

# **AC6965A Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

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# AC6965A Features

## CPU

- 32-bit DSP supports hardware Float Point Unit (FPU)
- Up to 160MHz programmable processor
- 64 Vectored 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 MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 10-band EQ configuration for voice Effects

## Audio Codec

- Two channels 16-bit DAC, SNR  $\geq$  95dB
- One channels 16-bit ADC, SNR  $\geq$  90dB
- 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
- Two channels Mono analog MUX
- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

## Bluetooth

- Compliant with Bluetooth V6.0+BR+EDR+BLE specification (DN Q334307)

- Meet class2 and class3 transmitting power requirement
- Support GFSK and  $\pi/4$  DQPSK all packet types
- Provides +6dbm transmitting power
- receiver with -90dBm sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smpt\att\gap\gatt\rfcomm\sdpl2cap profile
- a2dp 1.4\avctp 1.4\avdtp 1.3\avrcp 1.6.3\hfp 1.9\spp 1.2\rfcomm 1.2\pnp 1.3\hid 1.1.1\sdpcore 6.0\l2cap core 6.0

## 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, UART0 and UART1 supports DMA mode
- Two SPI interface supports host and device mode
- One hardware IIC interface supports host and device mode
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs

## PMU

- Low voltage LDO for internal digital and analog circuit supply
- 3uA current consumption in the soft-off mode
- Built-in LDO for the core, I/O, Bluetooth and flash
- VBAT is 2.2V to 5.5V
- VDDIO is 2.2V to 3.6V

## Packages

- QSOP24

## Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

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### Applications

- Bluetooth headset
- Bluetooth speaker



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# 1、 Pin Definition

## 1.1 Pin Assignment

PC5	1	24	BT_OSCO
PC4	2	23	BT_OSCI
USBDM/PC3	3	22	BT_RF
USBDP	4	21	FM_ANT
PA4	5	20	VSSIO
PA3	6	19	BT_AVDD
PA2/PA0	7	18	VDDIO
MIC	8	17	VBAT
DACVSS	9	16	LDO_IN/PB5
VCOM	10	15	PB4
DACL	11	14	PB6
DACR	12	13	PB7

Figure 1-1 AC6965A Package Diagram

## 1.2 Pin Description

Table 1-1 AC6965A Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	PC5	I/O	/	GPIO	SD0CLKA: SD0 Clock(A); SPI1DOB: SPI1 Data Out(B); IIC_SDA_B: IIC SDA(B); ADC12: ADC Input Channel 12; TMR1: Timer1 Clock Input; UART2RXD: Uart2 Data In(D);
2	PC4	I/O	/	GPIO	SD0CMDA: SD0 Command(A); SPI0_DAT3AB(3): SPI0 Data3(AB); SPI1CLKB: SPI1 Clock(B); IIC_SCL_B: IIC SCL(B); ADC11: ADC Input Channel 11; PWM1: Timer1 PWM Output; UART2TXD: Uart2 Data Out (D);
3	USBDM	I/O	/	USB Negative Data (pull down)	SPI2DOB: SPI2 Data Out(B); IIC_SDA_A: IIC SDA(A); ADC14: ADC Input Channel 14; UART1RXD: Uart1 Data In(D);
	PC3	I/O	/	GPIO	SD0DAT0A: SD0 Data0(A); SPI0_DAT2B(2): SPI0 Data2(B); SPI1DIB: SPI1 Data In(B); CAP2: Timer2 Capture; UART0TXD: Uart0 Data Out (D); UART0RXD: Uart0 Data In(D);
4	USBDP	I/O	/	USB Positive Data (pull down)	SPI2CLKB: SPI2 Clock(B); IIC_SCL_A: IIC SCL(A); ADC13: ADC Input Channel 13; UART1TXD: Uart1 Data Output(D);
5	PA4		/		SD0CMDC: SD0 Command(C) AMUX0R: Analog Channel0 Right; PLNK_DAT1: PLNK Data1; UART1_RTS: Uart1 Request to send; ADC3: ADC Input Channel 3; TMR4: Timer4 Clock Input; UART2RXA: Uart2 Data In(A);
6	PA3		/		SD0DATC: SD0 Data(C);

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					AMUX0L: Analog Channel0 Left; PLNK_SCLK: PLNK Serial Clock; UART1_CTS: Uart1 Clear to send; ADC2: ADC Input Channel 2; PWM5: Timer5 PWM Output; UART2TXA: Uart1 Data Output(D);
7	PA2	I/O	/	GPIO	SD0CLKC: SD0 Clock(C); MIC_BIAS: Microphone Bias Output CAP3: Timer3 Capture;
	PA0		/		SDPG: SD Power Supply ADC0: ADC Input Channel 0; CLKOUT0 UART1TXC: Uart1 Data Output(C);
8	MIC	I	/		MIC: MIC Input Channel;
9	DACVSS	P	/		DAC Ground
10	VCOM		/		
11	DACL	O	/		DAC Left Channel
12	DACR	O	/		DAC RightChannel
13	PB7	I/O	/	GPIO	SD0CLKF: SD0Clock(F) AMUX1R: Analog Channel1Right; SPI2DOA: SPI2 Data Out(A); IIC_SDA_C: IIC DAT(C); ADC9: ADC Input Channel 9; PWM5: Timer5 PWM Output; UART1RXA: Uart1 Data In(A);
14	PB6	I/O	/	GPIO	SD0CMD: SD0 Command(F); AMUX1L: Analog Channel1 Left; SPI2CLKA: SPI2 Data Out(A); IIC_SCL_C: IIC SCL(C); ADC8: ADC Input Channel 8; TMR3: Timer3 Clock Input; UART1TXA: Uart1 Data Out(A);
15	PB4	I/O	/	GPIO	SD0DAT0F: SD0 Data0(F); SPI0_DAT2A(2): SPI0 Data2 Out_A(2); ADC7: ADC Input Channel 7; CLKOUT1 UART2TXC: Uart2 Data Out(C); UART2RXC: Uart2 Data In(C);
16	LDO_IN	P	/		Battery Charger In
	PB5	I/O	/	GPIO (High Voltage Resistance)	SPI2DIA: SPI2 Data Input(A); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture;

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					UART0TXC: Uart0 Data Out(C); UART0RXC: Uart0 Data In(C);
17	VBAT	P	/		Battery Power Supply
18	VDDIO	P	/		IO Power 3.3v
19	BT_AVDD	P	/		BT Power
20	VSSIO	P	/		Ground
21	FMIP	I	/		
22	BT_RF	/	/		BT Antenna
23	BT_SOCI	I	/		BT OSC In
24	BT_SOCO	O	/		BT OSC Out

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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	5.5	V
LDO_IN	Charger Voltage	-0.3	5.5	V
V <sub>3.3IO</sub>	3.3V IO Input Voltage	-0.3	3.6	V

### 2.2 PMU Characteristics

Table 2-2

Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
VBAT	Voltage Input	2.2	3.7	5.5	V	
LDO_IN	Charger Voltage	4.5	5.0	5.5	V	
V <sub>3.3</sub>	Voltage output	–	3.3	–	V	VBAT = 4.2V, 100mA loading
V <sub>BT_AVDD</sub>	Voltage output	–	1.3	–	V	VBAT=4.2V, 100mA loading
V <sub>DACVDD</sub>	DAC Voltage	–	2.7	–	V	VBAT = 4.2V, 10mA loading
I <sub>L3.3</sub>	Loading current	–	–	150	mA	VBAT = 4.2V

### 2.3 IO Input/Output Electrical Logical Characteristics

Table 2-3

IO input characteristics						
Symbol	Parameter	Min	Typ	Max	Unit	Test Conditions
V <sub>IL</sub>	Low-Level Input Voltage	-0.3	–	0.3* VDDIO	V	VDDIO = 3.3V
V <sub>IH</sub>	High-Level Input Voltage	0.7* VDDIO	–	VDDIO+0.3	V	VDDIO = 3.3V
IO output characteristics						
V <sub>OL</sub>	Low-Level Output Voltage	–	–	0.33	V	VDDIO = 3.3V
V <sub>OH</sub>	High-Level Output Voltage	2.7	–	–	V	VDDIO = 3.3V

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## 2.4 Internal Resistor Characteristics

Table 2-4

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA2~PA4 PB4、PB6 PB7 PC4、PC5	8mA	24mA	10K	10K	1、USBDM & USBDP default pull down 2、PB5 can pull-up resistance to 5V 3、internal pull-up/pull-down resistance   accuracy $\pm 20\%$
PA0	Output 0	8mA	10K	10K	
	Output 1	8mA			
PB5	8mA	—	10K	10K	
USB DP	4mA	—	1.5K	15K	
USB DM	4mA	—	180K	15K	

## 2.5 DAC Characteristics

Table 2-5

Parameter	Min	Typ	Max	Unit	Test Conditions
Frequency Response	20	—	20K	Hz	1KHz/0dB 10Kohm loading With A-Weighted Filter
THD+N	—	-75	—	dB	
S/N	—	95	—	dB	
Crosstalk	—	-90	—	dB	
Output Swing	—	1	—	Vrms	
Dynamic Range	—	90	—	dB	1KHz/-60dB 10Kohm loading With A-Weighted Filter
DAC Output Power	11	—	—	mW	32ohm loading

## 2.6 ADC Characteristics

Table 2-6

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range	—	90	—	dB	Fsample=44.1kHz Fin=1KHz 2mVpp Input
S/N	—	90	91	dB	Fsample=44.1kHz Fin=1KHz 1.2Vpp Input
THD+N	—	-70	—	dB	
Crosstalk	—	-80	—	dB	

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## 2.7 BT Characteristics

### 2.7.1 Transmitter

**Basic Data Rate**

**Table 2-7**

Parameter		Min	Typ	Max	Unit	Test Conditions
RF Transmit Power			4	6	dBm	25°C, Power Supply VBAT=4.2V 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 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1		dB	25°C, Power Supply VBAT=4.2V 2441MHz
$\pi/4$ DQPSK	DEVM RMS		6		%	
	DEVM 99%		10		%	
	DEVM Peak		15		%	
Adjacent Channel	+2MHz		-40		dBm	
	-2MHz		-38		dBm	
Transmit Power	+3MHz		-44		dBm	
	-3MHz		-35		dBm	

### 2.7.2 Receiver

**Basic Data Rate**

**Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25°C, Power Supply VBAT=4.2V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
Interference Rejection	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

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**Enhanced Data Rate****Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25°C, Power Supply VBAT=4.2V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
Interference Rejection	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

**2.8 FM Receiver Characteristics****Table 2-11**

Parameter	Min	Typ	Max	Unit	Test Conditions
Input Frequency	76		108	MHz	
Usable Sensitivity	3	4	8	dB $\mu$ V EMF	(S+N)/N=26dB
Adjacent Channel Selectivity		48		dB	$\pm$ 200kHz
IIP3		88		db $\mu$ V EMF	$\Delta$ f1=200 kHz, $\Delta$ f2=400 kHz
Audio Output Voltage	0		3	V	Empty Load
Audio Frequency Response	20		20k	Hz	DacTest
Audio (S+N)/N		58		dB	
Stereo Separation		40		dB	

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## 3、 Package Information

### 3.1 QSOP24

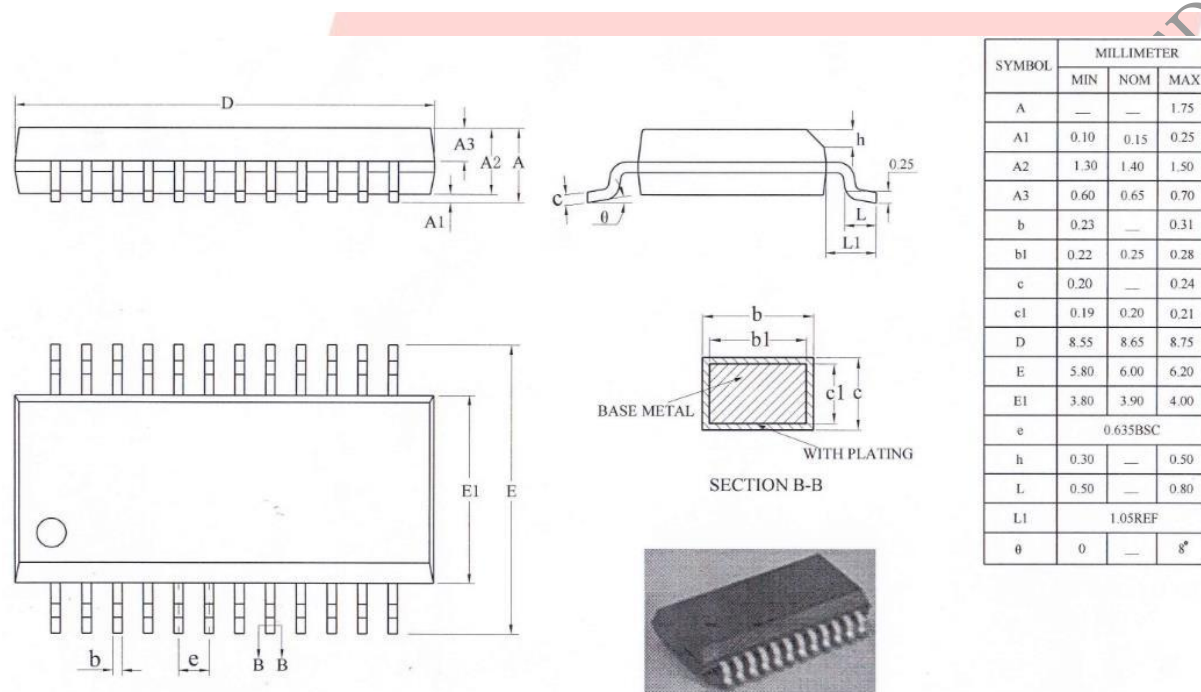


Figure 3-1. AC6965A Package

## 4、 Revision History

Date	Revision	Description
2020.05.20	V1.0	Initial Release
2021.08.10	V1.1	Update Bluetooth and profile Visions
2023.12.11	V1.2	Update Bluetooth and profile Visions
2025.01.09	V1.3	Update Bluetooth Vision and profiles
2026.03.21	V1.4	Update PMU Characteristics
2026.04.03	V1.5	Update Pin Description and PMU Characteristics

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