EC25 Series Mini PCIe Hardware Design

LTE Standard Module Series

Version: 2.6

Date: 2023-08-25

Status: Released

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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 terminal or mobile incorporating the module. Manufacturers of the 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 fueling 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
1.0	2016-06-07	Mountain ZHOU/ Frank WANG	Initial
1.1	2017-01-24	Lyndon LIU/ Frank WANG	1. Deleted description of EC25-AUT Mini PCIe in Table 1. 2. Added description of EC25-AU and EC25-J Mini PCIe in Table 1. 3. Updated key features of EC25 Mini PCIe in Table 2. 4. Added current consumption in Chapter 4.7. 5. Updated conducted RF receiving sensitivity of EC25-A Mini PCIe in Table 17. 6. Added conducted RF receiving sensitivity of EC25-J Mini PCIe in Table 18.
2.0	2019-04-30	Nathan LIU/ Frank WANG/ Ward WANG/ Ethan SHAN	1. Added new variants EC25-AF Mini PCIe, EC25-EU Mini PCIe, EC25-EC Mini PCIe, EC25-EUX Mini PCIe, EC25-MX Mini PCIe and their related information. 2. Updated LTE, UMTS and GSM features, and added storage temperature range in Table 2. 3. Added pin definition and description of pin 3, 5, 44 in Figure 2 and Table 4. 4. Modified the reference circuit of USB interface in Figure 6. 5. Updated the mechanical dimension of EC25 Mini PCIe in Figure 18. 6. Added USIM_PRESENCE in (U)SIM interface and updated the reference circuit in Chapter 3.4. 7. Added COEX UART interface (under development) as UART interface in Chapter 3.6. 8. Modified description of W_DISABLE# signal in

			Chapter 3.8.3. 9. Modified description of LED_WWAN# signal in Chapter 3.8.5. 10. Updated description of antenna connection in Chapter 5. 11. Added thermal consideration in Chapter 6.7. 12. Added operating frequencies in Table 16. 13. Added GNSS frequency in Table 17. 14. Updated antenna requirements in Table 18. 15. Updated EC25 Mini PCIe conducted RF output power in Table 21. 16. Updated conducted RF receiving sensitivity of EC25-A Mini PCIe in Table 22. 17. Added conducted RF receiving sensitivity of EC25-AU Mini PCIe in Table 23. 18. Updated conducted RF receiving sensitivity of EC25-J Mini PCIe in Table 24. 19. Updated conducted RF receiving sensitivity of EC25-E Mini PCIe in Table 25. 20. Updated conducted RF receiving sensitivity of EC25-V Mini PCIe in Table 26. 21. Added conducted RF receiving sensitivity of EC25-AF Mini PCIe in Table 27. 22. Added conducted RF receiving sensitivity of EC25-EU Mini PCIe in Table 28. 23. Added conducted RF receiving sensitivity of EC25-EC Mini PCIe in Table 29. 24. Added conducted RF receiving sensitivity of EC25-EUX Mini PCIe in Table 30. 25. Added current consumption of EC25-AU Mini PCIe in Table 33. 26. Added current consumption of EC25-J Mini PCIe in Table 34. 27. Added current consumption of EC25-AF Mini PCIe in Table 37. 28. Added current consumption of EC25-EC Mini PCIe in Table 38. 29. Added current consumption of EC25-EUX Mini PCIe in Table 39.
2.1	2019-07-05	Fanny CHEN/ Ethan SHAN	1. Added EC25-AFX/-AUX Mini PCIe and related information. 2. Updated supported protocols and USB serial drivers in Table 2. 3. Added EC25-AFX Mini PCIe conducted RF receiving

			sensitivity in Table 28. 4. Updated conducted RF receiving sensitivity of EC25-EU Mini PCIe in Table 29. 5. Updated EC25-AF Mini PCIe current consumption in Table 39. 6. Added EC25-AFX Mini PCIe current consumption in Table 42. 7. Added EC25-MX Mini PCIe conducted RF receiving sensitivity in Table 32. 8. Added EC25-MX Mini PCIe current consumption in Table 43.
2.2	2019-08-19	Ward WANG/ Owen WEI	1. Deleted the information of GNSS supported on EC25-EC Mini PCIe in Table 1. 2. Updated conducted RF receiving sensitivity of EC25-AU Mini PCIe in Table 24. 3. Updated conducted RF receiving sensitivity of EC25-EU Mini PCIe in Table 30. 4. Added conducted RF receiving sensitivity of EC25-AUX Mini PCIe in Table 34. 5. Updated current consumption of EC25-J Mini PCIe in Table 38. 6. Added current consumption of EC25-AUX Mini PCIe in Table 45. 7. Added current consumption of EC25-EU Mini PCIe in Table 46. 8. Deleted current consumption of EC21-EC Mini PCIe, and the data will be updated in the future version.
2.3	2019-11-26	Fanny CHEN	1. Removed the related information of ThreadX OS because the baseline has been updated. 2. Updated the supported protocols and USB serial drivers in Table 2. 3. Added operating modes of module in Chapter 3.3. 4. Updated description of W_DISABLE# in Chapter 3.10.3. 5. Updated the notes for GNSS performance in Chapter 4.2. 6. Updated the Mini PCI Express connector type in Figure 21.
2.4	2019-12-18	Ward WANG	1. Modified the I/O parameters definition of the I2C interface as OD in Table 4 and 11. 2. Modified the current consumption of EC25-EUX Mini PCIe in Table 43.
2.5	2022-05-26	Joe MA/ Frank WANG/	1. Added the applicable modules EC25-AFXD, EC25-EM, EC25-ADL and EC25-AFDL Mini PCIe;

		Ethan FANG	2. Deleted the applicable module EC25-EC Mini PCIe. 3. Updated the information of USB serial drivers (Chapter 2.3). 4. Added the chapter of EVB kit (Chapter 2.5). 5. Added the power consumption of B4 on EC25-AUX Mini PCIe (Chapter 6.6.6). 6. Updated the dimension tolerance of the module from ±0.05 mm to ±0.15 mm (Chapter 7). 7. Updated the information of package specifications (Chapter 7.2).
2.6	2023-08-25	Soley ZHANG/ Hebe BAO/ Frank WANG/ Aaron ZHANG/ Zoey CAO/ Lem JIN/ Gavin LU	1. Updated the USB serial drivers (Table 3). 2. Updated the reference circuit of power supply (Figure 4). 3. Updated the TTFF of the cold start in open sky with the condition of XTRA enabled (Table 18). 4. Updated the Rx sensitivity of EC25-EUX Mini PCIe (Table 35). 5. Updated the power consumption of EC25-EUX Mini PCIe (Table 51). 6. Added the notification of coating, cleaning and installing (Chapter 6.8).

Contents

Table Index

Figure Index

1 Introduction

This document defines EC25 series Mini PCIe LTE standard module, and describes its air interfaces and hardware interfaces which are connected with your applications.

This document helps you quickly understand module interface specifications, electrical characteristics, mechanical specifications and other related information of the module. To facilitate application designs, it also includes some reference designs for your reference. The document, coupled with application notes and user guides, makes it easy to design and set up wireless applications with EC25 series Mini PCIe.

1.1. Special Mark

Table 1: Special Mark

Mark	Definition
*	Unless otherwise specified, when an asterisk (*) is used after a function, feature, interface, pin name, AT command, or argument, it indicates that the function, feature, interface, pin, AT command, or argument is under development and currently not supported; and the asterisk (*) after a model indicates that the sample of the model is currently unavailable.

2 Product Overview

2.1. General Description

EC25 series Mini PCIe module provides data connectivity on LTE-FDD, LTE-TDD, DC-HSDPA, HSPA+, HSDPA, HSUPA, WCDMA, EDGE and GPRS networks with PCI Express Mini Card 1.2 standard interface. It supports embedded operating systems such as Linux, Android, and also provides audio, high-speed data transmission and GNSS functionalities for your applications.

EC25 series Mini PCIe 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

NOTE

EC25 series Mini PCIe module contains **Data + Voice** version and **Data-only** version. EC25-AFDL and EC25-AFXD only support **Data-only** version.

2.2. Frequency Bands and Functions

EC25 series Mini PCIe contains 15 variants, and are listed in the following table.

Table 2: Supported Frequency Bands and Functions of EC25 Series Mini PCIe

Module Series	LTE Bands	WCDMA Bands	GSM Bands	Rx-diversity	Digital Audio [1]	GNSS (Optional)
EC25-A Mini PCIe	**FDD:** B2/B4/B12	B2/B4/B5		√	√	
EC25-E Mini PCIe	**FDD:** B1/B3/B5/B7/B8/B20 **TDD:** B38/B40/B41	B1/B5/B8	EGSM900/DCS1800	√	√	
EC25-V Mini PCIe	**FDD:** B4/B13	-	-	√	√	
EC25-J Mini PCIe	**FDD:** B1/B3/B8/B18/B19/B26 **TDD:** B41	B1/B6/B8/B19	-	√	√	
EC25-AU Mini PCIe	**FDD:** B1/B2 [2]/B3/B4/B5/B7/B8/B28 **TDD:** B40	B1/B2/B5/B8	GSM850/EGSM900/DCS1800/PCS1900	√	√	
EC25-AUX Mini PCIe	**FDD:** B1/B2 [2]/B3/B4/B5/B7/B8/B28 **TDD:** B40	B1/B2/B4/B5/B8	GSM850/EGSM900/DCS1800/PCS1900	√	√	GPS, GLONASS, BDS, Galileo, QZSS
EC25-AF Mini PCIe	**FDD:** B2/B4/B5/B12/B13/B14/B66/B71	B2/B4/B5	-	√	√	
EC25-AFX Mini PCIe	**FDD:** B2/B4/B5/B12/B13/B14/B66/B71	B2/B4/B5	-	√	√	
EC25-AFXD Mini PCIe	**FDD:** B2/B4/B5/B12/B13/B14/B66/B71	B2/B4/B5	-	√	-	
EC25-EU Mini PCIe	**FDD:** B1/B3/B7/B8/B20/B28A **TDD:** B38/B40/B41	B1/B8	EGSM900/DCS1800	√	√	
EC25-EUX Mini PCIe	**FDD:** B1/B3/B7/B8/B20/B28A **TDD:** B38/B40/B41	B1/B8	EGSM900/DCS1800	√	√	
EC25-MX Mini PCIe	**FDD:** B2/B4/B5/B7/B28/B66	B2/B4/B5	-	√	√	-
EC25-EM Mini PCIe	**FDD:** B1/B3/B5/B7/B8/B20/B28 **TDD:** B38/B40/B41	B1/B5/B8	EGSM900/DCS1800	√	√	
EC25-ADL Mini PCIe	**FDD**: B2/B4/B12	-	-	√	√	GPS, GLONASS, BDS, Galileo, QZSS
EC25-AFDL Mini PCIe	**FDD:** B2/B4/B5/B12/B13/B14/B66/B71	-	-	√	-	

[1] Digital audio (PCM) function is only supported on **Data + Voice** version.
[2] LTE-FDD B2 on EC25-AU Mini PCIe and EC25-AUX Mini PCIe does not support Rx-diversity.

NOTE

"√": Supported. "-": Unsupported.

2.3. Key Features

The following table describes the detailed features of EC25 series Mini PCIe module.

Table 3: Key Features

Features	Description
Function Interface	PCI Express Mini Card 1.2 Standard Interface
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 E2 (27 dBm ±3 dB) for GSM850 8-PSK ● Class E2 (27 dBm ±3 dB) for EGSM900 8-PSK ● Class E2 (26 dBm ±3 dB) for DCS1800 8-PSK ● Class E2 (26 dBm ±3 dB) for PCS1900 8-PSK ● Class 3 (23 dBm ±2 dB) for WCDMA bands ● Class 3 (23 dBm ±2 dB) for LTE bands
LTE Features	● Supports up to 3GPP Rel-8 non-CA Cat 4 FDD and TDD ● Supports 1.4/3/5/10/15/20 MHz RF bandwidth ● Supports MIMO in DL direction ● LTE-FDD: Max. 150 Mbps (DL)/Max. 50 Mbps (UL) ● LTE-TDD: Max. 130 Mbps (DL)/Max. 30 Mbps (UL)
UMTS Features	● Supports 3GPP Rel-8 DC-HSDPA, HSPA+, HSDPA, HSUPA and WCDMA ● Supports QPSK, 16QAM and 64QAM modulation ● DC-HSDPA: Max. 42 Mbps (DL) ● HSUPA: Max. 5.76 Mbps (UL) ● WCDMA: Max. 384 kbps (DL)/Max. 384 kbps (UL)
GSM Features	**GPRS:** ● Supports GPRS multi-slot class 33 (33 by default) ● Coding scheme: CS 1–4 ● Max. 107 kbps (DL)/Max. 85.6 kbps (UL) **EDGE:**

	● Supports EDGE multi-slot class 33 (33 by default) ● Supports GMSK and 8-PSK for different MCS (Modulation and Coding Scheme) ● Downlink coding schemes: MCS 1–9 ● Uplink coding schemes: MCS 1–9 ● Max. 296 kbps (DL)/Max. 236.8 kbps (UL)
Internet Protocol Features	● Supports TCP/UDP/PPP/FTP/FTPS/HTTP/HTTPS/NTP/PING/QMI/ NITZ/SMTP/SSL/MQTT/CMUX/SMTPS/MMS*/FILE* protocols ● Supports protocols PAP and CHAP for PPP connection
SMS	● Text and PDU modes ● Point-to-point MO and MT ● SMS cell broadcast ● SMS storage: ME by default
(U)SIM Interface	Supports (U)SIM card: 1.8/3.0 V
UART Interfaces	**Main UART:** ● Supports 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 **Coexistence UART:** ● LTE/WLAN & Bluetooth coexistence UART
Audio Features	● Supports one digital audio interface: PCM interface ● GSM: HR/FR/EFR/AMR/AMR-WB ● WCDMA: AMR/AMR-WB ● LTE: AMR/AMR-WB ● Supports echo cancellation and noise suppression [3]
PCM Interface	● Supports 16-bit linear data format ● Supports long frame synchronization and short frame synchronization ● Supports master and slave modes, but must be used as the master mode in long frame synchronization
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, firmware upgrade, software debugging, GNSS NMEA output and voice over USB ● Supports USB serial drivers for: Windows 7/8/8.1/10/11, Linux 2.6–6.5, Android 4.x–13.x, etc.
Antenna Connectors	Main antenna, Rx-diversity antenna and GNSS antenna connectors
Rx-diversity	Supports LTE/WCDMA Rx-diversity
GNSS Features	● Protocol: NMEA 0183 ● Data update rate: 1 Hz by default

[3] EC25-ADL Mini PCIe, EC25-AFDL Mini PCIe and EC25-AFXD Mini PCIe do not support echo cancellation and noise suppression.

AT Commands	● Compliant with *3GPP TS 27.007* and *3GPP TS 27.005* ● Quectel enhanced AT commands
Physical Characteristics	● Size: 51.0 mm × 30.0 mm × 4.9 mm ● Weight: approx. 9.8 g
Temperature Range	● Operating temperature range: -35 °C to +75 °C [4] ● Extended temperature range: -40 °C to +80 °C [5] ● Storage temperature range: -40 °C to +90 °C
Firmware Upgrade	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 EC25 series Mini PCIe.

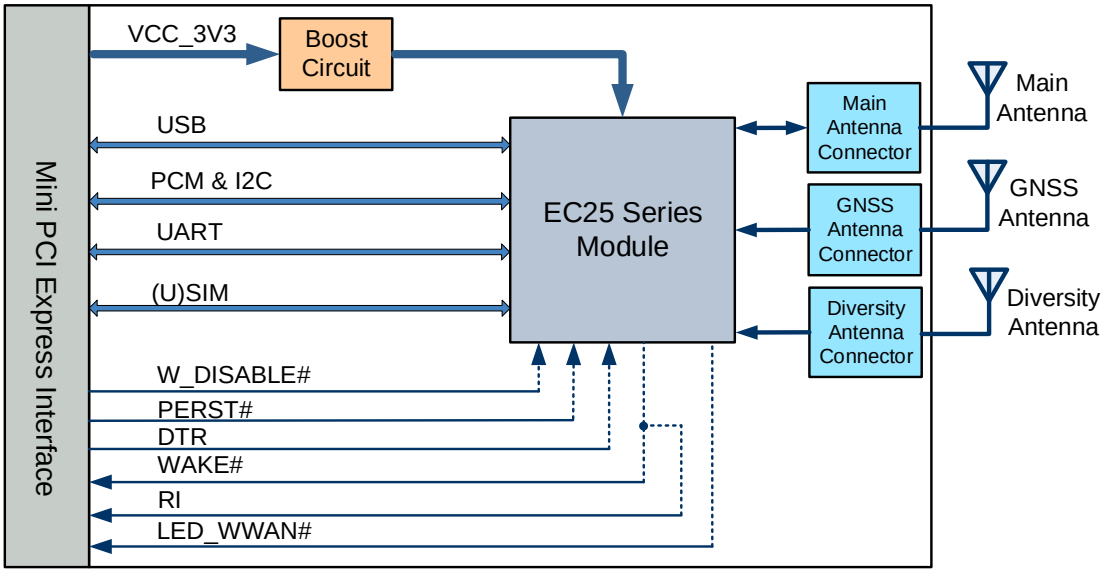


Figure 1: Functional Diagram

[4] To meet the normal operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heat sinks, heat pipes, vapor chambers. Within this range, the module meets 3GPP specifications.

[5] To meet the extended operating temperature range requirements, it is necessary to ensure effective thermal dissipation, e.g., by adding passive or active heat sinks, heat pipes, vapor chambers. Within this range, the module remains the ability to establish and maintain functions such as voice, SMS and data transmission, 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.

2.5. EVB Kit

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

3 Application Interfaces

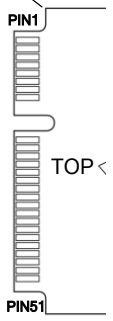
The physical connections and signal levels of EC25 series Mini PCIe comply with *PCI Express Mini Card Electromechanical Specification*. This chapter mainly describes the definition and application of the following interfaces/pins of EC25 series Mini PCIe.

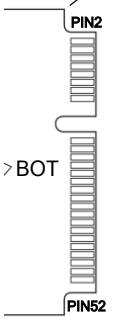
- Power supply pins
- (U)SIM interface
- USB interface
- UART interfaces
- PCM and I2C interfaces
- Control and indication signals

3.1. Pin Assignment

The following figure shows the pin assignment of EC25 series Mini PCIe module. The top side contains EC25 series module and antenna connectors.

Pin Name	Pin No.
WAKE#	1
COEX_UART_RX	3
COEX_UART_TX	5
RESERVED	7
GND	9
UART_RX	11
UART_TX	13
GND	15
RI	17
RESERVED	19
GND	21
UART_CTS	23
UART_RTS	25
GND	27
GND	29
DTR	31
RESERVED	33
GND	35
GND	37
VCC_3V3	39
VCC_3V3	41
GND	43
PCM_CLK	45
PCM_DOUT	47
PCM_DIN	49
PCM_SYNC	51





Pin No.	Pin Name
2	VCC_3V3
4	GND
6	NC
8	USIM_VDD
10	USIM_DATA
12	USIM_CLK
14	USIM_RST
16	RESERVED
18	GND
20	W_DISABLE#
22	PERST#
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_PRESENCE
46	RESERVED
48	NC
50	GND
52	VCC_3V3

Figure 2: Pin Assignment

3.2. Pin Description

Table 4: I/O Parameters Definition

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

The following tables show the pin definition and description of the 52 pins on EC25 series Mini PCIe. DC characteristics include power domain and rated current, etc.

Table 5: Pin Description

Pin No.	Pin Name	I/O	Description	DC Characteristic	Comment
1	WAKE#	OC	Wake up the host		
2	VCC_3V3	PI	Power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V	
3	COEX_UART_RX	DI	LTE/WLAN & Bluetooth coexistence receive	1.8 V	It is prohibited to be pulled up to high level before startup.
4	GND	-	Ground		
5	COEX_UART_TX	DO	LTE/WLAN & Bluetooth coexistence transmit	1.8 V	It is prohibited to be pulled up to high level before startup.
6	NC	-	Not connected		

7	RESERVED	-	Reserved		
8	USIM_VDD	PO	(U)SIM card power supply	1.8/3.0 V	
9	GND	-	Ground		
10	USIM_DATA	DIO	(U)SIM card data	1.8/3.0 V	
11	UART_RX	DI	UART receive	3.3 V	
12	USIM_CLK	DO	(U)SIM card clock	1.8/3.0 V	
13	UART_TX	DO	UART transmit	3.3 V	
14	USIM_RST	DO	(U)SIM card reset	1.8/3.0 V	
15	GND	-	Ground		
16	RESERVED	-	Reserved		
17	RI	DO	UART ring indication	3.3 V	
18	GND	-	Ground		
19	RESERVED	-	Reserved		
20	W_DISABLE#	DI	Airplane mode control	3.3 V	Pulled up by default. Active low.
21	GND	-	Ground		
22	PERST#	DI	Fundamental reset	3.3 V	Pulled up by default. Active low.
23	UART_CTS	DI	Clear to send signal from the module	3.3 V	
24	RESERVED	-	Reserved		
25	UART_RTS	DO	Request to send signal from the module	3.3 V	
26	GND	-	Ground		
27	GND	-	Ground		
28	NC	-	Not connected		
29	GND	-	Ground		
30	I2C_SCL	OD	I2C serial clock (for	1.8 V	Externally pulled up to

			external codec)		1.8 V.
31	DTR	DI	Data terminal ready, sleep mode control	3.3 V	Pulled up by default.
32	I2C_SDA	OD	I2C serial data (for external codec)	1.8 V	Externally pulled up to 1.8 V.
33	RESERVED	-	Reserved		
34	GND	-	Ground		
35	GND	-	Ground		
36	USB_DM	AIO	USB differential data (-)		Require differential impedance of 90 Ω.
37	GND	-	Ground		
38	USB_DP	AIO	USB differential data (+)		Require differential impedance of 90 Ω.
39	VCC_3V3	PI	Power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V	
40	GND	-	Ground		
41	VCC_3V3	PI	Power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V	
42	LED_WWAN#	OC	Indicates the network status of the module		Active low.
43	GND	-	Ground		
44	USIM_ PRESENCE	DI	(U)SIM card hot-plug detect	1.8 V	
45	PCM_CLK [6]	DIO	PCM clock	1.8 V	
46	RESERVED	-	Reserved		
47	PCM_DOUT [6]	DO	PCM data output	1.8 V	
48	NC	-	Not connected		
49	PCM_DIN [6]	DI	PCM data input	1.8 V	
50	GND	-	Ground		
51	PCM_SYNC [6]	DIO	PCM data frame sync	1.8 V	

[6] The digital audio (PCM) function is only supported on **Data + Voice** version.

52	VCC_3V3	PI	Power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V

NOTE

Keep all NC, RESERVED and unused pins unconnected.

3.3. Operating Modes

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

Table 6: 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 is decided by 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 are invalid.	
Airplane Mode	**AT+CFUN=4** or W_DISABLE# pin can set the module to airplane mode where RF function is invalid.	
Sleep Mode	The module remains the ability to receive paging message, SMS, voice call and TCP/UDP data from the network normally. In this mode, the power consumption is reduced to a low level.	

For details of the commands, see ***document [2]***.

3.4. Power Saving

3.4.1. Sleep Mode

EC25 series Mini PCIe can reduce its power consumption to a minimum value in sleep mode.

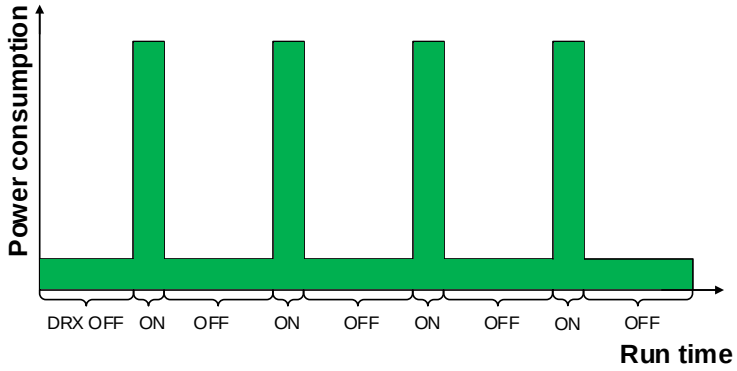


Figure 3: Module Power Consumption in Sleep Mode

NOTE

DRX cycle values are transmitted over the wireless network.

There are three preconditions must be met to set the module to sleep mode.

- Execute **AT+QSCLK=1** to enable sleep mode. For more details, see ***document [2]***.
- Ensure the DTR is kept at high level (internally pulled up by default) 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***.

3.5. Power Supply

The following table shows pin definition of VCC_3V3 pins and ground pins.

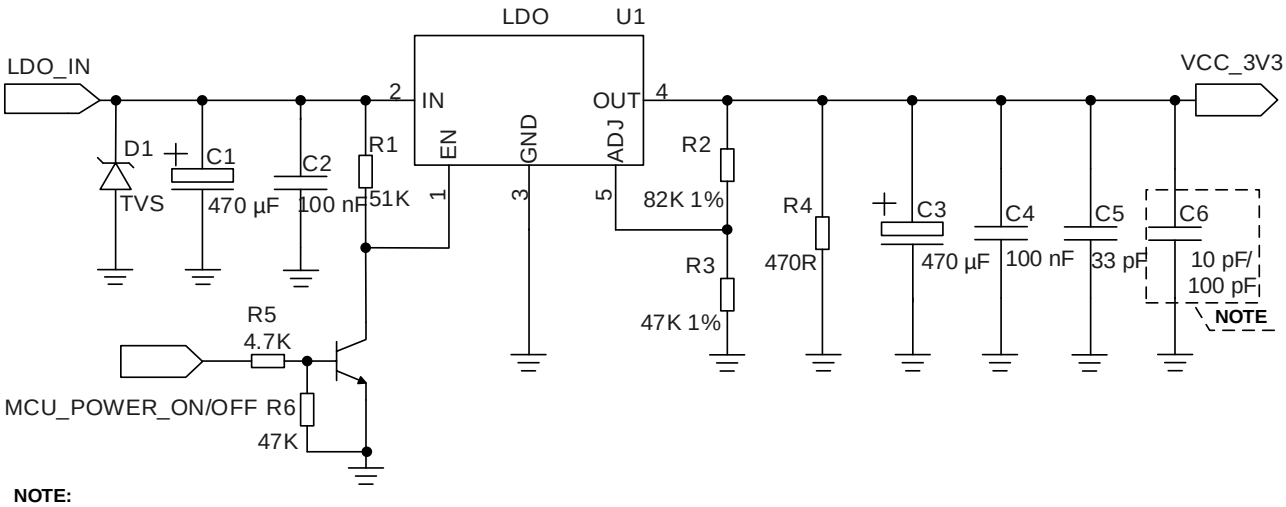
Table 7: Definition of VCC_3V3 and GND Pins

Pin Name	Pin No.	I/O	Description	Comment
VCC_3V3	2, 39, 41, 52	PI	Power supply for the module	Vmin = 3.0 V Vnom = 3.3 V Vmax = 3.6 V

GND	4, 9, 15, 18, 21, 26, 27, 29, 34, 35, 37, 40, 43, 50	-	Ground

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 (C3) of no 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 avoid the antennas as much as possible to prevent EMI interference.

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



NOTE:
For EC25-E/-J/-AU/-AUX/-EU/-EUX/-MX/-EM Mini PCIe, the capacitance of C6 is 10 pF.
For EC25-A/-V/-AF/-AFX/-AFXD/-ADL/-AFDL Mini PCIe, the capacitance of C6 is 100 pF.

Figure 4: 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 8: Pin Definition of (U)SIM Interface

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

EC25 series Mini PCIe supports (U)SIM card hot-plug via the USIM_PRESENCE pin. The function supports low level and high level detections. The function is disabled by default and can be configured via **AT+QSIMDET**. See ***document [2]*** for details about the command.

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

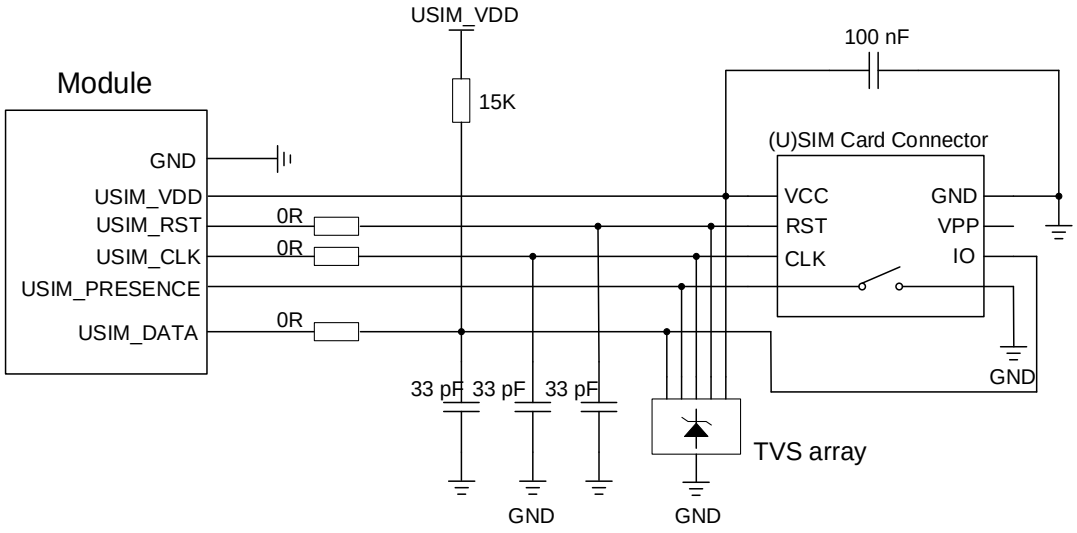


Figure 5: Reference Design of (U)SIM Interface with an 8-pin (U)SIM Card Connector

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

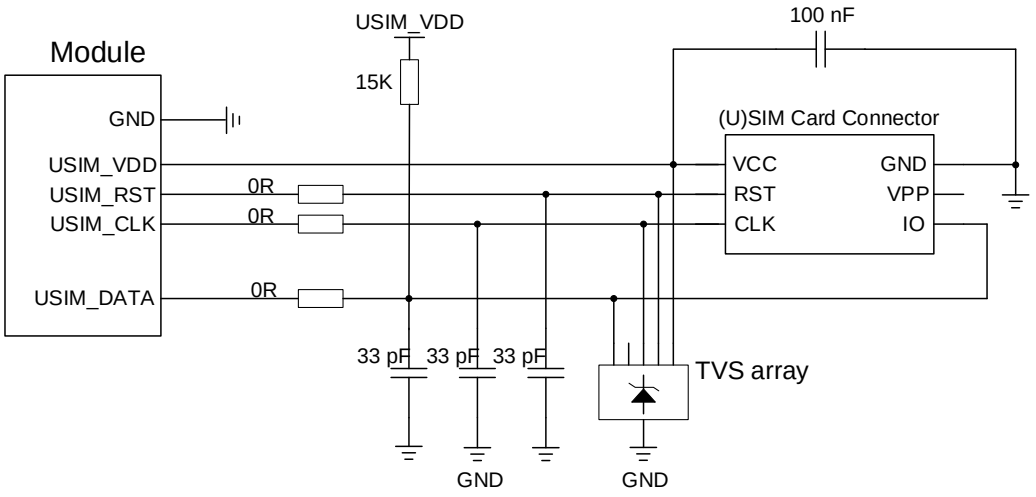


Figure 6: Reference Design of (U)SIM Interface with a 6-pin (U)SIM Card Connector

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

- Place (U)SIM card connector as close as possible to the module with a trace shorter than 200 mm.
- Keep (U)SIM card signal traces 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 surrounded ground.
- For better ESD protection, it is recommended to add a TVS diode with parasitic capacitance not exceeding 15 pF.
- The 0 Ω resistors should be added in series between the module and the (U)SIM card connector to facilitate debugging. The 33 pF capacitors are used for filtering out RF interference. Note that the (U)SIM peripheral circuit should be close to the (U)SIM card connector.
- The pull-up resistor on USIM_DATA trace 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

EC25 series Mini PCIe provides one integrated Universal Serial Bus (USB) interface which complies with USB 2.0 specification. It can only be used as a slave device.

The USB interface supports high-speed (480 Mbps) and full-speed (12 Mbps) modes. It is used for AT command communication, data transmission, firmware upgrade, software debugging, GNSS NMEA output and voice over USB.

The following table shows the pin definition of USB interface.

Table 9: Pin Definition of USB Interface

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

The following figure shows a reference circuit of USB interface.

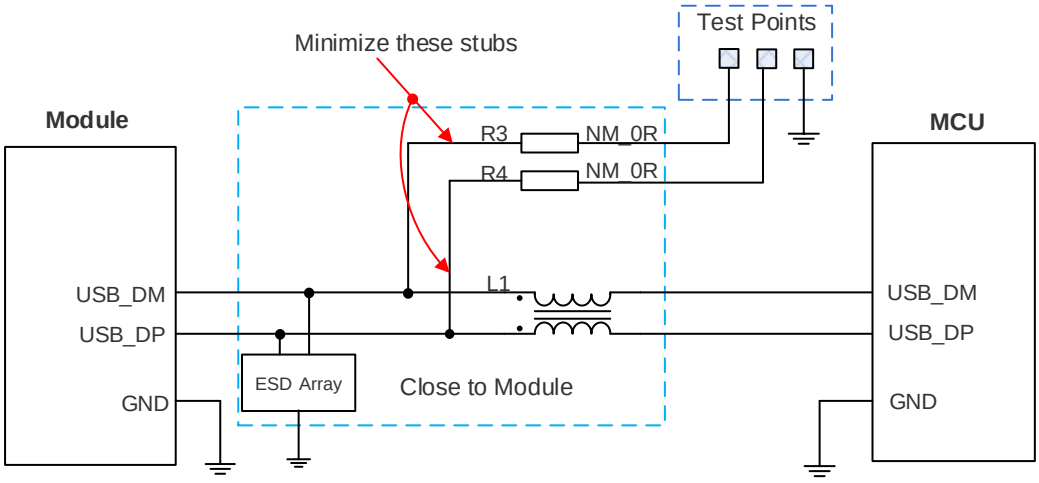


Figure 7: Reference Design of USB Interface

A common mode choke L1 is recommended to be added in series between the module and your MCU 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 to facilitate debugging, and the resistors are not mounted by default. To ensure the integrity of USB data trace signal, L1/R3/R4 components must be placed close to the module, and also these resistors 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 design the USB interface to meet USB 2.0 specification.

- It is important to route the USB signal traces as differential pairs with total grounding. 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, and surround the traces with ground on that layer and with ground planes above and below.
- Pay attention to ESD protection device selection. And the stray capacitance should be less than 2 pF. Keep the ESD protection components to the USB connector as close as possible.

3.8. UART Interfaces

The following table shows the pin definition of the main UART and coexistence UART interfaces.

3.8.1. Main UART Interface

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

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

Table 10: Pin Definition of Main UART Interface

Pin Name	Pin No.	I/O	Description
UART_RX	11	DI	UART receive
UART_TX	13	DO	UART transmit
UART_CTS	23	DI	Clear to send signal from the module
UART_RTS	25	DO	Request to send signal from the module

The power domain of the main UART interface is 3.3 V. Pay attention to the signal direction when connected to the MCU. The reference circuit is as follows.

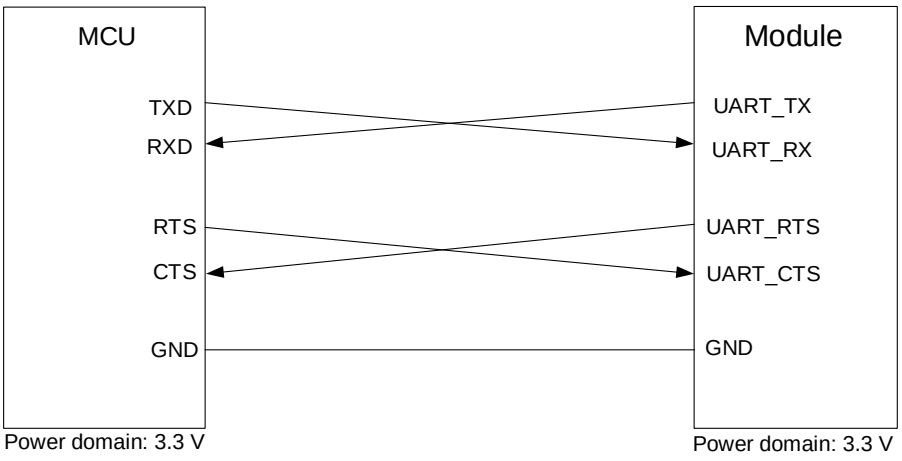


Figure 8: Reference Circuit of Main UART

3.8.2. Coexistence UART Interface

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

Table 11: Pin Definition of Coexistence UART Interface

Pin Name	Pin No.	I/O	Description	Comment
COEX_UART_RX	3	DI	LTE/WLAN & Bluetooth coexistence receive	It is prohibited to be pulled up high before startup.
COEX_UART_TX	5	DO	LTE/WLAN & Bluetooth coexistence transmit	

NOTE

AT+IPR can be used to set the baud rate of the main UART, and **AT+IFC** can be used to set the hardware flow control (hardware flow control is disabled by default). See ***document [2]*** for details.

3.9. PCM and I2C Interfaces

EC25 series Mini PCIe 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.

Table 12: Pin Definition of PCM and I2C Interfaces

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

EC25 series Mini PCIe provides one PCM digital interface, which supports 16-bit linear data format and the following modes:

- Primary mode (short frame synchronization, works as either master or slave)
- Auxiliary mode (long frame synchronization, works as master only)

In primary mode, the data is sampled on the falling edge of the PCM_CLK and transmitted on the rising edge. The PCM_SYNC falling edge represents the MSB. In this mode, the PCM interface supports 256 kHz, 512 kHz, 1024 kHz or 2048 kHz PCM_CLK at 8 kHz PCM_SYNC, and also supports 4096 kHz PCM_CLK at 16 kHz PCM_SYNC. The following figure shows the timing relationship in primary mode with 8 kHz PCM_SYNC and 2048 kHz PCM_CLK.

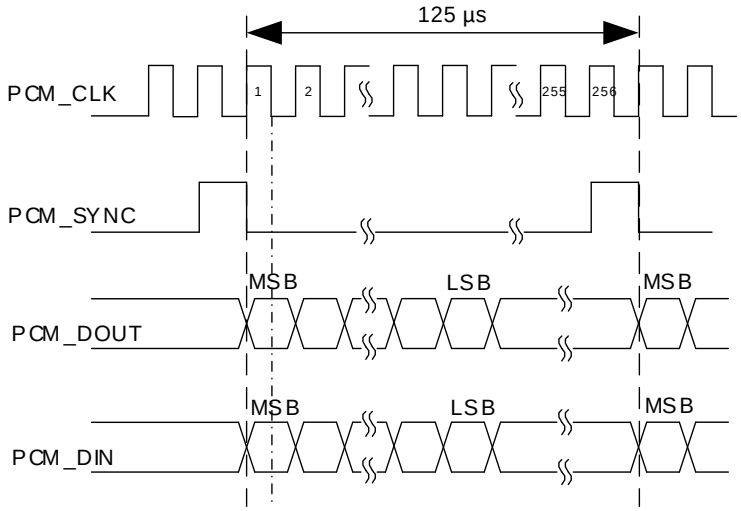


Figure 9: Primary Mode Timing

In auxiliary mode, the data is sampled on the falling edge of the PCM_CLK and transmitted on the rising edge. The PCM_SYNC rising edge represents the MSB. In this mode, the PCM interface operates with a 256 kHz, 512 kHz, 1024 kHz or 2048 kHz PCM_CLK and an 8 kHz, 50 % duty cycle PCM_SYNC. The following figure shows the timing relationship in auxiliary mode with 8 kHz PCM_SYNC and 256 kHz PCM_CLK.

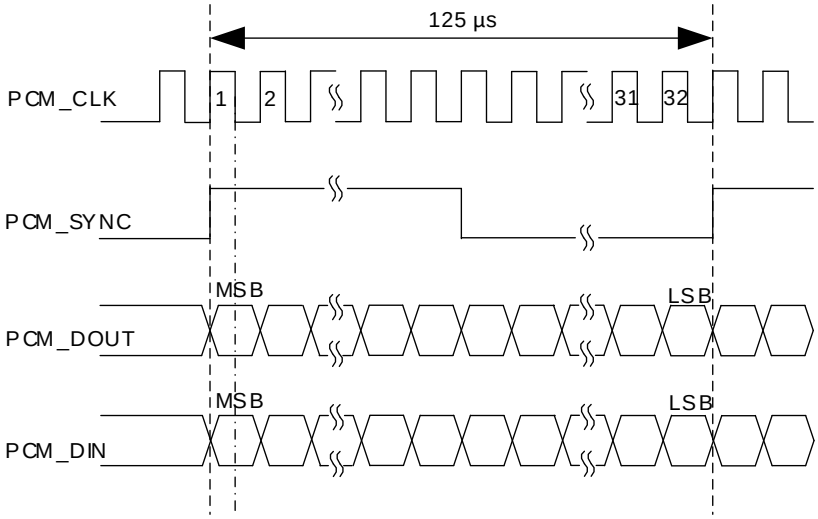


Figure 10: Auxiliary Mode Timing

Clock and mode can be configured by AT command, and the default configuration is master mode using short frame synchronization format with 2048 kHz PCM_CLK and 8 kHz PCM_SYNC. In addition, the module's firmware has integrated the configuration on some PCM codec's application with I2C interface. See ***document [2]*** for details about **AT+QDAI**.

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

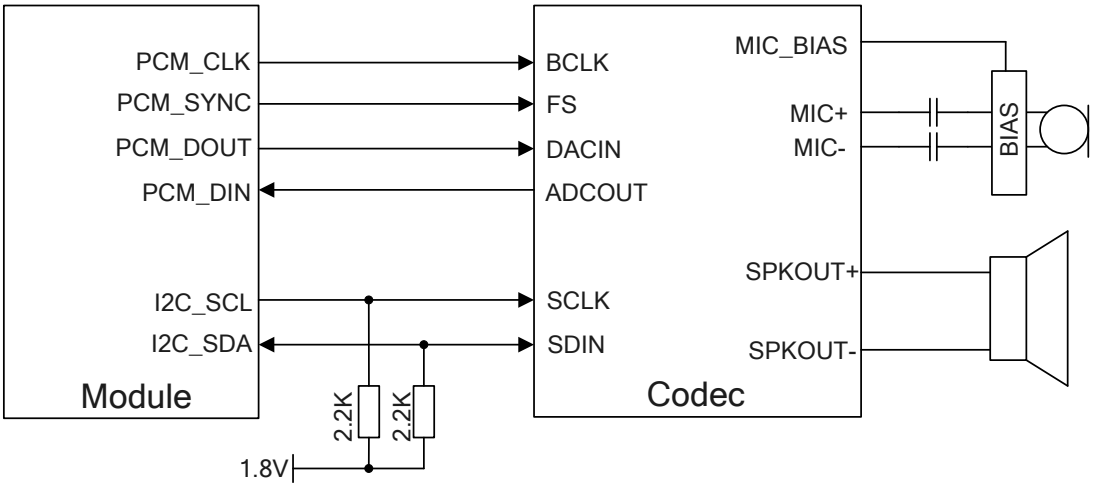


Figure 11: Reference Design of PCM Application with Audio Codec

NOTE

Digital audio (PCM) function is only supported on **Data + Voice** version.

3.10. Control and Indication Signals

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

Table 13: Pin Definition of Control and Indication Signals

Pin Name	Pin No.	I/O	Description	Comment
RI	17	DO	UART ring indication	
DTR	31	DI	Data terminal ready, sleep mode control	Pulled up by default.
W_DISABLE#	20	DI	Airplane mode control	Pulled up by default. Active low.
PERST#	22	DI	Fundamental reset	Pulled up by default. Active low.
LED_WWAN#	42	OC	Indicates the network status of the module	Active low.
WAKE#	1	OC	Wake up the host	

3.10.1. RI

The RI signal can be used to wake up the host. When a URC returns, there will be the following behaviors on the RI pin after executing **AT+QCFG="risignaltype","physical"**. For more details, see ***document [3]***.

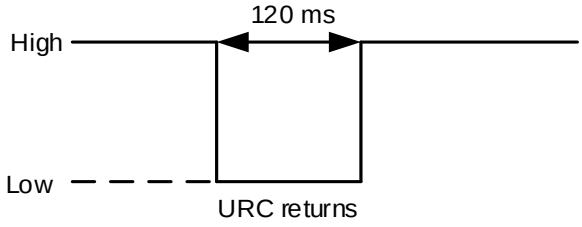


Figure 12: RI Behaviors

3.10.2. DTR

The 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#

EC25 series Mini PCIe provides a W_DISABLE# pin to disable or enable the RF function (excluding GNSS). 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. For more details, see ***document [3]***.

Table 14: 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**. For more details, see ***document [2]***.

Table 15: Airplane Mode Controlled by Software Method

AT+CFUN=?	RF Function Status	Module Operation Mode
0	RF and (U)SIM disabled	Minimum functionality mode
1	RF enabled	Normal operation mode
4	RF disabled	Airplane mode

3.10.4. PERST#

The PERST# pin can be used to force a hardware reset. The module can be reset by driving the PERST# signal low for 150–460 ms and then releasing it. The PERST# 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.

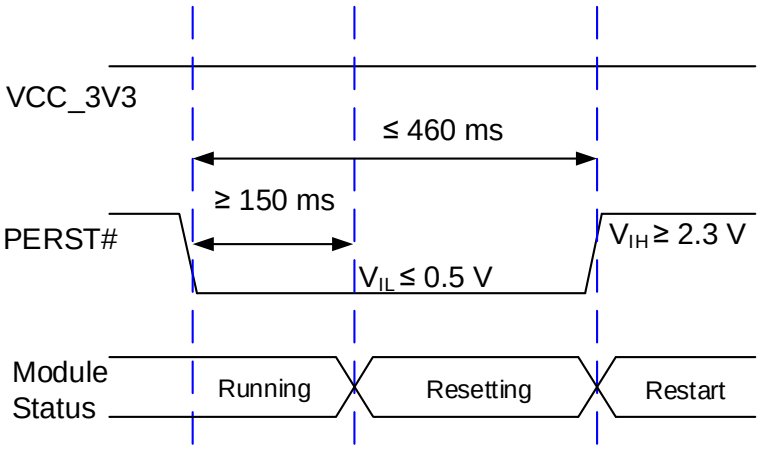


Figure 13: Reset Timing

3.10.5. LED_WWAN#

The LED_WWAN# signal of EC25 series Mini PCIe is used to indicate the network status of the module, and its maximum input current can be up to 40 mA. According to the following circuit, a resistor must be placed in series with the LED to reduce the current of the LED.

The LED is emitting light when the LED_WWAN# output signal is low.

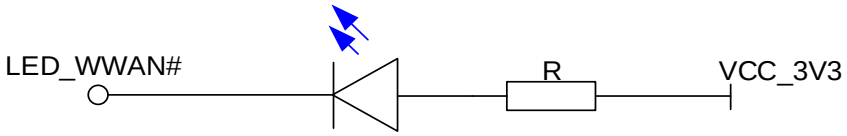


Figure 14: LED_WWAN# Signal Reference Circuit Diagram

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 16: 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 17: Indications of Network Status (AT+QCFG="ledmode",2)

Pin Status	Description
Low Level (LED ON)	Registered on network successfully
High Impedance (LED 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. WAKE#

The WAKE# signal is an open collector signal which is similar to RI signal, but a host pull-up resistor and **AT+QCFG="risignaltype","physical"** are required. When a URC returns, a 120 ms low level pulse will be outputted. The state of WAKE# signal is shown as below.

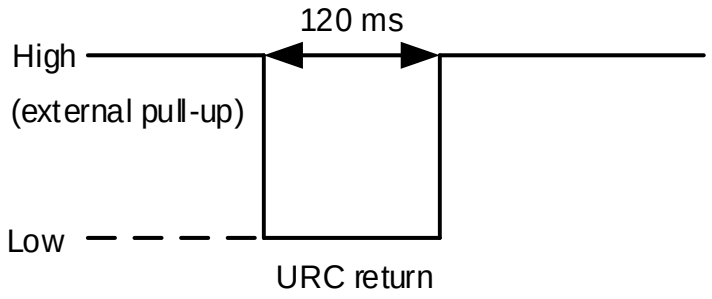


Figure 15: WAKE# Behavior

4 GNSS Receiver

EC25 series Mini PCIe (excluding EC25-MX Mini PCIe) includes a fully integrated global navigation satellite system solution that supports GPS, GLONASS, BDS, Galileo and QZSS. Additionally, it supports standard NMEA 0183 protocol, and outputs NMEA sentences at 1 Hz data update rate via USB interface by default.

The GNSS engine of the module is disabled by default, and can be enabled via AT command. For more details about GNSS engine technology and configurations, see ***document [4]***.

4.1. GNSS Performance

The following table shows the GNSS performance of EC25 series Mini PCIe.

Table 18: GNSS Performance

Parameter	Description	Conditions	Typ.	Unit
Sensitivity	Acquisition	Autonomous	-146	dBm
	Reacquisition	Autonomous	-157	dBm
	Tracking	Autonomous	-157	dBm
TTFF	Cold start @ open sky	Autonomous	35	s
		XTRA enabled	10	s
	Warm start @ open sky	Autonomous	26	s
		XTRA enabled	2.2	s
	Hot start @ open sky	Autonomous	2.5	s
		XTRA enabled	1.8	s
Accuracy	CEP-50	Autonomous @ open sky	2.5	m

NOTE

1. Tracking sensitivity: the minimum GNSS signal power at which the module can maintain lock (keep positioning for at least 3 minutes continuously).
2. Reacquisition sensitivity: the minimum GNSS signal power required for the module to maintain lock within 3 minutes after loss of lock.
3. Acquisition sensitivity: the minimum GNSS signal power at which the module can fix position successfully within 3 minutes after executing cold start command.

4.2. GNSS Frequency

The following table shows the GNSS frequency of EC25 series Mini PCIe.

Table 19: GNSS Frequency

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

5 Antenna Connectors

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.

EC25 series Mini PCIe is mounted with three antenna connectors for external antenna connection: a main antenna connector, an Rx-diversity antenna connector, and a GNSS antenna connector. And Rx-diversity function is enabled by default. The impedance of the antenna ports is 50 Ω.

5.1. Operating Frequency

Table 20: 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
WCDMA B1	1920–1980	2110–2170	MHz
WCDMA B2	1850–1910	1930–1990	MHz
WCDMA B4	1710–1755	2110–2155	MHz
WCDMA B5	824–849	869–894	MHz
WCDMA B6	830–840	875–885	MHz
WCDMA B8	880–915	925–960	MHz
WCDMA B19	830–845	875–890	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 B12	699–716	729–746	MHz
LTE-FDD B13	777–787	746–756	MHz
LTE-FDD B14	788–798	758–768	MHZ
LTE-FDD B18	815–830	860–875	MHz
LTE-FDD B19	830–845	875–890	MHz
LTE-FDD B20	832–862	791–821	MHz
LTE-FDD B26	814–849	859–894	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	2555–2655	2555–2655	MHz
LTE-FDD B66	1710–1780	2110–2180	MHz
LTE-FDD B71	663–698	617–652	MHz

5.2. Antenna Design Requirements

The following table shows the requirements on main antenna, Rx-diversity antenna and GNSS antenna.

Table 21: Antenna Design 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/UMTS/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)

NOTE

1. It is recommended to use a passive GNSS antenna when LTE B13 or B14 is supported, as the use of active antenna may generate harmonics which will affect the GNSS performance.
2. The output voltage of ANT_GNSS is 2.85 V, so it is not recommended to use passive antennas that may cause short-circuit after grounding, such as PIFA antennas.

5.3. RF Connector

EC25 series Mini PCIe is mounted with RF connectors (receptacles) for convenient antenna connection. The dimensions of the antenna connectors are shown as below.

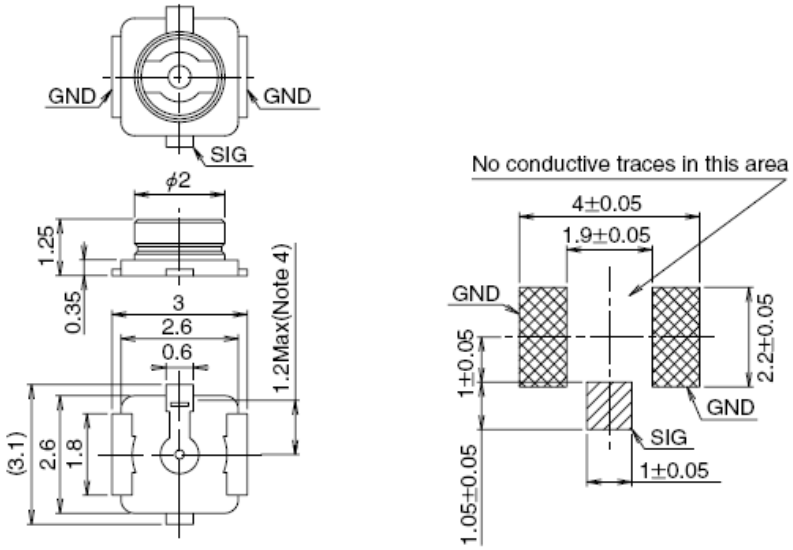


Figure 16: Dimensions of the Receptacle (Unit: mm)

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

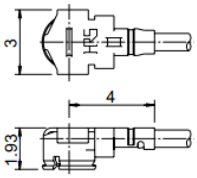
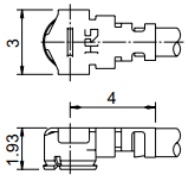
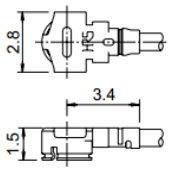
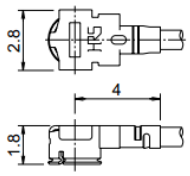
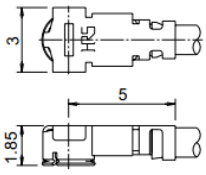
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 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 17: Specification of Mated Plugs

The following figure describes the space factor of mated plugs.

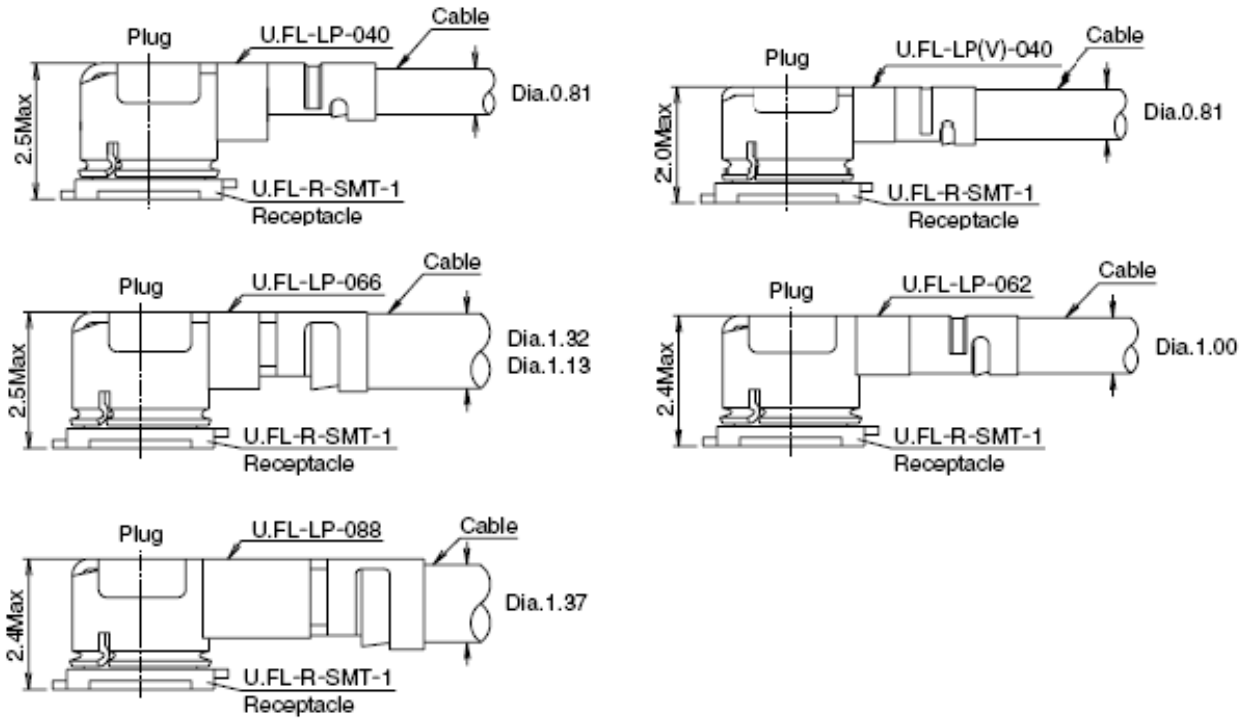


Figure 18: Space Factor of Mated Plugs (Unit: mm)

For more details of the recommended mating plugs, visit http://www.hirose.com.

6 Electrical, Reliability and Radio Characteristics

This chapter mainly describes the following electrical and radio characteristics of EC25 series Mini PCIe:

- Power supply requirements
- Digital I/O characteristics
- RF characteristics
- ESD protection
- Power consumption
- Thermal dissipation

6.1. Power Supply Requirements

The input voltage of EC25 series Mini PCIe is 3.0–3.6 V, as specified by *PCI Express Mini CEM Specifications 1.2*. The following table shows the power supply requirements of EC25 series Mini PCIe.

Table 22: Power Supply Requirements

Parameter	Description	Min.	Typ.	Max.	Unit
VCC_3V3	Power Supply	3.0	3.3	3.6	V

6.2. Digital I/O Characteristics

The following table shows the I/O requirements of EC25 series Mini PCIe.

Table 23:Digital I/O Requirements

Parameter	Description	Min.	Max.	Unit
V_{IH}	High-level input voltage	0.7 × VCC_3V3	VCC_3V3 + 0.3	V
V_{IL}	Low-level input voltage	-0.3	0.3 × VCC_3V3	V
V_{OH}	High-level output voltage	VCC_3V3 - 0.5	VCC_3V3	V
V_{OL}	Low-level output voltage	0	0.4	V

NOTE

1. The PCM and I2C interfaces belong to 1.8 V power domain and other I/O interfaces belong to VCC_3V3 power domain.
2. The maximum voltage value of V_{IL} for PERST# signal and W_DISABLE# signal is 0.5 V.

6.3. Tx Power

The following tables show the conducted RF output power of EC25 series Mini PCIe module.

Table 24: Conducted RF Output Power of EC25 Series Mini PCIe

Frequency Bands	Max. Tx Power	Min. Tx Power
GSM850/EGSM900	33 dBm ±2 dB	5 dBm ±5 dB
DCS1800/PCS1900	30 dBm ±2 dB	0 dBm ±5 dB
GSM850/EGSM900 (8-PSK)	27 dBm ±3 dB	5 dBm ±5 dB
DCS1800/PCS1900 (8-PSK)	26 dBm ±3 dB	0 dBm ±5 dB
WCDMA bands	23 dBm ±2 dB	< -49 dBm
LTE bands	23 dBm ±2 dB	< -39 dBm

NOTE

For GPRS transmission on 4 uplink timeslots, the maximum output power reduction is 4.0 dB. The design conforms to *3GPP TS 51.010-1* ***subclause 13.16.***

6.4. Rx Receiving Sensitivity

6.4.1. EC25-A Mini PCIe Rx Sensitivity

Table 25: Conducted RF Receiving Sensitivity of EC25-A Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B2	-110.0 dBm	-	-	-104.7 dBm
WCDMA B4	-110.0 dBm	-	-	-106.7 dBm
WCDMA B5	-110.5 dBm	-	-	-104.7 dBm
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.0 dBm	-101.0 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.5 dBm	-99.0 dBm	-101.0 dBm	-96.3 dBm
LTE-FDD B12 (10 MHz)	-97.2 dBm	-98.0 dBm	-101.0 dBm	-93.3 dBm

6.4.2. EC25-E Mini PCIe Rx Sensitivity

Table 26: Conducted RF Receiving Sensitivity of EC25-E Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
EGSM900	-109.0 dBm	-	-	-102.0 dBm
DCS1800	-109.0 dBm	-	-	-102.0 dBm
WCDMA B1	-110.5 dBm	-	-	-106.7 dBm
WCDMA B5	-110.5 dBm	-	-	-104.7 dBm
WCDMA B8	-110.5 dBm	-	-	-103.7 dBm
LTE-FDD B1 (10 MHz)	-98.0 dBm	-98.0 dBm	-101.5 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-96.5 dBm	-98.5 dBm	-101.5 dBm	-93.3 dBm

[7] SIMO is a smart antenna technology that uses a single antenna at the transmitter side and two antennas at the receiver side, which can improve Rx performance.

LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.5 dBm	-101.0 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-97.0 dBm	-97.0 dBm	-99.5 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-97.0 dBm	-97.0 dBm	-101.0 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-97.5 dBm	-99.0 dBm	-102.5 dBm	-93.3 dBm
LTE-TDD B38 (10 MHz)	-95.0 dBm	-97.0 dBm	-98.9 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-96.3 dBm	-98.0 dBm	-101.0 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-94.5 dBm	-97.0 dBm	-98.5 dBm	-94.3 dBm

6.4.3. EC25-V Mini PCIe Rx Sensitivity

Table 27: Conducted RF Receiving Sensitivity of EC25-V Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
LTE-FDD B4 (10 MHz)	-97.5 dBm	-99.0 dBm	-101.0 dBm	-96.3 dBm
LTE-FDD B13 (10 MHz)	-97.7 dBm	-97.0 dBm	-100.0 dBm	-93.3 dBm

6.4.4. EC25-J Mini PCIe Rx Sensitivity

Table 28: Conducted RF Receiving Sensitivity of EC25-J Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B1	-110.0 dBm	-	-	-106.7 dBm
WCDMA B6	-110.5 dBm	-	-	-106.7 dBm
WCDMA B8	-110.5 dBm	-	-	-103.7 dBm
WCDMA B19	-110.5 dBm	-	-	-106.7 dBm
LTE-FDD B1 (10 MHz)	-97.5 dBm	-98.7 dBm	-100.2 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-96.5 dBm	-97.1 dBm	-100.5 dBm	-93.3 dBm

LTE-FDD B8 (10 MHz)	-98.4 dBm	-99.0 dBm	-101.2 dBm	-93.3 dBm
LTE-FDD B18 (10 MHz)	-99.5 dBm	-99.0 dBm	-101.7 dBm	-96.3 dBm
LTE-FDD B19 (10 MHz)	-99.2 dBm	-99.0 dBm	-101.4 dBm	-96.3 dBm
LTE-FDD B26 (10 MHz)	-99.5 dBm	-99.0 dBm	-101.5 dBm	-93.8 dBm
LTE-TDD B41 (10 MHz)	-95.0 dBm	-95.7 dBm	-99.0 dBm	-94.3 dBm

6.4.5. EC25-AU Mini PCIe Rx Sensitivity

Table 29: Conducted RF Receiving Sensitivity of EC25-AU Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
GSM850	-109.0 dBm	-	-	-102.0 dBm
EGSM900	-109.0 dBm	-	-	-102.0 dBm
DCS1800	-109.0 dBm	-	-	-102.0 dBm
PCS1900	-109.0 dBm	-	-	-102.0 dBm
WCDMA B1	-110.0 dBm	-109 dBm	-112 dBm	-106.7 dBm
WCDMA B2	-110.0 dBm	-	-	-104.7 dBm
WCDMA B5	-111.0 dBm	-112 dBm	-113 dBm	-104.7 dBm
WCDMA B8	-111.0 dBm	-111 dBm	-113 dBm	-103.7 dBm
LTE-FDD B1 (10 MHz)	-97.2 dBm	-97.5 dBm	-100.2 dBm	-96.3 dBm
LTE-FDD B2 (10 MHz)	-98.2 dBm	-	-	-94.3 dBm
LTE-FDD B3 (10 MHz)	-98.7 dBm	-98.6 dBm	-102.2 dBm	-93.3 dBm
LTE-FDD B4 (10 MHz)	-97.7 dBm	-97.4 dBm	-100.2 dBm	-96.3 dBm
LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.2 dBm	-101.0 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-97.7 dBm	-97.7 dBm	-101.2 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-99.2 dBm	-98.2 dBm	-102.2 dBm	-93.3 dBm

LTE-FDD B28 (10 MHz)	-98.6 dBm	-98.7 dBm	-102.0 dBm	-94.8 dBm
LTE-TDD B40 (10 MHz)	-97.2 dBm	-98.4 dBm	-101.2 dBm	-96.3 dBm

6.4.6. EC25-AUX Mini PCIe Rx Sensitivity

Table 30: Conducted RF Receiving Sensitivity of EC25-AUX Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
GSM850	-109.0 dBm	-	-	-102.0 dBm
EGSM900	-109.0 dBm	-	-	-102.0 dBm
DCS1800	-109.0 dBm	-	-	-102.0 dBm
PCS1900	-109.0 dBm	-	-	-102.0 dBm
WCDMA B1	-110.0 dBm	-109.5 dBm	-112 dBm	-106.7 dBm
WCDMA B2	-110.5 dBm	-	-	-104.7 dBm
WCDMA B4	-110.0 dBm	-110 dBm	-112 dBm	-104.7 dBm
WCDMA B5	-111.0 dBm	-112 dBm	-113 dBm	-104.7 dBm
WCDMA B8	-111.0 dBm	-112 dBm	-113 dBm	-103.7 dBm
LTE-FDD B1 (10 MHz)	-98.0 dBm	-97.7 dBm	-101.2 dBm	-96.3 dBm
LTE-FDD B2 (10 MHz)	-98.5 dBm	-	-	-94.3 dBm
LTE-FDD B3 (10 MHz)	-99.0 dBm	-98.8 dBm	-102.2 dBm	-93.3 dBm
LTE-FDD B4 (10 MHz)	-97.7 dBm	-97.6 dBm	-100.2 dBm	-96.3 dBm
LTE-FDD B5 (10 MHz)	-98.5 dBm	-98.2 dBm	-101.0 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-97.7 dBm	-97.7 dBm	-101.2 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-99.0 dBm	-98.5 dBm	-102.2 dBm	-93.3 dBm
LTE-FDD B28 (10 MHz)	-98.0 dBm	-98.7 dBm	-101.5 dBm	-94.8 dBm
LTE-TDD B40 (10 MHz)	-97.5 dBm	-98.2 dBm	-101.2 dBm	-96.3 dBm

6.4.7. EC25-AF Mini PCIe Rx Sensitivity

Table 31: Conducted RF Receiving Sensitivity of EC25-AF Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B2	-109.5 dBm	-110 dBm	-110.4 dBm	-104.7 dBm
WCDMA B4	-109.6 dBm	-110 dBm	-110.6 dBm	-106.7 dBm
WCDMA B5	-110.5 dBm	-110 dBm	-110.7 dBm	-104.7 dBm
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.5 dBm	-98.2 dBm	-99.5 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B12 (10 MHz)	-99.0 dBm	-99.5 dBm	-100.5 dBm	-93.3 dBm
LTE-FDD B13 (10 MHz)	-98.5 dBm	-99.5 dBm	-100.7 dBm	-93.3 dBm
LTE-FDD B14 (10 MHz)	-99.4 dBm	-99.5 dBm	-100.9 dBm	-93.3 dBm
LTE-FDD B66 (10 MHz)	-97.5 dBm	-98.5 dBm	-99.6 dBm	-95.8 dBm
LTE-FDD B71 (10 MHz)	-98.6 dBm	-99.5 dBm	-100 dBm	-93.5 dBm

6.4.8. EC25-AFX Mini PCIe Rx Sensitivity

Table 32: Conducted RF Receiving Sensitivity of EC25-AFX Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B2	-109.6 dBm	-110 dBm	-110.4 dBm	-104.7 dBm
WCDMA B4	-109.6 dBm	-110 dBm	-110.6 dBm	-106.7 dBm
WCDMA B5	-110.5 dBm	-110 dBm	-110.7 dBm	-104.7 dBm
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm

LTE-FDD B4 (10 MHz)	-97.6 dBm	-98.2 dBm	-99.5 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B12 (10 MHz)	-99.0 dBm	-99.5 dBm	-100.5 dBm	-93.3 dBm
LTE-FDD B13 (10 MHz)	-98.5 dBm	-99.7 dBm	-100.8 dBm	-93.3 dBm
LTE-FDD B14 (10 MHz)	-99.4 dBm	-99.5 dBm	-100.9 dBm	-93.3 dBm
LTE-FDD B66 (10 MHz)	-97.5 dBm	-98.5 dBm	-99.6 dBm	-95.8 dBm
LTE-FDD B71 (10 MHz)	-98.8 dBm	-99.7 dBm	-100.5 dBm	-93.5 dBm

6.4.9. EC25-AFXD Mini PCIe Rx Sensitivity

Table 33: Conducted RF Receiving Sensitivity of EC25-AFXD Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B2	-109.6 dBm	-110 dBm	-110.4 dBm	-104.7 dBm
WCDMA B4	-109.6 dBm	-110 dBm	-110.6 dBm	-106.7 dBm
WCDMA B5	-110.5 dBm	-110 dBm	-110.7 dBm	-104.7 dBm
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.6 dBm	-98.2 dBm	-99.5 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B12 (10 MHz)	-99.0 dBm	-99.5 dBm	-100.5 dBm	-93.3 dBm
LTE-FDD B13 (10 MHz)	-98.5 dBm	-99.7 dBm	-100.8 dBm	-93.3 dBm
LTE-FDD B14 (10 MHz)	-99.4 dBm	-99.5 dBm	-100.9 dBm	-93.3 dBm
LTE-FDD B66 (10 MHz)	-97.5 dBm	-98.5 dBm	-99.6 dBm	-95.8 dBm
LTE-FDD B71 (10 MHz)	-98.8 dBm	-99.7 dBm	-100.5 dBm	-93.5 dBm

6.4.10. EC25-EU Mini PCIe Rx Sensitivity

Table 34: Conducted RF Receiving Sensitivity of EC25-EU Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
EGSM900	-108 dBm	-	-	-102.0 dBm
DCS1800	-108.6 dBm	-	-	-102.0 dBm
WCDMA B1	-110 dBm	-109 dBm	-	-106.7 dBm
WCDMA B8	-110 dBm	-111 dBm	-	-103.7 dBm
LTE-FDD B1 (10 MHz)	-98.2 dBm	-99.0 dBm	-101.2 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-97.7 dBm	-99.8 dBm	-101.0 dBm	-93.3 dBm
LTE-FDD B7 (10 MHz)	-96.7 dBm	-98.5 dBm	-100.2 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-98.2 dBm	-100.4 dBm	-101.7 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-98.2 dBm	-100.8 dBm	-101.7 dBm	-93.3 dBm
LTE-FDD B28A (10 MHz)	-98.2 dBm	-100.5 dBm	-101.7 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-95 dBm	-97.0 dBm	-99.7 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-95.9 dBm	-98.0 dBm	-100.2 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-94.8 dBm	-97.0 dBm	-99.7 dBm	-94.3 dBm

6.4.11. EC25-EUX Mini PCIe Rx Sensitivity

Table 35: Conducted RF Receiving Sensitivity of EC25-EUX Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
EGSM900	-109.0 dBm	-	-	-102.0 dBm
DCS1800	-109.0 dBm	-	-	-102.0 dBm

WCDMA B1	-110.0 dBm	-110.5 dBm	-111.0 dBm	-106.7 dBm
WCDMA B8	-110.0 dBm	-110.5 dBm	-111.0 dBm	-103.7 dBm
LTE-FDD B1 (10 MHz)	-98.0 dBm	-98.0 dBm	-101.0 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-97.5 dBm	-98.5 dBm	-100.5 dBm	-93.3 dBm
LTE-FDD B7 (10 MHz)	-97.0 dBm	-97.0 dBm	-99.5 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-98.0 dBm	-98.0 dBm	-101.0 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-98.0 dBm	-99.0 dBm	-101.0 dBm	-93.3 dBm
LTE-FDD B28A (10 MHz)	-98.6 dBm	-98.0 dBm	-101.0 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-95.0 dBm	-97.0 dBm	-98.5 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-95.5 dBm	-98.0 dBm	-99.0 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-94.3 dBm	-95.5 dBm	-98.0 dBm	-94.3 dBm

NOTE

The above RF Receiving sensitivity of EC25-EUX Mini PCIe is for reference only. For more details, contact Quectel Technical Support.

6.4.12. EC25-MX Mini PCIe Rx Sensitivity

Table 36: Conducted RF Receiving Sensitivity of EC25-MX Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
WCDMA B2	-110 dBm	-110 dBm	-	-104.7 dBm
WCDMA B4	-109.5 dBm	-110 dBm	-	-106.7 dBm
WCDMA B5	-110 dBm	-110 dBm	-	-104.7 dBm
LTE-FDD B2 (10 MHz)	-98.2 dBm	-99.1 dBm	-101.5 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.2 dBm	-98.2 dBm	-101.2 dBm	-96.3 dBm
LTE-FDD B5 (10 MHz)	-98.2 dBm	-99.2 dBm	-102.2 dBm	-94.3 dBm

LTE-FDD B7 (10 MHz)	-95.7 dBm	-98.5 dBm	-100.2 dBm	-94.3 dBm
LTE-FDD B28 (10 MHz)	-97.2 dBm	-99.3 dBm	-101.7 dBm	-94.8 dBm
LTE-FDD B66 (10 MHz)	-97.2 dBm	-98.4 dBm	-101.2 dBm	-95.8 dBm

6.4.13. EC25-EM Mini PCIe Rx Sensitivity

Table 37: Conducted RF Receiving Sensitivity of EC25-EM Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
EGSM900	-109.0 dBm	-	-	-102.0 dBm
DCS1800	-109.0 dBm	-	-	-102.0 dBm
WCDMA B1	-109.3 dBm	-109.7 dBm	-	-106.7 dBm
WCDMA B5	-110.0 dBm	-110.0 dBm	-	-104.7 dBm
WCDMA B8	-110.0 dBm	-110.0 dBm	-	-103.7 dBm
LTE-FDD B1 (10 MHz)	-97.5 dBm	-98.3 dBm	-100.4 dBm	-96.3 dBm
LTE-FDD B3 (10 MHz)	-98.3 dBm	-98.3 dBm	-101.2 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.9 dBm	-99.0 dBm	-101.9 dBm	-94.3 dBm
LTE-FDD B7 (10 MHz)	-96.0 dBm	-96.3 dBm	-98.4 dBm	-94.3 dBm
LTE-FDD B8 (10 MHz)	-99.0 dBm	-98.3 dBm	-101.7 dBm	-93.3 dBm
LTE-FDD B20 (10 MHz)	-97.9 dBm	-99.2 dBm	-101.6 dBm	-93.3 dBm
LTE-FDD B28 (10 MHz)	-99.0 dBm	-99.0 dBm	-102.0 dBm	-94.8 dBm
LTE-TDD B38 (10 MHz)	-98.0 dBm	-97.5 dBm	-100.1 dBm	-96.3 dBm
LTE-TDD B40 (10 MHz)	-98.0 dBm	-97.5 dBm	-101.0 dBm	-96.3 dBm
LTE-TDD B41 (10 MHz)	-97.8 dBm	-95.7 dBm	-99.5 dBm	-94.3 dBm

6.4.14. EC25-ADL Mini PCIe Rx Sensitivity

Table 38: Conducted RF Receiving Sensitivity of EC25-ADL Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.0 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.0 dBm	-98.0 dBm	-100.5 dBm	-96.3 dBm
LTE-FDD B12 (10 MHz)	-97.7 dBm	-98.0 dBm	-100.5 dBm	-93.3 dBm

6.4.15. EC25-AFDL Mini PCIe Rx Sensitivity

Table 39: Conducted RF Receiving Sensitivity of EC25-AFDL Mini PCIe

Frequency Bands	Receiving Sensitivity (Typ.)			3GPP (SIMO)
	Primary	Diversity	SIMO [7]	
LTE-FDD B2 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B4 (10 MHz)	-97.6 dBm	-98.2 dBm	-99.5 dBm	-93.3 dBm
LTE-FDD B5 (10 MHz)	-98.0 dBm	-98.5 dBm	-100.5 dBm	-94.3 dBm
LTE-FDD B12 (10 MHz)	-99.0 dBm	-99.5 dBm	-100.5 dBm	-93.3 dBm
LTE-FDD B13 (10 MHz)	-98.5 dBm	-99.7 dBm	-100.8 dBm	-93.3 dBm
LTE-FDD B14 (10 MHz)	-99.4 dBm	-99.5 dBm	-100.9 dBm	-93.3 dBm
LTE-FDD B66 (10 MHz)	-97.5 dBm	-98.5 dBm	-99.6 dBm	-95.8 dBm
LTE-FDD B71 (10 MHz)	-98.8 dBm	-99.7 dBm	-100.5 dBm	-93.5 dBm

6.5. 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 40: 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
USB Interface	±4	±8	kV
(U)SIM Interface	±4	±8	kV
Others	±0.5	±1	kV

6.6. Power Consumption

6.6.1. EC25-A Mini PCIe Power Consumption

Table 41: Power Consumption of EC25-A Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	3.6	mA
	WCDMA PF = 64 (USB disconnected)	4.4	mA
	WCDMA PF = 128 (USB disconnected)	3.8	mA
	LTE-FDD PF = 64 (USB disconnected)	5.9	mA
	LTE-FDD PF = 128 (USB disconnected)	4.8	mA
Idle state	WCDMA PF = 64 (USB disconnected)	27.0	mA
	WCDMA PF = 64 (USB connected)	40.0	mA
	LTE-FDD PF = 64 (USB disconnected)	43.0	mA
	LTE-FDD PF = 64 (USB connected)	59.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B2 HSDPA @ 22.63 dBm	764.0	mA
	WCDMA B2 HSUPA @ 23.19 dBm	741.0	mA

	WCDMA B4 HSDPA @ 22.45 dBm	745.0	mA
	WCDMA B4 HSUPA @ 22.57 dBm	752.0	mA
	WCDMA B5 HSDPA @ 22.49 dBm	616.0	mA
	WCDMA B5 HSUPA @ 22.43 dBm	637.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 22.92 dBm	977.0	mA
	LTE-FDD B4 @ 23.42 dBm	1094.0	mA
	LTE-FDD B12 @ 23.39 dBm	847.0	mA
WCDMA voice call	WCDMA B2 @ 23.59 dBm	861.0	mA
	WCDMA B4 @ 23.47 dBm	812.0	mA
	WCDMA B5 @ 23.46 dBm	683.0	mA

6.6.2. EC25-E Mini PCIe Power Consumption

Table 42: Power Consumption of EC25-E Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	3.9	mA
	EGSM900 DRX = 2 (USB disconnected)	5.1	mA
	EGSM900 DRX = 9 (USB disconnected)	4.3	mA
	WCDMA PF = 64 (USB disconnected)	5.5	mA
	WCDMA PF = 128 (USB disconnected)	4.8	mA
	LTE-FDD PF = 64 (USB disconnected)	5.8	mA
	LTE-FDD PF = 128 (USB disconnected)	5.0	mA
	LTE-TDD PF = 64 (USB disconnected)	5.8	mA
	LTE-TDD PF = 128 (USB disconnected)	4.9	mA
Idle state	EGSM900 DRX = 5 (USB disconnected)	30.0	mA
	EGSM900 DRX = 5 (USB connected)	43.0	mA

	WCDMA PF = 64 (USB disconnected)	31.0	mA
	WCDMA PF = 64 (USB connected)	45.0	mA
	LTE-FDD PF = 64 (USB disconnected)	31.0	mA
	LTE-FDD PF = 64 (USB connected)	44.0	mA
	LTE-TDD PF = 64 (USB disconnected)	32.0	mA
	LTE-TDD PF = 64 (USB connected)	44.0	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 33.08 dBm	372.0	mA
	EGSM900 3DL/2UL @ 31.03 dBm	626.0	mA
	EGSM900 2DL/3UL @ 29.86 dBm	706.0	mA
	EGSM900 1DL/4UL @ 29.44 dBm	767.0	mA
	DCS1800 4DL/1UL @ 30.39 dBm	262.0	mA
	DCS1800 3DL/2UL @ 30.19 dBm	417.0	mA
	DCS1800 2DL/3UL @ 30.02 dBm	564.0	mA
	DCS1800 1DL/4UL @ 29.86 dBm	709.0	mA
EDGE data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 27.59 dBm	233.0	mA
	EGSM900 3DL/2UL @ 27.45 dBm	370.0	mA
	EGSM900 2DL/3UL @ 27.31 dBm	500.0	mA
	EGSM900 1DL/4UL @ 27.14 dBm	623.0	mA
	DCS1800 4DL/1UL @ 26.24 dBm	224.0	mA
	DCS1800 3DL/2UL @ 26.13 dBm	334.0	mA
	DCS1800 2DL/3UL @ 25.97 dBm	440.0	mA
	DCS1800 1DL/4UL @ 25.82 dBm	553.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 22.49 dBm	798.0	mA
	WCDMA B1 HSUPA @ 21.87 dBm	788.0	mA
	WCDMA B5 HSDPA @ 22.66 dBm	781.0	mA

	WCDMA B5 HSUPA @ 21.99 dBm	770.0	mA
	WCDMA B8 HSDPA @ 22.23 dBm	655.0	mA
	WCDMA B8 HSUPA @ 21.68 dBm	659.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.12 dBm	940.0	mA
	LTE-FDD B3 @ 22.75 dBm	989.0	mA
	LTE-FDD B5 @ 22.92 dBm	962.0	mA
	LTE-FDD B7 @ 23.42 dBm	1188.0	mA
	LTE-FDD B8 @ 22.97 dBm	911.0	mA
	LTE-FDD B20 @ 22.51 dBm	946.0	mA
	LTE-TDD B38 @ 22.58 dBm	686.0	mA
	LTE-TDD B40 @ 22.31 dBm	576.0	mA
	LTE-TDD B41 @ 22.03 dBm	611.0	mA
GSM voice call	EGSM900 PCL = 5 @ 33.31 dBm	367.0	mA
	DCS1800 PCL = 0 @ 29.48 dBm	248.0	mA
WCDMA voice call	WCDMA B1 @ 23.18 dBm	868.0	mA
	WCDMA B5 @ 22.62 dBm	808.0	mA
	WCDMA B8 @ 23.02 dBm	728.0	mA

6.6.3. EC25-V Mini PCIe Power Consumption

Table 43: Power Consumption of EC25-V Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	3.4	mA
	LTE-FDD PF = 64 (USB disconnected)	4.8	mA
	LTE-FDD PF = 128 (USB disconnected)	4.3	mA
Idle state	LTE-FDD PF = 64 (USB disconnected)	30.0	mA

	LTE-FDD PF = 64 (USB connected)	42.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B4 @ 23.3 dBm	873.0	mA
	LTE-FDD B13 @ 22.13 dBm	638.0	mA

6.6.4. EC25-J Mini PCIe Power Consumption

Table 44: Power Consumption of EC25-J Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	3.2	mA
	WCDMA PF = 64 (USB disconnected)	4.3	mA
	WCDMA PF = 128 (USB disconnected)	3.8	mA
	LTE-FDD PF = 64 (USB disconnected)	5.0	mA
	LTE-FDD PF = 128 (USB disconnected)	4.4	mA
	LTE-TDD PF = 64 (USB disconnected)	5.1	mA
	LTE-TDD PF = 128 (USB disconnected)	4.4	mA
Idle state	WCDMA PF = 64 (USB disconnected)	31.5	mA
	WCDMA PF = 64 (USB connected)	43.5	mA
	LTE-FDD PF = 64 (USB disconnected)	32.3	mA
	LTE-FDD PF = 64 (USB connected)	45.4	mA
	LTE-TDD PF = 64 (USB disconnected)	32.3	mA
	LTE-TDD PF = 64 (USB connected)	43.3	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 22.55 dBm	829.0	mA
	WCDMA B1 HSUPA @ 22.25 dBm	848.2	mA
	WCDMA B6 HSDPA @ 22.79 dBm	649.2	mA
	WCDMA B6 HSUPA @ 22.59 dBm	661.4	mA
	WCDMA B8 HSDPA @ 22.71 dBm	691.0	mA

	WCDMA B8 HSUPA @ 22.63 dBm	700.0	mA
	WCDMA B19 HSDPA @ 22.77 dBm	644.2	mA
	WCDMA B19 HSUPA @ 22.53 dBm	657.6	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.15 dBm	1045.0	mA
	LTE-FDD B3 @ 23.29 dBm	1070.0	mA
	LTE-FDD B8 @ 23.29 dBm	867.3	mA
	LTE-FDD B18 @ 23.82 dBm	947.7	mA
	LTE-FDD B19 @ 23.78 dBm	955.1	mA
	LTE-FDD B26 @ 23.22 dBm	924.9	mA
	LTE-TDD B41 @ 22.95 dBm	609.6	mA
WCDMA voice call	WCDMA B1 @ 23.39 dBm	969.6	mA
	WCDMA B6 @ 23.36 dBm	692.3	mA
	WCDMA B8 @ 23.54 dBm	763.9	mA
	WCDMA B19 @ 23.29 dBm	682.1	mA

6.6.5. EC25-AU Mini PCIe Power Consumption

Table 45: Power Consumption of EC25-AU Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	2.6	mA
	GSM850 DRX = 2 (USB disconnected)	4.3	mA
	GSM850 DRX = 9 (USB disconnected)	3.1	mA
	WCDMA PF = 64 (USB disconnected)	3.8	mA
	WCDMA PF = 128 (USB disconnected)	3.3	mA
	LTE-FDD PF = 64 (USB disconnected)	4.2	mA
	LTE-FDD PF = 128 (USB disconnected)	3.5	mA

	LTE-TDD PF = 64 (USB disconnected)	4.5	mA
	LTE-TDD PF = 128 (USB disconnected)	3.7	mA
Idle state	GSM850 DRX = 5 (USB disconnected)	22.0	mA
	GSM850 DRX = 5 (USB connected)	34.0	mA
	WCDMA PF = 64 (USB disconnected)	22.0	mA
	WCDMA PF = 64 (USB connected)	33.0	mA
	LTE-FDD PF = 64 (USB disconnected)	29.0	mA
	LTE-FDD PF = 64 (USB connected)	42.0	mA
	LTE-TDD PF = 64 (USB disconnected)	30.0	mA
	LTE-TDD PF = 64 (USB connected)	42.0	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 33.10 dBm	385.0	mA
	EGSM900 3DL/2UL @ 32.93 dBm	631.0	mA
	EGSM900 2DL/3UL @ 31.15 dBm	730.0	mA
	EGSM900 1DL/4UL @ 29.94 dBm	830.0	mA
	DCS1800 4DL/1UL @ 30.35 dBm	255.0	mA
	DCS1800 3DL/2UL @ 30.25 dBm	392.0	mA
	DCS1800 2DL/3UL @ 30.18 dBm	527.0	mA
	DCS1800 1DL/4UL @ 29.93 dBm	667.0	mA
	GSM850 1UL/4DL @ 32.53 dBm	232.0	mA
	GSM850 2UL/3DL @ 32.34 dBm	384.0	mA
	GSM850 3UL/2DL @ 30.28 dBm	441.0	mA
	GSM850 4UL/1DL @ 29.09 dBm	511.0	mA
	PCS1900 1UL/4DL @ 29.61 dBm	174.0	mA
	PCS1900 2UL/3DL @ 29.48 dBm	273.0	mA
	PCS1900 3UL/2DL @ 29.32 dBm	367.0	mA

	PCS1900 4UL/1DL @ 29.19 dBm	465.0	mA
EDGE data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 27.54 dBm	264.0	mA
	EGSM900 3DL/2UL @ 27.38 dBm	368.0	mA
	EGSM900 2DL/3UL @ 27.27 dBm	498.0	mA
	EGSM900 1DL/4UL @ 27.17 dBm	634.0	mA
	DCS1800 4DL/1UL @ 27.64 dBm	223.0	mA
	DCS1800 3DL/2UL @ 27.45 dBm	333.0	mA
	DCS1800 2DL/3UL @ 27.34 dBm	449.0	mA
	DCS1800 1DL/4UL @ 27.29 dBm	573.0	mA
	GSM850 1UL/4DL @ 27.09 dBm	154.0	mA
	GSM850 2UL/3DL @ 26.94 dBm	245.0	mA
	GSM850 3UL/2DL @ 26.64 dBm	328.0	mA
	GSM850 4UL/1DL @ 26.53 dBm	416.0	mA
	PCS1900 1UL/4DL @ 25.65 dBm	148.0	mA
	PCS1900 2UL/3DL @ 25.63 dBm	232.0	mA
	PCS1900 3UL/2DL @ 25.54 dBm	313.0	mA
	PCS1900 4UL/1DL @ 25.26 dBm	401.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 22.45 dBm	815.0	mA
	WCDMA B1 HSUPA @ 21.75 dBm	804.0	mA
	WCDMA B2 HSDPA @ 22.51 dBm	610.0	mA
	WCDMA B2 HSUPA @ 22. 14 dBm	594.0	mA
	WCDMA B5 HSDPA @ 22.41 dBm	755.0	mA
	WCDMA B5 HSUPA @ 22.13 dBm	775.0	mA
	WCDMA B8 HSDPA @ 21.34 dBm	619.0	mA
	WCDMA B8 HSUPA @ 21.07 dBm	634.0	mA

LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.28 dBm	817.0	mA
	LTE-FDD B2 @ 23.34 dBm	803.0	mA
	LTE-FDD B3 @ 23.2 dBm	785.0	mA
	LTE-FDD B4 @ 22.9 dBm	774.0	mA
	LTE-FDD B5 @ 23.45 dBm	687.0	mA
	LTE-FDD B7 @ 22.84 dBm	843.0	mA
	LTE-FDD B8 @ 22.92 dBm	689.0	mA
	LTE-FDD B28 @ 23.23 dBm	804.0	mA
	LTE-TDD B40 @ 23.3 dBm	429.0	mA
GSM voice call	GSM850 PCL5 @ 32.66 dBm	228.0	mA
	EGSM900 PCL5 @ 32.59 dBm	235.0	mA
	DCS1800 PCL0 @ 29.72 dBm	178.0	mA
	PCS1900 PCL0 @ 29.82 dBm	170.0	mA
WCDMA voice call	WCDMA B1 @ 23.27 dBm	687.0	mA
	WCDMA B2 @ 23.38 dBm	668.0	mA
	WCDMA B5 @ 23.38 dBm	592.0	mA
	WCDMA B8 @ 23.32 dBm	595.0	mA

6.6.6. EC25-AUX Mini PCIe Power Consumption

Table 46: Power Consumption of EC25-AUX Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	1.9	mA
	GSM850 DRX = 2 (USB disconnected)	2.9	mA
	GSM850 DRX = 9 (USB disconnected)	2.4	mA
	WCDMA PF = 64 (USB disconnected)	3.8	mA

	WCDMA PF = 128 (USB disconnected)	3.4	mA
	LTE-FDD PF = 64 (USB disconnected)	4.5	mA
	LTE-FDD PF = 128 (USB disconnected)	3.9	mA
	LTE-TDD PF = 64 (USB disconnected)	4.5	mA
	LTE-TDD PF = 128 (USB disconnected)	3.7	mA
Idle state	GSM850 DRX = 5 (USB disconnected)	23.4	mA
	GSM850 DRX = 5 (USB connected)	43.4	mA
	WCDMA PF = 64 (USB disconnected)	24.2	mA
	WCDMA PF = 64 (USB connected)	45.6	mA
	LTE-FDD PF = 64 (USB disconnected)	28.7	mA
	LTE-FDD PF = 64 (USB connected)	43.7	mA
	LTE-TDD PF = 64 (USB disconnected)	30.4	mA
	LTE-TDD PF = 64 (USB connected)	43.9	mA
GPRS data transfer (GNSS OFF)	GSM850 4DL/1UL @ 32.88 dBm	368.0	mA
	GSM850 3DL/2UL @ 31.99 dBm	565.5	mA
	GSM850 2DL/3UL @ 29.94 dBm	636.7	mA
	GSM850 1DL/4UL @ 28.73 dBm	733.7	mA
	EGSM900 4DL/1UL @ 33.75 dBm	419.3	mA
	EGSM900 3DL/2UL @ 32.18 dBm	591.5	mA
	EGSM900 2DL/3UL @ 29.90 dBm	631.4	mA
	EGSM900 1DL/4UL @ 28.70 dBm	725.3	mA
	DCS1800 4DL/1UL @ 30.02 dBm	221.8	mA
	DCS1800 3DL/2UL @ 29.12 dBm	319.6	mA
	DCS1800 2DL/3UL @ 26.98 dBm	384.8	mA
	DCS1800 1DL/4UL @ 25.80 dBm	468.3	mA

	PCS1900 4DL/1UL @ 30.22 dBm	243.2	mA
	PCS1900 3DL/2UL @ 28.93 dBm	336.9	mA
	PCS1900 2DL/3UL @ 27.00 dBm	398.3	mA
	PCS1900 1DL/4UL @ 25.86 dBm	478.0	mA
EDGE data transfer (GNSS OFF)	GSM850 4DL/1UL @ 27.45 dBm	253.6	mA
	GSM850 3DL/2UL @ 26.29 dBm	389.8	mA
	GSM850 2DL/3UL @ 23.96 dBm	515.4	mA
	GSM850 1DL/4UL @ 22.72 dBm	647.6	mA
	EGSM900 4DL/1UL @ 27.63 dBm	257.2	mA
	EGSM900 3DL/2UL @ 26.45 dBm	399.1	mA
	EGSM900 2DL/3UL @ 24.27 dBm	515.3	mA
	EGSM900 1DL/4UL @ 22.99 dBm	642.0	mA
	DCS1800 4DL/1UL @ 26.55 dBm	196.7	mA
	DCS1800 3DL/2UL @ 25.90 dBm	304.4	mA
	DCS1800 2DL/3UL @ 23.91 dBm	408.8	mA
	DCS1800 1DL/4UL @ 22.61 dBm	524.3	mA
	PCS1900 4DL/1UL @ 26.67 dBm	194.7	mA
	PCS1900 3DL/2UL @ 25.88 dBm	299.1	mA
	PCS1900 2DL/3UL @ 23.85 dBm	399.7	mA
	PCS1900 1DL/4UL @ 22.73 dBm	510.1	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 21.54 dBm	679.4	mA
	WCDMA B1 HSUPA @ 21.82 dBm	721.1	mA
	WCDMA B2 HSDPA @ 22.10 dBm	723.0	mA
	WCDMA B2 HSUPA @ 21.84 dBm	708.6	mA
	WCDMA B4 HSDPA @ 22.50 dBm	613.9	mA

	WCDMA B4 HSUPA @ 22.51 dBm	598.6	mA
	WCDMA B5 HSDPA @ 23.27 dBm	672.6	mA
	WCDMA B5 HSUPA @ 22.93 dBm	672.0	mA
	WCDMA B8 HSDPA @ 21.70 dBm	667.9	mA
	WCDMA B8 HSUPA @ 21.12 dBm	674.5	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.50 dBm	963.9	mA
	LTE-FDD B2 @ 22.95 dBm	941.7	mA
	LTE-FDD B3 @ 23.27 dBm	856.4	mA
	LTE-FDD B4 @ 23.28 dBm	817.1	mA
	LTE-FDD B5 @ 23.09 dBm	724.5	mA
	LTE-FDD B7 @ 23.09 dBm	945.2	mA
	LTE-FDD B8 @ 23.64 dBm	888.3	mA
	LTE-FDD B28 @ 22.79 dBm	964.5	mA
	LTE-TDD B40 @ 23.70 dBm	428.9	mA
GSM voice call	GSM850 PCL5 @ 32.75 dBm	346.9	mA
	EGSM900 PCL5 @ 33.53 dBm	385.3	mA
	DCS1800 PCL0 @ 30.03 dBm	210.2	mA
	PCS1900 PCL0 @ 29.94 dBm	219.6	mA
WCDMA voice call	WCDMA B1 @ 23.75 dBm	785.1	mA
	WCDMA B2 @ 23.07 dBm	804.5	mA
	WCDMA B4 @ 23.28 dBm	658.47	mA
	WCDMA B5 @ 23.31 dBm	701.8	mA
	WCDMA B8 @ 22.65 dBm	739.7	mA

6.6.7. EC25-AF Mini PCIe Power Consumption

Table 47: Power Consumption of EC25-AF Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	2.2	mA
	WCDMA PF = 64 (USB disconnected)	3.1	mA
	WCDMA PF = 128 (USB disconnected)	2.8	mA
	LTE-FDD PF = 64 (USB disconnected)	3.7	mA
	LTE-FDD PF = 128 (USB disconnected)	3.1	mA
Idle state	WCDMA PF = 64 (USB disconnected)	21.7	mA
	WCDMA PF = 64 (USB connected)	32.5	mA
	LTE-FDD PF = 64 (USB disconnected)	25.0	mA
	LTE-FDD PF = 64 (USB connected)	38.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B2 HSDPA @ 22.63 dBm	560.0	mA
	WCDMA B2 HSUPA @ 22.49 dBm	564.0	mA
	WCDMA B4 HSDPA @ 22.45 dBm	601.0	mA
	WCDMA B4 HSUPA @ 22.57 dBm	610.0	mA
	WCDMA B5 HSDPA @ 22.49 dBm	603.0	mA
	WCDMA B5 HSUPA @ 22.43 dBm	617.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 22.92 dBm	758.0	mA
	LTE-FDD B4 @ 23.12 dBm	770.0	mA
	LTE-FDD B5 @ 22.98 dBm	700.0	mA
	LTE-FDD B12 @ 23.42 dBm	808.0	mA
	LTE-FDD B13 @ 22.92 dBm	790.0	mA
	LTE-FDD B14 @ 23.42 dBm	795.0	mA
	LTE-FDD B66 @ 23.35 dBm	816.0	mA

	LTE-FDD B71 @ 23.39 dBm	801.0	mA
WCDMA voice call	WCDMA B2 @ 23.59 dBm	585.0	mA
	WCDMA B4 @ 23.47 dBm	610.0	mA
	WCDMA B5 @ 23.46 dBm	605.0	mA

6.6.8. EC25-AFX Mini PCIe Power Consumption

Table 48: Power Consumption of EC25-AFX Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	1.67	mA
	WCDMA PF = 64 (USB disconnected)	2.51	mA
	WCDMA PF = 64 (USB connected)	2.93	mA
	WCDMA PF = 128 (USB disconnected)	2.16	mA
	WCDMA PF = 256 (USB disconnected)	2.07	mA
	WCDMA PF = 512 (USB disconnected)	1.88	mA
	LTE-FDD PF = 32 (USB disconnected)	4.29	mA
	LTE-FDD PF = 64 (USB disconnected)	3.04	mA
	LTE-FDD PF = 64 (USB connected)	3.23	mA
	LTE-FDD PF = 128 (USB disconnected)	2.39	mA
	LTE-FDD PF = 256 (USB disconnected)	2.06	mA
Idle state	WCDMA PF = 64 (USB disconnected)	22.0	mA
	WCDMA PF = 64 (USB connected)	43.0	mA
	LTE-FDD PF = 64 (USB disconnected)	22.0	mA
	LTE-FDD PF = 64 (USB connected)	42.8	mA
WCDMA data transfer (GNSS OFF)	WCDMA B2 HSDPA @ 22.45 dBm	691.0	mA
	WCDMA B2 HSUPA @ 22.23 dBm	605.0	mA

	WCDMA B4 HSDPA @ 22.42 dBm	628.0	mA
	WCDMA B4 HSUPA @ 22.11 dBm	630.0	mA
	WCDMA B5 HSDPA @ 22.02 dBm	618.0	mA
	WCDMA B5 HSUPA @ 22.10 dBm	634.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 23.01 dBm	743.0	mA
	LTE-FDD B4 @ 22.58 dBm	816.0	mA
	LTE-FDD B5 @ 23.2 dBm	751.0	mA
	LTE-FDD B12 @ 22.94 dBm	825.0	mA
	LTE-FDD B13 @ 23.18 dBm	815.0	mA
	LTE-FDD B14 @ 23.44 dBm	849.0	mA
	LTE-FDD B66 @ 23.2 dBm	850.0	mA
	LTE-FDD B71 @ 22.82 dBm	788.0	mA
WCDMA voice call	WCDMA B2 @ 23.27 dBm	672.0	mA
	WCDMA B4 @ 23.22 dBm	663.0	mA
	WCDMA B5 @ 23.02 dBm	680.0	mA

6.6.9. EC25-AFXD Mini PCIe Power Consumption

Table 49: Power Consumption of EC25-AFXD Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	1.67	mA
	WCDMA PF = 64 (USB disconnected)	2.51	mA
	WCDMA PF = 64 (USB connected)	2.93	mA
	WCDMA PF = 128 (USB disconnected)	2.16	mA
	WCDMA PF = 256 (USB disconnected)	2.07	mA
	WCDMA PF = 512 (USB disconnected)	1.88	mA

	LTE-FDD PF = 32 (USB disconnected)	4.29	mA
	LTE-FDD PF = 64 (USB disconnected)	3.04	mA
	LTE-FDD PF = 64 (USB connected)	3.23	mA
	LTE-FDD PF = 128 (USB disconnected)	2.39	mA
	LTE-FDD PF = 256 (USB disconnected)	2.06	mA
Idle state	WCDMA PF = 64 (USB disconnected)	22.0	mA
	WCDMA PF = 64 (USB connected)	43.0	mA
	LTE-FDD PF = 64 (USB disconnected)	22.0	mA
	LTE-FDD PF = 64 (USB connected)	42.8	mA
WCDMA data transfer (GNSS OFF)	WCDMA B2 HSDPA @ 22.45 dBm	691.0	mA
	WCDMA B2 HSUPA @ 22.23 dBm	605.0	mA
	WCDMA B4 HSDPA @ 22.42 dBm	628.0	mA
	WCDMA B4 HSUPA @ 22.11 dBm	630.0	mA
	WCDMA B5 HSDPA @ 22.02 dBm	618.0	mA
	WCDMA B5 HSUPA @ 22.10 dBm	634.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 23.01 dBm	743.0	mA
	LTE-FDD B4 @ 22.58 dBm	816.0	mA
	LTE-FDD B5 @ 23.2 dBm	751.0	mA
	LTE-FDD B12 @ 22.94 dBm	825.0	mA
	LTE-FDD B13 @ 23.18 dBm	815.0	mA
	LTE-FDD B14 @ 23.44 dBm	849.0	mA
	LTE-FDD B66 @ 23.2 dBm	850.0	mA
	LTE-FDD B71 @ 22.82 dBm	788.0	mA
WCDMA voice call	WCDMA B2 @ 23.27 dBm	672.0	mA
	WCDMA B4 @ 23.22 dBm	663.0	mA

	WCDMA B5 @ 23.02 dBm	680.0	mA

6.6.10. EC25-EU Mini PCIe Power Consumption

Table 50: Power Consumption of EC25-EU Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	3.4	mA
	EGSM900 DRX = 2 (USB disconnected)	5.2	mA
	EGSM900 DRX = 9 (USB disconnected)	4.1	mA
	WCDMA PF = 64 (USB disconnected)	4.9	mA
	WCDMA PF = 128 (USB disconnected)	4.4	mA
	LTE-FDD PF = 64 (USB disconnected)	5.3	mA
	LTE-FDD PF = 128 (USB disconnected)	4.6	mA
	LTE-TDD PF = 64 (USB disconnected)	5.3	mA
	LTE-TDD PF = 128 (USB disconnected)	4.5	mA
Idle state	EGSM900 DRX = 5 (USB disconnected)	23.3	mA
	EGSM900 DRX = 5 (USB connected)	35.4	mA
	WCDMA PF = 64 (USB disconnected)	23.9	mA
	WCDMA PF = 64 (USB connected)	36.3	mA
	LTE-FDD PF = 64 (USB disconnected)	24.1	mA
	LTE-FDD PF = 64 (USB connected)	36.4	mA
	LTE-TDD PF = 64 (USB disconnected)	24.1	mA
	LTE-TDD PF = 64 (USB connected)	36.3	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 32.54 dBm	379.0	mA
	EGSM900 3DL/2UL @ 31.96 dBm	610.0	mA
	EGSM900 2DL/3UL @ 29.59 dBm	654.0	mA

	EGSM900 1DL/4UL @ 28.34 dBm	734.0	mA
	DCS1800 4DL/1UL @ 29.63 dBm	236.0	mA
	DCS1800 3DL/2UL @ 28.59 dBm	343.0	mA
	DCS1800 2DL/3UL @ 26.62 dBm	413.0	mA
	DCS1800 1DL/4UL @ 25.29 dBm	498.0	mA
EDGE data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 27.51 dBm	234.0	mA
	EGSM900 3DL/2UL @ 27.23 dBm	372.0	mA
	EGSM900 2DL/3UL @ 27.08 dBm	501.0	mA
	EGSM900 1DL/4UL @ 26.81 dBm	628.0	mA
	DCS1800 4DL/1UL @ 26.29 dBm	199.0	mA
	DCS1800 3DL/2UL @ 26.18 dBm	309.0	mA
	DCS1800 2DL/3UL @ 26.05 dBm	415.0	mA
	DCS1800 1DL/4UL @ 25.35 dBm	503.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 22.01 dBm	755.0	mA
	WCDMA B1 HSUPA @ 22.79 dBm	776.0	mA
	WCDMA B8 HSDPA @ 22.21 dBm	670.6	mA
	WCDMA B8 HSUPA @ 22.04 dBm	692.6	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.63 dBm	918.7	mA
	LTE-FDD B3 @ 22.78 dBm	914.0	mA
	LTE-FDD B7 @ 22.31 dBm	985.2	mA
	LTE-FDD B8 @ 23.35 dBm	886.5	mA
	LTE-FDD B20 @ 22.71 dBm	909.1	mA
	LTE-FDD B28A @ 21.79 dBm	898.1	mA
	LTE-TDD B38 @ 22.85 dBm	587.8	mA
	LTE-TDD B40 @ 22.96 dBm	460.6	mA

	LTE-TDD B41 @ 22.69 dBm	571.2	mA
GSM voice call	EGSM900 PCL = 5 @ 32.80 dBm	370.0	mA
	DCS1800 PCL = 0 @ 29.51 dBm	221.0	mA
WCDMA voice call	WCDMA B1 @ 22.96 dBm	829.5	mA
	WCDMA B8 @ 23.21 dBm	752.9	mA

6.6.11. EC25-EUX Mini PCIe Power Consumption

Table 51: Power Consumption of EC25-EUX Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	1.69	mA
	EGSM900 DRX = 2 (USB disconnected)	2.59	mA
	EGSM900 DRX = 9 (USB disconnected)	1.97	mA
	WCDMA PF = 64 (USB disconnected)	2.52	mA
	WCDMA PF = 128 (USB disconnected)	2.25	mA
	LTE-FDD PF = 64 (USB disconnected)	3.01	mA
	LTE-FDD PF = 128 (USB disconnected)	2.4	mA
	LTE-TDD PF = 64 (USB disconnected)	3.08	mA
	LTE-TDD PF = 128 (USB disconnected)	2.46	mA
Idle state	EGSM900 DRX = 5 (USB disconnected)	18.51	mA
	EGSM900 DRX = 5 (USB connected)	37.56	mA
	WCDMA PF = 64 (USB disconnected)	20.5	mA
	WCDMA PF = 64 (USB connected)	38.42	mA
	LTE-FDD PF = 64 (USB disconnected)	19.29	mA
	LTE-FDD PF = 64 (USB connected)	38.46	mA
	LTE-TDD PF = 64 (USB disconnected)	19.41	mA

	LTE-TDD PF = 64 (USB connected)	37.21	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 32.5 dBm	293.0	mA
	EGSM900 3DL/2UL @ 31.56 dBm	464.0	mA
	EGSM900 2DL/3UL @ 29.52 dBm	592.0	mA
	EGSM900 1DL/4UL @ 28.26 dBm	718.0	mA
	DCS1800 4DL/1UL @ 29.06 dBm	182.5	mA
	DCS1800 3DL/2UL @ 28.88 dBm	352.0	mA
	DCS1800 2DL/3UL @ 26.54 dBm	457.0	mA
	DCS1800 1DL/4UL @ 25.44 dBm	573.0	mA
EDGE data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 25.54 dBm	200.1	mA
	EGSM900 3DL/2UL @ 25.41 dBm	343.4	mA
	EGSM900 2DL/3UL @ 23.51 dBm	471.5	mA
	EGSM900 1DL/4UL @ 22.52 dBm	675.0	mA
	DCS1800 4DL/1UL @ 25.05 dBm	183.1	mA
	DCS1800 3DL/2UL @ 25.07 dBm	291.0	mA
	DCS1800 2DL/3UL @ 22.54 dBm	392.0	mA
	DCS1800 1DL/4UL @ 22.34 dBm	556.0	mA
WCDMA data transfer (GNSS OFF)	WCDMA B1 HSDPA @ 21.72 dBm	681.1	mA
	WCDMA B1 HSUPA @ 21.90 dBm	633.0	mA
	WCDMA B8 HSDPA @ 21.87 dBm	638.0	mA
	WCDMA B8 HSUPA @ 22.06 dBm	667.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.68 dBm	879.0	mA
	LTE-FDD B3 @ 23.34 dBm	955.4	mA
	LTE-FDD B7 @ 23.24 dBm	970.8	mA
	LTE-FDD B8 @ 22.80 dBm	815.3	mA

	LTE-FDD B20 @ 22.15 dBm	826.0	mA
	LTE-FDD B28A @ 22.60 dBm	894.0	mA
	LTE-TDD B38 @ 23.77 dBm	556.0	mA
	LTE-TDD B40 @ 23.31 dBm	565.0	mA
	LTE-TDD B41 @ 23.23 dBm	638.0	mA
GSM voice call	EGSM900 PCL = 5 @ 32.17 dBm	276.9	mA
	DCS1800 PCL = 0 @ 29.09 dBm	174.3	mA
WCDMA voice call	WCDMA B1 @ 23.17 dBm	670.0	mA
	WCDMA B8 @ 22.17 dBm	689.3	mA

NOTE

The above power consumption of EC25-EUX Mini PCIe is for reference only. For detailed information, contact Quectel Technical Support for the power consumption test report of the specific module.

6.6.12. EC25-MX Mini PCIe Power Consumption

Table 52: Power Consumption of EC25-MX Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	1.55	mA
	WCDMA PF = 64 (USB disconnected)	2.82	mA
	WCDMA PF = 64 (USB connected)	2.98	mA
	WCDMA PF = 128 (USB disconnected)	2.33	mA
	WCDMA PF = 256 (USB disconnected)	2.13	mA
	WCDMA PF = 512 (USB disconnected)	1.97	mA
	LTE-FDD PF = 32 (USB disconnected)	4.36	mA
	LTE-FDD PF = 64 (USB disconnected)	3.14	mA
	LTE-FDD PF = 64 (USB connected)	3.33	mA

	LTE-FDD PF = 128 (USB disconnected)	2.55	mA
	LTE-FDD PF = 256 (USB disconnected)	2.38	mA
Idle state	WCDMA PF = 64 (USB disconnected)	20.0	mA
	WCDMA PF = 64 (USB connected)	41.1	mA
	LTE-FDD PF = 64 (USB disconnected)	20.5	mA
	LTE-FDD PF = 64 (USB connected)	40.7	mA
WCDMA data transfer (GNSS OFF)	WCDMA B2 HSDPA @ 22.75 dBm	848.0	mA
	WCDMA B2 HSUPA @ 22.3 dBm	818.0	mA
	WCDMA B4 HSDPA @ 23.34 dBm	813.0	mA
	WCDMA B4 HSUPA @ 23.11 dBm	774.0	mA
	WCDMA B5 HSDPA @ 22.53 dBm	759.0	mA
	WCDMA B5 HSUPA @ 22.58 dBm	717.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 23.09 dBm	918.0	mA
	LTE-FDD B4 @ 23.12 dBm	933.0	mA
	LTE-FDD B5 @ 22.28 dBm	706.0	mA
	LTE-FDD B7 @ 22.56 dBm	1011.0	mA
	LTE-FDD B28 @ 22.41 dBm	793.0	mA
	LTE-FDD B66 @ 23.94 dBm	937.0	mA
WCDMA voice call	WCDMA B2 @ 23.97 dBm	967.0	mA
	WCDMA B4 @ 23.92 dBm	825.0	mA
	WCDMA B5 @ 23.00 dBm	844.0	mA

6.6.13. EC25-EM Mini PCIe Power Consumption

Table 53: Power Consumption of EC25-EM Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	2.3	mA
	AT+CFUN=0 (USB connected)	2.51	mA
	AT+CFUN=4 (USB disconnected)	2.41	mA
	AT+CFUN=4 (USB connected)	2.62	mA
	EGSM900 DRX = 2 (USB disconnected)	3.71	mA
	EGSM900 DRX = 5 (USB disconnected)	3.12	mA
	EGSM900 DRX = 5 (USB connected)	3.26	mA
	EGSM900 DRX = 9 (USB disconnected)	2.81	mA
	DCS1800 DRX = 2 (USB disconnected)	3.73	mA
	DCS1800 DRX = 5 (USB disconnected)	3.06	mA
	DCS1800 DRX = 5 (USB connected)	3.28	mA
	DCS1800 DRX = 9 (USB disconnected)	2.81	mA
	WCDMA PF = 64 (USB disconnected)	3.78	mA
	WCDMA PF = 64 (USB connected)	4	mA
	WCDMA PF = 128 (USB disconnected)	3.22	mA
	WCDMA PF = 256 (USB disconnected)	2.89	mA
	LTE-FDD PF = 32 (USB disconnected)	5.47	mA
	LTE-FDD PF = 64 (USB connected)	4.1	mA
	LTE-FDD PF = 64 (USB disconnected)	3.89	mA
	LTE-FDD PF = 128 (USB disconnected)	3.11	mA
	LTE-FDD PF = 256 (USB disconnected)	2.71	mA
	LTE-TDD PF = 32 (USB disconnected)	5.84	mA

	LTE-TDD PF = 64 (USB disconnected)	4.07	mA
	LTE-TDD PF = 64 (USB connected)	4.3	mA
	LTE-TDD PF = 128 (USB disconnected)	3.21	mA
	LTE-TDD PF = 256 (USB disconnected)	2.76	mA
Idle state	EGSM900 DRX = 5 (USB disconnected)	29.65	mA
	EGSM900 DRX = 5 (USB connected)	41.34	mA
	WCDMA PF = 64 (USB disconnected)	29.55	mA
	WCDMA PF = 64 (USB connected)	41.21	mA
	LTE-FDD PF = 64 (USB disconnected)	28.78	mA
	LTE-FDD PF = 64 (USB connected)	40.76	mA
	LTE-TDD PF = 64 (USB disconnected)	28.86	mA
	LTE-TDD PF = 64 (USB connected)	40.69	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 32.61 dBm	347.0	mA
	EGSM900 3DL/2UL @ 30.95 dBm	531.0	mA
	EGSM900 2DL/3UL @ 28.52 dBm	618.0	mA
	EGSM900 1DL/4UL @ 27.99 dBm	762.0	mA
	DCS1800 4DL/1UL @ 29.25 dBm	220.0	mA
	DCS1800 3DL/2UL @ 27.29 dBm	305.0	mA
	DCS1800 2DL/3UL @ 25.17 dBm	348.0	mA
	DCS1800 1DL/4UL @ 24.19 dBm	402.0	mA
GPRS data transfer (GNSS OFF)	EGSM900 4DL/1UL @ 26.72 dBm	205.0	mA
	EGSM900 3DL/2UL @ 25.50 dBm	313.0	mA
	EGSM900 2DL/3UL @ 24.25 dBm	400.0	mA
	EGSM900 1DL/4UL @ 23.16 dBm	475.0	mA
	DCS1800 4DL/1UL @ 25.30 dBm	167.0	mA

	DCS1800 3DL/2UL @ 24.84 dBm	254.0	mA
	DCS1800 2DL/3UL @ 23.26 dBm	316.0	mA
	DCS1800 1DL/4UL @ 21.95 dBm	372.0	mA
WCDMA transfer (GNSS OFF)	WCDMA B1 HSDPA @ 22.14 dBm	642.0	mA
	WCDMA B1 HSUPA @ 22.15 dBm	661.0	mA
	WCDMA B5 HSDPA @ 22.87 dBm	687.0	mA
	WCDMA B5 HSUPA @ 22.52 dBm	688.0	mA
	WCDMA B8 HSDPA @ 22.18 dBm	631.0	mA
	WCDMA B8 HSUPA @ 22.08 dBm	648.0	mA
LTE data transfer (GNSS OFF)	LTE-FDD B1 @ 23.46 dBm	855.0	mA
	LTE-FDD B3 @ 23.45 dBm	967.0	mA
	LTE-FDD B5 @ 22.86 dBm	801.0	mA
	LTE-FDD B7 @ 23.42 dBm	1137.0	mA
	LTE-FDD B8 @ 23.06 dBm	751.0	mA
	LTE-FDD B20 @ 22.79 dBm	904.0	mA
	LTE-FDD B28 @ 22.73 dBm	907.0	mA
	LTE-TDD B38 @ 23.19 dBm	505.0	mA
	LTE-TDD B40 @ 23.52 dBm	567.0	mA
	LTE-TDD B41 @ 23.33 dBm	510.0	mA
GSM voice call	EGSM900 PCL = 5 @ 32.39 dBm	348.0	mA
	DCS1800 PCL = 0 @ 29.13 dBm	221.0	mA
WCDMA voice call	WCDMA B1 @ 23.25 dBm	687.0	mA
	WCDMA B5 @ 23.16 dBm	697.0	mA
	WCDMA B8 @ 23.05 dBm	682.0	mA

6.6.14. EC25-ADL Mini PCIe Power Consumption

Table 54: Power Consumption of EC25-ADL Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	2.27	mA
	AT+CFUN=0 (USB suspend)	2.3	mA
	AT+CFUN=4 (USB disconnected)	2.2	mA
	AT+CFUN=4 (USB suspend)	2.5	mA
	LTE-FDD PF = 32 (USB disconnected)	5.4	mA
	LTE-FDD PF = 64 (USB disconnected)	3.92	mA
	LTE-FDD PF = 64 (USB suspend)	4.10	mA
	LTE-FDD PF = 128 (USB disconnected)	3.13	mA
	LTE-FDD PF = 256 (USB disconnected)	2.74	mA
Idle state	LTE-FDD PF = 64 (USB disconnected)	25.23	mA
	LTE-FDD PF = 64 (USB connected)	37.56	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 22.7 dBm	810	mA
	LTE-FDD B4 @ 22.4 dBm	900	mA
	LTE-FDD B12 @ 22.9 dBm	800	mA

6.6.15. EC25-AFDL Mini PCIe Power Consumption

Table 55: Power Consumption of EC25-AFDL Mini PCIe

Description	Conditions	Typ.	Unit
Sleep state	**AT+CFUN=0** (USB disconnected)	2.30	mA
	AT+CFUN=0 (USB suspend)	2.58	mA
	AT+CFUN=4 (USB disconnected)	2.38	mA

	AT+CFUN=4 (USB suspend)	2.62	mA
	LTE-FDD PF = 64 (USB disconnected)	5.02	mA
	LTE-FDD PF = 64 (USB suspend)	5.26	mA
	LTE-FDD PF = 128 (USB disconnected)	4.21	mA
	LTE-FDD PF = 256 (USB disconnected)	3.77	mA
Idle state	LTE-FDD PF = 64 (USB disconnected)	26.54	mA
	LTE-FDD PF = 64 (USB connected)	38.85	mA
LTE data transfer (GNSS OFF)	LTE-FDD B2 @ 23.01 dBm	743.0	mA
	LTE-FDD B4 @ 22.58 dBm	816.0	mA
	LTE-FDD B5 @ 23.2 dBm	751.0	mA
	LTE-FDD B12 @ 22.94 dBm	825.0	mA
	LTE-FDD B13 @ 23.18 dBm	815.0	mA
	LTE-FDD B14 @ 23.44 dBm	849.0	mA
	LTE-FDD B66 @ 23.2 dBm	850.0	mA
	LTE-FDD B71 @ 22.82 dBm	788.0	mA

6.6.16. GNSS Power Consumption

Table 56: GNSS Power Consumption of EC25 Series Mini PCIe Module

Description	Conditions	Typ.	Unit
Searching (**AT+CFUN=0**)	Cold start @ Passive antenna	75.0	mA
	Lost state @ Passive antenna	74.0	mA
Tracking (**AT+CFUN=0**)	Instrument environment	44.0	mA
	Open sky @ Passive antenna	53.0	mA
	Open sky @ Active antenna	58.0	mA

6.7. Thermal Dissipation

In order to achieve better performance of the module, it is recommended to comply with the following principles for thermal consideration:

- On customers' PCB design, please keep placement of the PCI Express Mini Card away from heating sources.
- Do not place components on the PCB area where the module is mounted, in order to facilitate adding of heatsink.
- Do not apply solder mask on the PCB area where the module is mounted, so as to ensure better heat dissipation performance.
- The reference ground of the area where the module is mounted should be complete, and add ground vias as many as possible for better heat dissipation.
- Add a heatsink on the top of the module and the heatsink should be designed with as many fins as possible to increase heat dissipation area. Meanwhile, a thermal pad with high thermal conductivity should be used between the heatsink and module.
- Add a thermal pad with appropriate thickness at the bottom of the module to conduct the heat to PCB.

The following figure shows the referenced heatsink design.

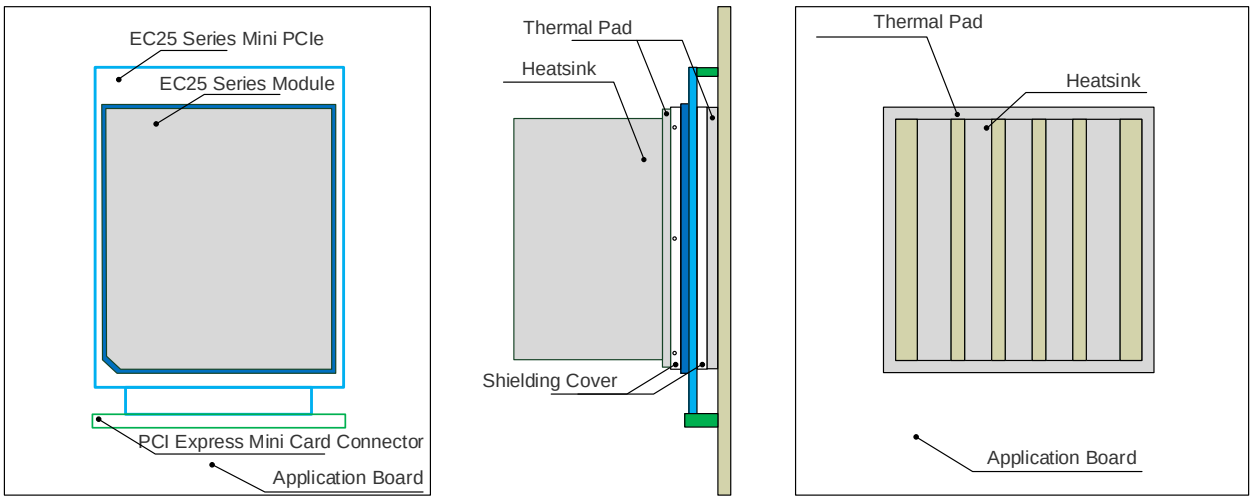


Figure 19: Referenced Heatsink Design

NOTE

The module offers the best performance when the internal BB chip stays below 105 °C. When the maximum temperature of the BB chip reaches or exceeds 105 °C, the module works normal but provides reduced performance (such as RF output power, data rate, etc.). When the maximum BB chip temperature reaches or exceeds 115 °C, the module will disconnect from the network, and it will recover

to network connected state after the maximum temperature falls below 115 °C. Therefore, the thermal design should be maximally optimized to make sure the maximum BB chip temperature always maintains below 105 °C. You can execute **AT+QTEMP** and get the maximum BB chip temperature from the first returned value. For more details of the command, see ***document [5]***.

6.8. Notification

Please follow the principles below in the module application.

6.8.1. 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.

6.8.2. Cleaning

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

6.8.3. Installing

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

7 Mechanical Information

This chapter mainly describes mechanical dimensions as well as packaging specifications of EC25 series Mini PCIe module. All dimensions are measured in millimeter (mm), and the dimensional tolerances are ±0.15 mm unless otherwise specified.

7.1. Mechanical Dimensions

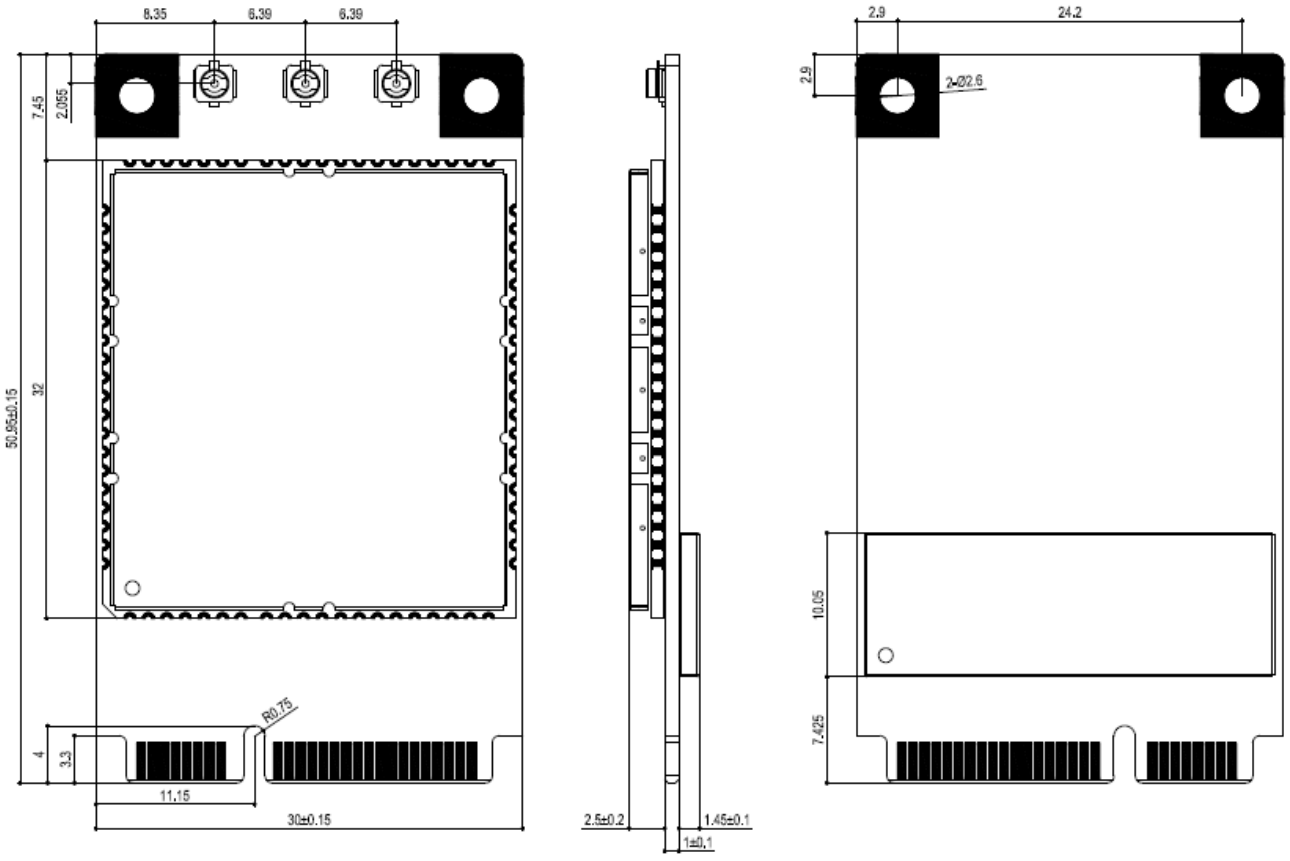


Figure 20: Mechanical Dimensions of EC25 Series Mini PCIe

NOTE

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

7.2. 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 blister tray packaging and details are as follow:

7.2.1. Blister Tray

Dimension details are as follow:

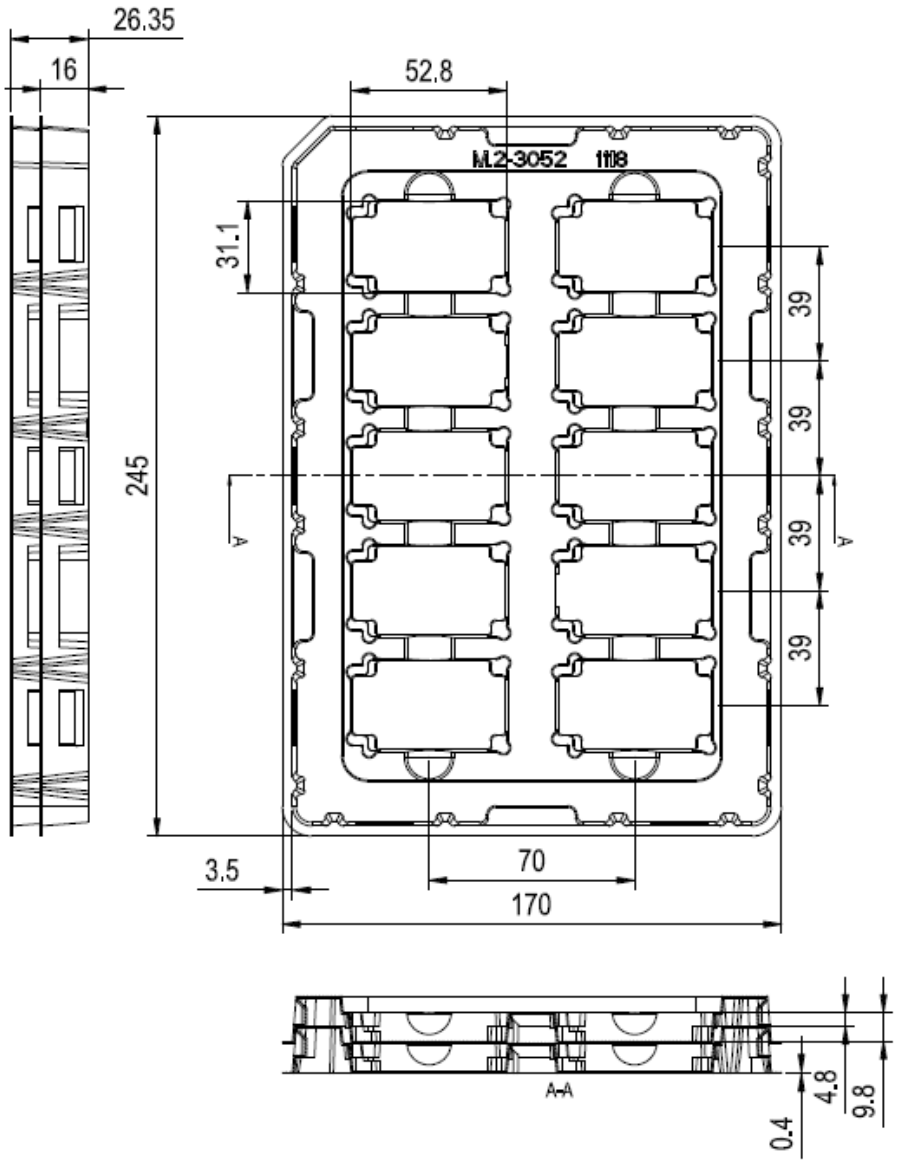
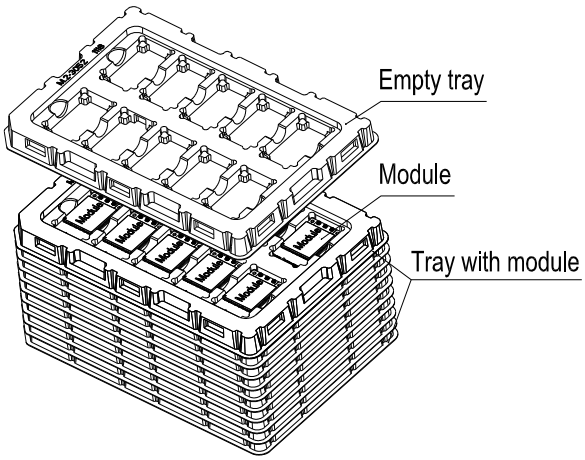
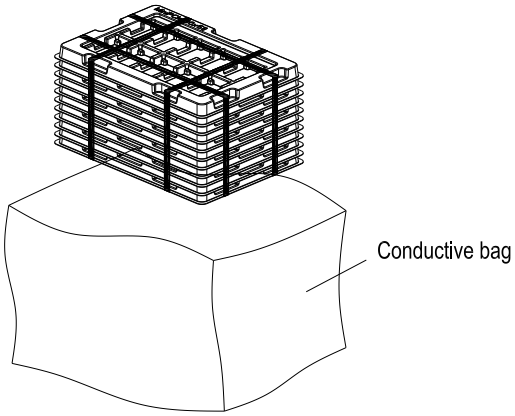


Figure 21: Blister Tray Dimension Drawing

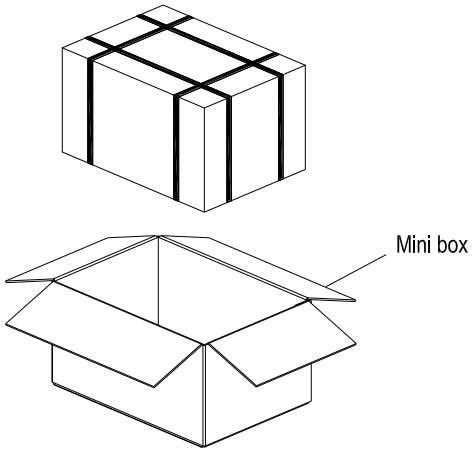
7.2.2. Packaging Process



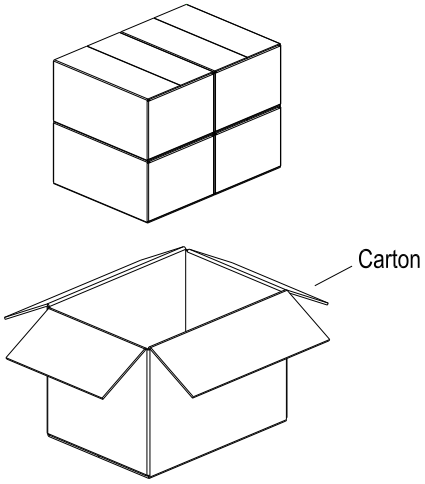
Each blister tray packs 10 modules. Stack 10 blister trays with modules together, and put 1 empty blister tray on the top.



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 cartoon box and then seal it. 1 cartoon box can pack 400 modules.

Figure 22: Packaging Process

8 Appendix References

Table 57: Related Documents

Document Name
[1] Quectel_Mini_PCIe_EVB_User_Guide
[2] Quectel_EC2x&EG2x-G(L)&EG9x&EM05_Series_AT_Commands_Manual
[3] Quectel_EC2x&EG2x&EG9x&EM05_Series_QCFG_AT_Commands_Manual
[4] Quectel_EC2x&EG2x&EG9x&EM05_Series_GNSS_Application_Note
[5] Quectel_EC2x&EG2x&EG9x&EM05_Series_Software_Thermal_Management_Guide

Table 58: Terms and Abbreviations

Abbreviation	Description
AMR	Adaptive Multi-rate
bps	Bits Per Second
BB	Baseband
CHAP	Challenge-Handshake Authentication Protocol
CS	Coding Scheme
CTS	Clear to Send
DC-HSDPA	Dual-carrier High Speed Downlink Packet Access
DFOTA	Delta Firmware Upgrade Over-The-Air
DL	Down Link
DRX	Discontinuous Reception

DTR	Data Terminal Ready
EDGE	Enhanced Data Rates for GSM Evolution
EFR	Enhanced Full Rate
EMI	Electro Magnetic Interference
ESD	Electrostatic Discharge
ESR	Equivalent Series Resistance
FDD	Frequency Division Duplexing
FR	Full Rate
FTP	File Transfer Protocol
FTPS	FTP Secure
GLONASS	Global Navigation Satellite System (Russia)
GMSK	Gaussian Minimum Shift Keying
GNSS	Global Navigation Satellite System
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
HR	Half Rate
HSPA	High Speed Packet Access
HSUPA	High Speed Uplink Packet Access
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
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
MIMO	Multiple-Input Multiple-Output
MMS	Multimedia Messaging Service
MO	Mobile Originated
MQTT	Message Queuing Telemetry Transport
MSB	Most Significant Bit
MT	Mobile Terminated
NITZ	Network Identity and Time Zone
NMEA	National Marine Electronics Association
NTP	Network Time Protocol
PAP	Password Authentication Protocol
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PDA	Personal Digital Assistant
PDU	Protocol Data Unit
PIFA	Planar Inverted F-shaped Antenna
PING	Packet Internet Groper
POS	Point of Sale
PPP	Point-to-Point Protocol
QAM	Quadrature Amplitude Modulation
QPSK	Quadrature Phase Shift Keying
RAM	Random Access Memory
RF	Radio Frequency
RTS	Request To Send

Rx	Receive
SIMO	Single Input Multiple Output
SMS	Short Message Service
SMTP	Simple Mail Transfer Protocol
SMTPS	Simple Mail Transfer Protocol Secure
SSL	Secure Sockets Layer
TCP	Transmission Control Protocol
TDD	Time Division Duplex
TX	Transmitting Direction
TVS	Transient Voltage Suppressor
UART	Universal Asynchronous Receiver & Transmitter
UDP	User Datagram Protocol
UL	Uplink
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identification Module
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access
WLAN	Wireless Local Area Networks