



# WBR1 Module Datasheet

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

Version: 20200810

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## 1 Product Overview

WBR1 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, WBR1 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. WBR1 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 3.6 V
3. Peripherals: 7 GPIOs, 2 universal asynchronous receiver/transmitter
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°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

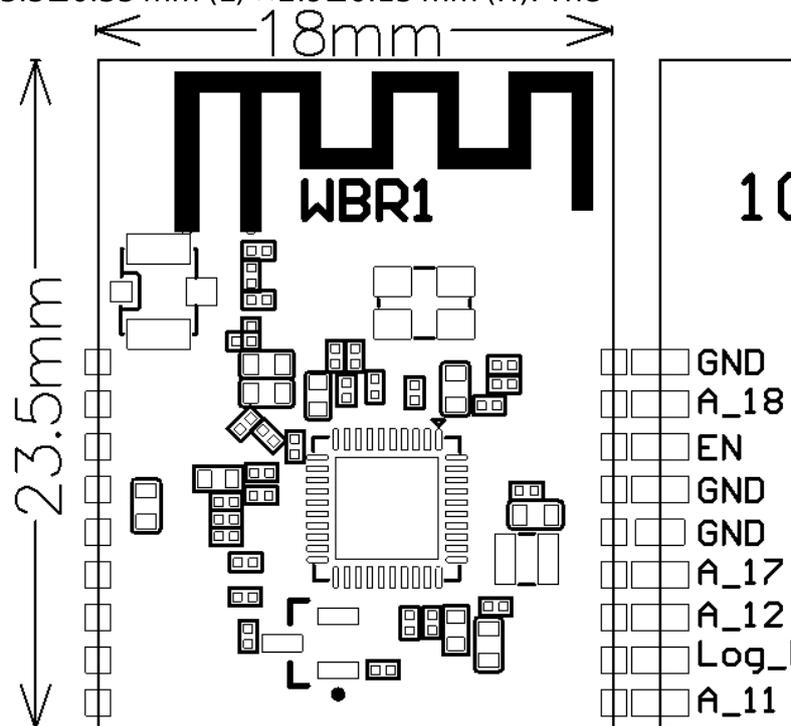
## 2 Change History

Serial Number	Update Date	Updated Content	Version after Update
1	10/21/2019	This is the first release.	V1.0.0

## 3 Module Interfaces

### 3.1 Dimensions and Footprint

WBR1 has two rows of pins with a 1.5 mm pin spacing. Each row has 9 pins. The WBR1 dimensions are  $18 \pm 0.35$  mm (W)  $\times$   $23.5 \pm 0.35$  mm (L)  $\times$   $2.9 \pm 0.15$  mm (H). The



dimensions of WBR1 are shown as follows:

### 3.2 Pin Definition

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

Pin Number	Symbol	I/O Type	Function
1	Vin	P	UART_TX, Power supply conversion (5V or 3.3V)
2	TX	I/O	GPIOA_14, UART_TX, which is used as a user-side serial interface pin
3	RX	I/O	GPIOA_13, UART_RX, which is used as a user-side serial interface pin
4	3V3	P	Power supply pin (3.3V)
5	GND	P	Power supply reference ground
6	A_2	I/O	GPIOA_2, hardware PWM, IC Pin 18
7	A_3	I/O	GPIOA_3, hardware PWM, IC Pin 19
8	Log_Tx	P	GPIOA_16, UART_Log_TXD, which is used for displaying the module internal information and can be configured as a common GPIO

Pin Number	Symbol	I/O Type	Function
9	A_4	I/O	GPIOA_4, hardware PWM, IC Pin 20
10	A_11	I/O	GPIOA_11, hardware PWM, IC Pin 25
11	Log_Rx	I/O	GPIOA_15, UART_Log_RXD, which is used for displaying the module internal information and can be configured as a common GPIO
12	A_12	I/O	GPIOA_12, hardware PWM, IC Pin 26
13	A_17	I/O	GPIOA_17, hardware PWM, IC Pin 38
14	GND	P	Power supply reference ground
15	GND	P	Power supply reference ground
16	EN	I/O	Enabling pin, which works at the high level and is pulled up and controlled by a user externally

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Pin Number	Symbol	I/O Type	Function
17	A_18	I/O	GPIOA_18, hardware PWM, IC Pin 39
18	GND	P	Power supply reference ground

---

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

## 4 Electrical Parameters

### 4.1 Absolute Electrical Parameters

Parameter	Description	Minimum/Maximum		Unit				
		Value	Value					
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	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
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 <sub>max</sub>	I/O drive current	-	-	16	mA
C <sub>pad</sub>	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	17dBm	217	268	mA
IRF	11b 11Mbps	18dBm	231	283	mA
IRF	11g 54Mbps	15dBm	159	188	mA
IRF	11g 54Mbps	17.5dBm	177	213	mA
IRF	11n BW20 MCS7	13dBm	145	167	mA
IRF	11n BW20 MCS7	16.5dBm	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
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)
Data transmission rate	11n: HT20 MCS0~7
Antenna Type	PCB antenna with a gain of 2.5dBi (default); Antenna to which a U.FL RF connector is externally connected (optional)

## 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

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, BLE 4.2, 1 Mbit/s	-	6.5	-	dBm
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11Mbps Mode 17.5dBm	-	-	-10	dB
EVM@802.11g OFDM 54Mbps Mode 14.5dBm	-	-	-29	dB
EVM@802.11n OFDM MCS7 Mode 13.5dBm	-	-	-30	dB

### 5.3 RX Performance

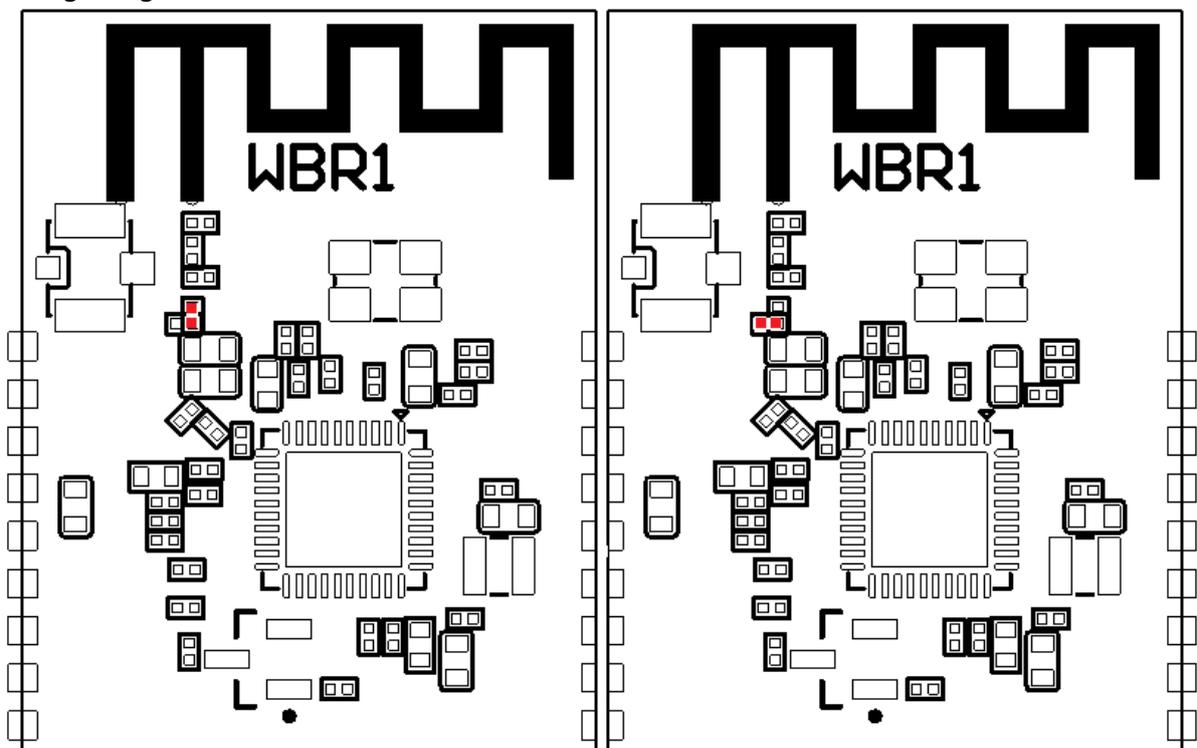
Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-75	-	dBm

Parameter	Minimum Value	Typical Value	Maximum Value	Unit
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-72	-	dBm
PER<10%, RX sensitivity, BLE 4.2 1M	-	-93	-	dBm

## 6 Antenna Information

### 6.1 Antenna Type

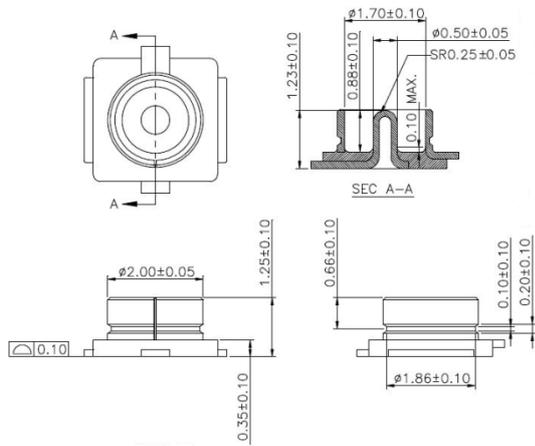
WBR1 uses two types of antennas: onboard PCB antenna and external antenna. By default, the onboard PCB antenna is preferred. You can select either of them by configuring a resistance.



### 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.

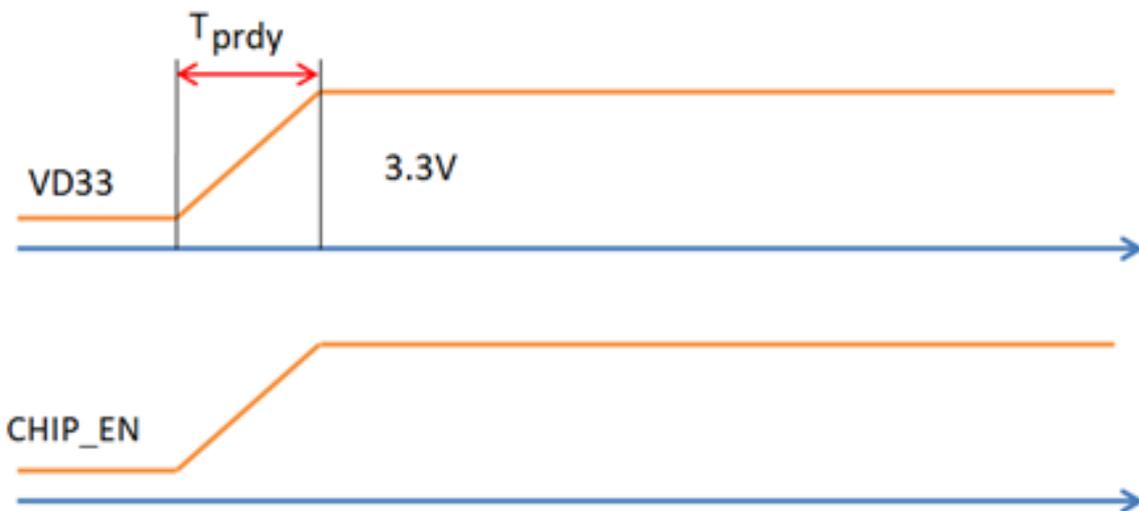
### 6.3 Antenna Connector Specifications



## 7 Power-on Sequence and Resetting

### 7.1 Power-on Sequence

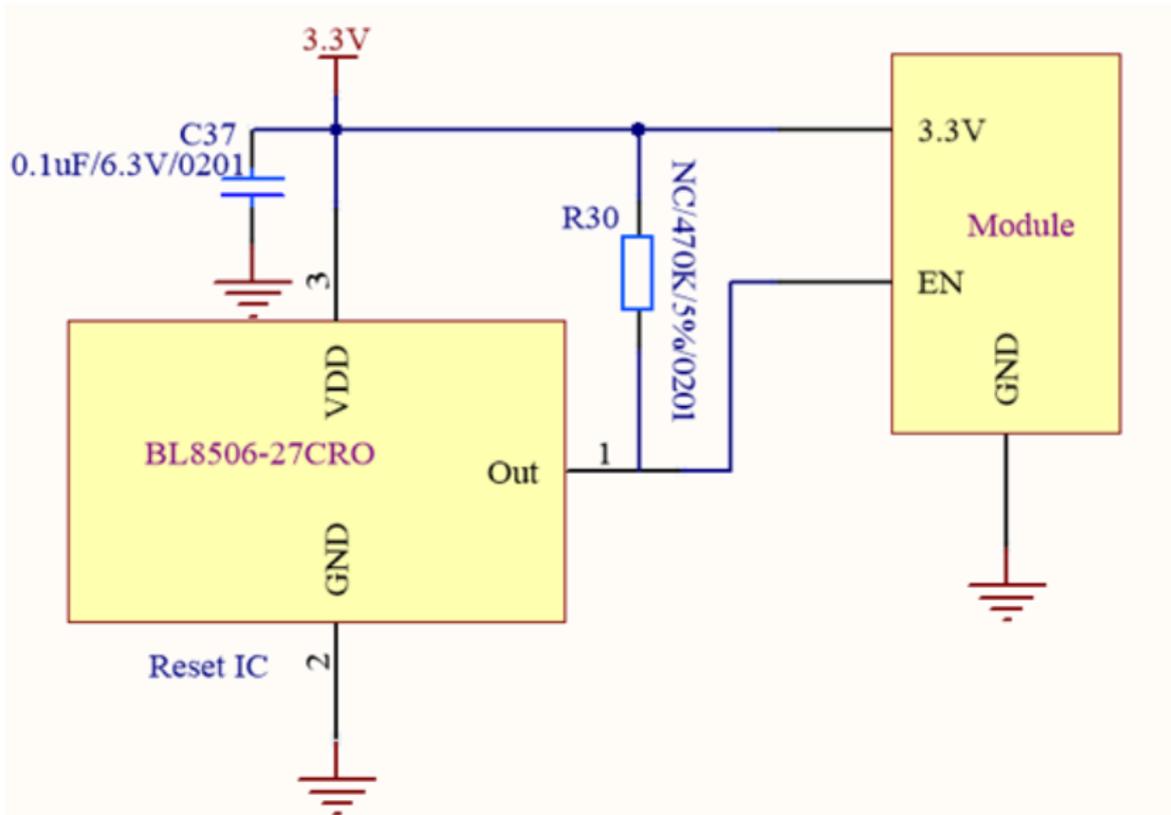
The RTL8720CF chip has requirements on the power-on sequence. It is recommended that the voltage rise from 0 to 3.3V within 40mS.



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

### 7.2 Resetting

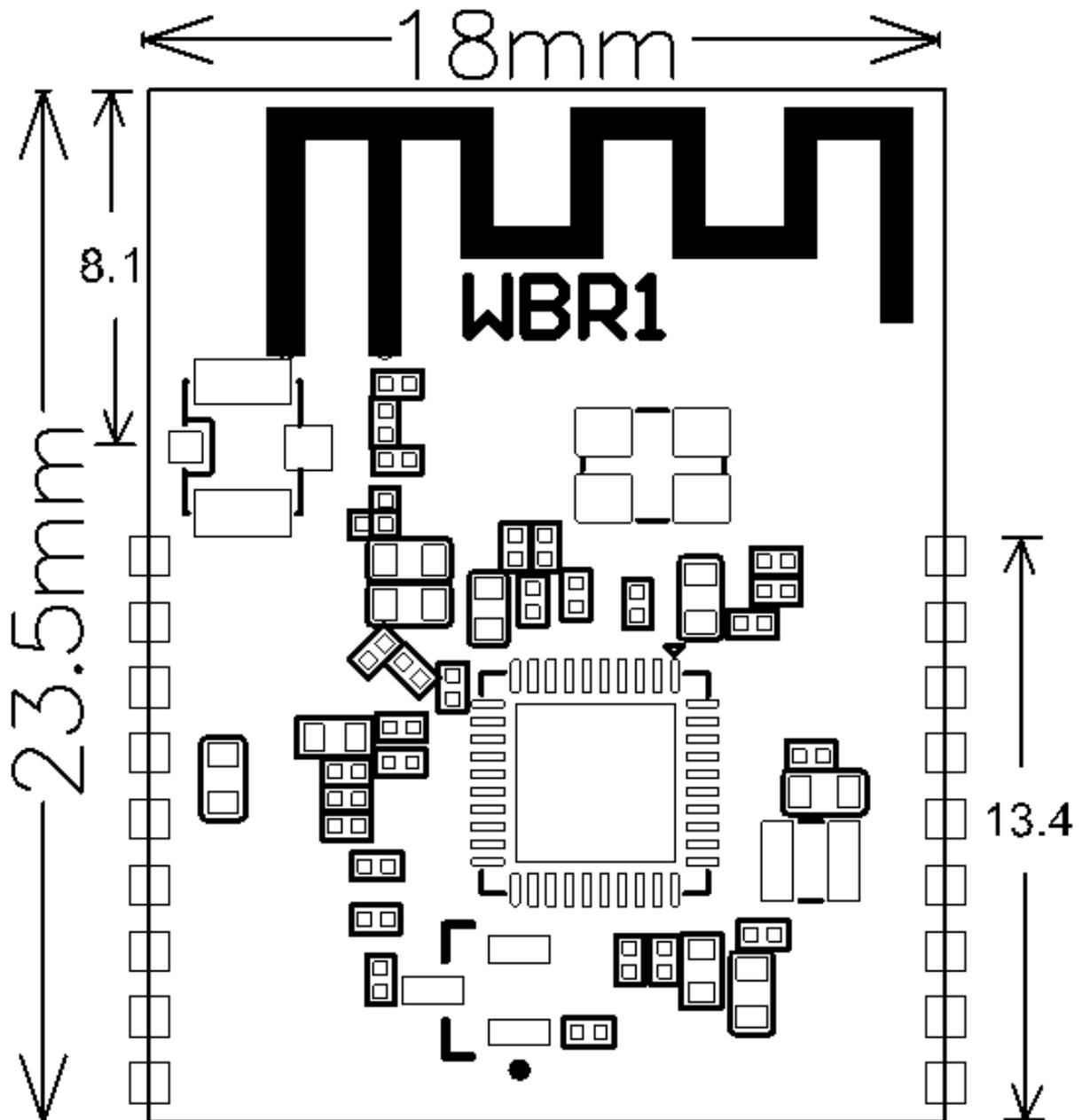
When designing a plate of a module, you should set a resetting IC at the foot of CHIP\_EN in advance. The preferable type of IC is BL8506-27CRO. The module is packaged in the form of SOT23. The following shows a circuit (R30 is preset and cannot be placed).



## 8 Packaging Information and Production Instructions

### 8.1 Mechanical Dimensions

The mechanical dimensions of PCB of WBR1 are  $18\pm 0.35$  mm (W) $\times 23.5\pm 0.35$  mm (L)  $\times 0.8\pm 0.1$  mm (H). The following figure shows mechanical dimensions of WBR1.

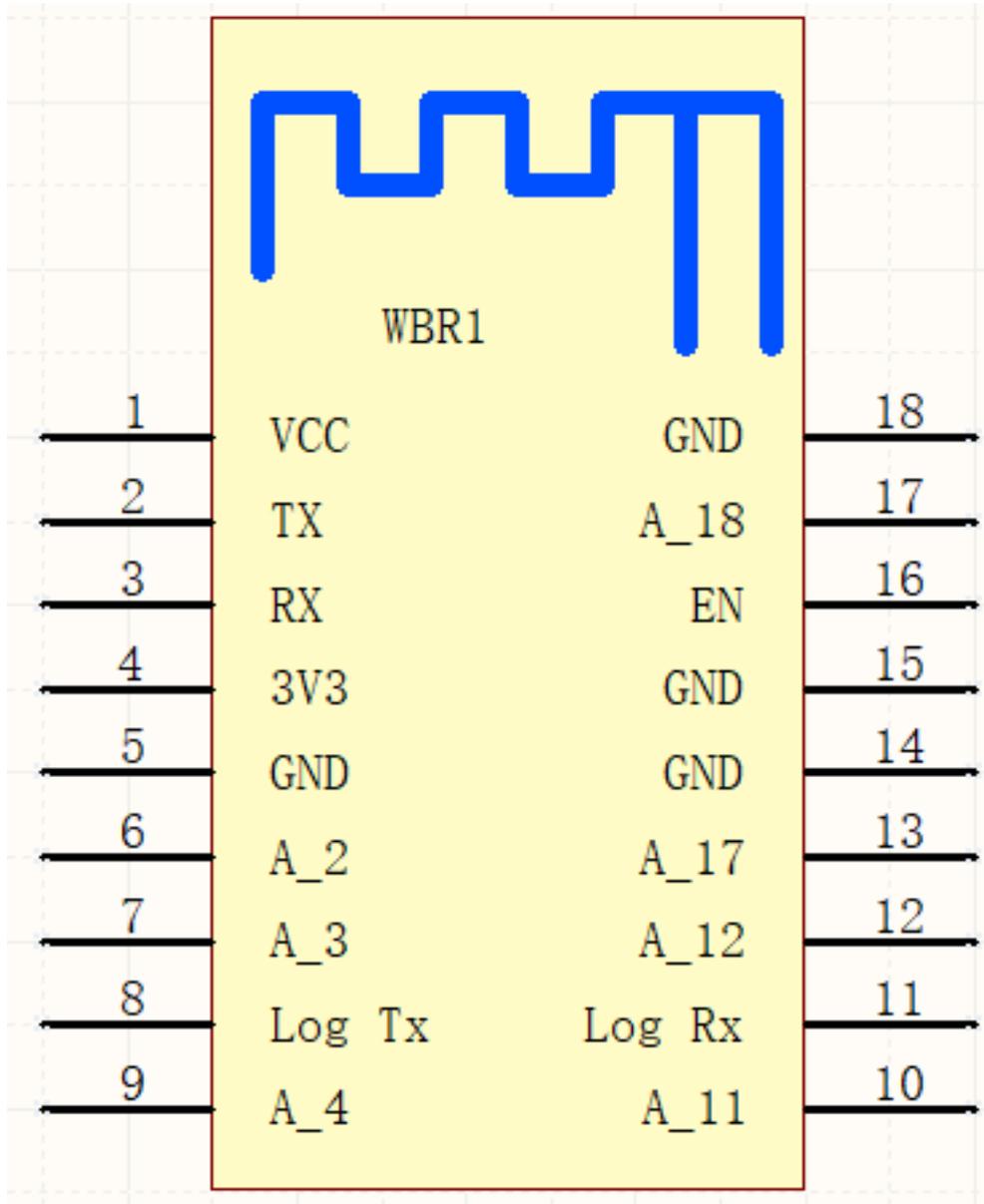




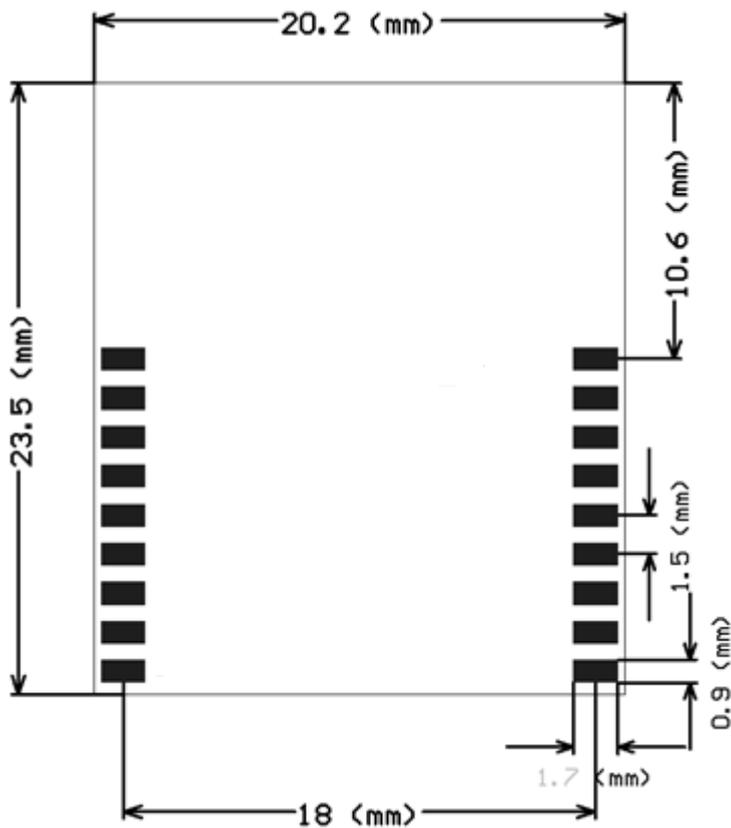
Note: The default dimensional tolerance is  $\pm 0.35$  mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

## 8.2 Recommended PCB Layout

The following figure is a schematic diagram of WBR1 which shows how pins correspond to each other.



WBR1 PCB Layout is shown as belows:



### 8.3 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

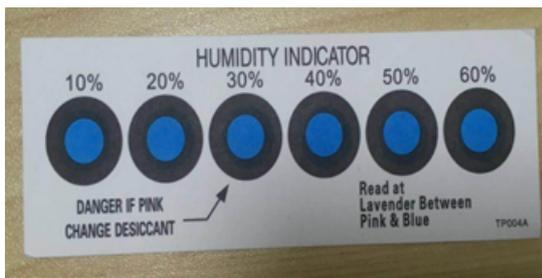
- Reflow soldering machine
- Automated optical inspection (AOI) equipment
- Nozzle with a 6 mm to 8 mm diameter

#### B. Baking equipment

- Cabinet oven
- Anti-static heat-resistant trays
- Anti-static heat-resistant gloves

2. Storage conditions for a delivered module are as follows:

- The moisture-proof bag is 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:

- If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive hours.
- If the 30% circle is pink, bake the module for 4 consecutive hours.
- If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.
- If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.

4. Baking settings:

- Baking temperature: 125±5°C
- Alarm temperature: 130°C
- SMT placement ready temperature after natural cooling: < 36°C
- The number of drying times: 1
- 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.

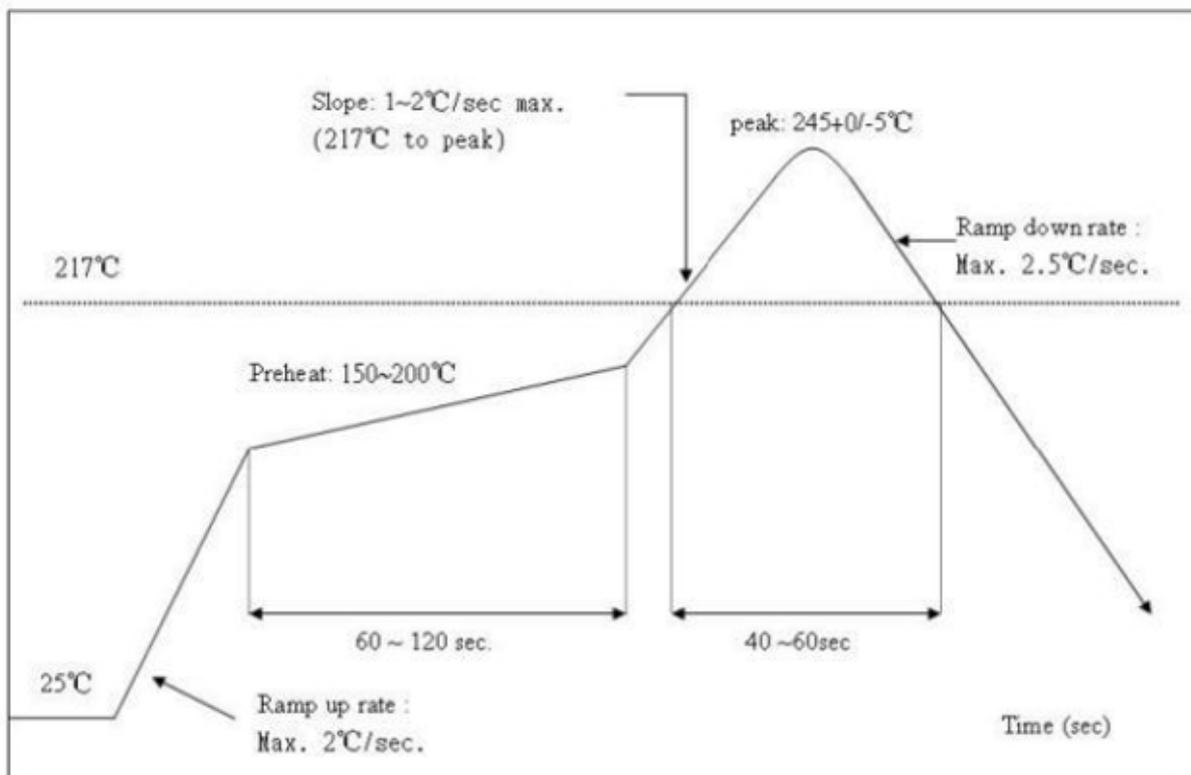
6. Before SMT placement, take electrostatic discharge (ESD) protective measures.

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 con-

trolling the oven temperature and attaching and placing components. Draw 5 to 10 modules from subsequent batches each hour for visual inspection and AOI.

### 8.4 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 belows: Refer to IPC/JEDEC standard; Peak Temperature: <math><245^{\circ}\text{C}</math>; The number of Times:  $\leq 2$  times



### 8.5 Storage Conditions

	<p><b>CAUTION</b>  <b>This bag contains</b>  <b>MOISTURE-SENSITIVE DEVICES</b></p>	<p><b>LEVEL</b>  <span style="border: 1px solid black; padding: 5px; font-size: 24px;"><b>3</b></span></p> <p><small>If Blank, see adjacent bar code label</small></p>
<p>1. Calculated shelf life in sealed bag: 12 months at &lt; 40°C and &lt; 90% relative humidity (RH)</p> <p>2. Peak package body temperature: <u>260</u> °C  <small>If Blank, see adjacent bar code label</small></p> <p>3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must</p> <p style="margin-left: 20px;">a) Mounted within: <u>168</u> hrs. of factory conditions  <small>If Blank, see adjacent bar code label</small>          ≤ 30°C/60%RH, OR</p> <p style="margin-left: 20px;">b) Stored at &lt;10% RH</p> <p>4. Devices require bake, before mounting, if:</p> <p style="margin-left: 20px;">a) Humidity Indicator Card is &gt; 10% when read at 23 ± 5°C</p> <p style="margin-left: 20px;">b) 3a or 3b not met.</p> <p>5. If baking is required, devices may be baked for 48 hrs. at 125 ± 5°C</p> <p>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</p> <p>Bag Seal Date: _____  <small>If Blank, see adjacent bar code label</small></p> <p>Note: Level and body temperature defined by IPC/JEDEC J-STD-020</p>		

## 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)
WBR1	4000	Tape reel	1000	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 be installed to co-locate and operate simultaneously with other radios in the host system except in accordance with FCC multi-transmitter product procedures. Additional testing and equipment authorization may be required to operate 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-WBR1. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBR1". 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.