

**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: TO-92 (bulk or ammo packing), SOT-23, SOT-23-5 and SOT-89.

**Features**

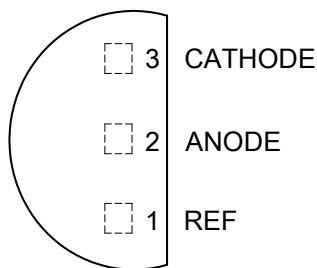
- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-range Temperature Coefficient: 20PPM/°C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C

**Applications**

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

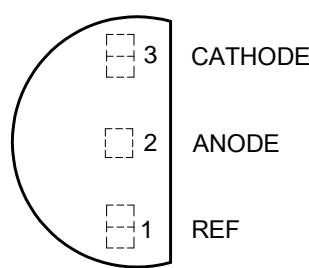
**Pin Assignments**

(Top View)



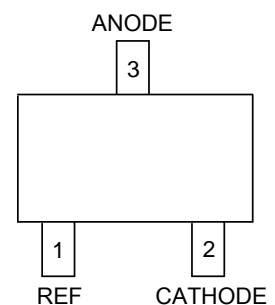
(TO-92 (Bulk Packing)/ Z Package)

(Top View)



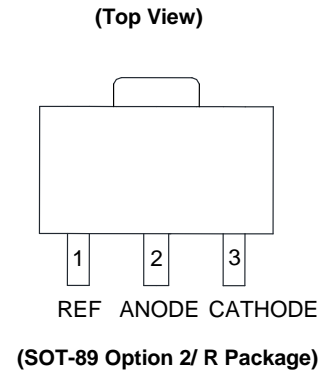
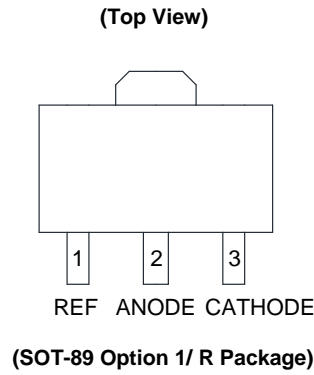
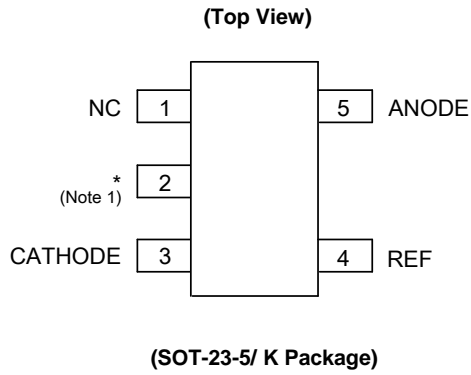
(TO-92 (Ammo Packing)/ Z Package)

(Top View)



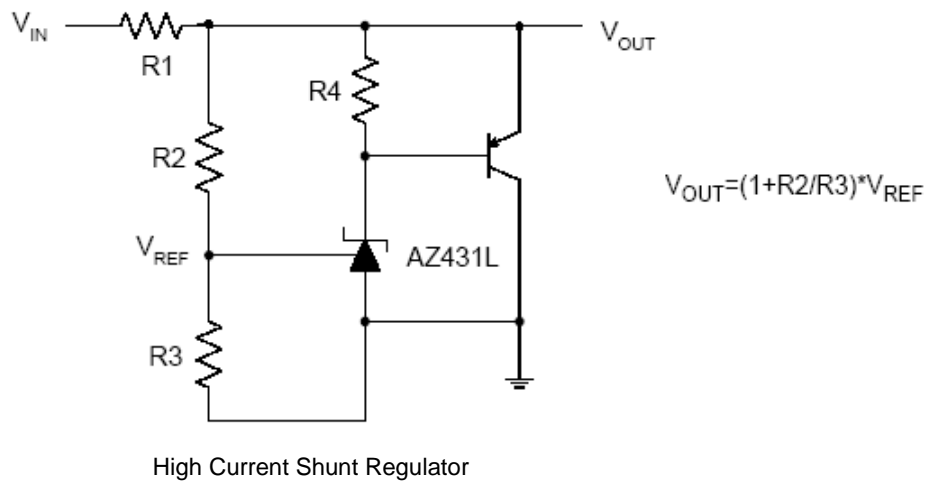
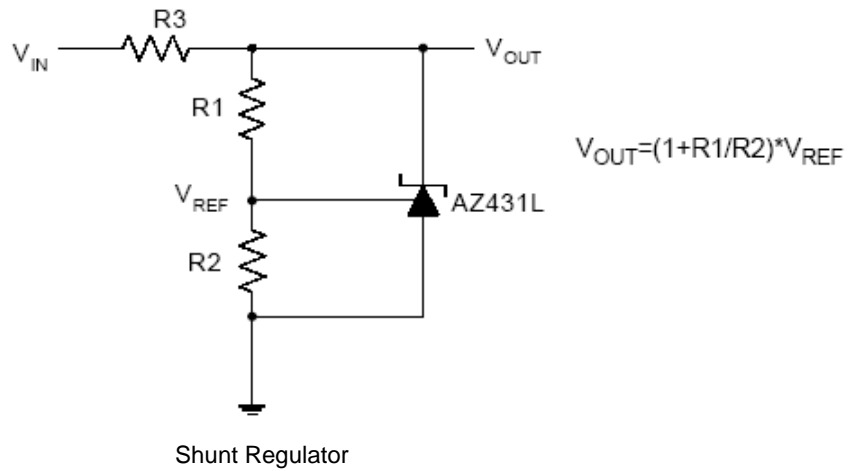
(SOT-23/ N Package)

**Pin Assignments (Cont.)**

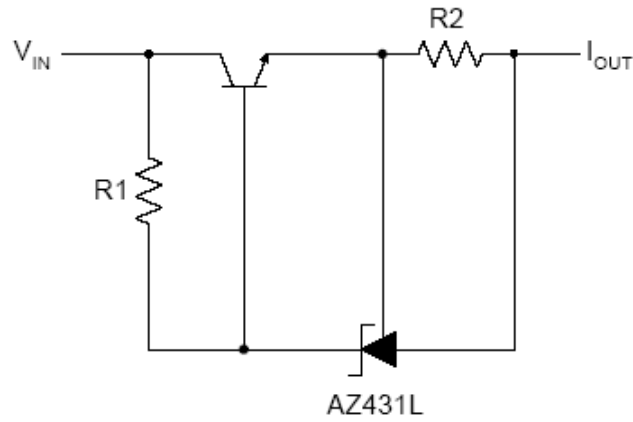


Note 1: \*Pin 2 is attached to substrate and must be connected to ANODE or open.

**Typical Applications Circuit**

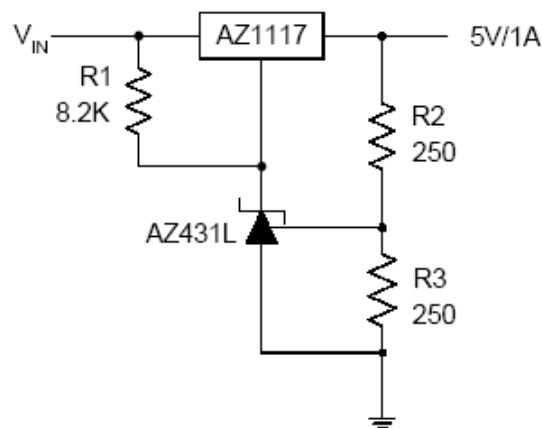


**Typical Applications Circuit (Cont.)**

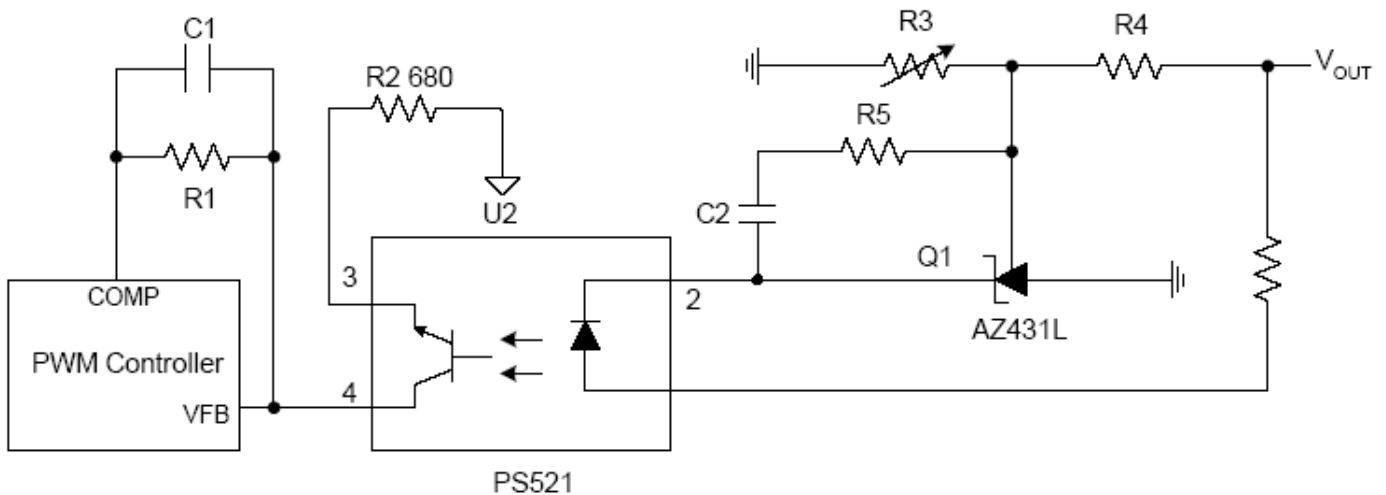


$$I_{OUT} = V_{REF} / R2 + I_{KA}$$

Current Source or Current Limit

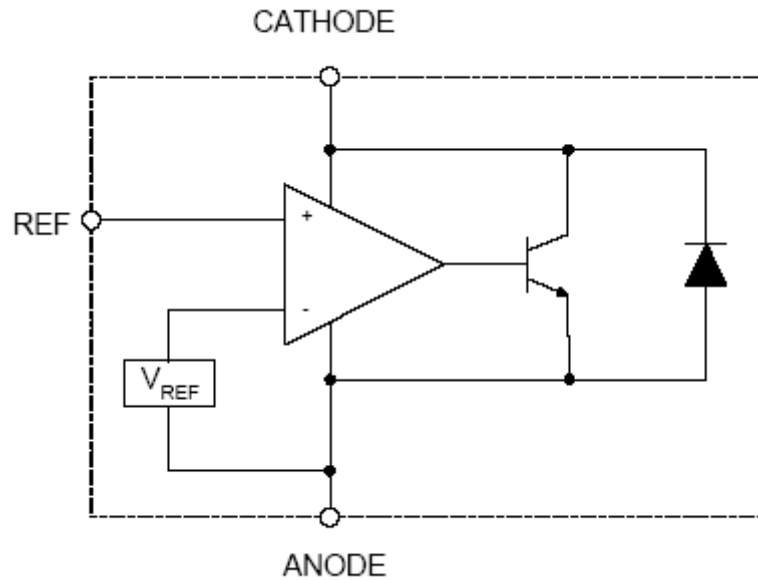


Precision 5V 1A Regulator



PWM Converter with Reference

## Functional Block Diagram



## Absolute Maximum Ratings (Note 2)

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 2: 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.

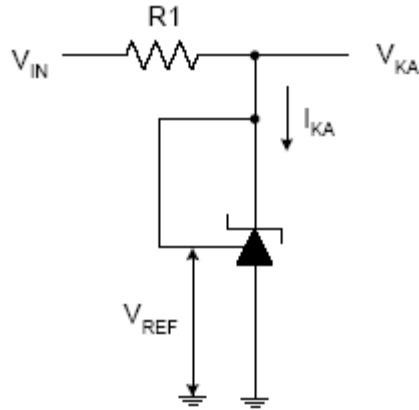
## Recommended Operating Conditions

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

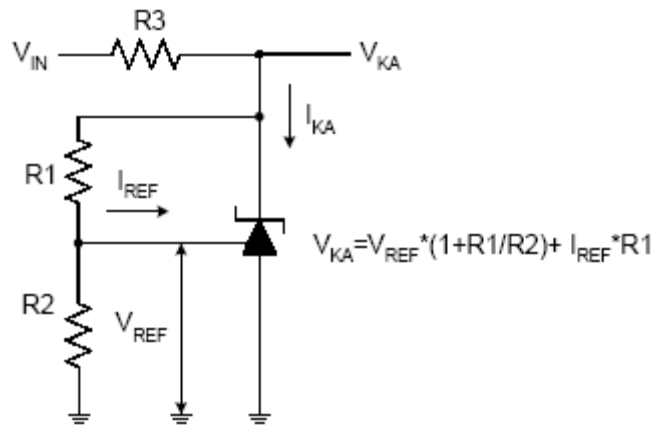
**Electrical Characteristics** (Operating Conditions:  $T_A = +25\text{ }^\circ\text{C}$ , unless otherwise noted.)

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		-	SOT-23	-	84.84	-	$^\circ\text{C/W}$	
				SOT-23-5	-	84.84	-		
				TO-92	-	140.80	-		
				SOT-89	-	29.80	-		

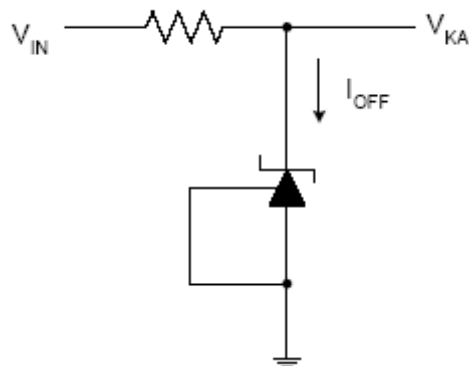
**Electrical Characteristics** (Cont.)



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



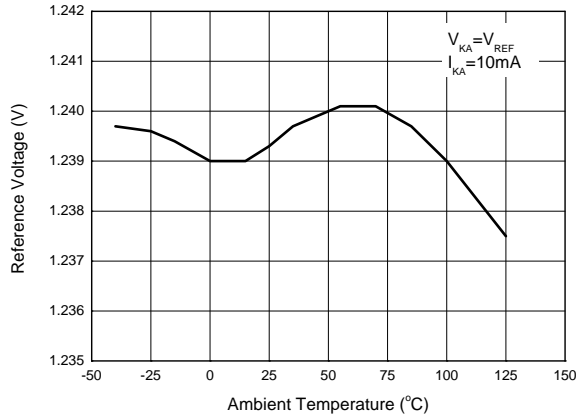
Test Circuit 5 for  $V_{KA} > V_{REF}$



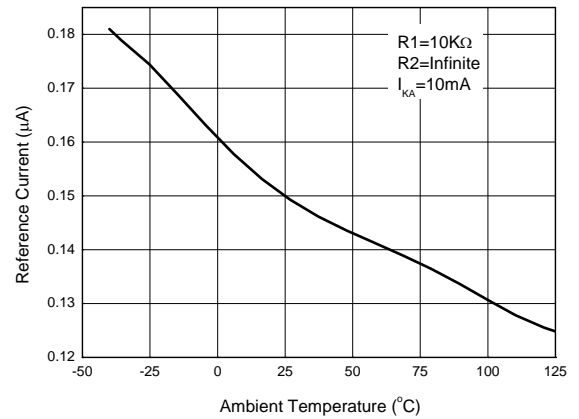
Test Circuit 6 for  $I_{OFF}$

**Performance Characteristics**

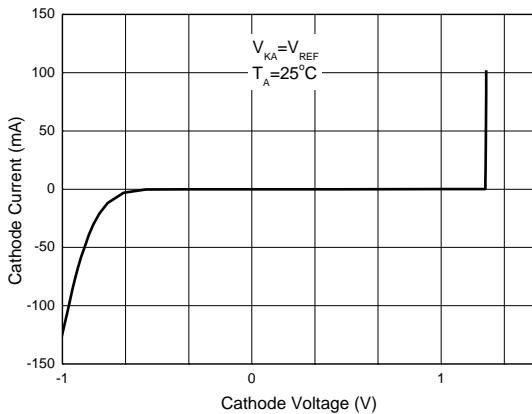
**Reference Voltage vs. Ambient Temperature**



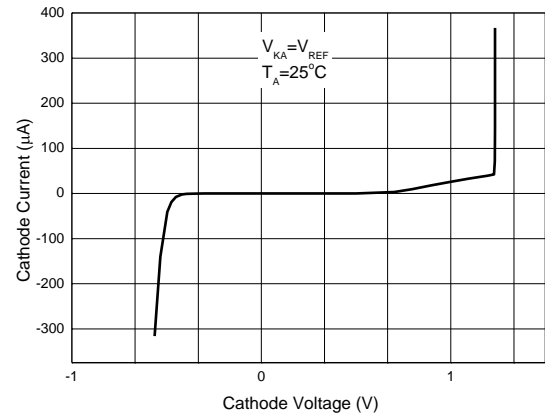
**Reference Current vs. Ambient Temperature**



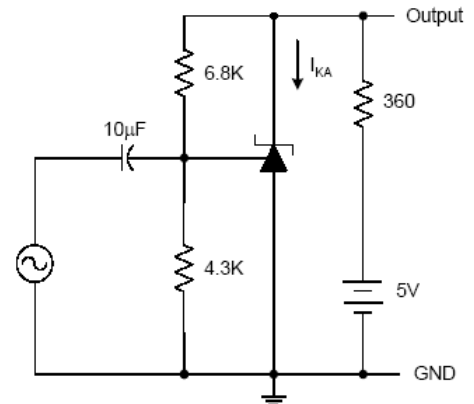
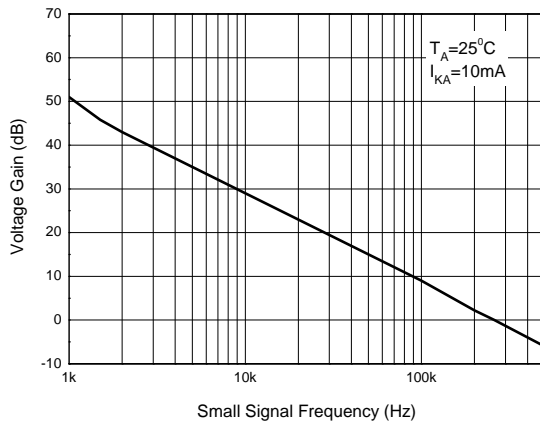
**Cathode Current vs. Cathode Voltage**



**Cathode Current vs. Cathode Voltage**

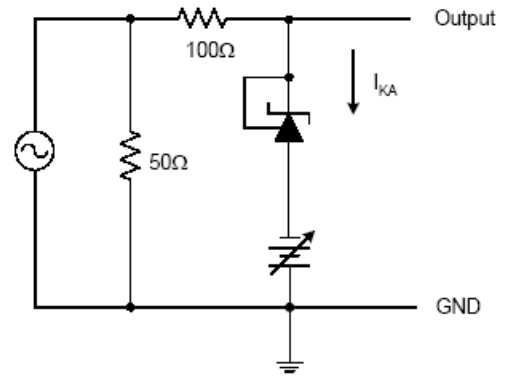
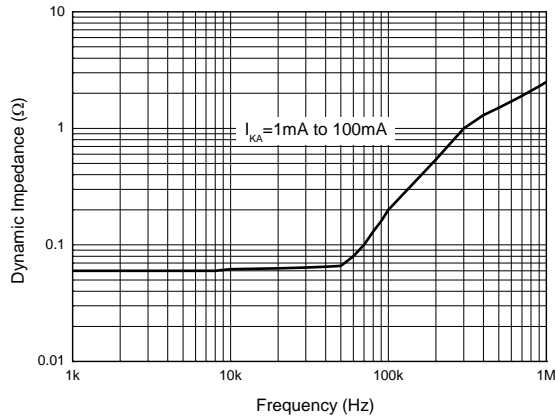


**Small Signal Voltage Gain vs. Frequency**

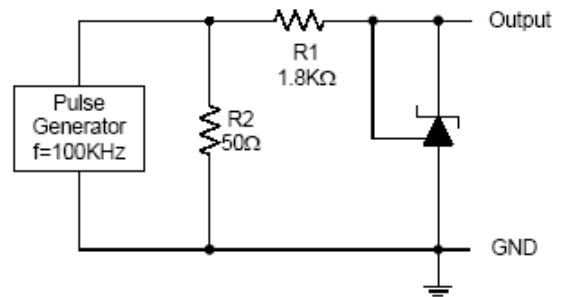
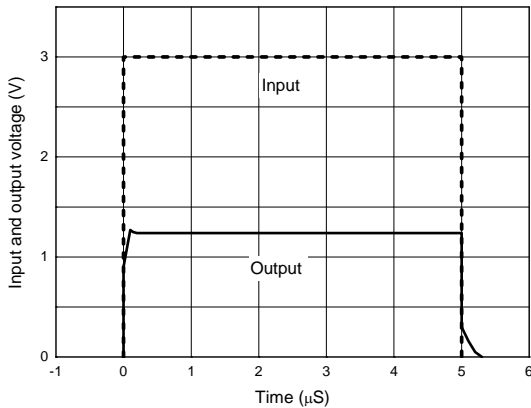


**Performance Characteristics (Cont.)**

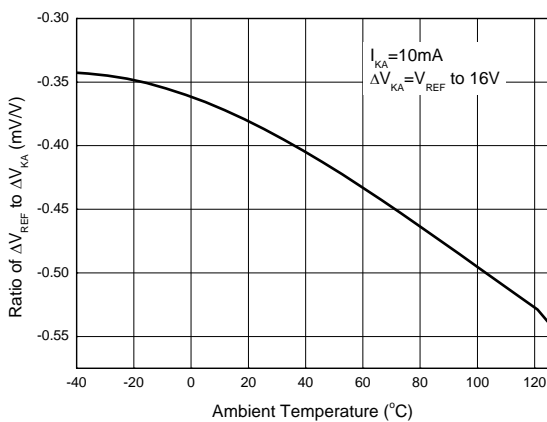
**Dynamic Impedance vs. Frequency**



**Pulse Response of Input and Output Voltage**

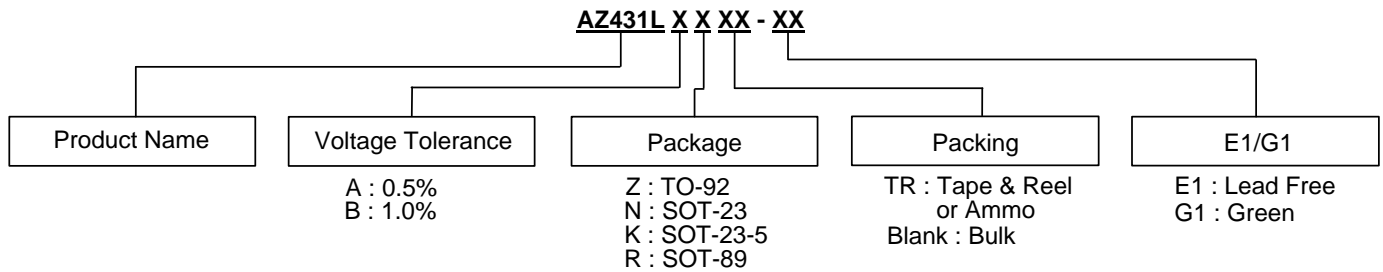


**Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature**





## Ordering Information

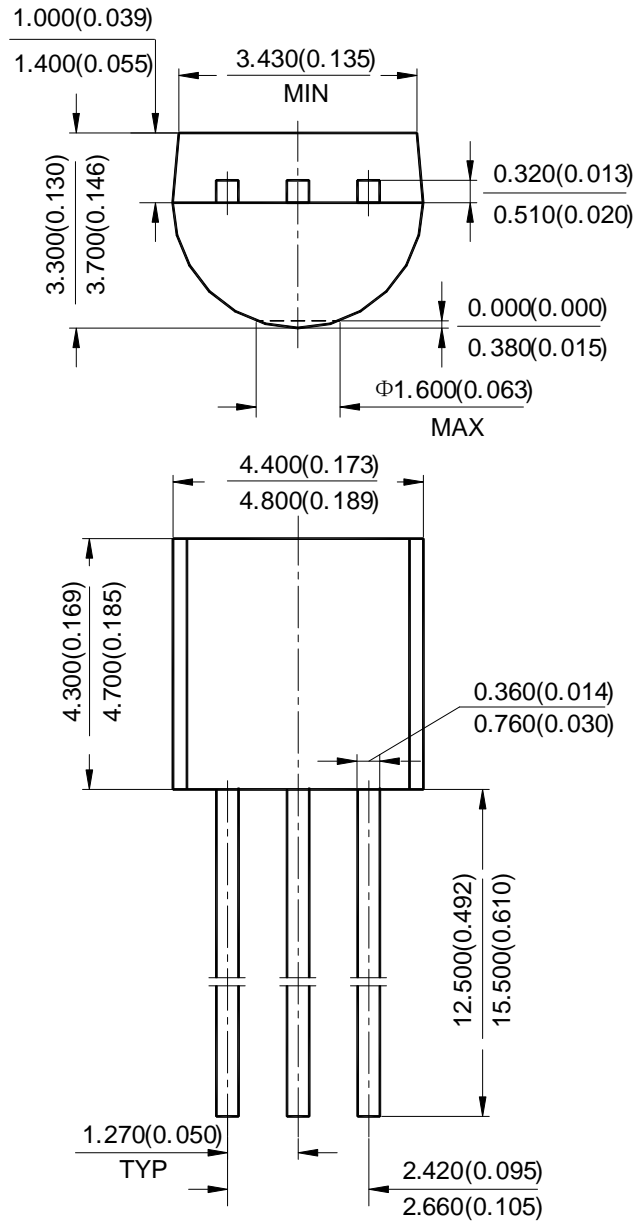


Diodes IC's Pb-free products, as designated with "E1" suffix in the part number, are RoHS compliant.  
Products with "G1" suffix are available in green packages.

Package	Temperature Range	Voltage Tolerance	Part Number		Marking ID		Packing Type
			Lead Free	Green	Lead Free	Green	
TO-92	-40 to +125°C	0.5%	AZ431LAZ-E1	AZ431LAZ-G1	AZ431LAZ-E1	AZ431LAZ-G1	Bulk
		0.5%	AZ431LAZTR-E1	AZ431LAZTR-G1	AZ431LAZ-E1	AZ431LAZ-G1	Ammo
		1.0%	AZ431LBZ-E1	AZ431LBZ-G1	AZ431LBZ-E1	AZ431LBZ-G1	Bulk
		1.0%	AZ431LBZTR-E1	AZ431LBZTR-G1	AZ431LBZ-E1	AZ431LBZ-G1	Ammo
SOT-23	-40 to +125°C	0.5%	AZ431LANTR-E1	AZ431LANTR-G1	EA6	GA6	Tape & Reel
		1.0%	AZ431LBNTR-E1	AZ431LBNTR-G1	EA7	GA7	Tape & Reel
SOT-23-5	-40 to +125°C	0.5%	AZ431LAKTR-E1	AZ431LAKTR-G1	E5A	G5A	Tape & Reel
		1.0%	AZ431LBKTR-E1	AZ431LBKTR-G1	E6A	G6A	Tape & Reel
SOT-89	-40 to +125°C	0.5%	AZ431LARTR-E1	AZ431LARTR-G1	E41A	G41A	Tape & Reel
		1.0%	AZ431LBRTR-E1	AZ431LBRTR-G1	E41B	G41B	Tape & Reel

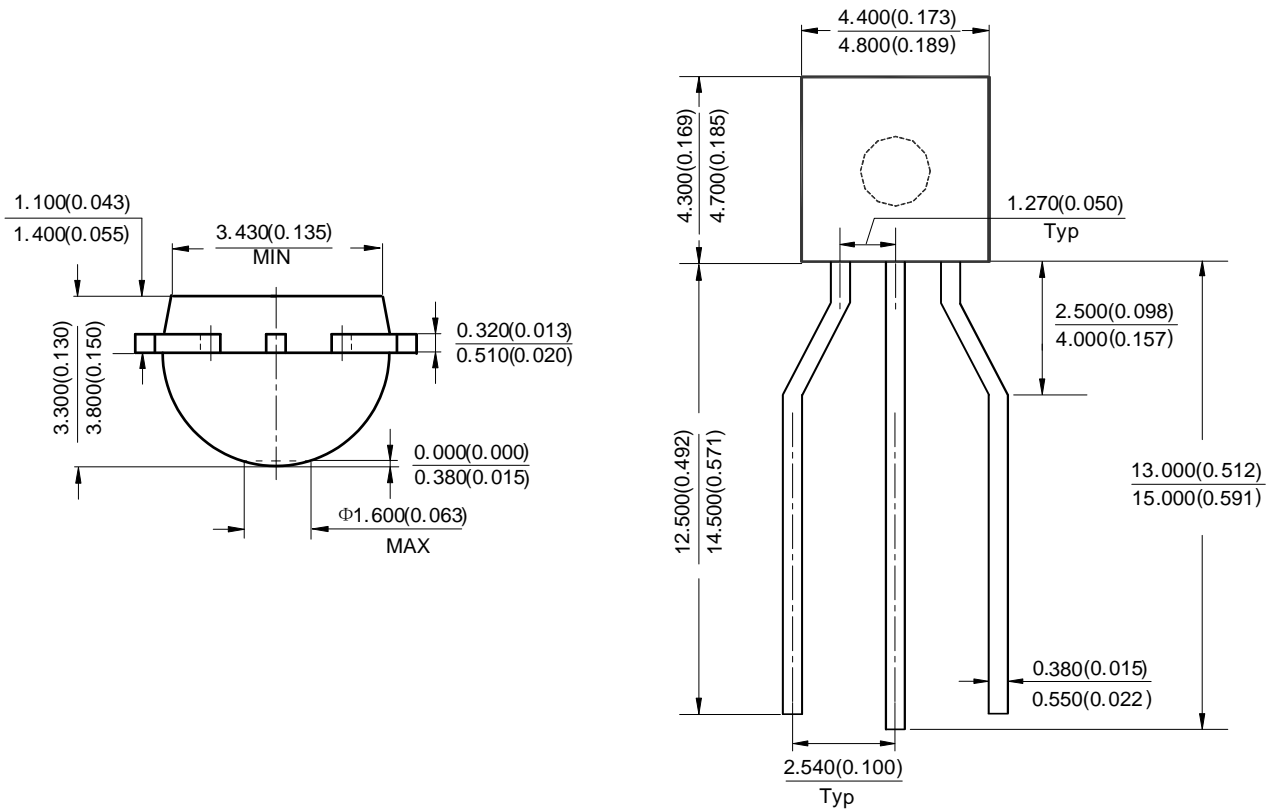
**Package Outline Dimensions** (All dimensions in mm(inch).)

(1) Package Type: TO-92 (Bulk Packing)



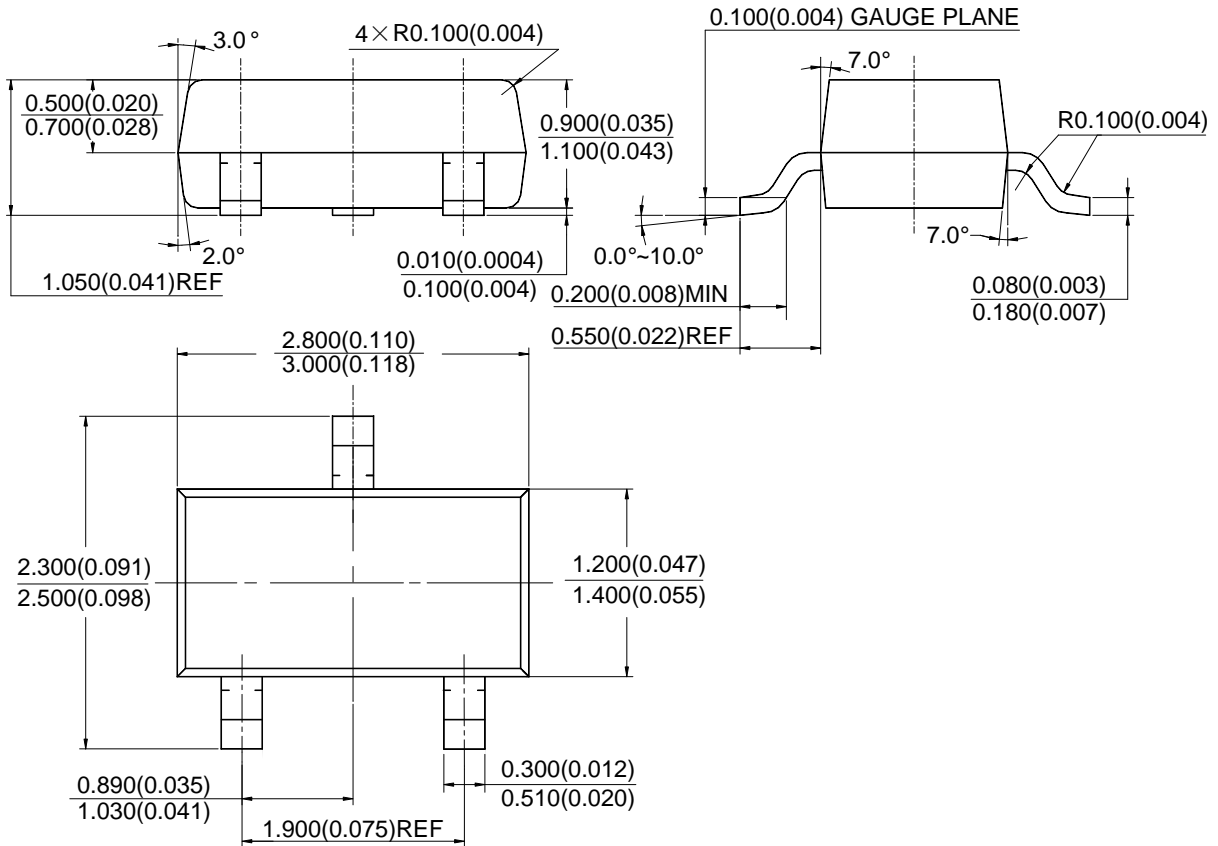
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(2) Package Type: TO-92 ( Ammo Packing)



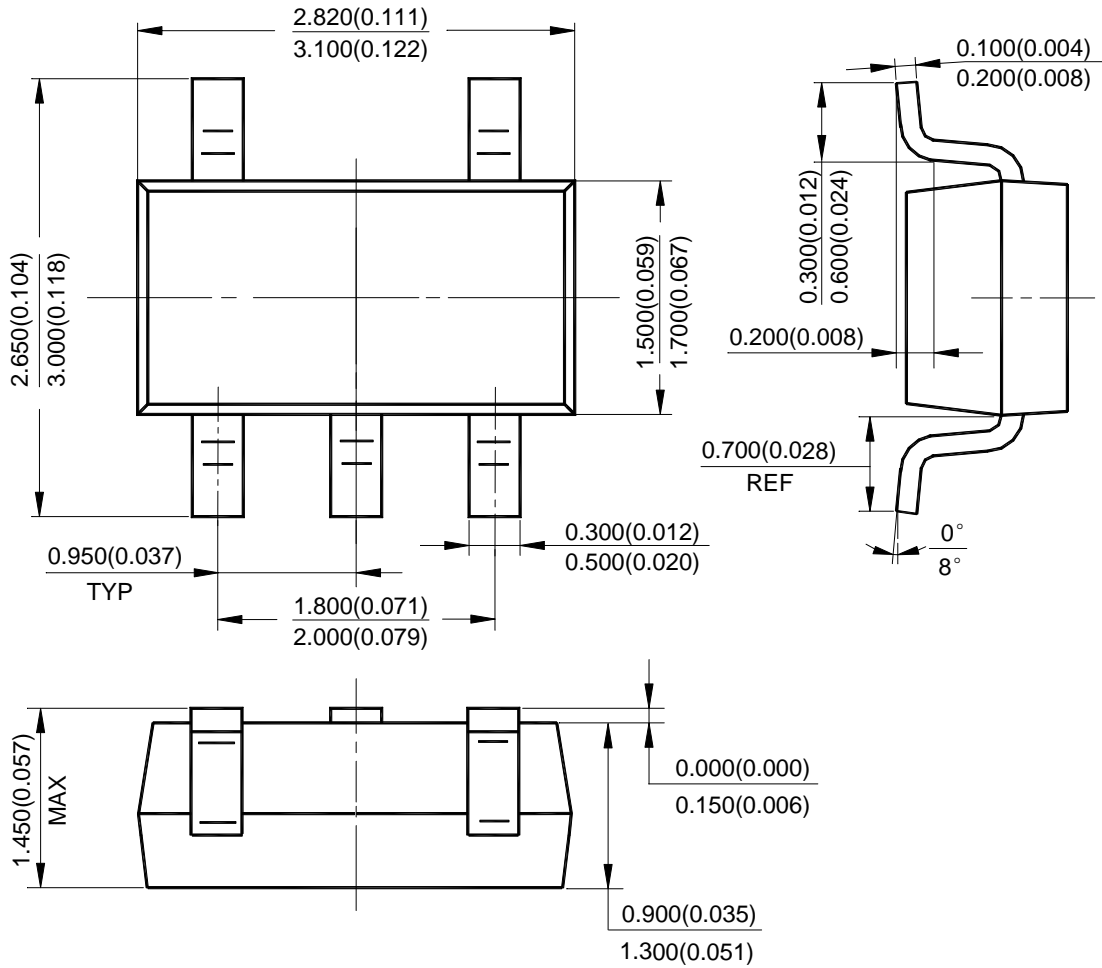
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT-23



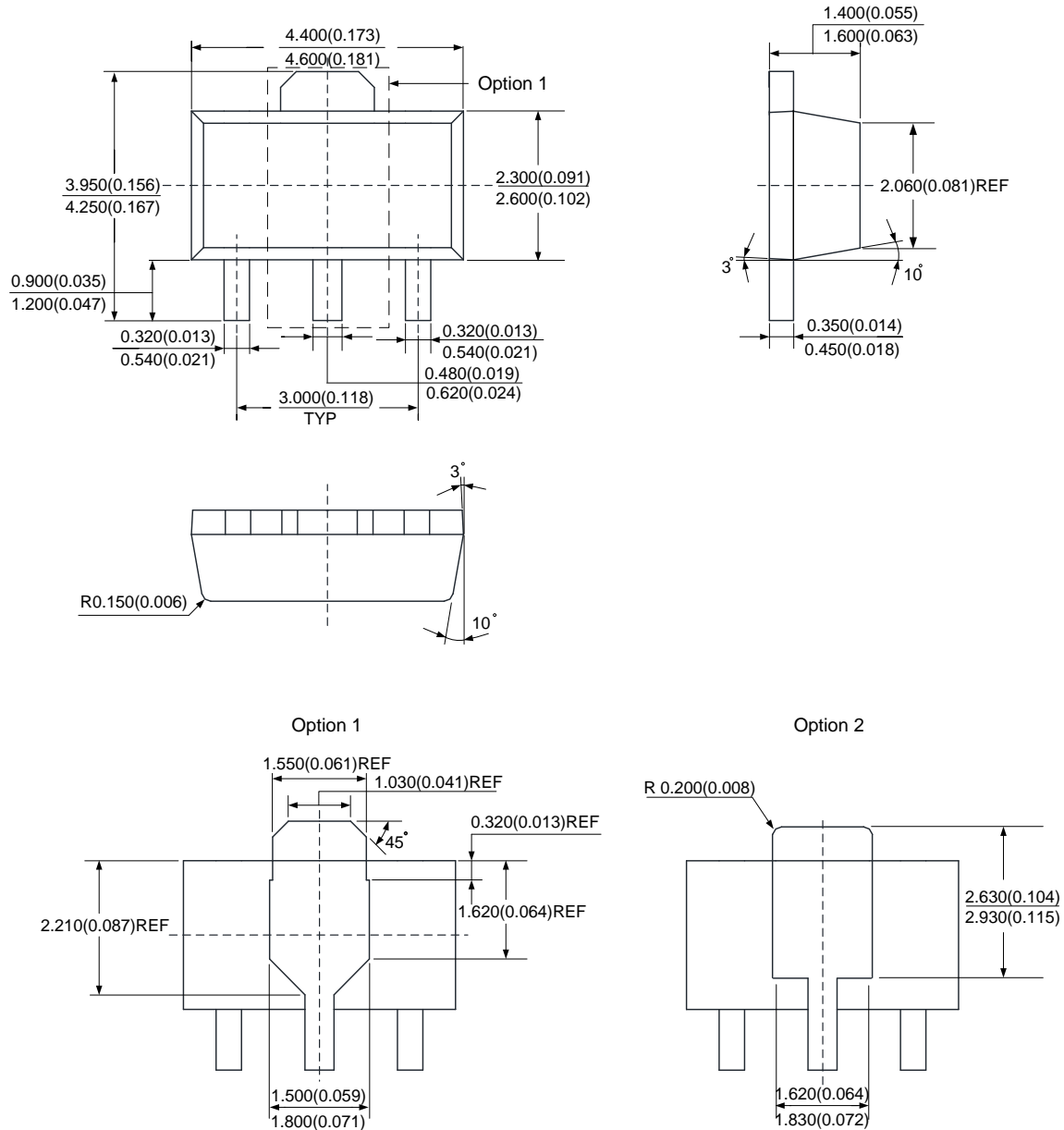
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(4) Package Type: SOT-23-5



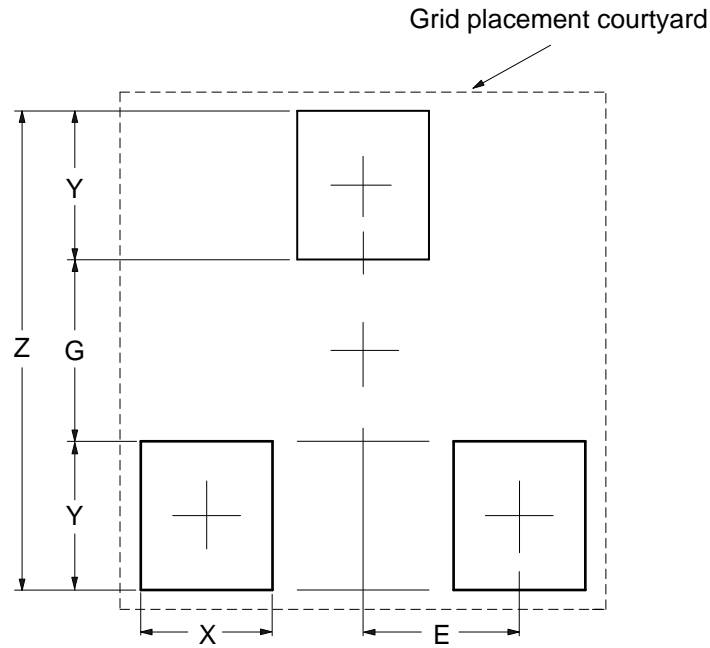
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(5) Package Type: SOT-89



## Suggested Pad Layout

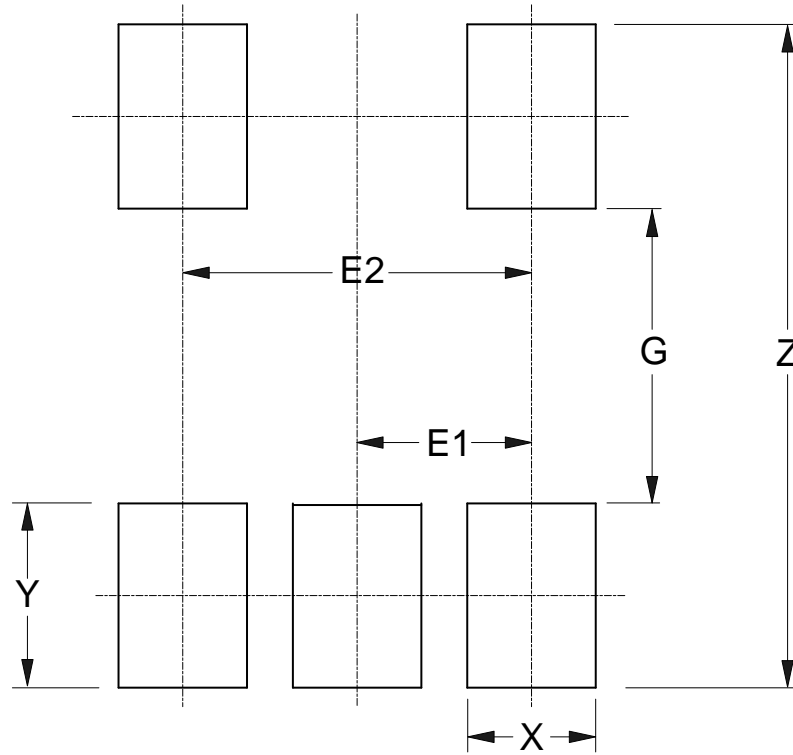
(1) Package Type: SOT-23



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: SOT-23-5

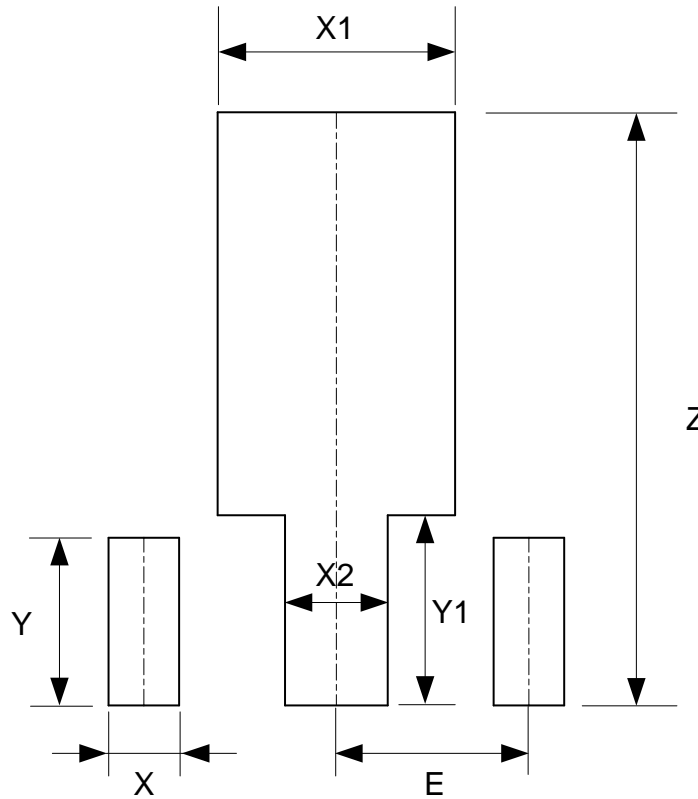


Dimensions	Z (mm)/(inch)	G (mm)/(inch)	X (mm)/(inch)	Y (mm)/(inch)	E1 (mm)/(inch)	E2 (mm)/(inch)
Value	3.600/0.142	1.600/0.063	0.700/0.028	1.000/0.039	0.950/0.037	1.900/0.075



**Suggested Pad Layout** (Cont.)

(3) Package Type: SOT-89



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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