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JL7031C Datasheet

Zhuhai Jieli Technology Co.,LTD

Version 1.7

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Revision History

Date	Revision	Description
2023.06.25	V1.0	Initial Release
2023.09.12	V1.1	Update Pin Assignment
2023.12.04	V1.2	Update BT_Features Update FM Characteristics Add IC Marking Information
2024.07.12	V1.3	Use New Datasheet Format Update DSP Audio Processing_Feature(Support Hi-Res Audio) Add PIN PC6 Note(PC6 input can not be Low in power on) Update IC Marking Information
2024.07.26	V1.4	Update Pin Description(Update FMIP&FMIN IO Type)
2024.08.22	V1.5	Update BT characteristics
2024.09.27	V1.6	Update Pin Description(Update FMIP&FMIN IO Type)
2024.11.21	V1.7	Update Peripherals_Features(Support High speed USB2.0)

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JL7031C Features

SYSTEM

- Dual Core 32bit DSP 320MHz
- With IEEE754 Single precision FPU
- Support FFT/MATRIX/MATH
- 2 x I-cache and D-cache
- Support SDTAP/EMU
- On-chip SRAM 528kbyte
- Support MMU
- Support MPU
- Support External PSRAM
- Built-In Flash
- 24MHz crystal oscillator
- 32.768kHz crystal oscillator
- Internal RC oscillator,PLL

DSP Audio Processing

- SBC/AAC/LDAC/LHDC/LC3/CVSD/mSBC codec
- mSBC voice codec supported for BT phone
- PLC for voice processing
- Multi-MIC ENC
- Multi-band DRC
- Multi-band EQ
- Support spatial sound
- Support Hi-Res Audio

Audio

- 3 x 24bit DAC
 - ❖ SNR 113dB
 - ❖ Noise 3uVrms
 - ❖ Supports differential mode
 - ❖ Supports VCMO mode
 - ❖ Sampling rate 8~96kHz
- 4 x 24bit ADC
 - ❖ SNR 105dB
 - ❖ Sampling rate 8~48kHz
 - ❖ Support AMUX
- I²S/TDM/PDM/SPDIF AUDIO Master/Slave interface

Bluetooth

- Dual-mode BT5.4 with LE Audio

(QDID 222830)

- Support AoA/AoD
- Support LE audio BIS/CIS
- Support long range BLE
- Maximum transmitting power 10dBm
- Receiver sensitivity
 - ❖ -95 dBm @BR
 - ❖ -95 dBm @EDR Π/4 DQPSK
 - ❖ -87 dBm @EDR 8DPSK

Peripherals

- 1 x High speed USB2.0
- 2 x SD host controller
- 6 x Multi-function 32bit timer
- 3 x UART interface
- 1 x I²C Master/Slave interface
- 3 x SPI Master/Slave interface
- 3 x QDEC
- 1 x 10bit ADC(15 Channel)
- 27 x GPIO Support function remapping
- 1 x VLCD driver
- 3 x Light strip controller
- 12 x MCPWM
- 7x LP_Touch with low power wake up

FM

- FM RX sensitivity minimum 4dBuV,Support mono/stereo
- FM TX power maximum 6dBm,Support mono/stereo

NFC

- NFC with low power wakeup

PMU

- Integrated battery charger up to 350mA
- 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 2.2V to 3.4V

Packages

- LQFP48 (7mm*7mm)

Temperature

- Operating temperature
TC = -20°C to +85°C (standard range)
TC = -40°C to +105°C (extended range)
- Storage temperature -65°C to +150°C

Applications

- Bluetooth live sound card
- Bluetooth soundbar
- Bluetooth TV Soundbar
- Bluetooth Party Speaker



1 Block Diagram

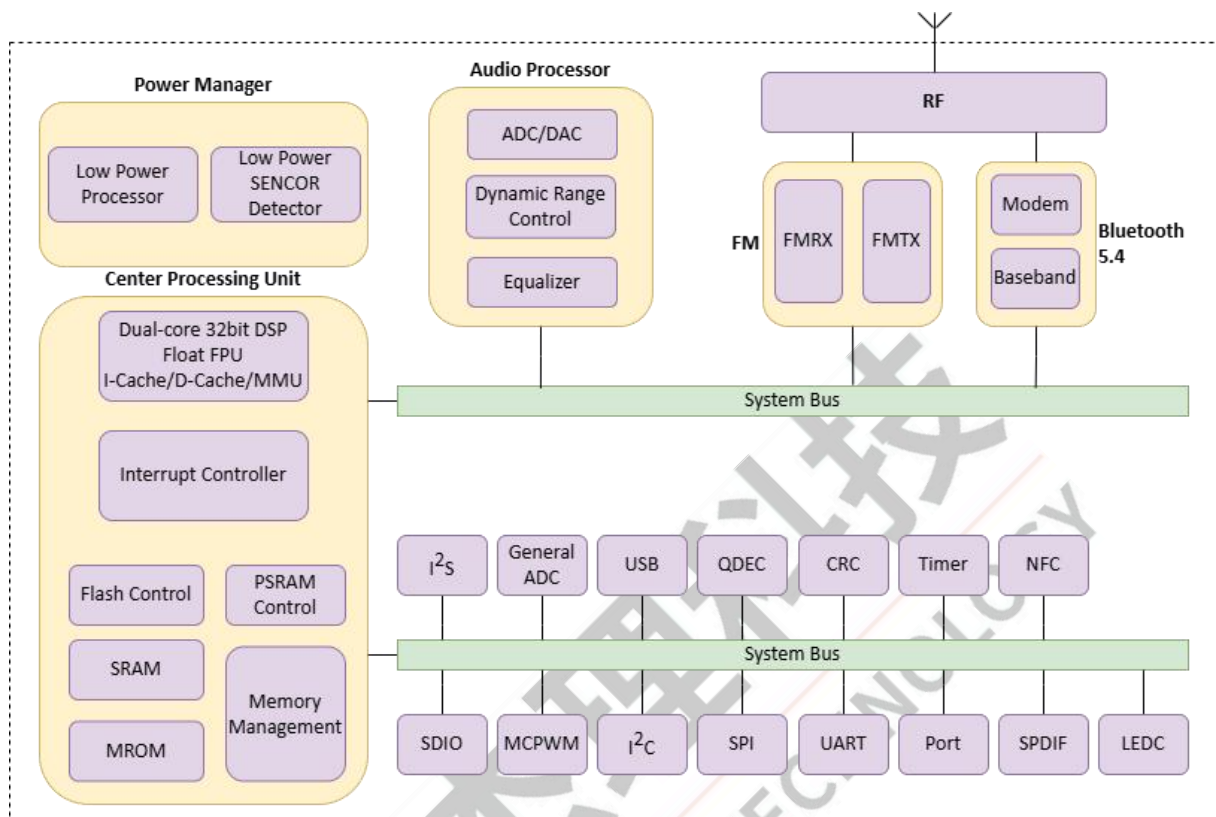


Figure 1-1 JL7031C Block Diagram

2 Pin Definition

2.1 Pin Assignment

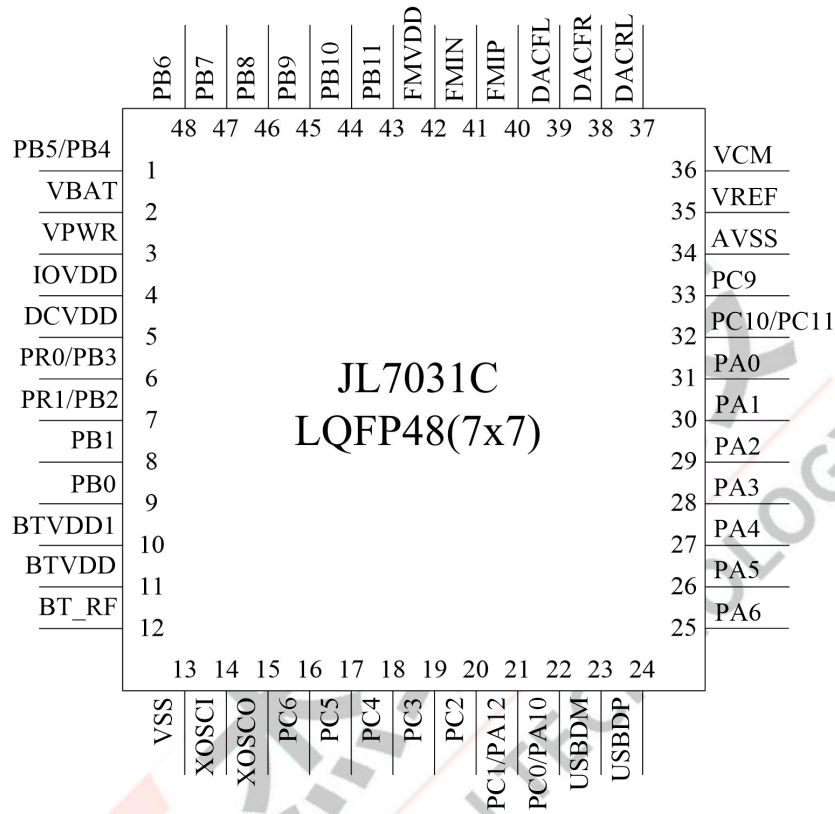


Figure 2-1 JL7031C Pin Assignment

2.2 Pin Description

Table 2-2-1 JL7031C Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	PB5	I/O	Z	LP_TOUCHB1(TOUCH_CHB1) LVD(External Low Voltage Detection Input) AIN_AN(Audio ADC Negative Input)
	PB4	I/O	Z	LP_TOUCHB0(TOUCH_CHB0) ADC7(ADC Input Channel 7)
2	VBAT	P	--	Battery Input
3	VPWR	I/O	Z	Charge Power Input
4	IOVDD	P	--	IO Power
5	DCVDD	P	--	DCDC power
6	PR0	I/O	Z	32.768k Crystal Oscillator Input LP_TOUCHA3(TOUCH_CHA3)
	PB3	I/O	Z	ADC6(ADC Input Channel 6) LP_TOUCHA2(TOUCH_CHA2) NFC_TX
7	PR1	I/O	Z	32.768k Crystal Oscillator Output LP_TOUCHA4(TOUCH_CHA4)
	PB2	I/O	Z	LP_TOUCHA1(TOUCH_CHA1) NFC_RX
8	PB1	I/O	10kΩ Pull-up	Hold down 0 to reset ADC5(ADC Input Channel 5) LP_TOUCHA0(TOUCH_CHA0)
9	PB0	I/O	Z	--
10	BTVDD1	P	--	BT Power
11	BTVDD	P	--	BT Power
12	BTRF	RF	--	Bluetooth RF Antenna
13	VSS	G	--	Ground
14	XOSCI	I	--	Crystal Oscillator Input
15	XOSCO	O	--	Crystal Oscillator Output
16	PC6	I/O	10kΩ Pull-up	ADC15(ADC Input Channel 15) LCD SEG19
17	PC5	I/O	Z	ADC14(ADC Input Channel 14) LCD COM0 PSRAM_D3A
18	PC4	I/O	Z	ADC13(ADC Input Channel 13) LCD COM1 PSRAM_CKA

Pin No.	Name	Type	IO Initial State	Description
19	PC3	I/O	Z	ADC12(ADC Input Channel 12) LCD COM2 PSRAM_CSA
20	PC2	I/O	Z	ADC11(ADC Input Channel 11) LCD COM3 LCD SEG18 PSRAM_D1A SPDIF_IN_AMP_D
21	PC1	I/O	Z	LCD COM4 LCD SEG17 PSRAM_D2A
	PA12	I/O	Z	ADC4(ADC Input Channel 4) LCD SEG12 PSRAM_D3B
22	PC0	I/O	Z	LCD COM5 LCD SEG16 PSRAM_D0A SPDIF_IN_AMP_C
	PA10	I/O	Z	ADC3(ADC Input Channel 3) LCD SEG10 PAP_WR LCD_SPI_D3
23	USBDM	I/O	15kΩ Pull-down	USB Negative Data
24	USBDP	I/O	15kΩ Pull-down	USB Positive Data
25	PA6	I/O	Z	ADC2(ADC Input Channel 2) LCD SEG6 PAP_D4 LCD_SPI_CLK SPDIF_IN_AMP_A
26	PA5	I/O	Z	ADC1(ADC Input Channel 1) LCD SEG5 PAP_D3 MICBIASD(MIC Bias Output)
27	PA4	I/O	Z	LCD SEG4 PAP_D2 AIN_DN(Audio ADC Negative Input)
28	PA3	I/O	Z	LCD SEG3 PAP_D1 AIN_D1(Audio ADC Positive Input)

Pin No.	Name	Type	IO Initial State	Description
29	PA2	I/O	Z	ADC0(ADC Input Channel 0) LCD SEG2 PAP_D0 AIN_D0(Audio ADC Positive Input)
30	PA1	I/O	Z	LCD SEG1 AIN_B2(Audio ADC Positive Input) MICBIASB(MIC Bias Output)
31	PA0	I/O	Z	LCD SEG0 AIN_A2(Audio ADC Positive Input) MICBIASA(MIC Bias Output)
32	PC11	I/O	Z	LCD SEG24 AIN_CON(Audio ADC Negative Input)
	PC10	I/O	Z	LCD SEG23 AIN_C1(Audio ADC Positive Input) MICBIASC(MIC Bias Output)
33	PC9	I/O	Z	LCD SEG22 AIN_CO(Audio ADC Positive Input)
34	AVSS	G	--	Audio Ground
35	VREF	P	--	Audio Power
36	VCM	P	--	Audio Reference Voltage
37	DACRL (VCMO)	O	--	Rear Left Channel DAC Output Audio Common-mode Output voltage
38	DACFR	O	--	Front Right Channel DAC Output
39	DACFL	O	--	Front Left Channel DAC Output
40	FMIP	RF	--	FM Positive Input
41	FMIN	RF	--	FM Negative Input
42	FMVDD	P	--	FM Power
43	PB11	I/O	Z	ADC10(ADC Input Channel 10) SD Power FM_TX_B
44	PB10	I/O	Z	ADC9(ADC Input Channel 9) AIN_B0(Audio ADC Positive Input) FM_TX_A
45	PB9	I/O	Z	AIN_A0(Audio ADC Positive Input)
46	PB8	I/O	Z	ADC8(ADC Input Channel 8) LP_TOUCHB4(TOUCH_CHB4) AIN_B1(Audio ADC Positive Input)
47	PB7	I/O	Z	LP_TOUCHB3(TOUCH_CHB3) AIN_A1(Audio ADC Positive Input)
48	PB6	I/O	Z	LP_TOUCHB2(TOUCH_CHB2) AIN_BN(Audio ADC Negative Input)

Note

1. IO initial state abbreviations Z--High resistance, H--High level, L--Low level, X--May be changed during power on.
2. Timer, MCPWM, QDEC, UART, LEDC, I²C, I²S, SPI and SD functions can be remapped to any I/O.
3. PC6 input can not be Low in power on.

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

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	1.4	V
BTVD		-0.3	3	V
BTVD1		-0.3	1.4	V
FMVDD		-0.3	3.6	V
GPIO		Input voltage of GPIO (except PB0)	-0.3	3.6
HVTIO	Input voltage of HVT-IO (PB0)	-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	JEDEC EIA/JESD22-A114
Machine Mode	±400V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±1kV	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	Voltage Input	--	2.7	3.7	4.5	V
VPWR	Charger supply Voltage	--	4.5	5.0	5.5	V
Operating mode						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Voltage output	VBAT = 4.2V, 10mA loading	--	3	--	V
	Loading current	IOVDD=3.0V@VBAT = 3.7V or VPWR=5V	--	--	300	mA
DCVDD	Voltage output	--	--	1.2	--	V
	Loading current	DCVDD=1.2V@IOVDD=3.0V on LDO mode	--	--	150	mA

Symbol	Parameter	Conditions	Min	Typ	Max	Unit
		DCVDD=1.2V@VBAT=3.7V on DCDC mode	--	--	180	mA
Low Power mode						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Loading current	IOVDD=3.0V@VBAT = 3.7V	--	--	20	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
		4.325	4.35	4.375	V
CC	CC Mode Current	15	--	350	mA
I _{end}	End Of Charge Current	1.5	--	35	mA
V _{Trickl}	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,P10,PA12 PB0~PB11 PC0~PC6,PC9~PC11 PR0~PR1 USBDP USBDM VPWR	-0.3	1.4	V
V _{IH}	High-Level Input Voltage	IOVDD = 3.0V	PA0~PA6,P10,PA12 PB1~PB11 PC0~PC6,PC9~PC11 PR0~PR1 USBDP USBDM	1.7	3.3	V
		IOVDD = 3.0V	PB0 VPWR	1.7	5.5	V
Output Characteristics						
Symbol	Parameter	Conditions	IO	Typ	Unit	
I _{OL}	Output Current	IOVDD = 3.0V V _{output} = 0.3V	PA0~PA6,P10,PA12 PB1~PB11	2(HD=0) 8(HD=1)	mA	

			PC0~PC6,PC9~PC11 PR0~PR1	26(HD=2) 50(HD=3)	
			PB0 USBDP USBDM	8	mA
			VPWR	2	mA
I _{OH}	Output Current	IOVDD = 3.0V Voutput = 2.7V	PA0~PA6,P10,PA12 PB1~PB11 PC0~PC6,PC9~PC11 PR0~PR1	2(HD=0) 8(HD=1) 26(HD=2) 50(HD=3)	mA
			PB0 USBDP USBDM	8	mA
			VPWR	2	mA
Internal Resistance Characteristics					
Symbol	Parameter	Conditions	IO	Typ	Unit
R _{pu}	Pull-up Resistance	IOVDD = 3.0V	PA0~PA6,P10,PA12 PB0~PB11 PC0~PC6,PC9~PC11 VPWR PR0~PR1	10k(PU=1) 100k(PU=2) 1M(PU=3)	Ω
			USBDP USBDM	1.5k(PU=1) 1k(PU=3)	Ω
R _{pd}	Pull-down Resistance	IOVDD = 3.0V	PA0~PA6,P10,PA12 PB0~PB11 PC0~PC6,PC9~PC11 VPWR PR0~PR1	10k(PD=1) 100k(PD=2) 1M(PD=3)	Ω
			USBDP USBDM	15k(PD=1)	Ω

Note

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

3.6 Audio DAC Characteristics

Table 3-6 Stereo DAC Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Resolution	--	--	--	24	bit
Output Sample Rate	--	8	--	96	kHz
SNR ^①	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	113	--	dB
	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	107	--	dB
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	110	--	dB
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	109	--	dB
	VCMO Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	104	--	dB
	Single-ended Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	106	--	dB
THD+N	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=32Ω	--	-86	--	dB
	VCMO Mode Fin=1kHz@0dBFS	--	-85	--	dB

	Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=32Ω				
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=32Ω	--	-86	--	dB
Noise Floor	Differential Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	7	--	uVrms
	VCMO Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	6	--	uVrms
	Single-ended Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	5	--	uVrms
Noise Floor with MUTE	Differential Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	4	--	uVrms
	VCMO Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	4	--	uVrms
	Single-ended Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	3	--	uVrms
Stereo Crosstalk	VCMO Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	-108	--	dB
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	-108	--	dB
Max Output Power	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=16Ω THD+N<0.1%	--	30	85	mW
	VCMO Mode	--	30	38	mW

	Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=16Ω THD+N<0.1%				
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=16Ω THD+N<0.1%	--	30	38	mW

Note

1. ^①SNR 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	--	--	--	24	bits
Input Sample Rate	--	8	--	48	kHz
SNR	Differential input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	105	--	dB
	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	102	--	dB
Dynamic Range	Differential input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	105	--	dB
	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	102	--	dB
THD+N	Differential input Mode Fin=1kHz@0dBFS Fs=44.1kHz	--	-90	--	dB

Parameter	Conditions	Min	Typ	Max	Unit
	B/W=20Hz~20kHz A-Weighted ADC gain=0dB				
	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	-90	--	dB
Analogue Gain		-6	--	28	dB
Max Input Level	Differential input Mode ADC gain=0dB	--	2	--	Vrms
	Single-ended input Mode ADC gain=0dB	--	1	--	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	--	9.5	--	dBm
Maximum RF Transmit Power	EDR $\pi/4$ DQPSK EDR 8DPSK	--	9.5	--	dBm
Relative Transmit Power	EDR $\pi/4$ DQPSK EDR 8DPSK	--	-3	--	dB
Maximum RF Transmit Power	BLE-1Mbps	--	9.5	--	dBm

3.8.2 Receiver

Table 3-8-2 Receiver characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Sensitivity	BR	--	-95	--	dBm
	EDR $\pi/4$ DQPSK	--	-95	--	dBm
	EDR 8DPSK	--	-87	--	dBm
	BLE-1Mbps	--	-98.5	--	dBm
	BLE-2Mbps	--	-95.5	--	dBm
	BLE-S2	--	-101	--	dBm
	BLE-S8	--	-106	--	dBm

3.9 FM Characteristics

Table 3-9-1 FM Transmitter Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Frequency range	--	64	--	108	MHz
RF Transmit Power	--	--	6	--	dBm

Table 3-9-2 FM Receiver Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Frequency range	--	64	--	108	MHz
RF Mono sensitivity	(S+N)/N=26dB	--	4	--	dBuV
Mono Audio SNDR	--	--	75	--	dB
Stereo Audio SNDR	--	--	64	--	dB
Stereo channel separation	--	--	54	--	dB

Note

1.The best FM sensitivity performance requires an external differential circuit, refer to the schematic diagram.

4 Package Information

4.1 LQFP48_7x7mm

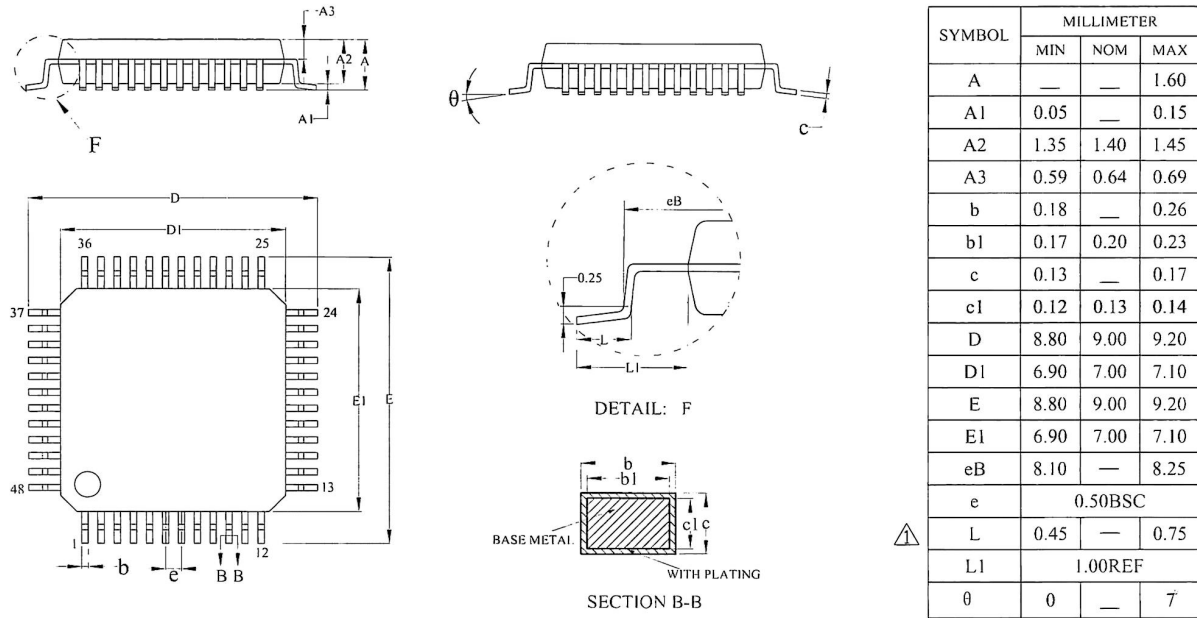


Figure 4-1 JL7031C Package

5 IC Marking Information

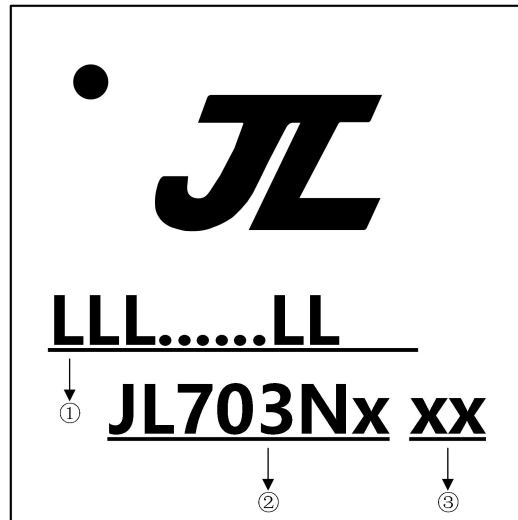


Figure 5-1 JL7031C Package Outline

- ① LLL.....LL LOT No. , It contains 7 to 18 alphanumerics
 - ② JL703Nx Chip Model
 - ③ xx Built-in Memory
 - 0 No Flash Memory
 - 2 2Mbit Flash
 - 4 4Mbit Flash
 - 8 8Mbit Flash
 - 6 16Mbit Flash
 - 3 32Mbit Flash
- nS memory is flash plus PSRAM, n represents the flash capacity, S represents 16Mbit PSRAM
 nT memory is flash plus PSRAM, n represents the flash capacity, T represents 64Mbit PSRAM

6 Solder-Reflow Condition

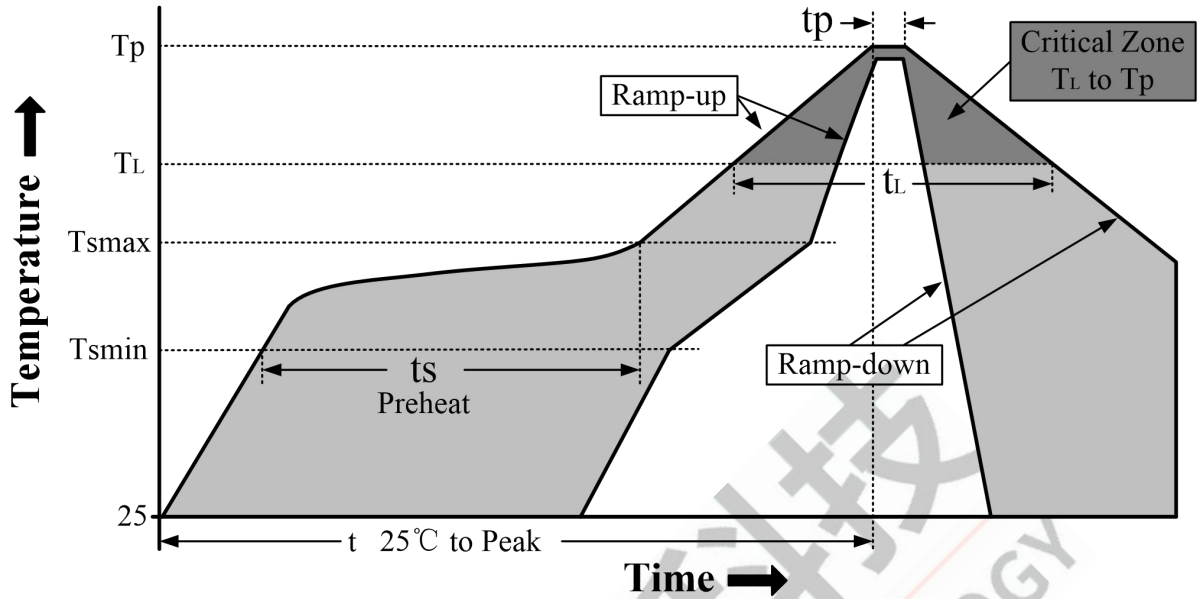


Figure 6-1 Classification Reflow Profile

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.