JL7006D Datasheet

Zhuhai Jieli Technology Co.,LTD

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JL7006D Features

CPU

- 32bit Dual-Issue DSP
- Up to 160MHz programmable processor
- With IEEE754 Single precision FPU
- With cordic accelerate engine
- Advanced debug with 8 hardware breakpoints/watchpoints
- Advanced system execption capture unit

Interrupt

- Support for up to 64 interrupts with 8 priority level
- NMI supported
- SWI supported, with configurable priority
- Low power wake up by polling pending 12 IO interrupts for low power wake up

DSP Audio Processing

- SBC, AAC, LDAC, LHDC Audio decodes supported for BT audio
- mSBC voice codec supported for BT phone
- Supports MP2, MP3, WMA, APE, FLAC, AAC, MP4, M4A, WAV, AIF, AIFC audio decoding
- Packet Loss Concealment (PLC) for voice processing
- Single/Dual MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 20-band EQ configuration for voice Effects
- Support Hi-Res Audio

Audio Codec

- Two channels 24-bit DAC, SNR >= 103dB
- Two channels 24-bit ADC , SNR >= 92dB
- DAC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/ 32kHz/44.1kHz/48kHz/64kHz/88.2kHz/ 96kHz are supported
- ADC Sampling rates of 8kHz/11.025kHz/16kHz/22.05kHz/24kHz/ 32kHz/44.1kHz/48kHz are supported
- Two analog MIC amplifier, build-in MIC bias generator
- Supports Four PDM digital MIC inputs
- Two channels analog AUX
- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

ANC

- ANC processing engine up to 750 kHz sample rate
- 7.5μs analog to analog latency
- Supports 4 digital microphone inputs, 2 differential or single-ended analog inputs for ANC
- Supports Feed-Forward, Feed-Back, Hybrid ANC
- ANC module include 20 double precision Biquad filters for each FF/FB/ music compensation control

Bluetooth

- Compliant with Bluetooth V5.4+BR+EDR+BLE specification （QDID：223418）
- Meet class2 and class3 transmitting power requirement
- Support GFSK and DQPSK all packet types
- Provides maximum +10dbm transmitting power
- EDR receiver with minimum -94dBm sensitivity
- Fast AGC for enhanced dynamic range
- Support a2dp\avctp\avdtp\avrcp\hfp\spp\smp\ att\gap\gatt\rfcomm\sdp\l2cap profile
- 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 2.0 OTG controller
- Six multi-function 32-bit timers, support capture and PWM mode
- Three full-duplex basic UART, UART0、UART1 support DMA mode
- One hardware IIC interface supports host and device mode
- Three Built-in low power Cap Sense Keys
- LED controller，support 2 LED control by one IO
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs
- Crossbar IO support: timer\SPI\SDC\IIC \UART\RDEC\ALINK\PLINK

PMU

- Low voltage LDO and DC-DC for internal digital and analog circuit supply
- Soft-off mode current:
  Build-in LP_Touch off：≤2uA
  Build-in LP_Touch on：≤13uA
- Built-in LDO and DC-DC for the core, I/O, Bluetooth and flash
- VBAT is 2.2V to 4.4V
- VDDIO is 2.2V to 3.6V

Packages

- QFN32(4mm*4mm)

Temperature

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

Applications

- Bluetooth TWS Earphones
- Bluetooth ANC TWS Earphones

1 Pin Definition

1.1 Pin Assignment

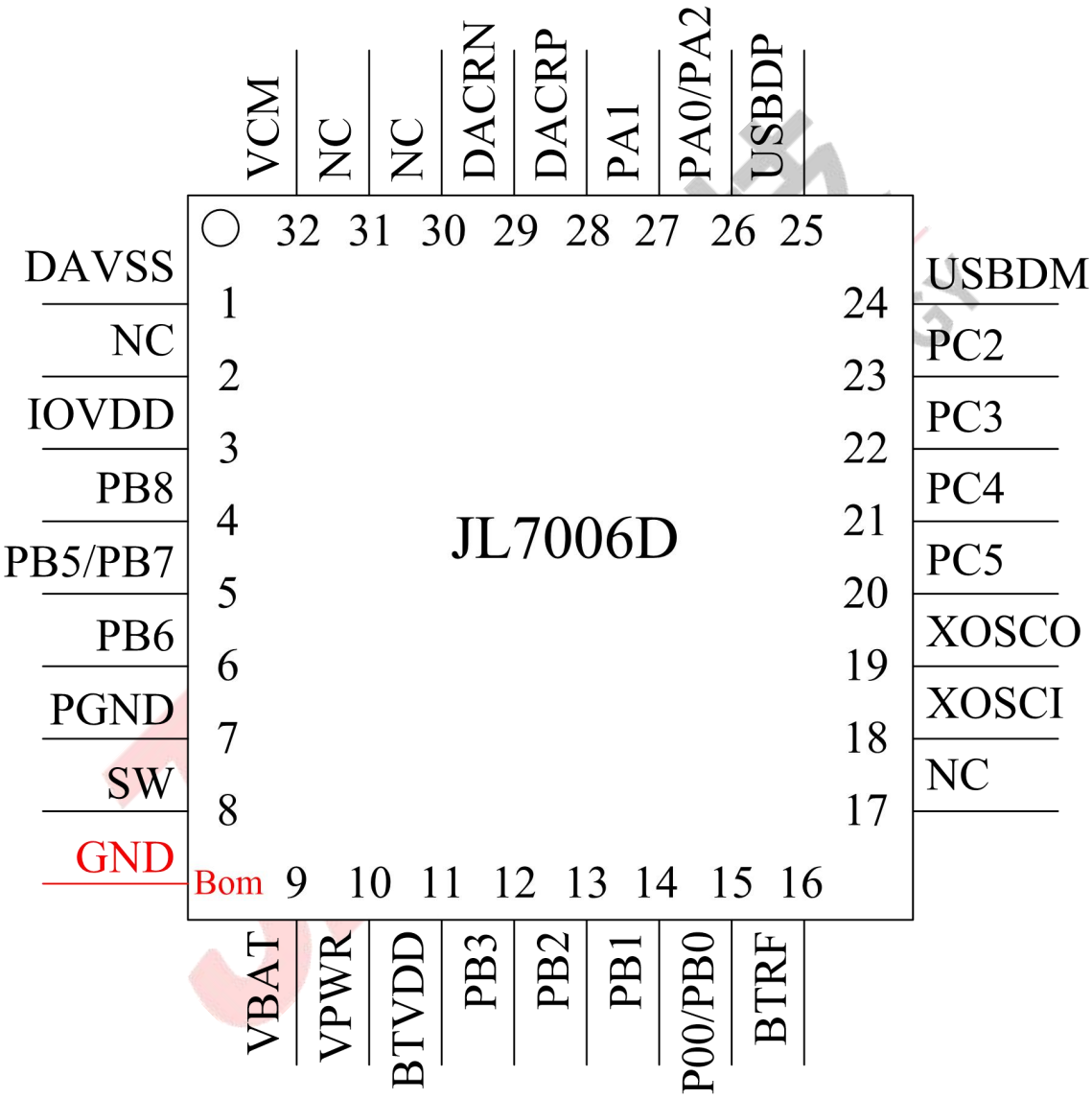


Figure 1-1 JL7006D Package Diagram

1.2 Pin Description

Table 1-1 JL7006D Pin Description

PIN NO.	Name	I/O Type	Drive (mA) 4 level	Function	Other Function
1	DAVSS	P	/		Analog Ground
2	NC				
3	IOVDD	PO	/		IO Power 3.3v
4	PB8	I/O	2.4~64	GPIO	AIN_B0; MIC1：MIC1 Input Channel; MIC1_P：Different MIC1 Positive; AMUX_B0：Analog Channel B0 L/R Input; UART0RXB：Uart0 Data Input(B); CAP4：Timer4 Capture.
5	PB5	I/O	2.4~64	GPIO	LP_TH4：Low Power Touch Channel 4; UART1TXA：Uart1 Data Output(A).
	PB7	I/O	2.4~64	GPIO	MIC_BIAS1：MIC1 Bias Output; MIC1_N：Different MIC1 Negative; AMUX_B1：Analog Channel B1 L/R Input; UART0TXB：Uart0 Data Output(B).
6	PB6	I/O	2.4~64	GPIO	ADC9：ADC Input Channel 9; UART1RXA：Uart1 Data Input(A); PWM2：Timer2 PWM Output.
7	PGND	P	/		DCDC Ground
8	SW	P	/		DCDC switch output, connected to inductor
9	VBAT	PI	/		Power Supply, connect to battery
10	VPWR	PI	/		Charge Power Input;
		I/O	8	GPIO	High Voltage Resistance I/O; UART0TXC：Uart0 Data Output(C); UART0RXC：Uart0 Data Input(C); PWM3：Timer3 PWM Output; CAP1：Timer1 Capture.
11	BTVDD	PO	/	GPIO	BT Power
12	PB3	I/O	2.4~64	GPIO	
	EVDD	PO	/		EVDD：Supply voltage to Peripherals
13	PB2	I/O	2.4~64	GPIO	LP_TH2：Low Power Touch Channel 2; ADC7：ADC Input Channel 7; CAP5：Timer5 Capture; UART2RXC：Uart2 Data Input(C);

					SPI2DOC：SPI2 Data Out(C).
14	PB1	I/O	2.4~64	GPIO (pull up)	Long Press Reset; LP_TH1：Low Power Touch Channel 1; UART2TXC：Uart2 Data Output(C); ADC6：ADC Input Channel 6; SPI2CLKC：SPI2 Clk(C).
15	P00	I/O	8		Test pin
	PB0	I/O	2.4~64		LP_TH0：Low Power Touch Channel 0; SPI2DIC：SPI2 Data Input(C); ALNK_MCLK(B)：ALNK Master Clock(B); TMR4：Timer4 Clock Input.
16	BTRF	/	/		BT Antenna
17	NC				
18	XOSCI	I	/		XOSC In
19	XOSCO	O	/		XOSC Out
20	PC5	I/O	2.4~64	GPIO	SD0CLKA: SD0 Clock(A); UART2RXD：Uart2 Data Input(D); SPI1DOB：SPI1 Data Out(B); ALNK_DAT3(B)：Audio Link Data3(B); IIC_SDA_B：IIC SDA(B); ADC5：ADC Input Channel 5.
21	PC4	I/O	2.4~64	GPIO	SD0CMDA: SD0 CMD(A); UART2TXD：Uart2 Data Output(D); SPI1CLKB：SPI1 Clock(B); ALNK_DAT2(B)：Audio Link Data2(B); IIC_SCL_B：IIC SCL(B); ADC4：ADC Input Channel 4; PWM4：Timer4 PWM Output.
22	PC3	I/O	2.4~64	GPIO	SD0DATA: SD0 Data(A); UART0RXD：Uart0 Data Input(D); SPI1DIB：SPI1 Data In(B); ALNK_LRCK(B)：Audio Link Word Select(B); IIC_SDA_C：IIC SDA(C); TMR3：Timer3 Clock Input.
23	PC2	I/O	2.4~64	GPIO	ALNK_SCLK(B)：Audio Link Serial Clock(B); IIC_SCL_C：IIC SCL(C); UART0TXD：Uart0 Data Output(D); TMR1：Timer1 Clock Input.
24	USBDM	I/O	4	USB Negative Data	UART1RXD：Uart1 Data Input(D); IIC_SDA_A：IIC SDA(A); ADC11：ADC Input Channel 11;

					SPI2DOB: SPI2 Data Out(B); ISP_DI.
25	USBDP	I/O	4	USB Positive Data	UART1TXD：Uart1 Data Output(D); IIC_SCL_A：IIC SCL(A); ADC10：ADC Input Channel 10； SPI2CLKB: SPI2 Clock(B); ISP_CLK.
26	PA0	I/O	2.4~64	GPIO	MIC_LDO：MIC Power Supply
	PA2	I/O	2.4~64	GPIO	ALNK_MCLK(A)：ALNK Master Clock(A); MIC_BIAS0：MIC0 Bias Output; MIC0_N：Different MIC0 Negative; AMUX_A1：Analog Channel A1 L/R Input; CAP3：Timer3 Capture; UART1RXC：Uart1 Data In(C); CLKOUT1.
27	PA1	I/O	2.4~64	GPIO	AIN_A0; MIC0：MIC0 Input Channel; MIC0_P：Different MIC0 Positive; AMUX_A0：Analog Channel A0 L/R Input; PWM0：Timer0 PWM Output; UART1TXC：Uart1 Data Output(C).
28	DACRP	O	/		Different DAC Right Positive Channel
29	DACRN	O	/		Different DAC Right Negative Channel
30	NC				
31	NC				
32	VCM	P	/		DAC reference voltage
/	Bom	P	/		Ground

P: Power or Ground PO:Power Output PI:Power Input I/O:Input or Output I:Input O:Output

2 Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

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
$V_{3.0IO}$	3.0V IO Input Voltage (IOVDD)	-0.3	3.6	V

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

2.2 PMU Characteristics

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	4.4	V	
VPWR	Charger supply Voltage	4.5	5.0	5.5	V	
Normal mode						
IOVDD	Voltage output	_	3.0	_	V	VBAT = 4.2V, 10mA loading
	Loading current	_	_	100	mA	IOVDD=3.0V@VBAT = 4.2V
BTVDD	Voltage output	_	1.25	_	V	IOVDD=3.0V, 10mA loading
	Loading current	_	_	60	mA	BTVDD=1.25V@IOVDD=3.0v
EVDD	Voltage output	_	1.1	_	V	BTVDD=1.25V, 1mA loading
	Loading current	_	_	5	mA	EVDD=1.1V@BTVDD=1.25v
LP mode						
IOVDD	Loading current			5	mA	IOVDD=3V@VBAT = 4.2V

2.3 Battery Charge

Table 2-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VPWR	Charge Input Voltage	4.5	5	5.5	V	_
V_{Charge}	Charge Voltage	4.15	4.2	4.25	V	VPWR＞4.5V

		4.30	4.35	4.40	V	VPWR＞4.65V
I_{Charge}	Charge Current	20		200	mA	Charge current at fast charge mode
I_{Trikl}	Trickle Charge Current	20	45	70	mA	$V_{BAT}<V_{Trikl}$

2.4 IO Input/Output Electrical Logical Characteristics

Table 2-4

IO input characteristics						
Symbol	**Parameter**	**Min**	**Typ**	**Max**	**Unit**	**Test Conditions**
V_{IL}	Low-Level Input Voltage	-0.3	_	0.3* IOVDD	V	IOVDD = 3.0V
V_{IH}	High-Level Input Voltage	0.7* IOVDD	_	IOVDD+0.3	V	IOVDD= 3.0V
IO output characteristics						
V_{OL}	Low-Level Output Voltage	_	_	0.33	V	IOVDD= 3.0V
V_{OH}	High-Level Output Voltage	2.7	_	_	V	IOVDD = 3.0V

2.5 Internal Resistor Characteristics

Table 2-5

Port	**Drive(mA)**				**Internal Pull-Up Resistor**	**Internal Pull-Down Resistor**	**Comment**
PA0~PA3 PB0~PB8 PC2~PC5	2.4	8	26.4	64	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull Down 3、PC0, PP0(VPWR), P00 are high voltage resistance to 5V 4、internal pull-up/pull-down resistance | accuracy ±20%
PP0(VPWR), P00	8				10K	10K	
USBDP	4				1.5K	15K	
USBDM	4				180K	15K	

2.6 DAC Characteristics

Table 2-6

Parameter	**Min**	**Typ**	**Max**	**Unit**	**Audio Format**	**Test Conditions**
Frequency Response	20	_	20K	Hz	_	Differential Mode

Output Swing		0.55	0.74	Vrms	_	1KHz/0dB 32 ohm loading With A-Weighted Filter
THD+N	_	-76	_	dB	PCM	
	_	-68.7	_	dB	SBC	
S/N	_	100.4	102	dB	PCM	
	_	98.7	_	dB	SBC	
Dynamic Range	_	100	_	dB	PCM	Differential Mode 1KHz/-60dB 32 ohm loading With A-Weighted Filter
	_	99.1	_	dB	SBC	
Noise Floor		6.0		uV	_	A-Weighted Filter
DAC Output Power	_	20	30.0	mW	_	Differential Mode 16ohm loading

2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		95		dB	Fsample=44.1kHz Fin=1KHz 2mVpp Input
S/N	_	95	_	dB	Fsample=44.1kHz Fin=1KHz 2Vpp Input
THD+N	_	-72	_	dB	
Crosstalk	_	-80	_	dB	

2.8 BT Characteristics

2.8.1 Transmitter

Basic Rate **Table 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
RF Transmit Power			7	9	dBm	25℃, Power Supply VBAT=3.7V 2441MHz
RF Power Control Range			18		dB	
20dB Bandwidth			950		KHz	
In-band spurious Emissions （BQB Test Mode RF_Tx Power=5dBm）	$F=F_0\pm1MHz$		-19		dBm	
	$F=F_0\pm2MHz$		-48		dBm	
	$F=F_0\pm3MHz$		-50		dBm	
	$F=F_0$+/->3MHz		-55		dBm	

Enhanced Data Rate **Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-2		dB	25℃, Power Supply VBAT=3.7V 2441MHz
π/4 DQPSK Modulation Accuracy	DEVM RMS		5		%	
	DEVM 99%		13		%	
	DEVM Peak		10		%	
In-band spurious Emissions （BQB Test Mode RF_Tx Power=5dBm）	$F=F_0\pm1MHz$		-1.5		dBm	
	$F=F_0\pm2MHz$		-28		dBm	
	$F=F_0\pm3MHz$		-42		dBm	
	$F=F_0$+/->3MHz		-45		dBm	

2.8.2 Receiver

Basic Rate **Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-92		dBm	25℃, Power Supply VBAT=3.7V 2441MHz DH5
Co-channel Interference Rejection			-10		dB	
Adjacent Channel Interference Rejection	+1MHz		+4		dB	
	-1MHz		+2		dB	
	+2MHz		+38		dB	
	-2MHz		+38		dB	
	+3MHz		>+40		dB	
	-3MHz		+34		dB	

Enhanced Data Rate **Table 2-11**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-93		dBm	25℃, Power Supply VBAT=3.7V 2441MHz 2DH5 2 Layer Board
Co-channel Interference Rejection			-11		dB	
Adjacent Channel Interference Rejection	+1MHz		+4		dB	
	-1MHz		+2		dB	
	+2MHz		+38		dB	
	-2MHz		+38		dB	
	+3MHz		>+40		dB	
	-3MHz		+34		dB	

2.9 ESD Protection

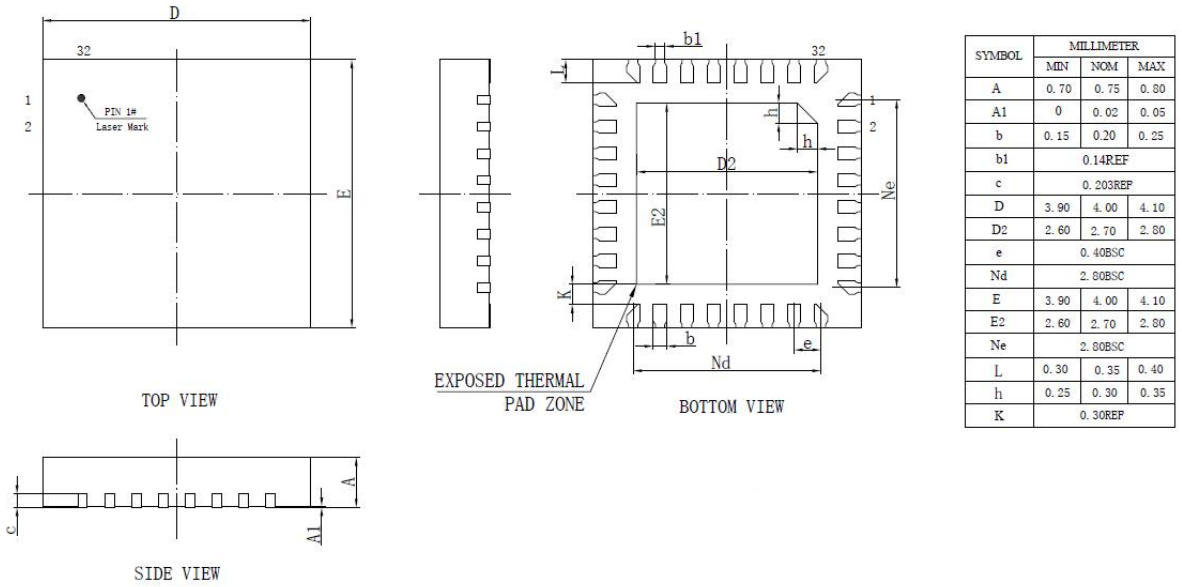
Table 2-12

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.

3 Package Information

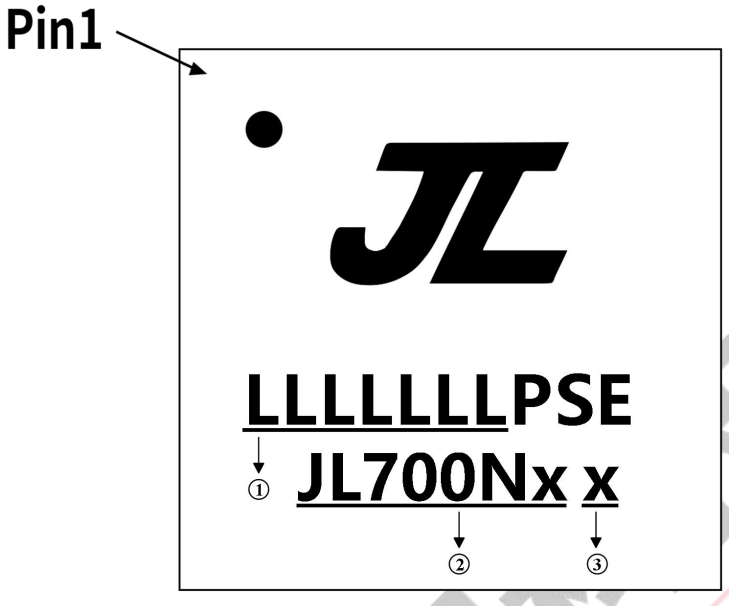
3.1 QFN32_4.0x4.0



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
b1	0.14REF		
c	0.203REF		
D	3.90	4.00	4.10
D2	2.60	2.70	2.80
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.60	2.70	2.80
Ne	2.80BSC		
L	0.30	0.35	0.40
h	0.25	0.30	0.35
K	0.30REF		

Figure 3-1 JL7006D Package

4 IC Marking Information



① LLLLLLL：Production Batch

② JL700Nx：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

5 Solder-Reflow Condition

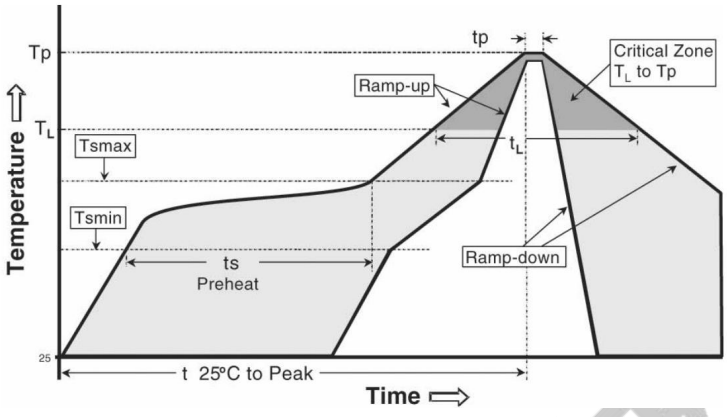


Figure 5-1 Classification Reflow Profile

Classification Profiles **Table 5-1**

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 5-2**

Package Thickness	Volume mm³ < 350	Volume mm³ ⩾ 350
<2.5 mm	240 +0/-5℃	225 +0/-5℃
⩾2.5 mm	225 +0/-5℃	225 +0/-5℃

Pb-free - Classification Temperature **Table 5-3**

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℃

6 Revision History

Date	Revision	Description
2022.05.14	V1.0	Initial Release
2022.07.13	V1.1	Update Soft-off mode current consumption
2022.07.19	V1.2	Update Package Information & Add ANC Mode description
2023.11.22	V1.3	Update JL7006D BT_Features
2024.08.26	V1.4	Update JL7006D Audio_Features Update DAC Characteristics