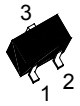
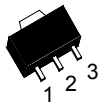
AX431 Series

Adjustable Shunt Regulator

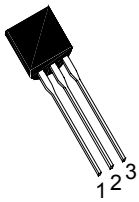
AX431 Series Pin Assignment



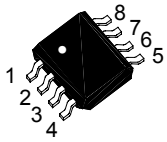
3-Lead Plastic **SOT-23**
Package Code: N
Pin 1: Reference
Pin 2: Cathode
Pin 3: Anode



3-Lead Plastic **SOT-89**
Package Code: M
Pin 1: Reference
Pin 2: Anode
Pin 3: Cathode



3-Lead Plastic **TO-92**
Package Code: A
Pin 1: Reference
Pin 2: Anode
Pin 3: Cathode



3-Lead Plastic **SO-8**
Package Code: S
Pin 1: Cathode
Pin 2/3/6/7: Anode
Pin 4/5: NC
Pin 8: Reference

Description

The AX431 series are three-terminal adjustable regulators with guaranteed thermal stability over applicable temperature ranges. The output voltage may be set to any value between V_{REF} (approximately 2.495 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 50ppm/°C typical
- Temperature compensated for operation over full temperature range
- Low output noise voltage
- Fast turn on response

Ordering Information

Package	V_{REF}: 2.495±2%	V_{REF}: 2.495±1%	V_{REF}: 2.495±0.5%
SOT-23	AX431AN	AX431BN	AX431CN
SOT-89	AX431AM	AX431BM	AX431CM
TO-92	AX431AA	AX431BA	AX431CA
SO-8	AX431AS	AX431BS	AX431CS

Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified)

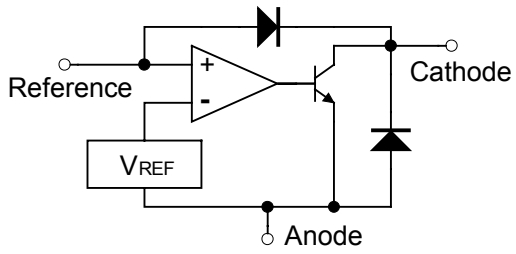
Characteristics	Symbol	Value		Unit
Cathode Voltage	V_{KA}	36		V
Cathode Current Range (Continuous)	I_K	-100~+150		mA
Reference Input Current Range	I_{REF}	0.05~+10		mA
Power Dissipation	P_D	SOT-23	280	mW
		SOT-89	770	
		TO-92	770	
		SO-8	770	
Operating Temperature Range	T_{opr}	0~+70		°C
Storage Temperature Range	T_{stg}	-65~+150		°C

Operating Conditions

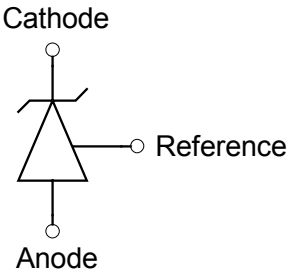
Characteristics	Symbol	Min.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	36	V
Cathode Current Range (Continuous)	I_K	1	100	mA

Functional Block Diagram & Symbol

Functional Block Diagram



Symbol



Test Circuits

Fig 1. $V_K=V_{REF}$

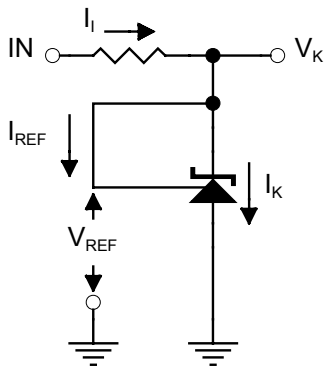
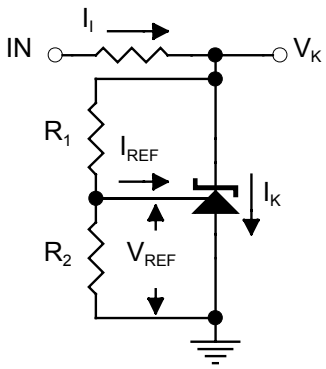
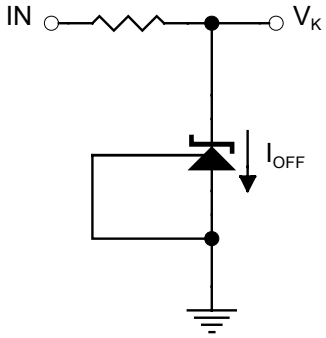


Fig 2. $V_K>V_{REF}$



Note: $V_K=V_{REF}(1+R_1/R_2)+I_{REF}xR_1$

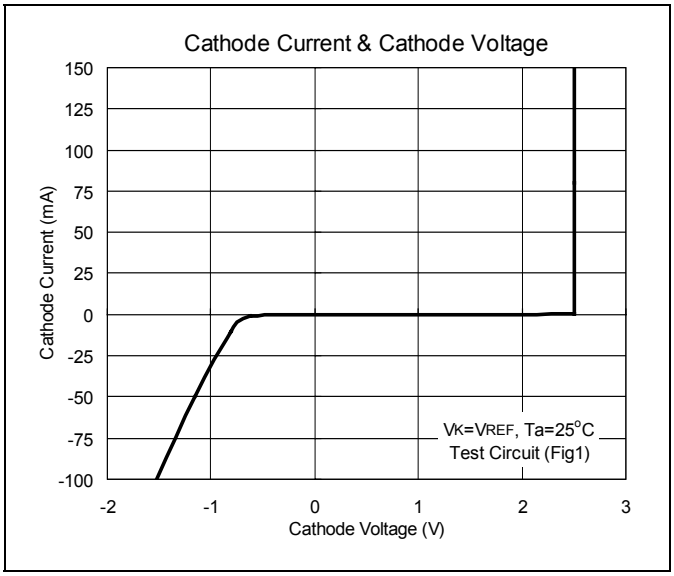
Fig 3. Off-State Current

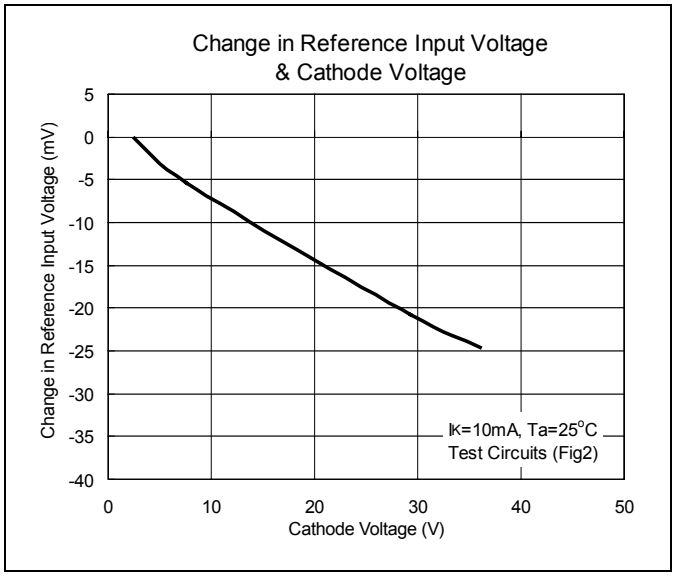


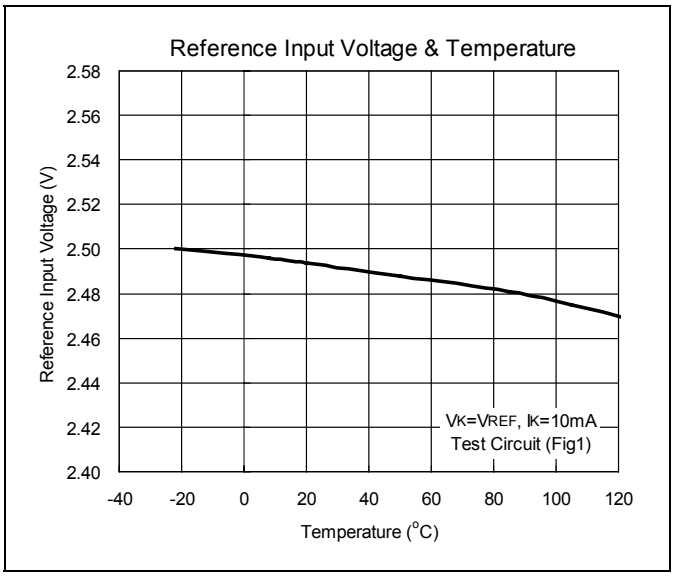
Electrical Characteristics (T_A=25°C unless otherwise specified)

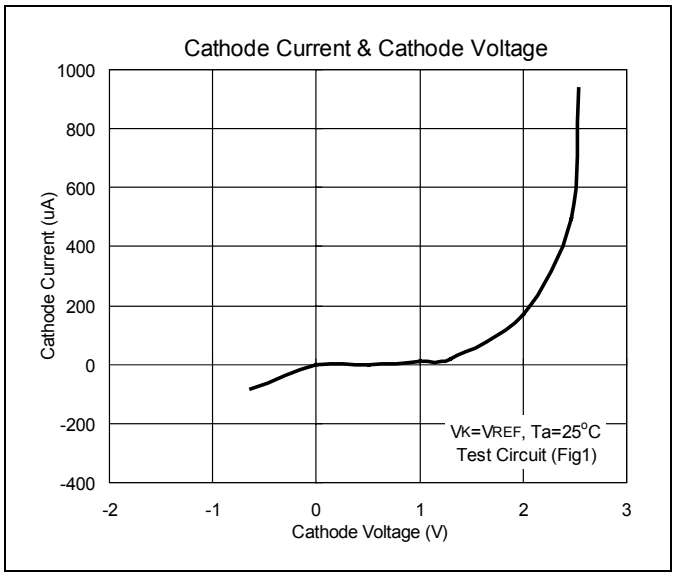
Characteristics		Symbol	Test Conditions	Min	Typ	Max	Unit
Reference Input Voltage (Fig1)	AX431AN/AM/AA/AS	V_{REF}	$V_K=V_{REF}$, I_K=10mA	2.445	2.495	2.545	V
	AX431BN/BM/BA/BS			2.470	2.495	2.520	
	AX431CN/CM/CA/CS			2.483	2.495	2.507	
Deviation of Reference Input Voltage Over-Temperature (Fig1)		$V_{REF(dev)}$	$V_K=V_{REF}$, I_K=10mA $T_{min}\le T_a\le T_{max}$	-	4	17	mV
Ratio of Change in Reference Input Voltage to the Change in Cathode Voltage (Fig2)		ΔV_{REF} / ΔV_K	I_K=10mA, ΔV_K=10V to V_{REF}	-	-1.4	-2.7	mV/V
			I_K=10mA, ΔV_K=36V to 10V	-	-1.0	-2.0	mV/V
Reference Input Current (Fig2)		I_{REF}	I_K=10mA, R_1=10kΩ, R_2=∞	-	2	4	uA
Deviation of Reference Input Current Over Full Temperature Range (Fig2)		$I_{REF(dev)}$	I_K=10mA, R_1=10kΩ, R_2=∞, T_a=Full Range	-	0.4	1.2	uA
Minimum Cathode Current for Regulation (Fig1)		$I_{K(min)}$	$V_K=V_{REF}$	-	0.4	1.0	mA
Off-State Cathode Current (Fig3)		$I_{K(off)}$	V_K=36V, V_{REF}=0	-	0.1	1.0	uA
Dynamic Output Impedance (Fig1)		Z_K	$V_K=V_{REF}$, f≤1kHz I_K=1 to 100mA	-	0.2	0.5	Ω

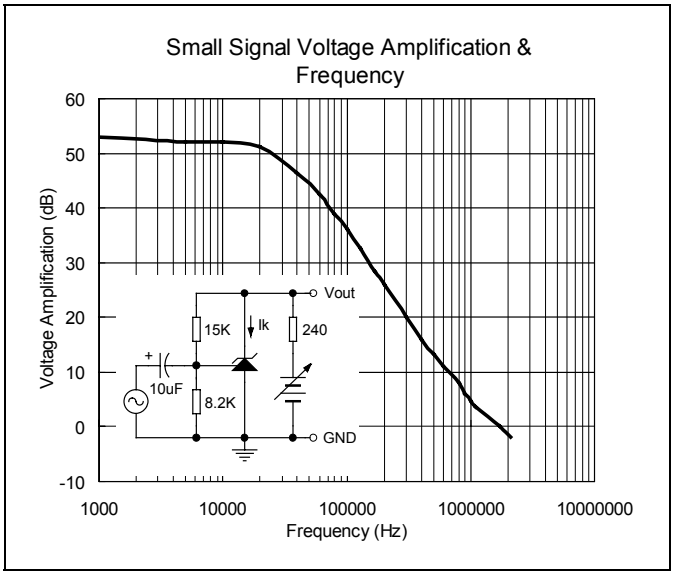
Characteristics Curve





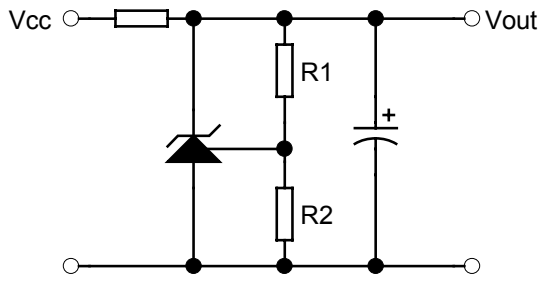






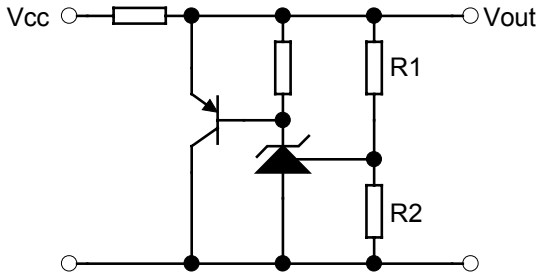
Typical Application

Fig 4. Shunt Regulator



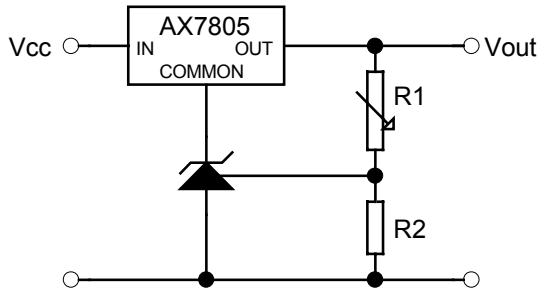
$Vout=(1+R_1/R_2)V_{REF}$

Fig 5. High Current Shunt Regulator



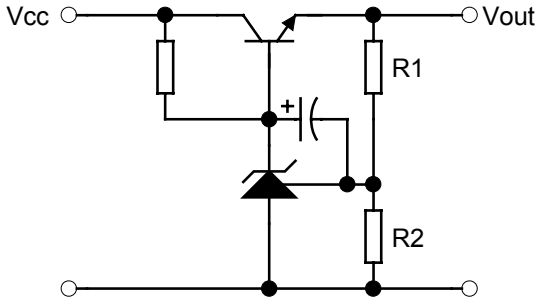
$Vout=(1+R_1/R_2)V_{REF}$

Fig 6. Output Control of a Three-Terminal Fixed Regulator



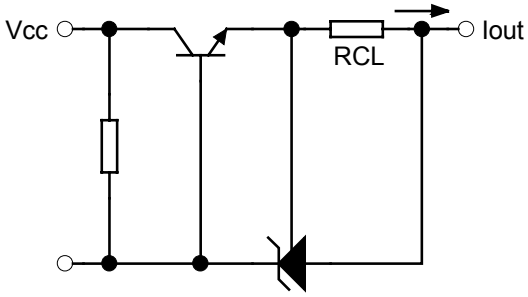
$Vout=(1+R_1/R_2)V_{REF}$; $V_{out(min)}=V_{REF}+5V$

Fig 7. Series Pass Regulator



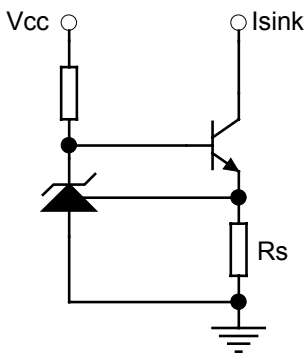
$Vout=(1+R_1/R_2)V_{REF}$; $V_{out(min)}=V_{REF}+V_{BE}$

Fig 8. Current Limiter or Current Source



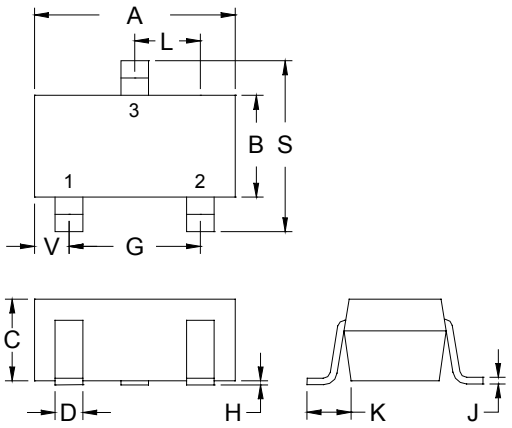
$Iout=V_{REF}/R_{CL}$

Fig 9. Constant Current Sink



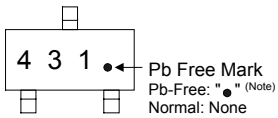
$Isink=V_{REF}/R_S$

SOT-23 Dimension



3-Lead SOT-23 Plastic
Surface Mounted Package
AVANTICS Package Code: N

Marking:



Note: Pb-free product can distinguish by the green label or the extra description on the right side of the label.

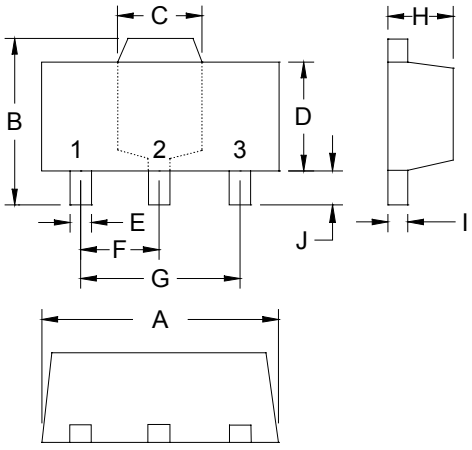
Pin Style: 1.Reference 2.Cathode 3.Anode

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	2.80	3.04
B	1.20	1.60
C	0.89	1.30
D	0.30	0.50
G	1.70	2.30
H	0.013	0.10
J	0.085	0.177
K	0.32	0.67
L	0.85	1.15
S	2.10	2.75
V	0.25	0.65

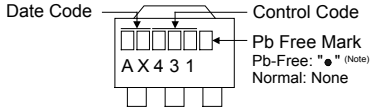
*: Typical, Unit: mm

SOT-89 Dimension



3-Lead SOT-89 Plastic
Surface Mounted Package
AVANTICS Package Code: M

Marking:



Note: Green label is used for pb-free packing

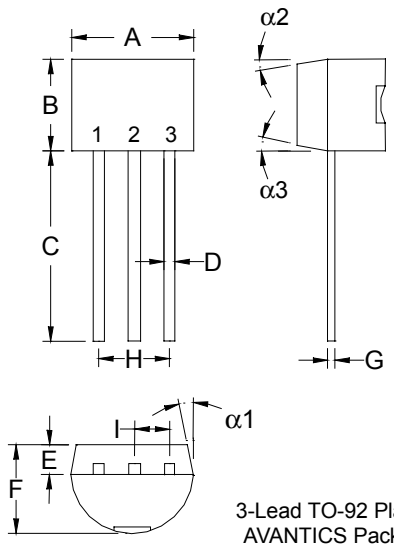
Pin Style: 1.Reference 2.Anode 3.Cathode

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	4.40	4.60
B	4.05	4.25
C	1.50	1.70
D	2.40	2.60
E	0.36	0.51
F	*1.50	-
G	*3.00	-
H	1.40	1.60
I	0.35	0.41

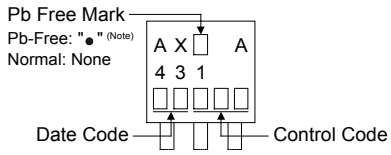
*: Typical, Unit: mm

TO-92 Dimension



3-Lead TO-92 Plastic Package
AVANTICS Package Code: A

Marking:



Note: Green label is used for pb-free packing

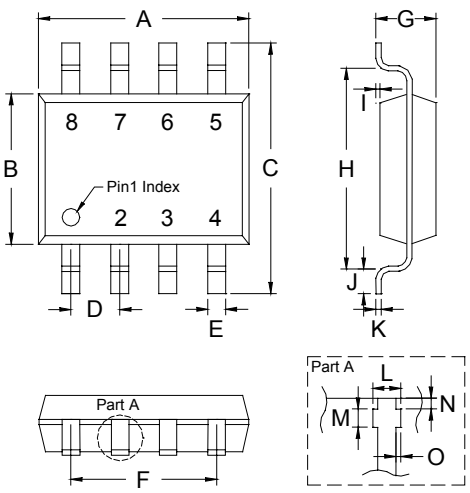
Pin Style: 1.Reference 2.Anode 3.Cathode

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	4.33	4.83
B	4.33	4.83
C	12.70	-
D	0.36	0.56
E	-	*1.27
F	3.36	3.76
G	0.36	0.56
H	-	*2.54
I	-	*1.27
α1	-	*5°
α2	-	*2°
α3	-	*2°

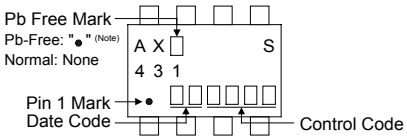
*: Typical, Unit: mm

SO-8 Dimension



8-Lead SO-8 Plastic
Surface Mounted Package
AVANTICS Package Code: S

Marking:



Note: Green label is used for pb-free packing

Pin Style: 1.Cathode 2/3/6/7.Anode 4/5.NC
8.Reference

Material:
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	4.85	5.10
B	3.85	3.95
C	5.80	6.20
D	1.22	1.32
E	0.37	0.47
F	3.74	3.88
G	1.45	1.65
H	4.80	5.10
I	0.05	0.20
J	0.30	0.70
K	0.19	0.25
L	0.37	0.52
M	0.23	0.28
N	0.08	0.13
O	0.00	0.15

*: Typical, Unit: mm

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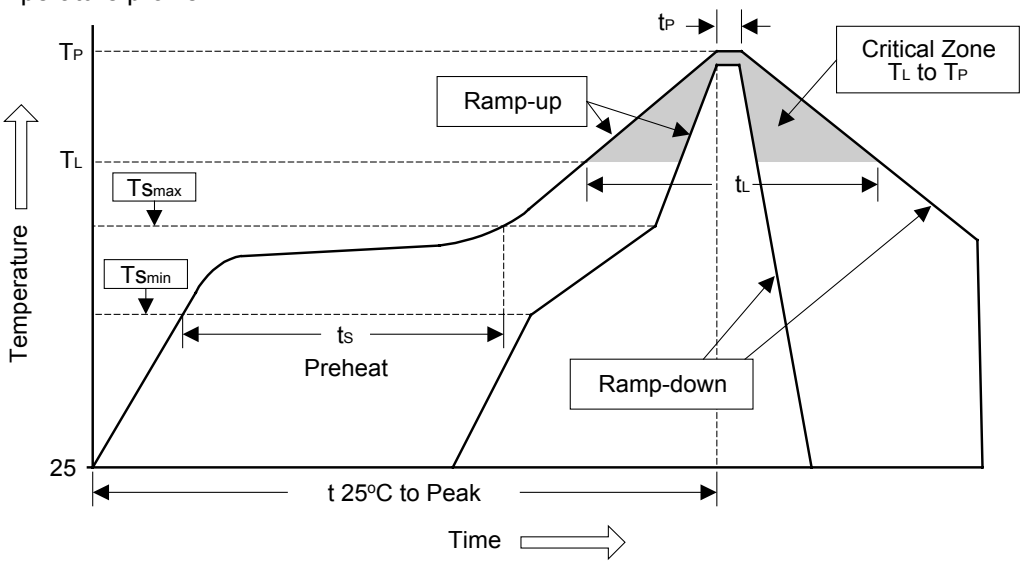
  Tel: 86-021-58955599 Fax: 86-021-58558038

Soldering Methods for AVANTICS's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%

2. Reflow soldering of surface-mount devices

Figure 1: Temperature profile



Profile Feature	Sn-Pb Eutectic Assembly	Pb-Free Assembly
Average ramp-up rate (T_L to T_P)	<3°C/sec	<3°C/sec
Preheat - Temperature Min (Ts_{min}) - Temperature Max (Ts_{max}) - Time (min to max) (ts)	 100°C 150°C 60~120 sec	 150°C 200°C 60~180 sec
Tsmax to T_L - Ramp-up Rate	 <3°C/sec	 <3°C/sec
Time maintained above: - Temperature (T_L) - Time (t_L)	 183°C 60~150 sec	 217°C 60~150 sec
Peak Temperature (T_P)	240°C +0/-5°C	260°C +0/-5°C
Time within 5°C of actual Peak Temperature (t_P)	10~30 sec	20~40 sec
Ramp-down Rate	<6°C/sec	<6°C/sec
Time 25°C to Peak Temperature	<6 minutes	<8 minutes

3. Flow (wave) soldering (solder dipping)

Products	Peak temperature	Dipping time
Pb devices.	245°C ±5°C	5sec ±1sec
Pb-Free devices.	260°C +0/-5°C	5sec ±1sec