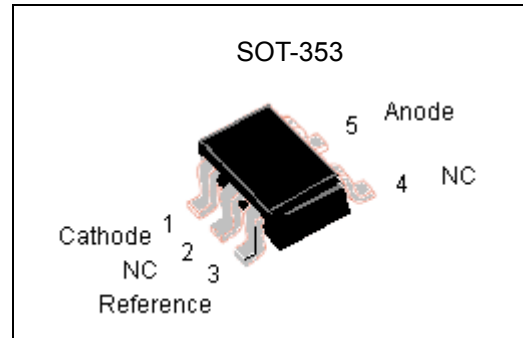


Adjustable Precision Shunt Regulators

TL431S5



Description

The TL431S5 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 2.500 volts) and 36 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

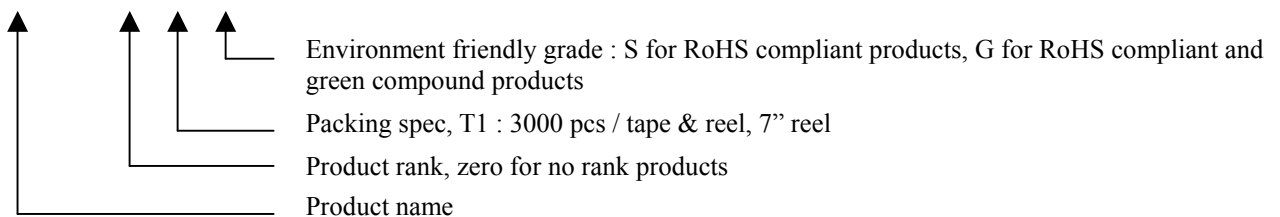
- Programmable output voltage
- Temperature coefficient is 20ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response
- Heat Resistance, Soldering iron : 300°C, 5 seconds
- Pb-free lead plating and halogen-free package

Classification

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

Ordering Information

Device	Package	Shipping
TL431S5- X - T1 - G	SOT-353 (Pb-free lead plating and halogen-free package)	3000 pcs / tape & reel

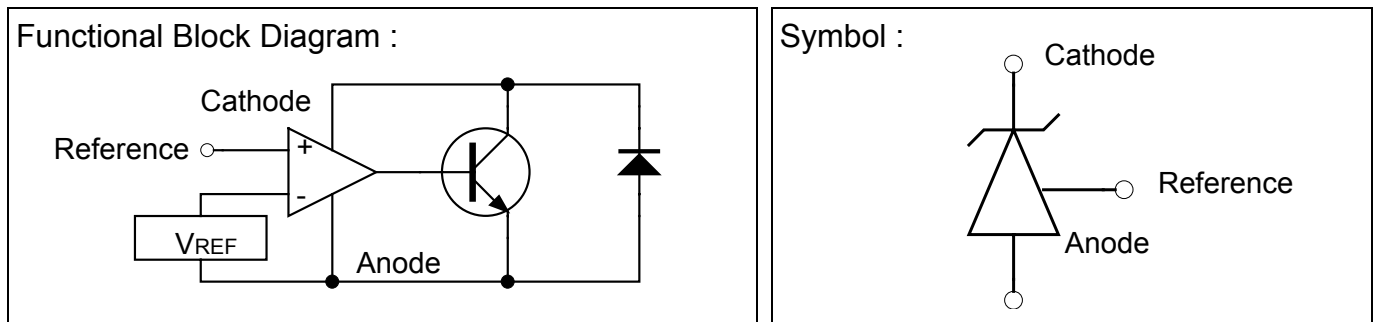


Absolute Maximum Ratings

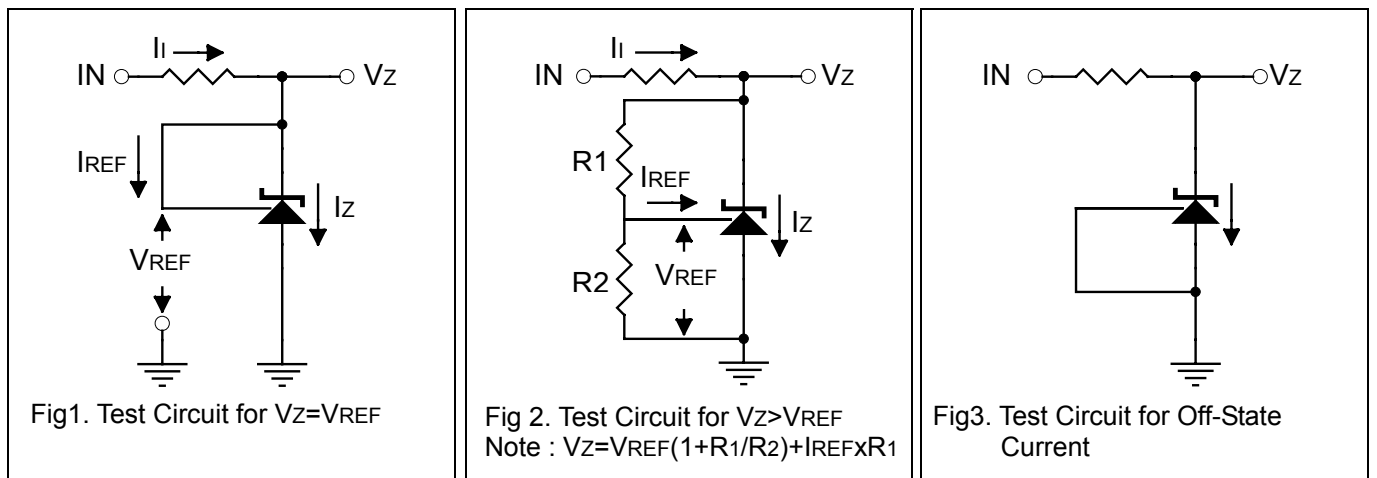
(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	V_{KA}	37	V
Cathode Current Range (Continuous)	I_K	-100~+150	mA
Reference Input Current Range	I_{REF}	0.05~+10	mA
Power Dissipation	P_D	200	mW
Thermal Resistance, Junction to Ambient	$R_{\theta JA}$	625	°C/W
Operating Temperature Range	T_{opr}	-40~+125	°C
Junction Temperature Range	T_j	-65~+150	°C
Storage Temperature Range	T_{stg}	-65~+150	°C

Functional Block Diagram & Symbol

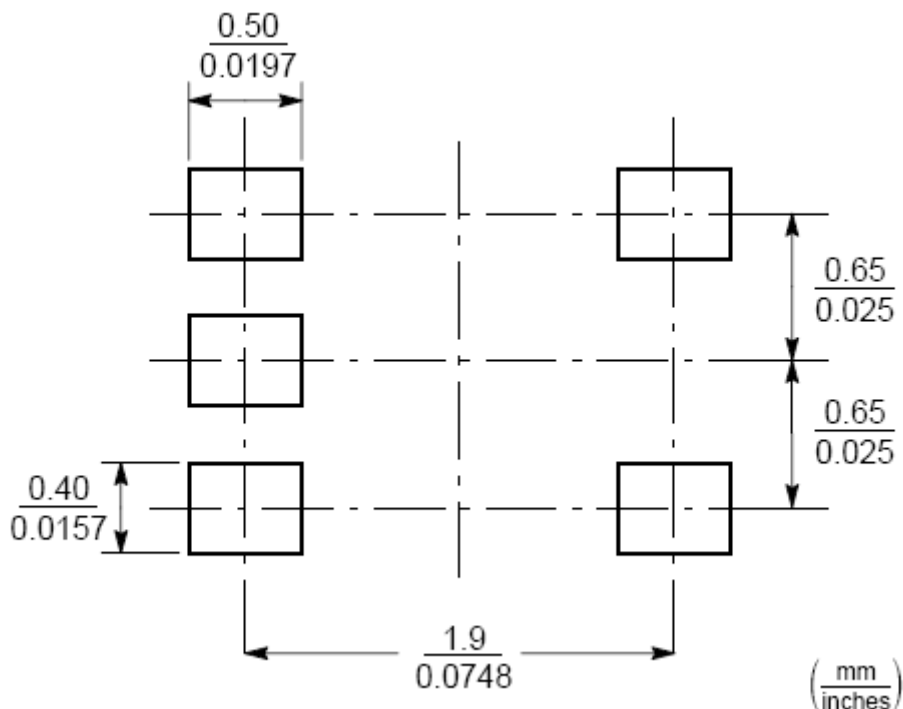


Test Circuits



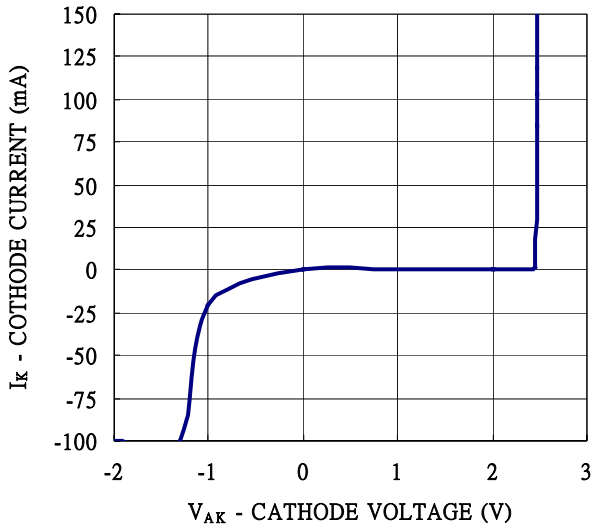
Electrical Characteristics (Ta=25°C unless otherwise specified)

Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage A-RANK B-RANK	V_{REF}	$V_{KA}=V_{REF}, I_K=10mA$	2.480 2.470	2.495 2.495	2.510 2.520	V
Deviation of Reference Input Voltage Over-Temperature	$V_{REF(dev)}$	$V_{KA}=V_{REF}, I_K=10mA$ $T_{min} \leq T_a \leq T_{max}$	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage	$\Delta V_{REF} / \Delta V_{KA}$	$I_K=10mA,$ $\Delta V_{KA}=10V-V_{REF}$	-	-1.4	-2.7	mV/V
		$I_K=10mA,$ $\Delta V_{KA}=36V-10V$	-	-1.0	-2.0	mV/V
Reference Input Current	I_{REF}	$I_K=10mA, R_1=10k\Omega,$ $R_2=\infty$	-	2	4	μA
Deviation of Reference Input Current Over Full Temperature Range	$I_{REF(dev)}$	$I_K=10mA, R_1=10k\Omega,$ $R_2=\infty, T_a=Full\ Range$	-	0.4	1.2	μA
Minimum Cathode Current for Regulation	$I_{K(min)}$	$V_{KA}=V_{REF}$	-	0.34	0.5	mA
Off-State Cathode Current	$I_{K(off)}$	$V_{KA}=36V, V_{REF}=0$	-	0.1	1.0	μA
Dynamic impedance	Z_{KA}	$V_{KA}=V_{REF}, f \leq 1.0KHz$ $I_K=1\ to\ 100mA$	-	0.2	0.5	Ω

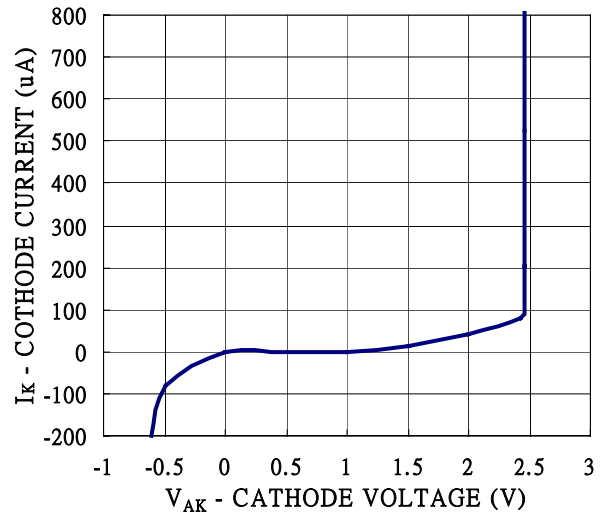
Recommended Soldering Footprint


Typical Characteristics

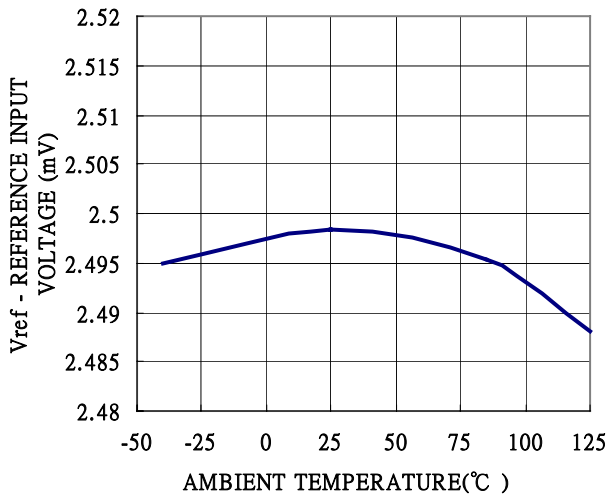
CATHODE CURRENT vs CATHODE VOLTAGE



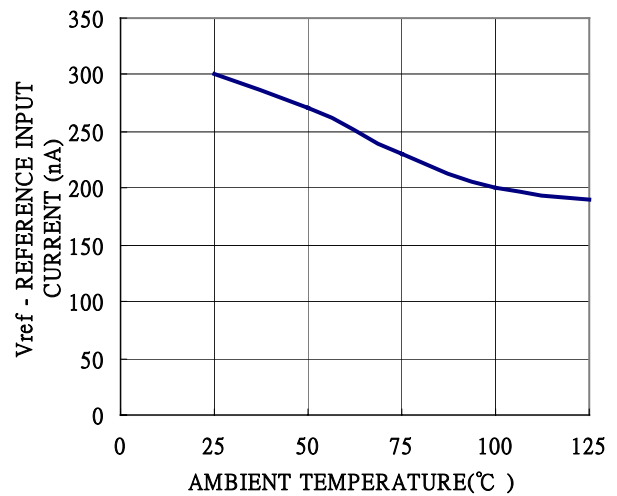
CATHODE CURRENT vs CATHODE VOLTAGE



REFERENCE INPUT VOLTAGE vs AMBIENT TEMPERATURE



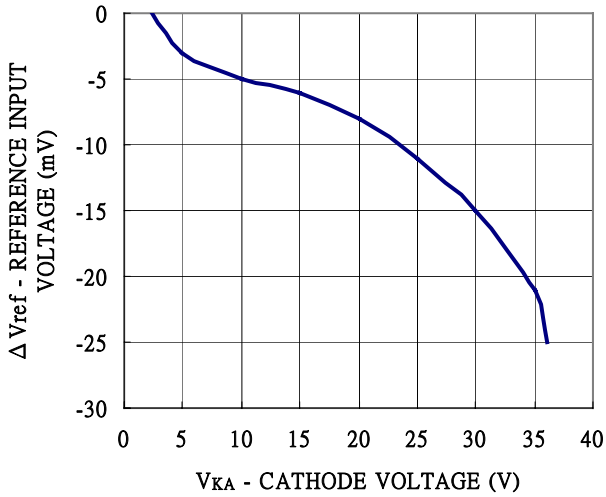
REFERENCE INPUT CURRENT vs AMBIENT TEMPERATURE



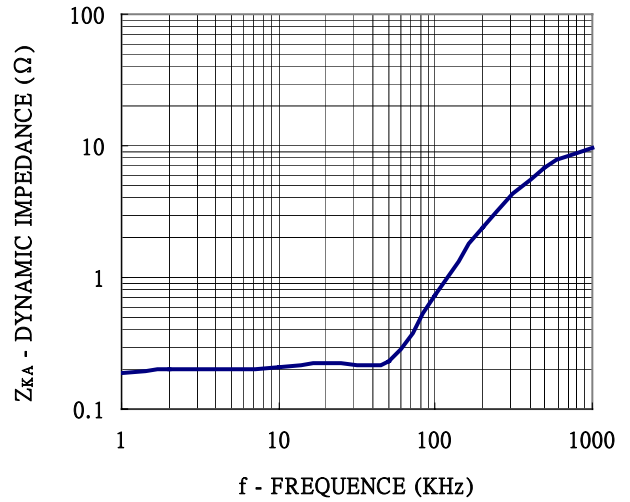


Typical Characteristics(Cont.)

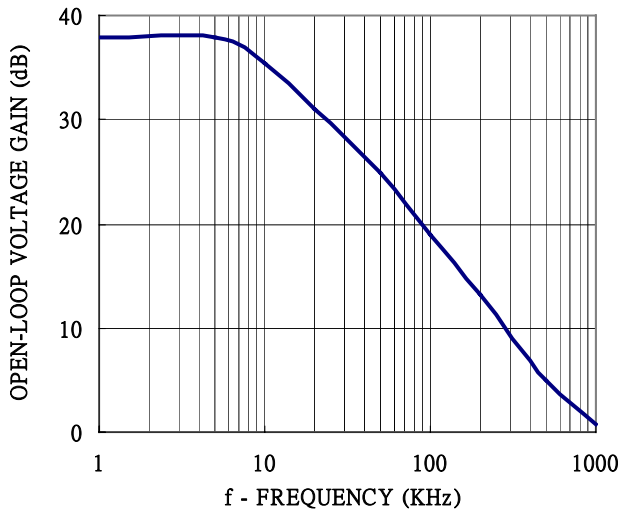
CATHODE VOLTAGE vs REFERENCE INPUT VOLTAGE



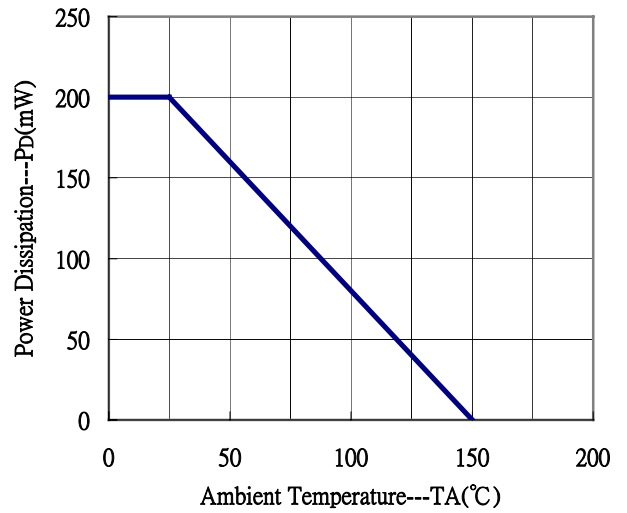
DYNAMIC IMPEDANCE vs FREQUENCY



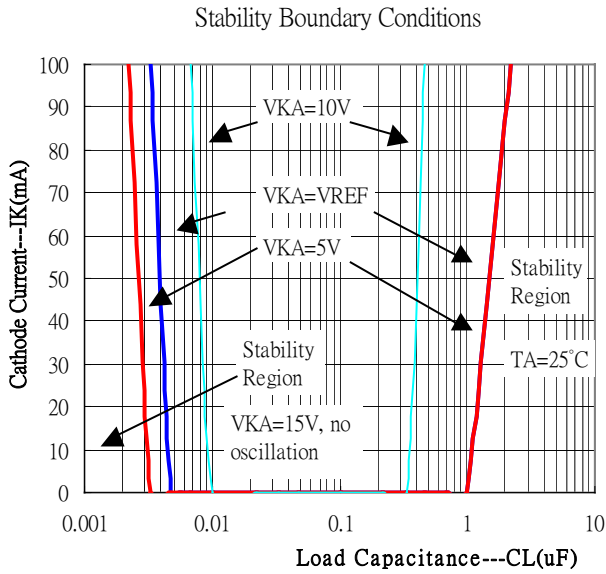
OPEN-LOOP VOLTAGE GAIN vs FREQUENCY



Power Derating Curve



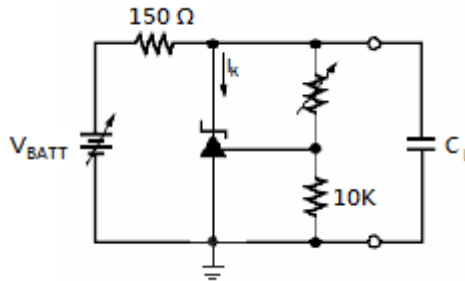
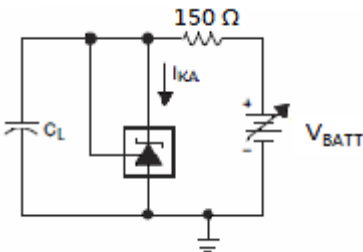
Typical Characteristics(Cont.)



Test Circuit for Stability Boundary Conditions

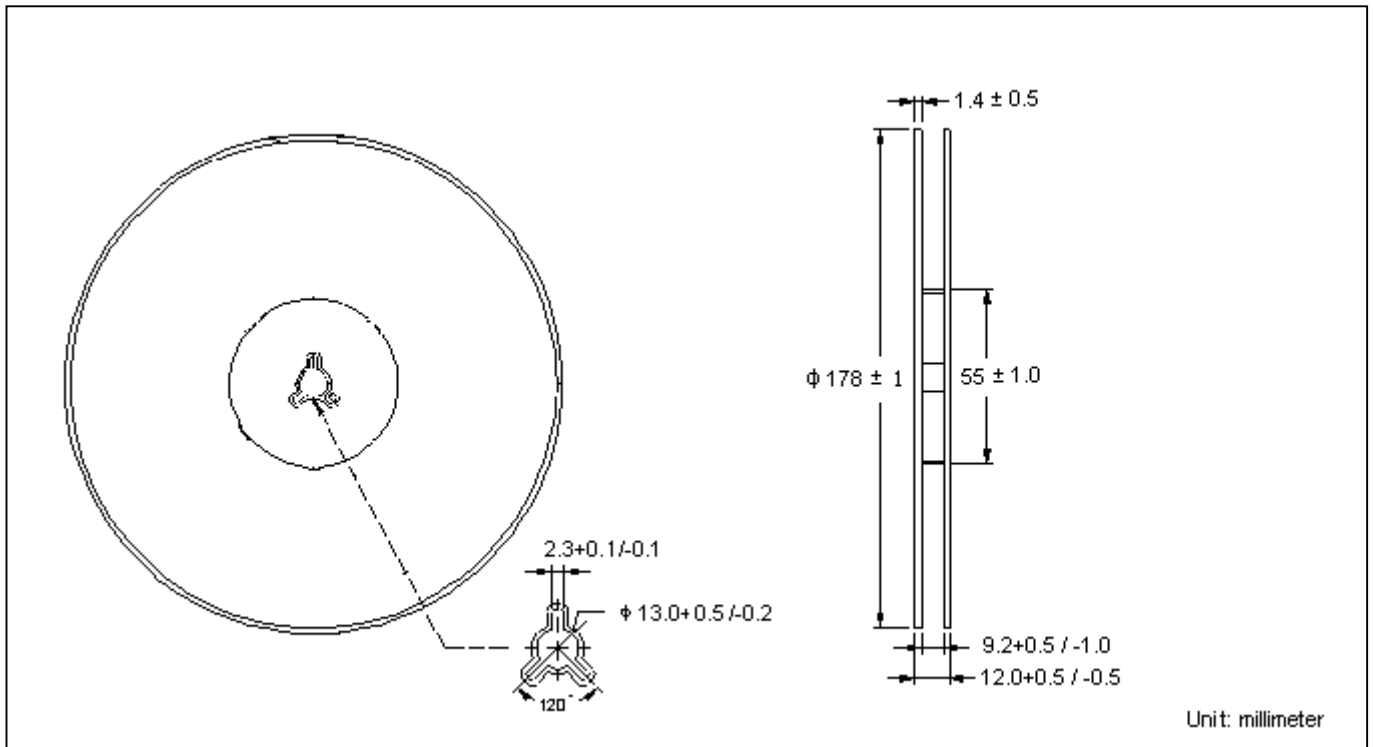
VKA=VREF

VKA=5V, 10V, 15V

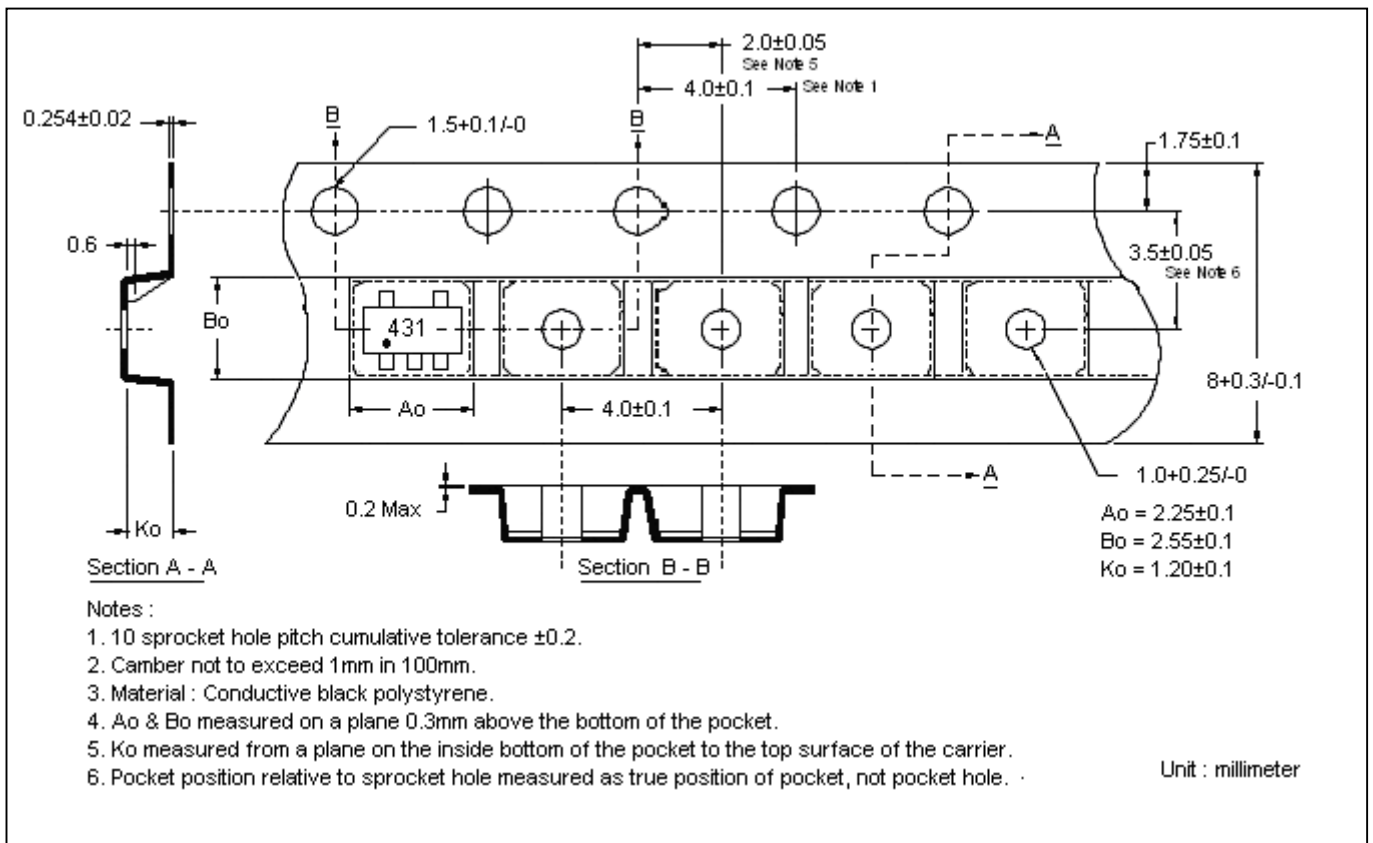


※ C_L : MLCC capacitor

Reel Dimension



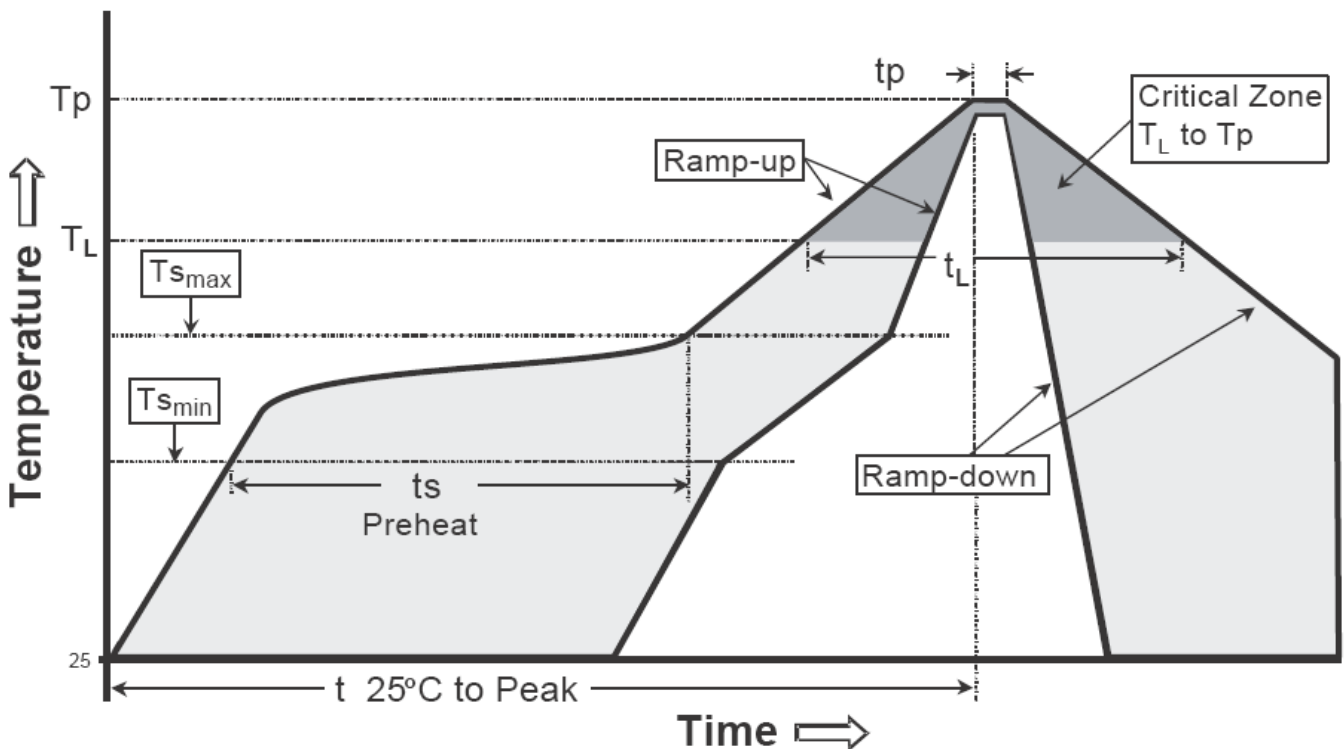
Carrier Tape Dimension



Recommended wave soldering condition

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

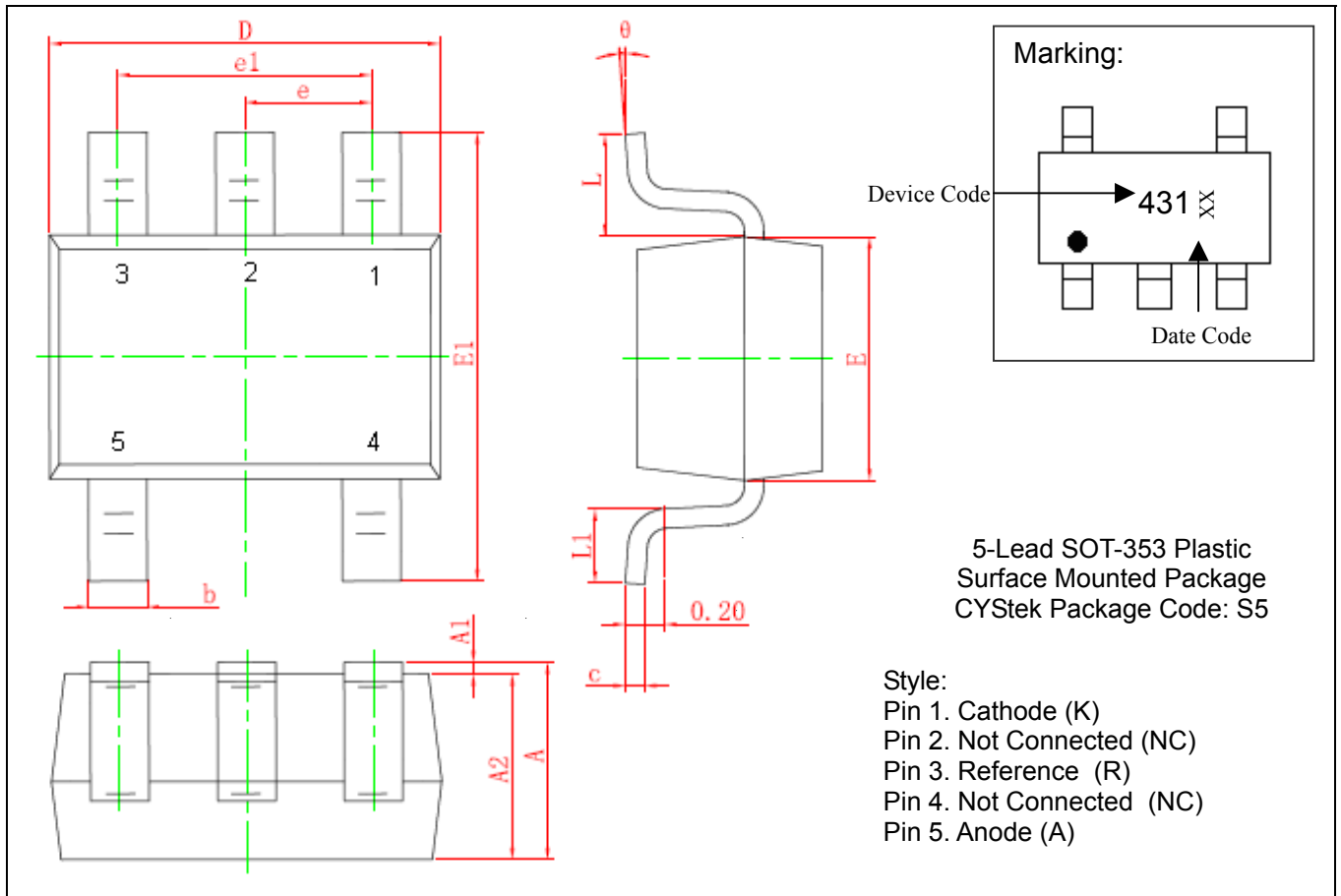
Recommended temperature profile for IR reflow



Profile feature	Sn-Pb eutectic Assembly	Pb-free Assembly
Average ramp-up rate (T _{smax} to T _p)	3°C/second max.	3°C/second max.
Preheat		
-Temperature Min(T _{s min})	100°C	150°C
-Temperature Max(T _{s max})	150°C	200°C
-Time(t _{s min} to t _{s max})	60-120 seconds	60-180 seconds
Time maintained above:		
-Temperature (T _L)	183°C	217°C
- Time (t _L)	60-150 seconds	60-150 seconds
Peak Temperature(T _P)	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-353 Dimension



*:Typical

DIM	Millimeters		Inches		DIM	Millimeters		Inches	
	Min.	Max.	Min.	Max.		Min.	Max.	Min.	Max.
A	0.900	1.100	0.035	0.043	E1	2.150	2.450	0.085	0.096
A1	0.000	0.100	0.000	0.004	e	0.650*		0.026*	
A2	0.900	1.000	0.035	0.039	e1	1.200	1.400	0.047	0.055
b	0.150	0.350	0.006	0.014	L	0.525	REF	0.021	REF
c	0.080	0.150	0.003	0.006	L1	0.260	0.460	0.010	0.018
D	2.000	2.200	0.079	0.087	θ	0°	8°	0°	8°
E	1.150	1.350	0.045	0.053					

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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