



WBR2 Module Datasheet

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

Version: 20200810

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1 Product Overview

WBR2 is a low-power embedded WiFi+BLE module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8720CF), with an embedded WiFi network protocol stack and varied library functions. With the maximum CPU clock rate of 100MHz, WBR2 also contains a low-power KM4 microcontroller unit (MCU), a WLAN MAC, a 1T1R WLAN module, 256 KB static random-access memory (SRAM), 2 MB flash memory, and extensive peripherals. WBR2 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 KM4 MCU, which can also function as an application processor; Clock rate: 100MHz
2. Working voltage: 3.0 to 3.6V
3. Peripherals: 6 GPIOs and 1 universal asynchronous receiver/transmitter (UART)
4. WiFi/BT connectivity
 - 802.11 B/G/N20
 - Channels 1 to 14 at 2.4 Ghz (channels 1 to 11 for US/CA and channels 1 to 13 for EU/CN)
 - Support BLE (Bluetooth Low Energy) 4.2
 - Support WEP/WPA/WPA2/WPA2 PSK (AES) security modes
 - Up to +20 dBm output power in 802.11b mode
 - Support SmartConfig functions for Android and iOS devices
 - Onboard PCB antenna
 - Passed CE and FCC certification
 - 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

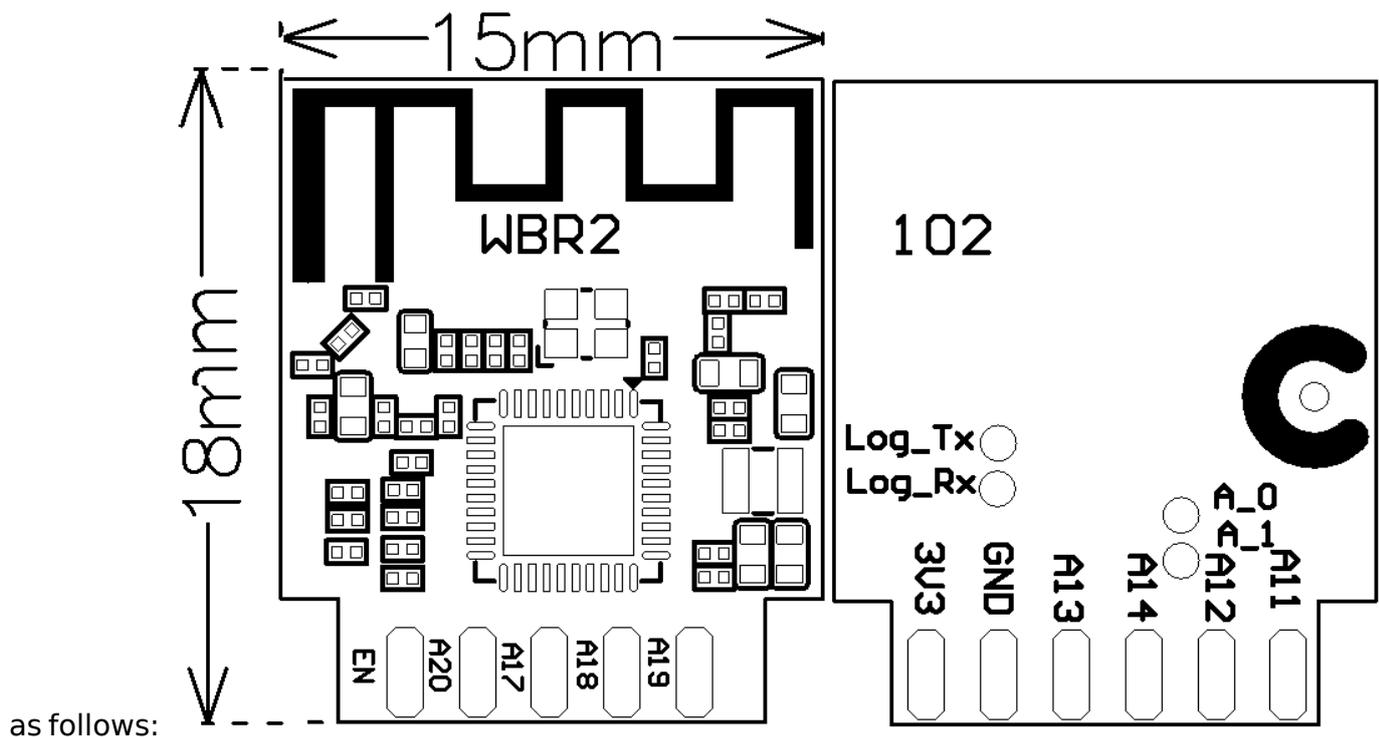
2 Change History

Serial Number	Update Date	Updated Content	Version after Update
1	10/28/2019	This is the first release.	V1.0.0

3 Module Interfaces

3.1 Dimensions and Footprint

WBR2 has two rows of pins with a 2mm pin spacing. The WBR2 dimensions are 15 ± 0.35 mm (W) \times 18 ± 0.35 mm (L) \times 2.9 ± 0.15 mm (H). The dimensions of WBR2 are



3.2 Pin Definition

The definition of interface pins is shown in the following table:

Pin Number	Symbol	IO Type	Function
1	3V3	/	Power supply pin (3.3V)
2	A19	I/O	GPIOA_19, hardware PWM, IC Pin40
3	GND	P	Power supply reference ground
4	A18	I/O	GPIOA_18, hardware PWM, IC Pin39
5	A13	I/O	GPIOA_13, UART0_RXD, which is used as a user-side serial interface pin
6	A17	I/O	GPIOA_17, hardware PWM, IC Pin38
7	A14	I/O	GPIOA_14, UART0_TXD, which is used as a user-side serial interface pin
8	A20	I/O	GPIOA_20, common GPIO, IC Pin1
9	A12	I/O	GPIOA_12, hardware PWM, IC Pin26

Pin Number	Symbol	IO Type	Function
10	EN	I/O	Enabling pin, which works at the high level and is pulled up and controlled by a user externally
11	A11	I/O	GPIOA_11, hardware PWM, IC Pin25

Note: P indicates power supply pins and I/O indicates input/output pins.

4 Electrical Parameters

4.1 Absolute Electrical Parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	-40	105	°C
VDD	Power supply voltage	-0.3	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 Working Conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	-20	-	85	°C
VDD	Working voltage	3.0	-	3.6	V
VIL	I/O low-level input	-	-	0.8	V

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
VIH	I/O high-level input	2.0	-	-	V
VOL	I/O low-level output	-	-	0.4	V
VOH	I/O high-level output	2.4	-	-	V
I _{max}	I/O drive current	-	-	16	mA
C _{pad}	Input pin capacitance	-	2	-	pF

4.3 RF Power Consumption

1. TX power consumption:

Symbol	Mode	Power	Average Value	Peak Value (Typical Value)	Unit
IRF	11b 11Mbps	17 dBm	217	268	mA
IRF	11b 11Mbps	18 dBm	231	283	mA
IRF	11g 54Mbps	15 dBm	159	188	mA
IRF	11g 54Mbps	17.5 dBm	177	213	mA

Symbol	Mode	Power	Average Value	Peak Value (Typical Value)	Unit
IRF	11n BW20 MCS7	13 dBm	145	167	mA
IRF	11n BW20 MCS7	16.5 dBm	165	193	mA

2. RX power consumption:

Symbol	Mode	Average Value	Peak Value (Typical Value)	Unit
IRF	11B 11M	63	65	mA
IRF	11G 54M	65	67	mA
IRF	11N HT20 MCS7	65	67	mA

4.4 Working Power Consumption

Working Mode	Working Status (Ta = 25°C)	Average Value	Peak Value (Typical Value)	Unit
Quick connection network status	The module is in the fast network connection state and the WiFi indicator always flashes	75	324	mA

Working Mode	Working Status (Ta = 25°C)	Average Value	Peak Value (Typical Value)	Unit
Network connection idle state	The module is connected to the network and the WiFi indicator is always on	64	314	mA
Network connection operation status	The module is connected to the network and the WiFi indicator is always on	66	305	mA
Disconnected status	The module is offline and the WiFi indicator is dark	66	309	mA

5 RF Parameters

5.1 Basic RF Features

Parameter	Description
Frequency range	2.400 to 2.4835 GHz
WiFi standard	IEEE 802.11b/g/n (channels 1 to 14)
BLE standard	Bluetooth 4.2
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps)
Data transmission rate	11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps)

Parameter	Description
Data transmission rate	11n: HT20 MCS0~7
Antenna Type	PCB antenna with a gain of 2.5 dBi

5.2 TX Performance

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 OFDM mode, MCS7	-	13.5	-	dBm
Average RF output power, BLE 4.2, 1 Mbit/s	-	6.5	-	dBm
Frequency error	-20	-	20	ppm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
EVM@802.11b - CCK 11Mbps Mode 17.5 dBm	-	-	-10	dB
EVM@802.11g - OFDM 54Mbps Mode 14.5 dBm	-	-	-29	dB
EVM@802.11n - OFDM MCS7 Mode 13.5 dBm	-	-	-30	dB

5.3 RX Performance

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-72	-	dBm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<10%, RX sensitivity, BLE 4.2 1M	-	-93	-	dBm

6 Antenna Information

6.1 Antenna Type

WBR2 uses only an onboard PCB antenna with a gain of 2.5dBi.

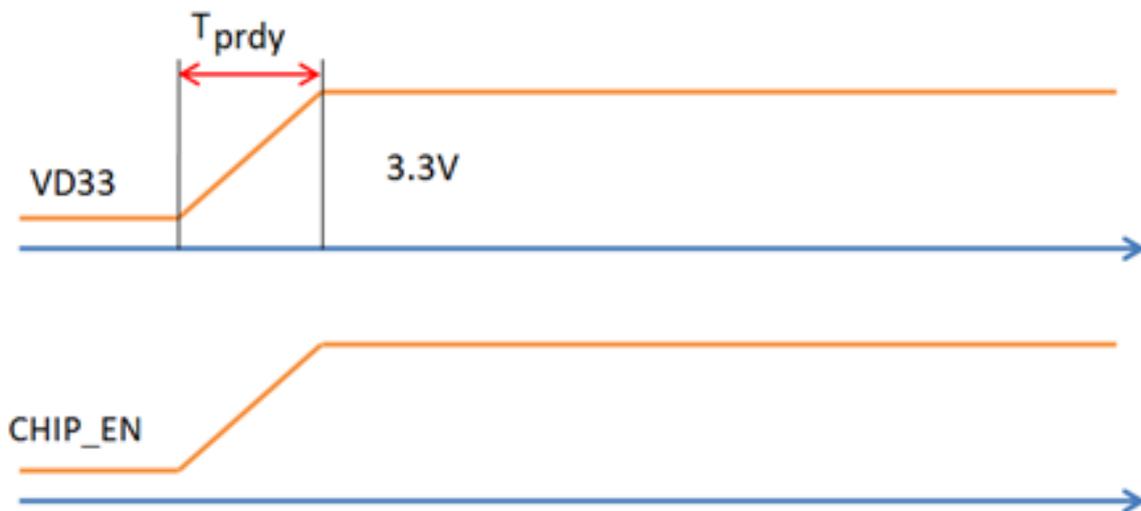
6.2 Antenna Interference Reduction

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.

7 Power-on Sequence and Resetting

7.1 Power-on Sequence

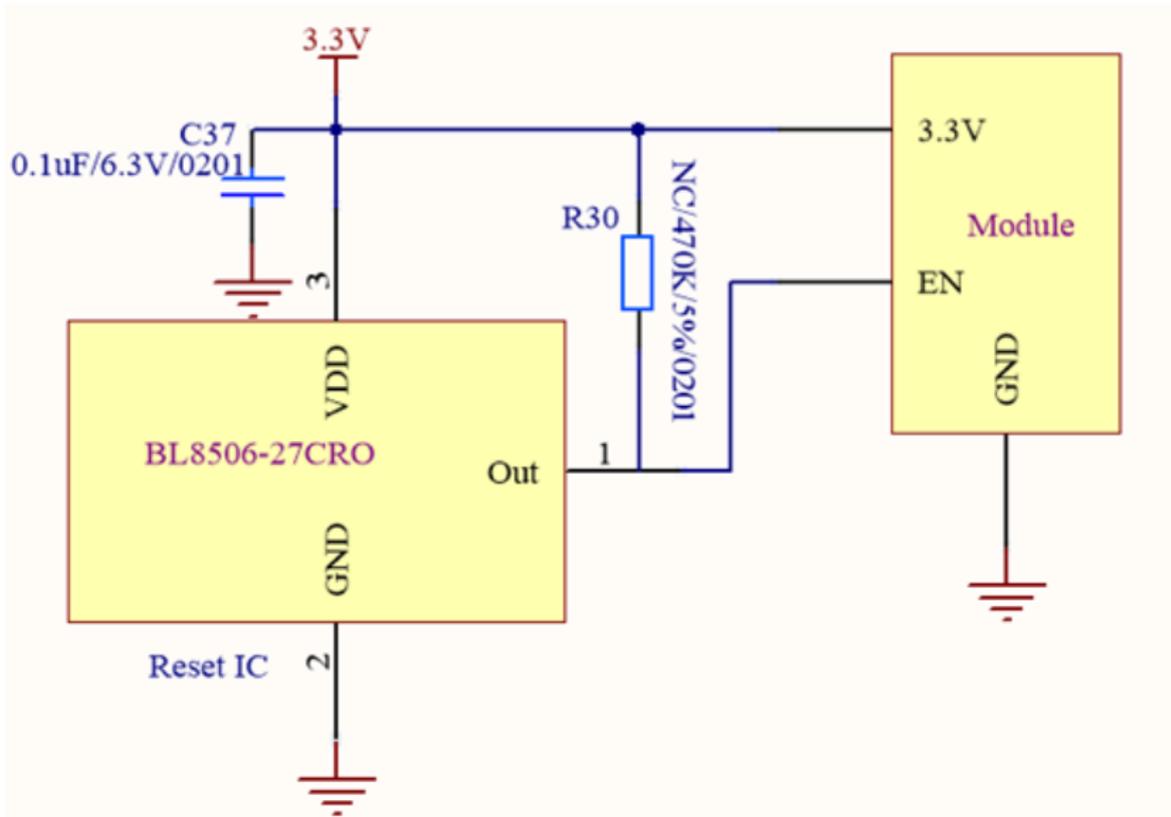
The RTL8720CF chip has requirements on the power-on sequence. It is recommended that the voltage rise from 0 to 3.3V within 40mS.



Symbol	Parameter	Minimum	Typical	Maximum	Unit
TPRDY	3.3V ready time	0.6		20	mS
CHIP_EN	CHIP_EN ready time	0.6		20	mS

7.2 Resetting

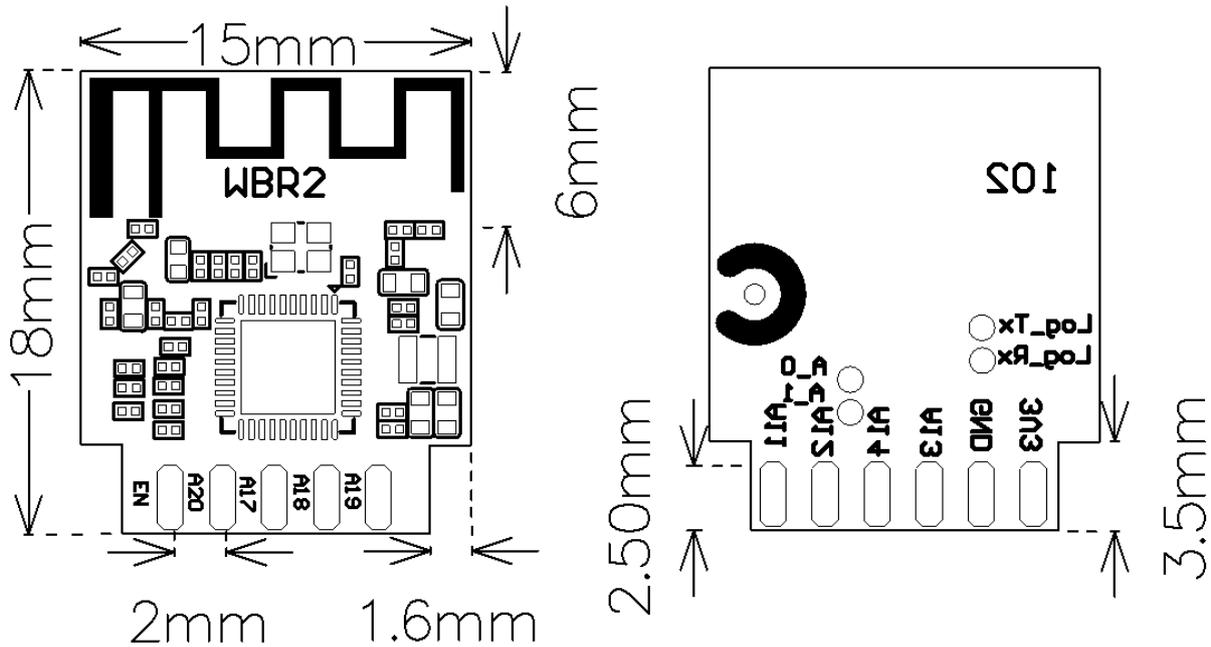
When designing a plate of a module, you should set a resetting IC at the foot of CHIP_EN in advance. The preferable type of IC is BL8506-27CRO. The module is packaged in the form of SOT23. Refer to the circuit in the following figure (R30 is preset and cannot be placed).



8 Packaging Information and Production Instructions

8.1 Mechanical Dimensions

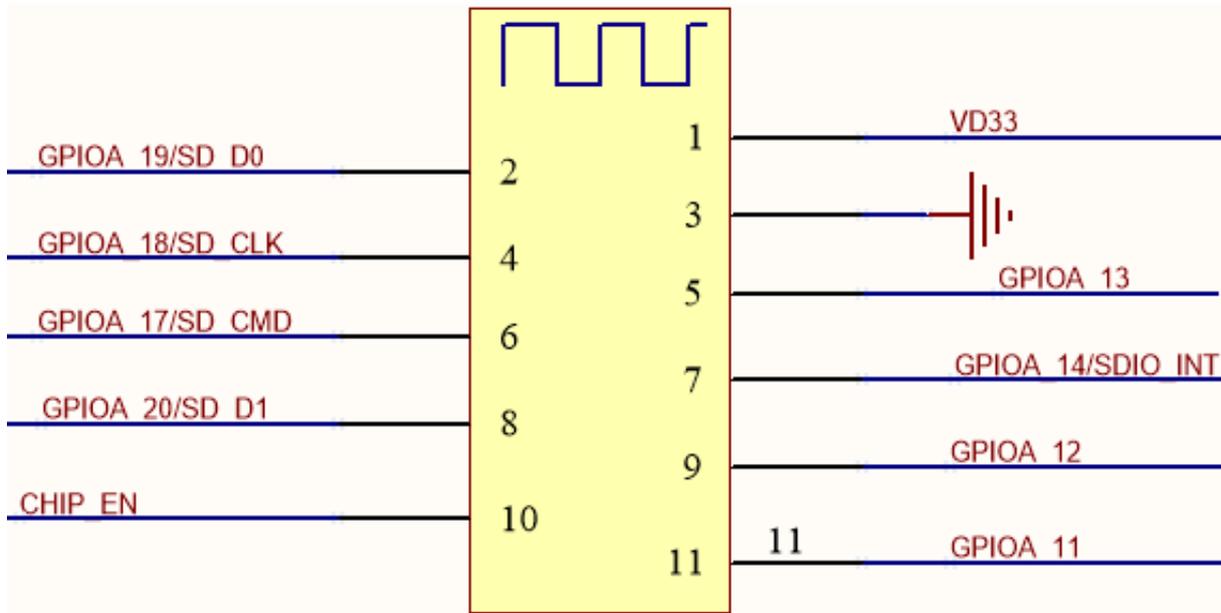
The mechanical dimensions of PCB of WBR2 are 15 ± 0.35 mm (W) \times 18 ± 0.35 mm (L) \times 0.8 ± 0.1 mm (H). The following figure shows mechanical dimensions of WBR2.



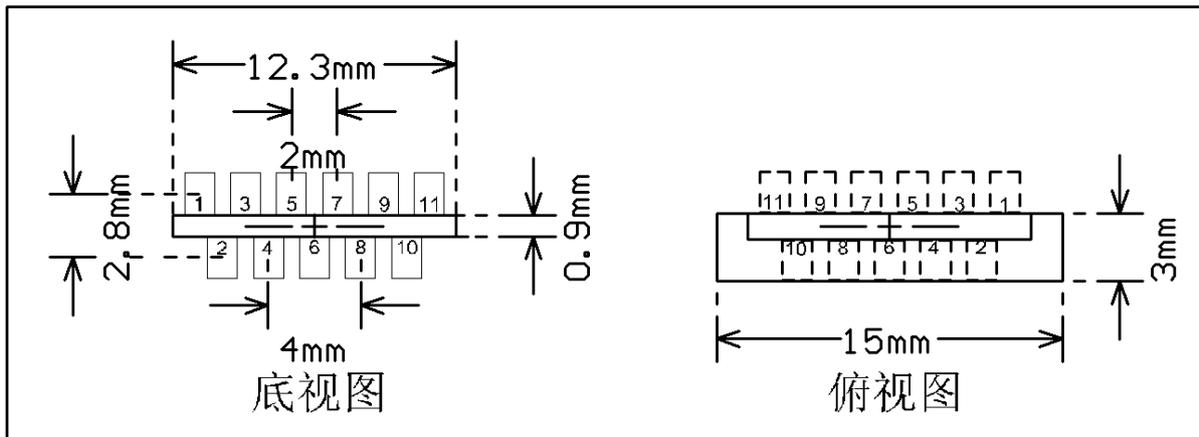
Note: The default dimensional tolerance is ± 0.35 mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

8.2 Recommended PCB Layout

The following figure is a schematic diagram of WBR2 which shows how pins correspond to each other.



WBR2 PCB Layout is shown as belows:



8.3 Production Instructions

1. For the in-line module developed by Tuya, wave soldering equipment is most preferred and manual soldering is less preferred. After unpacking, the module must be soldered within 24 hours; otherwise, vacuum packaging need to be carried out again.
 - A. Soldering equipment and materials: - Wave soldering equipment - Wave soldering fixture - Constant-temperature soldering iron - Tin bar, tin wire and flux - Oven temperature tester
 - B. Baking equipment: - Cabinet oven - Anti-static heat-resistant trays - Anti-static heat-resistant gloves

2. The module developed by Tuya needs to be baked in the following cases:

- Vacuum packaging bag was damaged before unpacking.
- There is no a humidity indicator card (HIC) in the vacuum packaging bag.
- After unpacking, 30% and above circles on the HIC become pink.
- Production is not completed within 72 hours after unpacking.
- More than 6 months after the date of sealing the bag.

3. Baking setting:

- Baking temperature: reel packing $65\pm 5^{\circ}\text{C}$, pallet packing $125\pm 5^{\circ}\text{C}$
- Baking time: reel packing 48 hours, pallet packing 12 hours
- Alarm Temperature : reel packing 70°C , pallet packing 130°C
- Production ready temperature after natural cooling: $< 36^{\circ}\text{C}$
- The number of baking times: 1
- Rebaking condition: The module is not soldered within 72 hours after baking.

4. Do not use wave soldering to process modules that have been unpacked for more than 3 months. Electroless nickel immersion gold (ENIG) is used for the PCBs. Wave soldering is very likely to cause false soldering and missing soldering. Tuya is not liable for such problems and consequences.

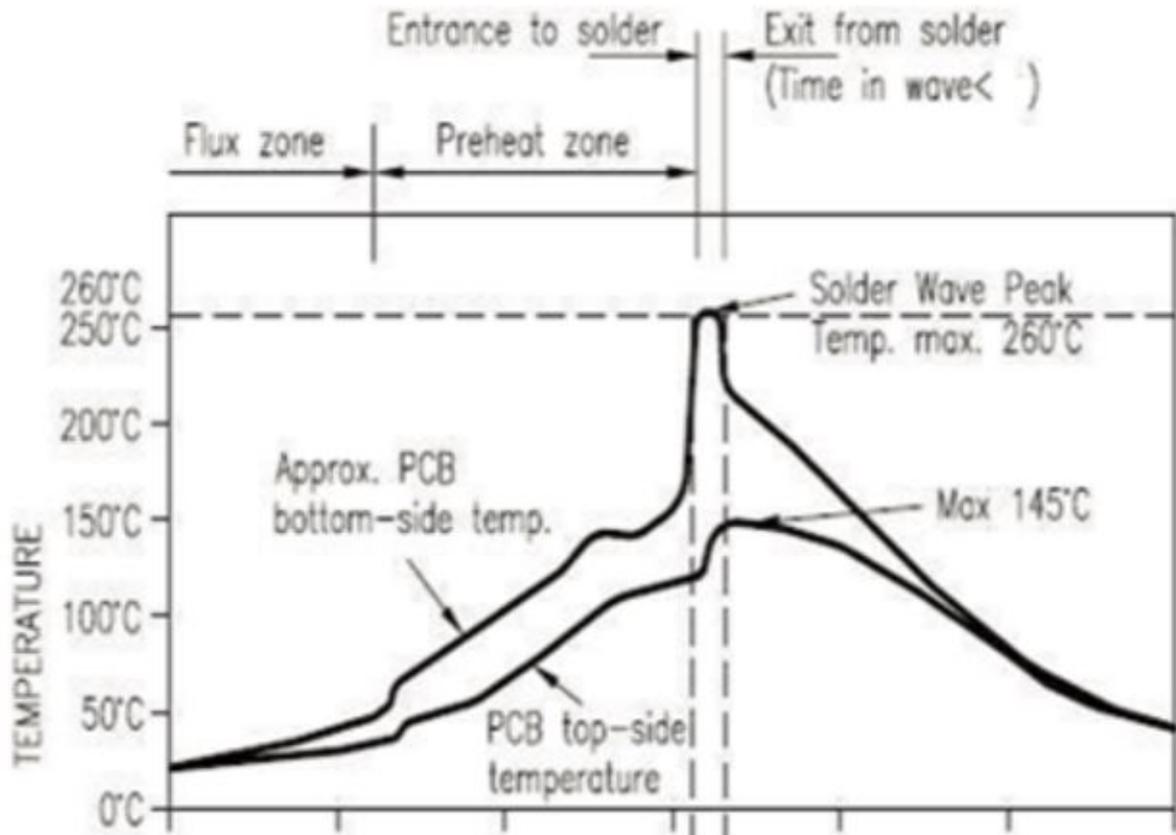
5. In the production process, take electrostatic discharge (ESD) protective measures.

6. To ensure the quality of products, you should pay attention to the amount of soldering flux, the height of the wave peak, whether the tin slag and copper content in the wave soldering tank exceed standards, whether the window and thickness of the wave soldering fixture are appropriate, and whether the wave soldering oven temperature curve is reasonable.

8.4 Recommended Oven Temperature Curve and Temperature

For oven temperature setting, refer to suggestions on oven temperatures for wave soldering. The peak temperature is $260\pm 5^{\circ}\text{C}$. The wave soldering temperature curve is as follows:

DIP Type Product Pass Wavesolder Graph

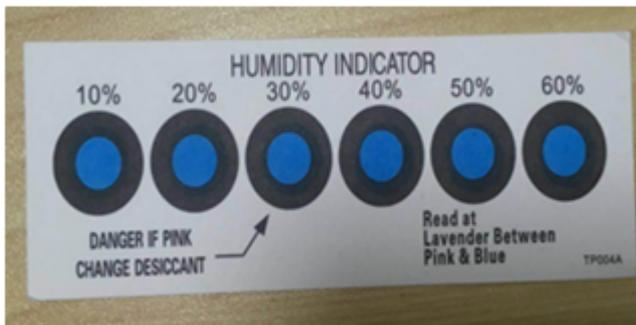


Suggestions on oven temperatures for wave solering

Recommended Wave Soldering Oven Temperature Curve		Recommended Manual Soldering Temperature	
Pre-heat temperature	80 to 130°C	Soldering temperature	360 ± 20°C
Pre-heat time	75 to 100s	Soldering time	< 3s/point
Peak constant time	3 to 5s	NA	NA
Temperature of tin cylinder	260 ± 5°C	NA	NA
	≤ 2°C/s	NA	NA
Ramp-down slope	≤ 6°C/s	NA	NA

8.5 Storage Conditions

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 6 months from the date when the product is packaged and sealed. C. The package contains a humidity indicator card (HIC).





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

9 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)
WBR2	4400	Tape reel	1100	4

10 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-WBR2. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBR2" . 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.