# AC6966B Datasheet

## Zhuhai Jieli Technology Co.,LTD

**Version：V1.2**

**Date：2021.12.23**

# AC6966B 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 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)
- One analog Environmental Noise Cancellation (ENC)
- Multi-band DRC limiter
- 10-band EQ configuration for voice Effects

## Audio Codec

- Two channels 16-bit DAC, SNR >= 95dB
- One 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
- Two channels Mono 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 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 1.3.2\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, UART0 and UART1 supports DMA mode
- Three SPI interface supports host and device mode
- One hardware IIC interface supports host and device mode
- 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 4.5V
- VDDIO is 2.2V to 3.6V

## Packages

- QFN32(4mm*4mm)

## Temperature

- Operating temperature: -40℃ to +85℃

- Storage temperature: -65℃ to +150℃

## Applications

- Bluetooth headset
- Bluetooth Speaker

# 1、Pin Definition

## 1.1 Pin Assignment

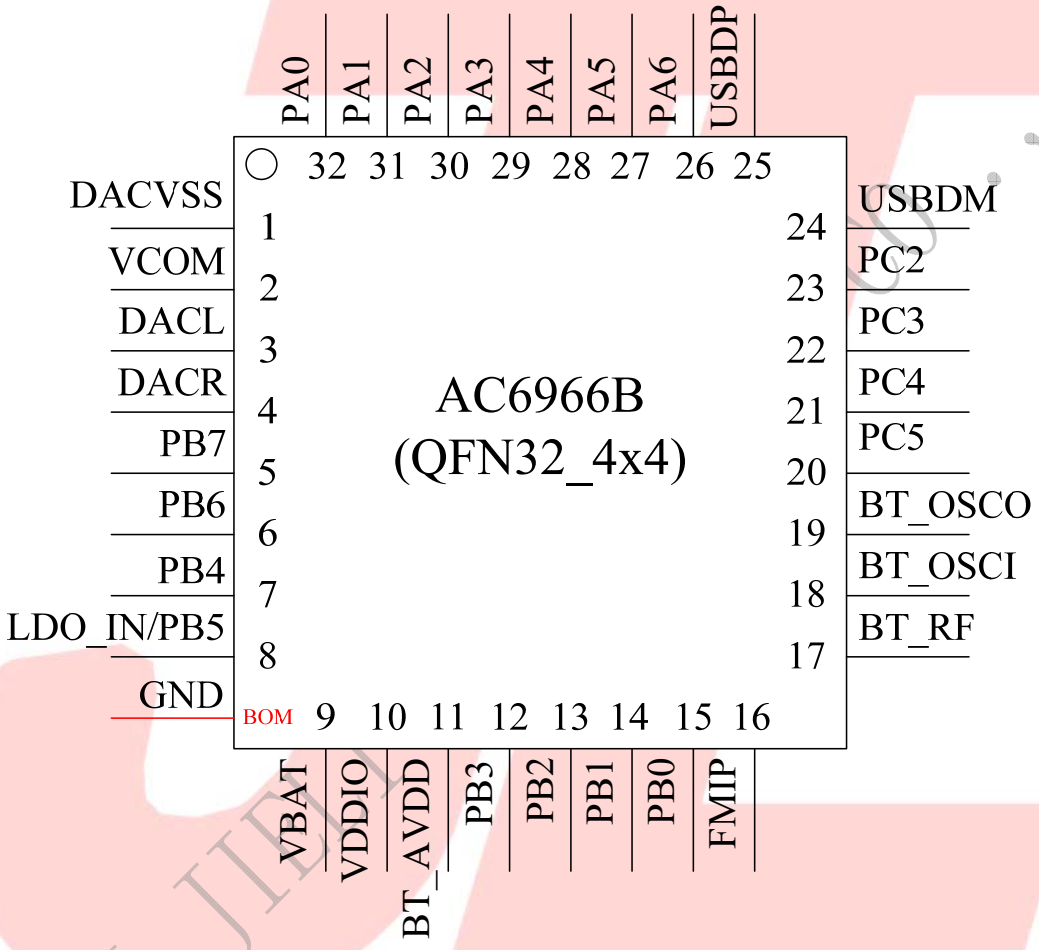



**Figure 1-1 AC6966B_QFN32 Package Diagram**

## 1.2 Pin Description

**Table 1-1 AC6966B_QFN32 Pin Description**

| PIN NO. | Name | I/O Type | Drive (mA) | Function | Other Function |
|---|---|---|---|---|---|
| 1 | DACVSS | P | / | | DAC Ground |
| 2 | VCOM | | / | | |
| 3 | DACL | O | / | | DAC Left Channel |
| 4 | DACR | O | / | | DAC Right Channel |
| 5 | PB7 | I/O | 24/8 | GPIO | SD0CLK_BF：SD0Clock(BF)<br>AMUX1R：Analog Channel1Right;<br>SPI2DOA：SPI2 Data Out(A);<br>IIC_SDA_C：IIC DAT(C);<br>ADC9：ADC Input Channel 9;<br>PWM5：Timer5 PWM Output；<br>UART1RXA：Uart1 Data In(A); |
| 6 | PB6 | I/O | 24/8 | GPIO | AMUX1L：Analog Channel1 Left;<br>SPI2CLKA：SPI2 Data Out(A);<br>IIC_SCL_C：IIC SCL(C);<br>ADC8：ADC Input Channel 8;<br>TMR3：Timer3 Clock Input;<br>UART1TXA：Uart1 Data Out(A); |
| 7 | PB4 | I/O | 24/8 | GPIO | SPI0_DAT2A(2)：SPI0 Data2 Out_A(2);<br>ADC7：ADC Input Channel 7;<br>CLKOUT1<br>UART2TXC：Uart2 Data Out(C);<br>UART2RXC：Uart2 Data In(C); |
| 8 | LDO_IN | P | / | | Battery Charger In |
| | PB5 | I/O | 8 | GPIO<br>(High Voltage Resistance) | SPI2DIA：SPI2 Data Input(A)；<br>PWM3：Timer3 PWM Output；<br>CAP1：Timer1 Capture;<br>UART0TXC：Uart0 Data Out(C)；<br>UART0RXC：Uart0 Data In(C); |
| 9 | VBAT | P | / | | Battery Power Supply |
| 10 | VDDIO | P | / | | IO Power 3.3v |
| 11 | BT_AVDD | P | / | | BT Power |
| 12 | PB3 | I/O | / | GPIO | SD0DAT_D：SD0 Data(D);<br>ADC6：ADC Input Channel 6;<br>PWM2：Timer2 PWM Output； |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | UART2RXB：Uart2 Data In(B); |
| 13 | PB2 | I/O | 8 | GPIO<br>(High Voltage Resistance) | SD0CMD_D：SD0 Command(D)<br>SPI1DIA：SPI1 Data In(A);<br>CAP0：Timer0 Capture;<br>UART2TXB：Uart2 Data Out (B)； |
| 14 | PB1 | I/O | 24/8 | GPIO<br>(pull up) | Long Press Reset；<br>SPI1DOA：SPI1 Data Out(A);<br>ADC5：ADC Input Channel 5;<br>TMR2：Timer2 Clock Input;<br>UART0RXB：Uart0 Data In(B);<br>SPDIF_IN_D：Sony/Philips Digital Interface Input(D) |
| 15 | PB0 | I/O | 8 | GPIO<br>(High Voltage Resistance) | SD0CLK_D：SD0Clock(D)<br>SPI1CLKA：SPI1 Clock(A);<br>UART0TXB：Uart1 Data Out(B);<br>TMR5：Timer5 Clock Input;<br>SPDIF_IN_C：Sony/Philips Digital Interface Input(C) |
| 16 | FMIP | / | / | | FM Antenna |
| 17 | BT_RF | / | / | | BT Antenna |
| 18 | BT_SOCI | I | / | | BT OSC In |
| 19 | BT_SOCO | O | / | | BT OSC Out |
| 20 | PC5 | I/O | 24/8 | GPIO | SD0CLK_AE：SD0 Clock(AE)<br>SPI1DOB：SPI1 Data Out(B);<br>IIC_SDA_B：IIC SDA(B);<br>ADC12：ADC Input Channel 12;<br>TMR1：Timer1 Clock Input;<br>UART2RXD：Uart2 Data In(D); |
| 21 | PC4 | I/O | 24/8 | GPIO | SD0CMD_A：SD0 Command(A);<br>SPI0_DAT3AB(3)：SPI0 Data3(AB)；<br>SPI1CLKB：SPI1 Clock(B);<br>IIC_SCL_B：IIC SCL(B);<br>ADC11：ADC Input Channel 11;<br>PWM1：Timer1 PWM Output；<br>UART2TXD：Uart2 Data Out (D)； |
| 22 | PC3 | I/O | 24/8 | GPIO | SD0DAT_A：SD0 Data(A);<br>SPI0_DAT2B(2)：SPI0 Data2(B)；<br>SPI1DIB：SPI1 Data In(B);<br>CAP2：Timer2 Capture;<br>UART0TXD：Uart0 Data Out (D)；<br>UART0RXD：Uart0 Data In(D); |
| 23 | PC2 | I/O | 24/8 | | SPI0_DIB(1)：SPI0 Data Input(B)； |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | ALNK_MCLK_B：ALNK Master Clock(B)；<br>ADC10：ADC Input Channel 10;<br>CAP5：Timer5 Capture;<br>UART1RXB：Uart1 Data In(B); |
| 24 | USBDM | I/O | 4 | USB Negative Data<br>(pull down) | SPI2DOB：SPI2 Data Out(B);<br>IIC_SDA_A：IIC SDA(A);<br>ADC14：ADC Input Channel 14;<br>UART1RXD：Uart1 Data In(D); |
| 25 | USBDP | I/O | 4 | USB Positive Data<br>(pull down) | SPI2CLKB：SPI2 Clock(B);<br>IIC_SCL_A：IIC SCL(A);<br>ADC13：ADC Input Channel 13;<br>UART1TXD：Uart1 Data Output(D)； |
| 26 | PA6 | I/O | 24/8 | | ALNK_DAT3_A：Audio Link Data3_A;<br>ALNK_LRCK_B：Audio Link Word Select(B);<br>IIC_SDA_D：IIC SDA(D);<br>ADC4：ADC Input Channel 4;<br>CAP4：Timer4 Capture;<br>UART0RXA：Uart0 Data In(A);<br>SPDIF_IN_B：Sony/Philips Digital Interface Input(B) |
| 27 | PA5 | I/O | 24/8 | | ALNK_DAT2_A：Audio Link Data2_A;<br>ALNK_SCLK_B：Audio Link Serial Clock(B);<br>IIC_SCL_D：IIC SCL(D);<br>PWM0：Timer0 PWM Output；<br>UART0TXA：Uart0 Data Output(A)；<br>SPDIF_IN_A：Sony/Philips Digital Interface Input(A) |
| 28 | PA4 | I/O | 24/8 | | SD0CMD_CE：SD0 Command(CE)<br>AMUX0R：Analog Channel0 Right;<br>PLNK_DAT1：PLNK Data1；<br>ALNK_LRCK_A：Audio Link Word Select(A);<br>ALNK_DAT3_B：Audio Link Data3_B;<br>UART1_RTS：Uart1 Request to send；<br>ADC3：ADC Input Channel 3;<br>TMR4：Timer4 Clock Input;<br>UART2RXA：Uart2 Data In(A); |
| 29 | PA3 | I/O | 24/8 | | SD0DAT_C：SD0 Data(C);<br>AMUX0L：Analog Channel0 Left;<br>PLNK_SCLK：PLNK Serial Clock； |

| | | | | | |
|---|---|---|---|---|---|
| | | | | | ALNK_SCLK_A：Audio Link Serial Clock(A)；<br>ALNK_DAT2_B：Audio Link Data2_B;<br>UART1_CTS：Uart1 Clear to send；<br>ADC2：ADC Input Channel 3;<br>PWM5：Timer5 PWM Output；<br>UART2TXA：Uart1 Data Output(D)； |
| 30 | PA2 | I/O | 24/8 | GPIO | SD0CLK_C：SD0 Clock(C);<br>MIC_BIAS：Microphone Bias Output<br>ALNK_MCLK_A：ALNK Master Clock_A;<br>ALNK_DAT1_B：Audio Link Data1_B;<br>CAP3：Timer3 Capture; |
| 31 | PA1 | I | 24/8 | | MIC：MIC Input Channel ;<br>ADC1：ADC Input Channel 1;<br>PWM4：Timer4 PWM Output；<br>UART1RXC：Uart0 Data In(C); |
| 32 | PA0 | I/O | / | | SDPG：SD Power Supply<br>ALNK_DAT0_A：Audio Link Data0_A;<br>ALNK_DAT0_B：Audio Link Data0_B;<br>ADC0：ADC Input Channel 0;<br>CLKOUT0<br>UART1TXC：Uart1 Data Output(C)； |

# 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 |
| $V_{3.3IO}$ | 3.3V IO Input Voltage | -0.3 | VDDIO+0.3 | V |
| LDO_IN | Charge Input Voltage | -0.3 | 6.5 | V |

## 2.2 PMU Characteristics

**Table** 2-2

| Symbol | Parameter | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| LDO_IN | Loading current | _ | _ | 300 | mA | VBAT = 4.2V |
| VBAT | Voltage Input | 2.2 | 3.7 | 4.5 | V | |
| $V_{VDDIO}$ | Voltage output | _ | 3.3 | _ | V | VBAT = 4.2V, 100mA loading |
| $V_{BT\_AVDD}$ | Voltage output | | 1.3 | | V | VBAT=4.2V, 100mA loading |

## 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 | | 300 | 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** |
|---|---|---|---|---|---|---|
| PA2~PA6<br>PB1,PB4<br>PB6,PB7<br>PC2~PC5 | | 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% |
| PA0<br>PB3 | Output 0 | 8mA | 24mA | 10K | 10K | |
| | Output 1 | 8mA | 64mA | | | |
| PB0, PB2, 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<br>10Kohm loading<br>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<br>10Kohm loading<br>With A-Weighted Filter |
| DAC Output Power | | 20 | _ | mW | 16ohm loading |

## 2.7 ADC Characteristics

**Table** 2-7

| Parameter | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|
| Dynamic Range | | 80 | | dB | Fsample=44.1kHz<br>Fin=1KHz 2mVpp Input |
| S/N | _ | 90 | 91 | dB | Fsample=44.1kHz<br>Fin=1KHz 1.2Vpp Input |
| THD+N | _ | -70 | _ | dB | |
| Crosstalk | _ | -90 | _ | 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℃,<br>Power Supply<br>VBAT=3.7V<br>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℃,<br>Power Supply<br>VBAT=3.7V<br>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** 2-10

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|---|---|---|---|---|---|---|
| Sensitivity | | | -90 | | dBm | 25℃, Power Supply VBAT=3.7V 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=3.7V 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 | |

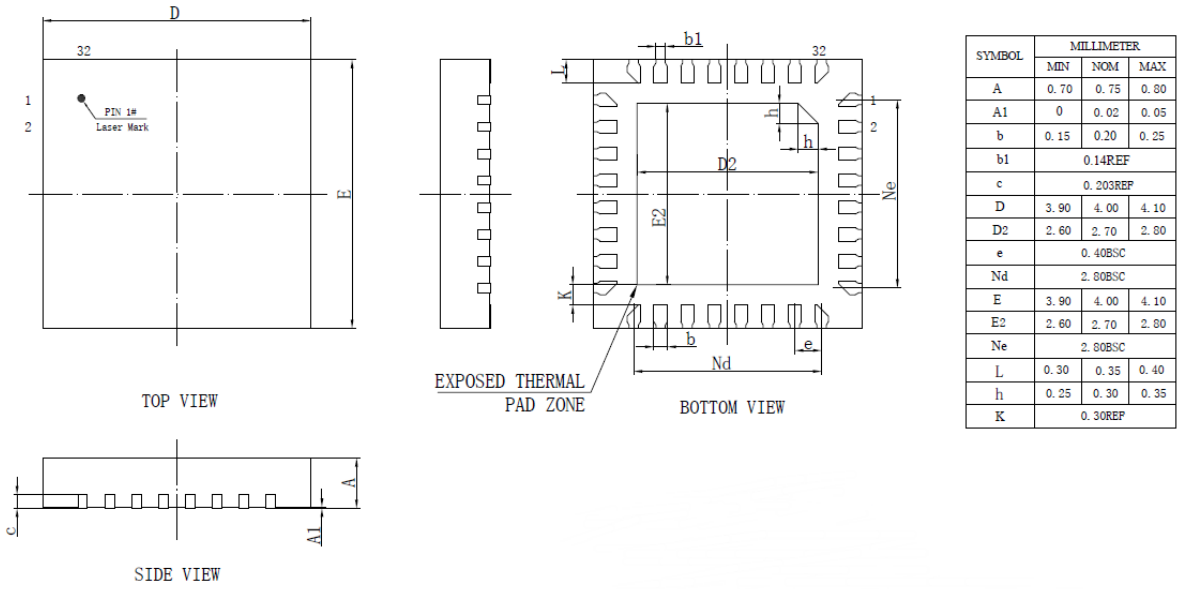
## 2.9 FM Receiver Characteristics

**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(4mm*4mm)




| 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 |
| b1 | 0.14REF | | |
| c | 0.203REF | | |
| D | 3.90 | 4.00 | 4.10 |
| D2 | 2.60 | 2.70 | 2.80 |
| e | 0.40BSC | | |
| Nd | 2.80BSC | | |
| E | 3.90 | 4.00 | 4.10 |
| E2 | 2.60 | 2.70 | 2.80 |
| Ne | 2.80BSC | | |
| L | 0.30 | 0.35 | 0.40 |
| h | 0.25 | 0.30 | 0.35 |
| K | 0.30REF | | |

**Figure 3-1. AC6966B_QFN32 Package**

# 4、 Revision History

| Date | Revision | Description |
|---|---|---|
| 2020.06.01 | V1.0 | Initial Release |
| 2021.11.22 | V1.1 | Update Bluetooth Vision and profiles，Update Audio characters |
| 2021.12.23 | V1.2 | Update package size |
| | | |