



WBR3N Datasheet

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

Version: 20200731

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1 Product Overview

WBR3N is a low-power embedded WiFi+BT module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8720CS), a few peripherals, an embedded WiFi network protocol stack, the BT network protocol, and varied library functions. WBR3N has an embedded low-power 32-bit CPU, 512 KB static random-access memory (SRAM), 4 MB flash memory, and rich peripherals. WBR3N 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.

1.1 Features

1. Embedded low-power 32-bit CPU, which can also function as an application processor
2. The maximum clock rate: 200 MHz
3. Working voltage: 3.0 to 3.6 V
4. Peripherals: 8 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 analog to digital converter (ADC)
5. WiFi connectivity
 - 802.11b/g/n 1x1 2.4 G
 - Channels 1 to 14 at 2.4 GHz
 - Support WPA and WPA2 security modes
 - Up to +17.5 dBm output power in 802.11b mode
 - Support STA/AP/STA+AP working modes
 - Support SmartConfig and AP network configuration manners for Android and iOS devices
 - Onboard PCB antenna with a gain of 2.5 dBi at 2.4 G
 - Working temperature: -20 to 85°C
6. BT/BLE connectivity
 - Support BLE V5.0
 - Up to the output power of +9 dBm The default output power is 7dB.
 - PCB antenna with a gain of 2.5 dBi at 2.4 G shared with WiFi
 - Working temperature: -20 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

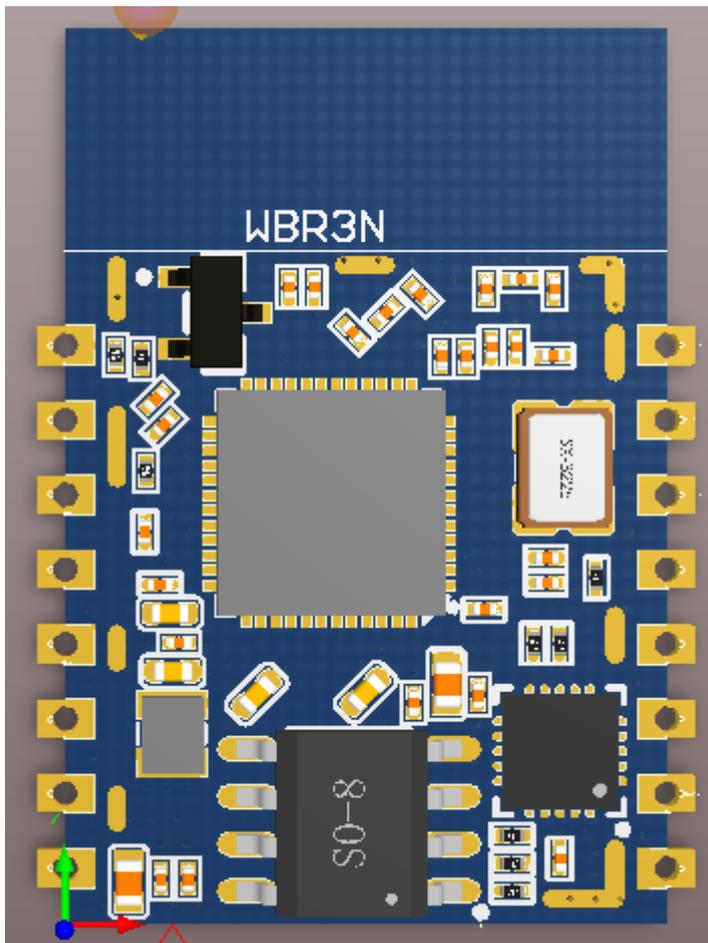
1.3 Change History

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

2 Module Interfaces

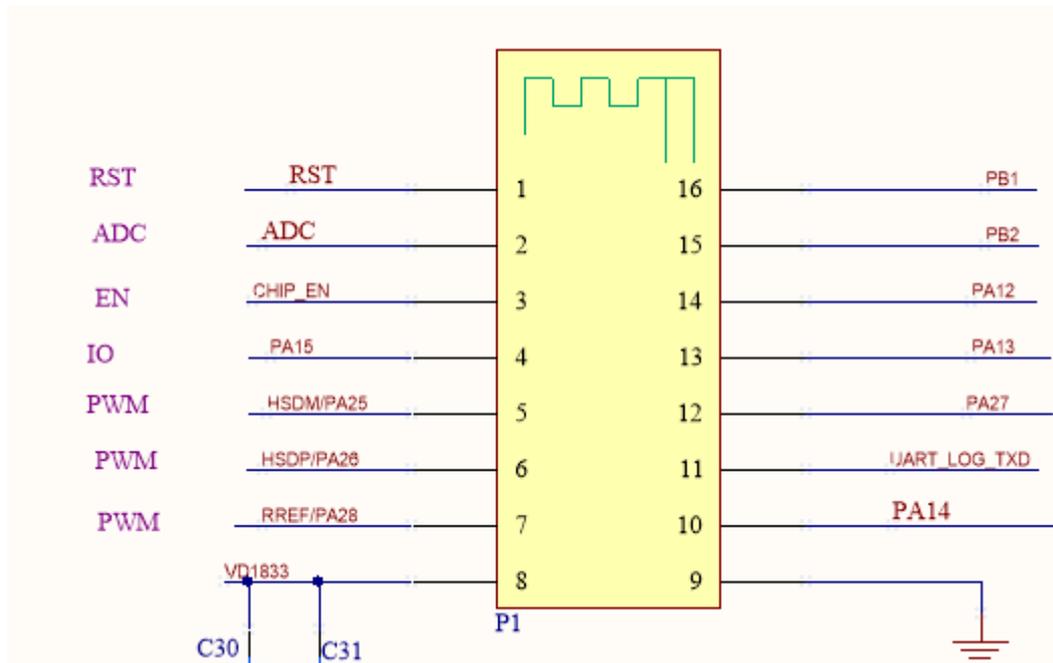
2.1 Dimensions and Footprint

WBR3N has two rows of pins with a 2 ± 0.1 mm pin spacing. The WBR3N dimensions are 16 (W)×24 (L) ×3.0mm (H). The diagram of dimensions of WBR3N is as follows:



Note: The general shape tolerance is ± 0.35 mm, the position tolerance related to the plug-in assembly is reduced to ± 0.1 mm, and the tolerance of the 0.8-mm-thick plate is ± 0.1 mm.

2.2 Pin Definition



Serial Number	Symbol	I/O Type	Function
1	RST	I/O	Reset
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 3.3V in normal cases and corresponds to CHIP_EN of IC
4	PA15	I/O	Common IO pin, which corresponds to PA 15 of IC

Serial Number	Symbol	I/O Type	Function
5	PA25	P	Support hardware PWM and correspond to PA 25 of IC
6	PA26	I/O	Support hardware PWM and correspond to PA 26 of IC
7	PA28	I/O	Support hardware PWM and correspond to PA 28 of IC
8	3V3	P	Power supply source (3.3V)
9	GND	P	Power supply reference ground
10	PA14	O	Common IO pin, which corresponds to PA 14 of IC
11	L_TX	O	UART0_TXD, which is used for displaying the internal information of a module and corresponds to UART_TXD of IC
12	PA27	I/O	Common IO pin, which corresponds to PA 27 of IC

Serial Number	Symbol	I/O Type	Function
13	PA13	I/O	Support hardware PWM and correspond to PA 13 of IC
14	PA12	I/O	Support hardware PWM and correspond to PA 12 of IC
15	RX/PB2	I/O	UART0_RXD ⁽²⁾ , which corresponds to PB 2 of IC
16	TX/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 resetting 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 port, the input voltage range is 0 to 1.0V. (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 Electrical Parameters

3.1 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

3.2 Normal Working 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

3.3 TX and RX Power Consumption:

3.3.1 Transmission and Receiving at 2.4G

Working Status	Mode	Rate	Transmit Power/Receiving	Maximum Value (Typical Value)	Unit
Transmission	11b	11 Mbps	+17.5 dBm	250	mA
Transmission	11g	54 Mbps	+14.5 dBm	200	mA
Transmission	11n-HT20	MCS7	+14.5 dBm	200	mA
Transmission	11n-HT40	MCS7	+13.5 dBm	162	mA
Receiving	11b	11 Mbps	constantly receive	70	mA

Working Status	Mode	Rate	Transmit Power/Receiving	Maximum Value (Typical Value)	Unit
Receiving	11g	54 Mbps	constantly receive	72	mA
Receiving	11n-HT20	MCS 7	constantly receive	70	mA
Receiving	11n-HT40	MCS 7	constantly receive	73	mA

3.4 Working Current

Working Mode	Working Status, Ta = 25°C	Average Value	Maximum Value (Typical Value)	Unit
Quick connection network status	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 always flashes slowly	203	392	mA

Working Mode	Working Status, Ta = 25°C	Average Value	Maximum Value (Typical Value)	Unit
Network connection state	The module is connected to the network and the WiFi indicator is always on	55	98	mA
Disconnected status	The module is disconnected and the WiFi indicator is dark	53	59	mA

4 RF Parameters

4.1 Basic RF Features

Parameter	Description
Working frequency	WiFi: 2.412 to 2.484 Ghz (channels 1 to 11 for US/CA and channels 1 to 13 for EU/CN); Bluetooth: 2402 to 2480 MHz
WiFi standard	IEEE 802.11 b/g/n
Data transmission rate	WiFi: 11b: 1, 2, 5.5, 11 (Mbps); 11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps); 11n: HT20 MCS 0 to 7; HT40 MCS 0 to 7; Bluetooth: 1M/2M
Antenna Type	PCB antenna with a gain of 2.5 dBi at 2.4 G

4.2 TX Performance

TX Performance at 2.4 G

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK Mode, 1 Mbit/s	-	17.5	-	dBm
Average RF output power, 802.11g OFDM mode, 54 Mbit/s	-	14.5	-	dBm
Average RF output power, 802.11n HT20 mode, MCS7	-	14.5	-	dBm
Average RF output power, 802.11n HT40 mode, MCS7	-	13.5	-	dBm
Frequency error	-10	-	10	ppm

4.3 RX Performance

RX sensitivity

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 11M	-	-90	-	dBm
PER<10%, RX sensitivity, 802.11g, 54 M	-	-77	-	dBm
PER<10%, RX sensitivity, 802.11n HT20-MCS7	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n HT20-MCS7	-	-72	-	dBm

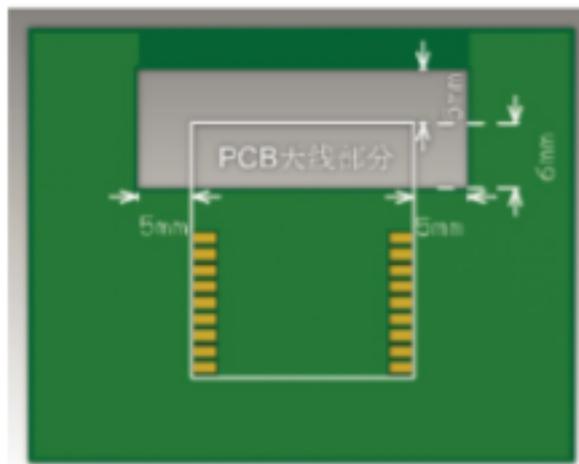
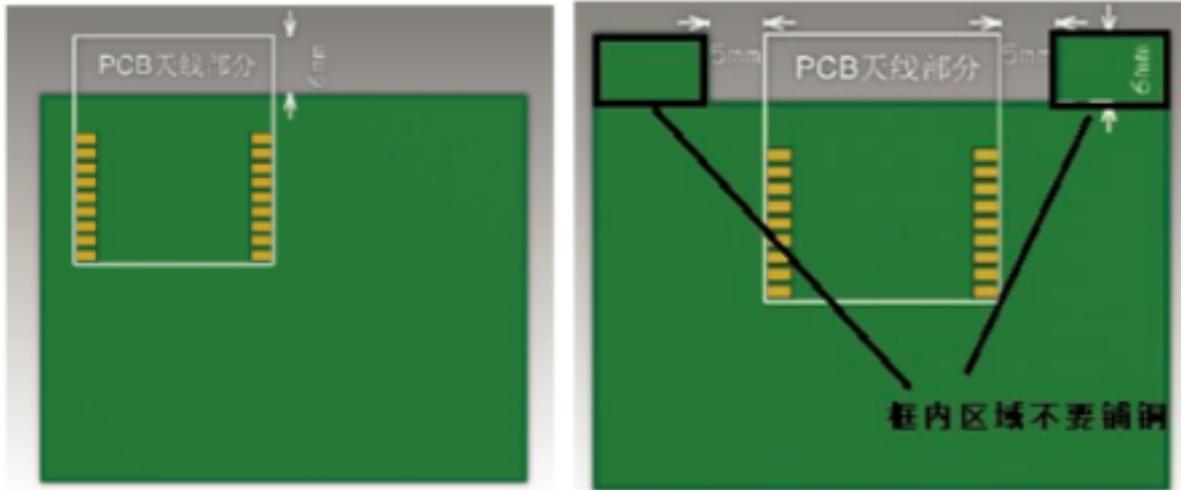
5 Antenna Information

5.1 Antenna Type

WBR3N uses only an onboard PCB antenna.

5.2 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.

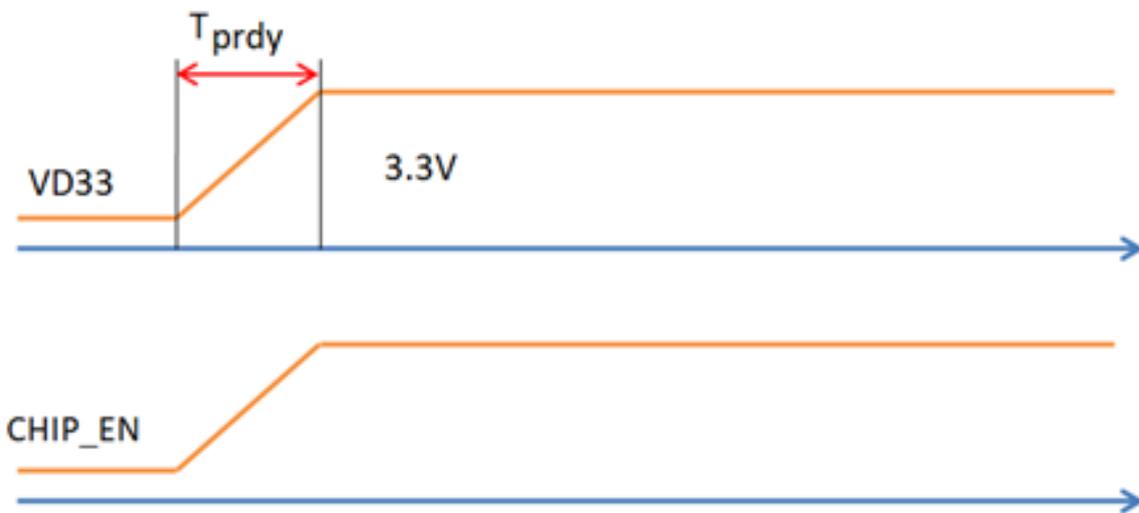


For the antenna area of the PCB of the module, refer to Diagram of Mechanical Dimensions.

6 Power-on Sequence and Resetting

6.1 Power-on Sequence

The RTL8720CS chip has requirements on the power-on sequence. It is recommended that the voltage rise from 0 to 3.3V within 40mS

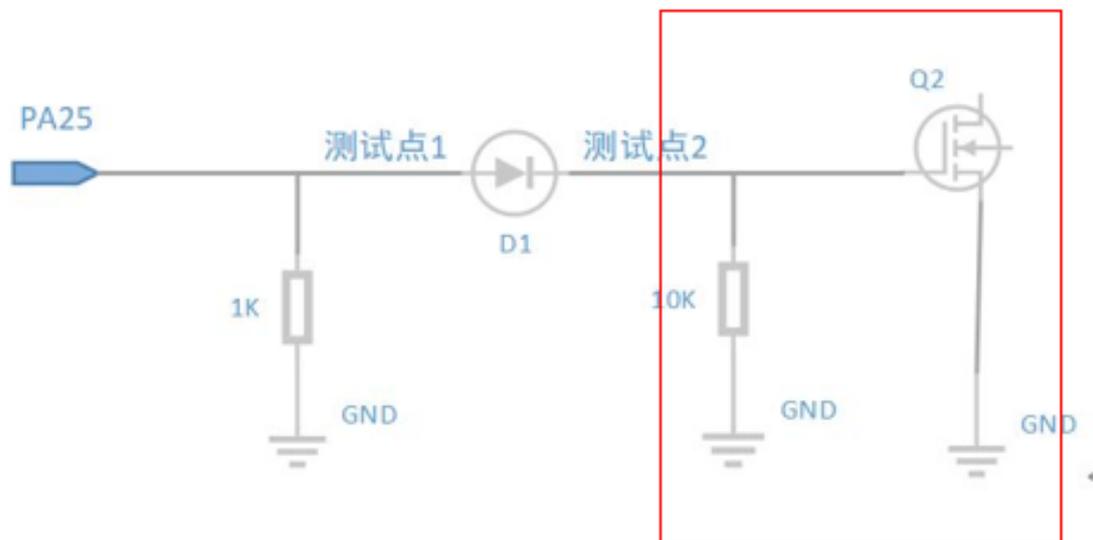


Symbol	Parameter	Minimum Value	Typical Value	Maximum Value	Unit
TPRDY	3.3V ready time	0.6		40	mS
CHIP_EN	CHIP_EN ready time	0.6		40	mS

6.2 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 power-on, refer to the following processing: Pull down a 1K 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

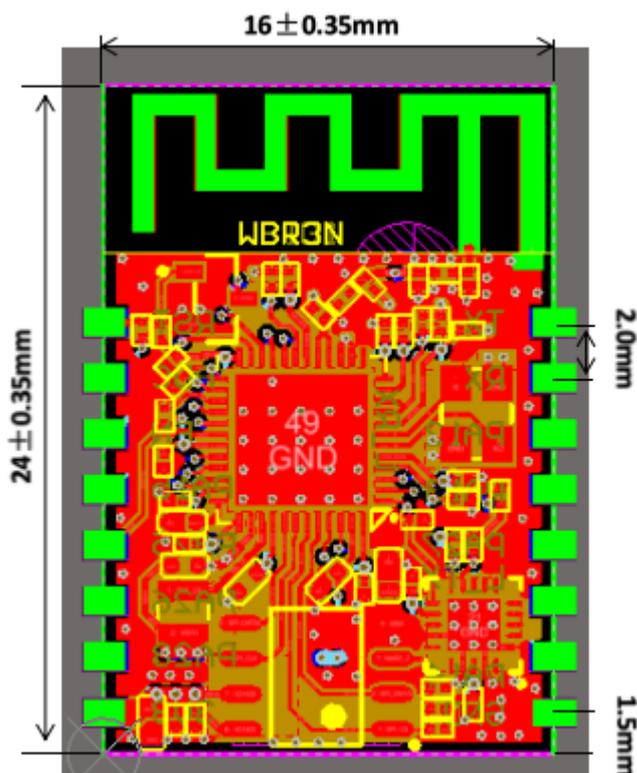
to about 2.7V after passing through the diode. The red box represents the original drive tube on the customer's baseboard. A diode D1 and pull-down 1K resistor need to be added. If a lamp is directly driven, pull down a 10K resistor on the grid of the positive Mos. If a lamp is not directly driven and 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 WBR3N dimensions are 16mm (W)×24mm (L) ×3.0mm (H).



Note: The default dimensional tolerance is ± 0.35 mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

7.2 Production Instructions

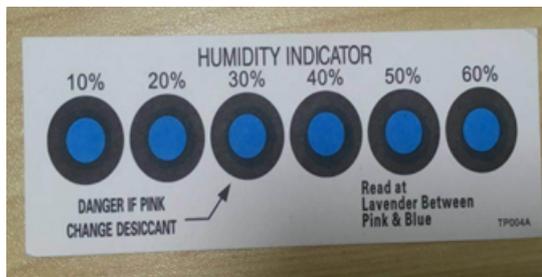
1. Use an SMT placement machine to mount the stamp hole module that Tuya produces onto the PCB within 24 hours after the module is unpacked and the firmware is burned. If not, vacuum pack the module again. Bake the module before mounting it onto the PCB.
 - A. SMT placement equipment
 - a) Reflow soldering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

- The moisture-proof bag must be placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.
- The shelf life of a dry-packaged product is 6 months from the date when the product is packaged and sealed.
- 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 blue, bake the module for 12 consecutive hours.

4. Baking settings:

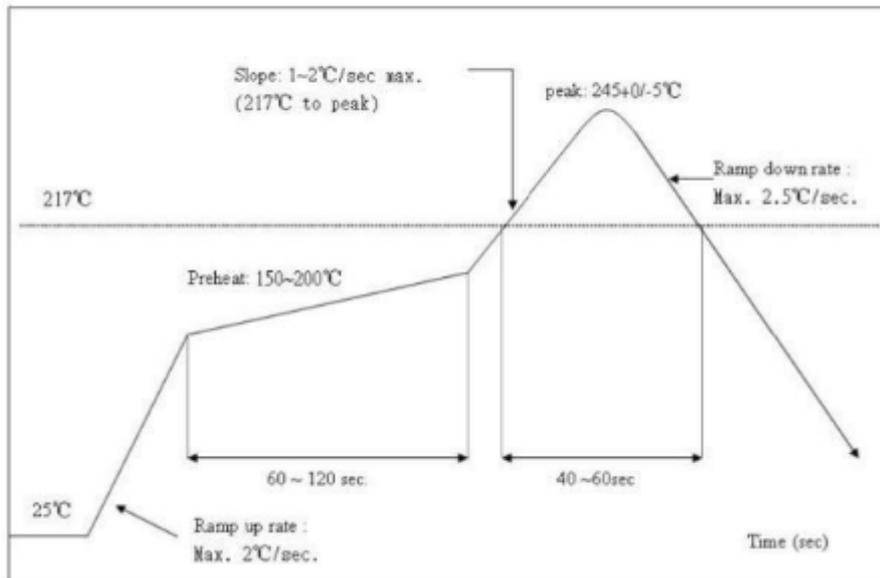
- A. Baking temperature: 125±5°C
- B. Baking time: 130°C
- C. SMT placement ready temperature after natural cooling: < 36°C
- D. The number of drying times: 1
- E. Rebaking condition: The module is not soldered within 12 hours after baking.

5. Do not use SMT to process modules that have been unpacked for more than 3 months. Electroless nickel immersion gold (ENIG) is used for the PCBs. If the solder pads are exposed to the air for more than 3 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 the first SMT placement 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.

7.3 Recommended Oven Temperature Curve

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

Refer to IPC/JEDEC standard; Peak Temperature: $245\pm 5^{\circ}\text{C}$; Number of Times: ≤ 2 times;



7.4 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)
WBR3N		Tape reel		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-WBR3N. The final end product must be labeled in a viApple area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBR3N"

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.