AC6354B Datasheet

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Version：V1.3

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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 π/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

- 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

Packages

- QFN52(6mm*6mm)

Temperature

- Operating temperature: -40℃ to +85℃
- Storage temperature: -65℃ to +150℃

Applications

- Bluetooth Keyboard

1、Pin Definition

1.1 Pin Assignment

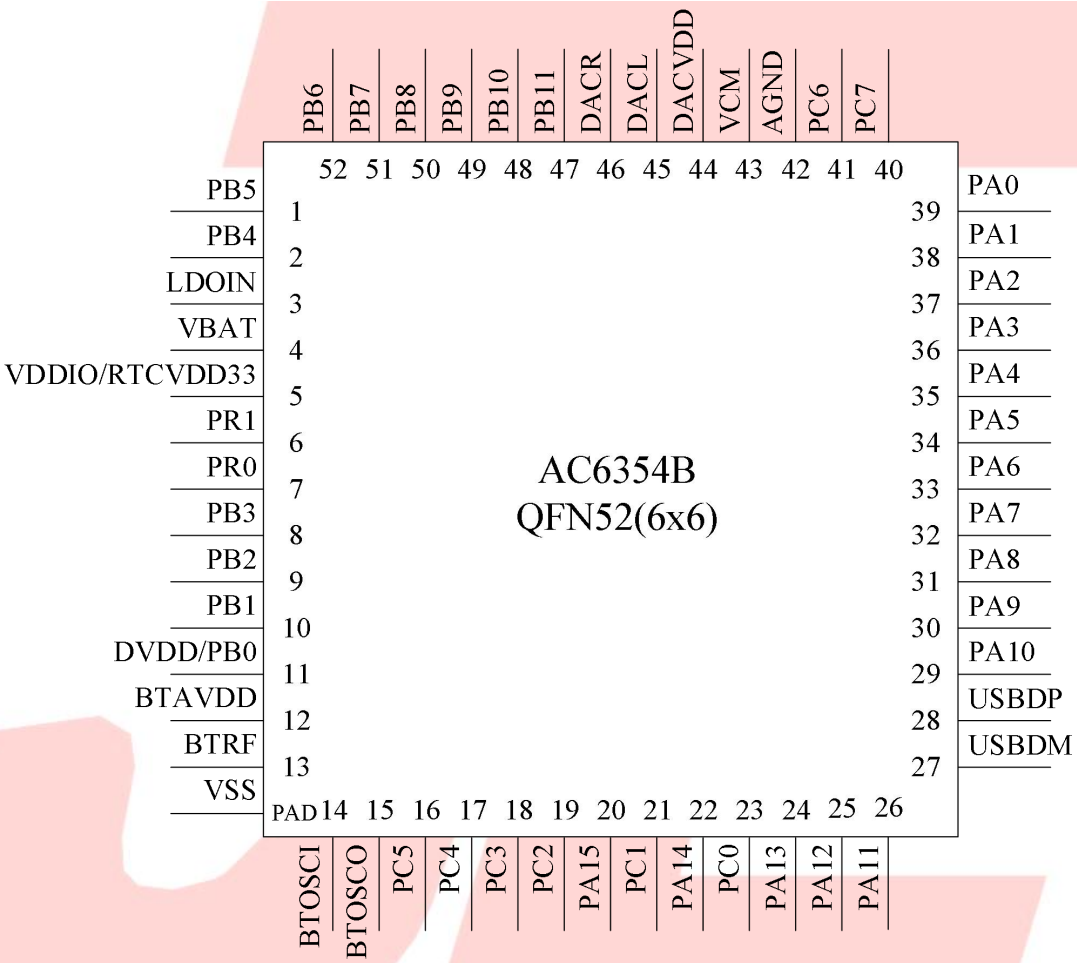


Figure 1-1 AC6354B_QFN52 Package Diagram

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	LDOIN	P	/		Battery Charger Power In;
4	VBAT	P	/		Power Supply;
5	VDDIO	P	/		IO Power 3.3V;
	RTCVDD33	P	/		RTC Power;
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	PB0	I/O	8	GPIO (High Voltage Resistance)	UART1TXA：Uart1 Data Out(A); PWMCH1H：Motor PWM Channel1 (H);
	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;
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); Touch13：Touch Input Channel 13;
19	PC2	I/O	24/8	GPIO	SD1DAT1A：SD1 Data1(A); 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;
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：Clk Out0; UART1TXC：Uart1 Data Out(C); PWMCH0H：Motor PWM Channel0(H);
40	PC7	I/O	/	GPIO	MIC BIAS: Microphone Bias Output;
41	PC6	I/O	/	GPIO	MIC: MIC Input Channel; ADC11：ADC Input Channel 11;
42	AGND	P	/		Ground for audio DAC logic;
43	VCM	P	/		DAC Reference;
44	DACVDD	P	/		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);
PAD		P	/		Ground

2、Electrical Characteristics

2.1 Absolute Maximum Ratings

Table 2-1

Symbol	Parameter	Min	Max	Unit
Tamb	Operating Temperature	-40	+85	℃
Tstg	Storage temperature	-65	+150	℃
VBAT	Supply Voltage	-0.3	5.5	V
LDOIN	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	-
LDOIN	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 = 3.3V
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

2.4 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~PC6		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	

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℃, 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)	$F=F_0\pm1MHz$	-	-20	-	dBm	
	$F=F_0\pm2MHz$	-	-45	-	dBm	
	$F=F_0\pm3MHz$	-	-35	-	dBm	
	$F=F_0\pm>3MHz$	-	-45	-	dBm	

Enhanced Data Rate **Table 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
Relative Power		-	-1	-	dB	25℃, Power Supply VBAT=3.7V 2441MHz 2DH5
π/4 DQPSK Modulation Accuracy	DEVM RMS	-	4	-	%	
	DEVM 99%	-	10	-	%	
	DEVM Peak	-	7	-	%	
In-band spurious Emissions (BQB Test Mode RF_Tx Power=4dBm)	$F=F_0\pm1MHz$	-	-4	-	dBm	
	$F=F_0\pm2MHz$	-	-30	-	dBm	
	$F=F_0\pm3MHz$	-	-30	-	dBm	
	$F=F_0\pm>3MHz$	-	-37	-	dBm	

2.7.2 Receiver

Basic Rate **Table 2-9**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-89	-	dBm	
Co-channel Interference Rejection		-	7	-	dB	25℃,
Adjacent Channel selectivity C/I	+1MHz	-	-6	-	dB	Power Supply VBAT=3.7V 2441MHz DH5
	-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	
Co-channel Interference Rejection		-	9	-	dB	25℃,
Adjacent Channel selectivity C/I	+1MHz	-	-13	-	dB	Power Supply VBAT=3.7V 2441MHz 2DH5
	-1MHz	-	-14	-	dB	
	+2MHz	-	-24	-	dB	
	-2MHz	-	-28	-	dB	
	+3MHz	-	-28	-	dB	
	-3MHz	-	-33	-	dB	

2.7.3 BLE

1M Data Rate **Table 2-11**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-93	-	dBm	
RF Transmit Power		-	6.5	8	dBm	
In-band Spurious Emission	|M-N|=2MHz	-	-34	-	dBm	25℃ Power Supply VBAT=3.7V 2440MHz
	|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**

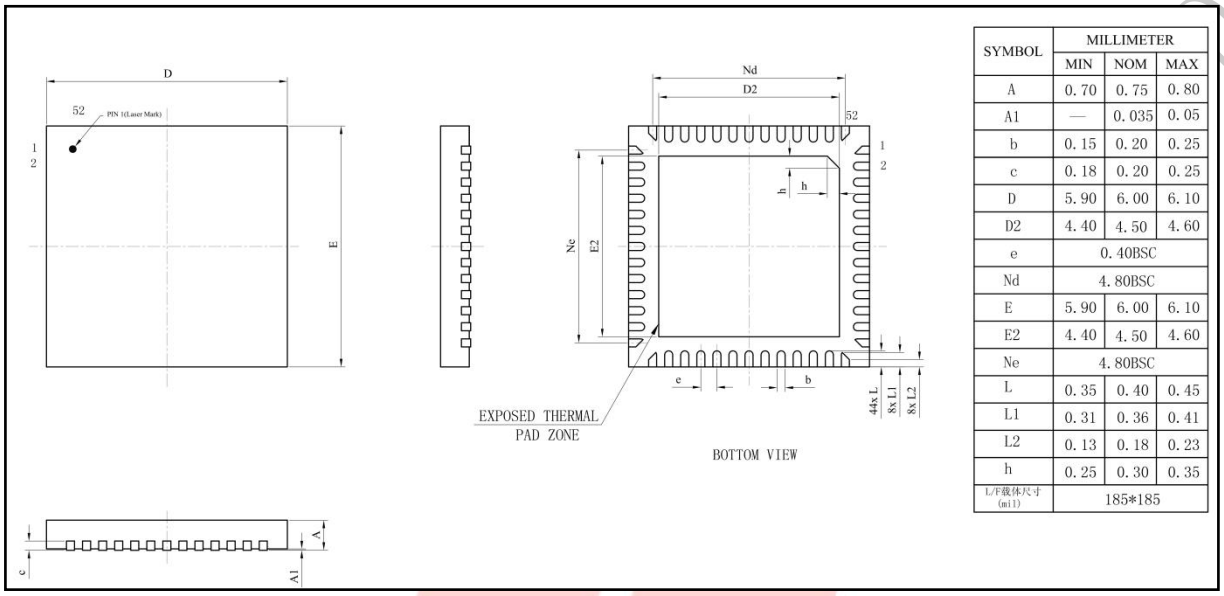
Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-90	-	dBm	
RF Transmit Power		-	6.5	8	dBm	
In-band Spurious Emission	|M-N|=4MHz	-	-40	-	dBm	25℃ Power Supply VBAT=3.7V 2440MHz
	|M-N|=5MHz	-	-40	-	dBm	
	|M-N|≥6MHz	-	-40	-	dBm	
Modulation Characteristics	Δf1 avg	-	500	-	KHz	
	Δf2 99%	-	430	-	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℃ 2440MHz
Sensitivity LE 500K(S2)	-	-96	-	dBm	

3、Package Information

3.1 QFN52(6mm*6mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	0.70	0.75	0.80
A1	—	0.035	0.05
b	0.15	0.20	0.25
c	0.18	0.20	0.25
D	5.90	6.00	6.10
D2	4.40	4.50	4.60
e	0.40BSC		
Nd	4.80BSC		
E	5.90	6.00	6.10
E2	4.40	4.50	4.60
Ne	4.80BSC		
L	0.35	0.40	0.45
L1	0.31	0.36	0.41
L2	0.13	0.18	0.23
h	0.25	0.30	0.35
L/F载体尺寸 (mil)	185*185		

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
2024.06.27	V1.3	Update Pin Description