



# SIM7500 Series Hardware Design

LTE Module

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|------------------------|--------------------------------|
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# 1 Introduction

This document describes the electronic specifications, RF specifications, interfaces, mechanical characteristics and testing results of the SIMCom SIM7500 series. With the help of this document and other software application notes/user guides, users can understand and use modules to design and develop applications quickly.

## 1.1 Product Outline

The SIM7500 series support many air-interface standards, refer to the following table.

**Table 1: Module frequency bands (\* stands for SIM7500)**

| Standard | Frequency | *A   | *E   | *JE  | *JC  | *V   | *SA  | *AD  |
|----------|-----------|------|------|------|------|------|------|------|
| GSM      | 850MHz    |      |      |      |      |      |      |      |
|          | 900MHz    |      | √    |      |      |      |      |      |
|          | 1800M Hz  |      | √    |      |      |      |      |      |
|          | 1900M Hz  |      |      |      |      |      |      |      |
| WCDMA    | B1        |      | √    |      |      |      | √    |      |
|          | B2        | √    |      |      |      |      |      | √    |
|          | B5        | √    |      |      |      |      | √    | √    |
|          | B8        |      | √    |      |      |      |      |      |
| LTE      | FDD B1    |      | √    | √    | √    |      | √    |      |
|          | FDD B2    | √    |      |      |      |      |      | √    |
|          | FDD B3    |      | √    | √    |      |      | √    |      |
|          | FDD B4    | √    |      |      |      | √    |      | √    |
|          | FDD B5    |      |      |      |      |      | √    |      |
|          | FDD B7    |      | √    |      |      |      | √    |      |
|          | FDD B8    |      | √    | √    |      |      | √    |      |
|          | FDD B12   | √    |      |      |      |      |      | √    |
|          | FDD B13   |      |      |      |      |      | √    |      |
|          | FDD B18   |      |      |      | √    |      | √    |      |
|          | FDD B19   |      |      |      | √    |      |      |      |
|          | FDD B20   |      | √    |      |      |      |      |      |
|          | FDD B26   |      |      |      | √    |      |      |      |
|          | FDD B28   |      |      |      |      |      |      |      |
| Category |           | CAT1 | CAT1 | CAT1 | CAT1 | CAT1 | CAT1 | CAT1 |

| Remark | -H for<br>CAT4 | -H for<br>CAT4 |   |   |   | -H for<br>CAT4 |   |
|--------|----------------|----------------|---|---|---|----------------|---|
| GNSS   | √              | √              | √ | √ | √ | √              | √ |

With a small physical dimension of 24\*27\*2.75 mm and with the functions integrated, the Module can meet almost any space requirement in users' applications, such as smart phones, PDA's, industrial handhelds, machine-to-machine, vehicle applications, etc.

**NOTE**

CAT1 or CAT4 correspond to different PN numbers.

## 1.2 Hardware Interface Overview

The interfaces are described in detail in the next chapters include:

- Power Supply
- USB Interface
- UART Interface
- SIM Interface
- GPIO
- ADC
- Power Output
- Current Sink Source
- PCM Interface
- I2C Interface

## 1.3 Hardware Block Diagram

The block diagram of the Module is shown in the figure below.



|                                 |  |
|---------------------------------|--|
|                                 | FDD-LTE CAT4: 150 Mbps (DL), 50 Mbps (UL)<br>TDD-LTE CAT4: 130 Mbps (DL), 35 Mbps (UL)<br>FDD-LTE CAT 1: 10 Mbps (DL), 5 Mbps (UL)<br>TDD-LTE CAT 1: 8.96 Mbps (DL), 3.1 Mbps (UL)   |
| <b>Antenna</b>                  | GSM/WCDMA /LTE main antenna<br>WCDMA /LTE auxiliary antenna<br>GNSS antenna  |
| <b>GNSS</b>                     | GNSS engine (GPS, GLONASS , BD and QZSS GALILEO)<br>Protocol: NMEA   |
| <b>SMS</b>                      | MT, MO, CB, Text and PDU mode<br>SMS storage: SIM card or ME(default)<br>Transmission of SMS alternatively over CS or PS.  |
| <b>SIM interface</b>            | Support identity card: 1.8V/ 3V  |
| <b>SIM application toolkit</b>  | Support SAT class 3, GSM 11.14 Release 98<br>Support USAT  |
| <b>Phonebook management</b>     | Support phonebook types: DC,MC,RC,SM,ME,FD,ON,LD,EN  |
| <b>Audio feature</b>            | Support PCM interface<br>Only support PCM master mode and short frame sync, 16-bit linear data formats   |
| <b>UART interface</b>           | A full modem serial port by default<br>Baud rate: 300bps to 3.6Mbps(default:115200bps)<br>Can be used as the AT commands or data stream channel.<br>Support RTS/CTS hardware handshake<br>Multiplex ability according to GSM 07.10 Multiplexer Protocol. |
| <b>USB</b>                      | USB 2.0 specification-compliant as a peripheral  |
| <b>Firmware upgrade</b>         | Firmware upgrade over USB interface<br>USB 2.0 specification-compliant as a peripheral   |
| <b>Physical characteristics</b> | Weight:4.0 g<br>Size:24*27*2.75mm  |
| <b>Temperature range</b>        | Normal operation temperature: -30°C to +80°C<br>Extended operation temperature: -40°C to +85°C*<br>Storage temperature -45°C to +90°C  |

**NOTE**

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

## 2 Package Information

### 2.1 Pin Assignment Overview

All functions of the SIM7500 series will be provided through 56 pads that will be connected to the customers' platform. The following Figure is a high-level view of the pin assignment of the SIM7500 series.

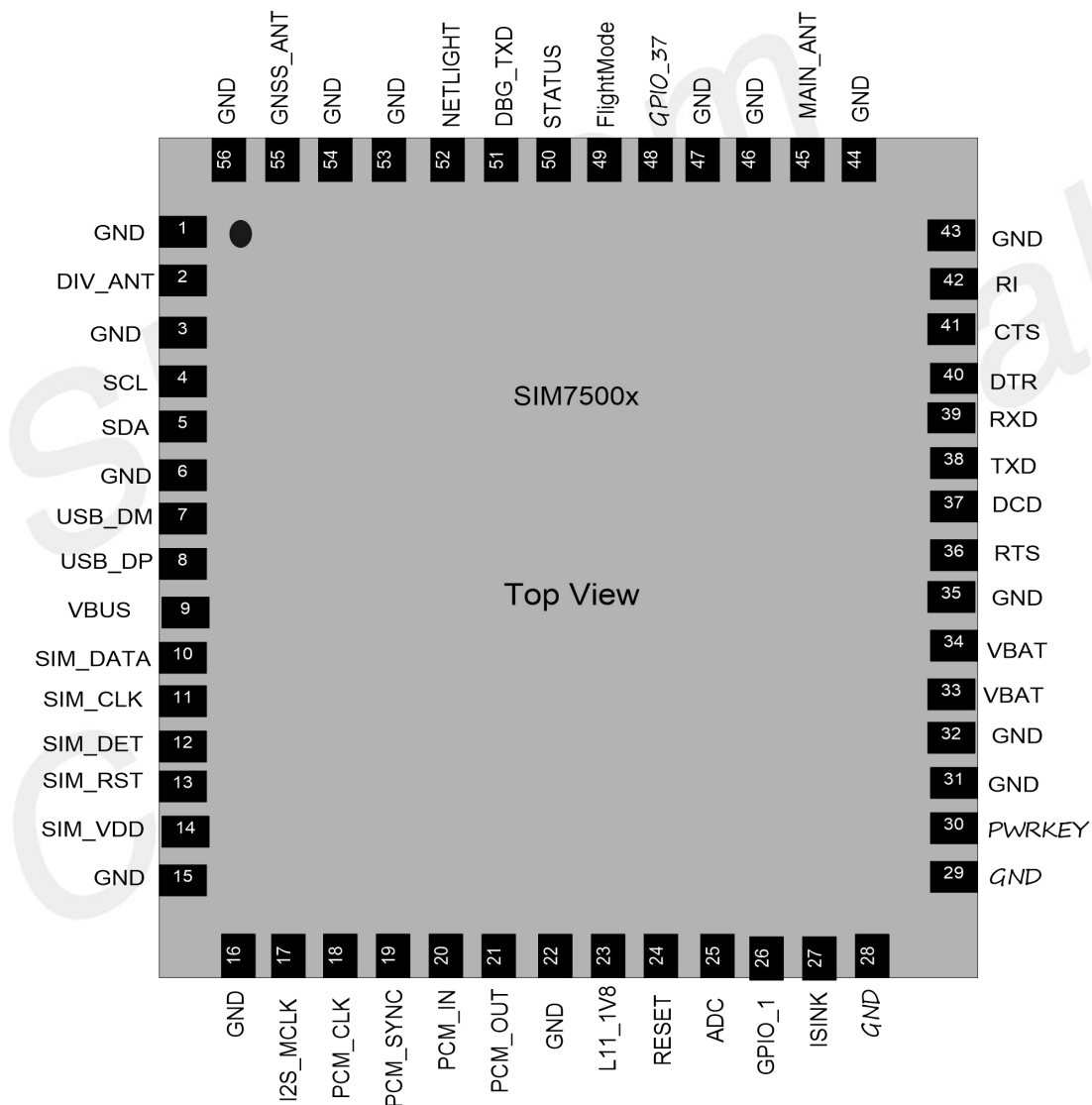


Figure 2: Pin assignment overview

**Table 3: Pin Definitions**

| Pin No. | Pin name   | Pin No. | Pin name |
|---------|------------|---------|----------|
| 1       | GND        | 2       | DIV_ANT  |
| 3       | GND        | 4       | SCL      |
| 5       | SDA        | 6       | GND      |
| 7       | USB_DM     | 8       | USB_DP   |
| 9       | VBUS       | 10      | SIM_DATA |
| 11      | SIM_CLK    | 12      | SIM_DET  |
| 13      | SIM_RST    | 14      | SIM_VDD  |
| 15      | GND        | 16      | GND      |
| 17      | I2S_MCLK   | 18      | PCM_CLK  |
| 19      | PCM_SYNC   | 20      | PCM_IN   |
| 21      | PCM_OUT    | 22      | GND      |
| 23      | L11_1V8    | 24      | RESET    |
| 25      | ADC        | 26      | GPIO_1   |
| 27      | ISINK      | 28      | GND      |
| 29      | GND        | 30      | PWRKEY   |
| 31      | GND        | 32      | GND      |
| 33      | VBAT       | 34      | VBAT     |
| 35      | GND        | 36      | RTS      |
| 37      | DCD        | 38      | TXD      |
| 39      | RXD        | 40      | DTR      |
| 41      | CTS        | 42      | RI       |
| 43      | GND        | 44      | GND      |
| 45      | MAIN_ANT   | 46      | GND      |
| 47      | GND        | 48*     | GPIO_37  |
| 49      | FlightMode | 50      | STATUS   |
| 51      | DBG_TXD    | 52      | NETLIGHT |
| 53      | GND        | 54      | GND      |
| 55      | GNSS_ANT   | 56      | GND      |

**NOTE**

Before the normal power up, pin48 cannot be pulled up.

## 2.2 Pin Description

Table 4: IO parameters definition

| Pin type | Description                    |
|----------|--------------------------------|
| PI       | Power input                    |
| PO       | Power output                   |
| AI       | Analog input                   |
| AIO      | Analog input/output            |
| I/O      | Bidirectional input /output    |
| DI       | Digital input                  |
| DO       | Digital output                 |
| DOH      | Digital output with high level |
| DOL      | Digital output with low level  |
| PU       | Pull up                        |
| PD       | Pull down                      |

Table 5: Pin Description

| Pin name              | Pin No.  | Default status | Description  | Comment   |
|-----------------------|--|----------------|--|---|
| <b>Power supply</b>   |  |                |  |   |
| VBAT                  | 33,34  | PI             | Power supply, voltage range: 3.4~4.2V.   |   |
| L11_1V8               | 23   | PO             | 1.8V output with Max. 50ma current output for external circuit, such as level shift circuit. | If unused, keep it open.                                    |
| GND                   | 1, 3, 6, 15,16,22,28, 29,31,32,35, 43,44,46,47, 53,54,56 |                | Ground   |   |
| <b>System Control</b> |  |                |  |   |
| PWRKEY                | 30   | DI,PU          | System power on/off control input, active low.   | Default 0.8V  |
| RESET                 | 24   | DI, PU         | System reset control input, active low.  | RESET has been pulled up to 1.8V via a resistor internally. |
| <b>SIM interface</b>  |  |                |  |   |
| SIM_DATA              | 10   | I/O,PU         | SIM Card data I/O, which has been pulled up via a 10KR resistor to SIM_VDD internally.       | All lines of SIM interface should be                        |

|                       |    |       |   |  |
|-----------------------|----|-------|---|--|
| SIM_RST               | 13 | DO    | SIM Reset   | protected against ESD.                                 |
| SIM_CLK               | 11 | DO    | SIM clock   |  |
| SIM_VDD               | 14 | PO    | Power output for SIM card, its output Voltage depends on SIM card type automatically. Its output current is up to 50ma. |  |
| <b>USB</b>            |    |       |   |  |
| VBUS                  | 9  | DI,PD | Valid USB detection input with 3.0~5.25V detection voltage  |  |
| USB_DM                | 7  | I/O   | Negative line of the differential, bi-directional USB signal.   |  |
| USB_DP                | 8  | I/O   | Positive line of the differential, bi-directional USB signal.   |  |
| <b>UART interface</b> |    |       |   |  |
| RTS                   | 36 | DOL   | Request to send   |  |
| CTS                   | 41 | DI,PU | Clear to Send   |  |
| RXD                   | 39 | DI,PU | Receive Data  |  |
| RI                    | 42 | DOH   | Ring Indicator  | If unused, keep them open.                             |
| DCD                   | 37 | DOH   | Carrier detects   |  |
| TXD                   | 38 | DOH   | Transmit Data   |  |
| DTR                   | 40 | DI,PU | DTE get ready   |  |
| <b>I2C interface</b>  |    |       |   |  |
| SCL                   | 4  | DO    | I2C clock output  | If unused, keep them open.                             |
| SDA                   | 5  | I/O   | I2C data input/output   |  |
| <b>PCM interface</b>  |    |       |   |  |
| PCM_OUT               | 21 | DO    | PCM data output.  |  |
| PCM_IN                | 20 | DI    | PCM data input.   | If unused, please keep them open.                      |
| PCM_SYNC              | 19 | DO    | PCM data frame sync signal.   |  |
| PCM_CLK               | 18 | DO    | PCM data bit clock.   |  |
| I2S_MCLK              | 17 | DO    | Audio Master clock  |  |
| <b>GPIO</b>           |    |       |   |  |
| NETLIGHT              | 52 | DO    | LED control output as network status indication.  |  |
| STATUS                | 50 | DO    | Operating status output.<br>High level: Power on and firmware ready<br>Low level: Power off                             | If unused, please keep them open.                      |
| GPIO_1                | 26 | IO    | GPIO  |  |
| FlightMode            | 49 | DI,PU | Flight Mode control input.<br>High level(or open): Normal Mode<br>Low level: Flight Mode<br>Default: GPIO               | FlightMode Can't be used when Module is in sleep mode. |
| SIM_DET               | 12 | IO    | Optional: SIM card detecting input.<br>H: SIM is removed<br>L: SIM is inserted  |  |
| GPIO_37               | 48 | IO    | Boot configuration input.<br>Module will be forced into USB down load mode by connect 23                                |  |

pin to VDD\_1V8 during power up.

**RF interface**

|          |    |     |                                 |
|----------|----|-----|---------------------------------|
| MAIN_ANT | 45 | AIO | MAIN antenna soldering pad      |
| DIV_ANT  | 2  | AI  | Auxiliary antenna soldering pad |
| GNSS_ANT | 55 | AI  | GNSS antenna soldering pad      |

**Other interface**

|         |    |    |                                 |                                   |
|---------|----|----|---------------------------------|-----------------------------------|
| ISINK   | 27 | AI | Ground-referenced current sink. |                                   |
| DGB_TXD | 51 | DO | Use for debug                   | If unused, please keep them open. |
| ADC     | 25 | AI | Analog-digital converter input  |                                   |

### 2.3 Mechanical Information

The following figure shows the package outline drawing of Module.

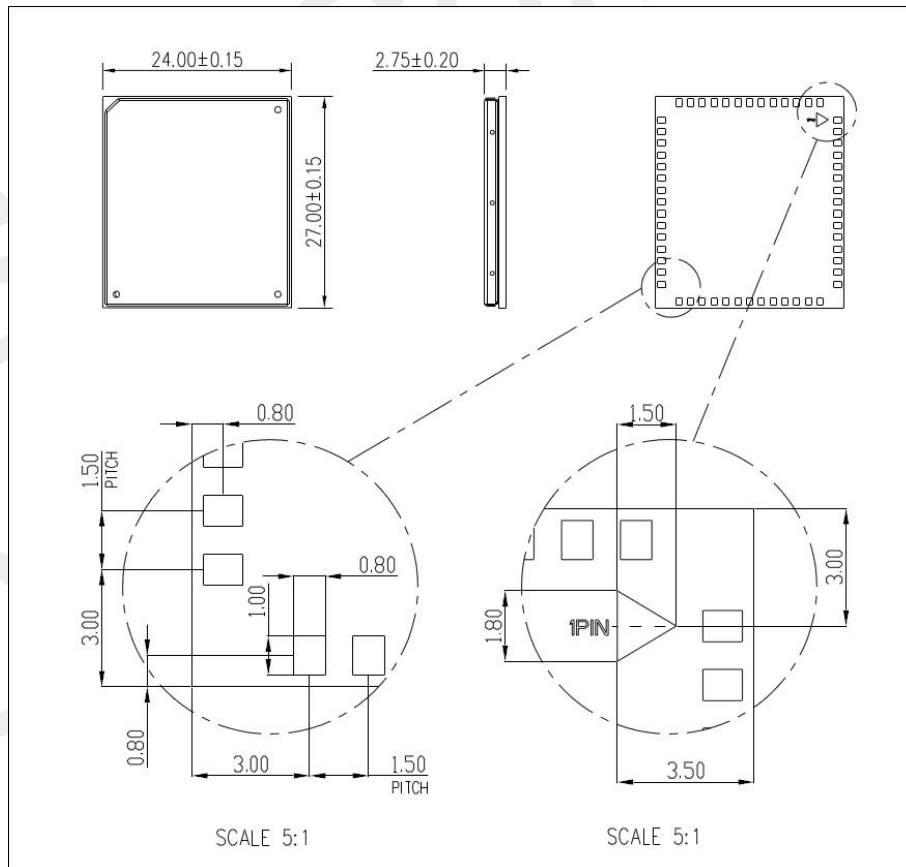


Figure 3: Dimensions (Unit: mm)

## 2.4 Footprint Recommendation

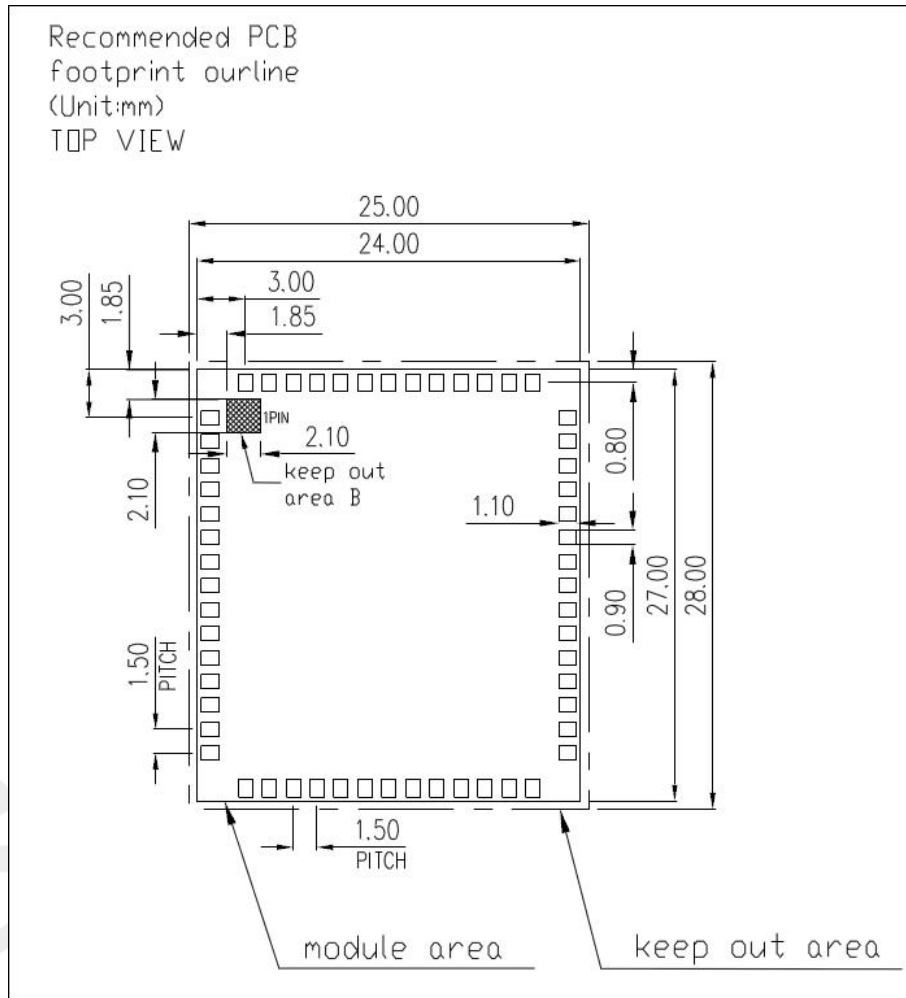


Figure 4: Footprint recommendation (Unit: mm)

## 3 Interface Application

### 3.1 Power Supply

On VBAT pads, a ripple current up to 2A typically, may cause voltage drop. Therefore, the power supply for these pads must be able to provide sufficient current up to more than 2A in order to avoid the voltage drop of more than 300mV.

**Table 6: VBAT Pins electronic characteristic**

| Symbol                       | Parameter                                   | Min                          | Type | Max | Unit |
|------------------------------|---|------------------------------|------|-----|------|
| VBAT                         | Module power voltage                        | 3.4                          | 3.8  | 4.2 | V    |
| I <sub>VBAT(peak)</sub>      | Module power peak current in normal mode.   | 1.0                          | -    | 2   | A    |
| I <sub>VBAT(average)</sub>   | Module power average current in normal mode | Please refer to the table 35 |      |     |      |
| I <sub>VBAT(sleep)</sub>     | Power supply current in sleep mode          |                              |      |     |      |
| I <sub>VBAT(power-off)</sub> | Module power current in power off mode.     | -                            | -    | 20  | uA   |

#### 3.1.1 Power supply Design Guide

Make sure that the voltage on the VBAT pins will never drop below 3.4V.

#### NOTE

If the power supply for BAT pins can support up to 2A, using a total of more than 220uF capacitors is recommended, or else users must use a total of 1000uF capacitors, in order to avoid the voltage drop of more than 300mV.

Some multi-layer ceramic chip (MLCC) capacitors (0.1/1uF) with low ESR in high frequency band can be used for EMC.

These capacitors should be put as close as possible to VBAT pads. Also, user should keep VBAT trace on the circuit board wider than 2 mm to minimize PCB trace impedance. The following figure shows the recommended circuit.

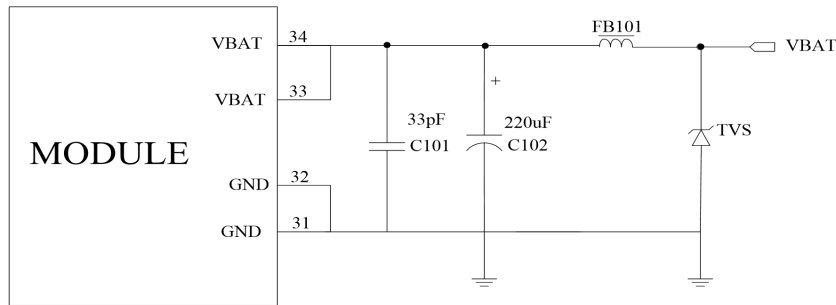


Figure 5: Power supply application circuit

In addition, in order to guard for ESD or surge protection, it is suggested to use a TVS to protect the module.

Table 7: Recommended TVS list

| No | Manufacturer | Part Number    | Reverse Stand-Off Voltage | Package    |
|----|--------------|----------------|---------------------------|------------|
| 1  | Js-ele       | ESDBW5V0A1     | 5V                        | DFN1006-2L |
| 2  | Prisem       | PESDHC2FD4V5BH | 4.5V                      | DFN1006-2L |
| 3  | Way-on       | WS05DPF-B      | 5V                        | DFN1006-2L |
| 4  | Will semi    | ESD5611N       | 5V                        | DFN1006-2L |
| 5  | Will semi    | ESD56151W05    | 5V                        | SOD-323    |
| 6  | Way-on       | WS4.5DPV       | 4.5V                      | DFN1610-2L |

### 3.1.2 Recommended Power Supply Circuit

It is recommended that a switching mode power supply or linear regulator power supply is used. It is important to make sure that all the components used in the power supply circuit can resist a peak current up to 2A.

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

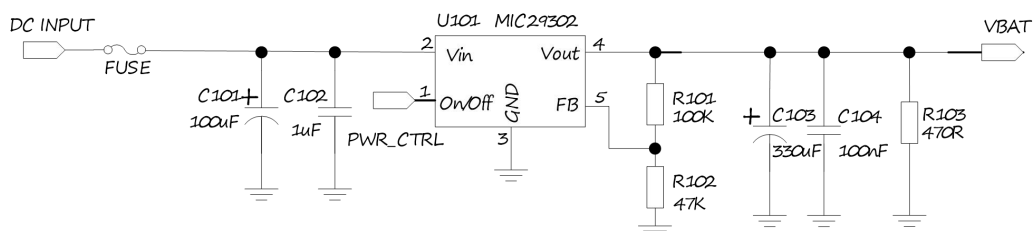


Figure 6: Linear regulator reference circuit

If there is a big voltage difference between input and output for VBAT power supply, or the efficiency is extremely important, then a switching mode power supply will be preferable. The following figure shows the switching mode power supply reference circuit.

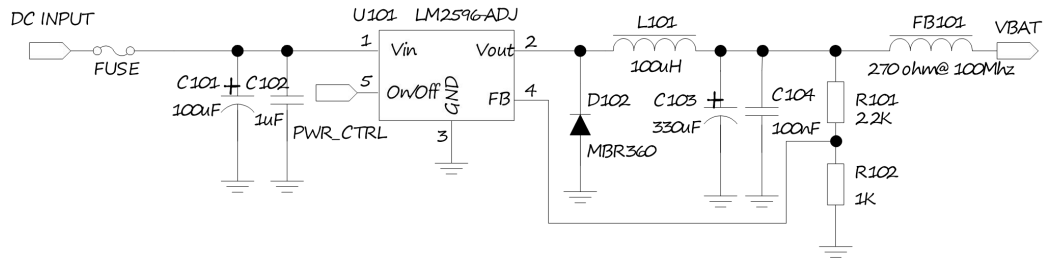


Figure 7: Switching mode power supply reference circuit

#### NOTE

The Switching Mode power supply solution for VBAT must be chosen carefully against Electro Magnetic Interference and ripple current from depraving RF performance.

### 3.1.3 Voltage Monitor

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

For monitoring the VBAT voltage outside or within a special range, the AT command “AT+CVALARM” can be used to enable the under-voltage warning function.

If users need to power off Module, when the VBAT voltage is out of a range, the AT command “AT+CPMVT” can be used to enable under-voltage power-off function.

#### NOTE

Under-voltage warning function and under-voltage power-off function are disabled by default. For more information about these AT commands, please refer to Document [1].

## 3.2 Power on/Power off/Reset Function

### 3.2.1 Power on

Module can be powered on by pulling the PWRKEY pin down to ground.

The PWRKEY pin has been pulled up with a diode to 1.8V internally, so it does not need to be pulled up externally. It is strongly recommended to put a 100nF capacitor, an ESD protection diode, close to the PWRKEY pin as it would strongly enhance the ESD performance of PWRKEY pin. Please refer to the following figure for the recommended reference circuit.

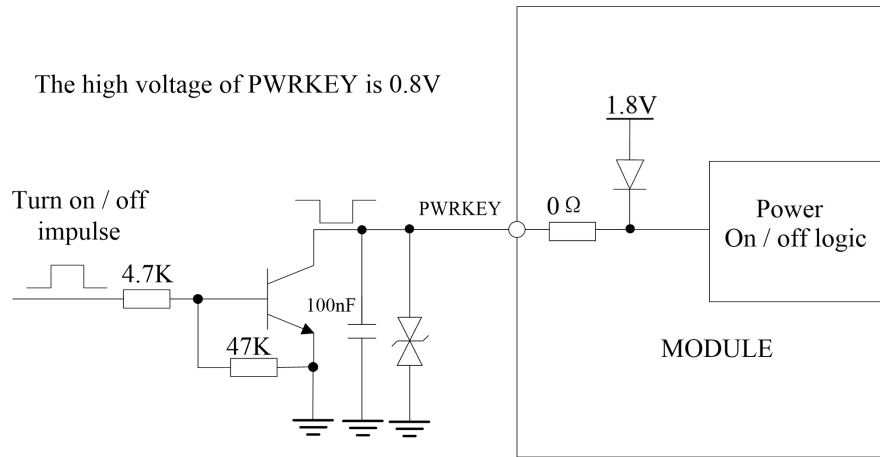


Figure 8: Reference Power on/off Circuit

**NOTE**

Module could be automatically power on by connecting PWRKEY pin to ground via 0R resistor directly.

The power-on scenarios are illustrated in the following figure.

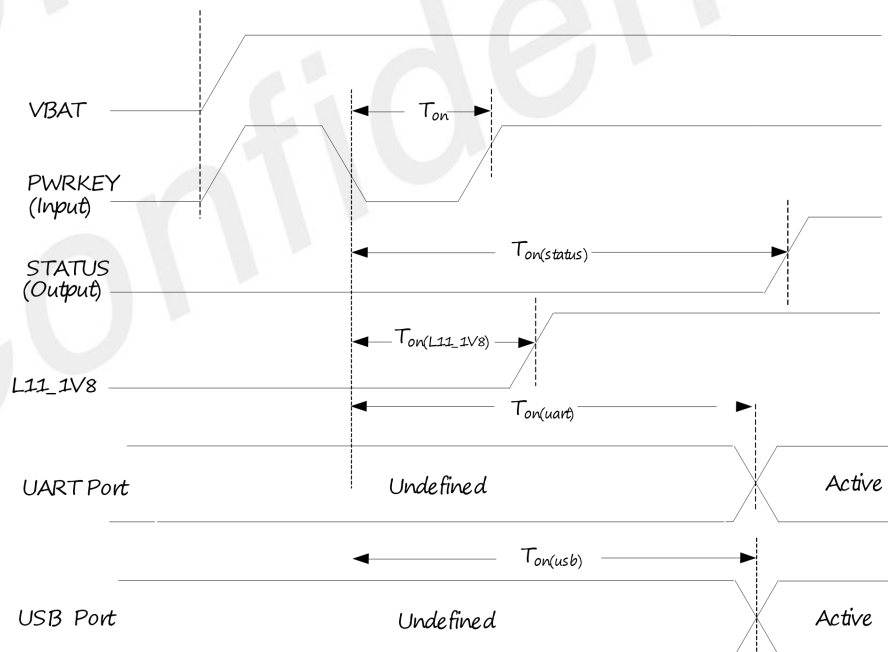


Figure 9: Power on timing sequence

**Table 8: Power on timing and Electronic Characteristic**

| Symbol             | Parameter  | Min  | Type | Max | Unit |
|--------------------|--|------|------|-----|------|
| $T_{on}$           | The time of active low level impulse of PWRKEY pin to power on module                    | 100  | 500  | -   | ms   |
| $T_{on(status)}$   | The time from power-on issue to STATUS pin output high level(indicating power up ready ) | 12   | 13   | -   | s    |
| $T_{on(L11\_1V8)}$ | The time from power-on issue to L11_1V8 ready  | 100  | -    | -   | ms   |
| $T_{on(uart)}$     | The time from power-on issue to UART port ready  | 11   | 12   |     | s    |
| $T_{on(usb)}$      | The time from power-on issue to USB port ready   | 11   | 12   |     | s    |
| $V_{IH}$           | Input high level voltage on PWRKEY pin   | 0.6  | 0.8  | 1.8 | V    |
| $V_{IL}$           | Input low level voltage on PWRKEY pin  | -0.3 | 0    | 0.5 | V    |

### 3.2.2 Power off

The following methods can be used to power off Module.

- Method 1: Power off Module by pulling the PWRKEY pin down to ground.
- Method 2: Power off Module by AT command “AT+CPOF”.
- Method 3: Over-voltage or under-voltage automatic power off. The voltage range can be set by AT command “AT+CPMVT”.
- Method 4: Over-temperature or under-temperature automatic power off.

#### NOTE

If the temperature is outside the range of  $-30\sim+80^{\circ}\text{C}$ , some warning will be reported via AT port. If the temperature is outside the range of  $-40\sim+85^{\circ}\text{C}$ , Module will be powered off automatically. For details about “AT+CPOF” and “AT+CPMVT”, please refer to Document [1].

These procedures will make modules disconnect from the network and allow the software to enter a safe state and save data before modules are powered off completely.

The power off scenario by pulling down the PWRKEY pin is illustrated in the following figure.

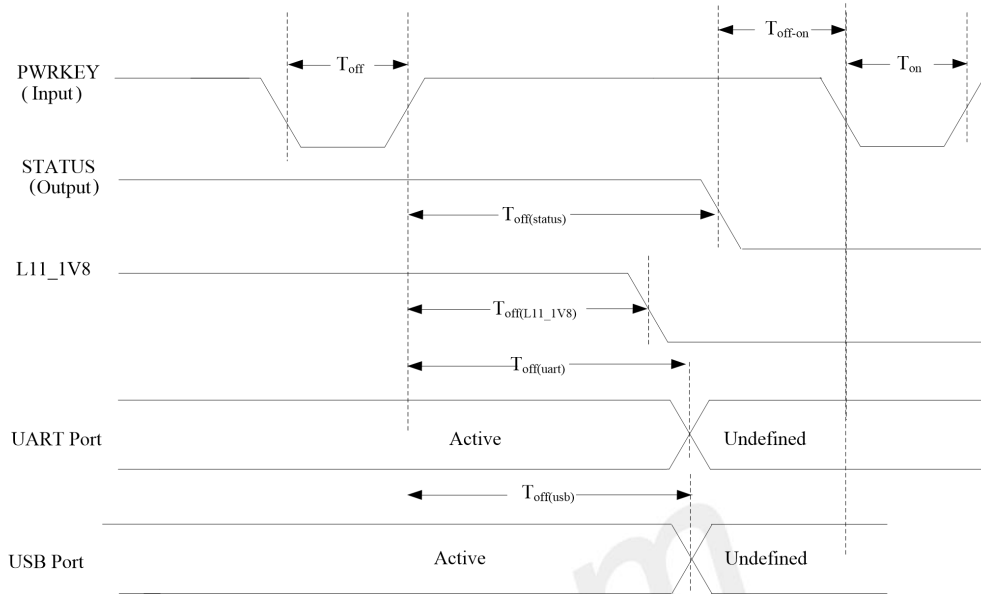


Figure 10: Power off timing sequence

Table 9: Power off timing and Electronic Characteristic

| Symbol              | Parameter  | Time value |      |     | Unit |
|---------------------|--|------------|------|-----|------|
|                     |  | Min        | Type | Max |      |
| $T_{off}$           | The active low level time pulse on PWRKEY pin to power off module                    | 2.5        | --   | 5.0 | s    |
| $T_{off(status)}$   | The time from power-off issue to STATUS pin output low level(indicating power off )* | 25         | 26   | -   | s    |
| $T_{off(L11\_1V8)}$ | The time from power-off issue to L11_1V8   | 20         | -    | -   | s    |
| $T_{off(usb)}$      | The time from power-off issue to UART port off                                       | 14         | 15   | -   | s    |
| $T_{off(usb)}$      | The time from power-off issue to USB port off  | 27         | 28   | -   | s    |
| $T_{off-on}$        | The buffer time from power-off issue to power-on issue                               | 0          | -    | -   | s    |

**NOTE**

The STATUS pin can be used to detect whether module is powered on or not. When module has been powered on and firmware goes ready, STATUS will be high level, or else STATUS will still low level. It is suggested that the host can cut off the power off the module, when the module could not switch off by PWRKEY of RESET interface, customer could cut off the power to restart the module. If the PWERKY and RESET key works normally, it is not suggested to switch off module by remove the power supply for that might damage the flash. The power off time may vary for the local net status.

### 3.2.3 Reset Function

Module can be reset by pulling the RESET pin down to ground.

#### NOTE

This function is only used as an emergency reset when AT command “AT+CPOF” and the PWRKEY pin all have lost efficacy.

The RESET pin has been pulled up to 1.8V internally, so it does not need to be pulled up externally. It is strongly recommended to put a 100nF capacitor and an ESD protection diode close to the RESET pin. Please refer to the following figure for the recommended reference circuit.

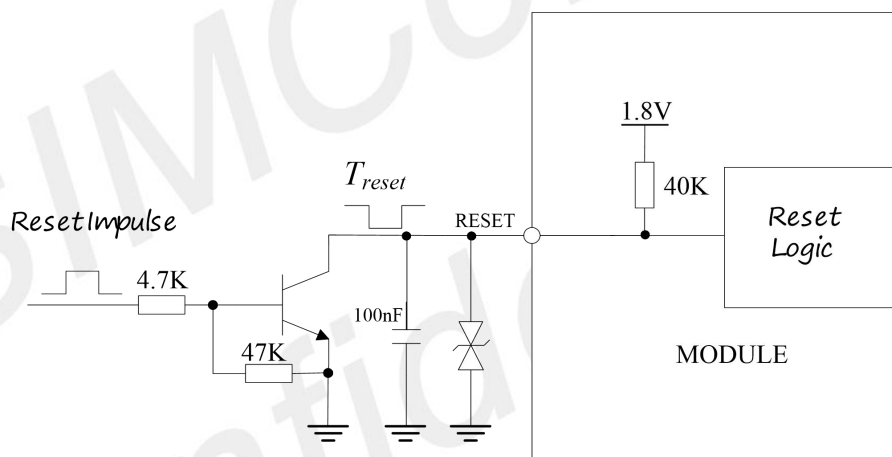


Figure 11: Reference reset circuit

Table 10: RESET pin electronic characteristic

| Symbol      | Parameter  | Min  | Type | Max | Unit |
|-------------|--|------|------|-----|------|
| $T_{reset}$ | The active low level time impulse on RESET pin to reset module | 100  |      |     | ms   |
| $V_{IH}$    | Input high level voltage                                       | 1.17 | 1.8  | 2.1 | V    |
| $V_{IL}$    | Input low level voltage  | -0.3 | 0    | 0.8 | V    |

### 3.3 UART Interface

Module provides a 7-wire UART (universal asynchronous serial transmission) interface as DCE (Data Communication Equipment). AT commands and data transmission can be performed through UART interface.

### 3.3.1 UART Design Guide

The following figures show the reference design.

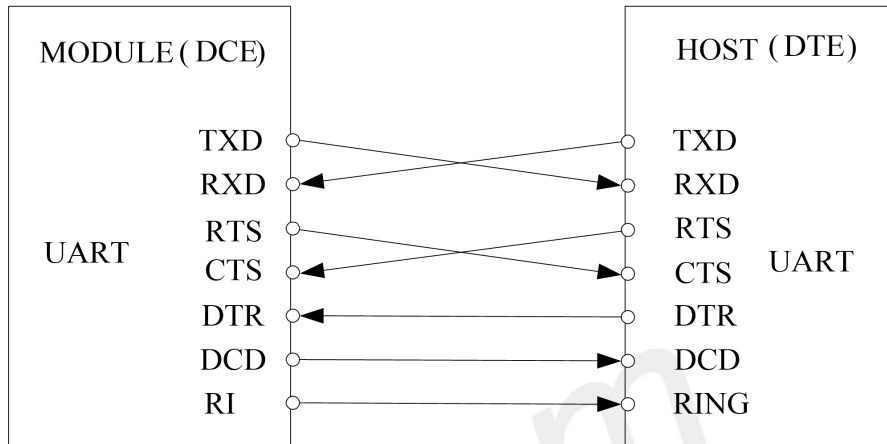


Figure 12: UART Full modem

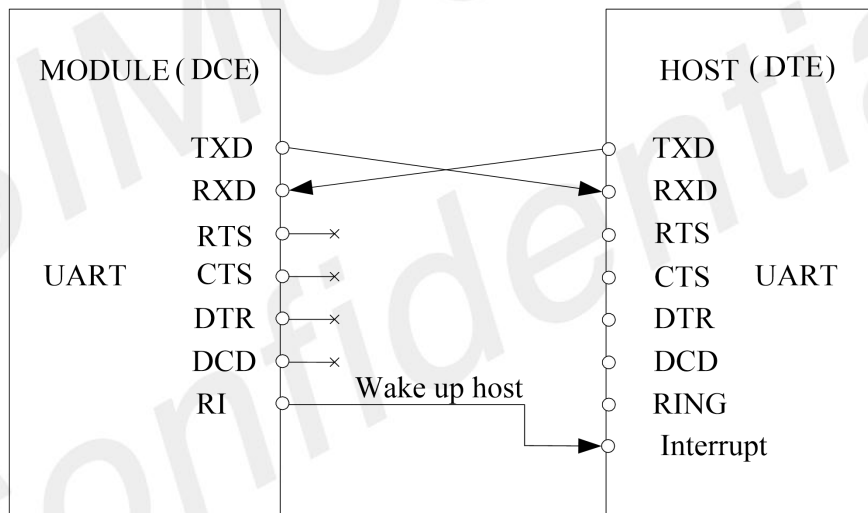


Figure 13: UART Null modem

The Module UART is 1.8V voltage interface. If user's UART application circuit is a 3.3V voltage interface, the level shifter circuits should be used for voltage matching. The TXB0108RGYR provided by Texas Instruments is recommended. The following figure shows the voltage matching reference design.

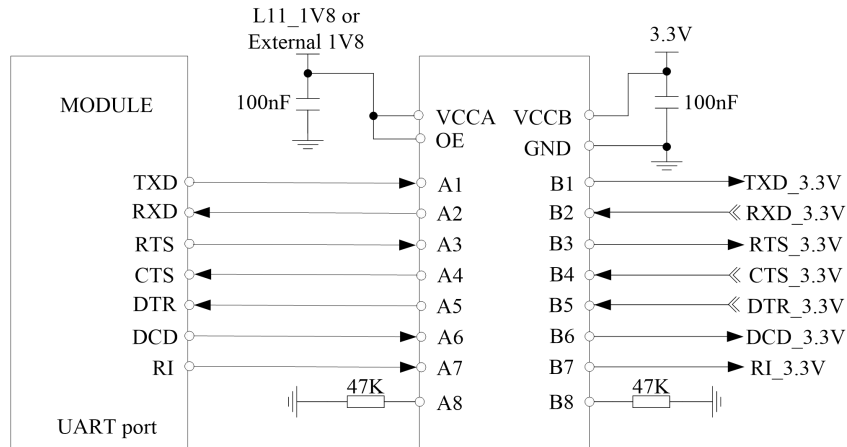


Figure 14: Reference circuit of level shift

To comply with RS-232-C protocol, the RS-232-C level shifter chip should be used to connect Module to the RS-232-C interface, for example SP3238ECA, etc.

**NOTE**

Module supports the following baud rates: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3200000, 3686400. The default band rate is 115200bps.

### 3.3.2 RI and DTR Behavior

The RI pin can be used to interrupt output signal to inform the host controller such as application CPU.

Normally RI will stay at high level until certain conditions such as receiving SMS, or a URC report come in. It will then change to low level. It will stay low until the host controller clears the interrupted event with "AT+CRIRS" AT command.

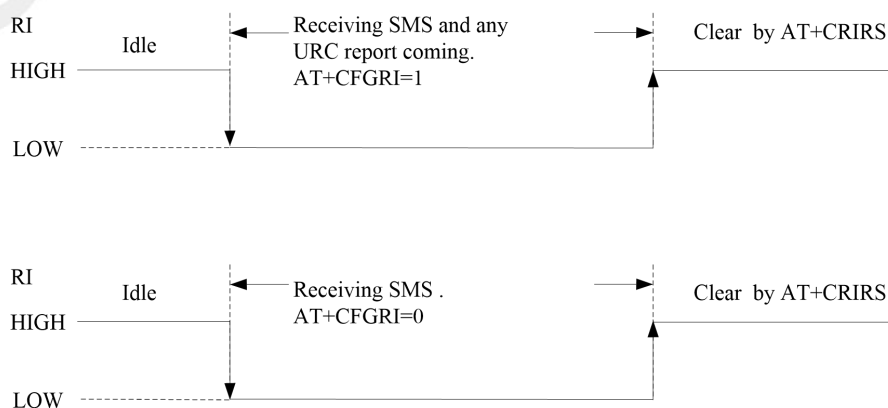


Figure 15: RI behaviour (SMS and URC report)

Normally RI will be kept high until a voice call, then it will output periodic rectangular wave with 5900ms low level and 100ms high level. It will output this kind of periodic rectangular wave until the call is answered or hung up.

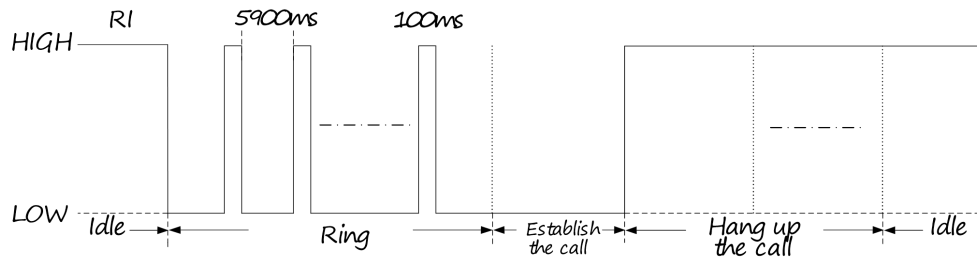


Figure 16: RI behaviour (voice call)

**NOTE**

For more details of AT commands about UART, please refer to document [1] and [22].

DTR pin can be used to wake Module from sleep. When Module enters sleep mode, pulling down DTR can wake Module.

### 3.4 USB Interface

The Module contains a USB interface compliant with the USB2.0 specification as a peripheral, but the USB charging function is not supported.

Module can be used as a USB device. Module supports the USB suspend and resume mechanism which can reduce power consumption. If there is no data transmission on the USB bus, Module will enter suspend mode automatically and will be resumed by some events such as voice call, receiving SMS, etc.

The USB interface is a frequency used debug port; it is suggested to reserved test point.

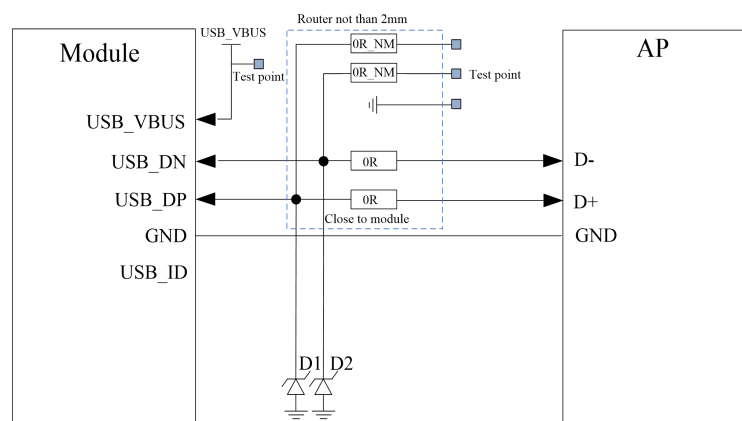


Figure 17: USB reference circuit

Because of the high bit rate on USB bus, more attention should be paid to the influence of the junction capacitance of the ESD component on USB data lines. Typically, the capacitance should be less than 1pF.

It is recommended to use an ESD protection component such as ESD9L5.0ST5G provided by On Semiconductor ([www.onsemi.com](http://www.onsemi.com)).

**NOTE**

1. The USB\_DM and USB\_DP nets must be traced by 90Ohm+/-10% differential impedance.
2. Must reserve USB interfaces or test points to for software debug.
3. Must reserve pin51(DBG\_TXD) and PIN23(L11\_1V8) interface or test point to for software debug.

### 3.5 SIM Interface

Module supports both 1.8V and 3.0V SIM Cards.

**Table 11: SIM Electronic characteristic in 1.8V mode (SIM\_VDD =1.8V)**

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

**Table 12: SIM Electronic characteristic 3.0V mode (SIM\_VDD =2.95V)**

| Symbol          | Parameter                 | Min           | Type | Max          | Unit |
|-----------------|---------------------------|---------------|------|--------------|------|
| SIM_VDD         | LDO power output voltage  | 2.75          | 2.95 | 3.05         | V    |
| V <sub>IH</sub> | High-level input voltage  | 0.65*SIM_VDD  | -    | SIM_VDD +0.3 | V    |
| V <sub>IL</sub> | Low-level input voltage   | -0.3          | 0    | 0.25*SIM_VDD | V    |
| V <sub>OH</sub> | High-level output voltage | SIM_VDD -0.45 | -    | SIM_VDD      | V    |
| V <sub>OL</sub> | Low-level output voltage  | 0             | 0    | 0.45         | V    |

### 3.5.1 SIM Application Guide

It is recommended to use an ESD protection component such as ESDA6V1W5 produced by ST ([www.st.com](http://www.st.com)) or SMF15C produced by ON SEMI ([www.onsemi.com](http://www.onsemi.com)). Note that the SIM peripheral circuit should be close to the SIM card socket. The following figure shows the 8-pin SIM card holder reference circuit.

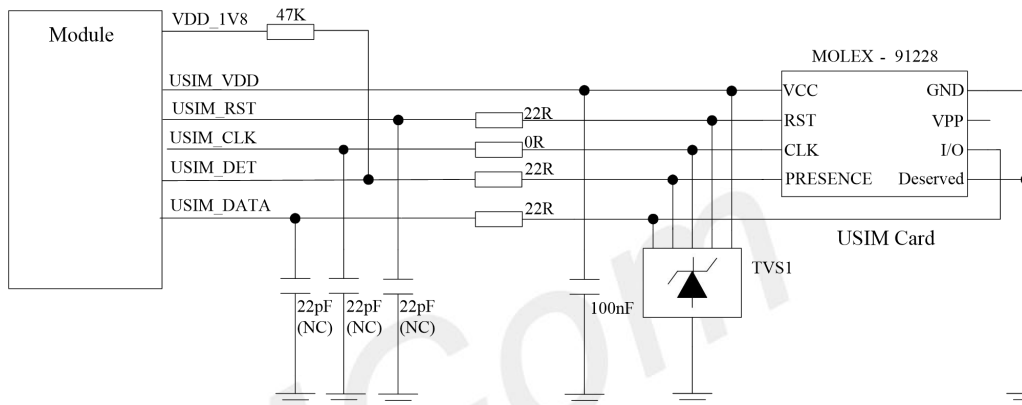


Figure 18: Reference circuit of the 8-pin SIM card holder

The SIM\_DET pin is used for detection of the SIM card hot plug in. User can select the 8-pin SIM card holder to implement SIM card detection function.

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

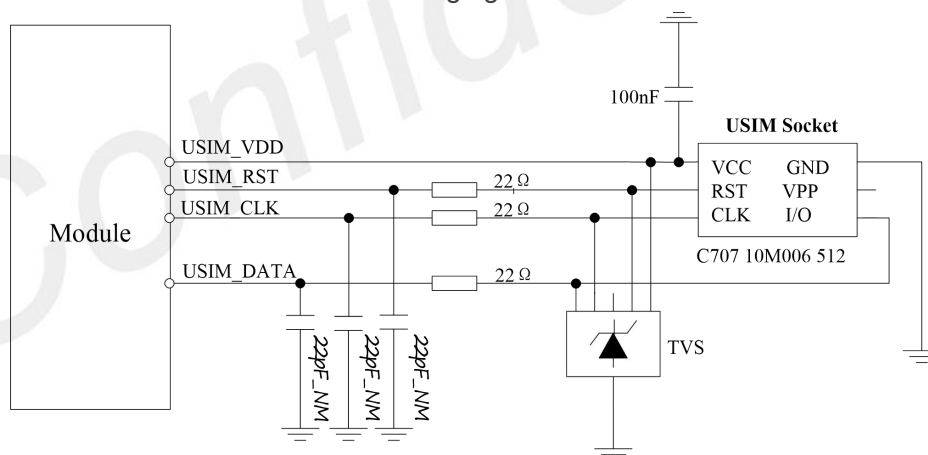


Figure 19: SIM interface reference circuit

#### NOTE

SIM\_DATA has been pulled up with a 10KΩ resistor to SIM\_VDD in module. A 100nF capacitor on SIM\_VDD is used to reduce interference. For more details of AT commands about SIM, please refer to document [1].

### 3.5.2 SIM Card Design Guide

SIM card signal could be interfered by some high frequency signal, it is strongly recommended to follow these guidelines while designing:

- SIM card holder should be far away from main antenna
- SIM traces should keep away from RF lines, VBAT and high-speed signal lines
- The traces should be as short as possible
- Keep SIM card holder's GND connect to main ground directly
- Shielding the SIM card signal by ground well
- Recommended to place a 100nF capacitor on SIM\_VDD line and keep close to the SIM card holder
- Add some TVS which parasitic capacitance should not exceed 50pF
- Add 22Ω resistor to (SIM\_RST/SIM\_CLK/SIM\_DATA) signal could enhance ESD protection
- Mount 22pF capacitor to (SIM\_RST/SIM\_CLK/SIM\_DATA) signal if having RF signal interference

### 3.5.3 Recommended SIM Card Holder

It is recommended to use the 6-pin SIM socket such as C707 10M006 512 produced by Amphenol. User can visit <http://www.amphenol.com> for more information about the holder.

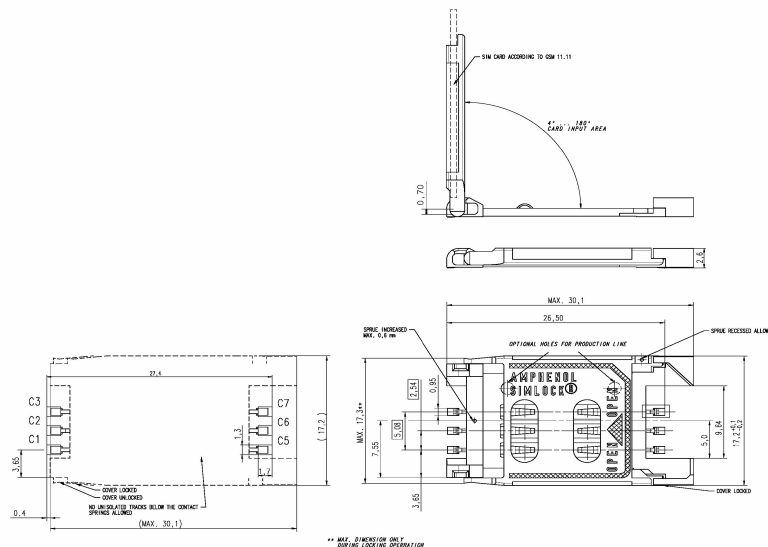


Figure 20: Amphenol SIM card socket

Table 13: Amphenol SIM Socket Pin Description

| Pin | Signal   | Description            |
|-----|----------|------------------------|
| C1  | SIM_VDD  | SIM Card Power supply. |
| C2  | SIM_RST  | SIM Card Reset.        |
| C3  | SIM_CLK  | SIM Card Clock.        |
| C5  | GND      | Connect to GND.        |
| C6  | VPP      |                        |
| C7  | SIM_DATA | SIM Card data I/O.     |

### 3.6 PCM Interface

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

**Table 14: PCM Format**

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

**NOTE**

For more details about PCM AT commands, please refer to document [1].

#### 3.6.1 PCM Timing

Module supports 2.048 MHz PCM data and sync timing for 16 bits linear format codec.

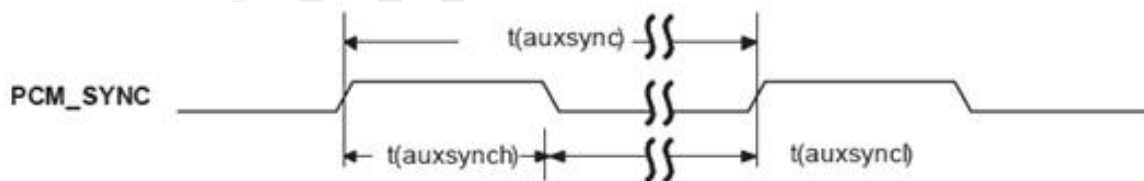


Figure 21: PCM\_SYNC timing

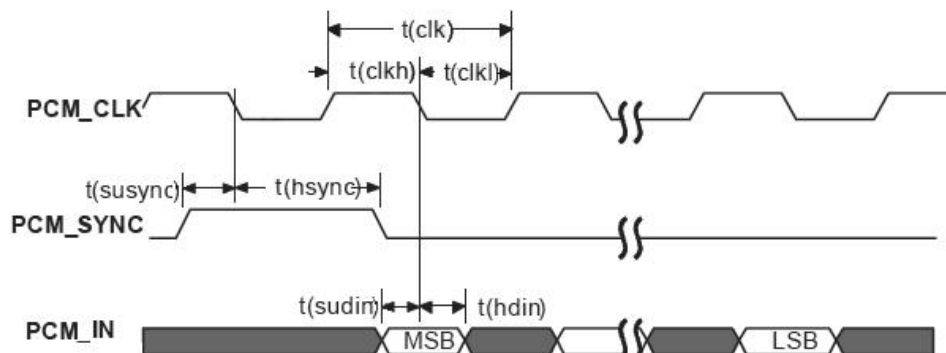


Figure 22: EXT CODEC to MODULE timing

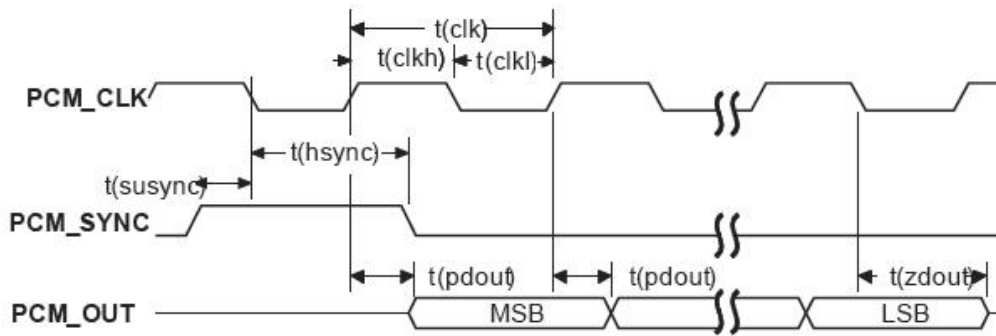


Figure 23: MODULE to EXT CODEC timing

Table 15: PCM Timing parameters

| Parameter             | Description   | Min. | Typ.  | Max. | Unit |
|-----------------------|---|------|-------|------|------|
| T(sync)               | PCM_SYNC cycle time                                     | –    | 125   | –    | µs   |
| T(synch)              | PCM_SYNC high level time                                | –    | 488   | –    | ns   |
| T(sync <sub>l</sub> ) | PCM_SYNC low level time                                 | –    | 124.5 | –    | µs   |
| T(clk)                | PCM_CLK cycle time                                      | –    | 488   | –    | ns   |
| T(clkh)               | PCM_CLK high level time                                 | –    | 244   | –    | ns   |
| T(clkl)               | PCM_CLK low level time                                  | –    | 244   | –    | ns   |
| T(susync)             | PCM_SYNC setup time high before falling edge of PCM_CLK | –    | 122   | –    | ns   |
| T(hsync)              | PCM_SYNC hold time after falling edge of PCM_CLK        | –    | 366   | –    | ns   |
| T(sudin)              | PCM_IN setup time before falling edge of PCM_CLK        | 60   | –     | –    | ns   |
| T(hdin)               | PCM_IN hold time after falling edge of PCM_CLK          | 60   | –     | –    | ns   |
| T(pdout)              | Delay from PCM_CLK rising to PCM_OUT valid              | –    | –     | 60   | ns   |
| T(zdout)              | Delay from PCM_CLK falling to PCM_OUT HIGH-Z            | –    | –     | 60   | ns   |

### 3.6.2 PCM Application Guide

The following figure shows the external codec reference design.

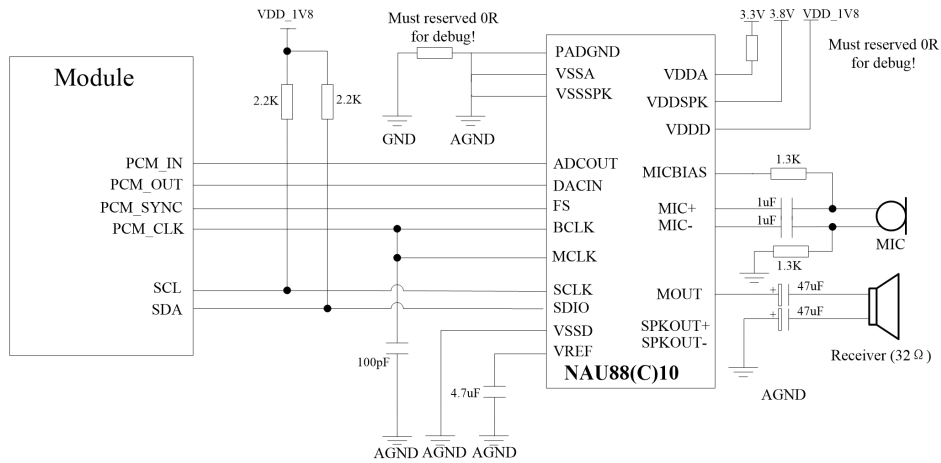


Figure 24: Audio Codec Reference Circuit

**NOTE**

Module can transmit PCM data by the USB port besides the PCM interface. For more details please refer to documents [1] and [23].

### 3.7 I2C Interface

Module provides a I2C interface compatible with I2C specification, version 2.1, with clock rate up to 400 kbps. Its operation voltage is 1.8V.

#### 3.7.1 I2C Design Guide

The following figure shows the I2C bus reference design.

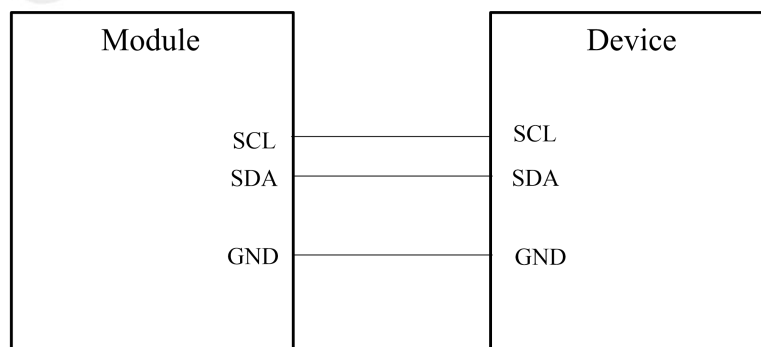


Figure 25: I2C reference circuit

**NOTE**

SDA and SCL have pull-up resistors in module. So, 2 external pull up resistors are not needed in application circuit.

“AT+CRIC and AT+CWIC” AT commands could be used to read/write register values of the I2C peripheral devices. For more details about AT commands please refer to document [1].

### 3.8 Network Status

The NETLIGHT pin is used to control Network Status LED, its reference circuit is shown in the following figure.

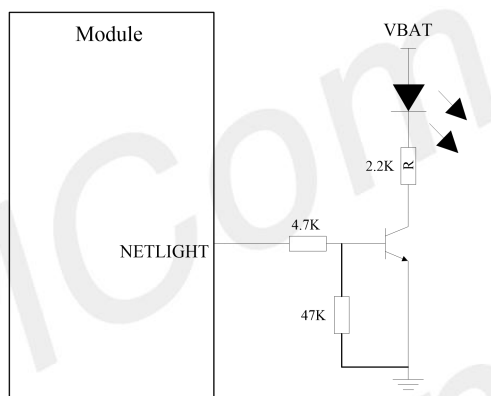


Figure 26: NETLIGHT reference circuit

**NOTE**

The value of the resistor named “R” depends on the LED characteristic.

Table 16: NETLIGHT pin status

| NETLIGHT pin status | Module status  |
|---------------------|--|
| Always On           | Searching Network; Call Connect(include VOLTE,SRLTE) |
| 200ms ON, 200ms OFF | Data Transmit; 4G registered;                        |
| 800ms ON, 800ms OFF | 2G/3G registered network                             |
| OFF                 | Power off ;Sleep                                     |

**NOTE**

NETLIGHT output low level as “OFF”, and high level as “ON”.

### 3.9 Operating Status Indication

The pin50 is for operating status indication of the module. The pin output is high when module is powered on, and output is low when module is powered off.

**Table 17: Pin definition of the STATUS**

| Pin name | Pin number | Description                 |
|----------|------------|-----------------------------|
| STATUS   | 50         | Operating status indication |

**NOTE**

For timing about STATUS, please reference to the chapter “3.2 power on/down scenarios”

### 3.10 Flight Mode Control

The FLIGHTMODE pin can be used to control SIM7500x to enter or exit the Flight mode. In Flight mode, the RF circuit is closed to prevent interference with other equipment’s and minimize current consumption. Bidirectional ESD protection component is suggested to add on FLIGHTMODE pin, its reference circuit is shown in the following figure.

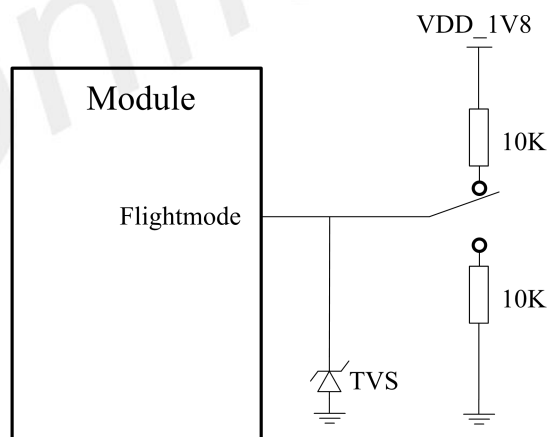


Figure 27: Flight Mode Switch Reference Circuit

**Table 18: FLIGHTMODE Pin Status**

| FLIGHTMODE Pin Status | Module operation          |
|-----------------------|---------------------------|
| Input Low Level       | Flight Mode: RF is closed |
| Input High Level      | AT+CFUN=0: RF is closed   |

AT+CFUN=1:RF is working

**NOTE**

FlightMode Can't be used when Module is in sleep mode.

### 3.11 Pin Multiplex Function

Some pins of Module could be used for alternate function besides default function.

**Table 19: Pin multiplex function list**

| Pin Number | Pin Name | Default Function | Alternate Function         |
|------------|----------|------------------|----------------------------|
| 4          | SCL      | SCL              | GPIO11                     |
| 5          | SDA      | SDA              | GPIO10                     |
| 12         | SIM_DET  | GPIO34           | SIM_DET                    |
| 18         | PCM_CLK  | PCM_CLK          | GPIO23,SPI_CLK<br>I2C_SCL  |
| 19         | PCM_SYNC | PCM_SYNC         | GPIO20,SPI_MOSI            |
| 20         | PCM_IN   | PCM_IN,          | GPIO21,SPI_MISO            |
| 21         | PCM_OUT  | PCM_OUT          | GPIO22,SPI_CS_N<br>I2C_SDA |

**NOTE**

For more details of AT commands about GPIO multiplex function, please refer to document [1].

### 3.12 Other interface

#### 3.12.1 Sink Current Source

The ISINK pin is VBAT tolerant and intended to drive some passive devices such as LCD backlight, white LED, etc. Its output current can be up to 40 mA and be set by the AT command “AT+ CLEDITST”.

**Table 20: Sink current electronic characteristic**

| Symbol | Description | Min. | Typ. | Max. | Unit |
|--------|-------------|------|------|------|------|
|--------|-------------|------|------|------|------|

|             |                  |     |   |           |    |
|-------------|------------------|-----|---|-----------|----|
| $V_{ISINK}$ | Voltage tolerant | 0.5 | - | $V_{BAT}$ | V  |
| $I_{ISINK}$ | Current tolerant | 0   | - | 40        | mA |

$I_{SINK}$  is a ground-referenced current sink. The following figure shows its reference circuit.

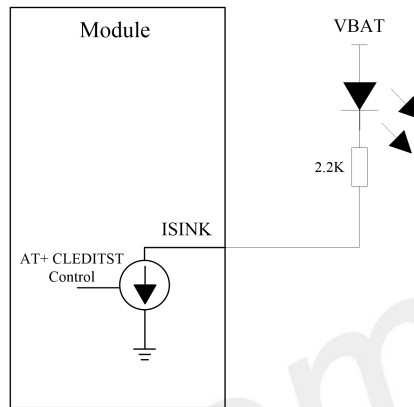


Figure 28:  $I_{SINK}$  reference circuit

**NOTE**

The sinking current can be adjusted to meet the design requirement through the AT command “AT+ CLEDITST =<0>, <value>”. The “value” ranges from 0 to 8, on behalf of the current from 0mA to 40mA by 5mA step.

### 3.12.2 ADC

Module has 1 dedicated ADC pins named ADC. They are available for digitizing analog signals such as battery voltage and so on. These electronic specifications are shown in the following table.

**Table 21: ADC Electronic Characteristics**

| Characteristics         | Min. | Typ. | Max. | Unit      |
|-------------------------|------|------|------|-----------|
| Resolution              | –    | 15   | –    | Bits      |
| Input Range             | 0.1  |      | 1.7  | V         |
| Input serial resistance | 1    | –    | –    | $M\Omega$ |

**NOTE**

“AT+CADC” can be used to read the voltage of the ADC pins, for more details, please refer to document

[1].

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## 4 RF Specifications

### 4.1 WCDMA/ LTE RF Specifications

Table 22: Conducted transmission power

| Frequency        | Power         | Min.       |
|------------------|---------------|------------|
| E-GSM900         | 33dBm ±2dB    | 5dBm ± 5dB |
| DCS1800          | 30dBm ±2dB    | 0dBm ± 5dB |
| E-GSM900 (8-PSK) | 27dBm ±3dB    | 5dBm ± 5dB |
| DCS1800 (8-PSK)  | 26dBm +3/-4dB | 0dBm ±5dB  |
| WCDMA B1         | 24dBm +1/-3dB | <-50dBm    |
| WCDMA B2         | 24dBm +1/-3dB | <-50dBm    |

|             |                |         |
|-------------|----------------|---------|
| WCDMA B5    | 24dBm +1/-3dB  | <-50dBm |
| WCDMA B8    | 24dBm +1/-3dB  | <-50dBm |
| LTE-FDD B1  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B2  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B3  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B4  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B5  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B7  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B8  | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B12 | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B18 | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B19 | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B20 | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B26 | 23dBm +/-2.7dB | <-40dBm |
| LTE-FDD B28 | 23dBm +/-2.7dB | <-40dBm |

**Table 23: Operating frequencies**

| Frequency   | Receiving           | Transmission   |
|-------------|---------------------|----------------|
| E-GSM900    | 925~960MHz          | 880~915 MHz    |
| DCS1800     | 1805~1880MHz        | 1710~1785MHz   |
| WCDMA B1    | 2110 ~2170 MHz      | 1920 ~1980 MHz |
| WCDMA B2    | 1930~1990 MHz       | 1850~1910 MHz  |
| WCDMA B5    | 869~894 MHz         | 824~849 MHz    |
| WCDMA B8    | 925~960 MHz         | 880 ~915 MHz   |
| LTE-FDD B1  | 2110 ~2170 MHz      | 1920 ~1980 MHz |
| LTE-FDD B2  | 1930 ~1990 MHz      | 1850 ~1910 MHz |
| LTE-FDD B3  | 1805 ~1880 MHz      | 1710 ~1785 MHz |
| LTE-FDD B4  | 2110~2155 MHz       | 1710 ~1755 MHz |
| LTE-FDD B5  | 869~894 MHz         | 824~849 MHz    |
| LTE-FDD B7  | 2620~2690 MHz       | 2500 ~2570 MHz |
| LTE-FDD B8  | 925~960 MHz         | 880 ~915 MHz   |
| LTE-FDD B12 | 729 ~746 MHz        | 699 ~716 MHz   |
| LTE-FDD B18 | 860 ~875 MHz        | 815~830 MHz    |
| LTE-FDD B19 | 875 ~890 MHz        | 830~845 MHz    |
| LTE-FDD B20 | 832 ~862 MHz        | 791~821 MHz    |
| LTE-FDD B26 | 859 ~894 MHz        | 814~849 MHz    |
| LTE-FDD B28 | 758 ~803 MHz        | 703~748 MHz    |
| GPS         | 1574.4 ~1576.44 MHz | -              |
| GLONASS     | 1598 ~1606 MHz      | -              |
| BD          | 1559 ~1563 MHz      | -              |

**Table 24: Conducted receive sensitivity**

| Frequency   | Receive sensitivity(Typical) | Receive sensitivity(MAX) |
|-------------|------------------------------|--------------------------|
| E-GSM900    | < -109dBm                    | 3GPP                     |
| DCS1800     | < -109dBm                    | 3GPP                     |
| WCDMA B1    | < -110dBm                    | 3GPP                     |
| WCDMA B2    | < -110dBm                    | 3GPP                     |
| WCDMA B5    | < -110dBm                    | 3GPP                     |
| WCDMA B8    | < -110dBm                    | 3GPP                     |
| LTE FDD/TDD | See table 21.                | 3GPP                     |

**Table 25: Reference sensitivity (QPSK)**

| E-UTRA band | 3GPP standard |        |       |       |        |        | Test value@ 10 MHz |
|-------------|---------------|--------|-------|-------|--------|--------|--------------------|
|             | 1.4 MHz       | 3MHz   | 5MHz  | 10MHz | 15 MHz | 20 MHz |                    |
| FDD B1      | -             | -      | -100  | -97   | -95.2  | -94    | -101.3             |
| FDD B2      | -102.7        | -99.7  | -98   | -95   | -93.2  | -92    | -101               |
| FDD B3      | -101.7        | -98.7  | -97   | -94   | -92.2  | -91    | -100               |
| FDD B4      | -104.7        | -101.7 | -100  | -97   | -95.2  | -94    | -102               |
| FDD B5      | -103.2        | -100.2 | -98   | -95   | -      | -      | -101               |
| FDD B7      | -             | -      | -98   | -95   | -93.2  | -92    | -98                |
| FDD B8      | -102.2        | -99.2  | -97   | -94   | -      | -      | -99.8              |
| FDD B12     | -101.7        | -98.7  | -97   | -94   | -      | -      | -101.5             |
| FDD B18     | -             | -      | -100  | -97   | -95.2  | -      | -101               |
| FDD B19     | -             | -      | -100  | -97   | -95.2  | -      | -101               |
| FDD B20     | -             | -      | -97   | -94   | -91.2  | -90    | -102               |
| FDD B25     | -101.2        | -98.2  | -96.5 | -93.5 | -91.7  | -90.5  | -100               |
| FDD B26     | -102.7        | -99.7  | -97.5 | -94.5 | -92.7  | -      | -101               |
| FDD B28     | -             | -100.2 | -98.5 | -95.5 | -93.7  | -91    | TBD                |

## 4.2 GSM/WCDMA/LTE Antenna Design Guide

Users should connect antennas to Module's antenna pads through the micro-strip line or other types of RF trace. The trace impedance must be controlled in 50Ω. SIMCom recommends that the total insertion loss between Module and antenna should meet the following requirements:

**Table 26: Recommended Passive Antenna Characteristics**

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

**Table 27: Trace Loss**

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

To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.

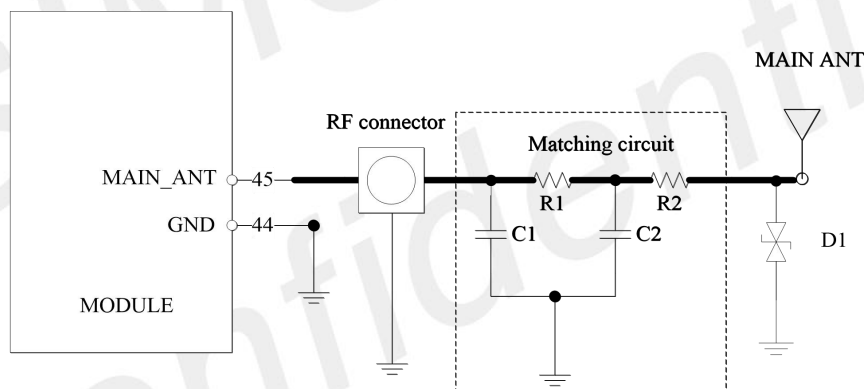


Figure 29: Antenna matching circuit (MAIN\_ANT)

In above figure, the components R1,C1,C2 and R2 are used for antenna matching, the value of components can only be achieved after the antenna tuning and usually provided by antenna vendor. By default, the R1, R2 are 0Ω resistors, and the C1, C2 are reserved for tuning. The component D1 is a TVS for ESD protection, and it is optional for users according to application environment.

The RF test connector is used for the conducted RF performance test, and should be placed as close as to the module's MAIN\_ANT pin. The traces impedance between Module and antenna must be controlled in 50Ω.

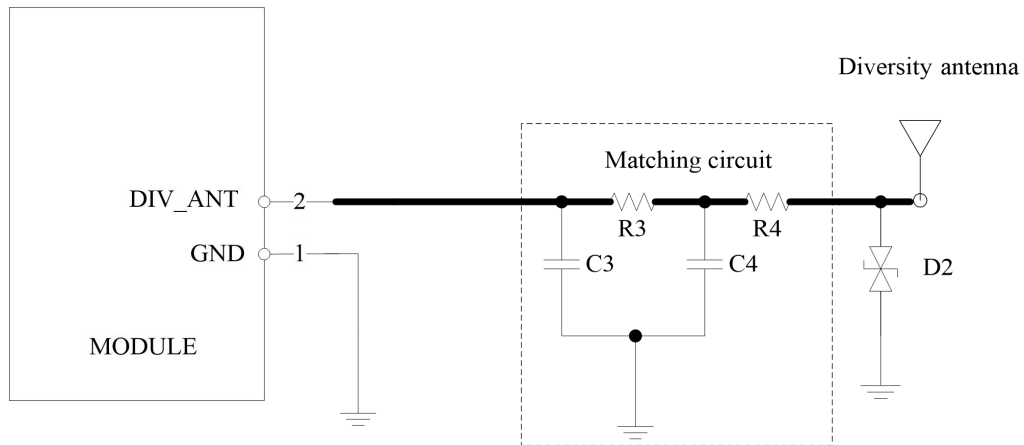


Figure 30: Antenna matching circuit (DIV\_ANT)

In above figure, R3, C3, C4 and R4 are used for auxiliary antenna matching. By default, the R3, R4 are 0Ω resistors, and the C3, C4 are reserved for tuning. D2 is a TVS for ESD protection, and it is optional for users according to application environment.

Two TVS are recommended in the table below.

Table 28: Recommended TVS

| Package | Part Number  | Vender   |
|---------|--------------|----------|
| 0201    | WE05DGCMS-BH | CYGWAYON |
| 0402    | PESD0402-03  | PRISEMI  |
| 0402    | PESD0402-12  | PRISEMI  |

**NOTE**

SIMCom suggests the LTE auxiliary antenna to be kept on, since there are many high bands in the designing of FDD-LTE. Because of the high insert loss of the RF cable and layout lines, the receiver sensitivity of these bands above will have risk to meet the authentication without the diversity antenna. For more details about auxiliary antenna design notice, please refer to document [24]

## 4.3 GNSS

SIM7500 series merges GNSS satellite and network information to provide a high-availability solution that offers industry-leading accuracy and performance. This solution performs well, even in very challenging environmental conditions where conventional GNSS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates.

### 4.3.1 GNSS Technical specification

- Tracking sensitivity: -159 dBm (GPS) /-158 dBm (GLONASS) /-159dBm(BD)
- Cold-start sensitivity: -148 dBm
- Accuracy (Open Sky): 2.5m (CEP50)
- TTFF (Open Sky) : Hot start <1s, Cold start<35s
- Receiver Type: 16-channel, C/A Code
- GPS L1 Frequency: 1575.42±1.023MHz
- GLONASS: 1597.5~1605.8 MHz
- BD: 1559.05~1563.14 MHz
- Update rate: Default 1 Hz
- GNSS data format: NMEA-0183
- GNSS Current consumption : 100mA ((WCDMA/LTE Sleep ,in total on VBAT pins)
- GNSS antenna: Passive/Active antenna

#### NOTE

If the antenna is active type, the power should be given by main board, because there is no power supply on GPS antenna pad. If the antenna is passive, it is suggested that the external LNA should be used.

### 4.3.2 GNSS Application Guide

Users can adopt an active antenna or a passive antenna as GNSS signal transceiver. In this document, all GNSS specification mentioned is from passive antenna. The following is the reference circuit.

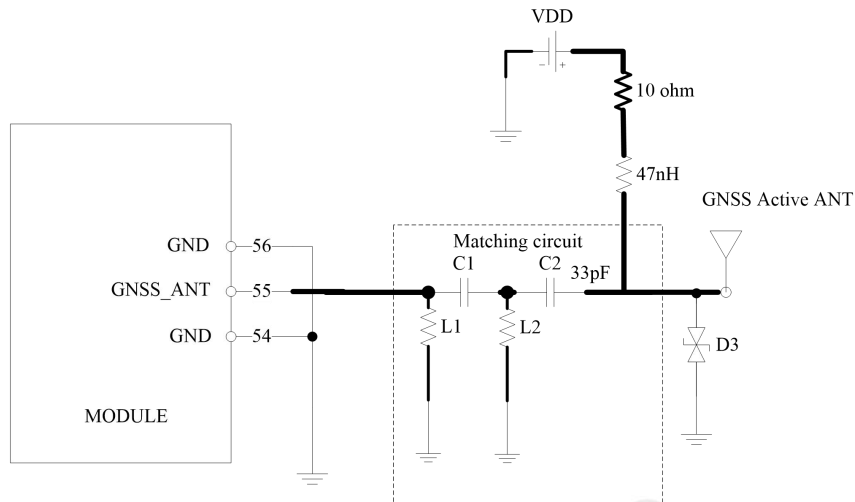


Figure 31: Active antenna circuit

**NOTE**

If customer need save the power when the GNSS function is disabled, then customer should design a switch circuit to cut off the active antenna power to get a lower power consumption.

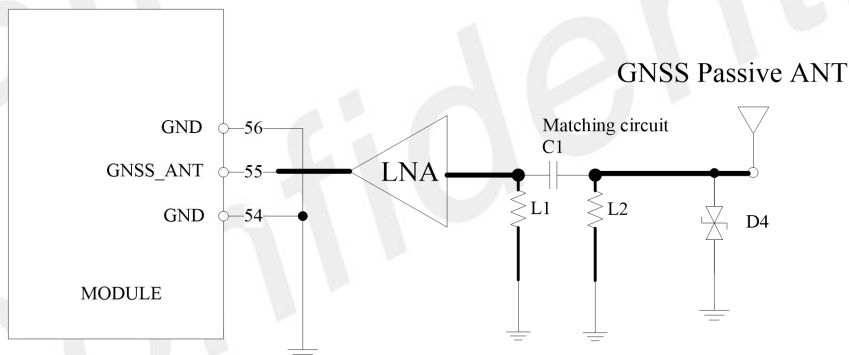


Figure 32: Passive antenna circuit (Default)

In above figures, the components C1 and L1, L2 are used for antenna matching, the values of the components can only be obtained after the antenna tuning and usually provided by antenna vendor. C2 in Figure 29 is used for DC blocking. L3 is the matching component of the external LNA, and the value of L3 is determined by the LNA characteristic and PCB layout. Both VDD of active antenna and V\_LNA need external power supplies which should be considered according to active antenna and LNA characteristic. LDO/DCDC is recommended to get lower current consuming by shutting down active antennas and LNA when GNSS is not working.

LNA should apply the following requirements as table 28. LNA is also suggested to put near the passive antenna.

**Table 29: LNA requirements**

| Parameter | Min | Max | Unit |
|-----------|-----|-----|------|
| Vdd       | 1.5 | 3.3 | V    |
| Idd       |     | 3   | mA   |
| LNA_EN    | 1.3 |     | V    |
| Gain      | 14  | 17  | dB   |
| VSWR      |     | 2   |      |

GNSS can be used by NMEA port. User can select NMEA as output through UART or USB. NMEA sentences are automatic and no command is provided. NMEA sentences include GSV, GGA, RMC, GSA, and VTG. Before using GNSS, user should configure SIM7500 series in proper operating mode by AT command. Please refer to related document for details. SIM7500 series can also get position location information through AT directly.

**NOTE**

GNSS is closed by default, it could be started by AT+CGPS. The AT command has two parameters, the first is on/off, and the second is GNSS mode. Default mode is standalone mode. AGPS mode needs more support from the mobile telecommunication network. Please refer to document [24] for more details.

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## 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 30: Absolute maximum ratings**

| Parameter       | Min  | Max | Unit |
|-----------------|------|-----|------|
| Voltage at VBAT | -0.5 | 4.7 | V    |

|   |      |      |   |
|---|------|------|---|
| Voltage at VBUS                                       | -0.5 | 5.5  | V |
| Voltage at digital pins (RESET,SPI,GPIO,I2C,UART,PCM) | -0.3 | 2.1  | V |
| Voltage at digital pins :SIM                          | -0.3 | 3.05 | V |
| Voltage at PWRKEY                                     | -0.3 | 1.8  | V |

## 5.2 Operating Conditions

**Table 31: Recommended operating ratings**

| Parameter       | Min | Type | Max  | Unit |
|-----------------|-----|------|------|------|
| Voltage at VBAT | 3.4 | 3.8  | 4.2  | V    |
| Voltage at VBUS | 3.0 | 5    | 5.25 | V    |

**Table 32: 1.8V Digital I/O characteristics**

| Parameter       | Description  | Min. | Typ. | Max. | Unit |
|-----------------|--|------|------|------|------|
| V <sub>IH</sub> | High-level input voltage                           | 1.17 | 1.8  | 2.1  | V    |
| V <sub>IL</sub> | Low-level input voltage                            | -0.3 | 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>OH</sub> | High-level output current(no pull down resistor)   | -    | 2    | -    | mA   |
| I <sub>OL</sub> | Low-level output current(no pull up resistor)      | -    | -2   | -    | mA   |
| I <sub>IH</sub> | Input high leakage current (no pull down resistor) | -    | -    | 1    | uA   |
| I <sub>IL</sub> | Input low leakage current(no pull up resistor)     | -1   | -    | -    | uA   |

### NOTE

These parameters are for digital interface pins, such as SPI, GPIOs (NETLIGHT), I2C, UART, PCM.

The operating temperature of Module is listed in the following table.

**Table 33: Operating temperature**

| Parameter                       | Min | Type | Max | Unit |
|---------------------------------|-----|------|-----|------|
| Normal operation temperature    | -30 | 25   | 80  | °C   |
| Extended operation temperature* | -40 | 25   | 85  | °C   |
| Storage temperature             | -45 | 25   | +90 | °C   |

**NOTE**

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

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## 5.3 Operating Mode

### 5.3.1 Operating Mode Definition

The table below summarizes the various operating modes of Module series products.

**Table 34: Operating Mode Definitions**

| Mode             | Function   |
|------------------|--|
| Normal operation | GSM/WCDMA / LTE<br>Sleep<br>In this case, the current consumption of module will be reduced to the minimal level and the module can still receive paging message and SMS and TCP/UDP.                    |
|                  | GSM/WCDMA / LTE<br>Idle<br>Software is active. Module is registered to the network, and the module is ready to communicate.  |
|                  | GSM/WCDMA / LTE<br>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, antenna. |

|                                    |   |
|------------------------------------|---|
| GSM/WCDMA/LTE Standby              | Module is ready for data transmission, but no data is currently sent or received. In this case, power consumption depends on network settings.  |
| GPRS/EDGE/WCDMA / LTE transmission | There is data transmission in progress. In this case, power consumption is related to network settings (e.g. power control level); uplink/downlink data rates, etc.   |
| Minimum functionality mode         | AT command "AT+CFUN=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 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 FLIGHTMODE pin can be used to set the module to flight mode without removing the power supply. In this mode, the RF part of the module will not work but the serial port and USB port are still accessible. The power consumption in this mode is lower than normal mode.                        |
| Power off                          | Module will go into power off mode by sending the AT command "AT+CPOF" or by pulling down the PWRKEY pin normally. In this mode the power management unit shuts down the power supply and software is not active. The serial port and USB are is not accessible.  |

### 5.3.2 Sleep mode

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

Several hardware and software conditions must be satisfied together 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 and refer to Document [25] for more details.

### 5.3.3 Minimum functionality mode and Flight Mode

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

AT+CFUN=0: Minimum functionality

AT+CFUN=1: Full functionality (Default)

AT+CFUN=4: Flight mode

If Module has been set to minimum functionality mode, the RF function and SIM card function will be closed. In this case, the serial port and USB are still accessible, but RF function and SIM card will be unavailable.

If Module has been set to flight mode, the RF function will be closed. In this case, the serial port and USB are still accessible, but RF function will be unavailable.

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 consumption is listed in the table below.

**Table 35: Current consumption on VBAT Pins (VBAT=3.8V)**

| <b>GNSS</b>   |  |
|---|--|
| GNSS supply current<br>(AT+CFUN=0,with USB connection)        | @-140dBm, Tracking Typical:35mA  |
| <b>GSM Sleep mode/Idle Mode</b>                               |  |
| GSM/GPRS supply current<br>(GNSS off, without USB connection) | Sleep mode@BS_PA_MFRMS=2 Typical: 2.8mA<br>Idle mode@BS_PA_MFRMS=2 Typical: 18mA |
| <b>UMTS Sleep/Idle Mode</b>                                   |  |
| WCDMA supply current<br>(without USB connection)              | Sleep mode @DRX=9 Typical: 3.3mA<br>Idle mode @DRX=9 Typical: 17.5mA             |
| <b>LTE Sleep/Idle mode</b>                                    |  |
| LTE supply current<br>(without USB connection)                | Sleep mode @DRX=9 Typical: 2.3mA<br>Idle mode @DRX=9 Typical: 17.5mA             |

### GSM Talk

|         |                                |
|---------|--------------------------------|
| GSM 900 | @power level #5 Typical: 220mA |
| DCS1800 | @power level #5 Typical: 162mA |

### UMTS Talk

|          |                |                |
|----------|----------------|----------------|
| WCDMA B1 | @Power 23.0dBm | Typical: 535mA |
| WCDMA B2 | @Power 22.0dBm | Typical: 524mA |
| WCDMA B5 | @Power 23.5dBm | Typical: 480mA |
| WCDMA B8 | @Power 23.5dBm | Typical: 530mA |

### GPRS

|                       |                                |
|-----------------------|--------------------------------|
| GSM 900 ( 1 Rx,4 Tx ) | @power level #5 Typical: 230mA |
| DCS1800 ( 1 Rx,4 Tx ) | @power level #0 Typical: 195mA |
| GSM 900 ( 3Rx, 2 Tx ) | @power level #5 Typical: 370mA |
| DCS1800 ( 3Rx, 2 Tx ) | @power level #0 Typical: 275mA |

### EDGE

|                       |                                |
|-----------------------|--------------------------------|
| GSM 900 ( 1 Rx,4 Tx ) | @power level #8 Typical: 400mA |
| DCS1800 ( 1 Rx,4 Tx ) | @power level #2 Typical: 300mA |
| GSM 900 ( 3Rx, 2 Tx ) | @power level #8 Typical: 320mA |
| DCS1800 ( 3Rx, 2 Tx ) | @power level #2 Typical: 230mA |

### HSDPA Data

|          |                |                |
|----------|----------------|----------------|
| WCDMA B1 | @Power 22.5dBm | Typical: 406mA |
| WCDMA B2 | @Power 23.4dBm | Typical: 468mA |
| WCDMA B5 | @Power 23.6dBm | Typical: 426mA |
| WCDMA B8 | @Power 21.9dBm | Typical: 420mA |

### LTE Data

|             |         |         |                |
|-------------|---------|---------|----------------|
| LTE-FDD B1  | @5 MHz  | 22.2dBm | Typical: 482mA |
|             | @10 MHz | 22.7dBm | Typical: 489mA |
|             | @20 MHz | 22.4dBm | Typical: 534mA |
| LTE-FDD B2  | @5 MHz  | 22.2dBm | Typical: 589mA |
|             | @10 MHz | 22.7dBm | Typical: 577mA |
|             | @20 MHz | 22.4dBm | Typical: 626mA |
| LTE-FDD B3  | @5 MHz  | 22.2dBm | Typical: 479mA |
|             | @10 MHz | 22.7dBm | Typical: 491mA |
|             | @20 MHz | 22.4dBm | Typical: 538mA |
| LTE-FDD B4  | @5 MHz  | 23.1dBm | Typical: 519mA |
|             | @10 MHz | 23.0dBm | Typical: 556mA |
|             | @20 MHz | 22.8dBm | Typical: 600mA |
| LTE-FDD B5  | @3 MHz  | 24.0dBm | Typical: 489mA |
|             | @5 MHz  | 23.8dBm | Typical: 483mA |
|             | @10 MHz | 23.9dBm | Typical: 497mA |
| LTE-FDD B7  | @5 MHz  | 22.6dBm | Typical: 593mA |
|             | @10 MHz | 22.7dBm | Typical: 611mA |
|             | @20 MHz | 24.5dBm | Typical: 650mA |
| LTE-FDD B8  | @5 MHz  | 22.2dBm | Typical: 476mA |
|             | @10 MHz | 22.7dBm | Typical: 481mA |
| LTE-FDD B12 | @5 MHz  | 22.7dBm | Typical: 516mA |
|             | @10 MHz | 22.9dBm | Typical: 512mA |

|             |         |         |                |
|-------------|---------|---------|----------------|
| LTE-FDD B18 | @5 MHz  | 22.7dBm | Typical: 516mA |
|             | @10 MHz | 22.9dBm | Typical: 512mA |
| LTE-FDD B19 | @5 MHz  | 23.3dBm | Typical: 477mA |
|             | @10 MHz | 23.5dBm | Typical: 482mA |
| LTE-FDD B20 | @5 MHz  | 23.6dBm | Typical: 412mA |
|             | @10 MHz | 23.4dBm | Typical: 450mA |
| LTE-FDD B26 | @5 MHz  | 24.0dBm | Typical: 591mA |
|             | @10 MHz | 24.0dBm | Typical: 526mA |
|             | @20 MHz | 23.9dBm | Typical: 670mA |
| LTE-FDD B28 | @5 MHz  | 23.6dBm | Typical: 433mA |
|             | @10 MHz | 23.4dBm | Typical: 480mA |
|             | @20 MHz | 24.5dBm | Typical: 700mA |
|             | @5 MHz  | 23.9dBm | Typical: 700mA |
|             | @10 MHz | 23.8dBm | Typical: 608mA |
|             | @20 MHz | 24.5dBm | Typical: 700mA |

## 5.5 ESD Notes

Module is sensitive to ESD in the process of storage, transporting and assembling. Especially, Module is mounted on the users' mother board, The ESD components should be placed beside the connectors which human body might touch, such as SIM card holder, audio jacks, switches and keys, etc. The following table shows the Module ESD measurement performance without any external ESD component.

**Table 36: The ESD performance measurement table (Temperature: 25°C, Humidity: 45%)**

| Part         | Contact discharge | Air discharge |
|--------------|-------------------|---------------|
| GND          | +/-4K             | +/-8K         |
| VBAT         | +/-4K             | +/-8K         |
| Antenna port | +/-4K             | +/-8K         |
| USB          | +/-1K             | +/-2K         |
| UART         | +/-1K             | +/-2K         |
| PCM          | +/-1K             | +/-2K         |
| Other PADs   | +/-1K             | +/-2K         |

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## 6 SMT Production Guide

### 6.1 Top and Bottom View of Module

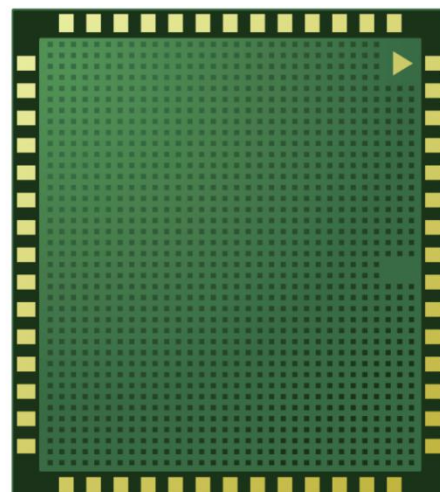
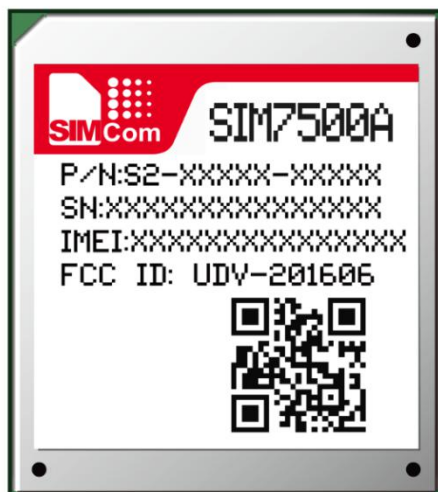


Figure 33: Top and bottom view of Module

**NOTE**

The above is the design effect diagram of the module for reference. The actual appearance is subject to the actual product.

## 6.2 Label Information

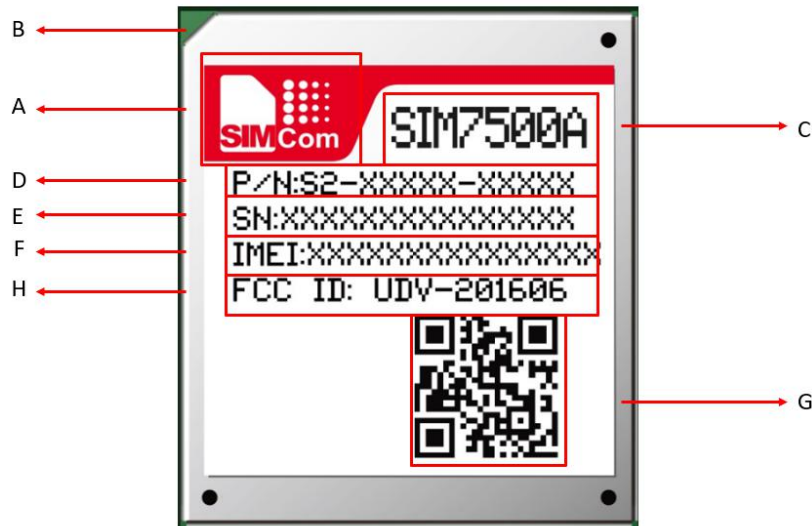


Figure 34: Label Information

Table 37: The Description of Label Information

| No. | Description                             |
|-----|---|
| A   | LOGO                                    |
| B   | No.1 Pin                                |
| C   | Project Name                            |
| D   | Product Code                            |
| E   | Serial Number                           |
| F   | International Mobile Equipment Identity |
| G   | QR code                                 |
| H   | Federal Communications Commission       |

## 6.3 Typical SMT Reflow Profile

SIMCom provides a typical soldering profile. Therefore the soldering profile shown below is only a generic recommendation and should be adjusted to the specific application and manufacturing constraints.

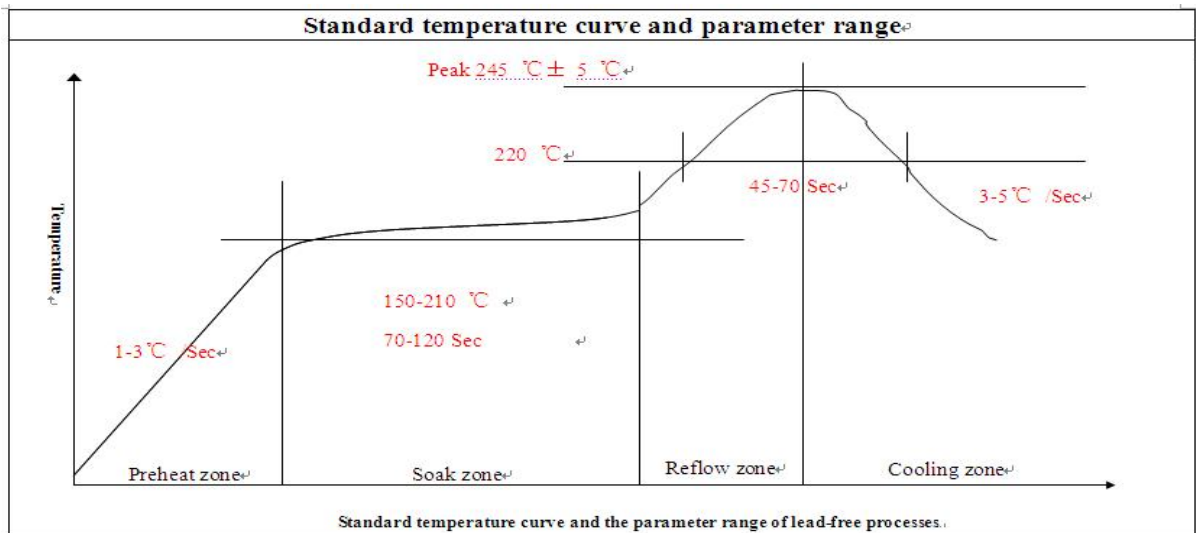


Figure 35: The ramp-soak-spike Reflow Profile of Module

**NOTE**

For more details about secondary SMT, please refer to the document [21].

## 6.4 Moisture Sensitivity Level (MSL)

Module is qualified to Moisture Sensitivity Level (MSL) 3 in accordance with JEDEC J-STD-033. If the prescribed time limit is exceeded, users should bake modules for 192 hours in drying equipment (<5% RH) at 40+5/-0°C, or 72 hours at 85+5/-5°C. Note that plastic tray is not heat-resistant, and only can be baked at 45° C.

**Table 38: Moisture Sensitivity Level and Floor Life**

| Moisture Sensitivity Level (MSL) | Floor Life (out of bag) at factory ambient ≤30°C/60% RH or as stated |
|----------------------------------|--|
| 1                                | Unlimited at ≤ 30°C/85% RH   |
| 2                                | 1 year   |
| 2a                               | 4 weeks  |
| 3                                | 168 hours  |
| 4                                | 72 hours   |
| 5                                | 48 hours   |

---

|    |  |
|----|--|
| 5a | 24 hours   |
| 6  | Mandatory bake before use. After bake, it must be reflowed within the time limit specified on the label. |

---

**NOTE**

IPC / JEDEC J-STD-033 standard must be followed for production and storage.

## 6.5 Stencil Foil Design Recommendation

The recommended thickness of stencil foil is 0.13mm.

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## 7 Packaging

Module support tray packaging.

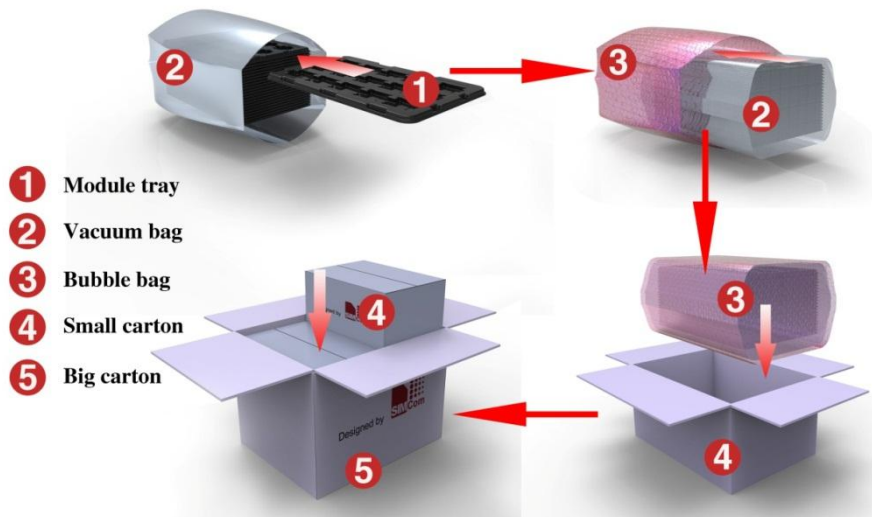


Figure 36: Packaging introduce

Module tray drawing:

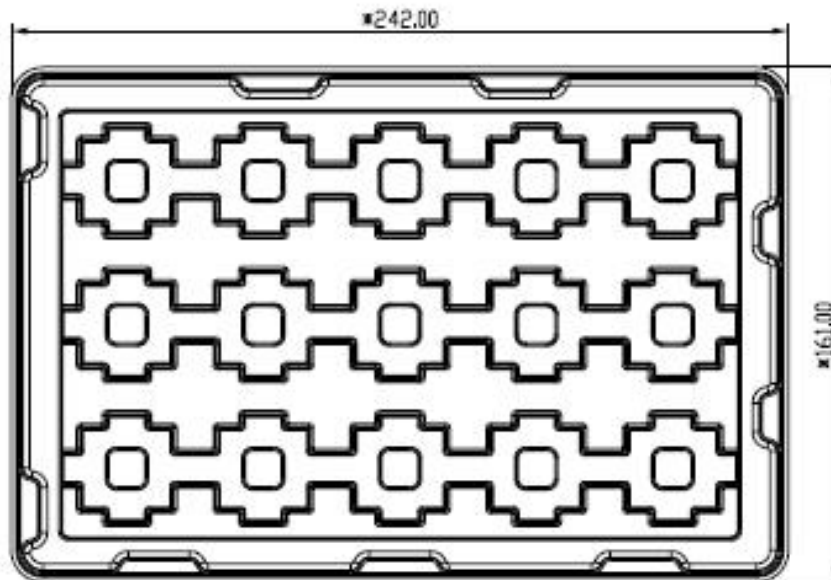


Figure 37: Tray drawing

Table 39: Tray size

| Length ( $\pm 3\text{mm}$ ) | Width ( $\pm 3\text{mm}$ ) | Number |
|-----------------------------|----------------------------|--------|
| 242.0                       | 161.0                      | 15     |

Small carton drawing:

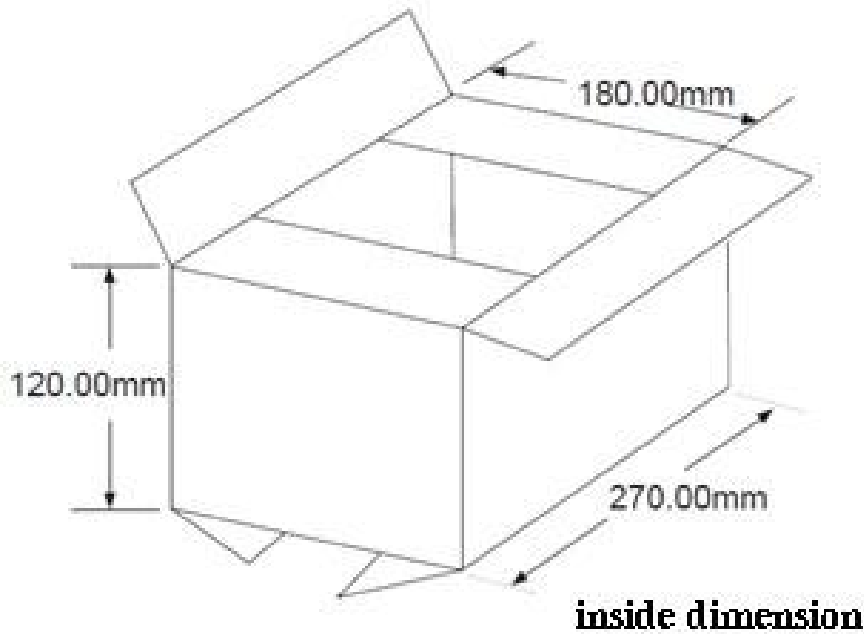


Figure 38: Small carton drawing introduce

Table 40: Small Carton size

| Length ( $\pm 10\text{mm}$ ) | Width ( $\pm 10\text{mm}$ ) | Height ( $\pm 10\text{mm}$ ) | Number    |
|------------------------------|-----------------------------|------------------------------|-----------|
| 270                          | 180                         | 120                          | 15*20=300 |

Big carton drawing:

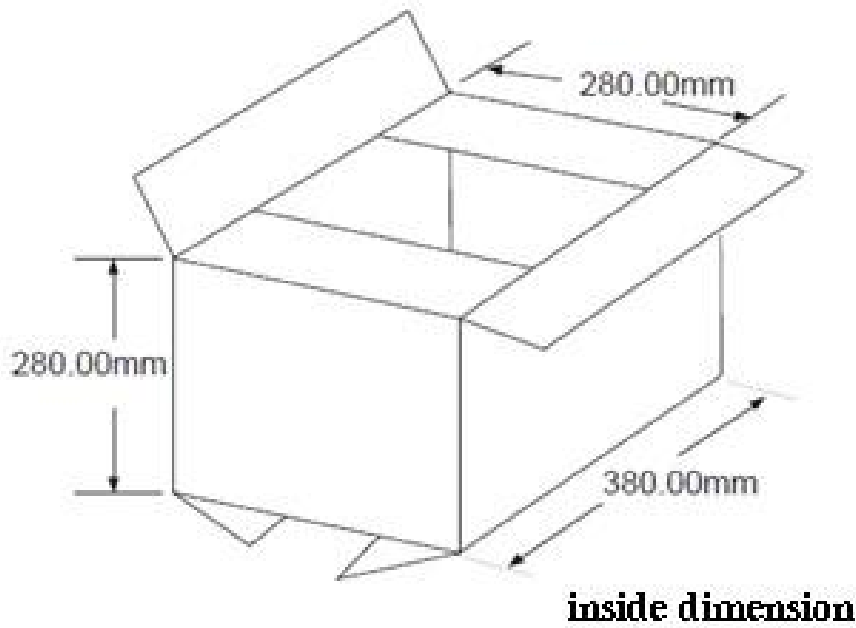


Figure 39: Big carton drawing introduce

Table 41: Big Carton size

| Length (±10mm) | Width (±10mm) | Height (±10mm) | Number     |
|----------------|---------------|----------------|------------|
| 380            | 280           | 280            | 300*4=1200 |

# 8 Appendix

## 8.1 Reference Design

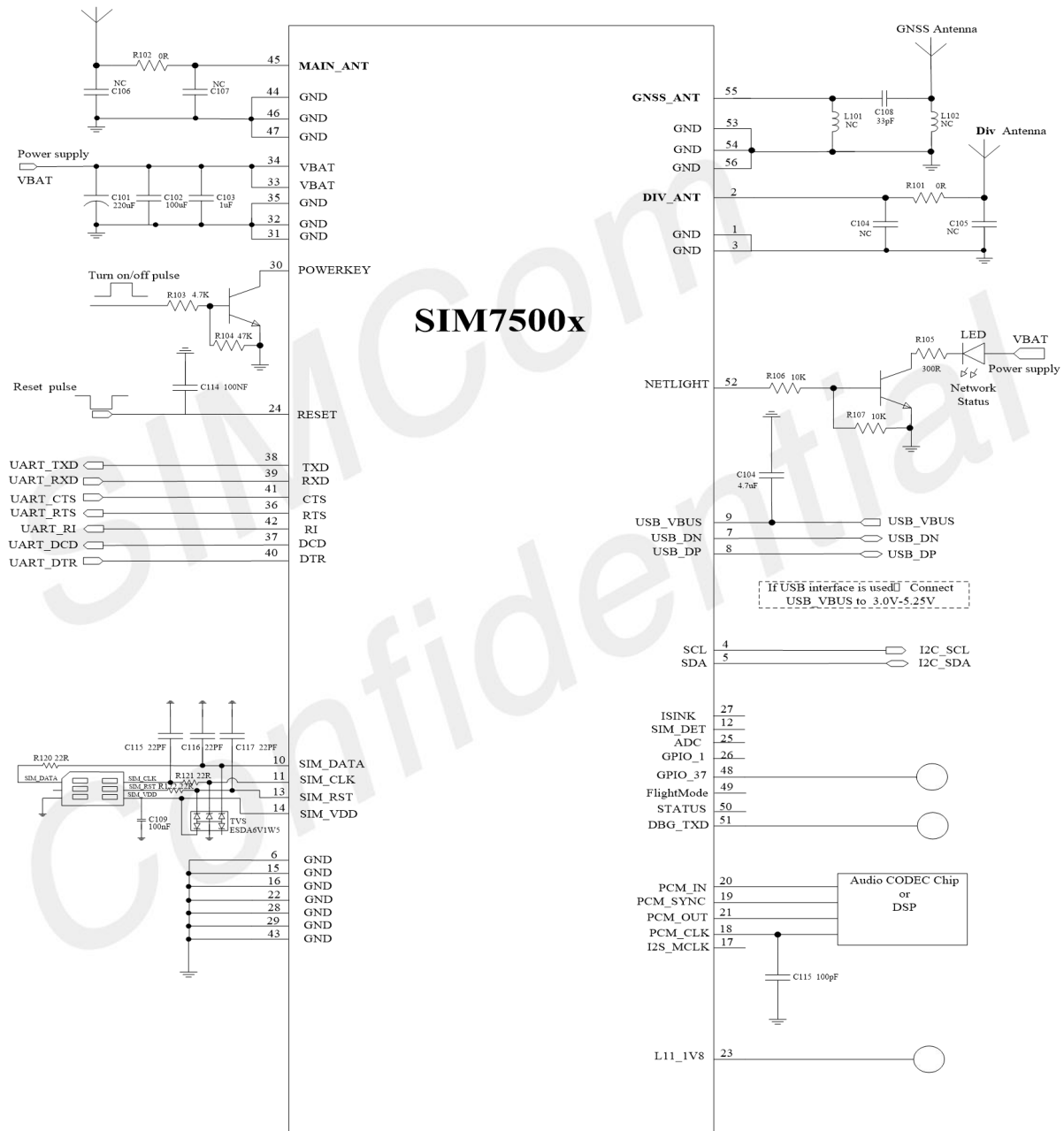


Figure 40: Reference design

**NOTE**

1. The UART port suggests to be used by isolated circuit.
2. If use SIM7500E Module, C115 should use 220pF.
3. C115 must be mounted.

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

Table 42: Coding schemes and maximum net data rates over air interface

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

|   |                             |                        |
|---|-----------------------------|------------------------|
| Category 6                                | 3.6Mbps                     | 16QAM,QPSK             |
| Category 7                                | 7.2Mbps                     | 16QAM,QPSK             |
| Category 8                                | 7.2Mbps                     | 16QAM,QPSK             |
| Category 9                                | 10.2Mbps                    | 16QAM,QPSK             |
| Category 10                               | 14.4Mbps                    | 16QAM,QPSK             |
| Category 11                               | 0.9Mbps                     | QPSK                   |
| Category 12                               | 1.8Mbps                     | QPSK                   |
| Category 13                               | 17.6Mbps                    | 64QAM                  |
| Category 14                               | 21.1Mbps                    | 64QAM                  |
| Category 15                               | 23.4Mbps                    | 16QAM                  |
| Category 16                               | 28Mbps                      | 16QAM                  |
| Category 17                               | 23.4Mbps                    | 64QAM                  |
| Category 18                               | 28Mbps                      | 64QAM                  |
| Category 19                               | 35.5Mbps                    | 64QAM                  |
| Category 20                               | 42Mbps                      | 64QAM                  |
| Category 21                               | 23.4Mbps                    | 16QAM                  |
| Category 22                               | 28Mbps                      | 16QAM                  |
| Category 23                               | 35.5Mbps                    | 64QAM                  |
| Category 24                               | 42.2Mbps                    | 64QAM                  |
| <b>HSUPA device category</b>              |                             |                        |
|   | <b>Max data rate (peak)</b> | <b>Modulation type</b> |
| 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       |
| <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             |

## 8.3 Related Documents

**Table 43: Related Documents**

| SN   | Title  | Description   |
|------|--|---|
| [1]  | SIM7500_SIM7600 Series_AT Command Manual_V1.xx | AT Command Manual   |
| [2]  | ITU-T Draft new recommendation V.25ter         | Serial asynchronous automatic dialing and control   |
| [3]  | GSM 07.07                                      | Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)  |
| [4]  | GSM 07.10                                      | Support GSM 07.10 multiplexing protocol   |
| [5]  | GSM 07.05                                      | Digital cellular telecommunications (Phase 2+); Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE – DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)  |
| [6]  | GSM 11.14                                      | Digital cellular telecommunications system (Phase 2+); Specification of the SIM Application Toolkit for the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface  |
| [7]  | GSM 11.11                                      | Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface  |
| [8]  | GSM 03.38                                      | Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information  |
| [9]  | GSM 11.10                                      | Digital cellular telecommunications system (Phase 2) ; Mobile Station (MS) conformance specification ; Part 1: Conformance specification  |
| [10] | 3GPP TS 51.010-1                               | Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification   |
| [11] | 3GPP TS 34.124                                 | Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.   |
| [12] | 3GPP TS 34.121                                 | Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.   |
| [13] | 3GPP TS 34.123-1                               | Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)  |
| [14] | 3GPP TS 34.123-3                               | User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.  |
| [15] | 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 |
| [16] | 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                             |
| [17] | IEC/EN60950-1(2001)                            | Safety of information technology equipment (2000)   |
| [18] | 3GPP TS 51.010-1                               | Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification   |
| [19] | GCF-CC V3.23.1                                 | Global Certification Forum - Certification Criteria   |

|      |   |  |
|------|---|--|
| [20] | 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) |
| [21] | Module secondary-SMT-UGD-V1.xx                          | Module secondary SMT Guidelines  |
| [22] | SIM7X00 Series_UART_Application Note_V1.xx              | SIM7X00 Series_UART_Application Note   |
| [23] | SIM7X00 Series_USBAUDIO_Application Note_V1.xx          | SIM7X00 Series_USBAUDIO_Application Note   |
| [24] | Antenna design guidelines for diversity receiver system | Antenna design guidelines for diversity receiver system  |
| [25] | SIM7X00 Series_Sleep Mode_Application Note_V1.xx        | SIM7X00 Series_Sleep Mode_Application Note   |

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## 8.4 Terms and Abbreviations







**Table 44: Terms and Abbreviations**

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

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

## 8.5 Safety Caution

Table 45: Safety Caution

| Marks   | Requirements   |
|---|--|
|    | <p>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.</p>   |
|    | <p>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.</p>  |
|  | <p>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.</p>   |
|  | <p>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.</p>  |
|  | <p>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>   |
|  | <p>GSM cellular terminals or 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 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. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.</p> |