AC6951C Datasheet

Zhuhai Jieli Technology Co.,LTD

Version：V1.2

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ZHUHAI JIELI TECHNOLOGY CO.,LTD

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AC6951A 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 >= 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 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
- 13 channels 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs

PMU

- Low voltage LDO for internal digital and analog circuit supply
- 1uA current consumption in the soft-off mode
- Built-in LDO for the core, I/O, Bluetooth and flash

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- VBAT is 2.2V to 5.5V
- VDDIO is 2.2V to 3.6V
- RTCVDD is 2.2V to 3.6V

Packages

- LQFP48(7mm*7mm)

Temperature

- Operating temperature: -20℃ to +70℃
- Storage temperature: -65℃ to +150℃

Applications

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

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1、Pin Definition

1.1 Pin Assignment

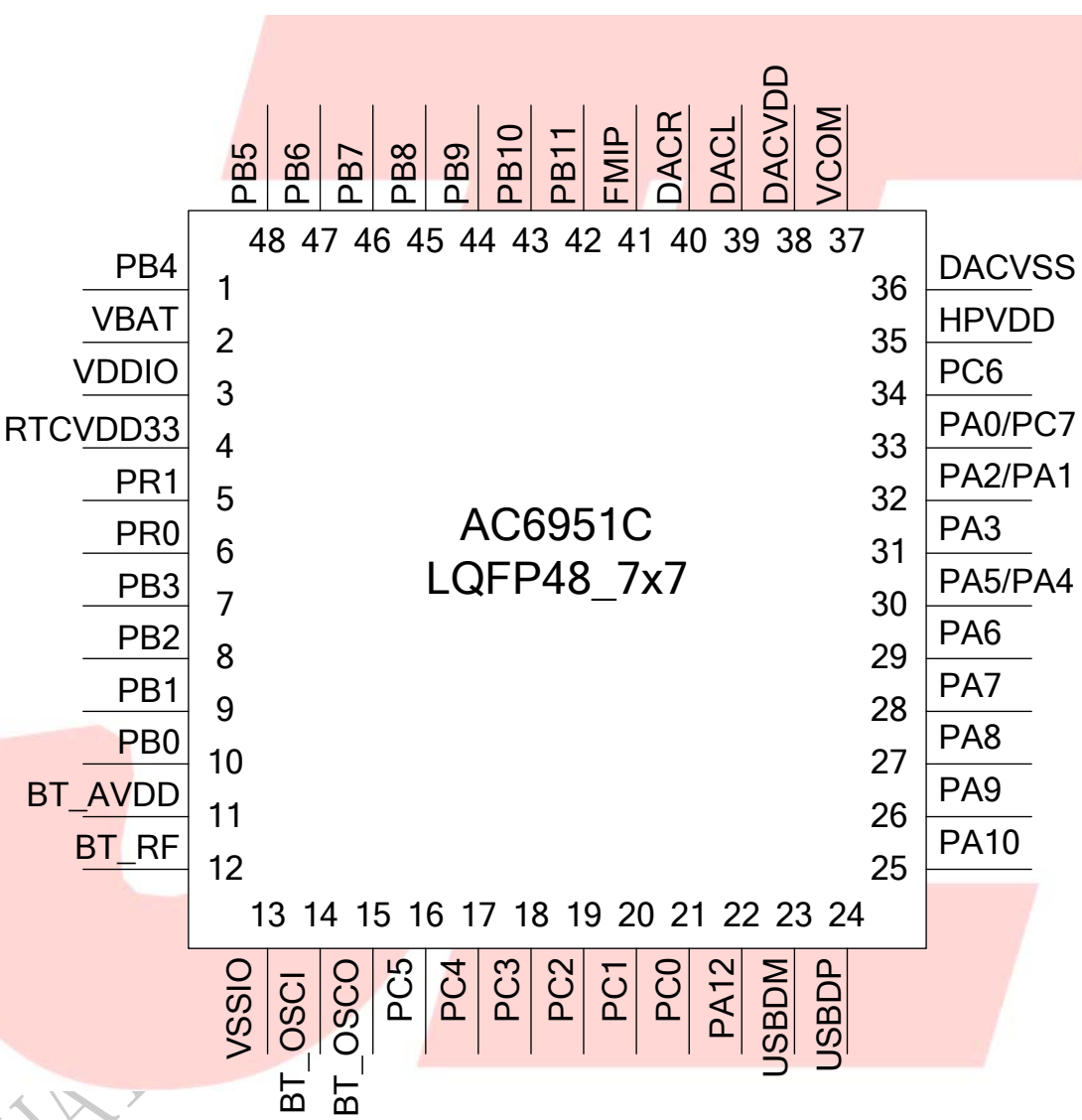


Figure 1-1 AC6951C_LQFP48 Package Diagram

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1.2 Pin Description

Table 1-1 AC6951C_LQFP48 Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
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)；
2	VBAT	P	/		Power Supply
3	VDDIO	P	/		IO Power 3.3v
4	RTVDDD33	P	/		RTC Power
5	PR1	I/O		RTCIO1	OSCO_32K
6	PR0	I/O		RTCIO0	OSCI_32K
7	PB3	I/O	24/8	GPIO	PWM2：Timer2 PWM Output; ADC6：ADC Input Channel 6;
8	PB2	I/O	8	GPIO (High Voltage Resistance)	SPI1DIA：SPI1 Data In(A); PWMCH1L：Motor PWM Channel1 (L)；
9	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)
10	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)；
11	BT_AVDD	P	/		BT Power
12	BT_RF	/	/		BT Antenna
13	VSSIO	P	/		Ground
14	BT_OSCI	I	/		BT OSC In

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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；
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);

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					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	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);
24	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;
25	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)；
26	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)；
27	PA8	I/O	24/8	GPIO	SD0DAT3A：SD0 Data3(A);

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					ALNK0_MCLKA：ALNK Master Clock(A); SEG8：LCD SEG Output8; BT_Freq FPIN2：Motor Auto-Stop Protective Pin2；
28	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;
29	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);
30	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);
	PA4	I/O	24/8	GPIO	ALNK0_DAT0A：Audio Link Data0(A); SEG4：LCD SEG Output4; Touch4：Touch Input Channel 4;
31	PA3	I/O	24/8	GPIO	PLNK_DAT1：PLNK Data1; ALNK0_LRCKA：Audio Link Word Select(A); SEG3：LCD SEG Output3; Touch3：Touch Input Channel 3; UART2RXA：Uart2 Data In(A);
32	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);

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					CAP3：Timer3 Capture;
	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);
33	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);
	PC7	I/O	/	GPIO	MIC_BIAS：Microphone Bias Output SEG21：LCD SEG Output21;
34	PC6	I/O	24/8	GPIO	MIC：MIC Input Channel; SEG20：LCD SEG Output20; ADC11：ADC Input Channel 11;
35	HPVDD	P	/		Headphone AMP Power
36	DACVSS	P	/		DAC Ground
37	VCOM	P	/		DAC Reference
38	DACVDD	P	/		DAC Power
39	DACL	O	/		DAC Left Channel
40	DACR	O	/		DAC Right Channel
41	FMIP	I	/		FM Single Input
42	PB11	I/O	/	GPIO	SDPG:SDC Power Gate;
43	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);
44	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);
45	PB8	I/O	24/8	GPIO	AMUX1R：Analog Channel1 Right; SD0DAT0B：SD0 Data0(B);

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					SPI2_DIA：SPI2 Data In(A); SD1DAT1B：SD1 Data1(B); ADC8：ADC Input Channel 8; CLKOUT1：Clk Out1;
46	PB7	I/O	24/8	GPIO	AMUX1L：Analog Channel1 Left;
47	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)；
48	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);

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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	℃
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	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	
$V_{3.3}$	Voltage output	_	3.3	_	V	VBAT = 5V, 100mA loading
V_{BT_AVDD}	Voltage output		1.3		V	VBAT=5V, 100mA loading
V_{DACVDD}	DAC Voltage	_	2.7	_	V	VBAT = 5V, 10mA 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

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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 PB0~PB11 PC0~PC6	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、internal pull-up/pull-down resistance | accuracy ±20%
PC7			10K	10K	
PB5			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	_	-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	

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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=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	

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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	

2.8 FM Receiver Characteristics

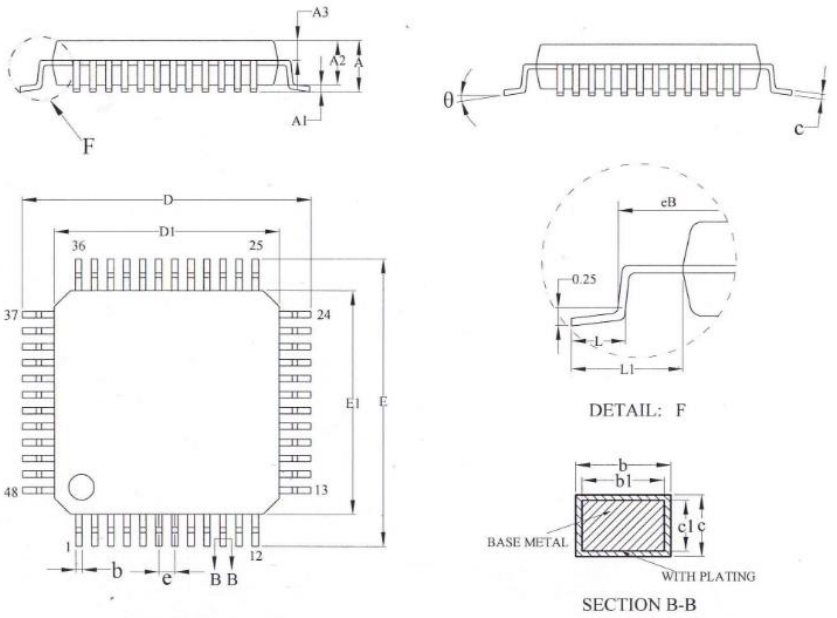
Table 2-11

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	
Audio Total Harmonic Distortion (THD)		0.4		%	

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3、 Package Information

3.1 LQFP48(7mm*7mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
A3	0.59	0.64	0.69
b	0.18	—	0.26
b1	0.17	0.20	0.23
c	0.13	—	0.17
c1	0.12	0.13	0.14
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
eB	8.10	—	8.25
e	0.50BSC		
L	0.40	—	0.65
L1	1.00REF		
θ	0	—	7°

Figure 3-1. AC6951C_LQFP48 Package

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3、Revision History

Date	Revision	Description
2019.11.15	V1.0	Initial Release
2019.12.04	V1.1	Updata 16-bit ADC Numbers
2019.12.17	V1.2	Updata Featrues

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