AC6351D Datasheet

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Version：V1.2

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AC6351D Features

CPU

- 32-bit DSP supports hardware Float Point Unit(FPU)
- Up to 240MHz programmable processor
- 64Vectored interrupts
- 4 Levels interrupt priority

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 paket 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
- 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 hardwareIIC interface supports host and device mode
- Built-in Cap Sense Key controller
- 14 channels 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-inLi-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

- LQFP48(7mm*7mm)

Temperature

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

Applications

- Bluetooth Keyboard

1、Pin Definition

1.1 Pin Assignment

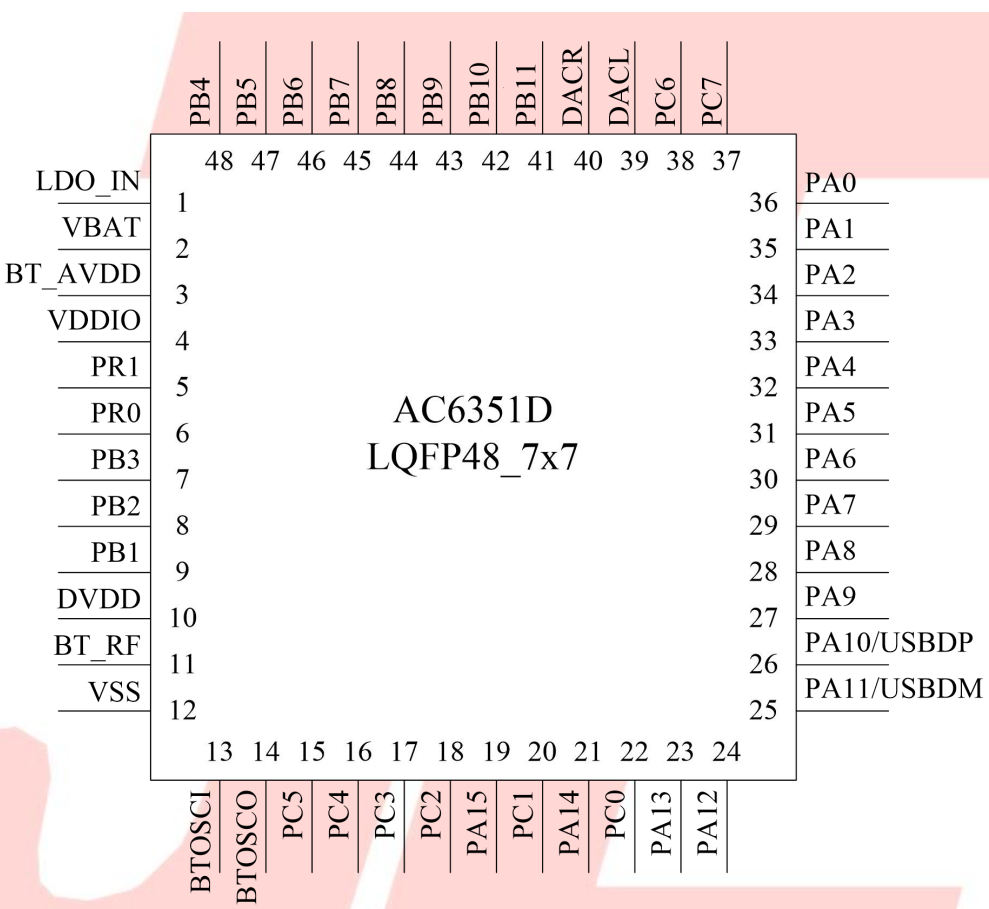


Figure 1-1 AC6351D_LQFP48 Package Diagram

1.2 Pin Description

Table 1-1 AC6351D_LQFP48 Pin Description

PIN NO.	Name	I/O Type	Drive (mA)	Function	Other Function
1	LDO_IN	P	/		Battery Charger Power In
2	VBAT	P	/		Power Supply
3	BT_AVDD	P	/		BT Power
4	VDDIO	P	/		IO Power 3.3v
5	PR1	I/O	8	GPIO	OSCO_32K：32KHz OSC Out
6	PR0	I/O	8	GPIO	OSCI_32K：32KHz OSC In
7	PB3	I/O	24/8	GPIO	PWM2：Timer2 PWM Output; ADC6：ADC Input Channel 6;
8	PB2	I/O	8	GPIO (High Voltage Resistance)	PWMCH1L：Motor PWM Channel1 (L)；
9	PB1	I/O	24/8	GPIO (pull up)	Long Press Reset； ADC5：ADC Input Channel 5; UART1RXA：Uart1 Data In(A);
10	DVDD	P	/		Core Power 1.2V
11	BT_RF	/	/		BTAntenna
12	VSS	P	/		Ground
13	BT_OSCI	I	/		BT OSC In
14	BT_OSCO	O	/		BT OSC Out
15	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)；
16	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)；

17	PC3	I/O	24/8	GPIO	SD1DAT0A：SD1 Data0(A); SPI1DIB：SPI1 Data In(B); ALNK1_DAT1： Touch13：Touch Input Channel 13;
18	PC2	I/O	24/8	GPIO	SD1DAT1A：SD1 Data1(A); ALNK1_DAT0： Touch12：Touch Input Channel 12; FPIN5：Motor Auto-Stop Protective Pin5；
19	PA15	I/O	24/8	GPIO	CAP2：Timer2 Capture;
20	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；
21	PA14	I/O	24/8	GPIO	FPIN0：Motor Auto-Stop Protective Pin0；
22	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；
23	PA13	I/O	24/8	GPIO	
24	PA12	I/O	24/8	GPIO	PWM1：Timer1 PWM Output; ADC4：ADC Input Channel 4; UART0RXD：Uart0 Data In(D);
25	PA11	I/O	24/8	GPIO	UART0TXD：Uart0 Data Out(D);
	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);
26	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)；
	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;
27	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)；
28	PA8	I/O	24/8	GPIO	SD0DAT3A：SD0 Data3(A); FPIN2：Motor Auto-Stop Protective Pin2；

29	PA7	I/O	24/8	GPIO	SD0DAT2A：SD0 Data2(A); TMR0：Timer0 Clock Input; Touch7：Touch Input Channel 7;
30	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);
31	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);
32	PA4	I/O	24/8	GPIO	Touch4：Touch Input Channel 4;
33	PA3	I/O	24/8	GPIO	Touch3：Touch Input Channel 3; UART2RXA：Uart2 Data In(A);
34	PA2	I/O	24/8	GPIO	Touch2：Touch Input Channel 2; UART2TXA：Uart2 Data Out(A); CAP3：Timer3 Capture;
35	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)；
36	PA0	I/O	24/8	GPIO	Touch0：Touch Input Channel 0; CLKOUT0： UART1TXC：Uart1 Data Out(C); PWMCH0H：Motor PWM Channel0(H)；
37	PC7	I/O	/	GPIO	
38	PC6	I/O	/	GPIO	ADC11：ADC Input Channel 11;
39	DACL	O	/		DAC Left Channel
40	DACR	O	/		DACRight Channel
41	PB11	I/O	/	GPIO	SDPG:SDC Power Gate;
42	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)；

43	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)；
44	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;
45	PB7	I/O	24/8	GPIO	
46	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)；
47	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);
48	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)；

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	4.5	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	4.5	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 = 5V, 100mA loading
V_{BT_AVDD}	Voltage output	1.2	1.25	1.35	V	VBAT=5V, 100mA loading
$I_{L3.3}$	Loading current	_	_	150	mA	VBAT = 5V

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~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 BT Characteristics

2.5.1 Transmitter

Basic Rate Table 2-5

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 2-6

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	

2.5.2 Receiver

Basic Rate **Table 2-7**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-89	-	dBm	25℃, 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 2-8**

Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-91	-	dBm	25℃, 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	

2.5.3 BLE

1M Data Rate **Table 2-9**

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 2-10**

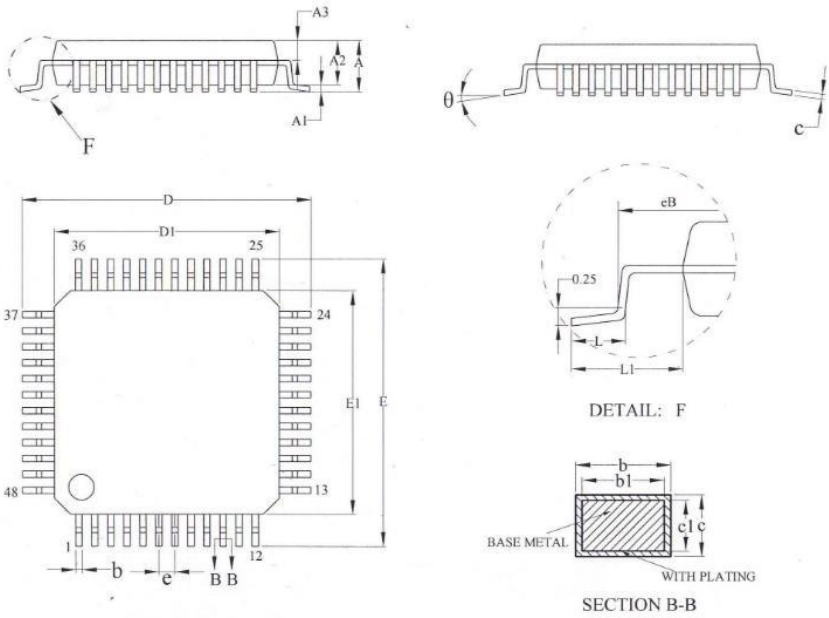
Parameter		Min	Typ	Max	Unit	Test Conditions
Sensitivity		-	-90	-	dBm	
RF Transmit Power		-	6.5	8	dBm	
In-band Spurious Emission	|M-N|=4MHz	-	-40	-	dBm	25℃ Power Supply VBAT=3.7V 2440MHz
	|M-N|=5MHz	-	-40	-	dBm	
	|M-N|≥6MHz	-	-40	-	dBm	
Modulation Characteristics	Δf1 avg	-	500	-	KHz	
	Δf2 99%	-	430	-	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 2-11**

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 LQFP48(7mm*7mm)



SYMBOL	MILLIMETER		
	MIN	NOM	MAX
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
A3	0.59	0.64	0.69
b	0.18	—	0.26
b1	0.17	0.20	0.23
c	0.13	—	0.17
c1	0.12	0.13	0.14
D	8.80	9.00	9.20
D1	6.90	7.00	7.10
E	8.80	9.00	9.20
E1	6.90	7.00	7.10
eB	8.10	—	8.25
e	0.50BSC		
L	0.40	—	0.65
L1	1.00REF		
θ	0	—	7°

Figure 3-1. AC6351D_LQFP48 Package

4、Revision History

Date	Revision	Description
2020.08.11	V1.0	Initial Release
2022.07.19	V1.1	Update Bluetooth Feature
2024.03.06	V1.2	Update Bluetooth Feature, Add BLE Parameter