



WBR2 Module Datasheet

Version: 20220414

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WBR2 is a low-power embedded WiFi+Bluetooth module that Tuya has developed. It consists of a highly integrated wireless RF chip (W701-VA2-CG), with an embedded WiFi network protocol stack and varied library functions.

1 Overview

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

- Embedded low-power KM4 MCU, which can also function as an application processor. Clock rate: 100MHz.
- Working voltage: 3.0 to 3.6V
- Peripherals: 6 GPIOs and 1 universal asynchronous receiver/transmitter (UART)
- Wi-Fi/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 Bluetooth (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

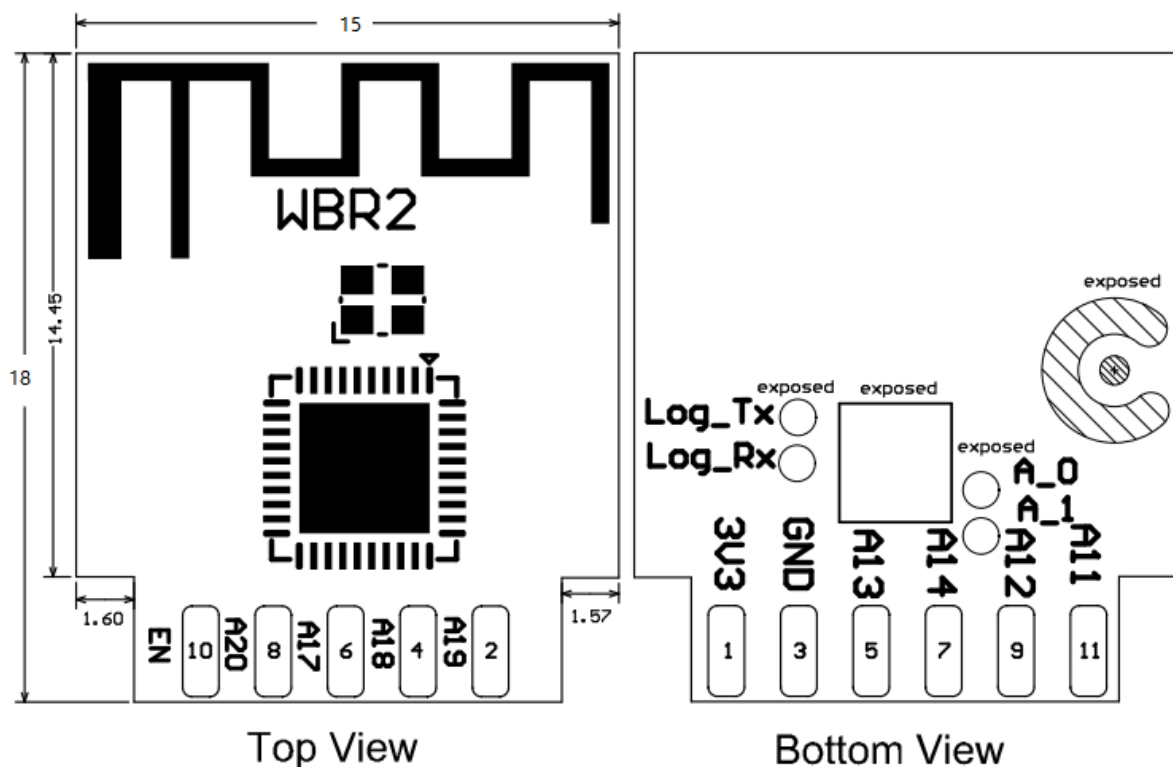
1.2 Applications

- Intelligent building
- Smart household and home appliances
- Smart socket and light
- Industrial wireless control
- Baby monitor
- Network camera
- Intelligent bus

2 Module interfaces

2.1 Dimensions and footprint

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



2.2 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

Pin number	Symbol	IO type	Function
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
10	EN	I/O	Enabling pin, which works at the high level and is pulled up and controlled by a user externally

Pin number	Symbol	IO type	Function
11	A11	I/O	GPIOA_11, hardware PWM, IC Pin25

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

3 Electrical parameters

3.1 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 discharge voltage (human body model)	TAMB-25°C	-	2	KV
Static electricity discharge 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	-	85	°C
VDD	Working voltage	3.0	-	3.6	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
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 _{max}	I/O drive current	-	-	16	mA
C _{pad}	Input pin capacitance	-	2	-	pF

3.3 RF power consumption

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
IRF	11n BW20 MCS7	13 dBm	145	167	mA

Symbol	Mode	Power	Average value	Peak value (Typical value)	Unit
IRF	11n BW20 MCS7	16.5 dBm	165	193	mA

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

3.4 Working power consumption

Working mode	Working status, Ta = 25°C	Average value	Maximum 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	61	272	mA

Working mode	Working status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Quick network connection state (AP)	The module is in the hotspot network connection state and the Wi-Fi indicator flashes slowly	59	272	mA
Quick network connection state (EZ)	The module is in the fast network connection state and the Wi-Fi indicator flashes fast	62	280	mA
No operation during network connection	The module is connected to the network and the Wi-Fi indicator is always on	51	260	mA
Operations are being performed during network connection	The module is connected to the network and the Wi-Fi indicator is always on	59	268	mA

Working mode	Working status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
Weakly connected	The module and the hotspot are weakly connected and the Wi-Fi indicator light is always on	62	264	mA
Disconnected	The module is in disconnected state and the Wi-Fi indicator light is always off	57	268	mA
Module disabled	The EN pin of the module is connected to the ground.	1.5	1.6	uA

4 RF parameters

4.1 Basic RF features

Parameter	Description
Frequency range	2.400 to 2.4835 GHz
WiFi standard	IEEE 802.11b/g/n (channels 1 to 14)
Bluetooth 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 MCS 0 to 7
Antenna Type	PCB antenna with a gain of 2.5 dBi

4.2 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, Bluetooth 4.2, 1 Mbit/s	-	6.5	-	dBm
Frequency error	-20	-	20	ppm
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

4.3 RX performance

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b CCK Mode 1M	-	-97	-	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, Bluetooth 4.2 1M	-	-93	-	dBm

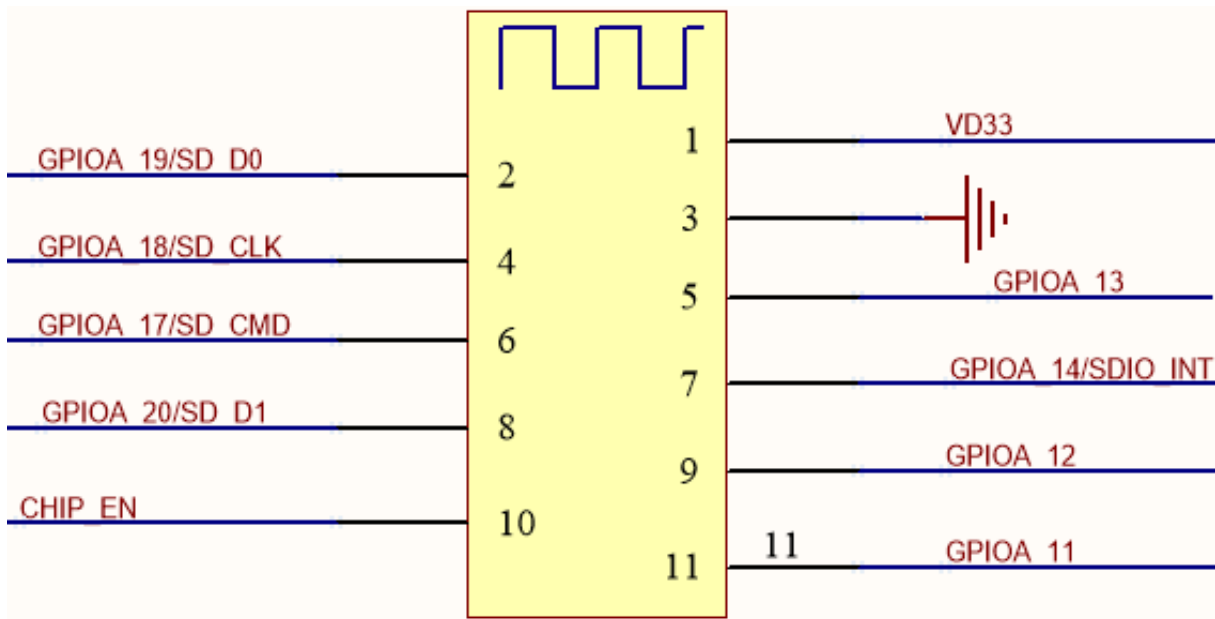
5 Antenna

5.1 Antenna type

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

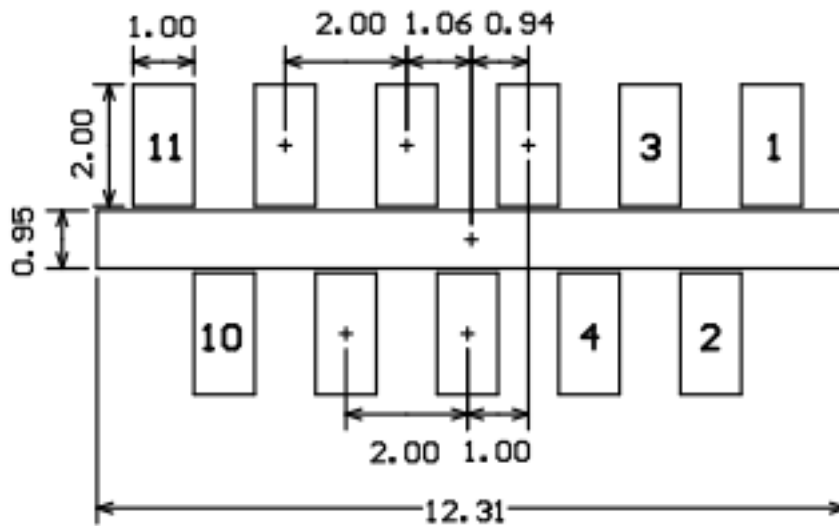
5.2 Antenna interference production

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.



WBR2 PCB Layout is shown as below:

Recommended footprint



6.3 Production instructions

1. For the Tuya in-line module, wave soldering is most preferred and manual soldering is less preferred. After being unpacked, the module must be soldered

within 24 hours. Otherwise, it must be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and record the exposure time (the total exposure time cannot exceed 168 hours).

2. Wave soldering devices and materials:

- Wave soldering equipment
- Wave soldering fixture
- Constant-temperature soldering iron
- Tin bar, tin wire, and flux
- Thermal profiler

3. Baking devices:

- Cabinet oven
- Anti-electrostatic and heat-resistant trays
- Anti-electrostatic and heat-resistant gloves

4. The module needs to be baked in the following cases:

- The packaging bag is damaged before unpacking.
- There is no humidity indicator card (HIC) in the packaging bag.
- After unpacking, circles of 10% and above on the HIC become pink.
- The total exposure time has lasted for over 168 hours since unpacking.
- More than 12 months have passed since the sealing of the bag.

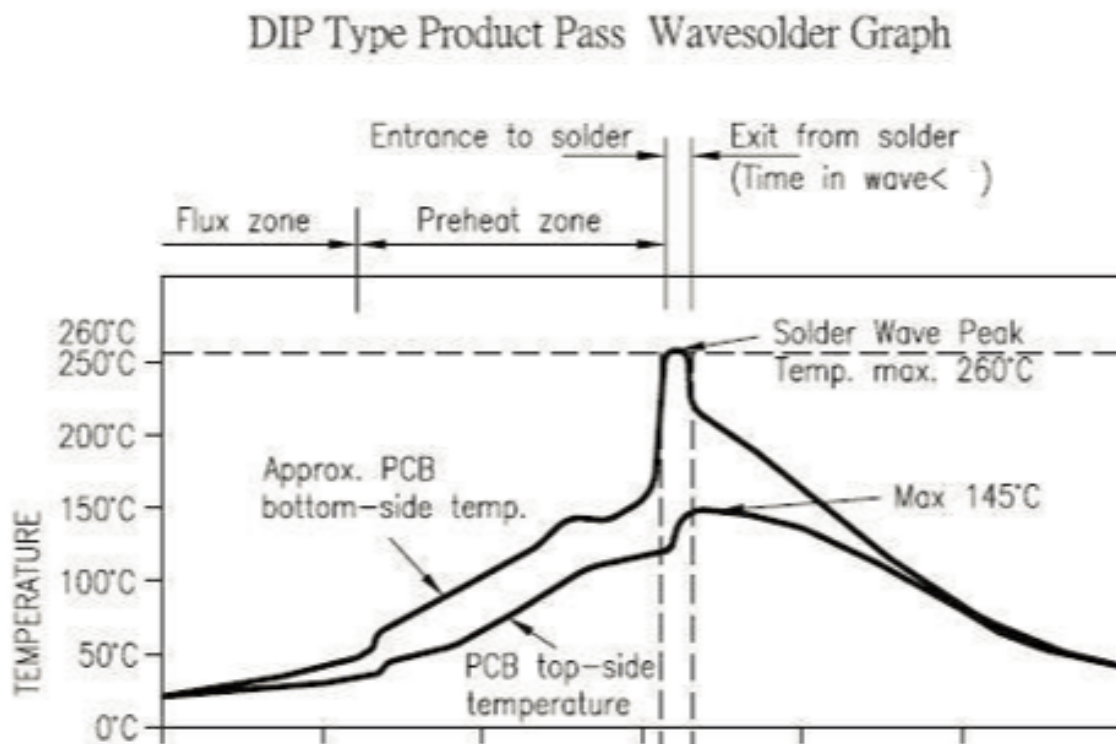
5. Baking settings:

- Temperature: 60°C and $\leq 5\%$ RH for reel package and 125°C and $\leq 5\%$ RH for tray package (please use the heat-resistant tray rather than plastic container)
- Time: 48 hours for reel package and 12 hours for tray package
- Alarm temperature: 65°C for reel package and 135°C for tray package
- Production-ready temperature after natural cooling: $< 36^\circ\text{C}$
- Re-baking situation: If a module remains unused for over 168 hours after being baked, it needs to be baked again.
- If a batch of modules is not baked within 168 hours, do not use the wave soldering to solder them. Because these modules are Level-3 moisture-sensitive devices, they are very likely to get damp when exposed beyond the allowable time. In this case, if they are soldered at high temperatures, it may result in device failure or poor soldering.

6. In the whole production process, take electrostatic discharge (ESD) protective measures.
7. To guarantee the quality of products, you must pay attention to the following items: 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 appropriate.

6.4 Recommended oven temperature curve and temperature

Set oven temperatures according to the following temperature curve of wave soldering. The peak temperature is $260^{\circ}\text{C} \pm 5^{\circ}\text{C}$.



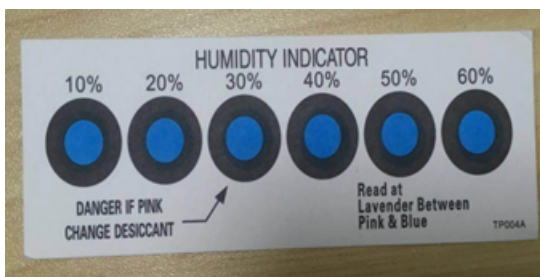
Recommended soldering temperature:

Suggestions on oven temperature curve of wave soldering		Suggestions on manual soldering temperature	
Preheat temperature	80 to 130 °C	Soldering temperature	360±20°C
Preheat time	75 to 100s	Soldering time	< 3s/point
Peak contact time	3 to 5s	NA	NA
Temperature of tin cylinder	260±5°C	NA	NA
Ramp-up slope	≤2°C/s	NA	NA
Ramp-down slope	≤6°C/s	NA	NA

6.5 Storage conditions

Storage conditions for a delivered module:

- The moisture-proof bag is placed in an environment where the temperature is below 40°C and the relative humidity is lower than 90%.
- The shelf life of a dry-packaged product is 12 months from the date when the product is packaged and sealed.
- There is a humidity indicator card (HIC) in the packaging bag.



7 MOQ and packaging information

Product Number	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
WBR2	4400	Tape reel	1100	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 device.

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 device has been tested and found to comply with the limits for a Class B digital device, according to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This device generates, uses, and can radiate radio frequency energy and, if not installed and used following 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 device does cause harmful interference to radio or television reception, which can be determined by turning the device 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 device and receiver.
- Connect the device 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 device complies with FCC radiation exposure limits set forth for an uncontrolled rolled environment. This device 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 following FCC multi-transmitter product procedures. Additional testing and device 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 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/warnings 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-WBR2. The 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:

The antenna must be installed such that 20cm is maintained between the antenna and users, and 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 the 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.