

AX432 Series

Adjustable Shunt Regulator

Description

The AX432 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 1.24 or 1.25 volts) and 30 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} 1.24V±2%	V_{REF} 1.24V±1%	V_{REF} 1.24V±0.5%	V_{REF} 1.25V±2%	V_{REF} 1.25V±1%	V_{REF} 1.25V±0.5%
SOT-23	AX432AN	AX432BN	AX432CN	AX432DN	AX432EN	AX432FN
SOT-89	AX432AM	AX432BM	AX432CM	AX432DM	AX432EM	AX432FM
TO-92	AX432AA	AX432BA	AX432CA	AX432DA	AX432EA	AX432FA

Absolute Maximum Ratings

(Operating temperature range applies unless otherwise specified)

Characteristics	Symbol	Value	Unit
Cathode Voltage	V_{KA}	30	V
Cathode Current Range (Continuous)	I_K	50	mA
Reference Input Current Range	I_{REF}	0.05~+10	mA
Power Dissipation	P_D	SOT-23	280
		SOT-89	770
		TO-92	770
Operating Temperature Range	T_{opr}	0~+70	°C
Junction Temperature	T_J	150	°C
Storage Temperature Range	T_{stg}	-65~+150	°C

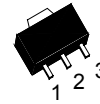
Operating Conditions

Characteristics	Symbol	Min.	Typ.	Max.	Unit
Cathode Voltage	V_{KA}	V_{REF}	-	30	V
Cathode Current Range (Continuous)	I_K	1	10	-	mA

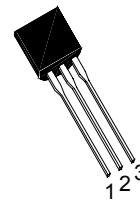
AX432 Series Pin Assignment



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

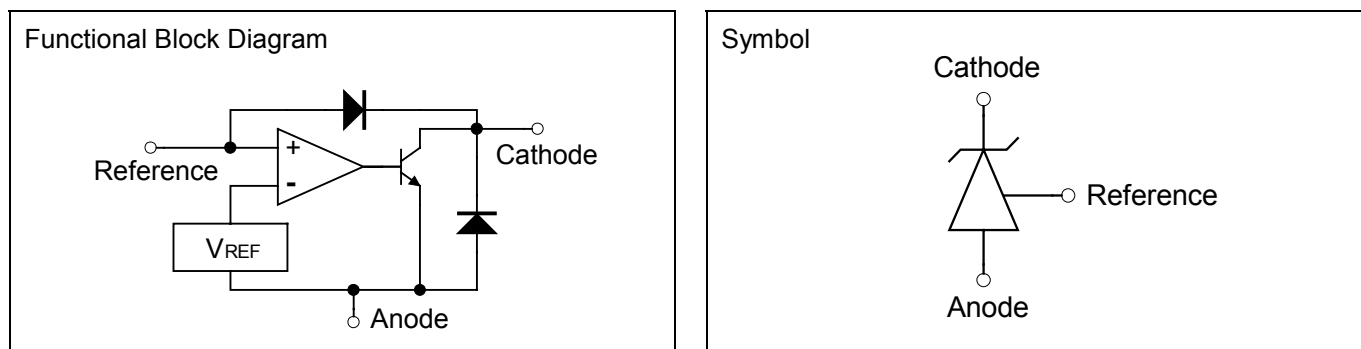


3-Lead Plastic **SOT-89**
Package Code: M
Pin 1: Reference
Pin 2: Anode
Pin 3: Cathode

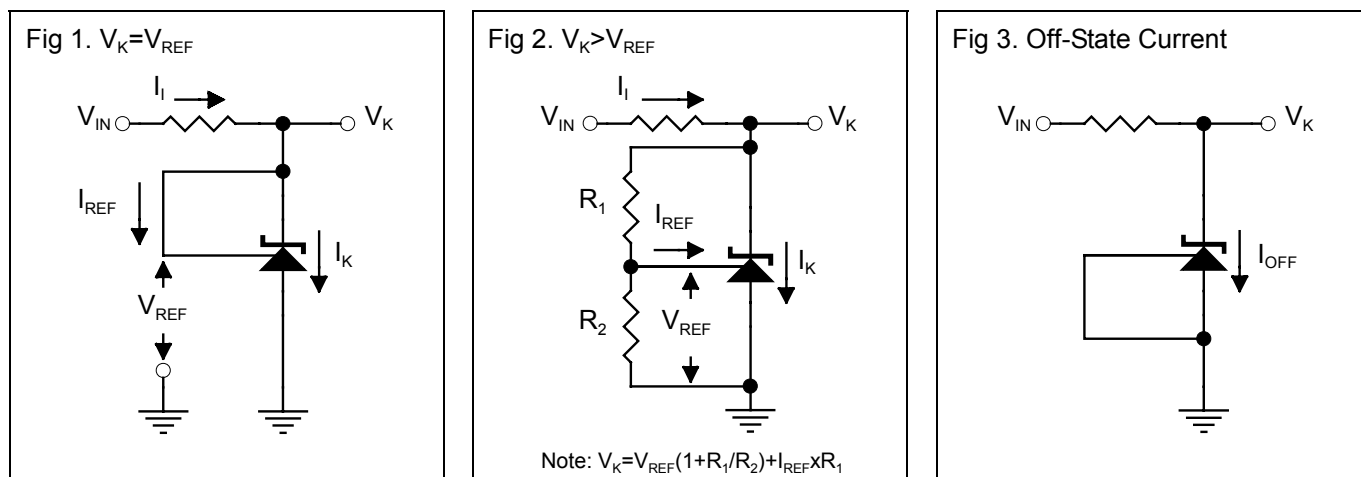


3-Lead Plastic **TO-92**
Package Code: A
Pin 1: Reference
Pin 2: Anode
Pin 3: Cathode

Functional Block Diagram & Symbol



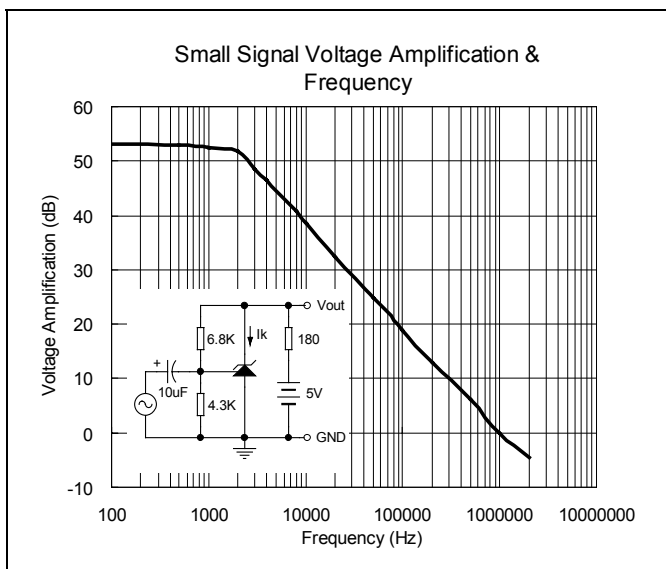
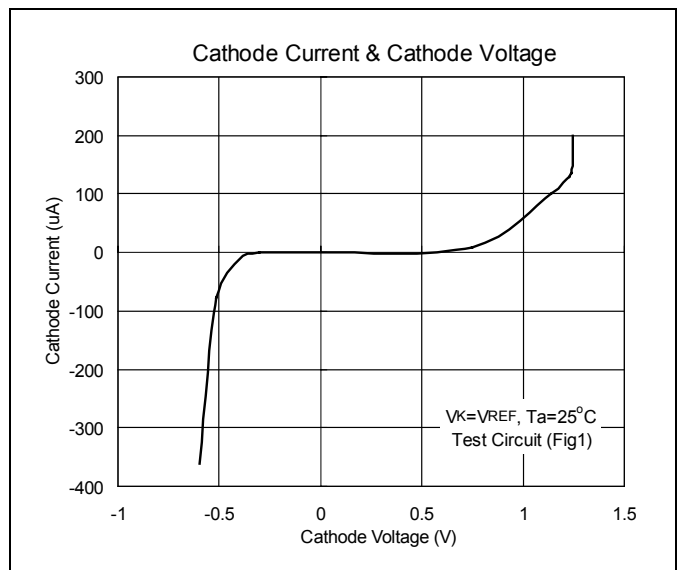
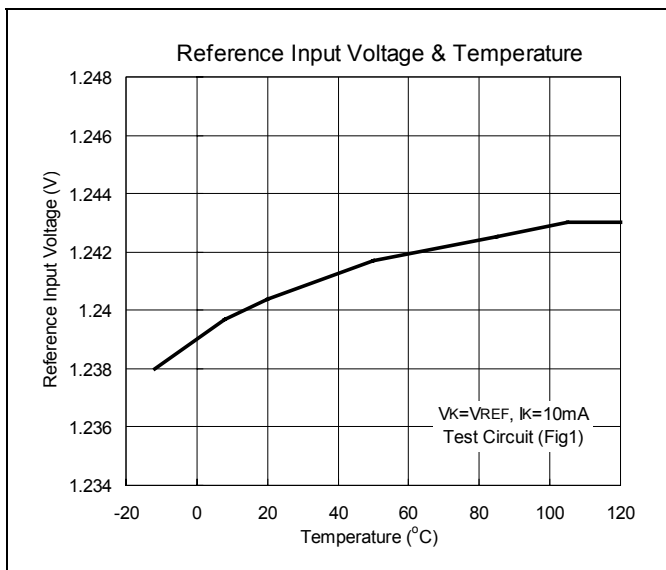
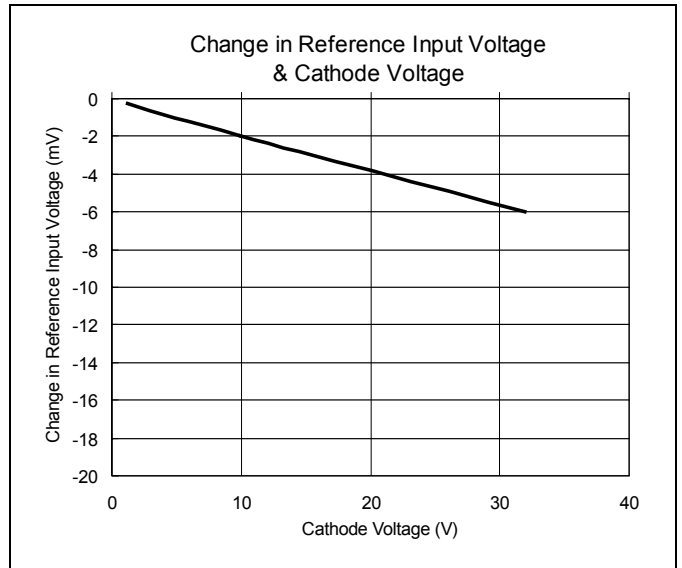
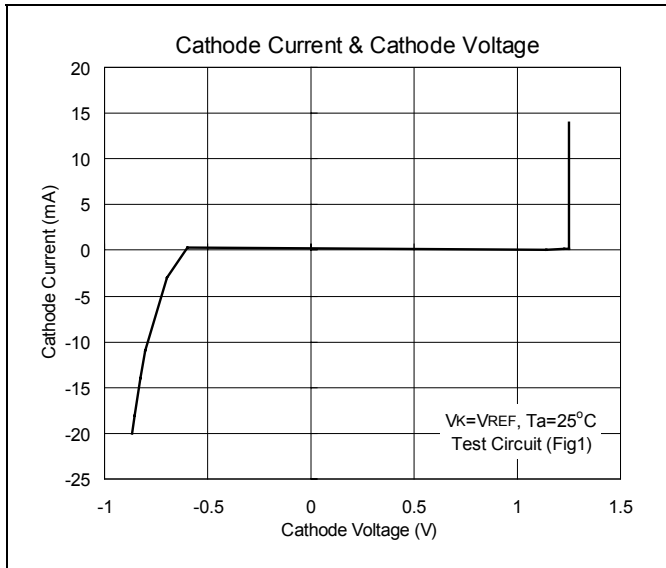
Test Circuits



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

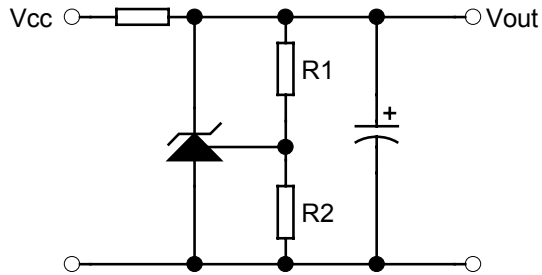
Characteristics	Symbol	Test Conditions	Min	Typ	Max	Unit	
Reference Input Voltage ^(Fig1)	V _{REF}	V _K =V _{REF} , I _K =10mA	1.215	1.24	1.265	V	
			AX432BN/BM/BA	1.228	1.24		1.252
			AX432CA/CM/CA	1.234	1.24		1.246
			AX432DN/DM/DA	1.225	1.25		1.275
			AX432EN/EM/EA	1.238	1.25		1.262
			AX432FN/FM/FA	1.244	1.25		1.256
Deviation of Reference Input Voltage Over-Temperature ^(Fig1)	V _{REF(dev)}	V _K =V _{REF} , I _K =10mA T _{min} ≤ T _a ≤ 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 =30V to 10V	-	-1	-2	mV/V	
Reference Input Current ^(Fig2)	I _{REF}	I _K =10mA, R ₁ =10kΩ, R ₂ =∞	-	1	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	mA	
Off-State Cathode Current ^(Fig3)	I _{K(off)}	V _K =30V, V _{REF} =0	-	0.1	1	uA	

Characteristics Curve



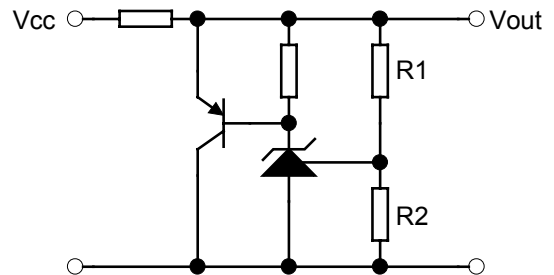
Typical Application

Fig 4. Shunt Regulator



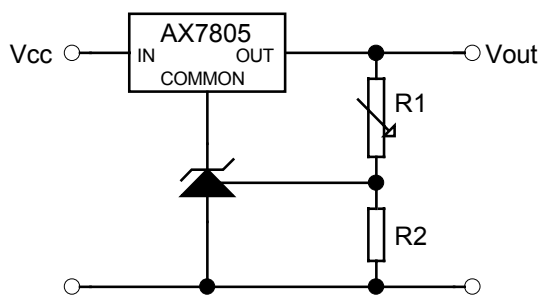
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

Fig 5. High Current Shunt Regulator



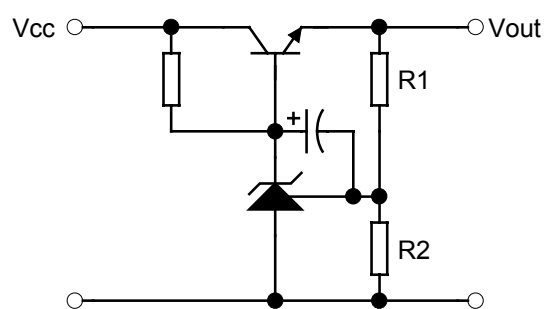
$$V_{out} = (1 + R_1/R_2)V_{REF}$$

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



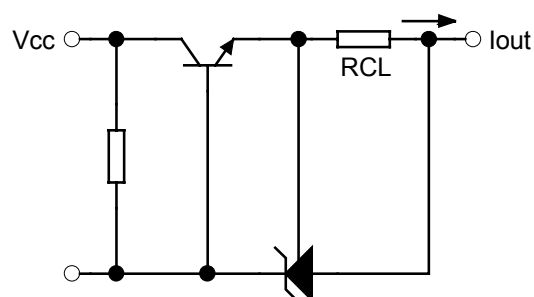
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + 5V$$

Fig 7. Series Pass Regulator



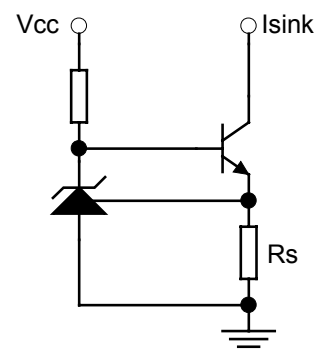
$$V_{out} = (1 + R_1/R_2)V_{REF}; V_{out(min)} = V_{REF} + V_{BE}$$

Fig 8. Current Limiter or Current Source



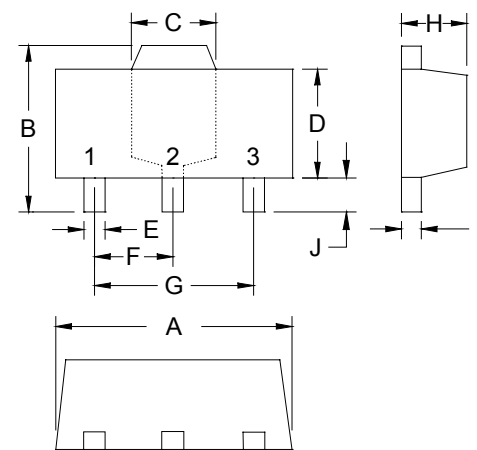
$$I_{out} = V_{REF}/R_{CL}$$

Fig 9. Constant Current Sink



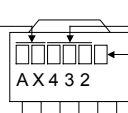
$$I_{sink} = V_{REF}/R_S$$

SOT-89 Dimension



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

Marking:

Date Code  Control Code

Pb Free Mark
Pb-Free: "●" (Note)
Normal: None

Note: Green label is used for pb-free packing

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

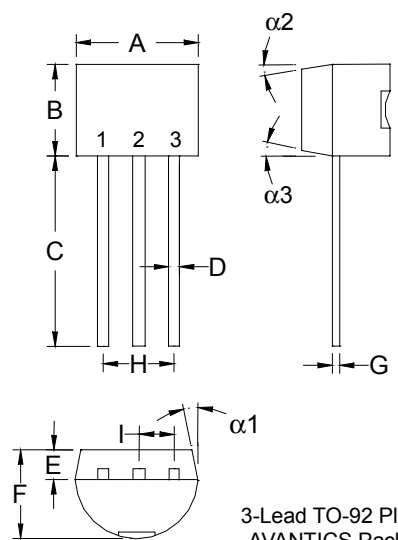
Material:

- 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

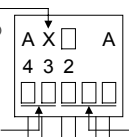
*: Typical, Unit: mm

TO-92 Dimension



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

Marking:

Pb Free Mark  Control Code

Pb-Free: "●" (Note)
Normal: None

Date Code

Note: Green label is used for pb-free packing

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

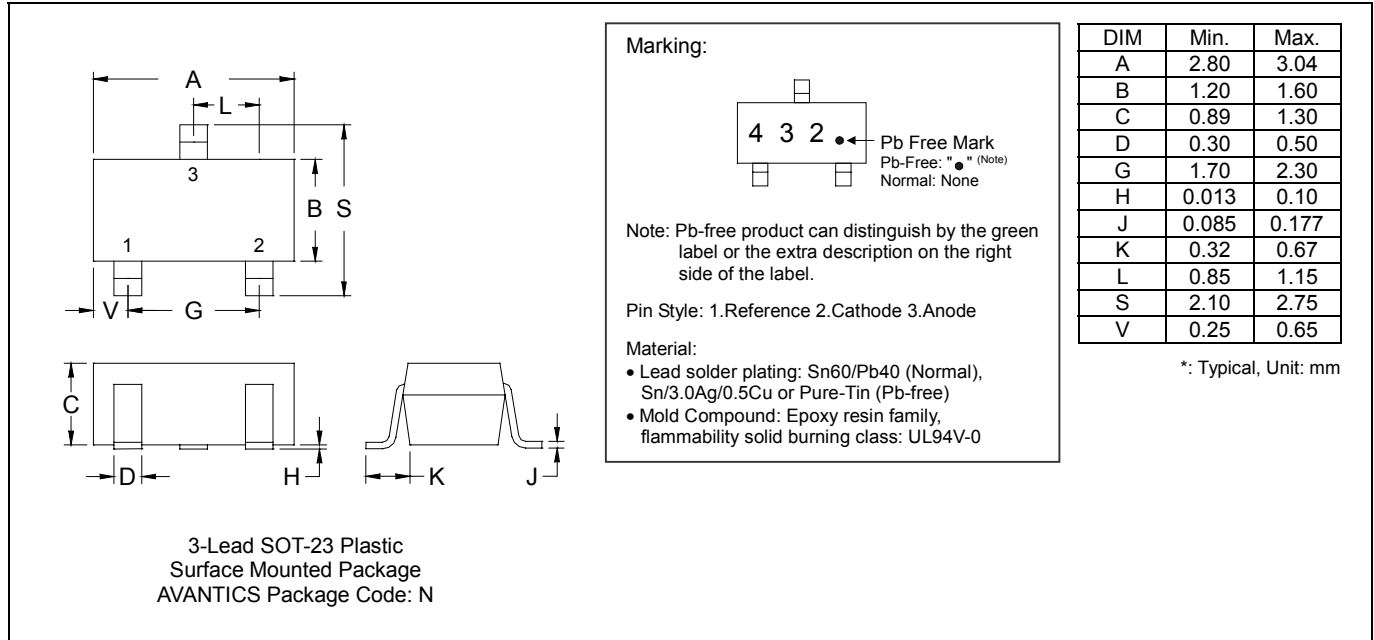
Material:

- 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
$\alpha 1$	-	*5°
$\alpha 2$	-	*2°
$\alpha 3$	-	*2°

*: Typical, Unit: mm

SOT-23 Dimension



Important Notice:

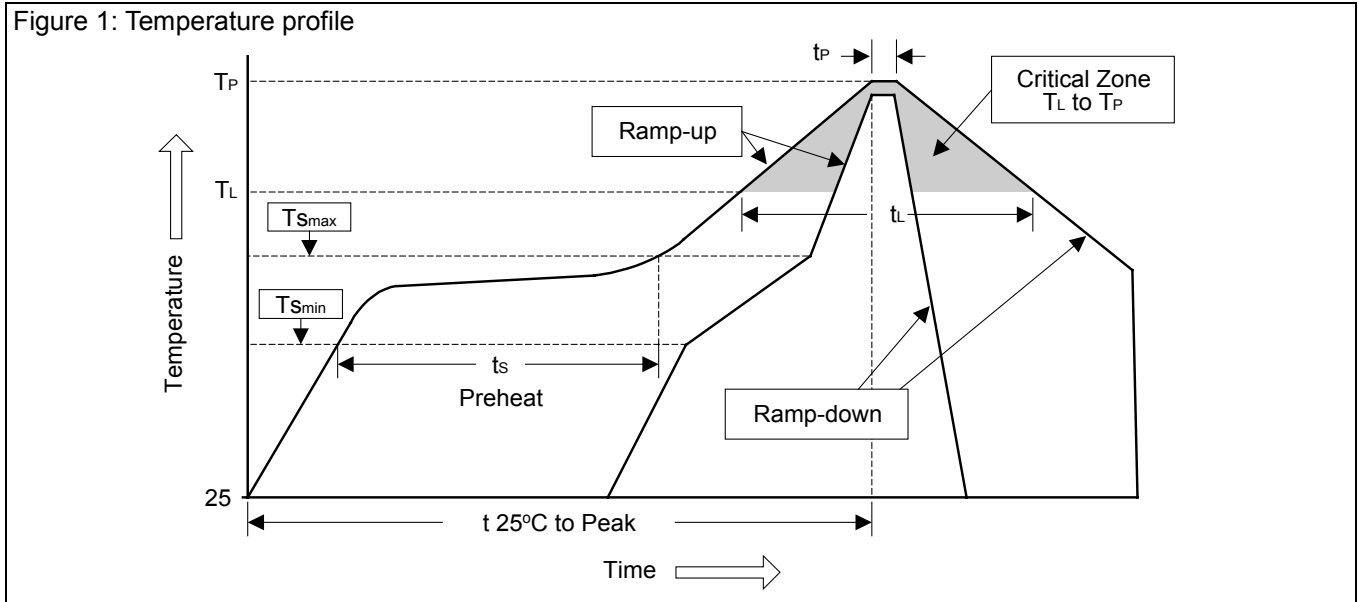
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Soldering Methods for AVANTICS's Products

1. Storage environment: Temperature=10°C~35°C Humidity=65%±15%
2. Reflow soldering of surface-mount devices



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 (T_{Smin})	100°C	150°C
- Temperature Max (T_{Smax})	150°C	200°C
- Time (min to max) (t_s)	60~120 sec	60~180 sec
T_{Smax} to T_L		
- Ramp-up Rate	<3°C/sec	<3°C/sec
Time maintained above:		
- Temperature (T_L)	183°C	217°C
- Time (t_L)	60~150 sec	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