



WB2L Module Datasheet

Hardware Product Development > Cloud Module > Wi-Fi & BLE Dual

Mode Module > WB Series Module

Version: 20201130

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WB2L is a low-power embedded Wi-Fi and BLE module that Tuya has developed. It consists of a highly integrated RF chip (BK7231T) and several peripheral components, with an embedded Wi-Fi network protocol stack and robust library functions.

1 Product overview

WB2L is embedded with a low-power 32-bit microcontroller unit (MCU), 2 MB flash memory, 256 KB static random-access memory (SRAM), and extensive peripherals.

WB2L 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: 120 MHz
- Working voltage: 3.0 V to 3.6 V
- Peripherals: 5 GPIOs
- Wi-Fi connectivity
 - 802.11 b/g/n
 - Channels 1 to 14 at 2.4 GHz
 - Support WEP, WPA/WPA2, WPA/WPA2 PSK (AES) security modes
 - Up to +17 dBm output power in 802.11b mode
 - EZ and AP net pairing modes for Android and iOS devices
 - Onboard PCB antenna with a gain of 1 dBi
 - Working temperature: -20°C to +105°C
- BLE connectivity
 - Support for BLE 4.2
 - Maximum output power of +7 dBm
 - Onboard PCB antenna with a gain of 1 dBi

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

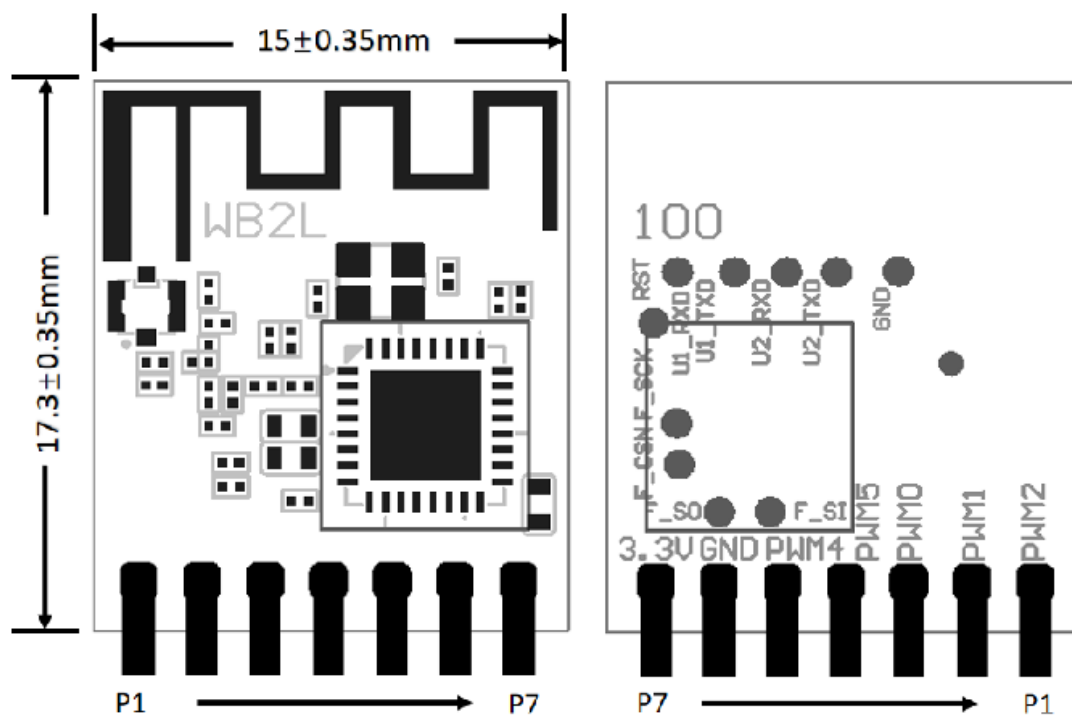
Date	Description	Version after change
2019-11-07	This is the first release.	V1.0.0
2019-11-23	Update antenna gain.	V1.0.1
2019-12-04	Update power consumption of distribution network.	V1.0.2
2019-12-10	Update Bluetooth related parameters.	V1.0.3

2 Module interfaces

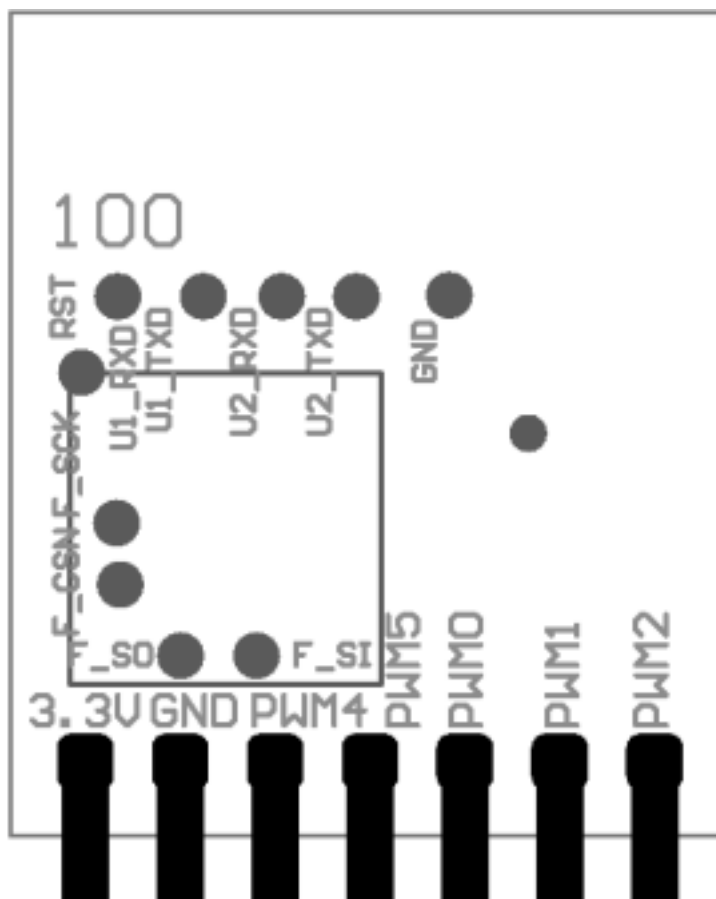
2.1 Dimensions and footprint

WB2L has one row of pins with a 2 ± 0.1 mm pin spacing.

The WB2L dimensions (H x W x D) are 2.8 ± 0.15 mm x 17.3 ± 0.35 mm x 15 ± 0.35 mm. The following figure shows the WB2L front and rear views.



2.2 Interface pin definition



Pin No.	Symbol	I/O type	Function
1	PWM2	I/O	Hardware PWM pin, which is connected to the P8/BT_ACTIVE/PWM2 (Pin24)
2	PWM1	I/O	Hardware PWM pin, which is connected to the P7/WIFI_ACTIVE/PWM1 (Pin23)

Pin No.	Symbol	I/O type	Function
3	PWM0	I/O	Hardware PWM pin, which is connected to the P6/CLK13M/PWM0 (Pin22)
4	PWM5	I/O	Hardware PWM pin, which is connected to the P26/IRDA/PWM5 (Pin15)
5	PWM4	I/O	Hardware PWM pin, which is connected to the P24/LPO_CLK/PWM4 (Pin16)
6	GND	P	Ground pin
7	3V3	P	Power supply pin (3.3 V)

2.3 Test pin definition

Pin No.	Symbol	I/O type	Function
-	GND	P	Ground pin
-	RST	I	Reset pin, Default high level, pull down effective
-	U1_TXD	I/O	UART1_TX, User serial port
-	U1_RXD	I/O	UART1_RX, User serial port

Pin No.	Symbol	I/O type	Function
-	U2_TXD	I/O	UART2_TX, LOG serial port
-	U2_RXD	I/O	UART2_RX, LOG serial port
-	F_SCK	I/O	Clock pin when data is downloaded from the flash memory, which is connected to the P20 pin on the internal IC
-	F_CSN	I/O	Command enabling pin when data is downloaded from the flash memory, which is connected to the P21 pin on the internal IC
-	F_SI	I/O	Data input pin when data is downloaded from the flash memory, which is connected to the P22 pin on the internal IC

Pin No.	Symbol	I/O type	Function
-	F_SO	I/O	Data output pin when data is downloaded from the flash memory, which is connected to the P23 pin on the internal IC

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-40	105	°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 Working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Working temperature	-20	-	105	°C
VBAT	Power supply voltage	3.0	3.3	3.6	V
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 Current consumption during constant transmission and receiving

Working status	Mode	Rate	TX Power/ Receiving	Typical value	Maximum value	Unit
TX	11b	11Mbps	+17dBm	295	354	mA
TX	11g	54Mbps	+13.5dBm	266	300	mA
TX	11n	MCS7	+12dBm	260	290	mA

Working status	Mode	Rate	TX Power/ Receiving	Typical value	Maximum value	Unit
RX	11b	11Mbps	Constant receiving	98	100	mA
RX	11g	54Mbps	Constant receiving	98	100	mA
RX	11n	MCS7	Constant receiving	98	100	mA

3.4 Working current

Working mode	Working status (Ta = 25°C)	Average value	Maximum value	Unit
EZ	The module is in EZ mode, and the Wi-Fi indicator blinks quickly.	70	312	mA
AP	The module is in AP mode, and the Wi-Fi indicator blinks slowly.	70	364	mA
Connected	The module is connected to the network, and the Wi-Fi indicator is steady on.	40	244	mA

Working mode	Working status (Ta = 25°C)	Average value	Maximum value	Unit
Disconnected	The module is disconnected from the network, and the Wi-Fi indicator is steady off.	100	232	mA

4 RF features

4.1 Basic RF features

Parameter	Description
Frequency band	2.412~2.484GHz
Wi-Fi standard	IEEE 802.11b/g/n(channels1-14)
Data transmission rate	11b:1,2,5.5, 11 (Mbps) 11g:6,9,12,18,24,36,48,54(Mbps) 11n: HT20 MCS0~7
Antenna type	PCB antenna with a gain of 1dBi

4.2 TX performance

Performance during constant transmission.

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	-	13.5	-	dBm
Average RF output power,802.11n OFDM Mode MCS7	-	12	-	dBm
EVM@802.11b CCK 11Mbps Mode 17dBm	-	-23	-	dB
EVM@802.11g OFDM 54Mbps Mode 13.5dBm	-	-27	-	dB
EVM@802.11n OFDM MCS7 Mode 12dBm	-	-28	-	dB
Frequency error	-15	-	15	ppm

4.3 RX performance

RX sensitivity

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b DSSS Mode 11M	-	-81	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-72	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-68	-	dBm

5 Antenna

5.1 Antenna type

WB2L uses an onboard PCB antenna or Ipex antenna.

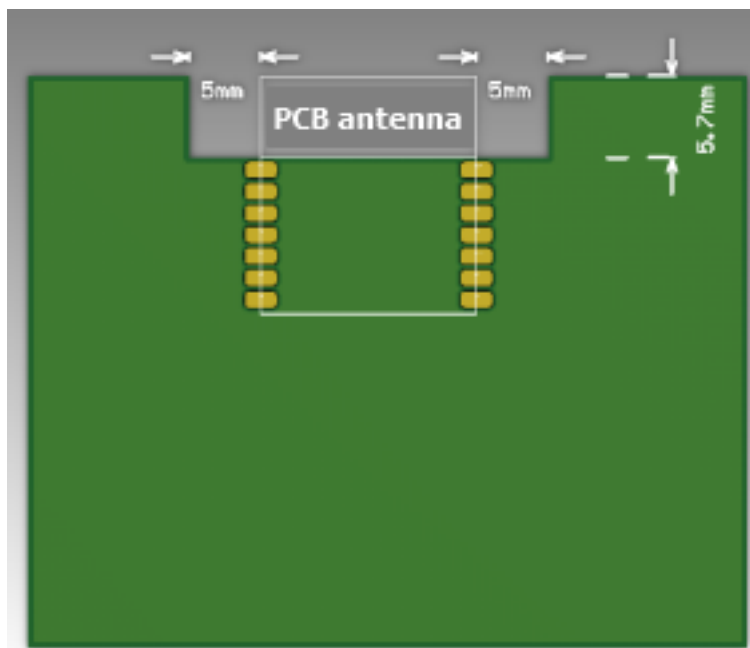
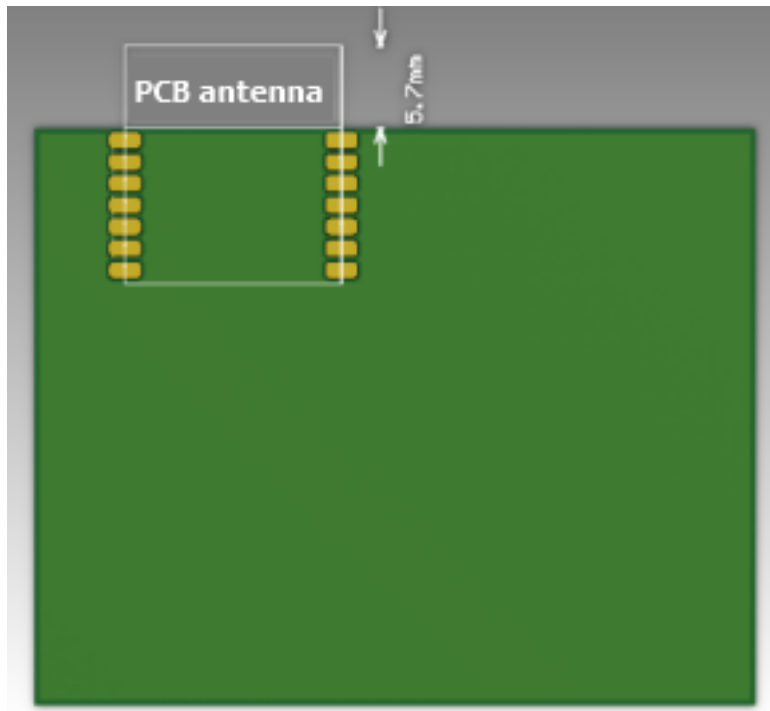
5.2 Antenna interference reduction

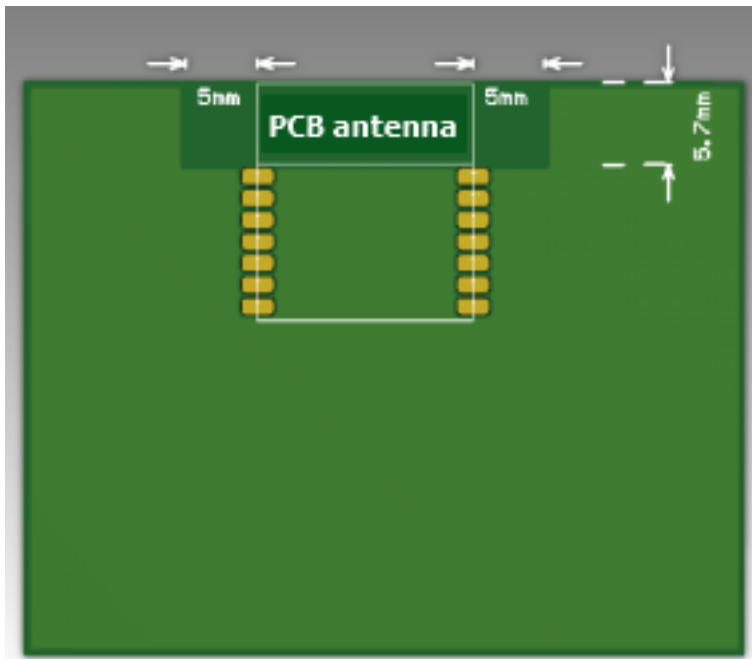
To ensure optimal Wi-Fi performance when the Wi-Fi module uses an onboard PCB antenna, it is recommended that the antenna be at least 15mm away from other metal parts.

To prevent an adverse impact on the antenna radiation performance, avoid copper or traces along the antenna area on the PCB. The following describes three antenna placement solutions:

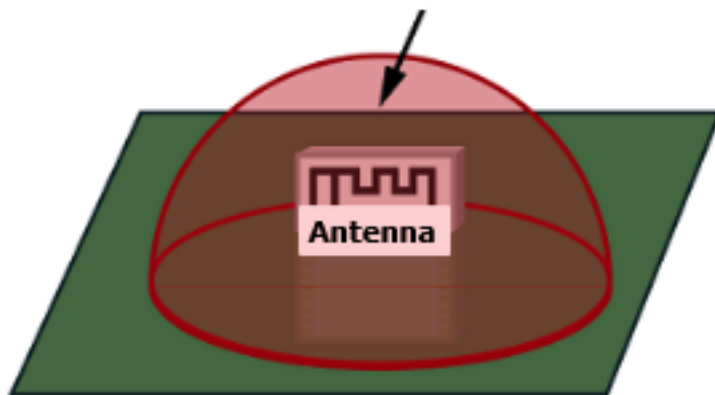
1. Place the antenna outside the PCB frame.
2. Place the antenna along with the PCB frame without copper nearby.
3. Place the antenna in a carved area on the PCB.

The preceding solutions 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.





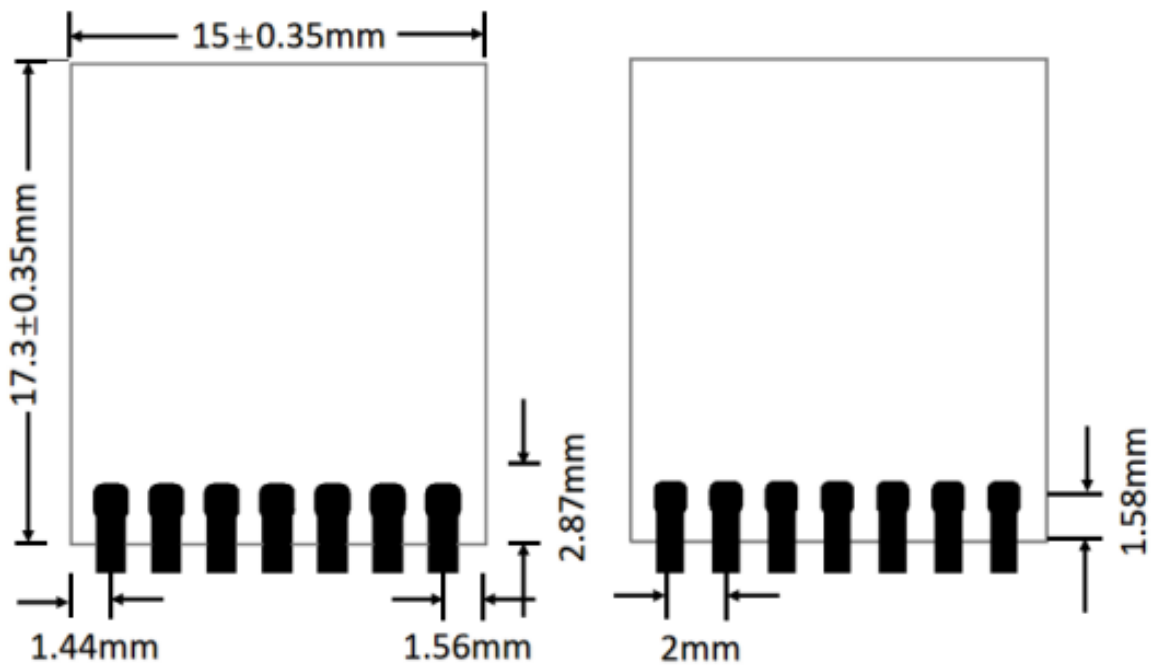
Do not place any metal in the red area above the antenna.
The recommended diameter of the circular arc is greater than 3 cm.



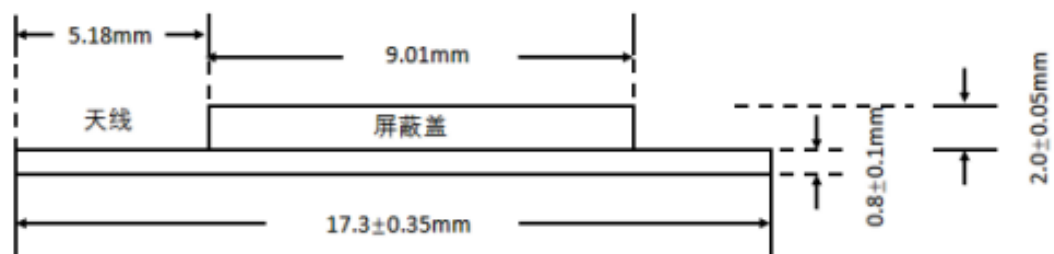
6 Packaging Information and Production Instructions

6.1 Mechanical Dimensions

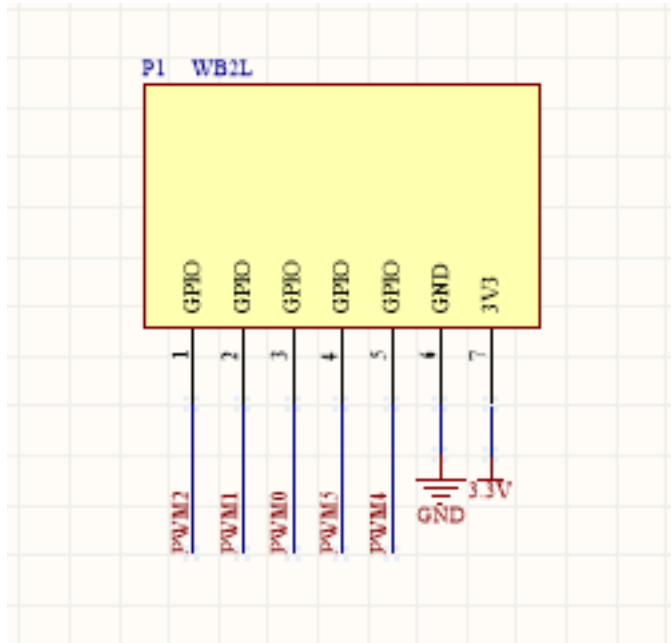
The PCB dimensions (W x L x H) are $17.3\pm0.35\text{mm}$ (W) $\times 15\pm0.35\text{mm}$ (L) $\times 2.8\pm0.15\text{mm}$ (H).



6.2 Side view

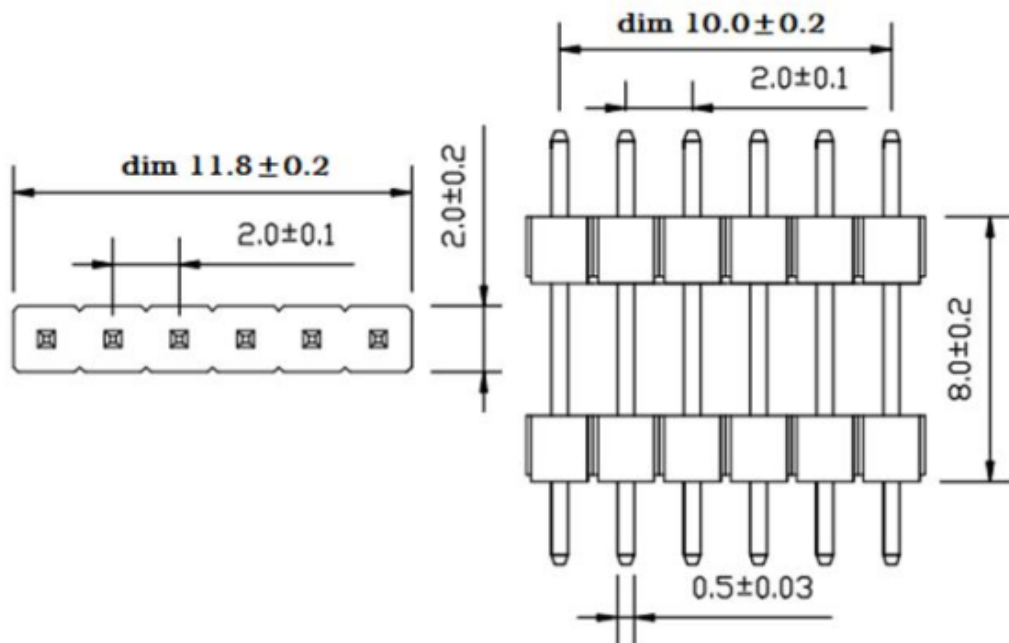


6.3 Recommended schematic encapsulation

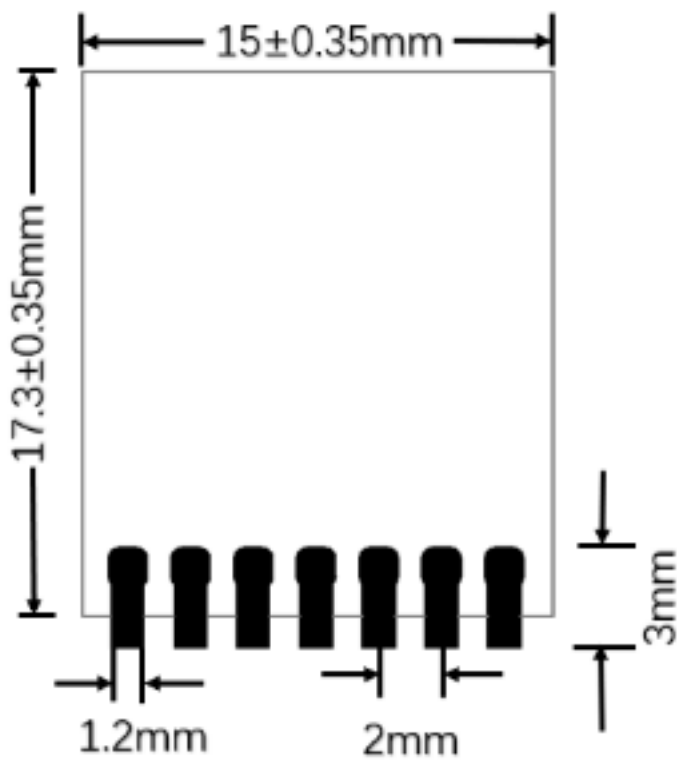


6.4 Recommended PCB Encapsulation-Pin header

WB2L can be mounted onto a PCB by using an SMT placement machine or through-hole mounted onto the PCB through a pin header.



6.5 Recommended PCB Encapsulation-SMT



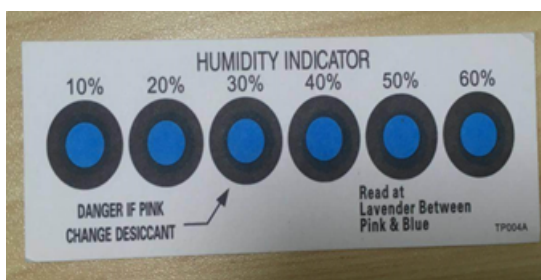
6.6 Production instructions

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.

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

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1 * Baking temperature: 125±5℃
2 * Alarm temperature: 130℃
3 * SMT placement ready temperature after natural cooling: < 36℃
4 * Number of drying times: 1
5 * Rebaking condition: The module is not soldered within 12 hours
  aft
6 er baking.

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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.

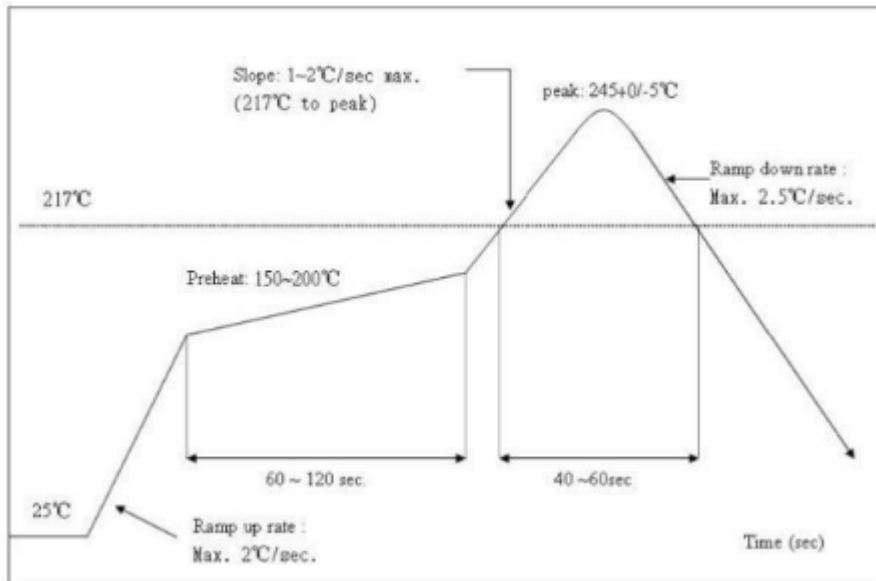
5. Before SMT placement, take electrostatic discharge (ESD) protective measures.
6. To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before first SMT placement to determine a proper oven temperature and component placement method. Draw 5 to 10 modules every hour from subsequent batches for visual inspection and AOI.

6.7 Recommended oven temperature curve

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

Based on the IPC/JEDEC standard, perform reflow soldering on a module at most twice.

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



6.8 Storage conditions

	CAUTION This bag contains MOISTURE-SENSITIVE DEVICES	LEVEL <div style="border: 1px solid black; padding: 5px; display: inline-block; font-size: 24pt; font-weight: bold;">3</div>
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: <u>260</u> °C <small style="display: block; text-align: right;">If Blank, see adjacent bar code label</small>		
3. After bag is opened, devices that will be subjected to reflow solder or other high temperature process must		
a) Mounted within: <u>168</u> hrs. of factory conditions <small style="display: block; text-align: right;">If Blank, see adjacent bar code label</small>		
≤ 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: _____ <small style="display: block; text-align: right;">If Blank, see adjacent bar code label</small>		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

7 MOQ and packing information

Product model	MOQ (pcs)	Packing method	Number of modules in each reel Pack	Number of Reel Packs in Each Box
WB2L	4000	Carrier tape and reel packing	1000	4

8 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 operate 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 operate simultaneously with other radios.

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 an FCC ID: 2ANDL-WB3L. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WB2L"

This device is intended only for OEM integrators under the following conditions:

- The antenna must be installed such that 20cm is maintained between the antenna and users.
- The transmitter module may not be co-located with any other transmitter or antenna.

As long as the 2 conditions above are met, further transmitter tests 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.