AB5301A 01 Dual mode Bluetooth module

Bluetooth /BLE

Datasheet

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1、Product Overview

1.1 Introduce

AB5301A is a 32 bits RISC microcontroller. It integrates advanced digital and analog peripherals to audio player applications.

1.2 Features

CPU and Flexible IO

- ◆ 32bit High performance CPU with DSP instruction
- ◆ Flexible GPIO pins with Programmable pull-up and pull-down resistors;
- ◆ Support GPIO wakeup or interrupt;

Bluetooth Radio

- Compliant to Bluetooth and BLE specification
- RX Sensitivity with -90.5dBm @Basic Rate;

Audio Interface

- Audio codec with 16bit stereo DAC and two channel 16bit ADC;
- Support flexible audio EQ adjust;
- Support Sample rate 8, 11.025, 12, 16, 22.05, 32, 44.1 and 48KHz;
- 4 channel Stereo Analog MUX;
- Two channel MIC amplifier input;
- High performance Stereo audio ADC with 90dB SNR
- High performance Stereo audio DAC with 95dB SNR, with headphone amplifier output;

Peripheral and Interfaces

- Three 32-bit timers;

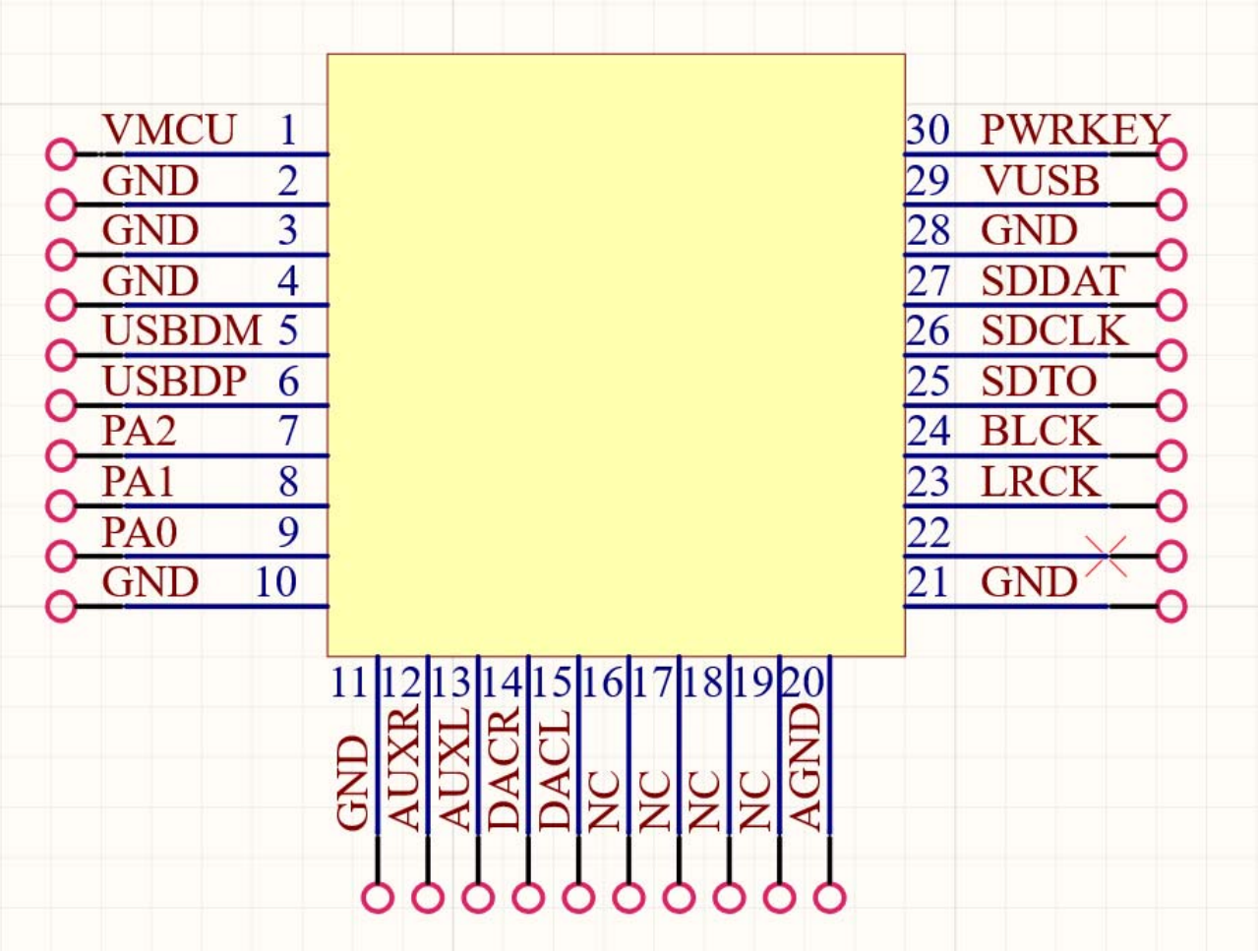
- Three multi-function 32-bit timers, support Capture and PWM mode;
- WatchDog;
- Three full-duplex UART;
- Two SPI;
- IR controller;
- SD Card Host controller;
- SPDIF receiver;
- Audio interface IIS;
- Full speed USB 2.0 HOST/DEVICE controller;
- Sixteen Channels 10-bit SARADC;
- Integrate IRTC;
- Build in PMU, such as LDO;

Temperature

- Operating temperature: -20℃ to +70℃;
- Storage temperature: -40℃ to +85℃;

2、Package Definition

2.1 Pin Assignment



Pin No.	Name	Type	Function
1	VMCU	PWR	VBAT power input
2	GND	GND	Digital Ground
3	GND	GND	Digital Ground
4	GND	GND	Digital Ground
5	USBDM	I/O	ADC6/USB DM/SPI0CLK-G3/RX0-G3/PB4
6	USBDP	I/O	ADC5/USB DP/SPI0DO-G3/TX0-G3/PB3
7	PA2	I/O	SPI1DI-G1/LPWM2-G3/IISSCLK-G1/PA2
8	PA1	I/O	SPDIF1/SPI1CLK-G1/TX0-G5/HSTRX-G5/LPWM1-G3/IISDO-G1/PA1
9	PA0	I/O	SPDIF0/RX0-G5/HSTRX-G10/LPWM0-G3/IISDI□G1/PA0

10	GND	GND	Digital Ground
11	GND	GND	Digital Ground
12	AUXR	I/O	AUXR3/SPI1CLK-G5/PF1
13	AUXL	I/O	AUXL3/SPI1DI-G5/PF0
14	DACR	A	DAC R
15	DACL	A	DAC L
16	NC	NC	NC
17	NC	NC	NC
18	NC	NC	NC
19	NC	NC	NC
20	AGND	GND	DAC Ground/ADC Ground
21	GND	GND	Digital Ground
22	NC	NC	NC
23	LRCK	I/O	IISLRCLK-G2/SPI0CLK-G2/SPI1CLK-G6/TX2-G1 /PWM2-T5/PE3
24	BCLK	I/O	IISSCLK-G2/SPI0DO-G2/SPI1DO-G6/RX2-G1/ PWM1-T5/PE2
25	SDTO	I/O	IISDO-G2/RX0-G6/PWM0-T5/PE1
26	SDCLK	I/O	ADC3/FM/AM-G1/AUXL1/SDCLK-G2/SPI1CLK-G3/RX0-G2/RX2-G2/HSTRX-G7/FMOSC-G4/PWM1-T3/TMR3CAP_G4/IR_G4/PB1
27	SDDAT	I/O	ADC4/AUXR1/SDDAT0-G2/SPI1DO-G3/TX0-G2/ TX2-G2/HSTRX-G2/PWM2-T3/PB2
28	GND	GND	Digital Ground
29	VUSB	PWR	VUSB power input
30	PWRKWY	A	Power key input

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
VUSB	Charger Voltage input	3.0	5.0	5.0	V
VBAT	Voltage input	3.0	3.7	5.0	V

Table 3-2 3.3V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit
VDDIO @ Light Loading	3.3V LDO voltage output	3.0	3.3	3.6	V
△VVDDIO @ VDDIO=3.3v	Output Mismatch 1-sigma	-	56	-	mV
ILOAD @@VBAT=3.6v	Maximum output current	-	-	150	mA
ISC @VBAT=3.8v	Short Circuit Current Limit	-	-	300	mA

Table 3-3 1.6V LDO Parameters

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

Table 3-4 1.2V LDO Parameters

Sym	Characteristics	Min	Typ	Max	Unit
VDDCORE @ Light Loading condition	1.2V LDO voltage output	-	1.2	-	V
△VVDDCORE @ VDDCORE=1.2v	Output Mismatch 1-sigma	-	20	-	mV

ILOAD @VBAT=3.6v	Maximum output current	-	-	80	mA
ISC @VBAT=3.8v	Short Circuit Current Limit	-	-	120	mA

3.2 IO Parameters

Table 3-5 I/O Parameters

Symbol	Description	Min	Typ	Max	Unit
VIL @VDDIO=3.3V	Low-level input voltage	-0.3		1.27	V
VIH @VDDIO=3.3V	High-level input voltage	2.03		3.6	V
Driver Ability 1 @VDDIO=3.3V	Output Driver Ability 1		32		mA
Driver Ability 0 @VDDIO=3.3V	Output Driver Ability 0		8		mA
R_{PUP0}	Internal pull-up resister 0	8	10	12	KΩ
R_{PUP1}	Internal pull-up resister 1	0.24	0.3	0.36	KΩ
R_{PUP2}	Internal pull-up resister 2	160	200	240	KΩ
R_{PDN0}	Internal pull-down resister 0	8	10	12	KΩ
R_{PDN1}	Internal pull-down resister 1	0.24	0.3	0.36	KΩ
R_{PDN2}	Internal pull-down resister 2	160	200	240	KΩ

3.3 Audio DAC Parameters

Table 3-6 Audio DAC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	96	-	dB	VCM cap=1uF VDDDAC cap=1uF with A-wt filter Output -3dBv Fin=1KHz
THD+N		-	-86	-	dB	VCM cap=1uF

						VDDDAC cap=1uF with A-wt filter Output -3dBv with 10k loading Fin=1KHz
Output Range	Maximum output voltage	-	2.6		V_{PP}	32ohm Loading

3.4 Audio ADC Parameters

Table 3-7 Audio ADC Parameters

Sym	Characteristics	Min	Typ	Max	Unit	Conditions
SNR		-	90	-	dB	VCM cap=1uF VDDDACcap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz
THD+N		-	-87	-	dB	VCM cap=1uF VDDDACcap=1uF with A-wt filter Input sine amplitude, 850mV RMS Fin=1KHz.
Input Range	Input sine wave peak amplitude	0		V_{CM}	V	From aux input, 0db gain, representVCM voltage.

3.5 BT Parameters

Table 3-8 BT Parameters

Characteristics	Min	Typical	Max	Unit	Conditions
MaximumTransmit Power	-	2	-	dBm	
RMSDEVM	-	5.5	-	%	Maximum TX power 2-DH5 packet
Peak DEVM	-	12.5		%	
EDR Relative Transmit Power		-0.2	-	dB	
Sensitivity @ Basic Rate		-90.5		dBm	BER=0.1%, using DH5 packet
Sensitivity @ EDR		-89.5		dBm	BER=0.01%, using 2-DH5 packet

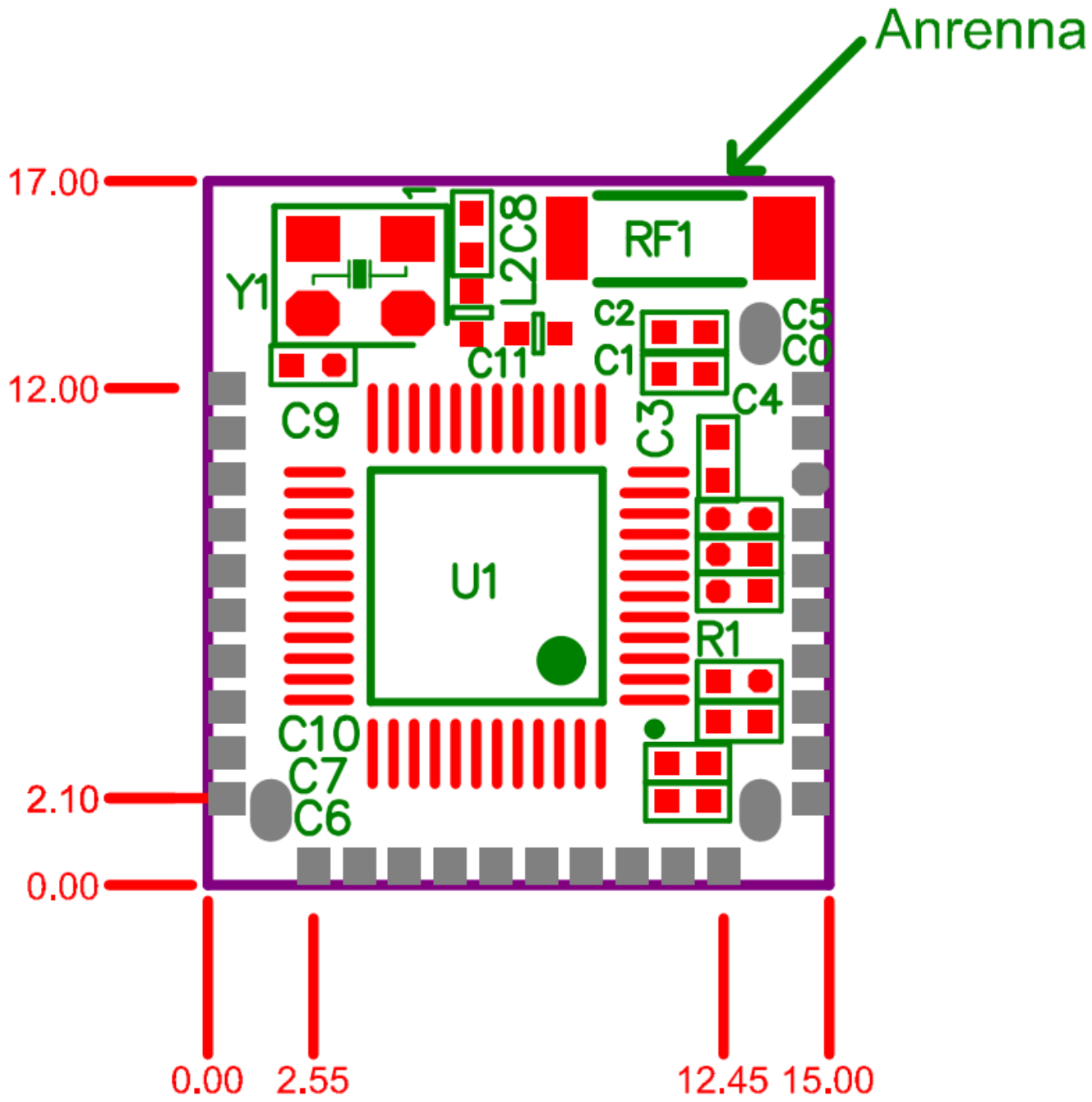
3.6 Current Parameters

Table 3-9 Current Parameters

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

4、Hardware Description

4.1 Module size and Pin assignment



4.2 PCB Layout Guide

Bluetooth works in a frequency of 2.4GHz, the design of PCB and Mechanical should be careful to avoid the impact of various factors on the RF performance. Please note the following:

1. Outer casing surrounding AB5301A01 module should avoid using metal materials. If the casing is metal, it is recommended to use an external 2.4GHz antenna.
2. Metal screws should be far away from RF part of module.
3. Module should be placed on the edge of motherboard, ensure the antenna towards outside.Please make sure that all layers have no trace or copper under the Antenna region.

Caution
Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) This device must accept any interference received, including interference that may cause undesired operation.

Note: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:
—Reorient or relocate the receiving antenna.
—Increase the separation between the equipment and receiver.
—Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
—Consult the dealer or an experienced radio/TV technician for help.

RF Exposure Statement
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

FCC Label Instructions
If using a permanently affixed label, the modular transmitter must be labeled with its own FCC identification number, and, if the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:
"Contains FCC ID: OCDAB5301A01".
Any similar wording that expresses the same meaning may be used. The Grantee may either provide such a label, an example of which must be included in the application for equipment authorization, or, must provide adequate instructions along with the module which explain this requirement.

OEM Guidance

- **Applicable FCC rules**

This device complies with part 15.247 of the FCC Rules.

- **The specific operational use conditions**

This module can be used in IoT devices. The input voltage to the module is nominally 3.3 V DC. The operational ambient temperature of the module is -20 °C ~ 70 °C. the external antenna is allowed, such as Ceramic antenna.

- **Limited module procedures**

N/A

- **Trace antenna designs**

N/A

- **RF exposure considerations**

The equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body. If the equipment built into a host as a portable usage, the additional RF exposure evaluation may be required as specified by 2.1093.

- **Antennas**

Antenna type: Ceramic antenna; Peak antenna gain : 2.5 dBi

- **Label and compliance information**

An exterior label on OEM's end product can use wording such as the following: "Contains Transmitter Module FCC ID: OCDAB5301A01"
or "Contains FCC ID: OCDAB5301A01"

- I**nformation on test modes and additional testing requirements**

The modular transmitter has been fully tested by the module grantee on the required number of channels,modulation types, and modes, it should not be necessary for the host installer to re-test all the available transmitter modes or settings. It is recommended that the host product manufacturer, installing the modular transmitter,perform some investigative measurements to confirm that the resulting composite system does not exceed the spurious emissions limits or band edge limits (e.g., where a different antenna may be causing additional emissions).
The testing should check for emissions that may occur due to the intermixing of emissions with the other transmitters, digital circuitry, or due to physical properties of the host product (enclosure). This investigation is especially important when integrating multiple modular transmitters where the certification is based on testing each of them in a stand-alone configuration. It is important to note that host product manufacturers should not assume that because the modular transmitter is certified that they do not have any responsibility for final product compliance.
If the investigation indicates a compliance concern the host product manufacturer is obligated to mitigate the issue. Host products using a modular transmitter are subject to all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference have been corrected.
The final host / module combination need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

- **Additional testing, Part 15 Sub part B disclaimer**

The host integrator installing this module into their product must ensure that the final composite product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation and should refer to guidance in KDB 996369. For host products with certified modular transmitter, the frequency range of investigation of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the higher frequency range of investigation.
When testing the host product, all the transmitters must be operating. The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory 50 devices or drivers are not available. When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/ or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.
The product under test is set into a link/association with a partnering device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.