AC8972A8 Datasheet

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AC8972A8 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 codecs 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 analog MIC, Dual digital 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 π/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

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 GPIO

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

- QFN22(3mm*2.5mm)

Temperature

- Operating temperature: -40℃ to +85℃

- Storage temperature: -65℃ to +150℃

Applications

- Bluetooth TWS headset

1、Pin Definition

1.1 Pin Assignment

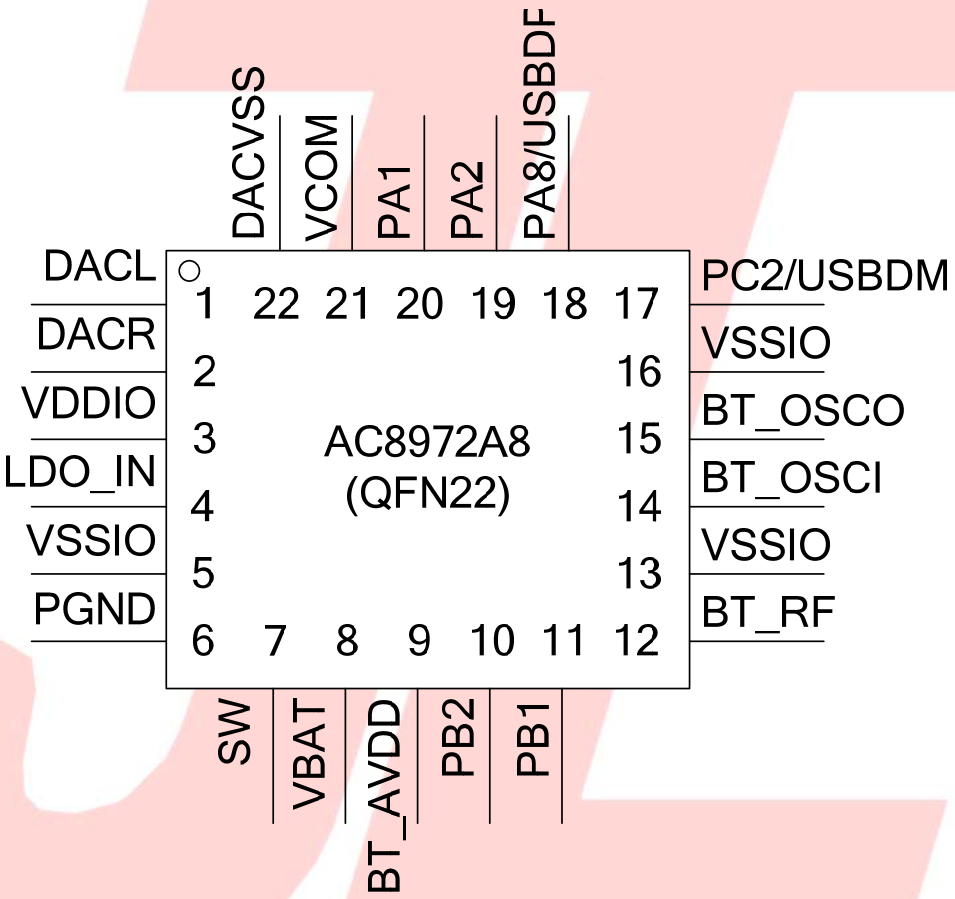


Figure 1-1 AC8972A8 Package Diagram

1.2 Pin Description

Table 1-1 AC8972A8 Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	DACL	O	/		DAC Left Channel
2	DACR	O	/		DAC Right Channel
3	VDDIO	P	/		IO Power 3.3v
4	LDO_IN	P	/		Charge Power 5v
5	VSSIO	P	/		Ground
6	PGND	P	/		DCDC Ground
7	SW	P	/		DC-DC switch output, connected to inductor
8	VBAT	P	/		LDO Power,connect
9	BT_AVDD	P	/		BT Power
10	PB2	I/O	8/24	GPIO	UART2RXC：Uart2 Data Input(C); CAP5：Timer5 Capture; ADC7：ADC Input Channel 7； LP_TH1：Low Power Touch Channel 1
11	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset； UART2TXC：Uart2 Data Output(C) ADC6：ADC Input Channel 6； LP_TH0：Low Power Touch Channel 0
12	BT_RF	/	/		BT Antenna
13	VSSIO	P	/		Ground
14	BT_OSCI	I	/		BTOSC In
15	BT_OSCO	O	/		BTOSC Out
16	VSSIO	P	/		Ground
17	PC2	I/O	8/24	GPIO	UART0TXD：Uart0 Data Output(D)； TMR1：Timer1 Clock Input;
	USBDM	I/O	4	USB Negative Data	UART1RXD：Uart1 Data Input(D)； IIC_SDA_A：IIC SDA(A)； ADC11：ADC Input Channel 11；
18	USBDP	I/O	4	USB Positive Data	UART1TXD：Uart1 Data Output(D)； IIC_SCL_A：IIC SCL(A)； ADC10：ADC Input Channel 10；
	PA8	I/O	8/24	GPIO	UART2RXB：Uart2 Data Input(B)； ADC3：ADC Input Channel 3； Touch5：Touch Input Channel 5;

19	PA2	I/O	8/24	GPIO	MIC_BIAS0：MIC0 Bias Output； MIC0_N：Different MIC0 Negative CAP3：Timer3 Capture； UART1RXC：Uart1 Data In(C)；
20	PA1	I/O	8/24	GPIO	MIC0：MIC0 Input Channel ; MIC0_P：Different MIC0 Positive PWM0：Timer0 PWM Output； UART1TXC：Uart1 Data Output(C)；
21	VCOM	P	/		DAC reference voltage
22	DACVSS	P	/		Ground

2、Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

Symbol	Parameter	Min	Max	Unit
Topt	Operating temperature	-40	+85	℃
Tstg	Storage temperature	-65	+150	℃
VBAT	Supply Voltage	-0.3	4.5	V
LDO_IN	Charger Voltage	-0.3	6	V
$V_{3.3IO}$	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 Recommended Operating Conditions

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	4.5	V	
LDO_IN	Charger Voltage	4.5	5.0	5.5	V	
$V_{3.3}$	Voltage output	2.2	3.0	3.4	V	VBAT = 4.2V, 100mA loading
V_{BT_AVDD}	Voltage output	1.2	1.25	1.35	V	VBAT=4.2V, 100mA loading
$I_{L3.3}$	Loading current	_	_	150	mA	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_{Charge}	Charge Voltage	4.15	4.2	4.25	V	_
I_{Charge}	Charge Current	20		200	mA	Charge current at fast charge mode
I_{Trikl}	Trickle Charge Current	20	45	70	mA	$V_{BAT}<V_{Trikl}$

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* VDDIO	V	VDDIO = 3.3V
V_{IH}	High-Level Input Voltage	0.7* VDDIO	_	VDDIO+0.3	V	VDDIO = 3.3V
IO output characteristics						
V_{OL}	Low-Level Output Voltage	_	_	0.33	V	VDDIO = 3.3V
V_{OH}	High-Level Output Voltage	2.7	_	_	V	VDDIO = 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,PA2 PC2 PB1 ,PB2 PA8	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、internal pull-up/pull-down resistance | accuracy ±20%
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	
THD+N	_	-80	_	dB	1KHz/0dB
S/N	_	101	_	dB	10Kohm loading
Crosstalk	_	-80	_	dB	With A-Weighted Filter
Output Swing		0.45		Vrms	
Dynamic Range		90		dB	1KHz/-60dB 10Kohm loading 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	93	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 Transmit Power	+2MHz		-40		dBm	
	-2MHz		-38		dBm	
	+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
π/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	

2.8.2 Receiver

Basic Data Rate **Table 2-10**

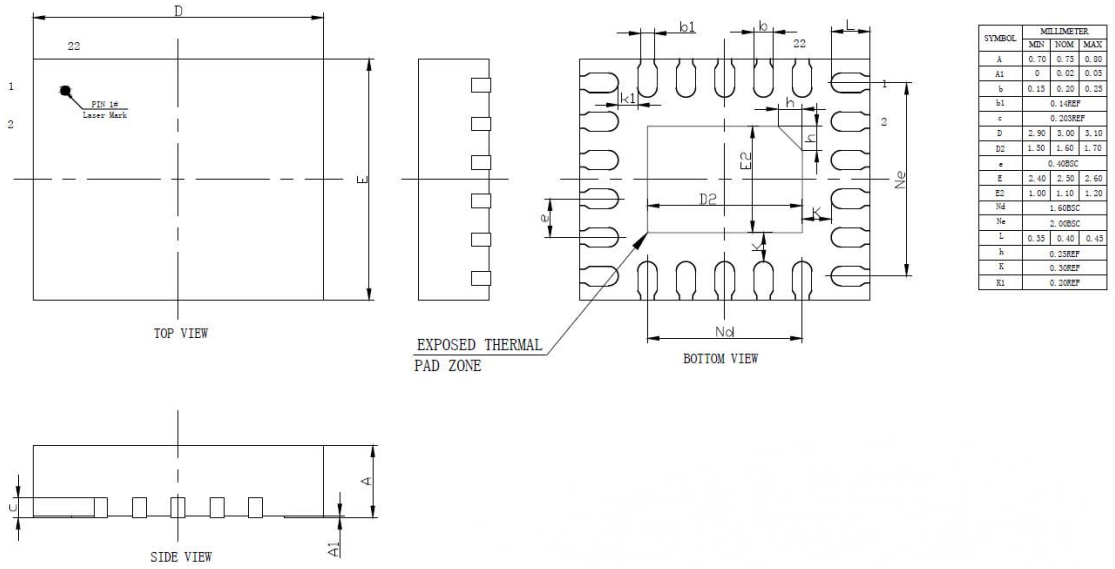
Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25℃, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

Enhanced Data Rate **Table 2-11**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-94		dBm	25℃, 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	

3、 Package Information

3.1 QFN22_3.0x2.5



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
b1	0.14REF		
c	0.203REF		
D	2.90	3.00	3.10
D2	1.50	1.60	1.70
e	0.40BSC		
E	2.40	2.50	2.60
E2	1.00	1.10	1.20
Nd	1.60BSC		
Ne	2.00BSC		
L	0.35	0.40	0.45
h	0.25REF		
K	0.30REF		
K1	0.20REF		

Figure 3-1 AC8972A8 Package

4、Revision History

Date	Revision	Description
2020.06.30	V1.0	Initial Release