

## SIM908 User Manual

**Note:** This device complies with part 15 Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

If this equipment is installed in a host, We can find the ID label when opening the host. For label requirement when transmitter module is installed in a host, the host shall have an additional permanent label referring to the enclosed module: “Contains Transmitter Module FCC ID: UDV-2011091310088” or “Contains FCC ID: UDV-2011091310088”.

This equipment has a GSM antenna and a GPS antenna, the GPS antenna peak gain is 5 dBi and modulation type is BPSK; the GSM antenna peak gain is 3 dBi and modulation type is GMSK.

**WARNING:** Changes or modifications to this unit not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The antenna of the product, under normal use condition is at least 24.22 cm away from the body of the user, the user must keep at least 24.22cm distance to the antenna.

The device has been evaluated to meet general RF exposure requirement. The device can be used in portable exposure condition without restriction.

## 1. SIM908 Description

### 1.1 Summarize

Designed for global market, SIM908 is integrated with a high performance GSM/GPRS engine and a GPS engine. The GSM/GPRS engine is a quad-band GSM/GPRS module that works on frequencies GSM 850MHz, EGSM 900MHz, DCS 1800MHz and PCS 1900MHz. SIM908 features GPRS multi-slot class 10/ class 8 (optional) and supports the GPRS coding schemes CS-1, CS-2, CS-3 and CS-4. The GPS solution offers best-in-class acquisition and tracking sensitivity, Time-To-First-Fix (TTFF) and accuracy.

With a tiny configuration of 30\*30\*3.2mm, SIM908 can meet almost all the space requirements in user applications, such as M2M, smart phone, PDA, tracker and other mobile devices.

SIM908 has 80 SMT pads, and provides all hardware interfaces between the module and customers' boards.

- Serial port and debug port can help user easily develop user's applications.
- GPS Serial port.
- Two audio channels include two audio inputs and two audio outputs. These can be easily configured by AT command.
- Charging interface.
- Programmable general purpose input and output.
- The keypad and SPI display interfaces will give users the flexibility to develop customized applications.
- RF pad and connector interface.

SIM908 is designed with power saving technique so that the current consumption is as low as 1.0mA in sleep

mode (GPS engine is powered down).

SIM908 integrates TCP/IP protocol and extended TCP/IP AT commands which are very useful for data transfer applications.

## 1.2 SIM908 Key Features

**Table 1: SIM908 GSM/GPRS engine key features**

Feature	Implementation
Power supply	3.4V ~ 4.5V
Power saving	Typical power consumption in sleep mode is 1.0mA ( BS-PA-MFRMS=9, GPS engine is powered down )
Charging	Supports charging control for Li-Ion battery
Frequency bands	<ul style="list-style-type: none"> <li>● SIM908 Quad-band: GSM 850, EGSM 900, DCS 1800, PCS 1900. SIM908 can search the 4 frequency bands automatically. The frequency bands also can be set by AT command “AT+CBAND”. For details, please refer to <i>document [1]</i>.</li> <li>● Compliant to GSM Phase 2/2+</li> </ul>
Transmitting power	<ul style="list-style-type: none"> <li>● Class 4 (2W) at GSM 850 and EGSM 900</li> <li>● Class 1 (1W) at DCS 1800 and PCS 1900</li> </ul>
GPRS connectivity	<ul style="list-style-type: none"> <li>● GPRS multi-slot class 10 (default)</li> <li>● GPRS multi-slot class 8 (option)</li> </ul>
Temperature range	<ul style="list-style-type: none"> <li>● Normal operation: -20°C ~ +60°C</li> <li>● Restricted operation: -40°C ~ -20°C and +80 °C ~ +60°C*</li> <li>● Storage temperature -45°C ~ +90°C</li> </ul>
Data GPRS	<ul style="list-style-type: none"> <li>● GPRS data downlink transfer: max. 85.6 kbps</li> <li>● GPRS data uplink transfer: max. 42.8 kbps</li> <li>● Coding scheme: CS-1, CS-2, CS-3 and CS-4</li> <li>● Integrate the TCP/IP protocol.</li> <li>● Support Packet Broadcast Control Channel (PBCCH)</li> </ul>
CSD	<ul style="list-style-type: none"> <li>● Support CSD transmission</li> </ul>
USSD	<ul style="list-style-type: none"> <li>● Unstructured Supplementary Services Data (USSD) support</li> </ul>
SMS	<ul style="list-style-type: none"> <li>● MT, MO, CB, Text and PDU mode</li> <li>● SMS storage: SIM card</li> </ul>
FAX	Group 3 Class 1
SIM interface	Support SIM card: 1.8V, 3V
External antenna	Antenna pad
Audio features	Speech codec modes: <ul style="list-style-type: none"> <li>● Half Rate (ETS 06.20)</li> <li>● Full Rate (ETS 06.10)</li> <li>● Enhanced Full Rate (ETS 06.50 / 06.60 / 06.80)</li> <li>● Adaptive multi rate (AMR)</li> </ul>

	<ul style="list-style-type: none"> <li>● Echo Cancellation</li> <li>● Noise Suppression</li> </ul>
Serial port and debug port	<p><b>Serial port:</b></p> <ul style="list-style-type: none"> <li>● Full modem interface with status and control lines, unbalanced, asynchronous.</li> <li>● 1200bps to 115200bps.</li> <li>● Can be used for AT commands or data stream.</li> <li>● Support RTS/CTS hardware handshake and software ON/OFF flow control.</li> <li>● Multiplex ability according to GSM 07.10 Multiplexer Protocol.</li> <li>● Autobauding supports baud rate from 1200 bps to 57600bps.</li> </ul> <p><b>Debug port:</b></p> <ul style="list-style-type: none"> <li>● Null modem interface GPS/DBG_TXD and GPS/DBG_RXD.</li> <li>● Can be used for debugging and upgrading firmware.</li> </ul>
Phonebook management	Support phonebook types: SM, FD, LD, RC, ON, MC.
SIM application toolkit	GSM 11.14 Release 99
Real time clock	Support RTC
Physical characteristics	Size: 30*30*3.2mm Weight: 5.2g
Firmware upgrade	Firmware upgradeable by debug port.

\*SIM908 does work at this temperature, but some radio frequency characteristics may deviate from the GSM specification.

**Table 2: GPS engine Performance**

Parameter	Description	Performance			
		Min	Typ	Max	Unit
Horizontal Position Accuracy <sup>(a)</sup>	Autonomous		2.5		m
Velocity Accuracy <sup>(b)</sup>	Speed	-	0.01	-	m/s
	Heading	-	0.01	-	°
Time To First Fix <sup>(c)</sup>	Hot start	-	1	-	s
	Cold start	-	30	-	s
Sensitivity	Autonomous acquisition		-143		dBm
	Tracking		-160		dBm
Receiver	Channels		42		
	Update rate		1		Hz
	Altitude			18288	m

	Velocity			1850	km/h
	Tracking L1, CA Code				
	Protocol support NMEA,OSP				
Power consumption <sup>(d)</sup>	Continuous tracking		76		mA
	acquisition		77		
	Power down current		0.03		uA

**Table 3: Coding schemes and maximum net data rates over air interface**

<b>Coding scheme</b>	<b>1 timeslot</b>	<b>2 timeslot</b>	<b>4 timeslot</b>
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. Package Information

### 2.1 Pin out Diagram

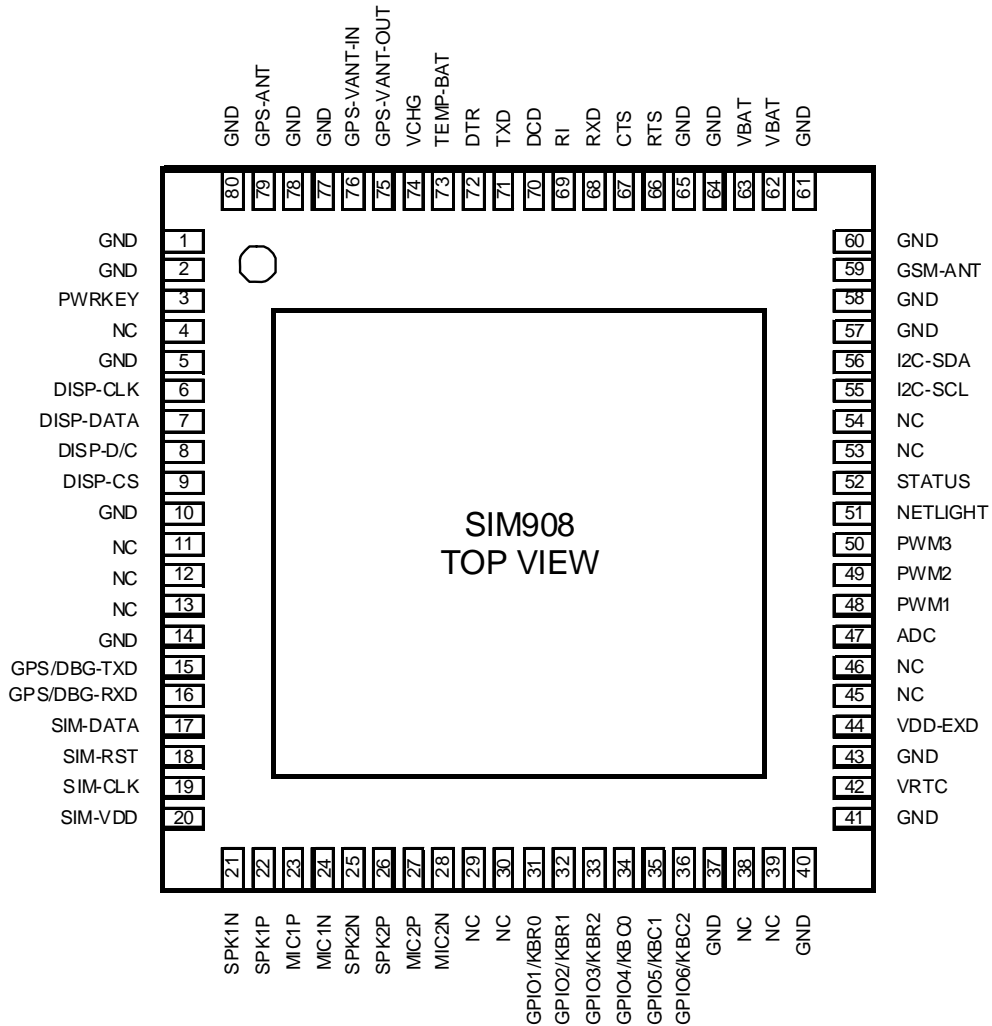


Figure 1: SIM908 pin out diagram (Top view)

### 2.2 Pin Description

Table 4: Pin description

Pin name	Pin number	I/O	Description	Comment
<b>Power supply</b>				
VBAT	62, 63	I	Power supply	3.2V ~ 4.8V
VRTC	42	I/O	Power supply for RTC	It is recommended to connect with a battery or a capacitor (e.g. 4.7uF).

VDD-EXT	44	O	2.8V output power supply	If it is unused, keep open.
GPS-VANT-OUT	75	O	2.8V output for GPS active antenna	If it is unused, keep open.
GPS-VANT-IN	76	I	GPS active antenna power supply	If it is unused, keep open.
GND	1, 2, 5, 10, 14, 37, 40, 41, 43, 57, 58, 60, 61, 64, 65, 77, 78, 80		Ground	
<b>Charge interface</b>				
VCHG	74	I	Charger input	
TEMP_BAT	73	I	Battery temperature sensor	
<b>Power on/down</b>				
PWRKEY	3	I	PWRKEY should be pulled low at least 1 second and then released to power on/down the module.	Pulled up internally.
<b>Audio interfaces</b>				
MIC1P	23	I	Differential audio input	If these pins are unused, keep open.
MIC1N	24			
SPK1P	22	O	Differential audio output	
SPK1N	21			
MIC2P	27	I	Differential audio input	
MIC2N	28			
SPK2N	25	O	Differential audio output	
SPK2P	26			
<b>Status</b>				
STATUS	52	O	Power on status	If these pins are unused, keep open.
NETLIGHT	51	O	Network status	
<b>LCD interface</b>				
DISP -CLK	6	O	Display interface	If these pins are unused, keep open.
DISP-DATA	7	I/O		
DISP -D/C	8	O		
DISP -CS	9	O		
<b>I<sup>2</sup>C interface</b>				
I2C-SDA	56	O	I <sup>2</sup> C serial bus data	If these pins are unused, keep open.
I2C-SCL	55	I/O	I <sup>2</sup> C serial bus clock	
<b>Keypad interface / GPIOs</b>				
GPIO1/KBR0	31	I/O	GPIO1/keypad row 0	If these pins are unused, keep open.
GPIO2/KBR1	32		GPIO2/keypad row 1	
GPIO3/KBR2	33		GPIO3/keypad row 2	

**SIM908 Document**

GPIO4/KBC0	34		GPIO4/keypad column 0	
GPIO5/KBC1	35		GPIO5/keypad column 1	
GPIO6/KBC2	36		GPIO6/keypad column 3	
<b>Serial port</b>				
RXD	68	I	Receive data	If only TXD and RXD are used, it is suggested to pull down DTR, and others pins can be kept open.
TXD	71	O	Transmit data	
RTS	66	O	Request to send	
CTS	67	I	Clear to send	
DCD	70	O	Data carrier detect	
RI	69	O	Ring indicator	
DTR	72	I	Data terminal ready	
<b>GPS/Debug interface</b>				
GPS/DBG-TXD	15	O	For GPS NMEA information output , debugging and upgrading firmware	If these pins are unused, keep open.
GPS/DBG-RXD	16	I		
<b>SIM interface</b>				
SIM-VDD	20	O	Voltage supply for SIM card. Support 1.8V or 3V SIM card	All signals of SIM interface should be protected against ESD with a TVS diode array.
SIM-DATA	17	I/O	SIM data input/output	
SIM-CLK	19	O	SIM clock	
SIM-RST	18	O	SIM reset	
<b>ADC</b>				
ADC	47	I	Input voltage range: 0V ~ 2.8V	If it is unused, keep open.
<b>Pulse width modulation( PWM )</b>				
PWM1	48	O	PWM	If these pins are unused, keep open.
PWM2	49	O	PWM	
PWM3	50	O	PWM	
<b>GSM/GPS RF interface</b>				
GSM-ANT	59	I/O	GSM radio antenna connection	Impedence must be controlled to 50Ω.
GPS-ANT	79	I	GPS radio antenna connection	Impedence must be controlled to 50Ω.
<b>Not connect</b>				
NC	4,11,12,13,29,30,38,39,45,46,53,54	-		These pins should be kept open.

### 2.3 Package Dimensions

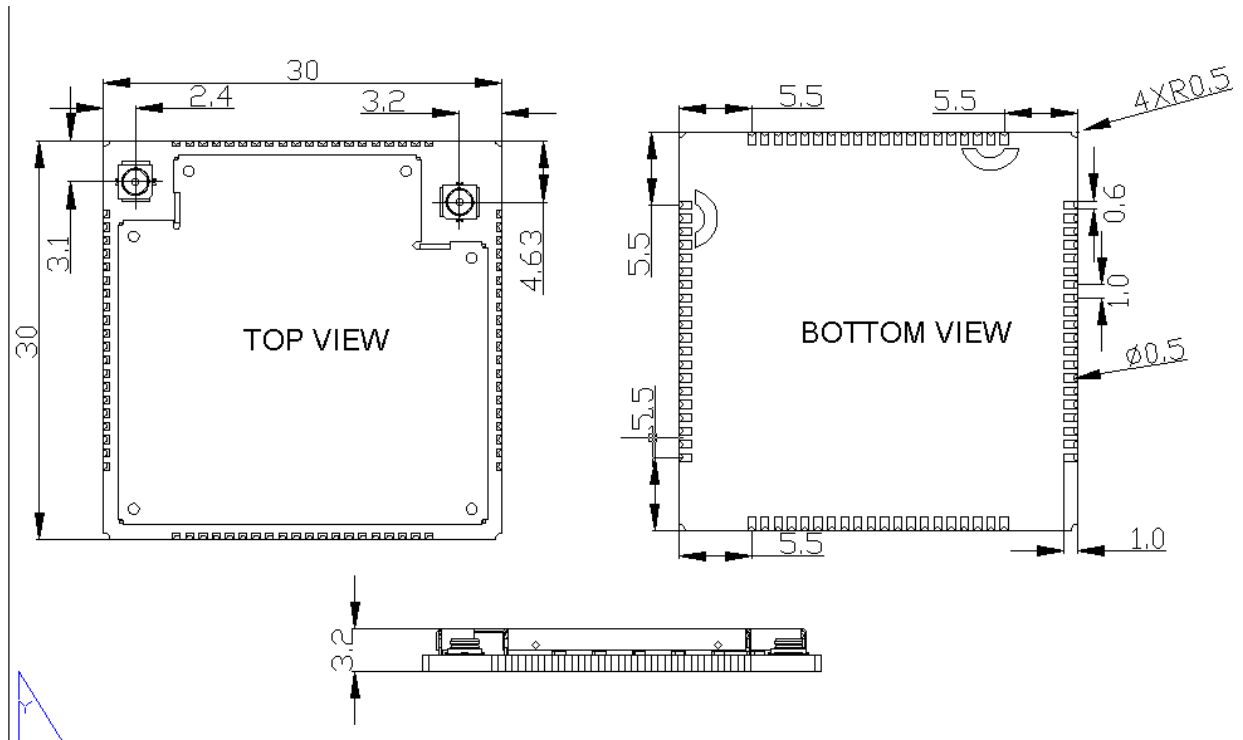


Figure 2: Dimensions of SIM908 (Unit: mm)

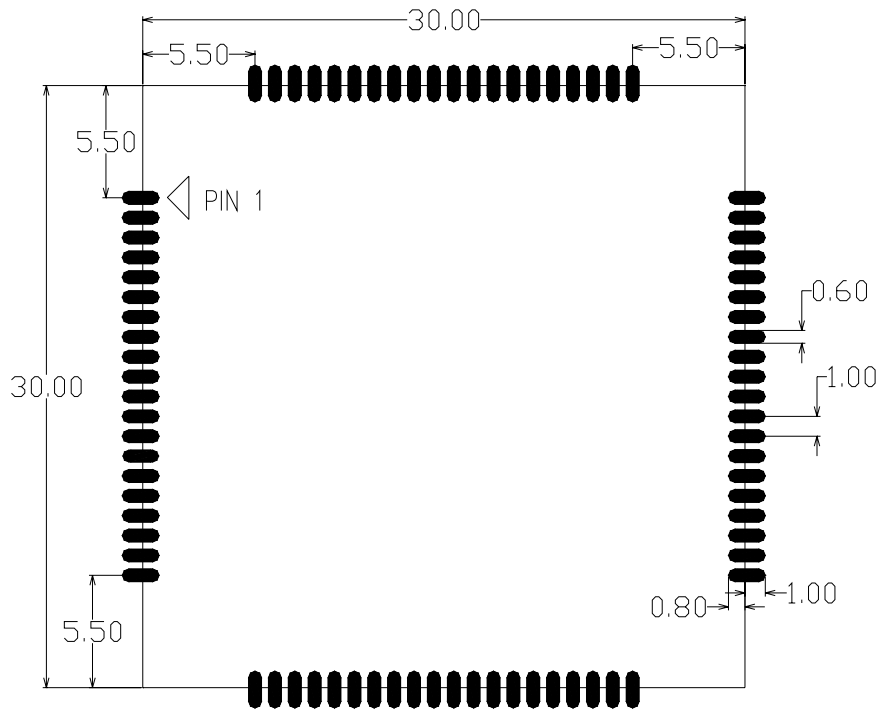


Figure 3: Recommended PCB footprint outline (Unit: mm)



## 2.4 Pictures

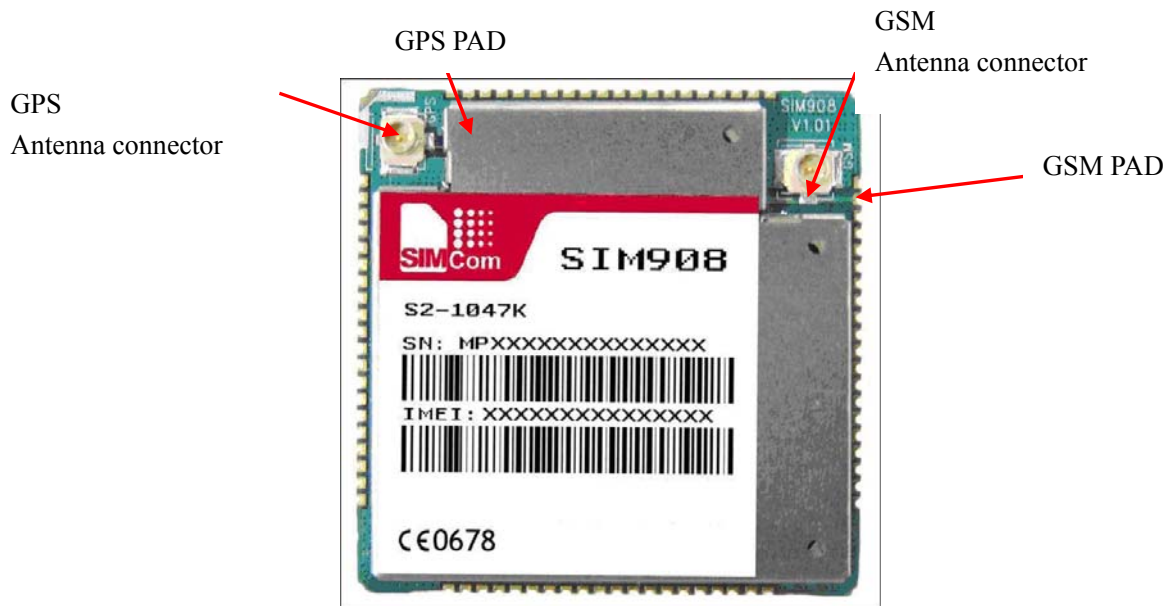


Figure 4: The RF interface of module

## 3. Detail Block Diagram

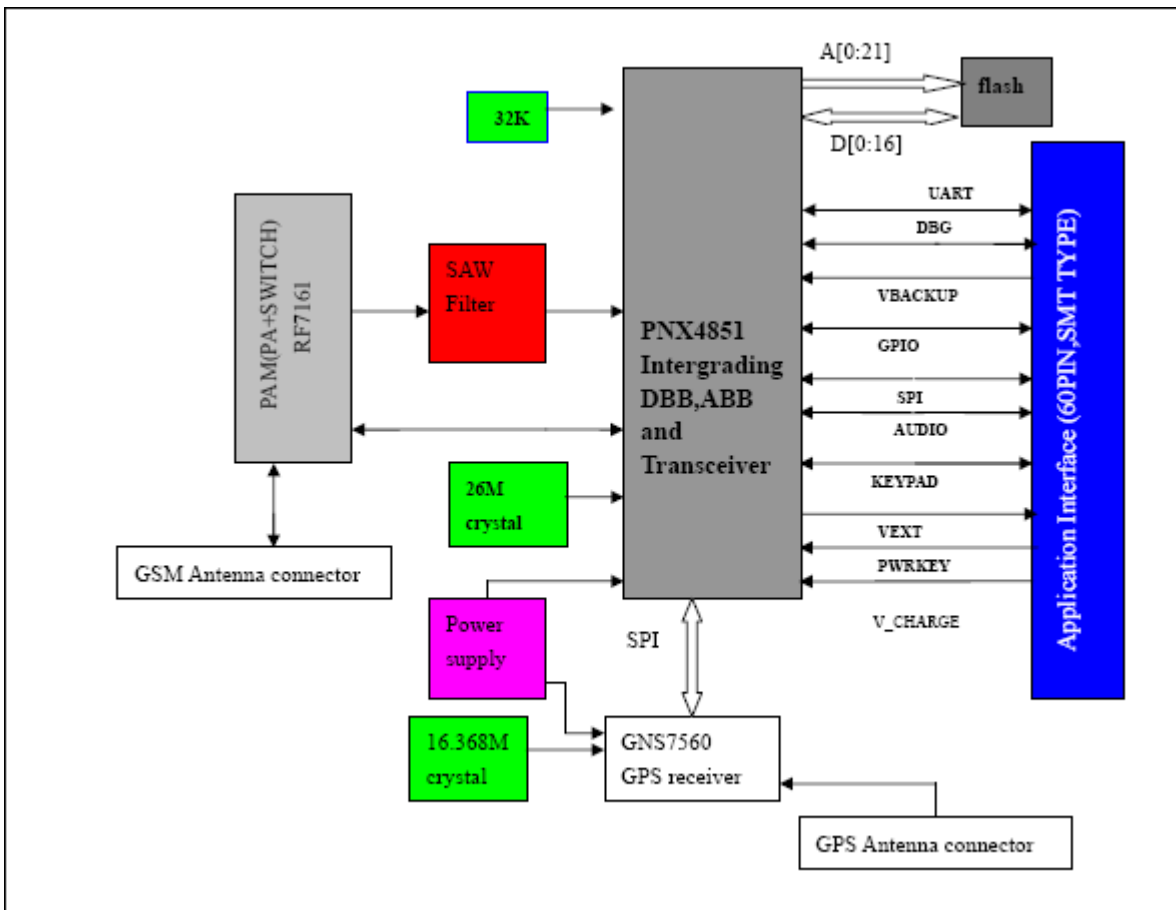


Figure 5: Block diagram of SIM908

## 4. Electrical and Reliability Characteristics

### 4.1 Absolute Maximum Ratings

The absolute maximum ratings stated in following table are stress ratings under non-operating conditions. Stresses beyond any of these limits will cause permanent damage to SIM908.

**Table 5: Absolute maximum ratings**

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>BAT</sub>	Power supply voltage	-	-	5.5	V
V <sub>I</sub> *	Input voltage	-0.3	-	3.1	V
I <sub>I</sub> *	Input current	-	-	10	mA
I <sub>O</sub> *	Output current	-	-	10	mA

\*These parameters are for digital interface pins, such as keypad, GPIO, I<sup>2</sup>C, UART, LCD, PWMs and DEBUG.

### 4.2 Recommended Operating Conditions

**Table 6: Recommended operating conditions**

Symbol	Parameter	Min	Typ	Max	Unit
V <sub>BAT</sub>	Power supply voltage	3.2	4.0	4.8	V
T <sub>OPER</sub>	Operating temperature	-40	+25	+85	°C
T <sub>STG</sub>	Storage temperature	-45		+90	°C

### 4.3 Digital Interface Characteristics

**Table 7: Digital interface characteristics**

Symbol	Parameter	Min	Typ	Max	Unit
I <sub>IH</sub>	High-level input current	-10	-	10	uA
I <sub>IL</sub>	Low-level input current	-10	-	10	uA
V <sub>IH</sub>	High-level input voltage	2.4	-	-	V
V <sub>IL</sub>	Low-level input voltage	-	-	0.4	V
V <sub>OH</sub>	High-level output voltage	2.7	-	-	V
V <sub>OL</sub>	Low-level output voltage	-	-	0.1	V

\* These parameters are for digital interface pins, such as keypad, GPIO, I<sup>2</sup>C, UART, LCD, PWMs and DEBUG.

## 4.4 SIM Card Interface Characteristics

Table 8: SIM card interface characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$I_{IH}$	High-level input current	-10	-	10	$\mu$ A
$I_{IL}$	Low-level input current	-10	-	10	$\mu$ A
$V_{IH}$	High-level input voltage	1.4	-	-	V
		2.4	-	-	V
$V_{IL}$	Low-level input voltage	-	-	0.4	V
		-	-	2.4	V
$V_{OH}$	High-level output voltage	1.7	-	-	V
		2.7	-	-	V
$V_{OL}$	Low-level output voltage	-	-	0.1	V
		-	-	0.1	V

## 4.5 VDD\_EXT Characteristics

Table 9: VDD\_EXT characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$V_O$	Output voltage	2.70	2.80	2.95	V
$I_O$	Output current	-	-	10	mA

## 4.6 SIM\_VDD Characteristics

Table 10: SIM\_VDD characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$V_O$	Output voltage	2.75	2.9	3.00	V
		1.65	1.80	1.95	
$I_O$	Output current	-	-	10	mA

## 4.7 VRTC Characteristics

Table 11: VRTC characteristics

Symbol	Parameter	Min	Typ	Max	Unit
$V_{RTC-IN}$	VRTC input voltage	2.00	3.00	3.15	V

$I_{RTC-IN}$	VRTC input current	-	2	-	uA
$V_{RTC-OUT}$	VRTC output voltage	-	3.00	-	V
$I_{RTC-OUT}$	VRTC output current	-	10	-	uA

#### 4.8 Current Consumption (VBAT = 3.8V, GPS engine is powered down)

**Table 12: GSM current consumption**

Symbol	Parameter	Conditions	Value	Unit		
$I_{VRTC}$	VRTC current	VBAT disconnects. Backup battery is 3 V	2	uA		
$I_{VBAT}$	VBAT current	Power down mode	50	uA		
		Sleep mode	BS-PA-MFRMS=9	1.2	mA	
			BS-PA-MFRMS=5	1.5		
			BS-PA-MFRMS=2	1.7		
		Idle mode	GSM 850	21	mA	
			EGSM 900			
			DCS 1800			
			PCS 1900			
		Voice call	GSM 850 EGSM 900	PCL=5	240	mA
				PCL=12	110	
				PCL=19	76	
			DCS 1800 PCS 1900	PCL=0	180	
				PCL=7	89	
				PCL=15	76	
		Data mode GPRS(1Rx,1Tx)	GSM 850 EGSM 900	PCL=5	240	mA
				PCL=12	110	
				PCL=19	83	
			DCS 1800 PCS 1900	PCL=0	170	mA
				PCL=7	95	
				PCL=15	80	
		Data mode GPRS(4Rx,1Tx)	GSM 850 EGSM 900	PCL=5	270	mA
				PCL=12	150	
				PCL=19	120	
DCS 1800 PCS 1900	PCL=0		210	mA		
	PCL=7		130			
	PCL=15		115			
Data mode GPRS(3Rx,2Tx)	GSM 850 EGSM 900	PCL=5	435	mA		
		PCL=12	185			
		PCL=19	130			

			DCS 1800 PCS 1900	PCL=0	320	mA
				PCL=7	155	
				PCL=15	122	
I <sub>VBAT-peak</sub>	Peak current	During Tx burst			2	A

## 4.9 Electro-Static Discharge

SIM908 is an ESD sensitive component, so more attention should be paid to the procedure of handling and packaging. The ESD test results are shown in the following table.

**Table 13: The ESD characteristics (Temperature: 25°C, Humidity: 45 %)**

Pin	Contact discharge	Air discharge
VBAT	±5KV	±10KV
GND	±4KV	±10KV
RXD, TXD	±3KV	±6KV
Antenna port	±5KV	±10KV
SPKP/ SPKN MICP/ MICN	±3KV	±8KV
PWRKEY	±3KV	±8KV

## 4.10 Radio Characteristics

### 4.10.1 Module RF Output Power

The following table shows the module conducted output power, it is followed by the 3GPP TS 05.05 technical specification requirement.

**Table 14: SIM908 GSM 900 and GSM 850 conducted RF output power**

GSM 900 and EGSM 850			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
0-2	39	±2	±2.5
3	37	±3	±4
4	35	±3	±4
5	33	±3	±4
6	31	±3	±4
7	29	±3	±4
8	27	±3	±4

9	25	±3	±4
10	23	±3	±4
11	21	±3	±4
12	19	±3	±4
13	17	±3	±4
14	15	±3	±4
15	13	±3	±4
16	11	±5	±6
17	9	±5	±6
18	7	±5	±6
19-31	5	±5	±6

**Table 15: SIM908 DCS 1800 and PCS 1900 conducted RF output power**

DCS 1800 and PCS 1900			
PCL	Nominal output power (dBm)	Tolerance (dB) for conditions	
		Normal	Extreme
29	36	±2	±2.5
30	34	±3	±4
31	32	±3	±4
0	30	±3	±4
1	28	±3	±4
2	26	±3	±4
3	24	±3	±4
4	22	±3	±4
5	20	±3	±4
6	18	±3	±4
7	16	±3	±4
8	14	±3	±4
9	12	±4	±5
10	10	±4	±5
11	8	±4	±5
12	6	±4	±5
13	4	±4	±5
14	2	±5	±6
15-28	0	±5	±6

For the module's output power, the following is should be noted:

At GSM900 and GSM850 band, the module is a class 4 device, so the module's output power should not exceed 33dBm, and at the maximum power level, the output power tolerance should not exceed +/-2dB under normal condition and +/-2.5dB under extreme condition.

At DCS1800 and PCS1900 band, the module is a class 1 device, so the module's output power should not exceed 30dBm, and at the maximum power level, the output power tolerance should not exceed +/-2dB under normal condition and +/-2.5dB under extreme condition.

#### 4.10.2 Module RF Receive Sensitivity

The following table shows the module's conducted receive sensitivity, it is tested under static condition.

**Table 16: SIM908 conducted RF receive sensitivity**

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

#### 4.10.3 Module Operating Frequencies

The following table shows the module's operating frequency range; it is followed by the 3GPP TS 05.05 technical specification requirement.

**Table 17: SIM908 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