

## Description

The ZXTR2005K monolithically integrates a transistor, Zener diode and resistor to function as a high voltage linear regulator. The device regulates with a 5V 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.

## Applications

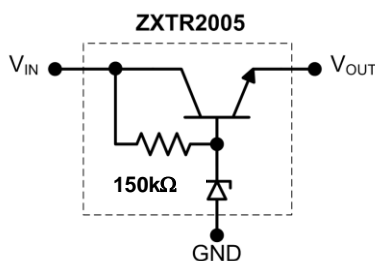
Supply voltage regulation in:

- Startup switch in DC-DC converters
- Networking
- Telecommunications
- Power over Ethernet (PoE)

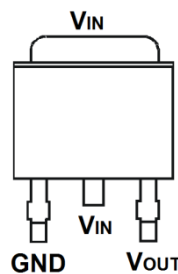
TO252 (DPAK)



Top View



Top View  
Pin-Out



Top View  
Pin-Out

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

## Features

- Series Linear Regulator Using Emitter-Follower Stage
- Input Voltage = 10 to 100V (For regulated output voltage)
- Output Voltage = 5V ± 10%
- 150kΩ resistor to limit quiescent current
- 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 for High Reliability**

## Mechanical Data

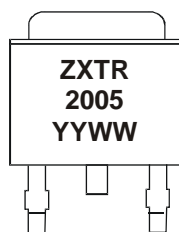
- Case: TO252 (DPAK)
- Case Material: Molded Plastic, "Green" Molding Compound. UL Flammability Rating 94V-0
- Moisture Sensitivity: Level 1 per J-STD-020
- Terminals: Finish - Matte Tin Plated Leads. Solderable per MIL-STD-202, Method 208 <sup>Ⓔ</sup>
- Weight: 0.34 grams (Approximate)

## Ordering Information (Note 4)

Product	Package	Marking	Reel size (inches)	Tape width (mm)	Quantity per reel
ZXTR2005K-13	TO252 (DPAK)	ZXTR 2005	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 2005 = Product Type Marking Code  
 YYWW = Date Code Marking  
 YY = Last Digit of Year (ex: 17 = 2017)  
 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 Voltage	V <sub>IN</sub>	-0.3 to 100	V
Continuous Input & Output Current	I <sub>IN</sub> , I <sub>OUT</sub>	450	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>	Smaller of V <sub>IN</sub> +5V or 11V	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>	50	mA
Pulsed Output Current	I <sub>OM</sub>	830	mA
		170	

**Thermal Characteristics**

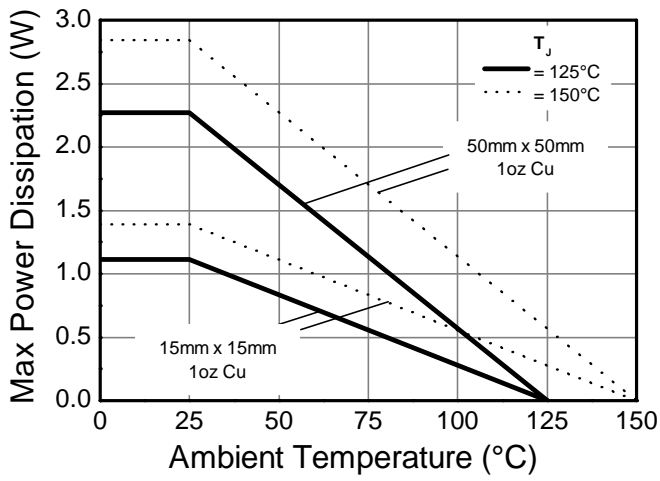
Characteristic	Symbol	Value	Unit
Power Dissipation	P <sub>D</sub>	2.3	W
		1.1	
Thermal Resistance, Junction to Ambient	R <sub>θJA</sub>	44	°C/W
		90	
Thermal Resistance, Junction to Lead	R <sub>θJL</sub>	8.4	°C/W
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	14.6	
Recommended Operating Junction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

**ESD Ratings** (Note 11)

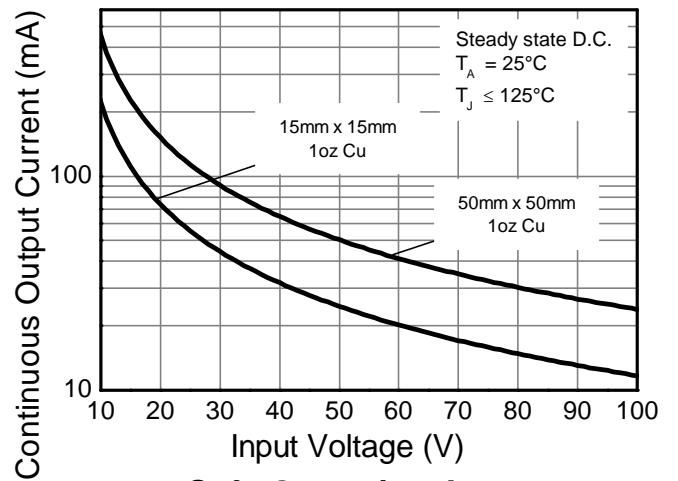
Characteristics	Symbols	Value	Unit	JEDEC Class
Electrostatic Discharge – Human Body Model	ESD HBM	4,000	V	3A
Electrostatic Discharge – Machine Model	ESD MM	400	V	C

- Notes:
- 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.

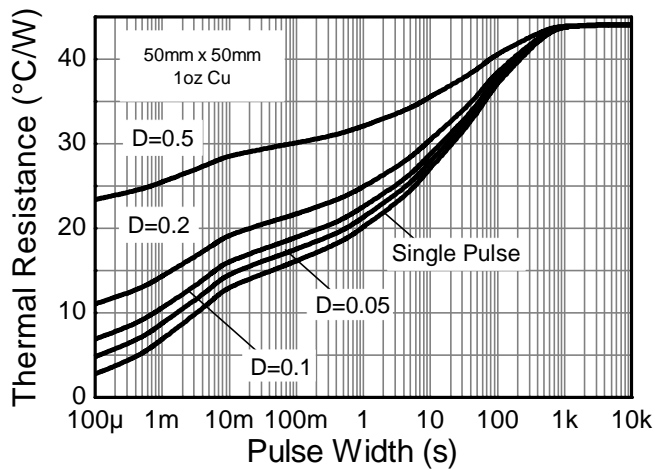
**Thermal Characteristics and Derating Information**



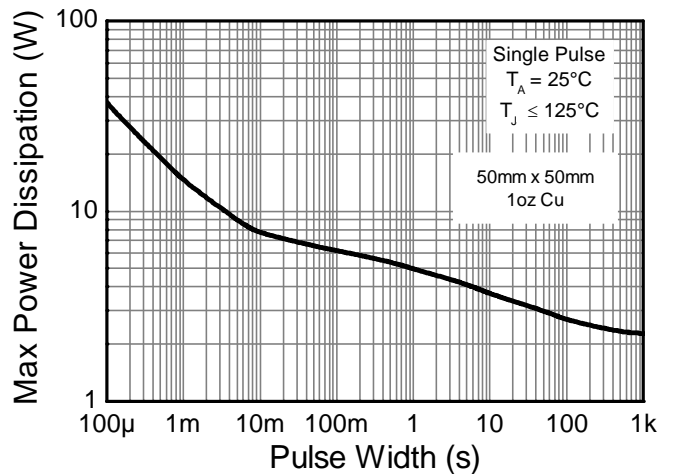
**Derating Curve**



**Safe Operating Area**



**Transient Thermal Impedance**

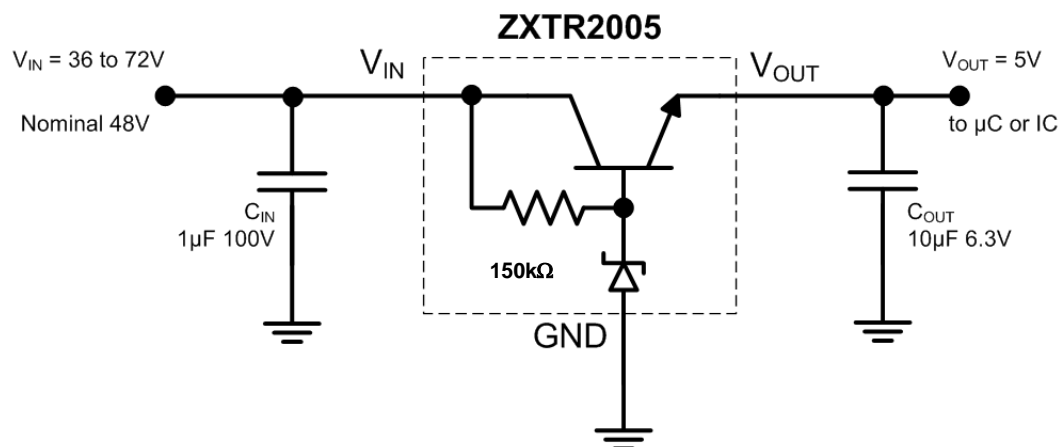


**Pulse Power Dissipation**

**Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Characteristic	Symbol	Min	Typ	Max	Unit	Test Condition
Output Voltage (Note 12)	$V_{OUT}$	4.5	5.0	5.5	V	$V_{IN} = 48\text{V}$ , $I_{OUT} = 15\text{mA}$
Line Regulation (Notes 12 & 13)	$\Delta V_{OUT}$	—	195	300	mV	$V_{IN} = 10$ to $72\text{V}$ , $I_{OUT} = 15\text{mA}$
Temperature Coefficient	$\Delta V_{OUT}/\Delta T$	—	7.0	—	mV/ $^\circ\text{C}$	$T_J = -40^\circ\text{C}$ to $+125^\circ\text{C}$ $V_{IN} = 48\text{V}$ , $I_{OUT} = 15\text{mA}$
Load Regulation (Notes 12 & 14)	$\Delta V_{OUT}$	—	-185 -205	-350 -400	mV	$I_{OUT} = 0.1$ to $30\text{mA}$ , $V_{IN} = 48\text{V}$ $I_{OUT} = 0.1$ to $100\text{mA}$ , $V_{IN} = 48\text{V}$
Minimum Value of Input Voltage Required to Maintain Line Regulation	$V_{IN(MIN)}$	10	—	—	V	—
Quiescent Current	$I_Q$	—	260 550	500 900	$\mu\text{A}$	$V_{IN} = 48\text{V}$ , $I_{OUT} = 10\mu\text{A}$ $V_{IN} = 100\text{V}$ , $I_{OUT} = 10\mu\text{A}$
Power Supply Rejection Ratio	$\Delta V_{IN}/\Delta V_{OUT}$	—	45	—	dB	$C_{OUT} = 100\text{nF}$ , $I_{OUT} = 15\text{mA}$ , $V_{OUT} = 5\text{V}$ , $V_{IN} = 10$ to $100\text{V}$ , $f = 100\text{Hz}$

- Notes:
- 12. Measured under pulsed conditions. Pulse width  $\leq 300\mu\text{s}$ . Duty cycle  $\leq 2\%$
  - 13. Line regulation  $\Delta V_{OUT} = V_{OUT} (@ V_{IN} = 72\text{V}) - V_{OUT} (@ V_{IN} = 10\text{V})$
  - 14. Load regulation  $\Delta V_{OUT} = V_{OUT} (@ I_{OUT} = 30\text{mA}) - V_{OUT} (@ I_{OUT} = 0.1\text{mA})$   
 $\Delta V_{OUT} = V_{OUT} (@ I_{OUT} = 100\text{mA}) - V_{OUT} (@ I_{OUT} = 0.1\text{mA})$

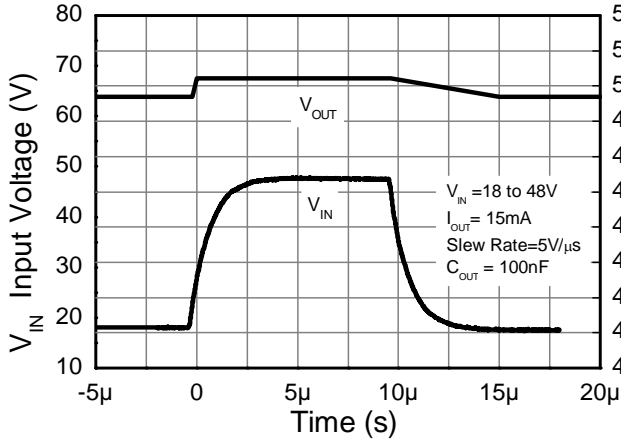
**Typical Application Circuit**


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

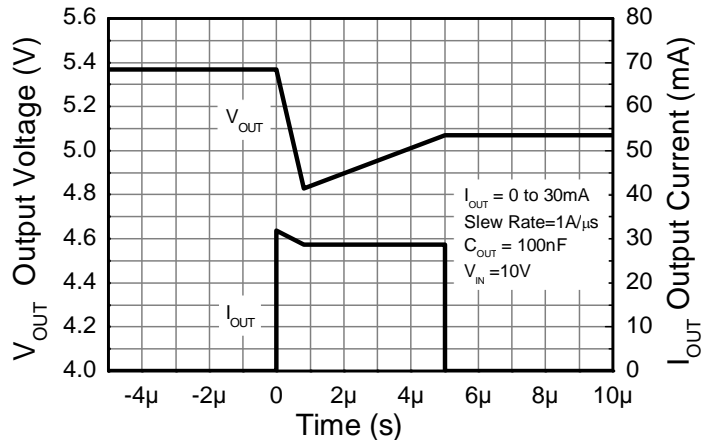
**Pin Functions**

Pin Name	Pin Function	Notes
<b>VIN</b>	Input Supply	Input voltage can vary from $-0.3\text{V}$ to $100\text{V}$ with respect to GND; for $V_{OUT}$ regulated then $10\text{V} \leq V_{IN} \leq 100\text{V}$ . It is recommended to connect a $1\mu\text{F}$ capacitor to GND.
<b>GND</b>	Power Ground	This pin should be tied to the system ground.
<b>VOUT</b>	Voltage Output	Outputs a regulated $5\text{V}$ when $10\text{V} \leq V_{IN} \leq 100\text{V}$ . When $V_{IN} < 10\text{V}$ , then $V_{OUT}$ maximum = $V_{IN} - 1.5\text{V}$ . The pin can be pulled high to a maximum of $+11\text{V}$ with respect to GND, or $+5\text{V}$ with respect to $V_{IN}$ , whichever is lower. It is recommended to connect a $10\mu\text{F}$ capacitor to GND and a minimum of $10\mu\text{A}$ to be drawn from $V_{OUT}$ to maintain regulation.

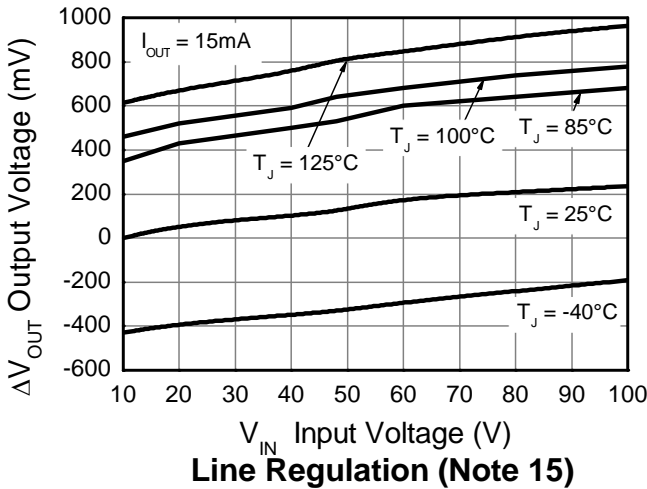
**Typical Electrical Characteristics** (@ $T_A = +25^\circ\text{C}$ , unless otherwise specified.)



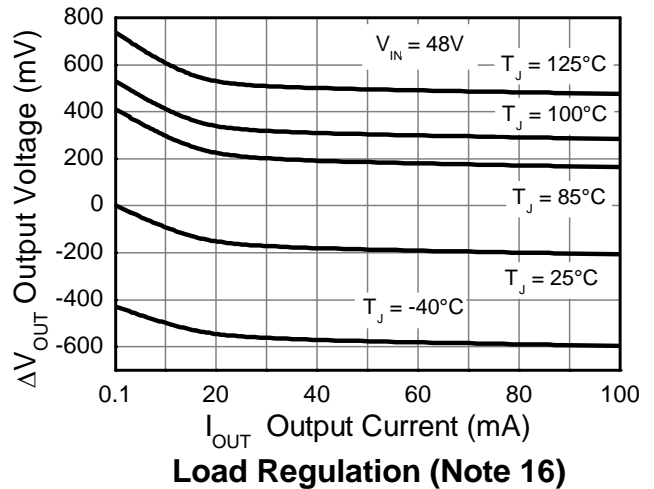
**Line transient response**



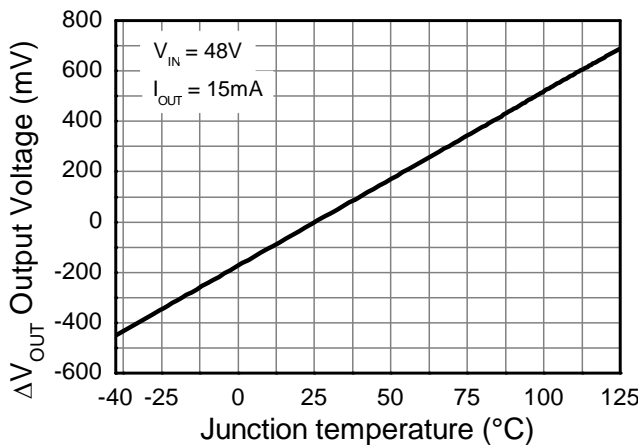
**Load transient response**



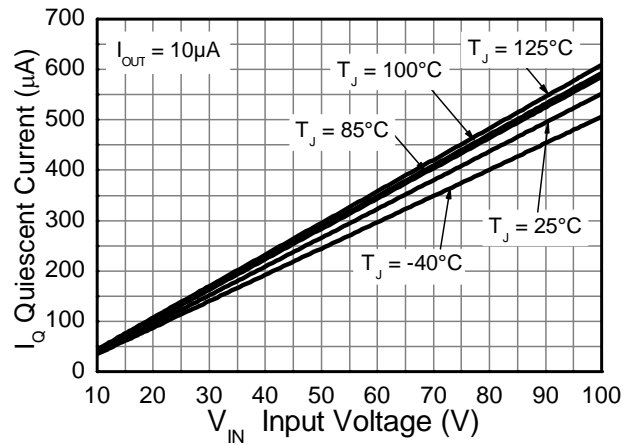
**Line Regulation (Note 15)**



**Load Regulation (Note 16)**



**Temperature Coefficient (Note 17)**

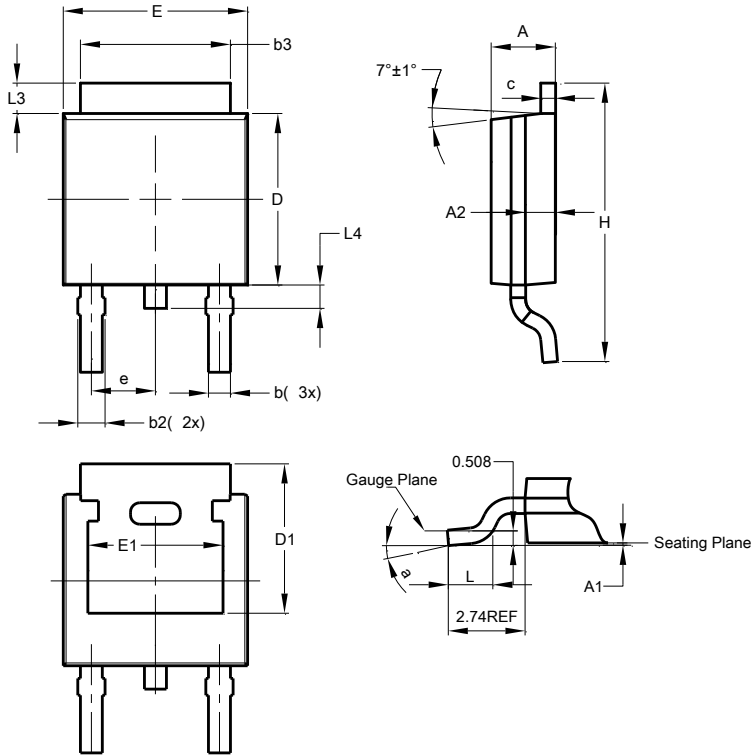


**Quiescent Current**

Notes:  
 15. Line regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 10\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$   
 16. Load regulation  $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 48\text{V}, I_{OUT} = 0.1\text{mA}, T_J = +25^\circ\text{C})$   
 17. Temperature Coefficient  $\Delta V_{OUT} = V_{OUT} - V_{OUT} (@ V_{IN} = 48\text{V}, I_{OUT} = 15\text{mA}, T_J = +25^\circ\text{C})$

## Package Outline Dimensions

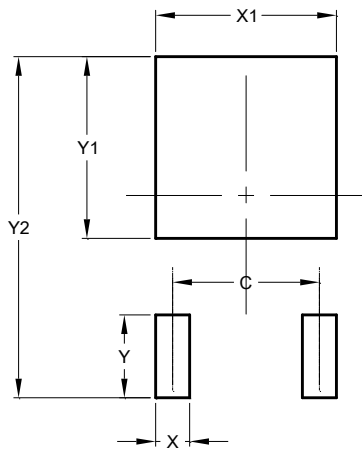
Please see <http://www.diodes.com/package-outlines.html> for the latest version.



TO252 (DPAK)			
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
c	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 <http://www.diodes.com/package-outlines.html> for the latest version.



Dimensions	Value (in mm)
C	4.572
X	1.060
X1	5.632
Y	2.600
Y1	5.700
Y2	10.700

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