

## XH431L

### Descriptions

The XH431L series ICs are low voltage three-terminal adjustable regulators with guaranteed thermal stability over a full operation range. These ICs feature sharp turn-on characteristics, low temperature coefficient and low output impedance, which make them ideal substitutes for Zener diodes in applications such as switching power supply, charger, motherboard and other adjustable regulators. The output voltage can be set to any value between 1.24V and 18V with two external resistors.

The XH431L precision reference is offered in two voltage tolerance: 0.5% and 1.0%.

These ICs are available in 4 packages: TO-92 (bulk or ammo packing), SOT-23, SOT-25 and SOT-89.

### Features

- Wide Programmable Precise Output Voltage from 1.24V to 18V
- High Stability under Capacitive Load
- Low Temperature Deviation: 3mV Typical
- Low Equivalent Full-range Temperature Coefficient: 20PPM/°C Typical
- Low Dynamic Output Resistance: 0.05Ω Typical
- High Sink Current Capacity from 0.1mA to 100mA
- Low Output Noise
- Wide Operating Range of -40 to +125°C

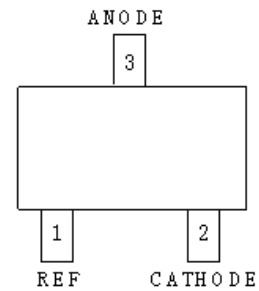
### Applications

- Graphic Card
- PC Motherboard
- Voltage Adapter
- Switching Power Supply
- Charger

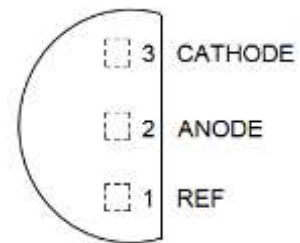
### Pin Assignments

#### Top View

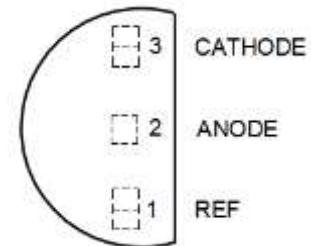
##### SOT-23



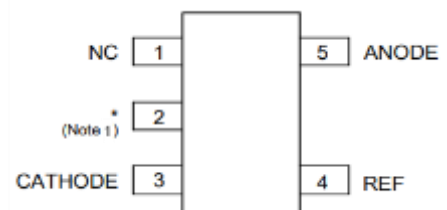
##### TO-92 (Bulk Packing)



##### TO-92 (Ammo Packing)

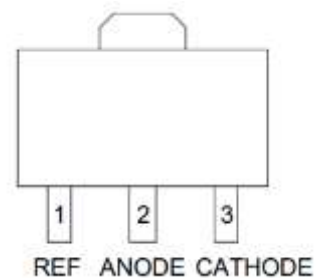


##### SOT25

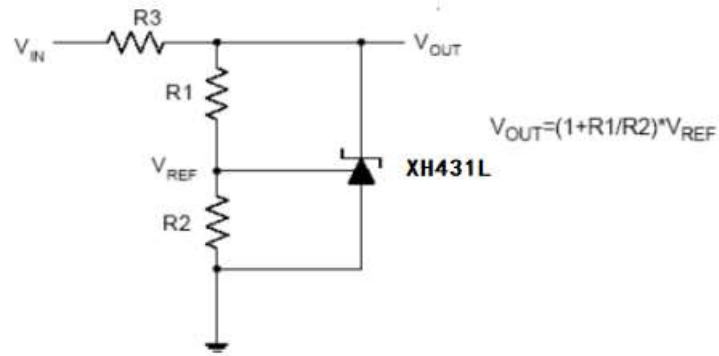


Note 1: \*Pin 2 is attached to substrate and must be connected to ANODE or open.

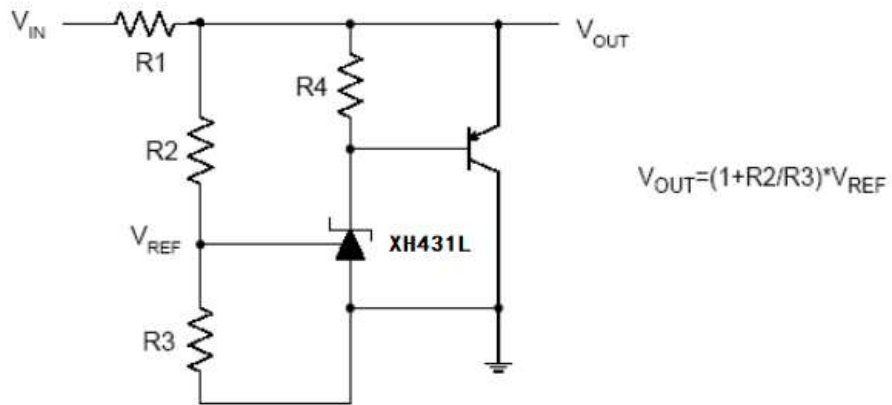
##### SOT-89



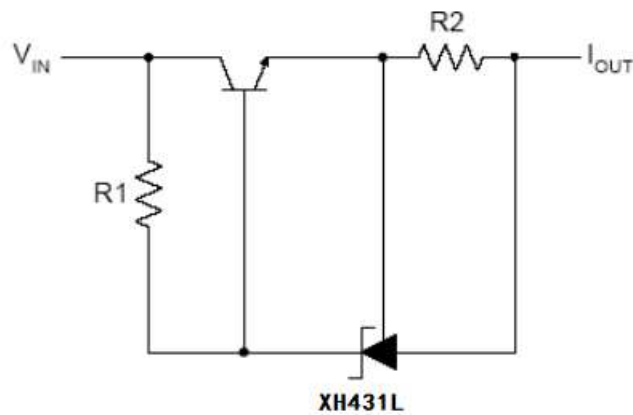
Typical Applications Circuit



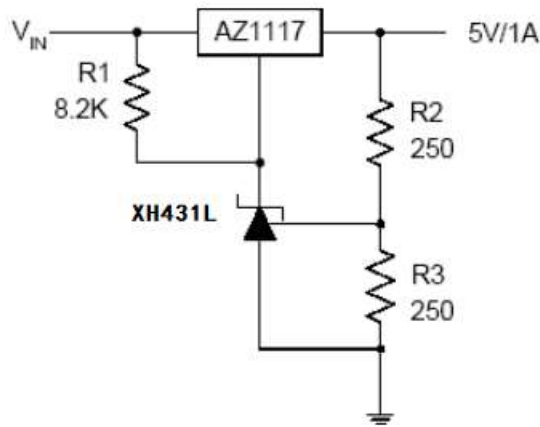
Shunt Regulator



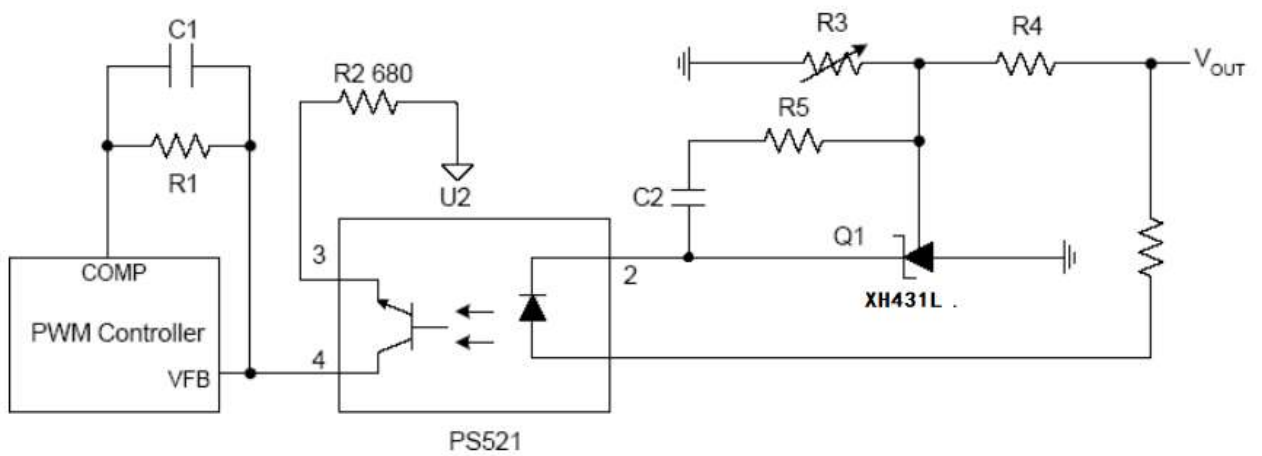
High Current Shunt Regulator



Current Source or Current Limit

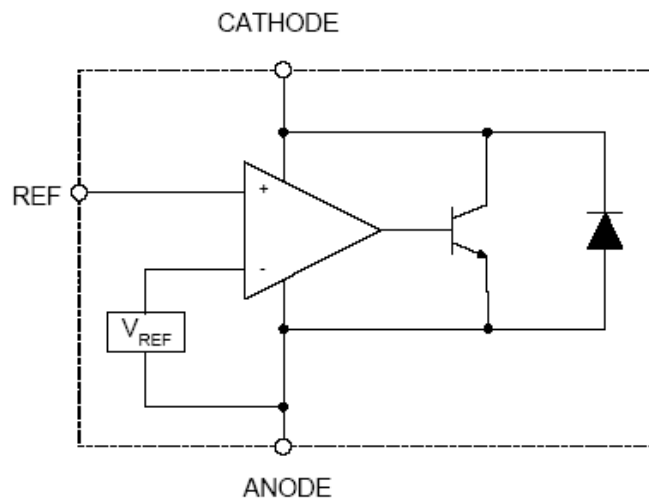


Precision 5V 1A Regulator



PWM Converter with Reference

### Functional Block Diagram



## Absolute Maximum Ratings

Symbol	Parameter	Rating	Unit
$V_{KA}$	Cathode Voltage	20	V
$I_{KA}$	Cathode Current Range (Continuous)	-100 to 100	mA
$I_{REF}$	Reference Input Current Range	10	mA
$P_D$	Power Dissipation	Z, R Package	770
		N, K Package	370
$T_J$	Junction Temperature	+150	°C
$T_{STG}$	Storage Temperature Range	-65 to +150	°C

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.

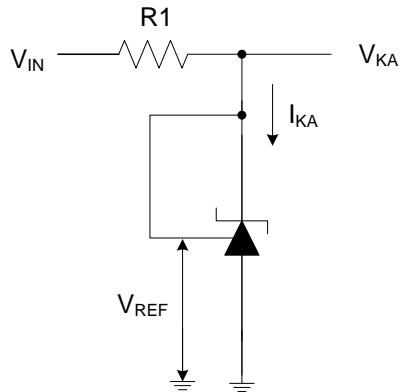
## Recommended Operating Conditions

Symbol	Parameter	Min	Max	Unit
$V_{KA}$	Cathode Voltage	$V_{REF}$	18	V
$I_{KA}$	Cathode Current	0.1	100	mA
–	Operating Ambient Temperature Range	-40	+125	°C

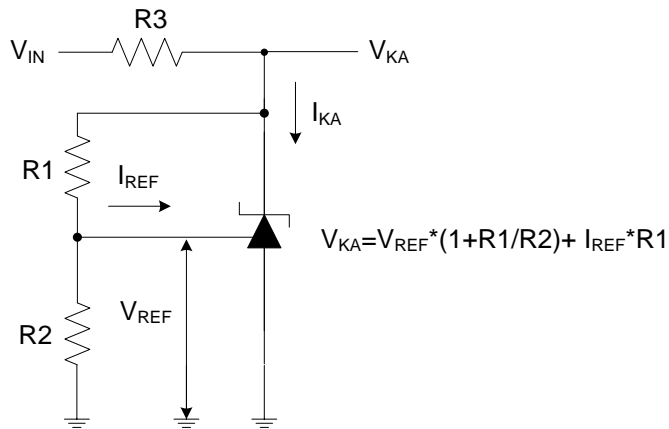
## Electrical Characteristics (@ $T_A=+25^\circ\text{C}$ , unless otherwise specified.)

Symbol	Parameter	Conditions	Min	Typ	Max	Unit	
$V_{REF}$	Reference Voltage	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	0.5%	1.234	1.240	1.246	V
			1.0%	1.228	1.240	1.242	
$\Delta V_{REF}$	Deviation of Reference Voltage Over Full Temperature Range	$V_{KA} = V_{REF}, I_{KA} = 10\text{mA}$	0 to +70°C	–	2	10	mV
			-40 to +85°C	–	3	10	
			-40 to +125°C	–	4	15	
$\frac{\Delta V_{REF}}{\Delta V_{KA}}$	Ratio of Change in $V_{REF}$ to the Change in Cathode Voltage	$I_{KA} = 10\text{mA}, \Delta V_{KA}: V_{REF} \text{ to } 16\text{V}$	–	-0.5	-1.5	mV/V	
$I_{REF}$	Reference Input Current	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty$	–	0.15	0.4	$\mu\text{A}$	
$\Delta I_{REF}$	Deviation of Reference Current Over Full Temperature Range	$I_{KA} = 10\text{mA}, R1 = 10\text{k}\Omega, R2 = \infty, T_A = -40 \text{ to } +125^\circ\text{C}$	–	0.1	0.4	$\mu\text{A}$	
$I_{KA}$ (Min)	Minimum Cathode Current for Regulation	$V_{KA} = V_{REF}$	–	55	80	$\mu\text{A}$	
$I_{KA}$ (Off)	Off-state Cathode Current	$V_{REF} = 0, V_{KA} = 18\text{V}$	–	0.04	0.10	$\mu\text{A}$	
		$V_{KA} = 6, V_{REF} = 0$	–	0.01	0.05		
$Z_{KA}$	Dynamic Impedance	$V_{KA} = V_{REF}, I_{KA} = 1 \text{ to } 100\text{mA}, f \leq 1.0\text{KHz}$	–	0.05	0.15	$\Omega$	
$\theta_{JC}$	Thermal Resistance	SOT-23	–	84	–	°C/W	
		SOT-25	–	84	–		
		TO-92	–	140	–		
		SOT-89	–	29	–		

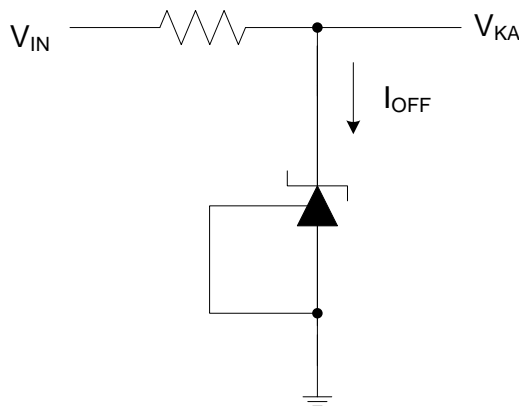
Electrical Characteristics



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

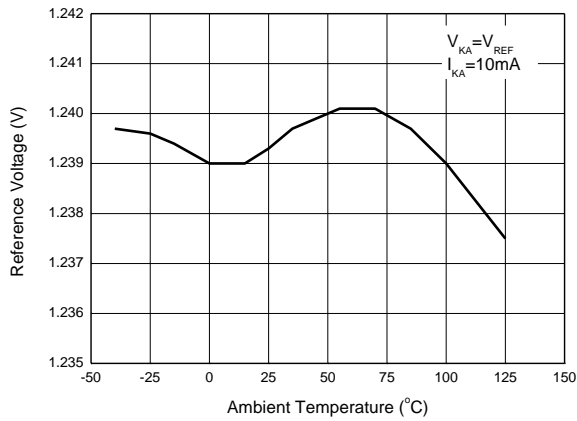


Test Circuit 5 for  $V_{KA}>V_{REF}$

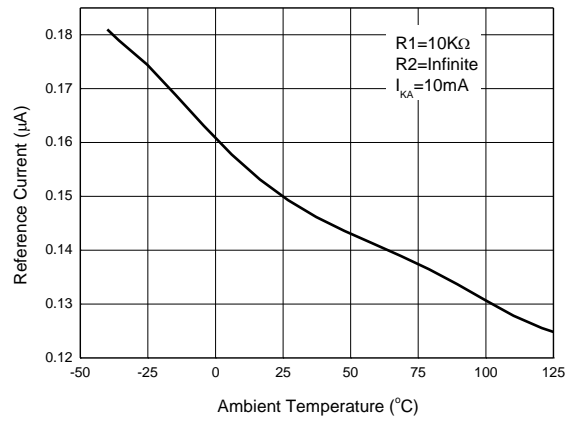


Test Circuit 6 for  $I_{OFF}$

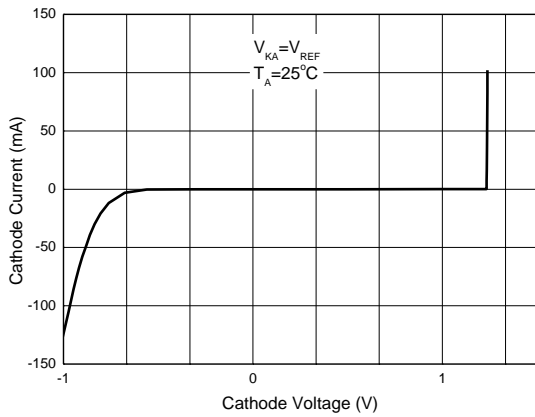
Reference Voltage vs. Ambient Temperature



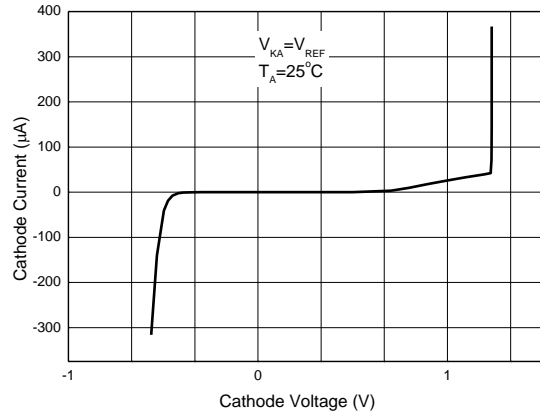
Reference Current vs. Ambient Temperature



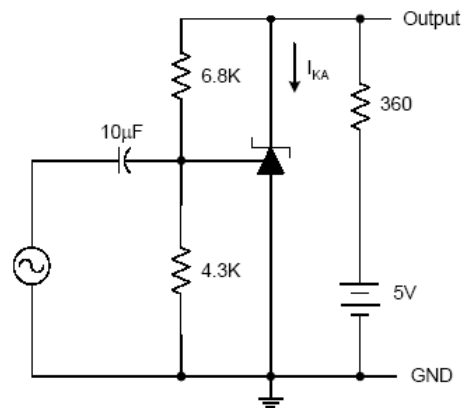
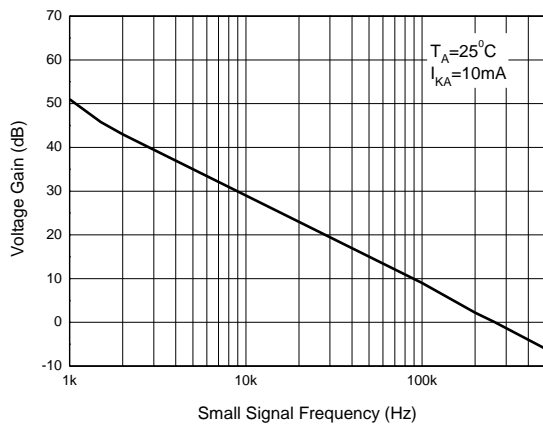
Cathode Current vs. Cathode Voltage



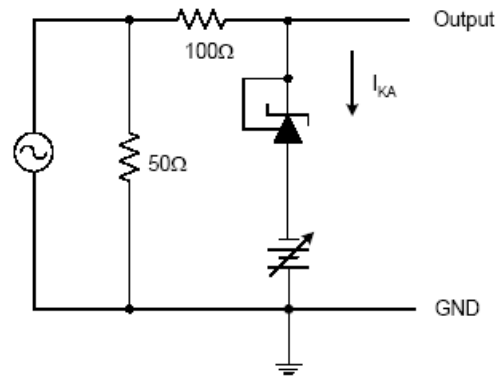
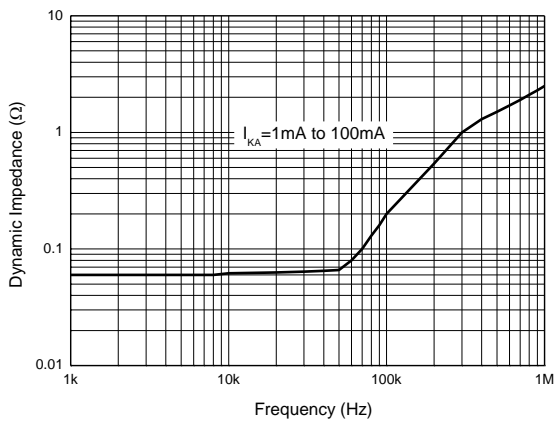
Cathode Current vs. Cathode Voltage



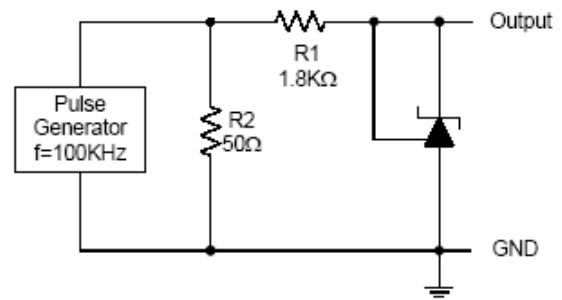
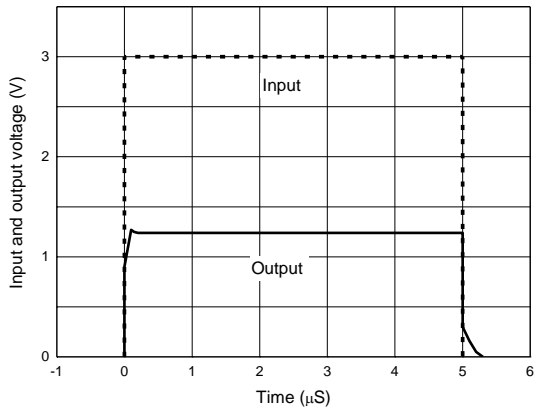
Small Signal Voltage Gain vs. Frequency



Dynamic Impedance vs. Frequency

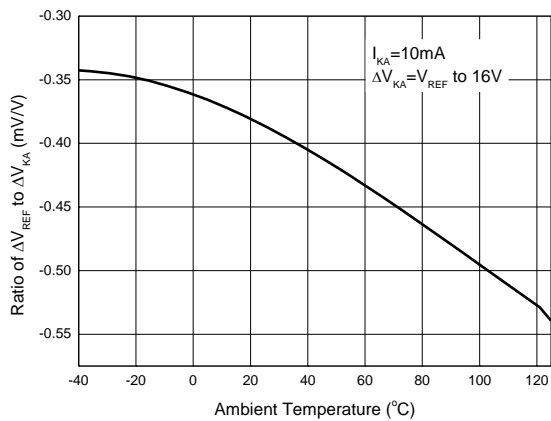


Pulse Response of Input and Output Voltage

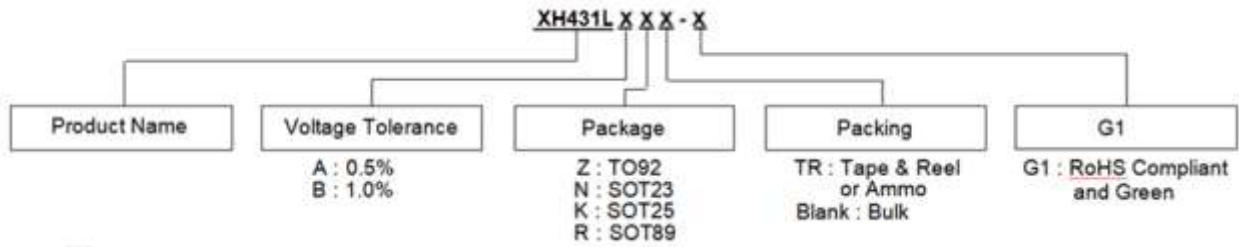


Stability Boundary Conditions vs. Load Capacitance

Ratio of Delta Reference Voltage to the Ratio of Cathode Voltage vs. Ambient Temperature



## Ordering Information



Package	Temperature Range	Voltage Tolerance	Part Number	Marking ID	Packing Type
			Green	Green	
TO-92	-40 to +125°C	0.5%	XH431LAZ-G1	431LAZ-G1	Bulk
		0.5%	XH431LAZTR-G1	431LAZ-G1	Ammo
		1.0%	XH431LBZ-G1	431LBZ-G1	Bulk
		1.0%	XH431LBZTR-G1	431LBZ-G1	Ammo
SOT-23	-40 to +125°C	0.5%	XH431LANTR-G1	NMA	Tape & Reel
		1.0%	XH431LBNTR-G1	NMB	Tape & Reel
SOT-25	-40 to +125°C	0.5%	XH431LAKTR-G1	KMA	Tape & Reel
		1.0%	XH431LBKTR-G1	KMB	Tape & Reel
SOT-89	-40 to +125°C	0.5%	XH431LARTR-G1	RMA	Tape & Reel
		1.0%	XH431LBRTR-G1	RMB	Tape & Reel

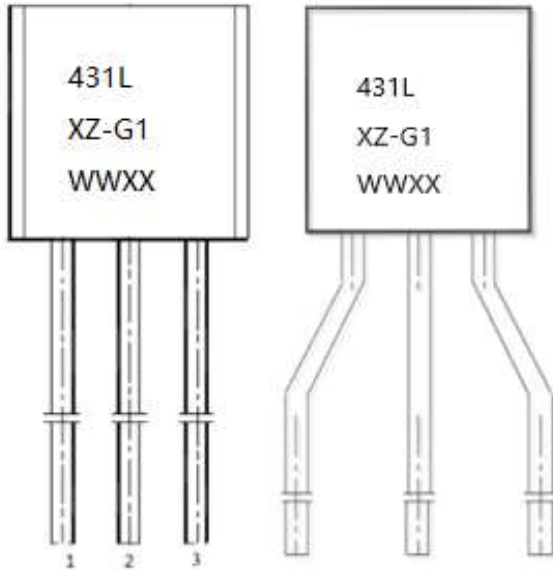


## Marking Information

(1) TO92 (Bulk Packing)

(2) TO92 ( Ammo Packing)

(Front View)



First and Second Lines: Marking ID

Second Lines: X: Grade : A or B

Marking ID (See Ordering Information)

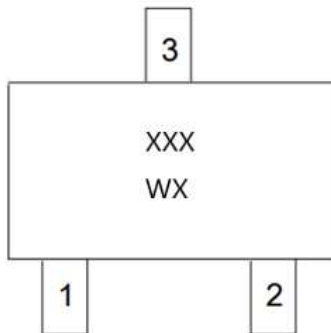
Third Line: Date Code

WWXX: WW: Weekly

XX: Internal Code

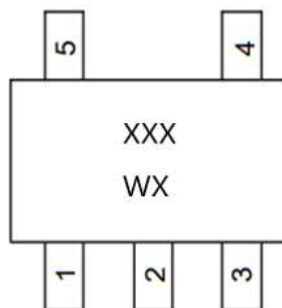
(3) SOT-23

(Top View)



(4) SOT-25

(Top View)



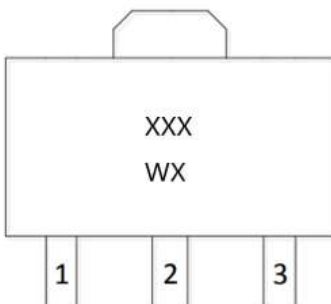
XXX: Marking ID (See Ordering Information)

WX W: Weekly

X: Internal Code

(5) SOT-89

(Top View)



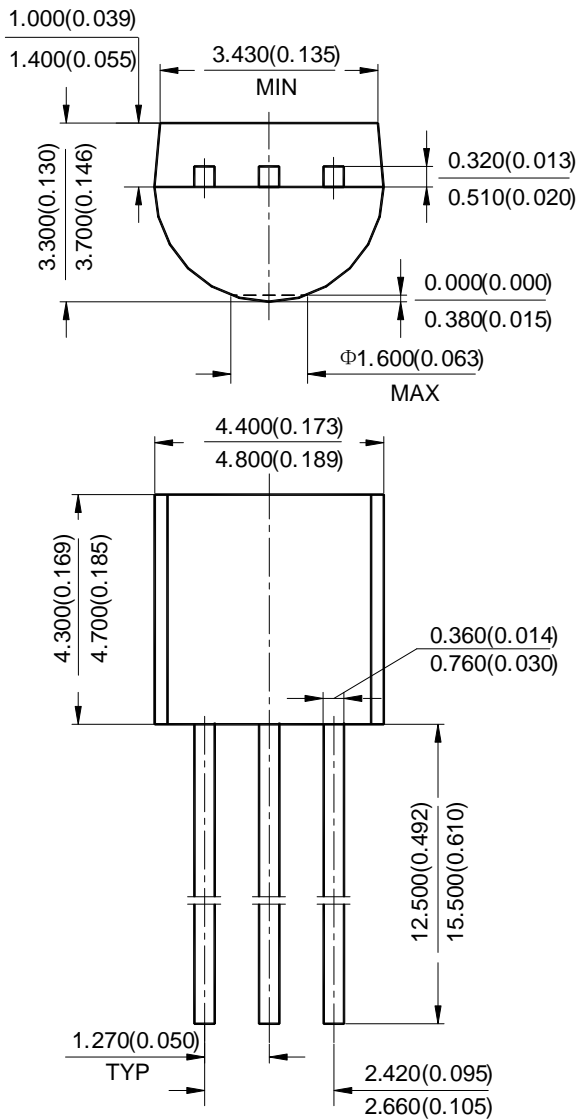
XXX: Marking ID (See Ordering Information)

WX W: Weekly

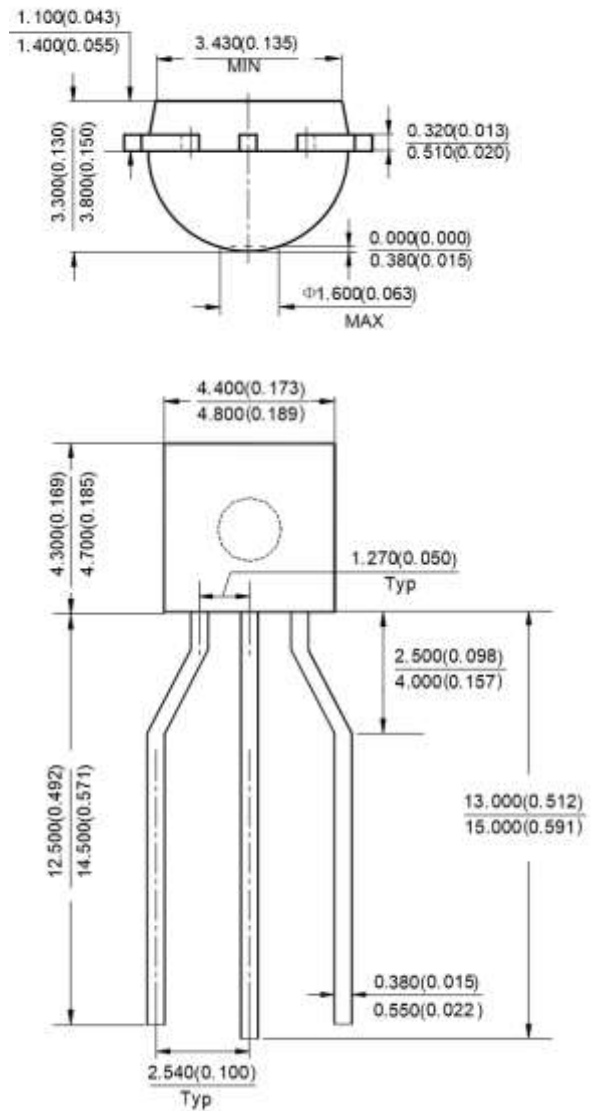
X: Internal Code

Package Outline Dimensions

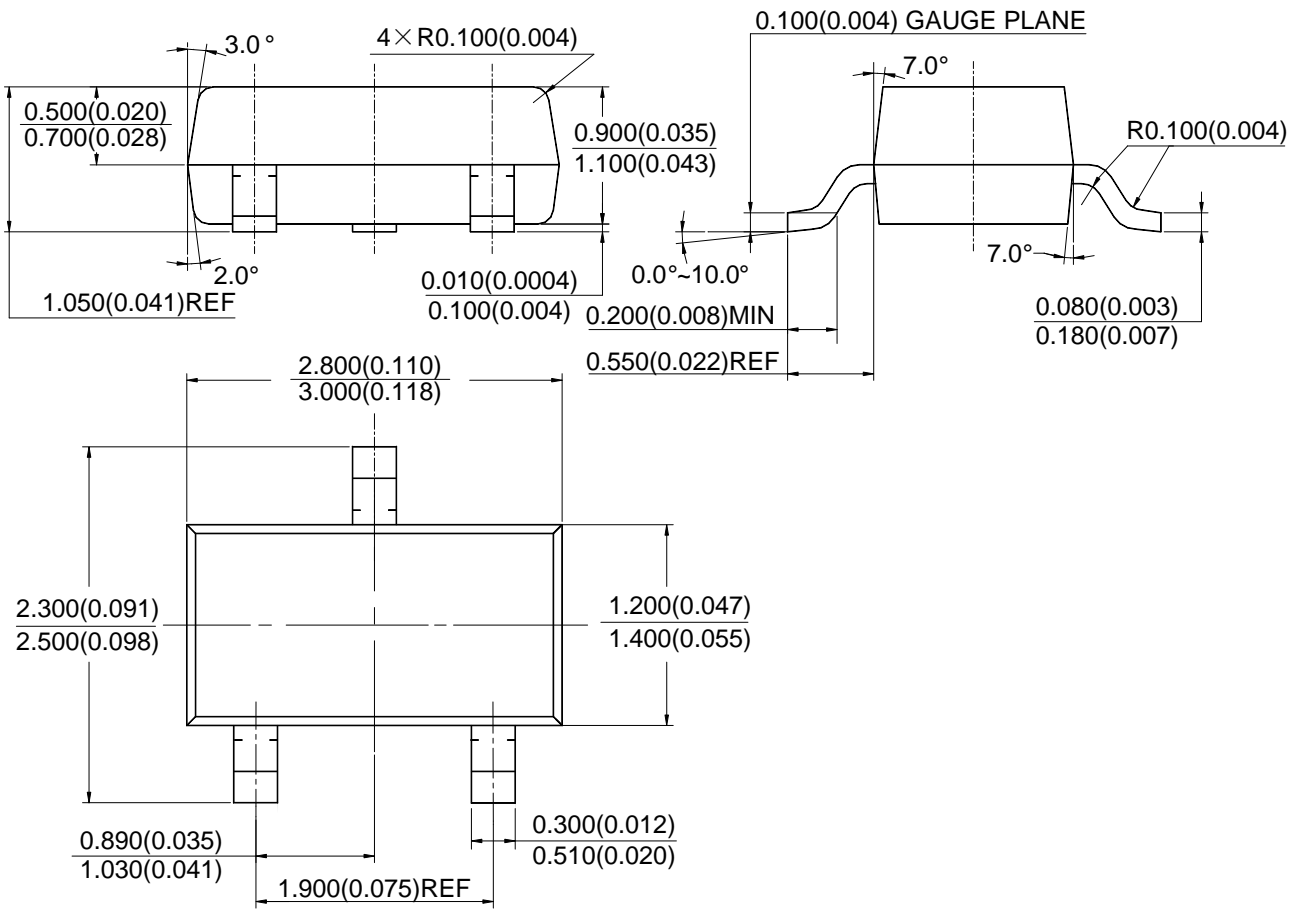
(1) Package Type: TO-92 (Bulk Packing)



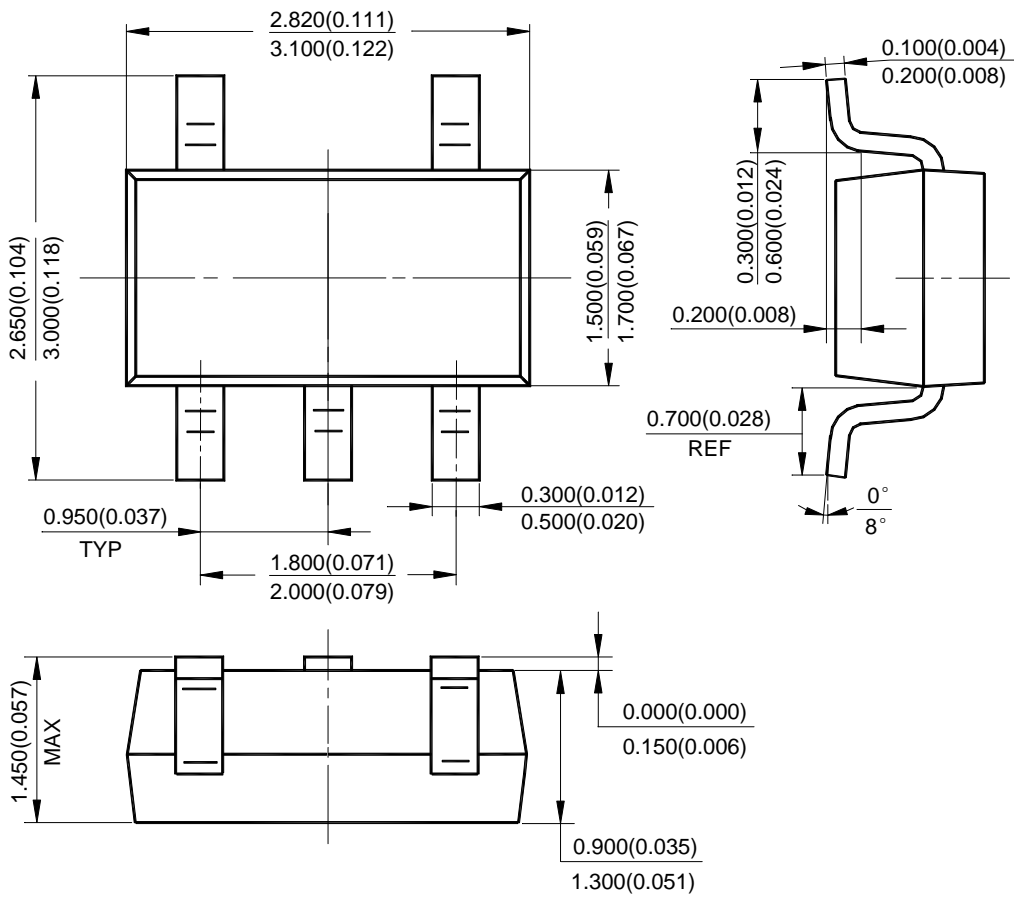
(2) Package Type: TO-92 ( Ammo Packing)



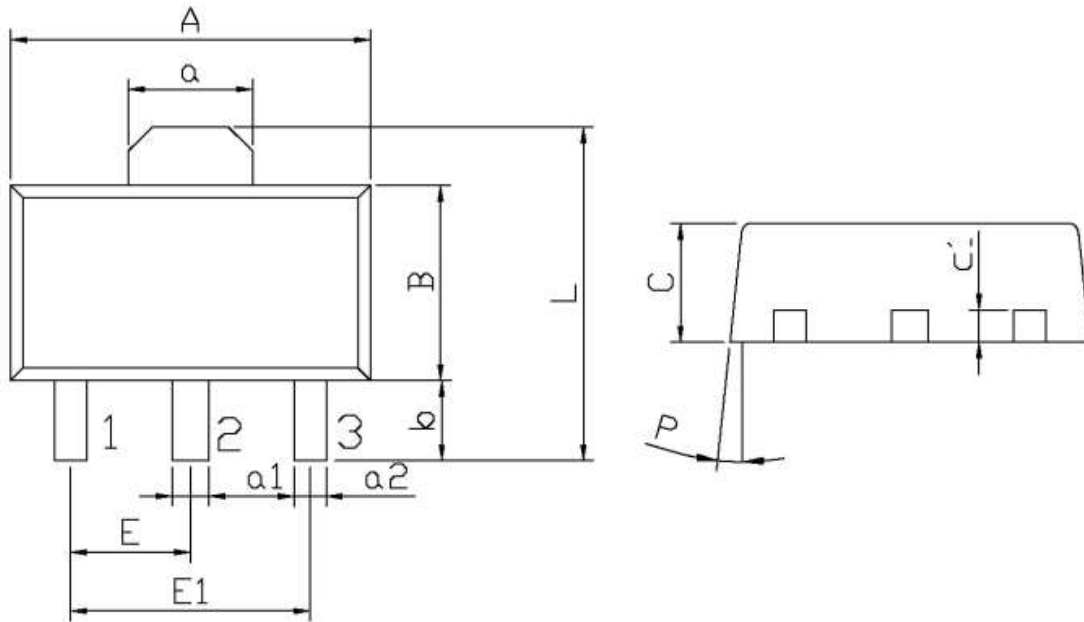
(3) Package Type: SOT-23



(4) SOT-25



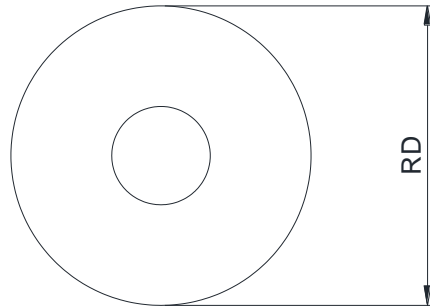
(5) SOT-89



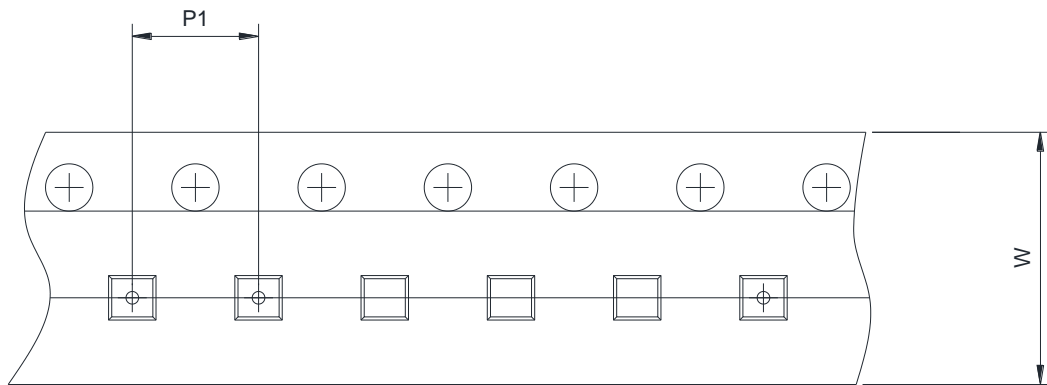
Symbol	Dimensions In Millimeters		Symbol	Dimensions In Millimeters	
	Min	Max		Min	Max
A	4.4	4.7	a1	0.36	0.56
B	2.35	2.65	a2	0.30	0.50
L	3.878	4.478	C	1.40	1.70
a	1.45	1.65	c1	0.35	0.50
E	1.40	1.60	P	6°	
E1	2.80	3.20			
b	0.80	1.20			

## Tape and Reel Information

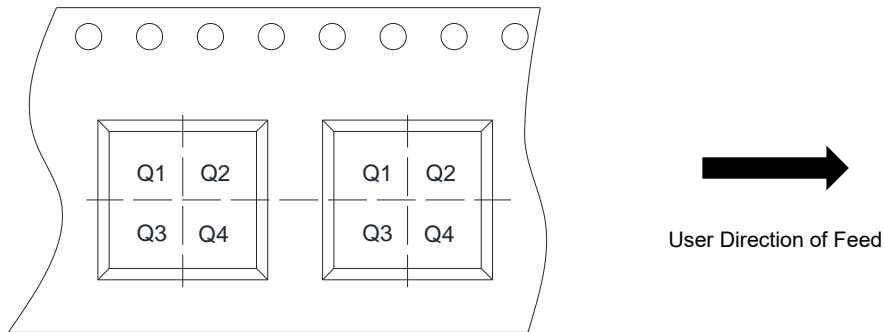
Reel Dimensions



Tape Dimensions



Quadrant Assignments for Pin1 Orientation in Tape



Project		SOT-23	SOT-25	SOT-89
RD	Reel Dimension	7inch	7inch	7inch
W	Overall Width of the Carrier Tape	8mm	8mm	12mm
P1	Pitch between Successive Cavity Centers	4mm	4mm	8mm
Pin1	Pin1 Quadrant	Q3	Q1	Q3