

## Description

The ZXTR2012K monolithically integrates a transistor, Zener diode and resistor to function as a high voltage 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 TO252 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 = 15V to 100V
- Output Voltage = 12V  $\pm$  10%
- Fully integrated into a TO252 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 in:

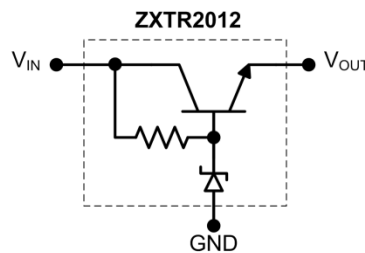
- Networking
- Telecom
- Power Over Ethernet (PoE)

## Mechanical Data

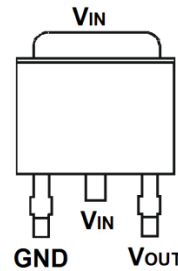
- Case: TO252-3L (DPAK)
- Case Material: Molded Plastic. "Green" Molding Compound.
- UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208
- Weight: 0.34 grams (approximate)



Top View



Internal Device Schematic



Top View Pin-Out

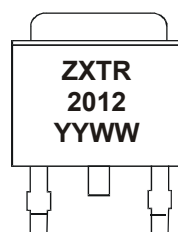
Pin Name	Pin Function
V <sub>IN</sub>	Input Supply
GND	Power Ground
V <sub>OUT</sub>	Voltage Output

## Ordering Information (Note 4)

Product	Package	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXTR2012K-13	TO252-3L	ZXTR 2012	13	16	2,500

- 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.html](http://www.diodes.com/quality/lead_free.html) 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 <http://www.diodes.com/products/packages.html>

## Marking Information



ZXTR 2012 = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Digit of Year, (ex: 13 = 2013)  
 WW = Week Code 01 - 52

**Absolute Maximum Ratings** (Voltage relative to GND, @T<sub>A</sub> = +25°C, unless otherwise specified.)

Characteristic	Symbol	Value	Unit
Input Supply Voltage	V <sub>IN</sub>	-0.3 to 100	V
Continuous Input & Output Current	I <sub>IN</sub> , I <sub>OUT</sub>	750	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>	18	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	I <sub>OUT</sub>	60	mA
Pulsed Output Current	I <sub>OM</sub>	960	mA
		200	

**Thermal Characteristics**

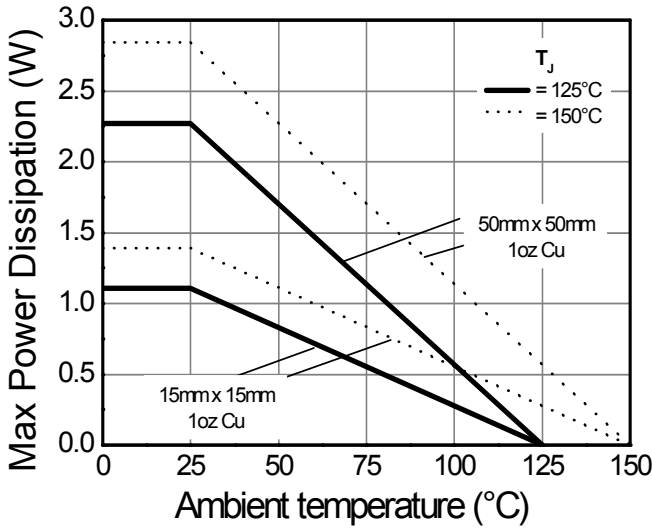
Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>D</sub>	2.3	W
		1.1	
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	44	°C/W
		90	
Thermal Resistance, Junction to Lead	R <sub>θJL</sub>	8.4	
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	14.6	
Recommended Operating Junction Temperature 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	

**ESD Ratings** (Note 11)

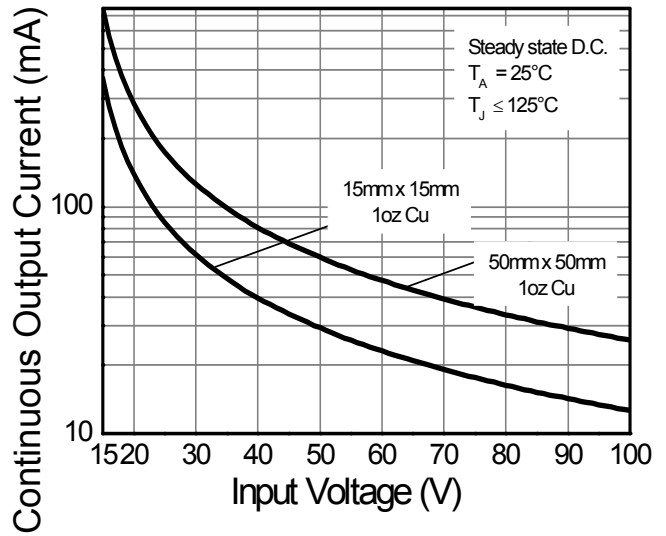
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

- 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.

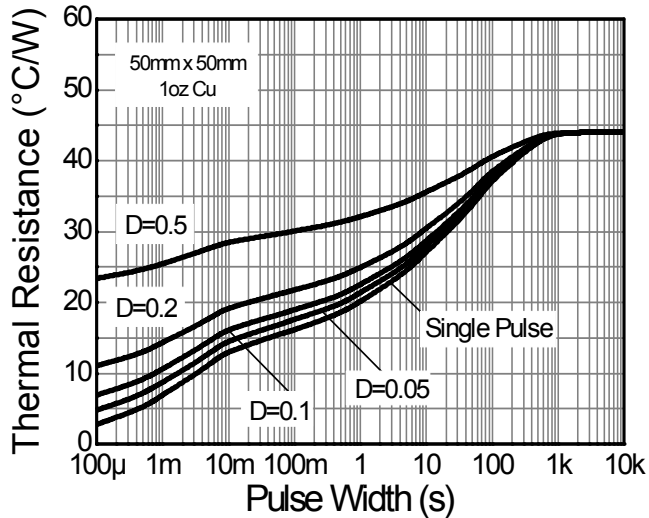
**Thermal Characteristics and Derating Information**



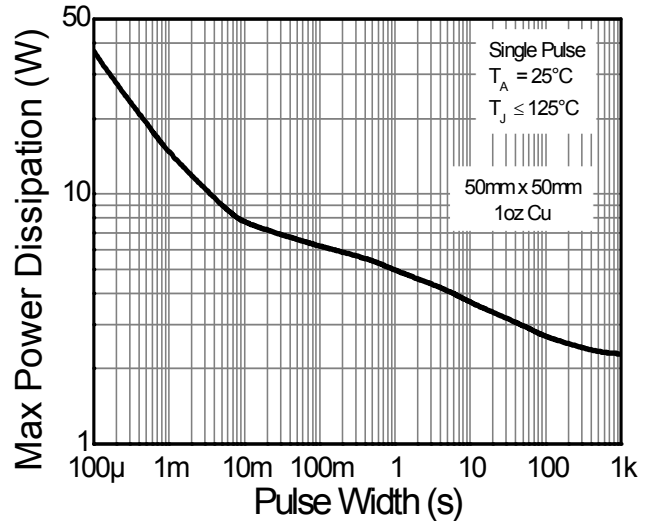
**Derating Curve**



**Safe Operating Area**



**Transient Thermal Impedance**



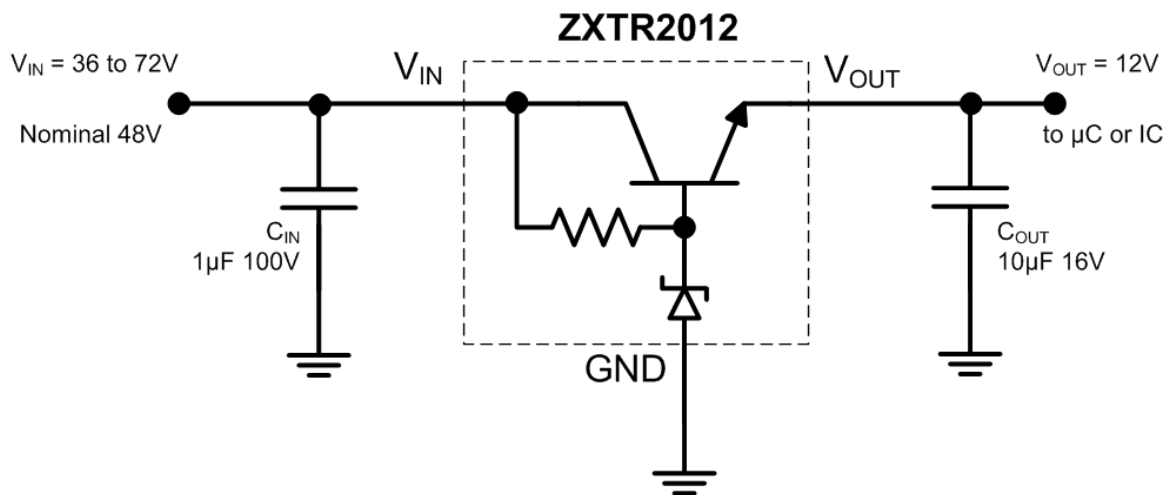
**Pulse Power Dissipation**

**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>	10.8	12	13.2	V	V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA
Line Regulation (Notes 12 & 13)	ΔV <sub>OUT</sub>	—	240	750	mV	V <sub>IN</sub> = 15 to 72V, I <sub>OUT</sub> = 15mA
Temperature Coefficient	ΔV <sub>OUT</sub> /ΔT	—	8.0	—	mV/°C	T <sub>J</sub> = -40°C to +125°C V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 15mA
Load Regulation (Notes 12 & 14)	ΔV <sub>OUT</sub>	—	-450 -600	-600 -750	mV	I <sub>OUT</sub> = 0.1 to 30mA, V <sub>IN</sub> = 48V 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>	15	—	—	V	—
Quiescent Current	I <sub>Q</sub>	—	240 590	400 900	μA	V <sub>IN</sub> = 48V, I <sub>OUT</sub> = 10μA 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, V <sub>OUT</sub> = 12V, V <sub>IN</sub> = 15 to 100V, f = 100Hz

Notes:  
 12. Measured under pulsed conditions. Pulse width ≤ 300μs. Duty cycle ≤ 2%.  
 13. Line regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@ V<sub>IN</sub> = 72V) - V<sub>OUT</sub>(@ V<sub>IN</sub> = 15V)  
 14. Load regulation ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@ I<sub>OUT</sub> = 30mA) - V<sub>OUT</sub>(@ I<sub>OUT</sub> = 0.1mA)  
 ΔV<sub>OUT</sub> = V<sub>OUT</sub>(@ I<sub>OUT</sub> = 100mA) - V<sub>OUT</sub>(@ I<sub>OUT</sub> = 0.1mA)

**Typical Application Circuit**

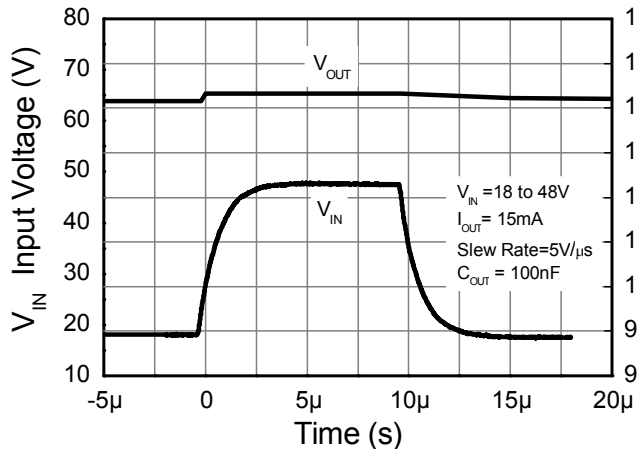


Example of an 12V regulated supply from a nominal 48V for powering a Controller IC.

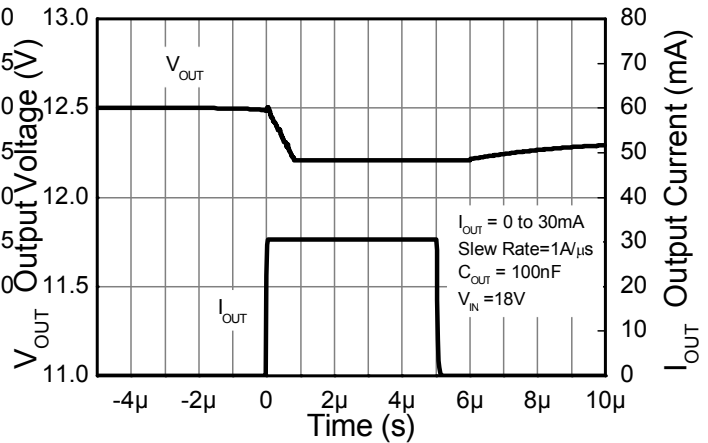
**Pin Functions**

Pin Name	Pin Function	Notes
V <sub>IN</sub>	Input Supply	To maintain output regulation, the input voltage can vary from 15V to 100V with respect to the GND pin. 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 12V. It is recommended to connect a 10μF capacitor to GND. Minimum of 10μA must be drawn from V <sub>OUT</sub> to maintain regulation. The pin can be pulled high to a maximum of 18V with respect to ground.

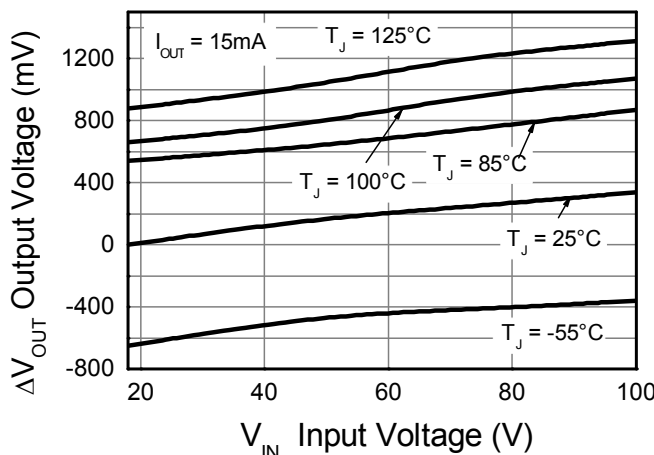
**Typical Electrical Characteristics** (@T<sub>A</sub> = +25°C, unless otherwise specified.)



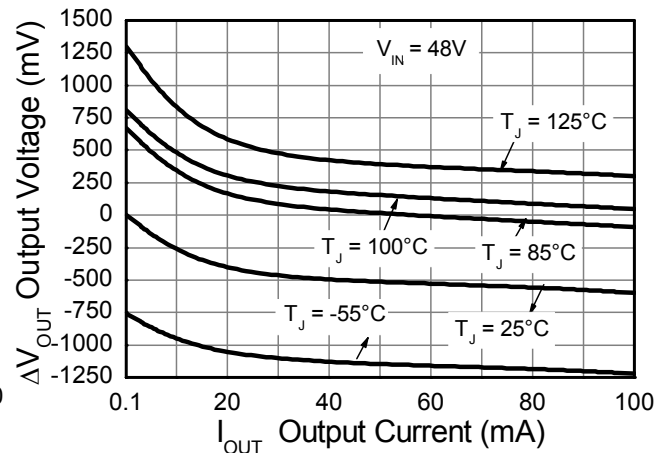
**Line transient response**



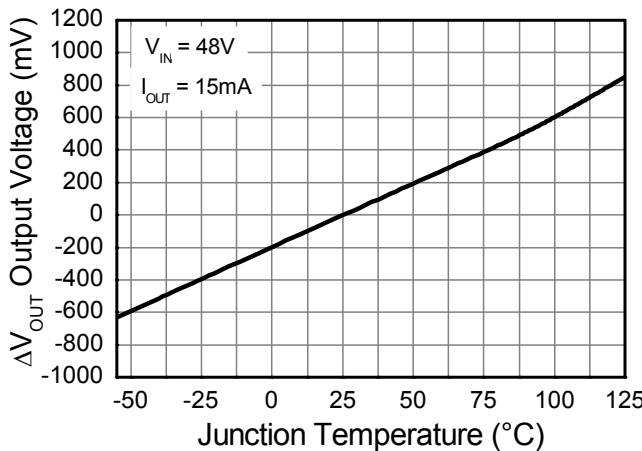
**Load transient response**



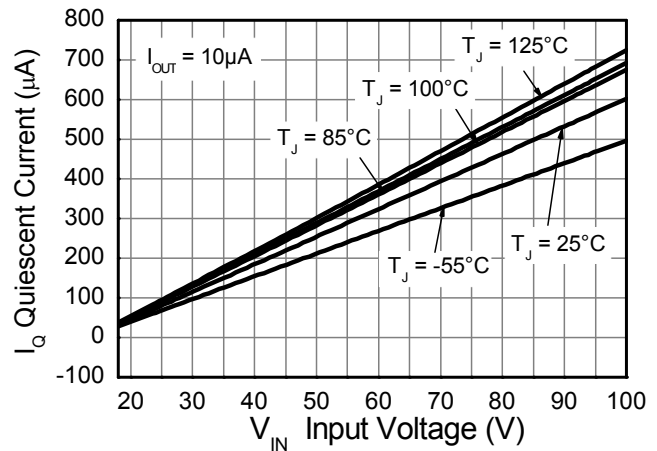
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



**Temperature Coefficient (Note 17)**

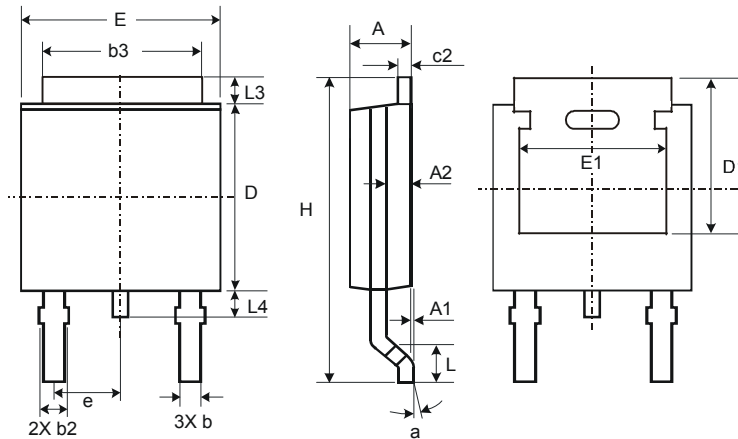


**Quiescent Current**

- Notes:
- 15. Line regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 15V, I_{OUT} = 15mA, T_J = +25^\circ C)$
  - 16. Load regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48V, I_{OUT} = 0.1mA, T_J = +25^\circ C)$
  - 17. Temperature Coefficient  $\Delta V_{OUT} = V_{OUT} - V_{OUT}(@ V_{IN} = 48V, I_{OUT} = 15mA, T_J = +25^\circ C)$

## Package Outline Dimensions

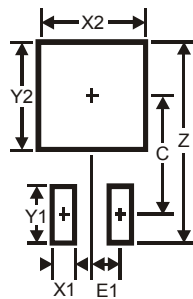
Please see AP02002 at <http://www.diodes.com/datasheets/ap02002.pdf> for latest version.



TO252			
Dim	Min	Max	Typ
A	2.19	2.39	2.29
A1	0.00	0.13	0.08
A2	0.97	1.17	1.07
b	0.64	0.88	0.783
b2	0.76	1.14	0.95
b3	5.21	5.46	5.33
c2	0.45	0.58	0.531
D	6.00	6.20	6.10
D1	5.21	-	-
e	-	-	2.286
E	6.45	6.70	6.58
E1	4.32	-	-
H	9.40	10.41	9.91
L	1.40	1.78	1.59
L3	0.88	1.27	1.08
L4	0.64	1.02	0.83
a	0°	10°	-
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	11.6
X1	1.5
X2	7.0
Y1	2.5
Y2	7.0
C	6.9
E1	2.3

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