



# SIM7070 Series PCIe Hardware Design

LPWA Module

**SIMCom Wireless Solutions Limited**

Building B, SIM Technology Building, No.633, Jinzhong Road  
Changning District, Shanghai P.R. China  
Tel: 86-21-31575100  
[support@simcom.com](mailto:support@simcom.com)  
[www.simcom.com](http://www.simcom.com)

<b>Document Title:</b>	SIM7070 Series PCIE Hardware Design
<b>Version:</b>	V1.01
<b>Date:</b>	2020-04-22
<b>Status:</b>	Released

## GENERAL NOTES

SIMCOM OFFERS THIS INFORMATION AS A SERVICE TO ITS CUSTOMERS, TO SUPPORT APPLICATION AND ENGINEERING EFFORTS THAT USE THE PRODUCTS DESIGNED BY SIMCOM. THE INFORMATION PROVIDED IS BASED UPON REQUIREMENTS SPECIFICALLY PROVIDED TO SIMCOM BY THE CUSTOMERS. SIMCOM HAS NOT UNDERTAKEN ANY INDEPENDENT SEARCH FOR ADDITIONAL RELEVANT INFORMATION, INCLUDING ANY INFORMATION THAT MAY BE IN THE CUSTOMER'S POSSESSION. FURTHERMORE, SYSTEM VALIDATION OF THIS PRODUCT DESIGNED BY SIMCOM WITHIN A LARGER ELECTRONIC SYSTEM REMAINS THE RESPONSIBILITY OF THE CUSTOMER OR THE CUSTOMER'S SYSTEM INTEGRATOR. ALL SPECIFICATIONS SUPPLIED HEREIN ARE SUBJECT TO CHANGE.

## COPYRIGHT

THIS DOCUMENT CONTAINS PROPRIETARY TECHNICAL INFORMATION WHICH IS THE PROPERTY OF SIMCOM WIRELESS SOLUTIONS LIMITED COPYING, TO OTHERS AND USING THIS DOCUMENT, ARE FORBIDDEN WITHOUT EXPRESS AUTHORITY BY SIMCOM. OFFENDERS ARE LIABLE TO THE PAYMENT OF INDEMNIFICATIONS. ALL RIGHTS RESERVED BY SIMCOM IN THE PROPRIETARY TECHNICAL INFORMATION , INCLUDING BUT NOT LIMITED TO REGISTRATION GRANTING OF A PATENT , A UTILITY MODEL OR DESIGN. ALL SPECIFICATION SUPPLIED HEREIN ARE SUBJECT TO CHANGE WITHOUT NOTICE AT ANY TIME.

### **SIMCom Wireless Solutions Limited**

Building B, SIM Technology Building, No.633 Jinzhong Road, Changning District, Shanghai P.R.China  
Tel: +86 21 31575100  
Email: simcom@simcom.com

**For more information, please visit:**

<https://www.simcom.com/download/list-863-en.html>

**For technical support, or to report documentation errors, please visit:**

<https://www.simcom.com/ask/> or email to: [support@simcom.com](mailto:support@simcom.com)

Copyright © 2020 SIMCom Wireless Solutions Limited All Rights Reserved.

## Version History

Date	Version	Description of change	Author
2019-11-19	1.00	Original	Zhao sen , Zhao xian jing
2020-04-22	1.01	Modify the format	Zhao sen , Zhao xian jing

# Contents

<b>Version History.....</b>	<b>3</b>
<b>Contents.....</b>	<b>4</b>
<b>Table Index.....</b>	<b>7</b>
<b>Figure Index.....</b>	<b>8</b>
<b>1 Introduction.....</b>	<b>9</b>
1.1 Product Outline.....	9
1.2 Hardware Interface Overview.....	10
1.3 Hardware Block Diagram.....	11
1.4 Functional Overview.....	11
<b>2 Package Information.....</b>	<b>13</b>
2.1 Pin Out Diagram.....	13
2.2 PCI Express Mini Card Connector Pin Description.....	13
2.3 Package Dimensions.....	16
<b>3 Interface Application.....</b>	<b>17</b>
3.1 Power Supply.....	17
3.2 W_DISABLE#.....	17
3.3 LED_WWAN#.....	18
3.4 LED_WLAN#.....	19
3.5 WAKE#.....	20
3.6 USB 2.0.....	21
3.7 USIM Interface.....	22
3.8 UART Interface.....	23
3.8.1 UART interface reference circuit.....	24
3.8.2 RI describe.....	26
3.8.3 DTR Describe.....	26
3.9 I2C Interface.....	27
3.10 PCM Interface.....	28
<b>4 RF Specifications.....</b>	<b>29</b>
4.1 GSM/LTE RF Specifications.....	29
4.2 LTE Antenna Design Guide.....	34
4.3 GNSS.....	36
4.3.1 GNSS Technical specification.....	36
4.3.2 GNSS Antenna interface.....	36

---

4.3.3	GSM/LTE Antenna Interface.....	37
<b>5</b>	<b>Electrical Specifications.....</b>	<b>38</b>
5.1	Absolute Maximum Ratings.....	38
5.2	Recommended Operating Conditions.....	38
5.3	Operating Mode.....	39
5.3.1	Operating Mode.....	39
5.3.2	Sleep mode.....	40
5.3.3	Minimum functionality mode.....	40
5.4	Current Consumption.....	40
5.5	Electro-Static Discharge.....	44
<b>6</b>	<b>Packaging.....</b>	<b>45</b>
<b>7</b>	<b>Appendix.....</b>	<b>47</b>
7.1	Coding Schemes and Maximum Net Data Rates over Air Interface.....	47
7.2	Related Documents.....	49
7.3	Terms and Abbreviations.....	51
7.4	Safety Caution.....	53

SIMCom  
Confidential

## Table Index

Table 1: SIM7070 Series PCIE Frequency Bands.....	9
Table 2: SIM7070 Series PCIE Key Features.....	11
Table 3: I/O parameters definition.....	13
Table 4: PCI Express Mini Card Connector Pin Description.....	14
Table 5: Recommended 3.3V Power Supply Characteristics.....	17
Table 6: W_DISABLE# Pin Status.....	17
Table 7: Network Status Indication LED Status.....	19
Table 8: USIM Electronic characteristic in 1.8V mode (USIM_VDD =1.8V).....	22
Table 9: UART Electrical Characteristic.....	24
Table 10: UART Electrical Characteristic.....	27
Table 10: PCM format.....	28
Table 11: Conducted transmission power.....	29
Table 12: Maximum Power Reduction (MPR) for UE category Power Class 5.....	31
Table 13: Operating frequencies.....	31
Table 14: E-UTRA operating bands.....	32
Table 15: Conducted receive sensitivity.....	32
Table 16:CAT-M1 Reference sensitivity (QPSK).....	33
Table 17: CAT-NB2 Reference sensitivity (QPSK).....	34
Table 18: Trace loss.....	34
Table 19: Absolute maximum ratings.....	38
Table 20:Recommended operating ratings.....	38
Table 21: 1.8V Digital I/O characteristics*.....	38
Table 22: Operating temperature.....	39
Table 23: Operating Mode.....	39
Table 24: Current Consumption (Testing Environment: VBAT=3.8V).....	40
Table 25: ESD characteristics (Temperature: 25°C, Humidity: 45 %).....	44
Table 26: Tray size.....	46
Table 27: Small Carton size.....	46
Table 28: Big Carton size.....	46
Table 29: Coding Schemes and Maximum Net Data Rates over Air Interface.....	47
Table 30: Related Documents.....	49
Table 31: Terms and Abbreviations.....	51
Table 32: Safety caution.....	53

## Figure Index

Figure 1: SIM7070 PCIE Block Diagram.....	11
Figure 2: SIM7070 Series Pin out Diagram.....	13
Figure 3: Dimensions of SIM7070-PCIE (Unit: mm).....	16
Figure 4: power supply reference circuit.....	17
Figure 5: W_DISABLE# Reference Circuit.....	18
Figure 6: LED_WWAN# Reference Circuit.....	19
Figure 7: LED_WLAN# Reference Circuit.....	20
Figure 8: WAKE# behaviour.....	20
Figure 9: WAKE# Reference Circuit.....	21
Figure 10: USB Reference Circuit.....	21
Figure 11: USIM interface reference circuit.....	22
Figure 12: UART Full modem.....	24
Figure 13: UART Null modem.....	25
Figure 14: Reference circuit of level shift.....	25
Figure 15: Reference circuit with Transistor.....	25
Figure 16: RI behavior (SMS and URC report).....	26
Figure 17:I2C Reference Circuit.....	27
Figure 18: Receiver interface configuration.....	28
Figure 19: Antenna matching circuit (MAIN_ANT).....	35
Figure 20: GNSS antenna Reference Circuit.....	37
Figure 21: Tray packaging.....	45
Figure 22: Tray drawing.....	45
Figure 23: Small carton drawing.....	46
Figure 24: Big carton drawing.....	46

# 1 Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of SIM7070 Series PCIE. With the help of this document and other related software application notes/user guides, users can understand and use SIM7070 Series PCIE to design and develop applications quickly.

## 1.1 Product Outline

Aimed at global market, the SIM7070 Series PCIE supports LTE CAT-M1, LTE CAT-NB1, GPRS and EDGE. Users can choose the PCIE according to the wireless network configuration. SIM7070 Series PCIE includes SIM7070G-PCIE, SIM7070E-PCIE, The supported radio frequency bands are described in the following table.

**Table 1: SIM7070 Series PCIE Frequency Bands**

Network Type	Band	SIM7070 Series PCIE			
		SIM7070G PCIE		SIM7070E PCIE	
	Category	M1	NB1/NB2	M1	NB1/NB2
LTE-HD-FDD	LTE-FDD B1	☒	☒	☒	☒
	LTE-FDD B2	☒	☒	☒	☒
	LTE-FDD B3	☒	☒	☒	☒
	LTE-FDD B4	☒	☒	☒	☒
	LTE-FDD B5	☒	☒	☒	☒
	LTE-FDD B8	☒	☒	☒	☒
	LTE-FDD B12	☒	☒	☒	☒
	LTE-FDD B13	☒	☒	☒	☒
	LTE-FDD B14	☒		☒	
	LTE-FDD B18	☒	☒	☒	☒
	LTE-FDD B19	☒	☒	☒	☒
	LTE-FDD B20	☒	☒	☒	☒
	LTE-FDD B25	☒	☒	☒	☒
	LTE-FDD B26	☒	☒	☒	☒
	LTE-FDD B27	☒		☒	
	LTE-FDD B28	☒	☒	☒	☒

LTE-FDD B31				
LTE-FDD B66	☒	☒	☒	☒
LTE-FDD B71		☒		
LTE-FDD B72			☒	
LTE-FDD B85	☒	☒	☒	☒
GSM850MHz	☒		☒	
GSM/GPRS/ EDGE	EGSM900MHz	☒	☒	
	DCS1800MHz	☒	☒	
	PCS1900MHz	☒	☒	
GNSS	GPS	☒	☒	
	GLONASS	☒	☒	
	BDS	☒	☒	
	Galileo	☒	☒	

### NOTE

Galileo is default closed in software. But users can open it via AT command "AT+CGNSMOD". For more information about these AT commands, please refer to Document [1]

## 1.2 Hardware Interface Overview

SIM7070 Series PCIE provides various hardware interfaces via Mini PCI Express card connector.

- Power Supply
- W\_DISABLE#
- LED\_WWAN#
- WAKE#
- USB Interface
- USIM Interface
- UART Interface
- I2C Interface
- PCM Interface
- GPIOs

## 1.3 Hardware Block Diagram

The following figure is SIM7070 Series PCIE hardware block diagram.

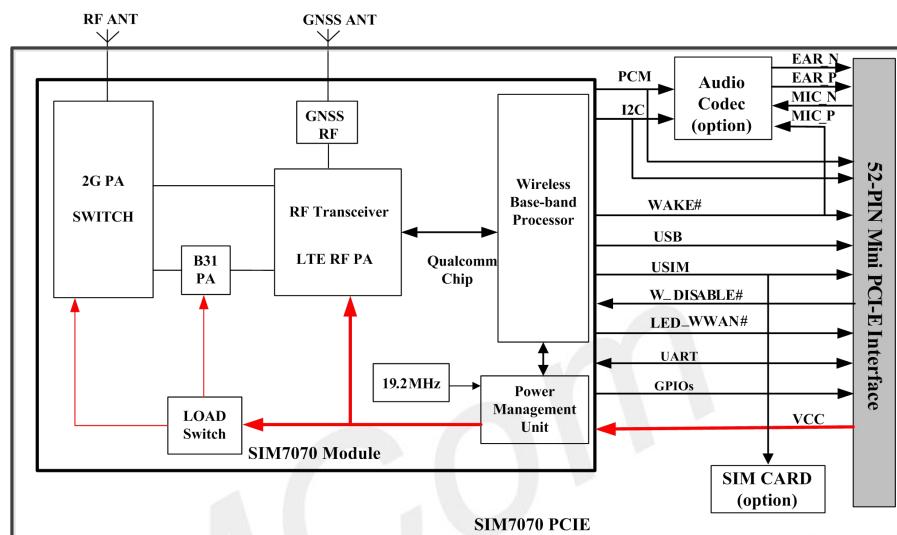


Figure 1: SIM7070 PCIE Block Diagram

## 1.4 Functional Overview

Table 2: SIM7070 Series PCIE Key Features

Feature	Implementation
Power supply	Single supply voltage 3.3V~4.2V. Default:3.8V
Radio frequency bands	Please refer to the table 1  GSM/GPRS power class: -- GSM850: 4 (2W) -- EGSM900: 4 (2W) -- DCS1800: 1 (1W) -- PCS1900: 4 (1W)
Transmitting power	EDGE power class: -- GSM850: E2 (0.5W) -- EGSM900: E2 (0.5W) -- DCS1800: E1 (0.4W) -- PCS1900: E1 (0.4W)  LTE power class: 5 (0.125W). Band31/Band72 power class: 3 (0.25W)  GPRS: Uplink up to 85.6Kbps, Downlink up to 85.6Kbps. EDGE: Uplink up to 236.8Kbps, Downlink up to 236.8Kbps
Data Transmission Throughput	LTE CAT M1: 589Kbps (DL). LTE CAT M1: 1119Kbps (UL). LTE CAT NB2: 136Kbps (DL). LTE CAT NB2: 150Kbps (UL).

Antenna	GPRS/EDGE/LTE main antenna. GNSS antenna.
GNSS	GNSS engine (GPS,GLONASS,BD and Galileo) Protocol: NMEA
SMS	Text and PDU mode
USIM interface	Support identity card: 1.8V
USIM application toolkit	Support SAT class 3,
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC
Audio feature	Support PCM interface. Only support PCM master mode and short frame sync, 16-bit linear data formats.
UART interface	A full modem serial port by default. Baud rate: 300bps to 3686400bps. Default rate is 0bps (auto baud rate).Support auto baud rate, but only limited to 9600, 19200, 38400, 57600 and 115200 bps. Can be used as the AT commands or data stream channel. Support RTS/CTS hardware handshake.
USB	USB 2.0 high speed interface
Firmware upgrade	Firmware upgrade over USB interface
Physical characteristics	Size: 50.80*30*5.2mm Weight: 9.4±0.2g
Temperature range	Normal operation temperature: -40°C ~ +85°C Storage temperature -45°C to +90°C

## 2 Package Information

### 2.1 Pin Out Diagram

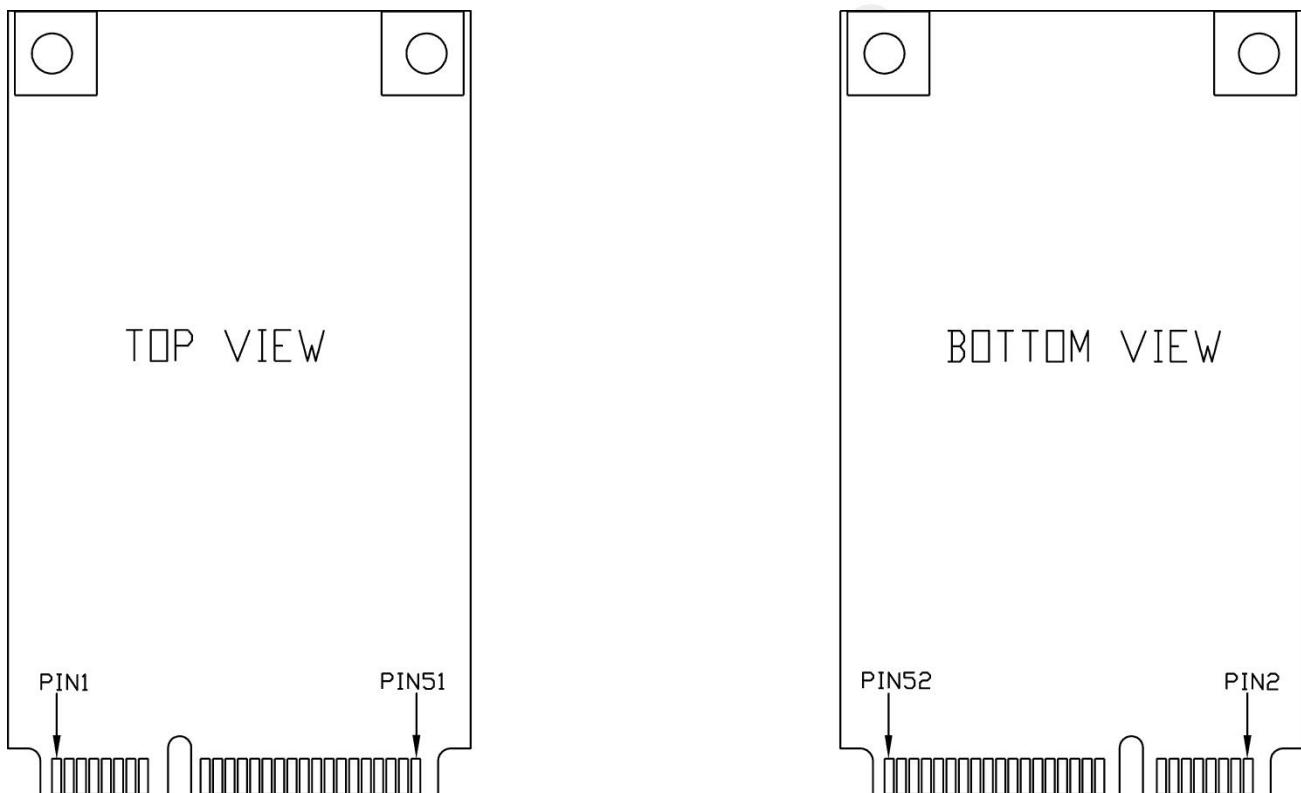


Figure 2: SIM7070 Series Pin out Diagram

### 2.2 PCI Express Mini Card Connector Pin Description

Table 3: I/O parameters definition

Pin type	Description
PI	Power input
PO	Power output
AI	Analog input
AIO	Analog input/output

I/O	Bidirectional input /output
DI	Digital input
DO	Digital output
DOH	Digital output with high level
DOL	Digital output with low level
PU	Pull up
PD	Pull down

**Table 4: PCI Express Mini Card Connector Pin Description**

Pin name	Pin number	I/O	Description	Comment
<b>Power supply</b>				
VBAT	2,24,39,41,52	PI	Power supply for PCIE	3.8V typical
GND	4,9,15,18,21,26,27,29,3,35,37,40,43,50		Ground	-
<b>USB 2.0</b>				
USB_DP	38	I/O	USB 2.0 high speed port for data transfer, voice call, debug and SW download, etc.	If unused, keep open.
USB_DN	36			
<b>USIM card interface</b>				
USIM_VDD	8	PO	Power output for USIM card, its output Voltage depends on USIM card type automatically. Its output current is up to 50mA.	
USIM_DATA	10	I/O,P,U	USIM Card data I/O, which has been pulled up via a 20KR resistor to USIM_VDD internally. Do not pull it up or down externally.	All lines of SIM interface should be protected against ESD
USIM_CLK	12	DO	USIM clock. Make sure the rise time and fall time of USIM_CLK less than 40ns;	
USIM_RST	14	DO	USIM Reset.	
<b>UART interface</b>				
UART_CTS	11	DOL	Clear to Send	If unused, keep open
UART_RTS	13	DI,PD	Request to send	

UART_RXD	17	DI,PL	Receive Data	
UART_TXD	19	DI,PU	Transmit Data	
UART_DCD	31	DOH	Carrier detects	
UART_RI	25	DOH	Ring Indicator	
UART_DTR	23	DOH	DTE get ready	
<b>PCM interface</b>				
PCM_CLK	45	DO	PCM data bit clock.	
PCM_SYNC	51	DO	PCM data frame sync signal.	If unused, keep open.
PCM_DIN	49	DI	PCM data input.	
PCM_DOUT	47	DO	PCM data output.	
<b>I2C interface</b>				
I2C_SCL	30	DO	I2C clock output	If unused, keep open
I2C_SDA	32	I/O	I2C data input/output	
<b>Others</b>				
WAKE#	1	I/O	Default function: wake up the host, output. When the user selects the codec used in the module, function as the MIC_P. Low power consumption control Input.	
W_DISABLE#	20	I	Low level effective. When input is low, the PCIE will enter low power mode.	
LED_WWAN#	42	O	Network Status Indication output. OC output.	If unused, keep open.
LED_WLAN#	44	O	LED_WLAN signal is the NETLIGHT of the connected module, which is for network light, but LED_WLAN is the	
			GPIO2 of the connected module. GPIO2 of the module does not do any functions by default, which needs to be configured and defined by software	
GPIO0	46	IO	General Purpose Input/output	GPIO power domain is 1.8V. If unused, keep open.
GPIO1	33	IO	General Purpose Input/output	
GPIO2	16	IO	General Purpose Input/output	
NC	3,5,7,6,22,28, 48	--	No connection	Keep open

## 2.3 Package Dimensions

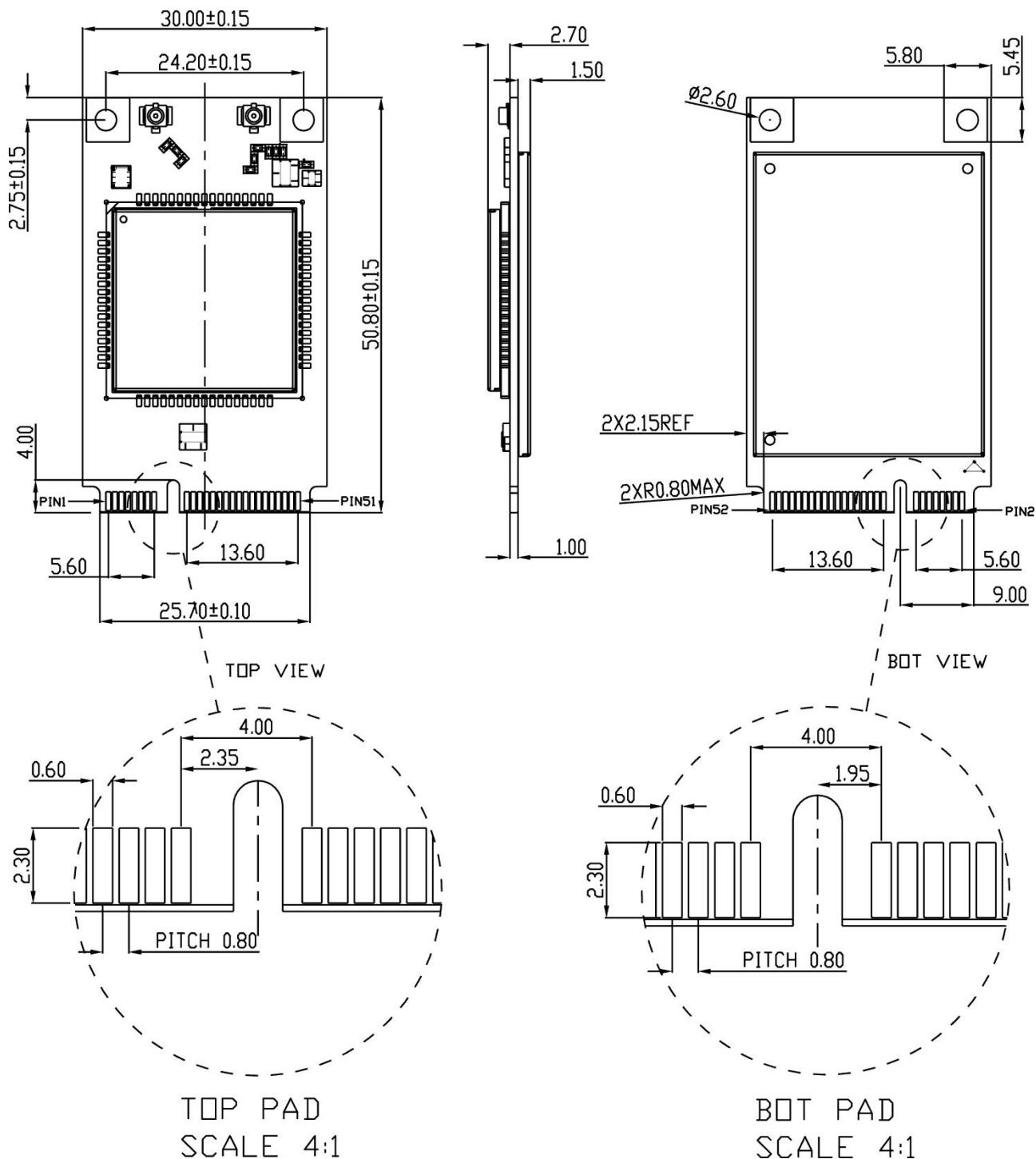


Figure 3: Dimensions of SIM7070-PCIE (Unit: mm)

# 3 Interface Application

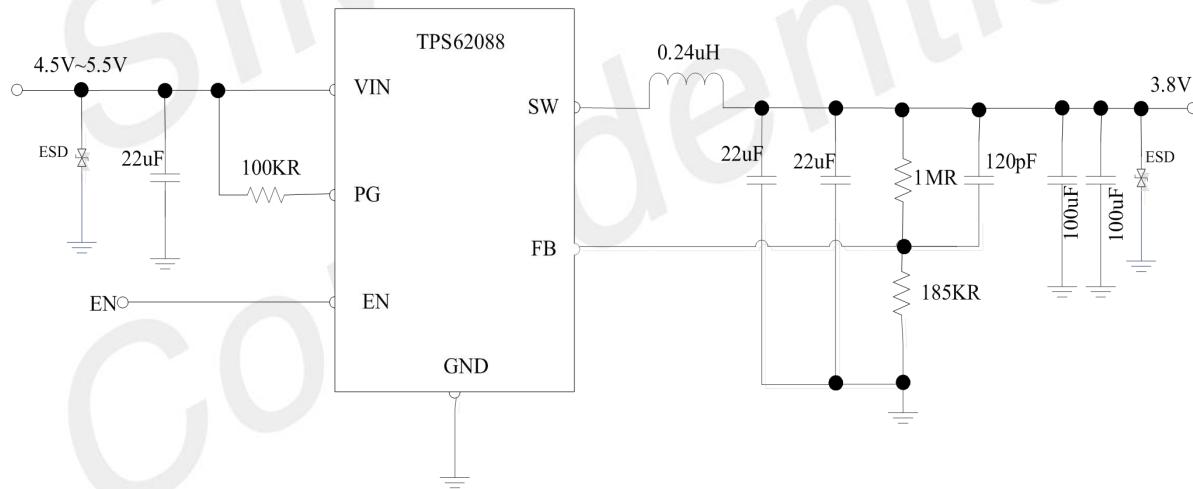
## 3.1 Power Supply

The power supply pins of SIM7070 Series PCIE are 3.8V

**Table 5: Recommended 3.3V Power Supply Characteristics**

Symbol	Description	Min.	Typ.	Max.	Unit
VBAT	PCIE power voltage	3.3	3.8	4.2	V
IVBAT(peak)	PCIE power peak current in GSM and EDGE emission mode.	-	2	-	A
IVBAT(peak)	PCIE power peak current in CAT-M1 and NB-IoT emission mode.	-	0.6	-	A

The following figure shows the reference circuit with 5V input and 3.8V output.



**Figure 4: power supply reference circuit**

## 3.2 W\_DISABLE#

The W\_DISABLE# pin can be used to control SIM7070-PCIE to enter or exit low power mode.

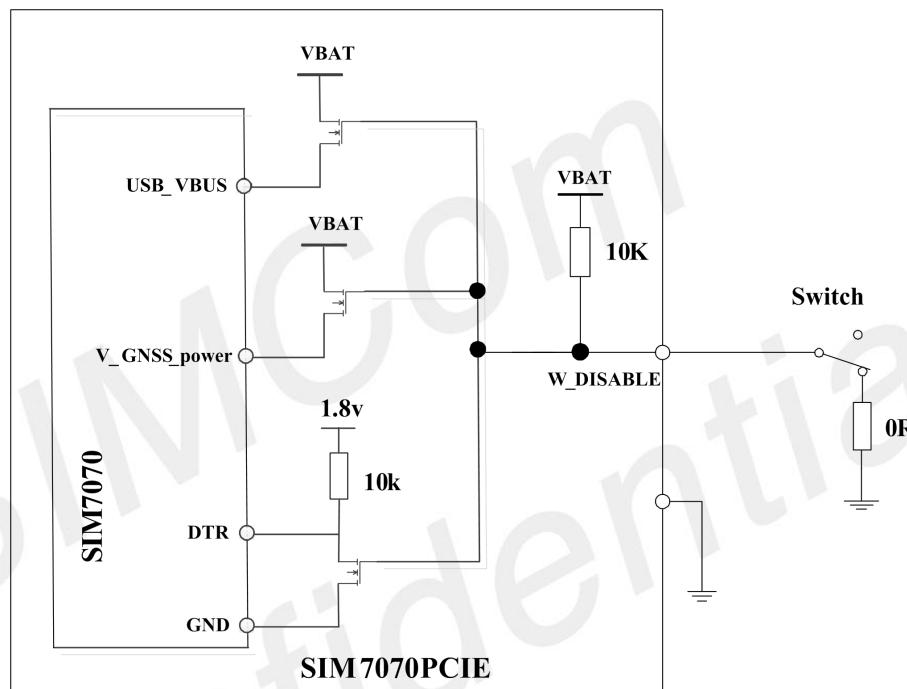
**Table 6: W\_DISABLE# Pin Status**

W_DISABLE# status	PCIE operation
Input Low Level	GNSS ANT power supply is closed.

	USB_VBUS power supply is closed. DTR PIN will be pulled up. PCIE, PCIEs are allowed to enter sleep mode.
Input High Level	GNSS ANT power supply is enabled. USB_VBUS power supply is enabled. DTR PIN will be pulled down. PCIEs will never enter sleep mode.

When the input state of the W\_DISABLE# pin is low, SIM7070 PCIE will enter the low-power mode after setting AT command "AT+CSCLK=1".

Reference circuit is recommended in the figure 5:



**Figure 5: W\_DISABLE# Reference Circuit**

### 3.3 LED\_WWAN#

The LED\_WWAN# pin can be used to drive a network status indication LED by default. Its status is listed in the following table.

Reference circuit is recommended in the following figure:

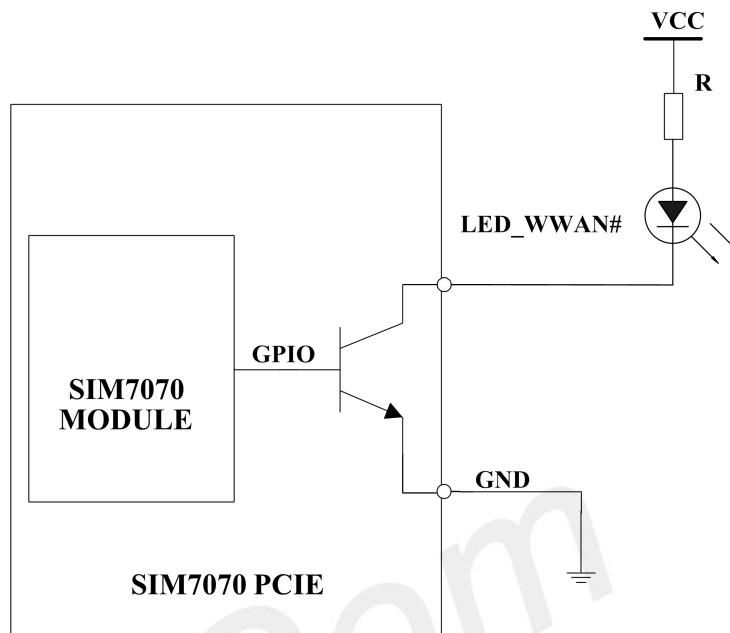


Figure 6: LED\_WWAN# Reference Circuit

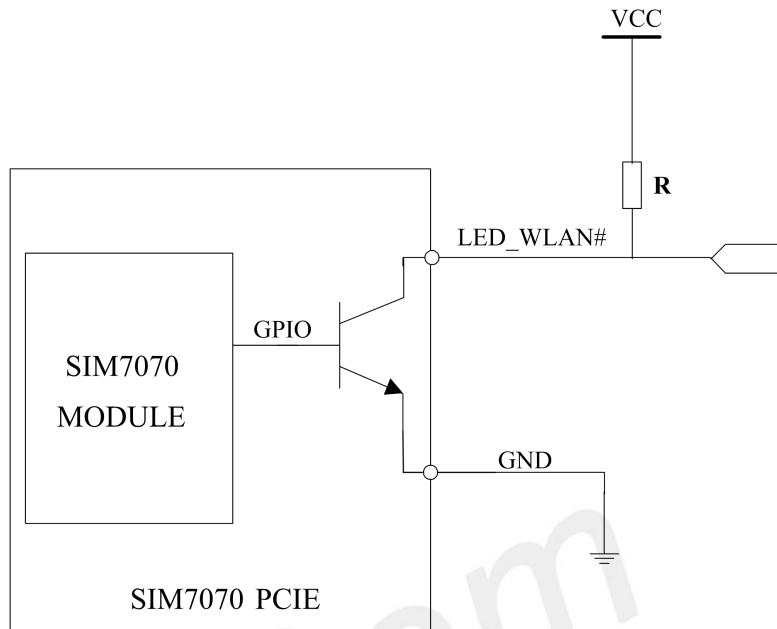
Table 7: Network Status Indication LED Status

NETLIGHT pin status	PCIE status
64ms ON, 800ms OFF	No registered network
64ms ON, 3000ms OFF	Registered network (PS domain registration success)
64ms ON, 300ms OFF	Data transmit (PPP dial-up state and use of data services such as internal TCP/FTP/HTTP)
OFF	Power off

### 3.4 LED\_WLAN#

The LED\_WLAN# pin is open collector gate (OC) output. It can drive external circuits in one direction.

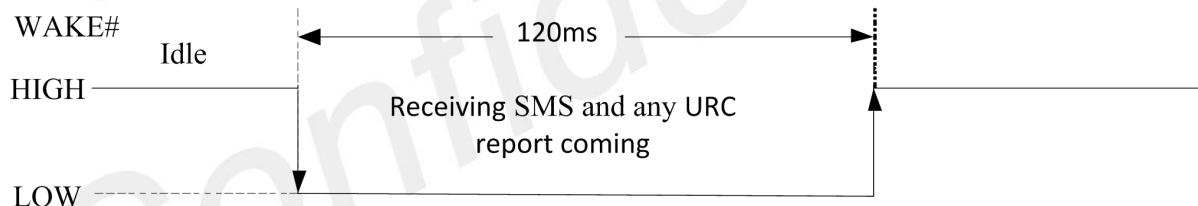
Reference circuit is recommended in the following figure:



**Figure 7: LED\_WLAN# Reference Circuit**

### 3.5 WAKE#

The WAKE# pin can be used as an interrupt signal to host. Normally it will keep high logic level until certain condition such as receiving SMS or URC reporting, then WAKE# will change to low logic level to inform the master (client PC).



**Figure 8: WAKE# behaviour**

WAKE# Reference circuit is recommended in the following figure:

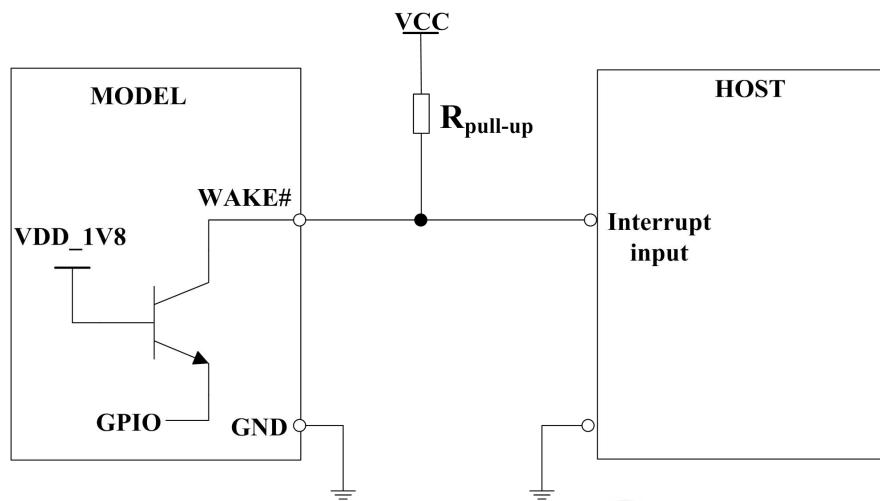


Figure 9: WAKE# Reference Circuit

### 3.6 USB 2.0

SIM7070 Series has a USB2.0 interface, it can be used for software upgrade and software debugging

The USB of the SIM7070 series only supports slave mode and does not support USB charging. USB does not support Suspend mode, the module will not be able to enter the minimum power mode when USB is connected.

SIM7070 PCIE USB\_VBUS had connected with VBAT power via a MOSFET. Users can control the USB\_VBUS power up or power down through W\_DISABLE. If W\_DISABLE is high level, the USB\_VBUS will power up. If W\_DISABLE is low level, VBUS will be power down.

Reference circuit is recommended in the following figure:

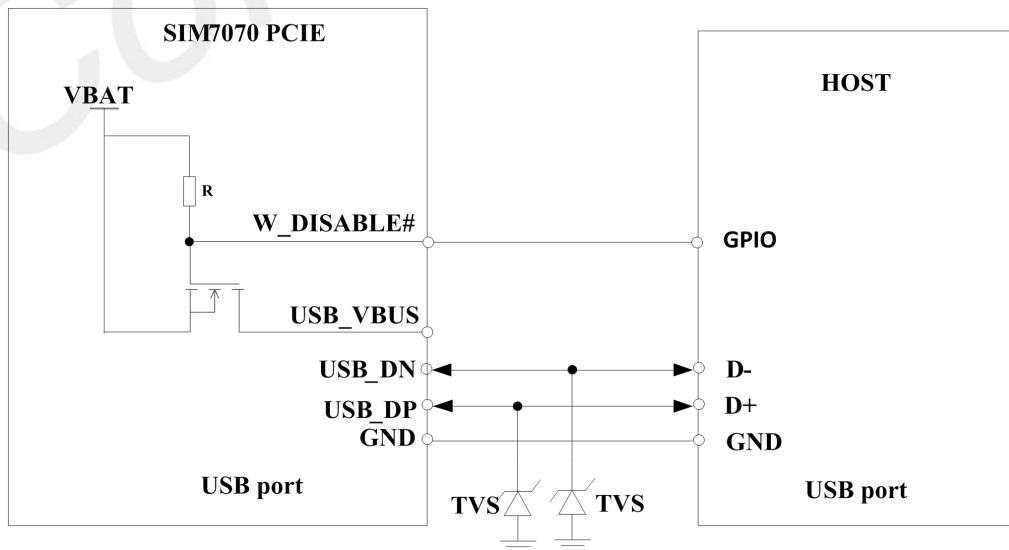


Figure 10: USB Reference Circuit

Because of the high bit rate on USB bus, please pay more attention to the influence of the junction capacitance of the ESD component on USB data lines. Typically, the capacitance should be less than 1pF. It is recommended to use an ESD protection component such as ESD9L5.0ST5G provided by On Semiconductor ([www.onsemi.com](http://www.onsemi.com) ).

### NOTE

1. The USB\_DN and USB\_DP nets must be traced by 90Ohm+/-10% differential impedance.
2. The USB VBUS of the PCIE is connected to VBAT internally, so there is no need to connect externally.

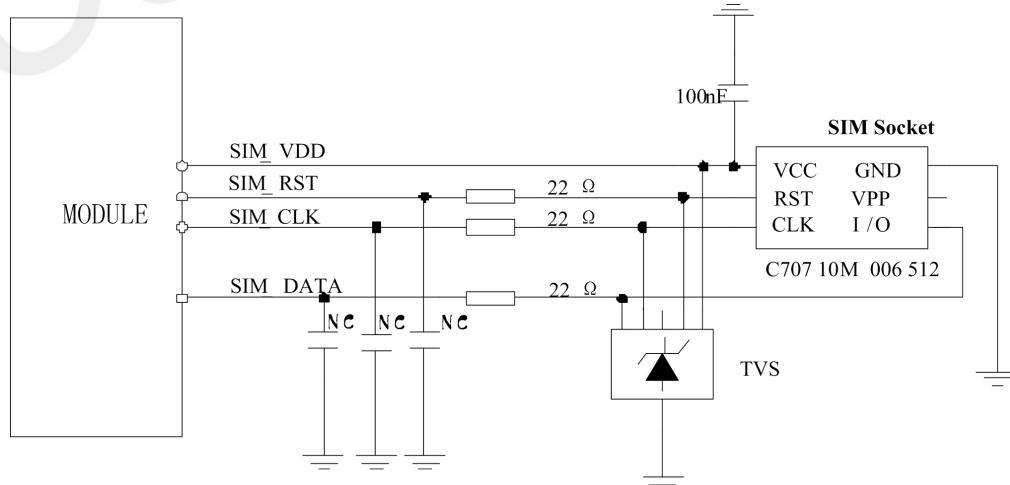
## 3.7 USIM Interface

SIM7070 Series PCIE only supports 1.8V SIM Cards. SIM\_VDD is provided by LDO inside the module, the default value is 1.8V

**Table 8: USIM Electronic characteristic in 1.8V mode (USIM\_VDD =1.8V)**

Symbol	Parameter	Min.	Typ.	Max.	Unit
USIM_VDD	LDO power output voltage	1.75	1.8	1.95	V
V <sub>IH</sub>	High-level input voltage	0.65*USIM_VDD	-	USIM_VDD +0.3	V
V <sub>IL</sub>	Low-level input voltage	-0.3	0	0.35*USIM_VDD	V
V <sub>OH</sub>	High-level output voltage	USIM_VDD -0.45	-	USIM_VDD	V
V <sub>OL</sub>	Low-level output voltage	0	0	0.45	V

Note that the SIM peripheral circuit should be close to the SIM card socket. The following figure shows the 6-pin SIM card holder reference circuit.



**Figure 11: USIM interface reference circuit**

SIM\_DATA has been pulled up with a 20KΩ resistor to SIM\_VDD in module, so it no need pulled up resistor anymore. SIM\_VDD needs a 100nF capacitor close to SIM socket.

SIM\_CLK is very important signal, the rise time and fall time of SIM\_CLK should be less than 40ns. So the junction capacity of the TVS need to less 50pF.

In order to enhance the reliability and availability of the (U)SIM card in applications, Please follow the guidelines below when designing.

- It is recommended to place a 100nF capacitor on the SIM\_VDD signal line close to the SIM card holder.
- Place TVS near the SIM card holder. The junction capacity of the TVS should not exceed 50pF. The 22Ω resistor in series between the SIM card holder and the module can enhance the ESD protection performance.
- Keep SIM card signals away from RF and VBAT traces.
- SIM card signal line traces to avoid branch.
- To avoid cross-talk between SIM\_DATA and SIM\_CLK, keep them away from each other and shield them with surrounded ground. USIM\_RST should also be ground shielded.

**NOTE**

USIM\_CLK is very important signal; customer must make sure the rise time and fall time of USIM\_CLK less than 40ns!

### 3.8 UART Interface

SIM7070-PCIE provides one UART (universal asynchronous serial transmission) port. The PCIE is as the DCE (Data Communication Equipment) and the client PC is as the DTE (Data Terminal Equipment). AT commands are entered and serial communication is performed through UART interface.

When the UART port is used as the AT communication port, it supports high speed mode, the baud rate is up to 4Mbps. The communication baud rates include: 0, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 921600, 2000000, 3000000, 3200000 and 3686400 bps. The rate 0bps marks auto baud rate. And it supports auto baud rate, but the rate only supported on 9600, 19200, 38400, 57600, 115200. If users need to change to other baud rate, it needs to switch via manual operation.

**NOTE**

Note: Customer can use AT command AT+IPR=x" to set a fixed baud rate and the setting will be saved to non-volatile flash memory automatically. After the configuration is set as fixed baud rate, the URC such as "RDY", "+CFUN: I" and "+CPIN: READY" will be reported when GSM is powered on.

Table 9: UART Electrical Characteristic

Symbol	Parameter	Min	Typ	Max	Unit
$V_{IH}$	High-level input voltage	1.17	1.8	2.1	V
$V_{IL}$	Low-level input voltage	-0.3	0	0.63	V
$V_{OH}$	High-level output voltage	1.35	1.8	1.8	V
$V_{OL}$	Low-level output voltage	0	0	0.45	V

### 3.8.1 UART interface reference circuit

The application circuit is in the following figures.

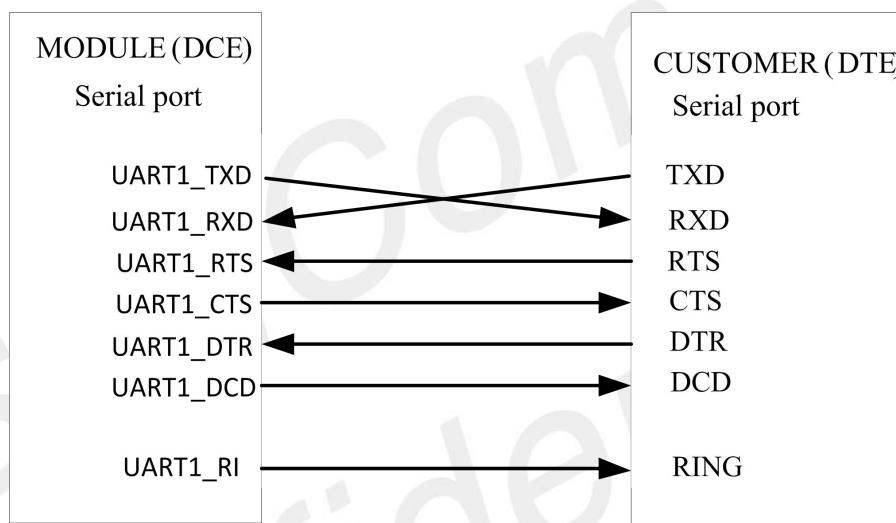
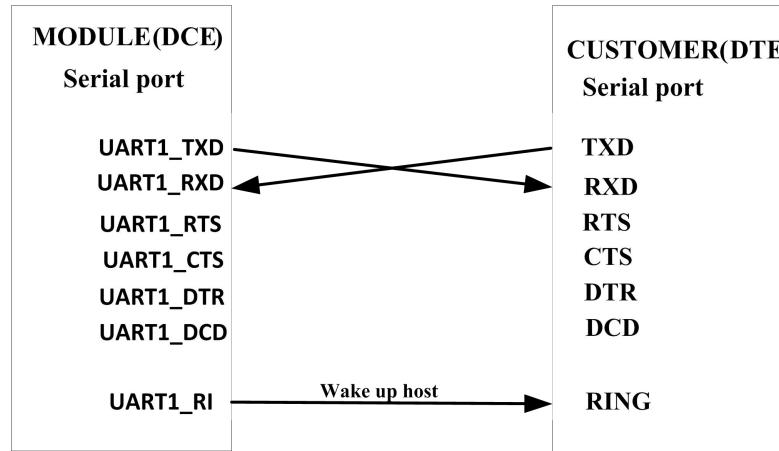
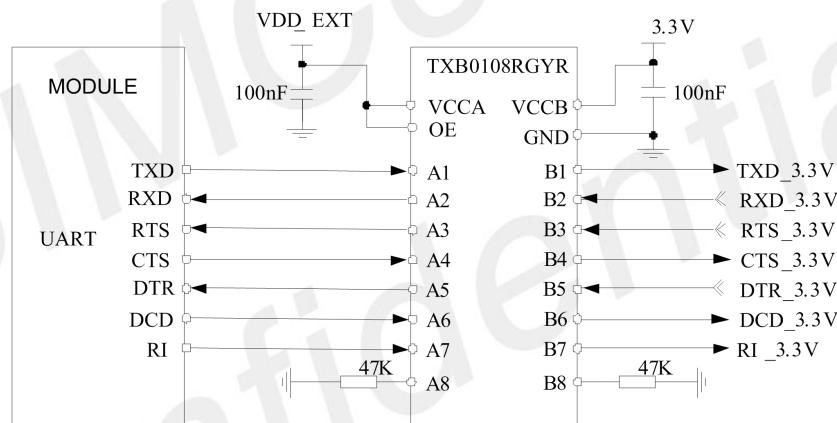


Figure 12: UART Full modem

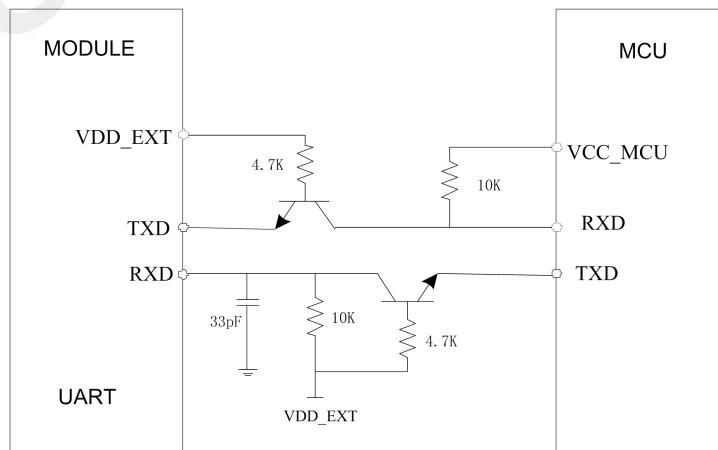


**Figure 13: UART Null modem**

The SIM7070-PCIE UART is 1.8V interface. A voltage level converter should be used if user's application is equipped with a 3.3V UART interface. A voltage level converter TXB0108RGYR provided by Texas Instruments is recommended. The reference design of the TXB0108RGYR is in the following figures.



**Figure 14: Reference circuit of level shift**



**Figure 15: Reference circuit with Transistor**

To comply with RS-232-C protocol, the RS-232-C level shifter chip should be used to connect SIM7070-PCIE to the RS-232-C interface. In this connection, the TTL level and RS-232-C level are converted mutually. SIMCom recommends that user uses the SP3238ECA chip with a full modem. For more information please refers to the RS-232-C chip datasheet.

### NOTE

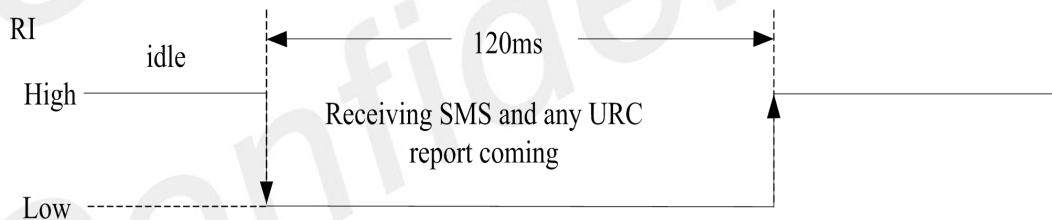
To comply with rs-232-c protocol, the rs-232-c level shifter chip should be used To connect if the customer USES UART with a baud rate exceeding 2Mbps, NMOS should be used To replace the NPN triode in the conversion circuit, otherwise the signal will be distorted.

### 3.8.2 RI describe

The RI pin description:

The RI pin can be used to interrupt output signal to inform the host controller such as application CPU. Before that, users must use AT command “AT+CFGRI=1” to enable this function.

Normally RI will keep high level until certain conditions such as receiving SMS, or a URC report coming, then it will output a low level pulse 120ms, in the end, it will become high level.



**Figure 16: RI behavior (SMS and URC report)**

### 3.8.3 DTR Describe

The DTR pin description:

After setting the AT command “AT+CSCLK=1”, and then pulling up the DTR pin, Module will enter sleep mode when module is in idle mode. In sleep mode, the UART is unavailable. When SIM7070 enters sleep mode, pulling down DTR can wake up module.

After setting the AT command “AT+CSCLK=0”, SIM7070 Series will do nothing when the DTR pin is pulling up.

The DTR pin can be controlled by the UART or by the W\_DISABLE# signal. When W\_DISABLE# is low, the DTR is pulled high. When W\_DISABLE# is high, the DTR is pulled low.

**NOTE**

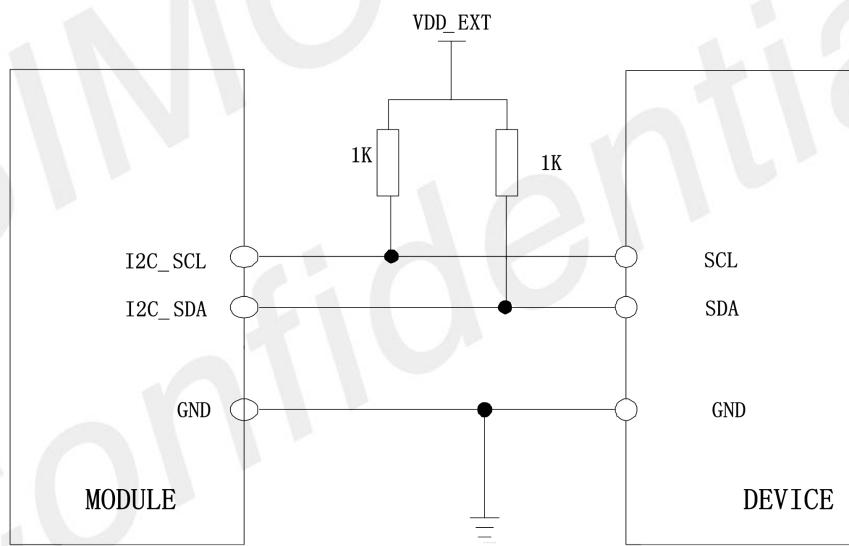
For more details of AT commands about UART, please refer to document [1] and [20].

### 3.9 I2C Interface

SIM7070-PCIE provides I2C interface compatible with I2C specification, version 5.0, with clock rate up to 400 kHz. Its operation voltage is 1.8V.

The I2C signal has no pull-up resistors in module. So the pulling up resistors 1KΩ to VDD\_EXT is necessary in application circuit.

The reference design circuit is shown in Figure 15:



**Figure 17:I2C Reference Circuit**

**Table 10: UART Electrical Characteristic**

Symbol	Parameter	Min	Typ	Max	Unit
$V_{IH}$	High-level input voltage	1.17	1.8	2.1	V
$V_{IL}$	Low-level input voltage	-0.3	0	0.63	V
$V_{OH}$	High-level output voltage	1.35	1.8	1.8	V
$V_{OL}$	Low-level output voltage	0	0	0.45	V

### 3.10 PCM Interface

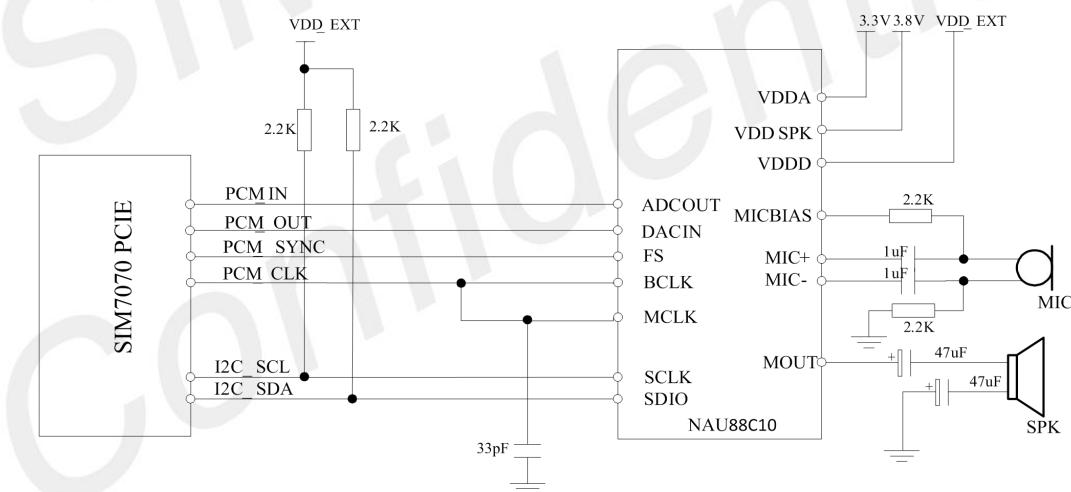
SIM7070-PCIE provides a PCM interface for external codec, which can be used in master mode with short sync and 16 bits linear format.

The specific parameters of the PCM interface are as follows table 10:

**Table 10: PCM format**

Characteristics	Specification
Line Interface Format	Linear(Fixed)
Data length	16bits(Fixed)
PCM Clock/Sync Source	Master Mode(Fixed)
PCM Clock Rate	2048 KHz (Fixed)
PCM Sync Format	Short sync(Fixed)
Data Ordering	MSB

The following figure shows the external codec reference design.



**Figure 18: Receiver interface configuration**

# 4 RF Specifications

## 4.1 GSM/LTE RF Specifications

Table 11: Conducted transmission power

Frequency	Power	Min.	
GSM850	33dBm ±2dB	5dBm ± 5dB	
EGSM900	33dBm ±2dB	5dBm ± 5dB	
DCS1800	30dBm ±2dB	0dBm ± 5dB	
PCS1900	30dBm ±2dB	0dBm ± 5dB	
CAT-NB1/ CAT-NB2	LTE-FDD B1 LTE-FDD B2 LTE-FDD B3 LTE-FDD B4 LTE-FDD B5 LTE-FDD B8 LTE-FDD B12 LTE-FDD B13 LTE-FDD B18 LTE-FDD B19 LTE-FDD B20 LTE-FDD B25 LTE-FDD B26 LTE-FDD B28 LTE-FDD B31 LTE-FDD B66 LTE-FDD B71 LTE-FDD B85	20dBm +/-2.7dB 20dBm +/-2.7dB	<-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm
CAT-NB1/ CAT-NB2	LTE-FDD B1 LTE-FDD B2 LTE-FDD B3 LTE-FDD B4 LTE-FDD B5 LTE-FDD B8 LTE-FDD B12 LTE-FDD B13	20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB 20dBm +/-2.7dB	<-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm <-40dBm

CAT-M1	LTE-FDD B18	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B19	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B20	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B25	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B26	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B28	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B31	23dBm +/-2.7dB	<-40dBm
	LTE-FDD B66	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B71	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B85	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B1	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B2	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B3	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B4	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B5	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B8	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B12	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B13	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B14	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B18	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B19	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B20	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B25	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B26	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B27	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B28	20dBm +2.7/-3.2dB	<-40dBm
	LTE-FDD B31	23dBm +/-2.7dB	<-40dBm
	LTE-FDD B66	20dBm +/-2.7dB	<-40dBm
	LTE-FDD B72	23dBm +/-2.7dB	<-40dBm
	LTE-FDD B85	20dBm +/-2.7dB	<-40dBm

**NOTE**

The max power is tested result for 1RB in CAT-M1 and single-tone in CAT-NB2. MPR for CAT-M1 please refer to 6.2.3EA.5 part for 3GPP. Multi-tone test results please refer to part 6.2.3F.3 for CAT-NB2.

**Table 12: Maximum Power Reduction (MPR) for UE category Power Class 5**

<b>Frequency</b>		<b>MPR</b>	<b>3GPP standard</b>
GPRS	GSM850	PCL5 (4Up 1Down)	33dBm+2dB/-8dB
	EGSM	PCL5 (4Up 1Down)	33dBm+2dB/-8dB
	DCS1800	PCL0 (4Up 1Down)	30dBm+3dB/-9dB
	PCS1900	PCL0 (4Up 1Down)	30dBm+3dB/-9dB
EGPRS	GSM850	PCL8 (4Up 1Down)	27dBm+3dB/-9dB
	EGSM	PCL8 (4Up 1Down)	27dBm+3dB/-9dB
	DCS1800	PCL2 (4Up 1Down)	26dBm+3dB/-9dB
	PCS1900	PCL2 (4Up 1Down)	26dBm+2dB/-8dB

**CAT-NB1/CAT-NB2**

<b>Modulation</b>	<b>QPSK</b>		
Tone positions for 3 Tones allocation	0-2	3-5 and 6-8	9-11
MPR	$\leq 0.5$ dB	0 dB	$\leq 0.5$ dB
Tone positions for 3 Tones allocation			0-5 and 6-11
MPR	$\leq 1$ dB	$\leq 1$ dB	
Tone positions for 3 Tones allocation	0-11		
MPR	$\leq 2$ dB		

**CAT-M1**

<b>Modulation</b>	<b>Channel bandwidth / Transmission bandwidth (NRB)</b>						<b>MPR (dB)</b>
	<b>1.4MHz</b>	<b>3.0MHz</b>	<b>5MHz</b>	<b>10MHz</b>	<b>15MHz</b>	<b>20MHz</b>	
QPSK	>2	>2	>3	>5	-	-	$\leq 1$
QPSK	>5	>5	-	-	-	-	$\leq 2$
16QAM	$\leq 2$	$\leq 2$	>3	>5	-	-	$\leq 1$
16QAM	>2	>2	>5	-	-	-	$\leq 2$

**NOTE**

For each sub-frame, the MPR is calculated per slot and is given by the maximum value transmitted within the slot; then the maximum MPR on both slots is applied to the entire sub-frame..

**Table 13: Operating frequencies**

<b>Frequency</b>	<b>Receiving</b>	<b>Transmission</b>
------------------	------------------	---------------------

EGSM900	925~960MHz	880~915 MHz
GSM800	869~894MHz	824~849MHz
DCS1800	1805~1880 MHz	1710~1785 MHz
PCS1900	1930~1990MHz	1850~1910MHz

**LTE BAND Information Refers to Table 1**

GPS L1 BAND	1574.4~1576.44 MHz	-
GLONASS	1598.0625 ~1605.375MHz	-
BDS	1559.052~1591.788MHz	-
Galileo	1574.4~1576.44 MHz	-

**Table 14: E-UTRA operating bands**

E-UTRA	UL Freq.	DL Freq.	Duplex Mode
1	1920 ~1980 MHz	2110 ~2170 MHz	HD-FDD
2	1850~1910MHz	1930~1990MHz	HD-FDD
3	1710 ~1785 MHz	1805 ~1880 MHz	HD-FDD
4	1710~1755MHz	2110~2155	HD-FDD
5	824 ~849 MHz	869 ~894 MHz	HD-FDD
8	880 ~915 MHz	925 ~960 MHz	HD-FDD
12	699~716MHz	729~746MHz	HD-FDD
13	777~787MHz	746~756MHz	HD-FDD
14	788~798MHz	758~768MHz	HD-FDD
18	815 ~830 MHz	860 ~875 MHz	HD-FDD
19	830 ~845 MHz	875 ~890 MHz	HD-FDD
20	832~862MHz	791~821MHz	HD-FDD
25	1850~1915MHz	1930~1995MHz	HD-FDD
26	814 ~849 MHz	859 ~894 MHz	HD-FDD
27	807~824MHz	852~869MHz	HD-FDD
28	703~748MHz	758~803MHz	HD-FDD
31	452.5~457.5MHz	462.5~467.5MHz	HD-FDD
66	1710~1780MHz	2110~2180MHz	HD-FDD
71	663~698MHz	617~652MHz	HD-FDD
72	451~456MHz	461~466MHz	HD-FDD
85	698~716MHzHz	728~746MHz	HD-FDD

**Table 15: Conducted receive sensitivity**

Frequency	Receive sensitivity(Typical) REFSENS MAX(dBm) 3GPP	SIM7070G		SIM7070E	
		REFSENS (dBm)	Typical	REFSENS (dBm)	Typical

Request			
EGSM900	<-104dBm	-107.9 dBm	-107.9 dBm
GSM850	<-104dBm	-108.2 dBm	-108.2 dBm
DCS1800	<-104dBm	-107.5 dBm	-107.5 dBm
PCS1900	<-104dBm	-107.2 dBm	-107.2 dBm
LTE HD-FDD	3GPP	ReferenceTable16, Table17	ReferenceTable16, Table17

Table 16:CAT-M1 Reference sensitivity (QPSK)

E-UTRA Band	REFSENS 3GPP Request	SIM7070G	SIM7070E	Duplex Mode
		REFSENS Typical (dBm)	REFSENS Typical (dBm)	
1	-103	-108.1	-108.4	HD-FDD
2	-101	-106.2	-106.6	HD-FDD
3	-100	-107.5	-107.3	HD-FDD
4	-103	-106.5	-106.2	HD-FDD
5	-101.5	-108.2	-108.8	HD-FDD
8	-100.5	-106.1	-106.5	HD-FDD
12	-100	-107.4	-107.3	HD-FDD
13	-100	-105.5	-106.1	HD-FDD
14	-100	-106.5	-107.3	HD-FDD
18	-103	-108.5	-109.5	HD-FDD
19	-103	-108.1	-108.8	HD-FDD
20	-100.5	-108.3	-107.8	HD-FDD
25	-99.5	-103.2	-103.8	HD-FDD
26	-101	-108.1	-108.3	HD-FDD
27	-101.5	-106.2	-106.8	HD-FDD
28	-101.5	-108.2	-108.8	HD-FDD
31	-97.3		TBD	HD-FDD
66	NA	-108.5	-108.4	HD-FDD
72	NA		TBD	HD-FDD
85	-100	-109.1	-109.4	HD-FDD

Table 17: CAT-NB2 Reference sensitivity (QPSK)

Operating band	REFSENS MAX(dBm) 3GPP Request	SIM7070G		SIM7070E	
		REFSENS Typical(dBm)	REFSENS Typical Repetition 12/ 7/1/128 [EPRE dbm/15KHz]①	REFSENS Typical(dBm)	REFSENS Typical Repetition 12/ 7/1/128 [EPRE dbm/15KHz]①
1	-108.2	-115.1	-131	-115.1	-131
2	-108.2	-114.8	-130	-114.8	-130
3	-108.2	-115.4	-131	-115.4	-131
4	-108.2	-115.1	-130	-115.1	-130
5	-108.2	-114.3	-129	-114.3	-129
8	-108.2	-113.9	-130	-113.9	-130
12	-108.2	-116	-130	-116	-130
13	-108.2	-115.7	-130	-115.7	-130
18	-108.2	-114.9	-129	-114.9	-129
19	-108.2	-115.1	-128	-115.1	-128
20	-108.2	-114.1	-128	-114.1	-128
25	-108.2	-114.6	-130	-114.6	-130
26	-108.2	-114.6	-129	-114.6	-129
28	-108.2	-115.9	-130	-115.9	-130
31	-108.2			-114.7	-129
66	-108.2	-114.8	-129	-114.8	-129
71	-108.2	-114.4	-129		
85	-108.2	-115.7	-130	-115.7	-130

**NOTE**

The 12/7/1/128 of the REFSENS Typical Repeated 12/ 7/1/128 [EPRE dbm/15KHz means Subcarriers=12, MCS.TBS=7, #SF/#RU=1, #Repetition=128.

## 4.2 LTE Antenna Design Guide

Users should connect antennas to SIM7070 series PCIE antenna pads through micro-strip line or other types of RF trace and the trace impedance must be controlled in  $50\Omega$ . SIMCom recommends that the total insertion loss between the antenna pads and antennas should meet the following requirements:

Table 18: Trace loss

Frequency	Loss
700MHz-960MHz	<0.5dB
1710MHz-2170MHz	<0.9dB
2300MHz-2650MHz	<1.2dB

The following figure is the recommended circuit.

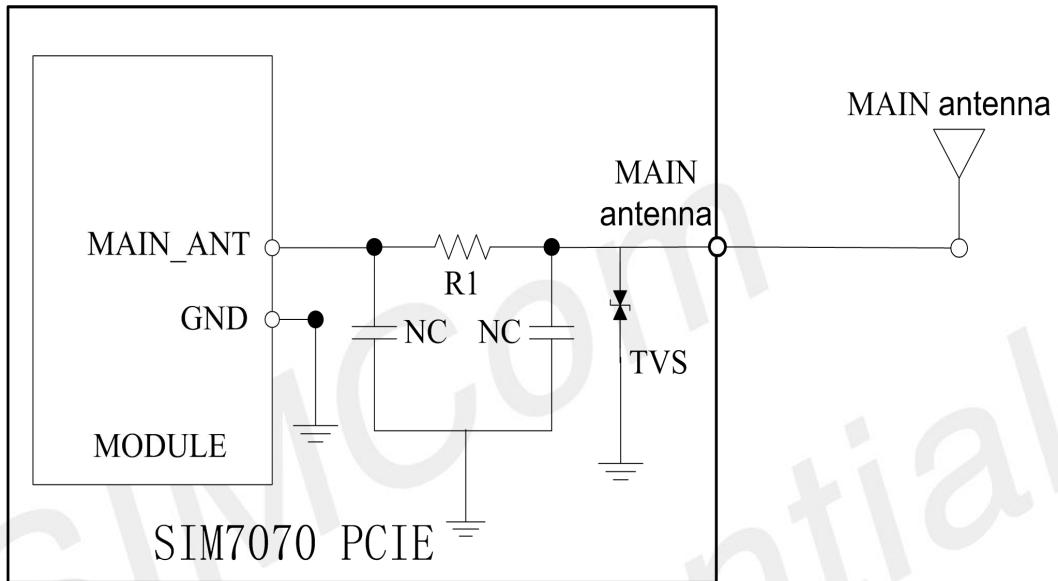


Figure 19: Antenna matching circuit (MAIN\_ANT)

## 4.3 GNSS

SIM7070 series PCIE merges GNSS (GPS/GLONASS/BD) satellite and network information to provide a high-availability solution that offers industry-leading accuracy and performance. This solution performs well, even in very challenging environmental conditions where conventional GNSS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates.

### 4.3.1 GNSS Technical specification

- Tracking sensitivity: -159 dBm (GPS+GLONASS)/-159 dBm (GPS+BD)
- Cold-start sensitivity: -147.5 dBm
- Accuracy (Open Sky): 0.4 m(GPS+BD)
- TTFF (Open Sky) : Hot start <1s, Cold start<31s
- Receiver Type: 16-channel, C/A Code
- GPS L1 Frequency:  $1575.42 \pm 1.023\text{MHz}$
- GLONASS: 1597.5~1605.8 MHz
- BD: 1559.05~1563.14 MHz
- Update rate: Default 1 Hz
- GNSS data format: NMEA-0183
- GNSS Current consumption : 54mA (AT+CFUN=0,without USB)
- GNSS antenna: Passive/Active antenna

### 4.3.2 GNSS Antenna interface

The power supply of GNSS active antenna is integrated in SIM7070 PCIE, the power supply range is from 2.5V to 3.3V.

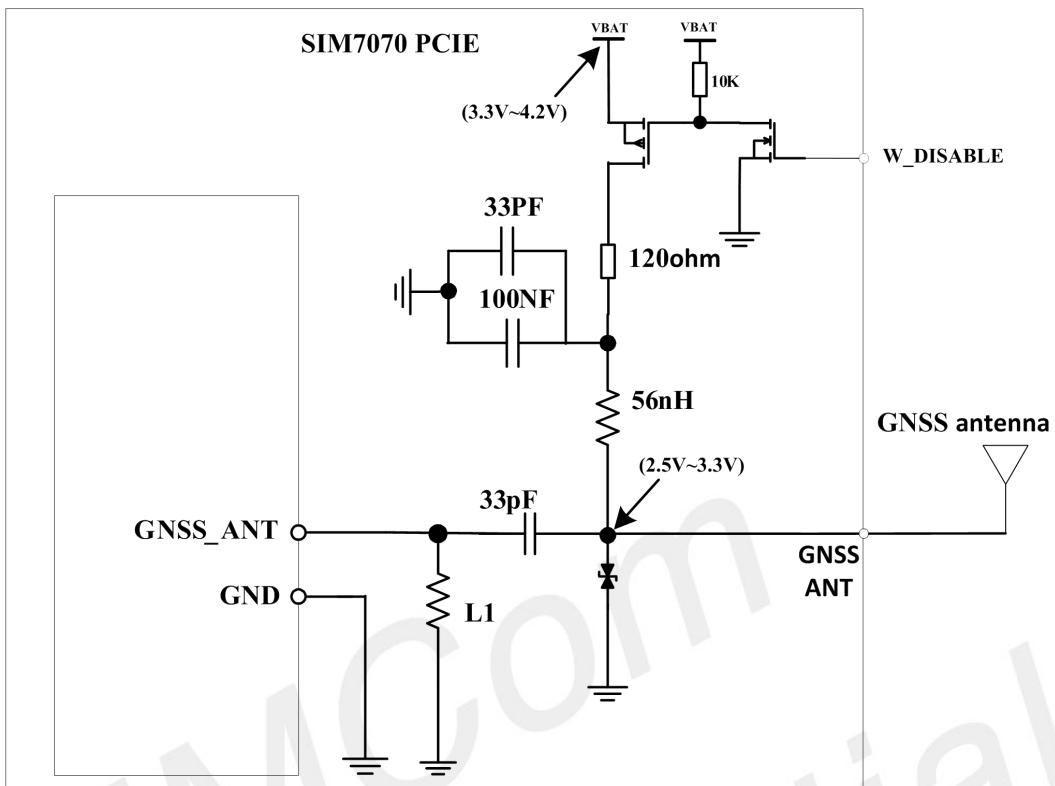


Figure 20: GNSS antenna Reference Circuit

#### 4.3.3 GSM/LTE Antenna Interface

Users should connect antennas to SIM7070's antenna connector. SIMCom recommends that the antennas used should meet the following requirements:

- Make sure the efficiency of LTE main ANT more than 40%
- Keep the decoupling of LTE main ANT to WLAN ANT more than 15dB
- Keep the decoupling of LTE main ANT to GNSS ANT more than 30dB

#### NOTE

The decoupling value can be provided by ANT adventure. More details can refer to the document [22].

# 5 Electrical Specifications

## 5.1 Absolute Maximum Ratings

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

**Table 19: Absolute maximum ratings**

Symbol	Parameter	Min	Type	Max	Unit
VBAT	VBAT input voltage	-0.3	-	4.5	V
VIO	Voltage at digital pins (1.8V digital I/O) *	-0.3	-	2.1	V

\*Note: These parameters are for digital interface pins, such as I2C, UART, and GPIO.

## 5.2 Recommended Operating Conditions

Please refer to the follow table for recommended operating conditions.

**Table 20: Recommended operating ratings**

Symbol	Parameter	Min	Type	Max	Unit
VBAT	3.8V Input voltage	3.3	3.8	4.2	V

**Table 21: 1.8V Digital I/O characteristics\***

Parameter	Description	Min.	Typ.	Max.	Unit
VIH	High-level input voltage	1.17	1.8	2.1	V
VIL	Low-level input voltage	-0.3	0	0.63	V
VOH	High-level output voltage	1.35	-	1.8	V
VOL	Low-level output voltage	0	-	0.45	V
IOH	High-level output current(no pull down resistor)	-	2	-	mA
IOL	Low-level output current(no pull up resistor)	-	-2	-	mA

**Table 22: Operating temperature**

Parameter	Min.	Typ.	Max.	Unit
Operation temperature	-40	25	85	°C
Storage temperature	-45	25	+90	°C

**NOTE**

Module is able to make and receive voice calls, data calls, SMS and make GPRS/LTE traffic in -40°C ~ +85 °C. The performance will be reduced slightly from the 3GPP specifications if the temperature is outside the normal operating temperature range and still within the extreme operating temperature range.

## 5.3 Operating Mode

### 5.3.1 Operating Mode

The table below summarizes the various operating modes of SIM7070-PCIE.

**Table 23: Operating Mode**

Mode	Function
Normal operation	GPRS/EDGE/LTE Sleep In this case, the current consumption of PCIE will be reduced to the minimal level and the PCIE can still receive paging message and SMS.
	GPRS/EDGE /LTE Idle Software is active. PCIE is registered to the network, and the PCIE is ready to communicate.
	GPRS/EDGE/LTE Standby PCIE is ready for data transmission, but no data is currently sent or received. In this case, power consumption depends on network settings.
	GPRS/EDGE/LTE Data transmission There is data transmission in progress. In this case, power consumption is related to network settings (e.g. power control level); uplink/downlink data rates, etc.
Minimum functionality mode	AT command "AT+CFUN" can be used to set the PCIE to a minimum functionality mode without removing the power supply. In this mode, the RF part of the PCIE 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 and USB port are still accessible. The power consumption in this mode is lower than normal mode.

Power ON	PCIE will turn on automatically after VBAT power supply.
Power off	Users could cut off the VBAT to power off PCIE.

### 5.3.2 Sleep mode

In sleep mode, the current consumption of PCIE will be reduced to the minimal level, and PCIE can still receive paging message and SMS.

Several hardware and software conditions must be satisfied together in order to let SIM7070-PCIE enter into sleep mode:

- UART condition
- USB condition
- Software condition

#### NOTE

Before designing, pay attention to how to realize sleeping/waking function and refer to Document [20] for more details.

### 5.3.3 Minimum functionality mode

Minimum functionality mode ceases a majority function of PCIE, thus minimizing the power consumption. This mode is set by the AT command which provides a choice of the functionality levels.

- AT+CFUN=0: Minimum functionality
- AT+CFUN=1: Full functionality (Default)
- AT+CFUN=4: Disable RF function of the PCIE (Flight mode)

If SIM7070-PCIE has been set to minimum functionality mode, the PCIE will firstly enter sleep mode, then the RF function and USIM card function will be closed. In this case, the serial port is still accessible, but RF function or USIM card will be unavailable. When SIM7070-PCIE is in minimum functionality or flight mode, it can return to full functionality by the AT command “AT+CFUN=1”.

## 5.4 Current Consumption

The current consumption is listed in the table below.

**Table 24: Current Consumption (Testing Environment: VBAT=3.8V)**

#### GNSS

5.4.1.1 GNSS supply current

5.4.1.2 (AT+CFUN=0,without USB connection)

5.4.1.3 Tracking, typical:54mA

### Idle mode

5.4.1.4 LTE supply current

5.4.1.8 GSM

5.4.1.9 typical:12mA

5.4.1.5 (AT+CSCLK=0; AT+CFUN=1,

CAT-M1

typical: 16mA

5.4.1.6 GNSS off, without USB

connection)

NB1/NB2

typical:14mA

5.4.1.7

### Sleep mode

GSM supply current

(AT+CSCLK=1; AT+CFUN=1,  
GNSS off, without USB connection)

GSM

typical:2.1mA

GSM supply current

(AT+CSCLK=1; AT+CFUN=0,  
GNSS off, without USB connection)

GSM

typical:0.45mA

### Power SavingMode

PSM supply current

PSM mode Typical: 3.5uA

### e-DRX

e-DRX mode supply current  
(@PTW=40.96s; eDRX=81.92s; DRX=2.56s)

Typical:0.6mA

e-DRX mode supply current  
(Tested in sleep mode)  
(@PTW=25.6s; eDRX=163.84s; DRX=2.56s)

Typical:0.4mA

### GPRSdata transmission

EGSM850(3DL,2UL)

@power class #5Typical:369mA

DCS1800(3DL,2UL)

@power class #0Typical:274mA

EGSM 850(1DL,4UL)

@power class #5Typical:500mA

DCS1800 (1DL,4UL)

@power class #0Typical:401mA

### EDGEdata transmission

EGSM850(3DL,2UL)

@power class #5 Typical: 210mA

DCS1800(3DL,2UL)

@power class #0 Typical:172mA

EGSM 850(1DL,4UL)

@power class #5 Typical: 311mA

DCS1800 (1DL,4UL)

@power class #0 Typical: 285mA

### LTE Cat-M (10MHz) data transmission

LTE-FDD B1

@21dbm Typical: 116mA

@10dbm Typical: 103mA

@0dbm Typical: 91mA

LTE-FDD B2

@21dbm Typical: 115mA

@10dbm Typical: 102mA

@0dbm Typical:90mA

LTE-FDD B3

@21dbm Typical: 114mA

@10dbm Typical: 102mA

@0dbm Typical: 90mA

LTE-FDD B4	@21dbm Typical: 114mA @10dbm Typical: 102mA @0dbm Typical: 91mA
LTE-FDD B5	@21dbm Typical: 117mA @10dbm Typical: 100mA @0dbm Typical: 90mA
LTE-FDD B8	@21dbm Typical: 117mA @10dbm Typical: 101mA @0dbm Typical: 91mA
LTE-FDD B12	@21dbm Typical: 116mA @10dbm Typical: 100mA @0dbm Typical: 90mA
LTE-FDD B13	@21dbm Typical: 118mA @10dbm Typical: 101mA @0dbm Typical: 93mA
LTE-FDD B14	@21dbm Typical: 119mA @10dbm Typical: 101mA @0dbm Typical: 90mA
LTE-FDD B18	@21dbm Typical: 117mA @10dbm Typical: 100mA @0dbm Typical: 90mA
LTE-FDD B19	@21dbm Typical: 117mA @10dbm Typical: 101mA @0dbm Typical: 90mA
LTE-FDD B20	@21dbm Typical: 118mA @10dbm Typical: 101mA @0dbm Typical: 91mA
LTE-FDD B25	@21dbm Typical: 115mA @10dbm Typical: 102mA @0dbm Typical: 91mA
LTE-FDD B26	@21dbm Typical: 116mA @10dbm Typical: 100mA @0dbm Typical: 90mA
LTE-FDD B27	@21dbm Typical: 117mA @10dbm Typical: 101mA @0dbm Typical: 90mA
LTE-FDD B28	@21dbm Typical: 116mA @10dbm Typical: 100mA @0dbm Typical: 91mA
LTE-FDD B31	@27dbm Typical: 345mA @17dbm Typical: 185mA @8dbm Typical: 137mA
LTE-FDD B66	@21dbm Typical: 167mA @10dbm Typical: 131mA @0dbm Typical: 103mA
LTE-FDD B72	@27dbm Typical: 348mA @17dbm Typical: 178mA

LTE-FDD B85	@8dbm Typical: 138mA @21dbm Typical: 172mA @10dbm Typical: 126mA @0dbm Typical: 103mA
<b>LTE Cat-NB2data transmission(15KHz single tone)</b>	
LTE-FDD B1	@21dbm Typical: 137mA @10dbm Typical: 87mA @0dbm Typical: 55mA
LTE-FDD B2	@21dbm Typical: 140mA @10dbm Typical: 87mA @0dbm Typical: 53mA
LTE-FDD B3	@21dbm Typical: 142mA @10dbm Typical: 87mA @0dbm Typical: 53mA
LTE-FDD B4	@21dbm Typical: 141mA @10dbm Typical: 86mA @0dbm Typical: 53mA
LTE-FDD B5	@21dbm Typical: 146mA @10dbm Typical: 80mA @0dbm Typical: 53mA
LTE-FDD B8	@21dbm Typical: 143mA @10dbm Typical: 80mA @0dbm Typical: 52mA
LTE-FDD B12	@21dbm Typical: 139mA @10dbm Typical: 78mA @0dbm Typical: 51mA
LTE-FDD B13	@21dbm Typical: 153mA @10dbm Typical: 83mA @0dbm Typical: 52mA
LTE-FDD B18	@21dbm Typical: 147mA @10dbm Typical: 80mA @0dbm Typical: 53mA
LTE-FDD B19	@21dbm Typical: 147mA @10dbm Typical: 80mA @0dbm Typical: 53mA
LTE-FDD B20	@21dbm Typical: 147mA @10dbm Typical: 81mA @0dbm Typical: 52mA
LTE-FDD B25	@21dbm Typical: 140mA @10dbm Typical: 87mA @0dbm Typical: 54mA
LTE-FDD B26	@21dbm Typical: 147mA @10dbm Typical: 81mA @0dbm Typical: 53mA
LTE-FDD B28	@21dbm Typical: 143mA @10dbm Typical: 81mA

LTE-FDD B31	@0dbm Typical: 53mA @26dbm Typical: 302mA @17dbm Typical: 185mA @8dbm Typical: 120mA @21dbm Typical: 141mA
LTE-FDD B66	@10dbm Typical: 87mA @0dbm Typical: 53mA
LTE-FDD B71	@21dbm Typical: 133mA @10dbm Typical: 76mA @0dbm Typical: 64mA
LTE-FDD B85	@21dbm Typical: 141mA @10dbm Typical: 78mA @0dbm Typical: 51mA

**NOTE**

In the table above the current consumption value is the typical one of the PCIE tested in the laboratory.  
In the mass production stage, there may be some difference.

## 5.5 Electro-Static Discharge

SIM7070-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 %)**

Part	Contact discharge	Air discharge
VBAT,GND	+/-6K	+/-12K
Antenna port	+/-5K	+/-10K
USB	+/-4K	+/-8K
UART	+/-3K	+/-6K
Other PADs	+/-3K	+/-6K

## 6 Packaging

SIM7070 PCIE supports tray packaging.

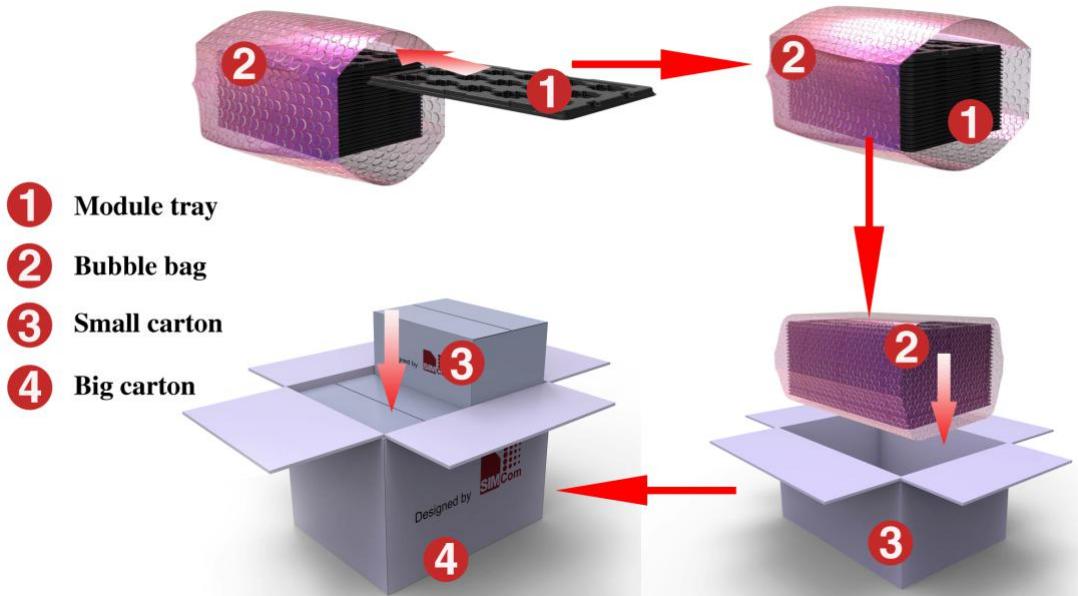


Figure 21: Tray packaging

SIM7070 PCIE tray drawing:

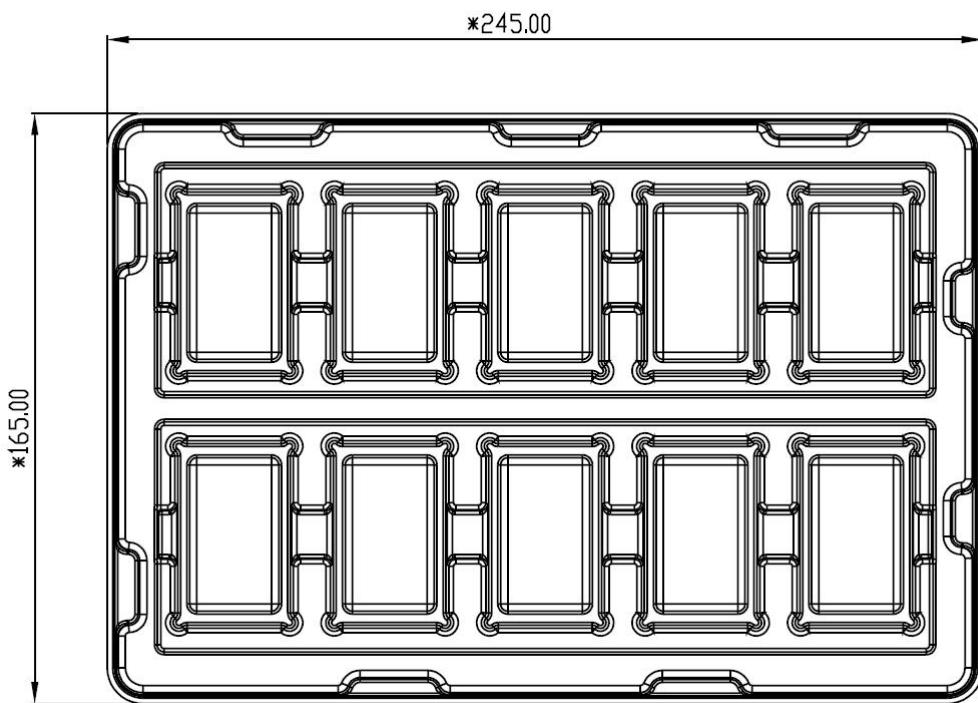
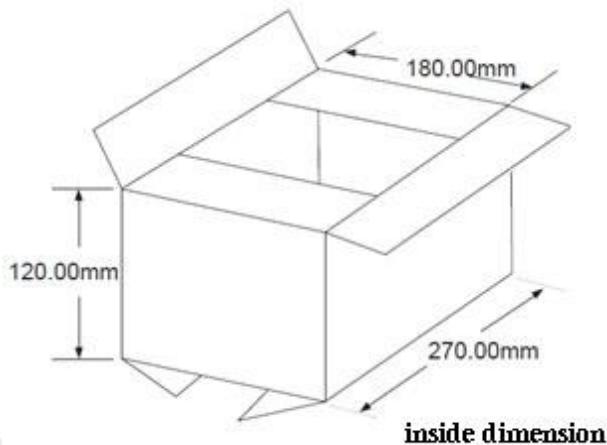


Figure 22: Tray drawing

**Table 26: Tray size**

<b>Length (<math>\pm 3\text{mm}</math>)</b>	<b>Width (<math>\pm 3\text{mm}</math>)</b>	<b>Number</b>
245.0	165.0	10

Small carton drawing:

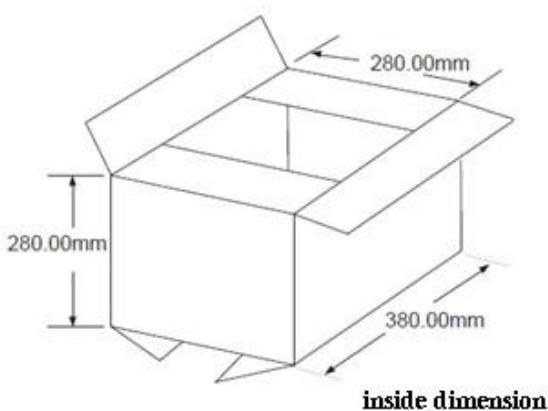


**Figure 23: Small carton drawing**

**Table 27: Small Carton size**

<b>Length (<math>\pm 10\text{mm}</math>)</b>	<b>Width (<math>\pm 10\text{mm}</math>)</b>	<b>Height (<math>\pm 10\text{mm}</math>)</b>	<b>Number</b>
270	180	120	$10 \times 10 = 100$

Big carton drawing:



**Figure 24: Big carton drawing**

**Table 28: Big Carton size**

<b>Length (<math>\pm 10\text{mm}</math>)</b>	<b>Width (<math>\pm 10\text{mm}</math>)</b>	<b>Height (<math>\pm 10\text{mm}</math>)</b>	<b>Number</b>
380	280	280	$100 \times 4 = 400$

# 7 Appendix

## 7.1 Coding Schemes and Maximum Net Data Rates over Air Interface

Table 29: Coding Schemes and Maximum Net Data Rates over Air Interface

Multislot definition(GPRS/EDGE)					
Slot class	DL number	slot	UL number	slot	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 rate (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 rate (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	

LTE-FDD device category (Uplink)	Max data rate (peak)	Modulation type
Category NB	DL/UL:~60kbps/~50kbps	QPSK
Category M1	DL/UL:1Mbps	QPSK/16QAM

## 7.2 Related Documents

**Table 30: Related Documents**

NO.	Title	Description
[1]	SIM7070 Series AT Command Manual V1.xx	AT Command Manual
[2]	GSM 07.07	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[3]	GSM 07.10	Support GSM 07.10 multiplexing protocol
[4]	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)
[5]	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
[6]	GSM 11.11	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[7]	GSM 03.38	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[8]	GSM 11.10	Digital cellular telecommunications system (Phase 2) ; Mobile Station (MS) conformance specification ; Part 1: Conformance specification
[9]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[10]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[11]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[12]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[13]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[14]	EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000. Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
[15]	EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for

		radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment
[16]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[17]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[18]	2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)
[19]	Module secondary-SMT-UGD V1.xx	Module secondary SMT Guidelines
[20]	SIM7070 Series UART Application Note_V1.xx	This document describes how to use UART interface of SIMCom modules.
[21]	ETSI EN 301 908-13 (ETSI TS 136521-1 R13.4.0)	IMT cellular networks; Harmonized EN covering the essential requirements of article 3.2 of the R&TTE Directive; Part 13
[22]	ANTENNA DESIGN GUIDELINES FOR MULTI-ANTENNA SYSTEM V1 01	Design notice for multi-antenna.

## 7.3 Terms and Abbreviations

**Table 31: Terms and Abbreviations**

Abbreviation	Description
ADC	Analog-to-Digital Converter
ARP	Antenna Reference Point
BER	Bit Error Rate
BTS	Base Transceiver Station
CS	Coding Scheme
CSD	Circuit Switched Data
CTS	Clear to Send
DAC	Digital-to-Analog Converter
DRX	Discontinuous Reception
DSP	Digital Signal Processor
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
EVDO	Evolution Data Only
FCC	Federal Communications Commission (U.S.)
FD	SIM fix dialing phonebook
FDMA	Frequency Division Multiple Access
FR	Full Rate
GMSK	Gaussian Minimum Shift Keying
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
HSPA	High Speed Packet Access
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LTE	Long Term Evolution
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Switched Broadcast Control Channel

PCB	Printed Circuit Board
PCS	Personal Communication System, also referred to as GSM 1900
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
SIM	Subscriber Identification PCIE
SMS	Short Message Service
SPI	serial peripheral interface
SMPS	Switched-mode power supply
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
VSWR	Voltage Standing Wave Ratio
SM	SIM phonebook
NC	Not connect
EDGE	Enhanced data rates for GSM evolution
HSDPA	High Speed Downlink Packet Access
HSUPA	High Speed Uplink Packet Access
ZIF	Zero intermediate frequency
WCDMA	Wideband Code Division Multiple Access
VCTCXO	Voltage control temperature-compensated crystal oscillator
USIM	Universal subscriber identity PCIE
UMTS	Universal mobile telecommunications system
UART	Universal asynchronous receiver transmitter

## 7.4 Safety Caution

**Table 32: 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.
	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 SIM 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.  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.  Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

SIMCom  
Confidential