AW302A Datasheet

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Version 2.0

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Revision History

Date	Revision	Description
2024.02.28	V1.0	Initial Release
2024.05.13	V1.1	Update Pin Assignment
2024.08.12	V1.2	Update BT Transmitter characteristics Update IC Marking Information
2025.01.17	V2.0	Update Features_Bluetooth

Table of Contents

AW302A Features

SYSTEM

- 32bit DSP 240MHz
- Support AES128
- I-cache
- Support EMU
- On-chip SRAM 80kbyte
- Support MPU
- Built-In Flash
- 24MHz crystal oscillator
- Internal RC oscillator,PLL

DSP Audio Processing

- SBC/SPEEX/OPUS/MP2/UMP3/MP3/MIDI/F1A/ADPCM/A codec
- mSBC voice codec

Audio

- 1 x 16bit DAC
  - SNR 90dB
  - Noise 18uVrms
  - Sampling rate 8~96kHz
- 1 x 16bit ADC
  - SNR 91dB
  - Sampling rate 8~48kHz
- 1 x 16bit Class-D Speaker Driver
  - SNR 98dB
  - Sampling rate 32~48kHz
  - Drive speaker directly 320mW @ 8Ω
- I^2S interface

Bluetooth

- BLE6.0 +2.4GHz-Proprietary (DN Q334307)
- Support AoA Transmitter
- Support long range BLE
- Maximum transmitting power 8dBm
- Receiver sensitivity
  - -95dBm @BLE-1Mbps
  - -93dBm @BLE-2Mbps
  - -99dBm @BLE-S2
  - -104dBm @BLE-S8

Peripherals

- 1 x Full speed USB
- 1 x SD host controller
- 4 x Multi-function 16bit timer
- 3 x UART interface
- 1 x I^2C Master/Slave interface
- 3 x SPI Master/Slave interface
- 1 x 12bit 1Msps ADC(5 Channel)
- 7 x GPIO Support function remapping
- 1 x CAN controller
- 6 x MCPWM

PMU

- VPWR range 2.7V to 5.5V
- IOVDD range 1.8V to 3.6V

Packages

- SOP16

Temperature

- Operating temperature
  TC = -20℃ to +85℃(standard range)
  TC = -40℃ to +105℃(extended range)
- Storage temperature -65℃ to +150℃

Applications

- Bluetooth TV remote controller
- Bluetooth intercom

1 Block Diagram

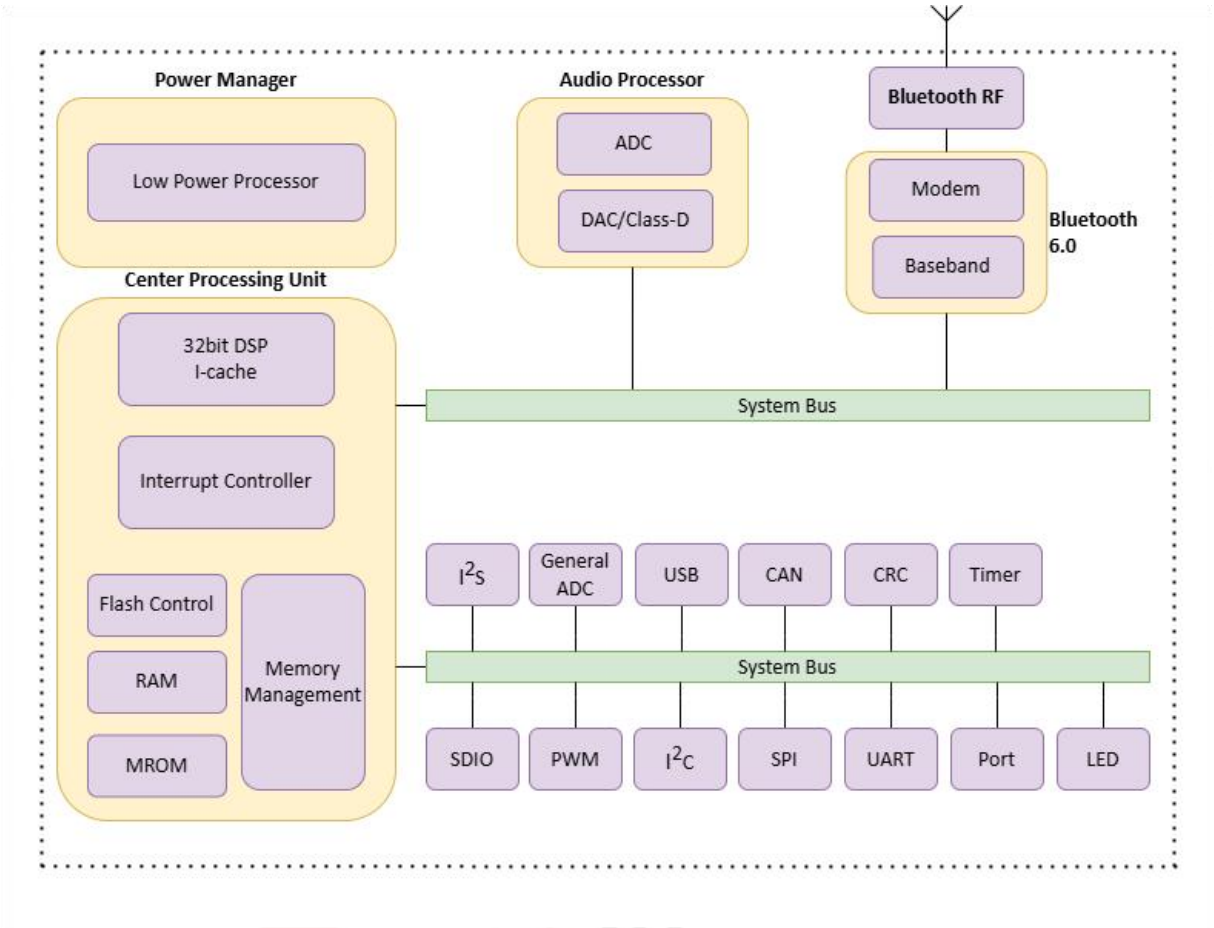


Figure 1-1 AW302A Block Diagram

2 Pin Definition

2.1 Pin Assignment

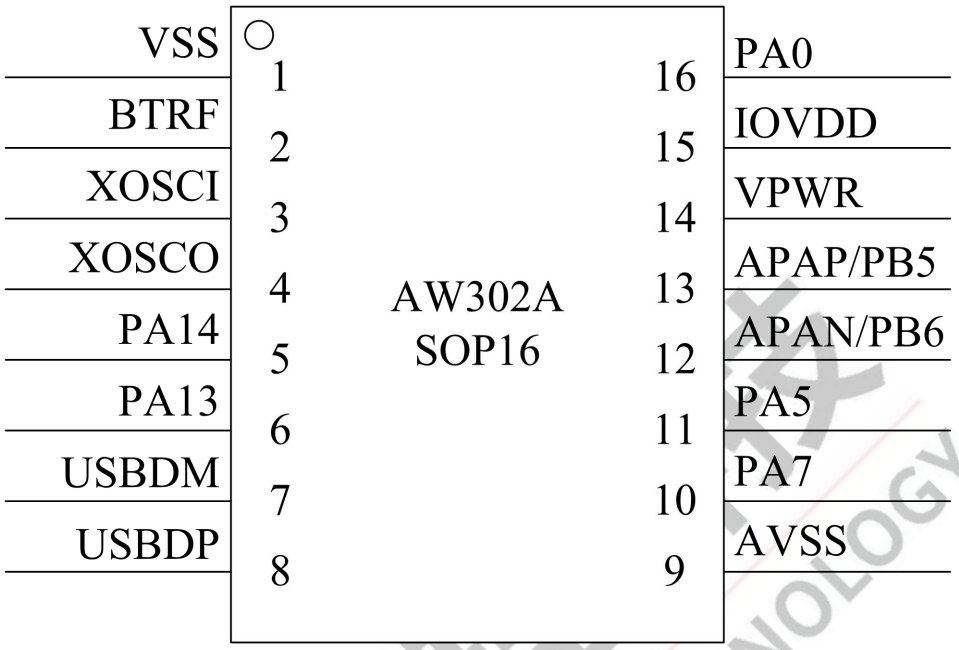


Figure 2-1 AW302A Pin Assignment

2.2 Pin Description

Table 2-2-1 AW302A Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	VSS	G	--	Ground
2	BTRF	RF	--	Bluetooth RF Antenna
3	XOSCI	I	--	Crystal Oscillator Input
4	XOSCO	O	--	Crystal Oscillator Output
5	PA14	I/O	Z	ADC4(ADC Input Channel 4) SPI0_DOB(0)
6	PA13	I/O	Z	ADC3(ADC Input Channel 3) SPI0_CLKB
7	USBDM	I/O	15kΩ Pull-down	ADC7(ADC Input Channel 7)
8	USBDP	I/O	15kΩ Pull-down	ADC6(ADC Input Channel 6)
9	AVSS	G	--	AUDIO Ground
10	PA7	I/O	Z	AIN_AP4(Audio ADC Positive Input) MICBIASC(MIC Bias Output)
11	PA5	I/O	Z	ADC1(ADC Input Channel 1) AIN_AP2(Audio ADC Positive Input) DAC Output
12	PB6	I/O	Z	--
	APAN	O	Z	Class-D Speaker Driver Negative Output
13	PB5	I/O	Z	--
	APAP	O	Z	Class-D Speaker Driver Positive Output
14	VPWR	P	--	Battery Input
15	IOVDD	P	--	IO Power
16	PA0	I/O	15kΩ Pull-down	--

Note

1.IO initial state abbreviations Z--High resistance, H--High level, L--Low level, X--May be changed during power on.

2.Timer, MCPWM, UART, I^2C, I^2S, SPI1/2, SD, CAN functions can be remapped to any I/O.

Table 2-2-2 Pin Types Description

Pin Type	Description	Pin Type	Description
P	Power	I/O	Input or Output
G	Ground	I	Input
RF	RF antenna	O	Output

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3-1 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
Topt	Operating temperature	-20	+85	℃
Tstg	Storage temperature	-65	+150	℃
VPWR	Supply Voltage	-0.3	6.0	V
IOVDD		-0.3	3.6	V
GPIO	Input voltage of GPIO (except PA0/PB5/PB6)	-0.3	3.6	V
HVTIO	Input voltage of HVT-IO (PA0/PB5/PB6)	-0.3	6.0	V

Note

1.Stresses beyond those listed under absolute maximum ratings may cause permanent damage to the device.

3.2 ESD Ratings

Table 3-2 ESD Ratings

Parameter	Typ	Test pin	Reference standard
Human Body Mode	±4kV	All pins	JEDEC EIA/JESD22-A114
Machine Mode	±200V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±2kV	All pins	ANSI/ESDA/JEDEC JS-002-2022

3.3 PMU Characteristics

Table 3-3-1 PMU Characteristics under VPWR supply

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VPWR	Power supply	--	2.7	--	5.5	V
Operating mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Voltage output	--	--	3.0	--	V
	Loading current	IOVDD=3.0V@VPWR = 3.7V	--	--	120	mA
Low Power mode						
Symbol	**Parameter**	**Conditions**	**Min**	**Typ**	**Max**	**Unit**
IOVDD	Loading current	IOVDD=3.0V@VPWR = 3.7V	--	--	10	mA

Table 3-3-2 PMU Characteristics under IOVDD supply

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Power supply	--	1.8	--	3.6	V

3.4 IO Characteristics

Table 3-4 IO Characteristics

Input Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Min**	**Max**	**Unit**
V_{IL}	Low-Level Input Voltage	IOVDD = 3.0V	PA0,PA5,PA7 PA13,PA14 PB5,PB6 USBDP USBDM	-0.3	1.4	V
V_{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA5,PA7 PA13,PA14 USBDP USBDM	1.7	3.3	V
		IOVDD = 3.0V	PA0 PB5 PB6	1.7	5.5	V
Output Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**		**Unit**
$\lvert I_{OL} \rvert$	Output Current	IOVDD = 3.0V Voutput = 0.3V	PA5,PA7 PA13,PA14	3(HD=0) 9(HD=1) 21(HD=2) 54(HD=3)		mA
		IOVDD = 3.0V Voutput = 0.3V	PA0 PB5 PB6 USBDP USBDM	8		mA
$\lvert I_{OH} \rvert$	Output Current	IOVDD = 3.0V Voutput = 2.7V	PA5,PA7 PA13,PA14	3(HD=0) 9(HD=1) 21(HD=2) 54(HD=3)		mA
		IOVDD = 3.0V Voutput = 2.7V	PA0 PB5 PB6 USBDP USBDM	8		mA
Internal Resistance Characteristics						
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**		**Unit**
R_{pu}	Pull-up Resistance	IOVDD = 3.0V	PA0,PA5,PA7 PA13,PA14 PB5,PB6	10k(PU=1) 100k(PU=2) 1M(PU=3)		Ω
		IOVDD = 3.0V	USBDP	1.5k		Ω

		IOVDD = 3.0V	USBDM	180k	Ω
Symbol	**Parameter**	**Conditions**	**IO**	**Typ**	**Unit**
R_{pd}	Pull-down Resistance	IOVDD = 3.0V	PA0,PA5,PA7 PA13,PA14 PB5,PB6	10k(PD=1) 100k(PD=2) 1M(PD=3)	Ω
		IOVDD = 3.0V	USBDP USBDM	15k	Ω

Note

1.Internal pull-up/pull-down resistance accuracy ±20%.

3.5 Audio DAC Characteristics

Table 3-5 Audio DAC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	--	bits
Output Sample Rate	--	8	--	96	kHz
SNR	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=100kΩ	--	90	--	dB
Dynamic Range	Single-ended Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=100kΩ	--	90	--	dB
THD+N	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=100kΩ	--	-83	--	dB
Noise Floor	Single-ended Mode B/W=20Hz~20kHz A-Weighted Load=100kΩ	--	18	--	uVrms
Max Amplitude	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=100kΩ THD+N＜0.1%	--	0.6	--	Vrms

3.6 Audio ADC Characteristics

Table 3-6 Audio ADC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	--	bits
Input Sample Rate	--	8	--	48	kHz
SNR	Single-ended Input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	91	--	dB
Dynamic Range	Single-ended Input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	91	--	dB
THD+N	Single-ended Input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	-80	--	dB
Analogue Gain	--	-6	--	21	dB
Max Input Level	Single-ended Input Mode ADC Gain=0dB	--	1	--	Vrms

3.7 Class-D Speaker Driver Characteristics

Table 3-7 Class-D Speaker Driver Characteristics under HPVDD 3.7V

Parameter	Conditions	Min	Typ	Max	Unit
SNR	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	98	--	dB
	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω	--	98	--	dB
THD+N	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz	--	-73	--	dB

Parameter	Conditions	Min	Typ	Max	Unit
	B/W=20Hz~20kHz A-Weighted Load=10kΩ				
	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω	--	-37	--	dB
Noise Floor	Differential Mode B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	30	--	uVrms
	Differential Mode B/W=20Hz~20kHz A-Weighted Load=8Ω	--	20	--	uVrms
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	88	--	dB
	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=8Ω	--	88	--	dB

3.8 12bit ADC Characteristics

Table 3-8 12bit ADC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
AVDD(ADC Supply Voltage)	AVDD=IOVDD	1.8	3	3.3	V
f_{ADC}(ADC Clock Frequency)	--	0.25	--	14	MHz
Ts(ADC Sampling Time)	--	1.5	--	--	$1/f_{ADC}$
ADC Conversion Time	Including Sampling Time	8	--	14	$1/f_{ADC}$
ADC Input Voltage Range	--	0	--	AVDD	V
ADC Internal Sample and Hold Capacitor	--	--	5	--	pF
Sampling Switch Resistance	--	--	--	1	kΩ
External Input Impedance	$Ts=1.5/f_{ADC}$	--	--	1.5	kΩ
	$Ts>=50/f_{ADC}$	--	--	50	kΩ
ADC Resolution	Programmable	6	12	12	bit
INL	AVDD=3V, f_{ADC}=14MHz	--	±2	--	LSB
DNL	AVDD=3V, f_{ADC}=14MHz	--	±1	--	LSB

Parameter	Conditions	Min	Typ	Max	Unit
ADC Offset Error	AVDD=3V, f_{ADC}=14MHz	--	3	--	LSB
Gain Error	AVDD=3V, f_{ADC}=14MHz	--	3	--	LSB
Current Consumption in Conversion Mode	Single-ended, f_{ADC} =14MHz	--	350	--	uA

3.9 BT Characteristics

3.9.1 Transmitter

Table 3-9-1 Transmitter characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Maximum RF Transmit Power	BLE-1Mbps	--	0	8	dBm

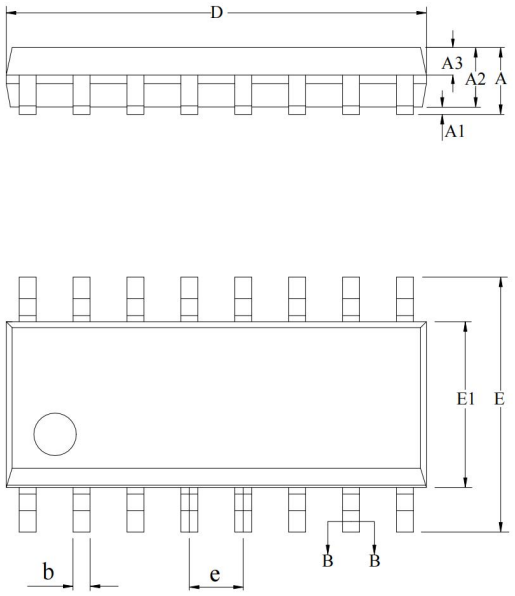
3.9.2 Receiver

Table 3-9-2 Receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	BLE-1Mbps	--	-95	--	dBm
	BLE-2Mbps	--	-93	--	dBm
	BLE-S2	-99	-98	--	dBm
	BLE-S8	-104	-103	--	dBm

4 Package Information

4.1 SOP16



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	–	–	1.75
A1	0.10	–	0.225
A2	1.30	1.40	1.50
A3	0.60	0.65	0.70
b	0.39	–	0.47
b1	0.38	0.41	0.44
c	0.20	–	0.24
c1	0.19	0.20	0.21
D	9.80	9.90	10.00
E	5.80	6.00	6.20
E1	3.80	3.90	4.00
e	1.27BSC		
h	0.25	—	0.50
L	0.50	—	0.80
L1	1.05REF		
θ	0	—	8°

Figure 4-1 AW302A Package

5 IC Marking Information

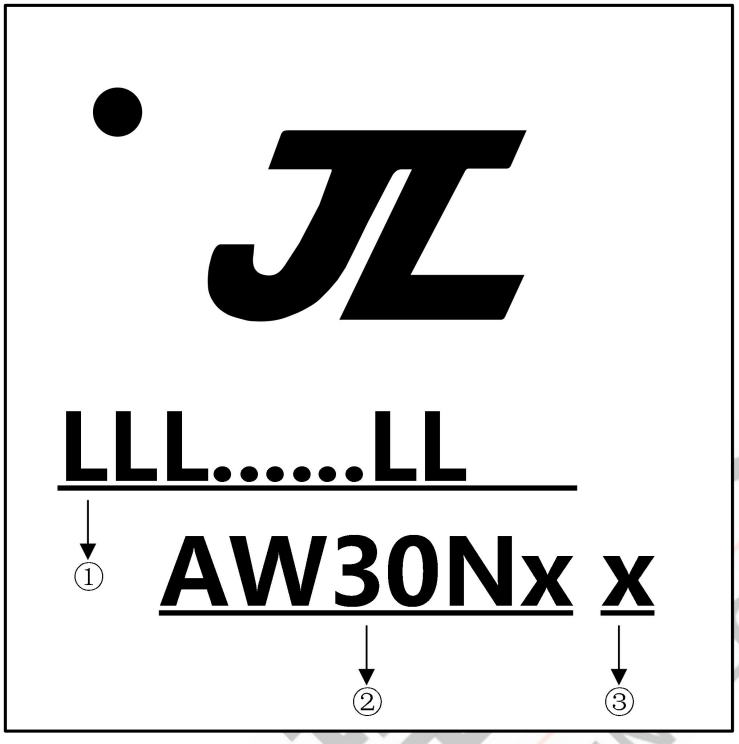


Figure 5-1 AW302A Package Outline

① LLL.....LL Production Batch
② AW30Nx Chip Model
③ x Built-in flash size
0 No Flash Memory
2 2Mbit Flash
4 4Mbit Flash

6 Solder-Reflow Condition

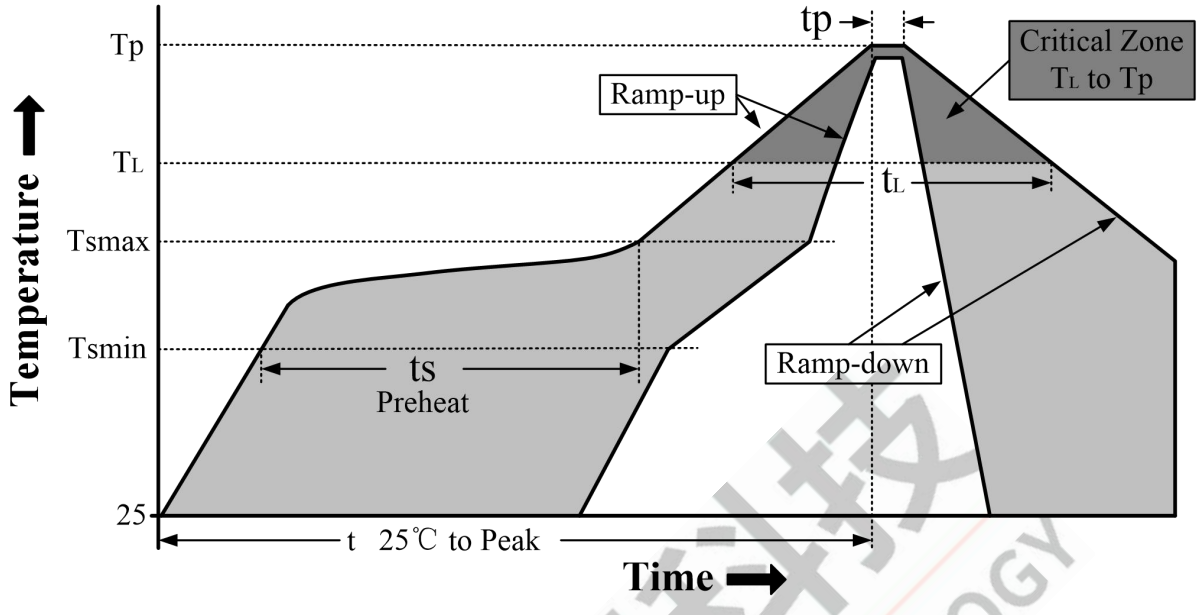


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak	Temperature Min (T_{smin})	100℃	150℃
	Temperature Max (T_{smax})	150℃	200℃
	Time (ts) from (T_{smin} to T_{smax})	60-120 seconds	60-180 seconds
Average ramp-up rate (T_{smax} to T_p)		3℃/second max	3℃/second max
Liquidus temperature (T_L) Time (t_L) maintained above T_L		183℃ 60-150 seconds	217℃ 60-150 seconds
Peak package body temperature (T_p)		See Table 6-2	See Table 6-3
Time within 5℃ of actual Peak Temperature (tp)[2]		10-30 seconds	20-40 seconds
Ramp-down rate (T_p to T_L)		6℃/second max	6℃/second max
Time 25℃ to peak temperature		6 minutes max	8 minutes max

Note

1.All temperatures refer to topside of the package, measured on the package body surface

2.Time within 5℃ of actual peak temperature (tp) specified for the reflow profiles is a "supplier" and "user" maximum.

Table 6-2 SnPb Classification Temperature

Package Thickness	Volume mm^3 < 350	Volume mm^3 ≥ 350
<2.5 mm	240 +0/-5℃	225 +0/-5℃
≥2.5 mm	225 +0/-5℃	225 +0/-5℃

Table 6-3 Pb-free - Classification Temperature

Package Thickness	Volume mm³ < 350	Volume mm³ 350 - 2000	Volume mm³ > 2000
< 1.6mm	260℃	260℃	260℃
1.6 mm - 2.5mm	260℃	250℃	245℃
> 2.5mm	250℃	245℃	245℃

Note

1.*Tolerance The device manufacturer/supplier shall assure process compatibility up to and including the stated classification temperature (this means Peak reflow temperature +0℃.For example 260℃+0℃)at the rated MSL level.