



WBR3 Module Datasheet

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WBR3 is a low-power embedded Wi-Fi+Bluetooth module that Tuya has developed. It consists of a highly integrated RF chip (W701-VA2-CG), with an embedded Wi-Fi network protocol stack and varied library functions.

1 Overview

With the maximum CPU clock rate of 100MHz, WBR3 also contains a low-power KM4 microcontroller unit (MCU), WLAN MAC, a 1T1R WLAN module, 256-KB static random-access memory (SRAM), 2-MB flash memory, and extensive peripherals.

WBR3 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 KM4 MCU, which can also function as an application processor, clock rate: 100 MHz
- Working voltage: 3.0 to 3.6 V
- Peripherals: 9 GPIOs, 1 universal asynchronous receiver/transmitter (UART), and 1 log transmitter
- Wi-Fi/Bluetooth connectivity
 - 802.11 B/G/N20
 - Channels 1 to 14 at 2.4 GHz (CH1-11 for US/CA, CH1-13 for EU/CN)
 - Support WEP/WPA/WPA2/WPA2 PSK (AES) security modes
 - Support Bluetooth 4.2 Low Energy
 - Up to +20 dBm output power in 802.11b mode
 - Support SmartConfig for Android and iOS devices
 - Onboard PCB antenna
 - Passed CE and FCC certification
 - Working temperature: -20 to +85°C

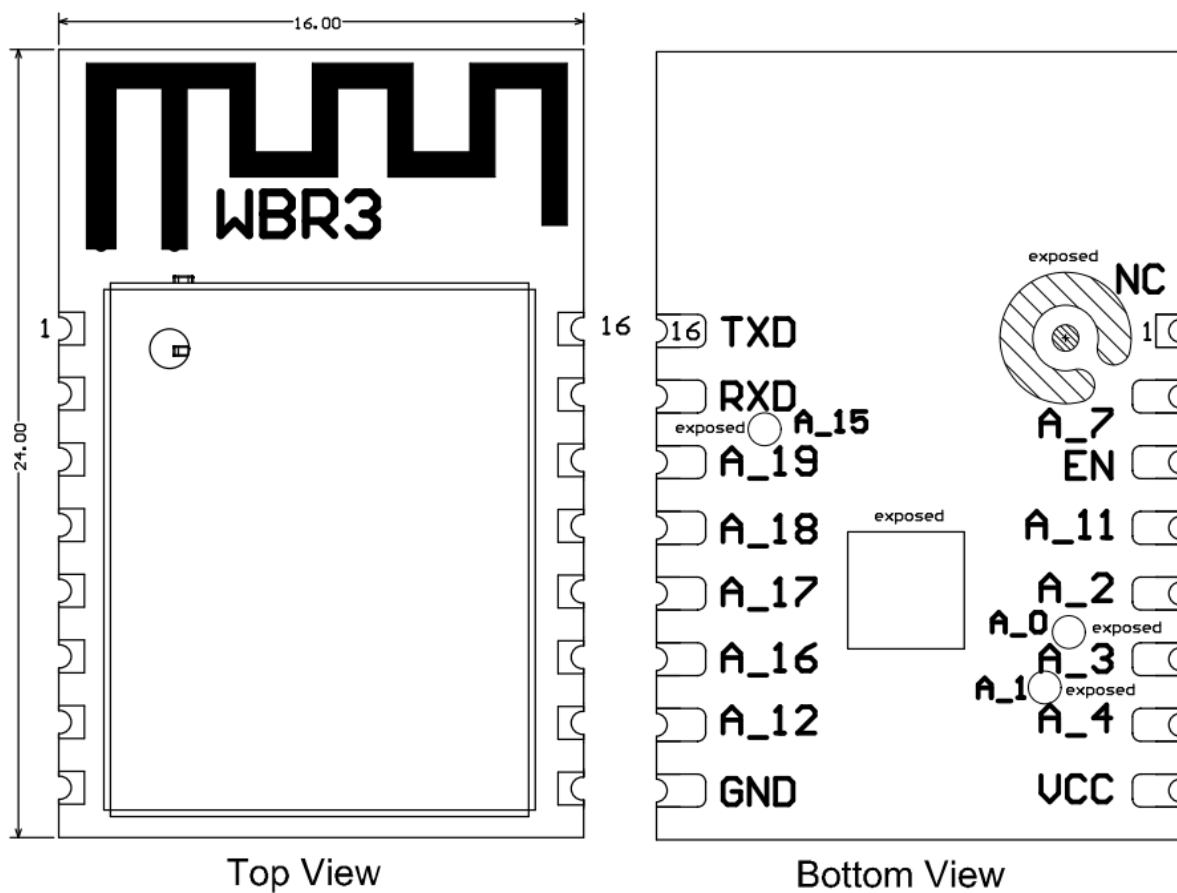
1.2 Applications

- 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

As shown in the following figure, WBR3 has two rows of pins and each row includes 8 pins with a 2 mm pin spacing. The WBR3 dimensions (H x W x L) are 2.9 mm x 16 mm x 24 mm. The default dimensional tolerance is ± 0.35 mm.



2.2 Pin definition

Pin number	Symbol	I/O type	Function
1	NC	/	The pin is pulled up to be compatible with other modules
2	A_7	I/O	GPIOA_7, hardware PWM, IC Pin 21
3	EN	I/O	Enabling pin, which works at the high level and is pulled up and controlled by a user externally
4	A_11	I/O	GPIOA_11, hardware PWM, IC Pin 25
5	A_2	I/O	GPIOA_2, hardware PWM, IC Pin 18
6	A_3	I/O	GPIOA_3, hardware PWM, IC Pin 19
7	A_4	I/O	GPIOA_4, hardware PWM, IC Pin 20
8	VCC	P	Power supply pin (3.3V)
9	GND	P	Power supply reference ground
10	A_12	I/O	GPIOA_12, hardware PWM, IC Pin 26

Pin number	Symbol	I/O type	Function
11	A_16	I/O	GPIOA_16, UART_Log_TXD, which is used for displaying the module internal information and can be configured as a common GPIO
12	A_17	I/O	GPIOA_17, hardware PWM, IC Pin 38
13	A_18	I/O	GPIOA_18, hardware PWM, IC Pin 39
14	A_19	I/O	GPIOA_19, hardware PWM, IC Pin 40
15	RXD	I/O	GPIOA_13, UART0_RXD, which is used as a user-side serial interface pin
16	TXD	I/O	GPIOA_14, UART0_TXD, which is used as a user-side serial interface pin

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
ESD voltage (human body model)	TAMB-25°C	-	2	KV
ESD 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	Power supply voltage	3.0	-	3.6	V
VIL	I/O low-level input	-	-	0.8	V
VIH	I/O high-level input	2.0	-	-	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
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 11 Mbps	17 dBm	217	268	mA
IRF	11b 11 Mbps	18 dBm	231	283	mA
IRF	11g 54 Mbps	15 dBm	159	188	mA
IRF	11g 54 Mbps	17.5 dBm	177	213	mA
IRF	11n BW20 MCS7	13 dBm	145	167	mA
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
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

Working mode	Working status, Ta = 25°C	Average value	Maximum value (Typical value)	Unit
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
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
Wi-Fi 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 peak gain of 2.54 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 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

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

WBR3 uses an onboard PCB antenna with a peak gain of 2.54 dBi.

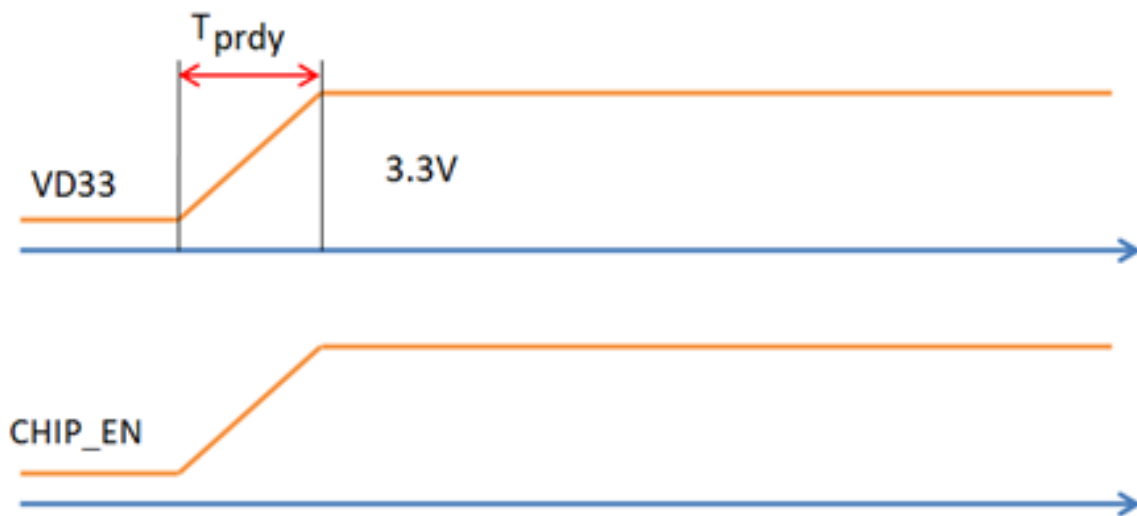
5.2 Antenna interference reduction

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.

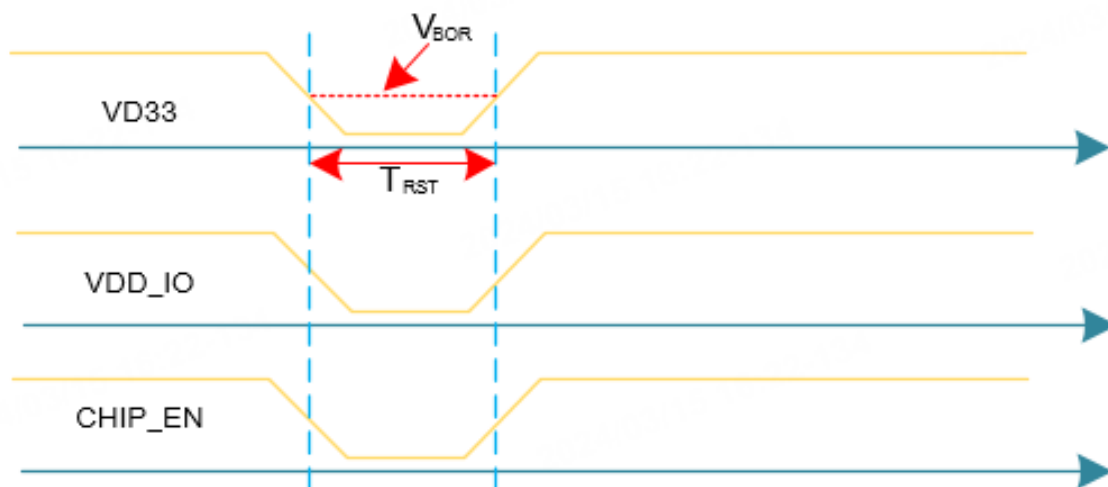
6 Power-on/off sequence

6.1 Power-on sequence

The W701 chip has requirements on the power-on sequence. It is recommended that the voltage rises from 0 to 3.3V within 20 ms.



6.2 Power-off sequence

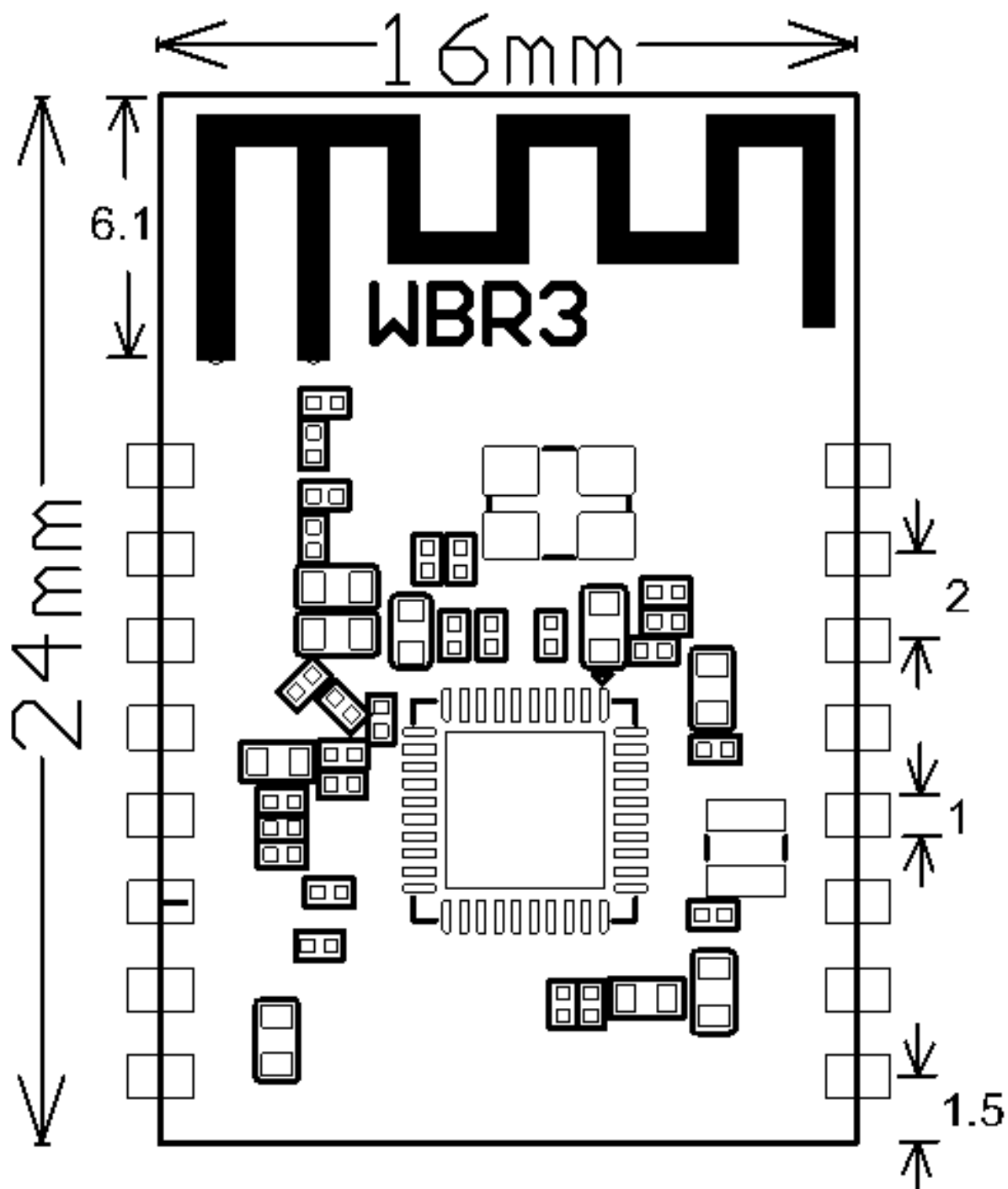


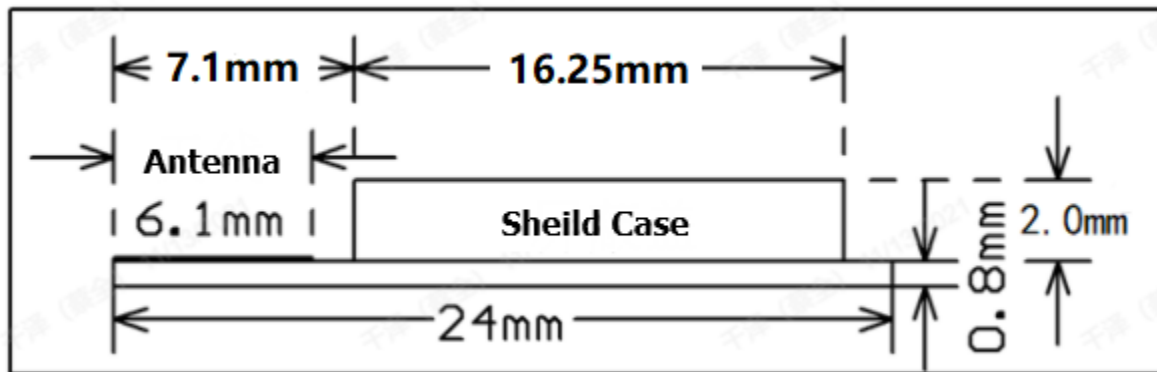
Symbol	Parameter	Minimum value	Typical value	Maximum value	Unit
TPRDY	3.3V ready time	0.6	-	20	ms
CHIP_EN	CHIP_EN ready time	0.6	-	20	ms
V _{BOR}	BOR occurs after 3.3V is lower than this voltage	2	-	-	V
T _{RST}	The required time that 3.3V is lower than V _{BOR}	1	-	-	ms

7 Packaging information and production instructions

7.1 Mechanical dimensions

As shown in the following figure, the mechanical dimensions of the PCB of WBR3 are 16 ± 0.35 mm (W) $\times$ 24 ± 0.35 mm (L) $\times$ 0.8 ± 0.1 mm (H).

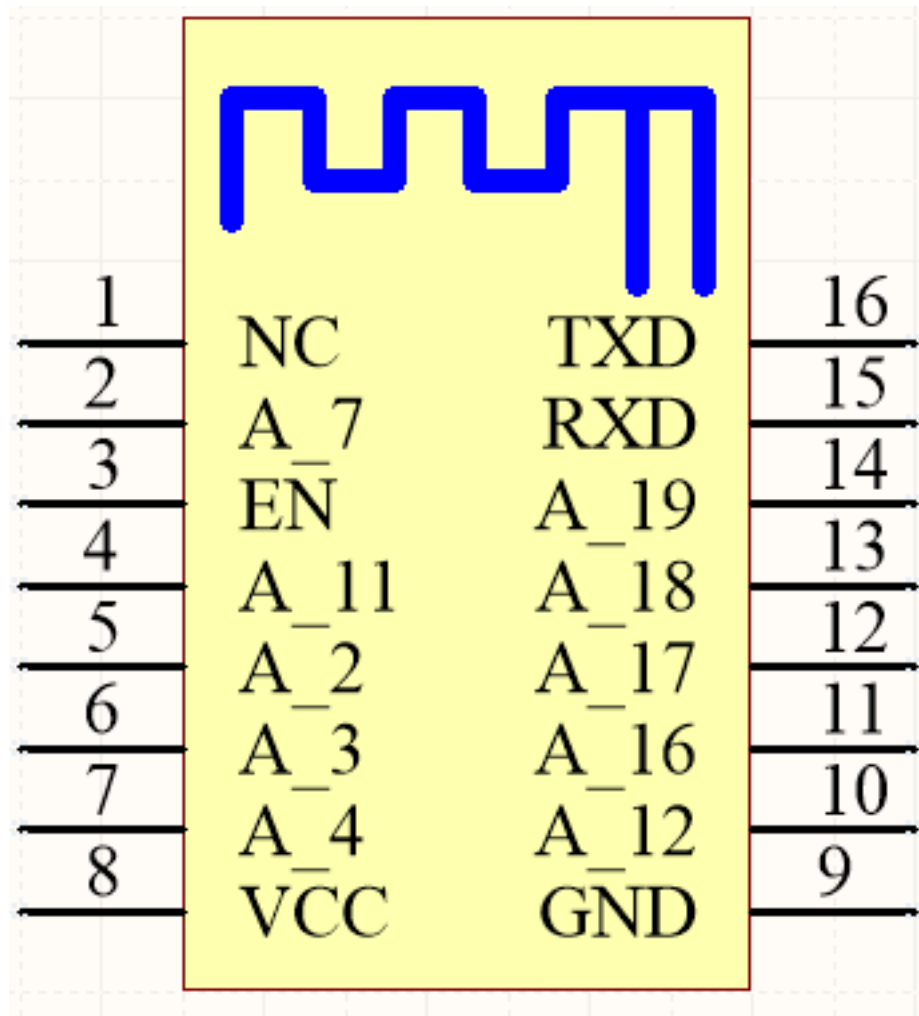




Note: The default dimensional tolerance is ± 0.35 mm. If you have specific requirements on dimensions, make them clear in the datasheet after communication.

7.2 Recommended PCB layout

The following figure is a schematic diagram of WBR3 which shows how pins correspond to each other.



WBR3 PCB Layout is shown as below:

7.3 Production instructions

1. The Tuya SMT module should be mounted by the SMT device. After being unpacked, it should be soldered within 24 hours. Otherwise, it should be put into the drying cupboard where the RH is not greater than 10%; or it needs to be packaged under vacuum again and the exposure time needs to be recorded (the total exposure time cannot exceed 168 hours).

- SMT devices:
 - Mounter
 - SPI
 - Reflow soldering machine
 - Thermal profiler
 - Automated optical inspection (AOI) equipment
- Baking devices:
 - Cabinet oven
 - Anti-electrostatic and heat-resistant trays
 - Anti-electrostatic and heat-resistant gloves

2. Storage conditions for a delivered module:

- The moisture-proof bag must be 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.

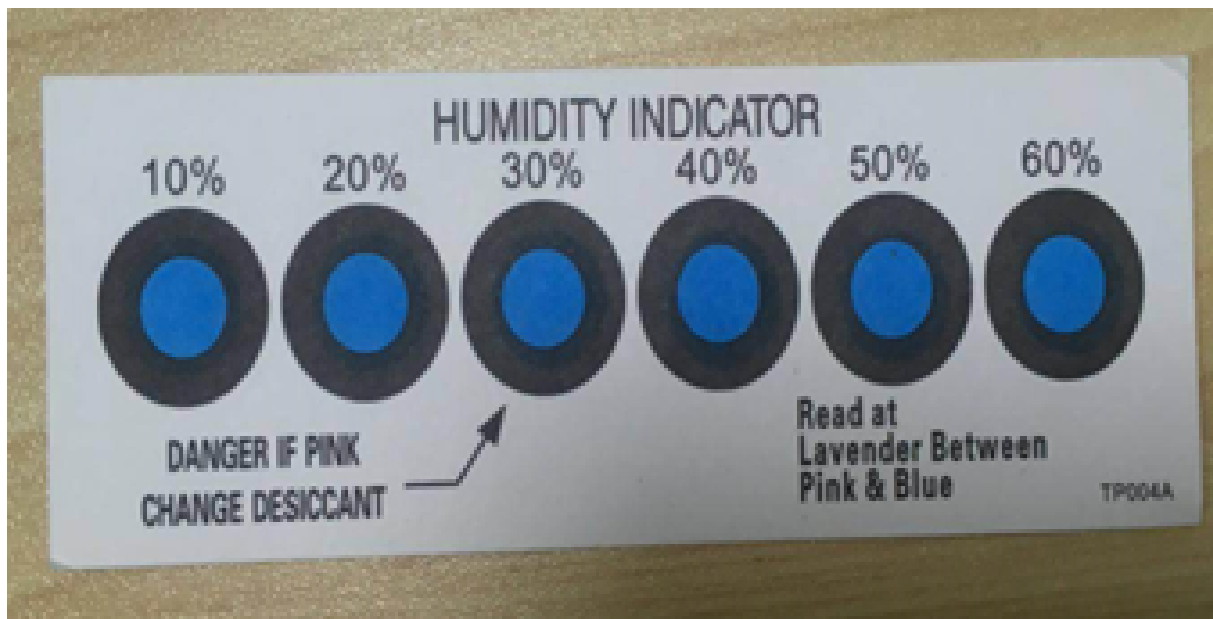


Figure 1: img

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

- The packaging bag is damaged before unpacking.
- There is no 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.

4. Baking settings:

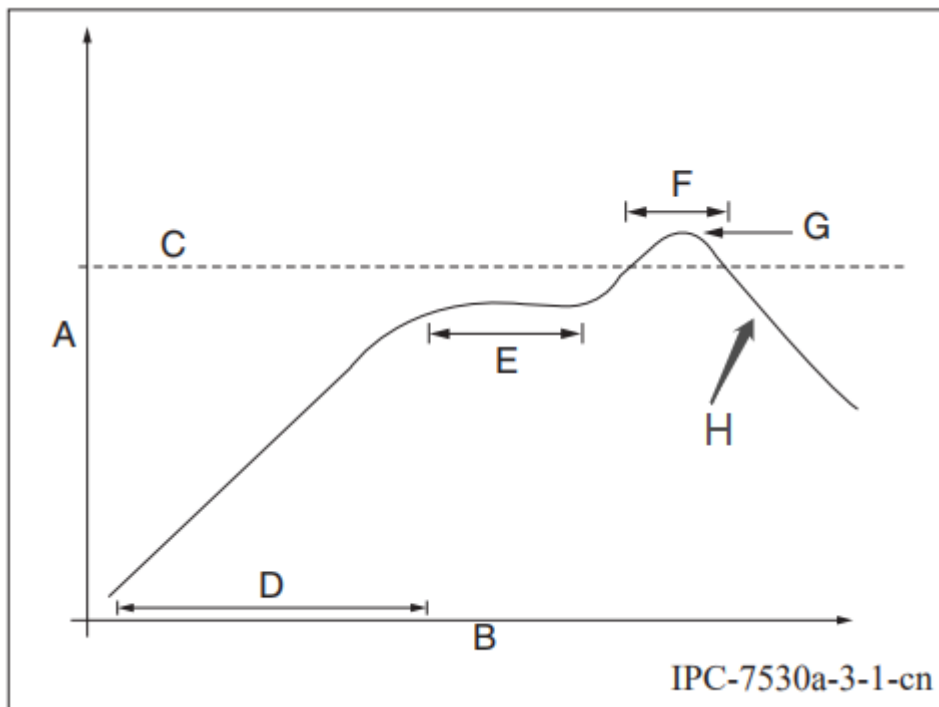
- Temperature: 40°C and $\leq 5\%$ RH for reel package and 125°C and $\leq 5\%$ RH for tray package (please use the heat-resistant tray rather than plastic container)
- Time: 168 hours for reel package and 12 hours for tray package
- Alarm temperature: 50°C for reel package and 135°C for tray package
- 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.

5. In the whole production process, take electrostatic discharge (ESD) protective measures.
6. To guarantee the passing rate, it is recommended that you use the SPI and AOI to monitor the quality of solder paste printing and mounting.

7.4 Recommended oven temperature curve

Set oven temperatures according to the following temperature curve of reflow soldering. The peak temperature is 245°C.



- A: Temperature axis
- B: Time axis
- C: Liquidus temperature: 217 to 220°C
- D: Ramp-up slope: 1 to 3°C/s
- E: Duration of constant temperature: 60 to 120s; the range of constant temperature: 150 to 200°C

- F: Duration above the liquidus: 50 to 70s
- G: Peak temperature: 235 to 245°C
- H: Ramp-down slope: 1 to 4°C/s

Note: The above curve is just an example of the solder paste SAC305. For more details about other solder pastes, please refer to Recommended oven temperature curve in the solder paste specifications.

7.5 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 be a) Mounted within: 168 hours of factory conditions If blank, see adjacent bar code label ≤30°C/60% RH, or b) Stored per J-STD-033 4. Devices require bake, before mounting, if: a) Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at 23 ± 5°C b) 3a or 3b are not met 5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure		
See Production Date Bag Seal Date: _____ If blank, see adjacent bar code label		
Note: Level and body temperature defined by IPC/JEDEC J-STD-020		

8 MOQ and packaging information

Product model	MOQ (pcs)	Shipping packaging method	The number of modules per reel	The number of reels per carton
WBR3	3600	Tape reel	900	4

9 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 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 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-WBR3. The final end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-WBR3” .

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.

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 a municipal recycling collection point.