WS8712

CC3551E Wi-Fi 6 Module

Data Sheet

Wi-Fi

- Supports 2.4GHz & 5GHz dual-band Wi-Fi 6
- Compliant with IEEE 802.11 b/g/n/ax standards
- Supports: STA, softAP with up to 4 stations, Wi-Fi Direct, multi-role AP + STA
- Supports up to 8 sockets, including TCP/TCPS client, UDP unicast, UDP multicast, and UDP broadcast;
- Supports one-way TCP server and TLS encryption;
- Supports mDNS and DNS-SD.
- Supports SNTP;
- Supports HTTP/HTTPS requests, including HEAD, GET, POST, PUT, DELTET;
- Supports PING;
- Supports MQTT/MQTTS v3.1.1,
- Module size: 19.2x18.0x2.8mm

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3	v1.2	1.Modify features 2.New feature description section	2025.09.28	XT
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Contents

1. Product Overview

1.1. Product Introduction

WS8712 is a high-performance, high-reliability dual-band Wi-Fi 6 module developed based on TI's next-generation Wi-Fi 6 chip CC3551E. It features a powerful built-in 160MHz Arm® Cortex®-M33 processor with FPU, TrustZone®, and AI acceleration capabilities. The module supports a maximum wireless transmit power of 17.5dBm

Functionally, the module supports IEEE 802.11 b/g/n/ax standards, Wi-Fi 6 operating in both the 2.4GHz and 5GHz bands, Key features of this module include a complete software development kit with open-source TCP/IP and TLS stacks, support for a 3-wire PTA coexistence architecture for use with external 2.4GHz radios (such as Thread or Zigbee®), STA support, softAP with up to four stations, Wi-Fi Direct, and multi-role AP + STA functionality, fully satisfying diverse applications.

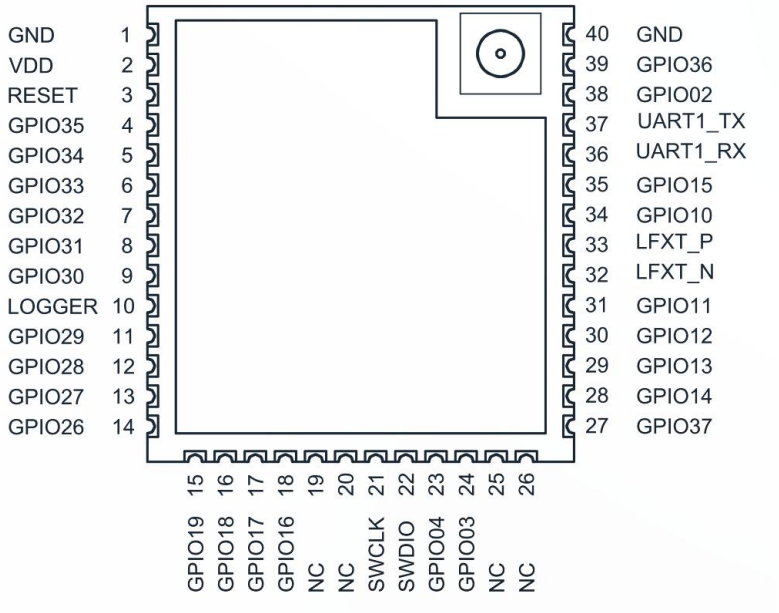
1.2. Features

Features
Supports 2.4GHz & 5GHz dual-band Wi-Fi 6
Compliant with IEEE 802.11 b/g/n/ax standards
Supports multi-role AP + STA
Achieve up to 17.5dBm output power
Receive sensitivity – 98.6dBm@1 Mbps DSSS
Supports up to 8 sockets, including TCP/TCPS client, UDP unicast, UDP multicast, and UDP broadcast;
Support one TCP server and TLS encryption;
Supports mDNS and DNS-SD.
Support HTTP/HTTPS requests, including HEAD, GET, POST, PUT, DELTET;
Supports SNTP;
Supports PING;
Supports MQTT/MQTTS v3.1.1
Supports -40~85℃ operating temperature
Module size: 19.2x18.0x2.8mm

1.3. Application Scenario

Application Scenario
Building automation (thermostats, wireless security cameras, video doorbells, garage door systems)
Medical wearables (infusion pumps, multi-parameter patient monitors, telehealth systems)
Smart appliances (refrigerators, ovens, washing machines, air conditioners, mowing robots)
Three meters, power grid infrastructure, factory automation and control
Asset Tracking

2. Pin Definition



Pin number	Pin Name	Pin Type	Pin Purpose
1	GND	P	Ground wire, connected to the power reference ground
2	VDD	P	Power supply positive reference, voltage range 3V to 3.6V, recommended 3.3V@1A
3	EN	I	Module enable reset pin, low level reset module, built-in 10K pull-up;
4	GPIO35	I/O	General IO port
5	GPIO34	I/O	General IO port
6	GPIO33	I/O	General IO port
7	GPIO32	I/O	General IO port
8	GPIO31	I/O	General IO port
9	GPIO30	I/O	General IO port
10	LOGGER	O	Logger output
11	GPIO29	I/O	General IO port
12	GPIO28	I/O	General IO port
13	GPIO27	I/O	General IO port
14	GPIO26	I/O	General IO port
15	GPIO19	I/O	General IO port
16	GPIO18	I/O	General IO port
17	GPIO17	I/O	General IO port
18	GPIO16	I/O	General IO port
19	NC	-	No Connect
20	NC	-	No Connect

21	SWCLK	O	SWD debug clock interface
22	SWDIO	I/O	SWD debugging data interface
23	GPIO04	I/O	General IO port
24	GPIO03	I/O	General IO port
25	NC	-	No Connect
26	NC	-	No Connect
27	GPIO37	I/O	General IO port
28	GPIO14	I/O	General IO port
29	GPIO13	I/O	General IO port
30	GPIO12	I/O	General IO port
31	GPIO11	I/O	General IO port
32	LFXT_N	I/O	External 32.768KHz low-speed clock interface N
33	LFXT_P	I/O	External 32.768KHz low-speed clock external interface P
34	GPIO10	I/O	General IO port
35	GPIO15	I/O	General IO port
36	UART1_RX	I	UART data reception (can be connected to XDS110 for debugging)
37	UART1_TX	O	UART data transmission (can be connected to XDS110 for debugging)
38	GPIO2	I/O	General IO port
39	GPIO36	I/O	General IO port
40	GND	P	Ground wire, connected to the power reference ground

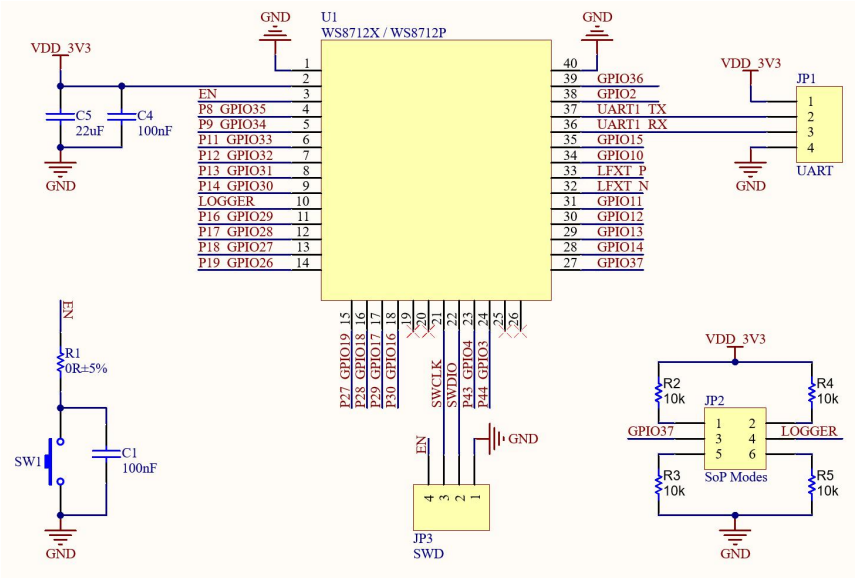
Note: 1. For detailed multiplexing functions of general-purpose I/O, refer to the CC3551E official manual provided by TI for settings;

2、The module GPIO uses a 3.3V voltage domain by default, and a 1.8V version can be customized;

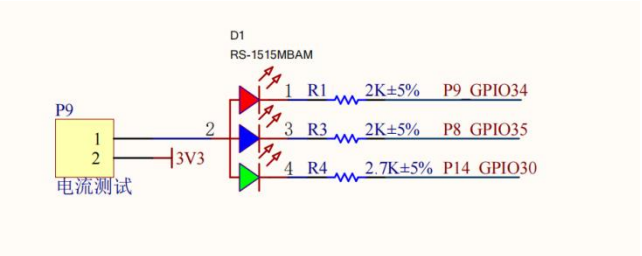
3、Unused GPIO can be left floating;

3. Peripheral hardware design

Application circuit diagram of the module connected to peripheral devices (such as power supply, antenna, reset button, SWD interface, UART interface , etc.) .



- The EPAD on the bottom of the module can be soldered to the baseplate without soldering it. Soldering to the baseplate provides better heat dissipation. If you wish to solder the EPAD to the baseplate, ensure that you use an appropriate amount of solder paste. Avoid excessive solder paste, which can increase the distance between the module and the baseplate and affect the fit between the pins and the baseplate.
- The figure above is a partial diagram of the recommended peripheral circuit based on WS8712. The detailed recommended circuit includes components such as SD card interface, buttons, LED indicators, USB to TTL converter, etc. For high-definition files, please see the "CC35X1_EVB_Sch.pdf" file in the sales materials;
- To ensure stable operation of the module, the module power supply must be between 3V and 3.6V, with 3.3V recommended. It is recommended to use an external LDO or DC-DC power supply with a power supply capacity greater than 800mA.
- The module pin level defaults to 3.3V, and supports customized 1.8V versions;
- Pins 30 and 31 of the module are UART1_RX and UART1_TX respectively. When the module is connected to XDS110 for debugging, these pins together with SWCLK, SWDIO, and RESET form the debugging interface.
- For details about the control and debugging information output of SOP, see the CC3551E chip manual. It is recommended to lead out the GPIO37 pull-up and LOGGER pins.
- The recommended circuit provides an RGB LED for test indication. The detailed interface is as follows:



- Pin GPIO34 controls the red LED, GPIO35 controls the blue LED, and GPIO30 controls the green LED;
- P9 is the power supply for the LED. If the LED is not in use, it can be disconnected to avoid affecting the working status of the pin.

4. Functional Description

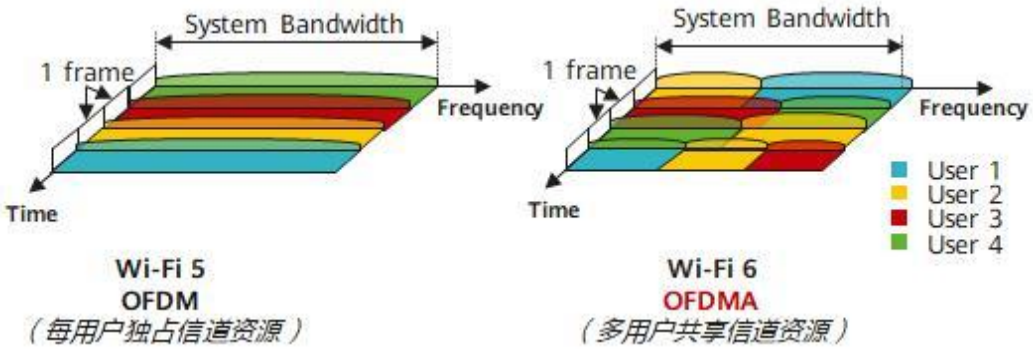
4.1. Wi-Fi 6 Key Technologies

This only describes the Wi-Fi 6 technology itself, and does not mean that the current module supports all Wi-Fi 6 features.

4.1.1. Multiple connections

Before Wi-Fi 6, data transmission utilized the OFDM mode, where users were distinguished by different time segments. In each time segment, one user exclusively occupied all channel resources and transmitted a complete data packet.

Wi-Fi 6 introduces a more efficient data transmission mode called OFDMA (also known as MU-OFDMA because it supports multi-user uplink and downlink). This mode allocates subcarriers to different users and adds multiple access to OFDM systems to achieve multi-user channel resource reuse. As a result, Wi-Fi 5 increases the number of connections by 4-8 times compared to Wi-Fi 4.



4.1.2. Low power consumption

Target Wake Time (TWT) is another crucial resource scheduling feature supported by 802.11ax, drawing inspiration from the 802.11ah standard. It allows devices to negotiate when and how frequently they will wake up to send or receive data. Furthermore, the Wi-Fi Access Point (AP) can group client devices into different TWT cycles, thereby reducing the number of devices simultaneously competing for the wireless medium after waking up. TWT also extends the sleep time for devices, significantly improving battery life for battery-powered terminals.

4.1.3. Low latency

By using OFDMA technology, IoT devices can quickly access unoccupied RU frequency domain resources to ensure instant communication.

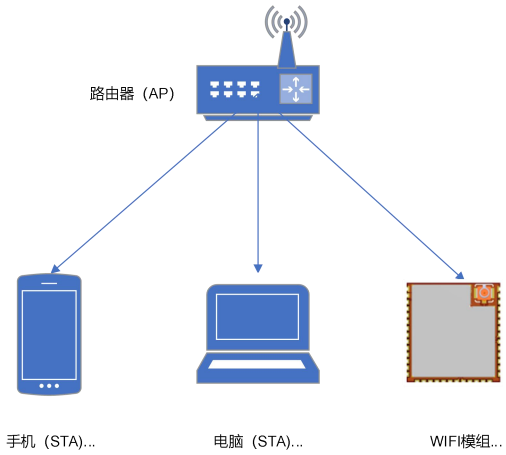
4.1.4. Improved coverage

Since the Wi-Fi 6 standard uses the Long OFDM Symbol transmission mechanism, the duration of each data transmission is increased from the original 3.2μs to 12.8μs. The longer transmission time can reduce the terminal packet loss rate; in addition, Wi-Fi 6 can use a minimum bandwidth of 2MHz for narrowband transmission, effectively reducing frequency band noise interference, improving terminal reception sensitivity, and increasing coverage distance.

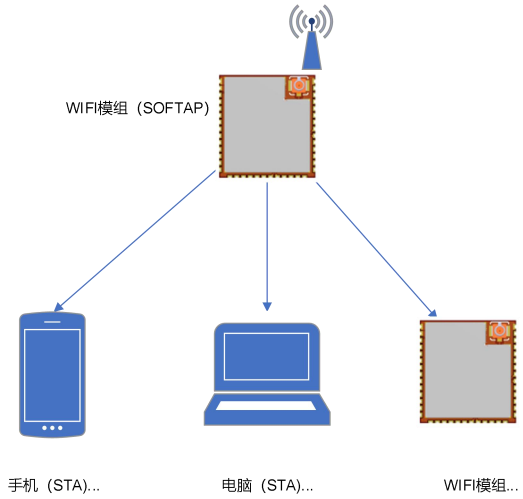
4.2. Wi-Fi function

4.2.1. STA and softAP

The WS8712 module supports two Wi-Fi modes: STA, SOFTAP, and STA+SOFTAP.
STA site, each terminal connected to the wireless network (such as laptops, PDAs and other user devices that can be connected to the Internet) can be called a site.



AP（access point）is the creator of a wireless network and the central node of the network. A typical wireless router used in a home or office is an AP.



Notice:

1. The Wi-Fi module must be configured in Wi-Fi mode before use.

4.3. SOCKET communication

The module provides up to 8 socket links, including TCP client, UDP unicast, UDP multicast, and UDP broadcast. It also supports a TCP server. When used as a TCP server, it can only accept a maximum of 8 connections.

4.3.1. Host address

When using AT commands to establish a link, you need to specify the remote IP or domain name. Because the module supports full mDNS and DNS-SD features, the host address can be filled in with the mDNS host name.

Here is an example:

```
AT+CIPSTART="TCP","tts.local.",3456
```

4.3.2. UDP multicast

UDP multicast, also known as UDP multicast, **is** a network communication technology that allows a single data packet to be sent to

multiple destinations. In multicast, packets are sent to a multicast address, which represents a group of devices rather than a single device. This communication method is very effective when information needs to be sent to multiple recipients simultaneously .

In IPv4, multicast addresses range from 224.0.0.0 to 239.255.255.255. These addresses are divided into different categories, including link-local multicast addresses, reserved multicast addresses, and administrative multicast addresses. For example, addresses 224.0.0.0 to 224.0.0.255 are link-local multicast addresses that can only be used within a local area network, while addresses 239.0.0.0 to 239.255.255.255 are locally administered multicast addresses that are valid only within a specific local scope .

To implement multicast communication, the sender needs to send data to a fixed multicast address and port. The receiver needs to bind to the corresponding port and join the multicast group. In this way, the receiver can receive the data sent to the multicast address.

4.3.3. UDP broadcast

Broadcast is used to send data to all hosts on the same network. The broadcast address is typically an IP address where all host bits in the subnet are set to 1.

For example:
When the IP address is 192.168.1.0 with a subnet mask of 255.255.255.0, the broadcast address becomes 192.168.1.255. Broadcasts are confined to the local area network, and routers do not forward broadcast packets

4.4. mDNS and DNS-SD

In a local area network, devices need to know each other's IP addresses before they can communicate with each other. In most cases, the IP addresses of devices are not static IP addresses, but are dynamically assigned IP addresses through the DHCP protocol. In order to communicate, the IP addresses of other devices must be known.

If the IP address is unknown, a device cannot communicate directly with the target within the local area network.The role of mDNS is to solve this problem. mDNS can get the IP address of the target host through the name like DNS, but the name must end with .local

Every host that enters the LAN and has the mDNS service enabled will multicast a message containing its own name and IP address to all hosts in the LAN. Other hosts that also have the service will respond by also sending their own name and IP address。

The module provides complete mDNS records, but only supports A record queries. For example:
We start an mDNS service: localhost is "ws8712 " , service name: " _http._tcp.local. ", service port is 80, and no text information is set.
Then its mDNS record is as follows:

Record Category	Record content	Remark
A	ws8712.local. maps to 192.168.1.120	The correspondence between host names and IPv4
SRV	ws8712._http._tcp.local. is mapped to ws8712.local., port 80	Identifies the host name and port number that the service instance name corresponds to
PTR	_http._tcp.local. maps to ws8712._http._tcp.local	Identifies the correspondence between the service instance name and the service type
TXT		Additional information provided by the service

		instance , given as key-value pairs

The module AT command only provides two query commands:

- AT+MDNSQUERY queries PRT records

```
➔ AT+MDNSQUERY="_http._tcp.local."
← +MDNSQUERY="192.168.1.111","ws8712","_http._tcp.local.",80,"test=1","other=value"
← +MDNSQUERY="192.168.1.11 2 ","test","_http._tcp.local.",80,"test=1","other=value"
← +OK
```

- AT+TGOTIP can query Class A record

```
AT+TGOTIP="ws8712.local"
+TGOTIP=192.168.1.111
```

All network functions of the module that require remote addresses can resolve mDNS addresses.

4.5. MQTT

MQTT (Message Queuing Telemetry Transport) is a lightweight, publish-subscribe messaging protocol suitable for resource-constrained devices and low-bandwidth, high-latency, or unstable network environments. It is popular in IoT applications, enabling efficient communication between sensors, actuators, and other devices.

4.5.1. MQTT Client

Any application or device that runs the MQTT client library is an MQTT client. For example, the WS8712 module, instant messaging applications using MQTT are clients, various sensors that use MQTT to report data are clients, and various MQTT Testing tools are also clients.

4.5.2. MQTT Broker

The MQTT Broker is a key component responsible for handling client requests, including establishing and disconnecting connections, subscribing, and unsubscribing. It also forwards messages. An efficient and robust MQTT Broker can easily handle massive connections and millions of message throughput, helping IoT service providers focus on business development and quickly build reliable MQTT applications.

4.5.3. Publish-Subscribe Model

The publish-subscribe model differs from the client-server model in that it decouples the clients that send messages (publishers) from the clients that receive messages (subscribers). Publishers and subscribers don't need to establish a direct connection; instead, the MQTT broker handles message routing and distribution .

4.5.4. theme

The MQTT protocol forwards messages based on topics. Topics are differentiated by /, similar to URL paths, for example:

```
chat/room/1
sensor/10/temperature
```

sensor/+/temperature

MQTT topics support the following two wildcard characters: + and #.

- +: represents a single-level wildcard, for example, a/+ matches a/x or a/y.
- #: Indicates multiple layers of wildcards. For example, a/# matches a/x, a/b/c/d.

Note: Wildcard topics can only be used for subscriptions, not for publishing.

For more details about MQTT topics, please refer to *"MQTT Version 3.1.1 4.7 Topic Names and Topic Filters ".*

4.5.5. QoS message quality

MQTT provides three qualities of service (QoS) to ensure message reliability in different network environments.

- QoS 0: Messages are delivered at most once. If the client is unavailable, it will lose the message.
- QoS 1: Messages are delivered at least once.
- QoS 2: Messages are delivered only once.

For more details about MQTT QoS, please refer to *"MQTT Version 3.1.1 4.3 Quality of Service levels and protocol flows ".*

4.5.6. Client ID

The MQTT server uses the Client ID to identify the client. Each client connected to the server must have a unique Client ID. The Client ID is usually a UTF-8 string of 1 to 23 bytes.

If a client uses a duplicate Client ID to connect to the server, the client that has successfully connected using the Client ID will be kicked offline.

Username & Password

The MQTT protocol can use usernames and passwords for authentication and authorization, but if this information is not encrypted, the username and password will be transmitted in plain text. If username and password authentication is set, it is best to use the MQTTs or WSS protocols.

Most MQTT servers use anonymous authentication by default. In anonymous authentication, just set the username and password to empty strings.

4.5.7. Connect Timeout

Connection timeout duration, the waiting time before receiving the connection confirmation from the server. If no connection confirmation is received within the waiting time, the connection fails.

4.5.8. Keep Alive

Keep Alive period is a time interval in seconds. When the client has no message to send, it will periodically send heartbeat messages to the server according to the value set by Keep Alive to ensure that the connection is not disconnected by the server.

After the connection is successfully established, if the server does not receive any packets from the client within 1.5 times the Keep Alive time, it will be considered that there is a problem with the connection with the client, and the server will disconnect the client.

4.5.9. Clean Session

When false, it means creating a persistent session. When the client disconnects, the session will still be maintained and offline messages will be saved until the session times out. When true, it means creating a new temporary session. When the client disconnects, the session will be automatically destroyed.

Persistent sessions prevent message loss after a client reconnects and eliminate the overhead of repeated subscriptions after the client reconnects. This feature is very useful in IoT scenarios with low bandwidth and unstable networks.

The number of messages the server saves for persistent sessions depends on the server configuration. For example, the free public MQTT server provided by EMQ sets the offline message retention time to 5 minutes, the maximum number of messages to 1,000, and does not save QoS 0 messages.
Note: The premise of persistent session recovery is that the client uses a fixed Client ID to connect again. If the Client ID is dynamic, a new persistent session will be created after the connection is successful.

4.5.10. Last Will

The Last Will is a mechanism in MQTT that allows a client to gracefully notify other clients in the event of its unexpected disconnection.When an MQTT client with a will message configured goes offline unexpectedly, the MQTT server will publish the will message configured by the client.

Unexpected disconnections include: the connection is closed by the server due to network failure; the device loses power unexpectedly; the device attempts to perform an unauthorized operation and the server closes the connection, etc.
The will message can be regarded as a simplified version of the MQTT message, which also contains Topic, Payload, QoS, Retain and other information.

- When the device is accidentally disconnected, the will message will be sent to the will topic;
- Will Payload is the content of the message to be sent;
- The QoS of the will is consistent with the QoS of ordinary MQTT messages.
- When Will Retain is true, the will message is a retained message. The MQTT server stores the latest retained message for each topic so that clients that come online after the message is published can still receive the message when they subscribe to the topic.

4.6. http

The module supports http1.1 and provides five request types: head, get, post, put and delete.
Users can add request headers to http requests according to their needs.

4.7. Other Features

The module supports the ping command and the sntp function. Ping can be used to determine whether the link with the remote host is connected. Sntp can be used to obtain the network time.

In addition, the module provides an iperf speed measurement function, but unfortunately, the iperf function is not complete and the actual throughput of the module cannot be tested through this test.

4.8. AT command list

Send AT command: AT+HELP to get the supported command list

AT commands	Execute Command	Query Command	Setting Commands	Help Command	Functional Description
AT+ECHO	×	√	√	√	Echo function switch
AT+GMR	×	√	×	√	Get module information
AT+HELP	√	×	√	×	Get the list of AT commands supported by the module
AT+NTPSVR	×	√	√	√	Set or get NTP server
AT+RST	√	×	×	×	Restart
AT+SLEEP	√	×	×	×	Hibernation
AT+SYSTIMESTAMP	×	√	×	×	Get network time
AT+UART	×	√	√	√	Set or query UART parameters
AT+CIPAP	×	√	√	√	Get or set SOFTAP IP
AT+CIPAPMAC	×	√	√	√	Get or set the MAC address of the SOFTAP
AT+CIPSTA	×	√	√	√	Get or set the STA's IP address
AT+CIPSTAMAC	×	√	√	√	Get or set the MAC address of a STA
AT+CWDHCP	×	√	√	√	DHCP enabled or disabled
AT+CWJAP	×	×	√	√	Connect to AP
AT+CWLAP	√	×	√	√	Scan for nearby APs
AT+CWLIF	×	√	×	√	Obtaining STA Information
AT+CWMODE	×	√	√	√	Set or get the module's Wi-Fi role
AT+CWQAP	√	×	×	√	Disconnect from Wi-Fi
AT+CWQIF	×	×	√	√	Disconnect the station from the SoftAP
AT+CWSAP	×	√	√	√	Create SoftAP
AT+MDNS	×	√	√	√	Start or stop the mDNS service
AT+MDNSQUERY	×	×	√	√	Querying the mDNS service
AT+CIPCLOSE	√	×	√	√	Disconnecting a TCP connection
AT+CIPMUX	×	√	√	√	Set or get TCP multiple connections
AT+CIPSEND	√	×	√	√	Sending Data
AT+CIPSERVER	×	√	√	√	Create or close a TCP service
AT+CIPSTART	×	×	√	√	Creating TCP and UDP connections
AT+IPERFRUN	×	×	√	√	iperf start
AT+IPERFSTOP	√	×	×	×	iperfstop
AT+PING	×	×	√	√	ping
AT+HTTPCHEAD	×	√	√	√	Set or get HTTP request header
AT+HTTPCLIENT	×	×	√	√	Sending HTTP requests
AT+HTTPCPOST	×	×	√	√	POST data of specified length
AT+HTTPCPUT	×	×	√	√	PUT data of specified length
AT+HTTPGETSIZE	×	×	√	√	Get the size of HTTP resources
AT+HTTPURLCFG	×	√	√	√	Set or get the HTTP long URL
AT+MQTTCLEAN	×	×	√	×	Disconnect MQTT
AT+MQTTCONN	×	√	√	√	Connecting to an MQTT Broker
AT+MQTTCONNCFG	×	√	√	√	Set or get MQTT connection parameters

AT+MQTTPUBRAW	×	×	√	√	Publishing MQTT messages
AT+MQTTSUB	×	×	√	√	Subscribe to a topic
AT+MQTTUNSUB	×	×	√	√	Unsubscribe
AT+MQTTUSERCFG	×	√	√	√	Set or get MQTT user parameters
AT+TGOTIP	×	×	√	×	Get the domain name or mDNS host IP

× : Not supported; √ : Supported

5. Built-in device parameters

5.1. Built-in crystal oscillator parameters

Frequency	Parameter
52MHz	10ppm, 9pF, -40°C to +85°C
32.768KHz	20ppm, 7pF, -40°C to +125°C

5.2. Built-in Flash parameters

The module has a built-in 32M-Bit Flash. The connection pins between CC3551E and FLASH are as follows:

Flash pin	CC3551E Pinout
SCK	xSPI_CLK (GPIO24), 21 pins
D0	xSPI_D0 (GPIO25), pin 20
D1	xSPI_D 1 (GPIO21), 25-pin
D2	xSPI_D 2 (GPIO22), 24-pin
D3	xSPI_D 3 (GPIO23), 22 pins
CS	xSPI_ CS (GPIO20), 60-pin

6. Specifications

6.1. Limit parameters

Main parameters	Performance		Remark
	Minimum	Maximum	
Power supply voltage (V)	-0.5	4.2	Over 4.2V will permanently burn the module
I/O voltage (V)	-0.5	3.6V	Over 3.6V will permanently burn the module
Blocking power (dBm)	-	10	The probability of burning is lower when used at close range
Operating temperature (°C)	-40	+85	Support customized 105°C version
Storage temperature (°C)	-40	+85	-

6.2. RF parameter indicators

Main parameters	Performance			Remark
	Minimum	Typical values	Maximum	
Operating voltage (V)	3	3.3	3.6	Recommended 3.3V power supply
Communication level (V)		3.3		The default interface voltage is 3.3V, and can be customized to 1.8V
Operating frequency band (Hz)	2.412G	2.442G	2.472G	Support 2.4G frequency band
	5.180G	5.550G	5.845G	Support 5G frequency bands

RF Performance	Transmitting power (dBm)	-	17.5	-	1 Mbps DSSS @2.4-GHz
		-	16	-	54 Mbps OFDM @2.4-GHz
		-	16	-	6 Mbps OFDM @5-GHz
		-	14		54 Mbps OFDM @5-GHz
	Receiving sensitivity (dBm)	-	-98	-	1 Mbps DSSS @2.4-GHz
		-	-92.2		6 Mbps OFDM @5-GHz
		-	-75.5	-	54 Mbps OFDM @2.4-GHz
	RF interface	-	IPEX	-	First generation IPEX interface, 50Ω characteristic impedance

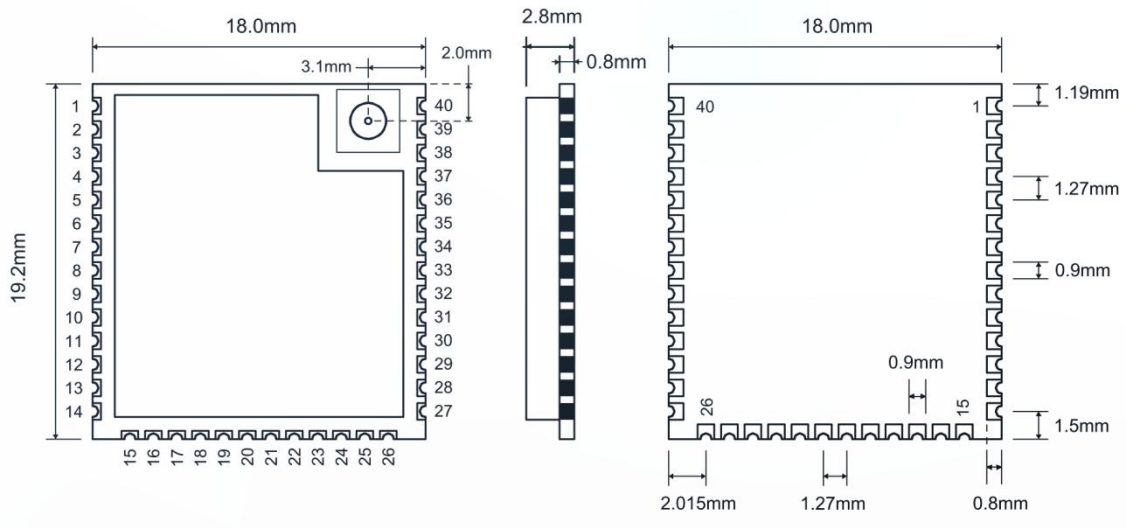
Note: For more parameter indicators, please refer to the CC3551E chip manual. The module performance indicators can be consistent with those of the chip.

6.3. Power consumption indicators

Main parameters	Performance			Remark
	Minimum	Typical values	Maximum	
Transmitting current (mA) @3.3V	-	390	560	6 OFDM @2.4-GHz
	-	360	430	6 OFDM@5-GHz
Receiving current (mA) @3.3V	-	68	-	@2.4-GHz
	-	115	-	@5-GHz

Note: For more parameter indicators, please refer to the CC3551E chip manual. The module performance indicators can be consistent with those of the chip.

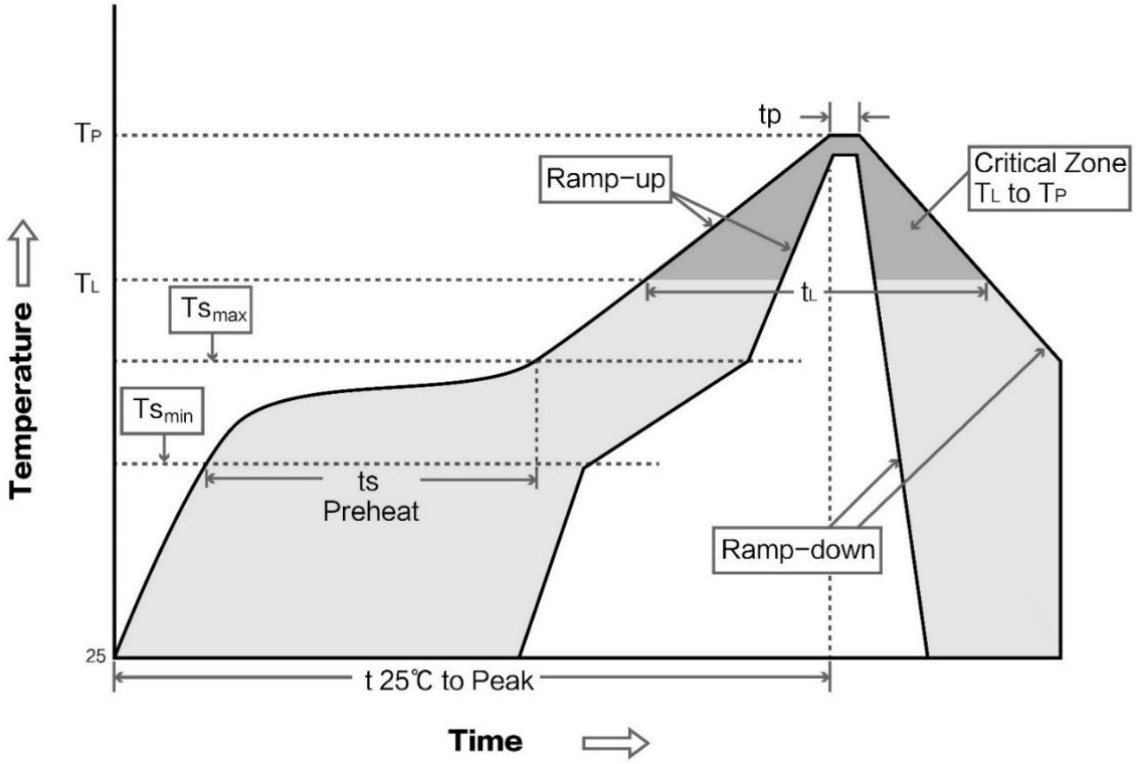
7. Package and size



- Module size: 19.2x18.0x2.8mm stamp hole interface;
- Antenna interface: first generation IPEX, characteristic impedance 50Ω;
- The back of the module contains EPAD detailed size parameters. Please refer to the Lib package library provided in the sales materials.

8. Production Guidance

8.1. 7.1 Reflow Oven Curve



8.2. 7.2 Reflow temperature and time

Profile Feature	Sn-Pb Assembly	Pb-Free Assembly
Solder Paste	Sn63/Pb37	Sn96.5/Ag3/Cu0.5
Preheat Temperature min (Tsmin)	100 ℃	150 ℃
Preheat temperature max (Tsmax)	150 ℃	200 ℃
Preheat Time (Tsmin to Tsmax)(ts)	60-120 seconds	60-120 seconds
Average ramp-up rate(Tsmax to Tp)	3 ℃ /second max	3 ℃ /second max
Liquidous Temperature (TL)	183 ℃	217 ℃
Time(tL)Maintained Above(TL)	60-90 seconds	30-90 seconds
Peak temperature (Tp)	220-235 ℃	230-250 ℃
Aveage ramp-down rate （Tp to Tsmax）	6 ℃ /second max	6 ℃ /second max
Time 25 ℃ to peak temperature	6 minutes max	8 minutes max

9. Contact

Contact	Tell	E-Mail
Mr Chen	+86 15000319232	chenliang@silent-smart.com
Tel: 028-64823553		
Address: Room 303-7, 3rd Floor, Building 12, IP Technology Center, Xingsheng West Road, Jinniu District, Chengdu, China		

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

FCC Radiation Exposure Statement:
This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

KDB 996369 D03 statements

2.2 List of applicable FCC rules:

The module complies with FCC Part 15.247& FCC Part 15.407.

FCC ID: 2BB8U-WS8712 on User manual and on the external of the packaging.

2.3 Summarize the specific operational use conditions

The module has been certified for Potable applications. This transmitter must not beco-located or operating in conjunction with any other antenna or transmitter

2.4 Limited module procedures

The module is not a limited module.

2.5 Trace antenna designs

Not applicable

2.6 RF exposure considerations

This equipment complies with FCC's RF radiation exposure limits set forth for an uncontrolled environment. The antenna(s) used for this transmitter must not be collocated or operating in conjunction with any other antenna or transmitter.

2.7 Antennas

The EUT use a permanently attached antenna which is unique.

2.8 Label and compliance information

The host system using this module, should have label in a visible area indicated the following texts: "Contains FCC ID: 2BB8U-WS8712

2.9 Information on test modes and additional testing requirements

When testing host product, the host manufacture should follow FCC KDB Publication 996369 D04 Module Integration Guide for testing the host products. The host manufacturer may operate their product during the measurements. In setting up the configurations, if the pairing and call box options for testing does not work, then the host product manufacturer should coordinate with the module manufacturer for access to test mode software.

The module has been certified for Potable applications. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter

2.10 Additional testing, Part 15 Subpart B disclaimer

The module without unintentional-radiator digital circuity, so the module does not require an evaluation by FCC Part 15 Subpart B. The host shoule be evaluated by the FCC Subpart B.

2.11 Note EMI Considerations

host manufacture is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties

2.12 How to make changes

This module is stand-alone modular. If the end product will involve the Multiple simultaneously transmitting condition or different operational conditions for a stand-alone modular transmitter in evaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device (including unintentional radiators) as a composite. The host manufacturer must fix any failure a host, host manufacturer have to consult with module manufacturer for the installation method in end system. According to the KDB 996369 D02 Q&A Q12, that a host manufacture only needs to do anevaluation (i.e., no C2PC required when no emission exceeds the limit of any individual device(including unintentional radiators) as a composite. The host manufacturer must fix any failure