TYWE3S Module Datasheet

Device Development > Cloud Module > Wi-Fi Module

Version: 20200818

Contents

1 Product Overview

TYWE3S is a low-power embedded Wi-Fi module developed by Hangzhou Tuya technology co., LTD. It consists of a highly integrated radio frequency chip ESP8266 and a handful of peripheral components, with a built-in Wi-Fi network protocol stack and rich library functions. TYWE3S is built in low-power 32-bit CPU, 2Mbyte flash memory, 50KB SRAM and rich peripheral resources.

TYWE3S is a RTOS platform that integrates all Wi-Fi MAC and TCP/IP protocol libraries. Users can develop embedded Wi-Fi products that meet their needs based on these developments.

1.1 Features

- Built-in low-power 32-bit CPU, can be concurrently used as an application processor (main-frequency support 80MHz & 160MHz)
- Built-in low-power 32-bit CPU can be concurrently used as an application processor (main-frequency support 80MHz and 160MHz)
- Working voltage：3V-3.6V
- Peripheral：9×GPIOs, 1×UART, 1×ADC
- Wi-Fi connectivity

  - 802.11b/g/n
  - Channel 1-14@2.4GHz
  - Support WPA／WPA2 safe mode
  - 802.11b mode + 20dBm output power
  - Support STA/AP/STA+AP work mode
  - Support SmartConfig function（including Android & iOS devices）
  - Onboard PCB antenna
  - Working temperature：-20℃-85℃

1.2 Major Application fields

- Smart building
- Smart home Appliances, smart home
- Smart plug. smart lighting
- Industrial wireless control
- Baby monitor

- Webcam
- Smart bus, etc

2 Dimensions and Footprint

2.1 Dimensions

TYWE3S has 2 rows of pins, lead pitch is 2mm.

TYWE3S size dimension：16±0.3mm (W)×24±0.3mm (L) ×3.4±0.2mm (H) 。
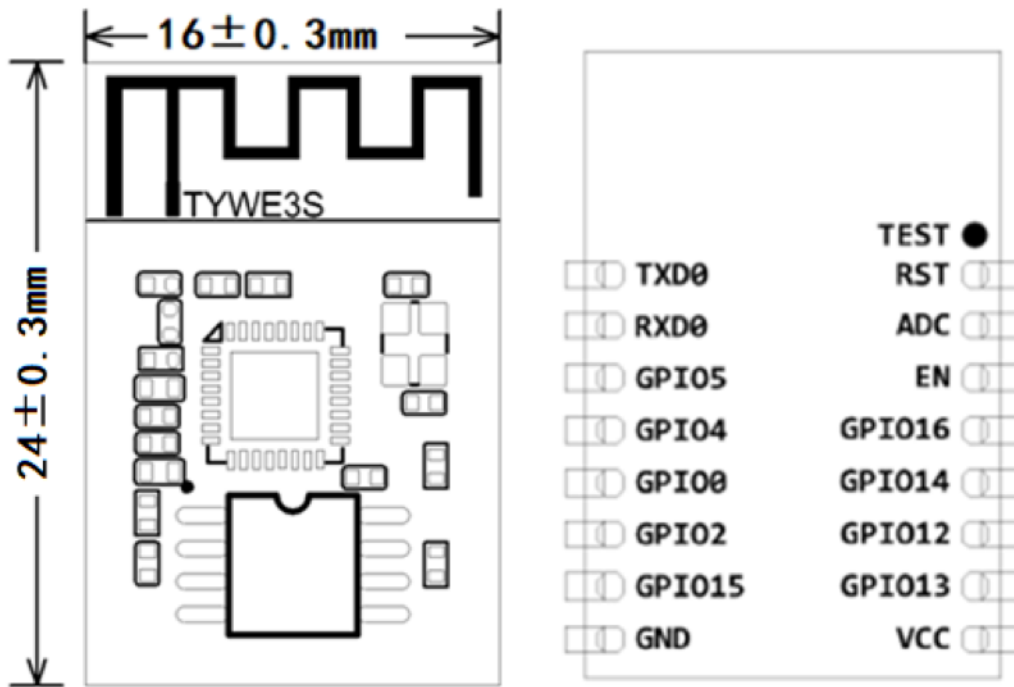
Figure 2. TYWE3S front and back view

2.2 Definition of pin

引脚序号	符号	IO 类型	功能
1	RST	I/O	Hardware reset pin (low level effective, internal pull-up resistance)

引脚序号	符号	IO 类型	功能
2	ADC	AI	ADC port, 10-bit precision SAR ADC
3	EN	I	Module enable pin,normal use needs to receive 3.3V
4	GPIO16	I/O	GPIO_16(Use 10K pull-up resistor for use)
5	GPIO14	I/O	GPIO_14
6	GPIO12	I/O	GPIO_12
7	GPIO13	I/O	GPIO_13
8	VCC	P	Module Power Pin(3.3V)
9	GND	P	Power Reference Ground
10	GPIO15	O	GPIO_15(Participate in the module power-on initialization process,use with caution)
11	GPIO2	O	LOG_TXD(Used to print module internal information)

引脚序号	符号	IO 类型	功能
12	GPIO0	I/O	GPIO5_0(Participate in the module power-on initialization process,use with caution)
13	GPIO4	I/O	GPIO_04
14	GPIO5	I/O	GPIO_05
15	RXD0	I/O	UART0_RXD
16	TXD0	O	UART0_TXD

Instructions：

P indicates the power pin,I/O means input and output pins，AI represents the analog input pin.

RST is just a module hardware reset pin, can't clear Wi-Fi distribution network.

(1):This pin can only be used as an ADC port, can not be used as a normol IO port,need to be suspended when not in use。When used ad an ADC input,input voltage range is limited to 0~1.0V

(2):UARTO is the user serial port

2.3 Definition of test point

Definition of test point pin is shown in the diagram as below.

Pin Number	Symbol	IO type	Function
-	TEST	I	For module production testing

Note: Test pins are not recommended.

3 Electrical Characteristics

3.1 Absolute Electrical Characteristics

Table 3,Absolute electrical characteristics

Parameters	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-20	85	℃
VCC	Power supply voltage	-0.3	3.6	V
Static electricity voltage (human model)	TAMB-25℃	-	2	KV
Static electricity voltage (machine model)	TAMB-25℃	-	0.5	KV

3.2 Electrical conditions

Table 4,Normal electrical conditions

Parameters	Description	Min	Typ	Max	Unit
Ta	Working temperature	-20	-	85	℃
VCC	Working voltage	3.0	3.3	3.6	V

Parameters	Description	Min	Typ	Max	Unit
VIL	I/O low-level input	-0.3	-	VCC*0.25	V
VIH	I/O high-level input	VCC*0.75	-	VCC	V
VOL	I/O low-level output	-	-	VCC*0.1	V
VOH	I/O high-level output	VCC*0.8	-	VCC	V
Imax	I/O drive current	-	-	12	mA

Table 4,Normal electrical conditions

3.3 WI-Fi TX Power Consumption

Table 5 TX power consumption during constant emission

Parameter	Mode	Rate	Tx power	Typ	Unit
IRF	11b	11 Mbit/s	+17 dBm	220	mA
IRF	11g	54 Mbit/s	+15 dBm	110	mA
IRF	11n	MCS7	+13 dBm	100	mA

3.4 WI-Fi RX Power Consumption

Table 6 RX power consumption during constant emission

Parameter	Mode	Rate	Typ	Unit
IRF	11b	11 Mbit/s	76	mA
IRF	11g	54 Mbit/s	76	mA
IRF	11n	MCS7	76	mA

3.5 Power Consumption in Operating Mode

Table 7 TYWE2L working current

Working Mode	Working Status(Ta=25°C)	Value	Max	Unit
EZ mode	The module is in EZ status and the Wi-Fi indicator quickly flashes.	80	151	mA
AP mode	The module is in AP status and the Wi-Fi indicator slowly flashes.	90	451	mA
Operation mode	The module is in connected status and the Wi-Fi indicator is steady on.	58.5	411	mA

Working Mode	Working Status(Ta=25°C)	Value	Max	Unit
Disconnection mode	The module is in disconnected status and the Wi-Fi indicator is steady off.	80	430	mA

4 RF Features

4.1 Basic RF Features

Table 8,Basic RF features

Parameter	Description
Frequency band	2.412–2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channel 1–14)
Data transmitting rate	11b: 1, 2, 5.5, 11 (Mbit/s)11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbit/s)11n: HT20 MCS0–MCS7
Antenna type	PCB antenna

4.2 WI-FI Output Power

Table 9 TX power during constant emission

Parameter		Min	Typ	Max	Unit
RF average output power, 802.11b CCK mode	1 M	-	20	-	dBm
RF average output power, 802.11g OFDM mode	54 M	-	17	-	dBm

Parameter		Min	Typ	Max	Unit
RF average output power, 802.11n OFDM mode	MCS7	-	14	-	dBm
Frequency error		-10	-	10	ppm

4.3 RF RX sensitivity

Table 10 RX Sensitivity

Parameter		Min	Typ	Max	Unit
PER < 8%, RX sensitivity, 802.11b CCK mode	1 M	-	-91	-	dBm
PER < 10%, RX sensitivity, 802.11g OFDM mode	54 M	-	-75	-	dBm
PER < 10%, RX sensitivity, 802.11n OFDM mode	MCS7	-	-72	-	dBm

5 Antenna Information

5.1 Antenna type

 TYWE3S uses a MIFA onboard antenna with a PCB antenna of 2.4G Wi-Fi band.

5.2 Antenna Interference Reduction

To ensure optimal Wi-Fi performance, it is recommended that the antenna portion of the module be at least 15 mm away from other metal parts.

Since the use of TYWE3S is applied to the main control board and other components through the SMT process, the placement and placement of the PCB antenna directly affects the RF performance. Below are our recommended placements and suggested placements.

It is recommended to use the placement of scheme 1 and scheme 2, the antenna is hollowed out outside the frame or near the antenna, and the performance is basically consistent with the performance of the individual module RF test.

If the design must be limited, the PCB antenna must be placed on the backplane. Refer to the layout of the scheme 3. The antenna is in the frame, but there is no copper or trace near the antenna, but the RF performance will be somewhat lost. 2dBm.

It is not recommended to use the placement position of scheme 4. The antenna is in the frame and the copper or trace is placed under the antenna. The RF signal will be significantly attenuated.

6 Packaging Information and Poduction Instructions
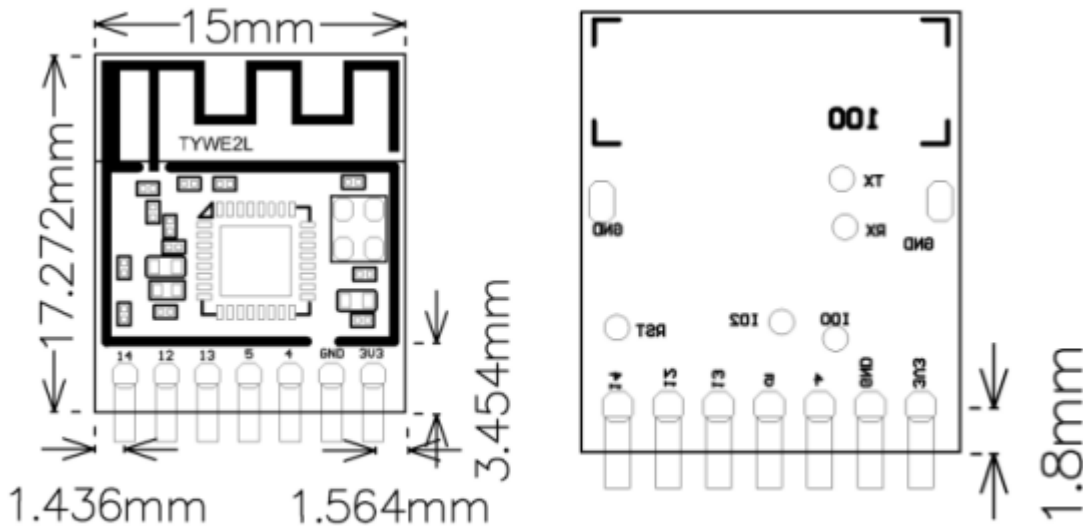
6.1 Mechanical Dimensions

Figure 3 TYWE2L front view and rear view

Figure 4 TYWE2L side view

Note: PCB frame tolerance ±0.15 mm, PCB depth tolerance ±0.1 mm

6.2 Production Instructions

Storage conditions of a delivered module are as follows:

1. The anti-moisture bag is placed in an environment where the temperature is under 30°C and the relative humidity is under 85%.

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 electrostatic ring.
2. During the operation, strictly protect the module from water and strains.

6.3 Recommended Oven Temperature Profile

![](https:// Product Overview

TYWE3S is a low-power embedded WiFi module that Tuya has developed. It consists of a highly integrated wireless RF chip (ESP8266), a few peripherals, an embedded WiFi network protocol stack and varied library functions. TYWE3S has an embedded low-power 32-bit CPU, 2-MB flash memory, 50-KB static random-access memory (SRAM), and rich peripherals. TYWE3S is an RTOS platform that integrates all function libraries of the WiFi MAC and TCP/IP protocols. You can develop embedded WiFi products as required.

6.4 Features

- Embedded low-power 32-bit CPU, which can also function as an application processor (The clock rate supports 80 Mhz and 160 Mhz)
- Working voltage: 3.0 to 3.6 V
- Peripherals: 9 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog-to-digital converter (ADC)
- WiFi connectivity

    – IEEE 802.11 b/g/n
    – Channels 1 to 14@2.4 GHz (CH1 to 11 for US/CA and CH1 to 13 for EU/CN)
    – Support WPA/WPA2 security mode
    – Up to +20 dBm output power in 802.11b mode
    – Support STA/AP/STA+AP working mode
    – Support SmartConfig and AP network configuration manners for Android and IOS devices
    – Onboard PCB antenna with a gain of 2.0 dBi
    – Working temperature: -20 to +85℃

6.5 Applications

- Intelligent building
- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
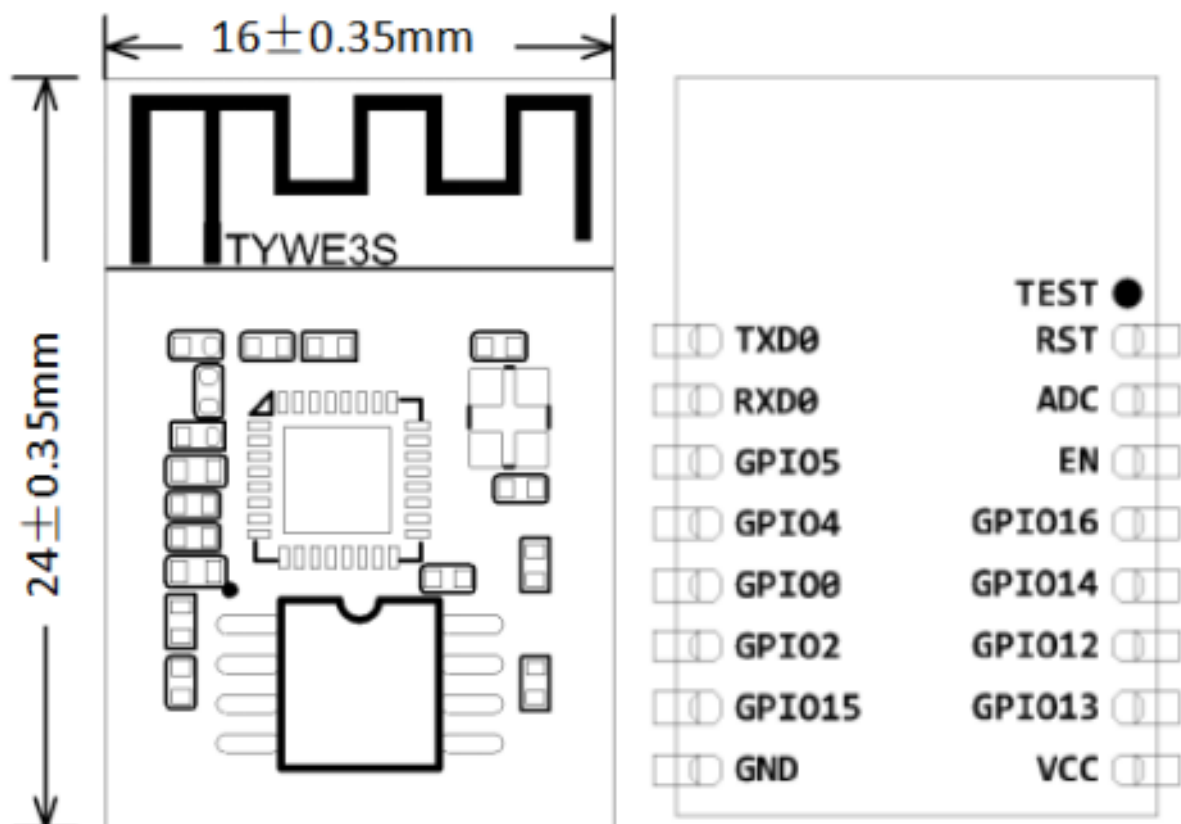- Network camera
- Intelligent bus

7 Change History

Serial Number	Update Date	Updated Content	Version after Update
1	07/23/2019	This is the first release.	V2.0.0

8 Module Interfaces

8.1 Dimensions and Footprint

TYWE3S has two rows of pins with a 2mm pin spacing. The TYWE3S dimensions are 16±0.35 mm (W)×24±0.35 mm (L) ×3.4±0.15 mm (H). The thickness of the PCB is 0.8 mm±0.1 mm.

8.2 Pin Definition

Pin Number	Symbol	I/O Type	Function
1	RST	I/O	Hardware reset pin (active low, a resistor has been pulled up internally)
2	ADC	AI	ADC interface (1), a 10-bit-precision SAR ADC
3	EN	I	Enabling pin, which needs to be connected to the voltage of 3.3V in normal cases
4	GPIO16	I/O	GPIO_16 (when used, it needs to be connected to a pulled-up resistor of 10K)
5	GPIO14	I/O	GPIO_14, which corresponds to MTMS (Pin 9) of IC
6	GPIO12	I/O	GPIO_12, which corresponds to MTDI (Pin 10) of IC
7	GPIO13	I/O	GPIO_13, which corresponds to MTCK (Pin 12) of IC
8	VCC	P	Power supply pin (3.3V)

Pin Number	Symbol	I/O Type	Function
9	GND	P	Power supply reference ground
10	GPIO15	O	GPIO_15 (in the module power-on initialization process, use with caution)
11	GPIO2	O	UART0_TXD (used to display the module internal information)
12	GPIO0	I/O	GPIO_0 (in the module power-on initialization process, use with caution)
13	GPIO4	I/O	GPIO_04, which corresponds to GPIO 4 (Pin 16) of IC
14	GPIO5	I/O	GPIO_05, which corresponds to GPIO 5 (Pin 24) of IC
15	RXD0	I/O	UART0_RXD (2)
16	TXD0	O	UART0_TXD (2)

Note:

- P indicates power supply pins, I/O indicates input/output pins, and AI indicates analog input pins.
- RST is only a module reset pin and cannot be used for clearing information about WiFi network configuration.

- Pin 2 ADC can only be used as an ADC interface but cannot be used as a common IO interface. Once not used, it needs to be pulled up. As an ADC input interface, the input voltage range is 0 to 1.0 V.
- UART0 is a user-side serial interface. When the module is enabled, there is information output from the user-side serial interface, which can be neglected.

8.3 Definitions on Test points

Pin Number	Symbol	I/O Type	Function
-	TEST	I	Be used for production tests of the module.

Note:

Test pins are not recommended for use.

9 Electrical Parameters

9.1 Absolute Electrical Parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	-40	125	℃
VIN	Power supply voltage	-0.3	3.6	V
Static electricity discharge voltage (human body model)	TAMB-25℃	-	2	KV
Static electricity discharge voltage (machine model)	TAMB-25℃	-	0.5	KV

9.2 Working Conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-20	-	85	℃
VCC	Working voltage	3.0	3.3	3.6	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
VIL	IO low level input	-0.3	-	VCC*0.25	V
VIH	IO high level input	VCC*0.75	-	VCC	V
VOL	IO low level output	-	-	VCC*0.1	V
VOH	IO high level output	VCC*0.8	-	VCC	V
Imax	IO drive current	-	-	12	mA

9.3 RF Power Consumption

Symbol	Mode	Rate	Transmit Power	Typical Value	Unit
Transmit	11b	11 Mbps	+17 dBM	220	mA
Transmit	11g	54 Mbps	+15 dBm	110	mA
Transmit	11n	MCS 7	+13 dBm	100	mA
Receive	11b	11 Mbps	Constantly receive	76	mA
Receive	11g	54 Mbps	Constantly receive	76	mA
Receive	11n	MCS7	Constantly receive	76	mA

9.4 Working Power Consumption

Working Mode	Working Status, Ta = 25°CTa=25°C	Average Value	Peak Value (Typical Value)	Unit
Quick connection network state	The module is in the fast network connection state and the WiFi indicator always flashes	80	151	mA
Hotspot network configuration state	The module is in the hotspot network configuration state and the WiFi indicator always flashes slowly	90	451	mA
Network connection idle state	The module is connected to the network and the WiFi indicator is always on	58.5	411	mA
Network connection operation state	The module is connected to the network and the WiFi indicator is always on	100	411	mA

Working Mode	Working Status, Ta = 25°CTa=25°C	Average Value	Peak Value (Typical Value)	Unit
Disconnected state	The module is disconnected and the WiFi indicator is dark	80	430	mA

10 RF Parameters

10.1 Basic RF Features

Parameter	Description
Working frequency	2.412 to 2.484 GHz
WiFi standard	IEEE 802.11 b/g/n (channels 1 to 14)
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps)
	11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps)
	11n: HT20 MCS 0 to 7
Antenna type	PCB antenna with a gain of 3.0 dBi

10.2 TX Performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK Mode 11M	-	20	-	dBm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11g OFDM Mode 54M	-	17	-	dBm
Average RF output power, 802.11n OFDM Mode MCS7	-	14	-	dBm
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11 Mbps Mode 17.5 dBm	-	- 16	-	dB
EVM@802.11g OFDM 54 Mbps Mode 15.0 dBm	-	- 30	-	dB
EVM@802.11n OFDM MCS7 Mode 14.0 dBm	-	-31	-	dB

10.3 RX Performance

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode	11 M	-	-84	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode	54 M	-	-73	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode	MCS 7	-	-70	-	dBm

11 Antenna Information

11.1 Antenna Type

TYWE3S uses an onboard PCB antenna with a gain of 3.0 dBi.

11.2 Antenna Interference Reduction

To ensure optimal WiFi performance when the WiFi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts. To ensure the antenna performance, the PCB should not be routed or clad with copper in the antenna area. The main points of the layout: 1. Make sure that there is no substrate medium directly below or above the printed antenna. 2. Make sure that the area around the printed antenna is far away from the metal

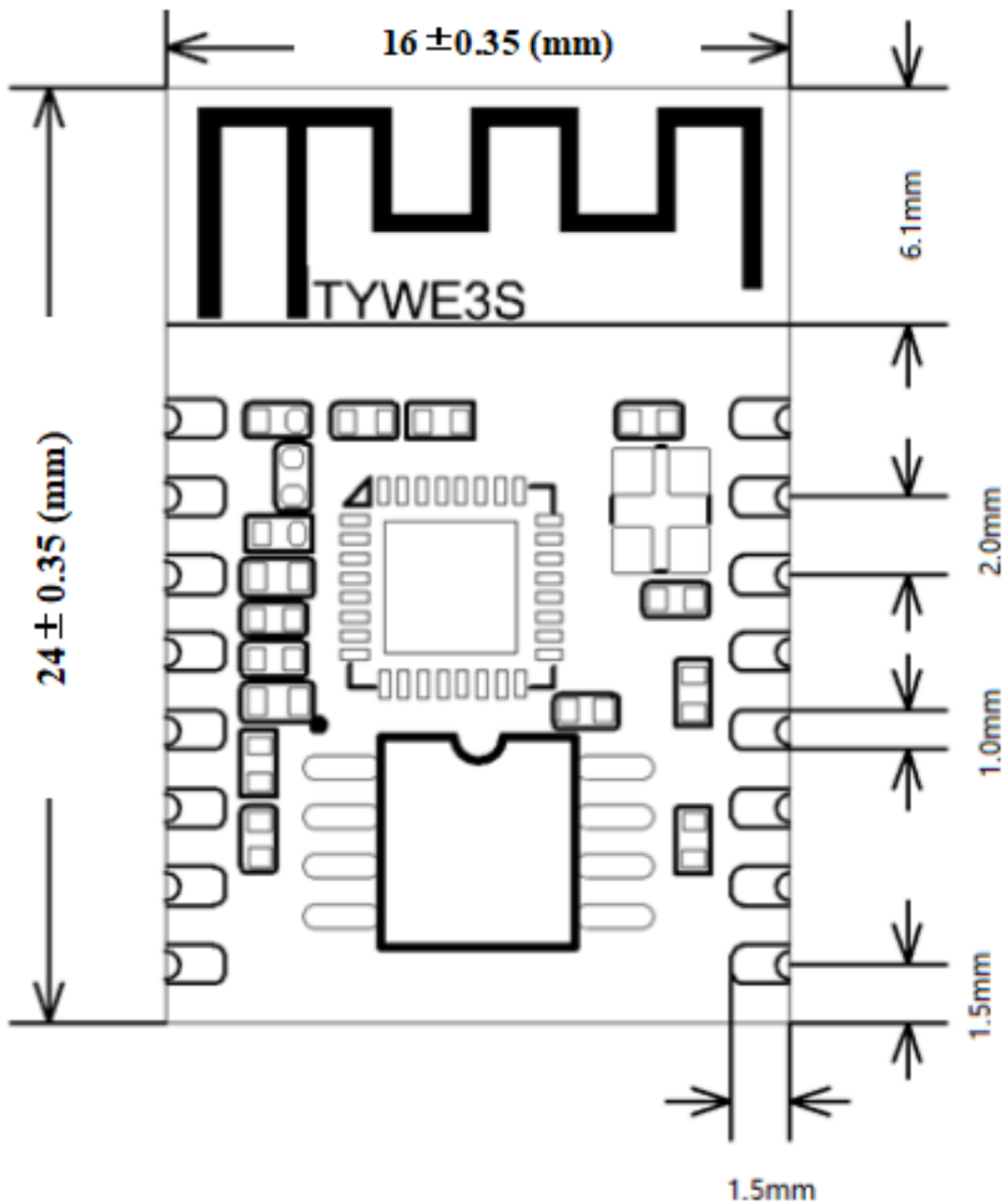copper skin, so as to ensure the radiation effect of the antenna to the greatest extent.
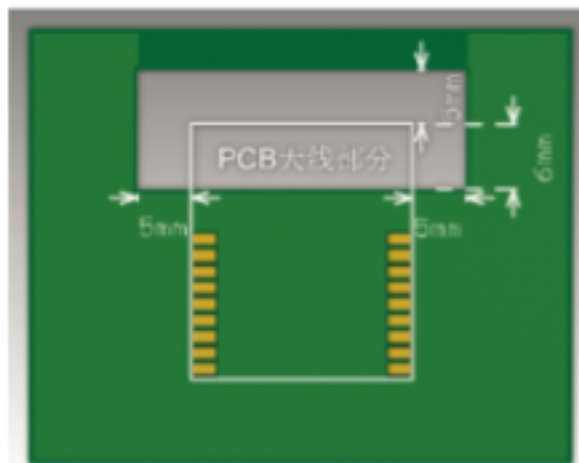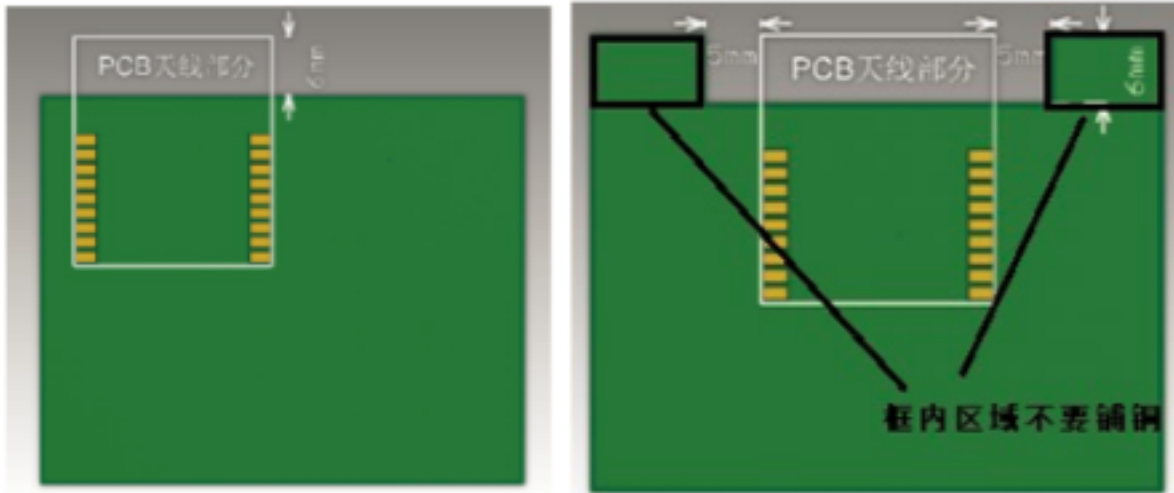
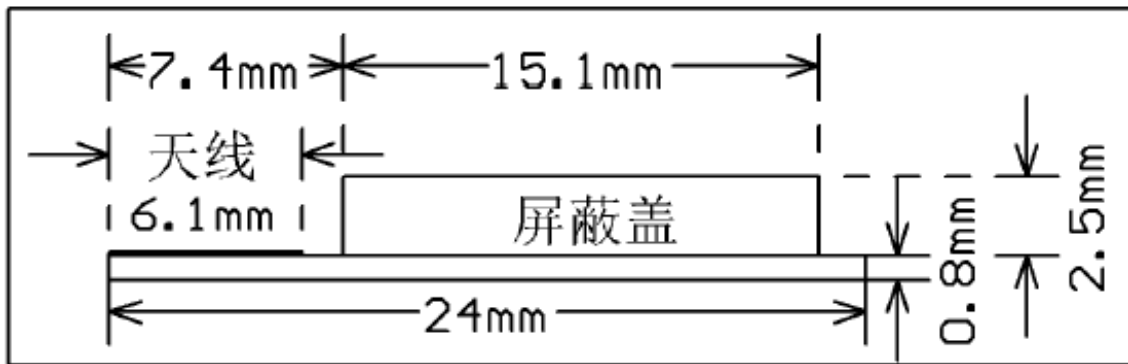## 11.3 Antenna Connector Specifications

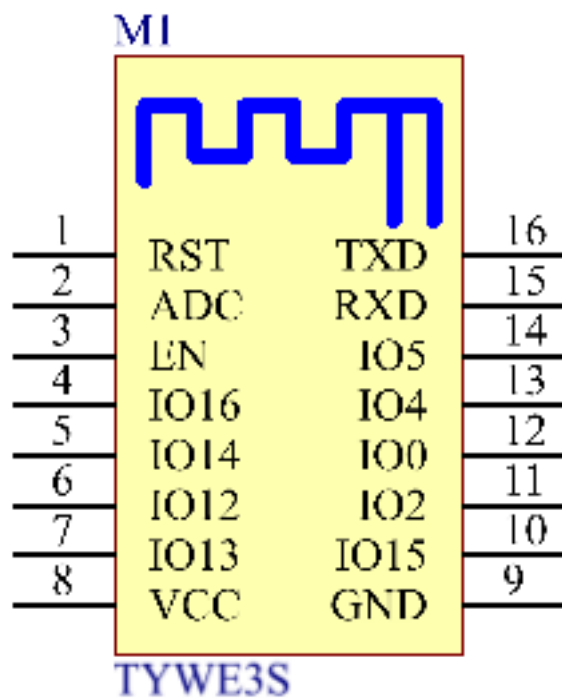There is no antenna connector for this module for the moment.
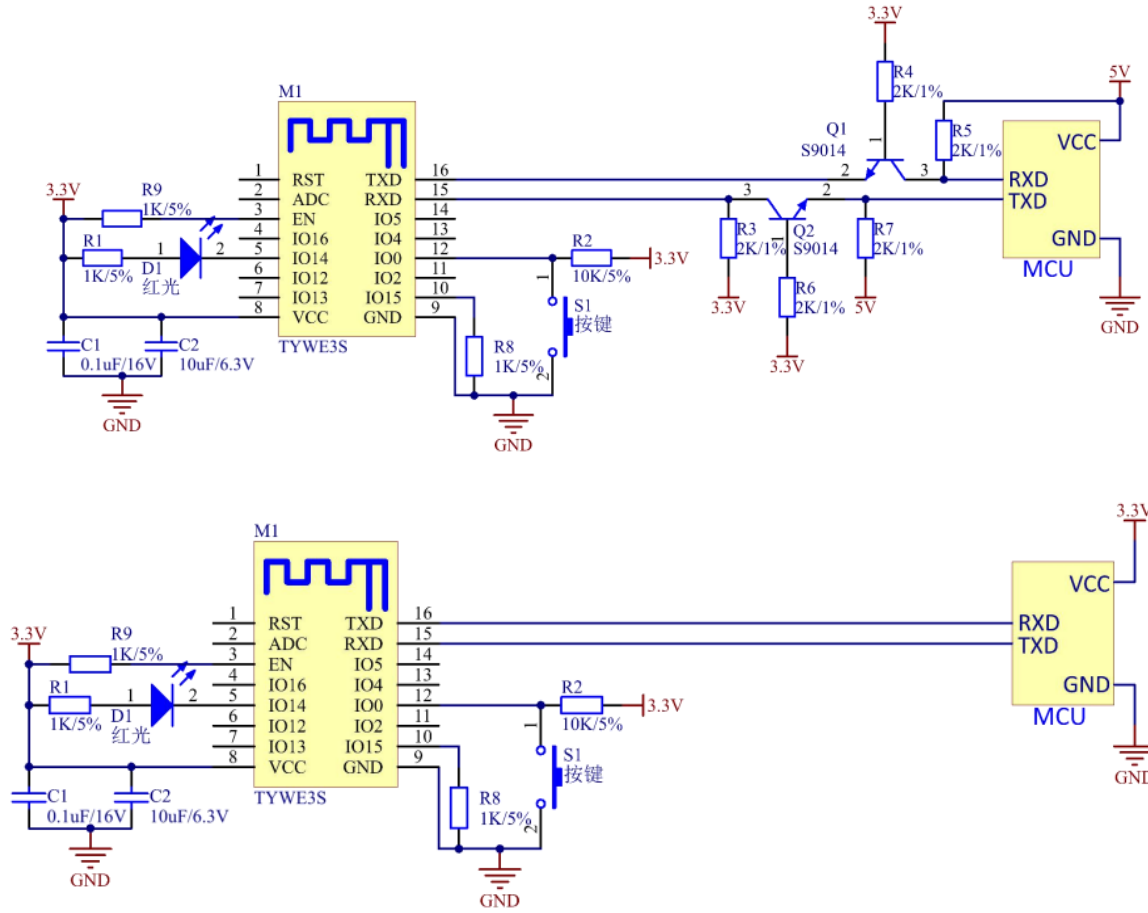
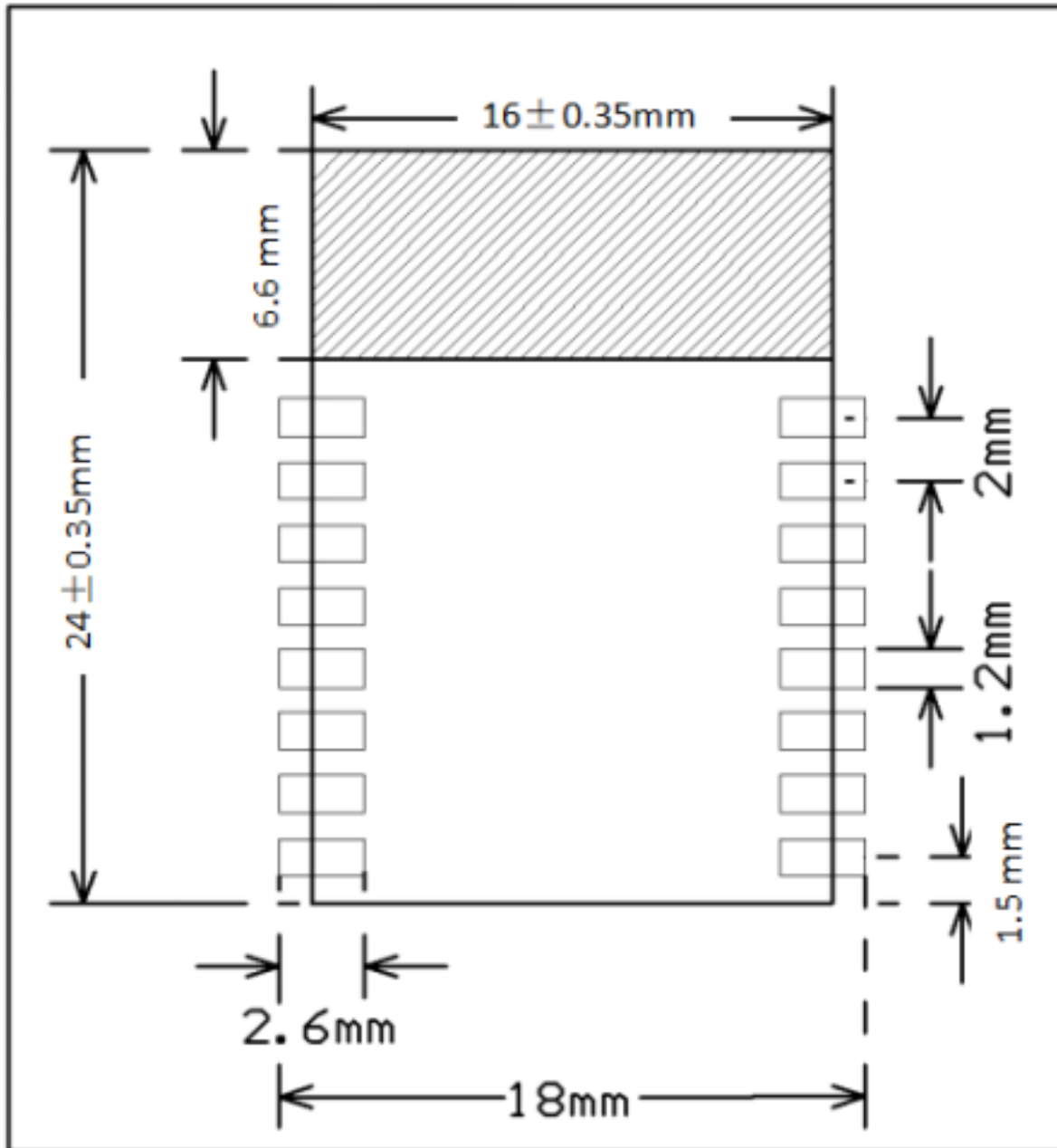# 12 Packaging Information and Production Instructions

12.1 Mechanical Dimensions

12.2 Recommended PCB Layout

12.3 Production Instructions

1. Tuya's stamp hole package module must be mounted by SMT machine, and the mounting must be completed within 24 hours after unpacking and programming of the firmware. Otherwise, it must be packaged again under vacuum. The module must be baked before mounting. A. SMT equipment

- Reflow soldering machine
- Automated optical inspection (AOI) equipment
- Nozzle with a 6 mm to 8 mm diameter

B. Baking equipment:

- Cabinet oven
- Anti-static heat-resistant trays
- Anti-static heat-resistant gloves

2. Storage conditions for a delivered module are as follows: A. The moisture-proof bag must be placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%. B. The shelf life of a dry-packaged product is 6 months from the date when the product is packaged and sealed. C. The package contains a humidity indicator card (HIC).
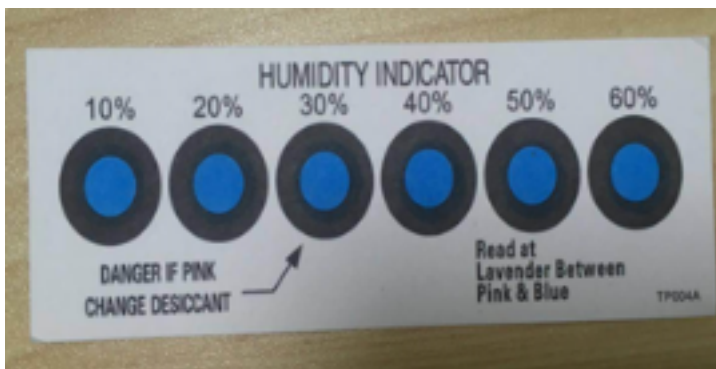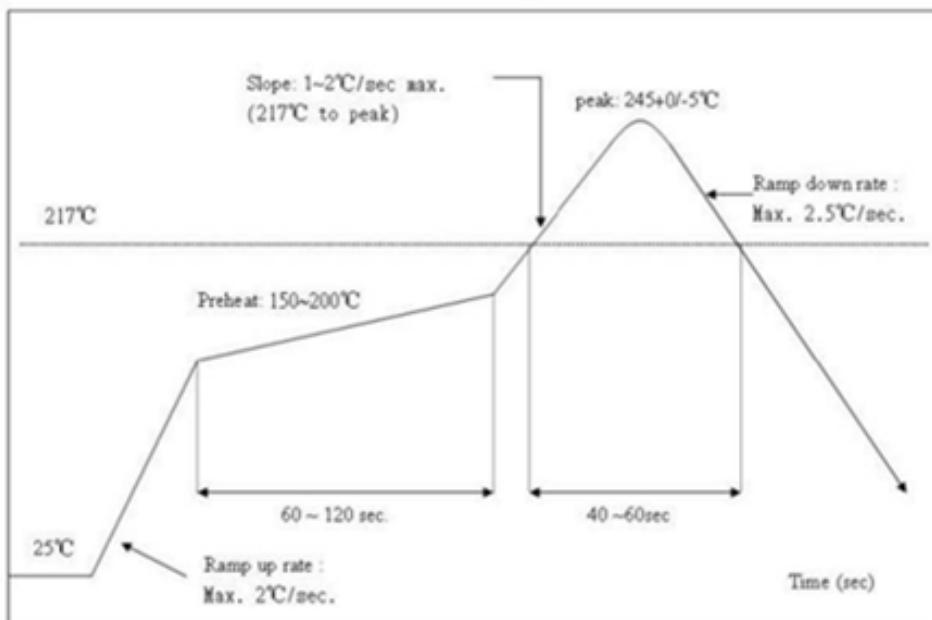

3. Bake a module based on HIC status as follows when you unpack the module package: A. If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours. B. If the 30% circle is pink, bake the module for 4 consecutive hours. C. If the 30% and 40% circles are pink, bake the module for 6 consecutive hours. D. If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.
4. Baking settings: A. Baking temperature: 125±5°C B. Alarm temperature: 130°C C. SMT ready temperature after natural cooling: < 36°C D. The number of drying times: 1 E. Rebaking condition: The module is not soldered within 12 hours after baking
5. Do not use SMT to process modules that have been unpacked for more than 3 months, because electroless nickel/immersion gold (ENIG) is used for PCBs and they are seriously oxidized after more than 3 months. SMT is very likely to cause pseudo and missing soldering. Tuya is not liable for such problems and consequences.

6. Before SMT, take electrostatic discharge (ESD) protective measures.
7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before the first mounting to determine proper methods for controlling the oven temperature and attaching and placing components. Draw 5 to 10 modules from subsequent batches each hour for visual inspection and AOI.

12.4 Recommended Oven Temperature Curve

Perform SMT based on the following reflow oven temperature curve. The highest temperature is 245°C. The reflow temperature curve is shown as belows:

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

Slope: 1~2°C/sec max.
(217°C to peak)

peak: 245+0/-5°C

Ramp down rate :
Max. 2.5°C/sec.

217°C

Preheat: 150~200°C

60 ~ 120 sec.

40 ~60sec

25°C

Ramp up rate :
Max. 2°C/sec.

Time (sec)

12.5 Storage Conditions

CAUTION
This bag contains
MOISTURE-SENSITIVE DEVICES

LEVEL
3
If Blank, see adjacent
bar code label

1. Calculated shelf life in sealed bag: 12 months at < 40°C and < 90% relative humidity (RH)

2. Peak package body temperature:_____260_____°C
   If Blank, see adjacent bar code label

3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must
   a) Mounted within:_____168_____hrs. of factory conditions
      If Blank, see adjacent bar code label
      ≤ 30°C/60%RH, OR
   b) Stored at <10% RH

4. Devices require bake, before mounting, if:
   a) Humidity Indicator Card is > 10% when read at 23 ± 5°C
   b) 3a or 3b not met.

5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C

   Note: If device containers cannot be subjected to high temperature or shorter bake times are desired, reference IPC/JEDEC J-STD-033 for bake procedure

Bag Seal Date: _____
   If Blank, see adjacent bar code label

Note: Level and body temperature defined by IPC/JEDEC J-STD-020

13 Appendix-Statement

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.

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.

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

Important Note This radio module must not installed to co-locate and operating simultaneously with other radios in host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operating simultaneously with other radio. The availability of some specific channels and/or operational frequency bands are country dependent and are firmware programmed at the factory to match the intended destination. The firmware setting is not accessible by the end user. 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. The final host product still requires

Part 15 Subpart B compliance testing with the modular transmitter installed. The end user manual shall include all required regulatory information/warning as shown in this manual, including: This product must be installed and operated with a minimum distance of 20 cm between the radiator and user body. This device have got a FCC ID: 2ANDL-TYWE3S. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-TYWE3S" 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.

As long as 2 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.

Declaration of Conformity European notice

Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EU, 2011/65/EU. A copy of the Declaration of conformity can be found at https://www.tuya.com.

This product must not be disposed of as normal household waste, in accordance with EU directive for waste electrical and electronic equipment (WEEE-2012/19/EU). Instead, it should be disposed of by returning it to the point of sale, or to a municipal recycling collection point. The device could be used with a separation distance of 20 cm to the human body.