

AC1123H Datasheet

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Revision History

Date	Revision	Description
2025.12.23	V1.0	Initial Release



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AC1123H Features

SYSTEM

- 32bit Single-core DSP
- With IEEE754 Single precision FPU
- With I-cache and D-cache
- Support FFT/MATH
- Support MMU
- Support MPU
- Built-In Flash
- 24MHz crystal oscillator
- Internal RC oscillator, PLL

DSP Audio Processing

- SBC/AAC codec
- mSBC voice codec supported for BT phone
- PLC for voice processing
- Single MIC ENC
- Multi-band EQ

Audio

- 2 x 24bit DAC
 - ❖ SNR 110dB
 - ❖ Noise 1uVrms
 - ❖ Support VCMO mode
 - ❖ Sampling rate 8~384kHz
- 1 x 24bit ADC
 - ❖ SNR 90dB
 - ❖ Sampling rate 8~96kHz
 - ❖ Support analog/digital microphone

Bluetooth

- Dual-mode BT6.0
(DN Q334307)
- Maximum transmitting power 13dBm
- Receiver sensitivity
 - ❖ -95dBm @BR
 - ❖ -96dBm @EDR $\pi/4$ DQPSK
 - ❖ -88dBm @EDR 8DPSK

Peripherals

- 1 x SD host controller
- 2 x Multi-function 16bit timers

- 2 x Uart interface no support DMA
- 1 x Uart interface support DMA
- 1 x SPI Master/Slave interface
- 1 x 10bit ADC(6 Channels)
- 8 x GPIO Support function remapping
- 3 x LP_Touch with low power wake up
- 1 x LED-IO specifically driving 2 LEDs

PMU

- Integrated battery charger up to 250mA
- 1 x Buck DC-DC converter
- Support temperature sensor
- VPWR range 4.5V to 5.5V
- VBAT range 2.7V to 4.5V
- IOVDD range 2.7V to 3.6V

Packages

- QFN20(3*3mm)

Temperature

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

Applications

- Bluetooth headphone
- Bluetooth audio device

1 Block Diagram

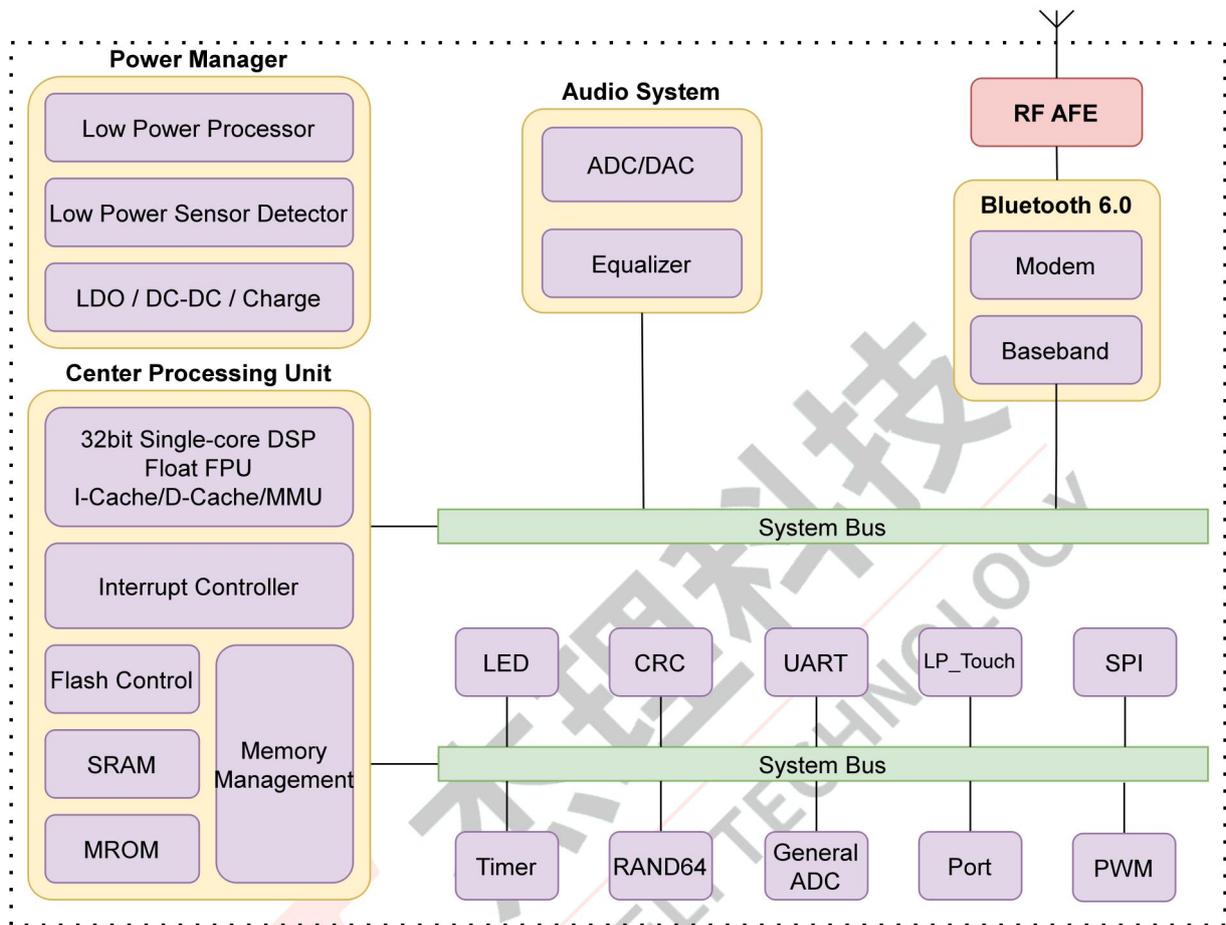


Figure 1-1 AC1123H Block Diagram

2 Pin Definition

2.1 Pin Assignment

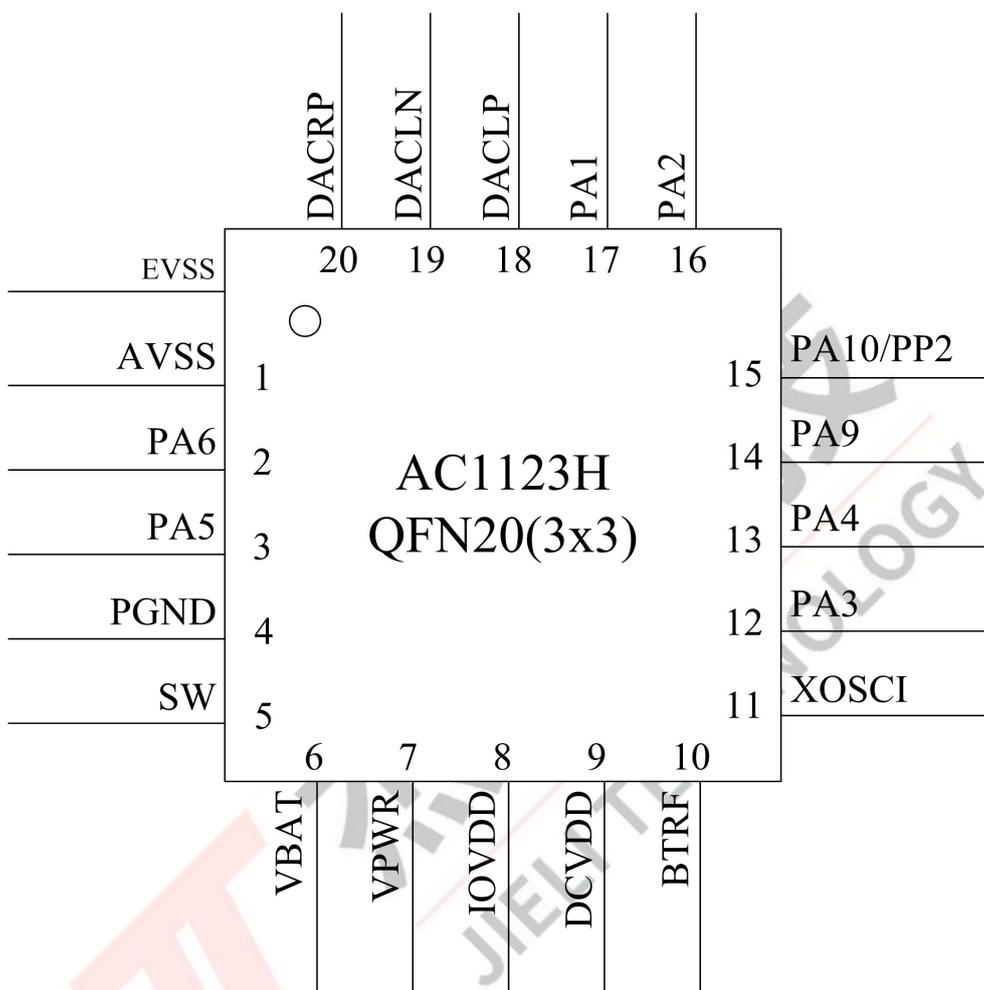


Figure 2-1 AC1123H Pin Assignment

2.2 Pin Description

Table 2-2-1 AC1123H Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	AVSS	G	--	Audio Ground
2	PA6	I/O	--	LP_TOUCH1(TOUCH_CH1)
3	PA5	I/O	10kΩ Pull-up	Hold down 0 to reset MCLR(Device Reset) LP_TOUCH0(TOUCH_CH0)
4	PGND	G	--	Ground of Buck DC-DC converter
5	SW	P	--	Buck DCDC Switch Port
6	VBAT	P	--	Battery Input
7	VPWR	I/O	Z	Charge Power Input LP_TOUCH3(TOUCH_CH3)
8	IOVDD	P	--	IO Power
9	DCVDD	P	--	DCDC Output
10	BTRF	RF	--	Bluetooth RF Antenna
11	XOSCI	I	--	Crystal Oscillator Input
12	PA3	I/O	--	ADC3(ADC Input Channel 3) LVD(External Low Voltage Detection Input)
13	PA4	I/O	--	ADC4(ADC Input Channel 4)
14	PA9	I/O	--	ADC5(ADC Input Channel 5) SPIO_DATA2
15	PA10	I/O	--	ADC6(ADC Input Channel 6) SPIO_DATA3
	PP2	I/O	--	ADC7(ADC Input Channel 7) SDPG(SD Power Output)
16	PA2	I/O	10kΩ Pull-down	ADC2(ADC Input Channel 2) MIC_A0(MIC Input) MICBIASA(MIC Bias Output)
17	PA1	I/O	--	ADC1(ADC Input Channel 1) AIN_A0(Audio ADC Positive Input)
18	DACLP	O	--	Left Channel DAC Positive Output
19	DACLN	O	--	Left Channel DAC Negative Output DAC VCMO Output
20	DACRP	O	--	Right Channel DAC Positive 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, UART, SPI and SD 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

2.3 Pin Specialist

Table 2-3-1 Pin keep Description

Pin	Description for IOVDD power off mode
PA5、PA6	keep IO state in IOVDD power off mode
VPWR	Keep detection of charging insertion in IOVDD power off mode
Others IO	IO state loss in IOVDD power off mode

3 Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3-1 Absolute Maximum Ratings

Symbol	Parameter	Min	Max	Unit
Topt	Operating temperature	-20	+85	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	4.5	V
VPWR		-0.3	6	V
IOVDD		-0.3	3.6	V
DCVDD		-0.3	1.55	V
GPIO	Input voltage of GPIO	-0.3	3.6	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	±300V	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 PMU Characteristics

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
VBAT	Power supply	--	2.7	3.7	4.5	V
VPWR	Power supply	--	4.5	5.0	5.5	V
Operating mode						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Voltage output	--	--	3	--	V
	Loading current	IOVDD=3.0V@VBAT = 3.7V	--	--	120	mA
DCVDD	Voltage output	--	--	1.25	--	V
	Loading current	DCVDD=1.25V@VBAT=3.7V in LDO mode	--	--	120	mA
		DCVDD=1.25V@VBAT=3.7V in DCDC mode	--	--	120	mA
Low Power mode						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Loading current	IOVDD=3.0V@VBAT = 3.7V	--	--	10	mA

3.4 Battery Charge

Table 3-4 Charger Characteristics

Symbol	Parameter	Min	Typ	Max	Unit
VPWR	Charge Input Voltage	4.5	5	5.5	V
CV	CV Mode Voltage Accuracy	4.175	4.2	4.225	V
		4.375	4.4	4.425	V
CC	CC Mode Current	20	--	250	mA
I _{end}	End Of Charge Current	2.0	--	25	mA
V _{Trikl}	Trickle Charge Voltage	--	3	--	V

3.5 IO Characteristics

Table 3-5 IO Characteristics

Input Characteristics						
Symbol	Parameter	Conditions	IO	Min	Max	Unit
V _{IL}	Low-Level Input Voltage	IOVDD = 3.0V	PA1~PA6,PA9,PA10 PP2 VPWR	-0.3	1.0	V
V _{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA1~PA6,PA9,PA10 PP2	2.0	3.3	V
		IOVDD = 3.0V	VPWR	2.0	5.5	V
Output Characteristics						
Symbol	Parameter	Conditions	IO	Typ	Unit	
I _{OL}	Output Current	IOVDD = 3.0V V _{output} = 0.3V	PA1~PA6,PA9,PA10	1(HD=0) 4(HD=1) 8(HD=2) 31(HD=3)	mA	
	Output Current	IOVDD = 3.0V V _{output} = 0.3V	VPWR	2	mA	
	Output Current	IOVDD = 3.0V V _{output} = 0.3V	PP2	30(HD=0) 30(HD=1)	mA	
I _{OH}	Output Current	IOVDD = 3.0V V _{output} = 2.7V	PA1~PA6,PA9,PA10	1(HD=0) 4(HD=1) 8(HD=2) 31(HD=3)	mA	
	Output Current	IOVDD = 3.0V V _{output} = 2.7V	VPWR	2	mA	
	Output Current	IOVDD = 3.0V V _{output} = 2.7V	PP2	30(HD=0) 120(HD=1)	mA	
Internal Resistance Characteristics						
Symbol	Parameter	Conditions	IO	Typ	Unit	

R _{pu}	Pull-up Resistance	IOVDD = 3.0V	PA1~PA6,PA9,PA10 PP2 VPWR	10k(PU=1) 200k(PU=2) 1M(PU=3)	Ω
R _{pd}	Pull-down Resistance	IOVDD = 3.0V	PA1~PA6,PA9,PA10 PP2 VPWR	10k(PD=1) 200k(PD=2) 1M(PD=3)	Ω

Note

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

3.6 Audio DAC Characteristics

Table 3-6-1 Stereo DAC Characteristics (Output Power 7.5mW)

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	24	bits
Input Sample Rate	--	8	--	384	kHz
SNR ^①	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω --	110	--	dB
Dynamic Range	VCMO Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω --	98	--	dB
THD+N	VCMO Mode Fin=1kHz@-0.5dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=32Ω --	80	--	dB
Noise Floor	VCMO Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω --	4.5	--	uVrms
Noise Floor with MUTE	VCMO Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω --	1.0	--	uVrms
Stereo Crosstalk	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=10kΩ --	-100	--	dB
Max Output Power	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted THD+N<0.1%	Load=16Ω --	7.5	--	mW

Table 3-6-2 Stereo DAC Characteristics(Output Power 12.5mW)

Parameter	Conditions	Min	Typ	Max	Unit	
Resolution	--	--	16	24	bits	
Input Sample Rate	--	8	--	384	kHz	
SNR ^①	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	113	--	dB
Dynamic Range	VCMO Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	100	--	dB
THD+N	VCMO Mode Fin=1kHz@-0.5dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=32Ω	--	-75	--	dB
Noise Floor	VCMO Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	4.5	--	uVrms
Noise Floor with MUTE	VCMO Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	1.0	--	uVrms
Stereo Crosstalk	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=10kΩ	--	-100	--	dB
Max Output Power	VCMO Mode Fin=1kHz@-0.2dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted THD+N<0.1%	Load=16Ω	--	12.5	--	mW

Note

- ① SNR is the ratio of output level with a 1kHz full-scale input to output level with MUTE on.

3.7 Audio ADC Characteristics

Table 3-7 Audio ADC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	16	24	bits
Input Sample Rate	--	8	--	96	kHz
SNR	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	90	--	dB
Dynamic Range	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	90	--	dB
THD+N	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	-81	--	dB
Analogue Gain	--	-3	--	27	dB
Max Input Level	Single-ended input Mode ADC gain=0dB	--	0.282	--	Vrms

3.8 BT Characteristics

3.8.1 Transmitter

Table 3-8-1-1 Transmitter characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Maximum RF Transmit Power	BR	--	10	13	dBm
Maximum RF Transmit Power	EDR $\pi/4$ DQPSK EDR 8DPSK	--	10	--	dBm
Relative Transmit Power	EDR $\pi/4$ DQPSK EDR 8DPSK	--	1	--	dB
1 σ of Maximum RF Transmit Power distribution	BR/EDR	--	2	--	dB

3.8.2 Receiver

Table 3-8-2 Receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	BR	--	-95	--	dBm
	EDR $\pi/4$ DQPSK	--	-96	--	dBm
	EDR 8DPSK	--	-88	--	dBm
1 σ of sensitivity distribution	BR/EDR	--	2	--	dB

4 Package Information

4.1 QFN20_3×3mm

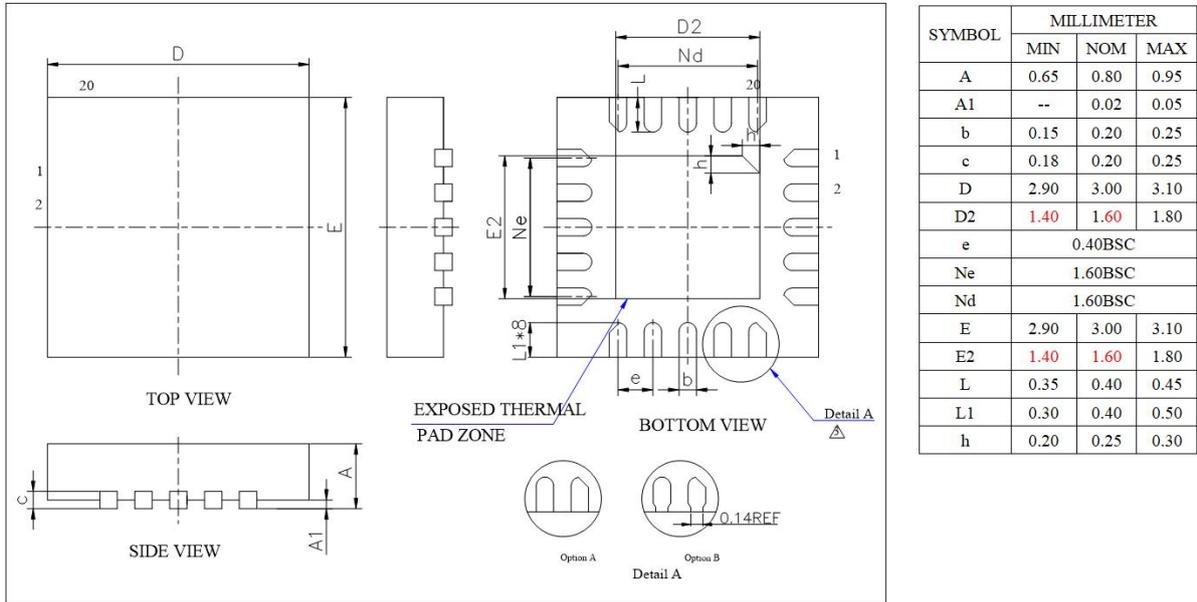


Figure 4-1 AC1123H Package

5 IC Marking Information

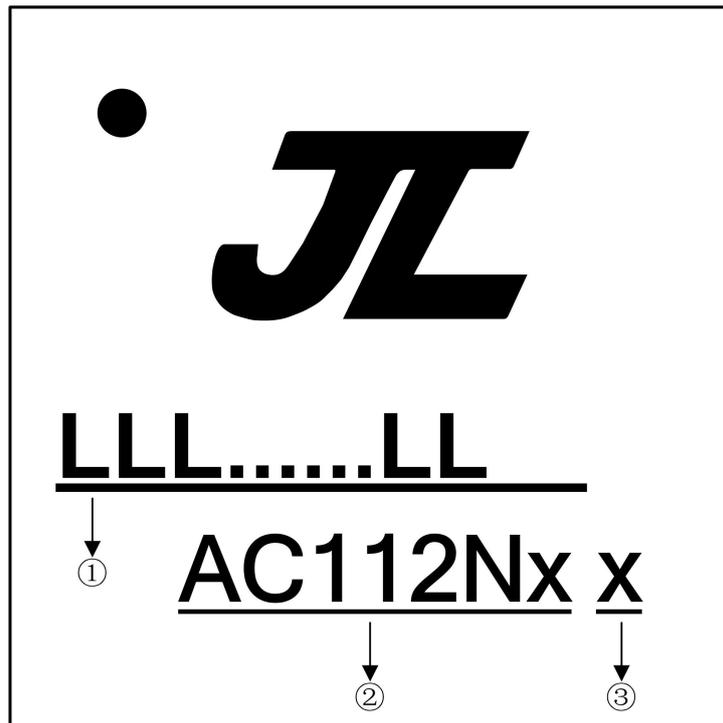


Figure 5-1 AC1123H Package Outline

- ① LLL.....LL Production Batch
- ② AC112Nx Chip Model
- ③ x Built-in flash size
2 2Mbit Flash

6 Solder-Reflow Condition

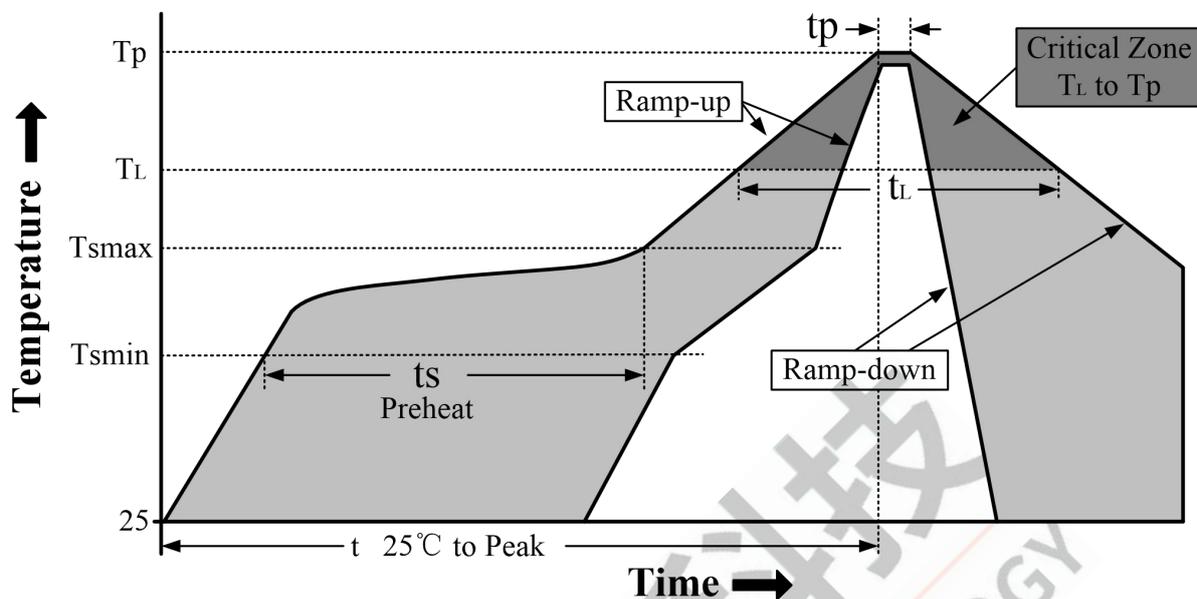


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak	Temperature Min (T_{smin})	100°C	150°C
	Temperature Max (T_{smax})	150°C	200°C
	Time (t_s) from (T_{smin} to T_{smax})	60-120 seconds	60-180 seconds
Average ramp-up rate (T_{smax} to T_p)		3°C/second max	3°C/second max
Liquidous temperature (T_L)		183°C	217°C
Time (t_L) maintained above T_L		60-150 seconds	60-150 seconds
Peak package body temperature (T_p)		See Table 6-2	See Table 6-3
Time within 5°C of actual Peak Temperature (t_p) ²		10-30 seconds	20-40 seconds
Ramp-down rate (T_p to T_L)		6°C/second max	6°C/second max
Time 25°C 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°C of actual peak temperature (t_p) specified for the reflow profiles is a “supplier” and “user” maximum.

Table 6-2 SnPb Classification Temperature

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

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°C	260°C	260°C
1.6 mm - 2.5mm	260°C	250°C	245°C
> 2.5mm	250°C	245°C	245°C

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°C.For example 260°C+0°C)at the rated MSL level.

