AC6954C Datasheet

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Version：V1.1

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AC6954C Features

CPU

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

Audio Codec

- Two channels 16-bit DAC, SNR >= 92dB
- 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 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 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

Peripherals

- One full speed USB 2.0 OTG controller
- Two PCM/IIS for external digital Audio code, supports host and device mode
- 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
- Three SPI interface supports host and device mode
- Two SD Card Host controller
- One hardware IIC interface supports host and device mode
- Four SPDIF receiving interface without analog amplify
- Supports HDMI ARC (Audio Return Channel) receiving
- Segment LCD panels
- Digital matrix LED panels
- 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
- RTCVDD33 is 2.2V to 3.6V

Packages

- LQFP52(6mm*6mm)

Temperature

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

Applications

- Bluetooth Stereo speaker
- Bluetooth soundbar
- Bluetooth car speaker
- Bluetooth TWS speaker
- Bluetooth alarm clock speaker
- Bluetooth Rod speaker
- Bluetooth Watch

1、Pin Definition

1.1 Pin Assignment

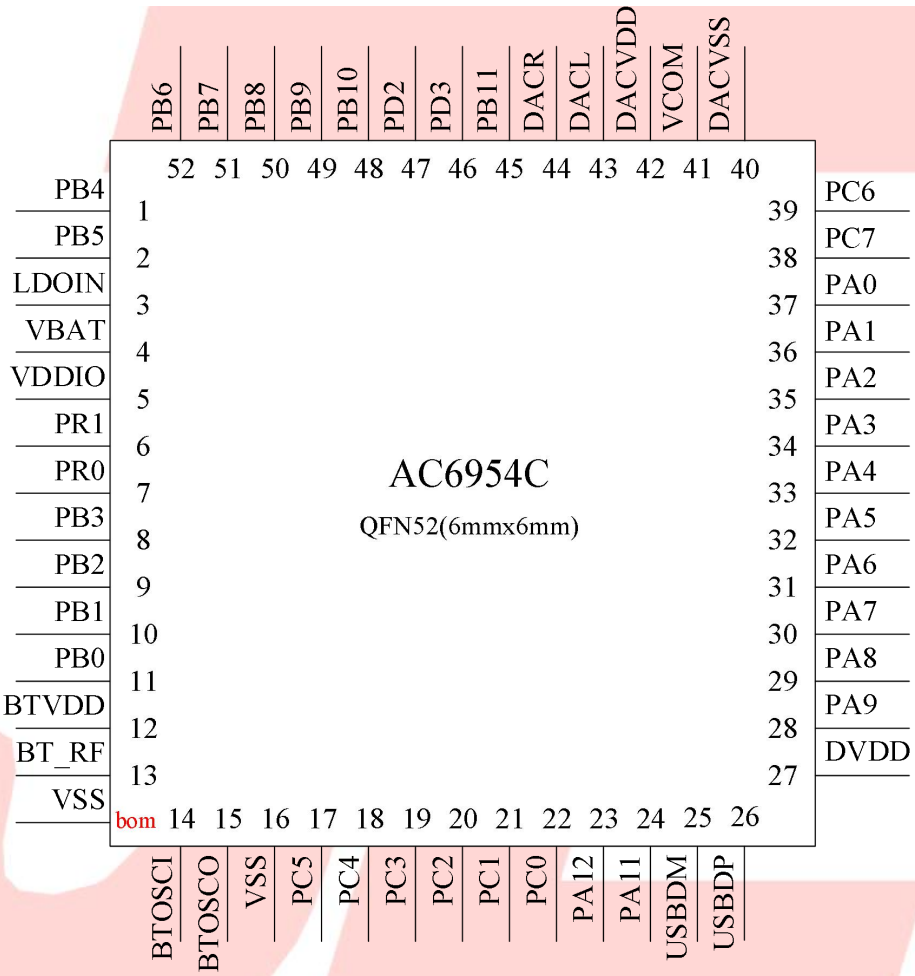


Figure 1-1 AC6954C Package Diagram

1.2 Pin Description

Table 1-1 AC6954C Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	PB4	I/O	24/8	GPIO	SD1DAT0B：SD1 Data0(B); SD0DAT3B：SD0 Data3(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)；
2	PB5	I/O	8	GPIO (High Voltage Resistance)	SD1CMDB：SD1 Command(B); SD0DAT2B：SD1 Data2(B); PWM3：Timer3 PWM Output; CAP1：Timer1 Capture; UART0TXC：Uart0 Data Out(C); UART0RXC：Uart0 Data In(C);
3	LDOIN	P	/		Battery Charge Input
4	VBAT	P	/		Power Supply
5	VDDIO	P	/		IO Power 3.3v
6	PR1	I/O	8	RTCIO1	OSCO_32K
7	PR0	I/O	8	RTCIO0	OSCI_32K
8	PB3	I/O	24/8	GPIO	PWM2：Timer2 PWM Output; ADC6：ADC Input Channel 6;
9	PB2	I/O	8	GPIO (High Voltage Resistance)	SPI1DIA：SPI1 Data In(A); PWMCH1L：Motor PWM Channel1 (L)；
10	PB1	I/O	24/8	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); SPDIF_IN_D：Sony/Philips Digital Interface Input(D)

11	PB0	I/O	8	GPIO (High Voltage Resistance)	SPI1CLKA：SPI1 Clock(A); ALNK1_MCLK：ALNK1 Master Clock; SPDIF_IN_C:Sony/Philips Digital Interface Input(C) UART1TXA：Uart1 Data Out(A); PWMCH1H：Motor PWM Channel1(H)；
12	BTVDD	P	/		BT Power
13	BT_RF	/	/		BT Antenna
14	BTOSCI	I	/		BT OSC In
15	BTOSCO	O	/		BT OSC Out
16	VSS	P	/		Ground
17	PC5	I/O	24/8	GPIO	SD1CLKA：SD1 Clock(A); SPI1DOB：SPI1 Data Out(B); UART2RXD：Uart2 Data In(D); IIC_SDA_B：IIC SDA(B); ALNK1_DAT3：Audio Link Data3; ADC13：ADC Input Channel 13; PAPD7：PAP Data 7; Touch15：Touch Input Channel 15; PWMCH5L：Motor PWM Channel5(L)；
18	PC4	I/O	24/8	GPIO	SD1CMDA：SD1 Command(A); SPI1CLKB：SPI1 Clock(B); UART2TXD：Uart2 Data Out(D); IIC_SCL_B：IIC SCL(B); ALNK1_DAT2：Audio Link Data2; ADC10：ADC Input Channel 10; Touch14：Touch Input Channel 14; PWMCH5H：Motor PWM Channel5(H)；
19	PC3	I/O	24/8	GPIO	SD1DAT0A：SD1 Data0(A); SPI1DIB：SPI1 Data In(B); ALNK1_DAT1：Audio Link Data1; Touch13：Touch Input Channel 13;
20	PC2	I/O	24/8	GPIO	SD1DAT1A：SD1 Data1(A); ALNK1_DAT0：Audio Link Data0; Touch12：Touch Input Channel 12; FPIN5：Motor Auto-Stop Protective Pin5；
21	PC1	I/O	24/8	GPIO	SD1DAT2A：SD1 Data2(A); ALNK1_LRCK：Audio Link Word Select; Touch11：Touch Input Channel 11; UART1RXB：Uart1 Data In(B); FPIN4：Motor Auto-Stop Protective Pin4；

22	PC0	I/O	24/8	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；
23	PA12	I/O	24/8	GPIO	PWM1：Timer1 PWM Output; ADC4：ADC Input Channel 4; UART0RXD：Uart0 Data In(D);
24	PA11	I/O	24/8	GPIO	UART0TXD：Uart0 Data Out(D);
25	USBDM	I/O	4	USB Negative Data (pull down)	UART1RXD：Uart1 Data In(D); SPI2DOB：SPI2 Data Out(B); IIC_SDA_A：IIC SDA(A);
26	USBDP	I/O	4	USB Positive Data (pull down)	UART1TXD：Uart1 Data Out(D); SPI2CLKB：SPI2 Clock(B); IIC_SCL_A：IIC SCL(A); ADC12：ADC Input Channel 12;
27	DVDD	P			System Power
28	PA9	I/O	24/8	GPIO	SPDIF_IN_A：Sony/Philips Digital Interface Input(A) Touch8：Touch Input Channel 8; UART2TXB：Uart2 Data Out(B); PWMCH4H：Motor PWM Channel4(H)；
29	PA8	I/O	24/8	GPIO	SPI0DOC：SPI0 Data0 Out(C); ALNK0_MCLKA：ALNK Master Clock(A); BT_Freq; FPIN2：Motor Auto-Stop Protective Pin2；
30	PA7	I/O	24/8	GPIO	SPI0D2C：SPI0 Data2(C); ALNK0_DAT3A：Audio Link Data3(A); BT_priority; TMR0：Timer0 Clock Input; Touch7：Touch Input Channel 7;
31	PA6	I/O	24/8	GPIO	SPI0DIC：SPI0 Data1In(C); ALNK0_DAT2A：Audio Link Data2(A); ADC2：ADC Input Channel 2; Wlan_Active; IIC_SDA_D：IIC SDA(D); Touch6：Touch Input Channel 6; UART0RXA：Uart0 Data In(A);

32	PA5	I/O	24/8	GPIO	ALNK0_DAT1A：Audio Link Data1(A); ADC1：ADC Input Channel 1; BT_Active; IIC_SCL_D：IIC SCL(D); Touch5：Touch Input Channel 5; PWM0：Timer0 PWM Output; UART0TXA：Uart0 Data Out(A);
33	PA4	I/O	24/8	GPIO	SPI0CSC：SPI0 Chip Selection(C); ALNK0_DAT0A：Audio Link Data0(A); Touch4：Touch Input Channel 4;
34	PA3	I/O	24/8	GPIO	SPI0CLKC：SPI0 Clock(C); PLNK_DAT1：PLNK Data1; ALNK0_LRCKA：Audio Link Word Select(A); Touch3：Touch Input Channel 3; UART2RXA：Uart2 Data In(A);
35	PA2	I/O	24/8	GPIO	SPI0D3C：SPI0 Data3(C); PLNK_SCLK：PLNK Serial Clock; ALNK0_SCLKA：Audio Link Serial Clock(A); Touch2：Touch Input Channel 2; UART2TXA：Uart2 Data Out(A); CAP3：Timer3 Capture;
36	PA1	I/O	24/8	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)；
37	PA0	I/O	24/8	GPIO	AMUX0L:Analog Channel0 Left; Touch0:Touch Input Channel 0; CLKOUT0; UART1TXC:Uart1 Data Out(C); PWMCH0H:Motor PWM Channel0(H)；
38	PC7	I/O	/	GPIO	MIC_BIAS:Microphone Bias Output
39	MIC	I	/		MIC:MIC Input Channel;
40	DACVSS	P	/		DAC Ground
41	VCOM	P	/		DAC Reference
42	DACVDD	P	/		DAC Power
43	DACL	O	/		DAC Left Channel
44	DACR	O	/		DAC Right Channel
45	PB11	I/O	24/8	GPIO	SDPG:SD CARD Power Gate;
46	PD3	I/O	24/8	GPIO	-
47	PD2	I/O	24/8	GPIO	-

48	PB10	I/O	24/8	GPIO	AMUX2R：Analog Channel2 Right; SD0CMB：SD0 Command(B); SPI2DOA：SPI2 Data Out(A); SD1DAT3B：SD1 Data3(B); ADC9：ADC Input Channel 9; UART2RXC：Uart2 Data In(C); PWMCH3L：Motor PWM Channel3(L)；
49	PB9	I/O	24/8	GPIO	AMUX2L：Analog Channel2 Left; SD0CLKB：SD0 Clock(B); SPI2CLKA：SPI2 Clk(A); SD1DAT2B：SD1 Data2(B); CAP0：Timer0 Capture; UART2TXC：Uart2 Data Out(C); PWMCH3H：Motor PWM Channel3(H)；
50	PB8	I/O	24/8	GPIO	AMUX1R：Analog Channel1 Right; SD0DAT0B：SD0 Data0(B); SPI2_DIA：SPI2 Data In(A); SD1DAT1B：SD1 Data1(B); ADC8：ADC Input Channel 8; CLKOUT1：Clk Out1;
51	PB7	I/O	24/8	GPIO	AMUX1L：Analog Channel1 Left;
52	PB6	I/O	24/8	GPIO	SD1CLKB：SD1 Clock(B); SD0DAT1B：SD0 Data1(B); IIC_SDA_C：IIC SDA(C); TMR3：Timer3 Clock Input; UART0RXB：Uart0 Data In(B); PWMCH2L：Motor PWM Channel2 (L)；

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	2.2	5.5	V
LDO_IN	Charger Voltage	4.5	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_{DDIO}	Voltage output	_	3.3	_	V	VBAT = 5V, 100mA loading
V_{BTVDD}	Voltage output	_	1.3	_	V	VBAT=5V, 100mA loading
$I_{L3.3}$	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_{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

2.4 Internal Resistor Characteristics

Table 2-4

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA0~PA12 PB1 PB3, PB4 PB6~PB10 PC0~PC5 PD2,PD3	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% 5、PRx supply by RTCVDD
(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	

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	_	92	_	dB	
Crosstalk	_	-80	_	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℃, 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 2-8**

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	

2.7.2 Receiver

Basic Data Rate **Table 2-9**

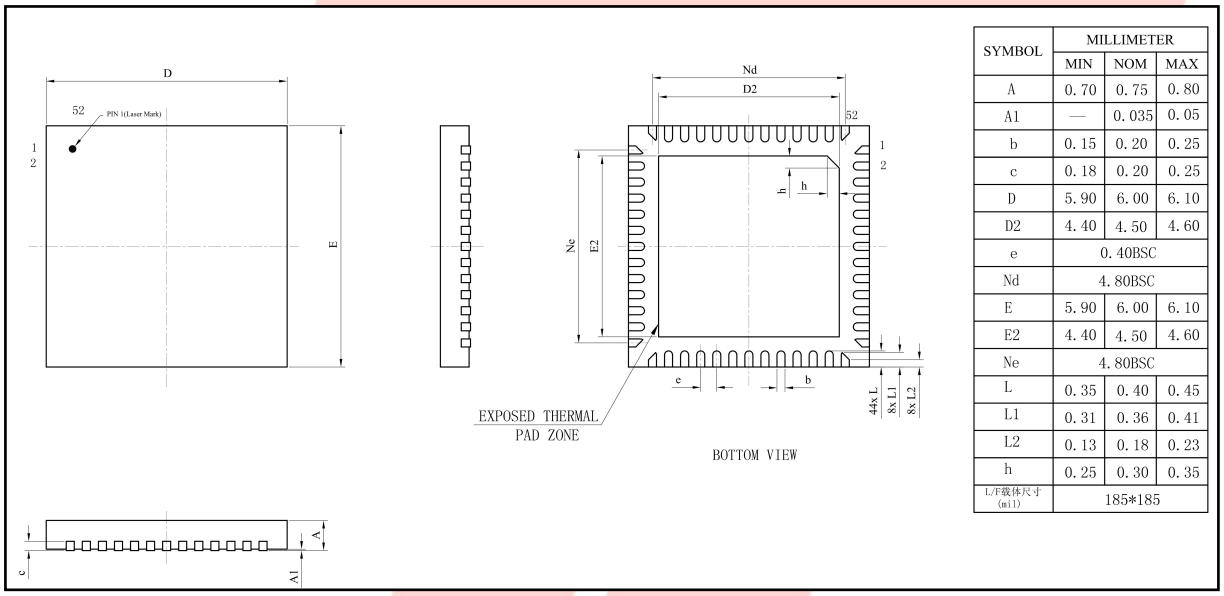
Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25℃, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

Enhanced Data Rate **Table 2-10**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		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 QFN52(6mm*6mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.035	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	5.90	6.00	6.10
D2	4.40	4.50	4.60
e	0.40BSC		
Nd	4.80BSC		
E	5.90	6.00	6.10
E2	4.40	4.50	4.60
Ne	4.80BSC		
L	0.35	0.40	0.45
L1	0.31	0.36	0.41
L2	0.13	0.18	0.23
h	0.25	0.30	0.35
L/F载体尺寸 (mil)	185*185		

Figure 3-1. AC6954C Package

3、Revision History

Date	Revision	Description
2020.07.20	V1.0	Initial Release