# AC7068M Datasheet

## Zhuhai Jieli Technology Co.,LTD

**Version 2.0**

**Date 2025.01.16**

# Revision History

| Date | Revision | Description |
|---|---|---|
| 2024.06.11 | V1.0 | Initial Release |
| 2025.01.16 | V2.0 | Update Features_Bluetooth<br>Update Block Diagram |
| | | |

# Table of Contents

# AC7068M Features

## SYSTEM

- 32-bit Dual-Issue DSP 192MHz
- With IEEE754 Single precision FPU
- Support FFT/MATRIX/MATH
- 1 x I-cache
- Support EMU
- Support MMU
- Support MPU
- Built-In Flash
- 24MHz crystal oscillator
- Internal RC oscillator,PLL

## DSP Audio Processing

- SBC/AAC codec
- mSBC voice codec supported for BT phone
- PLC for voice processing
- Single MIC ENC
- Multi-band DRC
- Multi-band EQ

## Audio

- 1 x 16bit ADC
  - SNR 94dB
  - Sampling rate 8~48kHz
  - Support AMUX

## Bluetooth

- Dual-mode BT6.0 with LE Audio (DN Q332415)
- Support LE audio BIS/CIS
- Support long range BLE
- Maximum transmitting power 10dBm
- Receiver sensitivity
  - -93dBm @BR
  - -92dBm @EDR Π/4 DQPSK
  - -84dBm @EDR 8DPSK

## Peripherals

- 1 x Full speed USB
- 4 x Multi-function 16bit timer
- 2x UART interface
- 1 x $I^2C$ Master/Slave interface
- 1 x SPI Master/Slave interface
- 1 x 10bit ADC(2 Channel)
- 2 x GPIO Support function remapping

## PMU

- Integrated battery charger up to 300mA
- Support temperature sensor
- VPWR range 4.5V to 5.5V
- VBAT range 2.7V to 4.5V
- IOVDD range 2.7V to 3.6V

## Packages

- ESOP8

## Temperature

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

## Applications

- Wireless microphone

# 1 Block Diagram

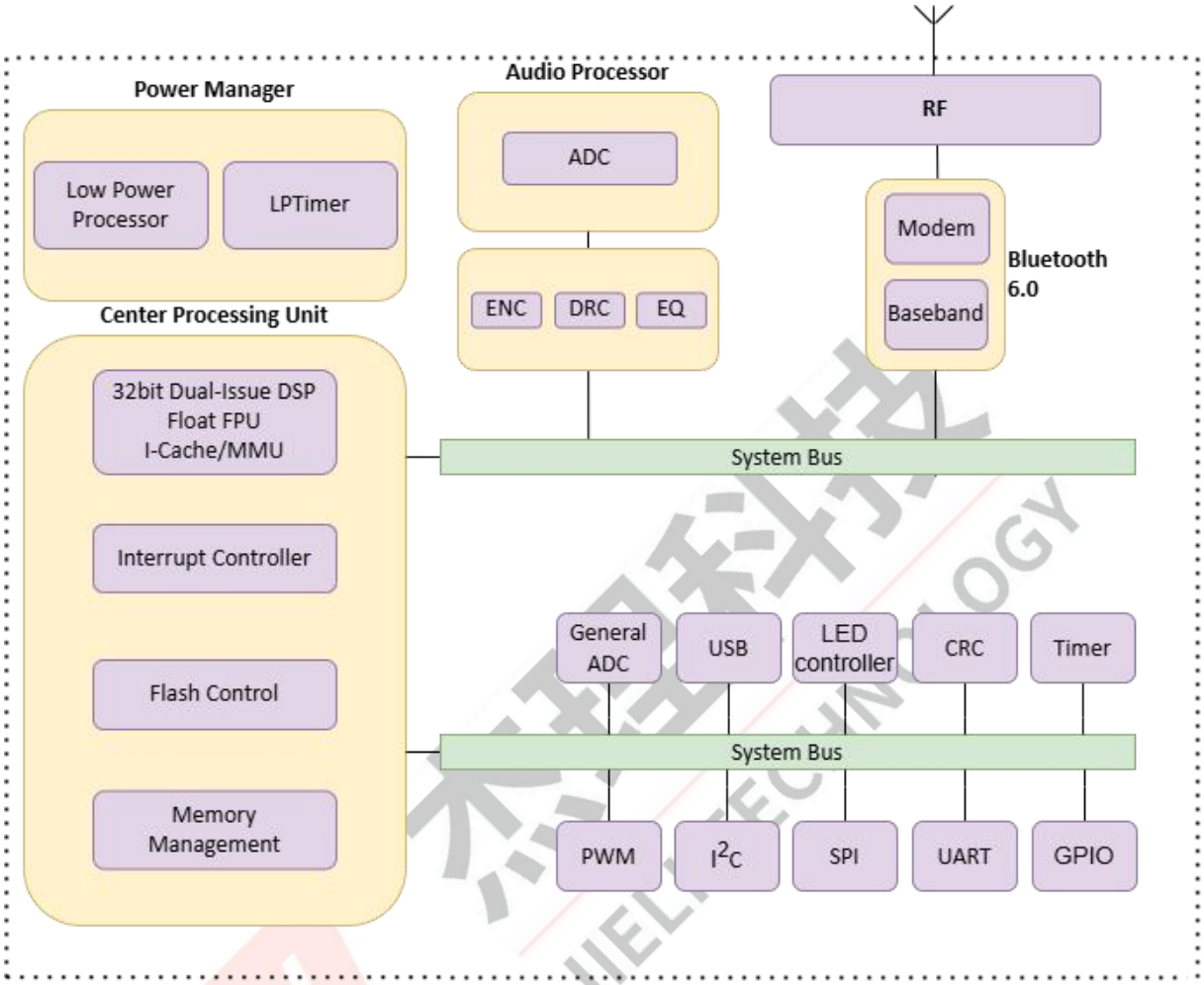



**Figure 1-1 AC7068M Block Diagram**

# 2 Pin Definition

## 2.1 Pin Assignment

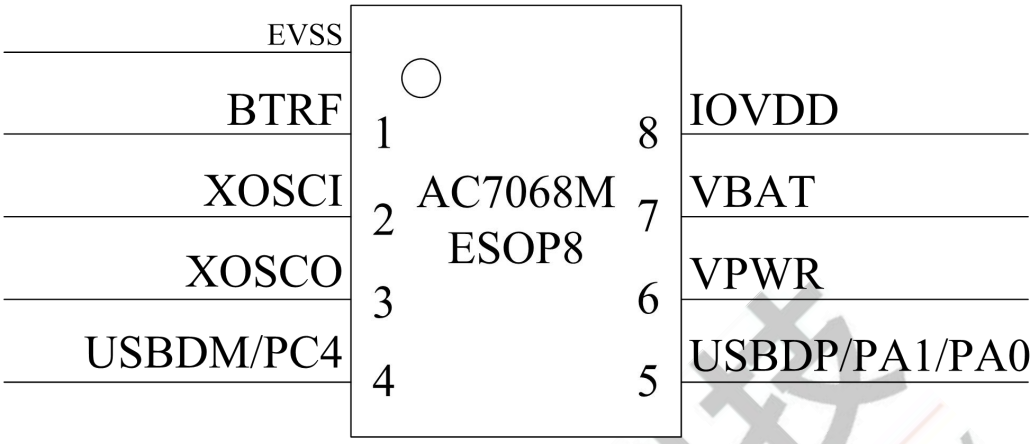



**Figure 2-1 AC7068M Pin Assignment**

## 2.2 Pin Description

**Table 2-2-1 AC7068M Pin Description**

| Pin No. | Name | Type | IO Initial State | Description |
|---|---|---|---|---|
| 1 | BTRF | RF | -- | Bluetooth RF Antenna |
| 2 | XOSCI | I | -- | Crystal Oscillator Input |
| 3 | XOSCO | O | -- | Crystal Oscillator Output |
| 4 | USBDM | I/O | 15kΩ Pull-down | ADC14(ADC Input Channel 14)<br>USB Negative Data<br>SPI1 DATA0(D)<br>I²C SDA(A) |
| | PC4 | I/O | Z | ADC11(ADC Input Channel 11)<br>SPI1 CLK(B)<br>I²C SCL(B)<br>TIMER1 PWM |
| 5 | USBDP | I/O | 15kΩ Pull-down | ADC13(ADC Input Channel 13)<br>USB Positive Data<br>SPI1 CLK(D)<br>I²C SCL(A) |
| | PA1 | I/O | Z | ADC1(ADC Input Channel 1)<br>MIC(Audio ADC Input) |
| | PA0 | I/O | Z | ADC0(ADC Input Channel 0)<br>MICBIAS(MIC Bias Output)<br>Clockout0 |
| 6 | VPWR | I/O | Z | Charge Power Input<br>UART0 TX(C)<br>UART0 RX(C)<br>TIMER3 PWM<br>TIMER1 Capture |
| 7 | VBAT | P | -- | Battery Input |
| 8 | IOVDD | P | -- | IO Power |

**Note**

**1.IO initial state abbreviations Z--High resistance, H--High level, L--Low level, X--May be changed during power on.**

**2.Timer, UART0 functions also can be remapped to any I/O.**

**3. UART1 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 |

| Pin Type | Description | Pin Type | Description |
|---|---|---|---|
| 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 | 4.5 | V |
| VPWR | | -0.3 | 6.0 | V |
| IOVDD | | -0.3 | 3.6 | V |
| GPIO | Input voltage of GPIO | -0.3 | 3.6 | V |
| HVTIO | Input voltage of HVT-IO | -0.3 | 6.0 | 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 | ±2kV | All pins | JEDEC EIA/JESD22-C101F |

## 3.3 PMU Characteristics

**Table 3-3 PMU Characteristics**

| Symbol | Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| VPWR | Power supply | -- | 4.5 | 5.0 | 5.5 | V |
| VBAT | Power supply | -- | 2.7 | 3.7 | 4.5 | V |
| **Operating mode** | | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **Min** | **Typ** | **Max** | **Unit** |
| IOVDD | Voltage output | -- | -- | 3.0 | -- | V |
| | Loading current | IOVDD=3.0V@VBAT = 3.7V | -- | -- | 250 | mA |
| **Low Power mode** | | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **Min** | **Typ** | **Max** | **Unit** |
| IOVDD | Loading current | IOVDD=3.0V@VBAT = 3.7V | -- | -- | 10 | mA |

## 3.4 Battery Charge

**Table 3-4 Charger Characteristics**

| Symbol | Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| VPWR | Charge Input Voltage | VBAT+0.1V | 5.0 | 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 | 20 | -- | 300 | mA |
| $I_{end}$ | End Of Charge Current | 2 | -- | 30 | mA |
| $V_{Trikl}$ | Trickle Charge Voltage | -- | 3.0 | -- | 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,PA1<br>PC4<br>USBDP<br>USBDM<br>VPWR | -0.3 | 1.4 | V |
| $V_{IH}$ | High-Level Input Voltage | IOVDD = 3.0V | PA0,PA1<br>PC4<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** |
| \| $I_{OL}$ \| | Output Current | IOVDD = 3.0V<br>Voutput = 0.3V | PA0,PA1<br>PC4 | 2(HD=0)<br>6(HD=1)<br>20(HD=2)<br>24(HD=3) | | mA |
| | | IOVDD = 3.0V<br>Voutput = 0.3V | VPWR | 2 | | mA |
| | | IOVDD = 3.0V<br>Voutput = 0.3V | USBDP<br>USBDM | 8 | | mA |
| \| $I_{OH}$ \| | Output Current | IOVDD = 3.0V<br>Voutput = 2.7V | PA0,PA1<br>PC4 | 2(HD=0)<br>6(HD=1)<br>20(HD=2)<br>45(HD=3) | | mA |
| | | IOVDD = 3.0V<br>Voutput = 2.7V | VPWR | 2 | | mA |
| | | IOVDD = 3.0V | USBDP | 8 | | mA |

| | | | | | |
|---|---|---|---|---|---|
| | | Voutput = 2.7V | USBDM | | |
| **Internal Resistance Characteristics** | | | | | |
| **Symbol** | **Parameter** | **Conditions** | **IO** | **Typ** | **Unit** |
| $R_{pu}$ | Pull-up Resistance | IOVDD = 3.0V | PA0,PA1<br>PC4 | 10k | Ω |
| | | IOVDD = 3.0V | VPWR | 200k | Ω |
| | | IOVDD = 3.0V | USBDP | 1.5k | Ω |
| | | IOVDD = 3.0V | USBDM | 180k | Ω |
| $R_{pd}$ | Pull-down Resistance | IOVDD = 3.0V | PA0,PA1<br>PC4<br>VPWR | 10k | Ω |
| | | IOVDD = 3.0V | USBDP<br>USBDM | 15k | Ω |

**Note**

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

## 3.6 Audio ADC Characteristics

**Table 3-7 Audio ADC Characteristics**

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Resolution | -- | -- | 16 | -- | bit |
| Sample Rate | -- | 8 | -- | 48 | kHz |
| SNR | Single-ended input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 94 | -- | dB |
| Dynamic Range | Single-ended input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | 94 | -- | dB |
| THD+N | Single-ended input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | -- | -80 | -- | dB |
| Analogue Gain | -- | -6 | -- | 21 | dB |
| Max Input Level | Single-ended input Mode<br>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 | -- | 8 | 10 | dBm |
| Maximum RF Transmit Power | EDR Π/4 DQPSK<br>EDR 8DPSK | -- | 8 | -- | dBm |
| Relative Transmit Power | EDR Π/4 DQPSK<br>EDR 8DPSK | -- | -3 | -- | dB |
| Maximum RF Transmit Power | BLE-1Mbps | -- | 8 | -- | dBm |

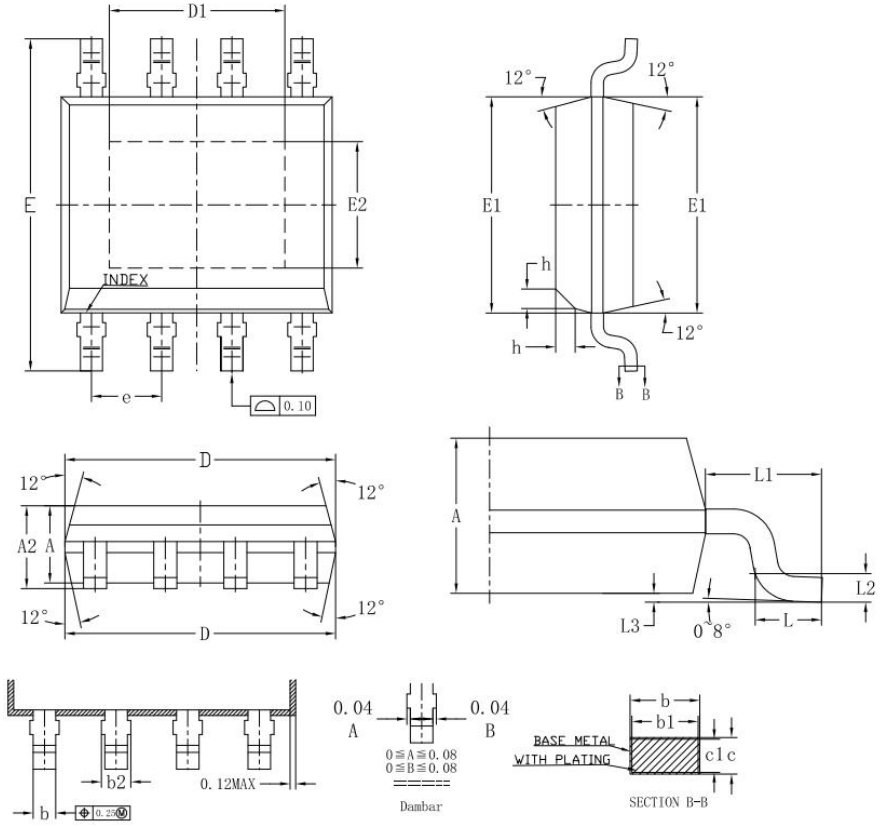
### 3.8.2 Receiver

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

| Parameter | Conditions | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| Sensitivity | BR | -- | -93 | -- | dBm |
| | EDR Π/4 DQPSK | -- | -92 | -- | dBm |
| | EDR 8DPSK | -- | -84 | -- | dBm |
| | BLE-1Mbps | -- | -96 | -- | dBm |
| | BLE-2Mbps | -- | -92 | -- | dBm |

# 4 Package Information

## 4.1 ESOP8




COMMON DIMENSIONS
(UNITS OF MEASURE=MILLIMETER)

| SYMBOL | MIN | NOM | MAX |
|---|---|---|---|
| A | 1.45 | 1.55 | 1.65 |
| A1 | 0.00 | – | 0.10 |
| A2 | 1.353 | 1.40 | 1.453 |
| A3 | 0.60 | 0.65 | 0.70 |
| b | 0.38 | – | 0.51 |
| b1 | 0.37 | 0.42 | 0.47 |
| b2 | – | – | 0.56 |
| c | 0.17 | – | 0.25 |
| c1 | 0.17 | 0.20 | 0.23 |
| D | 4.85 | 4.90 | 4.95 |
| D1 | 3.127REF | | |
| E | 5.85 | 6.00 | 6.20 |
| E1 | 3.85 | 3.90 | 3.95 |
| E2 | 2.283REF | | |
| e | 1.2450 | 1.27 | 1.30 |
| L | 0.45 | 0.60 | 0.75 |
| L1 | 1.040REF | | |
| L2 | 0.25BSC | | |
| L3 | — | 0.05 | 0.10 |
| h | 0.4REF | | |

**Figure 4-1 AC7068M Package**

# 5 IC Marking Information

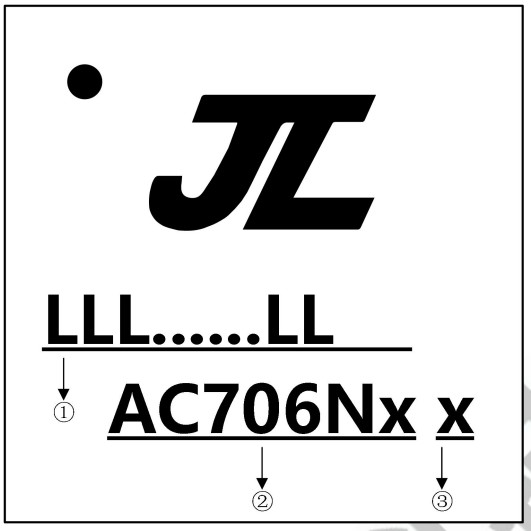



**Figure 5-1 AC7068M Package Outline**

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

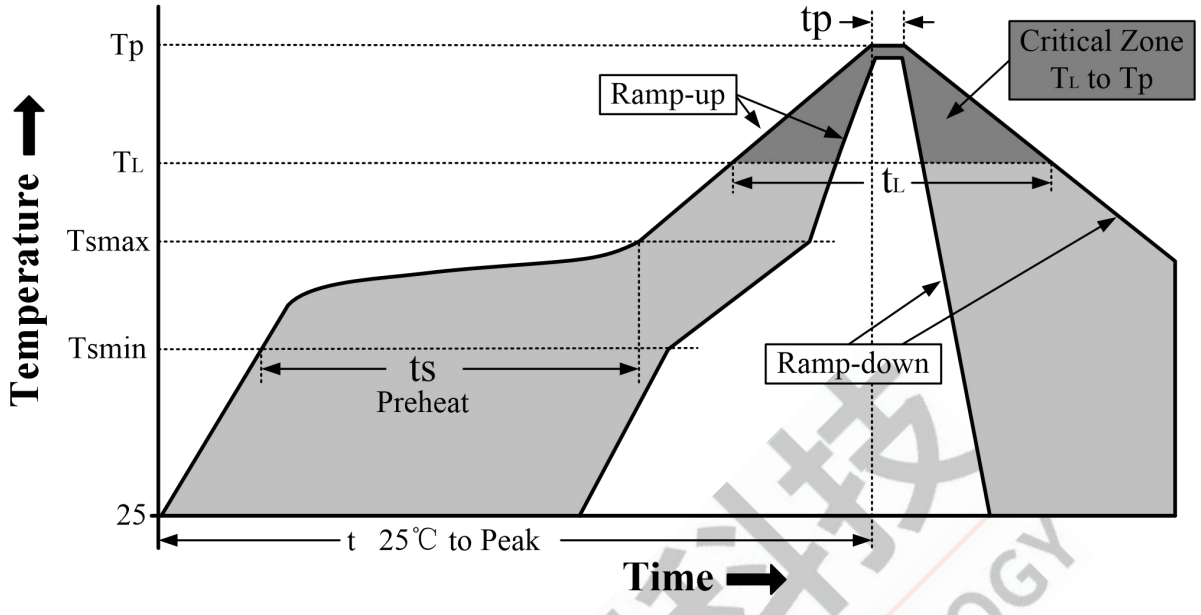



**Figure 6-1 Classification Reflow Profile**

**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 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℃ |

**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.**