

# **AC7063M Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version 1.6**

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## Revision History

Date	Revision	Description
2023.06.29	V1.0	Initial Release
2023.07.31	V1.1	Update resource description
2023.09.16	V1.2	Update Features
2023.10.13	V1.3	Add IC Marking Information Update Absolute Maximum Ratings Update IO Input/Output Electrical Logical Characteristics Update BT_Features
2023.10.24	V1.4	Update Block Diagram
2023.11.03	V1.5	Update BT_Features Update IC Marking Information
2024.07.30	V1.6	Update Datasheet Format And Content

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# AC7063M Features

## SYSTEM

- 32-bit Single-core 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
- Support spatial sound

## Audio

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

## Bluetooth

- Dual-mode BT5.4 with LE Audio (QDID 222830)
- Support LE audio BIS/CIS
- Support long range BLE
- Maximum transmitting power 10dBm
- Receiver sensitivity
  - ❖ -93dBm @BR
  - ❖ -92dBm @EDR  $\pi/4$  DQPSK

- ❖ -86dBm @EDR 8DPSK

## Peripherals

- 1 x Full speed USB
- 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(7 Channel)
- 7 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

- QFN20(3mm\*3mm)

## 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

- Wireless microphone

# 1 Block Diagram

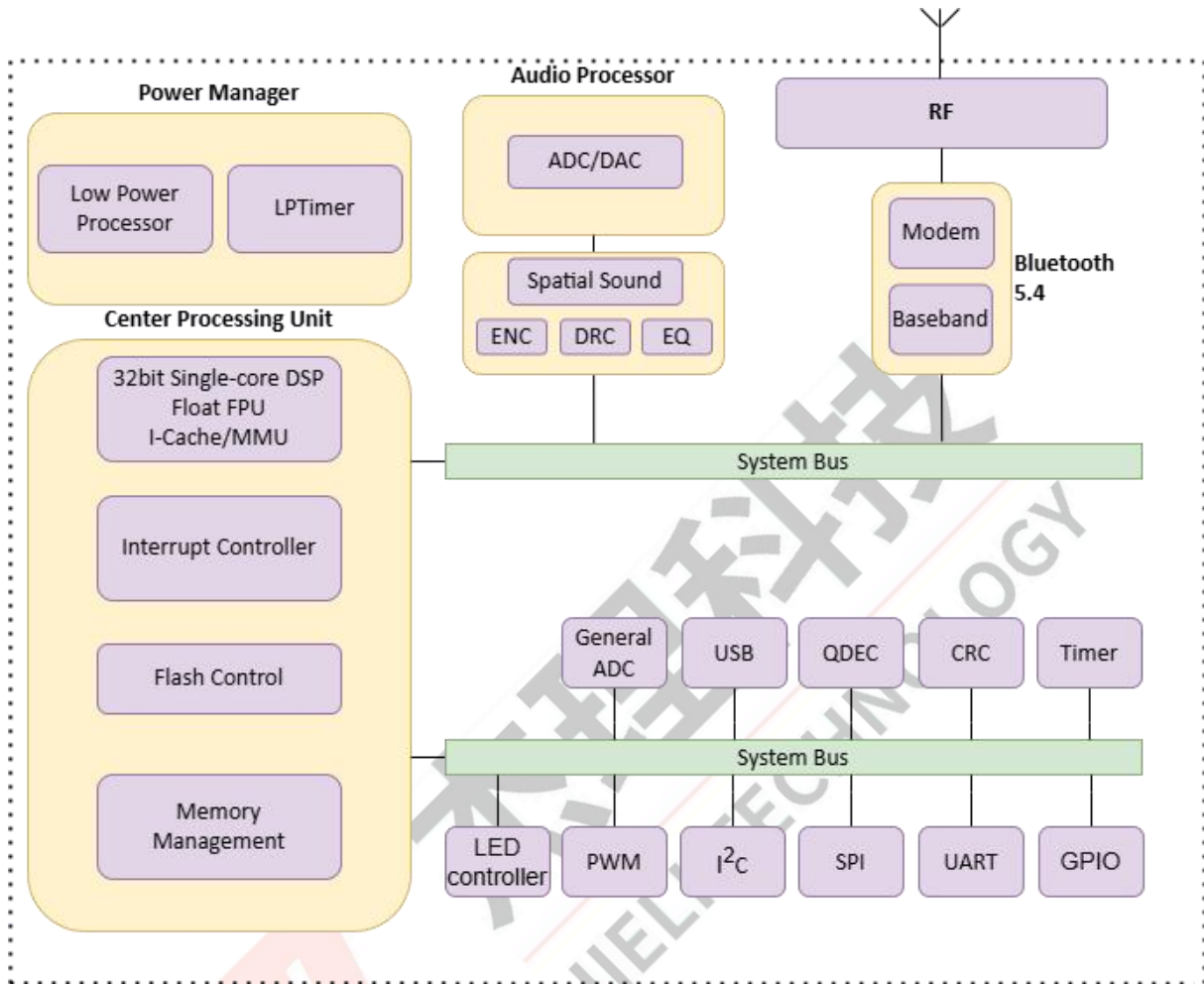


Figure 1-1 AC7063M Block Diagram

## 2 Pin Definition

### 2.1 Pin Assignment

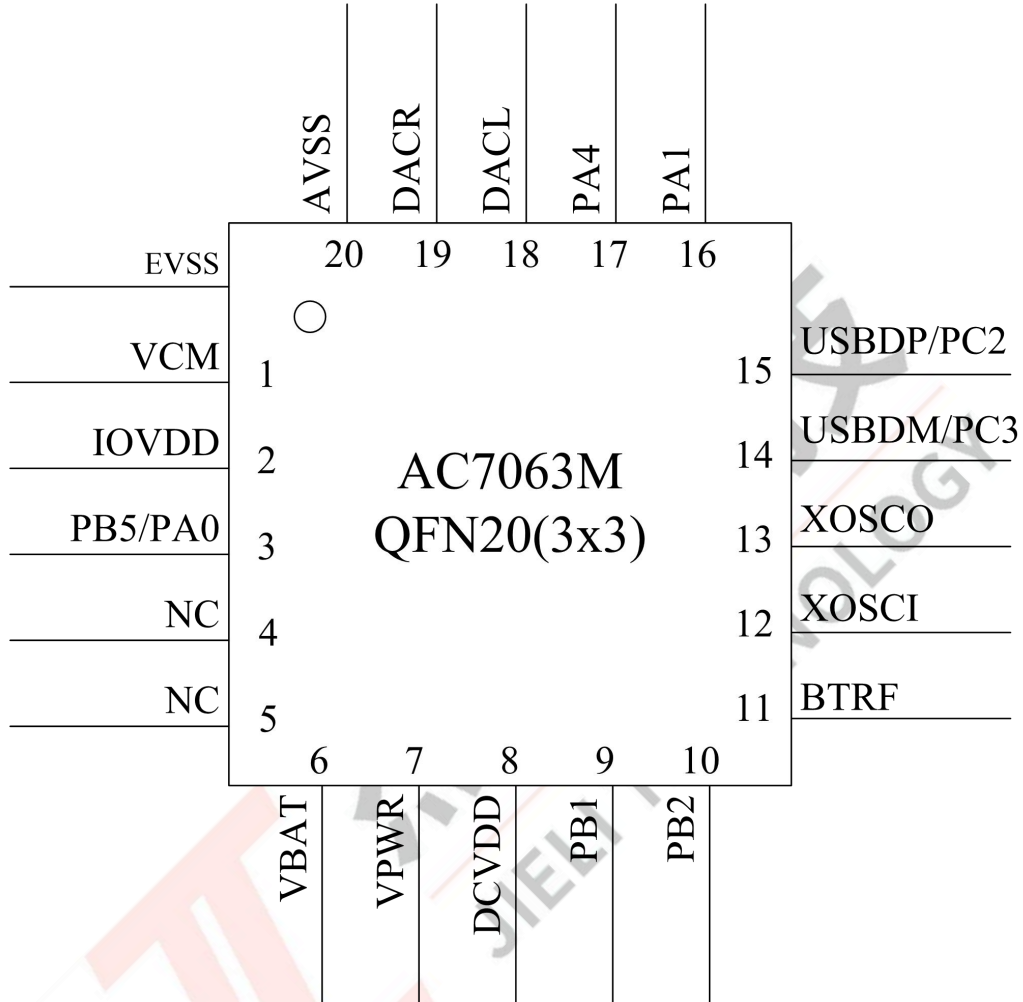


Figure 2-1 AC7063M Pin Assignment

## 2.2 Pin Description

Table 2-2-1 AC7063M Pin Description

Pin No.	Name	Type	IO Initial State	Description
1	VCM	P	--	Audio reference voltage
2	IOVDD	P	--	IO Power
3	PB5	I/O	Z	ADC5(ADC Input Channel 5) SD Power SPI0 DATA1(B) SPI1 DATA1(C)
	PA0	I/O	Z	ADC0(ADC Input Channel 0) MICBIAS(MIC Bias Output) I <sup>2</sup> S Data0(A) I <sup>2</sup> S Data0(B) Clockout0
4	NC	--	--	(No Connection)
5	NC	--	--	(No Connection)
6	VBAT	P	--	Battery Input
7	VPWR	I/O	Z	Charge Power Input UART0 TX(C) UART0 RX(C) TIMER3 PWM TIMER1 Capture
8	DCVDD	P	--	1.2V Power
9	PB1	I/O	200kΩ Pull-up	Hold down 0 to reset UART0 RX(B) TIMER2 CLK
10	PB2	I/O	Z	ADC6(ADC Input Channel 6) TIMER0 Capture
11	BTRF	RF	--	Bluetooth RF Antenna
12	XOSCI	I	--	Crystal Oscillator Input
13	XOSCO	O	--	Crystal Oscillator Output
14	USBDM	I/O	15kΩ Pull-down	ADC14(ADC Input Channel 14) USB Negative Data SPI1 DATA0(D) I <sup>2</sup> C SDA(A)
	PC3	I/O	Z	ADC10(ADC Input Channel 10) SPI1 Data1(B) SPI1 Data1(D) UART0 TX(D) UART0 RX(D) TIMER2 Capture

Pin No.	Name	Type	IO Initial State	Description
15	USBDP	I/O	15kΩ Pull-down	ADC13(ADC Input Channel 13) USB Positive Data SPI1 CLK(D) I <sup>2</sup> C SCL(A)
	PC2	I/O	Z	ADC15(ADC Input Channel 15) SPI1 DATA2(B) SPI1 DATA2(C) SPI1 DATA2(D) I <sup>2</sup> S MCLK(B)
16	PA1	I/O	Z	ADC1(ADC Input Channel 1) MIC(Audio ADC Input) I <sup>2</sup> S Data1(A)
17	PA4	I/O	Z	ADC3(ADC Input Channel 3) AUX2(Audio ADC Input) SPI1 DATA1(A) I <sup>2</sup> S LRCK(A) I <sup>2</sup> S Data3(B)
18	DACL	O	--	Left Channel DAC Output
19	DACR	O	--	Right Channel DAC Output
20	AVSS	G	--	Audio Ground

**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
Topt	Operating temperature	-20	+85	°C
Tstg	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
DCVDD		-0.3	1.5	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
<b>Operating mode</b>						
Symbol	Parameter	Conditions	Min	Typ	Max	Unit
IOVDD	Voltage output	--	--	3.0	--	V
	Loading current	IOVDD=3.0V@VBAT = 3.7V	--	--	250	mA
DCVDD	Voltage output	--	--	1.35	--	V
	Loading current	DCVDD=1.25V@IOVDD = 3V	--	--	50	mA
<b>Low Power mode</b>						
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>Trickl</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 PB1,PB2,PB5 PC2,PC3 USBDP USBDM VPWR	-0.3	1.4	V
V <sub>IH</sub>	High-Level Input Voltage	IOVDD = 3.0V	PA0,PA1,PA4 PB1,PB2,PB5 PC2,PC3 USBDP 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 Voutput = 0.3V	PA0,PA1,PA4 PB1,PB2,PB5 PC2,PC3	2(HD=0) 6(HD=1) 20(HD=2) 24(HD=3)	mA	
		IOVDD = 3.0V Voutput = 0.3V	VPWR	2	mA	
		IOVDD = 3.0V Voutput = 0.3V	USBDP USBDM	8	mA	
I <sub>OH</sub>	Output Current	IOVDD = 3.0V Voutput = 2.7V	PA0,PA1,PA4 PB1,PB2,PB5 PC2,PC3	2(HD=0) 6(HD=1) 20(HD=2) 45(HD=3)	mA	
		IOVDD = 3.0V	VPWR	2	mA	

		Voutput = 2.7V			
		IOVDD = 3.0V	USB DP	8	mA
		Voutput = 2.7V	USB DM		
Internal Resistance Characteristics					
Symbol	Parameter	Conditions	IO	Typ	Unit
R <sub>pu</sub>	Pull-up Resistance	IOVDD = 3.0V	PA0,PA1,PA4	10k	Ω
			PB2,PB5		
			PC2,PC3		
		IOVDD = 3.0V	PB1	200k	Ω
IOVDD = 3.0V	VPWR				
IOVDD = 3.0V	USB DP	1.5k	Ω		
IOVDD = 3.0V	USB DM	180k	Ω		
R <sub>pd</sub>	Pull-down Resistance	IOVDD = 3.0V	PA0,PA1,PA4	10k	Ω
			PB1,PB2,PB5		
		IOVDD = 3.0V	PC2,PC3		
		IOVDD = 3.0V	VPWR		
		IOVDD = 3.0V	USB DP	15k	Ω
		IOVDD = 3.0V	USB DM		

**Note**

1.Internal pull-up/pull-down resistance accuracy ±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 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	--	107	--	dB
Dynamic Range	Differential Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	102	--	dB

Parameter	Conditions	Min	Typ	Max	Unit
	Single-ended Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	100	--	dB
THD+N	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=32Ω	--	-85	--	dB
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=32Ω	--	-80	--	dB
Noise Floor	Differential Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	12	--	uVrms
	Single-ended Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	8	--	uVrms
Noise Floor with MUTE	Differential Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	6	--	uVrms
	Single-ended Mode B/W=20Hz~20kHz A-Weighted load=10kΩ	--	4	--	uVrms
Stereo Crosstalk	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=10kΩ	--	-110	--	dB
Max Output Power	Differential Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted load=16Ω THD+N < 0.1%	--	82	--	mW
	Single-ended Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted	--	33	--	mW

Parameter	Conditions	Min	Typ	Max	Unit
	load=16Ω THD+N<0.1%				

**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	--	--	16	--	bit
Sample Rate	--	8	--	48	kHz
SNR	Differential input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	98	--	dB
	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	97	--	dB
Dynamic Range	Differential input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	98	--	dB
	Single-ended input Mode Fin=1kHz@-60dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	97	--	dB
THD+N	Differential input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	-90	--	dB
	Single-ended input Mode Fin=1kHz@0dBFS Fs=44.1kHz B/W=20Hz~20kHz A-Weighted ADC gain=0dB	--	-80	--	dB
Analogue Gain	--	-6	--	21	dB

Parameter	Conditions	Min	Typ	Max	Unit
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	--	8	10	dBm
Maximum RF Transmit Power	EDR $\pi/4$ DQPSK EDR 8DPSK	--	8	--	dBm
Relative Transmit Power	EDR $\pi/4$ DQPSK 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	--	-86	--	dBm
	BLE-1Mbps	--	-96	--	dBm
	BLE-2Mbps	--	-93	--	dBm

## 4 Package Information

### 4.1 QFN20\_3×3mm

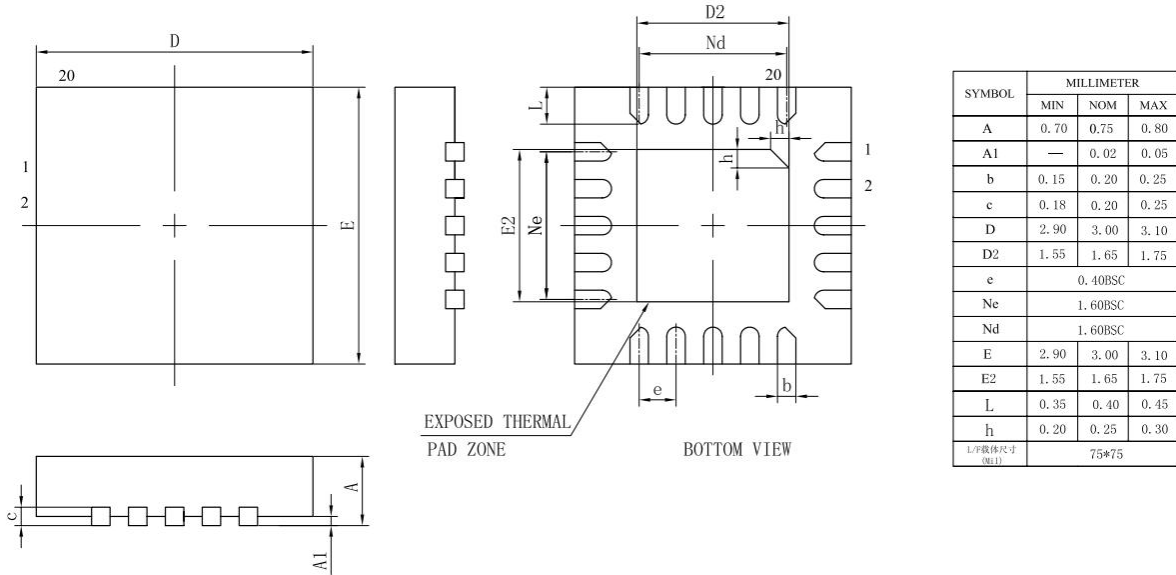


Figure 4-1 AC7063M Package

## 5 IC Marking Information

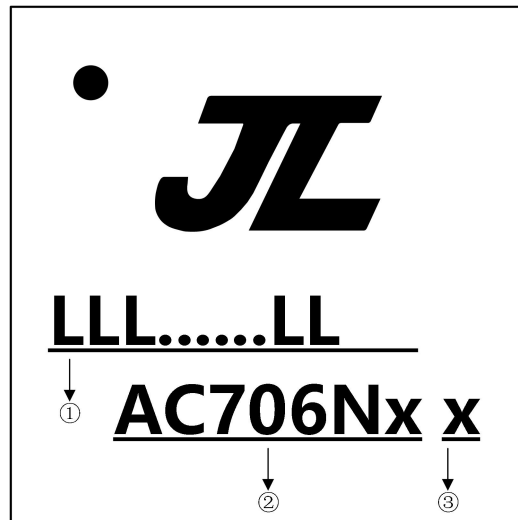


Figure 5-1 AC7063M Package Outline

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

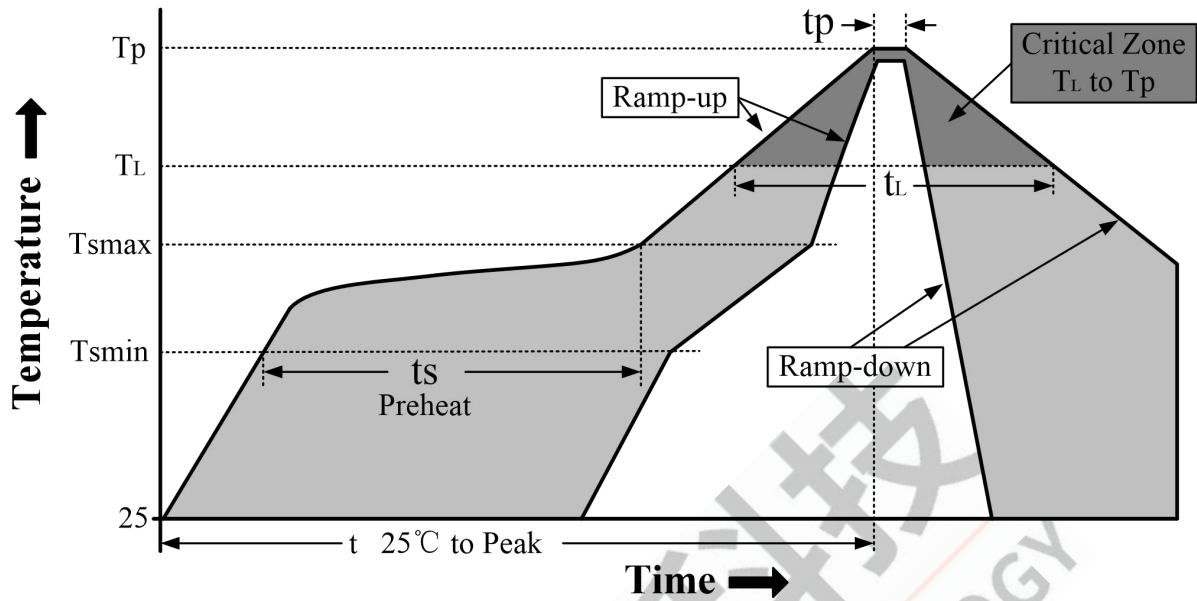


Figure 6-1 Classification Reflow Profile

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>	Volume mm <sup>3</sup>
	< 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 <sup>3</sup> < 350	Volume mm <sup>3</sup> 350 - 2000	Volume mm <sup>3</sup> > 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.