JL7003A Datasheet

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Version：1.1

Date：2022.07.13

JL7003A 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 8 IO interrupts for low power wake up

DSP Audio Processing

- SBC, AAC 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

Audio Codec

- Two channels 24-bit DAC, SNR >= 102dB
- Two channels 24-bit ADC , SNR >= 95dB
- 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
- One analog MIC amplifier, build-in MIC bias generator
- Supports cap-less, single-ended, and One 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,1 differential analog inputs for ANC
- Supports Feed-Forward/Feed-Back ANC
- ANC module include 20 double precision Biquad filters for each FF/FB/ music compensation control

Bluetooth

- Compliant with Bluetooth V5.3+BR+EDR+BLE specification
- 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
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gap\ gatt\rfcomm\sdp\l2cap profile
- a2dp 1.3.2\avctp 1.4\avdtp 1.3\ avrcp 1.6.2\ hfp 1.8 \spp 1.2\rfcomm 1.1\pnp 1.3\ hid 1.1.1\sdp core5.3\l2cap core 5.3

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
- Two Built-in low power Cap Sense Keys
- LED controller，support 2LED 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
- IOVDD is 2.2V to 3.6V

Packages

- QFN20(3mm*3mm)

Temperature

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

Applications

- Bluetooth TWS Earphones
- Bluetooth TWS ANC Earphones

1 Pin Definition

1.1 Pin Assignment

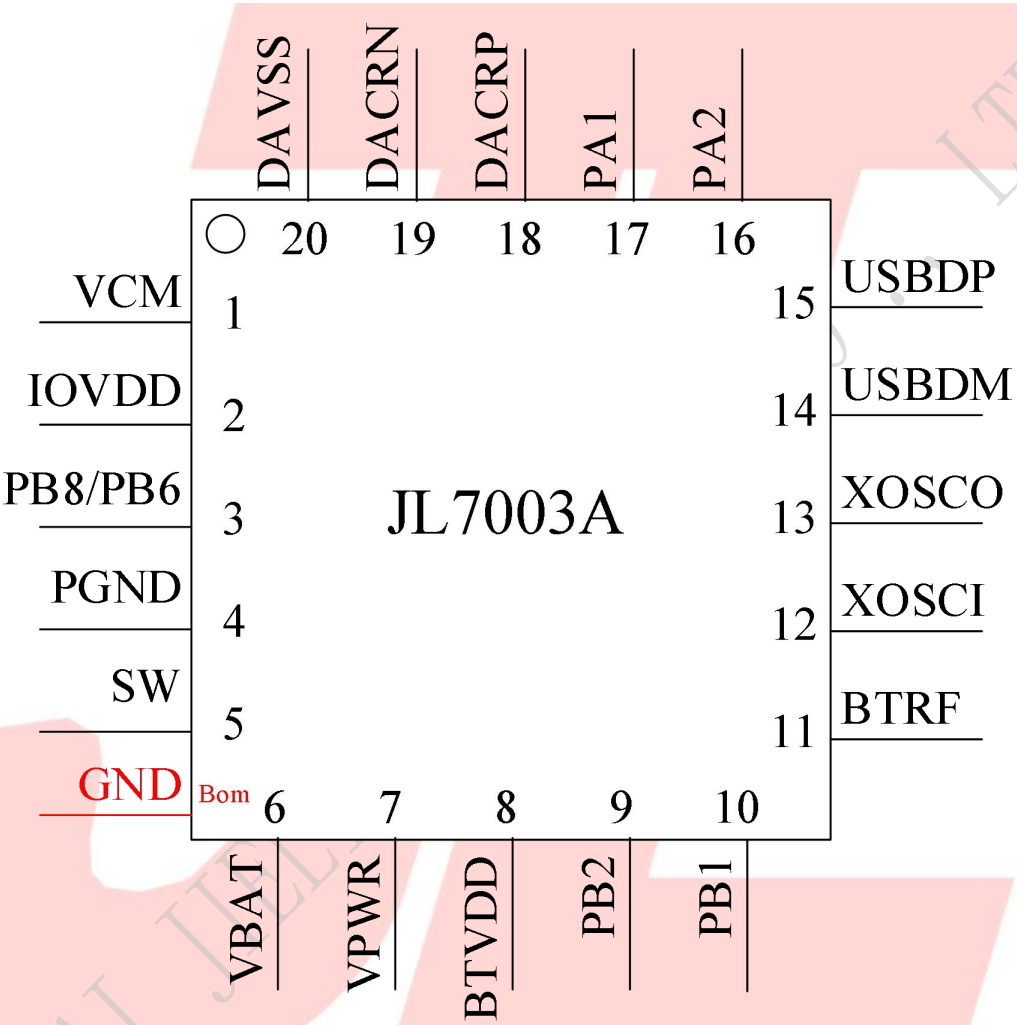


Figure 1-1 JL7003A Package Diagram

1.2 Pin Description

Table 1-1 JL7003A Pin Description

PIN NO.	Name	I/O Type	Drive (mA) 4 level	Function	Other Function
1	VCM	P	/		DAC reference voltage
2	IOVDD	PO	/		IO Power 3.3v
3	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.
	PB6	I/O	2.4~64	GPIO	ADC9：ADC Input Channel 9; UART1RXA：Uart1 Data Input(A); PWM2：Timer2 PWM Output.
4	PGND	P	/		DCDC Ground
5	SW	P	/		DCDC switch output, connected to inductor
6	VBAT	PI	/		Power Supply, connect to battery
7	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.
8	BTVDD	PO	/	GPIO	BT Power
9	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).
10	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).
11	BTRF	/	/		BT Antenna
12	XOSCI	I	/		XOSC In
13	XOSCO	O	/		XOSC Out

14	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.
15	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.
16	PA2	I/O	2.4~64	GPIO	AIN_A1; 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.
17	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).
18	DACRP	O	/		Different DAC Right Positive Channel
19	DACRN	O	/		Different DAC Right Negative Channel
20	DAVSS	P	/		Analog Ground
/	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
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
PA1 PA2 PB1 PB2 PB6 PB8	2.4	8	26.4	64	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull Down 3、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 1KHz/0dB 32 ohm loading With A-Weighted Filter
Output Swing		0.56	0.72	Vrms		
THD+N	_	-78	_	dB	PCM	
	_	-69.6	_	dB	SBC	
S/N	_	100	102	dB	PCM	
	_	99.5	_	dB	SBC	
Dynamic Range	_	100.2	_	dB	PCM	Differential Mode 1KHz/-60dB 32 ohm loading With A-Weighted Filter
	_	100	_	dB	SBC	
Noise Floor		5.9		uV	_	A-Weighted Filter
DAC Output Power	_	9.7	16.0	mW	_	Differential Mode 32ohm 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 Data Rate **Table 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
RF Transmit Power			8.2	10	dBm	25℃, Power Supply VBAT=3.7V
RF Power Control Range			18.0		dB	
20dB Bandwidth			950		KHz	
Adjacent Channel	+2MHz		-40		dBm	

	-2MHz		-38		dBm	
	+3MHz		-44		dBm	
	-3MHz		-35		dBm	

Enhanced Data Rate **Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1.2		dB	
π/4 DQPSK Modulation Accuracy	DEVM RMS	6	10.9		%	25℃, Power Supply VBAT=3.7V 2441MHz 2 Layer Board
	DEVM 99%	10	19.0		%	
	DEVM Peak	15	24.3		%	
Adjacent Channel Transmit Power	+2MHz		-40		dBm	
	-2MHz		-38		dBm	
	+3MHz		-44		dBm	
	-3MHz		-35		dBm	

2.8.2 Receiver

Basic Data Rate **Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-91		dBm	25℃, Power Supply VBAT=3.7V 2441MHz DH5 2 Layer Board
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			-94		dBm	25℃, Power Supply VBAT=3.7V
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

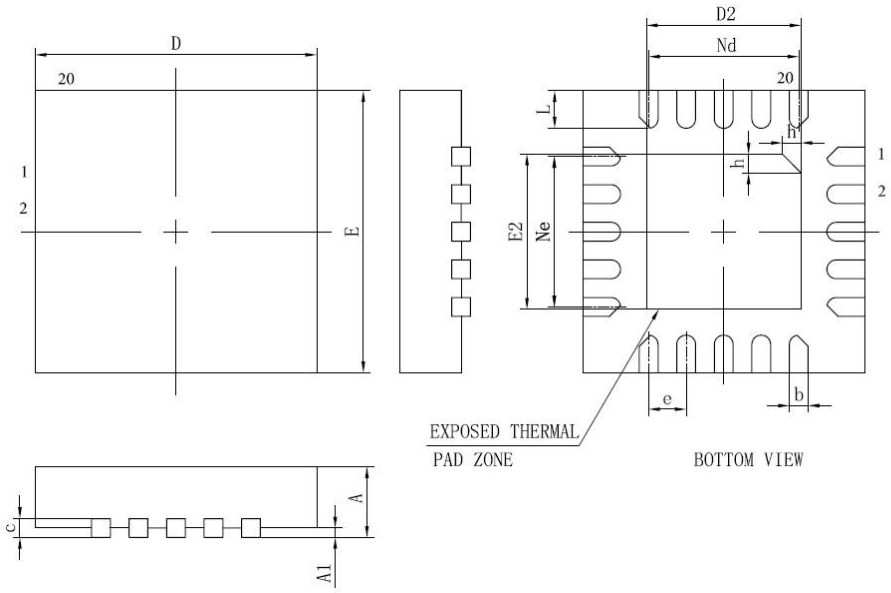
Table 2-12

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

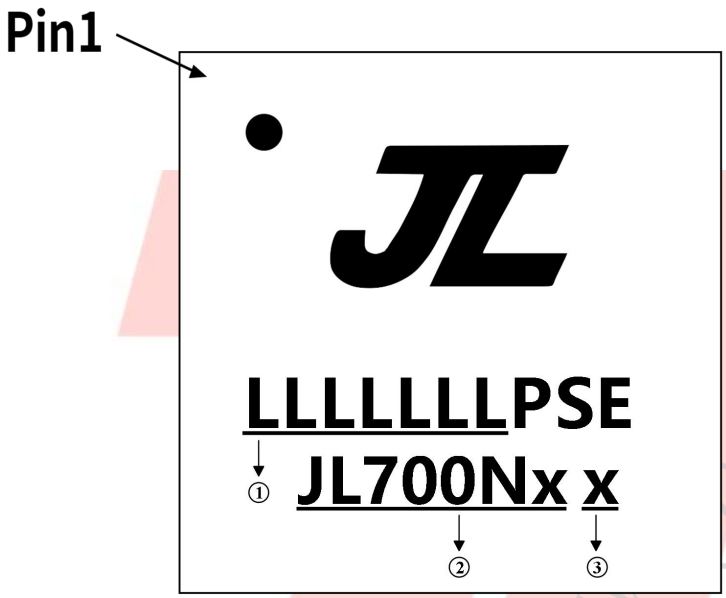
3.1 QFN20_3.0x3.0



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	2.90	3.00	3.10
D2	1.55	1.65	1.75
e	0.40BSC		
Ne	1.60BSC		
Nd	1.60BSC		
E	2.90	3.00	3.10
E2	1.55	1.65	1.75
L	0.35	0.40	0.45
h	0.20	0.25	0.30
L/F载体尺寸 (M1)	75*75		

Figure 3-1 JL7003A 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

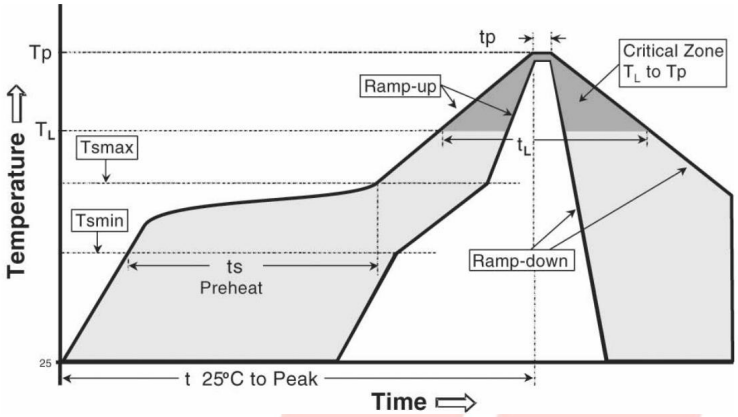


Figure 5-1 Classification Reflow Profile

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 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 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 Package Information & Soft-off mode current consumption