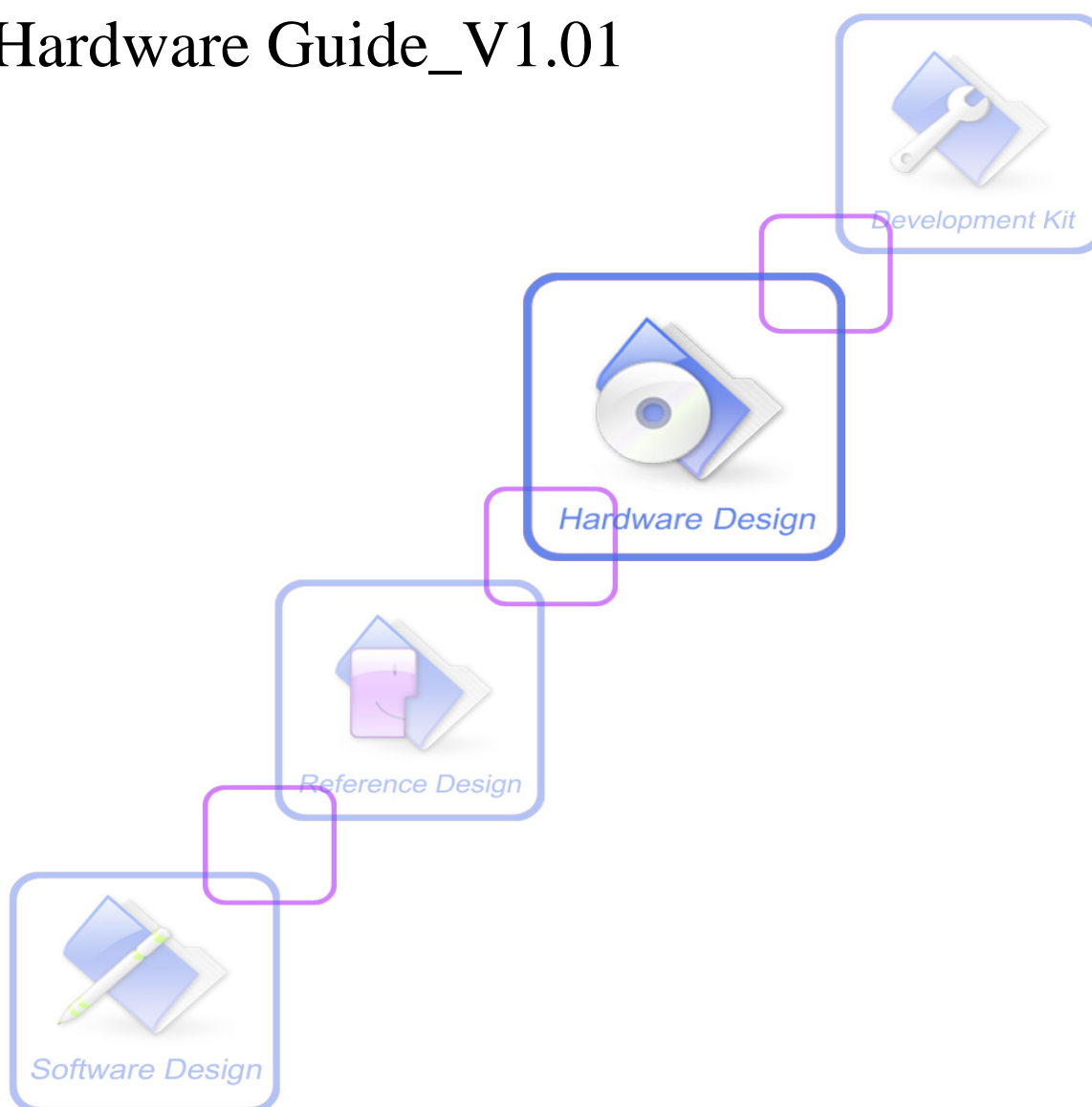




SIM7200 Mini PCIe Module

Hardware Guide_V1.01



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Contents

1. Introduction	8
2. SIM7200 Overview	8
2.1. Operating Mode	13
2.2. Functional Diagram	13
2.3. SIM7200 Mini PCIe Interface	15
3. Package Information	错误！未定义书签。
3.1 Pin Out Diagram	16
3.2 Package Dimensions	17
3.3 Mini PCI Express Connector and Latch	18
3.4 Installing SIM7200 on main board	19
3.5 Removing SIM7200 from main board	20
4. Application Interface	21
4.1 Power Supply	21
4.2 Power Saving Mode	22
4.2.1. Minimum Functionality Mode and Sleep Mode	22
4.2.2. Wake Up SIM7200 from Sleep Mode	23
4.3 USB 2.0	23
4.3.1 USB Port Specification	23
4.3.2 Firmware Update	24
4.3.3 High-speed USB Layout Guide Lines	24
4.4 USIM Card Interface	24
4.5 I2C Interface	26
4.6 GPIO Interface	27
4.7 PERST#	27
4.8 W_DISABLE#	28
4.9 LED_WWAN#	29
5 RF Specifications	30
5.1 The Antenna Connector	30
5.2 The Antenna Specifications	31
6. Electrical, Reliability and Radio Characteristics	32
6.1 Absolute Maximum Ratings	32
6.2 Recommended Operating Conditions	32
6.3 USIM Card Interface Characteristics	32
6.4 USIM_VDD Characteristics	33
6.5 Current Consumption (3.3V)	33
6.6 Electro-Static Discharge	错误！未定义书签。
6.7 Radio Characteristics	35
6.7.1 Conducted Output Power	35
6.7.2 Conducted Receive Sensitivity	36
6.7.3 Supported Band	37
7. Appendix	40
I. SIM7200-PCIe Top and Bottom View	40
II. Related Documents	40

III.	Terms and Abbreviations	41
IV.	Safety Caution	43
Contact us:.....		44
URL: www.simcomm2m.com		44

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Table Index

TABLE 1: SIM7200 KEY FEATURES	9
TABLE 2: SIM7200 SERIES FREQUENCY BANDS	10
TABLE 3: CODING SCHEMES AND MAXIMUM NET DATA RATES OVER AIR INTERFACE	11
TABLE 4: OPERATING MODE.....	13
TABLE 5: PCI EXPRESS MINI CARD CONNECTOR PIN DESCRIPTION	15
TABLE 6: RECOMMENDED ZENER DIODE	22
TABLE 7: POWER AND GROUND SPECIFICATIONS	22
TABLE 8: USB INTERFACE SIGNALS.....	23
TABLE 9: USB PORT SPECIFICATION	24
TABLE 10: USIM CARD INTERFACE SIGNALS	26
TABLE 15: I2C MULTIPLEXING FUNCTION	26
TABLE 16: PIN DEFINITION OF THE GPIO.....	27
TABLE 17: PERST# ELECTRICAL CHARACTERISTIC.....	27
TABLE 18: AIRPLANE MODE CONTROL FUNCTION.....	28
TABLE 19: W_DISABLE# ELECTRICAL CHARACTERISTIC	28
TABLE 20: NETWORK STATUS INDICATION PIN STATUS	29
TABLE 21: RECOMMENDED PASSIVE ANTENNA CHARACTERISTICS	31
TABLE 22: RECOMMENDED ANTENNA CHARACTERISTICS.....	31
TABLE 23: ABSOLUTE MAXIMUM RATINGS.....	32
TABLE 24: OPERATING CONDITIONS	32
TABLE 25: USIM CARD INTERFACE CHARACTERISTICS.....	32
TABLE 26: USIM_VDD CHARACTERISTICS	33
TABLE 27: CURRENT CONSUMPTION(SIM7200E).....	33
TABLE 28: ESD CHARACTERISTICS (TEMPERATURE: 25°C, HUMIDITY: 45 %).....	35
TABLE 29: CONDUCTED OUTPUT POWER.....	35
TABLE 30: CONDUCTED RECEIVE SENSITIVITY	36
TABLE 31: RELATED DOCUMENTS	40
TABLE 32: TERMS AND ABBREVIATIONS.....	41
TABLE 33: SAFETY CAUTION.....	43

Figure Index

FIGURE 1: SIM7200 OVERVIEW	8
FIGURE 2: SIM7200 FUNCTIONAL DIAGRAM.....	14
FIGURE 3: SIM7200-PCIE PIN OUT DIAGRAM	16
FIGURE 4: DIMENSIONS OF SIM7200-PCIE (UNIT: MM)	17
FIGURE 5: DETAIL DIMENSIONS OF GOLDEN FINGER.....	17
FIGURE 6: DIMENSIONS OF PCI EXPRESS CONNECTOR.....	18
FIGURE 7: DIMENSIONS OF LATCH FOR PCI EXPRESS CONNECTOR	18
FIGURE 8: STEP 1 OF INSTALLING SIM7200 ON THE MAIN BOARD	19
FIGURE 9: STEP 2 OF INSTALLING SIM7200 ON THE MAIN BOARD	19
FIGURE 10: STEP 3 OF INSTALLING SIM7200 ON THE MAIN BOARD	19
FIGURE 11: STEP 1 OF REMOVING SIM7200 FROM THE MAIN BOARD	20
FIGURE 12: STEP 2 OF REMOVING SIM7200 FROM THE MAIN BOARD.....	20
FIGURE 13: STEP 3 OF REMOVING SIM7200 FROM THE MAIN BOARD.....	20
FIGURE 14: STEP 4 OF REMOVING SIM7200 FROM THE MAIN BOARD.....	21
FIGURE 15: RECOMMENDED POWER CIRCUIT OF SIM7200 MODULE.....	21
FIGURE 16: 8 PIN USIM CARD HOLDER REFERENCE CIRCUIT.....	25
FIGURE 17: 6 PIN USIM CARD HOLDER REFERENCE CIRCUIT.....	25
FIGURE 18: RESET TIMING	27
FIGURE 19: RECOMMEND CIRCUIT OF PERST#.....	28
FIGURE 20: LED_WWAN# REFERENCE CIRCUIT.....	29
FIGURE 23: ANTENNA CONNECTOR.....	30
FIGURE 24: ANTENNA CONNECTOR.....	30
FIGURE 25: SIM7200-PCIE TOP AND BOTTOM VIEW.....	40

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Date	Version	Description of change	Author
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1. Introduction

Scope of this document is to give a detail design guide of the SIMCom SIM7200 series, this document can help user to quickly understand SIM7200 interface specifications, electrical and mechanical details. With the help of this document and other SIM7200 application notes, user guide, users can apply SIM7200 in various applications quickly.

2. SIM7200 Overview

SIM7200 is a PC embedded Wireless Wide Area Network (WWAN) module, it offers a Mini PCI Express interface, which complies with the *PCI Express Mini Card Electromechanical Specification Revision 1.2*. It provides LTE, WCDMA, GSM and GPS connectivity, and it is very convenient to equip in portable or other devices.

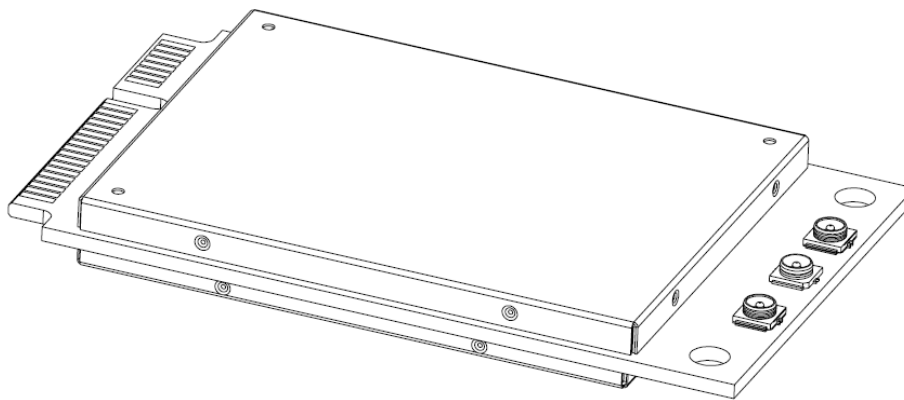


Figure 1: SIM7200 overview

With the frontier technology, SIM7200 supports LTE – FDD Cat 4, it has 3 antenna ports which support multi-band MIMO antenna systems, and the LTE data rate can reach up to 150 Mbps downlink and the 50 Mbps uplink.

SIM7200 has the dimension of 50.95*30*4.65mm, and it provides the following hardware interfaces between the module and customers' board.

- Host device wake up function
- One high speed USB port can be used as data transmission, communication, debugging and firmware upgrading
- Audio interface
- One USIM card interface supporting hot swap function
- One WWAN indicator LED
- Hardware reset function
- Airplane mode control

SIM7200 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications. For details about TCP/IP applications, please refer to *document [2]*.

Table 1: SIM7200 key features

Feature	Implementation
Power supply	3.3V
Frequency bands	Reference Table 2
Transmitting power	GSM/GPRS: <ul style="list-style-type: none"> ● Class 4 (2W): GSM850、EGSM900 ● Class 1 (1W): DCS1800、PCS1900 EDGE: <ul style="list-style-type: none"> ● Class E2 (0.5W): GSM850、EGSM900 ● Class E1 (0.4W): DCS1800、PCS1900 UMTS: <ul style="list-style-type: none"> ● Class 3 (0.25W): WCDMA2100/1800/900/850/800 TDSCDMA <ul style="list-style-type: none"> ● Class 3 (0.25W):Band34/Band39 LTE: <ul style="list-style-type: none"> ● Class 3 (0.25W): LTE B1/B3/B4/B5/B7/B8/B20/B28 /B38/B39/B40/B41
Connectivity Speed	GPRS Class B, multi-slot class 12 operation, coding scheme: CS1-4, DL maximum speed: 85.6kbps; UL maximum speed: 85.6kbps <ul style="list-style-type: none"> ● EDGE multi-slot class 12 operation, coding scheme: MSC1-9, DL maximum speed: 236.8kbps; UL maximum speed: 236.8kbps ● UMTS R99 speed: 384 kbps DL/UL ● HSDPA Category 24 - 42.2 Mbps, HSUPA Category 7 - 11.5 Mbps ● TD-HSDPA/HSUPA: 2.2 Mbps(UL), 2.8 Mbps(DL) ● LTE Category 4 - 150 Mbps (DL) ● LTE Category 4 - 50 Mbps (UL)
SMS	<ul style="list-style-type: none"> ● MT, MO, CB, Text and PDU mode ● SMS storage: USIM Card or NAND
USB	USB 2.0 High speed port <ul style="list-style-type: none"> ● USB Application Port ● USB Debug Port ● USB Speech Port ● Modem
USIM interface	Support USIM card: 1.8V, 2.85V
I2C interface	Compliant with I2C protocol, support high speed and master mode. Open drain output and has been pulled up Inside the module.
External antenna	Three antenna SMT connectors
Temperature range	<ul style="list-style-type: none"> ● Normal operation temperature: -40 $^{\circ}\text{C}$ ~ +8 $^{\circ}\text{C}$ ● Storage temperature: -45 $^{\circ}\text{C}$ ~ +90$^{\circ}\text{C}$
Physical characteristics	Size: 50.80*30*4.65mm Weight: 11g
Memory capacity	2Gbit DDR2 RAM and 4Gbit NAND flash.
Firmware upgrade	Firmware upgrade over USB interface

In this document, the entire radio band configuration of SIM7200 and SIM7200SA are described in the following table.

Table 2: SIM7200 series frequency bands

Standard	Frequency	SIM7200	SIM7200SA
GSM	GSM 850MHz	✓	✓
	EGSM 900MHz	✓	✓
	DCS1800MHz	✓	✓
	PCS1900MHz	✓	✓
WCDMA	WCDMA 850MHz	✓	✓
	WCDMA 900MHz	✓	✓
	WCDMA 1900MHz		
	WCDMA 2100MHz	✓	✓
TD-SCDMA	1880-1920MHz	✓	
	2010-2025MHz	✓	
HSPA	HSDPA	✓	✓
	HSUPA	✓	✓
HSPA+	HSPA+	✓	✓
	DC-HSPA+	✓	✓
GNSS	GPS	✓	✓
	GLONASS	✓	✓
LTE-FDD	LTE-FDD B1	✓	✓
	LTE-FDD B3	✓	✓
	LTE-FDD B4		✓
	LTE-FDD B5		✓
	LTE-FDD B7	✓	✓
	LTE-FDD B8	✓	✓
	LTE-FDD B20	✓	
	LTE-FDD B28		✓
LTE-TDD	LTE TDD B38	✓	✓
	LTE TDD B39	✓	
	LTE TDD B40	✓	✓
	LTE TDD B41 (100M BW)	✓	✓

Note: Operating bandwidth frequencies of LTE TDD B41 for SIM7200 and SIM7200SA is 100MHz, from 2555MHz to 2655MHz

Table 3: Coding schemes and maximum net data rates over air interface

Multislot definition(GPRS/EDGE)			
Slot class	DL slot number	UL slot number	Active slot number
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
GPRS coding scheme	Max data rata (4 slots)		Modulation type
CS 1 = 9.05 kb/s / time slot	36.2 kb/s		GMSK
CS 2 = 13.4 kb/s / time slot	53.6 kb/s		GMSK
CS 3 = 15.6 kb/s / time slot	62.4 kb/s		GMSK
CS 4 = 21.4 kb/s / time slot	85.6 kb/s		GMSK
EDGE coding scheme	Max data rata (4 slots)		Modulation type
MCS 1 = 8.8 kb/s/ time slot	35.2 kb/s		GMSK
MCS 2 = 11.2 kb/s/ time slot	44.8 kb/s		GMSK
MCS 3 = 14.8 kb/s/ time slot	59.2 kb/s		GMSK
MCS 4 = 17.6 kb/s/ time slot	70.4 kb/s		GMSK
MCS 5 = 22.4 kb/s/ time slot	89.6 kb/s		8PSK
MCS 6 = 29.6 kb/s/ time slot	118.4 kb/s		8PSK
MCS 7 = 44.8 kb/s/ time slot	179.2 kb/s		8PSK
MCS 8 = 54.4 kb/s/ time slot	217.6 kb/s		8PSK
MCS 9 = 59.2 kb/s/ time slot	236.8 kb/s		8PSK
HSDPA device category	Max data rate (peak)		Modulation type
Category 1	1.2Mbps		16QAM,QPSK
Category 2	1.2Mbps		16QAM,QPSK
Category 3	1.8Mbps		16QAM,QPSK
Category 4	1.8Mbps		16QAM,QPSK
Category 5	3.6Mbps		16QAM,QPSK
Category 6	3.6Mbps		16QAM,QPSK
Category 7	7.2Mbps		16QAM,QPSK
Category 8	7.2Mbps		16QAM,QPSK
Category 9	10.2Mbps		16QAM,QPSK
Category 10	14.4Mbps		16QAM,QPSK

Category 11	0.9Mbps	QPSK
Category 12	1.8Mbps	QPSK
Category 13	17.6Mbps	64QAM
Category 14	21.1Mbps	64QAM
Category 15	23.4Mbps	16QAM
Category 16	28Mbps	16QAM
Category 17	23.4Mbps	64QAM
Category 18	28Mbps	64QAM
Category 19	35.5Mbps	64QAM
Category 20	42Mbps	64QAM
Category 21	23.4Mbps	16QAM
Category 22	28Mbps	16QAM
Category 23	35.5Mbps	64QAM
Category 24	42.2Mbps	64QAM
HSUPA device category	Max data rate (peak)	Modulation type
Category 1	0.96Mbps	QPSK
Category 2	1.92Mbps	QPSK
Category 3	1.92Mbps	QPSK
Category 4	3.84Mbps	QPSK
Category 5	3.84Mbps	QPSK
Category 6	5.76Mbps	QPSK
Category 7	11.5Mbps	16QAM
LTE-FDD device category (Downlink)	Max data rate (peak)	Modulation type
Category 1	10Mbps	QPSK/16QAM/64QAM
Category 2	50Mbps	QPSK/16QAM/64QAM
Category 3	100Mbps	QPSK/16QAM/64QAM
Category 4	150Mbps	QPSK/16QAM/64QAM
LTE-FDD device category (Uplink)	Max data rate (peak)	Modulation type
Category 1	5Mbps	QPSK/16QAM
Category 2	25Mbps	QPSK/16QAM
Category 3	50Mbps	QPSK/16QAM
Category 4	50Mbps	QPSK/16QAM

2.1. Operating Mode

The table below summarizes the various operating modes of SIM7200 PCIe.

Table 4: Operating Mode

Mode	Status	Function
Normal operation	Sleep	<p>GSM/GPRS/EDGE/WCDMA /LTE</p> <p>Module will automatically go into sleep mode if the conditions of sleep mode are enabling and there is no on air and no hardware interrupt (such as USB wake-up operation or data on serial port).</p> <p>In this case, the current consumption of module will be reduced to the minimal level.</p> <p>In sleep mode, the module can still receive paging message and SMS.</p>
	Idle	<p>GSM/WCDMA/LTE</p> <p>Software is active. Module is registered to the GSM/WCDMA/LTE network, and the module is ready to communicate.</p>
	Voice Call	<p>GSM/WCDMA</p> <p>Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.</p>
	Standby	<p>EDGE/HSPA+/LTE</p> <p>Module is ready for EDGE/HSPA+ /LTE data transfer, but no data is currently sent or received. In this case, power consumption depends on network settings and EDGE/HSPA+ /LTE configuration.</p>
	Data transfer	<p>EDGE/HSPA+/LTE</p> <p>There is EDGE/HSPA+/LTE data transfer in progress. In this case, power consumption is related to network settings (e.g. power control level); uplink/downlink data rates and GPRS configuration (e.g. used multi-slot settings).</p>
Minimum functionality mode		<p>AT command “AT+CFUN” can be used to set the module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the module will not work or the USIM card will not be accessible, or both RF part and USIM card will be closed, and the serial port is still accessible. The power consumption in this mode is lower than normal mode.</p>

2.2. Functional Diagram

Figure 2 shows the functional diagram of the SIM7200 module, the major functional units of SIM7200 including the following parts:

- Baseband processor
- Power management unit
- Multi-chip package memory
- Radio frequency transceiver
- Antenna interfaces
- 52 PIN Mini PCIe Interface

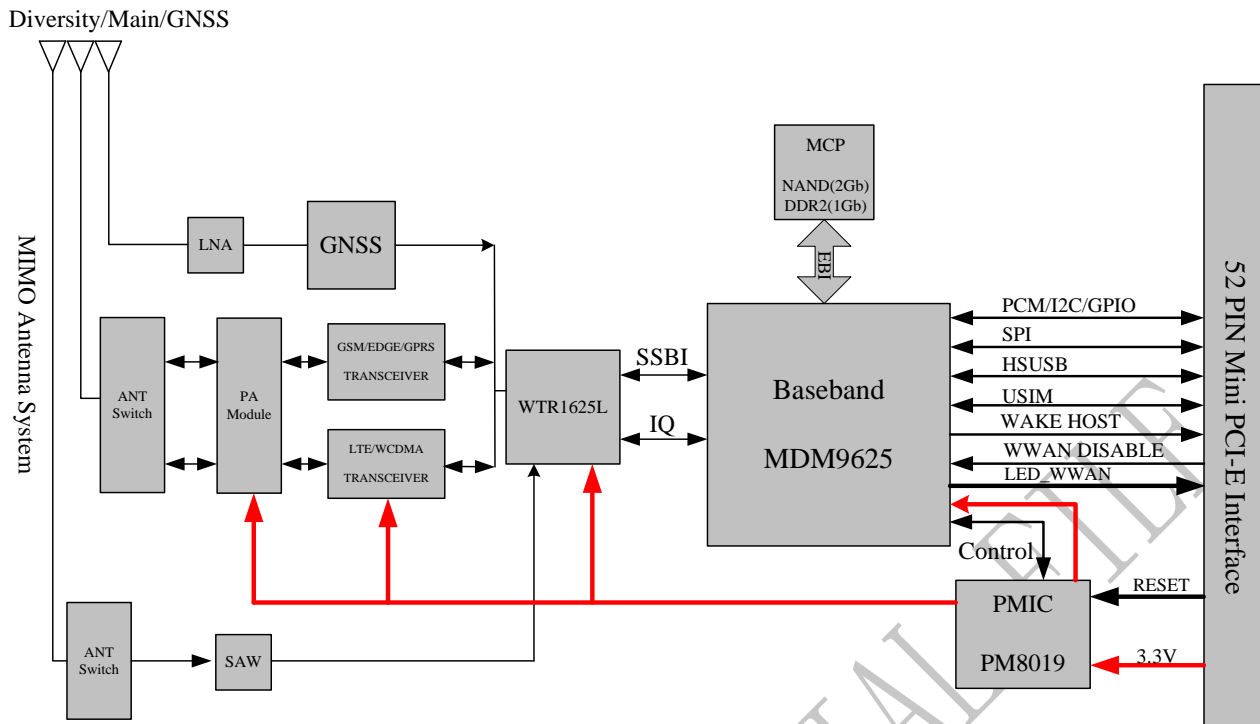


Figure 2: SIM7200 functional diagram

2.3. SIM7200 Mini PCIe Interface

Table 5: PCI Express Mini Card Connector Pin Description

No	PIN Description	I/O	Comment	No	PIN Description	I/O	Comment
1	MICP	I	Audio input	2	VCC	I	3.3V power supply
3	MICN	I	Audio input	4	GND	-	Ground
5	EAR_P	O	Audio output	6	NC	-	Not connected
7	EAR_N	O	Audio output	8	USIM_VDD	O	Power source for the external USIM card
9	GND	-	Ground	10	USIM_DATA	I/O	External USIM card data signal
11	UART_CTS	I	Clear to send	12	USIM_CLK	O	External USIM card clock signal
13	UART_RTS	O	Request to send	14	USIM_RST	O	External USIM card reset signal
15	GND	-	Ground	16	USIM_DET	I	External USIM card presence detect signal, hot swap
17	UART_RXD	I	Receive data	18	GND	-	Ground
19	UART_TXD	O	Transmit data	20	W_DISABLE #	I	Active low signal for wireless disabling (Airplane mode)
21	GND	-	Ground	22	PERST#		Active low functional reset to the card
23	NC	-	Not connected	24	NC	-	Not connected
25	NC	-	Not connected	26	GND	-	Ground
27	GND	-	Ground	28	NC	-	Not connected
29	GND	-	Ground	30	SCL	O	I2C bus clock signal
31	NC	-	Not connected	32	SDA	I/O	I2C bus data signal
33	NC	-	Not connected	34	GND	-	Ground
35	GND	-	Ground	36	USB_D-	-	USB differential data (-)
37	GND	-	Ground	38	USB_D+		USB differential data (+)
39	VCC	I	3.3V power supply	40	GND	-	Ground
41	VCC	I	3.3V power supply	42	LED_WWAN #	O	Active low, open drain signal for WWAN LED driving, used to provide

							module's status indication
43	GND	-	Ground	44	GPIO7	I/O	General purpose input/output
45	NC	-	Not connected	46	GPIO6	I/O	General purpose input/output
47	NC	-	Not connected	48	NC	-	Not connected
49	NC	-	Not connected	50	GND	-	Ground
51	NC	-	Not connected	52	VCC	I	3.3V supply

3. Package Information

The Mini PCIe Adapter adopts a standard Mini PCI Express connector that has 52 pins and complies with the *PCI Express Mini Card Electromechanical Specification Revision 1.2*.

3.1 Pin Out Diagram

The following figure shows the PIN sequence of SIM7200:

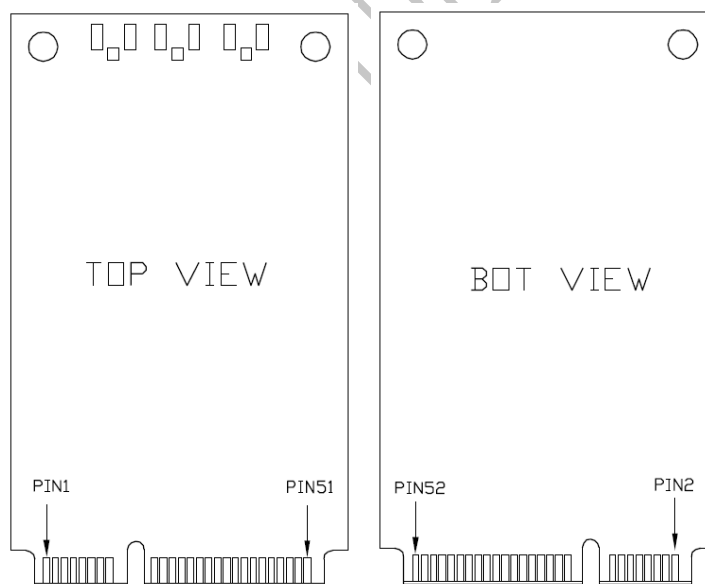


Figure 3: SIM7200-PCIe pin out Diagram

3.2 Package Dimensions

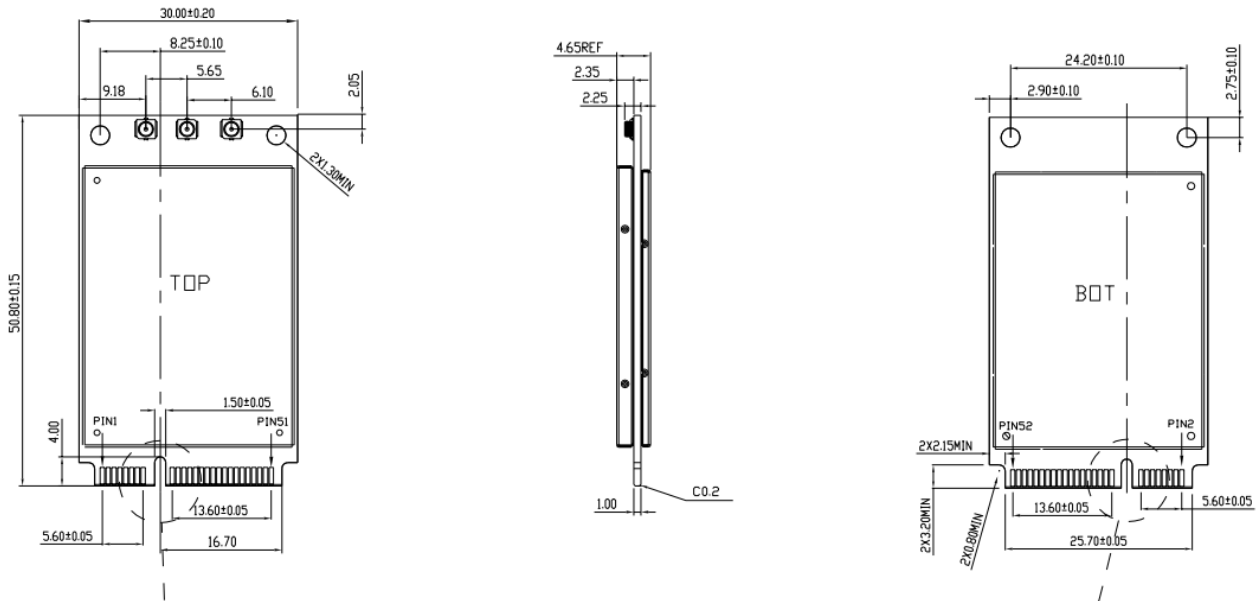


Figure 4: Dimensions of SIM7200-PCIe (Unit: mm)

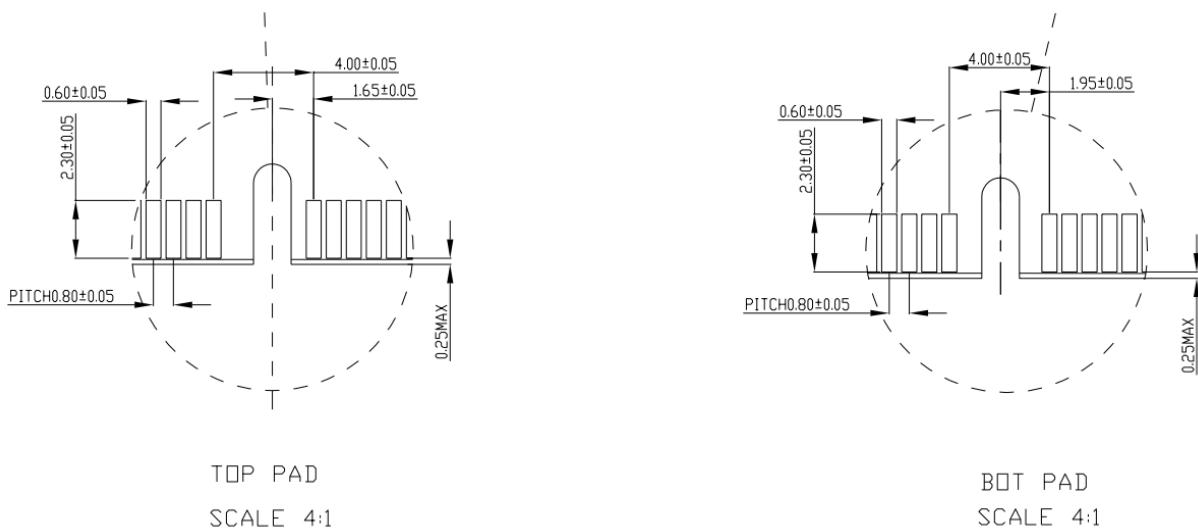
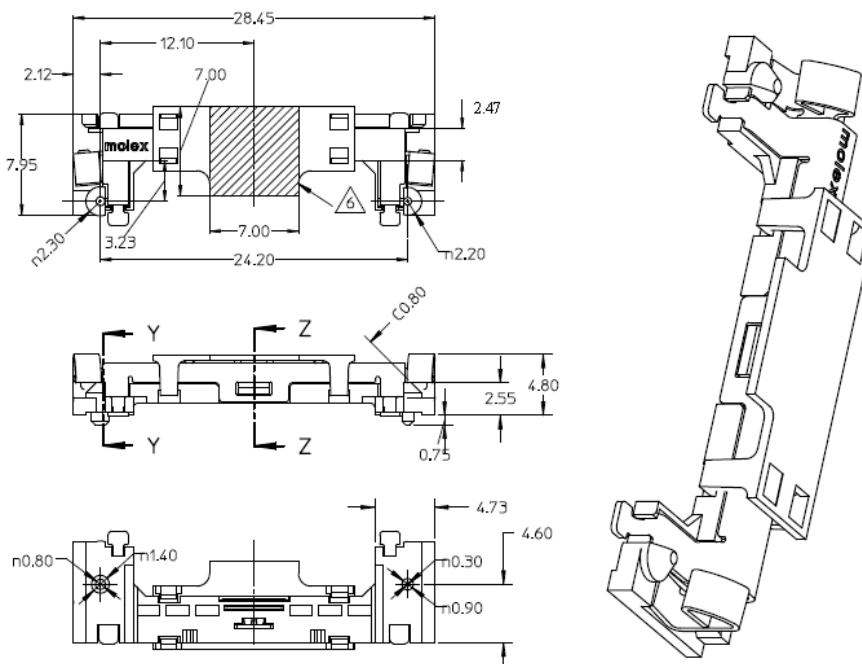


Figure 5: Detail dimensions of golden finger

Please refer to *PCI Express Mini Card Electromechanical Specification Revision 1.2* for package dimension details.

SIM7200 should equip to the edge card connector and lock down by the Latch, this chapter takes the Molex 67910-0002 and 48099-4000 as an example.

The figure 7 shows the Latch for the edge card connector:



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3.4 Installing SIM7200 on main board

Step 1: Insert SIM7200 into the Mini PCI Express connector on the main board.

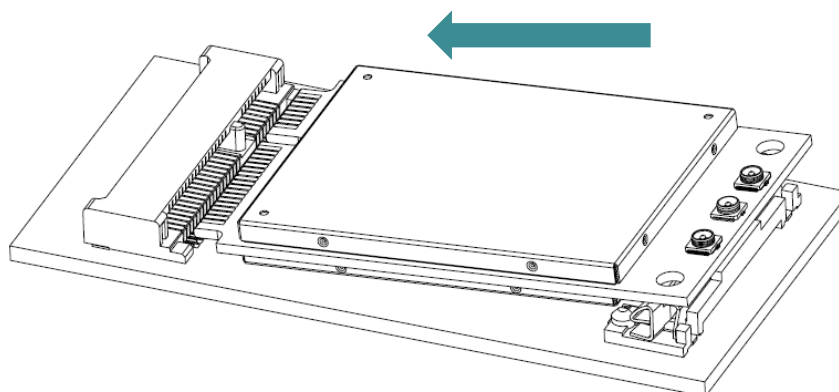


Figure 8: Step 1 of installing SIM7200 on the main board

Step 2: Press downwards to fix SIM7200 Adapter in the module slot.

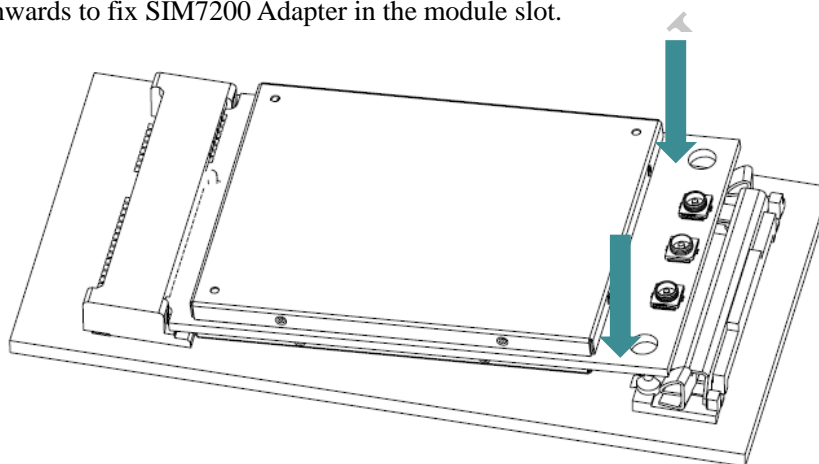


Figure 9: Step 2 of installing SIM7200 on the main board

Step 3: Equip the antenna to the main board via the connector; customer should notice the sequence of antenna and connector size matching.

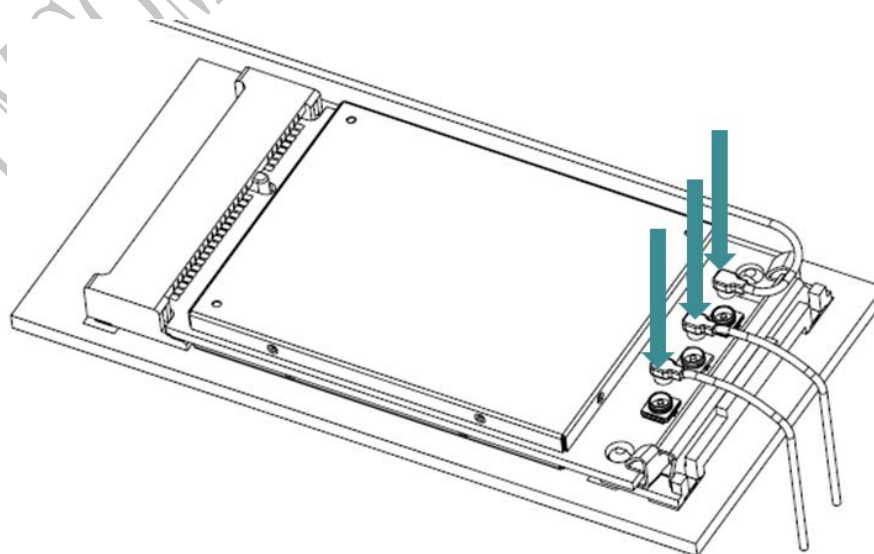


Figure 10: Step 3 of installing SIM7200 on the main board

3.5 Removing SIM7200 from main board

Step 1: Disconnect the antenna cables from SIM7200 cables.

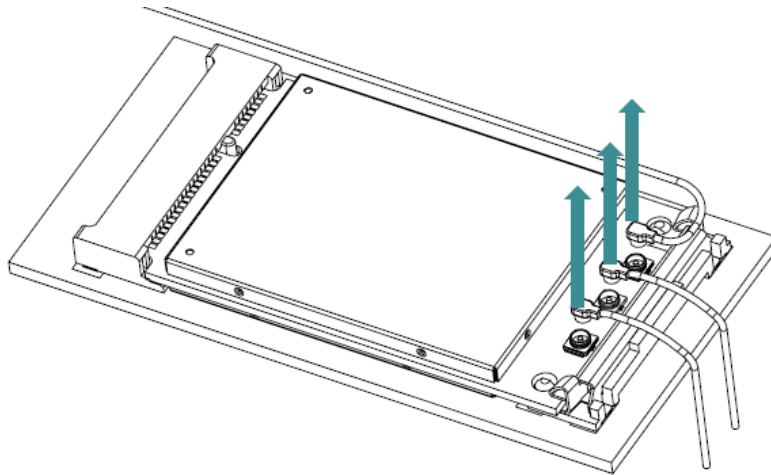


Figure 11: Step 1 of removing SIM7200 from the main board

Step 2: Push the two clips to release SIM7200 from the slot.

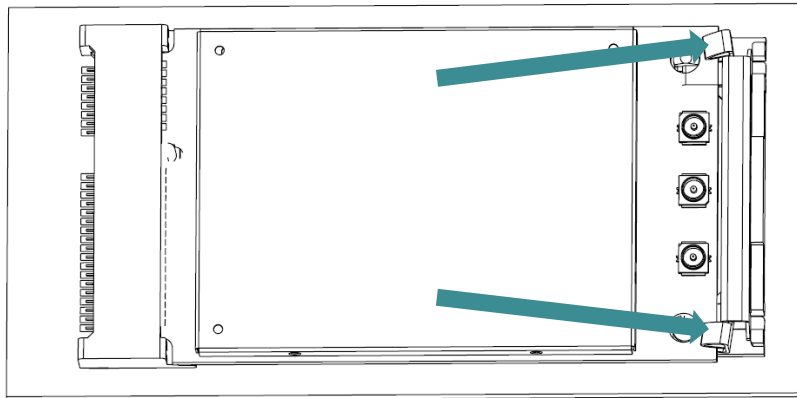


Figure 12: Step 2 of removing SIM7200 from the main board

Step 3: Push SIM7200 from the direction as following figure shows.

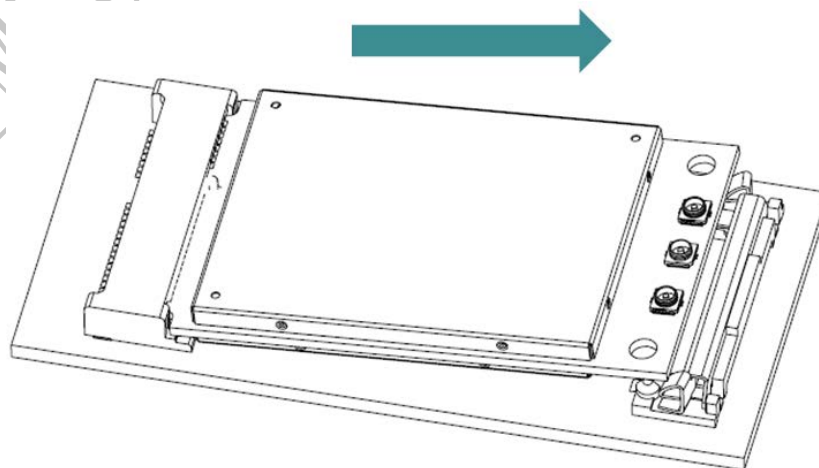


Figure 13: Step 3 of removing SIM7200 from the main board

Step 4: Push SIM7200 from the direction as following figure shows.

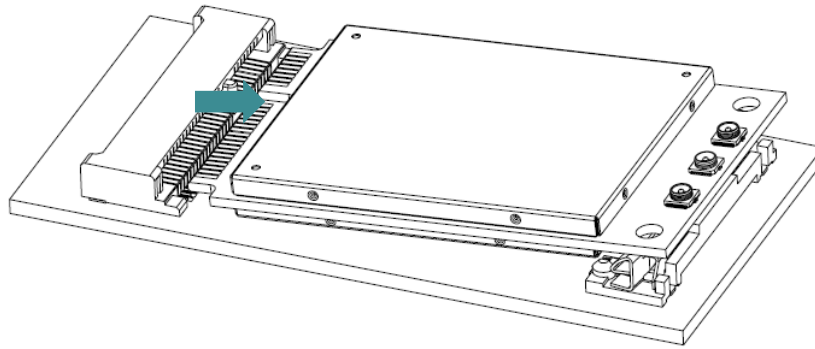


Figure 14: Step 4 of removing SIM7200 from the main board

4. Application Interface

4.1 Power Supply

The recommended power supply of SIM7200 is 3.3V and the voltage ranges from 3.2 V to 3.6 V. The SIM7200 has 4 power pins and 13 Ground pins, to ensure the SIM7200 module works normally, all the pins must be connected. The PCIe connector pin is defined as necessary to support 500mA per Pin continuously.

When the module works at the 2G mode, the transmitting burst will cause voltage drop and the power supply must be able to provide sufficient current up to 2.5A. For the 3.3V input, 3 bypass capacitors (low ESR) such as 220 μ F are strongly recommended. Make sure that the voltage does not drop below 3.2 V in any case.

The 10pF and 33pF capacitors can effectively eliminate the high frequency interference. A 5.1V/500mW Zener diode can be reserved, the diode can prevent chip from damaging by the voltage surge. These capacitors and Zener diode should be placed as close to SIM7200 VCC pins as possible.

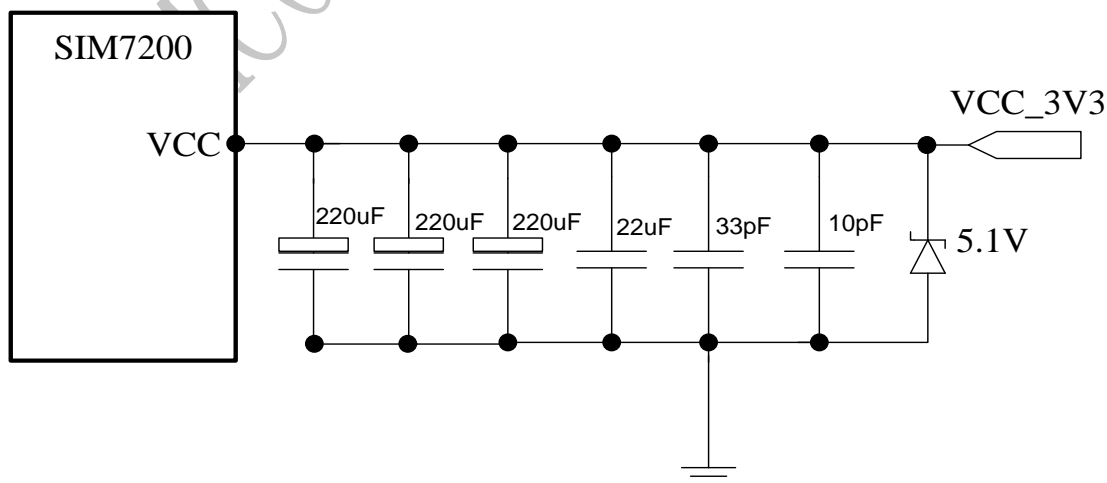


Figure 15: Recommended power circuit of SIM7200 module

Table 6: Recommended Zener diode

	Vendor	Part number	Power (watts)	Package
1	On semi	MMSZ5231BT1G	500mW	SOD123
2	cj-elec	MMSZ5231B	500mW	SOD123
3	Prisemi	PZ3D4V2H	500mW	SOD323
4	Vishay	MMSZ4689-V	500mW	SOD123
5	Crownpo	CDZ55C5V1SM	500mW	0805

Table 7: Power and ground specifications

Pin Name	Pin No	Min	Type	Max
VCC	2, 39,41,52	3.2V	3.3V	3.6V
GND	4,9,15,18,21,26,27,29, 34,35,37,40,43,50			

4.2 Power Saving Mode

SIM7200 has two power saving modes: minimum functionality mode and sleep mode. When SIM7200 is in sleep mode and minimum functionality mode, the current consumption of module is lowest.

4.2.1. Minimum Functionality Mode and Sleep Mode

The AT command “AT+CFUN=<fun>” can be used to set SIM7200 into minimum functionality.

There are three functionality modes, which could be set by the AT command “AT+CFUN=<fun>”. The command provides the choice of the functionality levels <fun>=0, 1, 4.

- AT+CFUN=0: Minimum functionality.
- AT+CFUN=1: Full functionality (default).
- AT+CFUN=4: Airplane mode (disable RF function).

Minimum functionality mode minimizes the current consumption to the lowest level. If SIM7200 is set to minimum functionality by “AT+CFUN=0”, the RF function and USIM card function will be disabled. In this case, the serial port and USB port are still accessible, but all AT commands correlative with RF function and USIM card function will not be accessible.

Note: For detailed information about the AT Command “AT+CFUN=<fun>”, please refer to document [1].

If host sends USB suspend request, SIM7200 will enter sleep mode automatically for reducing power consumption, when peripheral equipment of SIM7200 stops working, and module has no on air or audio activity required. In sleep mode, SIM7200 can still receive paging or SMS from network.

Note: SIM7200 could enter sleep mode if the host CPU supports USB suspend mode, otherwise it could not enter sleep mode.

4.2.2. Wake Up SIM7200 from Sleep Mode

When SIM7200 is in sleep mode, the following methods can wake up the module:

- Host sends USB resume request.
- Receive a data call from network.
- Receive a voice call from network.
- Receive a SMS from network.

4.3 USB 2.0

SIM7200 is compliant with Universal Serial Bus Specification Rev 2.0, It supports full-speed and high-speed when acting as a USB device.

Currently SIM7200 supports the USB suspend and resume mechanism which can help to save power. If no transaction is on USB bus, SIM7200 will enter suspend mode. When some events such as voice call or receiving SMS happen, SIM7200 will resume normal mode automatically.

For the large data rate of LTE network, SIMCom strongly suggests customer to design the device with the high speed USB specification with the data rate of 480Mbps to satisfy the increasing needs of data application.

USB interface features include:

- Windows: Modem or COM ports, using host Windows drivers
- Linux: / dev / ttyUSBn devices for Linux systems
- USB-compliant transceivers
- Selective suspend mode
- Data rate: Full-speed (12 Mbps) / High-speed (480 Mbps)
- Resumption initiated by host or module

Table 8: USB interface signals

Pin Name	Pin No	I/O	Description
USB_DN	36	I/O	USB differential data (-)
USB_DP	38	I/O	USB differential data (+)

4.3.1 USB Port Specification

SIM7200 could achieve data transfer, voice call (voice data input/output from the host device's MIC and SPEAKER), debug and software download, etc, through USB interface. When module is powered on, and USB_DP, USB_DN and GND are connected to the host, and the driver is installed successfully, then 4 COM port could be recognized by the host.

Table 9: USB port Specification

Port Name	Description
SimTech HS-USB AT Port	Module could be controlled by sending AT command via AT port.
SimTech HS-USB Diagnostics	Module could be debugged by grabbing log through Diagnostics port.
SimTech HS-USB NMEA	NMEA information could be grabbed from the NMEA port.
SimTech HS-USB PCM Voice	Voice call could be achieved through PCM Voice port.
SimTech HS-USB Modem	Module could transfer data through Modem.

Note: SimTech HS-USB PCM Voice function is under development.

4.3.2 Firmware Update

If users need to upgrade through USB port, it is necessary to power on SIM7200 first, and then connect USB_DP, USB_DN, GND to host device.

4.3.3 High-speed USB Layout Guide Lines

This section summarize the guidelines for designing controlled-impedance, high-speed USB PCBs to comply with the USB specification.

- The impedance could be controlled to 90Ω
- Route the high-speed clock and high-speed USB differential signals with minimum trace lengths.
- Route the high-speed USB signals on the plane closest to the ground plane
- Route the high-speed USB signals using a minimum of vias and corners.
- When it becomes necessary to turn 90°, use two 45° turns or an arc instead of making a single 90° turn. This reduces reflections on the signal traces by minimizing impedance discontinuities.
- Route the high-speed USB signals using a minimum of vias and corners. This reduces signal reflections and impedance changes.
- Do not route USB traces under or near crystals, oscillators, clock signal generators, switching regulators, magnetic devices or IC's that use or duplicate clock signals.
- Avoid stubs on the high-speed USB signals because they cause signal reflections. If a stub is unavoidable, then the stub should be less than 200 mils.
- Route all high-speed USB signal traces over continuous planes (VCC or GND), with no interruptions. Avoid crossing over anti-etch, commonly found with plane splits.

4.4 USIM Card Interface

SIM7200 supports one USIM card, and the USIM interface complies with ISO/IEC 7816-3 standard. Both 1.8V and 3.0V USIM card are supported. The USIM interface is powered from an internal regulator in the module, and it supports USIM card detecting and hot swap function.

Both 1.8V and 3.0V USIM card are supported. The USIM interface is powered from an internal regulator in the module, and supports USIM card detecting and hot swap function.

It is recommended to use an ESD protection component such as PHILIPS (www.ohilips.com) IP42220CZ6, the USIM peripheral circuit including resistors and ESD TVSs should be close to the USIM card socket. The

reference circuit of the 8-pin USIM card holder is illustrated as in the following figure.

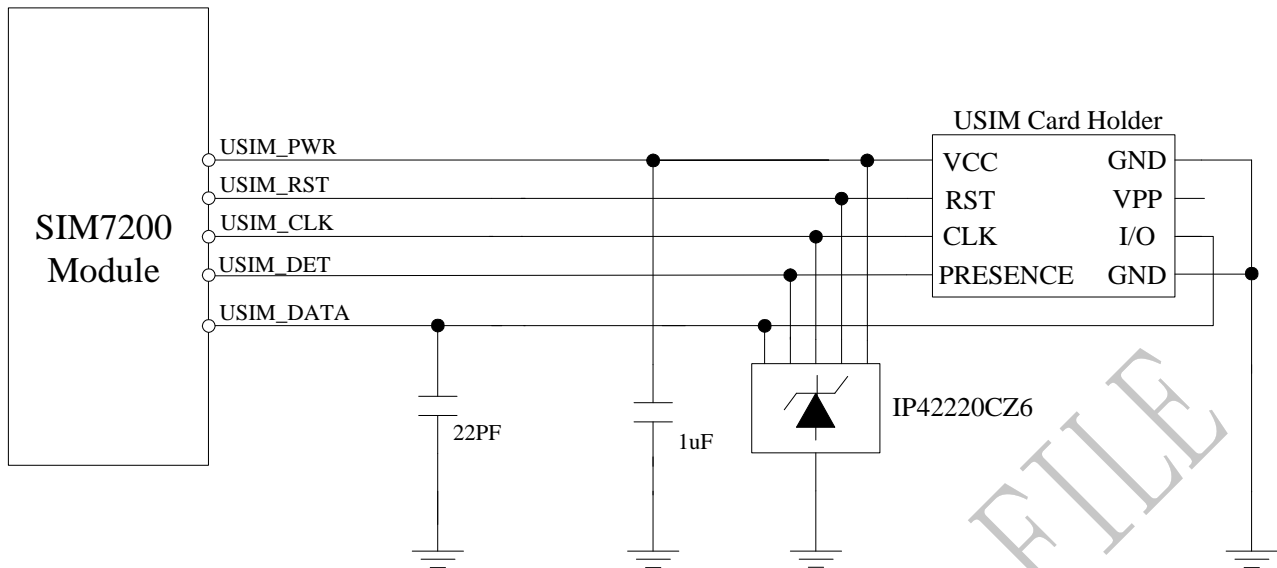


Figure 16: 8 Pin USIM card holder reference circuit

The USIM_DET pin is used for detection of the USIM card hot swap. User can select the 8-pin USIM card holder to implement USIM card detection function.

If the USIM card detection function is not used, user can keep the USIM_DET pin open. The reference circuit of 6-pin USIM card holder is illustrated in the following figure.

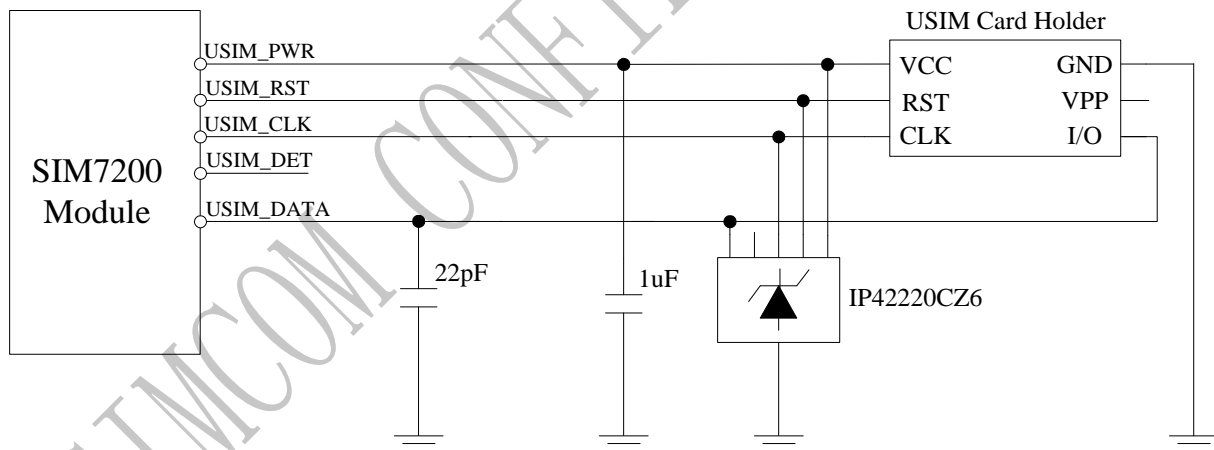


Figure 17: 6 Pin USIM card holder reference circuit

USIM card circuit is susceptible to be interfered, causing the USIM card failure or some other issues, so it is strongly recommended to follow these guidelines while designing:

- Make sure that USIM card holder stay away from antenna while in PCB layout, distance of the USIM connector and the module should be less than 10cm, shield the signals by GND to keep USIM interface away from system noise;
- USIM traces should keep away from RF lines, VBAT and high-speed signal lines, and the shorter the better; Avoid routing the USIM_CLK and USIM_DATA lines in parallel and distances over 2 cm, the cross-coupling of these lines can cause failures;
- The rise time of USIM_CLK and USIM_DATA should be less than 1μs, user should keep low

capacitance of these signals when layout, high capacitance will increase signal rise time. To optimize the signal rise time, the USIM_DATA has been pulled up to USIM_VDD with 10K resistor inside the SIM7200, customer do not need to add pull up;.

- Keep good connectivity between USIM holder GND and module GND;
- Recommended to place a 1 μ F capacitor on USIM_VDD line for decoupling and keep close to the holder;
- Add TVS to protect the USIM card and SIM7200 IC, but the parasitic capacitance should not exceed 50pF. Customer should decide whether the TVS diode is necessary depending on the application, mechanical enclosure, and USIM connector design.

Table 10: USIM card interface signals

Pin Name	Pin No	I/O	Description	DC Characteristics (V)		
				Min	Typ	Max
USIM_VDD	8	O	External USIM card power	-	1.8/2.85	-
USIM_DATA	10	I/O	External USIM card data	-	1.8/2.85	-
USIM_CLK	12	O	External USIM card clock	-	1.8/2.85	-
USIM_RST	14	O	External USIM card reset signal	-	1.8/2.85	-
USIM_DET	16	I	External USIM card detect	-	1.8	-

4.5 I2C Interface

The SIM7200 provides an industry standard I2C serial bus, It is I2C-compliant, high-speed mode (HS-mode)-compliant, and a master-only device. The interface has been pulled up to 1.8V with 2.2K.

Table 11: Pin definition of the I2C

Pin name	Pin number	Description
SCL	30	I2C serial bus clock
SDA	32	I2C serial bus data

I2C has the multiplexing function like the PCM interface, and the relation ship can be found in the following table.

Table 12: I2C multiplexing function

Pin number	Pin name	Mode 0(default)	Mode 1
30	SCL	SCL	GPIO19
32	SDA	SDA	GPIO18

4.6 GPIO Interface

SIM7200 provides 2 GPIO pins. The output voltage level of the GPIO can be set by AT command “AT+ SGPIO”. The input voltage level of the GPIO can also be read by AT command “AT+ SGPIO”. For more details, please refer to *document [1]*.

Table 13: Pin definition of the GPIO

Pin name	Pin number	Reset state
GPIO7	44	Pull up
GPIO6	46	Pull up

4.7 PERST#

The PERST# pin could be used as an emergency reset. SIM7200 has power-up reset function, so power-up reset pulse is not necessary. When the PERST# pin is pulled to ground, the module will be reset.

The following table is the electrical characteristics of The PERST# pin.

Table 14: PERST# Electrical Characteristic

Symbol	Parameter	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.2	1.8	2.1	V
V_{IL}	Low-level input voltage	-0.3	-	0.63	V
$T_{low\text{-}hold}$	Reset low level hold on time	50	-	-	us

The low level pulse time must be longer than **50us**, The following figure is the timing of reset function.

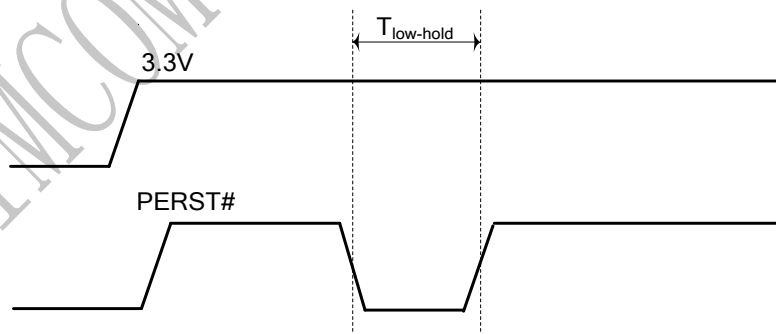


Figure 18: Reset timing

Reference circuit is recommended in the following figure:

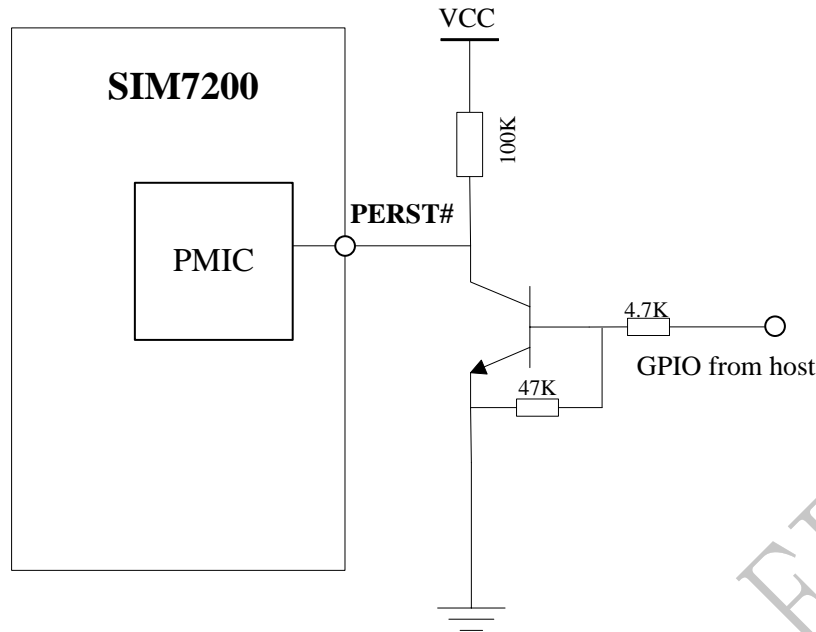


Figure 19: Recommend circuit of PERST#

4.8 W_DISABLE#

The W_DISABLE# pin controls SIM7200 to enter or exit the airplane mode, when the W_DISABLE# signal is asserted, all radios would be disabled. When the W_DISABLE# signal is not asserted, the radio may transmit if it was not disabled by other means such as software.

The W_DISABLE# is an active low signal and has been pulled up inside the module, the combination of the W_DISABLE# and the software configuration can set SIM7200 to airplane mode or normal operation mode.

Table 15: Airplane mode control Function

W_DISABLE# status	AT+CFUN=<fun>	Module operation
High Level	1	Normal Mode: RF is working. Airplane mode: RF is closed.
High Level	0	
Low Level	1	
Low Level	0	

Table 16: W_DISABLE# Electrical Characteristic

Symbol	Parameter	Min	Type	Max	Unit
V _{IH}	High-level input voltage	1.2	1.8	2.1	V
V _{IL}	Low-level input voltage	-	-	0.45	V

4.9 LED_WWAN#

LED_WWAN# is an Open drain active low signal; this signal is used to allow SIM7200 to provide network status via LED which will be provided by the host.

Table 17: Network Status Indication Pin Status

LED_WWAN# Status	Working Status
On	Module is powering up; Searching service;
200ms On, 200ms Off	Data Transmit
800ms On, 800ms Off	Registered network and not in a call
2S, 1S On, 1S Off	Airplane mode
1.6S, 0.6S On, 1S Off	Device error has occurred
Off	Power off / Sleep

Reference circuit is recommended in the following figure:

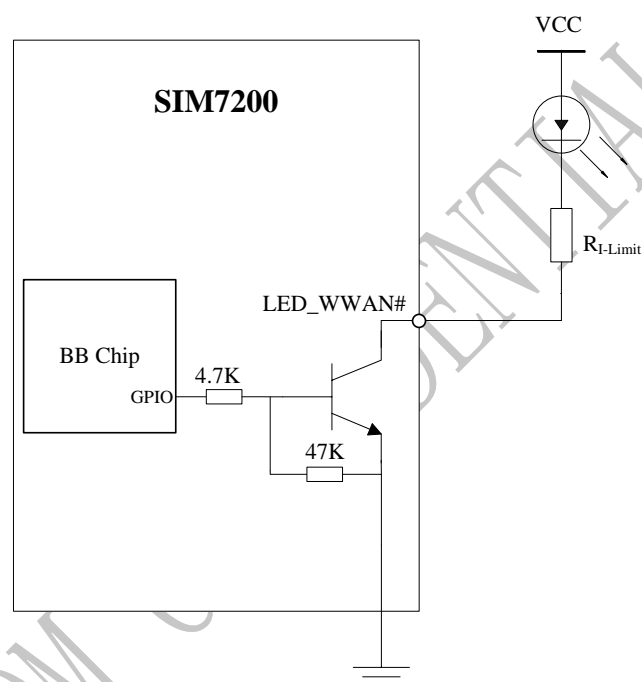


Figure 20: LED_WWAN# reference circuit

5 RF Specifications

SIM7200 has 3 antenna connectors, one of which is the main antenna connector for GSM/WCDMA/LTE, one is the diversity antenna connector for WCDMA/LTE, and the last is the GNSS antenna connector. Customer can find the connector name on the label of SIM7200.

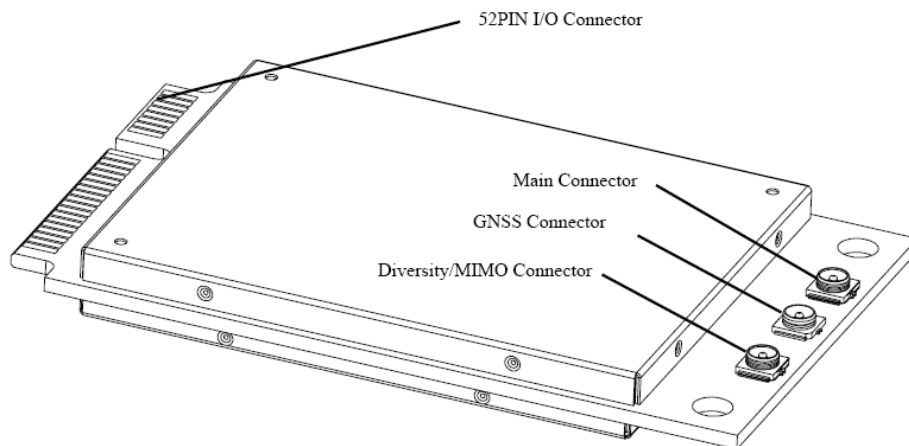


Figure 21: Antenna connector

5.1 The Antenna Connector

When choosing antennas, customer should pay attentions to the connector on antenna that should match with the connector on the module.

The dimension of the connector on SIM7200 is 2.6*2.6*1.25mm, which is from Hirose, and the part number is U.FL-R-SMT (10), Use KLC-1401 (www.lccable.com) to attach antennas to connection points on the module, as shown in Figure 18, likewise, customer can choose other vendor if the component's size match with U.FL-R-SMT (10).

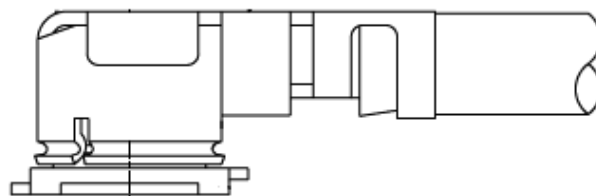


Figure 22: Antenna connector

Match coaxial connections between the module and the antenna to 50Ω. Minimize RF cable losses to the antenna; the recommended maximum cable loss for antenna cabling is 0.5 dB. To ensure best thermal performance, if possible use the mounting holes to attach (ground) the device to the main PCB ground or a metal chassis.

5.2 The Antenna Specifications

Recommended antenna characteristics of SIM7200 are described by following two tables.

Table 18: Recommended Passive Antenna Characteristics

Passive	Recommended standard
Direction	Omni directional
Gain	> -3dBi (Avg)
Input impedance	50 ohm
Efficiency	> 50 %
VSWR	< 2

Table 19: Recommended Antenna Characteristics

Band	Performance	
	TRP	TIS
GSM850	$\geq 29\text{dBm}$	$\leq -104\text{dBm}$
EGSM900	$\geq 29\text{dBm}$	$\leq -104\text{dBm}$
DCS1800	$\geq 26\text{dBm}$	$\leq -104\text{dBm}$
PCS1900	$\geq 26\text{dBm}$	$\leq -104\text{dBm}$
WCDMA B1	$\geq 19\text{dBm}$	$\leq -104\text{dBm}$
WCDMA B2	$\geq 19\text{dBm}$	$\leq -104\text{dBm}$
WCDMA B5	$\geq 19\text{dBm}$	$\leq -104\text{dBm}$
WCDMA B8	$\geq 19\text{dBm}$	$\leq -104\text{dBm}$
LTE-FDD B1	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B2	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B3	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B4	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B5	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B7	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B8	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B20	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-FDD B28	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-TDD B38	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-TDD B39	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-TDD B40	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$
LTE-TDD B41	$\geq 19\text{dBm}$	$\leq -90\text{dBm}$

6. Electrical, Reliability and Radio Characteristics

6.1 Absolute Maximum Ratings

The absolute maximum ratings are described by the following table. Module may be damaged beyond these ratings.

Table 20: Absolute maximum ratings

Symbol	Parameter	Min	Type	Max	Unit
V _{IN}	VCC input voltage	0	-	3.6	V
I _{IN}	VCC total peak current	0	-	2.5	A
I _I *	Input current	2	8	16	mA
I _O *	Output current	2	8	16	mA

*Note: * These parameters are for digital interface pins and 2mA steps, such as PCM.*

6.2 Recommended Operating Conditions

Please refer to the following table for recommended operating conditions.

Table 21: Operating Conditions

Symbol	Parameter	Min	Type	Max	Unit
VCC	3.3V Input voltage	3.2	3.3	3.6	V
T _{OPER}	Operating temperature	-40	+25	+85	°C
T _{STG}	Storage temperature	-45	+25	+90	°C

6.3 USIM Card Interface Characteristics

Table 22: USIM Card Interface Characteristics

Symbol	Parameter		Min	Type	Max	Unit
USIM_RST	V _{OH}	USIM_VDD=1.8V	1.35	-	1.8	V
		USIM_VDD=2.85V	2.4	-	2.85	V
	V _{OL}	USIM_VDD=1.8V	0	-	0.45	V
		USIM_VDD=2.85V	0	-	0.45	V
USIM_CLK	V _{OH}	USIM_VDD=1.8V	1.35	-	1.8	V
		USIM_VDD=2.85V	2.4	-	2.85	V
	V _{OL}	USIM_VDD=1.8V	1.35	-	1.8	V
		USIM_VDD=2.85V	2.4	-	2.85	V
USIM_DATA	V _{IH}	USIM_VDD=1.8V	1.2	-	2.1	V
		USIM_VDD=2.85V	1.85	-	3.15	V
	V _{IL}	USIM_VDD=1.8V	1.2	-	2.1	V
		USIM_VDD=2.85V	1.85	-	3.15	V
	V _{OH}	USIM_VDD=2.85V	1.35	-	1.8	V

		USIM_VDD=2.85V	2.4	-	2.85	V
	V _{OL}	USIM_VDD=1.8V	1.35	-	1.8	V
		USIM_VDD=2.85V	2.4	-	2.85	V

6.4 USIM_VDD Characteristics

Table 23: USIM_VDD Characteristics

Symbol	Parameter	Min	Type	Max	Unit
V _O	Output voltage	2.75	2.85	3.05	V
		1.7	1.80	1.9	
I _O	Output current	-	-	150	mA

6.5 Current Consumption (3.3V)

Table 24: Current Consumption(SIM7200E)

Idle(AT+CSCLK=0; AT+CFUN=1)	
GSM900	23.0 mA
WCDMA	21.0 mA
FDD	24.0 mA
TDD	21.0 mA
Voice Call	
GSM 850	PCL5 CH189 <300mA, Typical 250mA
GSM 900	PCL5 CH62 <300mA, Typical 260mA
DCS1800	PCL0 CH698 <250mA, Typical 200mA
DCS1900	PCL0 CH661 <250mA, Typical 190mA
GPRS Data	
DATA mode, GPRS (1 Rx,4 Tx) CLASS 12 CS4	
GSM 850	PCL5 CH189 <660mA, Typical 550mA
GSM 900	PCL5 CH62 <660mA, Typical 570mA
DCS1800	PCL0 CH698 <530mA, Typical 460mA
DCS1900	PCL0 CH661 <530mA, Typical 450mA
DATA mode, GPRS (3Rx, 2 Tx) CLASS 12 CS4	
GSM 850	PCL5 CH189 <500mA, Typical 410mA
GSM 900	PCL5 CH62 <500mA, Typical 400mA
DCS1800	PCL0 CH698 <400mA, Typical 310mA
DCS1900	PCL0 CH661 <400mA, Typical 290mA
EDGE Data	
DATA mode, EDGE(1 Rx,4 Tx) CLASS 12 MCS9	
GSM 850	PCL8 CH189 <500mA, Typical 375mA
GSM 900	PCL8 CH62 <500mA, Typical 385mA
DCS1800	PCL2 CH698 <450mA, Typical 400mA
DCS1900	PCL2 CH661 <450mA, Typical 390mA
DATA mode, EDGE(3Rx, 2 Tx) CLASS 12 MCS9	
GSM 850	PCL8 CH189 <330mA, Typical 260mA
GSM 900	PCL8 CH62 <330mA, Typical 270mA
DCS1800	PCL2 CH698 <220mA, Typical 260mA

DCS1900		PCL2 CH661 <220mA, Typical 240mA
UMTS Voice Call		
WCDMA B1		CH10838 @Power 21dBm Typical 590mA
		CH10838 @Power 10dBm Typical 270mA
WCDMA B2		TBD
WCDMA B5		CH4408 @Power 21dBm Typical 470mA
		CH4408 @Power 10dBm Typical 210mA
WCDMA B8		CH3088 @Power 21dBm Typical 480mA
		CH3088 @Power 10dBm Typical 220mA
FDD		
Band 1	5M	CH18300 10dBm Typical 280mA
	10M	CH18300 10dBm Typical 290mA
	15M	CH18300 10dBm Typical 330mA
	20M	CH18300 10dBm Typical 340mA
Band 3	1.4M	CH19575 10dBm Typical 310mA
	3M	CH19575 10dBm Typical 315mA
	5M	CH19575 10dBm Typical 315mA
	10M	CH19575 10dBm Typical 315mA
	15M	CH19575 10dBm Typical 355mA
	20M	CH19575 10dBm Typical 365mA
Band 4	1.4M	CH20175 10dBm Typical 300mA
	3M	CH20175 10dBm Typical 305mA
	5M	CH20175 10dBm Typical 300mA
	10M	CH20175 10dBm Typical 310mA
	15M	CH20175 10dBm Typical 360mA
	20M	CH20175 10dBm Typical 360mA
Band 5	1.4M	CH20525 10dBm Typical 270mA
	3M	CH20525 10dBm Typical 280mA
	5M	CH20525 10dBm Typical 280mA
	10M	CH20525 10dBm Typical 260mA
	15M	
	20M	
Band 7	1.4M	
	3M	
	5M	CH21100 10dBm Typical 310mA
	10M	CH21100 10dBm Typical 320mA
	15M	CH21100 10dBm Typical 360mA
	20M	CH21100 10dBm Typical 365mA
Band 8	1.4M	CH21625 10dBm Typical 260mA
	3M	CH21625 10dBm Typical 260mA
	5M	CH21625 10dBm Typical 260mA
	10M	CH21625 10dBm Typical 270mA
	15M	

	20M	
TDD		
Band38	5M	CH38000 10dBm Typical 190mA
	10M	CH38000 10dBm Typical 200mA
	15M	CH38000 10dBm Typical 230mA
	20M	CH38000 10dBm Typical 230mA
Band40	5M	CH39150 10dBm Typical 220mA
	10M	CH39150 10dBm Typical 220mA
	15M	CH39150 10dBm Typical 250mA
	20M	CH39150 10dBm Typical 250mA

Note: In above table the current consumption value is the typical one of the SIM7200 module tested in laboratory. In the mass production stage, there may be differences among each individual.

6.6 Electro-Static Discharge

SIM7200-PCIe is an ESD sensitive component, so more attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

Table 25: ESD characteristics (Temperature: 25 °C, Humidity: 45 %)

Pin	Contact discharge	Air discharge
VCC	±5KV	±10KV
GND	±5KV	±10KV
Antenna port	±5KV	±10KV
USB_DP,USB_DN	±3KV	±6KV
RESET	±1KV	±3KV

6.7 Radio Characteristics

6.7.1 Conducted Output Power

The following table shows SIM7200-PCIe's conducted output power, comply with 3GPP TS 05.05and TS 34.121.

Table 26: Conducted Output Power

Frequency	Max	Min
GSM850	33dBm ±2dB	5dBm ± 5dB
E-GSM900	33dBm ±2dB	5dBm ± 5dB
DCS1800	30dBm ±2dB	0dBm ± 5dB
PCS1900	30dBm ±2dB	0dBm ± 5dB
GSM850 (8-PSK)	27dBm ±3dB	5dBm ± 5dB
E-GSM900 (8-PSK)	27dBm ±3dB	5dBm ± 5dB

DCS1800 (8-PSK)	26dBm +3/-4dB	0dBm \pm 5dB
PCS1900(8-PSK)	26dBm +3/-4dB	0dBm \pm 5dB
WCDMA B1	24dBm +1/-3dB	-56dBm \pm 5dB
WCDMA B2	24dBm +1/-3dB	-56dBm \pm 5dB
WCDMA B5	24dBm +1/-3dB	-56dBm \pm 5dB
WCDMA B8	24dBm + 1/-3dB	-56dBm \pm 5dB
LTE-FDD B1	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B2	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B3	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B4	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B5	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B7	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B8	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B20	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B28	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B38	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B39	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B40	23dBm +2.7dB	-50dBm \pm 5dB
LTE-FDD B41	23dBm +2.7dB	-50dBm \pm 5dB

6.7.2 Conducted Receive Sensitivity

The following table shows conducted receiving sensitivity of SIM7200-PCIE.

Table 27: Conducted Receive Sensitivity

Frequency	Receive sensitivity
GSM850	< -108dBm
E-GSM900	< -108dBm
DCS1800	< -108dBm
PCS1900	< -108dBm
WCDMA B1	< -108dBm
WCDMA B2	< -108dBm
WCDMA B5	< -106dBm
WCDMA B8	< -106dBm
LTE FDD/TDD	See table 30.

Table 30: Reference sensitivity (QPSK)

Channel bandwidth							
E-UTRA Band	1.4 MHz (dBm)	3 MHz (dBm)	5 MHz (dBm)	10 MHz (dBm)	15 MHz (dBm)	20 MHz (dBm)	Duplex Mode
1	-	-	-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6	-	-	-100	-97			FDD
7	-	-	-98	-95	-93.2	-92	FDD

8	-102.2	-99.2	-97	-94			FDD
9	-	-	-99	-96	-94.2	-93	FDD
10	-	-	-100	-97	-95.2	-94	FDD
11	-	-	-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14		-	-97	-94			FDD
17	-	-	-97	-94			FDD
18	-	-	-100	-97	-95.2	-	FDD
19	-	-	-100	-97	-95.2	-	FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97			FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
33	-	-	-100	-97	-95.2	-94	TDD
34	-	-	-100	-97	-95.2	-	TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37	-	-	-100	-97	-95.2	-94	TDD
38	-	-	-100	-97	-95.2	-94	TDD
39	-	-	-100	-97	-95.2	-94	TDD
40	-	-	-100	-97	-95.2	-94	TDD
41	-	-	-99	-96	-94.2	-93	TDD

Remark: The data in above table are gotten at static condition.

6.7.3 Supported Band

Table 31: Operating frequencies

Frequency	Receiving	Transmission
GSM850	869 ~894 MHz	824 ~849 MHz
E-GSM900	925 ~960 MHz	880 ~915 MHz
DCS1800	1805~1880 MHz	1710~1785 MHz
PCS1900	1930~1990 MHz	1850~1910 MHz
WCDMA 2100	2110~2170 MHz	1920~1980 MHz
WCDMA1900	1930~1990 MHz	1850~1910 MHz
WCDMA 850	869 ~894 MHz	824 ~849 MHz
WCDMA 900	925 ~960 MHz	880 ~915 MHz
TDSCDMA 1900	1880~1920 MHz	1880~1920 MHz
TDSCDMA 2000	2010~2025 MHz	2010~2025 MHz
LTE BAND		

LTE Operating frequencies are shown in following table 32.

Note: Operating frequencies of LTE TDD B41 for SIM7200 is 100MHz BW, 2555~2655 MHz

GPS L1 BAND	1574.4 ~1576.44 MHz	-
GLONASS	1598 ~1606 MHz	-

Table32: E-UTRA operating bands

E-UTRA Operating Band	Uplink (UL) operating band	Downlink (DL) operating band	Duplex Mode
	BS receive / UE transmit(UL)	BS transmit / UE receive(DL)	
1	1920 MHz~1980 MHz	2110 MHz~2170 MHz	FDD
2	1850 MHz~1910 MHz	1930 MHz~1990 MHz	FDD
3	1710 MHz~1785 MHz	1805 MHz~1880 MHz	FDD
4	1710 MHz~1755 MHz	2110 MHz~2155 MHz	FDD
5	824 MHz~849 MHz	869 MHz~894MHz	FDD
6 ¹	830 MHz~840 MHz	875 MHz~885 MHz	FDD
7	2500 MHz~2570 MHz	2620 MHz~2690 MHz	FDD
8	880 MHz~915 MHz	925 MHz~960 MHz	FDD
9	1749.9 MHz~1784.9 MHz	1844.9 MHz~1879.9 MHz	FDD
10	1710 MHz~1770 MHz	2110 MHz~2170 MHz	FDD
11	1427.9 MHz~1447.9 MHz	1475.9 MHz~1495.9 MHz	FDD
12	699 MHz~716 MHz	729 MHz~746 MHz	FDD
13	777 MHz~787 MHz	746 MHz~756 MHz	FDD
14	788 MHz~798 MHz	758 MHz~768 MHz	FDD
17	704 MHz~716 MHz	734 MHz~746 MHz	FDD
18	815 MHz~830 MHz	860 MHz~875 MHz	FDD
19	830 MHz~845 MHz	875 MHz~890 MHz	FDD
20	832 MHz~862 MHz	791 MHz~821 MHz	FDD
21	1447.9 MHz~1462.9 MHz	1495.9 MHz~1510.9 MHz	FDD
22	3410 MHz~3490 MHz	3510 MHz~3590 MHz	FDD
23	2000 MHz~2020 MHz	2180 MHz~2200 MHz	FDD
24	1626.5 MHz~1660.5 MHz	1525 MHz~1559 MHz	FDD
25	1850 MHz~1915 MHz	1930 MHz~1995 MHz	FDD
26	814 MHz~849 MHz	859 MHz~894 MHz	FDD
27	807 MHz~824 MHz	852 MHz~869 MHz	FDD
28	703 MHz~748 MHz	758 MHz~803 MHz	FDD
31	452.5 MHz~457.5 MHz	462.5 MHz~467.5 MHz	FDD
33	1900 MHz~1920 MHz	1900 MHz~1920 MHz	TDD
34	2010 MHz~2025 MHz	2010 MHz~2025 MHz	TDD
35	1850 MHz~1910 MHz	1850 MHz~1910 MHz	TDD
36	1930 MHz~1990 MHz	1930 MHz~1990 MHz	TDD

37	1910 MHz~1930 MHz	1910 MHz~1930 MHz	TDD
38	2570 MHz~2620 MHz	2570 MHz~2620 MHz	TDD
39	1880 MHz~1920 MHz	1880 MHz~1920 MHz	TDD
40	2300 MHz~2400 MHz	2300 MHz~2400 MHz	TDD
41	2496 MHz~2690 MHz	2496 MHz~2690 MHz	TDD

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7. Appendix

I. SIM7200-PCIe Top and Bottom View

Figure 23: SIM7200-PCIe top and bottom View

II. Related Documents

Table 28: Related Documents

SN	Document name	Remark
[1]	SIMCOM_SIM7200_ATC_EN_V1.XX.doc	
[2]	AN_SIM7200_TCPIP	TCP/IP Applications User Manual
[3]	PCI Express Mini Card Electromechanical Specification Revision 1.2	
[4]	Mini PCIe_EVB kit_User Guide_VX.XX	EVB User Guide
[5]	ITU-T Draft new recommendation V.25ter:	Serial asynchronous automatic dialing and control
[6]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[7]	GSM 07.10:	Support GSM 07.10 multiplexing protocol
[8]	GSM 07.05:	Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
[9]	GSM 11.14:	Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[10]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[11]	GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[12]	GSM 11.10	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification

III. Terms and Abbreviations







Table 29: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
APAC	Asia Pacific
BB	Baseband
CA	Carrier aggregation
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DRX	Discontinuous Reception
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EDGE	Enhanced Data Rate for GSM Evolution
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
ESD	Electrostatic Discharge
ESR	Equivalent Series Resistance
ETS	European Telecommunication Standard
FDD	Frequency Division Dual
FR	Full Rate
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
GPS	Global Position System
GSM	Global Standard for Mobile Communications
HR	Half Rate
I2C	Inter — Integrated Circuit
IMEI	International Mobile Equipment Identity
LED	Light-emitting Diode
LNA	Low Noise Amplifier
Li-ion	Lithium-Ion
LTE	Long Term Evolution
MCP	Multiple-chip Package
MIMO	Multi-Input Multi-Output
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
NC	Not Connect

PAP	Password Authentication Protocol
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PCM	Pulse Code Modulation
PCIe	Peripheral Component Interface Express
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PMIC	Power Management IC
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
TBD	To Be Determined
WCDMA	Wideband Code Division Multiple Access
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
RX	Receive Direction
SMS	Short Message Service
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
USIM	User Identity Module
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identity Module
URC	Unsolicited Result Code
USB	Universal Serial Bus
USSD	Unstructured Supplementary Service Data
WCDMA	Wide Code Division Multiple Access
WWAN	Wireless Wide Area Network
Phonebook abbreviations	
FD	SIM fix dialing phonebook
LD	USIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	USIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	USIM phonebook
NC	Not connect

IV. Safety Caution

Table 30: Safety caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive to not operate normally for RF energy interference.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forget to think much of these instructions may lead to the flight safety or offend against local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	<p>GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, for example no mobile fee or a invalid USIM card. While you are in this condition and need emergent help, please remember using emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.</p> <p>Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call.</p> <p>Also, some networks require that a valid USIM card be properly inserted in the cellular terminal or mobile.</p>

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