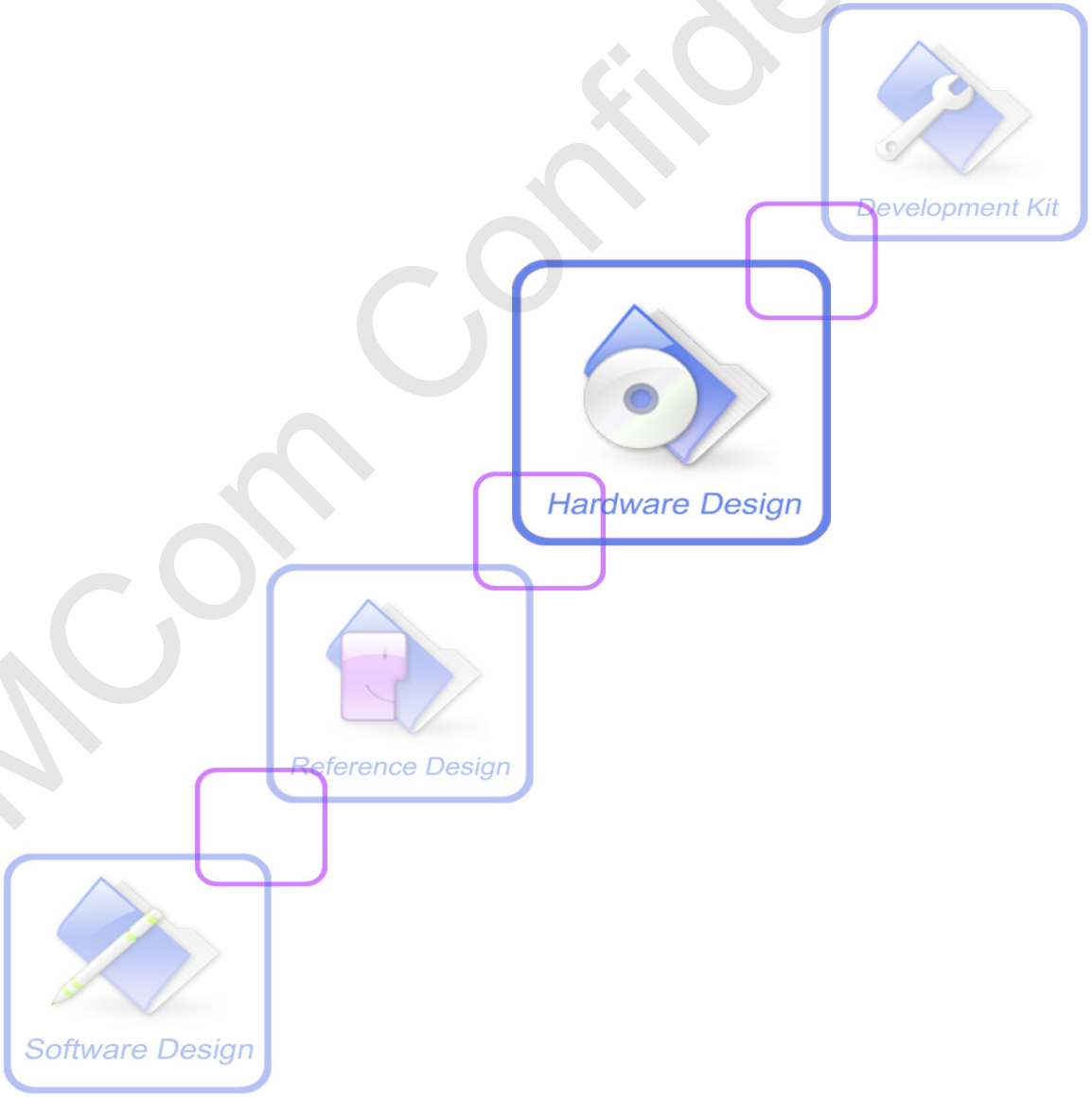
SIM7070 Series PCIE Hardware Design_V1.00



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Version History

Date	Version	Description of change	Author
2019-11-19	1.00	Origin	Zhao sen , zhao xian jing

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	
LTE-HD-FDD	Category	M1	NB1/NB2	M1	NB1/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 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	✓	✓	✓	✓
GSM/GPRS/ EDGE	GSM850MHz	✓		✓	
	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.

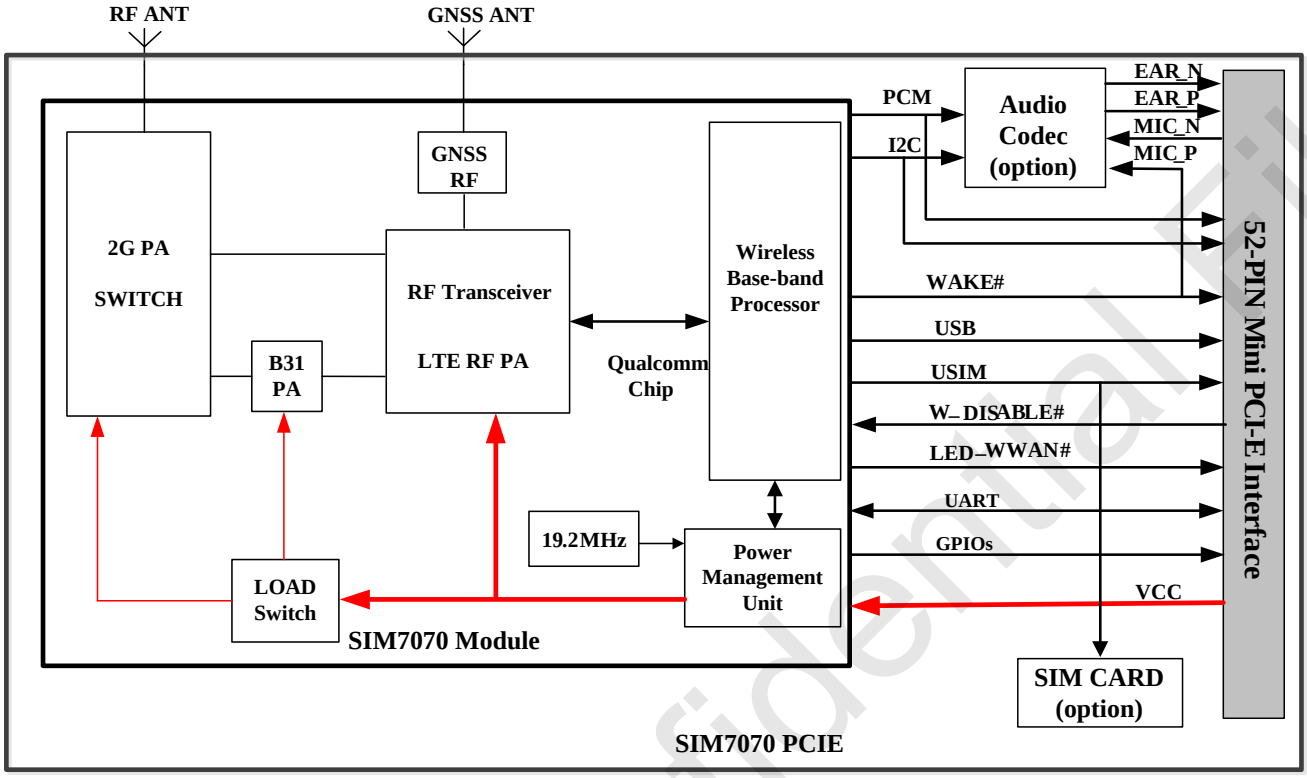

Figure 1: SIM7070 PCIE Block Diagram

1.4 Functional Overview

Table 2: SIM7070 Series PCIE Key Features

Feature	Implementation
Power supply	Single supply voltage 3.3V~4.2V. Defalut:3.8V
Radio frequency bands	Please refer to the table 1
Transmitting power	GSM/GPRS power class: -- GSM850: 4 (2W) -- EGSM900: 4 (2W) -- DCS1800: 1 (1W) -- PCS1900: 4 (1W) 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)
Data Transmission	GPRS: Uplink up to 85.6Kbps, Downlink up to 85.6Kbps.

Throughput	EDGE:Uplink up to 236.8Kbps, Downlink up to 236.8Kbps 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:
Temperature range	Normal operation temperature: -40℃ ~ +85℃ Storage temperature -45°C to +90°C

2. Package Information

2.1 Pin Out Diagram

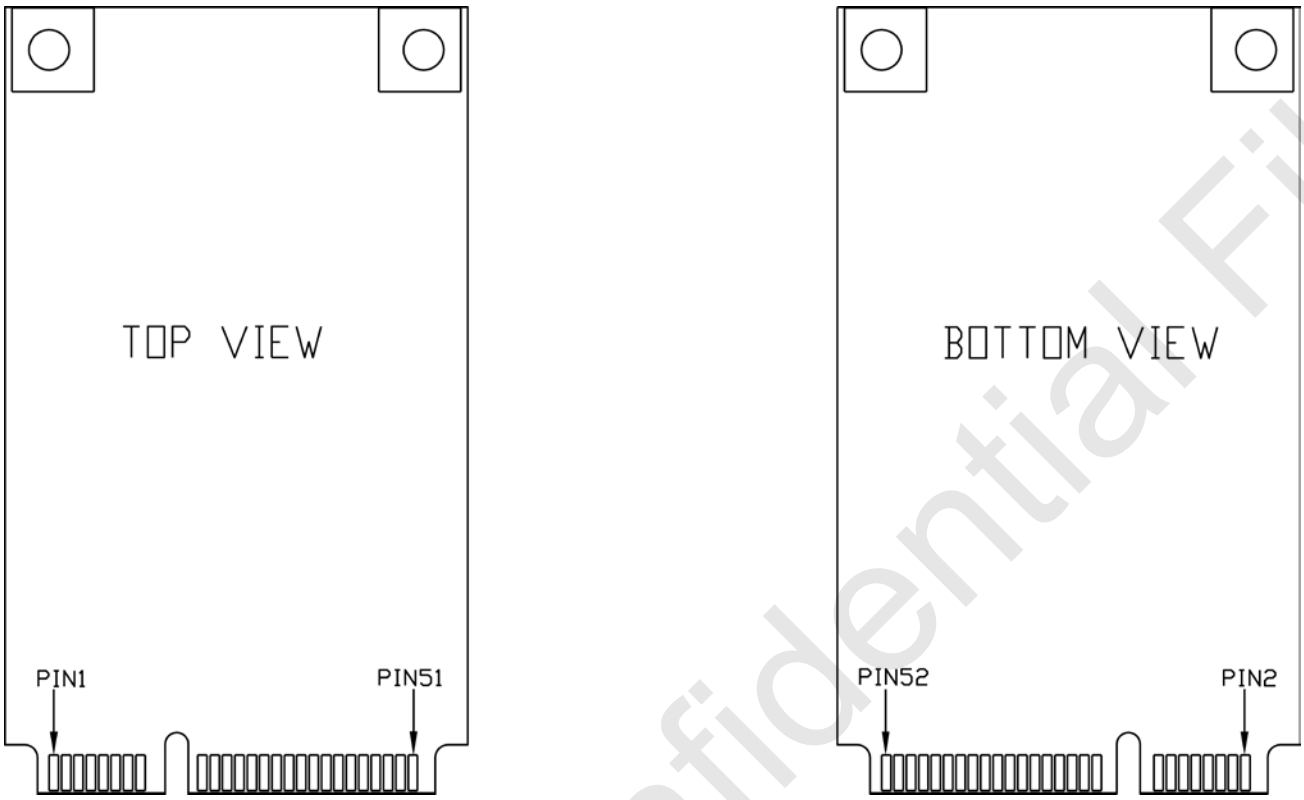

Figure 2: SIM7070 Series Pin out Diagram

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
Power supply				
VBAT	2,24,39,41,52	PI	Power supply for PCIE	3.8V typical
GND	4,9,15,18,21,26,27,29,34,35,37,40,43,50		Ground	-
USB 2.0				
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			
USIM card interface				
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.	All lines of SIM interface should be protected against ESD
USIM_DATA	10	I/O,PU	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.	
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.	
UART interface				
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	
PCM interface				
PCM_CLK	45	DO	PCM data bit clock.	If unused, keep open.
PCM_SYNC	51	DO	PCM data frame sync signal.	

PCM_DIN	49	DI	PCM data input.	
PCM_DOUT	47	DO	PCM data output.	
I2C interface				
I2C_SCL	30	DO	I2C clock output	If unused, keep open
I2C_SDA	32	I/O	I2C data input/output	
Others				
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.	If unused, keep open.
W_DISABLE#	20	I	Low power consumption control Input. Low level effective. When input is low, the PCIE will enter low power mode.	
LED_WWAN#	42	O	Network Status Indication output. OC output.	
LED_WLAN#	44	O	LED Indication output. OC output.	
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

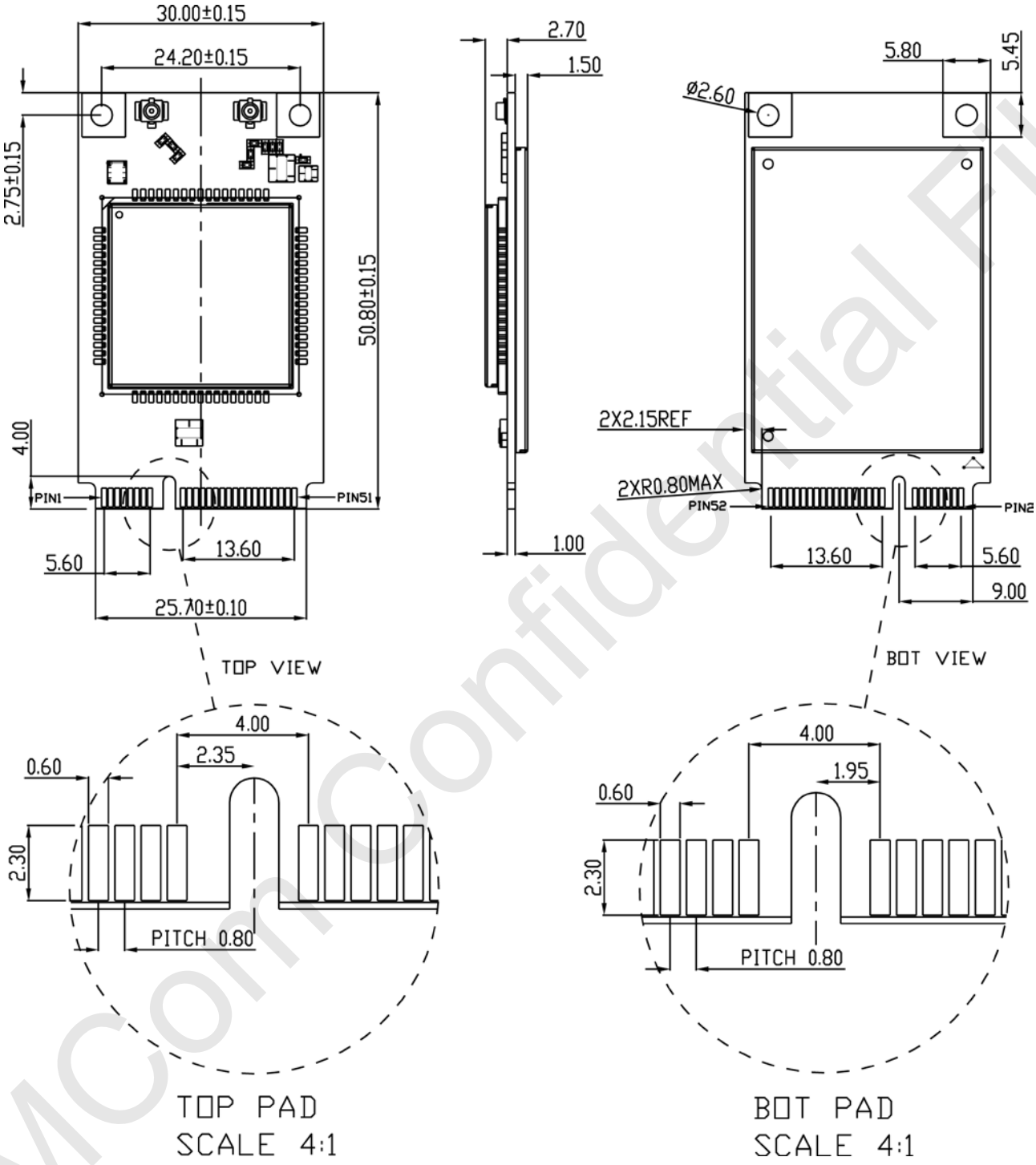

Figure 3: Dimensions of SIM7070-PCIE (Unit: mm)

3. Interface Application

3.1 Power Supply

The power supply pins of SIM7070 Series PCIE are VBAT

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
	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.

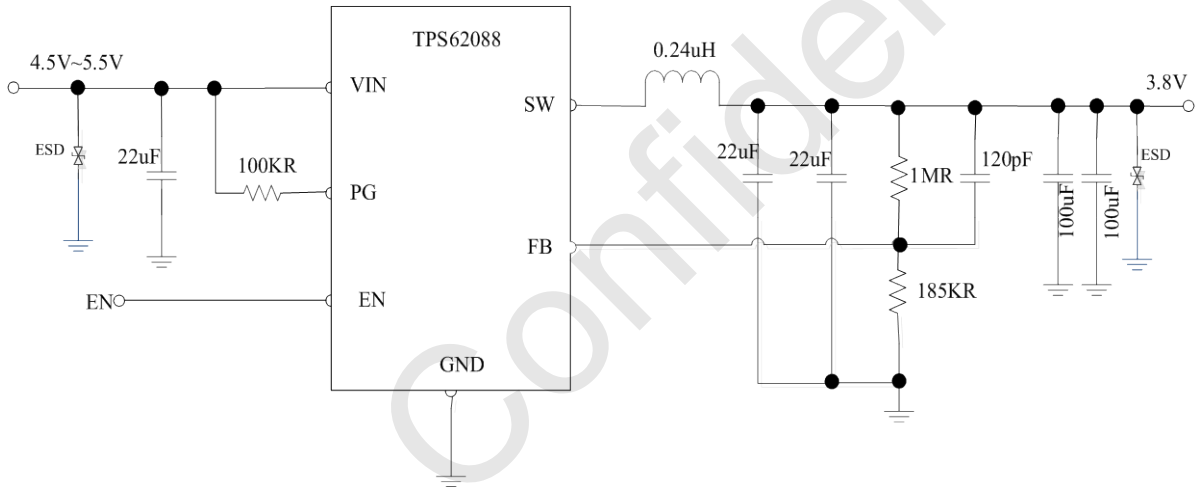

Figure 4: power supply reference circuit

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:

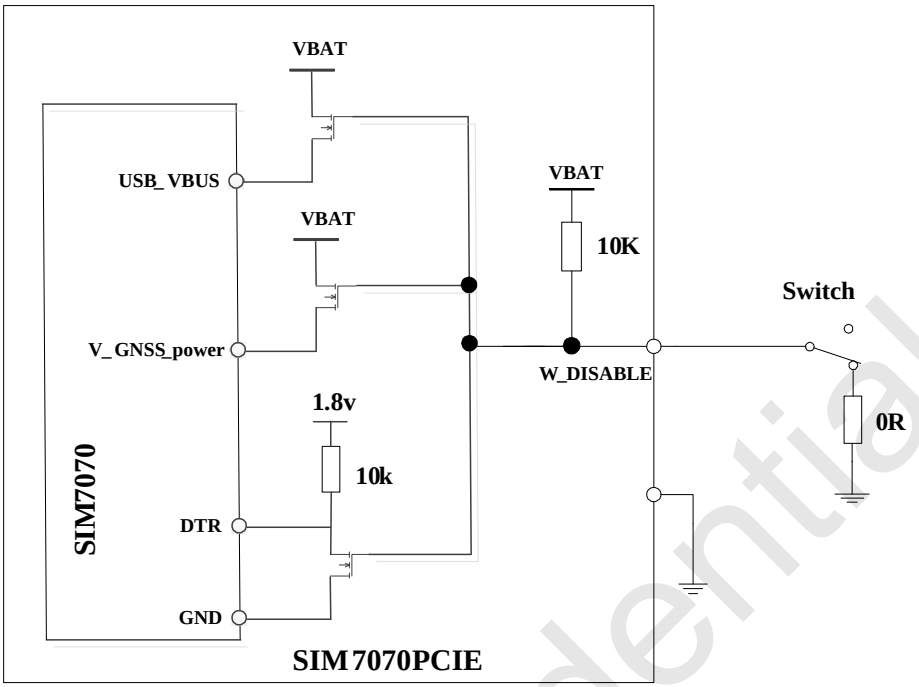

Figure 5: W_DISABLE# Reference Circuit

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:

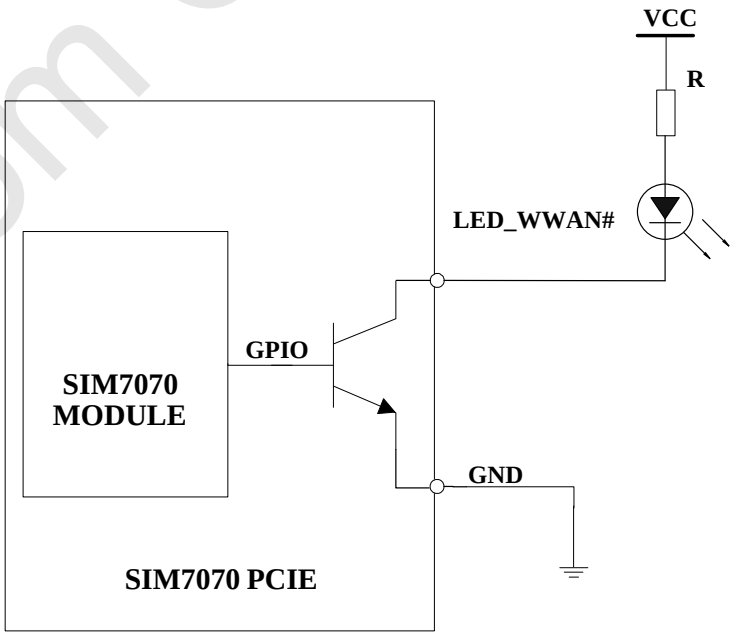

Figure 6: LED_WWAN# Reference Circuit

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:

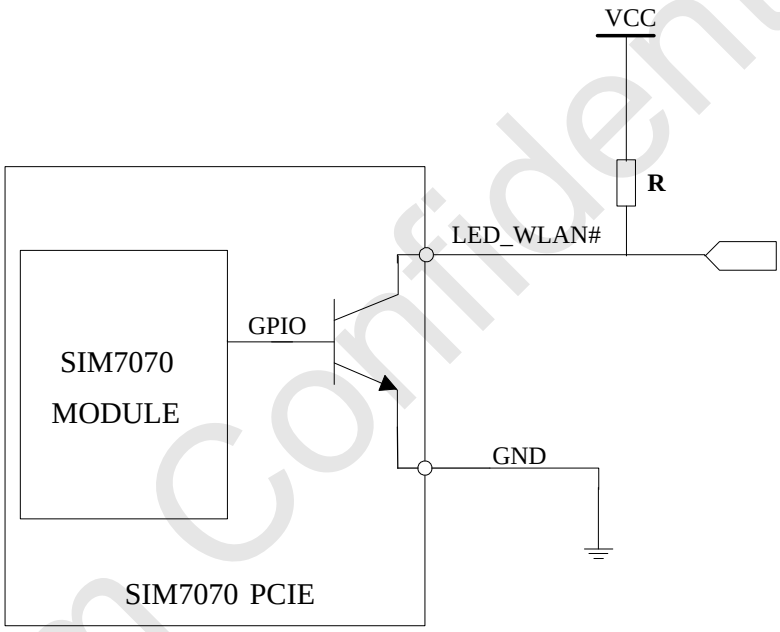

Figure 7: LED_WLAN# Reference Circuit

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).

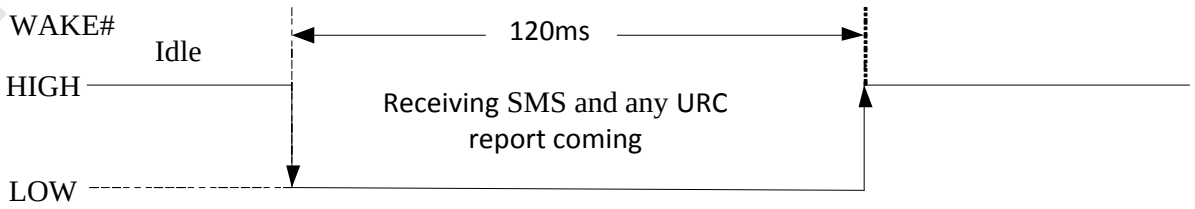

Figure 8: WAKE# behaviour

WAKE# Reference circuit is recommended in the following figure:

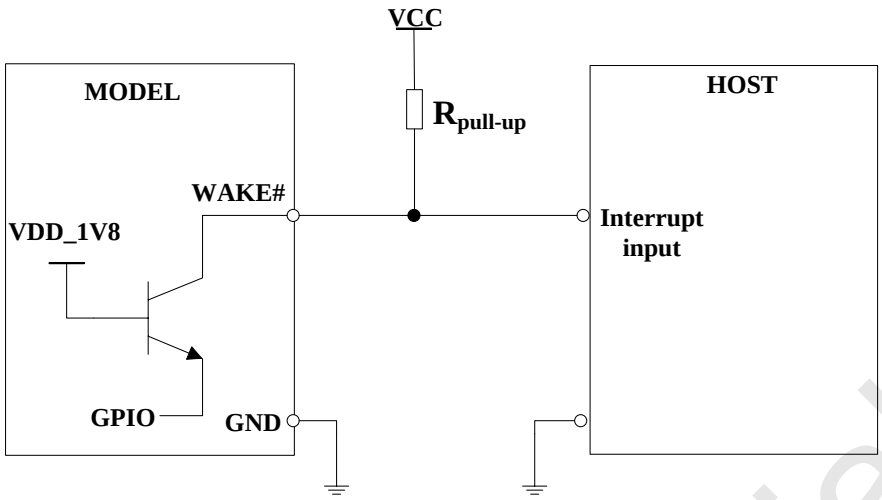

Figure 9: WAKE# Reference Circuit

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:

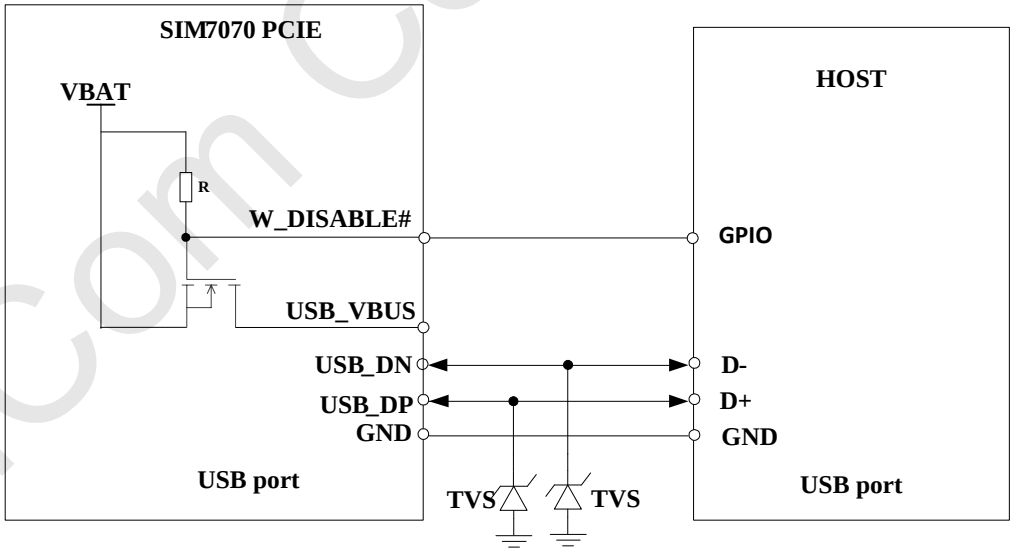

Figure 10: USB Reference Circuit

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).

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
VIH	High-level input voltage	0.65*USIM_VDD	-	USIM_VDD +0.3	V
VIL	Low-level input voltage	-0.3	0	0.35*USIM_VDD	V
VOH	High-level output voltage	USIM_VDD -0.45	-	USIM_VDD	V
VOL	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.

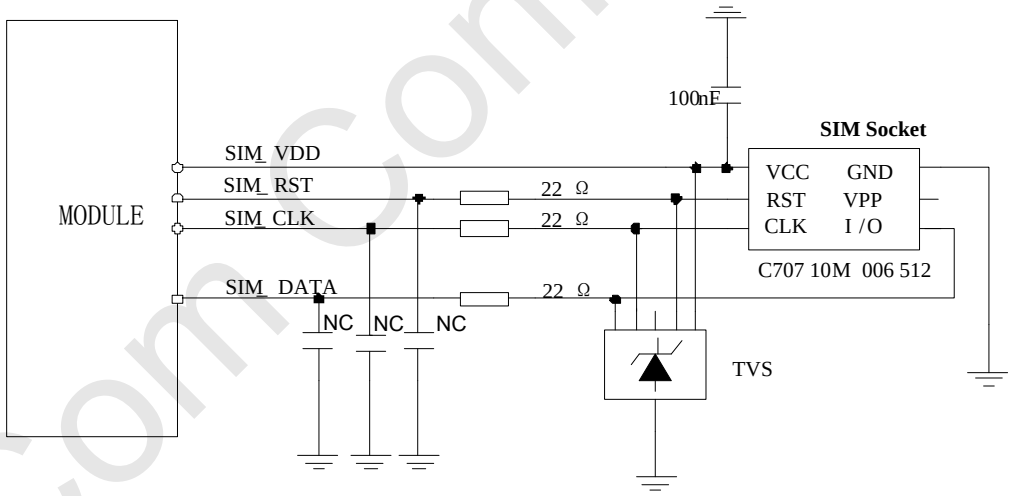

Figure 11: USIM interface reference circuit

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..

Table 9: UART Electrical Characteristic

Symbol	Parameter	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	1.8	V
VOL	Low-level output voltage	0	0	0.45	V

3.8.1 UART interface reference circuit

The application circuit is in the following figures.

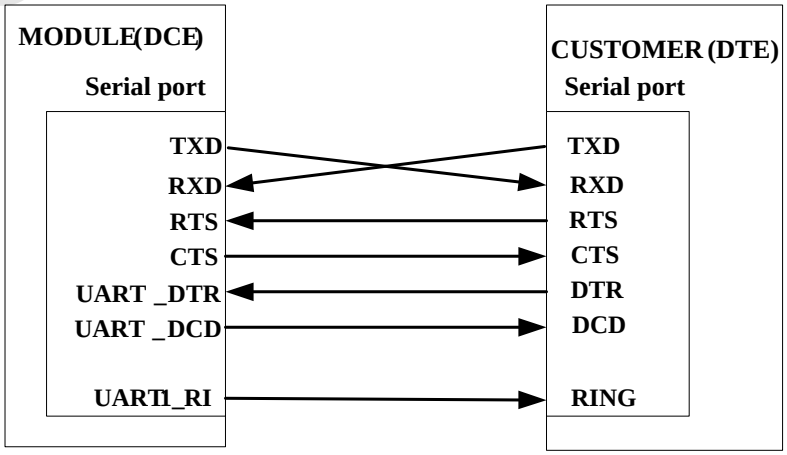

Figure 12: UART Full modem

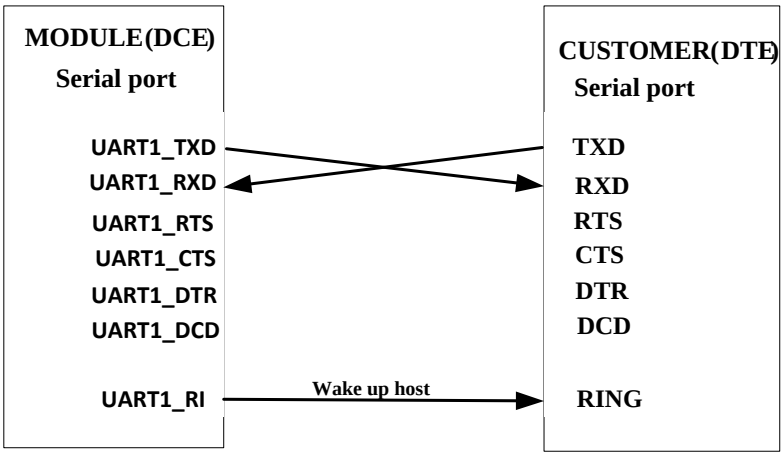

Figure 13: UART Null modem

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.

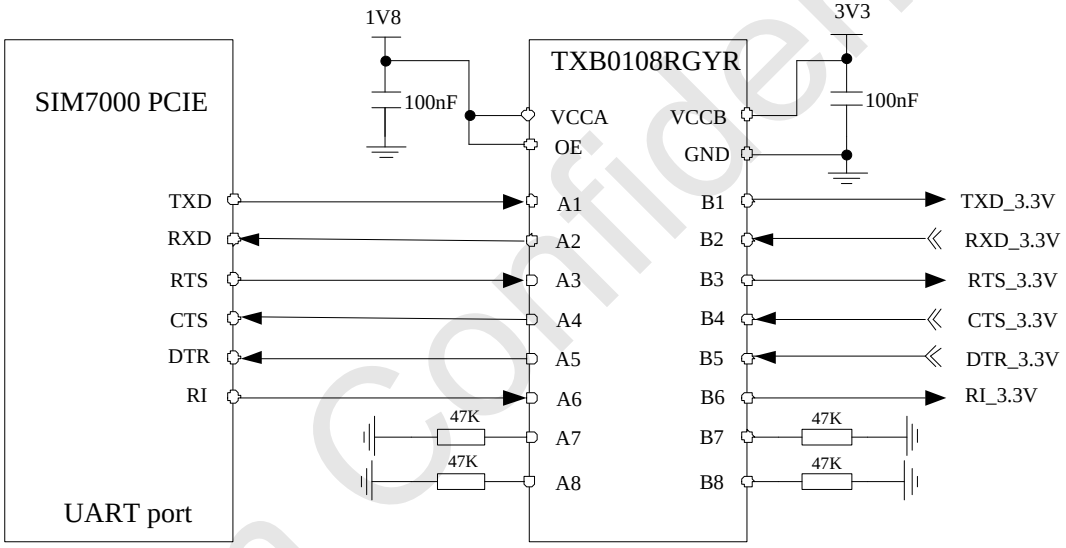

Figure 14: Reference circuit of level shift

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.

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.

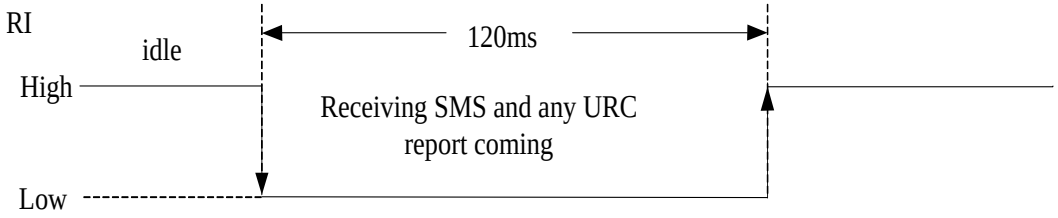

Figure 15: RI behaviour（SMS and URC report）

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 kbps. 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:

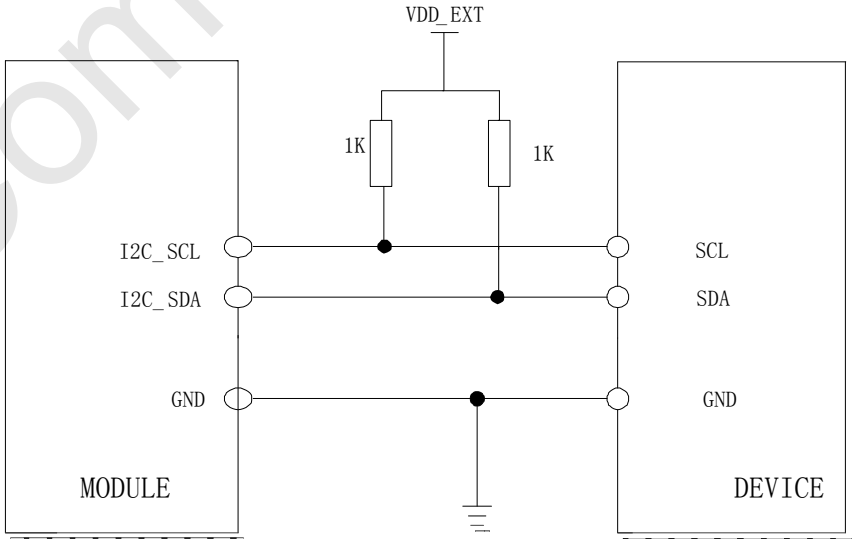

Figure 16:I2C Reference Circuit

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.

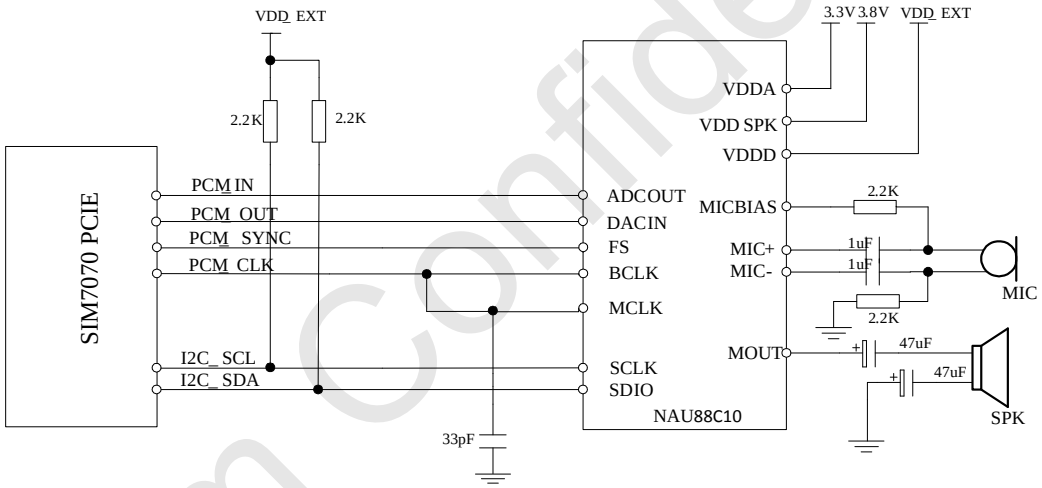

Figure 17: Receiver interface configuration

4. RF Specifications

4. 1 GSM/LTE RF Specifications

Table 11: Conducted transmission power

GSM

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

Frequency	Power	Min.
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 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

CAT-M1

Frequency	Power	Min.
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

GPRS

frequency	MPR	3GPP standard
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

frequency	MPR	3GPP standard
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

Modulation	QPSK		
Tone positions for 3 Tones allocation	0-2	3-5 and 6-8	9-11
MPR	≤ 0.5 dB	0 dB	≤ 0.5 dB
Tone positions for 3 Tones allocation	0-5 and 6-11		
MPR	≤ 1 dB	≤ 1 dB	
Tone positions for 3 Tones allocation	0-11		
MPR	≤ 2 dB		

CAT-M1

Modulation	Channel bandwidth / Transmission bandwidth (N_{RB})						MPR (dB)
	1.4 MHz	3.0 MHz	5 MHz	10 MHz	15 MHz	20 MHz	
QPSK	>2	>2	>3	>5	-	-	≤ 1
QPSK	>5	>5	-	-	-	-	≤ 2
16 QAM	≤ 2	≤ 2	>3	>5	-	-	≤ 1
16QAM	>2	>2	>5	-	-	-	≤ 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

Frequency	Receiving	Transmission
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 Request	SIM7070G	SIM7070E
		REFSENS Typical (dBm)	REFSENS Typical (dBm)
EGSM900	<-104dBm	TBD dBm	TBD dBm
GSM850	<-104dBm	TBD dBm	TBD dBm
DCS1800	<-104dBm	TBD dBm	TBD dBm
PCS1900	<-104dBm	TBD dBm	TBD dBm
LTE HD-FDD	Reference【Table16】【Table17】	3GPP	3GPP

Table 16:CAT-M1 Reference sensitivity (QPSK)

E-UTRA Band	REFSENS MAX(dBm) 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	TBD	-115.1	TBD
2	-108.2	-114.8	TBD	-114.8	TBD
3	-108.2	-115.4	TBD	-115.4	TBD
4	-108.2	-115.1	TBD	-115.1	TBD
5	-108.2	-114.3	TBD	-114.3	TBD
8	-108.2	-113.9	TBD	-113.9	TBD
12	-108.2	-116	TBD	-116	TBD
13	-108.2	-115.7	TBD	-115.7	TBD
18	-108.2	-114.9	TBD	-114.9	TBD
19	-108.2	-115.1	TBD	-115.1	TBD
20	-108.2	-114.1	TBD	-114.1	TBD
25	-108.2	-114.6	TBD	-114.6	TBD
26	-108.2	-114.6	TBD	-114.6	TBD
28	-108.2	-115.9	TBD	-115.9	TBD
31	-108.2			-114.7	TBD
66	-108.2	-114.8	TBD	-114.8	TBD
71	-108.2	-114.4	TBD		

85	-108.2	-115.7	TBD	-115.7	TBD

Note:①.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 50Ω. 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.

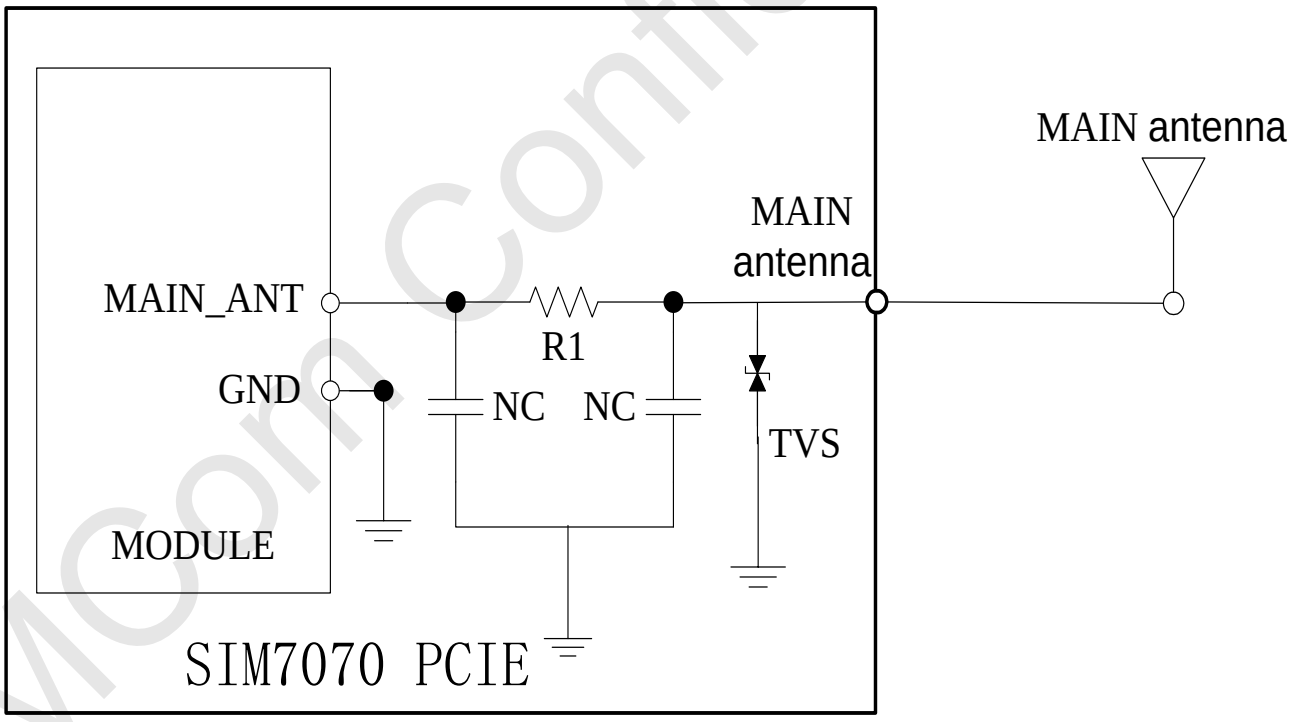

Figure 18: Antenna matching circuit (MAIN_ANT)

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: TBD dBm（GPS）/TBDdBm（GLONASS）/TBD (BD)/TBD(Galileo)
- Cold-start sensitivity: TBD dBm
- Accuracy (Open Sky): TBD (CEP50)
- TTFF (Open Sky) : Hot start <TBDs, Cold start<TBDs
- Receiver Type: 16-channel, C/A Code
- GPS L1 Frequency: 1575.42±1.023MHz
- 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 : TBDmA (GSM/LTE Sleep, in total on VBAT pins)
- 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.

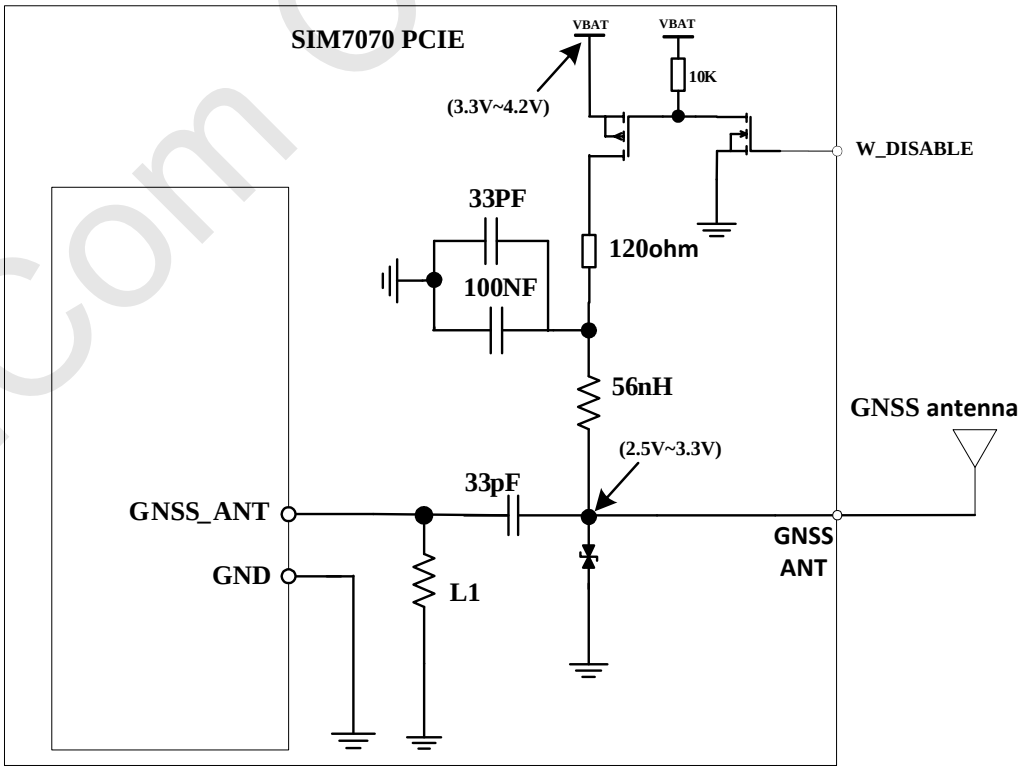

Figure 19: GNSS antenna Reference Circuit

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	℃
Storage temperature	-45	25	+90	℃

Note: Module is able to make and receive voice calls, data calls, SMS and make GPRS/LTE traffic in -40℃ ~ +85℃. 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 [22] 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	
GNSS supply current (AT+CFUN=0,without USB connection)	@ -140dBm，Tracking Typical:TBD
GSM sleep/idle mode	
GSM/GPRS supply current (GNSS off，without USB connection)	Sleep mode@ BS_PA_MFRMS=2 Typical:TBD Idle mode@ BS_PA_MFRMS=2 Typical: TBD
LTE sleep/idle mode	
LTE supply current (GNSS off，without USB connection)	Sleep mode Typical: TBD Idle mode Typical: TBD
GPRS	
EGSM900(1 Rx,4 Tx)	@power level #5 Typical: TBD
DCS1800(1 Rx,4 Tx)	@power level #0 Typical: TBD
EGSM900(3Rx, 2 Tx)	@power level #5 Typical: TBD
DCS1800(3Rx, 2 Tx)	@power level #0 Typical: TBD
EDGE	
EGSM900(1 Rx,4 Tx)	@power level #8 Typical: TBD
DCS1800(1 Rx,4 Tx)	@power level #2 Typical: TBD
EGSM900(3Rx, 2 Tx)	@power level #8 Typical: TBD
DCS1800(3Rx, 2 Tx)	@power level #2 Typical: TBD

LTE Cat-M data transmission	
LTE-FDD B1	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B2	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B3	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B4	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B5	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B8	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B12	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B13	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B18	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B19	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B20	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B26	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B28	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B31	@23dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B66	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD

LTE-FDD B72	@23dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B85	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD

LTE Cat-NB2 data transmission	
LTE-FDD B1	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B2	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B3	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B4	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B5	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B8	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B12	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B13	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B18	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B19	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B20	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B25	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B26	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD

LTE-FDD B28	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B31	@23dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B66	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B71	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD
LTE-FDD B85	@20dbm Typical: TBD @10dbm Typical: TBD @0dbm Typical: TBD

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℃, 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.

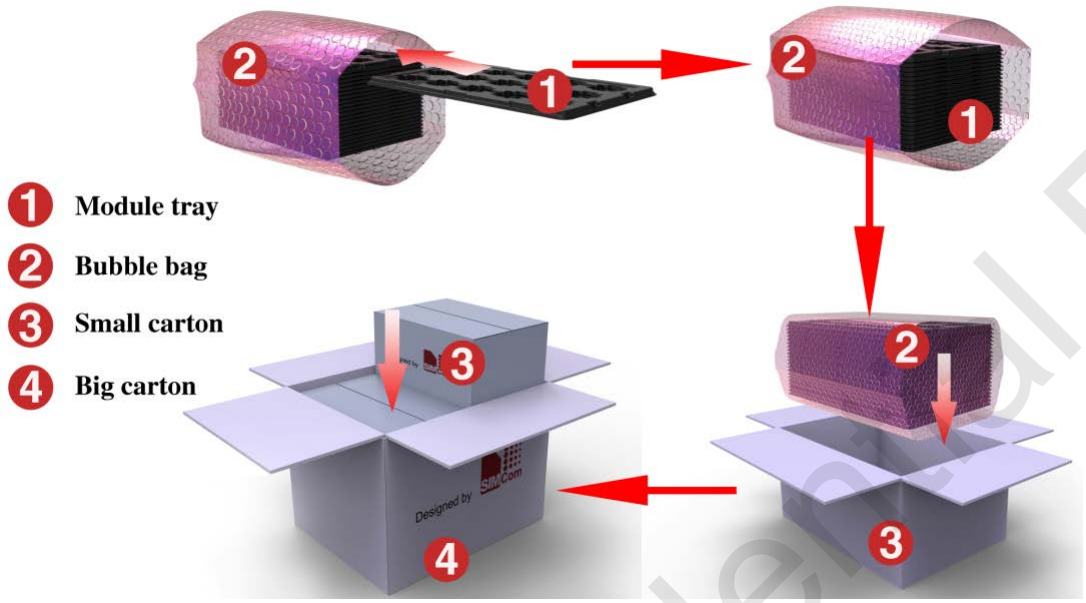

Figure 20: Tray packaging

SIM7070 PCIE tray drawing:

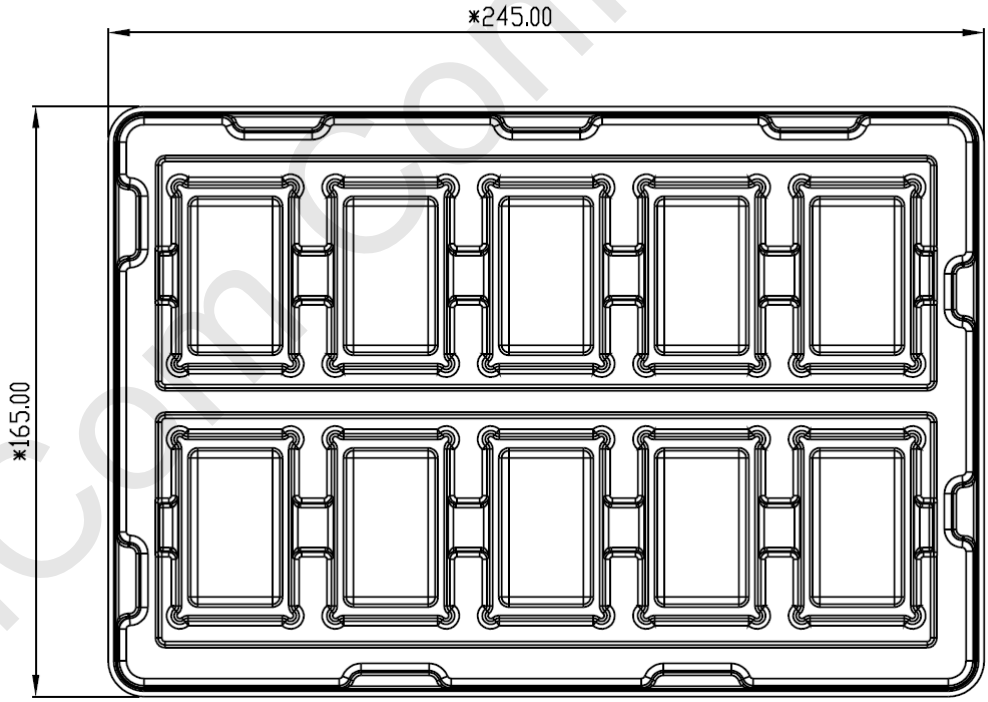

Figure 21: Tray drawing

Table 26: Tray size

Length（±3mm）	Width（±3mm）	Number
245.0	165.0	10

Small carton drawing:

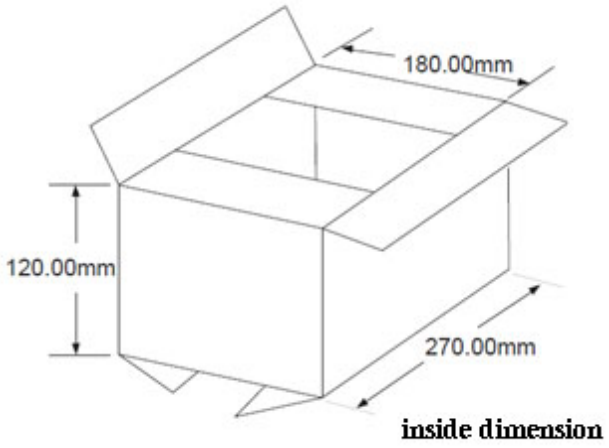

Figure 22: Small carton drawing

Table 27: Small Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
270	180	120	10*10=100

Big carton drawing:

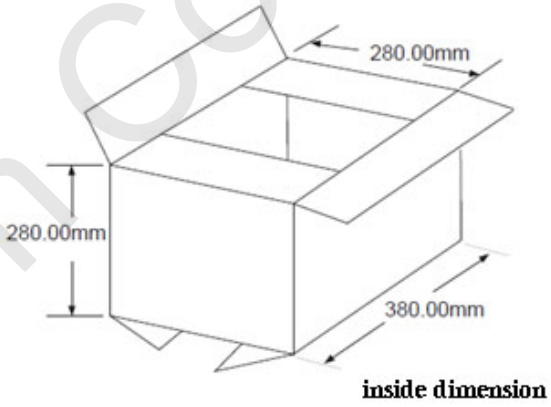

Figure 23: Big carton drawing

Table 28: Big Carton size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Number
380	280	280	100*4=400

Appendix

I. 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 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
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

II. 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.

III. 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

IV. 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.

Contact us:

Shanghai SIMCom Wireless Solutions Ltd.

Add: SIM Technology Building, No.633, Jinzhong Road, Changning District, Shanghai, P.R. China 200335

Tel：+86 21 3157 5200

URL：www.simcom.com