AS431I

LOW CATHODE CURRENT ADJUSTABLE PRECISION SHUNT REGULATOR

Description

The AS431I 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 AS431I can be set to any value between V_{REF} (2.5V) and the corresponding maximum cathode voltage (36V).

The AS431I is offered in two grade initial voltage tolerance at +25°C, 0.5%, and 1%.

This IC is available in 3 packages: TO-92 (bulk or ammo packing), SOT-23 and SOT-89.

Features

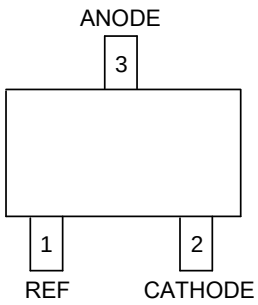
- Programmable Precise Output Voltage from 2.5V to 36V
- High Stability Under Capacitive Load
- Low Minimum Cathode Current for Regulation: 10μA (Typ.), 50μA (Max.)
- Low Temperature Deviation: 4.5mV Typical
- Sink Current Capacity from 50μA to 100mA
- Low Output Noise
- Wide Operating Range: -40 to +125°C

Applications

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

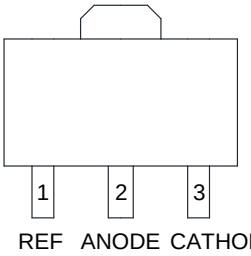
Pin Assignments

(Top View)



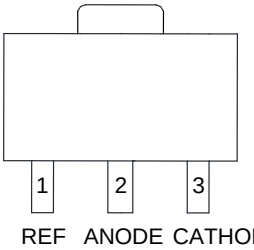
(SOT-23/ N Package)

(Top View)



(SOT-89 (Option 1/ R Package)

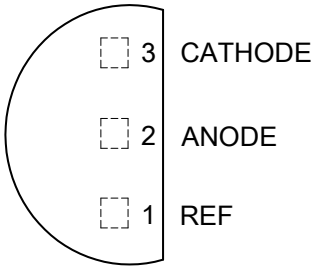
(Top View)



(SOT-89 (Option 2/ R Package)

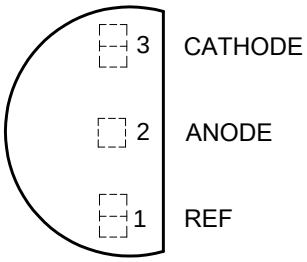
Pin Assignments (Cont.)

(Top View)



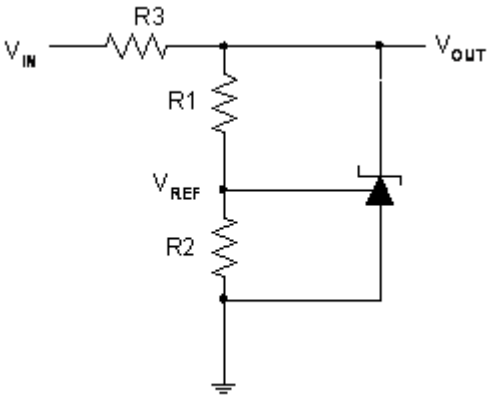
(TO-92 (Bulk Packing)/ Z Package)

(Top View)



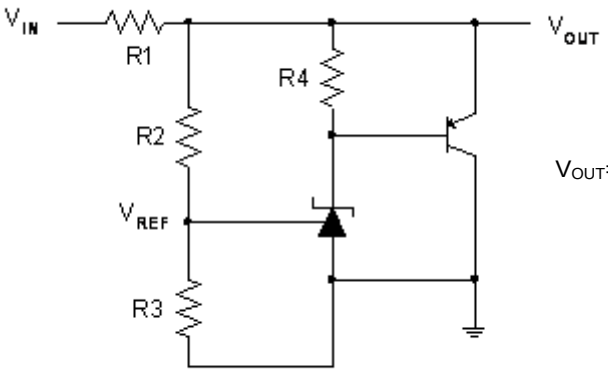
(TO-92 (Ammo Packing)/ Z Package)

Typical Applications Circuit



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

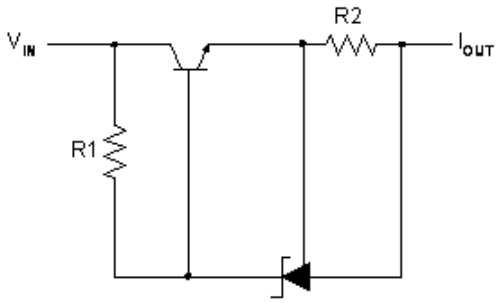
Shunt Regulator



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

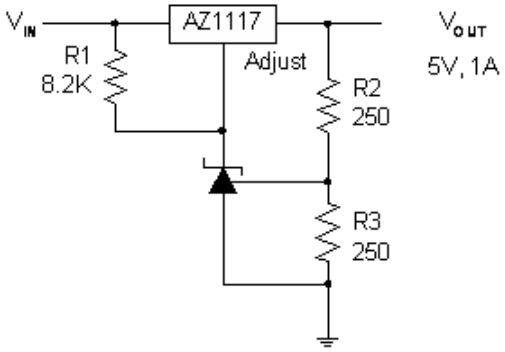
High Current Shunt Regulator

Typical Applications Circuit (Cont.)

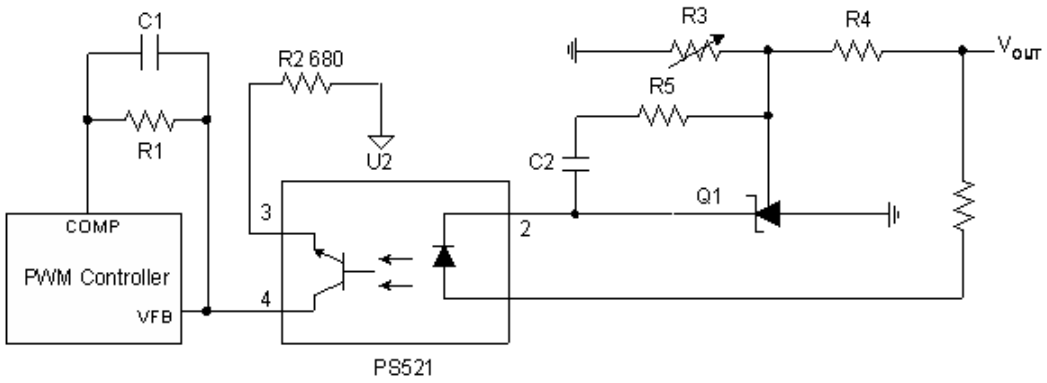


$I_{OUT}=V_{REF}/R2+ I_{KA}$

Current Source or Current Limit

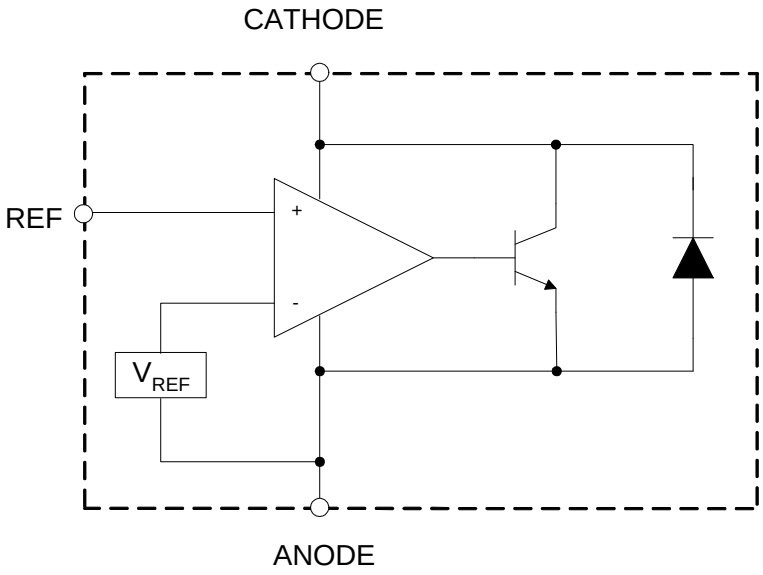


Precision 5V 1A Regulator



PWM Converter with Reference

Functional Block Diagram



Absolute Maximum Ratings (Note 1)

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	TO-92	770	mW
		SOT-89	770	
		SOT-23	370	
T_J	Junction Temperature	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
ESD	ESD (Human Body Model)	2000		V

Note 1: 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.

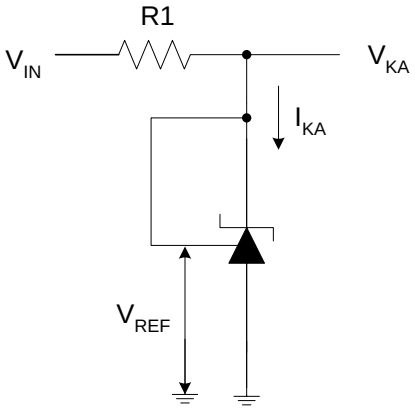
Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	0.05	100	mA
T_A	Operating Ambient Temperature Range	-40	+125	°C

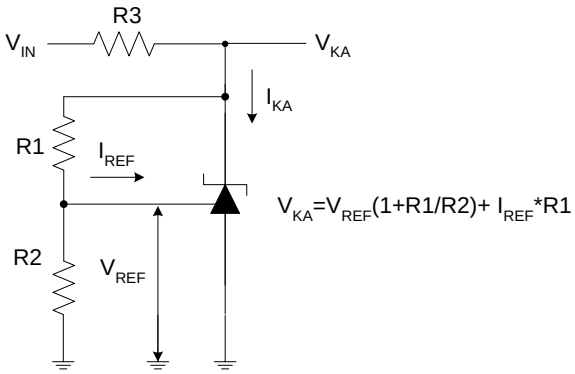
Electrical Characteristics (Operating Conditions: T_A = +25ºC, unless otherwise specified.)

Symbol	Parameter		Test Circuit	Conditions		Min	Typ	Max	Unit
V_{REF}	Reference Voltage	0.5%	4	$V_{KA} = V_{REF}$, I_{KA} = 10mA		2.487	2.500	2.512	V
		1.0%				2.475	2.500	2.525	
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range		4	$V_{KA} = V_{REF}$, 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	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage		5	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}	Reference Current		5	I_{KA} = 10mA, R1 = 10KΩ, R2 = ∞		–	0.035	0.5	µA
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		5	I_{KA} = 10mA, R1 = 10KΩ, R2 = ∞, T_A = -40 to +125°C		–	0.03	0.3	µA
I_{KA} (Min)	Minimum Cathode Current for Regulation		4	$V_{KA} = V_{REF}$		–	10	50	µA
I_{KA} (Off)	Off-state Cathode Current		6	V_{KA} = 36V, V_{REF} = 0		–	0.05	1.0	µA
Z_{KA}	Dynamic Impedance		4	$V_{KA} = V_{REF}$, I_{KA} = 1 to 100mA, f ≤ 1.0KHz		–	0.15	0.5	Ω
θ_{JC}	Thermal Resistance		–	TO-92		–	68	–	°C/W
				SOT-89		–	29	–	
				SOT-23		–	113	–	

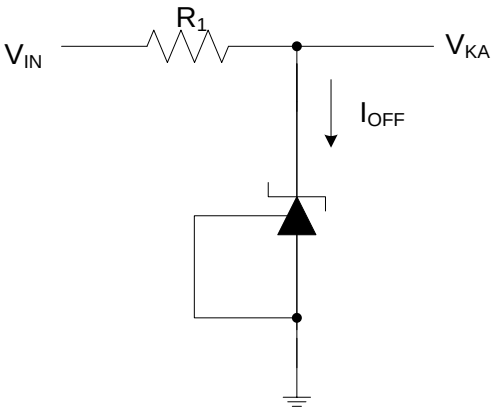
Electrical Characteristics (Cont.)



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



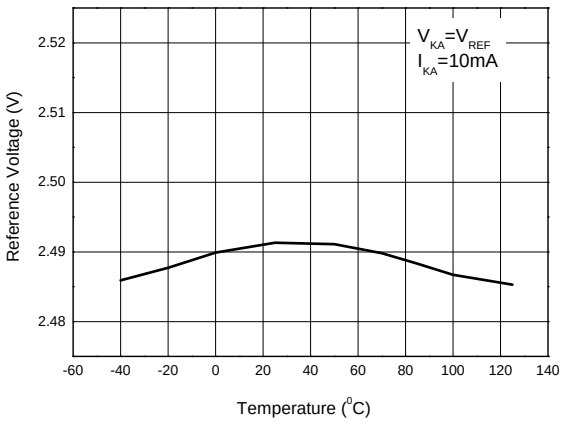
Test Circuit 5 for $V_{KA} > V_{REF}$



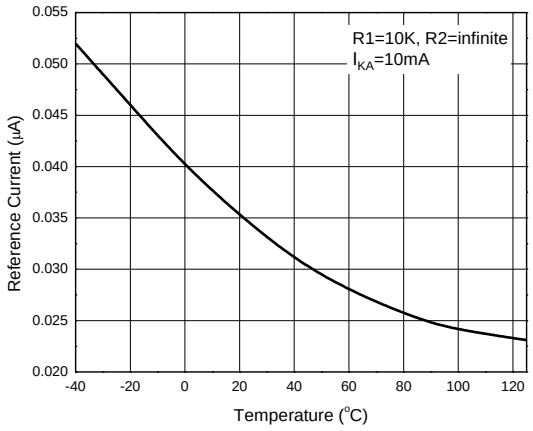
Test Circuit 6 for I_{OFF}

Performance Characteristics

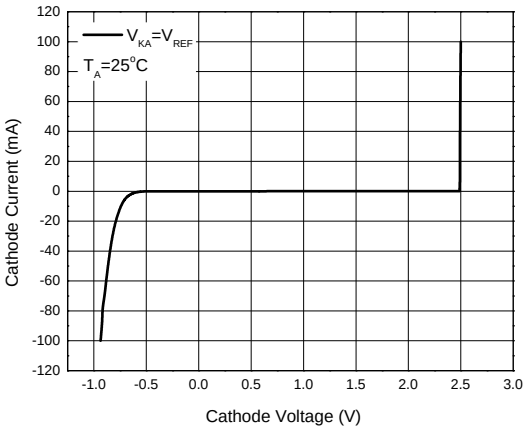
Reference Voltage vs. Ambient Temperature



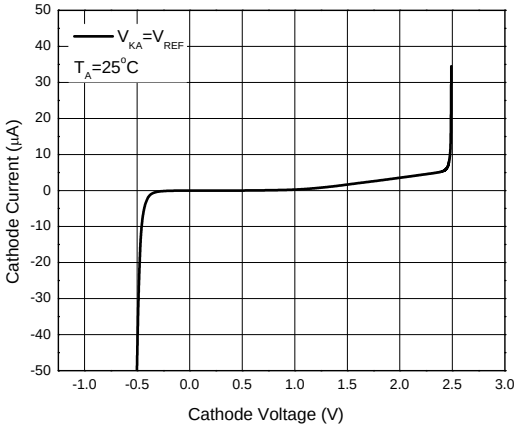
Reference Current vs. Ambient Temperature



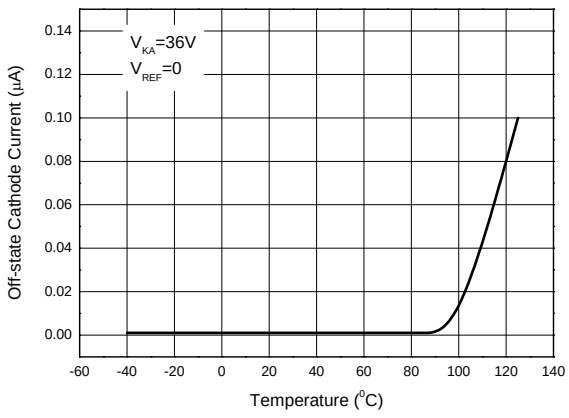
Cathode Current vs. Cathode Voltage



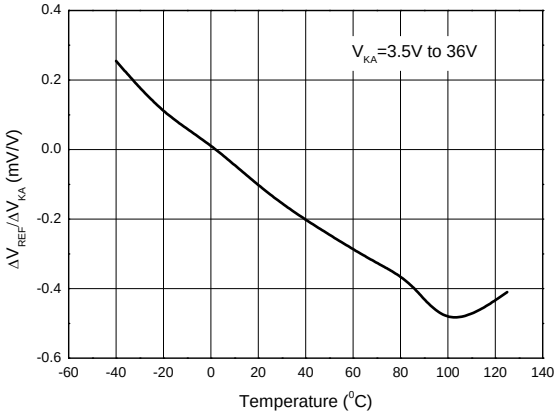
Cathode Current vs. Cathode Voltage



Off-state Cathode Current vs. Ambient Temperature

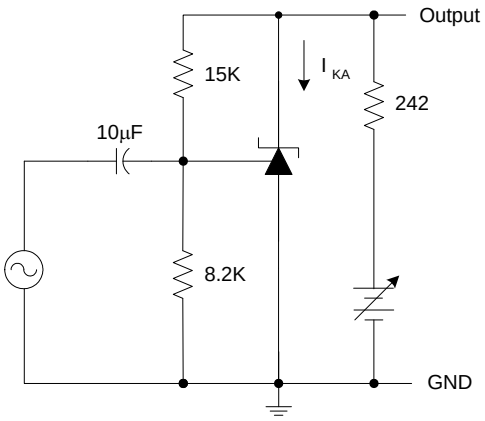


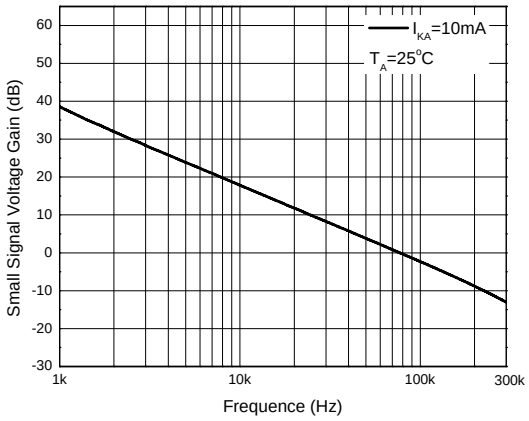
Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage



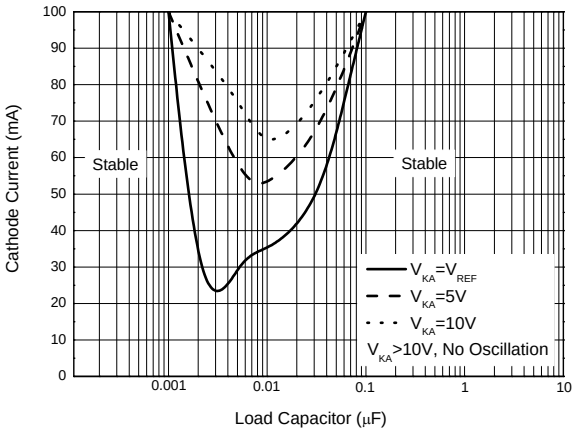
Performance Characteristics (Cont.)

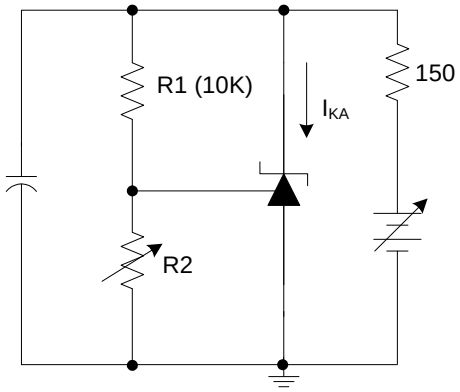
Small Signal Voltage Gain vs. Frequency



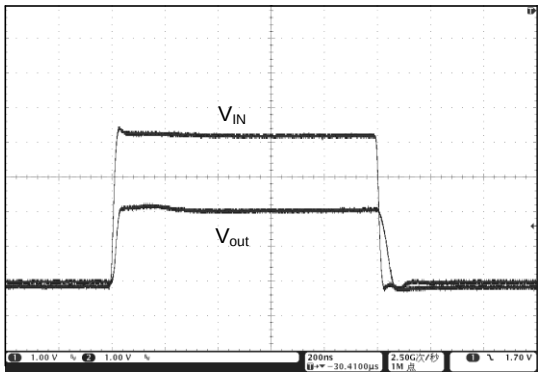


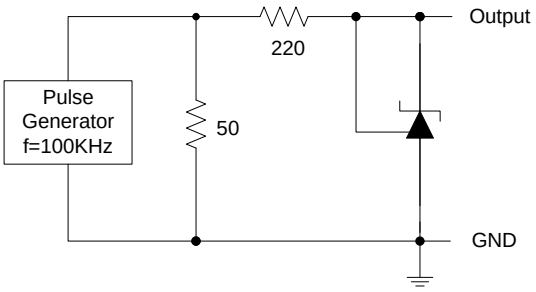
Stability Boundary Conditions vs. Load Capacitance



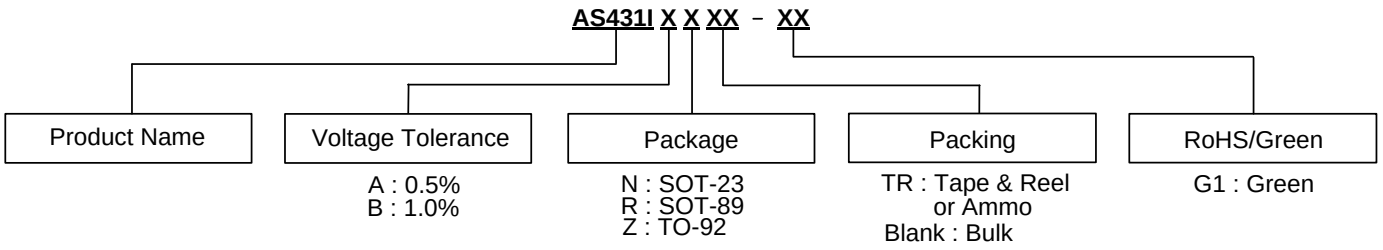


Pulse Response of Input and Output Voltage





Ordering Information

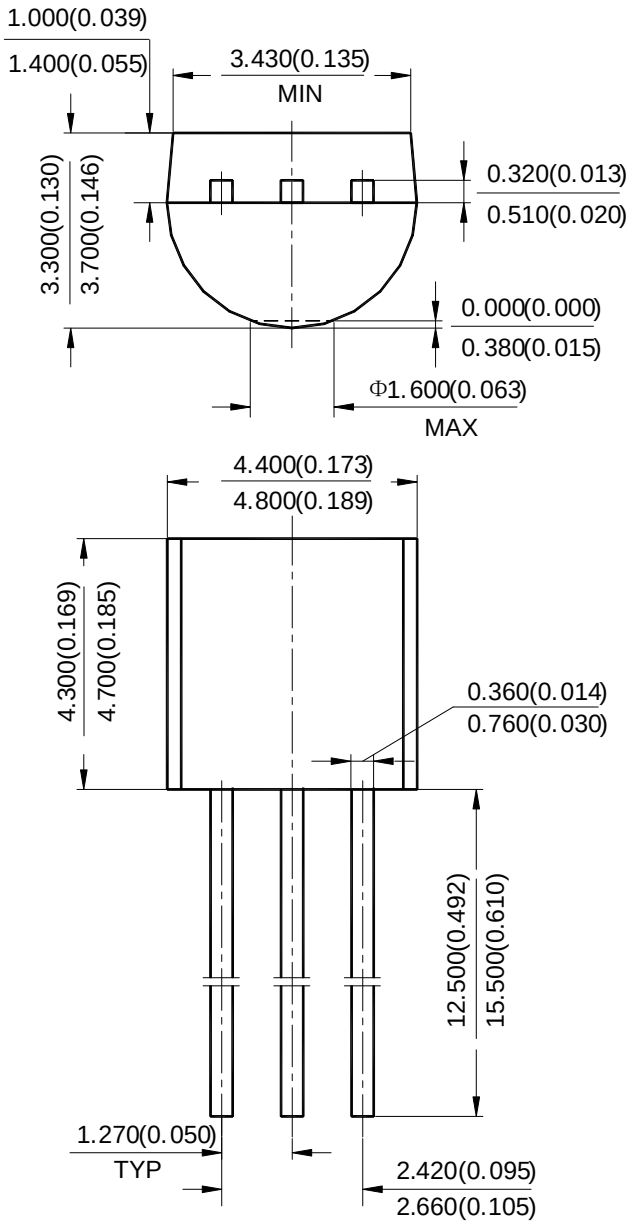


Diodes IC's Pb-free products with "G1" suffix in the part number, are RoHS compliant and green.

Package	Temperature Range	Voltage Tolerance	Part Number	Marking ID	Packing Type
SOT-23	-40 to +125°C	0.5%	AS431IANTR-G1	GB8	Tape & Reel
		1.0%	AS431IBNTR-G1	GC9	Tape & Reel
TO-92	-40 to +125°C	0.5%	AS431IAZ-G1	AS431IAZ-G1	Bulk
		0.5%	AS431IAZTR-G1	AS431IAZ-G1	Ammo
		1.0%	AS431IBZ-G1	AS431IBZ-G1	Bulk
		1.0%	AS431IBZTR-G1	AS431IBZ-G1	Ammo
SOT-89	-40 to +125°C	0.5%	AS431IARTR-G1	G43J	Tape & Reel
		1.0%	AS431IBRTR-G1	G43K	Tape & Reel

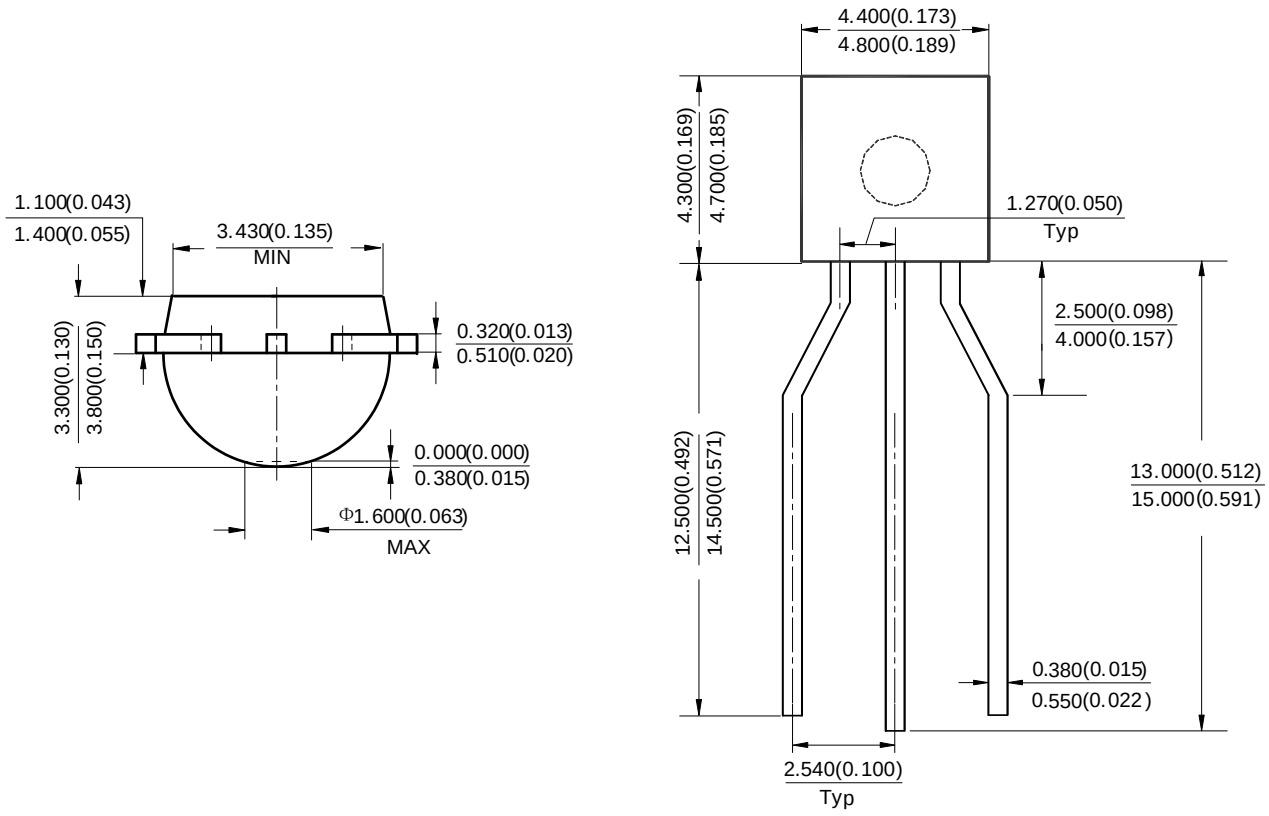
Package Outline Dimensions (All dimensions in mm(inch).)

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



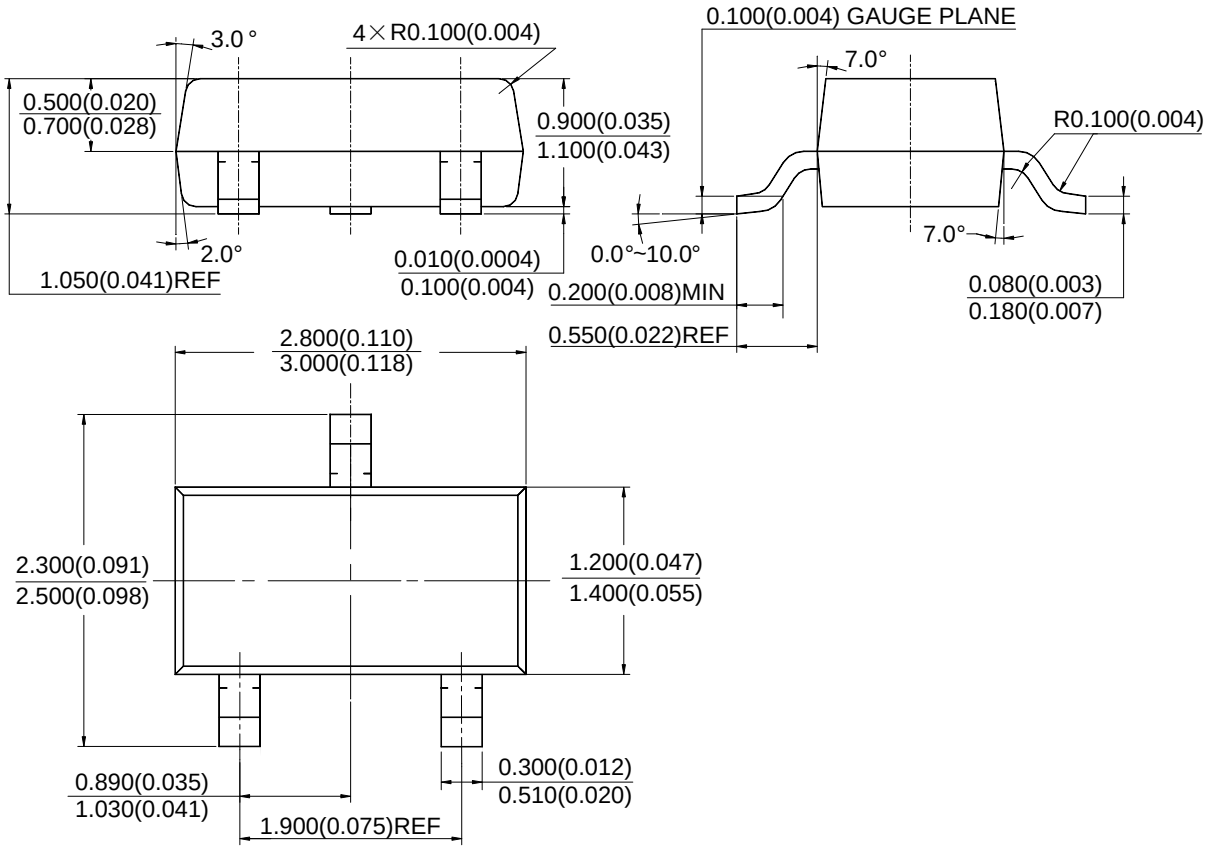
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

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



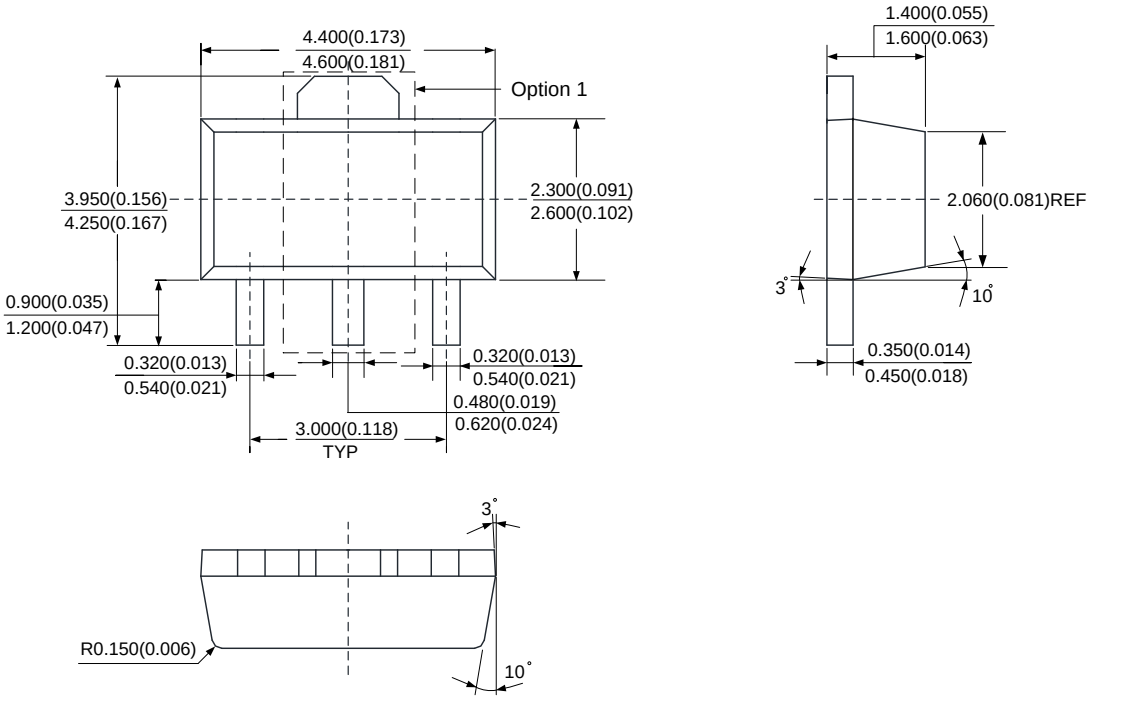
Package Outline Dimensions (Cont. All dimensions in mm(inch).)

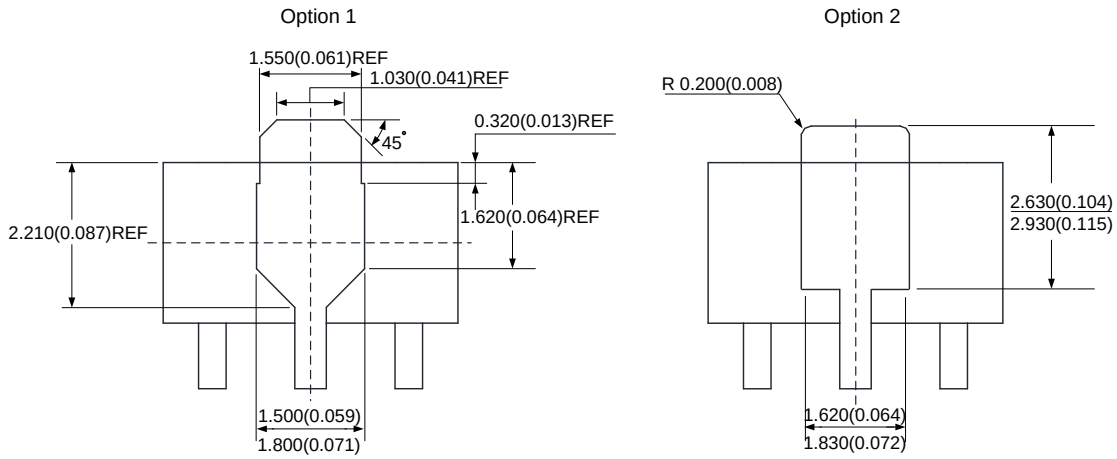
(3) Package Type: SOT-23



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

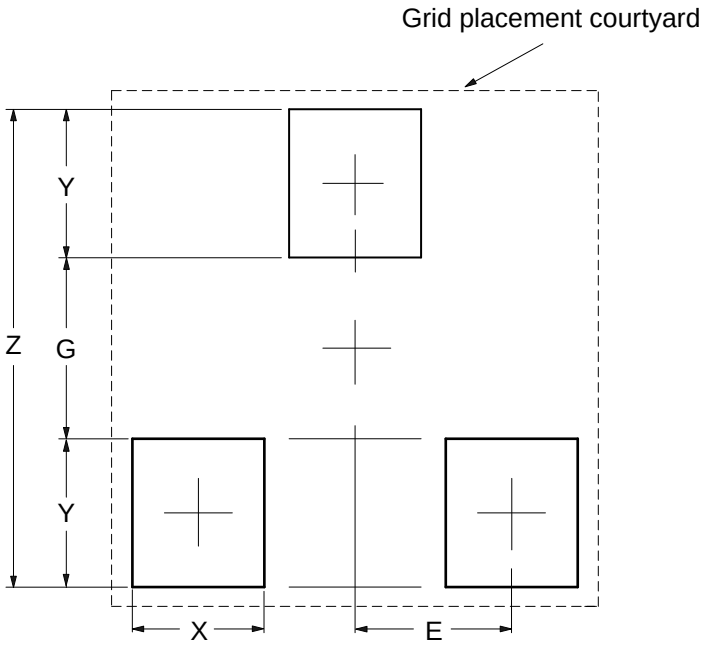
(4) Package Type: SOT-89





Suggested Pad Layout

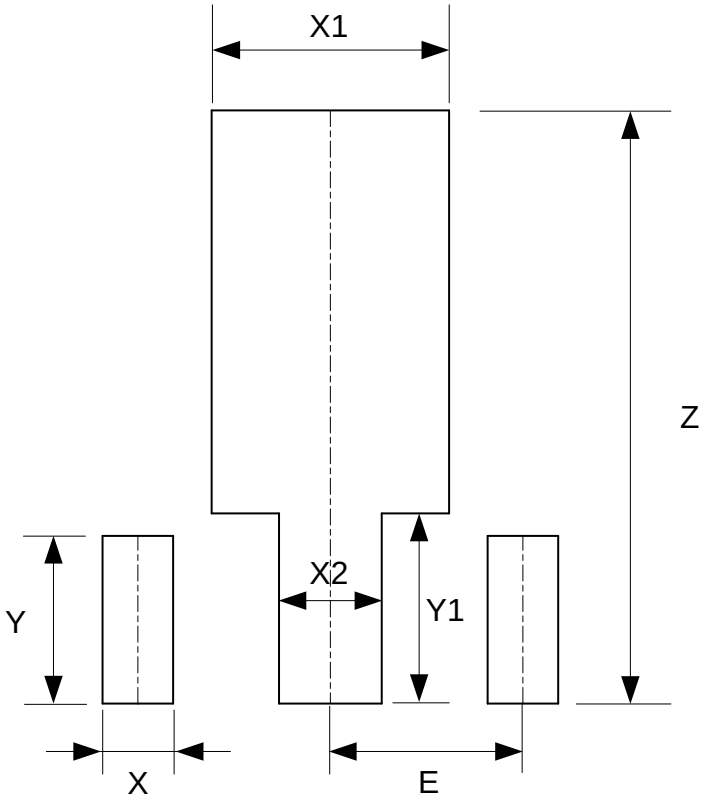
(1) Package Type: SOT-23



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-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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