Tuya TYWE3SE Wi-Fi and Bluetooth Module

Version: 1.0.1 Date: 2019-07-23 No.: 0000000001

1. Product Overview

TYWE3SE is a low-power embedded 2.4 GHz Wi-Fi and Bluetooth module that Tuya has developed. It consists of a highly integrated RF chip (ESP32) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions. TYWE3SE is embedded with a low-power 32-bit CPU, 4 MB flash memory, 448 KB read only memory (ROM), and 520 KB static random-access memory (SRAM), and has extensive peripherals. TYWE3SE is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop embedded Wi-Fi and Bluetooth products as required.

1.1 Features

- Embedded low-power 32-bit CPU, which can also function as an application processor
  - Dominant frequency: 160 MHz
- Working voltage: 3.0 V to 3.6 V
- Peripherals: 14 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog-to-digital converter (ADC)
- Wi-Fi connectivity
  - 802.11b/g/n
  - 2.4 GHz Wi-fi
  - WPA and WPA2 security modes

- Up to +20 dBm output power in 802.11b mode
- Smart and AP network configuration modes for Android and iOS devices
- Onboard PCB antenna with a gain of 2.5 dBi
- Working temperature: –20°C to +85°C

✧ Bluetooth connectivity

- Complete Bluetooth 4.2 standards: Bluetooth Basic Rate/Enhanced Data Rate (BR/EDR) and Bluetooth Low Energy (BLE)
- Class 1, Class 2, and Class 3 standards, requiring no external power amplifiers
- Up to +9 dBm output power
- Zero-IF receiver: –92 dBm BLE RX sensitivity
- Adaptive frequency hopping (AFH)
- Connections with multiple traditional Bluetooth and BLE devices
- Simultaneous broadcasting and scanning

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	2019-06-25	This is the first release.	1.0.0
2	2019-07-23	Added GPIO information.	1.0.1

Contents

Tables

Figures

2. Module Interfaces

2.1 Dimensions and Footprint

TYWE3SE has three rows of pins with a 2 mm pin spacing.

The TYWE3SE dimensions (H x W x D) are 3.3±0.15 mm x 16±0.35 mm x 24±0.35 mm. The PCB thickness is 0.8±0.1 mm. The shield cover height is 2.5±0.05 mm. Figure 2-1 shows the TYWE3SE front and rear views.

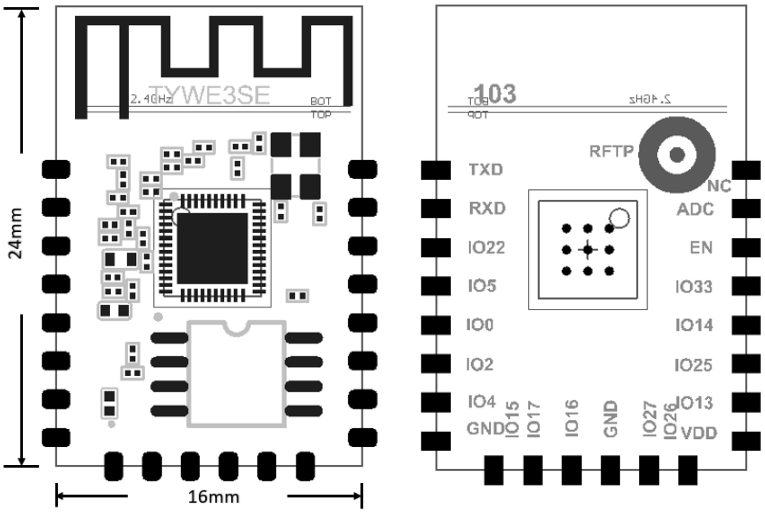


Figure 2-1 TYWE3SE front and rear views

2.2 Interface Pin Definition

Table 2-1 TYWE3SE interface pins

Pin No.	Symbol	I/O Type	Function
1	NC	N/A	N/A
2	ADC	AI	10-bit SAR ADC (See the following Note 2.)
3	EN	Input	Module enabling pin, which is connected to 3.3 V for normal use

Pin No.	Symbol	I/O Type	Function
4	IO33	I/O	Used as a GPIO, which is connected to 32K_XN (pin 13) on the internal IC
5	IO14	I/O	Used as a GPIO, which is connected to MTMS (pin 17) on the internal IC
6	IO25	I/O	Used as a GPIO, which is connected to GPIO25 (pin 14) on the internal IC
7	IO13	I/O	Used as a GPIO, which is connected to MTCK (pin 20) on the internal IC
8	VDD	P	Power supply pin (3.3 V)
9	IO26	I/O	Used as a GPIO, which is connected to GPIO_26 (pin 15) on the internal IC
10	IO27	I/O	Used as a GPIO, which is connected to GPIO_27 (pin 16) on the internal IC
11	GND	P	Power supply reference ground pin
12	IO16	I/O	Used as a GPIO, which is connected to GPIO_16 (pin 25) on the internal IC
13	IO17	I/O	Used as a GPIO, which is connected to GPIO_17 (pin 27) on the internal IC
14	IO15	I/O	Used as a GPIO, which is connected to MTDO (pin 21) on the internal IC
15	GND	P	Power supply reference ground pin
16	IO4	I/O	Used as a GPIO, which is connected to GPIO_4 (pin 24) on the internal IC
17	IO2	Output	UART0_TXD (used to print the module internal information, but not recommended to be used. For details, see the following Note 3.)
18	IO0	I/O	GPIO_0 (used during module power-on and

Pin No.	Symbol	I/O Type	Function
			initialization; cannot be pulled down when the module is powered on)
19	IO5	I/O	Used as a GPIO, which is connected to GPIO_5 (pin 34) on the internal IC
20	GPIO22	I/O	Used as a GPIO, which is connected to GPIO_22 (pin 39) on the internal IC
21	RXD	I/O	UART0_RXD (See the following Note 3.)
22	TXD	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.
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 3.3 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 TYWE3SE test pins

Pin No.	Symbol	I/O Type	Function
N/A	RFTP	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
VDD	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
VDD	Power supply voltage	3.0	3.3	3.6	V
V_{IL}	I/O low-level input	–0.3	N/A	VDD x 0.25	V
V_{IH}	I/O high-level input	VDD x 0.75	N/A	VDD	V
V_{OL}	I/O low-level output	N/A	N/A	VDD x 0.1	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
V_{OH}	I/O high-level output	VDD x 0.8	N/A	VDD	V
I_{max}	I/O drive current	N/A	N/A	16	mA
C_{pad}	Input pin capacitance	N/A	2	N/A	pF

3.3 RF Current

Table 3-3 Current during constant transmission and receiving

Working Status	Parameter			Typical Value	Unit
	Mode	Rate	TX Power/ Receiving		
TX	802.11b	11 Mbit/s	+18 dBm	220	mA
	802.11g	54 Mbit/s	+14 dBm	185	mA
	802.11n	MCS0	+14 dBm	200	mA
	802.11n	MCS7	+12 dBm	185	mA
	Bluetooth/BLE		P_{out} = 0 dBm	130	mA
RX	802.11b	11 Mbit/s	Constant receiving	100	mA
	802.11g	54 Mbit/s	Constant receiving	100	mA
	802.11n	MCS7	Constant receiving	100	mA
	Bluetooth/BLE		Constant receiving	100	mA

3.4 Working Current

Table 3-4 TYWE3SE 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	140	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	90	430	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	55	400	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	2.4 GHz Wi-fi
Wi-Fi standard	IEEE 802.11b/g/n
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 HT40 MCS0 to MCS7

Antenna type	PCB antenna with a gain of 2.5 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	14	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	12	N/A	dBm
BLE TX power	1 Mbit/s	–11	N/A	9	dBm
Frequency error		–10	N/A	+10	ppm
EVM under 802.11b CCK 11 Mbit/s 20 dBm			–22		dB
EVM under 802.11g OFDM 54 Mbit/s 14.0 dBm			–28		dB
EVM under 802.11n OFDM MCS7 12.0 dBm			–30		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	–97.5	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
BLE	1 Mbit/s	–94	–92	–90	

5. Antenna Information

5.1 Antenna Type

TYWE3SE uses an onboard PCB antenna.

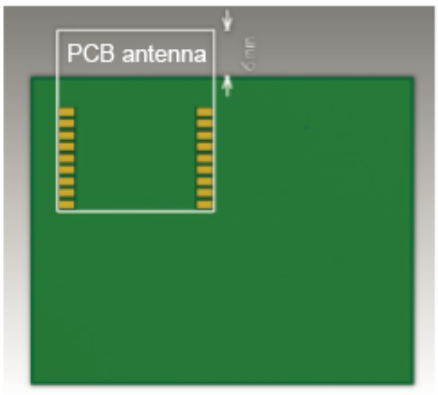
5.2 Antenna Interference Reduction

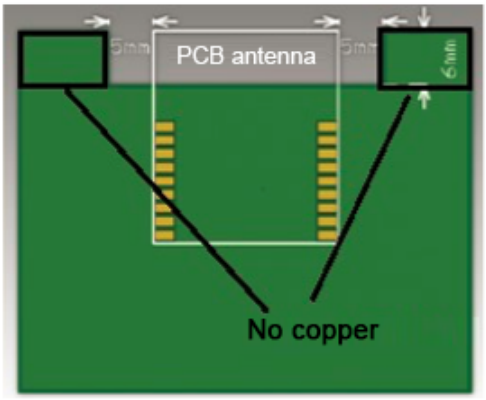
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts.

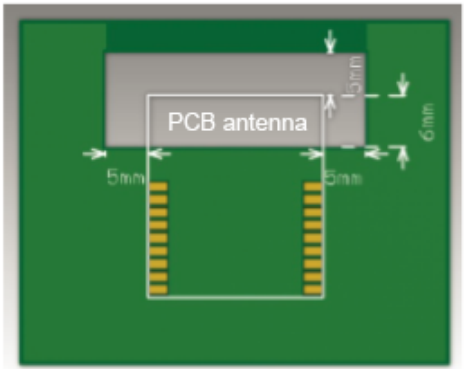
To prevent adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. The following describes three antenna placement solutions:

1. Place the antenna outside the PCB frame.
2. Place the antenna along the PCB frame without copper nearby.
3. Place the antenna in a carved area on the PCB.

The preceding solutions 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.







5.3 Antenna Connector Specifications

TYWE3SE does not use an antenna connector.

6. Packaging Information and Production Instructions

6.1 Mechanical Dimensions

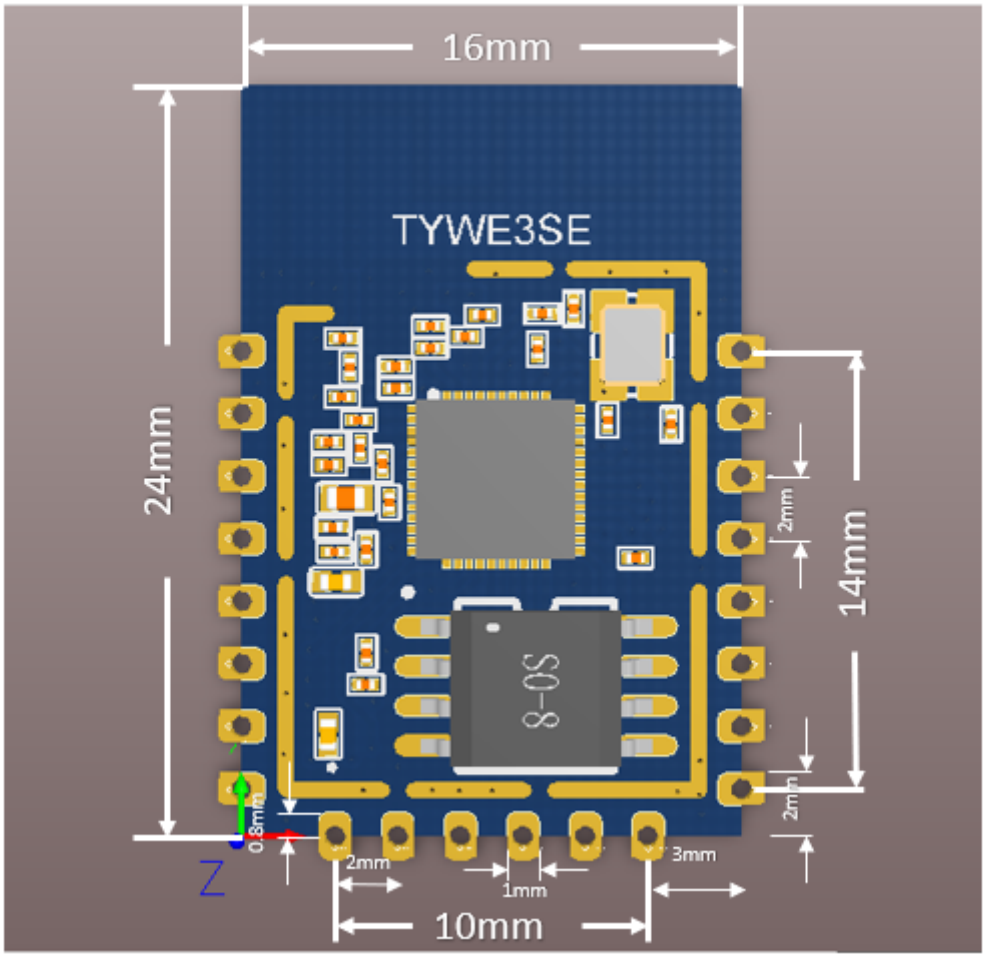


Figure 6-1 TYWE3SE mechanical dimensions

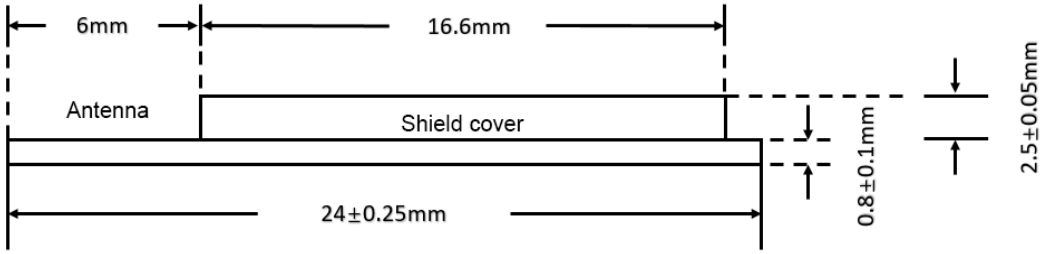


Figure 6-2 Side view

Note:

The default dimensional tolerance is ±0.25 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

6.2 Recommended PCB Encapsulation

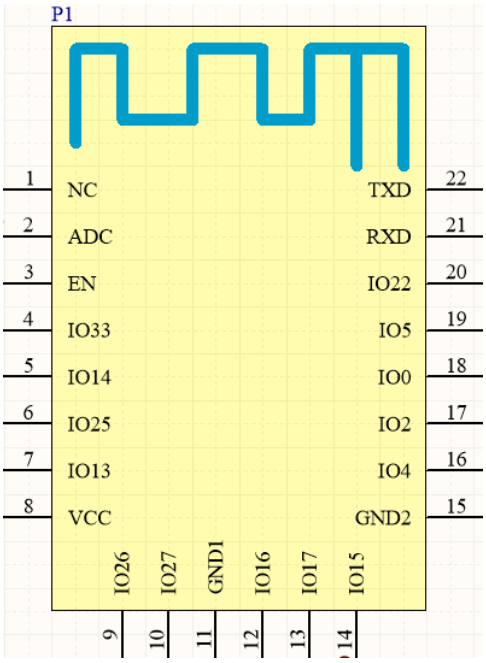


Figure 6-3 TYWE3SE pins

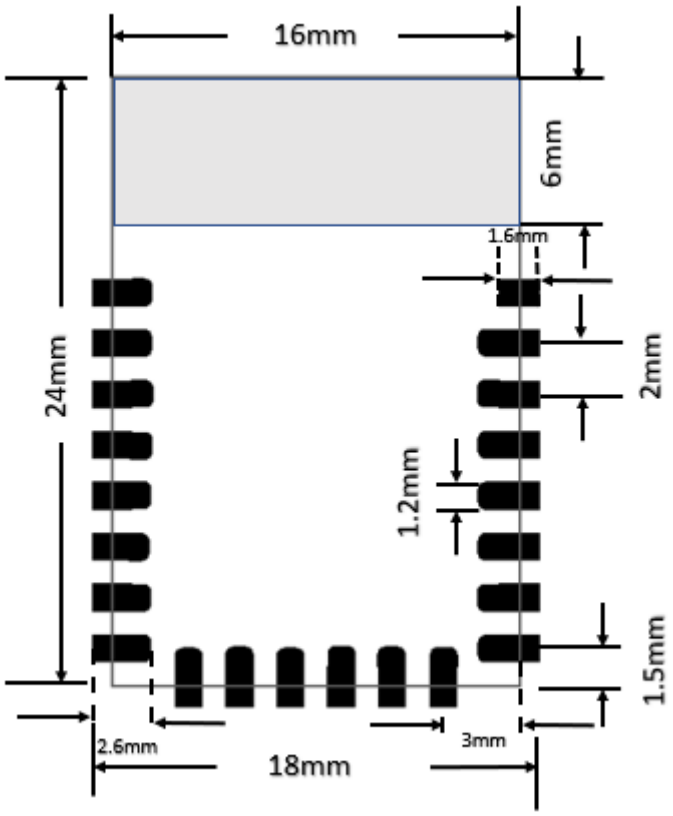


Figure 6-4 PCB encapsulation diagram of TYWE3SE

6.3 Production Instructions

1. Use an SMT placement machine to mount components to the stamp hole module that Tuya produces 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 components to the module.

   (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).

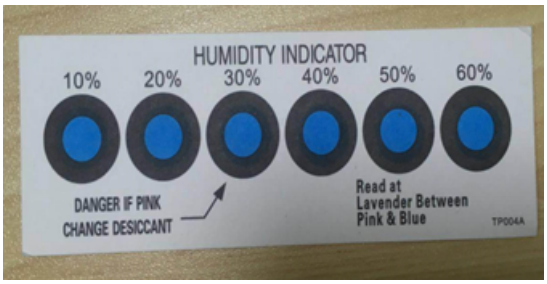


Figure 6-5 HIC for TYWE3SE

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 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

1. Perform SMT placement based on the following reflow oven temperature curve. The highest temperature is 245°C.
2. Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.

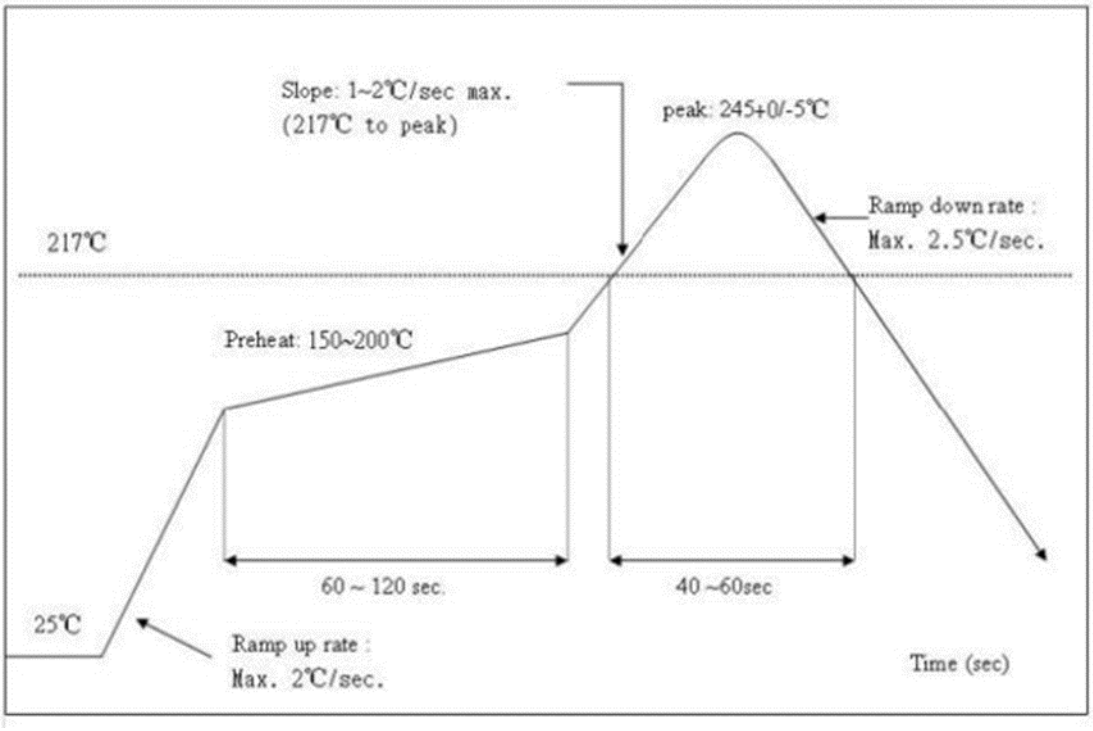


Figure 6-6 Oven temperature curve

6.5 Storage Conditions

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. MOQ and Packing Information

MOQ and packing information				
Product Model	MOQ(PCS)	Packing Method	Number of Modules in Each Reel Pack	Number of Reel Packs in Each Box
TYWE3SE	3200	Carrier tape and reel packing	800	4

8. Appendix: Statement

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

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 2ANDL-TYWE3SE"

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 Tuya Information 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 https://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