

## 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 (bulk or ammo packing), SOT23, SOT25 and SOT89.

## Features

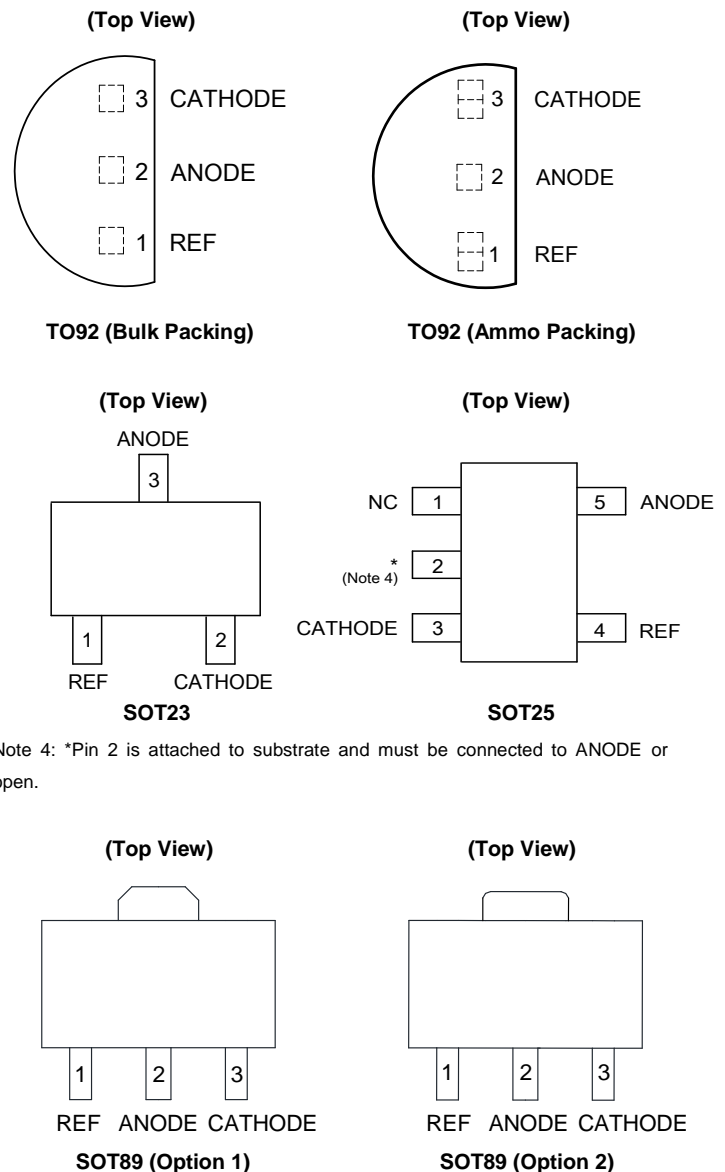
- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-range Temperature Coefficient: 20PPM/°C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages: TO92, SOT23, SOT25, SOT89
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: TO92, SOT23, SOT25, SOT89
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**

## Applications

- Graphic Card
- PC Motherboard
- Voltage Adapter
- Switching Power Supply
- Charger

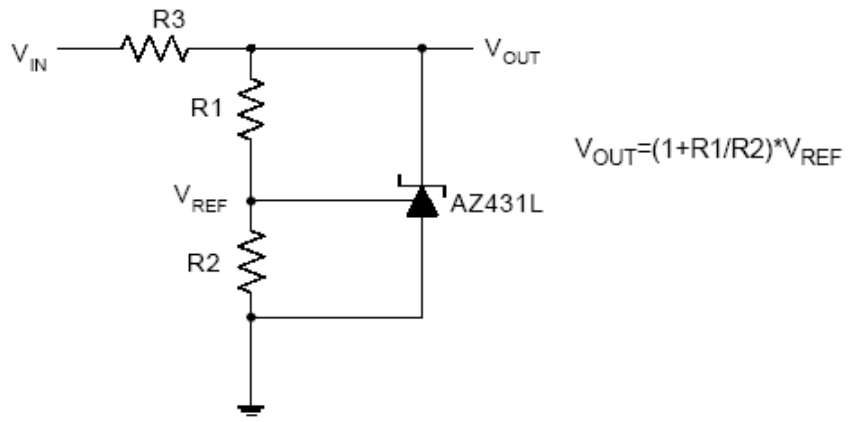
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS), 2011/65/EU (RoHS 2) & 2015/863/EU (RoHS 3) compliant.
  2. See <https://www.diodes.com/quality/lead-free/> for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "Green" and Lead-free.
  3. Halogen- and Antimony-free "Green" products are defined as those which contain <900ppm bromine, <900ppm chlorine (<1500ppm total Br + Cl) and <1000ppm antimony compounds.

## Pin Assignments



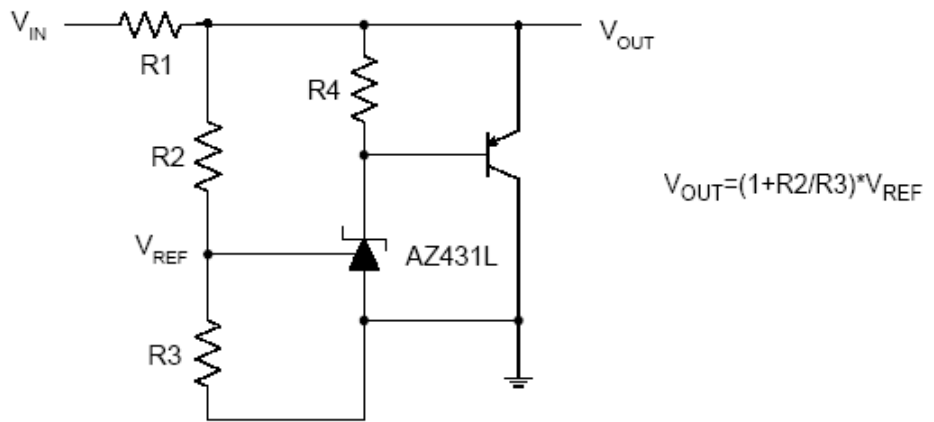
Note 4: \*Pin 2 is attached to substrate and must be connected to ANODE or open.

**Typical Applications Circuit**



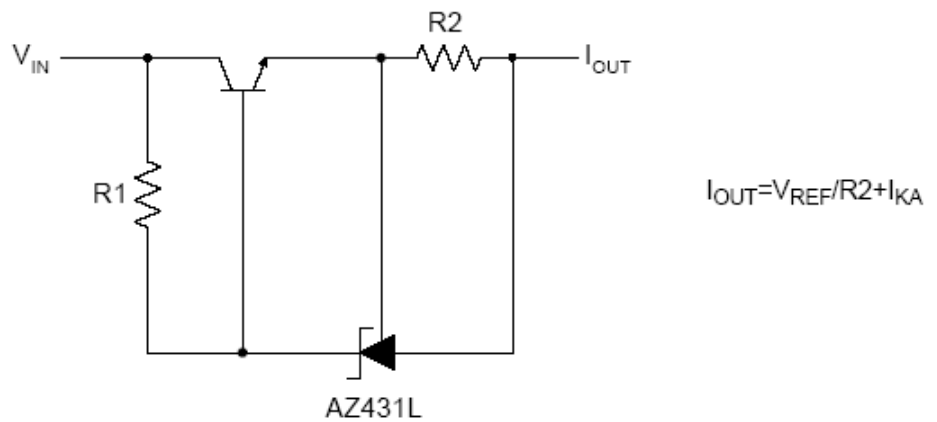
$$V_{OUT} = (1 + R1/R2) * V_{REF}$$

Shunt Regulator



$$V_{OUT} = (1 + R2/R3) * V_{REF}$$

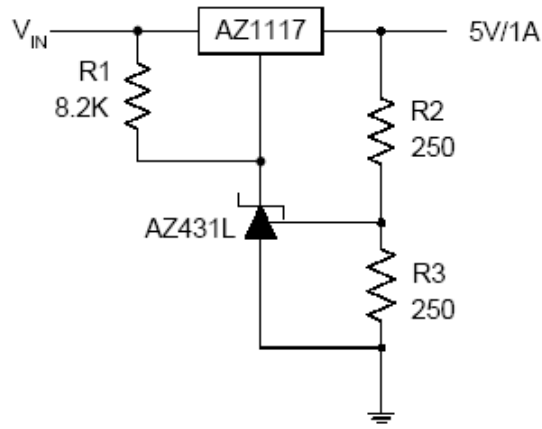
High Current Shunt Regulator



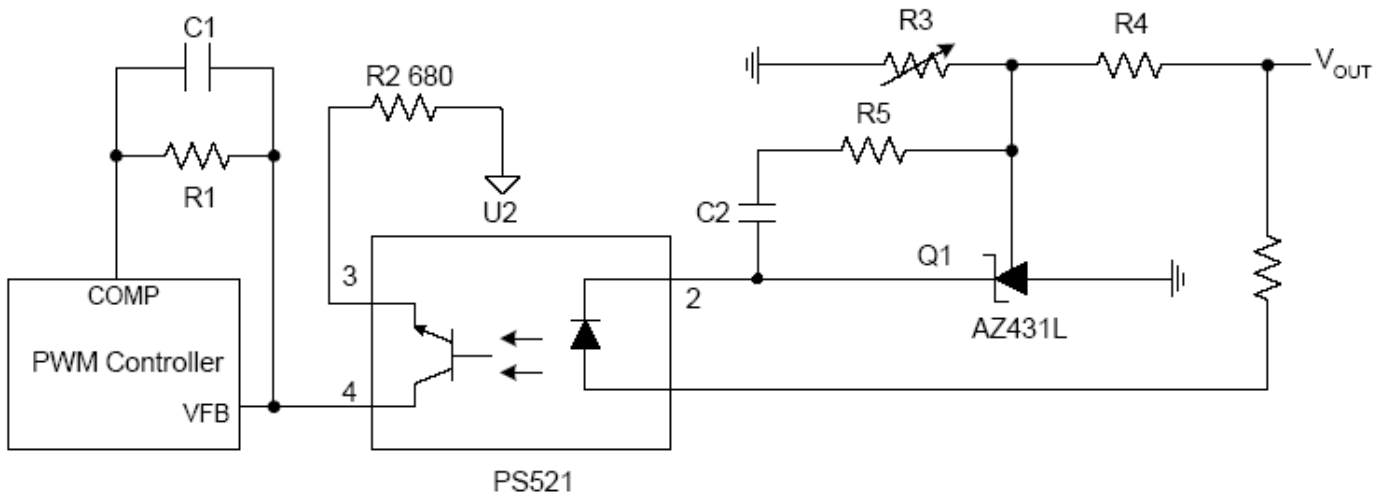
$$I_{OUT} = V_{REF}/R2 + I_{KA}$$

Current Source or Current Limit

**Typical Applications Circuit (Cont.)**

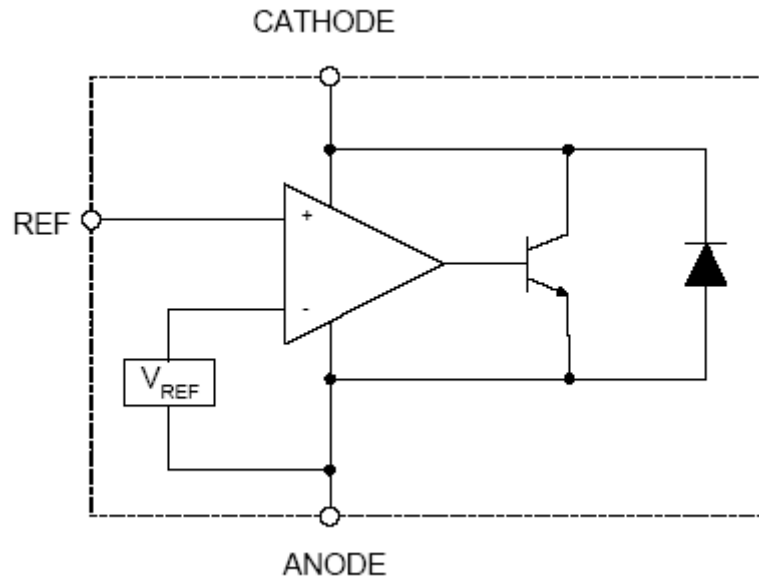


Precision 5V 1A Regulator



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	Z, R Package	770	mW
		N, K Package	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” may 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 may affect device reliability.

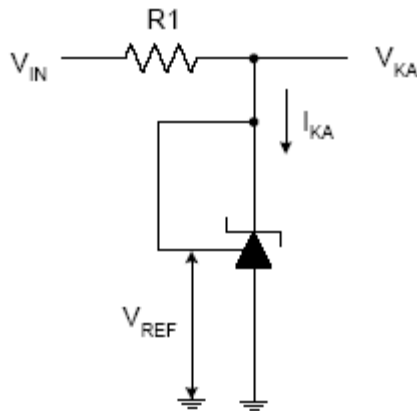
**Recommended Operating Conditions**

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

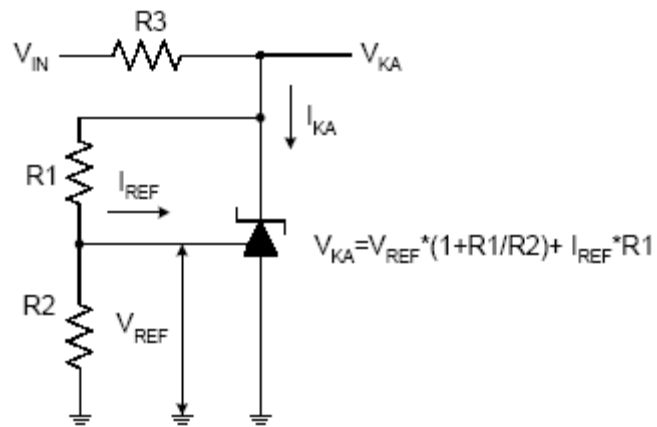
**Electrical Characteristics** (Operating Conditions:  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted.)

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

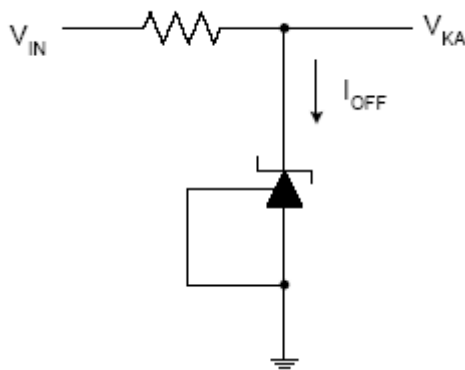
**Electrical Characteristics** (Cont.)



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



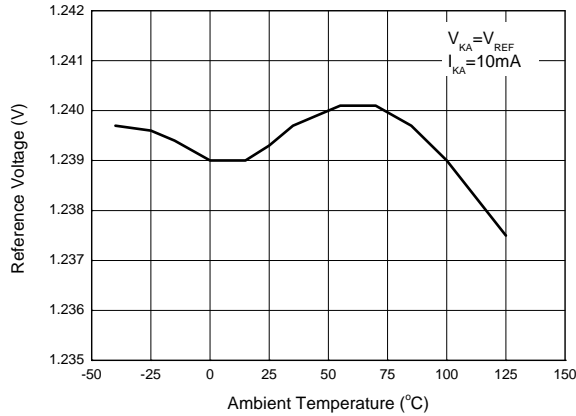
Test Circuit 5 for  $V_{KA} > V_{REF}$



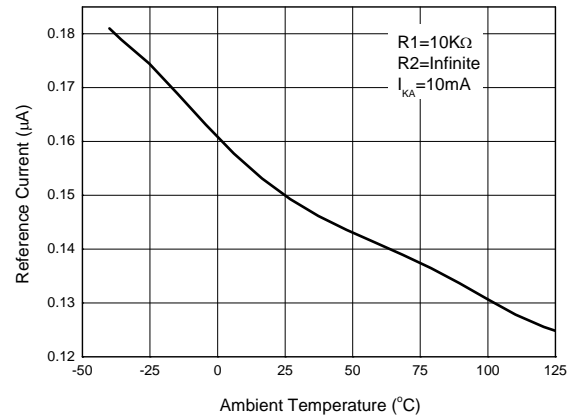
Test Circuit 6 for I<sub>OFF</sub>

**Performance Characteristics**

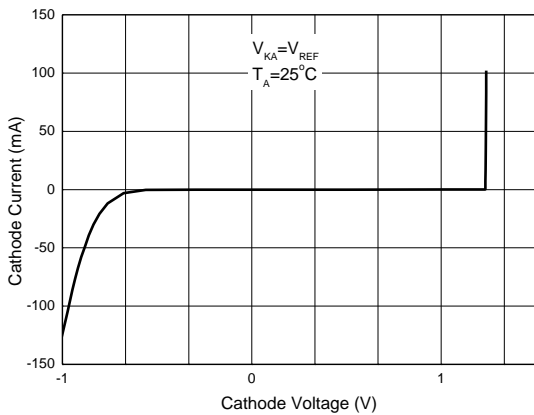
**Reference Voltage vs. Ambient Temperature**



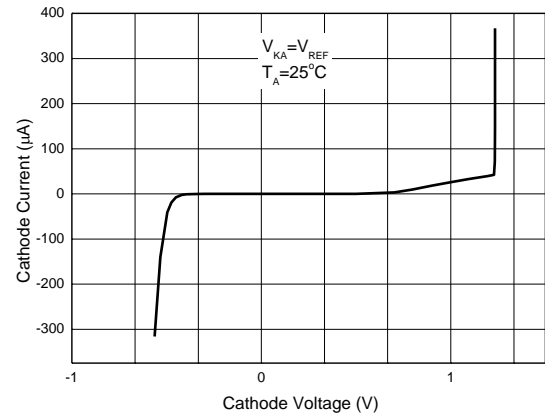
**Reference Current vs. Ambient Temperature**



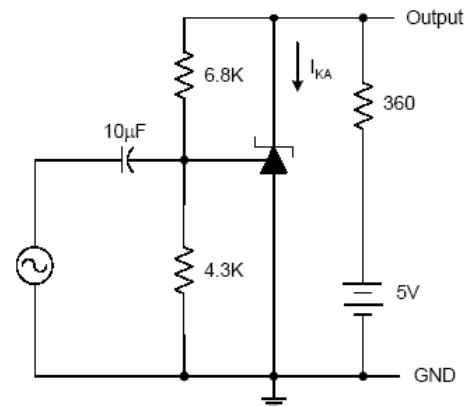
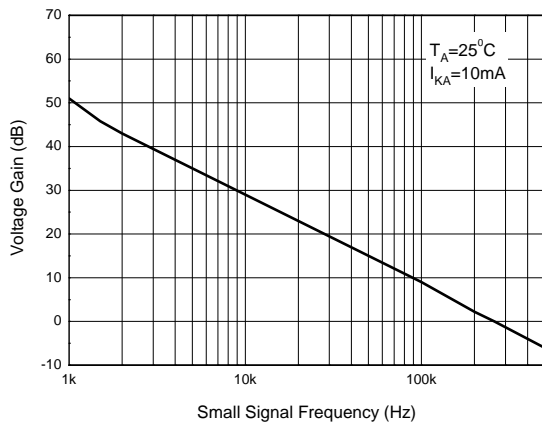
**Cathode Current vs. Cathode Voltage**



**Cathode Current vs. Cathode Voltage**

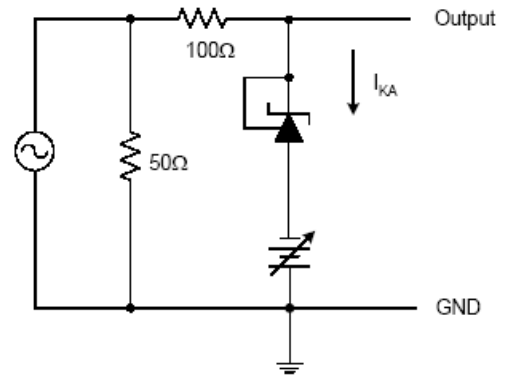
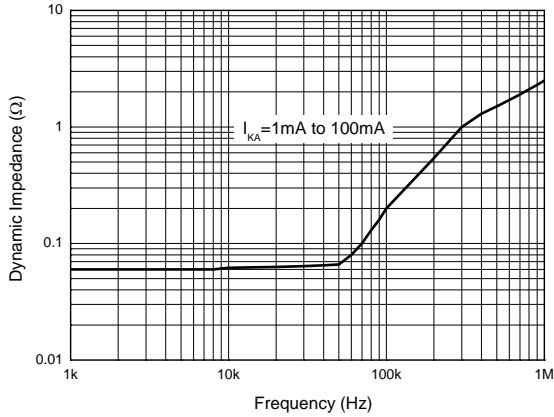


**Small Signal Voltage Gain vs. Frequency**

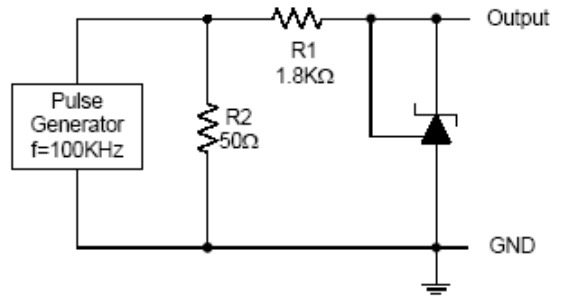
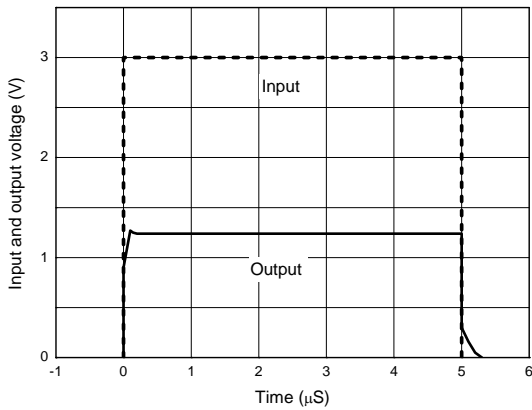


**Performance Characteristics (Cont.)**

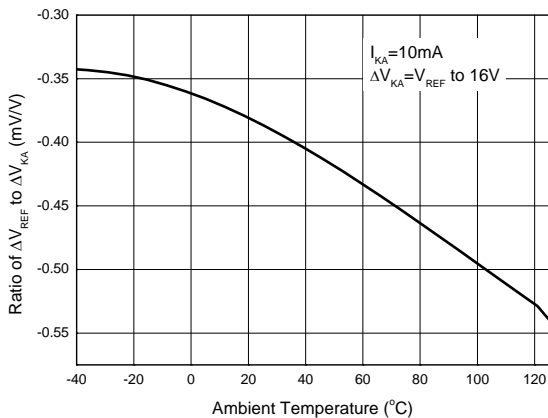
**Dynamic Impedance vs. Frequency**



**Pulse Response of Input and Output Voltage**

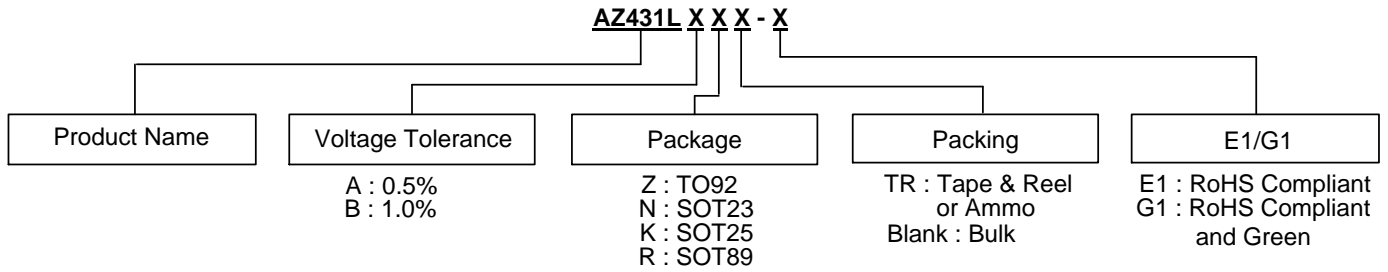


**Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature**





## Ordering Information



	Part Number	Voltage Tolerance	Package (Note 7)	RoHS Compliant Lead Free / Green	Marking ID	Packing	Quantity	Status (Note 6)	Alternative
	AZ431LAZ-E1	0.5%	TO92	Lead Free	AZ431LAZ-E1	Bulk	1000	End of Life	AZ431LAZTR-E1
	AZ431LAZTR-E1	0.5%	TO92	Lead Free	AZ431LAZ-E1	Ammo	2000	In Production	—
	AZ431LBZ-E1	1.0%	TO92	Lead Free	AZ431LBZ-E1	Bulk	1000	End of Life	AZ431LBZTR-E1
	AZ431LBZTR-E1	1.0%	TO92	Lead Free	AZ431LBZ-E1	Ammo	2000	In Production	—
	AZ431LAZ-G1	0.5%	TO92	Green	AZ431LAZ-G1	Bulk	1000	End of Life	AZ431LAZTR-E1
	AZ431LAZTR-G1	0.5%	TO92	Green	AZ431LAZ-G1	Ammo	2000	In Production	—
	AZ431LBZ-G1	1.0%	TO92	Green	AZ431LBZ-G1	Bulk	1000	In Production	—
	AZ431LBZTR-G1	1.0%	TO92	Green	AZ431LBZ-G1	Ammo	2000	In Production	—
	AZ431LANTR-E1	0.5%	SOT23	Lead Free	EA6	Tape & Reel	3000	NRND	None
	AZ431LBNTR-E1	1.0%	SOT23	Lead Free	EA7	Tape & Reel	3000	NRND	None
	AZ431LANTR-G1	0.5%	SOT23	Green	GA6	Tape & Reel	3000	In Production	—
	AZ431LBNTR-G1	1.0%	SOT23	Green	GA7	Tape & Reel	3000	In Production	—
	AZ431LAKTR-E1	0.5%	SOT25	Lead Free	E5A	Tape & Reel	3000	NRND	None
	AZ431LBKTR-E1	1.0%	SOT25	Lead Free	E6A	Tape & Reel	3000	NRND	None
	AZ431LAKTR-G1	0.5%	SOT25	Green	G5A	Tape & Reel	3000	In Production	—
	AZ431LBKTR-G1	1.0%	SOT25	Green	G6A	Tape & Reel	3000	In Production	—
	AZ431LARTR-E1	0.5%	SOT89	Lead Free	E41A	Tape & Reel	1000	End of Life	AZ431LARTR-G1
	AZ431LBRTR-E1	1.0%	SOT89	Lead Free	E41B	Tape & Reel	1000	NRND	None
	AZ431LARTR-G1	0.5%	SOT89	Green	G41A	Tape & Reel	1000	In Production	—
	AZ431LBRTR-G1	1.0%	SOT89	Green	G41B	Tape & Reel	1000	In Production	—

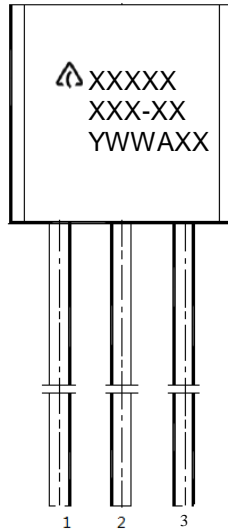
Notes: 6. NRND: Not Recommended For New Design.

7. For packaging details, go to our website at: <https://www.diodes.com/design/support/packaging/diodes-packaging/>.

## Marking Information

(1) TO92 (Bulk Packing)

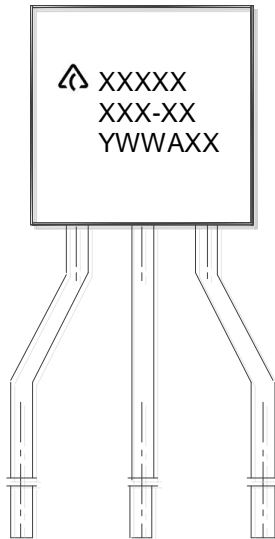
(Front View)



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) TO92 (Ammo Packing)

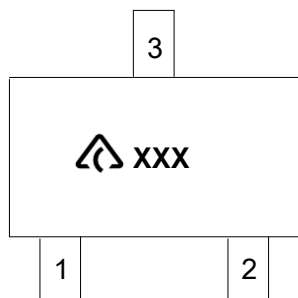
(Front View)




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

(3) SOT23

(Top View)

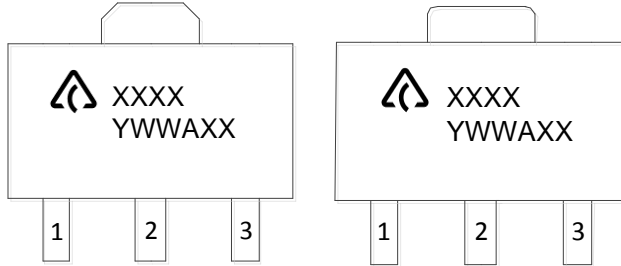


 : Logo  
XXX: Marking ID (See Ordering Information)

**Marking Information** (Cont.)

(4) SOT89

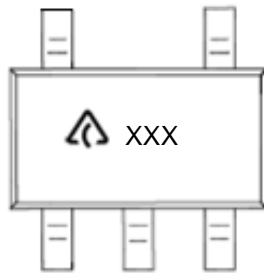
(Top View)




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

(5) SOT25

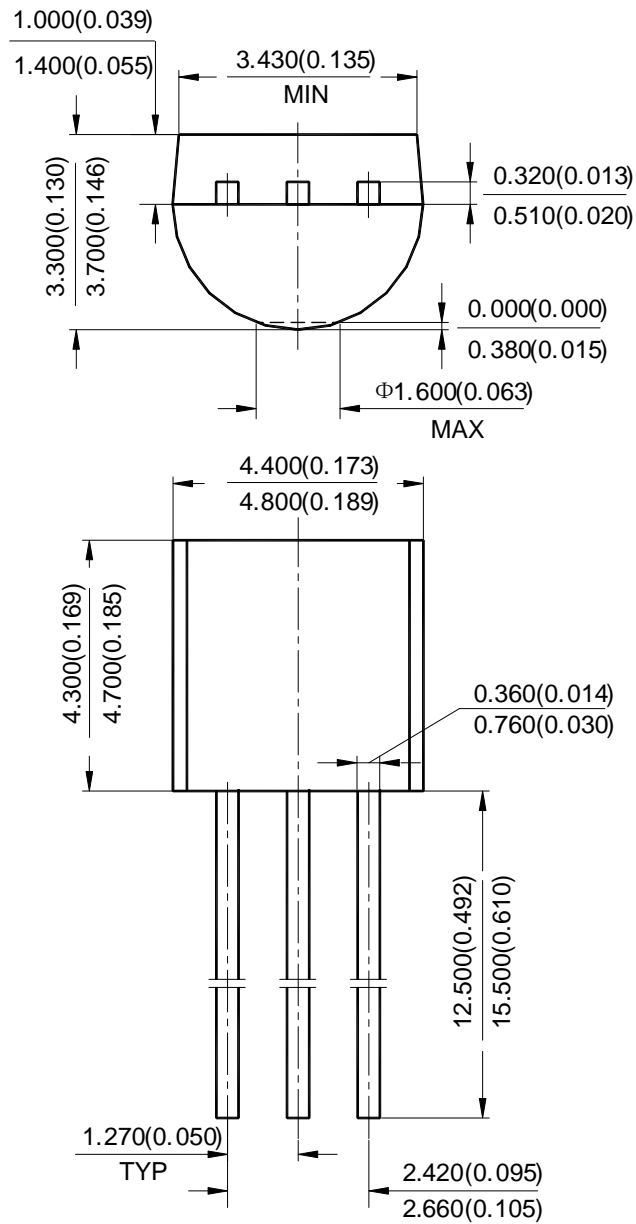
(Top View)



 : Logo  
 XXX: Marking ID (See Ordering Information)

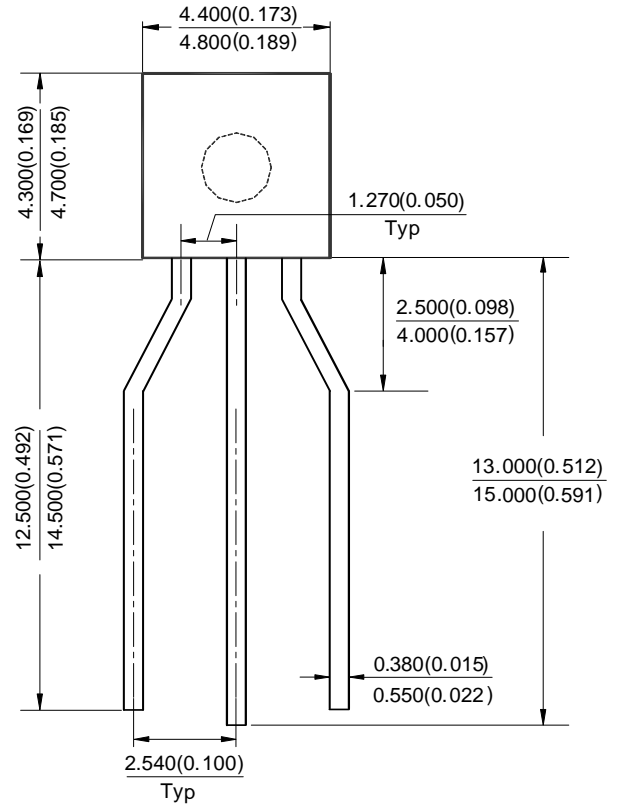
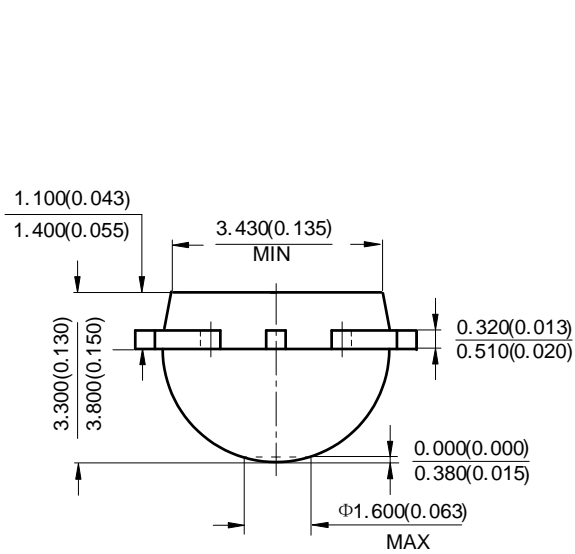
**Package Outline Dimensions** (All dimensions in mm (inch).)

(1) Package Type: TO92 (Bulk Packing)



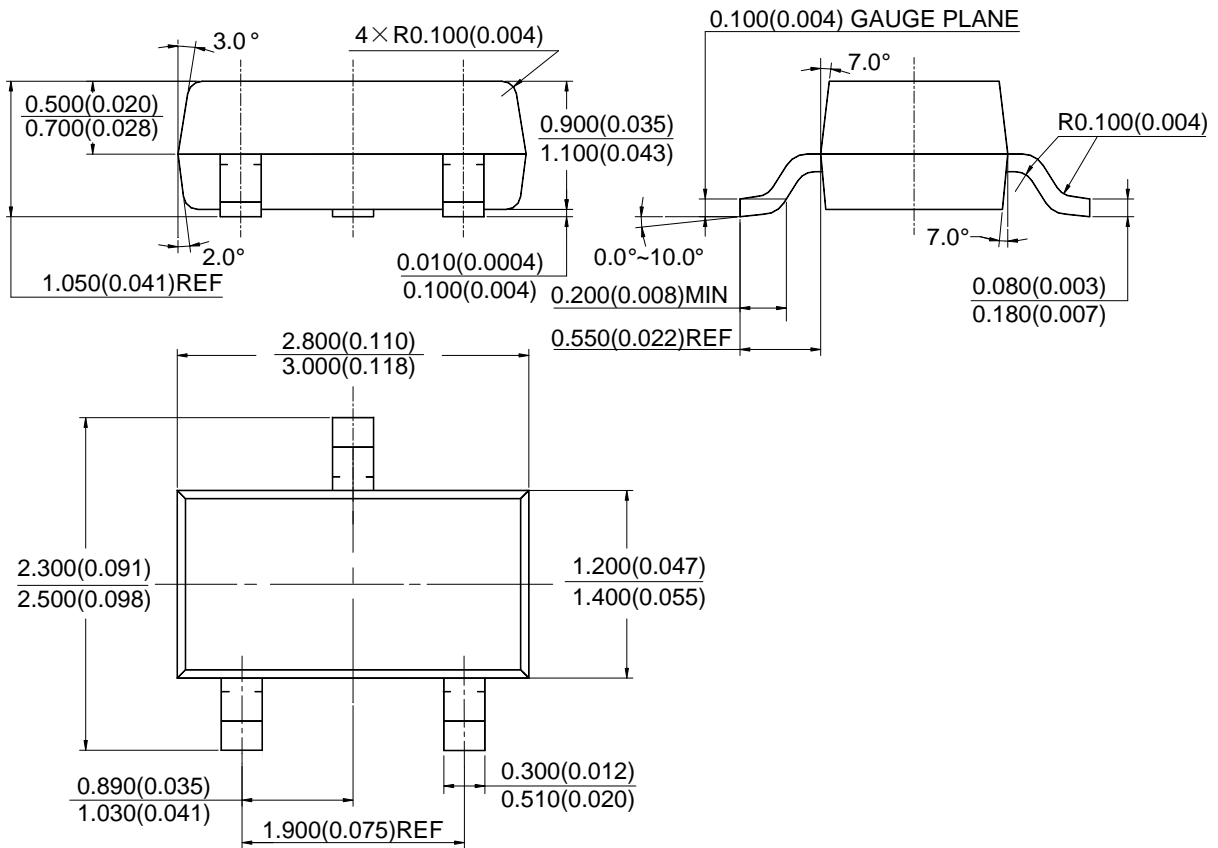
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(2) Package Type: TO92 (Ammo Packing)



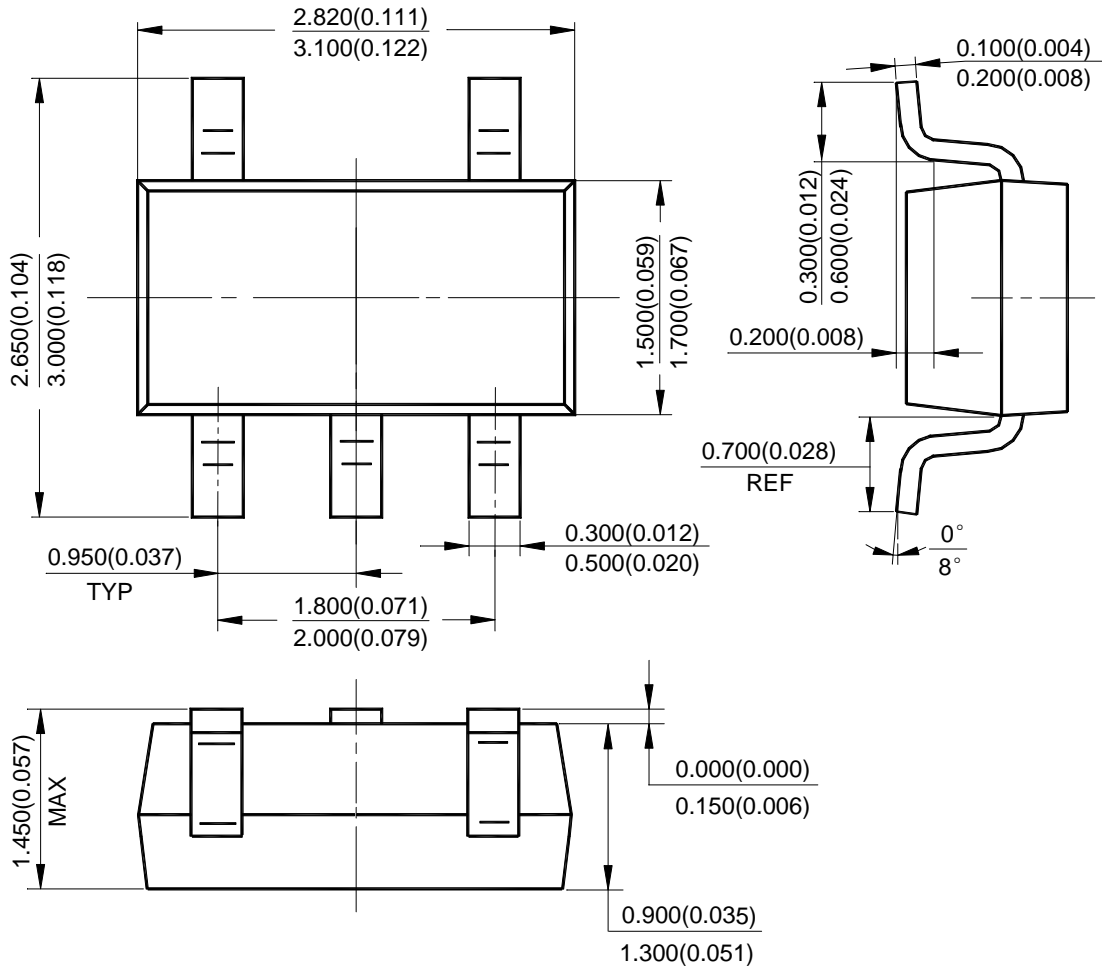
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT23



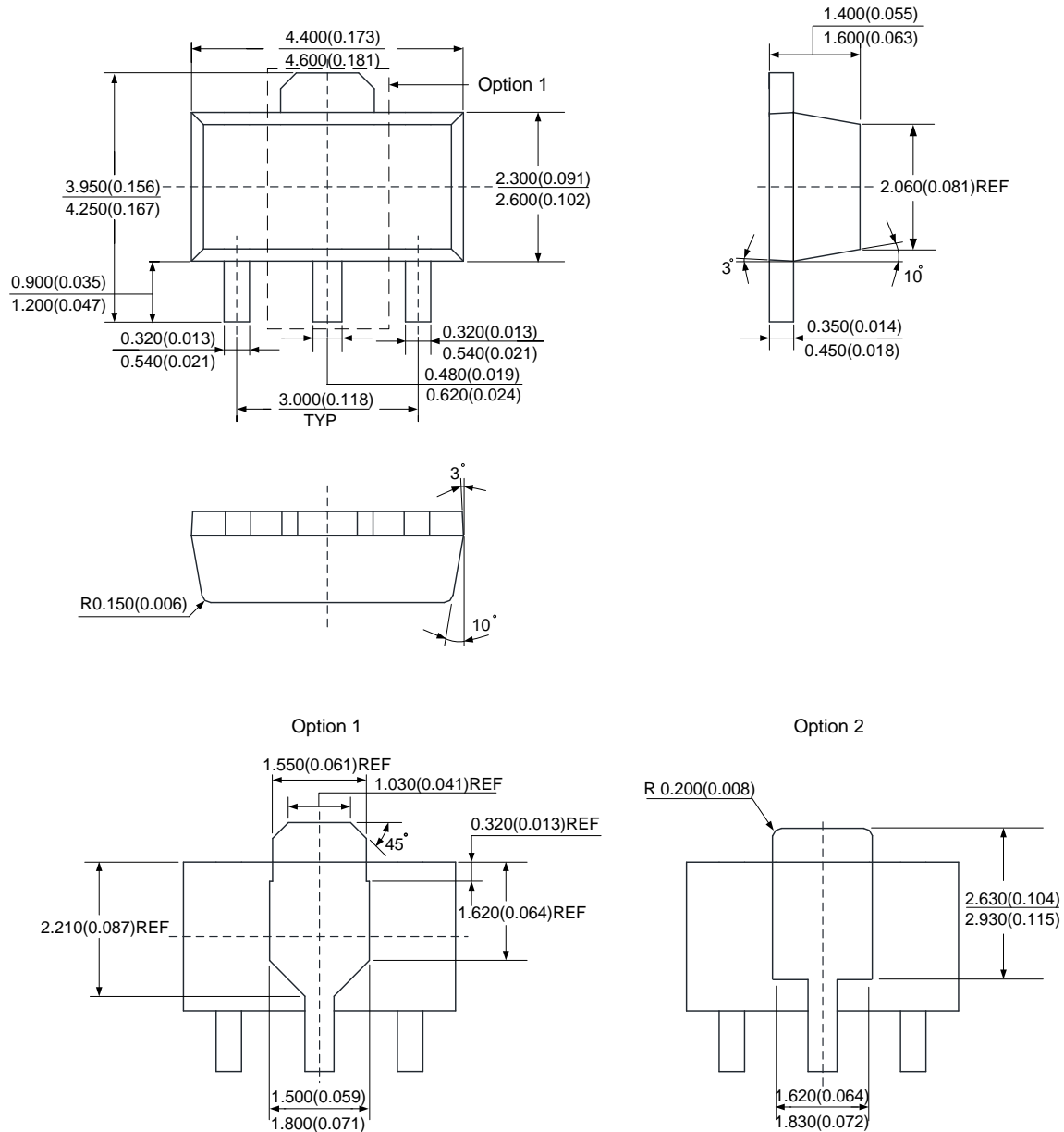
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(4) Package Type: SOT25



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

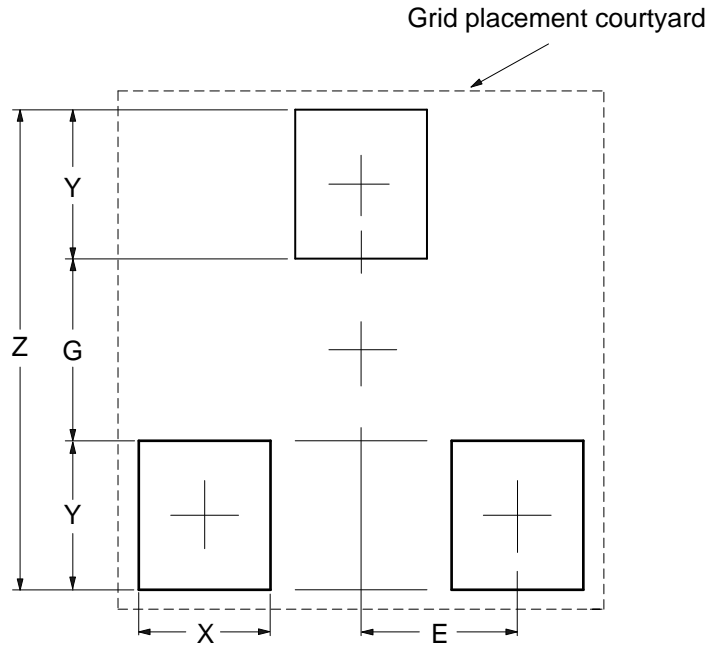
(5) Package Type: SOT89





**Suggested Pad Layout**

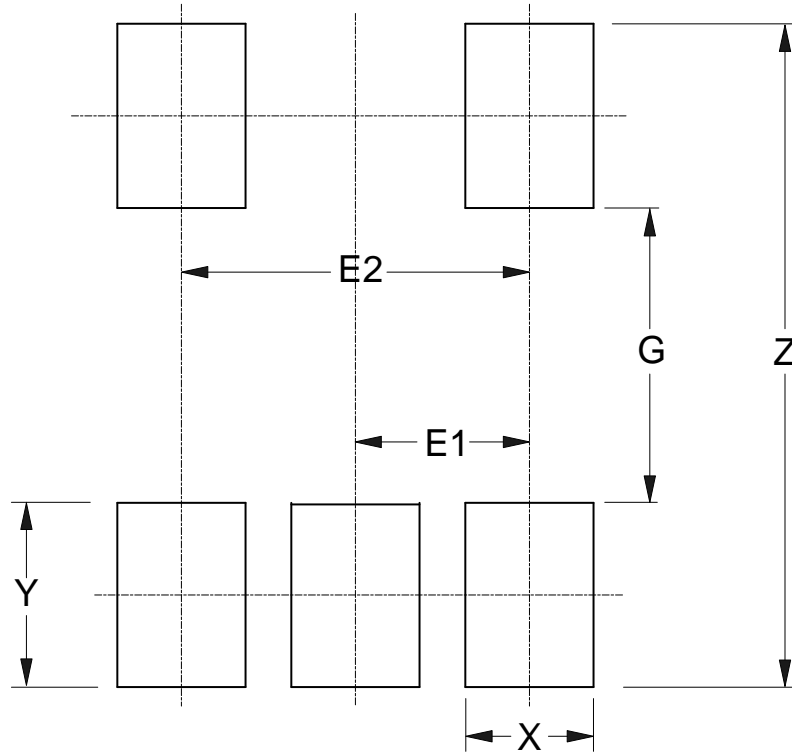
(1) Package Type: SOT23



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** (Cont.)

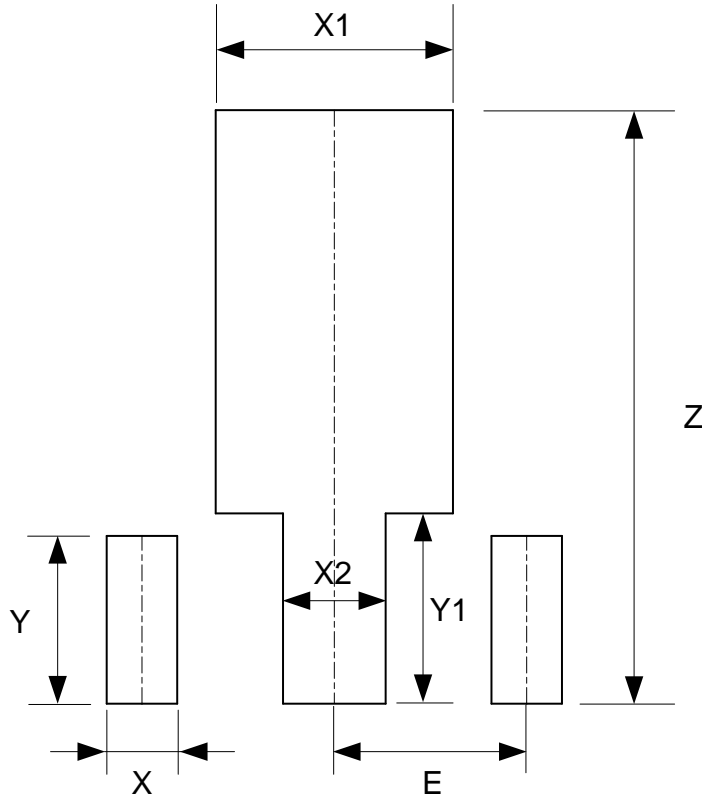
(2) Package Type: SOT25



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 (Cont.)**

(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

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1. are intended to implant into the body, or
2. support or sustain life and whose failure to perform when properly used in accordance with instructions for use provided in the labeling can be reasonably expected to result in significant injury to the user.

B. A critical component is any component in a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or to affect its safety or effectiveness.

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