AC7066D2 Datasheet

Zhuhai Jieli Technology Co.,LTD

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AC7066D2 Features

CPU

- 32-bit DSP
- with IEEE754 Single precision FPU
- Icache
- 64Vectored interrupts
- 8 Levels interrupt priority
- Support EMU

Memory

- Support MMU
- Built-In Flash
- 8 region MPU protects

Clocks

- On-chip 16 MHz clock oscillator
- On-chip 200 kHz lower-temperature-drift clock oscillator
- 24 MHz crystal oscillator

DSP Audio Processing

- SBC, AAC Audio decodes supported for BT audio
- mSBC voice codec supported for BT phone
- Packet Loss Concealment (PLC) for voice processing
- Single MIC Environmental Noise Cancellation (ENC)
- Single-band DRC limiter
- Multi-band EQ configuration for voice Effects

Audio Codec

- Double channels 16-bit DAC,SNR maximum 102dB
- One channel 16-bit ADC,SNR maximum 98dB
- Audio DAC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/ 32kHz/44.1kHz/48kHz/64kHz/88.2kHz/ 96kHz are supported
- Audio ADC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/32 kHz/44.1kHz/48kHz are supported
- Support digital MIC input (I2S Port) / analog MIC input
- Support AMUX and ADC to DAC
- Audio DAC supports differential cap-less mode or single-ended mode
- Direct drive 16ohm/32ohm Speaker loading

Bluetooth

- Compliant with Bluetooth V5.4+BR+EDR+BLE specification （QDID：222830）
- Support AoA/AoD direction finding
- Support LE audio BIS/CIS full function
- Meet class1、class2 and class3 transmitting power requirement
- Maximum +10dbm transmitting power
- EDR receiver with minimum -93dBm sensitivity
- Support a2dp\avctp\avdtp\avrcp\hfp\spp\smp\ att\gap\gatt\rfcomm\sdp\l2cap profile
- BAP 1.0.1\PACS 1.0.1\CCP 1.0\MCP 1.0\MICP 1.0\VCP 1.0\CSIP 1.0.1\ASCS1.0\BASS 1.0\CAP 1.0\HAP 1.0\PBP 1.0\TMAP 1.0\LC3 1.0
- A2DP 1.4\AVCTP 1.4\AVDTP 1.3\ AVRCP 1.6.2\HFP 1.8 \SPP 1.2\RFCOMM 1.2\PNP 1.3\HID 1.1.1\SDP core5.4\L2CAP core 5.4

Peripherals

- One full speed USB OTG controller
- Four multi-function 16-bit timers, support capture and PWM mode
- Two UART interface
- I2C Master/Slave interface
- Two SPI Master/Slave interface
- I2S/TDM AUDIO Master/Slave interface
- One QDEC
- 14-channel 10-bit ADC for analog sampling
- 18 Individually programmable and

multiplexed GPIO pins
- Support IO function remapping
- Up to 18 external interrupt/wake-up source(low power available,can be multiplexed to any I/O)

PMU
- Built-in lithium battery charging manager,up to 300mA charging current
- Built-in LDO
- Minimum 3uA current consumption in the soft-off mode

- VPWR range : 4.5V to 5.5V
- VBAT range : 2.7V to 4.5V
- IOVDD range : 2.2V to 3.4V

Packages
- QFN32（4mm*4mm）

Temperature
- Operating temperature: -40℃ to +85℃
- Storage temperature: -65℃ to +150℃

Applications
- Wireless microphone

1. Block Diagram

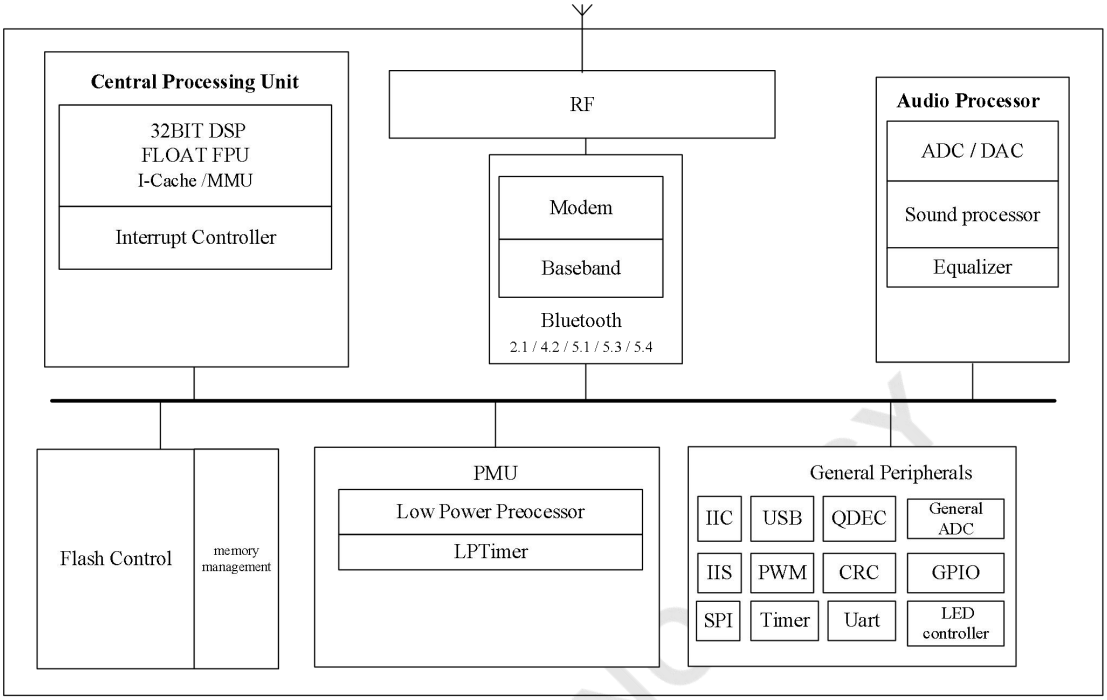


Figure 1-1 AC7066D Block Diagram

2. Pin Definition

2.1. Pin Assignment

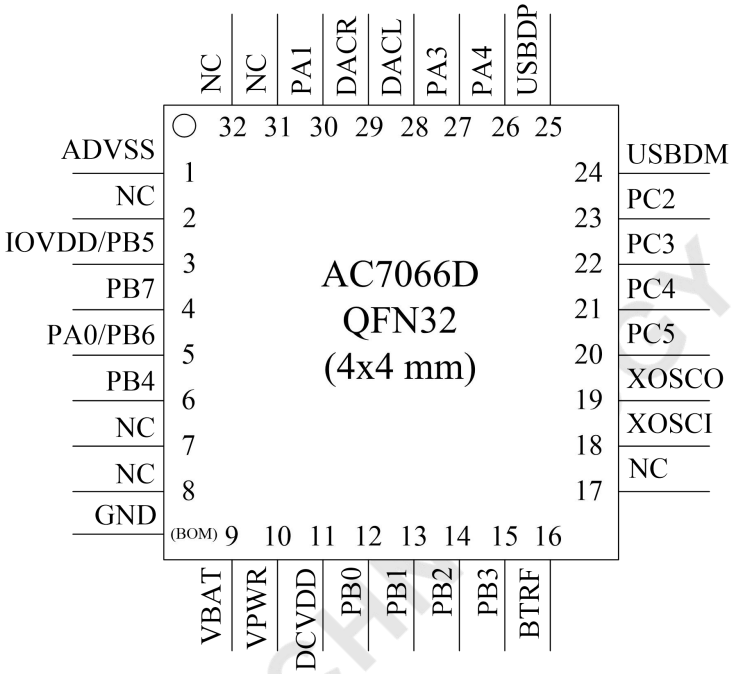


Figure 2-1 AC7066D2 Package Diagram

2.2. Pin Description

Table 2-2 AC7066D Pin Description

Pin No.	Pin name	Type	Function	Other function
1	ADVSS	G		Audio Ground
2	NC		(No Connection)	
3	IOVDD	PO		
	PB5	I/O	GPIO	ADC Input Channel 5 SD power gate SPI1 Data1 In(C)/SPI0 Data1 In(B)
4	PB7	I/O	GPIO	ADC Input Channel 9 SPI1 Data0 Out/SPI0 Data0 Out(B) IIC Data(C) Q-decoder_1
5	PA0	I/O	GPIO	ADC Input Channel 0; MIC0 Bias Output(Built-in resistor)/MICLDO Audio Link Data0(A)/Audio Link Data0(B) Clock Out0 WiFi bluetooth co-existence WLC_EXT_ACT
	PB6	I/O	GPIO	ADC Input Channel 8 AUX0 input SPI1 Clock(C)/SPI0 Clock(B) IIC Serial Clock(C) Timer3 Clock In
6	PB4	I/O	GPIO	ADC Input Channel 7 LVD input Q-decoder0_0 Clock Out1
7	NC		(No Connection)	
8	NC		(No Connection)	
9	VBAT	PI		Battery Input
10	VPWR	PI (I/O)	GPIO (High Voltage Resistant)	Charge Power Input Uart0 Data Out(C)/Uart0 Data In(C) Timer3 PWM Output Timer1 Capture
11	DCVDD	P		
12	PB0	I/O	GPIO (High Voltage Resistant)	Uart0 Data Out(B)

13	PB1	I/O	GPIO (pull up)	Hold down 0 to reset ADC Input channel 0 Uart0 Data In(B) Timer2 Clock In Uart0 Data In
14	PB2	I/O	GPIO	ADC Input Channel 6 32k Crystal Oscillator input Timer0 Capture
15	PB3	I/O	GPIO	AUX3 32k Crystal Oscillator Output Timer2 PWM Output
16	BTRF	RF		Bluetooth RF antenna
17	NC		(No Connection)	
18	XOSCI	I		System Crystal Oscillator Input
19	XOSCO	O		System Crystal Oscillator Output
20	PC5	I/O	GPIO	ADC Input Channel 12 SPI1 Data0 Out(B) IIC Serial Data(B) Timer1 Clock In External PA enable
21	PC4	I/O	GPIO	ADC Input Channel 11 SPI1 Clock(B) IIC Serial Clock(B) Timer1 PWM Output
22	PC3	I/O	GPIO	ADC Input Channel 10 SPI1 Data1 In(D) Uart0 Data Out(D)/Uart0 Data In(D) Timer2 Capture Clock Out2
23	PC2	I/O	GPIO	ADC Input Channel 15 SPI1 Data2(B/C/D) Audio Link Main Clock(B) Clock Out1 External LNA enable
24	USBDM	I/O	GPIO (pull down)	USB Negative Data ADC Input Channel 14 SPI1 Data0 Out(D) IIC Serial Data(A)
25	USBDP	I/O	GPIO (pull down)	USB Positive Data ADC Input Channel 13 SPI1 Clock(D) IIC Serial Clock(A)

26	PA4	I/O	GPIO	ADC Input Channel 3 AUX2 input SPI1 Data In(A) ALNK left and right channel frame clock(A) Audio Link Data3(B) SPI0 Data Out WiFi bluetooth co-existence WLC_EXT_ACTIVE
27	PA3	I/O	GPIO	ADC Input Channel 2 AUX1 input SPI1 Data0 Out(A) Audio Link Slave Clock(A)/Audio Link Data2(B) CLK_MUX WiFi bluetooth co-existence WLC_INT_ACTIVE
28	DACL	AO	Analog Output	Left channel audio output
29	DACR	AO	Analog Output	Right channel audio output
30	PA1	I/O	GPIO	ADC Input Channel 1 MIC input Audio Link Data1(A)
31	NC		(No Connection)	
32	NC		(No Connection)	
BOM	GND	G		Ground
Uart1、SD-card function can be remapped to any I/O				

Pin Type	**Description**	**Pin Type**	**Description**
P	Power	I/O	Input or Output
PO	Power Output	I	Input
PI	Power Input	O	Output
G	Ground	RF	RF antenna
AO	Analog Output		

3. Electrical Characteristics

3.1. Absolute Maximum Ratings

Table 3-1

Symbol	Parameter	Min	Max	Unit
Topt	Operating temperature	-40	+85	℃
Tstg	Storage temperature	-65	+150	℃
VBAT	Supply Voltage	-0.3	4.5	V
VPWR	Charger Voltage	-0.3	6	V
V_{IOVDD}	Voltage applied at IOVDD	-0.3	3.6	V
V_{GPIO}	Voltage applied to GPIO(Except PB0)	-0.3	3.6	V
V_{HVTIO}	Voltage applied to High Voltage Resistant IO (PB0)	-0.3	+5.5	V

Note : The chip can be damaged by any stress in excess of the absolute maximum ratings listed below

3.2. PMU Characteristics

Table 3-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.7	3.7	4.5	V	
VPWR	Charger supply Voltage	4.5	5.0	5.5	V	
Operating mode						
IOVDD	Voltage output		3.2		V	VBAT = 4.2V, 10mA loading
	Loading current			300	mA	IOVDD=3.2V@VBAT = 3.7V
DCVDD	Voltage output		1.4		V	IOVDD=3.2V, 10mA loading
	Loading current			150	mA	DCVDD=1.4V@IOVDD=3.2v on LDO mode
Low Power mode						
IOVDD	Loading current			20	mA	IOVDD=3.2V@VBAT = 3.7V

3.3. Battery Charge

Table 3-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VPWR	Charge Input Voltage	4.5	5	5.5	V	
$V_{bat\ float}$	Charge Voltage	4.15	4.2	4.25	V	VPWR＞4.5V
		4.30	4.35	4.40	V	VPWR＞4.65V
I_{bat}	Charge Current	15		350	mA	Charge current at fast charge mode VBAT=4.0V@VPWR=5.0V
I_{end}	End Of Charge Current	1.5		35	mA	End of charge current
V_{Trikl}	Trickle Charge Voltage		3.0		V	VPWR＞4.5V

3.4. IO Input/Output Electrical Logical Characteristics

Table 3-4

GPIO (Except PB0) input characteristics						
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
V_{IL}	Low-Level Input Voltage	-0.3		1.4	V	IOVDD = 3.2V
V_{IH}	High-Level Input Voltage	1.8		3.6	V	IOVDD = 3.2V
High Voltage Resistant IO (PB0) input characteristics						
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
V_{IL}	Low-Level Input Voltage	-0.3		1.4	V	IOVDD = 3.2V
V_{IH}	High-Level Input Voltage	1.8		5.5	V	IOVDD = 3.2V
GPIO & High Voltage Resistant IO (PB0) output characteristics						
Symbol	**Parameter**	GPIO	**Typ**		**Unit**	**Test Conditions**
V_{OL}	0.1* IOVDD Drive current	Except PB0	HD=0 : -1.8 HD=1 :- 6 HD=2 : -20 HD=3 : -24		mA	IOVDD = 3.2V
		PB0、VPWR	-8			
V_{OH}	0.9* IOVDD Drive current	Except PB0	HD=0 : 1.8 HD=1 : 6 HD=2 : 20 HD=3 : 45		mA	IOVDD = 3.2V
		PB0、VPWR	8			

3.5. Internal Resistor Characteristics

Table 3-5

Port	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA0,PA1,PA3,PA4 PB0,PB2~PB4,PB6,PB7 PC2~PC5	10K	10K	1、PB1 default pull up 200KΩ 2、USBDM & USBDP default pull Down 15KΩ 3、internal pull-up / pull-down resistance | accuracy ±20%
PB1,PB5 PP0(VPWR)	200K	10K	
USBDP	1.5K	15K	
USBDM	180K	15K	

3.6. Audio DAC Characteristics

Table 3-6

Parameter	MODE		Min	Typ	Max	Unit	Test Conditions
Frequency Response			20		20k	Hz	Fin=1kHz/0dB Fs=44.1kHz B/W=20Hz~20kHz A-Weighted Filter 10k ohm loading
Output Swing	Single-ended			0.8		Vrms	
	Differential			1.7		Vrms	
THD+N	Single-ended			-80		dB	
	Differential			-85		dB	
S/N	Single-ended			94		dB	
	Differential			102		dB	
Noise Floor	Single-ended			16		uVrms	A-Weighted Filter
	Differential			13		uVrms	
Crosstalk	Single-ended			-110		dB	Fin=1kHz/0dB
Output Power	32ohm	Single-ended		20		mW	Fin=1kHz Fs=44.1kHz THD+N < 0.1%
		Differential		52		mW	
	16ohm	Single-ended		30		mW	
		Differential		75		mW	

3.7. Audio ADC Characteristics

Table 3-7

Parameter		Min	Typ	Max	Unit	Test Conditions
Maximum Input Level	Differential		1.8		Vrms	Gain Level = 0 Fin = 1kHz Fs = 44.1kHz THD+N < 0.1%
	Single-ended		0.9		Vrms	
SNR	Differential		98		dB	Gain Level = 0 Fs = 44.1kHz Fin = 1kHz,Maximum Input B/W = 20Hz~20kHz A-Weighted Filter
	Single-ended		94		dB	
THD+N	Differential		-80		dB	
	Single-ended		-80		dB	
SNR (AD to DA)	Differential to Single-ended		92		dB	
	Differential to Differential		96		dB	
	Single-ended to Single-ended		90		dB	
	Single-ended to Differential		92		dB	
THD+N (AD to DA)	Differential to Single-ended		-80		dB	
	Differential to Differential		-80		dB	
	Single-ended to Single-ended		-80		dB	
	Single-ended to Differential		-80		dB	

3.8. BT Characteristics

3.8.1. Transmitter

Basic Data Rate **Table 3-8-1-1**

Parameter		Min	Typ	Max	Unit	Test Conditions
RF Transmit Power，DH5			7.5	10	dBm	25℃ Power Supply VBAT=3.7V 2441MHz 4 Layer Board
RF Power Control Range，DH1			20		dB	
20dB Bandwidth，DH5			950		KHz	
Adjacent Channel Transmit Power，DH1	+2MHz		-40		dBm	
	-2MHz		-40		dBm	
	+3MHz		-45		dBm	
	-3MHz		-45		dBm	

Enhanced Data Rate **Table 3-8-1-2**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-3		dB	25℃ Power Supply VBAT=3.7V 2441MHz 2DH5 4 Layer Board
π/4 DQPSK Modulation Accuracy	DEVM RMS		10		%	
	DEVM 99%		15		%	
	DEVM Peak		20		%	
In-band spurious Emissions	+2MHz		-35		dBm	
	-2MHz		-35		dBm	
	+3MHz		-40		dBm	
	-3MHz		-40		dBm	

3.8.2. Receiver

Basic Data Rate **Table 3-8-2-1**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25℃ Power Supply VBAT=3.7V 2441MHz DH1 4 Layer Board
Co-channel Interference Rejection			10		dB	
Adjacent Channel Interference Rejection	+1MHz		-30		dB	
	-1MHz		-30		dB	
	+2MHz		-40		dB	
	-2MHz		-40		dB	
	+3MHz		-40		dB	
	-3MHz		-		dB	

Enhanced Data Rate **Table 3-8-2-2**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25℃ Power Supply VBAT=3.7V 2441MHz 2DH5 4 Layer Board
Co-channel Interference Rejection			10		dB	
Adjacent Channel Interference Rejection	+1MHz		-30		dB	
	-1MHz		-30		dB	
	+2MHz		-40		dB	
	-2MHz		-40		dB	
	+3MHz		-40		dB	
	-3MHz		-		dB	

3.8.3. BLE

1M Data Rate **Table 3-8-3-1**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-95		dBm	25℃ Power Supply VBAT=3.7V 2440MHz 4 Layer Board
RF Transmit Power			7.5		dB	
In-band spurious Emissions	+2MHz		-40		dBm	
	-2MHz		-40		dBm	
	+3MHz		-40		dBm	
	-3MHz		-40		dBm	
Modulation Characteristics	Δf1 avg		250		KHz	
	Δf2 99%		210		KHz	
	Δf1avg/Δf2av		0.9			
Carrier Frequency Offset		-15		+15	KHz	
Frequency Drift		-25		+25	KHz	
Frequency Drift Rate		-5		+5	KHz/50us	

2M Data Rate **Table 3-8-3-2**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25℃ Power Supply VBAT=3.7V 2440MHz 4 Layer Board
RF Transmit Power			7.5		dB	
In-band spurious Emissions	+4MHz		-40		dBm	
	-4MHz		-40		dBm	
	+5MHz		-40		dBm	
	-5MHz		-40		dBm	
	+6MHz		-50		dBm	
	-6MHz		-35		dBm	
Modulation Characteristics	Δf1 avg		500		KHz	
	Δf2 99%		430		KHz	
	Δf1avg/Δf2av		0.9			
Carrier Frequency Offset		-15		+15	KHz	
Frequency Drift		-25		+25	KHz	
Frequency Drift Rate		-5		+5	KHz/50us	

3.9. ESD Protection

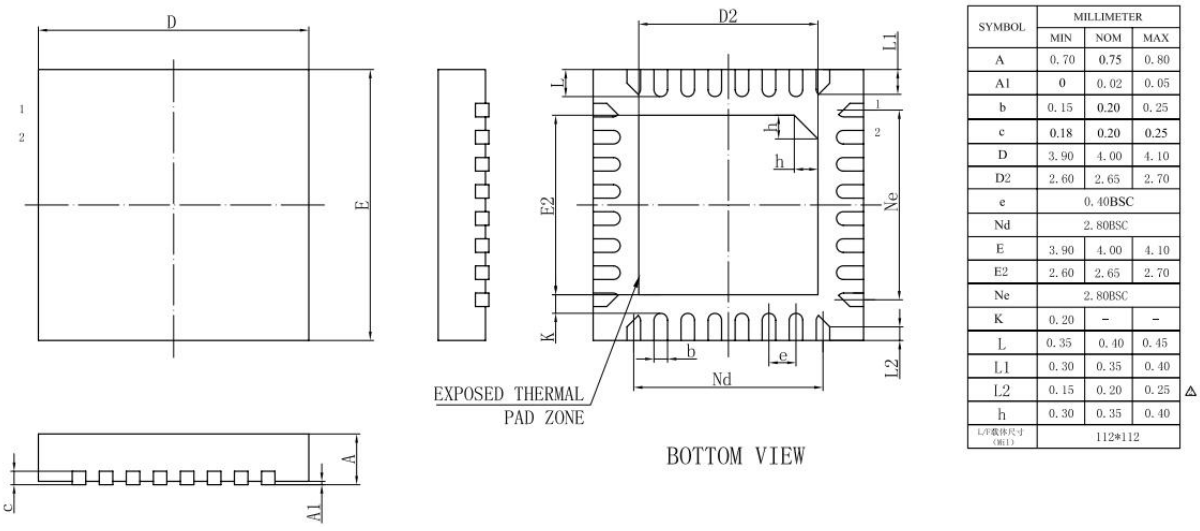
Table 3-10

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	±1KV	All pins	JEDEC EIA/JESD22-C101F
Latch up	±200mA	All GPIO pins	JEDEC STANDARD NO.78E
	1.5xVopmax	All power pins	

Note : 1.5xVopmax = 1.5 times maximum operating voltage.

4. Package Information

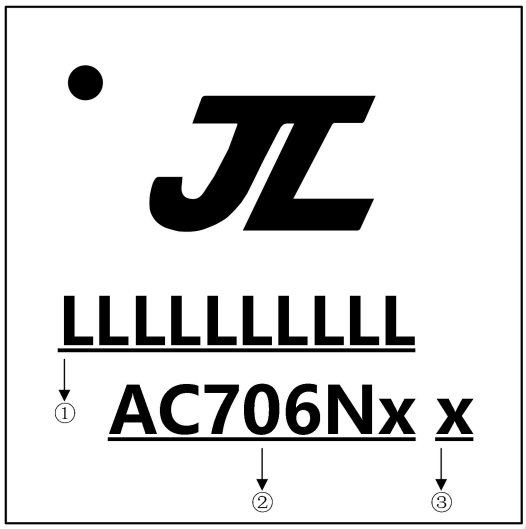
4.1 QFN32_4mm x 4mm



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	2.60	2.65	2.70
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.60	2.65	2.70
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 (单位)	112*112		

Figure 4-1 AC7066D Package

5. IC Marking Information



① LLLLLLLLLL：Production Batch

② AC706Nx：Chip Model

③ x：Built-in flash size

0: No Flash Memory

2: 2Mbit Flash

4: 4Mbit Flash

8: 8Mbit Flash

6: 16Mbit Flash

3: 32Mbit Flash

6. Solder-Reflow Condition

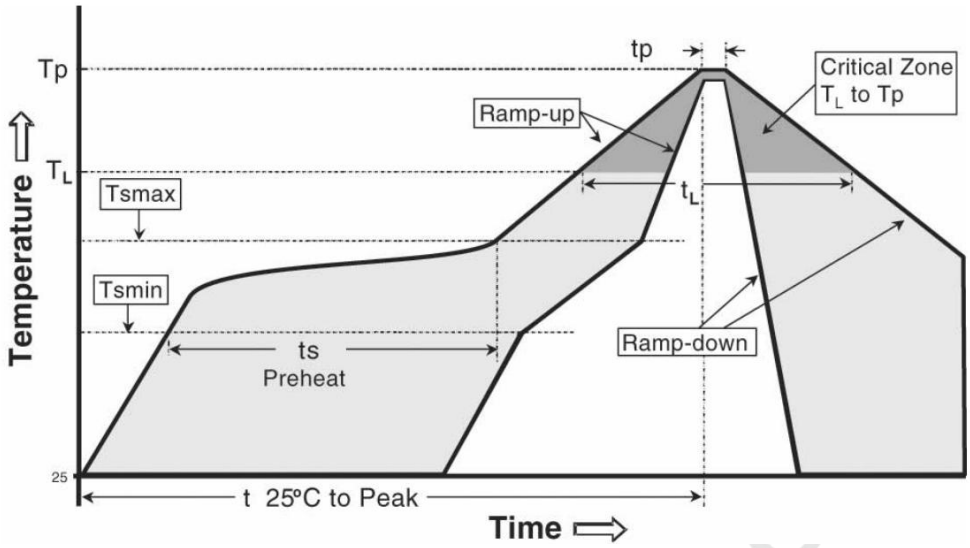


Figure 6-1 Classification Reflow Profile

Classification Profiles **Table 6-1**

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
Liquidous 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 5-2	See Table 5-3
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.

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

SnPb - Classification Temperature **Table 6-2**

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℃

Pb-free - Classification Temperature **Table 6-3**

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℃

*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.

7. Revision History

Date	Revision	Description
2023.06.12	V1.0	Initial Release
2023.07.31	V1.1	Update resource description
2023.10.13	V1.2	Add IC Marking Information Update BT_Features
2023.10.24	V1.3	Update Block Diagram
2023.11.03	V1.4	Update BT_Features Update IC Marking Information