TuyaSmartWi-Fi Module

1. Product Overview

WR5E is a low power consumption module with built-in Wi-Fi connectivity solution designed by Hangzhou Tuya Information Technology Co., Ltd. The Wi-Fi Module consists of a highly integrated wireless radio chip RTL8710BX and some extra flash that has been programed with Wi-Fi network protocol and plenty of software examples.WR5E include a ARM CM4F, WLAN MAC, 1T1R WLAN, maximum frequency reaches 125MHz, 256K SRAM, 1M byte flash and various peripheral resources.

WR5E is a RTOS platform, embedded with all the Wi-Fi MAC and TCP/IP protocol function examples, users can customize their Wi-Fi product by using these software examples.

1.1 Features

✧ Integrated low power consumption 32-bit CPU, also known as application processor
✧ Basic frequency of the CPU can support 125 MHz
✧ Supply voltage range: 3V to 3.6V
✧ Peripherals:9 GPIO channels, 1 UART, 1 ADC
✧ Wi-Fi connectivity:
  ● 802.11 B/G/N20/N40
  ● Channel 1 to 11 @ 2.4GHz
  ● Support WPA/WPA2
  ● Support Smart Config function for both Android and IOS devices
  ● On-board PCB antenna
  ● Pass CE, FCC, SRRC certifications
  ● Operating temperature range: -20℃ to 85℃

1.2 Main ApplicationFields

✧ Intelligent Building
✧ Intelligent home, Intelligent household applications
✧ Healthy devices
✧ Industrial wireless control
✧ Baby monitor
✧ Webcam
✧ Intelligent bus

2. Dimensions and Footprint

2.1 Dimensions

WR5E has 2 columns of Pins (2*8).The distance between each Pin is2 mm.

Size of WR5E: （16±0.25） mm (W)×（24.74±0.25） mm (L) ×（3.6±0.1） mm (H)

2.2 Pin Definition

Table 1 shows the generalpin attributes of WR5E

Table 1. The typical pin definition of WR5E

PIN NO.	NAME	TYPE	DISCREPTION
1	GPIOA_23	I/O	UART0_TXD
2	GPIOA_12	I/O	GPIOA_12
3	GPIOA_18	I/O	UART0_RXD
4	GPIOA_14	I/O	GPIOA_14
5	GND	P	
6	GPIOA_22	I/O	GPIOA_22
7	VD33	P	3.3V）
8	GPIOA_30	I/O	UART_Log_TXD
9	GPIOA_0	I/O	GPIOA_0
10	GPIOA_5	I/O	GPIOA_5
11	GPIOA_15	I/O	GPIOA_15
12	GPIOA_19	I/O	GPIOA_19
13	GPIOA_29	I/O	UART_Log_RXD
14	EN	I/O	
15	ADC	AI	ADC，Max5V

Note: S: Power supply pins; I/O: Digital input or output pins; AI: Analog input.

3. Electrical Characteristics

3.1 Absolute Maximum Ratings

Table 3.1. Absolute Maximum Ratings

PARAMETERS	DESCRIPTION	MIN	MAX	UNIT
Ts	Storage temperature	-40	125	℃
VCC	Supply voltage	-0.3	3.6	V
Static electricity voltage (human model)	TAMB-25℃	-	2	KV
Static electricity voltage (machine model)	TAMB-25℃	-	0.5	KV

3.2 Electrical Conditions

Table 3.2. Electrical Conditions

PARAMETERS	DESCRIPTION	MIN	TYPICAL	MAX	UNIT
Ta	Working temperature	-20	-	85	℃
VCC	Working voltage	3	3.3	3.6	V
VIL	IO low level input	-0.3	-	VDD*0.25	V
VIH	IO high level input	VDD*0.75	-	VDD	V
VOL	IO low level output	-	-	VDD*0.1	V
VoH	IO high level output	VDD*0.8	-	V	V
Imax	IO drive current	-	-	16	mA
Cpad	Input capacitor	-	2	-	pF

3.3 Wi-Fi Receiving Current Consumptions

Table 3.3. Wi-Fi RX current consumption

PARAMETERS	MODE	TYPICAL	UNIT
IRF	CPU sleep	90	mA
IRF	CPU active	120	mA

3.4 Working Mode Current Consumptions

Table 3.4. The module working current consumption

WORK MODE	AT TA=25℃	TYPICAL	MAX*	UNIT
EZ Mode	WR5E is under EZ paring mode, Wi-Fi indicator light flashes quickly	115	125	mA
Standby Mode	WR5E is connected, Wi-Fi indicator light is on	60	209	mA
Operation Mode	WR5E is connected, Wi-Fi indicator light is on	118	198	mA
Disconnection Mode	WR5E is disconnected, Wi-Fi indicator light is off	34	192	mA

Note: peak continuous time is about 5us.

The parameter shown above will vary depending on different firmware functions.

4. WLAN Radio Specification

4.1 Basic Radio Frequency Characteristics

Table 41.Basic Radio frequency characteristics

PARAMETERS	DESCRIPTION
Frequency band	2412MHz-2462MHz
Wi-Fi standard	IEEE 802.11n/g/b (Terminal 1-11)
Data transmitting rate	11b:1,2,5.5,11(Mbps)
	11g:6,9,12,18,24,36,48,54(Mbps)
	11n:HT20,MCS0~7
	11n:HT40,MCS0~7
Antenna type	On-board PCB Antenna

4.2Wi-Fi TransmittingPower

Table 4.2. Wi-Fi transmitting power

RF output power
802.11b:19.80dBm 802.11g:24.59dBm 802.11n20:23.88dBm 802.11n40:22.70dBm

4.3Wi-Fi Receiving Sensitivity

Table 4.3. Wi-Fi Receiving sensitivity

PARAMETERS		MIN	TYPICAL	MAX	UNIT
PER<8%, Receiving sensitivity, 802.11b CCK Mode	11M	-	-91	-	dBm
PER<10%, Receiving sensitivity, 802.11g OFDM Mode	54M	-	-75	-	dBm
PER<10%, Receiving sensitivity, 802.11n OFDM Mode	MCS7	-	-72	-	dBm

5. Antenna Information

5.1 Antenna Type

PCB antenna.

5.2 Reduce Antenna Interference

While using the On-board PCBantenna, in order to have the best Wi-Fi performance, it's recommended to keep a minimum15mm distance between the antenna part and the other metal pieces.
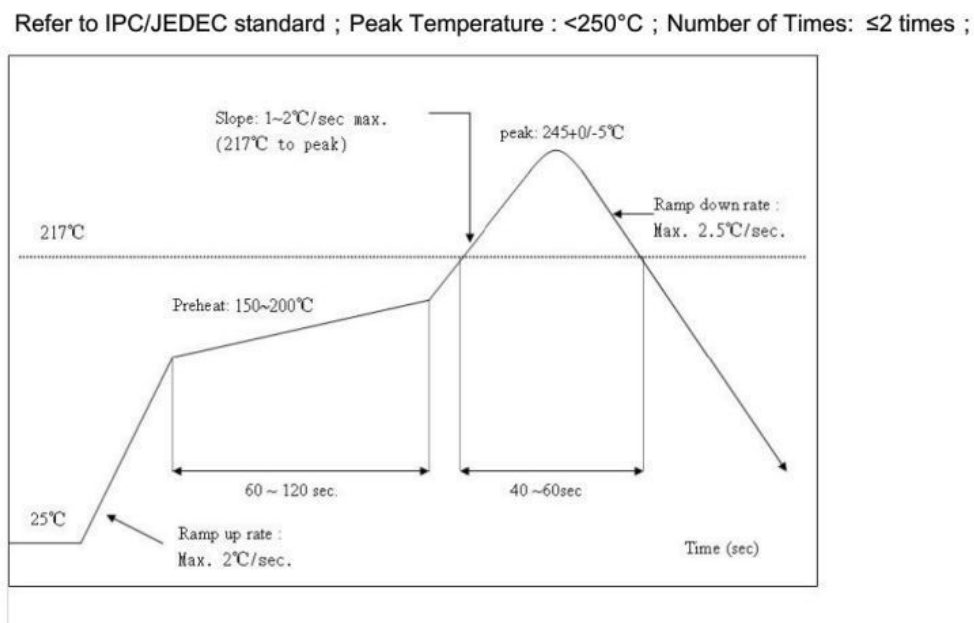
6. Packaging Information And Production Guide

6.1 Production Guide

✧ The storage for the delivered module should meet the following condition:

1. The anti-moisture bag should be kept in the environment withtemperature< 30℃ and humidity< 85% RH.

2. The expiration date is 6 months since the dry packaging products was sealed.

✧ Cautions:

1. All the operators should wear electrostatic ringin the whole process of production.

2. While operating, water and dirt should not have any contact with the modules.

6.2 Recommended furnace temperature curve

Figure 6.2. PCB Package Drawing Recommended furnace temperature curve

Refer to IPC/JEDEC standard ; Peak Temperature : <250°C ; Number of Times: ≤2 times ;

Slope: 1~2℃/sec max.
(217℃ to peak)

peak: 245+0/-5℃

Ramp down rate :
Max. 2.5℃/sec.

217℃

Preheat: 150~200℃

60 ~ 120 sec.

40 ~60sec

25℃

Ramp up rate :
Max. 2℃/sec.

Time (sec)

Regulatory Module Integration Instructions

2.2 List of applicable FCC rules

This device complies with part 15.247 of the FCC Rules.

2.3 Summarize the specific operational use conditions

This module can be used in household electrical appliances as well as lighting

equipments. The input voltage to the module should be nominally 3.0 to 3.6 V_{DC} ,typical

value 3.3V_{DC} and the ambient temperature of the module should not exceed 85℃.

This module using only one kind of antennas with maximum gain is 2.5dBi .Other antenna

arrangement is not covered by this certification.

The antenna is not field replaceable. If the antenna needs to be changed, the certification

should be re-applied.

2.4 Limited module procedures

Not applicable

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

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

environment .This equipment should be installed and operated with minimum distance

20cm between the radiator& your body. If the device built into a host as a portable usage,

the additional RF exposure evaluation may be required as specified by§ 2.1093.

2.7 Antennas

Module only contains one PCB antenna. No additional external connectors.

2.8 Label and compliance information

The outside of final products that contains this module device must display a label

referring to the enclosed module. This exterior label can use wording such as: "Contains

Transmitter Module FCC ID: 2ANDL-WR5E ", or "Contains FCC ID: 2ANDL-WR5E ",

Any similar wording that expresses the same meaning may be used.

2.9 Information on test modes and additional testing requirements

a) The modular transmitter has been fully tested by the module grantee on the required

number of channels, modulation types, and modes, it should not be necessary for the

host installer to re-test all the available transmitter modes or settings. It is

recommended that the host product manufacturer, installing the modular transmitter,

perform some investigative measurements to confirm that the resulting composite

system does not exceed the spurious emissions limits or band edge limits (e.g., where a

different antenna may be causing additional emissions).

b) The testing should check for emissions that may occur due to the intermixing of

emissions with the other transmitters, digital circuitry, or due to physical properties of

the host product (enclosure). This investigation is especially important when integrating

multiple modular transmitters where the certification is based on testing each of them in

a stand-alone configuration. It is important to note that host product manufacturers

should not assume that because the modular transmitter is certified that they do not

have any responsibility for final product compliance.

c) If the investigation indicates a compliance concern the host product manufacturer is

obligated to mitigate the issue. Host products using a modular transmitter are subject to

all the applicable individual technical rules as well as to the general conditions of operation in Sections 15.5, 15.15, and 15.29 to not cause interference. The operator of the host product will be obligated to stop operating the device until the interference has been corrected

Below are steps for on test modes :

tx_contin_en 1   // return : wifi tx continuous test!

wifitxout   < parameter 1>   < parameter 2>   < parameter 3>

: Send channel option and allowed number is 1~11.

: Send data rate option, the relationship between input parameters and rates is shown in table 1.

: Send power attenuation

Table 1: allowed input for speed of receiving or sending data package

11b mode		11g mode		11n mode	
Input	Dial Speed	Input	Dial Speed	Input	Dial Speed
0x0	1M	0xb	6M	0x10	6.5M / MCS0
0x1	2M	0xf	9M	0x11	13M / MCS1
0x2	5.5M	0xa	12M	0x12	19.5M / MCS2

0x3	11M	0xe	18M	0x13	26M / MCS3
		0x9	24M	0x14	39M / MCS4
		0xd	36M	0x15	52M / MCS5
		0x8	48M	0x16	58.5M / MCS6
		0xc	54M	0x17	65M / MCS7

cmdstop   // Stop sending data package command

2.10 Additional testing, Part 15 subpart B disclaimer

The final host / module combination need to be evaluated against the FCC Part 15B

criteria for unintentional radiators in order to be properly authorized for operation as a Part

15 digital device.

The host integrator installing this module into their product must ensure that the final

composite product complies with the FCC requirements by a technical assessment or

evaluation to the FCC rules, including the transmitter operation and should refer to

guidance in KDB 996369.

Frequency spectrum to be investigated

For host products with certified modular transmitter, the frequency range of investigation

of the composite system is specified by rule in Sections 15.33(a)(1) through (a)(3), or the

range applicable to the digital device, as shown in Section 15.33(b)(1), whichever is the

higher frequency range of investigation.

Operating the host product

When testing the host product, all the transmitters must be operating.The transmitters can be enabled by using publicly-available drivers and turned on, so the transmitters are active. In certain conditions it might be appropriate to use a technology-specific call box (test set) where accessory devices or drivers are not available.

When testing for emissions from the unintentional radiator, the transmitter shall be placed in the receive mode or idle mode, if possible. If receive mode only is not possible then, the radio shall be passive (preferred) and/or active scanning. In these cases, this would need to enable activity on the communication BUS (i.e., PCIe, SDIO, USB) to ensure the unintentional radiator circuitry is enabled. Testing laboratories may need to add attenuation or filters depending on the signal strength of any active beacons (if applicable) from the enabled radio(s). See ANSI C63.4, ANSI C63.10 and ANSI C63.26 for further general testing details.

The product under test is set into a link/association with a partnering WLAN device, as per the normal intended use of the product. To ease testing, the product under test is set to transmit at a high duty cycle, such as by sending a file or streaming some media content.

FCC Statement

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the 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.