

### General Description

The AHK432 is a low voltage adjustable shunt reference with thermal stability guaranteed over the full industrial temperature range. This three-terminal regulator has an output voltage range that extends from  $V_{REF}$  (1.24V) to 20V, giving designers outstanding flexibility in the development of power supplies and instrumentation. With a low operating current of 60μA, the AHK432 is well suited for battery-powered portable electronic applications. It also has a sharp turn-on characteristic and a dynamic resistance of only 50mΩ, making it an excellent replacement for zener diodes in low tempco designs.

The AHK432 is available in the Pb-free, surface-mount 3- or 5-pin SOT23, as well as the through hole TO-92. Three voltage tolerance options are offered in each package: ±0.5%, ±1%, and ±2%.

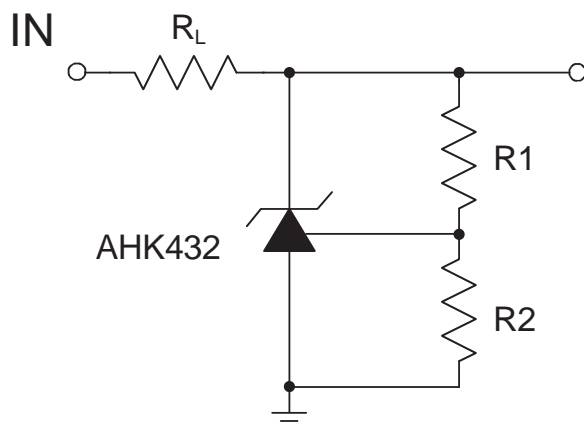
### Features

- Wide Output Voltage Range (1.24V to 20V)
- Operating Current From 60μA to 100mA
- Low Dynamic Output Resistance of 50mΩ
- ±0.5% Trimmed Voltage Reference
- 10mV (Typical)  $V_{REF}$  Deviation, From -40°C to +105°C
- Surface Mount 3- or 5-Pin SOT23 or Through-Hole 3-Pin TO-92 Package

### Applications

- Adjustable and Programmable Supplies
- Global Voltage Reference for Multiple Power Supplies
- Instrumentation
- Isolated Feedback in Switching Power Supplies
- Linear Regulators (External Reference)
- Medical Electronics (see Endnote, page 10)
- Notebook Computers

### Typical Application



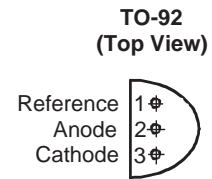
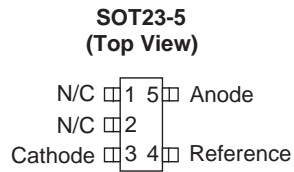
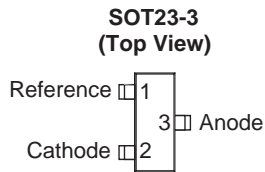
Adjustable regulator:

$$OUT = V_{REF} \left( \frac{R1 + R2}{R2} \right)$$

### Pin Descriptions

Pin			Description
SOT23-3	SOT23-5	TO-92	
1	4	1	Reference.
2	3	3	Cathode.
3	5	2	Anode.
N/A	1, 2	N/A	Not internally connected.

### Pin Configuration



### Absolute Maximum Ratings<sup>1</sup>

$T_A = 25^\circ\text{C}$ , unless otherwise noted.

Symbol	Description	Value	Units
$V_Z$	Cathode Voltage	20	V
$I_Z$	Continuous Cathode Current	100	mA
$I_{REF}$	Reference Current	3	mA
$T_J$	Operating Junction Temperature Range	-40 to 150	$^\circ\text{C}$
$T_{LEAD}$	Maximum Soldering Temperature (at Leads)	260	$^\circ\text{C}$

### Thermal Characteristics

Symbol	Description	Package	Value	Units
$\theta_{JA}$	Maximum Thermal Resistance	TO-92	160	$^\circ\text{C}/\text{W}$
		SOT23-3, SOT23-5	410	
$P_D$	Maximum Power Dissipation	TO-92	780	mW
		SOT23-3, SOT23-5	300	

1. Stresses above those listed in Absolute Maximum Ratings may cause permanent damage to the device. Functional operation at conditions other than the operating conditions specified is not implied. Only one Absolute Maximum Rating should be applied at any one time.

### Electrical Characteristics

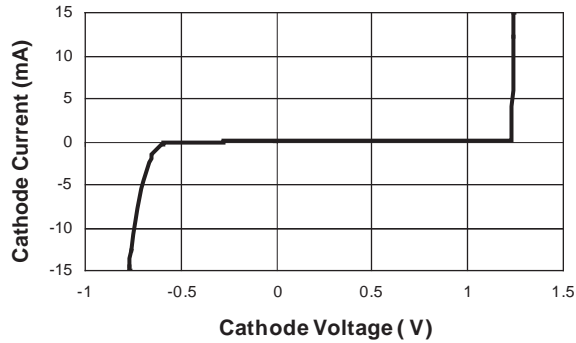
$T_A = 25^\circ\text{C}$ , unless otherwise noted.

Symbol	Description	Conditions	AHK432 0.5%			AHK432 1.0%			AHK432 2.0%			Units	
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max		
$V_{REF}$	Reference Voltage	$V_Z = V_{REF}$ $I_Z = 10\text{mA}$ (test circuit 1)	$T_A = 25^\circ\text{C}$	1.234	1.240	1.246	1.228	1.240	1.252	1.215	1.240	1.265	V
			$T_A = -40$ to $+105^\circ\text{C}$	1.222		1.258	1.215		1.265	1.200		1.280	
$V_{DEV}$	$V_{REF}$ Temp Deviation	$T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$ , $V_Z = V_{REF}$ , $I_Z = 10\text{mA}$ (test circuit 1)		10	25		10	25		10	25	mV	
$\frac{\Delta V_{REF}}{\Delta V_Z}$	Ratio of Change in $V_{REF}$ to Change in Cathode Voltage	$I_Z = 10\text{mA}$ , $\Delta V_Z = 16\text{V}$ to $V_{REF}$ (test circuit 2)		-1.0	-2.7		-1.0	-2.7		-1.0	-2.7	mV/V	
$I_{REF}$	Reference Input Current	$R1 = 10\text{k}\Omega$ , $R2 = \infty$ , $I_Z = 10\text{mA}$ (test circuit 2)		0.15	0.5		0.15	0.5		0.15	0.5	$\mu\text{A}$	
$I_{REF(DEV)}$	$I_{REF}$ Temp Deviation	$T_A = -40^\circ\text{C}$ to $+105^\circ\text{C}$ $R1 = 10\text{k}\Omega$ , $R2 = \infty$ , $I_Z = 10\text{mA}$ (test circuit 2)		0.1	0.4		0.1	0.4		0.1	0.4	$\mu\text{A}$	
$I_{Z(OFF)}$	Off State Cathode Current	$V_{REF} = 0\text{V}$ (test circuit 3)	$V_Z = 6\text{V}$	0.04	0.1		0.04	0.1		0.04	0.1	$\mu\text{A}$	
			$V_Z = 16\text{V}$	0.04	0.5		0.04	0.5		0.04	0.5		
$R_Z$	Dynamic Output Impedance	$f < 1\text{kHz}$ , $V_Z = V_{REF}$ , $I_Z = 100\mu\text{A}$ to $100\text{mA}$ (test circuit 1)		0.05	0.2		0.05	0.2		0.05	0.2	$\Omega$	
$I_{Z(MIN)}$	Minimum Operating Current	$V_Z = V_{REF}$ (test circuit 1)		60	80		60	80		60	80	$\mu\text{A}$	

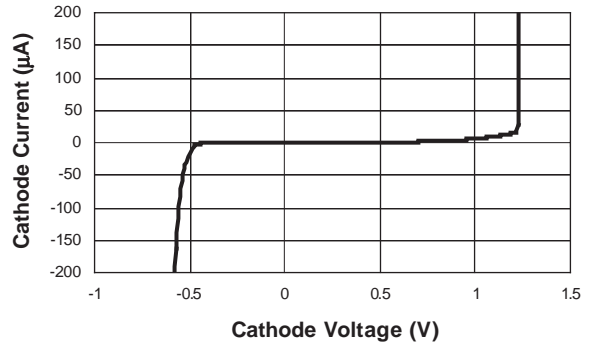
### Typical Characteristics

Unless otherwise noted,  $T_A = 25^\circ\text{C}$ ,  $I_Z = 10\text{mA}$ .

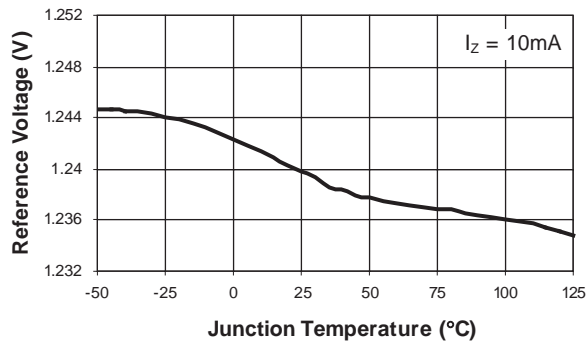
Cathode Current vs. Cathode Voltage



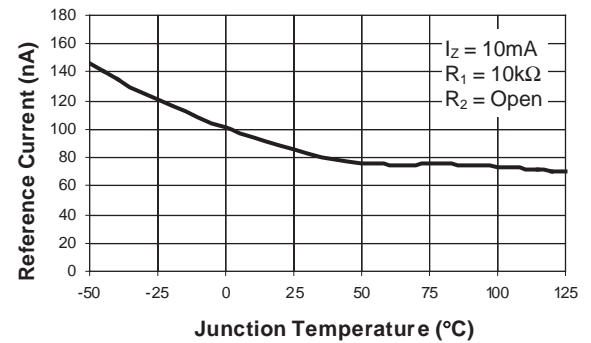
Cathode Current vs. Cathode Voltage



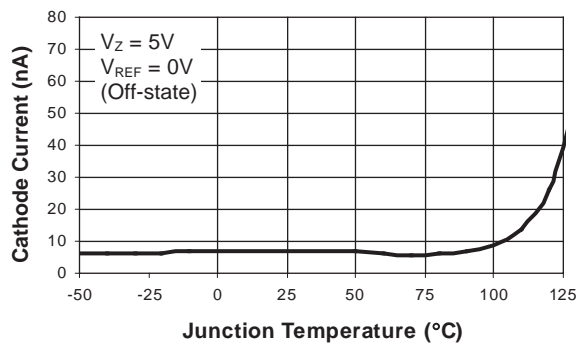
Reference Voltage vs. Temperature



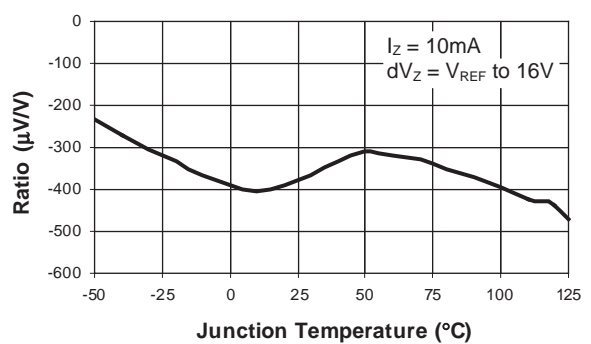
Reference Current vs. Temperature



Cathode Current vs. Temperature



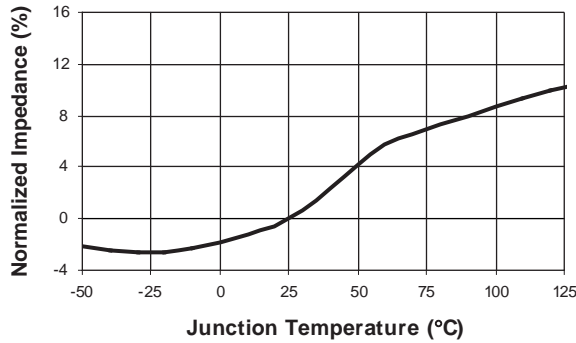
Ratio of  $\Delta V_{REF} / \Delta V_Z$  vs. Temperature



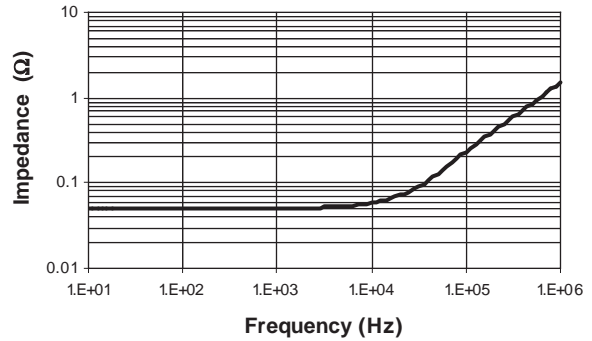
### Typical Characteristics

Unless otherwise noted,  $T_A = 25^\circ\text{C}$ ,  $I_Z = 10\text{mA}$ .

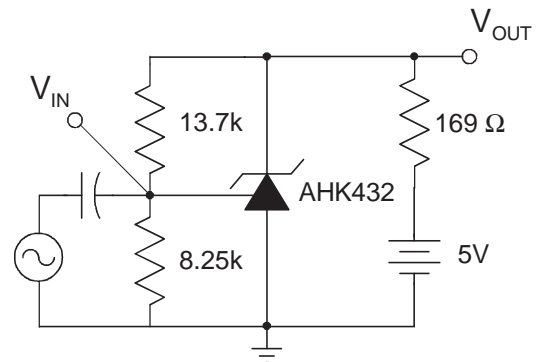
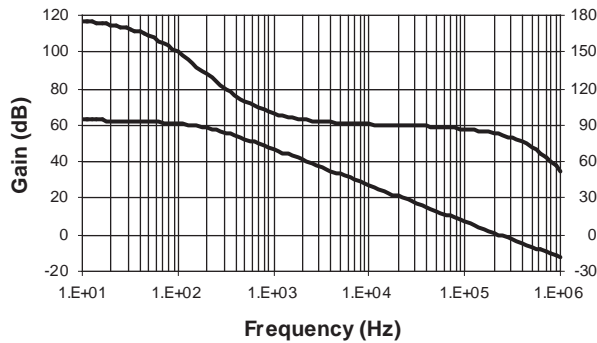
**Cathode Impedance vs. Temperature**



**Impedance vs. Frequency**

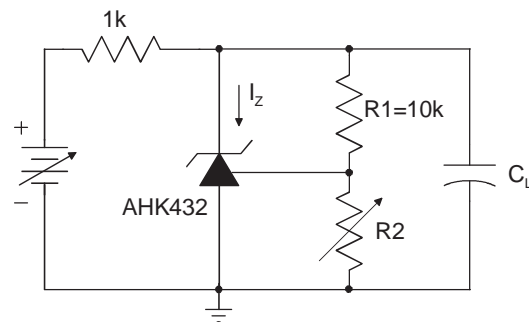
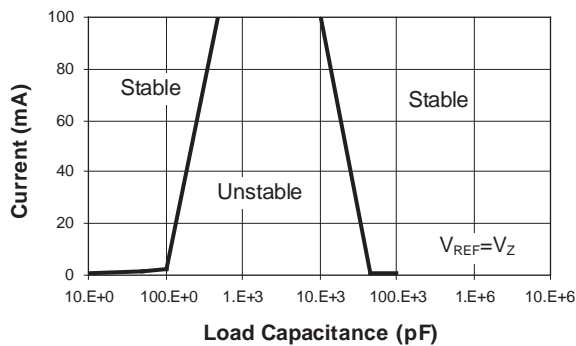


**Gain and Phase vs. Frequency**



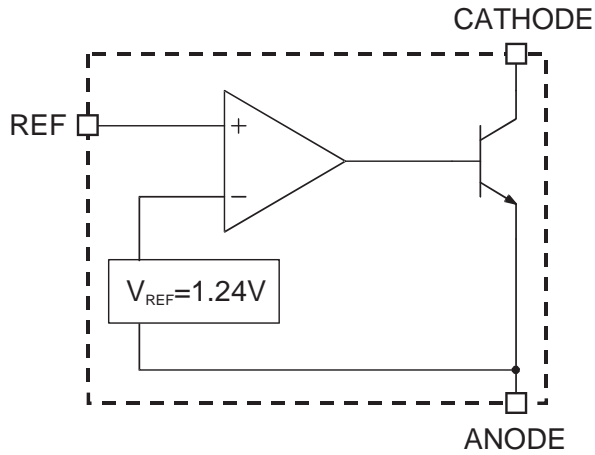
Test Circuit for Voltage Gain and Phase

**Stability Boundary**

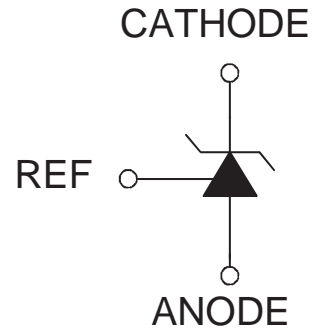


Test Circuit for Stability

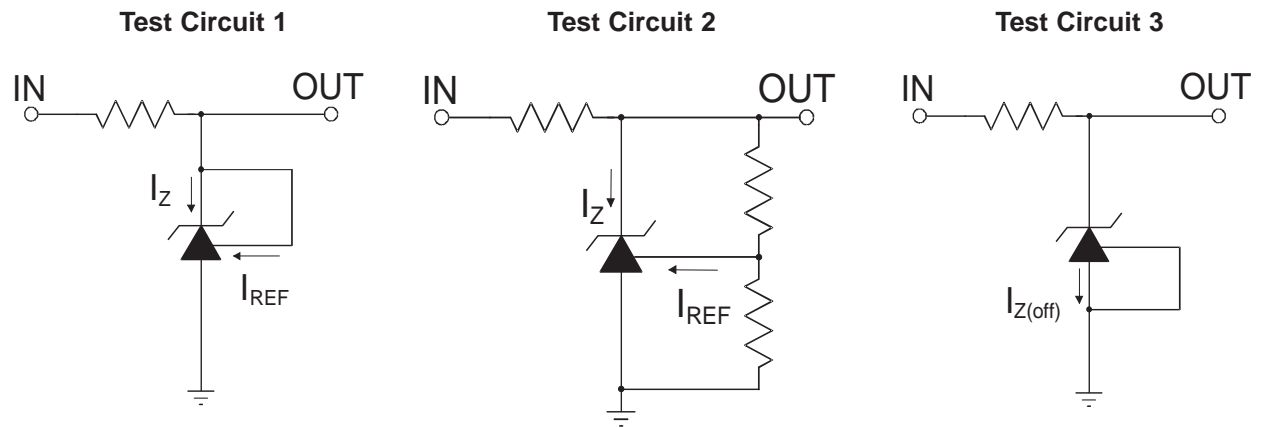
### Functional Block Diagram



### Symbol Diagram



### Test Circuits



### Ordering Information<sup>1</sup>

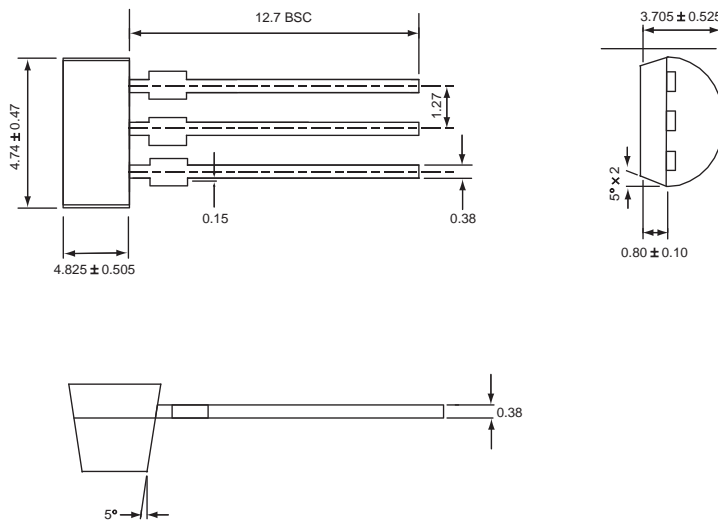
Package	Bulk or Tape and Reel	Tolerance		
		0.5%	1.0%	2.0%
SOT23-3	Bulk	N/A	N/A	N/A
SOT23-5		N/A	N/A	N/A
TO92		<b>AHK432ILY-.5-B1</b>	<b>AHK432ILY-1-B1</b>	<b>AHK432ILY-2-B1</b>
SOT23-3	Tape and Reel	<b>AHK432IGY-.5-T1</b>	<b>AHK432IGY-1-T1</b>	N/A
SOT23-5		<b>AHK432IGV-.5-T1</b>	<b>AHK432IGV-1-T1</b>	N/A
TO-92	Ammo	<b>AHK432ILY-.5-A1</b>	<b>AHK432ILY-1-A1</b>	<b>AHK432ILY-2-A1</b>



All AnalogicTech products are offered in Pb-free packaging. The term “Pb-free” means semiconductor products that are in compliance with current RoHS standards, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. For more information, please visit our website at <http://www.analogictech.com/pbfree>.

### Package Information

#### TO-92 (Bulk packing option)

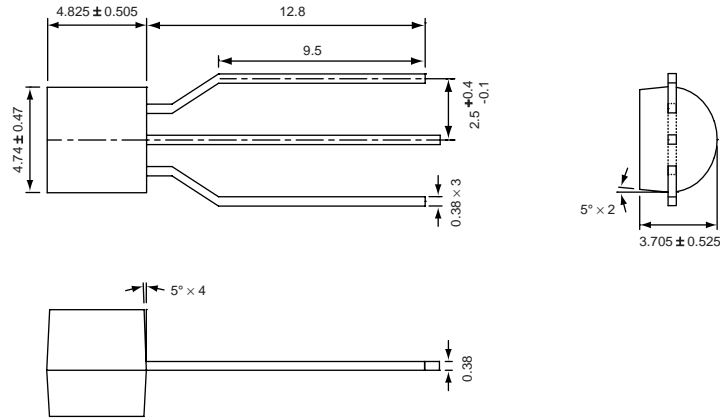


All dimensions in millimeters.

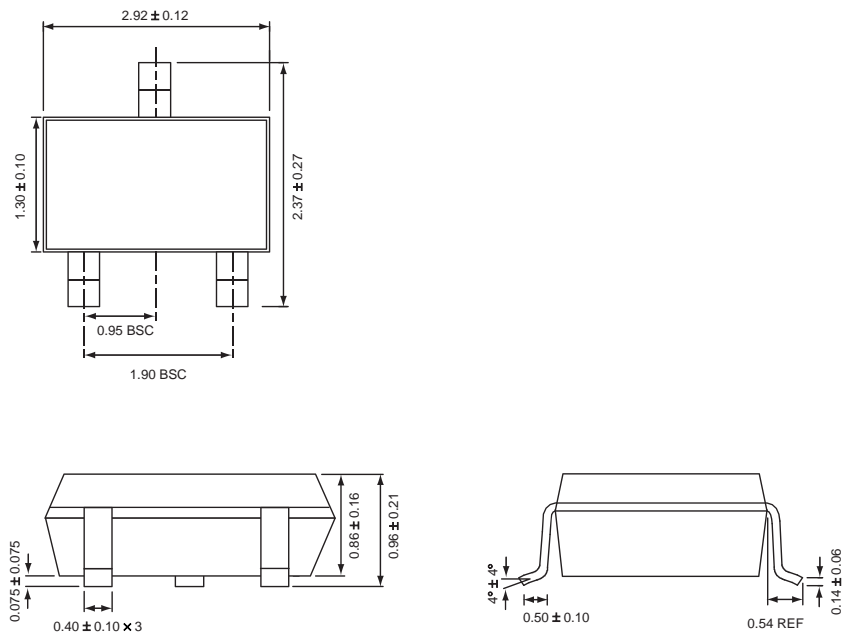
1. Sample stock is generally held on part numbers listed in **BOLD**.



### TO-92 ( Ammo packing option)

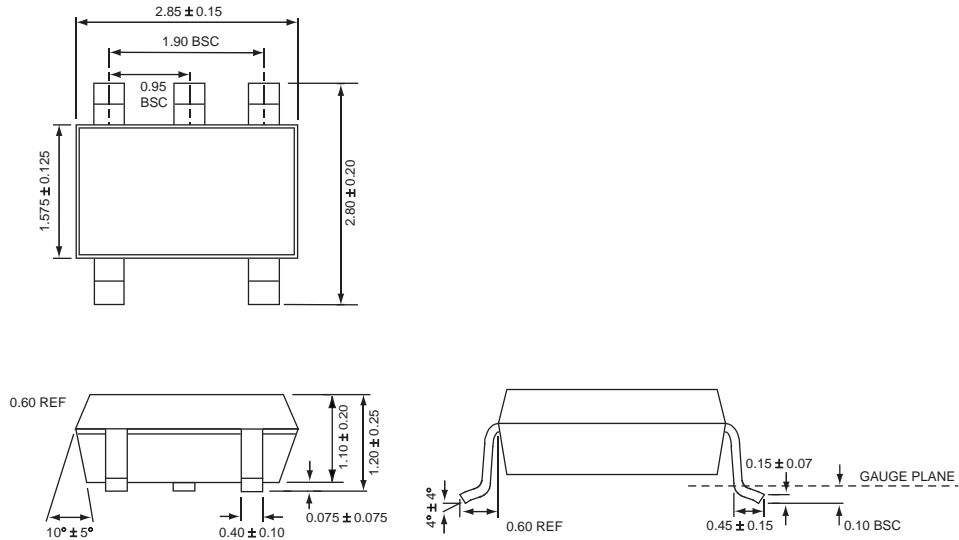


### SOT23-3



All dimensions in millimeters.

### SOT23-5



All dimensions in millimeters.

Endnote:

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

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