# JL7096M Datasheet

## Zhuhai Jieli Technology Co.,LTD

**Version 1.0**

**Date 2025.12.04**

# Revision History

| Date | Revision | Description |
|---|---|---|
| 2025.12.04 | V1.0 | Initial Release |
| | | |
| | | |

# Table of Contents

# JL7096M Features

## SYSTEM

- Dual Core 32bit DSP 192MHz
- With IEEE754 Single precision FPU
- Support FFT/MATRIX/MATH
- 2 x I-cache and D-cache
- Support SDTAP/EMU
- On-chip SRAM 320kbyte
- Support MMU
- Support MPU
- Built-In Flash
- 24MHz 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
- Single/Multi MIC ENC
- Multi-band DRC
- Multi-band EQ
- Support spatial sound
- Support assistive listening

## Audio

- 2 x 24bit DAC
  - SNR 113dB
  - Noise 1.2uVrms
  - Support differential mode
  - Sampling rate 8~384kHz
- 3 x 24bit ADC
  - SNR 100dB
  - Sampling rate 8~192kHz
- $I^2S$/TDM/PDM AUDIO Master/Slave interface

## Bluetooth

- Dual-mode BT6.0 with LE Audio
  (DN Q332415)
- Support AoA/AoD
- Support LE audio BIS/CIS
- Maximum transmitting power 13dBm
- Receiver sensitivity
  - -97dBm @BR
  - -97dBm @EDR Π/4 DQPSK
  - -89dBm @EDR 8DPSK

## Peripherals

- 1 x Full speed USB
- 6 x Multi-function 32bit timer
- 3 x UART interface
- 1 x $I^2C$ Master/Slave interface
- 3 x SPI Master/Slave interface
- 1 x 10bit ADC(10 Channels)
- 15 x GPIO Support function remapping
- 3 x LP_Touch with low power wake up

## PMU

- Integrated battery charger up to 180mA
- 1 x Buck DC-DC converter
- Support temperature sensor
- VPWR range 4.5V to 5.5V
- VBAT range 2.7V to 5.5V
- IOVDD range 2.7V to 3.6V

## Packages

- QFN32(4*4mm)

## Temperature

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

## Applications

- Bluetooth Dongle

# 1 Block Diagram

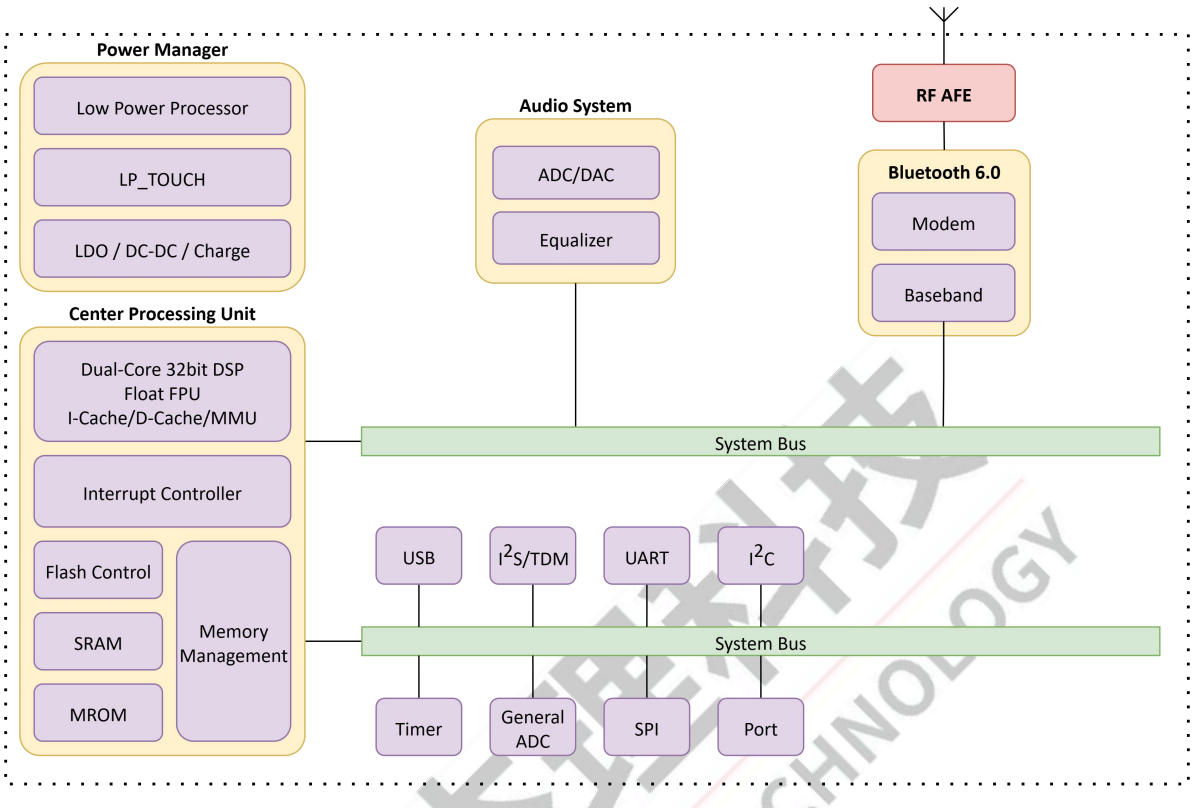



**Figure 1-1 JL7096M Block Diagram**

# 2 Pin Definition

## 2.1 Pin Assignment

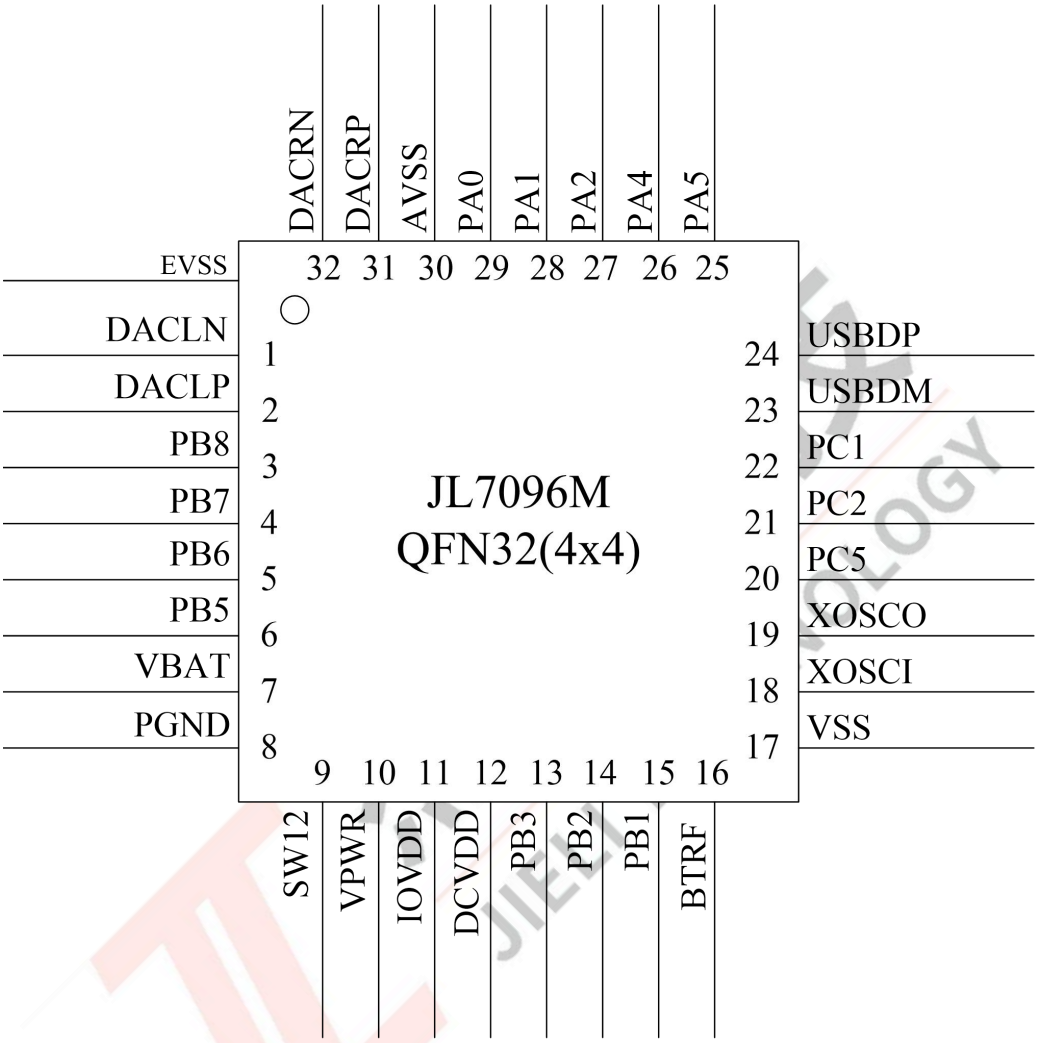



**Figure 2-1 JL7096M Pin Assignment**

## 2.2 Pin Description

**Table 2-2-1 JL7096M Pin Description**

| Pin No. | Name | Type | IO Initial State | Description |
|---|---|---|---|---|
| 1 | DACLN | O | -- | Left Channel DAC Negative Output |
| 2 | DACLP | O | -- | Left Channel DAC Positive Output |
| 3 | PB8 | I/O | Z | AIN_CP0(Audio ADC Positive Input) |
| 4 | PB7 | I/O | Z | AIN_CN0(Audio ADC Negative Input) |
| 5 | PB6 | I/O | Z | LVD(External Low Voltage Detection Input)<br>AIN_BP1(Audio ADC Positive Input)<br>MICBIASC(MIC Bias Output) |
| 6 | PB5 | I/O | Z | AIN_BN1(Audio ADC Negative Input)<br>ADC5(ADC Input Channel 5) |
| 7 | VBAT | P | -- | Battery Input |
| 8 | PGND | P | -- | Ground of Buck DC-DC converter |
| 9 | SW12 | P | -- | Buck DCDC12 Switch Port |
| 10 | VPWR | I/O | Z | Charge Power Input |
| 11 | IOVDD | P | -- | IO Power |
| 12 | DCVDD | P | -- | Buck DCDC12 Output Power |
| 13 | PB3 | I/O | Z | ADC3(ADC Input Channel 3)<br>LP_TOUCH3(TOUCH_CH3) |
| 14 | PB2 | I/O | Z | ADC2(ADC Input Channel 2)<br>LP_TOUCH2(TOUCH_CH2) |
| 15 | PB1 | I/O | 10kΩ Pull-up | ADC1(ADC Input Channel 1)<br>LP_TOUCH1(TOUCH_CH1)<br>Hold down 0 to reset |
| 16 | BTRF | RF | -- | Bluetooth RF Antenna |
| 17 | VSS | G | -- | Ground |
| 18 | XOSCI | I | -- | Crystal Oscillator Input |
| 19 | XOSCO | O | -- | Crystal Oscillator Output |
| 20 | PC5 | I/O | Z | ADC11(ADC Input Channel 11) |
| 21 | PC2 | I/O | Z | ADC8(ADC Input Channel 8) |
| 22 | PC1 | I/O | Z | ADC7(ADC Input Channel 7) |
| 23 | USBDM | I/O | 15kΩ Pull-down | USB Negative Data<br>ADC15(ADC Input Channel 15) |
| 24 | USBDP | I/O | 15kΩ Pull-down | USB Positive Data<br>ADC14(ADC Input Channel 14) |
| 25 | PA5 | I/O | Z | AIN_BP0(Audio ADC Positive Input) |
| 26 | PA4 | I/O | Z | AIN_BN0(Audio ADC Negative Input)<br>AIN_AN1(Audio ADC Negative Input) |
| 27 | PA2 | I/O | Z | AIN_AN0(Audio ADC Negative Input) |

| Pin No. | Name | Type | IO Initial State | Description |
|---|---|---|---|---|
| 28 | PA1 | I/O | Z | AIN_AP0(Audio ADC Positive Input) |
| 29 | PA0 | I/O | Z | ADC6(ADC Input Channel 6)<br>MICBIASA(MIC Bias Output)<br>MICLDO(MIC Bias LDO Output) |
| 30 | AVSS | G | -- | Audio Ground |
| 31 | DACRP | O | -- | Right Channel DAC Positive Output |
| 32 | DACRN | O | -- | Right Channel DAC Negative Output |

**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, $I^2C$, $I^2S$, SPI functions can be remapped to any I/O.**

**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 | ℃ |
| Tstg | Storage temperature | -65 | +150 | ℃ |
| VBAT | Supply Voltage | -0.3 | 5.5 | V |
| VPWR | | -0.3 | 6 | V |
| IOVDD | | -0.3 | 3.6 | V |
| DCVDD | | -0.3 | 1.25 | V |
| GPIO | Input voltage of GPIO | -0.3 | 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 | ±300V | All pins | JEDEC EIA/JESD22-A115 |
| 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 | 5.5 | 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 or VPWR=5V | -- | -- | 120 | mA |
| DCVDD | Voltage output | -- | -- | 1.15 | -- | V |
| | Loading current | DCVDD=1.15V@IOVDD=3.0V in LDO mode | -- | -- | 120 | mA |
| | | DCVDD=1.15V@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 or VPWR=5V | -- | -- | 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 |
| | | 4.325 | 4.35 | 4.375 | V |
| CC | CC Mode Current | 15 | -- | 180 | mA |
| $I_{end}$ | End Of Charge Current | 1.5 | -- | 18 | 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~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5<br>USBDP<br>USBDM<br>VPWR | -0.3 | 1.4 | V |
| $V_{IH}$ | High-Level Input Voltage | IOVDD = 3.0V | PA0~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5<br>USBDP<br>USBDM | 1.7 | 3.3 | V |
| | | IOVDD = 3.0V | VPWR | 1.7 | 5.5 | V |
| **Output Characteristics** | | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **IO** | **Typ** | | **Unit** |
| $\lvert I_{OL} \rvert$ | Output Current | IOVDD = 3.0V<br>Voutput = 0.3V | PA0~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5 | 4(HD=0)<br>8(HD=1)<br>16(HD=2)<br>32(HD=3) | | mA |
| | | IOVDD = 3.0V<br>Voutput = 0.3V | USBDP<br>USBDM | 8 | | mA |
| | | IOVDD = 3.0V<br>Voutput = 0.3V | VPWR | 2 | | mA |
| $\lvert I_{OH} \rvert$ | Output Current | IOVDD = 3.0V<br>Voutput = 2.7V | PA0~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5 | 4(HD=0)<br>8(HD=1)<br>16(HD=2)<br>32(HD=3) | | mA |

| | | | | | |
|---|---|---|---|---|---|
| | | IOVDD = 3.0V<br>Voutput = 2.7V | USBDP<br>USBDM | 8 | mA |
| | | IOVDD = 3.0V<br>Voutput = 2.7V | VPWR | 2 | mA |
| **Internal Resistance Characteristics** | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **IO** | **Typ** | **Unit** |
| $R_{pu}$ | Pull-up Resistance | IOVDD = 3.0V | PA0~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5<br>VPWR | 10k(PU=1)<br>100k(PU=2)<br>1M(PU=3) | Ω |
| | | IOVDD = 3.0V | USBDP | 1.5k | Ω |
| | | IOVDD = 3.0V | USBDM | 180k | Ω |
| $R_{pd}$ | Pull-down Resistance | IOVDD = 3.0V | PA0~PA2,PA4,PA5<br>PB1~PB3,PB5~PB8<br>PC1,PC2,PC5<br>VPWR | 10k(PD=1)<br>100k(PD=2)<br>1M(PD=3) | Ω |
| | | IOVDD = 3.0V | USBDP<br>USBDM | 15k | 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 | -- | bits |
| Input Sample Rate | -- | 8 | -- | 384 | kHz |
| SNR① | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>Load=10kΩ | -- | 113 | -- | dB |
| Dynamic Range | Differential Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>Load=10kΩ | -- | 106 | -- | dB |
| THD+N | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>Load=32Ω | -- | -85 | -- | dB |

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Noise Floor | Differential Mode<br>B/W=20Hz~20kHz A-Weighted<br>Load=10kΩ | -- | 2.7 | -- | uVrms |
| Noise Floor with MUTE | Differential Mode<br>B/W=20Hz~20kHz A-Weighted<br>Load=10kΩ | -- | 1.2 | -- | uVrms |
| Max Output Power | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>Load=16Ω<br>THD+N＜1% | -- | 20 | 30 | 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 |
| Output Sample Rate | -- | 8 | -- | 192 | kHz |
| SNR | Differential input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 100 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 93 | -- | dB |
| Dynamic Range | Differential input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 100 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 93 | -- | dB |
| THD+N | Differential input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | -85 | -- | dB |
| | Single-ended input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | -83 | -- | dB |
| Analogue Gain | -- | -6 | -- | 27 | dB |
| Max Input Level | Differential input Mode<br>ADC gain=0dB | -- | 0.56 | -- | Vrms |
| | Single-ended input Mode<br>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 Π/4 DQPSK<br>EDR 8DPSK | -- | 10 | -- | dBm |
| Relative Transmit Power | EDR Π/4 DQPSK<br>EDR 8DPSK | -- | 3 | -- | dB |
| Maximum RF Transmit Power | BLE-1Mbps | -- | 10 | 13 | dBm |

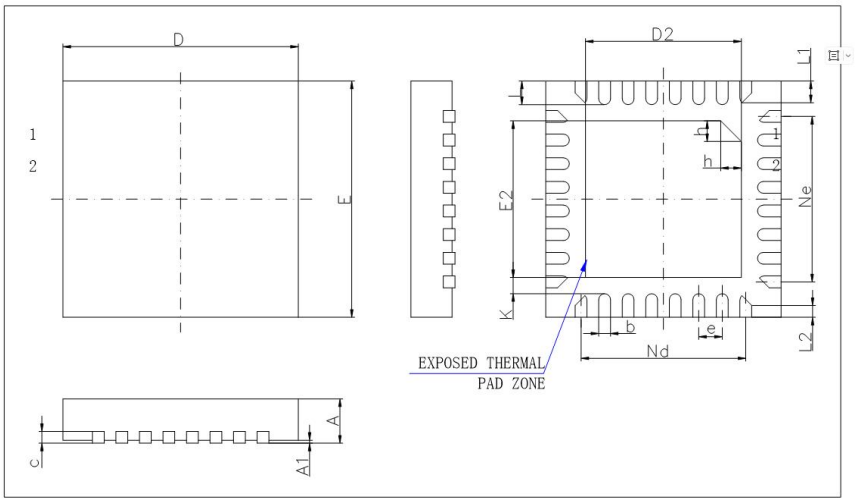
### 3.8.2 Receiver

**Table 3-8-2 Receiver characteristics**

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Sensitivity | BR | -- | -97 | -- | dBm |
| | EDR Π/4 DQPSK | -- | -97 | -- | dBm |
| | EDR 8DPSK | -- | -89 | -- | dBm |
| | BLE-1Mbps | -- | -99.5 | -- | dBm |
| | BLE-2Mbps | -- | -96.5 | -- | dBm |

# 4 Package Information

## 4.1 QFN32_4×4mm




| SYMBOL | MILLIMETER | | |
|---|---|---|---|
| | MIN | NOM | MAX |
| A | 0.65 | 0.80 | 0.95 |
| 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 | 2.50 | 2.65 | 2.80 |
| e | 0.40BSC | | |
| Nd | 2.80BSC | | |
| E | 3.90 | 4.00 | 4.10 |
| E2 | 2.50 | 2.65 | 2.80 |
| 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 (mil) | 112*112 | | |

**Figure 4-1 JL7096M Package**

# 5 IC Marking Information

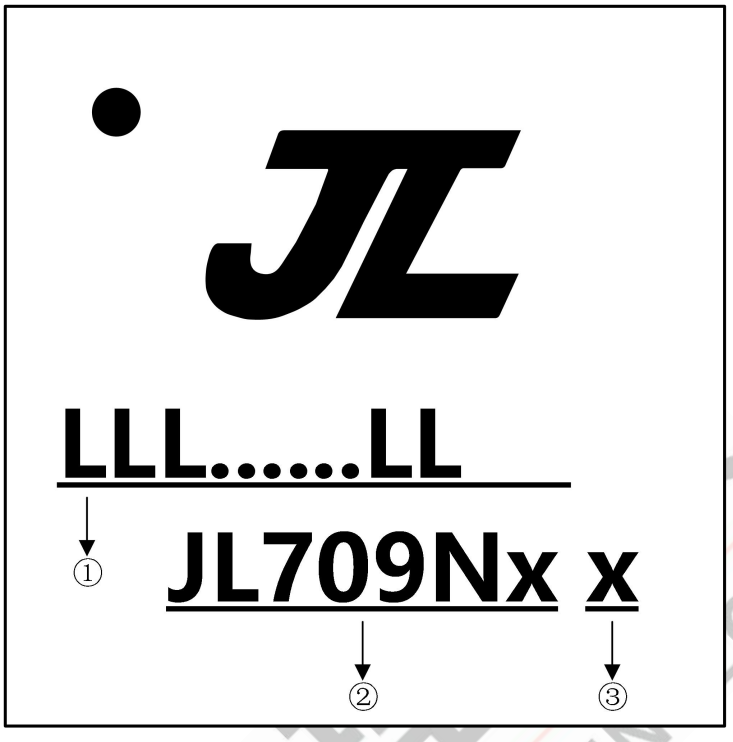



**Figure 5-1 JL7096M Package Outline**

① LLL.....LL LOT No. , It contains 7 to 18 alphanumerics

② JL709Nx 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

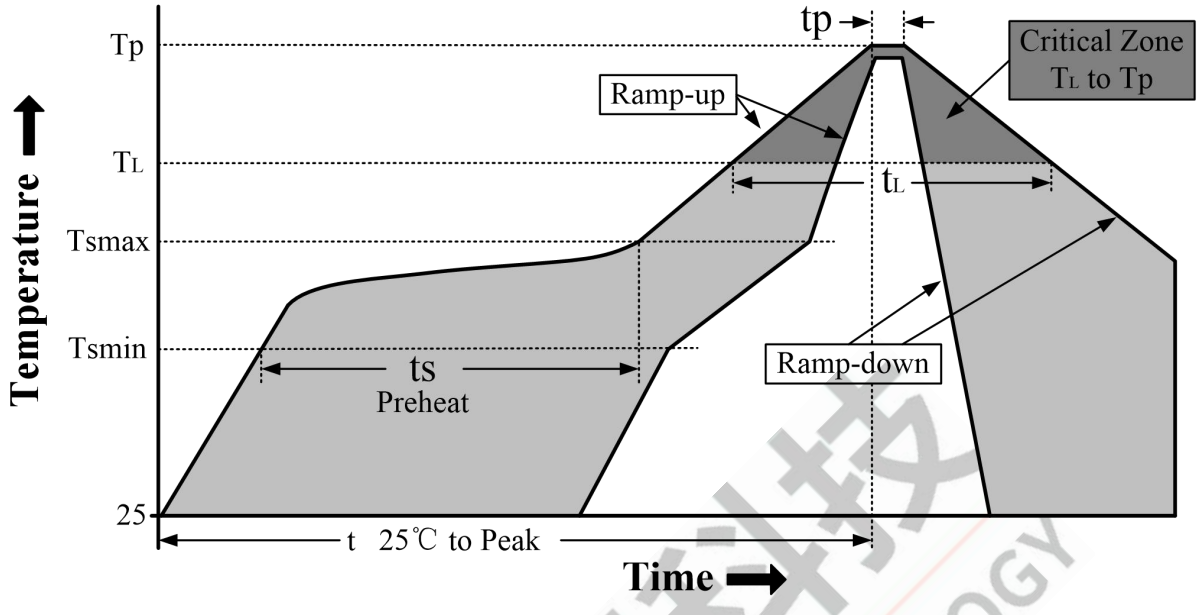



**Figure 6-1 Classification Reflow Profile**

**Table 6-1 Classification Profiles**

| 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 ($T_L$)<br>Time ($t_L$) maintained above $T_L$ | | 183℃<br>60-150 seconds | 217℃<br>60-150 seconds |
| Peak package body temperature ($T_p$) | | See Table 6-2 | See Table 6-3 |
| 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**

**2.Time within 5℃ 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℃ | 225 +0/-5℃ |
| ≥2.5 mm | 225 +0/-5℃ | 225 +0/-5℃ |

**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℃ | 260℃ | 260℃ |
| 1.6 mm - 2.5mm | 260℃ | 250℃ | 245℃ |
| > 2.5mm | 250℃ | 245℃ | 245℃ |

**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℃.For example 260℃+0℃)at the rated MSL level.**