



WBRG1 Module Datasheet

Device Development > Cloud Module > Wi-Fi & BLE Dual Mode

Module

Version: 20201104

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1 Product overview

WBRG1 is a low-power embedded Wi-Fi module that Tuya has developed. It consists of a highly integrated wireless RF chip (RTL8721CSM) and an external flash chip, with an embedded Wi-Fi network protocol stack and varied library functions. With the maximum CPU clock rate of 200 MHz, WBRG1 also contains a KM4 microcontroller unit (MCU), a low-power KM0 MCU, a WLAN MAC, a 1T1R WLAN module, a 4-MB pseudo-static random-access memory (PSRAM), 8-MB flash memory, and rich extensive peripherals.

WBRG1 is an RTOS platform that integrates all function libraries of the Wi-Fi MAC and TCP/IP. You can develop embedded Wi-Fi products as required.

1.1 Features

- Embedded low-power 32-bit Cortex-M33 CPU, which can also function as an application processor
- The maximum clock rate: 200 MHz
- Working voltage: 3.0V to 3.6V
- Peripherals: 6 pulse width modulations (PWM), 3 universal asynchronous receiver/transmitters (UART), 1 inter-IC sound (I2S), 1 packet traffic arbitration (PTA), and 1 audio
- Wi-Fi/BT connectivity
 - 802.11 b/g/n20/n40
 - Channels 1 to [14@2.4 GHz](#) (CH 1 to 11 for US/CA, and CH 1 to 13 for EU/CN)
 - Support WEP, WPA, WPA2, and WPA2 PSK (AES) security modes
 - Support BLE (Bluetooth Low Energy) 5.0
 - Up to + 20dBm output power in 802.11b mode
 - Support SmartConfig and AP network configuration modes for Android and IOS devices
 - Onboard PC antenna and external antenna IPEX connector
 - 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

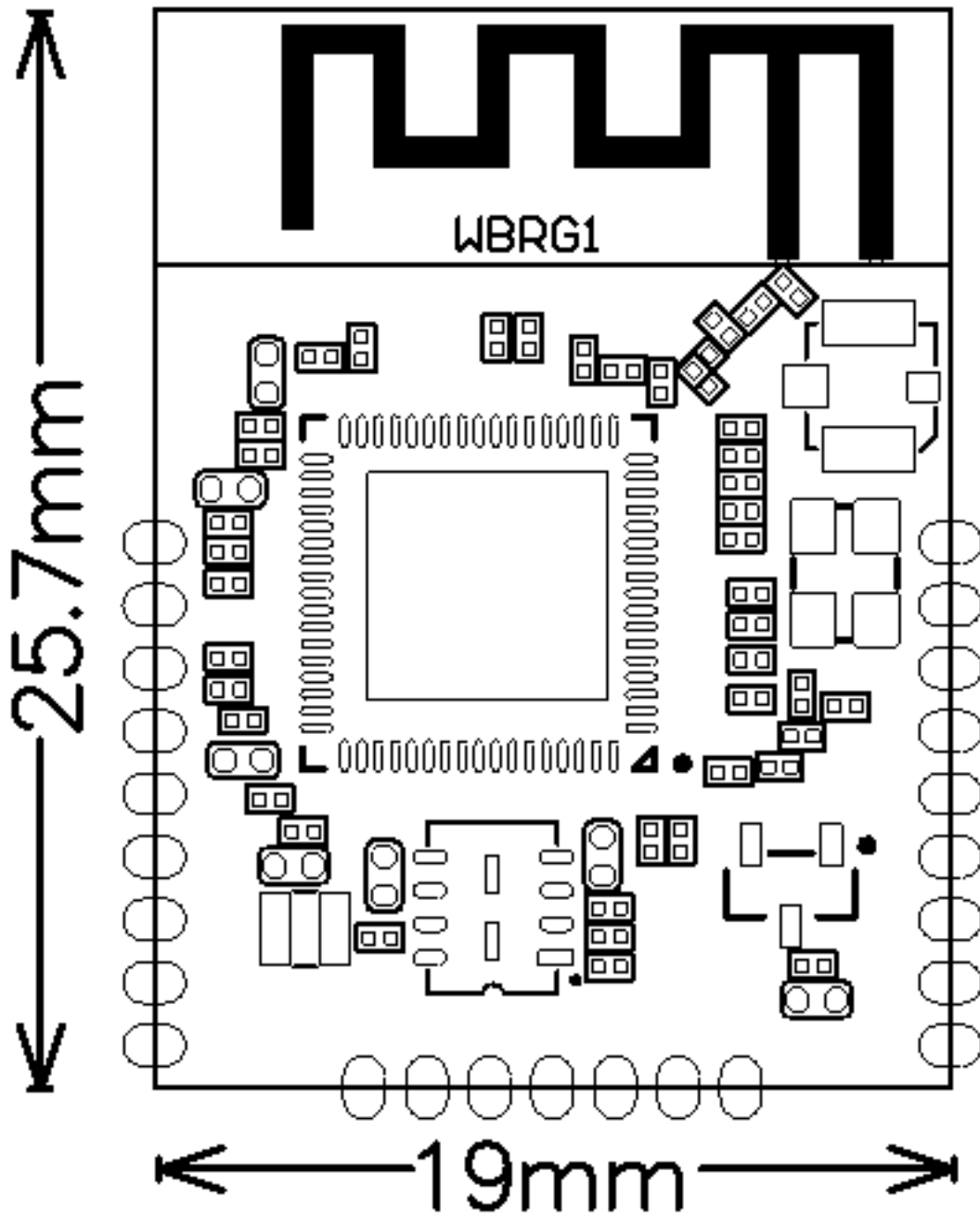
1.3 Change history

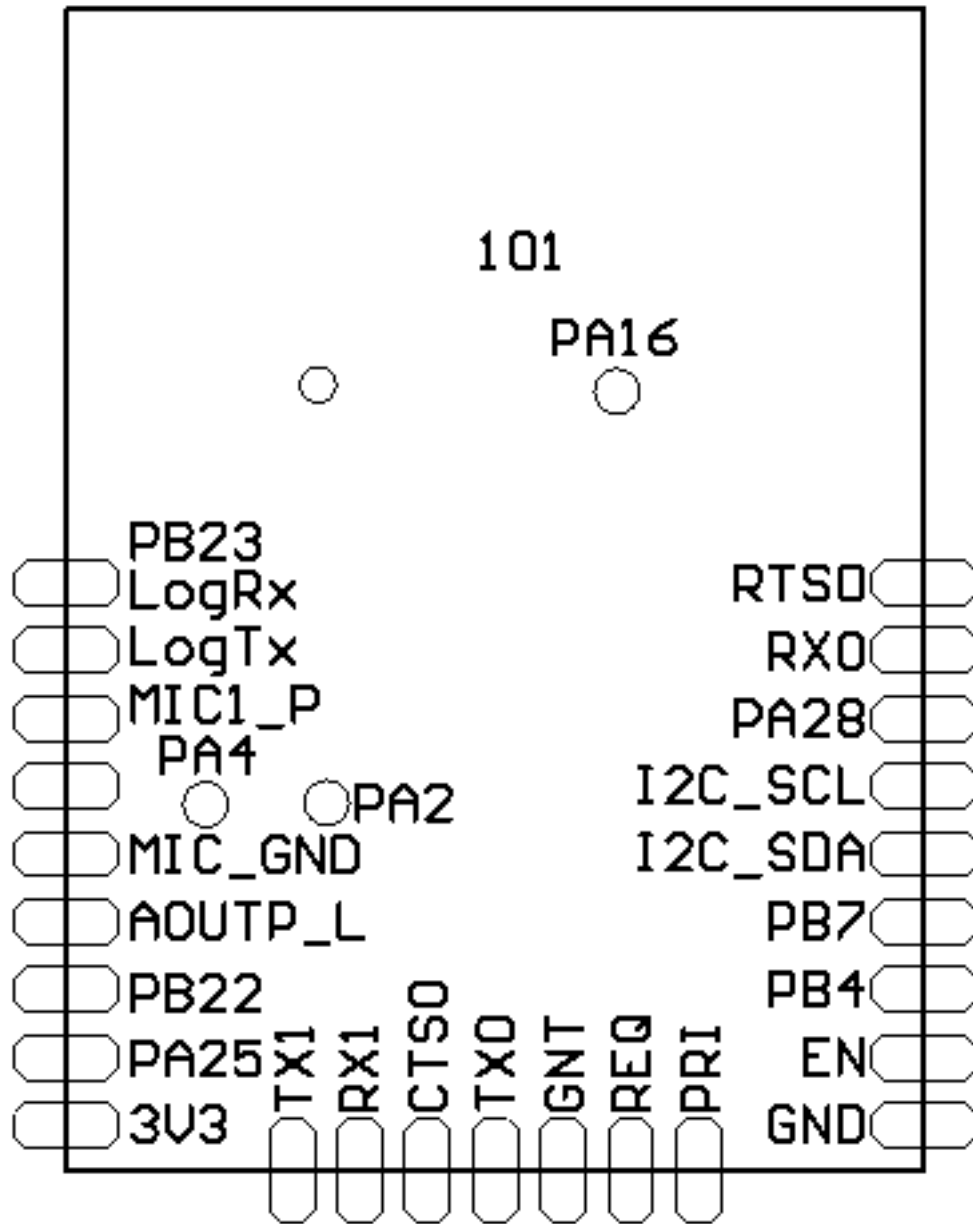
Update date	Updated content	Version after update
10/10/2020	The first release.	V1.0.0

2 Module interfaces

2.1 Dimensions and package

WBRG1 has 3 rows of pins with a 1.5 mm pin spacing. As shown in the following figures, the dimensions of WBRG1 are 19 ± 0.35 mm (W) \times 25.7 ± 0.35 mm (L) \times 2.9 ± 0.1 mm (H). The thickness of the PCB is 0.8 ± 0.1 mm.





2.2 Pin definition

Symbol	I/O type	Function
RTS0	I/O	PA 16, which corresponds to Pin 29 and is a serial port Uart0 flow control request-to-send pin
RX0	I/O	PA 19, which corresponds to Pin 32 and Uart0_RX and is the docking serial port of a user's MCU
PA28	I/O	PA 28, which corresponds to Pin 38, is a hardware PWM and can be configured as a GPIO
I2C_SCL	I/O	PB 5, which corresponds to Pin 45 and can be configured as an I2C or GPIO
I2C_SDA	I/O	PB 6, which corresponds to Pin 46 and can be configured as an I2C or GPIO
PB7	I/O	PB7, which corresponds to Pin 47, is a hardware PWM and can be configured as a GPIO
PB4	I/O	PB4, which corresponds to Pin 44, is a hardware PWM and can be configured as a GPIO

Symbol	I/O type	Function
EN	P	Enabling pin, which works at the voltage of 3.3V and is pulled up
GND	P	Power supply reference ground
PRI	I/O	PB1, which corresponds to Pin 41 and has the PTA_PRI function
REQ	I/O	PA26, which corresponds to Pin 39 and has the PTA_REQ function
GNT	I/O	PA27, which corresponds to Pin 33 and has the PTA_GNT function
TX0	I/O	PA18, which corresponds to Pin 31 and Uart0_TX and is the docking serial port of a user's MCU
CTS0	I/O	PA17, which corresponds to Pin 30 and is a serial port Uart0 flow control clear-to-send pin
RX1	I/O	PA13, which corresponds to Pin 26 and Uart1_RX and is the docking serial port of a user's MCU
TX1	I/O	PA12, which corresponds to Pin 25 and Uart1_TX and is the docking serial port of a user's MCU
3V3	P	Power supply pin (3.3V)

Symbol	I/O type	Function
PA25	I/O	PA 25, which corresponds to Pin 40, is a hardware PWM and can be configured as a GPIO
PB22	I/O	PB 22, which corresponds to Pin 60, is a hardware PWM and can be configured as a GPIO
AOUTP_L	I/O	PB31, which corresponds to Pin 65, audio's analog output positive electrode (left channel)
MIC GND	I/O	MIC_GND
MIC1_P	I/O	PA4, which corresponds to Pin 3, the input positive electrode of MIC1, main MIC
Log TX	I/O	PA7, which corresponds to Pin 7 and is used to print system logs
Log Rx	I/O	PA8, which corresponds to Pin8 and is used to print system logs
PB23	I/O	PB23, which corresponds to Pin 61, is a hardware PWM and can be configured as a GPIO

Note: P indicates a power supply pin and I/O indicates an input/output pin.

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	-0.3	3.6	V
Static electricity discharge voltage (human body model)	TAMB-25°C	-	2	KV
Static electricity discharge 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
VCC	Power supply voltage	3.0	3.3	3.6	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
V_{IL}	I/O low level input	-	-	-	0.8 V
V_{IH}	I/O high-level input	2.0	-	-	V
V_{OL}	I/O low level output	-	-	0.4	V
V_{OH}	I/O high level output	2.4	-	-	V
I_{max}	I/O drive current	-	-	16	mA
C_{pad}	Input pin capacitance	-	2	-	mA

3.3 TX power consumption

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11b 11Mbps	17 dBm	247	272	mA
IRF	11b 11Mbps	18 dBm	252	285	mA
IRF	11g 54Mbps	15 dBm	177	238	mA
IRF	11g 54Mbps	17.5 dBm	202	280	mA

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11n BW20 MCS7	13 dBm	165	240	mA
IRF	11n BW20 MCS7	16.5 dBm	192	269	mA
IRF	11n BW40 MCS7	13 dBm	144	236	mA
IRF	11n BW40 MCS7	16.5 dBm	166	266	mA

3.4 RX power consumption

Symbol	Mode	Average Value	Peak Value (Typical Value)	Unit
IRF	11B 11M	61	77	mA
IRF	11G 54M	61	75	mA
IRF	11N HT20 MCS7	61	77	mA

3.5 Power consumption in working mode

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
Quick network connection state (Bluetooth)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast	57	284	mA
Quick network connection state (AP)	The module is in the fast network connection state and the Wi-Fi indicator flashes slowly	203	392	mA
Quick network connection state (EZ)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast	55	298	mA
Idle state	The module is connected to the network and the indicator is always on	53	259	mA

Working mode	Working status, TA = 25°C	Average value	Peak value (Typical value)	Unit
Operation state	The module is connected to the network and the WiFi indicator is always on	56	293	mA
Disconnected state	The module is disconnected	58	287	mA

Note: The above parameters vary with firmware functions.

4 RF parameters

4.1 Basic RF features

Parameter	Description
Frequency range	2.400 to 2.4835 GHz
Wi-Fi standard	IEEE 802.11b/g/n (channels 1 to 14)
BLE standard	BLE 5.0
Data transmission rate	11b: 1, 2, 5.5, and 11 (Mbps)
Data transmission rate	11g: 6, 9, 12, 18, 24, 36, 48, and 54 (Mbps)
Data transmission rate	11n: HT20 MCS 0 to 7
Data transmission rate	11n: HT40 MCS 0 to 7
Antenna type	PCB antenna with a gain of 1.05 dBi

4.2 TX performance

TX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11b CCK Mode 11M	-	17.5	-	dBm
Average RF output power, 802.11g OFDM Mode 54M	-	14.5	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
Average RF output power, 802.11n HT20 Mode MCS7	-	13.5	-	dBm
Average RF output power, 802.11n HT40 Mode MCS7	-	13.5	-	dBm
Average RF output power, BLE5.0	-	6.5	-	dBm
Frequency error	-20	-	20	ppm
EVM@802.11b CCK 11 Mbps Mode 17.5 dBm	-	-	-10	dB
EVM@802.11g OFDM 54 Mbps Mode 14.5 dBm	-	-	-29	dB
EVM@802.11n OFDM MCS7 Mode 13.5 dBm	-	-	-30	dB

4.3 RX performance

RX sensitivity

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b DSSS Mode 1M	-	-92	-	dBm
PER<10%, RX sensitivity, 802.11g OFDM Mode 54M	-	-76	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode MCS7	-	-73	-	dBm

5 Antenna

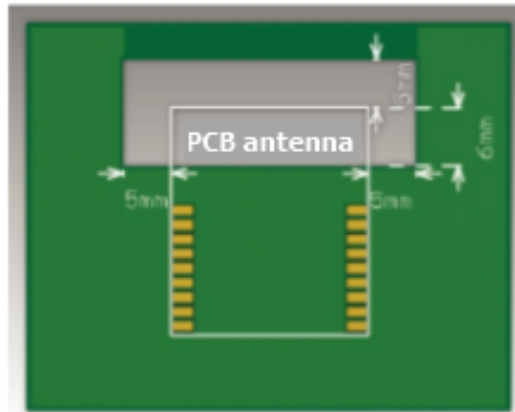
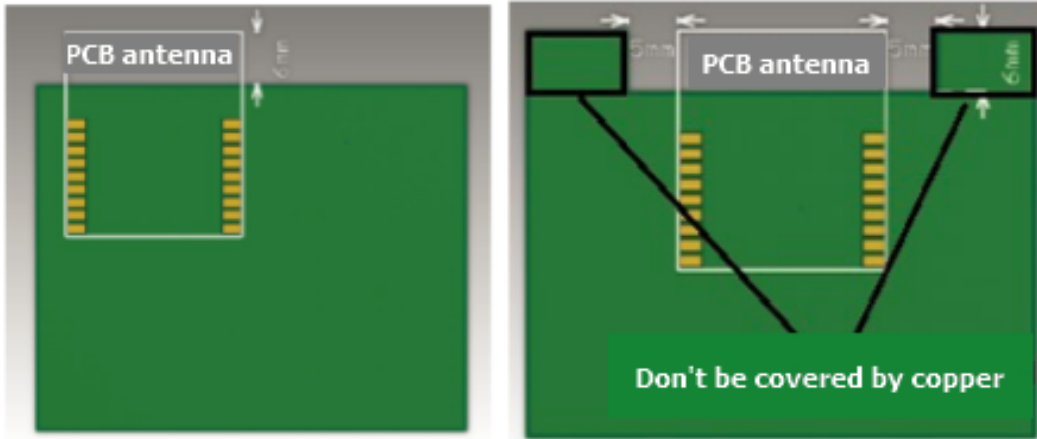
5.1 Antenna type

WBRG1 supports two types of antennas: onboard PCB antenna and external antenna. By default, the onboard PCB antenna is preferred.

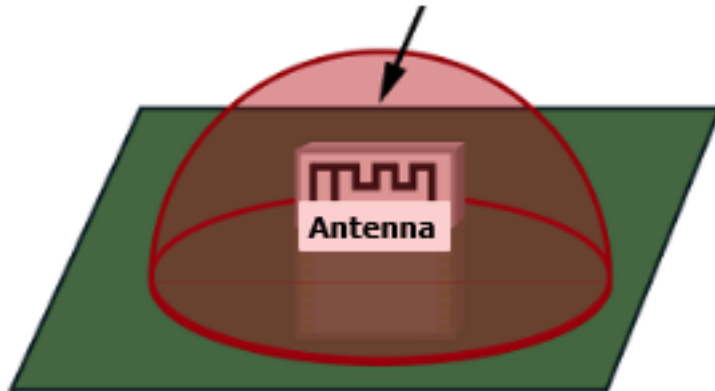
5.2 Antenna interference reduction

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 15 mm 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.

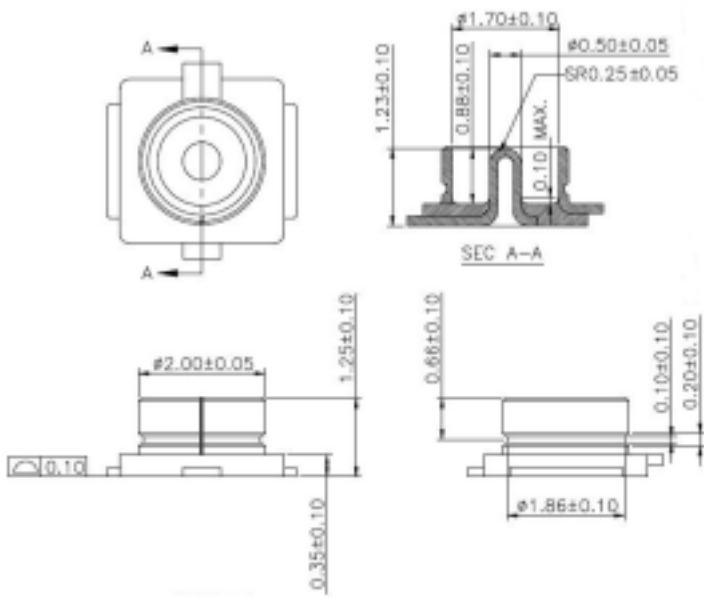


**Do not place any metal in the red area above the antenna.
The recommended diameter of the circular arc is greater than 3 cm.**



5.3 U.FL RF connector

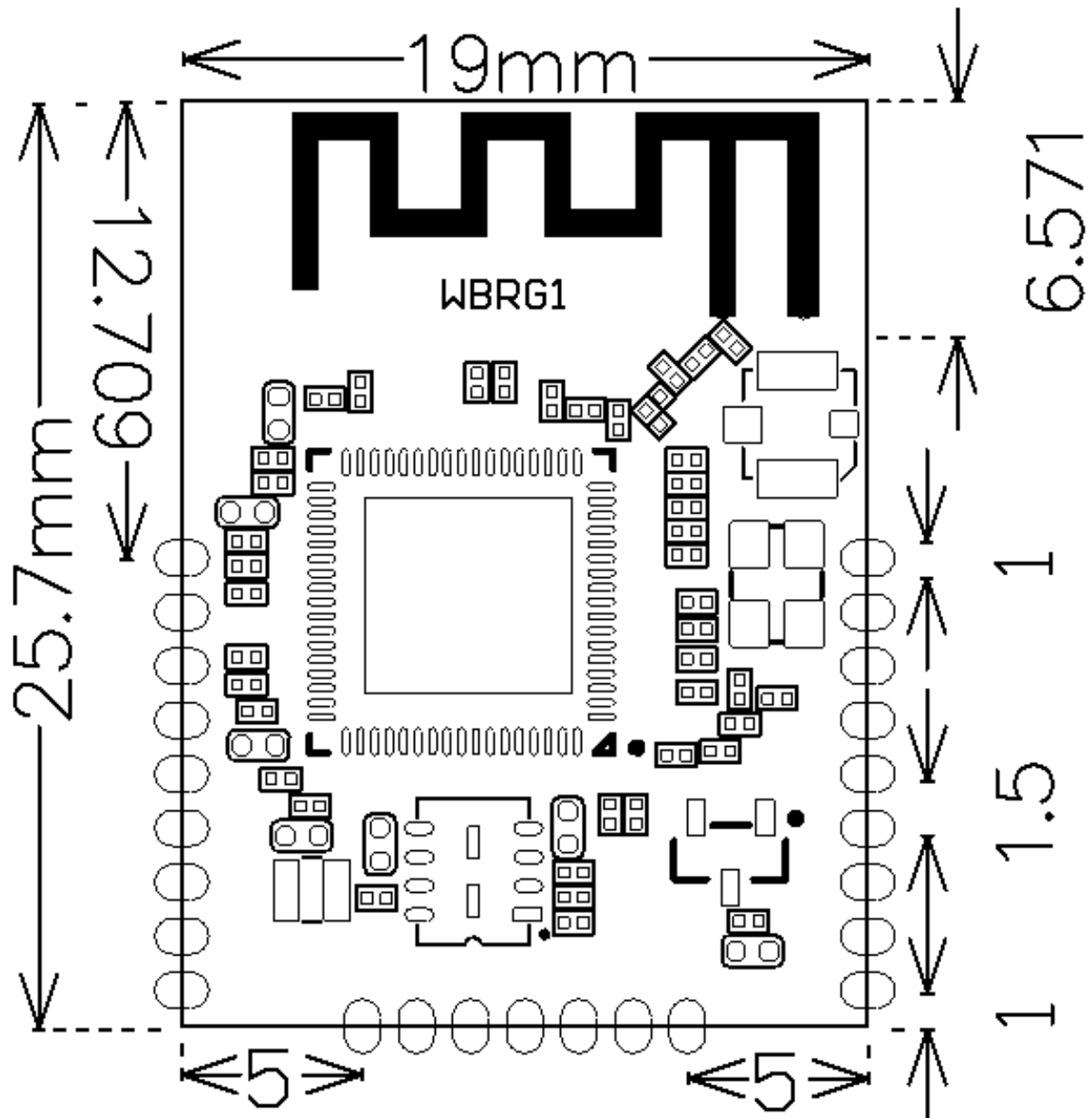
Parameters of the U.FL RF connector are as below:



6 Packaging information and production instructions

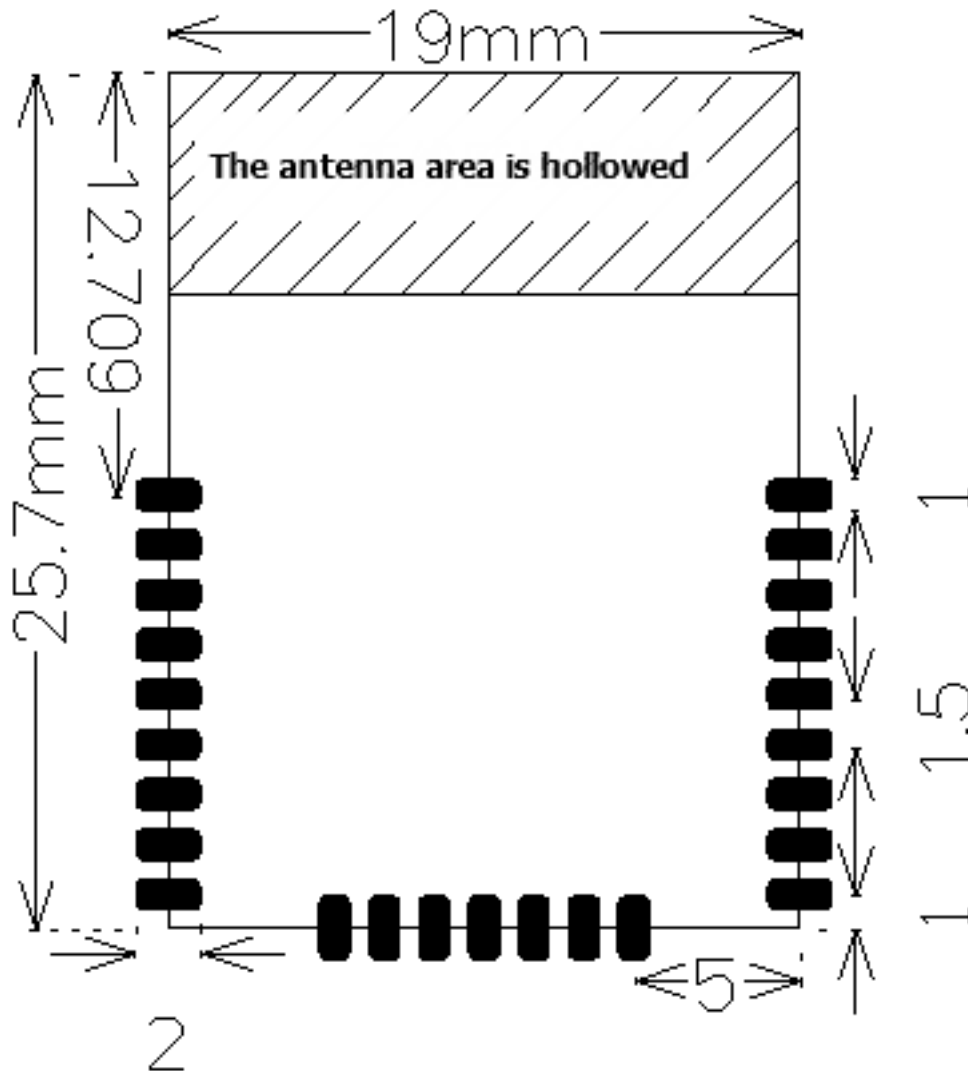
6.1 Mechanical dimensions

The PCB dimensions are 19 ± 0.35 mm (W) \times 25.7 ± 0.35 mm (L) \times 0.8 ± 0.15 mm (H).



Note: For the PCB frame, the dimensional tolerance is ± 0.35 mm, and for the thickness of the PCB, the dimensional tolerance is ± 0.1 mm.

6.2 The diagram of PCB packaging



6.3 Mounting requirements

Use an SMT 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, pack the module again in a vacuum.

Note:

Bake the module before mounting components to the module.

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

Do not use SMT to process modules that have been unpacked for more than 3 months, unless they will be seriously oxidized because electroless nickel/immersion gold (ENIG) is used for PCBs. SMT is very likely to cause pseudo and missing soldering. Tuya is not liable for such problems and consequences.

To reduce the reflow defect rate, draw 10% of the products for visual inspection and AOI before the first mounting, to determine the rationality of oven temperature control and component attachment and placement manners. Draw 5 to 10 modules from subsequent batches each hour for visual inspection and AOI.

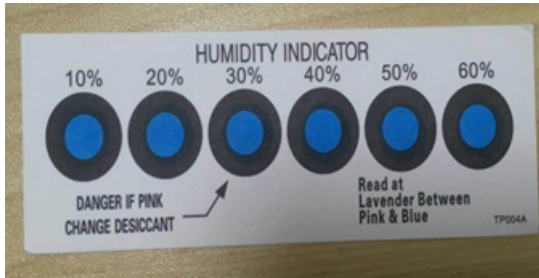
The following equipment or instrument is required:

Instrument/device	Description
SMT machine	Reflow soldering machine
	Automated optical inspection (AOI) equipment
	Nozzle with a 6 to 8 mm diameter
Baking devices	Cabinet oven
	Anti-static heat-resistant trays
	Anti-static heat-resistant gloves

6.4 Storage conditions

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).



6.5 Baking requirements

Bake a module based on HIC status as follows when you unpack the module package:

Value read from the HIC	Color circle color	Operation
30%, 40%, and 50%	All circles are blue	Bake the module for 2 consecutive hours
30%	Pink	Bake the module for 4 consecutive hours
30% and 40%	All circles are pink	Bake the module for 6 consecutive hours
30%, 40%, and 50%	All circles are pink	Bake the module for 12 consecutive hours

6.6 Baking settings

Parameter	Description
Baking temperature	125±5°C

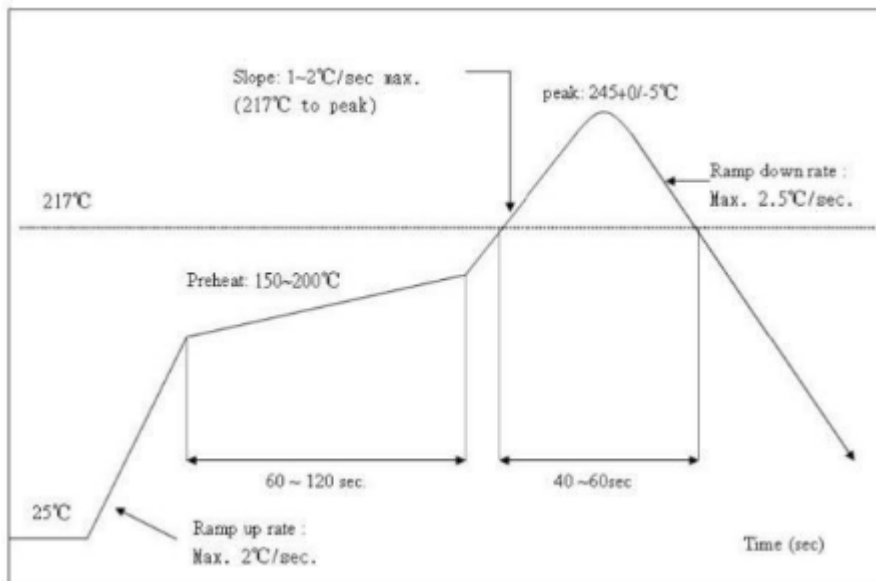
Parameter	Description
Alarm temperature	130°C
SMT ready temperature	Naturally cooling temperature: < 36°C
The number of drying times	1

Note: If the module is not soldered within 12 hours after being baked, you need to bake it again.

6.7 Recommended oven temperature curve

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

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



6.8 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

7 MOQ and packaging information

Product Number	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
WBRG1	3600	Tape reel	900	4

8 Appendix: Statement

8.1 Federal Communications Commission (FCC) Declaration of Conformity

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 a minimum distance of 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 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 with 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-WBRG1. The final end product must be labeled in a visible area with the following: "Contains Transmitter Module FCC ID: 2ANDL-WBRG1.

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 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.

8.2 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.