

# **AC6965A Datasheet**

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# AC6965A 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 MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 10-band EQ configuration for voice Effects

## Audio Codec

- Two channels 16-bit DAC, SNR >= 95dB
- One channels 16-bit ADC , SNR >= 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 V5.1+BR+EDR+BLE specification
- Meet class1 class2 and class3 transmitting

power requirement

- Support GFSK and  $\pi/4$  DQPSK all paket types
- Provides +6dbm transmitting power
- receiver with -90dBm sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gap\gatt\rfcomm\sdpl2cap 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, 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: -20°C to +70°C
- Storage temperature: -65°C to +150°C

## Applications

- Bluetooth headset
- Bluetooth speaker

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# 1、 Pin Definition

## 1.1 Pin Assignment

PC5	1	AC6965A (QSOP24)	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 3; 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	SD0CMDf: 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	-20	+70	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	2.2	5.5	V
LDO_IN	Charger Voltage	4.5	5.5	V
V <sub>3.3IO</sub>	3.3V IO Input Voltage	-0.3	VDDIO+0.3	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 = 5V, 100mA loading
V <sub>BT_AVDD</sub>	Voltage output	–	1.3	–	V	VBAT=5V, 100mA loading
V <sub>DACVDD</sub>	DAC Voltage	–	2.7	–	V	VBAT = 5V, 10mA loading
I <sub>L3.3</sub>	Loading current	–	–	150	mA	VBAT = 5V

### 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 ±20%
PA0	Output 0	8mA	24mA	10K	10K	
	Output 1	8mA	64mA			
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	—	80	—	dB	1KHz/-60dB
S/N	—	90	91	dB	1KHz/-60dB
THD+N	—	-70	—	dB	
Crosstalk	—	-80	—	dB	



## 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=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 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1		dB	25°C, Power Supply VBAT=5V 2441MHz
$\pi/4$ DQPSK Modulation Accuracy	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=5V 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	

**Enhanced Data Rate**

**Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25°C, Power Supply VBAT=5V 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	

**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	dBμV EMF	(S+N)/N=26dB
Adjacent Channel Selectivity		48		dB	± 200kHz
IIP3		88		dbμV EMF	Δf1=200 kHz, Δf2=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	

### 3、 Package Information

#### 3.1 QSOP24

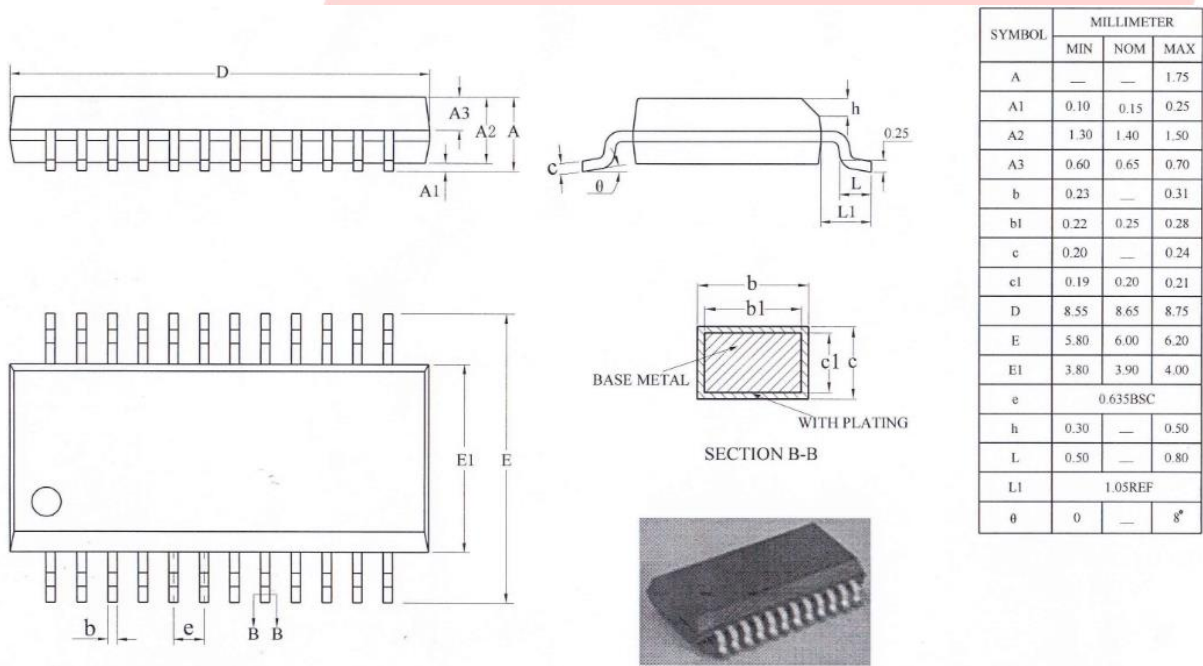


Figure 3-1. AC6965A Package

## 4、 Revision History

Date	Revision	Description
2020.05.20	V1.0	Initial Release