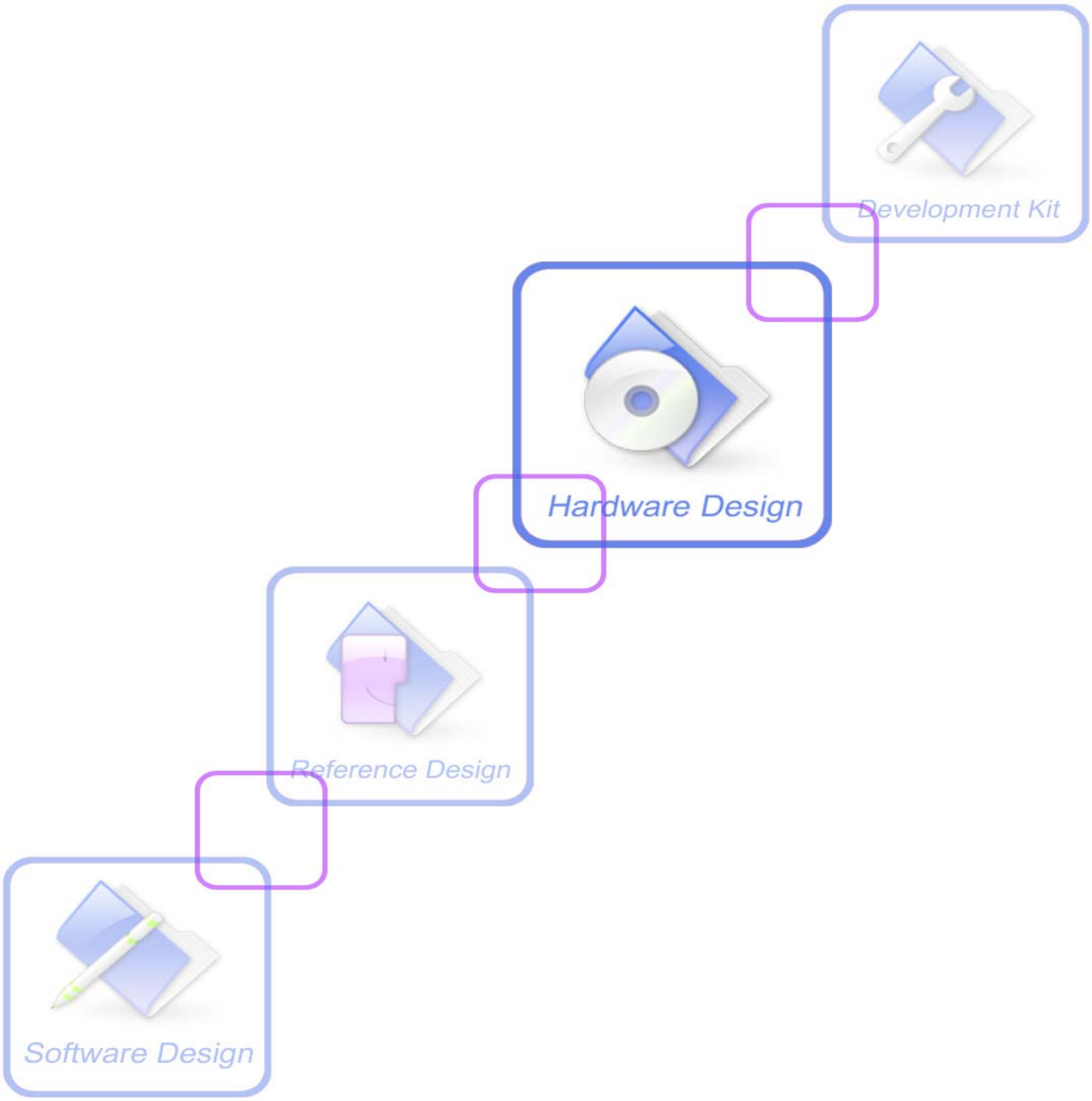
Hardware Design

SIM900_HD_V1.06



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Version history

Date	Version	Description of change	Author
2009-12-26	1.01	Origin	LiGang
2010-02-04	1.02	Modify the voltage range of ADC input. Modify the figure of bottom mechanical dimensions of module. Modify the figure of recommended PCB decal and the note.	LiGang
2010-04-07	1.03	§2, § 2.1 Changed the lowest current consumption in sleep mode from 1.5mA to 1.0mA.	LiGang
		§3.1 Add the description of the RXD pin, this pin should be pulled up to VDD_EXT.	
		§3.4.2.1 Change the pull down time of the figure 12. Change the impulse time of the figure 13.	
		§3.8.1 Update the description of autobauding. The default setting is autobauding mode.	
		§3.9.4 Add audio parameters in table 10 and table 11.	
		§3.10.1 Change the value of the capacitance from 220nF to 100nF in figure 27 and figure 28.	
		§3.13 Delete the pull up resistor of figure 32.	
2010-05-07	1.04	§2.1, § 3.4.2.3 Modify the power supply range from 3.4V~4.5V to 3.2V~4.8V.	LiGang
2010-06-23	1.05	§3.7, Modify the VRTC pin connection when backup is not needed. §3.4, Revise Figure 8 & Figure 11 §5.3 Revise the Supply Voltage Range	ZhouQiang
2010-07-16	1.06	Modify the power supply range to 3.2V~4.8V. §3.3.2 Add Figure 1: The minimal VBAT voltage at VBAT drop. §3.4 Modified figure 7，figure8，figure15. §3.4 Add table 7. §3.5 Add 3.5.4 and 3.5.5 description. Delete chapter 3.6. §3.11 Modified the keypad from 5x5 to 4x5. ADD figure 32, figure 33, figure 34, figure 38. §6.2 Modified figure 42	LiGang

1 Introduction

This document describes the hardware interface of the SIMCom SIM900 module that connects to the specific application and the air interface. As SIM900 can be integrated into a wide range of applications, all functional components of SIM900 are described in great detail.

This document can help user to quickly understand SIM900 interface specifications, electrical and mechanical details. With the help of this document and other SIM900 application notes, user guide, users can use SIM900 module to design and set-up mobile applications quickly.

1.1 Related Documents

Table 1: Related documents

SN	Document name	Remark
[1]	SIM900_ATC	SIM900_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
kbps	Kilo bits per second

Abbreviation	Description
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

Abbreviation	Description
Inorm	Normal Current
Imax	Maximum Load Current
Phonebook abbreviations	
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

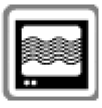
1.3 Safety Caution

The following safety precautions must be observed during all phases of the operation. Usage, service or repair of any cellular terminal or mobile incorporating SIM900 module. Manufactures of the cellular terminal should send words of the following safety information to users and operating personnel and to incorporate these guidelines into all manuals supplied with the product. If not so, SIMCom does not take on any liability for customer failure to comply with these precautions.

When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive to not operate normally for RF energy interference.

Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forget to think much of these instructions may lead to the flight safety or offend against local legal action, or both.

Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.



Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.

Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.

GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, for example no mobile fee or a invalid SIM card. While you are in this condition and need emergent help, please remember using emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength.

Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may
have to deactivate those features before you can make an emergency call.

Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.

2 SIM900 Overview

Designed for global market, SIM900 is a quad-band GSM/GPRS engine that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM900 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 24mm x 24mm x 3mm, SIM900 can meet almost all the space requirements in your applications, such as M2M, smart phone, PDA and other mobile devices.

The physical interface to the mobile application is a 68-pin SMT pad, which provides all hardware interfaces between the module and customers' boards.

- The keypad and SPI display interface will give users the flexibility to develop customized applications.
- Serial port and Debug port can help user easily develop user's applications.
- One audio channel includes a microphone input and a speaker output.
- Programmable General Purpose Input & Output.

The SIM900 is designed with power saving technique so that the current consumption is as low as 1.0mA in SLEEP mode.

The SIM900 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 SIM900 Key Features

Table 3: SIM900 key features

Feature	Implementation
Power supply	Single supply voltage： 3.2V – 4.8V
Power saving	Typical power consumption in SLEEP mode is 1.0mA (BS-PA-MFRMS=9)
Frequency Bands	● SIM900 Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900. The SIM900 can search the 4 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 GSM 850 and 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: -30°C to +80°C

	● Restricted operation: -40°C to -30°C and +80 °C to +85°C(1) ● Storage temperature -45°C to +90°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 ● Supports the protocols PAP (Password Authentication Protocol) usually used for PPP connections. ● 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	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 ● Noise Suppression
Serial port and Debug port	Serial Port: ● 8-wire modem interface with status and control lines, unbalanced, asynchronous. ● 1200kbps to 115200kbps. ● Serial Port can be used for AT commands or data stream. ● Supports RTS/CTS hardware handshake and software ON/OFF flow control. ● Multiplex ability according to GSM 07.10 Multiplexer Protocol. ● Autobauding supports baud rate from 1200 bps to 57600bps. Debug port: ● 2-wire null modem interface DBG_TXD and DBG_RXD. ● Can be used for debugging and upgrading firmware.
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: 24mm x 24mm x 3mm Weight: 3.4g
Firmware upgrade	Firmware upgradeable by debug port.

(1) The SIM900 does work, but deviations from the GSM specification may occur.

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 SIM900 Functional Diagram

The following figure shows a functional diagram of the SIM900 and illustrates the mainly functional part:

- The GSM baseband engine
- Flash and SRAM
- The GSM radio frequency part
- The antenna interface
- The Other interfaces

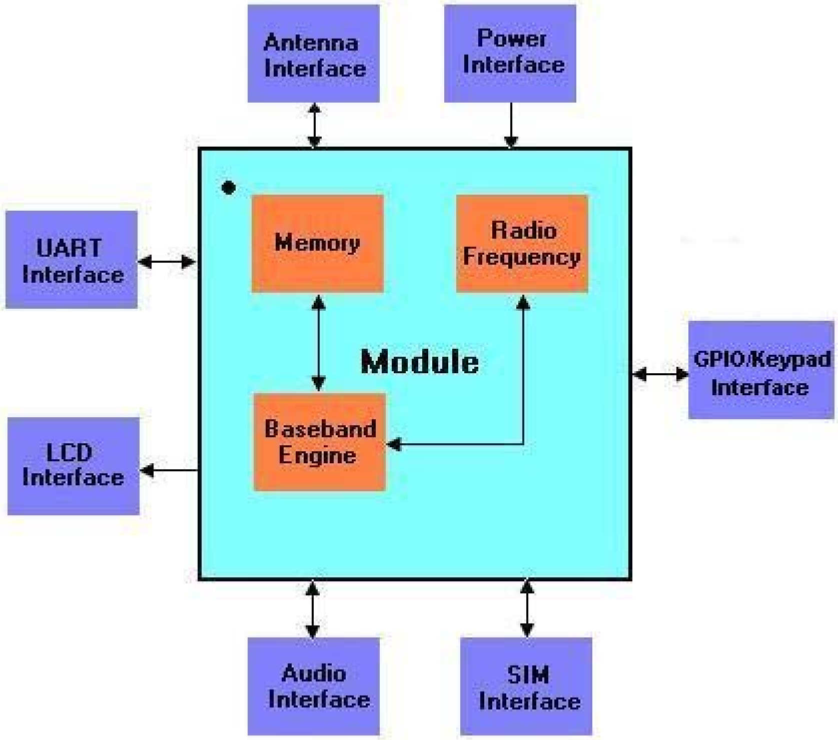


Figure 2: SIM900 functional diagram

2.3 SIM900 Evaluation Board

In order to help you on the application of SIM900, SIMCom can supply an Evaluation Board (EVB) that interfaces the SIM900 directly with appropriate power supply, SIM card holder, RS232 serial port, handset port, earphone port, line in port, antenna and all GPIO of the SIM900.

Figure 3: Top view of SIM900 EVB

For details please refer to the *SIM900-EVB_UGD* document.

3 Application Interface

SIM900 is equipped with a 68-pin SMT pad that connects to the cellular application platform. Sub-interfaces included in these SMT pads are described in detail in following chapters:

- Power supply (*please refer to Chapter 3.3*)
- Serial interfaces (*please refer to Chapter 3.7*)
- Analog audio interfaces (*please refer to Chapter 3.8*)
- SIM interface (*please refer to Chapter 3.9*)

Electrical and mechanical characteristics of the SMT pad are specified in *Chapter 5*.

3.1 SIM900 Pin Description

Table 5: Pin description

Power Supply				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
VBAT	I	3 VBAT pins are dedicated to connect the supply voltage. The power supply of SIM900 has to be a single voltage source of VBAT= 3.2V...4.8V. It must be able to provide sufficient current in a transmit burst which typically rises to 2A	Vmax= 4.8V Vmin=3.2V 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=3.15V Vmin=2.0V Vnorm=3.0V Iout(max)= 300uA Iin=2 uA	Do not keep pin open, it should be connected to a battery or a capacitor.
VDD_EXT	O	2.8V output power supply	Vmax=2.95V Vmin=2.70V Vnorm=2.80V Iout(max)= 10mA	If unused, keep open.
GND		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 drive the PWRKEY to low level voltage for a short time when power on or power off the system because the system need margin time in order to assert the software.	VILmax=0.15*VDD_EXT VIHmin=0.85* VDD_EXT VImax=VDD_EXT VILmin= 0V	It is already pulled up.
PWRKEY_OUT	O	Connecting PWRKEY and PWRKEY_OUT for a short time then release also can power on or power off the module.	VOHmin= VDD_EXT-0.1V VOLmax=0.1V VOHmax= VDD_EXT VOLmin= 0V	

Audio interfaces

PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
MIC_P MIC_N	I	Positive and negative voice band input	Audio DC Characteristics refer to chapter 3.9	If unused keep open
SPK_P SPK_N	O	Positive and negative voice band output		If unused keep open
LINEIN_R LINEIN_L	I	Line input		If unused keep open

GERNERAL PURPOSE input/output

PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
STATUS	O	Indicate status of module 's working	VILmax=0.15 *VDD_EXT VIHmin=0.85*VDD_EXT VILmin= 0V VIHmax= VDD_EXT VOHmin= VDD_EXT-0.1V VOLmax=0.1V VOHmax= VDD_EXT VOLmin= 0V	If unused keep open
NETLIGHT	O	Indicate status of module's network		If unused keep open
DISP_DATA	I/O	Display interface		If unused keep open
DISP _CLK	O			
DISP _CS	O			
DISP _D/C	O			
SCL	O	I^2C bus clock		If unused keep open
SDA	I/O	I^2C bus data		
KBR0~KBR4	O	Keypad interface		If unused keep these pins open
KBC1~KBC4	I			Pull up to

				VDD_EXT, if unused keep pins open
Serial port				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
RXD	I	Receive data	VILmax=0.15 *VDD_EXT VIHmin=0.85*VDD_EXT VILmin= 0V VIHmax= VDD_EXT VOHmin= VDD_EXT-0.1V VOLmax=0.1V VOHmax= VDD_EXT VOLmin= 0V	If RXD pin not used，it should be pulled up to VDD_EXT. DTR Pin has been pulled up to VDD_EXT internally. Other unused pins can keep open
TXD	O	Transmit data		
RTS	I	Request to send		
CTS	O	Clear to send		
RI	O	Ring indicator		
DSR	O	Data Set Ready		
DCD	O	Data carrier detect		
DTR	I	Data terminal Ready		
Debug interface				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
DBG_TXD	O	Serial interface for debugging and firmware upgrade	VILmax=0.15 *VDD_EXT VIHmin=0.85*VDD_EXT VILmin= 0V VIHmax= VDD_EXT VOHmin= VDD_EXT-0.1V VOLmax=0.1V VOHmax= VDD_EXT VOLmin= 0V	If unused keep pins open
DBG_RXD	I			
SIM interface				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
SIM_VDD	O	Voltage supply for SIM card	The voltage can be select by software automatically either 1.8V or 3V	
SIM_DATA	I/O	SIM data input/output	VILmax=0.15 *SIM_VDD VIHmin=0.85*SIM_VDD VILmin= 0V VIHmax= SIM_VDD VOHmin= SIM_VDD-0.1V VOLmax=0.1V VOHmax= SIM_VDD VOLmin= 0V	All signals of SIM interface are protected against ESD with a TVS diode array.
SIM_CLK	O	SIM clock		
SIM_RST	O	SIM reset		

SIM_PRESENCE	I	SIM Card Detection	VILmax=0.15 *VDD_EXT VIHmin=0.85*VDD_EXT VILmin= 0V VIHmax= VDD_EXT	If unused keep open
ADC				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
ADC	I	General purpose analog to digital converter.	Input voltage range: 0V ~ 2.8V	If unused keep open
External Reset				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
NRESET	I	External reset input(Active low)	VILmax=0.15 *VDD_EXT VIHmin=0.85*VDD_EXT VILmin= 0V VIHmax= VDD_EXT	If unused keep open
Pulse Width Modulation				
PIN NAME	I/O	DESCRIPTION	DC CHARACTERISTICS	COMMENT
PWM1	O	PWM Output	VOHmin= VDD_EXT-0.1V VOLmax=0.1V VOHmax= VDD_EXT VOLmin=0	If unused keep open
PWM2	O	PWM Output		

3.2 Operating Modes

The table below briefly summarizes the various operating modes referred to 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. In 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 between two subscribers is in progress. In this case, the power consumption depends on network settings such as DTX off/on, FR/EFR/HR, hopping sequences, antenna.
	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).
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 baseband 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.	

3.3 Power Supply

The power supply of SIM900 is from a single voltage source of VBAT= 3.2V~4.8V. 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 be placed as close as possible to the SIM900 VBAT pins. The following figure is the recommended circuit.

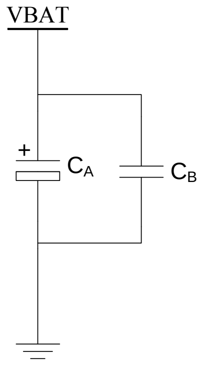


Figure 4: Reference circuit of the VBAT input

The circuit design of the power supply depends strongly upon 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 4.1V, 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 SIM900 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.

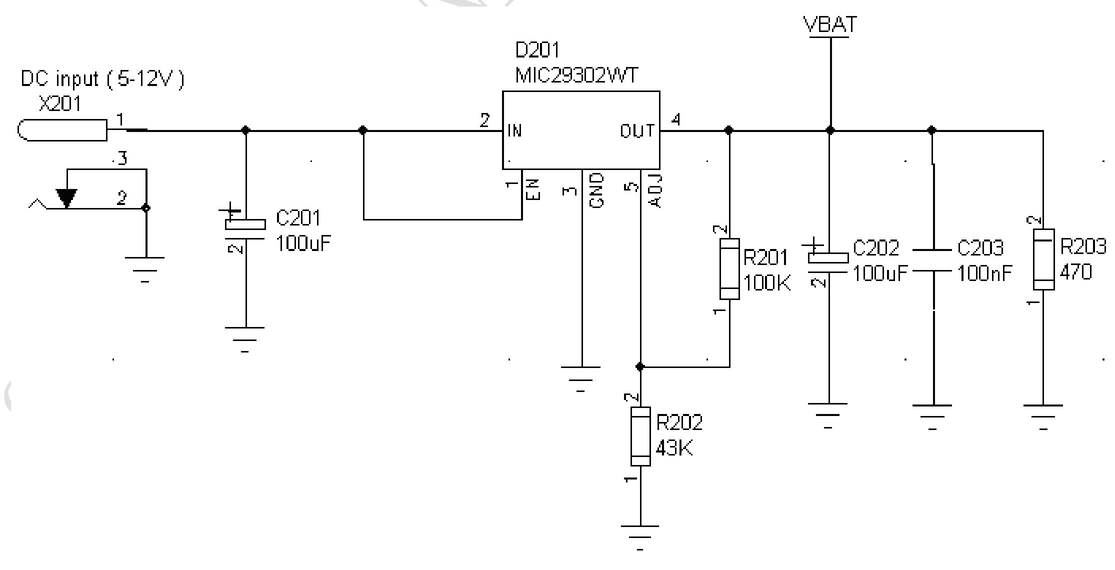


Figure 5: Reference circuit of the source power supply input

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.

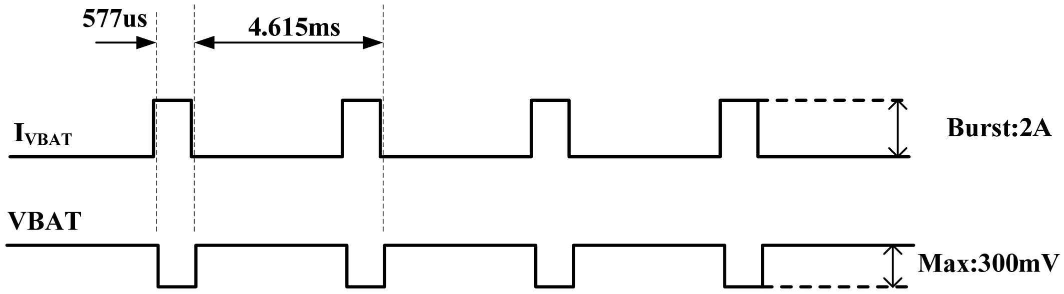


Figure 6: VBAT voltage drop during transmit burst

3.3.1 Power Supply Pins

Three VBAT pins are dedicated to connect the supply voltage and fifteen GND pins are dedicated to connect ground. VRTC pin can be used to back up the RTC.

3.3.2 Minimizing Power Losses

When designing the power supply for user's application please pay specific attention to power losses. Ensure that the input voltage VBAT never drops below 3.1V even in a transmit burst where current consumption can rise to typical peaks of 2A. If the power voltage drops below 3.1V, the module may be shut down automatically. The PCB traces from the VBAT pins to the power source must be wide enough to decrease voltage drops in the transmitting burst mode.

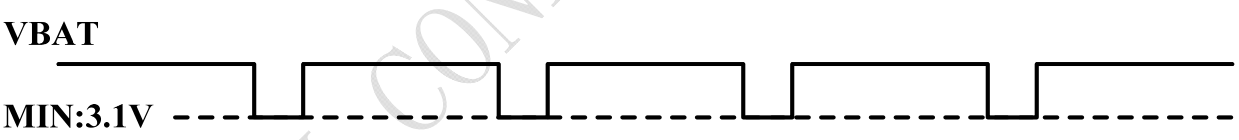


Figure 7: The minimal VBAT voltage at VBAT drop

3.3.3 Monitoring Power Supply

To monitor the supply voltage, you can use the "AT+CBC" command which includes a parameter: voltage value (in mV).
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 command "AT+CBC" is executed.
For details information about "AT+CBC" please refer to *document [1]*

3.4 Power Up and Power Down Scenarios

In general, be sure not to turn on SIM900 while it is beyond the safety limits of voltage and temperature stated in Chapter 3.4.2. SIM900 would immediately power down after the module having started and detected these

inappropriate conditions. In extreme cases this can cause permanent damage to the module.

3.4.1 Turn On SIM900

SIM900 can be turned on by two ways, which are described in following chapters:

- Via PWRKEY pin: starts normal operating mode *(please refer to chapter 3.4.1.1)*;
- Via PWRKEY pin and PWRKEY_OUT pin：starts normal operating mode

Note: The AT command must be set after the SIM900 is powered on and Unsolicited Result Code "RDY" is received from the serial port. However if the SIM900 is set to autobauding, the serial port will receive nothing. The AT commands can be set after the SIM900 is powered on. User can use AT+IPR=x 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 SIM900 is poweedr on. Please refer to the chapter "AT+IPR" in document [1].

3.4.1.1 Turn On SIM900 Using the PWRKEY Pin (Power On)

User can turn on the SIM900 by driving the PWRKEY to a low level voltage for a short time and then release. This pin has pulled up to 3V in the module. The simple circuit illustrates as the following figures.

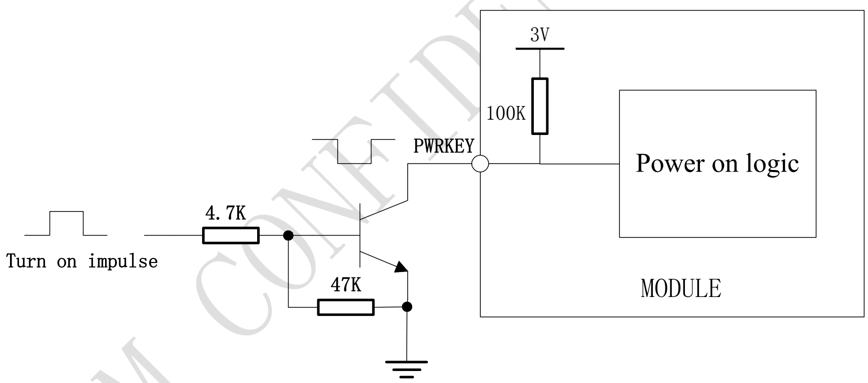


Figure 8: Turn on SIM900 using PWRKEY driving circuit

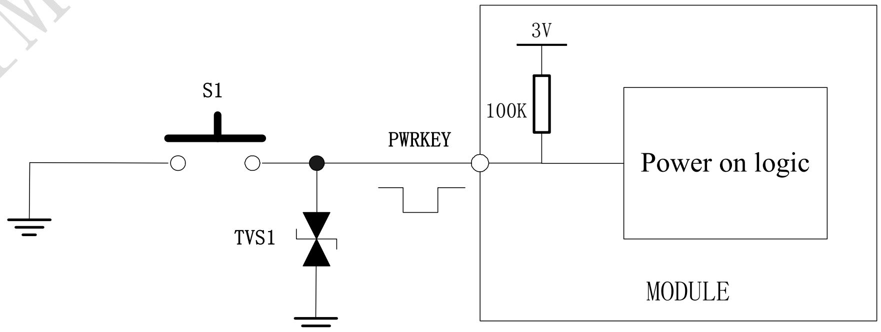


Figure 9: Turn on SIM900 using PWRKEY button

The power on scenarios illustrates as following figure.

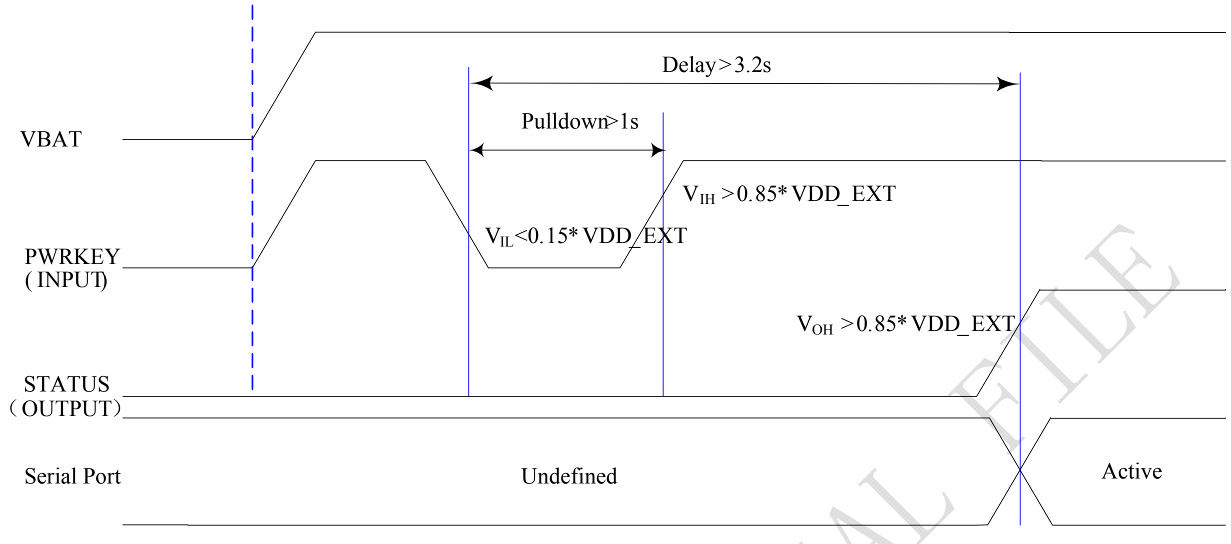


Figure 10: Timing of turn on system using PWRKEY

When power on procedure completes, the SIM900 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 SIM900 Using the PWRKEY Pin and PWRKEY_OUT Pin (Power On)

User can turn on SIM900 by connecting PWRKEY Pin and PWRKEY_OUT Pin for a short time and then release. The simple circuit illustrates as the following figures.

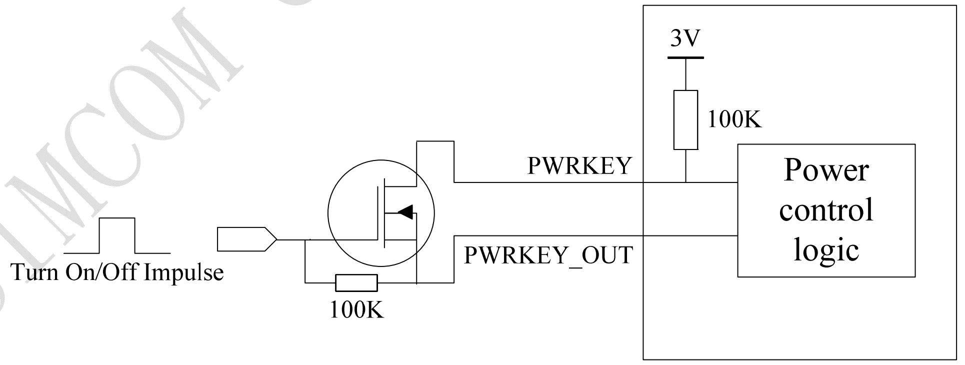


Figure 11: Turn on SIM900 using PWRKEY and PWRKEY_OUT **driving circuit**

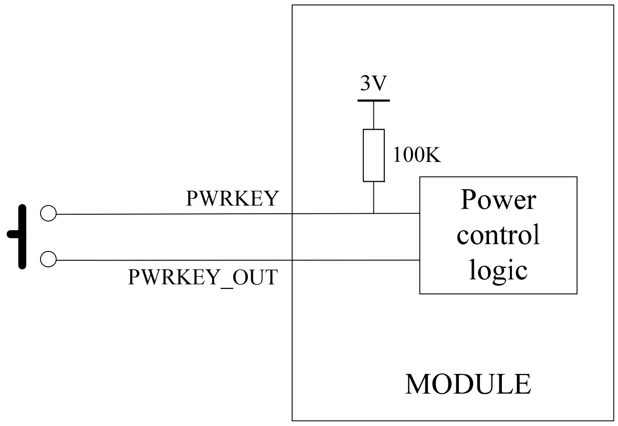


Figure 12: Turn on SIM900 using PWKEY and PWRKEY_OUT button

The power on scenarios illustrates as following figure.

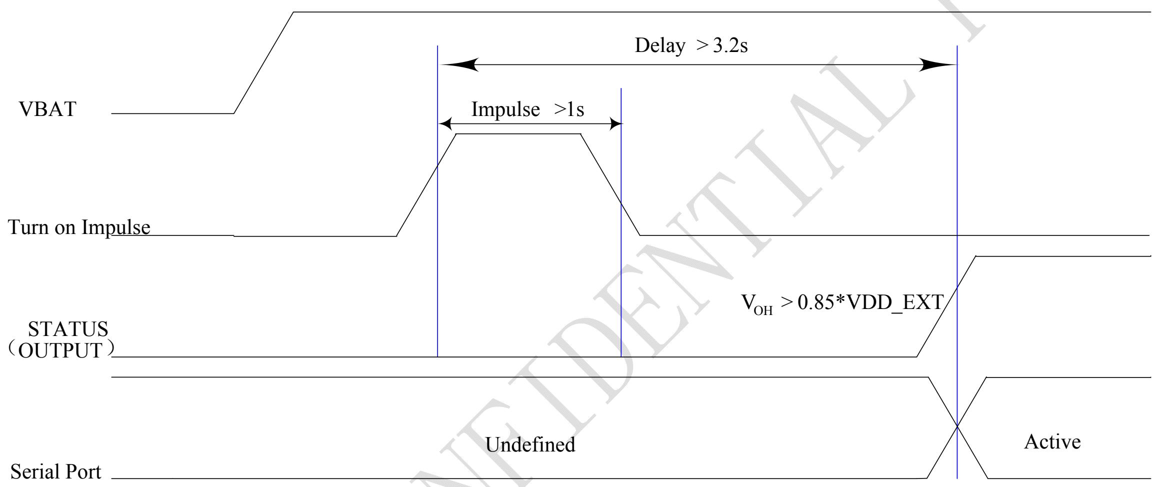


Figure 13: Timing of turn on SIM900 using PWRKEY and PWRKEY_OUT

3.4.2 Turn Off SIM900

Following ways can be used to turn off the SIM900:

- Normal power down procedure: Turn off SIM900 using the PWRKEY pin
- Normal power down procedure: Turn off SIM900 using AT command
- Over-voltage or under-voltage automatic power down: Take effect if over-voltage or under-voltage is detected
- Over-temperature or under-temperature automatic power down: Take effect if over-temperature or under-temperature is detected

3.4.2.1 Turn Off SIM900 Using the PWRKEY Pin (Power Down)

You can turn off the SIM900 by driving the PWRKEY to a low level voltage for a short time and then release. You also can turn off the SIM900 by connecting PWRKEY and PWRKEY_OUT for a short time and then release. 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 power down procedure the module will send out result code:

NORMAL POWER DOWN

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

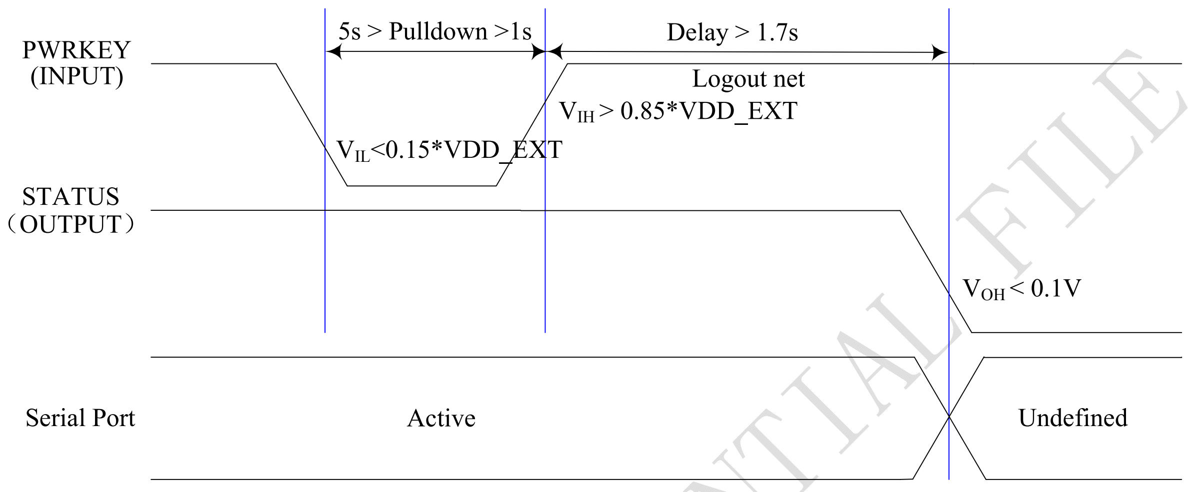


Figure 14: Timing of turn off SIM900 using PWRKEY

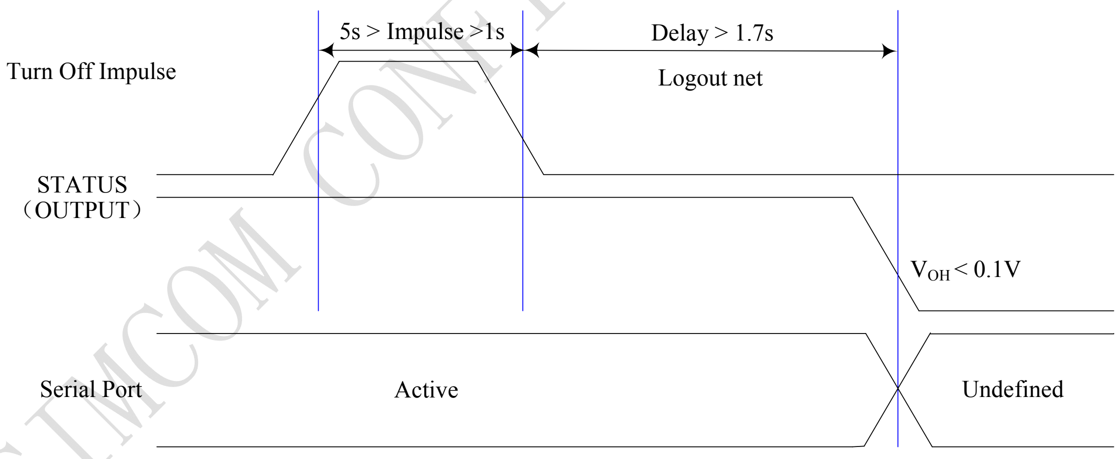


Figure 15: Timing of turn off SIM900 using PWRKEY and PWRKEY_OUT

3.4.2.2 Turn Off SIM900 Using AT Command

User can use the 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 power down procedure the module will send out result code:

NORMAL POWER DOWN

After this moment, the AT commands can not be executed. The module enters the POWER DOWN mode, only the RTC is still active. POWER DOWN can also be indicated by STATUS 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 Power Down

The module will constantly monitor the voltage applied on the VBAT. If the voltage ≤ 3.3V, the following URC will be presented:

UNDER-VOLTAGE WARNNING

If the voltage ≥ 4.7V, the following URC will be presented:

OVER-VOLTAGE WARNNING

The uncritical voltage range is 3.2V to 4.8V. If the voltage > 4.8V or < 3.2V, the module will be automatic power down soon.

If the voltage < 3.2V, the following URC will be presented:

UNDER-VOLTAGE POWER DOWN

If the voltage > 4.8V, the following URC will be presented:

OVER-VOLTAGE POWER DOWN

After this moment, no 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 STATUS pin, which is a low level voltage in this mode.

3.4.2.4 Over-temperature or Under-temperature Automatic Power Down

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 -40℃ to +85℃. If the temperature > +85℃ or < -40℃, the module will be automatic power down soon.

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

+CMTE:2

If the temperature < -40℃, the following URC will be presented:

+CMTE:-2

After this moment, the AT commands can not 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 STATUS 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 SIM900 Using the PWRKEY Pin

User can restart SIM900 by driving the PWRKEY to a low level voltage for a short time and then release, the same as turning on SIM900 using the PWRKEY pin. Before restarting the SIM900, user need delay at least 800ms from detecting the STATUS low level on. The restarting scenario illustrates as the following figure.

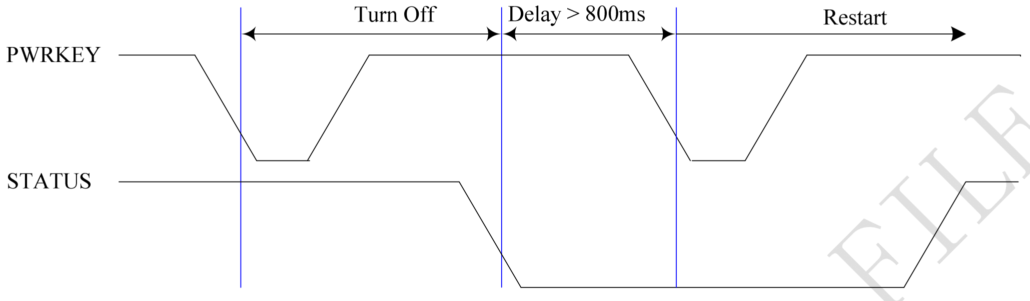


Figure 16: Timing of restart SIM900

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;

Table 7: The Current consumption of different configuration of AT+CFUN

MODE	SLEEP		
AT+CFUN	1	4	0
Current Consumption(uA)	960	715	651

If SIM900 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 SIM900 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 SIM900 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(CSCLK=1) (Slow Clock Mode)

User can control SIM900 module to enter or exit the SLEEP mode(CSCLK=1) 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 in serial port), SIM900 will enter SLEEP mode automatically. In this mode, SIM900 can still receive paging or SMS from network but the serial port is not accessible.
Note: For SIM900, it requests to set AT command “AT+CSCLK=1” to enable the SLEEP mode; the default value is 0, that can not make the module enter SLEEP mode. For more details please refer to document [1].

3.5.3 Wake Up SIM900 from SLEEP Mode(CSCLK=1)

When SIM900 is in SLEEP mode(CSCLK=1), the following methods can wake up the module.

- Enable DTR pin to wake up SIM900.
  If DTR pin is pulled down to a low level，this signal will wake up SIM900 from SLEEP mode. The serial port will be active after DTR changed to low level for about 50ms.
- Receiving a voice or data call from network to wake up SIM900.
- Receiving a SMS from network to wake up SIM900.

3.5.4 Sleep Mode(CSCLK=2) (Slow Clock Mode)

In this mode, the SIM900 will continuously monitor the main serial port data signal. When there has no data transferred exceed 5 seconds on the RXD signal and there is no on air and hardware interrupt (such as GPIO interrupt or data in serial port), SIM900 will enter SLEEP mode automatically. In this mode, SIM900 can still receive paging or SMS from network but the serial port is not accessible.
Note: For SIM900, it requests to set AT command “AT+CSCLK=2” to enable the SLEEP mode; the default value is 0, that can not make the module enter SLEEP mode. For more details please refer to document [1].

3.5.5 Wake Up SIM900 from SLEEP Mode(CSCLK=2)

When SIM900 is in SLEEP mode(CSCLK=2), the following methods can wake up the module.

- User can send data to SIM900 using main serial port, when SIM900 detect the change on the RXD. The first byte data of user will not be send via module.
- Receiving a voice or data call from network to wake up SIM900.
- Receiving a SMS from network to wake up SIM900.

3.6 RTC Backup

The RTC power supply of module can be provided by an external capacitor or a battery (rechargeable or non-chargeable) through the VRTC.

Note: The VRTC could not be designed to a NC pin in user's circuit. User should connect the VRTC pin to a battery or a capacitor.

The following figures show various sample circuits for RTC backup.

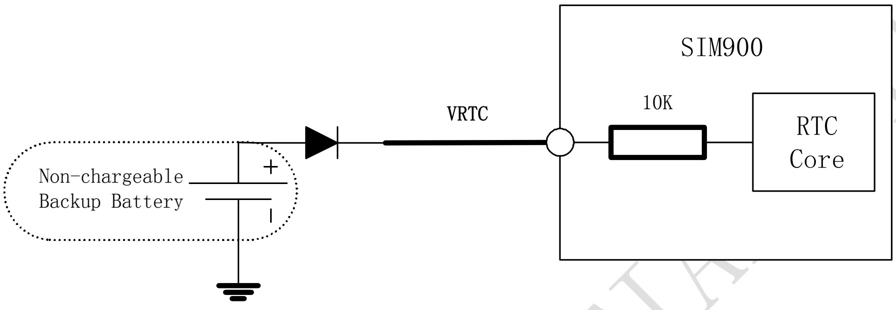


Figure 17: RTC supply from non-chargeable battery

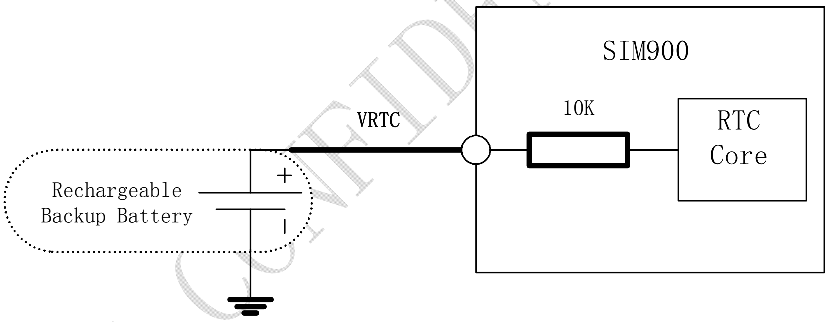


Figure 18: RTC supply from rechargeable battery

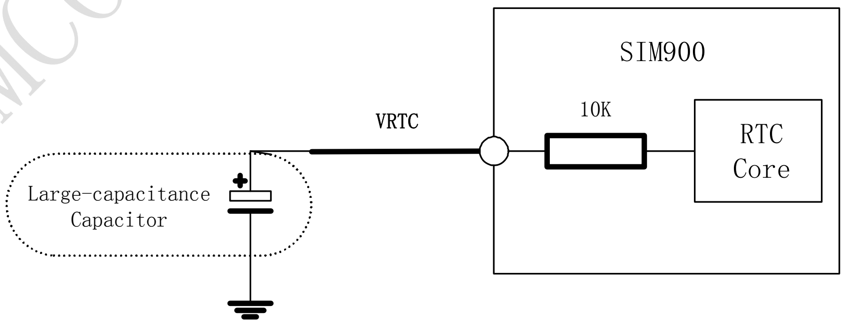


Figure 19: RTC supply from capacitor

- **Li-battery backup**

Coin-type Rechargeable Capacitor such as XH414H-IV01E form Seiko can be used.

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.

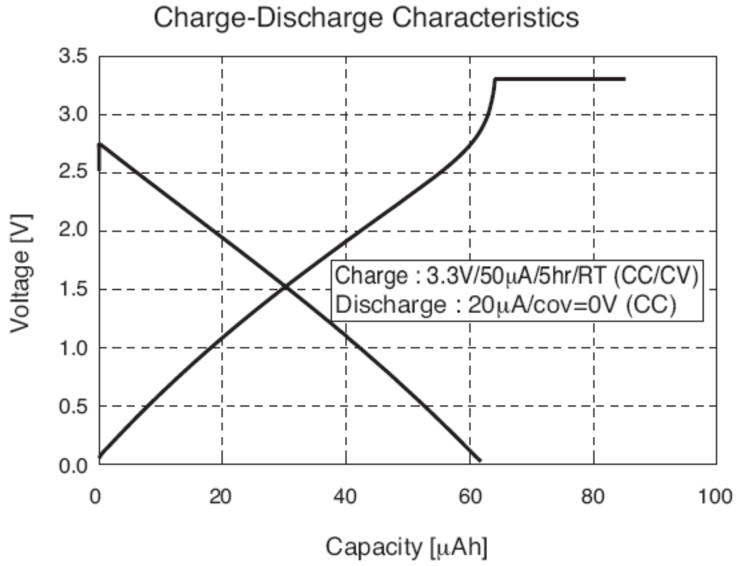


Figure 20: Seiko XH414H-IV01E Charge-Discharge Characteristic

3.7 Serial Interfaces

Table 8: Pin definition of the serial interfaces

	Name	Pin	Function
Serial port	DTR	3	Data terminal ready
	RI	4	Ring indicator
	DCD	5	Data carrier detection
	DSR	6	Data set ready
	CTS	7	Clear to send
	RTS	8	Request to send
	TXD	9	Transmit data
	RXD	10	Receive data
Debug port	DBG_RXD	28	Receive data
	DBG_TXD	27	Transmit data

SIM900 provides two unbalanced asynchronous serial ports. One is the serial port and the other 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 1200bps to 57600bps.

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 9: Logic levels of the serial port and debug port

Parameter	Min	Max	Unit
V_{IL}	0	0.15*VDD_EXT	V
V_{IH}	0.85 *VDD_EXT	VDD_EXT	V
V_{OL}	0	0.1	V
V_{OH}	VDD_EXT -0.1	VDD_EXT	V

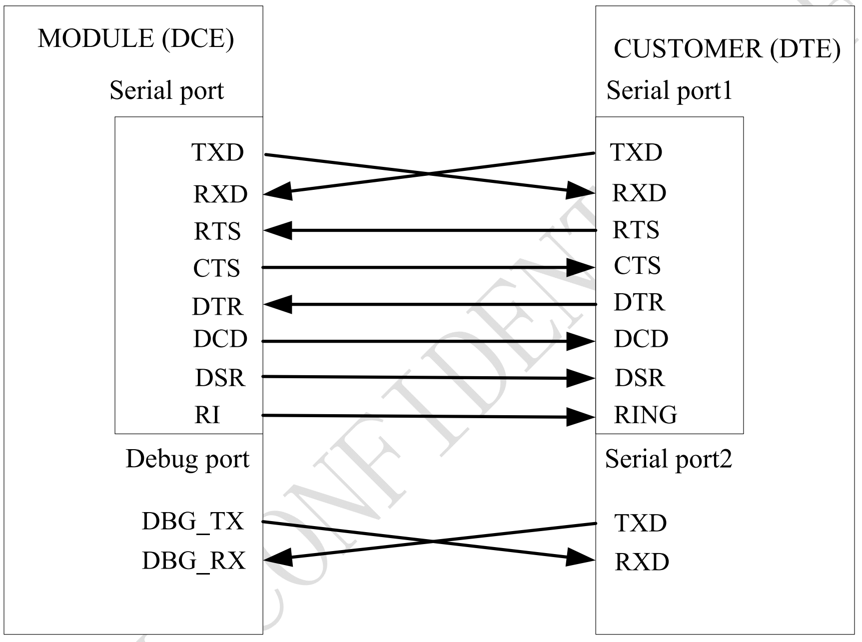


Figure 21: Connection of the serial interfaces

3.7.1 Function of serial port & debug port supporting

Serial port

- Modem device.
- Contains data lines TXD and RXD, State lines RTS and CTS, Control lines DTR, DCD, DSR 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. SIM900 supports only basic mode of multiplexing so far.
- Serial port supports the communication rates as following:
  1200, 2400, 4800, 9600, 19200, 38400, 57600 and 115200bps.
- Autobauding supports baud rates as following:
  1200, 2400, 4800, 9600, 19200, 38400 and 57600bps, the default setting is autobauding.

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: 1200, 2400, 4800, 9600, 19200, 38400 and 57600bps. 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, user must first send “AT” to synchronize the baud rate. It is recommended to wait 2 to 3 seconds before sending “AT” character. After receiving the “OK” response, DTE and DCE are correctly synchronized. The more information please refer to the AT command “AT+IPR”.

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: User can use “AT+IPR=x” 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 SIM900 is power on.

Debug port

- Only contain Data lines TXD and RXD
- Debug Port used for debugging and upgrading firmware. 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 is 115200bps

3.7.2 Software Upgrade and Software Debug

The DBG_TXD, DBG_RXD and GND must be connected to the IO connector when user need to upgrade software and debug software, the DBG_TXD, DBG_RXD should be used for software upgrade and for software debugging. The TXD and RXD also should be connected to the IO connector, if user wants to send AT command or data stream to SIM900. 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 SIM900 is upgrading software. Please refer to the following figure.

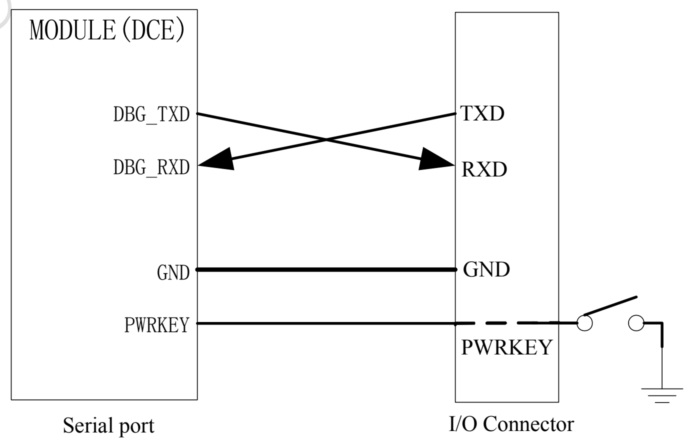


Figure 22: Connection of software upgrade and software debug

The serial port and the debug port don not support the RS_232 level and it only supports the CMOS level. Please refer to the table 10 for details about the voltage level. User should add the level converter IC between the DCE and DTE, if user connect it to the computer. Please refer to the following figure.

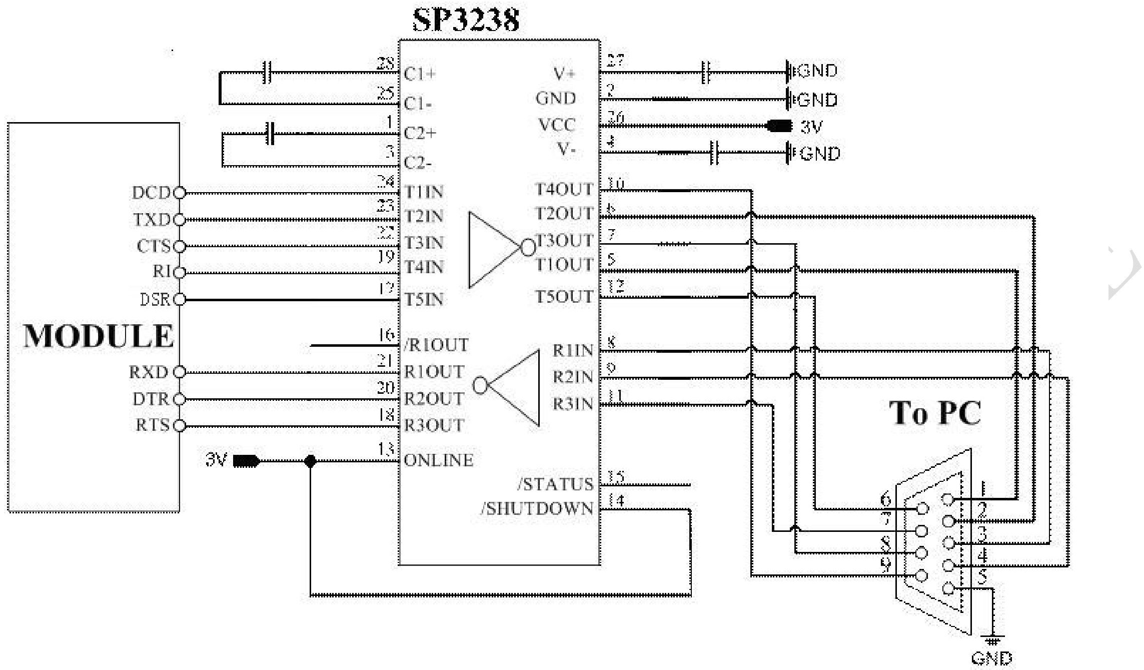


Figure 23: RS232 level converter circuit

3.8 Audio Interfaces

Table 10: Pin define of the Audio interface

	Pin Name	Pin Number	Function
AIN/AOUT	MIC_P	19	Microphone1 input +
	MIC_N	20	Microphone1 input -
	SPK_P	21	Audio1 output+
	SPK_N	22	Audio1 output-
LINE IN	LINEIN_R	23	Right Channel input
	LINEIN_L	24	Lift Channel input

The module provides one analog input channel, AIN, which may be used for microphone. The electret microphone is recommended when the interface is used for microphone. The module also provides one analog output channel, AOUT. The output only can directly drive 32Ω receiver.

External line inputs are available to directly mix or multiplex externally generated analog signals such as polyphonic tones from an external melody IC or music generated by an FM tuner IC or module.

User can use “AT+CMIC” to adjust the input gain level of microphone, use “AT+SIDET” to set the side-tone level. In addition, user can also use “AT+CLVL” to adjust the output gain level. For more details, please refer to *document [1]*.

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.

3.8.1 Speaker Interface Configuration

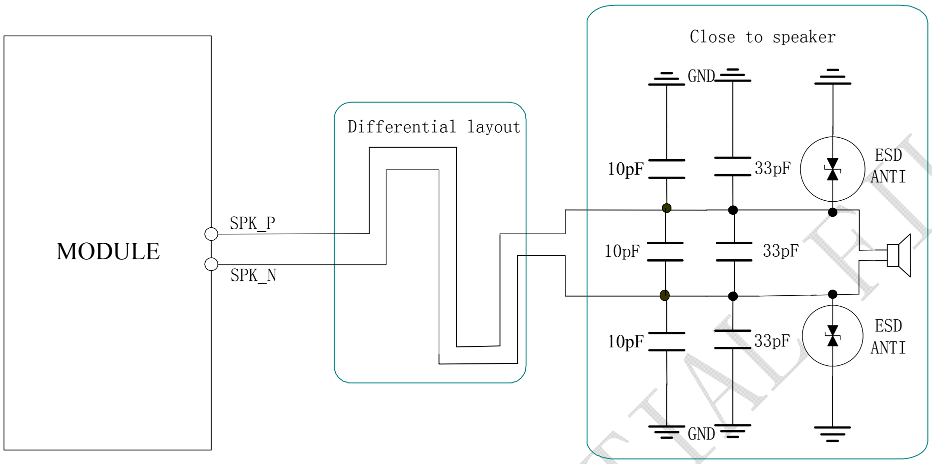


Figure 24: Speaker interface configuration

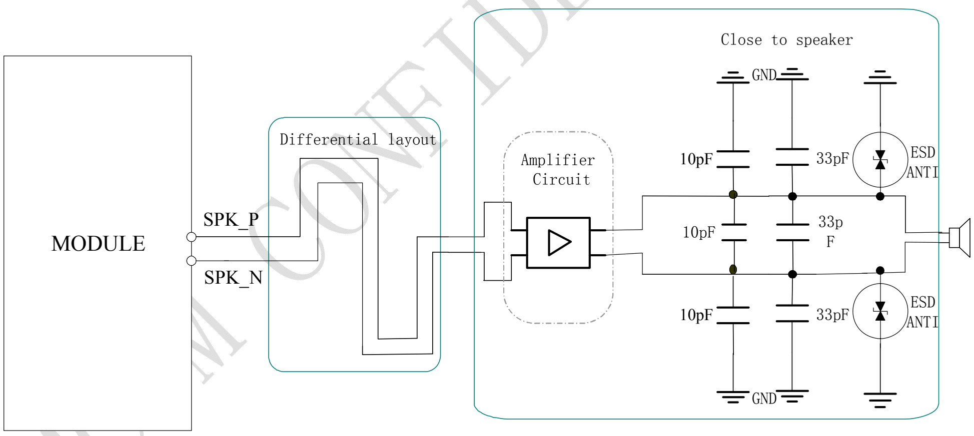


Figure 25: Speaker interface with amplifier configuration

3.8.2 Microphone Interfaces Configuration

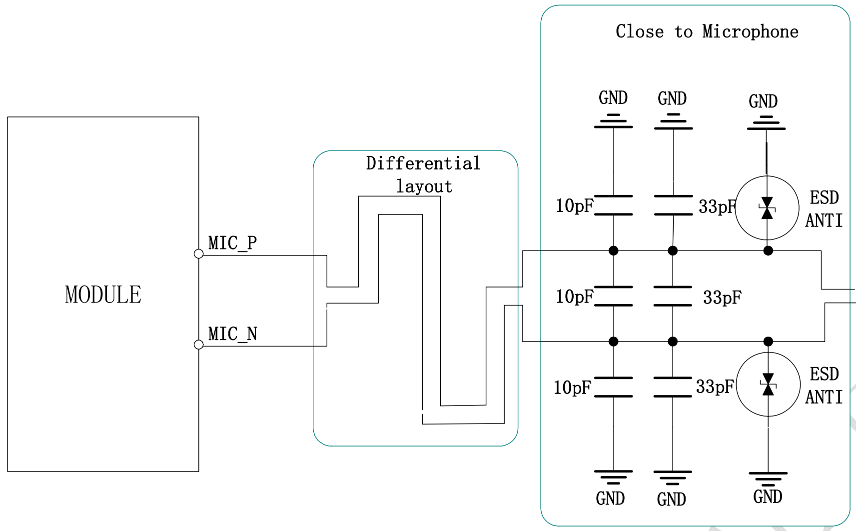


Figure 26: Microphone interface configuration

3.8.3 Earphone Interface Configuration

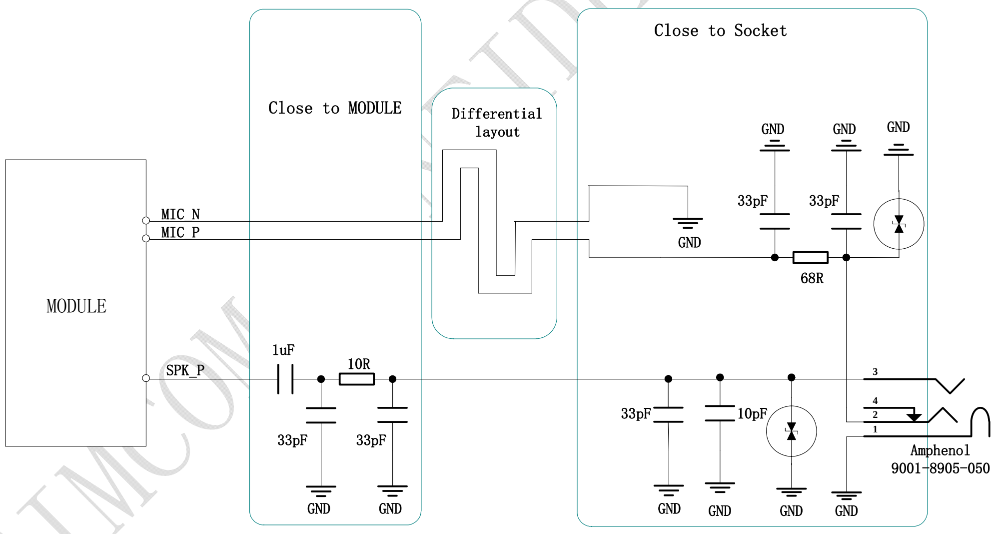


Figure 27: Earphone interface configuration

3.8.4 Referenced Electronic Characteristics

Table 11: 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
Internal biasing DC Characteristics				2.5	V
Differential input voltage	THD <1% at F=1KHz; pre-amp gain = 20 dB; PGA gain = 14 dB		15.9		mVrms
	THD <5% at F=1KHz;pre-amp gain = 0 dB; PGA gain = 0 dB		740		mVrms

Table 12: Audio Output Characteristics

Parameter	Conditions	Min	Typ	Max	Unit
Normal Output(SPK)	RL=32 Ohm THD=0.1%	-	91	-	mW
	RL=32 Ohm THD=1%	-	96	-	mW
	Output swing Voltage(single)			1.1V	Vpp
	Output swing Voltage(differential)			2.2	Vpp

3.9 SIM Card Interface

3.9.1 SIM Card Application

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

The SIM interface complies the GSM Phase 1 specification and 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. All pins are described in the following table.

Table 13: Pin define of the SIM interface

Pin Name	Pin Number	Function
SIM_VDD	30	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	31	SIM Card data I/O
SIM_CLK	32	SIM Card Clock
SIM_RST	33	SIM Card Reset
SIM_PRESENCE	34	SIM Card detection

Following figure is the reference circuit for SIM interface. SIMCom recommend using 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 15KΩ) on the SIM_DATA line already added in the module. 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 insert or removal. User can use the AT command "AT+CSDT" to switching on or off SIM card detection function. For details of this AT command, please refer to *document [1]*:

User can select the 8-pin SIM card holder to implement SIM card detection function. The reference circuit of the 8-pin SIM card holder is illustrated as following figure.

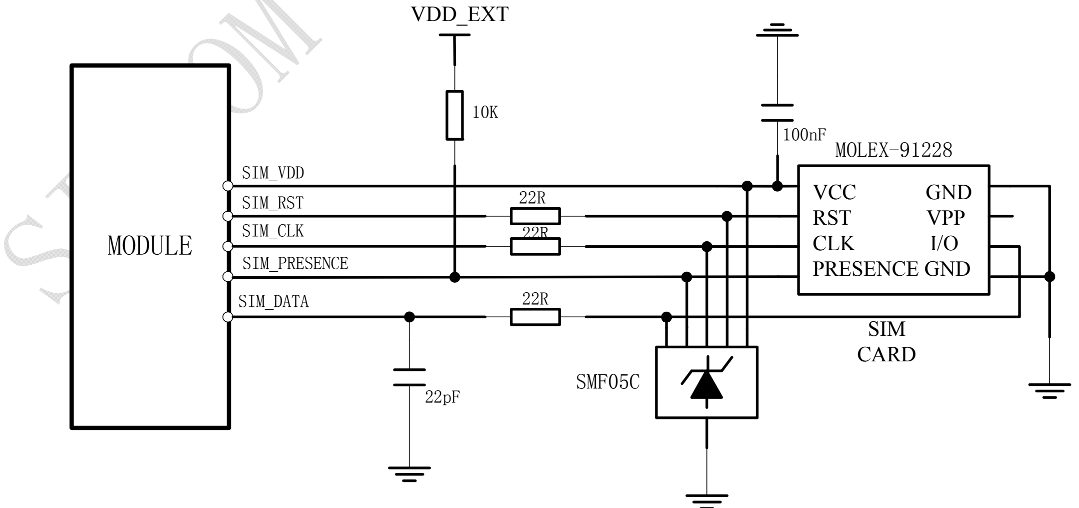


Figure 28: Reference circuit of the 8-pin SIM card holder

If user don not use the SIM card detection function, user can leave the SIM_PRESENCE pin open. The reference circuit of 6-pin SIM card is illustrated as following figure.

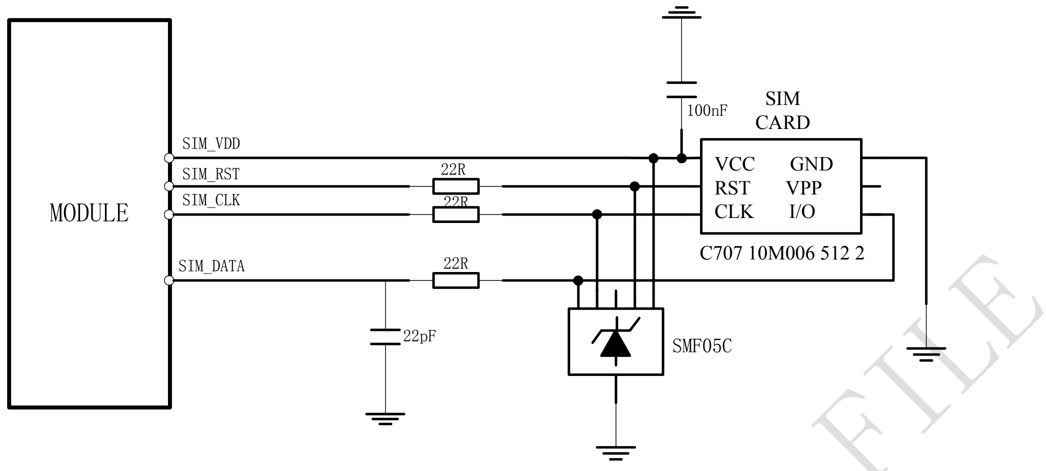


Figure 29: Reference circuit of the 6-pin SIM card holder

3.9.2 Design Considerations for SIM Card Holder

For 6-pin SIM card holder, SIMCom recommend to use Amphenol C707 10M006 5122 .User can visit http://www.amphenol.com for more information about the holder.

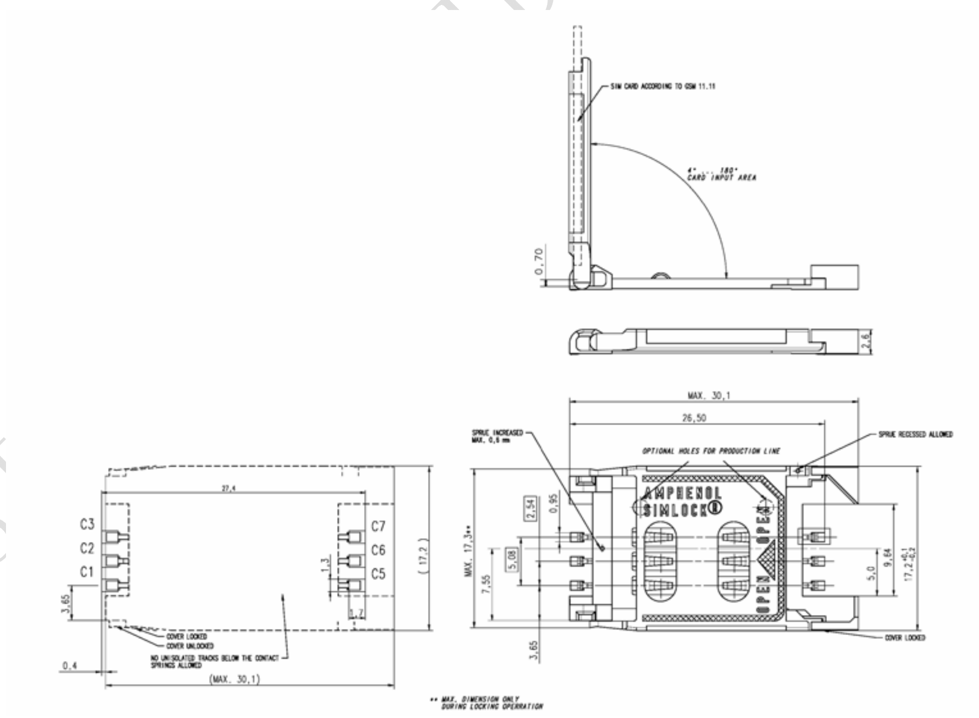


Figure 30: Amphenol C707 10M006 5122 SIM card holder

Table 14: Pin description (Amphenol SIM card holder)

Pin Name	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.

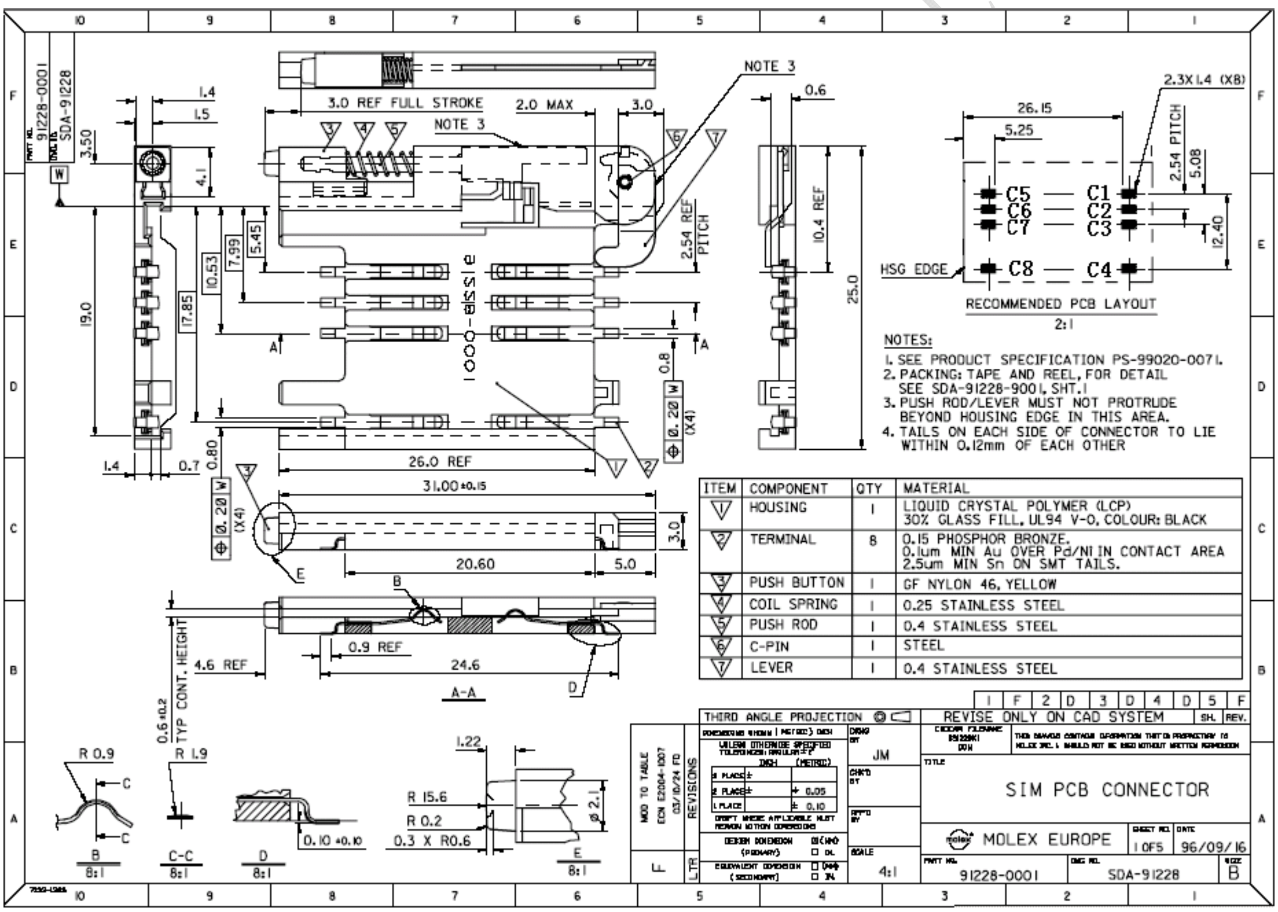


Figure 31: Molex 91228 SIM card holder

Table 15: Pin description (Molex SIM card holder)

Pin Name	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

3.10 LCD Display Interface

SIM900 provides a serial LCD display interface that supports serial communication with LCD device. When used as LCD interface, the following table is the pin definition. LCD interface timing should be united with the LCD device.

Table 16: Pin define of the LCD interface

Pin Name	Pin Number	Function
DISP_CLK	11	Display clock for LCD
DISP_DATA	12	Display data output
DISP_D/C	13	Display data or command select
DISP_CS	14	Display enable

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

3.11 Keypad Interface

The keypad interface consists of 4 keypad column outputs and 5 keypad row inputs. The basic configuration is 4 keypad columns and 5 keypad rows, giving 20 keys.

Table 17: Pin define of the keypad interface

GPIO2/ KBR3	41	GPIO2		Output Pull down
GPIO3/ KBR2	42	GPIO3		Output Pull down
GPIO4/ KBR1	43	GPIO4		Output Pull down

GPIO5/ KBR0	44	GPIO5		Output Pull down
GPIO6/ KBC4	47	GPIO6	Keypad matrix row	Output Pull down
GPIO7/ KBC3	48	GPIO7		Output Pull down
GPIO8/ KBC2	49	GPIO8		Output Pull down
GPIO9/ KBC1	50	GPIO9		Output Pull down

The keypad interface allows a direct external matrix connection. A typical recommended circuit of the keypad is as shown in the following figure.

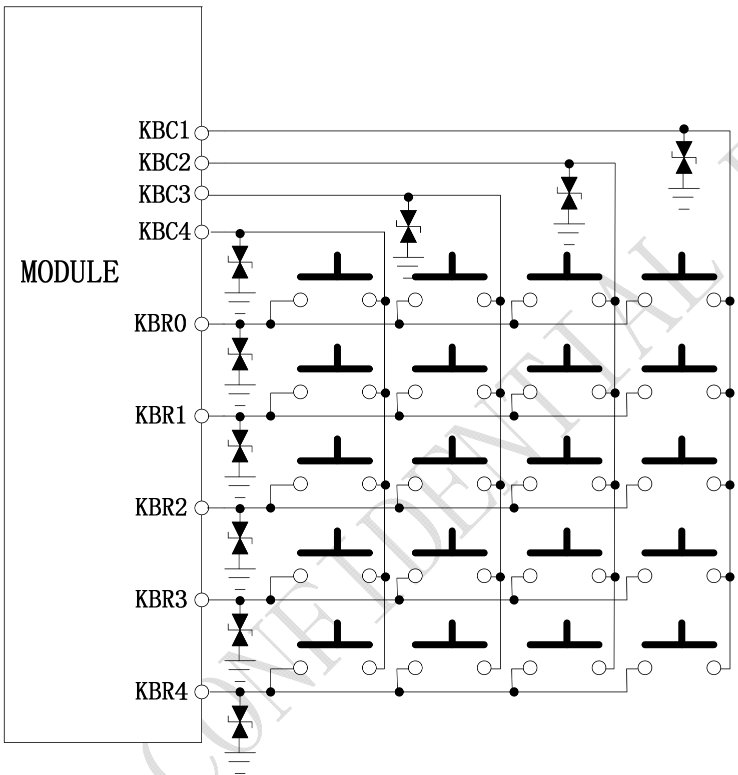


Figure 32: Reference circuit of the keypad interface

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

3.12 ADC

SIM900 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. User can use AT command “AT+CADC” to read the voltage value on ADC. For details of this AT command, please refer to *document [1]*.

Table 18: ADC specification

	MIN	Type	MAX	Units

Voltage range	**0**	**-**	**2.8**	**V**
ADC Resolution	**-**	**10**	**-**	**bits**
Sampling rate	**-**	**-**	**200K**	**Hz**

3.13 Behaviors of the RI

Table 19: Behaviours of the RI

State	RI respond
Standby	HIGH
Voice call	Change LOW, then: （1）Change to HIGH when establish the call. （2）Use AT command ATH, the RI pin changes to HIGH. （3）Sender hangs up, change to HIGH.
Data call	Change LOW, then： （1）Change to HIGH when establish the call. （2）Use AT command ATH, the RI changes to HIGH.
SMS	Change to low and hold low level about 120 ms when receive a SMS,, 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 will maintain high. However, when it is used as receiver, following is timing of ring.

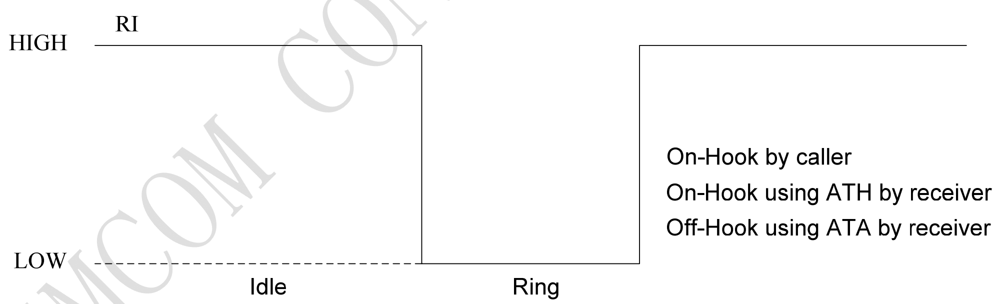


Figure 33: RI behaviour of voice calling as a receiver

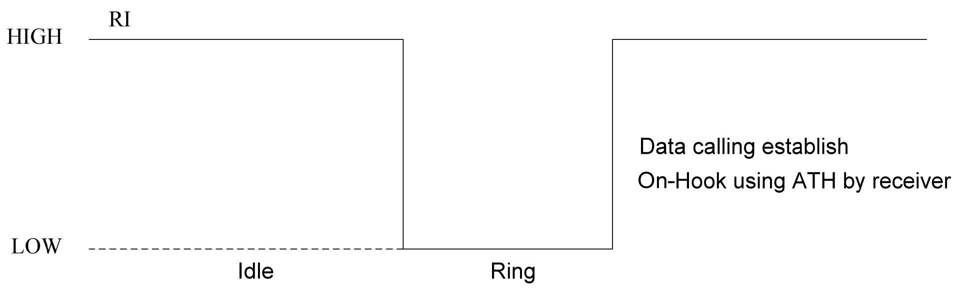


Figure 34: RI behaviour of data calling as a receiver

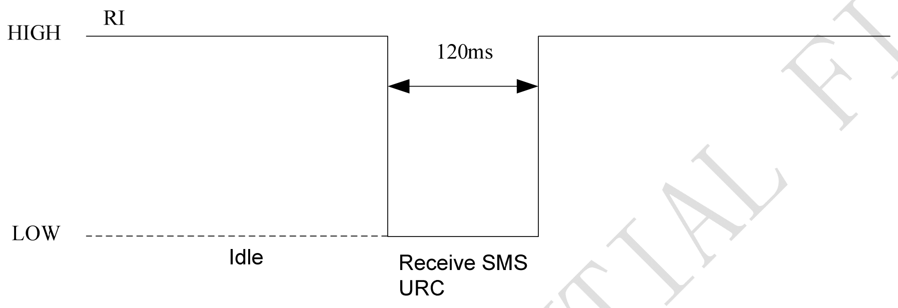


Figure 35: RI behaviour of URC or receive SMS

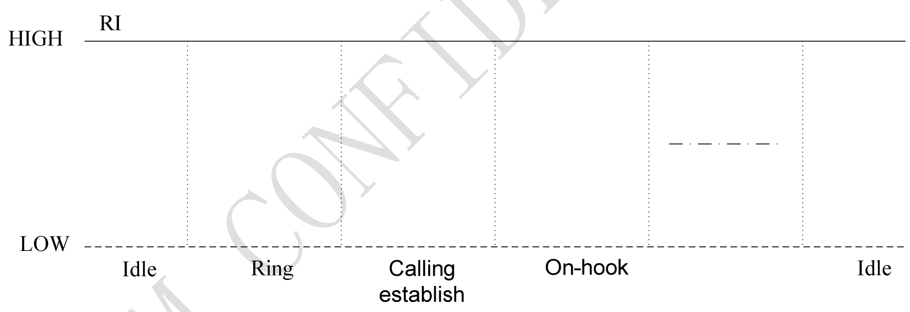


Figure 36: RI behaviour as a caller

3.14 Network Status Indication

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

Table 20: Working state of the NETLIGHT

State	SIM900 function
Off	SIM900 is not running
64ms On/ 800ms Off	SIM900 does not find the network
64ms On/ 3000ms Off	SIM900 find the network

64ms On/ 300ms Off	GPRS communication

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

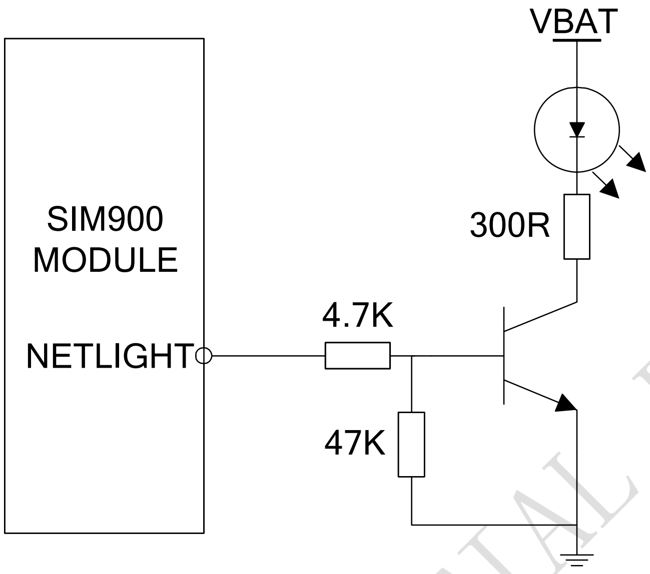


Figure 37: Reference circuit of NETLIGHT

3.15 General Purpose Input Output (GPIO)

SIM900 provides a limited number of General Purpose Input/Output signal pin. The output and input voltage level of the GPIO can be set by AT command. ***For more details, please refer to document [1]***

Table 21: Pin define of the GPIO interface

GPIO9/ KBC1	50	GPIO9	KBC1	Output Pull down
GPIO10	51	GPIO10		Output Pull down
GPIO11	67	GPIO11		Output Pull down
GPIO12	68	GPIO12		Output Pull down
GPIO4/ KBR1	43	GPIO4	KBR1	Output Pull down
GPIO5/ KBR0	44	GPIO5	KBR0	Output Pull down
GPIO6/ KBC4	47	GPIO6	KBC4	Output Pull down
GPIO7/ KBC3	48	GPIO7	KBC3	Output Pull down
GPIO8/ KBC2	49	GPIO8	KBC2	Output Pull down

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

3.16 External Reset

The external NRESET pin provides a means for external circuitry to force the device into a reset state. This signal has to be considered as an emergency reset only. Asserting an active-low signal on the NRESET pin generates a reset; already pull up in module. A decoupling of the NRESET pin may be necessary to avoid erroneous noise-induced resets.

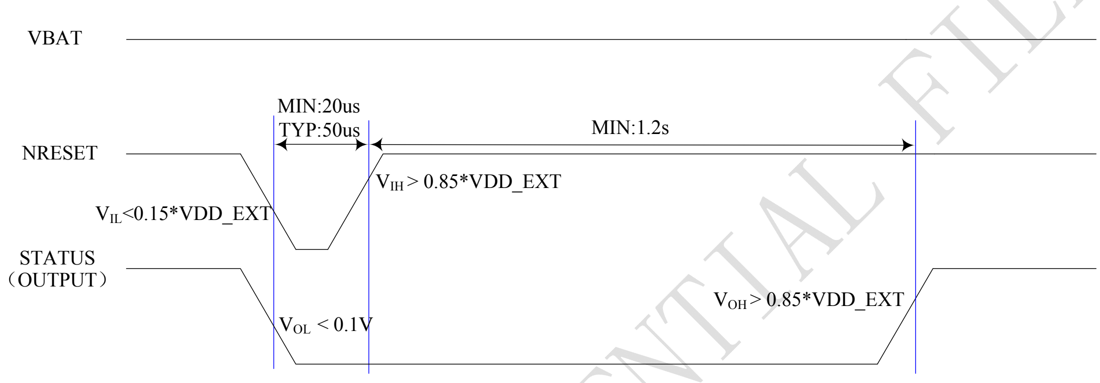


Figure 38: Reset timing

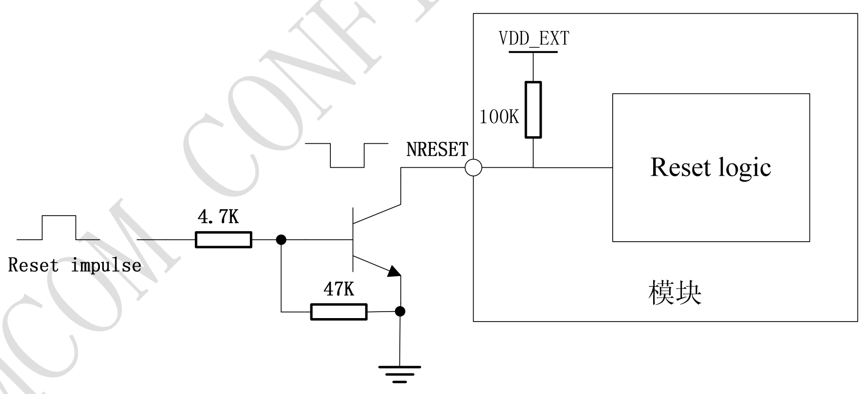


Figure 39: Reset reference design circuit

3.17 PWM

SIM900 contains two DC Pulse-Width Modulators (PWMs) which can be used in conjunction with an external transistor for driving a vibrator, or a backlight LED for illuminating an LCD display or keyboard.
Each PWM features 7-bit resolution and a maximum conversion rate is 3.25 MHz. Each PWM uses two 7-bit unsigned binary numbers: one for the output period and one for the pulse width or the duty cycle.

Table 22: Pin define of the PWM

Pin Name	Pin Number	
PWM1	35	Pulse-Width Modulator Signal
PWM2	36	Pulse-Width Modulator Signal

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

3.18 I^{2}C Bus

The SIM900 initiates a data transfer on the bus and generates the clock signal to execute the transfer. The features include the following:

- Maximum output rate equal to 400 kbit/s
- Open-drain outputs
- Automatic Start and Stop generation
- Automatic acknowledge generation and checking
- Automatically generates Start repeated pattern when performing read operations
- Automatically observes and generates the acknowledge bit
- Implements a hardware assisted I^{2}C-bus protocol

Table 23: Pin define of the I^{2}C Bus

Pin Name	Pin Number	Function
SCL	38	I^{2}C Bus Clock
SDA	37	I^{2}C Bus Data

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

4 Antenna Interface

SIM900 provides RF antenna interface. And customer’s antenna should be located in the customer’s main board and connect to module’s antenna pad through microstrip line or other type RF trace which impendence must be controlled in 50Ω. The Pin 60 is the RF antenna pad.
SIM900 material properties:
SIM900 PCB Material: FR4
Antenna pad: Gold plated pad

4.1 Module RF Output Power

Table 24: SIM900 conducted RF output power

Frequency	Max	Min
GSM850	33dBm ±2dB	5dBm±5dB
EGSM900	33dBm ±2dB	5dBm±5dB
DCS1800	30dBm ±2dB	0dBm±5dB
PCS1900	30dBm ±2dB	0dBm±5dB

4.2 Module RF Receive Sensitivity

Table 25: SIM900 conducted RF receive sensitivity

Frequency	Receive sensitivity（Typical）	Receive sensitivity(Max)
GSM850	-109dBm	-107dBm
EGSM900	-109dBm	-107dBm
DCS1800	-109dBm	-107dBm
PCS1900	-109dBm	-107dBm

4.3 Module Operating Frequencies

Table 26: SIM900 operating frequencies

Frequency	Receive	Transmit
GSM850	869 ～ 894MHz	824 ～ 849 MHz
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

The absolute maximum ratings stated in Table 28 are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to SIM900.

Table 27: Absolute maximum ratings

Parameter	Min	Max	Unit
VBAT	-	5.5	V
Peak current of power supply	0	3.0	A
Voltage at digit pins*	-0.3	3.1	V

I_I*	-	10	mA
I_O*	-	10	mA

*For digital interface pins, such as keypad, GPIO, I²C, UART, LCD and PWMs.

5.2 Operating Temperatures

The operating temperature is listed in following table:

Table 28: SIM900 operating temperature

Parameter	Min	Typ	Max	Unit
Ambient temperature	-30	+25	+80	℃
Restricted operation*	-40 to -30		+80 to +85	℃
Storage temperature	-45		+90	℃

* The SIM900 does work, but deviations from the GSM specification may occur.

5.3 Power Supply Ratings

Table 29: SIM900 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.	3.2	4.0	4.8	V
	Voltage drop during transmit burst	Normal condition, power control level for Pout max			300	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 (BS-PA-MFRMS=9) (BS-PA-MFRMS=5) (BS-PA-MFRMS=2)		30 1.0 1.2 1.5		uA mA
		IDLE mode GSM 850 EGSM 900 DCS1800 PCS1900		 22 22 22 22		mA

		TALK mode GSM 850 EGSM 900 DCS1800 PCS1900		 235 241 158 166		 mA
		DATA mode, GPRS (3 Rx,2Tx) GSM 850 EGSM 900 DCS1800 PCS1900		 435 444 287 299		 mA
		DATA mode, GPRS (4 Rx,1Tx) GSM 850 EGSM 900 DCS1800 PCS1900		 266 270 191 202		 mA
	Peak supply current (during Tx burst)	Power control level for Pout max.		2.0		A

5.4 Current Consumption(VBAT = 3.8V)

Please refer to the following table for the values of current consumption.

Table 30: SIM900 current consumption(VBAT = 3.8V)

Voice Call	
GSM 850/EGSM 900	@power level #5 <300mA,Typical 250mA @power level #12,Typical 110mA @power level #19,Typical 76mA
DCS 1800/PCS 1900	@power level #0 <200mA,Typical 168mA @power level #7,Typical 89mA @power level #15,Typical 76mA
GPRS Data	
DATA mode, GPRS (1 Rx,1 Tx) CLASS 8	
GSM 850/EGSM 900	@power level #5 <300mA,Typical 240mA @power level #12,Typical 110mA @power level #19,Typical 83mA
DCS 1800/PCS 1900	@power level #0 <200mA,Typical 170mA @power level #7,Typical 95mA @power level #15,Typical 80mA
DATA mode, GPRS (3 Rx, 2 Tx) CLASS 10	

GSM 850/EGSM 900	@power level #5 <450mA,Typical 440mA @power level #12,Typical 185mA @power level #19,Typical 130mA
DCS 1800/PCS 1900	@power level #0 <350mA,Typical 300mA @power level #7,Typical 155mA @power level #15,Typical 122mA
DATA mode, GPRS (4 Rx,1 Tx) CLASS 8	
GSM 850/EGSM 900	@power level #5 <300mA,Typical 270mA @power level #12,Typical 150mA @power level #19,Typical 120mA
DCS 1800/PCS 1900	@power level #0 <300mA,Typical 205mA @power level #7,Typical 130mA @power level #15,Typical 115mA

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 SIM900 module.
The measured values of SIM900 are shown as the following table:

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

Part	Contact discharge	Air discharge
VBAT	±5KV	±10KV
GND	±4KV	±10KV
RXD, TXD	±3KV	±6KV
Antenna port	±5KV	±10KV
SPK_P/N MIC_P/N	±2KV	±6KV
PWRKEY	±1KV	±6KV

6 Mechanics

This chapter describes the mechanical dimensions of SIM900.

6.1 Mechanical Dimensions of SIM900

Following shows the Mechanical dimensions of SIM900 (top view, side view and bottom view).

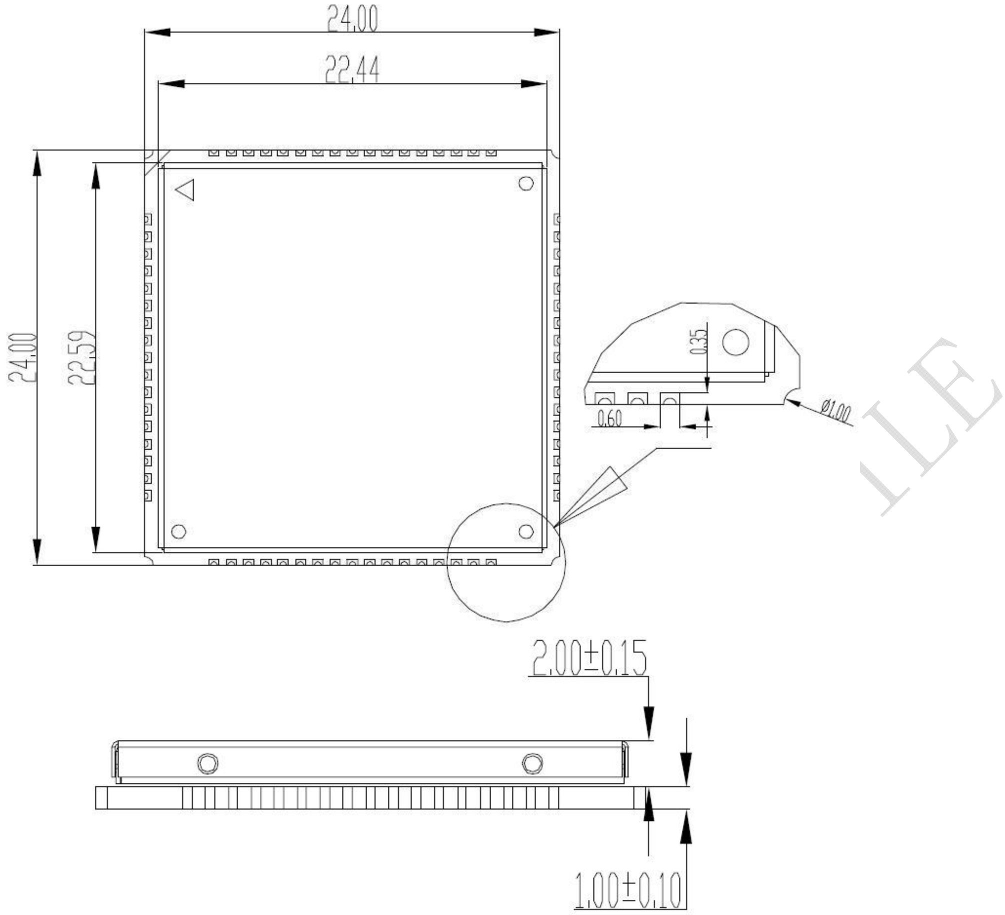


Figure 40: Top an Side Mechanical dimensions of module （Unit: mm）

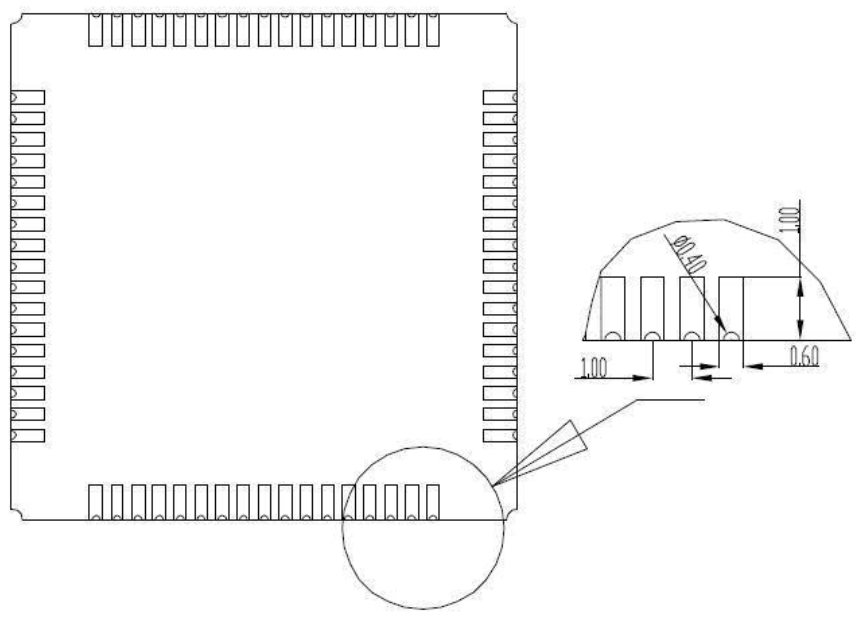


Figure 41：Bottom Mechanical dimensions of module （Unit: mm）

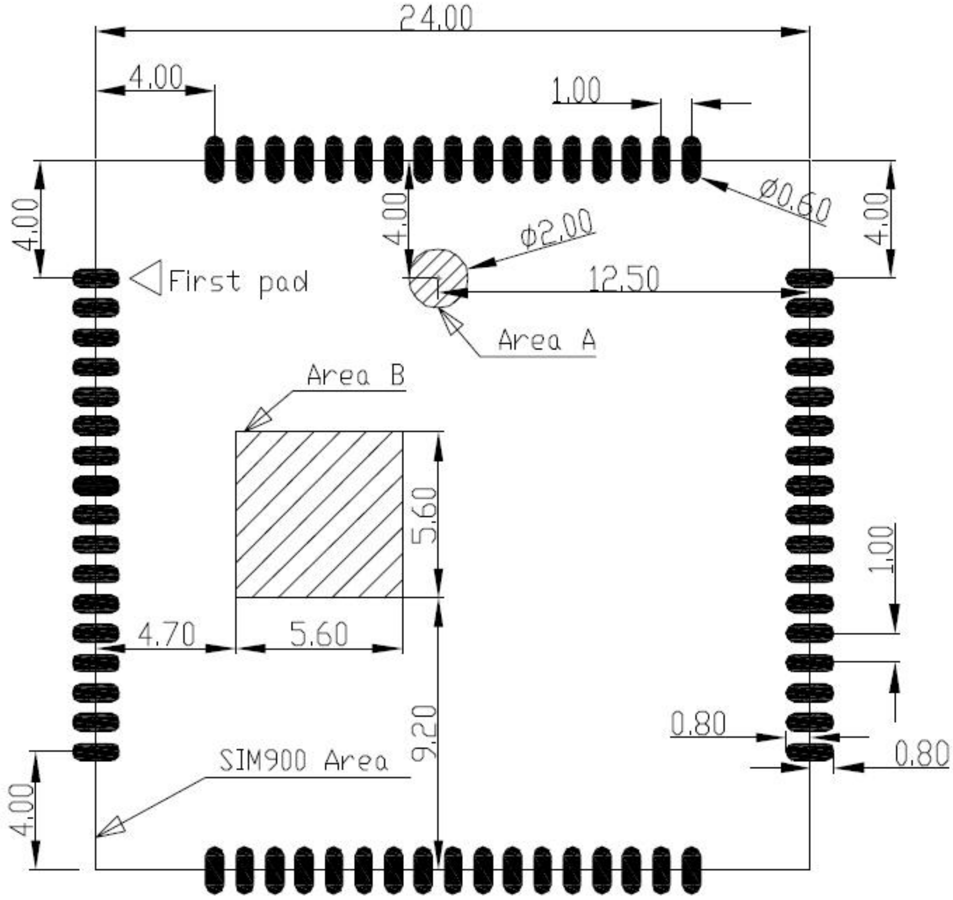


Figure 42: Recommended PCB decal（Unit: mm）

Note: ***Area A is keep route out area. Area B should be covered by silkscreen to prevent from the short between the via on customer board and the test points on the bottom side of the module.***

6.2 Top and Bottom View of the SIM900

Figure 43: Top view of the SIM900

6.3 PIN Assignment of SIM900

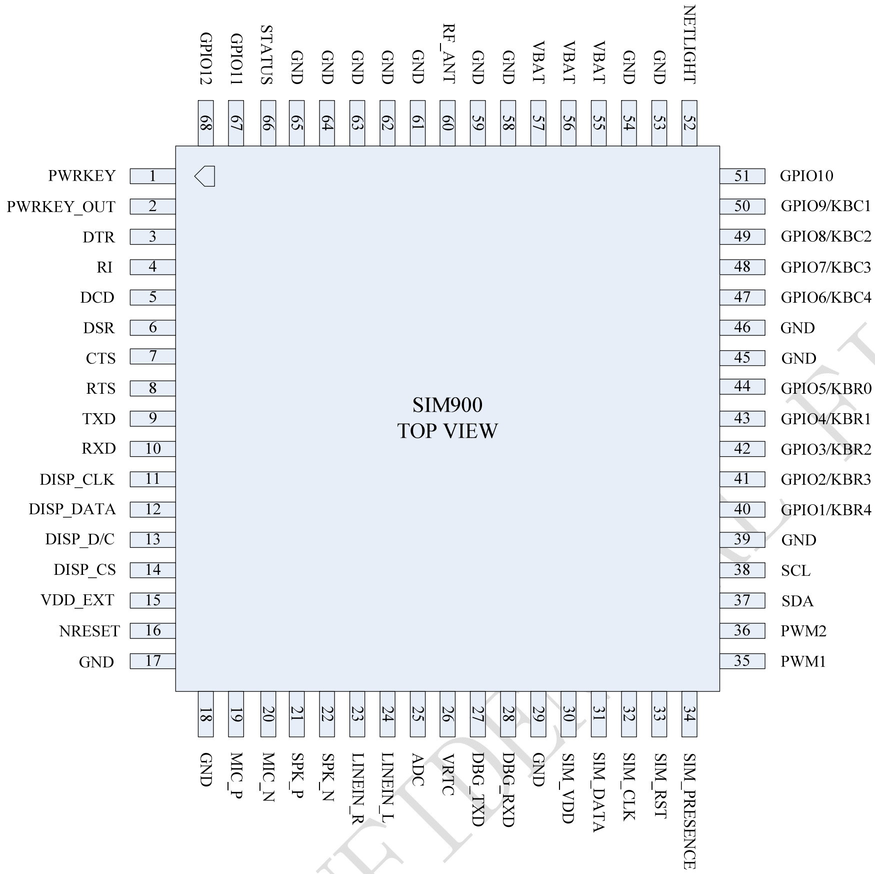
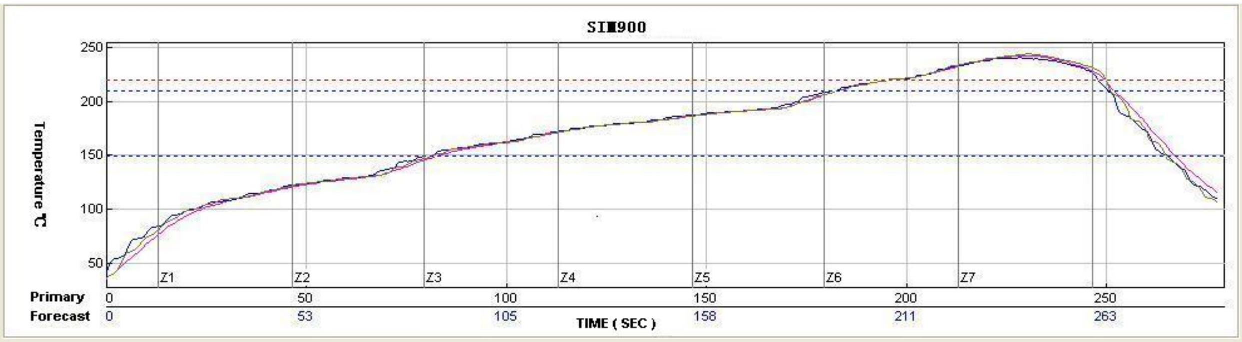


Figure 44: SIM900 pin out diagram (Top View)

Table 32: PIN assignment

Pin Number	Pin Name	Pin Number	Pin Name
1	PWRKEY	35	PMW1
2	PWRKEY_OUT	36	PWM2
3	DTR	37	SDA
4	RI	38	SCL
5	DCD	39	GND
6	DSR	40	GPIO1/KBR4
7	CTS	41	GPIO2/KBR3
8	RTS	42	GPIO3/KBR2
9	TXD	43	GPIO4/KBR1
10	RXD	44	GPIO5/KBR0
11	DISP_CLK	45	GND
12	DISP_DATA	46	GND
13	DISP_D/C	47	GPIO6/KBC4
14	DISP_CS	48	GPIO7/KBC3
15	VDD_EXT	49	GPIO8/KBC2
16	NRESET	50	GPIO9/KBC1
17	GND	51	GPIO10
18	GND	52	NETLIGHT
19	MIC_P	53	GND
20	MIC_N	54	GND
21	SPK_P	55	VBAT
22	SPK_N	56	VBAT
23	LINEIN_R	57	VBAT
24	LINEIN_L	58	GND
25	ADC	59	GND
26	VRTC	60	RF_ANT
27	DBG_TXD	61	GND
28	DBG_RXD	62	GND
29	GND	63	GND
30	SIM_VDD	64	GND
31	SIM_DATA	65	GND
32	SIM_CLK	66	STATUS
33	SIM_RST	67	GPIO11
34	SIM_PRESENCE	68	GPIO12

6.4 The Ramp-Soak-Spike Reflow Profile of SIM900



TCs	RAMP		SOAP Between 150 to 210 ℃		Reflow 220℃		Peak Temperature ℃	
2	1.4	-7%	99.4	31%	53.8	38%	243.1	62%
3	1.4	-4%	100.5	35%	51.5	15%	241.0	20%
4	1.4	-5%	101.4	38%	54.4	44%	244.7	93%
Different in Temp	0.04		1.99		2.92		3.65	
P.2	1.4	-7%	99.4	31%	53.8	38%	243.1	62%
P.3	1.4	-4%	100.5	35%	51.5	15%	241.0	20%
P.4	1.4	-5%	101.4	38%	54.4	44%	244.7	93%
Different in Temp	0.04		1.99		2.92		3.65	

Figure 45: The ramp-soak-spike reflow profile of SIM900

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