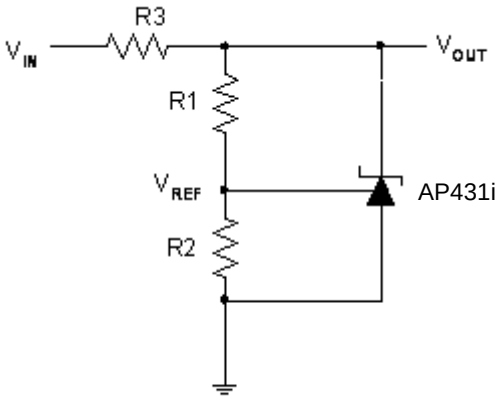
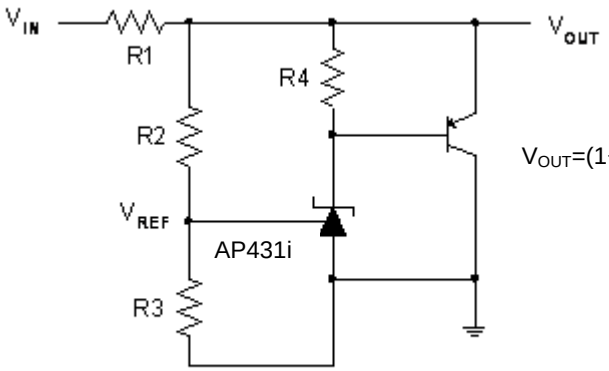
Typical Applications Circuit



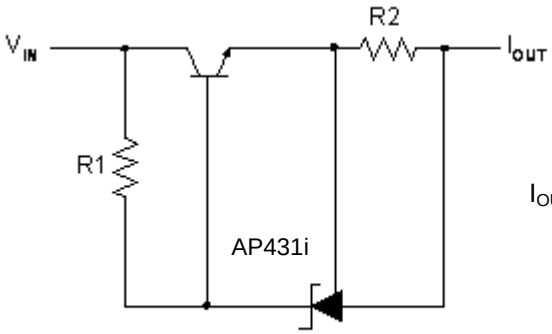
$V_{OUT}=(1+R1/R2) \times V_{REF}$

Shunt Regulator



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

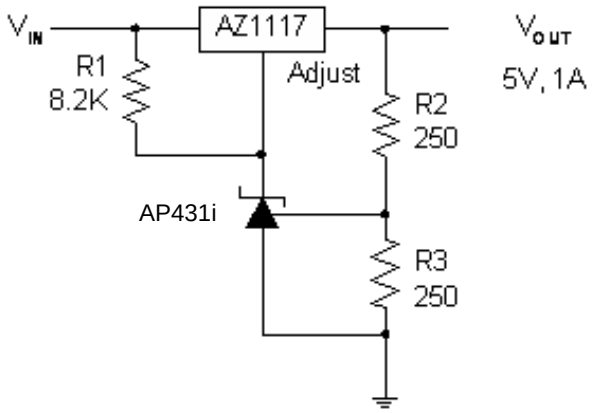
High Current Shunt Regulator



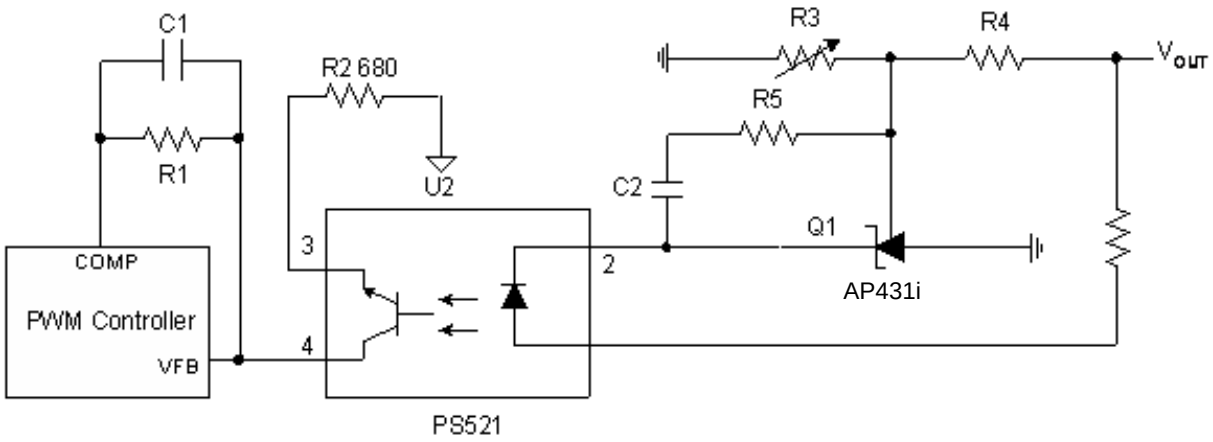
$I_{OUT}=V_{REF}/R2+I_{KA}$

Current Source or Current Limit

Typical Applications Circuit (Cont.)

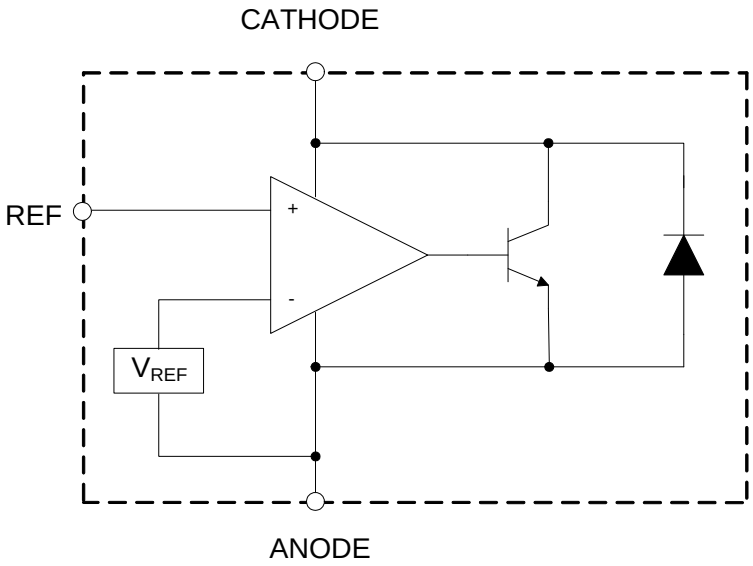


Precision 5V 1A Regulator



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	TO-92	750	mW
		SOT-89	750	
		SOT-23	350	
T_J	Junction Temperature	+150		°C
T_{STG}	Storage Temperature Range	-65 to +150		°C
ESD	ESD (Human Body Model)	5,500		V
ESD	ESD (Machine Model)	300		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.

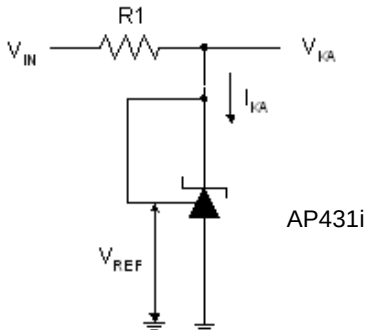
Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
V_{KA}	Cathode Voltage	V_{REF}	36	V
I_{KA}	Cathode Current	0.1	100	mA
T_A	Operating Ambient Temperature Range	-40	+125	°C

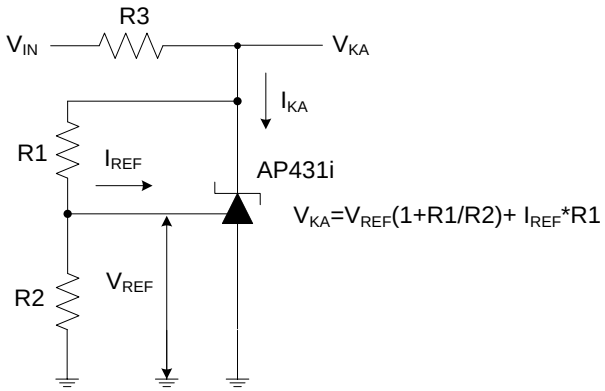
Electrical Characteristics (T_A = +25°C, unless otherwise specified.)

Symbol	Parameter		Test Circuit	Conditions		Min	Typ	Max	Unit
V_{REF}	Reference Voltage	0.5%	4	$V_{KA} = V_{REF}$, I_{KA} = 1mA (AP431iA)		2.487	2.500	2.512	V
				$V_{KA} = V_{REF}$, I_{KA} = 1mA (AP431iHA)		2.483	2.495	2.507	
		1.0%		$V_{KA} = V_{REF}$, I_{KA} = 1mA (AP431iB)		2.475	2.500	2.525	
				$V_{KA} = V_{REF}$, I_{KA} = 1mA (AP431iHB)		2.470	2.495	2.520	
ΔV_{REF}	Deviation of Reference Voltage Over Full Temperature Range		4	$V_{KA} = V_{REF}$ I_{KA} = 1mA	0 to +70°C	—	3	6	mV
					-40 to +85°C	—	6	10	
					-40 to +125°C	—	11	18	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in Reference Voltage to the Change in Cathode Voltage		5	I_{KA} = 1mA	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} = 1mA, R1 = 10kΩ, R2 = ∞		—	0.2	0.5	µA
ΔI_{REF}	Deviation of Reference Current Over Full Temperature Range		5	I_{KA} = 1mA, R1 = 10kΩ R2 = ∞, T_A = -40 to +125°C		—	0.1	0.3	µA
I_{KA} (Min)	Minimum Cathode Current for Regulation		4	$V_{KA} = V_{REF}$		—	50	100	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		—	0.1	0.3	Ω
θ_{JC}	Thermal Resistance		—	TO-92		—	80	—	°C/W
				SOT-89		—	80	—	
				SOT-23		—	140	—	

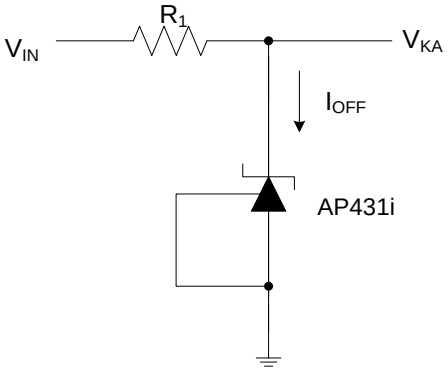
Electrical Characteristics (Cont.)



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



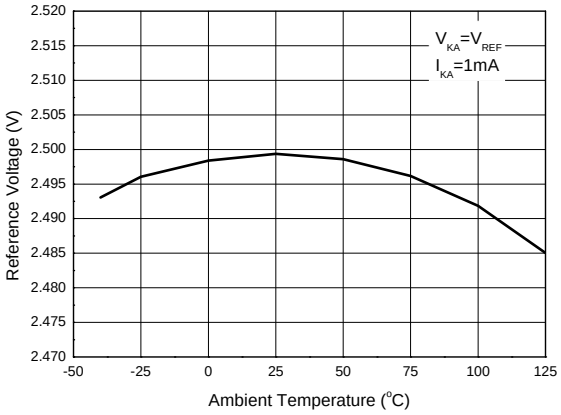
Test Circuit 5 for $V_{KA} > V_{REF}$



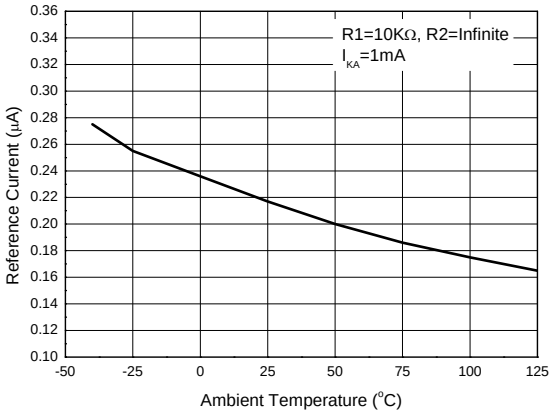
Test Circuit 6 for I_{OFF}

Performance Characteristics

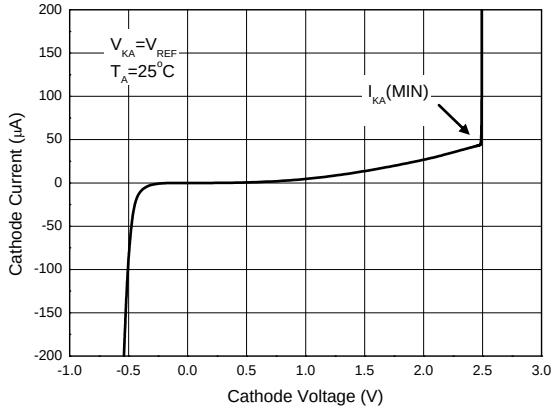
Reference Voltage vs. Ambient Temperature



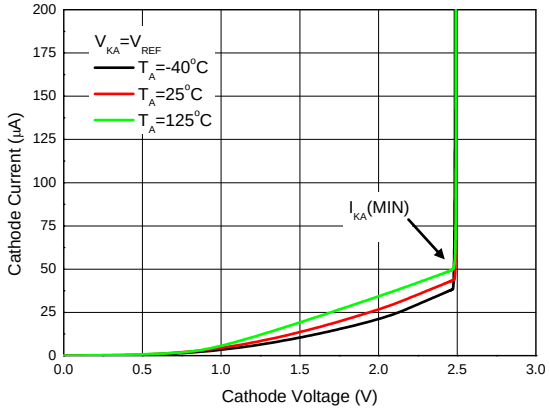
Reference Current vs. Ambient Temperature



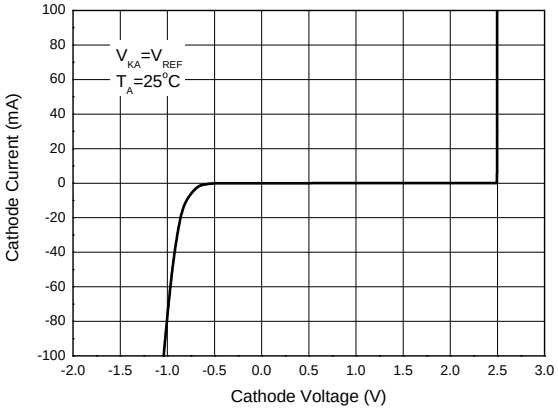
Minimal Cathode Current for Regulation



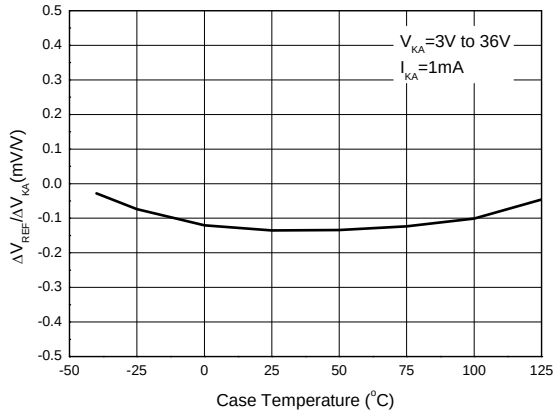
Minimal Cathode Current for Regulation at Different Ambient Temperature



Cathode Current vs. Cathode Voltage

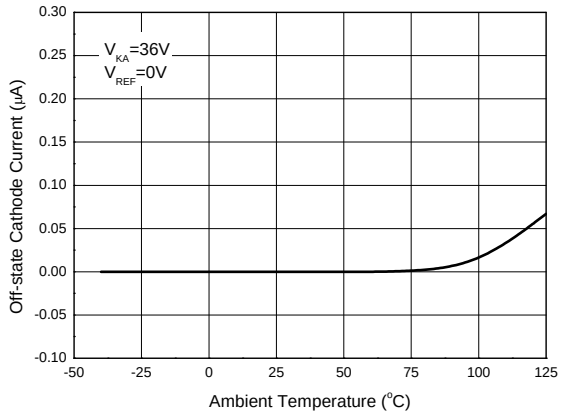


Ratio of Delta Reference Voltage to Delta Cathode Voltage vs. Case Temperature

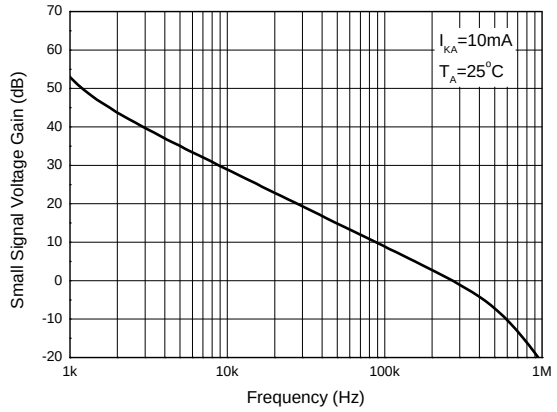


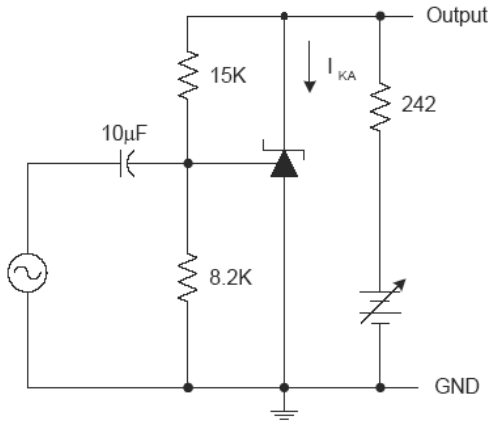
Performance Characteristics (Cont.)

Off-state Cathode Current vs. Ambient Temperature

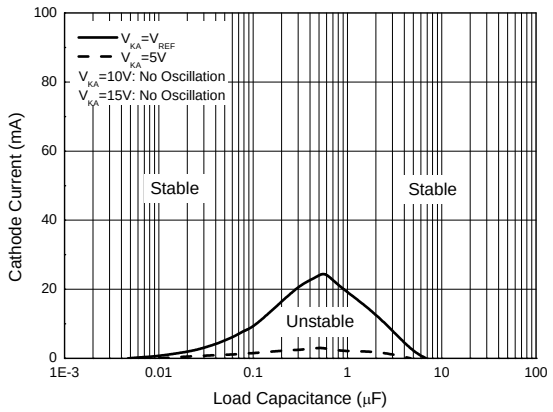


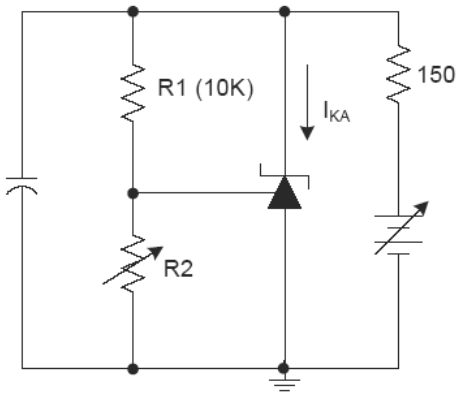
Small Signal Voltage Gain vs. Frequency





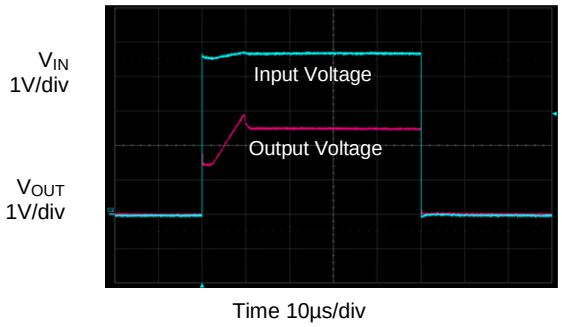
Stability Boundary Conditions

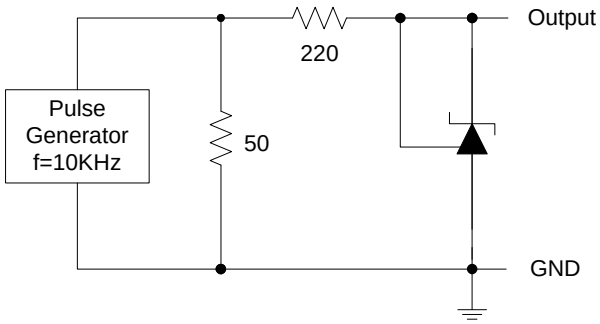




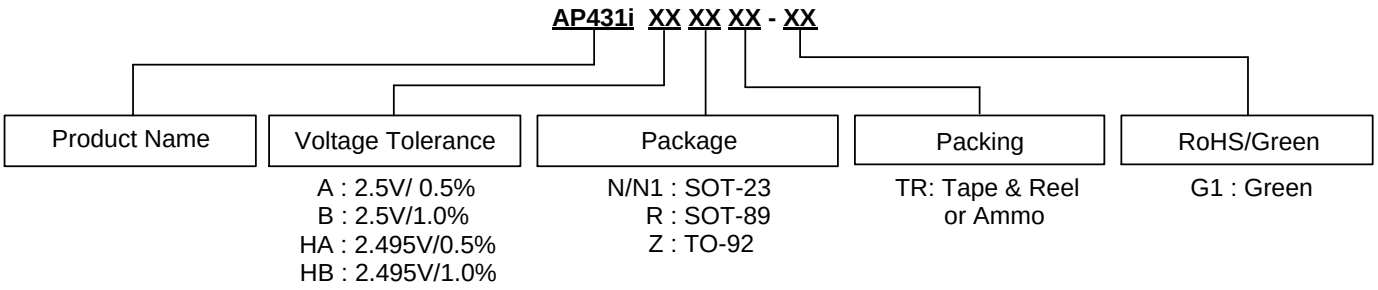
Performance Characteristics (Cont.)

Pulse Response





Ordering Information



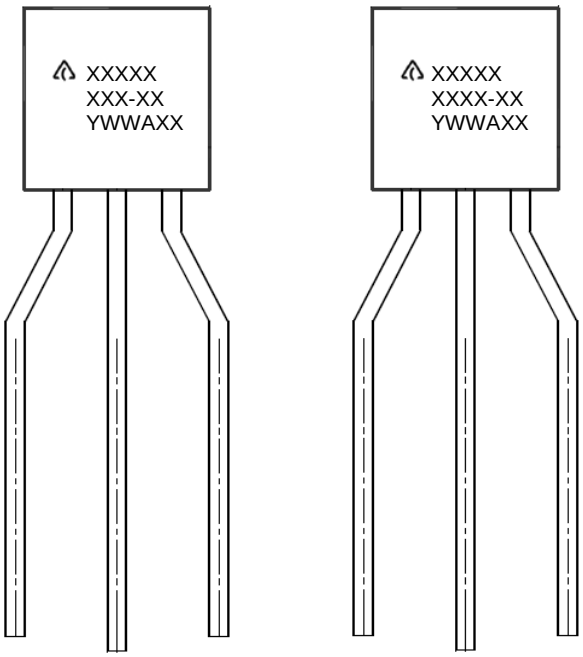
Package	Package Code	Temperature Range	Voltage Tolerance	Part Number	Marking ID	Packing
SOT-23	N	-40 to +125°C	0.5%	AP431iANTR-G1	GCA	3,000/Tape & Reel
	N1		0.5%	AP431iAN1TR-G1 (Note 5)	GCC	
	N		0.5%	AP431iHANTR-G1 (Note 5)	GCD	
	N1		0.5%	AP431iHAN1TR-G1 (Note 5)	GCE	
	N		1.0%	AP431iBNTR-G1	GCB	
	N1		1.0%	AP431iBN1TR-G1 (Note 5)	GCF	
	N		1.0%	AP431iHBNTR-G1 (Note 5)	GCG	
	N1		1.0%	AP431iHBN1TR-G1 (Note 5)	GCH	
SOT-89	R	-40 to +125°C	0.5%	AP431iARTR-G1 (Note 5)	G33M	1,000/Tape & Reel
	R		0.5%	AP431iHARTR-G1 (Note 5)	G37M	
	R		1.0%	AP431iBRTR-G1 (Note 5)	G33R	
	R		1.0%	AP431iHBRTR-G1 (Note 5)	G33S	
TO-92	Z	-40 to +125°C	0.5%	AP431iAZTR-G1 (Note 5)	AP431iAZ-G1	2,000/Ammo
	Z		0.5%	AP431iHAZTR-G1 (Note 5)	AP431iHAZ-G1	
	Z		1.0%	AP431iBZTR-G1 (Note 5)	AP431iBZ-G1	
	Z		1.0%	AP431iHBZTR-G1 (Note 5)	AP431iHBZ-G1	

Note 5: Not Recommended for New Design, they can be replaced by AP431S Series.

Marking Information

(1) TO-92 (Ammo Packing)

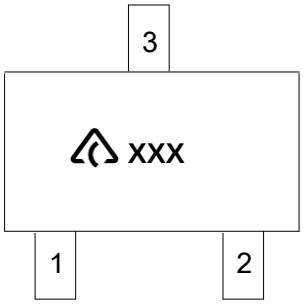
(Front View)



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: Internal Code

(2) SOT-23

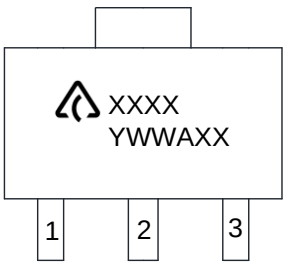
(Top View)



: Logo
XXX: Marking ID (See Ordering Information)

(3) SOT-89

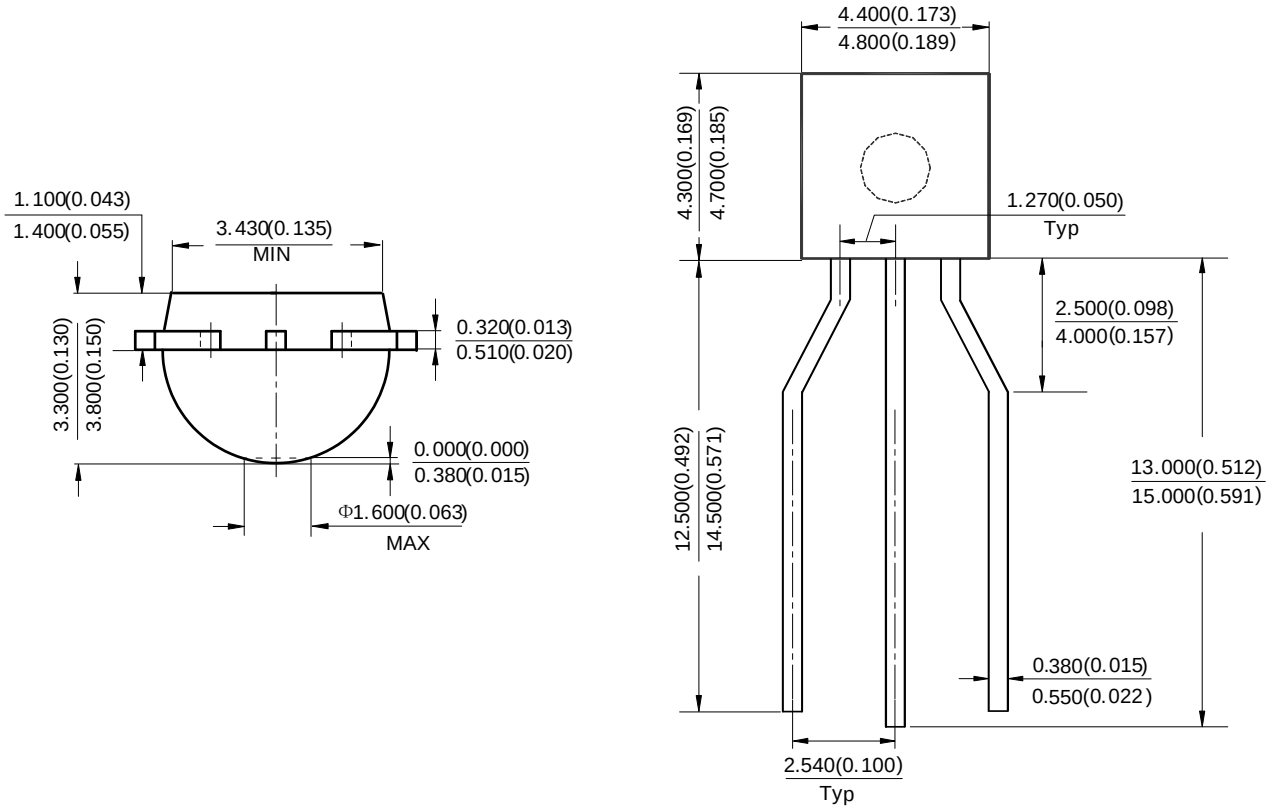
(Top View)



First Line: Logo and Marking ID
(See Ordering Information)
Second Line: Date Code
Y: Year
WW: Work Week of Molding
A: Assembly House Code
XX: Internal Code

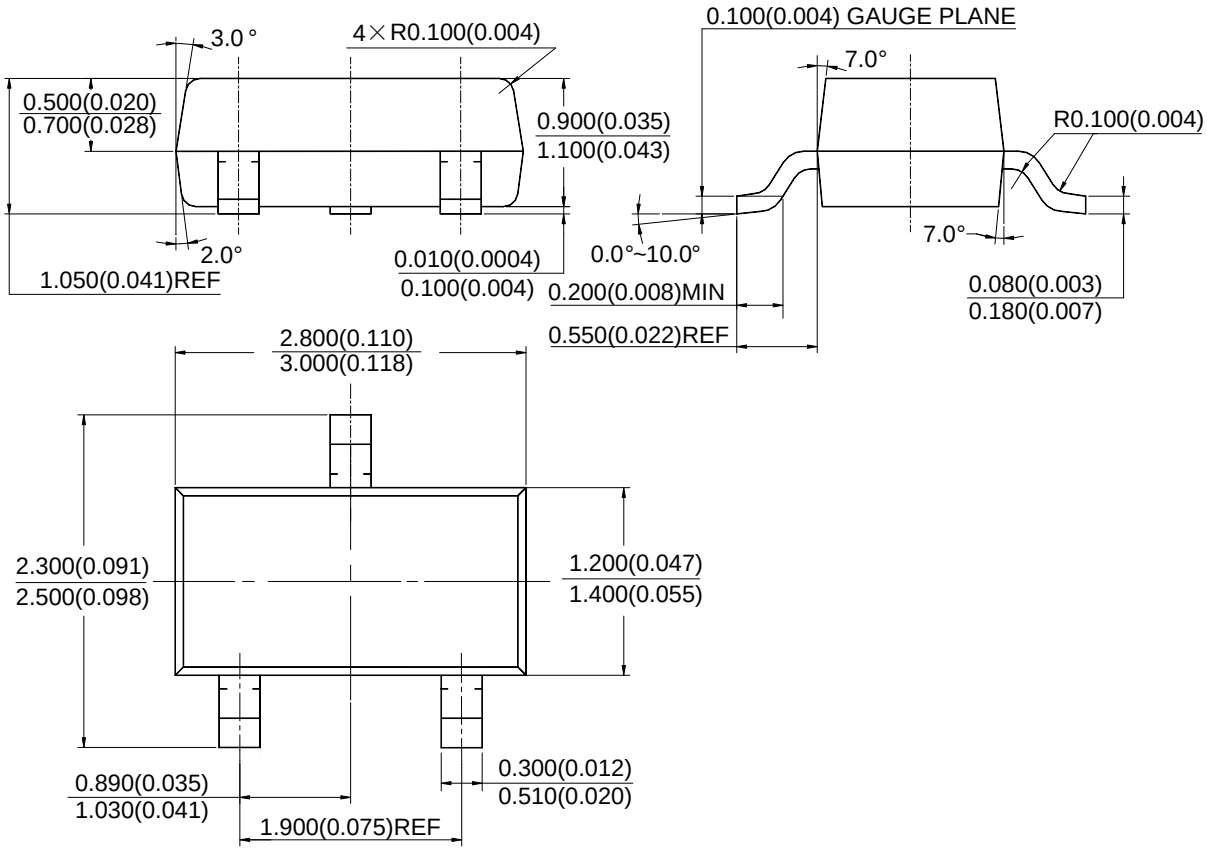
Package Outline Dimensions (All dimensions in mm (inch).)

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



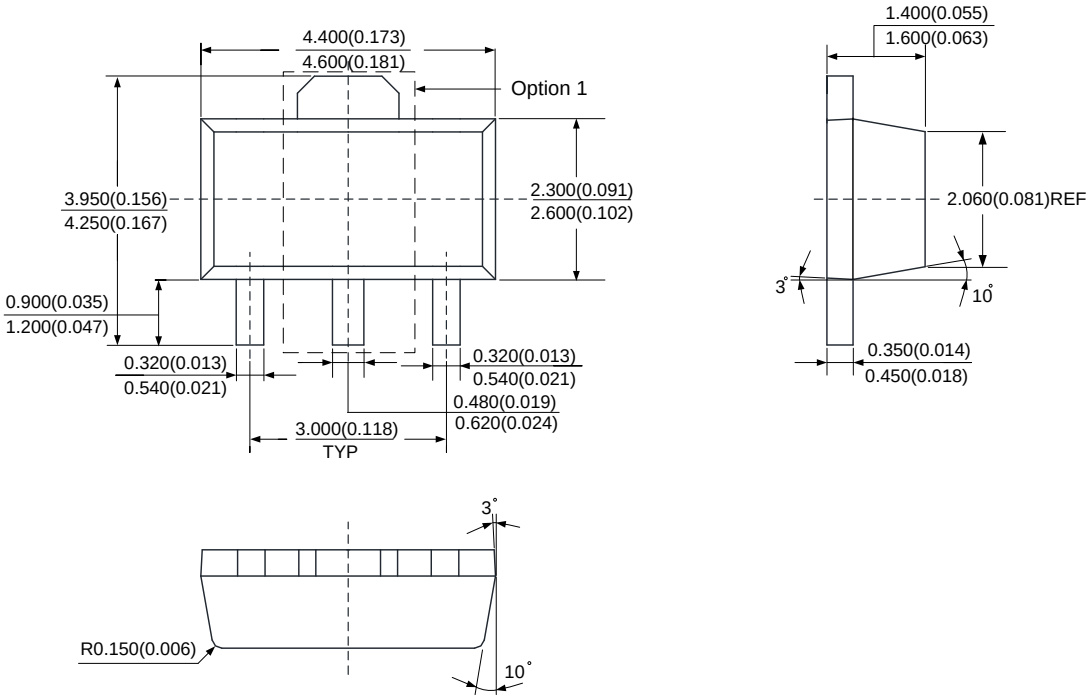
Package Outline Dimensions (Cont.) (All dimensions in mm(inch).)

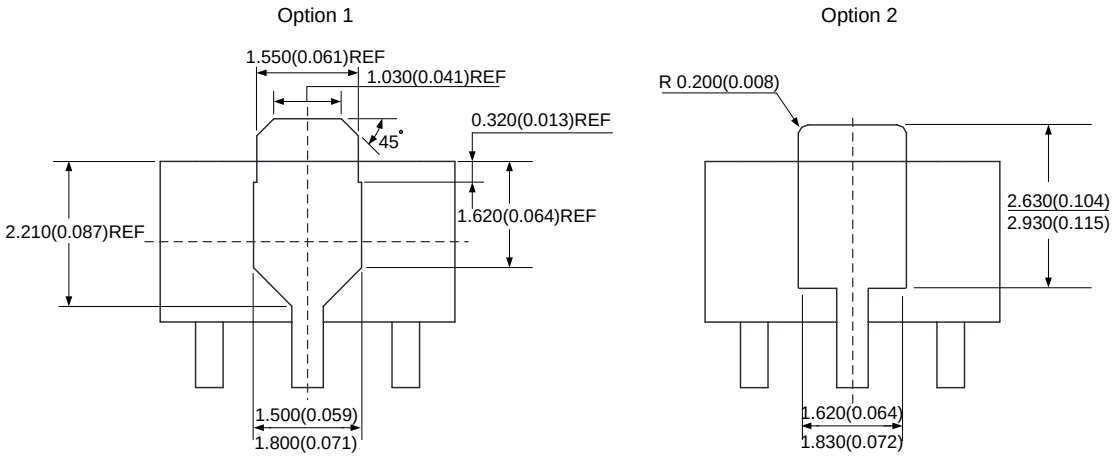
(2) Package Type: SOT-23



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

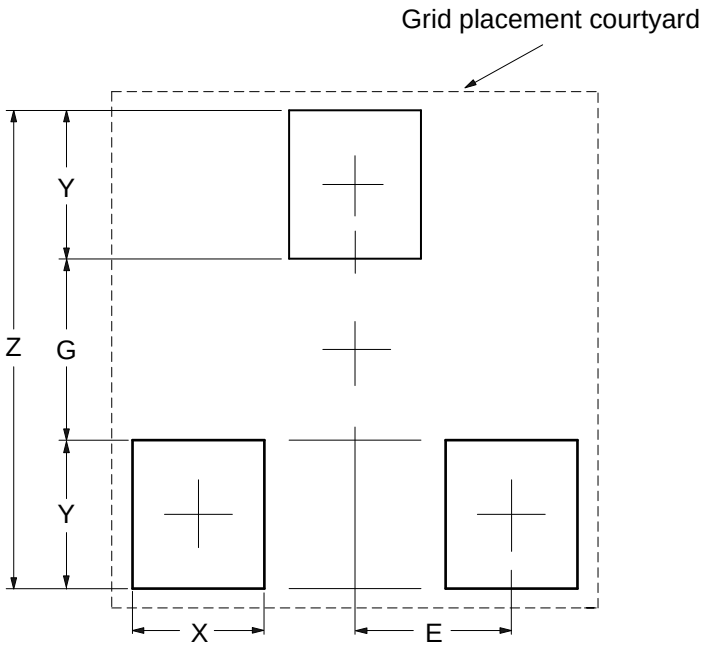
(3) Package Type: SOT-89





Suggested Pad Layout

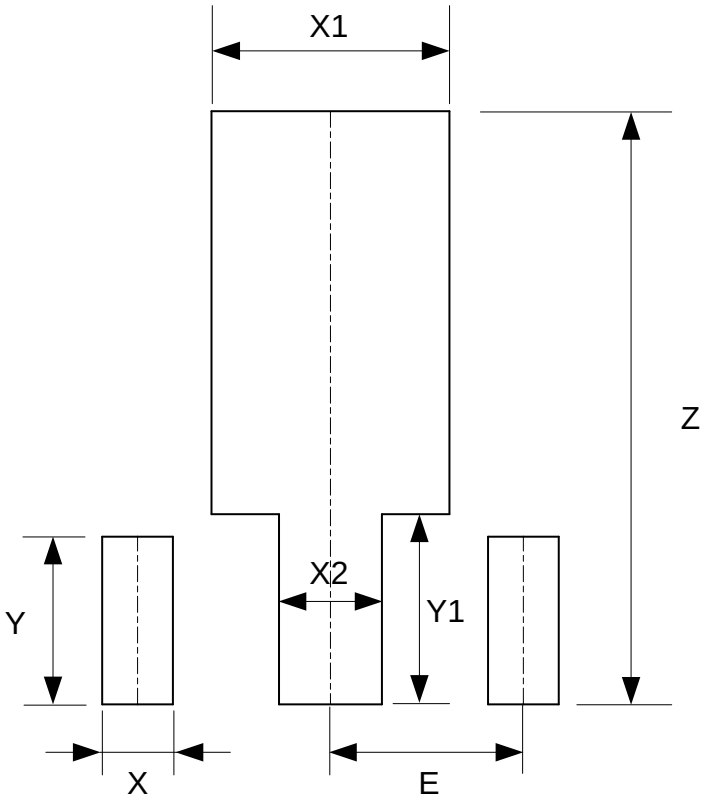
(1) Package Type: SOT-23



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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