ZXTR2112F

60V INPUT, 12V 15mA REGULATOR TRANSISTOR

Description

The ZXTR2112F monolithically integrates a transistor, zener diode and resistor to function as a linear regulator. The device regulates with a 12V 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 number of components when compared with a multi-chip discrete solution.

Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 15 to 60V (For regulated output voltage)
- Output Voltage = 12V ± 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

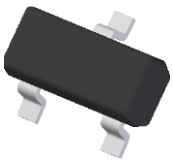
Supply voltage regulation for:

- 24V to 12V Rails
- Other Customized Input Rails

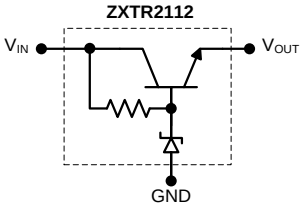
Mechanical Data

- 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)

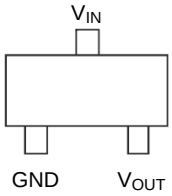
SOT23



Top View



Internal Device Schematic



Top View
Pin-Out

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

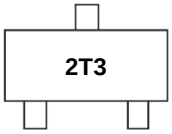
Ordering Information (Note 4)

Product	Compliance	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXTR2112F-7	AEC-Q101	2T3	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



2T3 = 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 17V	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}	50	mA
Pulsed Output Current	(Note 8)	I_{OM}	2,000	mA
	(Note 9)		500	

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.

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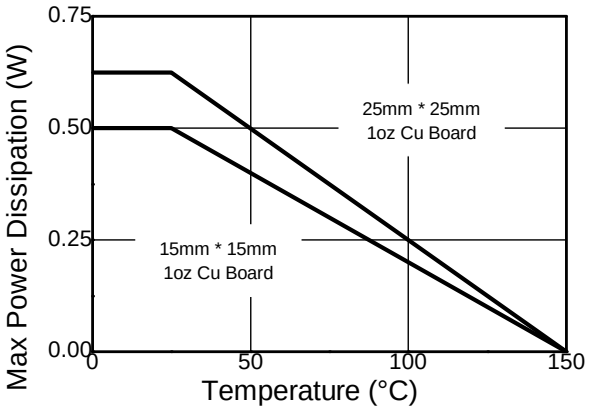
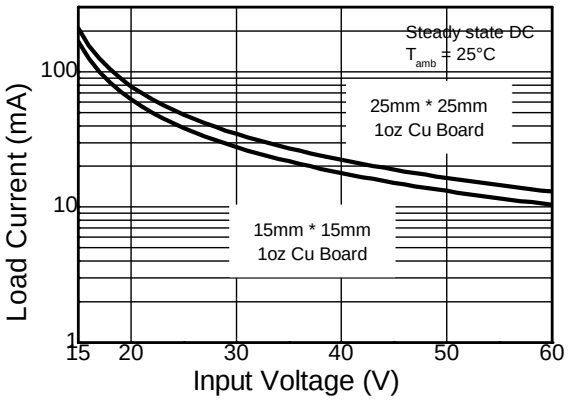
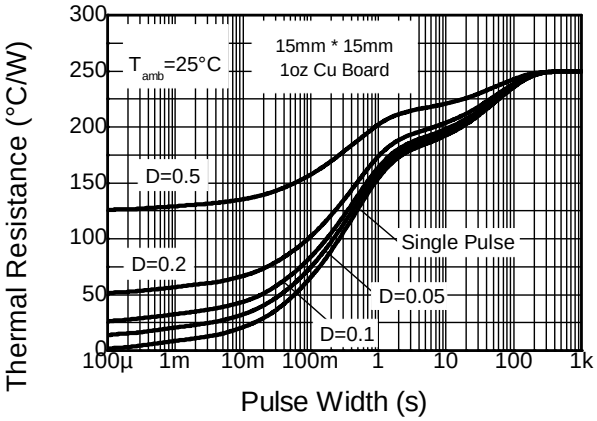
Thermal Characteristics and Derating Information



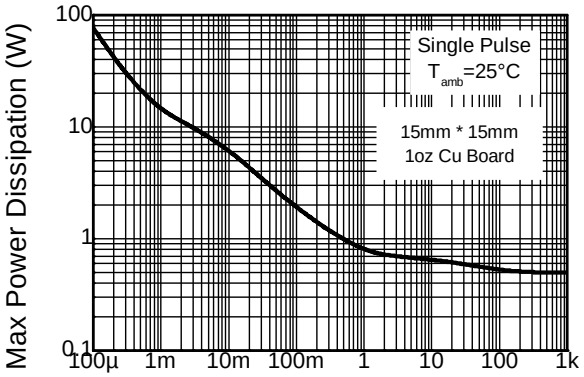
Derating Curve



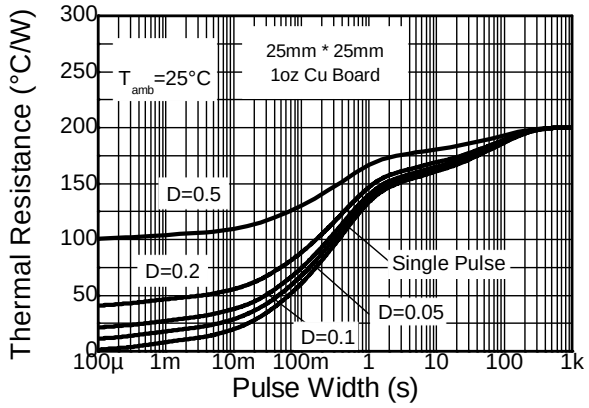
Safe Operating Area



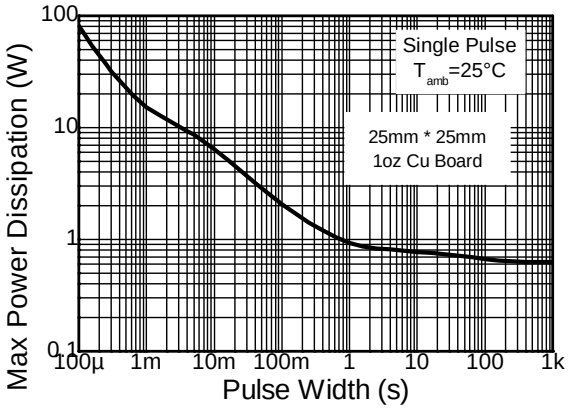
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

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

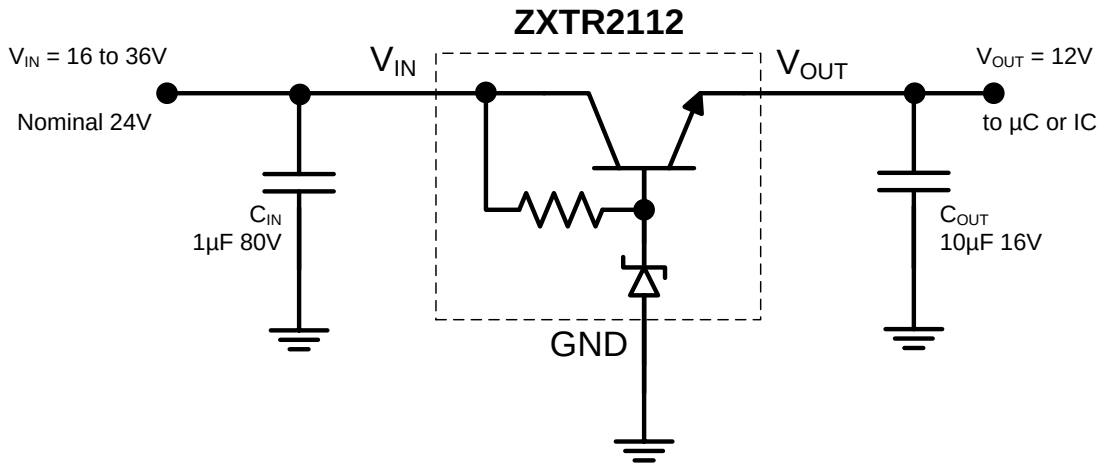
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	V_{OUT}	10.8	12	13.2	V	V_{IN} = 24V, I_{OUT} = 15mA
Line Regulation (Notes 12 & 13)	ΔV_{OUT}	—	20	50	mV	V_{IN} = 18 to 24V, I_{OUT} = 15mA
			130	-		V_{IN} = 18 to 60V, I_{OUT} = 15mA
			150	-		V_{IN} = 15 to 60V, I_{OUT} = 15mA
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	10.4	—	mV/°C	T_J = -40°C to +125°C V_{IN} = 24V, I_{OUT} = 15mA
Load Regulation (Notes 12 & 14)	ΔV_{OUT}	—	-30 -190	-100 -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	$V_{IN(MIN)}$	15	—	—	V	—
Quiescent Current	I_Q	— —	160 3,500	360 6,000	µA	V_{IN} = 15V, I_{OUT} = 10µA V_{IN} = 60V, I_{OUT} = 10µA
Power Supply Rejection Ratio	$\Delta V_{in}/\Delta V_{out}$	—	50	—	dB	C_{OUT} = 100nF, I_{OUT} = 15mA, V_{OUT} = 12V, V_{IN} = 15 to 60V,f = 100Hz

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

13. Line regulation ΔV_{OUT}= V_{OUT}(@V_{IN}=24V)– V_{OUT}(@V_{IN} = 18V)
ΔV_{OUT}= V_{OUT}(@V_{IN}=60V)– V_{OUT}(@V_{IN} = 15V)
ΔV_{OUT}= V_{OUT}(@V_{IN}=60V)– V_{OUT}(@V_{IN} = 18V)

14. Load regulation ΔV_{OUT}= V_{OUT}(@I_{OUT}= 20mA)– V_{OUT}(@I_{OUT}= 10mA)
ΔV_{OUT} =V_{OUT}(@I_{OUT}= 50mA)– V_{OUT}(@I_{OUT} = 0.1mA)

Typical Application Circuit



Example of a 12V regulated supply from a nominal 24V for powering a Controller IC.

Pin Functions

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 15V ≤ 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 12V when 15V ≤ V_{IN} ≤ 60V. When V_{IN} < 15V, then V_{OUT} maximum = V_{IN} – 1V. The pin can be pulled high to a maximum of +17V 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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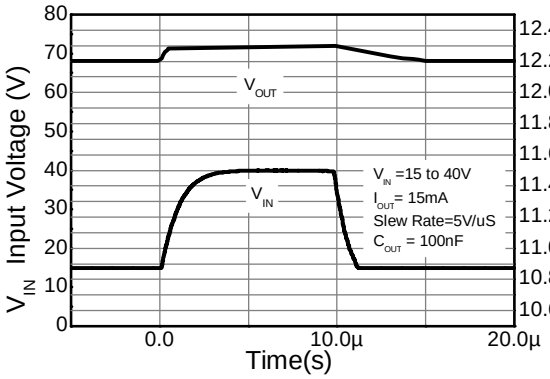
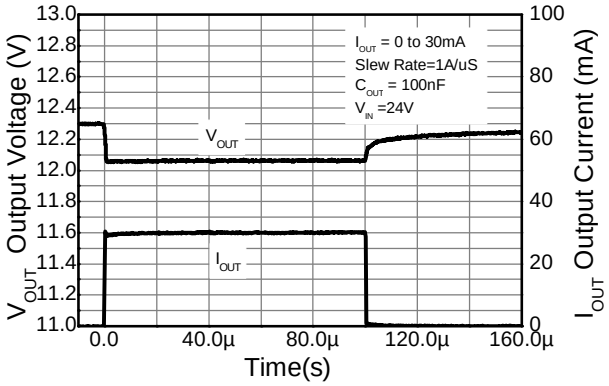
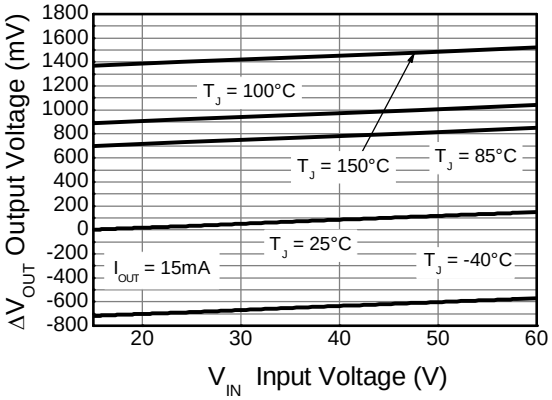
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



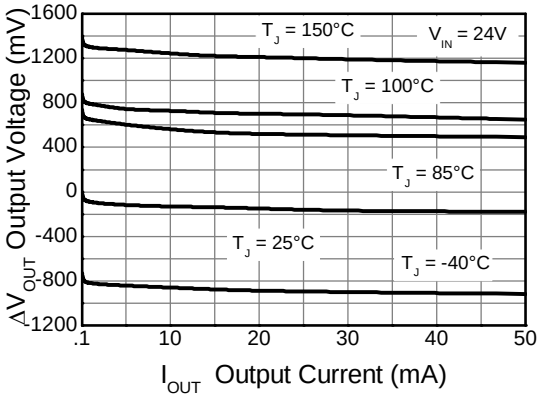
Line transient response



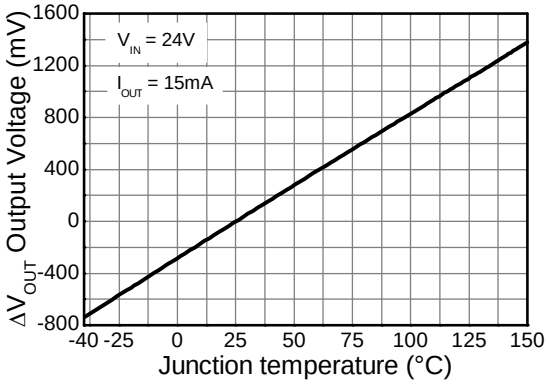
Load transient response



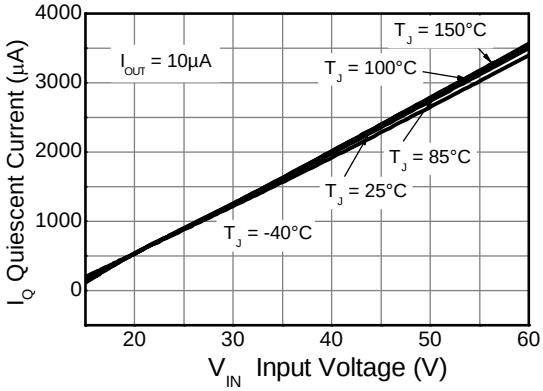
Line Regulation (Note 15)



Load Regulation (Note 16)



Temperature Coefficient (Note 17)



Quiescent Current

Notes: 15. Line Regulation ΔVOUT = VOUT – VOUT(@ VIN = 15V, 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).

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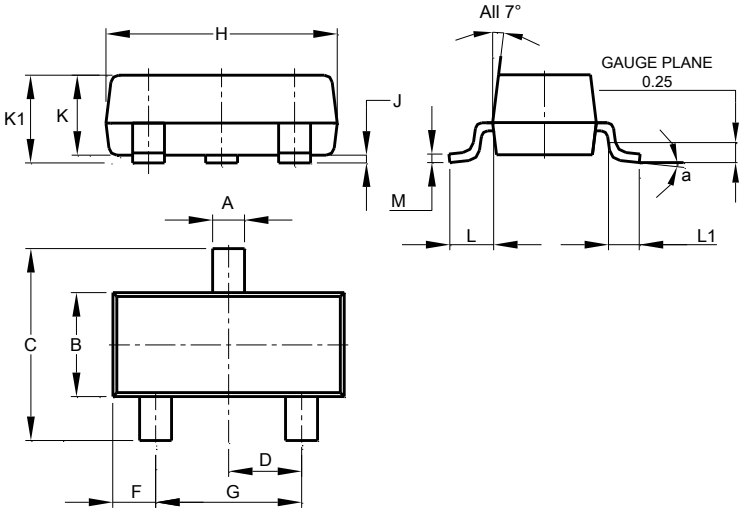
Package Outline Dimensions

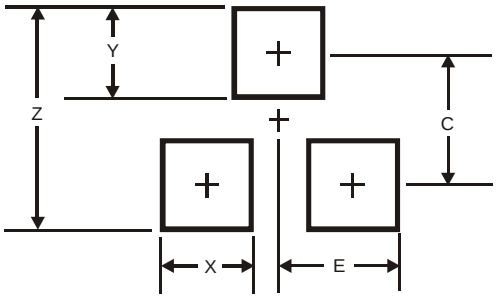
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for the latest version.



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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