



WBR3D Module Datasheet

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

Version: 20200729

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1 Product Overview

WBR3D is a low-power embedded Wi-Fi and BLE module that Tuya has developed. It consists of a highly integrated RF chip (RTL8720DN) and several peripheral components, with an embedded Wi-Fi network protocol stack, BLE network protocol, and robust library functions. WBR3D is embedded with a low-power 32-bit CPU, 512 KB static random-access memory (SRAM), and 4 MB flash memory, and has extensive peripherals. WBR3D 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
- Dominant frequency: up to 200 MHz
- Working voltage: 3.0 V to 3.6 V
- Peripherals: eight GPIOs, one universal asynchronous receiver/transmitter (UART), and one analog-to-digital converter (ADC)
- Wi-Fi connectivity
 - 802.11a/b/g/n 1T1R, 2.4 GHz and 5 GHz capable
 - Channels 1 to 14 at 2.4 GHz and channels 36 to 177 at 5 GHz
 - WPA and WPA2 security modes
 - Up to +17 dBm output power in 802.11b mode and up to +15 dBm in 802.11a 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 2dBi in 2.4G band, and 2.6dBi of 5G band
 - Working temperature: -20°C to +85°C
- BLE connectivity
 - Support BLE(V5.0)
 - Up to +8dBm TX power
 - Onboard PCB antenna with a gain of 2dBi in 2.4G band
 - 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

1.3 Change History

NO.	Date	Change Description	Version After Change
1	2020-10-10	This is the first release.	V1.0.0

2 WBR3D Tag information



- P/N: Module Type:
- Model: WBR3D
- S/N: Production serial number
- CE: European Conformity marking
- RoHS: RoHS compliance logo

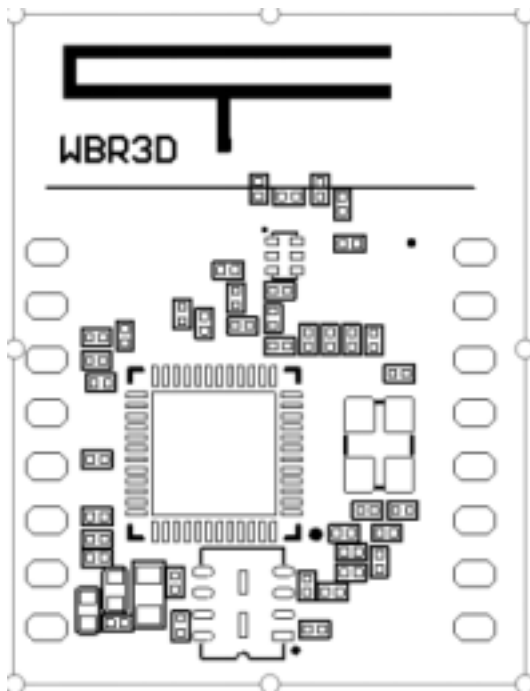
3 Module Interfaces

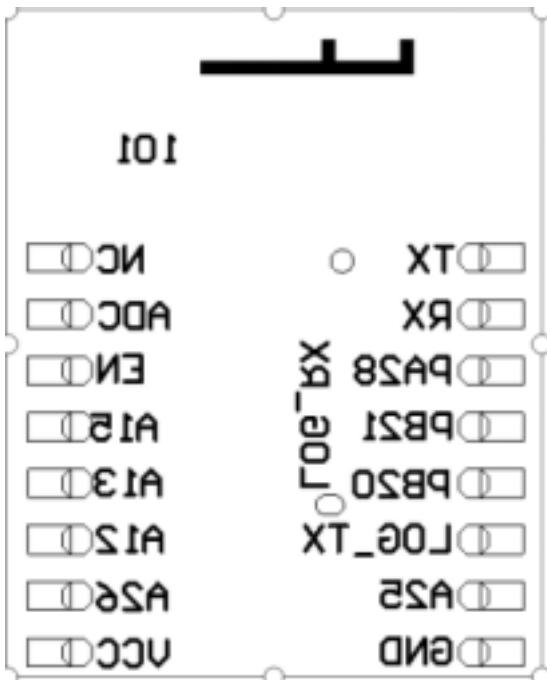
3.1 Dimensions and Footprint

WBR3D has two rows of pins with a 2 ± 0.1 mm pin spacing.

The WBR3D dimensions (H x W x D) are 2.8 mm x 16 mm x 24 mm.

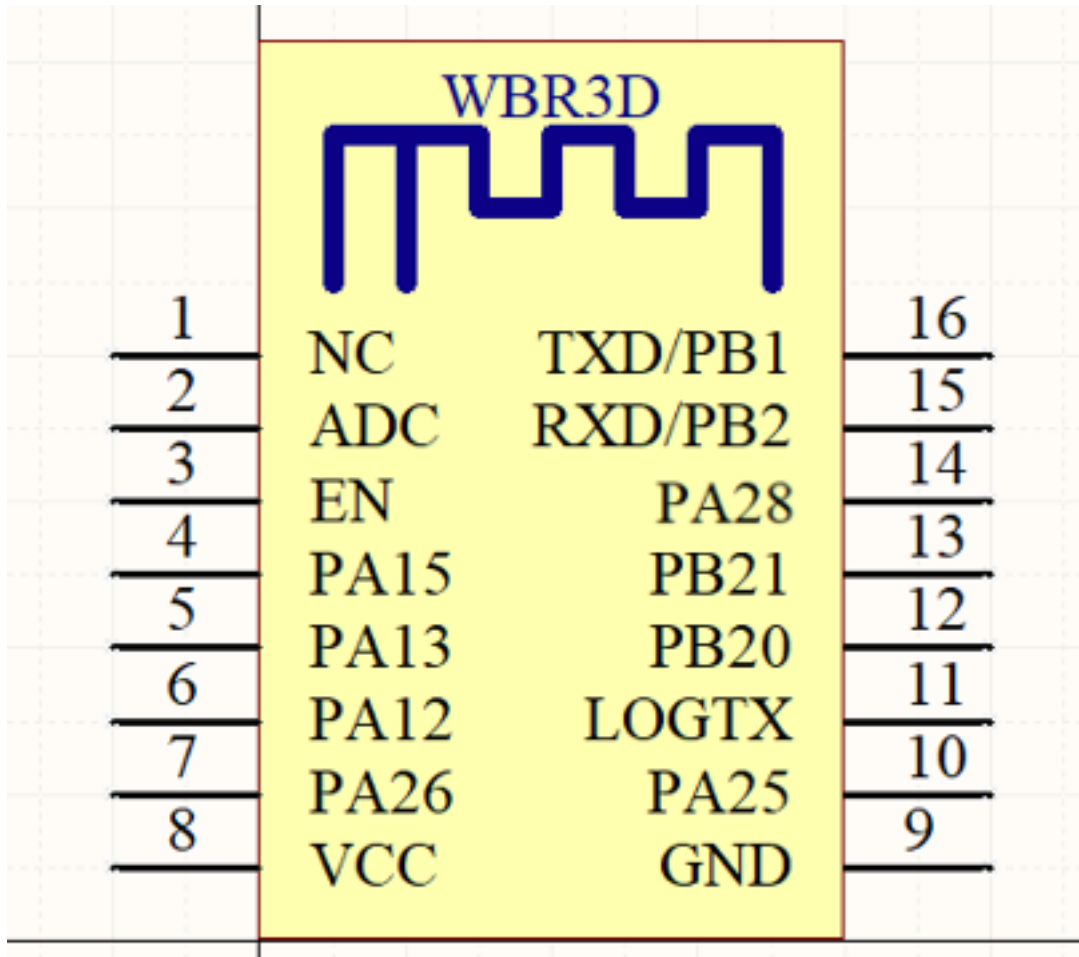
The front and rear views of WBR3D:





Note: The common appearance tolerance is ± 0.3 mm. The tolerance of positions that involve plug-in assembly is ± 0.1 mm. The thickness tolerance of a 1 mm thick PCB is ± 0.1 mm.

3.2 Interface Pin Definition



Pin No.	Symbol	I/O Type	Function
1	NC	I/O	No Connection
2	ADC	AI	10-bit precision SAR ADC ⁽¹⁾ , the Pin PB3 of IC
3	EN	I	Module enabling pin, which is connected to 3.3 V for normal use, 对应 IC 的 CHIP_EN

Pin No.	Symbol	I/O Type	Function
4	PA15	I/O	GPIO, The pin PA15 of IC
5	PA13	P	PWM Pin, The pin PA13 of IC
6	PA12	I/O	PWM Pin, The pin PA12 of IC
7	PA26	I/O	PWM Pin, The pin PA26 of IC
8	VCC	P	Power supply pin (3.3 V)
9	GND	P	Power supply reference ground pin
10	PA25	O	GPIO, The pin PA25 of IC
11	LOG_TX	O	UART0_TXD (used to display the module internal information)
12	PB20	I/O	GPIO, The pin PB20 of IC
13	PB21	I/O	PWM Pin, The pin PB21 of IC
14	PA28	I/O	PWM Pin, The pin PA28 of IC
15	RXD/PB2	I/O	UART0_RXD ⁽²⁾ , 对应 IC 的 PB2
16	TXD/PB1	I/O	UART0_TXD ⁽²⁾ , 对应 IC 的 PB1

Note: P indicates power supply pins, I/O indicates input/output pins, and AI indicates analog input pins. (1): 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. (2): UART0 is a user-side serial interface, which generates information when the module is powered on and starts.

3.3 Test Pin Definition

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

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	85	°C
VBAT	Power supply voltage	3.0	3.6	V
Static electricity voltage (human body model)	TAMB-25°C	-	2	KV
Static electricity voltage (machine model)	TAMB-25°C	-	0.5	KV

4.2 Normal electrical conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-20	-	85	°C
VBAT	Power supply voltage	3.0	3.3	3.6	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
VIL	I/O low-level input	-0.3	-	VCC*0.25	V
VIH	I/O high-level input	VCC*0.75	-	VCC	V
VOL	I/O low-level output	-	-	VCC*0.1	V
VoH	I/O high-level output	VCC*0.8	-	VCC	V
I _{max}	I/O drive current	-	-	12	mA

4.3 Current during constant transmission and receiving

4.3.1 2.4G transmission and receive

Working Status	Mode	Rate	TX Power/Receiving	Typical Value	Unit
TX	11b	11Mbps	+18dBm	250	mA
TX	11g	54Mbps	+17dBm	180	mA
TX	11n-HT20	MCS7	+16dBm	170	mA
TX	11n-HT40	MCS7	+16dBm	150	mA
RX	11b	11Mbps	Receiving	70	mA
RX	11g	54Mbps	Receiving	72	mA
RX	11n-HT20	MCS7	Receiving	70	mA

Working Status	Mode	Rate	TX Power/Receiving	Typical Value	Unit
RX	11n-HT40	MCS7	Receiving	73	mA

4.3.2 5G transmission and receive

Working Status	Mode	Rate	TX Power/Receiving	Typical Value	Unit
TX	11a	54Mbps	+15dBm	300	mA
TX	11n-HT20	MCS7	+15dBm	230	mA
TX	11n-HT40	MCS7	+14dBm	220	mA
RX	11a	54Mbps	Receiving	71	mA
RX	11n-HT20	MCS7	Receiving	72	mA
RX	11n-HT40	MCS7	Receiving	76	mA

4.4 Working Current

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value(Typical Value)	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	57	184	mA

Working Mode	Working Status (Ta = 25°C)	Average Value	Maximum Value(Typical Value)	Unit
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly	203	392	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	55	98	mA
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	53	59	mA

5 RF Features

5.1 Basic RF Features

Parameter	Description
Frequency band	2.412~2.484GHz; 5.180~5.885GHz
Wi-Fi standard	IEEE 802.11a/b/g/n (Channels 1 to 14 and 36 to 177)

Parameter	Description
Data transmission rate	802.11b: 1, 2, 5.5, or 11 (Mbit/s);802.11a/g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s);802.11n: HT20 MCS0 to MCS7;802.11n: HT40 MCS0 to MCS7
Antenna type	PCB antenna with a gain of 2 dBi at 2.4 GHz and 2.6 dBi at 5 GHz

5.2 TX Performance

Performance during constant transmission at 2.4 GHz

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
Average RF output power, 802.11n HT40 Mode MCS7	-	14	-	dBm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Frequency error	-10	-	10	ppm

Performance during constant transmission at 5 GHz

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11aOFDM 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

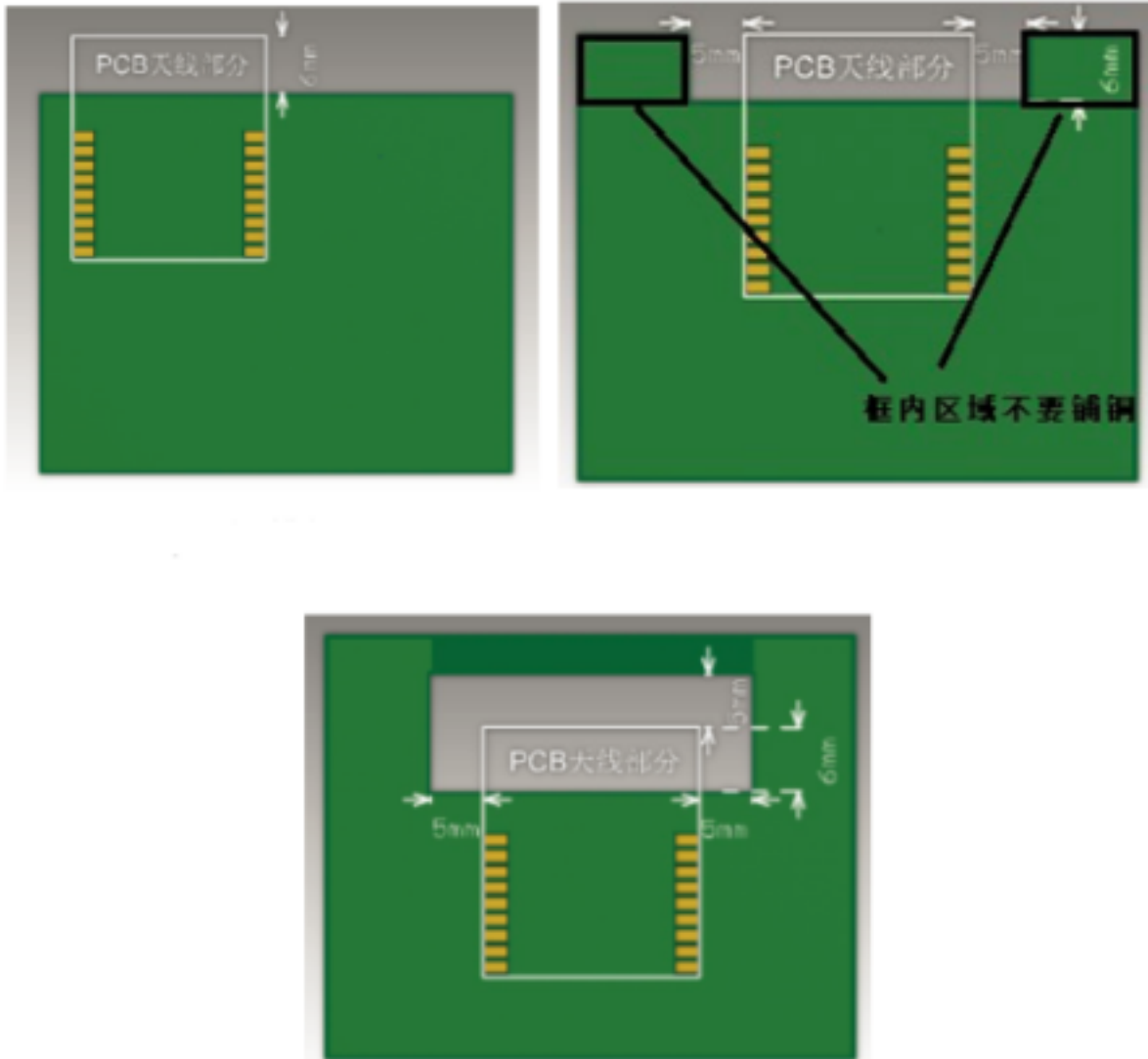
Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, 802.11b DSSS Mode 11M	-	-91	-	dBm
PER<10%, 802.11a/g OFDM Mode 54 M	-	-75	-	dBm
PER<10%, 802.11n OFDM Mode HT20-MCS7	-	-72	-	dBm

6 Antenna Information

###Antenna Type WBR3T uses an onboard PCB antenna.

6.1 Antenna Interference Reduction

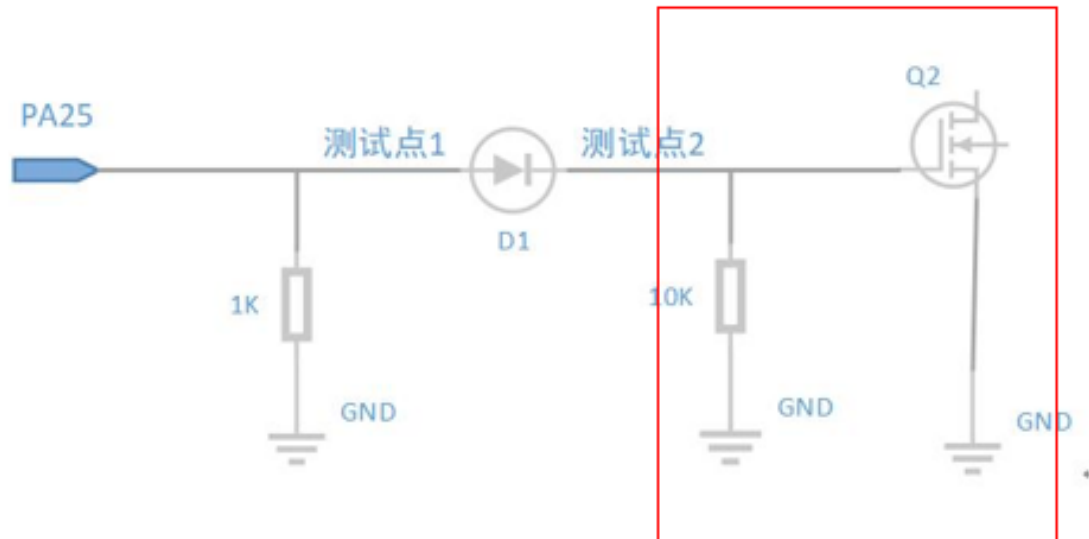
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15 mm away from other metal parts. To prevent adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. Ensure that 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.



6.2 GPIO Pin processing

Module individual pin (PA15 PA12, PA13, PA25, PA28, PA26) before the chip didn't completely work. It will be instantaneous high level pulse, But everything is ok after the chip work .For these pins, if used directly as a driver of light source or relay, the following reference processing can be done to avoid the effect of instant burr during the power on. Pull-down a 1K resistor at the output port of the pin, then series a diode, and the VOLTAGE of GPIO will drop to about 2.7V after passing the diode.The red frame represents the original drive tube on the customer bottom plate, diode D1 and drop 1K need to be added. If the lamp class is driven directly, then the 10K resistor is pulled down from the gate of the MOS tube. If the lamp class is not driven

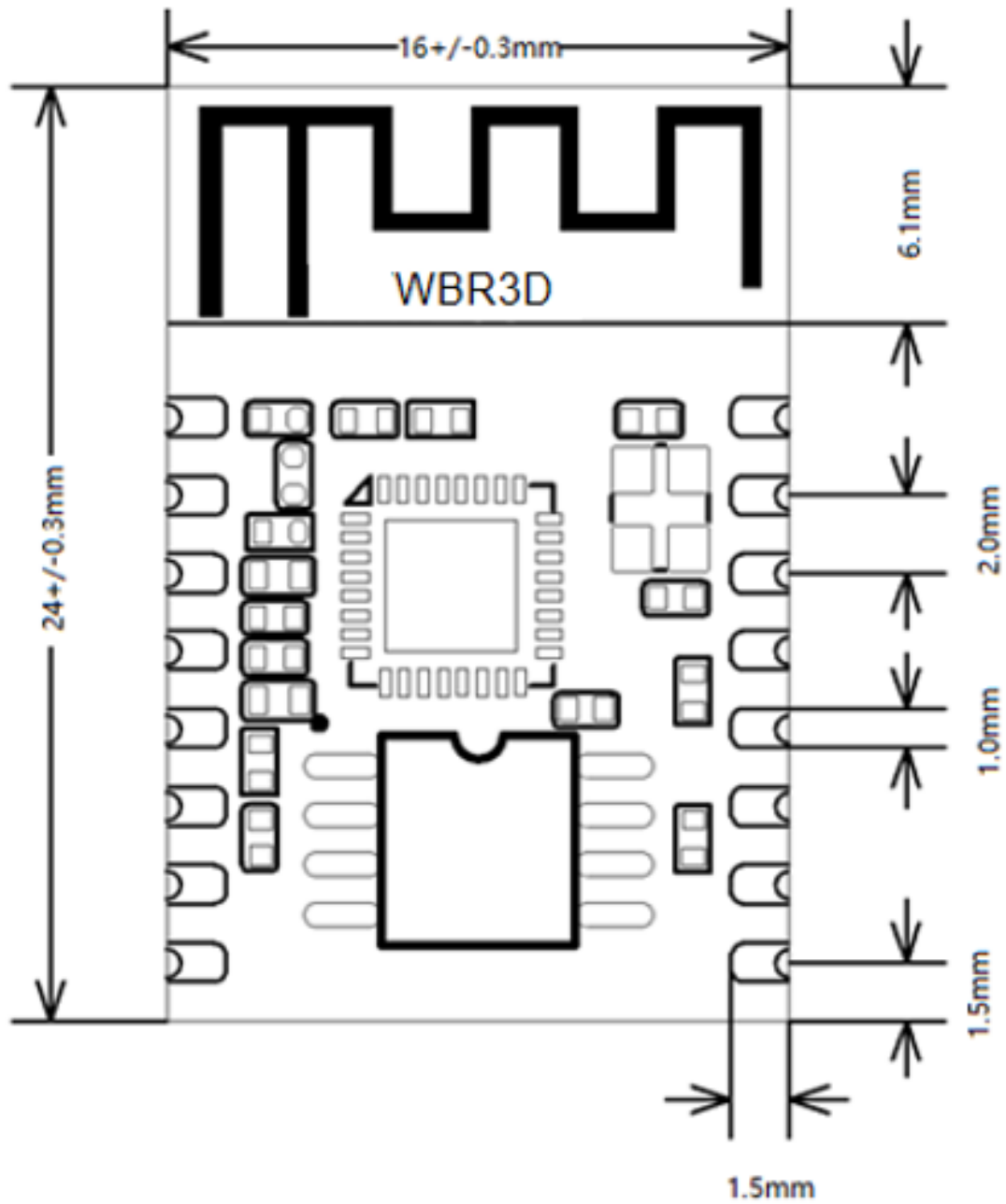
directly and the PWM signal is not sent until the module is formally set up, then there is no need to add the pull-down resistor and diode. If the relay is driven, the diode can be replaced with 0 ohm according to the actual situation.



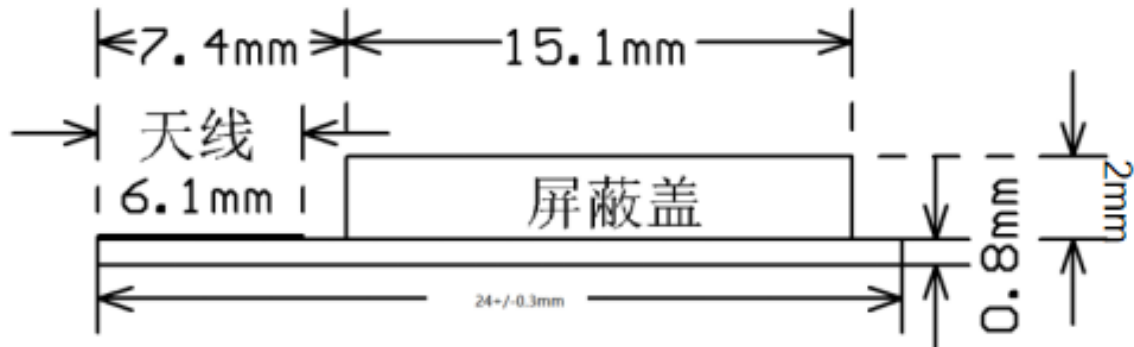
7 Packaging Information and Production Instructions

7.1 Mechanical Dimensions

PCB mechanical dimensions: 16mm (W)×24mm (L) ×3.5mm (H)。

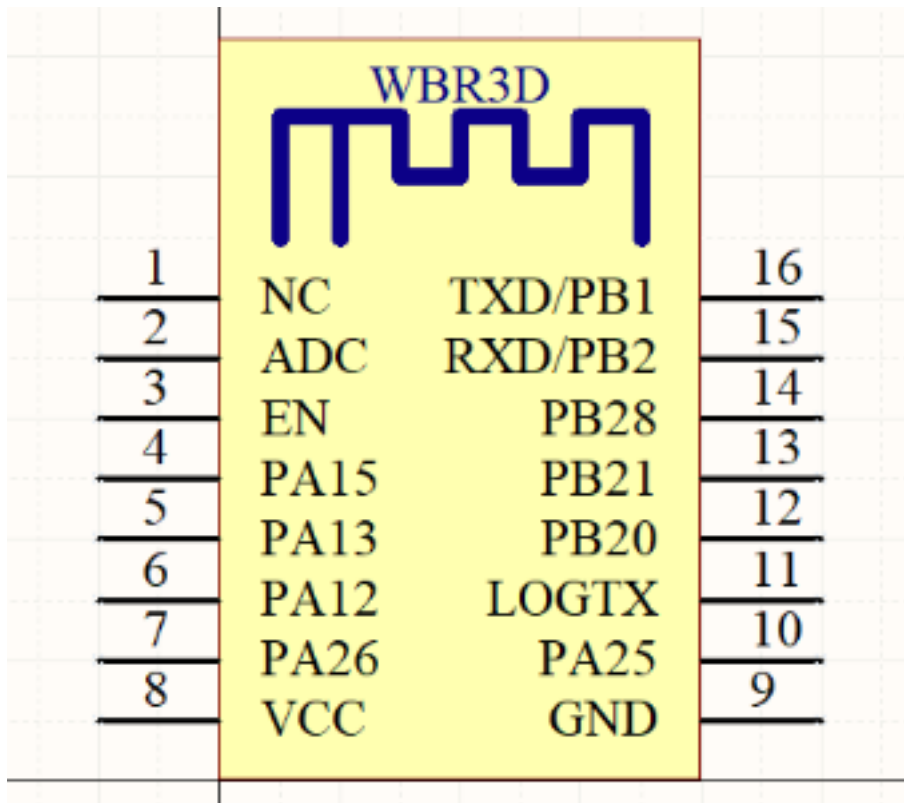


7.2 Side view



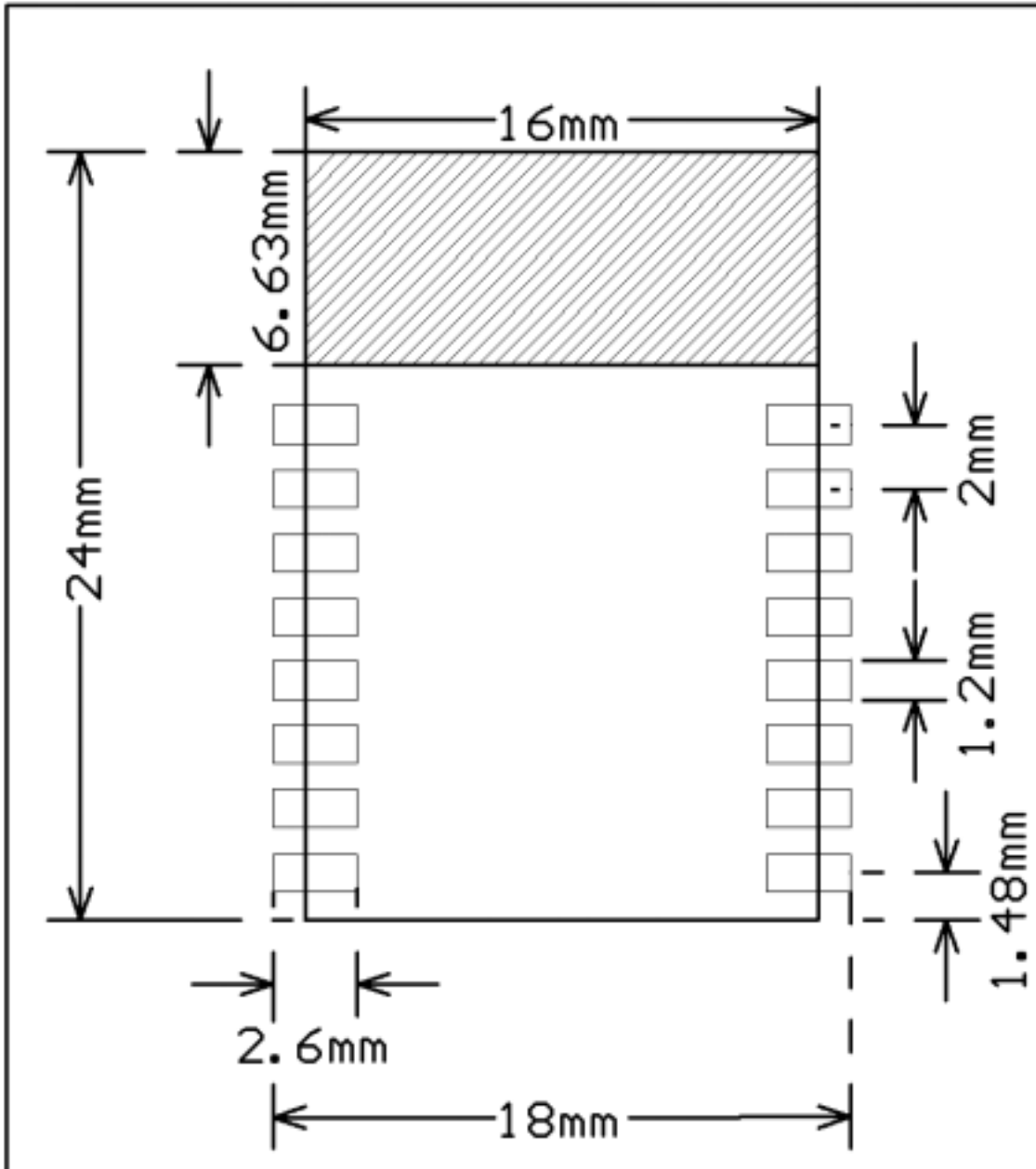
The default dimensional tolerance is ± 0.3 mm. If a customer has other requirements, clearly specify them in the datasheet after communication.

7.3 Schematic packaging



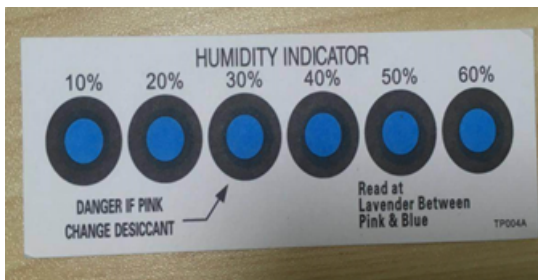
7.4 Recommended PCB Encapsulation

7.5 PCB encapsulation-SMT



7.6 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. A.SMT placement equipment
a)Reflow soldering machine b)Automated optical inspection (AOI) equipment
c)Nozzle with a 6 mm to 8 mm diameter B.Baking equipment a)Cabinet oven
b)Anti-static heat-resistant trays c)Anti-static heat-resistant gloves
2. Storage conditions for a delivered module are as follows: A.The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%. B.The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed. C.The package contains a humidity indicator card (HIC).



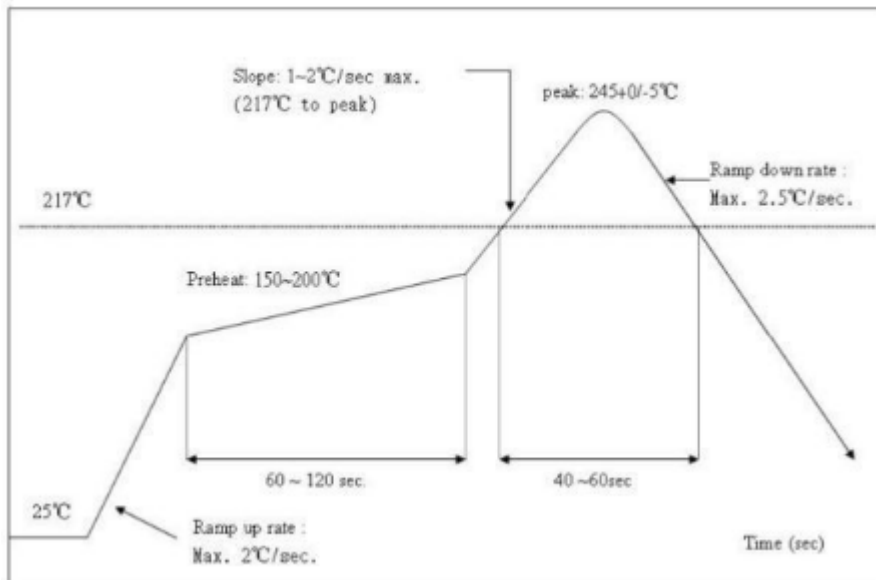
3. Bake a module based on HIC status as follows when you unpack the module package: A.If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours. B.If the 30% circle is pink, bake the module for 4 consecutive hours. C.If the 30% and 40% circles are pink, bake the module for 6 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±5°C B.Alarm temperature: 130°C C.SMT placement ready temperature after natural cooling: < 36°C D.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 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.

7.7 Recommended Oven Temperature Curve

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

Refer to IPC/JEDEC standard; Peak Temperature: <245°C; Number of Times: ≤2 times;



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 Packing Information

product model	MOQ (pcs)	Delivery packing method	pcs	Number of reels per carton
WBR3D	4000	Loaded with 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 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 be 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 has got a FCC ID: 2ANDL-WBR3D. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBR3D"

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 20cm to the human body.