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# **AD6983D Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version: 1.3**

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# AD6983D Features

## CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 160MHz programmable processor
- 64Vectored interrupts
- 4 Levels interrupt priority

## DSP Audio Processing

- SBC, AAC Audio decodes supported for BT audio
- mSBC voice codec 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 MIC (Analog/Digital) Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 20-band EQ configuration for voice Effects

## Audio Codec

- Two channels 24-bit DAC, SNR >= 101dB
- One channel 24-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
- One channel analog MUX
- Supports cap-less, single-ended, and differential mode at the DAC path
- Supports 16ohm and 32ohm Speaker loading

## Bluetooth

- Compliant with Bluetooth V5.3+BR+EDR+BLE specification

- Meet class2 and class3 transmitting power requirement
- Support GFSK and  $\pi/4$  DQPSK all packet types
- Provides maximum +8dbm@BDR, +6dbm@EDR transmitting power
- receiver with minimum -92dBm@EDR sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gapgat\rfcomm\sdp\l2cap profile
- a2dp 1.3.2\avctp 1.4\avdtp 1.3\ avrcp 1.6.2\ hfp 1.8 \spp 1.2\rfcomm 1.1\pnp 1.3\ hid 1.1.1\sdp core5.3\l2cap core 5.3

## Peripherals

- One full speed USB 2.0 OTG controller
- Six multi-function 32-bit timers, support capture and PWM mode
- Three full-duplex basic UART, support DMA mode
- One hardware IIC interface supports host and device mode
- Two Built-in low power Cap Sense Keys
- Built-in Cap Sense Key controller
- 10-bit ADC for analog sampling
- External wake up/interrupt on all GPIOs

## PMU

- Low voltage LDO and DC-DC for internal digital and analog circuit supply
- 2uA current consumption in the soft-off mode
- Built-in LDO and DC-DC for the core, I/O, Bluetooth and flash
- VBAT is 2.2V to 4.5V
- VDDIO is 2.2V to 3.4V

## Packages

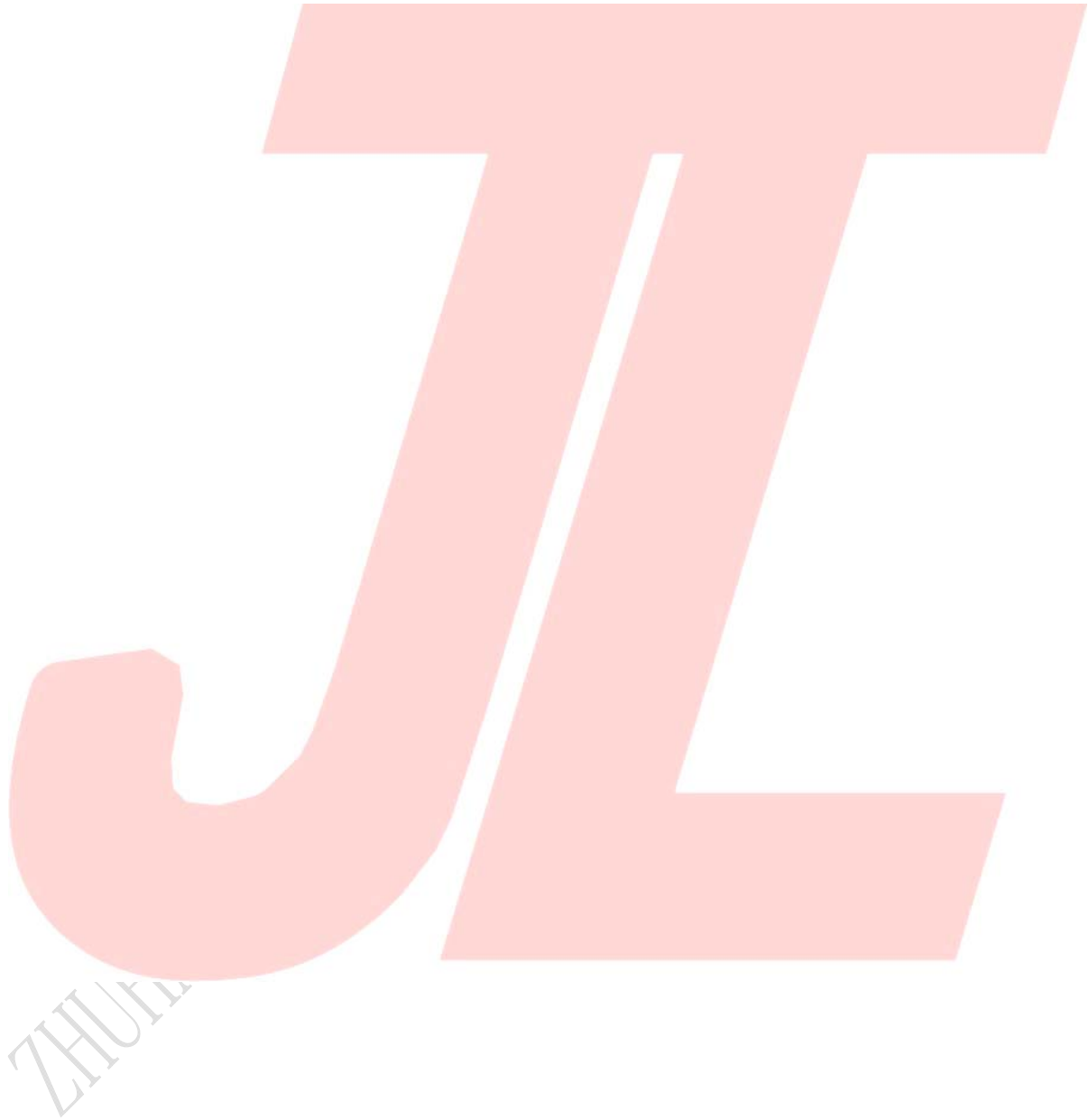
- QFN20(3mm\*3mm)

### Temperature

- Operating temperature: -40°C to +85°C
- Storage temperature: -65°C to +150°C

### Applications

- Bluetooth TWS headsets



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# 1、 Pin Definition

## 1.1 Pin Assignment

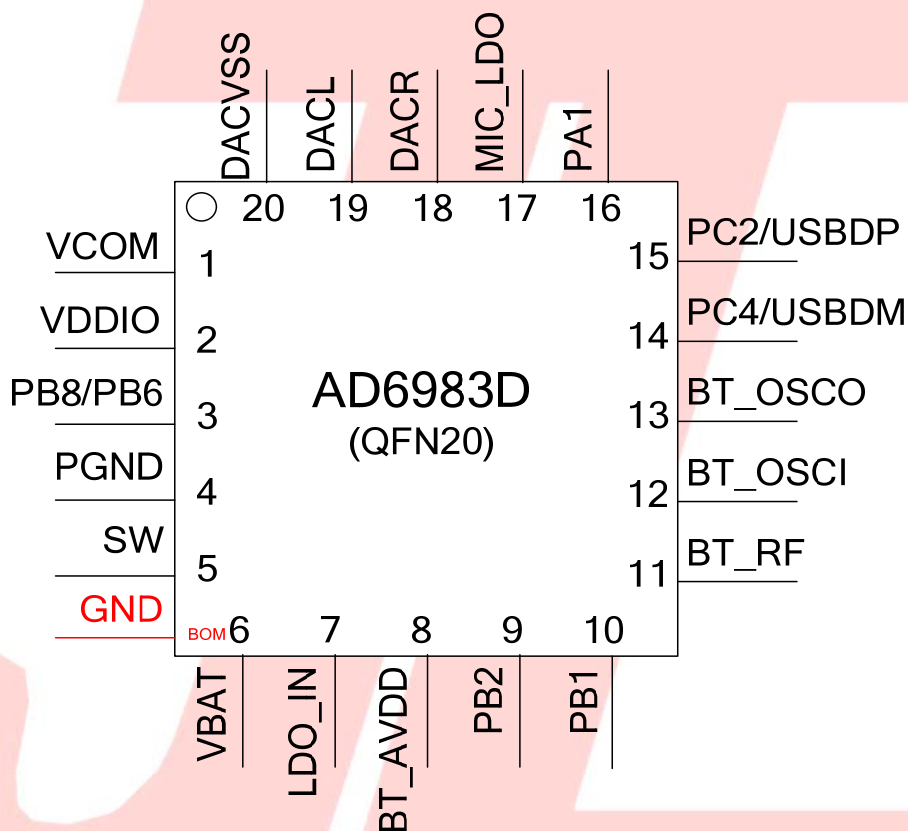


Figure 1-1 AD6983D Package Diagram

## 1.2 Pin Description

Table 1-1 AD6983D Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	VCOM	P	/		DAC reference voltage
2	VDDIO	P	/		IO Power 3.3v
3	PB8	I/O	8	GPIO	UART0RXB: Uart0 Data Input(B); CAP4: Timer4 Capture;
	PB6	I/O	8/24	GPIO	UART1RXA: Uart1 Data Input(A); PWM2: Timer2 PWM Output; ADC9: ADC Input Channel 9; Touch7: Touch Input Channel 7;
4	PGND	P	/		DCDC Ground
5	SW	P	/	DCDC output	DCDC switch output, connected to inductor
6	VBAT	P	/		Connect to battery
7	LDO_IN	P	/		Charge Power Input; UART0TXC: Uart0 Data Output(C); UART0RXC: Uart0 Data Input(C); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture;
8	BT_AVDD	P	/		BT Power
9	PB2	I/O	8/24	GPIO	UART2RXC: Uart2 Data Input(C); CAP5: Timer5 Capture; ADC7: ADC Input Channel 7; LP_TH1: Low Power Touch Channel 1
10	PB1	I/O	8/24	GPIO (pull up)	Long Press Reset; UART2TXC: Uart2 Data Output(C) ADC6: ADC Input Channel 6; LP_TH0: Low Power Touch Channel 0
11	BT_RF	/	/		BT Antenna
12	BT_OSCI	I	/		BTOSC In
13	BT_OSCO	O	/		BTOSC Out
14	PC4	I/O	8/24	GPIO	UART2TXD: Uart2 Data Output(D); IIC_SCL_B: IIC SCL(B); ADC4: ADC Input Channel 4; PWM4: Timer4 PWM Output;
	USBDM	I/O	4	USB Negative Data	UART1RXD: Uart1 Data Input(D); IIC_SDA_A: IIC SDA(A);

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					ADC11: ADC Input Channel 11;
15	USBDP	I/O	4	USB Positive Data	UART1TXD: Uart1 Data Output(D); IIC_SCL_A: IIC SCL(A); ADC10: ADC Input Channel 10;
	PC2	I/O	8/24		IIC_SCL_C: IIC SCL(C); UART0TXD: Uart0 Data Output(D); TMR1: Timer1 Clock Input;
16	PA1	I/O	8/24	GPIO	MIC0: MIC0 Input Channel ; PWM0: Timer0 PWM Output; UART1TXC: Uart1 Data Output(C);
17	MIC_LDO	P	/		MIC Power
18	DACR	O	/		DAC Right Channel
19	DACL	O	/		DAC Left Channel
20	DACVSS	P	/		Analog Ground

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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	°C
Tstg	Storage temperature	-65	+150	°C
VBAT	Supply Voltage	-0.3	4.5	V
LDO_IN	Charger Voltage	-0.3	6	V
V <sub>3.3IO</sub>	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	4.2	V	
LDO_IN	Charger supply Voltage	4.5	5.0	5.5	V	
Normal mode						
VDDIO	Voltage output	–	3.0	–	V	VBAT = 4.2V, 10mA loading
	Loading current	–	–	100	mA	VDDIO=3V@VBAT = 4.2V
BT_AVDD	Voltage output	–	1.25V	–	V	VDDIO=3.0V, 10mA loading
	Loading current	–	–	60	mA	BT_AVDD=1.25V@VDDIO=3.0v
LP mode						
VDDIO	Loading current			5	mA	VDDIO=3V@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 <sub>Charge</sub>	Charge Voltage	4.15	4.2	4.25	V	LDO_IN>4.5V
		4.30	4.35	4.40	V	LDO_IN>4.65V

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$I_{Charge}$	Charge Current	20		200	mA	Charge current at fast charge mode
$I_{Trinkl}$	Trickle Charge Current	20	45	70	mA	$V_{BAT} < V_{Trinkl}$

## 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	–	$0.3 * V_{DDIO}$	V	$V_{DDIO} = 3.0V$
$V_{IH}$	High-Level Input Voltage	$0.7 * V_{DDIO}$	–	$V_{DDIO} + 0.3$	V	$V_{DDIO} = 3.0V$
IO output characteristics						
$V_{OL}$	Low-Level Output Voltage	–	–	0.3	V	$V_{DDIO} = 3.0V$
$V_{OH}$	High-Level Output Voltage	2.7	–	–	V	$V_{DDIO} = 3.0V$

## 2.5 Internal Resistor Characteristics

Table 2-5

Port	General Output	High Drive	Internal Pull-Up Resistor	Internal Pull-Down Resistor	Comment
PA1, PB1,PB2, PB6 PC2,PC4	8mA	24mA	10K	10K	1、PB1 default pull up 2、USBDM & USBDP default pull down 3、internal pull-up/pull-down resistance   accuracy $\pm 20\%$
PB8	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	–	-80	–	dB	
S/N	–	101	–	dB	
Crosstalk	–	-80	–	dB	
Output Swing		0.45		V <sub>rms</sub>	
Dynamic Range		95		dB	1KHz/-60dB

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					10Kohm loading With A-Weighted Filter
DAC Output Power	–	6	–	mW	32ohm loading

## 2.7 ADC Characteristics

Table 2-7

Parameter	Min	Typ	Max	Unit	Test Conditions
Dynamic Range		90		dB	Fsample=44.1kHz Fin=1KHz 2mVpp Input
SNR	–	90	–	dB	Fsample=44.1kHz Fin=1KHz 1.2Vpp Input
THD+N	–	-72	–	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		7	8.5	dBm	25°C, Power Supply VBAT=3.7V 2441MHz
RF Power Control Range		20		dB	
20dB Bandwidth		950		KHz	
Adjacent Channel	+2MHz	-40		dBm	
	-2MHz	-38		dBm	
Transmit Power	+3MHz	-44		dBm	
	-3MHz	-35		dBm	

#### Enhanced Data Rate

Table 2-9

Parameter	Min	Typ	Max	Unit	Test Conditions
Relative Power		-1	-3	dB	25°C, Power Supply VBAT=3.7 2441MHz
$\pi/4$ 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	

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	-3MHz		-35		dBm	
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## 2.8.2 Receiver

### Basic Data Rate

Table 2-10

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-94	-92		dBm	25°C, Power Supply VBAT=3.7 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
Interference Rejection	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

### Enhanced Data Rate

Table 2-11

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-94	-92		dBm	25°C, Power Supply VBAT=5V 2441MHz
Co-channel Interference Rejection			-13		dB	
Adjacent Channel	+1MHz		+5		dB	
	-1MHz		+2		dB	
	+2MHz		+37		dB	
Interference Rejection	-2MHz		+36		dB	
	+3MHz		+40		dB	
	-3MHz		+35		dB	

## 2.9 ESD Protection

Parameter	Typ.	Test pin	Reference standard
Human Body Mode	±4KV	All pins	JEDEC EIA/JESD22-A114
Machine Mode	±200V	All pins	JEDEC EIA/JESD22-A115
Charge Device Model	±1KV	All pins	JEDEC EIA/JESD22-C101F
Latch up	±200mA	All GPIO pins	JEDEC STANDARD NO.78E
	1.5xVopmax	All power pins	

Note : 1.5xVopmax = 1.5 times maximum operating voltage

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### 3、 Package Information

#### 3.1 QFN20\_3.0x3.0

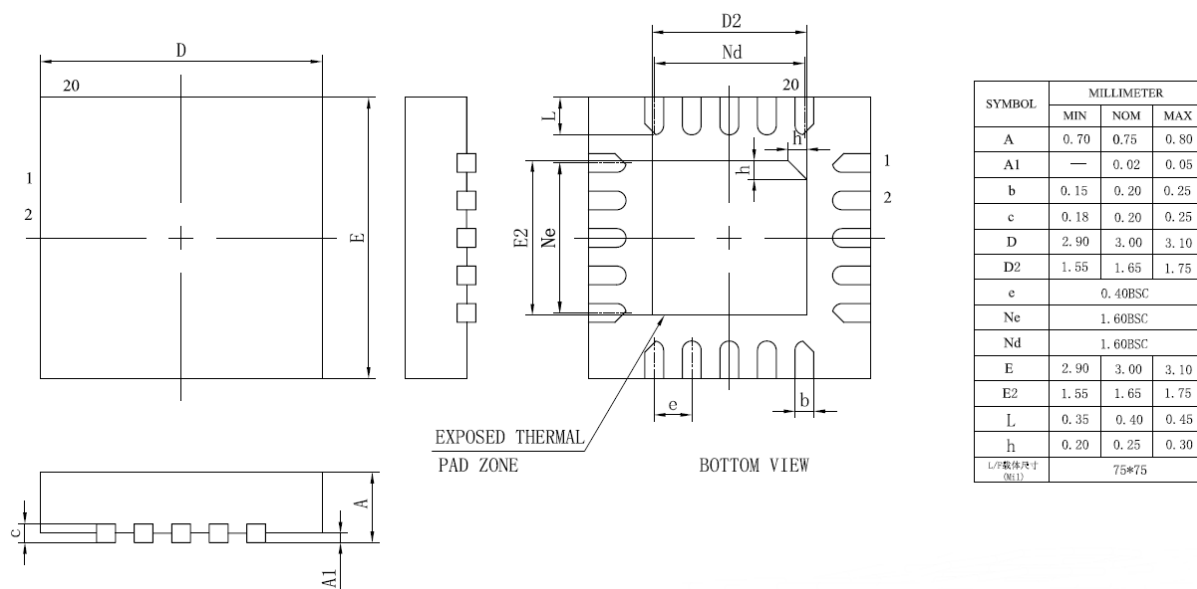


Figure 3-1 AD6983D Package

## 4、 Revision History

Date	Revision	Description
2020.11.23	V1.0	Initial Release
2021.07.23	V1.1	Update Bluetooth characteristics, Charge characteristics, Audio characteristics
2021.08.26	V1.2	Update Bluetooth and profile Visions
2022.01.10	V1.3	Add Chip ESD Protection Characteristics

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