AC6958C Datasheet

Zhuhai Jieli Technology Co.,LTD

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AC6958C Features

CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 240MHz programmable processor
- 64Vectored interrupts
- 8 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/Dual MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 30-band EQ configuration for voice Effects

Audio Codec

- One channels 16-bit DAC, SNR >= 95dB
- Three 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
- three channels 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 π/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\sdp\l2cap 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\sdp core 6.0\l2cap core 6.0

Peripherals

- One full speed USB 2.0 OTG controller
- Four multi-function 16-bit timers, support capture and PWM mode
- Three 16-bit PWM generator for motor driving
- 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
- Built-in Cap Sense Key controller
- 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

- QFN40(5mm*5mm)

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Temperature

- Operating temperature: -40℃ to +85℃
- Storage temperature: -65℃ to +150℃

Applications

- Smart Watch

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1、Pin Definition

1.1 Pin Assignment

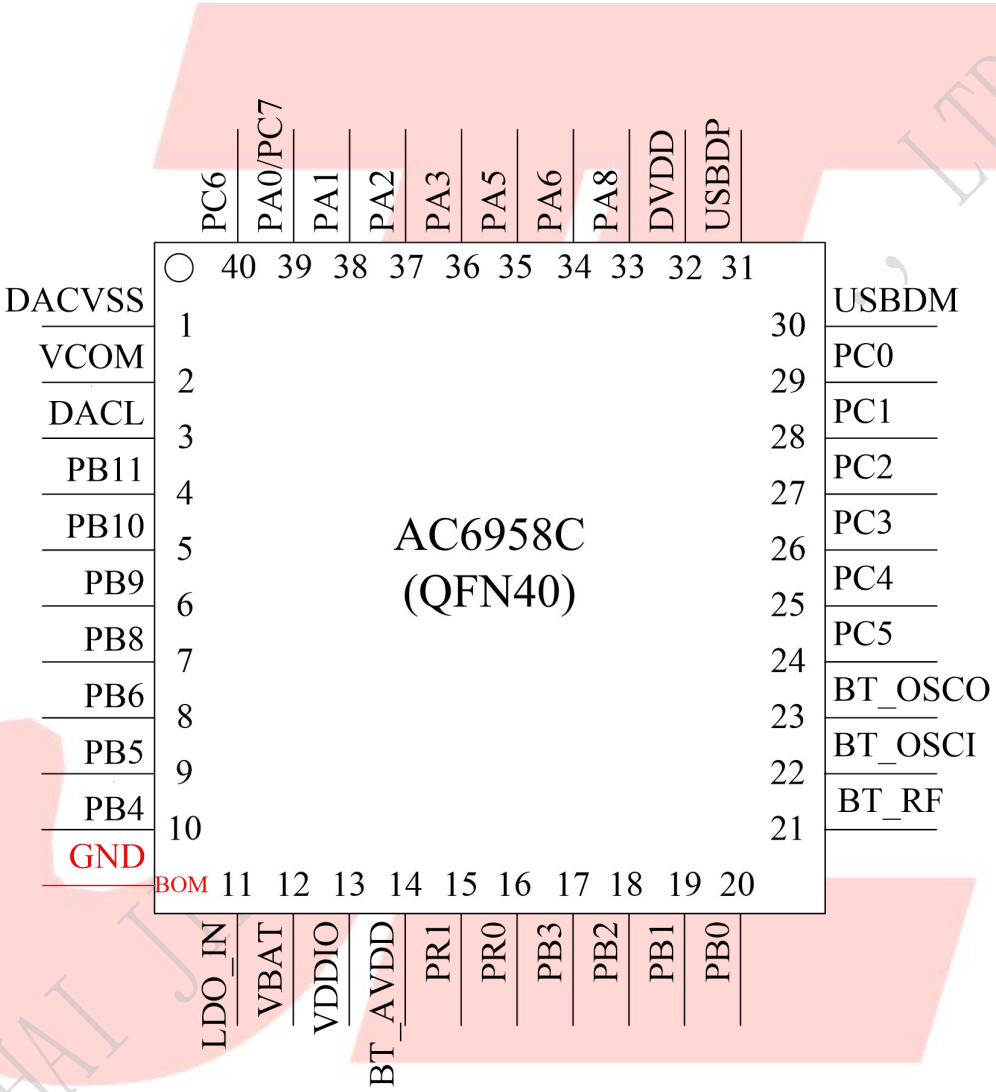


Figure 1-1 AC6958C Package Diagram

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1.2 Pin Description

Table 1-1 AC6958C Pin Description

PIN NO.	Name	I/O Type	Function	Other Function
1	DACVSS	P		DAC Ground
2	VCOM	P		DAC Reference
3	DACL	O		DAC Left Channel
4	PB11	I/O	GPIO	SDPG:SDC Power Gate; SPDIF_OUT：Sony/Philips Digital Interface Out
5	PB10	I/O	GPIO	SD0CMDB：SD0 Command (B); AMUX2R：Analog Channel2 Right; SPI2DOA：SPI2 Data Out(A); ADC9：ADC Input Channel 9; UART2RXC：Uart2 Data In(C); PWMCH3L：Motor PWM Channel3(L);
6	PB9	I/O	GPIO	SD0CLKB：SD0 Clock(B); AMUX2L：Analog Channel2 Left; SPI2CLKA：SPI2 Clk(A); CAP0：Timer0 Capture; UART2TXC：Uart2 Data Out(C); PWMCH3H：Motor PWM Channel3(H);
7	PB8	I/O	GPIO	SD0DAT0B：SD0 Data0(B); AMUX1R：Analog Channel1 Right; SPI2_DIA：SPI2 Data In(A); ADC8：ADC Input Channel 8; CLKOUT1：Clk Out1;
8	PB6	I/O	GPIO	SD1CLKB：SD1 Clock(B); IIC_SDA_C：IIC SDA(C); TMR3：Timer3 Clock Input; UART0RXB：Uart0 Data In(B); PWMCH2L：Motor PWM Channel2 (L);
9	PB5	I/O	GPIO (High Voltage Resistance) *type1	SD1CMDB：SD1 Command (B); PWM3：Timer3 PWM Output; CAP1：Timer1 Capture; UART0TXC：Uart0 Data Out(C); UART0RXC：Uart0 Data In(C);

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10	PB4	I/O	GPIO	SD1DAT0B：SD1 Data0(B); IIC_SCL_C：IIC SCL(C); ADC7：ADC Input Channel 7; UART0TXB：Uart0 Data Out(B); LVD：Low Voltage Detect Input; PWMCH2H：Motor PWM Channel2 (H);
11	LDO_IN	P		Battery Charge Input
12	VBAT	P		Power Supply
13	VDDIO	P		IO Power 3.3v
14	BT_AVDD	P		BT Power
15	PR1	I/O	RTCIO1 *type1	OSCO_32K
16	PR0	I/O	RTCIO0 *type1	OSCI_32K
17	PB3	I/O	GPIO	PWM2：Timer2 PWM Output; ADC6：ADC Input Channel 6;
18	PB2	I/O	GPIO (High Voltage Resistance)	SPI1DIA：SPI1 Data In(A); PWMCH1L：Motor PWM Channel1 (L);
19	PB1	I/O	GPIO (pull up)	Long Press Reset； SPI1DOA：SPI1 Data Out(A); ADC5：ADC Input Channel 5; TMR2：Timer2 Clock Input; UART1RXA：Uart1 Data In(A);
20	PB0	I/O	GPIO (High Voltage Resistance)	SPI1CLKA：SPI1 Clock(A); UART1TXA：Uart1 Data Out(A); PWMCH1H：Motor PWM Channel1(H)；
21	BT_RF	/		BT Antenna
22	BT_OSCI	I	OSC In	
23	BT_OSCO	O	OSC Out	
24	PC5	I/O	GPIO	SD1CLKA：SD1 Clock(A); SPI1DOB：SPI1 Data Out(B); UART2RXD：Uart2 Data In(D); IIC_SDA_B：IIC SDA(B); ADC13：ADC Input Channel 13; PWMCH5L：Motor PWM Channel5(L);
25	PC4	I/O	GPIO	SD1CMDA：SD1 Command(A); SPI1CLKB：SPI1 Clock(B); UART2TXD：Uart2 Data Out(D); IIC_SCL_B：IIC SCL(B); ADC10：ADC Input Channel 10; PWMCH5H：Motor PWM Channel5(H);

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26	PC3	I/O	GPIO	SD1DAT0A：SD1 Data0(A); SPI1DIB：SPI1 Data In(B);
27	PC2	I/O	GPIO	SD1DAT1A：SD1 Data1(A); Touch12：Touch Input Channel 12; FPIN5：Motor Auto-Stop Protective Pin5;
28	PC1	I/O	GPIO	SD1DAT2A：SD1 Data2(A); Touch11：Touch Input Channel 11; UART1RXB：Uart1 Data In(B); FPIN4：Motor Auto-Stop Protective Pin4;
29	PC0	I/O	GPIO	SD1DAT3A：SD1 Data3(A); ALNK1_SCLK：Audio Link Serial Clock; Touch10：Touch Input Channel 10; UART1TXB：Uart1 Data Out(B); FPIN3：Motor Auto-Stop Protective Pin3；
30	USBDM	I/O	USB Negative Data (pull down) *type1	UART1RXD：Uart1 Data In(D); IIC_SDA_A：IIC SDA(A);
31	USBDP	I/O	USB Positive Data (pull down) *type1	UART1TXD：Uart1 Data Out(D); IIC_SCL_A：IIC SCL(A); ADC12：ADC Input Channel 12;
32	DVDD	P		CORE POWER
33	PA8	I/O	GPIO	SPI0DOC：SPI0 Data0 Out(C); ALNK0_MCLKA：ALNK Master Clock(A); BT_Freq; FPIN2：Motor Auto-Stop Protective Pin2；
34	PA6	I/O	GPIO	SPI0DIC：SPI0 Data1In(C); ADC2：ADC Input Channel 2; IIC_SDA_D：IIC SDA(D); Touch6：Touch Input Channel 6; UART0RXA：Uart0 Data In(A);
35	PA5	I/O	GPIO	ADC1：ADC Input Channel 1; IIC_SCL_D：IIC SCL(D); Touch5：Touch Input Channel 5; PWM0：Timer0 PWM Output; UART0TXA：Uart0 Data Out(A);
36	PA3	I/O	GPIO	SPI0CLKC：SPI0 Clock(C); Touch3：Touch Input Channel 3; UART2RXA：Uart2 Data In(A);
37	PA2	I/O	GPIO	Touch2：Touch Input Channel 2; UART2TXA：Uart2 Data Out(A); CAP3：Timer3 Capture;

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38	PA1	I/O	GPIO	AMUX0R：Analog Channel0 Right; Touch1：Touch Input Channel 1; ADC0：ADC Input Channel 0; UART1RXC：Uart1 Data In(C); PWMCH0L：Motor PWM Channel0(L);
39	PC7	I/O	GPIO	MIC_BIAS：Microphone Bias Output
	PA0	I/O	GPIO	AMUX0L：Analog Channel0 Left; Touch0：Touch Input Channel 0; CLKOUT0： UART1TXC：Uart1 Data Out(C); PWMCH0H：Motor PWM Channel0(H);
40	MIC	I		MIC：Microphone Input Channel;

Note:

*type1:The GPIO is uncontrollable during the initial process

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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	℃
Tstg	Storage temperature	-65	+150	℃
VBAT	Supply Voltage	-0.3	+5.5	V
LDO_IN	Charger Voltage	-0.3	+5.5	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 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	
$V_{3.3}$	Voltage output	_	3.3	_	V	VBAT = 4.2V, 100mA loading
V_{BT_AVDD}	Voltage output		1.3		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	$V_{BAT}<V_{Trikl}$

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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* 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~PA8 PB1、PB3、PB4 PB6、PB8~PB10 PC0~PC5	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、PB0, PB2, PB5 are high voltage resistance to 5V 4、internal pull-up/pull-down resistance | accuracy ±20%
(driving low) PB11, PC7	8mA	24mA	10K	10K	
(driving high)	8mA	64mA			
PB0、PB2 PB5	8mA		10K	10K	
PR0、PR1	8mA		10K	10K	
USBDP	4mA		1.5K	15K	
USBDM	4mA		180K	15K	

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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	_	-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			20	mW	32ohm loading

2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		89		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	

2.8 BT Characteristics

2.8.1 Transmitter

Basic Data Rate

Table 2-8

Parameter		Min	Typ	Max	Unit	Test Conditions
RF Transmit Power			4	6	dBm	25℃, Power Supply VBAT=4.2V 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	

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Enhanced Data Rate **Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power			-1		dB	25℃, Power Supply VBAT=4.2V 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			-90		dBm	25℃, 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	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

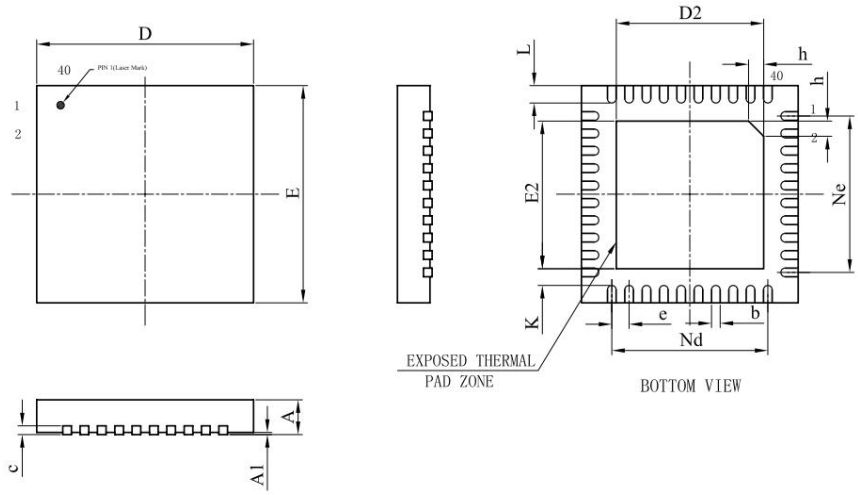
Enhanced Data Rate **Table 2-11**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25℃, 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	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

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3、 Package Information

3.1 QFN40(5mm×5mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	4.90	5.00	5.10
D2	3.30	3.40	3.50
e	0.40BSC		
Nd	3.60BSC		
E	4.90	5.00	5.10
E2	3.30	3.40	3.50
Ne	3.60BSC		
L	0.35	0.40	0.45
K	0.20	—	—
h	0.30	0.35	0.40
L/F载体尺寸 (mil)	150*150		

Figure 3-1 AC6958C_QFN40 Package

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4、Revision History

Date	Revision	Description
2020.10.27	V1.0	Initial Release
2022.05.20	V1.1	Update Bluetooth Vision and profiles，Update Audio characters
2023.01.11	V1.2	Update Pin Description
2023.12.12	V1.3	Update Bluetooth Vision and profiles
2025.01.09	V1.4	Update Bluetooth Vision and profiles
2026.03.23	V1.5	Update PMU Characteristics
2026.04.07	V1.6	Update PMU Characteristics

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