SIM8905 Series Hardware Design

Smart Module

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Document Title:	SIM8905 Series Hardware Design
Version:	1.08
Date:	2020-09-23
Status:	Released

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Version History

Date	Version	Description of change	Author
2017-10-10	1.01	Initial release	Bing Li Xiaobo Bai
2017-11-13	1.02	ADD SIM8905A description in the table1 Update Figure 17	Bing Li Xiaobo Bai
2018-04-02	1.03	Update Figure 1 and Figure 2.	Bing Li
2019-01-25	1.04	ADD SIM8905E-W description in the table1.	Bing Li
2019-04-02	1.05	Add chapter8: List of Recommended Devices	Bing Li
2019-12-20	1.06	ADD SIM8905E-W description in the table1.	Bing Li
2020-04-26	1.07	Modify document template format	Bing Li
2020-09-23	1.08	Update Table 41	Xiabobo Bai

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1 Introduction

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

1.1 Product Outline

SIM8905/SIM8905A/SIM8905E/SIM8905E-W is a multi-mode and multi-band wireless smart module, which is based on Qualcomm MSM8909 platform. It includes baseband, memory, RF front end and required circuitry to support rich multimedia features, global location-based service, wireless connectivity, and air interface standards including GSM, WCDMA, TD-SCDMA, CDMA2000, and LTE.

In this document, the entire radio band configuration of SIM8905 series is described in the following table.

Table 1: SIM8905 Series frequency bands

Standard	Frequency	SIM8905	SIM8905A	SIM8905E	SIM8905-L	SIM8905E-W
GSM	850MHz	✓	✓	✓	✓	
	900MHz	✓	✓	✓	✓	
	1800M Hz	✓		✓	✓	
	1900M Hz		✓	✓		
WCDMA	B1	✓	✓	✓	✓	
	B2		✓	✓		
	B4		✓			
	B5	✓	✓	✓	✓	
	B8	✓	✓	✓	✓	
CDMA2000/ EVDO	BC0	✓			✓	
TD-SCDMA	B34	✓			✓	
	B39	✓			✓	
LTE-FDD	FDD B1	✓		✓	✓	
	FDD B2		✓			
	FDD B3	✓		✓	✓	
	FDD B4		✓			
	FDD B5	✓	✓	✓	✓	

	FDD B7		✓	✓		
	FDD B8	✓		✓	✓	
	FDD B12		✓			
	FDD B13		✓			
	FDD B17		✓			
	FDD B20			✓		
	FDD B25		✓			
	FDD B26		✓			
LTE-TDD	TDD B38	✓		✓	✓	
	TDD B39	✓			✓	
	TDD B40	✓		✓	✓	
	TDD B41*	✓	✓	✓	✓	
Diversity	Diversity	✓	✓	✓		
WIFI	802.11 a		✓	✓		✓
	802.11 b	✓	✓	✓	✓	✓
	802.11 g	✓	✓	✓	✓	✓
	802.11 n	✓	✓	✓	✓	✓
	2.4GHz	✓	✓	✓	✓	✓
	5GHz		✓	✓		✓
BT	V2.1+EDR / 3.0+HS / V4.0 BLE	✓	✓	✓	✓	✓
GNSS	GPS	✓	✓	✓	✓	
	GLONASS	✓	✓	✓	✓	
	BEIDOU	✓	✓	✓	✓	
Battery-temperature monitoring	Adjust resistors (R_S1/ R_S2 in the Figure 17)	100K/39K	100K/39K	100K/39K	100K/39K	100K/39K
	Support NTC thermistor	47K (B4050K)	47K (B4050K)	47K (B4050K)	47K (B4050K)	47K (B4050K)
Memory	DDR SDRAM	8Gb	8Gb	8Gb	8Gb	8Gb
	Flash	8GB	8GB	8GB	8GB	8GB

NOTE

SIM8905's TDD-LTE B41 bandwidth is 100MHz (2555 ~ 2655 MHz), the channel is 40240 ~ 41240.

With a small physical dimension of 40.5*40.5*2.8 mm and with the functions integrated, the module can meet almost any space requirement in users' applications, such as smart phone, PDA, industrial handhold,

machine-to-machine and vehicle application, etc.

1.2 Hardware Interface Overview

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

- Power Supply
- Charge management
- USB2.0 Interface
- SDIO /SD Interface
- LCM Interface(MIPI DSI)
- Camera Interface(MIPI CSI0/CSI1)
- USIM Interface
- GPIO
- ADC
- LDO Power Output
- Vibrator
- AUDIO Interface (Two inputs and Three outputs)
- UART Interface
- SPI Interface
- I2C Interface

1.3 Hardware Block Diagram

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

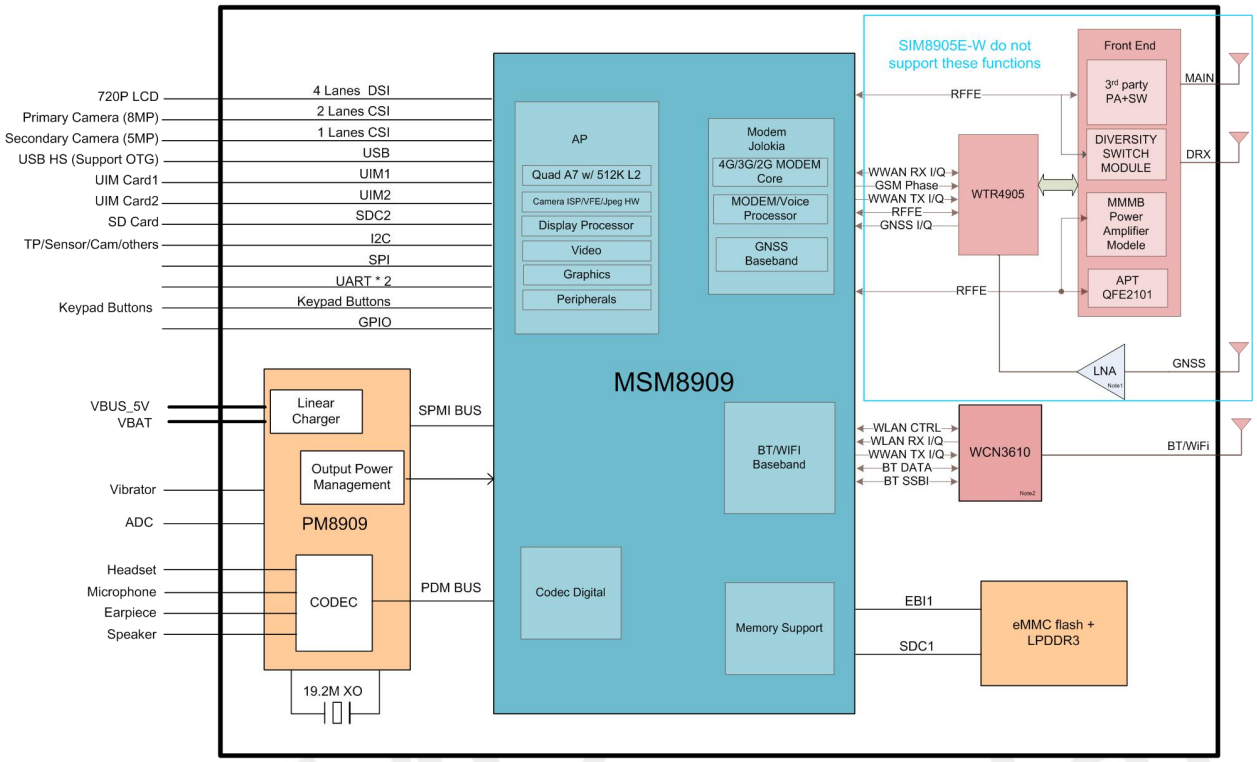

Figure 1: module block diagram

1.4 Functional Overview

Table 2: General features

Feature	Implementation
Power supply	Single supply voltage 3.4～4.4V， recommend 3.8V.
Power saving	Current in sleep mode : <5mA
Application Processor	Quad ARM Cortex-A7 cores up to 1.1 GHz 32 kB L1, 512 kB L2 cache ARMv7 32-bit architecture
Memory	LPDDR3 up to 533Mhz eMMC NAND flash Default configuration: please refer to the table 1 Optional configuration：DDR SDRAM: 2GB； Flash:16GB
External memory via SD	SD3.0; Support SD flash devices up to 32GB
Operating System	Android OS 5.x/7.x/8.x Linux3.18
Charge management	Integrated 1.44 A linear charger for single-cell lithium-ion batteries
Display	4-lane MIPI_DSI, 1.5Gbps each HD(720P), 60fps
Camera	Primary camera: 2-lane MIPI_CSI, 8MP Secondary camera: 1-lane MIPI_CSI, 5MP
Video performance	Encode: H.264 BP/MP –720p, 30fps MPEG-4 SP / H.263 P0 –WVGA, 30fps VP8 –WVGA, 30fps Decode: H.264 BP/MP/HP–1080p, 30 fps MPEG-4 SP/ASP–1080p, 30 fps DivX 4x/5x/6x–1080p, 30 fps H.263 P0–WVGA, 30 fps VP8 –1080p, 30 fps (HEVC) H.265 MP 8 bit –1080p, 30 fps
Audio	Two inputs that support single-ended configurations Three outputs: earpiece, stereo headphones, and mono class-D speaker driver Voice codec support: G711; Raw PCM; QCELP; EVRC, -B, -WB; AMR-NB, -WB; GSM-EFR, -FR, -HR; Audio codec support: MP3; AAC+, eAAC; AMR-NB, -WB, G.711, WMA 9/10 Pro
Radio frequency bands	Please refer to the table 1
Transmitting power	GSM/GPRS: Class 4 : GSM850/EGSM900 Class 1 : DCS1800/PCS1900 EDGE: Class E2: GSM850/EGSM900 Class E1: DCS1800/PCS1900 TD-SCDMA: Class 2: B34/B39 CDMA: Class 3: BC0 UMTS:

	Class 3: B1/B2/B4/B5/B8 LTE: Class 3: B1/B2/B3/B4/B5/B7/B8/B12/B13/B17/B20/B25/B26/B38/B39/B40/B41 [1]
Data Transmission Throughput	GPRS Class B, multi-slot class 33 operation, coding scheme: CS1-4, DL maximum speed: 107kbps; UL maximum speed: 85.6kbps EDGE multi-slot class 33 operation, coding scheme: MSC1-9, DL maximum speed: 296kbps; UL maximum speed: 236.8kbps TD-SCDMA 2.8Mbps(DL) 2.2Mbps(UL) CDMA DORA 3.1Mbps(DL) 1.8Mbps(UL) UMTS R99 speed: 384 kbps DL/UL DC-HSDPA Category 24 - 42.2 Mbps, HSUPA Category 6 - 11.5 Mbps LTE Category 4 - 150 Mbps (DL) LTE Category 4 - 50 Mbps (UL)
Antenna	GSM/UMTS/LTE main antenna. UMTS/LTE auxiliary antenna GNSS antenna WIFI/BT antenna
GNSS	GNSS engine (GPS,GLONASS and BD) Protocol: NMEA
Bluetooth	Specification: V2.1+EDR , 3.0+HS, V4.0 BLE Tx power levels: Class 1 & 2
Wi-Fi/WAPI	Support SoftAP Function Encryption: WFA WPA/WPA2 Qos: WFA WMM , WMM PS RF performance: 11a power 15dBm, EVM<-25dB 11b power 17 dBm, EVM<35% 11g power 15dBm, EVM<-25dB 11n power 12 dBm, EVM<-27dB
GNSS	Receiver type: GPS,GLONASS,BEIDOU Sensitivity : Tracking & Navigation : -160dBm Reacquisition : -156dBm Cold Start : -148dBm TTFF@-130dBm: hot start <5s warm start <15s cold start <35s CNo : 39dB/Hz@-130dBm
USIM interface	Support identity card: 1.8V/ 2.95V Dual cards dual standby
USB	USB 2.0 high speed interface
Firmware upgrade	Firmware upgrade over USB interface
Physical characteristics	Dimension: 40.5*40.5*2.8mm Weight: 10.6g
Temperature range	Normal operating temperature: -35℃ ~ +75℃ Extended operation temperature: -40°C to +85°C [2] Storage temperature: -40℃ ~ +90℃

NOTE

1. SIM8905's TDD-LTE B41 bandwidth is 100MHz (2555 ~ 2655 MHz), the channel is 40240 ~ 41240.

2. Module is able to establish and maintain voice, data transmission, SMS and emergency call, etc. The performance may deviate slightly from the 3GPP specifications and will meet 3GPP specifications again when the temperature returns to normal operating temperature levels.

2 Package Information

2.1 Pin Assignment Overview

All functions of the module will be provided through 210 pads that will be connected to the customers' platform. The following Figure is a high-level view of the pin assignment of the module.

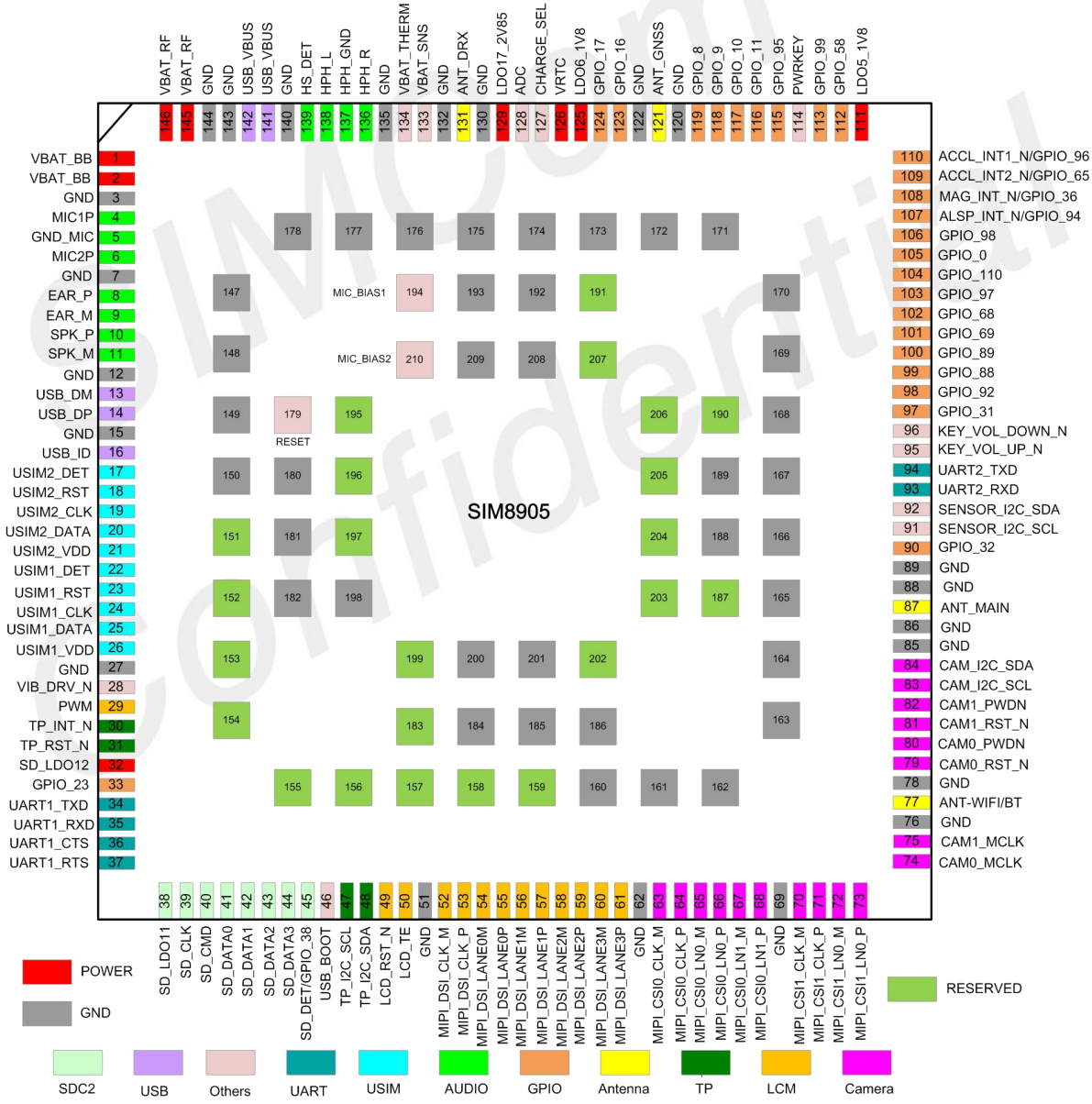

Figure 2: Pin assignment overview

2.2 Pin Description

Table 3: Pin Characters

Pin#	Pin Name	Voltage	MSM8909 Platform Pin Name	Reset Status [1]	Wakeup Interrupt	Note
1	VBAT_BB	3.4~4.4V				
2	VBAT_BB	3.4~4.4V				
3	GND					
4	MIC1P					
5	GND_MIC					
6	MIC2P					
7	GND					
8	EAR_P					
9	EAR_M					
10	SPK_P					
11	SPK_M					
12	GND					
13	USB_DM					
14	USB_DP					
15	GND					
16	USB_ID					
17	USIM2_DET	1.8V	GPIO_52	PD		
18	USIM2_RST	1.8/2.95V	GPIO_51	PD		
19	USIM2_CLK	1.8/2.95V	GPIO_50	PD	√	
20	USIM2_DAT	1.8/2.95V	GPIO_49	PD	√	
21	USIM2_VDD	1.8/2.95V				
22	USIM1_DET	1.8V	GPIO_56	PD		
23	USIM1_RST	1.8/2.95V	GPIO_55	PD		
24	USIM1_CLK	1.8/2.95V	GPIO_54	PD		
25	USIM1_DAT	1.8/2.95V	GPIO_53	PD		
26	USIM1_VDD	1.8/2.95V				
27	GND					
28	VIB_DRV_N					
29	PWM	V_MPP [3]	PM_MPP_2 [2]			
30	TP_INT_N	1.8V	GPIO_13	PD		
31	TP_RST_N	1.8V	GPIO_12	PD		
32	SD_LDO12	1.8/2.95V				

33	GPIO_23	1.8V	GPIO_23	PD		
34	UART1_TXD	1.8V	GPIO_20	PD	√	
35	UART1_RXD	1.8V	GPIO_21	PD	√	
36	UART1_CTS	1.8V	GPIO_111	PD	√	
37	UART1_RTS	1.8V	GPIO_112	PD	√	
38	SD_LDO11	2.95V				
39	SD_CLK	1.8/2.95V		NP		
40	SD_CMD	1.8/2.95V		PD		
41	SD_DATA0	1.8/2.95V		PD		
42	SD_DATA1	1.8/2.95V		PD		
43	SD_DATA2	1.8/2.95V		PD		
44	SD_DATA3	1.8/2.95V		PD		
45	SD_DET/GPIO_38	1.8V	GPIO_38	PD	√	
46	USB_BOOT	1.8V	GPIO_37	PD	√	
47	TP_I2C_SCL	1.8V	GPIO_19	PD		
48	TP_I2C_SDA	1.8V	GPIO_18	PD		
49	LCD_RST_N	1.8V	GPIO_25	PD	√	
50	LCD_TE	1.8V	GPIO_24	PD		
51	GND					
52	MIPI_DSI_CLK_M					
53	MIPI_DSI_CLK_P					
54	MIPI_DSI_LANE0M					
55	MIPI_DSI_LANE0P					
56	MIPI_DSI_LANE1M					
57	MIPI_DSI_LANE1P					
58	MIPI_DSI_LANE2M					
59	MIPI_DSI_LANE2P					
60	MIPI_DSI_LANE3M					
61	MIPI_DSI_LANE3P					
62	GND					
63	MIPI_CSI0_CLK_M					
64	MIPI_CSI0_CLK_P					
65	MIPI_CSI0_LN0_M					
66	MIPI_CSI0_LN0_P					
67	MIPI_CSI0_LN1_M					
68	MIPI_CSI0_LN1_P					
69	GND					
70	MIPI_CSI1_CLK_M					
71	MIPI_CSI1_CLK_P					
72	MIPI_CSI1_LN0_M					
73	MIPI_CSI1_LN0_P					

74	CAM0_MCLK	1.8V	GPIO_26	PD		
75	CAM1_MCLK	1.8V	GPIO_27	PD		
76	GND					
77	ANT-WIFI/BT					
78	GND					
79	CAM0_RST_N	1.8V	GPIO_35	PD	√	
80	CAM0_PWDN	1.8V	GPIO_34	PD	√	
81	CAM1_RST_N	1.8V	GPIO_28	PD	√	
82	CAM1_PWDN	1.8V	GPIO_33	PD		
83	CAM_I2C_SCL	1.8V	GPIO_30	PD		
84	CAM_I2C_SDA	1.8V	GPIO_29	PD		
85	GND					
86	GND					
87	SIM8905：ANT_MAIN SIM8905E-W：NC					
88	GND					
89	GND					
90	GPIO_32	1.8V	GPIO_32	PD		
91	SENSOR_I2C_SCL	1.8V	GPIO_7	PD		
92	SENSOR_I2C_SDA	1.8V	GPIO_6	PD		
93	UART2_RXD	1.8V	GPIO_5	PD	√	
94	UART2_TXD	1.8V	GPIO_4	PD		
95	KEY_VOL_UP_N	1.8V	GPIO_90	PD	√	
96	KEY_VOL_DOWN_N	1.8V	GPIO_91	PD	√	
97	GPIO_31	1.8V	GPIO_31	PD	√	
98	GPIO_92	1.8V	GPIO_92	PD	√	
99	GPIO_88	1.8V	GPIO_88	PD		
100	GPIO_89	1.8V	GPIO_89	PD		
101	GPIO_69	1.8V	GPIO_69	PD		
102	GPIO_68	1.8V	GPIO_68	PD		
103	GPIO_97	1.8V	GPIO_97	PD	√	
104	GPIO_110	1.8V	GPIO_110	PD	√	
105	GPIO_0	1.8V	GPIO_0	PD		
106	GPIO_98	1.8V	GPIO_98	PD	√	
107	ALSP_INT_N/ GPIO_94	1.8V	GPIO_94	PD		
108	MAG_INT_N/ GPIO_36	1.8V	GPIO_36	PD	√	
109	ACCL_INT2_N/ GPIO_65	1.8V	GPIO_65	PD	√	
110	ACCL_INT1_N/ GPIO_96	1.8V	GPIO_96	PD	√	

111	LDO5_1V8	1.8V				
112	GPIO_58	1.8V	GPIO_58	PD	√	
113	GPIO_99	1.8V	GPIO_99	PD		
114	PWRKEY	1.8V				
115	GPIO_95	1.8V	GPIO_95	PD	√	
116	GPIO_11	1.8V	GPIO_11	PD	√	
117	GPIO_10	1.8V	GPIO_10	PD		
118	GPIO_9	1.8V	GPIO_9	PD		
119	GPIO_8	1.8V	GPIO_8	PD		
120	GND					
121	SIM8905：ANT_GNSS SIM8905E-W：NC					
122	GND					
123	GPIO_16	1.8V	GPIO_16	PD		
124	GPIO_17	1.8V	GPIO_17	PD		
125	LDO6_1V8	1.8V				
126	VRTC					
127	CHARGE_SEL	1.8V	PM_OPT_1 [2]			
128	ADC	1.8V	PM_MPP_4 [2]			
129	LDO17_2V85	2.85V				
130	GND					
131	SIM8905：ANT_DRX SIM8905E-W：NC SIM8905-L：NC					
132	GND					
133	VBAT_SNS					
134	VBAT_THERM					
135	GND					
136	HPH_R					
137	HPH_GND					
138	HPH_L					
139	HS_DET					
140	GND					
141	USB_VBUS	5V				
142	USB_VBUS	5V				
143	GND					
144	GND					
145	VBAT_RF	3.4~4.4V				
146	VBAT_RF	3.4~4.4V				
147	GND					
148	GND					

149	GND					
150	GND					
151	RESERVED					
152	RESERVED					
153	RESERVED					
154	RESERVED					
155	RESERVED					
156	RESERVED					
157	RESERVED					
158	RESERVED					
159	RESERVED					
160	GND					
161	GND					
162	GND					
163	GND					
164	GND					
165	GND					
166	GND					
167	GND					
168	GND					
169	GND					
170	GND					
171	GND					
172	GND					
173	GND					
174	GND					
175	GND					
176	GND					
177	GND					
178	GND					
179	RESIN_N					
180	GND					
181	GND					
182	GND					
183	RESERVED					
184	GND					
185	GND					
186	GND					
187	RESERVED					
188	GND					
189	GND					

190	RESERVED					
191	RESERVED					
192	GND					
193	GND					
194	MIC_BIAS1					
195	RESERVED					
196	RESERVED					
197	RESERVED					
198	GND					
199	RESERVED					
200	GND					
201	GND					
202	RESERVED					
203	RESERVED					
204	RESERVED					
205	RESERVED					
206	RESERVED					
207	RESERVED					
208	GND					
209	GND					
210	MIC_BIAS2					

NOTE

1. NP = no-pull, PD = pull down, PU = pull up, KP = keeper
2. PM_XX means that it is a pin of PM8909
3. V_MPP is a selectable supply for MPP circuits; options include: VBAT, VREG_L2 (1.2V), VREG_L5(1.8V)

Table 4: Pin description

Pin Name	Pin No.	Type	Description	Note
Power Supply				
VBAT_BB	1，2	P	Main power supply for the Baseband, and linear charger output	It must be able to provide sufficient current up to 3A. TVS is recommended for surge protection.
VBAT_RF	145，146	P	Main power supply for the RF	
VRTC	126	P	Coin cell or backup-battery charger supply and input	If unused, keep it open.
LDO6_1V8	125	P	1.8V LDO output	Power supply for external external

				circuit. A parallel 2.2uF~4.7uf capacitance is required. If unused, keep it open.
LDO17_2V85	129	P	2.85V LDO output	Power supply for external external circuit. A parallel 2.2uF~4.7uf capacitance is required. If unused, keep it open.
LDO5_1V8	111	P	1.8V LDO output	Power supply for external GPIO's pull up and level shift circuits. If unused, keep it open.
LDO12_1V8	32	P	1.8V/2.95V LDO output	For SD pull-up only.
GND	3，7，12，15，27，51，62，69，76，78，85，86，88，89，120，122，130，132，135，140，143，144，147-150，160-178，180-182，184-186，188，189，192，193，198，200，201，208，209	P		
USB				
VBUS_USB	141，142	P	Input power from USB source	USB insertion detection
USB_DM	13	I/O	USB HS data negative	Require differential impedance of 90ohm.
USB_DP	14	I/O	USB HS data positive	
USB _ID	16	I	USB HS ID	Default high level

SIM card				
USIM2_DET	17	I	USIM2 presence detection	1.8V power domain. External pull-up resistor is required. If unused, keep it open.
USIM2_RST	18	O	USIM2 reset	
USIM2_CLK	19	O	USIM2 clock	
USIM2_DAT	20	I/O	USIM2 data	
USIM2_VDD	21	P	LDO 15 output for USIM2, 1.8V/2.95V	The 1.8V or 2.95v USIM card is automatically identified
USIM1_DET	22	I	USIM1 presence detection	1.8V power domain. External pull-up resistor is required. If unused, keep it open.
USIM1_RST	23	O	USIM1 reset	
USIM1_CLK	24	O	USIM1 clock	
USIM1_DAT	25	I/O	USIM1 data	
USIM1_VDD	26	P	LDO 14 output for USIM1, 1.8V/2.95V	The 1.8V or 2.95v USIM card is automatically identified
SDIO/SD card				
SD_LDO11	38	P	LDO 11 output for SD card	
SD_CLK	39	O	Secure digital card clock	
SD_CMD	40	I/O	Secure digital card command	
SD_DATA0	41	I/O	Secure digital card data bit 0	
SD_DATA1	42	I/O	Secure digital card data bit 1	
SD_DATA2	43	I/O	Secure digital card data bit 2	
SD_DATA3	44	I/O	Secure digital card data bit 3	
SD_DET/GPIO_38	45	I	Secure digital card detection	
Touch Screen				
TP_I2C_SDA	48	I/O	Touch screen I2C	1.8V power domain. External pull-up resistors are required.
TP_I2C_SCL	47	O		
TP_INT_N	30	I	Touch screen interrupt	
TP_RST_N	31	O	Touch screen reset	
LCD				
PWM	29	O	PWM control for external WLED driver	
LCD_RST_N	49	O	LCD reset	
LCD_TE	50	I	LCD tear effect	
MIPI_DSI_CLK_M	52	O	MIPI display serial interface	
MIPI_DSI_CLK_P	53	O		

MIPI_DSI_LANE0M	54	O		
MIPI_DSI_LANE0P	55	O		
MIPI_DSI_LANE1M	56	O		
MIPI_DSI_LANE1P	57	O		
MIPI_DSI_LANE2M	58	O		
MIPI_DSI_LANE2P	59	O		
MIPI_DSI_LANE3M	60	O		
MIPI_DSI_LANE3P	61	O		
Camera				
MIPI_CSI0_CLK_M	63	I	Primary camera serial interface	
MIPI_CSI0_CLK_P	64	I		
MIPI_CSI0_LN0_M	65	I		
MIPI_CSI0_LN0_P	66	I		
MIPI_CSI0_LN1_M	67	I		
MIPI_CSI0_LN1_P	68	I		
MIPI_CSI1_CLK_M	70	I	Secondary camera serial interface	
MIPI_CSI1_CLK_P	71	I		
MIPI_CSI1_LN0_M	72	I		
MIPI_CSI1_LN0_P	73	I		
CAM0_MCLK	74	O	Primary Camera master clock	
CAM1_MCLK	75	O	Secondary Camera master clock	
CAM0_RST_N	79	O	Primary Camera reset	
CAM0_PWDN	80	O	Primary Camera power down	
CAM1_RST_N	81	O	Secondary Camera reset	
CAM1_PWDN	82	O	Secondary Camera power down	
CAM_I2C_SCL	83	O	Camera I2C	1.8V power domain. External pull-up resistors are required.
CAM_I2C_SDA	84	I/O		
Keypad				
KEY_VOL_UP_N	95	I	Volume up keypad	If unused, keep it open.
KEY_VOL_DOWN_N	96	I	Volume down keypad	If unused, keep it open.
PWRKEY	114	I	Power on keypad	
Sensors				
SENSOR_I2C_SCL	91	O	Sensors I2C, pull-up resistors are needed externally	1.8V power domain. External pull-up resistors are required.
SENSOR_I2C_SDA	92	I/O		
ALSP_INT_N/ GPIO_94	107	I	Ambient light and proximity sensor interrupt	
MAG_INT_N/ GPIO_36	108	I	Magnetic sensor interrupt	

ACCL_INT2_N/ GPIO_65	109	I	Accelerate sensor interrupt 2	
ACCL_INT1_N/ GPIO_96	110	I	Accelerate sensor interrupt 1	
ADC				
VBAT_SNS	133	I	Battery voltage sense	Must be used. Maximum input voltage is 1.7V.
ADC	128	I	Analog to digital converter	Maximum input voltage is 4.5V. If unused, keep it open.
VBAT_THERM	134	I	Battery thermistor	
Audio				
EAR_P	8	O	Earpiece output, positive	
EAR_M	9	O	Earpiece output, negative	
HPH_R	136	O	Headphone output, right channel	
HPH_GND	137	I	Headphone ground reference	
HPH_L	138	O	Headphone output, left channel	
HS_DET	139	I	Headset detection	
GND_MIC	5	P	Microphone input 2 ground reference	
MIC2P	6	I	Microphone input 2, positive	
MIC1P	4	I	Microphone input 1, positive	
SPK_P	10	O	Speaker driver output, positive	
SPK_M	11	O	Speaker driver output, negative	
MIC_BIAS1	194	O	Microphone bias 1	Bias for external MEMS Microphone； ECM: keep MIC_BIAS1/2 open
MIC_BIAS2	210	O	Microphone bias 2	
Vibrator				
VIB_DRV_N	28	P,O	Vibration motor driver output control	
Antenna				
ANT_MAIN	87	I/O	2G/3G/4G main antenna port	SIM8905：ANT_MAIN SIM8905E-W：NC
ANT_DRX	131	I	4G diversity antenna port	SIM8905：ANT_DRX SIM8905E-W：NC SIM8905-L：NC
ANT_GNSS	121	I	GNSS antenna port	SIM8905： ANT_GNSS SIM8905E-W：NC
ANT-WIFI/BT	77	I/O	WIFI/BT antenna port	

Others				
USB_BOOT	46	I	Force boot from USB interface	
GPIO_23	33	I/O	GPIO	
GPIO_31	97	I/O	GPIO	
UART1_TXD	34	I/O	UART1_TXD	
UART1_RXD	35	I/O	UART1_RXD	
UART1_CTS	36	I/O	UART1_CTS	
UART1_RTS	37	I/O	UART1_RTS	
GPIO_32	90	I/O	GPIO	
UART2_RXD	93	I/O	UART2_RXD	
UART2_TXD	94	I/O	UART2_TXD	
GPIO_92	98	I/O	GPIO	
GPIO_88	99	I/O	GPIO	
GPIO_89	100	I/O	GPIO	
GPIO_69	101	I/O	GPIO	
GPIO_68	102	I/O	GPIO	
GPIO_97	103	I/O	GPIO	
GPIO_110	104	I/O	GPIO	
GPIO_0	105	I/O	GPIO	
GPIO_98	106	I/O	GPIO	
GPIO_58	112	I/O	GPIO	
GPIO_99	113	I/O	GPIO	
GPIO_95	115	I/O	GPIO	
GPIO_11	116	I/O	GPIO	
GPIO_10	117	I/O	GPIO	
GPIO_9	118	I/O	GPIO	
GPIO_8	119	I/O	GPIO	
GPIO_16	123	I/O	GPIO	
GPIO_17	124	I/O	GPIO	
RESIN_N	179	I	Reset	
CHARGE_SEL	127	I	Option configuration control bit1： Hi-Z → internal charger is used GND → external charger is used	
RESERVED				
RESERVED	151, 152, 153, 154, 155, 156, 157, 158,		Do not connect	

	159, 183, 187, 190, 191, 195, 196, 197, 199, 202, 203, 204, 205, 206，207		

NOTE

1. Leave unused pins floating unless otherwise specified.

2.3 Package Dimensions

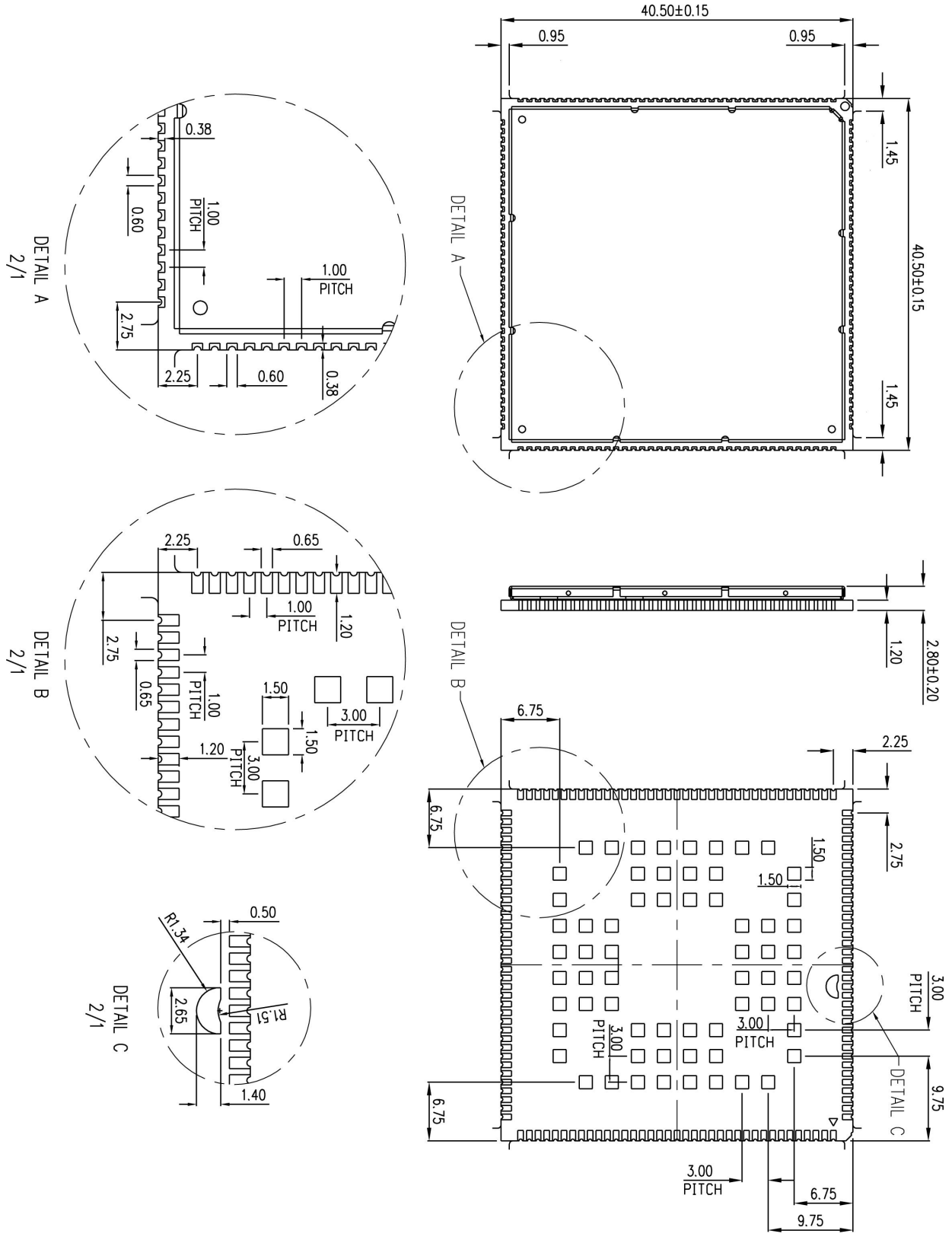

Figure 3: Dimensions of SIM8905 (Unit: mm)

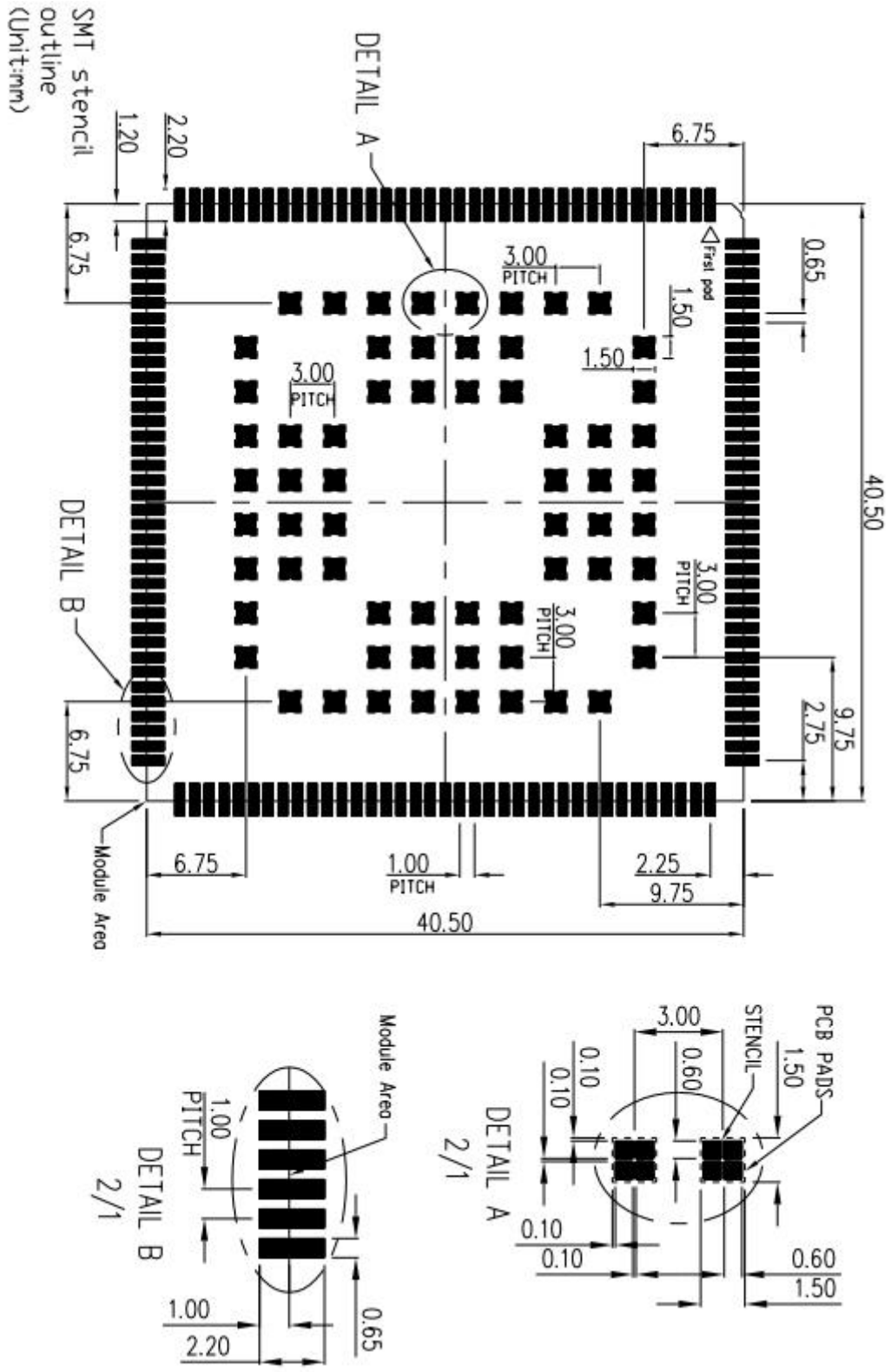

Figure 4: Recommended PCB footprint outline (Unit: mm)

3 Interface Application

3.1 Power Supply

The power supply pins of SIM8905 include VBAT_RF and VBAT_BB. VBAT_RF directly supplies the power to RF PA; VBAT_BB supplies the power to the baseband system. The power supply of SIM8905 ranges from 3.4V to 4.4V, and 3.9V is recommended. It must be able to provide sufficient current up to 3A for the high-power transmitting. Make sure the input voltage will never drop below 2.9V.

If the DC input voltage is +5V and customers do not care about the power efficiency, a high-current low-dropout regulator is recommended. Figure 5 is the reference design.

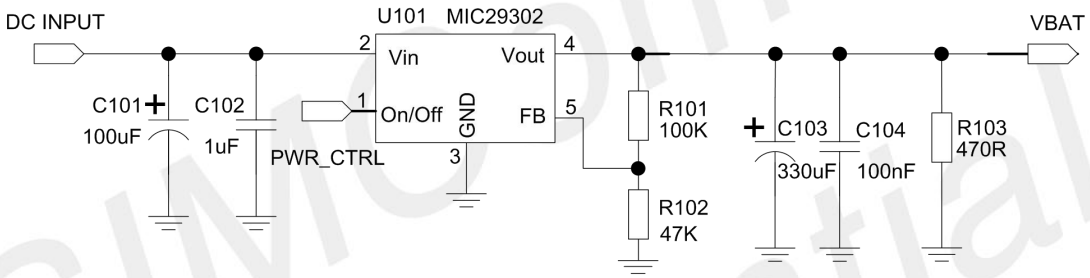

Figure 5: LDO power supply reference circuit

NOTE

1. To ensure a proper behavior of the regulator under light load, an extra minimum load (R103 in Figure 5) is required, because the current SIM8905 consumed is very small in sleep mode and power off mode. For more details about minimum load, please refer to specification of MIC29302.

To increase power efficiency, the switching mode DC-DC converter is preferable, especially when DC input voltage is quite high. The following figure is the reference design, and it is recommended to reserve a proper ferrite bead (FB101 in Figure 6) in series for EMI suppression.

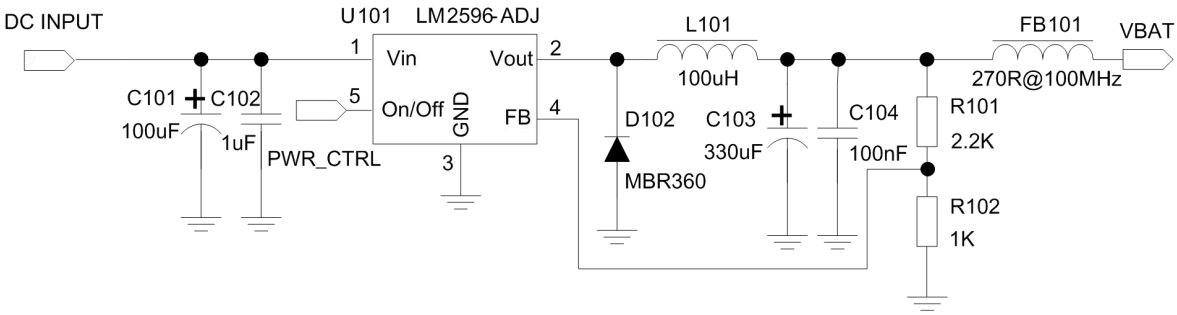

Figure 6: DC-DC power supply reference circuit

For battery-powered application, the 3.7V lithium battery can be connected to SIM8905 VBAT pins directly, but other types of battery must be used carefully, since their maximum voltage may rise over the absolute maximum voltage of the module. When battery is used, the total impedance between battery and VBAT pins should be less than 150mΩ.

In any case mentioned above, at the VBAT input pins side, please take Figure 7 as a reference:

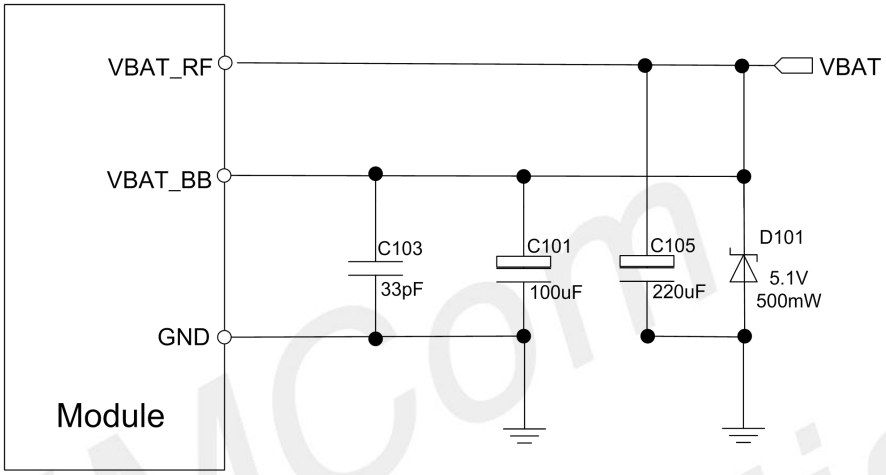

Figure 7: VBAT input reference circuit

Where C101 is a 100uF tantalum capacitor with low ESR; C105 is a 220uF tantalum capacitor with low ESR; 33pF and 10pF capacitors are used for eliminating the high frequency interference; 5.1V/500mW zener diode can protect the module against voltage surge.
All of these components should be placed as close to VBAT pins as possible.

Table 5: Recommended zener diode

No.	Vendor	Part number	Power(watts)	Packages
1	On semi	MMSZ5231BT1G	500mW	SOD123
2	Prisemi	PZ3D4V2H	500mW	SOD323
3	Vishay	MMSZ4689-V	500mW	SOD123
4	Crownpo	CDZ55C5V1SM	500mW	0805

3.2 Power on/off

3.2.1 Power on

Users can power on SIM8905 by pulling down the PWRKEY pin for more than 2 second then release. This pin is already pulled up to 1.8V internally, so external pull up is not necessary. Reference circuits are shown

as below:

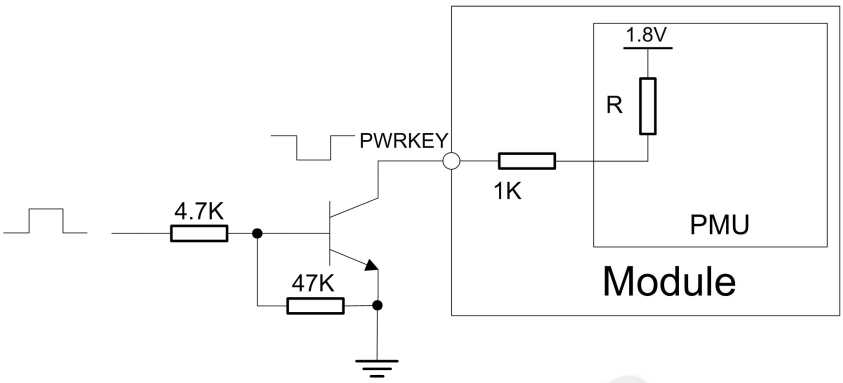

Figure 8: Powered on/down module using transistor

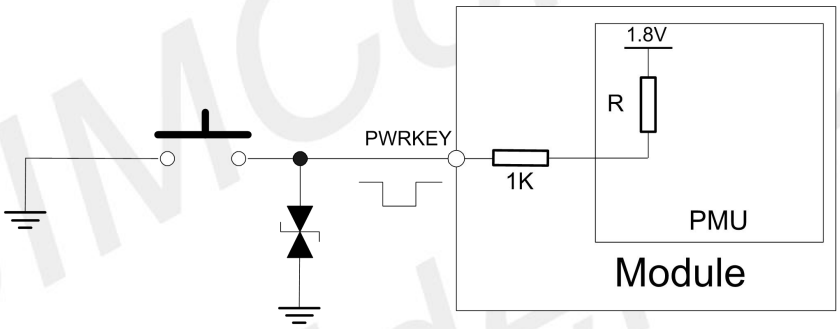

Figure 9: Powered on/down module using button

The power on sequence is illustrated in Figure 10.

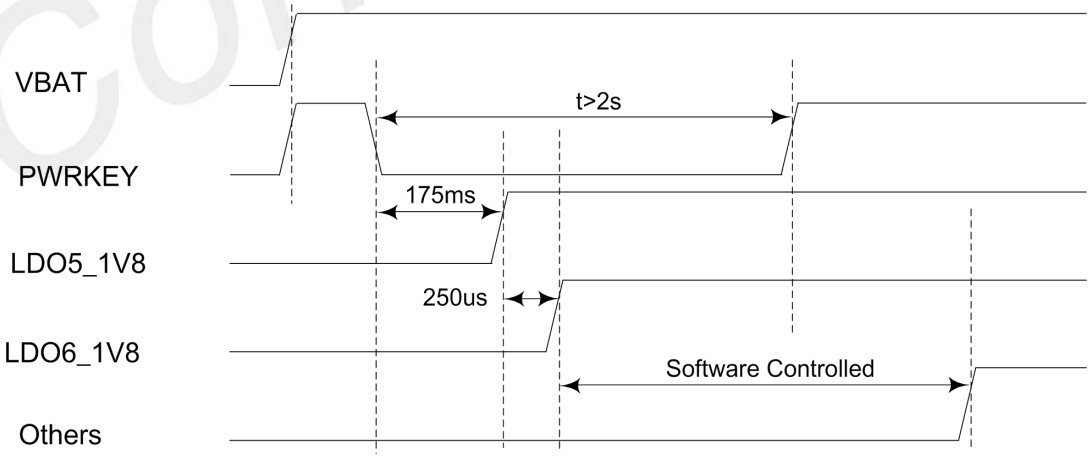

Figure 10: Timing of power on module

NOTE

1. Make sure that VBAT is stable before pulling down PWRKEY pin. The time between them is no less than 50ms.
2. PWRKEY pin cannot be pulled down all the time.
3. Please pay attention to the maximum conditions (such as voltage and temperature range) allowed by the module before starting the module,otherwise exceeding the absolute maximum value of the module may cause permanent damage to the module.

3.2.2 Power off

Users can turn off SIM8905 by pulling down the PWRKEY pin for more than 1 second. After the module detects that the PWRKEY is low level, a prompt window will pop up on the screen to confirm whether to execute the shutdown action.
Module can also be forced to shut down by pulling down PWRKEY for more than 8 seconds.

NOTE

1. The VBAT power supply circuit of the module can be cut off in the customer's hardware design.
2. It is recommended to add a low-cost MCU, which can control the PWRKEY to power on and power off the module, as well as the hardware watchdog to protect the normal operation.
3. Do not directly cut off the power supply VBAT of the module when the module is working normally, otherwise the internal flash of the module will be damaged. It is strongly recommended to shut down the module through PWRKEY or AT command before disconnecting the power supply VBAT of the module.

3.3 VRTC

VRTC is the power supply for RTC circuit and charger output for coin cell or backup battery. If RTC support is needed when the battery is removed, a qualified coin cell or keep-alive capacitor is required on the VRTC pin. When VBAT is present and valid, coin cell charging is enabled through software control and powered from VBAT.

- If the RTC fails, the module can synchronize the RTC clock through data connection after power on.
- Refer to table 34: VRTC characteristics for VRTC hardware parameters.
- Input voltage range of VRTC power supply is 2.0-3.25V, typical value is 3.0V, and the average current consumption is 5ua when VBAT is disconnected and VRTC is connected only.

- RTC error is 50ppm when the module is powered by VBAT; RTC error is 200ppm when the module is powered by VRTC.
- When the rechargeable button battery is connected externally, the ESR of button battery is required to be less than 2K. It is recommended to use Seiko's ms621fe fl11e.
- If VRTC PIN is connected with large capacitance externally, the recommended capacitance value is 100uF with low ESR, which can keep the real-time clock for about 45 seconds.

Reference circuits are shown as below:

Keep-alive capacitor:

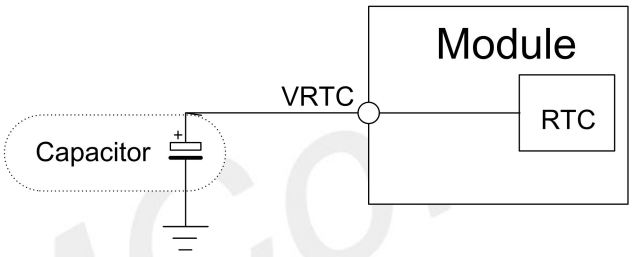

Figure 11: Keep-alive capacitor

Non-rechargeable battery:

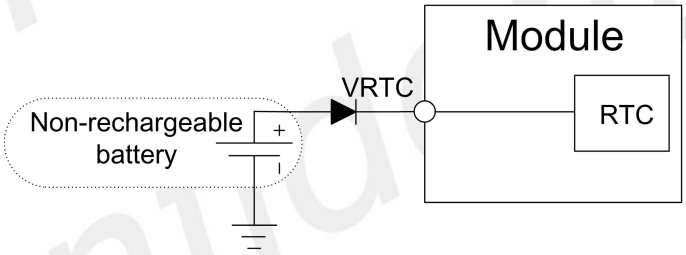

Figure 12: Non-rechargeable battery

Rechargeable battery:

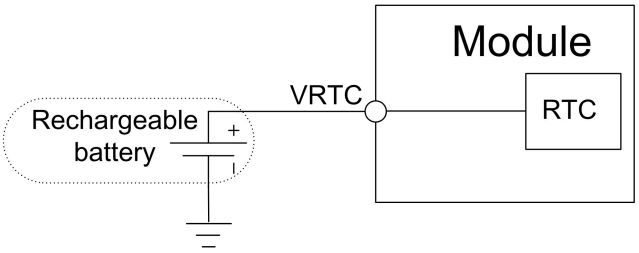

Figure 13: Rechargeable battery

VRTC typical voltage is 3.0V, and the current consumption is about 5uA when VBAT is absence. For electrical characteristics, please refer to Table 31: VRTC characteristic.

3.4 Output Power Management

Table 6: Output power management summary

Pin Name	Pin#	Specified range (V)	Rated current (mA)	Expected use
LDO5_1V8	111	1.8	50	Force USB boot
LDO6_1V8	125	1.8	200	Display, camera, sensors
SD_LDO11	38	2.95	600	SD/MMC card
SD_LDO12	32	1.8/2.95	50	For SD signals pull-up
USIM1_VDD	26	1.8/2.95	50	USIM 1
USIM2_VDD	21	1.8/2.95	50	USIM 2
LDO17_2V85	129	2.85	420	Display, camera, sensors

3.5 USB Interface

SIM8905 provides one High-speed USB 2.0 interface, used for software upgrading, debugging, charging, etc.

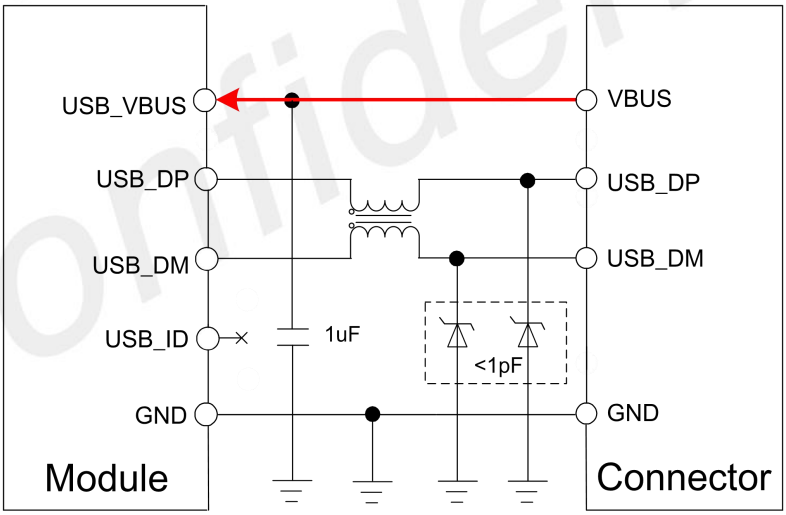

Figure 14: USB reference circuit

In addition, SIM8905 supports OTG function, but external 5V power supply is required.

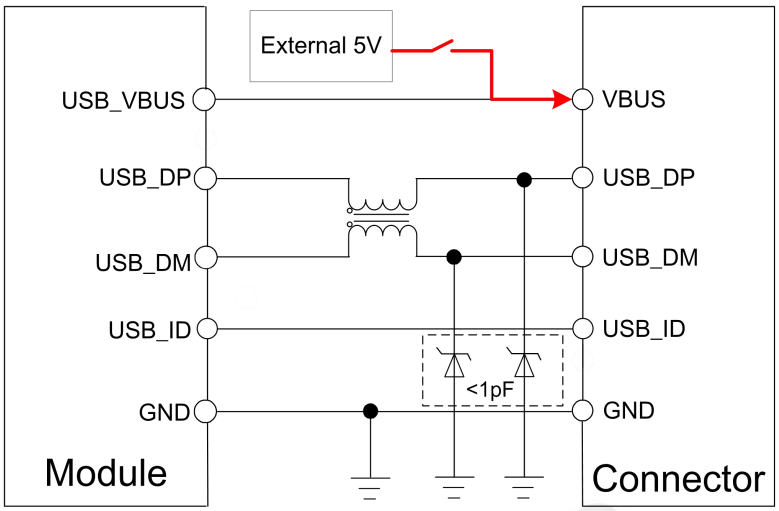

Figure 15: USB_OTG reference circuit

3.6 Linear Battery Charger

SIM8905 module integrates a 1.44A linear battery charger for single-cell lithium-ion batteries.

3.6.1 Charging Control

Battery charging is controlled by a PMIC state-machine. The first step in the automated charging process determines if trickle charging is needed. Charging of a severely depleted battery must begin with trickle charging to limit the current, avoid pulling VDD down, and protect the battery from more charging current than it can handle. Once a minimum battery voltage is established using trickle charging, constant-current charging is enabled to charge the battery quickly – this mode is sometimes called fast charging. Once the battery approaches its target voltage, the charge is completed using constant-voltage charging.

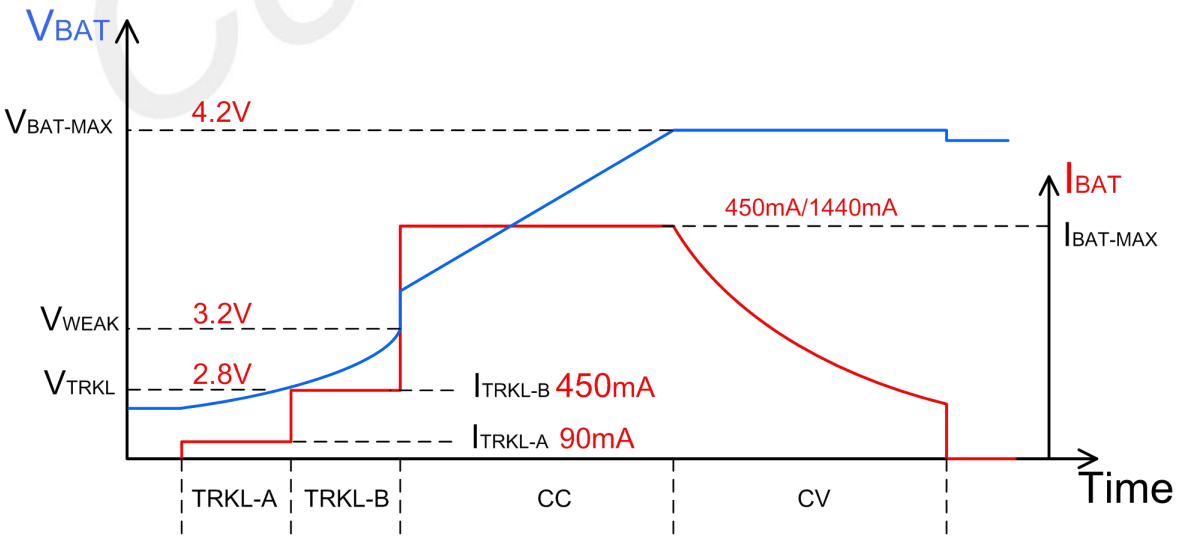

Figure 16: Charging control diagram

Table 7: Linear battery charger performance specifications

Parameter	Comments	Min	Typ	Max	Units
ITRKL-A	Trickle-A Charging current	81	90	99	mA
ITRKL-B	Trickle-B Charging current	405	450	495	mA
VTRKL	Trickle-B threshold voltage range Programmable, 15.62 mV steps	2.5	2.796	2.984	V
VWEAK	Weak battery threshold range Programmable, 18.75 mV steps	3.0	3.206	3.581	V
VBAT_MAX	Maximum battery voltage Programmable, 25 mV steps	4	4.2	4.775	V
IBAT_MAX	Fast charging current range Programmable, 90mA steps	90		1440	mA

3.6.2 VBAT_SNS

VBAT_SNS is used for battery voltage sensing, the typical input range is 2.5V~4.5V.
VBAT_SNS pin cannot be unused. It is connected to the battery positive pin when the lithium battery is used for module power supply. it is connected to the module VBAT_BB, which is powered by LDO or DCDC.

3.6.3 VBAT_THERM

VBAT_THERM is used for battery-temperature monitoring (BTM) and battery-presence detection (BPD).

To support this function, the 47K NTC thermistor (B-Constant =4050K) is required in battery pack, and the cold/hot comparator threshold settings should be 70%/35%. The allowed charging temperature range from -2℃ to 52℃, ±2℃.

If this function is not used, connecting a 47K resistor is recommended.

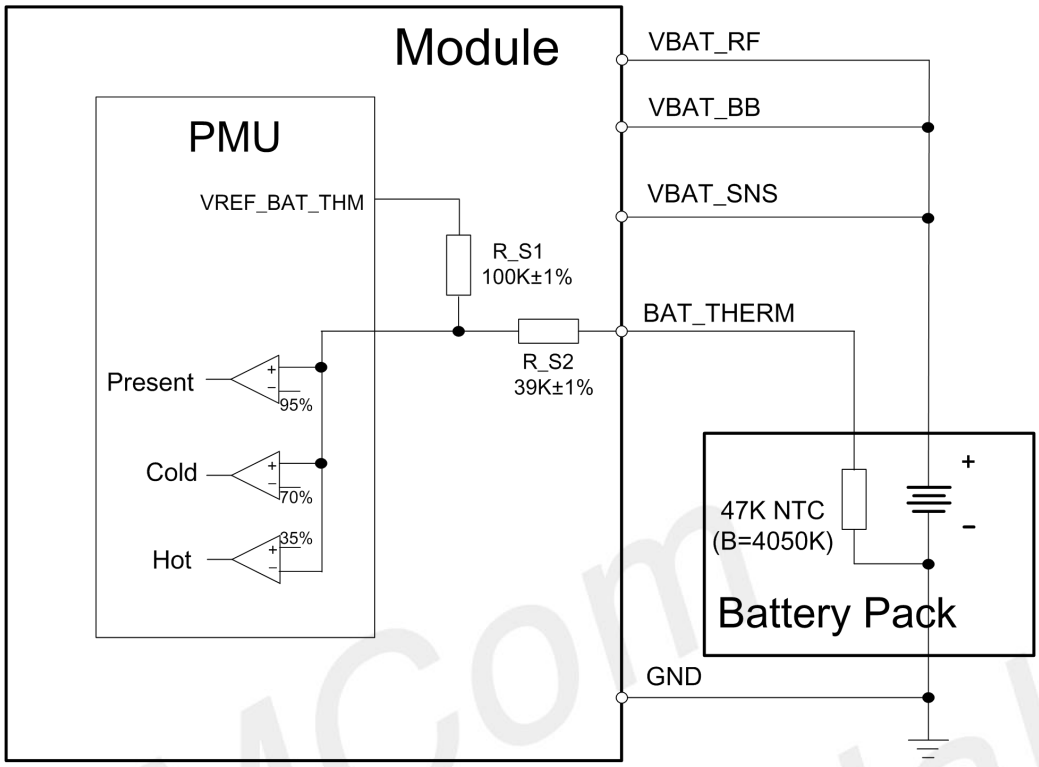

Figure 17: BPD and BTM functional block diagram

3.7 UART/SPI/I2C

SIM8905 provides several sets of GPIOs which are available as BLSP (BAM-enabled low-speed peripheral) interfaces that can be configured to support various interface combinations, as shown in the following table. The operation voltage is 1.8V

Table 8: UART/SPI/I2C functional assignments

Pin Name	Pin#	Expected or Default Function	Alternative Function 1	Alternative Function 2
UART2_TXD	94	BLSP1_UART_TX	BLSP1_SPI_MOSI	
UART2_RXD	93	BLSP1_UART_RX	BLSP1_SPI_MISO	
SENSOR_I2C_SDA	92	BLSP1_I2C_SDA	BLSP1_SPI_CS_N	BLSP1_UART_CTS
SENSOR_I2C_SCL	91	BLSP1_I2C_SCL	BLSP1_SPI_CLK	BLSP1_UART_RTS
GPIO_8	119	GPIO	BLSP6_SPI_MOSI	
GPIO_9	118	GPIO	BLSP6_SPI_MISO	
GPIO_10	117	GPIO	BLSP6_SPI_CS_N	BLSP6_I2C_SDA
GPIO_11	116	GPIO	BLSP6_SPI_CLK	BLSP6_I2C_SCL

GPIO_16	123	GPIO	BLSP5_SPI_MOSI	
GPIO_17	124	GPIO	BLSP5_SPI_MISO	
TP_I2C_SDA	48	BLSP5_I2C_SDA	BLSP5_SPI_CS_N	
TP_I2C_SCL	47	BLSP5_I2C_SCL	BLSP5_SPI_CLK	
UART1_TXD	34	BLSP2_UART_TX	BLSP2_SPI_MOSI	
UART1_RXD	35	BLSP2_UART_RX	BLSP2_SPI_MISO	
UART1_CTS	36	BLSP2_UART_CTS	BLSP2_SPI_CS_N	BLSP2_I2C_SDA
UART1_RTS	37	BLSP2_UART_RTS	BLSP2_SPI_CLK	BLSP2_I2C_SCL
CAM_I2C_SDA	84	BLSP3_I2C_SDA		
CAM_I2C_SCL	83	BLSP3_I2C_SCL		

NOTE

1. UART: can be used as a diagnostic port, up to 4 Mbps;
2. I2C: supports master-only mode; up to 3.4 MHz, 2.2Kohm pull-up resistors are needed externally;
3. SPI: supports master-only mode; up to 52 MHz.

3.8 Secure Digital Interface

SIM8905 provides one 4-bit secure digital interface, which supports the following standards:

- SD Specifications Part 1 Physical Layer Specification Version 3.00
- Part A2 SD Host Controller Standard Specification Version 3.00
- Part E1 SDIO Specification Version 3.00

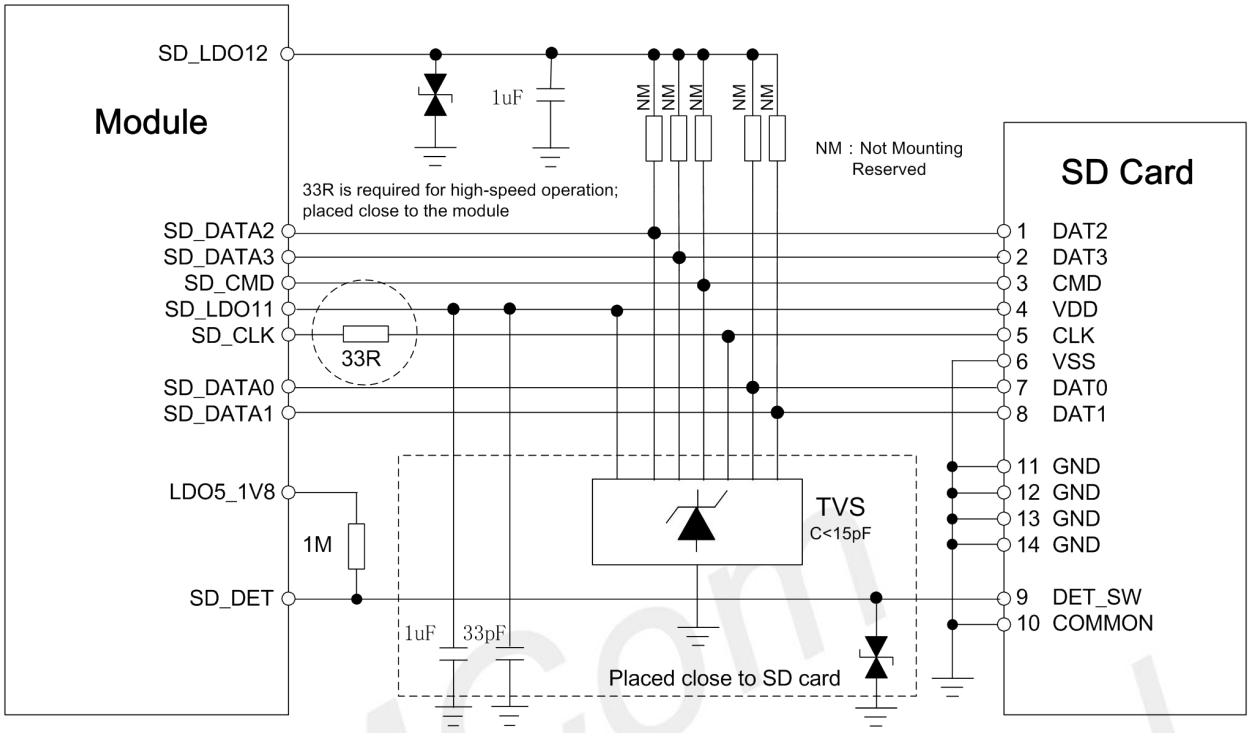

Figure 18: SD card reference circuit

3.9 Display Interface

SIM8905 provides a 4-lane MIPI_DSI, with 1.5 Gbps per lane high-speed mode bandwidth, to support 720p HD display.

PWM is used as PWM control for external WLED driver.

Table 9: Display interface pin definitions

Pin Name	Pin#	Type	Description
PWM	29	O	PWM control for external WLED driver
LCD_RST_N	49	O	LCD reset
LCD_TE	50	I	LCD tear effect
MIPI_DSI_CLK_M	52	O	MIPI display serial interface
MIPI_DSI_CLK_P	53	O	
MIPI_DSI_LANE0M	54	O	
MIPI_DSI_LANE0P	55	O	
MIPI_DSI_LANE1M	56	O	
MIPI_DSI_LANE1P	57	O	
MIPI_DSI_LANE2M	58	O	
MIPI_DSI_LANE2P	59	O	
MIPI_DSI_LANE3M	60	O	
MIPI_DSI_LANE3P	61	O	

If only 2-lane MIPI_DSI is needed, just leave LANE2 and LANE3 floating.

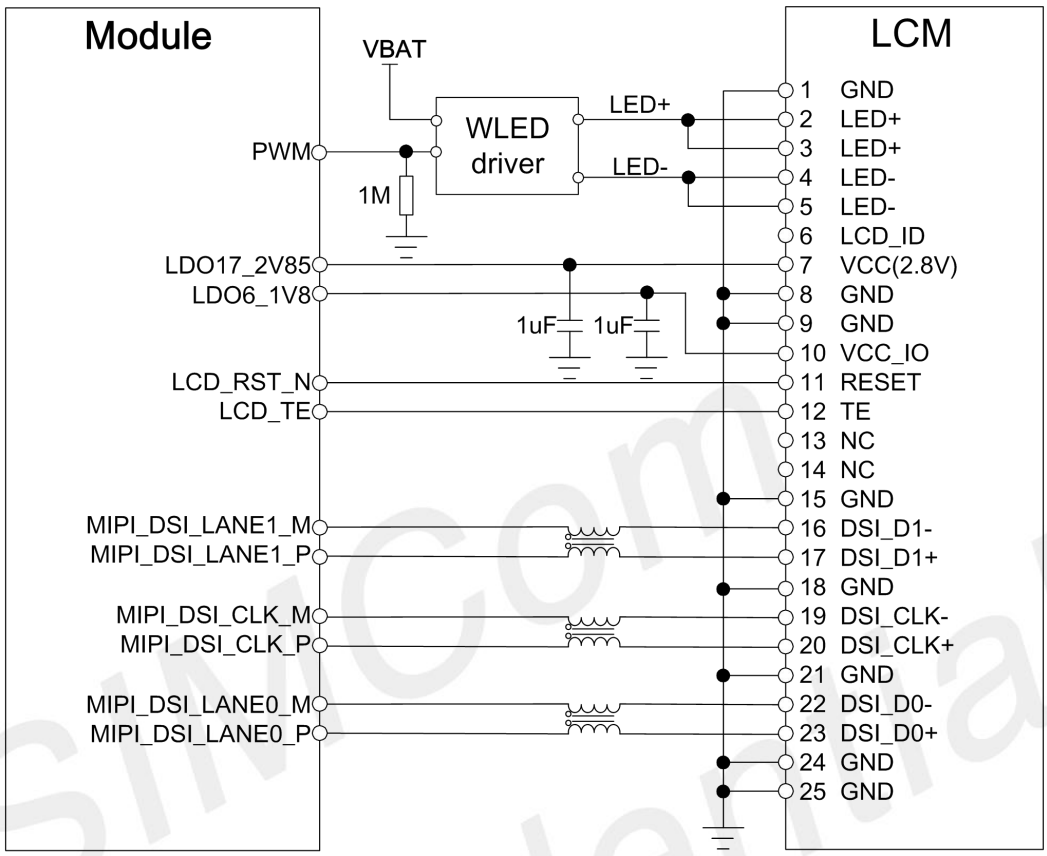

Figure 19: Display reference circuit

3.10 Touch Screen Interface

Table 10: Touch screen interface pin definitions

Pin Name	Pin#	Type	Description
TP_I2C_SDA	48	I/O	Touch screen I2C data
TP_I2C_SCL	47	O	Touch screen I2C clock
TP_INT_N	30	I	Touch screen interrupt
TP_RST_N	31	O	Touch screen reset

NOTE

1. TP_I2C: supports master-only mode; 2.2Kohm pull-up resistors are needed externally;

3.11 Camera Interface

SIM8905 supports two cameras: 2-lane MIPI_CSI primary camera up to 8MP resolution and 1-lane MIPI_CSI secondary camera up to 5MP resolution.

Table 11: Camera interface pin definitions

Pin Name	Pin#	Type	Description
MIPI_CSI0_CLK_M	63	I	Primary camera serial interface
MIPI_CSI0_CLK_P	64	I	
MIPI_CSI0_LN0_M	65	I	
MIPI_CSI0_LN0_P	66	I	
MIPI_CSI0_LN1_M	67	I	
MIPI_CSI0_LN1_P	68	I	
MIPI_CSI1_CLK_M	70	I	Secondary camera serial interface
MIPI_CSI1_CLK_P	71	I	
MIPI_CSI1_LN0_M	72	I	
MIPI_CSI1_LN0_P	73	I	
CAM0_MCLK	74	O	Primary Camera master clock
CAM1_MCLK	75	O	Secondary Camera master clock
CAM0_RST_N	79	O	Primary Camera reset
CAM0_PWDN	80	O	Primary Camera power down
CAM1_RST_N	81	O	Secondary Camera reset
CAM1_PWDN	82	O	Secondary Camera power down
CAM_I2C_SCL	83	O	Camera I2C clock
CAM_I2C_SDA	84	I/O	Camera I2C data

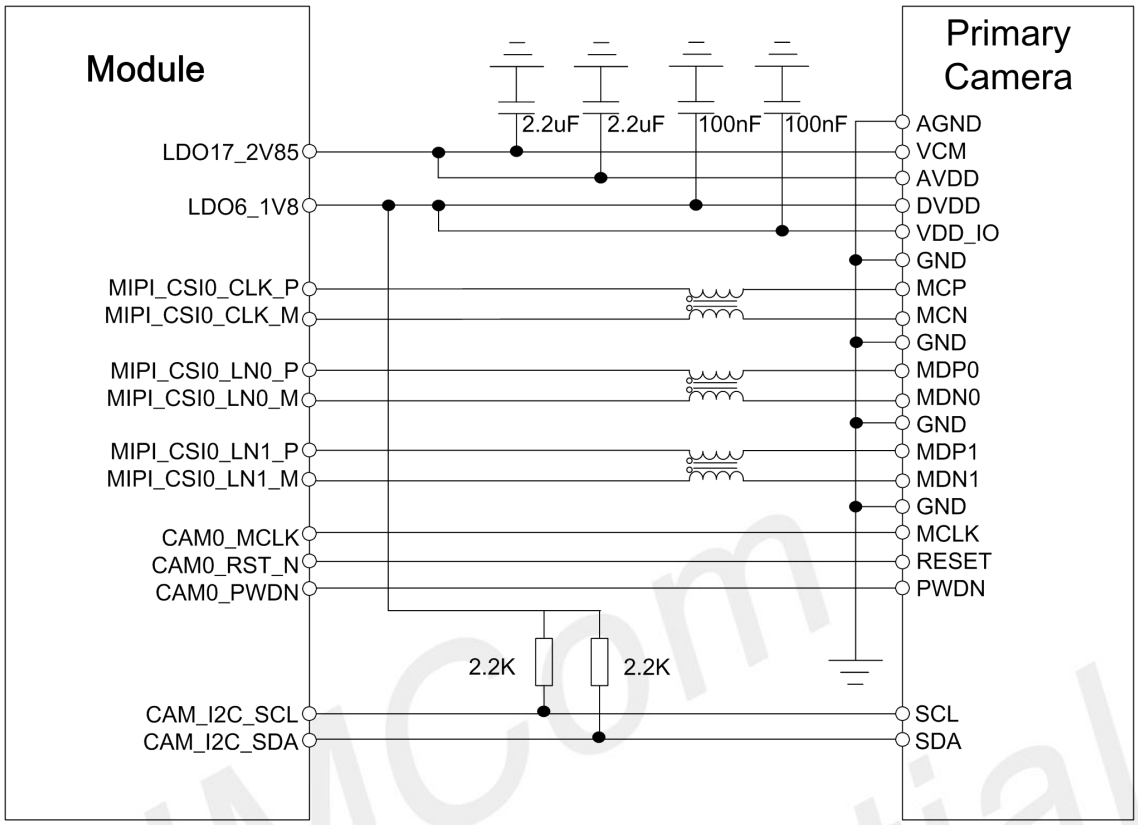

Figure 20: Primary camera reference circuit

3.12 Audio

SIM8905 provides two microphone inputs and three outputs including earpiece, stereo headphones, and mono class-D speaker driver.

Table 12: Audio interface pin definitions

Pin Name	Pin#	Type	Description
EAR_P	8	O	Earpiece output, positive
EAR_M	9	O	Earpiece output, negative
HPH_R	136	O	Headphone output, right channel
HPH_GND	137	I	Headphone ground reference
HPH_L	138	O	Headphone output, left channel
HS_DET	139	I	Headset detection
GND_MIC	5	P	Microphone input 2 ground reference
MIC2P	6	I	Microphone input 2, positive
MIC1P	4	I	Microphone input 1, positive
SPK_P	10	O	Speaker driver output, positive
SPK_M	11	O	Speaker driver output, negative

MIC_BIAS1	194	O	Microphone bias 1
MIC_BIAS2	210	O	Microphone bias 2

3.12.1 Microphone

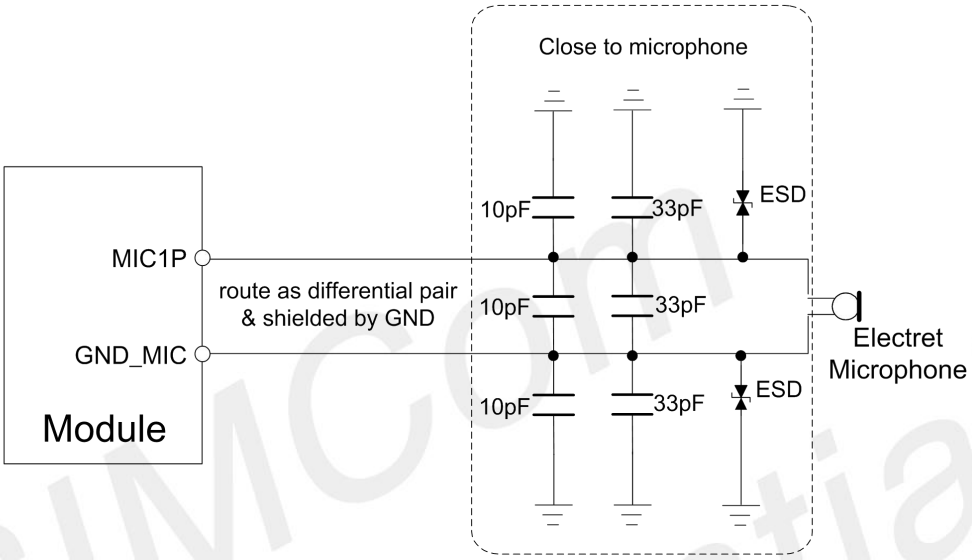

Figure 21: Microphone reference circuit

NOTE

1. Internal MIC_BIAS pull-up is used to reduce BOM cost and PCB routing.
2. Single-ended capless input is the only supported configuration, but differential routing is recommended.

Table 13: Analog microphone input performance

Parameter	Test conditions	Min	Typ	Max	Units
Microphone amplifier gain = 0 dB (minimum gain)					
Input referred noise	Single-ended, A-weighted, capless	-	19.3	25.1	μVrms
Signal-to-noise ratio	Single-ended, A-weighted, capless	92.0	94.0	-	dB
THD+N ratio Analog input = -1 dBV	f = 1.02 kHz; single-ended input; 200 Hz to 20 kHz bandwidth; capless	-	-86.0	-70.0	dB
Microphone amplifier gain = 6 dB					
Input referred noise	Single-ended, A-weighted, capless	-	5.9	7.1	μVrms
Signal-to-noise ratio	Single-ended, A-weighted, capless	91.0	92.5	-	dB
THD+N ratio	f = 1.02 kHz; single-ended input;	-	-85.0	-70	dB

Analog input = -1 dBV	200 Hz to 20 kHz bandwidth; capless				
Microphone amplifier gain = 24 dB (maximum gain)					
Input referred noise	Single-ended, A-weighted, capless	-	3.4	4.2	μVrms
Signal-to-noise ratio	Single-ended, A-weighted, capless	84.2	85.4	-	dB
THD+N ratio Analog input = -1 dBV	f = 1.02 kHz; single-ended input; 200 Hz to 20 kHz bandwidth; capless	-	-82.4	-76.0	dB
General requirements					
Full-scale input voltage	Single-ended 1 kHz input. Input signal level required to get 0 dBFS digital output	-0.5	0	0.5	dBV
Input impedance Capless input Input disabled		 1.0 3.0	 - -	 - -	 MΩ MΩ
Input capacitance	Capless input	-	-	15	pF

3.12.2 Headset

Stereo class-AB headphone supports 16 Ω, 32 Ω, and up to 50 KΩ loads. Its typical output power at 1.02 KHz and THD + N ≤ 1% is:

- 21.5 mW with 16 Ω loads, 0 dBFS and -4.5 dB gain
- 30.8 mW with 32 Ω loads, 0 dBFS and 0 dB gain

A 100KΩ pull-down resistor is integrated at HPH_L pin, which could be used for mechanical insertion or removal detection through HS_DET pin. Figure 22 shows the reference circuit for normally-closed (NC) type headset jack.

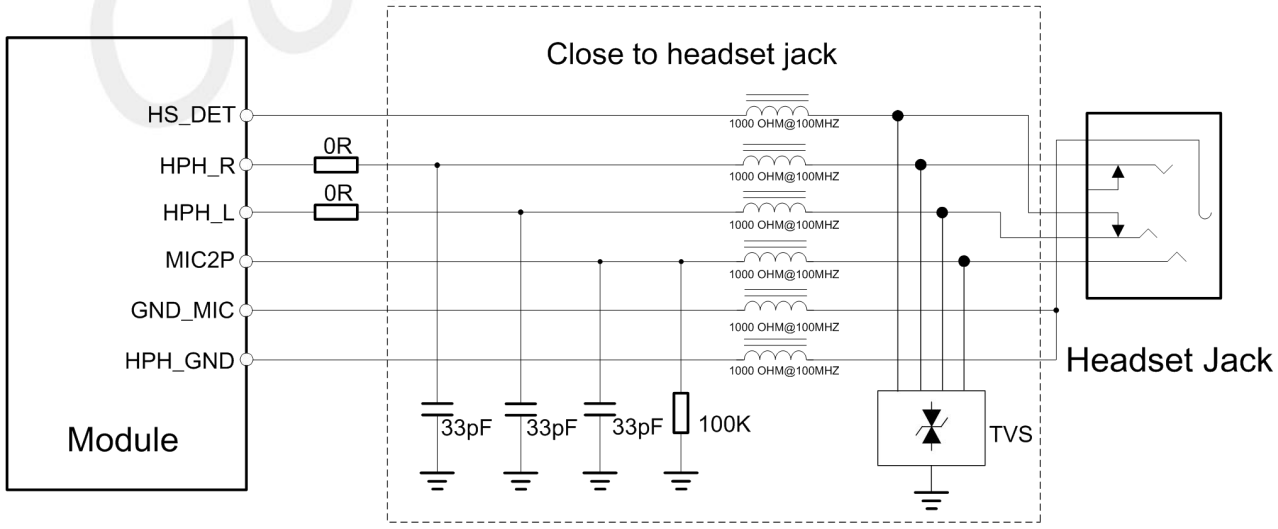

Figure 22: Headset reference circuit

NOTE

1. SIM8905 also supports NO/NC type headset jack with detect pin on HPH_L or GND.
2. HPH has a negative swing and requires a bi-directional TVS diode.

Table 14: Headphone output performance specifications

Parameter	Test conditions	Min	Typ	Max	Units
Output power	16 Ω load f = 1.02 kHz, 0 dB FS; VDD_CP* = 1.95 V	15.6	21.5	25.5	mW
	32 Ω load f = 1.02 kHz, 0 dB FS; VDD_CP* = 1.95 V	27.0	30.8	32.0	mW
Full-scale output Voltage	16 Ω load f = 1.02 kHz, 0 dB FS; VDD_CP* = 1.95 V	0.50	0.59	0.64	Vrms
	32 Ω load f = 1.02 kHz, 0 dB FS; VDD_CP* = 1.95 V	0.96	0.99	1.00	Vrms
Output load		13.0	16/32	-	Ω
Disabled output impedance	Measured externally, with amplifier disabled	1.0	-	-	MΩ

NOTE

1. The VDD_CP is internal Voltage of module.

3.12.3 Earpiece

Class AB earpiece driver supports 10.67 Ω, 16 Ω, 32 Ω, and up to 50 KΩ loads. Its typical output power at 1.02 KHz, 6 dB gain, and THD + N ≤ 1% is:

- 119 mW with 32 Ω loads
- 243 mW with 16 Ω loads
- 320 mW with 10.67 Ω loads

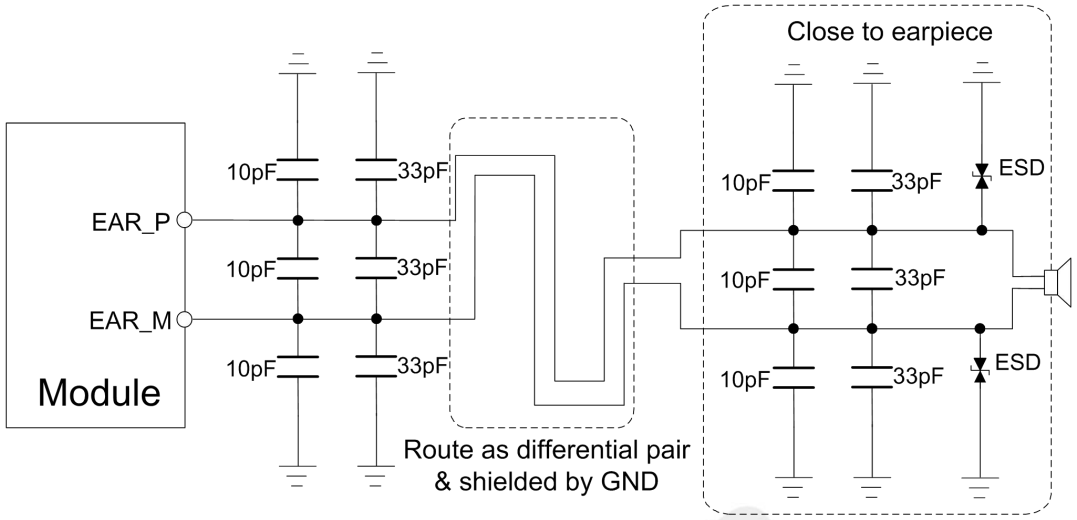

Figure 23: Earpiece reference circuit

Table 15: Earpiece output performance specifications

Parameter	Test conditions	Min	Typ	Max	Units
Output power	32 Ω load f = 1.02 kHz, 6 dB gain THD+N < 1%	120.0	124.5	-	mW
	16 Ω load f = 1.02 kHz, 6 dB gain THD+N < 1%	235.0	243.0	-	mW
Full-scale output Voltage	6 dB gain mode f = 1.02 kHz	1.8	2.0	2.1	Vrms
	1.5 dB gain mode f = 1.02 kHz	1.0	1.2	1.3	Vrms
Output load		10.7	32	-	Ω
Disabled output impedance	Measured externally, amplifier disabled	1.0	-	-	MΩ

3.12.4 Speaker

Class-D mono differential loud speaker driver supports 4 Ω and 8 Ω loads. The driver is powered from VBAT, and does not support external 5 V Boost Option. Its typical output power at 1.02 KHz, 12 dB gain, and THD + N ≤ 1% is:

- 950 mW with 8 Ω loads, VDD_SPKR=VBAT= 4.2 V
- 692 mW with 8 Ω loads, VDD_SPKR=VBAT= 3.6 V
- 1063 mW with 4 Ω loads, VDD_SPKR=VBAT= 3.6 V

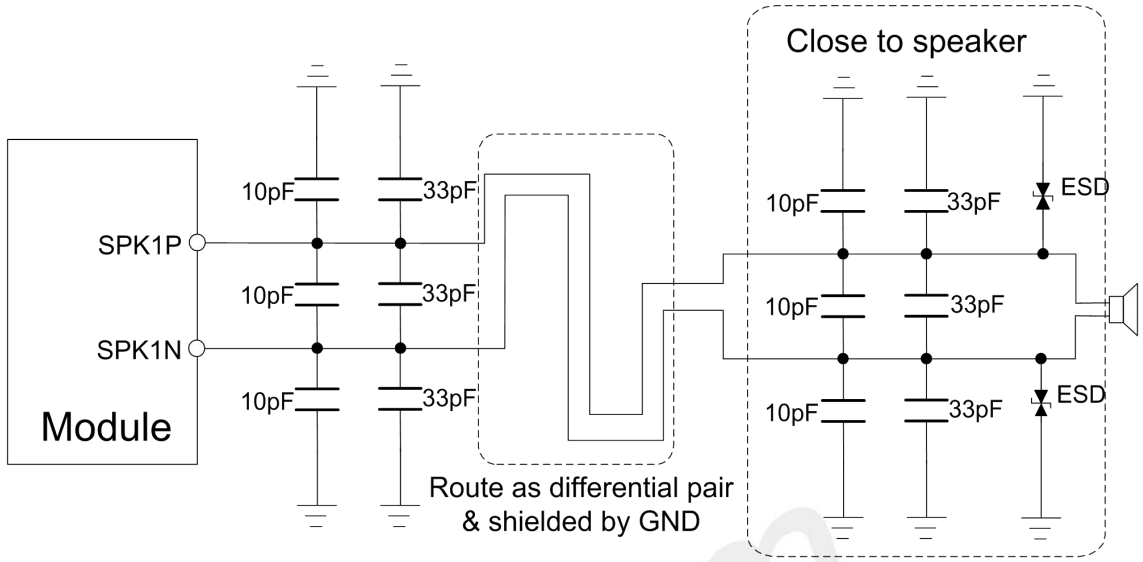

Figure 24: Speaker reference circuit

Table 16: speaker driver output performance specifications

Parameter	Test conditions	Min	Typ	Max	Units
Output power (Pout) (f = 1 kHz, gain = 12 dB, THD+N ≤ 1%)	15 μH + 8 Ω + 15 μH, Vdd = 3.6 V	584	631	-	mW
	15 μH + 4 Ω + 15 μH, Vdd = 3.6 V	862	953	-	mW
	15 μH + 8 Ω + 15 μH, Vdd = 3.8 V	662	710	-	mW
	15 μH + 8 Ω + 15 μH, Vdd = 4.2 V	819	879	-	mW
THD+N (1 kHz)	1 W Pout, VDD_SPKR = 4.2 V	-	-85.0	-75.0	dB
	800 mW Pout, VDD_SPKR = 4.2 V	-	-75.0	-45.0	dB
	600 mW Pout, VDD_SPKR = 3.8 V	-	-75.0	-70.0	dB
	500 mW Pout, VDD_SPKR = 3.6 V	-	-76.0	-71.0	dB
Efficiency （Vdd = 3.7 V）	500 mW Pout, 15 μH + 8 Ω + 15 μH	82.0	84.0	-	%
	1 W Pout, 15 μH + 4 Ω + 15 μH	73.0	78.0	-	%
output impedance	Disabled	25	-	-	kΩ
Shutdown	current	-	0.1	1.0	μA
Turn on time		-	0.2	10.0	ms

3.12.5 Microphone bias

SIM8905 provides two microphone bias outputs: MIC_BIAS1and MIC_BIAS2. The microphone bias cannot be used for ECM-type microphone. MIC_BIAS1and MIC_BIAS2 could be used for External MEMS microphone as power supply.

The microphone bias output performance specifications are shown in the following table:

Table 17: Microphone bias output performance specifications

Parameter	Test conditions	Min	Typ	Max	Units
Output voltage	No load	1.60	-	2.85	V
Output voltage error	No load	-3.00	0.00	3.00	%
Output current	2 microphone loads of 1.0 to 1.5 mA each	2.0	3.0	-	mA
Output switch to ground	On resistance	-	-	20	Ω
	Sink current	2.0	-	-	mA
Output noise	0.1 μF bypass	0.0	2.0	4.0	μVrms
PSRR-Power supply rejection ratio	at 20 Hz	80	-	-	dB
	at 200 Hz to 1 kHz	80	-	-	dB
	at 5 kHz	80	-	-	dB
	at 10 kHz	80	-	-	dB
	at 20 kHz	75	-	-	dB
Output capacitor value [2]	External bypass mode [1]	0.1	0.1	0.5	μF

3.13 USIM Interface

SIM8905 supports dual cards dual standby, and card presence detection.

NOTE

1. The standard software provided by SIMCom only supports single USIM1 card configuration.

Table 18: USIM interface pin definitions

Pin Name	Pin#	Type	Description
USIM2_DET	17	I	USIM2 presence detection
USIM2_RST	18	O	USIM2 reset
USIM2_CLK	19	O	USIM2 clock
USIM2_DAT	20	I/O	USIM2 data
USIM2_VDD	21	P	LDO 15 output for USIM2, 1.8V/2.95V
USIM1_DET	22	I	USIM1 presence detection
USIM1_RST	23	O	USIM1 reset
USIM1_CLK	24	O	USIM1 clock
USIM1_DAT	25	I/O	USIM1 data
USIM1_VDD	26	P	LDO 14 output for USIM1, 1.8V/2.95V

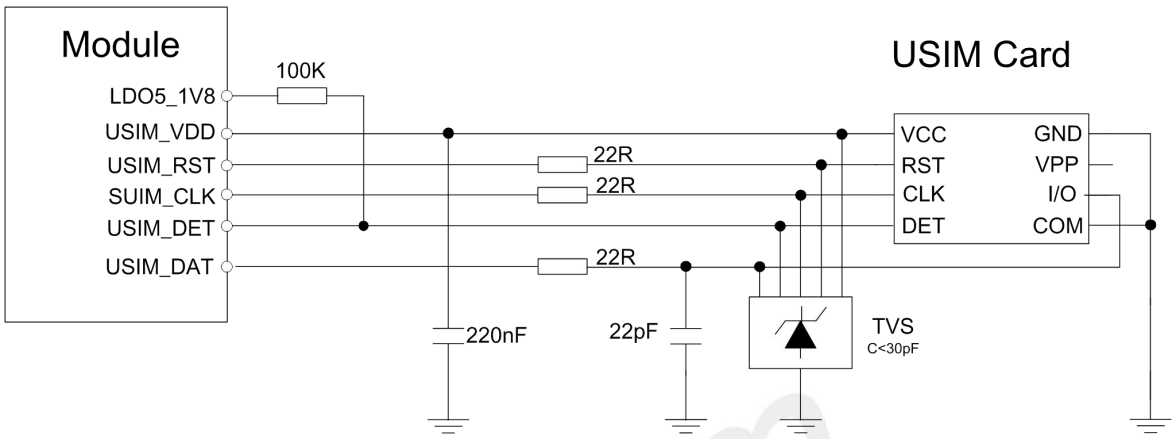

Figure 25: USIM card reference circuit

NOTE

1. USIM_DAT has been pulled up with a 10kohm resistor to USIM_VDD in module.
2. A 220nF shut capacitor on USIM_VDD is used to reduce interference.

3.14 ADC

SIM8905 provides one 16bits ADC. Its performance parameters are shown as the following table.

Table 19: ADC performance parameters

Parameter	Test conditions	Min	Typ	Max	Units
Input voltage range	Programmable	0.1 0.3	- -	1.7 4.5	V
Resolution		-	16	-	bits
Analog input bandwidth		-	100	-	kHz
Sample rate	XO/8	-	2.4	-	MHz
INL	15-bit output	-	-	±8	LSB
DNL	15-bit output	-	-	±4	LSB
Offset error	Relative to full-scale	-	-	±1	%
Gain error	Relative to full-scale	-	-	±1	%

3.15 Vibrator

SIM8905 supports silent incoming-call alarms with its vibration motor driver. The vibration driver is a programmable voltage output that is referenced to VBAT; when off, its output voltage is VBAT. The motor is connected between VBAT and the VIB_DRV_N pin. The programmable motor voltage ranges from 1.2 to 3.1 V in 100 mV steps.

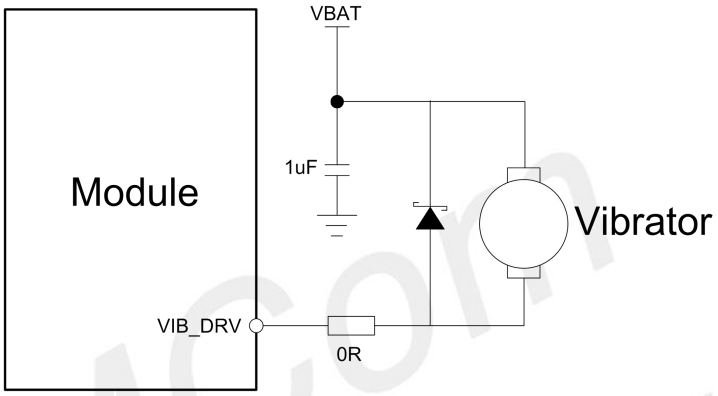

Figure 26: Vibrator reference circuit

3.16 Antenna Interface

SIM8905 provides four antenna interfaces including MAIN antenna, DRX antenna, GNSS antenna, and WiFi/BT antenna. To ensure good RF performance, users should meet the following requirements:

- Keep the RF traces at 50Ω.
- Maintain a complete and continuous reference ground plane from antenna pin to the RF connector.
- The RF traces should be away from any other noisy traces.
- Keep the RF traces as short as possible.

3.16.1 MAIN Antenna reference circuit

The recommended circuit is shown as below:

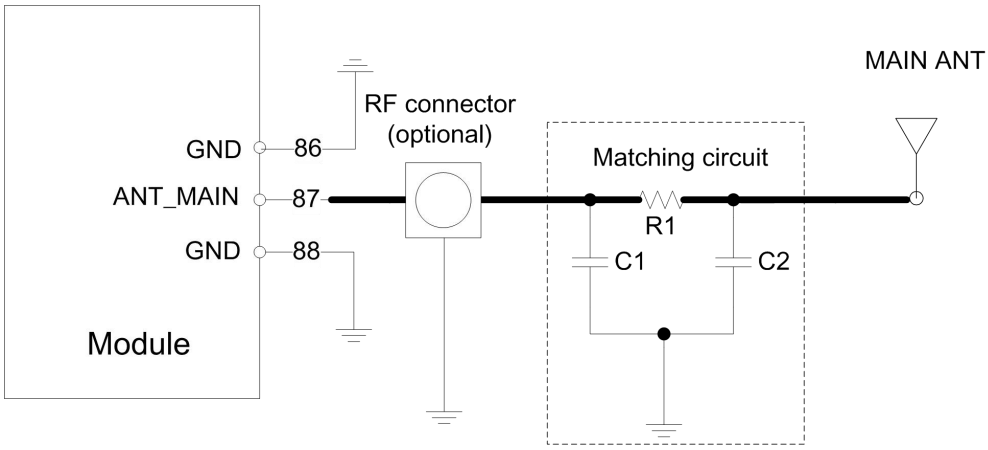

Figure 27: MAIN antenna recommended circuit

R1, C1 and C2 are antenna matching components in Figure 27, the value of these components are determined according to the antenna tuning results. By default, R1 is 0Ω, C1 and C2 are reserved. The RF connector in Figure 27 is used to ensure the accuracy and convenience of the conduction testing, so SIMCOM suggest keeping it. If considering Low-Cost BOM, user can cancel the connector.

3.16.2 DRX Antenna reference circuit

The recommended circuit is shown as below:

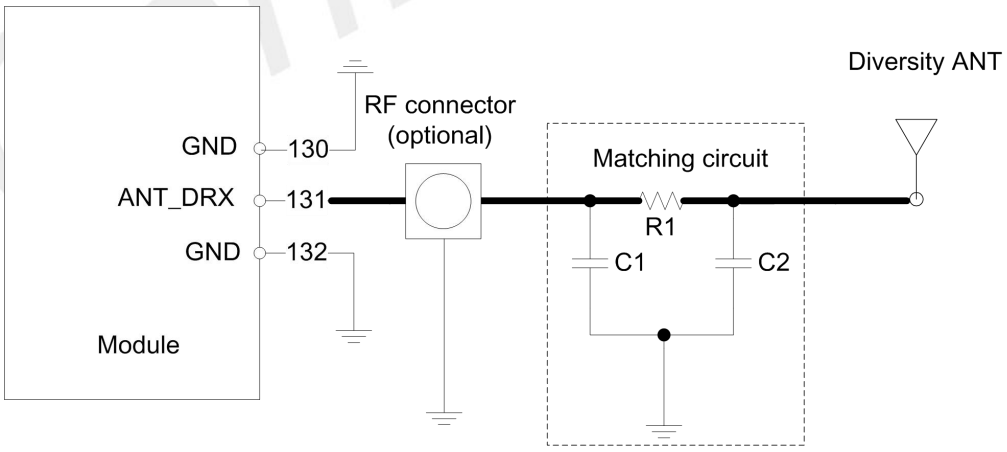

Figure 28: DRX antenna recommended circuit

R1, C1 and C2 are antenna matching components in Figure 28, the value of these components are determined according to the antenna tuning results. By default, R1 is 0Ω, C1 and C2 are reserved. The RF connector in Figure 28 is used to ensure the accuracy and convenience of the conduction testing, so

SIMCOM suggest keeping it. If considering Low-Cost BOM, user can cancel the connector.

3.16.3 GNSS Antenna reference circuit

The recommended circuit is shown as below:

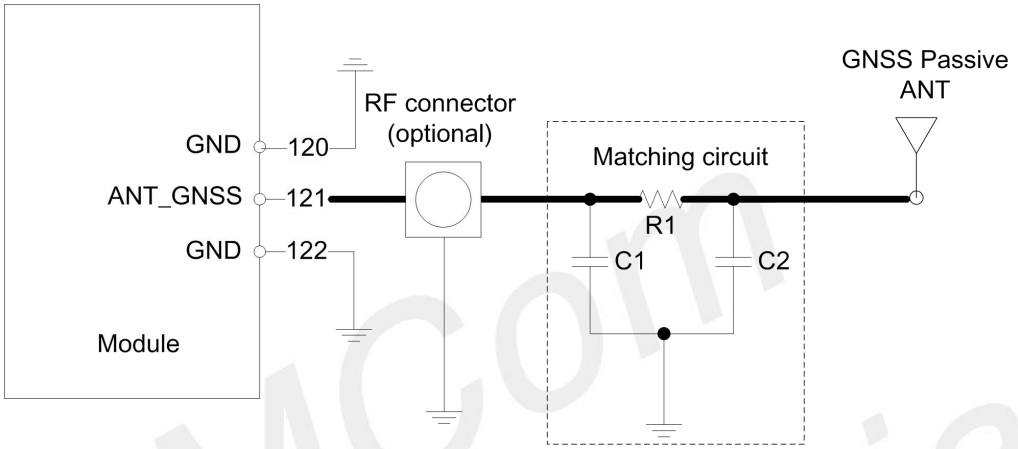

Figure 29: GNSS antenna recommended circuit

R1, C1 and C2 are antenna matching components in Figure 29, the value of these components are determined according to the antenna tuning results. By default, R1 is 0Ω, C1 and C2 are reserved. The RF connector in Figure 29 is used to ensure the accuracy and convenience of the conduction testing, so SIMCOM suggest keeping it. If considering Low-Cost BOM, user can cancel the connector.

The module has internal LAN, so there is no need for external active antenna. But if the antenna is far away the module and need a long cable to connect, users can use external active antenna, the recommended circuit is shown as Figure 30:

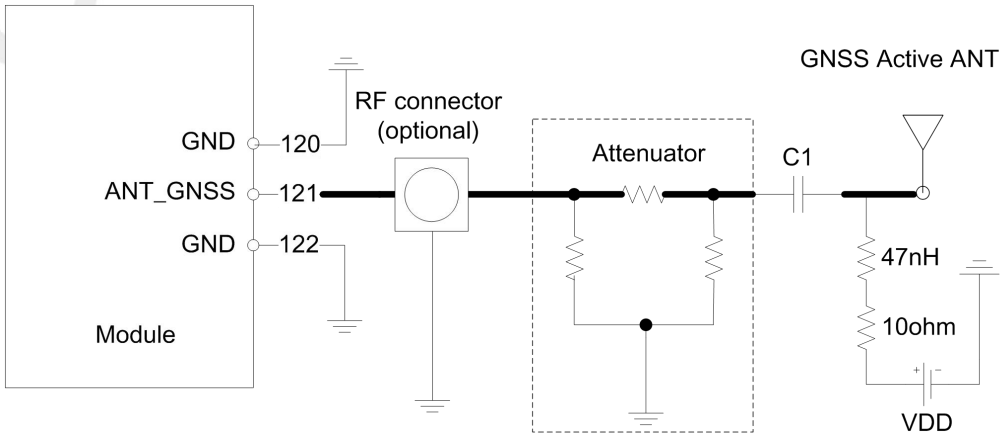

Figure 30: GNSS active antenna circuit

The attenuator in Figure 30 must be added as required and attenuation value is determined according to the active antenna gain. Normally, the relationship between the attenuation value and the gain satisfies the following formula:

Antenna gain = Attenuation value + Cable Losses

In Figure 30, the VDD is used to provide voltage to the external active antenna and its value should be taken according to antenna characteristic; C1 is used for DC blocking and its value is 33pF by default.; the RF connector is used to ensure the accuracy and convenience of the conduction testing, if considering LOW-Cost BOM, users can cancel it.

3.16.4 WiFi/BT Antenna reference circuit

The recommended circuit is shown as below:

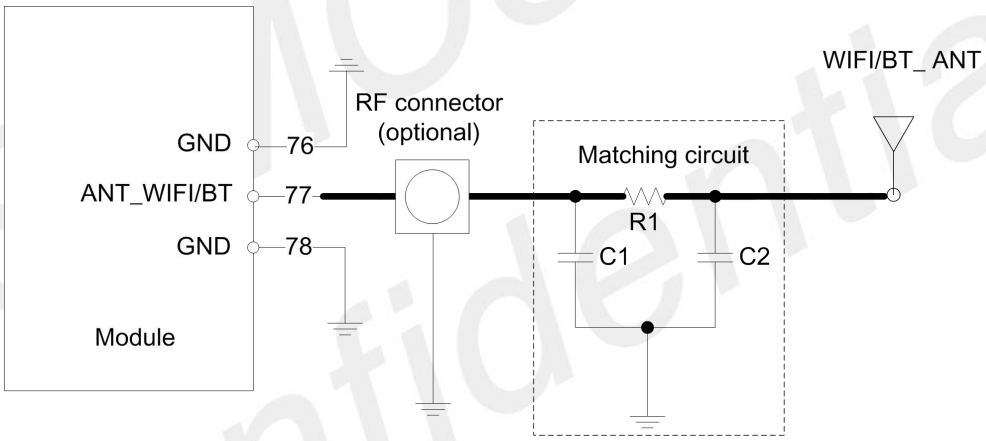

Figure 31: WIFI/BT antenna recommended circuit

R1, C1 and C2 are antenna matching components in Figure 31, the value of these components are determined according to the antenna tuning results. By default, R1 is 0Ω, C1 and C2 are reserved. The RF connector in Figure 31 is used to ensure the accuracy and convenience of the conduction testing, so SIMCOM suggest keeping it. If considering Low-Cost BOM, user can cancel the connector.

3.16.5 GSM / CDMA 1X / UMTS / LTE layout guidance

The characteristic impedance of RF signals should be controlled at 50 ohm. In general, the impedance of RF signal is determined by the Permittivity (ER) of PCB material, line width (W), ground clearance (S), height of reference ground plane (H) and other factors.

Microstrip line and coplanar waveguide are usually used to control the characteristic impedance of RF

wiring. The following illustrations show the structure design of microstrip line and coplanar waveguide.

- **Microstrip line structure**

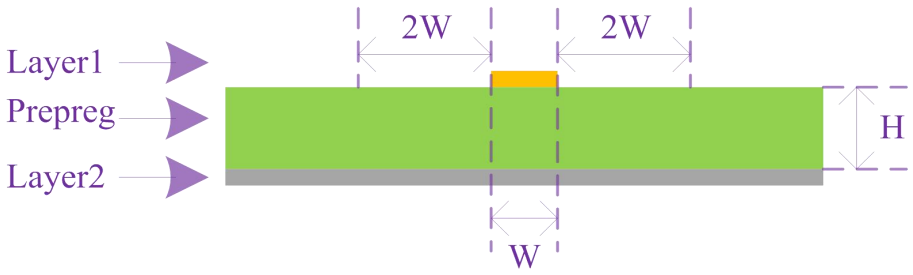

Figure 32: Two layer PCB microstrip structure

Table 20: Example of impedance control of microstrip line structure

PCB thickness	Permittivity (ER)	Line thickness	Layer	Reference plane	Target impedance	Expected linewidth W
1mm	4.2	0.035mm	Layer1	Layer2	50 ohm	1.7mm (67 mil)
1.6mm	4.2	0.035mm	Layer1	Layer2	50 ohm	3mm (118 mil)

- **Coplanar waveguide (CPW) structure**

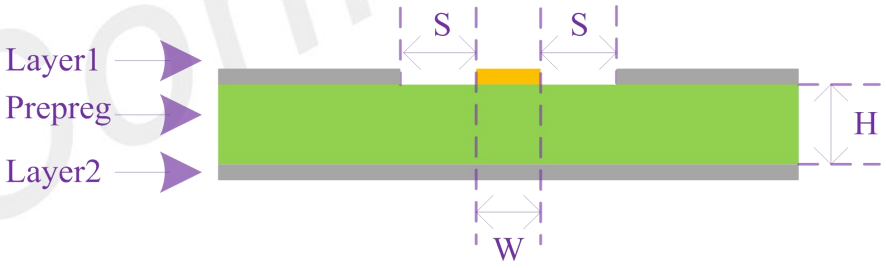

Figure 33: Two layer PCB coplanar waveguide structure

Table 21: Example of impedance control of coplanar waveguide structure

PCB thickness	Permittivity (ER)	Line thickness	Layer	Reference plane	Target impedance	Expected gap to ground S	Expected linewidth W
1mm	4.2	0.035mm	Layer 1	Layer2	50 ohm	0.65mm (25.6 mil)	0.2mm (7.8 mil)
1.6mm	4.2	0.035mm	Layer 1	Layer2	50 ohm	0.65mm (25.6 mil)	0.15mm (5.9 mil)

Four layer PCB coplanar waveguide structure 1# is shown in following figure. The third layer is reference layer.

Figure 34: Four layer PCB coplanar waveguide structure 1#

Four layer PCB coplanar waveguide structure 2# is shown in following figure. The fourth layer is reference layer.

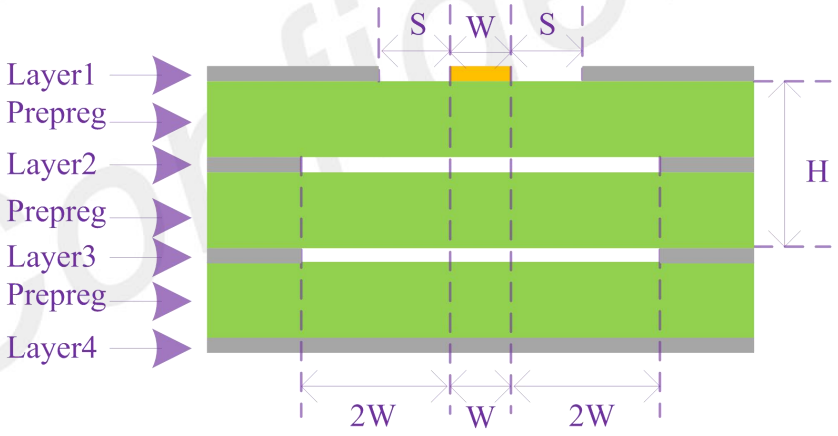

Figure 35: Four layer PCB coplanar waveguide structure 2#

3.16.6 Antenna Requirement

The following table shows the requirements on main antenna, Rx-diversity antenna and GNSS antenna.

Table 22: Antenna Requirement

Antenna	Requirements
GSM/WCDMA/TD-SCDMA/LTE	VSWR: ≤ 2 Gain (dBi): 1 Max Input Power (W): 50 Input Impedance (ohm): 50 Polarization Type: Vertical Cable Insertion Loss: < 1dB (GSM850/EGSM900, WCDMA B5/B8, CDMA BC0, LTE B5/B8/B12/B17/ B20) Cable Insertion Loss: < 1.5dB (DCS1800/PCS1900, WCDMA B1/B2/B3/B4, TD-SCDMAB34/B39, LTE B1/B2/B3/B4/B39) Cable insertion loss < 2dB (LTE B7/B38/B40/B41)
Wi-Fi/BT	VSWR: ≤ 2 Gain (dBi): 1 Max Input Power (W): 50 Input Impedance (ohm): 50 Polarization Type: Vertical Cable Insertion Loss: < 1dB
GNSS	Frequency range: 1565 - 1607MHz Polarization: RHCP or linear VSWR: < 2 (Typ.) Passive antenna gain: > 0dBi Active antenna noise figure: < 1.5dB Active antenna gain: > -2dBi Active antenna embedded LNA gain: 20dB (Typ.) Active antenna total gain: > 18dBi (Typ.)

3.16.7 Install the Antenna with RF Connector

The recommended RF connector is HIROSE UF.L-R-SMT. The antenna installation with RF connector is shown in following figure.

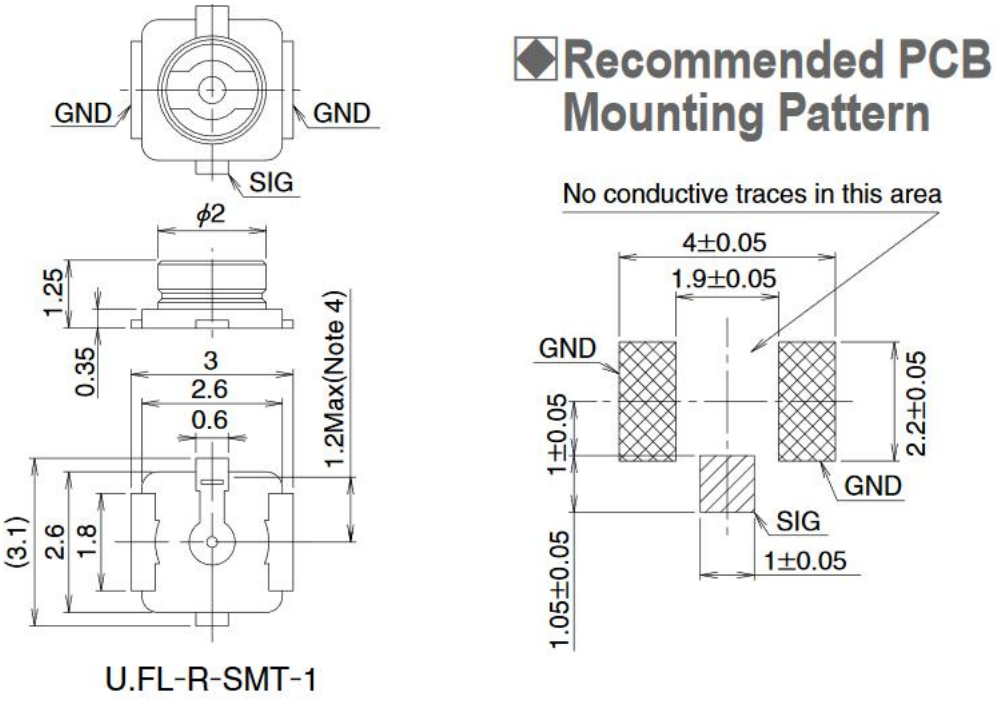

Figure 36: Dimensions of the UF.L-R-SMT Connector (Unit: mm)

4 PCB Layout

This section provides PCB layout guidelines for SIM8905 users to ensure their production against lots of issues, and achieve the optimum performance.

4.1 Stack-up Options

At least, 4-layer through-hole PCB should be chosen for good impedance control and signal shielding.

4.2 General Placement Guidelines

- Locate SIM8905 module in the center of PCB, rather than in the corner.
- Digital devices and traces should not be placed near sensitive signals like RF and clock.
- Keep SPKR and MIC away from sensitive RF lines.

4.3 PCB Layout Guideline Details

4.3.1 RF Trace

- RF connector should be placed close to the module's antenna pin.
- Antenna matching circuit should be placed close to the antenna.
- Keep the RF traces at 50Ω.
- Maintain a complete and continuous reference ground plane from antenna pin to the RF connector.
- The RF traces should be far away from any other noisy traces.
- Keep the RF traces as short as possible.
- If using a coaxial RF cable to connect the antenna, please avoid spanning on USIM cards, power circuits and high-speed digital circuits to minimize the impact of each other.

4.3.2 Power/GND

- Both VBAT and return path should be as short and wide as possible to minimize the IR drop

- The VBAT current should go through Zener diode, capacitors, then VBAT pins
- Must have a solid ground plane throughout the board as the primary reference plane for most signals

4.3.3 USIM Card

- Ensure USIM card holder is far way from antenna or RF signal
- ESD component and bypass caps should be placed closed to USIM Card
- USIM card signals should be far away from other high-speed signal

4.3.4 MIPI_DSI/CSI

- Protect MIPI_DSI/CSI signals from noisy signals (clocks, SMPS, etc.)
- Differential pairs, 100 Ω nominal, ±10%
- Total routing length < 305 mm
- Intra-pair length matching < 5 ps (0.67 mm)
- Inter-pair length matching < 10 ps (1.3 mm)
- Lane-to-lane trace spacing = 3x line width
- Spacing to all other signals = 4x line width
- Maintain a solid ground reference for clocks to provide a low-impedance path for return currents
- Each trace needs to be next to a ground plane
- Minimize the number of via on the trace

Refer to the following table for the length of MIPI traces inside the module.

Table 23: Length of MIPI traces inside the module

Pin#	Net Name	Length(mm)
52	MIPI_DSI_CLK_M	8.08
53	MIPI_DSI_CLK_P	9.03
54	MIPI_DSI_LANE0M	9.04
55	MIPI_DSI_LANE0P	8.73
56	MIPI_DSI_LANE1M	9.29
57	MIPI_DSI_LANE1P	9.10
58	MIPI_DSI_LANE2M	8.69
59	MIPI_DSI_LANE2P	8.95
60	MIPI_DSI_LANE3M	9.10
61	MIPI_DSI_LANE3P	9.85
63	MIPI_CSI0_CLK_M	14.04
64	MIPI_CSI0_CLK_P	13.79

65	MIPI_CSI0_LN0_M	13.27
66	MIPI_CSI0_LN0_P	13.23
67	MIPI_CSI0_LN1_M	13.96
68	MIPI_CSI0_LN1_P	14.49
70	MIPI_CSI1_CLK_M	17.21
71	MIPI_CSI1_CLK_P	17.69
72	MIPI_CSI1_LN0_M	16.34
73	MIPI_CSI1_LN0_P	17.25

4.3.5 USB

- 90 Ω differential, ± 10% trace impedance
- Differential data pair matching < 6.6 mm (50 ps)
- External components should be located near the USB connector.
- Should be routed away from sensitive circuits and signals.
- If there are test points, place them on the trace to keep branches as short as possible
- If USB connector is used as the charger input, USB_VBUS node must be routed to the module using extremely wide traces or sub planes.

Refer to the following table for the length of USB traces inside the module.

Table 24: Length of USB traces inside the module

Pin#	Net Name	Length(mm)
13	USB_DM	30.58
14	USB_DP	30.22

4.3.6 SDC Signal

- Protect other sensitive signals/circuits from SDC corruption.
- Protect SDC signals from noisy signals (clocks, SMPS, etc.).
- Up to 200 MHz clock rate
- 50 Ω nominal, ±10% trace impedance
- CLK to DATA/CMD length matching < 1 mm
- 30–35 Ω termination resistor on clock lines near the module
- Total routing length < 50 mm recommended
- Spacing to all other signals = 2x line width
- Bus capacitance < 15 pF

Refer to the following table for the length of SD traces inside the module.

Table 25: Length of SD traces inside the module

Pin#	Net Name	Length(mm)
39	SD_CLK	14.24
40	SD_CMD	15.19
41	SD_DATA0	14.87
42	SD_DATA1	13.63
43	SD_DATA2	12.90
44	SD_DATA3	13.05

4.3.7 Audio

Analog input

- 4 to 5 mil trace widths; 4 to 5 mil spacing between traces
- Differential route for MIC1P with GND_MIC and MIC2P with GND_MIC;
- Isolate from noise sources, such as antenna, RF signals, SMPS, clocks, and other digital signals with fast transients
- Analog output
- Coplanar ground fill on both sides (of traces or pair as appropriate); in between ground planes – grounds above and below
- Isolate from noise sources such as antenna, RF signals, SMPS, clocks, and other digital signals with fast transients.
- EAR output signal – route as differential pair with 10 mil trace widths.
- SPK output signals – route as differential pair with 20 mil trace widths with 8 Ω load and 25 mil trace widths with 4 Ω load
- HPH output signals – not a differential pair; 10 mil trace widths for HPH_L and HPH_R; 15 mil trace widths for HPH_GND
- Connect HPH_GND to the ground pin of the jack connector and route HPH_GND in between HPH_L and HPH_R for best crosstalk minimization

5 Electrical and Reliability

5.1 Absolute Maximum Ratings

Absolute maximum ratings reflect the stress levels that, if exceeded, may cause permanent damage to the device. Functionality and reliability are only guaranteed within the operating conditions.

Table 26: Absolute maximum ratings

Parameter	Min	Max	Unit
VBAT	-0.3	5	V
VBUS	-0.3	7	V
VRTC	-	3.5	V

5.2 Temperature Range

Table 27: Temperature range

Parameter	Min	Typ	Max	Unit
Operating temperature	-35	25	+75	℃
Storage temperature	-40		+90	℃

5.3 Operating Voltage

Table 28: Operating voltage

Parameter	Min	Typ	Max	Unit
VBAT	3.4	3.9	4.4	V
VBUS	4.35	5	5.5	V
VRTC	2.0	3.0	3.25	V

5.4 Digital-logic Characteristics

Table 29: 1.8 V digital I/O characteristics

Parameter	Description	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.17	-	-	V
V_{IL}	Low-level input voltage	-	-	0.63	V
V_{OH}	High-level output voltage	1.35	-	-	V
V_{OL}	Low-level output voltage	-	-	0.45	V

Table 30: USIM interface characteristics (USIM_VDD=1.8V/2.95V)

Parameter	Description	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	0.7* USIM_VDD	-	USIM_VDD+0.3	V
V_{IL}	Low-level input voltage	-0.3	-	0.2* USIM_VDD	V
V_{OH}	High-level output voltage	0.8*USIM_VDD	-	USIM_VDD	V
V_{OL}	Low-level output voltage	0	-	0.4	V

Table 31: SD interface characteristics (SD_LDO11 =1.8V)

Parameter	Description	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.27	-	2	V
V_{IL}	Low-level input voltage	-0.3	-	0.58	V
V_{OH}	High-level output voltage	1.4	-	-	V
V_{OL}	Low-level output voltage	0	-	0.45	V

Table 32: SD interface characteristics (SD_LDO11 =2.95V)

Parameter	Description	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	0.625* SD_LDO11	-	SD_LDO11+0.3	V
V_{IL}	Low-level input voltage	-0.3	-	0.25* SD_LDO11	V
V_{OH}	High-level output voltage	0.75* SD_LDO11	-	SD_LDO11	V
V_{OL}	Low-level output voltage	0	-	0.125* SD_LDO11	V

5.5 PWRKEY Characteristics

Table 33: PWRKEY characteristics

Parameter	Description	Min	Typ	Max	Unit
V_{IH}	High-level input voltage	1.4	-	-	V
V_{IL}	Low-level input voltage	-	-	0.6	V

5.6 VRTC Characteristics

Table 34: VRTC characteristic

Parameter	Description	Min	Typ	Max	Unit
$VRTC_{-IN}$	VRTC input voltage	2.0	3.0	3.25	V
I_{RTC-IN}	VRTC current consumption	-	5	10	uA
$VRTC_{-OUT}$	VRTC output voltage	2.5	3.1	3.2	V
$I_{RTC-OUT}$	VRTC output current	-		2	mA

5.7 Current Consumption (VBAT=3.9V)

Table 35: Current consumption

Parameter	Conditions	Min	Typ	Max	Unit
Leakage current	Off mode		20		uA
Standby current	Flight mode		1.22		mA
	GSM:				
	BS-PA-MFRMS=9		1.65		mA
	BS-PA-MFRMS=5		1.85		mA
	BS-PA-MFRMS=2		3.00		mA
	WCDMA @DRX=8		2.48		mA
	CDMA 1X @max slot=1~7		3.00		mA
	EVDO @max slot=1~7		1.7		mA
	TD-SCDMA @DRX=7		2.25		mA
	LTE-FDD @standby 1.28s		2.11		mA
	LTE-TDD @standby 1.28s		2.56		mA
GSM Voice Call	GSM850 @PCL5		259		mA

	EGSM900 @PCL5	248		mA
	DCS1800 @PCL0	209		mA
WCDMA Voice Call	Band 1 @max power	460		mA
	Band 5 @max power	452		mA
	Band 8 @max power	467		mA
EVDO Voice Call	BC0 @max power	510		mA
GPRS Data	GSM850 (1UL/4DL) @PCL5	236		mA
	GSM850 (2UL/3DL) @PCL5	385		mA
	GSM850 (4UL/1DL) @PCL5	723		mA
	GSM900(1UL/4DL) @PCL5	228		mA
	GSM900 (2UL/3DL) @PCL5	372		mA
	GSM900 (4UL/1DL) @PCL5	497		mA
	DCS1800 (1UL/4DL) @PCL5	184		mA
	DCS1800 (2UL/3DL) @PCL5	291		mA
	DCS1800 (4UL/1DL) @PCL5	476		mA
EDGE Data	GSM850 (1UL/4DL) @PCL8	163		mA
	GSM850 (2UL/3DL) @PCL8	247		mA
	GSM850 (4UL/1DL) @PCL8	411		mA
	GSM900(1UL/4DL) @PCL8	159		mA
	GSM900 (2UL/3DL) @PCL8	242		mA
	GSM900 (4UL/1DL) @PCL8	346		mA
	DCS1800 (1UL/4DL) @PCL2	150		mA
	DCS1800 (2UL/3DL) @PCL2	240		mA
	DCS1800 (4UL/1DL) @PCL2	381		mA
CDMA Data	BC0 @max power	467		mA
LTE Data	FDD Band1 @max power	715		mA
	FDD Band3 @max power	712		mA
	FDD Band5 @max power	678		mA
	FDD Band8 @max power	610		mA
	TDD Band38 @max power	436		mA
	TDD Band39 @max power	361		mA
	TDD Band40 @max power	363		mA
	TDD Band41 @max power	369		mA
Peak current			3.0	A

5.8 Electro-Static Discharge

Electrostatic discharge (ESD) occurs naturally in laboratory and factory environments. An established high-voltage potential is always at risk of discharging to a lower potential. If this discharge path is through a semiconductor device, it may result in destructive damage.

SIM8905 must be handled according to the ESD Association standard: ANSI/ESD S20.20-1999, Protection of Electrical and Electronic Parts, Assemblies, and Equipment.

Table 36: ESD performance parameters（Temperature: 25℃, Humidity: 45%）

Pin	Contact discharge	Air discharge
VBAT	±5KV	±10 KV
GND	±5KV	±12KV
Antenna	±5KV	±10KV
PWRKEY	±4KV	±6KV

5.9 Module Operating Frequencies

Table 37: Module operating frequencies

Frequency	Receive	Transmit	Physical channel
GSM850	869-894MHz	824-849MHz	128-251
EGSM900	925-960MHz	880-915MHz	0-124, 975-1023
DCS1800	1805-1880MHz	1710-1785MHz	512-885
PCS1900	1930-1990MHz	1850-1910MHz	512-810
WCDMA B1	2110-2170 MHz	1920-1980 MHz	TX: 9612-9888 RX: 10562-10838
WCDMA B2	1930-1990MHz	1850-1910MHz	TX: 9262-9538 RX: 9662-9938
WCDMA B5	869-894MHz	824-849MHz	TX: 4132-4233 RX: 4357-4458
WCDMA B8	925-960MHz	880-915 MHz	TX: 2712-2863 RX: 2937-3088
CDMA BC0	869-894MHz	824-849MHz	1-799 ;991-1023
TDSCDMA B39	1880-1920 MHz	1880-1920MHz	9400-9600
TDSCDMA B34	2010-2025 MHz	2010-2025MHz	10054-10121
LTE B1	2110-2170 MHz	1920-1980 MHz	TX: 18000-18599 RX: 0-599
LTE B3	1805-1880 MHz	1710-1785 MHz	TX: 19200-19949 RX: 1200-1949
LTE B5	869-894 MHz	824-849MHz	TX: 20400-20649 RX: 2400-2649

LTE B7	2620-2690 MHz	2500-2570 MHz	TX: 20750-21449 RX: 2750-3449
LTE B8	925-960 MHz	880-915 MHz	TX: 21450-21799 RX: 3450-3799
LTE B38	2570-2620 MHz	2570-2620 MHz	37750-38249
LTE B39	1880-1920 MHz	1880-1920 MHz	38250-38649
LTE B40	2300-2400 MHz	2300-2400 MHz	38650-39649
LTE B41[1]	2555-2655 MHz	2555-2655MHz	40240-41240

NOTE

SIM8905's TDD-LTE B41 bandwidth is 100MHz (2555 ~ 2655 MHz), the channel is 40240 ~ 41240.

5.10 Module Output power

Table 38: Conducted transmission power

Frequency	Power	Min.
GSM850	33dBm ±2dB	5dBm ± 5dB
E-GSM900	33dBm ±2dB	5dBm ± 5dB
DCS1800	30dBm ±2dB	0dBm ± 5dB
PCS1900	30dBm ±2dB	0dBm ± 5dB
E-GSM900 (8-PSK)	27dBm ±3dB	5dBm ± 5dB
DCS1800 (8-PSK)	26dBm +3/-4dB	0dBm ±5dB
WCDMA B1	24dBm +1/-3dB	<-50dBm
WCDMA B2	24dBm +1/-3dB	<-50dBm
WCDMA B5	24dBm +1/-3dB	<-50dBm
WCDMA B8	24dBm + 1/-3dB	<-50dBm
CDMA BC0	24dBm + 1/-1dB	<-50dBm
TDSCDMA B34	24dBm + 1/-3dB	<-50dBm
TDSCDMA B39	24dBm + 1/-3dB	<-50dBm
LTE-FDD B1	23dBm +/-2.7dB	<-40dBm
LTE-FDD B3	23dBm +/-2.7dB	<-40dBm
LTE-FDD B5	23dBm +/-2.7dB	<-40dBm
LTE-FDD B7	23dBm +/-2.7dB	<-40dBm
LTE-FDD B8	23dBm +/-2.7dB	<-40dBm
LTE-FDD B20	23dBm +/-2.7dB	<-40dBm
LTE-TDD B38	23dBm +/-2.7dB	<-40dBm
LTE-TDD B39	23dBm +/-2.7dB	<-40dBm

LTE-TDD B40	23dBm +/-2.7dB	<-40dBm
LTE-TDD B41	23dBm +/-2.7dB	<-40dBm

5.11 Module Receiving Sensitivity

Table 39: Conducted receiving sensitivity

Band	Receiving sensitivity（Typ）	Receiving sensitivity（Max）
GSM850	< -108dBm	3GPP standard
EGSM900	< -108dBm	3GPP standard
DCS1800	< -108dBm	3GPP standard
PCS1900	< -108dBm	3GPP standard
WCDMA B1	<-109 dBm	3GPP standard
WCDMA B2	<-109 dBm	3GPP standard
WCDMA B5	<-109 dBm	3GPP standard
WCDMA B8	<-109 dBm	3GPP standard
CDMA BC0	<-109 dBm	3GPP standard
TDSCDMA B34	<-110 dBm	3GPP standard
TDSCDMA B39	<-110 dBm	3GPP standard
LTE FDD/TDD	Table 38	3GPP standard

Table 40: Reference sensitivity QPSk PREFSENS (LTE)

E-UTRA Band number	1.4 MHz	3 MHz	5 MHz	10 MHz	15 MHz	20 MHz	Duplex mode
1	-	-	-100	-97	-95.2	-94	FDD
2	-102.7	-99.7	-98	-95	-93.2	-92	FDD
3	-101.7	-98.7	-97	-94	-92.2	-91	FDD
4	-104.7	-101.7	-100	-97	-95.2	-94	FDD
5	-103.2	-100.2	-98	-95			FDD
6	-	-	-100	-97			FDD
7	-	-	-98	-95	-93.2	-92	FDD
8	-102.2	-99.2	-97	-94			FDD
9	-	-	-99	-96	-94.2	-93	FDD
10	-	-	-100	-97	-95.2	-94	FDD
11	-	-	-100	-97			FDD
12	-101.7	-98.7	-97	-94			FDD
13			-97	-94			FDD
14		-	-97	-94			FDD

17	-	-	-97	-94			FDD
18	-	-	-100	-97	-95.2	-	FDD
19	-	-	-100	-97	-95.2	-	FDD
20			-97	-94	-91.2	-90	FDD
21			-100	-97	-95.2		FDD
22			-97	-94	-92.2	-91	FDD
23	-104.7	-101.7	-100	-97			FDD
24			-100	-97			FDD
25	-101.2	-98.2	-96.5	-93.5	-91.7	-90.5	FDD
33	-	-	-100	-97	-95.2	-94	TDD
34	-	-	-100	-97	-95.2	-	TDD
35	-106.2	-102.2	-100	-97	-95.2	-94	TDD
36	-106.2	-102.2	-100	-97	-95.2	-94	TDD
37	-	-	-100	-97	-95.2	-94	TDD
38	-	-	-100	-97	-95.2	-94	TDD
39	-	-	-100	-97	-95.2	-94	TDD
40	-	-	-100	-97	-95.2	-94	TDD
41	-	-	-99	-96	-94.2	-93	TDD
42	-	-	-99	-96	-94.2	-93	TDD
43	-	-	-99	-96	-94.2	-93	TDD

5.12 WIFI Main RF Characteristics

Table 41: WIFI main RF Characteristics

Transmission performance				
	802.11B	802.11A/G	802.11N	
Output power	17	15	12	dBm
EVM	<35%	<-25dB	<-27dB	
Receiving performance				
	802.11B	802.11G	802.11N	
Receiving sensitivity	-89	-74.5	-72.5	dBm

5.13 BT Main RF Characteristics

Table 42: BT Main RF Characteristics

Transmission performance				
	DH5	2DH5	3DH5	
Output power	9	7	7	dBm
Receiving performance				
	DH5	2DH5	3DH5	
Receiving sensitivity	-90	-80	-80	dBm

5.14 GNSS Main RF Characteristics

Table 43: GNSS Main RF Characteristics

Receiver type	GPS,GLANOSS,BEIDOU	
CNo	39dB/Hz@-130dBm	
Sensitivity	Tracking & Navigation	-160dBm
	Reacquisition	-156dBm
	Cold start	-148dBm
TTFF	Cold start	<35s
	Warm start	<15s
	Hot start	<5s

6 Manufacturing

6.1 Top and Bottom View of SIM8905

Figure 37: Top and bottom view of SIM8905

NOTE

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

6.2 Typical SMT Reflow Profile

The thickness of SMT stencil shall be increased to 0.15-0.18mm.

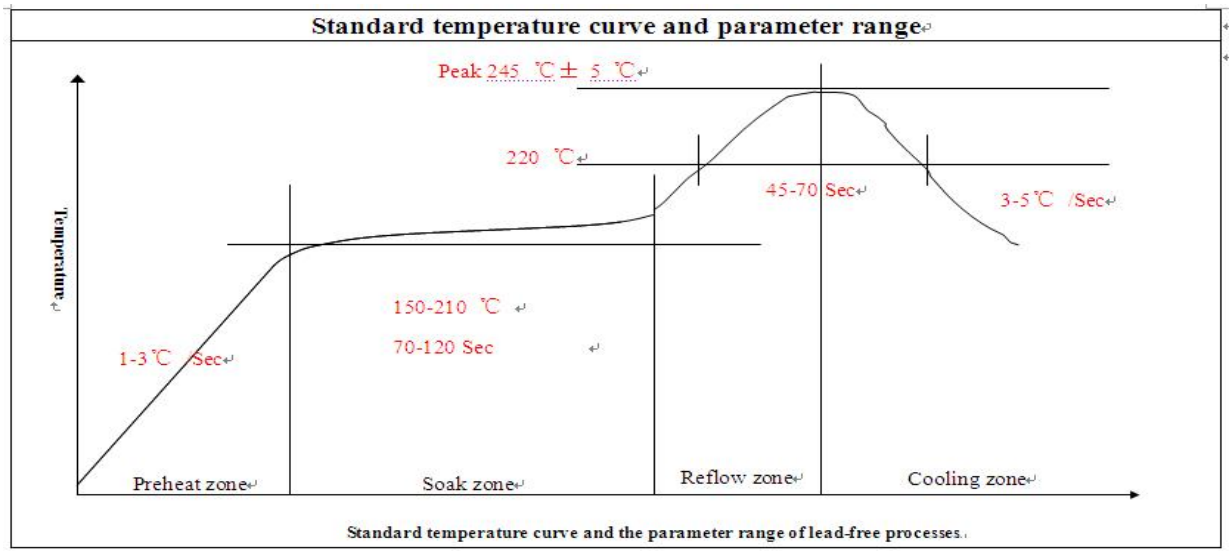

Figure 38: Typical SMT reflow profile

NOTE

Please refer to “SIM8905_Module_SMT_Secondary_User_Guide_V1.00” for more information about the module shipping and manufacturing.

6.3 Moisture Sensitivity Level (MSL)

SIM8905 is susceptible to damage induced by absorbed moisture and high temperature. A package’s moisture-sensitivity level (MSL) indicates its ability to withstand exposure after it is removed from its shipment bag, while it is on the factory floor awaiting PCB installation. A low MSL rating is better than a high rating; a low MSL device can be exposed on the factory floor longer than a high MSL device. All pertinent MSL ratings are summarized in the following table.

Table 44: Moisture classification level and floor life

MSL	Out-of-bag floor life	Comments
1	Unlimited	≤+30℃/85% RH

2	1 year	≤+30℃/60% RH
2a	4 weeks	≤+30℃/60% RH
3	168 hours	≤+30℃/60% RH
4	72 hours	≤+30℃/60% RH
5	48 hours	≤+30℃/60% RH
5a	24 hours	≤+30℃/60% RH
6	Mandatory bake before use. After bake, it must be reflowed within the time limit specified on the label.	≤+30℃/60% RH

The MSM8909 device samples are currently classified as MSL4 at 255 (+5, -0)°C, following the latest IPC/JEDEC J-STD-020 standard revision for moisture-sensitivity qualification This qualification temperature (255 (+5, -0)°C) should not be confused with the peak temperature within the recommended solder reflow profile.

6.4 Baking Requirements

It is necessary to bake modules if the prescribed time limit has been exceeded. The baking conditions are specified in Table 42. Note that if baking is required, the devices must be transferred into trays that can be baked to at least 125°C.

Table 45: Baking requirements

Baking conditions options	Duration
40°C±5°C, <5% RH	192 hours
120°C±5°C, <5% RH	4 hours

7 Packing System

The SIM8905 is packaged on trays.
The production flow of module package is shown as below:

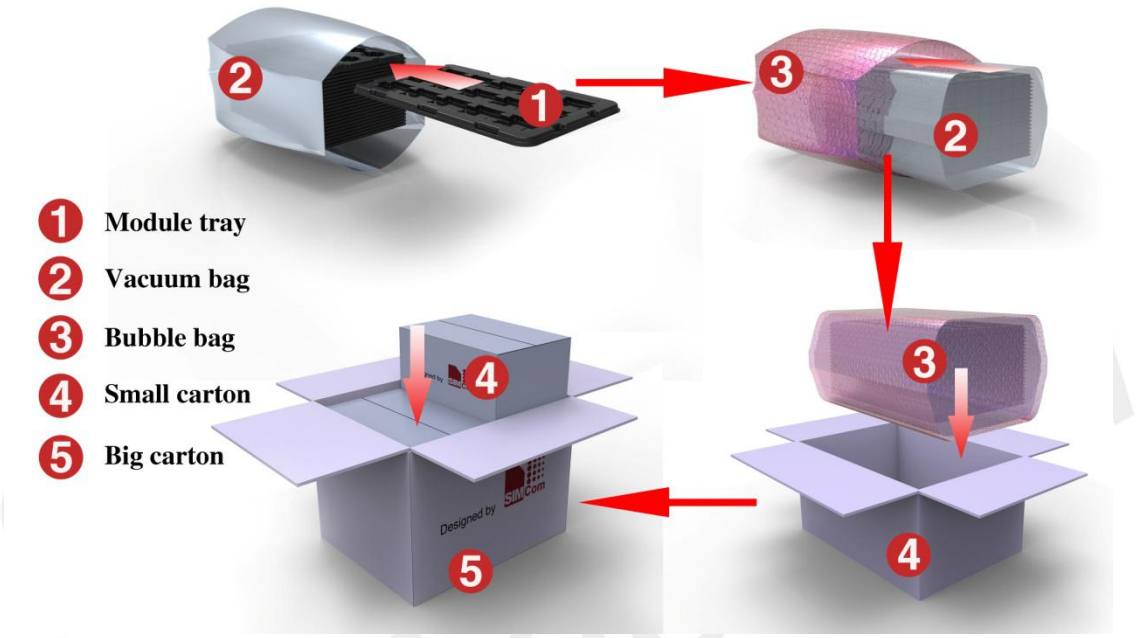

Figure 39: production flow of module package

The dimension of module tray is shown as below:

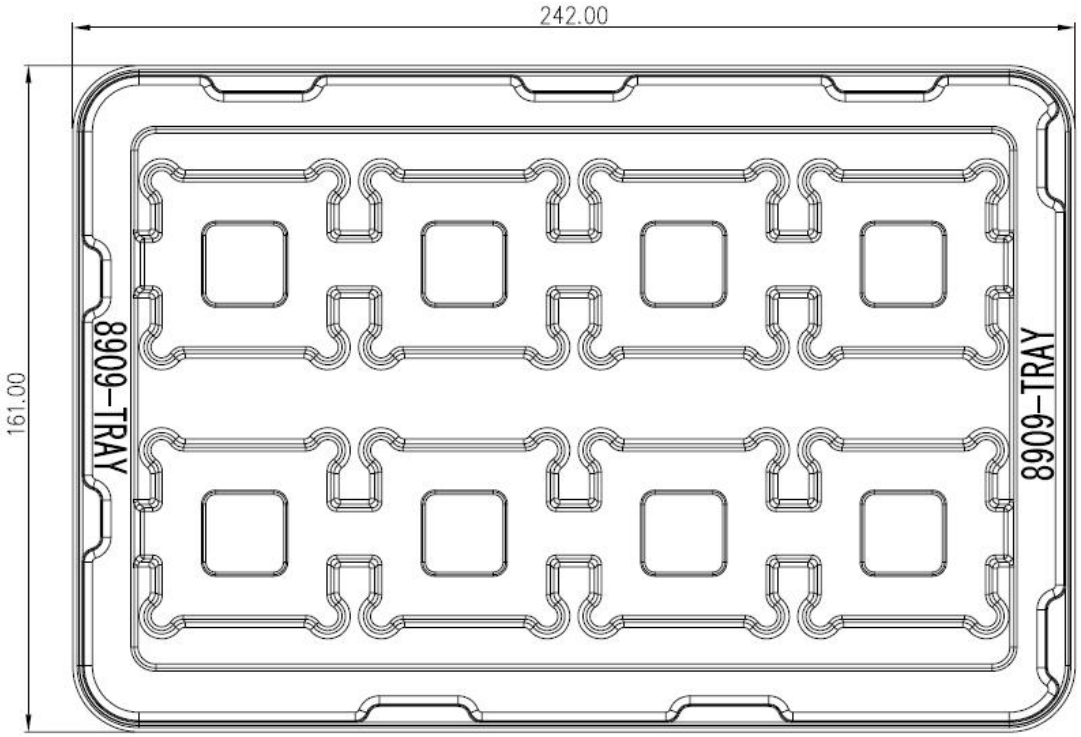

Figure 40: The dimension of module tray

Table 46: Tray information

Length（±3mm）	Width（±3mm）	Count of module
242.0	161.0	8

The dimension of small carton is shown as below:

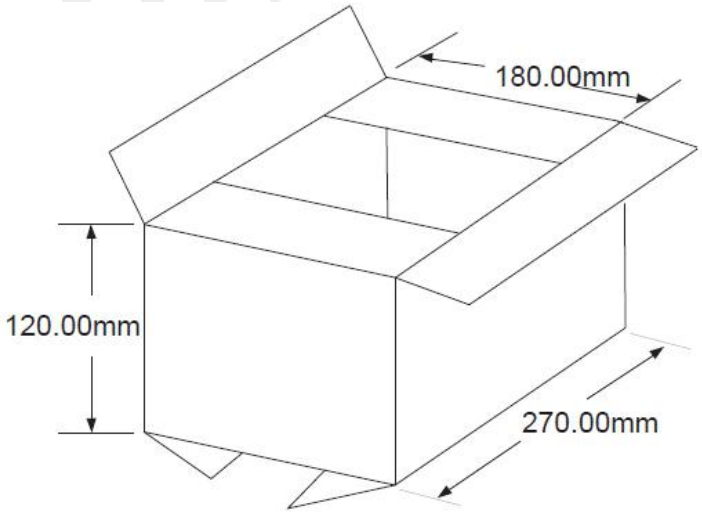

Figure 41: The dimension of small carton

Table 47: Small carton information

Length（±10mm）	Width（±10mm）	Height（±10mm）	Count of tray
270	180	120	8*19-2=150

The dimension of big carton is shown as below:

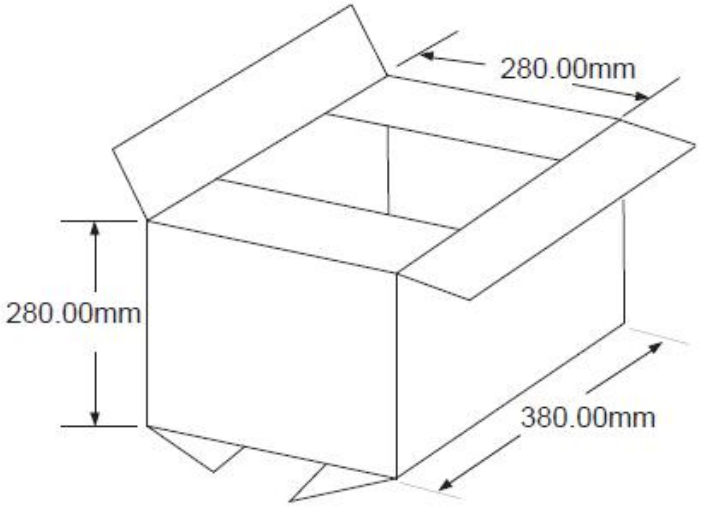

Figure 42: The dimension of big carton

Table 48: Big carton information

Length（±10mm）	Width（±10mm）	Height（±10mm）	Count of small carton
380	280	280	150*4=600

8 List of Recommended Devices

Table 49: Recommended touch screen Controller

Model	Vendor
FocalTech-FT5336GQQ	Focaltech systems Co., Ltd.
FocalTech- FT5436i	Focaltech systems Co., Ltd.
FocalTech- FT6306	Focaltech systems Co., Ltd.
FocalTech- FT6336	Focaltech systems Co., Ltd.
SYNAPTICS-S2202	Synaptics Incorporated.
Goodix-GT9 series	Shenzhen Goodix Technology Co., Ltd.
Goodix-GT5688	Shenzhen Goodix Technology Co., Ltd.

Table 50: Recommended capacitive touch screen models

Model	Vendor	Size	Touch points
FocalTech-FT5336GQQ-Truly-CT4F0694	Truly Opto-electronics Ltd.	5"	5
FocalTech-FT5436i-Truly-CT2S0438	Truly Opto-electronics Ltd.	5"	5
FocalTech-FT6336-Truly-CT1F1753-E	Truly Opto-electronics Ltd.	5"	2
Silead-GSL2682-Top Touch-TTCT045030	Top-Touch Electronics Co., Ltd.	4.5"	5
SYNAPTICS-S2202-Truly-CT3G0225-V1-E	Truly Opto-electronics Ltd.	4.7"	10

Table 51: Recommended Sensors

Type of Sensor	Model	Vendor
Accelerometer	Bosch-BMA222E	Bosch Sensortec GmbH
	Bosch-BMA223	Bosch Sensortec GmbH
	Kionix-KXTJ2-1009	Kionix, Inc.
Magnetometer	AKM-AK09911	Asahi Kasei Corporation.
	Memsic-MMC3416xPJ	MEMSIC, Inc
	MEMSIC-MMC3630KJ Andriod M	MEMSIC, Inc
Distance and ambient light	ams-TMD27723T	ams AG
	Avago-APDS9930	Broadcom
	Lite-On-LTR553ALS	Lite-On
	ROHM-RPR0521RS	ROHM Semiconductor

Table 52: Recommended Camera Sensors

Camera	Resolution	Model	Vendor
Camera Front Camera	Resolution VGA	GC0310	GalaxyCore Inc.
		GC0339	GalaxyCore Inc.
		SP0A20	SuperPix Micro Technology Co., Ltd.
	2M	GC2355	GalaxyCore Inc.
		GC2145	GalaxyCore Inc.
		OV2680	OmniVision Technology (Shanghai) Co., Ltd.
		OV2685	OmniVision Technology (Shanghai) Co., Ltd.
		SP2508	SuperPix Micro Technology Co., Ltd.
		SP2529	SuperPix Micro Technology Co., Ltd.
		HI258	SK hynix
	5M	GC5005	GalaxyCore Inc.
		AR0542	ON Semiconductor
		OV5670	OmniVision Technology (Shanghai) Co., Ltd.
		OV5675	OmniVision Technology (Shanghai) Co., Ltd.
		OV5695	OmniVision Technology (Shanghai) Co., Ltd.
		S5K5E2	Samsung Electronics Co., Ltd.
		S5K5E8	Samsung Electronics Co., Ltd.
		Hi551	SK hynix
Rear Camera	2M	OV2680	OmniVision Technology (Shanghai) Co., Ltd.
		GC2355	GalaxyCore Inc.
		SP2508	SuperPix Micro Technology Co., Ltd.
	5M	OV5648	OmniVision Technology (Shanghai) Co., Ltd.
		OV5670	OmniVision Technology (Shanghai) Co., Ltd.
		S5K5E2	Samsung Electronics Co., Ltd.
		Hi551	SK hynix
		SP5409	SuperPix Micro Technology Co., Ltd.
	8M	HM8040	Himax Imaging,Inc
		Hi842	SK hynix
		OV8856	OmniVision Technology (Shanghai) Co., Ltd.
		OV8858-R1A	OmniVision Technology (Shanghai) Co., Ltd.
		OV8858	OmniVision Technology (Shanghai) Co., Ltd.

Table 53: Recommended LCM models

Model	Vendor	Resolution	Type	Size
Himax-HX8379A-Truly Semiconductor-TFT1P6457-V1-E	Truly Opto-electronics Ltd.	FWVGA	TFT	4.46"
Himax-HX8379C-Truly Semiconductor-TDO-FWVGA0446G00002	Truly Opto-electronics Ltd.	FWVGA	TFT	4.46"
Himax-HX8379C-Truly Semiconductor-TDO-FWVGA0446G00002	Truly Opto-electronics Ltd.	FWVGA	TFT	4.46"
Himax-HX8389B-Truly Semiconductor-TFT540960-20-E	Truly Opto-electronics Ltd.	qHD	TFT	4.5"
Ilitek-ILI9806E-DIJING-ART45BI2026A-1	Shenzhen DJN Optronics Co., Ltd.	FWVGA	TFT	4.5"
Ilitek-ILI9881-CPT-CLAA053WD41-3XB	Chunghwa Picture Tubes Ltd.	HD	IPS	5.3"
Novatek-NT35512-TCL-TD-TNWV4306	China Display Optoelectronics Technology Holdings limited.	WVGA	TFT	4.3"
Orise-OTM8018B-Truly Semiconductor-TFT480854-11-E	Truly Opto-electronics Ltd.	FWVGA	TFT	4.63"
Orise-OTM8019A-DSBJ-D0400BO01	DSBJ	WVGA	TFT	3.97"

NOTE

If the peripheral devices selected by the customer are not listed in above tables, please contact SIMom for technical support.

9 Appendix

9.1 Related Documents

Table 54: Related Documents

No.	Document name	Remark
[1]	GSM 07.07：	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[2]	GSM 07.10：	Support GSM 07.10 multiplexing protocol
[3]	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)
[4]	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
[5]	GSM 11.11：	Digital cellular telecommunications system (Phase 2+); Specification of the Subscriber Identity Module – Mobile Equipment (SIM – ME) interface
[6]	GSM 03.38：	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[7]	GSM 11.10	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification
[8]	3GPP TS 51.010-1	Digital cellular telecommunications system (Release 5); Mobile Station (MS) conformance specification
[9]	3GPP TS 34.124	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[10]	3GPP TS 34.121	Electromagnetic Compatibility (EMC) for mobile terminals and ancillary equipment.
[11]	3GPP TS 34.123-1	Technical Specification Group Radio Access Network; Terminal conformance specification; Radio transmission and reception (FDD)
[12]	3GPP TS 34.123-3	User Equipment (UE) conformance specification; Part 3: Abstract Test Suites.
[13]	EN 301 908-02 V2.2.1	Electromagnetic compatibility and Radio spectrum Matters (ERM); Base Stations (BS) and User Equipment (UE) for IMT-2000. Third Generation cellular networks; Part 2: Harmonized EN for IMT-2000, CDMA Direct Spread (UTRA FDD) (UE) covering essential requirements of article 3.2 of the R&TTE Directive
[14]	EN 301 489-24 V1.2.1	Electromagnetic compatibility and Radio Spectrum Matters (ERM); Electromagnetic Compatibility (EMC) standard for radio equipment and services; Part 24: Specific conditions for IMT-2000 CDMA Direct Spread (UTRA) for Mobile and portable (UE) radio and ancillary equipment

[15]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[16]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[17]	2002/95/EC	Directive of the European Parliament and of the Council of 27 January 2003 on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)

9.2 Terms and Abbreviations

Table 55: Terms and abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
BOM	Bill of materials
bps	Bits per second
BT	Bluetooth
CDMA	Code division multiple access
CS	Coding Scheme
CSD	Circuit Switched Data
CSI	Camera serial interface
CTS	Clear to Send
DAC	Digital-to-analog converter
DDR	Double data rate
DSDA	Dual SIM dual active
DSDS	Dual SIM dual standby
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
ESD	Electrostatic Discharge
ESR	Effective series resistance
ETS	European Telecommunication Standard
EVDO	Evolution data optimized
FDD	Frequency division duplex

FR	Full Rate
GNSS	Global navigation satellite system
GPIO	General-purpose input/output
GPRS	General Packet Radio Service
GPU	Graphics processing unit
GSM	Global Standard for Mobile Communications
HR	Half Rate
HSPA	High-speed packet access
I2C	Inter-integrated circuit
IMEI	International Mobile Equipment Identity
ISP	Image signal processing
Kbps	kilobits per second
LCD	Liquid crystal display
LDO	Low dropout (linear regulator)
LPDDR	Low-power DDR
MIC	Microphone
MIPI	Mobile industry processor interface
PA	Power amplifier
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
RF	Radio Frequency
PM	Power management
RoHS	Restriction of hazardous substances
PPP	Point-to-point protocol
PWM	Pulse-width modulator
RMS	Root Mean Square (value)
RTC	Real-time clock
RX	Receive Direction
SD	Secure digital
SDC	Secure digital controller
SIM	Subscriber Identification Module
SMS	Short Message Service
SMT	Surface mount technology

SPI	Serial peripheral interface
TDD	Time Division Distortion
TE	Terminal Equipment, also referred to as DTE
TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
USIM	User identity module
URC	Unsolicited Result Code
USB	Universal serial bus
USSD	Unstructured Supplementary Service Data
WCDMA	Wideband code division multiple access
WCN	Wireless connectivity network
WLAN	Wireless local area network

9.3 Safety Caution

Pay attention to the following safety precautions when using or maintaining any terminal or mobile phone that contains the module. Inform the users of the following security information on the terminal device. Otherwise SIMCom will not bear any consequences resulting from the users' not operating according to these warnings.

Table 56: Safety Caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive and not operate normally due to 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. Forgetting to think much of these instructions may impact the flight safety, or offend 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, especially with a mobile fee or an invalid SIM card. While you are in this condition and need emergent help, please remember to use emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call.

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