

AC1113A Datasheet

Version 1.0

Date 2026.08.17

Revision History

Date	Revision	Description
2026.08.17	V1.0	Initial Release



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AC1113A 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

- 1 x 24bit DAC
 - ❖ SNR 116dB
 - ❖ Noise 1uVrms
 - ❖ Support differential mode
 - ❖ Sampling rate 8~384kHz
 - ❖ Drive speaker directly 50mW@16Ω
 - ❖ Support OWS dynamic power control
- 1 x 24bit ADC
 - ❖ SNR 96dB
 - ❖ Sampling rate 8~96kHz
 - ❖ Support analog/digital microphone

Bluetooth

- Dual-mode BT6.0
(DN Q334307)
- Maximum transmitting power 13dBm
- Receiver sensitivity
 - ❖ -94.5dBm @BR
 - ❖ -95.5dBm @EDR Π/4 DQPSK
 - ❖ -88dBm @EDR 8DPSK

Peripherals

- 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(5 Channels)
- 7 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℃ to +85℃
TC = -40℃ to +105℃(extended range)
- Storage temperature -65℃ to +150℃

Applications

- TWS
- OWS
- Bluetooth audio device

1 Block Diagram

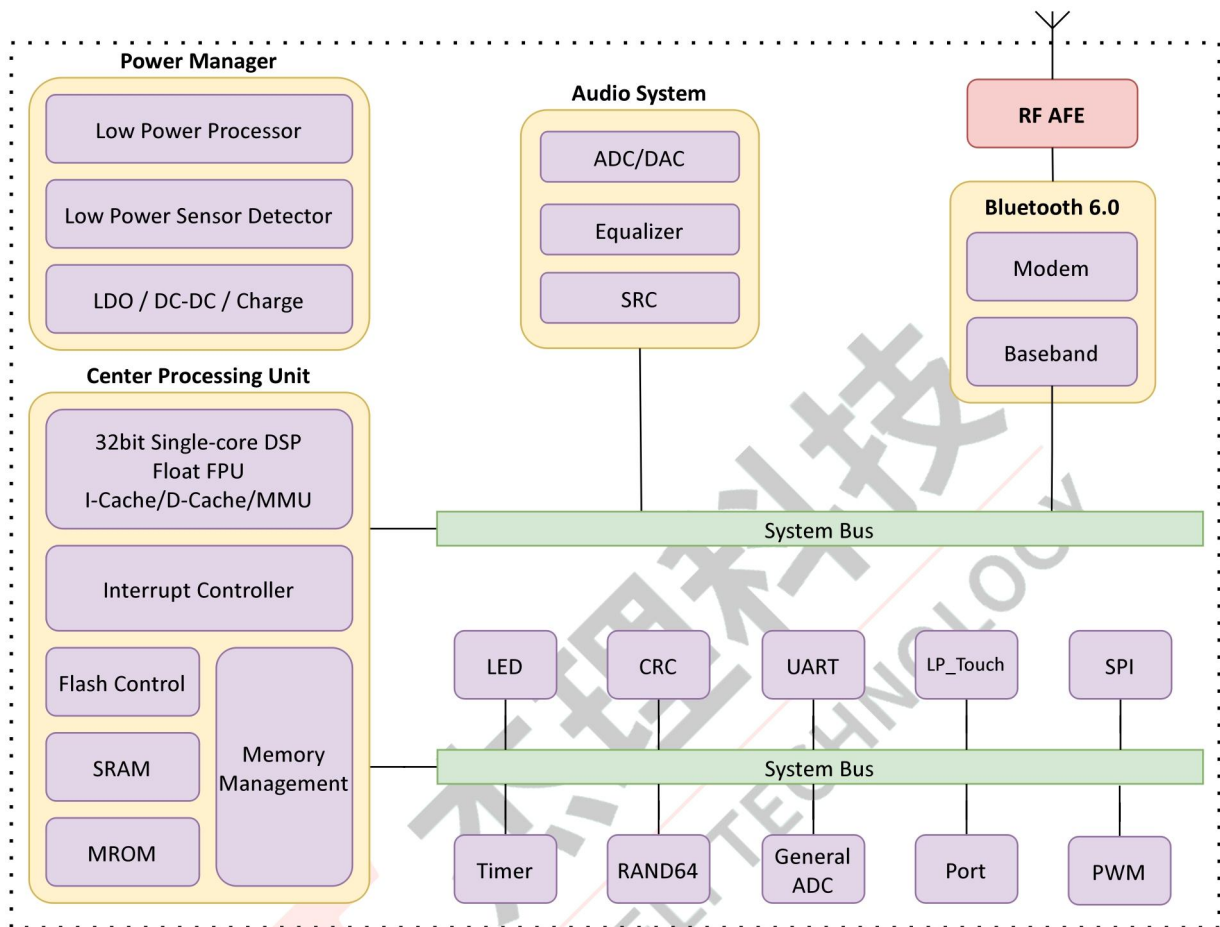


Figure 1-1 AC1113A Block Diagram

2 Pin Definition

2.1 Pin Assignment

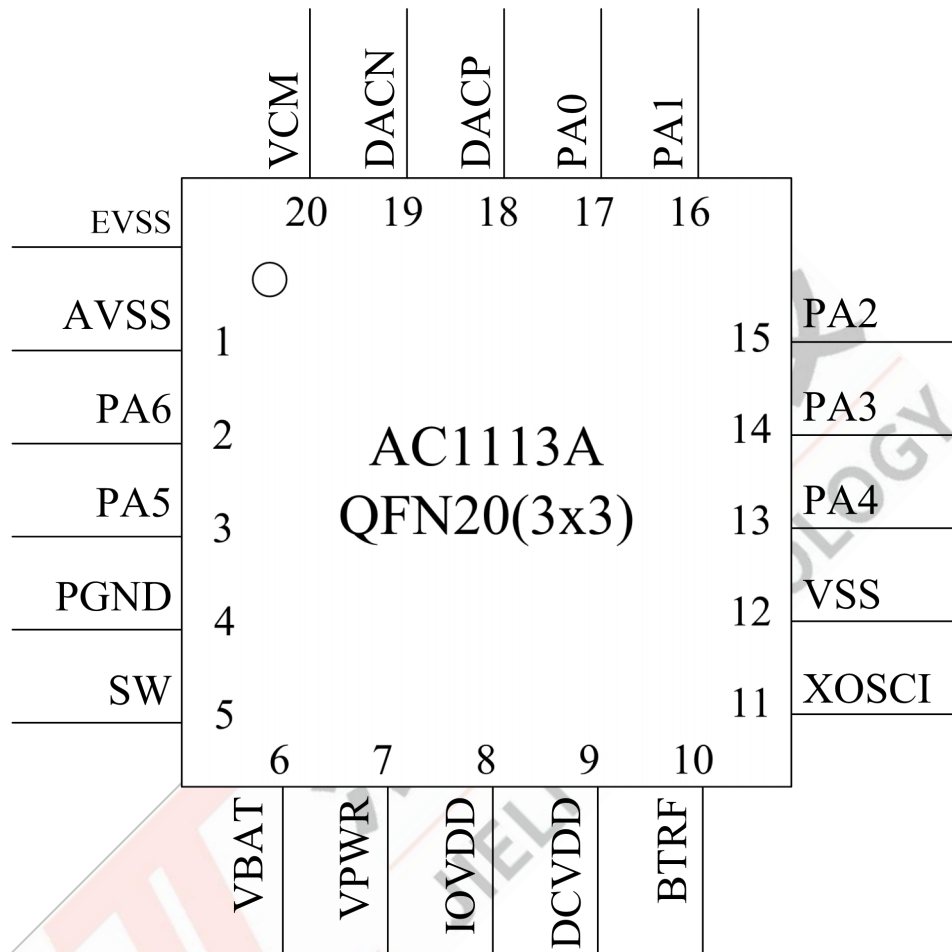


Figure 2-1 AC1113A Pin Assignment

2.2 Pin Description

Table 2-2-1 AC1113A Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	AVSS	G	--	Audio Ground
2	PA6	I/O	Z	PADC1(ADC Input Channel P1) LP_TOUCH1(TOUCH_CH1)
3	PA5	I/O	Z	PADC0(ADC Input Channel P0) 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	VSS	G	--	Ground
13	PA4	I/O	Z	ADCA3(ADC Analog Channel 3)
14	PA3	I/O	10kΩ Pull-up	ADC3(ADC Input Channel 3) Hold down 0 to reset MCLR(Device Reset) LVD(External Low Voltage Detection Input)
15	PA2	I/O	10kΩ Pull-down	MICBIASA(MIC Bias Output) MIC_A0(Audio ADC Input) MICRLED(Mic reuse for led)
16	PA1	I/O	Z	AIN_A0(Audio ADC Positive Input) ADC1(ADC Input Channel 1)
17	PA0	I/O	Z	AIN_AN(Audio ADC Negative Input) AIN_A1(Audio ADC Positive Input)
18	DACP	O	Z	Audio DAC positive output
19	DACN	O	Z	Audio DAC negative output
20	VCM	P	--	Audio reference voltage

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 functions can be remapped to any I/O.
- 3.If the ADCA3 function is enabled,PA4 will be pulled down by 200kΩ resistor.

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
T _{opt}	Operating temperature	-20	+85	°C
T _{stg}	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 (except PA4)	-0.3	3.6	V
HVTIO	Input voltage of HVT-IO (PA4)	-0.3	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(except PA4)	JEDEC EIA/JESD22-A114
	±2kV	PA4	
Machine Mode	±200V	All pins(except PA4)	JEDEC EIA/JESD22-A115
	±100V	PA4	
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	--	--	1.3	--	V
	Loading current	DCVDD=1.3V@VBAT=3.7V in LDO mode	--	--	120	mA
		DCVDD=1.3V@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	PA0~PA6 VPWR	-0.3	1.0	V
V _{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA0~PA3 PA5,PA6	2.0	3.3	V
			VPWR PA4	2.0	5.5	V
Symbol	Parameter	Conditions	IO	Typ	Unit	
I _{OL}	Output Current	IOVDD = 3.0V Voutput = 0.3V	VPWR	2	mA	
			PA4	1(HD=0) 4(HD=1) 8(HD=2) 9(HD=3)	mA	
			PA0~PA3 PA5,PA6	1(HD=0) 4(HD=1) 8(HD=2) 32(HD=3)	mA	
I _{OH}	Output Current	IOVDD = 3.0V Voutput = 2.7V	VPWR	2	mA	
			PA4	1(HD=0) 4(HD=1) 8(HD=2) 9(HD=3)	mA	

			PA0~PA3 PA5,PA6	1(HD=0) 4(HD=1) 8(HD=2) 32(HD=3)	mA
Internal Resistance Characteristics					
Symbol	Parameter	Conditions	IO	Typ	Unit
R _{pu}	Pull-up Resistance	IOVDD = 3.0V	PA0~PA6 VPWR	10k(PU=1) 200k(PU=2) 1M(PU=3)	Ω
R _{pd}	Pull-down Resistance	IOVDD = 3.0V	PA0~PA6 VPWR	10k(PD=1) 200k(PD=2) 1M(PD=3)	Ω

Note

1. Internal pull-up/pull-down resistance accuracy $\pm 20\%$

3.6 Audio DAC Characteristics

Table 3-6-1 DAC Characteristics (Output Power 30mW)

Parameter	Conditions		Min	Typ	Max	Unit
Resolution	--		16	--	24	bits
Input Sample Rate	--		8	--	384	kHz
SNR ^①	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	116	--	dB
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	106	--	dB
THD+N	Differential Mode Fin=1kHz@-0.5dBFS* Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=32Ω	--	-85	--	dB
Noise Floor	Differential Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	3.5	--	uVrms
Noise Floor with MUTE	Differential Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	1.0	--	uVrms

Max Output Power	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted THD+N<0.1%	Load=16Ω	--	30	--	mW
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Table 3-6-2 DAC Characteristics (Output Power 50mW)

Parameter	Conditions		Min	Typ	Max	Unit
Resolution	--		16	--	24	bits
Input Sample Rate	--		8	--	384	kHz
SNR ^①	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	119	--	dB
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	108	--	dB
THD+N	Differential Mode Fin=1kHz@-0.5dBFS* Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=32Ω	--	-85	--	dB
Noise Floor	Differential Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	3.5	--	uVrms
Noise Floor with MUTE	Differential Mode Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	Load=16Ω	--	1.0	--	uVrms
Max Output Power	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted THD+N<0.1%	Load=16Ω	--	50	--	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	Differential input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	96	--	dB
	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	96	--	dB
Dynamic Range	Differential input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	96	--	dB
	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	96	--	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	--	-85	--	dB
Analogue Gain	--	0	0	27	dB
Max Input Level	Differential input Mode ADC gain=0dB	--	0.56	--	Vrms
	Single-ended input Mode ADC gain=0dB	--	0.28	--	Vrms

3.8 BT Characteristics

3.8.1 Transmitter

Table 3-8-1 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
Maximum RF Transmit Power	BLE-1Mbps	--	10	--	dBm
Maximum RF Transmit Power	BLE-2Mbps	--	10	--	dBm
1 σ of Maximum RF Transmit Power distribution	BR/EDR/BLE	--	2	--	dB

3.8.2 Receiver

Table 3-8-2 Receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	BR	--	-94.5	--	dBm
	EDR $\pi/4$ DQPSK	--	-95.5	--	dBm
	EDR 8DPSK	--	-88	--	dBm
	BLE-1Mbps	--	-98	--	dBm
	BLE-2Mbps	--	-95	--	dBm
1 σ of sensitivity distribution	BR/EDR/BLE	--	2	--	dB

4 Package Information

4.1 QFN20_3×3mm

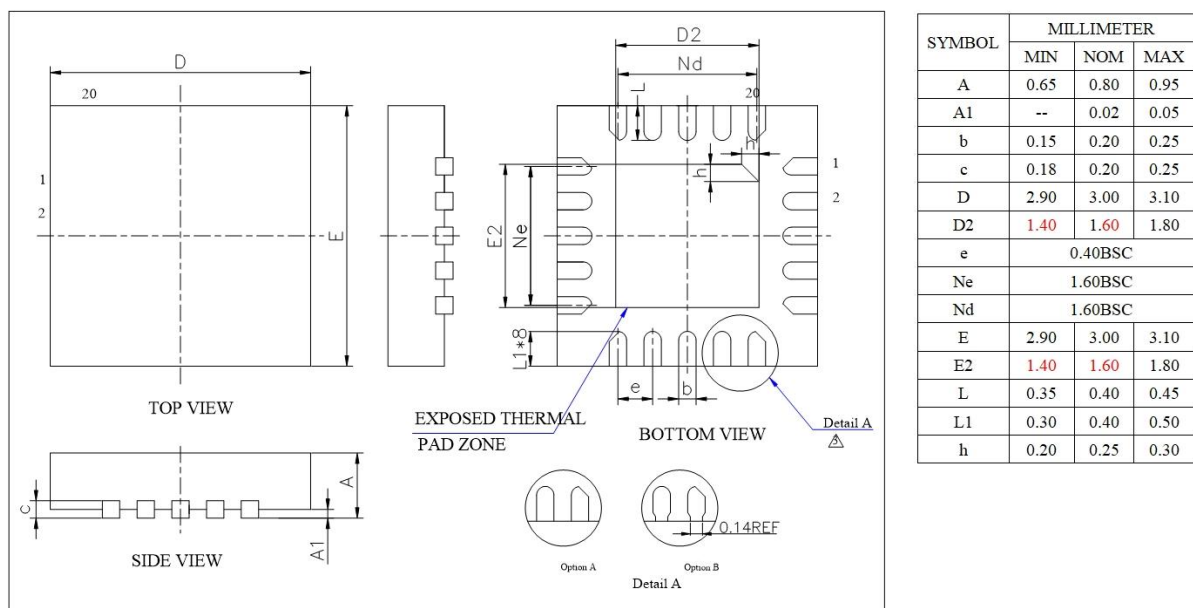


Figure 4-1 AC1113A Package

5 IC Marking Information

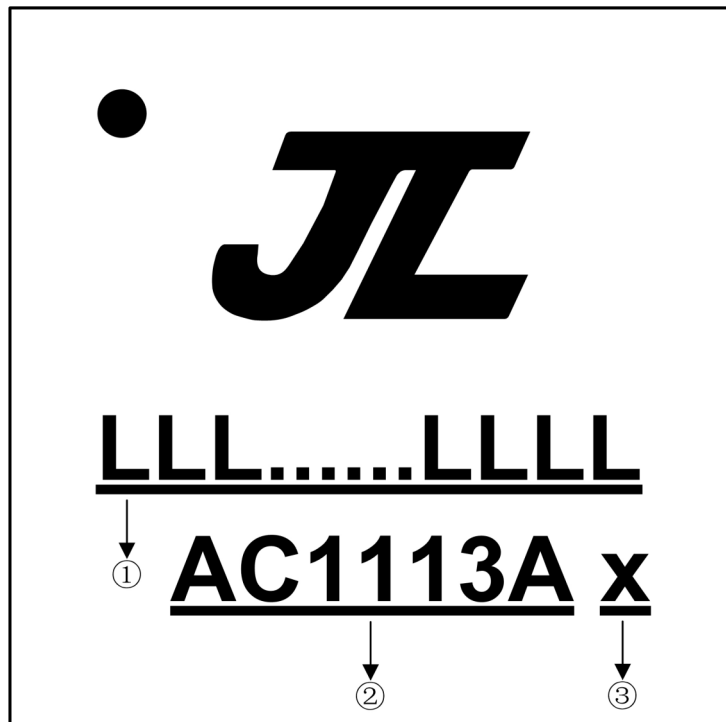


Figure 5-1 AC1113A Package Outline

- ① LLL.....LLLL Production Batch
- ② AC1113A Chip Model
- ③ x Built-in flash size
 - 0 No Flash
 - 2 2Mbit Flash
 - 4 4Mbit Flash

6 Solder-Reflow Condition

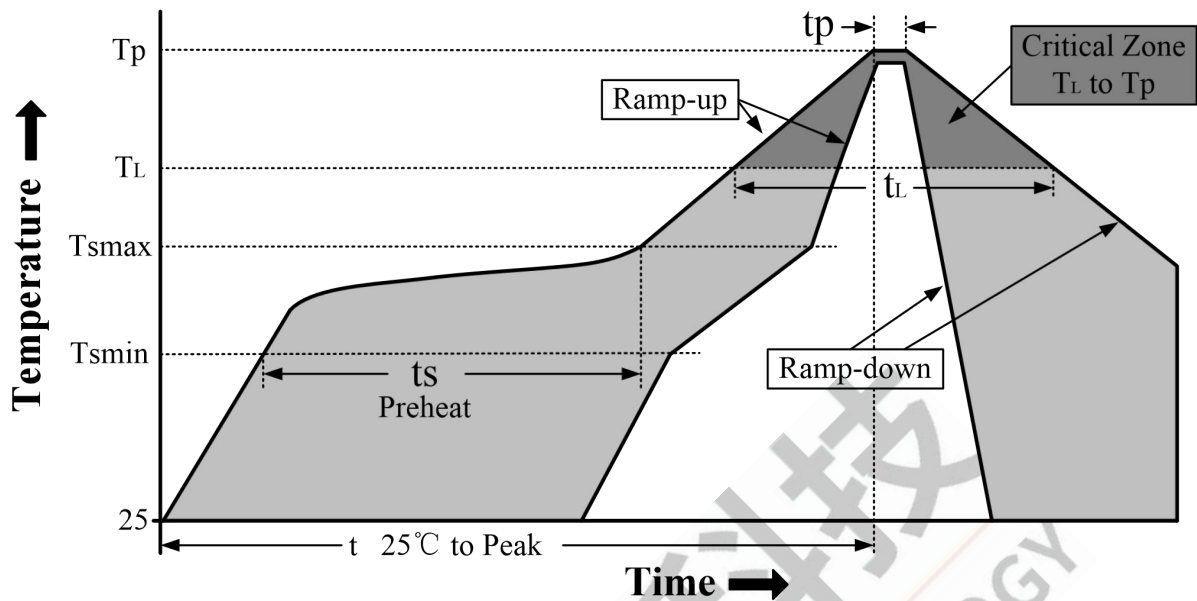


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

Profile Feature		Sn-Pb Eutectic Assembly	Pb-Free Assembly
Preheat/Soak	Temperature Min (T _{sm})	100°C	150°C
	Temperature Max (T _{smax})	150°C	200°C
	Time (ts) from (T _{sm} 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 (tp) 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 (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°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.