AC6954A Datasheet

Zhuhai Jieli Technology Co.,LTD

Version：V1.7

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AC6954A 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 analog MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- Multi-band EQ configuration for voice Effects

Audio Codec

- Four 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 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 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 maximum +6dBm transmitting power
- receiver with minimum -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
- 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

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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
- RTCVDD is 2.2V to 3.6V

Packages

- QFN52(6mm*6mm)

Temperature

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

Applications

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

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1、Pin Definition

1.1 Pin Assignment

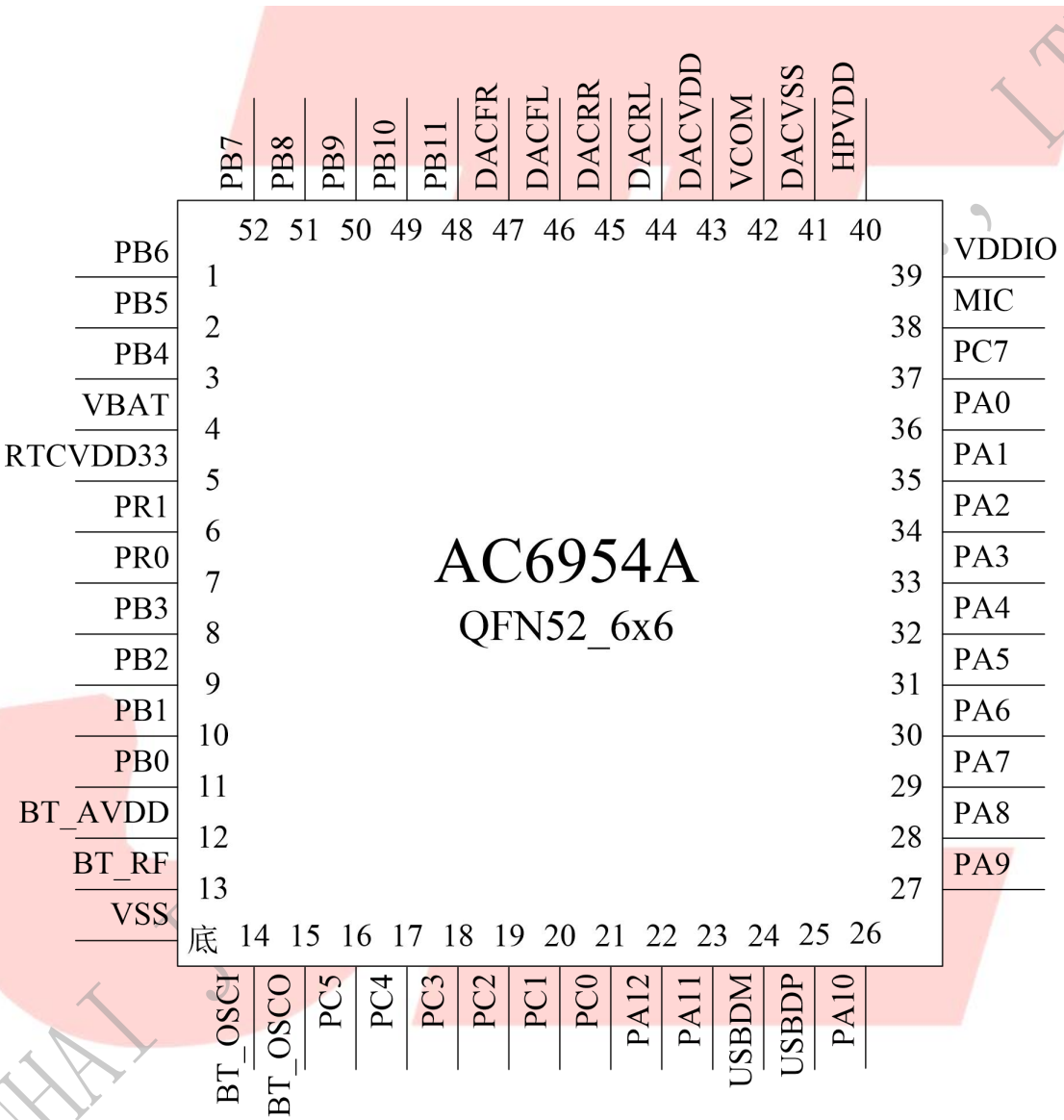


Figure 1-1 AC6954A Package Diagram

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1.2 Pin Description

Table 1-1 AC6954A Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	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	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	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)；
4	VBAT	P	/		Power Supply
5	RTVDDD33	P	/		RTC Power
6	PR1	I/O		RTCIO1	OSCO_32K
7	PR0	I/O		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)

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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	BT_AVDD	P	/		BT Power
13	BT_RF	/	/		BT Antenna
14	BT_OSCI	I	/		BT OSC In
15	BT_OSCO	O	/		BT OSC Out
16	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; COM0：LCD COM Output 0; PAPD7：PAP Data 7; Touch15：Touch Input Channel 15; PWMCH5L：Motor PWM Channel5(L)；
17	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; COM1：LCD COM Output 1; PAPD6：PAP Data 6; Touch14：Touch Input Channel 14; PWMCH5H：Motor PWM Channel5(H)；
18	PC3	I/O	24/8	GPIO	SD1DAT0A：SD1 Data0(A); SPI1DIB：SPI1 Data In(B); ALNK1_DAT1：Audio Link Data1; COM2：LCD COM Output 2; PAPD5：PAP Data 5; Touch13：Touch Input Channel 13;
19	PC2	I/O	24/8	GPIO	SD1DAT1A：SD1 Data1(A); ALNK1_DAT0：Audio Link Data0; COM3：LCD COM Output 3; SEG18：LCD SEG Output18; PAPD4：PAP Data 4; Touch12：Touch Input Channel 12; FPIN5：Motor Auto-Stop Protective Pin5；

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20	PC1	I/O	24/8	GPIO	SD1DAT2A：SD1 Data2(A); ALNK1_LRCK：Audio Link Word Select; COM4：LCD COM Output 4; SEG17：LCD SEG Output17; PAPD3：PAP Data 3; Touch11：Touch Input Channel 11; UART1RXB：Uart1 Data In(B); FPIN4：Motor Auto-Stop Protective Pin4；
21	PC0	I/O	24/8	GPIO	SD1DAT3A：SD1 Data3(A); ALNK1_SCLK：Audio Link Serial Clock; COM5：LCD COM Output 5; SEG16：LCD SEG Output16; PAPD2：PAP Data 2; Touch10：Touch Input Channel 10; UART1TXB：Uart1 Data Out(B); FPIN3：Motor Auto-Stop Protective Pin3；
22	PA12	I/O	24/8	GPIO	PWM1：Timer1 PWM Output; ALNK0_DAT1B：Audio Link Data1(B); ADC4：ADC Input Channel 4; SEG12：LCD SEG Output12; PAPWR：PAP Write; UART0RXD：Uart0 Data In(D);
23	PA11	I/O	24/8	GPIO	ALNK0_DAT0B：Audio Link Data0(B); SEG11：LCD SEG Output11; PAPRD：PAP Read; UART0TXD：Uart0 Data Out(D);
24	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);
25	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;
26	PA10	I/O	24/8	GPIO	SD0CLKA：SD0 Clock(A); ALNK0_LRCKB：Audio Link Word Select(B); ADC3：ADC Input Channel 3; SPDIF_IN_B：Sony/Philips Digital Interface Input(B) TMR1：Timer1 Clock Input; SEG10：LCD SEG Output10; PAPD1：PAP Data 1; Touch9：Touch Input Channel 9; UART2RXB：Uart2 Data In(B); PWMCH4L：Motor PWM Channel4(L)；

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27	PA9	I/O	24/8	GPIO	SD0CMA：SD0 Command(A); ALNK0_SCLKB：Audio Link Serial Clock(B); SPDIF_IN_A：Sony/Philips Digital Interface Input(A) SEG9：LCD SEG Output9; PAPD0：PAP Data 0; Touch8：Touch Input Channel 8; UART2TXB：Uart2 Data Out(B); PWMCH4H：Motor PWM Channel4(H)；
28	PA8	I/O	24/8	GPIO	SD0DAT3A：SD0 Data3(A); ALNK0_MCLKA：ALNK Master Clock(A); SEG8：LCD SEG Output8; BT_Freq FPIN2：Motor Auto-Stop Protective Pin2；
29	PA7	I/O	24/8	GPIO	SD0DAT2A：SD0 Data2(A); ALNK0_DAT3A：Audio Link Data3(A); SEG7：LCD SEG Output7; BT_priority TMR0：Timer0 Clock Input; Touch7：Touch Input Channel 7;
30	PA6	I/O	24/8	GPIO	SD0DAT1A：SD0 Data1(A); ALNK0_DAT2A：Audio Link Data2(A); ADC2：ADC Input Channel 2; Wlan_Active： IIC_SDA_D：IIC SDA(D); SEG6：LCD SEG Output6; Touch6：Touch Input Channel 6; UART0RXA：Uart0 Data In(A);
31	PA5	I/O	24/8	GPIO	SD0DAT0A：SD0 Data0(A); ALNK0_DAT1A：Audio Link Data1(A); ADC1：ADC Input Channel 1; BT_Active： IIC_SCL_D：IIC SCL(D); SEG5：LCD SEG Output5; Touch5：Touch Input Channel 5; PWM0：Timer0 PWM Output; UART0TXA：Uart0 Data Out(A);
32	PA4	I/O	24/8	GPIO	ALNK0_DAT0A：Audio Link Data0(A); SEG4：LCD SEG Output4; Touch4：Touch Input Channel 4;
33	PA3	I/O	24/8	GPIO	PLNK_DAT1：PLNK Data1; ALNK0_LRCKA：Audio Link Word Select(A); SEG3：LCD SEG Output3;

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					Touch3：Touch Input Channel 3; UART2RXA：Uart2 Data In(A);
34	PA2	I/O	24/8	GPIO	PLNK_SCLK：PLNK Serial Clock; ALNK0_SCLKA：Audio Link Serial Clock(A); SEG2：LCD SEG Output2; Touch2：Touch Input Channel 2; UART2TXA：Uart2 Data Out(A); CAP3：Timer3 Capture;
35	PA1	I/O	24/8	GPIO	AMUX0R：Analog Channel0 Right; SEG1：LCD SEG Output1; Touch1：Touch Input Channel 1; ADC0：ADC Input Channel 0; UART1RXC：Uart1 Data In(C); PWMCH0L：Motor PWM Channel0(L)；
36	PA0	I/O	24/8	GPIO	AMUX0L：Analog Channel0 Left; SEG0：LCD SEG Output0; Touch0：Touch Input Channel 0; CLKOUT0： UART1TXC：Uart1 Data Out(C); PWMCH0H：Motor PWM Channel0(H)；
37	PC7	I/O	/	GPIO	MIC_BIAS：Microphone Bias Output SEG21：LCD SEG Output21;
38	MIC	I	/		MIC：MIC Input Channel;
39	VDDIO	P	/		IO Power 3.3v
40	HPVDD	P	/		Headphone AMP Power
41	DACVSS	P	/		DAC Ground
42	VCOM	P	/		DAC Reference
43	DACVDD	P	/		DAC Power
44	DACRL	O	/		DAC Rear Left Channel
45	DACRR	O	/		DAC Rear Right Channel
46	DACFL	O	/		DAC Front Left Channel
47	DACFR	O	/		DAC Front Right Channel
48	PB11	I/O	/	GPIO	SDPG:SDC Power Gate;
49	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)；
50	PB9	I/O	24/8	GPIO	AMUX2L：Analog Channel2 Left; SD0CLKB：

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					SD0 Clock(B); SPI2CLKA：SPI2 Clk(A); SD1DAT2B：SD1 Data2(B); CAP0：Timer0 Capture; UART2TXC：Uart2 Data Out(C); PWMCH3H：Motor PWM Channel3(H);
51	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;
52	PB7	I/O	24/8	GPIO	AMUX1L：Analog Channel1 Left;

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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
$V_{3.3IO}$	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	
$V_{3.3}$	Voltage output	_	3.3	_	V	VBAT = 4.2V, 100mA loading
V_{BT_AVDD}	Voltage output		1.3		V	VBAT=4.2V, 100mA loading
V_{DACVDD}	DAC Voltage	_	2.7	_	V	VBAT = 4.2V, 10mA loading
$I_{L3.3}$	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_{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

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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
PA0~PA12 PB1, PB3, PB4, PB6~PB10 PC0~PC5		8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、PB0, PB2, PB5 can pull-up resistance to 5V 4、internal pull-up/pull-down resistance | accuracy ±20% 5、PRx supply by RTCVDD
PB11 PC7	Output 0	8mA	24mA	10K	10K	
	Output 1	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	_	95	_	dB	
Crosstalk	_	-90	_	dB	
Output Swing		1		Vrms	
Dynamic Range		95		dB	1KHz/-60dB 10Kohm loading With A-Weighted Filter
DAC Output Power		20	_	mW	16ohm loading

2.6 ADC Characteristics

Table 2-6

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		80		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	_	-90	_	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℃, 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	

Enhanced Data Rate Table 2-8

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	

2.7.2 Receiver

Basic Data Rate Table 2-9

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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Enhanced Data Rate **Table** 2-10

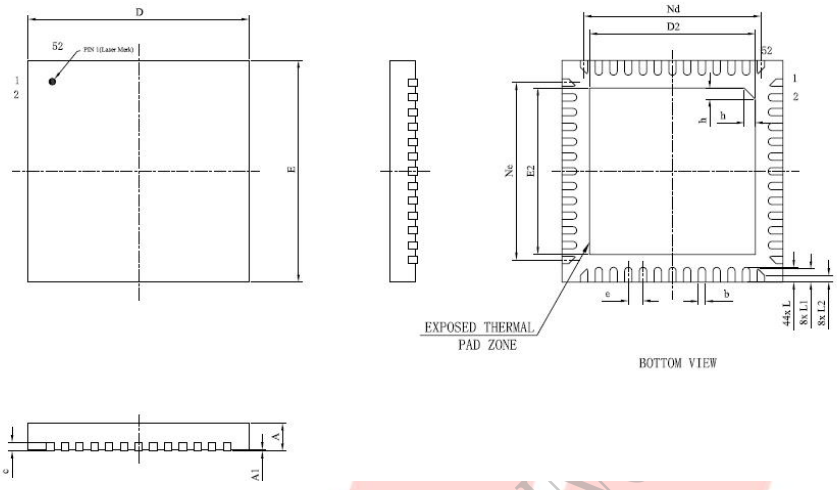
Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity			-90		dBm	25℃, Power Supply VBAT=4.2V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel Interference Rejection	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

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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. AC6954A Package

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4、Revision History

Date	Revision	Description
2020.01.07	V1.0	Initial Release
2020.03.19	V1.1	Updata Pin Assignment
2021.11.02	V1.2	Update Bluetooth and profile Visions
2021.11.26	V1.3	Update Audio characters，Update Absolute Maximum Ratings
2023.12.12	V1.4	Update Bluetooth and profile Visions
2025.01.09	V1.5	Update Bluetooth Vision and profiles
2026.03.23	V1.6	Update PMU Characteristics
2026.04.07	V1.7	Update PMU Characteristics

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