

Applications

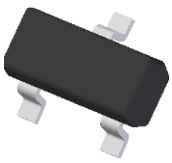
Supply Voltage Regulation for:

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

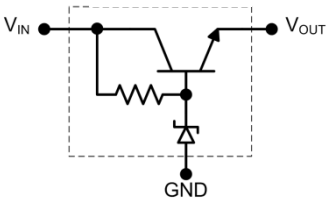
Mechanical Data

- 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)

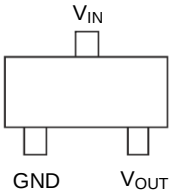
SOT23



Top View



Internal Device Schematic



Top View Pin-Out

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

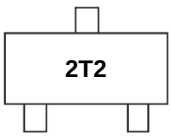
Ordering Information (Notes 4 & 5)

Product	Compliance	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXTR2108FQ-7	Automotive	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. Automotive products are AEC-Q101 qualified and are PPAP capable. Refer to http://www.diodes.com/quality/product_compliance_definitions/.
5. For packaging details, go to our website at http://www.diodes.com/products/packages.html.

Marking Information

SOT23



2T2 = Product Type Marking Code

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

Characteristic		Symbol	Value	Unit
Continuous Output Current	(Note 8)	I_{OUT}	40	mA
Pulsed Output Current	(Note 9)	I_{OM}	2,000	mA
	(Note 10)		375	

Thermal Characteristics

Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 6)	P_D	625	mW
	(Note 7)		500	
Thermal Resistance, Junction to Ambient	(Note 6)	$R_{\theta JA}$	200	°C/W
	(Note 7)		250	
Thermal Resistance, Junction to Lead	(Note 11)	$R_{\theta JL}$	197	
Thermal Resistance, Junction to Case	(Note 11)	$R_{\theta JC}$	17	
Maximum Operating Junction and Storage Temperature Range		T_J, T_{STG}	-65 to +150	°C

ESD Ratings (Note 12)

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:
6. 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.
7. Same as Note 6, except mounted on 15mm x 15mm 1oz copper.
8. Same as Note 6, whilst operating at V_{IN}=24V. Refer to Safe Operating Area for other Input Voltages.
9. Same as Note 6, except measured with a single pulse width = 100µs and V_{IN}=24V.
10. Same as Note 6, except measured with a single pulse width = 10ms and V_{IN}=24V.
11. $R_{\theta JL}$ = 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.
12. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

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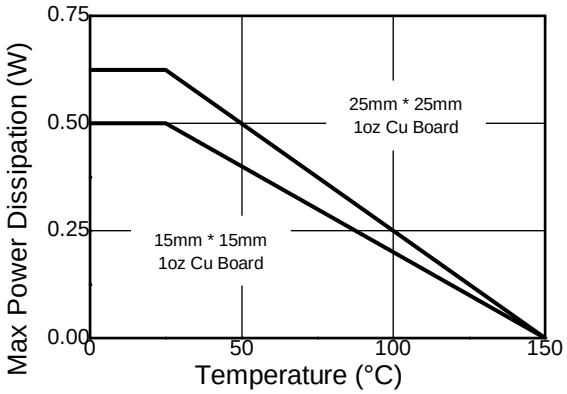
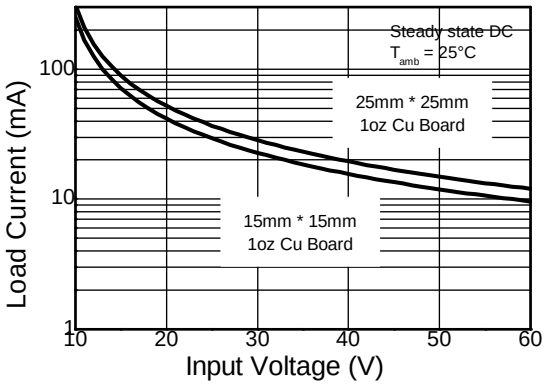
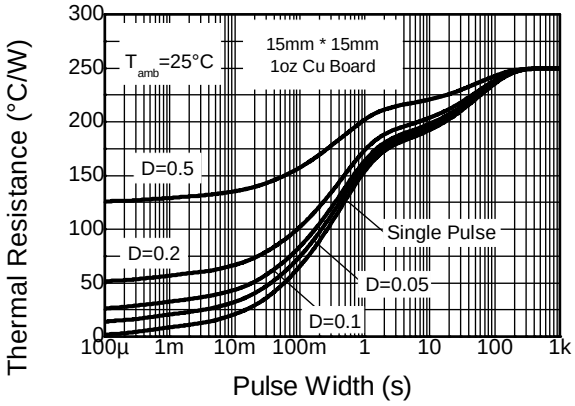
Thermal Characteristics and Derating Information



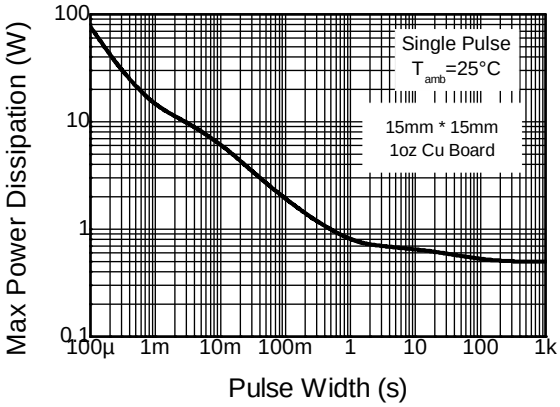
Derating Curve



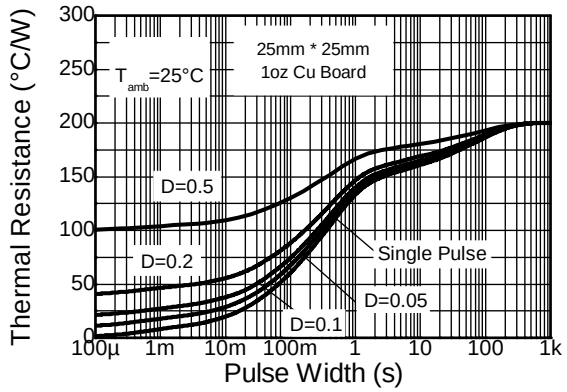
Safe Operating Area



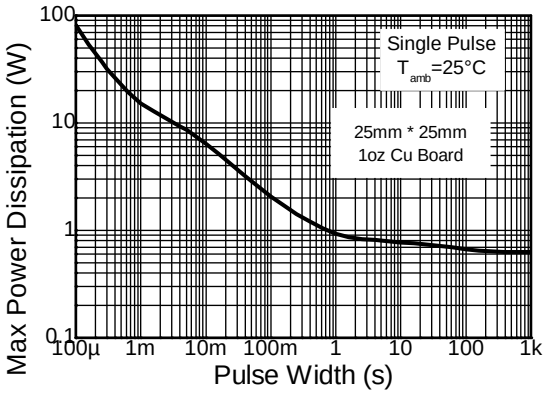
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

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

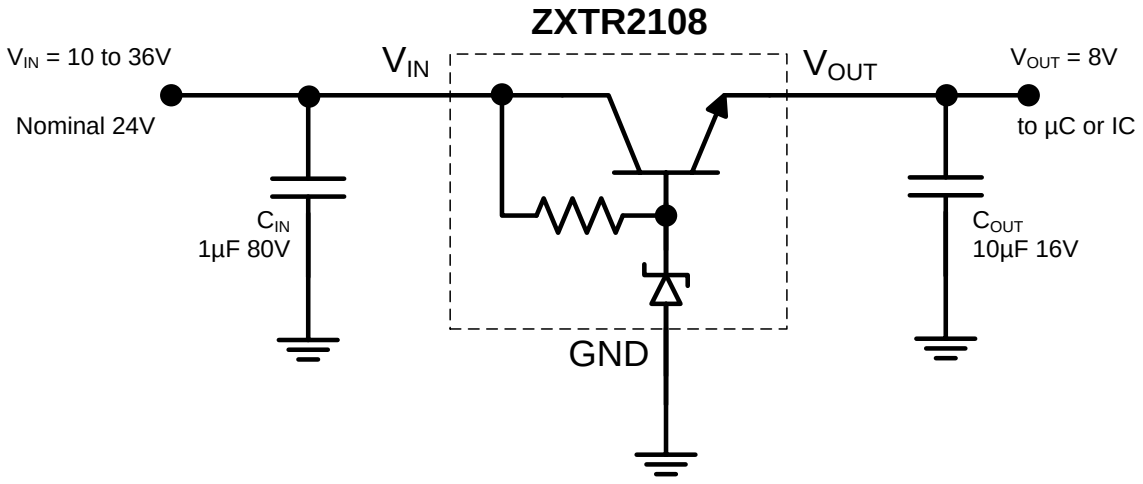
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 13)	V_{OUT}	7.2	8	8.8	V	V_{IN} = 24V, I_{OUT} = 15mA
Line Regulation (Notes 13 & 14)	ΔV_{OUT}	—	15	50	mV	V_{IN} = 18 to 24V, I_{OUT} = 15mA
		—	110	—		V_{IN} = 12 to 60V, I_{OUT} = 15mA
		—	120	—		V_{IN} = 10 to 60V, I_{OUT} =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

Notes: 13. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.

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

15. 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. 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.

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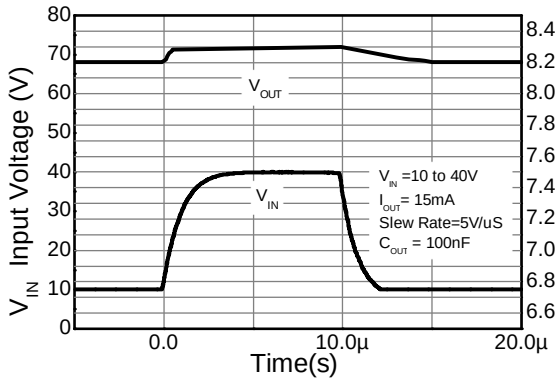
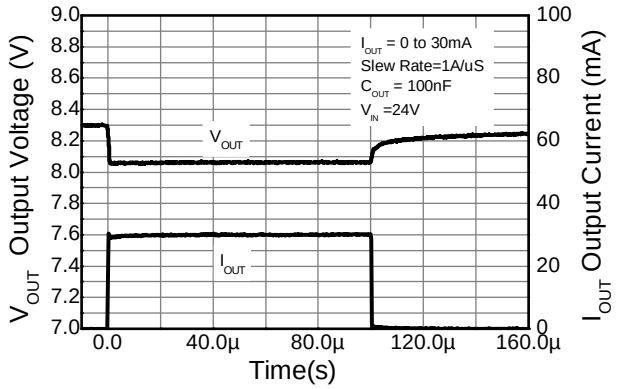
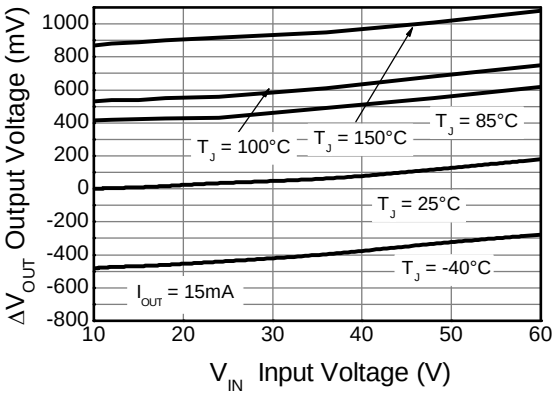
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



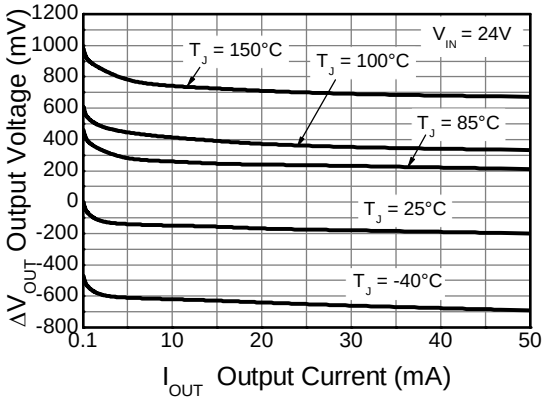
Line transient response



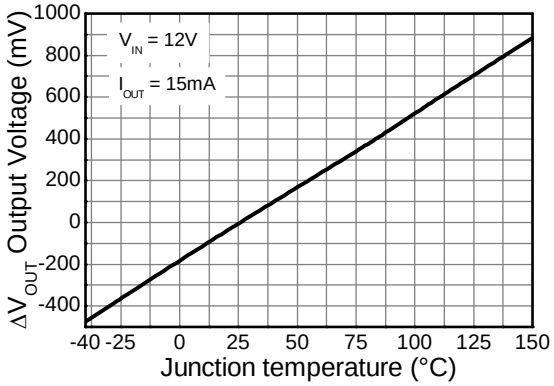
Load transient response



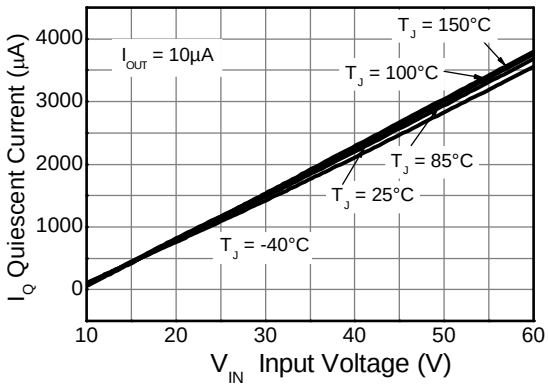
Line Regulation (Note 16)



Load Regulation (Note 17)



Temperature Coefficient (Note 18)



Quiescent Current

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

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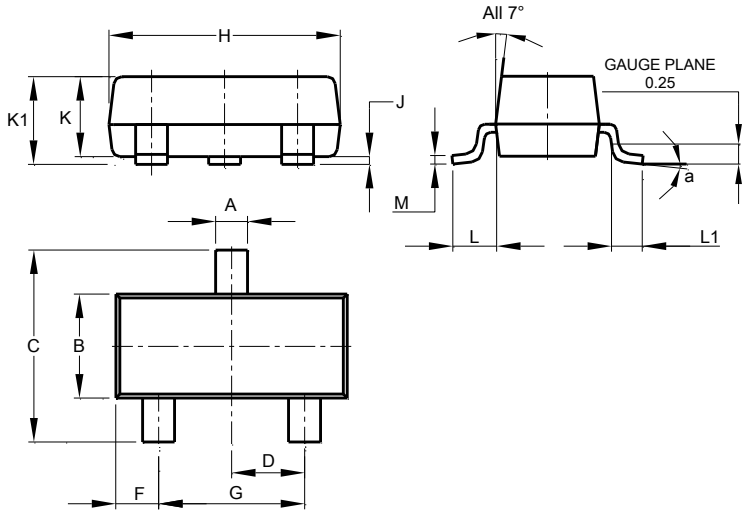
Package Outline Dimensions

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

SOT23

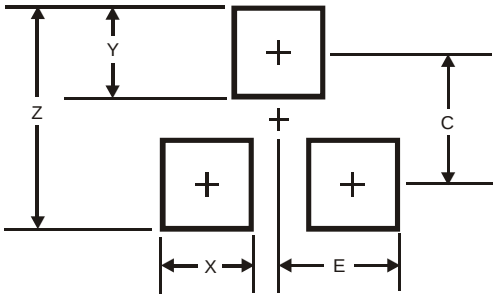


SOT23			
Dim	**Min**	**Max**	**Typ**
A	0.37	0.51	0.40
B	1.20	1.40	1.30
C	2.30	2.50	2.40
D	0.89	1.03	0.915
F	0.45	0.60	0.535
G	1.78	2.05	1.83
H	2.80	3.00	2.90
J	0.013	0.10	0.05
K	0.890	1.00	0.975
K1	0.903	1.10	1.025
L	0.45	0.61	0.55
L1	0.25	0.55	0.40
M	0.085	0.150	0.110
a	8°		
All Dimensions in mm			

Suggested Pad Layout

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

SOT23



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

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