Global Intelligent Platform

Product Manual

Tuya TYWRD3S Wi-Fi Module

Version: 2.0.2 **Date: 2019-11-5** **No.: 0000000004**

1. Product Overview

TYWRD3S is a low-power built-in Wi-Fi module that Hangzhou Tuya Inc has developed. It consists of a highly integrated RF chip (RDA5981B) and several peripheral components, with a built-in Wi-Fi network protocol stack and robust library functions. TYWRD3S is embedded with a low-power ARM-CM4 MCU, 2 MB flash memory, 448 KB SRAM, and rich peripheral resources.

TYWRD3S is an RTOS platform that integrates all the function libraries of the Wi-Fi MAC and TCP/IP protocols. You can develop built-in Wi-Fi products as required.

1.1 Features

- ✧ Built-in low-power CPU, which can also be used as an application processor
  - Dominant frequency: up to 160 MHz

✧Working voltage: 3.0 V to 3.6 V

✧Peripherals: nine GPIOs, one UART, and one ADC

✧Wi-Fi connectivity

- 802.11b/g/n/HT20
- 2.4GHz WIFI
- WPA, WPA2, WEP, and TKIP security modes
- Up to +20 dBm EIRP output power
- STA, AP, and STA+AP working modes
- Smart and AP network configuration modes (for Android and iOS devices)

- Onboard PCB antenna
- 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

Change History

No.	Date	Change Description	Version After Change
1	2019-07-26	This is the first release.	2.0.0
2	2019-07-26	Modify the pin number.	2.0.1
3	2019-07-26	Delete the Block diagram	2.0.2

Contents

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Tables

2 Module Interfaces

2.1 Dimensions and Footprint

TYWRD3S has two rows of pins with the distance of 2 mm between every two pins.

TYWRD3S dimensions: 16mm±0.35mm(W)×24±0.35mm(L) ×3.5±0.15mm (H)

Figure 1 shows the TYWRD3S dimensions.

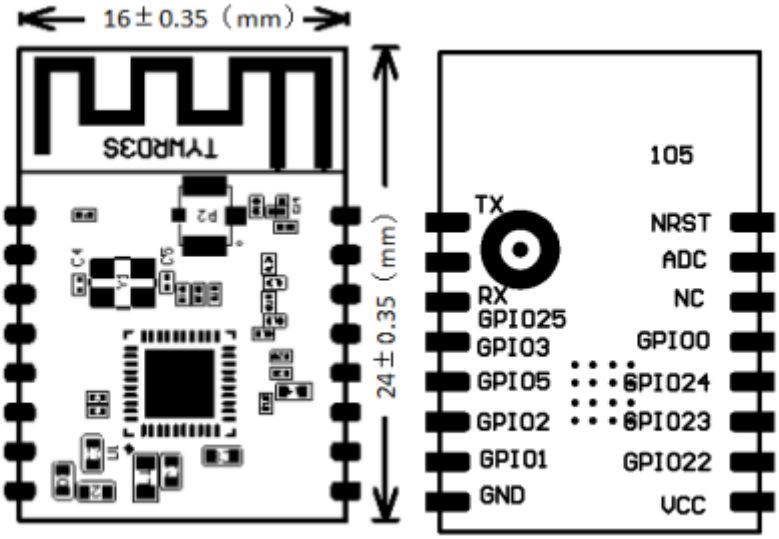


Figure 1 TYWRD3S front and back views

2.2 Pin Definition

Table 1 describes the interface pins.

Table 1 TYWRD3S interface pins

No.	Symbol	I/O Type	Function
1	nRST	I/O	Hardware reset pin (active at a low level)
2	ADC	AI	ADC interface(1)

3	NC	I	Null pin, no internal connection
4	GPIO0	I/O	GPIO_0,which is connected to GPIO0 on the IC
5	GPIO23	I/O	GPIO_23, a standard PWM interface,which is connected to GPIO23 on the IC
6	GPIO24	I/O	GPIO_24, a standard PWM interface,which is connected to GPIO24 on the IC
7	GPIO25	I/O	GPIO_25, a standard PWM interface,which is connected to GPIO25 on the IC
8	3.3 V	P	Power supply pin
9	GND	P	Power supply reference ground pin
10	GPIO1	Output	GPIO_1,which is connected to GPIO1 on the IC
11	GPIO2	Output	UART2_TXD (used to display the module internal information),which is connected to GPIO2on the IC
12	GPIO5	I/O	GPIO_5,which is connected to GPIO5 on the IC
13	GPIO22	I/O	GPIO_22, a standard PWM interface,which is connected to GPIO22 on the IC
14	GPIO3	I/O	GPIO_3, a standard PWM interface,which is connected to GPIO3 on the IC
15	RX	I/O	UART_RX(2), which is connected to GPIO27 on the IC
16	TX	Output	UART_TX(2), which is connected to GPIO26 on the IC

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

nRST is only a module hardware reset pin and cannot clear the Wi-Fi network configuration.

(1) This pin can only be used as an ADC interface and cannot be used as a common I/O pin. If this pin is not used, it must be disconnected. When this pin is used as the ADC input interface, the input voltage range is 0 V to 2.0 V.

(2) The UART pins are user-side serial interfaces.

2.3 Test Pin Definition

Table 2 describes the test pins.

Table 2 TYWRD3S test pins

No.	Symbol	I/O Type	Function
1		N/A	Used for the module production test

Note: Test pins cannot be used.

3 Electrical Parameters

3.1 Absolute Electrical Parameters

Table 3 Absolute electrical parameters

Parameter	Description	Minimum Value	Maximum Value	Unit
Ts	Storage temperature	–20	85	°C

Parameter	Description	Minimum Value	Maximum Value	Unit
VBAT	Power supply voltage	3.0	3.6	V
Static electricity voltage (human body model)	Tamb = 25°C	N/A	2	kV
Static electricity voltage (machine model)	Tamb = 25°C	N/A	0.5	kV

3.2 Electrical Conditions

Table 4 Normal electrical conditions

Parameter	Description	Minimum Value	Typical Value	Maximum Value	Unit
Ta	Working temperature	–20	N/A	85	°C
VBAT	Power supply voltage	3.0	3.3	3.6	V
V_{IL}	I/O low-level input	–0.3	N/A	VCC x 0.3	V
V_{IH}	I/O high-level input	VCC x 0.75	N/A	VCC	V
V_{OL}	I/O low-level output	N/A	N/A	VCC x 0.1	V
V_{OH}	I/O high-level output	VCC x 0.8	N/A	VCC	V
I_{max}	I/O drive current	N/A	N/A	10	mA

3.3 Wi-Fi RX Power Consumption

Table 6 RX power consumption during constant receiving

Symbol	Mode	Rate	Typical Value	Unit
I_{RF}	802.11b	11 Mbit/s	80	mA
I_{RF}	802.11g	54 Mbit/s	80	mA
I_{RF}	802.11n	MCS7	80	mA

3.4 Power Consumption in Working Mode

Table 7 TYWRD3S working current

Working Mode	Working Status (Ta = 25°C)	Average Value	Peak Value	Unit
EZ mode	The module is in EZ mode.	70	335	mA
AP mode	The module is in AP mode.	80	350	mA
Connected	The module is connected to the network.	70	240	mA

Note: ALL the parameter vary according to the different firmware

4 RF Features

4.1 Basic RF Features

Table 8 Basic RF features

Parameter	Description
Frequency band	2.4GHz
Wi-Fi standard	IEEE 802.11b/g/n20
Data transmission rate	802.11b: 1, 2, 5.5, or 11 (Mbit/s) 802.11g: 6, 9, 12, 18, 24, 36, 48, or 54 (Mbit/s) 802.11n: HT20 MCS0 to MCS7
Antenna type	Onboard PCB antenna

4.2 Wi-Fi Output Power

Table 9 TX power during constant emission

Parameter		Minimum Value	Typical Value	Maximum Value	Unit
Average RF output power, 802.11b CCK mode	1 Mbit/s	N/A	17	N/A	dBm
Average RF output power, 802.11g OFDM mode	54 Mbit/s	N/A	14	N/A	dBm
Average RF output power, 802.11n OFDM mode	MCS7	N/A	12	N/A	dBm
Frequency error		–20	N/A	20	ppm

4.3 Wi-Fi RX Sensitivity

Table 10 RX sensitivity

Parameter	Minimum	Typical	Maximum	Unit

		Value	Value	Value	
PER < 8%, 802.11b CCK mode	1 Mbit/s	N/A	–90	N/A	dBm
PER < 10%, 802.11g OFDM mode	54 Mbit/s	N/A	–73	N/A	dBm
PER < 10%, 802.11n OFDM mode	MCS7	N/A	–70	N/A	dBm

5 Antenna Information

5.1 Antenna Type

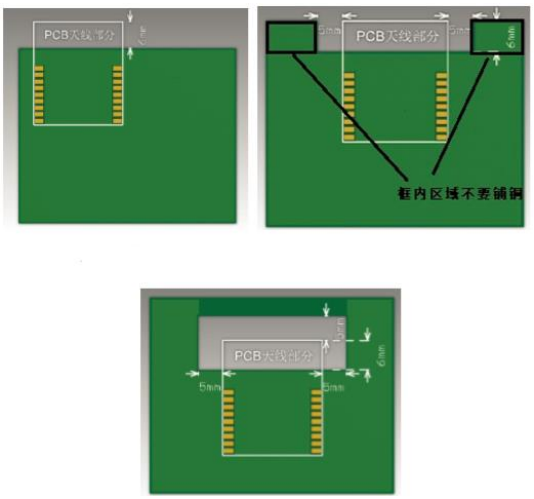
TYWRD3S uses the onboard PCB antenna.

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 prevent adverse impact on the antenna performance, do not use copper or route cables along the antenna area on the PCB.

For details about the onboard PCB antenna area on a module, see Figure 3.



5.3 Antenna Connector Specifications

There is no antenna connector for this module

6. Packaging Information and Production Instructions

6.1 Mechanical Dimensions

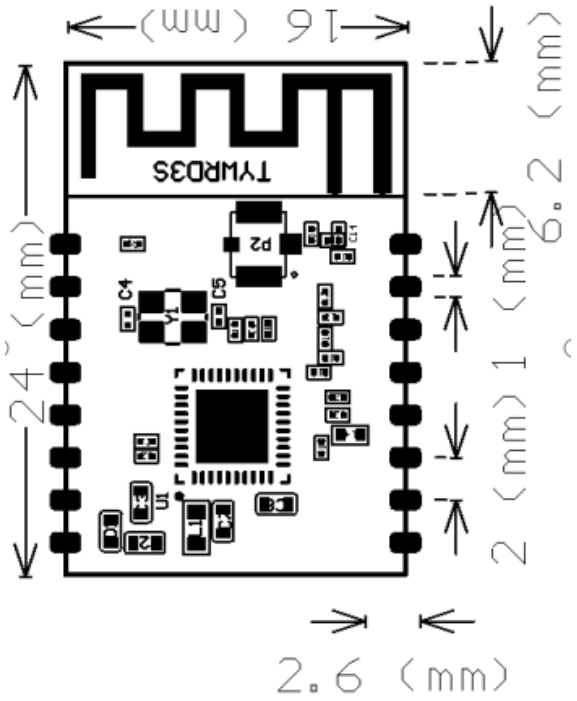


Figure 2 TYWRD3S mechanical dimensions

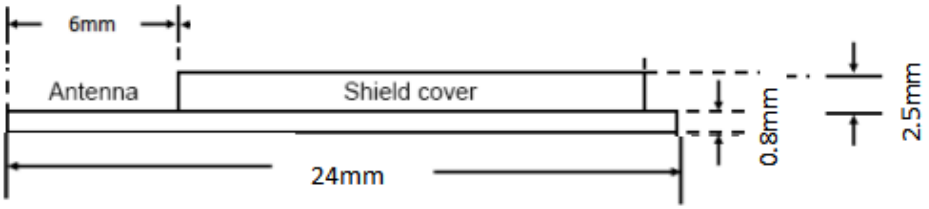


Figure 3 Side view

6.2 Recommended PCB Encapsulation

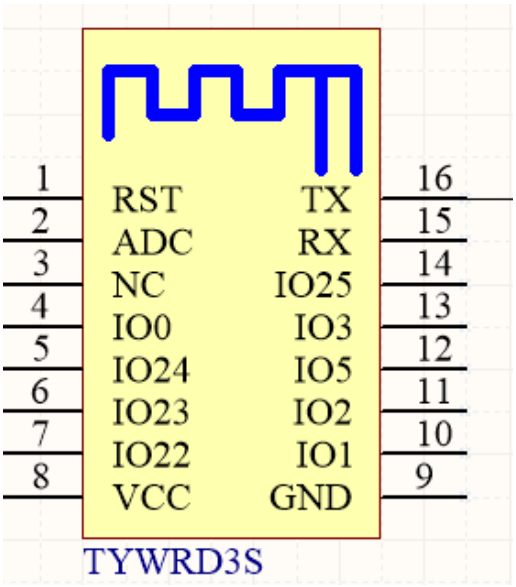


Figure 4 TYWRD3S schematic diagram and pin connection

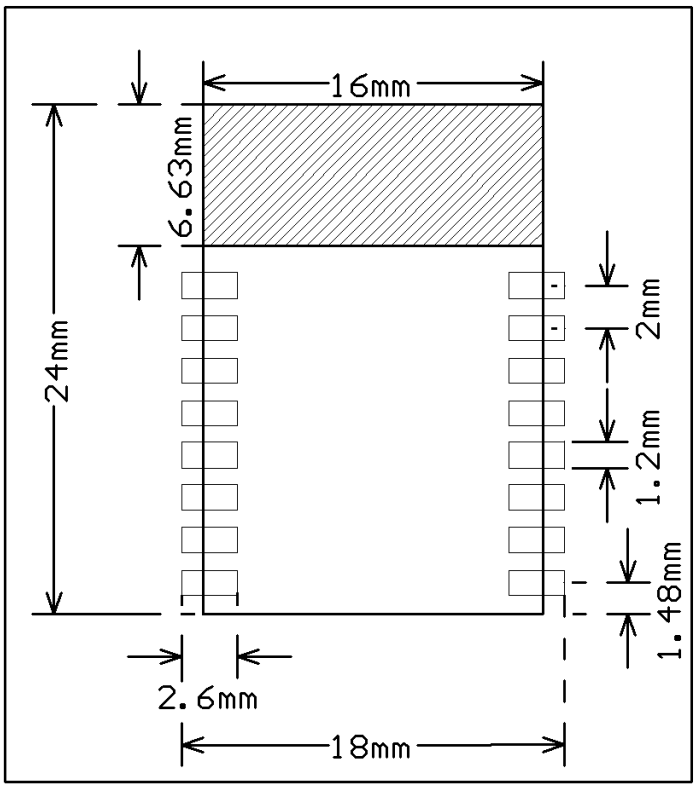


Figure 5 TYWRD3S encapsulation on the PCB

6.3 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.

   (1) SMT placement equipment

      i. Reflow soldering machine

      ii. Automated optical inspection (AOI) equipment

      iii. Nozzle with a 6 mm to 8 mm diameter

   (2) Baking equipment

      i. Cabinet oven

      ii. Anti-static heat-resistant trays

      iii. Anti-static heat-resistant gloves

2. Storage conditions for a delivered module are as follows:

   (1) The moisture-proof bag is placed in an environment where the temperature is below 30°C and the relative humidity is lower than 70%.

   (2) The shelf life of a dry-packaged product is six months from the date when the product is packaged and sealed.

   (3) The package contains a humidity indicator card (HIC).

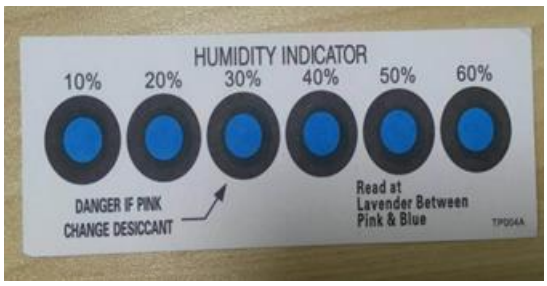


Figure 6 HIC for TYWRD3S

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

   (1) If the 30%, 40%, and 50% circles are blue, bake the module for 2 consecutive

hours.

(2) If the 30% circle is pink, bake the module for 4 consecutive hours.

(3) If the 30% and 40% circles are pink, bake the module for 6 consecutive hours.

(4) If the 30%, 40%, and 50% circles are pink, bake the module for 12 consecutive hours.

4. Baking settings:

   (1) Baking temperature: 125±5°C

   (2) Alarm temperature: 130°C

   (3) SMT placement ready temperature after natural cooling: < 36°C

   (4) Number of drying times: 1

   (5) Rebaking condition: The module is not soldered within 12 hours after baking.

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.

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

7. 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.

6.4 Recommended Oven Temperature Curve

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

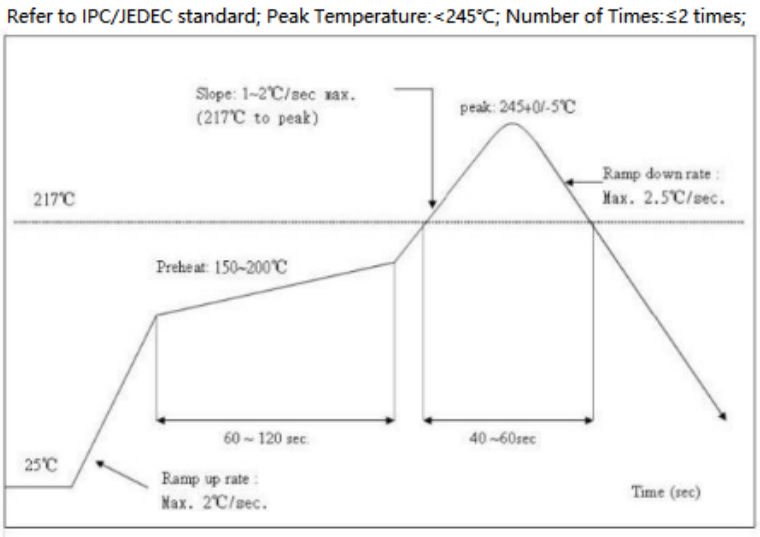


Figure 6-6 Oven temperature curve

6.5 Storage Conditions

7 MDQ and Packing Information

MOQ and packing information				
Product Model	**MOQ**	**Packing Method**	**Number of Modules in Each Reel Pack**	**Number of Reel Packs in Each Box**
TYWRD3S	3600	Carrier tape and reel packing	900	4

8 Appendix: Statement

Federal Communications Commission (FCC) Declaration ofConformity

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.

This device and its antenna(s) must not be co-located or operating in conjunction with any other antenna or transmitter.

15.105 Information to the user.

(b) For a Class B digital device or peripheral, the instructions furnished the user shall include the following or similar statement, placed in a prominent location in the text of the manual:

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.

This equipment complies with FCC radiation exposure limits set forth for an uncont rolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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 final end product must be label led in a visible area with the following:

“Contains Transmitter Module 2ANDL-TYWRD3S”

This radio module must not installed to co-locate and operating simultaneously with other radios in host system, additional testing and equipment authorization may be required to operating simultaneously with other radio.

Declaration of Conformity European notice

Hereby, Hangzhou Tuya Information Technology Co., Ltd declares that this WIFI module product is in compliance with essential requirements and other relevant provisions of Directive 2014/53/EC. A copy of the Declaration of conformity can be found at http://www.tuya.com.

EN 300 328 V2.1.1

EN 301 489-1 V2.1.1; EN 301 489-17 V3.1.1

EN 62311:2008

EN 60950-1:2006+A11:2009+A1:2010+A12:2011+A2:2013