

## Description

The AZ431-B is a three-terminal adjustable shunt regulator with guaranteed thermal stability over a full operation range. It features sharp turn-on characteristics, low temperature coefficient and low output impedance, which make it ideal substitute for Zener diode in applications such as switching power supply, charger and other adjustable regulators.

The output voltage of AZ431-B can be set to any value between  $V_{REF}$  (2.5V) and the corresponding maximum cathode voltage.

The AZ431-B precision reference is offered in two voltage tolerance: 0.4% and 0.8%.

This IC is available in 4 packages: TO-92 (bulk or ammo packing), SOT-23, SOT-23-5 and SOT-89.

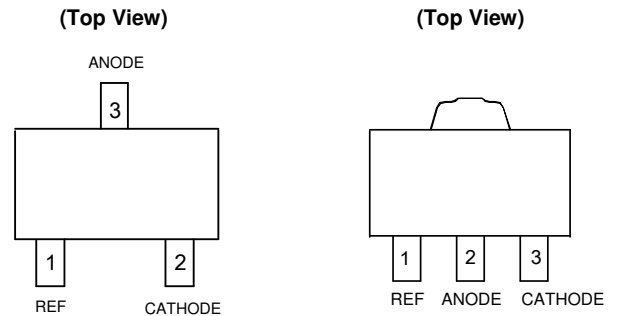
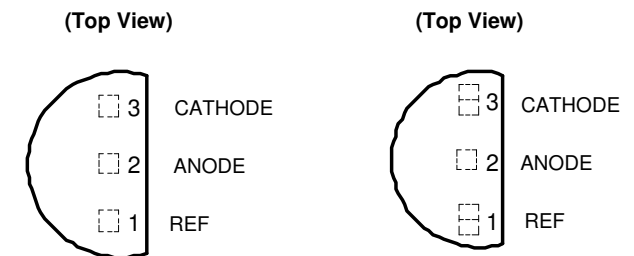
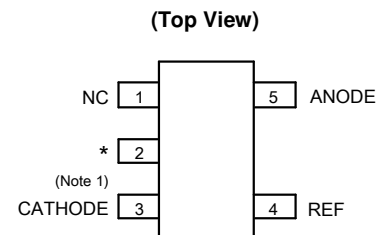
## Features

- Programmable Precise Output Voltage from 2.5V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C

## Applications

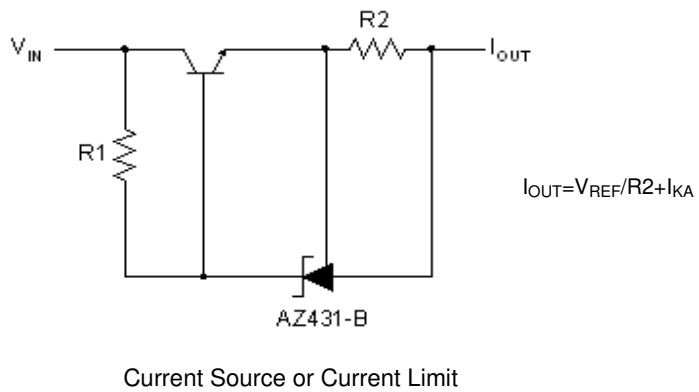
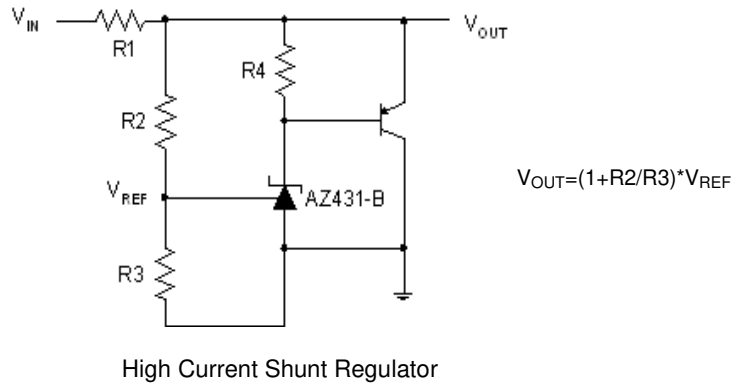
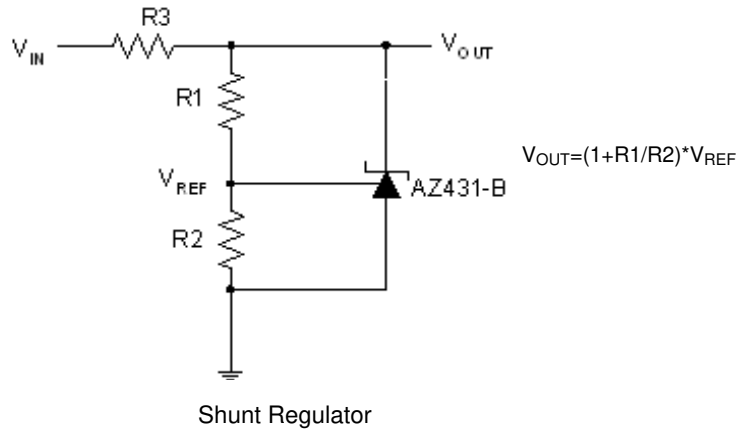
- Charger
- Voltage Adapter
- Switching Power Supply
- Graphic Card
- Precision Voltage Reference

## Pin Assignments

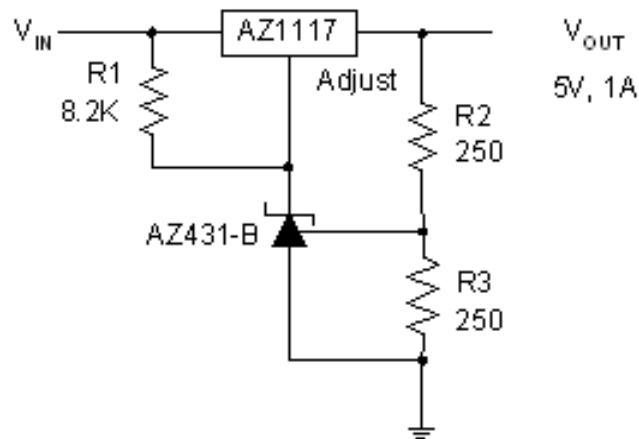

**SOT-23**
**SOT-89**

**TO-92 (Bulk Packing)**
**TO-92 (Ammo Packing)**

**SOT-23-5**

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

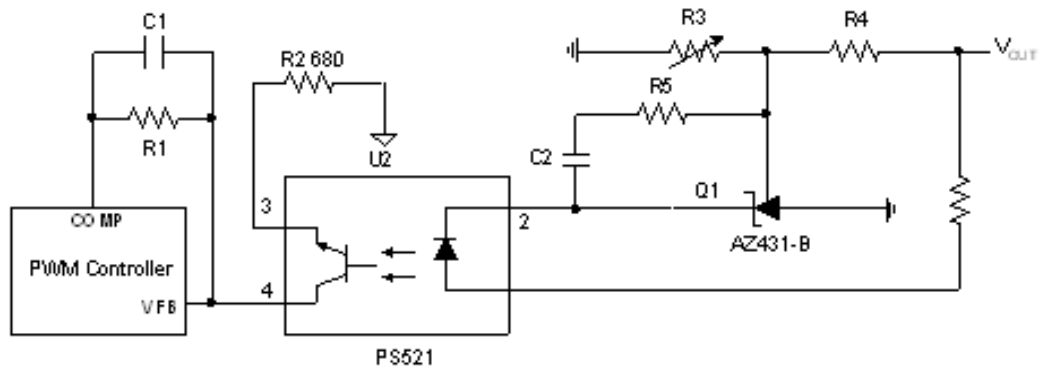
**Typical Applications Circuit**



**Typical Applications Circuit (Cont.)**

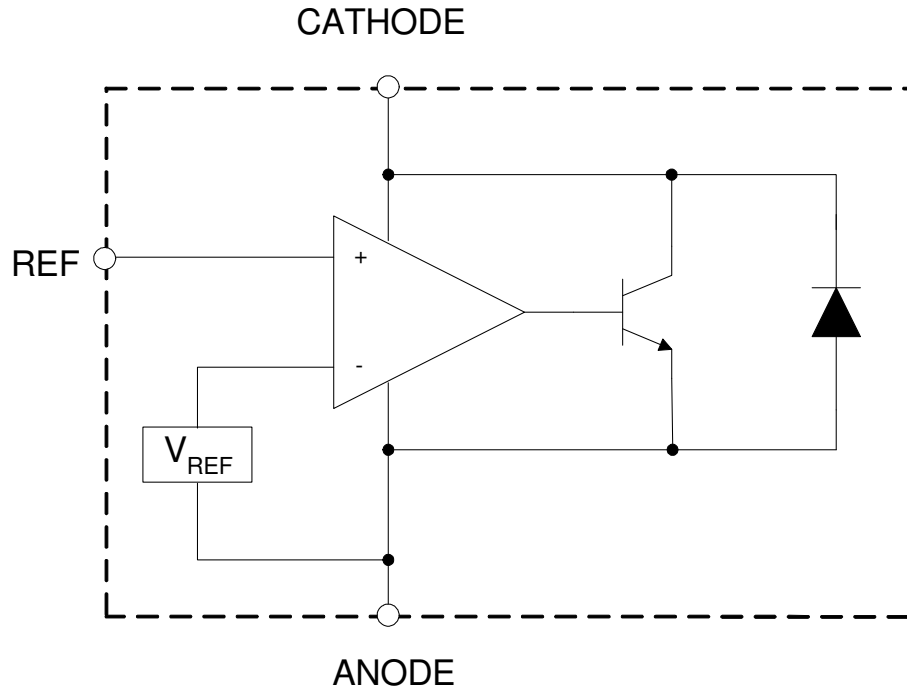


Precision 5V 1A Regulator



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 150	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
ESD	ESD (Human Body Model)	2000	V

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.

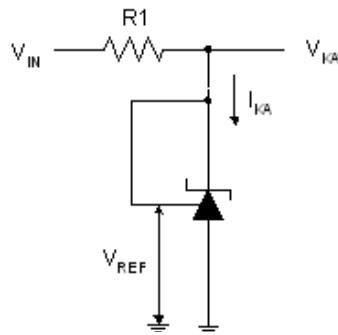
## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{KA}$	Cathode Voltage	$V_{REF}$	18	V
$I_{KA}$	Cathode Current	1.0	100	mA
$T_A$	Operating Ambient Temperature Range	-40	+125	°C

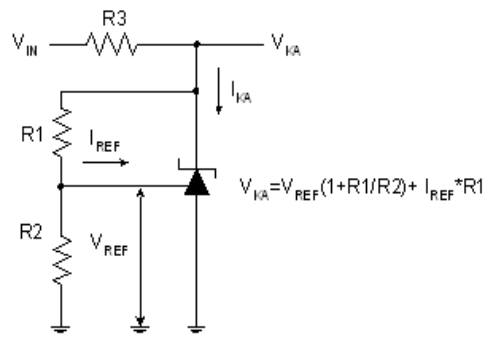
## Electrical Characteristics (Operating Conditions: $T_A = +25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Test Circuit	Conditions	Min	Typ	Max	Unit	
$V_{REF}$	Reference Voltage	4	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	0 to $+70^\circ\text{C}$	2.490	2.500	2.510	V
				-40 to $+85^\circ\text{C}$	2.480	2.500	2.520	
$\Delta V_{REF}$	Deviation of Reference Voltage Over Full Temperature Range	4	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	0 to $+70^\circ\text{C}$	—	4.5	8	mV
				-40 to $+85^\circ\text{C}$	—	4.5	10	
				-40 to $+125^\circ\text{C}$	—	4.5	16	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage	5	$I_{KA} = 10\text{mA}$	$\Delta V_{KA} = 10\text{V}$ to $V_{REF}$	—	-1.0	-2.7	mV/V
				$\Delta V_{KA} = 18\text{V}$ to 10V	—	-0.5	-2.0	
$I_{REF}$	Reference Current	5	$I_{KA} = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty$	—	0.7	4	$\mu\text{A}$	
$\Delta I_{REF}$	Deviation of Reference Current Over Full Temperature Range	5	$I_{KA} = 10\text{mA}, R_1 = 10\text{k}\Omega, R_2 = \infty, T_A = -40^\circ\text{C}$ to $+125^\circ\text{C}$	—	0.4	1.2	$\mu\text{A}$	
$I_{KA(\text{Min})}$	Minimum Cathode Current for Regulation	4	$V_{KA} = V_{REF}$	—	0.4	1.0	mA	
$I_{KA(\text{Off})}$	Off-state Cathode Current	6	$V_{KA} = 18\text{V}, V_{REF} = 0$	—	0.05	1.0	$\mu\text{A}$	
$Z_{KA}$	Dynamic Impedance	4	$V_{KA} = V_{REF}, I_{KA} = 1$ to $100\text{mA}$ $f \leq 1.0\text{kHz}$	—	0.2	0.5	$\Omega$	
$\theta_{JC}$	Thermal Resistance	—	SOT-23	—	177.65	—	°C/W	
		—	SOT-23-5	—	177.65	—		
		—	TO-92	—	107.04	—		
		—	SOT-89	—	30.30	—		

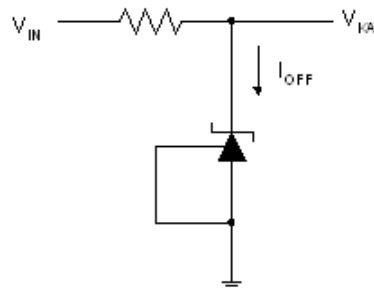
**Electrical Characteristics** (Cont.)



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



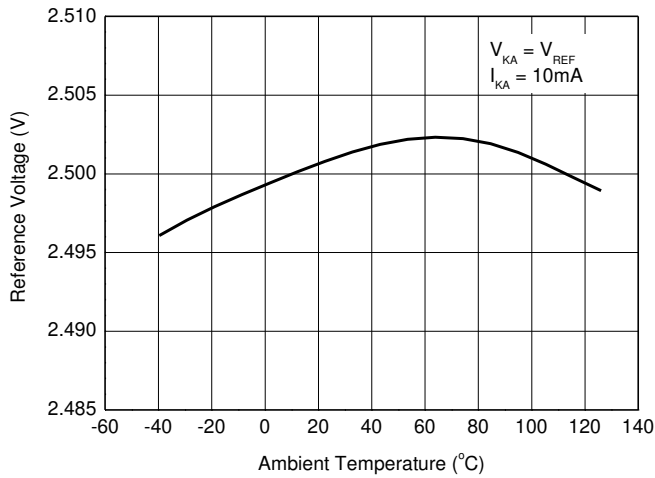
Test Circuit 5 for  $V_{KA} > V_{REF}$



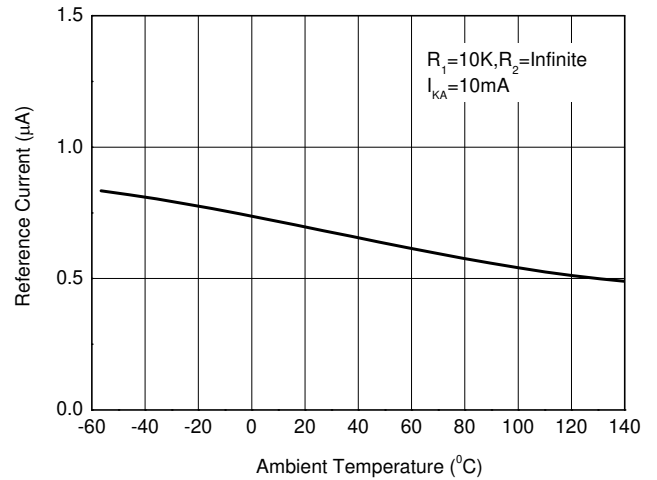
Test Circuit 6 for I<sub>OFF</sub>

**Performance Characteristics**

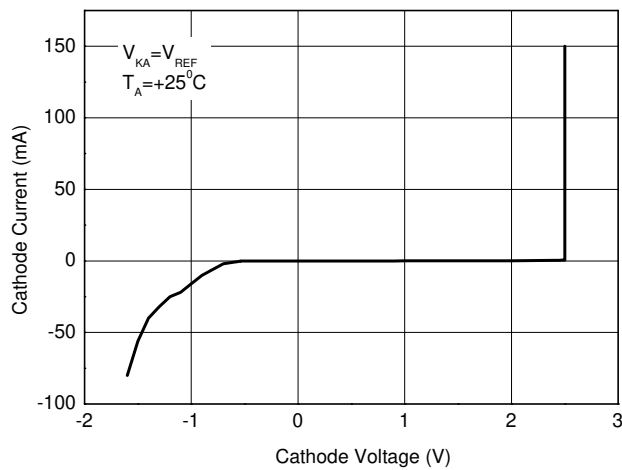
**Reference Voltage vs. Ambient Temperature**



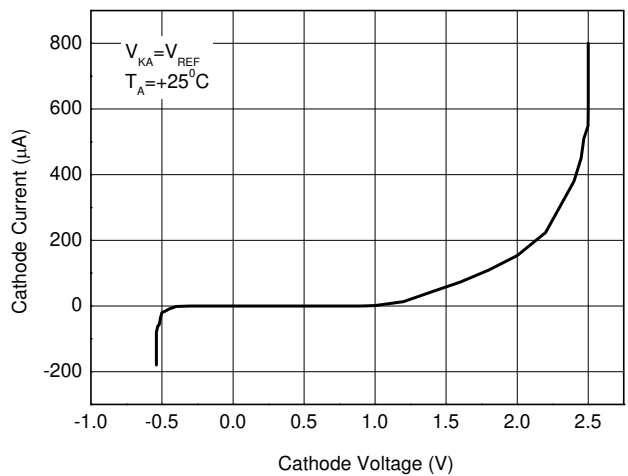
**Reference Current vs. Ambient Temperature**



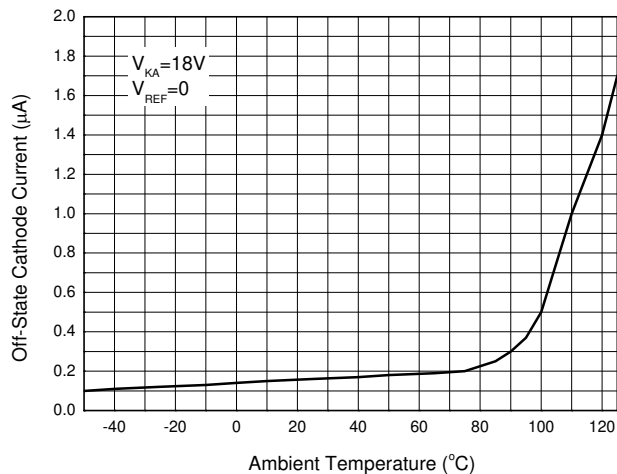
**Cathode Current vs. Cathode Voltage**



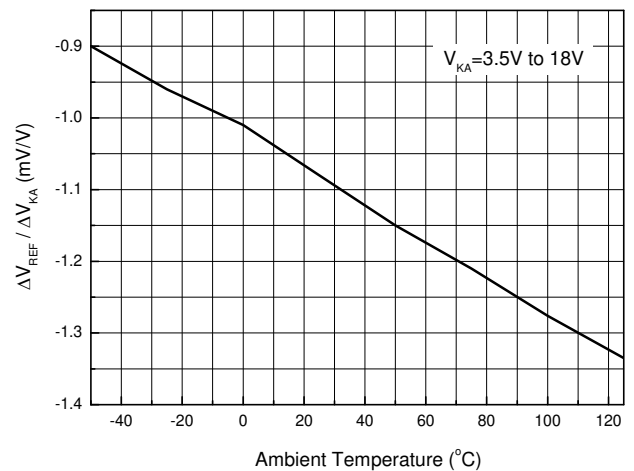
**Cathode Current vs. Cathode Voltage**



**Off-State Cathode Current vs. Ambient Temperature**

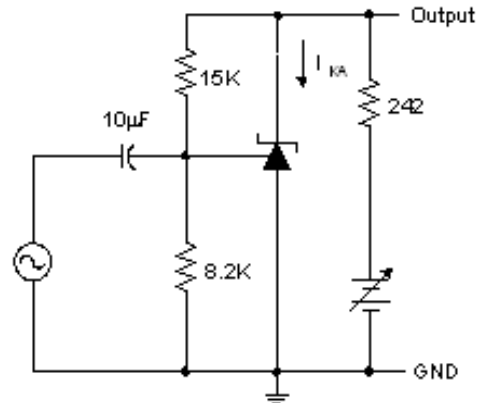
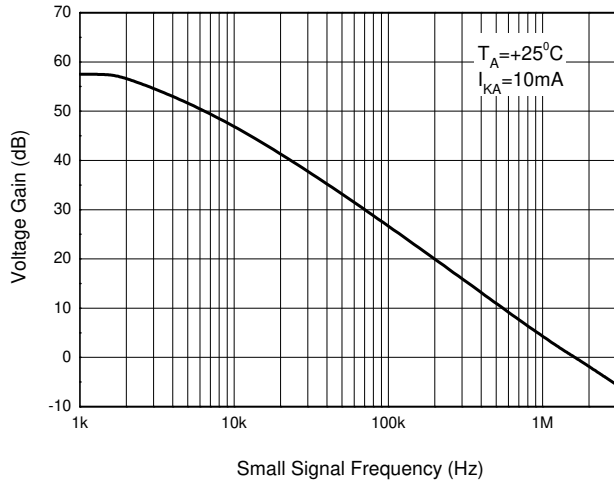


**Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage**

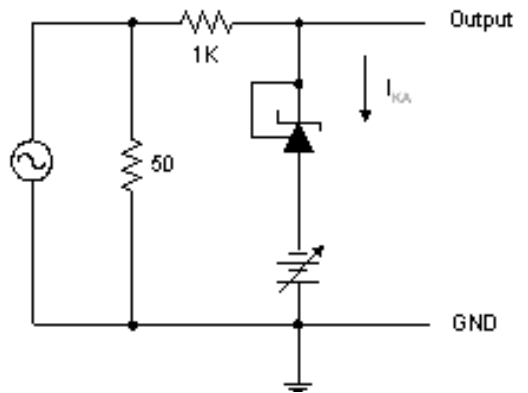
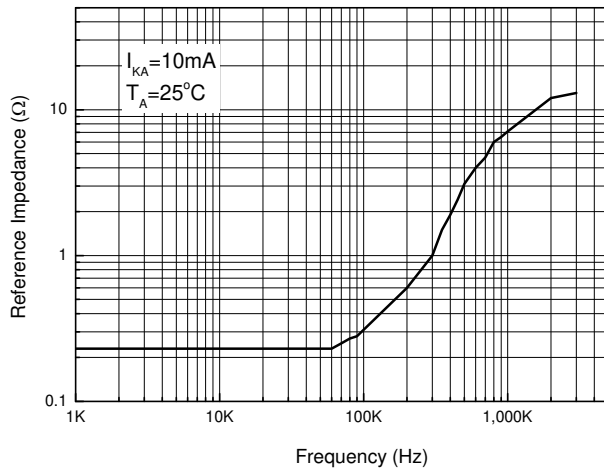


**Performance Characteristics (Cont.)**

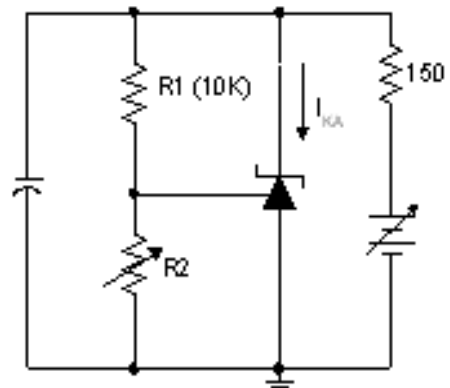
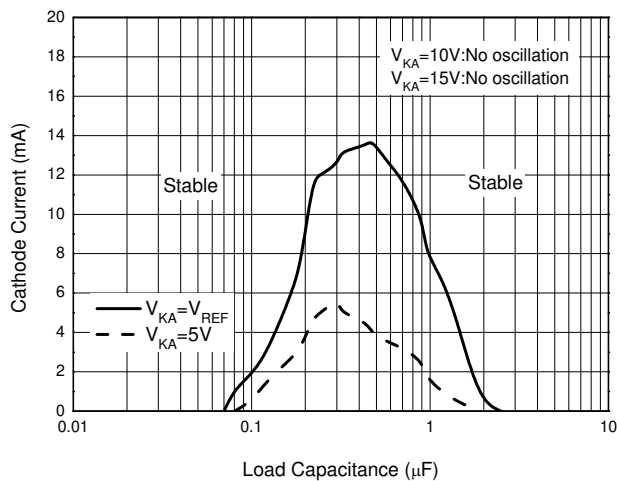
**Small Signal Voltage Gain vs. Frequency**



**Reference Impedance vs. Frequency**



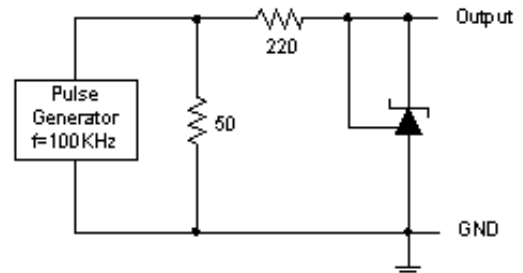
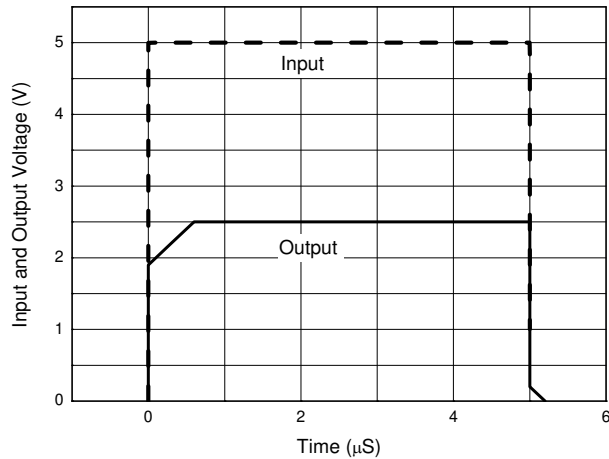
**Stability Boundary Conditions vs. Load Capacitance**



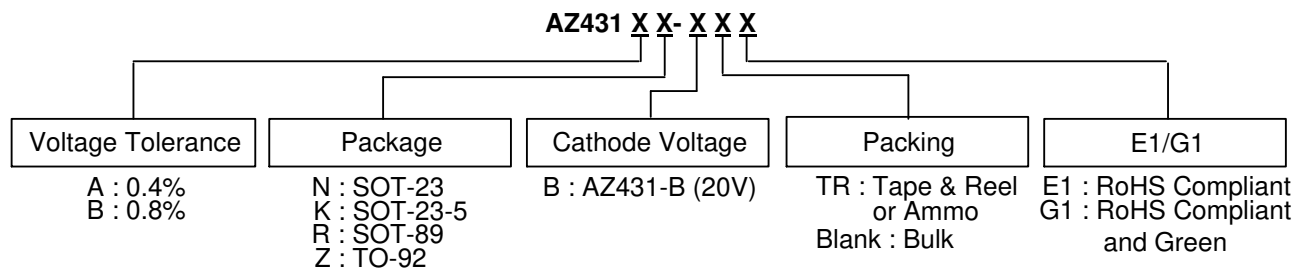


**Performance Characteristics (Cont.)**

**Pulse Response of Input and Output Voltage**



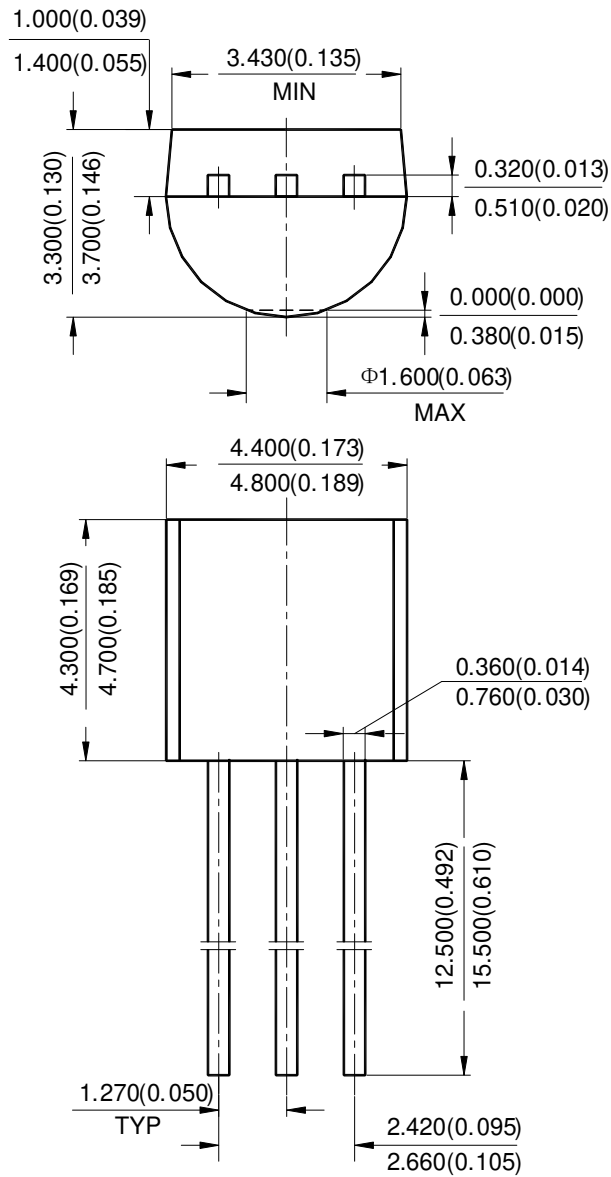
**Ordering Information**



Package	Temperature Range	Voltage Tolerance	Part Number		Marking ID		Packing
			RoHS Compliant	RoHS Compliant and Green	RoHS Compliant	RoHS Compliant and Green	
SOT-23	-40 to +125°C	0.4%	AZ431AN-BTRE1	AZ431AN-BTRG1	EA4	GA4	Tape & Reel
		0.8%	AZ431BN-BTRE1	AZ431BN-BTRG1	EA5	GA5	Tape & Reel
SOT-23-5	-40 to +125°C	0.4%	AZ431AK-BTRE1	AZ431AK-BTRG1	E4A	G4A	Tape & Reel
		0.8%	AZ431BK-BTRE1	AZ431BK-BTRG1	E4B	G4B	Tape & Reel
TO-92	-40 to +125°C	0.4%	AZ431AZ-BE1	AZ431AZ-BG1	AZ431AZ-BE1	AZ431AZ-BG1	Bulk
		0.4%	AZ431AZ-BTRE1	AZ431AZ-BTRG1	AZ431AZ-BE1	AZ431AZ-BG1	Ammo
		0.8%	AZ431BZ-BE1	AZ431BZ-BG1	AZ431BZ-BE1	AZ431BZ-BG1	Bulk
		0.8%	AZ431BZ-BTRE1	AZ431BZ-BTRG1	AZ431BZ-BE1	AZ431BZ-BG1	Ammo
SOT-89	-40 to +125°C	0.4%	AZ431AR-BTRE1	AZ431AR-BTRG1	E43C	G43C	Tape & Reel
		0.8%	AZ431BR-BTRE1	AZ431BR-BTRG1	E43D	G43D	Tape & Reel

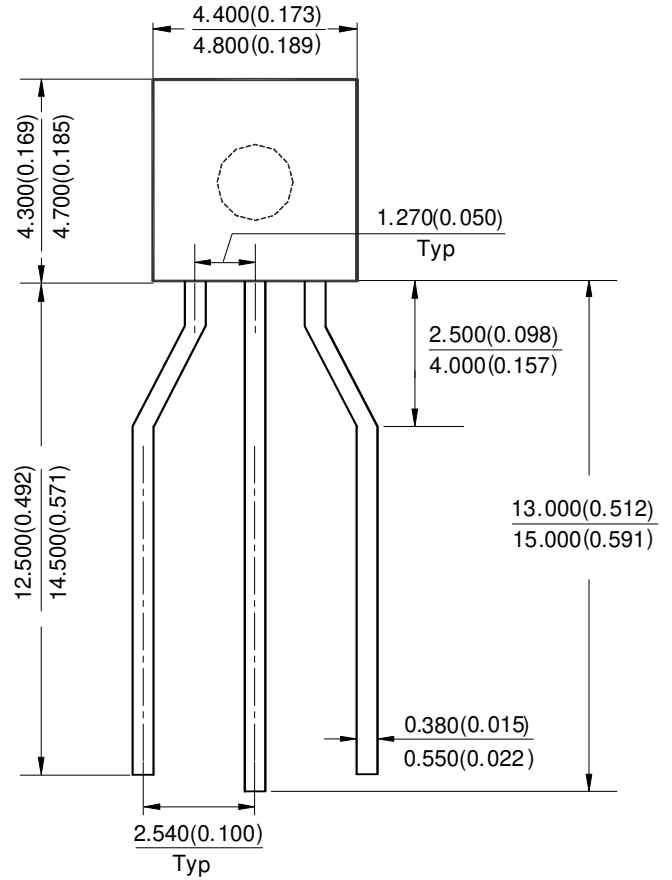
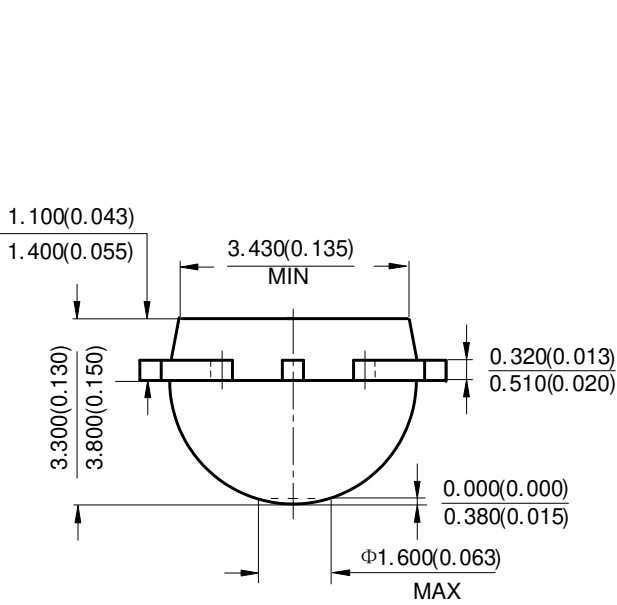
**Package Outline Dimensions** (All dimensions in mm (inch).)

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



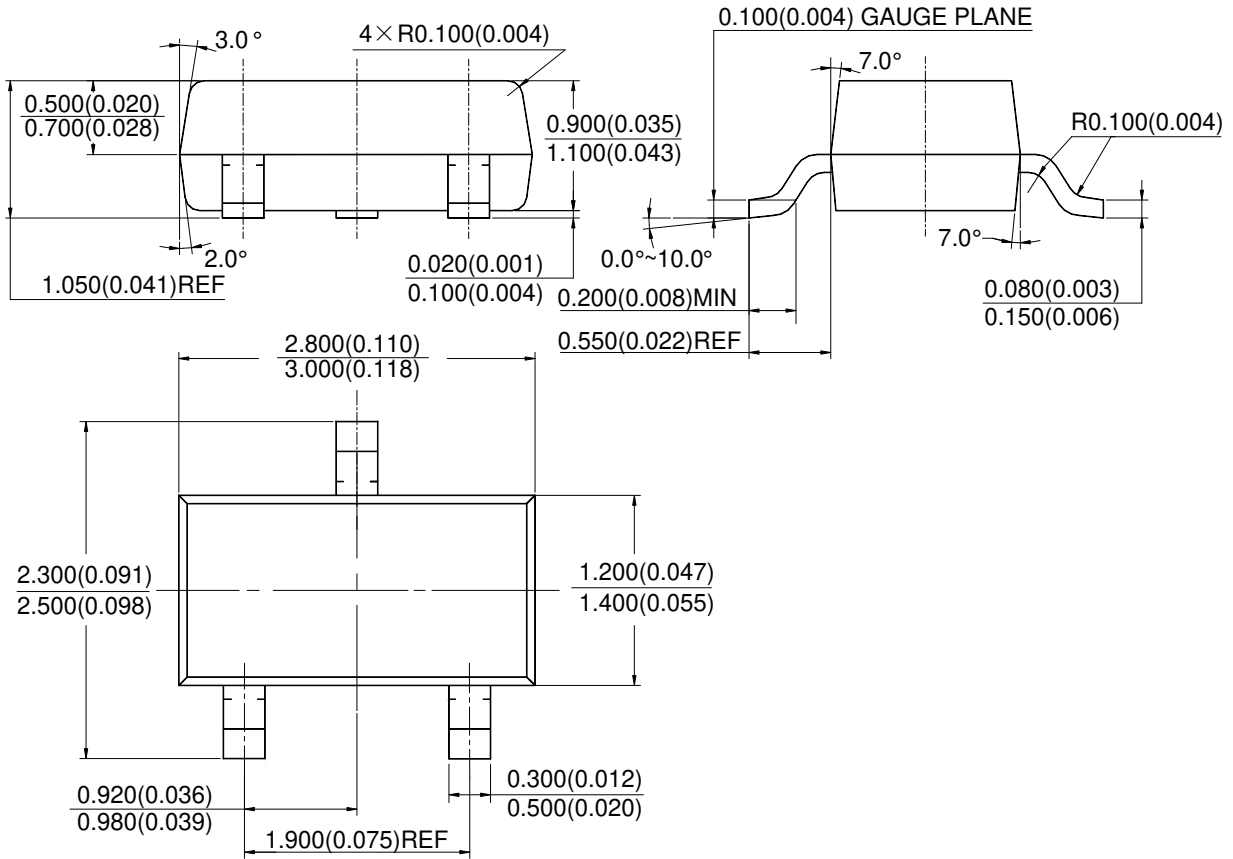
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

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



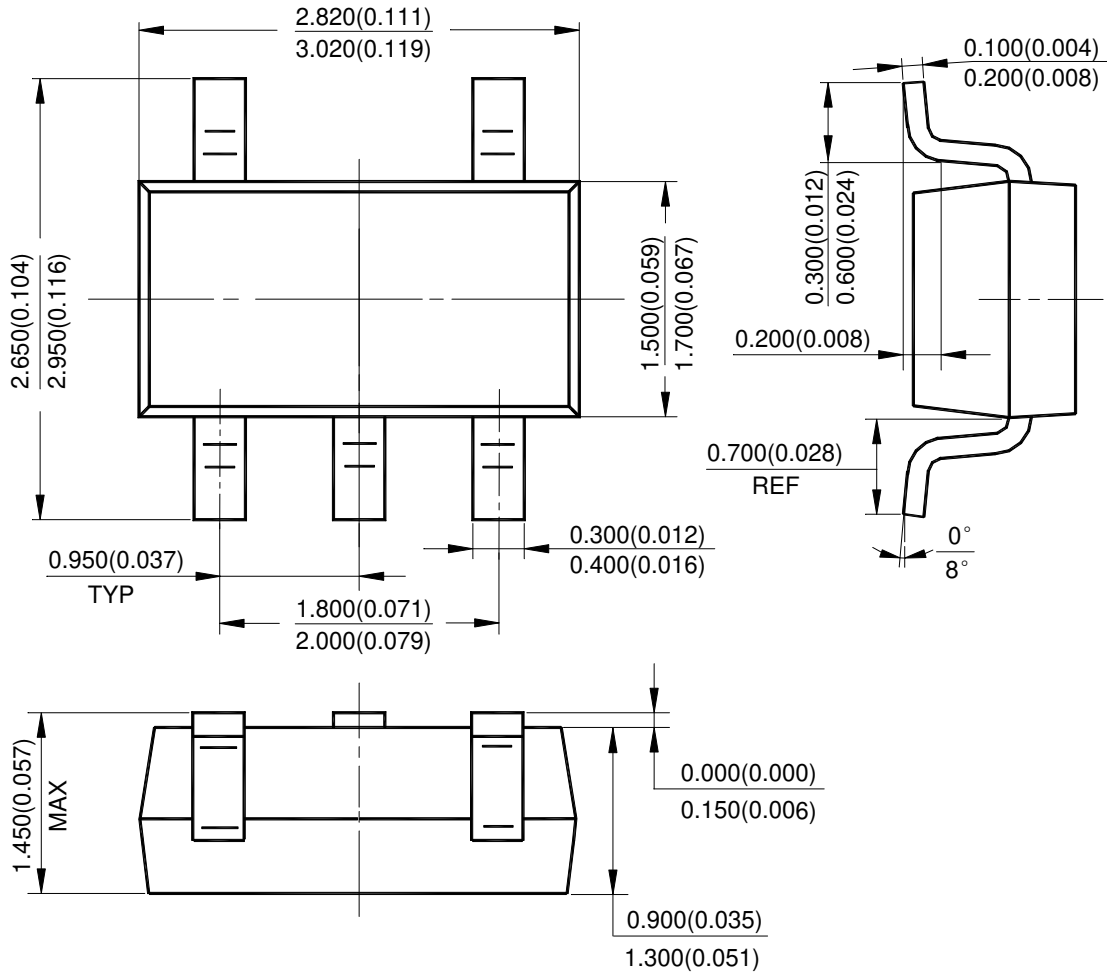
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(3) Package Type: SOT-23



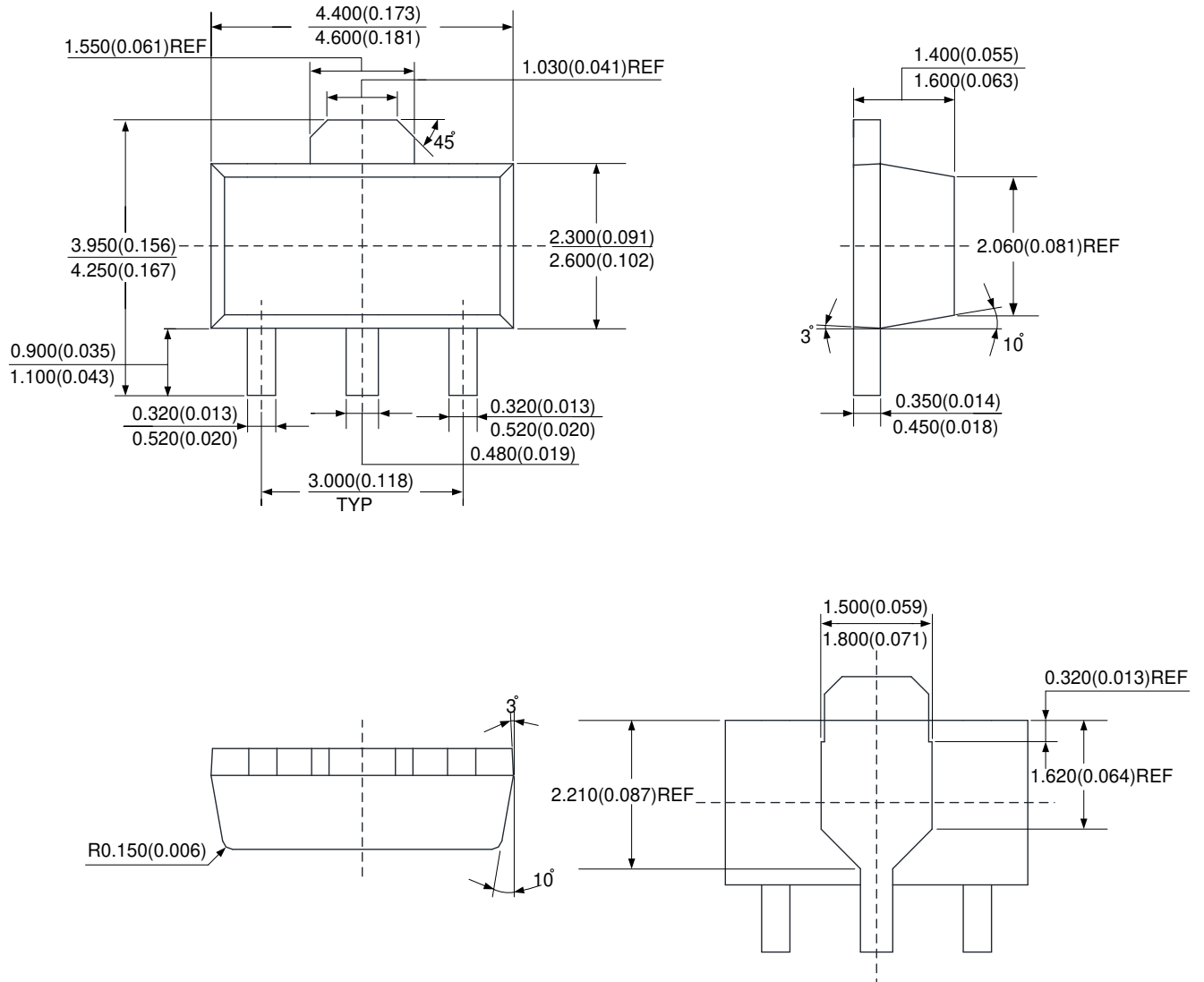
**Package Outline Dimensions** (Cont. All dimensions in mm(inch).)

(4) Package Type: SOT-23-5



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

(5) Package Type: SOT-89



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