



WR3 Module Datasheet

Version: 20210926

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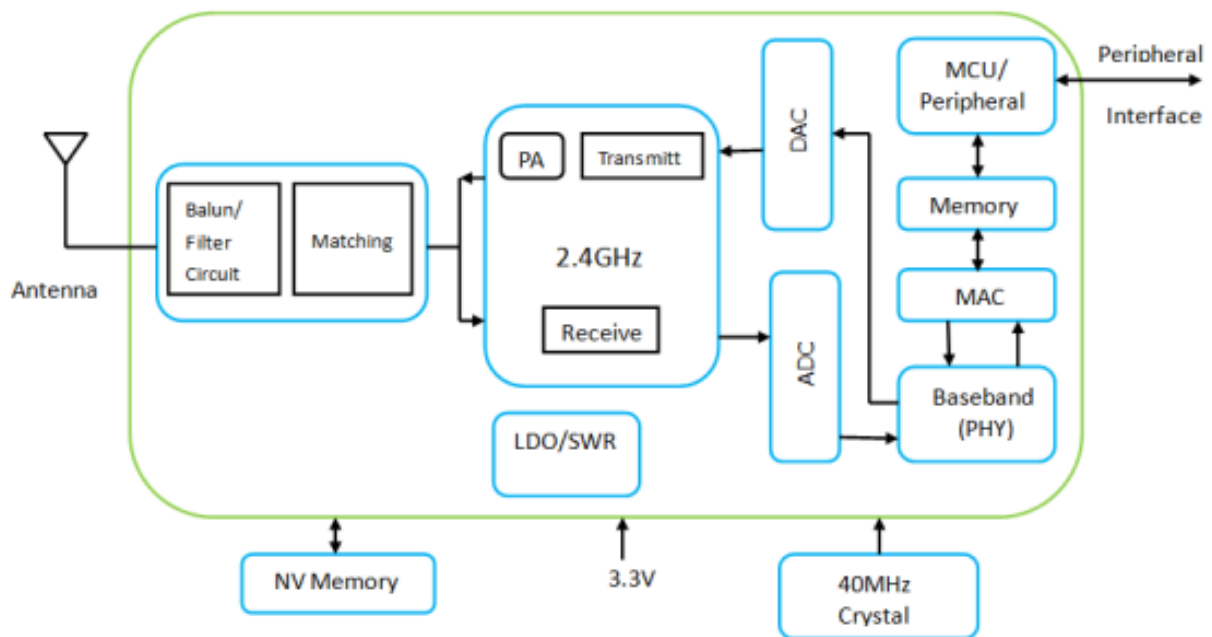
WR3 is a low-power embedded Wi-Fi module that Tuya has developed. Embedded with the Wi-Fi network protocol stack and rich library functions, it also consists of a highly integrated RF chip (RTL8710BN) and an external flash chip.

1 Overview

With the maximum CPU clock rate of 125 MHz, WR3 contains a low-power ARM CM4F, a WLAN MAC, a 1T1R WLAN module, 256-KB SRAM, 2-MB flash memory, and rich peripherals.

WR3 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.

The following is the structural diagram of WR3:



1.1 Features

- Embedded low-power 32-bit CPU, which can also function as an application processor
- The maximum clock rate: 125MH
- Operating voltage: $3.3 \pm 0.3V$
- Peripherals: 7 GPIOs, 2 UARTs, and 1 ADC
- Wi-Fi connectivity
 - IEEE 802.11 b/g/n
 - Channels 1 to 14@2.4 GHz
 - Support WEP/WPA/WPA2/WPA2 PSK (AES) security mode

- Up to + 20dBm output power in 802.11b mode
- Support STA/AP/STA+AP working mode
- Support SmartConfig functions
- Operating 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

Date	Updated content	Version after update
03/09/2020	This is the first release.	1.0.0
04/13/2020	Update power consumption data	1.0.1

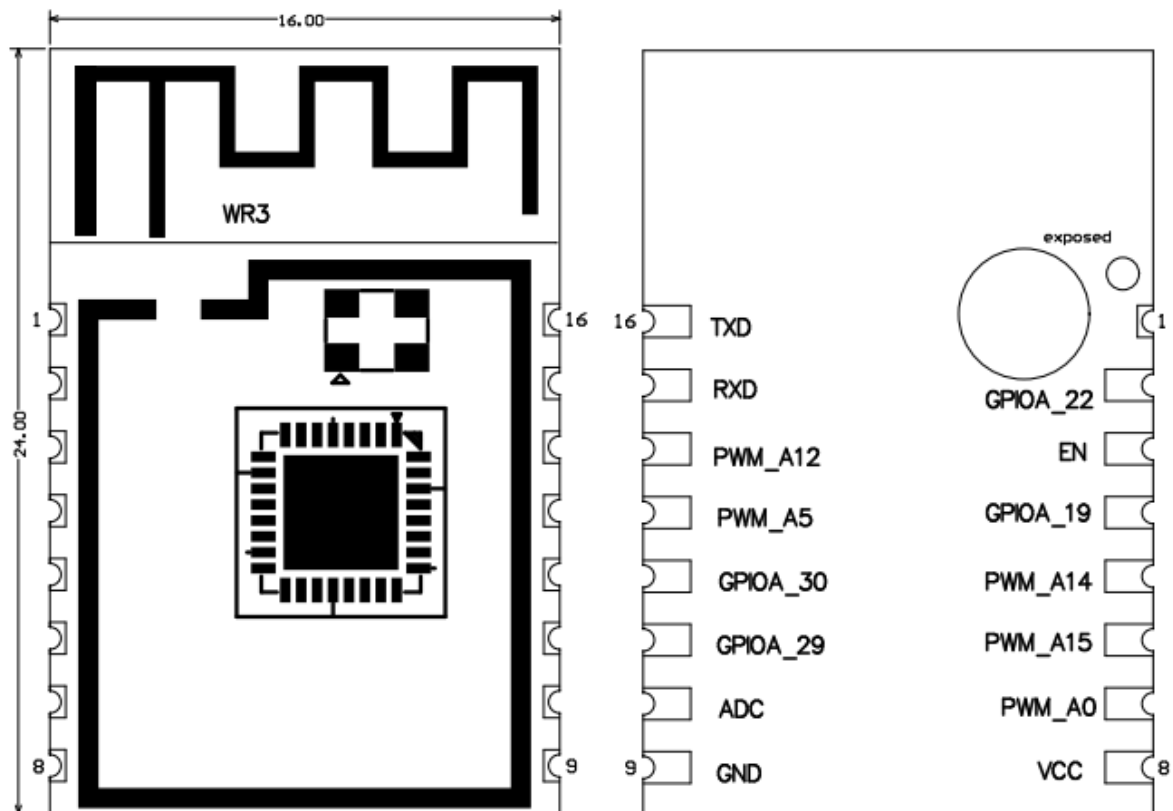
2 Module interfaces

2.1 Dimensions and footprint

WR3 has two lines of pins with a spacing of 2.0 mm. There are 8 pins in a line.

The WR3 dimensions are 16 ± 0.35 mm (W) \times 24 ± 0.35 mm (L) \times 3.4 ± 0.15 mm (H).

The diagram of dimensions of WR3:



Top View

Bottom View

2.2 Pin definition

Pin number	Symbol	I/O type	Function
1	NC	/	Pulled up and not connected, to be compatible with other modules
2	GPIOA_22	I/O	GPIOA_22, hardware PWM, Pin 31 of the IC
3	CHIP_EN	I/O	When software disables the function, connection by a user fails
4	GPIOA_19	I/O	GPIOA_19, a universal I/O port, Pin 30 of the IC
5	GPIOA_14	I/O	GPIOA_14, hardware PWM, Pin 13 of the IC
6	GPIOA_15	I/O	GPIOA_15, hardware PWM, Pin 14 of the IC
7	GPIOA_0	I/O	GPIOA_0, which cannot be pulled high when powered on, and which is configurable after the level is pulled to be high, hardware PWM, Pin 16 of the IC
8	VD33	P	Power supply pin (3.3V)

Pin number	Symbol	I/O type	Function
9	GND	P	Power supply reference ground
10	ADC	AI	ADC port, the maximum input voltage is 5V
11	GPIOA_29	I/O	UART_Log_RXD (used to print the internal information of the module), which can be configured as a universal GPIO. The module has been pulled up. The pin cannot be triggered at high level
12	GPIOA_30	I/O	UART_Log_TXD (used to print the internal information of the module), which can be configured as a universal GPIO
13	GPIOA_5	I/O	GPIOA_5, hardware PWM, Pin 28 of IC
14	GPIOA_12	I/O	GPIOA_12, hardware PWM, Pin 17 of IC
15	RXD	I/O	UART0_RXD (user-side serial interface)

Pin number	Symbol	I/O type	Function
16	TXD	I/O	UART0_TXD (user-side serial interface)

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

3 Electrical parameters

3.1 Absolute electrical parameters

Parameter	Description	Minimum value	Maximum value	Unit
Ts	Storage temperature	-20	105	°C
V _{BAT}	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 Normal working conditions

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
Ta	Operating temperature	-20	-	85	°C
V _{BAT}	Power supply voltage	3.0	3.3	3.6	V
V _{IL}	I/O low-level input	-0.3	-	VCC*0.25	V
V _{IH}	I/O high-level input	VCC*0.75	-	VCC	V

Parameter	Description	Minimum value	Typical value	Maximum value	Unit
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	-	-	16	mA

3.3 TX power consumption

Working status	Mode	Rate	Transmit power/Receive	Average value	Peak value (Typical value)	Unit
Transmit	11b	11Mbps	+17dBm	287	367	mA
Transmit	11b	11Mbps	+18dBm	295	382	mA
Transmit	11g	54Mbps	+15dBm	255	406	mA
Transmit	11g	54Mbps	+17.5dBm	267	428	mA
Transmit	11n-HT20	MCS7	13dBm	244	395	mA
Transmit	11n-HT20	MCS7	16.5dBm	257	422	mA
Transmit	11n-HT40	MCS7	13dBm	220	393	mA
Transmit	11n-HT40	MCS7	16.5dBm	230	420	mA

3.4 Operating current

Working mode	Working status, Ta = 25°C	Average value	Peak value (Typical value)	Unit
Quick connection network state	The module is in the fast network connection state and the Wi-Fi indicator flashes fast	115	376	mA
Pairing with the network with the hotspot	The module is pairing with the network with the hotspot and the Wi-Fi indicator flashes slowly	60	386	mA
Connected	The module is connected to the network and the Wi-Fi indicator is always on	105	389	mA
Disconnected	The module is disconnected and the Wi-Fi indicator is off	45	381	mA

4 RF parameters

4.1 Basic RF features

Parameter	Description
Working frequency	2.412 to 2.480 GHz
Wi-Fi standard	IEEE 802.11/g/n (channels 1 to 14)
Data transmission rate	11b: 1, 2, 5.5, 11 (Mbps); 11g: 6, 9, 12, 18, 24, 36, 48, 54 (Mbps); 11n: HT20 MCS 0 to 7; HT40 MCS 0 to 7
Antenna type	Onboard PCB antenna with the gain of 2.5 dBi

4.2 TX performance

2.4G 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
Average RF output power, 802.11n Mode	-	13.5	-	dBm

Parameter	Minimum value	Typical value	Maximum value	Unit
Frequency error	-10	-	10	ppm

4.3 RX performance

RX sensitivity

Parameter	Minimum value	Typical value	Maximum value	Unit
PER<8%, RX sensitivity, 802.11b DSSS Mode 11M	-	-91	-	dBm
PER<10%, RX sensitivity, 802.11a/g OFDM Mode 54M	-	-75	-	dBm
PER<10%, RX sensitivity, 802.11n OFDM Mode HT20-MCS7	-	-72	-	dBm

5 Antenna

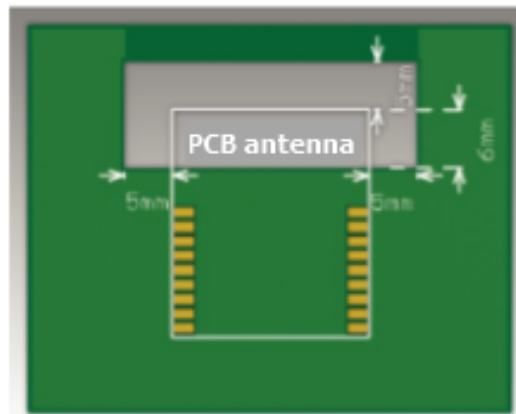
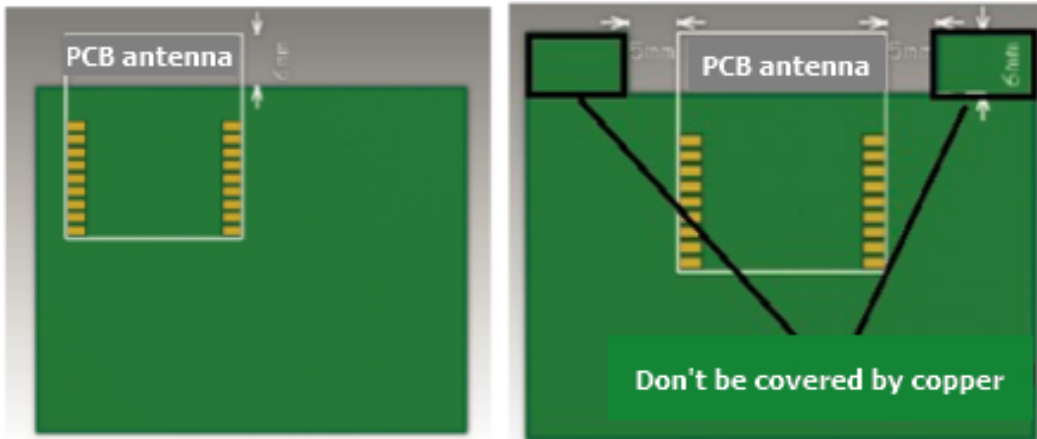
5.1 Antenna type

WR3 uses only an onboard PCB 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 15 mm away from other metal parts.

To ensure antenna performance, the antenna area in the PCB should not be routed or clad with copper. The main points of the layout: 1. Make sure that there is no substrate medium directly below or above the printed antenna. 2. Make sure that the area around the printed antenna is far away from copper, so as to ensure the radiation effect of the antenna to the greatest extent.

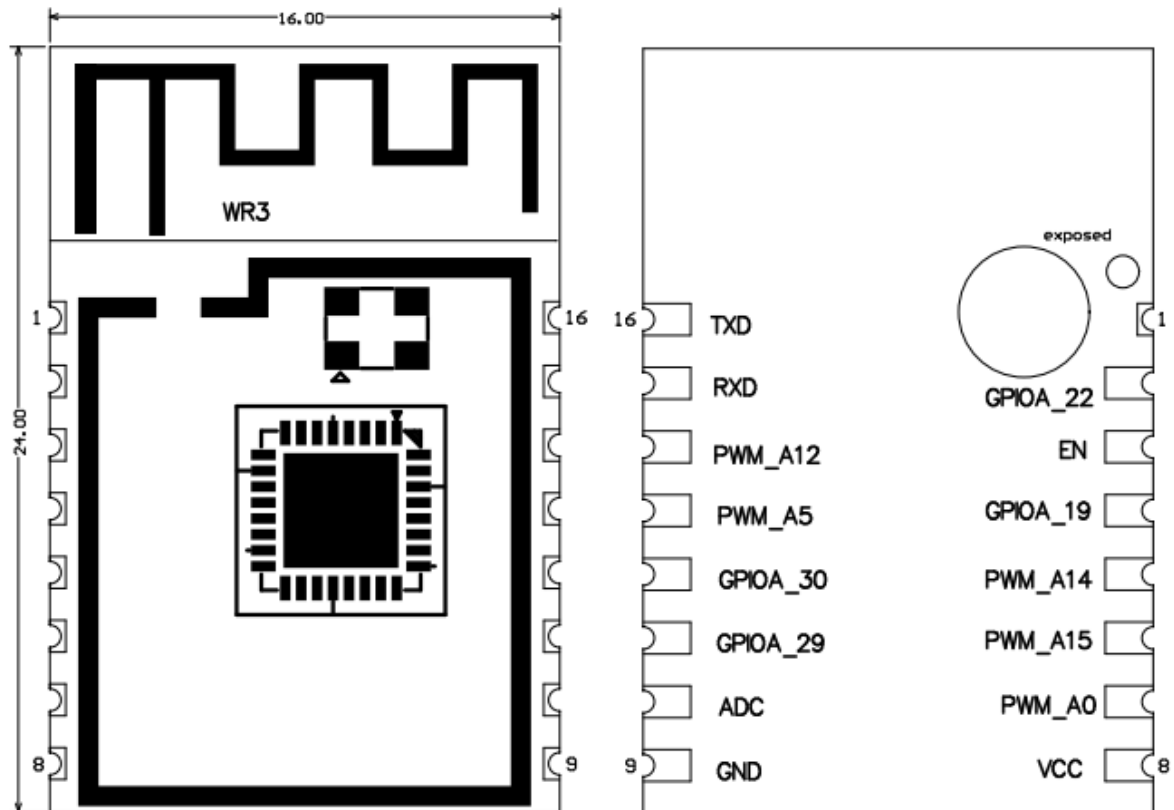


For the antenna area of the PCB of the module, see the diagram of mechanical dimensions.

6 Packaging information and production instructions

6.1 Mechanical dimensions

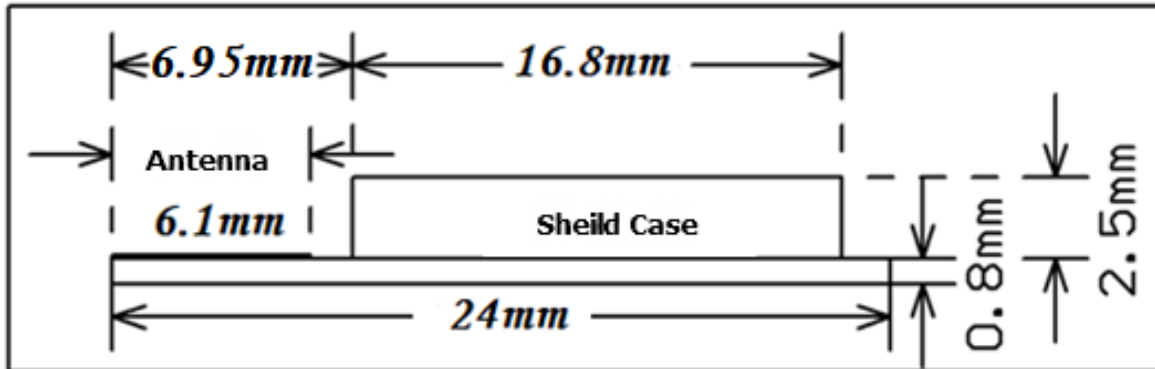
The PCB dimensions are 16 ± 0.35 mm (W) \times 24 ± 0.35 mm (L) \times 0.8 ± 0.1 mm (H).



Top View

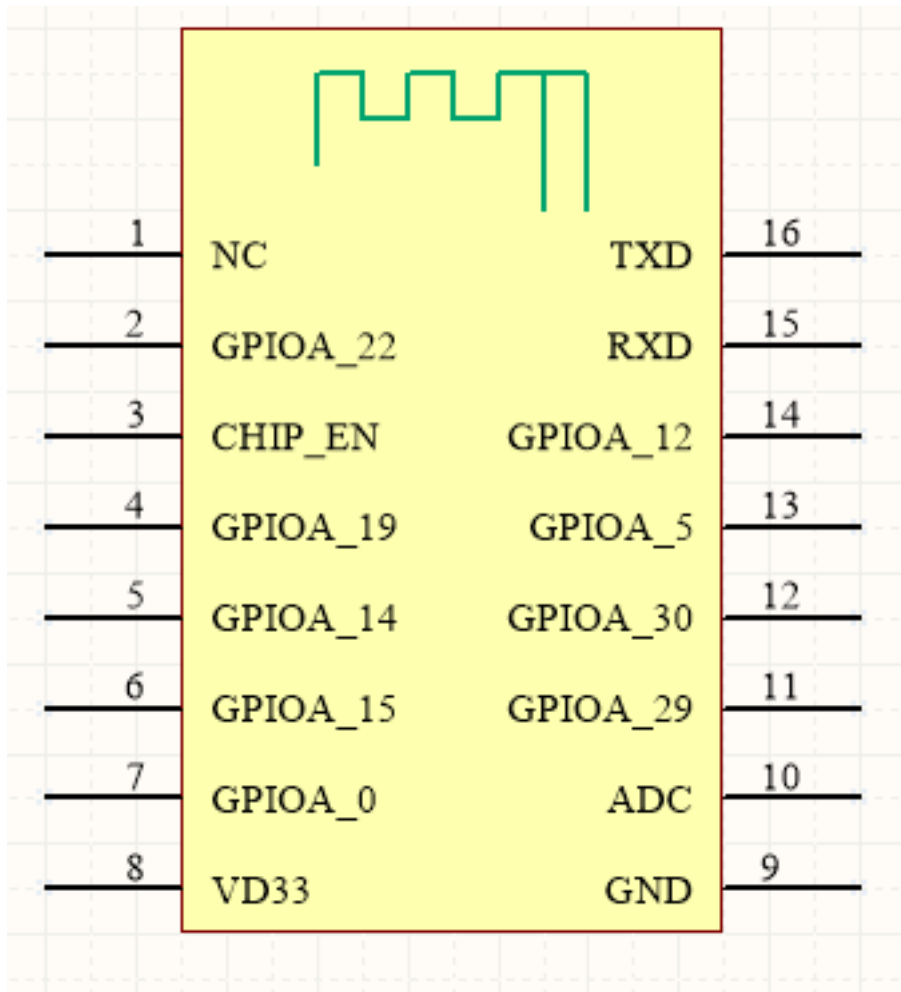
Bottom View

6.2 Side view



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

6.3 The schematic diagram of footprint

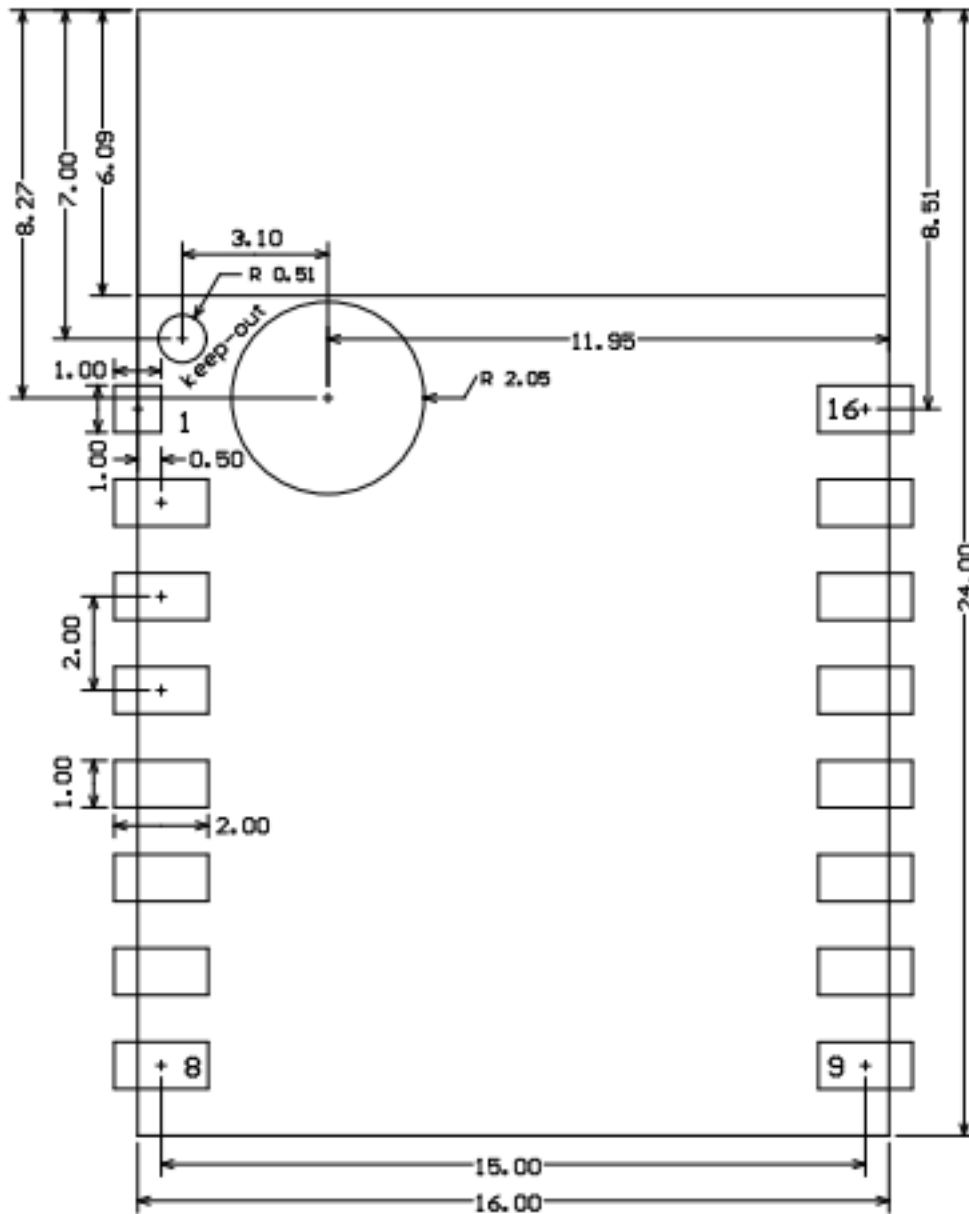


6.4 PCB footprint-Pin header

Optionally, WR3 can use the SMT.

6.5 PCB footprint-SMT

Recommended footprint



6.6 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.

```
1 ! [HIC-SMT module.png] (https://airtake-public-data-1254153901.cos.ap
2 -shanghai.myqcloud.com/goat/20210410/48793a0e11ea40d4839db36535e47bf
3 5.png)
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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.

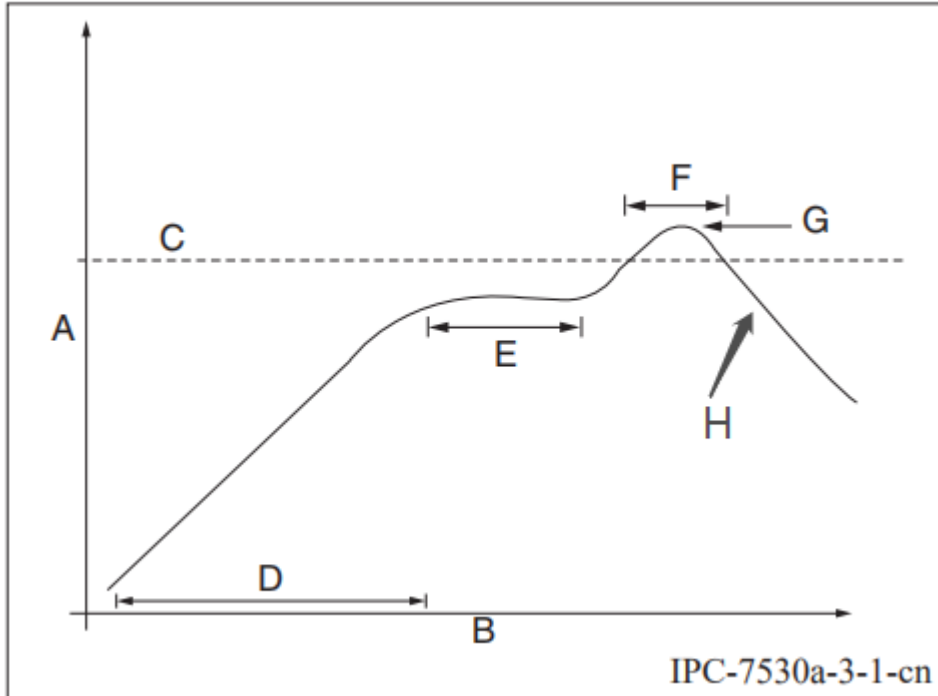
4. Baking settings:

- Temperature: 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°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 reflow 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.

6.7 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.

6.8 Storage conditions

	<p>Caution This bag contains MOISTURE-SENSITIVE DEVICES</p>	<p>LEVEL</p> <table border="1" style="margin: auto;"> <tr> <td style="text-align: center; padding: 5px;">3</td> </tr> </table> <p><small>If blank, see adjacent bar code label</small></p>	3
3			
<p>1. Calculated shelf life in sealed bag: 12 months at <math><40^{\circ}\text{C}</math> and <math><90\%</math> 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 be</p>			
<p>a) Mounted within: <u>168</u> hours of factory conditions <small>If blank, see adjacent bar code label</small> ≤30°C/60% RH, or</p>			
<p>b) Stored per J-STD-033</p>			
<p>4. Devices require bake, before mounting, if:</p>			
<p>a) Humidity Indicator Card reads >10% for level 2a - 5a devices or >60% for level 2 devices when read at $23 \pm 5^{\circ}\text{C}$</p>			
<p>b) 3a or 3b are not met</p>			
<p>5. If baking is required, refer to IPC/JEDEC J-STD-033 for bake procedure</p>			
<p>See Production Date</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>			

7 MOQ and packaging information

Product model	MOQ (pcs)	Shipping packaging method	Number of modules per reel (pcs)	Number of reels per carton (reel)
WR3	4000	Tape reel	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 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-WR3. The end product must be labeled in a visible area with the following: “Contains Transmitter Module FCC ID: 2ANDL-WR3” .

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.