EC200U Series Mini PCIe Hardware Design

LTE Standard Module Series

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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 paid 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
-	2021-12-16	Demon ZHANG/ Nathan LIU	Creation of the document
1.0	2022-01-25	Demon ZHANG/ Nathan LIU	First official release
1.1	2023-01-09	Denny QIN/ Chris LIANG/ Ryan YI	1. Added EC200U-AU and related information. 2. Updated USB serial driver information (Table 2). 3. Updated the module size to 30.0 mm × 51.0 mm × 4.95 mm (Table 2). 4. Detailed the description of PCM interface; added timing of PCM interface and a note on clock signals of PCM_SYNC and PCM_CLK; added a note on I2C interface (Chapter 3.9). 5. Updated the description of WAKEUP_IN signal (Chapter 3.10.6). 6. Updated the current consumption of EC200U-EU Mini PCIe module (Table 29). 7. Updated mechanical dimensions (Chapter 6.2). 8. Updated packaging specifications (Chapter 6.3).

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1 Introduction

This document defines EC200U series Mini PCIe module and describes its air interfaces and hardware interfaces which relate to 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

EC200U series Mini PCIe module provides data connectivity on LTE-FDD, LTE-TDD, GSM and GPRS networks compliant with *PCI Express Mini Card Electromechanical Specification Revision 1.2*. It supports embedded operating systems and provides GNSS function.

The module can be applied in the following fields:

- PDA and Laptop Computer
- Remote Monitor System
- Wireless POS System
- Intelligent Meter Reading System
- Wireless Router and Switch
- Other Wireless Terminal Devices

2.2. Frequency Band

Table 1: Frequency Bands of EC200U Series Mini PCIe

Module	Description
EC200U-EU Mini PCIe	LTE-FDD: B1/B3/B5/B7/B8/B20/B28 LTE-TDD: B38/B40/B41 GSM: 850/900/1800/1900 MHz GNSS [1]: GPS, GLONASS, BDS, Galileo, QZSS
EC200U-AU Mini PCIe	LTE-FDD: B1/B2/B3/B4/B5/B7/B8/B28/B66 LTE-TDD: B38/B40/B41 GSM: 850/900/1800/1900 MHz GNSS [1]: GPS, GLONASS, BDS, Galileo, QZSS

[1] GNSS function is optional.

2.3. Key Features

The following table describes the detailed features of EC200U series Mini PCIe module.

Table 2: Key Features of EC200U Series Mini PCIe

Features	Description
Mini PCIe Interface	Compliant with *Express Mini Card Electromechanical Specification Revision 1.2* standard
Power Supply	Supply voltage: 3.0–3.6 V Typical supply voltage: 3.3 V
Transmitting Power	Class 4 (33 dBm ±2 dB) for GSM850 Class 4 (33 dBm ±2 dB) for EGSM900 Class 1 (30 dBm ±2 dB) for DCS1800 Class 1 (30 dBm ±2 dB) for PCS1900 Class 3 (23 dBm ±2 dB) for LTE-FDD bands Class 3 (23 dBm ±2 dB) for LTE-TDD bands
LTE Features	Support up to Cat 1 FDD and TDD Support 1.4/3/5/10/15/20 MHz RF bandwidth LTE-FDD: Max. 10 Mbps (DL), Max. 5 Mbps (UL) LTE-TDD: Max. 8.96 Mbps (DL), Max. 3.1 Mbps (UL)
GSM Features	**GPRS:** Support GPRS multi-slot class 12 Coding scheme: CS1–4 Max. 85.6 kbps (DL), Max. 85.6 kbps (UL)
Internet Protocol Features	Support protocols TCP/UDP/PPP/NTP/NITZ/FTP/HTTP/PING/CMUX/ HTTPS/FTPS/SSL/FILE/MQTT/MMS Support PAP and CHAP for PPP connections
SMS	Text and PDU modes Point-to-point MO and MT SMS cell broadcast SMS storage: (U)SIM and ME, ME by default
(U)SIM Interface	Support USIM/SIM card: 1.8/3.0 V
UART Interface	**Main UART:** Support RTS and CTS hardware flow control Baud rate can reach up to 230400 bps, 115200 bps by default Used for AT command communication and data transmission
Audio Features	Support one digital audio interface: PCM interface (slave mode only) HR/FR/EFR/AMR/AMR-WB Support echo cancellation and noise suppression

I2C Interface	One I2C interface, applied in external codec with PCM interface
USB Interface	Compliant with USB 2.0 specification (slave only); the data transfer rate can reach up to 480 Mbps Used for AT command communication, data transmission, software debugging, and firmware upgrade Support USB serial drivers for: Windows 7/8/8.1/10/11, Linux 2.6–5.18, Android 4.x–12.x
Antenna Connectors	Main antenna and GNSS antenna connectors 50 Ω impedance
AT Commands	Compliant with *3GPP TS 27.007, 27.005* and Quectel enhanced AT commands
Physical Characteristics	Size: 30.0 mm × 51.0 mm × 4.95 mm Weight: approx. 5.96 g
Temperature Range	Operation temperature range: -35 °C to +75 °C [3] Extended temperature range: -40 °C to +80 °C [4] Storage temperature range: -40 °C to +90 °C
Firmware Upgrade	Upgrade via USB interface or DFOTA
RoHS	All hardware components are fully compliant with EU RoHS directive

2.4. Functional Diagram

The following figure shows the block diagram of the module.

[3] Within the operating temperature range, the module meets 3GPP specifications.

[4] Within the extended temperature range, the module remains the ability to establish and maintain functions such as voice, SMS, data transmission, emergency call, etc., without any unrecoverable malfunction. Radio spectrum and radio network are not influenced, while one or more specifications, such as P_{out}, may exceed the specified tolerances of 3GPP. When the temperature returns to the operating temperature range, the module meets 3GPP specifications again.

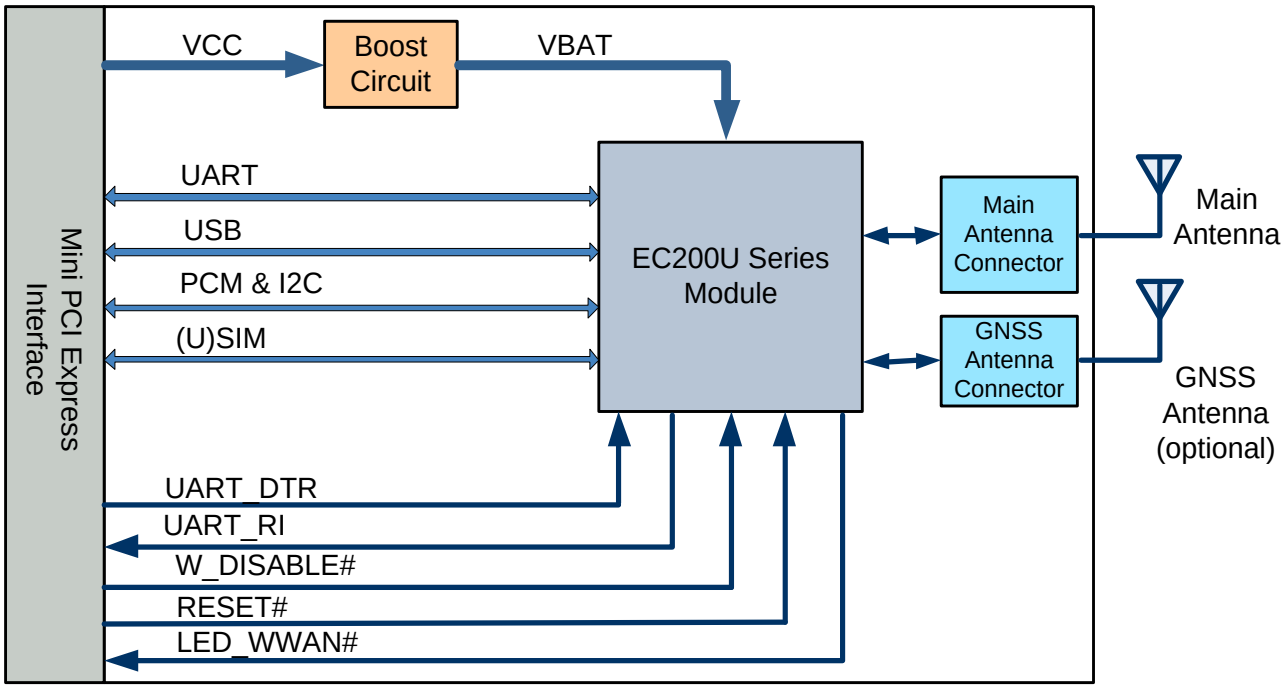


Figure 1: Functional Diagram

2.5. EVB Kit

To help you develop applications with the module, Quectel supplies an evaluation board (Mini PCIe EVB) with accessories to control or test the module. For more details, see ***document [1]***.

3 Application Interfaces

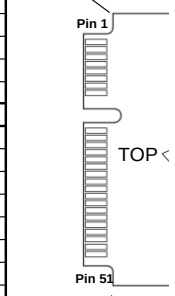
The physical connections and signal levels of the module comply with *Express Mini Card Electromechanical Specification Revision 1.2*. This chapter mainly describes the definition and application of the following interfaces.

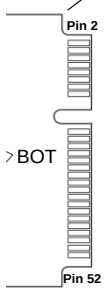
- Power supply
- (U)SIM interface
- USB interface
- UART interface
- PCM and I2C interfaces
- Control and indication signals

3.1. Pin Assignment

The following figure shows the pin assignment of the module. The top side contains EC200U series module and antenna connectors.

Pin Name	Pin No.
WAKEUP_IN	1
RESERVED	3
RESERVED	5
RESERVED	7
GND	9
UART_RXD	11
UART_TXD	13
GND	15
UART_RI	17
RESERVED	19
GND	21
UART_CTS	23
UART_RTS	25
GND	27
GND	29
UART_DTR	31
RESERVED	33
GND	35
GND	37
VCC	39
VCC	41
GND	43
PCM_CLK	45
PCM_DOUT	47
PCM_DIN	49
PCM_SYNC	51





Pin No.	Pin Name
2	VCC
4	GND
6	NC
8	USIM_VDD
10	USIM_DATA
12	USIM_CLK
14	USIM_RST
16	RESERVED
18	GND
20	W_DISABLE#
22	RESET#
24	RESERVED
26	GND
28	NC
30	I2C_SCL
32	I2C_SDA
34	GND
36	USB_DM
38	USB_DP
40	GND
42	LED_WWAN#
44	USIM_DET
46	RESERVED
48	NC
50	GND
52	VCC

Figure 2: Pin Assignment

3.2. Pin Description

The following tables show the pin definition and description of the module.

Table 3: I/O Parameters Definition

Type	Description
AIO	Analog Input/Output
DI	Digital Input
DIO	Digital Input/Output
DO	Digital Output
PI	Power Input
PO	Power Output
OC	Open Collector
OD	Open Drain

Table 4: Pin Description

Pin No.	Pin Name	I/O	Description	Comment
1	WAKEUP_IN	OC	Wake up the module from sleep mode	-
2	VCC	PI	Power supply for the module	3.3 V power domain.
3	RESERVED	-	Reserved	-
4	GND	-	Ground	-
5	RESERVED	-	Reserved	-
6	NC	-	Not connected	-
7	RESERVED	-	Reserved	-
8	USIM_VDD	PO	(U)SIM card power supply	-
9	GND	-	Ground	-

10	USIM_DATA	DIO	(U)SIM card data	-
11	UART_RXD	DI	UART receive	Connect to DTE's TXD.
12	USIM_CLK	DO	(U)SIM card clock	-
13	UART_TXD	DO	UART transmit	Connect to DTE's RXD.
14	USIM_RST	DO	(U)SIM card reset	-
15	GND	-	Ground	-
16	RESERVED	-	Reserved	-
17	UART_RI	DO	UART ring indication	-
18	GND	-	Ground	-
19	RESERVED	-	Reserved	-
20	W_DISABLE#	DI	Airplane mode control	Pulled up by default. Active low.
21	GND	-	Ground	-
22	RESET#	DI	Module reset	Pulled up by default. Active low.
23	UART_CTS	DI	DCE clear to send signal from DTE	Connect to DTE's RTS.
24	RESERVED	-	Reserved	-
25	UART_RTS	DO	DCE request to send signal to DTE	Connect to DTE's CTS.
26	GND	-	Ground	-
27	GND	-	Ground	-
28	NC	-	Not connected	-
29	GND	-	Ground	-
30	I2C_SCL	OD	I2C serial clock (for external codec)	External pull-up to 1.8 V.
31	UART_DTR	DI	Data terminal ready	Sleep mode control.
32	I2C_SDA	OD	I2C serial data (for external codec)	External pull-up to 1.8 V.
33	RESERVED	-	Reserved	-
34	GND	-	Ground	-

35	GND	-	Ground	-
36	USB_DM	AIO	USB differential data (-)	90 Ω differential impedance.
37	GND	-	Ground	-
38	USB_DP	AIO	USB differential data (+)	90 Ω differential impedance.
39	VCC	PI	Power supply for the module	3.3 V power domain.
40	GND	-	Ground	-
41	VCC	PI	Power supply for the module	3.3 V power domain.
42	LED_WWAN#	OC	LED signal for indicating the network status of the module	Active low.
43	GND	-	Ground	-
44	USIM_DET	DI	(U)SIM card hot-plug detect	-
45	PCM_CLK	DI	PCM clock	-
46	RESERVED	-	Reserved	-
47	PCM_DOUT	DO	PCM data output	-
48	NC	-	Not connected	-
49	PCM_DIN	DI	PCM data input	-
50	GND	-	Ground	-
51	PCM_SYNC	DI	PCM data frame sync	-
52	VCC	PI	Power supply for the module	3.3 V power domain.

NOTE

Keep all NC, reserved and unused pins unconnected and all GND pins connected to ground.

3.3. Operating Modes

The following table briefly outlines the operating modes to be mentioned in the following chapters.

Table 5: Overview of Operating Modes

Mode	Details	
Full Functionality Mode	Idle	Software is active. The module has registered on the network, and it is ready to send and receive data.
	Voice/Data	Network connection is ongoing. In this mode, the power consumption varies with network setting and data transfer rate.
Minimum Functionality Mode	**AT+CFUN=0** can set the module to a minimum functionality mode without removing the power supply. In this case, both RF function and (U)SIM card will be invalid.	
Airplane Mode	**AT+CFUN=4** or W_DISABLE# pin can set the module to airplane mode. In this case, RF function will be invalid.	
Sleep Mode	In this mode, the current consumption of the module will be reduced to the minimal level. In this mode, the module can still receive paging message, SMS, voice call and TCP/UDP data from the network normally.	

3.4. Power Saving

3.4.1. Sleep Mode

The module is able to reduce its current consumption to a minimum value in sleep mode. There are three preconditions must be met to make the module enter sleep mode.

- Execute **AT+QSCLK=1** to enable sleep mode.
- Ensure UART_DTR is kept at high level or be kept open.
- The host's USB bus, which is connected with the module's USB interface, enters suspend state.

3.4.2. Airplane Mode

When the module enters airplane mode, the RF function will be disabled, and all AT commands related to it will be inaccessible. For more details, see ***Chapter 3.10.3***.

NOTE

For more details about AT command, see ***document [2]***.

3.5. Power Supply

The following table shows pin definition of power supply interface.

Table 6: Definition of VCC and GND Pins

Pin Name	Pin No.	I/O	Description
VCC	2, 39, 41, 52	PI	3.0–3.6 V, typ. 3.3 V.
GND	4, 9, 15, 18, 21,26, 27, 29, 34, 35, 37, 40, 43, 50		

The typical supply voltage of the module is 3.3 V. In the 2G network, the input peak current may reach 2.7 A during the transmitting time. Therefore, the power supply must be able to provide a rated output current of 2.7 A at least, and a bypass capacitor of not less than 470 μF with low ESR should be used to prevent the voltage from dropping. If the switching power supply is used to supply power to the module, the power device and power supply routing traces of the switching power supply should be kept away from the antennas as much as possible to prevent EMI interference.

The following figure shows a reference design of power supply. The precision of resistors R2 and R3 is 1 %, and C3 is a low-ESR capacitor.

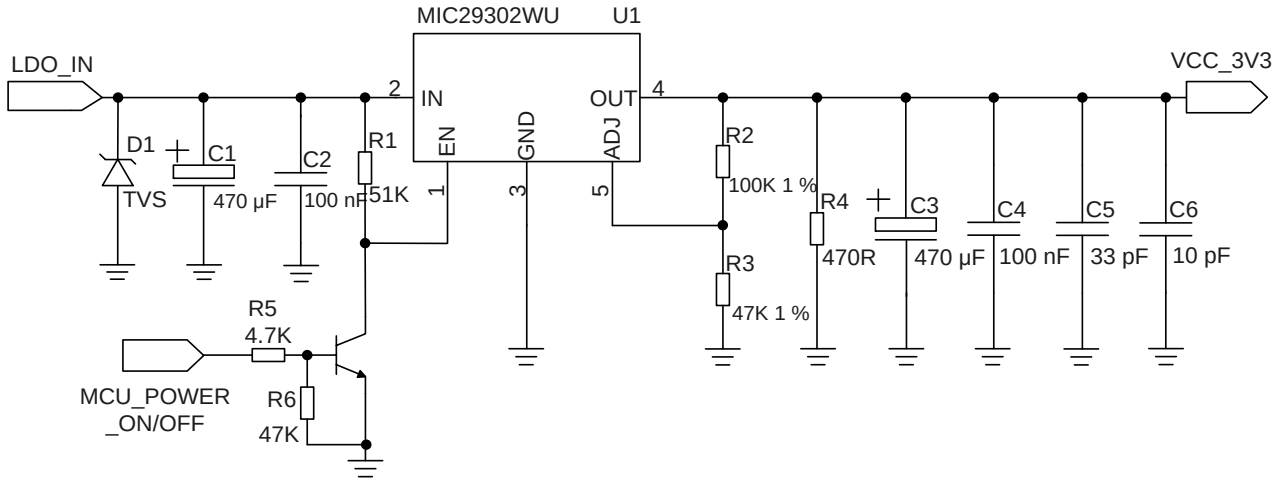


Figure 3: Reference Circuit of Power Supply

3.6. (U)SIM Interface

The (U)SIM interface circuitry meets ETSI and IMT-2000 requirements. Both 1.8 V and 3.0 V (U)SIM cards are supported. The following table shows the pin definition of (U)SIM interface.

Table 7: Pin Definition of (U)SIM Interface

Pin Name	Pin No.	I/O	Power Domain	Description
USIM_VDD	8	PO	1.8/3.0 V	(U)SIM card power supply
USIM_DATA	10	DIO	1.8/3.0 V	(U)SIM card data
USIM_CLK	12	DO	1.8/3.0 V	(U)SIM card clock
USIM_RST	14	DO	1.8/3.0 V	(U)SIM card reset
USIM_DET	44	DI	1.8 V	(U)SIM card hot-plug detect

The module supports (U)SIM card hot-plug via the USIM_DET pin. The function supports both low-level and high-level detections. By default, it is disabled, and can be configured via **AT+QSIMDET**. See ***document [2]*** for details.

The following figure shows a reference design for (U)SIM interface with an 8-pin (U)SIM card connector.

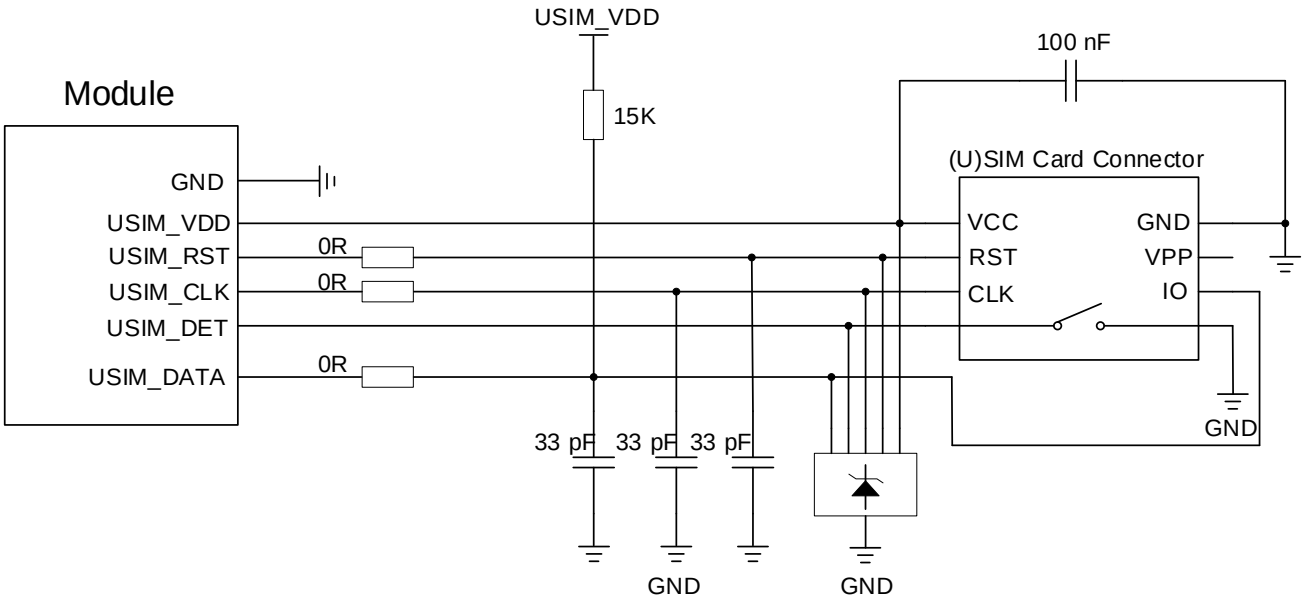


Figure 4: Reference Circuit of (U)SIM Interface with an 8-pin (U)SIM Card Connector

If (U)SIM card detection function is not needed, keep USIM_DET unconnected. A reference circuit for (U)SIM interface with a 6-pin (U)SIM card connector is illustrated in the following figure.

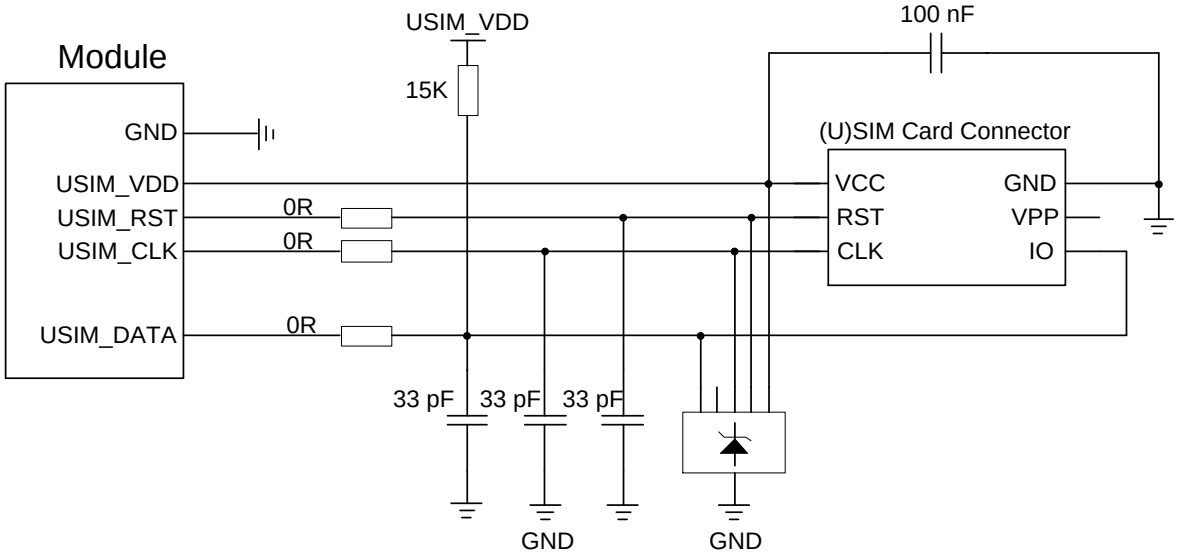


Figure 5: Reference Circuit of (U)SIM Interface with a 6-pin (U)SIM Card Connector

In order to enhance the reliability and availability of the (U)SIM card in your applications, please follow the criteria below in (U)SIM circuit design:

- Keep (U)SIM card connector as close as possible to the module. Keep the trace length as less than 200 mm as possible.
- Keep (U)SIM card signals away from RF and power supply traces.
- To avoid cross-talk between USIM_DATA and USIM_CLK, keep them away from each other and shield them with ground surrounded.
- In order to offer good ESD protection, it is recommended to add a TVS array whose parasitic capacitance should not exceed 15 pF.
- The 0 Ω resistors should be added in series between the module and the (U)SIM card connector so as to facilitate debugging. The 33 pF capacitors are used for filtering interference of EGSM900. Please note that the (U)SIM peripheral circuit should be close to the (U)SIM card connector.
- The pull-up resistor on USIM_DATA line can improve anti-jamming capability when long layout trace and sensitive occasion are applied, and should be placed close to the (U)SIM card connector.

3.7. USB Interface

The module provides one integrated Universal Serial Bus (USB) interface which complies with USB 2.0 specification. It can only be used as a slave device. Meanwhile, it supports high speed (480 Mbps) mode and full speed (12 Mbps) mode. The USB interface is used for AT command communication, data transmission, software debugging and firmware upgrade.

Table 8: Pin Definition of USB Interface

Pin Name	Pin No.	I/O	Description	Comment
USB_DM	36	AIO	USB differential data (-)	90 Ω differential impedance
USB_DP	38	AIO	USB differential data (+)	90 Ω differential impedance

The following figure shows a reference circuit of USB interface.

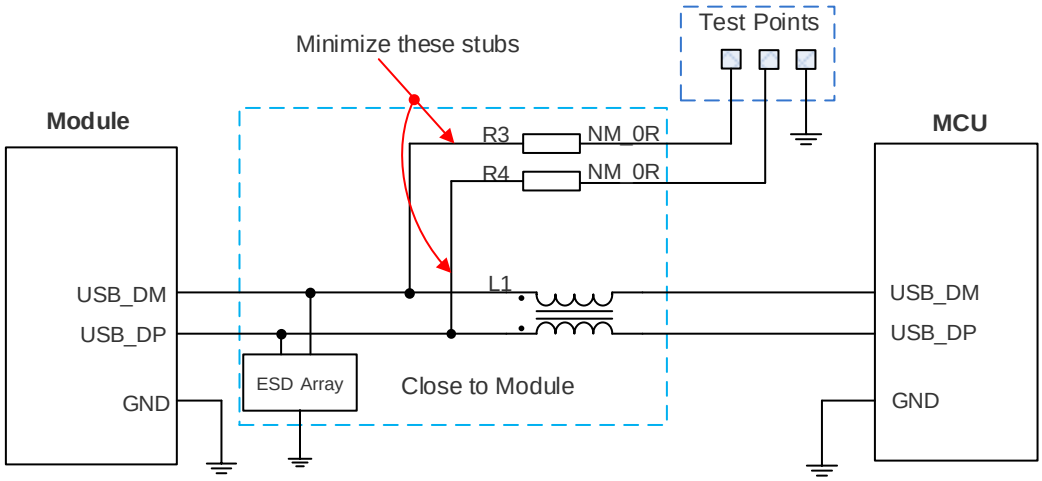


Figure 6: Reference Circuit of USB Interface

A common mode choke L1 is recommended to be added in series between the module and your MCU in order to suppress EMI spurious transmission. Meanwhile, the 0 Ω resistors (R3 and R4) should be added in series between the module and the test points so as to facilitate debugging, and the resistors are not mounted by default. In order to ensure the integrity of USB data line signal, L1, R3 and R4 components must be placed close to the module, and also resistors R3 and R4 should be placed close to each other. The extra stubs of trace must be as short as possible.

The following principles should be complied with when designing the USB interface, so as to meet USB 2.0 specification.

- It is important to route the USB signal traces as differential pairs with ground surrounded. The impedance of USB differential trace is 90 Ω.
- Do not route signal traces under crystals, oscillators, magnetic devices and RF signal traces. It is important to route the USB differential traces in inner-layer of the PCB, and surround the traces with ground on that layer and ground planes above and below.
- Junction capacitance of the ESD protection device might cause influences on USB data lines, so please pay attention to the selection of the device. Typically, the stray capacitance should be less than 2 pF for USB.

3.8. UART Interface

The following table shows the pin definition of the main UART interface.

The main UART interface supports 9600 bps, 19200 bps, 38400 bps, 57600 bps, 115200 bps and 230400 bps baud rates, and the default is 115200 bps. This interface supports RTS and CTS hardware flow control, and can be used for AT command communication and data transmission.

Table 9: Pin Definition of Main UART Interface

Pin Name	Pin No.	I/O	Power Domain	Description
UART_RXD	11	DI	3.3 V	UART receive
UART_TXD	13	DO	3.3 V	UART transmit
UART_CTS	23	DI	3.3 V	DCE clear to send signal from DTE (Connect to DTE's RTS)
UART_RTS	25	DO	3.3 V	DCE request to send signal to DTE (Connect to DTE's CTS)

The signal level of main UART interface is 3.3 V. When connecting to the peripheral MCU/ARM, you need to pay attention to the signal direction. The reference circuit is as follows:

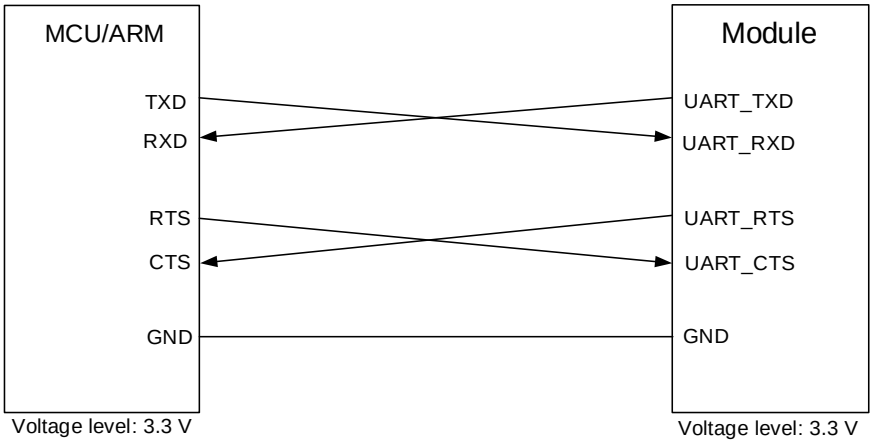


Figure 7: Reference Circuit of Power Supply

3.9. PCM and I2C Interfaces

The module provides one Pulse Code Modulation (PCM) digital interface and one I2C interface.

The following table shows the pin definition of PCM and I2C interfaces that can be applied in audio codec design. The module can only be used as a slave device.

Table 10: Pin Definition of PCM and I2C Interfaces

Pin Name	Pin No.	I/O	Power Domain	Description
PCM_CLK	45	DI	1.8 V	PCM clock
PCM_DOUT	47	DO	1.8 V	PCM data output
PCM_DIN	49	DI	1.8 V	PCM data input
PCM_SYNC	51	DI	1.8 V	PCM data frame sync
I2C_SCL	30	OD	1.8 V	I2C serial clock (for external codec). External pull-up to 1.8 V.
I2C_SDA	32	OD	1.8 V	I2C serial data (for external codec). External pull-up to 1.8 V.

PCM interface supports the short frame mode, in which PCM_CLK = number of channels × PCM_SYNC × word length. 1–4 channels are supported, but only data at the first channel will be used; PCM_SYNC equals the audio sampling frequency, which supports 8–44.1 kHz; the word length is 16-bit.

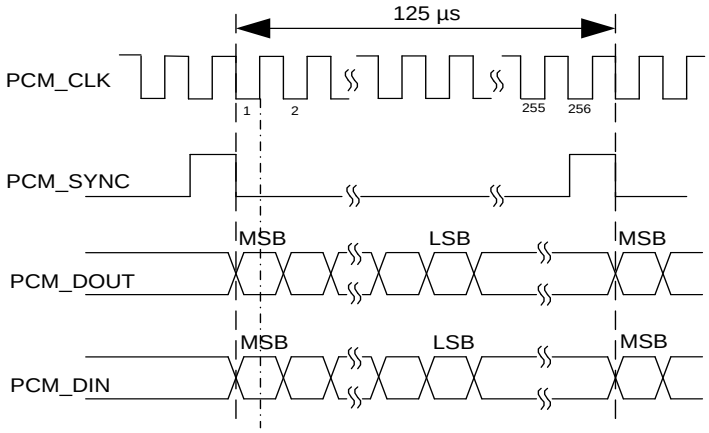


Figure 8: Timing of PCM Interface

The following figure shows a reference design of PCM interface with an external codec IC.

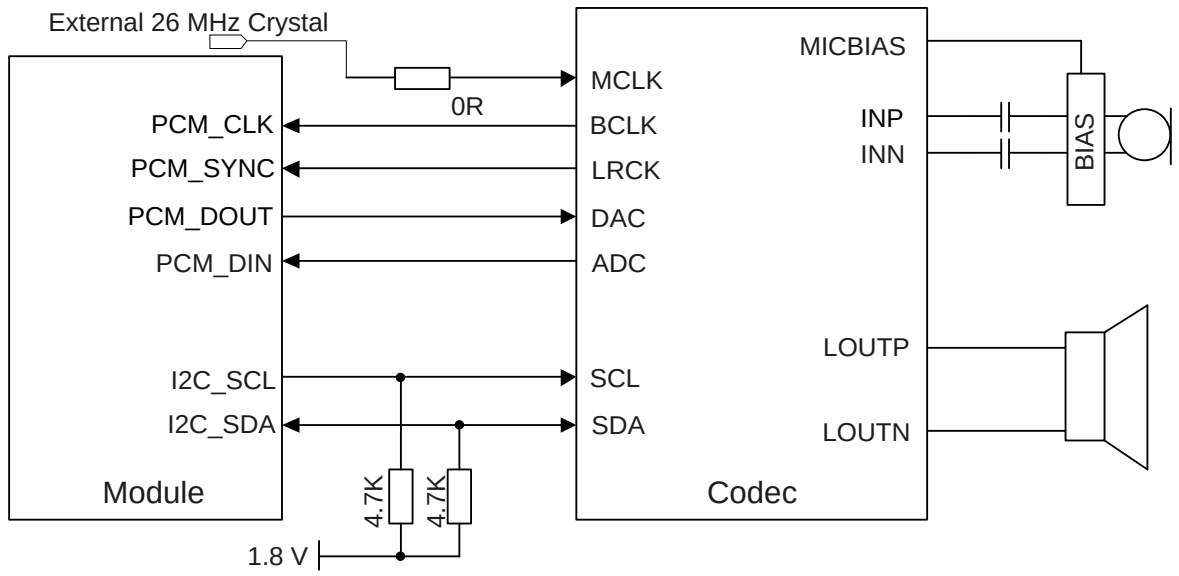


Figure 9: Reference Circuit of PCM Application with Audio Codec

NOTE

1. The clock signals of PCM_SYNC and PCM_CLK are provided by the codec of the master device, but the provided PCM_SYNC frequency must be equal to the sampling frequency of the audio file played by the module.
2. It is recommended to reserve an RC (R = 22 Ω, C = 22 pF) circuit on the PCM signal lines, especially for PCM_CLK.
3. The I2C interface supports simultaneous connection of multiple peripherals except for codec IC, i.e., if a codec IC has been mounted on the I2C bus, no other peripherals can be mounted; if there is no codec IC on the bus, multiple peripherals can be mounted.

3.10. Control and Indication Signals

The following table shows the pin definition of control and indication signals.

Table 11: Pin Definition of Control and Indication Signals

Pin Name	Pin No.	I/O	Power Domain	Description
UART_RI	17	DO	3.3 V	UART ring indication
UART_DTR	31	DI	3.3 V	Data terminal ready. Sleep mode control.

W_DISABLE#	20	DI	3.3 V	Airplane mode control. Pulled up by default. Active low.
RESET#	22	DI	3.3 V	Module reset. Pulled up by default. Active low.
LED_WWAN#	42	OC	-	LED signal for indicating the network status of the module. Active low.
WAKEUP_IN	1	OC	-	Wake up the module from sleep mode.

3.10.1. UART_RI Signal

The UART_RI signal can be used to wake up the host. When a URC returns, there will be the following behaviors on the UART_RI pin after executing **AT+QCFG="risignaltype","physical"**.

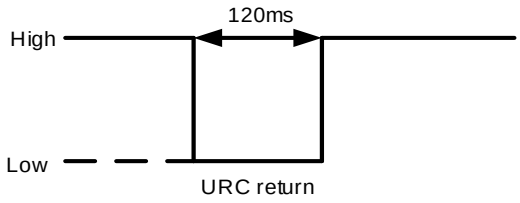


Figure 10: UART_RI Behaviors

3.10.2. UART_DTR Signal

The UART_DTR signal is used for sleep mode control. It is pulled up by default. When the module is in sleep mode, driving it low can wake up the module. For more details about the preconditions for the module to enter sleep mode, see ***Chapter 3.4.1***.

3.10.3. W_DISABLE# Signal

The module provides a W_DISABLE# signal to disable or enable the RF function (excluding GNSS and Bluetooth). The W_DISABLE# pin is pulled up by default. Its control function for airplane mode is disabled by default, and **AT+QCFG="airplanecontrol",1** can be used to enable the function. Driving it low can make the module enter airplane mode.

Table 12: Airplane Mode Controlled by Hardware Method

W_DISABLE#	RF Function Status	Module Operation Mode
High level	RF enabled	Full functionality mode
Low level	RF disabled	Airplane mode

The RF function can also be enabled or disabled through AT commands **AT+CFUN=<fun>**, and the details are as follows.

Table 13: Airplane Mode Controlled by Software Method

AT+CFUN=<fun>	RF Function Status	Module Operation Mode
<fun>=0	RF and (U)SIM disabled	Minimum functionality mode
<fun>=1	RF enabled	Full functionality mode
<fun>=4	RF disabled	Airplane mode

3.10.4. RESET# Signal

The RESET# signal forces a hardware reset on the module. The module can be reset by driving the RESET# signal low for at least 100 ms and then release it. The RESET# signal is sensitive to interference. The traces should be as short as possible and be surrounded with ground. The reset timing is illustrated in the following figure.

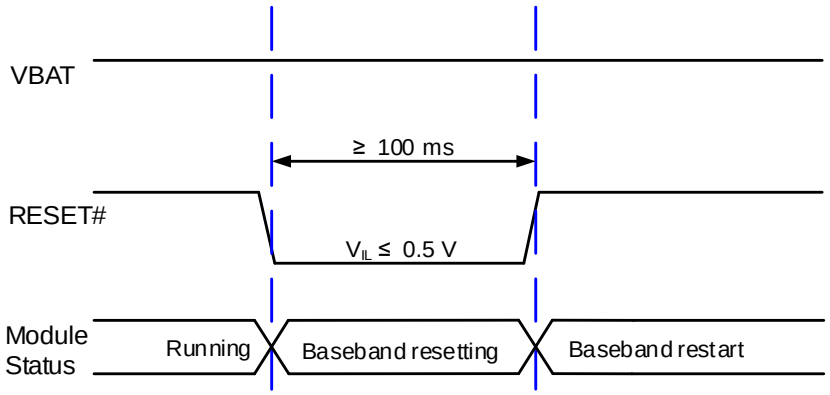


Figure 11: Timing of Resetting Module

NOTE

1. Ensure that there is no large capacitance exceeding 10 nF on RESET# pin.
2. RESET# only resets the internal baseband chip of the module and does not reset the power management chip.

3.10.5. LED_WWAN# Signal

The LED_WWAN# signal of the module is used to indicate the network status of the module, and can absorb a current up to 40 mA. In order to reduce the current of the LED, a resistor must be placed in series with the LED. The reference circuit is as follows.

The LED light is powered on when the LED_WWAN# is at low level.

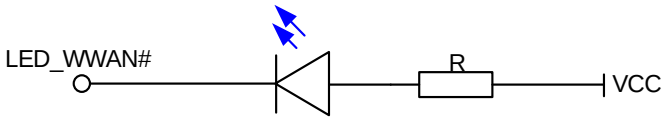


Figure 12: LED_WWAN# Signal Reference Circuit Diagram

There are two indication modes for LED_WWAN# signal to indicate network status, which can be switched through following AT commands:

- **AT+QCFG="ledmode",0** (Default setting)
- **AT+QCFG="ledmode",2**

The following tables show the detailed network status indications of the LED_WWAN# signal.

Table 14: Indications of Network Status (AT+QCFG="ledmode",0, Default Setting)

Pin Status	Description
Flicker slowly (200 ms Low/1800 ms High)	Network searching
Flicker slowly (1800 ms Low/200 ms High)	Idle
Flicker quickly (125 ms Low/125 ms High)	Data transfer is ongoing
Always low	Voice calling

Table 15: Indications of Network Status (AT+QCFG="ledmode",2)

Pin Status	Description
Low Level (Light ON)	Registered on network successfully.
High Impedance (Light OFF)	● No network coverage or not registered ● W_DISABLE# signal is at low level (Disable RF) ● **AT+CFUN=0**, **AT+CFUN=4**

3.10.6. WAKEUP_IN Signal

The WAKEUP_IN pin requires an external pull-up resistor and it can wake up the module from sleep mode with default low-level, you can also use **AT+QCFG="wakeupin/level"** to configure the pin to high level to wake up the module.

NOTE

For details on the above-mentioned AT commands, see ***document [2]***.

4 Antenna Connection

4.1. Antenna Connectors

The module is mounted with two antenna connectors for external antenna connection: a main antenna connector and a GNSS antenna connector. And GNSS function is optional. The impedance of the antenna connectors is 50 Ω.

4.1.1. Operating Frequency

Table 16: EC200U-EU Mini PCIe Operating Frequencies

3GPP Band	Transmit	Receive	Unit
GSM850	824–849	869–894	MHz
EGSM900	880–915	925–960	MHz
DCS1800	1710–1785	1805–1880	MHz
PCS1900	1850–1910	1930–1990	MHz
LTE-FDD B1	1920–1980	2110–2170	MHz
LTE-FDD B3	1710–1785	1805–1880	MHz
LTE-FDD B5	824–849	869–894	MHz
LTE-FDD B7	2500–2570	2620–2690	MHz
LTE-FDD B8	880–915	925–960	MHz
LTE-FDD B20	832–862	791–821	MHz
LTE-FDD B28	703–748	758–803	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz

LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2496–2690	2496–2690	MHz

Table 17: EC200U-AU Mini PCIe Operating Frequencies

3GPP Band	Transmit	Receive	Unit
GSM850	824–849	869–894	MHz
EGSM900	880–915	925–960	MHz
DCS1800	1710–1785	1805–1880	MHz
PCS1900	1850–1910	1930–1990	MHz
LTE-FDD B1	1920–1980	2110–2170	MHz
LTE-FDD B2	1850–1910	1930–1990	MHz
LTE-FDD B3	1710–1785	1805–1880	MHz
LTE-FDD B4	1710–1755	2110–2155	MHz
LTE-FDD B5	824–849	869–894	MHz
LTE-FDD B7	2500–2570	2620–2690	MHz
LTE-FDD B8	880–915	925–960	MHz
LTE-FDD B28	703–748	758–803	MHz
LTE-FDD B66	1710–1780	2110–2180	MHz
LTE-TDD B38	2570–2620	2570–2620	MHz
LTE-TDD B40	2300–2400	2300–2400	MHz
LTE-TDD B41	2496–2690	2496–2690	MHz

Table 18: GNSS Frequencies

Type	Frequency	Unit
GPS	1575.42 ±1.023	MHz
GLONASS	1597.5–1605.8	MHz
Galileo	1575.42 ±2.046	MHz
BDS	1561.098 ±2.046	MHz
QZSS	1575.42	MHz

4.2. Antenna Requirements

The following table shows the requirements on antenna.

Table 19: Antenna Requirements

Type	Requirements
GNSS	Frequency range: 1559–1609 MHz Polarization: RHCP or linear VSWR: < 2 (Typ.) Passive antenna gain: > 0 dBi Active antenna noise figure: < 1.5 dB Active antenna gain: > 0 dBi Active antenna embedded LNA gain: < 17 dB
GSM/LTE	VSWR: ≤ 2 Efficiency: > 30 % Max. input power: 50 W Input impedance: 50 Ω Cable insertion loss: **< 1 dB:** LB (< 1 GHz) **< 1.5 dB:** MB (1–2.3 GHz) **< 2 dB:** HB (> 2.3 GHz)

4.3. Recommended Mated Plugs for Antenna Connection

The module is mounted with RF connectors (receptacles) for convenient antenna connection. The dimensions of the antenna connectors are shown as below.

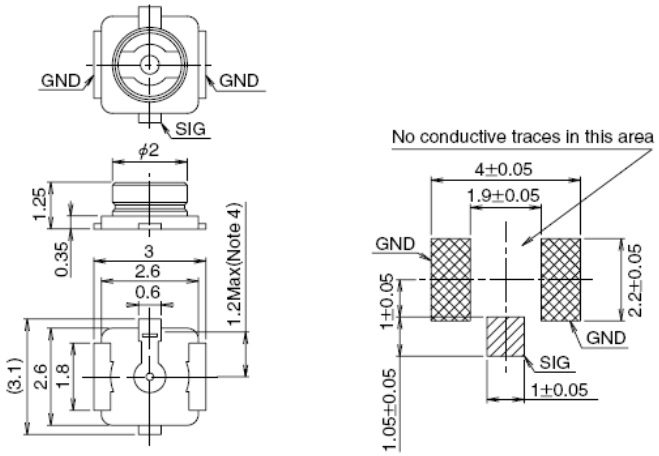


Figure 13: Dimensions of the Receptacle RF Connectors (Unit: mm)

U.FL-LP mated plugs listed in the following figure can be used to match the receptacles.

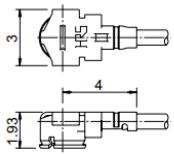
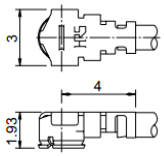
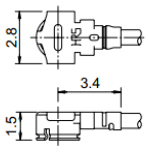
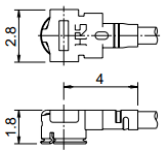
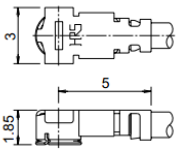
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 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 14: Specifications of Mated Plugs

The following figure describes the space factor of mated connectors.

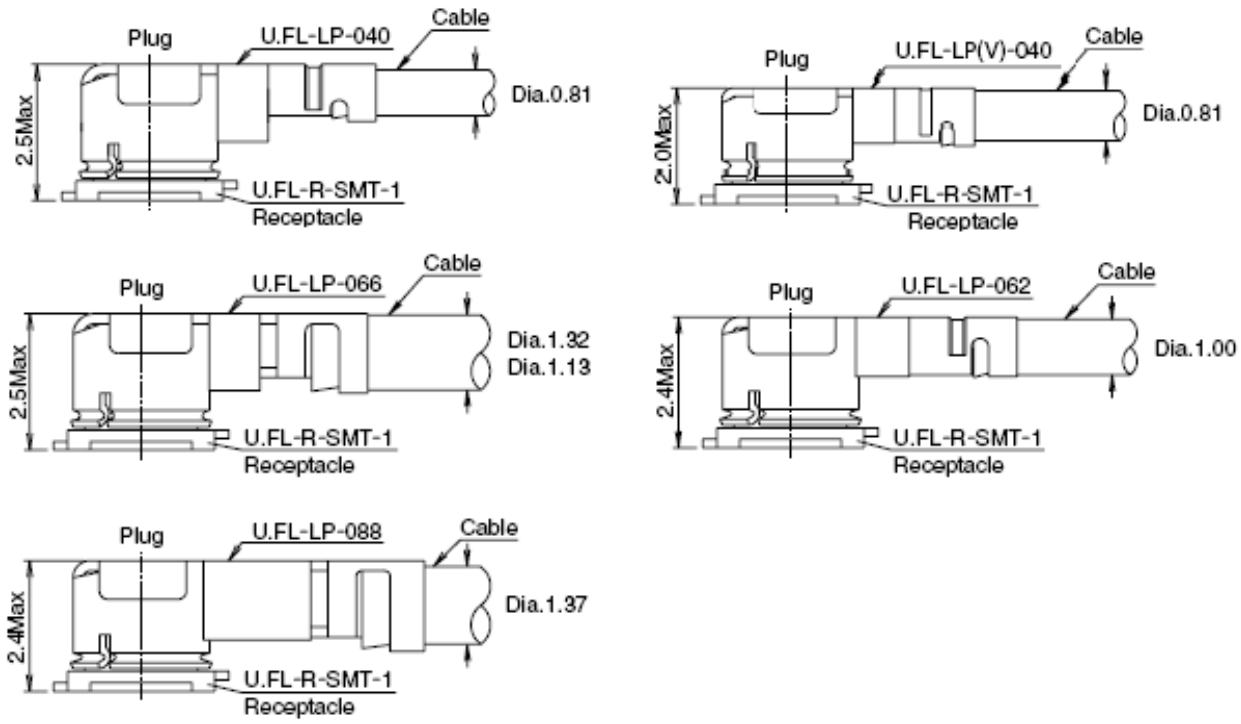


Figure 15: Space Factor of Mated Connectors (Unit: mm)

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

5 Reliability, Radio and Electrical Characteristics

5.1. General Description

This chapter mainly describes the following electrical and radio characteristics of the module:

- Power supply requirements
- I/O requirements
- RF characteristics
- ESD protection
- Current consumption

5.2. Power Supply Requirements

The input voltage of the module is 3.0–3.6 V, as specified by *PCI Express Mini Card Electromechanical Specification Revision 1.2*. The following table shows the power supply requirements.

Table 20: Power Supply Requirements

Parameter	Description	Min.	Typ.	Max.	Unit
VCC	Power Supply	3.0	3.3	3.6	V

5.3. I/O Requirements

The following table shows the I/O requirements of the module.

Table 21: I/O Requirements

Parameter	Description	Min.	Max.	Unit
V_{IH}	Input High Voltage	0.7 × VDDIO	VDDIO + 0.3	V
V_{IL}	Input Low Voltage	-0.3	0.3 × VDDIO	V
V_{OH}	Output High Voltage	VDDIO - 0.5	VDDIO	V
V_{OL}	Output Low Voltage	0	0.4	V

Table 22: (U)SIM Low-voltage I/O Requirements

Parameter	Description	Min.	Max.	Unit
USIM_VDD	Power supply	1.65	1.95	V
V_{IH}	Input high voltage	0.7 × USIM_VDD	USIM_VDD + 0.3	V
V_{IL}	Input low voltage	-0.3	0.2 × USIM_VDD	V
V_{OH}	Output high voltage	0.8 × USIM_VDD	USIM_VDD	V
V_{OL}	Output low voltage	0	0.4	V

Table 23: (U)SIM High-voltage I/O Requirements

Parameter	Description	Min.	Max.	Unit
USIM_VDD	Power supply	2.7	3.05	V
V_{IH}	Input high voltage	0.7 × USIM_VDD	USIM_VDD + 0.3	V
V_{IL}	Input low voltage	-0.3	0.2 × USIM_VDD	V
V_{OH}	Output high voltage	0.8 × USIM_VDD	USIM_VDD	V
V_{OL}	Output low voltage	0	0.4	V

NOTE

1. The PCM and I2C interfaces are 1.8 V power domain and other I/O interfaces are 3.3 V power domain.
2. The maximum voltage value of V_{IL} for RESET# signal and W_DISABLE# signal is 0.5 V.

5.4. RF Characteristics

The following tables show the conducted RF output power and receiving sensitivity of EC200U series Mini PCIe module.

Table 24: Conducted RF Output Power of EC200U-EU Mini PCIe

Frequency Bands	Max. RF Output Power	Min. RF Output Power
GSM850	33 dBm ±2 dB	5 dBm ±5 dB
EGSM900	33 dBm ±2 dB	5 dBm ±5 dB
DCS1800	30 dBm ±2 dB	0 dBm ±5 dB
PCS1900	30 dBm ±2 dB	0 dBm ±5 dB
LTE-FDD B1/B3/B5/B7/B8/B20/B28	23 dBm ±2 dB	< -39 dBm
LTE-TDD B38/B40/B41	23 dBm ±2 dB	< -39 dBm

Table 25: Conducted RF Output Power of EC200U-AU Mini PCIe

Frequency Bands	Max. RF Output Power	Min. RF Output Power
GSM850	33 dBm ±2 dB	5 dBm ±5 dB
EGSM900	33 dBm ±2 dB	5 dBm ±5 dB
DCS1800	30 dBm ±2 dB	0 dBm ±5 dB
PCS1900	30 dBm ±2 dB	0 dBm ±5 dB
LTE-FDD B1/B2/B3/B4/B5/B7/B8/B28/B66	23 dBm ±2 dB	< -39 dBm
LTE-TDD B38/B40/B41	23 dBm ±2 dB	< -39 dBm

Table 26: Conducted RF Receiving Sensitivity of EC200U-EU Mini PCIe

Frequency	Receiving Sensitivity (Typ.)	3GPP (SIMO)
	Primary	
GSM850	-109 dBm	-102.0 dBm
EGSM900	-109 dBm	-102.0 dBm
DCS1800	-109 dBm	-102.0 dBm
PCS1900	-109 dBm	-102.0 dBm
LTE-FDD B1 (10 MHz)	-97.8 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-98.4 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-99.0 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-97.8 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-99 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-97.6 dBm	-93.3 dBm
LTE-FDD B28 (10 MHz)	-99 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-98.5 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-99 dBm	-96.3 dBm

LTE-TDD B41 (10 MHz)	-98 dBm	-94.3 dBm

Table 27: Conducted RF Receiving Sensitivity of EC200U-AU Mini PCIe

Frequency	Receiving Sensitivity (Typ.)	3GPP (SIMO)
	Primary	
GSM850	-109 dBm	-102.0 dBm
EGSM900	-110 dBm	-102.0 dBm
DCS1800	-109 dBm	-102.0 dBm
PCS1900	-109 dBm	-102.0 dBm
LTE-FDD B1 (10 MHz)	-98.7 dBm	-96.3 dBm
LTE-FDD B2 (10 MHz)	-98.8 dBm	-94.3 dBm
LTE-FDD B3 (10 MHz)	-99.1 dBm	-93.3 dBm
LTE-FDD B4 (10 MHz)	-98.8 dBm	-96.3 dBm
LTE-FDD B5 (10 MHz)	-98.8 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-98.2 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-99.3 dBm	-93.3 dBm
LTE-FDD B28 (10 MHz)	-99.8 dBm	-94.8 dBm
LTE-FDD B66 (10 MHz)	-98.7 dBm	-96.5 dBm
LTE-TDD B38 (10 MHz)	-99.1 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-99.8 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-99.1 dBm	-94.3 dBm

5.5. 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 28: ESD Characteristics (Temperature: 25–30 °C, Humidity: 40 ±5 %)

Tested Interfaces	Contact Discharge	Air Discharge	Unit
Power Supply and GND	±5	±10	kV
Antenna Interfaces	±4	±8	kV
Others	±0.5	±1	kV

5.6. Current Consumption

Table 29: EC200U-EU Mini PCIe Current Consumption

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	4.06	mA
	EGSM900 @ DRX = 2 (USB disconnected)	5.33	mA
	EGSM900 @ DRX = 5 (USB disconnected)	4.65	mA
	EGSM900 @ DRX = 5 (USB suspend)	4.86	mA
	EGSM900 @ DRX = 9 (USB disconnected)	4.47	mA
	DCS1800 @ DRX = 2 (USB disconnected)	5.34	mA
	DCS1800 @ DRX = 5 (USB disconnected)	4.66	mA
	DCS1800 @ DRX = 5 (USB suspend)	4.87	mA
	DCS1800 @ DRX = 9 (USB disconnected)	4.43	mA
	LTE-FDD @ PF = 32 (USB disconnected)	5.81	mA

	LTE-FDD @ PF = 64 (USB disconnected)	4.98	mA
	LTE-FDD @ PF = 64 (USB suspend)	5.25	mA
	LTE-FDD @ PF = 128 (USB disconnected)	4.53	mA
	LTE-FDD @ PF = 256 (USB disconnected)	4.30	mA
	LTE-TDD @ PF = 32 (USB disconnected)	5.87	mA
	LTE-TDD @ PF = 64 (USB disconnected)	5.01	mA
	LTE-TDD @ PF = 64 (USB suspend)	5.30	mA
	LTE-TDD @ PF = 128 (USB disconnected)	4.54	mA
	LTE-TDD @ PF = 256 (USB disconnected)	4.31	mA
Idle state	EGSM900 DRX = 5 (USB disconnected)	22.19	mA
	EGSM900 DRX = 5 (USB connected)	36.95	mA
	LTE-FDD @ PF = 64 (USB disconnected)	22.38	mA
	LTE-FDD @ PF = 64 (USB connected)	37.13	mA
	LTE-TDD @ PF = 64 (USB disconnected)	22.40	mA
	LTE-TDD @ PF = 64 (USB connected)	37.17	mA
GPRS data transfer (GNSS OFF)	GSM850 4DL/1UL @ 32.46 dBm	357	mA
	GSM850 3DL/2UL @ 30.27 dBm	494	mA
	GSM850 2DL/3UL @ 28.07 dBm	549	mA
	GSM850 1DL/4UL @ 25.92 dBm	548	mA
	EGSM900 4DL/1UL @ 31.72 dBm	276	mA
	EGSM900 3DL/2UL @ 30.16 dBm	411	mA
	EGSM900 2DL/3UL @ 28.10 dBm	460	mA
	EGSM900 1DL/4UL @ 26.02 dBm	474	mA
	DCS1800 4DL/1UL @ 28.96 dBm	174	mA
	DCS1800 3DL/2UL @ 27.49 dBm	251	mA

	DCS1800 2DL/3UL @ 25.45 dBm	286	mA
	DCS1800 1DL/4UL @ 23.27 dBm	291	mA
	PCS1900 4DL/1UL @ 29.49 dBm	201	mA
	PCS1900 3DL/2UL @ 27.38 dBm	274	mA
	PCS1900 2DL/3UL @ 25.35 dBm	307	mA
	PCS1900 1DL/4UL @ 23.22 dBm	319	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.34 dBm	734	mA
	LTE-FDD B3 @ 22.29 dBm	683	mA
	LTE-FDD B5 @ 23.33 dBm	754	mA
	LTE-FDD B7 @ 22.28 dBm	974	mA
	LTE-FDD B8 @ 22.25 dBm	776	mA
	LTE-FDD B20 @ 22.15 dBm	768	mA
	LTE-FDD B28 @ 23.09 dBm	779	mA
	LTE-TDD B38 @ 23.10 dBm	418	mA
	LTE-TDD B40 @ 22.69 dBm	452	mA
	LTE-TDD B41 @ 22.10 dBm	398	mA
GSM voice call	GSM850 PCL = 5 @ 32.37 dBm	368	mA
	GSM850 PCL = 12 @ 18.50 dBm	123	mA
	GSM850 PCL = 19 @ 4.93 dBm	83	mA
	EGSM900 PCL = 5 @ 31.67 dBm	291	mA
	EGSM900 PCL = 12 @ 18.08 dBm	112	mA
	EGSM900 PCL = 19 @ 4.28 dBm	81	mA
	DCS1800 PCL = 0 @ 29.01 dBm	197	mA
	DCS1800 PCL = 7 @ 15.41 dBm	99	mA
	DCS1800 PCL = 15 @ -0.18 dBm	79	mA

	PCS1900 PCL = 0 @ 29.38 dBm	218	mA
	PCS1900 PCL = 7 @ 15.26 dBm	101	mA
	PCS1900 PCL = 15 @ 0.47 dBm	80	mA

Table 30: EC200U-AU Mini PCIe Current Consumption

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	4.282	mA
	EGSM900 @ DRX = 2 (USB disconnected)	5.58	mA
	EGSM900 @ DRX = 5 (USB disconnected)	4.88	mA
	EGSM900 @ DRX = 5 (USB suspend)	8.09	mA
	EGSM900 @ DRX = 9 (USB disconnected)	4.65	mA
	DCS1800 @ DRX = 2 (USB disconnected)	5.54	mA
	DCS1800 @ DRX = 5 (USB disconnected)	4.86	mA
	DCS1800 @ DRX = 5 (USB suspend)	8.20	mA
	DCS1800 @ DRX = 9 (USB disconnected)	4.66	mA
	LTE-FDD @ PF = 32 (USB disconnected)	6.52	mA
	LTE-FDD @ PF = 64 (USB disconnected)	5.52	mA
	LTE-FDD @ PF = 64 (USB suspend)	8.84	mA
	LTE-FDD @ PF = 128 (USB disconnected)	4.92	mA
	LTE-FDD @ PF = 256 (USB disconnected)	4.65	mA
	LTE-TDD @ PF = 32 (USB disconnected)	6.56	mA
	LTE-TDD @ PF = 64 (USB disconnected)	5.48	mA
	LTE-TDD @ PF = 64 (USB suspend)	8.86	mA
	LTE-TDD @ PF = 128 (USB disconnected)	4.93	mA
	LTE-TDD @ PF = 256 (USB disconnected)	4.68	mA

Idle state	EGSM900 DRX = 5 (USB disconnected)	36.38	mA
	EGSM900 DRX = 5 (USB connected)	37.96	mA
	LTE-FDD @ PF = 64 (USB disconnected)	37.08	mA
	LTE-FDD @ PF = 64 (USB connected)	38.36	mA
	LTE-TDD @ PF = 64 (USB disconnected)	37.13	mA
	LTE-TDD @ PF = 64 (USB connected)	38.42	mA
GPRS data transfer (GNSS OFF)	GSM850 4DL/1UL @ 32.08 dBm	359	mA
	GSM850 3DL/2UL @ 30.41 dBm	520	mA
	GSM850 2DL/3UL @ 28.20 dBm	571	mA
	GSM850 1DL/4UL @ 26.13 dBm	578	mA
	EGSM900 4DL/1UL @ 32.17 dBm	311	mA
	EGSM900 3DL/2UL @ 30.77 dBm	459	mA
	EGSM900 2DL/3UL @ 28.71 dBm	516	mA
	EGSM900 1DL/4UL @ 26.56 dBm	523	mA
	DCS1800 4DL/1UL @ 29.43 dBm	201	mA
	DCS1800 3DL/2UL @ 27.97 dBm	273	mA
	DCS1800 2DL/3UL @ 25.92 dBm	304	mA
	DCS1800 1DL/4UL @ 23.78 dBm	309	mA
	PCS1900 4DL/1UL @ 29.44 dBm	205	mA
	PCS1900 3DL/2UL @ 27.94 dBm	287	mA
	PCS1900 2DL/3UL @ 25.95 dBm	326	mA
	PCS1900 1DL/4UL @ 23.95 dBm	336	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.73 dBm	789	mA
	LTE-FDD B2 @ 23.01 dBm	712	mA
	LTE-FDD B3 @ 23.00 dBm	721	mA

	LTE-FDD B4 @ 23.40 dBm	756	mA
	LTE-FDD B5 @ 23.08 dBm	656	mA
	LTE-FDD B7 @ 23.04 dBm	885	mA
	LTE-FDD B8 @ 22.80 dBm	802	mA
	LTE-FDD B28 @ 23.27 dBm	768	mA
	LTE-FDD B66 @ 23.42 dBm	758	mA
	LTE-TDD B38 @ 23.34 dBm	411	mA
	LTE-TDD B40 @ 22.91 dBm	506	mA
	LTE-TDD B41 @ 22.44 dBm	393	mA
GSM voice call	GSM850 PCL = 5 @ 32.03 dBm	364	mA
	GSM850 PCL = 12 @ 18.52 dBm	127	mA
	GSM850 PCL = 19 @ 5.97 dBm	88	mA
	EGSM900 PCL = 5 @ 32.11 dBm	311	mA
	EGSM900 PCL = 12 @ 18.59 dBm	119	mA
	EGSM900 PCL = 19 @ 5.54 dBm	84	mA
	DCS1800 PCL = 0 @ 29.34 dBm	202	mA
	DCS1800 PCL = 7 @ 15.99 dBm	99	mA
	DCS1800 PCL = 15 @ 0.26 dBm	79	mA
	PCS1900 PCL = 0 @ 29.42 dBm	210	mA
	PCS1900 PCL = 7 @ 16.01 dBm	103	mA
	PCS1900 PCL = 15 @ 0.88 dBm	80	mA

5.7. Notification

Please follow the principles below in the module application.

5.7.1. Coating

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.

5.7.2. Cleaning

Avoid using ultrasonic technology for module cleaning since it can damage crystals inside the module.

5.7.3. Installing

It is recommended to fix the module firmly when the module is inserted into a socket.

6 Dimensions and Packaging

6.1. General Description

This chapter mainly describes mechanical dimensions as well as packaging specification of the module. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.15 mm unless otherwise specified.

6.2. Mechanical Dimensions

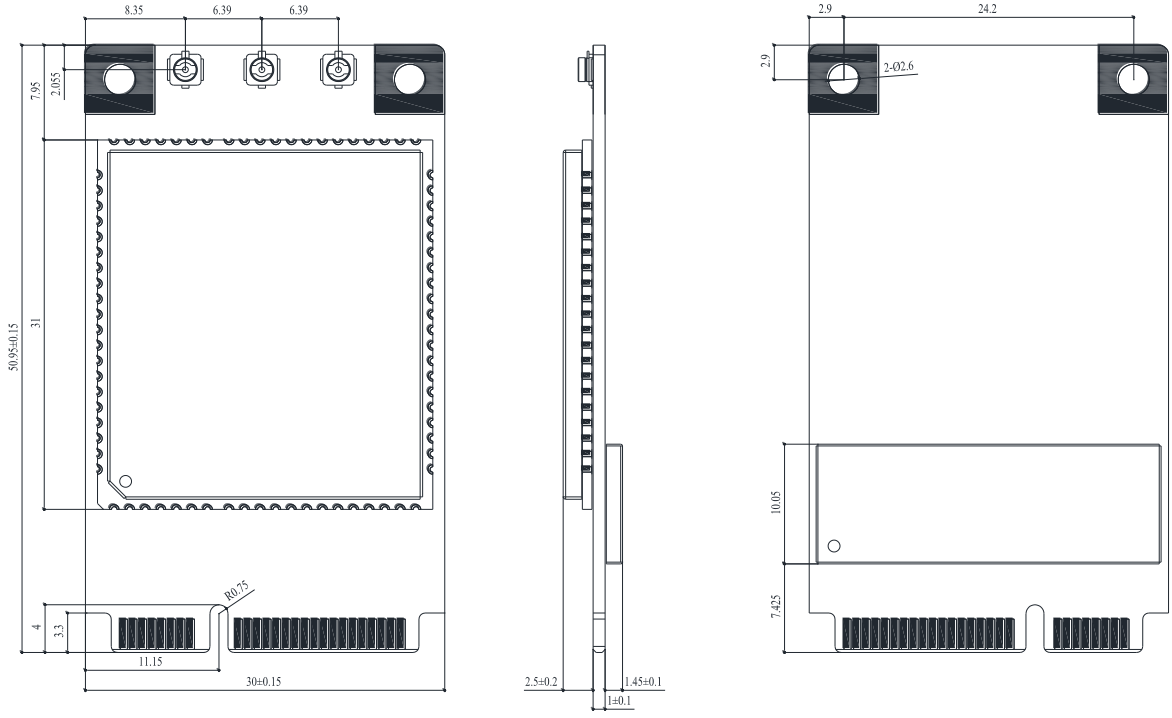


Figure 16: Mechanical Dimensions of EC200U Series Mini PCIe

The module adopts a standard Mini PCI Express connector which compiles with the directives and standards listed in the ***document [3]***. The following figure takes the Molex 679105700 as an example.

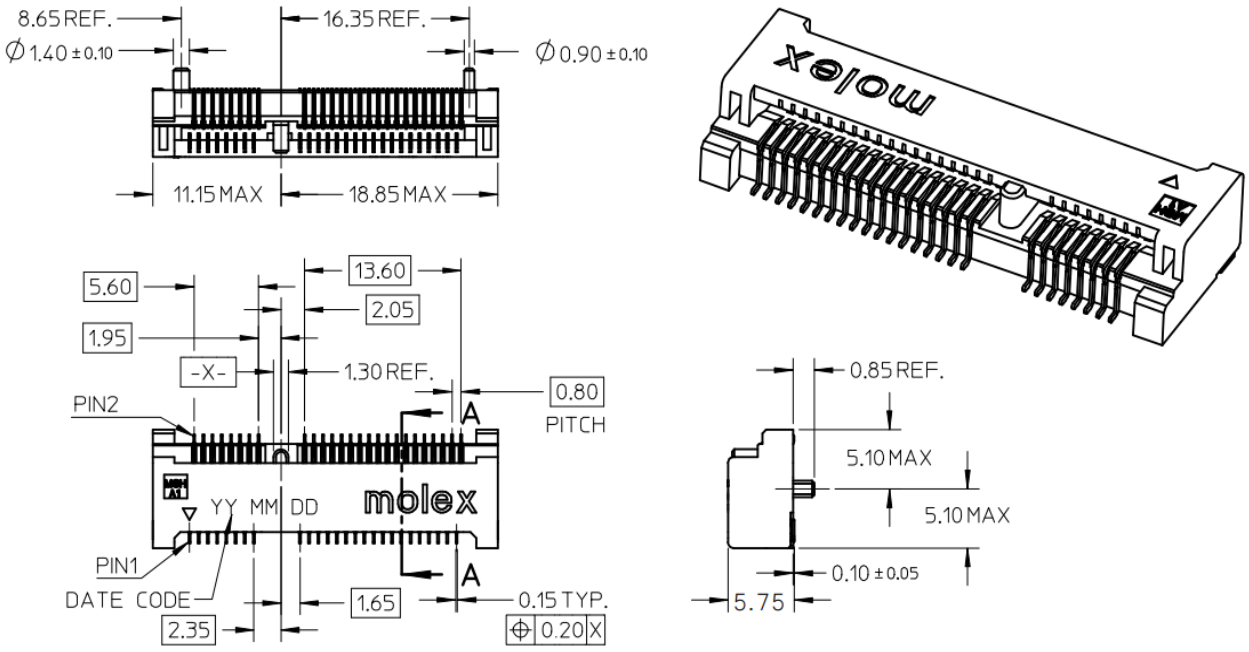


Figure 17: Dimensions of the Mini PCI Express Connector (Molex 679105700)

6.3. 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 blister tray packaging and details are as follow:

6.3.1. Blister Tray

Dimension details are as follow:

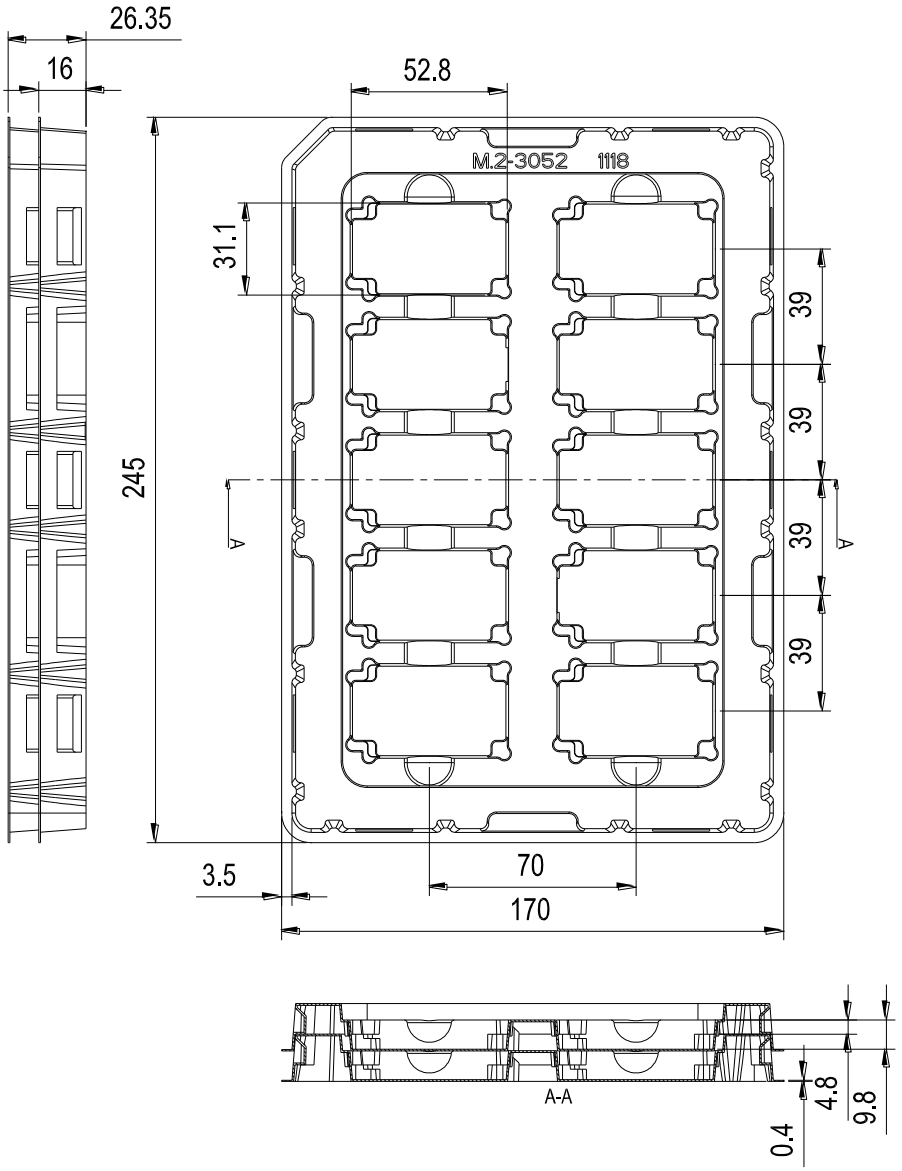
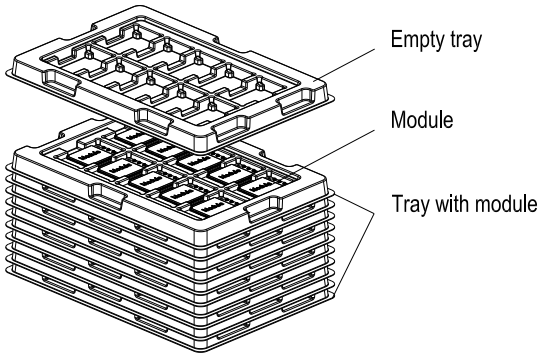
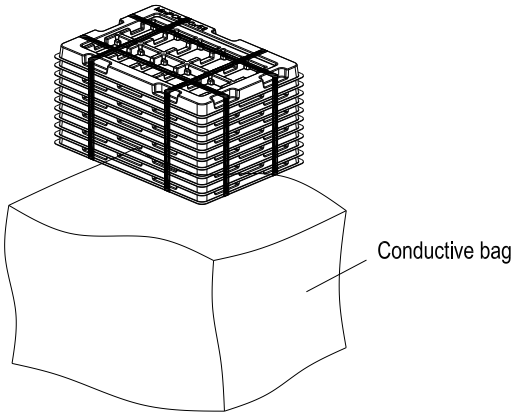


Figure 18: Blister Tray Dimension Drawing

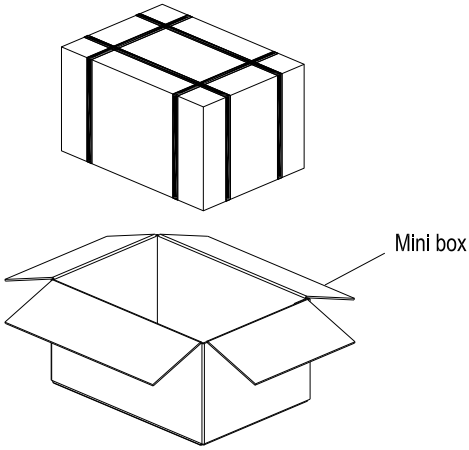
6.3.2. Packaging Process



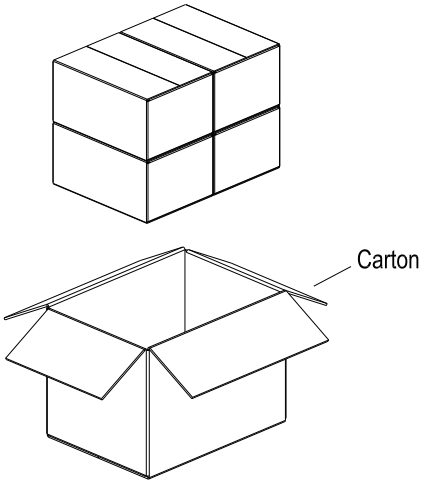
Each blister tray packs 10 modules. Stack 10 blister trays with modules together, and put 1 empty blister tray on the top.



Packing 11 blister trays together and then put blister trays into conductive bag, seal and pack the conductive bag.



Put the seal-packed blister trays into the mini box. 1 mini box can pack 100 modules.



Put 4 packaged mini boxes into 1 carton box and then seal it. 1 carton box can pack 400 modules.

Figure 19: Packaging Process

7 Appendix References

Table 31: Related Documents

Document Name
[1] Quectel_Mini_PCIe_EVB_User_Guide
[2] Quectel_EC200U&EG915U_Series_AT_Commands_Manual
[3] PCI Express Mini Card Electromechanical Specification Revision 1.2

Table 32: Terms and Abbreviations

Abbreviation	Description
AMR	Adaptive Multi-rate
bps	Bits Per Second
CS	Coding Scheme
CTS	Clear to Send
DL	Down Link
DFOTA	Delta Firmware Upgrade Over-The-Air
DTE	Data Terminal Equipment
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
ESR	Equivalent Series Resistance

FDD	Frequency Division Duplexing
FR	Full Rate
GSM	Global System for Mobile Communications
HR	Half Rate
kbps	Kilo Bits Per Second
LED	Light Emitting Diode
LTE	Long-Term Evolution
Mbps	Million Bits Per Second
MCU	Micro Control Unit
ME	Mobile Equipment
MMS	Multimedia Messaging Service
MO	Mobile Originated
MT	Mobile Terminated
PCM	Pulse Code Modulation
PDA	Personal Digital Assistant
PDU	Protocol Data Unit
POS	Point of Sale
PPP	Point-to-Point Protocol
RF	Radio Frequency
RTS	Ready To Send
Rx	Receive
SIMO	Single Input Multiple Output
SMS	Short Message Service
TX	Transmitting Direction
TVS	Transient Voltage Suppressor

UART	Universal Asynchronous Receiver & Transmitter
UL	Uplink
URC	Unsolicited Result Code
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identification Module