Manuals+ — User Manuals Simplified.

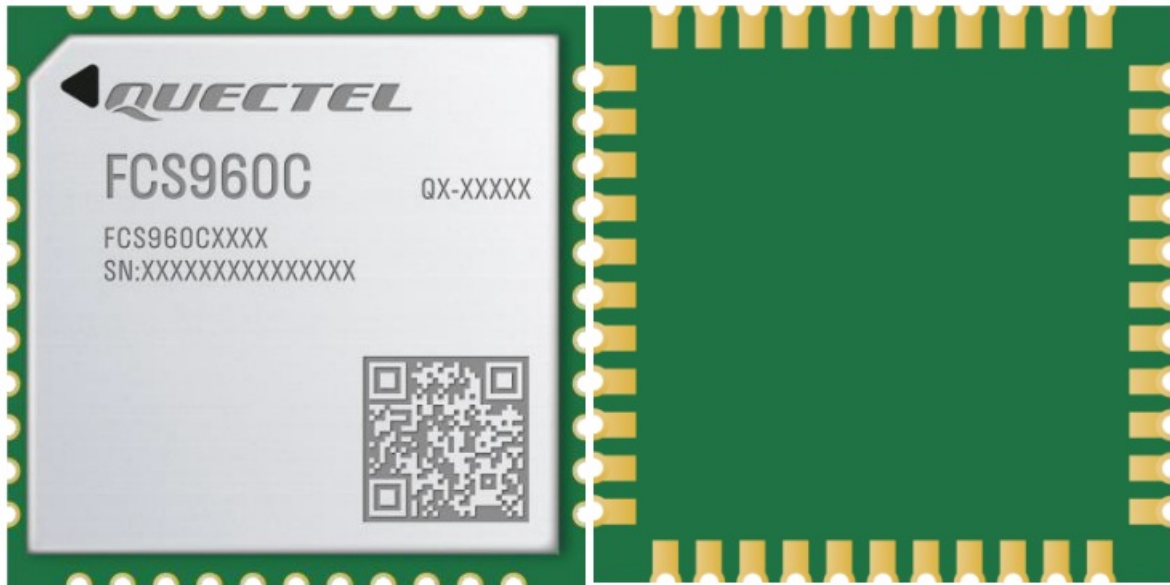# QUECTEL FCS960C Wi-Fi and Bluetooth Module Series User Manual

Contents

QUECTEL FCS960C Wi-Fi and Bluetooth Module Series

Product Information

- **Product Name:** FCS960C Hardware Design
- **Product Type:** Wi-Fi & Bluetooth Module Series
- **Version:** 1.0.0
- **Date:** 2023-02-25
- **Status:** Preliminary

  The FCS960C Hardware Design is a part of the Wi-F i& Bluetooth Module Series developed by Quectel.

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FCS960C
Hardware Design

- **Wi-Fi&Bluetooth Module Series Version:** 1.0.0
- **Date:** 2023-02-25
- **Status:** Preliminary

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- Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.

- Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If there is an Airplane Mode, it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on an aircraft.

- Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.

- Cellular terminals or mobiles operating over radio signal and cellular network cannot be guaranteed to connect in certain conditions, such as when the mobile bill is unpaid or the (U)SIM card is invalid. When emergency help is needed in such conditions, use emergency call if the device supports it. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength. In an emergency, the device with emergency call function cannot be used as the only contact method

considering network connection cannot be guaranteed under all circumstances.

- The cellular terminal or mobile contains a transceiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.

- In locations with explosive or potentially explosive atmospheres, obey all posted signs and turn off wireless devices such as mobile phone or other cellular terminals. Areas with explosive or potentially explosive atmospheres include fuelling areas, below decks on boats, fuel or chemical transfer or storage facilities, and areas where the air contains chemicals or particles such as grain, dust or metal powders.

About the Document

Revision History

Version	Date	Author	Description
–	2023-02-25	Devin YU	Creation of the document
1.0.0	2023-02-25	Devin YU	Preliminary

Introduction

This document defines the FCS960C and describes its air interfaces and hardware interfaces which are connected with your applications.
With this document, you can quickly understand module interface specifications, electrical and mechanical details, as well as other related information of the module. The document, coupled with application notes and user guides, makes it easy to design and set up mobile applications with the module.

Special Mark
Table 1: Special Mark

Mark	Definition
[…]	Brackets ([…]) used after a pin enclosing a range of numbers indicate all pins of the same type. For example, SDIO_DATA[0:3] refers to all four SDIO pins: SDIO_DATA0, SDIO_DATA1, SDIO_DATA2, and SDIO_DATA3.

Product Overview

- FCS960C is a high-performance IEEE 802.11 b/g/n/ax Wi-Fi and Bluetooth 5.0 module. It supports 2.4 GHz

band and 1T1R with maximum data rates up to 229 Mbps. It provides SDIO 2.0 interface for Wi-Fi functions and UART for Bluetooth functions.

- It is an SMD module with compact packaging. Related information is listed in the table below:

Table 2: Basic Information

FCU760C	
Packaging type	LCC
Pin counts	44
Dimensions	(12.0 ±0.15) mm × (12.0 ±0.15) mm × (1.9 ±0.2) mm
Weight	Approx. 0.6 g

Key Features

Table 3: Key Features

| Basic Information	
Protocol and Standard	• Wi-Fi protocols: IEEE 802.11b/g/n/ax • Bluetooth protocol: Bluetooth 5.1 • All hardware components are fully compliant with EU RoHS directive
Power Supply	**VBAT Power Supply:** • 2.1–3.46 V • Typ.: 3.3 V **VDDIO Power Supply:** • 1.75–3.46 V • Typ.: 3.3 V
Temperature Ranges	• Operating temperature [1]: -20 to +70 °C • Storage temperature: -40 to +125 °C
EVB Kit	FC90X-M.2
RF Antenna Interface	
Wi-Fi Antenna Interface	• ANT_WIFI/BT • 50 Ω impedance
Hardware Interface	
Wi-Fi Application Interface	SDIO 2.0
Bluetooth Application Interface	UART

Functional Diagram
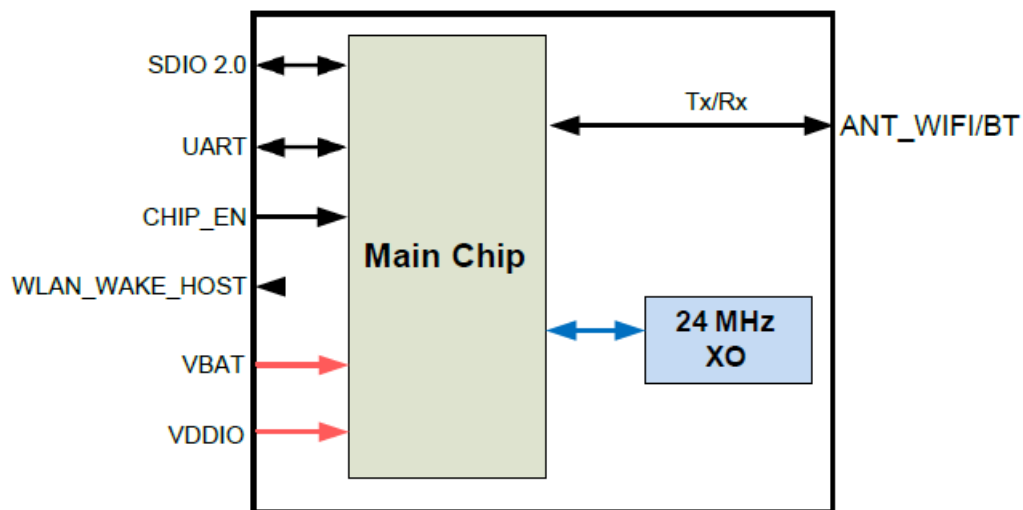
Figure 1: Functional Diagram

- To meet the normal operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heatsinks, heat pipes, vapor chambers, etc. Within this range, the module's indicators comply with IEEE and Bluetooth specification requirements.

RF Performances

Wi-Fi Performances
Table 4: Wi-Fi Performances

Operating Frequency
2.4 GHz: 2.400–2.4835 GHz

Modulation
DSSS, OFDM, DBPSK, DQPSK, CCK, BPSK, QPSK, 16QAM, 64QAM, 256QAM

Operating Mode
- AP
- STA

Transmission Data Rate
- 802.11b: 1 Mbps, 2 Mbps, 5.5 Mbps, 11 Mbps
- 802.11g: 6 Mbps, 9 Mbps, 12 Mbps, 18 Mbps, 24 Mbps, 36 Mbps, 48 Mbps, 54 Mbps
- 802.11n: HT20 (MCS 0–7), HT40 (MCS 0–7)
- 802.11ax: HE20 (MCS 0–9), HE40 (MCS 0–9)

Condition		EVM	Unit: dBm, Tolerance: ±2 dB	
			Transmitting Power @ Typ.	Receiving Sensitivity @ Typ.
2.4 GHz	802.11b @ 1 Mbps	≤ -9 dB	18	-96
	802.11b @ 11 Mbps		18	-87
	802.11g @ 6 Mbps	≤ -5 dB	18	-91
	802.11g @ 54 Mbps	≤ -25 dB	15	-73.5
	802.11n, HT20 @ MCS 0	≤ -5 dB	18	-91
	802.11n, HT20 @ MCS 7	≤ -27 dB	15	-73

Condition			
802.11n, HT40 @ MCS 0	≤ -5 dB	18	-88
802.11n, HT40 @ MCS 7	≤ -27 dB	15	-68
802.11ax, HE20 @ MCS 0	≤ -5 dB	18	-91
802.11ax, HE20 @ MCS 9	≤ -32 dB	12	-65
802.11ax, HE40 @ MCS 0	≤ -5 dB	17	-87
802.11ax, HE40 @ MCS 9	≤ -32 dB	12	-64

Table 5: Wi-Fi Power Consumption

Protocol	Condition	I_{VDDIO}	I_{VBAT}	Unit
802.11b	Tx @ 1 Mbps	6.6	311	mA
	Tx @ 11 Mbps	6.6	280	mA
	Rx @ 1 Mbps	6.6	103	mA
	Rx @ 11 Mbps	6.6	103	mA
802.11g	Tx @ 6 Mbps	6.6	288	mA
	Tx @ 54 Mbps	6.6	191	mA
	Rx @ 6 Mbps	6.6	103	mA
	Rx @ 54 Mbps	6.6	103	mA
802.11n, HT20	Tx @ MCS 0	6.6	315	mA
	Tx @ MCS 7	6.6	247	mA
	Rx @ MCS 0	6.6	103	mA
	Rx @ MCS 7	6.6	103	mA
802.11n, HT40	Tx @ MCS 0	6.6	307	mA
	Tx @ MCS 7	6.6	218	mA
	Rx @ MCS 0	6.6	103	mA
	Rx @ MCS 7	6.6	103	mA
802.11ax, HE20	Tx @ MCS 0	6.6	315	mA
	Tx @ MCS 9	6.6	255	mA
	Rx @ MCS 0	6.6	103	mA
	Rx @ MCS 9	6.6	103	mA
802.11ax, HE40	Tx @ MCS 0	6.6	308	mA
	Tx @ MCS 9	6.6	225	mA
	Rx @ MCS 0	6.6	103	mA
	Rx @ MCS 9	6.6	103	mA

Bluetooth Performances

Table 6: Bluetooth Performances

Operating Frequency	
2.400–2.4835 GHz	
Modulation	
GFSK	
Operating Mode	
BLE	

Condition	Unit: dBm, Tolerance: ±2 dB	
	Transmitting Power @ Typ.	Receiving Sensitivity @ Typ.
BLE	6	-97

Table 7: BLE Power Consumption in Non-signaling Modes

Mode	Transmitting Power	IVBAT	IVDDIO
BLE	6 dBm	120 mA	6.6 mA

Application Interfaces

Pin Assignment
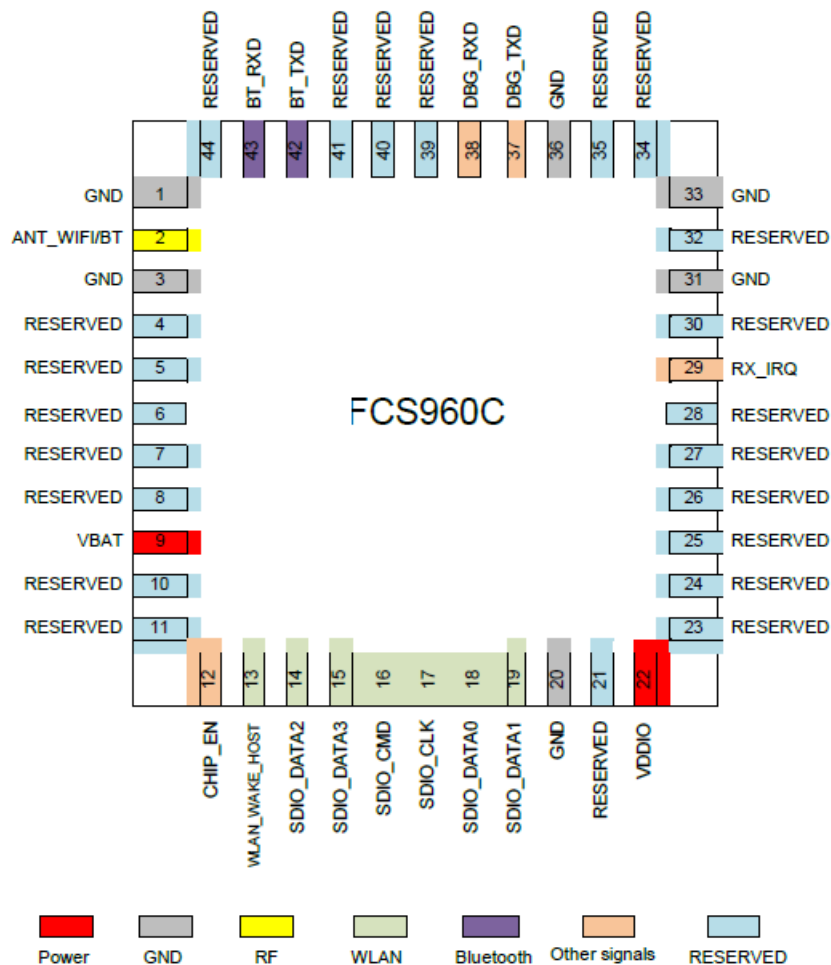
Figure 2: Pin Assignment (Top View)

NOTE

1. Keep all RESERVED or unused pins unconnected.

2. All GND pins should be connected to ground.

Pin Description

Table 8: I/O Parameters Definition

Type	Description
AIO	Analog Input/Output
DI	Digital Input
DO	Digital Output
DIO	Digital Input/Output
PI	Power Input

DC characteristics include power domain and rate current.

Table 9: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VBAT	9	PI	Power supply for the module	Vmin = 2.1 V Vnom = 3.3 V Vmax = 3.46 V	It must be provided with sufficient current more than 0.6 A.
VDDIO	22	PI	Power supply for the module's I/O pins	Vmin = 1.75 V Vnom = 3.3 V Vmax = 3.46 V	It must be provided with sufficient current more than 10 mA.
GND	1, 3, 20, 31, 33, 36				

Wi-Fi Application Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
WLAN_WAKE_HOST	13	DO	Wi-Fi wakes up host		Active high.
SDIO_CMD	16	DIO	SDIO command	VDDIO	Requires differential impedance of 50 Ω. SDIO 2.0 compliant.
SDIO_CLK	17	DI	SDIO clock		
SDIO_DATA3	15	DIO	SDIO data bit 3		

Pin Name	Pin No.	I/O	Description
SDIO_DATA2	14	DIO	SDIO data bit 2
SDIO_DATA0	18	DIO	SDIO data bit 0
SDIO_DATA1	19	DIO	SDIO data bit 1

Bluetooth Application Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
BT_TXD	42	DO	Bluetooth UART transmit	VDDIO	
BT_RXD	43	DI	Bluetooth UART receive		

RF Antenna Interface

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
ANT_WIFI/BT	2	AIO	Wi-Fi/Bluetooth antenna interface		50 Ω impedance.

Other Interfaces

Pin Name	Pin No.	I/O	Description	DC Characteristics	Comment
CHIP_EN	12	DI	Module enable		Active high.
RX_IRQ	29	DO	Interrupt request	VDDIO	Used for interrupt request if the SDIO_DATA1 of the host cannot be used as interrupt signal. If unused, keep it open.
DBG_TXD	37	DO	Debug UART transmit		Test points must be reserved.
DBG_RXD	38	DI	Debug UART receive		

RESERVED Pins

Pin Name	Pin No.		Comment
RESERVED	4~8、10、11、21、23~28、30、32、34、35、39~41、44		Keep them open.

Power Supply

The module is powered by VBAT. It is recommended to use a 3.3 V power supply chip with sufficient more than 0.6 A. For better power supply performance, it is recommended to parallel a 47 µF decoupling capacitor, and 1 µF and 100 nF filter capacitors near the module's VBAT pin. In addition, it is recommended to add a TVS near the VBAT to improve the surge voltage bearing capacity of the module. In principle, the longer the VBAT trace is, the wider it should be.
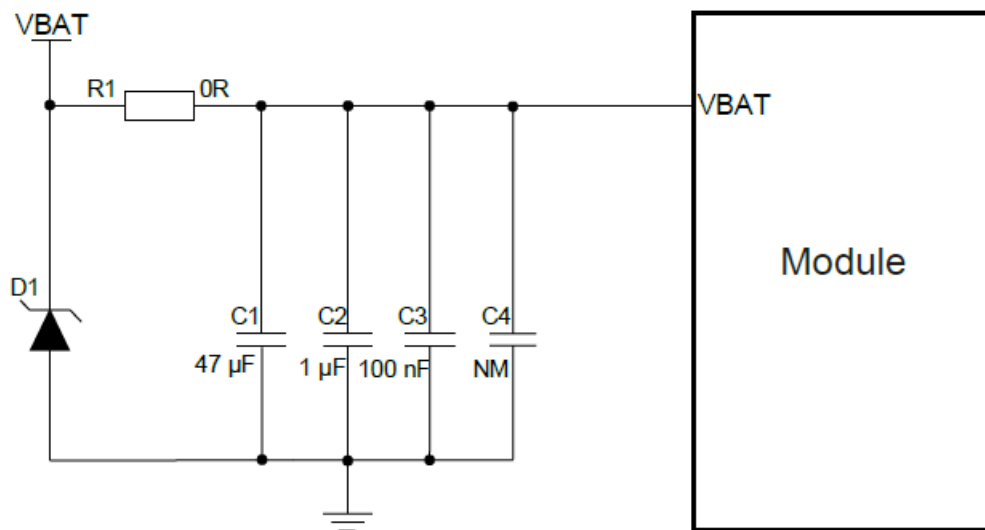
VBAT reference circuit is shown below:

Figure 3: Reference Circuit of Power Supply

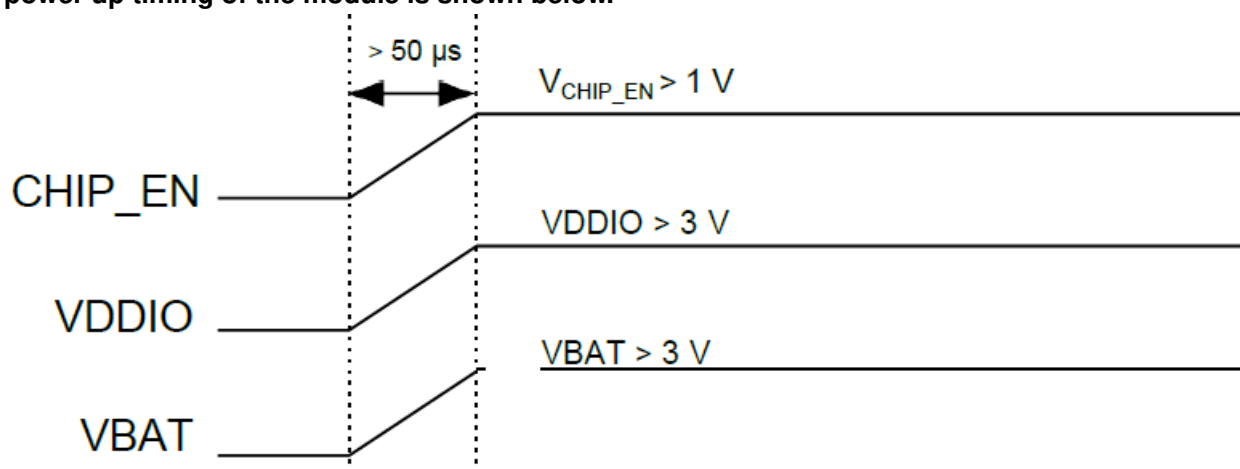**The power-up timing of the module is shown below.**

Figure 4: Power-up Timing

Wi-Fi Application Interface

Wi-Fi application interface connection between the module and the host is illustrated in the figure below.
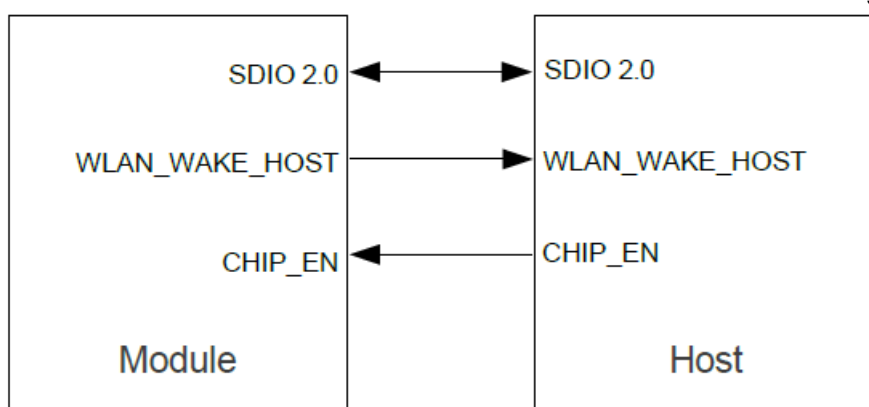

Figure 5: Wi-Fi Application Interface Connection

SDIO Interface

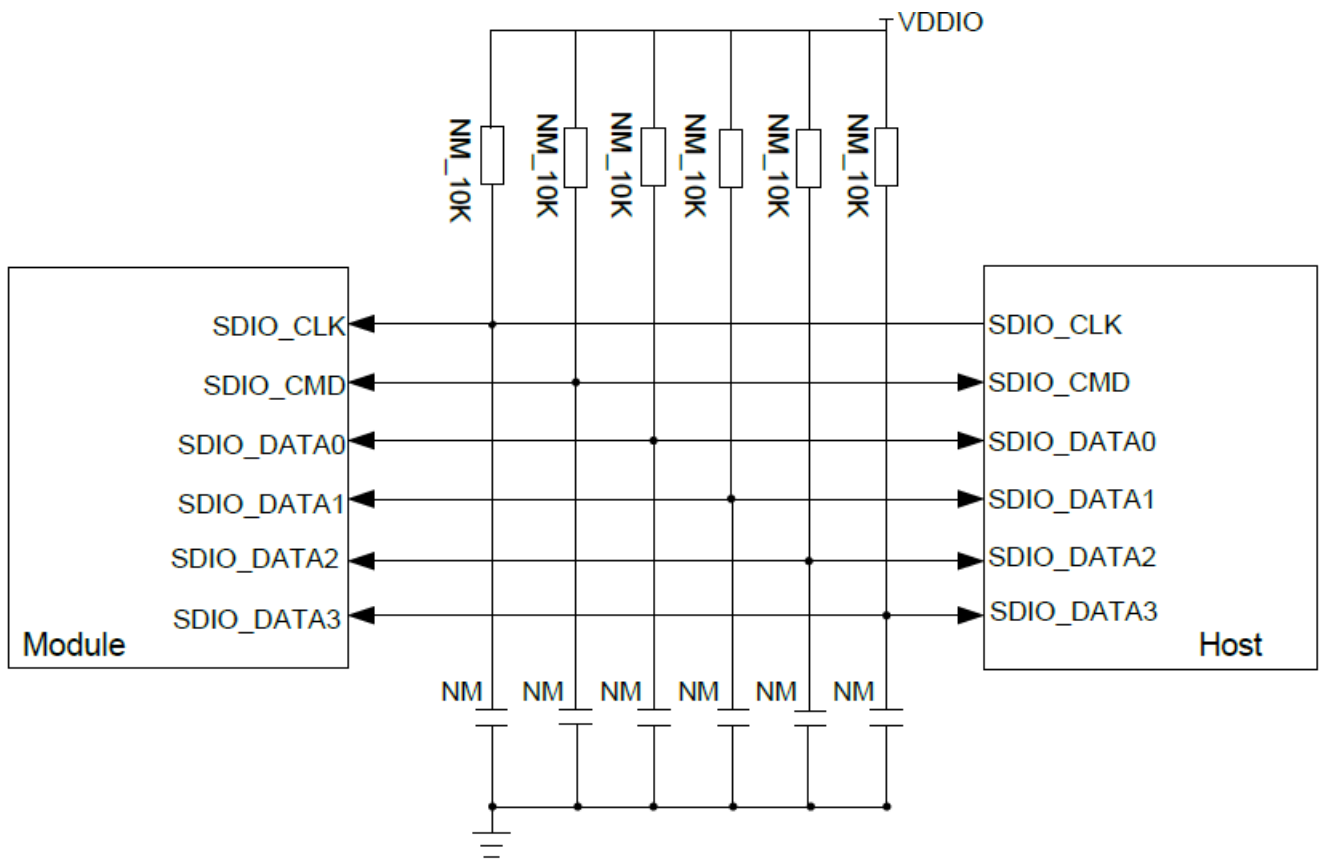SDIO interface connection between the module and the host is illustrated in the following figure.

Figure 6: SDIO Interface Connection

To ensure compliance of interface design with the SDIO 2.0 specification, it is recommended to adopt the following principles:

- Route the SDIO traces in inner layer of the PCB, and surround the traces with ground on that layer and with ground planes above and below. The impedance of SDIO signal trace is 50 Ω ±10 %.
- Keep SDIO signals far away from other sensitive circuits/signals such as RF circuits and analog signals, as well as noise signals such as clock signals and DC-DC signals.
- SDIO signal traces (SDIO_CLK and SDIO_DATA[0:3]/SDIO_CMD) need to be equal in length (less than 1 mm distance between the traces).
- The distance between SDIO signals and other signals must be greater than twice the trace width, and the bus load capacitance must be less than 15 pF.

Bluetooth Application Interface

Bluetooth application interface connection between the module and the host is illustrated in the figure below.
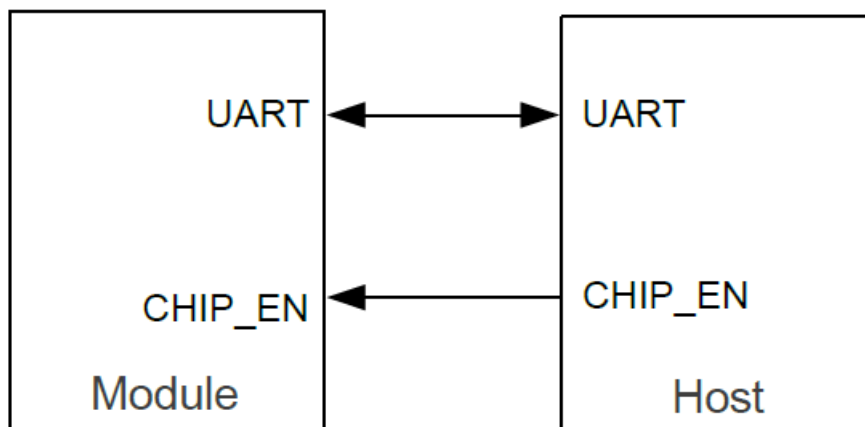
UART

- The module supports an HCI (Host Controller Interface) UART. The UART is used for data transmission with the host. It supports up to 921.6 Kbps baud rate.
- The module serves as DCE (Data Communication Equipment), which is connected in the classic DCE-DTE (Data Terminal Equipment) mode.
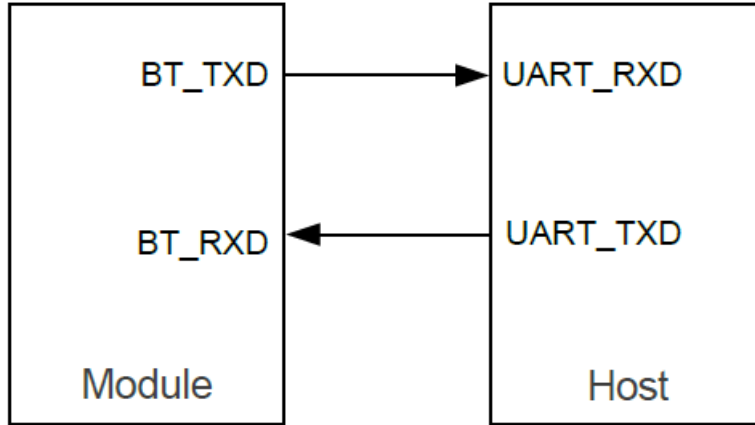

Figure 8: UART Connection

RF Antenna Interface

- The module supports pin antenna interface (ANT_WIFI/BT). The impedance of antenna port is 50 Ω.
- Appropriate antenna type and design should be used with matched antenna parameters according to specific application. It is required to perform a comprehensive functional test for the RF design before mass production of terminal products. The entire content of this chapter is provided for illustration only. Analysis, evaluation and determination are still necessary when designing target products.

Table 10: Antenna Design Requirements

Parameter	Requirement [2]
Frequency Ranges (GHz)	2.400–2.4835
Cable Insertion Loss (dB)	< 1
VSWR	≤ 2
Gain (dBi)	1 (Typ)
Max Input Power (W)	50
Input Impedance (Ω)	50
Polarization Type	Vertical

Reference Design

- A reference circuit for the RF antenna interface is shown below. It is recommended to reserve a π-type

matching circuit and add ESD protection components for better RF performance.

- Reserved matching components (R1, C1, C2, and D1) shall be placed as close to the antenna as possible. C1, C2 and D1 are not mounted by default. The parasitic capacitance of TVS should be less than 0.05 pF and R1 is recommended to be 0 Ω.
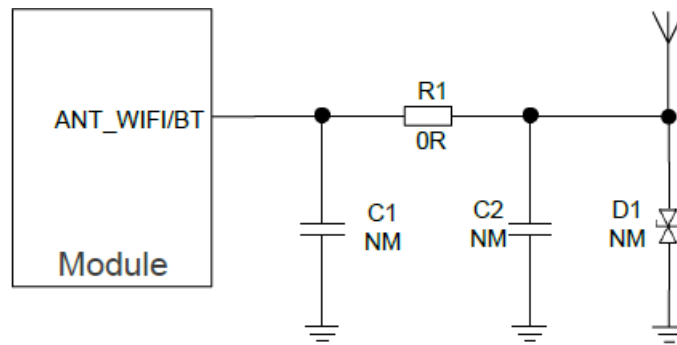

Figure 9: Reference Circuit for RF Antenna Interface

RF Routing Guidelines

For user's PCB, the characteristic impedance of all RF traces should be controlled to 50 Ω. The impedance of the RF traces is usually determined by the trace width (W), the materials' dielectric constant, the height from the reference ground to the signal layer (H), and the spacing between RF traces and grounds (S). Microstrip or coplanar waveguide is typically used in RF layout to control characteristic impedance. The following are reference designs of microstrip or coplanar waveguide with different PCB structures.
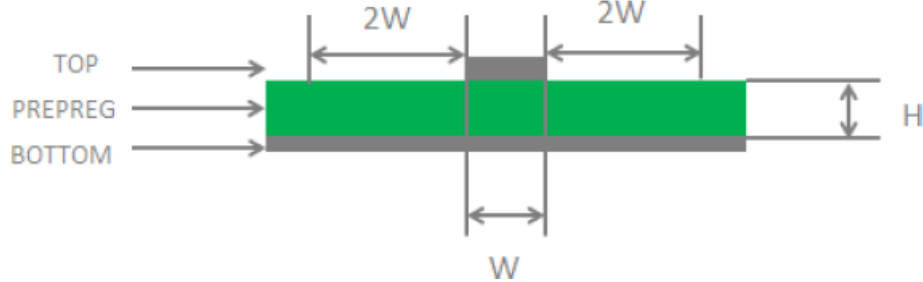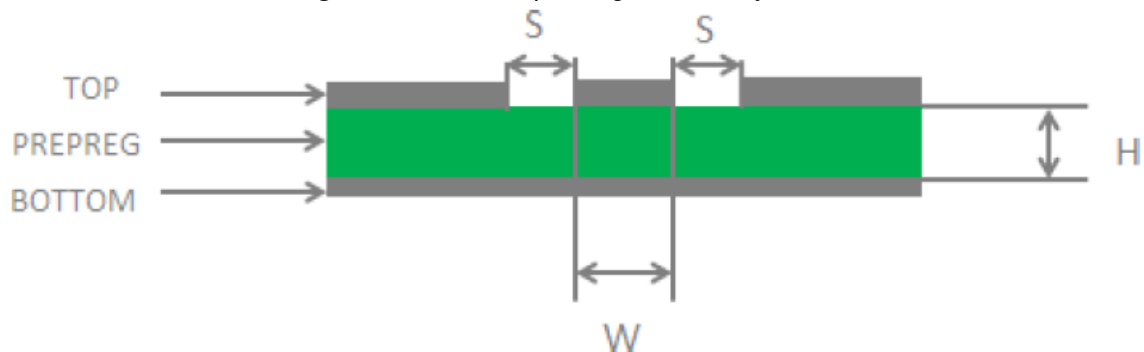

Figure 10: Microstrip Design on a 2-layer PCB

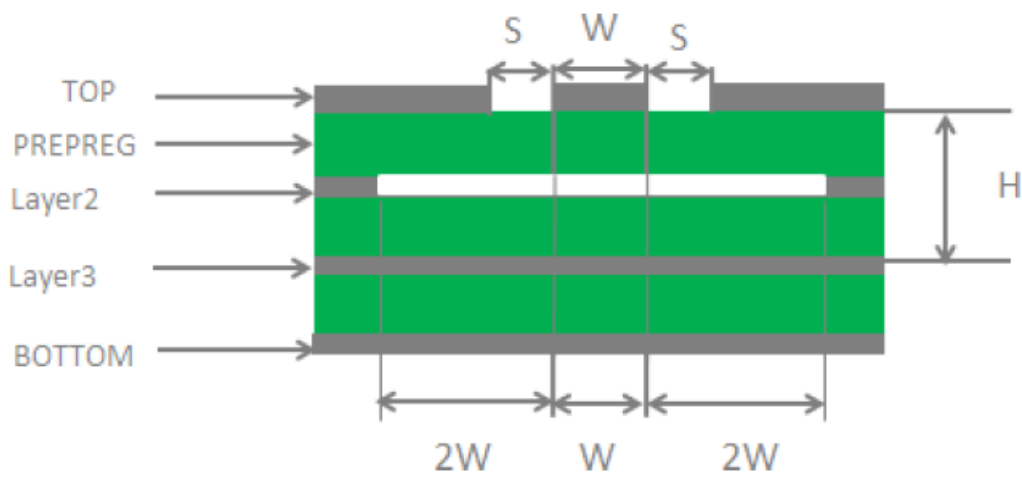**Figure** 11: Coplanar Waveguide Design on a 2-layer PCB

Figure 12: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)
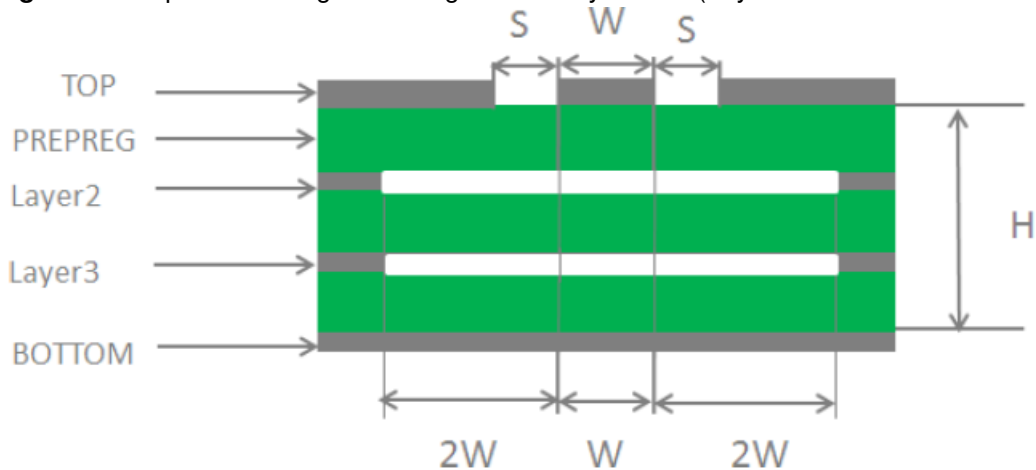

Figure 13: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

To ensure RF performance and reliability, follow the principles below in RF layout design:

- Use an impedance simulation tool to accurately control the characteristic impedance of RF traces to 50 Ω.
- The GND pins adjacent to RF pins should not be designed as thermal relief pads, and should be fully connected to ground.
- The distance between the RF pins and the RF connector should be as short as possible and all the right-angle traces should be changed to curved ones. The recommended trace angle is 135°.
- There should be clearance under the signal pin of the antenna connector or solder joint.
- The reference ground of RF traces should be complete. Meanwhile, adding some ground vias around RF traces and the reference ground could help to improve RF performance. The distance between the ground vias and RF traces should be not less than twice the width of RF signal traces (2 × W).
- Keep RF traces away from interference sources, and avoid intersection and paralleling between traces on adjacent layers.

For more details about RF layout, see document [1].

RF Connector Recommendation
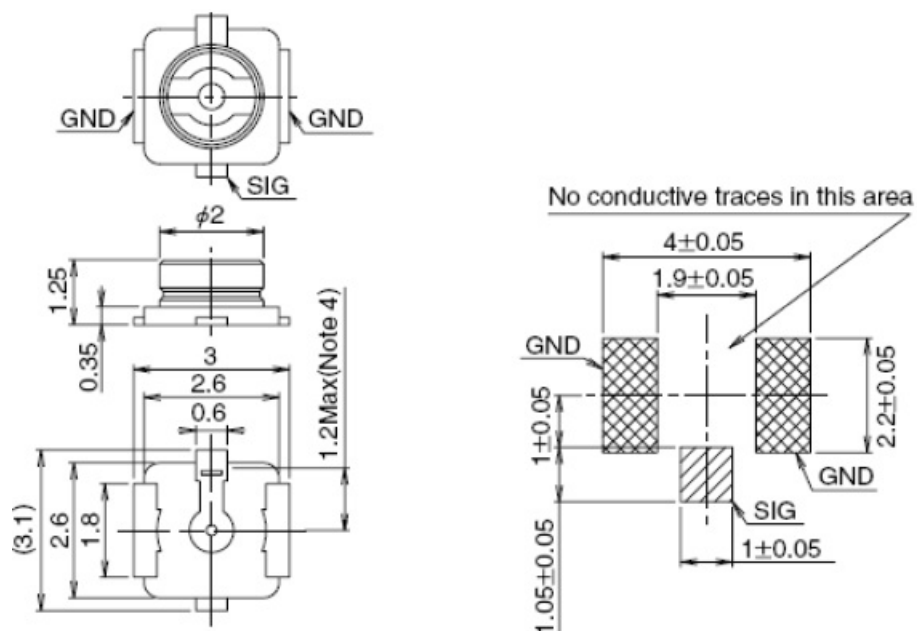If RF connector is used for antenna connection, it is recommended to use the U.FL-R-SMT connector provided by Hirose.

Figure 14: Dimensions of the Receptacle (Unit: mm)

U.FL-LP series mated plugs listed in the following figure can be used to match the U.FL-R-SMT connector.

	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
Part No.					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7
RoHS	YES				

Figure 15: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors.
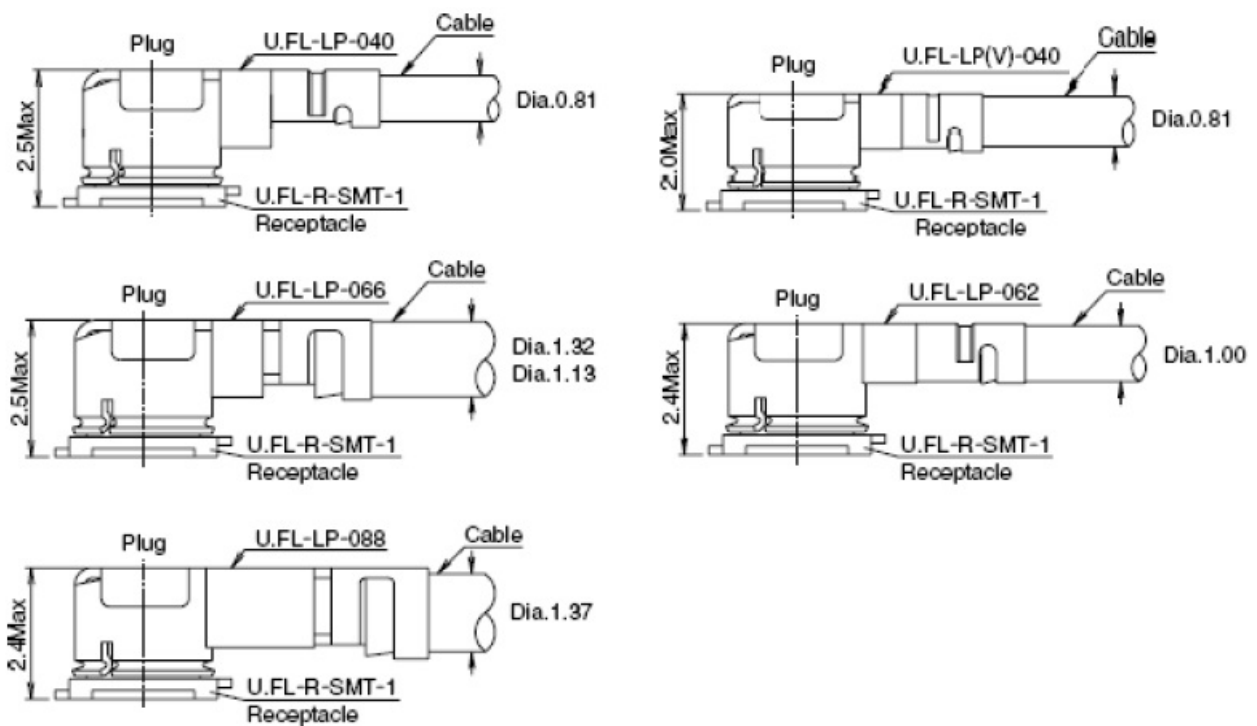
Figure 16: Space Factor of Mated Connectors (Unit: mm)

For more details, please visit **http://www.hirose.com** .

Electrical Characteristics & Reliability

Absolute Maximum Ratings

Table 11: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.6
VDDIO	-0.3	3.6
Voltage at Digital Pins	-0.3	3.6

Power Supply Ratings

Table 12: Module Power Supply Ratings (Unit: V)

Parameter	Min.	Typ.	Max.
VBAT	2.1	3.3	3.46
VDDIO	1.75	3.3	3.46

ESD Protection
Static electricity occurs naturally and it may damage the module. Therefore, applying proper ESD countermeasures and handling methods is imperative. For example, wear anti-static gloves during the development, production, assembly and testing of the module; add ESD protection components to the ESD sensitive interfaces and points in the product design.

Table 13: Electrostatics Discharge Characteristics (Unit: kV)

Model	Test Result	Standard
Human Body Model (HBM)	±2	JEDEC EIA/JESD22-A114

Digital I/O Characteristics

Table 14: VDDIO I/O Characteristics (Unit: V)

Parameter	Description	Min.	Max.
VIH	High-level Input Voltage	2	3.6
VIL	Low-level Input Voltage	-0.3	0.8
VOH	High-level Output Voltage	2.4	–
VOL	Low-level Output Voltage	–	0.4

Thermal Dissipation

The module offers the best performance when all internal IC chips are working within their operating temperatures. When the IC chip reaches or exceeds the maximum junction temperature, the module may still work but the performance and function (such as RF output power, data rate, etc.) will be affected to a certain extent. Therefore, the thermal design should be maximally optimized to ensure all internal IC chips always work within the recommended operating temperature range.

The following principles for thermal consideration are provided for reference:

- Keep the module away from heat sources on your PCB, especially high-power components such as processor, power amplifier, and power supply.
- Maintain the integrity of the PCB copper layer and drill as many thermal vias as possible.
- Follow the principles below when the heatsink is necessary:
  - Do not place large size components in the area where the module is mounted on your PCB to reserve enough place for heatsink installation.
  - Attach the heatsink to the shielding cover of the module; In general, the base plate area of the heatsink should be larger than the module area to cover the module completely;
  - Choose the heatsink with adequate fins to dissipate heat;
  - Choose a TIM (Thermal Interface Material) with high thermal conductivity, good softness and good wettability and place it between the heatsink and the module;
  - Fasten the heatsink with four screws to ensure that it is in close contact with the module to prevent the heatsink from falling off during the drop, vibration test, or transportation.
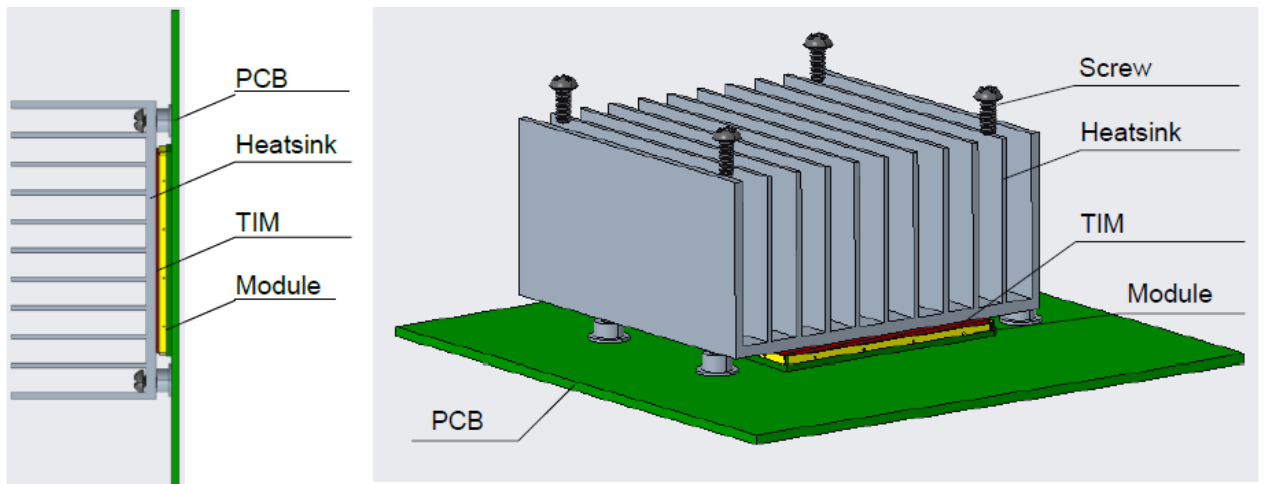
Figure 17: Placement and Fixing of the Heatsink

Mechanical Information

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.2 mm unless otherwise specified.
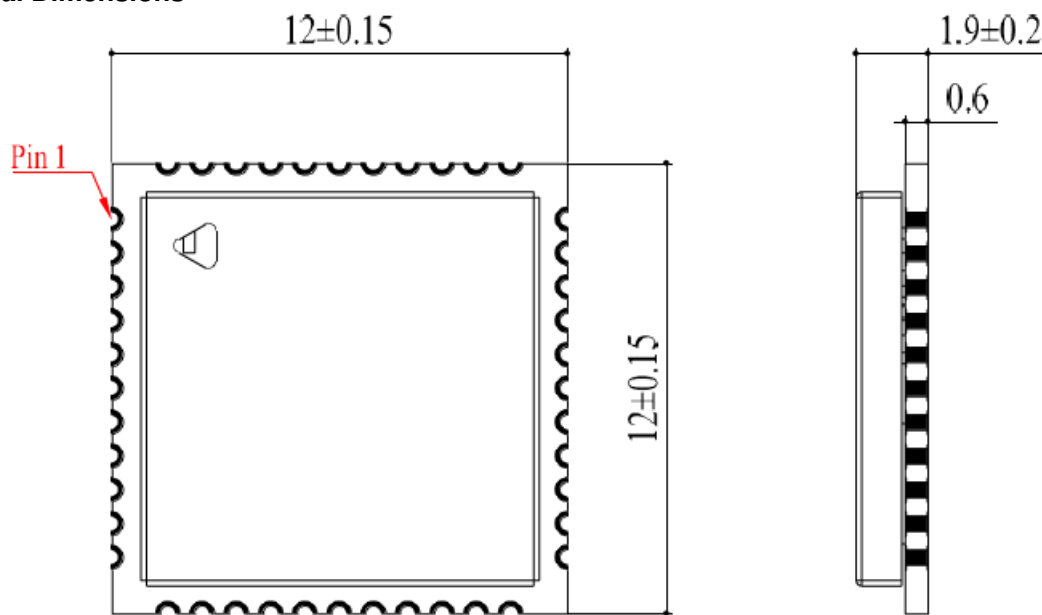
Mechanical Dimensions

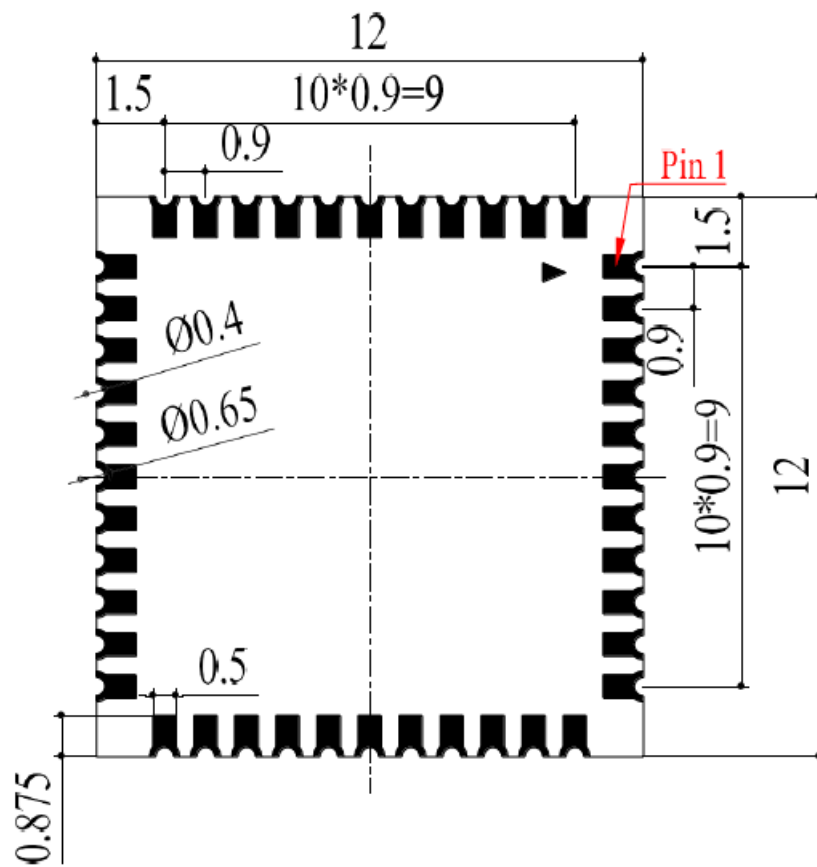

Figure 18: Top and Side Dimensions

Figure 19: Bottom Dimension (Bottom View)

NOTE
The package warpage level of the module conforms to JEITA ED-7306 standard.
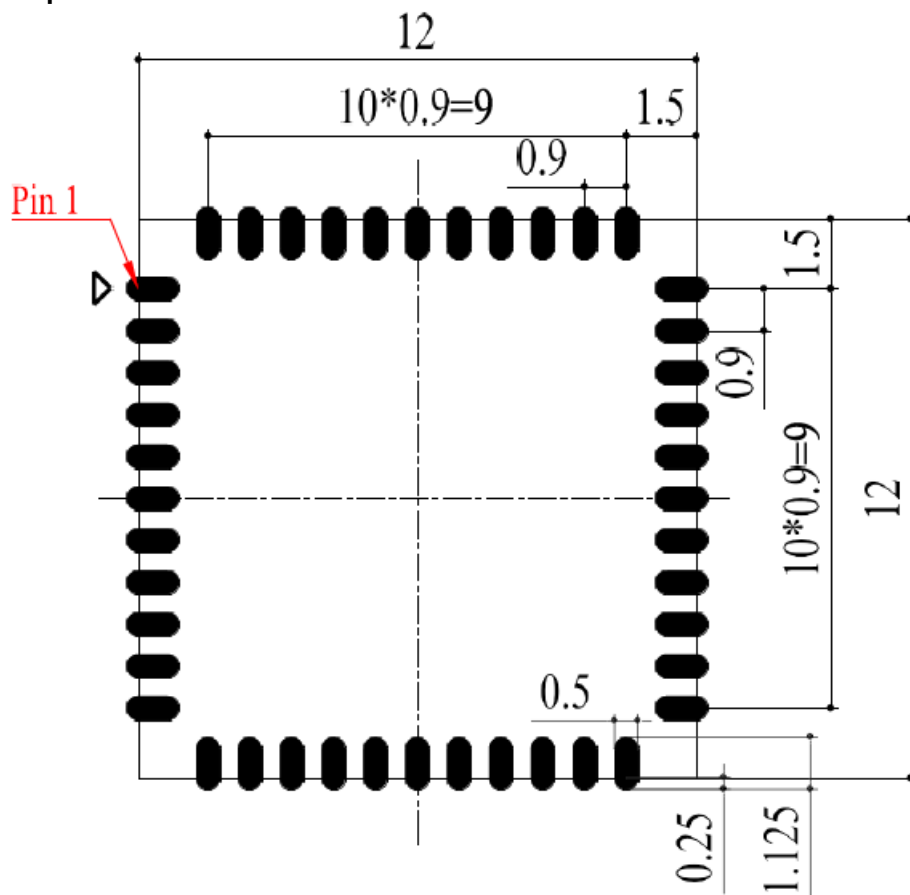
Recommended Footprint

NOTE

Keep at least 3 mm between the module and other components on the motherboard to improve soldering quality and maintenance convenience.
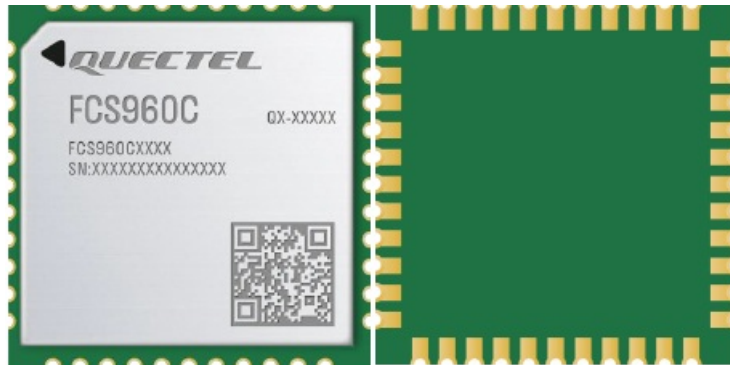
Top and Bottom Views

Figure 21: Top and Bottom Views

NOTE

Images above are for illustrative purposes only and may differ from the actual module. For authentic appearance and label, please refer to the module received from Quectel.

Storage, Manufacturing & Packaging

Storage Conditions

The module is provided with vacuum-sealed packaging. MSL of the module is rated as 3. The storage requirements are shown below.

1. Recommended Storage Condition: the temperature should be 23 ±5 °C and the relative humidity should be 35–60 %.
2. Shelf life (in a vacuum-sealed packaging): 12 months in Recommended Storage Condition.
3. Floor life: 168 hours 3 in a factory where the temperature is 23 ±5 °C and relative humidity is below 60 %. After the vacuum-sealed packaging is removed, the module must be processed in reflow soldering or other high-temperature operations within 168 hours. Otherwise, the module should be stored in an environment where the relative humidity is less than 10 % (e.g., a dry cabinet).
4. The module should be pre-baked to avoid blistering, cracks and inner-layer separation in PCB under the following circumstances:
   1. The module is not stored in Recommended Storage Condition;
   2. Violation of the third requirement mentioned above;
   3. Vacuum-sealed packaging is broken, or the packaging has been removed for over 24 hours;
   4. Before module repairing.
5. **If needed, the pre-baking should follow the requirements below:**
   1. The module should be baked for 8 hours at 120 ±5 °C;
   2. The module must be soldered to PCB within 24 hours after the baking, otherwise it should be put in a dry environment such as in a dry cabinet.

- This floor life is only applicable when the environment conforms to IPC/JEDEC J-STD-033. It is recommended

to start the solder reflow process within 24 hours after the package is removed if the temperature and moisture do not conform to, or are not sure to conform to IPC/JEDEC J-STD-033. Do not unpack the modules in large quantities until they are ready for soldering.

NOTE

1. To avoid blistering, layer separation and other soldering issues, extended exposure of the module to the air is forbidden.
2. Take out the module from the package and put it on high-temperature-resistant fixtures before baking. If shorter baking time is desired, see IPC/JEDEC J-STD-033 for the baking procedure.
3. Pay attention to ESD protection, such as wearing anti-static gloves, when touching the modules.

Manufacturing and Soldering

- Push the squeegee to apply the solder paste on the surface of stencil, thus making the paste fill the stencil openings and then penetrate to the PCB. Apply proper force on the squeegee to produce a clean stencil surface on a single pass. To guarantee module soldering quality, the thickness of stencil for the module is recommended to be 0.15–0.18 mm.
- For more details, see document [2].
- The recommended peak reflow temperature should be 235–246 ºC, with 246 ºC as the absolute maximum reflow temperature. To avoid damage to the module caused by repeated heating, it is recommended that the module should be mounted only after reflow soldering for the other side of PCB has been completed. The recommended reflow soldering thermal profile (lead-free reflow soldering) and related parameters are shown below.
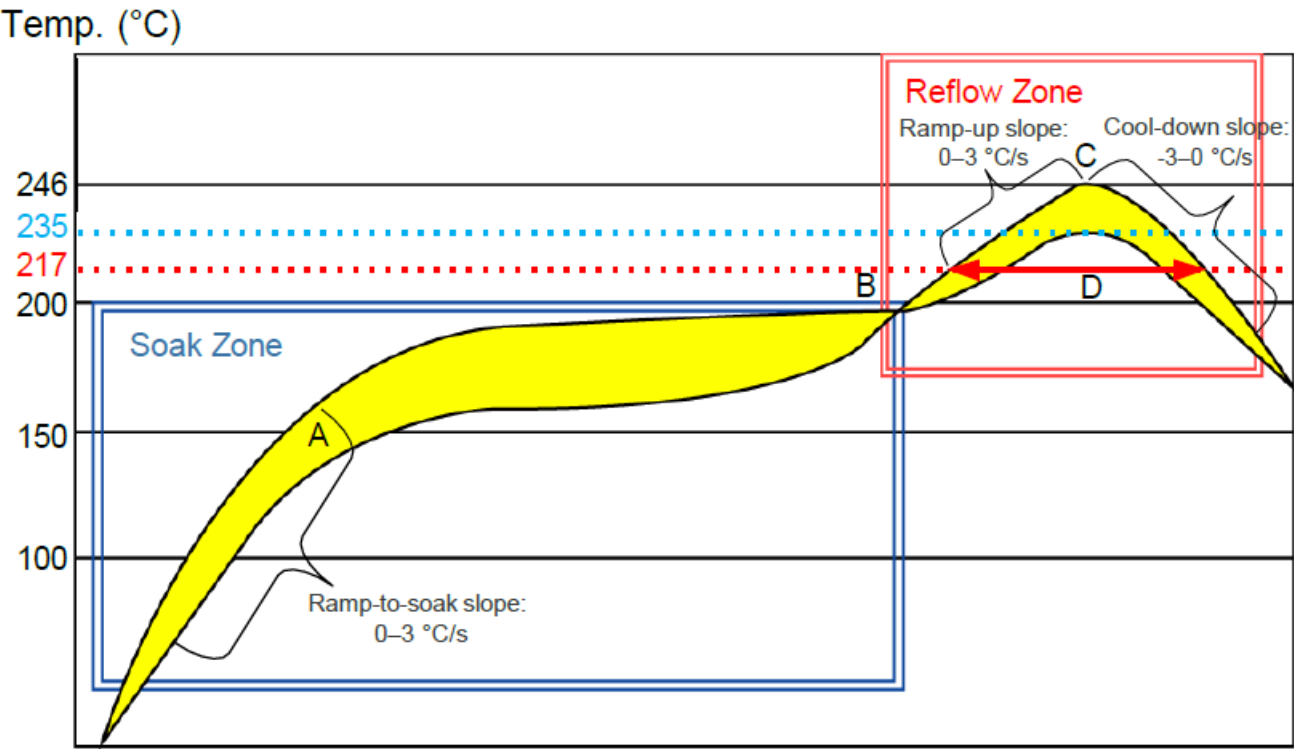

Figure 22: Recommended Reflow Soldering Thermal Profile

Table 15: Recommended Thermal Profile Parameters

Factor	Recommended Value
Soak Zone	
Ramp-to-soak slope	0–3 °C/s
Soak time (between A and B: 150 °C and 200 °C)	70–120 s
Reflow Zone	
Ramp-up slope	0–3 °C/s
Reflow time (D: over 217 °C)	40–70 s
Max temperature	235–246 °C
Cool-down slope	-3–0 °C/s
Reflow Cycle	
Max reflow cycle	1

NOTE

1. The above profile parameter requirements are for the measured temperature of the solder joints. Both the hottest and coldest spots of solder joints on the PCB should meet the above requirements.
2. During manufacturing and soldering, or any other processes that may contact the module directly, NEVER wipe the module's shielding can with organic solvents, such as acetone, ethyl alcohol, isopropyl alcohol, trichloroethylene, etc. Otherwise, the shielding can may become rusted.
3. The shielding can for the module is made of Cupro-Nickel base material. It is tested that after 12 hours' Neutral Salt Spray test, the laser engraved label information on the shielding can is still clearly identifiable and the QR code is still readable, although white rust may be found.
4. If a conformal coating is necessary for the module, do NOT use any coating material that may chemically react with the PCB or shielding cover, and prevent the coating material from flowing into the module.
5. Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.
6. Due to the complexity of the SMT process, please contact Quectel Technical Support in advance for any situation that you are not sure about, or any process (e.g. selective soldering, ultrasonic soldering) that is not mentioned in document [2].

Packaging Specifications
This chapter describes only the key parameters and process of packaging. All figures below are for reference only. The appearance and structure of the packaging materials are subject to the actual delivery.
The module adopts carrier tape packaging and details are as follow:
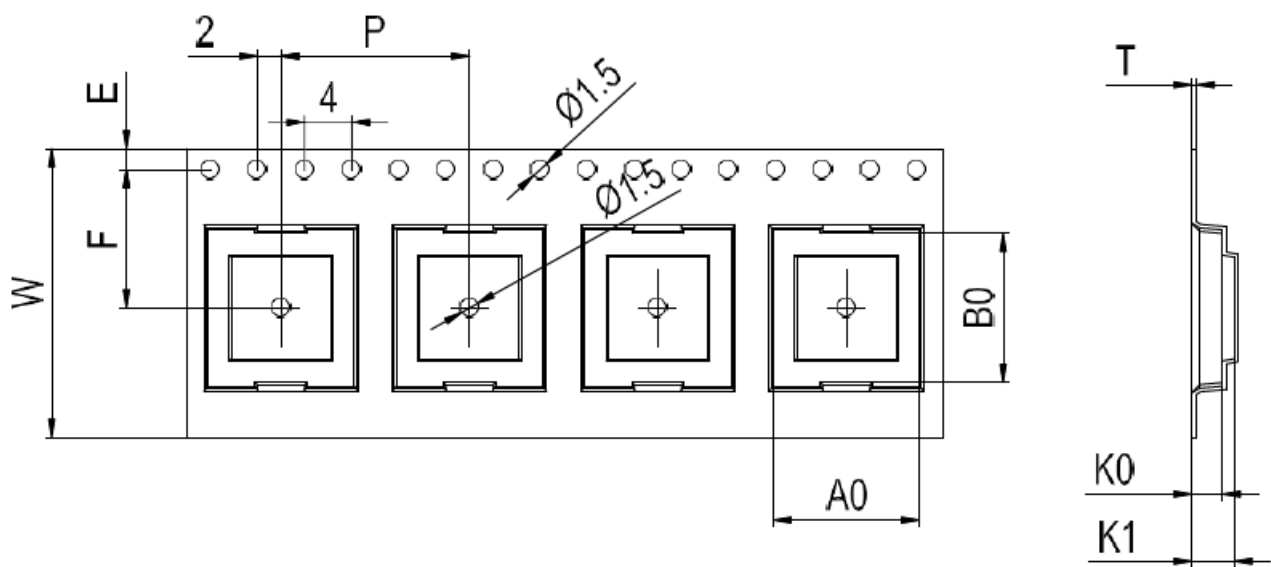
Carrier Tape
Dimension details are as follow:

Figure 23: Carrier Tape Dimension Drawing

Table 16: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
24	16	0.35	12.4	12.4	2.6	3.6	11.5	1.75

Plastic Reel
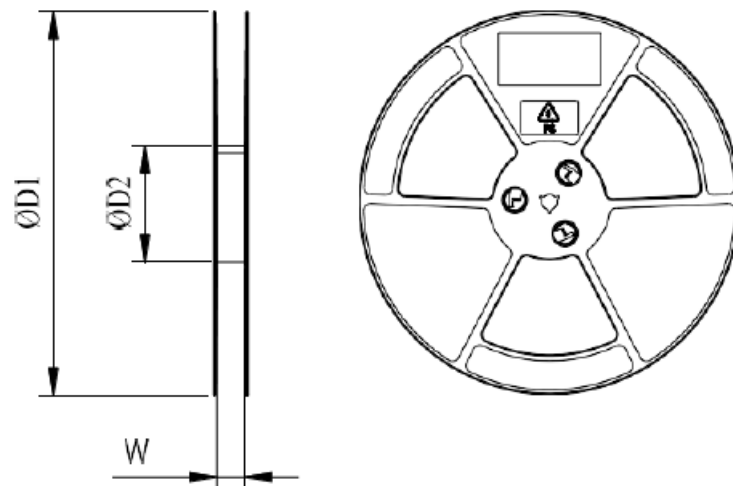
Figure 24: Plastic Reel Dimension Drawing

Table 17: Plastic Reel Dimension Table (Unit: mm)

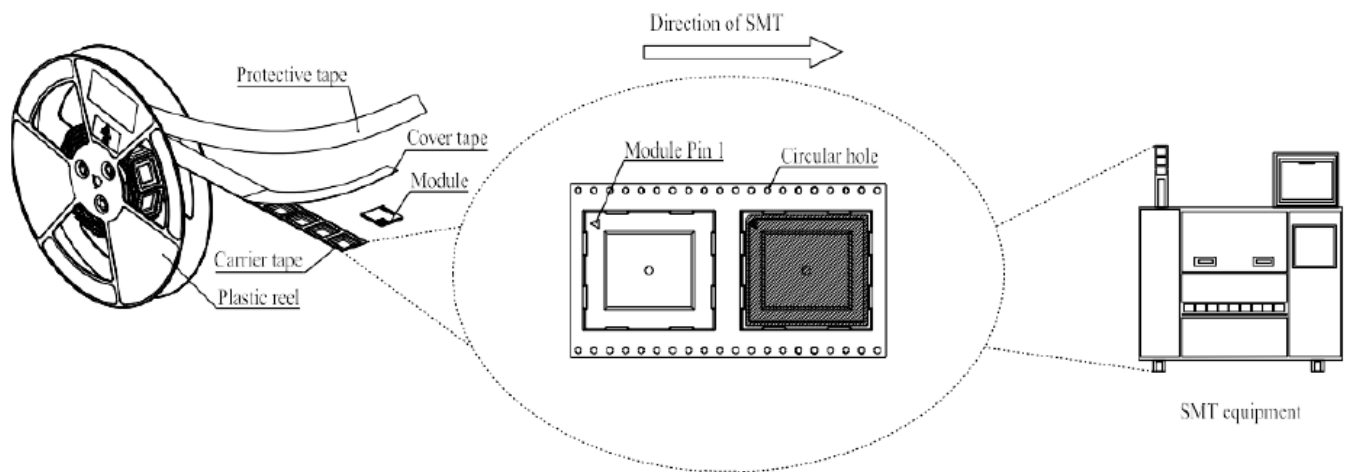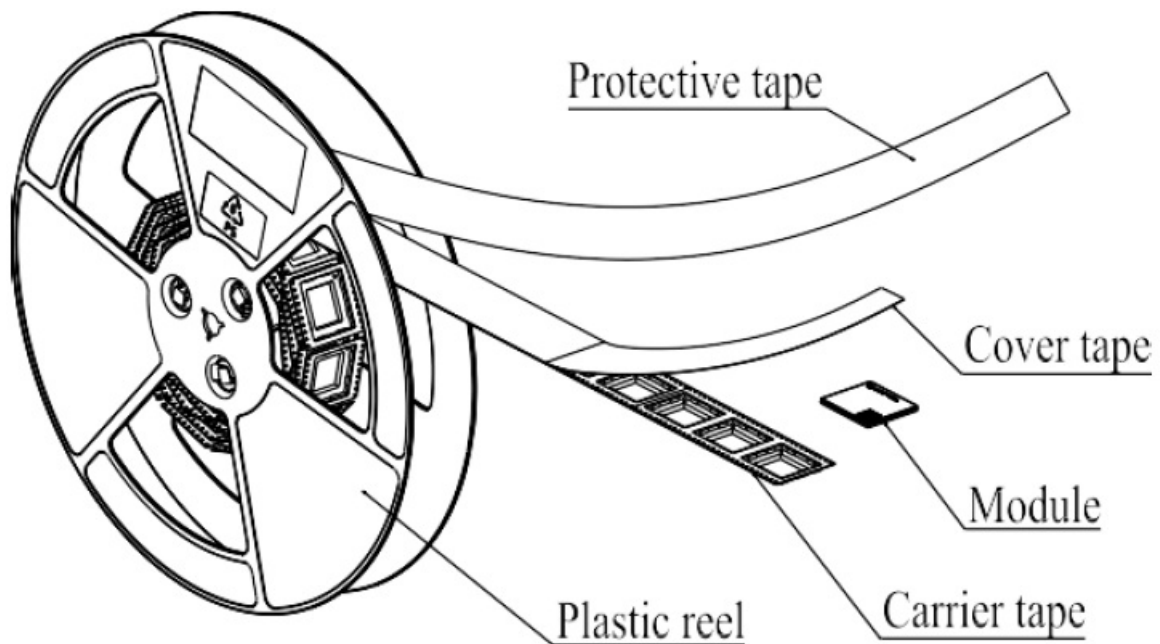| øD1	øD2	W
330	100	24.5

Mounting Direction

Figure 25: Mounting Direction

Packaging Process

- Place the module into the carrier tape and use the cover tape to cover it; then wind the heat-sealed carrier tape to the plastic reel and use the protective tape for protection. 1 plastic reel can load 500 modules.

- Place the packaged plastic reel, 1 humidity indicator card and 1 desiccant bag into a vacuum bag, vacuumize it.
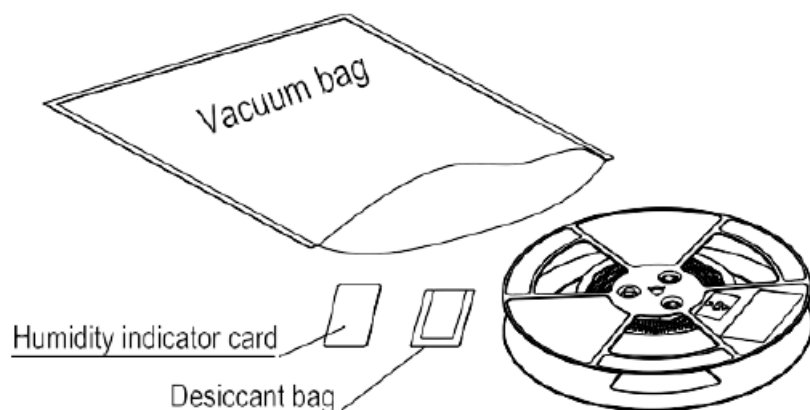
- Place the vacuum-packed plastic reel into the pizza box.
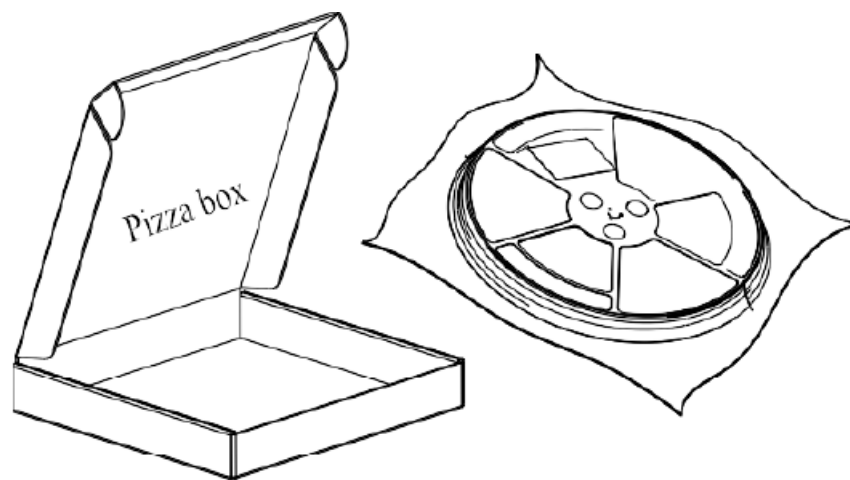
- Put 4 packaged pizza boxes into 1 carton box and seal it. 1 carton box can pack 2000 modules.
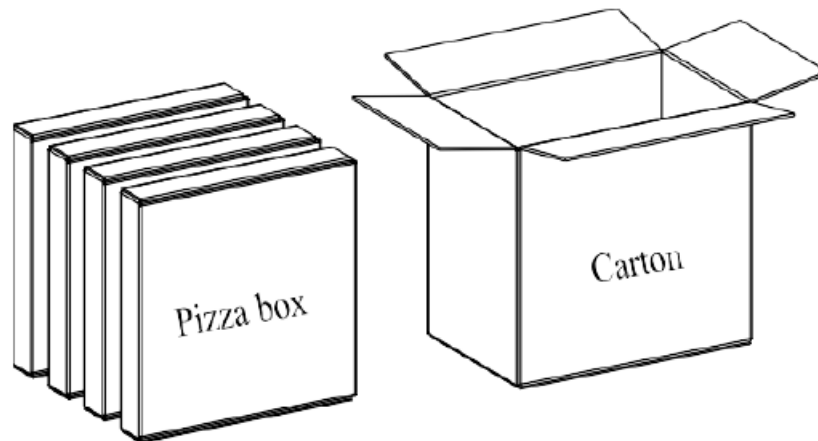

Figure 26: Packaging Process

Appendix References

Table 18: Related Documents

Document Name
[1] Quectel_RF_Layout_Application_Note
[2] Quectel_Module_SMT_Application_Note

Table 19: Terms and Abbreviations

Abbreviation	Description
1T1R	One Transmit One Receive
AP	Access Point
BLE	Bluetooth Low Energy
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
DBPSK	Differential Binary Phase Shift Keying
DCE	Data Communication Equipment
DQPSK	Differential Quadrature Phase Shift Keying
DSSS	Direct Sequence Spread Spectrum
DTE	Data Terminal Equipment
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
GFSK	Gauss Frequency Shift Keying
GND	Ground
HCI	Host Controller Interface
HBM	Human Body Model
HE	High Efficiency
HT	High Throughput
IEEE	Institute of Electrical and Electronics Engineers
I/O	Input/Output
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
PCB	Printed Circuit Board
OFDM	Orthogonal Frequency-Division Multiplexing
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying

RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
Rx	Receive
SDIO	Secure Digital Input/Output
SMT	Surface Mount Technology
STA	Station
TVS	Transient Voltage Suppressor
Tx	Transmit
UART	Universal Asynchronous Receiver/Transmitter
V_{IH}	High-level Input Voltage
V_{IL}	Low-level Input Voltage
Vmax	Maximum Voltage
Vmin	Minimum Voltage
Vnom	Nominal Voltage
V_{OH}	High-level Output Voltage
V_{OL}	Low-level Output Voltage
VSWR	Voltage Standing Wave Ratio
Wi-Fi	Wireless Fidelity

The device could be used with a separation distance of 20cm to the human body.

FCC Certification Requirements

According to the definition of mobile and fixed device is described in Part 2.1091(b), this device is a mobile device.

And the following conditions must be met:

1. This Modular Approval is limited to OEM installation for mobile and fixed applications only. The antenna installation and operating configurations of this transmitter, including any applicable source-based timeaveraging duty factor, antenna gain and cable loss must satisfy MPE categorical Exclusion Requirements of 2.1091.
2. The EUT is a mobile device; maintain at least a 20 cm separation between the EUT and the user's body and must not transmit simultaneously with any other antenna or transmitter.
3. A label with the following statements must be attached to the host end product: This device contains FCC ID: XMR2023FCS960C

4. This module must not transmit simultaneously with any other antenna or transmitter

5. The host end product must include a user manual that clearly defines operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines.

- For portable devices, in addition to the conditions 3 through 6 described above, a separate approval is required to satisfy the SAR requirements of FCC Part 2.1093

- If the device is used for other equipment that separate approval is required for all other operating configurations, including portable configurations with respect to 2.1093 and different antenna configurations.

- For this device, OEM integrators must be provided with labeling instructions of finished products. Please refer to KDB784748 D01 v07, section 8. Page 6/7 last two paragraphs:

- A certified modular has the option to use a permanently affixed label, or an electronic label. For a permanently affixed label, the module must be labeled with an FCC ID – Section 2.926 (see 2.2 Certification (labeling requirements) above). The OEM manual must provide clear instructions explaining to the OEM the labeling requirements, options and OEM user manual instructions that are required (see next paragraph).

- For a host using a certified modular with a standard fixed label, if (1) the module's FCC ID is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the FCC ID of the module is visible; then an additional permanent label referring to the enclosed module:
  - "Contains Transmitter Module FCC ID: XMR2023FCS960C" or "Contains FCC ID: XMR2023FCS960C" must be used. The host OEM user manual must also contain clear instructions on how end users can find and/or access the module and the FCC ID. The final host / module combination may also 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 user's manual or instruction manual for an intentional or unintentional radiator shall caution the user that changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. In cases where the manual is provided only in a form other than paper, such as on a computer disk or over the Internet, the information required by this section may be included in the manual in that alternative form, provided the user can reasonably be expected to have the capability to access information in that form.

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.

- Changes or modifications not expressly approved by the manufacturer could void the user's authority to operate the equipment. To ensure compliance with all non-transmitter functions the host manufacturer is responsible for ensuring compliance with the module(s) installed and fully operational. For example, if a host was previously authorized as an unintentional radiator under the Supplier's Declaration of Conformity procedure without a transmitter certified module and a module is added, the host manufacturer is responsible for ensuring that the after the module is installed and operational the host continues to be compliant with the Part 15B unintentional radiator requirements.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

Documents / Resources

FCS960C **Hardware Design** Wi-Fi&Bluetooth Module Series Version: 1.0.0 Date: 2021-02-25 Status: Preliminary	**QUECTEL FCS960C Wi-Fi and Bluetooth Module Series** [pdf] User Manual FCS960C Wi-Fi and Bluetooth Module Series, FCS960C, Wi-Fi and Bluetooth Module Series, Bluetooth Module SeriesModule Series

References

- **Electrical and Electronic Connectors - HIROSE Electric Group [Connector]**
- **Electrical and Electronic Connectors - HIROSE Electric Group [Connector]**
- **Contact | Quectel**
- **|**
- **User Manual**