100V INPUT, 5V 50mA VOLTAGE REGULATOR

Description

The ZXTR1005K4 is a high voltage regulator with fixed output voltage of 5V ± 2% and a 50mA drive capability. 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.

The device also features an enable pin which disables the regulator when pulled low.

Applications

Supply voltage regulation in:

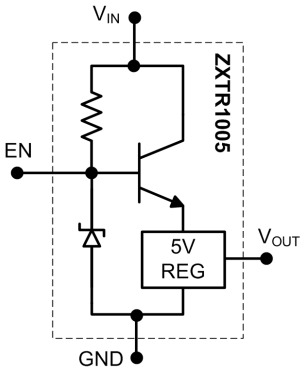
- Networking
- Telecom
- Power Over Ethernet (PoE)

Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10 to 100V
- Output Voltage = 5V ± 2%
- ± 4% tolerance over -55 to +125°C
- Output Current up to 50mA
- Toggle Output On/Off with Enable pin
- **Totally Lead-Free & Fully RoHS compliant (Notes 1 & 2)**
- **Halogen and Antimony Free. "Green" Device (Note 3)**

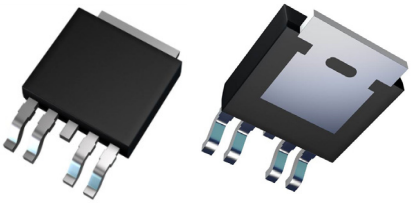
Mechanical Data

- Case: TO252-4
- 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: 0.34 grams (approximate)



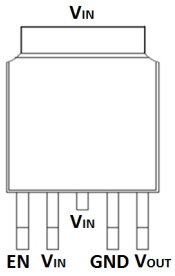
Internal Device Schematic

TO252-4



Top View

Bottom View



Top View
Pin-Out

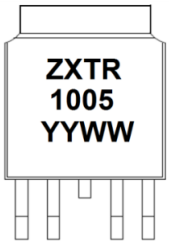
Pin Name	Pin Function
V_{IN}	Input Supply
GND	Power Ground
V_{OUT}	Voltage Output
EN	Enable Output

Ordering Information (Note 4)

Product	Package	Marking	Reel Size (inches)	Tape Width (mm)	Quantity per Reel
ZXTR1005K4-13	TO252-4	ZXTR 1005	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 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 1005 = Product Type Marking Code
YYWW = Date Code Marking
YY = Year (ex: 13 = 2013)
WW = Week (01-52)

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
Enable Current	I_{EN}	±1	mA
Continuous Input & Output Current	I_{IN}, I_{OUT}	100	mA
Peak Pulsed Input & Output Current	I_{IM}, I_{OM}	100	mA
Maximum Voltage applied to V_{OUT}	$V_{OUT(max)}$	10	V

Maximum Current (@ V_{IN} = 48V, 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}	100	mA
	(Note 9)		100	

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

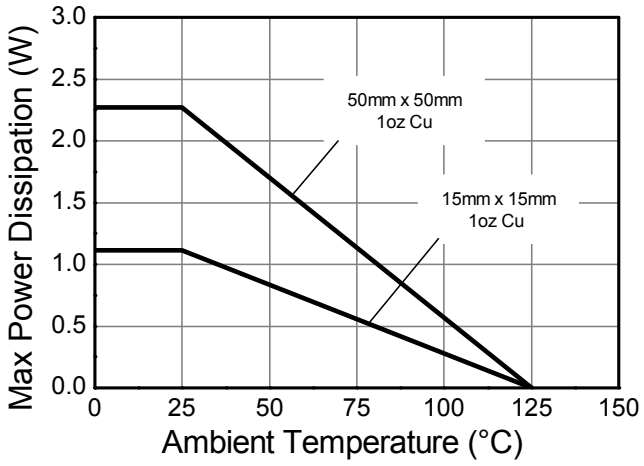
Characteristic		Symbol	Value	Unit
Power Dissipation	(Note 5)	P_D	2.3	W
	(Note 6)		1.1	
Thermal Resistance, Junction to Ambient	(Note 5)	$R_{\theta JA}$	44	°C/W
	(Note 6)		90	
Thermal Resistance, Junction to Lead	(Note 10)	$R_{\theta JL}$	8.39	
Thermal Resistance, Junction to Case	(Note 10)	$R_{\theta JC}$	8.15	
Maximum Operating Junction Temperature Range		T_J	-55 to +125	°C
Storage Temperature Range		T_{STG}	-65 to +150	°C

ESD Ratings (Note 11)

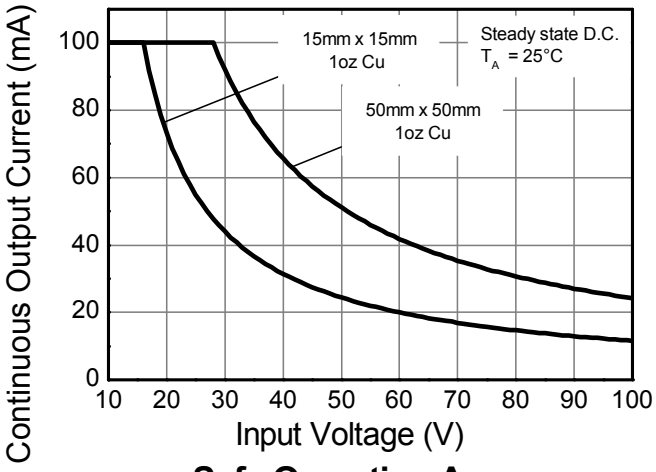
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

Notes:
5. For a device mounted with the 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.
6. Same as note 5, except mounted on 15mm x 15mm 1oz copper.
7. Same as note 5, whilst operating at V_{IN}=48V this is thermally limited. 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}=48V. This is limited by the absolute maximum I_{OM} rating.
9. Same as note 5, except measured with a single pulse width = 10ms and V_{IN}=48V. This is limited by the absolute maximum I_{OM} rating.
10. $R_{\theta JL}$ = Thermal resistance from junction to solder-point (on the exposed V_{IN} pad).
    $R_{\theta JC}$ = Thermal resistance from junction to the top of case.
11. Refer to JEDEC specification JESD22-A114 and JESD22-A115.

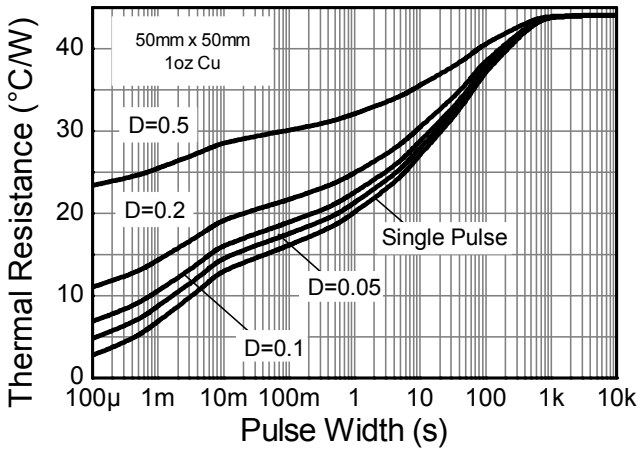
Thermal Characteristics and Derating Information



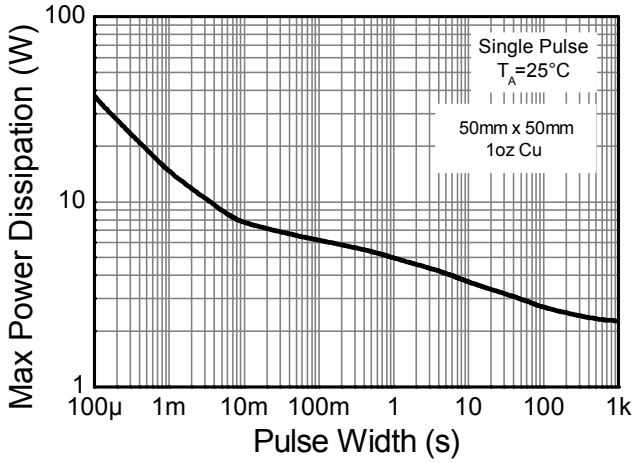
Derating Curve



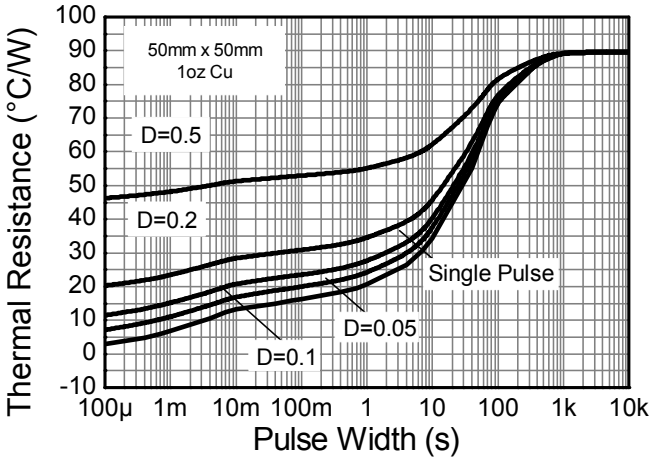
Safe Operating Area



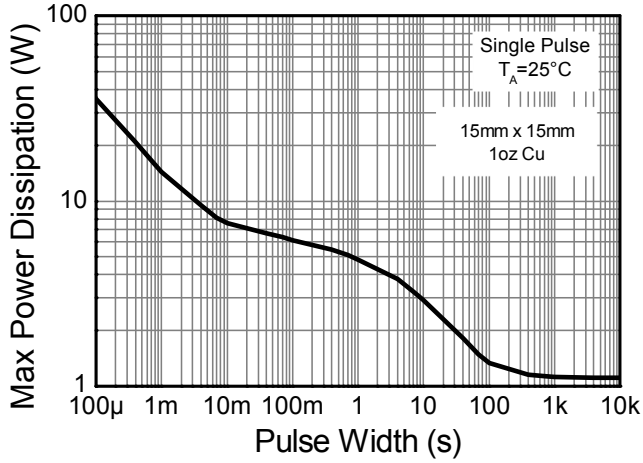
Transient Thermal Impedance



Pulse Power Dissipation



Transient Thermal Impedance



Pulse Power Dissipation

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

Enable Output with EN =OPEN (i.e. -100nA < I_{EN} <100nA)

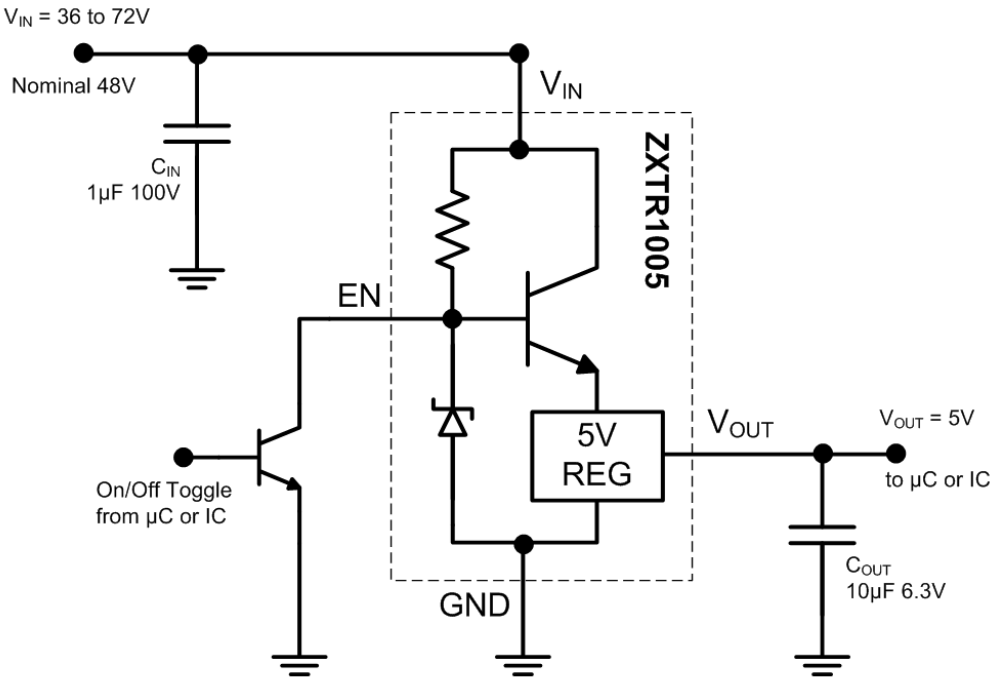
Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	V_{OUT}	4.9	5.0	5.1	V	V_{IN} = 48V, I_{OUT} = 15mA
Line Regulation (Note 12 & 13)	ΔV_{OUT}	-10	2	10	mV	V_{IN} = 10 to 100V, I_{OUT} = 15mA
Average Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	0.44	0.7	mV/°C	T_J = -55°C to +125°C V_{IN} = 48V, I_{OUT} = 15mA
Load Regulation (Note 12 & 14)	ΔV_{OUT}	—	20	50	mV	I_{OUT} = 0.1 to 50mA, V_{IN} = 48V
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	10	—	—	V	—
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	57	—	dB	C_{OUT} = 100nF, I_{OUT} = 15mA, V_{OUT} = 5V, V_{IN} = 10 to 100V, f = 100Hz
Toggle Output On/Off						
Enable Output	V_{OUT}	4.9	5.0	5.1	V	EN = OPEN, -100nA < I_{EN} <100nA, V_{IN} = 48V, I_{OUT} = 15mA
Disable Output	V_{OUT}	—	0	1	V	EN = GND, -0.3V < V_{EN} < 1V, V_{IN} = 48V, I_{OUT} = 100nA
Quiescent Current (Note 12) with Enable Output	I_Q	—	300 650	500 900	µA	EN = OPEN, V_{IN} = 48V EN = OPEN, V_{IN} = 100V
Quiescent Current (Note 12) with Disable Output	I_Q	—	300 650	500 900	µA	EN = GND, V_{IN} = 48V EN = GND, V_{IN} = 100V

Notes: 12. Measured under pulsed conditions. Pulse width ≤ 300µs. Duty cycle ≤ 2%.
13. Line regulation ΔV_{OUT} = V_{OUT}(@ V_{IN} = 100V) – V_{OUT}(@ V_{IN} = 10V)
14. Load regulation ΔV_{OUT} = V_{OUT}(@ I_{OUT} = 50mA) – V_{OUT}(@ I_{OUT} = 0mA)

Pin Functions

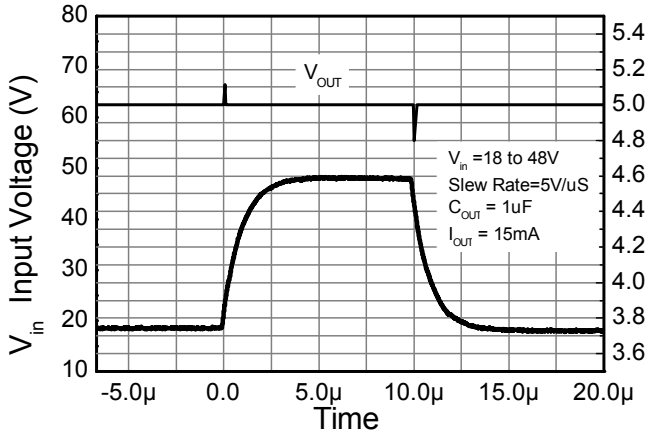
Pin Name	Pin Function	Notes	
V_{IN}	Input Supply	To maintain output regulation the input voltage can vary from 10 to 100V with respect to the GND pin. It is recommended to connect a 1µF capacitor to GND.	
GND	Power Ground	This pin should be tied to the system ground.	
V_{OUT}	Voltage Output	Outputs a regulated 5V when drawing between 0.1 to 50mA current. It is recommended to connect a ≥100nF capacitor to GND to minimize the noise on the regulated output. The pin can be pulled high to a maximum of 10V with respect to ground.	
EN	Enable Output	**Output Always On** When the output state is required to be permanently on, then the EN pin should be left floating in an OPEN state.	EN pin = Do not connect
		Toggle Output On/Off Toggle the regulator's output state between on (5V) and off (0V). **Enable Output** Leave the EN pin floating in an OPEN state. **Disable Output** Pull the EN pin to GND in a SHORT state. For example, see the Typical Application Circuit showing a transistor toggling the EN pin.	**Enable Output** EN pin = -100nA < I_{EN} <100nA **Disable Output** EN pin = -0.3V < V_{EN} < 1V

Typical Application Circuit

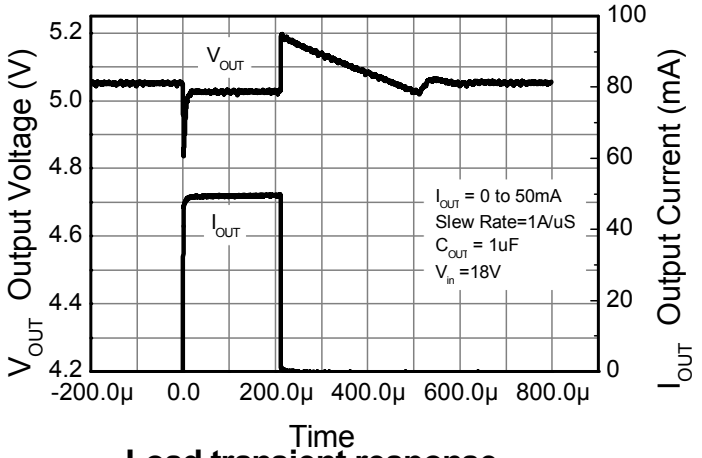


Example of a 5V regulated supply from a nominal 48V for powering a Controller IC.

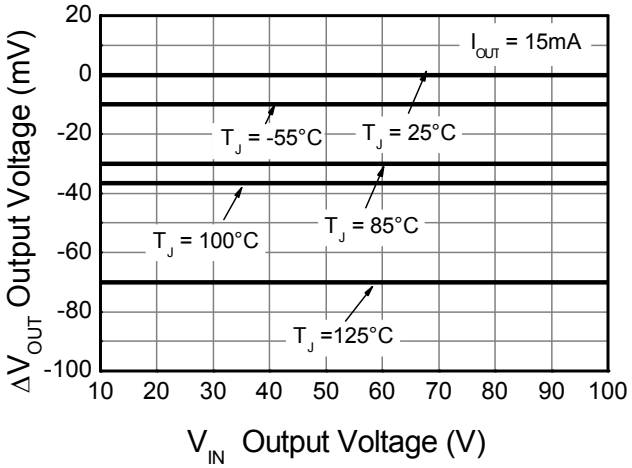
Typical Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)



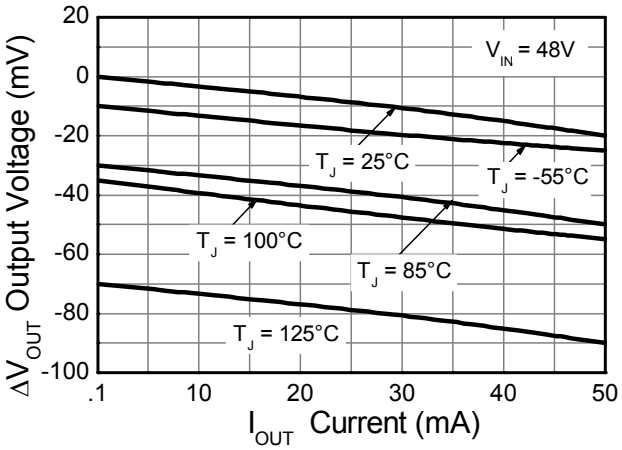
Line transient response



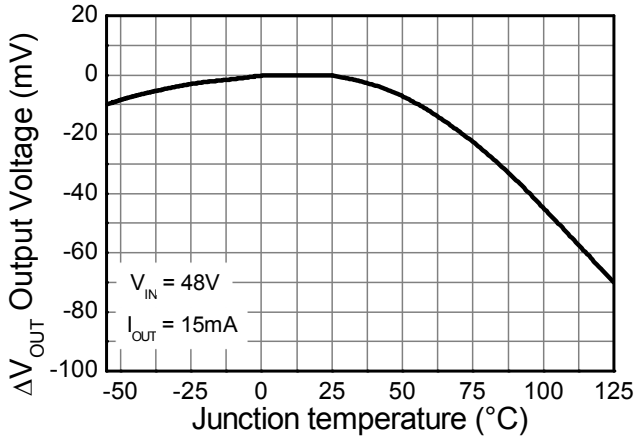
Load transient response



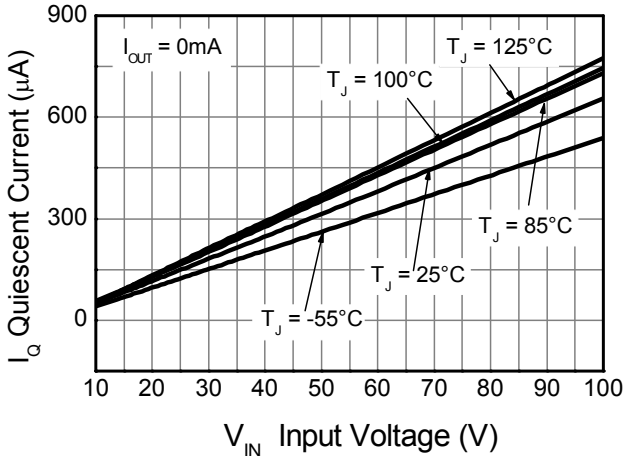
Line Regulation (Note 15)



Load Regulation (Note 16)



Temperature Coefficient (Note 17)

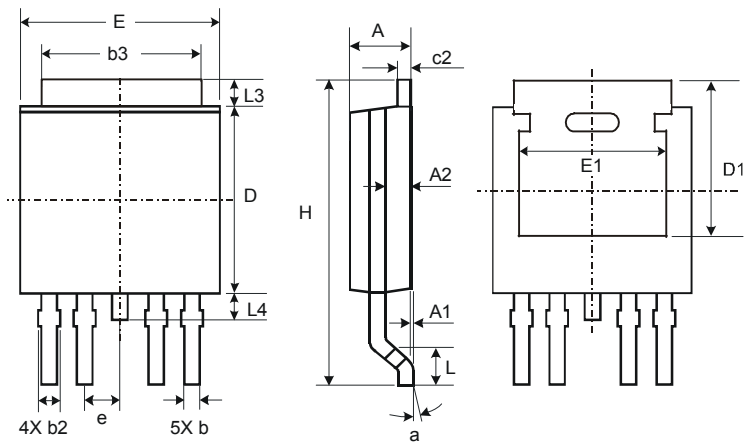


Quiescent Current

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} = 0A, T_J = +25°C)
17. Temperature Coefficient $\Delta V_{OUT} = V_{OUT} - V_{OUT}$(@ V_{IN} = 48V, I_{OUT} = 30mA, T_J = +25°C)

Package Outline Dimensions

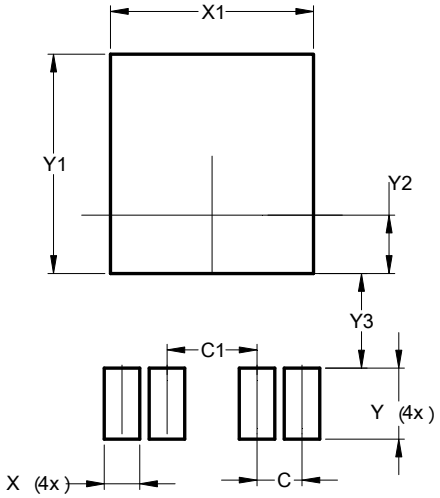
Please see AP02002 at http://www.diodes.com/datasheets/ap02002.pdf for latest version.



TO252-4			
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	0.51	0.71	0.583
b2	0.61	0.79	0.70
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	-	-	1.27
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)
c	1.27
c1	2.54
X	1.00
X1	5.73
Y	2.00
Y1	6.17
Y2	1.64
Y3	2.66

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