

# **AC7065F Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version 2.0**

**Date 2025.01.16**

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## Revision History

| Date       | Revision | Description                                         |
|------------|----------|-----------------------------------------------------|
| 2024.06.07 | V1.0     | Initial Release                                     |
| 2024.07.30 | V1.1     | Update Pin Description<br>Update FM Characteristics |
| 2024.09.27 | V1.2     | Update Pin Description(Update FMIP&FMIN IO Type)    |
| 2025.01.16 | V2.0     | Update Features_Bluetooth<br>Update Block Diagram   |

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# AC7065F Features

## SYSTEM

- 32-bit Single-core DSP 192MHz
- With IEEE754 Single precision FPU
- Support FFT/MATRIX/MATH
- 1 x I-cache
- Support EMU
- On-chip SRAM 152kbyte
- 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
- Support spatial sound

## Audio

- 2 x 16bit DAC
  - ❖ SNR 108dB
  - ❖ Noise 6uVrms
  - ❖ Support differential mode
  - ❖ Support VCMO mode
  - ❖ Sampling rate 8~96kHz
- 1 x 16bit ADC
  - ❖ SNR 98dB
  - ❖ Sampling rate 8~48kHz
  - ❖ Support AMUX

## Bluetooth

- Dual-mode BT6.0 with LE Audio (DN Q332415)
- Support AoA/AoD
- Support LE audio BIS/CIS
- Support long range BLE
- Maximum transmitting power 10dBm

- Receiver sensitivity
  - ❖ -93dBm @BR
  - ❖ -92dBm @EDR  $\pi/4$  DQPSK
  - ❖ -85dBm @EDR 8DPSK

## FM

- Support Mono/Stereo
- Receiver sensitivity 6 dBuV

## Peripherals

- 1 x Full speed USB
- 1 x SD host controller
- 4 x Multi-function 16bit timer
- 2 x UART interface
- 1 x I<sup>2</sup>C Master/Slave interface
- 2 x SPI Master/Slave interface
- 1 x QDEC
- 4 x MCPWM
- 1 x 10bit ADC(11 Channel)
- 10 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

- SSOP24

## Temperature

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

## Applications

- Bluetooth Stereo Headphones

## 1 Block Diagram

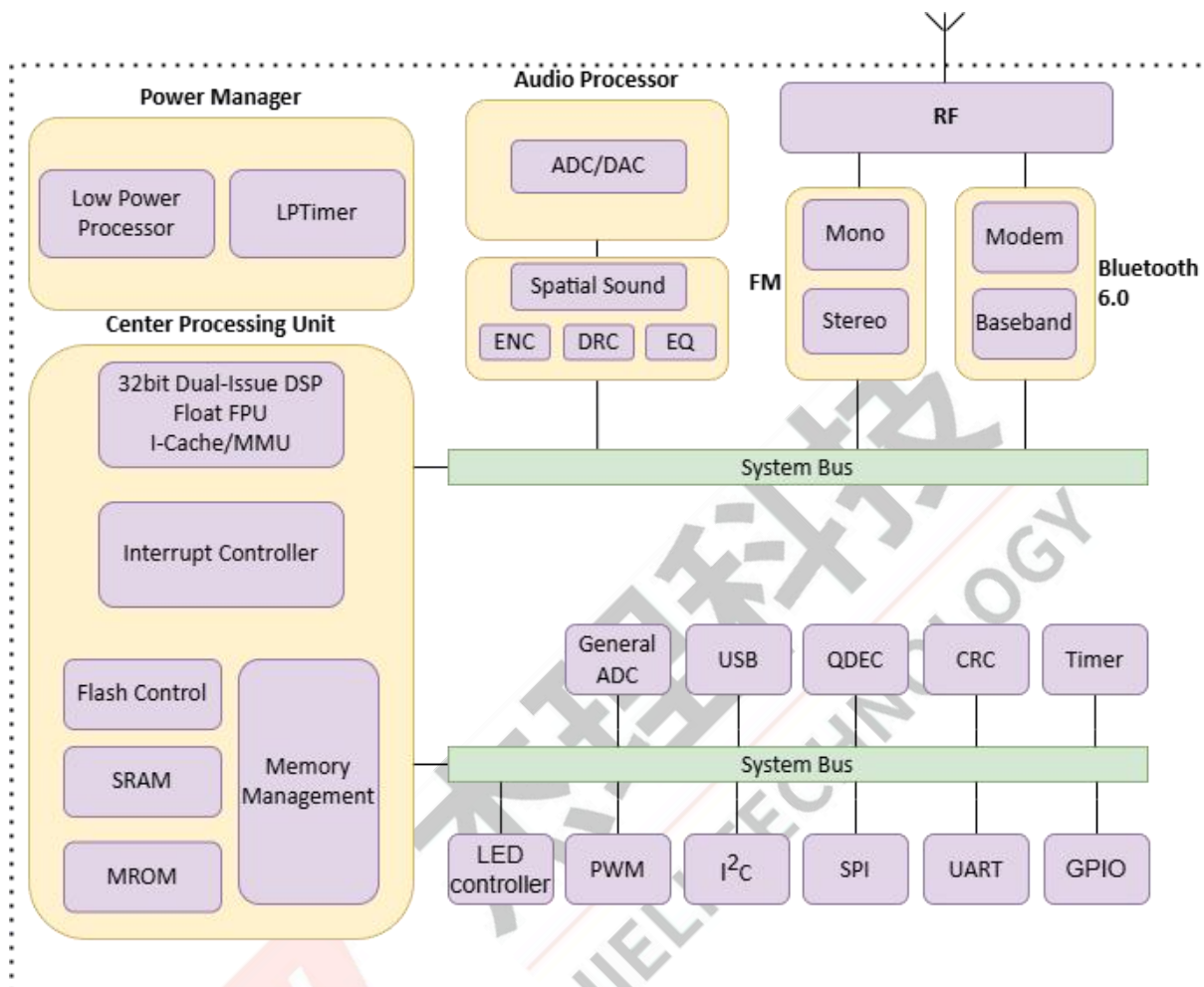


Figure 1-1 AC7065F Block Diagram

## 2 Pin Definition

### 2.1 Pin Assignment

|          |    |    |       |
|----------|----|----|-------|
| PC5      | 1  | 24 | XOSCO |
| PC4      | 2  | 23 | XOSCI |
| PC3      | 3  | 22 | VSS   |
| USBDM    | 4  | 21 | FMIP  |
| USBDP    | 5  | 20 | FMIN  |
| PA4      | 6  | 19 | BTRF  |
| PA1      | 7  | 18 | PB2   |
| PA0      | 8  | 17 | PB1   |
| AVSS     | 9  | 16 | IOVDD |
| DACR     | 10 | 15 | VBAT  |
| DACL     | 11 | 14 | VPWR  |
| VCMO/PB6 | 12 | 13 | PB5   |

Figure 2-1 AC7065F Pin Assignment

## 2.2 Pin Description

Table 2-2-1 AC7065F Pin Description

| Pin No. | Name  | Type | IO Initial State | Description                                                                                                   |
|---------|-------|------|------------------|---------------------------------------------------------------------------------------------------------------|
| 1       | PC5   | I/O  | Z                | ADC12(ADC Input Channel 12)<br>SPI1 DATA0(B)<br>I <sup>2</sup> C SDA(B)<br>TIMER1 CLK                         |
| 2       | PC4   | I/O  | Z                | ADC11(ADC Input Channel 11)<br>SPI1 CLK(B)<br>I <sup>2</sup> C SCL(B)<br>TIMER1 PWM                           |
| 3       | PC3   | I/O  | Z                | ADC10(ADC Input Channel 10)<br>SPI1 Data1(B)<br>SPI1 Data1(D)<br>UART0 TX(D)<br>UART0 RX(D)<br>TIMER2 Capture |
| 4       | USBDM | I/O  | 15kΩ Pull-down   | ADC14(ADC Input Channel 14)<br>USB Negative Data<br>SPI1 DATA0(D)<br>I <sup>2</sup> C SDA(A)                  |
| 5       | USBDP | I/O  | 15kΩ Pull-down   | ADC13(ADC Input Channel 13)<br>USB Positive Data<br>SPI1 CLK(D)<br>I <sup>2</sup> C SCL(A)                    |
| 6       | PA4   | I/O  | Z                | ADC3(ADC Input Channel 3)<br>AUX2(Audio ADC Input)<br>SPI1 DATA1(A)                                           |
| 7       | PA1   | I/O  | Z                | ADC1(ADC Input Channel 1)<br>MIC(Audio ADC Input)                                                             |
| 8       | PA0   | I/O  | Z                | ADC0(ADC Input Channel 0)<br>MICBIAS(MIC Bias Output)<br>Clockout0                                            |
| 9       | AVSS  | G    | --               | Audio Ground                                                                                                  |
| 10      | DACR  | O    | --               | Right Channel DAC Output                                                                                      |
| 11      | DACL  | O    | --               | Left Channel DAC Output                                                                                       |
| 12      | VCMO  | O    | --               | Audio Common-mode Output voltage                                                                              |

| Pin No. | Name  | Type | IO Initial State | Description                                                                                                               |
|---------|-------|------|------------------|---------------------------------------------------------------------------------------------------------------------------|
|         | PB6   | I/O  | Z                | ADC8(ADC Input Channel 8)<br>AUX0(Audio ADC Input)<br>SPI0 CLK(B)<br>SPI1 CLK(C)<br>I <sup>2</sup> C SCL(C)<br>TIMER3 CLK |
| 13      | PB5   | I/O  | Z                | ADC5(ADC Input Channel 5)<br>SD Power<br>SPI0 DATA1(B)<br>SPI1 DATA1(C)                                                   |
| 14      | VPWR  | I/O  | Z                | Charge Power Input<br>UART0 TX(C)<br>UART0 RX(C)<br>TIMER3 PWM<br>TIMER1 Capture                                          |
| 15      | VBAT  | P    | --               | Battery Input                                                                                                             |
| 16      | IOVDD | P    | --               | IO Power                                                                                                                  |
| 17      | PB1   | I/O  | 200kΩ Pull-up    | Hold down 0 to reset<br>UART0 RX(B)<br>TIMER2 CLK                                                                         |
| 18      | PB2   | I/O  | Z                | ADC6(ADC Input Channel 6)<br>TIMER0 Capture                                                                               |
| 19      | BTRF  | RF   | --               | Bluetooth RF Antenna                                                                                                      |
| 20      | FMIN  | RF   | --               | FM Negative Input                                                                                                         |
| 21      | FMIP  | RF   | --               | FM Positive Input                                                                                                         |
| 22      | VSS   | G    | --               | Ground                                                                                                                    |
| 23      | XOSCI | I    | --               | Crystal Oscillator Input                                                                                                  |
| 24      | XOSCO | O    | --               | Crystal Oscillator 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, UART0 functions also can be remapped to any I/O.

3.MCPWM, UART1, SD and QDEC 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 |
|------------------|-----------------------|------|------|------|
| T <sub>opt</sub> | Operating temperature | -20  | +85  | °C   |
| T <sub>stg</sub> | Storage temperature   | -65  | +150 | °C   |
| 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    |

##### 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 <sub>end</sub>   | End Of Charge Current    | 2         | --   | 30    | mA   |
| V <sub>Trikl</sub> | 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 <sub>IL</sub>        | Low-Level Input Voltage  | IOVDD = 3.0V                   | PA0,PA1,PA4<br>PB1,PB2,PB5,PB6<br>PC3~PC5<br>USBDP<br>USBDM<br>VPWR | -0.3                                       | 1.4 | V    |
| V <sub>IH</sub>        | High-Level Input Voltage | IOVDD = 3.0V                   | PA0,PA1,PA4<br>PB1,PB2,PB5,PB6<br>PC3~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 |
| I <sub>OL</sub>        | Output Current           | IOVDD = 3.0V<br>Voutput = 0.3V | PA0,PA1,PA4<br>PB1,PB2,PB5,PB6<br>PC3~PC5                           | 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 <sub>OH</sub>        | Output Current           | IOVDD = 3.0V<br>Voutput = 2.7V | PA0,PA1,PA4<br>PB1,PB2,PB5,PB6<br>PC3~PC5                           | 2(HD=0)<br>6(HD=1)<br>20(HD=2)<br>45(HD=3) |     | mA   |
|                        |                          | IOVDD = 3.0V                   | VPWR                                                                | 2                                          |     | mA   |

|                                            |                      | Voutput = 2.7V |                                                   |      |      |
|--------------------------------------------|----------------------|----------------|---------------------------------------------------|------|------|
|                                            |                      | IOVDD = 3.0V   | USBDP                                             | 8    | mA   |
|                                            |                      | Voutput = 2.7V | USBDM                                             |      |      |
| <b>Internal Resistance Characteristics</b> |                      |                |                                                   |      |      |
| Symbol                                     | Parameter            | Conditions     | IO                                                | Typ  | Unit |
| R <sub>pu</sub>                            | Pull-up Resistance   | IOVDD = 3.0V   | PA0,PA1,PA4<br>PB2,PB5,PB6<br>PC3~PC5             | 10k  | Ω    |
|                                            |                      | IOVDD = 3.0V   | PB1<br>VPWR                                       | 200k | Ω    |
|                                            |                      | IOVDD = 3.0V   | USBDP                                             | 1.5k | Ω    |
|                                            |                      | IOVDD = 3.0V   | USBDM                                             | 180k | Ω    |
| R <sub>pd</sub>                            | Pull-down Resistance | IOVDD = 3.0V   | PA0,PA1,PA4<br>PB1,PB2,PB5,PB6<br>PC3~PC5<br>VPWR | 10k  | Ω    |
|                                            |                      | IOVDD = 3.0V   | USBDP<br>USBDM                                    | 15k  | Ω    |

**Note**1.Internal pull-up/pull-down resistance accuracy  $\pm 20\%$ **3.6 Audio DAC Characteristics****Table 3-6 DAC Characteristics**

| Parameter        | Conditions                                                                                  | Min | Typ | Max | Unit |
|------------------|---------------------------------------------------------------------------------------------|-----|-----|-----|------|
| Resolution       | --                                                                                          | --  | 16  | --  | bit  |
| Sample Rate      | --                                                                                          | 8   | --  | 96  | kHz  |
| SNR <sup>①</sup> | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ | --  | 108 | --  | dB   |
|                  | VCMO Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ         | --  | 105 | --  | dB   |
|                  | Single-ended Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted              | --  | 97  | --  | dB   |

| Parameter             | Conditions                                                                                    | Min | Typ | Max | Unit  |
|-----------------------|-----------------------------------------------------------------------------------------------|-----|-----|-----|-------|
|                       | load=10kΩ                                                                                     |     |     |     |       |
| Dynamic Range         | Differential Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ | --  | 102 | --  | dB    |
|                       | VCMO Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ         | --  | 98  | --  | dB    |
|                       | Single-ended Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ | --  | 94  | --  | 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    |
|                       | VCMO Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=32Ω            | --  | -80 | --  | dB    |
|                       | Single-ended Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=32Ω    | --  | -80 | --  | dB    |
| Noise Floor           | Differential Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ                                   | --  | 13  | --  | uVrms |
|                       | VCMO Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ                                           | --  | 9   | --  | uVrms |
|                       | Single-ended Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=10kΩ                                   | --  | 16  | --  | uVrms |
| Noise Floor with MUTE | Differential Mode<br>B/W=20Hz~20kHz A-Weighted                                                | --  | 6   | --  | uVrms |

| Parameter        | Conditions                                                                                                       | Min | Typ  | Max | Unit       |
|------------------|------------------------------------------------------------------------------------------------------------------|-----|------|-----|------------|
|                  | load=10k $\Omega$                                                                                                |     |      |     |            |
|                  | VCMO Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=10k $\Omega$                                                      | --  | 5    | --  | $\mu$ Vrms |
|                  | Single-ended Mode<br>B/W=20Hz~20kHz A-Weighted<br>load=10k $\Omega$                                              | --  | 12   | --  | $\mu$ Vrms |
| Stereo Crosstalk | VCMO Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10k $\Omega$                      | --  | -120 | --  | dB         |
|                  | Single-ended Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=10k $\Omega$              | --  | -110 | --  | dB         |
| Max Output Power | Differential Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=16 $\Omega$<br>THD+N<0.1% | --  | 82   | --  | mW         |
|                  | VCMO Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=16 $\Omega$<br>THD+N<0.1%         | --  | 33   | --  | mW         |
|                  | Single-ended Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>load=16 $\Omega$<br>THD+N<0.1% | --  | 33   | --  | mW         |

**Note**

1. ① SNR 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      | --                                                                                                     | --  | 16  | --  | bit  |
| Sample Rate     | --                                                                                                     | 8   | --  | 48  | kHz  |
| SNR             | Differential input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB   | --  | 98  | --  | dB   |
|                 | 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   | Differential input Mode<br>Fin=1kHz@-60dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB | --  | 98  | --  | dB   |
|                 | 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           | Differential input Mode<br>Fin=1kHz@0dBFS<br>Fs=44.1kHz<br>B/W=20Hz~20kHz A-Weighted<br>ADC gain=0dB   | --  | -90 | --  | dB   |
|                 | 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 | Differential input Mode<br>ADC gain=0dB                                                                | --  | 2   | --  | Vrms |
|                 | 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 $\pi/4$ DQPSK<br>EDR 8DPSK | --  | 8   | --  | dBm  |
| Relative Transmit Power   | EDR $\pi/4$ 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 $\pi/4$ DQPSK | --  | -92 | --  | dBm  |
|             | EDR 8DPSK         | --  | -85 | --  | dBm  |
|             | BLE-1Mbps         | --  | -96 | --  | dBm  |
|             | BLE-2Mbps         | --  | -93 | --  | dBm  |

### 3.9 FM Characteristics

**Table 3-9 FM Characteristics**

| Parameter                 | Conditions   | Min | Typ | Max | Unit |
|---------------------------|--------------|-----|-----|-----|------|
| Frequency range           | --           | 64  | --  | 108 | MHz  |
| RF Mono sensitivity       | (S+N)/N=26dB | --  | 6   | --  | dBuV |
| Mono Audio SNDR           | --           | --  | 65  | --  | dB   |
| Stereo Audio SNDR         | --           | --  | 55  | --  | dB   |
| Stereo channel separation | --           | --  | 40  | --  | dB   |

**Note**

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

## 4 Package Information

### 4.1 SSOP24

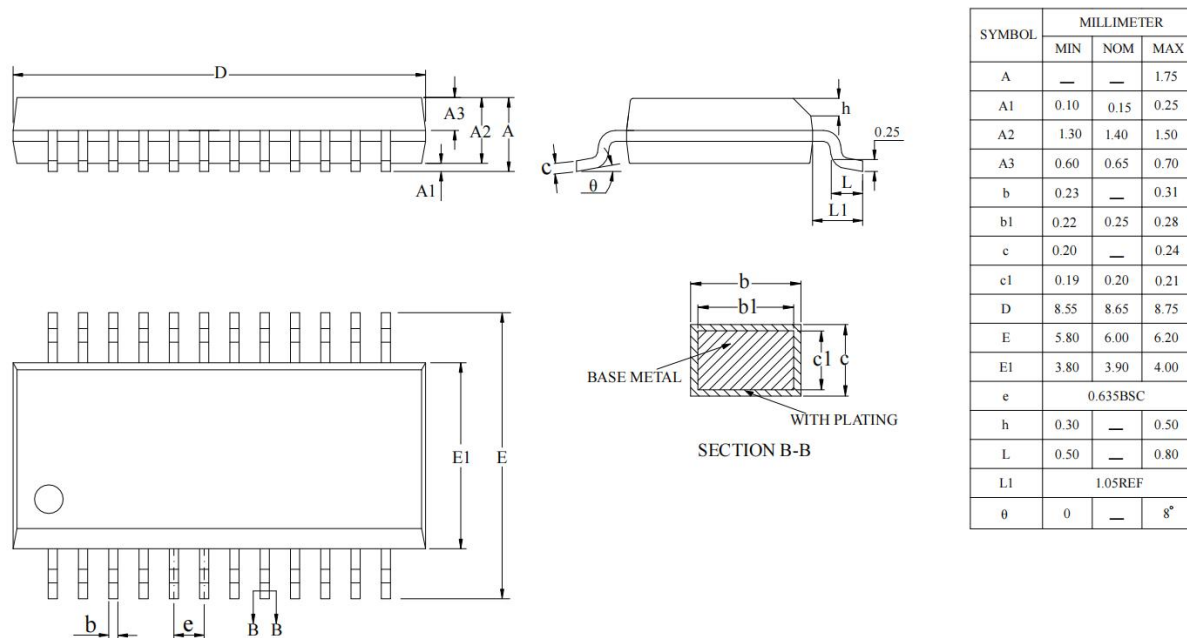


Figure 4-1 AC7065F Package

## 5 IC Marking Information

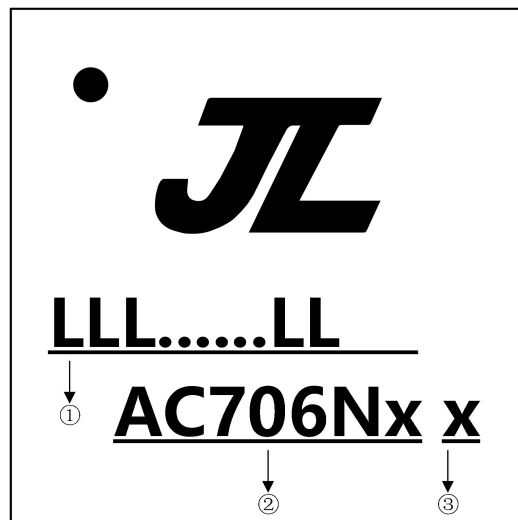


Figure 5-1 AC7065F Package Outline

- 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

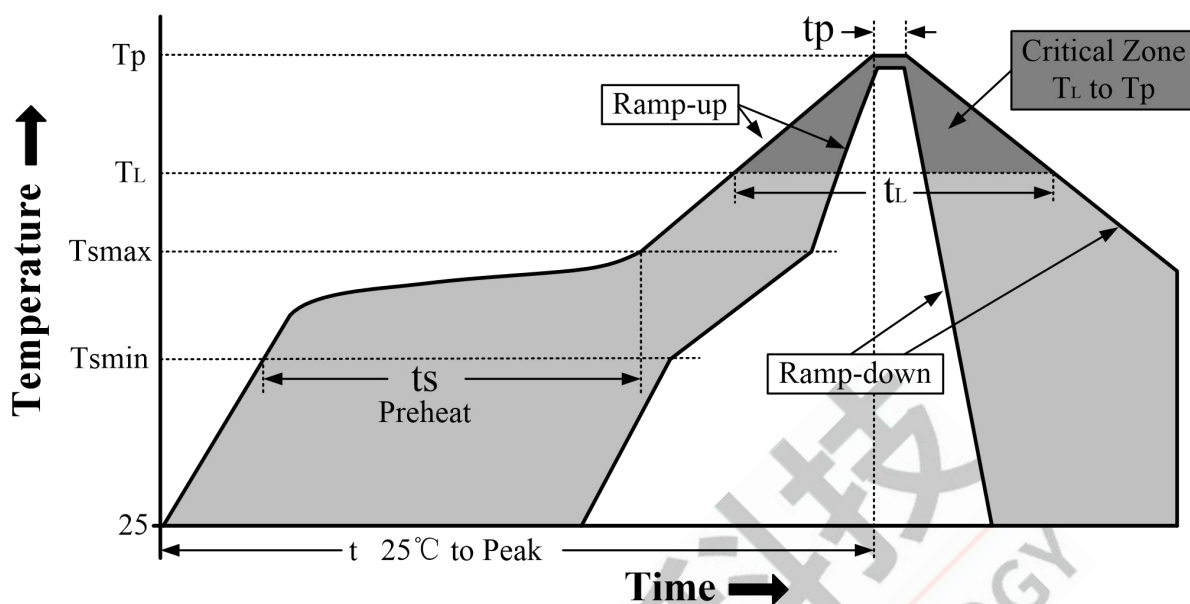


Figure 6-1 Classification Reflow Profile

Table 6-1 Classification Profiles

| Profile Feature                                                   |                                                  | Sn-Pb Eutectic Assembly | Pb-Free Assembly |
|-------------------------------------------------------------------|--------------------------------------------------|-------------------------|------------------|
| Preheat/Soak                                                      | Temperature Min ( $T_{smin}$ )                   | 100°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 ( $t_p$ ) <sup>2</sup> |                                                  | 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 <sup>3</sup><br>< 350 | Volume mm <sup>3</sup><br>≥ 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 <sup>3</sup><br>< 350 | Volume mm <sup>3</sup><br>350 - 2000 | Volume mm <sup>3</sup><br>> 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.