

# AB5616T3

Audio Player Microcontroller

Versions: 0.0.6  
2023.01.06



## Declaration

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## Revision History

Date	Version	Comments	Revised by
2021-10-26	0.0.1	First draft	Leo
2022-01-22	0.0.2	Update QDID	Leo
2022-03-17	0.0.3	Modify the information of Product Features	Leo
2022-06-21	0.0.4	Add Power Consumption Parameters	Leo
2022-11-15	0.0.5	Update QDID	Leo
2023-01-06	0.0.6	Update Product Features	Leo

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## 1 Product Features

### CPU and Flexible IO

- High performance 32bit RISC-V processor Core with DSP instruction
- RISC-V typical speed: 125MHz
- Program memory: internal 2K-BIT OTP
- Internal 96KB RAM for data and program
- Flexible GPIO pins with Programmable pull-up and pull-down resistors
- Support GPIO wakeup or interrupt

### Bluetooth Radio

- Compliant to Bluetooth 5.3 (QDID:194248);
- TX output power +8dBm in MAX;
- RX Sensitivity with -93dBm @EDR;

### Audio Interface

- Audio codec with 16bit mono DAC and 16bit mono ADC;
- Support flexible audio EQ adjust;
- Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1 and 48KHz;
- Mono MIC amplifier input;
- High performance mono audio ADC with 91dB SNR;
- High performance mono audio DAC with 97dB SNR, with headphone amplifier output;

### Peripheral and Interfaces

- Three 32-bit timers;
- One multi-function 32-bit timers, support Capture and PWM mode;
- WatchDog;
- Three full-duplex UART;
- Sixteen Channels 10-bit SARADC;
- Build in PMU, such as Charger/Buck/LDO;

### Package

- QFN20 3.00x3.00x0.75 e=0.40;

### Temperature

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

### Supports

- A2DP/AVDTP/AVRCP/RFCOMM/HFP/HSP/SPP/HID

2 Package Definition

2.1 Pin Assignment

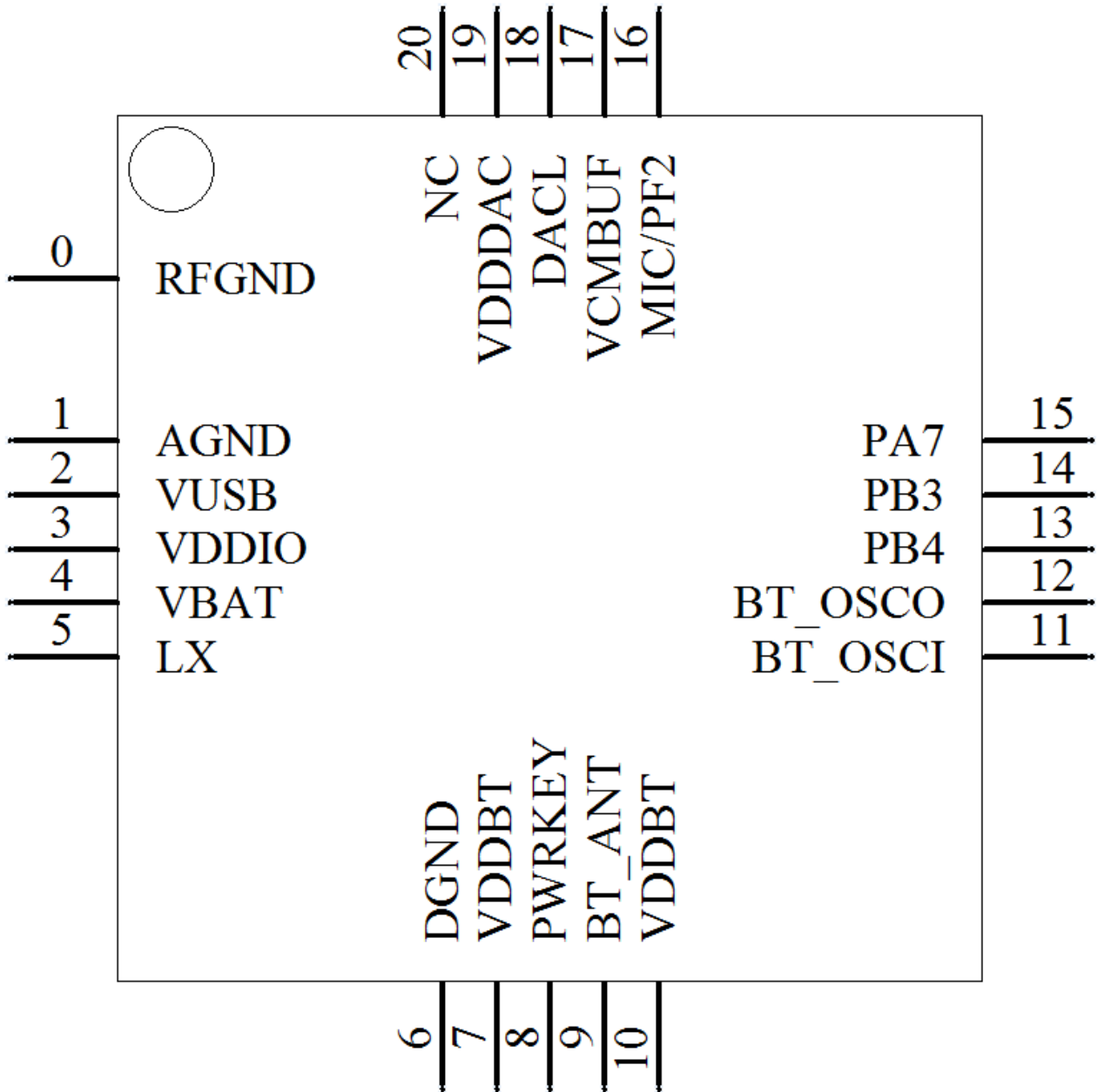


Figure 2-1 Pin assignment for QFN20

## 2.2 Pin Descriptions

**Table 2-1 QFN20 pin description**

Pin No.	Name	Type	Function
0 E-PAD	RFGND	GND	BT RF Ground
1	AGND	GND	DAC Ground
2	VUSB	PWR	VUSB power input
3	VDDIO	PWR	VDDIO power output
4	VBAT	PWR	VBAT power input
5	LX	PWR	Buck inductor connect pin
6	DGND	GND	Digital Ground
7	VDDBT	PWR	BT power
8	PWRKEY	A	Power key input
9	BT_ANT	A	BT ANT
10	VDDBT	PWR	BT power
11	BT_OSCI	A	26M OSC input
12	BT_OSCO	A	26M OSC output
13	PB4	I/O	ADC6 SPI0CLK-G3 RX0-G3 HSTRX-G8 PB4
14	PB3	I/O	ADC5 SPI0DO-G3 TX0-G3 HSTRX-G3 PWM2-T3 PB3
15	PA7	I/O	ADC2 TX0-G1 TX1-G1 HSTRX-G1 PWM1-T3 PA7
16	MIC/PF2	I/O	ADC10 MIC TX0-G7 PF2
17	VCMBUF	A	VCM buffer output

18	DACL	A	DAC L
19	VDDDAC	PWR	DAC power
20	NC		

Note: I/O: Digital input/output; I : Digital input; A : Analog Pin; PWR: Power Pin; GND: Ground.

### 3 Characteristics

#### 3.1 PMU Parameters

Table 3-1 PMU voltage input Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VUSB	Charger Voltage input	4.6	5.0	5.5	V	
VBAT	Voltage input	3.0	3.7	4.5	V	

Table 3-2 3.3V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDIO	3.3V LDO voltage output	-	3.3	-	V	Light Loading condition
$\Delta$ VDDIO	Output Mismatch 1-sigma	-	56	-	mV	VDDIO=3.3v
ILOAD	Maximum output current	-	-	150	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	300	mA	@VBAT=3.8v

Table 3-3 1.6V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDBT	1.6V LDO voltage output	-	1.6	-	V	Light Loading condition
$\Delta$ VDDBT	Output Mismatch 1-sigma	-	27	-	mV	VDDBT=1.6v
ILOAD	Maximum output current	-	-	100	mA	@VBAT=3.0v
ISC	Short Circuit Current Limit	-	-	200	mA	@VBAT=3.8v

Table 3-4 1.2V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
VDDCORE	1.2V LDO voltage output	-	1.2	-	V	Light Loading condition
$\Delta$ VDDCORE	Output Mismatch 1-sigma	-	20	-	mV	VDDCORE=1.2v
ILOAD	Maximum output current	-	-	80	mA	@VBAT=3.6v
ISC	Short Circuit Current Limit	-	-	120	mA	@VBAT=3.8v



### 3.2 IO Parameters

Table 3-5 I/O Parameters

GPIO—Electrical Characteristics							
Symbol	Description	Related GPIO	Min	Typical	Max	Units	Conditions
VIL	Low-level input voltage		-0.3		1.27	V	VDDIO=3.3V
VIH	High-level input voltage		2.03		3.6	V	VDDIO=3.3V
Driver Ability 1	Output Driver Ability 1			32		mA	VDDIO=3.3V
Driver Ability 0	Output Driver Ability 0			8		mA	VDDIO=3.3V
RPUP0	Internal pull-up resistor 0		8	10	12	KΩ	
RPUP1	Internal pull-up resistor 1		0.24	0.3	0.36	KΩ	
RPUP2	Internal pull-up resistor 2		160	200	240	KΩ	
RPDN0	Internal pull-down resistor 0		8	10	12	KΩ	
RPDN1	Internal pull-down resistor 1		0.24	0.3	0.36	KΩ	
RPDN2	Internal pull-down resistor 2		160	200	240	KΩ	

### 3.3 Audio DAC Parameters

Table 3-6 Audio DAC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	97	-	dB	VCM cap=NC VDDDAC cap=1uF with A-wt filter Output -4dBV Fin=1KHz
THD+N		-	-75	-	dB	VCM cap=NC VDDDAC cap=1uF with A-wt filter Output -4dBV with 10K loading Fin=1KHz
Output Range	Maximum output voltage	-	2.5		Vpeak-peak	32ohm Loading

### 3.4 Audio ADC Parameters

Table 3-7 Audio ADC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	91	-	dB	VCM cap=NC VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz
THD+N		-	-87	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz.
Input Range	Input sine wave peak amplitude	0		VCM	V	From aux input, aux 0db gain, VCM represent VCM voltage.

### 3.5 BT Parameters

Table 3-8 BT Parameters

Characteristics	Min	Typical	Max	Unit	Conditions
Maximum Transmit Power	-	-	8	dBm	Maximum TX power 2-DH5 packet
RMS DEVM	-	5.5	-	%	
Peak DEVM	-	12.5		%	
EDR Relative Transmit Power		-0.2		dB	
Sensitivity @ Basic Rate		-91		dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR		-93		dBm	BER=0.01%, using 2-DH5 packet

### 3.6 Current Parameters

Table 3-9 Current Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
IRTC	RTC mode current	-	4	-	uA	4.2V input, room temp.
Sleep	Sleep current	-	500	2000	uA	3.3V input, room temp

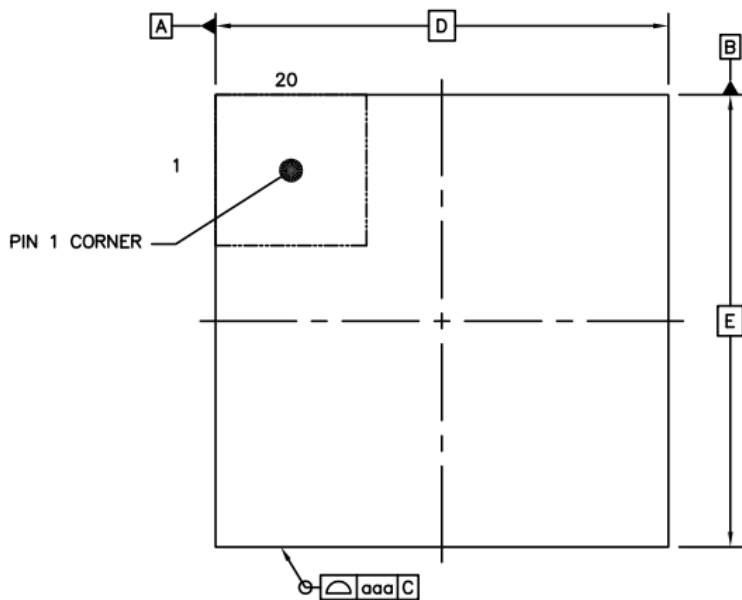
### 3.7 Power Consumption Parameters

Table 3-10 Power Consumption Parameters

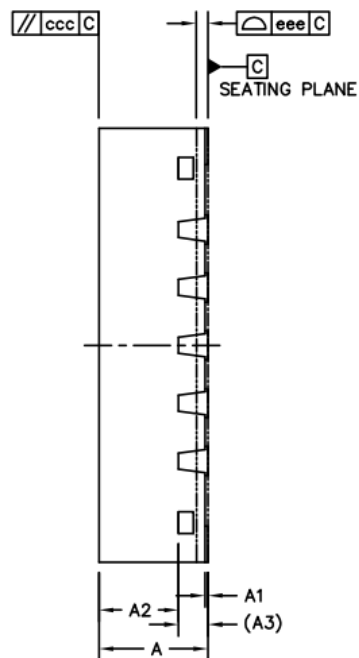
Mode	Min	Typ	Max	Unit	Conditions
Sniff mode	450	500	550	uA	
Power Down mode (no touch)		3.5	6	uA	No touch function
Power Down mode (with touch)		10	12	uA	With touch function

4 Package Information

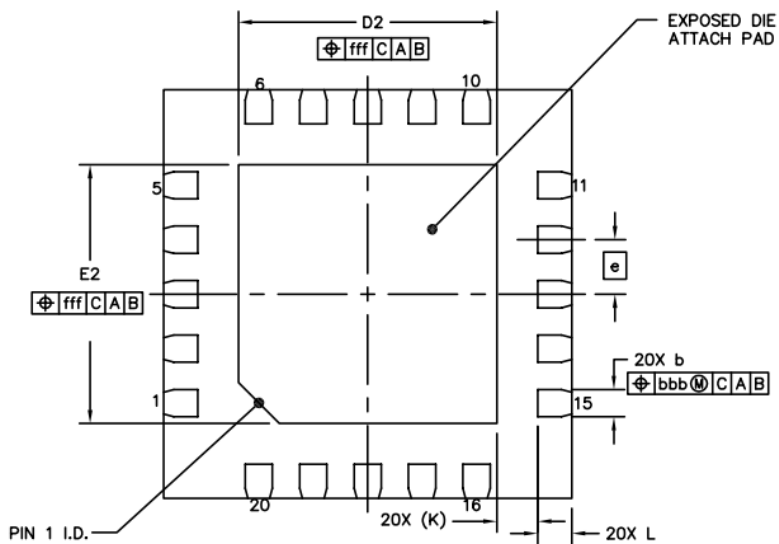
QFN3X3-20L(P0.4T0.75)



TOP VIEW



SIDE VIEW



BOTTOM VIEW

		<b>SYMBOL</b>	<b>MIN</b>	<b>NOM</b>	<b>MAX</b>
TOTAL THICKNESS		A	0.7	0.75	0.8
STAND OFF		A1	0	0.02	0.05
MOLD THICKNESS		A2	---	0.55	---
L/F THICKNESS		A3	0.203 REF		
LEAD WIDTH		b	0.15	0.2	0.25
BODY SIZE	X	D	3 BSC		
	Y	E	3 BSC		
LEAD PITCH		e	0.4 BSC		
EP SIZE	X	D2	1.8	1.9	2
	Y	E2	1.8	1.9	2
LEAD LENGTH		L	0.15	0.25	0.35
LEAD TIP TO EXPOSED PAD EDGE		K	0.3 REF		
PACKAGE EDGE TOLERANCE		aaa	0.1		
MOLD FLATNESS		ccc	0.1		
COPLANARITY		eee	0.08		
LEAD OFFSET		bbb	0.07		
EXPOSED PAD OFFSET		fff	0.1		



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