

## Description

The AS431H 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 AS431H can be set to any value between  $V_{REF}$  (2.495V) and the corresponding maximum cathode voltage (36V).

The AS431H precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

This IC is available in 2 packages: TO92 (Ammo Packing) and SOT23.

## Features

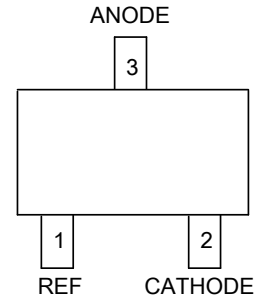
- Programmable Precise Output Voltage from 2.495V to 36V
- High Stability under Capacitive Load
- Low Temperature Deviation: 5mV Typical
- Low Equivalent Full-range Temperature Coefficient with 20PPM/°C Typical
- Sink Current Capacity from 0.5mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C
- Lead-Free Packages, Available in "Green" Molding Compound: SOT23, TO92 (Ammo Packing)
- **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

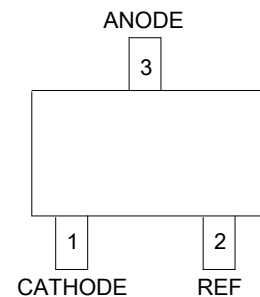
## Pin Assignments

(Top View)



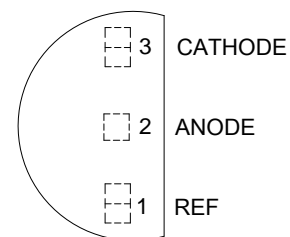
**SOT23**  
(Normal Pin-out)

(Top View)



**SOT23**  
(Mirror Pin-out)

(Top View)

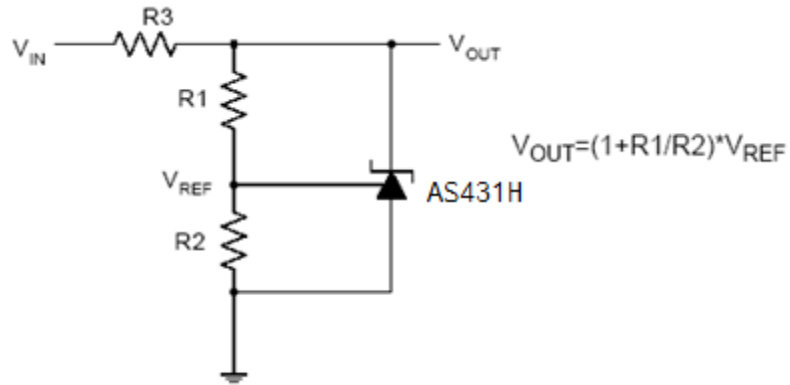


**TO92 (Ammo Packing)**

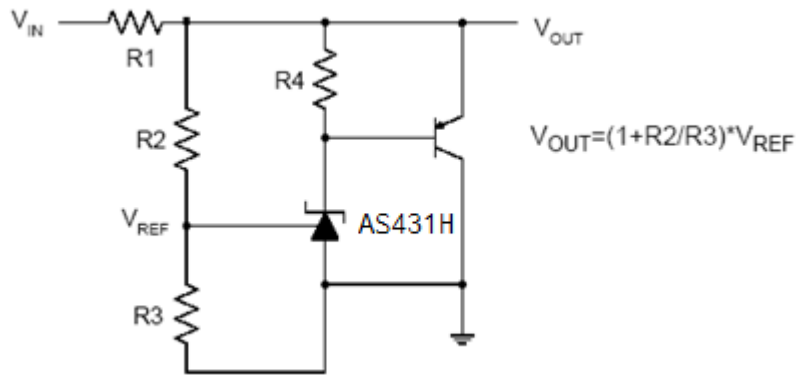
- Notes:
1. No purposely added lead. Fully EU Directive 2002/95/EC (RoHS) & 2011/65/EU (RoHS 2) compliant.
  2. See [http://www.diodes.com/quality/lead\\_free.html](http://www.diodes.com/quality/lead_free.html) for more information about Diodes Incorporated's definitions of Halogen- and Antimony-free, "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

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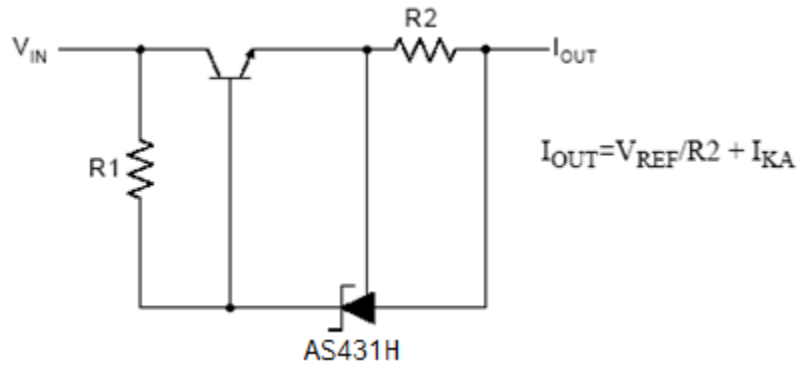
Shunt Regulator



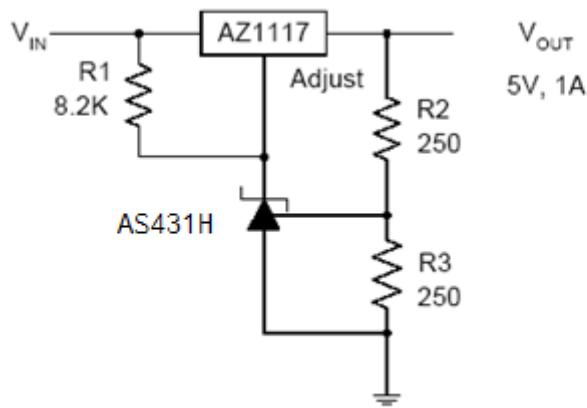
High Current Shunt Regulator

**Typical Applications Circuit (Cont.)**

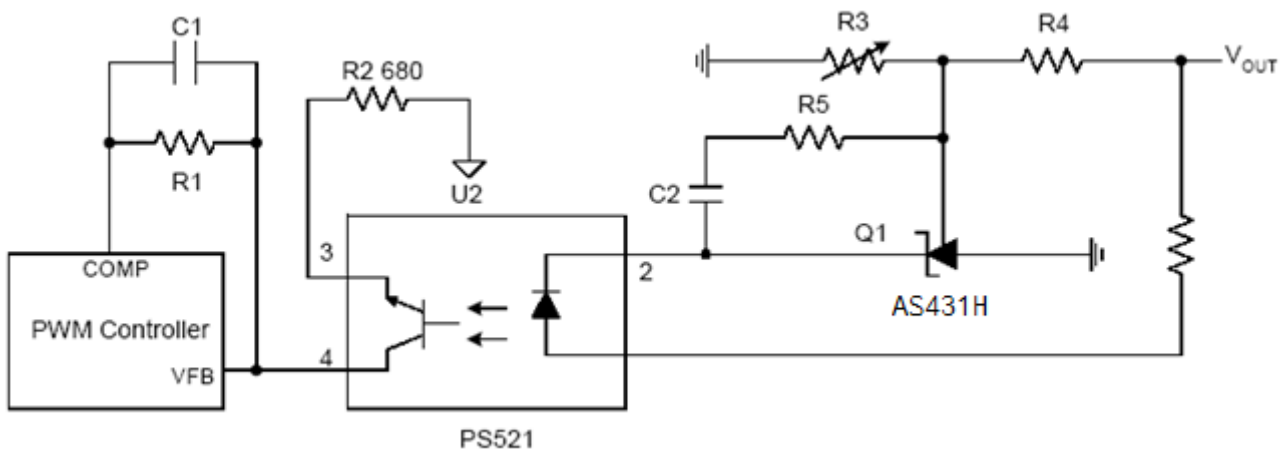
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Current Source or Current Limit



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
$\theta_{JA}$	Thermal Resistance	SOT23	380	°C/W
		TO92 ( Ammo Packing)	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**

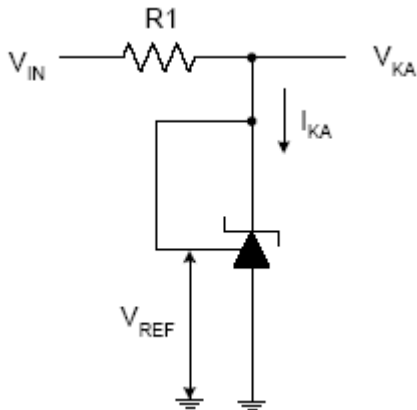
Symbol	Parameter	Min	Max	Unit
$V_{KA}$	Cathode Voltage	$V_{REF}$	36	V
$I_{KA}$	Cathode Current	0.5	100	mA
$T_A$	Operating Ambient Temperature Range	-40	+125	°C

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

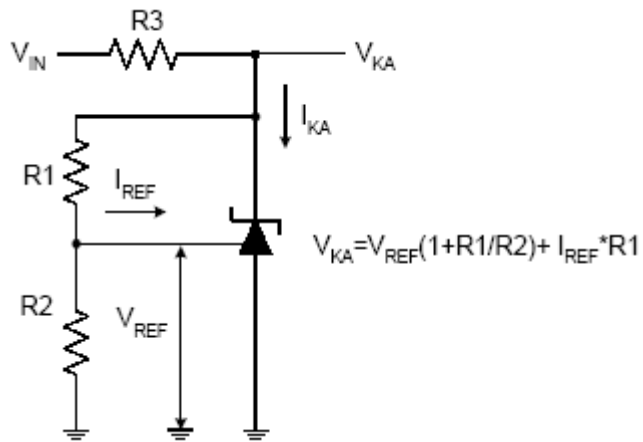
Symbol	Parameter	Test Circuit	Conditions	Min	Typ	Max	Unit	
$V_{REF}$	Reference Voltage	4	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	2.483	2.495	2.507	V	
				2.470	2.495	2.520		
$\Delta V_{REF}$	Deviation of Reference Voltage Over Full Temperature Range	4	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	0 to $+70^\circ\text{C}$	—	5	8	mV
				$-40$ to $+85^\circ\text{C}$	—	5	14	
				$-40$ to $+125^\circ\text{C}$	—	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
				$\Delta V_{KA} = 36\text{V to } 10\text{V}$	—	-0.5	-2.0	
$I_{REF}$	Reference Current	5	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty$	—	0.7	4	$\mu\text{A}$	
$\Delta I_{REF}$	Deviation of Reference Current Over Full Temperature Range	5	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty, T_A = -40$ to $+125^\circ\text{C}$	—	0.4	1.2	$\mu\text{A}$	
$I_{KA}$ (Min)	Minimum Cathode Current for Regulation	4	$V_{KA} = V_{REF}$	—	0.35	0.5	mA	
$I_{KA}$ (Off)	Off-state Cathode Current	6	$V_{KA} = 36\text{V}, V_{REF} = 0$	—	0.002	0.5	$\mu\text{A}$	
$Z_{KA}$	Dynamic Impedance	4	$V_{KA} = V_{REF}, I_{KA} = 0.5$ to $100\text{mA}, f \leq 1.0\text{KHz}$	—	0.15	0.5	$\Omega$	
$\theta_{JC}$	Thermal Resistance	—	SOT23	—	136	—	$^\circ\text{C/W}$	
			TO92 (Ammo Packing)	—	80	—		

**Electrical Characteristics** (Cont.)

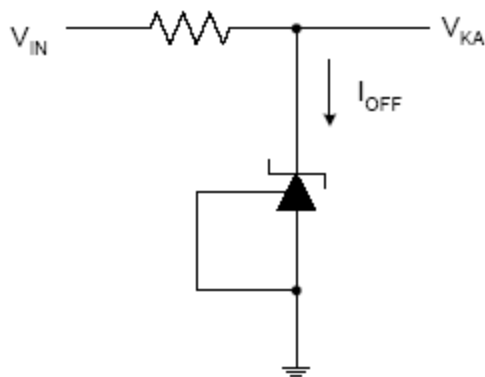
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Test Circuit 4 for  $V_{KA} = V_{REF}$



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



Test Circuit 6 for  $I_{OFF}$

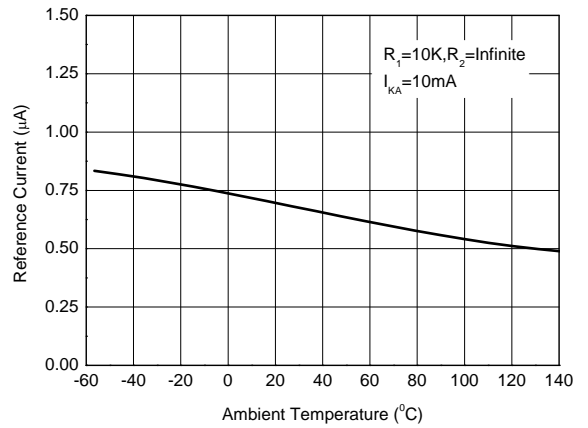
**Performance Characteristics**

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**Reference Voltage vs. Ambient Temperature**



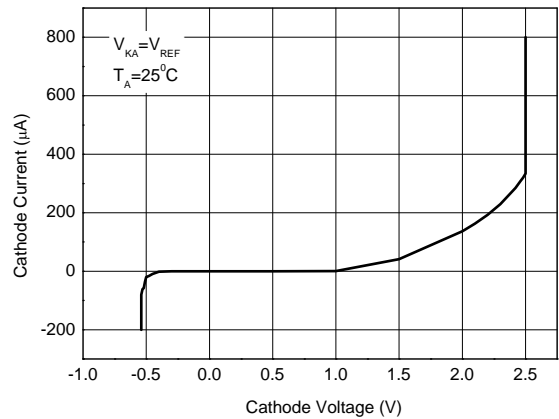
**Reference Current vs. Ambient Temperature**



**Cathode Current vs. Cathode Voltage**



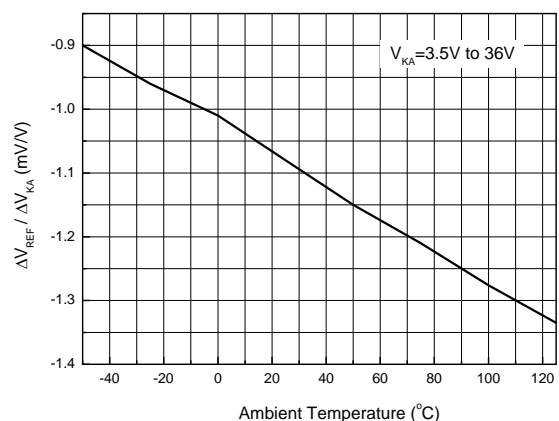
**Cathode Current vs. Cathode Voltage**



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

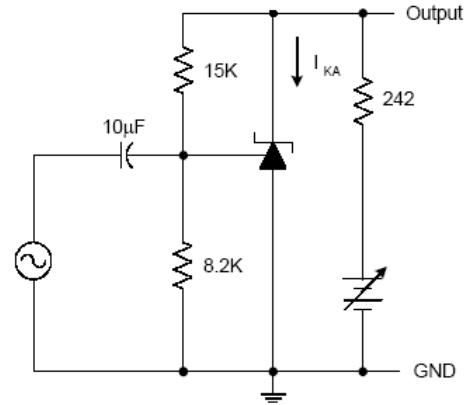
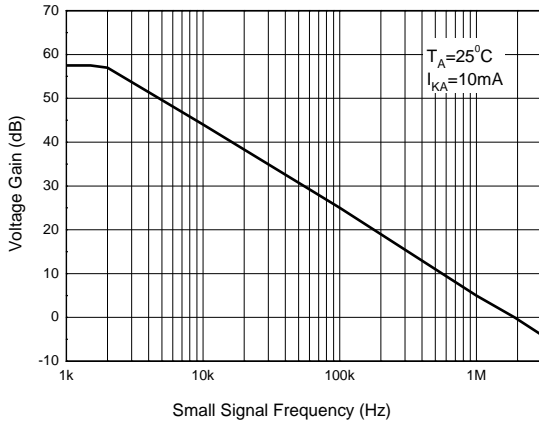


**Ratio of Delta Reference Voltage to the Ratio of Delta Cathode Voltage**

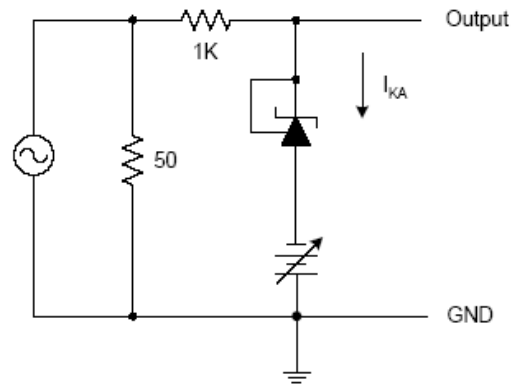


**Performance Characteristics (Cont.)**

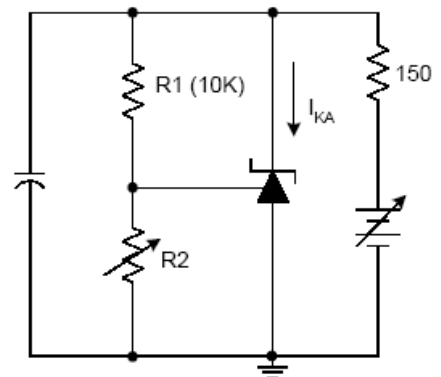
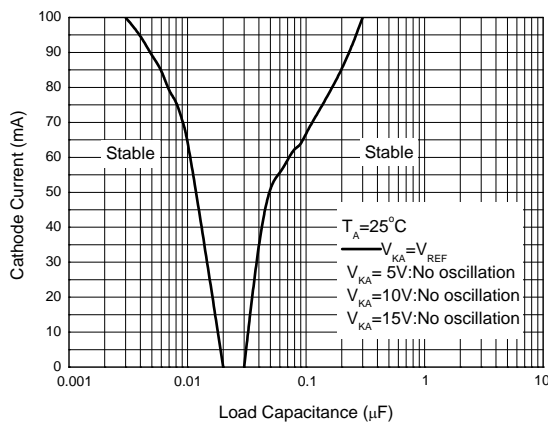
**Small Signal Voltage Gain vs. Frequency**



**Reference Impedance vs. Frequency**



**Stability Boundary Conditions vs. Load Capacitance**

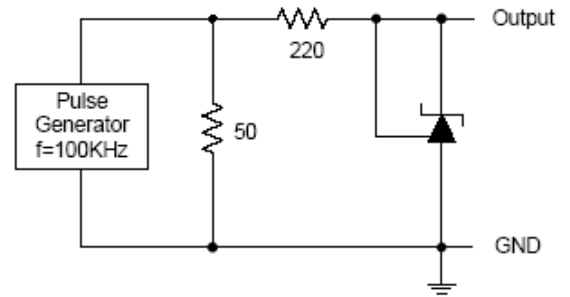


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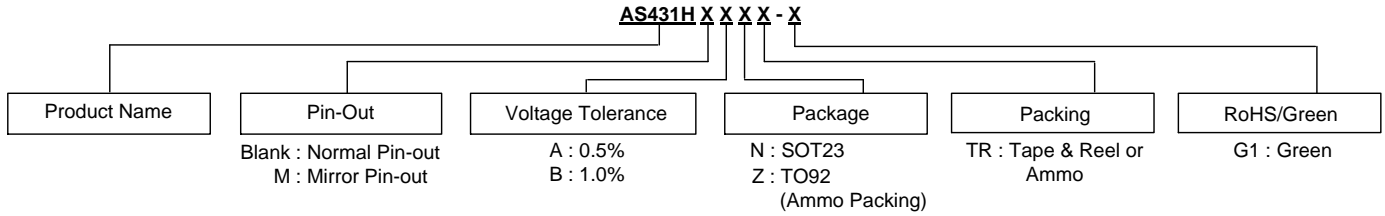
**Performance Characteristics (Cont.)**

**Pulse Response of Input and Output Voltage**



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**Ordering Information**



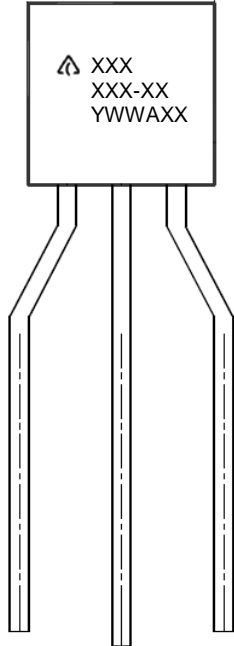
Package	Temperature Range	Pin-Out	Voltage Tolerance	Part Number	Marking ID	Packing
SOT23	-40 to +125°C	Normal Pin-out	0.5%	AS431HANTR-G1	GJA	3000/Tape & Reel
			1.0%	AS431HBNTR-G1	GJB	3000/Tape & Reel
SOT23	-40 to +125°C	Mirror Pin-out	0.5%	AS431HMANTR-G1	GM5	3000/Tape & Reel
			1.0%	AS431HMBNTR-G1	GM6	3000/Tape & Reel
TO92 (Ammo Packing)	-40 to +125°C	Normal Pin-out	0.5%	AS431HAZTR-G1	431HAZ-G1	2000/Ammo
			1.0%	AS431HBZTR-G1	431HBZ-G1	2000/Ammo

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**Marking Information**

(1) TO92 (Ammo Packing)

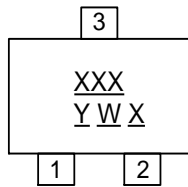
(Top View)



First and Second Line: 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) SOT23

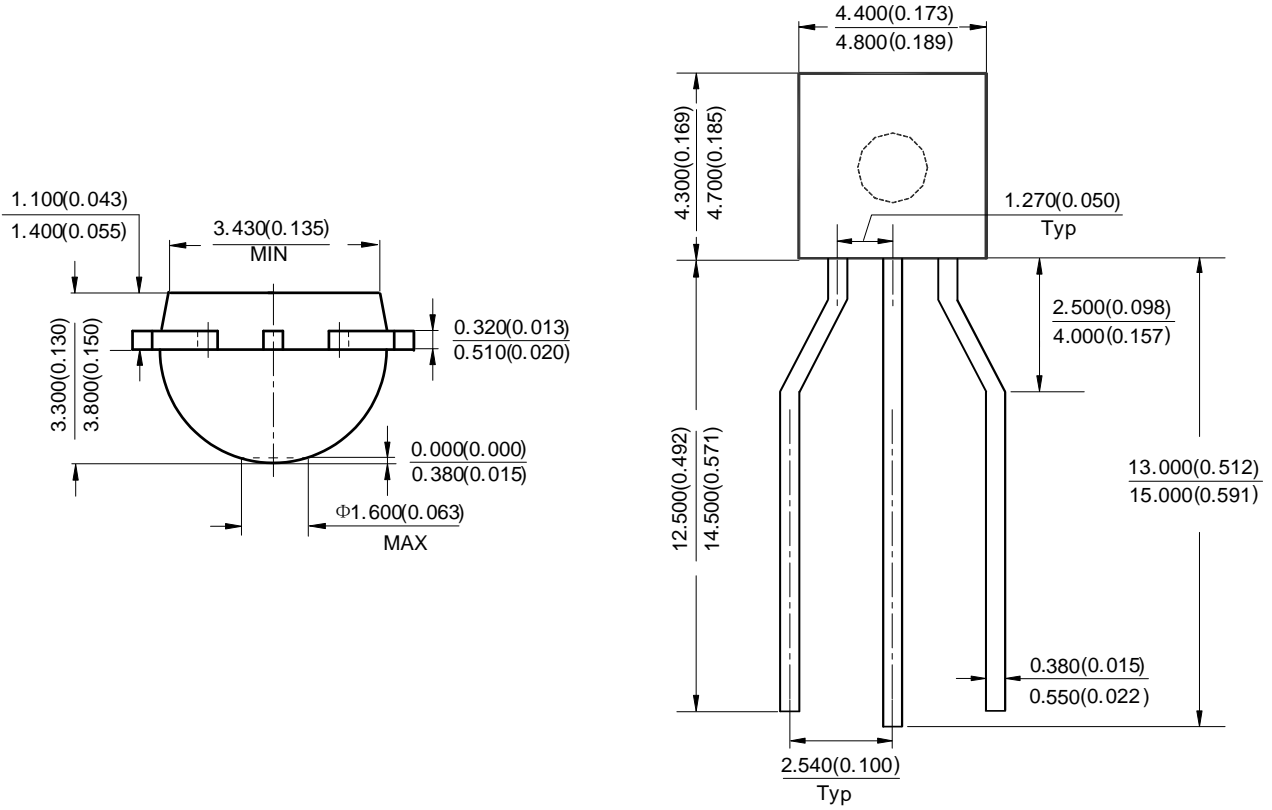
(Top View)



XXX : Identification Code  
Y : Year 0 to 9  
W : Week : A to Z : 1 to 26 week;  
a to z : 27 to 52 week; z represents  
52 and 53 week  
X : Internal Code

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

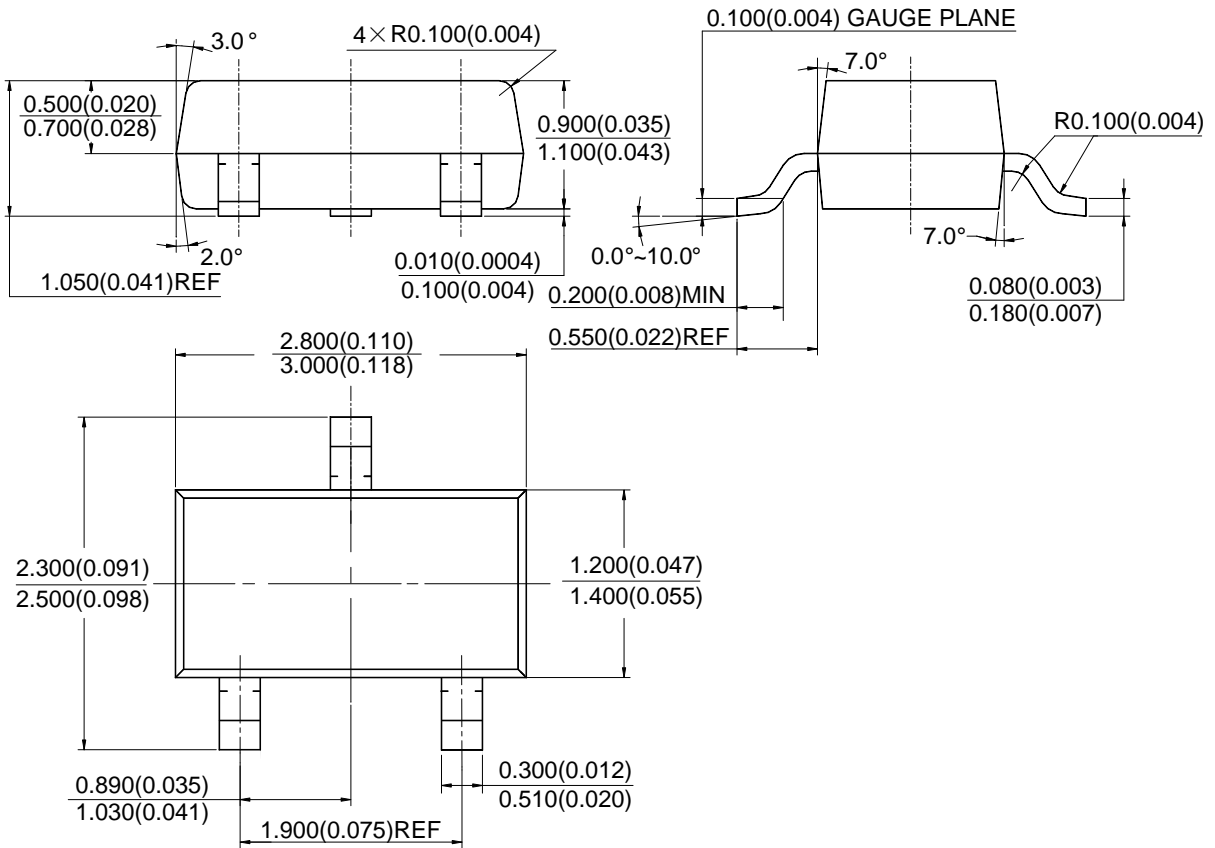
(1) TO92 (Ammo Packing)



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

(2) SOT23



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**Suggested Pad Layout**

(1) 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

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