LOW-VOLTAGE (1.24V) ADJUSTABLE PRECISION SHUNT REGULATOR

Description

The AZ431L series ICs are low-voltage three-terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators.

The output voltage can be set to any value between 1.24V and 18V with two external resistors.

The AZ431L precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

These ICs are available in 4 packages: TO92 (Ammo Packing), SOT23, SOT25 and SOT89.

Features

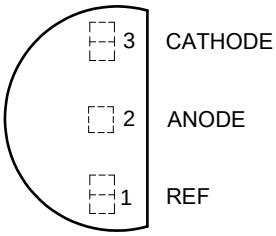
- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-Range Temperature Coefficient: 20PPM/°C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Package: SOT23
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: TO92 (Ammo Packing), SOT23, SOT25, SOT89
  - **Totally Lead-Free & Fully RoHS Compliant (Note 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**
- **For automotive applications requiring specific change control (i.e. parts qualified to AEC-Q100/101/104/200, PPAP capable, and manufactured in IATF 16949 certified facilities), please contact us or your local Diodes representative. https://www.diodes.com/quality/product-definitions/**

Applications

- Graphic cards
- PC motherboards
- Voltage adapters
- Switching power supplies
- Chargers

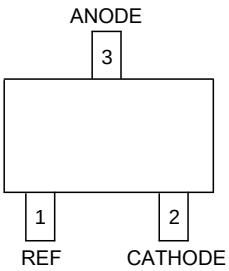
Pin Assignments

(Top View)



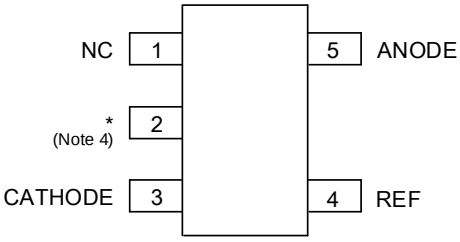
TO92 (Ammo Packing)

(Top View)



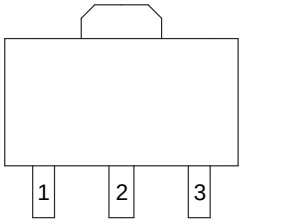
SOT23

(Top View)



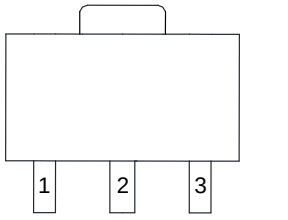
SOT25

(Top View)



SOT89 (Option 1)

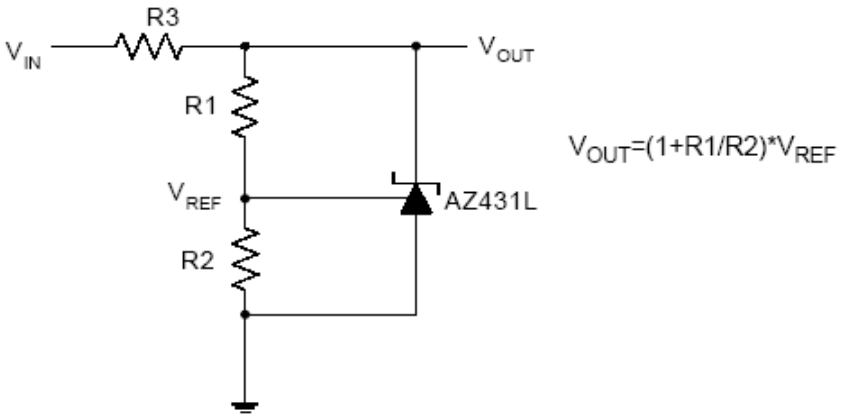
(Top View)



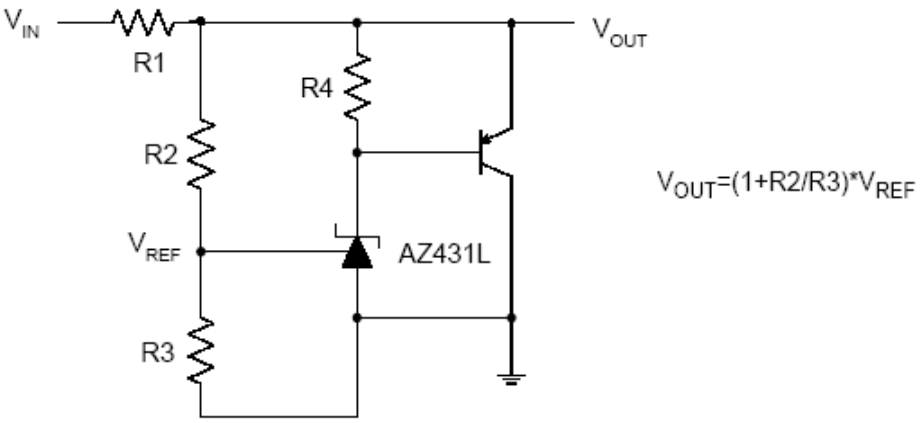
SOT89 (Option 2)

Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
2. See https://www.diodes.com/quality/lead-free/ 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. Pin 2 is attached to substrate and must be connected to ANODE or open.

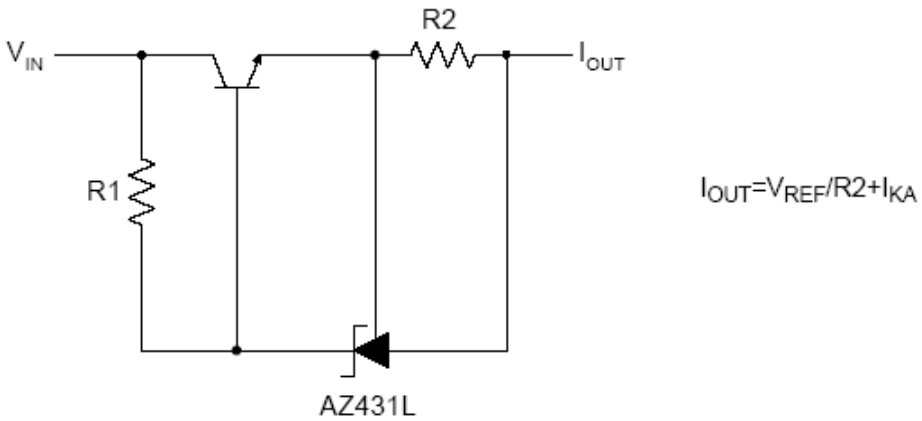
Typical Applications Circuit



Shunt Regulator

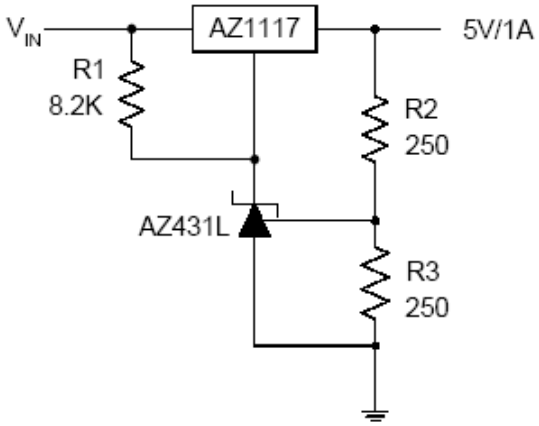


High Current Shunt Regulator

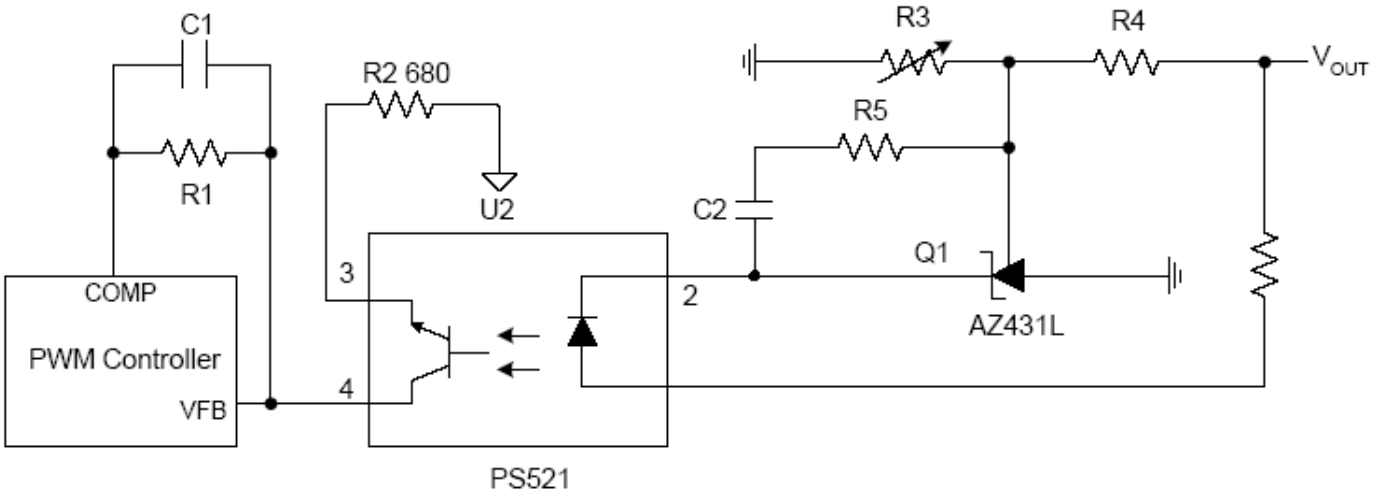


Current Source or Current Limit

Typical Applications Circuit (continued)

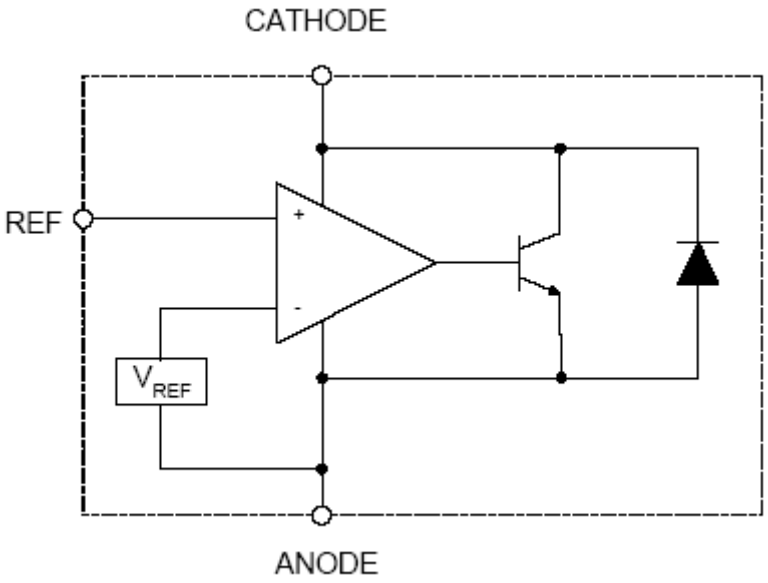


Precision 5V 1A Regulator



PWM Converter with Reference

Functional Block Diagram



Absolute Maximum Ratings (Note 5)

Symbol	Parameter		Rating	Unit
V_{KA}	Cathode Voltage		20	V
I_{KA}	Cathode Current Range (Continuous)		-100 to 100	mA
I_{REF}	Reference Input Current Range		10	mA
P_D	Power Dissipation	TO92 (Ammo Packing) SOT89	770	mW
		SOT23 SOT25	370	
T_J	Junction Temperature		+150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C

Note: 5. Stresses greater than those listed under *Absolute Maximum Ratings* can cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under *Recommended Operating Conditions* is not implied. Exposure to *Absolute Maximum Ratings* for extended periods can affect device reliability.

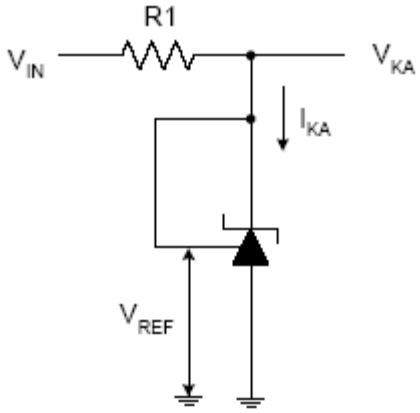
Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	18	V
I_{KA}	Cathode Current	0.1	100	mA
—	Operating Ambient Temperature Range	-40	+125	°C

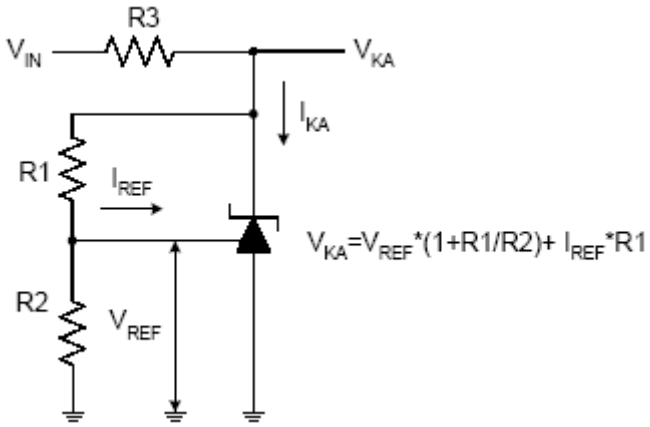
Electrical Characteristics (Operating Conditions: T_A = +25°C, unless otherwise noted.)

Symbol	Parameter		Test Circuit	Conditions		Min	Typ	Max	Unit
V_{REF}	Reference Voltage	0.5%	4	$V_{KA} = V_{REF}$, I_{KA} = 10mA		1.234	1.240	1.246	V
		1.0%				1.228	1.240	1.252	
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range		4	$V_{KA} = V_{REF}$ I_{KA} = 10mA	0°C to +70°C	—	2	10	mV
					-40°C to +85°C	—	3	10	
					-40°C to +125°C	—	4	15	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in V_{REF} to the Change in Cathode Voltage		5	I_{KA} = 10mA ΔV_{KA}: V_{REF} to 16V		—	-0.5	-1.5	mV/V
I_{REF}	Reference Input Current		5	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞		—	0.15	0.4	µA
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		5	I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞ T_A = -40°C to +125°C		—	0.1	0.4	µA
I_{KA} (Min)	Minimum Cathode Current for Regulation		4	$V_{KA} = V_{REF}$		—	55	80	µA
I_{KA} (Off)	Off-State Cathode Current		6	V_{REF} = 0, V_{KA} = 18V		—	0.04	0.10	µA
				V_{KA} = 6, V_{REF} = 0		—	0.01	0.05	
Z_{KA}	Dynamic Impedance		4	$V_{KA} = V_{REF}$, I_{KA} = 1 to 100mA f ≤ 1.0kHz		—	0.05	0.15	Ω
θ_{JC}	Thermal Resistance		—	SOT23		—	84.84	—	°C/W
				SOT25		—	84.84	—	
				TO92 (Ammo Packing)		—	140.80	—	
				SOT89		—	29.80	—	

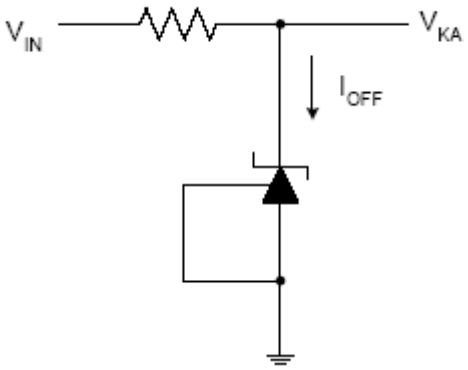
Electrical Characteristics (continued)



Test Circuit 4 for $V_{KA} = V_{REF}$



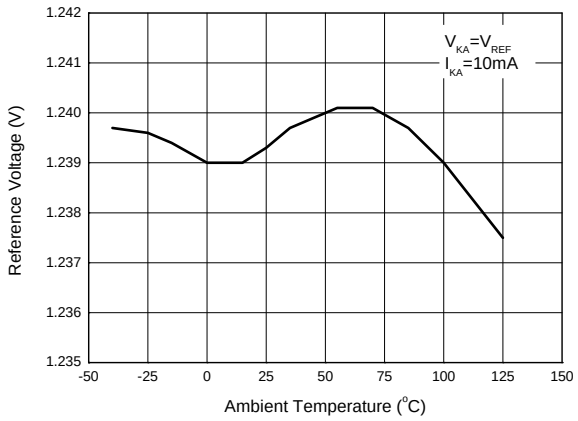
Test Circuit 5 for $V_{KA} > V_{REF}$



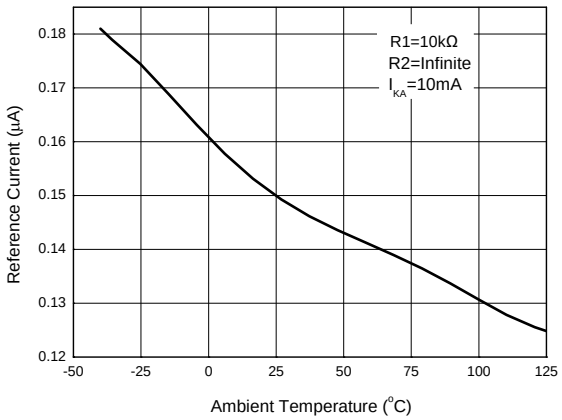
Test Circuit 6 for I_{OFF}

Performance Characteristics

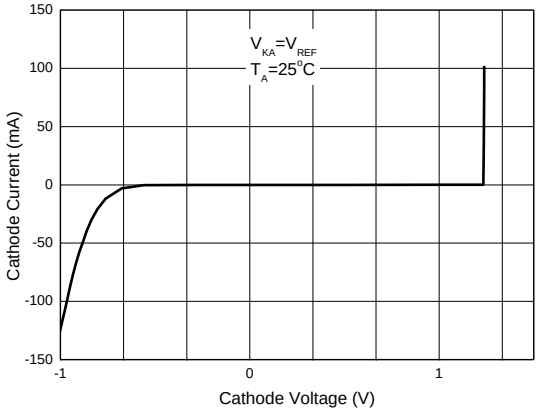
Reference Voltage vs. Ambient Temperature



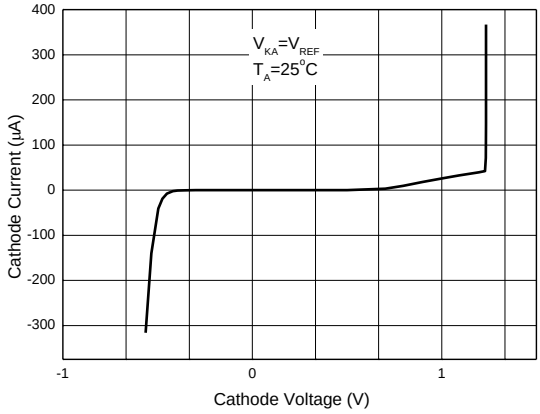
Reference Current vs. Ambient Temperature



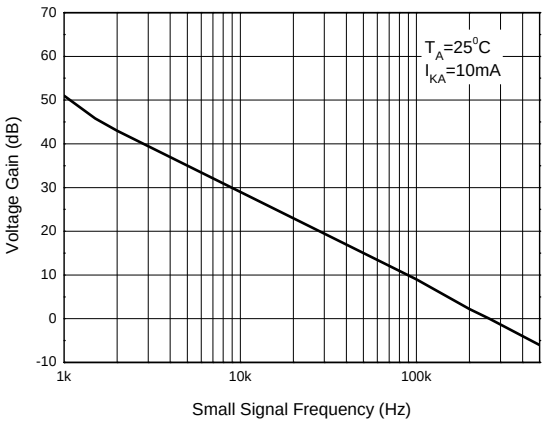
Cathode Current vs. Cathode Voltage

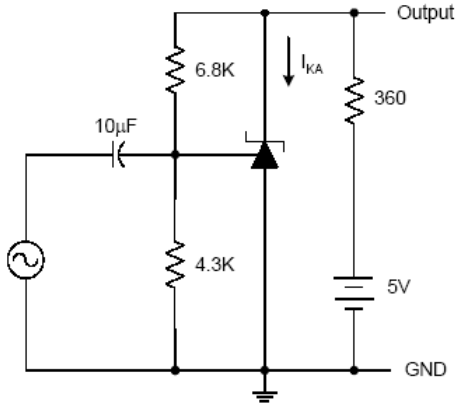


Cathode Current vs. Cathode Voltage



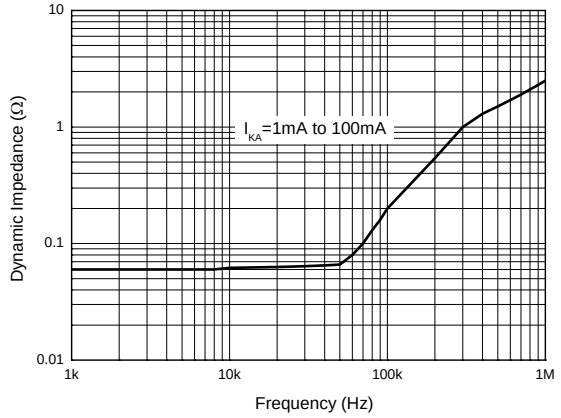
Small-Signal Voltage Gain vs. Frequency

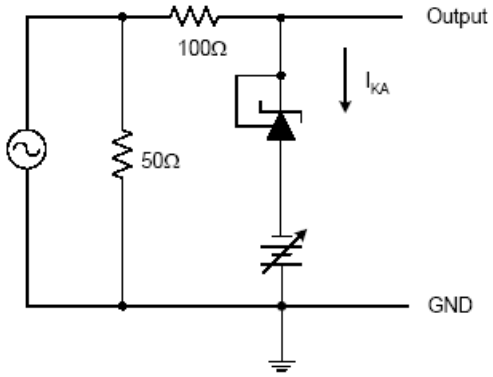




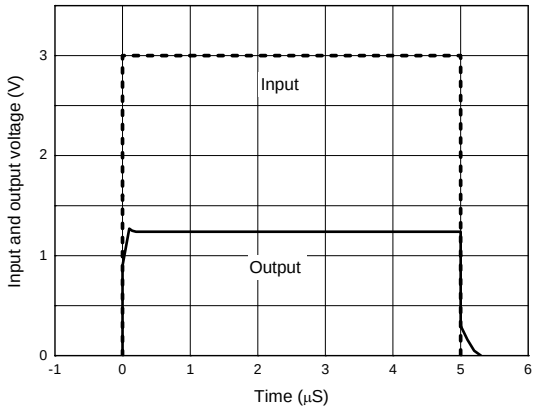
Performance Characteristics (continued)

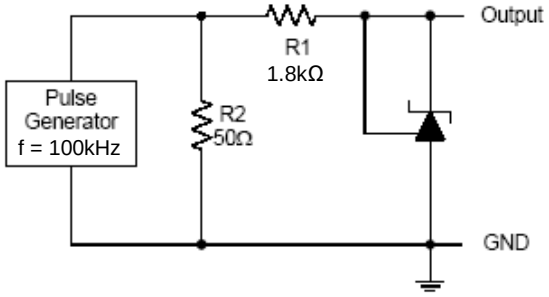
Dynamic Impedance vs. Frequency



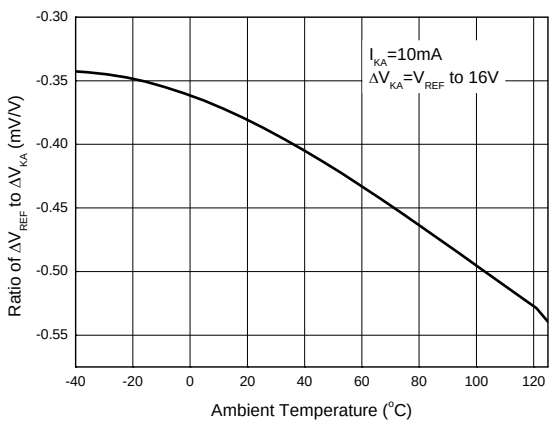


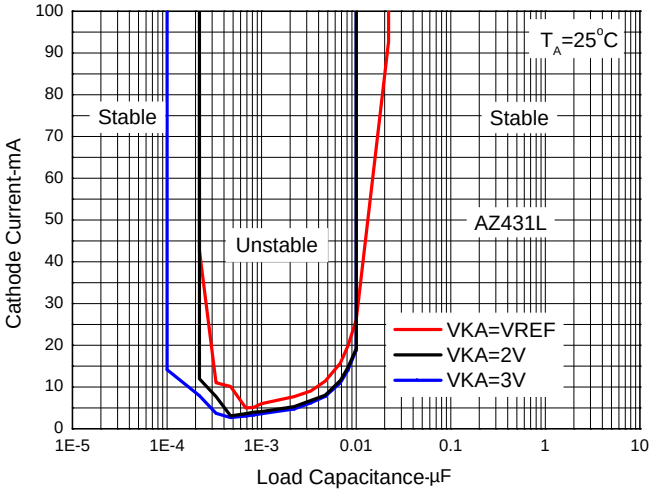
Pulse Response of Input and Output Voltage



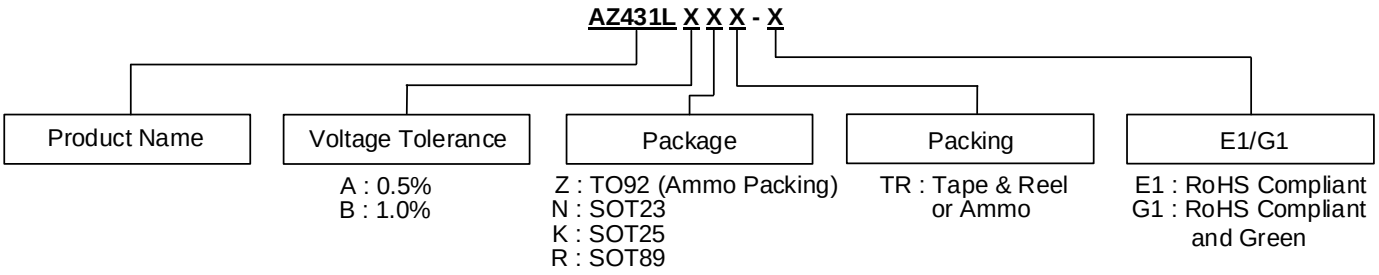


Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature





Ordering Information



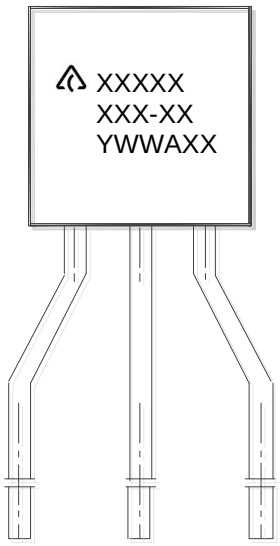
Orderable Part Number	Voltage Tolerance	Package (Note 6)	RoHS Compliant Lead Free / Green	Marking ID	Packing		Status (Note 7)	Alternative
					Qty.	Carrier		
AZ431LAZTR-G1	0.5%	TO92 (Ammo Packing)	Green	AZ431LAZ-G1	2000	Ammo	In Production	—
AZ431LBZTR-G1	1.0%	TO92 (Ammo Packing)	Green	AZ431LBZ-G1	2000	Ammo	In Production	—
AZ431LANTR-E1	0.5%	SOT23	Lead Free	EA6	3000	Tape & Reel	NRND	AZ431LANTR-G1
AZ431LANTR-G1	0.5%	SOT23	Green	GA6	3000	Tape & Reel	In Production	—
AZ431LBNTR-G1	1.0%	SOT23	Green	GA7	3000	Tape & Reel	In Production	—
AZ431LAKTR-G1	0.5%	SOT25	Green	G5A	3000	Tape & Reel	In Production	—
AZ431LBKTR-G1	1.0%	SOT25	Green	G6A	3000	Tape & Reel	In Production	—
AZ431LARTR-G1	0.5%	SOT89	Green	G41A	1000	Tape & Reel	In Production	—
AZ431LBRTR-G1	1.0%	SOT89	Green	G41B	1000	Tape & Reel	In Production	—

Notes: 6. For packaging details, go to our website at: https://www.diodes.com/design/support/packaging/diodes-packaging/.
7. NRND: Not Recommended for New Design.

Marking Information

(1) TO92 (Ammo Packing)

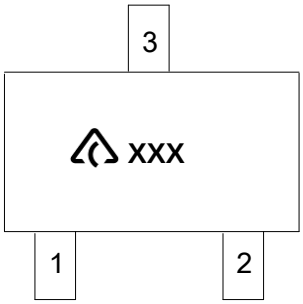
(Front View)



First and Second Lines: Logo and Marking ID
(See *Ordering Information*)
Third Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

(2) SOT23

(Top View)

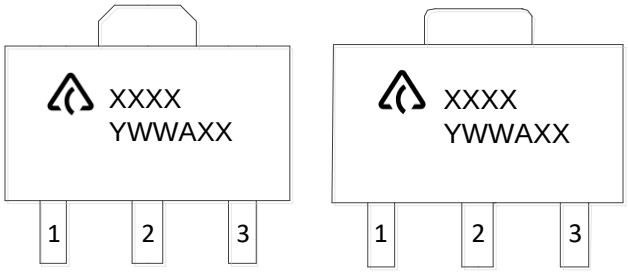


: Logo
XXX: Marking ID (See *Ordering Information*)

Marking Information (continued)

(3) SOT89

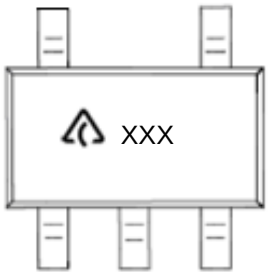
(Top View)



First Line: Logo and Marking ID (See *Ordering Information*)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

(4) SOT25

(Top View)

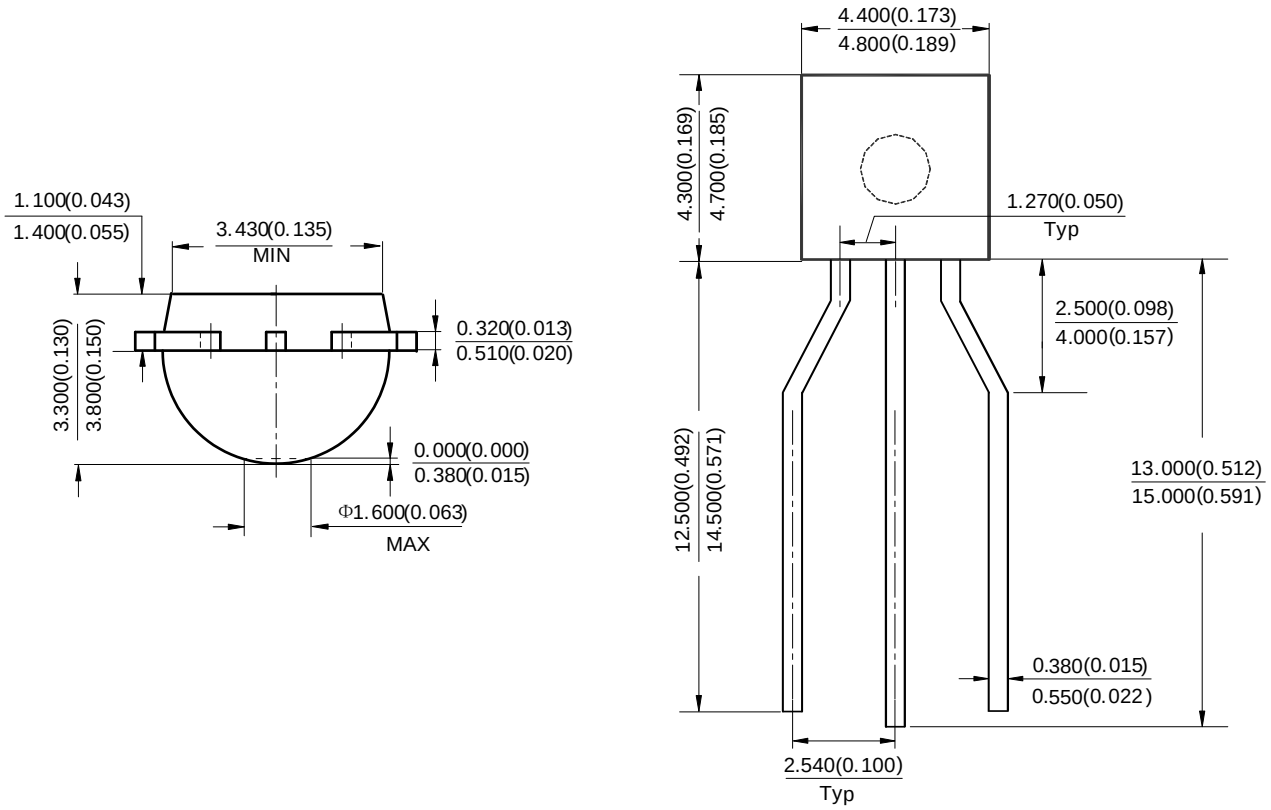


: Logo
XXX: Marking ID (See *Ordering Information*)

Package Outline Dimensions (All dimensions in mm(inch).)

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

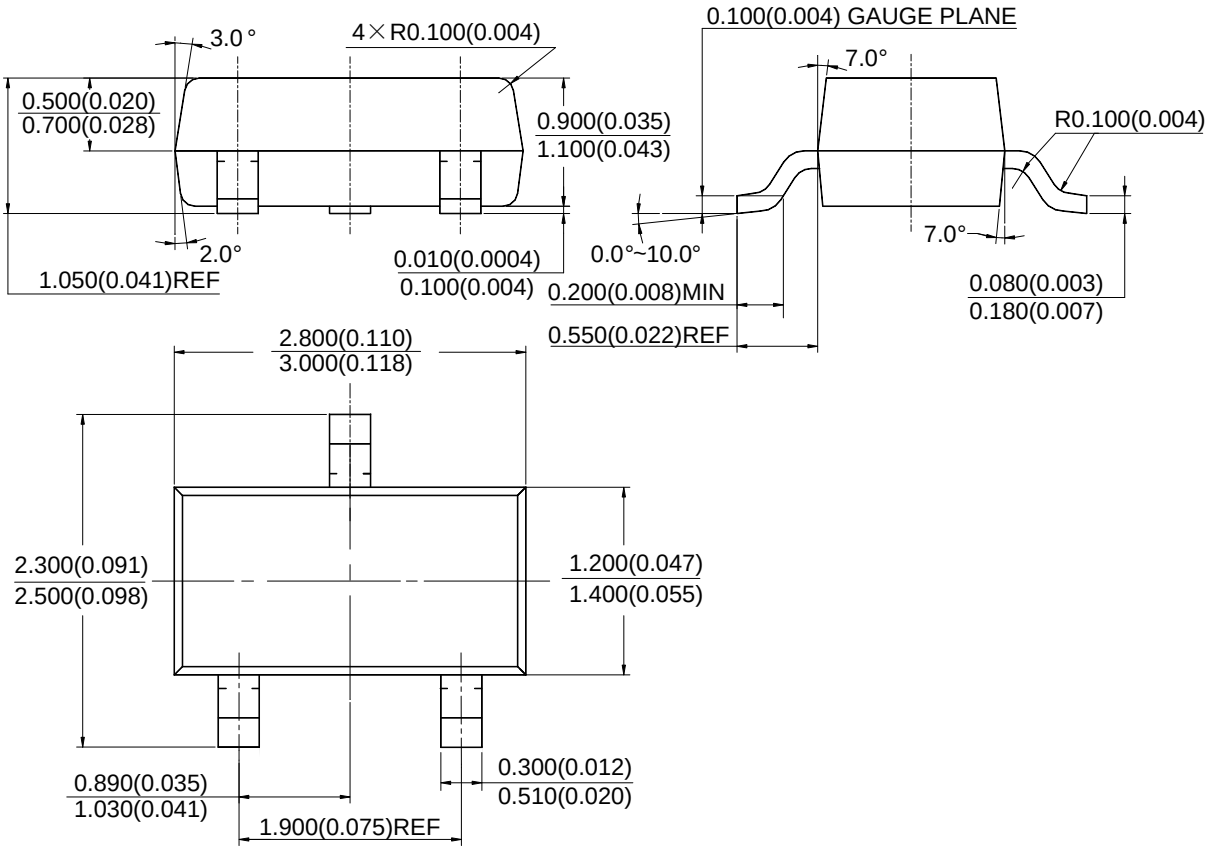
(1) Package Type: TO92 (Ammo Packing)



Package Outline Dimensions (continued) (All dimensions in mm(inch).)

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

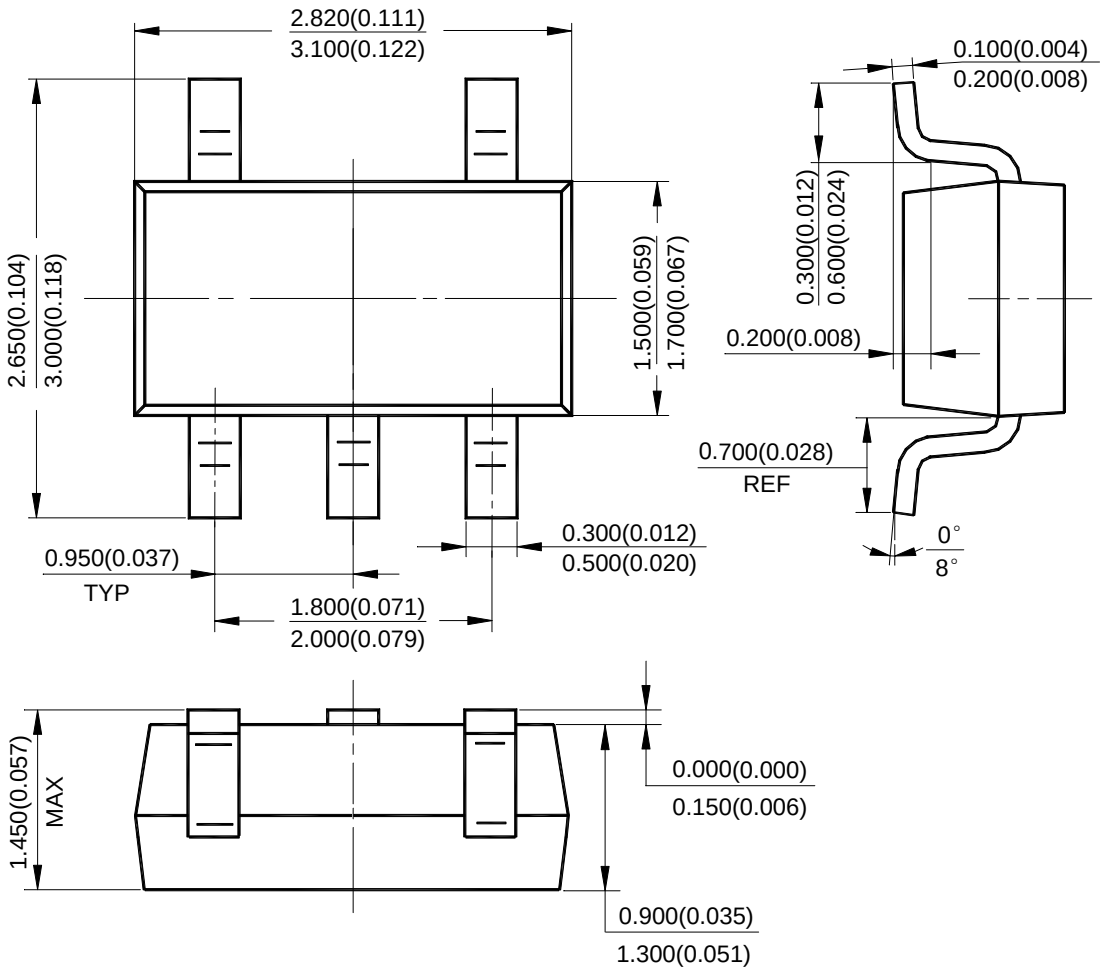
(2) Package Type: SOT23



Package Outline Dimensions (continued) (All dimensions in mm(inch).)

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

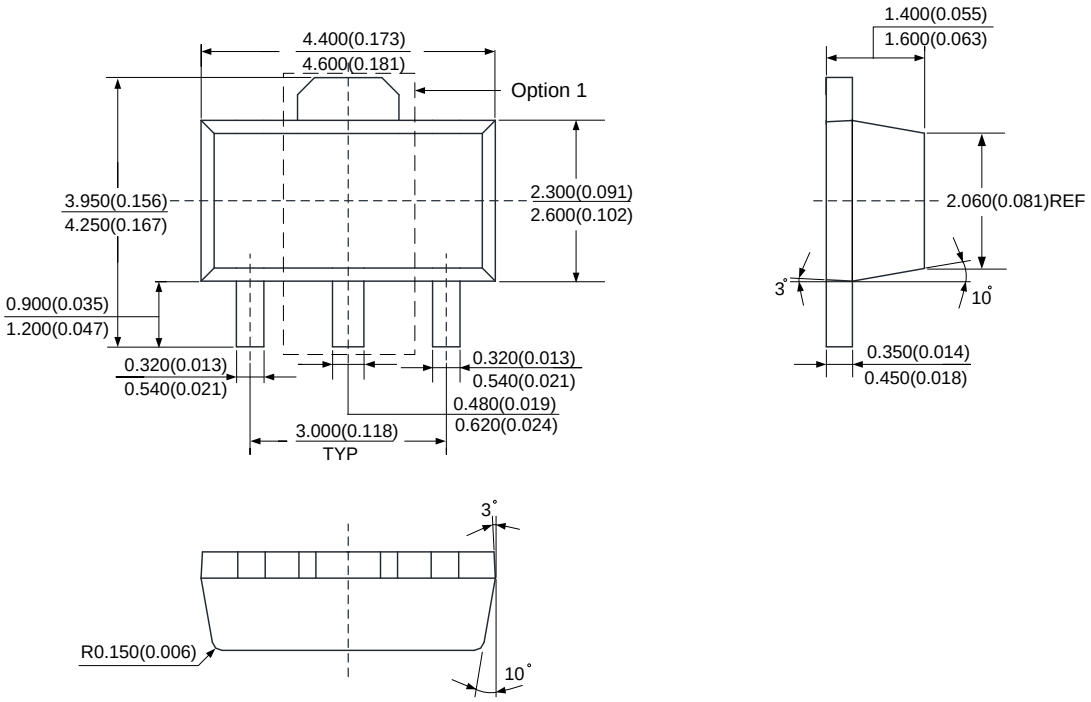
(3) Package Type: SOT25

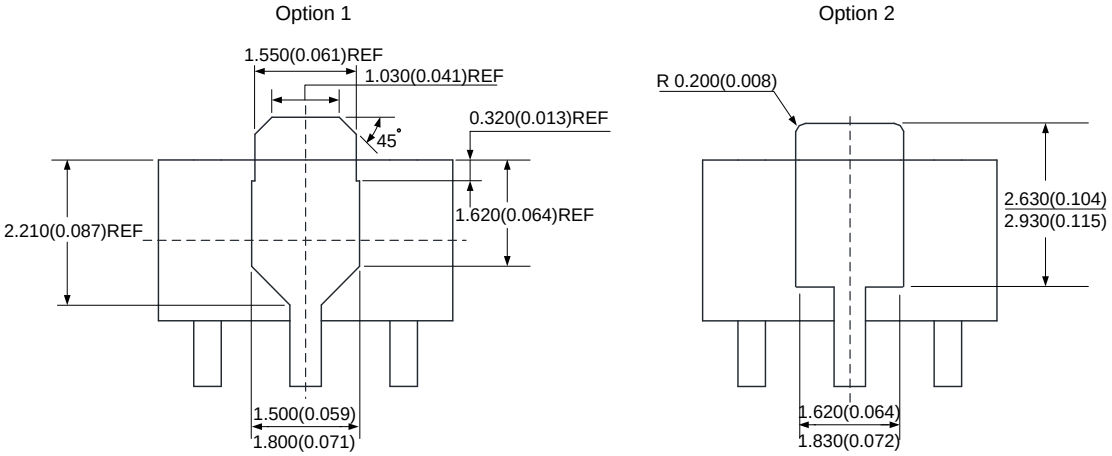


Package Outline Dimensions (continued) (All dimensions in mm(inch).)

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

(4) Package Type: SOT89

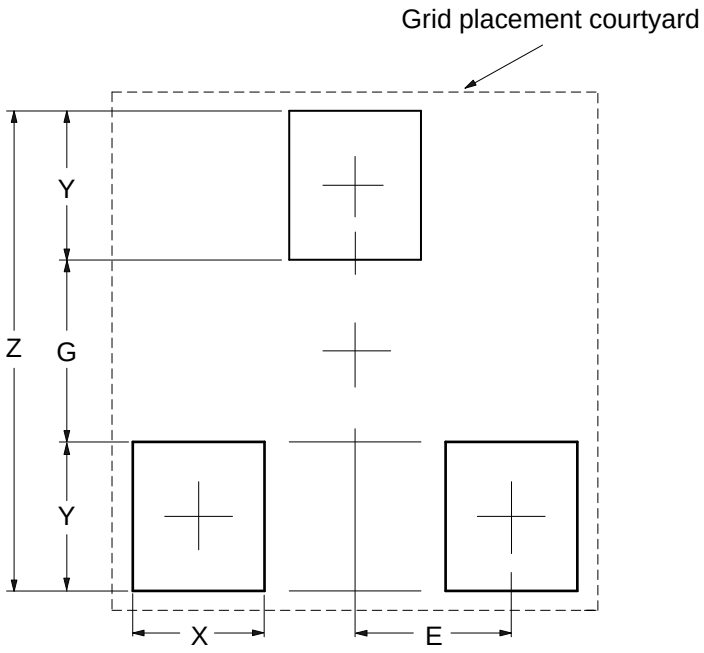




Suggested Pad Layout

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

(1) Package Type: SOT23

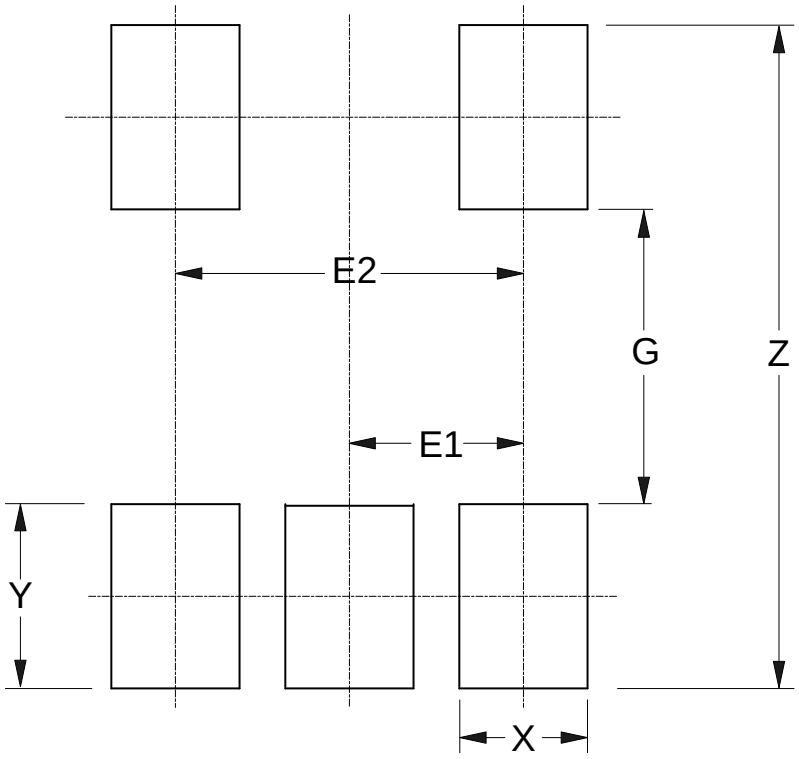


Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E (mm)/(inch)
Value	2.900/0.114	1.100/0.043	0.800/0.031	0.900/0.035	0.950/0.037

Suggested Pad Layout (continued)

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

(2) Package Type: SOT25

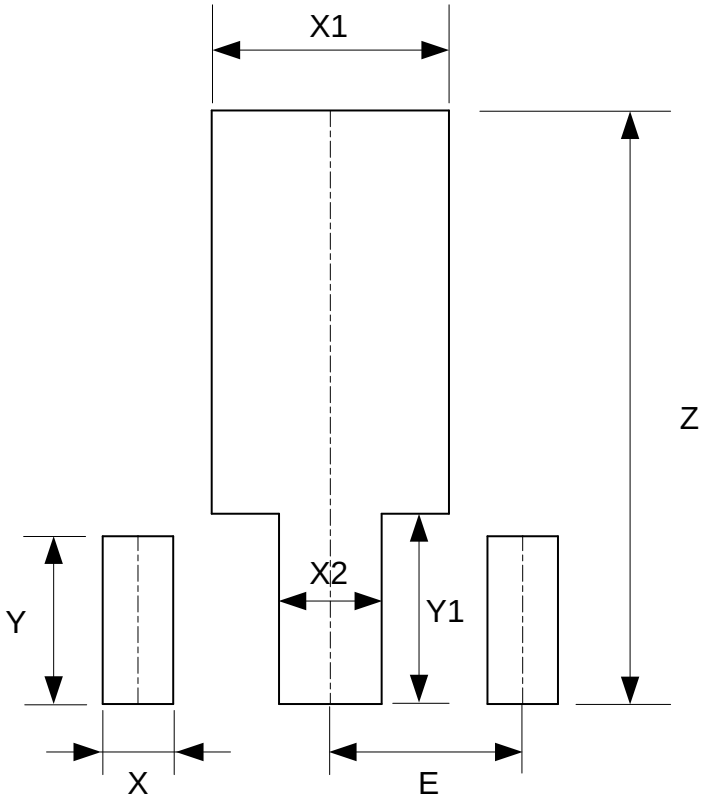


Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075

Suggested Pad Layout (continued)

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

(3) Package Type: SOT89



Dimensions	Z (mm)/(inch)	X (mm)/(inch)	X1 (mm)/(inch)	X2 (mm)/(inch)	Y (mm)/(inch)	Y1 (mm)/(inch)	E (mm)/(inch)
Value	4.600/0.181	0.550/0.022	1.850/0.073	0.800/0.031	1.300/0.051	1.475/0.058	1.500/0.059

Mechanical Data

- Moisture Sensitivity: Level 3 per J-STD-020
- Terminals: Finish — Matte Tin Plated Leads, Solderable per MIL-STD-202, Method 208 e3
- Weight:
  - SOT23: 0.009 grams (Approximate)
  - SOT25: 0.0153 grams (Approximate)
  - SOT89: 0.055 grams (Approximate)
  - TO92 (Ammo Packing): 0.157 grams (Approximate)

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