

AdapuADB1Module Specification

V1.1

1. Cover Information

- Module Model: ADB1
- Wireless Protocol: Wi-Fi 2.4 GHz + Bluetooth 5.0
- Module Dimensions: $18 \pm 0.2 \times 25.5 \pm 0.2 \times 3.1 \pm 0.15$ mm (including shielding/plate thickness)
- Package/Pin: Module outer pin 40

2. Revision Record

Version	Date	Change Description
V1.0	2025/9/15	Overall Framework, Key Specifications, Pins, and Design Recommendations
V1.1	2025/9/19	Improve Content

3. Product Overview

- **ADB1** is a 2.4 GHz Wi-Fi + BLE module.
- The module provides **download serial ports (DL_RX/DL_TX)** . To ensure the stability of mass production programming and power-on startup, **the four-wire SPI cannot be reused as GPIO** .
- Suitable for scenarios such as smart home appliances, sensor gateways, voice/audio control, human-computer interaction, etc.

4. Features and Applications

Main Features

- 2.4 GHz **802.11 b/g/n + BLE**
- The main frequency of the MCU (SoC core) can reach 160 MHz;
- Peripheral: **SPI / UART ×2 / I²C ×2 / SDIO / PWM / AUX-ADC / DVP / 音频**

DAC/ADC/MICBIAS

- Power Supply:VCC 2.7–4.35 V, with built-in LDO in the module

Typical Applications

- Wi-Fi + BLE dual-mode networking, audio/voice I/O, home appliance and lighting control, sensors/data recording, HMI/camera (DVP), etc.

5. Key specification parameters

The following table shows **module-level summary** ; for specific chip-level limits and timing, please refer to the chip data sheet during design verification.

Power Supply and Environment

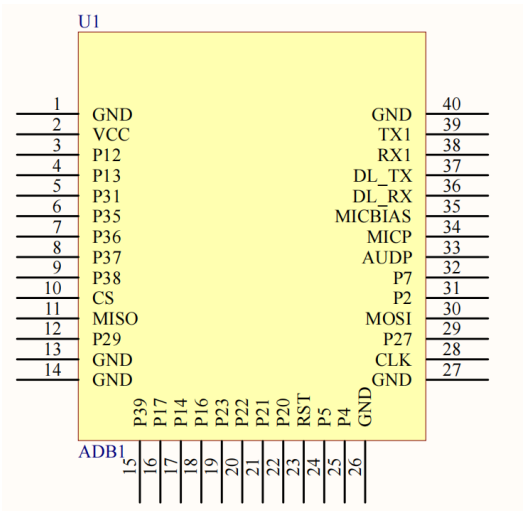
Project	Condition	Minimum	Typical	Maximum	Unit
VCCBAT	Battery/DC Input	2.7	—	4.35	V
Operating Temperature	—	−40	—	85	° C
Storage temperature	Packaged/Not on Machine	−40	—	85	° C
Charging current	USB → Battery	—	—	200	mA

Wireless and Interfaces (Summary)

Category	Explanation
Wi-Fi	2.4 GHz 802.11 b/g/n, 1×1
BLE	5.x (1M/2M/LE Coded) capabilities are affected by specific SDK/firmware configurations
Peripheral	SPI、I ² C×2、UART×2、SDIO、PWM、AUX-ADC×6、DVP、音频 DAC/ADC/MICBIAS
Storage	Built-in 4 MB; cheating software SPI Flash 2/4/8/16 MB (SPI 4-wire exclusive)

6. Pin Definitions and Function Descriptions

Layout Encapsulation



Foot-by-foot Table

Pin Number	Name	Type	Description/Default Function
1	GND	P	Power Ground
2	VCC	P	Module main power input (see specifications)
3	P12	IO	Universal IO/ADC6
4	P13	IO	Universal IO/ADC7
5	P31	IO	General purpose IO
6	P35	IO	General purpose IO
7	P36	IO	General purpose IO
8	P37	IO	General purpose IO
9	P38	IO	General purpose IO
10	CS	IO	SPI_CS (dedicated line)
11	MISO	IO	SPI_SO//MISO (Dedicated Line)
12	WP	IO	SPI_WP (Dedicated Line)
13	GND	P	Ground
14	GND	P	Ground
15	P39	IO	General purpose IO
16	P17	IO	General purpose IO
17	P14	IO	General purpose IO
18	P16	IO	General purpose IO
19	P23	IO	Universal IO/ADC3
20	P22	IO	General purpose IO
21	P21	IO	General purpose IO
22	P20	IO	General purpose IO
23	RST	I	Reset Input (Active Low, Internal Pull-up)
24	P5	IO	Universal IO/ADC2
25	P4	IO	Universal IO/ADC1
26	GND	P	Ground
27	GND	P	Ground

28	SCK	IO	SPI_SCK (dedicated line)
29	P27	IO	General purpose IO
30	MOSI	IO	SPI_SI/MOSI (Dedicated Line)
31	P2	IO	Universal IO/ADC4
32	P7	IO	Universal IO/PWM1
33	AUDP	AI/AO	Audio Output (DACP)/Analog Domain
34	MICP	AI	Microphone Input Positive Terminal
35	MICBIAS	AO	Microphone Bias Output
36	DL_RX	I	Download serial port RX (UART0)
37	DL_TX	O	Download Serial Port TX (UART0)
38	RX1	I	UART1_RX (General)/SDA
39	TX1	O	UART1_TX (General)/SCL
40	GND	P	Ground

In the table, (CS/SCK/MOSI/MISO/WP) are dedicated to hardware SPI , and the module has an internal connection to flash, not used externally as general-purpose GPIO.

For the specific reuse of other IOs (such as I²C/SDIO/PWM/DVP, etc.), please refer to the firmware/SDK configuration.

7. Typical Schematic

DiagramApplicationRecommendation

1. **Power supply input:** VCC (2.7~4.35V, 3.3V recommended) **10 μ F + 0.1 μ F** Distributed decoupling.

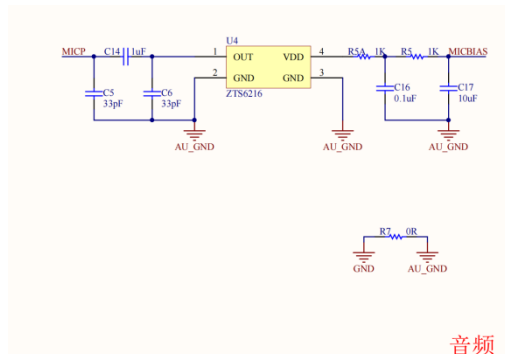
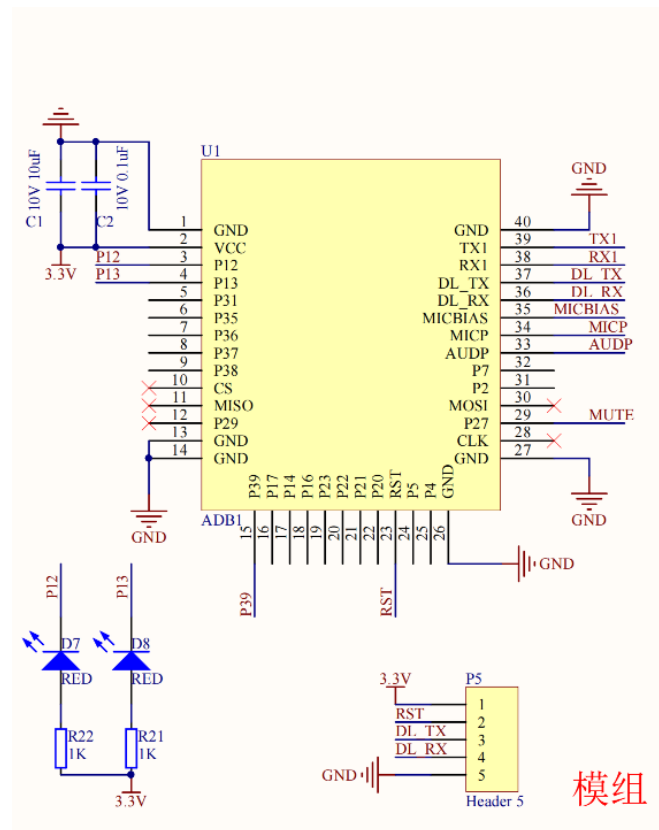
- Power supply link: VCCBAT/VCCUSB $\rightarrow$ on-chip LDOs (VIO/VDDDIG/VDDAON/VDDAUD/VDDRAM); each LDO output is decoupled with a 0.1–1 μ F capacitor nearby.
- Power-on sequence: According to the order of internal power supply/clock power-on (IO-LDO $\rightarrow$ AON-LDO $\rightarrow$ DIG-LDO $\rightarrow$ crystal stabilization); after the typical values of T0/T1/T2/T3 (cascaded millisecond level) are met, firmware operations can be performed.

2. **Download and Storage:**

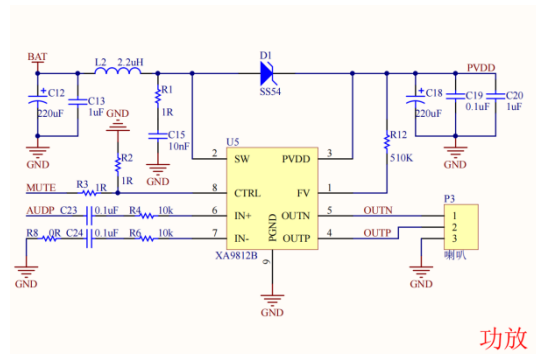
- UART 下载:** DL_RX (P10) /DL_TX (P11) 引出 5P (VCC/GND/RX/TX/CEN) 。
- ; **Prohibited to reuse** .

3. **Audio: MICP/MICBIAS/AUDP** traces should be kept away from RF , strong

interference signals, etc. .



音频



功放

8. PCB Layout Guide

- Partitioning:** Five partitions of RF / clock / analog / digital / power; the bottom layer is a solid ground plane, and critical traces have short return paths on the top layer + bottom layer.
- Antenna:** It is recommended that the distance between the module antenna part and other metal parts be at least 15mm. Do not route traces or even pour copper in the antenna area of the user's PCB to avoid affecting antenna performance.
- Power supply and ground :** LDO decoupling close to the pin; analog ground and digital ground **single point convergence** ; large current reflux to avoid

RF/crystal.

- **Testing and Jig:** Download port close to board edge; Power/GND/Reset/Serial Portleave test points.

9. Programming and Startup (Download Method)

- **UART Download** (Recommended): DL_RX (P10)/DL_TX (P11); Mass production fixture is fixed at 3.3 V TTL level.

If the customer chooses to purchase the standard MCU docking module, there is no need to download or authorize.

10. SMT/Reflow Soldering and Storage Conditions

This section presents **directly implementable process parameters** and **material storage specifications**, with the format aligned to the general mass production specification.

10.1 Pad and Solder Paste

- Recommended **SAC305** lead-free solder paste, particle **Type-4/4.5**; print thickness **100-120 μm** .
- Pad openings follow the module package diagram (width of user board connection pads ≥ 0.25 mm to prevent tombstoning/solder bridging).

10.2 Reflow Soldering Temperature Profile (Recommended)

The peak value and holding zone should be fine-tuned in combination with the actual measurement of the production line furnace temperature curve; the following table shows the recommended range for ****lead-free reflow (SAC305)****.

Section	Parameter	Recommended scope
Preheating (Ramp-up)	Room temperature $\rightarrow$ 150 ° C slope	0.5 - 2.0 ° C/s
Constant Temperature (Soaking)	150 - 200 ° C	60 - 120 s
Heating to peak	200 ° C $\rightarrow$ Peak	0.5 - 1.5 ° C/s
Peak temperature	Tp	235 - 245 ° C (not higher than 250 ° C)
Above-liquid time	>217 ° C	40 - 70 s

Cooling (Ramp-down)	—	1.0 - 3.0 ° C/s
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Key Points of Process

- Avoid a second peak; if a second reflux is necessary, the peak value and time should not exceed those of the first time.
- Module TopShielding CoverPay attention to temperature difference during reflow, and useHot Air Knife/Top Heatingfor temperature equalization if necessary.

10.3 Storage and Moisture Protection

- **Moisture Sensitivity Level** : It is recommended to manage according to **MSL3** (unopened **≤12 months** , **≤30 °C** / **≤60%RH** dry environment).
- **Kaifeng in the production line** : **≤ 30 °C/≤ 60% RH** conditions, **≤ 168 h** used up; overtime according to the specification **baking** .
- **Baking Conditions** : **60 °C**, **<5% RH**, **≥24 h** (or **125 °C**, **4–8 h**, depending on the temperature resistance of the carrier); sufficient desiccants and humidity cards shall be placed inside the package.
- **Transportation and storage** : anti-static, moisture-proof, salt spray-proof; anti-pressure and anti-drop, avoid **> 1 m** drop.

11. Mechanical Dimensions and Assembly

- **Module shape** : **18 × 25.5 × 3.1 mm** ; machine reserved **around ≥ 0.5 mm** clearance; top shell/shield and module top clearance **** ≥ 1.0 mm ****.
- **Connecting Pad** : It is recommended that the solder mask opening be slightly larger than the pad by **0.05–0.1 mm** (unilateral), which is beneficial for wetting and manufacturability.
- **Cleaning and Three-Defense** : If cleaning is required, avoid solvents entering the shield; Three-Defense coating should maintain **antenna area Keep-out** .

12. Regulatory and Certification Notice

- The product must meet the corresponding market **EMC/RF, safety and environmental protection** regulations (such as CE/FCC/SRRC, RoHS/REACH).
- Antenna replacement/external antenna gain changes may affect type testing; it is recommended to perform pre-consistency testing under the target housing and antenna version.

13. Downstream Application Checklist

- **DL_RX/DL_TX (P10/P11)** It has been led out and marked clearly, and can be connected with the fixture
- SPI five-wire (CS/SCK/MOSI/MISO/WP) is dedicated to hardware SPI and cannot be used as a regular GPIO.
- Antenna area **Keep-out** , π matching bit (C-L-C) reserved; net distance from metal parts $\geq 15\text{ mm}$
- LDO decoupling snug, analog/digital ground **single point convergence**
- Key interface (USB/UART/button/external connector) **ESD protection** complete
- Process Documents:**SMT Process Card/Reflow Profile/Baking and MSL Control**have been incorporated into SOP
- Mass production **burning process** (UART/SPI) and fixture needle bed position confirmation

FCC Statement

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.

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

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 important announcement

Important Note:

Radiation 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.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following"

Contains FCC ID: **2A2X5-ADB1** "

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

2.2 List of applicable FCC rules

CFR 47 FCC PART 15 SUBPART C has been investigated. It is applicable to the modular transmitter

2.3 Specific operational use conditions

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

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 & your body.

2.7 Antennas

This radio transmitter **FCC ID:2A2X5-ADB1** has been approved by Federal Communications Commission to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Antenna No.	Model No. of antenna:	Type of antenna:	Gain of the antenna (Max.)	Frequency range:
Bluetooth	/	PCB Antenna	1.5	2400-2500MHz
2.4G Wi-Fi	/	PCB Antenna	1.5	2400-2500MHz

2.8 Label and compliance information

The final end product must be labeled in a visible area with the following" Contains **FCC ID:2A2X5-ADB1**".

2.9 Information on test modes and additional testing requirements

Host manufacturer is strongly recommended to confirm compliance with FCC requirements for the transmitter when the module is installed in the host.

2.10 Additional testing, Part 15 Subpart B disclaimer

Host manufacturer is responsible for compliance of the host system with module installed with all other applicable requirements for the system such as Part 15 B.

2.11 Note EMI Considerations

Host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties.

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do an evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure.