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Product Manual

Tuya TYWE3S Wi-Fi Module

Version: 2.0.0 **Date: 2019-07-23** **No.: 0000000001**

1. Product Overview

TYWE3S is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated RF chip (ESP8266) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions. TYWE3S is embedded with a low-power 32-bit CPU, 2 MB flash memory, and 50 KB static random-access memory (SRAM), and has extensive 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.

Figure 1-1 shows the TYWE3S architecture.

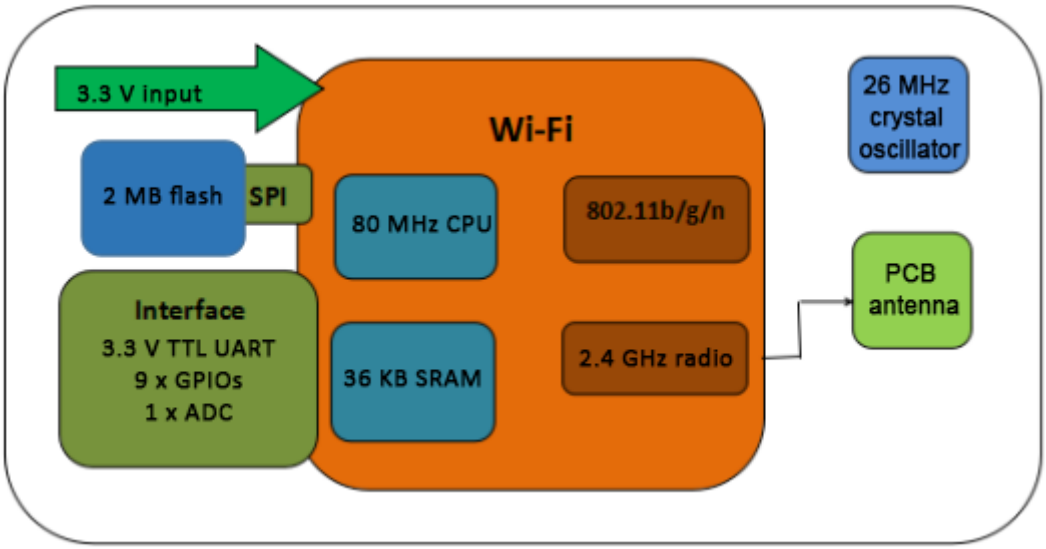

Figure 1-1 TYWE3S architecture

1.1 Features

- ✧ Embedded low-power 32-bit CPU, which can also function as an application processor
  - Dominant frequencies: 80 MHz and 160 MHz
- ✧ Working voltage: 3.0 V to 3.6 V
- ✧ Peripherals: nine GPIOs, one universal asynchronous receiver/transmitter (UART), and one analog-to-digital converter (ADC)
- ✧ Wi-Fi connectivity
  - 802.11b/g/n
  - Channels 1 to 14 at 2.4 GHz
  - WPA and WPA2 security modes
  - Up to +20 dBm output power in 802.11b mode
  - STA, AP, and STA+AP working modes
  - Smart and AP network configuration modes for Android and iOS devices
  - Onboard PCB antenna with a gain of 2.0 dBi
  - Working temperature: –20°C to +85°C

1.2 Applications

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

Change History

No.	Date	Change Description	Version After Change
1	2019-07-23	This is the first release.	2.0.0

Contents

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Figures

2. Module Interfaces

2.1 Dimensions and Footprint

TYWE3S has two rows of pins with a 2 mm pin spacing.

The TYWE3S dimensions (H x W x D) are 3.4±0.15 mm x 16±0.35 mm x 24±0.35 mm. The PCB thickness is 0.8±0.1 mm.

Figure 2-1 shows the TYWE3S front and rear views.

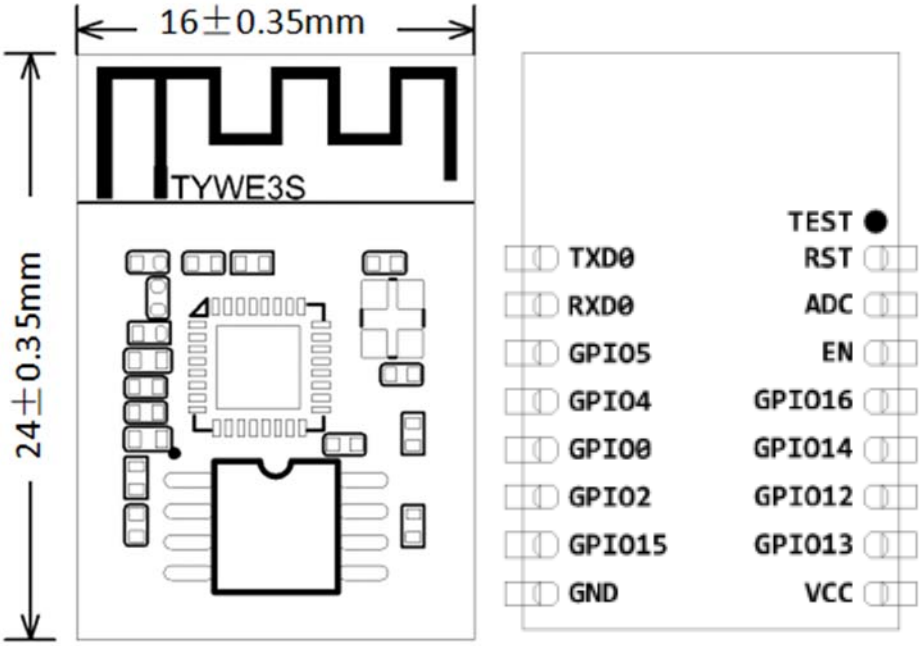

Figure 2-1 TYWE3S front and rear views

2.2 Interface Pin Definition

Table 2-1 TYWE3S interface pins

Pin No.	Symbol	I/O Type	Function
1	RST	I/O	Hardware reset pin (The module has an internal pull-up resistor, and the reset pin is active at a low level.)
2	ADC	AI	10-bit SAR ADC (See the following Note 2.)

Pin No.	Symbol	I/O Type	Function
3	EN	Input	Module enabling pin, which is connected to 3.3 V for normal use
4	GPIO16	I/O	GPIO_16, which needs to be connected to a 10-kiloohm pull-up resistor when being used
5	GPIO14	I/O	GPIO_14, which is connected to MTMS (pin9) on the internal IC
6	GPIO12	I/O	GPIO_12, which is connected to MTDI (pin10) on the internal IC
7	GPIO13	I/O	GPIO_13, which is connected to MTCK (pin12) on the internal IC
8	VCC	P	Power supply pin (3.3 V)
9	GND	P	Power supply reference ground pin
10	GPIO15	Output	GPIO_15 (used during module power-on and initialization; use it with caution)
11	GPIO2	Output	UART0_TXD (used to display the module internal information)
12	GPIO0	I/O	GPIO_0 (used during module power-on and initialization; use it with caution)
13	GPIO4	I/O	GPIO_04, which is connected to GPIO4 (pin16) on the internal IC
14	GPIO5	I/O	GPIO_05, which is connected to GPIO5 (pin24) on the internal IC
15	RXD0	I/O	UART0_RXD (See the following Note 3.)
16	TXD0	Output	UART0_TXD (See the following Note 3.)

Note:

1. **P** indicates power supply pins, **I/O** indicates input/output pins, and **AI** indicates analog input pins.RST is only a hardware reset pin and cannot clear the Wi-Fi network configuration.
2. This pin can only function as an ADC input and not a common I/O. If this pin is not used, it must be disconnected.

When this pin is used as the ADC input, the input voltage range is 0 V to 1.0 V.

3. UART0 is a user-side serial interface, which generates information when the module is powered on and starts.

2.3 Test Pin Definition

Table 2-2 TYWE3S test pins

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

Note:

Test pins are not recommended.

3 Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3-1 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	–40	125	°C
VCC	Power supply voltage	–0.3	3.6	V
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2	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	Power supply voltage	3.0	3.3	3.6	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
I_{max}	I/O drive current	N/A	N/A	12	mA

3.3 RF Current Consumption

Table 3-3 Current consumption during constant transmission and receiving

Working Status	Parameter			Typical Value	Unit
	Mode	Rate	TX Power/Receiving		
TX	802.11b	11 Mbit/s	+17 dBm	220	mA
	802.11g	54 Mbit/s	+15 dBm	110	mA
	802.11n	MCS0	+14 dBm	120	mA
	802.11n	MCS7	+13 dBm	100	mA
RX	802.11b	11 Mbit/s	Constant receiving	76	mA
	802.11g	54 Mbit/s	Constant receiving	76	mA
	802.11n	MCS7	Constant receiving	76	mA

3.4 Working Current

Table 3-4 TYWE3S working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	80	151	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	90	451	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	58.5	411	mA
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	80	430	mA

4. RF Features

4.1 Basic RF Features

Table 4-1 Basic RF features

Parameter	Description
Frequency band	2.412 GHz to 2.484 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
Data transmission rate	802.11b: 1, 2, 5.5, or 11 (Mbit/s) 802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s) 802.11n: HT20 MCS0 to MCS7
Antenna type	PCB antenna with a gain of 2.0 dBi

4.2 TX Performance

Table 4-2 Performance during constant transmission

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK mode	1 Mbit/s	N/A	20	N/A	dBm
Average RF output power, 802.11g OFDM mode	54 Mbit/s	N/A	17	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	14	N/A	dBm
Frequency error		–20	N/A	+20	ppm
EVM under 802.11b CCK, 11 Mbit/s, 17.5dBm			–16.0		dB
EVM under 802.11g OFDM, 54 Mbit/s, 15.0 dBm			–30.0		dB
EVM under 802.11n OFDM, MCS7, 14.0dBm			–31.0		dB

4.3 RX Performance

Table 4-3 RX sensitivity

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
PER < 8%, 802.11b CCK mode	1 Mbit/s	N/A	–91	N/A	dBm
PER < 10%, 802.11g OFDM mode	54 Mbit/s	N/A	–75	N/A	dBm
PER < 10%, 802.11n OFDM mode	MCS7	N/A	–72	N/A	dBm

5. Antenna Information

5.1 Antenna Type

TYWE3S uses an onboard PCB antenna.

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 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.

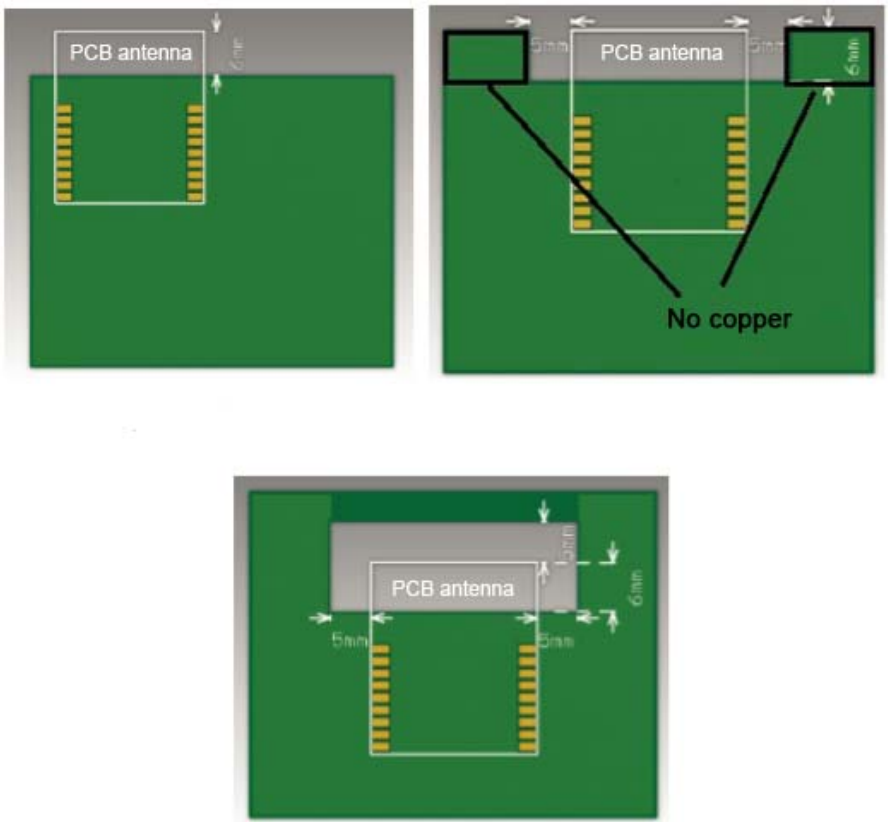

Figure 5-1 Antenna clearance part

For details about the onboard PCB antenna area on TYWE3S, see Figure 6-1.

5.3 Antenna Connector Specifications

TYWE3S does not use an antenna connector.

6. Packaging Information and Production Instructions

6.1 Mechanical Dimensions

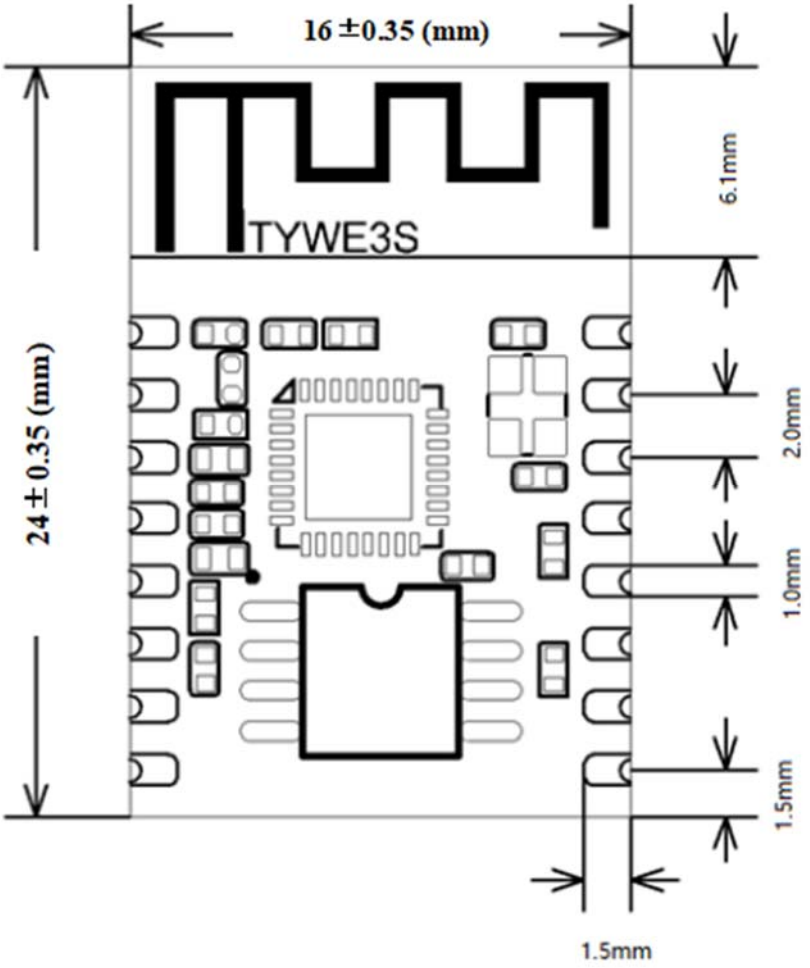

Figure 6-1 TYWE3S PCB mechanical dimensions

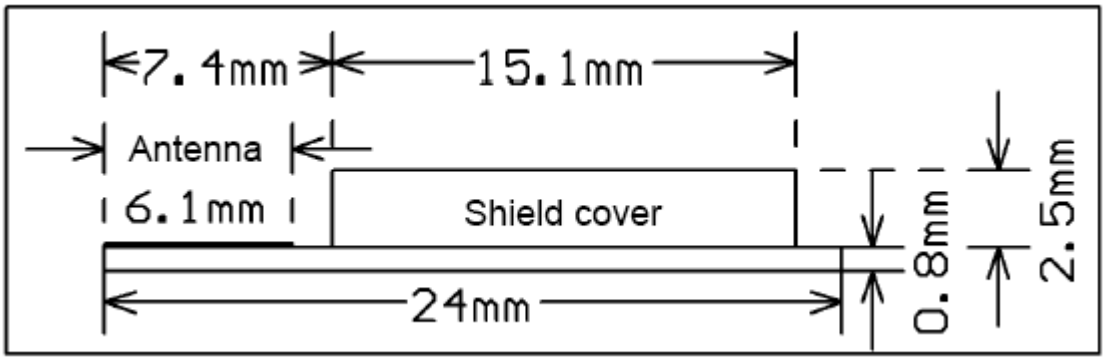

Figure 6-2 Side view

Note:

The default dimensional tolerance is ±0.35 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

6.2 Recommended PCB Layout

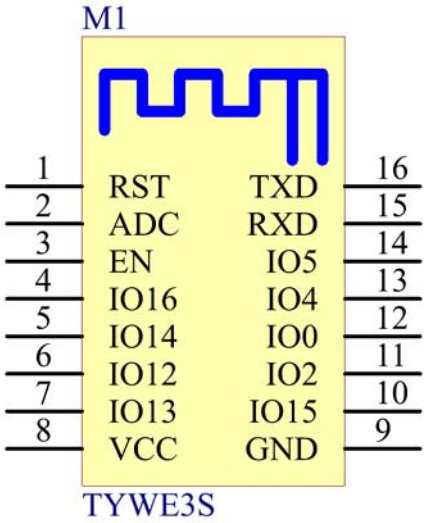

Figure 6-3 TYWE3S pins

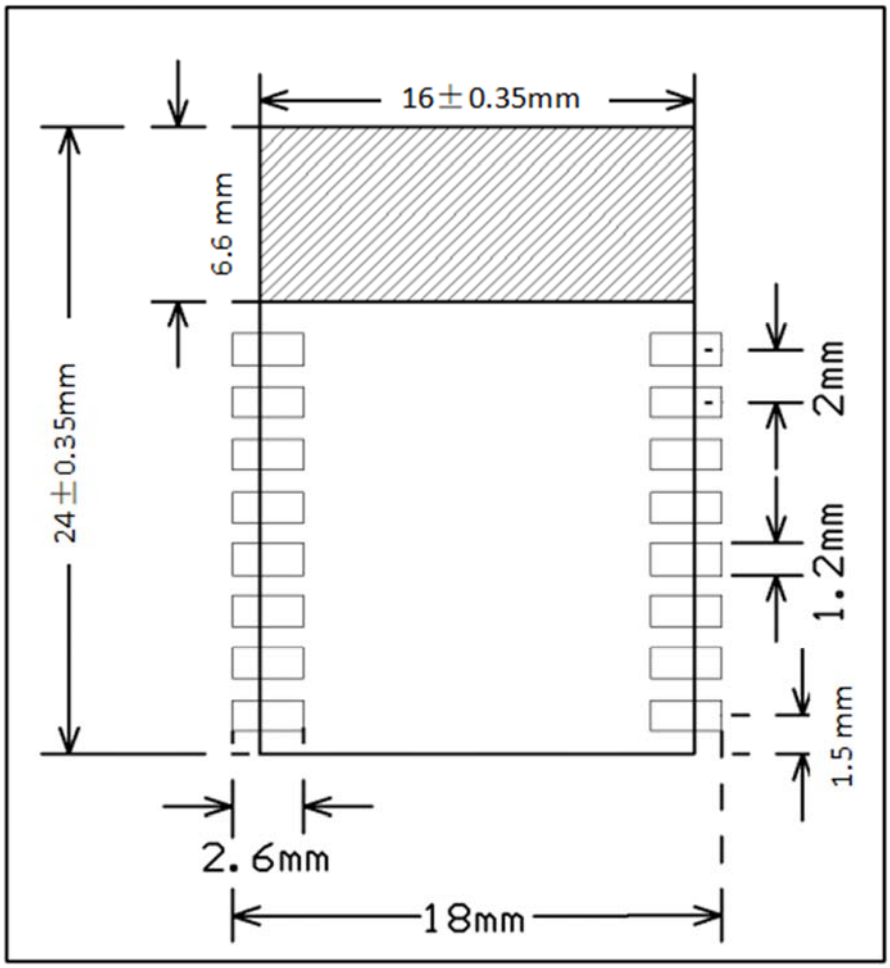

Figure 6-4 Layout of the PCB to which TYWE3S applies

6.3Production Instructions

1. Use an SMT placement machine to mount the stamp hole module that Tuya produces onto the PCB within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum pack the module again. Bake the module before mounting the module onto the PCB.

   (1) SMT placement equipment

   i. Reflow soldering machine

   ii. Automated optical inspection (AOI) equipment

   iii. Nozzle with a 6 mm to 8 mm diameter

(2) Baking equipment

i. Cabinet oven

ii. Anti-static heat-resistant trays

iii. Anti-static heat-resistant gloves

2. 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.

(3) The package contains a humidity indicator card (HIC).

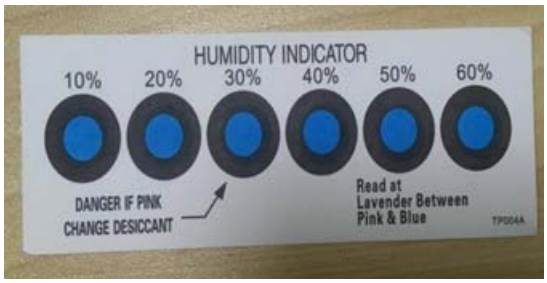

Figure 6-5 HIC for TYWE3S

3. Bake a module based on HIC status as follows when you unpack the module package:

(1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.

(2) If the 30% circle is pink, bake the module for 4 consecutive hours.

(3) If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.

(4) If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.

4. Baking settings:

(1) Baking temperature: 125±5°C

(2) Alarm temperature: 130°C

(3) SMT placement ready temperature after natural cooling: < 36°C

(4) Number of drying times: 1

(5) 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 over three months. Electroless nickel immersion gold (ENIG) is used for the PCBs. If the solder pads are exposed to the air for over three months, they will be oxidized severely and dry joints or solder skips may occur. Tuya is not liable for such problems and consequences.
6. Before SMT placement, take electrostatic discharge (ESD) protective measures.
7. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

6.4 Recommended Oven Temperature Curve

Perform SMT placement based on the following reflow oven temperature curve. The highest temperature is 245°C.

Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.

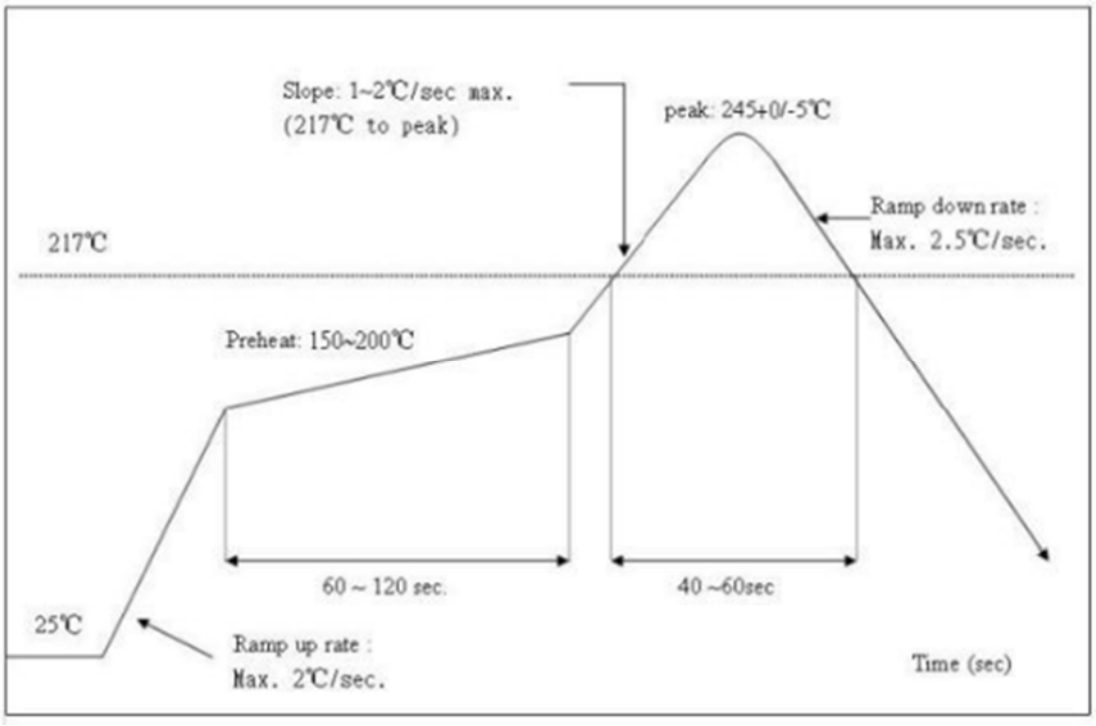

Figure 6-6 Oven temperature curve

6.5 Storage Conditions

7. Reference Circuit

7.1 Serial Interface Connection

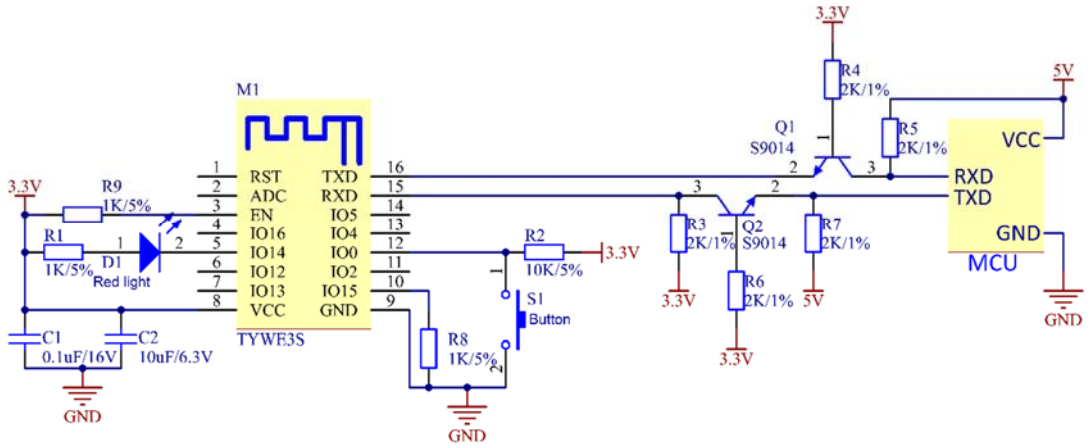

Figure 7-1 Connection between the module and a 5 V MCU over the serial interface

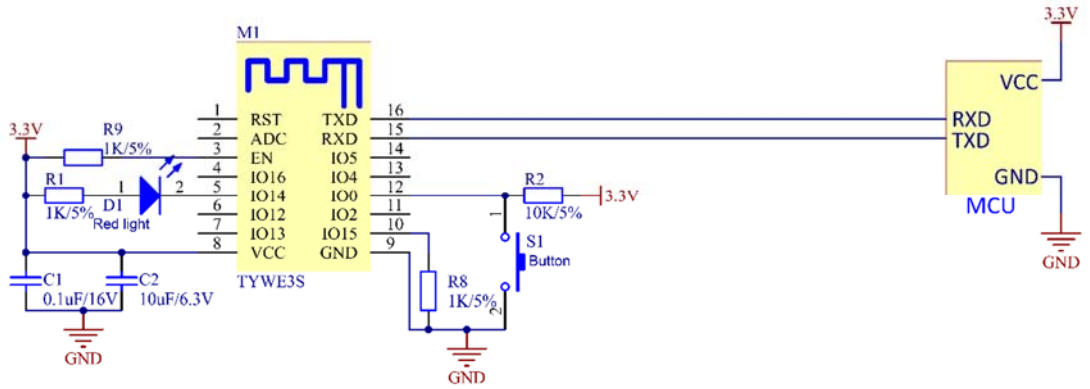

Figure 7-2 Connection between the module and a 3.3 V MCU over the serial interface

8. MOQ and Packing Information

MOQ and packing information				
Product Model	MOQ	Packing Method	Number of Modules in Each Reel Pack	Number of Reel Packs in Each Box
TYWE3S	3200	Carrier tape and reel packing	800	4

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