Global Intelligent Platform

Tuya TYZS3 Zigbee Module

Version: 2.0.0 **Date: 2019-07-26** **No.:**

1 Product Overview

TYZS3 is a low-power embedded Zigbee module that Hangzhou Tuya Inc. has developed. It consists of a highly integrated wireless radio processor chip (EFR32MG13P732F512GM48) and several peripheral components, with an embedded 802.15.4 PHY/MAC Zigbee network protocol stack and robust library functions. TYZS3 is embedded with a low-power 32-bit ARM Cortex-M4 core, 512 KB flash memory, and 64 KB random-access memory (RAM), and has extensive peripherals.

TYZS3 is a FreeRTOS platform that integrates all the function libraries of the Zigbee MAC and TCP/IP protocols. You can develop built-in Zigbee products as required.

Figure 1-1 shows the TYZS3 architecture.

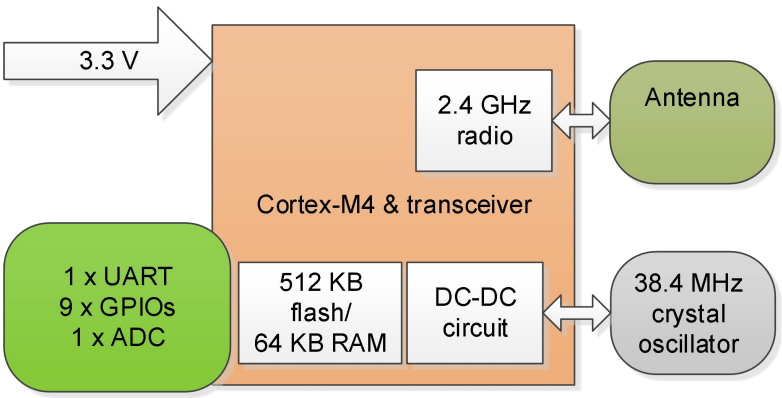


Figure 1-1 TYZS3 architecture

1.1 Features

- ✧ Embedded low-power 32-bit ARM Cortex-M4 processor, which provides digital signal processor (DSP) instructions and floating-point units (FPUs) and also functions as an application processor
  - Dominant frequency: 40 MHz
- ✧ Working voltage: 2.0 V to 3.8 V
- ✧ Peripherals: nine GPIOs, one UART, and one ADC
- ✧ Zigbee features
  - 802.15.4 MAC/PHY
  - Working channels 11 to 26 at 2.400 GHz to 2.483 GHz; 250 kbit/s air interface rate
  - Embedded DC-DC circuit, maximizing the power efficiency
  - Maximum output power: +10 dBm; dynamic output power: > 35 dB
  - Runtime power consumption: 63 μA/MHz; current in sleep mode: 3.5 μA
  - Proactive network configuration for terminals
  - TYZS3: Embedded onboard PCB antenna with 2.2 dBi gain.
  - TYZS3_IPEX: external high-gain antenna used with the I-PEX connector with 3 dBi gain. Antenna manufacturer: Dongguan UB Electronic CO.,LTD;Antenna model: UB01C55F3D814A
  - Working temperature: –20°C to +85°C
  - AES-128/AES-256 hardware encryption

1.2 Applications

- ✧ Intelligent building
- ✧ Smart household and home appliances
- ✧ Intelligent socket and light
- ✧ Industrial wireless control
- ✧ Health care and measurement
- ✧ Asset tracing

Change History

No.	Date	Change Description	Version After Change
1	2018-05-16	This is the first release.	1.0.0
2	2018-05-23	Updated the module silkscreen.	1.0.1
3	2019-01-17	Updated the ADC pin description.	1.0.2
4	2019-02-20	Updated dimensions of the module's shield cover.	1.0.3
5	2019-04-08	Updated the dimensions tolerance of the module's shield cover.	1.0.4
6	2019-04-16	Updated the module's working temperature range.	1.0.5
7	2019-07-23	Updated the dimensions tolerance, and added the antenna placement reference figure.	2.0.0

Contents

2 Module Interfaces

2.1 Dimensions and Footprint

TYZS3 has two rows of pins with a 2 mm pin spacing.

TYZS3 dimensions (H x W x D): 2.6 mm x 16 mm x 24 mm

Figure 2-1 shows the TYZS3 front and rear views.

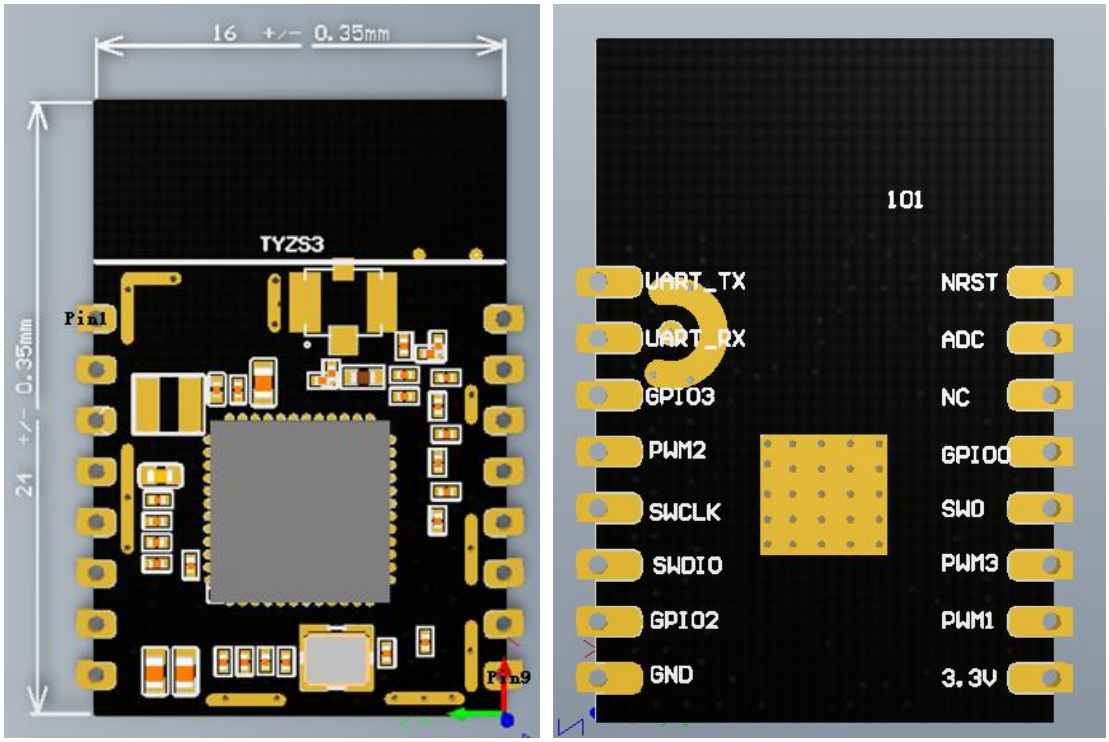


Figure 2-1 TYZS3 front and rear views

2.2 Pin Definition

Table 2-1 TYZS3 interface pins

Pin No.	Symbol	I/O Type	Function
1	nRST	I	Hardware reset pin. When the pin is at a low level, the chip is reset. TYZS3 is reset upon power-on, and therefore, this pin may not be used.
2	ADC	AI	12-bit precision SAR ADC. For more information, see the following Note 3.

Pin No.	Symbol	I/O Type	Function
3	NC	N/A	NC pin. External processing is not required.
4	GPIO0	I/O	Used as a GPIO. It corresponds to the PA3 pin on the internal IC.
5	SWO	I/O	Used as a GPIO or an output pin in J-Link communication state. It corresponds to the PF2 pin on the internal IC.
6	PWM3	I/O	Used as a GPIO. It corresponds to the PF4 pin on the internal IC.
7	PWM1	I/O	Used as a GPIO. It corresponds to the PF5 pin on the internal IC.
8	VCC	P	Power supply pin. The typical power supply voltage is 3.3 V.
9	GND	P	Reference ground pin.
10	GPIO2	I/O	Used as a GPIO. It corresponds to the PA5 pin on the internal IC.
11	SWDIO	I/O	J-Link SWDIO programming pin. It can be used as a GPIO in common application programs.
12	SWCLK	I/O	J-Link SWCLK programming pin. It can be used as a GPIO in common application programs, corresponding to the PF0 pin on the internal IC.
13	PWM2	I/O	Used as a GPIO. It corresponds to the PA2 pin on the internal IC.
14	GPIO3	I/O	Used as a GPIO. It corresponds to the PD15 pin on the internal IC.
15	RXD	I/O	UART0_RXD. It corresponds to the PA1 pin on the internal IC.
16	TXD	Output	UART0_TXD. It corresponds to the PA0 pin on the internal IC.

Note:

1. **P** indicates power supply pins, **I/O** indicates input/output pins, and **AI** indicates analog input pins.
2. nRST is only a hardware reset pin. It cannot clear the Zigbee network configuration

information.

3. This pin can be used as an ADC interface or a common I/O interface. It must be disconnected when not being used. When this pin is used as the ADC input interface, the input voltage range must be 0 to AVDD, which can be configured by using software.

2.3 Test Pin Definition

Table 2-2 TYZS3 test pins

Pin No.	Symbol	I/O Type	Function
N/A	N/A	I	Used for the module production test

Note: It is not recommended that test pins be used.

3 Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	–50	150	°C
VCC	Power supply voltage	–0.3	3.8	V
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2.5	kV
Static electricity voltage (machine model)	Tamb = 25°C	N/A	0.5	kV

3.2 Electrical Conditions

Table 3-2 Normal electrical conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	–20	N/A	85	°C
VCC	Working voltage	2.0	3.3	3.8	V
V_{IL}	I/O low-level input	–0.3	N/A	VCC x 0.25	V
V_{IH}	I/O high-level input	VCC x 0.75	N/A	VCC	V
V_{OL}	I/O low-level output	N/A	N/A	VCC x 0.1	V
V_{OH}	I/O high-level output	VCC x 0.8	N/A	VCC	V
Imax	I/O drive current	N/A	N/A	12	mA

3.3 Zigbee TX Power Consumption

Table 3-3 Power consumption during constant transmission

Symbol	Parameter		Typical Value	Unit
	Rate	TX Power		
I_{RF}	250 kbit/s	+19 dBm	120	mA
I_{RF}	250 kbit/s	+13 dBm	50	mA
I_{RF}	250 kbit/s	+10 dBm	32	mA
I_{RF}	250 kbit/s	+4 dBm	17	mA
I_{RF}	250 kbit/s	+1 dBm	11.8	mA

Note: When the preceding data is being tested, the duty cycle is set to 100%.

3.4 Zigbee RX Power Consumption

Table 3-4 Power consumption during constant receiving

Symbol	Rate	Typical Value	Unit
I_{RF}	250 kbit/s	8	mA

Note: When the UART is in active state, the receiving current is 14 mA.

3.5 Working Current

Table 3-5 TYZS3 working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value	Unit
EZ	The module is in EZ mode.	10	40	mA
Connected	The module is connected to the network.	3	5	mA
Deep sleep mode	The module is in deep sleep mode, with 64 KB flash memory.	3	5	μA

4 RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency band	2.400 GHz to 2.484 GHz
Physical-layer standard	IEEE 802.15.4
Data transmission rate	250 kbit/s
Antenna type	Default PCB antenna

Parameter	Description
Line-of-sight transmission distance	> 150 m

4.2 Zigbee Output Performance

Table 4-2 Performance during constant transmission

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Maximum output power	N/A	+19	N/A	dBm
Minimum output power	N/A	–30	N/A	dBm
Output power adjustment step	N/A	0.5	1	dB
Frequency error	–15	N/A	+15	ppm
Output spectrum adjacent-channel rejection ratio		–31		dBc

Note: The maximum output power can reach +19 dBm. The output power can be adjusted under normal use. The high-power output can be used for coverage in extremely complex conditions, for example, modules installed in walls.

4.3 Zigbee RX Sensitivity

Table 4-3 RX sensitivity

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER < 10%, 250 kbit/s, OQPSK	–102	–101	–99	dBm

5 Antenna Information

5.1 Antenna Type

By default, TYZS3 uses an onboard PCB antenna. You can also use an I-PEX connector

to connect the module to an external antenna to extend the coverage in a complex installation environment. If you use an I-PEX connector, the module BOM needs to be changed. For the I-PEX connector version, contact Tuya business personnel.

5.2 Antenna Interference Reduction

To ensure optimal wireless performance when the Zigbee module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts and that the antenna location on the PCB be hollowed out.

To prevent adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. Ensure that there are no substrate media above or below the antenna and that copper is at a certain distance away from the antenna to maximize the antenna radiation performance, as shown in Figure 5-1.

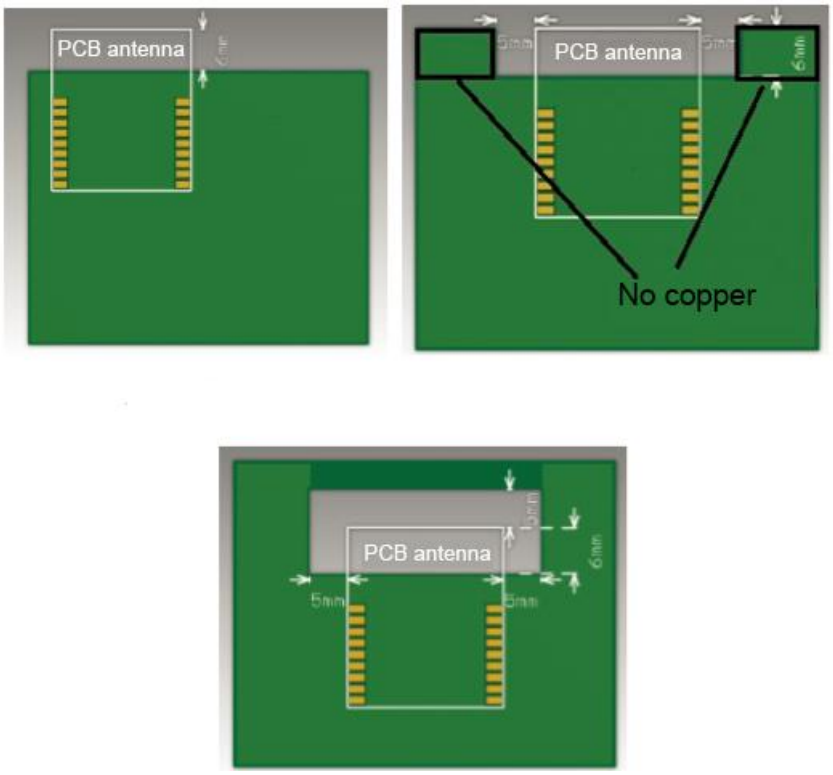


Figure 5-1 Antenna placement

For details about the onboard PCB antenna area on TYZS3, see Figure 6-1.

6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions

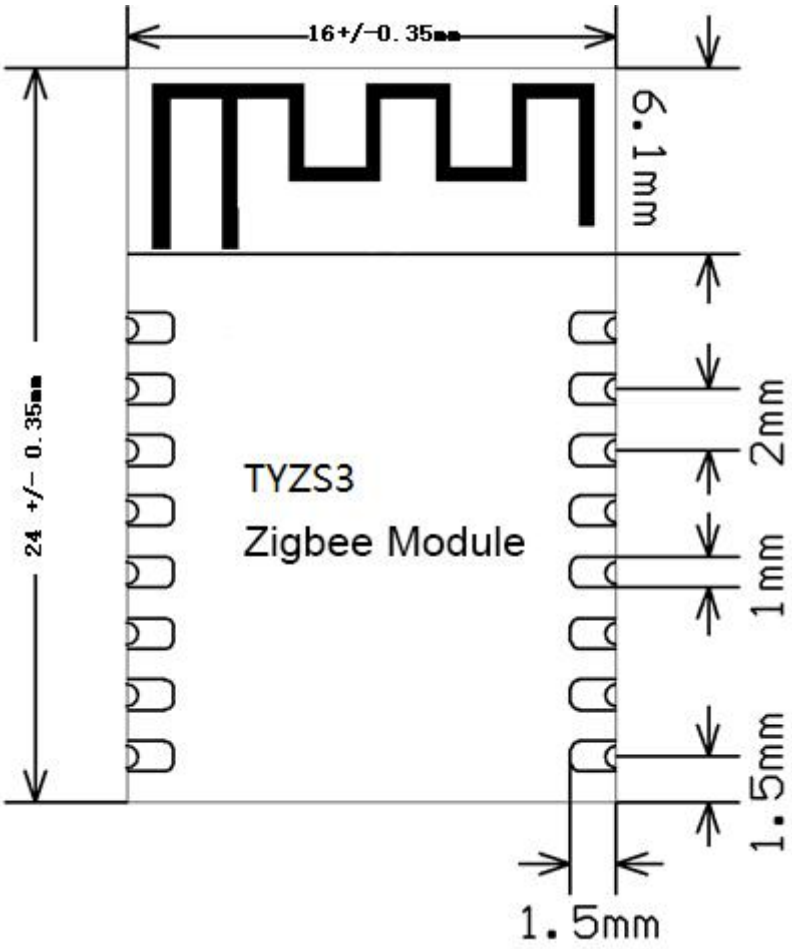


Figure 6-1 TYZS3 mechanical dimensions

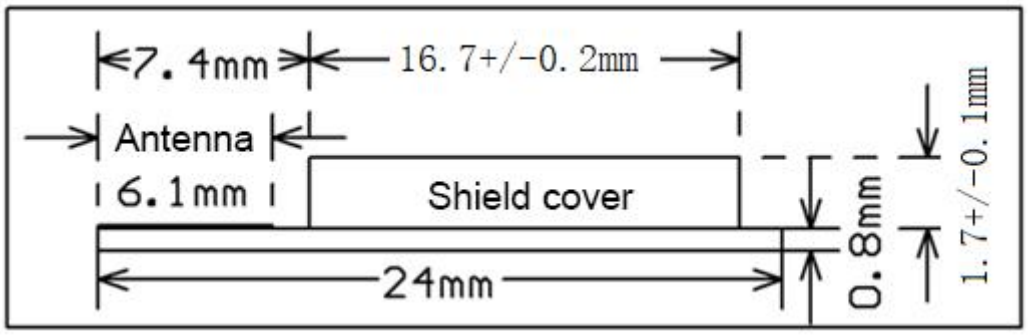


Figure 6-2 TYZS3 side view

6.2 Recommended PCB Encapsulation

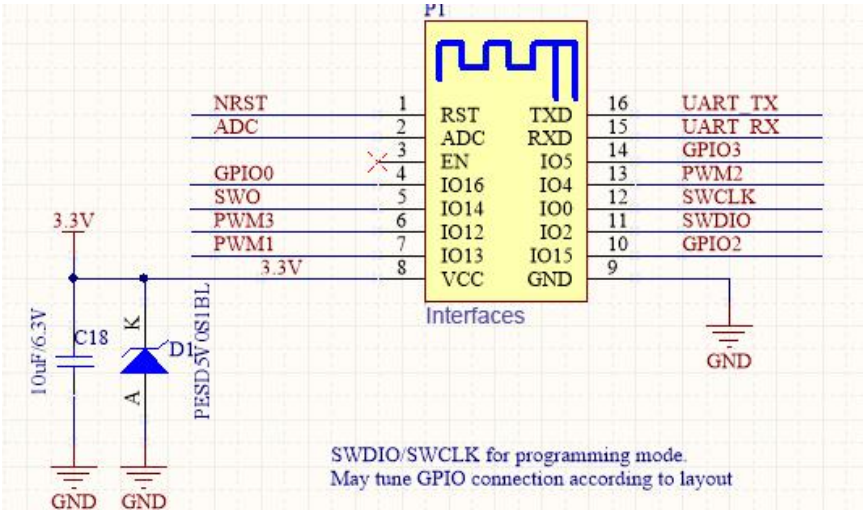


Figure 6-3 TYZS3 schematic diagram and pin connection

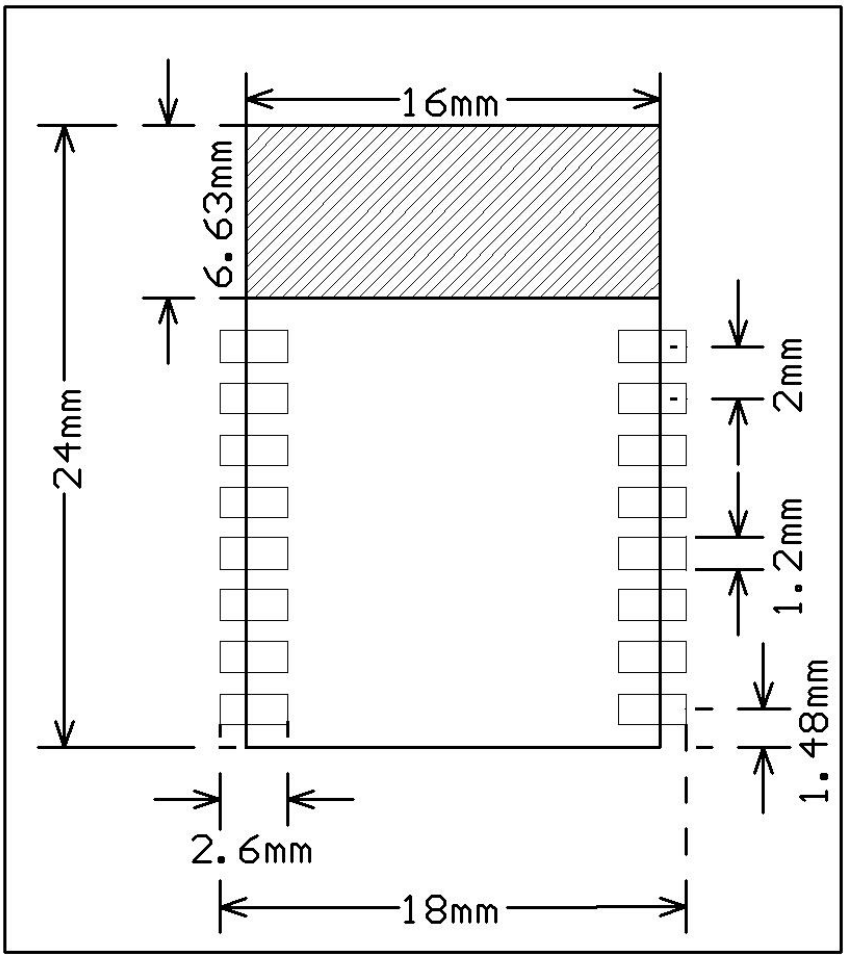


Figure 6-4 PCB encapsulation diagram of TYZS3

6.3 Production Instructions

Storage conditions for a delivered module are as follows:

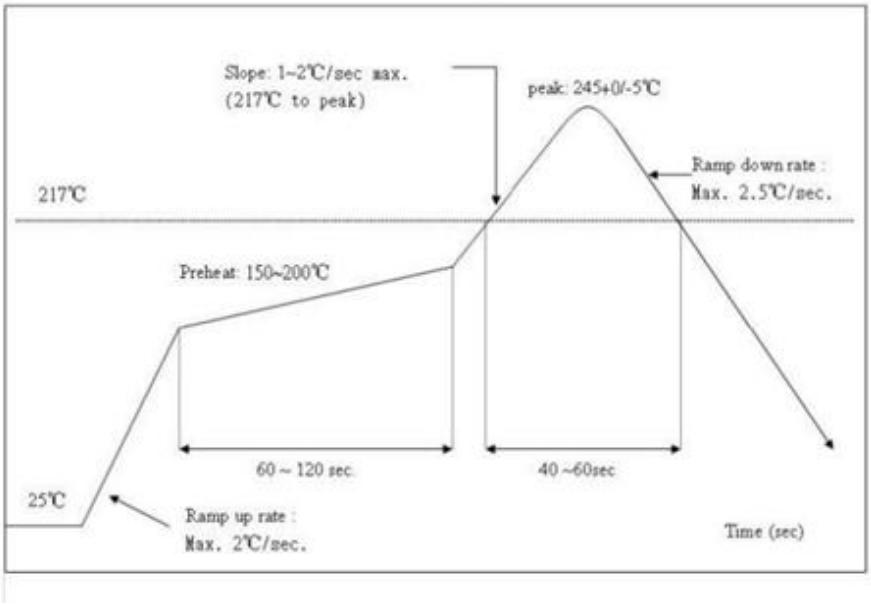
1. The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
2. The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.

Precautions:

1. Throughout the production process, each involved operator must wear an ESD wrist strap and ESD suit.
2. During the operation, strictly protect the module from water and stains.

6.4 Recommended Oven Temperature Curve

Refer to IPC/JEDEC standard ; Peak Temperature : <245℃ ; Number of Times: ≤2 times ;



6.5 Storage Conditions

7 Appendix

Federal Communications Commission (FCC) Declaration of Conformity

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.

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.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

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

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

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

The availability of some specific channels and/or operational frequency bands is country dependent and firmware programmed at the factory to match the intended destination.

The firmware setting is not accessible by the end user.

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

"Contains Transmitter Module 2AFNL-TYWXXX"

TYZS3 Module FCC ID: 2ANDL-TYZS3

TYZS3_IPEX Module FCC ID: 2ANDL-TYZS3

This radio module must not be installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

Declaration of Conformity European notice

Hereby, Hangzhou AiXiangJi Technology Co., Ltd declares that this Wi-Fi module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EC. A copy of the Declaration of conformity can be found at http://www.tuya.com.

EN 300 328 V2.1.1

EN 301 489-1 V2.1.1; EN 301 489-17 V3.1.1

EN 62311:2008

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013