TYWE3S Module Datasheet

Version: 20210525

Contents

TYWE3S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated wireless RF chip (ESP8266), a few peripherals, an embedded Wi-Fi network protocol stack, and varied library functions.

1 Overview

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 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: 9 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog-to-digital converter (ADC)
- Wi-Fi 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 WEP/WPA/WPA2/WPA2 PSK (AES) 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 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

2 Change history

Update date	Updated content	Version after update
07/23/2019	This is the first release.	V2.0.0

3 Module interfaces

3.1 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.
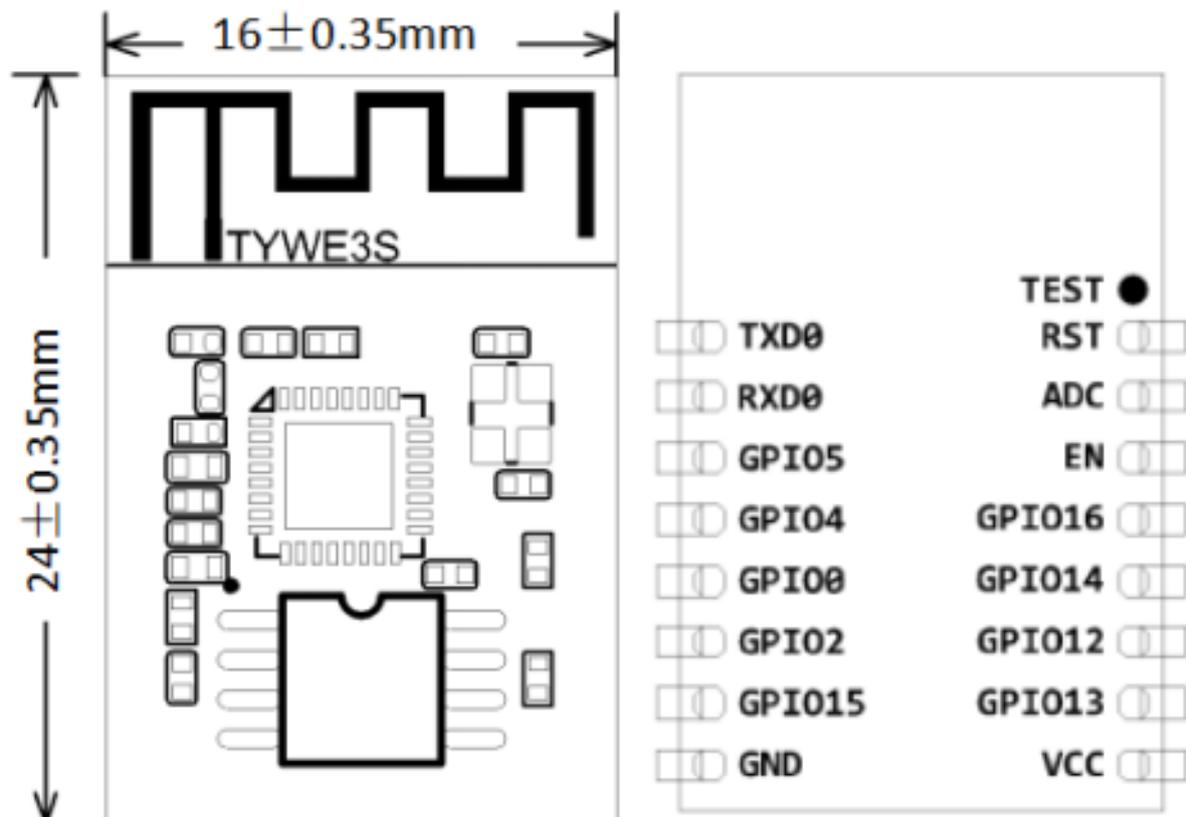
3.2 Pin definition

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

Wi-Fi 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.

3.3 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.

4 Electrical parameters

4.1 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

4.2 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

4.3 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

4.4 Working power consumption

Working mode	Working status, Ta = 25°CTa=25℃	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

Working mode	Working status, Ta = 25°CTa=25℃	Average value	Peak value (Typical value)	Unit
Disconnected state	The module is disconnected and the Wi-Fi indicator is dark	80	430	mA

5 RF parameters

5.1 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

5.2 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

5.3 RX performance

Parameter		Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode	1 M	-	-91	-	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

6 Antenna

6.1 Antenna type

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

6.2 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.
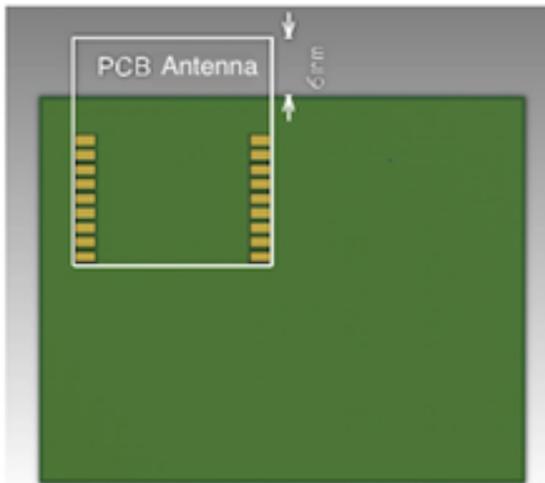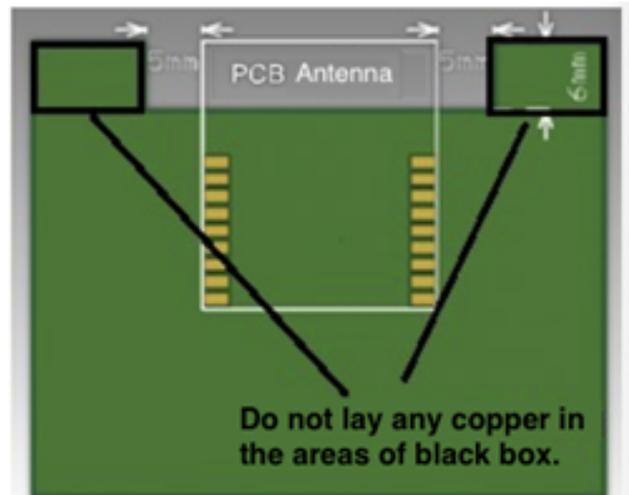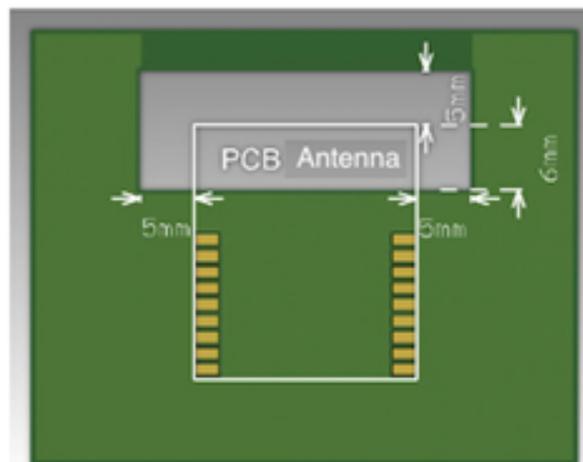

Fig 4

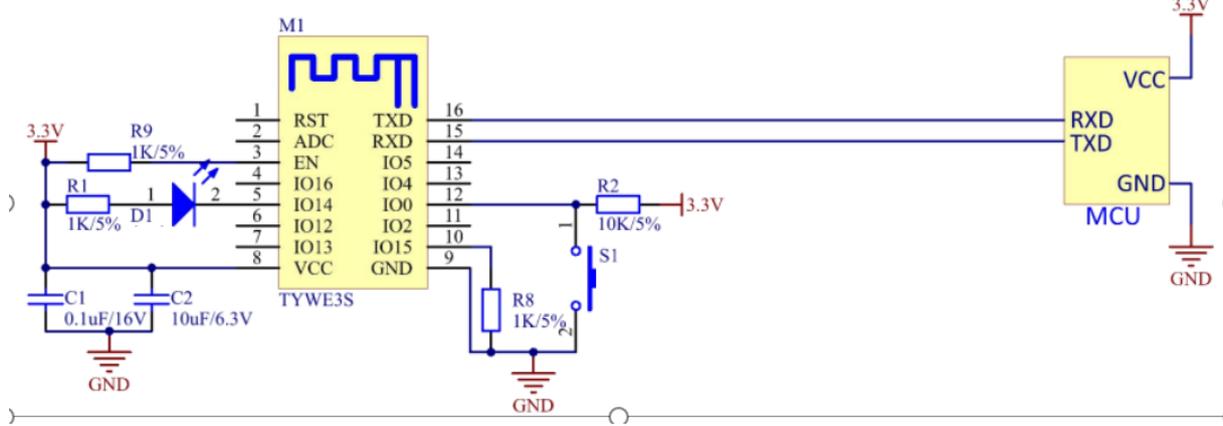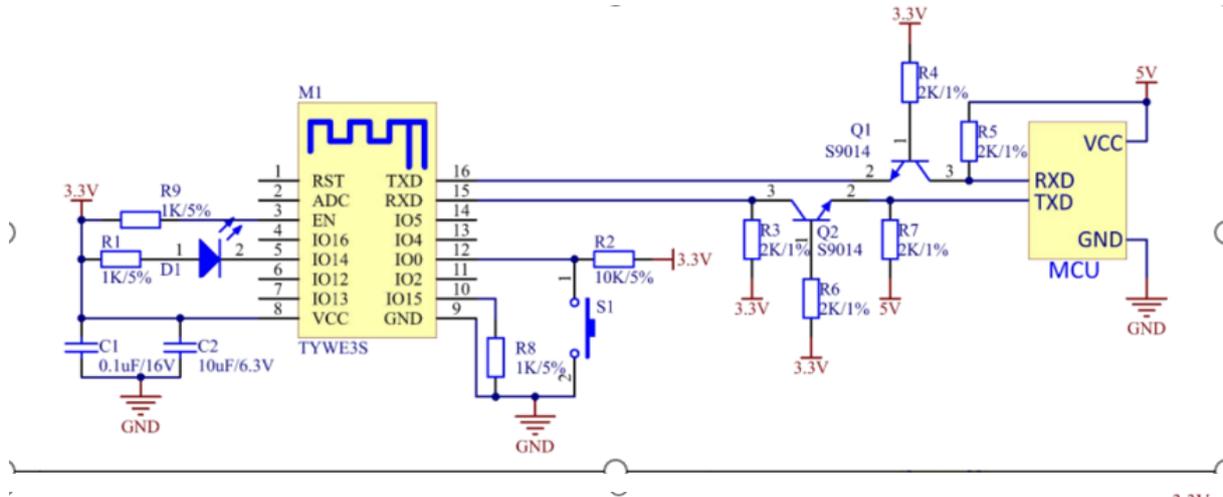Do not lay any copper in the areas of black box.
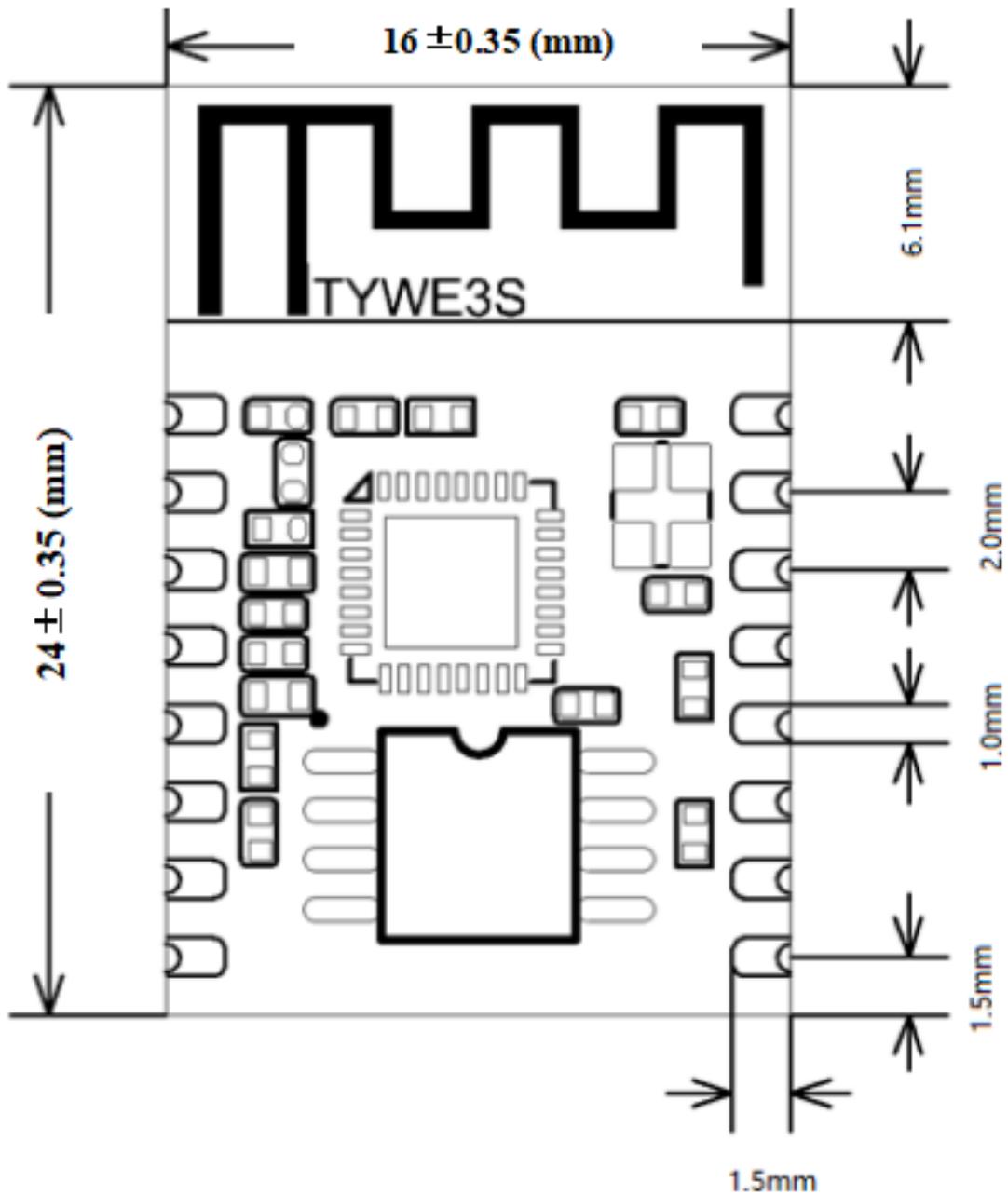
Fig 5

Fig 6

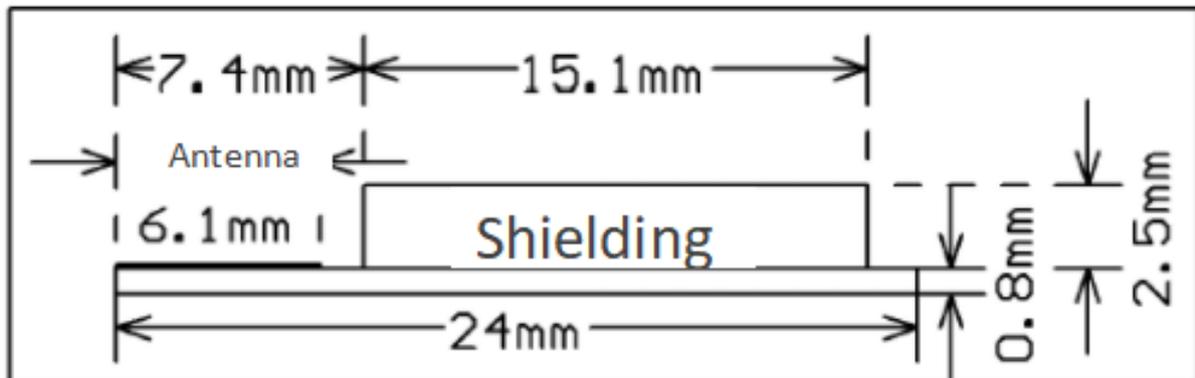## 6.3 Antenna connector specifications

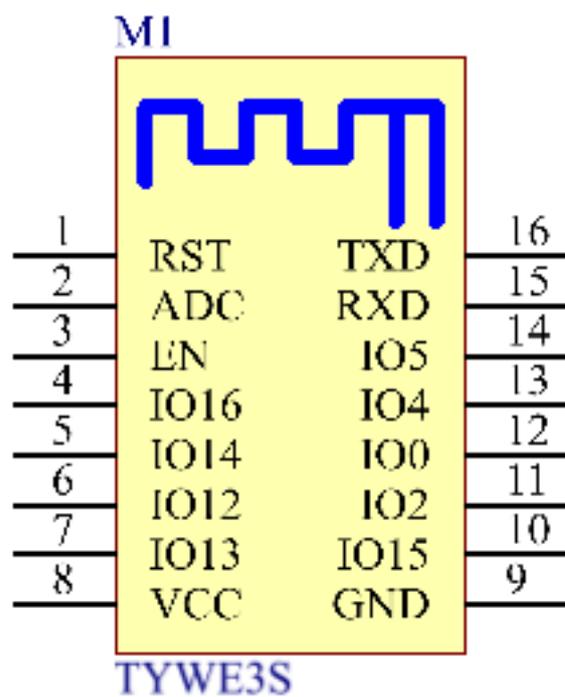There is no antenna connector for this module at the moment.

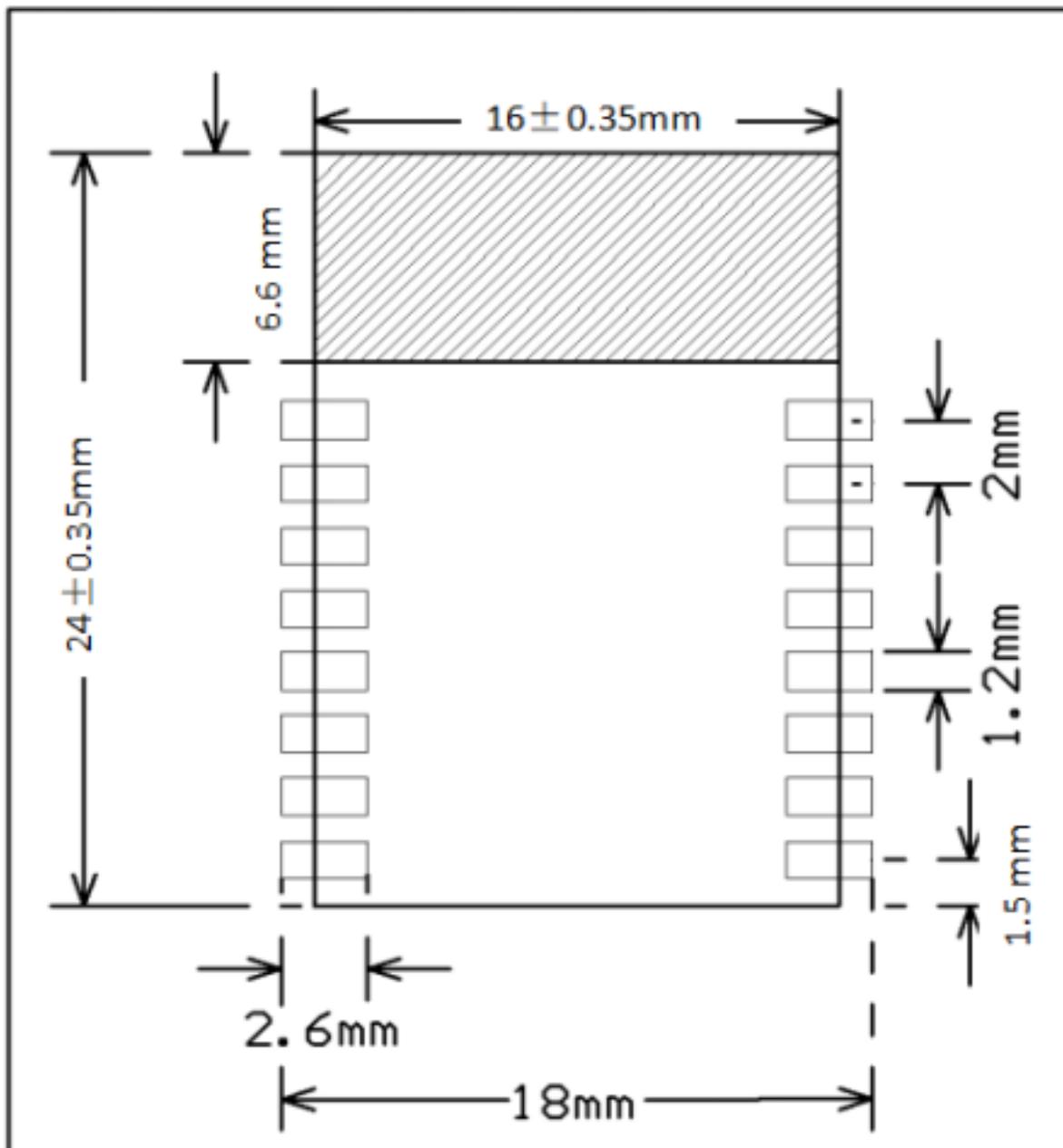# 7 Packaging information and production instructions

7.1 Mechanical dimensions

7.2 Recommended PCB layout

7.3 Production instructions

- The stamp-hole module must be mounted by the SMT machine. After being unpacked, it 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 the exposure time needs to be recorded

(the total exposure time cannot exceed 168 hours).

- – SMT equipment:
    - ∗ Mounter
    - ∗ SPI
    - ∗ Reflow soldering machine
    - ∗ Oven temperature tester
    - ∗ Automated optical inspection (AOI) equipment
  - – Baking equipment:
    - ∗ Cabinet oven
    - ∗ Anti-static heat-resistant pallets
    - ∗ Anti-static heat-resistant gloves

- Storage conditions for a delivered module are as follows:

  - – The moisture-proof bag must be 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).
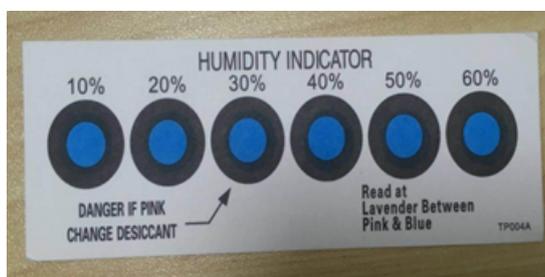
- The module needs to be baked in the following cases:

  - – 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:

  - – Temperature: 60°C and ≤ 5%RH for reelizing and 125°C and ≤5%RH for palletizing (please use heat-resistant pallet rather than plastic pallet)

- Time: 48 hours for reelizing and 12 hours for palletizing
- Alarm temperature: 65°C for reelizing and 135°C for palletizing
- Production ready temperature after natural cooling: < 36°C
- The number of drying times: 1
- Re-baking condition: If a module remains unused for 168 hours after being unpacked, it must be baked again. > **Important**: If this batch of modules is not baked within 168 hours, do not use the wave soldering to solder them. Because these 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 passing rate, it is recommended that you use the SPI and AOI to monitor the quality of solder paste printing and mounting.

7.4 Recommended oven temperature curve

Perform mounting with the SMT based on the following reflow oven temperature curve. The highest temperature is 245°C. The reflow temperature curve is as below:
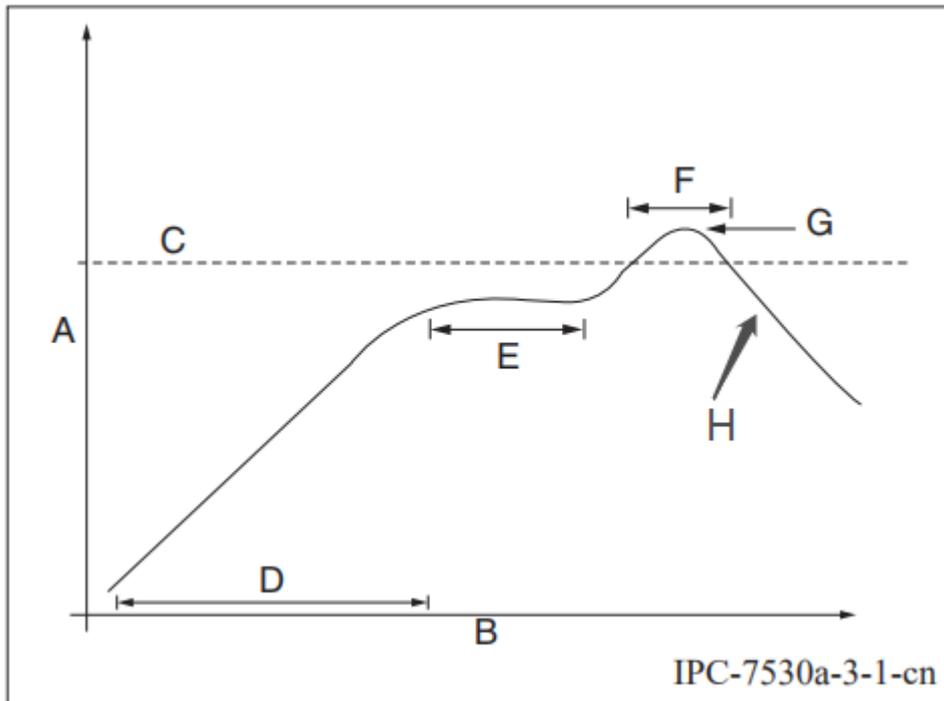
- A: Temperature axis

- B: Time axis

- C: Liquidus temperature: 217 to 220°C

- D: Ramp-up slope: 1 to 3°C/s

- E: Duration of constant temperature: 60 to 120s; the range of constant temperature: 150 to 200°C

- F: Duration above the liquidus: 50 to 70s

- G: Peak temperature: 235 to 245°C

- H: Ramp-down slope: 1 to 4°C/s

  Note: The above curve is just an example of the solder paste SAC305. For more details about other solder pastes, please refer to Recommended oven temperature curve in the solder paste specifications.

7.5 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

8 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 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 in-tended destination. The firmware setting is not accessible by the end-user.

The host product manufacturer is responsible for compliance with any other FCC rules that apply to the host not covered by the modular transmitter grant of certi-fication. 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-TYWE3S. The final end product must be la-belled 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 an-tenna 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 re-quired. 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 a municipal recycling collection point.

The device could be used with a separation distance of 20 cm to the human body.