

# **AC6963B Datasheet**

**Zhuhai Jieli Technology Co.,LTD**

**Version: V1.0**

**Date: 2020.11.11**

# AC6963B Features

## CPU

- 32-bit DSP supports hardware Float Point Unit (FPU)
- Up to 160MHz programmable processor
- 64 Vectored 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
- 10-band EQ configuration for voice Effects

## Audio Codec

- Two channels 16-bit DAC, SNR  $\geq$  95dB
- One channels 16-bit ADC, SNR  $\geq$  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 V5.1+BR+EDR+BLE specification
- Meet class1 class2 and class3 transmitting

power requirement

- Support GFSK and  $\pi/4$  DQPSK all packet 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
- Six multi-function 32-bit timers, support capture and PWM mode
- Three full-duplex basic UART, UART0 and UART1 supports DMA 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 5.5V
- VDDIO is 2.2V to 3.6V

## Packages

- QFN20(3mm\*3mm)

## Temperature

- Operating temperature: -40°C to +70°C
- Storage temperature: -65°C to +150°C

## Applications

- Bluetooth Stereo speaker
- Bluetooth TWS speaker

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# 1、Pin Definition

## 1.1 Pin Assignment

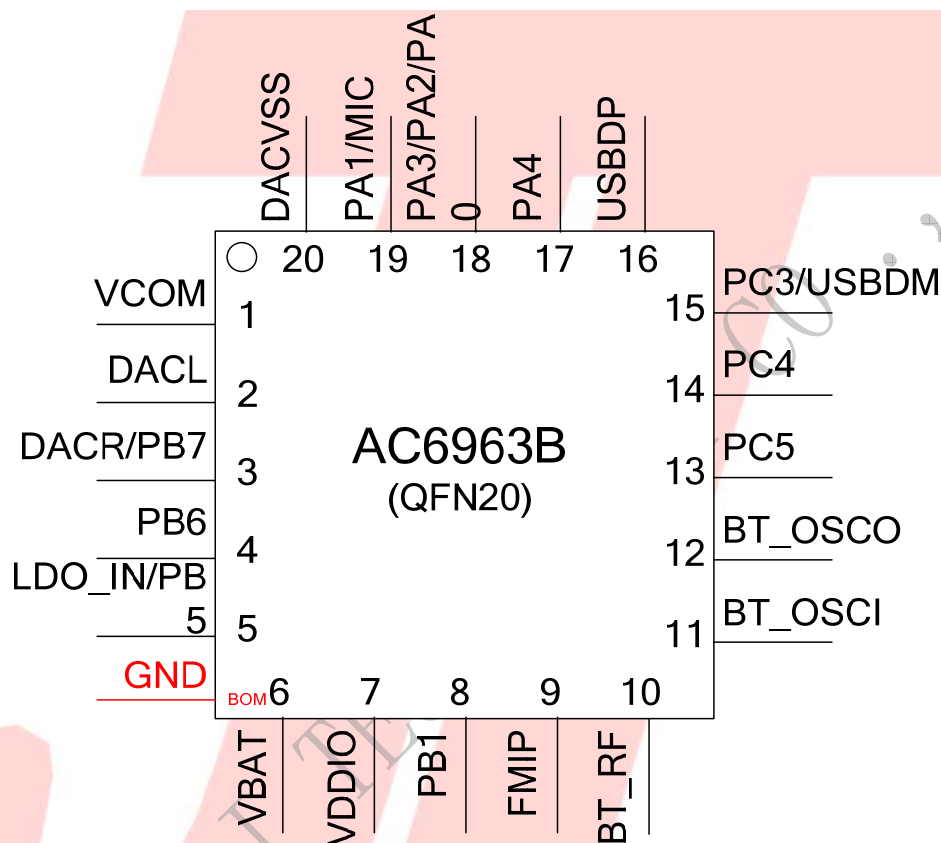


Figure 1-1 AC6963B\_QFN20

## 1.2 Pin Description

Table 1-1 AC6963B\_QFN20 Pin Description

| PIN NO. | Name    | I/O Type | Drive (mA) | Function                          | Other Function                                                                                                                                                                    |
|---------|---------|----------|------------|-----------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 1       | VCOM    | P        | /          |                                   |                                                                                                                                                                                   |
| 2       | DACL    | O        | /          |                                   | DAC Left Channel                                                                                                                                                                  |
|         | DACR    | O        | /          |                                   | DAC Right Channel                                                                                                                                                                 |
| 3       | PB7     | I/O      | 24/8       | GPIO                              | AMUX1R: Analog Channel1 Right;<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);   |
| 4       | 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); |
|         | LDO_IN  | P        | /          |                                   | Battery Charger In                                                                                                                                                                |
| 5       | 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);                                  |
| 6       | VBAT    | P        | /          |                                   | Battery Power Supply                                                                                                                                                              |
| 7       | VDDIO   | P        | /          |                                   | IO Power 3.3v                                                                                                                                                                     |
| 8       | 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);                                         |
| 9       | FMIP    | I        | /          |                                   | FM Antenna                                                                                                                                                                        |
| 10      | BT_RF   | /        | /          |                                   | BT Antenna                                                                                                                                                                        |
| 11      | BT_SOCI | I        | /          |                                   | BT OSC In                                                                                                                                                                         |
| 12      | BT_SOCO | O        | /          |                                   | BT OSC Out                                                                                                                                                                        |
| 13      | PC5     | I/O      | 24/8       | GPIO                              | SD0CLKA: SD0 Clock(A);<br>SPI1DOB: SPI1 Data Out(B);                                                                                                                              |

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|    |       |     |      |                                  |                                                                                                                                                                                                                         |
|----|-------|-----|------|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|    |       |     |      |                                  | IIC_SDA_B: IIC SDA(B);<br>ADC12: ADC Input Channel 12;<br>TMR1: Timer1 Clock Input;<br>UART2RXD: Uart2 Data In(D);                                                                                                      |
| 14 | PC4   | I/O | 24/8 | GPIO                             | SD0CMDA: 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);          |
| 15 | PC3   | I/O | 24/8 | GPIO                             | SD0DAT0A: SD0 Data0(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);                                          |
|    | 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);                                                                                                     |
| 16 | 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);                                                                                                   |
| 17 | PA4   | I/O | 24/8 |                                  | SD0CMDC: SD0 Command(C)<br>AMUX0R: Analog Channel0 Right;<br>PLNK_DAT1: PLNK Data1;<br>UART1_RTS: Uart1 Request to send;<br>ADC3: ADC Input Channel 3;<br>TMR4: Timer4 Clock Input;<br>UART2RXA: Uart2 Data In(A);      |
| 18 | PA3   | I/O | 24/8 |                                  | SD0DATC: SD0 Data(C);<br>AMUX0L: Analog Channel0 Left;<br>PLNK_SCLK: PLNK Serial Clock;<br>UART1_CTS: Uart1 Clear to send;<br>ADC2: ADC Input Channel 3;<br>PWM5: Timer5 PWM Output;<br>UART2TXA: Uart1 Data Output(D); |
|    | PA2   | I/O | 24/8 | GPIO                             | MIC_BIAS: Microphone Bias Output<br>CAP3: Timer3 Capture;                                                                                                                                                               |
|    | PA0   | I/O | /    |                                  | SDPG: SD Power Supply<br>ADC0: ADC Input Channel 0;                                                                                                                                                                     |

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|    |        |     |      |      |                                                                                       |
|----|--------|-----|------|------|---------------------------------------------------------------------------------------|
|    |        |     |      |      | CLKOUT0<br>UART1TXC: Uart1 Data Output(C);                                            |
| 19 | PA1    | I/O | 24/8 | GPIO | ADC1: ADC Input Channel 1;<br>PWM4: Timer4 PWM Output;<br>UART1RXC: Uart0 Data In(C); |
|    | MIC    | I   | /    |      | MIC: MIC Input Channel ;                                                              |
| 20 | DACVSS | P   | /    |      | DAC Ground                                                                            |

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## 2、Electrical Characteristics

### 2.1 Absolute Maximum Ratings

Table 2-1

| Symbol             | Parameter             | Min  | Max  | Unit |
|--------------------|-----------------------|------|------|------|
| T <sub>opt</sub>   | Operating temperature | -40  | +85  | °C   |
| T <sub>stg</sub>   | Storage temperature   | -65  | +150 | °C   |
| V <sub>BAT</sub>   | Supply Voltage        | -0.3 | 5.5  | 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                        |
|--------------------|-----------------|-----|-----|-----|------|----------------------------------------|
| LDO_IN             | Loading current | —   | —   | 250 | mA   | V <sub>BAT</sub> = 4.2V                |
| V <sub>BAT</sub>   | Voltage Input   | 2.2 | 3.7 | 5.5 | V    | LDO_IN = 5V                            |
| V <sub>VDDIO</sub> | Voltage output  | —   | 3.3 | —   | V    | V <sub>BAT</sub> = 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 <sub>Charge</sub> | Charge Voltage       | 4.15 | 4.2 | 4.25 | V    | —                                  |
| I <sub>Charge</sub> | Charge Current       | 20   |     | 250  | mA   | Charge current at fast charge mode |

### 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                  | — | $0.3 \times V_{DDIO}$ | V | $V_{DDIO} = 3.3V$ |
| $V_{IH}$                         | High-Level Input Voltage  | $0.7 \times V_{DDIO}$ | — | $V_{DDIO} + 0.3$      | V | $V_{DDIO} = 3.3V$ |
| <b>IO output characteristics</b> |                           |                       |   |                       |   |                   |
| $V_{OL}$                         | Low-Level Output Voltage  | —                     | — | 0.33                  | V | $V_{DDIO} = 3.3V$ |
| $V_{OH}$                         | High-Level Output Voltage | 2.7                   | — | —                     | V | $V_{DDIO} = 3.3V$ |

## 2.5 Internal Resistor Characteristics

Table 2-5

| Port                                 | General Output | High Drive | Internal Pull-Up Resistor | Internal Pull-Down Resistor | Comment                                                                                                                     |
|--------------------------------------|----------------|------------|---------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------|
| PA1~PA4<br>PB1<br>PB6,PB7<br>PC3~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 $\pm 20\%$ |
| PA0                                  | 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 | 1KHz/-60dB<br>10Kohm loading<br>With A-Weighted Filter |
| Dynamic Range      | —   | 90  | —   | dB   |                                                        |
| 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      |

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|           |   |     |    |    |            |
|-----------|---|-----|----|----|------------|
| S/N       | — | 90  | 91 | dB | 1KHz/-60dB |
| 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°C,<br>Power Supply<br>VBAT=5V<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  |     | dB   | 25°C,<br>Power Supply<br>VBAT=5V<br>2441MHz |
| $\pi/4$ DQPSK<br>Modulation Accuracy | DEVM RMS  |     | 6   |     | %    |                                             |
|                                      | DEVM 99%  |     | 10  |     | %    |                                             |
|                                      | DEVM Peak |     | 15  |     | %    |                                             |
| Adjacent Channel                     | +2MHz     |     | -40 |     | dBm  |                                             |
|                                      | -2MHz     |     | -38 |     | dBm  |                                             |
| Transmit Power                       | +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°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 |     | +37 |     | dB   |                                             |

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|  |       |  |     |  |    |  |
|--|-------|--|-----|--|----|--|
|  | -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°C,<br>Power Supply<br>VBAT=5V<br>2441MHz |
| Co-channel Interference Rejection          |       | -13 |     | dB   |                                             |
| Adjacent Channel<br>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<br>EMF | (S+N)/N=26dB             |
| Adjacent Channel Selectivity             |     | 48  |     | dB          | ± 200kHz                 |
| IIP3                                     |     | 88  |     | dBμV<br>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<br>Distortion (THD) |     | 0.4 |     | %           |                          |

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### 3、 Package Information

#### 3.1 QFN20(3mm\*3mm)

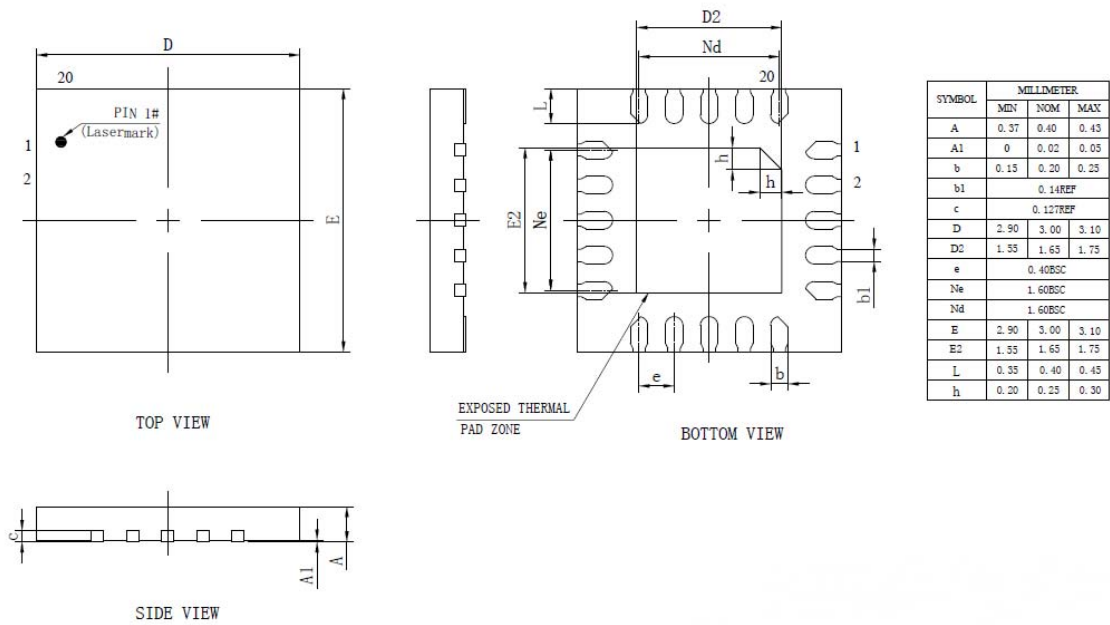


Figure 3-1. AC6963B\_QFN20 Package

## 4、Revision History

| Date       | Revision | Description     |
|------------|----------|-----------------|
| 2020.11.11 | V1.0     | Initial Release |
|            |          |                 |
|            |          |                 |

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