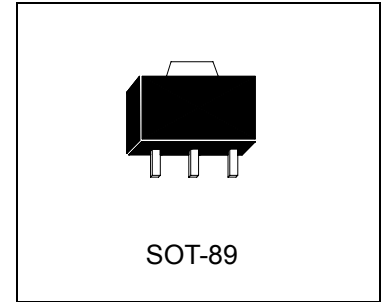


Adjustable Precision Shunt Regulators

TL431M3


Description

The TL431M3 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 0.2Ω . 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

Classification

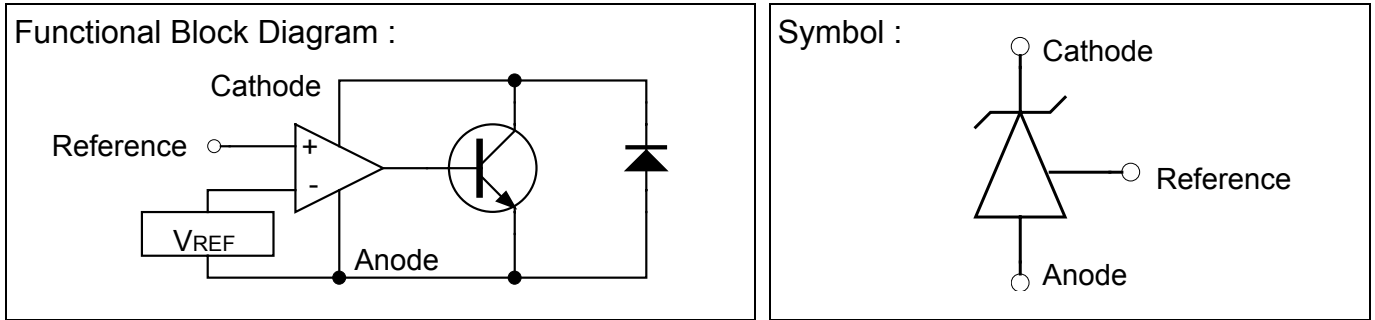
Rank	A	B	C
V_{REF}	$2.495\pm 0.5\%$	$2.495\pm 1\%$	$2.495\pm 2\%$

Absolute Maximum Ratings

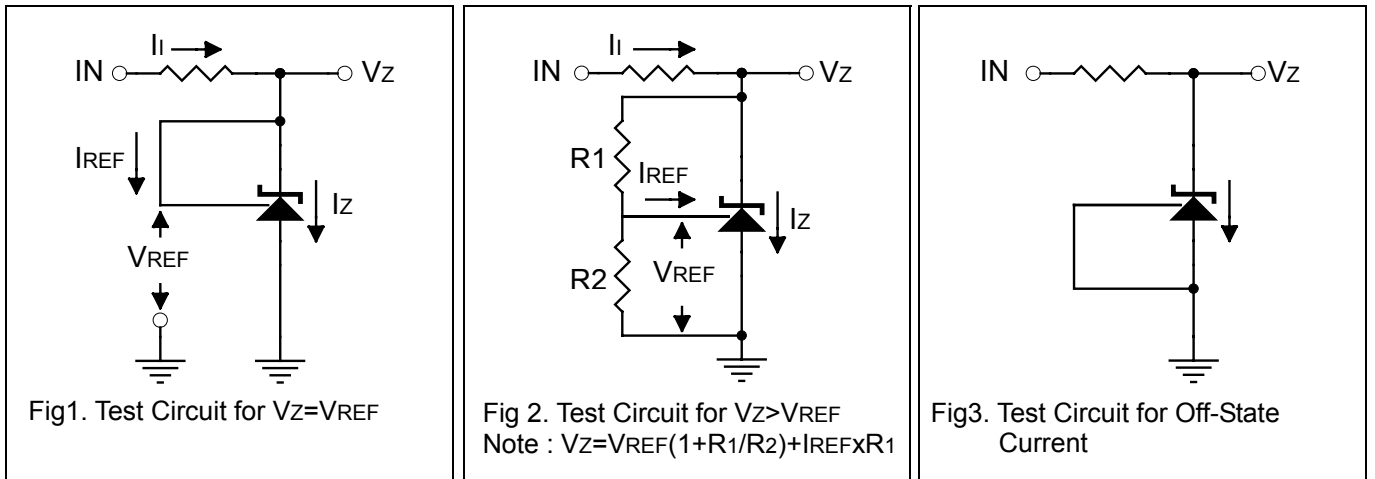
(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	V_{KA}	42	V
Cathode Current Range (Continuous)	I_K	-100~+150	mA
Reference Input Current Range	I_{REF}	-0.05~+10	mA
Power Dissipation	P_D	1	W
Operating Temperature Range	T_{opr}	-40~+125	°C
Storage Temperature Range	T_{stg}	-65~+150	°C

Functional Block Diagram & Symbol



Test Circuits



Electrical Characteristics ($T_a=25^\circ\text{C}$ unless otherwise specified)

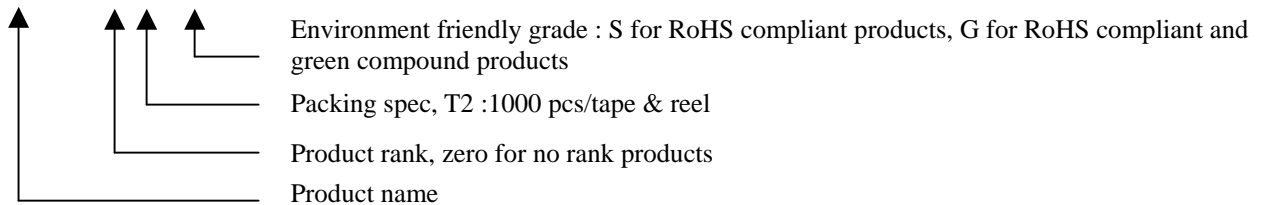
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage TL431 A-rank TL431 B-rank TL431 C-rank	V_{REF}	$V_{KA}=V_{REF}, I_K=10\text{mA}$	2.483	2.495	2.507	V
			2.470	2.495	2.520	
			2.445	2.495	2.545	
Deviation of Reference Input Voltage Over-Temperature (Note)	$V_{REF(\text{dev})}$	$V_{KA}=V_{REF}, I_K=10\text{mA}$ $T_{\min} \leq T_a \leq T_{\max}$	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF} / \Delta V_{KA}$	$I_K=10\text{mA},$ $\Delta V_{KA}=10\text{V} \sim V_{REF}$	-	-1.4	-2.7	mV/ V
		$I_K=10\text{mA},$ $\Delta V_{KA}=36\text{V} \sim 10\text{V}$	-	-1.0	-2.0	
Reference Input Current	I_{REF}	$I_K=10\text{mA}, R_1=10\text{k}\Omega,$ $R_2=\infty$	-	1.1	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$I_{REF(\text{dev})}$	$I_K=10\text{mA}, R_1=10\text{k}\Omega,$ $R_2=\infty, T_a=\text{Full Range}$	-	0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{K(\text{min})}$	$V_{KA}=V_{REF}$	-	0.33	0.5	mA
Off-State Cathode Current	$I_{K(\text{off})}$	$V_{KA}=36\text{V}, V_{REF}=0$	-	0.17	1.0	μA
Dynamic impedance	$ Z_{KA} $	$V_{KA}=V_{REF}, f \leq 1.0\text{KHz}$ $I_K=1$ to 100mA	-	0.2	0.5	Ω

Note : $T_{\min}=0^\circ\text{C}, T_{\max}=70^\circ\text{C}$



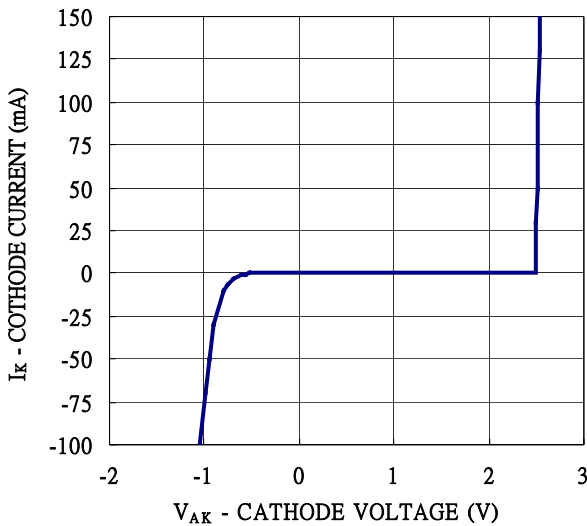
Ordering Information

Device	Package	Shipping
TL431M3-X-T2-G	SOT-89 (Pb-free lead plating and halogen-free package)	1000 pcs / Tape & Reel

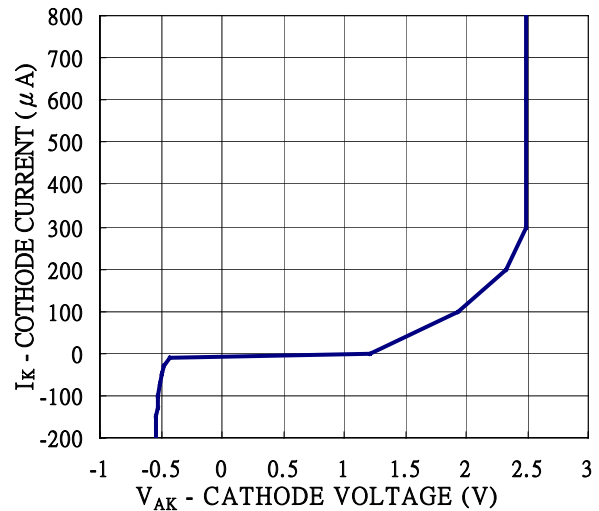


Typical Characteristics

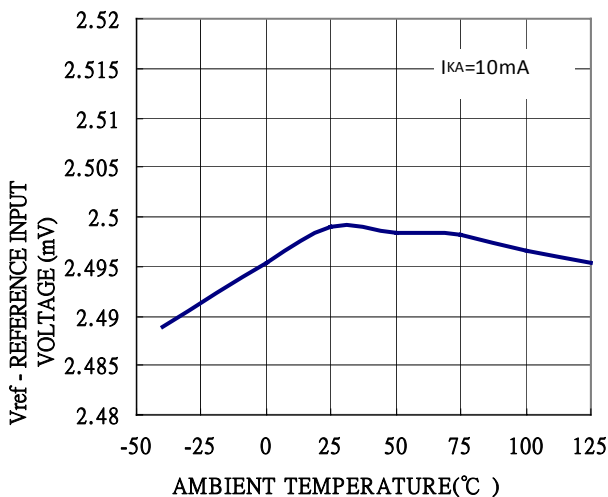
CATHODE CURRENT vs CATHODE VOLTAGE



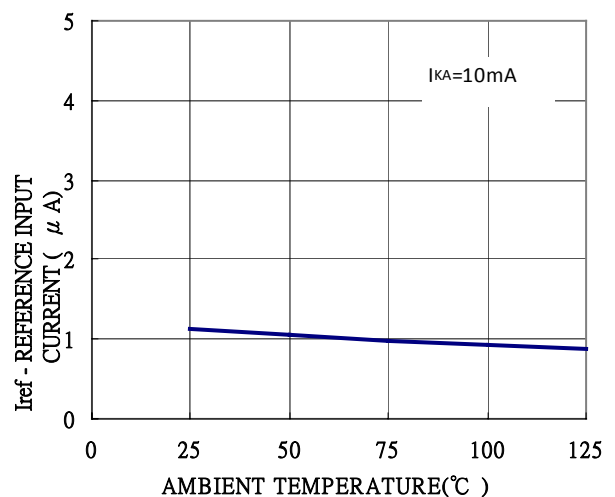
CATHODE CURRENT vs CATHODE VOLTAGE



REFERENCE INPUT VOLTAGE vs AMBIENT TEMPERATURE



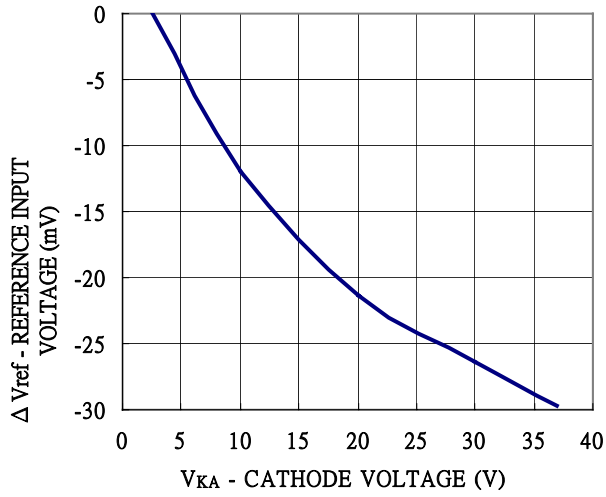
REFERENCE INPUT CURRENT vs AMBIENT TEMPERATURE



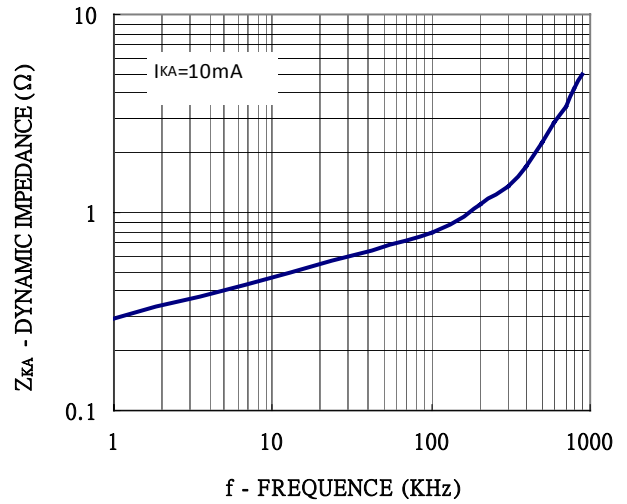


Typical Characteristics(Cont.)

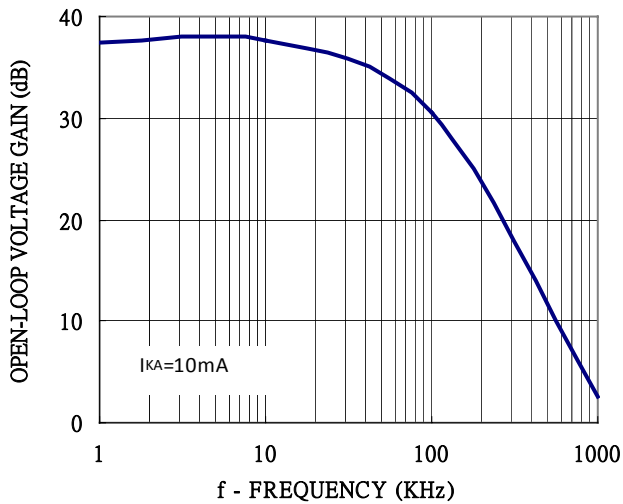
CATHODE VOLTAGE vs REFERENCE INPUT VOLTAGE



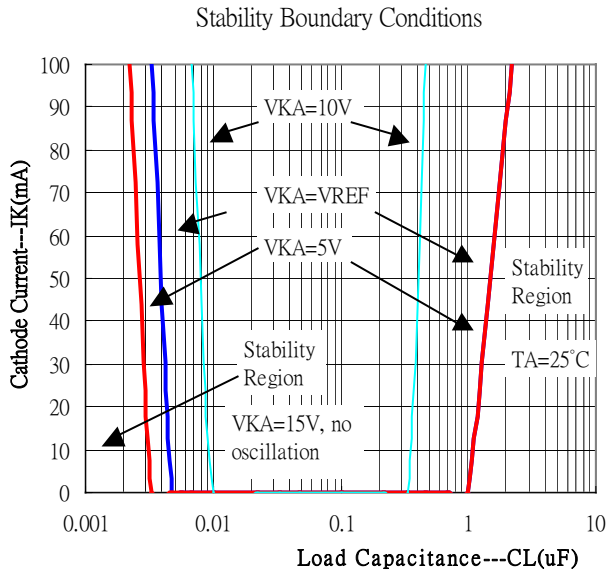
DYNAMIC IMPEDANCE vs FREQUENCY



OPEN-LOOP VOLTAGE GAIN vs FREQUENCY



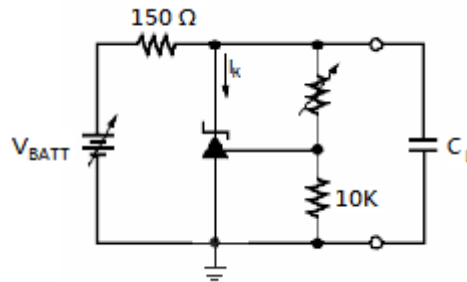
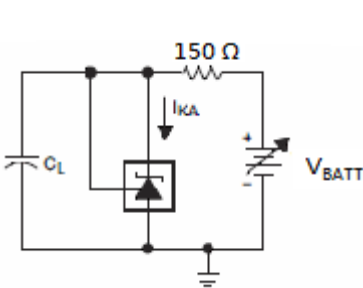
Typical Characteristics(Cont.)



Test Circuit for Stability Boundary Conditions

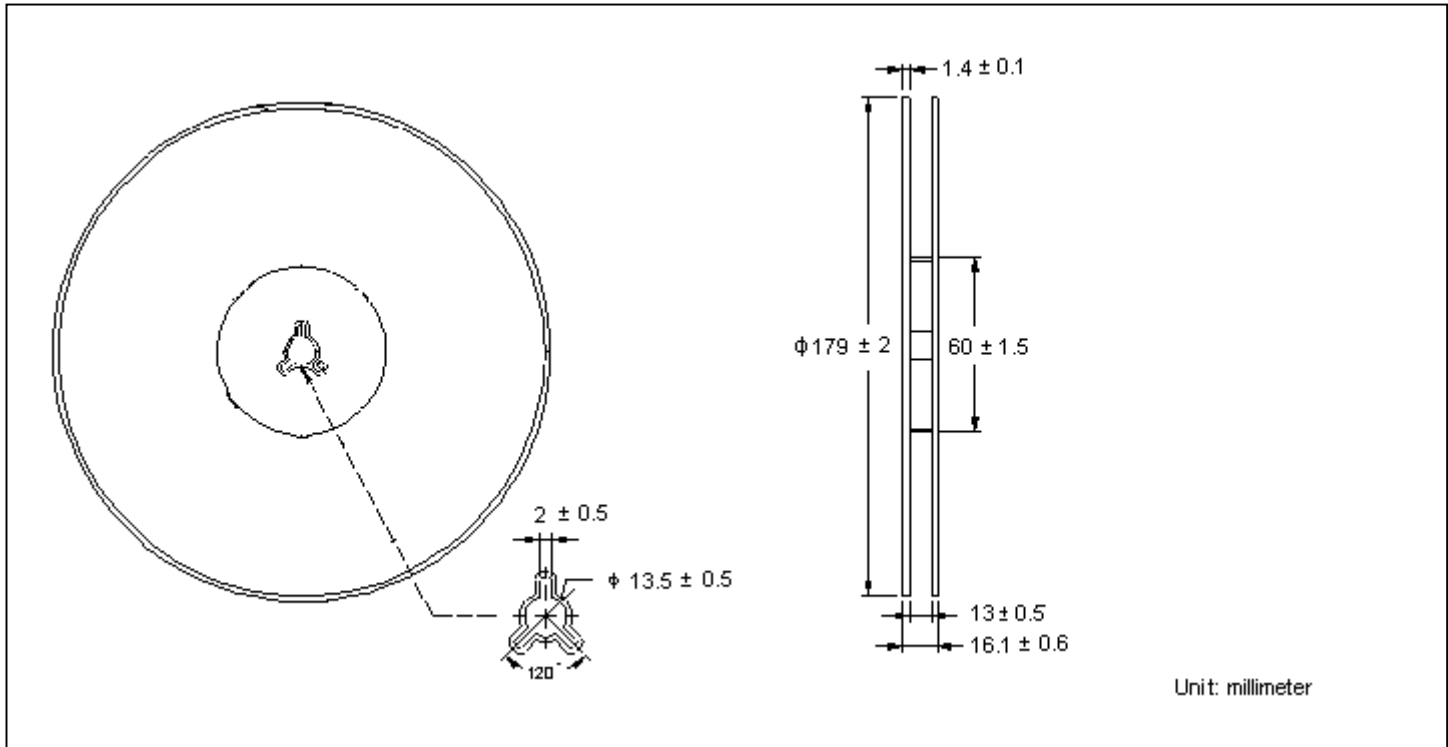
VKA=VREF

VKA=5V, 10V, 15V

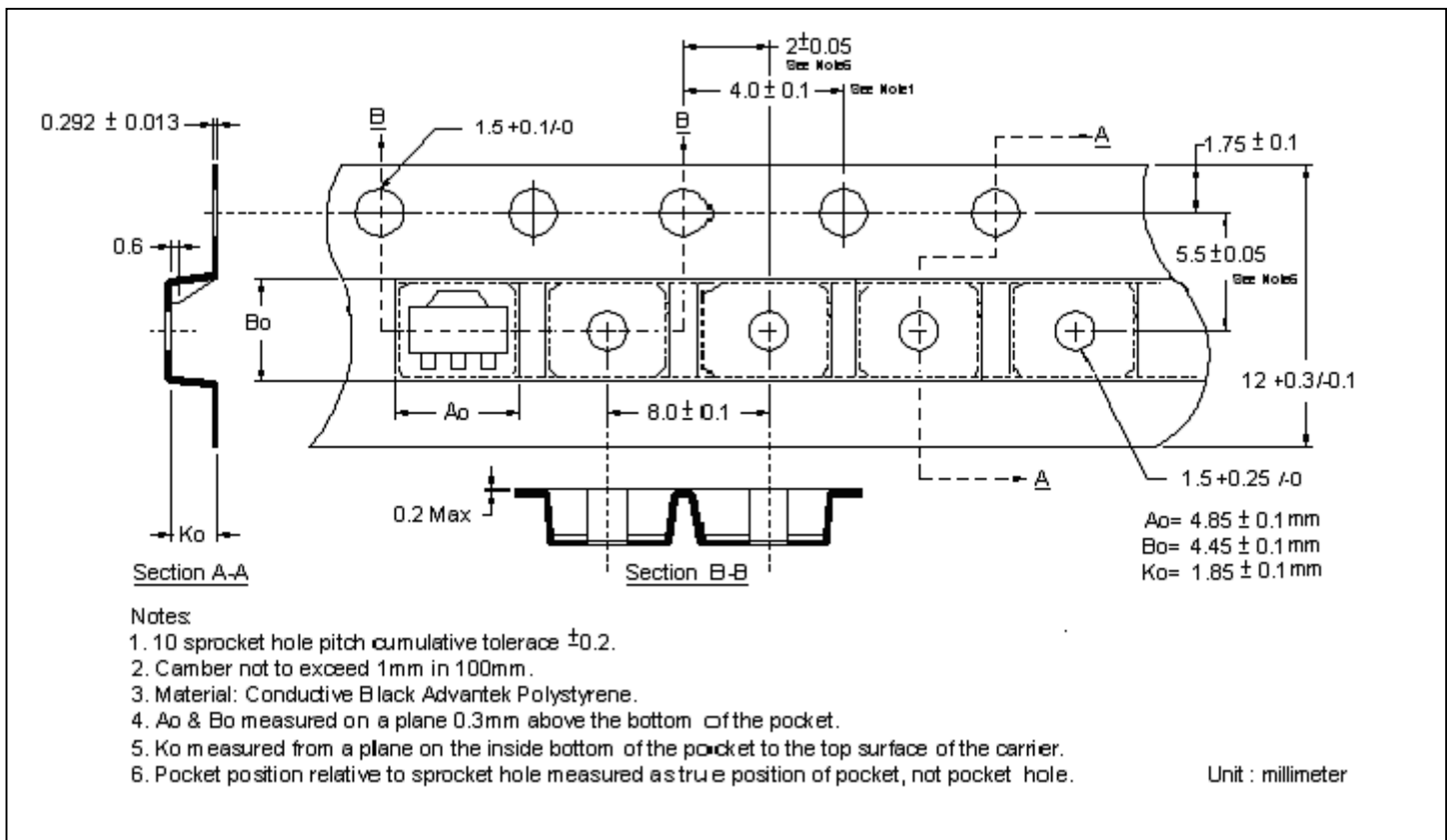


※ C_L : MLCC capacitor

Reel Dimension



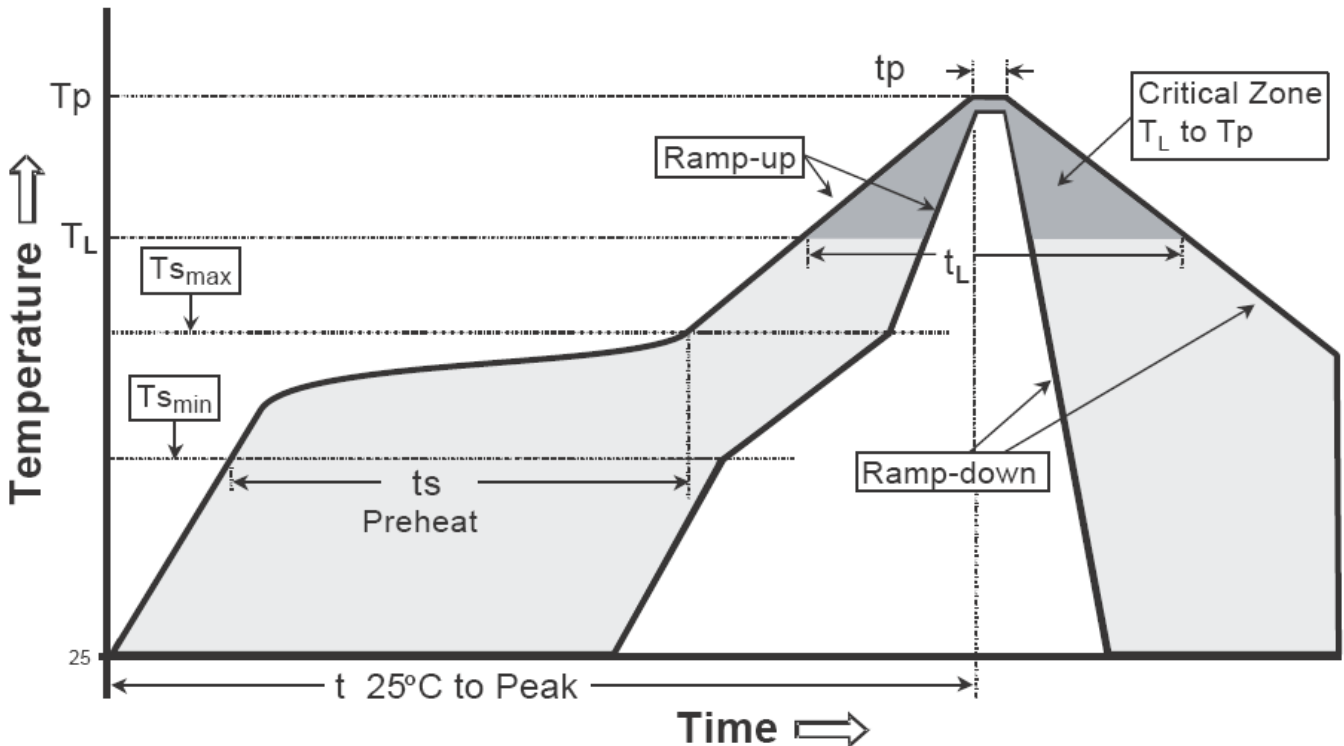
Carrier Tape Dimension



Recommended wave soldering condition

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

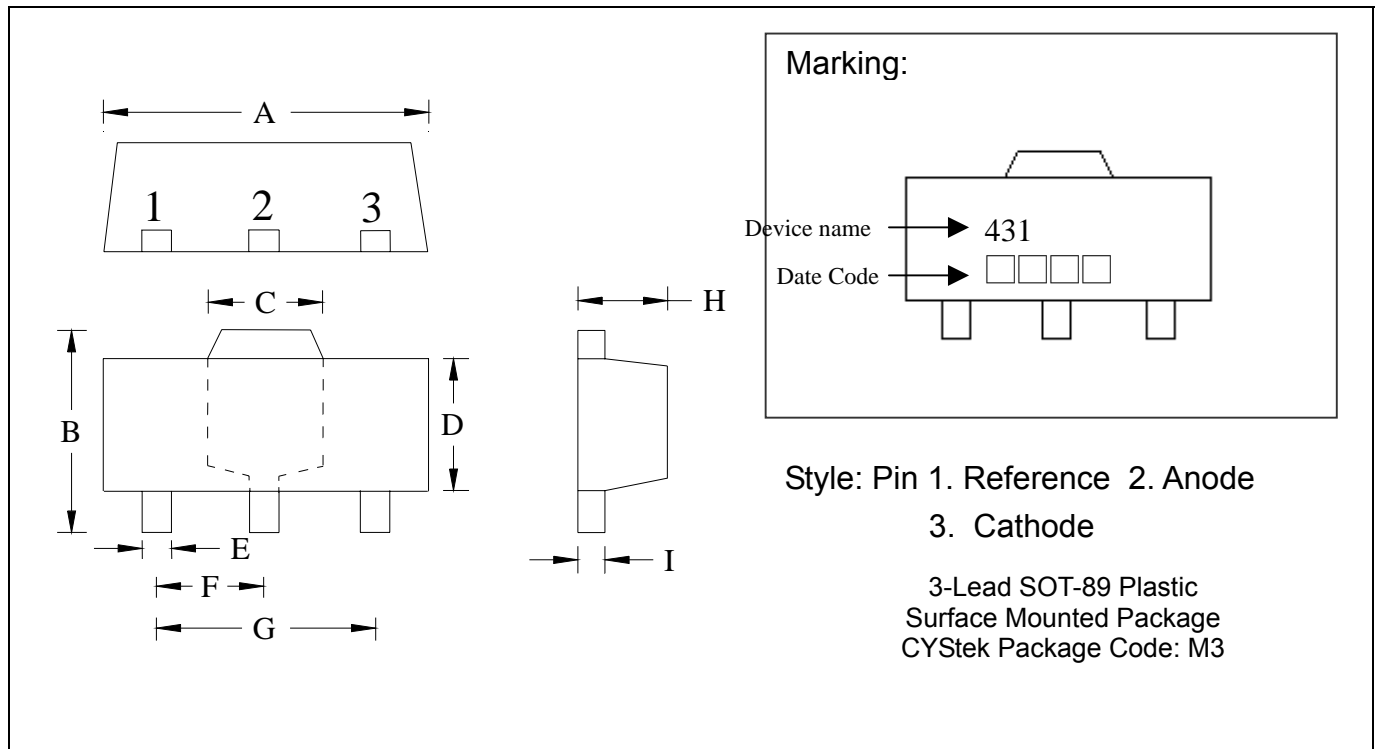
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (Tsmmax 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-89 Dimension



DIM	Inches		Millimeters		DIM	Inches		Millimeters	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.1732	0.1811	4.40	4.60	F	0.0591	TYP	1.50	TYP
B	0.1551	0.1673	3.94	4.25	G	0.1181	TYP	3.00	TYP
C	0.0610	REF	1.55	REF	H	0.0551	0.0630	1.40	1.60
D	0.0906	0.1024	2.30	2.60	I	0.0138	0.0173	0.35	0.44
E	0.0126	0.0205	0.32	0.52					

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 CYStek sales office.

Material:

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

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