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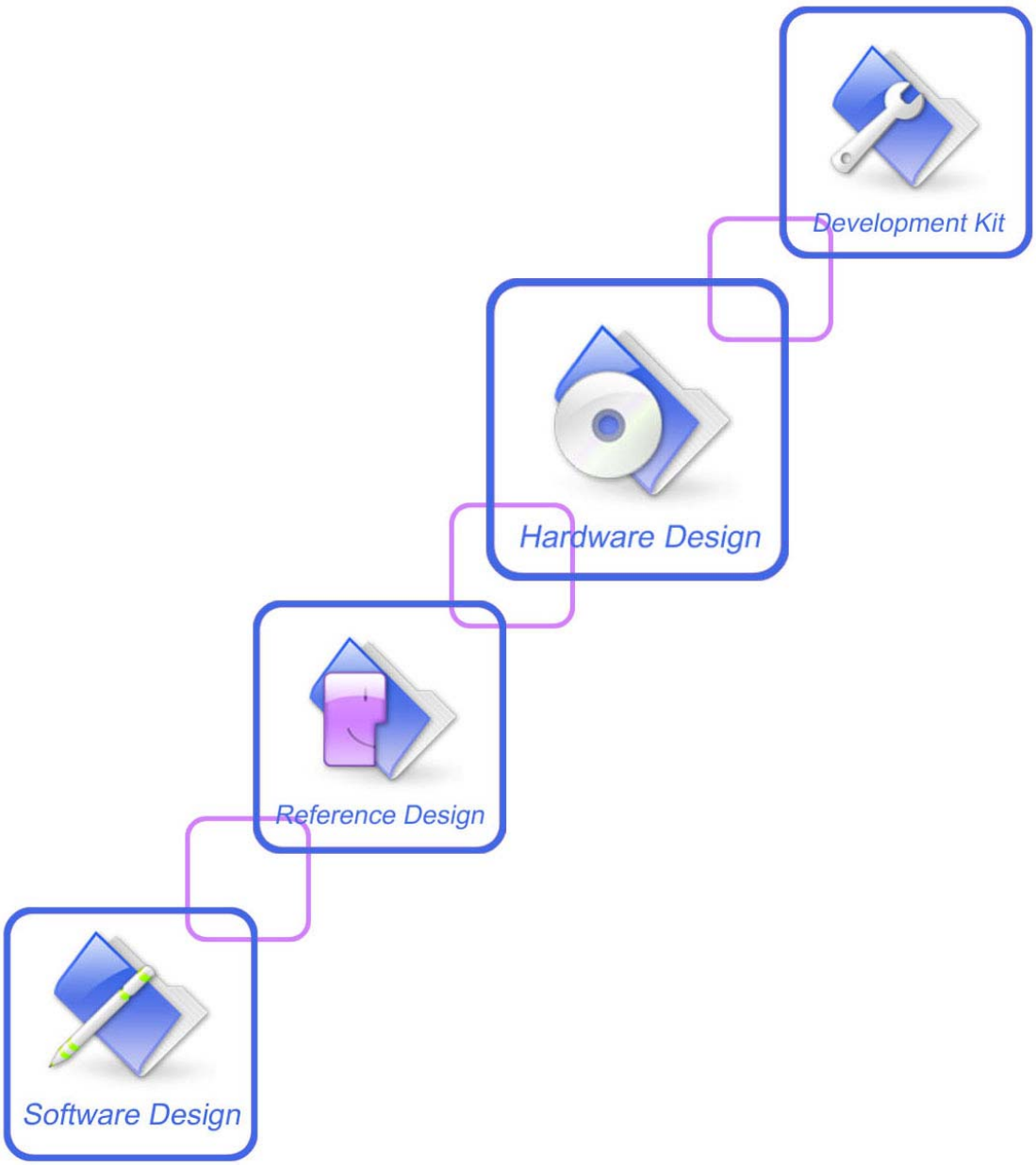
# SIM5320JE-TE_Hardware Design_V1.03



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# Revision History

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|---|---|---|---|
| 2012-07-10 | 1.01 | Original | Libing |
| 2012-08-10 | 1.02 | Delete the chapter of Automatic power on.<br>Modify time value in table 6 and table 7. | Libing |
| 2012-09-21 | 1.03 | Add time to power on again in table 7. Modify Figure 1 and UART chapter. | Libing |
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# 1 Introduction

This document describes electronic specifications, RF specifications, function interface, mechanical characteristic and testing conclusions of the SIMCom SIM5320JE-TE module. With the help of this document and other SIM5320JE-TE software application notes, user guides, users can quickly understand and use SIM5320JE-TE module to design and develop applications quickly.

## 1.1 Product Outline

Designed for global market, SIM5320JE-TE is a quad-band GSM/GPRS/EDGE and dual-band UMTS /HSDPA that works on frequencies of GSM 850MHz, EGSM 900 MHz, DCS 1800 MHz, PCS 1900MHz and WCDMA 2100/900MHz...In this document, the entire radio band configuration of SIM5320JE-TE series is described in the following table.

**Table 1: SIM5320JE-TE series frequency bands**

| Standard | Frequency | SIM5320JE-TE |
|---|---|---|
| GSM | GSM 850MHz | ✓ |
| | EGSM 900MHz | ✓ |
| | DCS1800MHz | ✓ |
| | PCS1900MHz | ✓ |
| WCDMA | WCDMA 850MHz | |
| | WCDMA 900MHz | ✓ |
| | WCDMA 1900MHz | |
| | WCDMA 2100MHz | ✓ |
| HSPA | HSDPA | ✓ |
| | HSUPA | |

With a tiny configuration of 47.5*35*4 mm and integrated functions, SIM5320JE-TE can meet almost any space requirement in users' application, such as industrial handhelds, machine-to-machine, vehicle applications, etc..

The SIM5320JE-TE provides RF and GPS antenna interface with two alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700. And customer's antenna can be soldered to the antenna pad.

There are 80 pins on SIM5320JE-TE, which provide most application interfaces for customers' board.

## 1.2 Hardware Interface Overview

The physical interface to the mobile application is made through a 80 pins board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface. Sub-interfaces are described in detail in the next chapter, which includes:

- **Power Supply**
- **USB Interface**
- **Serial Interface**
- **Analog Audio Interfaces**
- **SIM Interface**
- **GPIO**
- **ADC**
- **LDO Power Output**
- **Sink Current Source**
- **PCM Interface**
- **Keypad Interface**
- **SPI Interface**
- **RTC**
- **I2C Interface**

## 1.3 Hardware Diagram

The global architecture of the SIM5320JE-TE Embedded module is described in the figure below.

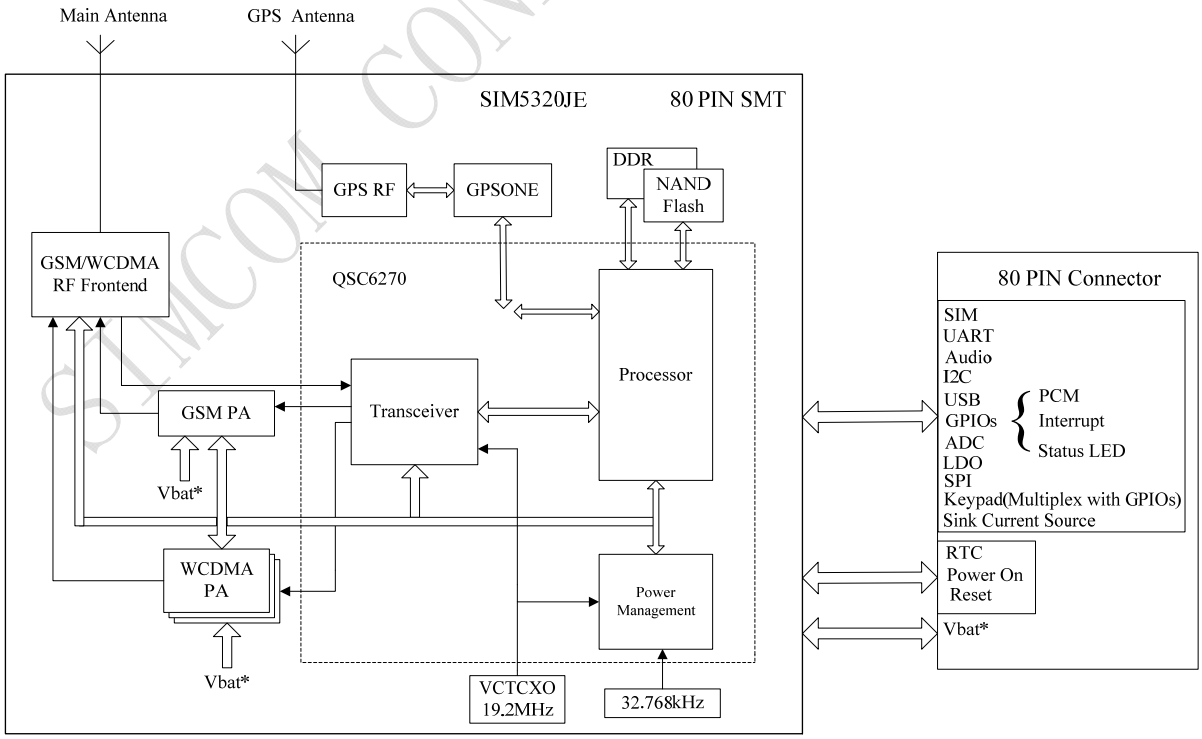


**Figure 2: SIM5320JE-TE functional architecture**

## 1.4 Functional Overview

**Table 2: General Feature**

| Feature | Implementation |
|---|---|
| Power supply | Single supply voltage 3.3～4.2V |
| Transmission data | ● Dual-mode UMTS/HSDPA/EDGE/GPRS operation<br>● GPRS Class B, multislot class 12 operation, Supports coding scheme: CS1-4<br>● EDGE multislot class 12 operation, Supports coding schemes MSC1-9<br>● UMTS R99 data rates-384 kbps DL/UL<br>● HSDPA Category 5/6 -3.6 Mbps Category12-1.8 Mbps<br>● CSD feature: 9.6, 14.4, 64 kbps UL/DL |
| GPS | ● Mobile-Assisted mode<br>● Mobile-based mode<br>● Standalone mode |
| SMS | ● MT, MO, CB, Text and PDU mode<br>● SMS storage: SIM card<br>● Support transmission of SMS alternatively over CSD or GPRS. User can choose preferred mode. |
| SIM interface | Support identity card: 1.8V, 3V. |
| Audio features(optional) | Speech codec modes:<br>● Half Rate (ETS 06.20)<br>● Full Rate (ETS 06.10)<br>● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80)<br>● AMR (WCDMA)<br>● AMR+QCP (GSM)<br>● A5/1, A5/2, and A5/3 ciphering |
| Serial interface | ● Serial Port standard or null modem mode on Serial Port Interface<br>● Serial Port can be used to control module by sending AT command |
| USB | Support USB2.0 Slave mode |
| Phonebook management | Support phonebook types: SM, FD, LD, RC, ON, MC. |
| SIM application toolkit | Support SAT class 3, GSM 11.14 Release 98<br>Support USAT |
| Real Time Clock | Support RTC |
| Timer function | Programmable by AT command |
| Physical characteristics | Size:47.5*35*4mm<br>Weight:10g |
| Firmware upgrade | Firmware upgrade over USB interface |
| PCM | Multiplex on GPIOs. 3 kinds of coding formats: 8 bit (υ-law or A-law) and 16 bit (linear). |
| Temperature range | ● Operation temperature: -30°C to +80°C<br>● Storage temperature -40°C to +85°C |

# 2 Package Information

## 2.1 Pin Configuration

All hardware interfaces which connect SIM5320JE-TE to customers' application platform are through 80 pins Board-to-Board Connector . Figure 2 is SIM5320JE-TE outline diagram.


**Figure 3: Pin view**

**Table 3: Board-to-Board Connector pin description**

| Pin No. | Define | Pin No. | Define |
|---|---|---|---|
| 1 | VBAT | 80 | GND |
| 2 | VBAT | 79 | GND |
| 3 | VBAT | 78 | GND |
| 4 | VBAT | 77 | GND |
| 5 | VBAT | 76 | GND |
| 6 | VBAT | 75 | GND |
| 7 | VBAT | 74 | GND |
| 8 | VBAT | 73 | GND |
| 9 | VRTC | 72 | GPIO44 |
| 10 | VREG_AUX | 71 | GPIO40 |
| 11 | CURRENT_SINK | 70 | GPIO43 |
| 12 | ADC2 | 69 | GPIO41 |
| 13 | ADC1 | 68 | GPIO1 |
| 14 | KEYSENSE_N4 | 67 | GPIO42 |
| 15 | KEYPAD_3 | 66 | GPIO4 |
| 16 | KEYPAD_4 | 65 | I2C_SCL |
| 17 | KEYPAD_1 | 64 | I2C_SDA |
| 18 | KEYSENSE_N3 | 63 | UART_RTS |
| 19 | KEYSENSE_N2 | 62 | UART_CTS |
| 20 | KEYPAD_2 | 61 | UART_RXD |
| 21 | KEYPAD_0 | 60 | UART_RI |
| 22 | KEYSENSE_N0 | 59 | UART_DCD |
| 23 | KEYSENSE_N1 | 58 | UART_TXD |
| 24 | GND | 57 | UART_DTR |
| 25 | RESERVED | 56 | GND |
| 26 | RESERVED | 55 | PCM_DOUT |
| 27 | USIM_RESET | 54 | PCM_DIN |
| 28 | USIM_CLK | 53 | PCM_SYNC |
| 29 | USIM_DATA | 52 | PCM_CLK |
| 30 | V_USIM | 51 | USB_DP |
| 31 | POWER_ON | 50 | USB_DM |
| 32 | GND | 49 | USB_VBUS |
| 33 | EAR1P | 48 | GND |

| | | | |
|---|---|---|---|
| 34 | EAR1N | 47 | RESET |
| 35 | MIC1N | 46 | SPI_CS_N |
| 36 | MIC1P | 45 | SPI_MOSI_DATA |
| 37 | SPK_P | 44 | SPI_MISO_DATA |
| 38 | SPK_M | 43 | SPI_CLK |
| 39 | GND | 42 | GND |
| 40 | GND | 41 | GND |

## 2.2 Pin description

**Table 4: Pin description**

| Pin name | I/O | Description | Comment |
|---|---|---|---|
| **Power Supply** | | | |
| VBAT | | Power supply voltage | |
| VRTC | I/O | Power supply for RTC | If it is unused, keep open. |
| VREG_AUX | O | LDO power output | |
| GND | | Ground | |
| **Power on/off** | | | |
| POWER_ON | I | POWER_ON should be pulled low at least 64ms to power on or 500ms to power off the module. | |
| **Audio interface** | | | |
| MIC1P | I | Differential audio input | If it is unused, connect to ground through a 100N capacitor. |
| MIC1N | | | |
| EAR1P | O | Differential audio output | If these pins are unused，keep open. |
| EAR1N | | | |
| SPK_P | O | | |
| SPK_N | | | |
| **USIM interface** | | | |
| V_USIM | O | Voltage Supply for SIM card<br>Support 1.8V or 3V SIM card | All signals of SIM interface should be protected against ESD/EMC. |
| USIM_DATA | I/O | SIM Data Output/Input | |
| USIM_CLK | O | SIM Clock | |
| USIM_RESET | O | SIM Reset | |
| **SPI interface** | | | |
| SPI_CLK | O | SPI clock | If it is unused, keep open. |
| SPI_CS_N | O | SPI chip-select | |

| | | | |
|---|---|---|---|
| SPI_MOSI_DATA | O | SPI (master only) master out/slave in data | |
| SPI_MISO_DATA | I | SPI (master only) master in/slave out data | |
| **USB** | | | |
| USB_VBUS | I | USB power supply input | They are compliant with the USB 2.0 specification.<br>If it is unused, keep open. |
| USB_DP | I/O | Plus (+) line of the differential, bi-directional USB signal to/from the peripheral device. | |
| USB_DM | I/O | Minus (-) line of the differential, bi-directional USB signal to/from the peripheral device. | |
| **Serial interface** | | | |
| UART_RXD | I | Receive Data | UART_RXD has been pulled down with a 12kR resistor to ground in the module.<br>If it is unused, keep open. |
| UART_TXD | O | Transmit Data | |
| UART_RTS | O | Request to send | |
| UART_CTS | I | Clear to Send | |
| UART_RI | O | Ring Indicator | |
| UART_DTR | I/O | DTE get ready | |
| UART_DCD | O | Carrier detects | |
| **I2C interface** | | | |
| I2C_SDA | I/O | I2C data | Pulled up with a 2.2kR resistor to 2.6V internally.<br>If it is unused, keep open. |
| I2C_SCL | O | I2C clock output | |
| **Keypad interface** | | | |
| KEYPAD_0 | O | Bit 0 drive to the pad matrix | All Keypad pins can be configured as GPIOs.<br>If it is unused, keep open. |
| KEYPAD_1 | O | Bit 1 drive to the pad matrix | |
| KEYPAD_2 | O | Bit 2 drive to the pad matrix | |
| KEYPAD_3 | O | Bit 3 drive to the pad matrix | |
| KEYPAD_4 | O | Bit 4 drive to the pad matrix | |
| KEYSENSE_N0 | I | Bit 0 for sensing key press on pad matrix | |
| KEYSENSE_ N1 | I | Bit 1 for sensing key press on pad matrix | |
| KEYSENSE_ N2 | I | Bit 2 for sensing key press on pad matrix | |
| KEYSENSE_ N3 | I | Bit 3 for sensing key press on pad matrix | |
| KEYSENSE_ N4 | I | Bit 4 for sensing key press on pad matrix | |
| **PCM interface** | | | |
| PCM_DIN/GPIO0 | I | General Input PIN with module wake/interrupt. It also can be multiplexed as the PCM_DIN pin. | If it is unused, keep open. |

| | | | |
|---|---|---|---|
| PCM_SYNC/GPIO2 | I | General Input PIN. It also can be multiplexed as the PCM_SYNC pin. | |
| PCM_CLK/GPIO3 | O | General Output PIN. It also can be multiplexed as the PCM_CLK pin. | |
| PCM_DOUT/GPIO5 | O | General Output PIN. It also can be multiplexed as the PCM_DOUT pin. | |
| **GPIOs** | | | |
| GPIO1 | O | Output PIN as LED control for network status. | If it is unused, keep open. |
| GPIO4 | I | Input PIN as RF operating control. | |
| GPIO40 | O | Output PIN as operating status indicating of module. | |
| GPIO41 | I/O | General input/output PIN. It can be used as wake/interrupt signal to host from module | |
| GPIO43 | I/O | General input/output PIN. It can be used as wake/interrupt signal to module from host. | |
| GPIO44 | I/O | General input/output PIN. | |
| GPIO42 | I/O | General input/output PIN. | |
| **Other interface** | | | |
| RESET | I | System reset in, active low. | |
| CURRENT_SINK | I | Current source of ground-referenced current sink | Refer to 3.13.1 |
| ADC1 | I | Analog Digital Converter Input | Refer to 3.13.3 |
| ADC2 | I | Battery temperature ADC input pin | |

## 2.3 Package Dimensions

The following figure shows mechanical dimensions of SIM5320JE-TE.

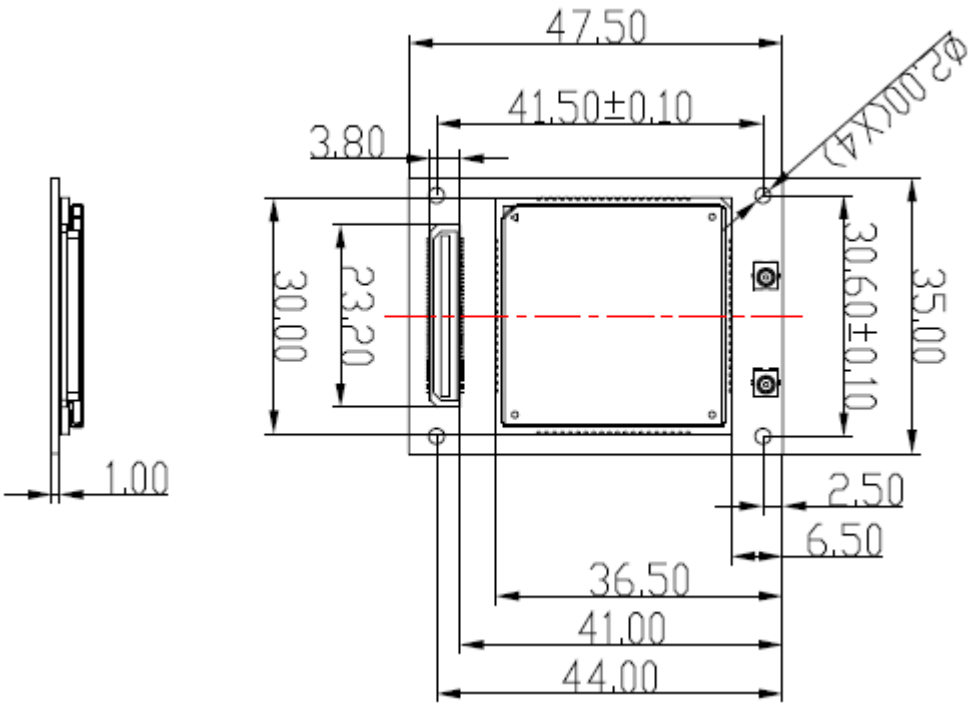


**Figure 4: Top dimensions (Unit: mm)**

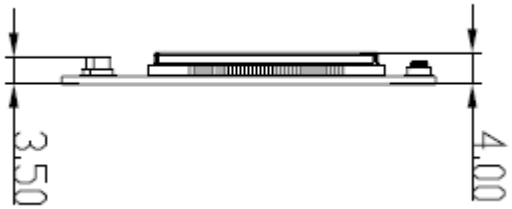


**Figure 5: Side dimensions (Unit: mm)**

## 2.4 Board-to-board connector

We recommend users to adopt Panasonic AXK770247G as the board to board connector in their own PCB

to connect with SIM5320JE-TE. These high density SMT connectors are designed for parallel PCB-to-PCB applications. They are ideal for using in VCRs, notebook PCs, cordless telephones, mobile phones, audio/visual and other telecommunications equipment where reduced size and weight are important.

Following are parameters of Panasonic AXK580147YG for more details, user can login http://industrial.panasonic.com/ac/e/ for more information.

***NOTE：The height of Mated height is 3.0mm.***

**Mechanical dimensions of the Panasonic 80pin connector**

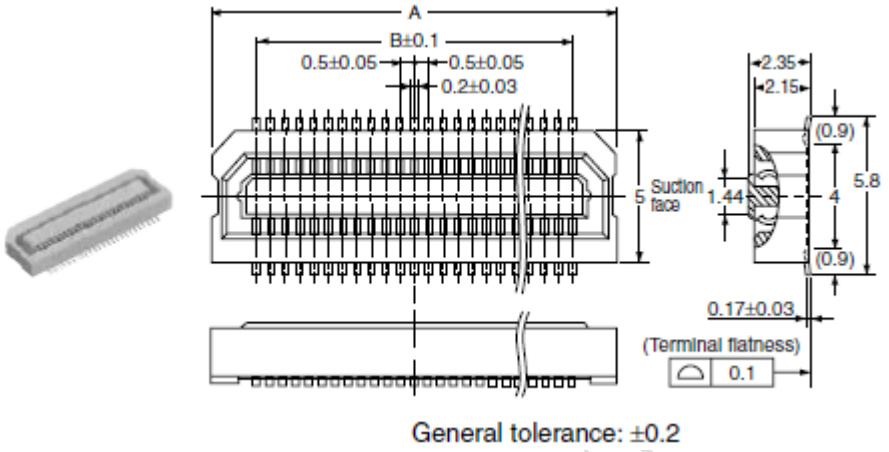


**Figure 6: Panasonic AXK580147YG board-to-board connector pin side**

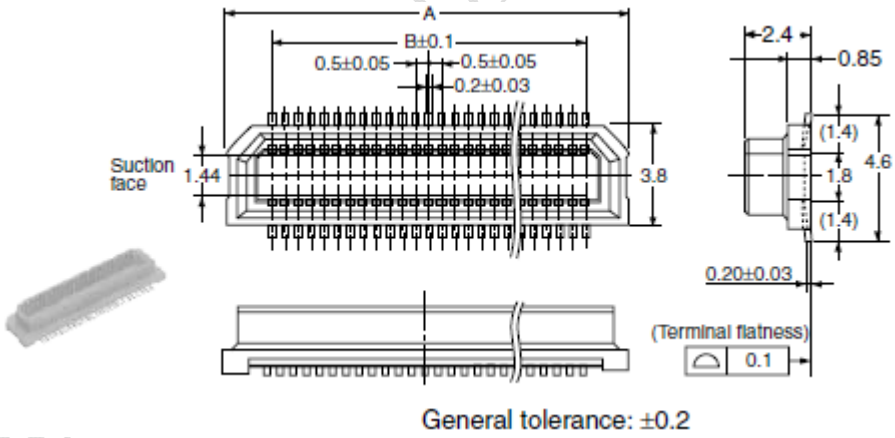


**Figure 7: Panasonic AXK680347YG board-to-board connector pin side**

***NOTE：The connector AXK680347YG is used in SIM5320JE-TE side and AXK580147YG is used in pin side (host board side).***

## 2.5 RF connector and adapter cable

The RF connector in module side is Murata Company RF Connectors MM9329-2700, it makes a pair with Murata Company RF cable MXTK88TK2000. It has high performance with wide frequency range, surface mountable and reflow solderable. Following are parameters. Certainly user can visit http://www.murata.com/ for more information.

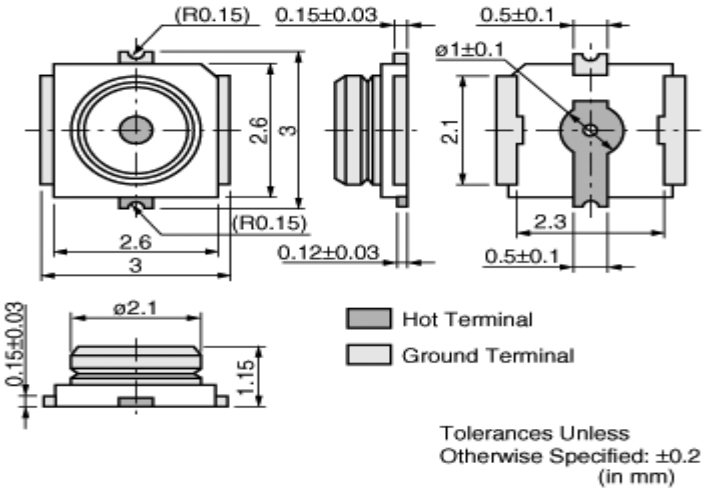


**Figure 8: RF connector MM9329-2700**

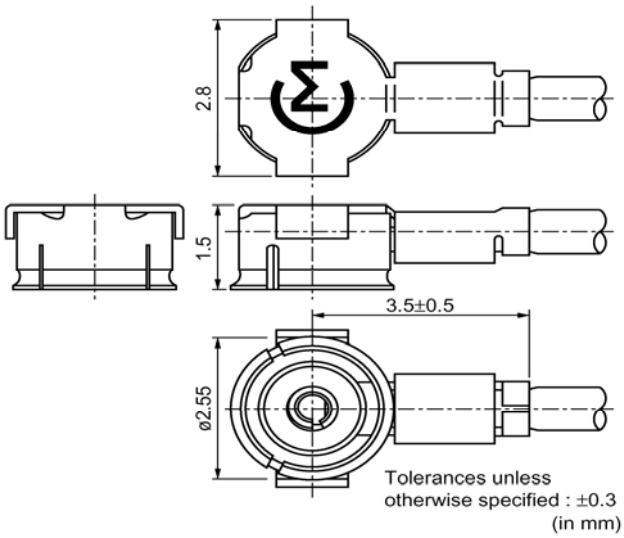


**Figure 9: RF adapter cable MXTK88TK2000**

For more information about the connector, please visit http://www.murata.com/

# 3 Application Interface Specification

## 3.1 Power Supply

The power supply range of SIM5320JE-TE is from 3.3V to 4.2V. For the VBAT, the ripple due to GSM/GPRS emission burst (every 4.615ms） may cause voltage drop, and the current consumption rises typically to peak of more than 2A. So the power supply must be able to provide sufficient current up to more than 2A. The following figure is the VBAT voltage ripple wave at the maximum power transmit phase.

The test condition: VBAT =4.0V, VBAT maximum output current =2A, $C_A$=100 μF tantalum capacitor (ESR=0.7Ω) and $C_B$=1μF.

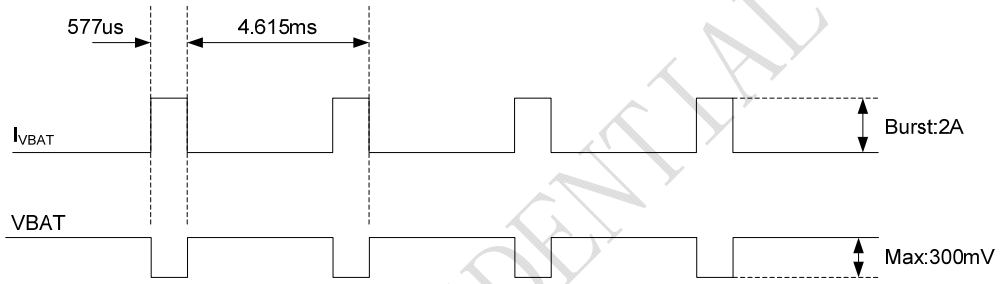


**Figure 10: VBAT voltage drop during burst emission (GSM/GPRS)**

### 3.1.1 Power Supply Pin

The VBAT pins are dedicated to connect the supply voltage.

**Table 5: Pin description**

| Pin type | Pin name | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| POWER | VBAT | 3.3 | 3.8 | 4.2 | V |

***Note: When the module is power off, users must pay attention to the issue about current leakage. Refer to Chapter 3.10.2 Note2.***

### 3.1.2 Design Guide

Mostly, user connects the VBAT pins with one power supply. Make sure that the input voltage at the VBAT pin will never drop below 3.3V even during a transmit burst when the current consumption rises up

to 2A. If the power voltage drops below 3.3V, the module may be shut down automatically. Using a large tantalum capacitor (above 100uF) will be the best way to reduce the voltage drops. If the power current cannot support up to more than 2A, users must introduce larger capacitor (typical 1000uF) to storage electric power, especially GPRS multiple time slots emission.

For the consideration of RF performance and system stability, another large capacitor (above 100uF) should be located at the VBAT pin and some multi-layer ceramic chip (MLCC) capacitors (0.1uF) need to be used for EMC because of their low ESR in high frequencies. Note that capacitors should be put beside VBAT pins as close as possible. Also User should minimize the PCB trace impedance from the power supply to the VBAT pins through widening the trace to 80 mil or more on the board.

There are three sections about how to design and optimize users' power systems.

**Power supply circuit**

We recommend DCDC or LDO is used for the power supply of the module, make sure that the peak current of power components can rise up to more than 2A. The following figure is the reference design of +5V input power supply. The designed output for the power supply is 4.1V, here a linear regulator can be used.

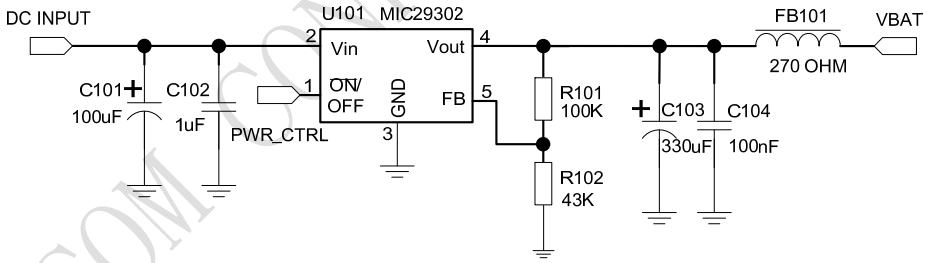


**Figure 11: Reference circuit of the LDO power supply**

If there is a big difference between the input voltage and the desired output (VBAT), a switching converter power will be preferable because of its better efficiency, especially at the high current situation. The following figure is the reference circuit. Note that DCDC may deprave RF performance because of ripple current intrinsically.

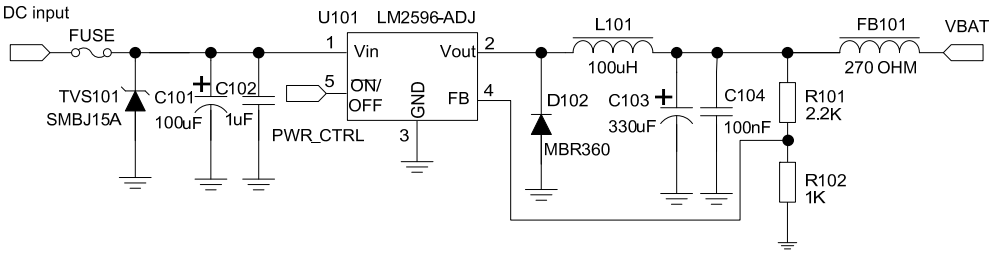


**Figure 12: Reference circuit of the DCDC power supply**

### Voltage monitor

To monitor the power supply voltage, user can use the AT command "AT+CBC", this command has two parameters: the battery status and the voltage value (mV). It will return the capacity percentage and actual value of battery (at the VBAT pin). The voltage is continuously measured at intervals, whenever the measured battery voltage is lower than a specific value set by the AT command "AT+CVALARM". For example, if the voltage value is set to be 3.4V, the following URC will be presented: "warning! voltage is low: 3.3v".

If the voltage is lower than a specific value which is set by the AT command "AT+CPMVT", the module will be powered off automatically and AT commands cannot be executed any more.

***Note:*** ***Under-voltage warning function is disabled by default, user can enable it by the AT command "AT+CVALARM". Auto power off feature is disabled by default, user should set it by the AT command "AT+CPMVT" to an appropriate value. Please refer to Document [1].***

### 3.1.3 RTC Backup

The module uses RTC (Real Time Clock) to update and maintain inherent time and keeps system alive at no power supply status. The RTC power supply of module can be provided by an external capacitor or a battery (non-chargeable or rechargeable) through the VRTC. The following figures show various reference circuits for RTC back up. The discharge current is less than 10uA. If this feature is used, please refer to the AT commands "AT+CTZU" and "AT +CTZR".

- **External capacitor backup**

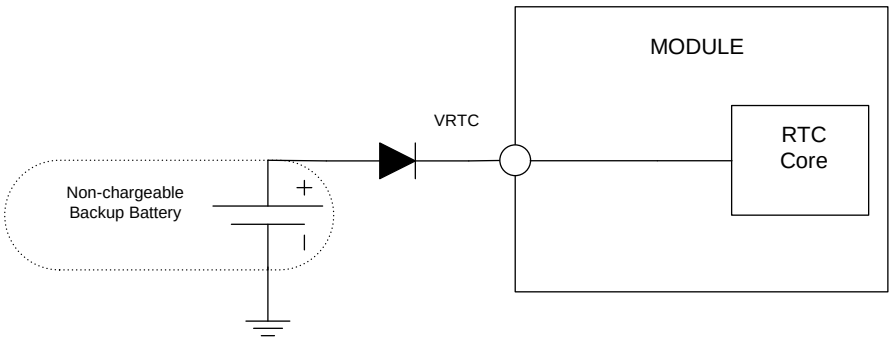


**Figure 13: RTC supply from capacitor**

- **Non-chargeable battery backup**

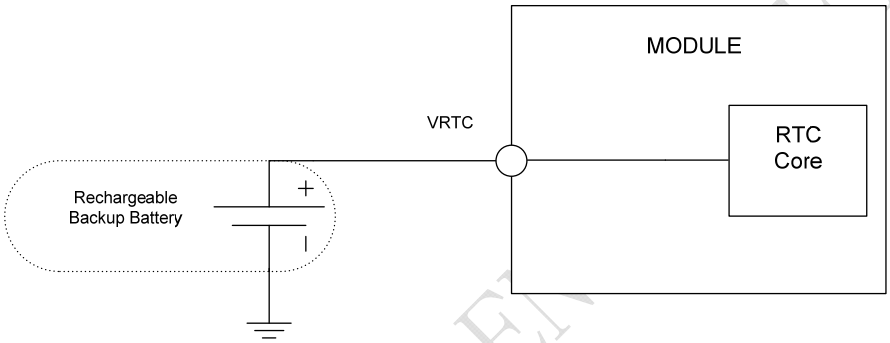


**Figure 14: RTC supply from non-chargeable battery**

- **Rechargeable battery backup**

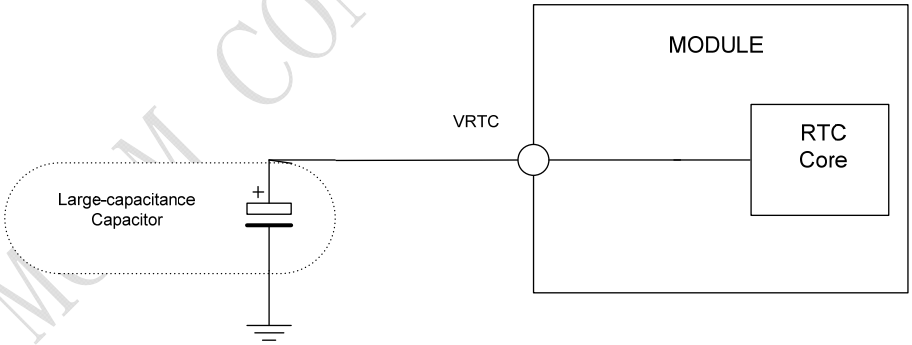


**Figure 15: RTC supply from rechargeable battery**

***Note: The VRTC can be disabled, jus disconnect it in application circuit.***

Coin-type rechargeable battery is recommended, such as XH414H-IV01E form Seiko can be used. Typical charge-discharge curves for this battery are shown in the following figure.

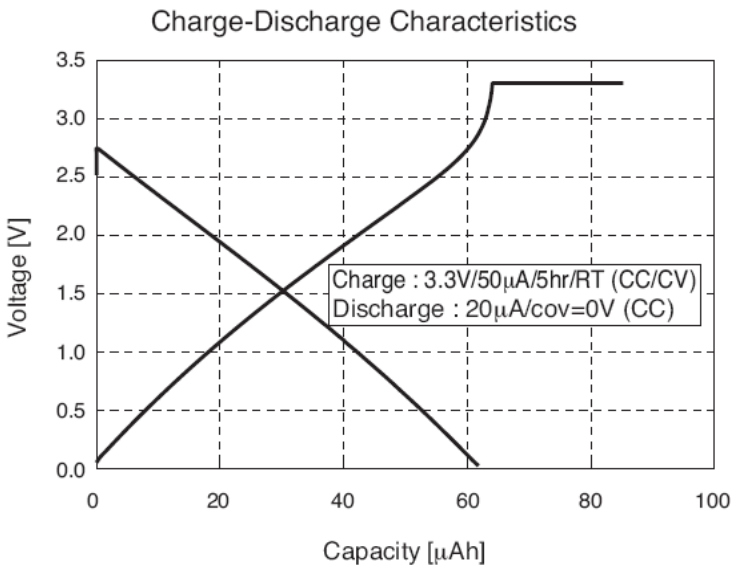


**Figure 16: Seiko XH414H-IV01E Charge-Discharge characteristic**

## 3.2 Power on/off Time Sequence

### 3.2.1 Power on Sequence

SIM5320JE-TE can be powered on by POWER_ON pin, which starts normal operating mode.
POWER_ON pin is pulled up with a 200kR resistor to 1.8V in module. User can power on the SIM5320JE-TE by pulling the POWER_ON pin down for a short time. The power-on scenarios are illustrated in the following figures.

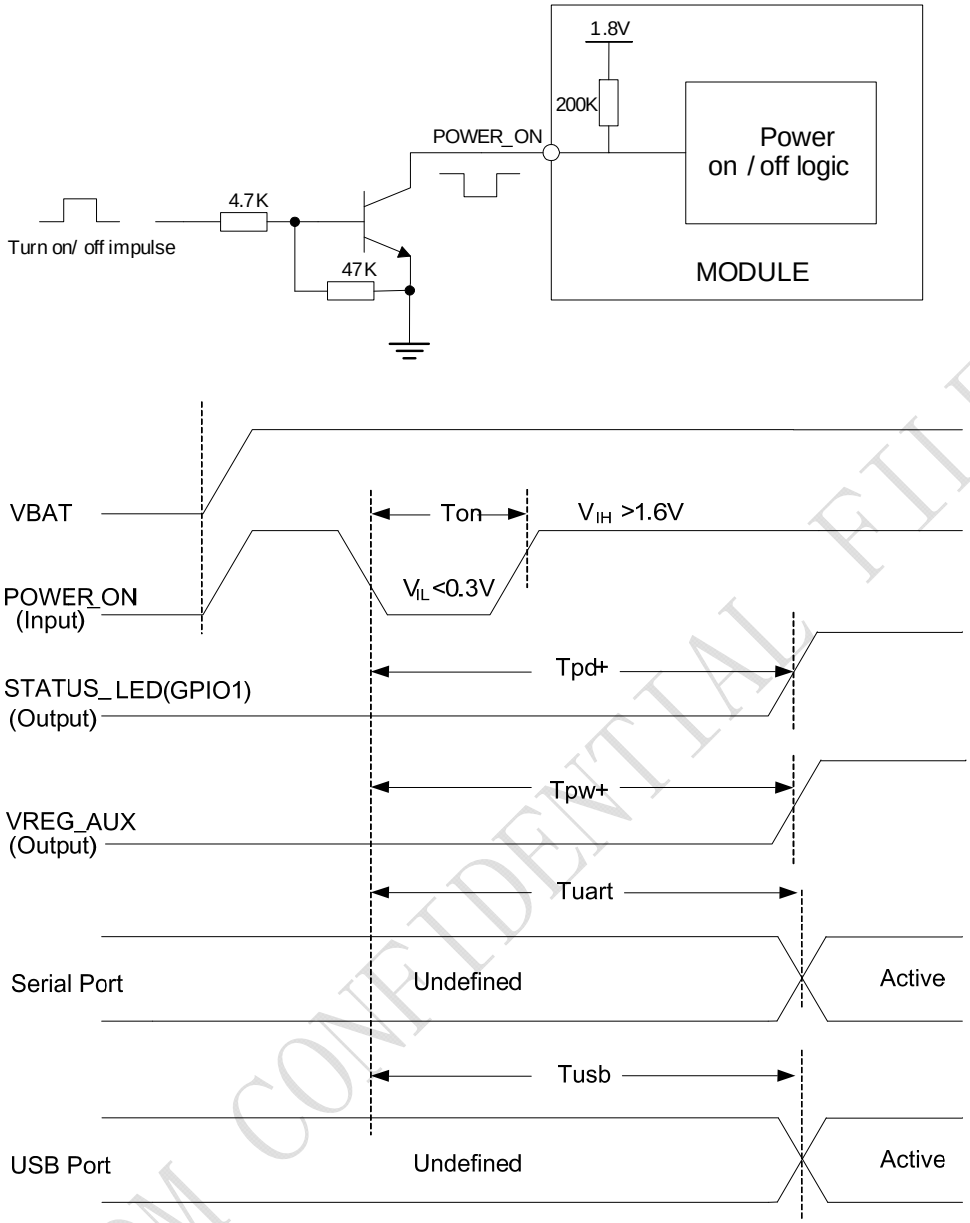


**Figure 17: Power on Timing Sequence**



**Table 6: Power on timing**

| Parameter | Description | Time value | | | Unit |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | |
| Ton | The time to pull POWER_ON down to power on | 64 | 180 | - | ms |
| TpD+ | The time to indicate connecting with the network | - | - | 5.5 | s |
| Tpw+ | The time to indicate the module is powered on completely | - | - | 4.5 | s |
| Tuart | The time to enable UART | - | - | 5 | s |

| | | | | | |
|---|---|---|---|---|---|
| Tusb | The time to enable USB | - | - | 9 | s |

***Note: Module could be automatically power on by connecting Power ON pin to Low level directly. Before designing, please refer to Document [27] for more detail.***

### 3.2.2 Power off Sequence

The following methods can be used to power down SIM5320JE-TE. These procedures will make module disconnect from the network and allow the software to enter a safe state, and then save data before completely powering the module off.

- Method 1: Power off SIM5320JE-TE by pulling the POWER_ON pin down
- Method 2: Power off SIM5320JE-TE by AT command

User can power off the SIM5320JE-TE by pulling POWER_ON down for a specific time. The power off scenario is illustrated in the following figure.

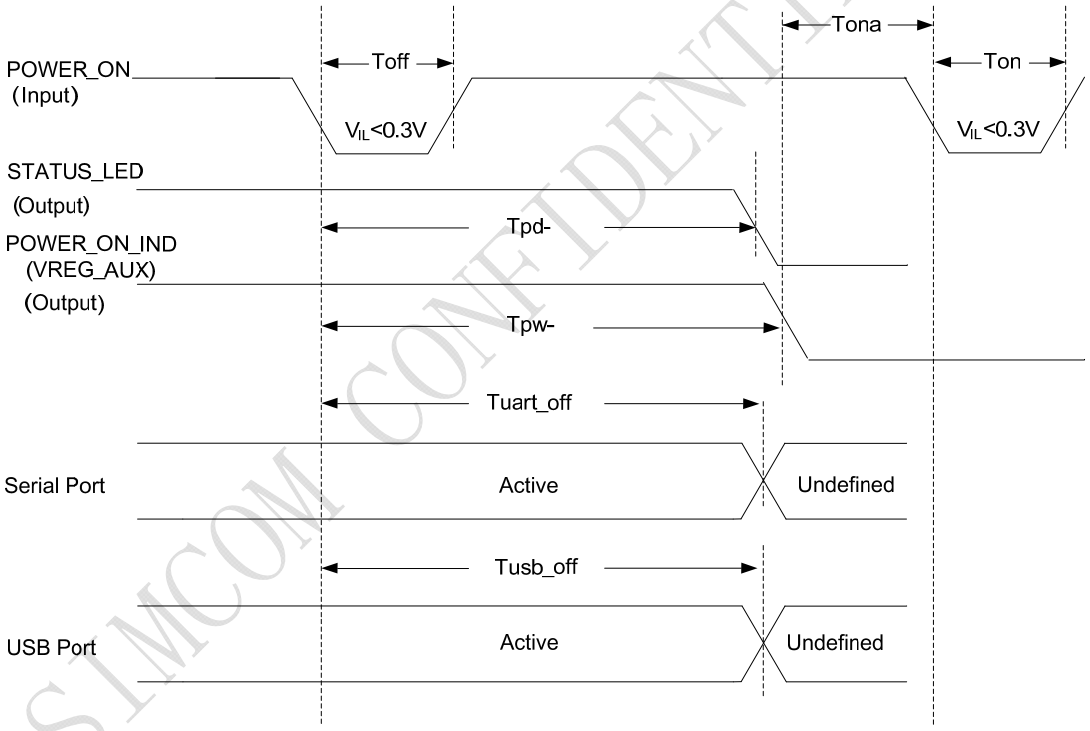


**Figure 18: Power off timing sequence**

**Table 7: Power off timing**

| Parameter | Description | Time value | | | |
|---|---|---|---|---|---|
| | | Min. | Typ. | Max. | Unit |

| | | | | | |
|---|---|---|---|---|---|
| Toff | The time pulling POWER_ON down to power off | 0.5 | - | 5 | s |
| TpD- | The time to indicate disconnecting from the network | - | - | 7 | s |
| Tpw- | The time to indicate the module power off completely | - | - | 7.5 | s |
| Tuart_off | The time to disable UART | - | - | 6 | s |
| Tusb_off | The time to disable USB | - | - | 7.5 | s |
| Tona | The time to power on again after Tpw- | 0 | - | - | s |

User can also use the AT command "AT+CPOF" to power down the module. After that, the AT commands cannot be executed any longer. The module enters the POWER DOWN mode, only the RTC is still active. For details, refer to *Document [1]*.

## 3.3 UART Interface

SIM5320JE-TE provides a UART (universal asynchronous serial transmission) port. It consists of a flexible 7-wire serial interface. The module is as the DCE (Data Communication Equipment) and the client PC is as the DTE (Data Terminal Equipment). AT commands are entered and serial communication is performed through UART interface.
In order to prevent the UART signals of the module damaged due to voltage spikes or ESD, some resistors can be added on UART signals. The values of resistors are adjusted according to the actual circuit. The resistors should be placed close to the module.

The application circuit is in the following figures.

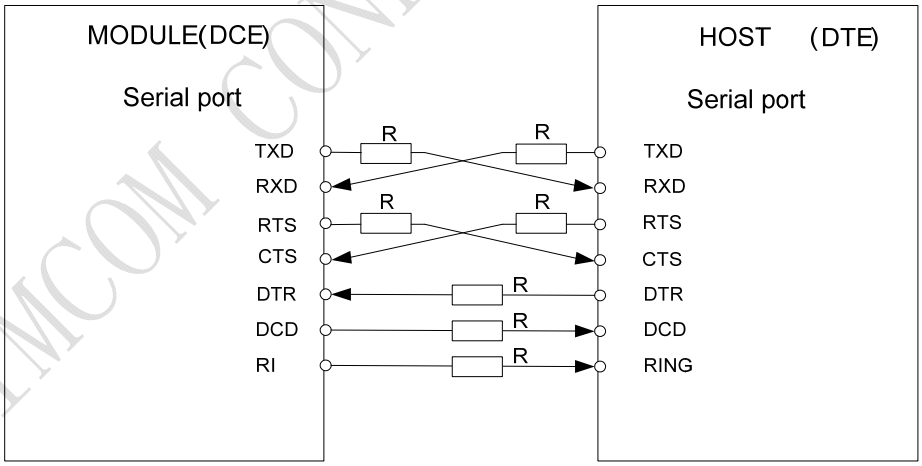


**Figure 19: Full modem**

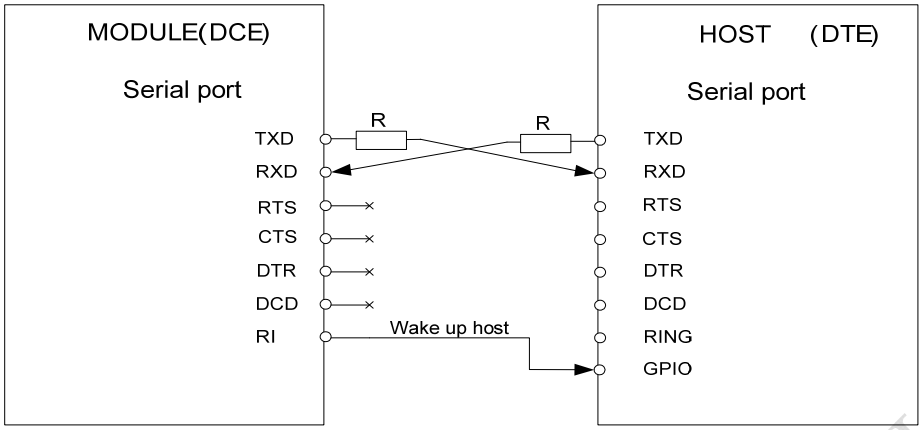


**Figure 20: Null modem**

### 3.3.1 Pin Description

**Table 8: Pin description**

| Pin type | Pin name | Pin No. | I/O | Active voltage | Default Status |
|---|---|---|---|---|---|
| UART | UART_RXD | 61 | I | High/Low | Pull-Down |
| | UART_TXD | 58 | O | High/Low | Pull-Up |
| | UART_RTS | 63 | O | High/Low | |
| | UART_CTS | 62 | I | High/Low | Pull-Up |
| | UART_DTR | 57 | I | High/Low | Pull-Up |
| | UART_DCD | 59 | O | High/Low | |
| | UART_RI | 60 | O | High/Low | |

More pin information refers to chapter 2.2.

**Table 9: Logic level**

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Logic low input | -0.3 | 0.91 | V |
| Logic high input | 1.69 | 2.9 | V |
| Logic low output | 0 | 0.45 | V |
| Logic high output | 2.15 | 2.6 | V |

### 3.3.2 Application Guide

If UART port is used in Null Modem, the pin “RI” can be used as an interrupt signal to HOST. Normally it will keep high logic level until certain condition such as receiving SMS, voice call (CSD, video) or URC

reporting, then “RI” will change to low logic level to inform the master (client PC). It will stay low until the master clears the interrupt event with AT command.

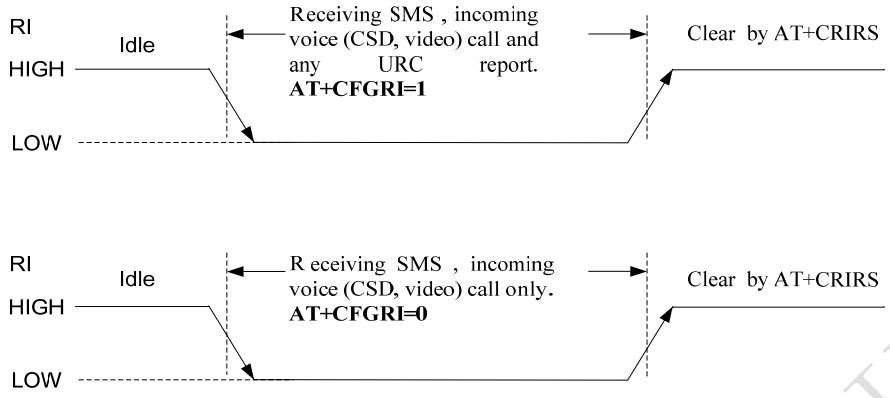


**Figure 21: RI behaviour in NULL Modem**

If Full Modem is used to establish communication between devices, the pin “RI” is another operation status. Initially it keeps high, when a voice call or CSD call comes, the pin “RI” will change to low for about 5900ms, then it will return to high level for 100ms. It will repeat this procedure until this call is answered or hung up.

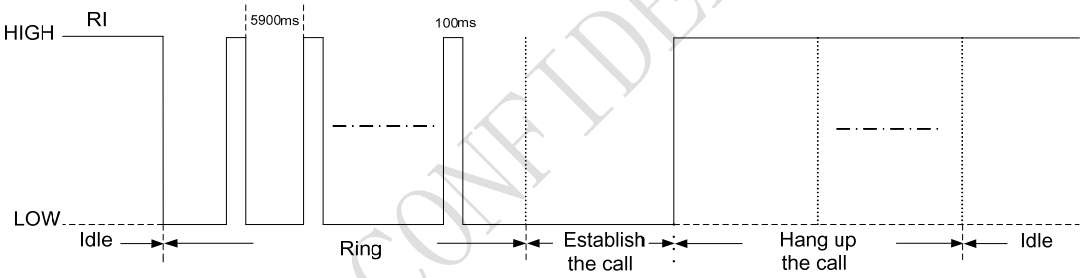


**Figure 22: RI behaviour in FULL Modem**

To comply with RS-232 protocol, the RS-232 level shifter chip should be used to connect SIM5320JE-TE to the RS-232-C interface. In this connection, the TTL level and RS-232 level are converted mutually. SIMCom recommends that user uses the SP3238ECA chip with a full modem. For more information please refers to the RS-232 chip datasheet.

***Note: SIM5320JE-TE supports the communication rate: 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200, 230400, 460800, 921600, 3200000, 3686400, 4000000bps. Default rate is 115200bps.***

## 3.4 Audio Interfaces

SIM5320JE-TE provides two analog signal outputs and one analog input. MIC1P/N is used as microphone, EAR1P/N and SPK_P/N are used as audio output. Regarding audio parameters configuration, please refer

to the ATC manual.

### 3.4.1 Pin Description

**Table 10: Pin description**

| Audio channel | Pin name | Pin No. | Function |
|---|---|---|---|
| Normal | MIC1P | 36 | MIC positive input |
| | MIC1N | 35 | MIC negative input |
| | EAR1P | 33 | Receiver positive output |
| | EAR1N | 34 | Receiver negative output |
| Hand-free | MIC1P | 36 | MIC positive input |
| | MIC1N | 35 | MIC negative input |
| | SPK_P | 37 | Loudspeaker positive output |
| | SPK_N | 38 | Loudspeaker negative output |

**Table 11: MIC input characteristics**

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Working Voltage | - | 1.8 | - | V |
| Working Current | 0.07 | 0.4 | 1 | mA |
| External Microphone Load Resistance | 1.2 | 2.2 | | k Ohms |

**Table 12: Audio output characteristics**

| Parameter | | | Min | Typ | Max | Unit |
|---|---|---|---|---|---|---|
| Normal (EAR_P,EAR_N) | Differential | Load resistance | 27 | 32 | - | Ohm |
| | | Output power | - | 50 | - | mW |

**Table 13: Speaker output characteristics**

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Quiescent Current | - | 2.5 | 4 | mA |
| Load resistance | - | 8 | - | Ohm |
| Output power(1KHz) | - | 500 | - | mW |

### 3.4.2 Design Guide

There are three audio channels in SIM5320JE-TE，including speaker output , receiver output and microphone input.

SPEAKER circuit in SIM5320JE-TE is a Class-D amplifier, optional EMI filter is shown in the following figure; these components (two ferrite beads and two capacitors) can reduce electromagnetic interference. If used, they should be located beside SPK_P and SPK_N pins. Considerable current flows in the channels,

so wider PCB traces are recommended (~ 20 mils).

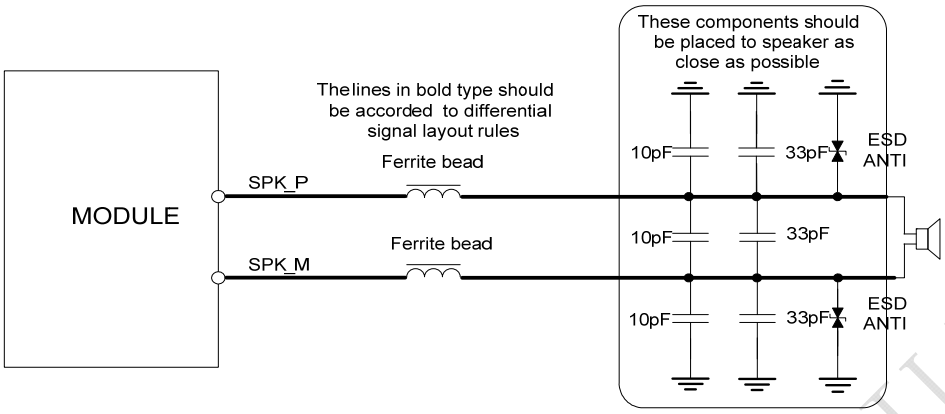


**Figure 23: Speaker interface configuration**

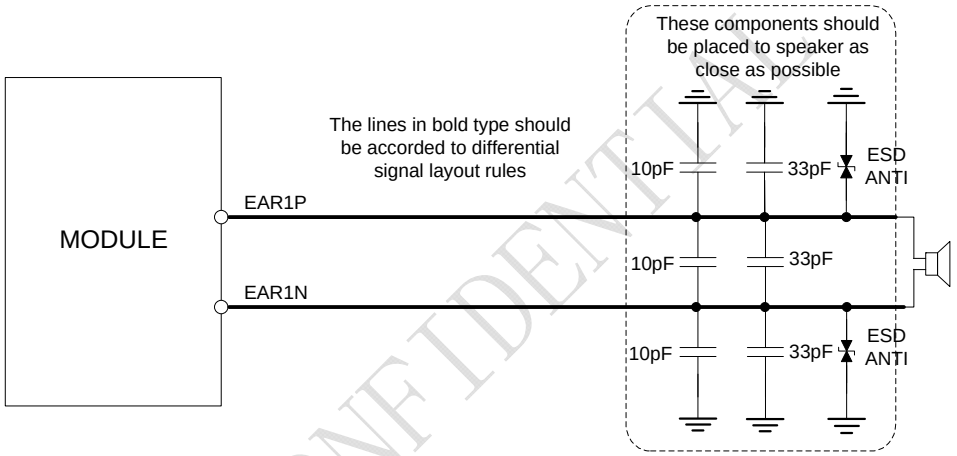


**Figure 24: Receiver interface configuration**

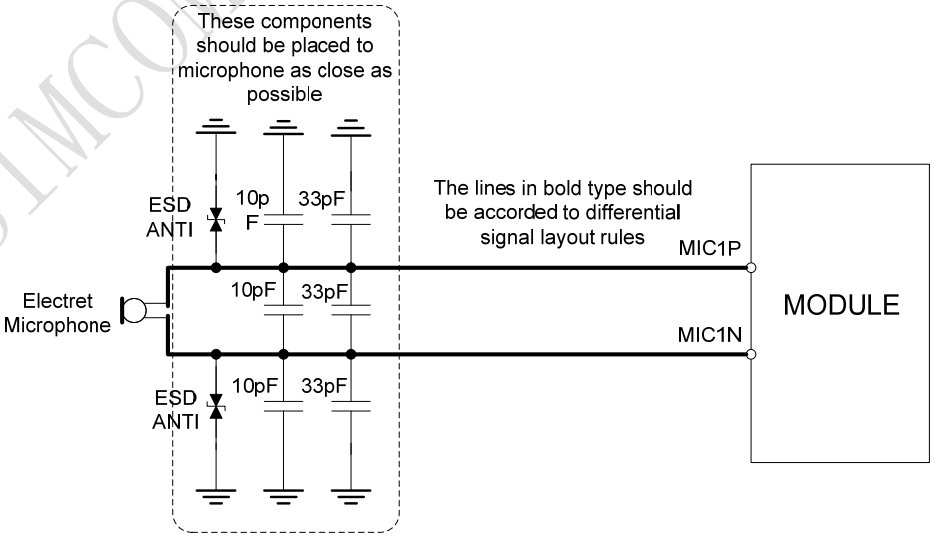


**Figure 25: Microphone interface configuration**

***Note: SIM5320JE-TE has integrated MIC bias circuit. There is no need to pull the MIC1P and MIC1N up to the external power, just connect it to microphone. MIC1P and MIC1N must be differential lines.***

### 3.4.3 Audio Parameter Characteristic

Main audio parameters can be changed to satisfy users' requirement. Here primary register parameters and related description are listed. User can adjust them through AT command. For more detail please refers to Audio Application Document.

**Table 14: Audio parameter**

| Parameter | Influence to | Range | Gain range | Calculation | AT command |
|---|---|---|---|---|---|
| **micAmp1** | MICP/MICN analogue amplifier gain before ADC | 0…1 | 0…24dB | 2 steps | AT+CMICAMP1 |
| **txVol** | Digital gain of input signal after ADC | 0, 1...65535 | Mute, -84...+12dB | 20 * log (txVol/ 16384) | AT+CTXVOL |
| **txGain** | Digital gain of input signal after summation of sidetone | 0, 1...65535 | Mute, -84...+12dB | 20 * log (txGain/ 16384) | AT+CTXGAIN |
| **txFilter** | Input PCM 13-tap filter parameters, 7 values | 0...65535 | --- | MATLAB calculate | AT+CTXFTR |
| **rxGain** | Digital gain of output signal after summation of sidetone | 0, 1...65535 | Mute, -84...+12dB | 20 * log (rxGain/ 16384) | AT+CRXGAIN |
| **rxVol** | Digital Volume of output signal after speech decoder, before summation of sidetone and DAC | -300…300 | dbm | -300…300dbm | AT+CLVL AT+CVLVL AT+CRXVOL |
| **stGain** | Digital attenuation of sidetone | 0, 1...65535 | Mute, -96...0dB | 20 * log (stGain/ 16384) -12 | AT+SIDET |
| **rxFilter** | Output PCM 13-tap filter parameters, 7 values | 0...65535 | --- | MATLAB calculate | AT+CRXFTR |

***Note: If users require better experience on audio, users should modify these parameters according to their own electronic***

*and mechanical design.*

## 3.5 USIM Interface

The USIM provides the required subscription verification information to allow the mobile equipment to attach to a GSM or UMTS network. Both 1.8V and 3.0V SIM Cards are supported.

### 3.5.1 Pin description

**Table 15: Electronic characteristic**

| Pin name | 3.0V mode | | | 1.8V mode | | |
|---|---|---|---|---|---|---|
| | Min | Typ | Max | Min | Typ | Max |
| V_USIM | 2.7 | 3.00 | 3.3 | 1.65 | 1.8 | 2.0 |
| USIM_RESET | 0.8* V_USIM | 3.00 | V_USIM | 0.8* V_USIM | 1.8 | V_USIM |
| USIM_CLK | 0.7* V_USIM | 3.00 | V_USIM | 0.8* V_USIM | 1.8 | V_USIM |
| USIM_DATA | 0.7* V_USIM | 3.00 | V_USIM | 0.8* V_USIM | 1.8 | V_USIM |

**Table 16: Pin description**

| Pin name | Pin | Description |
|---|---|---|
| USIM_CLK | 28 | USIM Card Clock |
| USIM_RESET | 27 | USIM Card Reset |
| USIM_DATA | 29 | USIM Card data I/O, which has been pulled up with a 22kR resistor to V_USIM in module. Do not pull up or pull down in users' application circuit. |
| V_USIM | 30 | USIM Card Power output depends automatically on USIM mode，one is 3.0V±10%, another is 1.8V±10%. Current is less than 50mA. |

### 3.5.2 Application Guide

It is recommended to use an ESD protection component such as ST (www.st.com ) ESDA6V1W5 or ON SEMI (www.onsemi.com ) SMF05C. Note that the SIM peripheral circuit should be close to the SIM card socket. The reference circuit of the 8-pin SIM card holder is illustrated in the following figure.

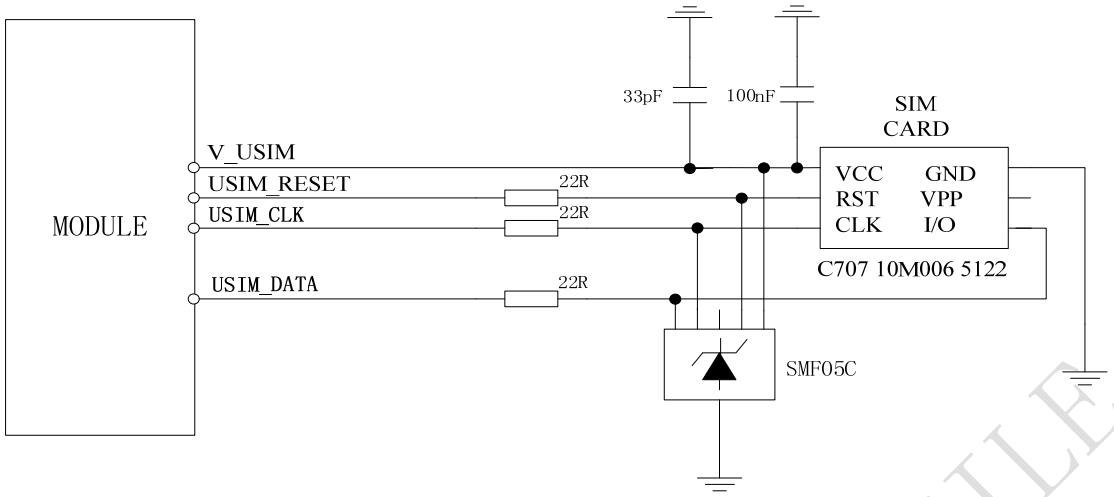


**Figure 26: USIM interface reference circuit**

***Note: USIM_DATA has been pulled up with a 22kR resistor to V_USIM in module. A 220nF shut capacitor on V_USIM is used to reduce interference. Use AT Commands to get information in USIM card. For more detail, please refer to document [1].***

### 3.5.3 Recommend Components

For 6 pins USIM socket, SIMCom recommend to use Amphenol **C707 10M006 512 2**. User can visit http://www.amphenol.com for more information about the holder.

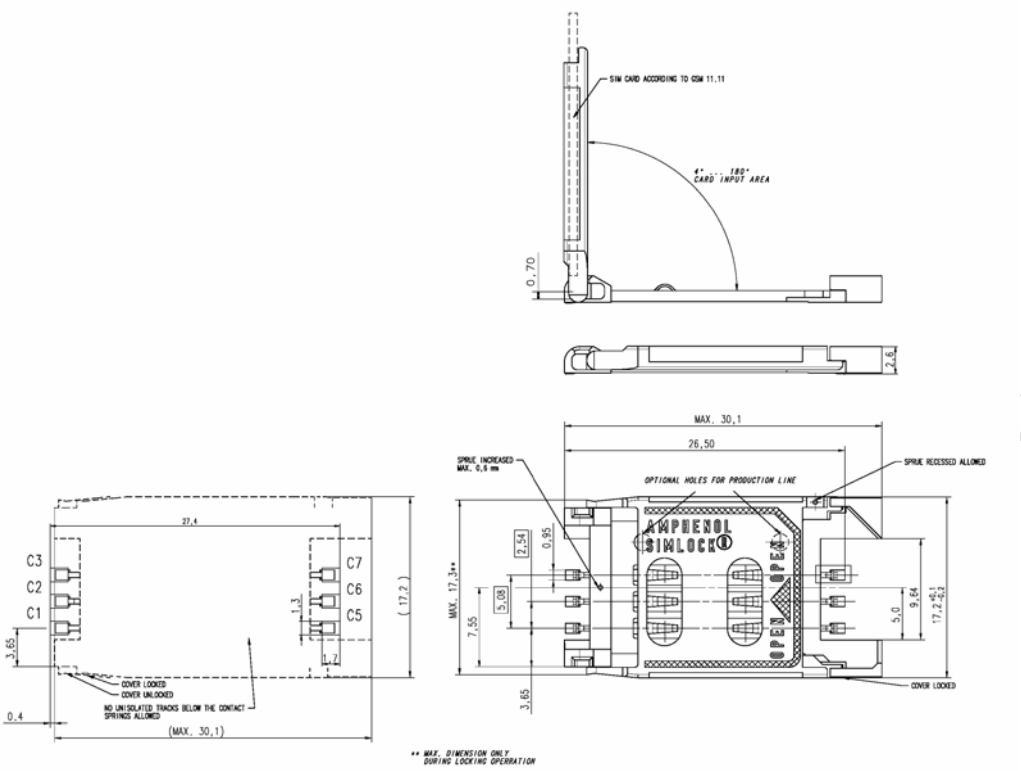


**Figure 27: Amphenol SIM card socket**

**Table 17: Amphenol USIM socket pin description**

| Pin | Signal | Description |
|---|---|---|
| C1 | USIM_VDD | SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%. |
| C2 | USIM_RST | SIM Card Reset. |
| C3 | USIM_CLK | SIM Card Clock. |
| C5 | GND | Connect to GND. |
| C6 | VPP | Connect to USIM_VDD |
| C7 | USIM_DATA | SIM Card data I/O. |

## 3.6 I2C Interface

I2C is used to communicate with peripheral equipments and can be operated as either a transmitter or receiver, depending on the device function. Use AT Commands “AT+CRIIC and AT+CWIIC” to read/write register values of related peripheral equipments connected with I2C interface.

### 3.6.1 Pin Description

**Table 18: Pin description**

| Pin name | Pin No. | Function |
|---|---|---|
| I2C_SDA | 64 | Serial interface data input and output |
| I2C_SCL | 65 | Serial interface clock input |

### 3.6.2 Signal Description

Both SDA and SCL are bidirectional lines, connected to a positive supply via a pull-up resistor respectively. When the bus is free, both lines are high.

### 3.6.3 Design Guide

For SIM5320JE-TE, the data on the I2C bus can be transferred at rates up to 400kbps. The number of peripheral devices connected to the bus is solely dependent on the bus capacitance limit of 400pF. Note that PCB traces length and bending are in users' control to minimize load capacitance.

***Note：I2C_SDA and I2C _SCL have been pulled up with two 2.2kR resistors to 2.6V level in module. So there is no need to pull them up in users' application circuit.***

## 3.7 Keypad Interface

SIM5320JE-TE module provides a keypad interface that supports five sense lines, or columns, and five keypad rows. The interface generates an interrupt when any key is pressed. Its operation voltage is 1.8V.

### 3.7.1 Pin Description

**Table 19: Pin description**

| Pin name | Pin No. | Function |
|---|---|---|
| KEYSENSE_N0 | 22 | Sensing keys |
| KEYSENSE_N1 | 23 | |
| KEYSENSE_N2 | 19 | |
| KEYSENSE_N3 | 18 | |
| KEYSENSE_N4 | 14 | |
| KEYPAD_0 | 21 | Driving pads |
| KEYPAD_1 | 17 | |
| KEYPAD_2 | 20 | |
| KEYPAD_3 | 15 | |
| KEYPAD_4 | 16 | |

### 3.7.2 Application Guide

All keypad pins can be configured for GPIOs. These GPIOs also support interruption operation if used as input pins. A typical circuit about the keypad (5*5 keypad matrix) is shown in the following figure.

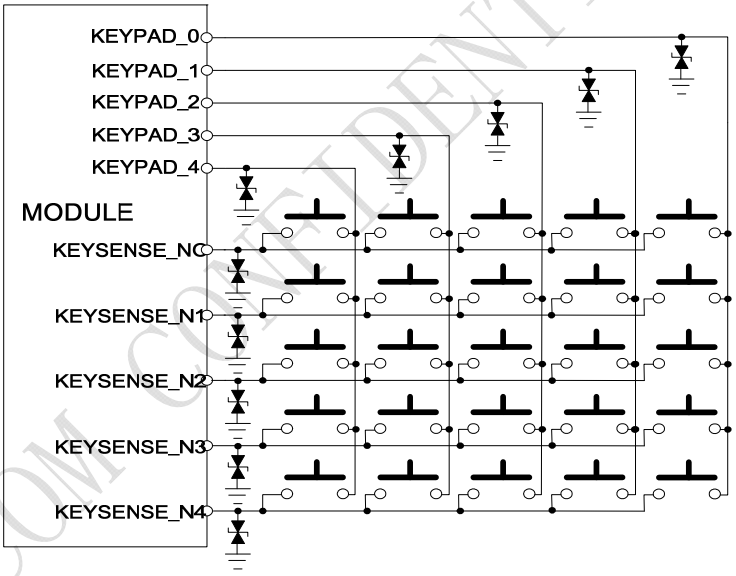


**Figure 28: Reference circuit**

If these pins are configured for GPIOs, the sequence is listed in the following table.

**Table 20: GPIO configuration**

| Keypad interface | GPIO No. |
|---|---|
| KEYPAD_4 | GPIO6 |
| KEYPAD_3 | GPIO7 |
| KEYPAD_2 | GPIO8 |
| KEYPAD_1 | GPIO9 |
| KEYPAD_0 | GPIO10 |
| KEYSENSE_N4 | GPIO11 |
| KEYSENSE_N 3 | GPIO12 |
| KEYSENSE_N 2 | GPIO13 |
| KEYSENSE_N 1 | GPIO14 |
| KEYSENSE_N 0 | GPIO15 |

***Note: Refer to document [23] for detailed information of Keypad Application Note.***

## 3.8 USB Interface

SIM5320JE-TE module contains a USB interface. This interface is compliant with the USB2.0 specification. The USB2.0 specification requires hosts such as the computer to support all three USB speeds, namely low-speed (1.5Mbps), full-speed (12Mbps) and high-speed (480Mbps). USB charging and USB-OTG is not supported.

**Table 21: Electronic characteristic**

| Pin name | Pin No. | Input voltage scope( V ) | | |
|---|---|---|---|---|
| | | Min | Typ | Max |
| USB_VBUS | 49 | 4.4 | 5.0 | 5.25 |
| USB_DM | 50 | They are compliant with the USB 2.0 specification. | | |
| USB_DP | 51 | | | |

### 3.8.1 Application Guide

Currently SIM5320JE-TE supports the USB suspend and resume mechanism which can help to save power. If no transaction is on USB bus, SIM5320JE-TE will enter suspend mode. When some events such as voice call or receiving SMS happen, SIM5320JE-TE will resume normal mode automatically.

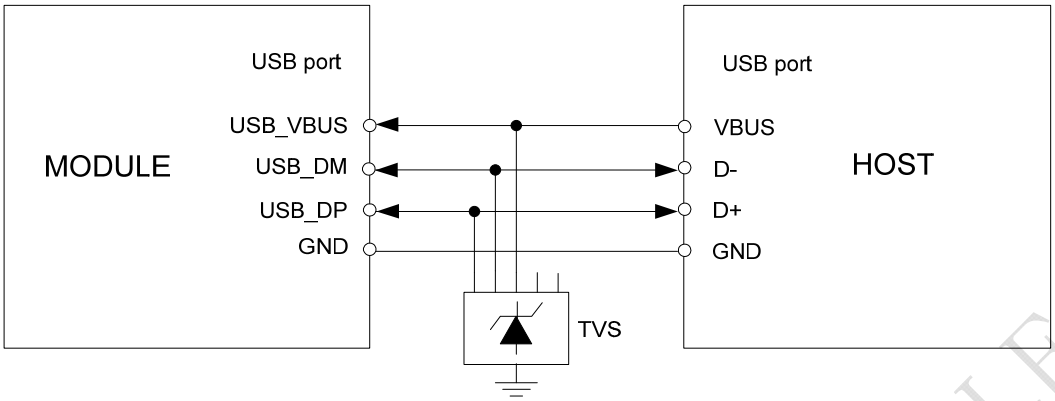


**Figure 29: USB interface**

Because of high bit rate on USB bus, pay attention to influence of junction capacitance of ESD component on USB data lines. Typically, the capacitance should be less than 4pF @1MHz.

***Note：The SIM5320JE-TE has two kinds of interface (UART and USB) to connect to host CPU. USB interface is mapped to five virtual ports: "SIMTECH USB Modem", "SIMTECH NMEA Device", "SIMTECH ATCOM Device", "SIMTECH Diagnostics interface" and "SIMTECH Wireless Ethernet Adapter".***

## 3.9 SPI Interface

SPI interface of SIM5320JE-TE is master only. It provides a duplex, synchronous, serial communication link with peripheral devices. Its operation voltage is 1.8V, with clock rates up to 26 MHz.

### 3.9.1 Pin Description

**Table 22: Electronic characteristic**

| Pin name | DC Characteristics | | |
|---|---|---|---|
| | Min | Typ | Max |
| SPI_CLK | -0.3 | 1.8 | 2.1 |
| SPI_CS_N | -0.3 | 1.8 | 2.1 |
| SPI_MOMI_DATA | -0.3 | 1.8 | 2.1 |
| SPI_MIMO_DATA | -0.3 | 1.8 | 2.1 |

**Table 23: Pin description**

| Pin name | Pin No. | Function |
|---|---|---|
| SPI_CS | 46 | SPI chip-select; not mandatory in a point-to-point connection |
| SPI_MISO_DATA | 44 | SPI master in/slave out data |
| SPI_CLK | 43 | SPI clock |
| SPI_MOSI_DATA | 45 | SPI master out/slave in data |

## 3.10 GPIO Interface

SIM5320JE-TE provides a limited number of GPIO pins. All GPIOs can be configured as inputs or outputs. User can use AT Commands to read or write GPIOs status. Refer to ATC document for details.

### 3.10.1 Pin Description

**Table 24: Electronic characteristic**

| Pin name | DC Characteristics | | |
|---|---|---|---|
| | Min | Typ | Max |
| GPIO1 | -0.3 | 2.6 | 2.9 |
| GPIO4 | -0.3 | 2.6 | 2.9 |
| GPIO40 | -0.3 | 2.6 | 2.9 |
| GPIO41 | -0.3 | 2.6 | 2.9 |
| GPIO43 | -0.3 | 2.6 | 2.9 |
| GPIO44 | -0.3 | 2.6 | 2.9 |
| GPIO42 | -0.3 | 2.6 | 2.9 |

***Note: If more GPIOs need to be used, users can configure GPIO on other multiple function interfaces, such as PCM. Please refer to GPIO list.***

**Table 25: Pin description**

| Pin name | Pin No. | I/O | Function |
|---|---|---|---|
| GPIO1 | 68 | O | Output PIN as LED control for network status. If it is unused, left open. |
| GPIO4 | 66 | I | Input PIN as RF operating control.<br>H: Normal Mode L:Flight Mode<br>If it is unused, left open. |
| GPIO40 | 71 | O | Output PIN as operating status indicating of module.<br>H: Power on L: Power off<br>If it is unused, left open. |
| GPIO41 | 69 | I/O | General input/output PIN. It can be used as wake/interrupt signal to host from module If it is unused, left open. |
| GPIO42 | 67 | I/O | General Purpose Input/Output Port. |
| GPIO43 | 70 | I/O | General Purpose Input/Output Port. It can be used as wake/interrupt signal to module from host. If it is unused, left open. |
| GPIO44 | 72 | I/O | General Purpose Input/Output Port |

***Note: The output driver current of GPIOs is 2mA.***

### 3.10.2 Application Guide

**Network status**

GPIO1 is used to control Network Status LED; application circuit is shown below.

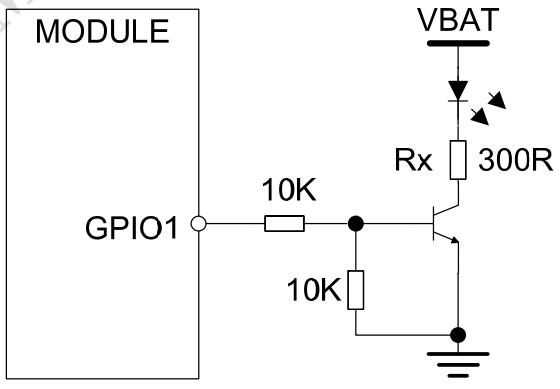


**Figure 30: Application circuit**

***Note: The value of resistor Rx depends on LED characteristic.***

**Table 26: LED status**

| LED Status | Module Status |
|---|---|
| Always On | Searching Network/Call Connect |
| 200ms ON, 200ms OFF | Data Transmit |
| 800ms ON, 800ms OFF | Registered network |
| Off | Power off / Sleep |

**Flight mode control**

GPIO4 controls SIM5320JE-TE module to enter or exit the Flight mode. In Flight mode, SIM5320JE-TE closes RF function to prevent interference with other equipments or minimize current consumption. Bidirectional ESD protection component is suggested to add on GPIO4.

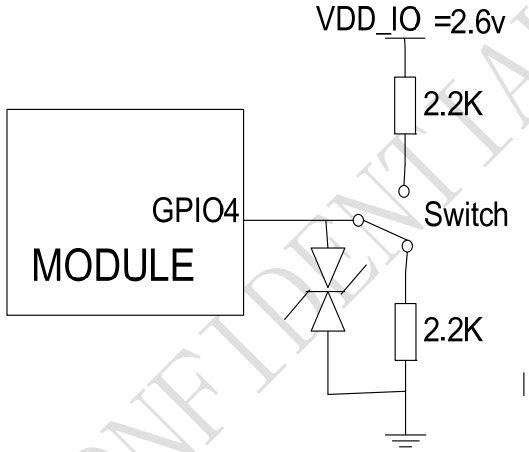


**Figure 31: Flight mode switch**

**Table 27: Control status**

| GPIO4 Status | Module operation |
|---|---|
| Low Level | Flight Mode: RF is closed. |
| High Level | Normal Mode: RF is working. |

***Note：1. For SIM5320JE-TE, GPIO0, GPIO2, GPIO3 and GPIO5 have multiplex function, user can use them as PCM interface to connect extend codec. Refer to section 3.10 and document [1] for details.***

***2. When the module is powered off, make sure all digital interfaces (PCM UART, etc) connected with peripheral devices have no voltage higher than 0.3V. If users' design cannot meet above conditions, high level voltages maybe occur in GPIO pins because current leakage from above digital interfaces may occur.***

## 3.11 PCM Interface

SIM5320JE-TE provides hardware PCM interface for external codec. The PCM interface enables communication with an external codec to support hands-free applications. SIM5320JE-TE PCM interface can be used in two modes: the default mode is auxiliary PCM (8 KHz long sync mode at 128 KHz PCM CLK); the other mode is primary PCM (8 KHz short sync mode at 2048 KHz PCM CLK). In short-sync (primary PCM) mode, SIM5320JE-TE can be a master or a slave. In long-sync (auxiliary PCM) mode, SIM5320JE-TE is always a master. SIM5320JE-TE also supports 3 kinds of coding formats: 8 bits (υ-law or A-law) and 16 bits (linear).

***Note: PCM interface is multiplexed from GPIO (default setting). The AT command "AT+CPCM" is used to switch between PCM and GPIO functions. Please refer to document [22] and document [1] for details.***

### 3.11.1 Pin Description

**Table 28: Electronic characteristic**

| Pin name | DC Characteristics | | |
|---|---|---|---|
| | Min | Typ | Max |
| PCM_CLK | -0.3 | 2.6 | 2.9 |
| PCM_SYNC | -0.3 | 2.6 | 2.9 |
| PCM_DOUT | -0.3 | 2.6 | 2.9 |
| PCM_DIN | -0.3 | 2.6 | 2.9 |

**Table 29: Pin description**

| Pins | Pin No. | AUX_PCM functionality | Primary PCM functionality | Description |
|---|---|---|---|---|
| PCM_DIN/GPIO0 | 54 | AUX_PCM_DIN | PCM_DIN | PCM data input |
| PCM_SYNC/GPIO2 | 53 | AUX_PCM_SYNC | PCM_SYNC | PCM data synchrony |
| PCM_DOUT/GPIO5 | 55 | AUX_PCM_DOUT | PCM_DOUT | PCM data output |
| PCM_CLK/GPIO3 | 52 | AUX_PCM_CLK | PCM_CLK | PCM data clock |

### 3.11.2 Signal Description

The default PCM interface in SIM5320JE-TE is the auxiliary PCM interface. The data changes on the high level of PCM_CLK and is sampled at the falling edge of PCM_CLK in one period. Primary PCM is disabled after every power-on or every reset event. So user must use AT command to enable the primary

PCM mode after powering on or resetting the module every time if user wants to use Primary PCM.SIM5320JE-TE PCM Interface can be operated in Master or Slave mode if it is configured to primary PCM. In Master Mode, the Module drives the clock and sync signals that are sent to the external codec. When it is in Slave Mode, the external codec drives the clock and sync signals which are sent to the module. Both PCM modes are discussed in this section followed by additional PCM topics.

**Auxiliary PCM (128 KHz PCM clock)**

υ-law coding is supported by the auxiliary PCM. The auxiliary codec port operates with standard long-sync timing and a 128 KHz clock. The AUX_PCM_SYNC runs at 8 KHz with 50% duty cycle. Most υ-law codec support the 128 KHz clock.

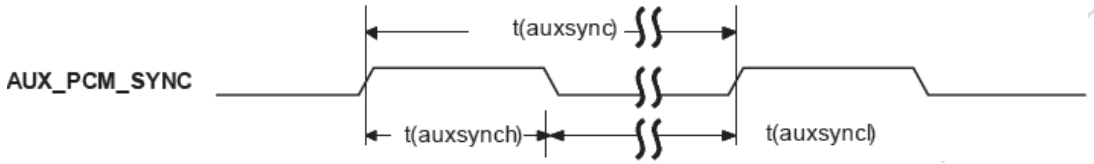


**Figure 32: Synchrony timing**

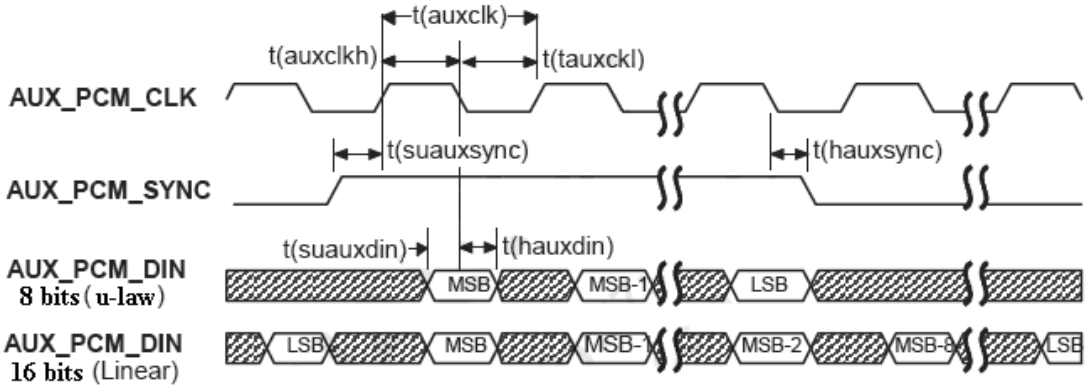


**Figure 33: EXT CODEC to MODULE timing**

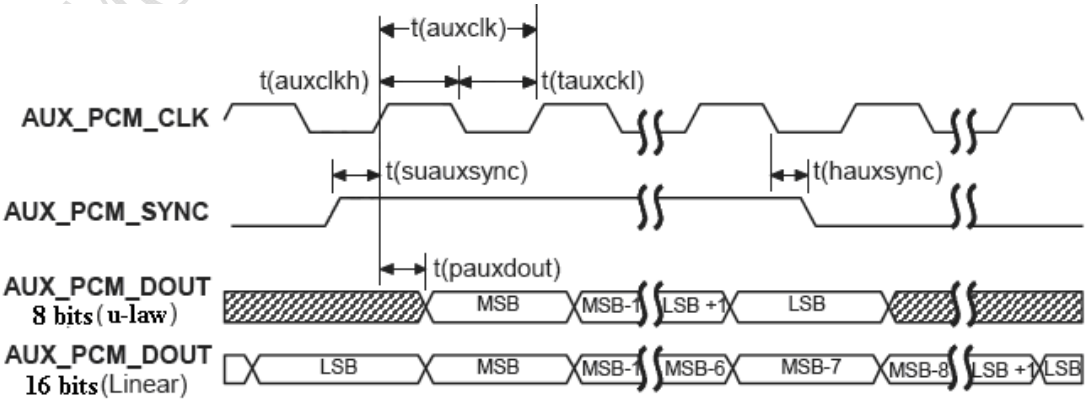


**Figure 34: MODULE to EXT CODEC timing**

**Table 30: Timing parameters**

| Parameter | Description | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| T(auxsync) | AUX_PCM_SYNC cycle time | – | 125 | - | µs |
| T(auxsynch) | AUX_PCM_SYNC high time | 62.4 | 62.5 | - | µs |
| T(auxsyncl) | AUX_PCM_SYNC low time | 62.4 | 62.5 | - | µs |
| T(auxclk)* | AUX_PCM_CLK cycle time | - | 7.8 | – | µs |
| T(auxclkh) | AUX_PCM_CLK high time | 3.8 | 3.9 | – | µs |
| T(auxclkl) | AUX_PCM_CLK low time | 3.8 | 3.9 | – | µs |
| T(suauxsync) | AUX_PCM_SYNC setup time high before falling edge of PCM_CLK | 1.95 | – | – | µs |
| T(hauxsync) | AUX_PCM SYNC hold time after falling edge of PCM_CLK | 1.95 | – | – | µs |
| T(suauxdin) | AUX_PCM_DIN setup time before falling edge of AUX_PCM_CLK | 70 | – | – | ns |
| T(hauxdin) | AUX_PCM_DIN hold time after falling edge of AUX_PCM_CLK | 20 | – | – | ns |
| T(pauxdout) | Delay from AUX_PCM_CLK rising to AUX_PCM_DOUT valid | – | – | 50 | ns |

***Note: T(auxclk) = 1/(128 KHz).**

**Primary PCM (2048 KHz PCM clock)**

SIM5320JE-TE also supports 2.048 MHz PCM data and sync timing for υ-law codec. This is called the primary PCM interface. User can use AT command to take the mode you want as discussed above.

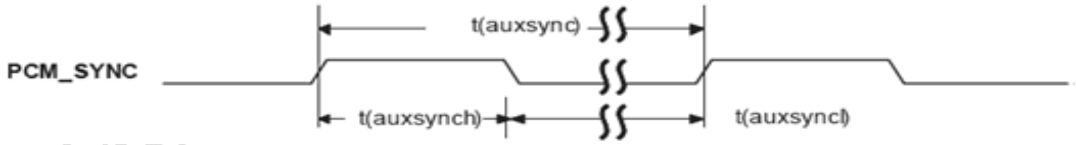


**Figure 35: Synchrony timing**

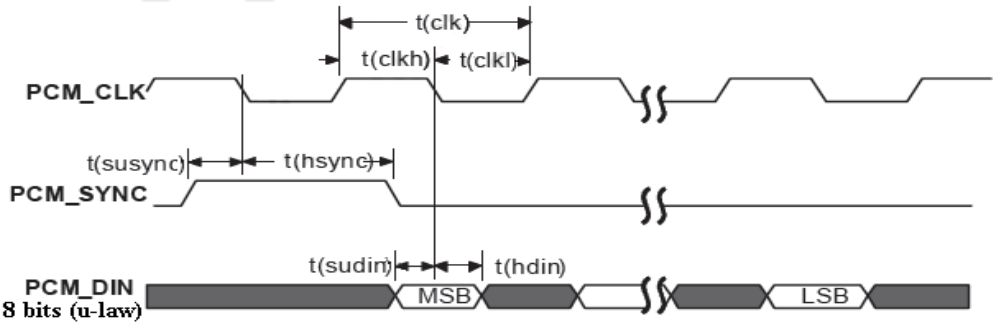


**Figure 36: EXT CODEC to MODULE timing**

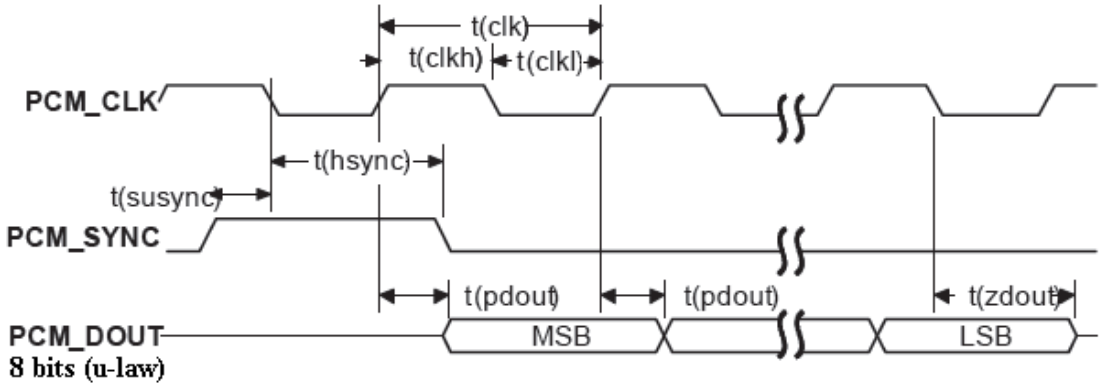


**Figure 37: MODULE to EXT CODEC timing**

**Table 31: Timing parameters**

| Parameter | Description | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| T(sync) | PCM_SYNC cycle time | – | 125 | – | µs |
| T(synch) | PCM_SYNC high time | 400 | 500 | – | ns |
| T(syncl) | PCM_SYNC low time | – | 124.5 | – | µs |
| T(clk) | PCM_CLK cycle time | – | 488 | – | ns |
| T(clkh) | PCM_CLK high time | – | 244 | – | ns |
| T(clkl) | PCM_CLK low time | – | 244 | – | ns |
| T(susync) | PCM_SYNC setup time high before falling edge of PCM_CLK | 60 | – | – | ns |
| T(hsync) | PCM_SYNC hold time after falling edge of PCM_CLK | 60 | – | – | ns |
| T(sudin) | PCM_DIN setup time before falling edge of PCM_CLK | 50 | – | – | ns |
| T(hdin) | PCM_DIN hold time after falling edge of PCM_CLK | 10 | – | – | ns |
| T(pdout) | Delay from PCM_CLK rising to PCM_DOUT valid | – | – | 350 | ns |
| T(zdout) | Delay from PCM_CLK falling to PCM_DOUT HIGH-Z | – | 160 | – | ns |

*Note:* ***SIM5320JE-TE can transmit PCM data by USB except for PCM interface. Please refer to document [22] for more information of PCM Application Note.***

## 3.12 Global Positioning System

SIM5320JE-TE merges GPS 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 GPS receivers fail, and provides a platform to enable wireless operators to address both location-based services and emergency mandates.

### 3.12.1 Technical specification

| | |
|---|---|
| **Tracking sensitivity** | -157 dBm |
| **Cold-start sensitivity** | -144 dBm |
| **Accuracy (Open Sky)** | <2m (CEP50) |
| **TTFF (Open Sky)** | Hot start <1s Cold start 35s（good signal）/ 100s(weak signal) |
| **Receiver Type** | 16-channel, GPS L1 Frequency (1575.42MHz), C/A Code |
| **Update rate** | Default 1 Hz |
| **GPS data format** | NMEA-0183 |
| **GPS Current consumption (WCDMA/GSM Sleep mode)** | 100mA (Total supply current) |
| **GPS antenna** | Passive/Active antenna |

***Note: Performance will vary depending on the environment, antenna type and signal conditions and so on.***

### 3.12.2 Operate Mode

SIM5320JE-TE supports both A-GPS and S-GPS, and then provides three operating modes: mobile-assisted mode, mobile-based mode and standalone mode. A-GPS includes mobile-assisted and mobile-based mode.

In mobile-assisted mode, when a request for position location is issued, available network information is provided to the location server (e.g. Cell-ID) and assistance is requested from the location server. The location server sends the assistance information to the handset. The handset/mobile unit measures the GPS observables and provides the GPS measurements along with available network data (that is appropriate for the given air interface technology) to the location server. The location server then calculates the position location and returns results to the requesting entity.

In mobile-based mode, the assistant data provided by the location server encompasses not only the information required to assist the handset in measuring the satellite signals, but also the information required to calculate the handset's position. Therefore, rather than provide the GPS measurements and available network data back to the location server, the mobile calculates the location on the handset and passes the result to the requesting entity.

In standalone (autonomous) mode, the handset demodulates the data directly from the GPS satellites. This mode has some reduced cold-start sensitivity, and a longer time to first fix as compared to the assisted modes. However, it requires no server interaction and works out of network coverage.

This combination of GPS measurements and available network information provides:

- High-sensitivity solution that works in all terrains: Indoor, outdoor, urban, and rural
- High availability that is enabled by using both satellite and network information

Therefore, while network solutions typically perform poorly in rural areas and areas of poor cell geometry/density, and while unassisted, GPS-only solutions typically perform poorly indoors. The SIM5320JE-TE GPS solution provides optimal time to fix, accuracy, sensitivity, availability, and reduced network utilization in both of these environments, depending on the given condition.

### 3.12.3 Application Guide

Users can adopt an active antenna or a passive antenna as GPS signal transceiver.
In active antenna circuit, SIM5320JE-TE provides DC 2.6V (VREG_AUX) for active antenna.

GPS 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 GPS, user should configure SIM5320JE-TE in proper operating mode by AT command. Please refer to related document for details. SIM5320JE-TE can also get position location information through AT directly.

***Note:GPS 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 GPS mode. Default mode is standalone mode.***
***AGPS mode needs more support from the mobile telecommunication network. Refer to AGPS application document for details.***

## 3.13 Multi-functional interface

SIM5320JE-TE merges functions for various applications. It can enrich users' design and lower the cost of users' hardware.

### 3.13.1 Sink Current Source

The dedicated pin (CURRENT_SINK) is intended for driving passive devices，such as LCD backlight, this implementation is +5V tolerant and suitable for driving white LEDs. The high-current driver can maintain a constant current which is set by *the AT command "AT+ CLEDITST"*, capable of up to 150 mA.

**Table 32: Electronic characteristic**

| Symbol | Description | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| CURRENT_SINK | Input voltage | 0.5 | VDD | 5 | V |
| $I_O$ | Input current | - | - | 150 | mA |

Since the driver is ground-referenced current sink, the operating device it drives must form a current path between the VDD pin and the CURRENT_SINK pin. The following figure is for users reference.

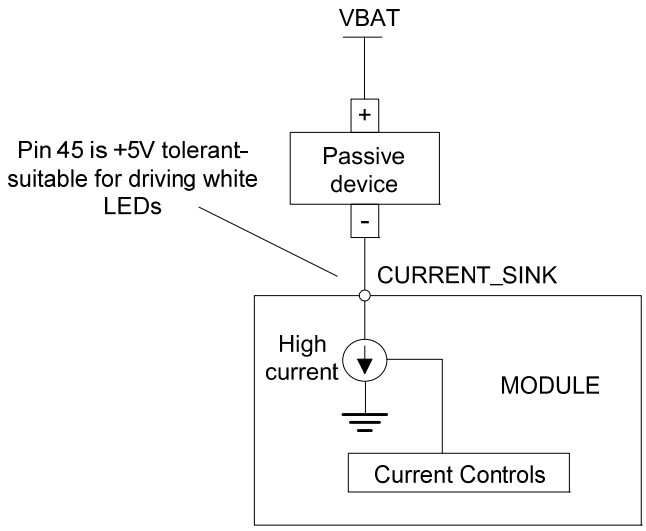


**Figure 38: Current drive**

***Note: The sinking current can be adjusted to meet design requirement through the AT command "AT+ CLEDITST =<0>, <value>".The "value" ranges from 0 to 15,on behalf of the current changes from 0mA to 150mA in steps of 10mA.***

### 3.13.2 Reset Function

SIM5320JE-TE also have a RESET pin (PIN4) to reset the module. This function is used as an emergency reset only when AT command "AT+CPOF" and the POWER_ON pin has no effect. User can pull the RESET pin to ground, then the module will reset.

This pin is already pulled up in module, so the external pull-up resistor is not necessary. A 100nF capacitor close to the RESET pin is strongly recommended. A reference circuit is recommended in the following figure.

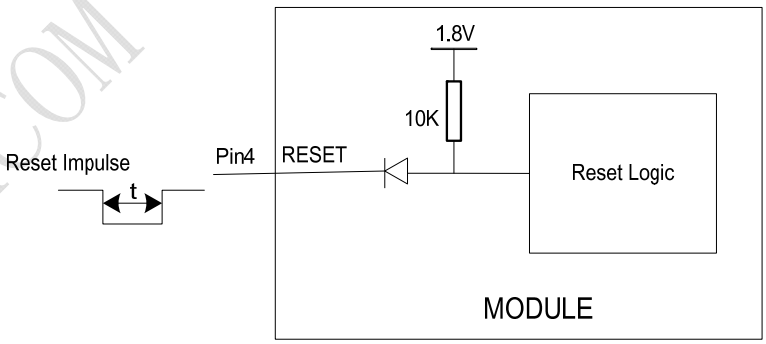


**Figure 39: Reset circuit**

*Note：50ms<t<200ms. ESD components are suggested to be used on Reset pin.*

### 3.13.3 ADC

SIM5320JE-TE has a dedicated ADC that is available for digitizing analog signals such as battery voltage

and so on; it is on PIN 13 and PIN 12 , namely ADC1 and ADC2 . This ADC is 12 bit successive-approximation circuit, and electronic specification is shown in the following table.

**Table 33: Electronic Characteristics**

| Specification | Min | Typ | Max | Unit | Comments/Conditions |
|---|---|---|---|---|---|
| Resolution | | 12 | | Bits | |
| Differential nonlinearity | -4 | | +4 | LSB | Analog Vdd = ADC reference 2.4MHz sample rate |
| Integral nonlinearity | -8 | | +8 | LSB | |
| Gain Error | -2.5 | | +2.5 | % | |
| Offset Error | -4 | | +40 | LSB | |
| Input Range | GND | | 2.2V | V | |
| Input serial resistance | | 2 | | kΩ | Sample and hold switch resistance |
| Input capacitance | | 53 | | pF | |
| Power-down to wakeup | | 9.6 | 19.2 | μs | |

User can introduce a signal in the ADC pin directly and use the AT command "AT+CADC" to get the raw data which is between 0 and 4095. The data can be transformed to any type such as voltage, temperature etc.

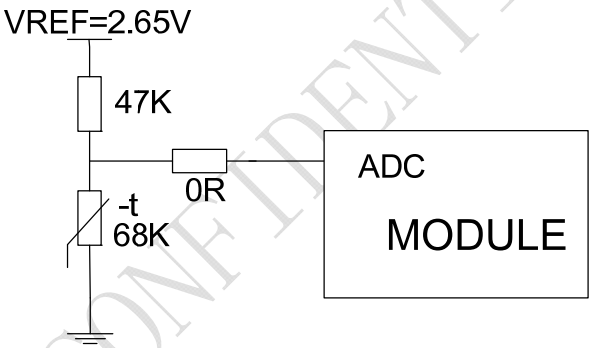


**Figure 40: Reference circuit**

***Note: The input signal voltage value in ADC must not be higher than 2.2V.***

### 3.13.4 LDO

SIM5320JE-TE has a LDO power output, namely VREG_AUX. The LDO is available and output voltage is 2.6V by default, rated for 250mA. User can switch the LDO on or off by the AT command "AT+CVAUXS" and configure its output voltage by the AT command "AT+CVAUXV".

**Table 34: Electronic characteristic**

| Symbol | Description | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| VREG_AUX | Output voltage | 1.5 | 2.6 | 3.05 | V |
| $I_O$ | Output current | - | - | 250 | mA |

# 4 RF Specification

## 4.1 RF Specification

**Table 35: Conducted transmission power**

| Frequency | Max | Min |
|---|---|---|
| GSM850 | 33dBm ±2dB | 5dBm ± 5dB |
| E-GSM900 | 33dBm ±2dB | 5dBm ± 5dB |
| DCS1800 | 30dBm ±2dB | 0dBm ± 5dB |
| PCS1900 | 30dBm ±2dB | 0dBm ± 5dB |
| GSM850 (8-PSK) | 27dBm ±3dB | 5dBm ± 5dB |
| E-GSM900 (8-PSK) | 27dBm ±3dB | 5dBm ± 5dB |
| DCS1800 (8-PSK) | 26dBm +3/-4dB | 0dBm ±5dB |
| PCS1900(8-PSK) | 26dBm +3/-4dB | 0dBm ±5dB |
| WCDMA 2100 | 24dBm +1/-3dB | -56dBm ±5dB |
| WCDMA 900 | 24dBm + 1/-3dB | -56dBm ±5dB |

**Table 36: Operating frequencies**

| Frequency | Receiving | Transmission |
|---|---|---|
| GSM850 | 869 ～894 MHz | 824 ～849 MHz |
| E-GSM900 | 925 ～960 MHz | 880 ～915 MHz |
| DCS1800 | 1805～1880 MHz | 1710～1785 MHz |
| PCS1900 | 1930～1990 MHz | 1850～1910 MHz |
| WCDMA 2100 | 2110～2170 MHz | 1920～1980 MHz |
| WCDMA 900 | 925 ～960 MHz | 880 ～915 MHz |

**Table 37: Conducted receive sensitivity**

| Frequency | Receive sensitivity |
|---|---|
| GSM850 | < -106dBm |
| E-GSM900 | < -106dBm |
| DCS1800 | < -106dBm |
| DCS1800 | < -106dBm |
| WCDMA 2100 | < -108dBm |
| WCDMA 900 | < -106dBm |

## 4.2 Operating Specification

SIM5320JE-TE can support high rate data by GSM/WCDMA wireless network. In the different network environment, data transmission rate shifts depending on modulation and encoding.

**Table 38: GPRS/EDGE data throughout**

| Function | Coding schemes | 1 Timeslot | 2 Timeslot | 4 Timeslot |
|---|---|---|---|---|
| GPRS | CS-1 | 9.05kbps | 18.1kbps | 36.2kbps |
| | CS-2 | 13.4kbps | 26.8kbps | 53.6kbps |
| | CS-3 | 15.6kbps | 31.2kbps | 62.4kbps |
| | CS-4 | 21.4kbps | 42.8kbps | 85.6kbps |
| EDGE | MCS-1 | 8.80kbps | 17.6kbps | 35.20kbps |
| | MCS-2 | 11.2kbps | 22.4kbps | 44.8kbps |
| | MCS-3 | 14.8kbps | 29.6kbps | 59.2kbps |
| | MCS-4 | 17.6kbps | 35.2kbps | 70.4kbps |
| | MCS-5 | 22.4kbps | 44.8kbps | 89.6kbps |
| | MCS-6 | 29.6kbps | 59.2kbps | 118.4kbps |
| | MCS-7 | 44.8kbps | 89.6kbps | 179.2kbps |
| | MCS-8 | 54.4kbps | 108.8kbps | 217.6kbps |
| | MCS-9 | 59.2kbps | 118.4kbps | 236.8kbps |

**Table 39: HSDPA throughout**

| Category | Supported | Max supported HS-DSCH codes | Theoretical max peak rate(Mbps) | Modulation |
|---|---|---|---|---|
| Category1 | | 5 | 1.2 | 16QAM,QPSK |
| Category2 | | 5 | 1.2 | 16QAM,QPSK |
| Category3 | | 5 | 1.8 | 16QAM,QPSK |
| Category4 | | 5 | 1.8 | 16QAM,QPSK |
| Category5 | ✓ | 5 | 3.6 | 16QAM,QPSK |
| Category6 | ✓ | 5 | 3.6 | 16QAM,QPSK |
| Category7 | | 10 | 7.2 | 16QAM,QPSK |
| Category8 | | 10 | 7.2 | 16QAM,QPSK |
| Category9 | | 15 | 10.0 | 16QAM,QPSK |
| Category10 | | 15 | 14.0 | 16QAM,QPSK |
| Category11 | | 5 | 0.9 | QPSK |
| Category12 | ✓ | 5 | 1.8 | QPSK |

*Note: Actual throughout rates depend on network configuration, network loading, signal condition and so on.*

## 4.3 Antenna Design Guide

The RF interface has an impedance of 50Ω. To suit the physical design of individual applications SIM5320JE-TE offers two alternatives:

- Recommended approach: antenna connector on the component side of the PCB
- Antenna pad and grounding plane placed on the bottom side.

To minimize the loss on the RF cable, it needs to be very careful to choose RF cable. We recommend that the insertion loss should be meet the following requirement:

- GSM900/GSM850<0.5dB
- DCS1800/PCS1900 <0.9dB
- WCDMA 2100<0.9dB
- WCDMA 900<0.5dB

# 5 Reliability and Operating Characteristics

## 5.1 Electronic Characteristics

Absolute maximum rating for digital and analog pins of SIM5320JE-TE are listed in the following table:

**Table 40: Absolute maximum ratings**

| Parameter | Min | Max | Unit |
|---|---|---|---|
| Voltage at digital pins (1.8v digital I/O) | -0.3 | 2.1 | V |
| Voltage at digital pins (2.6v digital I/O) | -0.3 | 2.9 | V |
| Voltage at VBAT | -0.5 | 6.0 | V |
| Voltage at VRTC | 1.5 | 3.2 | V |
| Voltage at USB_VBUS | -0.5 | 6.0 | V |

**Table 41: Recommended operating ratings**

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Voltage at digital pins (1.8v digital I/O) | 0 | 1.8 | 1.95 | V |
| Voltage at digital pins (2.6v digital I/O) | 0 | 2.6 | 2.8 | V |
| Voltage at VBAT | 3.3 | 3.8 | 4.2 | V |
| Voltage at VRTC | 1.5 | - | 3.0 | V |
| Voltage at USB_VBUS | 4.4 | 5 | 5.25 | V |

The operating temperature and power specification is listed in the following table.

**Table 42: Operating temperature**

| Parameter | Min | Typ | Max | Unit |
|---|---|---|---|---|
| Ambient temperature | -30 | 25 | 80 | ℃ |
| Storage temperature | -40 | 25 | +85 | ℃ |

***Note: SIMCom recommends user to install a heat sink on the module shielding case if SIM5320JE-TE operates in WCDMA band.***

## 5.2 Operating Mode

The following table summarizes the various operating modes, each operating modes will be referred to in the following chapters.

### 5.2.1 Operating Modes Overview

**Table 43: Operating Modes Overview**

| Mode | Function | |
|---|---|---|
| Sleep mode | GSM/WCDMA SLEEP | Module will automatically enter SLEEP mode if DTR is set to high level and there is no on air or hardware interrupt (such as GPIO interrupt or data on serial port).<br>In this case, the current consumption of module will be reduced to the minimal level.<br>In SLEEP mode, the module can still receive paging message，voice call and SMS. |
| GSM | GSM IDLE | Software is active. Module has registered to the GSM network, and the module is ready to communicate. |
| | GSM TALK | Connection between two subscribers is in progress. In this case, the power consumption depends on network settings (DTX off/on, FR/EFR/HR, hopping sequences, etc.) and antenna. |
| GPRS | GPRS STANDBY | Module is ready for GPRS data transfer, but no data is currently sent or received. In this case, power consumption depends on network settings and GPRS configuration. |
| | GPRS DATA | There is GPRS data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level), uplink/downlink data rates and GPRS configuration (e.g. used multi-slot settings). |
| EDGE | EDGE STANDBY | Module is ready for data transfer in EDGE mode, but no data is currently sent or received. In this case, power consumption depends on network settings and EDGE configuration |
| | EDGE DATA | There is EDGE data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level), uplink/downlink data rates and EDGE configuration. |
| WCDMA | WCDMA IDLE | Module has registered to the WCDMA network, and the module is ready to communicate. |
| | WCDMA TALK | Module is active in WCDMA mode. The power consumption depends on network settings. |
| HSDPA | HSDPA IDLE | Module is ready for data transmission, but no data is currently sent or received. Power consumption depends on network settings and HSDPA configuration |
| | HSDPA DATA | There is HSDPA data transfer (PPP or TCP or UDP) in progress. In this case, power consumption is related with network settings (e.g. power control level), uplink/downlink data rates and HSDPA configuration |
| Power down | Module can be powered down by the AT command “AT+CPOF” or the POWER_ON pin. The power management unit shuts down the power supply of the module, only the power supply of RTC is remained. The serial interface is not accessible. Operating voltage (connected to VBAT) remains applied. | |
| Minimum functionality mode | The AT command “AT+CFUN” can be used to set the module to a minimum functionality mode without removing the power supply. In this mode, the RF part of the module will not work or the SIM card will not be accessible, or both will be closed, and the serial port is still accessible. The power consumption in this mode is very low. | |

### 5.2.2 Minimize Power Consumption

There are two modes that SIM5320JE-TE achieves low power consumption.

**Sleep mode**

If peripheral equipments stops working, and there is no on air or hardware interrupts (such as GPIO interrupts or data on UART), SIM5320JE-TE will enter sleep mode automatically. In this mode, SIM5320JE-TE can still receive paging，voice call or SMS from network. If USB interface of SIM5320JE-TE is connected to host CPU, but host CPU does not support USB suspending, then SIM5320JE-TE will not enter sleep mode. After USB is disconnected, SIM5320JE-TE will enter sleep mode.

***Note: When UART interface is connected with host CPU, SIM5320JE-TE can not enter sleep mode until RXD is pulled down by the host CPU. If the module is in the idle mode, make sure to pull the RXD to low level by host CPU. SIMCom recommends using GPIO43 or UART_DTR to wake up the module from host CPU and to use GPIO41 or UART_RI to wake up the host CPU. Before designing, pay attention to how to realize waking function and refer to Document[24] and Document[25] for more detail.***

**Minimum functionality 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: Disable RF function of the module (Flight mode)

If SIM5320JE-TE has been set to minimum functionality mode, the module will firstly enter sleep mode, then the RF function and SIM card function will be closed. In this case, the serial port is still accessible, but RF function or SIM card will be unavailable. When SIM5320JE-TE is in minimum functionality or flight mode, it can return to full functionality by the AT command “AT+CFUN=1”.

***Note: For flight mode, please refer to Chapter3.10.2.***

## 5.3 Current Consumption

The current consumption in suspended mode and without USB connection is listed in the table below. Here, “suspended mode” means that SIM5320JE-TE is connected to USB bus, but it does not transfer data.

**Table 44: Current consumption**

| | |
|---|---|
| **GSM Sleep mode (without USB connection)** | |
| GSM850 | Sleep @DRX=2 4.5mA<br>Sleep @DRX=5 2.7mA<br>Sleep @DRX=9 2.3mA |
| GSM900 | Sleep @DRX=2 4.5mA<br>Sleep @DRX=5 2.7mA<br>Sleep @DRX=9 2.3mA |
| DCS1800 | Sleep @DRX=2 4.5mA<br>Sleep @DRX=5 2.7mA<br>Sleep @DRX=9 2.3mA |
| PCS1900 | Sleep @DRX=2 4.5mA<br>Sleep @DRX=5 2.7mA<br>Sleep @DRX=9 2.3mA |
| **GSM Sleep Mode (with USB suspended)** | |
| GSM850 | Sleep @DRX=2 4.6mA<br>Sleep @DRX=5 2.8mA<br>Sleep @DRX=9 2.5mA |
| GSM900 | Sleep @DRX=2 4.6mA<br>Sleep @DRX=5 2.8mA<br>Sleep @DRX=9 2.5mA |
| DCS1800 | Sleep @DRX=2 4.6mA<br>Sleep @DRX=5 2.8mA<br>Sleep @DRX=9 2.5mA |
| PCS1900 | Sleep @DRX=2 4.6mA<br>Sleep @DRX=5 2.8mA<br>Sleep @DRX=9 2.5mA |
| **Voice Call** | |
| GSM850 | @power level #5 <300mA,Typical 305mA |
| GSM 900 | @power level #5 <300mA,Typical 305mA |
| DCS1800 | @power level #0 <250mA,Typical 237mA |
| PCS1900 | @power level #0 <250mA,Typical 237mA |
| GPRS Data | |
| **DATA mode, GPRS ( 1 Rx,4 Tx ) CLASS 12** | |
| GSM 850 | @power level #5 <660mA,Typical 488mA |
| GSM 900 | @power level #5 <660mA,Typical 484mA |
| DCS1800 | @power level #0 <530mA,Typical 346mA |
| PCS1900 | @power level #0 <530mA,Typical 353mA |
| **DATA mode, GPRS ( 3Rx, 2 Tx ) CLASS 12** | |
| GSM 850 | @power level #5 <460mA,Typical 335mA |
| GSM 900 | @power level #5 <440mA,Typical 332mA |

| | |
|---|---|
| DCS1800 | @power level #0 <400mA,Typical 260mA |
| PCS1900 | @power level #0 <300mA,Typical 263mA |
| EDGE Data | |
| **DATA mode, EDGE( 1 Rx,4 Tx ) CLASS 12** | |
| GSM 850 | @power level #8 <500mA,Typical 335mA |
| GSM 900 | @power level #8 <500mA,Typical 332mA |
| DCS1800 | @power level #2 <450mA,Typical 291mA |
| PCS1900 | @power level #2 <450mA,Typical 293mA |
| **DATA mode, EDGE( 3Rx, 2 Tx ) CLASS 12** | |
| GSM 850 | @power level #8 <330mA,Typical 235mA |
| GSM 900 | @power level #8 <330mA,Typical 231mA |
| DCS1800 | @power level #2 <300mA,Typical 206mA |
| PCS1900 | @power level #2 <300mA,Typical 209mA |
| **UMTS Sleep Mode (without USB connection)** | |
| WCDMA 2100 | Sleep @DRX=9 2.2mA<br>Sleep @DRX=8 2.7 mA<br>Sleep @DRX=6 4.7mA |
| WCDMA 900 | Sleep @DRX=9 2.2mA<br>Sleep @DRX=8 2.7 mA<br>Sleep @DRX=6 4.7mA |
| **UMTS Sleep Mode (with USB suspended)** | |
| WCDMA 2100 | Sleep @DRX=9 2.4mA<br>Sleep @DRX=8 2.8 mA<br>Sleep @DRX=6 4.8mA |
| WCDMA 900 | Sleep @DRX=9 2.4mA<br>Sleep @DRX=8 2.8 mA<br>Sleep @DRX=6 4.8mA |
| **UMTS Talk** | |
| WCDMA 2100 | @Power 23dBm Typical 539mA<br>@Power 21dBm Typical 461mA<br>@Power 10dBm Typical 195mA |
| WCDMA 900 | @Power 23dBm Typical 524mA<br>@Power 21dBm Typical 417mA<br>@Power 10dBm Typical 179mA |
| **HSDPA Data** | |
| WCDMA 2100 | @Power 23dBm CQI=22 Typical 550mA<br>@Power 21dBm CQI=5 Typical 520mA<br>@Power -5dBm CQI=22 Typical 270mA |
| WCDMA 900 | @Power 23dBm CQI=22 Typical 550mA<br>@Power 21dBm CQI=5 Typical 490mA<br>@Power -5dBm CQI=22 Typical 220mA |

## 5.4 EMC and ESD Notes

EMC tests should be performed to detect any potential problems. Possible harmful emissions radiate by

the application to the RF receiver in the receiver band. RF emissions interfere with audio input/output. It is recommended to shield the sensitive components and trace with common ground and user can add beads where necessary.

Normally SIM5320JE-TE is mounted on customer host board. Although some ESD components have been added in SIM5320JE-TE, to prevent ESD, user should put some ESD components on customers' board. The ESD components should be placed beside the connectors which human body might touch, such as SIM card holder, audio jacks, switches, keys, etc. The following table is the SIM5320JE-TE ESD measurement performance; the results are from SIMCom EVB test.

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

| Part | Contact discharge | Air discharge |
|---|---|---|
| VBAT,GND | ±4KV | ±6KV |
| UART,USB | ±2KV | ±6KV |
| Antenna port | ±4KV | ±6KV |
| Other ports | ±2KV | ±2KV |

# Appendix

## A. SIM5320JE-TE GPIOs List

**Table 46: SIM5320JE-TE GPIOs list**

| Name | GPIO Index | Default Function | Alternate Function |
|---|---|---|---|
| PCM_DIN | 0 | GPIO Interrupt [LEVEL/LOW] | PCM_DIN |
| STATUS_LED | 1 | Status led | GPIO |
| PCM_SYNC | 2 | GPIO [IN] | PCM_SYNC |
| PCM_CLK | 3 | GPIO [OUT/LOW] | PCM_CLK |
| RF_SWITCH | 4 | RF Switch | Enable/Disable RF subsystem |
| PCM_OUT | 5 | GPIO [OUT/LOW] | PCM_OUT |
| KEYPAD_4 | 6 | Keypad | GPIO |
| KEYPAD_3 | 7 | Keypad | GPIO |
| KEYPAD_2 | 8 | Keypad | GPIO |
| KEYPAD_1 | 9 | Keypad | GPIO |
| KEYPAD_0 | 10 | Keypad | GPIO |
| KEYSENSE_N4 | 11 | Keypad | GPIO |
| KEYSENSE_N3 | 12 | Keypad | GPIO |
| KEYSENSE_N2 | 13 | Keypad | GPIO |
| KEYSENSE_N1 | 14 | Keypad | GPIO |
| KEYSENSE_N0 | 15 | Keypad | GPIO |
| UART1_CTS | 33 | CTS | GPIO |
| UART1_RFR | 34 | RTS | GPIO |
| UART1_DTR | 35 | DTR wake up module | GPIO |
| UART_DCD | 36 | DCD | GPIO |
| UART_RI | 37 | RI wake up host | GPIO |
| GPIO40 | 40 | Module power up status | GPIO |
| GPIO41 | 41 | Wake up host | GPIO |
| GPIO42 | 42 | GPIO[OUT/LOW] | GPIO |
| GPIO43 | 43 | Wake up module | GPIO |
| GPIO44 | 44 | GPIO[OUT/LOW] | GPIO |

## B. Digital I/O Characteristics

**Table 47: Digital I/O characteristics**

| Parameter | Description | 2.6V Digital I/O | | | 1.8V Digital I/O | | | Unit |
|---|---|---|---|---|---|---|---|---|
| | | Min | Typ | Max | Min | Typ | Max | |
| $V_{IH}$ | High-level input voltage | 1.69 | 2.6 | 2.9 | 1.26 | 1.8 | 2.1 | V |
| $V_{IL}$ | Low-level input voltage | -0.3 | 0 | 0.91 | -0.3 | 0 | 0.63 | V |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| $V_{OH}$ | High-level output voltage | 2.15 | 2.6 | 2.6 | 1.35 | 1.8 | 1.8 | V |
| $V_{OL}$ | Low-level output voltage | 0 | 0 | 0.45 | 0 | 0 | 0.45 | V |
| IOH | High-level output current | - | 2 | - | - | 1 | - | mA |
| IOL | Low-level output current | - | -2 | - | - | -1 | - | mA |
| $I_{IH}$ | Input high leakage current | - | - | 1 | - | - | 1 | uA |
| $I_{IL}$ | Input low leakage current | -1 | - | - | -1 | - | - | uA |
| $C_{IN}$ | Input capacitance | - | - | 7 | - | - | 7 | pF |

***Note: These parameters are for digital interface pins, such as keypad, GPIO, I²C, UART, SPI. Digital I/O specifications under both conditions are presented in the above tables.***

***SPI and keypad are 1.8v** Digital I/O **voltage.***

***GPIO, I²C and UART are 2.6v** Digital I/O **voltage.***

## C. Related Documents

**Table 48: Related documents**

| SN | Document name | Remark |
|---|---|---|
| [1] | SIM5320 _ATC_V1.00 | SIM5320 _ATC_V1.00 |
| [2] | ITU-T Draft new recommendationV.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] | Audio Application Note V1.01 | Audio Application Note V1.01 |
| [22] | PCM Application Note V1.02 | PCM Application Note V1.02 |
| [23] | Keypad Application Note V1.01 | Keypad Application Note V1.01 |
| [24] | *Sleep_Application_Note* | *Sleep_Application_Note* |
| [25] | *Waking_up_Application_Note* | *Waking_up_Application_Note* |
| [26] | Module secondary-SMT-UGD | SMT Note |
| [27] | SIM5xxx_Automatic_power_on_Application_Note | SIM5xxx_Automatic_power_on_Application_Note |

## D. Terms and Abbreviations

**Table 49: 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 |
| FCC | Federal Communications Commission (U.S.) |
| FD | SIM fix dialing phonebook |
| FDMA | Frequency Division Multiple Access |
| FR | Full Rate |
| GMSK | Gaussian Minimum Shift Keying |
| GPRS | General Packet Radio Service |
| GSM | Global Standard for Mobile Communications |
| HR | Half Rate |
| I2C | Inter-Integrated Circuit |
| IMEI | International Mobile Equipment Identity |
| Inorm | Normal Current |
| Imax | Maximum Load Current |
| kbps | Kilo bits per second |
| Li-Ion | Lithium-Ion |
| 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 |
| Rx | Receive Direction |
| SIM | Subscriber Identification Module |
| SMS | Short Message Service |
| SPI | serial peripheral interface |
| 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 |
| Vmax | Maximum Voltage Value |
| Vnorm | Normal Voltage Value |
| Vmin | Minimum Voltage Value |
| VIHmax | Maximum Input High Level Voltage Value |
| VIHmin | Minimum Input High Level Voltage Value |
| VILmax | Maximum Input Low Level Voltage Value |
| VILmin | Minimum Input Low Level Voltage Value |
| VImax | Absolute Maximum Input Voltage Value |
| VImin | Absolute Minimum Input Voltage Value |
| VOHmax | Maximum Output High Level Voltage Value |
| VOHmin | Minimum Output High Level Voltage Value |
| VOLmax | Maximum Output Low Level Voltage Value |
| VOLmin | Minimum Output Low Level Voltage Value |
| SM | SIM phonebook |
| NC | Not connect |
| EDGE | Enhanced data rates for GSM evolution |
| HSDPA | High Speed Downlink Packet Access |
| HSUPA | High Speed Uplink Packet Access |
| ZIF | Zero intermediate frequency |
| WCDMA | Wideband Code Division Multiple Access |
| VCTCXO | Voltage control temperature-compensated crystal oscillator |
| USIM | Universal subscriber identity module |
| UMTS | Universal mobile telecommunications system |
| UART | Universal asynchronous receiver transmitter |

## E. Safety Caution

**Table 50: Safety caution**

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

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