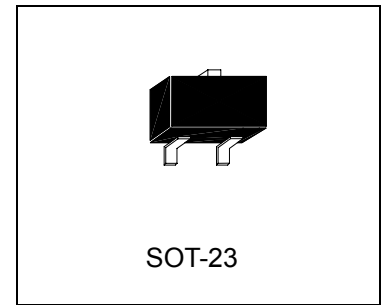


**Adjustable Precision Shunt Regulators**

# TL431N3



## Description

The TL431N3 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature range. The output voltage may be set to any value between  $V_{REF}$  (approximately 2.495 volts) and 40 volts with two external resistors. These devices have a typical dynamic output impedance of  $0.2\Omega$ . Active output circuitry provides a very sharp turn-on characteristic, making these devices excellent replacement for zener diodes in many applications.

## Features

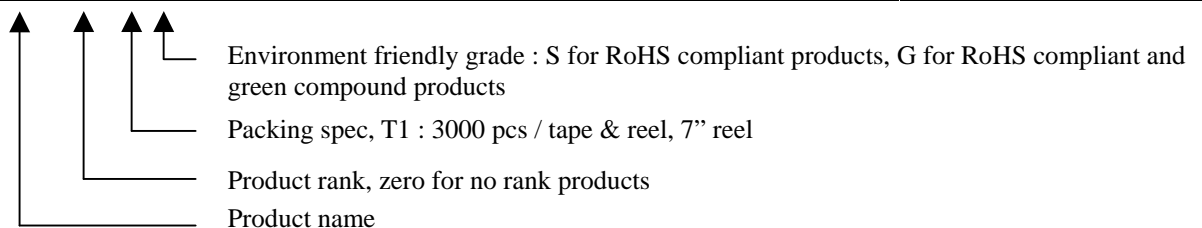
- Programmable output voltage
- Temperature coefficient is 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response
- Heat Resistance, Soldering iron : 300°C, 5 seconds
- Pb-free lead plating and halogen-free package

## Classification

Rank	A	B	C	AA
$V_{REF}$	$2.495\pm0.5\%$	$2.495\pm1\%$	$2.495\pm2\%$	$2.495\pm0.3\%$

## Ordering Information

Device	Package	Shipping
TL431N3-XX-T1-G	SOT-23 (Pb-free lead plating and halogen-free package)	3000 pcs / tape & reel





**Absolute Maximum Ratings**

(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	V <sub>KA</sub>	42	V
Cathode Current Range (Continuous)	I <sub>K</sub>	-100~+150	mA
Reference Input Current Range	I <sub>REF</sub>	0.05~+10	mA
Power Dissipation	P <sub>D</sub>	300	mW
Operating Temperature Range	T <sub>opr</sub>	-40~+125	°C
Junction Temperature Range	T <sub>j</sub>	-40~+150	°C
Storage Temperature Range	T <sub>stg</sub>	-65~+150	°C

**Thermal Characteristics**

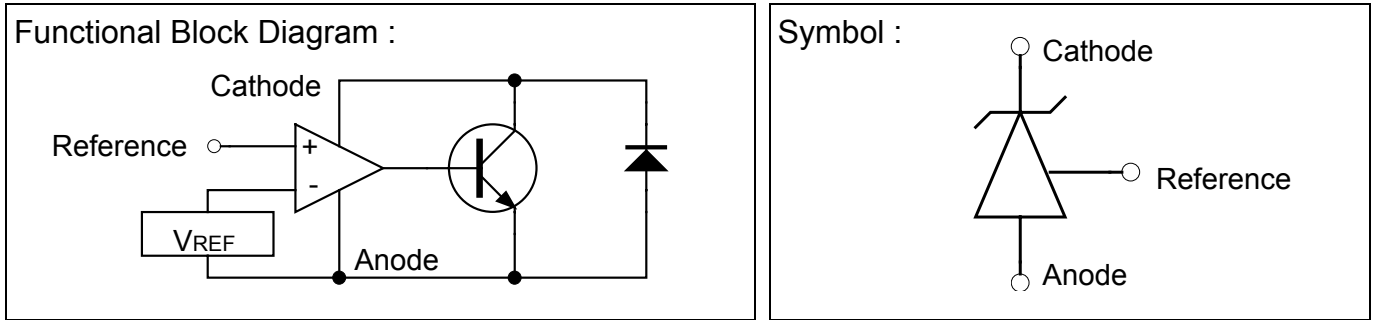
Symbol	Parameter	Conditions	Value	Unit
R <sub>th,j-c</sub>	thermal resistance from junction to case		223	°C/W
R <sub>th, j-a</sub>	thermal resistance from junction to ambient	(Note )	417	°C/W

Note : Free air condition

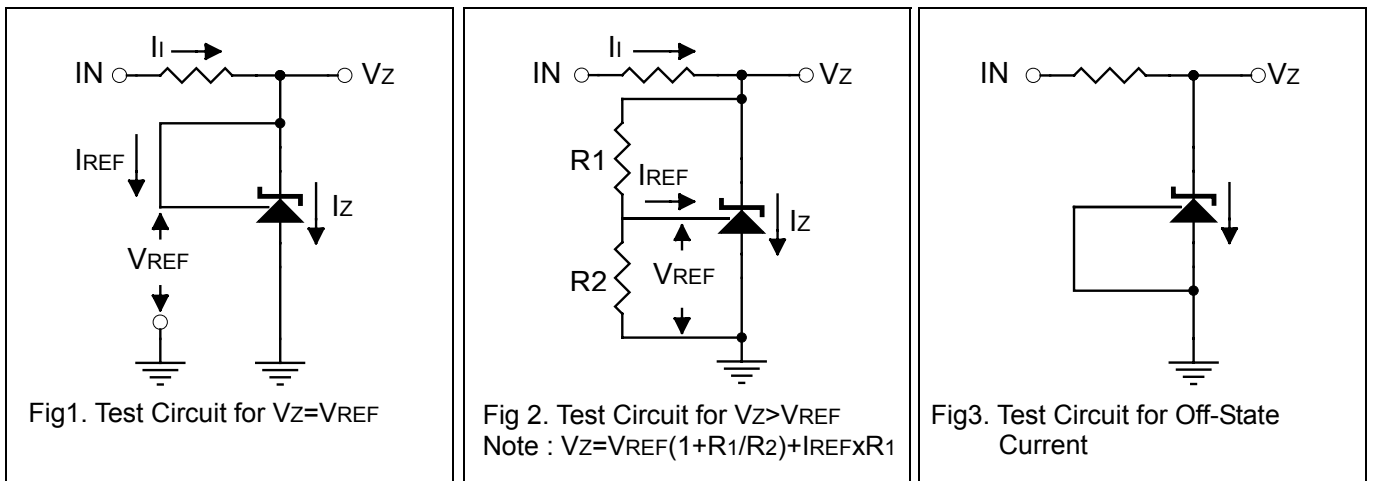
**Electrical Characteristics ( Ta=25°C unless otherwise specified )**

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage	V <sub>REF</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>K</sub> =10mA	2.483	2.495	2.507	V
			2.470	2.495	2.520	
			2.445	2.495	2.545	
			2.487	2.495	2.502	
Deviation of Reference Input Voltage Over-Temperature	V <sub>REF(dev)</sub>	V <sub>KA</sub> =V <sub>REF</sub> , I <sub>K</sub> =10mA T <sub>min</sub> ≤T <sub>a</sub> ≤T <sub>max</sub>	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	ΔV <sub>REF</sub> / ΔV <sub>KA</sub>	I <sub>K</sub> =10mA, ΔV <sub>KA</sub> =10V-V <sub>REF</sub>	-	-1.4	-2.7	mV/V
		I <sub>K</sub> =10mA, ΔV <sub>KA</sub> =36V-10V	-	-1.0	-2.0	mV/V
Reference Input Current	I <sub>REF</sub>	I <sub>K</sub> =10mA, R <sub>1</sub> =10kΩ, R <sub>2</sub> =∞	-	1.1	4	uA
Deviation of Reference Input Current Over Full Temperature Range	I <sub>REF(dev)</sub>	I <sub>K</sub> =10mA, R <sub>1</sub> =10kΩ, R <sub>2</sub> =∞, T <sub>a</sub> =Full Range	-	0.4	1.2	uA
Minimum Cathode Current for Regulation	I <sub>K(min)</sub>	V <sub>KA</sub> =V <sub>REF</sub>	-	0.33	0.5	mA
Off-State Cathode Current	I <sub>K(off)</sub>	V <sub>KA</sub> =42V, V <sub>REF</sub> =0	-	0.17	1.0	uA
Dynamic impedance	Z <sub>KA</sub>	V <sub>KA</sub> =V <sub>REF</sub> , f≤1.0KHz I <sub>K</sub> =1 to 100mA	-	0.2	0.5	Ω

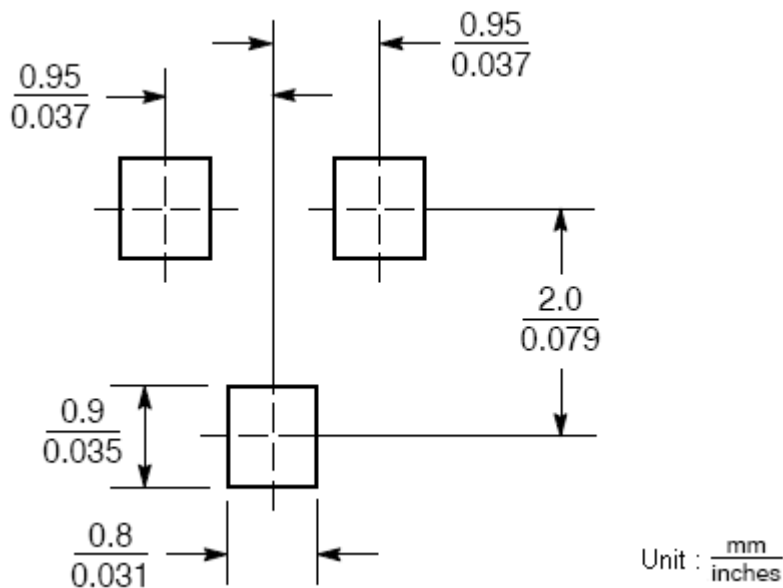
**Functional Block Diagram & Symbol**



**Test Circuits**

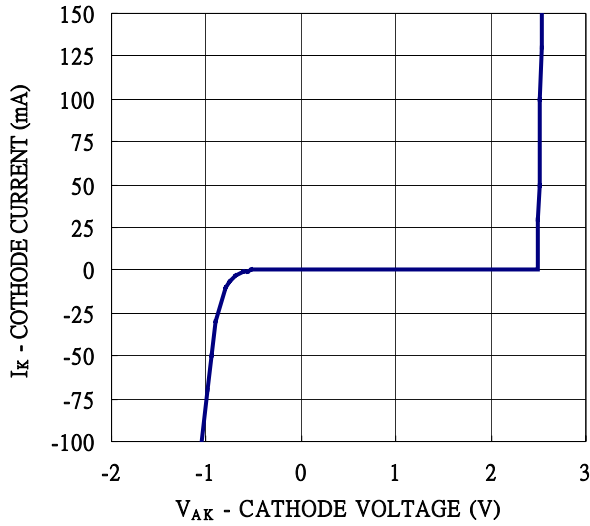


**Recommended Soldering Footprint**

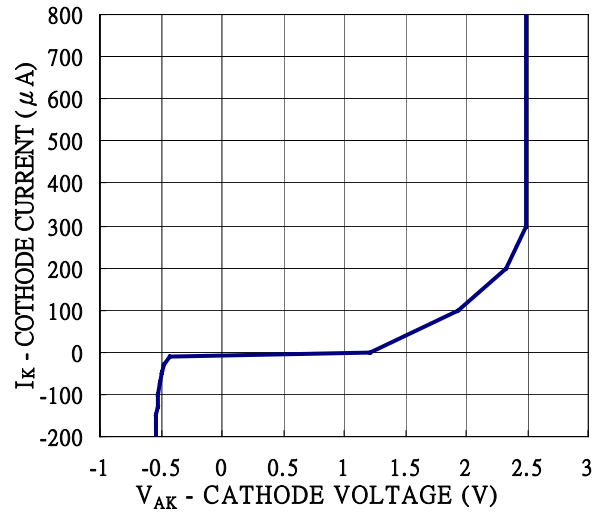


## Characteristic Curves

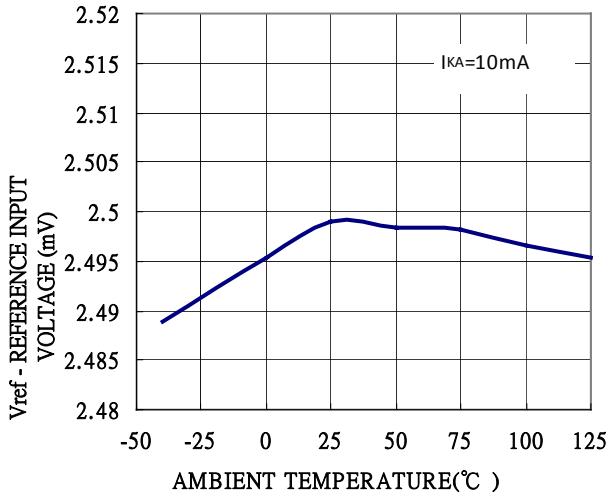
CATHODE CURRENT vs CATHODE VOLTAGE



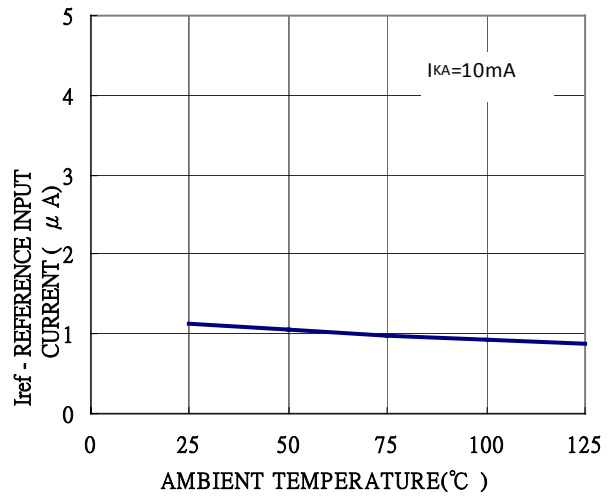
CATHODE CURRENT vs CATHODE VOLTAGE



REFERENCE INPUT VOLTAGE vs AMBIENT TEMPERATURE

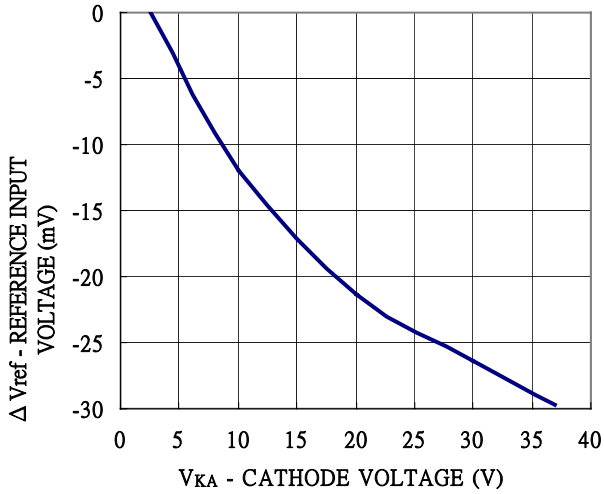


REFERENCE INPUT CURRENT vs AMBIENT TEMPERATURE

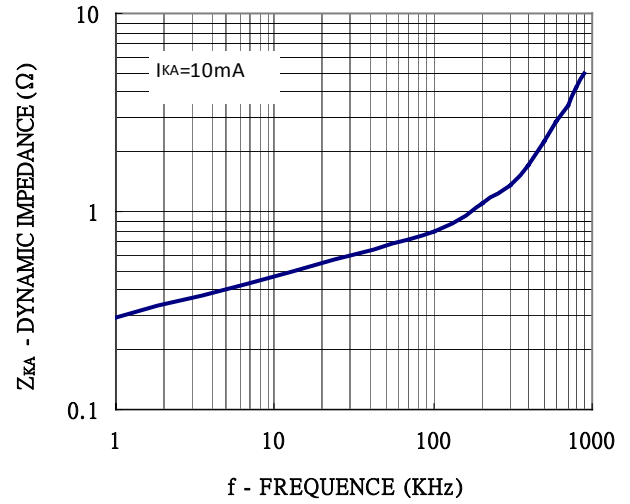


**Characteristic Curves(Cont.)**

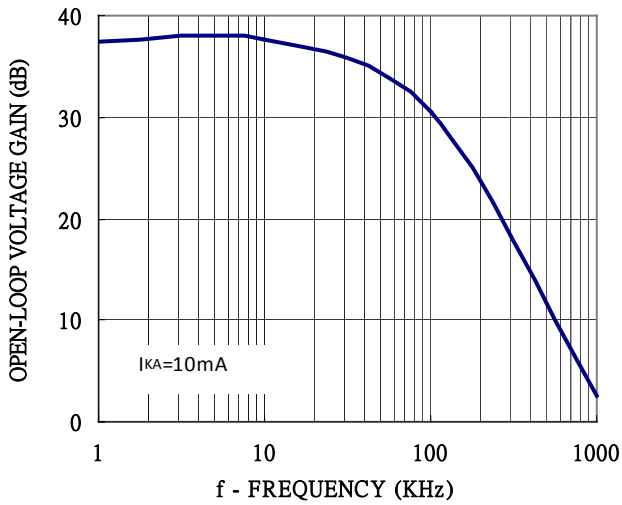
CATHODE VOLTAGE vs REFERENCE INPUT VOLTAGE



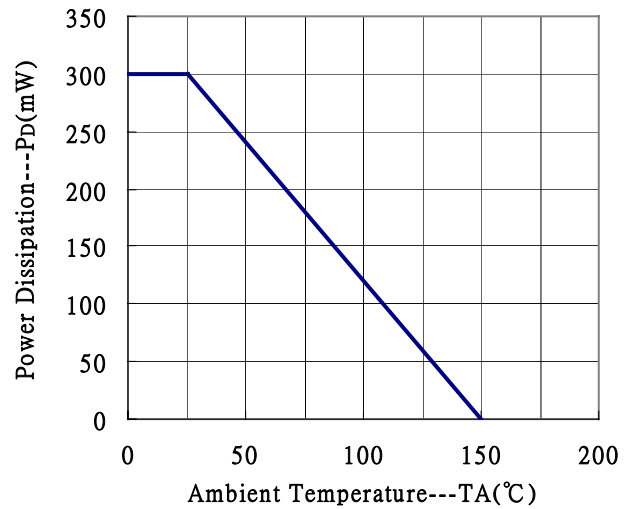
DYNAMIC IMPEDANCE vs FREQUENCY



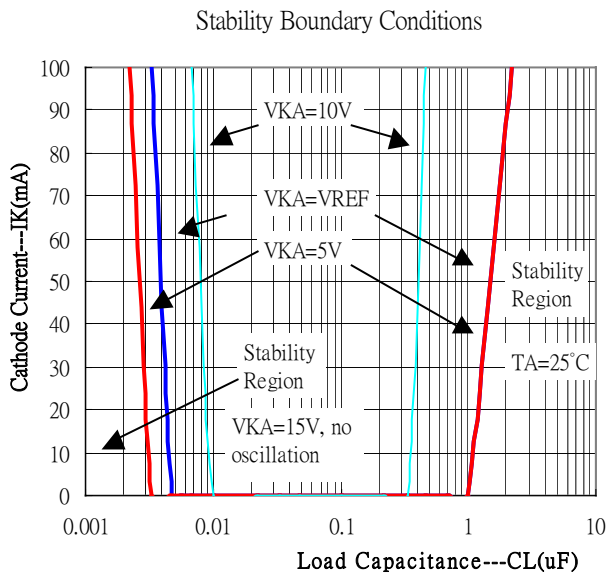
OPEN-LOOP VOLTAGE GAIN vs FREQUENCY



Power Derating Curve



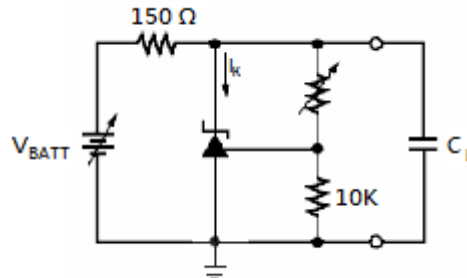
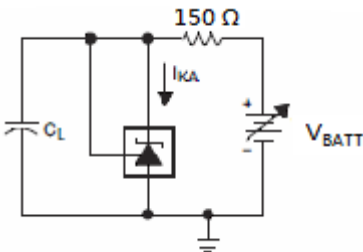
**Typical Characteristics(Cont.)**



**Test Circuit for Stability Boundary Conditions**

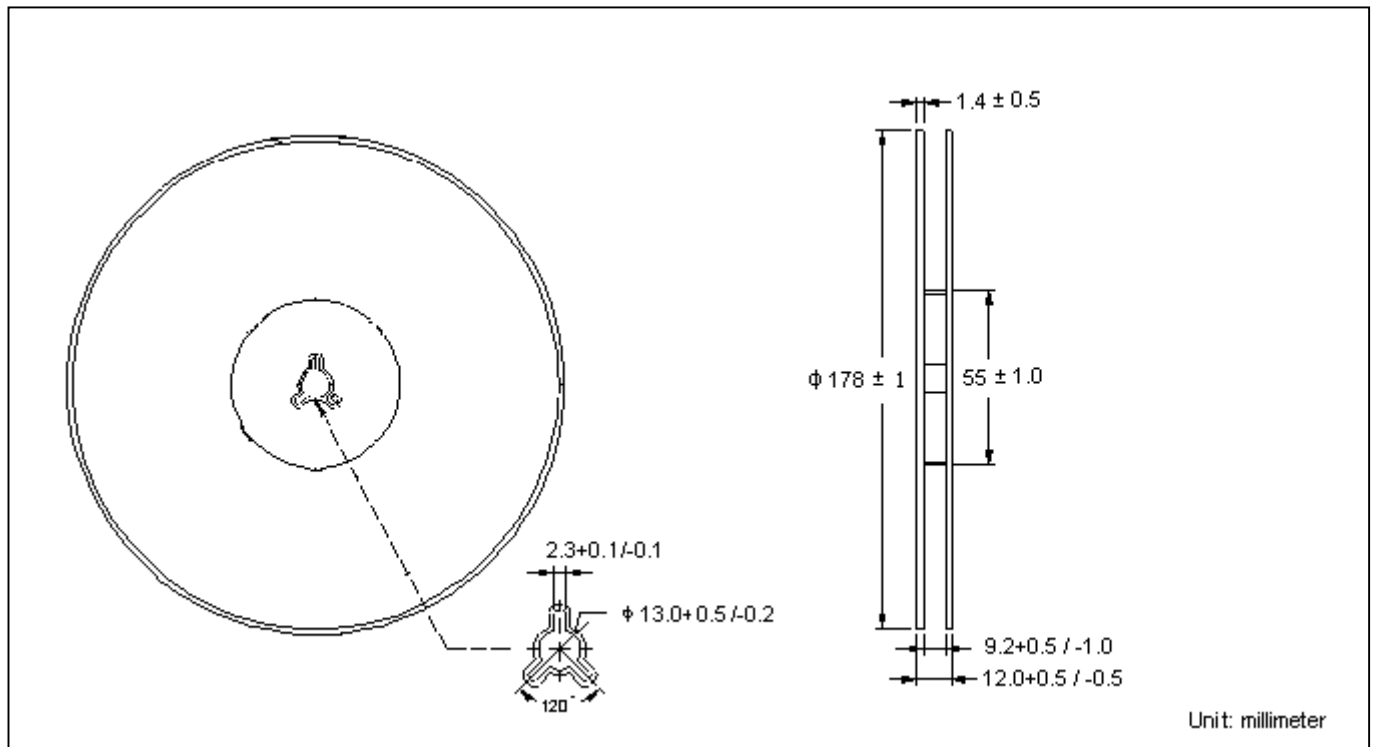
VKA=VREF

VKA=5V, 10V, 15V

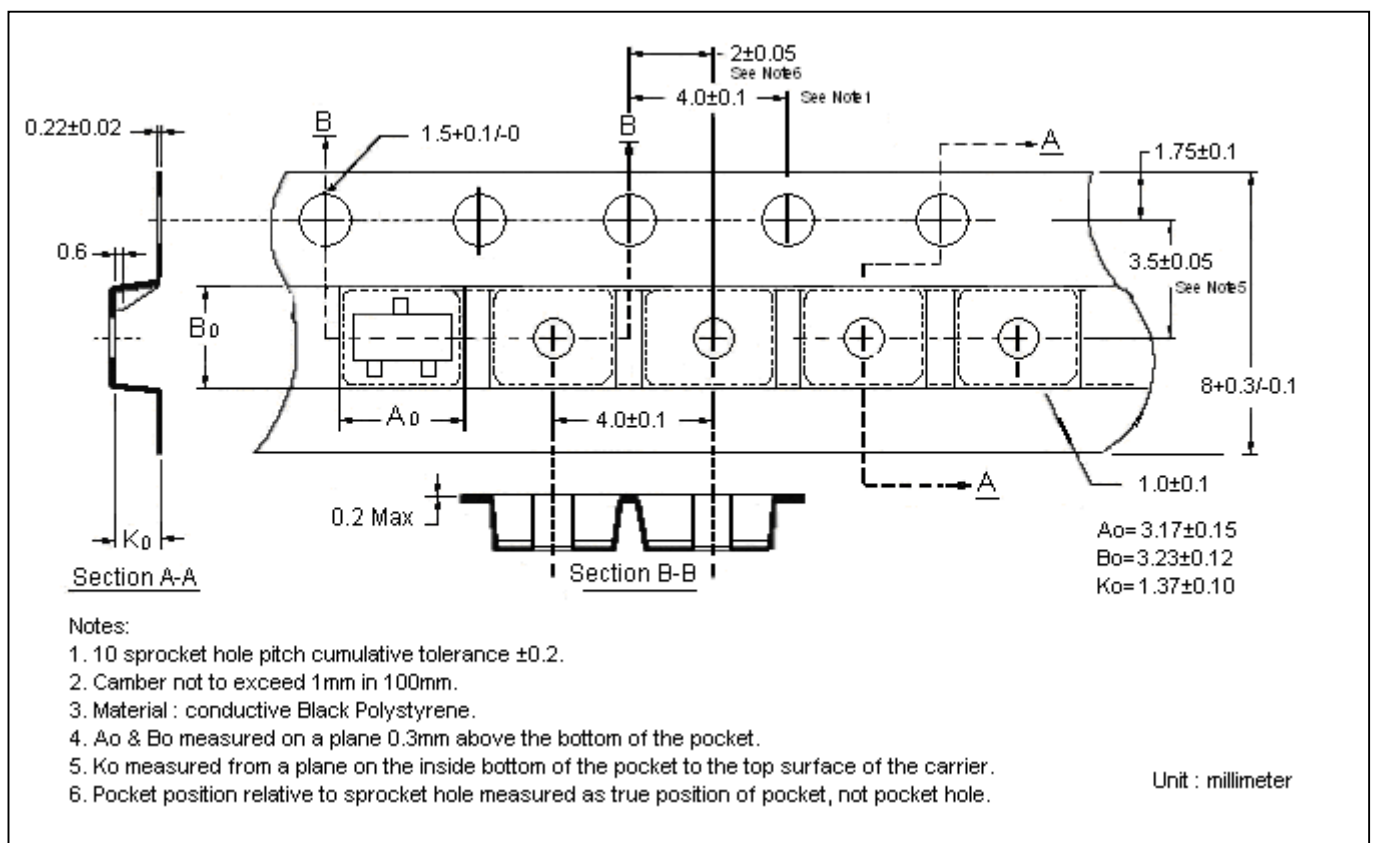


※  $C_L$  : MLCC capacitor

### Reel Dimension



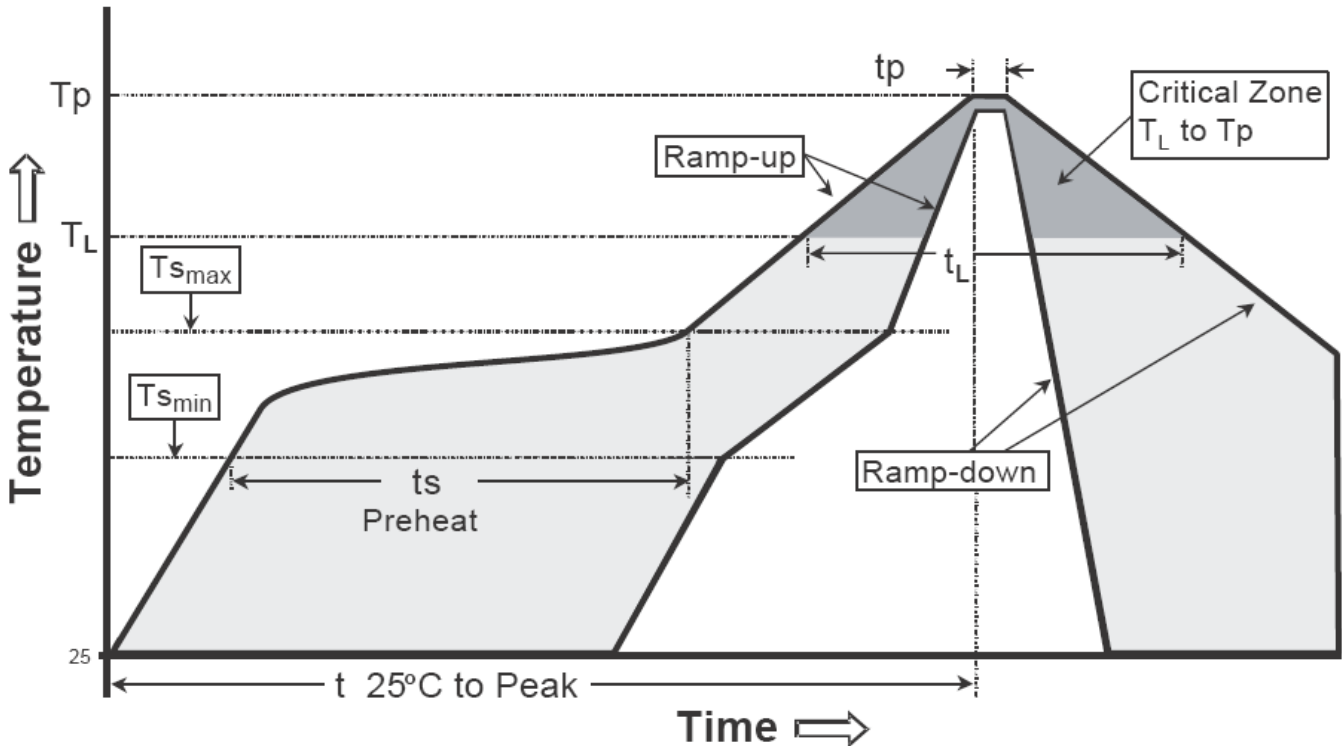
### Carrier Tape Dimension



**Recommended wave soldering condition**

Product	Peak Temperature	Soldering Time
Pb-free devices	260 +0/-5 °C	5 +1/-1 seconds

**Recommended temperature profile for IR reflow**

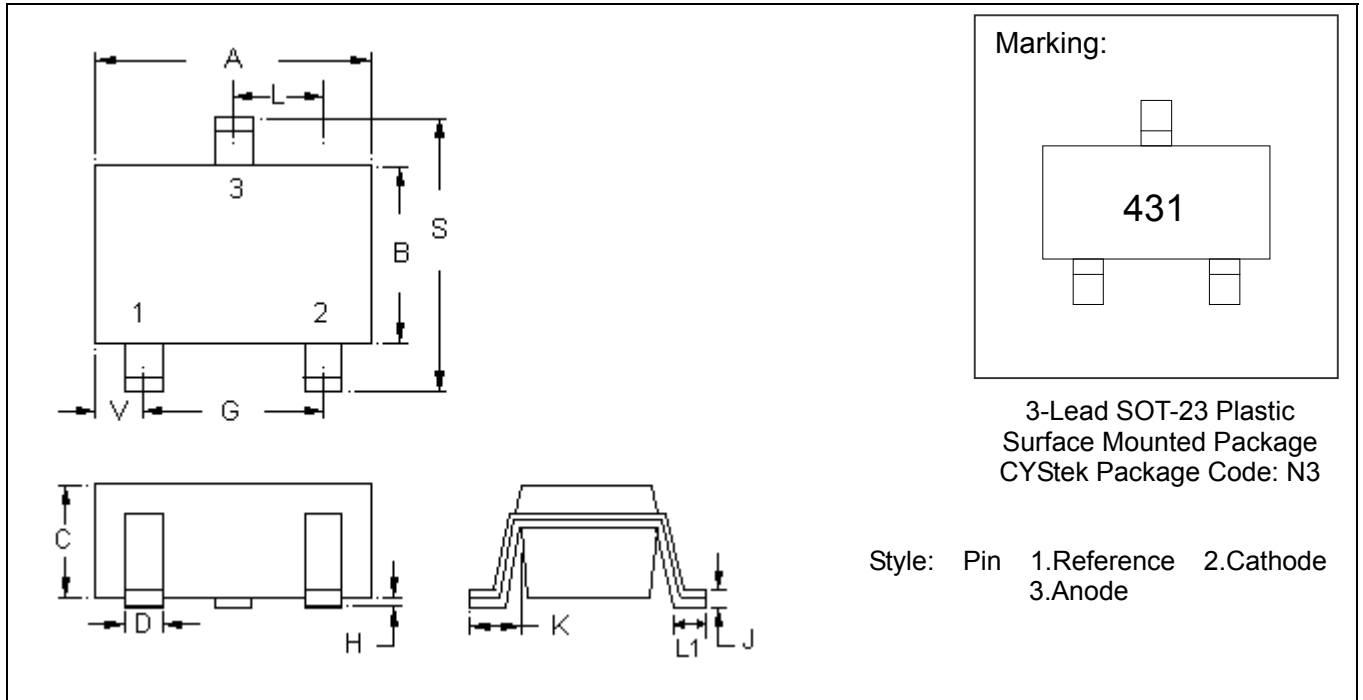


Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmax to Tp)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(Ts min)	100°C	150°C
-Temperature Max(Ts max)	150°C	200°C
-Time(ts min to ts max)	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (Tl)	183°C	217°C
- Time (tL)	60-150 seconds	60-150 seconds
Peak Temperature(Tp)	240 +0/-5 °C	260 +0/-5 °C
Time within 5°C of actual peak temperature(tp)	10-30 seconds	20-40 seconds
Ramp down rate	6°C/second max.	6°C/second max.
Time 25 °C to peak temperature	6 minutes max.	8 minutes max.

Note : All temperatures refer to topside of the package, measured on the package body surface.



**SOT-23 Dimension**



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1102	0.1204	2.80	3.04	J	0.0032	0.0079	0.08	0.20
B	0.0472	0.0669	1.20	1.70	K	0.0118	0.0266	0.30	0.67
C	0.0335	0.0512	0.89	1.30	L	0.0335	0.0453	0.85	1.15
D	0.0118	0.0197	0.30	0.50	S	0.0830	0.1161	2.10	2.95
G	0.0669	0.0910	1.70	2.30	V	0.0098	0.0256	0.25	0.65
H	0.0000	0.0040	0.00	0.10	L1	0.0118	0.0197	0.30	0.50

**Notes:** 1.Controlling dimension: millimeters.  
 2.Maximum lead thickness includes lead finish thickness, and minimum lead thickness is the minimum thickness of base material.  
 3.If there is any question with packing specification or packing method, please contact your local CYCtek sales office.

**Material:**

- Lead: Pure tin plated.
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0.

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