Description

The AZ431-A 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-A can be set to any value between V_{REF} (2.5V) and the corresponding maximum cathode voltage (36V).

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

This IC is available in 3 packages: TO92 (Bulk or Ammo Packing), SOT23 and SOT89.

Features

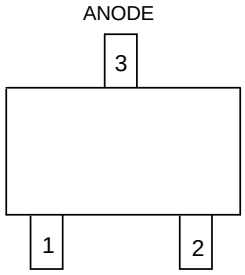
- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 4.5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages: TO92, SOT23, SOT89
  - **Totally Lead-Free; RoHS Compliant (Notes 1 & 2)**
- Lead-Free Packages, Available in "Green" Molding Compound: TO92, SOT23
  - **Totally Lead-Free & Fully RoHS Compliant (Notes 1 & 2)**
  - **Halogen and Antimony Free. "Green" Device (Note 3)**

Applications

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

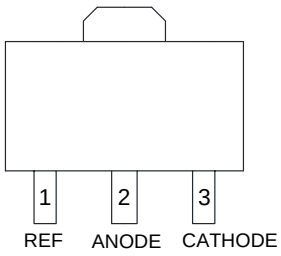
Pin Assignments

(Top View)



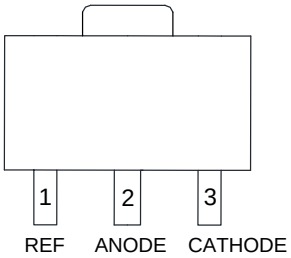
SOT23

(Top View)



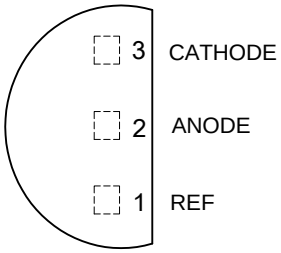
SOT89 (Option 1)

(Top View)



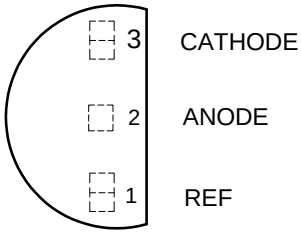
SOT89 (Option 2)

(Top View)



TO92 (Bulk Packing)

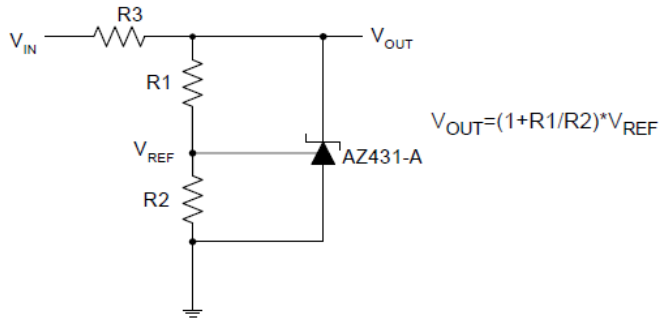
(Top View)



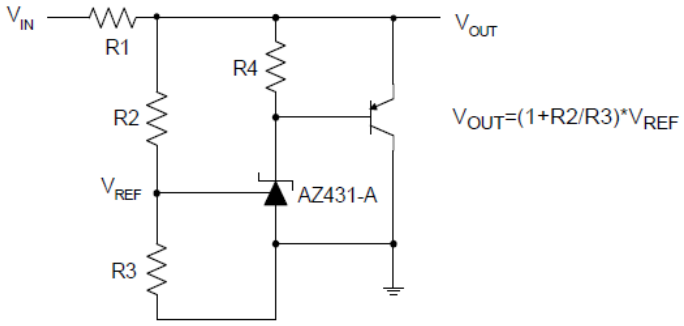
TO92 (Ammo Packing)

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.

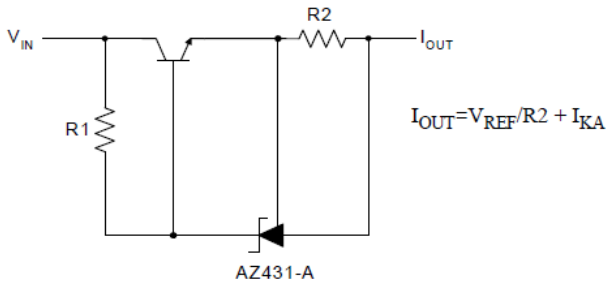
Typical Applications Circuit



Shunt Regulator

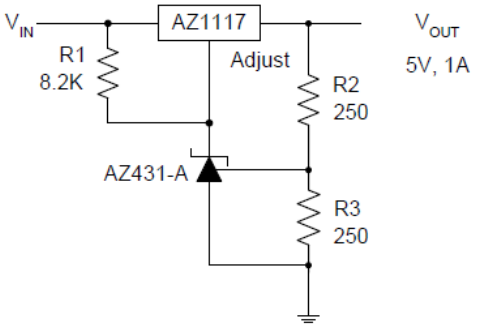


High Current Shunt Regulator

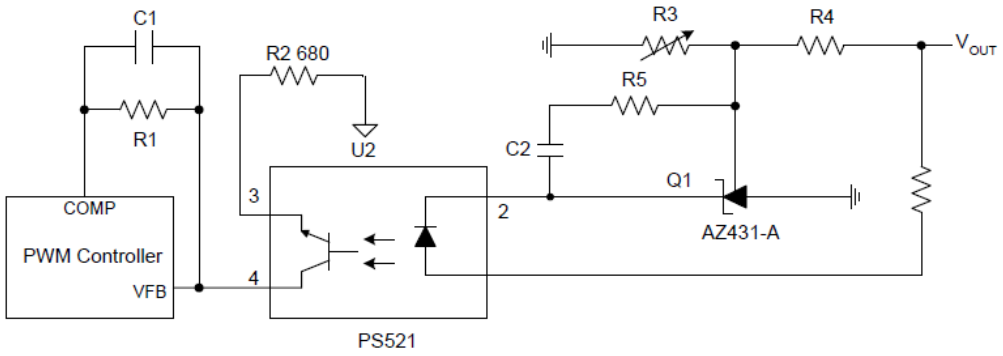


Current Source or Current Limit

Typical Applications Circuit (Cont.)

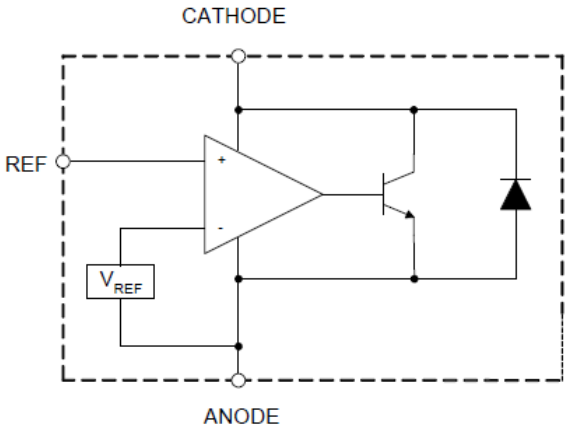


Precision 5V 1A Regulator



PWM Converter with Reference

Functional Block Diagram



Absolute Maximum Ratings (Note 4)

Symbol	Parameter		Rating	Unit
V_{KA}	Cathode Voltage		40	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 Package: 370	
θ_{JA}	Thermal Resistance (Junction to Ambient)	SOT23	380	°C/W
		TO92	165	
		SOT89	165	
T_J	Junction Temperature		+150	°C
T_{STG}	Storage Temperature Range		-65 to +150	°C
ESD	ESD (Human Body Model)		2000	V

Note 4: 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.

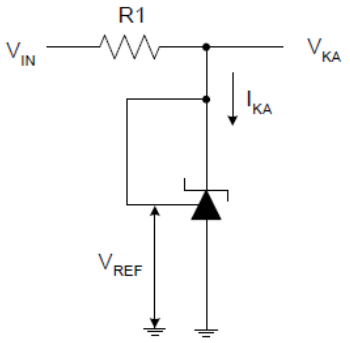
Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	1.0	100	mA
T_A	Operating Ambient Temperature Range	-40	+125	℃

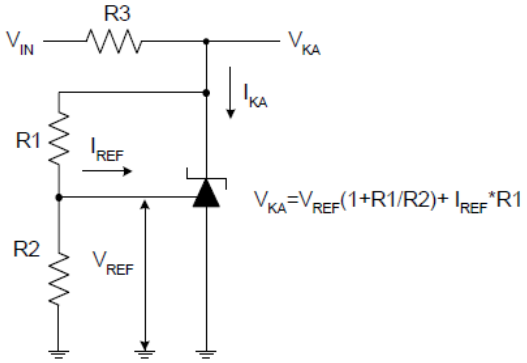
Electrical Characteristics (@T_A = +25°C, unless otherwise specified.)

Symbol	Test Circuit	Parameter		Conditions		Min	Typ	Max	Unit
V_{REF}	4	Reference Voltage	0.4%	$V_{KA} = V_{REF}$, I_{KA} = 10mA		2.490	2.500	2.510	V
			0.8%			2.480	2.500	2.520	
ΔV_{REF}	4	Deviation of Reference Voltage Over Full Temperature Range		$V_{KA} = V_{REF}$ I_{KA} = 10mA	0 to +70°C	—	4.5	8	mV
					-40 to +85°C	—	4.5	10	
					-40 to +125°C	—	4.5	16	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	5	Ratio of Change in Reference Voltage to the Change in Cathode Voltage		I_{KA} = 10mA	ΔV_{KA} = 10V to V_{REF}	—	-1.0	-2.7	mV/V
					ΔV_{KA} = 36V to 10V	—	-0.5	-2.0	
I_{REF}	5	Reference Current		I_{KA} = 10mA, R1 = 10kΩ, R2 = ∞		—	0.7	4	μA
ΔI_{REF}	5	Deviation of Reference Current Over Full Temperature Range		I_{KA} = 10mA, R1 = 10kΩ R2 = ∞, T_A = -40 to +125°C		—	0.4	1.2	μA
I_{KA} (Min)	4	Minimum Cathode Current for Regulation		$V_{KA} = V_{REF}$		—	0.4	1.0	mA
I_{KA} (Off)	6	Off-state Cathode Current		V_{KA} = 36V, V_{REF} = 0		—	0.05	1.0	μA
Z_{KA}	4	Dynamic Impedance		$V_{KA} = V_{REF}$, I_{KA} = 1 to 100mA, f ≤ 1.0kHz		—	0.15	0.5	Ω
θ_{JC}	—	Thermal Resistance		SOT23		—	135.48	—	°C/W
	—			TO92		—	81.63	—	
	—			SOT89		—	29.80	—	

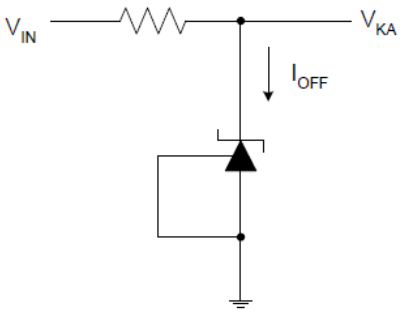
Electrical Characteristics (Cont.)



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



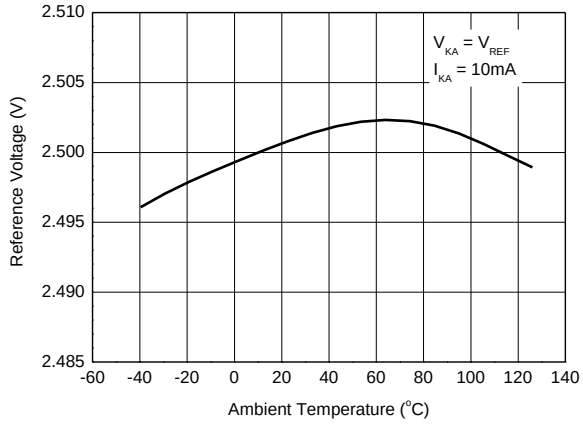
Test Circuit 5 for $V_{KA} > V_{REF}$



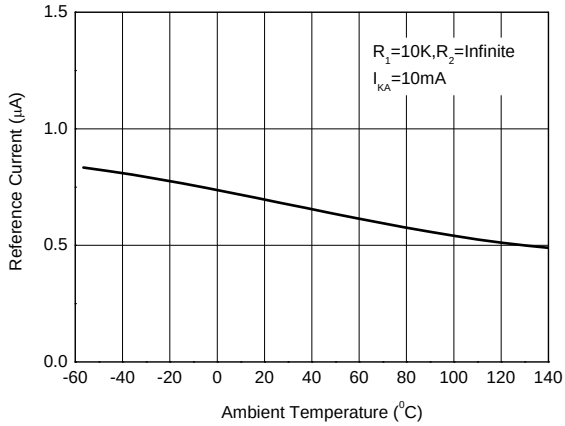
Test Circuit 6 for I_{OFF}

Performance Characteristics

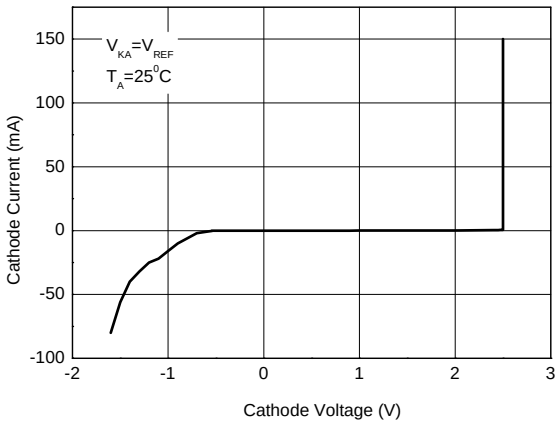
Reference Voltage vs. Ambient Temperature



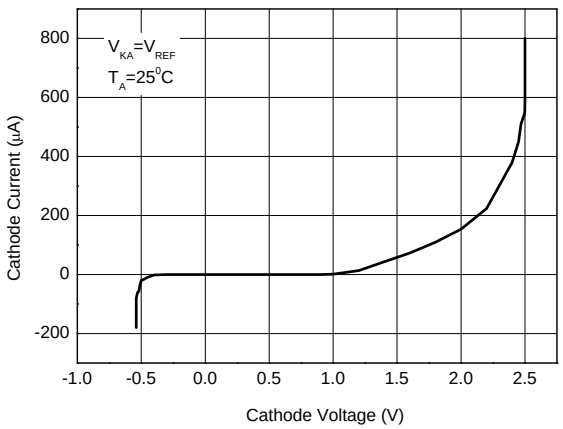
Reference Current vs. Ambient Temperature



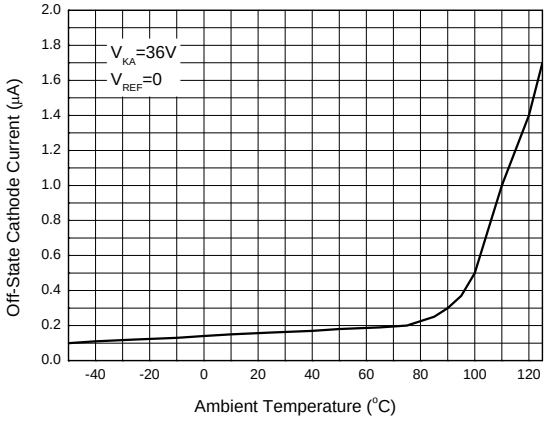
Cathode Current vs. Cathode Voltage



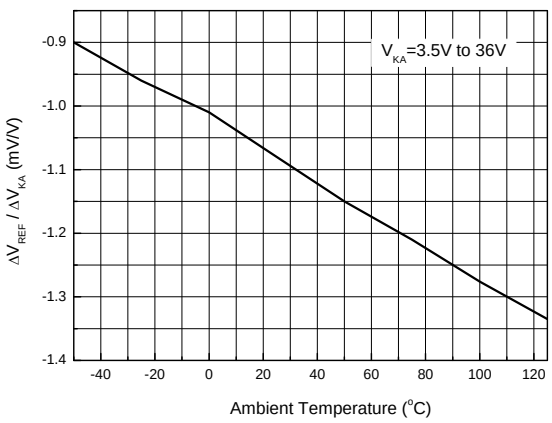
Cathode Current vs. Cathode Voltage



Off-State Cathode Current vs. Ambient Temperature

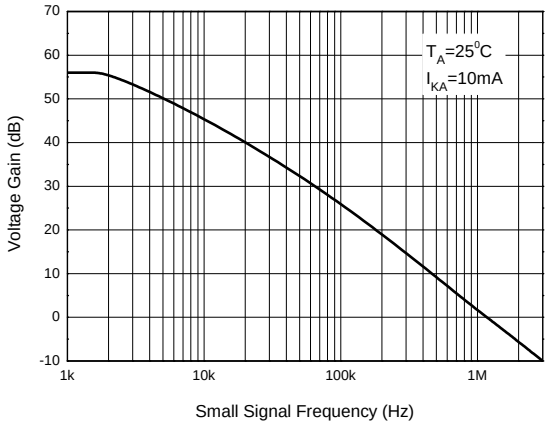


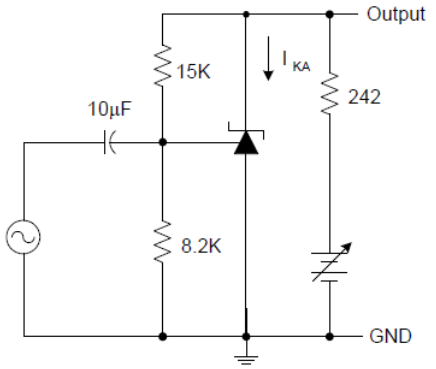
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



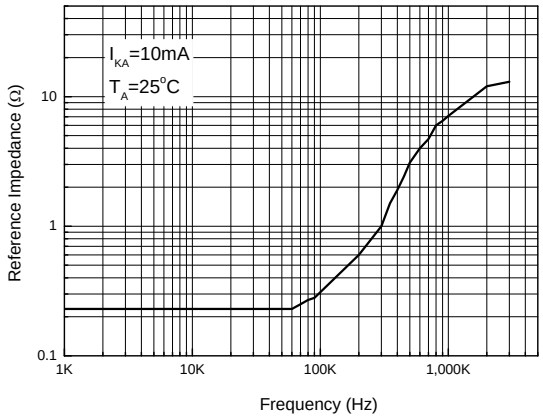
Performance Characteristics (Cont.)

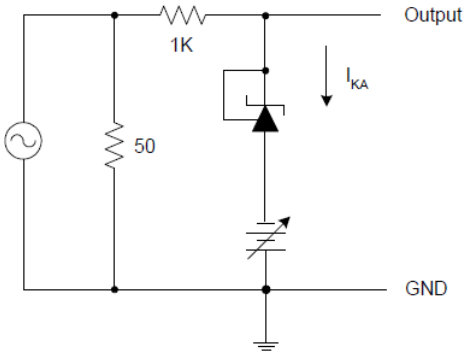
Small Signal Voltage Gain vs. Frequency



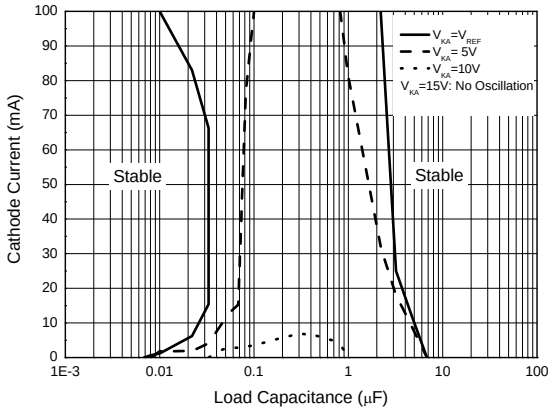


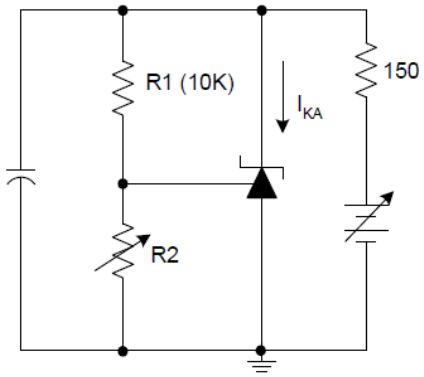
Reference Impedance vs. Frequency





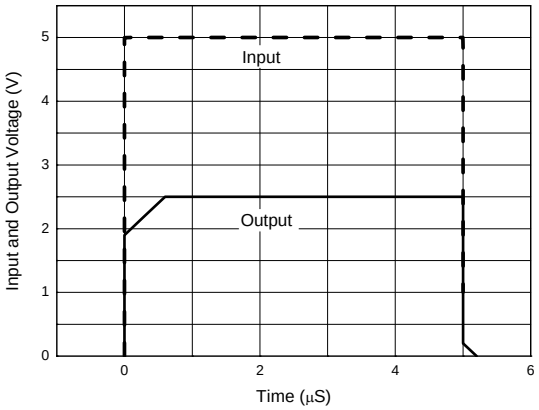
Stability Boundary Conditions vs. Load Capacitance

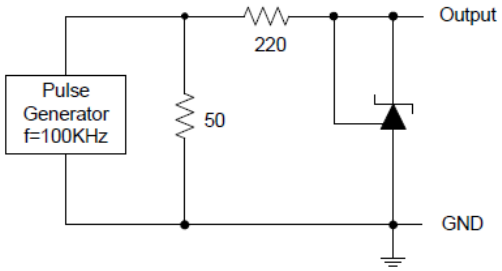




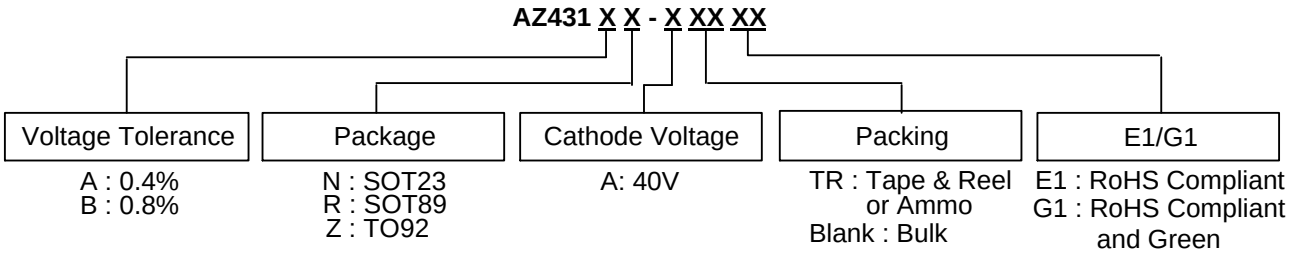
Performance Characteristics (Cont.)

Pulse Response of Input and Output Voltage





Ordering Information



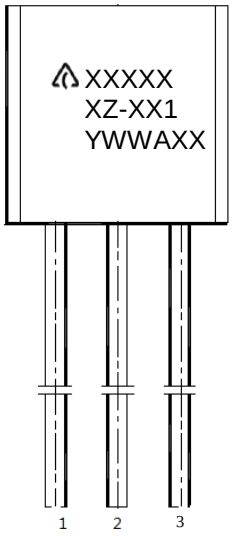
	Part Number	Voltage Tolerance	Package (Note 6)	RoHS Compliant Lead Free / Green	Marking ID	Packing	Quantity	Status (Note 5)	Alternative
Lead-Free	AZ431AN-ATRE1	0.4%	SOT23	Lead Free	EA1	Tape & Reel	3000	NRND	AZ431AN-ATRG1
Lead-Free	AZ431BN-ATRE1	0.8%		Lead Free	EA2	Tape & Reel	3000	NRND	AZ431BN-ATRG1
Lead-free Green	AZ431AN-ATRG1	0.4%		Green	GA1	Tape & Reel	3000	In Production	—
Lead-free Green	AZ431BN-ATRG1	0.8%		Green	GA2	Tape & Reel	3000	In Production	—
Lead-Free	AZ431AK-ATRE1	0.4%	SOT25	Lead Free	E3A	Tape & Reel	3000	End of Life	None
Lead-Free	AZ431BK-ATRE1	0.8%		Lead Free	E3B	Tape & Reel	3000	End of Life	None
Lead-free Green	AZ431AK-ATRG1	0.4%		Green	G3A	Tape & Reel	3000	End of Life	None
Lead-free Green	AZ431BK-ATRG1	0.8%		Green	G3B	Tape & Reel	3000	End of Life	None
	AZ431AZ-AE1	0.4%	TO92	Lead Free	AZ431AZ-AE1	Bulk	1000	In Production	—
Lead-Free	AZ431AZ-ATRE1	0.4%		Lead Free	AZ431AZ-AE1	Ammo	2000	In Production	—
Lead-Free	AZ431BZ-AE1	0.8%		Lead Free	AZ431BZ-AE1	Bulk	1000	In Production	—
Lead-Free	AZ431BZ-ATRE1	0.8%		Lead Free	AZ431BZ-AE1	Ammo	2000	In Production	—
	AZ431AZ-AG1	0.4%		Green	AZ431AZ-AG1	Bulk	1000	End of Life	AZ431AZ-ATRG1
Lead-free Green	AZ431AZ-ATRG1	0.4%		Green	AZ431AZ-AG1	Ammo	2000	In Production	—
Lead-free Green	AZ431BZ-AG1	0.8%		Green	AZ431BZ-AG1	Bulk	1000	End of Life	AZ431BZ-ATRG1
Lead-free Green	AZ431BZ-ATRG1	0.8%		Green	AZ431BZ-AG1	Ammo	2000	In Production	—
Lead-Free	AZ431AR-ATRE1	0.4%	SOT89	Lead Free	E43A	Tape & Reel	1000	NRND	None
Lead-Free	AZ431BR-ATRE1	0.8%		Lead Free	E43B	Tape & Reel	1000	NRND	None
Lead-free Green	AZ431AR-ATRG1	0.4%		Green	G43A	Tape & Reel	1000	End of Life	None
Lead-free Green	AZ431BR-ATRG1	0.8%		Green	G43B	Tape & Reel	1000	End of Life	None

Notes: 5. All variants with SOT25 package are End of Life without alternatives.
NRND: Not Recommended for New Design.
6. For packaging details, go to our website at: https://www.diodes.com/design/support/packaging/diodes-packaging/.

Marking Information

(1) TO92 (Bulk Packing)

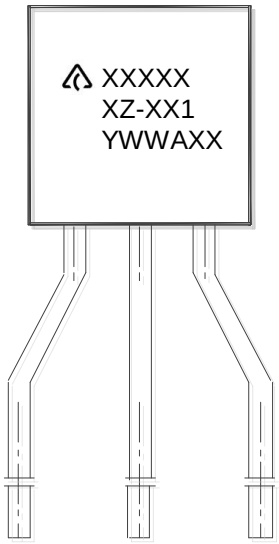
(Top View)



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: 7th and 8th Digits of Batch Number

(2) TO92 (Ammo Packing)

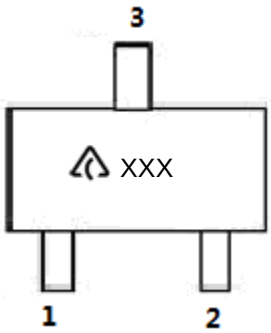
(Top View)



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: 7th and 8th Digits of Batch Number

(3) SOT23

(Top View)

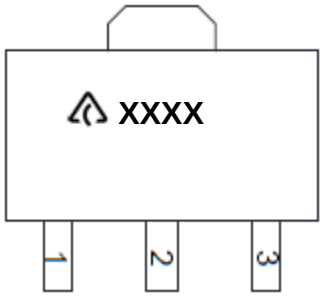


: Logo
XXX: Marking ID
(See Ordering Information)

Marking Information (Cont.)

(4) SOT89

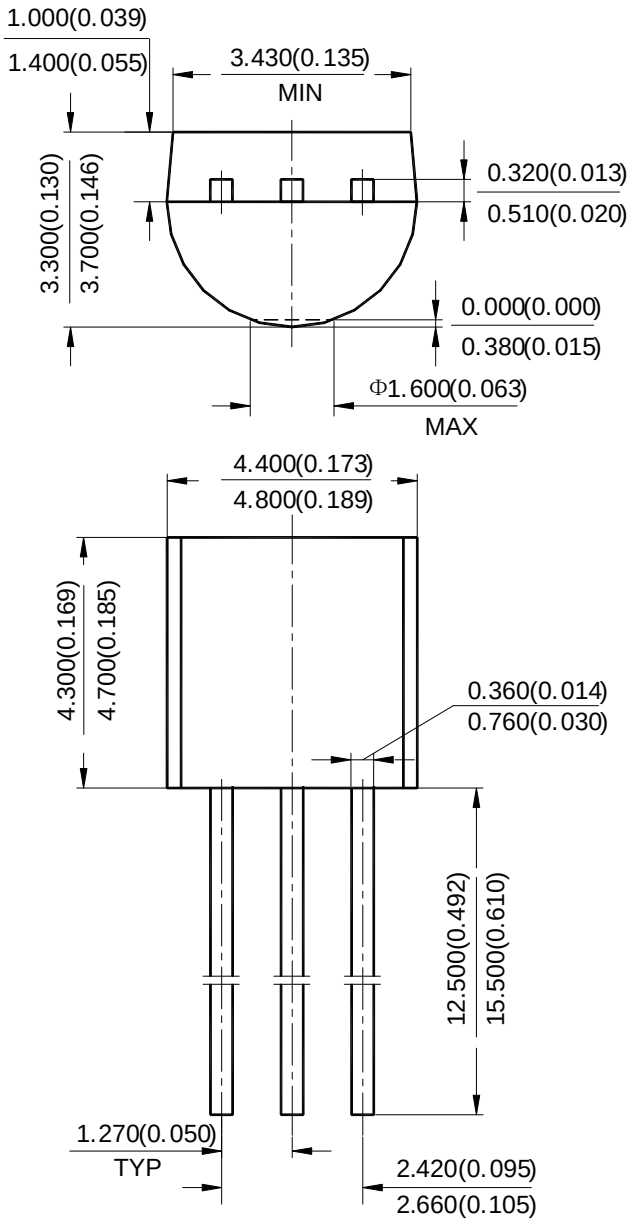
(Top View)



: Logo
XXXX: Marking ID
(See Ordering Information)

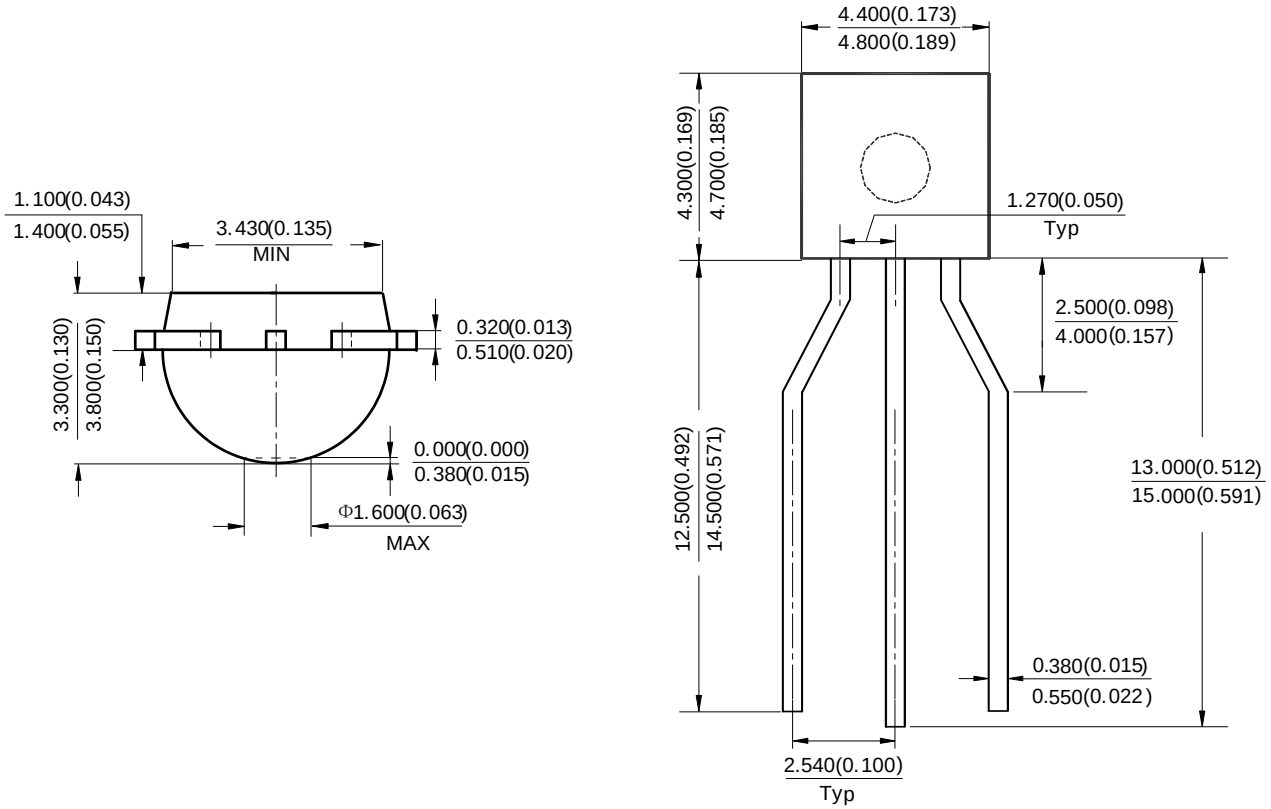
Package Outline Dimensions (All dimensions in mm.)

(1) Package Type: TO92 (Bulk Packing)



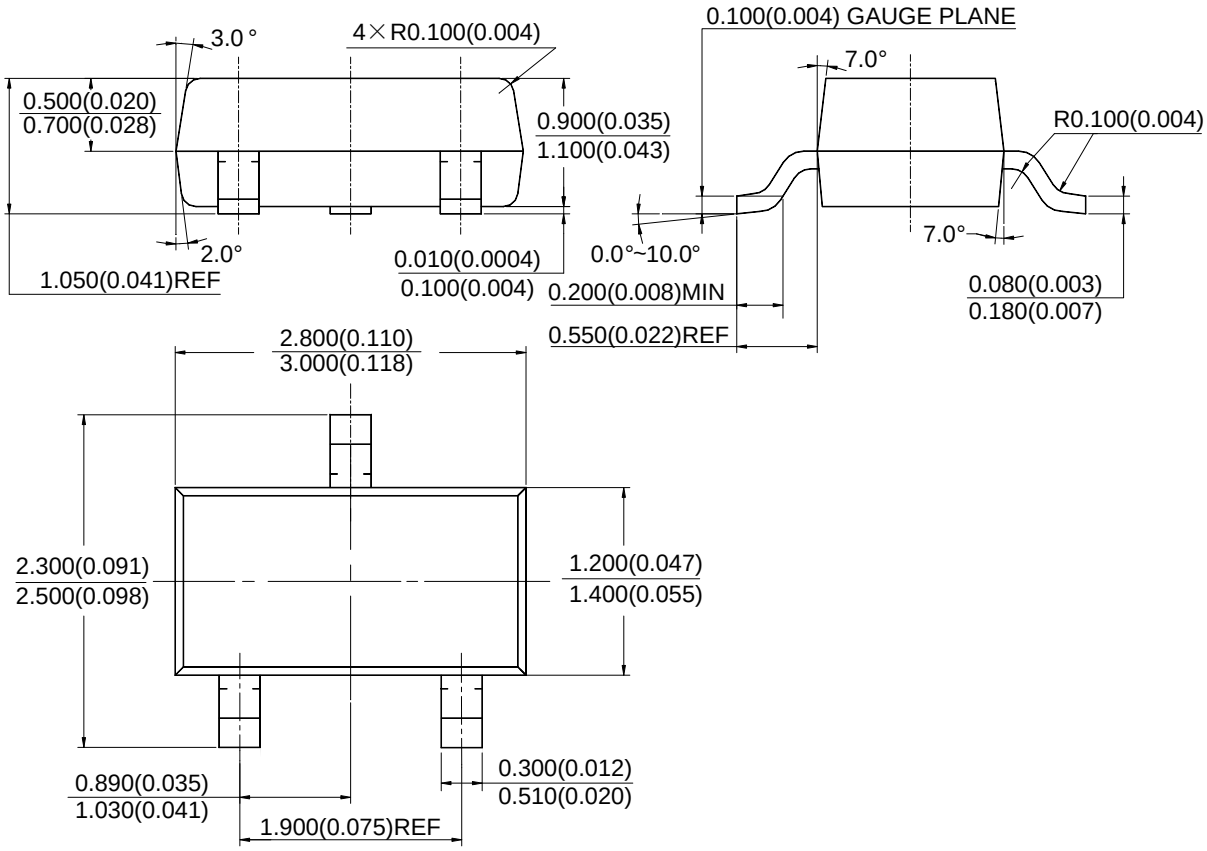
Package Outline Dimensions (Cont. All dimensions in mm.)

(2) Package Type: TO92 (Ammo Packing)



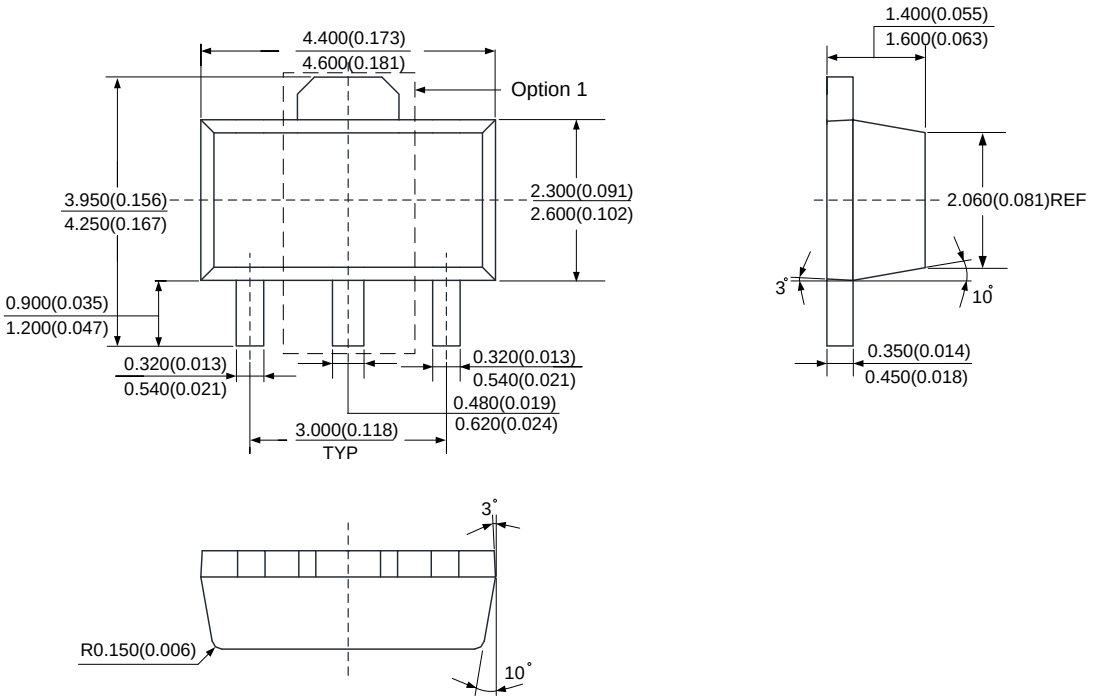
Package Outline Dimensions (Cont. All dimensions in mm.)

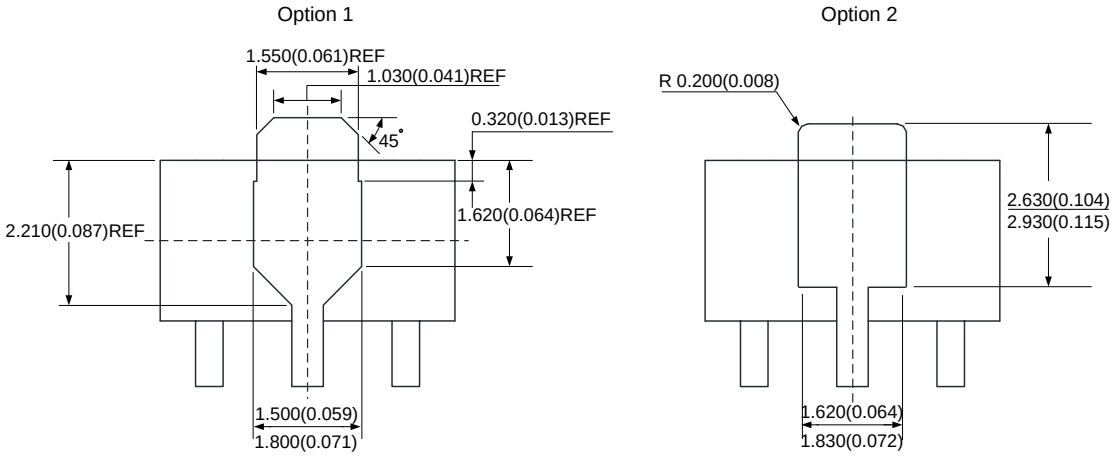
(3) Package Type: SOT23



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

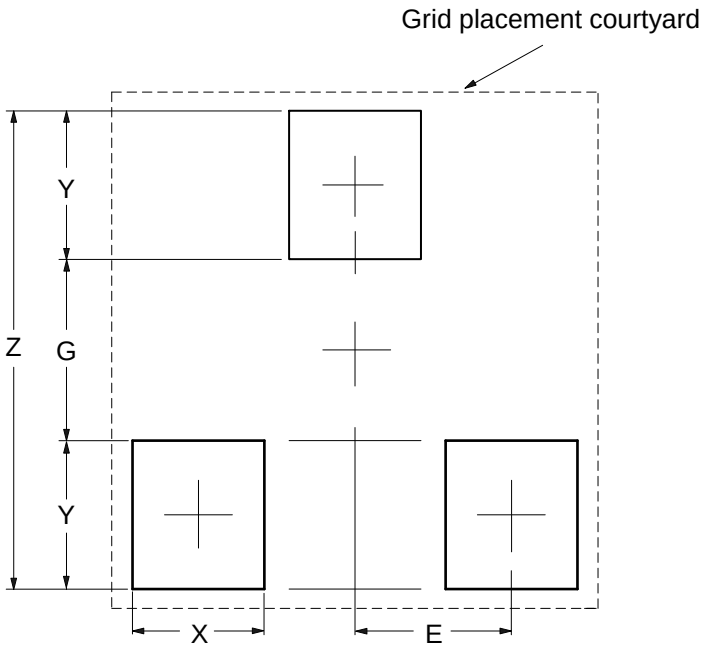
(4) Package Type: SOT89





Suggested Pad Layout

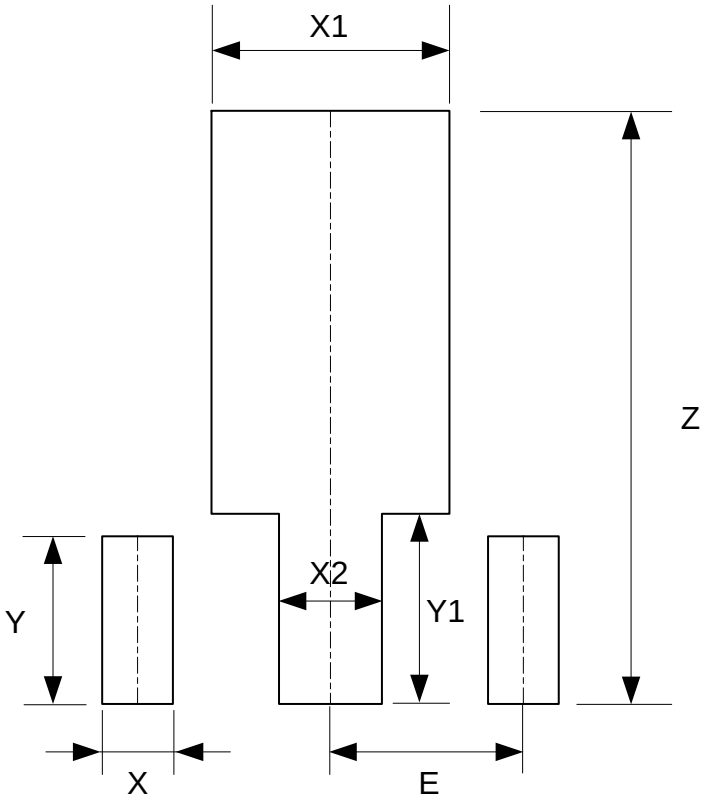
(1) Package Type: SOT23



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: 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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