TYWE2S Module Datasheet

Version: 20220802

Contents

TYWE2S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated wireless RF chip (ESP8285), a few peripherals, an embedded Wi-Fi network protocol stack, and varied library functions.

1 Overview

TYWE2S has an embedded low-power 32-bit CPU, 1-MB flash memory, 50-KB static random-access memory (SRAM), and rich peripherals.

TYWE2S is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi products as required.

1.1 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: 5 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog-to-digital converter (ADC)
- Wi-Fi connectivity

    - 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 WEP/WPA/WPA2/WPA2 PSK（AES）security modes
    - 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 3.0 dBi
    - Working temperature: -20 to 85℃

1.2 Applications

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

1.3 Change history

Date	Updated content	Version after update
07/18/2019	This is the first release.	V2.0.0
09/21/2019	Update the production process of the in-line module	V2.0.1

2 Module interfaces

2.1 Dimensions and footprint

TYWE2S has two rows of pins with a 2 mm pin spacing.

The TYWE2S dimensions are 17.3±0.35 mm (L)×15±0.35 mm (W) ×2.9±0.15 mm (H). The thickness of the PCB is 0.8±0.1 mm.
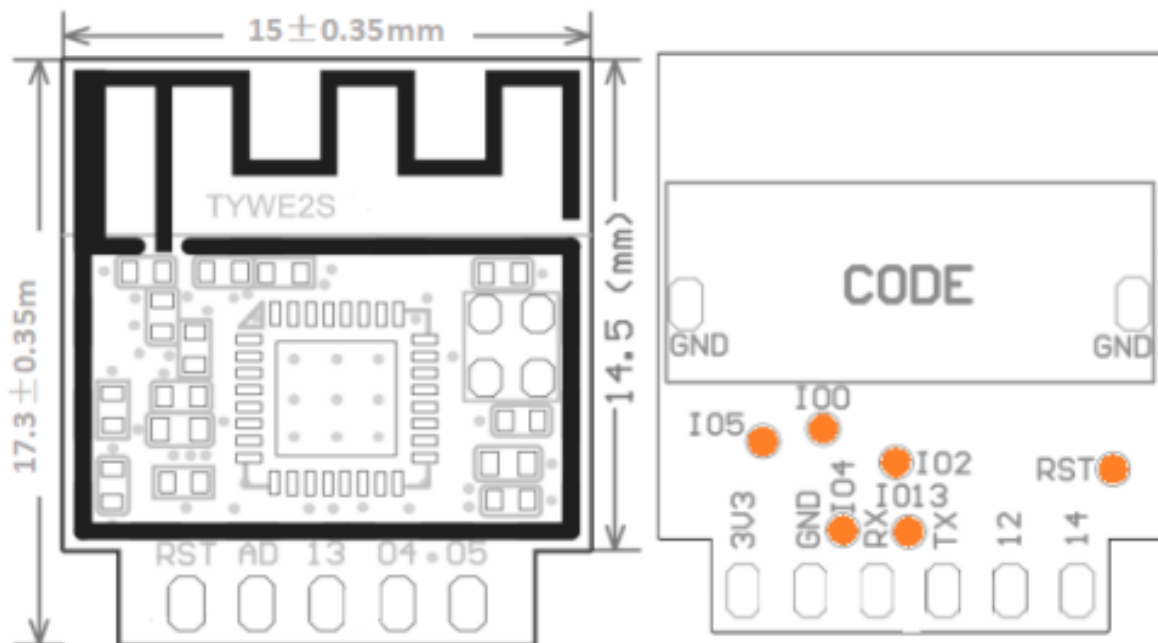
2.2 Pin definition

Illustration of the arrangement of general pins:

Pin number	Symbol	I/O type	Function
1	3V3	P	Power supply pin (3.3 V)

Pin number	Symbol	I/O type	Function
2	IO5	I/O	Same with module Silkscreen 05, GPIO_05, which corresponds to GPIO 5 (Pin 24) of IC
3	GND	P	Power supply reference ground
4	IO4	I/O	Same with module Silkscreen 04, GPIO_04, which corresponds to GPIO 4 (Pin 16) of IC
5	RX	I/O	UART0_RXD (used to display the internal information of the module)
6	IO13	I/O	Same with module Silkscreen 13, GPIO_13, which corresponds to MTCK (Pin 12) of IC
7	TX	I/O	UART0_TXD (used to display the internal information of the module)
8	ADC	AI	Same with module Silkscreen AD, ADC interface, a 10-bit-precision SAR ADC

Pin number	Symbol	I/O type	Function
9	IO12	I/O	Same with module Silkscreen 12, GPIO_12, which corresponds to MTDI (Pin 10) of IC
10	RST	I/O	Hardware reset pin (active low, a resistor has been pulled up internally)
11	IO14	I/O	Same with module Silkscreen 14, GPIO_14, which corresponds to MTMS (Pin 9) of IC

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 Wi-Fi network configuration.

Pin AD 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.

2.3 Definitions on test points

Illustration on test pins:

Pin number	Symbol	I/O type	Function
12	IO4	I/O	GPIO_04, which corresponds to GPIO 4 (Pin 16) of IC
13	IO13	I/O	GPIO_13, which corresponds to MTCK (Pin 12) of IC
14	IO2	I/O	UART1_TXD, (an interface for displaying information about the module)
15	RST	I/O	Reset pin
16	IO5	I/O	GPIO_05, which corresponds to GPIO 5 (Pin 24) of IC
17	IO0	I/O	GPIO_0 (in the module power-on initialization process, use with caution)

Note:

I/O indicates input/output pins.

When IO0 is pulled up, the module runs normally. When IO0 is at a low level, the module is in the state of firmware programming.

Test pins are not recommended for use.

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-40	125	℃
VDD	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

3.2 Working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working tempera-ture	-20	-	85	℃
VDD	Working voltage	3.0	-	3.6	V
VIL	IO low level input	-0.3	-	3V3*0.25	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
VIH	IO high level input	3V3*0.75	-	3.6	V
VOL	IO low level output	-	-	3V3*0.1	V
VOH	IO high level output	0.8	-	3V3	V
Imax	IO drive current	-	-	12	mA
Cpad	Input pin capacitance	-	2	-	pF

3.3 RF power consumption

Working Status	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

3.4 Working power consumption

Working Mode	Working Status, Ta = 25°C	Average value	Peak value (Typical value)	Unit
Quick connection network state	The module is in the fast network connection state and the Wi-Fi indicator always flashes	80	415	mA
Hotspot network configuration state	The module is in the hotspot network configuration state and the Wi-Fi indicator always flashes slowly	90	451	mA
Network connection idle state	The module is connected to the network and the Wi-Fi indicator is always on	58.5	411	mA
Network connection operation state	The module is connected to the network and the Wi-Fi indicator is always on	100	411	mA
Disconnected state	The module is disconnected and the Wi-Fi indicator is dark	80	430	mA

Note: The peak value lasts about 5μs. The above parameters may vary with different firmware functions.

4 RF parameters

4.1 Basic RF features

Parameter	Description
Working frequency	2.412 to 2.484 GHz
Wi-Fi 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 (default)

4.2 TX performance

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

Parameter	Minimum value	Typical value	Maximum value	Unit
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

4.3 RX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-73	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-70	-	dBm

5 Antenna

5.1 Antenna type

TYWE2S uses an onboard PCB antenna with a gain of 3.0 dBi.

5.2 Antenna interference reduction

To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

To ensure 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.
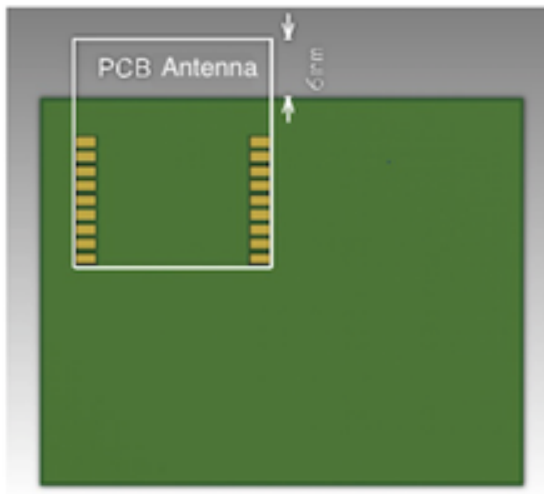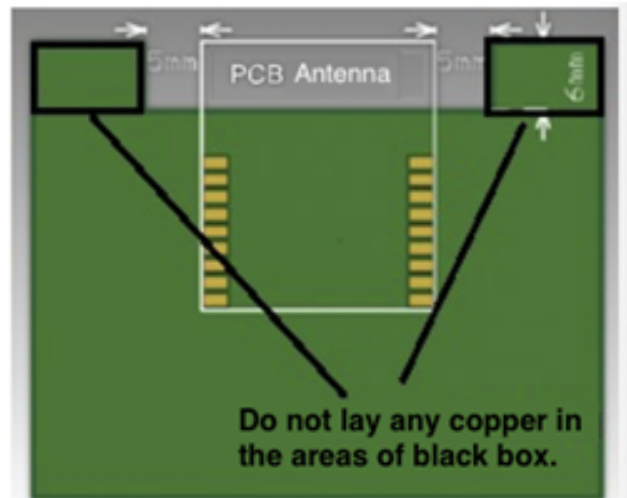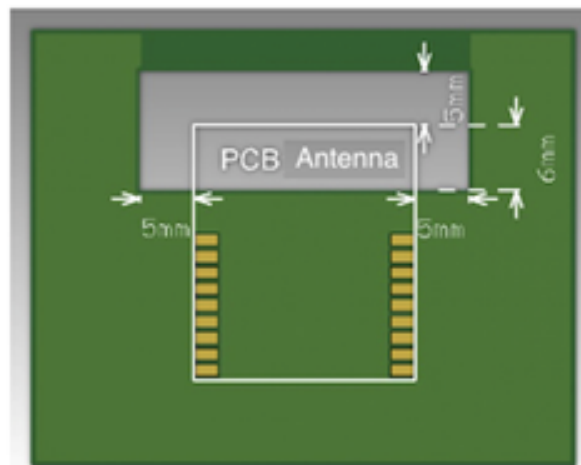
Fig 4

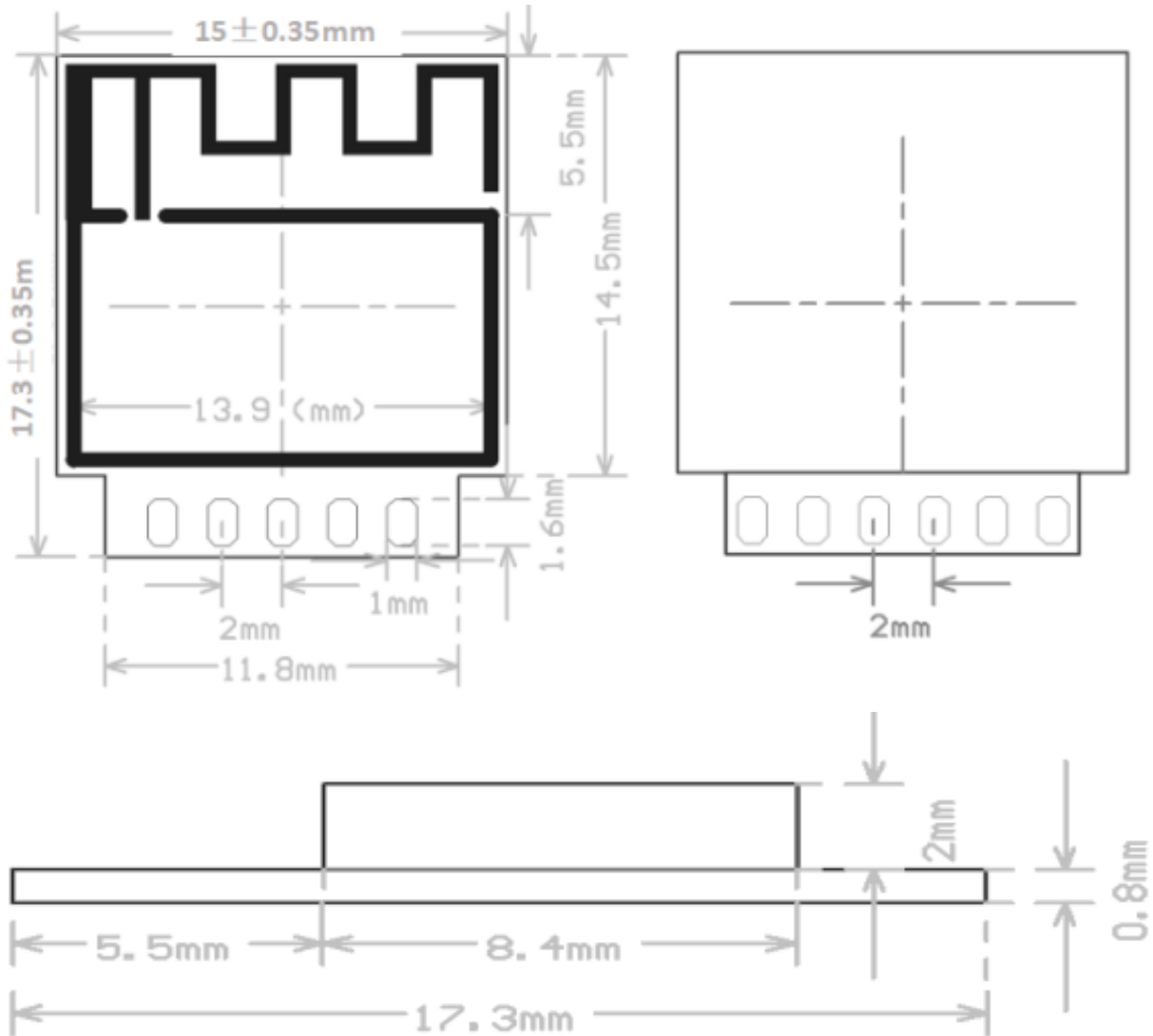Do not lay any copper in the areas of black box.

Fig 5

Fig 6

5.3 Antenna connector specifications
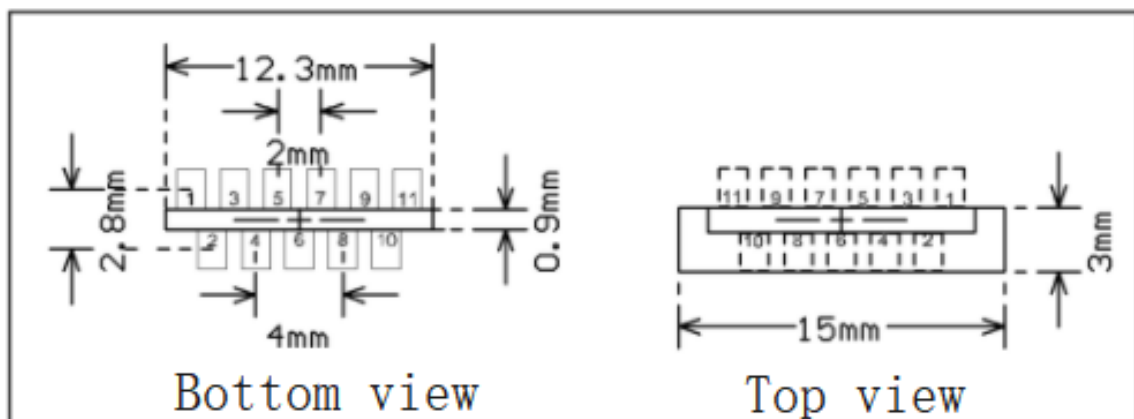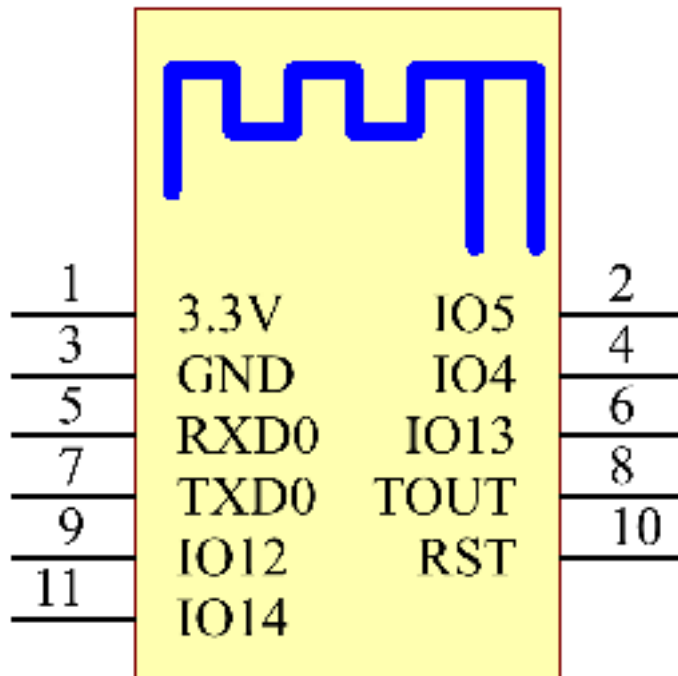
There is no antenna connector for this module at the moment.

6 Packaging information and production instructions

6.1 Mechanical dimensions

Note: The default dimensional tolerance is ±0.35 mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

6.2 Recommended PCB layout

6.3 Production instructions

- For the in-line module developed by Tuya, the wave soldering equipment is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered within 24 hours. Otherwise, it must be put into the drying cupboard where the RH is not greater than 10%, or it needs to be

packaged under vacuum again and record the exposure time (the total exposure time cannot exceed 168 hours).

- Soldering equipment and materials:

    - Wave soldering equipment
    - Wave soldering fixture
    - Constant-temperature soldering iron
    - Tin bar, tin wire, and flux
    - Oven temperature tester

- Baking equipment:

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

- The module needs to be baked in the following cases:

    - The vacuum packing bag was found to be damaged before being unpacked.
    - There is no humidity indicator card (HIC) in the vacuum packing bag.
    - After being unpacked, 10% and above circles on the HIC become pink.
    - The total exposure time has been more than 168 hours since unpacking.
    - More than 12 months have passed since the sealing date of the bag.

*Baking settings:

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 1  * Temperature: 40°C and   5% RH for reel package and 125°C and  5% R
 2  H for tray package (please use the heat-resistant tray rather than p
 3  lastic container)
 4  *  Time: 168 hours for reel package and 12 hours for tray package
 5  * Alarm temperature: 50°C for reel package and 135°C for tray packag
 6  e
 7  * Production-ready temperature after natural cooling: < 36°C
 8  * Re-baking situation: If a module remains unused for over 168 hours
 9   after being baked, it needs to be baked again.
10  *  If a batch of modules is not baked within 168 hours, do not use t
11  he wave soldering to solder them. Because these modules are Level-3
12  moisture-sensitive devices, they are very likely to get damp when ex
13  posed beyond the allowable time. In this case, if they are soldered
14  at high temperatures, it may result in device failure or poor solder
15  ing.
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Important: If this batch of modules is not baked within 168 hours, do not use the wave soldering to solder them. Because the modules are 3-level moisture-sensitive components, they are very likely to get damp when exposed outside. In this case, if they are soldered at high temperatures, it may result in component failure or poor soldering.

- In the whole production process, take electrostatic discharge (ESD) protective measures.
- To guarantee the quality of products, you must pay attention to the following items:

  - The amount of soldering flux.
  - The height of the wave peak.
  - Whether the tin slag and copper content in the wave soldering tank exceed standards.
  - Whether the window and thickness of the wave soldering fixture are appropriate.
  - Whether the wave soldering oven temperature curve is reasonable.

6.4 Recommended oven temperature curve and temperature

For oven temperature setting, refer to oven temperatures for wave soldering. The peak temperature is 260°C±5°C. The wave soldering temperature curve is shown below:
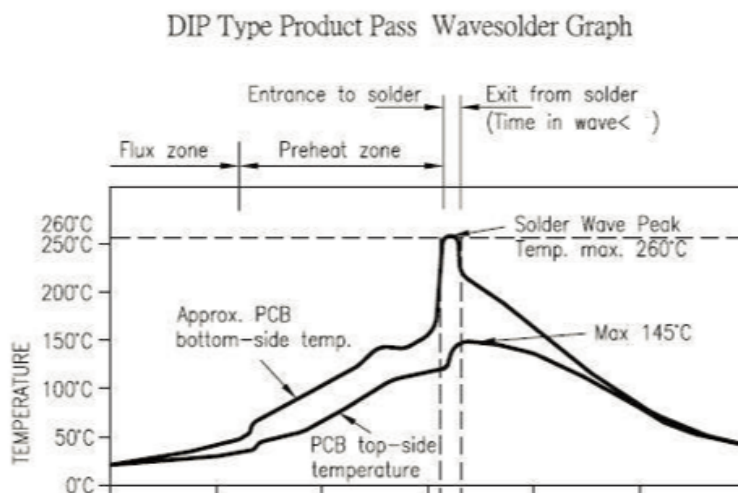

Recommended soldering temperature:

Recommended wave soldering oven temperature		Recommended manual soldering temperature	
Preheat temperature	80 to 130 °C	Soldering temperature	360±20°C
Preheat time	75 to 100s	Soldering time	＜ 3s/point
Peak contact time	3 to 5s	NA	NA
Temperature of tin cylinder	260±5°C	NA	NA
Ramp-up slope	≤2°C/s	NA	NA
Ramp-down slope	≤6°C/s	NA	NA

6.5 Storage conditions

Storage conditions for a delivered module are as follows:

- The moisture-proof bag is placed in an environment where the temperature is below 40°C and the relative humidity is lower than 90%.
- The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.
- The package contains a humidity indicator card (HIC).
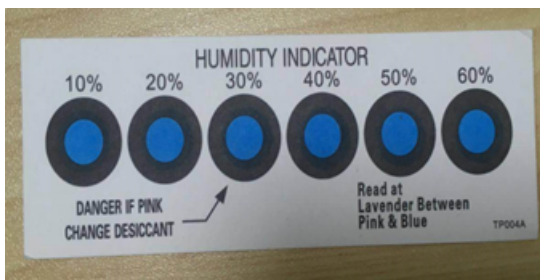
CAUTION
This bag contains
MOISTURE-SENSITIVE DEVICES

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

7 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 a minimum distance of 20 cm between the radiator and your body.

Important Note

This radio module must not be installed to co-locate and operating simultaneously with other radios in the host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operate simultaneously with other radios.

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 has got an FCC ID: 2ANDL-TYWE2S. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-TYWE2S".

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 the 2 conditions above are met, further transmitter tests 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 the 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.