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# SIM8202G-M2

## Hardware Design

5G Module

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# 1. Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and test results of the SIM8202G-M2 module. With the help of this document, customers can quickly understand SIM8202G-M2 module.

Associated with other software application notes and user guides, customers can use SIM8202G-M2 to design and develop mobile and laptop applications easily.

## 1.1 Product Outline

SIM8202G-M2 is a wireless communication module focusing on 5G market; it supports multi-air access technology including 5G NR (NSA/SA), LTE-FDD, LTE-TDD, and WCDMA, can meet the 3GPP R15 NR specification, and data rate which up to 4.0Gps.

The module's supported radio frequency bands are shown in the following table.

**Table 1: SIM8202G-M2 frequency bands**

| Standard          | Frequency Bands                                                                      |
|-------------------|--------------------------------------------------------------------------------------|
| 5G NR             | n1/n2/n3/n5/n7/n8/n12/n20/n25/n28/n38/n40/n41/n48/n66/n71/n77/n78/n79                |
| LTE-FDD           | B1/B2/B3/B4/B5/B7/B8/B12/B13/B14/B17/B18/B19/B20/B25/B26/B28/B29/B30/B32/B46/B66/B71 |
| LTE-TDD           | B34/B38/B39/B40/B41/B42/B43/B48                                                      |
| WCDMA             | B1/B2/B3/B4/B5/B8                                                                    |
| GNSS <sup>1</sup> | GPS L1+L5 dual bands/GLONASS/BeiDou/Galileo/QZSS                                     |

### NOTE

1. GNSS is optional.
2. Please confirm with SIMCom for the details information about the combination of ENDC.

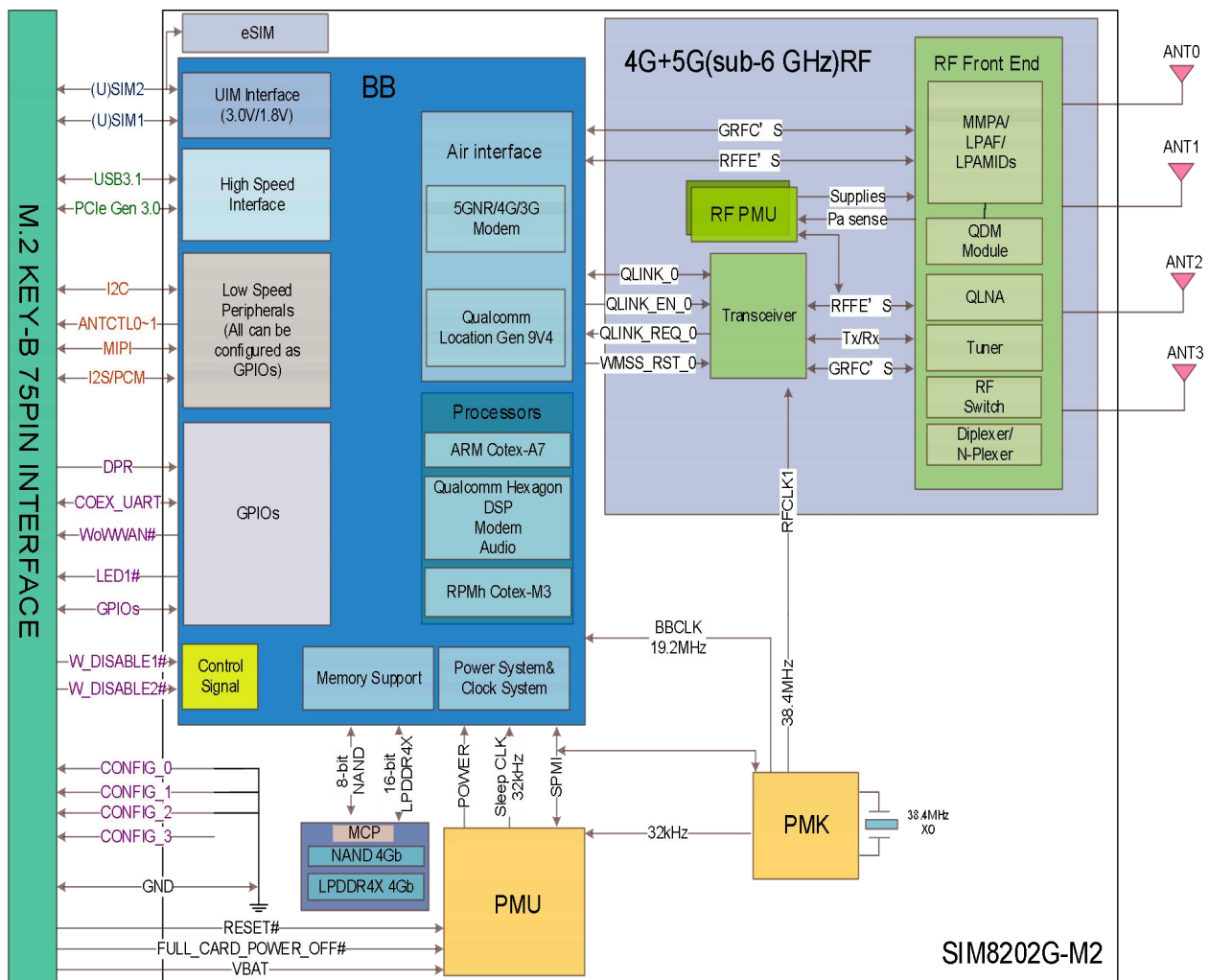
The physical dimension of SIM8202G-M2 is 30.0mm\*42.0mm\*2.3mm, which can meet PCI Express M.2 specifications, and can meet almost all space requirements in customer's applications.

With M.2 Type 3042, SIM8202G-M2 owns rich interfaces, includes USB3.1, PCIe3.0, (U)SIM card, digital audio (I2S or PCM), I2C, GPIOs, four antennas for 3G/4G/5G and GNSS.

With all the interfaces, SIM8202G-M2 can also be utilized in the handheld terminal, machine-to-machine laptop application and especially the notebook.

## 1.2 Hardware Block Diagram

The block diagram of SIM8202G-M2 is shown in the following figure.



**Figure 1: Block diagram**

## 1.3 Feature Overview

**Table 2: Key features**

| Feature                      | Implementation                                                                                                                                                                                                                                                                                                 |
|------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Power supply <sup>1</sup>    | VBAT: 3.135~4.4V<br>Typical: 3.8V                                                                                                                                                                                                                                                                              |
| Power consumption*           | <5mA @sleep mode(VBAT=3.8V)                                                                                                                                                                                                                                                                                    |
| Transmit power               | Power Class 3 for WCDMA/LTE/5G NR<br>Power Class 2 for n41/n78/n79                                                                                                                                                                                                                                             |
| Data transmission throughput | 4Gbps (DL)/500Mbps(UL) for NR<br>2Gbps (DL)/200Mbps (UL) for LTE<br>42Mbps(DL)/5.76Mbps(UL) for HSPA+                                                                                                                                                                                                          |
| Antenna                      | Four antennas for 3G/4G/5G and GNSS                                                                                                                                                                                                                                                                            |
| GNSS(optional)               | GNSS engine : GPS L1+L5/GLONASS/BeiDou/Galileo/QZSS<br>Protocol: NMEA                                                                                                                                                                                                                                          |
| SMS                          | MT, MO, CB, Text and PDU mode<br>SMS storage: (U)SIM card or ME(default)<br>Transmission of SMS alternatively over CS or PS                                                                                                                                                                                    |
| (U)SIM interface             | Support (U)SIM card:1.8V/3.0V<br>Include (U)SIM1 and (U)SIM2 interfaces<br>Support dual (U)SIM single standby                                                                                                                                                                                                  |
| (U)SIM application toolkit   | Support SAT class 3<br>Support USAT                                                                                                                                                                                                                                                                            |
| Phonebook management         | Support phonebook types: DC,MC,RC,SM,ME,FD,ON,LD,EN                                                                                                                                                                                                                                                            |
| Digital audio interface      | One I2S interface with dedicated main-clock for primary digital audio, the I2S also can be configured as PCM <ul style="list-style-type: none"> <li>● MCLK frequency: 12.288MHz (default)</li> <li>● WCDMA AMR-NB</li> <li>● VoLTE AMR-WB</li> <li>● Echo Cancellation</li> <li>● Noise Suppression</li> </ul> |
| PCIe interface               | <ul style="list-style-type: none"> <li>● One lane PCIe interface, support Gen 3 (Gen 1/2 compatible)</li> <li>● High communication data rate which up to 8Gbps</li> </ul>                                                                                                                                      |
| I2C interface                | <ul style="list-style-type: none"> <li>● Meet I2C specification, version 5.0</li> <li>● Data rate up to 400Kbps</li> </ul>                                                                                                                                                                                     |
| USB                          | Support USB 3.1 Gen2 or USB 2.0<br>USB3.1: super speed, with data rate which up to 10Gbps<br>USB2.0: high speed interface, support USB operations at low-speed and full-speed, which refer to USB1.0 and USB1.1                                                                                                |
| Firmware upgrade             | Firmware upgrade over USB interface                                                                                                                                                                                                                                                                            |
| Physical characteristics     | Size: 30mm*42mm*2.3mm                                                                                                                                                                                                                                                                                          |

|                   |                                                                                                                                                                   |
|-------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                   | Weight: TBD                                                                                                                                                       |
| Temperature range | Normal operation temperature: -30°C to +70°C 3GPP compliant<br>Extended operation temperature: -40°C to +85°C <sup>3</sup><br>Storage temperature: -40°C to +90°C |

**NOTE**

1. The recommended operating voltage of the module is 3.8V. If the voltage is lower than 3.3V, the RF performance may deviate from the 3GPP specifications.
2. “\*” means under development.
3. The module is able to establish and maintain voice, data transmission, SMS and emergency call, etc. The performance may deviate slightly from the 3GPP specifications and will meet 3GPP specifications again when the temperature returns to normal operating temperature levels.

## 2. Package Information

### 2.1 Pin Assignment Overview

SIM8202G-M2 has 75 pins, including 8 notch pins. Customer design should match pins functions. The following figure is the pin assignment of the module.

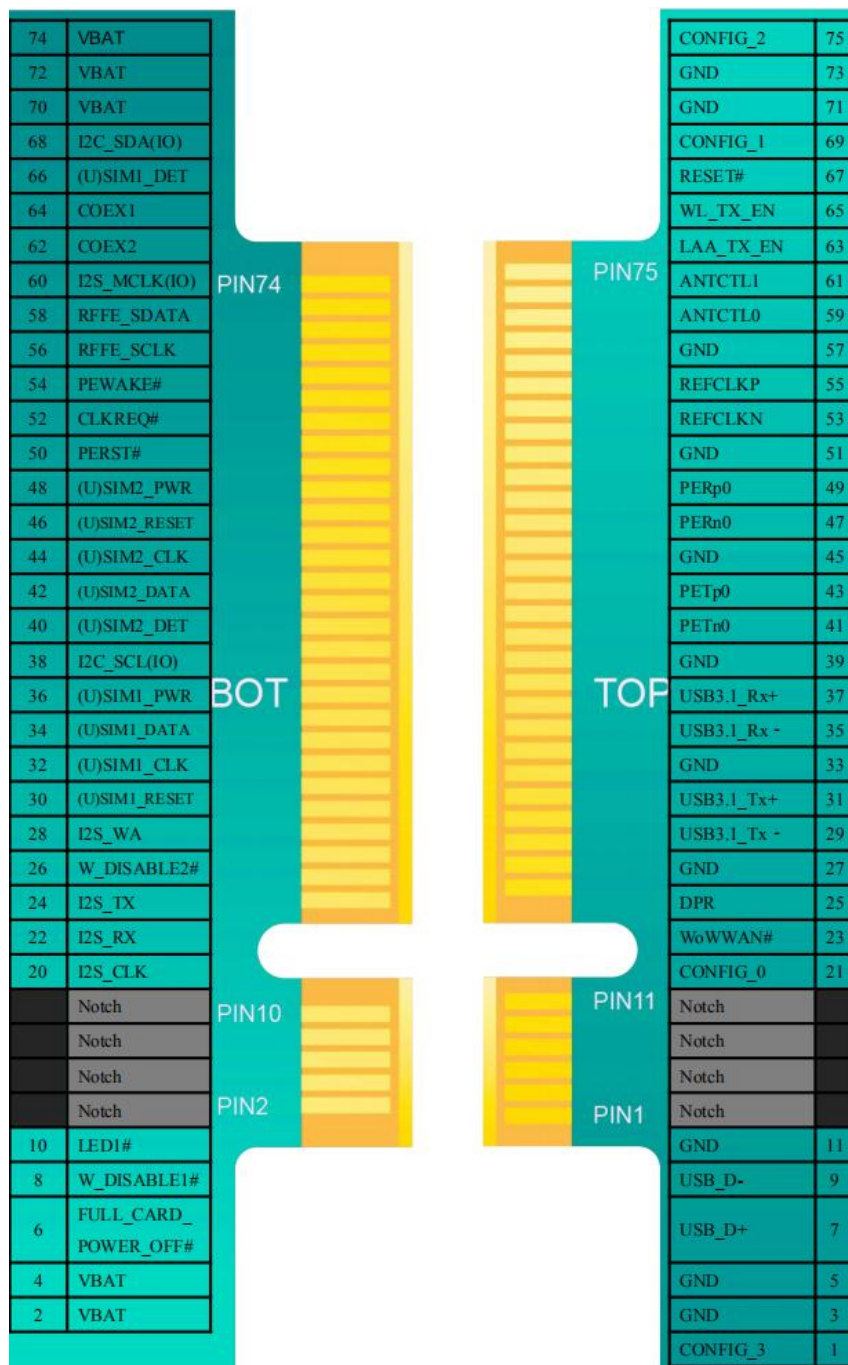


Figure 2: Pin assignment

## 2.2 Pin Description

Table 3: IO parameters definition

| Pin type | Description                         |
|----------|-------------------------------------|
| PI       | Power Input                         |
| PO       | Power Output                        |
| AI       | Analog Input                        |
| AIO      | Analog Input/Output                 |
| DIO      | Bidirectional Digital 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                           |
| OD       | Open Drain                          |
| OC       | Open Collector                      |

Table 4: DC parameters definition

| Voltage domain | Parameter       |                       | Min     | Typ  | Max      |
|----------------|-----------------|-----------------------|---------|------|----------|
| P3             | VDD_P3=1.8V     |                       |         |      |          |
|                | V <sub>OH</sub> | High level output     | 1.35V   | -    | 1.8V     |
|                | V <sub>OL</sub> | Low level output      | 0V      | -    | 0.45V    |
|                | V <sub>IH</sub> | High level input      | 1.26V   | 1.8V | 2.1V     |
|                | V <sub>IL</sub> | Low level input       | 0V      | -    | 0.54V    |
|                | R <sub>p</sub>  | Pull up/down resistor | 20K ohm | -    | 60K ohm  |
| P4/P5          | VDD_P4/P5=1.8V  |                       |         |      |          |
|                | V <sub>OH</sub> | High level output     | 1.44V   | -    | 1.8V     |
|                | V <sub>OL</sub> | Low level output      | 0V      | -    | 0.4V     |
|                | V <sub>IH</sub> | High level input      | 1.26V   | -    | 1.95V    |
|                | V <sub>IL</sub> | Low level input       | 0V      | -    | 0.36V    |
|                | R <sub>p</sub>  | Pull up/down resistor | 10K ohm | -    | 100K ohm |
|                | VDD_P4/P5=3.0V  |                       |         |      |          |
|                | V <sub>OH</sub> | High level output     | 2.4V    | -    | 3.0V     |
|                | V <sub>OL</sub> | Low level output      | 0V      | -    | 0.4V     |
|                | V <sub>IH</sub> | High level input      | 2.1V    | -    | 3.05V    |
|                | V <sub>IL</sub> | Low level input       | 0V      | -    | 0.6V     |
|                | R <sub>p</sub>  | Pull up/down          | 10K ohm |      | 100K ohm |

**Table 5: Pin description**

| Pin name             | Pin No.                        | Electrical Description | Description | Comment                                                            |                                                                                                 |
|----------------------|--------------------------------|------------------------|-------------|--------------------------------------------------------------------|-------------------------------------------------------------------------------------------------|
| Power supply         |                                |                        |             |                                                                    |                                                                                                 |
| VBAT                 | 2,4,70,72,74                   |                        | PI          | Power supply<br>Range : 3.135~4.4V<br>Typical : 3.8V               | These pins should be connected together to withstand sufficient current                         |
| GND                  | 3,5,11,27,33,39,45,51,57,71,73 |                        |             | Ground                                                             |                                                                                                 |
| System control       |                                |                        |             |                                                                    |                                                                                                 |
| FULL_CARD_POWER_OFF# | 6                              |                        | DI,PD       | High level: the module power on<br>Low level: the module power off | It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO                                |
| RESET#               | 67                             | P3                     | DI,PU       | System reset control input<br>Active low                           | RESET# has been pulled up to 1.8V internally                                                    |
| W_DISABLE1#          | 8                              |                        | DI          | WWAN RF disable<br>Active low                                      | 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO                                     |
| W_DISABLE2#*         | 26                             |                        | DI          | GNSS disable<br>Active low                                         | 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO                                     |
| WoWWAN#              | 23                             |                        | OD          | Wake on the host<br>Active low                                     |                                                                                                 |
| Configuration pins   |                                |                        |             |                                                                    |                                                                                                 |
| CONFIG_0             | 21                             |                        | GND         | Connected to ground internally                                     | The module is configured as the WWAN USB3.1 interface type                                      |
| CONFIG_1             | 69                             |                        | GND         | Connected to ground internally                                     |                                                                                                 |
| CONFIG_2             | 75                             |                        | GND         | Connected to ground internally                                     |                                                                                                 |
| CONFIG_3             | 1                              |                        | NC          | Not connected                                                      |                                                                                                 |
| USB2.0/USB3.1        |                                |                        |             |                                                                    |                                                                                                 |
| USB_D+               | 7                              |                        | AIO         | Differential USB bi-directional data positive                      | Main communication interface<br>USB3.1 data rate up to 10Gbps<br>USB2.0 data rate up to 480Mbps |
| USB_D-               | 9                              |                        | AIO         | Differential USB bi-directional data negative                      |                                                                                                 |
| USB3.1_Tx-           | 29                             |                        | AO          | USB3.1 transmit data negative                                      |                                                                                                 |
| USB3.1_Tx+           | 31                             |                        | AO          | USB3.1 transmit data positive                                      |                                                                                                 |
| USB3.1_Rx-           | 35                             |                        | AI          | USB3.1 receive data negative                                       |                                                                                                 |
| USB3.1_Rx+           | 37                             |                        | AI          | USB3.1 receive data positive                                       |                                                                                                 |
| PCIe interface       |                                |                        |             |                                                                    |                                                                                                 |
| PETn0                | 41                             |                        | AO          | PCIe transmit data                                                 | Support PCIe Gen 3.0,                                                                           |

|                                        |    |    |          |                                                                                           |                                                                                                                                 |
|----------------------------------------|----|----|----------|-------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------|
|                                        |    |    |          | negative                                                                                  | data rate up to 8Gbps.<br>If unused, please keep open                                                                           |
| PETp0                                  | 43 |    | AO       | PCIe transmit data positive                                                               |                                                                                                                                 |
| PERn0                                  | 47 |    | AI       | PCIe receive data negative                                                                |                                                                                                                                 |
| PERp0                                  | 49 |    | AI       | PCIe receive data positive                                                                |                                                                                                                                 |
| REFCLKN                                | 53 |    | AIO      | PCIe reference clock negative                                                             |                                                                                                                                 |
| REFCLKP                                | 55 |    | AIO      | PCIe reference clock positive                                                             |                                                                                                                                 |
| PCIe assistant interface               |    |    |          |                                                                                           |                                                                                                                                 |
| PERST#                                 | 50 |    | DI       | PCIe reset signal<br>Active low                                                           | 3.3V voltage domain,<br>CLKREQ# and<br>PEWAKE# required pull up external,<br>Default as EP mode,<br>If unused, please keep open |
| CLKREQ#                                | 52 |    | DIO      | PCIe reference clock request signal<br>Active low                                         |                                                                                                                                 |
| PEWAKE#                                | 54 |    | DIO      | PCIe wake up control<br>Active low                                                        |                                                                                                                                 |
| (U)SIM interface                       |    |    |          |                                                                                           |                                                                                                                                 |
| (U)SIM1_PWR                            | 36 |    | PO       | Power supply for (U)SIM1 card                                                             | 1.8/3.0V voltage domain,<br>(U)SIM interfaces should be protected against ESD ,<br><br>If unused, please keep open              |
| (U)SIM1_DATA                           | 34 | P4 | DIO      | (U)SIM1 card data, which has been pulled up to (U)SIM1_VDD via a 20KR resistor internally |                                                                                                                                 |
| (U)SIM1_CLK                            | 32 | P4 | DO       | (U)SIM1 clock signal                                                                      |                                                                                                                                 |
| (U)SIM1_RESET                          | 30 | P4 | DO       | (U)SIM1 reset control                                                                     |                                                                                                                                 |
| (U)SIM1_DET                            | 66 | P3 | DI       | (U)SIM1 card detect, which has been pulled up to VDD_P3 via a 470KR resistor internally   |                                                                                                                                 |
| (U)SIM2_PWR                            | 48 |    | PO       | Power supply for (U)SIM2 card                                                             |                                                                                                                                 |
| (U)SIM2_DATA                           | 42 | P5 | DIO      | (U)SIM2 card data, which has been pulled up to (U)SIM2_VDD via a 20KR resistor internally |                                                                                                                                 |
| (U)SIM2_CLK                            | 44 | P5 | DO       | (U)SIM2 clock signal                                                                      |                                                                                                                                 |
| (U)SIM2_RESET                          | 46 | P5 | DO       | (U)SIM2 reset control                                                                     |                                                                                                                                 |
| (U)SIM2_DET                            | 40 | P3 | DI       | (U)SIM2 card detect, which has been pulled up to VDD_P3 via a 470KR resistor internally   |                                                                                                                                 |
| Antenna control interface <sup>2</sup> |    |    |          |                                                                                           |                                                                                                                                 |
| ANTCTL0                                | 59 | P3 | DO       | Antenna tuner control0                                                                    | 1.8V voltage domain. If unused, please keep open                                                                                |
| ANTCTL1                                | 61 | P3 | DO       | Antenna tuner control1                                                                    |                                                                                                                                 |
| ANTCTL 2 (RFFE_SDATA) <sup>3</sup>     | 58 | P3 | DO (DIO) | Antenna tuner control2 (Antenna tuner MIPI DATA) <sup>3</sup>                             |                                                                                                                                 |
| ANTCTL3 (RFFE_SCLK) <sup>3</sup>       | 56 | P3 | DO       | Antenna tuner control3 (Antenna tuner MIPI CLK) <sup>3</sup>                              |                                                                                                                                 |
| I2S interface                          |    |    |          |                                                                                           |                                                                                                                                 |
| I2S_CLK                                | 20 | P3 | DO       | I2S clock output                                                                          | 1.8V voltage domain,                                                                                                            |

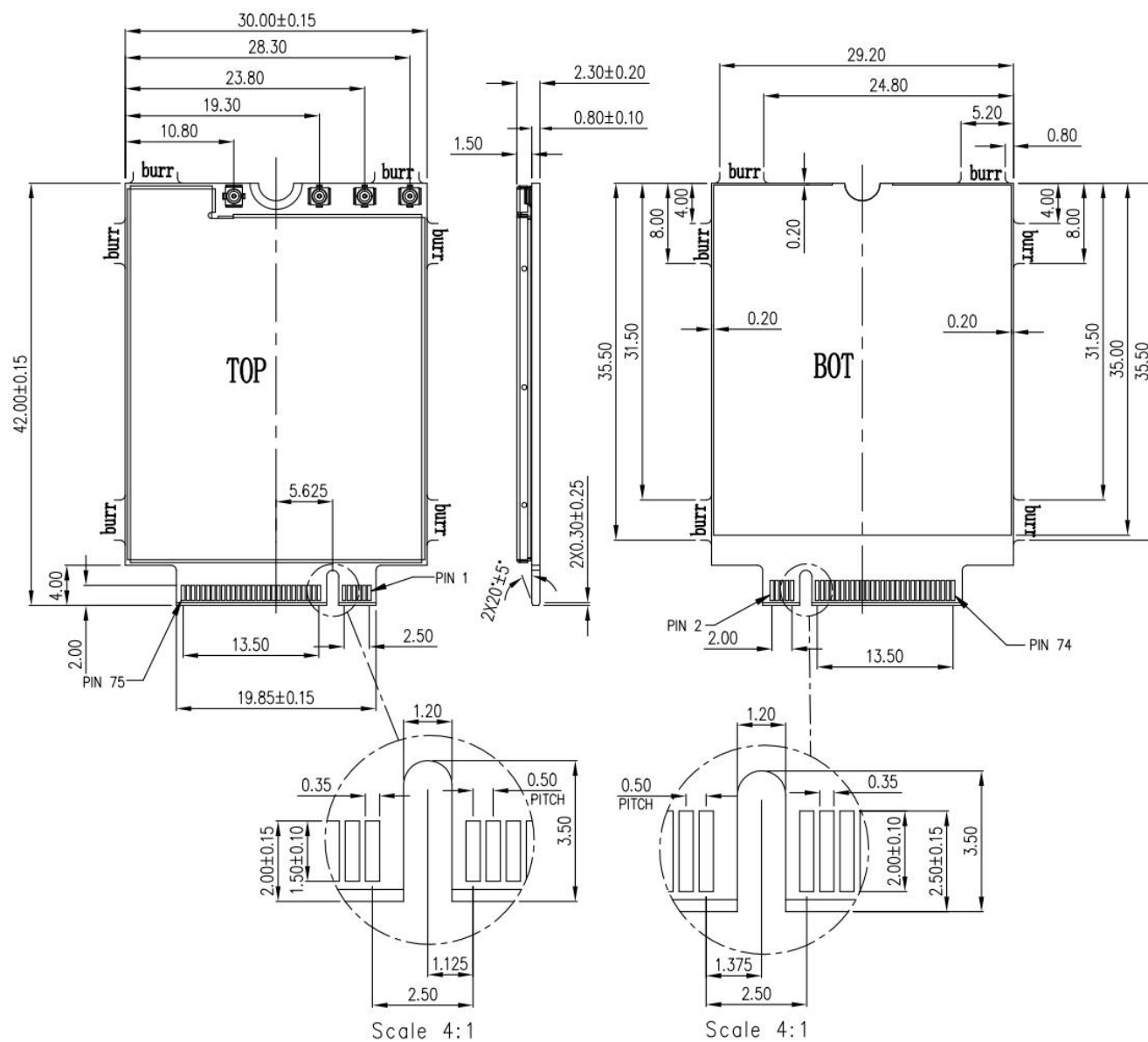
|                             |                                |    |     |                                                                                                                                 |                                                                              |
|-----------------------------|--------------------------------|----|-----|---------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|
| I2S_RX                      | 22                             | P3 | DI  | I2S data input                                                                                                                  | also can be used as PCM interface, If unused, please keep open               |
| I2S_TX                      | 24                             | P3 | DO  | I2S data output                                                                                                                 |                                                                              |
| I2S_WA                      | 28                             | P3 | DO  | I2S word alignment select (L/R)                                                                                                 |                                                                              |
| I2S_MCLK                    | 60                             | P3 | DO  | I2S master clock                                                                                                                |                                                                              |
| I2C interface               |                                |    |     |                                                                                                                                 |                                                                              |
| I2C_SDA                     | 68                             | P3 | DIO | I2C data signal                                                                                                                 | 1.8V voltage domain, Internal pulled up to 1.8V. If unused, please keep open |
| I2C_SCL                     | 38                             | P3 | DO  | I2C clock signal                                                                                                                |                                                                              |
| Coex interface <sup>2</sup> |                                |    |     |                                                                                                                                 |                                                                              |
| COEX1*<br>(COEX_RX*)        | 64                             | P3 | DI  | Wireless coexistence of WWAN and WiFi/BT, based on BT-sig coexistence protocol                                                  | If unused, please keep open                                                  |
| COEX2*<br>(COEX_TX*)        | 62                             | P3 | DO  | Wireless coexistence of WWAN and WiFi/BT, based on BT-sig coexistence protocol                                                  |                                                                              |
| WL_TX_EN*                   | 65                             | P3 | DI  | WiFi 5G TX indicator                                                                                                            | If unused, please keep open                                                  |
| LAA_TX_EN*                  | 63                             | P3 | DO  | n79 TX indicator                                                                                                                | If unused, please keep open                                                  |
| Other pins                  |                                |    |     |                                                                                                                                 |                                                                              |
| LED1#*                      | 10                             | P3 | OD  | The module status indicator via LED devices<br>Active low                                                                       |                                                                              |
| DPR*                        | 25                             | P3 | DI  | Dynamic power reduction<br>H: Max transmitting power will not be reduced (default)<br>L: Max transmitting power will be reduced |                                                                              |
| Notch                       |                                |    |     |                                                                                                                                 |                                                                              |
| Notch                       | 12, 13, 14, 15, 16, 17, 18, 19 |    |     | Notch                                                                                                                           |                                                                              |

#### NOTE

1. "\*" means under development.
2. Please confirm with SIMCom for the detail design about antenna control and coex interface.
3. The RFFE signals are multiplexed with ANTCTL2 and ANTCTL3.

## 2.3 Mechanical Dimensions

The following figure shows the mechanical dimensions of SIM8202G-M2.



**Figure 3: Dimensions of the module (unit: mm)**

## 3. Interface Application

### 3.1 Power Supply

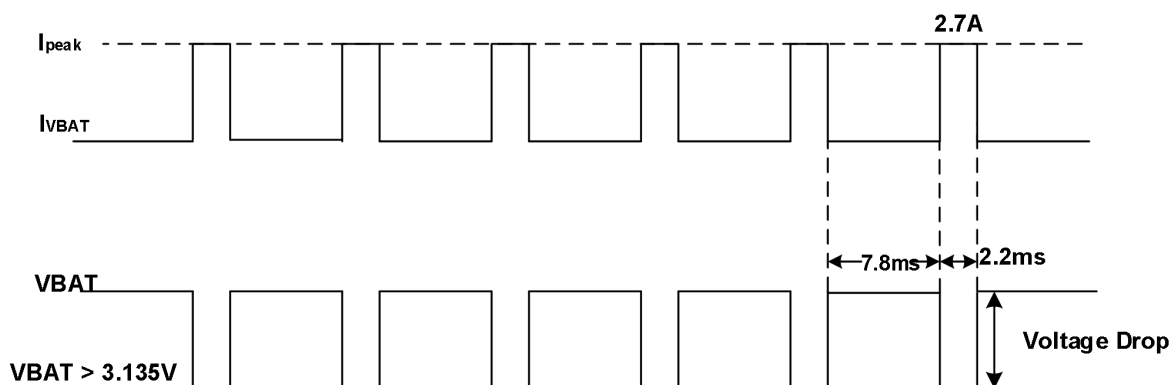
The recommended power supply of SIM8202G-M2 is 3.8V and the voltage ranges from 3.135 V to 4.4 V. Please make sure that the input voltage will never drop below 3.135V, otherwise the module will be powered off automatically. The module has 5 power pins and 11 ground pins. To ensure the module works properly, all pins should be connected.

**Table 6: VBAT pins electrical characteristics**

| Symbol        | Description                 | Min.  | Typ. | Max.             | Unit |
|---------------|-----------------------------|-------|------|------------------|------|
| VBAT          | Module power supply voltage | 3.135 | 3.8  | 4.4              | V    |
| $I_{peak}$    | Peak current                | -     | -    | 2.7 <sup>2</sup> | A    |
| $I_{sleep}$   | Current in sleep mode       | -     | 3    | -                | mA   |
| $I_{leakage}$ | Current in power off mode   | -     | 50   | -                | uA   |

#### 3.1.1 Power Supply Design Guide

When the module transmits at the maximum power, the peak current can reach 2.7A, which results in voltage dropping on VBAT. To ensure that the voltage is no less than required 3.135V, the capacity of external power supply cannot be less than 3A. The following figure shows the maximum voltage drop during the maximum power radio transmission.



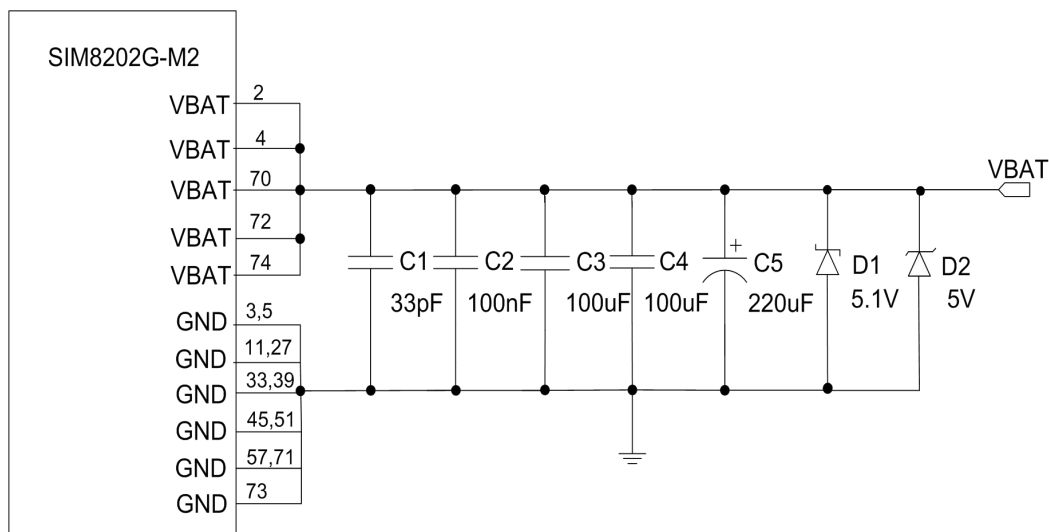
**Figure 4: VBAT voltage drop at the maximum power radio transmission**

**NOTE**

Test conditions:

1. The total capacitors of VBAT net are not less than 420uF.
2. The  $I_{peak}$  data in Table 6 and Figure 4 were tested using SIMCom EVB and connect instrument.

To decrease the voltage dropping, make sure the VBAT voltage no less than 3.135V. The following figure shows the reference circuit of power supply for the VBAT.



**Figure 5: Power supply reference circuit**

**Table 7: Definition of VBAT and GND pins**

| Pin name | Pin no.                        | Electrical description | description                                          | Comment                                                                 |
|----------|--------------------------------|------------------------|------------------------------------------------------|-------------------------------------------------------------------------|
| VABT     | 2,4,70,72,74                   | PI                     | Power supply<br>Range : 3.135~4.4V<br>Typical : 3.8V | These pins should be connected together to withstand sufficient current |
| GND      | 3,5,11,27,33,39,45,51,57,71,73 |                        | Ground                                               |                                                                         |

In this reference circuit, some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) with low ESR in high frequency band can be used for EMI suppression.

These capacitors should be put as close as possible to VBAT pins. Also, users should keep VBAT trace on circuit board wider than 3.0mm to minimize PCB trace impedance.

**NOTE**

1. C5 is 220  $\mu$ F tantalum capacitor, ESR=0.7 $\Omega$ .
2. C1 and C2 are multi-layer ceramic chip (MLCC) capacitors from 33pF to 1uF with low ESR in high frequency band, which can be used for EMC performance.
3. D2 is used for ESD protection and D1 is used for surge protection.

**Table 8: Recommended D1 and D2 list**

| No. | Manufacturer | Part number | VRWM | Package    | Ref. Designator |
|-----|--------------|-------------|------|------------|-----------------|
| 1   | JCET         | ESDBW5V0A1  | 5V   | DFN1006-2L | D2              |
| 2   | WAYON        | WS05DPF-B   | 5V   | DFN1006-2L |                 |
| 3   | LRC          | LEDZ5.1BT1G | 5.1V | SOD-523    | D1              |
| 4   | Prisemi      | PZ5D4V2H    | 5.1V | SOD-523    |                 |

Power supply layout guidelines:

- Both VBAT and return trace should be as short and wide as possible to minimize the voltage drop.
- The width of VBAT trace cannot be less than 3.0mm.
- These capacitors should be placed as closely as possible with VBAT pins.
- The VBAT trace should pass through TVS diode, zener diode and capacitors, and then VBAT pins. The capacitor of the small value should be placed close to VBAT pins.
- The PCB design must have a solid ground plane as the primary reference plane for most signals.

### 3.1.2 Recommended Power Supply Circuit

It is recommended to use a switching mode power supply or a linear regulator power supply. Make sure it can provide the current up to 3A at least.

Figure6 shows the linear regulator reference circuit with 5V input and 3.8V output.

Figure7 shows the switching mode power supply reference circuit with 5~12V input and 3.8V output.

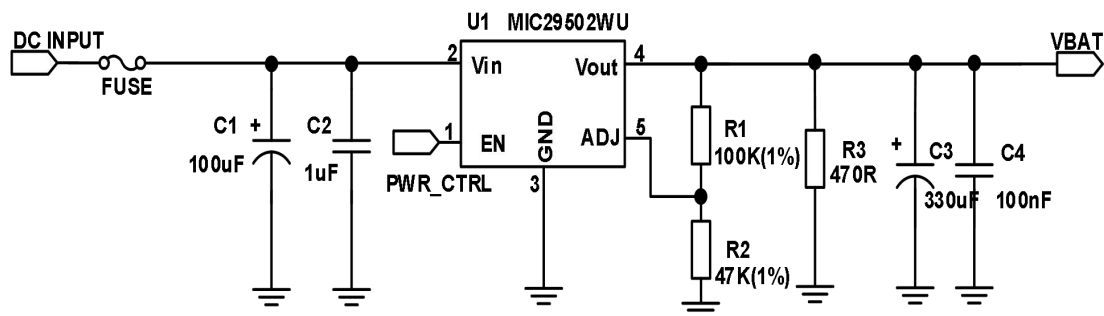


Figure 6: Linear regulator reference circuit

**NOTE**

An extra minimum load of R3 is required, to ensure it work properly under light load in sleep mode and power off mode. For the details about minimum load, please refer to specification of MIC29502WU.

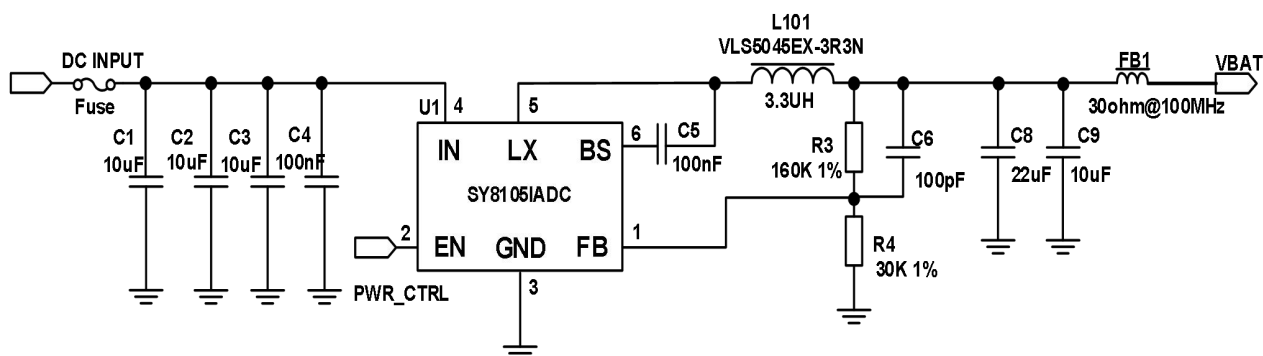


Figure 7: Switching mode power supply reference circuit

Table 9: Recommended ferrite bead FB1

| Name         | Manufacturer | Part number       |
|--------------|--------------|-------------------|
| Ferrite bead | Sunlord      | UPZ1608E300-5R0TF |

**NOTE**

1. In order to avoid damaging the module, please do not switch off the power supply when module works normally. Only after the module is shut down by FULL\_CARD\_POWER\_OFF# or AT command, then the power supply can be cut off.
2. It is suggested that customer's design should have the ability to switch off the power supply for module in abnormal state, and then switch on the power to restart the module.
3. The PWR\_CTRL signal recommend connect to the host and can be controlled.

### 3.1.3 Voltage Monitor

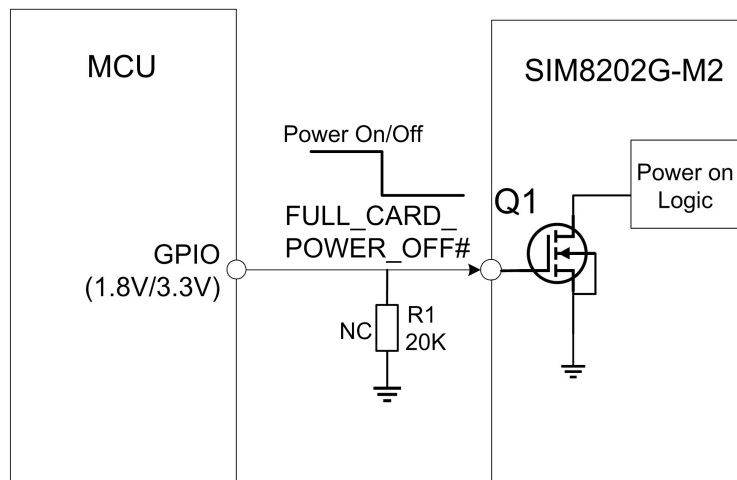
To monitor the VBAT voltage, the AT command "AT+CBC" can be used.

**NOTE**

For the details about voltage monitor commands, please refer to [Document \[1\]](#) in the appendix.

### 3.2 Power On and Off Module

Driving the FULL\_CARD\_POWER\_OFF# pin to a high level, SIM8202G-M2 will be powered on. It can be driven by either 1.8V or 3.3V GPIO. The following figure shows the power on/off circuit.



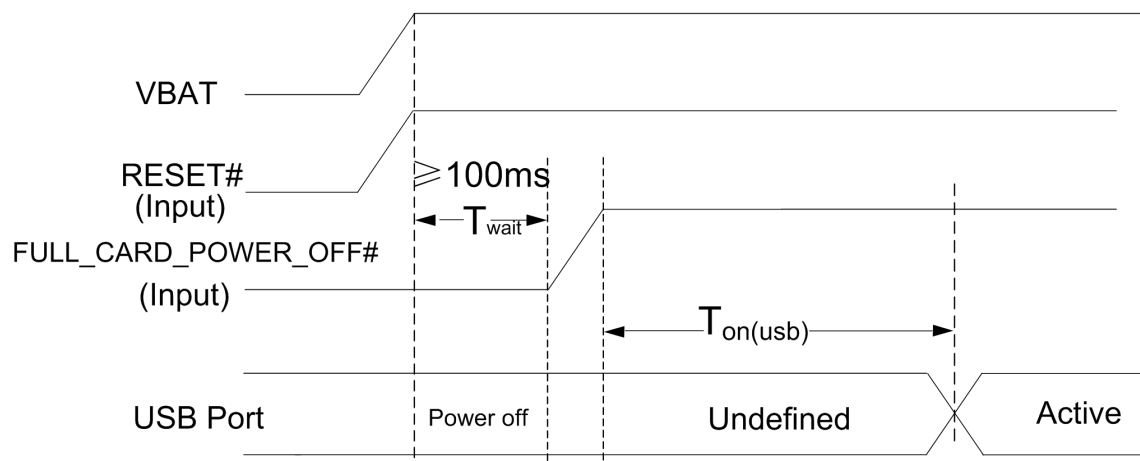
**Figure 8: Reference power on/off circuit**

**Table 10: Definition of FULL\_CARD\_POWER\_OFF# pin**

| Pin name             | Pin no. | Electrical description | description                                                          | Comment                                                          |
|----------------------|---------|------------------------|----------------------------------------------------------------------|------------------------------------------------------------------|
| FULL_CARD_POWER_OFF# | 6       | DI,PD                  | High level: the module powers on<br>Low level: the module powers off | It's 3.3V tolerant but can be driven by either 1.8V or 3.3V GPIO |

### 3.2.1 Power On

The power on sequence is shown in the following figure.



**Figure 9: Power on sequence**

**Table 11: Power on timing and electrical characteristics**

| Symbol        | Parameter                                                       | Min. | Typ. | Max. | Unit |
|---------------|-----------------------------------------------------------------|------|------|------|------|
| $T_{wait}$    | The waiting time from power supply available to power-on action | 100  | -    | -    | ms   |
| $T_{on(usb)}$ | The time from power-on action to USB port ready                 | -    | TBD  | -    | s    |
| $V_{IH}$      | Input high level voltage on FULL_CARD_POWER_OFF# pin            | 1.2  | 1.8  | 4.4  | V    |
| $V_{IL}$      | Input low level voltage on FULL_CARD_POWER_OFF# pin             | 0    | -    | 0.2  | V    |

### 3.2.2 Power Off

The following methods can be used to power off the module.

- Method 1: Power off the module by holding the FULL\_CARD\_POWER\_OFF# pin to low level.
- Method 2: Power off module by AT command “AT+CPOF”.

#### NOTE

1. If the temperature is outside the range of  $-30^{\circ}\text{C}\sim+70^{\circ}\text{C}$ , some warning will be reported via AT port. If the temperature is outside the range of  $-40^{\circ}\text{C}\sim+85^{\circ}\text{C}$ , module will be powered off automatically. For the details about “AT+CPOF”, please refer to [Document \[1\]](#) in the appendix.
2. When the module is powered off by AT command, if the power supply and FULL\_CARD\_POWER\_OFF# are not shut down, the module will automatically power on again.

Above normal power-off action will make the module disconnect from the network, allow the software to enter a safe state, and save key data before the module is powered off completely.

The power off sequence is shown in the following figure.

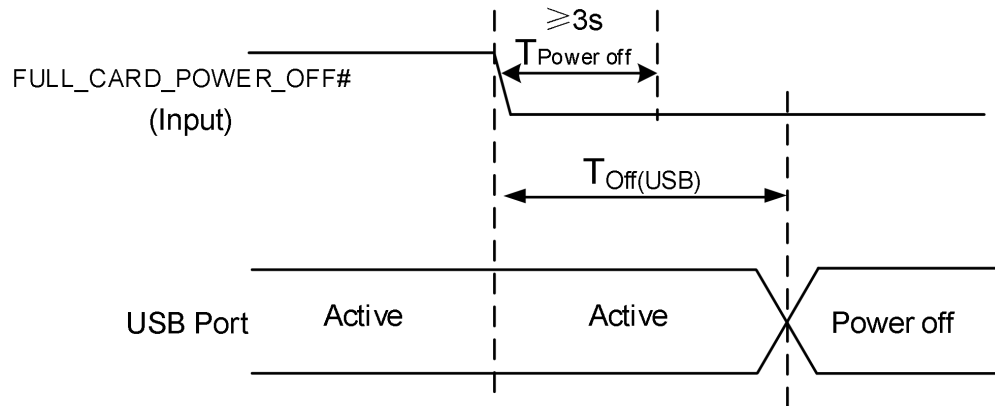


Figure 10: Power off sequence

Table 12: Power off timing and electrical characteristics

| Symbol                 | Parameter                                                                                       | Time value |      |      | Unit |
|------------------------|-------------------------------------------------------------------------------------------------|------------|------|------|------|
|                        |                                                                                                 | Min.       | Typ. | Max. |      |
| $T_{\text{Off(USB)}}$  | The time from power-off action to USB port off                                                  | -          | 9    | -    | s    |
| $T_{\text{Power off}}$ | The time holding the FULL_CARD_POWER_OFF# pin to low level for the module into power off status | -          | 3    | -    | s    |

### 3.3 Reset Function

SIM8202G-M2 can be reset by driving the RESET# pin down to a low level.

The RESET# signal has been internally pulled up to 1.8V, so it does not need pull up externally. Please refer to the following figure for the recommended reference circuit.

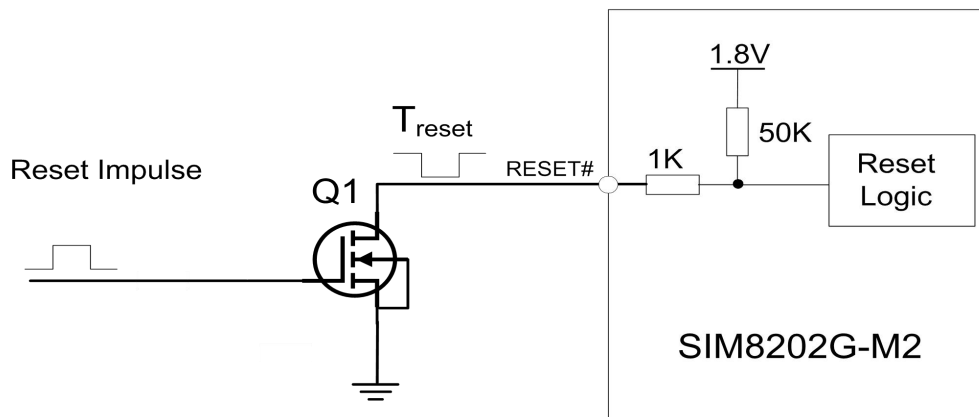


Figure 11: Reference reset circuit

Table 13: Definition of RESET# pin

| Pin name | Pin no. | Electrical description | description                              | Comment                                      |
|----------|---------|------------------------|------------------------------------------|----------------------------------------------|
| RESET#   | 67      | DI,PU                  | System reset control input<br>Active low | RESET# has been pulled up to 1.8V internally |

The reset timing sequence of the module is shown in the following figure.

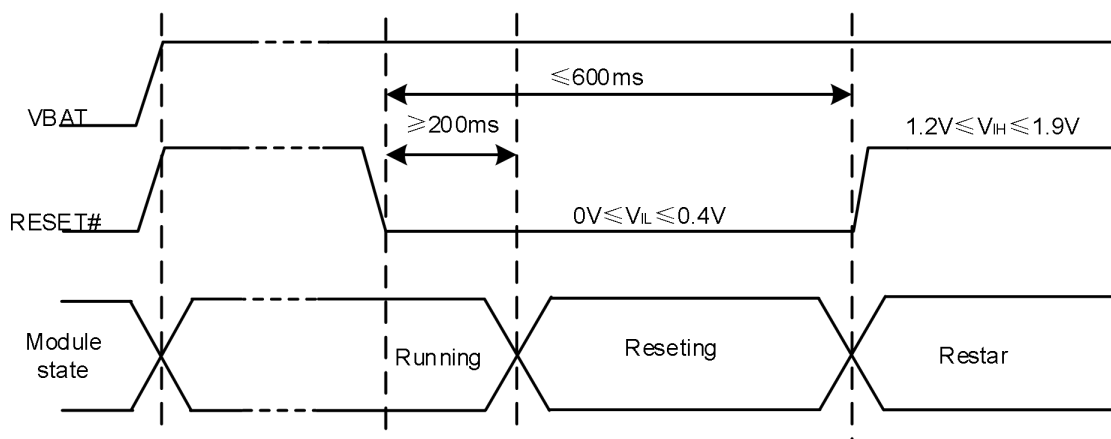


Figure 12: The reset timing sequence of the module

**Table 14: RESET# pin electrical characteristics**

| Symbol             | Description                       | Min. | Typ. | Max. | Unit |
|--------------------|-----------------------------------|------|------|------|------|
| $T_{\text{reset}}$ | Low level hold time on RESET# pin | 200  | -    | 600  | ms   |
| $V_{\text{IH}}$    | Input high level voltage          | 1.2  | -    | 1.9  | V    |
| $V_{\text{IL}}$    | Input low level voltage           | 0    | -    | 0.4  | V    |

**NOTE**

Please ensure that there is no capacitance on RESET# pin.

## 3.4 I2C Interface

SIM8202G-M2 supports an I2C interface meet I2C specification version 5.0, with data rate up to 400kbps.

The following figure shows the I2C interface reference circuit.

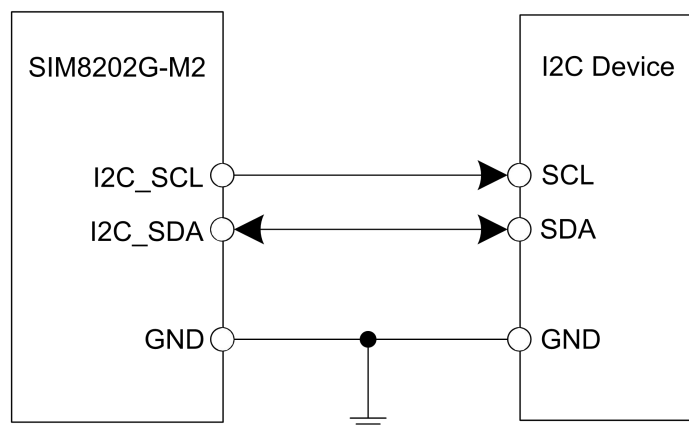


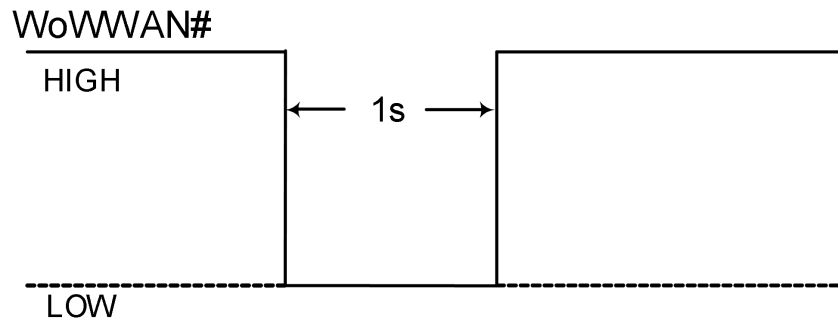
Figure 13: I2C reference circuit

Table 15: Definition of I2C interface

| Pin name | Pin no. | Electrical description | description      | Comment                                                                         |
|----------|---------|------------------------|------------------|---------------------------------------------------------------------------------|
| I2C_SDA  | 68      | DIO                    | I2C data signal  | 1.8V voltage domain,<br>Internal pulled up to 1.8V. If unused, please keep open |
| I2C_SCL  | 38      | DO                     | I2C clock signal |                                                                                 |

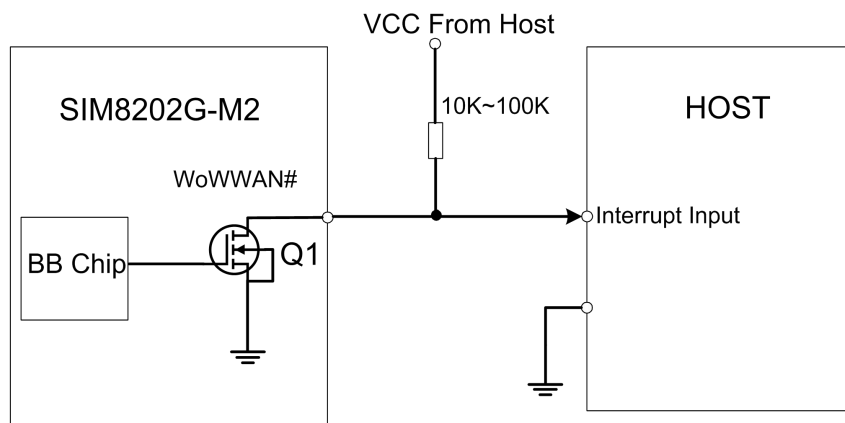
### 3.5 WoWWAN#\*

The WoWWAN# pin is a system wake-on signal which can be used as an interrupt signal for the host. Normally it keeps high level. And it will change to low level when certain conditions occur, such as receiving SMS, voice call (CSD, video) or URC reporting, the low level pulse time is 1 second.



**Figure 14: WoWWAN# signal level at SMS and URC report**

WoWWAN# recommended reference circuit is shown in the following figure.



**Figure 15: WoWWAN# reference circuit**

**Table 16: Definition of WoWWAN# pin**

| Pin name | Pin no. | Electrical description | description                    | Comment |
|----------|---------|------------------------|--------------------------------|---------|
| WoWWAN#  | 23      | OD                     | Wake on the host<br>Active low |         |

#### NOTE

“\*” means under development.

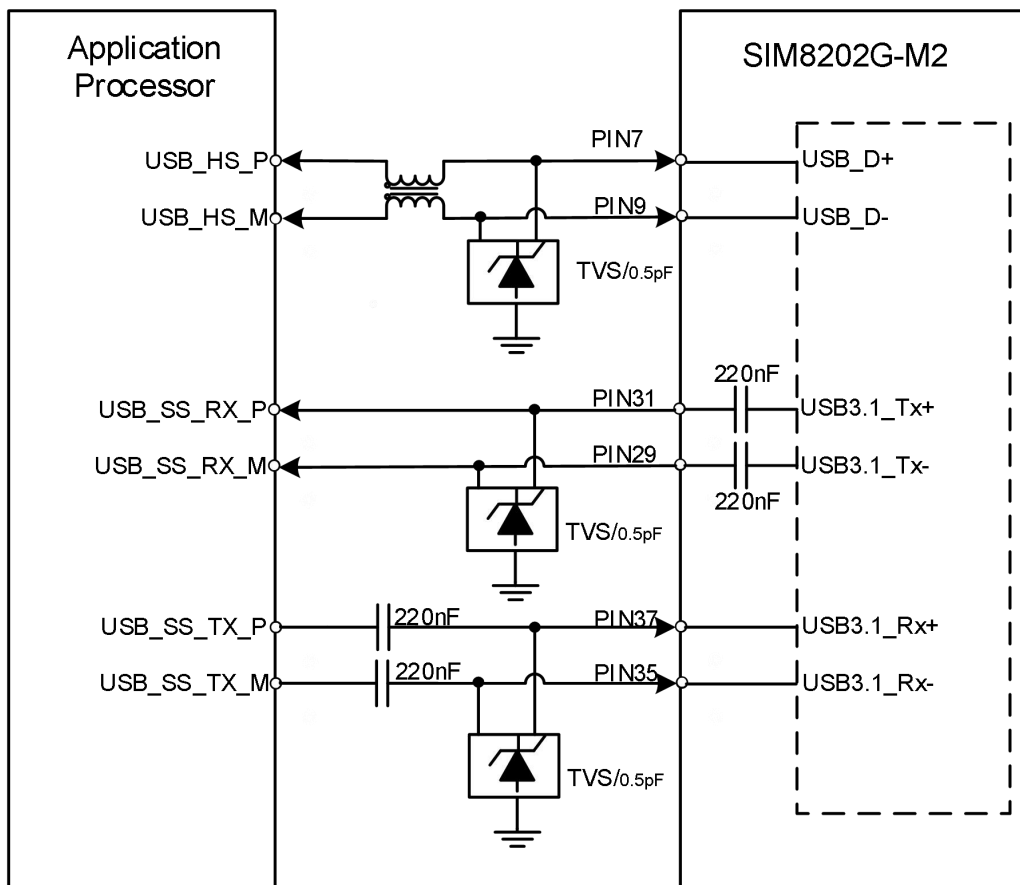
## 3.6 USB Interface

SIM8202G-M2 supports one USB interface which complies with the USB3.1 and 2.0 specifications. Customers can choose USB3.1 or USB2.0 for their needs. USB 3.1 data rate up to 10Gbps.

The USB interface is used for AT command communication, data transmission, GNSS NMEA output, firmware upgrade and software debugging.

The module supports USB suspend and resume mechanism which can save power consumption. If there is no data transmission on the USB bus, the module will enter suspend mode automatically.

The following figure is the USB reference circuit.



**Figure 16: USB reference circuit**

**Table 17: Definition of USB interface**

| Pin name   | Pin no. | Electrical description | description                                   | Comment                                                         |
|------------|---------|------------------------|-----------------------------------------------|-----------------------------------------------------------------|
| USB_D+     | 7       | AIO                    | Differential USB bi-directional data positive | USB3.1 data rate up to 10Gbps<br>USB2.0 data rate up to 480Mbps |
| USB_D-     | 9       | AIO                    | Differential USB bi-directional data negative |                                                                 |
| USB3.1_Tx- | 29      | AO                     | USB3.1 transmit data negative                 |                                                                 |
| USB3.1_Tx+ | 31      | AO                     | USB3.1 transmit data positive                 |                                                                 |
| USB3.1_Rx- | 35      | AI                     | USB3.1 receive data negative                  |                                                                 |
| USB3.1_Rx+ | 37      | AI                     | USB3.1 receive data positive                  |                                                                 |

**Table 18: USB interface recommended TVS diode list**

| No. | Manufacturer | Part number   | Package    |
|-----|--------------|---------------|------------|
| 1   | WILL         | ESD5302N-3/TR | DFN1006-3L |

USB HS D+/D- layout guidelines:

- Require differential trace impedance is  $90\pm 10\% \Omega$ .
- The intra-lane length mismatch of the differential signal lanes is less than 1mm.
- Gap from other signals keeps 3xline width.
- External components should be placed near the USB connector.
- Trace routes away from other sensitive signals.
- The TVS diode should be placed close to the USB pins of M.2 connector.

USB SS TX/RX layout guidelines:

- Require differential trace impedance is  $90\pm 10\% \Omega$ .
- The intra-lane length mismatch of the differential signal lanes is less than 700um (5ps).
- Gap from other signals keeps 4xline width.
- Gap between Rx-to-Tx keeps 4xline width.
- External components should be placed near the USB connector.
- Trace routes away from other sensitive signals.
- The TVS diode should be placed close to the USB pins of M.2 connector.

### 3.7 PCIe Interface

SIM8202G-M2 supports PCIe Gen3 one lane interfaces, which data rate up to 8Gbps, and can be used as EP or RC\* mode. CLKREQ# and PEWAKE# needs pull up to 3.3V by 100K resistor in customer's design. The following figure is the PCIe reference circuit.

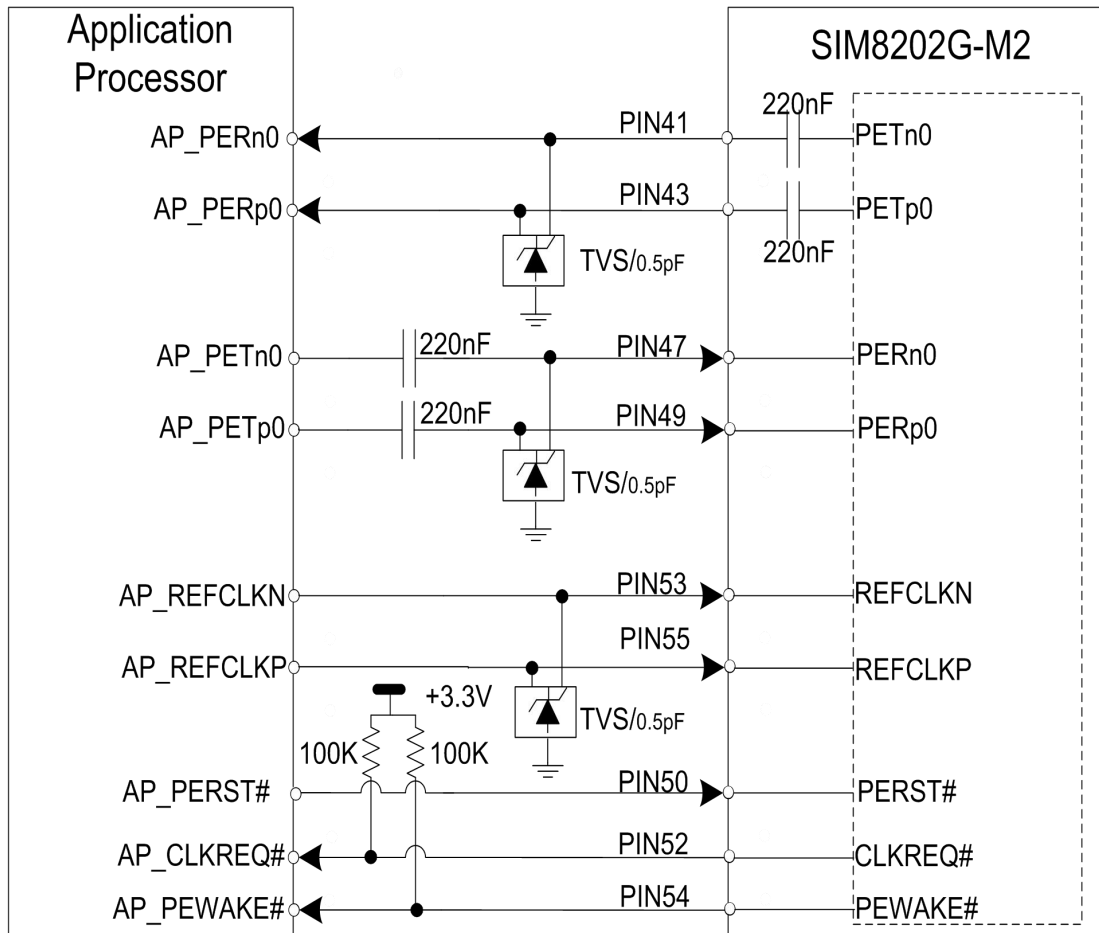


Figure 17: PCIe interface reference circuit (EP Mode)

#### NOTE

1. “\*” means under development.
2. The AC capacitors of AP\_PETn0 and AP\_PETp0 should be closed to AP.
3. The voltage domain of PCIe assistant signals is 3.3V.
4. If the module use as EP module, the USB interface not support at the same time.

**Table 19: Definition of PCIe interface**

| Pin name | Pin no. | Electrical description | Functional description                                       | Comment                                                                                                             |
|----------|---------|------------------------|--------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|
| PETn0    | 41      | AO                     | PCIe transmit data negative                                  |                                                                                                                     |
| PETp0    | 43      | AO                     | PCIe transmit data positive                                  |                                                                                                                     |
| PERn0    | 47      | AI                     | PCIe receive data negative                                   |                                                                                                                     |
| PERp0    | 49      | AI                     | PCIe receive data positive                                   |                                                                                                                     |
| REFCLKN  | 53      | AIO                    | PCIe reference clock negative                                |                                                                                                                     |
| REFCLKP  | 55      | AIO                    | PCIe reference clock positive                                |                                                                                                                     |
| PERST#   | 50      | DI                     | PERST# is a functional reset to the Add-In module active low | 3.3V voltage domain, CLKREQ# and PEWAKE# required pull up external, Default as EP mode. If unused, please keep open |
| CLKREQ#  | 52      | DIO                    | PCIe reference clock request signal active low               |                                                                                                                     |
| PEWAKE#  | 54      | DIO                    | PCIe wake up signal active low                               |                                                                                                                     |

**Table 20: PCIe interface recommended TVS diode list**

| No. | Manufacturer | Part number   | Package    |
|-----|--------------|---------------|------------|
| 1   | WILL         | ESD5302N-3/TR | DFN1006-3L |

PCIe interface layout guidelines:

- Require differential trace impedance is  $90 \pm 10\% \Omega$ .
- The intra-lane length mismatch of the differential signal lanes is less than 700um.
- Gap from other signals keeps 4xline width.
- Gap between Rx-to-Tx keeps 4xline width.
- Should be routed away from sensitive signals.
- The TVS diode should be placed close to the PCIe pins of M.2 connector.

### 3.8 (U)SIM Interface

SIM8202G-M2 supports two (U)SIM cards but single standby. The (U)SIM2 can use e-(U)SIM\* card in the module or external (U)SIM card, the size is 2mm\*2mm\*1mm of the e-(U)SIM in the module. Both (U)SIM1 and (U)SIM2 are dual-voltage 1.8V or 3.0V.

#### NOTE

Customers choose the e-(U)SIM products according to the above size, SIMCom will provide the e-(U)SIM assemble into the module.

**Table 21: (U)SIM electrical characteristics in 1.8V mode ((U)SIM\_PWR=1.8V)**

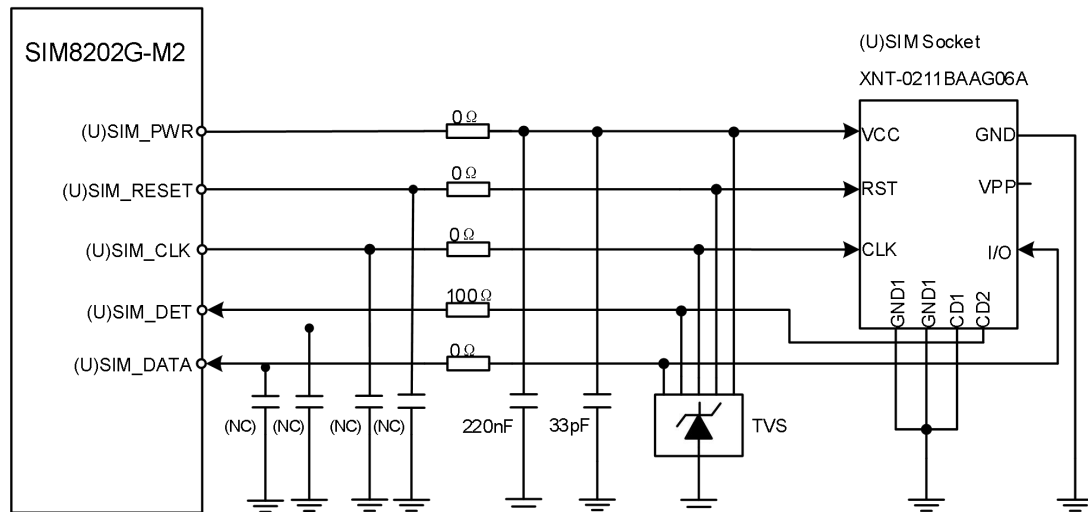
| Symbol          | Parameter                    | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------|------|------|------|------|
| (U)SIM_PWR      | Power supply for (U)SIM card | 1.65 | 1.8  | 1.95 | V    |
| V <sub>IH</sub> | High-level input voltage     | 1.26 | -    | 1.95 | V    |
| V <sub>IL</sub> | Low-level input voltage      | 0    | -    | 0.36 | V    |
| V <sub>OH</sub> | High-level output voltage    | 1.44 | -    | 1.8  | V    |
| V <sub>OL</sub> | Low-level output voltage     | 0    | -    | 0.4  | V    |

**Table 22: (U)SIM electrical characteristics in 3.0V mode ((U)SIM\_PWR=3.0V)**

| Symbol          | Parameter                    | Min. | Typ. | Max. | Unit |
|-----------------|------------------------------|------|------|------|------|
| (U)SIM_PWR      | Power supply for (U)SIM card | 2.7  | 3.0  | 3.05 | V    |
| V <sub>IH</sub> | High-level input voltage     | 2.1  | -    | 3.05 | V    |
| V <sub>IL</sub> | Low-level input voltage      | 0    | 0    | 0.6  | V    |
| V <sub>OH</sub> | High-level output voltage    | 2.4  | -    | 3.0  | V    |
| V <sub>OL</sub> | Low-level output voltage     | 0    | 0    | 0.4  | V    |

The module supports (U)SIM card hot-swap by the (U)SIM\_DET pin, which is a level trigger pin. The (U)SIM\_DET pin pulled up internally.

The following figure shows (U)SIM card reference circuit.



**Figure 18: (U)SIM interface reference circuit**

When the (U)SIM card is inserted, the (U)SIM\_DET will change from high to low level. The falling edge will indicate insertion of the (U)SIM card. When the (U)SIM card is removed, the (U)SIM\_DET will change from low to high level. This rising edge will indicate unplug the (U)SIM card.

The SIM card hot swap function needs to be enabled by AT. Please refer to the SIM8200 Series\_AT Command Manual for the setting of the detection level of (U)SIM\_DET pin.

**Table 23: Definition of (U)SIM interface**

| Pin name      | Pin no. | Electrical description | Description                                                                               | Comment                                                                                                     |
|---------------|---------|------------------------|-------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------|
| (U)SIM1_PWR   | 36      | PO                     | Power supply for (U)SIM1 card                                                             | 1.8/3.0V voltage domain, all (U)SIM interfaces should be protected against ESD. If unused, please keep open |
| (U)SIM 1_DATA | 34      | DIO                    | (U)SIM1 card data, which has been pulled up to (U)SIM1_VDD via a 20KR resistor internally |                                                                                                             |
| (U)SIM 1_CLK  | 32      | DO                     | (U)SIM1 clock signal                                                                      |                                                                                                             |
| (U)SIM1_RESET | 30      | DO                     | (U)SIM1 Reset control                                                                     |                                                                                                             |
| (U)SIM 1_DET  | 66      | DI                     | (U)SIM1 card detect, which has been pulled up to VDD_P3 via a 470KR resistor internally   |                                                                                                             |
| (U)SIM2_PWR   | 48      | PO                     | Power supply for (U)SIM2 card                                                             |                                                                                                             |
| (U)SIM2_DATA  | 42      | DIO                    | (U)SIM2 card data, which has been pulled up to (U)SIM2_VDD via a 20KR resistor internally |                                                                                                             |
| (U)SIM2_CLK   | 44      | DO                     | (U)SIM2 clock signal                                                                      |                                                                                                             |
| (U)SIM2_RESET | 46      | DO                     | (U)SIM2 Reset control                                                                     |                                                                                                             |
| (U)SIM2_DET   | 40      | DI                     | (U)SIM2 card detect, which has been pulled up to VDD_P3 via a 470KR resistor internally   |                                                                                                             |

The following table shows recommended TVS of ESD protect and (U)SIM socket.

**Table 24: Recommended TVS and (U)SIM socket list**

| Name          | Manufacturer | Part number     |
|---------------|--------------|-----------------|
| TVS           | ST           | ESDA6V1-5W6     |
| (U)SIM socket | Suntech      | XNT-0211BAAG06A |

If the (U)SIM card hot-swap function is not used, customers can keep the (U)SIM\_DET pin open.

The (U)SIM card layout guidelines:

- Make sure that the (U)SIM card holder should be far away from the antenna while in PCB layout.
- (U)SIM traces should keep away from RF lines, VBAT and high-speed signal lines.
- The traces should be as short as possible.
- Keep (U)SIM holder's GND connect to main ground directly.
- Shielding the (U)SIM card signal by ground.
- Recommended to place a 33pF ~ 1uF capacitor on (U)SIM\_PWR line and keep close to the holder.
- The rise/fall time of (U)SIM\_CLK should not be more than 40ns.
- The parasitic capacitance of TVS should not exceed 60pF and the TVS should be placed close to the (U)SIM socket.

### 3.9 I2S Interface

SIM8202G-M2 supports one I2S interface for external codec, which follows the requirements in the Phillips I2S bus specification.

**Table 25: I2S format**

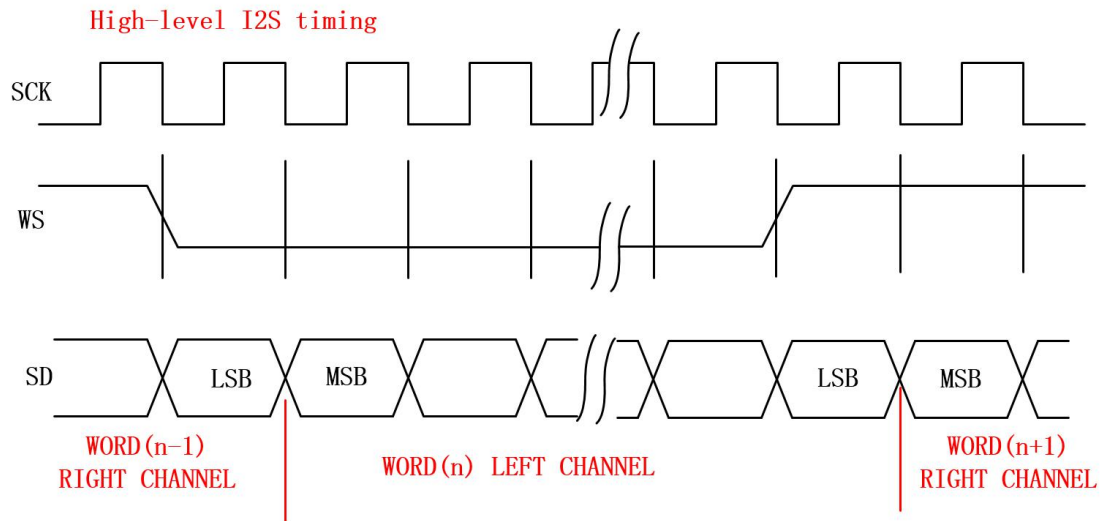
| Characteristics       | Specification       |
|-----------------------|---------------------|
| Line interface format | Linear(Fixed)       |
| Data length           | 16bits(Fixed)       |
| I2S clock/sync source | Master mode(Fixed)  |
| I2S clock frequency   | 1.536MHz (Default)  |
| I2S MCLK frequency    | 12.288MHz (Default) |
| Data ordering         | MSB                 |

#### NOTE

For the details about I2S AT commands, please refer to [document \[1\]](#) in the appendix.

### 3.9.1 I2S Timing

The module supports I2S sampling rate of 48 KHz and 32 bit coding signal (16 bit length), the timing sequence is shown in the following figure.



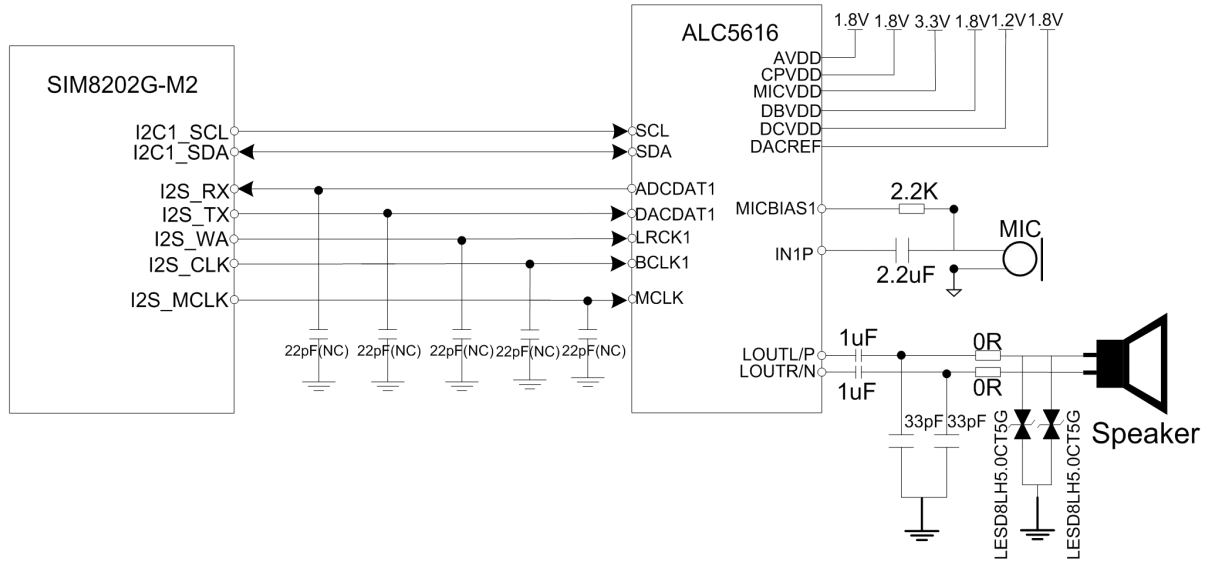
**Figure 19: I2S timing**

**Table 26: I2S timing parameters**

| Signal   | Parameter | Description                      | Min.   | Typ.   | Max.   | Unit |
|----------|-----------|----------------------------------|--------|--------|--------|------|
| I2S_MCLK | Frequency | Working Frequency                | –      | 12.288 | 12.288 | MHz  |
|          | T         | Clock period                     | 81.380 | 81.380 | –      | ns   |
|          | t(HC)     | Clock high                       | 0.45T  | –      | 0.55T  | ns   |
|          | t(LC)     | Clock low                        | 0.45T  | –      | 0.55T  | ns   |
| I2S_CLK  | Frequency | Working Frequency                | 8      | 48     | 48     | KHz  |
|          | T         | Clock period                     | 20.83  | 20.83  | 125    | us   |
|          | t(HC)     | Clock high                       | 0.45T  | –      | 0.55T  | ns   |
|          | t(LC)     | Clock low                        | 0.45T  | –      | 0.55T  | ns   |
| I2S_WA   | t(sr)     | DIN/DOUT and WA input setup time | 16.276 | –      | –      | ns   |
|          | t(hr)     | DIN/DOUT and WA input hold time  | 0      | –      | –      | ns   |
|          | t(dtr)    | DIN/DOUT and WA output delay     | –      | –      | 65.10  | ns   |
|          | t(htr)    | DIN/DOUT and WA output hold time | 0      | –      | –      | ns   |

### 3.9.2 I2S Reference Circuit

The following figure is the external codec reference design circuit.



**Figure 20: Audio codec diagram circuit**

**Table 27: Definition of I2S interface**

| Pin name | Pin no. | Electrical description | Description                     | Comment                                                                             |
|----------|---------|------------------------|---------------------------------|-------------------------------------------------------------------------------------|
| I2S_CLK  | 20      | DO                     | I2S clock output                | 1.8V voltage domain, also can be used as PCM interface, If unused, please keep open |
| I2S_RX   | 22      | DI                     | I2S data input                  |                                                                                     |
| I2S_TX   | 24      | DO                     | I2S data output                 |                                                                                     |
| I2S_WA   | 28      | DO                     | I2S word alignment select (L/R) |                                                                                     |
| I2S_MCLK | 60      | DO                     | I2S master clock                |                                                                                     |

The PCM interface is multiplexing with I2S interface. The default audio interface of the module is I2S.

**Table 28: The PCM interface is multiplexing with I2S interface**

| Pin name | PCM interface |
|----------|---------------|
| I2S_RX   | PCM_DIN       |
| I2S_TX   | PCM_OUT       |
| I2S_WA   | PCM_SYNC      |
| I2S_CLK  | PCM_CLK       |
| I2S_MCLK | -             |

Audio layout guidelines:

Analog input

- 0.2mm trace widths; 0.2mm spacing between other signals trace.
- Pseudo differential route for MIC.
- Isolate from noise sources, such as antenna, RF signals, SMPS, clocks, and other high speed signals.

Analog output

- Isolate from noise sources such as antenna, RF signals, SMPS, clocks, and other high speed signals.
- Speaker output signal – route as differential pair with 0.5mm trace widths.

Audio power and GND

- Recommend add magnetic bead on AVDD net reserved for debug.
- VDD cannot directly use VBAT as the power supply.
- AGND need add GND via to the main GND plane directly.

### 3.10 DPR\*

DPR (Dynamic Power Reduction) signal is used for SAR (Specific Absorption Rate) requirements. The RF output power would reduce if this signal is triggered by sensor under some certain conditions, such as SAR sensor triggered, defined by customers.

User can activate this function with AT command.

**Table 29: Definition of DPR# pin**

| Pin no. | Pin name | Pin status | Function                                                         |
|---------|----------|------------|------------------------------------------------------------------|
| 25      | DPR      | Low        | Max transmitting power will be reduced by set through AT command |
|         |          | High       | Max transmitting power will not be reduced (default)             |
|         |          | Floating   | Max transmitting power will not be reduced                       |

#### NOTE

“\*” means under development.

### 3.11 CONFIG Pins

These signals are provided to indicate its specific configuration that is WWAN-USB3.1 of SIM8202G-M2.

**Table 30: CONFIG pins state of the module**

| Pin no. | Pin name | Description                    |
|---------|----------|--------------------------------|
| 21      | CONFIG_0 | Connected to ground internally |
| 69      | CONFIG_1 | Connected to ground internally |
| 75      | CONFIG_2 | Connected to ground internally |
| 1       | CONFIG_3 | Not connected                  |

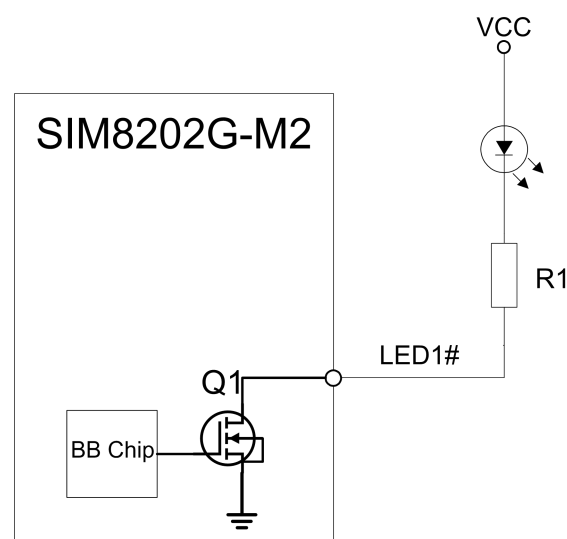
In the M.2 specifications, the CONFIG pins are defined as below.

**Table 31: CONFIG interface definition**

| CONFIG_0<br>(Pin 21) | CONFIG_1<br>(Pin 69) | CONFIG_2<br>(Pin 75) | CONFIG_3<br>(Pin 1) | Module type and<br>Main host interface | Comments       |
|----------------------|----------------------|----------------------|---------------------|----------------------------------------|----------------|
| GND                  | GND                  | GND                  | NC                  | WWAN – USB 3.1                         | Vender defined |

### 3.12 LED1#\*

LED1# is open drain output and is used to allow SIM8202G-M2 to provide network status via LED which will be provided by the host.



**Figure 21: LED1# reference circuit**

**Table 32: Definition of LED1# pin**

| Pin Name | Pin No. | Electrical Description | Description                                               | Comments |
|----------|---------|------------------------|-----------------------------------------------------------|----------|
| LED1#    | 10      | OD                     | The module status indicator via LED devices<br>Active low |          |

**NOTE**

1. “\*” means under development.
2. The value of the resistor R1 depends on the LED characteristics.

The timing parameters are shown in the following table.

**Table 33: LED1# pin status**

| LED1# pin status    | Module status                                          |
|---------------------|--------------------------------------------------------|
| Always On           | Searching network; call connection(including 5G,VOLTE) |
| 100ms ON, 100ms OFF | Data transmit; 5G registered network                   |
| 200ms ON, 200ms OFF | Data transmit; 4G registered network                   |
| 800ms ON, 800ms OFF | Data transmit; 3G registered network                   |
| OFF                 | Power off ;Sleep mode                                  |

### 3.13 W\_DISABLE1#

The W\_DISABLE1# pin controls SIM8202G-M2 to enter the flight mode. When the W\_DISABLE1# signal is pulled to low level, RF function would be disabled. Otherwise the RF function would be active.

Recommended reference circuit is shown in the following figure.

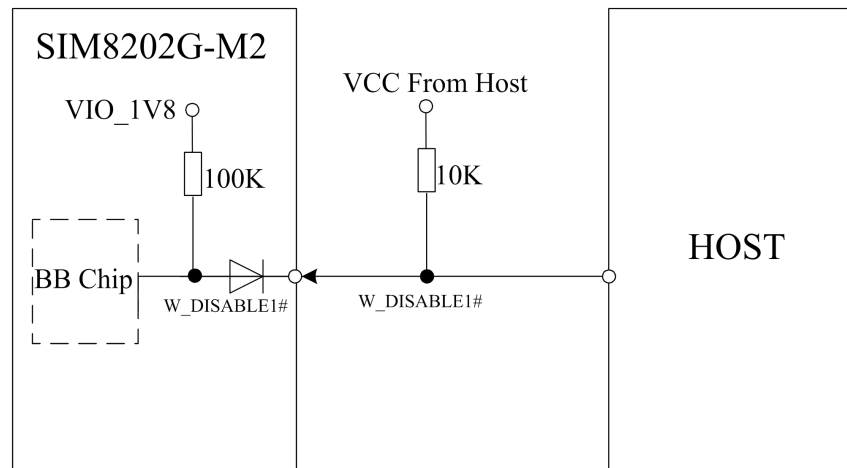


Figure 22: W\_DISABLE1# pin reference circuit

Table 34: Definition of W\_DISABLE1# pin

| Pin Name    | Pin No. | Electrical Description | Description                   | Comments                                                             |
|-------------|---------|------------------------|-------------------------------|----------------------------------------------------------------------|
| W_DISABLE1# | 8       | DI                     | WWAN RF disable<br>Active low | 3.3V tolerant but<br>can be driven by<br>either 1.8V or 3.3V<br>GPIO |

Table 35: W\_DISABLE1# pin status

| W_DISABLE1# pin status | Module operation                                             |
|------------------------|--------------------------------------------------------------|
| Input low level        | Flight mode: RF is disabled                                  |
| Input high level       | AT+CFUN=4: Flight mode<br>AT+CFUN=1: RF is enabled (default) |

### 3.14 W\_DISABLE2#

The W\_DISABLE2# pin controls SIM8202G-M2 to disable the GNSS function. When the W\_DISABLE2# signal is pulled to low level, the GNSS function would be disabled.

Recommended reference circuit is shown in the following figure.

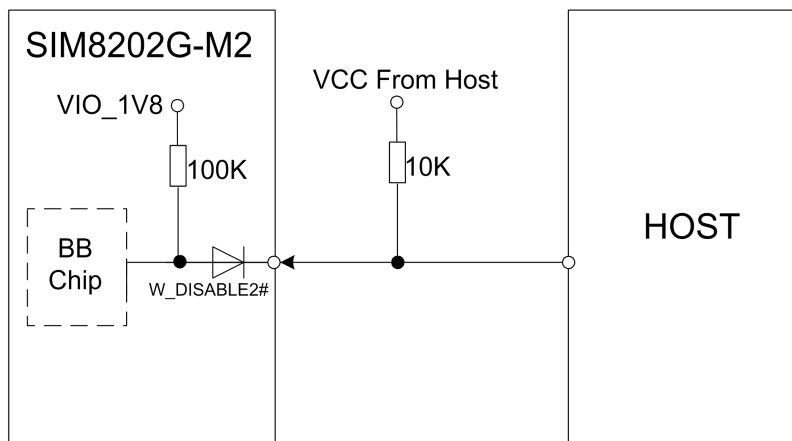


Figure 23: W\_DISABLE2# pin reference circuit

Table 36: Definition of W\_DISABLE2# pin

| Pin Name    | Pin No. | Electrical Description | Description                | Comments                                                             |
|-------------|---------|------------------------|----------------------------|----------------------------------------------------------------------|
| W_DISABLE2# | 26      | DI                     | GNSS disable<br>Active low | 3.3V tolerant but<br>can be driven by<br>either 1.8V or 3.3V<br>GPIO |

Table 37: W\_DISABLE2#\* pin status

| W_DISABLE2# pin status | Module operation                                                                     |
|------------------------|--------------------------------------------------------------------------------------|
| Input Low Level        | GNSS function is disabled                                                            |
| Input High Level       | AT+CGPS=0: GNSS function is disabled<br>AT+CGPS=1: GNSS function is enabled(default) |

#### NOTE

“\*” means under development.

### 3.15 Antenna Control Interface\*

ANTCTL[0:3] and RFFE signals are used for tunable antenna control and should be routed to an appropriate antenna control circuitry.

The following table are the definitions for antenna control interfaces.

**Table 38: Definition of antenna control interface through GPIOs**

| Pin Name                              | Pin No. | Electrical Description | Description                                                      | Comments                                         |
|---------------------------------------|---------|------------------------|------------------------------------------------------------------|--------------------------------------------------|
| ANTCTL0                               | 59      | DO                     | Antenna tuner control0                                           | 1.8V voltage domain. If unused, please keep open |
| ANTCTL1                               | 61      | DO                     | Antenna tuner control1                                           |                                                  |
| ANTCTL 2<br>(RFFE_SDATA) <sup>2</sup> | 58      | DO<br>(DIO)            | Antenna tuner control2<br>(Antenna tuner MIPI DATA) <sup>2</sup> |                                                  |
| ANTCTL3<br>(RFFE_SCLK) <sup>2</sup>   | 56      | DO                     | Antenna tuner control3<br>(Antenna tuner MIPI CLK) <sup>2</sup>  |                                                  |

#### NOTE

1. "\*" means under development, for details please contact SIMCom support teams.
2. The RFFE signals are multiplexed with ANTCTL2 and ANTCTL3.

## 4. Antenna Interfaces

SIM8202G-M2 provides four antenna interfaces, and all of them should be 50Ω impedance controlled for RF signal.

### 4.1 Antenna Definitions

Antenna interfaces are shown in the following figure.

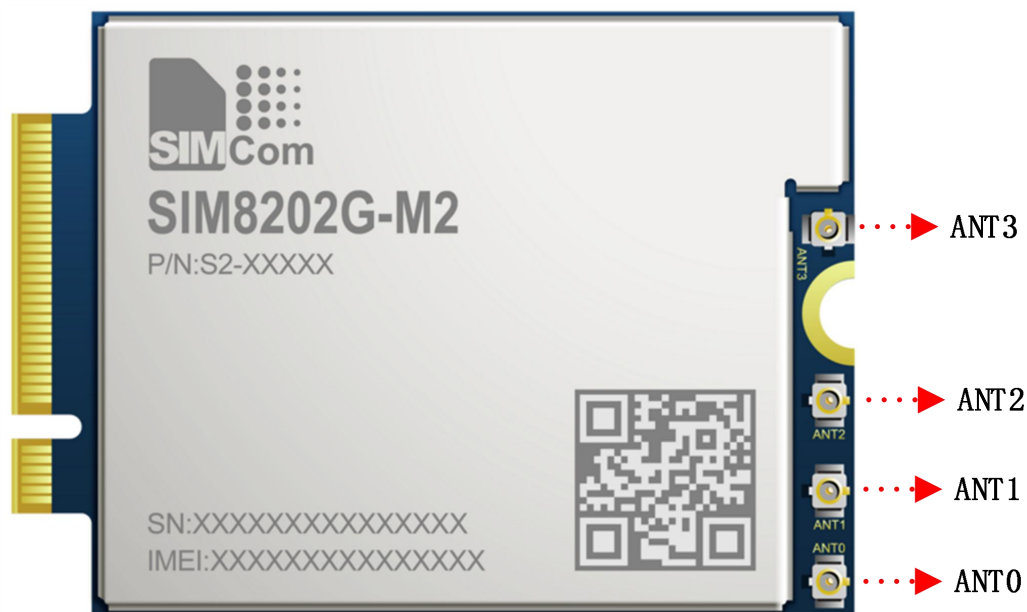


Figure 24: Antenna interfaces

Table 39: Antenna port definitions

| ANT item | ANT function                                                               | Frequency Range                                                         | Functional description           |
|----------|----------------------------------------------------------------------------|-------------------------------------------------------------------------|----------------------------------|
| ANT0     | 3G/4G/5G LB/MHB TRX<br>4G UHB DIV<br>5G n41 DL-MIMO1<br>5G n77/n78/n79 DIV | 617MHz~2690MHz<br>3400MHz~3700MHz<br>2496MHz~2690MHz<br>3300MHz~5000MHz | 3G/4G/5G signal send and receive |
| ANT1     | 3G/4G/5G MHB DL-MIMO1<br>4G UHB DL-MIMO2<br>4G LAA DIV                     | 1710MHz~2690MHz<br>3400MHz~3700MHz<br>5150MHz~5925MHz                   | 3G/4G/5G signal send and receive |

|      |                                                                                                         |                                                                                                                |                                     |
|------|---------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------------------|
|      | 5G N41 TRX<br>5G n77/n78/n79 DL-MIMO2                                                                   | 2496MHz~2690MHz<br>3300MHz~5000MHz                                                                             |                                     |
| ANT2 | 3G/4G/5G MHB DL-MIMO2<br>4G UHB DL-MIMO1<br>4G LAA PRX<br>5G n41 DIV<br>5G n77/n78/n79 DL-MIMO1<br>GNSS | 1710MHz~2690MHz<br>3400MHz~3700MHz<br>5150MHz~5925MHz<br>2496MHz~2690MHz<br>3300MHz~5000MHz<br>1166MHz~1610MHz | 3G/4G/5G/GNSS signal<br>receive     |
| ANT3 | 3G/4G/5G LB/MHB DIV<br>4G UHB TRX<br>5G n41 DL-MIMO2<br>5G n77/n78/n79 TRX                              | 617MHz~2690MHz<br>3400MHz~3700MHz<br>2496MHz~2690MHz<br>3300MHz~5000MHz                                        | 3G/4G/5G signal send and<br>receive |

**Table 40: SIM8202G-M2 frequency band and antenna ports mapping**

| ANTENNAS |             |          | ANT0 | ANT1 | ANT2 | ANT3 |
|----------|-------------|----------|------|------|------|------|
| BANDS    | FUNCTIONS   |          |      |      |      |      |
| 3G/4G/5G | LB/MHB      | TRX      |      |      |      |      |
| 4G       | UHB         | DIV      | ✓    |      |      |      |
| 5G       | n41         | DL-MIMO1 |      |      |      |      |
| 5G       | n77/n78/n79 | DIV      |      |      |      |      |
| 3G/4G/5G | MHB         | DL-MIMO1 |      |      |      |      |
| 4G       | UHB         | DL-MIMO2 |      |      |      |      |
| 4G       | LAA         | DIV      |      | ✓    |      |      |
| 5G       | n41         | TRX      |      |      |      |      |
| 5G       | n77/n78/n79 | DL-MIMO2 |      |      |      |      |
| 3G/4G/5G | MHB         | DL-MIMO2 |      |      |      |      |
| 4G       | UHB         | DL-MIMO1 |      |      |      |      |
| 4G       | LAA         | PRX      |      |      | ✓    |      |
| 5G       | n41         | DIV      |      |      |      |      |
| 5G       | n77/n78/n79 | DL-MIMO1 |      |      |      |      |
| GNSS     |             |          |      |      |      |      |
| 3G/4G/5G | LB/MHB      | DIV      |      |      |      |      |
| 4G       | UHB         | TRX      |      |      |      | ✓    |
| 5G       | n41         | DL-MIMO2 |      |      |      |      |
| 5G       | n77/n78/n79 | TRX      |      |      |      |      |

**NOTE**

1. For basic function, only the antennas responding to TRX are needed.

### 4.1.1 3G/4G/5G Operating Frequency

**Table 41: The module operating frequency**

| Frequency Bands      | Uplink (UL)    | Downlink (DL) | Duplex Mode |
|----------------------|----------------|---------------|-------------|
| WCDMA B1             | 1920 ~1980MHz  | 2110 ~2170MHz | FDD         |
| WCDMA B2             | 1850~1910MHz   | 1930~1990MHz  | FDD         |
| WCDMA B3             | 1710 ~1785MHz  | 1805 ~1880MHz | FDD         |
| WCDMA B4             | 1710 ~1755MHz  | 2110~ 2155MHz | FDD         |
| WCDMA B5             | 824 ~849MHz    | 869 ~894MHz   | FDD         |
| WCDMA B8             | 880 ~915MHz    | 925 ~960MHz   | FDD         |
| LTE B1               | 1920 ~1980MHz  | 2110 ~2170MHz | FDD         |
| LTE B2               | 1850~1910MHz   | 1930~1990MHz  | FDD         |
| LTE B3               | 1710 ~1785 MHz | 1805 ~1880MHz | FDD         |
| LTE B4               | 1710~1755MHz   | 2110~2155MHz  | FDD         |
| LTE B5               | 824 ~849 MHz   | 869 ~894MHz   | FDD         |
| LTE B7               | 2500~2570MHz   | 2620~2690MHz  | FDD         |
| LTE B8               | 880 ~915MHz    | 925 ~960MHz   | FDD         |
| LTE B12              | 699~716MHz     | 729~746MHz    | FDD         |
| LTE B13              | 777~787MHz     | 746~756MHz    | FDD         |
| LTE B14              | 788~798MHz     | 758~768MHz    | FDD         |
| LTE B17              | 704~716MHz     | 734~746MHz    | FDD         |
| LTE B18              | 815~830MHz     | 860~875MHz    | FDD         |
| LTE B19              | 830~845MHz     | 875~890MHz    | FDD         |
| LTE B20              | 832~862MHz     | 791~ 821MHz   | FDD         |
| LTE B25              | 1850~1915MHz   | 1930~1995MHz  | FDD         |
| LTE B26              | 814~849MHz     | 859~894MHz    | FDD         |
| LTE B28              | 703~748MHz     | 758~803MHz    | FDD         |
| LTE B29 <sup>1</sup> | /              | 717~728MHz    | SDL         |
| LTE B30              | 2305~2315MHz   | 2350~2360MHz  | FDD         |
| LTE B32 <sup>1</sup> | /              | 1452~1496MHz  | SDL         |
| LTE B34              | 2010~2025MHz   | 2010~2025MHz  | TDD         |
| LTE B38              | 2570 ~2620MHz  | 2570 ~2620MHz | TDD         |
| LTE B39              | 1880~1920MHz   | 1880~1920MHz  | TDD         |
| LTE B40              | 2300 ~2400MHz  | 2300 ~2400MHz | TDD         |
| LTE B41              | 2496 ~2690MHz  | 2496 ~2690MHz | TDD         |
| LTE B42              | 3400~3600MHz   | 3400~3600MHz  | TDD         |
| LTE B46 <sup>1</sup> | /              | 5150~5925MHz  | SDL         |
| LTE B48              | 3550~3700MHz   | 3550~3700MHz  | TDD         |
| LTE B66              | 1710~1780MHz   | 2110~2180MHz  | FDD         |

|         |               |               |     |
|---------|---------------|---------------|-----|
| LTE B71 | 663~698MHz    | 617~652MHz    | FDD |
| 5G n1   | 1920 ~1980MHz | 2110 ~2170MHz | FDD |
| 5G n2   | 1850~1910MHz  | 1930~1990MHz  | FDD |
| 5G n3   | 1710 ~1785MHz | 1805 ~1880MHz | FDD |
| 5G n5   | 824~849MHz    | 869~894MHz    | FDD |
| 5G n7   | 2500~2570MHz  | 2620~2690MHz  | FDD |
| 5G n8   | 880 ~915MHz   | 925 ~960MHz   | FDD |
| 5G n12  | 699~716MHz    | 729~746MHz    | FDD |
| 5G n20  | 832~862MHz    | 791~ 821MHz   | FDD |
| 5G n25  | 1850~1915MHz  | 1930~1995MHz  | FDD |
| 5G n28  | 703~748MHz    | 758~803MHz    | FDD |
| 5G n38  | 2570~2620MHz  | 2570~2620MHz  | TDD |
| 5G n40  | 2300~2400MHz  | 2300~2400MHz  | TDD |
| 5G n41  | 2496~2690MHz  | 2496~2690MHz  | TDD |
| 5G n48  | 3550~3700MHz  | 3550~3700MHz  | TDD |
| 5G n66  | 1710~1780MHz  | 2110~2180MHz  | FDD |
| 5G n77  | 3300~4200MHz  | 3300~4200MHz  | TDD |
| 5G n78  | 3300~3800MHz  | 3300~3800MHz  | TDD |
| 5G n79  | 4400~5000MHz  | 4400~5000MHz  | TDD |

#### NOTE

1. LTE-FDD B29 B32 B46 supports Rx only for secondary component carrier.

### 4.1.2 GNSS Frequency

The following table shows frequency specifications of GNSS antenna interface.

**Table 42: GNSS frequency**

| Type                | Frequency         |
|---------------------|-------------------|
| GPS L1/Galileo/QZSS | 1575.42±1.023MHz  |
| GPS L5              | 1176.45±10.23MHz  |
| GLONASS             | 1597.5~1605.8MHz  |
| BeiDou/Compass      | 1561.098±2.046MHz |

### 4.2 Antenna Installation

## 4.2.1 Antenna Requirements

The following table shows the requirements on 3G/4G/5G antennas and GNSS antenna.

Table 43: 3G/4G/5G/GNSS antennas

| Parameter                          | Requirement                   |
|------------------------------------|-------------------------------|
| Operating Frequency                | See Table 39 for each antenna |
| Direction                          | Omni Directional              |
| Gain                               | > -3dBi (Avg)                 |
| Impedance                          | 50 $\Omega$                   |
| Efficiency                         | > 50 %                        |
| Max. Input Power                   | 50W                           |
| VSWR                               | < 2                           |
| Isolation                          | 20dB is preferred             |
| Cable Insertion Loss <1GHz         | <1dB                          |
| Cable Insertion Loss 1GHz~2.2GHz   | <1.5dB                        |
| Cable Insertion Loss 2.3GHz~2.7GHz | <2dB                          |
| Cable Insertion Loss 3.3GHz~6GHz   | <2.5dB                        |

Table 44: GNSS antenna (for dedicated GNSS antenna only)\*

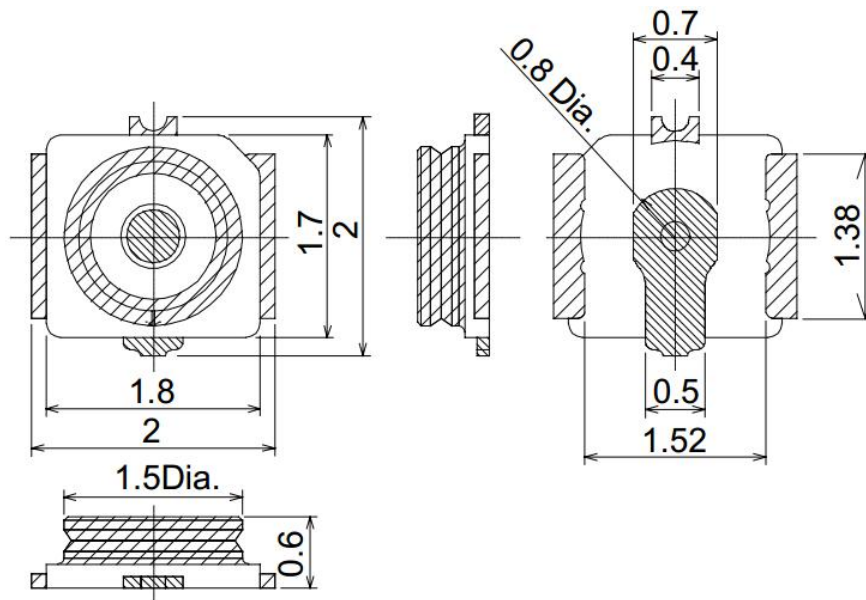
| Parameter                       | Requirement                          |
|---------------------------------|--------------------------------------|
| Operating Frequency             | L1: 1559~1609MHZ<br>L5: 1166~1187MHz |
| Direction                       | Hemisphere, face to sky              |
| Antenna Gain                    | > 2 dB <sub>ic</sub>                 |
| Impedance                       | 50 $\Omega$                          |
| Efficiency                      | > 50 %                               |
| Max. Input Power                | 50W                                  |
| VSWR                            | < 2                                  |
| Polarization                    | RHCP or Linear                       |
| Noise Figure for Active Antenna | < 1.5                                |
| Total Gain for Active Antenna   | < 17 dB                              |
| Cable Insertion Loss            | <1.5dB                               |

### NOTE

“\*” means these recommendations are for dedicated GNSS antenna which the application need best of class GNSS tracking performance.

## 4.2.2 RF Plug Recommendation

SIM8202G-M2 is mounted with Murata's receptacle RF connectors MM4829-2702B/RA4/RB0, which size is 2.0mm\*2.0mm\*0.6mm. The connector dimensions are shown as below.



**Figure 25: 3D view of MM4829-2702B/ RA4/ RB0**

The following table shows the RF connector's electrical specifications.

**Table 45: Electrical Specifications of MM4829-2702B/RA4/RB0**

| Item                                                         | Specification                                                       |
|--------------------------------------------------------------|---------------------------------------------------------------------|
| Voltage Rating                                               | 250V r.m.s. maximum                                                 |
| Nominal Frequency Range                                      | DC to 6GHz                                                          |
| Nominal Impedance                                            | 50Ω                                                                 |
| Temperature Rating                                           | -40°C to +85°C                                                      |
| Insulation Resistance                                        | 500 MΩ minimum                                                      |
| Withstanding Voltage                                         | No evidence of breakdown                                            |
| Initial Contact Resistance<br>(without conductor resistance) | Center contact 20.0mΩmax.<br>Outer contact 20.0mΩmax.               |
| Voltage Standing Wave Ratio (V.S.W.R.)                       | Meet the requirements of<br>1.3max.(DC~3GHz)<br>1.45max.(3GHz~6GHz) |

To get best RF performance, the RF plug connector should be designed to match the receptacle

MM4829-2702B/RA4/RB0, and the parts come from Murata is the recommended.

The following is the mechanical information of the Murata's RF coaxial cable MXHJD3HJ1000 for reference. For further technical support, the customer could visit the Murata's website ([www.murata.com](http://www.murata.com)) or contact the local sales team.



Preliminary Specification of COAXIAL CONNECTOR

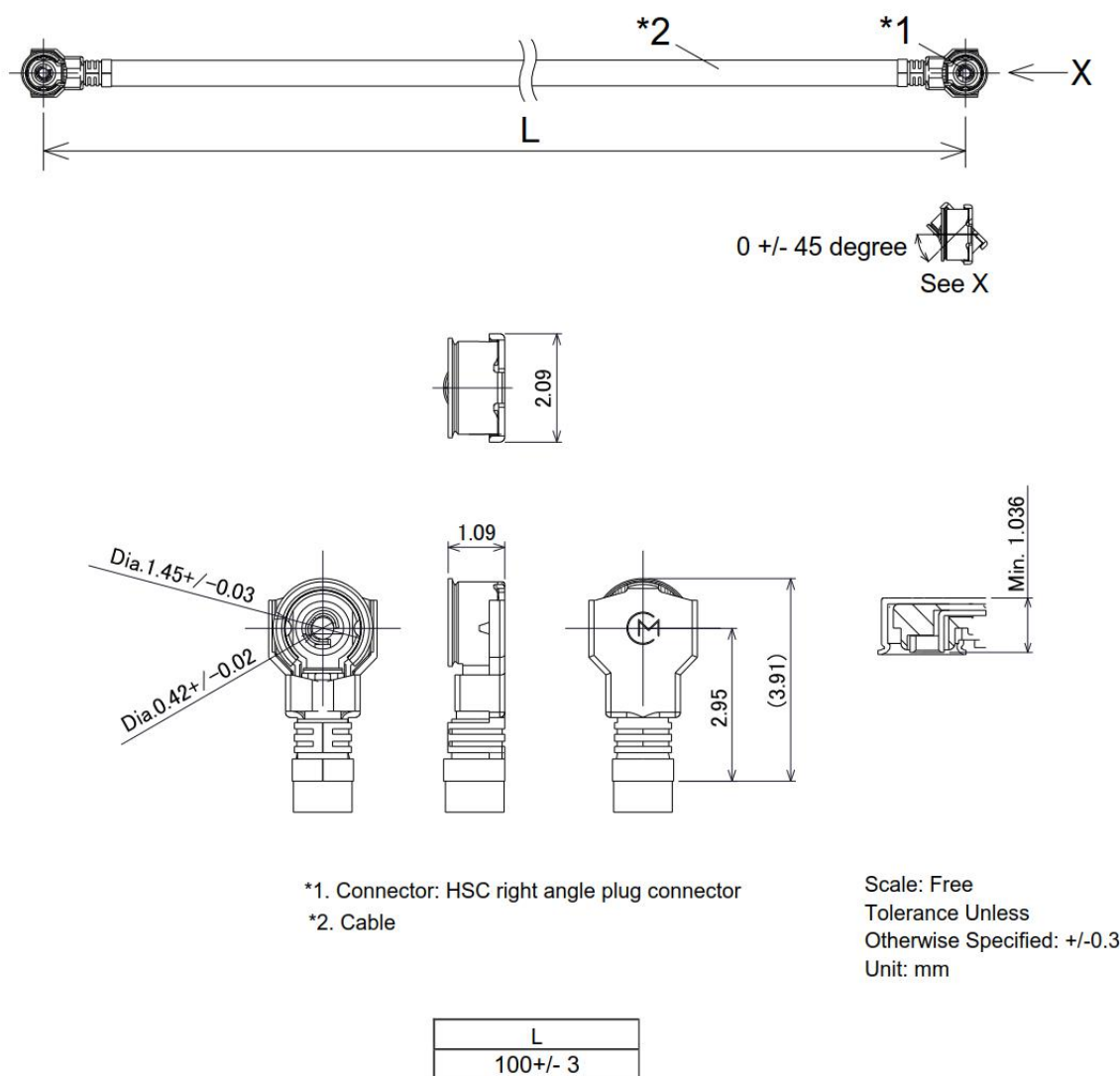
Preliminary SPEC No. : NMM04-PH0938A

Part Number : MXHJD3HJ1000

SPECIFICATION

1. MECHANICAL

Written by H. Toda  
Checked by T. Kuriyama  
Date 25/Jan./2018  
Revised A: 26/Feb./'19 IU



**Figure 26: 3D view of MXHJD3HJ1000**

## 5. Electrical Specifications

### 5.1 Absolute Maximum Ratings

Absolute maximum rating for digital and analog pins of module are listed in the following table.

**Table 46: Absolute maximum ratings**

| Parameter                                    | Min. | Typ. | Max. | Unit |
|----------------------------------------------|------|------|------|------|
| Voltage at VBAT pins                         | -    | -    | 4.8  | V    |
| Voltage at digital pins (GPIO,I2C,UART, I2S) | -    | -    | 2.1  | V    |
| Voltage at digital pins ((U)SIM)             | -    | -    | 3.05 | V    |
| Voltage at FULL_CARD_POWER_OFF#              | -    | -    | 4.4  | V    |
| Voltage at RESET#                            | -    | -    | 1.9  | V    |

### 5.2 Operating Conditions

**Table 47: VBAT recommended operating ratings**

| Parameter       | Min.  | Typ. | Max. | Unit |
|-----------------|-------|------|------|------|
| Voltage at VBAT | 3.135 | 3.8  | 4.4  | V    |

**Table 48: 1.8V Digital I/O characteristics**

| Parameter        | Description                                                      | Min. | Typ. | Max. | Unit |
|------------------|------------------------------------------------------------------|------|------|------|------|
| V <sub>IH</sub>  | High-level input voltage                                         | 1.17 | -    | 2.1  | V    |
| V <sub>IL</sub>  | Low-level input voltage                                          | 0    | -    | 0.63 | V    |
| V <sub>OH</sub>  | High-level output voltage                                        | 1.35 | -    | 1.8  | V    |
| V <sub>OL</sub>  | Low-level output voltage                                         | 0    | -    | 0.45 | V    |
| I <sub>OZH</sub> | High-level, tri-state leakage current<br>(no pull down resistor) | -    | -    | 1    | uA   |
| I <sub>OZL</sub> | Low-level, tri-state leakage current<br>(no pull up resistor)    | -1   | -    | -    | uA   |

|          |                                                    |    |   |   |    |
|----------|----------------------------------------------------|----|---|---|----|
| $I_{IH}$ | Input high leakage current (no pull down resistor) | -  | - | 1 | uA |
| $I_{IL}$ | Input low leakage current(no pull up resistor)     | -1 | - | - | uA |

**Table 49: Operating temperature**

| Parameter                                    | Min. | Typ. | Max. | Unit |
|----------------------------------------------|------|------|------|------|
| Normal operation temperature(3GPP compliant) | -30  | -    | 70   | °C   |
| Extended operation temperature*              | -40  | -    | 85   | °C   |
| Storage temperature                          | -40  | -    | 90   | °C   |

## 5.3 Operating Mode

### 5.3.1 Operating Mode Definition

The table below summarizes the various operating modes of SIM8202G-M2.

**Table 50: Operating mode definition**

| Mode                       | Function                                                                                                                                                                                                                                                                                                                                       |
|----------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Normal operation           | UMTS/LTE/5G Sleep<br>AT command “AT+CSCLK=1” can be used to set the module to a sleep mode. In this case, the current consumption of module will be reduced to a very low level and the module can still receive paging message and SMS.                                                                                                       |
|                            | UMTS/LTE/5G Idle<br>Software is active. Module is registered to the network, and ready to communicate.                                                                                                                                                                                                                                         |
|                            | UMTS/LTE/5G Talk<br>Connection between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, and antennas.                                                                                                                                         |
|                            | UMTS/LTE/5G Standby<br>Module is ready for data transmission, but no data is currently sent or received. In this case, power consumption depends on network settings.                                                                                                                                                                          |
|                            | UMTS/LTE/5G Data transmission<br>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=0” can be used to set the module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the module will not work and the (U)SIM card will not be accessible, but the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode. |
| Flight mode                | AT command “AT+CFUN=4” or pulling down the W_disable1# pin can                                                                                                                                                                                                                                                                                 |

|           |                                                                                                                                                                                                                                                                       |
|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|           | be used to set the module to flight mode without removing the power supply. In this case, the RF part of the module will not work, but the serial port and USB are still available. The power consumption is lower than normal mode.                                  |
| Power off | Normally module will go into power off mode by sending the AT command "AT+CPOF" or pull down the FULL_CARD_POWER_OFF# pin. In this mode the power management unit shuts down the power supply, and software is not active. The serial port and USB are not available. |

### 5.3.2 Sleep Mode

In sleep mode, the current consumption of the module will be reduced to a very low level.

Several hardware and software conditions must be satisfied in order to let module enter into sleep mode:

1. UART condition
2. USB condition
3. Software condition

#### NOTE

Before designing, pay attention to how to realize sleeping/waking function.

### 5.3.3 Minimum Functionality Mode and Flight Mode

Minimum functionality mode ceases a majority of functions of the module, in order to minimize the power consumption. This mode is set by the AT command which provides a choice of 3 different functionality levels.

- AT+CFUN=0: Minimum functionality
- AT+CFUN=1: Full functionality (Default)
- AT+CFUN=4: Flight mode

If module has been set to minimum functionality mode, the RF (U)SIM card functions will be closed while the serial port and USB are still available.

If module has been set to flight mode, the RF function will be closed while the (U)SIM card, the serial port and USB are still available.

When module 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 consumptions are listed in the table below.

**Table 51: Current consumption on VBAT pins (VBAT=3.8V)**

| GNSS                                                         |                                  |               |              |
|--------------------------------------------------------------|----------------------------------|---------------|--------------|
| GNSS supply current<br>(AT+CFUN=0,with USB connection)       | @ -140dBm, Tracking Typical:60mA |               |              |
| UMTS sleep/idle mode                                         |                                  |               |              |
| WCDMA supply current<br>(GNSS off, without USB connection)   | Sleep mode                       | Typical: 3mA  |              |
|                                                              | Idle mode                        | Typical: 34mA |              |
| LTE sleep/idle mode                                          |                                  |               |              |
| LTE FDD supply current<br>(GNSS off, without USB connection) | Sleep mode                       | Typical: 3mA  |              |
|                                                              | Idle mode                        | Typical: 38mA |              |
| LTE TDD supply current<br>(GNSS off, without USB connection) | Sleep mode                       | Typical: TBD  |              |
|                                                              | Idle mode                        | Typical: 36mA |              |
| UMTS talk                                                    |                                  |               |              |
| WCDMA B1                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B2                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B3                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B4                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B5                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B8                                                     | @Power 23dBm Typical: TBD        |               |              |
| HSDPA data                                                   |                                  |               |              |
| WCDMA B1                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B2                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B3                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B4                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B5                                                     | @Power 23dBm Typical: TBD        |               |              |
| WCDMA B8                                                     | @Power 23dBm Typical: TBD        |               |              |
| LTE data                                                     |                                  |               |              |
| LTE-FDD B1                                                   | @5MHz                            | 23dBm         | Typical :TBD |
|                                                              | @10MHz                           | 23dBm         | Typical :TBD |
|                                                              | @20MHz                           | 23dBm         | Typical :TBD |
| LTE-FDD B2                                                   | @5MHz                            | 23dBm         | Typical :TBD |
|                                                              | @10MHz                           | 23dBm         | Typical :TBD |
|                                                              | @20MHz                           | 23dBm         | Typical :TBD |
| LTE-FDD B3                                                   | @5MHz                            | 23dBm         | Typical :TBD |
|                                                              | @10MHz                           | 23dBm         | Typical :TBD |
|                                                              | @20MHz                           | 23dBm         | Typical :TBD |
| LTE-FDD B4                                                   | @5MHz                            | 23dBm         | Typical :TBD |
|                                                              | @10MHz                           | 23dBm         | Typical :TBD |
|                                                              | @20MHz                           | 23dBm         | Typical :TBD |
| LTE-FDD B5                                                   | @5MHz                            | 23dBm         | Typical :TBD |
|                                                              | @10MHz                           | 23dBm         | Typical :TBD |

|                   |                           |       |              |
|-------------------|---------------------------|-------|--------------|
| LTE-FDD B7        | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B8        | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B12       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B13       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B14       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B17       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B18       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B19       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B20       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B25       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B26       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B28       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-FDD B30       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B34       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B38       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B39       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B40       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B41       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B42       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| LTE-TDD B48       | @5MHz                     | 23dBm | Typical :TBD |
|                   | @10MHz                    | 23dBm | Typical :TBD |
|                   | @20MHz                    | 23dBm | Typical :TBD |
| <b>HSDPA data</b> |                           |       |              |
| 5G n1             | @Power 23dBm Typical: TBD |       |              |
| 5G n2             | @Power 23dBm Typical: TBD |       |              |
| 5G n3             | @Power 23dBm Typical: TBD |       |              |
| 5G n5             | @Power 23dBm Typical: TBD |       |              |
| 5G n7             | @Power 23dBm Typical: TBD |       |              |

|                     |                           |
|---------------------|---------------------------|
| 5G n8               | @Power 23dBm Typical: TBD |
| 5G n12              | @Power 23dBm Typical: TBD |
| 5G n20              | @Power 23dBm Typical: TBD |
| 5G n25              | @Power 23dBm Typical: TBD |
| 5G n28              | @Power 23dBm Typical: TBD |
| 5G n40              | @Power 23dBm Typical: TBD |
| 5G n41              | @Power 23dBm Typical: TBD |
| 5G n66              | @Power 23dBm Typical: TBD |
| 5G n71              | @Power 23dBm Typical: TBD |
| 5G n77              | @Power 23dBm Typical: TBD |
| 5G n78              | @Power 23dBm Typical: TBD |
| 5G n79 <sup>1</sup> | @Power 23dBm Typical: TBD |

## 5.5 RF Output Power

The RF output power is shown in the following table.

**Table 52: Conducted output power**

| Bands          | Max            | Min      |
|----------------|----------------|----------|
| WCDMA Bands    | 23dBm + 1/-3dB | < -50dBm |
| LTE-FDD Bands  | 23dBm + 2/-2dB | < -40dBm |
| LTE-TDD Bands  | 23dBm + 2/-2dB | < -40dBm |
| 5G Sub-6 Bands | 23dBm + 2/-2dB | < -40dBm |

## 5.6 Conducted Receive Sensitivity

The conducted RF receiving sensitivity is shown in the following table.

**Table 53: Conducted RF receiving sensitivity**

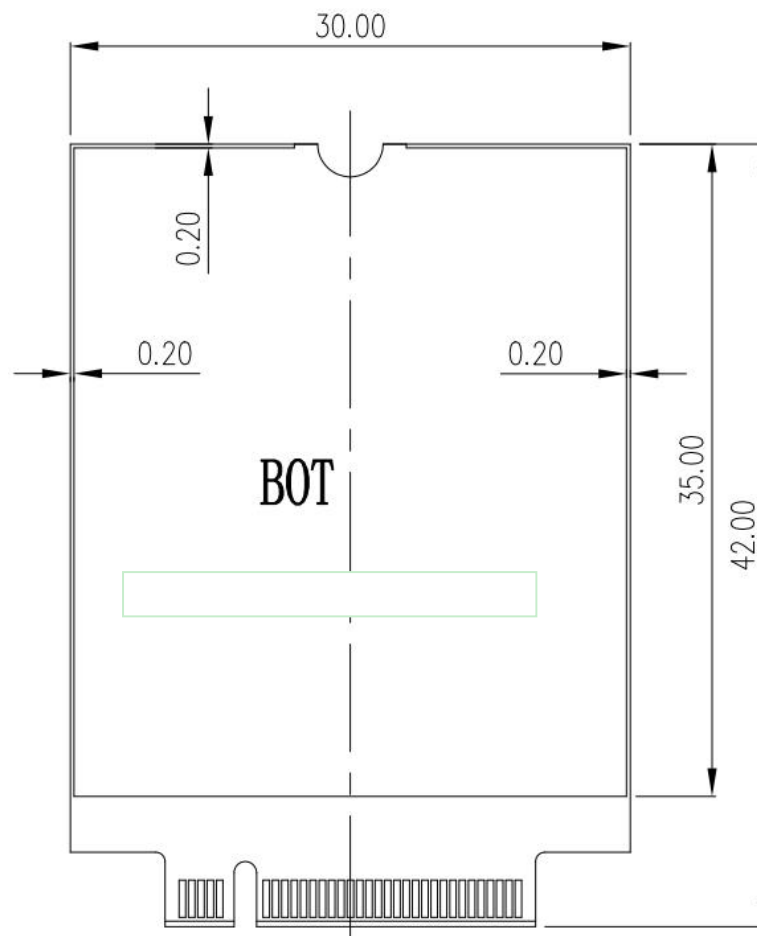
| Frequency | Primary (Typ.) | Diversity (Typ.) | SIMO1(Typ.) | SIMO2(Worst Case) |
|-----------|----------------|------------------|-------------|-------------------|
| WCDMA B1  | TBD            | TBD              | TBD         | -106.7dBm         |
| WCDMA B2  | TBD            | TBD              | TBD         | -103.7dBm         |
| WCDMA B3  | TBD            | TBD              | TBD         | -104.7dBm         |
| WCDMA B4  | TBD            | TBD              | TBD         | -103.7dBm         |
| WCDMA B5  | TBD            | TBD              | TBD         | -96.3dBm          |
| WCDMA B8  | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B1    | TBD            | TBD              | TBD         | -94.3dBm          |
| LTE B2    | TBD            | TBD              | TBD         | -94.3dBm          |
| LTE B3    | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B4    | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B5    | TBD            | TBD              | TBD         | -94.8dBm          |
| LTE B7    | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B8    | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B12   | TBD            | TBD              | TBD         | -94.3dBm          |
| LTE B13   | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B14   | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B17   | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B18   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B19   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B20   | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B25   | TBD            | TBD              | TBD         | -92.8dBm          |
| LTE B26   | TBD            | TBD              | TBD         | -93.8dBm          |
| LTE B28   | TBD            | TBD              | TBD         | -94.8dBm          |
| LTE B29   | TBD            | TBD              | TBD         | -93.3dBm          |
| LTE B30   | TBD            | TBD              | TBD         | -95.3dBm          |
| LTE B34   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B38   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B39   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B40   | TBD            | TBD              | TBD         | -96.3dBm          |
| LTE B41   | TBD            | TBD              | TBD         | -94.3dBm          |
| LTE B42   | TBD            | TBD              | TBD         | -95.0dBm          |
| LTE B48   | TBD            | TBD              | TBD         | TBD               |
| 5G n1     | TBD            | TBD              | TBD         | -97.1dBm          |

|        |     |     |     |          |
|--------|-----|-----|-----|----------|
| 5G n2  | TBD | TBD | TBD | -95.1dBm |
| 5G n3  | TBD | TBD | TBD | -94.1dBm |
| 5G n5  | TBD | TBD | TBD | -95.1dBm |
| 5G n7  | TBD | TBD | TBD | -95.1dBm |
| 5G n8  | TBD | TBD | TBD | -94.1dBm |
| 5G n12 | TBD | TBD | TBD | -94.1dBm |
| 5G n20 | TBD | TBD | TBD | -94.1dBm |
| 5G n25 | TBD | TBD | TBD | -93.6dBm |
| 5G n28 | TBD | TBD | TBD | -95.6dBm |
| 5G n40 | TBD | TBD | TBD | -97.1dBm |
| 5G n41 | TBD | TBD | TBD | -95.1dBm |
| 5G n66 | TBD | TBD | TBD | -96.6dBm |
| 5G n71 | TBD | TBD | TBD | -94.3dBm |
| 5G n77 | TBD | TBD | TBD | -94.1dBm |
| 5G n78 | TBD | TBD | TBD | -94.1dBm |
| 5G n79 | TBD | TBD | TBD | TBD      |

## 5.7 Thermal Design

Make sure that the SIM8202G-M2 can reach maximum work performance under extended temperature or extreme conditions for a long time, thermal dissipation design is very important.

It is strongly recommended to add a thermal pad on the customer's main PCB, and add thermally conductive material between the module and the main PCB. The thermal dissipation area on bottom side of the module and the dimensions is shown in the following figure. The dimensions are measured in mm.



**Figure 27: Thermal dissipation area on bottom side of the module**

There are some design rules to enhance thermal dissipation performance:

- Keep the module away from other heat sources such as battery, power, AP, etc.
- Make sure that the module mounting holes connect to the main PCB ground fully.
- Add enough through via on the main PCB. Via material is very important solid copper and stacked via is better.
- Make sure maximize airflow around the module.
- Recommend use heat dissipation material connect to the customer's devices on the top side of the module to enhance the heat dissipation. Large thermal dissipation area is better.
- Chose a high effective heat dissipation material is better such as heat pipe, graphite sheets. The recommend thermal conductivity is 8w/m-k.

## 5.8 ESD

SIM8202G-M2 is sensitive to ESD in the process of storage, transporting, and assembling. When module is mounted on the customer's main board, the ESD components should be placed closed to the connectors which human body may touch, such as (U)SIM card holder, audio jacks, switches, USB interface, etc. The following table shows the module ESD test performance.

**Table 54: The ESD performance measurement table (Temperature: 25℃, Humidity: 45%)**

| Part                 | Contact discharge | Air discharge |
|----------------------|-------------------|---------------|
| VBAT,GND             | +/- 4KV           | +/- 8KV       |
| Antenna              | +/- 4KV           | +/- 8KV       |
| FULL_CARD_POWER_OFF# | +/- 3KV           | +/- 6KV       |
| USB                  | +/- 3KV           | +/- 6KV       |
| RESET#               | +/- 2KV           | +/- 5KV       |
| (U)SIM               | +/- 2KV           | +/- 5KV       |
| Other PAD            | +/- 2KV           | +/- 5KV       |

### NOTE

Test conditions:

1. The external of the module has surge protection diodes and ESD protection diodes.
2. The data in Table 54 was tested using SIMCom EVB.

## 6. Appearance

### 6.1 Top and Bottom View of SIM8202G-M2

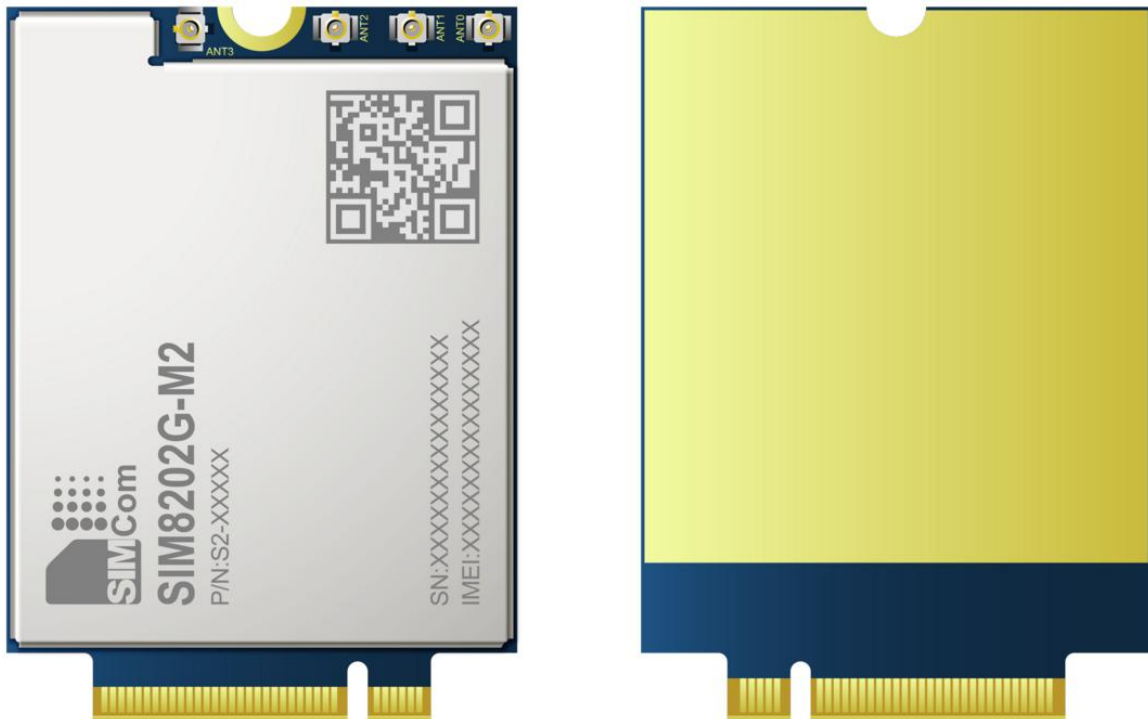


Figure 28: Top and bottom view of the module

### 6.2 Label Description Information

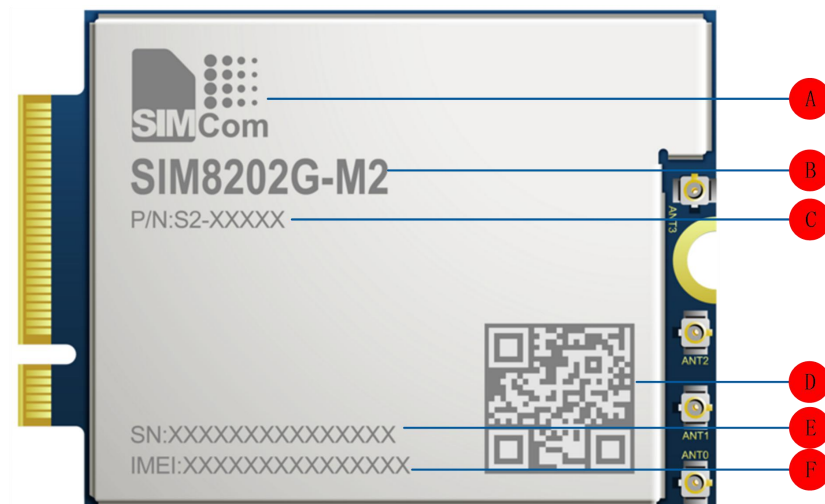


Figure 29: Label description of the module

Table 55: Label description of the module information

| No. | Description                             |
|-----|-----------------------------------------|
| A   | LOGO                                    |
| B   | Project name                            |
| C   | Product code                            |
| D   | QR code                                 |
| E   | Serial number                           |
| F   | International mobile equipment identity |

**NOTE**

Figure 28 and Figure 29 are the effect diagrams of the module, for reference only. The outward appearance please subject to the actual product.

## 7. Packaging

SIM8202G-M2 supports tray packaging. The packaging procedures are shown in the following figure.

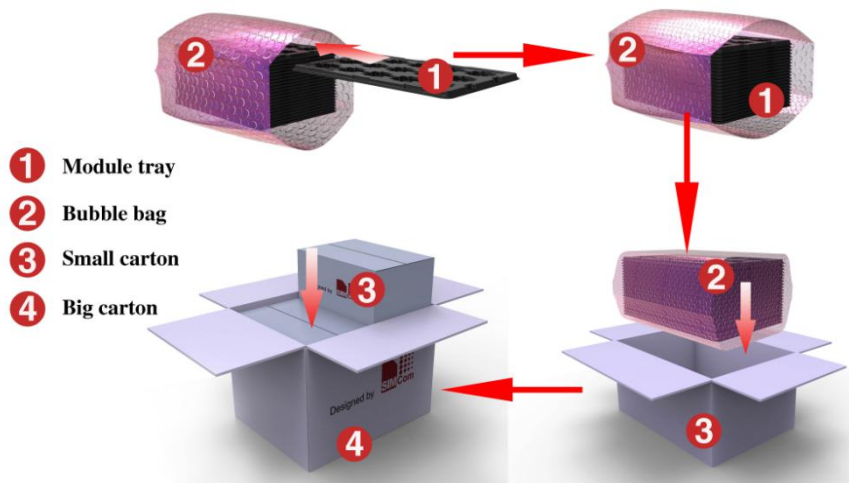


Figure 30: Packaging procedures

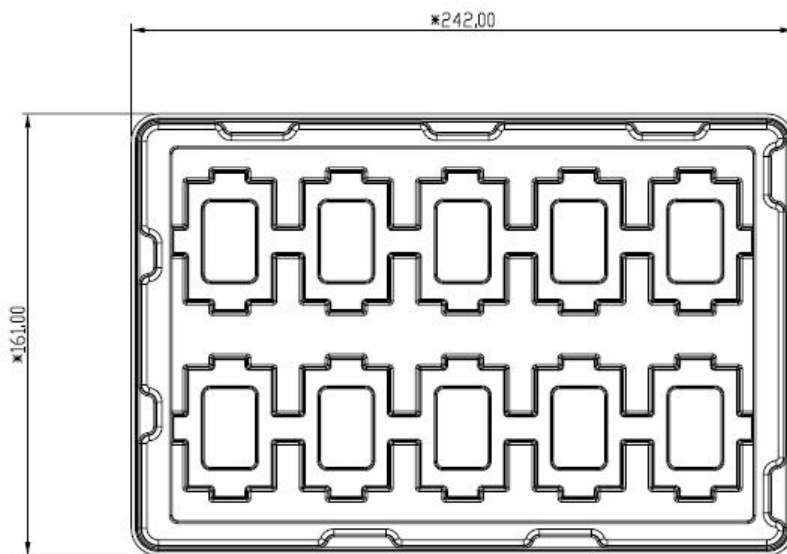


Figure 31: Tray view of the module

Table 56: Tray size

| Length ( $\pm 3\text{mm}$ ) | Width ( $\pm 3\text{mm}$ ) | Number |
|-----------------------------|----------------------------|--------|
| 245.0                       | 165.0                      | 10     |

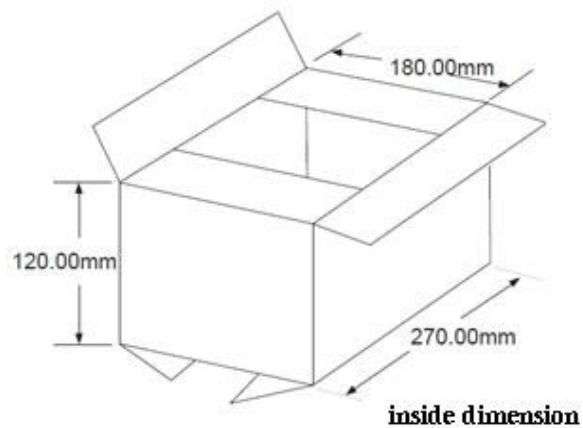


Figure 32: Small carton view

Table 57: Small carton size

| Length ( $\pm 10\text{mm}$ ) | Width ( $\pm 10\text{mm}$ ) | Height ( $\pm 10\text{mm}$ ) | Number    |
|------------------------------|-----------------------------|------------------------------|-----------|
| 270                          | 180                         | 120                          | 10*20=200 |

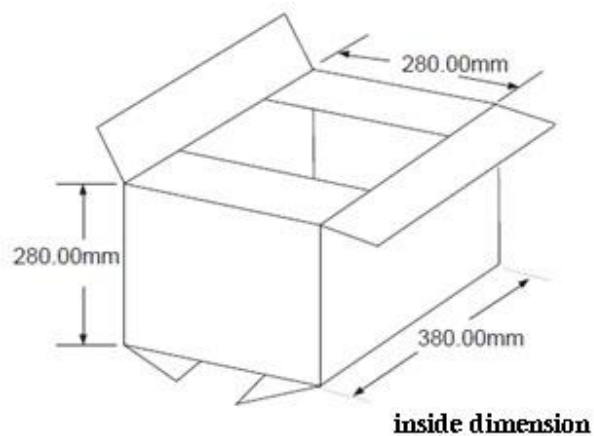


Figure 33: Big carton view

Table 58: Big carton size

| Length ( $\pm 10\text{mm}$ ) | Width ( $\pm 10\text{mm}$ ) | Height ( $\pm 10\text{mm}$ ) | Number    |
|------------------------------|-----------------------------|------------------------------|-----------|
| 380                          | 280                         | 280                          | 200*4=800 |

## 8. Appendix

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

Table 59: Coding schemes and maximum net data rates over air interface

| HSDPA device category | Max data rate (peak) | Modulation type |
|-----------------------|----------------------|-----------------|
| Category 1            | 1.2Mbps              | 16QAM,QPSK      |
| Category 2            | 1.2Mbps              | 16QAM,QPSK      |
| Category 3            | 1.8Mbps              | 16QAM,QPSK      |
| Category 4            | 1.8Mbps              | 16QAM,QPSK      |
| Category 5            | 3.6Mbps              | 16QAM,QPSK      |
| Category 6            | 3.6Mbps              | 16QAM,QPSK      |
| Category 7            | 7.2Mbps              | 16QAM,QPSK      |
| Category 8            | 7.2Mbps              | 16QAM,QPSK      |
| Category 9            | 10.2Mbps             | 16QAM,QPSK      |
| Category 10           | 14.4Mbps             | 16QAM,QPSK      |
| Category 11           | 0.9Mbps              | QPSK            |
| Category 12           | 1.8Mbps              | QPSK            |
| Category 13           | 17.6Mbps             | 64QAM           |
| Category 14           | 21.1Mbps             | 64QAM           |
| Category 15           | 23.4Mbps             | 16QAM           |
| Category 16           | 28Mbps               | 16QAM           |
| Category 17           | 23.4Mbps             | 64QAM           |
| Category 18           | 28Mbps               | 64QAM           |
| Category 19           | 35.5Mbps             | 64QAM           |
| Category 20           | 42Mbps               | 64QAM           |
| Category 21           | 23.4Mbps             | 16QAM           |
| Category 22           | 28Mbps               | 16QAM           |
| Category 23           | 35.5Mbps             | 64QAM           |
| Category 24           | 42.2Mbps             | 64QAM           |
| HSUPA device category | Max data rate (peak) | Modulation type |
| Category 1            | 0.96Mbps             | QPSK            |
| Category 2            | 1.92Mbps             | QPSK            |
| Category 3            | 1.92Mbps             | QPSK            |
| Category 4            | 3.84Mbps             | QPSK            |
| Category 5            | 3.84Mbps             | QPSK            |

| Category 6                                | 5.76Mbps                    | QPSK                   |
|-------------------------------------------|-----------------------------|------------------------|
| <b>LTE-FDD device category (Downlink)</b> | <b>Max data rate (peak)</b> | <b>Modulation type</b> |
| Category 1                                | 10Mbps                      | QPSK/16QAM/64QAM       |
| Category 2                                | 50Mbps                      | QPSK/16QAM/64QAM       |
| Category 3                                | 100Mbps                     | QPSK/16QAM/64QAM       |
| Category 4                                | 150Mbps                     | QPSK/16QAM/64QAM       |
| Category 5                                | 300Mbps                     | QPSK/16QAM/64QAM       |
| Category 6                                | 300Mbps                     | QPSK/16QAM/64QAM       |
| <b>LTE-FDD device category (Uplink)</b>   | <b>Max data rate (peak)</b> | <b>Modulation type</b> |
| Category 1                                | 5Mbps                       | QPSK/16QAM             |
| Category 2                                | 25Mbps                      | QPSK/16QAM             |
| Category 3                                | 50Mbps                      | QPSK/16QAM             |
| Category 4                                | 50Mbps                      | QPSK/16QAM             |
| Category 5                                | 75Mbps                      | QPSK/16QAM/64QAM       |
| Category 6                                | 50Mbps                      | QPSK/16QAM             |

## 8.2 Related Documents

**Table 60: Related documents**

| No.  | Title                                                               | Description                                                                                                                                                                                                                                                                                               |
|------|---------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| [1]  | SIM8200 Series_AT Command Manual                                    | AT Command Manual                                                                                                                                                                                                                                                                                         |
| [2]  | ITU-T Draft new recommendation V.25ter                              | Serial asynchronous automatic dialing and control                                                                                                                                                                                                                                                         |
| [3]  | 3GPP TS 51.010-1                                                    | Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification                                                                                                                                                                                                     |
| [4]  | 3GPP TS 38.401                                                      | NG-RAN; Architecture description                                                                                                                                                                                                                                                                          |
| [5]  | 3GPP TS 34.124                                                      | Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.                                                                                                                                                                                                                         |
| [6]  | 3GPP TS 34.121                                                      | Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.                                                                                                                                                                                                                         |
| [7]  | 3GPP TS 34.123-1                                                    | Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)                                                                                                                                                                            |
| [8]  | 3GPP TS 34.123-3                                                    | User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.                                                                                                                                                                                                                              |
| [9]  | 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 |
| [10] | 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                             |
| [11] | IEC/EN60950-1(2001)                                                 | Safety of information technology equipment (2000)                                                                                                                                                                                                                                                         |
| [12] | 3GPP TS 51.010-1                                                    | Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification                                                                                                                                                                                                     |
| [13] | GCF-CC V3.23.1                                                      | Global Certification Forum - Certification Criteria                                                                                                                                                                                                                                                       |
| [14] | 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)                                                                                                                    |
| [15] | SIM8202G-M2 Series_UART_Application Note_V1.xx                      | This document describes how to use UART interface of SIMCom modules.                                                                                                                                                                                                                                      |
| [16] | SIM8202G-M2 Series_GPS_Application Note_V1.xx                       | GPS Application Note                                                                                                                                                                                                                                                                                      |
| [17] | 3GPP TS 38.101                                                      | NR radio transmission and reception technical specification                                                                                                                                                                                                                                               |
| [18] | SIM8202G-M2 Antenna design guidelines for diversity receiver system | Antenna design guidelines for diversity receiver system                                                                                                                                                                                                                                                   |

## 8.3 Terms and Abbreviations

Table 61: 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                                      |
| DPR          | Dynamic Power Reduction                                         |
| DIV          | The Diversity Receive signal                                    |
| EFR          | Enhanced Full Rate                                              |
| EMC          | Electromagnetic Compatibility                                   |
| ESD          | Electrostatic Discharge                                         |
| ETS          | European Telecommunication Standard                             |
| EVDO         | Evolution Data Only                                             |
| FCC          | Federal Communications Commission (U.S.)                        |
| FD           | (U)SIM fix dialing phonebook                                    |
| FDD          | Frequency Division Dual                                         |
| FDMA         | Frequency Division Multiple Access                              |
| FR           | Full Rate                                                       |
| GMSK         | Gaussian Minimum Shift Keying                                   |
| GNSS         | Global Navigation Satellite System                              |
| GPS          | Global Positioning System                                       |
| HR           | Half Rate                                                       |
| HSPA         | High Speed Packet Access                                        |
| HSIC         | High-Speed Inter-Chip                                           |
| I2C          | Inter-Integrated Circuit                                        |
| I2S          | Inter-IC Sound                                                  |
| IMEI         | International Mobile Equipment Identity                         |
| LTE          | Long Term Evolution                                             |
| LB           | Low Frequency Band                                              |
| LAA          | Limited Access Authorization                                    |

|        |                                                            |
|--------|------------------------------------------------------------|
| MO     | Mobile Originated                                          |
| MSB    | Most Significant Bit                                       |
| MHB    | Middle And High Frequency Band                             |
| MT     | Mobile Terminated                                          |
| MIMO   | Multiple Input Multiple Output                             |
| NMEA   | National Marine Electronics Association                    |
| PAP    | Password Authentication Protocol                           |
| PBCCH  | Packet Switched Broadcast Control Channel                  |
| PCB    | Printed Circuit Board                                      |
| PCIe   | Peripheral Component Interface Express                     |
| RF     | Radio Frequency                                            |
| RMS    | Root Mean Square (value)                                   |
| RTC    | Real Time Clock                                            |
| SIM    | Subscriber Identification Module                           |
| SMS    | Short Message Service                                      |
| SPI    | Serial Peripheral Interface                                |
| SMPS   | Switched-Mode Power Supply                                 |
| TDD    | Time Division Dual                                         |
| TDMA   | Time Division Multiple Access                              |
| TE     | Terminal Equipment(also referred to as DTE)                |
| TX     | Transmit Direction                                         |
| TRX    | The Diversity Receive signal                               |
| VSWR   | Voltage Standing Wave Ratio                                |
| SM     | (U)SIM Phonebook                                           |
| SGMII  | Serial Gigabit Media Independent Interface                 |
| NC     | Not connect                                                |
| 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 |
| (U)SIM | Universal Subscriber Identity Module                       |
| UHB    | Ultra High Frequency Band                                  |
| UMTS   | Universal Mobile Telecommunications System                 |
| UART   | Universal Asynchronous Receiver Transmitter                |

## 8.4 Safety Caution

**Table 62: 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 and not operate normally due to 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. Forgetting to think much of these instructions may impact the flight safety, or offend local legal action, or both.                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|    | Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|   | Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|  | Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|  | <p>Mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, especially with a mobile fee or an invalid (U)SIM card. While you are in this condition and need emergent help, please remember to use emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.</p> <p>Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call.</p> <p>Also, some networks require that a valid (U)SIM card be properly inserted in the cellular terminal or mobile.</p> |

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