AW306A Datasheet

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Version 1.3

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Revision History

Date	Revision	Description
2023.12.08	V1.0	Initial Release
2023.12.14	V1.1	Update APA Characteristics Update BT Characteristics
2024.01.24	V1.2	Update Features Update Pin Description
2024.02.28	V1.3	Update Datasheet Format And Content

Table of Contents

AW306A 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 91dB
  - Noise 16uVrms
  - Sampling rate 8~96kHz
- 1 x 16bit ADC
  - SNR 95dB
  - 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

- BLE5.4 +2.4GHz-Proprietary (QDID 223418)
- Support AoA Transmitter
- Support long range BLE
- Maximum transmitting power 6 dBm
- Receiver sensitivity
  - -97dBm @BLE-1Mbps
  - -94dBm @BLE-2Mbps
  - -100dBm @BLE-S2
  - -105dBm @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(9 Channel)
- 23 x GPIO Support function remapping
- 1 x CAN controller
- 6 x MCPWM
- 8 x Touchkey

PMU

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

Packages

- QFN32(4mm*4mm)

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

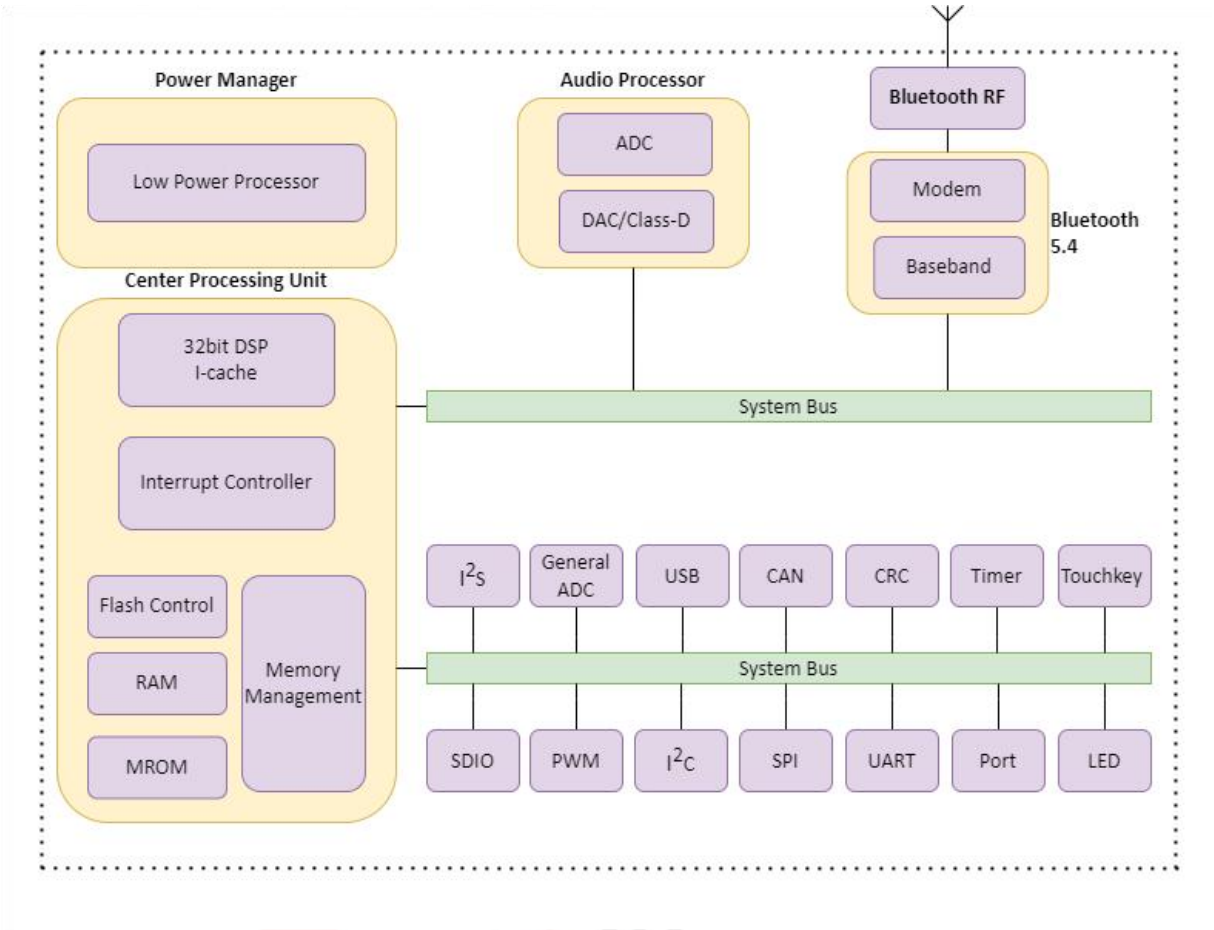


Figure 1-1 AW306A Block Diagram

2 Pin Definition

2.1 Pin Assignment

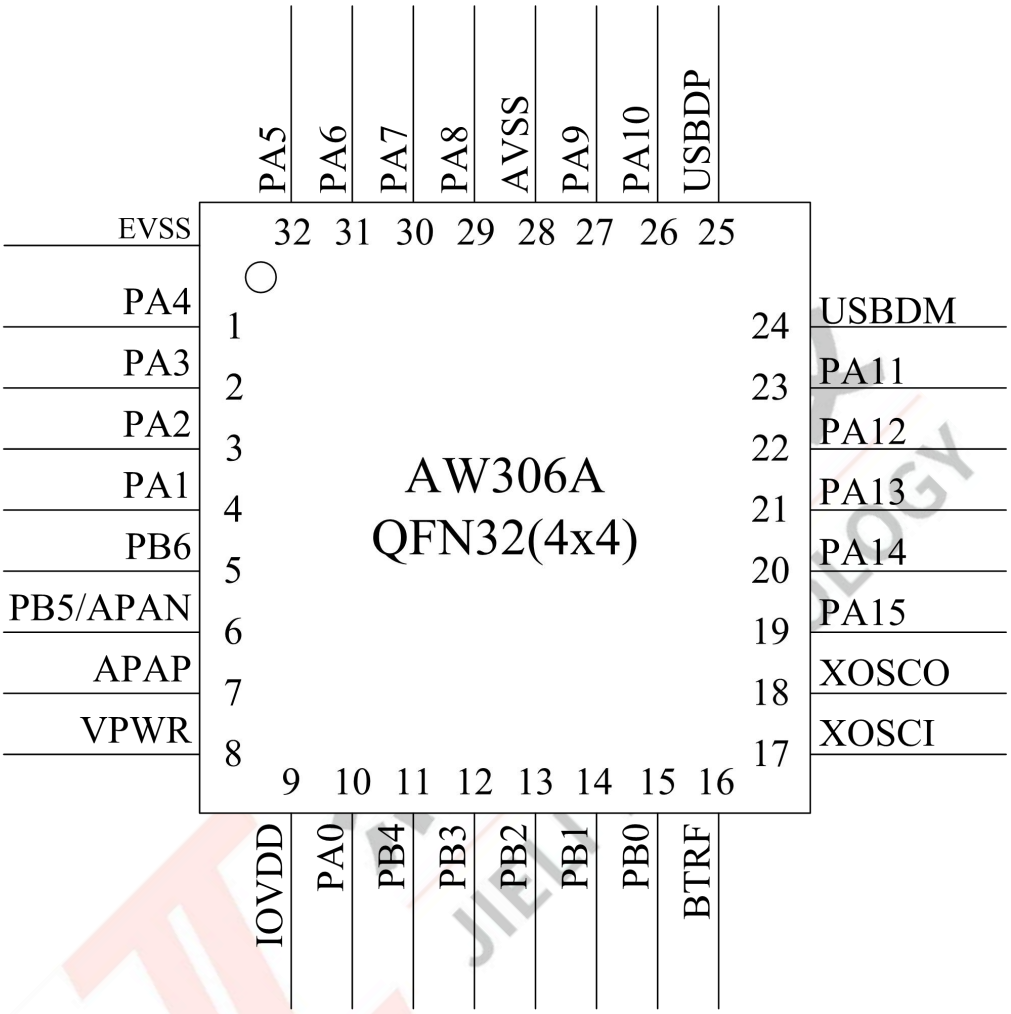


Figure 2-1 AW306A Pin Assignment

2.2 Pin Description

Table 2-2-1 AW306A Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	PA4	I/O	Z	ADC0(ADC Input Channel 0) AIN_AP1(Audio ADC Positive Input)
2	PA3	I/O	Z	Touch2
3	PA2	I/O	10kΩ Pull-up	Touch1 Hold down 0 to reset
4	PA1	I/O	Z	LVD(External Low Voltage Detection Input) Touch0
5	PB6	I/O	Z	--
6	PB5	I/O	Z	--
	APAN	O	Z	Class-D Speaker Driver Negative Output
7	APAP	O	Z	Class-D Speaker Driver Positive Output
8	VPWR	P	--	Charge Power Input
9	IOVDD	P	--	IO Power
10	PA0	I/O	15kΩ Pull-down	--
11	PB4	I/O	Z	Touch7
12	PB3	I/O	Z	Touch6
13	PB2	I/O	Z	Touch5 32k Crystal Oscillator Output
14	PB1	I/O	Z	Touch4 32k Crystal Oscillator Input
15	PB0	I/O	10kΩ Pull-up	Touch3 MCLR(Device Reset)
16	BTRF	RF	--	Bluetooth RF Antenna
17	XOSCI	I	--	Crystal Oscillator Input
18	XOSCO	O	--	Crystal Oscillator Output
19	PA15	I/O	Z	ADC5(ADC Input Channel 5) SPI0_DIB(1)
20	PA14	I/O	Z	ADC4(ADC Input Channel 4) SPI0_DOB(0)
21	PA13	I/O	Z	ADC3(ADC Input Channel 3) SPI0_CLKB
22	PA12	I/O	Z	AINN(ADC Negative Input) SPI0_DATB(3)
23	PA11	I/O	Z	AINP(ADC Positive Input) SPI0_DATB(2)
24	USBDM	I/O	15kΩ Pull-down	ADC7(ADC Input Channel 7)
25	USBDP	I/O	15kΩ Pull-down	ADC6(ADC Input Channel 6)

Pin No.	Name	Type	IO Initial State	Description
26	PA10	I/O	Z	--
27	PA9	I/O	Z	--
28	AVSS	G	--	AUDIO Ground
29	PA8	I/O	Z	ADC2(ADC Input Channel 2) AIN_AP0(Audio ADC Positive Input)
30	PA7	I/O	Z	AIN_AP4(Audio ADC Positive Input) MICBIASC(MIC Bias Output)
31	PA6	I/O	Z	AIN_AP3(Audio ADC Positive Input) AIN_AN(Audio ADC Negative Input)
32	PA5	I/O	Z	ADC1(ADC Input Channel 1) AIN_AP2(Audio ADC Positive Input) DAC Output

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~PA15 PB0~PB6 USBDP USBDM	-0.3	1.4	V
V_{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA1~PA15 PB0~PB4 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	PA1~PA15 PB0~PB4	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	PA1~PA15 PB0~PB4	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~PA15 PB0~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~PA15 PB0~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	--	91	--	dB
Dynamic Range	Single-ended Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Load=100kΩ	--	91	--	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	--	16	--	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	Differential Input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	95	--	dB
	Single-ended Input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	92	--	dB
Dynamic Range	Differential Input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	95	--	dB
	Single-ended Input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	92	--	dB
THD+N	Differential Input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC Gain=0dB	--	-85	--	dB
	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	Differential Input Mode ADC Gain=0dB	--	2	--	Vrms
	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 B/W=20Hz~20kHz A-Weighted Load=10kΩ	--	-73	--	dB
	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
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	6	dBm

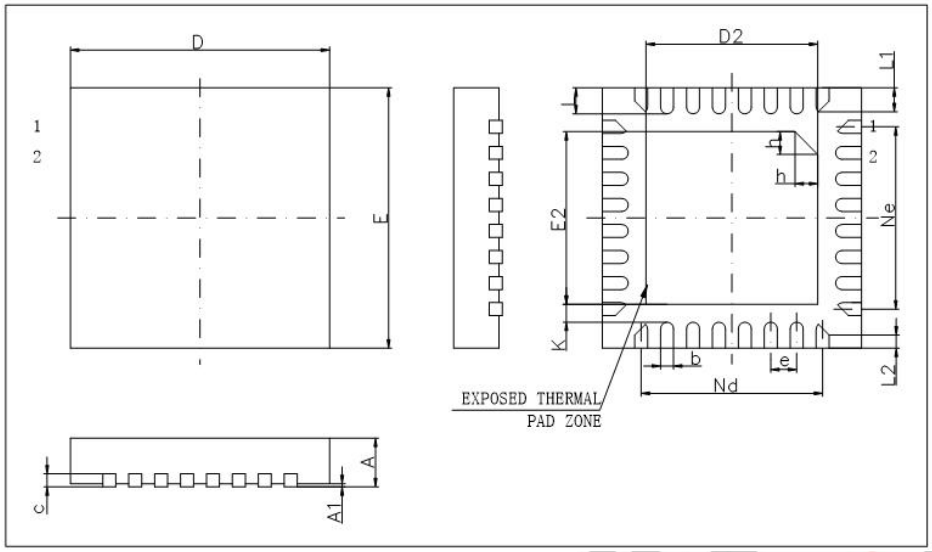
3.9.2 Receiver

Table 3-9-2 Receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	BLE-1Mbps	--	-97	--	dBm
	BLE-2Mbps	-95	-94	--	dBm
	BLE-S2	-100	-99	--	dBm
	BLE-S8	-105	-104	--	dBm

4 Package Information

4.1 QFN32_4×4mm



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.50	2.65	2.80
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.50	2.65	2.80
Ne	2.80BSC		
K	0.20	-	-
L	0.35	0.40	0.45
L1	0.30	0.35	0.40
L2	0.15	0.20	0.25
h	0.30	0.35	0.40
L/F载体尺寸 (mil)	112*112		

Figure 4-1 AW306A Package

5 IC Marking Information

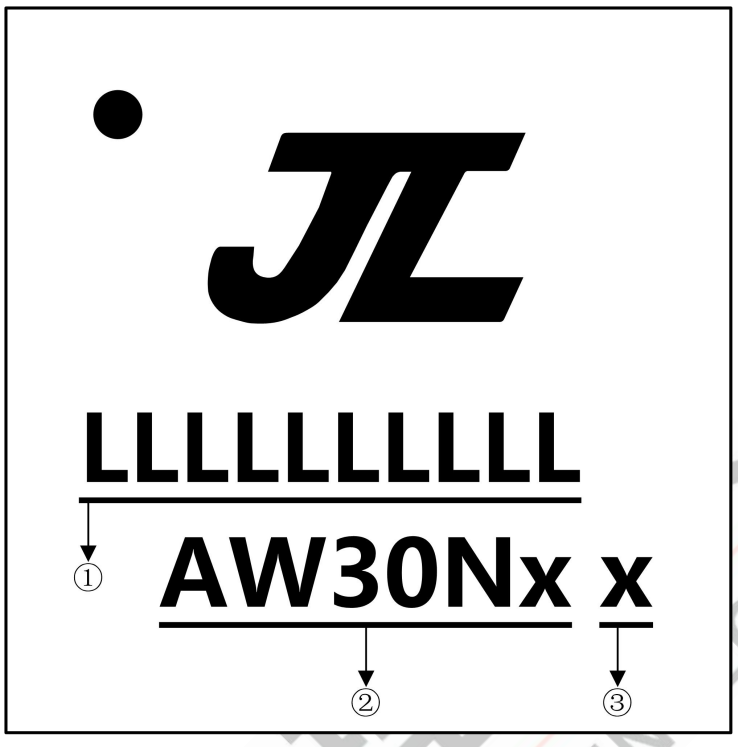


Figure 5-1 AW306A Package Outline

① LLLLLLLLL 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

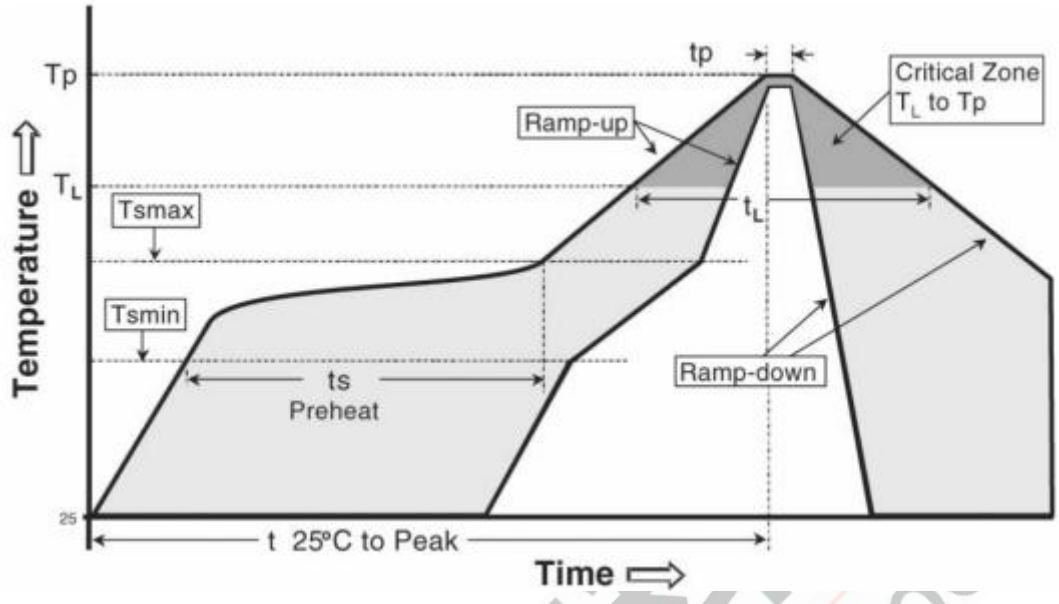


Figure 6-1 Classification Reflow Profile

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 mm^3 < 350	Volume mm^3 350 - 2000	Volume mm^3 > 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.