

AC6354B Datasheet

Zhuhai Jieli Technology Co.,LTD

Version: V1.2

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AC6354B Features

CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 240MHz 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
- 30-band EQ configuration for voice Effects

Audio Codec

- Two channels 16-bit DAC, SNR >= 92dB
- 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 V5.4+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
- Two PCM/IIS for external digital Audio code, supports host and device mode
- 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
- Three SPI interface supports host and device mode
- Two SD Card Host controller
- One hardware IIC interface supports host and device mode
- Four SPDIF receiving interface without analog amplify
- Supports HDMI ARC (Audio Return Channel) receiving
- Segment LCD panels
- Digital matrix LED panels
- 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

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- Built-in Li-Ion battery charger with up to 200mA charger current capability
- VBAT is 2.2V to 5.5V
- VDDIO is 2.2V to 3.6V

Temperature

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

Packages

- QFN52(6mm*6mm)

Applications

- Bluetooth Keyboard

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1、 Pin Definition

1.1 Pin Assignment

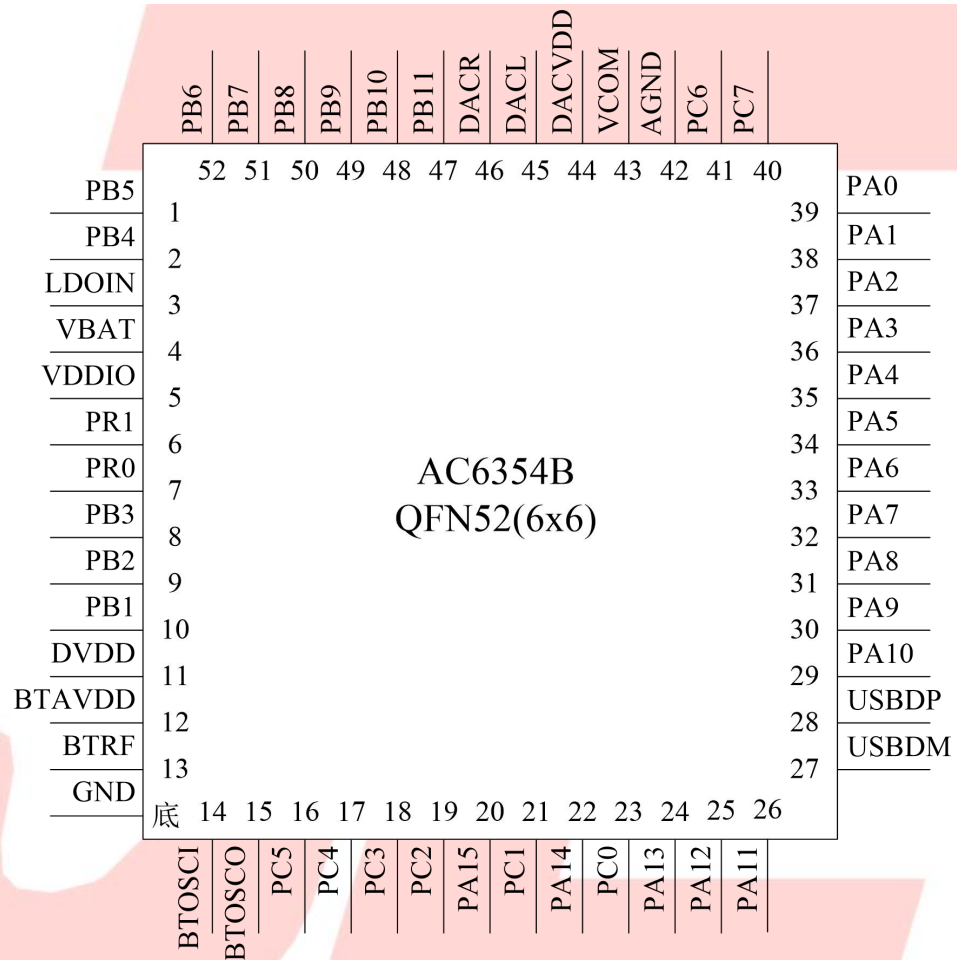


Figure 1-1 AC6354B_QFN52 Package Diagram

1.2 Pin Description

Table 1-1 AC6354B_QFN52 Pin Description

| PIN NO. | Name | I/O Type | Drive (mA) | Function | Other Function |
|---------|--------|----------|------------|-----------------------------------|--|
| 1 | PB5 | I/O | / | GPIO (High Voltage Resistance) | SD1CMDB: SD1 Command(B); SD0DAT2B: SD1 Data2(B); PWM3: Timer3 PWM Output; CAP1: Timer1 Capture; UART0TXC: Uart0 Data Out(C); UART0RXC: Uart0 Data In(C); |
| 2 | PB4 | I/O | 24/8 | GPIO | SD1DAT0B: SD1 Data0(B); SD0DAT3B: SD0 Data3(B); IIC_SCL_C: IIC SCL(C); ADC7: ADC Input Channel 7; UART0TXB: Uart0 Data Out(B); LVD: Low Voltage Detect Input; PWMCH2H: Motor PWM Channel2 (H); |
| 3 | LDO_IN | P | / | | Battery Charger Power In |
| 4 | VBAT | P | / | | Power Supply |
| 5 | VDDIO | P | / | | IO Power 3.3V |
| 6 | PR1 | I/O | 8 | GPIO | OSCO_32K: 32KHz OSC Out |
| 7 | PR0 | I/O | 8 | GPIO | OSCI_32K: 32KHz OSC In |
| 8 | PB3 | I/O | 24/8 | GPIO | PWM2: Timer2 PWM Output; ADC6: ADC Input Channel 6; |
| 9 | PB2 | I/O | 8 | GPIO (High Voltage Resistance) | PWMCH1L: Motor PWM Channel1 (L); |
| 10 | PB1 | I/O | 24/8 | GPIO (pull up) | Long Press Reset; ADC5: ADC Input Channel 5; UART1RXA: Uart1 Data In(A); |
| 11 | DVDD | P | / | | Core Power 1.2V |
| 12 | BTAVDD | P | / | | BT Power |
| 13 | BTRF | / | / | | BT Antenna |
| 14 | BTOSCI | I | / | | BT OSC In |
| 15 | BTOSCO | O | / | | BT OSC Out |

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| | | | | | |
|----|-------|-----|------|----------------------------------|---|
| 16 | 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; Touch15: Touch Input Channel 15; PWMCH5L: Motor PWM Channel5(L); |
| 17 | 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; Touch14: Touch Input Channel 14; PWMCH5H: Motor PWM Channel5(H); |
| 18 | PC3 | I/O | 24/8 | GPIO | SD1DAT0A: SD1 Data0(A); SPI1DIB: SPI1 Data In(B); ALNK1_DAT1; Touch13: Touch Input Channel 13; |
| 19 | PC2 | I/O | 24/8 | GPIO | SD1DAT1A: SD1 Data1(A); ALNK1_DAT0; Touch12: Touch Input Channel 12; FPIN5: Motor Auto-Stop Protective Pin5; |
| 20 | PA15 | I/O | 24/8 | GPIO | CAP2: Timer2 Capture; |
| 21 | PC1 | I/O | 24/8 | GPIO | SD1DAT2A: SD1 Data2(A); Touch11: Touch Input Channel 11; UART1RXB: Uart1 Data In(B); FPIN4: Motor Auto-Stop Protective Pin4; |
| 22 | PA14 | I/O | 24/8 | GPIO | FPIN0: Motor Auto-Stop Protective Pin0; |
| 23 | PC0 | I/O | 24/8 | GPIO | SD1DAT3A: SD1 Data3(A); Touch10: Touch Input Channel 10; UART1TXB: Uart1 Data Out(B); FPIN3: Motor Auto-Stop Protective Pin3; |
| 24 | PA13 | I/O | 24/8 | GPIO | |
| 25 | PA12 | I/O | 24/8 | GPIO | PWM1: Timer1 PWM Output; ADC4: ADC Input Channel 4; UART0RXD: Uart0 Data In(D); |
| 26 | PA11 | I/O | 24/8 | GPIO | UART0TXD: Uart0 Data Out(D); |
| 27 | USBDM | I/O | 4 | USB Negative Data (pull down) | UART1RXD: Uart1 Data In(D); SPI2DOB: SPI2 Data Out(B); IIC_SDA_A: IIC SDA(A); |
| 28 | USBDP | I/O | 4 | USB Positive Data (pull down) | UART1TXD: Uart1 Data Out(D); SPI2CLKB: SPI2 Clock(B); IIC_SCL_A: IIC SCL(A); ADC12: ADC Input Channel 12; |

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| | | | | | |
|----|------|-----|------|------|---|
| 29 | PA10 | I/O | 24/8 | GPIO | SD0CLKA: SD0 Clock(A); ADC3: ADC Input Channel 3; TMR1: Timer1 Clock Input; Touch9: Touch Input Channel 9; UART2RXB: Uart2 Data In(B); PWMCH4L: Motor PWM Channel4(L); |
| 30 | 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); |
| 31 | PA8 | I/O | 24/8 | GPIO | SD0DAT3A: SD0 Data3(A); FPIN2: Motor Auto-Stop Protective Pin2; |
| 32 | PA7 | I/O | 24/8 | GPIO | SD0DAT2A: SD0 Data2(A); TMR0: Timer0 Clock Input; Touch7: Touch Input Channel 7; |
| 33 | PA6 | I/O | 24/8 | GPIO | SD0DAT1A: SD0 Data1(A); ADC2: ADC Input Channel 2; IIC_SDA_D: IIC SDA(D); Touch6: Touch Input Channel 6; UART0RXA: Uart0 Data In(A); |
| 34 | PA5 | I/O | 24/8 | GPIO | SD0DAT0A: SD0 Data0(A); ADC1: ADC Input Channel 1; IIC_SCL_D: IIC SCL(D); Touch5: Touch Input Channel 5; PWM0: Timer0 PWM Output; UART0TXA: Uart0 Data Out(A); |
| 35 | PA4 | I/O | 24/8 | GPIO | Touch4: Touch Input Channel 4; |
| 36 | PA3 | I/O | 24/8 | GPIO | Touch3: Touch Input Channel 3; UART2RXA: Uart2 Data In(A); |
| 37 | PA2 | I/O | 24/8 | GPIO | Touch2: Touch Input Channel 2; UART2TXA: Uart2 Data Out(A); CAP3: Timer3 Capture; |
| 38 | PA1 | I/O | 24/8 | GPIO | Touch1: Touch Input Channel 1; ADC0: ADC Input Channel 0; UART1RXC: Uart1 Data In(C); PWMCH0L: Motor PWM Channel0(L); |
| 39 | PA0 | I/O | 24/8 | GPIO | Touch0: Touch Input Channel 0; CLKOUT0: UART1TXC: Uart1 Data Out(C); PWMCH0H: Motor PWM Channel0(H); |
| 40 | PC7 | I/O | / | GPIO | |
| 41 | PC6 | I/O | / | GPIO | ADC11: ADC Input Channel 11; |

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| | | | | | |
|----|-----------|-----|------|----------------------------|--|
| 42 | AGND | P | / | Ground for audio DAC logic | |
| 43 | VCOM | | | DAC Reference | |
| 44 | DACVDD | | | Power for audio DAC logic | |
| 45 | DACL | O | / | DAC Left Channel | |
| 46 | DACR | O | / | DAC Right Channel | |
| 47 | PB11 | I/O | / | GPIO | SDPG:SDC Power Gate; |
| 48 | PB10 | I/O | 24/8 | GPIO | 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); |
| 49 | PB9 | I/O | 24/8 | GPIO | SD0 Clock(B); SPI2CLKA: SPI2 Clk(A); SD1DAT2B: SD1 Data2(B); CAP0: Timer0 Capture; UART2TXC: Uart2 Data Out(C); PWMCH3H: Motor PWM Channel3(H); |
| 50 | PB8 | I/O | 24/8 | GPIO | SD0DAT0B: SD0 Data0(B); SPI2_DIA: SPI2 Data In(A); SD1DAT1B: SD1 Data1(B); ADC8: ADC Input Channel 8; CLKOUT1: Clk Out1; |
| 51 | PB7 | I/O | 24/8 | GPIO | |
| 52 | PB6 | I/O | 24/8 | GPIO | SD1CLKB: SD1 Clock(B); SD0DAT1B: SD0 Data1(B); IIC_SDA_C: IIC SDA(C); TMR3: Timer3 Clock Input; UART0RXB: Uart0 Data In(B); PWMCH2L: Motor PWM Channel2 (L); |
| | Substrate | GND | - | Substrate | |

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2、Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

| Symbol | Parameter | Min | Max | Unit |
|--------------------|-----------------------|------|------|------|
| Tamb | Operating Temperature | -40 | +85 | °C |
| Tstg | Storage temperature | -65 | +150 | °C |
| VBAT | Supply Voltage | -0.3 | 5.5 | V |
| LDO_IN | Charger Voltage | -0.3 | 6 | V |
| V _{3.3IO} | 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 | 5.5 | V | |
| LDO_IN | Charger Voltage | 4.5 | 5.0 | 5.5 | V | |
| V _{3.3} | Voltage output | 2.2 | 3.0 | 3.4 | V | VBAT = 3.7V, 100mA loading |
| V _{BT_AVDD} | Voltage output | 1.2 | 1.25 | 1.35 | V | VBAT=3.7V, 100mA loading |
| I _{L3.3} | Loading current | — | — | 150 | mA | VBAT = 3.7V |

2.3 IO Input/Output Electrical Logical Characteristics

Table 2-3

| 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 | — | — | 0.33 | V | VDDIO = 3.0V |
| V _{OH} | High-Level Output Voltage | 2.7 | — | — | V | VDDIO = 3.0V |

2.4 Internal Resistor Characteristics

Table 2-4

| Port | | General Output | High Drive | Internal Pull-Up Resistor | Internal Pull-Down Resistor | Comment |
|--|---------|----------------|------------|---------------------------|-----------------------------|---|
| PA0~PA15 PB1, PB3, PB4, PB6~PB10 PC0~PC5 | | 8mA | 24mA | 10K | 10K | 1、PB1 default pull up 2、USBDM & USBDP default pull down 3、PB0, PB2, PB5 can pull-up resistance to 5V 4、internal pull-up/pull-down resistance accuracy ±20% |
| PB11 PC7 | Output0 | 8mA | 24mA | 10K | 10K | |
| | Output1 | 8mA | 64mA | | | |
| PB0, PB2, PB5 | | 8mA | — | 10K | 10K | |
| PR0-PR1 | | 8mA | — | 10K | 10K | |
| USBDP | | 4mA | — | 1.5K | 15K | |
| USBDM | | 4mA | — | 180K | 15K | |

2.5 DAC Characteristics

Table 2-5

| 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 | — | 92 | — | 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 |

2.6 ADC Characteristics

Table 2-6

| 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 | |

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2.7 BT Characteristics

2.7.1 Transmitter

Basic Rate

Table 2-7

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|--|-------------------------|-----|-----|-----|------|--|
| RF Transmit Power | | - | 4 | 6 | dBm | 25°C, Power Supply VBAT=3.7V 2441MHz DH5 |
| RF Power Control Range | | - | 20 | - | dB | |
| 20dB Bandwidth | | - | 950 | - | KHz | |
| In-band spurious Emissions (BQB Test Mode RF_Tx Power=4dBm) | F=F ₀ ±1MHz | - | -20 | - | dBm | |
| | F=F ₀ ±2MHz | - | -45 | - | dBm | |
| | F=F ₀ ±3MHz | - | -35 | - | dBm | |
| | F=F ₀ ±>3MHz | - | -45 | - | dBm | |

Enhanced Data Rate

Table 2-8

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|--|-------------------------|-----|-----|-----|------|---|
| Relative Power | | - | -1 | - | dB | 25°C, Power Supply VBAT=3.7V 2441MHz 2DH5 |
| $\pi/4$ DQPSK Modulation Accuracy | DEVM RMS | - | 4 | - | % | |
| | DEVM 99% | - | 10 | - | % | |
| | DEVM Peak | - | 7 | - | % | |
| In-band spurious Emissions (BQB Test Mode RF_Tx Power=4dBm) | F=F ₀ ±1MHz | - | -4 | - | dBm | |
| | F=F ₀ ±2MHz | - | -30 | - | dBm | |
| | F=F ₀ ±3MHz | - | -30 | - | dBm | |
| | F=F ₀ ±>3MHz | - | -37 | - | dBm | |

2.7.2 Receiver

Basic Rate

Table 2-9

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|-------------------------------------|-------|-----|-----|-----|------|--|
| Sensitivity | | - | -89 | - | dBm | 25°C, Power Supply VBAT=3.7V 2441MHz DH5 |
| Co-channel Interference Rejection | | - | 7 | - | dB | |
| Adjacent Channel selectivity C/I | +1MHz | - | -6 | - | dB | |
| | -1MHz | - | -6 | - | dB | |
| | +2MHz | - | -22 | - | dB | |
| | -2MHz | - | -27 | - | dB | |
| | +3MHz | - | -29 | - | dB | |
| | -3MHz | - | -31 | - | dB | |

Enhanced Data Rate

Table 2-10

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|-------------------------------------|-------|-----|-----|-----|------|---|
| Sensitivity | | - | -91 | - | dBm | 25°C, Power Supply VBAT=3.7V 2441MHz 2DH5 |
| Co-channel Interference Rejection | | - | 9 | - | dB | |
| Adjacent Channel selectivity C/I | +1MHz | - | -13 | - | dB | |
| | -1MHz | - | -14 | - | dB | |
| | +2MHz | - | -24 | - | dB | |
| | -2MHz | - | -28 | - | dB | |
| | +3MHz | - | -28 | - | dB | |
| | -3MHz | - | -33 | - | dB | |

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2.7.3 BLE

1M Data Rate

Table 2-11

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|----------------------------|---------------|-----|-----|-----|----------|--|
| Sensitivity | | - | -93 | - | dBm | 25°C Power Supply VBAT=3.7V 2440MHz |
| RF Transmit Power | | - | 6.5 | 8 | dBm | |
| In-band Spurious Emission | M-N =2MHz | - | -34 | - | dBm | |
| | M-N ≥3MHz | - | -31 | - | dBm | |
| Modulation Characteristics | Δf1 avg | - | 250 | - | KHz | |
| | Δf2 99% | - | 210 | - | KHz | |
| | Δf1avg/Δf2avg | - | 0.9 | - | / | |
| Carrier Frequency Offset | | -15 | - | +15 | KHz | |
| Frequency Drift | | -25 | - | +25 | KHz | |
| Frequency Drift Rate | | -5 | - | +5 | KHz/50us | |

2M Data Rate

Table 2-12

| Parameter | | Min | Typ | Max | Unit | Test Conditions |
|----------------------------|---------------|-----|-----|-----|----------|--|
| Sensitivity | | - | -90 | - | dBm | 25°C Power Supply VBAT=3.7V 2440MHz |
| RF Transmit Power | | - | 6.5 | 8 | dBm | |
| In-band Spurious Emission | M-N =4MHz | - | -40 | - | dBm | |
| | M-N =5MHz | - | -40 | - | dBm | |
| | M-N ≥6MHz | - | -40 | - | dBm | |
| Modulation Characteristics | Δf1 avg | - | 500 | - | KHz | |
| | Δf2 99% | - | 430 | - | KHz | |
| | Δf1avg/Δf2avg | - | 0.9 | - | / | |
| Carrier Frequency Offset | | -20 | - | +20 | KHz | |
| Frequency Drift | | -25 | - | +25 | KHz | |
| Frequency Drift Rate | | -5 | - | +5 | KHz/50us | |

Long Range

Table 2-13

| Parameter | Min | Typ | Max | Unit | Test Conditions |
|-------------------------|-----|------|-----|------|---------------------------|
| Sensitivity LE 125K(S8) | - | -100 | - | dBm | VBAT=3.7V,25°C 2440MHz |
| Sensitivity LE 500K(S2) | - | -96 | - | dBm | |

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3、Package Information

3.1 QFN52(6mm*6mm)

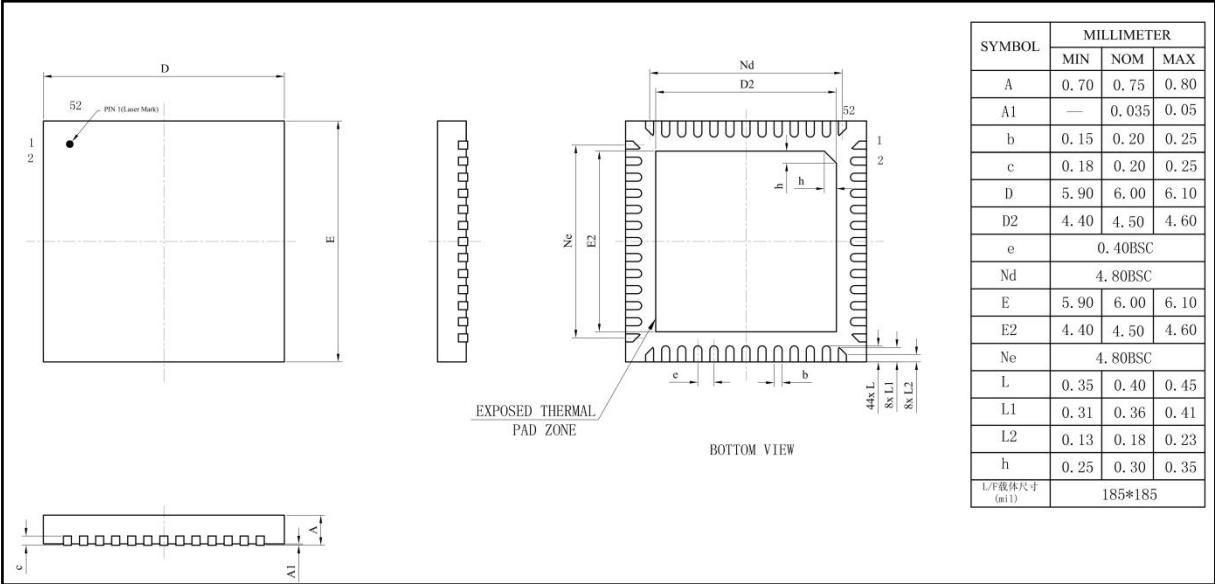


Figure 3-1. AC6354B_QFN52 Package

4、Revision History

| Date | Revision | Description |
|------------|----------|---|
| 2021.06.02 | V1.0 | Initial Release |
| 2022.07.19 | V1.1 | Update Bluetooth Feature |
| 2024.03.06 | V1.2 | Update Bluetooth Feature, Add BLE Parameter |
| | | |