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# **AC8973D8 Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version: 2.1**

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# AC8973D8 Features

## CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 160MHz programmable processor
- 64Vectored interrupts
- 4 Levels interrupt priority

## DSP Audio Processing

- SBC, AAC Audio decodes supported for BT audio
- mSBC voice codec supported for BT phone
- Supports MP2, MP3, WMA, APE, FLAC, AAC, MP4, M4A, WAV, AIF, AIFC audio decoding
- Packet Loss Concealment (PLC) for voice processing
- Acoustic echo cancellation/suppression (AEC,AES)
- Single/Dual MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 20-band EQ configuration for voice Effects

## Audio Codec

- Two channels 24-bit DAC, SNR >= 101dB
- Two channels 24-bit ADC , SNR >= 92dB
- Sampling rates of 8KHz/11.025KHz/16KHz/22.05KHz/24KHz/32KHz/44.1KHz/48KHz are supported
- One analog MIC amplifier, build-in MIC bias generator
- Supports two PDM digital MIC inputs
- One channel Stereo analog MUX
- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

## Bluetooth

- Compliant with Bluetooth

V5.1+BR+EDR+BLE specification

- Meet class1 class2 and class3 transmitting power requirement
- Support GFSK and  $\pi/4$  DQPSK all packet types
- Provides amaximum+8dbm transmitting power
- receiver with -94dBm sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gap gatt\rfcomm\sdp\l2cap profile
- a2dp 1.3\avctp 1.4\avdtp 1.3\ avrcp 1.5\ hfp 1.5 \spp 1.0\rfcomm 1.2\pnp 1.3\ hid 1.0\sdp core4.2\l2cap core 4.2

## Peripherals

- One full speed USB 2.0 OTG controller
- Six multi-function 32-bit timers, support capture and PWM mode
- Three full-duplex basic UART, support DMA mode
- One hardware IIC interface supports host and device mode
- Two Built-in low power Cap Sense Keys
- Built-in Cap Sense Key controller
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs

## PMU

- Low voltage LDO and DC-DC for internal digital and analog circuit supply
- 2uA current consumption in the soft-off mode
- Built-in LDO and DC-DC for the core, I/O, Bluetooth and flash
- VBAT is 2.2V to 4.5V
- VDDIO is 2.2V to 3.4V

## Packages

- QFN20(3mm\*3mm)

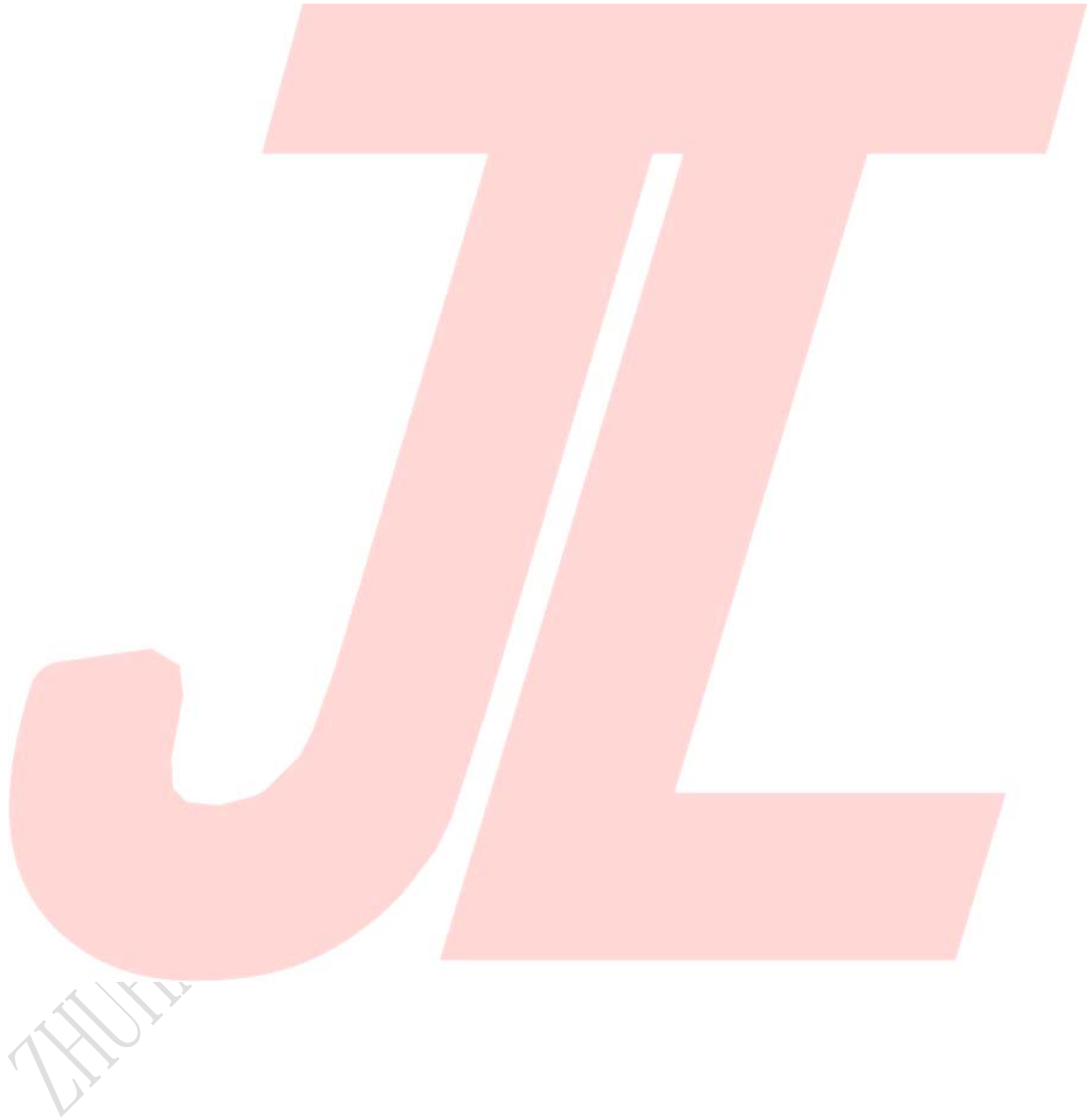
● Storage temperature: -65°C to +150°C

### Temperature

● Operating temperature: -40°C to +85°C

### Applications

● Bluetooth TWS Headset



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# 1、 Pin Definition

## 1.1 Pin Assignment

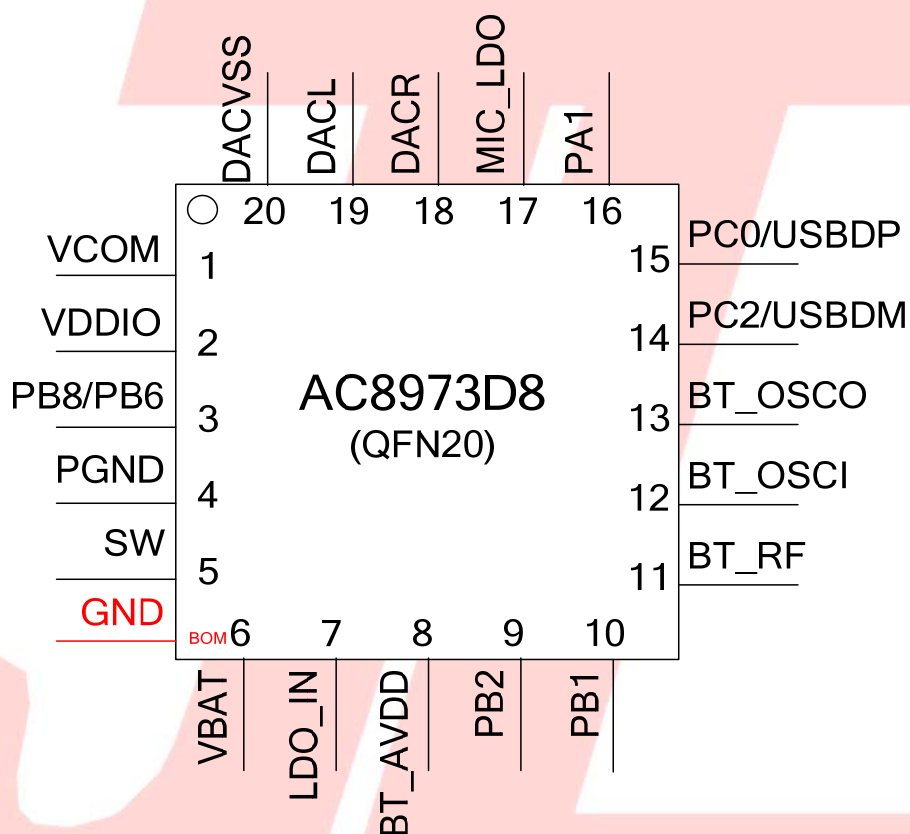


Figure 1-1 AC8973D8 Package Diagram

## 1.2 Pin Description

**Table 1-1 AC8973D8 Pin Description**

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	VCOM	P	/		DAC reference voltage
2	VDDIO	P	/		IO Power 3.3v
3	PB8	I/O	8/24	GPIO	MIC1: MIC1 Input Channel; UART0RXB: Uart0 Data Input(B); CAP4: Timer4 Capture;
	PB6	I/O	8/24	GPIO	UART1RXA: Uart1 Data Input(A); PWM2: Timer2 PWM Output; ADC9: ADC Input Channel 9; Touch7: Touch Input Channel 7;
4	PGND	P	/		DCDC Ground
5	SW	P	/	DCDC output	DCDC switch output, connected to inductor
6	VBAT	P	/		connect to battery
7	LDO_IN	P	/		Charge Power Input; UART0TXC: Uart0 Data Output(C); UART0RXC: Uart0 Data Input(C); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture;
8	BT_AVDD	P	/		BT Power
9	PB2	I/O	8/24	GPIO	UART2RXC: Uart2 Data Input(C); SPI2DOC: SPI2 Data Out(C); CAP5: Timer5 Capture; ADC7: ADC Input Channel 7; LP_TH1: Low Power Touch Channel 1
10	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset; SPI2CLKC: SPI2 Clk(C); UART2TXC: Uart2 Data Output(C) ADC6: ADC Input Channel 6; LP_TH0: Low Power Touch Channel 0
11	BT_RF	/	/		BT Antenna
12	BT_OSCI	I	/		BTOSC In
13	BT_OSCO	O	/		BTOSC Out
14	PC2	I/O	8/24		IIC_SCL_C: IIC SCL(C); UART0TXD: Uart0 Data Output(D); TMR1: Timer1 Clock Input;

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	USBDM	I/O	4	USB Negative Data	UART1RXD: Uart1 Data Input(D); IIC_SDA_A: IIC SDA(A); ADC11: ADC Input Channel 11;
15	USBDP	I/O	4	USB Positive Data	UART1TXD: Uart1 Data Output(D); IIC_SCL_A: IIC SCL(A); ADC10: ADC Input Channel 10;
	PC0	I/O	8	GPIO	UART1TXB: Uart1 Data Output(B);
16	PA1	I/O	8/24	GPIO	MIC0: MIC0 Input Channel ; PWM0: Timer0 PWM Output; UART1TXC: Uart1 Data Output(C);
17	MIC_LDO	P	/		MIC Power
18	DACR	O	/		DAC Right Channel
19	DACL	O	/		DAC Left Channel
20	DACVSS	P	/		Analog Ground

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## 2、Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Table 2-1

Symbol	Parameter	Min	Max	Unit
Tamb	Ambient Temperature	-40	+85	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	4.5	V
LDO_IN	Charger Voltage	-0.3	6	V
V <sub>3.3IO</sub>	3.3V IO Input Voltage	-0.3	3.6	V

Note : The chip can be damaged by any stress in excess of the absolute maximum ratings listed below

### 2.2 PMU Characteristics

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	4.2	V	
LDO_IN	Charger supply Voltage	4.5	5.0	5.5	V	
Normal mode						
VDDIO	Voltage output	—	3.0	—	V	VBAT = 4.2V, 10mA loading
	Loading current	—	—	100	mA	VDDIO=3V@VBAT = 4.2V
BT_AVDD	Voltage output	—	1.3	—	V	VDDIO=3.0V, 10mA loading
	Loading current	—	—	60	mA	BT_AVDD=1.25V@VDDIO=3.0v
LP mode						
VDDIO	Loading current			5	mA	VDDIO=3V@VBAT = 4.2V

### 2.3 Battery Charge

Table 2-3

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
LDO_IN	Charge Input Voltage	4.5	5	5.5	V	—
V <sub>Charge</sub>	Charge Voltage	4.15	4.2	4.25	V	—
I <sub>Charge</sub>	Charge Current	20		200	mA	Charge current at fast charge mode

$I_{Trikl}$	Trickle Charge Current	20	45	70	mA	$V_{BAT} < V_{Trikl}$
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## 2.4 IO Input/Output Electrical Logical Characteristics

Table 2-4

IO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
$V_{IL}$	Low-Level Input Voltage	-0.3	—	$0.3 * V_{DDIO}$	V	$V_{DDIO} = 3.3V$
$V_{IH}$	High-Level Input Voltage	$0.7 * V_{DDIO}$	—	$V_{DDIO} + 0.3$	V	$V_{DDIO} = 3.3V$
IO output characteristics						
$V_{OL}$	Low-Level Output Voltage	—	—	0.33	V	$V_{DDIO} = 3.3V$
$V_{OH}$	High-Level Output Voltage	2.7	—	—	V	$V_{DDIO} = 3.3V$

## 2.5 Internal Resistor Characteristics

Table 2-5

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA1, PB1,PB2, PB6,PB8, PC2	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、internal pull-up/pull-down resistance   accuracy $\pm 20\%$
PC0	8mA	-	10K	10K	
USBDP	4mA	—	1.5K	15K	
USBDM	4mA	—	180K	15K	

## 2.6 DAC Characteristics

Table 2-6

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	—	20K	Hz	1KHz/0dB 10Kohm loading With A-Weighted Filter
THD+N	—	-80	—	dB	
S/N	—	101	—	dB	
Crosstalk	—	-80	—	dB	
Output Swing		0.45		Vrms	1KHz/-60dB 10Kohm loading
Dynamic Range		90		dB	

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					With A-Weighted Filter
DAC Output Power	—	4	—	mW	32ohm loading

## 2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		80		dB	1KHz/-60dB
S/N	—	92	—	dB	1KHz/-60dB
THD+N	—	-75	—	dB	
Crosstalk	—	-80	—	dB	

## 2.8 BT Characteristics

### 2.8.1 Transmitter

#### Basic Data Rate

Table 2-8

Parameter	Min	Typ	Max	Unit	Test Conditions
RF Transmit Power		6	8	dBm	25℃, Power Supply VBAT=5V 2441MHz
RF Power Control Range		20		dB	
20dB Bandwidth		950		KHz	
Adjacent Channel	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

#### Enhanced Data Rate

Table 2-9

Parameter	Min	Typ	Max	Unit	Test Conditions
Relative Power		-1		dB	25℃, Power Supply VBAT=5V 2441MHz
$\pi/4$ DQPSK Modulation Accuracy	DEVM RMS	6		%	
	DEVM 99%	10		%	
	DEVM Peak	15		%	
Adjacent Channel Transmit Power	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

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## 2.8.2 Receiver

### Basic Data Rate

Table 2-10

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

### Enhanced Data Rate

Table 2-11

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

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### 3、 Package Information

#### 3.1 QFN20\_3.0x3.0

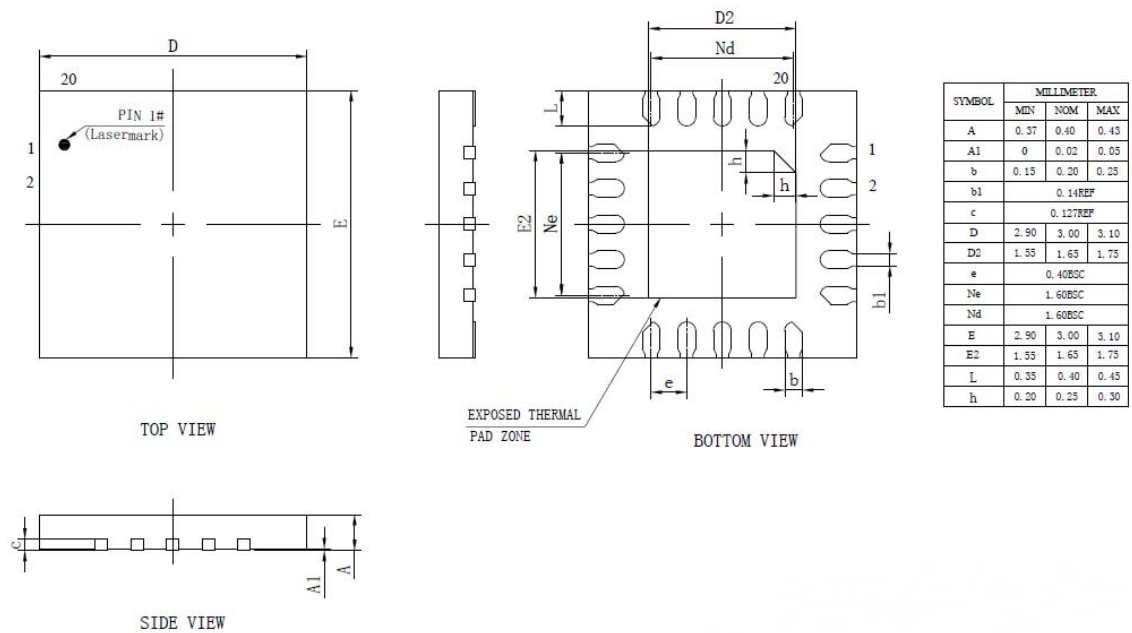


Figure 3-1 AC8973D8 Package

## 4、Revision History

Date	Revision	Description
2020.08.18	V2.0	Initial Release
2020.10.12	V2.1	Update PMU characteristics Add Bluetooth profiles version number

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