WBR3T Module Datasheet

Device Development > Cloud Module > WiFi&BT Dual Mode Module

Version: 20200812

Contents

1 Product Overview

WBR3T is a low-power embedded WiFi+BLE module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8720DN), a few peripherals, an embedded WiFi network protocol stack, the BT network protocol, and varied library functions. WBR3T has an embedded low-power 32-bit CPU, 512-KB static random-access memory (SRAM), 4-MB flash memory, and rich peripherals. WBR3T 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. The functional block diagram of WBR3T is shown as belows:
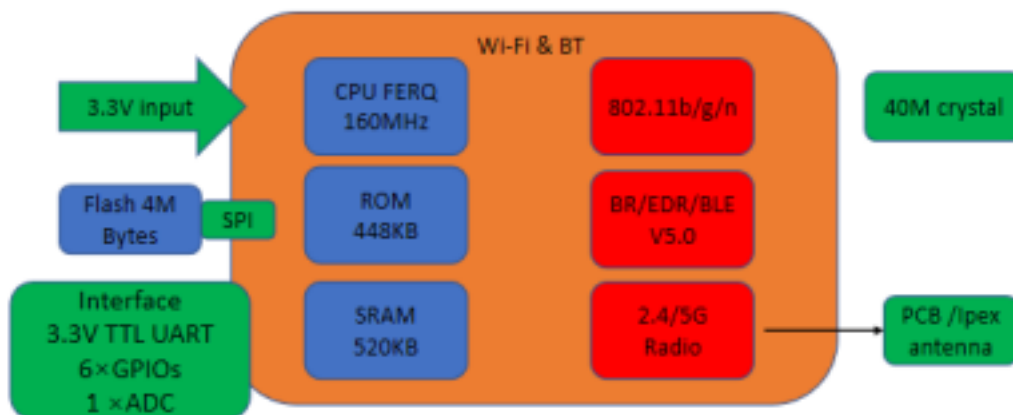
1.1 Features

- Embedded low-power 32-bit CPU, which can also function as an application processor
- The maxium clock rate: 200 MHz
- Working voltage: 3.3±0.3V
- Peripherals: 8 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog to digital converter (ADC)
- WiFi connectivity

    - 802.11 a/b/g/n 1x1, 2.4 G&5 G

- Channels 1 to 14 at 2.4 Ghz; channels 36 to 177 at 5 Ghz

- Support WPA and WPA 2 security modes
- Up to +17 dBm output power in 802.11b mode; Up to +15 dBm output power in 802.11a 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 0 dBi at 2.4G; onboard PCB antenna with a gain of 0.7 dBi at 5.0 G
- Working temperature: -20 to 105℃

- BLE connectivity

  - Support BLE (V5.0) and the rates of 1 M and 2 M
  - Up to +9 dbm output power
  - PCB antenna with a gain of 0 dBi at 2.4 G, which is shared with WiFi.
  - Working temperature: -20 to 105℃

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

Serial Number	Update Date	Updated Content	Version after Update
1	7/13/2020	This is the first release.	V1.0.0

2 Information about Labels of WBR3T

- P/N: Module Number
- Model: Product material code: WBR3T
- S/N: Production serial number
- CE: CE certification logo
- RoHS: RoHS certification logo

3 Module Interfaces

3.1 Dimensions and Footprint

WBR3T has two rows of pins with a 2±0.1 mm pin spacing. The WBR3T dimensions are 16 mm (W)×24 mm (L) ×3 mm (H).

Diagram of dimensions of WBR3T

101

TP1

TX   RST
RX   ADC
PA28 LOG_RX   EN
PB21 TP2   A15
PB20   A13
LOG_TX   A12
A25   A26
GND   VCC
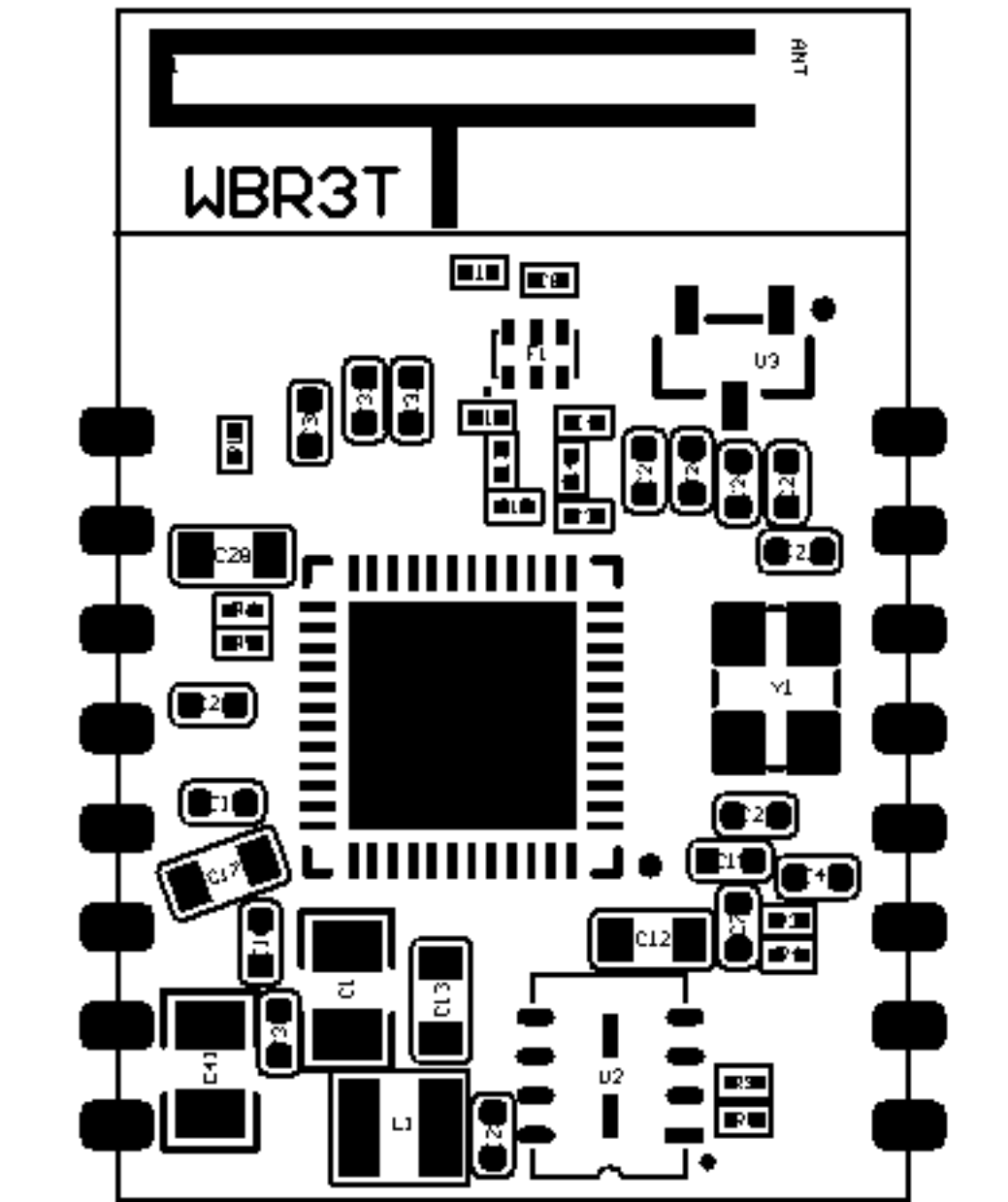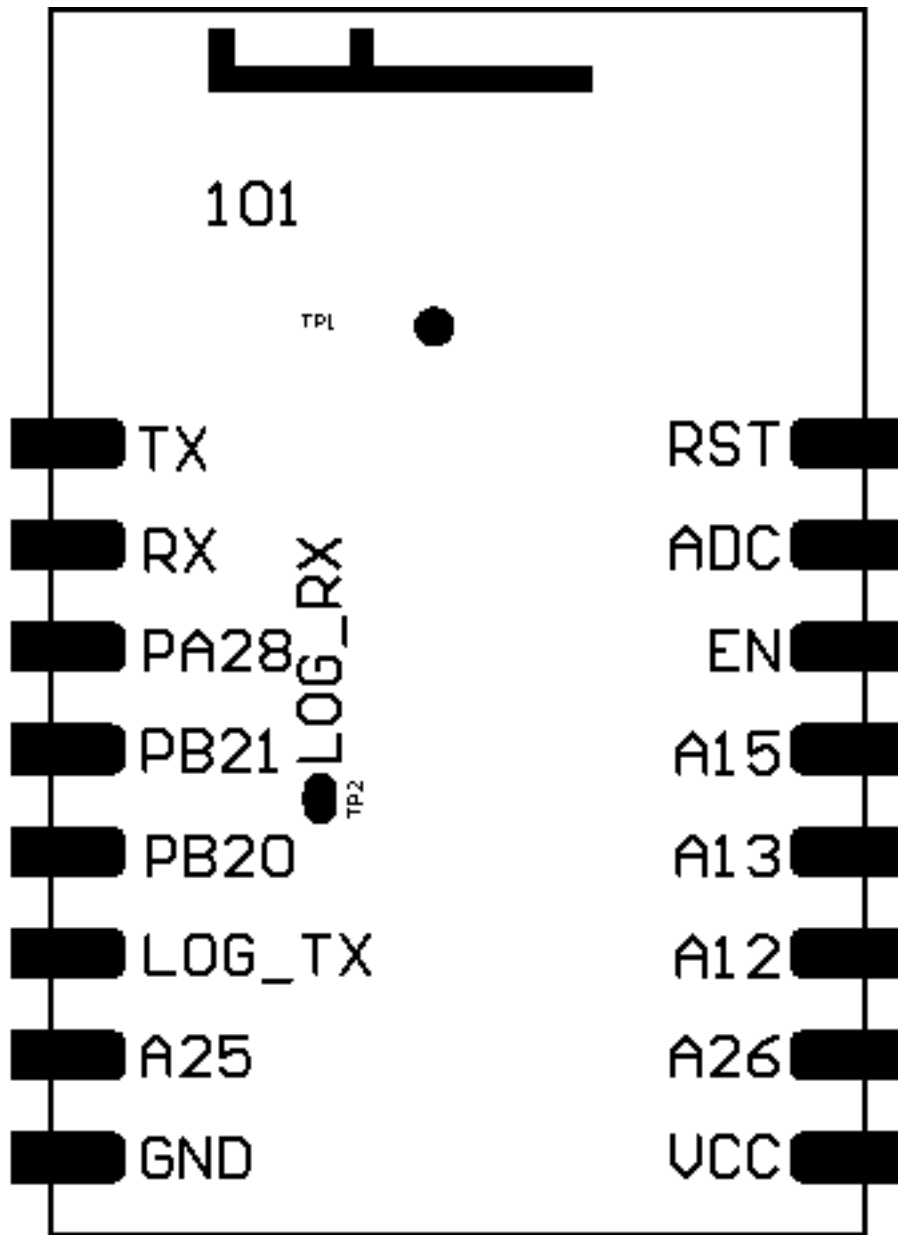
Note: The general shape tolerance is 0.3 mm, the position tolerance related to the plug-in assembly is reduced to 0.1 mm, and the tolerance of the 1-mm-thick plate is 0.1 mm.

3.2 Pin Definition
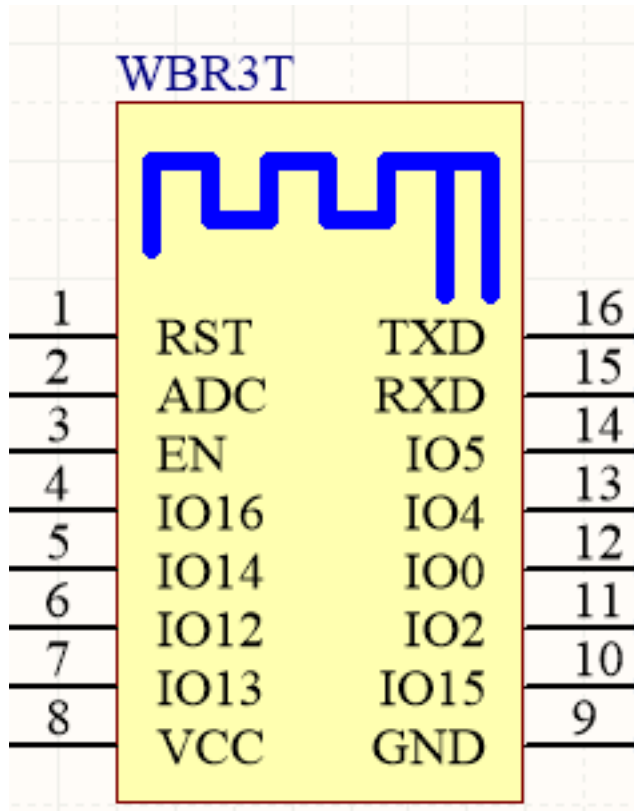
Pin Number	Symbol	I/O Type	Function
1	RST	I/O	Reset pin
2	ADC	AI	ADC[1], which corresponds to PB 3 of IC
3	EN	I	Enabling pin, which needs to be connected to the voltage of 3.3 V when normally used, and corresponds to CHIP_EN of IC

Pin Number	Symbol	I/O Type	Function
4	PA15	I/O	Common IO pin, which corresponds to PA 15 of IC
5	PA13	P	Need to support hardware PWM, which corresponds to PA 13 of IC
6	PA12	I/O	Need to support hardware PWM, which corresponds to PA 12 of IC
7	PA26	I/O	Need to support hardware PWM, which corresponds to PA 26 of IC
8	VCC	P	Power supply pin (3.3 V)
9	GND	P	Power supply reference ground
10	PA25	O	Common IO pin, which corresponds to PA 25 of IC

Pin Number	Symbol	I/O Type	Function
11	LOG_TX	O	UART0_TXD (used to display the internal information of the module), which corresponds to UART_TXD of IC
12	PB20	I/O	A common IO pin, which corresponds to PB 20 of IC
13	PB21	I/O	Need to support hardware PWM and correspond to PB 21 of IC
14	PA28	I/O	Need to support hardware PWM and correspond to PA 28 of IC
15	RXD/PB2	I/O	UART0_RXD[2], which corresponds to PB 2 of IC
16	TXD/PB1	I/O	UART0_TXD[2], which corresponds to PB 1 of IC

Note: P indicates power supply pins, I/O indicates input/output pins, and AI indicates analog input pins. RST is only a reset pin of a module and cannot be used for clearing information about WiFi network configuration. (1): The pin 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. (2): UART0 is a user-side serial interface pin. When a module is enabled, there is information output from the user-side serial interface pin, which can be neglected.

3.3 Definitions on Test points

Pin Number	Symbol	I/O Type	Function
-	TEST	I	Be used to the production test of the module

Note: Test pins are not recommended.

4 Electrical Parameters

4.1 Absolute Electrical Parameters

Parameter	Description	Minimum value	Maximum Value	Unit
Ts	Storage temperature	-20	105	℃
VBAT	Power supply voltage	3.0	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 Normal Working Conditions

Parameter	Description	Minimum value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-20	-	105	℃
VBAT	Power supply 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 TX and RX Power Consumption:

4.3.1 Transmission and Receiving at 2.4G

Working Status	Mode	Rate	Transmit Power/Receive	Typical Value	Unit
Transmit	11b	11 Mbps	+18 dBm	250	mA
Transmit	11g	54 Mbps	+17 dBm	180	mA
Transmit	11n-HT20	MCS 7	+16 dBm	170	mA
Transmit	11n-HT40	MCS 7	+16 dBm	150	mA
Receive	11b	11 Mbps	Constantly receive	70	mA
Receive	11g	54 Mbps	Constantly receive	72	mA

Working Status	Mode	Rate	Transmit Power/Receive	Typical Value	Unit	
Receive	11n-HT20	MCS 7	Constantly receive	70	80	mA
Receive	11n-HT40	MCS 7	Constantly receive	73	80	mA

4.3.2 Transmission and Receiving at 5G

Working Status	Mode	Rate	Transmit Power/Receive	Typical Value	Unit	
Transmit	11a	54 Mbps	+15 dBm	300	mA	
Transmit	11n-HT20	MCS 7	+15 dBm	230	mA	
Transmit	11n-HT40	MCS 7	+14 dBm	220	mA	
Receive	11a	54 Mbps	Constantly receive	71	mA	
Receive	11n-HT20	MCS 7	Constantly receive	72	80	mA
Receive	11n-HT40	MCS 7	Constantly receive	76	80	mA

4.4 Working Current

Working Mode	Working Status, Ta = 25℃	Average Value	Maximum Value (Typical Value)	Unit
Quick connection network state	The module is in the fast network connection state and the WiFi indicator always flashes	57	184	mA
Hotspot network configuration state	The module is in the hotspot network configuration state and the WiFi indicator flashes slowly	203	392	mA
Network connection operation state	The module is connected to the network and the WiFi indicator is always on	55	98	mA
Disconnected state	The module is disconnected and the WiFi indicator is dark	53	59	mA

5 RF Parameters

5.1 Basic RF Features

Parameter	Description
Working frequency	2.412 to 2.484 GHz; 5.180 to 5.885 GHz BT 2.4000 to 2.4835GHZ
WiFi standard	IEEE 802.11 a/b/g/n (Channels 1 to 14; channels 36 to 177)
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps); 11 a/g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps); 11n: HT20 MCS 0 to 7; HT40 MCS 0 to 7
Antenna type	PCB antenna with a gain of 0 dBi at 2.4 G & BT; PCB antenna with a gain of 0.7 dBi at 5 G

5.2 TX Performance

2.4 G TX Performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK Mode 11M	-	17	-	dBm
Average RF output power, 802.11g OFDM Mode 54M	-	16	-	dBm
Average RF output power, 802.11n HT20 Mode MCS7	-	15	-	dBm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11n HT40 Mode MCS7	-	14	-	dBm
Frequency error	-10	-	10	ppm

5G-TX Performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11a OFDM Mode 54M	-	15	-	dBm
Average RF output power, 802.11n HT20 Mode MCS7	-	14	-	dBm
Average RF output power, 802.11n HT40 Mode MCS7	-	13	-	dBm
Frequency error	-10	-	10	ppm

5.3 RX Performance

RX sensitivity

| Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, RX sensitivity, 802.11b DSSS Mode 11M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11a/g OFDM Mode 54M	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode HT20-MCS7	-	-72	-	dBm

6 Antenna Information

6.1 Antenna Type

WB8P uses only an onboard PCB antenna.

6.2 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.
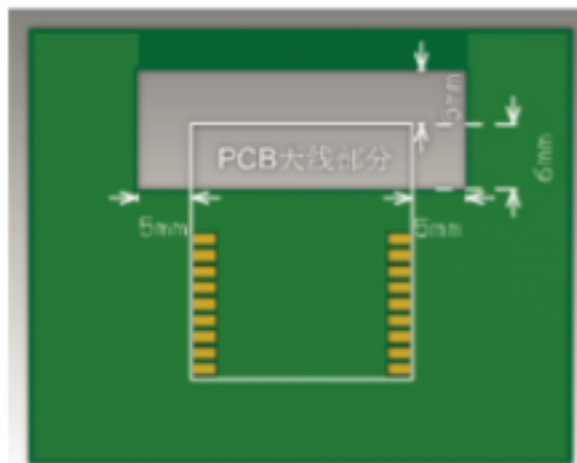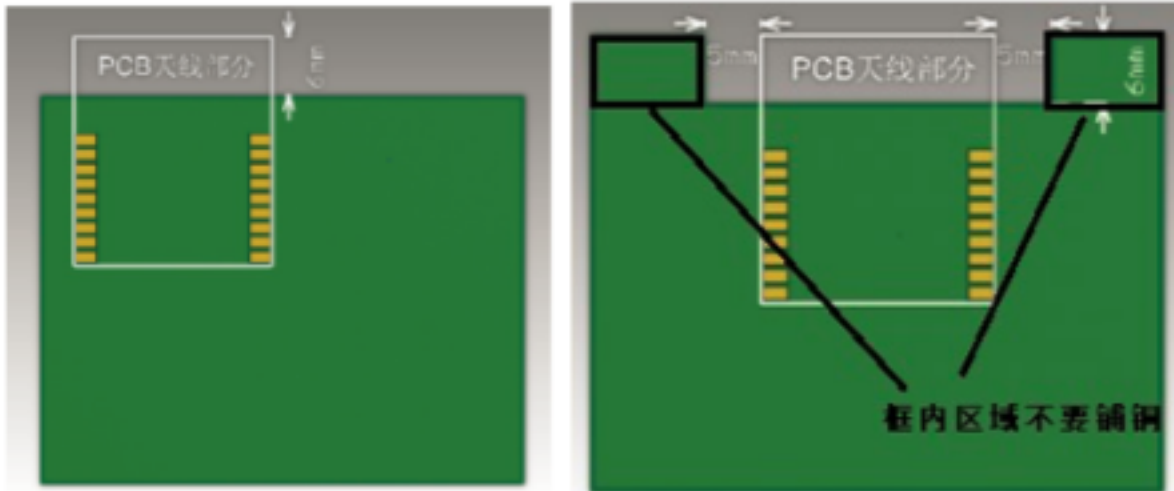
For the antenna area of the PCB of the module, refer to Diagram of Mechanical Dimensions.

6.3 Treatment of GPIO Pins

A few pins (PA 12, PA 13, PA 15, PA 25, PA 28, and PA 26) of the module will have instantaneous high-level pulses before the chip fully works, and everything will be normal after the chip works. For these pins, if they are directly used as driving light sources or relays, in order to avoid the effect of burrs at the moment of powering on, refer to the following processing methods: Pull down a 1-K resistor at an output port of a pin, and then connect a diode in series. At this time, the voltage of a GPIO

will drop to about 2.7V after passing through the diode. The red box represents the original drive tube on the customer's baseboard. A diode D1 and pull-down 1-K resistor need to be added. If a lamp is directly driven, pull down a 10-K resistor on the grid of the positive Mos. If a lamp is not directly driven and a PWM signal will not be sent until the module is officially launched, there is no need to add a pull-down resistor and diode. If a relay is driven, you can change the diode to a resistor of 0 ohm according to the actual situation.
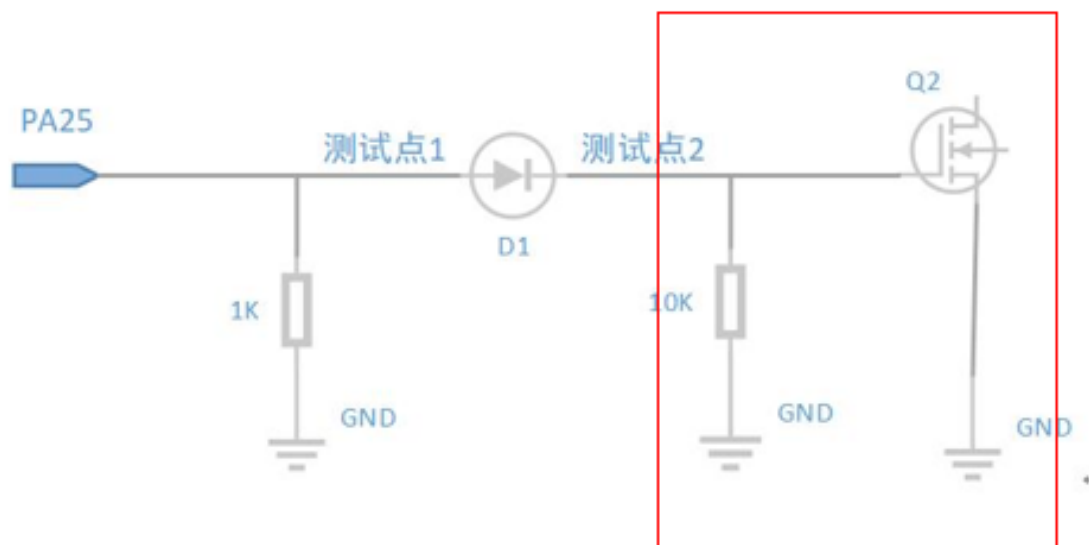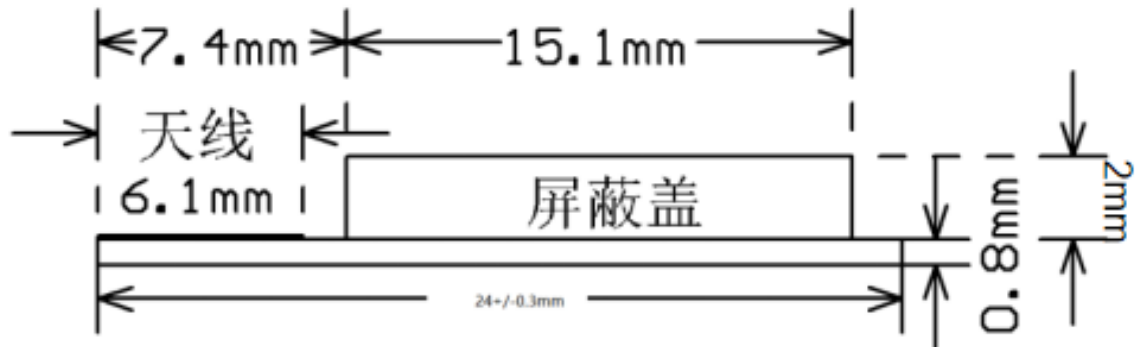
7 Packaging Information and Production Instructions

7.1 Mechanical Dimensions
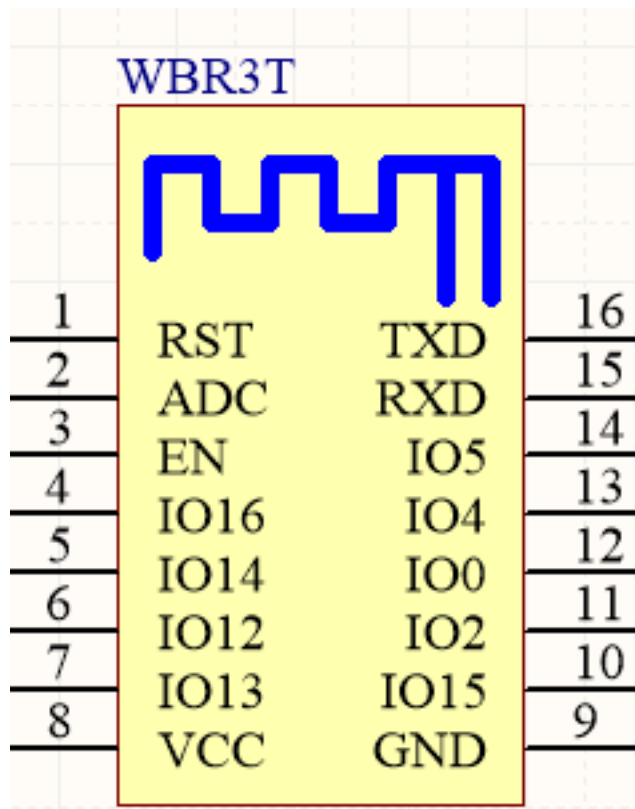
The WBR3T dimensions are 16 mm (W)×24 mm (L) ×2.8 mm (H).
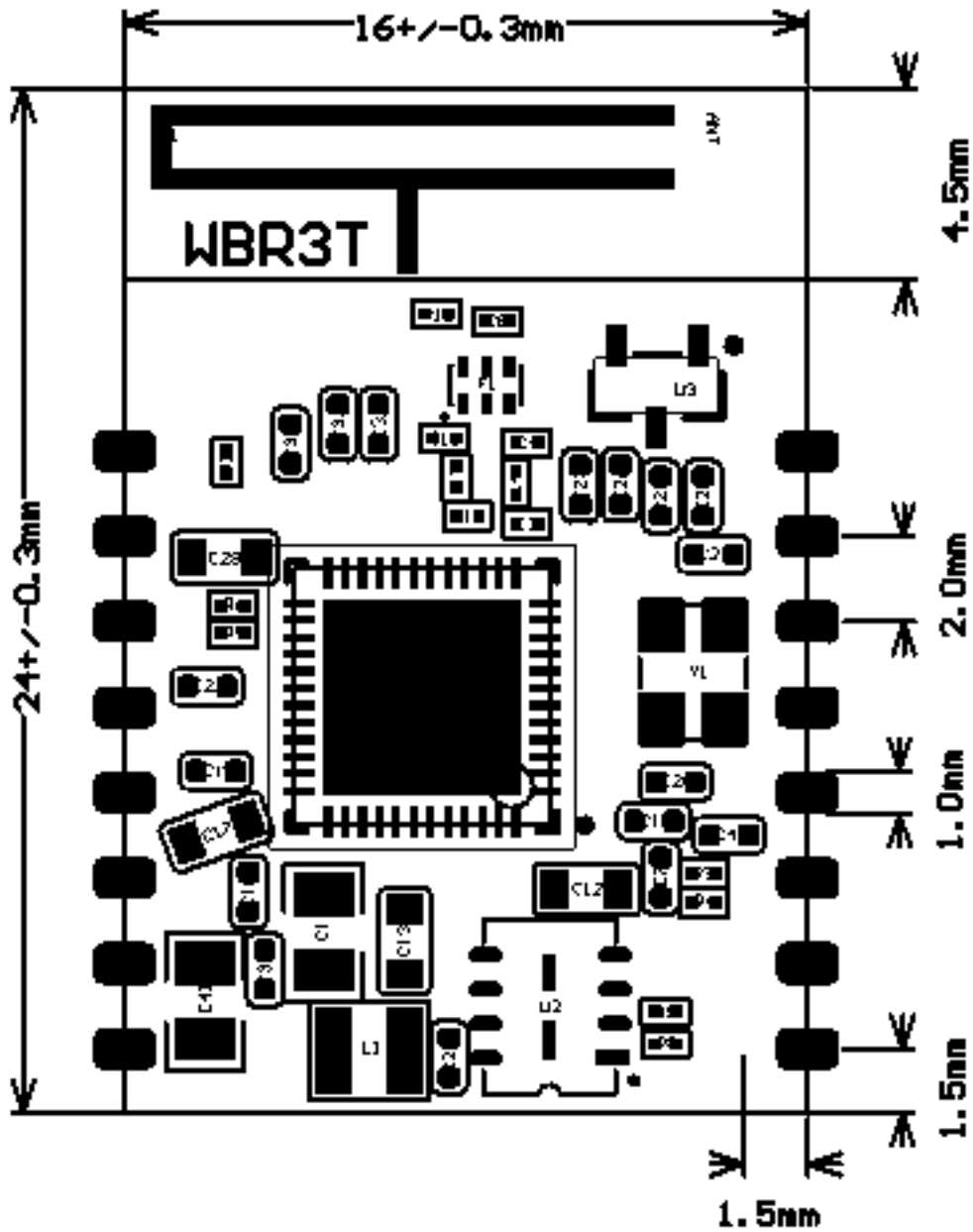
7.2 Side View

Note: The default dimensional tolerance is 0.3 mm. If you have specific require-
ments on dimensions, make them clear in the datasheet after communication.
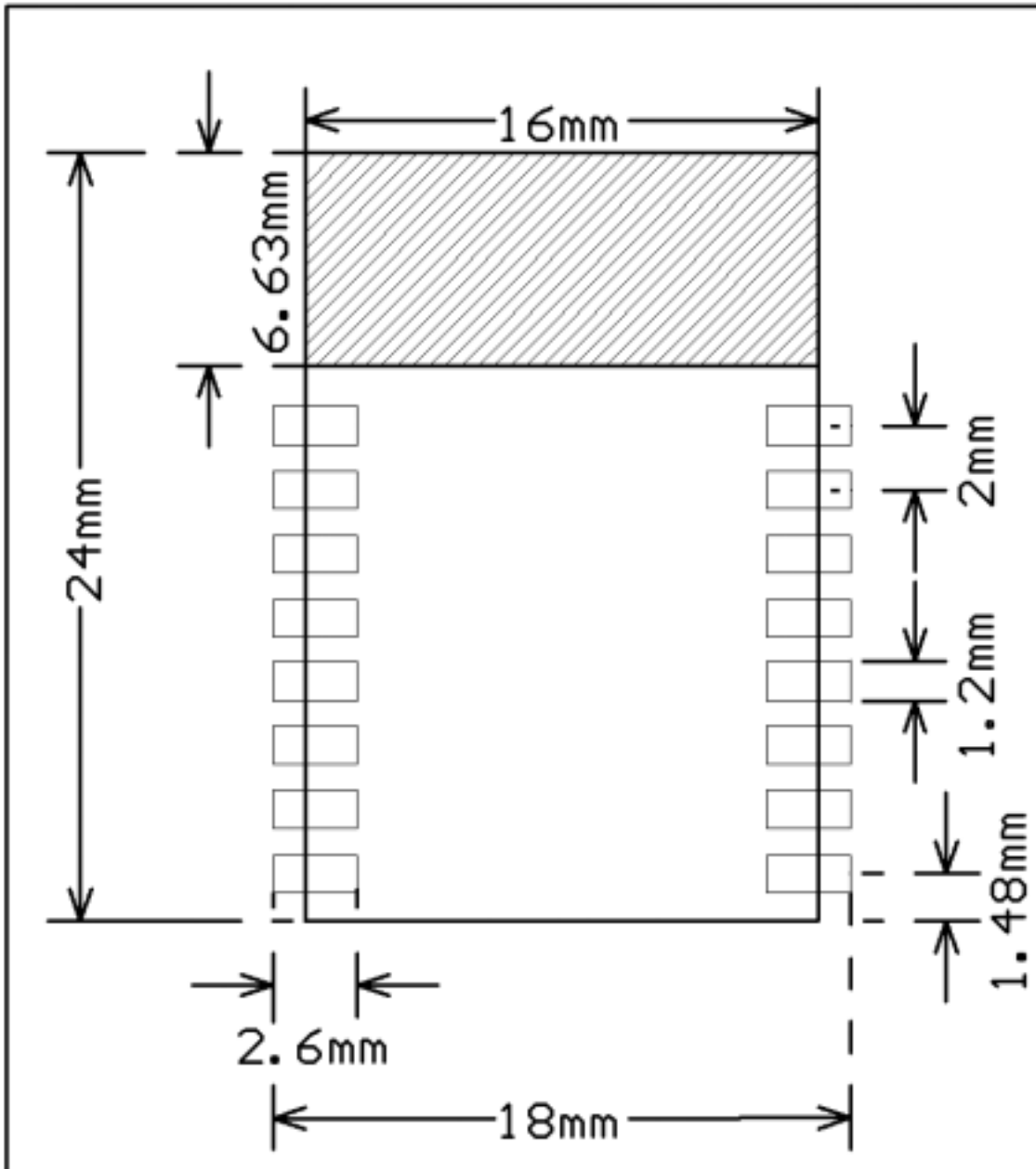
7.3 The Schematic Diagram of Packaging

## 7.4 The Diagram of PCB Packaging-Pin

WBR3T can use SMT.

7.5 The Diagram of PCB Packaging-SMT

7.6 Production Instructions

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

   a) Reflow soldering machine
   b) Automated optical inspection (AOI) equipment
   c) Nozzle with a 6 mm to 8 mm diameter B. Baking equipment
   d) Cabinet oven
   e) Anti-static heat-resistant trays
   f) 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℃ 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).
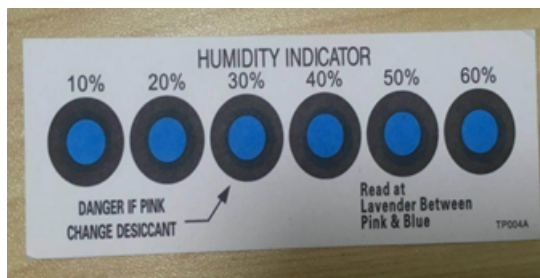
3. Bake a module based on HIC status as follows when you unpack the module package: A. If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours. B. If the 30% circle is pink, bake the module for 4 consecutive hours. C. If the 30% and 40% circles are pink, bake the module for 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℃ B. Alarm temperature: 130℃ C. SMT ready temperature after natural cooling: < 36℃ 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 SMT 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.

7.7 Recommended Oven Temperature Curve

Perform SMT based on the following reflow oven temperature curve. The highest temperature is 245℃. The reflow temperature curve is shown as belows:
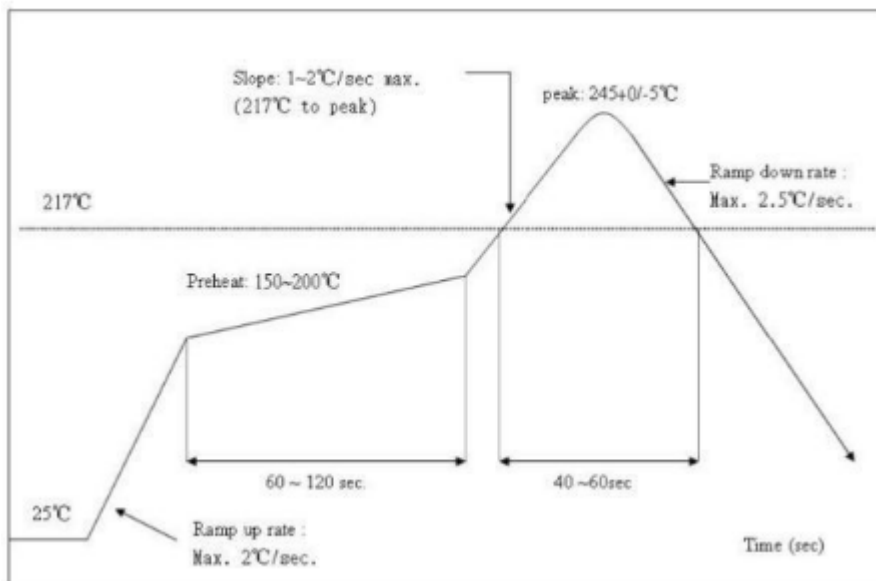
7.8 Storage conditions

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 MOQ and Packaging Information

Product Number	MOQ(pcs)	Shipping packaging method	The number of modules per reel (pcs)	The number of reels per carton (reel)
WBR3T	4000	Tape reel	1000	4

9 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 20cm 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-WBR3T. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBR3T".

This device is intended only for OEM integrators under the following conditions: 1) The antenna must be installed such that 20cm 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.