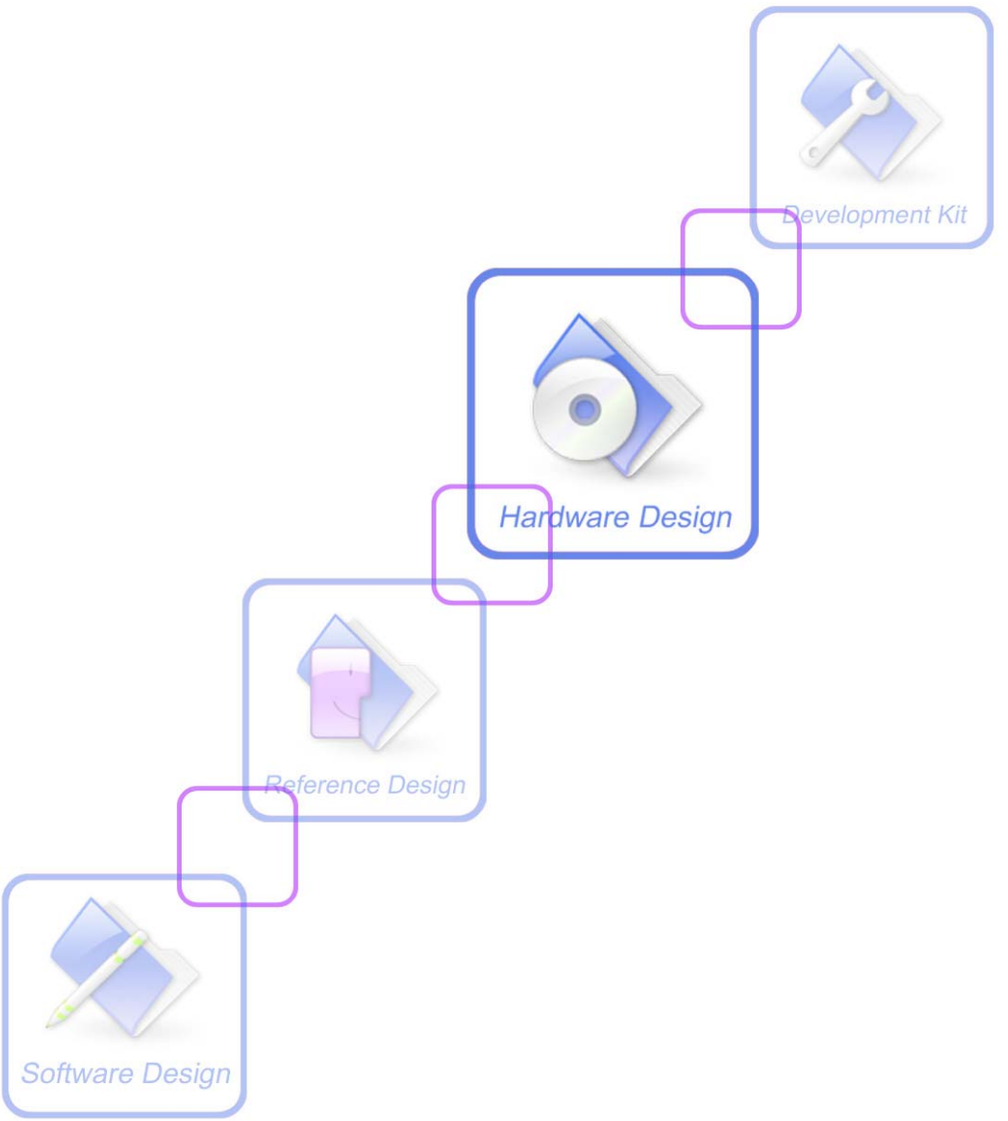
Hardware Design

SIM300_HD_V4.02



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Version history

Date	Version	Description of change	Author
2005-04-13	01.00	Origin	anthony
2005-06-29	01.01	Modify the RESET pin DC characteristics etc	anthony
2005-08-02	01.02	Modify the ESD characteristics etc	anthony
2005-08-23	01.03	Delete reset part, update mechanical dimensions, sleep mode and board-to-board connector description	anthony
2005-11-02	01.04	Add the SIM300 current consumption, modify the Buzzer pin	anthony
2005-11-22	01.05	Add the restart timing figure	anthony
2005-12-27	01.06	Add the Software upgrade, the auto-baud and the over temperature power off Modify the sleep mode control and the SIM card detection	anthony
2006-02-22	01.07	Modify the figure 3,4,5,20,28 and add the figure 14	anthony
2006-03-16	02.01	Modify for SIM300_V7.02 Add support GPRS class 8, Modify the VDD_EXT level, “RDY” out by set fixed baudrate, timing of the turn on system	anthony
2006-04-04	02.02	Modify the function of GPIO5 and BUZZER pins, the 10K resistance integrated in the VRTC pin. Add the description of the Autobauding function	anthony
2006-05-09	02.03	Update Temperature range Modify the mechanical dimensions of SIM300 Delete the description of MOLEX connector Modify the figure of the SIM reference circuit	anthony
2006-6-10	03.01	Update the figure of SIM card holder	anthony
2006-7-27	03.02	Add the note about the VRTC pin Add the note about the configuration be set and saved as the fixed baud rate	anthony
2006-8-30	03.03	Delete the chapter of antenna gain Modify the figure of the timing of turning on system Modify the figure of the timing of turning off system Modify the high voltage and low voltage of the PWRKEY Modify the PIN name	anthony
2006-11-09	03.04	Modify the audio output characteristics	anthony
2007-01-09	03.05	Modify the SIM300 key features Modify the overview of operating modes Modify the MIC input characteristics	anthony

		Modify the BUZZER & NETLIGHT reference circuits Add the note in the chapter of the Serial Interfaces about RTS	
2007-07-31	03.06	Modify the current of VDD_EXT to 10mA. Modify the range of autobauding as 4800-115200bps. Add the function of over-voltage automatic shutdown. Add the chapter 2.2, the chapter 2.3, the chapter 3.13, the chapter 6.3.2 (add the description of **JXT 210-106001-001** connector). Add the figure 1, 2, 4, 6, 7, 20, 30, 35, 38 and the table 9, 19. Modify the figure 9: Timing of turning off system (pulldown time of the PWRKEY from 1s-2s to 2s-3s), figure 5, figure 10, and table 20: ADC specification.	Anthony. Yang
2007-10-25	03.07	Modify the figure 9: Timing of turning off system (pulldown time of the PWRKEY from 2s-3s to 0.5s-1s) Add notes about Restricted operation	anyong
2008-02-14	04.01	Firmware upgrade to R16 platform. Add AMR Speech codec mode and delete ECHO suppression in the audio feature column. Modify the duration of DTR low level that wakes up the module from sleep mode. Modify the behaviours of RI. Modify RF connector type MM9329-2700B to MM9329-2700RA1 Remark on ”AT+CHFA” commands. Add notes that LCD display interface function is option. Add notes that keypad interface function is option. Add notes that GPIO0 function is option. Add the figure 34: The RF interface of module	anyong
2008-07-25	04.02	Modify the description about RF connector and RF adapter cable in paragraph 6.4 Modify the mechanical dimension of the module and recommend PCB decal drawing.in paragraph 6.1	Zhou qiang

1 Introduction

This document describes the hardware interface of the SIMCom SIM300 module that connects to the specific application and the air interface. As SIM300 can be integrated with a wide range of applications, all functional components of SIM300 are described in great detail.

This document can help you quickly understand SIM300 interface specifications, electrical and mechanical details. With the help of this document and other SIM300 application notes, user guide, you can use SIM300 module to design and set-up mobile applications quickly.

1.1 Related documents

Table 1: Related documents

SN	Document name	Remark
[1]	SIM300_ATC	SIM300_ATC
[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]	*AN_Serial Port*	*AN_Serial Port*

1.2 Terms and abbreviations

Table 2: Terms and abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
ARP	Antenna Reference Point
ASIC	Application Specific Integrated Circuit
BER	Bit Error Rate
BTS	Base Transceiver Station
CHAP	Challenge Handshake Authentication Protocol
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.)
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
I/O	Input/Output
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
Inorm	Normal Current
Imax	Maximum Load Current

Abbreviation	Description
kbps	Kilo bits per second
LED	Light Emitting Diode
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
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RTC	Real Time Clock
Rx	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TDMA	Time Division Multiple Access
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
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
Phonebook abbreviations	
Abbreviation	**Description**
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook
NC	Not connect

2 SIM300 overview

Designed for global market, SIM300 is a Tri-band GSM/GPRS engine that works on frequencies EGSM 900 MHz, DCS 1800 MHz and PCS 1900 MHz. SIM300 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4.

With a tiny configuration of 40mm x 33mm x 2.9mm , SIM300 can meet almost all the space requirements in your applications, such as smart phone, PDA phone and other mobile devices.

The physical interface to the mobile application is a 60-pin board-to-board connector, which provides all hardware interfaces between the module and customers' boards except the RF antenna interface.

- The keypad and SPI display interface will give you the flexibility to develop customized applications.
- Serial port and Debug port can help you easily develop your applications.
- Two audio channels include two microphones' inputs and two speakers' outputs. This can be easily configured by AT command.

The SIM300 provides RF antenna interface with alternatives: antenna connector and antenna pad. The antenna connector is MURATA MM9329-2700RA1. And customer's antenna can be soldered to the antenna pad.

The SIM300 is designed with power saving technique so that the current consumption is as low as 2.5mA in SLEEP mode.

The SIM300 is integrated with the TCP/IP protocol; extended TCP/IP AT commands are developed for customers to use the TCP/IP protocol easily, which is very useful for those data transfer applications.

2.1 SIM300 key features

Table 3: SIM300 key features

Feature	Implementation
Power supply	Single supply voltage 3.4V – 4.5V
Power saving	Typical power consumption in SLEEP mode to 2.5mA (BS-PA-MFRMS=5)
Frequency Bands	● SIM300 Tri-band: EGSM 900, DCS 1800, PCS 1900. The SIM300 can search the 3 frequency bands automatically. The frequency bands also can be set by AT command. ● Compliant to GSM Phase 2/2+
GSM class	Small MS
Transmitting power	● Class 4 (2W) at EGSM 900 ● Class 1 (1W) at DCS 1800 and PCS 1900
GPRS connectivity	● GPRS multi-slot class 10 （default） ● GPRS multi-slot class 8 (option) ● GPRS mobile station class B
Temperature range	● Normal operation: -20°C to +60°C ● Restricted operation: -30°C to -20°C and +60°C to +80°C (1) ● Storage temperature -40°C to +85°C
DATA *GPRS:* *CSD:*	● GPRS data downlink transfer: max. 85.6 kbps ● GPRS data uplink transfer: max. 42.8 kbps ● Coding scheme: CS-1, CS-2, CS-3 and CS-4 ● SIM300 supports the protocols PAP (Password Authentication Protocol) usually used for PPP connections. ● The SIM300 integrates the TCP/IP protocol. ● Support Packet Switched Broadcast Control Channel (PBCCH) ● CSD transmission rates: 2.4, 4.8, 9.6, 14.4 kbps, non-transparent ● Unstructured Supplementary Services Data (USSD) support
SMS	● MT, MO, CB, Text and PDU mode ● SMS storage: SIM card
FAX	Group 3 Class 1
SIM interface	Support SIM card: 1.8V, 3V
External antenna	Connected via 50 Ohm antenna connector or antenna pad
Audio features	Speech codec modes: ● Half Rate (ETS 06.20) ● Full Rate (ETS 06.10) ● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80) ● Adaptive multi rate (AMR)

	● Echo Cancellation
Serial port and Debug port	● Serial Port: Seven lines on Serial Port Interface ● Serial Port can be used for CSD FAX, GPRS service and send AT command of controlling module. ● Serial Port can use multiplexing function. ● Autobauding supports baud rate from 4800 bps to 115200bps. ● Debug Port: Two lines on Serial Port Interface /TXD and /RXD ● Debug Port only used for debugging
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM Application Toolkit	Support SAT class 3, GSM 11.14 Release 99
Real time clock	Implemented
Timer function	Programmable via AT command
Physical characteristics	Size: 40±0.15 x 33±0.15 x 3.2±0.2mm (including application connector) 40±0.15 x 33±0.15 x 2.9+0.3/-0.1mm (excluding application connector) Weight: 8g
Firmware upgrade	Firmware upgrade by serial port.

(1) The SIM300 does work, but deviations from the GSM specification may occur, For example, the frequency error or the phase error will be large.

Table 4: Coding schemes and maximum net data rates over air interface

Coding scheme	1 Timeslot	2 Timeslot	4 Timeslot
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

2.2 SIM300 functional diagram

The following figure shows a functional diagram of the SIM300 and illustrates the mainly functional part:

- The GSM baseband engine
- Flash and SRAM
- The GSM radio frequency part
- The antenna interface
- The board-to-board interface

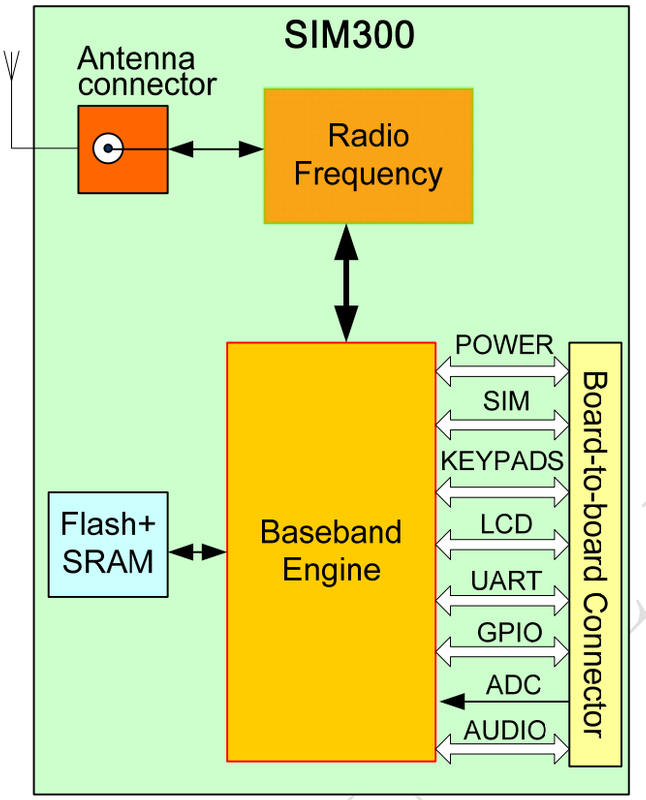


Figure 1: SIM300 functional diagram

2.3 SIM300 evaluation board

In order to help you on the application of SIM300, SIMCom can supply an Evaluation Board (EVB) that interfaces the SIM300 directly with appropriate power supply, SIM card holder, RS232 serial port, handset port, earphone port, antenna and all GPIO of the SIM300.

Figure 2: Top view of SIM300 EVB

For details please refer to the *SIM300-EVB_UGD* document.

3 Application interface

SIM 300 is equipped with a 60-pin 0.5mm pitch board-to-board connector that connects to the cellular application platform. Sub-interfaces included in this board-to-board connector are described in detail in following chapters:

- Power supply *(please refer to Chapter 3.3)*
- Serial interfaces *(please refer to Chapter 3.8)*
- Two analog audio interfaces *(please refer to Chapter 3.9)*
- SIM interface *(please refer to Chapter 3.11)*

Electrical and mechanical characteristics of the board-to-board connector are specified in *Chapter 6.* There we also include order information for mating connectors.

3.1 SIM300 pin description

Table 5: Board-to-Board connector pin description

Power Supply				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
VBAT	I	8 VBAT pins of the board-to-board connector are dedicated to connect the supply voltage. The power supply of SIM300 has to be a single voltage source of VBAT= 3.4V...4.5V. It must be able to provide sufficient current in a transmitting burst which typically rises to 2A.mostly. These 8 pins are voltage input	Vmax= 4.5V Vmin=3.4V Vnorm=4.0V	
VRTC	I/O	Current input for RTC when the battery is not supplied for the system. Current output for backup battery when the main battery is present and the backup battery is in low voltage state.	Vmax=2.0V Vmin=1.2V Vnorm=1.8V $I_{out(max)}$= 20uA I_{in}=5 uA	Do not keep pin open, it should be connected to a battery or a capacitor.
VDD_EXT	O	Supply 2.93V voltage for external circuit. By measuring this pin, user can judge whether the system is	Vmax=3.0V Vmin=2.75V Vnorm=2.93V	If unused keep pin open

		power on or off. When the voltage is low, the system is power off. Otherwise, the system is power on.	Imax=10mA	
GND			Digital ground	
Power on or power off				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	
PWRKEY	I	Voltage input for PWRKEY. PWRKEY should be pulled low to power on or power off the system. The user should keep pressing the key for a moment when power on or power off the system because the system need margin time in order to assert the software.	VILmax=0.2*VBAT VIHmin=0.6*VBAT VImax=VBAT	pull up to VBAT
Audio interfaces				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	DC
MIC1P MIC1N	I	Positive and negative voice-band input	Audio DC Characteristics refer to chapter 3.9.4	If unused keep pins open
MIC2P MIC2N	I	Auxiliary positive and negative voice-band input		
SPK1P SPK1N	O	Positive and negative voice-band output		If unused keep pins open
SPK2P SPK2N	O	Auxiliary positive and negative voice-band output		
BUZZER	O	Buzzer output		If unused keep pin open
AGND		Analog ground		Separate ground connection for external audio circuits. If unused keep pin open
General purpose input/output				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	
KBC0~KBC4	O/4mA	Keypad interface	VILmin=0V VILmax=0.3 *VDD_EXT VIHmin=0.7*VDD_EXT VIHmax= VDD_EXT+0.3 VOLmin=GND VOLmax=0.2V	Tri-out, If unused keep pins open
KBR0~KBR4	I/4mA			Pull up to VEXT, if unused keep

			VOHmin= VDD_EXT-0.2	pins open
DISP_DATA	I/O/4mA	LCD display interface	VOHmax= VDD_EXT	If unused keep pins open
DISP_CLK	O/4mA			
DISP_CS	O/4mA			
DISP_D/C	O/4mA			
DISP_RST	O/4mA			
NETLIGHT	O/4mA	Network status indication		If unused keep pins open
GPIO0	I/O/4mA	Normal input/output port		
Serial port				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	
DTR	I/8mA	Data terminal ready	VILmin=0V VILmax=0.3*VDD_EXT VIHmin=0.7*VDD_EXT VIHmax= VDD_EXT+0.3 VOLmin=GND VOLmax=0.2V VOHmin= VDD_EXT-0.2 VOHmax= VDD_EXT	If use only TXD,RXD GND three pins to communicate, RTS pin connect to GND directly. DTR pin is pull up to VEXT with 100K If unused keep pins open
RXD	I/8mA	Receive data		
TXD	O/8mA	Transmit data		
RTS	I/8mA	Request to send		
CTS	O/8mA	Clear to send		
RI	O/8mA	Ring indicator		
DCD	O/4mA	Data carrier detection		
Debug port				
DBG_TXD	O/4mA	Serial interface for debugging only		If unused keep pins open
DBG_RXD	I/4mA			
SIM interface				

PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	
SIM_VDD	O	Voltage supply for SIM card	The voltage can be select by software automatically either 1.8V or 3V	All signals of SIM interface are protected against ESD with a TVS diode array. Maximum cable length 200mm from the module connctor to SIM card holder.
SIM_DATA	I/O/4mA	SIM data output	VILmin=0V VILmax=0.3*SIM_VDD VIHmin=0.7*SIM_VDD VIHmax= SIM_VDD+0.3 VOLmin=GND VOLmax=0.2V VOHmin= SIM_VDD-0.2 VOHmax= SIM_VDD	
SIM_CLK	O/4mA	SIM clock		
SIM_RST	O/4mA	SIM reset		
SIM_PRESENCE	I/4mA	SIM card detection		If unused , connect to GND.
AUXADC				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	
ADC0	I	General purpose analog to digital converter.	Input voltage range: 0V to 2.4V	If unused keep pin open

3.2 Operating modes

The table below briefly summarizes the various operating modes referred to in the following chapters.

Table 6: Overview of operating modes

Mode	Function	
Normal operation	GSM/GPRS SLEEP	Module will automatically go into SLEEP mode if DTR is set to high level and there is no on air and no hardware interrupt (such as GPIO interrupt or data on serial port). In this case, the current consumption of module will reduce to the minimal level. During SLEEP mode, the module can still receive paging message and SMS from the system normally.
	GSM IDLE	Software is active. Module has registered to the GSM network, and the module is ready to send and receive.
	GSM TALK	Connection is going on between two subscribers. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.

	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 in transfer (PPP or TCP or UDP). 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).
POWER DOWN	Normal shutdown by sending the "AT+CPOWD=1" command or using the PWRKEY. The power management ASIC disconnects the power supply from the base band part of the module, and only the power supply for the RTC is remained. Software is not active. The serial port is not accessible. Operating voltage (connected to VBAT) remains applied.	
Minimum functionality mode (without remove power supply)	Use the "AT+CFUN" command can set the module to a minimum functionality mode without remove the power supply. In this case, the RF part of the module will not work or the SIM card will not be accessible, or both RF part and SIM card will be closed, and the serial port is still accessible. The power consumption in this case is very low.	
Alarm mode	RTC alert function launches this restricted operation while the module is in POWER DOWN mode. SIM300 will not register to GSM network and only parts of AT commands can be available.	

3.3 Power supply

The power supply of SIM300 is from a single voltage source of VBAT= 3.4V...4.5V. In some case, the ripple in a transmitting burst may cause voltage drops when current consumption rises to typical peaks of 2A. So the power supply must be able to provide sufficient current up to 2A.
For the VBAT input, a local bypass capacitor is recommended. A capacitor (about 100 μF, low ESR) is recommended. Multi-layer ceramic chip (MLCC) capacitors can provide the best combination of low ESR and small size but may not be cost effective. A lower cost choice may be a 100 μF tantalum capacitor (low ESR) with a small (0.1μF to 1μF) ceramic in parallel, which is illustrated as following figure. The capacitors should put as close as possible to the SIM300 VBAT pins. The following figure is the recommended circuit.

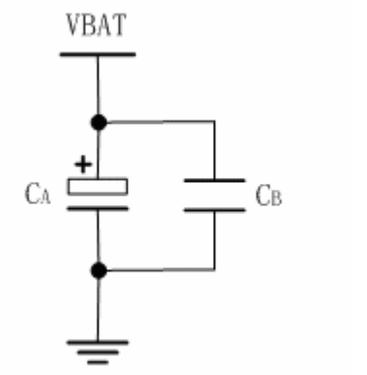


Figure 3: Reference circuit of the VBAT input

The circuit design of the power supply depends strongly from the power source where this power is drained. The following figure is the reference design of +5V input source power supply. The designed output for the power supply is 4V, thus a linear regulator can be used. If there's a big difference between the input source and the desired output (VBAT), a switching converter power supply will be preferable because of its better efficiency especially with the 2A peak current in burst mode of the module.

The single 3.6V Li-Ion cell battery type can be connected to the power supply of the SIM300 VBAT directly. But the Ni_Cd or Ni_MH battery types must be used carefully, since their maximum voltage can rise over the absolute maximum voltage for the module and damage it.

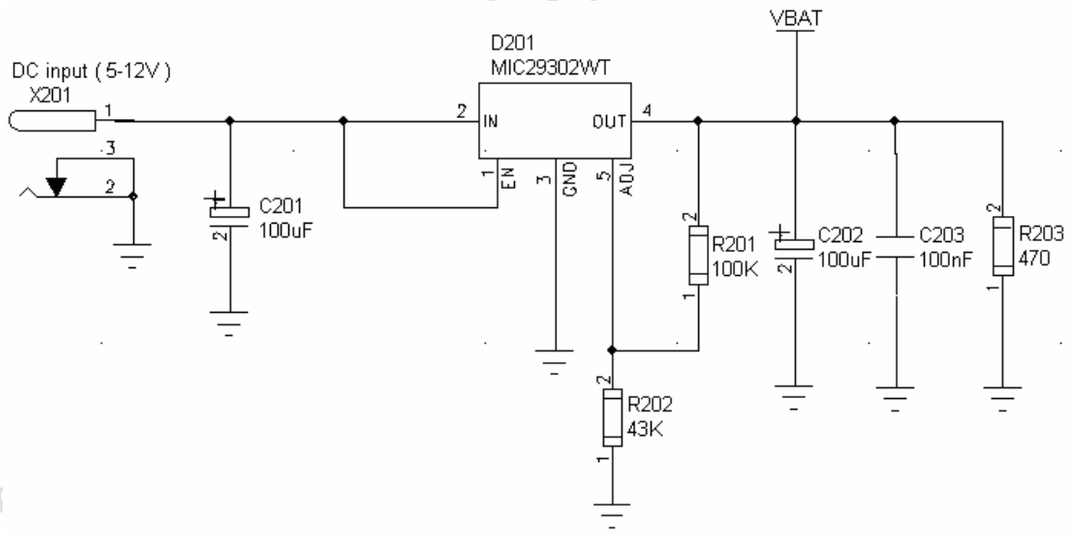


Figure 4: Reference circuit of the source power supply input

The following figure is the VBAT voltage ripple wave at the maximum power transmit phase, the test condition is VBAT=4.0V, VBAT maximum output current =2A, C_A=100μF tantalum capacitor (ESR=0.7Ω) and C_B=1μF.

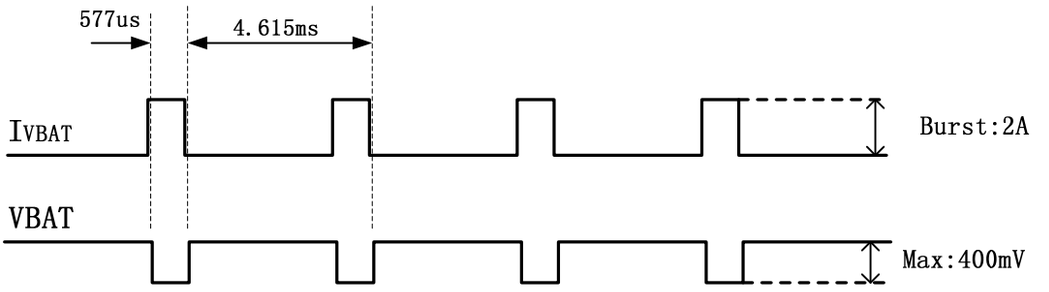


Figure 5: VBAT voltage drop during transmit burst

3.3.1 Power supply pins on the board-to-board connector

Eight VBAT pins of the board-to-board connector are dedicated to connect the supply voltage; six GND pins are recommended for grounding. VRTC pin can be used to back up the RTC.

3.3.2 Minimizing power losses

Please pay special attention to the supply power when you are designing your applications. Please make sure that the input voltage will never drop below 3.4V even in a transmitting burst during which the current consumption may rise up to 2A. If the power voltage drops below 3.4V, the module may be switched off. The PCB traces from the VBAT pins of connector to the power source must be wide enough to ensure no voltage drops occur in the transmitting burst mode.

3.3.3 Monitoring power supply

To monitor the supply voltage, you can use the "AT+CBC" command which include three parameters: charging status, voltage percentage and voltage value (in mV). It returns the battery voltage 1-100 percent of capacity and actual value measured at VBAT and GND.
The voltage is continuously measured at intervals depending on the operating mode. The displayed voltage (in mV) is averaged over the last measuring period before the AT+CBC command is executed.

For details please refer to *document [1]*

3.4 Power up and power down scenarios

3.4.1 Turn on SIM300

SIM300 can be turned on by various ways, which are described in following chapters:

- Via PWRKEY pin: starts normal operating mode *(please refer to chapter 3.4.1.1)*;
- Via RTC interrupt: starts ALARM modes *(please refer to chapter 3.4.1.2)*

Note: The AT command must be set after the SIM300 is power on and Unsolicited Result Code "RDY" is received from the serial port. However if the SIM300 is set autobauding, the serial port will receive nothing. The AT command can be set in 2-3s after the SIM300 is power on. You can use AT+IPR=x;&W to set a fixed baud rate and save the configuration to non-volatile flash memory. After the configuration is saved as fixed baud rate, the Code "RDY" should be received from the serial port all the time that the SIM300 is power on. Please refer to the chapter AT+IPR in document [1].

3.4.1.1 Turn on SIM300 using the PWRKEY pin (Power on)

You can turn on the SIM300 by driving the PWRKEY to a low level voltage for some time and then release. This pin is pulled up to VBAT in the module. The maximum current that can be drained from the PWRKEY pin is 0.4mA. The simple circuit illustrates as the following figures.

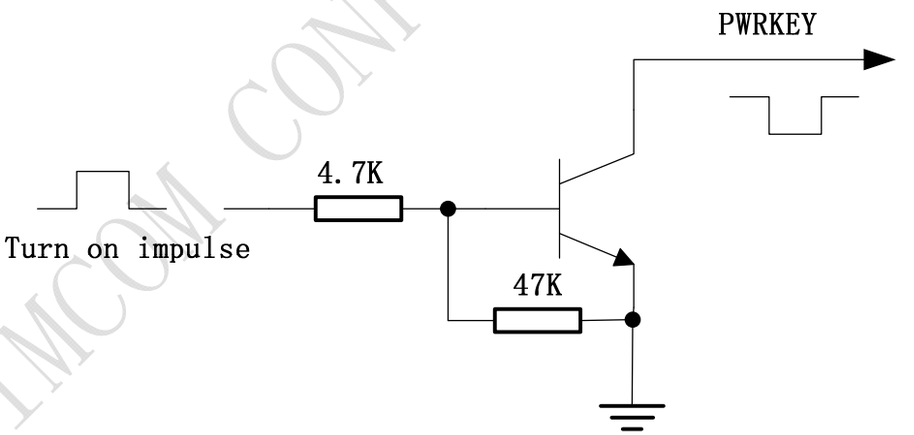


Figure 6: Turn on SIM300 using driving circuit

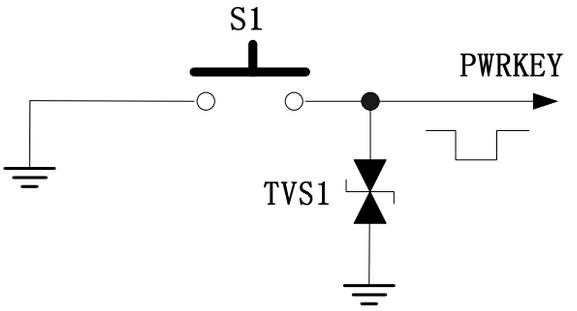


Figure 7: Turn on SIM300 using button

The power on scenarios illustrates as following figure.

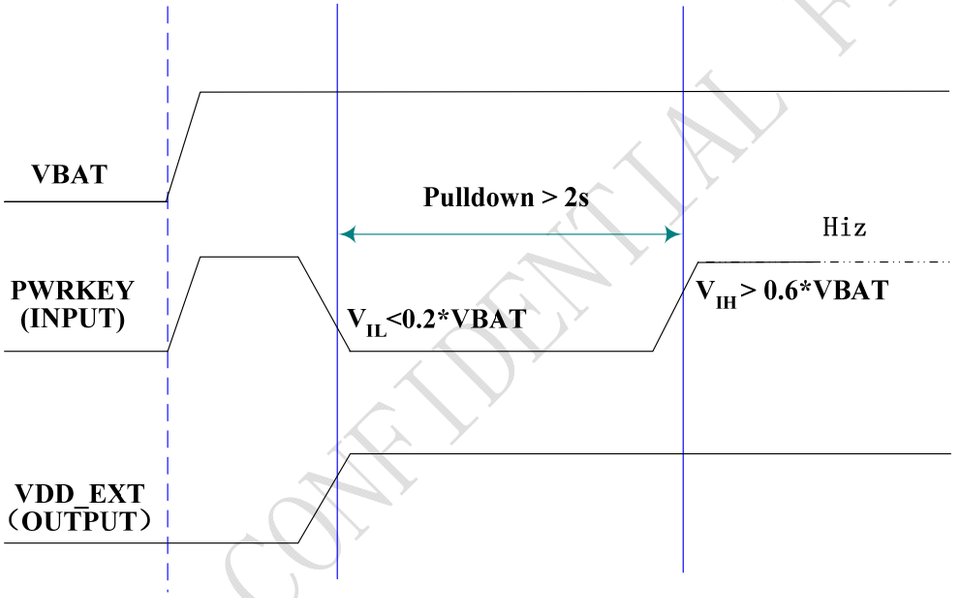


Figure 8: Timing of turn on system

When power on procedure completes, the SIM300 will send out following result code to indicate the module is ready to operate when set as fixed baud rate.

RDY

This result code does not appear when autobauding is active.

3.4.1.2 Turn on SIM300 using the RTC (Alarm mode)

Alarm mode is a power-on approach by using the RTC. The alert function of RTC makes the SIM300 wake up while the module is power off. In alarm mode, SIM300 will not register to GSM network and the software protocol stack is closed. Thus the parts of AT commands related with SIM card and Protocol stack will not be accessible, and the others can be used as in normal mode.

Use the AT+CALARM command to set the alarm time. The RTC remains the alarm time if SIM300 is power down by "AT+CPOWD=1" or by PWRKEY pin. Once the alarm time is expired and executed, SIM300 will go into the alarm mode. In this case, SIM300 will send out an Unsolicited Result Code (URC) when set as fixed baud rate:

RDY

ALARM MODE

This result code does not appear when autobauding is active.

During alarm mode, use AT+CFUN command to query the status of software protocol stack; it will return 0 which indicates that the protocol stack is closed. Then after 90s, SIM300 will power down automatically. However, during alarm mode, if the software protocol is started by AT+CFUN=1 command, the process of automatic power down will not be available. In alarm mode, driving the PWRKEY to a low level voltage for a period will cause SIM300 to be powered down (Please refer to the power down scenario).

The table follow briefly summarizes the AT commands that are used usually during alarm mode, for details of the instructions refer to *document [1]*:

Table 7: AT commands used in Alarm mode

AT command	USE
AT+CALARM	Set alarm time
AT+CCLK	Set data and time of RTC
AT+CPOWD	Power down
AT+CFUN	Start or close the protocol stack

3.4.2 Turn off SIM300

Following procedure can be used to turn off the SIM300:

- Normal power down procedure: Turn off SIM300 using the PWRKEY pin
- Normal power down procedure: Turn off SIM300 using AT command
- Over-voltage or under-voltage automatic shutdown: Take effect if over-voltage or under-voltage is detected
- Over-temperature or under-temperature automatic shutdown: Take effect if over-temperature or under-temperature is detected

3.4.2.1 Turn off SIM300 using the PWRKEY pin (Power down)

You can turn off the SIM300 by driving the PWRKEY to a low level voltage for some time. Please

refer to the turn on circuit. The power down scenario illustrates as following figure.

This procedure lets the module log off from the network and allows the software to enter into a secure state and save data before completely disconnecting the power supply.

Before the completion of the switching off procedure the module will send out result code:

NORMAL POWER DOWN

After this moment, the AT commands can't be executed. The module enters the POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

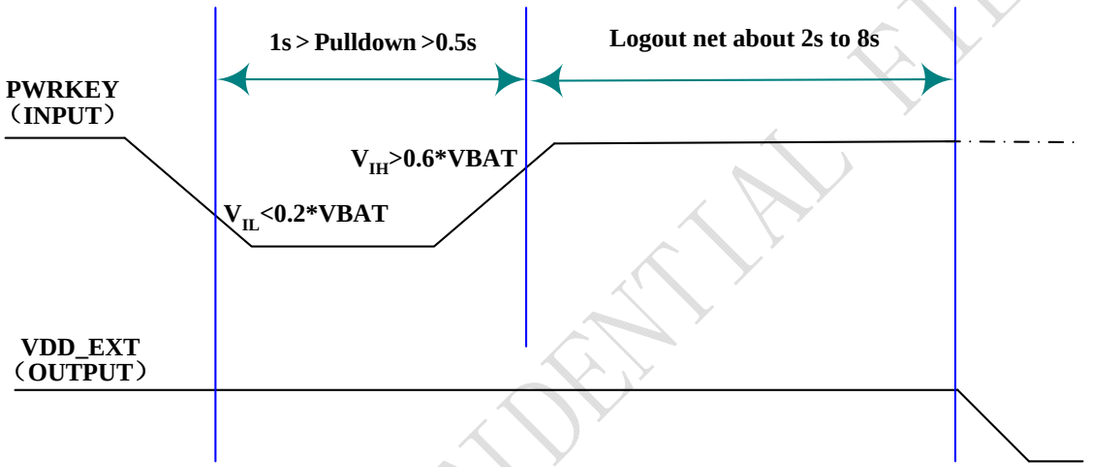


Figure 9: Timing of turn off system

3.4.2.2 Turn off SIM300 using AT command

You can use an AT command "AT+CPOWD=1" to turn off the module. This command lets the module log off from the network and allows the module to enter into a secure state and save data before completely disconnecting the power supply.

Before the completion of the switching off procedure the module will send out result code:

NORMAL POWER DOWN

After this moment, the AT commands can't be executed. The module enters the POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

Please refer to *document [1]* for detail about the AT command of "AT+CPOWD".

3.4.2.3 Over-voltage or under-voltage automatic shutdown

The module will constantly monitor the voltage applied on the VBAT. If the voltage ≤ 3.5V, the following URC will be presented:

UNDER-VOLTAGE WARNNING

If the voltage ≥ 4.5V, the following URC will be presented:

OVER-VOLTAGE WARNNING

The uncritical voltage range is 3.4V to 4.6V. If the voltage ≥ 4.6V or ≤ 3.4V, the module will be automatic shutdown soon.

If the voltage ≤ 3.4V, the following URC will be presented:

UNDER-VOLTAGE POWER DOWN

If the voltage ≥ 4.6V, the following URC will be presented:

OVER-VOLTAGE POWER DOWN

After this moment, no further more AT commands can be executed. The module logs off from network and enters POWER DOWN mode, and only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

3.4.2.4 Over-temperature or under-temperature automatic shutdown

The module will constantly monitor the temperature of the module, if the temperature ≥ 80℃, the following URC will be presented:

+CMTE:1

If the temperature ≤ -30℃, the following URC will be presented:

+CMTE:-1

The uncritical temperature range is -35℃ to 85℃. If the temperature ≥ 85℃ or ≤ -35℃, the module will be automatic shutdown soon.

If the temperature ≥ 85℃, the following URC will be presented:

+CMTE:2

If the temperature ≤ -35℃, the following URC will be presented:

+CMTE:-2

After this moment, the AT commands can't be executed. The module logs off from network and enters POWER DOWN mode, and only the RTC is still active. POWER DOWN can also be indicated by VDD_EXT pin, which is a low level voltage in this mode.

To monitor the temperature, you can use the "AT+CMTE" command to read the temperature when the module is power on.

For details please refer to *document [1]*

3.4.3 Restart SIM300 using the PWRKEY pin

You can restart SIM300 by driving the PWRKEY to a low level voltage for some time, the same as turning on SIM300 using the PWRKEY pin. Before restarting the SIM300, you need delay at least 500ms from detecting the VDD_EXT low level on. The restarting scenario illustrates as the following figure.

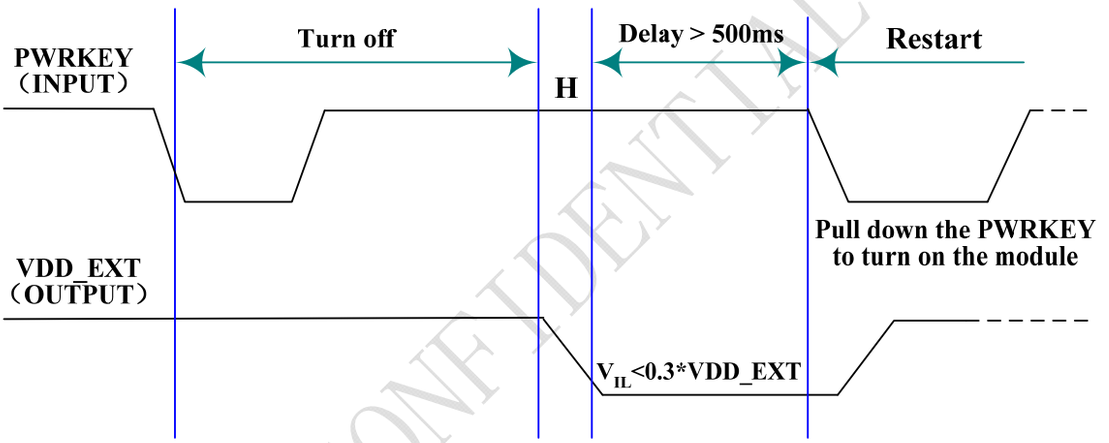


Figure 10: Timing of restart system

3.5 Power saving

There are two methods for the module to enter into low current consumption status. "AT+CFUN" is used to set module into minimum functionality mode and DTR hardware interface signal can be used to lead system to be in SLEEP mode (or slow clocking mode).

3.5.1 Minimum functionality mode

Minimum functionality mode reduces the functionality of the module to a minimum and, thus, minimizes the current consumption to the lowest level. This mode is set with the "AT+CFUN" command which provides the choice of the functionality levels <fun>=0，1，4

- 0: minimum functionality;

- 1: full functionality (default);
- 4: disable phone both transmit and receive RF circuits;

If SIM300 has been set to minimum functionality by “AT+CFUN=0”, the RF function and SIM card function will be closed. In this case, the serial port is still accessible, but all AT commands correlative with RF function or SIM card function will not be accessible.

If SIM300 has been set by “AT+CFUN=4”, the RF function will be closed, the serial port is still active. In this case all AT commands correlative with RF function will not be accessible.

After SIM300 has been set by “AT+CFUN=0” or “AT+CFUN=4”, it can return to full functionality by “AT+CFUN=1”.

For detailed information about “AT+CFUN”, please refer to *document [1]*.

3.5.2 Sleep mode (slow clock mode)

We can control SIM300 module to enter or exit the SLEEP mode in customer applications through DTR signal.

When DTR is in high level and there is no on air and hardware interrupt (such as GPIO interrupt or data on serial port), SIM300 will enter SLEEP mode automatically. In this mode, SIM300 can still receive paging or SMS from network but the serial port is not accessible.

Note: For SIM300, it requests to set AT command “AT+CSCLK=1” to enable the sleep mode; the default value is 0, that can’t make the module enter sleep mode. For more details please refer to our AT command list.

3.5.3 Wake up SIM300 from SLEEP mode

When SIM300 is in SLEEP mode, the following methods can wake up the module.

- Enable DTR pin to wake up SIM300.
  If DTR pin is pulled down to a low level，this signal will wake up SIM300 from power saving mode. The serial port will be active after DTR changed to low level for about 40ms.
- Receiving a voice or data call from network to wake up SIM300.
- Receiving a SMS from network to wake up SIM300.
- RTC alarm expired to wake up SIM300.

Note: DTR pin should be held low level during communicating between the module and DTE.

3.6 Summary of state transitions (except SLEEP mode)

Table 8: Summary of state transitions

Further mode Current mode	POWER DOWN	Normal mode	Alarm mode
POWER DOWN		Use PWRKEY	Switch on from POWER DOWN mode by RTC
Normal mode	AT+CPOWD or use PWRKEY pin		Set alarm by "AT+CALARM", and then switch off the module. When the timer expires, the module turns on and enters Alarm mode
Alarm mode	Use PWRKEY pin or wait module switch off automatically	Use AT+CFUN	

3.7 RTC backup

The RTC (Real Time Clock) power supply of module can be provided by an external capacitor or a battery (rechargeable or non-chargeable) through the VRTC on the board-to-board connector. There is a 10K resistance has been integrated in SIM300 module used for limiting current. You need only a coin-cell battery or a super-cap to VRTC to backup power supply for RTC.

Note: The VRTC couldn't be designed to a NC pin in your circuit. You should connect the VRTC pin to a battery or a capacitor.

The following figures show various sample circuits for RTC backup.

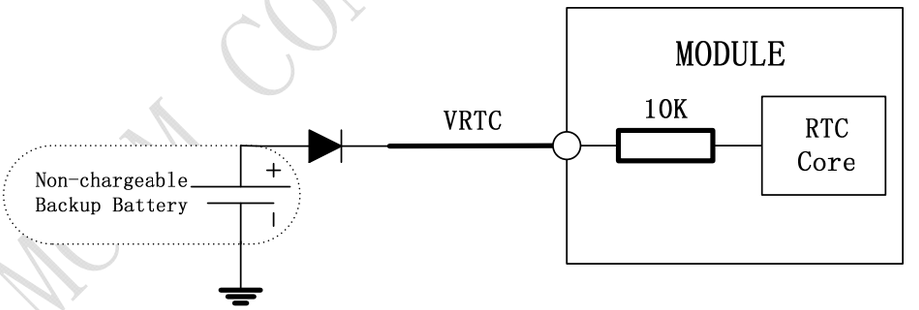


Figure 11: RTC supply from non-chargeable battery

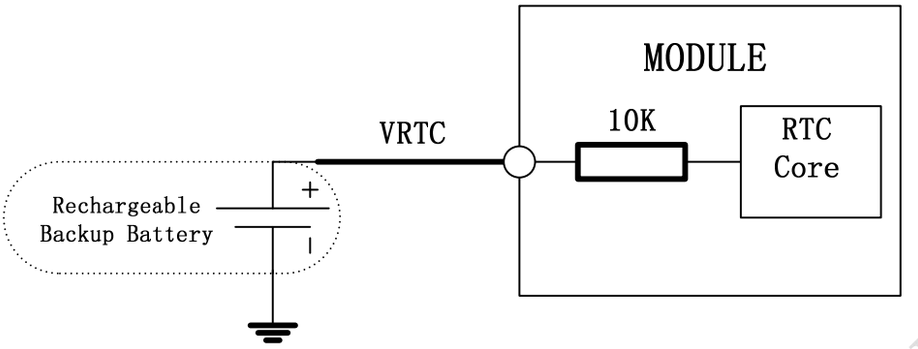


Figure 12: RTC supply from rechargeable battery

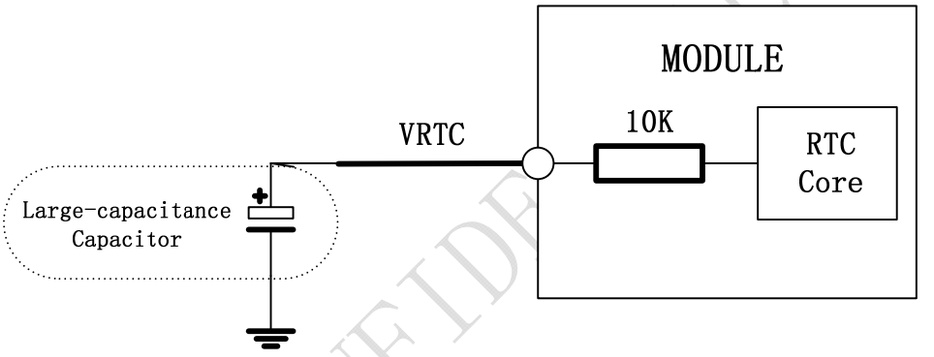


Figure 13: RTC supply from capacitor

- **Li-battery backup**

Rechargeable Lithium coin cells such as the TC614 from Maxell, or the TS621 from Seiko, are also small in size, but have higher capacity than the double layer capacitors resulting in longer backup times.

Typical charge curves for each cell type are shown in following figures. Note that the rechargeable Lithium type coin cells generally come pre-charged from the vendor.

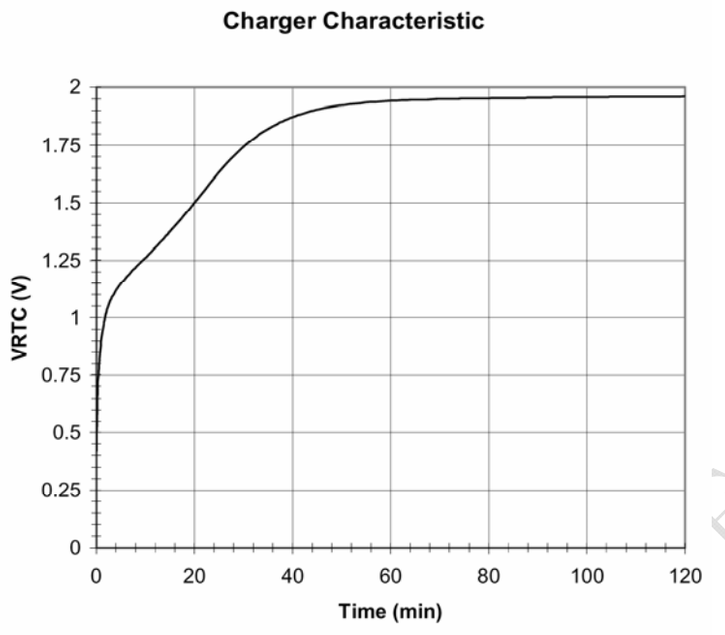


Figure 14: Panasonic EECEMOE204A Charge Characteristic

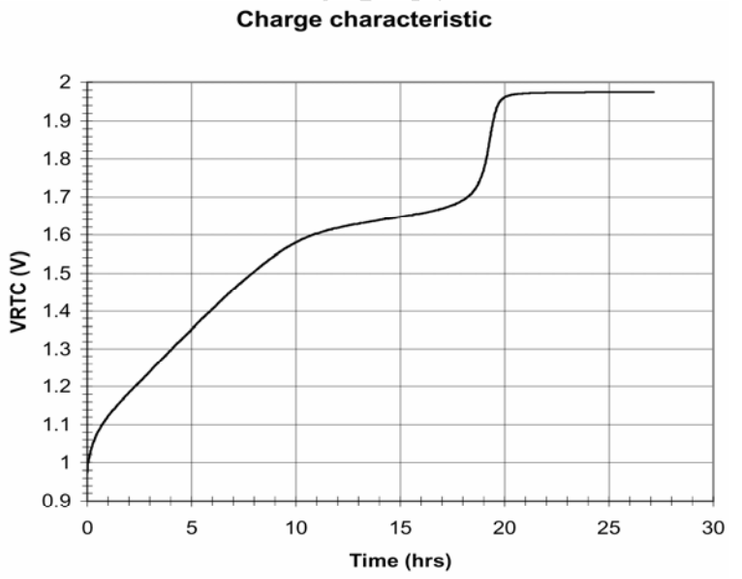


Figure 15: Maxell TC614 Charge Characteristic

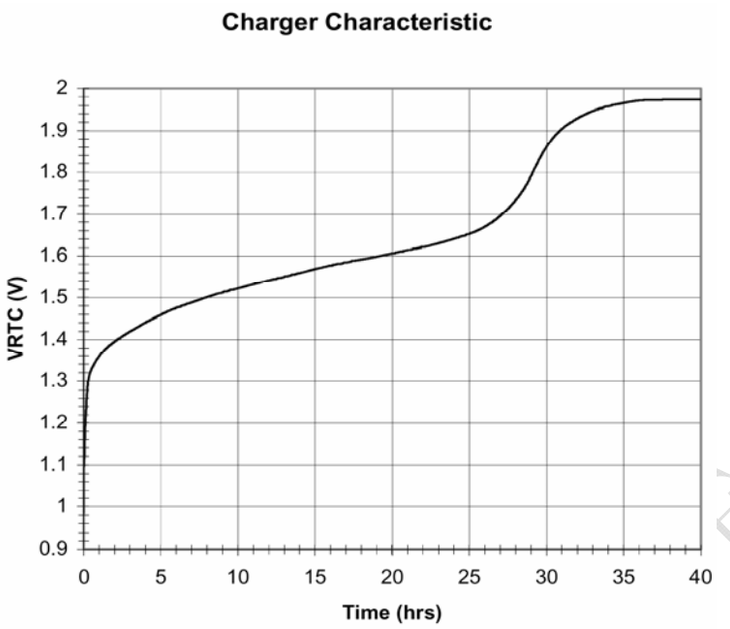


Figure 16: Seiko TS621 Charge Characteristic

Note:

Gold-capacitance backup

Some suitable coin cells are the electric double layer capacitors available from Seiko (XC621), or from Panasonic (EECEM0E204A). They have a small physical size (6.8mm diameter) and a nominal capacity of 0.2F to 0.3F, giving hours of backup time.

3.8 Serial interfaces

Table 9: Pin definition of the serial interfaces

	Name	Pin	Function
Serial port	DCD	28	Data carrier detection
	DTR	38	Data terminal ready
	RXD	40	Receive data
	TXD	42	Transmit data
	RTS	44	Request to send
	CTS	46	Clear to send
	RI	48	Ring indicator
Debug port	DBG_RXD	47	Receive data
	DBG_TXD	49	Transmit data

SIM300 provides two unbalanced asynchronous serial ports. One is the serial port and another is the debug port. The GSM module is designed as a DCE (Data Communication Equipment),

following the traditional DCE-DTE (Data Terminal Equipment) connection. The module and the client (DTE) are connected through the following signal (as following figure shows). Autobauding supports baud rate from 4800bps to 115200bps.

Serial port

- TXD: Send data to the RXD signal line of the DTE
- RXD: Receive data from the TXD signal line of the DTE

Debug port

- DBG_TXD: Send data to the /RXD signal line of the DTE
- DBG_RXD: Receive data from the /TXD signal line of the DTE

The logic levels are described in following table

Table 10: Logic levels of the serial port and debug port

Parameter	Min	Max	Unit
V_{IL}	0	0.3*VDD_EXT	V
V_{IH}	0.7 *VDD_EXT	VDD_EXT +0.3	V
V_{OL}	GND	0.2	V
V_{OH}	VDD_EXT -0.2	VDD_EXT	V

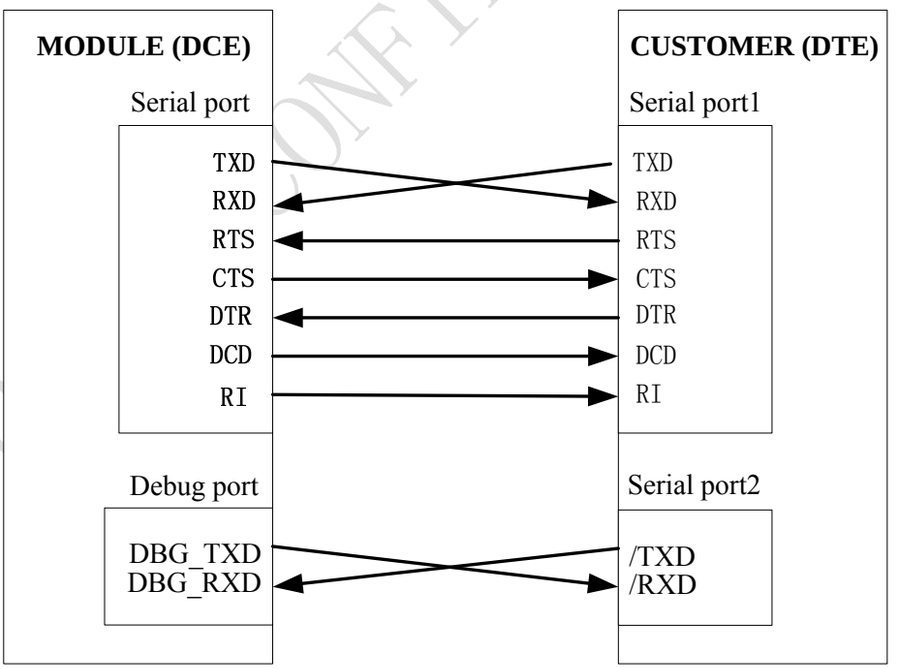


Figure 17: Connection of the serial interfaces

Note: The RTS PIN must be connected to the GND in the customer circuit when only the TXD and RXD are used in the Serial Port communication.

3.8.1 Function of serial port & debug port supporting

Serial port

- Seven lines on serial port.
- Contains data lines TXD and RXD, State lines RTS and CTS, Control lines DTR, DCD and RI.
- Serial port can be used for CSD FAX, GPRS service and send AT command of controlling module. Also serial port can be used for multiplexing function. SIM300 supports only basic mode of multiplexing so far.
- Serial port supports the communication rates as following:
  300, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200 Default as 115200bps.
- Autobauding supports baud rates as following:
  4800, 9600, 19200, 38400, 57600 and 115200bps.

Autobauding allows the GSM engine to automatically detect the baud rate configured in the host application. The serial port of the GSM engine supports autobauding for the following baud rates: 4800, 9600, 19200, 38400, 57600, 115200bps. Factory setting is autobauding enabled. This gives you the flexibility to put the GSM engine into operation no matter what baud rate your host application is configured to. To take advantage of autobauding mode, specific attention should be paid to the following requirements:

Synchronization between DTE and DCE:

When DCE powers on with the autobauding enabled, it is recommended to wait 2 to 3 seconds before sending the first AT character. After receiving the “OK” response, DTE and DCE are correctly synchronized.

Restrictions on autobauding operation

- The serial port has to be operated at 8 data bits, no parity and 1 stop bit (factory setting).
- The Unsolicited Result Codes like "RDY", "+CFUN: 1" and "+CPIN: READY” are not indicated when you start up the ME while autobauding is enabled. This is due to the fact that the new baud rate is not detected unless DTE and DCE are correctly synchronized as described above.

Note: You can use AT+IPR=x;&W to set a fixed baud rate and save the configuration to non-volatile flash memory. After the configuration is saved as fixed baud rate, the Unsolicited Result Codes like "RDY" should be received from the serial port all the time that the SIM300 is power on.

Debug port

- Two lines on Debug port
- Only contains Data lines /TXD and /RXD
- Debug Port only used for debugging. It cannot be used for CSD call, FAX call. And the Debug port can not use multiplexing function. It does not support autobauding function.
- Debug port supports the communication rates as following:
  9600, 19200, 38400, 57600, 115200bps

3.8.2 Software upgrade and software debug

The TXD、RXD、DBG_TXD、DBG_RXD and GND must be connected to the IO connector when user need to upgrade software and debug software, the TXD、RXD should be used for software upgrade and the DBG_TXD、DBG_RXD for software debugging. The PWRKEY pin is recommended to connect to the IO connector. The user also can add a switch between the PWRKEY and the GND. The PWRKEY should be connected to the GND when SIM300 is upgrading software. Please refer to the following figures.

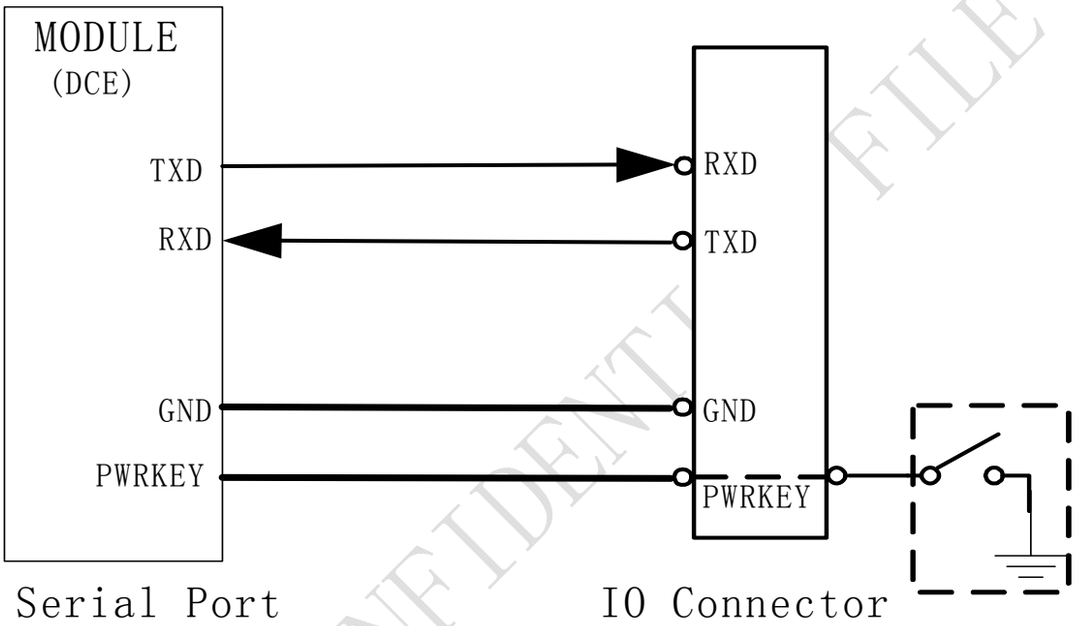


Figure 18: Connection of software upgrade

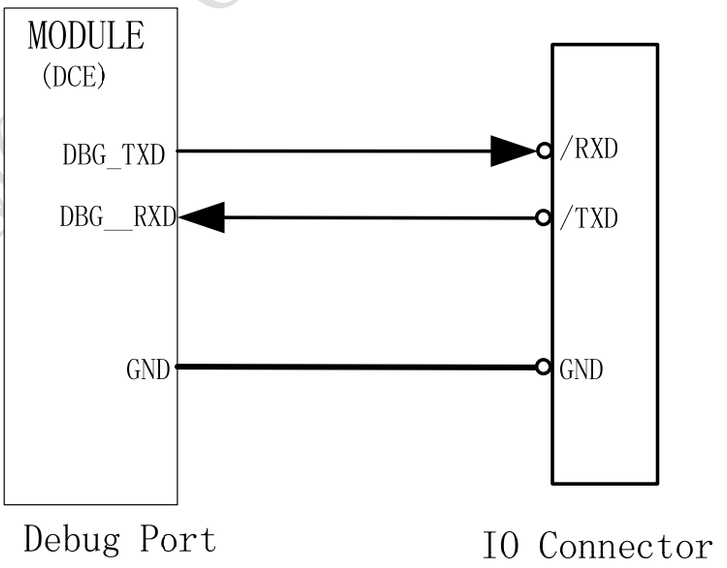


Figure 19: Connection of software debug

The serial port and the debug port don't support the RS_232 level and it only supports the CMOS level. Please refer to the table 9 for details about the voltage level. You should add the level converter IC between the DCE and DTE. If you connect it to the computer. Please refer to the following figure.

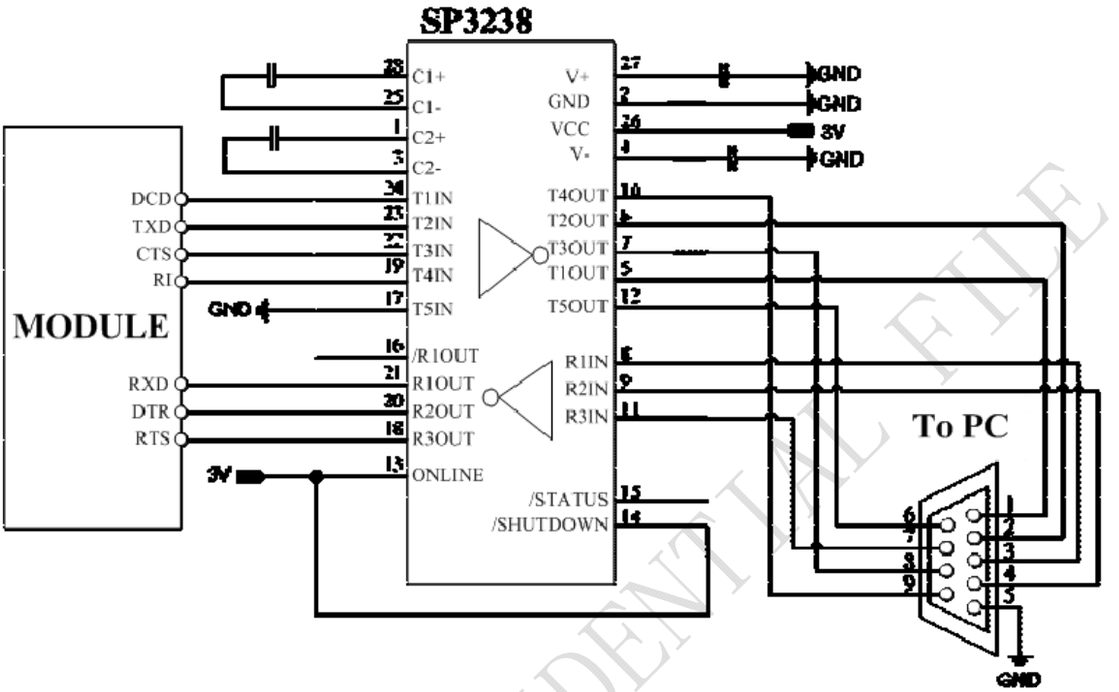


Figure 20: RS232 level converter circuit

Note：For detail information about serial port application, please refer to document [10]

3.9 Audio interfaces

Table 11: Pin define of the Audio interface

	Name	Pin	Function
(AIN1/AOUT1)	MIC1P	53	Microphone1 input +
	MIC1N	55	Microphone1 input -
	SPK1P	54	Audio1 output+
	SPK1N	56	Audio1 output-
(AIN2/AOUT2)	MIC2P	57	Microphone2 input +
	MIC2N	59	Microphone2 input -
	SPK2P	58	Audio2 output+
	SPK2N	60	Audio2 output-

The module provides two analogy input channels, AIN1 and AIN2, which may be used for both microphone and line inputs. The electret microphone is recommended when the interface is used

for microphone. One of the two channels is typically used with a microphone built into a handset. The other channel is typically used with an external microphone or external line input. The module analogy input configuration is determined by control register settings and established using analogy multiplexes.

For each channels, you can use AT+CMIC to adjust the input gain level of microphone, use AT+SIDET to set the side-tone level. In addition, you can also use AT+CLVL to adjust the output gain level of both receiver and speaker at the same time, use AT+CHFA to activate one of the two audio channels and deactivate the other one.. For more details, please refer to *document [1]*.

Note: Use AT command AT+CHFA to select_audio channel:
0— AIN1/AOUT1 (normal audio channel), the default value is 0.
1— AIN2/AOUT2(aux_audio channel) .

It is suggested that you adopt one of the following two matching circuits in order to improve audio performance. The difference audio signals have to be layout according to difference signal layout rules. As show in following figures ***(Note: all components package are 0603.)*** If you want to adopt an amplifier circuit for audio, we recommend National company's LM4890. Of course you can select it according to your requirement.

3.9.1 Speaker interface configuration

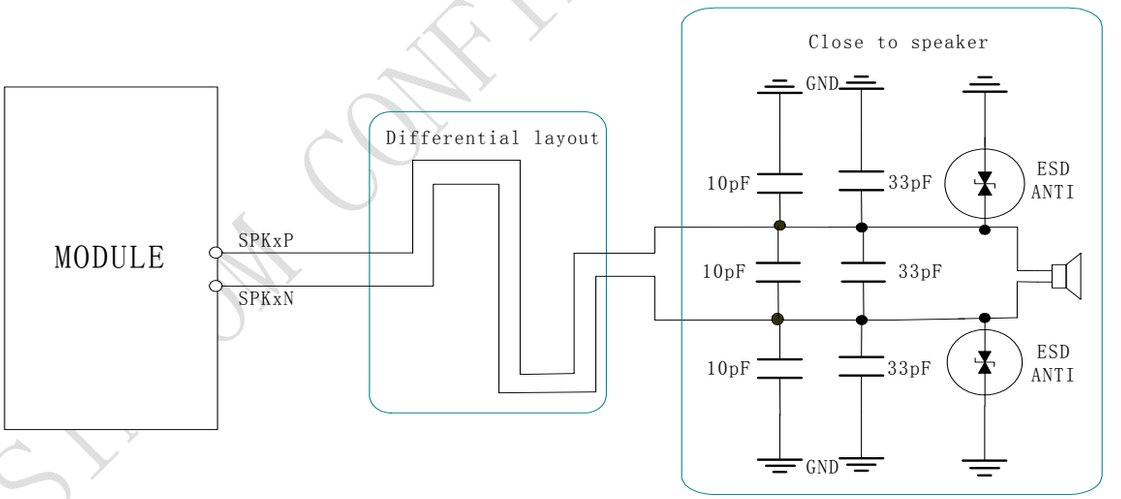


Figure 21: Speaker interface configuration

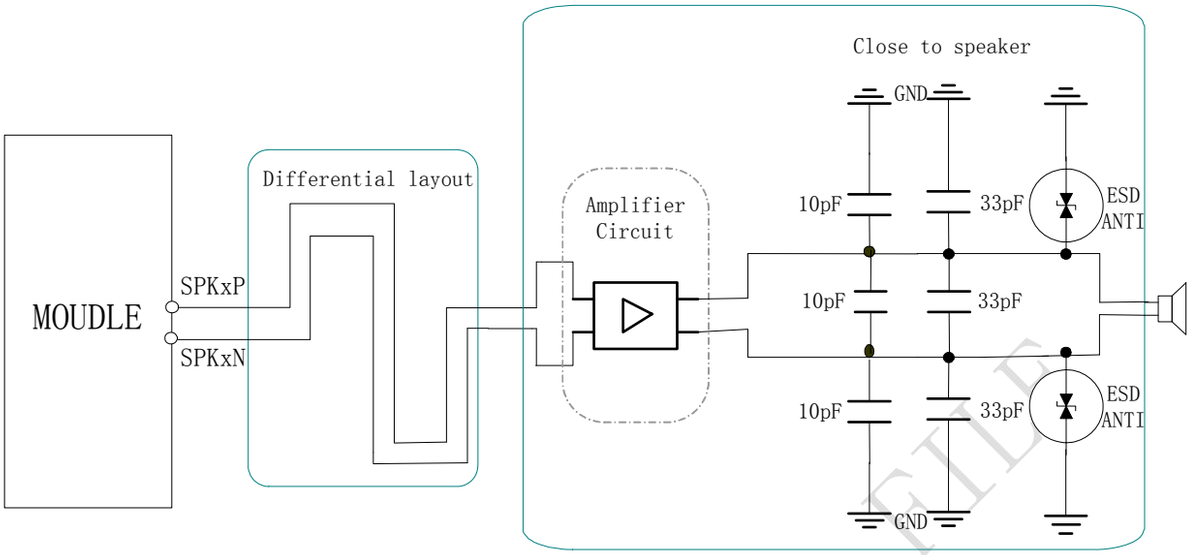


Figure 22: Speaker interface with amplifier configuration

3.9.2 Microphone interfaces configuration

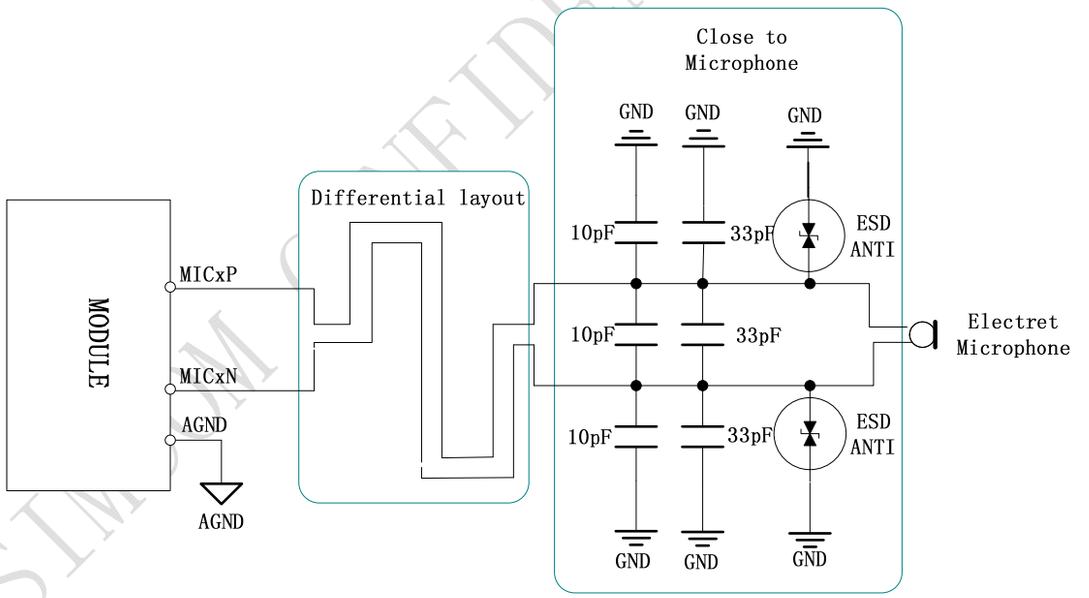


Figure 23: Microphone interface configuration

3.9.3 Earphone interface configuration

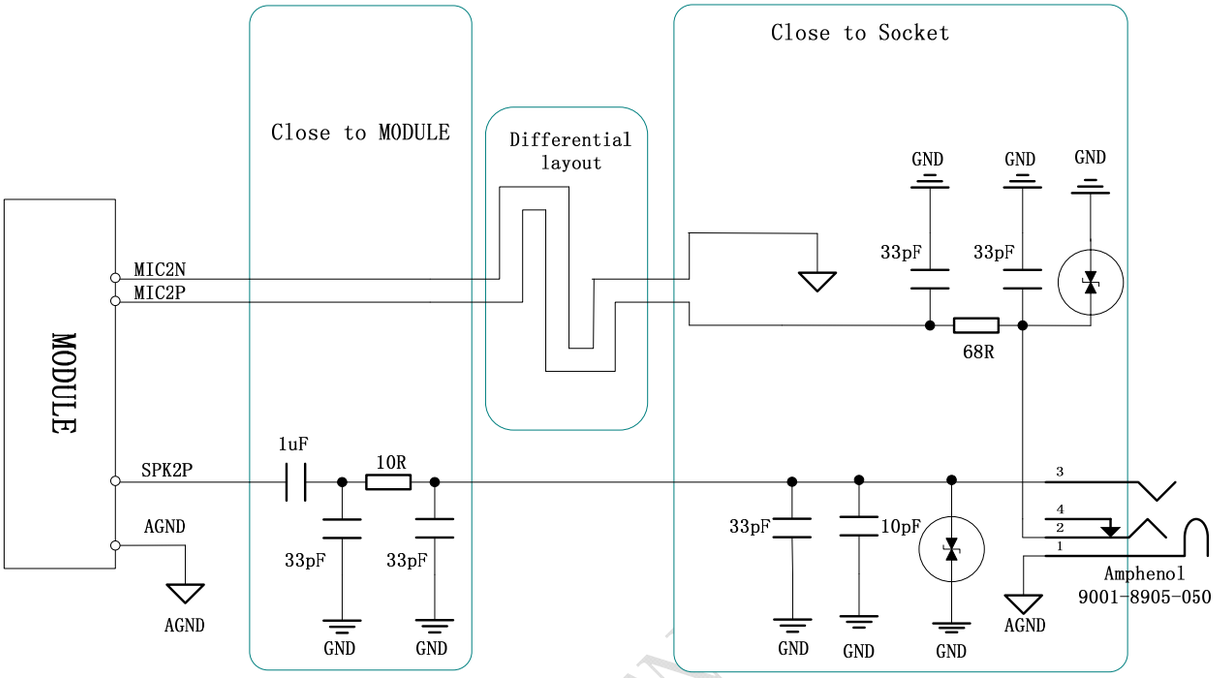


Figure 24: Earphone interface configuration

3.9.4 Referenced electronic characteristic

Table 12: MIC Input Characteristics

Parameter	Min	Typ	Max	Unit
Working Voltage	1.2	1.5	2.0	V
Working Current	200		500	uA
External Microphone Load Resistance	1.2	2.2		k Ohms

Table 13: Audio Output Characteristics

Parameter			Min	Typ	Max	Unit
Normal Output(SPK1)	Single Ended	load Resistance	27	32		Ohm
		Nominal Output		0.5477 -12.04		Vpp dBm

		Level (PGA=0dB)				
	Differential	load Resistance	27	32		Ohm
		Nominal Output Level (PGA=0dB)		1.0954 -6.02		Vpp dBm
Auxiliary Output(SPK2)	Single Ended	load Resistance	27	32		Ohm
		Nominal Output Level (PGA=0dB)		0.5477 -12.04		Vpp dBm
	Differential	load Resistance	27	32		Ohm
		Nominal Output Level (PGA=0dB)		1.0954 -6.02		Vpp dBm

3.10 Buzzer

The BUZZER on the board-to-board connector can be used to drive a buzzer to indicate incoming call. The output volume of buzzer can be set by "AT+CRSL". The reference circuit for buzzer shown as following figure:

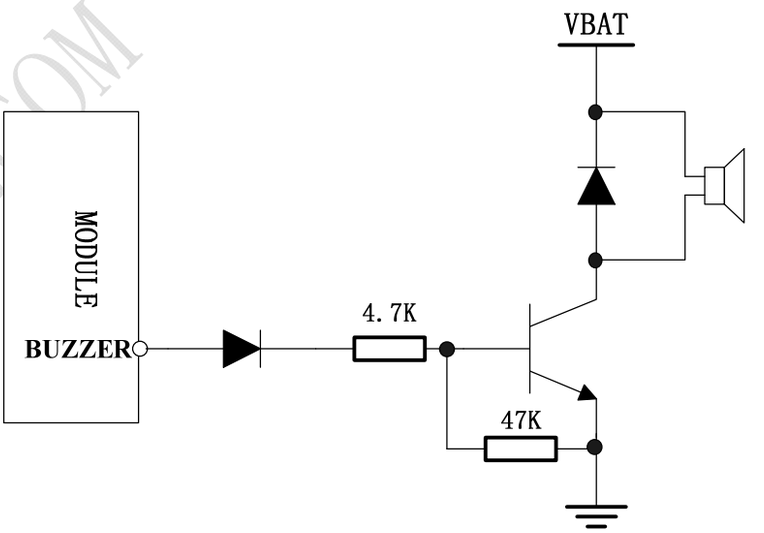


Figure 25: Reference circuit of Buzzer

Table 14: Buzzer Output Characteristics

Parameter	Min	Typ	Max	Unit
Working Voltage	2.4	2.8	3.3	V
Working Current		2		mA
Load Resistance	1			k Ohms

3.11 SIM card interface

3.11.1 SIM card application

You can use AT Command to get information in SIM card. For more information, please refer to *document [1]*.

The SIM interface supports the functionality of the GSM Phase 1 specification and also supports the functionality of the new GSM Phase 2+ specification for FAST 64 kbps SIM (intended for use with a SIM application Tool-kit).

Both 1.8V and 3.0V SIM Cards are supported.

The SIM interface is powered from an internal regulator in the module having normal voltage 3V. All pins reset as outputs driving low. Logic levels are as described in table

Table 15: Pin define of the SIM interface

Name	Pin	Function
SIM_VDD	19	SIM Card Power output automatic output on SIM mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
SIM_DATA	21	SIM Card data I/O
SIM_CLK	23	SIM Card Clock
SIM_RST	25	SIM Card Reset
SIM_PRESENCE	16	SIM Card Presence

Following is the reference circuit about SIM interface. We recommend an Electro-Static discharge device ST (www.st.com) ESDA6V1W5 or ON SEMI (www.onsemi.com) SMF05C for “ESD ANTI”. The 22Ω resistors showed in the following figure should be added in series on the IO line between the module and the SIM card for protecting the SIM I/O port. The pull up resistor (about 10KΩ) must be added on the SIM_DATA line. Note that the SIM peripheral circuit should be

close to the SIM card socket.

The SIM_PRESENCE pin is used for detecting the SIM card removal. You can use the AT command “AT+CSDT” to set the SIMCARD configuration. For detail of this AT command, please refer to *document [1]*:

You can select the 8 pins SIM card holder. The reference circuit about 8 pins SIM card holder illustrates as following figure.

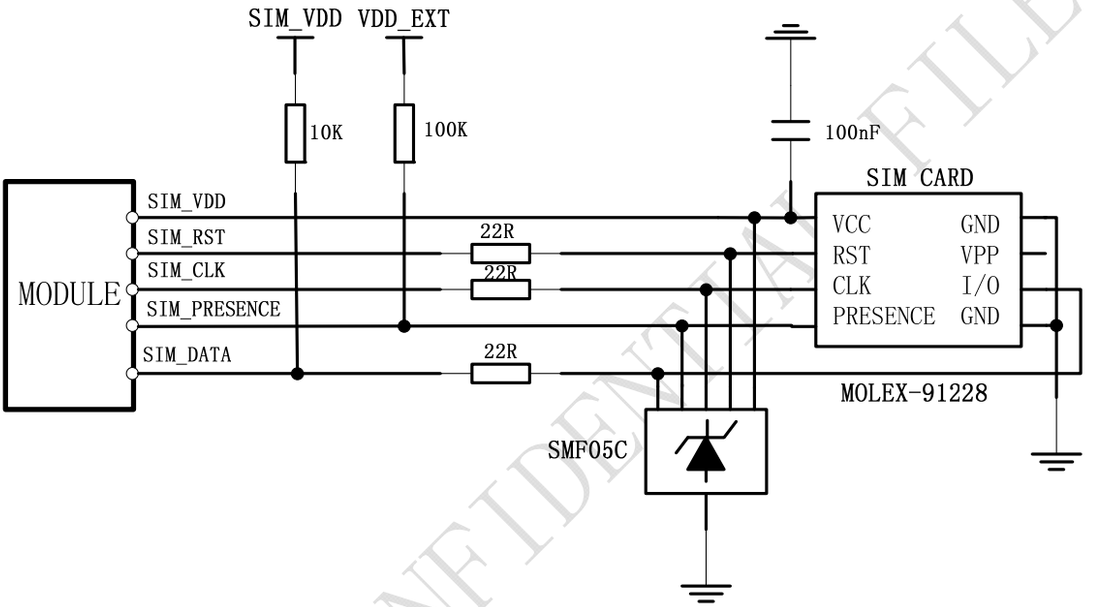


Figure 26: Reference circuit of the 8 pins SIM card

If you don’t use the SIM card detection function, you can let the SIM_PRESENCE pin connect to the GND. The reference circuit about 6 pins SIM card illustrates as following figure.

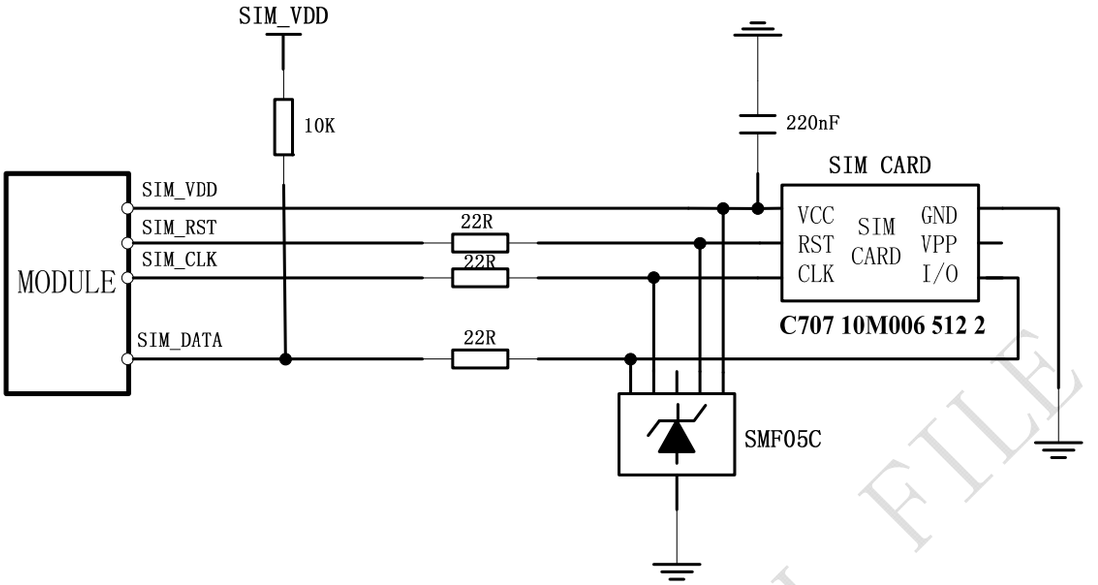


Figure 27: Reference circuit of the 6 pins SIM card

3.11.2 Design considerations for SIM card holder

For 6 pins SIM card holder, we recommend to use Amphenol C707 10M006 512 2 .You can visit http://www.amphenol.com for more information about the holder.

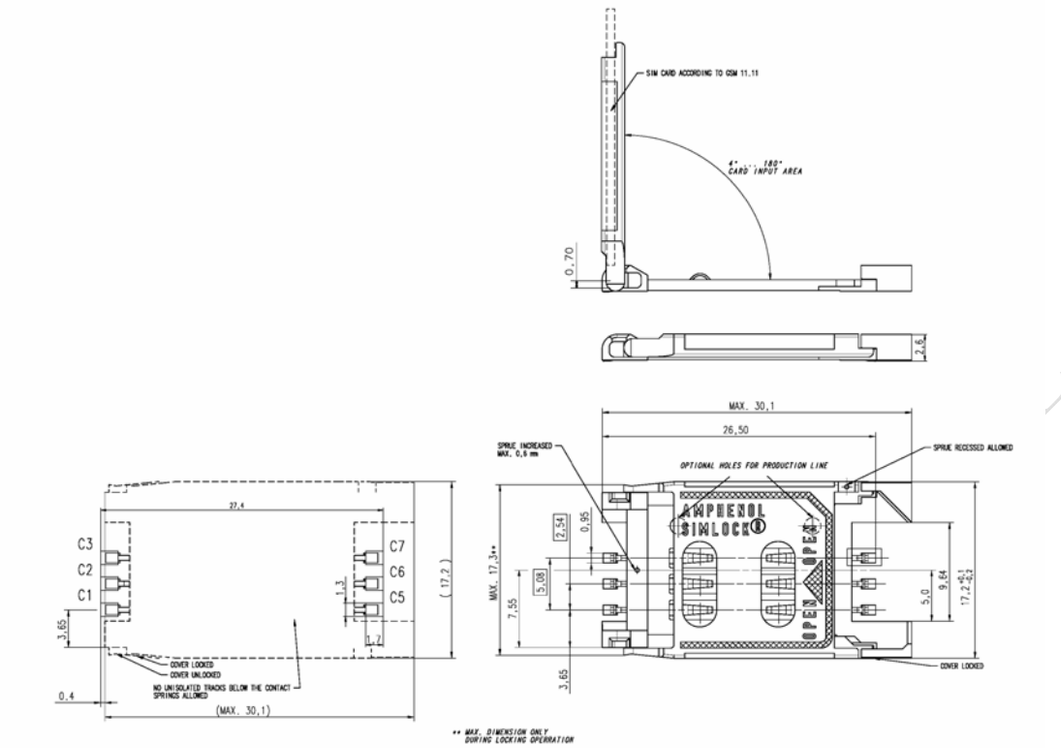


Figure 28: Amphenol C707 10M006 512 2 SIM card holder

Table 16: Pin description (Amphenol SIM card holder)

Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset.
C3	SIM_CLK	SIM Card Clock.
C5	GND	Connect to GND.
C6	VPP	Not connect.
C7	SIM_DATA	SIM Card data I/O.

For 8 pins SIM card holder, we recommend to use Molex 91228.You can visit http://www.molex.com for more information about the holder.

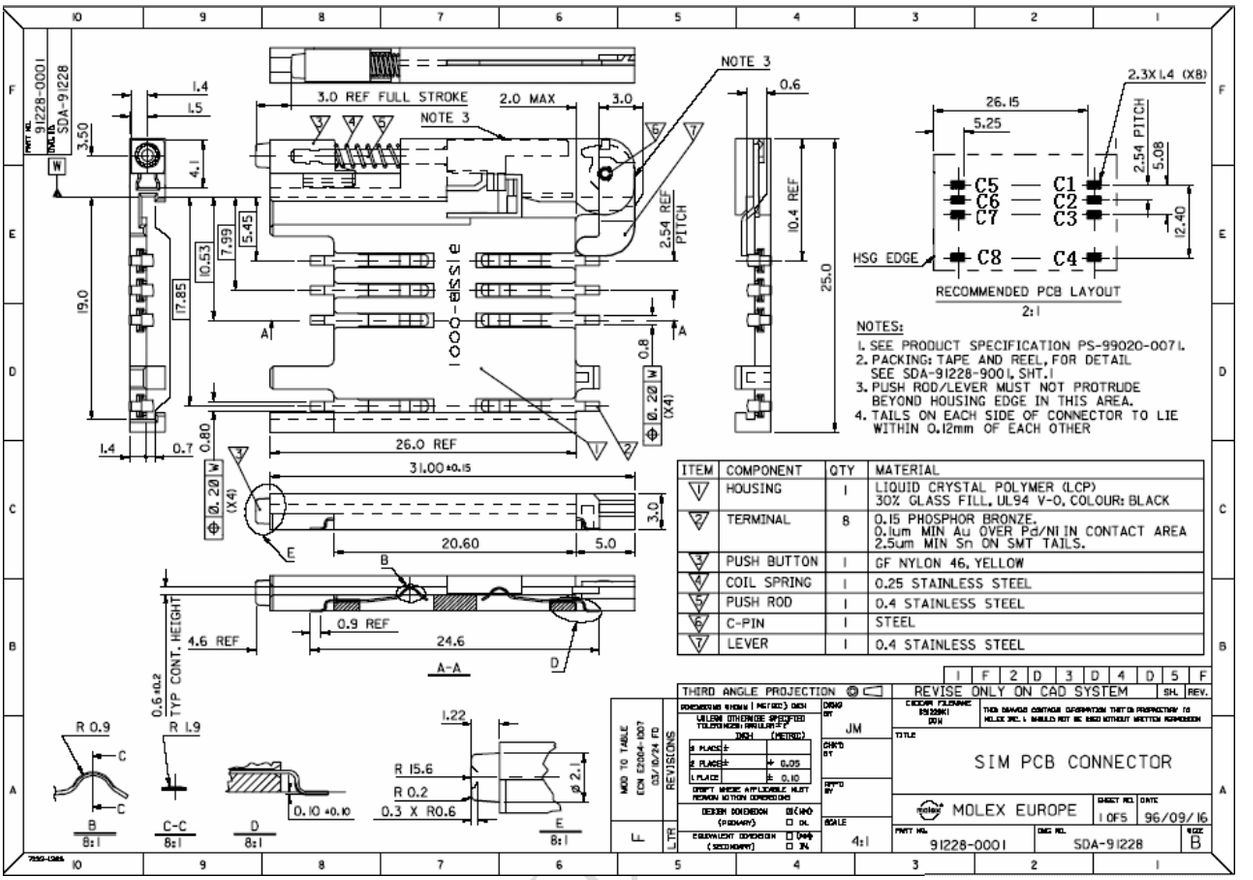


Figure 29: Molex 91228 SIM card holder

Table 17: Pin description (Molex SIM card holder)

Pin	Signal	Description
C1	SIM_VDD	SIM Card Power supply, it can identify automatically the SIM Card power mode，one is 3.0V±10%, another is 1.8V±10%. Current is about 10mA.
C2	SIM_RST	SIM Card Reset
C3	SIM_CLK	SIM Card Clock
C4	GND	Connect to GND
C5	GND	Connect to GND
C6	VPP	Not connect
C7	SIM_DATA	SIM Card data I/O
C8	SIM_PRESENCE	Detect SIM Card Presence

3.12 LCD display interface

SIM300 provides a serial LCD display interface that supports serial communication with LCD device. These are composite pins that can be used as GPIO ports or LCD display interface according to your application. When used as LCD interface, the following table is the pin definition. LCD interface timing should be united with the LCD device.

Table 18: Pin define of the LCD interface

Name	Pin	Function
DISP_DATA	18	Display data output
DISP_CLK	20	Display clock for LCD
DISP_CS	22	Display enable
DISP_D/C	24	Display data or command select
DISP_RST	26	LCD reset

Note: This function is not supported in the default firmware.There must be some special firmware if you want. Please contact SIMCom for more details.

3.13 Keypad interface

The keypad interface consists of 5 keypad column outputs and 5 keypad row inputs. The basic configuration is 5 keypad columns and 5 keypad rows, giving 25 keys, plus the 5 additional keys (i.e. where a keypad row is pulled low regardless of which column is enabled).

Table 19: Pin define of the keypad interface

Name	Pin	Function
KBC0	27	Keypad matrix column
KBC1	29	
KBC2	31	
KBC3	33	
KBC4	35	
KBR0	37	Keypad matrix row
KBR1	39	
KBR2	41	
KBR3	43	
KBR4	45	

The keypad interface allows a direct external matrix connection. A typical recommended circuit

about the keypad is as shown in the following figure. The GND column is added for the additional 5 keys.

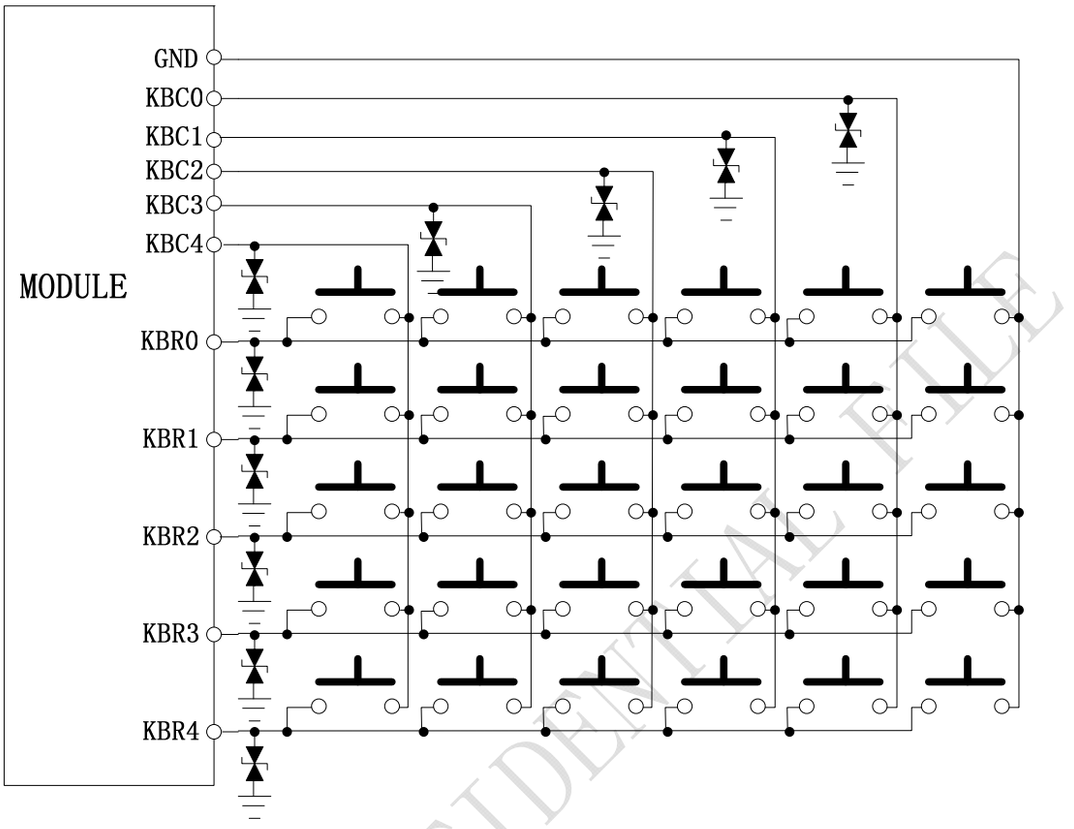


Figure 30: Reference circuit of the keypad interface

Note: This function is not supported in the default firmware. There must be special firmware if you want. Please contact SIMCom for more details.

3.14 ADC

SIM300 provides one auxiliary ADC (General purpose analog to digital converter.) as voltage input pin, which can be used to detect the values of some external items such as voltage, temperature etc. We can use AT command "AT+CADC" to read the voltage value on ADC0. For detail of this AT command, please refer to *document [1]*.

Table 20: ADC specification

	Min	Typ	Max	Units
Voltage range	0		2.4	V
ADC Resolution	16		16	bits
ADC accuracy[1]		0.59		mV
Sampling rate		5		Sec

(1): ADC accuracy 12bits.

3.15 Behaviors of the RI

Table 21: Behaviours of the RI

State	RI respond
Standby	HIGH
Voice calling	Change LOW, then: （1）Change to HIGH when establish calling. （2）Use AT command ATH, the RI pin changes to HIGH. （3）Sender hangs up, change to HIGH. (4) Change to HIGH when SMS received.
Data calling	Change LOW, then： （1）Change to HIGH when establish calling. （2）Use AT command ATH, the RI changes to HIGH.
SMS	When receive SMS, The RI will change to LOW and hold low level about 120 ms, then change to HIGH.
URC	Some URCs triggers 120ms low level on RI. For more details, ***please refer to document [10]***

If the module is used as caller, the RI on the board-to-board connector will maintain high. However, when it is used as receiver, following is timing of ring.

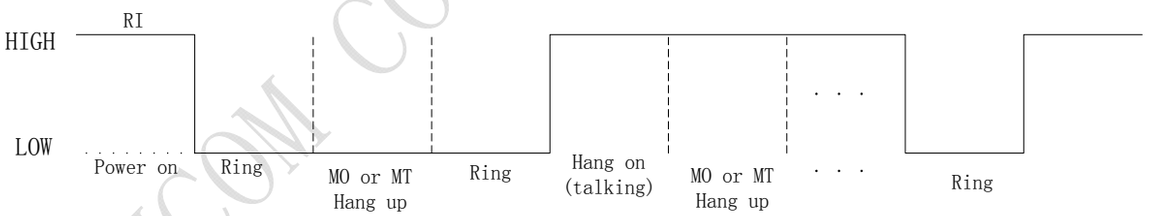


Figure 31: SIM300 Services as Receiver

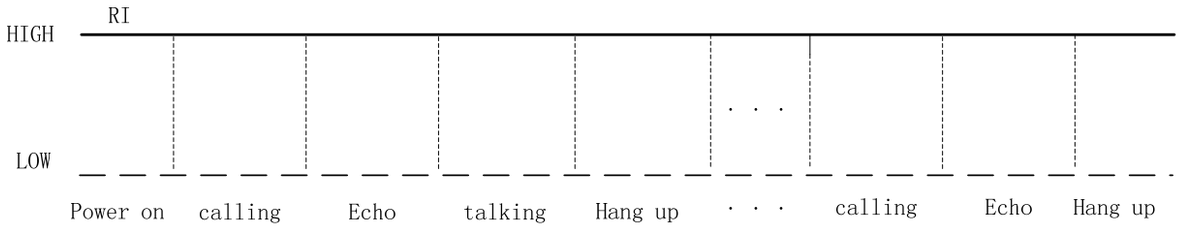


Figure 32: SIM300 Services as caller

3.16 Network status indication

The NETLIGHT on the board-to-board connector can be used to drive a network status indication LED lamp. The working state of this pin is listed in following table:

Table 22: Working state of the NETLIGHT

State	SIM300 function
Off	SIM300 is not running
64ms On/ 800ms Off	SIM300 does not find the network
64ms On/ 3000ms Off	SIM300 find the network
64ms On/ 300ms Off	GPRS communication

We provide a reference circuit for you, shown as following figure:

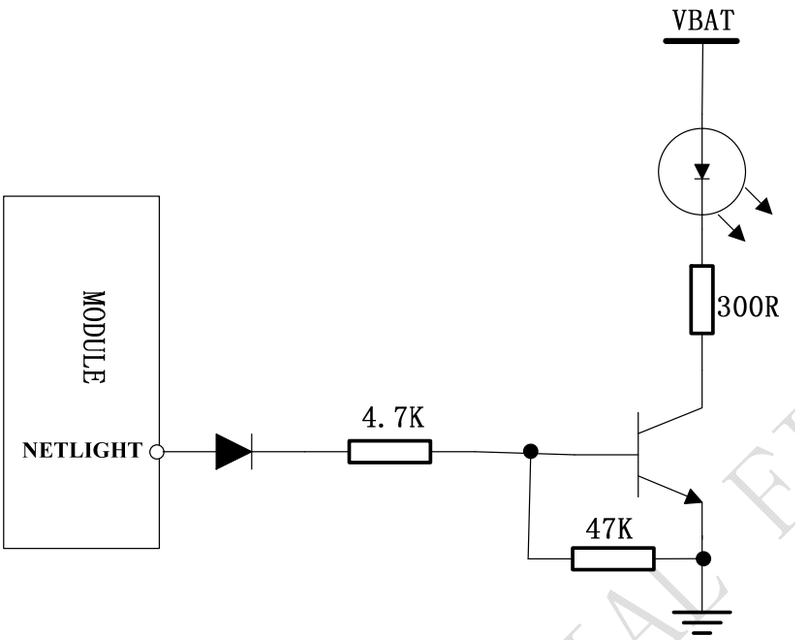


Figure 33: Reference circuit of NETLIGHT

3.17 General purpose input & output (GPIO)

SIM300 provides a limited number of General Purpose Input/Output signal pin.

Table 23: Pin define of the GPIO interface

Name	Pin	Function
GPIO0	32	General Purpose Input/Output Port

Note: This function is not supported in the default firmware. There must be special firmware if you require. Please contact SIMCom for more details .

4 Antenna interface

The RF interface has an impedance of 50Ω. To suit the physical design of individual applications SIM300 offers alternatives:

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

Figure 34: The RF interface of module

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

- GSM900<1dB
- DCS1800/PCS1900<1.5dB

4.1 Antenna installation

4.1.1 Antenna connector

SIM300 uses MURATA's MM9329-2700RA1 RF connector on the module side, we recommend to use MURATA's MXTK92XXXXX as matching connector on the application side. Please refer to appendix for detail info about MURATA's MXTK92XXXXX.

4.1.2 Antenna pad

The antenna can be soldered to the pad, or attached via contact springs. To help you to ground the antenna, SIM300 comes with a grounding plane located close to the antenna pad.
SIM300 material properties:
SIM300 PCB Material: FR4
Antenna pad: Gold plated pad
Antenna pad soldering temperature: we recommend 350℃.

Note: The soldering time for antenna pad and GND pad are different, less than 3s for antenna pad and less than 10s for GND pad.

4.2 Module RF output power

Table 24: SIM300 conducted RF output power

Frequency	Max	Min
EGSM900	33dBm ±2db	5dBm±5db
DCS1800	30dBm ±2db	0dBm±5db
PCS1900	30dBm ±2db	0dBm±5db

4.3 Module RF receive sensitivity

Table 25: SIM300 conducted RF receive sensitivity

Frequency	Receive sensitivity
EGSM900	< -106dBm
DCS1800	< -106dBm
PCS1900	< -106dBm

4.4 Module operating frequencies

Table 26: SIM300 operating frequencies

Frequency	Receive	Transmit
EGSM900	925 ～ 960MHz	880 ～ 915MHz
DCS1800	1805 ～ 1880MHz	1710 ～ 1785MHz
PCS1900	1930 ～ 1990MHz	1850 ～ 1910MHz

5 Electrical, reliability and radio characteristics

5.1 Absolute maximum ratings

Absolute maximum rating for power supply and voltage on digital and analog pins of SIM300 are listed in following table:

Table 27: Absolute maximum ratings

Parameter	Min	Max	Unit
Peak current of power supply	0	3.0	A
RMS current of power supply (during one TDMA- frame)	0	0.7	A
Voltage at digit pins	-0.3	3.3	V
Voltage at analog pins	-0.3	3.0	V
Voltage at digit/analog pins in POWER DOWN mode	-0.25	0.25	V

5.2 Operating temperatures

The operating temperature is listed in following table:

Table 28: SIM300 operating temperature

Parameter	Min	Typ	Max	Unit
Ambient temperature	-20	25	60	℃
Restricted operation*	-30 to -20		60 to 80	℃
Storage temperature	-40		85	℃

* The SIM300 does work, but deviations from the GSM specification may occur, For example, the frequency error or the phase error will be large.

5.3 Power supply ratings

Table 29: SIM300 power supply ratings

Parameter	Description	Conditions	Min	Typ	Max	Unit
VBAT	Supply voltage	Voltage must stay within the min/max values, including voltage drop, ripple, and spikes.	3.4	4.0	4.5	V
	Voltage drop during transmit burst	Normal condition, power control level for Pout max			400	mV
	Voltage ripple	Normal condition, power control level for Pout max @ f<200kHz @ f>200kHz			 50 2	 mV
I_{VBAT}	Average supply current	POWER DOWN mode SLEEP mode		35 2.5		uA mA
		IDLE mode EGSM 900 DCS1800/PCS1900		 23 23		 mA
		TALK mode EGSM 900 DCS1800/PCS1900		 260 190		 mA
		DATA mode, GPRS (3 Rx,2Tx) EGSM 900 DCS1800/PCS1900		 490 340		 mA
		DATA mode, GPRS (4 Rx,1Tx) EGSM 900 DCS1800/PCS1900		 290 220		 mA
	Peak supply current (during Tx burst)	Power control level for Pout max.		2		A

5.4 Current consumption

The values for current consumption listed below refer to Table 28.

Table 30: SIM300 current consumption

Voice Call	
EGSM 900	@power level #5 <350mA,Typical 260mA @power level #10,Typical 130mA @power level #19,Typical 86mA
DCS 1800/PCS 1900	@power level #0 <300mA,Typical 200mA @power level #10,Typical 87mA @power level #15,Typical 80mA
GPRS Data	
DATA mode, GPRS (1 Rx,1 Tx) CLASS 8	
EGSM 900	@power level #5 <350mA,Typical 260mA @power level #10,Typical 125mA @power level #19,Typical 84mA
DCS 1800/PCS 1900	@power level #0 <300mA,Typical 200mA @power level #10,Typical 83mA @power level #15,Typical 76mA
DATA mode, GPRS (3 Rx, 2 Tx) CLASS 10	
EGSM 900	@power level #5 <550mA,Typical 470mA @power level #10,Typical 225mA @power level #19,Typical 142mA
DCS 1800/PCS 1900	@power level #0 <450mA,Typical 340mA @power level #10,Typical 140mA @power level #15,Typical 127mA
DATA mode, GPRS (4 Rx,1 Tx) CLASS 8	
EGSM 900	@power level #5 <350mA,Typical 270mA @power level #10,Typical 160mA @power level #19,Typical 120mA
DCS 1800/PCS 1900	@power level #0 <300mA,Typical 220mA @power level #10,Typical 120mA @power level #15,Typical 113mA

Class 10 is default set when the module works at data translation mode, the module can also work at class 8 set by AT command.

5.5 Electro-Static discharge

The GSM engine is not protected against Electrostatic Discharge (ESD) in general. Therefore, it is subject to ESD handing precautions that typically apply to ESD sensitive components. Proper ESD handing and packaging procedures must be applied throughout the processing, handing and operation of any application using a SIM300 module.

The measured values of SIM300 are shown as the following table:

Table 31: The ESD endure statue measured table (Temperature: 25℃, Humidity:45%)

Part	Contact discharge	Air discharge
VBAT,GND	±4KV	±8KV
RXD, TXD	±2KV	±4KV
Antenna port	±2KV	±4KV
SPK1P/1N, SPK2P/2N, MIC1P/1N, MIC2P/2N,	±1KV	±2KV
Other port	±1KV	

6 Mechanics

This chapter describes the mechanical dimensions of SIM300.

6.1 Mechanical dimensions of SIM300

Following shows the Mechanical dimensions of SIM300 (top view, side view and bottom view).

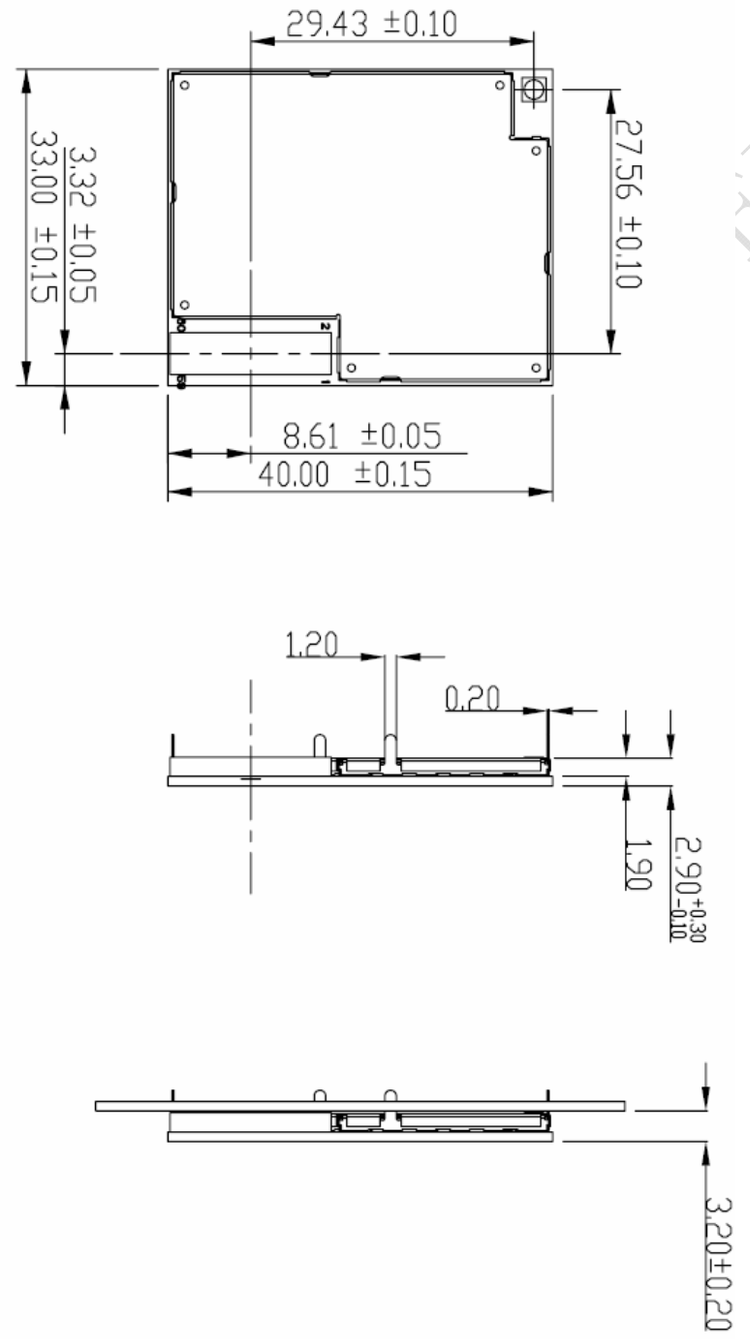


Figure 35: Mechanical dimensions of module（Unit: mm）

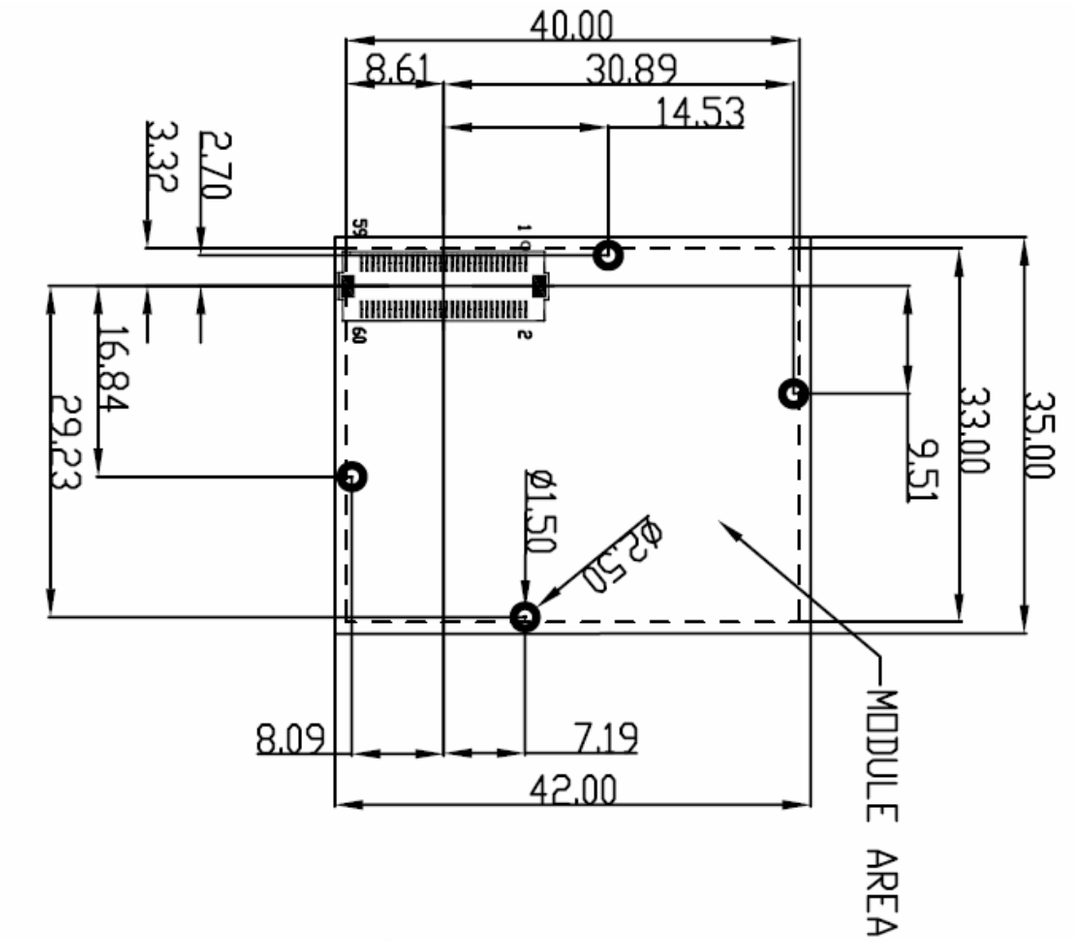


Figure 36: Mechanical dimensions of module PCB decal（Unit: mm）

6.2 Mounting SIM300 onto the application platform

Use the connector ENTERY 1008-G60N-01R or JXT 210-106001-001to fix the SIM300 onto the customer platform.

6.3 Board-to-board connector

We recommend to use ENTERY Company's 1008-G60N-01R or JXT's 210-106001-001 as the board-to-board connector. They are fully compatible each other. This high density SMT connector is designed for parallel PCB-to-PCB applications. It is ideal to use in VCRs, notebook PCs, cordless telephones, mobile phones, audio/visual and other telecommunications equipment where reduced size and weight are important. Following is parameter of 1008-G60N-01R and 210-106001-001. For more details, you can login http://www.entery.com.tw or http://www.jxt-china.com for more information.

6.3.1 Mechanical dimensions of the ENTERY 1008-G60N-01R

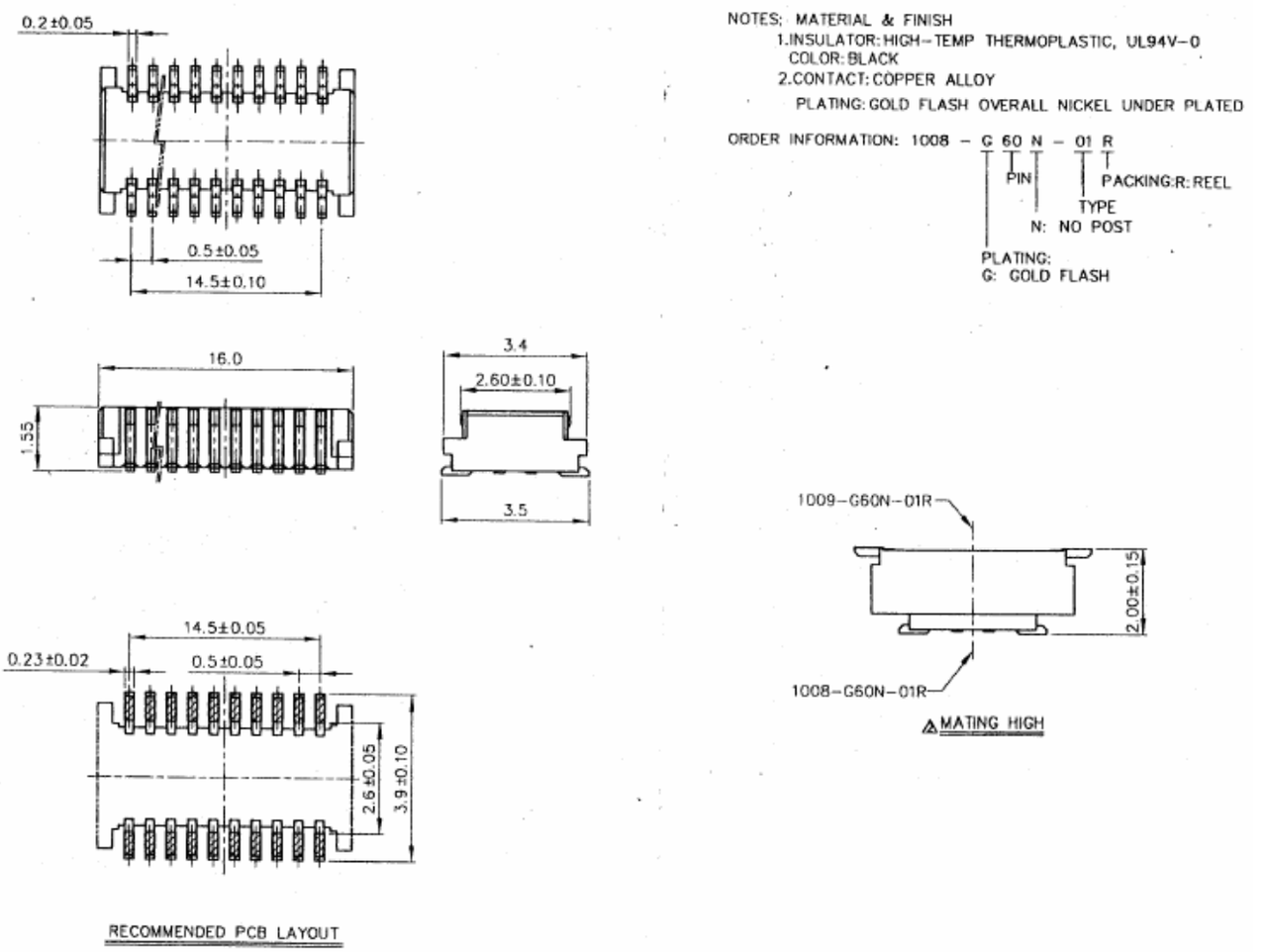
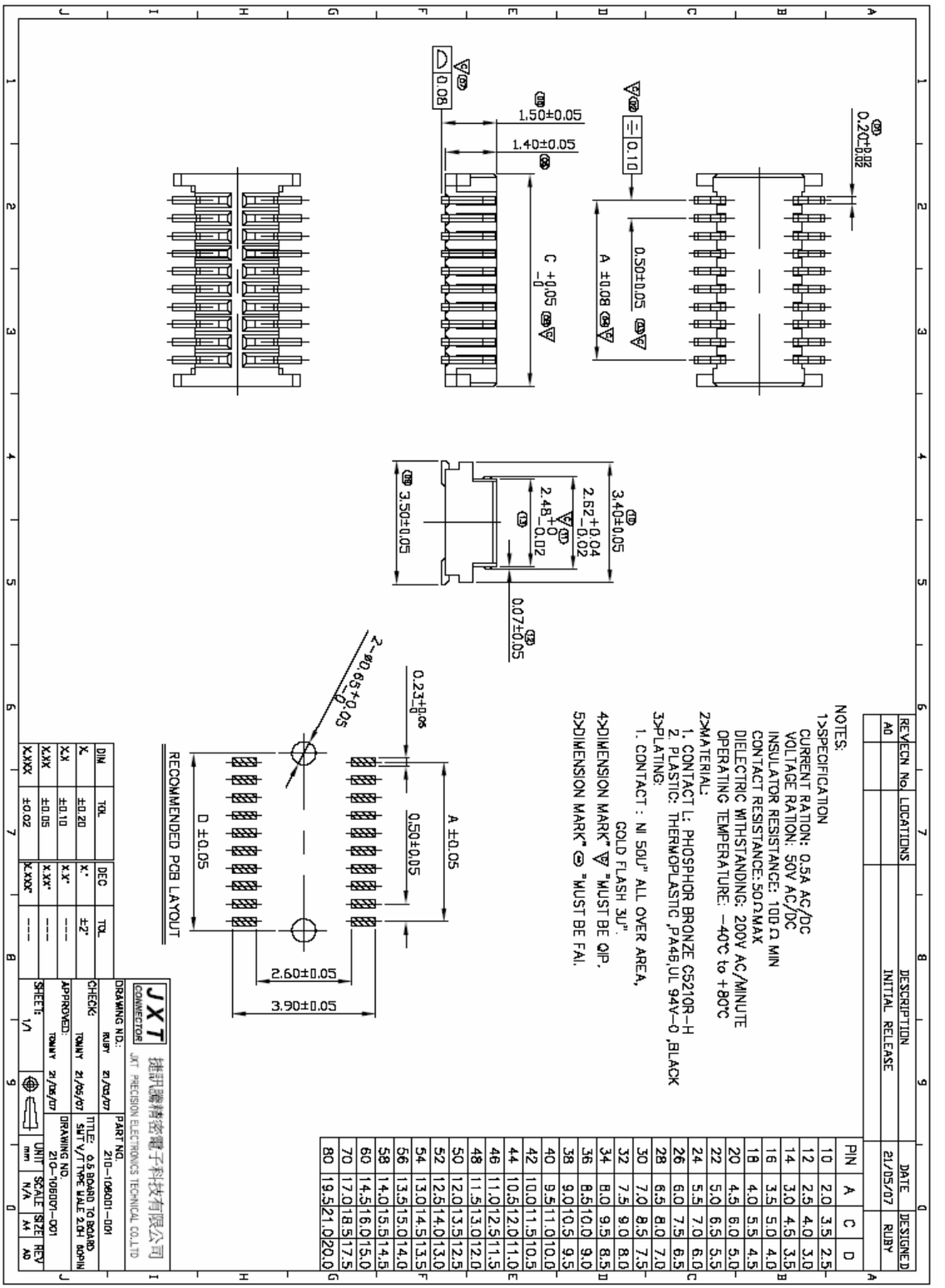


Figure 37: ENTERY 1008-G60N-01R board-to-board connector

6.3.2 Mechanical dimensions of the JXT 210-106001-001



PIN	A	C	D
10	2.0	3.5	2.5
12	2.5	4.0	3.0
14	3.0	4.5	3.5
16	3.5	5.0	4.0
18	4.0	5.5	4.5
20	4.5	6.0	5.0
22	5.0	6.5	5.5
24	5.5	7.0	6.0
26	6.0	7.5	6.5
28	6.5	8.0	7.0
30	7.0	8.5	7.5
32	7.5	9.0	8.0
34	8.0	9.5	8.5
36	8.5	10.0	9.0
38	9.0	10.5	9.5
40	9.5	11.0	10.0
42	10.0	11.5	10.5
44	10.5	12.0	11.0
46	11.0	12.5	11.5
48	11.5	13.0	12.0
50	12.0	13.5	12.5
52	12.5	14.0	13.0
54	13.0	14.5	13.5
56	13.5	15.0	14.0
58	14.0	15.5	14.5
60	14.5	16.0	15.0
70	17.0	18.5	17.5
80	19.5	21.0	20.0

Figure 38: JXT 210-106001-001 board-to-board connector

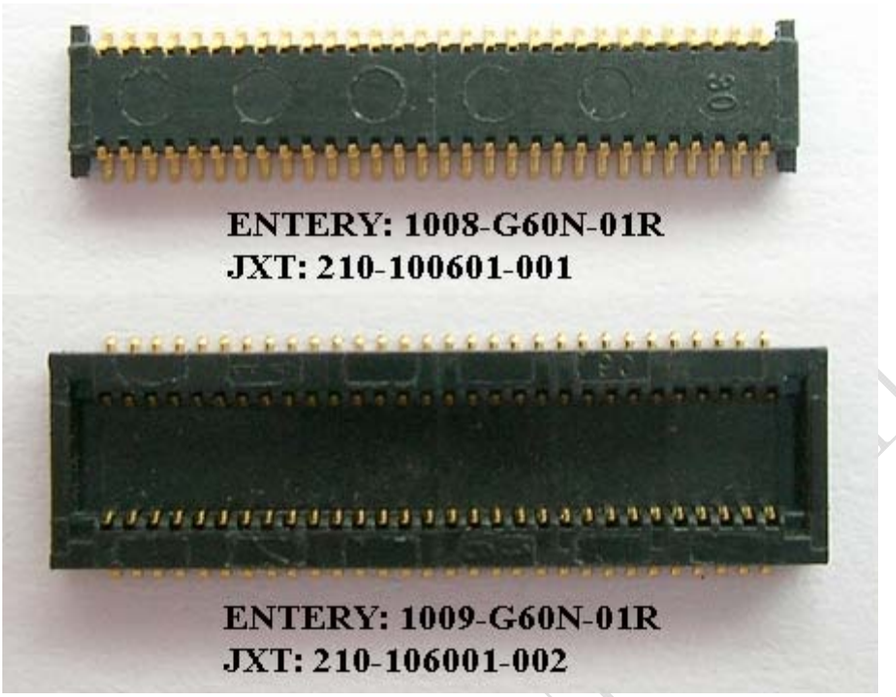


Figure 39: Board-to-board connector physical photo

NOTE：

The connector ENTERY 1009-G60N-01R or JXT 210-106001-002 is used in socket side (module side) and ENTERY 1008-G60N-01R or JXT 210-100601-001 is used in pin side (user side).

6.4 RF connector

The RF connector in module side is a ultra-miniature SMT GSC Type Microwave Coaxial Connector (Part Number: MM9329-2700RA1, vended by Murata), It has high performance with wide frequency range, surface mountable and reflows solderable. Following is parameter (Figure 40). Certainly you can visit http://www.murata.com/ for more information.

To get good RF performance in customer's design, we suggest the customer to use the matching RF adapter cable which is also supplied by murata (Part Number: MXTK92 or MXTK88), the following figure 41 is the dimensions of MXTK series RF adapter cable. The customer can get it from the cable's manufacturer murata, and for details, please visit http://www.murata.com/.

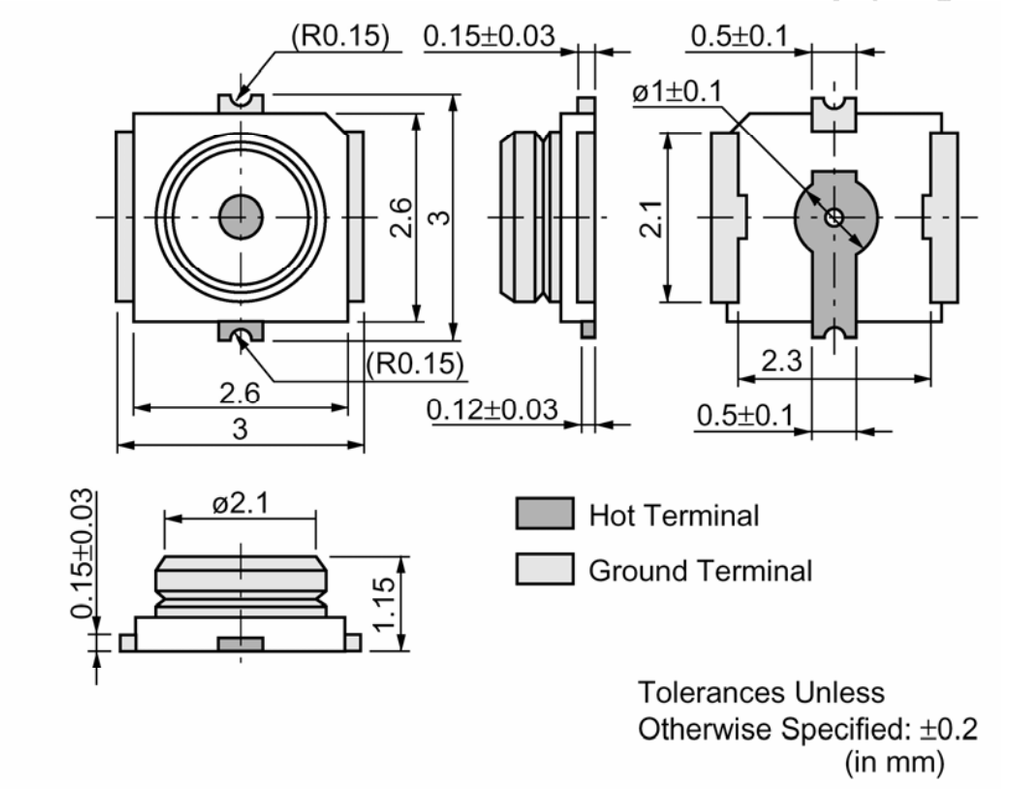


Figure 40: MM9329-2700RA1

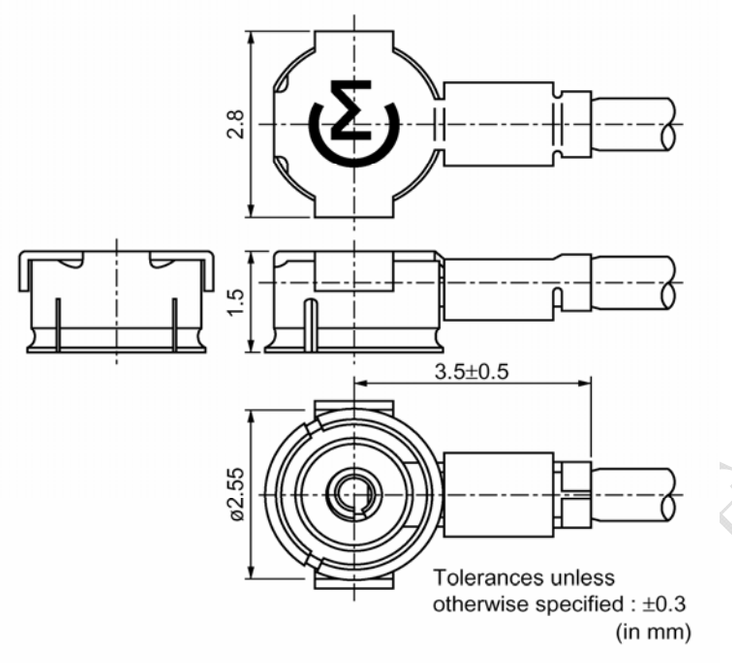


Figure 41: MXTK series RF adapter cable

6.5 Top view of the SIM300

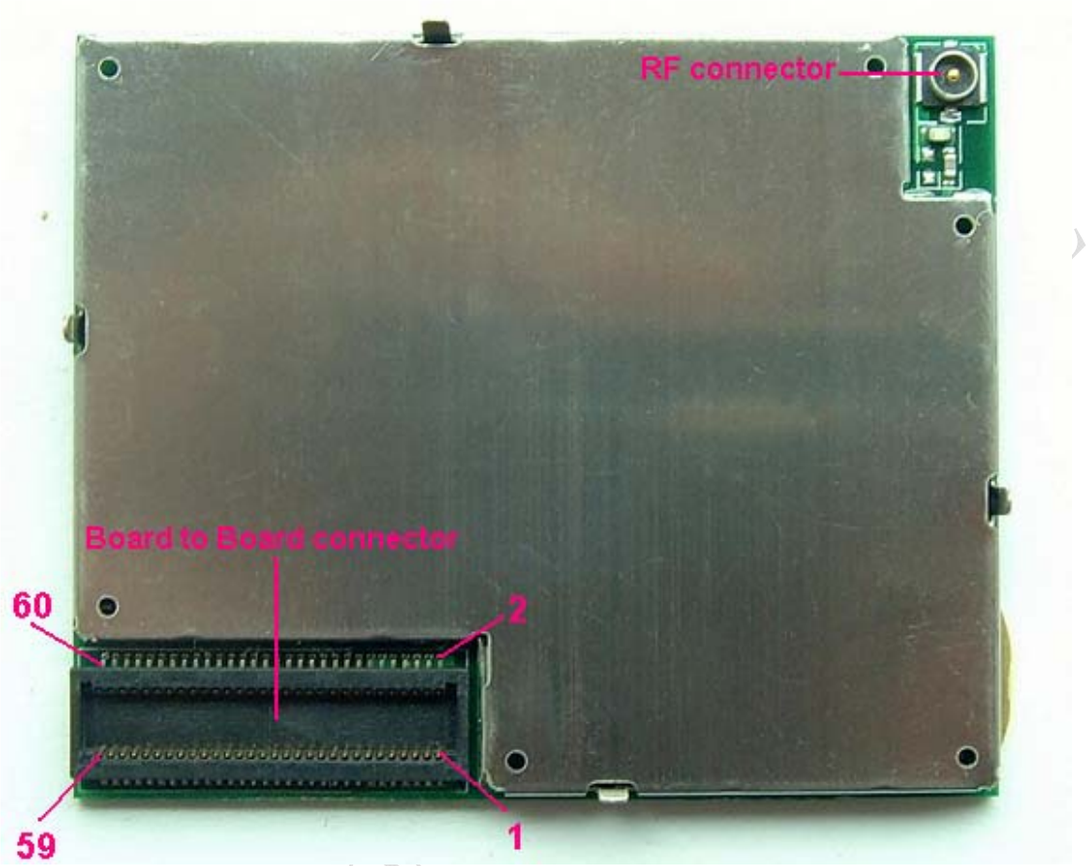


Figure 42: Top view of the SIM300

6.6 PIN assignment of board-to-board connector of SIM300

Table 32: Connection diagrams

PIN NO.	PIN NAME	I/O		PIN NO.	PIN NAME	I/O
1	VBAT	I		**2**	VBAT	I
3	VBAT	I		**4**	VBAT	I
5	VBAT	I		**6**	VBAT	I
7	VBAT	I		**8**	VBAT	I
9	GND			**10**	GND	
11	GND			**12**	GND	
13	GND			**14**	GND	
15	VRTC	I/O		**16**	SIM_PRESENCE	I
17	VDD_EXT	O		**18**	DISP_DATA	I/O
19	SIM_VDD	O		**20**	DISP_CLK	O
21	SIM_DATA	I/O		**22**	DISP_CS	O
23	SIM_CLK	O		**24**	DISP_D/C	O
25	SIM_RST	O		**26**	DISP_RST	O
27	KBC0	O		**28**	DCD	O
29	KBC1	O		**30**	NETLIGHT	O
31	KBC2	O		**32**	GPIO0	I/O
33	KBC3	O		**34**	PWRKEY	I
35	KBC4	O		**36**	BUZZER	O
37	KBR0	I		**38**	DTR	I
39	KBR1	I		**40**	RXD	I
41	KBR2	I		**42**	TXD	O
43	KBR3	I		**44**	RTS	I
45	KBR4	I		**46**	CTS	O
47	DBG_RXD	I		**48**	RI	O
49	DBG_TXD	O		**50**	AGND	
51	AGND			**52**	ADC0	I
53	MIC1P	I		**54**	SPK1P	O
55	MIC1N	I		**56**	SPK1N	O
57	MIC2P	I		**58**	SPK2P	O
59	MIC2N	I		**60**	SPK2N	O

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