AC6956F Datasheet

Zhuhai Jieli Technology Co.,LTD

Version：2.2

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AC6956F 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
- 20-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 +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
- Two SD Card Host controller
- 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

- QFN32(4mm*4mm)

- Operating temperature: -40℃ to +85℃

Temperature

- Storage temperature: -65℃ to +150℃

Applications

- Bluetooth Stereo headset
- Bluetooth Mono headset

1、Pin Definition

1.1 Pin Assignment

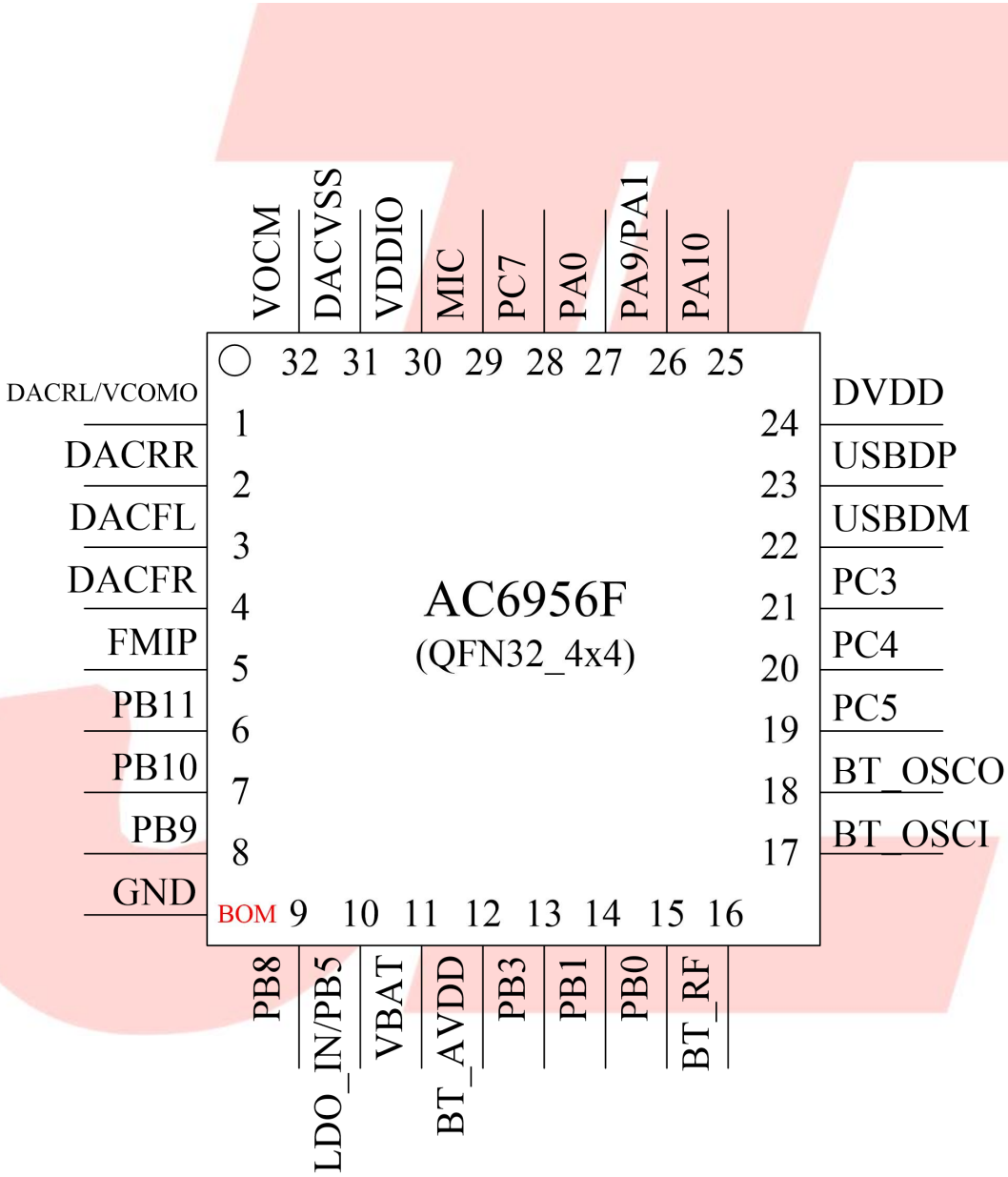


Figure 1-1 AC6956F Package Diagram

1.2 Pin Description

Table 1-1 AC6956F Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	DACRL	O	/		DAC Rear Left Channel
	VCOMO	O	/		DAC Reference Output
2	DACRR	O	/		DAC RearRight Channel
3	DACFL	O	/		DAC Front Left Channel
4	DACFR	O	/		DAC FrontRight Channel
5	FMIP	I	/		FM Single Input
6	PB11	I/O	/	GPIO	SDPG:SDC Power Gate;
7	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);
8	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);
9	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;
10	LDO_IN	P	/	Charge Power 5v	
	PB5	I/O	/	GPIO (High Voltage Resistance) *type1	PWM3：Timer3 PWM Output; CAP1：Timer1 Capture; UART0TXC：Uart0 Data Out(C); UART0RXC：Uart0 Data In(C);
11	VBAT	P	/	LDO Power	
12	BT_AVDD	P	/	BT Power 1.3v	

13	PB3	I/O	24/8	GPIO	PWM2：Timer2 PWM Output; ADC6：ADC Input Channel 6;
14	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);
15	PB0	I/O	8	GPIO (High Voltage Resistance)	SPI1CLKA：SPI1 Clock(A); UART1TXA：Uart1 Data Out(A); PWMCH1H：Motor PWM Channel1(H)；
16	BT_RF	/	/		
17	BT_OSCI	I	/	OSC In	
18	BT_OSCO	O	/	OSC Out	
19	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); ADC13：ADC Input Channel 13; PWMCH5L：Motor PWM Channel5(L)；
20	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); ADC10：ADC Input Channel 10; PWMCH5H：Motor PWM Channel5(H)；
21	PC3	I/O	24/8	GPIO	SD1DAT0A：SD1 Data0(A); SPI1DIB：SPI1 Data In(B);
22	USBDM	I/O	4	USB Negative Data (pull down) *type1	UART1RXD：Uart1 Data In(D); IIC_SDA_A：IIC SDA(A);
23	USBDP	I/O	4	USB Positive Data (pull down) *type1	UART1TXD：Uart1 Data Out(D); IIC_SCL_A：IIC SCL(A); ADC12：ADC Input Channel 12;
24	DVDD	P	/	Core Power	
25	PA10	I/O	24/8	GPIO	SD0CLKA：SD0 Clock(A); ADC3：ADC Input Channel 3; 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); Touch8：Touch Input Channel 8; UART2TXB：Uart2 Data Out(B);

					PWMCH4H：Motor PWM Channel4(H)；
	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)；
27	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)；
28	PC7	I/O	/	GPIO	MIC_BIAS：Microphone Bias Output
29	MIC	I	/		MIC：MIC Input Channel;
30	VDDIO	P	/	IO Power 3.3v	
31	DACVSS	P	/		DAC Ground
32	VCOM	P	/		DAC Reference

Note:

*type1:The GPIO is uncontrollable during the initial process

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

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		320	mA	Charge current at fast charge mode
I_{Trikl}	Trickle Charge Current	20	45	70	mA	$V_{BAT}<V_{Trikl}$

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**
PA0、PA1 PA9、PA10 PB1、PB3 PB8~PB10 PC3~PC5		8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、PB0, 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, PB5		8mA	_	10K	10K	
USBDP		4mA	_	1.5K	15K	
USBDM		4mA	_	180K	15K	

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	_	-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

2.7 ADC Characteristics

Table 2-7

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	

2.8 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	

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	

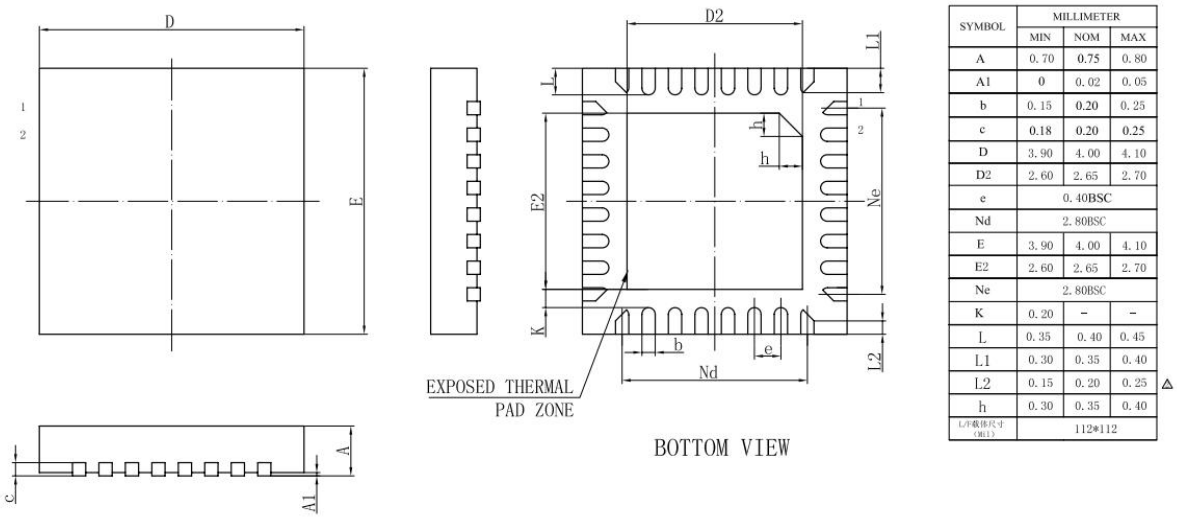
2.9 FM Receiver Characteristics

Table 2-12

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		%	

3、 Package Information

3.1 QFN32_4x4



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	0	0.02	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	3.90	4.00	4.10
D2	2.60	2.65	2.70
e	0.40BSC		
Nd	2.80BSC		
E	3.90	4.00	4.10
E2	2.60	2.65	2.70
Ne	2.80BSC		
K	0.20	-	-
L	0.35	0.40	0.45
L1	0.30	0.35	0.40
L2	0.15	0.20	0.25 △
h	0.30	0.35	0.40
L/F载体尺寸 (单位)	112*112		

Figure 3-1 AC6956F Package

4、Revision History

Date	Revision	Description
2020.01.16	V1.0	Initial Release
2020.02.28	V1.1	Update Pin Assignment，Add DVDD
2020.03.20	V1.2	Update Pin Assignment
2022.06.29	V1.3	Update Bluetooth Vision and profile
2023.01.11	V1.4	Update Pin Description
2023.11.01	V1.5	Update Bluetooth Vision and profile
2025.01.09	V2.0	Update Bluetooth Vision and profiles
2026.03.23	V2.1	Update PMU Characteristics
2026.04.07	V2.2	Update PMU Characteristics