FCU760C

Hardware Design

Wi-Fi Module Series

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Quectel Wireless Solutions Co., Ltd.
Building 5, Shanghai Business Park Phase III (Area B), No.1016 Tianlin Road, Minhang District, Shanghai 200233, China
Tel: +86 21 5108 6236
Email: info@quectel.com

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Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating the module. Manufacturers of the cellular terminal should notify users and operating personnel of the following safety information by incorporating these guidelines into all manuals of the product. Otherwise, Quectel assumes no liability for customers' failure to comply with these precautions.

	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
-	2023-02-14	Devin YU	Creation of the document
1.0.0	2023-02-14	Devin YU	Preliminary

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1 Introduction

This document defines the FCU760C 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.

2 Product Overview

2.1. General Description

FCU760C is a high-performance IEEE 802.11 b/g/n/ax Wi-Fi module supporting 2.4 GHz band and 1T1R. It supports USB 2.0 interface for Wi-Fi functions.

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

Table 1: Basic Information

FCU760C	
Packaging type	LCC
Pin counts	6
Dimensions	(13.0 ±0.15) mm × (12.2 ±0.15) mm × (1.9 ±0.2) mm
Weight	Approx. 0.6 g

2.2. Key Features

Table 1: Key Features

Basic Information	
Protocol and Standard	Wi-Fi protocols: IEEE 802.11b/g/n/ax
	All hardware components are fully compliant with EU RoHS directive
Power Supply	**VBAT Power Supply:** ● 2.1–3.46 V ● Typ.: 3.3 V

Temperature Ranges	● Operating temperature [1]: -20 to +70 °C ● Storage temperature: -40 to +125 °C
EVB Kit	FCU760C TE-A
RF Antenna Interface	
Wi-Fi Antenna Interface	● ANT_WIFI ● Coaxial RF connector (optional) ● 50 Ω impedance
Hardware Interface	
Wi-Fi Application Interface	USB 2.0

2.3. Functional Diagram

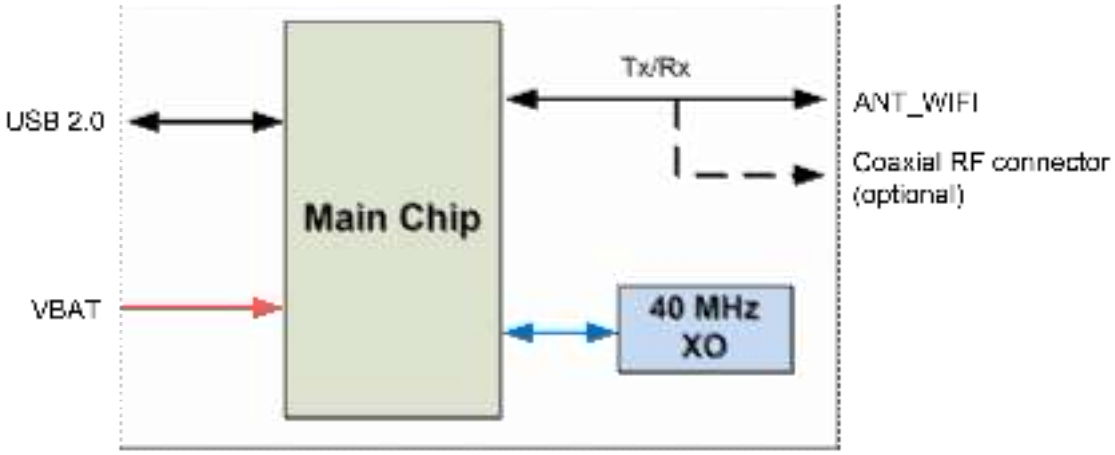


Figure 1: Functional Diagram

NOTE

The module supports pin antenna (ANT_WIFI) by default; coaxial RF connector is optional.

[1] 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 specification requirements.

3 RF Performances

3.1. Wi-Fi Performances

Table 2: RF Performances

Operating Frequency				
2.4 GHz: 2.412–2.484 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
	802.11n, HT20 @ MCS 0	≤ -5 dB	18	-91
	802.11n, HT20 @ MCS 7	≤ -27 dB	15	-72

	802.11n, HT40 @ MCS 0	≤ -5 dB	18	-86
	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	-68
	802.11ax, HE40 @ MCS 0	≤ -5 dB	17	-88
	802.11ax, HE40 @ MCS 9	≤ -32 dB	12	-65

Table 3: Power Consumption

Protocol	Condition	I_{VBAT}	Unit
802.11b	Tx @ 1 Mbps	294	mA
	Tx @ 11 Mbps	265	mA
	Rx @ 1 Mbps	103	mA
	Rx @ 11 Mbps	103	mA
802.11g	Tx @ 6 Mbps	268	mA
	Tx @ 54 Mbps	177	mA
	Rx @ 6 bps	103	mA
	Rx @ 54 Mbps	103	mA
802.11n, HT20	Tx @ MCS 0	296	mA
	Tx @ MCS 7	223	mA
	Rx @ MCS 0	103	mA
	Rx @ MCS 7	103	mA
802.11n, HT40	Tx @ MCS 0	287	mA
	Tx @ MCS 7	199	mA
	Rx @ MCS 0	103	mA
	Rx @ MCS 7	103	mA
802.11ax, HE20	Tx @ MCS 0	294	mA

	Tx @ MCS 9	234	mA
	Rx @ MCS 0	103	mA
	Rx @ MCS 9	103	mA
802.11ax, HE40	Tx @ MCS 0	287	mA
	Tx @ MCS 9	207	mA
	Rx @ MCS 0	103	mA
	Rx @ MCS 9	103	mA

4 Application Interfaces

4.1. Pin Assignment

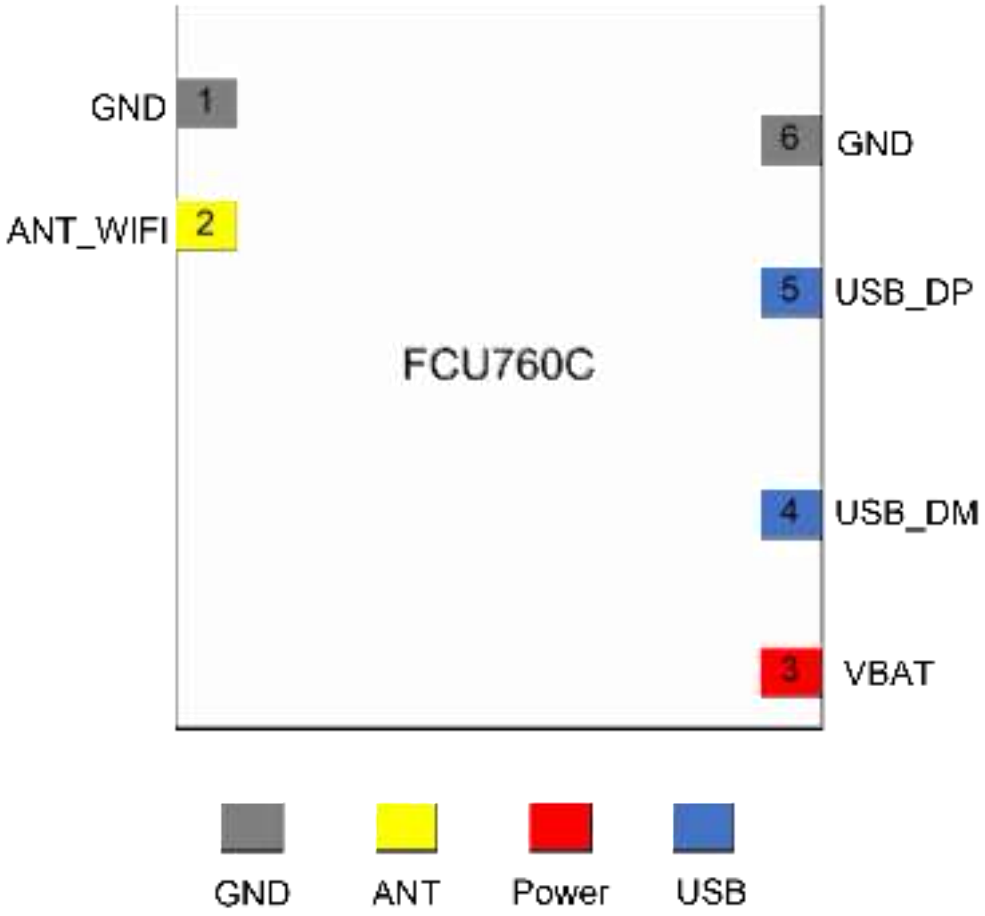


Figure 2: Pin Assignment (Top View)

NOTE

All GND pins should be connected to ground.

4.2. Pin Description

Table 4: I/O Parameters Definition

Type	Description
AIO	Analog Input/Output
PI	Power Input

DC characteristics include power domain and rate current.

Table 5: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VBAT	3	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.
GND	1, 6				
Wi-Fi Application Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
USB_DM	4	AIO	USB differential data (-)		Requires differential impedance of 90 Ω. USB 2.0 compliant. Test points must be reserved.
USB_DP	5	AIO	USB differential data (+)		
RF Antenna Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
ANT_WIFI	2	AIO	Wi-Fi antenna interface		50 Ω impedance.

4.3. 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:

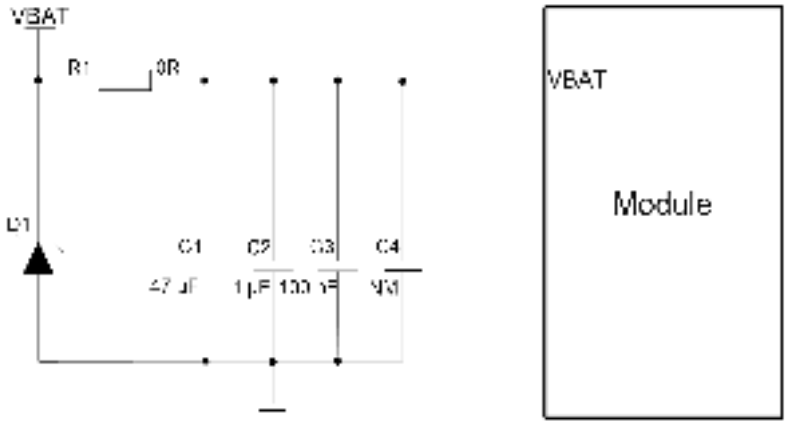


Figure 3: Reference Circuit of Power Supply

4.4. USB Interface

The module provides one USB interface which complies with the USB 2.0 specifications. It supports high-speed (480 Mbps) mode and is backward-compatible with full-speed (12 Mbps) and low-speed (1.5 Mbps) modes. The following figure shows the USB interface connection between the module and the host.

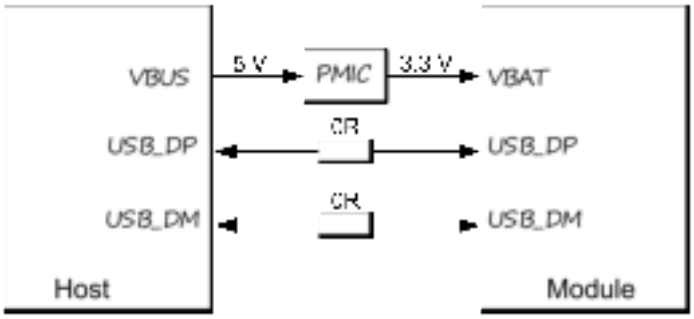


Figure 4: USB Interface Connection

The following principles should be complied with when design the USB interface, to meet USB 2.0 specifications.

- Route the USB signal traces as differential pairs with ground surrounded. The differential impedance of USB 2.0 is 90 Ω ±10 %.
- For USB 2.0 signal traces, the differential data pair matching should be less than 1 mm.
- Do not route signal traces under crystals, oscillators, magnetic devices, sensitive circuits/signals, such as RF circuits and analog signals, as well as noisy signals such as clock signals and DC-DC signals. Route the USB differential traces in inner-layer of the PCB, and surround the traces with ground on that layer and with ground planes above and below.
- Junction capacitance of the ESD protection components might cause influences on USB data lines, so you should pay attention to the selection of the device. Typically, the stray capacitance should be less than 2.0 pF for USB 2.0.
- If possible, reserve a 0 Ω resistor on USB_DP and USB_DM lines respectively.

For more details about the USB 2.0 specifications, visit http://www.usb.org/home.

4.5. RF Antenna Interfaces

The module supports ANT_WIFI antenna (stamp hole) by default and coaxial RF connector which is optional. The coaxial RF connector is not mounted on the module when using ANT_WIFI/BT antenna.

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.

4.5.1. ANT_WIFI Antenna

Table 6: Antenna Design Requirements

Parameter	Requirement [2]
Frequency Ranges (GHz)	● 2.4 GHz Wi-Fi: 2.412–2.484
Cable Insertion Loss (dB)	< 1
VSWR	≤ 2
Gain (dBi)	1 (Typ)
Max Input Power (W)	50

[2] For more details about the RF performances, see ***Chapter 3***.

Input Impedance (Ω)	50
Polarization Type	Vertical

4.5.2. Reference Design

A reference circuit for the RF antenna interface is shown below. It is recommended to reserve LC and a π-type matching circuit for better RF performance. Matching components (R1, C1, C2, C3 and L1) shall be placed as close to the antenna as possible. Capacitors C1, C2 and C3, and inductance L1 are not mounted by default.

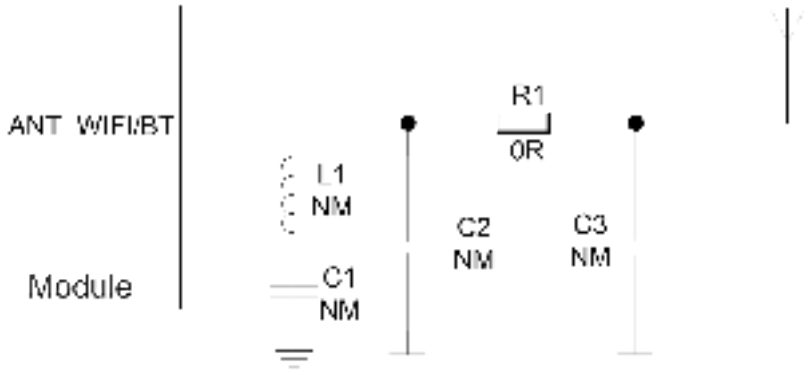


Figure 5: Reference Circuit for RF Antenna Interface

4.5.3. 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.

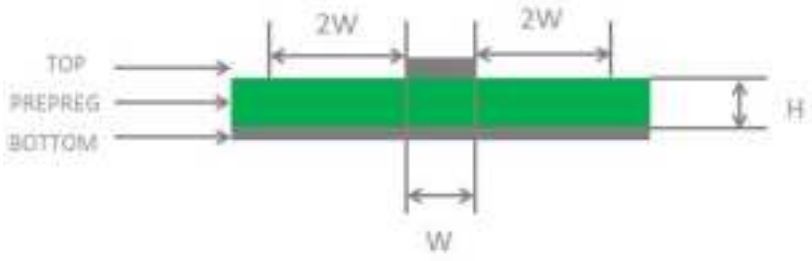


Figure 6: Microstrip Design on a 2-layer PCB

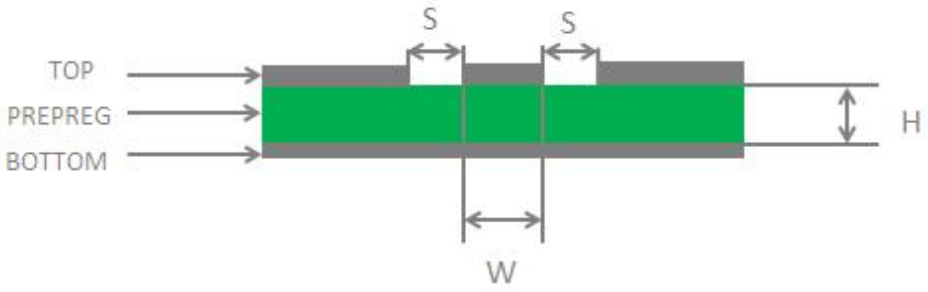


Figure 7: Coplanar Waveguide Design on a 2-layer PCB

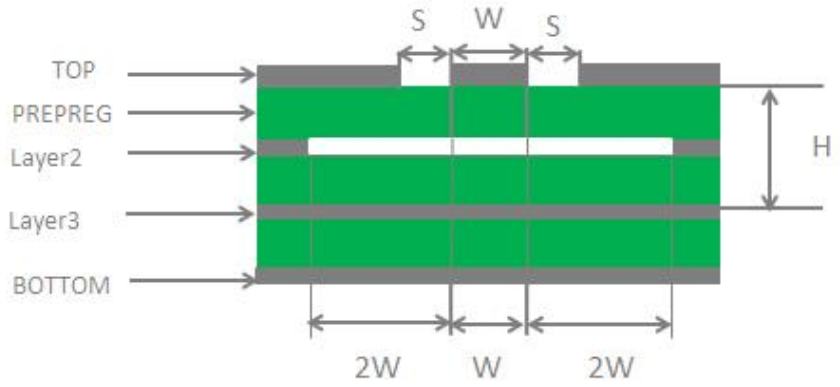


Figure 8: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

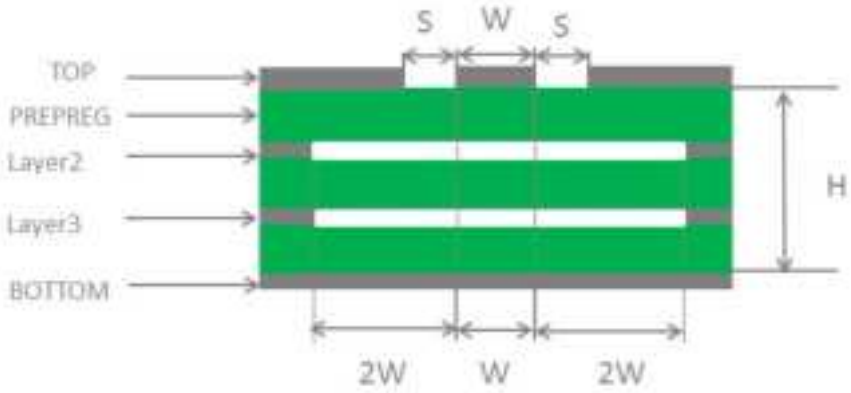


Figure 9: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

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]***.

4.5.1. Coaxial RF Connector (Optional)

4.5.1.1. Receptacle Specifications

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

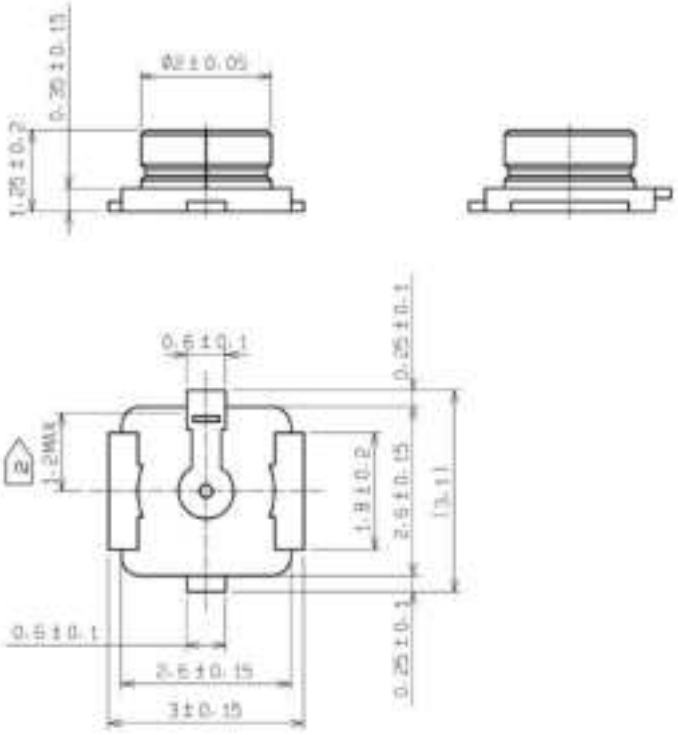


Figure 10: Dimensions of the Receptacle (Unit: mm)

Table 2: Major Specifications of the Receptacle

Item	Specification
Nominal Frequency Range	DC to 6 GHz
Nominal Impedance	50 Ω
Temperature Rating	-40 °C to +85 °C
Voltage Standing Wave Ratio (VSWR)	Meet the requirements of: Max. 1.3 (DC–3 GHz) Max. 1.45 (3–6 GHz)

4.5.1.2. RF Connector Installation

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

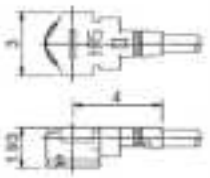
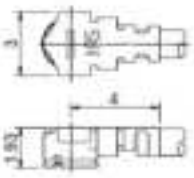
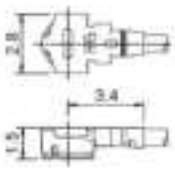
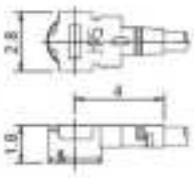
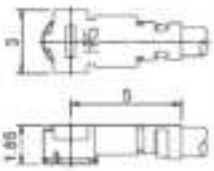
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 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 11: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors.

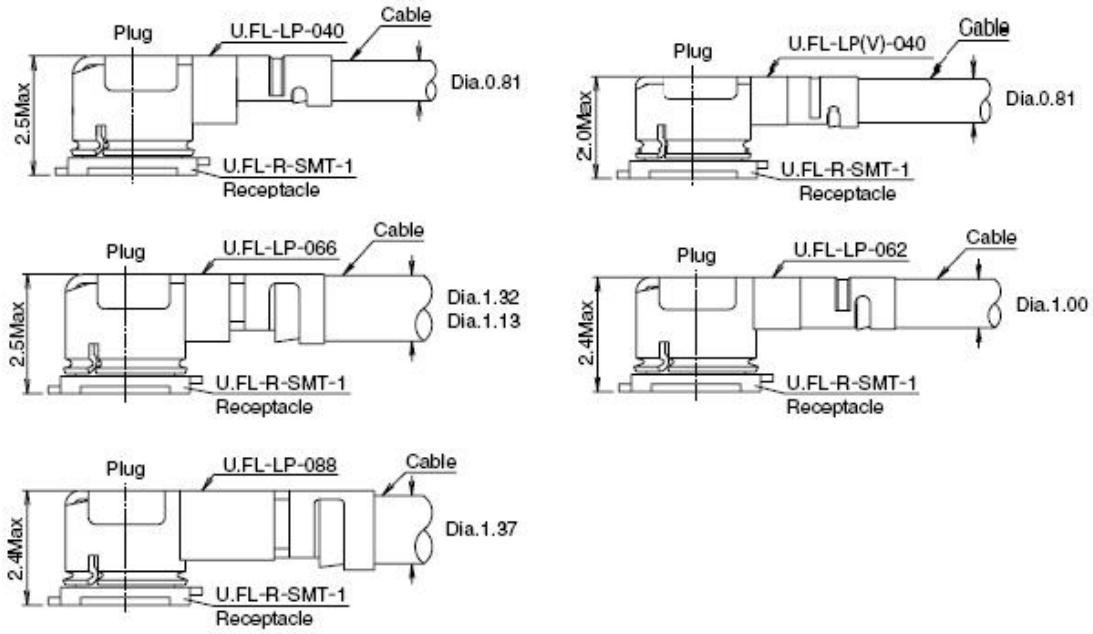


Figure 12: Space Factor of Mated Connectors (Unit: mm)

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

5 Electrical Characteristics & Reliability

5.1. Absolute Maximum Ratings

Table 7: Absolute Maximum Ratings (Unit: V)

Parameter	Min.	Max.
VBAT	-0.3	3.6

5.2. Power Supply Ratings

Table 8: Module Power Supply Ratings (Unit: V)

Parameter	Min.	Typ.	Max.
VBAT	2.1	3.3	3.46

5.3. 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 9: Electrostatics Discharge Characteristics (Unit: kV)

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

5.4. 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.

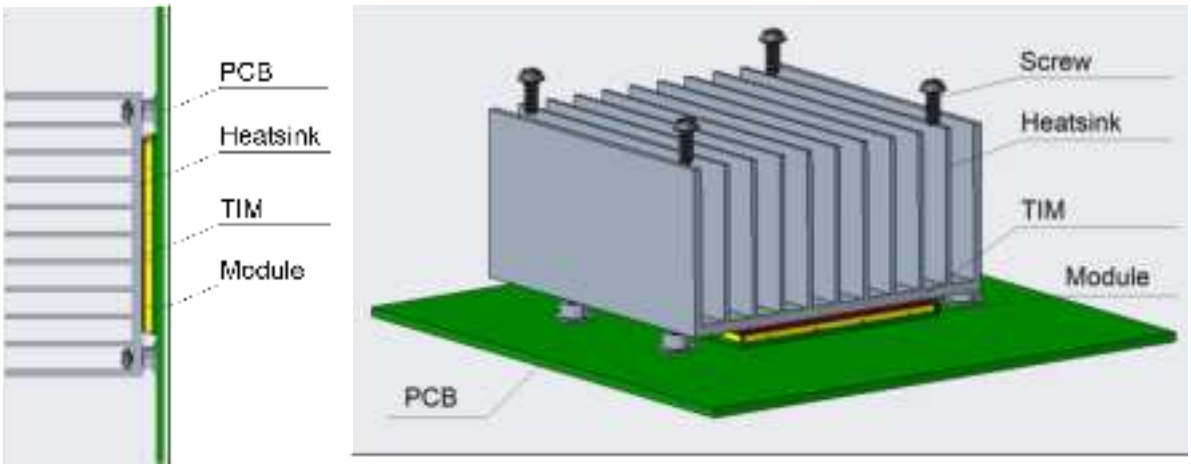


Figure 13: Placement and Fixing of the Heatsink

6 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.

6.1. Mechanical Dimensions

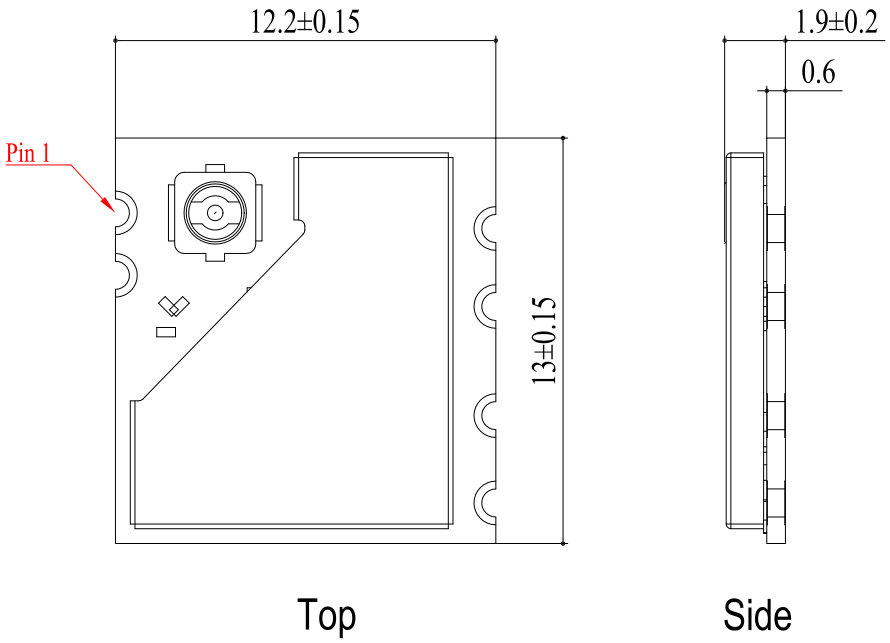


Figure 14: Top and Side Dimensions

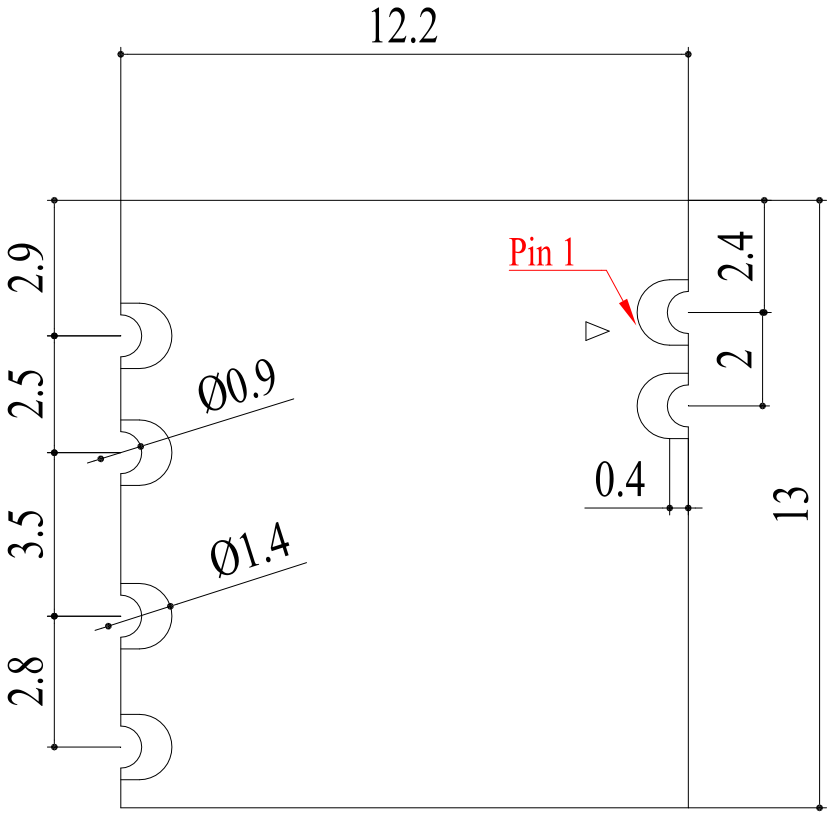


Figure 15: Bottom Dimension (Bottom View)

NOTE

The package warpage level of the module conforms to *JEITA ED-7306* standard.

6.2. Recommended Footprint

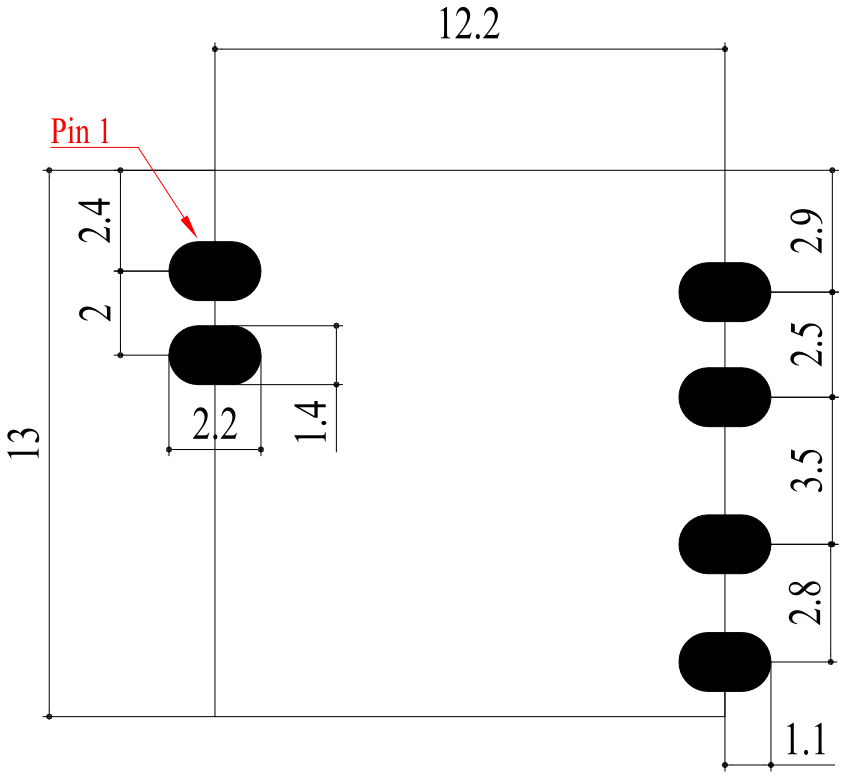


Figure 16: Recommended Footprint

NOTE

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

6.3. Top and Bottom Views

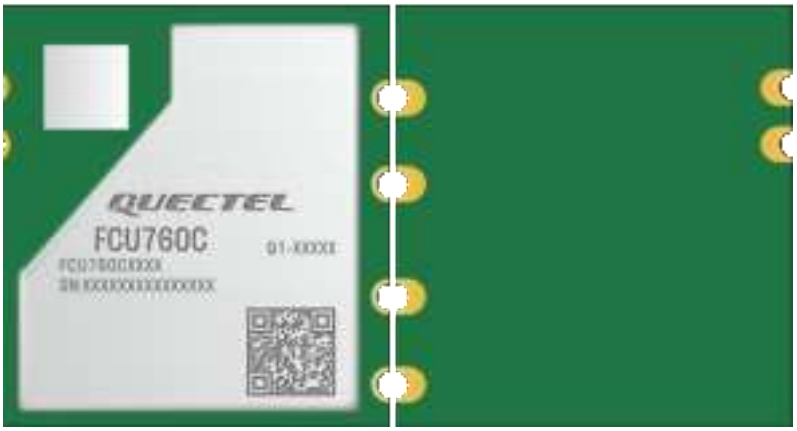


Figure 17: Top and Bottom Views

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.

7 Storage, Manufacturing & Packaging

7.1. 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:

   - The module is not stored in Recommended Storage Condition;
   - Violation of the third requirement mentioned above;
   - Vacuum-sealed packaging is broken, or the packaging has been removed for over 24 hours;
   - Before module repairing.

5. If needed, the pre-baking should follow the requirements below:

   - The module should be baked for 8 hours at 120 ±5 °C;
   - 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.

[3] 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.

7.2. 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.

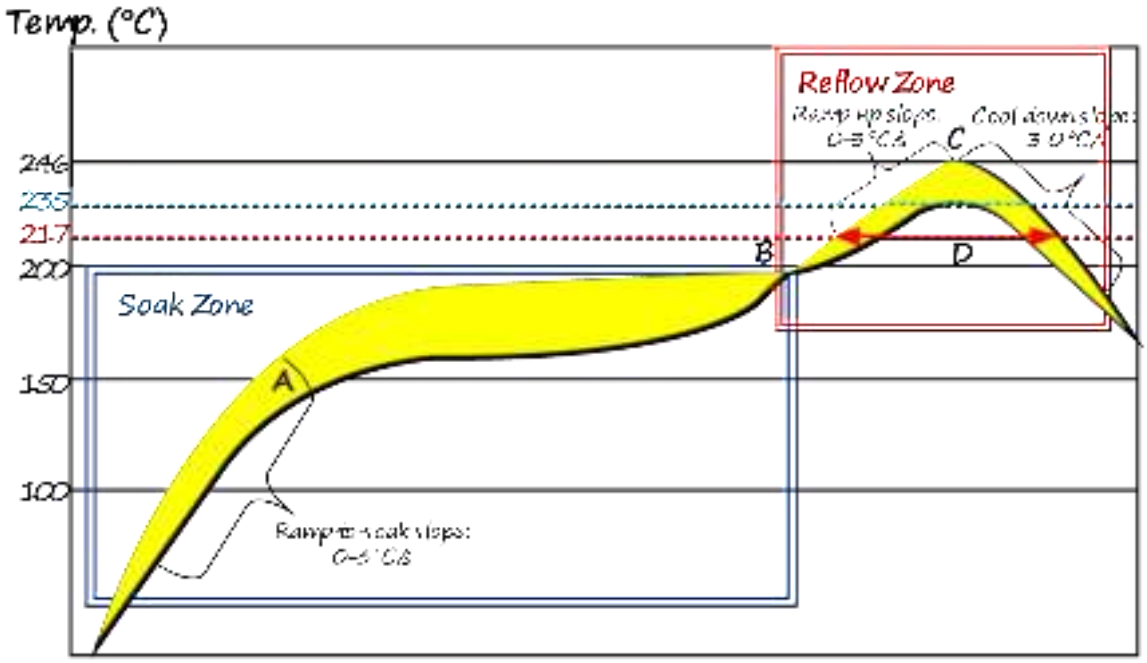


Figure 18: Recommended Reflow Soldering Thermal Profile

Table 10: 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]***.

7.3. 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:

7.3.1. Carrier Tape

Dimension details are as follow:

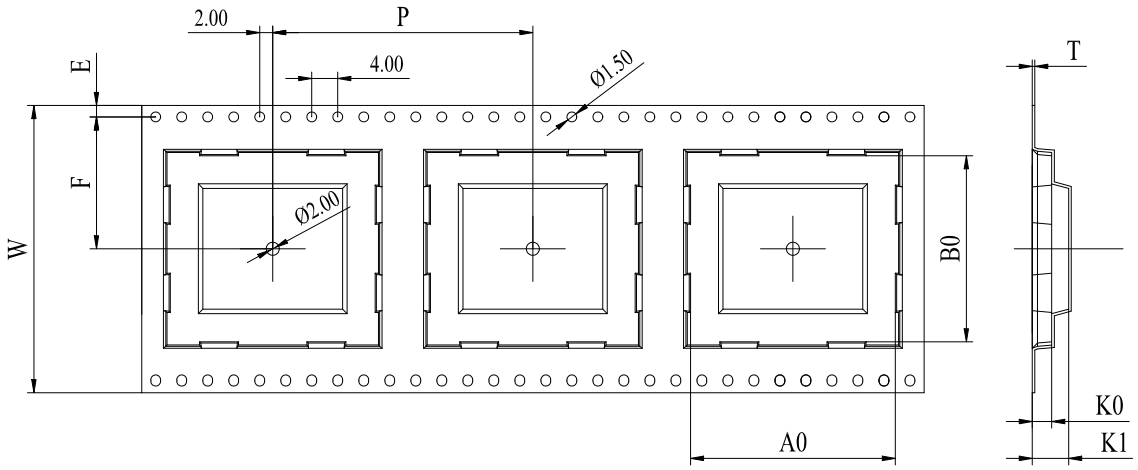


Figure 19: Carrier Tape Dimension Drawing

Table 11: Carrier Tape Dimension Table (Unit: mm)

W	P	T	A0	B0	K0	K1	F	E
32	20	0.4	12.6	13.4	2.55	5.9	14.2	1.75

7.3.2. Plastic Reel

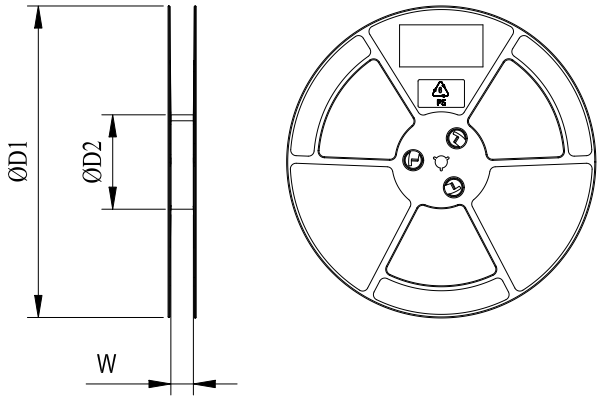


Figure 20: Plastic Reel Dimension Drawing

Table 12: Plastic Reel Dimension Table (Unit: mm)

øD1	øD2	W
330	100	32.5

7.3.3. Mounting Direction

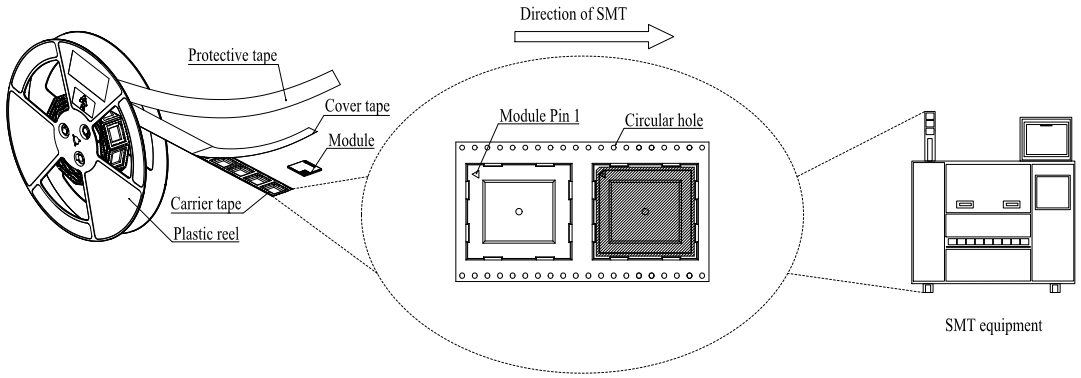
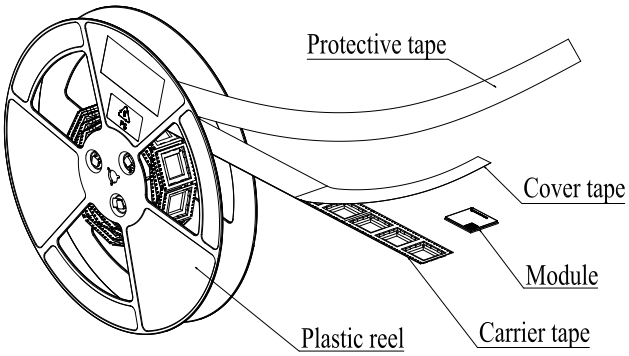


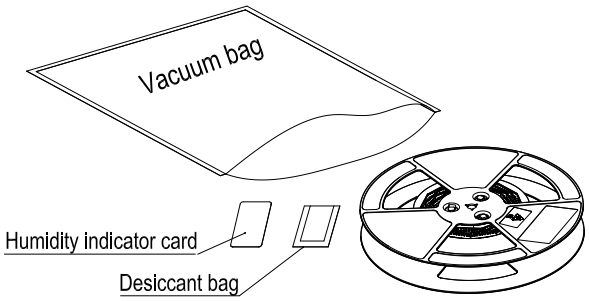
Figure 21: Mounting Direction

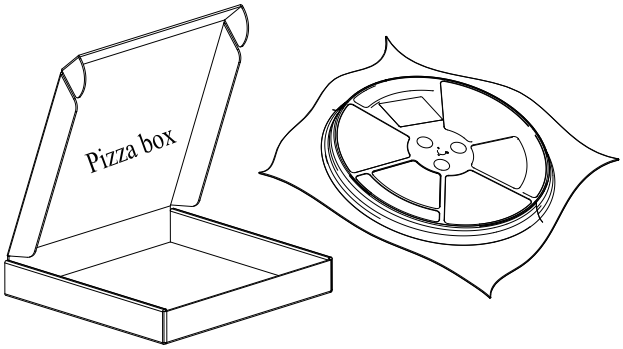
7.3.4. Packaging Process



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.

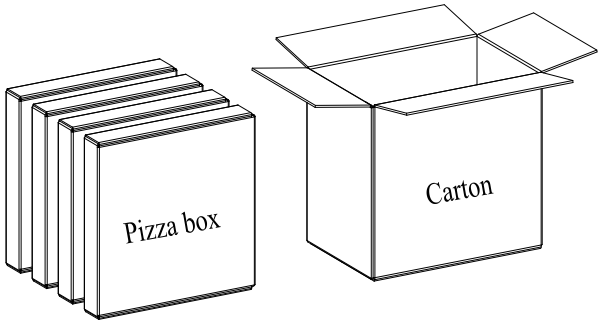


Figure 22: Packaging Process

8 Appendix References

Table 13: Related Documents

Document Name
[1] Quectel_RF_Layout_Application_Note
[2] Quectel_Module_SMT_Application_Note

Table 14: Terms and Abbreviations

Abbreviation	Description
1T1R	One Transmit One Receive
AP	Access Point
BPSK	Binary Phase Shift Keying
CCK	Complementary Code Keying
DBPSK	Differential Binary Phase Shift Keying
DQPSK	Differential Quadrature Phase Shift Keying
DSSS	Direct Sequence Spread Spectrum
ESD	Electrostatic Discharge
EVM	Error Vector Magnitude
GND	Ground
HE	High Efficiency
HBM	Human Body Model
HT	High Throughput
IEEE	Institute of Electrical and Electronics Engineers

LC	Inductance and Capacitance
Mbps	Million Bits Per Second
MCS	Modulation and Coding Scheme
PCB	Printed Circuit Board
PMIC	Power Management IC
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RoHS	Restriction of Hazardous Substances
SMT	Surface Mount Technology
STA	Station
TVS	Transient Voltage Suppressor
USB	Universal Serial Bus
Vmax	Maximum Voltage
Vmin	Minimum Voltage
Vnom	Nominal 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: XMR2023FCU760C

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: XMR2023FCU760C" or "Contains FCC ID: XMR2023FCU760C" 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.