

# **AD6983D Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version: 1.0**

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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/Dual MIC Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 20-band EQ configuration for voice Effects

## Audio Codec

- Two channels 24-bit DAC, SNR >= 101dB
- Two channels 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 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  $\pi/4$  DQPSK all packet types
- Provides maximum +8dbm@BDR, +6dbm@EDR transmitting power
- receiver with -94dBm@EDR sensitivity
- Fast AGC for enhanced dynamic range
- Supports a2dp\avctp\avdtp\avrcp\hfp\spp\smp\att\gap gatt\rfcomm\sdp\l2cap profile
- a2dp 1.3\avctp 1.4\avdtp 1.3\avrcp 1.5\hfp 1.5 \spp 1.0\rfcomm 1.2\pnp 1.3\hid 1.0\sdp core4.2\l2cap core 4.2

## 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 Headset



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# 1、 Pin Definition

## 1.1 Pin Assignment

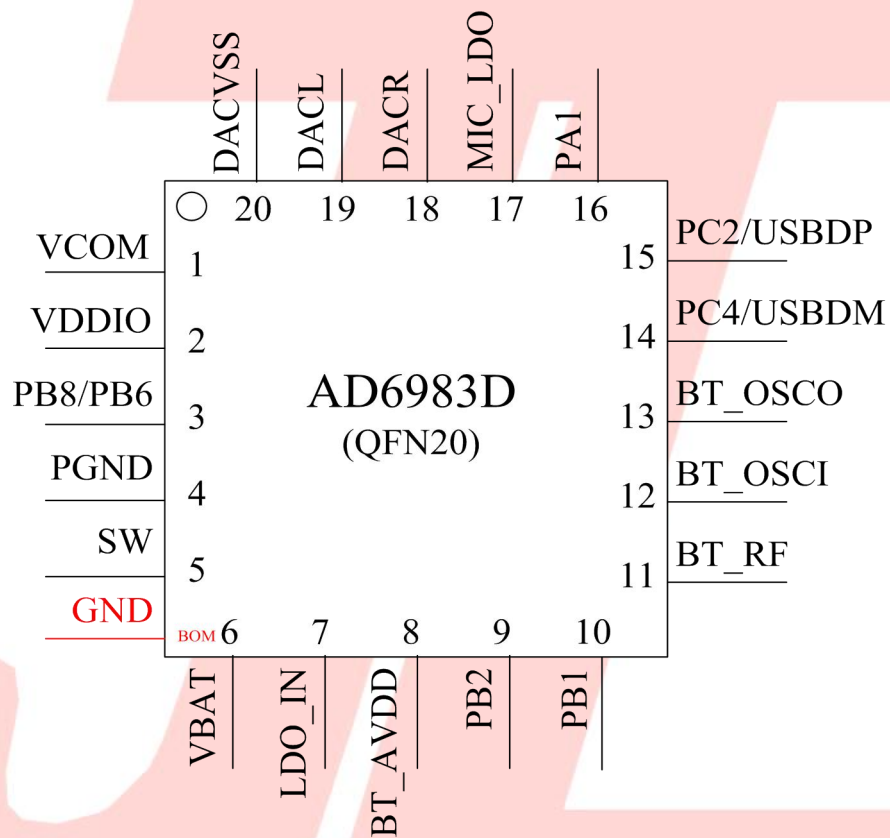


Figure 1-1 AD6983D Package Diagram

## 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);<br>CAP4: Timer4 Capture;   |
|         | PB6     | I/O      | 8/24       | GPIO              | UART1RXA: Uart1 Data Input(A);<br>PWM2: Timer2 PWM Output;<br>ADC9: ADC Input Channel 9;<br>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;<br>UART0TXC: Uart0 Data Output(C);<br>UART0RXC: Uart0 Data Input(C);<br>PWM3: Timer3 PWM Output;<br>CAP1: Timer1 Capture; |
| 8       | BT_AVDD | P        | /          |                   | BT Power  |
| 9       | PB2     | I/O      | 8/24       | GPIO              | UART2RXC: Uart2 Data Input(C);<br>CAP5: Timer5 Capture;<br>ADC7: ADC Input Channel 7;<br>LP_TH1: Low Power Touch Channel 1                    |
| 10      | PB1     | I/O      | 8/24       | GPIO<br>(pull up) | Long Press Reset;<br>UART2TXC: Uart2 Data Output(C)<br>ADC6: ADC Input Channel 6;<br>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);<br>IIC_SCL_B: IIC SCL(B);<br>ADC4: ADC Input Channel 4;<br>PWM4: Timer4 PWM Output;                           |
|         | USBDM   | I/O      | 4          | USB Negative Data | UART1RXD: Uart1 Data Input(D);<br>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);<br>IIC_SCL_A: IIC SCL(A);<br>ADC10: ADC Input Channel 10; |
|    | PC2     | I/O | 8/24 |                   | IIC_SCL_C: IIC SCL(C);<br>UART0TXD: Uart0 Data Output(D);<br>TMR1: Timer1 Clock Input;    |
| 16 | PA1     | I/O | 8/24 | GPIO              | MIC0: MIC0 Input Channel ;<br>PWM0: Timer0 PWM Output;<br>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    | –                                  |
| I <sub>Charge</sub> | Charge Current       | 20   |     | 200  | mA   | Charge current at fast charge mode |

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|              |                        |    |    |    |    |                        |
|--------------|------------------------|----|----|----|----|------------------------|
| $I_{Trickl}$ | Trickle Charge Current | 20 | 45 | 70 | mA | $V_{BAT} < V_{Trickl}$ |
|--------------|------------------------|----|----|----|----|------------------------|

## 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 = 3.0V    |
| $V_{IH}$                  | High-Level Input Voltage  | 0.7* VDDIO | –   | VDDIO+0.3  | V    | VDDIO = 3.0V    |
| IO output characteristics |                           |            |     |            |      |                 |
| $V_{OL}$                  | Low-Level Output Voltage  | –          | –   | 0.3        | V    | VDDIO = 3.0V    |
| $V_{OH}$                  | High-Level Output Voltage | 2.7        | –   | –          | V    | VDDIO = 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,<br>PB1,PB2,<br>PB6<br>PC2,PC4 | 8mA            | 24mA       | 10K                       | 10K                         | 1、PB1 default pull up<br>2、USBDM & USBDP default pull down<br>3、internal pull-up/pull-down resistance   accuracy ±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<br>10Kohm loading<br>With A-Weighted Filter |
| THD+N              | –   | -80  | –   | dB   |  |
| S/N                | –   | 101  | –   | dB   |  |
| Crosstalk          | –   | -80  | –   | dB   |  |
| Output Swing       |     | 0.45 |     | Vrms |  |
| Dynamic Range      |     | 95   |     | dB   | 1KHz/-60dB<br>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 |     | 80  |     | dB   | 1KHz/-60dB      |
| S/N           | _   | 92  | _   | dB   | 1KHz/-60dB      |
| 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      |       | 6   | 8   | dBm  | 25°C,<br>Power Supply<br>VBAT=3.7V<br>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,<br>Power Supply<br>VBAT=3.7<br>2441MHz |
| $\pi/4$ DQPSK<br>Modulation Accuracy | DEVM RMS  | 6   |     | %    |  |
|                                      | DEVM 99%  | 10  |     | %    |  |
|                                      | DEVM Peak | 15  |     | %    |  |
| Adjacent Channel<br>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                       |       |     | -94 |     | dBm  | 25°C,<br>Power Supply<br>VBAT=3.7<br>2441MHz |
| Co-channel Interference Rejection |       |     | -13 |     | dB   |  |
| Adjacent Channel                  | +1MHz |     | +5  |     | dB   |  |
|                                   | -1MHz |     | +2  |     | dB   |  |
| Interference Rejection            | +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                       |       |     | -94 |     | dBm  | 25°C,<br>Power Supply<br>VBAT=5V<br>2441MHz |
| Co-channel Interference Rejection |       |     | -13 |     | dB   |   |
| Adjacent Channel                  | +1MHz |     | +5  |     | dB   |   |
|                                   | -1MHz |     | +2  |     | dB   |   |
| Interference Rejection            | +2MHz |     | +37 |     | dB   |   |
|                                   | -2MHz |     | +36 |     | dB   |   |
|                                   | +3MHz |     | +40 |     | dB   |   |
|                                   | -3MHz |     | +35 |     | dB   |   |

### 3、 Package Information

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

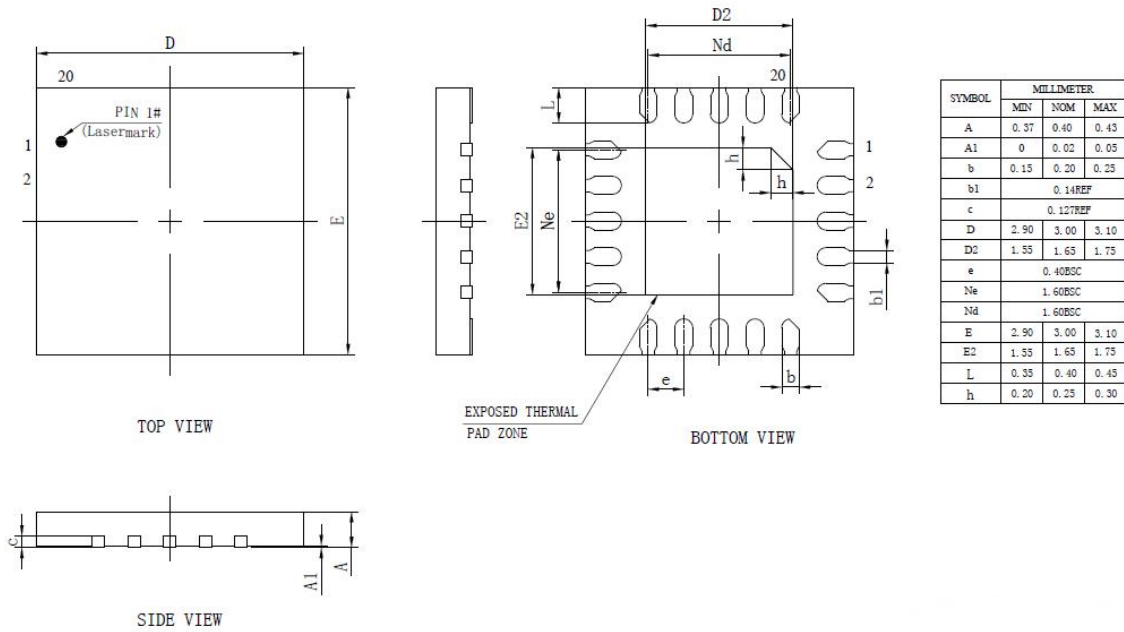


Figure 3-1 AD6983D Package

## 4、 Revision History

| Date       | Revision | Description     |
|------------|----------|-----------------|
| 2020.11.23 | V1.0     | Initial Release |
|            |          |                 |
|            |          |                 |
|            |          |                 |
|            |          |                 |

ZHUO