WT0132C6-S5/S5U series Datasheet

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Wireless-Tag Technology Co.,Limited

About this document

This document provides users with WT0132C6-S5 and WT0132C6-S5U specifications.

Document Version

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Revision History

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Note

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Revision History

No.	Version	Changes	Change (+/-) Descriptions	Author	Date
1	V1.0.0	C	First release	GUO	2023-4-11
2	V1.0.1	A	Add Pin Descriptions	Zeng	2023-8-3
3	V1.0.2	A	Add warnings	Wang	2025-5-15

Table of Contents

1 Overview

WT0132C6-S5 and WT0132C6-S5U are low-power, cost-effective embedded wireless module. It is an ideal choice for smart grid, building automation, security, smart home, telemedicine and other IoT applications.

The WT0132C6-S5 and WT0132C6-S5U modules are built around the ESP32-C6 core processor, which industry-leading high-performance RISC-V 32-bit processor and a low-power RISC- V 32-bit processor in a relatively small package.

WT0132C6-S5 and WT0132C6-S5U support 2.4 GHz Wi-Fi 6, Bluetooth LE v5.0, Zigbee 3.0 and Thread 1.3 system-on-chip (SoC), sharing the same antenna.

It operates at up to 160 MHz. Antenna options can be switched between on-board PCB antenna and IPEX antenna. Users can use the module to add Bluetooth pairing and networking capabilities to existing devices or to build a standalone network controller.

2 Features

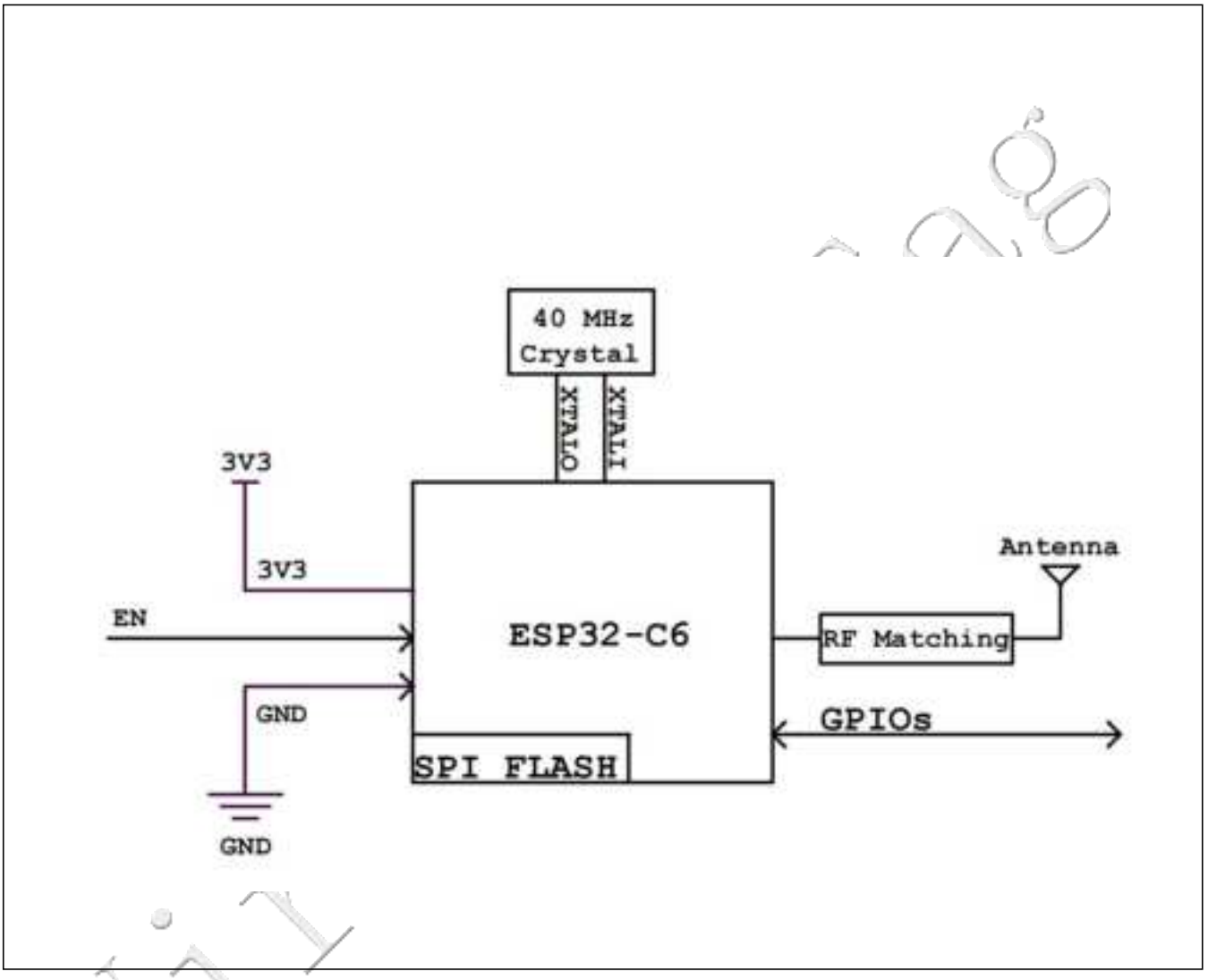
- QFN40 (5*5) package; SDM-19 package (Figure 4 Module Dimensions)
- On-board PCB antenna、IPEX antenna
- Operating voltage: 3.3V
- Operating ambient temperature: -40-105° C
- Built-in ESP32-C6 SoC, 32-bit RISC-V single-core microprocessor, up to 160MHz
- SRAM 512KB
- ROM 320KB
- Embedded Flash 4MB
- Support IEEE 802.11ax protocol
- Support 1T1R mode with data rate up to 150Mbps
- WIFI 2.4 GHz, support WEP/WPA-PSK/WPA2-PSK security mode
- Frame aggregation (TX/RX A-MPDU, RX A-MSDU)
- Bluetooth
- Bluetooth LE: Bluetooth LE v5.3、Bluetooth mesh
- Speed: 125Kbps, 500Kbps, 1Mbps, 2Mbps
- Advertising Extensions
- Multiple Advertisement Sets
- Channel Selection Algorithm #2
- Hardware
- Support GPIO, SPI, UART, I2C, I2S, Infrared transceiver , LED PWM controller, USB JTAG interface, General-purpose DMA controller, TWAITM controller (compatible with ISO11898-1), temperature sensor, SAR Analog/Digital converter
- Support STA/AP/STA+AP modes
- Support OTA
- RF Specifications:
- Operation Frequency:
- BLE:2402-2480MHz;2.4G WIFI:2412-2462MHz; Zigbee:2405-2480MHz
- Antenna Type:ANT1:PCB Antenna; ANT2:FPC Antenna
- Antenna Gain:ANT1:2.90dBi; ANT2:-0.25dBi
- EIPR:
- BLE(ANT1): 5.11dBm

- BLE(ANT2): 5.75dBm
- 2.4G WIFI(ANT1): 18.18dBm
- 2.4G WIFI (ANT2): 18.47dBm

3 Hardware Specifications

3.1 Hardware Block Diagram

Figure 1 Hardware Block Diagram



3.2 Pin Description

Figure 2 Pin Layout

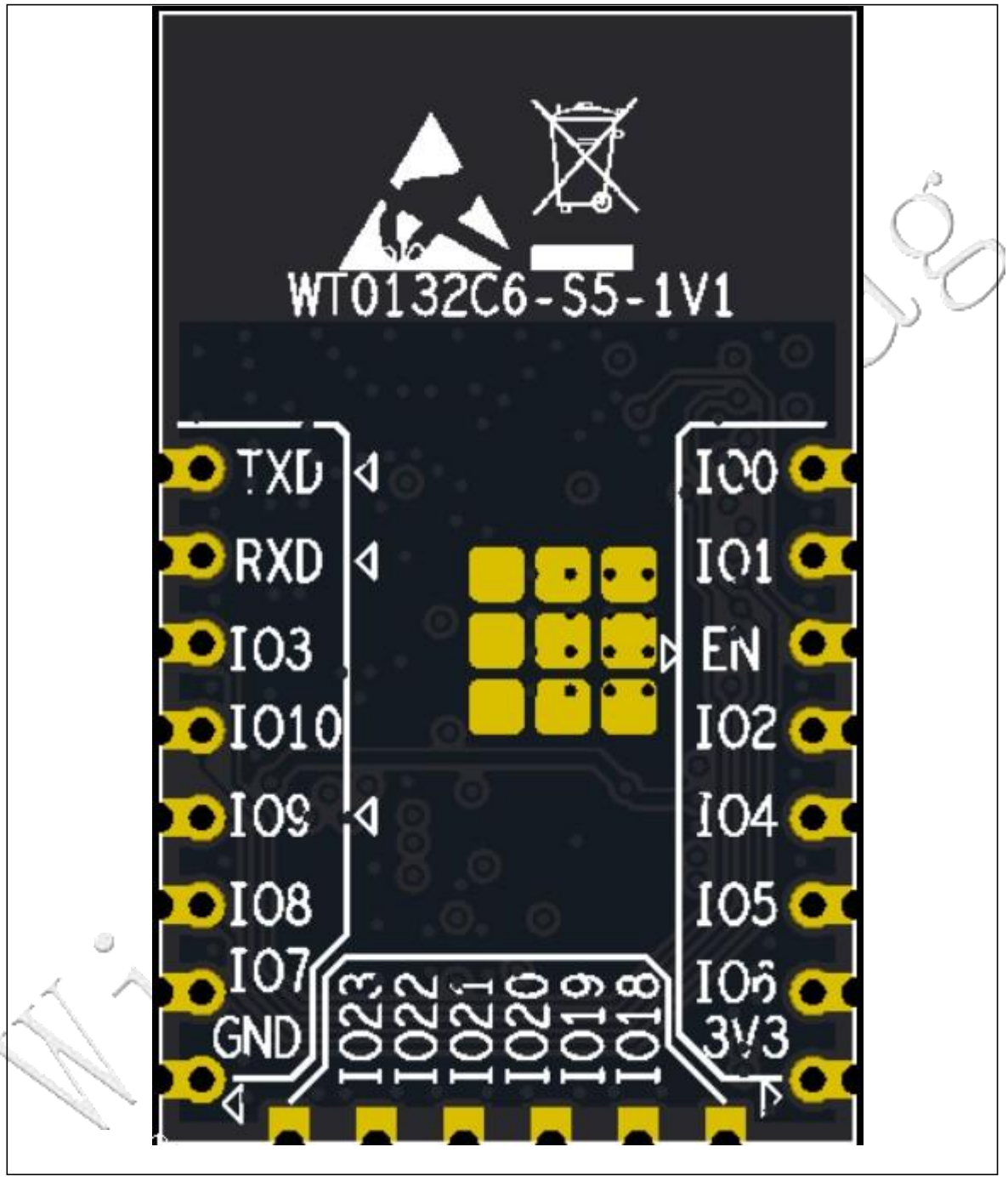


Table 1 Pin Definitions and Descriptions

Pin	Name	Description
1	IO0	XTAL_32K_P,GPIO0,LP_GPIO0,LP_UART_DTRN,ADC1_CH0
2	IO1	XTAL_32K_N,GPIO1,LP_GPIO1,LP_UART_DSRN,ADC1_CH1

3	EN	Analog, CHIP_PU Chip Enable Pin: High: on, enables the chip. Low: off, the chip powers off. The current is very low. Note: Do not leave the EN pin floating.
4	IO2	GPIO2,FSPIQ,LP_GPIO2,LP_UART_RTSN,ADC1_CH2
5	IO4	MTMS,GPIO4,LP_GPIO4,LP_UART_RXD,ADC1_CH4,FSPIHD
6	IO5	MTDI,GPIO5,LP_GPIO5,LP_UART_TXD,ADC1_CH5,FSPIWP
7	IO6	MTCK,GPIO6,LP_GPIO6,LP_I2C_SDA,ADC1_CH6,FSPICLK
8	VCC	3.3V power supply; The output current of the external power supply is recommended to be above 500mA
9	IO18	SDIO_CMD,GPIO18,FSPICS2
10	IO19	SDIO_CLK,GPIO19,FSPICS3
11	IO20	SDIO_DATA0,GPIO20,FSPICS4
12	IO21	SDIO_DATA1,GPIO21,FSPICS5
13	IO22	SDIO_DATA2,GPIO22
14	IO23	SDIO_DATA3,GPIO23
15	GND	Power supply, GND
16	GPIO7	MTDO,GPIO7,LP_GPIO7,LP_I2C_SCL,FSPID
17	GPIO8	GPIO8
18	GPIO9	GPIO9
19	GPIO10	GPIO10
20	GPIO3	GPIO3,LP_GPIO3,LP_UART_CTSN,ADC1_CH3
21	U0RXD	U0RXD,GPIO17,FSPICS1
22	U0TXD	U0TXD,GPIO16,FSPICS0

Table 2 Factory Default AT Command Communication Pins

pinout	name	Description
7	IO6	RX
16	IO7	TX

3.3 Strapping Pins

At each startup or reset, the WT0132C6-S5 and WT0132C6-S5U modules requires some parameters, such as in which boot mode to load the chip, etc. These parameters are passed over via the strapping pins. After reset, the strapping pins operate

as regular IO pins. The parameters controlled by the given strapping pins at chip reset are as follows:

- •SDIO input sampling and output driving clock edge - MTMS and MTDI
- •Chip boot mode - GPIO8 and GPIO9
- •ROM code printing - GPIO8
- •JTAG signal source - GPIO15

GPIO9 is connected to the chip's internal weak pull-up resistor at chip reset. This resistor determines the default bit value of GPIO9. Also, the resistor determines the bit value if GPIO9 is connected to an external high-impedance circuit.

Table 3 Strapping Pins

Strapping Pin	Default Configuration	Bit Value
MTMS	Floating	-
MTDI	Floating	-
GPIO8	Floating	-
GPIO9	Pull-up	1
GPIO15	Floating	-

Table 4 System Boot Mode

Pin	Default	SPI Boot Mode	Download Boot Mode
GPIO8	(Floating)	Any value	1
GPIO9	1 (Pull-up)	1	0

Table 5 ROM Code Printing Control During Boot Process

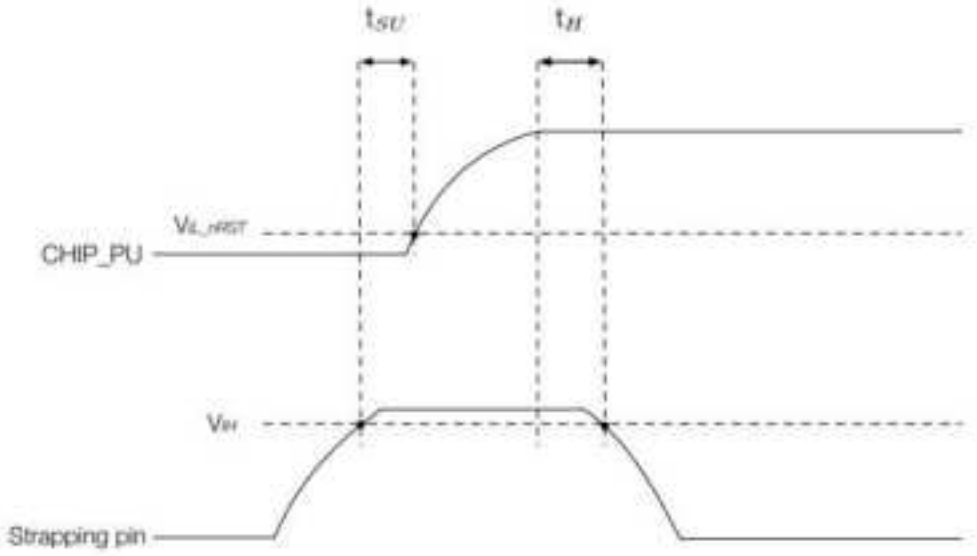
Pin	Default	Functionality
GPIO8	N/A	When the value of eFuse field UART_PRINT_CONTROL is 0 , print is enabled and not controlled by GPIO8. 1, if GPIO8 is 0, print is enabled; if GPIO8 is 1, it is disabled. 2, if GPIO8 is 0, print is disabled; if GPIO8 is 1, it is enabled. 3, print is disabled and not controlled by GPIO8.

Table 6 Parameter Descriptions of Setup and Hold Times for the Strapping Pins

Parameter	Description	Min(ms)
tSU	Setup time before CHIP_EN goes from low to high	0ms
tH	Hold time after CHIP_EN goes high	3ms

Figure 3 shows the setup and hold times for the strapping pins before and after the CHIP_EN signal goes high.

Figure 3 Setup and Hold Times for the Strapping Pins



4 Electrical Characteristics

4.1 Absolute Maximum Ratings

Stresses above the absolute maximum ratings may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under the specification is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

4.2 Recommended Operating Conditions

Table 7 Operating Conditions

Symbol	Parameter		Min	Typ	Max	Unit
VDD	Power supply voltage		3.0	3.3	3.6	V
IVDD	Current delivered by external power supply		0.5	-	-	A
T_A	Ambient Temperature	85℃ version	-40	-	85	℃
		105℃ version			105	
Humidity	Humidity		-	-	85	%RH

4.3 Current Consumption

Table 8 RF Current Consumption

RF Current Consumption			
	Work Mode	Description	Peak (mA)
Active (RF working)	TX	802.11b, 1 Mbps, DSSS @ 21.0 dBm	354
		802.11g, 54 Mbps, OFDM @ 19.5 dBm	300
		802.11n, HT20, MCS7 @ 18.5 dBm	280
		802.11n, HT40, MCS7 @ 18.0 dBm	268
		802.11ax, MCS9, @ 16.5 dBm	252
	RX	802.11b/g/n, HT20	78
		802.11n, HT40	82
		802.11ax, HE2	78

Note:

Room temperature, 3.3V power supply, TX continues mode, DC power supply accuracy 100 microamps

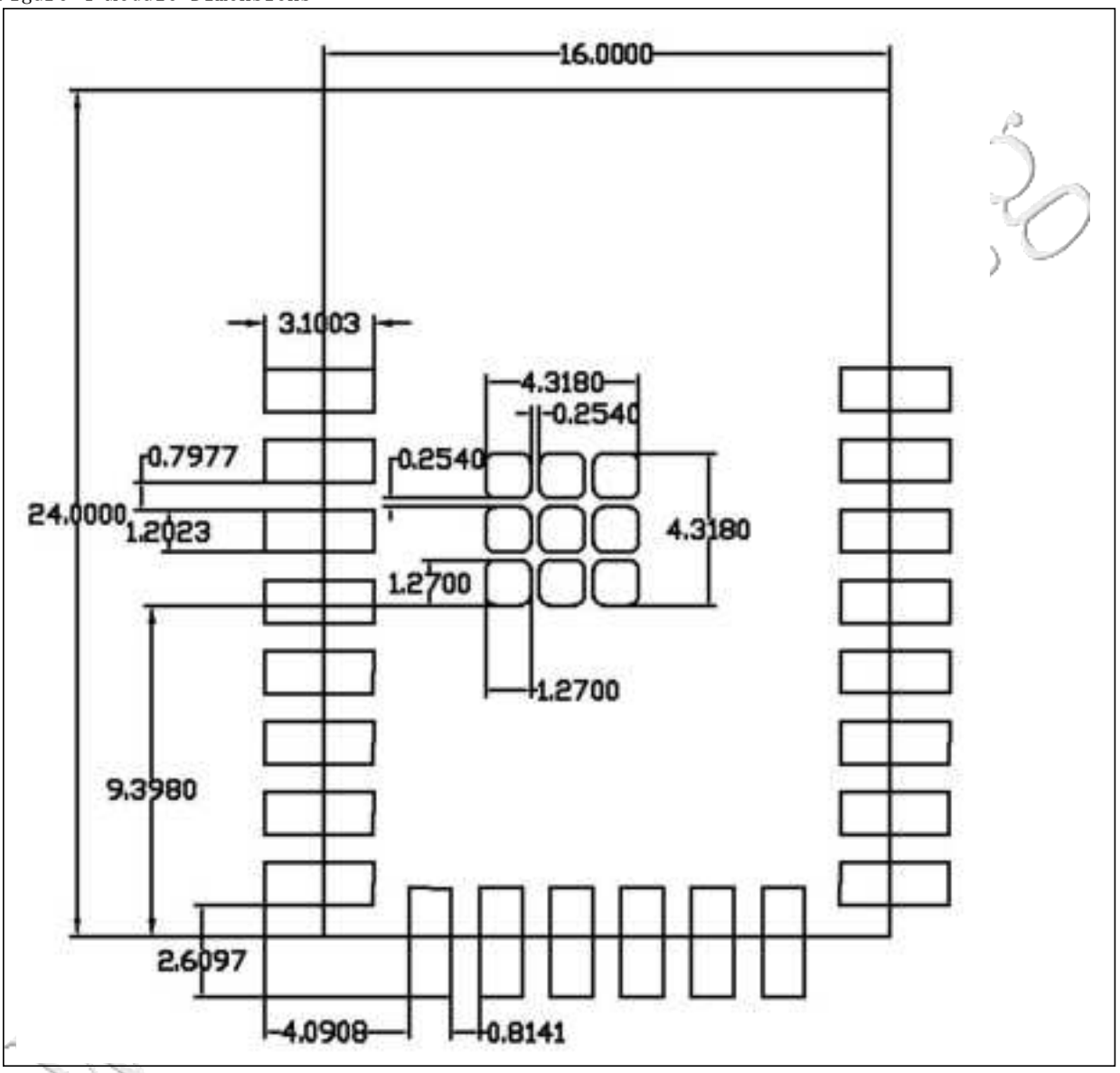
Table 9 Current Consumption Modes

Mode	Description		Typical value
Modem-sleep	CPU is running	160MHz	27mA
		80MHz	19mA
Light-sleep			180uA
Deep-sleep			7uA
Power off	EN is set to low level		0

5 Application Notes

5.1 Module Dimensions

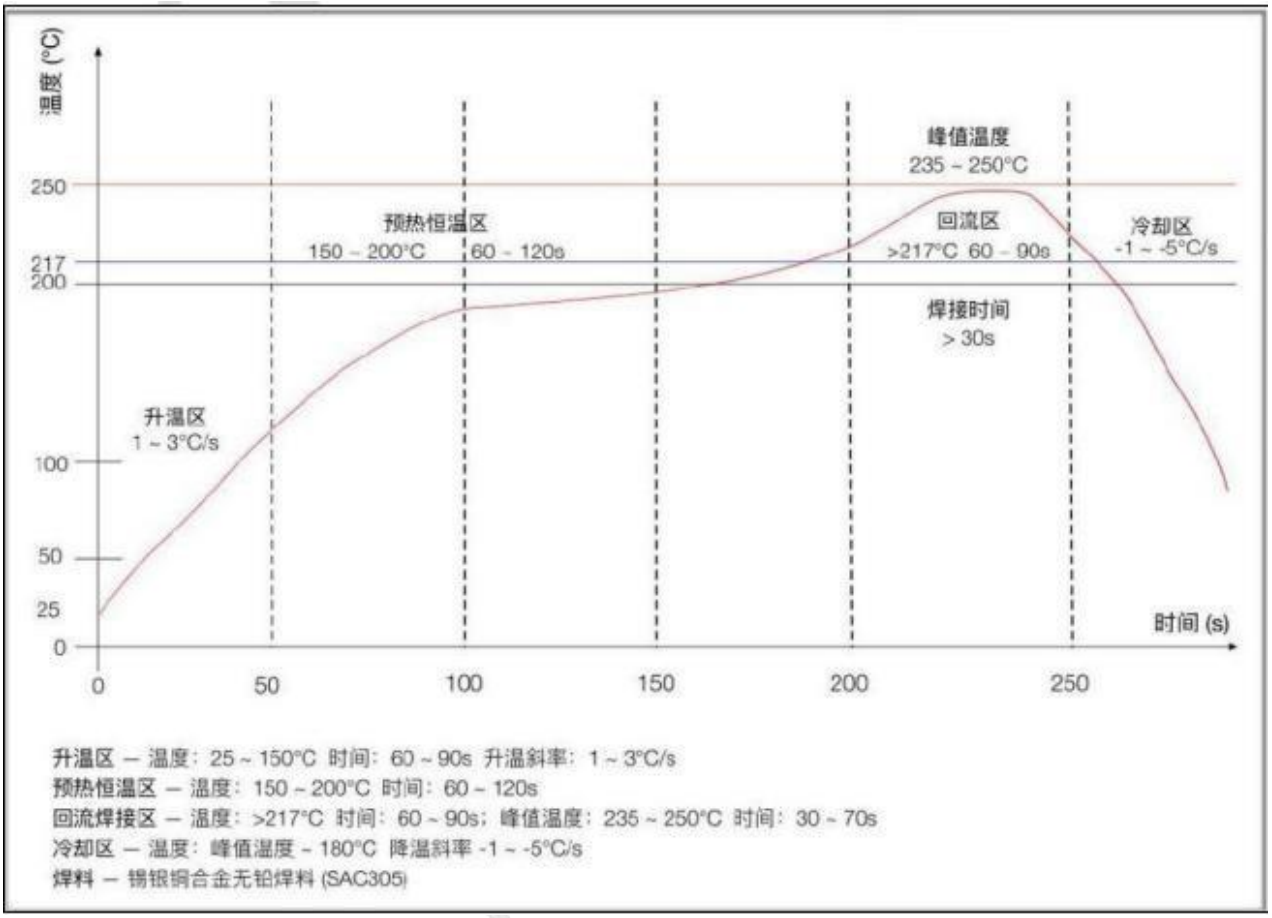
Figure 4 Module Dimensions



SDM-19 Package (Figure 4 Module Dimensions)

5.2 Reflow Soldering Profile

Figure 5 Reflow Profile



6 Product Trial

- Sales Email: enquiry@wireless-tag.com
- Technical Support Email:technical@wireless-tag.com

7 Manufacturer's name and address

Wireless-Tag Technology Co., Ltd
801, Block A, Building 6, Shenzhen International Innovation Valley, Dashi Road, Xili Community, Xili Street, Nanshan District, Shenzhen

EU:
This device was tested for uncontrolled environment operations. To comply with RF exposure requirements, a minimum separation distance of 20cm must be maintained between the user's body and the product.

Declaration of Conformity
Hereby, Wireless-Tag Technology Co., Ltd declares that the product is in compliance with Directives 2014/53/EU & 2011/65/EU. The full text of the EU declaration of conformity is available at the following internet address: http://www.wireless-tag.com.

Federal Communication Commission Statement (FCC, U.S.)

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 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.

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.

FCC Caution:

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

FCC 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 & your body.

IMPORTANT NOTES

Co-location warning:

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

OEM integration instructions:

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

The transmitter module may not be co-located with any other transmitter or antenna. The module shall
be only used with the external antenna(s) that has been originally tested and certified with this module.
As long as the conditions above are met, further transmitter test 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 (for example, digital device emissions, PC peripheral requirements, etc.).

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module 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 Transmitter Module
FCC ID: 2AFOS-WTO132C6-S5" .

Information that must be placed in the end user manual:

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 manufactures according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209

2.3 Specific operational use conditions

The module is a WiFi+BLE+Zigbee Module with 2.4G WLAN and BLE2.4G and Zigbee function.

2.4G WLAN Specification:

Operation Frequency: 2412~2462MHz
Number of Channel: 11
Modulation: DSSS, OFDM
Type: ANT 1:PCB Antenna, ANT2:FPC Antenna
Gain: ANT 1:2.9 dBi, ANT2:-0.25 dBi

BLE Specification:

Operation Frequency: 2402~2480MHz
Number of Channel: 40
Modulation: GFSK
Type: ANT 1:PCB Antenna, ANT2:FPC Antenna
Gain: ANT 1:2.9 dBi, ANT2:-0.25 dBi

Zigbee Specification:

Operation Frequency: 2405~2480MHz
Number of Channel: 1 6
Modulation: GFSK
Type: ANT 1:PCB Antenna, ANT2:FPC Antenna
Gain: ANT 1:2.9 dBi, ANT2:-0.25 dBi

The module can be used for mobile or applications with a maximum ANT 1:2.9 dBi, ANT2:-0.25 dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operaition. The host manufacturer 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.

2.4 Limited module procedures

Not applicable.

2.5 Trace antenna designs

Not applicable. The module has its own antenna, and doesn't need a host's printed board microstrip trace antenna etc.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users' body; and if RF exposure statement or module layout is changed, then the host
product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

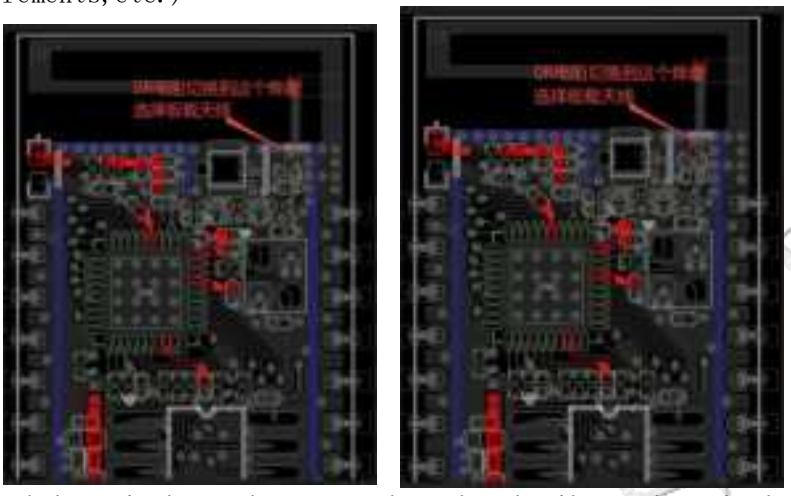
2.7 Antennas

Antenna Specification are as follows:
Type: ANT 1:PCB Antenna, ANT2:FPC Antenna
Gain: ANT 1:2.9 dBi, ANT2:-0.25 dBi

This device is intended only for host manufacturers under the following conditions: The transmitter module may not be co-located with any other transmitter or antenna; The module shall be only used with the internal antenna(s) that has been originally tested and certified with this module. The

antenna must be either permanently attached or employ a ‘unique’ antenna coupler.

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements,etc.)



The position of the resistor as shown in the figure is switched on the module to select the onboard antenna or external antenna.

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains Transmitter Module FCC ID: 2AFOS-WTO132C6-S5” with their finished product.

2.9 Information on test modes and additional testing requirements

Host manufacturer must perfom test of radiated & conducted emission and spurious emission, etc. according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product. Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 & 15.207 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.