

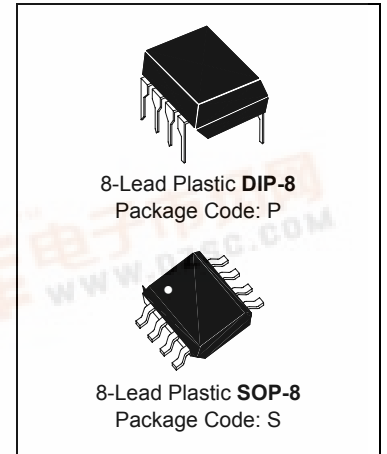


AX1509

150KHz, 2A PWM Buck DC/DC Converter

Description

The AX1509 is Monolithic IC that design for a step-down DC/DC Converter, and own the ability of driving a 2A load without additional transistor component. The output version included 3.3V, 5V, 12V and an adjustable type. It operates at a switching frequency of 150KHz thus allowing smaller sized filter components than what would be needed with lower frequency switching regulators. Other features include a guaranteed $\pm 4\%$ tolerance on output voltage under specified input voltage and output load conditions, and $\pm 15\%$ on the oscillator frequency. Regarding protected function, thermal shutdown is to prevent over temperature operating from damage, and current limit is against over current operating of the output switch.



Features

- 3.3V, 5V, 12V and adjustable
- Adjustable version output voltage range: 1.25-18V
- $\pm 4\%$ max over line and load conditions
- 150KHz $\pm 15\%$ fixed switching frequency
- TTL shutdown capability
- Operating voltage can be up to 22V
- Output load current: 2A
- SOP-8 and DIP-8 packages
- Low power standby mode
- Thermal-shutdown and current-limit protection
- High efficiency
- Built-in switching a transistor on chip, requires only 4 external components

Applications

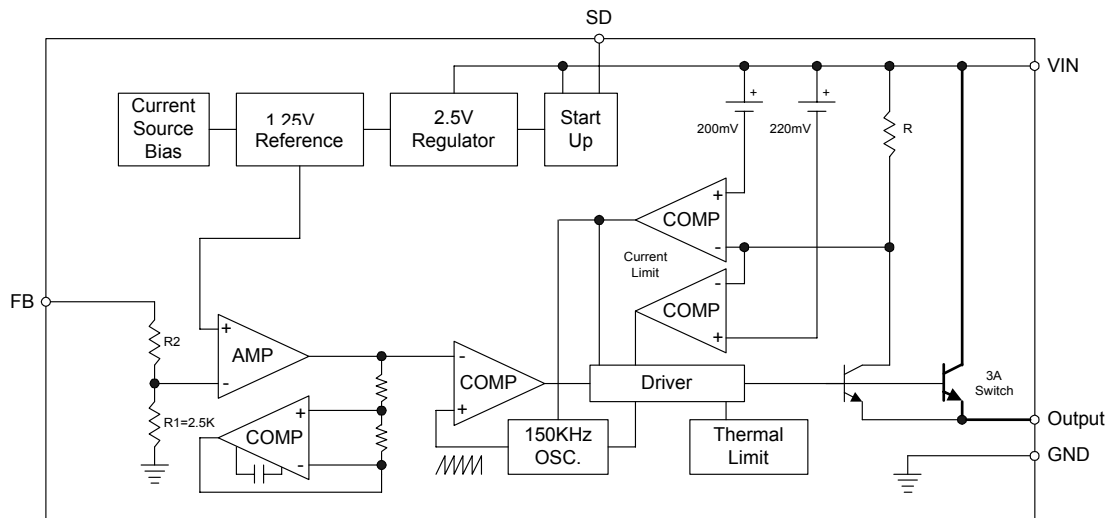
- Simple High-efficiency step-down regulator
- Positive to negative converter
- On-card switching regulators

Pin Connections

	Pin1: Operating Voltage Input	Pin5: Ground
	Pin2: Switch Output	Pin6: Ground
	Pin3: Output Voltage Feedback Control	Pin7: Ground
	Pin4: ON/OFF Shutdown	Pin8: Ground



Pin Connections



Absolute Maximum Rating (Note1)

Parameter	Symbol	Value	Unit
Supply Voltage	V_{CC}	+24	V
On/Off Pin Input Voltage	V_{SD}	-0.3~+18	V
Feedback Pin Voltage	V_{FB}	-0.3~+18	V
Output Voltage to Ground	V_{OUT}	-1	V
Power Dissipation	P_D	Internally Limited	W
Operating Temperature	T_{opr}	-40~+125	°C
Storage Temperature	T_{stg}	-65~+150	°C
Operating Voltage	V_{OP}	+4.5~+22	V

Electrical Characteristics (Continued)

Specifications with **boldface type** apply over for full operating temperature range, the other type are for $T_J=25^{\circ}C$ (Note 2)

Part No.	Parameter	Symbol	Conditions	Min.	Typ. (Note3)	Max. (Note4)	Unit
AX1509-3.3	Output Voltage	V_{OUT}	$4.75V \leq V_{IN} \leq 22V, 0.2A \leq I_{LOAD} \leq 2A$	3.168 3.135	3.3	3.342 3.465	V
	Efficiency	η	$V_{IN}=12V, I_{LOAD}=2A$	-	73	-	%
AX1509-5.0	Output Voltage	V_{OUT}	$7V \leq V_{IN} \leq 22V, 0.2A \leq I_{LOAD} \leq 2A$	4.800 4.750	5.0	5.200 5.250	V
	Efficiency	η	$V_{IN}=12V, I_{LOAD}=2A$	-	80	-	%
AX1509-12	Output Voltage	V_{OUT}	$15V \leq V_{IN} \leq 22V, 0.2A \leq I_{LOAD} \leq 2A$	11.52 11.40	12.0	12.48 12.60	V
	Efficiency	η	$V_{IN}=25V, I_{LOAD}=2A$	-	90	-	%
AX1509-ADJ	Output Voltage	V_{OUT}	$4.5V \leq V_{IN} \leq 22V, 0.2A \leq I_{LOAD} \leq 2A$ V_{OUT} programmed for 3V	1.213 1.200	1.25	1.287 1.300	V
	Efficiency	η	$V_{IN}=12V, V_{OUT}=3V, I_{LOAD}=2A$	-	73	-	%

All Output Voltage Versions Electrical Characteristics

Specifications with **boldface type** apply over for full operating temperature range, the other type are for $T_J=25^{\circ}\text{C}$
 (Unless otherwise specified, $V_{IN}=12\text{V}$ for the 3.3V, 5V, and adjustable version and $V_{IN}=18\text{V}$ for the 12V version, $I_{LOAD}=500\text{mA}$)

Parameter	Symbol	Test Condition	Min.	Typ.	Max.	Unit	
Device Parameters							
Feedback Bias Current	I_b	Adjustable Version Only, $V_{FB}=1.3\text{V}$	-	-10	-50 -100	nA	
Oscillator Frequency	f_O	(Note 5)	120 110	150	173 173	KHz	
Saturation Voltage	V_{SAT}	$I_{OUT}=2\text{A}$ (Note 6,7)	-	1.3	1.4 1.5	V	
Max. Duty Cycle (ON) Min. Duty Cycle (OFF)	DC	(Note 7) (Note 8)	-	100 0	-	%	
Current Limit	I_{CL}	Peak Current (Note 6,7)	3.6	4.5	6.5 7.5	A	
Output Leakage Current	I_L	Output=0V (Note 6,8)	-	-	-50	μA	
Quiescent Current	I_Q	(Note 8)	-	5	10	mA	
Standby Quiescent Current	I_{STBY}	ON/OFF pin=5V (Note 9)	-	150	250 300	μA	
Thermal Resistance	θ_{JC}	DIP-8	Junction to Case	-	14	-	$^{\circ}\text{C/W}$
		SOP-8		-	15	-	
	θ_{JA} (Note 10)	DIP-8	Junction to ambient	-	80	-	$^{\circ}\text{C/W}$
		SOP-8		-	70	-	
ON/OFF Control							
ON/OFF Pin Logic Input Threshold Voltage	V_{IH}	Low (Regulator ON)	-	1.3	0.6	V	
	V_{IL}	High (Regulator OFF)	2.0		-		
ON/OFF Pin Input Current	I_{IH}	$V_{LOGIC}=2.5\text{V}$ (Regulator OFF)	-	-5	-15	μA	
	I_{IL}	$V_{LOGIC}=0.5\text{V}$ (Regulator ON)	-	-0.02	-5		

Note 1: Absolute Maximum Ratings indicate limits beyond which damage to the device may occur. Operating Ratings indicate conditions for which the device is intended to be functional, but do not guarantee specific performance limits. For guaranteed specifications and test conditions, see the Electrical Characteristics.

Note 2: External components such as the catch diode, inductor, input and output capacitors, and voltage programming resistors can affect switching regulator system performance.

Note 3: Typical numbers are at 25°C and represent the most likely norm.

Note 4: All limits guaranteed at room temperature (standard type face) and at temperature extremes (bold type face). All room temperature limits are 100% production tested. All limits at temperature extremes are guaranteed via correlation using standard Statistical Quality Control (SQC) methods. All limits are used to calculate Average Outgoing Quality Level (AOQL).

Note 5: The switching frequency is reduced when the second stage current limit is activated.

Note 6: No diode, inductor or capacitor connected to output pin.

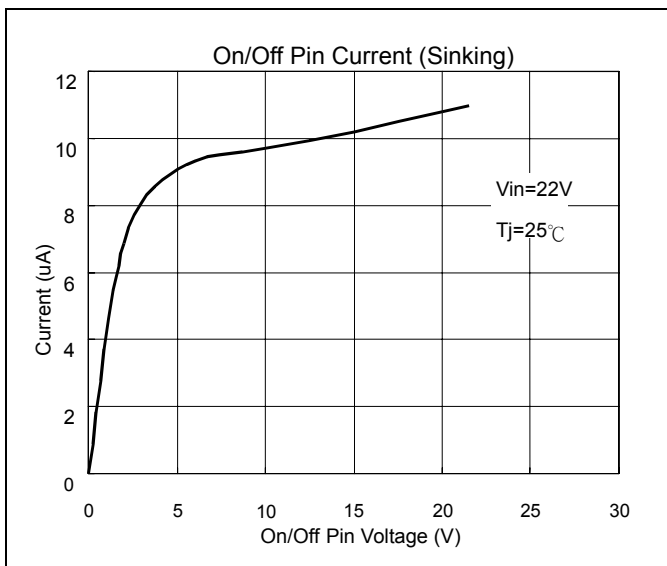
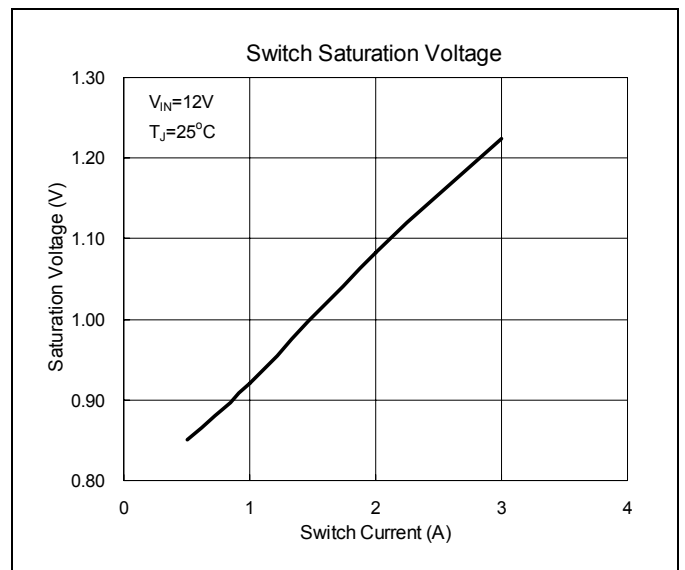
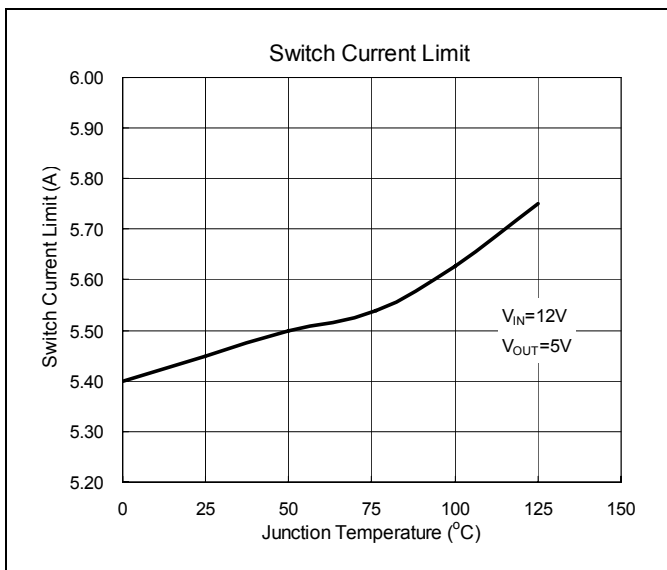
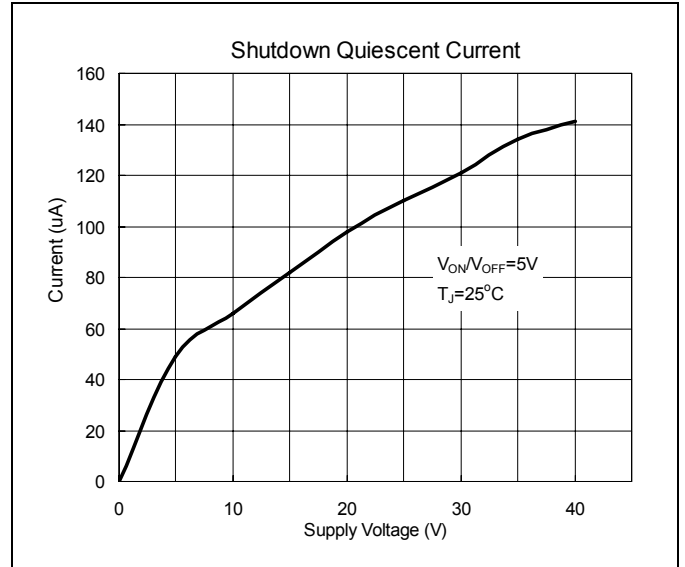
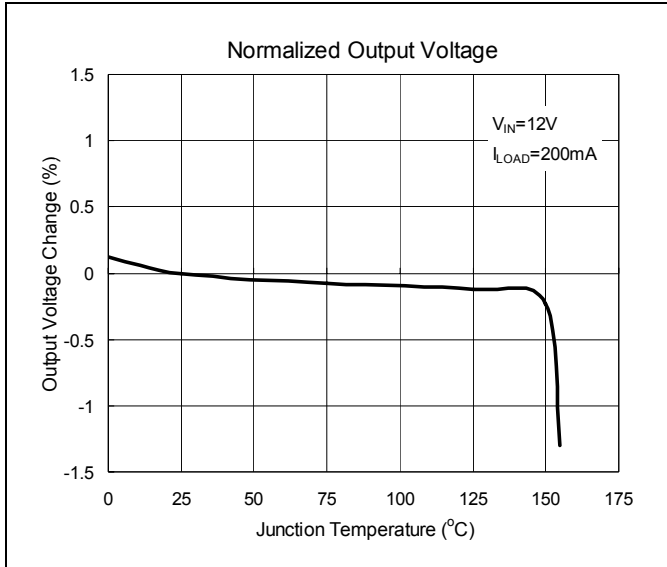
Note 7: Feedback pin removed from output and connected to 0V to force the output transistor switch ON.

Note 8: Feedback pin removed from output and connected to 12V for the 3.3V, 5V, ADJ. version, and 15V for the 12V version, to force the output transistor switch OFF.

Note 9: $V_{IN}=22\text{V}$.

Note 10: Junction to ambient thermal resistance. (With copper area of approximately 3in^2)

Characteristics Curve



Typical Application Circuit

Fig.1 Fixed Type Circuit

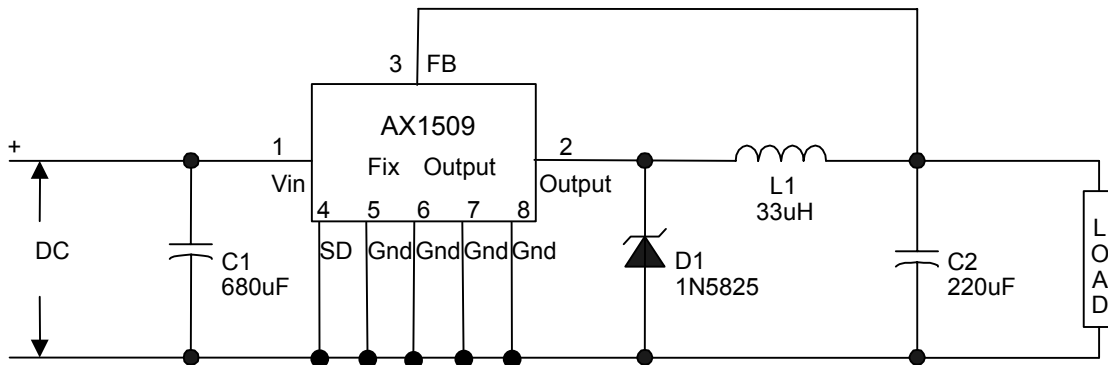
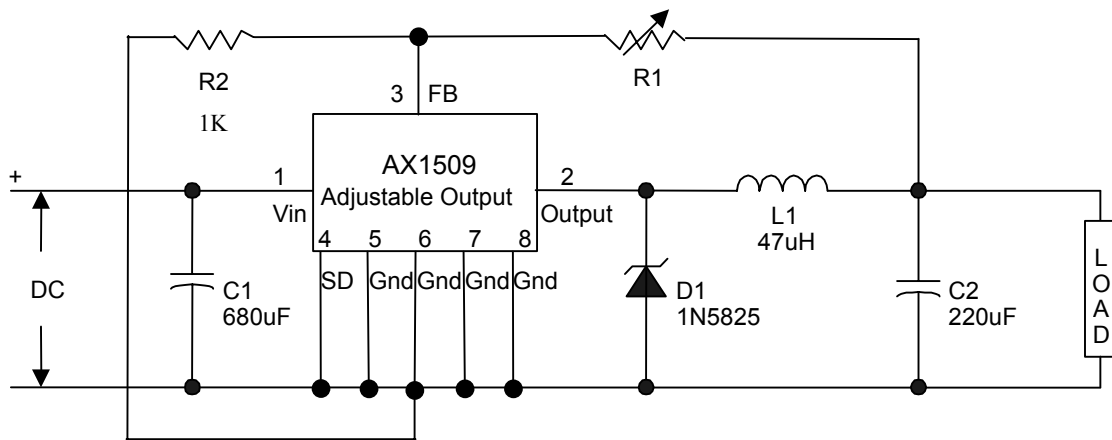
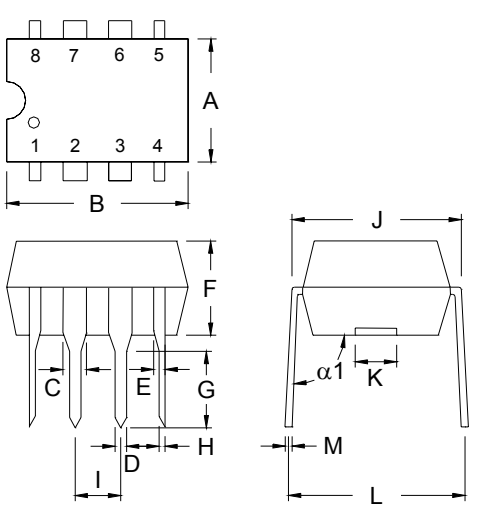


Fig.2 Adjustable Output Voltage Versions



DIP-8 Dimension



The diagram shows three views of an 8-Lead DIP-8 Plastic Package. The top view shows a rectangular package with pins 1-8 and dimensions A (height), B (width), C (pin width), D (pin pitch), E (pin length), G (pin thickness), H (pin diameter), I (pin diameter), and J (lead length). The side view shows dimensions F (package height), K (lead angle $\alpha 1$), L (total length), and M (lead thickness). The bottom view shows dimensions C, E, G, H, I, and D.

Marking:

Pb Free Mark
 Pb-Free: "●" (000)
 Normal: None

Product Series
 ADJ,3,3,5,0,12

Date Code **Control Code**

Note: Green label is used for pb-free packing

Pin Style: 1.Vin 2.Output 3.FB 4.SD
 5.Gnd 6.Gnd 7.Gnd 8.Gnd

Material:

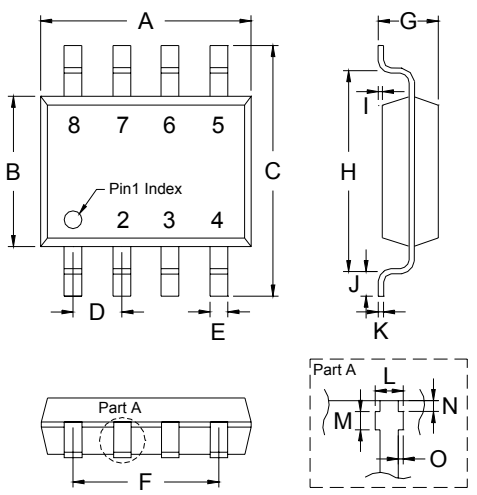
- Lead solder plating: Sn60/Pb40 (Normal), Sn/3.0Ag/0.5Cu or Pure-Tin (Pb-free)
- Mold Compound: Epoxy resin family, flammability solid burning class: UL94V-0

DIM	Min.	Max.
A	6.29	6.40
B	9.22	9.32
C	-	*1.52
D	-	*1.27
E	-	*0.99
F	3.25	3.35
G	3.17	3.55
H	0.38	0.53
I	2.28	2.79
J	7.49	7.74
K	-	*3.00
L	8.56	8.81
M	0.229	0.381
$\alpha 1$	94°	97°

*: Typical, Unit: mm

8-Lead DIP-8
 Plastic Package
 Package Code: P

SOP-8 Dimension



The diagram shows three views of an 8-Lead SO-8 Plastic Surface Mounted Package. The top view shows a rectangular package with pins 1-8 and dimensions A (width), B (height), C (total height), D (pin width), E (pin pitch), F (package length), G (lead length), H (lead height), I (lead thickness), J (lead diameter), K (lead diameter), L (lead diameter), M (lead diameter), N (lead diameter), and O (lead diameter).

Marking:

Pb Free Mark
 Pb-Free: "●" (000)
 Normal: None

Product Series
 ADJ,3,3,5,0,12

Pin 1 Index **Control Code**

Date Code

Note: Green label is used for pb-free packing

Pin Style: 1.Vin 2.Output 3.FB 4.SD
 5.Gnd 6.Gnd 7.Gnd 8.Gnd

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

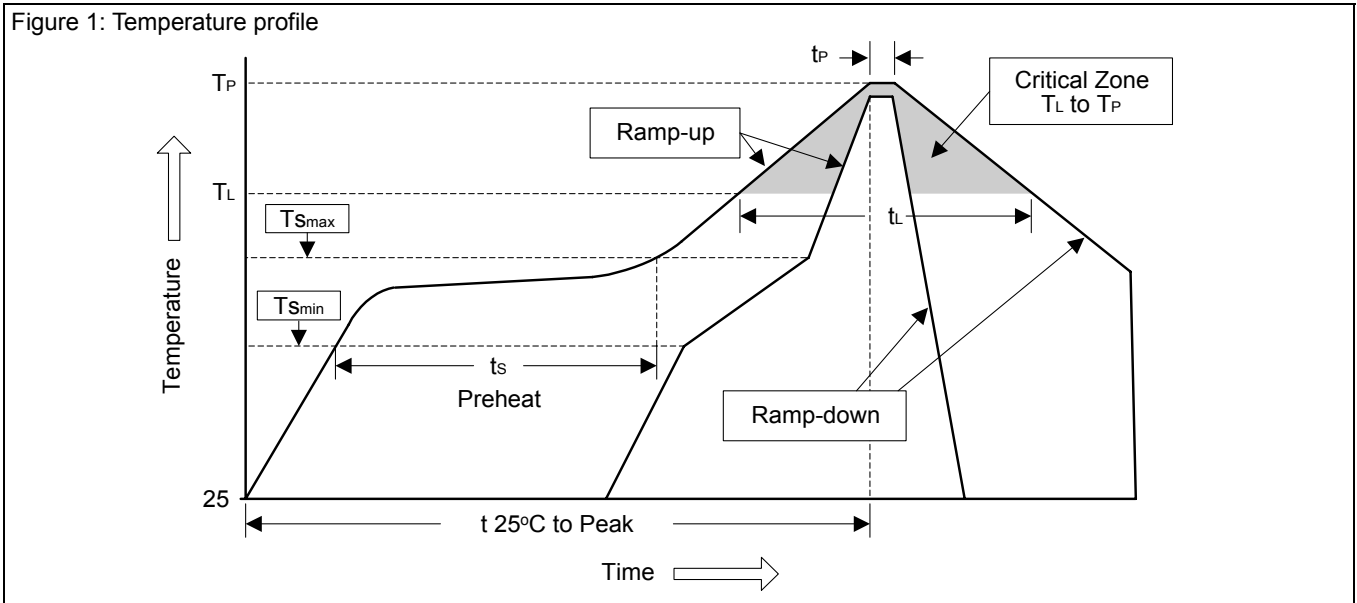
8-Lead SO-8 Plastic
 Surface Mounted Package
 Package Code: S

Ordering Information

Part Number	Package	Part Number	Package
AX1509S-ADJ	SOP-8	AX1509P-ADJ	DIP-8
AX1509S -3.3	SOP-8	AX1509P -3.3	DIP-8
AX1509S -5.0	SOP-8	AX1509P -5.0	DIP-8
AX1509S -12	SOP-8	AX1509P -12	DIP-8

Soldering Methods for Orister'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

Important Notice:

- All rights are reserved. Reproduction in whole or in part is prohibited without the prior written approval of Orister Corporation.
- Orister Corporation reserves the right to make changes to its products without notice.
- **Orister Corporation products are not warranted to be suitable for use in Life-Support Applications, or systems.**
- Orister Corporation assumes no liability for any consequence of customer product design, infringement of patents, or application assistance.

Contact Info:

Orister Corporation

- No. 8, Lane 136, Jiaren St., ZhuBei City,
HsinChu Country 302, Taiwan
- TEL: +886 3 5588 908
- FAX: +886 3 5588 909
- <http://www.orister.com>
- sales@orister.com