SIM8070
Hardware Design

Wireless Data Module

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Document Title:	SIM8070 Hardware Design
Version:	V1.01
Date:	2023-08-20
Status:	Released

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Version History

Date	Version	Description of change	Author
2023-08-20	1.01	Original	Junfeng Zhang

Contents

Table Index

Figure Index

1 Introduction

SIM8070 module is a smart module newly released by SIMCom Wireless Solutions Co., Ltd. This module has the Android operating system, and the customers could use it for the development of their hardware devices.

This document introduces the hardware interfaces of the SIM8070 module. The users could quickly understand the definition of the interfaces, the electrical performance, and the die size of the module. Notice that SIM8070x series modules support different radio frequency (RF) bands, different memory capacity, and different software version, etc. Please consult the local sales for more detailed information if needed.

1.1 Product Outline

SIM8070x series module is a 4G Android smart module developing by the platform of Qualcomm QCM6125. QCM6125 is an 8-Core customized 64-Bit ARM V-8 compatible application processor (Qualcomm® Kryo™ 260 CPU) adopting 11nm FinFET production process. It’s high performance 4-Core basic frequency is up to 2.0GHz, and low power consumption 4-Core is up to 1.8GHz. SIM8070x series module has abundant multi-media functions, including the 4K@30 fps video codec, the 2520*1080 single displaying screen, four MIPI cameras, and the multi-channel analog- and digital-audio input and output. SIM8070x series module supports the WiFi 802.11 a/b/g/n/ac, and the BT5.X short range communication. In conclusion, SIM8070x series module is a highly integrated product, which is widely applying to intelligent terminal devices in the field of the Internet of Things(IOT).

Table 1 shows the frequency bands differences working on the SIM8070x series module.

Table 1: SIM8070x series module

		SIM8070
General Configuration		
CPU Frequency		2.0GHz
Memory	**RAM**	4GB
	ROM	64GB
WLAN	802.11a/b/g/n/ac	✓
BT	BT5.X	✓

1.2 Functional Overview

Table 2: General features

Feature	Description
Processor	Customized 64-bit ARM V-8 compatible application processor (Qualcomm® Kryo™ 260 CPU) High Performance 4-Core frequency up to 2.0GHz,1MB L2 Low power consumption 4-Core frequency up to 1.8GHz,512KB L2
Memory	LPDDR4X RAM, (2 × 16 Bit)BUS, Highest working frequency 1804MHz Built-in eMMC 5.1 Flash, Refer to the Table 1 for memory capacity, Default configuration: 64GB eMMC + 4GB LPDDR4, Optional configuration: 64GB eMMC+6GB LPDDR4
SD	SDC2 external interface supports SD3.0 TF card (Maximum 256G), support hot plug detection
Operation System	Support Android 10.1
System Upgrade	Upgrade via USB interface, support forced download
Power Supply	Power Domain: 3.5V~4.4V, support single-cell lithium battery power supply.
Charge	Internal integrated PMI632 charging management chip, support QC2.0/QC3.0
Display	Support double screen asynchronous display. One 4-Lane MIPI_DSI interface, the highest resolution is 2520*1080, 60fps. DP1.4 over USB Type-C, the highest resolution is 1920*1200@60Hz.
Camera	MIPI combination DPHY 1.2 / CPHY 1.0 can be configured as 4/4/4 or 4/4/2/1 D-PHY: 2.5Gbps/Channel, C-PHY: ~10Gbps(3.42Gbps/Channel) Dual 14-bit ISP, 16 MP + 16MP Single ISP: 16 MP 30 ZSL, Dual ISP: 25 MP 30 ZSL
Video Codec	Encoding: 4k30 10-Bit HEVC, 4K30: H264/VP8 Decoding: 4K30 8-Bit H.264/VP8, 4K30 10-Bit HEVC/VP9, 1080p60 MPEG-2 Wireless display(Encoding & Decoding): 4K30 decode & 1080p30 encode
Audio	3-Channel Digital Audio Interface I2S: Support Master- and Salve-Mode 3-Channel Analog Audio Input Master Microphone: Differential Input, Built-in Bias Headphone Microphone: Single-ended Input, Built-in Bias Denoise Microphone: Differential Input, Built-in Bias 4-Channel Digital Microphone Input 4-Channel Analog Audio Output Headphone: Class AB Amplifier Stereo Output Handset: Class AB Amplifier Differential Output LINEOUT: Class AB Amplifier Differential Output Speaker: Class D Amplifier Differential Output
Audio Codec	MP3, AAC, He-AAC v1, v2, WMA 9/Pro, Dolby AC-3, eAC-3, DTS-HD, FLAC, APE, ALAC, AIFF, and EVS

Speech Codec	EVRC, EVRC-B, EVRC-WB, G.711, G.729A/AB, GSM-FR, GSM-EFR, GSM-HR, AMR-NB, AMR-WB, AMR-eAMR, AMR-BeAMR
USB	Support USB 3.1 with DP interface, support USB2.0 Support USB Type-C Interface, Support MICRO-USB Interface USB1 support OTG.
UART	Support up to 6 Serial Ports A 2-Wire Serial Port for Debug Four 4-Wrie Serial Ports support hardware flow control, High-speed up to 4Mbps.
I2C	Support up to ten I2C for touch screen, camera, sensor and other peripherals
SPI	Support up to four SPI interfaces, support master mode, the highest rate 50MHz
UIM Card	Support Dual Card Dual Standby: 1.8V/2.95V Dual Voltage Adaptive
WLAN Features	2.4G/5G Dual Frequency Range, Support 802.11a/b/g/n/ac, Maximum 433Mbps Support Wake-on-WLAN(WoWLAN) Support ad-hoc Mode WAPI supports SMS4 Hardware Encryption Support AP Mode Support Wi-Fi Direct
BT Features	BT2.1+EDR /3.0 /4.2 LE/5.x
Temperature	Operation Temperature: -30℃~ +75℃ Extend Operation Temperature: -40℃ ~ +85℃［1］ Storage Temperature: -40℃~ +90℃
Physical Size	Size: 44.1(±0.2)*45.6(±0.2)*2.8(±0.2)mm Weight: 13.6g

NOTE

SIM8070x series module works normally within the extend operation temperature range, but if the testing procedures fully accord with 3GPP standard could not be guaranteed.

2 Package Information

2.1 Hardware Block Diagram

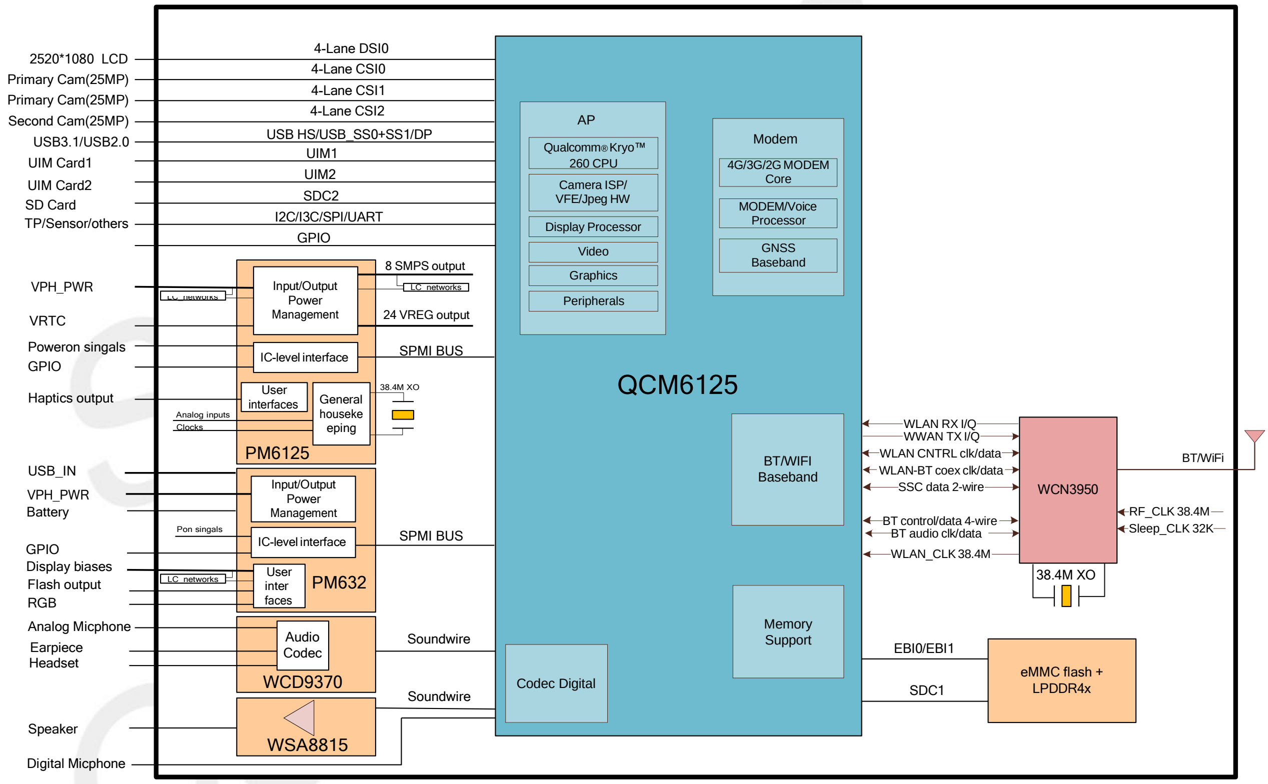


Figure 1: Module Block Diagram

Note: SIM8070 hardware does not support 2G, 3G, 4G and GNSS.

2.2 Pin Assignment Overview

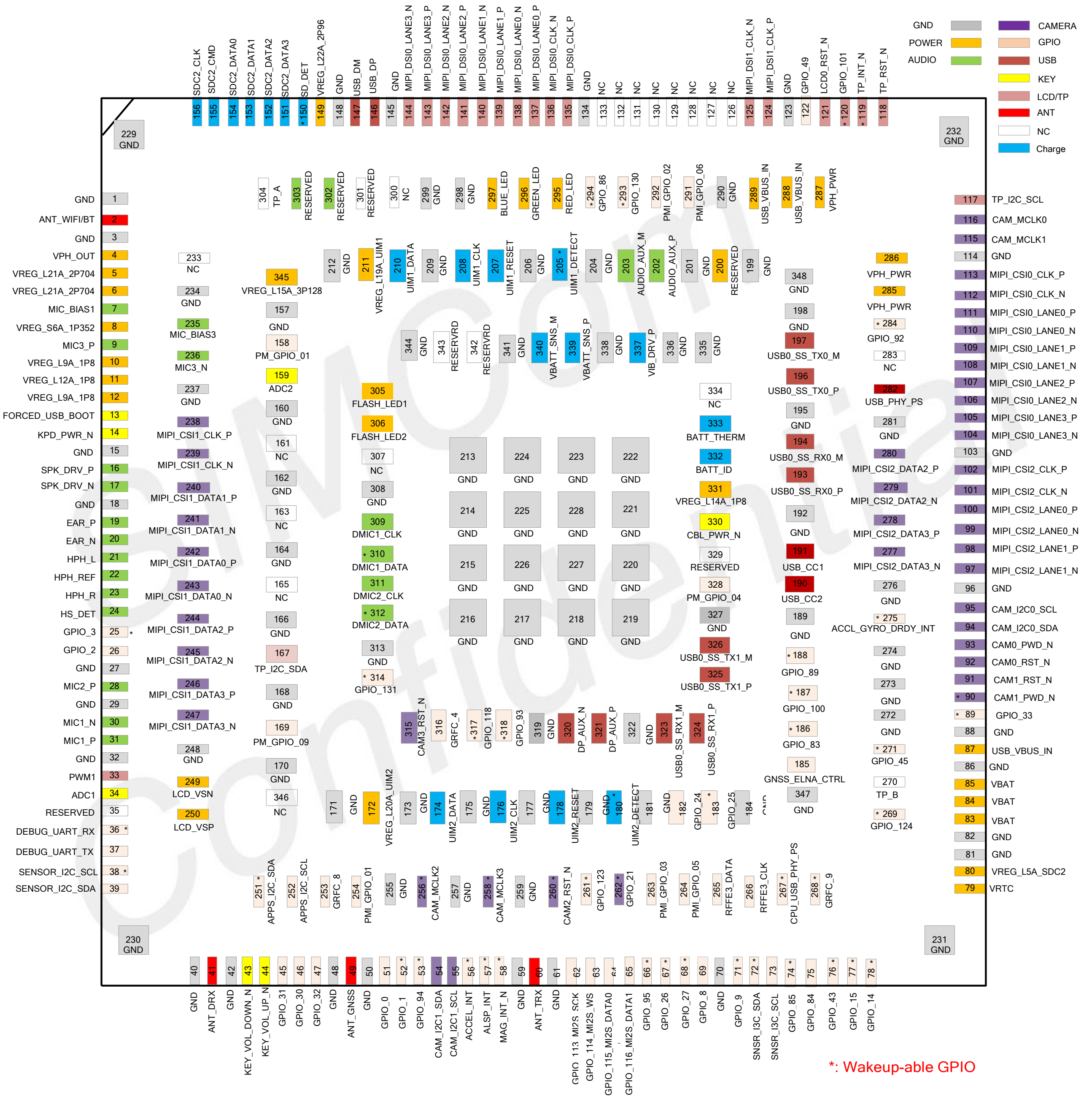


Figure 2: Pin Assignment Overview

2.3 PIN Description

Table 3: Defination of the I/O Parameters

Symble	**Description**
PIN Properties	
PI	Power Input
PO	Power Output
AI	Analog Input
AO	Analog Output
DI	Digital Input
DO	Digital Output
Digital Interface Pull Up and Pull Down	
NP	No Pull Up or No Pull Down
PU	Pull Up
PD	Pull Down

Table 4: Pin Properties

PIN Num	**PIN Name**	**Power Domain**	**QCM6125 PIN**	**Reset Status**	**Wakeup Interrupt**	**Note**
1	GND					
2	ANT-WIFI/BT					
3	GND					
4	VPH_PWR	3.5-4.4V				
5	VREG_L21A_2P704	2.704V				
6	VREG_L21A_2P704	2.704V				
7	MIC_BIAS1	1.8V				1.0~2.85V
8	VREG_S6A_1P352	1.352V				
9	MIC3_P					
10	VREG_L9A_1P8	1.8V				
11	VREG_L12A_1P8	1.8V				
12	VREG_L9A_1P8	1.8V				
13	FORCED_USB_BOOT	1.8V	GPIO_99	B-PD	√	
14	KPD_PWR_N	1.8V				
15	GND					
16	SPKR_OUT_P					

17	SPKR_OUT_N					
18	GND					
19	EAR_P					
20	EAR_N					
21	HPH_L					
22	HPH_REF					
23	HPH_R					
24	HS_DET					
25	GPIO_3	1.8V	GPIO_3	B-PD	√	
26	GPIO_2	1.8V	GPIO_2	B-PD		
27	GND					
28	MIC2_P					
29	GND					
30	MIC1_N					
31	MIC1_P					
32	GND					
33	PWM1		PM6125_GPIO_08			
34	ADC1	0~ 1.875V	PM6125_GPIO_07			
35	RESERVED					
36	DEBUG_UART_RX	1.8V	GPIO_17	DI	√	
37	DEBUG_UART_TX	1.8V	GPIO_16	DO		
38	SENSOR_I2C_SCL	1.8V	GPIO_29	B-PD	√	
39	SENSOR_I2C_SDA	1.8V	GPIO_28	B-PD		
40	GND					
41	ANT_DRX					
42	GND					
43	KEY_VOL_DOWN_N	1.8V		I-PU		
44	KEY_VOL_UP_N	1.8V	PM6125_GPIO_05	I-PU	√	
45	GPIO_31	1.8V	GPIO_31	B-PD		
46	GPIO_30	1.8V	GPIO_30	B-PD		
47	GPIO_32	1.8V	GPIO_32	B-PD		
48	GND					
49	ANT_GNSS					
50	GND					
51	GPIO_0	1.8V	GPIO_0	B-PD		
52	GPIO_1	1.8V	GPIO_1	B-PD	√	
53	GPIO_94	1.8V	GPIO_94	B-PD	√	
54	CCI_I2C_SDA1	1.8V	GPIO_39	B-PD		
55	CCI_I2C_SCL1	1.8V	GPIO_40	B-PD		

56	ACCEL_INT	1.8V	GPIO_81	B-PD	√	
57	ALSP_INT_N	1.8V	GPIO_91	B-PD	√	
58	MAG_INT_N	1.8V	GPIO_82	B-PD	√	
59	GND					
60	ANT_TRX					
61	GND					
62	GPIO_113_PRI_MI2S_SCK	1.8V	GPIO_113	B-PD		
63	GPIO_114_PRI_MI2S_WS	1.8V	GPIO_114	B-PD		
64	GPIO_115_PRI_MI2S_DATA0	1.8V	GPIO_115	B-PD		
65	GPIO_116_PRI_MI2S_DATA1	1.8V	GPIO_116	B-PD		
66	GPIO_95	1.8V	GPIO_95	B-PD	√	
67	GPIO_26	1.8V	GPIO_26	B-PD	√	
68	GPIO_27	1.8V	GPIO_27	B-PD	√	
69	GPIO_8	1.8V	GPIO_8	B-PD		
70	GND					
71	GPIO_9	1.8V	GPIO_9	B-PD	√	
72	SNSR_I3C_SDA	1.8V	GPIO_22	B-PD	√	
73	SNSR_I3C_SCL	1.8V	GPIO_23	B-PD		
74	GPIO_85	1.8V	GPIO_85	B-PD	√	
75	GPIO_84	1.8V	GPIO_84	B-PD		
76	GPIO_43	1.8V	GPIO_43	B-PD	√	
77	GPIO_15	1.8V	GPIO_15	B-PD	√	
78	GPIO_14	1.8V	GPIO_14	B-PD	√	
79	VRTC	3.0V				2.0-3.25V
80	VREG_L5A_SDC2	2.85V				
81	GND					
82	GND					
83	VBAT	3.5~4.4V				
84	VBAT	3.5~4.4V				
85	VBAT	3.5~4.4V				
86	GND					
87	VBUS_USB_IN	5V~9V				
88	GND					
89	GPIO_33	1.8V	GPIO_33	B-PD	√	
90	CAM1_PWD_N	1.8V	GPIO_47	B-PD	√	
91	CAM1_RST_N	1.8V	GPIO_46	B-PD		
92	CAM0_RST_N	1.8V	GPIO_48	B-PD		
93	CAM0_PWD_N	1.8V	GPIO_52	B-PD		

94	CAM_I2C0_SDA	1.8V	GPIO_37	B-PD		
95	CAM_I2C0_SCL	1.8V	GPIO_38	B-PD		
96	GND					
97	MIPI_CSI2_LANE1_N					
98	MIPI_CSI2_LANE1_P					
99	MIPI_CSI2_LANE0_N					
100	MIPI_CSI2_LANE0_P					
101	MIPI_CSI2_CLK_N					
102	MIPI_CSI2_CLK_P					
103	GND					
104	MIPI_CSI0_LANE3_N					
105	MIPI_CSI0_LANE3_P					
106	MIPI_CSI0_LANE2_N					
107	MIPI_CSI0_LANE2_P					
108	MIPI_CSI0_LANE1_N					
109	MIPI_CSI0_LANE1_P					
110	MIPI_CSI0_LANE0_N					
111	MIPI_CSI0_LANE0_P					
112	MIPI_CSI0_CLK_N					
113	MIPI_CSI0_CLK_P					
114	GND					
115	CAM_MCLK1	1.8V	GPIO_35	B-PD		
116	CAM_MCLK0	1.8V	GPIO_34	B-PD		
117	GPIO_7_TP_I2C_SCL	1.8V	GPIO_7	B-PD		
118	TP_RST_N	1.8V	GPIO_87	B-PD		
119	TP_INT_N	1.8V	GPIO_88	B-PD	√	
120	GPIO_101	1.8V	GPIO_101	B-PD	√	
121	LCD0_RST_N	1.8V	GPIO_90	B-PD		
122	GPIO_49	1.8V	GPIO_49	B-PD		
123	GND					
124	MIPI_DSI1_CLK_P					
125	MIPI_DSI1_CLK_N					
126	NC					
127	NC					
128	NC					
129	NC					
130	NC					
131	NC					
132	NC					
133	NC					
134	GND					

135	MIPI_DSI0_CLK_P					
136	MIPI_DSI0_CLK_N					
137	MIPI_DSI0_LANE0_P					
138	MIPI_DSI0_LANE0_N					
139	MIPI_DSI0_LANE1_P					
140	MIPI_DSI0_LANE1_N					
141	MIPI_DSI0_LANE2_P					
142	MIPI_DSI0_LANE2_N					
143	MIPI_DSI0_LANE3_P					
144	MIPI_DSI0_LANE3_N					
145	GND					
146	USB_DP					
147	USB_DM					
148	GND					
149	VREG_L22A_2P96	2.96V				
150	SDCARD_DET_N	1.8V	GPIO_98	B-PD	√	
151	SDC2_DAT3	1.8/2.95V		B		
152	SDC2_DAT2	1.8/2.95 V		B		
153	SDC2_DAT1	1.8/2.95 V		B		
154	SDC2_DAT0	1.8/2.95 V		B		
155	SDC2_CMD	1.8/2.95 V		B		
156	SDC2_CLK	1.8/2.95 V		DO		
157	GND					
158	PM_GPIO_01	1.8V	PM6125_GPIO_01	DI		
159	ADC2	0~ 1.875V	PM6125_GPIO_02			
160	GND					
161	NC					
162	GND					
163	NC					
164	GND					
165	NC					
166	GND					
167	GPIO_6_TP_I2C_SDA	1.8V	GPIO_6	B-PD		
168	GND					
169	PM_GPIO_09	1.8V	PM6125_GPIO_09	B-PD		
170	GND					
171	GND					
172	VREG_L20A_UIM2	1.8/2.95 V				
173	GND					

174	UIM2_DATA	1.8/2.95 V	GPIO_72	B-PD		
175	GND					
176	UIM2_CLK	1.8/2.95 V	GPIO_73	B-PD		
177	GND					
178	UIM2_RESET	1.8/2.95 V	GPIO_74	B-PD		
179	GND					
180	UIM2_DETECT	1.8V	GPIO_75	B-PD	√	
181	GND					
182	GPIO_24_UART_TX	1.8V	GPIO_24	B-PD		
183	GPIO_25_UART_RX	1.8V	GPIO_25	B-PD	√	
184	GND					
185	GNSS_LNA_CTRL	1.8V		B-PD		
186	GPIO_83	1.8V	GPIO_83	B-PD	√	
187	GPIO_100	1.8V	GPIO_100	B-PD	√	
188	GPIO_89	1.8V	GPIO_89	B-PD	√	
189	GND					
190	USB_CC2					
191	USB_CC1					
192	GND					
193	USB0_SS_RX0_P					
194	USB0_SS_RX0_M					
195	GND					
196	USB0_SS_TX0_P					
197	USB0_SS_TX0_M					
198	GND					
199	GND					
200	USB_IN_MID					
201	GND					
202	AUDIO_AUX_P					
203	AUDIO_AUX_M					
204	GND					
205	UIM1_DETECT	1.8V	GPIO_79	B-PD	√	
206	GND					
207	UIM1_RESET	1.8 /2.95 V	GPIO_78	B-PD		
208	UIM1_CLK	1.8 /2.95 V	GPIO_77	B-PD		
209	GND					
210	UIM1_DATA	1.8 /2.95 V	GPIO_76	B-PD		
211	VREG_L19A_UIM1	1.8 /2.95 V				

212	GND					
213	GND					
214	GND					
215	GND					
216	GND					
217	GND					
218	GND					
219	GND					
220	GND					
221	GND					
222	GND					
223	GND					
224	GND					
225	GND					
226	GND					
227	GND					
228	GND					
229	GND					
230	GND					
231	GND					
232	GND					
233	NC					
234	GND					
235	MIC_BIAS3	1.6~2.85V				
236	MIC3_N					
237	GND					
238	MIPI_CSI1_CLK_P					
239	MIPI_CSI1_CLK_N					
240	MIPI_CSI1_LANE1_P					
241	MIPI_CSI1_LANE1_N					
242	MIPI_CSI1_LANE0_P					
243	MIPI_CSI1_LANE0_N					
244	MIPI_CSI1_LANE2_P					
245	MIPI_CSI1_LANE2_N					
246	MIPI_CSI1_LANE3_P					
247	MIPI_CSI1_LANE3_N					
248	GND					
249	LCD_VSN	-6.0~-4.0V				
250	LCD_VSP	4.0~6.0V				
251	APPS_I2C_SDA	1.8V	GPIO_4	B-PD	√	
252	APPS_I2C_SCL	1.8V	GPIO_5	B-PD		

253	GRFC_8	1.8V	GPIO_58	B-PD		
254	PMI_GPIO_01	1.8V	PMI632_GPIO_01	B-PD		
255	GND					
256	CAM_MCLK2	1.8V	GPIO_36	B-PD	√	
257	GND					
258	CAM_MCLK3	1.8V	GPIO_44	B-PD	√	
259	GND					
260	CAM2_RST_N	1.8V	GPIO_42	B-PD	√	
261	GPIO_123	1.8V	GPIO_123	B-PD	√	
262	GPIO_21	1.8V	GPIO_21	B-PD	√	
263	PMI_GPIO_03_SKIN_THERM		PMI632_GPIO_03			
264	PMI_GPIO_05		PMI632_GPIO_05			
265	RFFE3_DATA	1.8V	GPIO_64	B-PD		
266	RFFE3_CLK	1.8V	GPIO_65	B-PD		
267	CPU_USB_PHY_PS	1.8V	GPIO_102	B-PD	√	
268	GRFC_9	1.8V	GPIO_59	B-PD	√	
269	GPIO_124	1.8V	GPIO_124	B-PD		
270	TP_B					
271	GPIO_45	1.8V	GPIO_45	B-PD	√	
272	GND					
273	GND					
274	GND					
275	ACCL_GYRO_DRDY_INT	1.8V	GPIO_80	B-PD	√	
276	GND					
277	MIPI_CSI2_LANE3_N					
278	MIPI_CSI2_LANE3_P					
279	MIPI_CSI2_LANE2_N					
280	MIPI_CSI2_LANE2_P					
281	GND					
282	USB_PHY_PS	1.8V				
283	PON_OPTION					
284	GPIO_92	1.8V	GPIO_92	B-PD	√	
285	VPH_PWR	3.5-4.4V				
286	VPH_PWR	3.5-4.4V				
287	VPH_PWR	3.5-4.4V				
288	USB_VBUS_IN	5V~9V				
289	USB_VBUS_IN	5V~9V				
290	GND					

291	PMI_GPIO_06	1.8V	PMI632_GPIO_06	B-PD		
292	PMI_GPIO_02	1.8V	PMI632_GPIO_02	B-PD		
293	GPIO_130	1.8V	GPIO_130	B-PD	√	
294	GPIO_86	1.8V	GPIO_86	B-PD	√	
295	RED_LED					
296	GREEN_LED					
297	BLUE_LED					
298	GND					
299	GND					
300	NC					
301	RESERVED					
302	MIC4_N					
303	MIC4_P					
304	TP_A					
305	FLASH_LED1					
306	FLASH_LED2					
307	NC					
308	GND					
309	DMIC1_CLK	1.8V	GPIO_125	B		
310	DMIC1_DATA	1.8V	GPIO_126	DI	√	
311	DMIC2_CLK	1.8V	GPIO_127	B		
312	DMIC2_DATA	1.8V	GPIO_128	DI	√	
313	GND					
314	GPIO_131_CAM_AVDD1_2_2P85_EN	1.8V	GPIO_131	B-PD	√	
315	CAM3_RST_N	1.8V	GPIO_41	B-PD		
316	GRFC_4					
317	GPIO_118	1.8V	GPIO_118	B-PD	√	
318	GPIO_93	1.8V	GPIO_93	B-PD	√	
319	GND					
320	USB0_DP_AUX_M					
321	USB0_DP_AUX_P					
322	GND					
323	USB0_SS_RX1_M					
324	USB0_SS_RX1_P					
325	USB0_SS_TX1_P					
326	USB0_SS_TX1_M					
327	GND					
328	PM_GPIO_04		PM6125_GPIO_04	B-PD		

329	RESERVED					
330	CBL_PWR_N					
331	VREG_L14A_1P8	1.8V				
332	BATT_ID					
333	BATT_THERM					
334	NC					
335	GND					
336	GND					
337	VIB_DRV_P					
338	GND					
339	VBATT_SNS_P					
340	VBATT_SNS_M					
341	GND					
342	RESERVED					
343	RESERVED					
344	GND					
345	VREG_L15A_3P128					
346	NC					
347	GND					
348	GND					

NOTE

In the column of the QCM6125 PIN, all the GPIO_XX are configurable GPIOs except the UIM Cards signals. But pulling up the following GPIOs would affect the module's boot-up. These GPIOs are including GPIO_32, GPIO_56, GPIO_86, GPIO_87, GPIO_99, GPIO_100, GPIO_101, and GPIO_118.

Table 5: Pin Description

PIN Name	PIN Num	I/O	Description	Note
Power Supply				
VREG_L21A_2P704	5，6	PO	Power Supply of the TP AVDD and the LCD AVDD 2.8V	External Power Supply, Highly recommend a capacitor of 2.2-4.7uF parallel connection, If unused, keep it open.
VREG_L9A_1P8	10，12	PO	Mainly for external GPIO pull up and the 1.8V power level conversion, the TP_IOVDD 1.8V, etc.	Power supply for external circuit. A parallel 2.2uF~4.7uf capacitance is required.

				If unused, keep it open.
VREG_L14A_1P8	331	PO	Mainly for the Audio Codec Power Supply	Power supply for external circuit. A parallel 2.2uF~4.7uf capacitance is required. If unused, keep it open..
VRTC	79	PI/PO	3V Secondary Power Supply Input and Charging Output	If unused, keep it open.
VBAT	83 84 85	PI/PO	Primary Power Supply, Single Lithium Battery Input	Maximum Current 3A, Highly recommend increasing the TVS diode Surge to prevent the surge and electrostatic discharge（ESD）.
VPH_PWR	285 286 287	PO	Power Output, provide by battery or charging	Maximum Current 2A, External circuit needs this Pin for precision electric quantity detection
Ground				
GND	1,3,15,18,27,29,32,40,42,48,50,59,61,70,81,82,86,88,96, 103,114,123,134,145,148,157,160,162,164,166,168,170, 171,173,175,177,179,181,184,189,192,195,198,199,201, 204,206,209,212,213,214,215,216,217,218,219,220,221, 222,223,224,225,226,227,228,229,230,231,232,234,237, 248,255.257.259,272,273,274,276,281,290,298,299,308, 313,319, 322,327,335,336,338,341,344,347,348			
Micro-USB/Type-C/DP Interface				
USB_VBUS_IN	87 288 289	PI/PO	VBUS Power Input, USB1 OTG Mode 5V Power Output	Highly recommend increasing the power of the diode to prevent the surge and the static electricity
USB_DP	146	AI/AO	USB_HS Differential Signal	The USB data line traces should have a 90Ω±10% differential impedance.
USB_DM	147	AI/AO		
USB_CC2	190	AI/AO	USB Type-C Connector Direction Detection Pin2	
USB_CC1	191	AI/AO	USB Type-C Connector Direction Detection Pin1, OTG Mode ID Pin	
USB0_SS_RX0_P	193	AI	USB Super-Speed Receiver P, or DP_LANE3_P for DP	

USB0_SS_RX0_M	194	AI	USB Super-Speed Receiver M, or DP_LANE3_M for DP	
USB0_SS_TX0_P	196	AO	USB Super-Speed Transmitter P, or DP_LANE2_P for DP	
USB0_SS_TX0_M	197	AO	USB Super-Speed Transmitter M, or DP_LANE2_M for DP	
USB0_SS_RX1_M	323	AI	USB Super-Speed Receiver M, or DP_LANE0_M for DP	
USB0_SS_RX1_P	324	AI	USB Super-Speed Receiver P, or DP_LANE0_P for DP	
USB0_SS_TX1_P	325	AO	USB Super-Speed Transmitter P, or DP_LANE1_P for DP	
USB0_SS_TX1_M	326	AO	USB Super-Speed Transmitter M, or DP_LANE1_M for DP	
USB0_DP_AUX_M	320	AI/AO	Auxiliary Channel Differential Signal for DP LCD M	
USB0_DP_AUX_P	321	AI/AO	Auxiliary Channel Differential Signal for DP LCD P	
VREG_L15A_3P128	345	PO	DP Switch VDD Power Supply	
CPU_USB_PHY_PS	267	DI	Connect to Ground for Micro-USB, Connect to Pin 282 for Type-C	
USB_PHY_PS	282	DO	Connect to Pin 267 for Type-C	
UIM Card Interface				
VREG_L20A_UIM2	172	PO	LDO L20A Output for SIM Card2 Power Supply, 1.8V/2.95V Dual Voltage	Highly recommend an external capacitor of 220nF parallel connection
UIM2_DATA	174	DI/DO	SIM Card2 Data Signal	Do not use these signals as configurable GPIO
UIM2_CLK	176	DO	SIM Card2 Clock Signal	
UIM2_RESET	178	DO	SIM Card2 Reset Signal	
UIM2_DETCET	180	DI	SIM Card2 insert detecting signal, Active Low when inserting the SIM Card	1.8V Power Domain, SIM Card detect pin is low active by default, Highly recommend connecting to the ground if the SIM Card does not support the hot plug detection.
UIM1_DETCET	205	DI	SIM Card1 insert detecting signal, Active Low when inserting the SIM Card	1.8V Power Domain, SIM Card detect pin is low active by default, Highly recommend connecting to the ground if the SIM Card does not support the hot plug detection.
UIM1_RESET	207	DO	SIM Card1 Reset Signal	Do not use these signals

UIM1_CLK	208	DO	SIM Card1 Clock Signal	as configurable GPIO
UIM1_DATA	210	DI/DO	SIM Card1 Data Signal	
VREG_L19A_UIM1	211	PO	LDO L19A Output for SIM Card1 Power Supply, 1.8V/2.95V Dual Voltage	Highly recommend an external capacitor of 220nF parallel connection
SDIO/SD Card Interface				
VREG_L5A_SDC2	80	PO	LDO L5A Power Output, 1.8V/2.95V	Only for pulling up the SD Card Data Signal
VREG_L22A_2P96	149	PO	LDO L5B Power Output for SD VDD, Typical Voltage 2.95V, Maximum Output Current 800mA	Routing lines in PCB requires an 800mA standard if supporting the SD3.0, Highly recommend an external capacitor of 2.2uF parallel connection
SDCARD_DET_N	150	DI	SD Card insert detecting signal, Active Low when inserting the SD Card	Active Low when inserting the SD Card, Highly recommend connecting to the ground with a 1KR resistor if no connection.
SDC2_DATA3	151	DI/DO	SDIO Data3	The SDIO data line traces should have a 50 Ω ± 10% differential impedance.
SDC2_DATA2	152	DI/DO	SDIO Data2	
SDC2_DATA1	153	DI/DO	SDIO Data1	
SDC2_DATA0	154	DID/O	SDIO Data0	
SDC2_CMD	155	DI/DO	SDIO Commend	
SDC2_CLK	156	DO	SDIO Clock	
Touching Screen Interface				
TP_I2C_SDA	167	DI/DO	TP I2C Data Signal	Highly recommend an external 2.2KR resistor pulling up to the VREG_L9A_1P8.
TP_I2C_SCL	117	DO	TP I2C Clock Signal	
TP_INT_N	119	DI	TP Interruption Signal	Highly recommend an external 10KR resistor pulling up to the VREG_L9A_1P8.
TP_RST_N	118	DO	TP Reset Signal	With Boot function, avoid an external pull up.
Displaying Screen Interface				
MIPI_DSI0_CLK_P	135	AO	LCD0 MIPI Signals	The MIPI data line traces should have a 85Ω ±15% differential impedance.
MIPI_DSI0_CLK_N	136	AO		
MIPI_DSI0_LANE0_P	137	AI/AO		
MIPI_DSI0_LANE0_N	138	AI/AO		
MIPI_DSI0_LANE1_P	139	AI/AO		

MIPI_DSI0_LANE1_N	140	AI/AO		
MIPI_DSI0_LANE2_P	141	AI/AO		
MIPI_DSI0_LANE2_N	142	AI/AO		
MIPI_DSI0_LANE3_P	143	AI/AO		
MIPI_DSI0_LANE3_N	144	AI/AO		
MIPI_DSI1_CLK_P	124	AO	LCD1 MIPI Signals	The MIPI data line traces should have a 85Ω ±15% differential impedance.
MIPI_DSI1_CLK_N	125	AO		
LCD0_RST_N	121	DO	LCD0 Reset Signal	
GPIO_89	188	DO	LCD0 TE Signal	
GPIO_83	186	DI	LCD0 ID PIN	
LCD_VSN	249	PO	Integrated LCM Bias Voltage -5.4V	Power Domain: -6V ~ -4V Typ. ： -5.4V
LCD_VSP	250	PO	Integrated LCM Bias Voltage +5.5V	Power Domain :4V ~ 6V Typ. ： +5.5V
PWM1	33	DO	Output PWM1 Control for Backlight	
Camera Interface				
MIPI_CSI0_LANE3_N	104	AI/AO	MIPI CSI0 Data3 Negative	Default Rear Camera, The MIPI data line traces should have a 85Ω ±15% differential impedance.
MIPI_CSI0_LANE3_P	105	AI/AO	MIPI CSI0 Data3 Positive	
MIPI_CSI0_LANE2_N	106	AI/AO	MIPI CSI0 Data2 Negative	
MIPI_CSI0_LANE2_P	107	AI/AO	MIPI CSI0 Data2 Positive	
MIPI_CSI0_LANE1_N	108	AI/AO	MIPI CSI0 Data1 Negative	
MIPI_CSI0_LANE1_P	109	AI/AO	MIPI CSI0 Data1 Positive	
MIPI_CSI0_LANE0_N	110	AI/AO	MIPI CSI0 Data0 Negative	
MIPI_CSI0_LANE0_P	111	AI/AO	MIPI CSI0 Data0 Positive	
MIPI_CSI0_CLK_N	112	AI	MIPI CSI0 Clock Negative	
MIPI_CSI0_CLK_P	113	AI	MIPI CSI0 Clock Positive	
MIPI_CSI2_LANE3_N	277	AI/AO	MIPI CSI2 Data3 Negative	Default Front Camera, The MIPI data line traces should have a 85Ω ±15% differential impedance. Divide into two cameras with a 2-Lane and an 1-Lane.
MIPI_CSI2_LANE3_P	278	AI/AO	MIPI CSI2 Data3 Positive	
MIPI_CSI2_LANE2_N	279	AI/AO	MIPI CSI2 Data2 Negative	
MIPI_CSI2_LANE2_P	280	AI/AO	MIPI CSI2 Data2 Positive	
MIPI_CSI2_LANE1_N	97	AI/AO	MIPI CSI2 Data1 Negative	
MIPI_CSI2_LANE1_P	98	AI/AO	MIPI CSI2 Data1 Positive	
MIPI_CSI2_LANE0_N	99	AI/AO	MIPI CSI2 Data0 Negative	
MIPI_CSI2_LANE0_P	100	AI/AO	MIPI CSI2 Data0 Positive	
MIPI_CSI2_CLK_N	101	AI	MIPI CSI2 Clock Negative	
MIPI_CSI2_CLK_P	102	AI	MIPI CSI2 Clock Positive	
MIPI_CSI1_LANE3_N	247	AI/AO	MIPI CSI1 Data3 Negative	
MIPI_CSI1_LANE3_P	246	AI/AO	MIPI CSI1 Data3 Positive	

MIPI_CSI1_LANE2_N	245	AI/AO	MIPI CSI1 Data2 Negaitve	Default 2nd Rear Camera, The MIPI data line traces should have a 85Ω ±15% differential impedance.
MIPI_CSI1_LANE2_P	244	AI/AO	MIPI CSI1 Data2 Positive	
MIPI_CSI1_LANE1_N	241	AI/AO	MIPI CSI1 Data1 Negative	
MIPI_CSI1_LANE1_P	240	AI/AO	MIPI CSI1 Data1 Positive	
MIPI_CSI1_LANE0_N	243	AI/AO	MIPI CSI1 Data0 Negative	
MIPI_CSI1_LANE0_P	242	AI/AO	MIPI CSI1 Data0 Positive	
MIPI_CSI1_CLK_N	239	AI	MIPI CSI1 Clock Negative	
MIPI_CSI1_CLK_P	238	AI	MIPI CSI1 Clock Positive	
CAM1_PWD_N	90	DO	Camera1 Power Down Signal	Default 2nd Rear Camera Power Down Signal
CAM1_RST_N	91	DO	Camera1 Reset Signal	Default 2nd Rear Camera Reset Signal
CAM0_RST_N	92	DO	Camera0 Reset Signal	Default Primary Rear Camera Reset Signal
CAM0_PWD_N	93	DO	Camera0 Power Down Signal	Default Primary Rear Camera Power Down Signal
CAM2_RST_N	260	DO	Camera2 Reset Signal	Default Primary Front Camera Reset Signal
CAM3_RST_N	315	DO	Camera3 Reset Signal, Camera AVDD LDO Enable Pin	Default 2nd Front Camera Reset Signal
CAM_I2C0_SDA	94	DI/DO	Camera I2C0 Data	I2C0 applies for Primary Rear Camera, I2C1 applies for Front Camera or 2nd Rear Camera, Notice that distinguish I2C register address when applying for multiple cameras. Highly recommend an external 2.2KR resistor pulling up to the VREG_L12A_1P8.
CAM_I2C0_SCL	95	DO	Camera I2C0 Clock	
CAM_I2C1_SDA	54	DI/DO	Camera I2C1 Data	
CAM_I2C1_SCL	55	DO	Camera I2C1 Clock	
CAM_MCLK0	116	DO	Camera0 Primary Clock	Default Primary Rear Camera Clock Signal
CAM_MCLK1	115	DO	Camera1 Primary Clock	Default 2nd Rear Camera Clock Signal
CAM_MCLK2	256	DO	Camera2 Primary Clock	Default Primary Front Camera Clock Signal
CAM_MCLK3	258	DO	Camera3 Primary Clock, Camera DVDD LDO Enable Pin	Default 2nd Front Camera Clock Signal
GPIO_21	262	DO	Camera DVDD LDO Enable Pin	

GPIO_45	271	DO	Camera AFVDD LDO Enable Pin	
GPIO_131_CAM_AVDD1_2_2P85_EN	314	DO	Camera AVDD LDO Enable Pin	
VPH_OUT	4	PO	Camera AVDD/AFVDD LDO Power Supply, Highly recommend an external capacitor of 2.2-4.7nF parallel connection.	Power Domain: 3.0 ~ 4.4V
VREG_S6A_1P352	8	PO	Camera DVDD(1.1V/1.2V) LDO Power Supply, Highly recommend an external capacitor of 2.2-4.7nF parallel connection.	Typical value: 1.352V
VREG_L12A_1P8	11	PO	Camera IOVDD(1.8V) Power Supply, Highly recommend an external capacitor of 2.2-4.7nF parallel connection.	Typical value: 1.8V
Key Interface				
KEY_VOL_UP_N	44	DI	Volume Up Key	Avoid an external pull up, If unused, keep it open.
KEY_VOL_DOWN_N	43	DI	Volume Down Key	If unused, keep it open.
KPD_PWR_N	14	DI	Power Key	
Sensor Interface				
SENSOR_I2C_SCL	38	DO	Sensor I2C Clock Signal	Highly recommend an external 2.2KR resistor pulling up to the VREG_L9A_1P8
SENSOR_I2C_SDA	39	DI/DO	Sensor I2C Data Signal	
GPIO_94	53	DI	Hal Sensor Interruption Pin	
GPIO_82	58	DO	Magnetic Sensor Interruption Pin	
ACCEL_INT	56	DI	Accelerate Sensor Interruption Pin	
ALSP_INT	57	DI	Light Sensor Interruption Pin	
ACCL_GYRO_DRDY_INT	275	DI	Gyroscope Sensor Interruption Pin	
SNSR_I3C_SDA	72	DI/DO	Sensor I3C Clock Signal	Highly recommend an external 2.2KR resistor pulling up to the VREG_L9A_1P8
SNSR_I3C_SCL	73	DO	Sensor I3C Data Signal	
Audio Interface				
SPKR_OUT_P	16	AO	Speaker Lineout Positive	Differential Pair Routing, Stereo ground plane
SPKR_OUT_N	17	AO	Speaker Lineout	

			Negative	
EAR_P	19	AO	Headphone Output Positive	Differential Pair Routing, Stereo ground plane
EAR_N	20	AO	Headphone Output Negative	
HPH_L	21	AO	Headphone Left-Channel	Isolate the Left- and the Right-Channel by the Main HPH_REF Ground, Stereo ground plane
HPH_REF	22	AI	Headphone Main Reference Ground	
HPH_R	23	AO	Headphone Right-Channel	
HS_DET	24	AI	Headphone Push-in Detect	
MIC2_P	28	AI	Headphone Microphone Input Positive	Pseudo Differential Pair Routing, Stereo ground plane
MIC1_N	30	AI	Primary Microphone Input Negative	Differential Pair Routing, Stereo ground plane
MIC1_P	31	AI	Primary Microphone Input Positive	
MIC3_P	9	AI	Denoise Microphone Input Positive	Differential Pair Routing, Stereo ground plane
MIC3_N	236	AI	Denoise Microphone Input Negative	
MIC_BIAS1	7	PO	Microphone Bias Voltage	Apply Bias Voltage for Digital Microphone and Silicon Microphone, Keep it open on Electret Microphone
MIC_BIAS3	235	PO	Headphone Microphone Bias Voltage	Headphone Bias Voltage
DMIC1_CLK	309	DO	Digital Microphone Clock Signal	
DMIC1_DATA	310	DI	Digital Microphone Data Signal	
DMIC2_CLK	311	DO	Digital Microphone Clock Signal	
DMIC2_DATA	312	DI	Digital Microphone Data Signal	
AUDIO_AUX_P	202	AO	Audio Lineout Positive	
AUDIO_AUX_M	203	AO	Audio Lineout Negative	
Radio Frequency Antenna Interface				
ANT_WIFI/BT	2	AI/AO	WIFI/BT Antenna Interface	
UART Interface				
DEBUG_UART_R	36	DI	Debug UART Data Receiver	Mainly for the module's

X				Debugging
DEBUG_UART_TX	37	DO	Debug UART Data Transmitter	
ADC Interface				
ADC1	34	AI	ADC Detection 1	Input Power Domain: 0 ~ 1.875V
ADC2	159	AI	ADC Detection 2	Input Power Domain: 0 ~ 1.875V
MOTOR Interface				
VIB_DRV_P	337	AO	Motor Drive Positive	Available for Linear Motor
Flash LED Interface				
FLASH_LED1	305	AO	Flash LED1 Channel	Maximum Current 1.5A
FLASH_LED2	306	AO	Flash LED2 Channel	Maximum Current 1.5A
LED Interface				
RED_LED	295	AO	Red Indicator	PWM1 Lighting Adjustment each Channel Maximum Current 12mA each Channel
GREEN_LED	296	AO	Green Indicator	
BLUE_LED	297	AO	Blue Indicator	
Forced Download Interface				
FORCED_USB_BOOT	13	DI	USB Forced Boot Signal, Forced connect to the VREG_L9A_1P8 Pin when booting up the device	Avoid an external pull up, Reserved Testing Points
GPIO				
GPIO_0	51	DI/DO	GPIO_0	
GPIO_1	52	DI/DO	GPIO_1	
GPIO_2	26	DI/DO	GPIO_2	
GPIO_3	25	DI/DO	GPIO_3	
GPIO_31	45	DI/DO	GPIO_31	
GPIO_30	46	DI/DO	GPIO_30	
GPIO_32	47	DI/DO	GPIO_32	Avoid an external pull up due to the BOOT function
GPIO_113	62	DI/DO	GPIO_113	PRI_MI2S_SCK
GPIO_114	63	DI/DO	GPIO_114	PRI_MI2S_WS
GPIO_115	64	DI/DO	GPIO_115	PRI_MI2S_DATA0
GPIO_116	65	DI/DO	GPIO_116	PRI_MI2S_DATA1
GPIO_95	66	DI/DO	GPIO_95	
GPIO_26	67	DI/DO	GPIO_26	
GPIO_27	68	DI/DO	GPIO_27	
GPIO_8	69	DI/DO	GPIO_8	
GPIO_9	71	DI/DO	GPIO_9	
GPIO_85	74	DI/DO	GPIO_85	
GPIO_84	75	DI/DO	GPIO_84	
GPIO_43	76	DI/DO	GPIO_43	

GPIO_15	77	DI/DO	GPIO_15	
GPIO_14	78	DI/DO	GPIO_14	
GPIO_33	89	DI/DO	GPIO_33	
GPIO_101	120	DI/DO	GPIO_101	Avoid an external pull up due to the BOOT function
GPIO_49	122	DI/DO	GPIO_49	
GPIO_24	182	DI/DO	GPIO_24	UART_TX
GPIO_25	183	DI/DO	GPIO_25	UART_RX
GPIO_100	187	DI/DO	GPIO_100	Avoid an external pull up due to the BOOT function
APPS_I2C_SDA	251	DI/DO	GPIO_4	APPS_I2C_SDA
APPS_I2C_SCL	252	DI/DO	GPIO_5	APPS_I2C_SCL
GRFC_8	253	DI/DO	GPIO_58	Default Antenna Tuner
GPIO_123	261	DI/DO	GPIO_123	
RFFE3_DATA	265	DI/DO	GPIO_64	Default Antenna Tuner, Avoid an external pull up due to the BOOT function
RFFE3_CLK	266	DI/DO	GPIO_65	Default Antenna Tuner
GRFC_9	268	DI/DO	GPIO_59	Default Antenna Tuner
GPIO_124	269	DI/DO	GPIO_124	
GPIO_92	284	DI/DO	GPIO_92	
GPIO_130	293	DI/DO	GPIO_130	
GPIO_86	294	DI/DO	GPIO_86	Avoid an external pull up due to the BOOT function
GRFC_4	316	DI/DO	GPIO_56	Default Antenna Tuner, Avoid an external pull up due to the BOOT function
GPIO_118	317	DI/DO	GPIO_118	Avoid an external pull up due to the BOOT function
GPIO_93	318	DI/DO	GPIO_93	
PM_GPIO_01	158	DI/DO	PM_GPIO_01	PM6125 GPIO_01
PM_GPIO_09	169	DI/DO	PM_GPIO_09	PM6125 GPIO_09
PM_GPIO_04	328	DI/DO	PM_GPIO_04	PM6125 GPIO_04, Avoid an external pull up due to the BOOT function
PMI_GPIO_01	254	DI/DO	PMI_GPIO_01	PMI632 GPIO_01
PMI_GPIO_03	263	AI	PMI_GPIO_03	SKIN_THERM Detection ADC Input, Highly recommend an external 47KR resistor pulling down to the ground when no connection.
PMI_GPIO_05	264	DI/DO	PMI_GPIO_05	PMI632 GPIO_05
PMI_GPIO_06	291	DI/DO	PMI_GPIO_06	PMI632 GPIO_06

PMI_GPIO_02	292	DI/DO	PMI_GPIO_02	PMI632 GPIO_02
Other Interface				
CBL_PWR_N	330	DO	Pull down for power on	
GNSS_LNA_CTRL	185	DO	Internal GNSS LNA Control Signal Output	If unused, keep it open.
TP_B	270	-	Testing Pin, Connect to TP_A on the module for security design	If unused, keep it open.
TP_A	304	-	Testing Pin, Connect to TP_B on the module for security design	If unused, keep it open.
BATT_ID	332	AI	Battery ID Pin, Highly recommend an external 100KR resistor connecting to the ground.	Avoid float, An external 100KR resistor pulling down to the ground if no connection.
BATT_THERM	333	AI	Battery Thermal Detect Pin, Highly recommend an external 47KR NTC resistor connecting to the ground.	Avoid float, An external 47KR resistor pulling down to the ground if no connection.
VBATT_SNS_P	339	AI	Battery Voltage Detection Positive, Connect to the battery Positive Pin.	Avoid float
VBATT_SNS_M	340	AI	Battery Voltage Detection Negative, Connect to the battery Negative Pin.	Avoid float
PON_OPTION	283		USB Mode selection for Micro USB and Type-C. The default mode is Type-C due to the internal 1MR pulling down resistor. Micro USB mode when grounding through a 1KR resistor on this pin.	
NC Pins（NC）				
NC	126-133,161,163,165,233,283,300,307,334,346			If unused, keep it open.
Reserved Pins				
RESERVED	35,200,301,302,303,329,342,343			If unused, keep it open.

NOTE

1、 Highly recommend all the GND pins are connecting to the ground.
2、 Highly recommend all the RESERVED and the unused pins disconnected.
3、 Note that, for SIM8070, pin ANT_TRX, pin ANT_DRX, and pin ANT_GNSS should be disconnected.

3 Interface Applications

3.1 Power Supply

The VBAT Input power range of the SIM8070 module is 3.5V to 4.4V, and the typical voltage is 3.9V. The instantaneous peak current of the SIM8070 module could reach 3A. So, to enable the module is running smoothly, the power supply should be able to provide the peak current up to 3A. If the power supply is designed improperly, there would be a large voltage drop on the VBAT. The shutdown voltage of the SIM8070 module is 3.2V. If the voltage drop on the VBAT is lower than 3.2V, the module would power off.

3.1.1 Pin Overview

SIM8070x series module supports a single lithium battery power supply (4.2V or 4.35V battery cell). It also supports the other types of batteries. But the maximum voltage could not exceed the maximum allowance voltage of the module. Otherwise, the module would be burned.In terms of the non-battery power supply applications, the module would power by an LDO when the DC input is up to 5V. The reference design is showing in Figure 3.

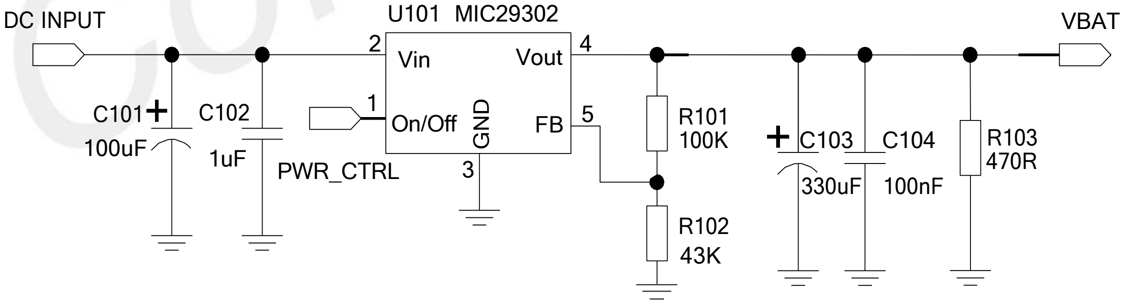


Figure 3: LDO Power Supply Reference Design

NOTE

Since the current consumption of the module is very small when powering off or sleeping. Highly recommend adding R103 as the minimum load to ensure the MIC29302 is working smoothly with the light load. Please refer to the MIC29302’s specification for detailed information.

Highly recommend selecting a relative high efficiency switching power supply for hardware design when the difference between the input (DC Input) and the output (VBAT) is too large. The reference design is showing in Figure 4.

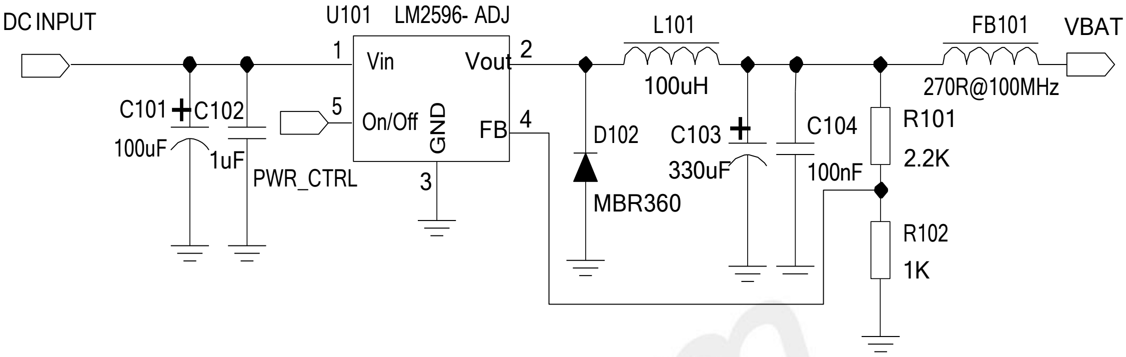


Figure 4: DC-DC Power Supply Reference Design

NOTE

1. Highly recommend disconnect the VBAT power supply to power off the module when the module is running abnormally. After that, restart the module by powering.
2. The module supports the charging function. There is a need to turn off the charging function in the software patch when the customers are using the power supply without the charging function. Or connect Schottky diodes in series on the VBAT channel to prevent the current anti-flowing into the chip.

3.1.2 Power Supply Stability Design

Highly recommend place bypass capacitors and voltage stabilizing components near the VBAT Pin to enhance the stability of the power supply. The reference design is showing in the Figure 5.

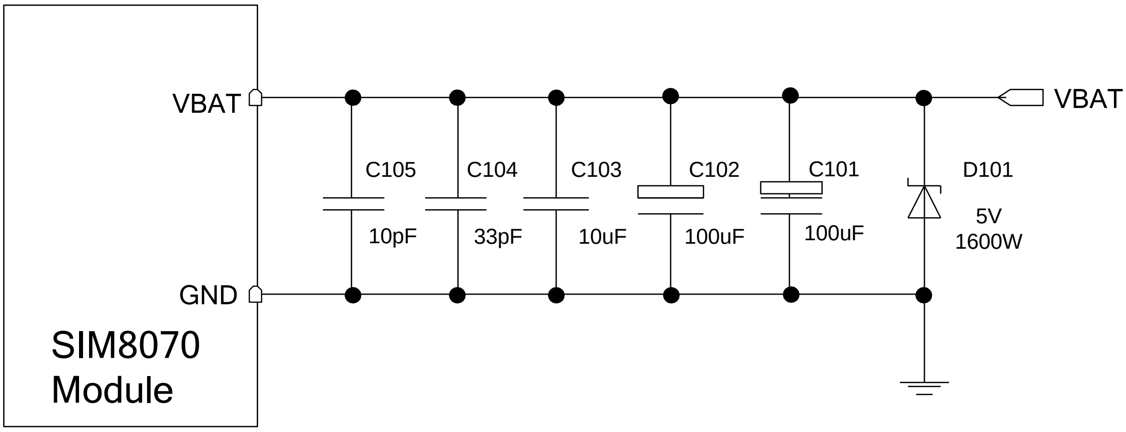


Figure 5: VBAT Input Reference Design

In Figure 5, C101 and C102 are two Low-ESR 100Uf tantalum capacitors. C103 is a 1uF to 10uF ceramic capacitor. The function of C104 and C105 is to decrease the high frequency interference. D101 is a 5V/1600W transient voltage suppression diode, preventing the chip from being damaged by surge. For PCB wiring, the capacitors and the diodes should be close to the VBAT Pin as far as possible, and the VBAT wiring should be as short as possible with the width at least 3mm.

Table 6: Recommended TVS Diode

	Vendor	Manufacture Number	Power(Watts)	Package
1	Prisemi	PTVSHC3N4V8U	3200W	DFN2×2-3L
2	Prisemi	PTVSHC2EN5VU	1600W	DFN1610-2L

3.2 Power On & Power Off

The on-off of the SIM8070x series module has two status, including the normal on-off and the abnormal on-off. In terms of the high- and low-pressure, and the high- and low-temperature, it should be working within the maximum power domain when running the module. Otherwise, exceeding the absolute maximum power domain would cause permanent damage to the module.

3.2.1 Power On

KPD_PWR_N Pin defines as the boot-up key when the VBAT is powering on, and triggering KPD_PWR_N with at least 2s low-level pulse starts the module. KPD_PWR_N Pin has internal pull-up, and the typical high-level voltage is 1.8V. The reference design is showing as below.

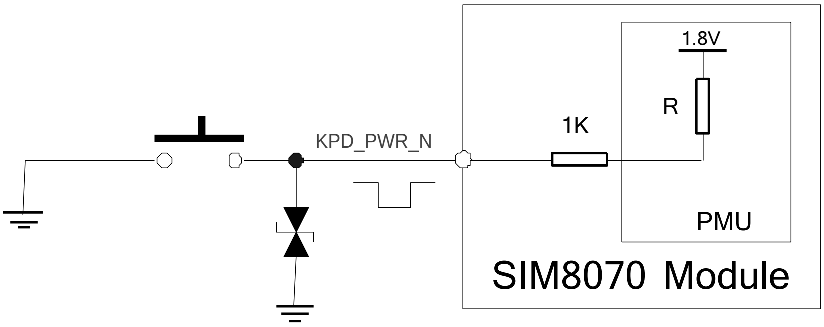


Figure 6: Power On/Off Design with a Key

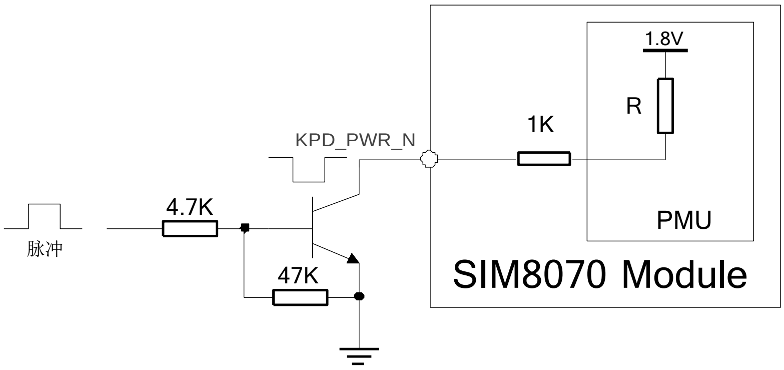


Figure 7: Power On/Off Design with an OC Gate

Highly recommend the customers consider the KPD_PWR_N Pin's electrical characteristics when designing. The electrical characteristics are showing in Table 7.

Table 7: KPD_PWR_N Features

Parameters	Description	Minimum	Typical	Maximum	Unit
V_{IH}	High-Level Input Voltage	1.4	-	-	V
V_{IL}	Low-Level Input Voltage	-	-	0.6	V

3.2.2 Power On Sequence

Figure 8 shows the power on sequence of the module.

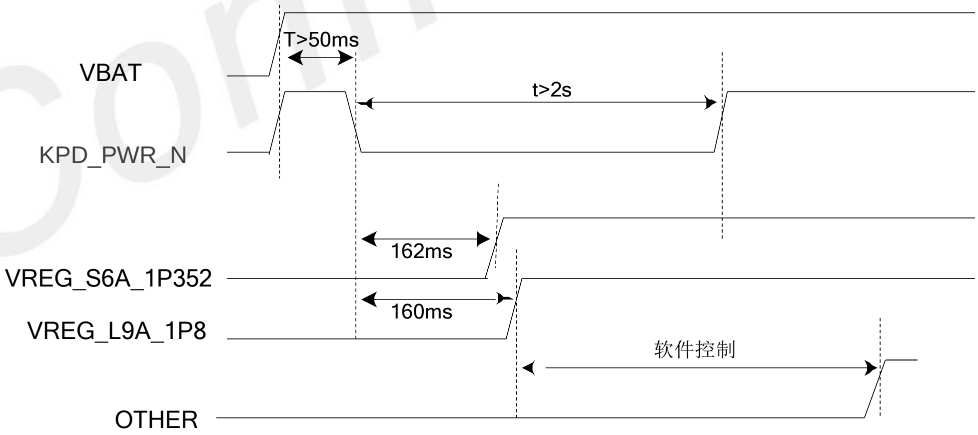


Figure 8: Power Sequence

NOTE

Highly recommend pulling down the KPD_PWR_N Pin when booting up the VBAT voltage at 3.8V stabilizing for at least 50ms. Do not pull down the KPD_PWR_N Pin all the time.

3.2.3 Power Off

Pull down the KPD_PWR_N Pin with at least 1s to power off the module. There is a pop up prompt window confirming the action of shutting down the device when the module detects the control instructions. Apart from that, pulling down the KPD_PWR_N Pin with over 8s would be forced restart the module.

Powering on and powering off are using the same pin, and they have the same reference design.

NOTE

1. The hardware design should cove the function of powering off the module. It is forbidden to run the module when powering off or restarting. Forced powering off the module adopts only when the module is running abnormally.
2. Highly recommend adding a low-cost microcontroller to control the KPD_PWR_N. Not only for the normal powering on and powering off but also for the watchdog function to protect the operation system.
3. Do not cut off the VBAT power supply directly when the module is running smoothly. It is to protect the internal flash memory.
4. Highly recommend to power off the module by the KPD_PWR_N Pin or the AT command before disconnecting the VBAT power supply.

3.3 Power On & Power Off

The VRTC is a standby power supply, connecting with a button battery or a large capacitor. VRTC would help to maintain the RTC timing when the VBAT is powering off. VRTC would also work as charging the button battery or a large capacitor when the VBAT is powering on.

- If the RTC fails, the RTC clock could be synchronized by connecting the data when the module is powering on.
- Please refer to the Table 8 for VRTC characteristics.
- The input power domain for the VRTC voltage supply is 2.0V to 2.35V. The typical voltage is 3.0V. The average current consumption is 20uA when disconnecting the VBAT and connecting the RTC only.
- When powering on via the VBAT, the RTC working error is 50ppm. Switching the power supply mode of the VRTC Pin cause the RTC working error is 200ppm.
- Highly recommend the ESR of the button battery is less than 2K when connecting an external rechargeable button battery. Highly recommend to pick SEIKO’s MS621FE FL11E.
- Highly recommend the ESR of the capacitor is 100uF when connecting an external large capacitor.

The reference designs for VRTC are showing below.

- **External Capacitor Power Supply for RTC**

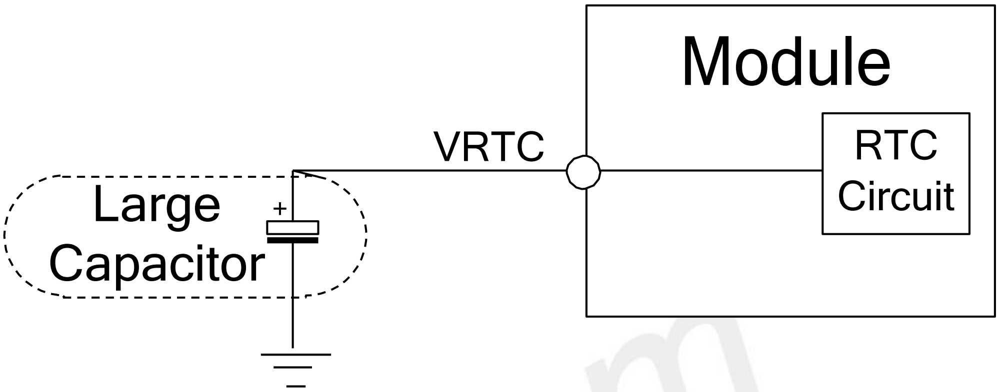


Figure 9: External Capacitor Power Supply for RTC

- **Non Rechargeable Battery Power Supply for RTC**

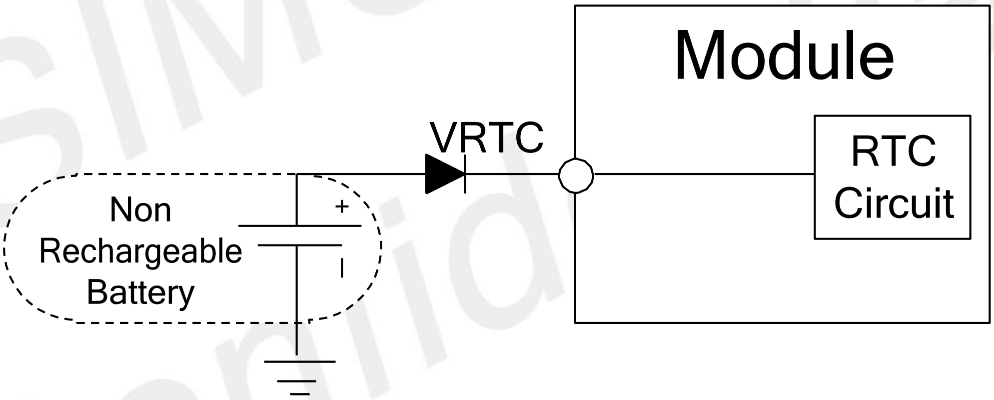


Figure 10: Non Rechargeable Battery Power Supply for RTC

- **Rechargeable Battery Power Supply for RTC**

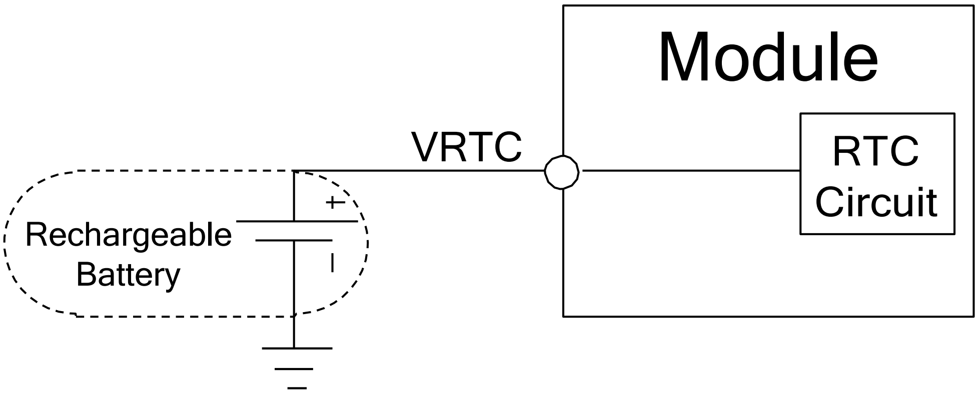


Figure 11: Rechargeable Battery Power Supply for RTC

The typical voltage of the VRTC is 3.0V. And the average current consumption is 20uA when disconnecting the VBAT and connecting the RTC only. The VRTC characteristics are showing in Table 8.

Table 8: VRTC Features

Parameters	Description	Minimum	Typical	Maximum	Unit
$VRTC_{-IN}$	VRTC Input Voltage	2.0	3.0	3.25	V
$T_{-\text{ series resistance}}$	Standby Battery connecting in series resistor	800		2100	Ω
I_{RTC-IN}	VRTC Current Consumption（VBAT=0V）	-	20.0	-	uA
$VRTC_{-OUT}$	VRTC Output Voltage	2.5	3.1	3.2	V
$I_{RTC-OUT}$	VRTC Output Current	-		2	mA

NOTE

If the VBAT is connecting an external non-removable rechargeable battery, float the VRTC Pin. Also, the software should be modified to turn off the VRTC charging instructions.

3.4 Power Output

SIM8070x series module has 18 power outputs in total, which are suitable for a wide range of external interfaces and peripherals. Highly recommend a capacitor of 33pF and a capacitor of 10pF parallel connection to the ground, which could prevent high-frequency interference effectively.

Table 9: Power Definition

Power Name	PIN Num	Output Voltage (V)	Rated Current (mA)	Default On	Description
VPH_OUT	4	3.5-4.4	500	ON	Camera AVDD、AFVDD LDO, Connecting the VPH_OUT and the VPH_PWR internally
VREG_L12A_1P8	11	1.8	300	ON	Cameras and MIPI IOVDD(1.8V) Power
VREG_S6A_1P352	8	1.352	1200	ON	Camera DVDD LDO
VREG_L9A_1P8	10，12	1.8	300	ON	External Power and External GPIO pull up and the 1.8V power

					level conversion
VREG_L14A_1P8	331	1.8	500	Off	Mainly for External Audio Codec Power
VREG_L19A_UIM1	211	1.8/2.95	150	Off	SIM Card1 Power
VREG_L20A_UIM2	172	1.8/2.95	150	Off	SIM Card2 Power
VREG_L5A_SDC2	80	1.8/2.95	50	Off	SDIO Pull up Power
VREG_L21A_2P704	5 6	2.704	500	Off	TP AVDD and LCD AVDD2.8V Power
VREG_L22A_2P96	149	2.96	600	Off	SD Card Power
VREG_L15A_3P128	345	3.128	150	ON	DP Switching Power
LCD_VSN	249	-5.4	80	Off	LCD VSN Power
LCD_VSP	250	+5.5	80	Off	LCD VSP Power
FLASH_LED1	305	-	1500	Off	FLASH 1 LED Power
FLASH_LED2	306	-	1500	Off	FLASH 2 LED Power
MIC_BIAS1	7	1.8	6	Off	Microphone Bias
MIC_BIAS3	235	1.8	6	Off	Headphone Microphone Bias
VPH_PWR	285 286 287	-	2000	Lowered	Output Power by the VBAT or the VBUS for external peripherals

3.5 Charging and Battery Management

SIM8070x series module supports the Qualcomm Quick Charge (QC) 2.0 and 3.0 fast charging protocol. The current of the QC3.0 protocol is up to 3A, and the charging power is about 15W to 18W. The module integrates the internal charging temperature rising control function. Decreasing the charging voltage and the charging current happens automatically when the temperature is too high.

Table 10: Comparison of the Charge Protocol

Charge Protocol	DP Vol.	DM Vol.	Charge Voltage	Charge Current	Charge Power	Connector	Description
QC2.0	0.6V	0.6V	12V	1.5-2A	> 7.5 W	Type-C Micro-USB	Higher charging voltage, Lower charging efficiency, Higher charging heat, Charging over 9V works improperly.
	3.3V	0.6V	9V				
	0.6V	GND	Default 5V				

QC3.0	0.6V	3.3V	Continuous Mode 3.6-12V	3A	≥ 18 W	Type-C Micro-USB	Adopts INOV Algorithm, Adjustable with 200mV for Charging, Higher charging efficiency, Higher charging speed, Lower charging heat.

SIM8070x series module could charge the battery. It supports several charging modes, including the trickle charging mode, the pre-charging mode, the constant current charging mode, and the other charging modes.

- The Trickle Charging Mode:
  The system is running into the trickle charging mode when the voltage of the battery is lower than 2.1V. In this case, the charging current is about 75mA.
- The Pre-charging Mode:
  The system is running into the pre-charging mode when the voltage of the battery is between 2.1V and 3.0V (The cut-off voltage is programmable between 2.4V and 3.0V, Default 3.0V). The charging current is about 300mA (The current is programmable between 100mA and 450mA, Default 300mA).
- The Constant Current Charging Mode:
  The system is running into the constant current charging mode when the voltage of the battery is between the cut-off voltage of the pre-charging mode and 4.2V (The voltage is programmable between 3.6V and 4.2V, Default 4.2V). The charging current is programmable between 300mA and 3000mA (The Default USB charging current is setting at 500mA in the software configuration).
- The Constant Voltage Charging Mode:
  The system is running into the constant voltage charging mode when the voltage of the battery is reaching at 4.2V. In this case, the charging current is decreasing gradually. The charging status would stop when the charging current is reaching at 100mA.

Table 11: The Battery's Pin Definition

PIN Name	PIN Num	I/O	Description	Note
VBAT	83 84 85	PI/PO	Module Power Input, Battery Charge Output	
BATT_ID	332	AI	Battery Detection	Highly recommend an external 100KR resistor connecting to the ground when no battery ID.
BATT_THERM	333	AI	Battery Thermal Detection	Connect to the battery NTC Resistor, Highly recommend an external 47KR resistor connecting to the ground when no battery.
VBATT_SNS_P	339	AI	Battery Voltage Detection +	Connect
VBATT_SNS_M	340	AI	Battery Voltage Detection -	Connect

SIM8070x series module has the function of battery detection. Generally, there is a BATT_ID Pin in the battery. Highly recommend an external 100KR resistor (R2) connecting to the ground when the battery has no BATT_ID. Avoid float.

SIM8070x series module has the function of battery temperature detection. This function requires an integrated thermistor in the battery (Recommend a 47KR ± 1% NTC Resistor). And the NTC resistor needs to connect to the BATT_THERM Pin. The module would charge fail when floating the BATT_THERM pin. Highly recommend the R2=100KR and the R3=47KR when there is no BATT_ID and BATT_THERM. In this case, the module would power on by the adapter.

SIM8070x series module has the function of battery's fuel gauge. It estimates the real-time power of the battery accurately. Not only protect the battery and prevent the over dis-charge but also help the users to estimate the entertainment time and save the important data. For different types of batteries, modifying the software settings enables the designated battery working properly.

The VBATT_SNS_P Pin and the VBATT_SNS_M Pin must be connected whether the module is powering on by a battery or a stable power supply. The module would not work well if floating these two pins. These two pins are for battery voltage detection. Differential pair routing and stereo ground plane are needed.

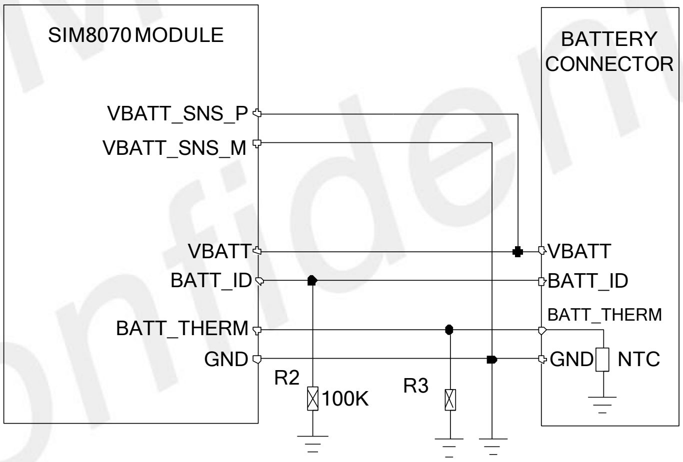


Figure 12: Battery Connection Reference Design

3.6 USB Interface

3.6.1 Micro-USB Interface and Type-C Interface

SIM8070x series module supports a USB interface, complying with USB 3.1/2.0 protocol and supporting

USB OTG. The speed for the USB3.1 is up to 10Gbps, and for the USB 2.0 is up to 480Mbps. It is downward compatible with full speed (12Mbps) mode. USB_HS interface supports the function of the AT command transmission, of the data transmission, of the software debugging, and of the software upgrading.

SIM8070x series module only supports Micro-USB or Type-C at one time due to different protocols. If the hardware configuration is connecting with Type-C, but the physical channel is running through the Micro-USB interface, the USB identification would run timeout.

Table 12: The Interface Configuration of the Micro-USB or the Type-C

PIN Name	PIN Num	Micro-USB	Type-C
USB_PHY_PS	282	Float	Connect to PIN 267
CPU_USB_PHY_PS	267	10K Pull down to the Ground	Connect to PIN 282

- **The Type-C Interface Reference Design**

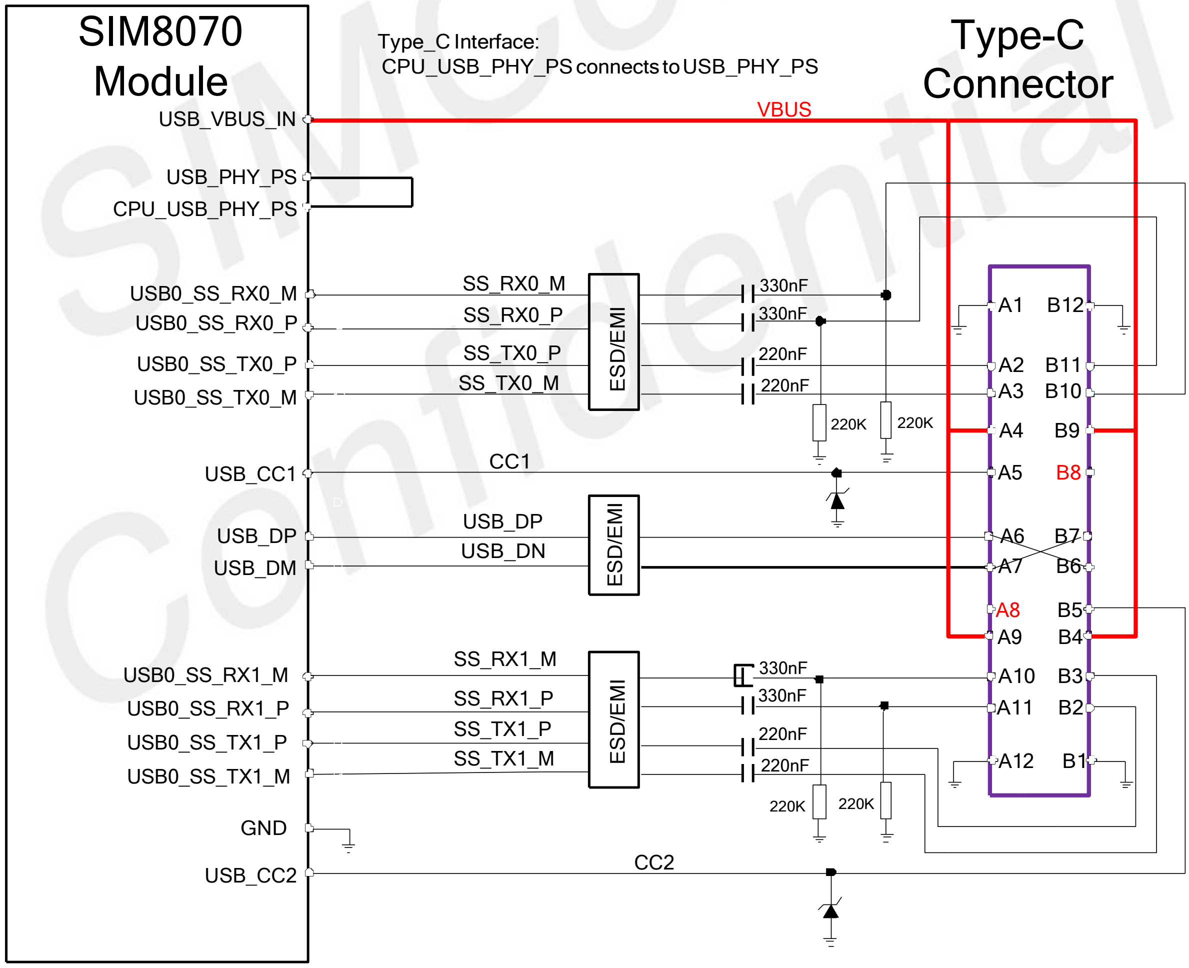


Figure 13: USB Type-C Connection Reference Design

- **The Micro-USB Interface Reference Design**

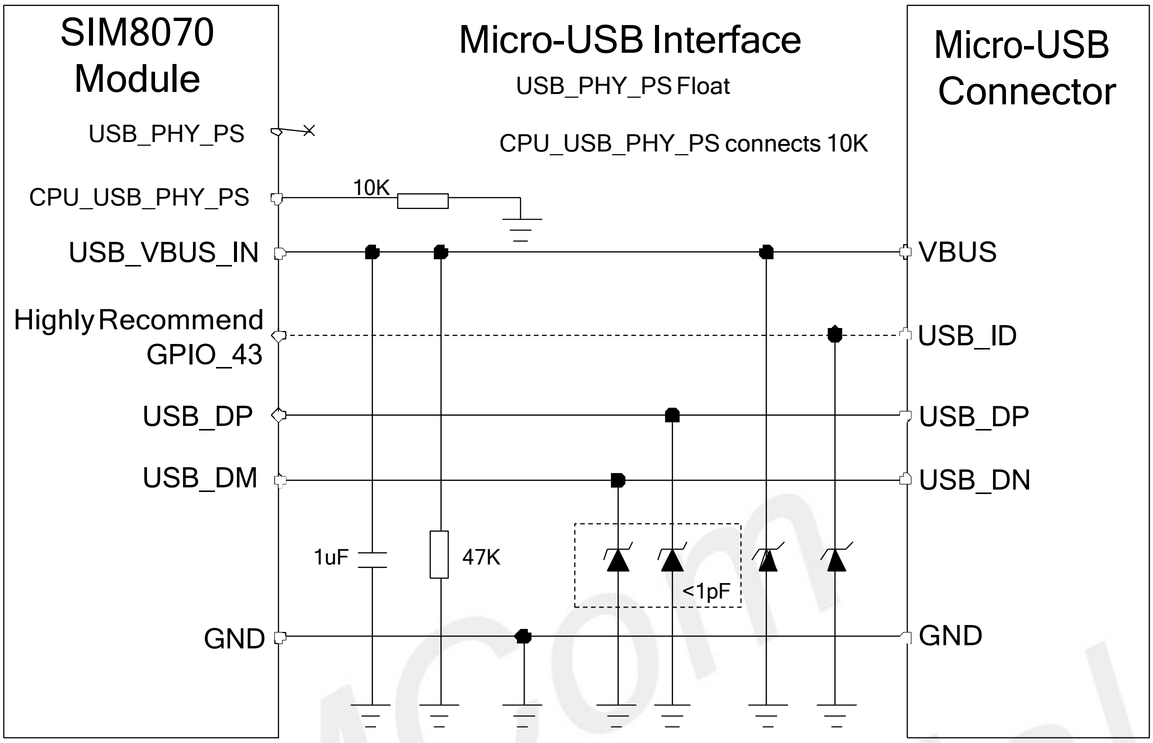


Figure 14: USB Micro-USB Connection Reference Design

3.6.2 Micro-USB Interface and Type-C Interface Feature

Table 13: DP and USB3.1 Type-C Compatible Pin Definition

PIN Name	PIN Num	USB Mode	Display Port Mode
USB0_SS_RX0_P/M	193/194	USB0_SS_RX0_P/M	DP_LANE3_P/M
USB0_SS_TX0_P/M	196/197	USB0_SS_TX0_P/M	DP_LANE2_P/M
USB0_SS_RX1_P/M	324/323	USB0_SS_RX1_P/M	DP_LANE0_P/M
USB0_SS_TX1_P/M	325/326	USB0_SS_TX1_P/M	DP_LANE1_P/M
USB0_DP_AUX_P/M	321/320	SBU1/2	USB0_DP_AUX_P/M
USB _DP/M	146/147	USB _DP/M	USB1_HS_DP/M
USB_CC1/USB_CC2	191/190	CC/VCONN	HOTPLUG_DET/ VCONN
USB_VBUS_IN	87/288/289	VBUS	VBUS

SIM8070x series module supports the 4-Lane DP interface, and it supports 1920X1200 displaying screen. Apart from that, it shares functional pins with the USB3.1 Type-C interface.

USB Mode: USB mode and DP mode could not work at the same time.

DP Mode: DP and USB2.0 could work properly at the same time. But not for the USB3.1. For the DP interface, the USB0_DP_AUX_P pin and the USB0_DP_AUX_M pin are needed in addition to the USB3.1 compatible pins.

Highly recommend disconnect the Type-C interface and the DP_AUX_P/N signals when running with the USB function. A switch is needed in this case. The switch is closing by default. The DP_EN_N output is active low when switching into the DP interface. The USBC_ORTENTAION output is active high when switching into the MHL channel.

- **The Type-C Interface with DP Function Reference Design**

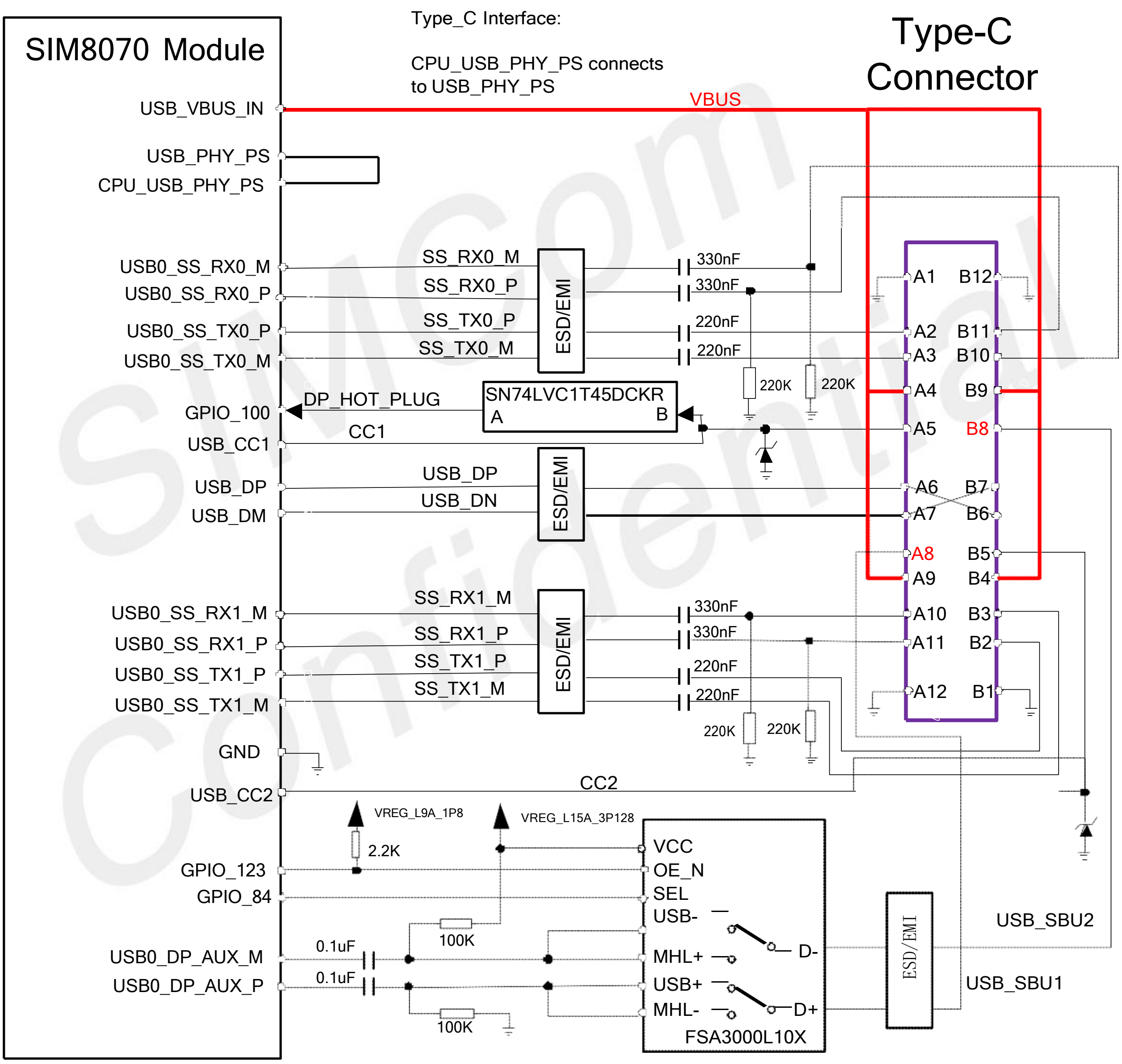


Figure 15: USB Type-C with DP Function Connection Reference Design

PCB wiring protocols and hardware design notices for USB signals are listing below.

- Differential pair routing, 90+-10% differential impedance, and stereo ground plane are needed.
- Reserved ESD protection components close to the USB interface:
  Highly recommend the TVS junction capacitance value on the USB2.0 signal lines less than 2pF.
  Highly recommend the TVS junction capacitance value on the USB3.1 signal lines less than 0.5pF.

- Do not wiring the USB signals under the crystal oscillator, the oscillator, the magnetic devices, and the RF signals. Highly recommend routing in the inner layer and stereo ground plane.
- Highly recommend the USB2.0 signals, the USB3.1 TX signals, and the USB 3.1 RX signals are wiring as differential pairs separately. For DP displaying function, highly recommend the USB3.1 TX signals, the USB 3.1 RX signals, and the DP_AUX signals are wiring as differential pairs separately.

3.7 UART/SPI/I2C/I2S Interface

SIM8070x series module supports multiple sets of the UART, the I2C, the SPI, and the I2S. The combination of multiple interfaces is flexible and achievable by the configuration of GPIOs. The interface voltage is 1.8V.

3.7.1 UART/SPI/I2C Interface Multiplexing

Table 14: UART/SPI/I2C Interface Multiplexing Feature

Set	PIN Name	PIN Num	GPIO	Multiplex1 SPI	Multiplex2 UART	Multiplex3 I2C/I3C
1	GPIO_0	51	GPIO_0	SPI1_MISO	UART1_CTS	I2C1_SDA
	GPIO_1	52	GPIO_1	SPI1_MOSI	UART1_RTS	I2C1_SCL
	GPIO_2	26	GPIO_2	SPI1_CLK	UART1_TX	
	GPIO_3	25	GPIO_3	SPI1_CS_N	UART1_RX	
2	APPS_I2C_SDA	251	GPIO_4			APPS_I2C_SDA
	APPS_I2C_SCL	252	GPIO_5			APPS_I2C_SCL
3	TP_I2C_SDA	167	GPIO_6	SPI2_MISO	UART2_CTS	TP_I2C_SDA
	TP_I2C_SCL	117	GPIO_7	SPI2_MOSI	UART2_RTS	TP_I2C_SCL
	GPIO_8	69	GPIO_8	SPI2_CLK	UART2_TX	
	GPIO_9	71	GPIO_9	SPI2_CS_N	UART2_RX	
4	GPIO_14	78	GPIO_14		UART3_TX	I2C3_SDA
	GPIO_15	77	GPIO_15		UART3_RX	I2C3_SCL
5	DEBUG_UART_TX	37	GPIO_16		DEBUG_UART_TX	I2C4_SDA
	DEBUG_UART_RX	36	GPIO_17		DEBUG_UART_RX	I2C4_SCL
6	SNSR_I3C_SDA	72	GPIO_22	SPI3_MISO	UART4_CTS	SNSR_I3C_SDA
	SNSR_I3C_SCL	73	GPIO_23	SPI3_MOSI	UART4_RTS	SNSR_I3C_SCL
	GPIO_24	182	GPIO_24	SPI3_CLK	UART4_TX	
	GPIO_25	183	GPIO_25	SPI3_CS_N	UART4_RX	
7	SENSOR_I2C_SDA	39	GPIO_28			SENSOR_I2C_SDA
	SENSOR_I2C_SCL	38	GPIO_29			SENSOR_I2C_SCL

8	GPIO_30	46	GPIO_30	SPI4_MISO	UART5_CTS	I2C5_SDA
	GPIO_31	45	GPIO_31	SPI4_MOSI	UART5_RTS	I2C5_SCL
	GPIO_32	47	GPIO_32	SPI4_CLK	UART5_TX	
	GPIO_33	89	GPIO_33	SPI4_CS_N	UART5_RX	
	CAM_I2C0_SDA	94	GPIO_37			CCI_I2C_SDA0
	CAM_I2C0_SCL	95	GPIO_38			CCI_I2C_SCL0
	CAM_I2C1_SDA	54	GPIO_39			CCI_I2C_SDA1
	CAM_I2C1_SCL	55	GPIO_40			CCI_I2C_SCL1

- SIM8070x series module defines the default configuration for these pins highlighting in green. Please consult SIMCom staff to review the reference design and functions for these pins.
- SIM8070x series module supports 4 sets of SPI, 6 sets of UART, and 8 sets of I2C (excluding camera's I2C). Choosing only one function among the SPI, the UART, and the I2C in the same bus set. For example, the I2C5 and the UART5 (TX/RX) could not function well at the same time.
- Highly recommend an external 2.2KR resister pulling up to the 1.8V power supply for I2C.
- Do not reuse the Debug GPIO16 and GPIO17.
- SPI interface could support the working frequency up to 50MHz.

3.7.2 UART Voltage Level Shift Circuit

SIM8070x series module supports up to 6 sets of the UART interfaces, including the 2 sets of the 2-Lane interface, and the Debug UART for debugging. The other 4 sets of the 4-Lane interface support the hardware flow control with the speed up to 4Mbps. The interface voltage for UART on the SIM8070x series module is 1.8V. Taking a voltage level shift chip for voltage switching if needed. Highly recommend pick TI's TXS0104EPWR, and the reference design is showing in the following Figures.

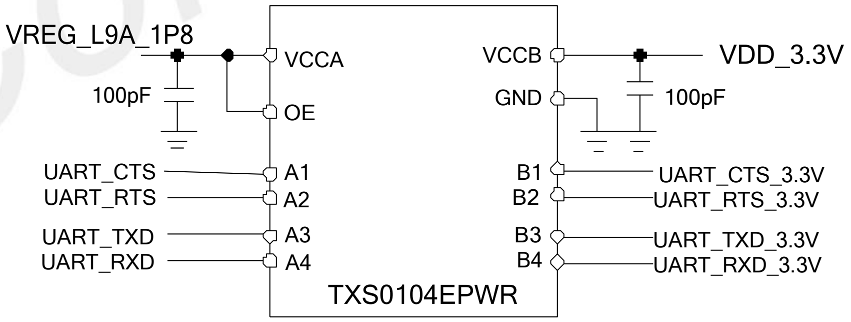


Figure 16: UART Voltage Level Shift Reference Design

The compatible reference design is showing below.

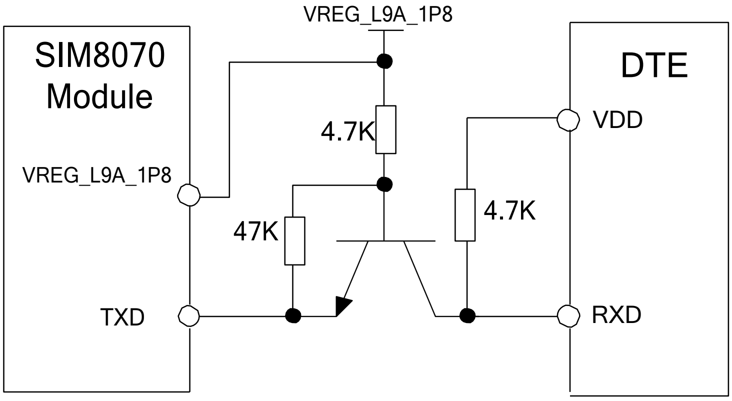


Figure 17: TX Voltage Level Shift Reference Design

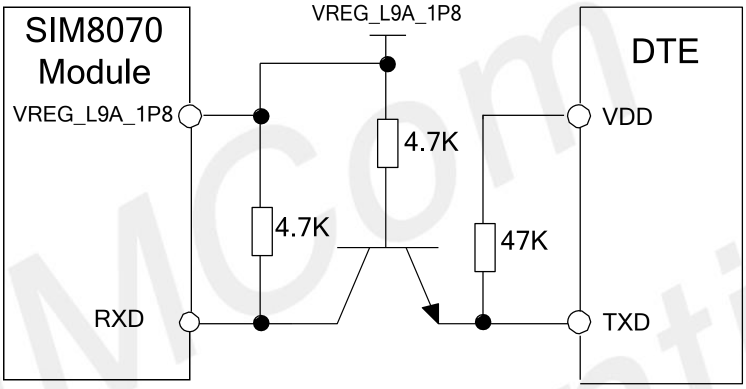


Figure 18: RX Voltage Level Shift Reference Design

3.7.3 SPI Interface

SIM8070x series module supports up to 4 sets of the SPI interfaces. They only support the host mode, and the highest working frequency is 50MHz.

Table 15: Recommend SPI Interface

PIN Name	PIN Num	I/O	Description	Notes
GPIO_0	51	DI	SPI Data Input Signal	
GPIO_1	52	DO	SPI Data Output Signal	
GPIO_2	26	DO	SPI Clock Signal	
GPIO_3	25	DO	SPI Chip Select Signal	
GPIO_30	46	DI	SPI Data Input Signal	
GPIO_31	45	DO	SPI Data Output Signal	
GPIO_32	47	DO	SPI Clock Signal	
GPIO_33	89	DO	SPI Chip Select Signal	

3.7.4 I2C Interface

SIM8070x series module supports up to 8 sets of the I2C interfaces, but only open the following 6 sets of the I2C interfaces by default. They only support the host mode, and the highest speed is 400Kbps. Highly recommend an external 2.2KR resister pulling up to the 1.8V power supply for I2C.

Table 16: Recommend I2C Interface

PIN Name	PIN Num	I/O	Pull Up Voltage	Description	Notes
APPS_I2C_SDA	251	DI/DO	VREG_L9A_1P8	Default External I2C Data Signal	For External PD Interface
APPS_I2C_SCL	252	DO	VREG_L9A_1P8	Default External I2C Clock Signal	
TP_I2C_SDA	167	DI/DO	VREG_L9A_1P8	TP1 I2C Data Signal	For TP
TP_I2C_SCL	117	DO	VREG_L9A_1P8	TP1 I2C Clock Signal	
SNSR_I3C_SDA	72	DI/DO	VREG_L9A_1P8	Sensor I3C Data	For Sensors
SNSR_I3C_SCL	73	DO	VREG_L9A_1P8	Sensor I3C Clock	
CAM_I2C0_SDA	94	DI/DO	VREG_L12A_1P8	Camera I2C Data	For Cameras
CAM_I2C0_SCL	95	DO	VREG_L12A_1P8	Camera I2C Clock	
CAM_I2C1_SDA	54	DI/DO	VREG_L12A_1P8	Camera I2C Data	For Cameras
CAM_I2C1_SCL	55	DO	VREG_L12A_1P8	Camera I2C Clock	
SENSOR_I2C_SDA	39	DI/DO	VREG_L9A_1P8	External Sensor I2C Data	For External Sensors
SENSOR_I2C_SCL	38	DO	VREG_L9A_1P8	External Sensor I2C Clock	

3.7.5 I2S Interface

SIM8070x series module supports 2 sets of the I2S interfaces. It supports the input- mode, the output-mode, and the host-/device-mode. The definition is showing in Table 17.

Table 17: Recommend I2S Interface

PIN Name	PIN Num	Multiplex I2S	I/O	Description	Notes
DMIC1_CLK	309	MI2S1_SCK	DI/DO	I2S2 Clock	Occupy when select 2 LCDs
DMIC1_DATA	310	MI2S1_WS	DI/DO	I2S2 Word Select	
DMIC2_CLK	311	MI2S1_DATA0	DI/DO	I2S2 Data0	
DMIC2_DATA	312	MI2S1_DATA1	DI/DO	I2S2 Data1	

GPIO_113_PRI_MI2S_SCK	62	PRI_MI2S_SCK	DI/DO	PRI_MI2S Clock
GPIO_114_PRI_MI2S_WS	63	PRI_MI2S_WS	DI/DO	PRI_MI2S Word Select
GPIO_115_PRI_MI2S_DATA0	64	PRI_MI2S_DATA0	DI/DO	PRI_MI2S Data0
GPIO_116_PRI_MI2S_DATA1	65	PRI_MI2S_DATA1	DI/DO	PRI_MI2S Data1

3.8 SD Card Interface

SIM8070x series module supports SD 3.0/MMC cards with 4-Bit data interface or SDIO 3.0 devices. The SD cards comply with the following protocols.

- 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

The reference design for SD card is showing in the Figure 19.

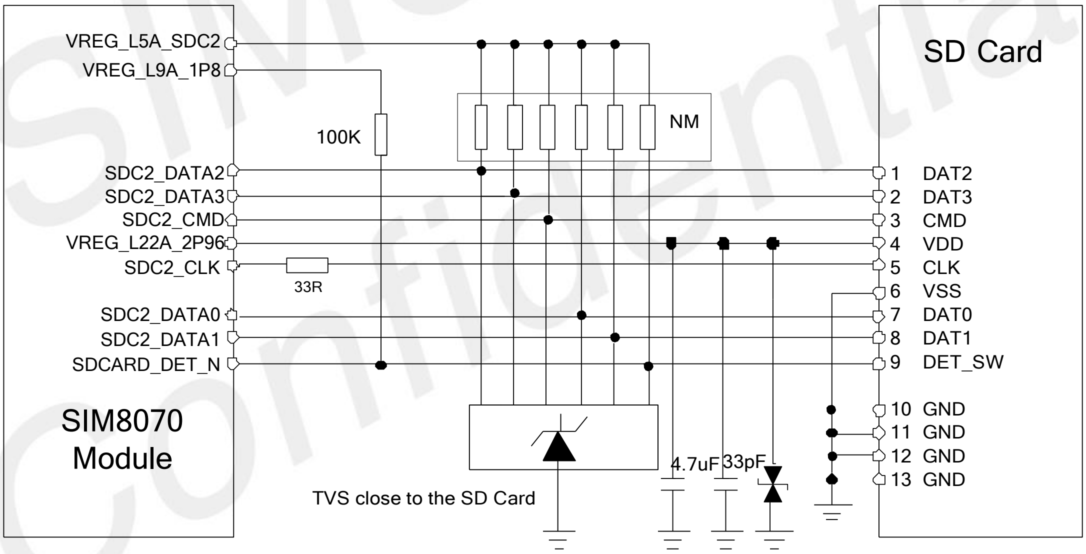


Figure 19: SD Card Reference Design

NOTE

VREG_L22A_2P96 is a fixed 2.96V power output.
Highly recommend avoiding pull up the SDC2 signal lines to the VREG_L22A_2P96.
Refer to chapter 4 for PCB design rules.

3.9 TP Interface

SIM8070x series module provides an I2C interface, an interruption function pin, and a reset pin, connecting the touching panel to operate.

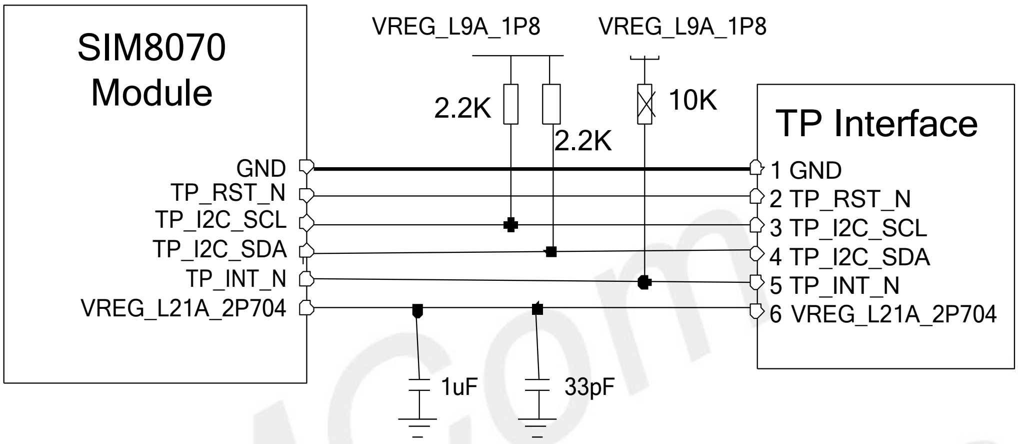


Figure 20: TP Interface Reference Design

NOTE

Highly recommend an external 2.2KR resister pulling up to the 1.8V power supply for TP I2C.

3.10 LCD Interface

SIM8070x series module's video output interface meets the requirements of MIPI_DSI standard. It has a 4-Lane DSI DPHY 1.2 interface with the speed up to 1.5Gbps. It also supports dual screen display with the maximum resolution of 2520*1080 (FHD+). Apart from that, the SIM8070x series module supports displaying screen with display port protocol via the USB Type-C interface.

The PWM1 pin of the module could control the backlight brightness by software configuration.

The MIPI signal lines are high-speed signal lines. Highly recommend place a common mode inductor close to the LCM to avoiding EMI interference. Float the MIPI_Lane2 and the MIPI_Lane3 when the LCM only has 2-Lane differential pair data signals. Highly recommend adopting the module's integrated reference circuits if the LCD interface has no bias voltage hardware design. Notice that the positive bias voltage and the negative bias voltage of the LCD are between the LCD_VSN and the LCD_VSP of the module. The reference design is showing in the Figure 21.

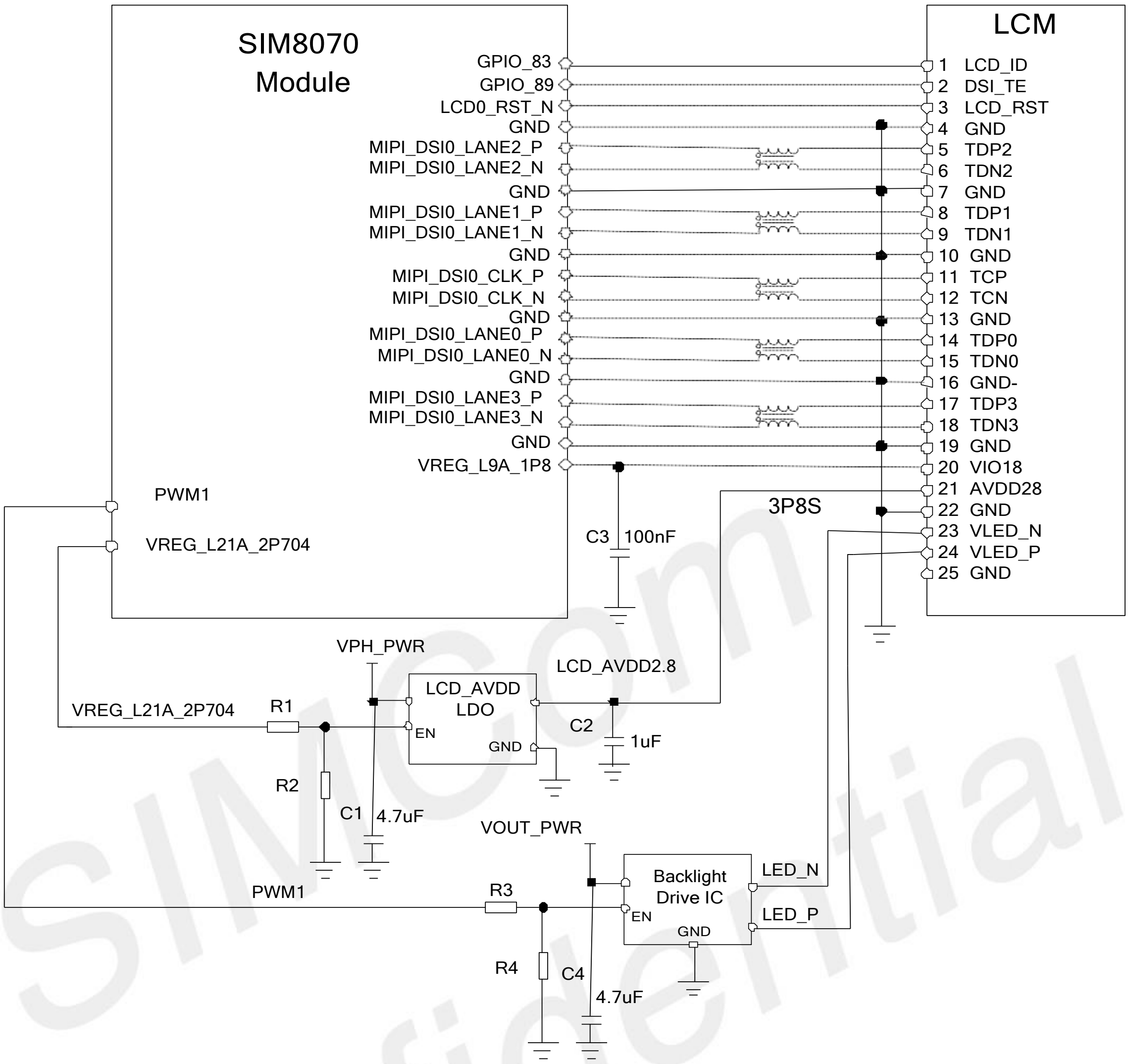


Figure 21: LCD Interface & the Backlight Reference Design

3.11 Camera Interface

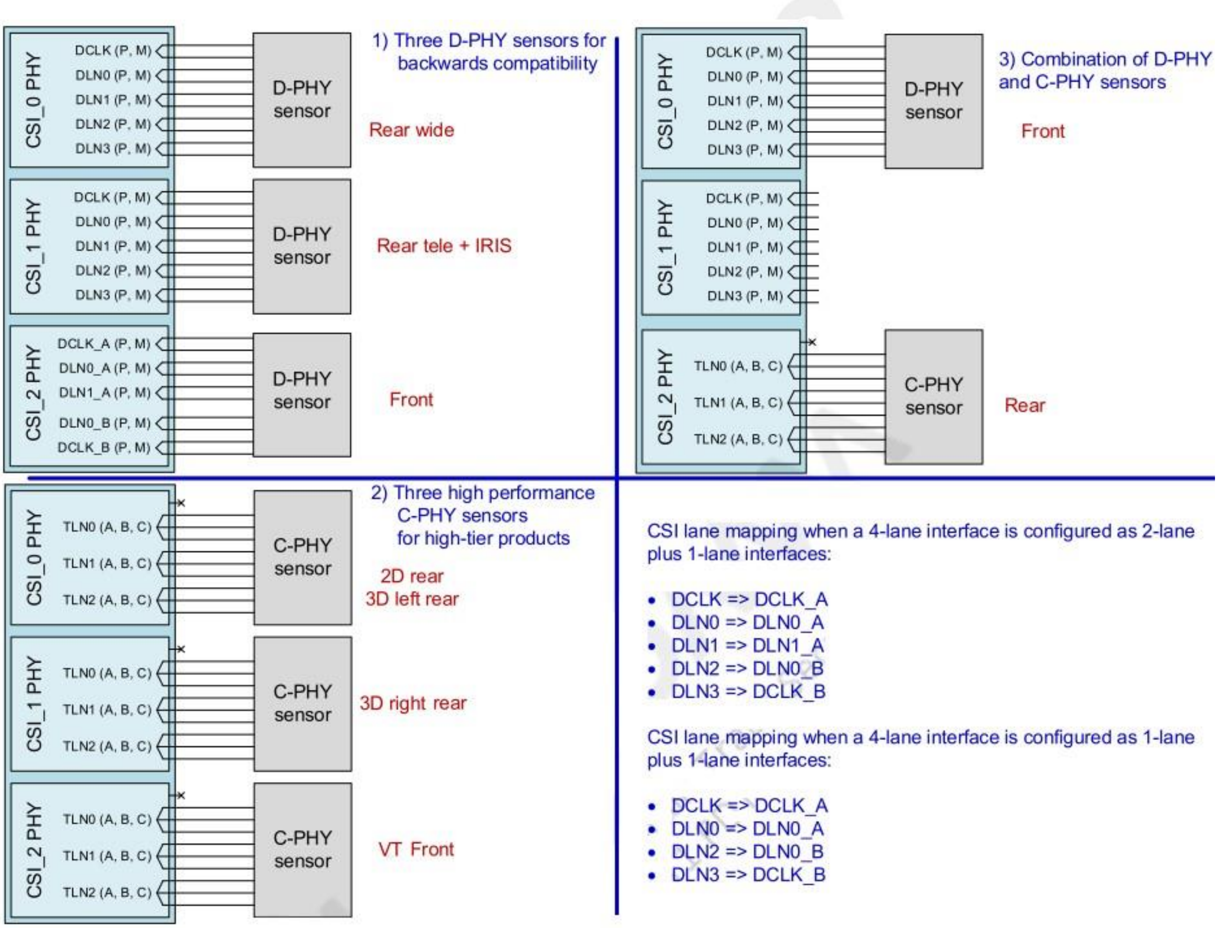
SIM8070x series module’s video input interface meets the requirements of MIPI_CSI standard.

- 3 sets of 4-Lane CSI interfaces.
  Support 3 (4-Lane + 4-Lane + 4-Lane) cameras or
  Support 4 (4-Lane + 4-Lane + 2-Lane + 1-Lane) cameras.
- Selectable on in the following two settings.
  Support DPHY 1.2 with the speed up to 1.5Gbps/Lane or
  Support CPHY 1.0 with the speed up to 10.26Gbps(total).
- Support dual image signal processing (ISP) with the resolution up to 25M pixels (dual ISP). The maximum capacity of each ISP is 16M pixels. Only support one when the ISP is over 16M pixels.
- Support 4-Lane MCLKs, 2-Lane CCI I2C interfaces, and the GPIOs with different functions.

3.11.1 CPHY & DPHY Interface of the Cameras

SIM8070x series module supports CPHY 1.0. The difference between the CPHY and the DPHY are the different effective transmission mode. CPHY enables the data transmission speed faster through the following technical improvements. Firstly, CPHY converts the original 2-Lane group transmission of DPHY into 3-Lane group transmission. Then, CPHY does not need the Clock lane. The two are compatible in pin definitions. Detailed information is showing in Table 18.

Figure 22 shows the application diagram of the CSI interface. It is a combination configuration, including 4 DPHY sensors, 3 CPHY sensors, a DPHY sensor, and a CPHY sensor. Note that CSI2 could be split into two cameras (2-Lane + 1-Lane or 1-Lane + 1-Lane). The following applications are flexible.



CSI lane mapping when a 4-lane interface is configured as 2-lane plus 1-lane interfaces:

- DCLK => DCLK_A
- DLN0 => DLN0_A
- DLN1 => DLN1_A
- DLN2 => DLN0_B
- DLN3 => DCLK_B

CSI lane mapping when a 4-lane interface is configured as 1-lane plus 1-lane interfaces:

- DCLK => DCLK_A
- DLN0 => DLN0_A
- DLN2 => DLN0_B
- DLN3 => DCLK_B

Figure 22: CPHY & DPHY Interface Applications

Table 18: DPHY & CPHY PIN Definition

CSIx PHY（1 of 3）	DPHY	CPHY
Lane0	MIPI_CSIx_DCLK_P	/
	MIPI_CSIx_DCLK_N	MIPI_CSIx_TLN0_A
Lane1	MIPI_CSIx_DLN0_P	MIPI_CSIx_TLN0_B
	MIPI_CSIx_DLN0_N	MIPI_CSIx_TLN0_C

Lane2	MIPI_CSIx_DLN1_P	MIPI_CSIx_TLN1_A
	MIPI_CSIx_DLN1_N	MIPI_CSIx_TLN1_B
Lane3	MIPI_CSIx_DLN2_P	MIPI_CSIx_TLN1_C
	MIPI_CSIx_DLN2_N	MIPI_CSIx_TLN2_A
Lane4	MIPI_CSIx_DLN3_P	MIPI_CSIx_TLN2_B
	MIPI_CSIx_DLN3_N	MIPI_CSIx_TLN2_C

3.11.2 DPHY Applications

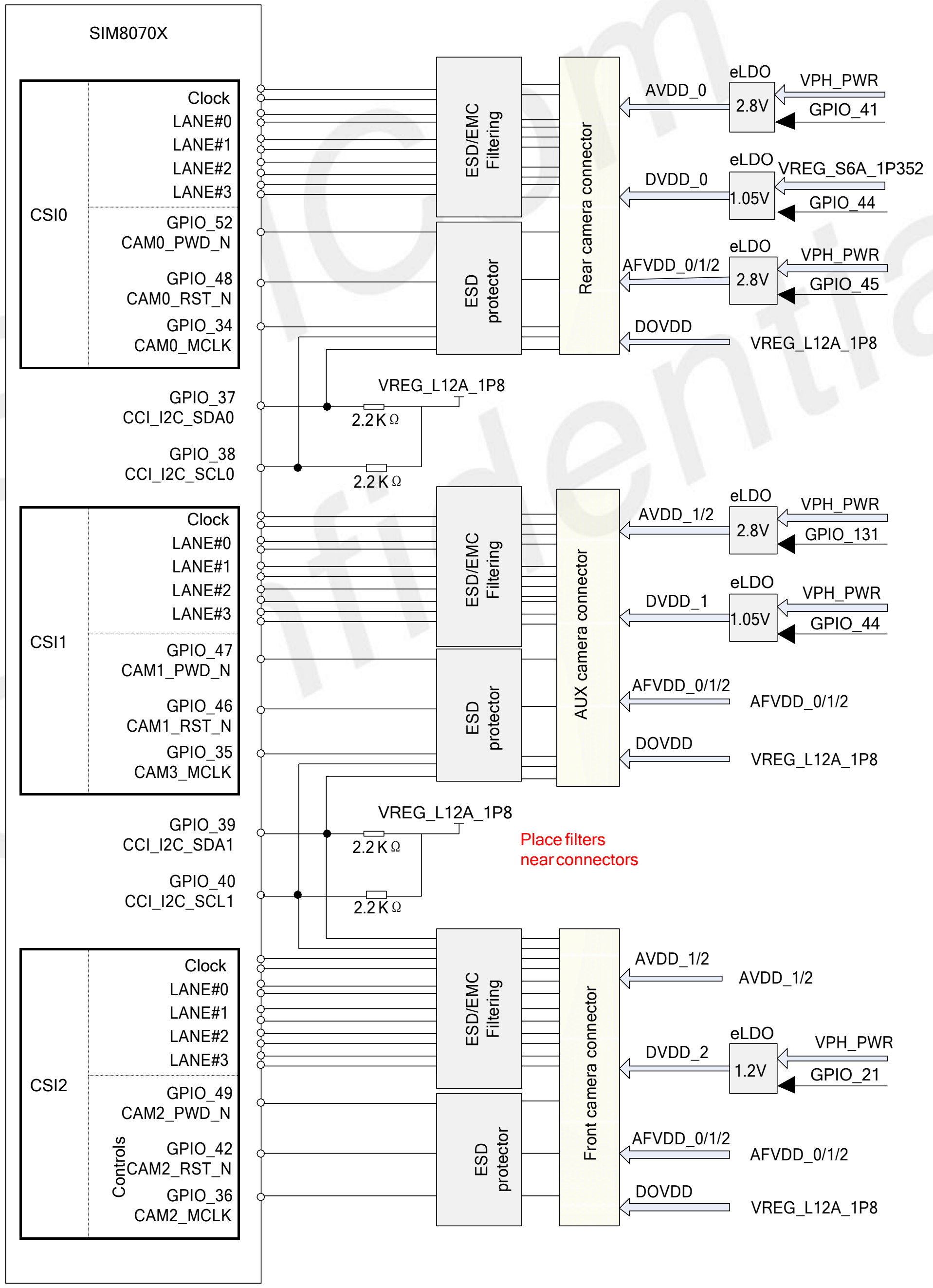


Figure 23: Three sets of MIPI-CSI Interface Applications

3.12 Audio Interface

SIM8070x series module supports three analog audio inputs, including the MIC1 differential pair interface for the master microphone, the MIC3 differential pair interface for the denoising microphone, and the MIC2 single ended interface for the audio jack.

- Three-Channel analog audio output interface.
  Handset.
  Speaker.
  Stereo Headphone and LINEOUT.
- Two-Channel digital microphone interface.
  Support 4 digital microphones.

3.12.1 Microphone Interface

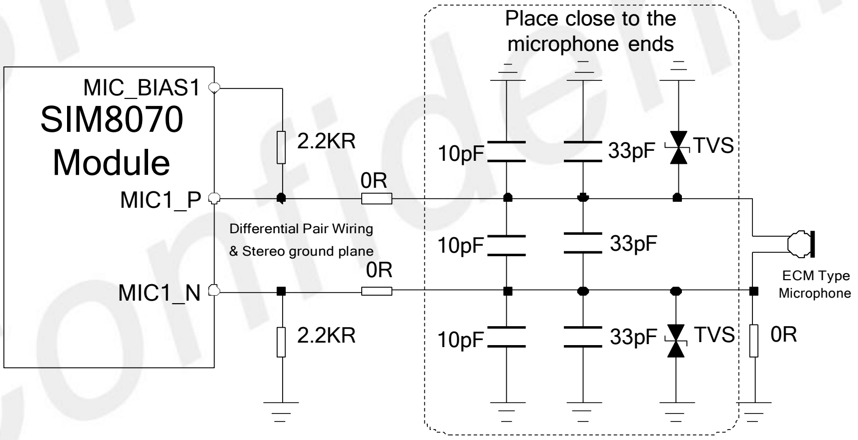


Figure 24: ECM Type Microphone Reference Design

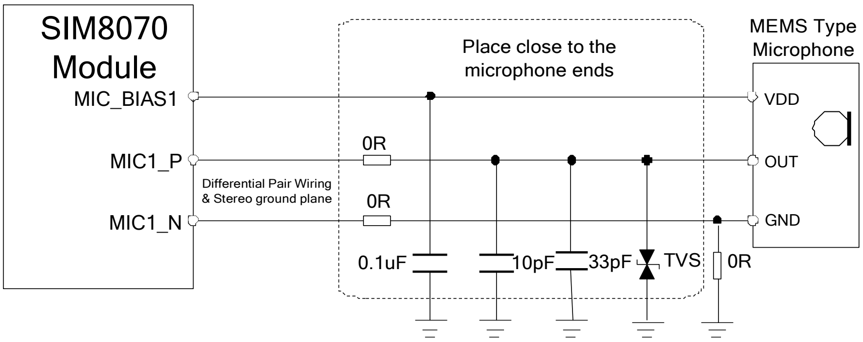


Figure 25: MEMS Type Microphone Reference Design

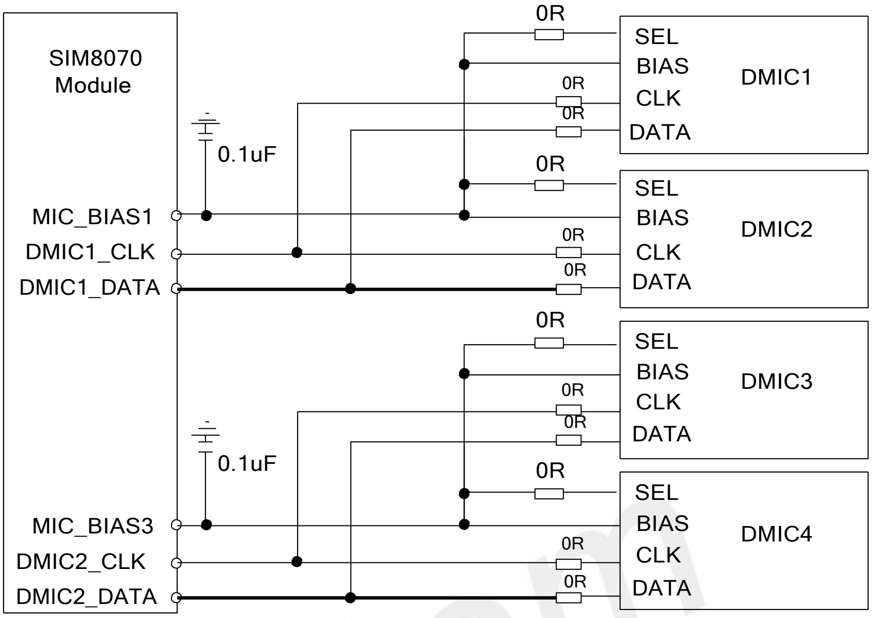


Figure 26: Digital Microphone Reference Design

3.12.2 Headphone Interface

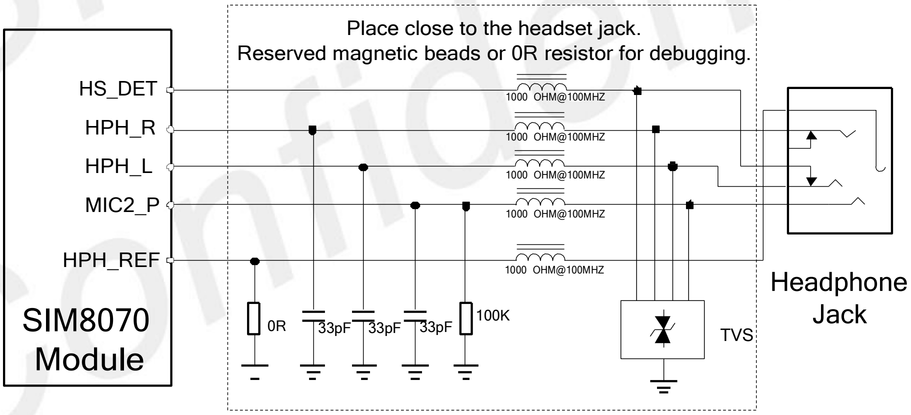


Figure 27: Headphone Reference Design

NOTE

1. The reference design for headphone in the Figure 27 is working actively high. The software detection mode configuration changes if the customers are picking an audio working actively low.
2. Highly recommend the HS_DET and the HPH_L form a detection loop, and the HPH_L has an internal 100KR resistor pulling down to the ground. The HS_DET is connecting to the HPH_L presenting actively low when disconnecting the headphone. The HS_DET and the HPH_L are disconnecting presenting actively high when inserting the headphone.
3. Picking a bidirectional TVS on the network due to the negative voltage on the HPH signal.

Table 19: Headphone Output Feature

Parameter	Testing Condition	Minimum	Typical	Maximum	Unit
Output Power	Input = 0 dBFS	27	30	-	mW
Output Voltage	Input = 0 dBFS	0.94	0.99	-	Vrms
Loads		4	32	-	Ω
Off Impedance		-	20	-	Ω

3.12.3 Speaker Interface

SIM8070x series module integrates a Class-D Type audio power amplifier (PA) internally. The PA integrates an internal SPKR_BOOST (Maximum Output Voltage 5.5V) circuit. The audio PA feature is listing in Table 20, and the reference design for the speaker interface is showing in the Figure 28.

Table 20: Audio PA Feature

Parameter	Testing Condition	Minimum	Typical	Maximum	Unit
Power (f = 1 kHz, THD+N≤1%)	15 μH + 4Ω + 15 μH, VDD_SPKR = 7.5V	-	4000	-	mW
	15 μH + 8 Ω + 15 μH, VDD_SPKR = 9 V	-	4000	-	mW
SNR	A-weighted, DRE on, 15 dB gain, 0 dBFS input, 300 kHz carrier frequency, VBAT ≥ 3.6 V	109	112		dB
	A-weighted, DRE on, 15 dB gain, 0 dBFS input, 600 kHz carrier frequency, VBAT ≥ 3.6 V	111	114	-	dB
Efficiency	4W Pout, 15 μH + 8 Ω + 15 μH	87.0	87.0	-	%
	4W Pout, 15 μH + 4 Ω + 15 μH	83.5.0	84.5	-	%
Off Impedance		25	-	-	kΩ
Loads		3.2	-	-	Ω

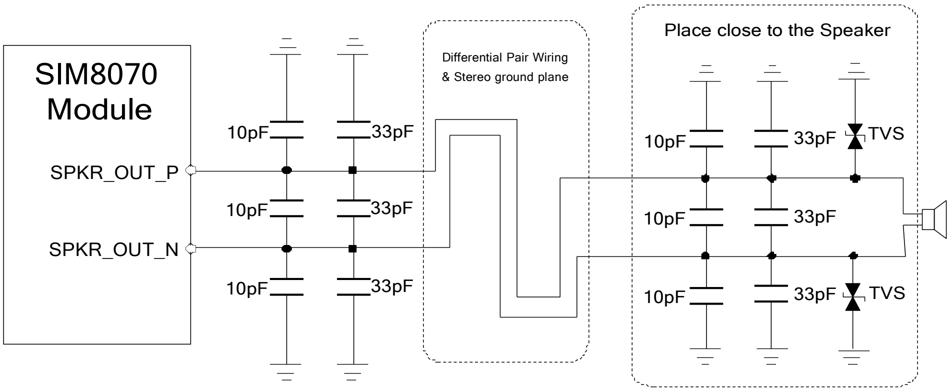


Figure 28: Speaker Reference Design

3.12.4 Handset Interface

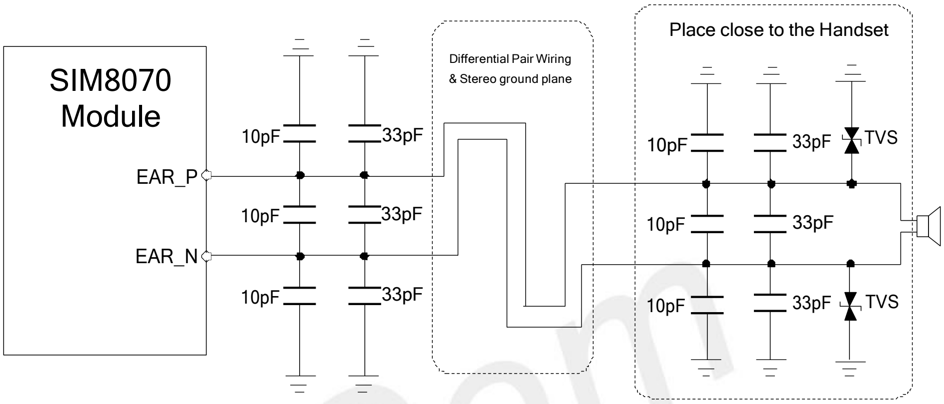


Figure 29: Handset Reference Design

Table 21: Handset Output Feature

Parameter	Testing Condition	Minimum	Typical	Maximum	Unit
Output Power	PA gain = 6 dB, 32 Ω, THD+N ≤ 1%	115	123	-	mW
	PA gain = 6 dB, 10.67 Ω, THD+N ≤ 1%	150	-	-	mW
Output Voltage	Input = 0 dBFS, PA gain = 6 dB	1.93	1.97	-	Vrms
Loads		10.67	32	-	Ω

3.13 UIM Card Interface

SIM8070x series module offers two UIM Cards interface, supporting dual card dual standby. The UIM Cards interface also supports the 1.8V/2.95V dual voltage and the hot plug detection.

NOTE

The standard software version supports dual cards, and the single card function needs to be supported by the special software version.

The reference design for the UIM Card is showing in the Figure 30.

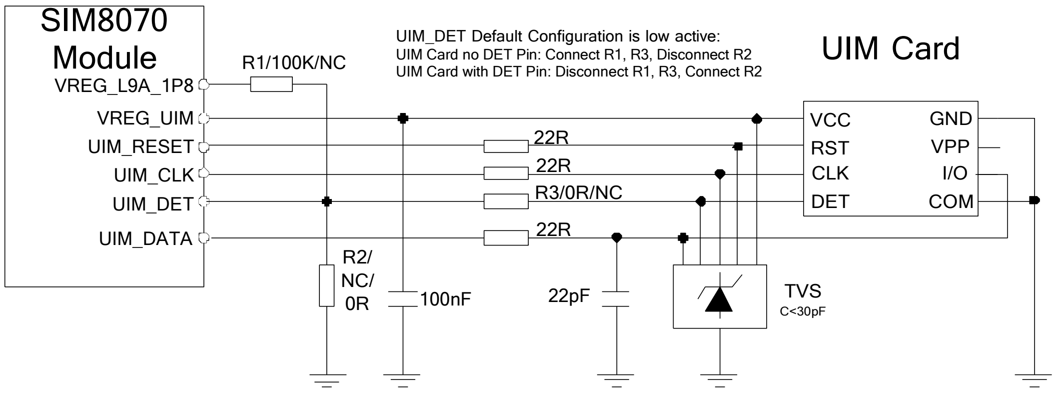


Figure 30: UIM Card Interface Reference Design

NOTE

1. The UIM_DATA Pin of the module pulls up to the VREG_UIM internally. Avoid external pull up.
2. Place the TVS close to the UIM Card receptacle interface.
3. Highly recommend the parasitic capacitance of the TVS on the UIM_CLK should be less than 30pF.
4. Highly recommend the 22R resistor in series on the signal lines to enhance the ESD protection.
5. Highly recommend reserved 22pF capacitor pulling down to the ground on the UIM_DATA line preventing the radio frequency interference.

3.14 ADC

SIM8070x series module offers two 16-Bit resolution ADC providing by the power management IC. The feature is showing in Table 22.

Table 22: ADC Interface Feature

Parameter	Description	Minimum	Typical	Maximum	Unit
Input Power Domain	Programmable	0	-	1.875	V
Resolution		-	16	-	bits
Analog input bandwidth		-	500	-	kHz
Sample rate		-	4.8	-	MHz
ADC resolution (LSB)		-	64.879	-	uV
1/1 channel end-to-end accuracy	Calibrated data result	-11	6	11	mV
1/1 channel end-to-end accuracy with internal pull-up	Calibrated data result	-12.5	7	12.5	mV

1/3 channel end-to-end accuracy	Calibrated data result	-20	10	20	mV
100 K pull-up	Trimmed value	99.5	100	100.5	kΩ
400 K pull-up	Trimmed value	398	100	402	kΩ
30 K pull-up	Trimmed value	29.7	30	30.3	kΩ
1/1 channel AMUX input resistance		10	-	-	MΩ
1/3 channel AMUX input resistance		1	-	-	MΩ

NOTE

Highly recommend connecting the ADC with a resistance voltage division circuit preventing the module from burning due to the high power supply voltage ADC detection.

3.15 Sensor Interface

SIM8070x series module communicates with sensors via I2C or I3C. It supports various sensors, including the hall sensor, the acceleration sensor, the geomagnetism sensor, the gyroscope sensor, the temperature sensor, the light sensor, and the pressure sensor.

The sensors interface's pins in the module are showing in Table 23.

Table 23: Sensor Interface Feature

PIN Name	PIN Num	I/O	Description	Notes
SENSOR_I2C_CLK	38	DO	External Sensor I2C Clock	Need an external 2.2KR pull up resistor
SENSOR_I2C_SDA	39	DI/DO	External Sensor I2C Data	
SNSR_I3C_SDA	72	DI/DO	Sensor I3C Clock	Default for external sensors
SNSR_I3C_SCL	73	DO	Sensor I3C Data	
GPIO_94	53	DI	Hall Interruption	
ACCEL_INT	56	DI	Gyroscope Interruption	
ALSP_INT	57	DI	Light Sensor Interruption	
ACCL_GYRO_DRDY_INT	275	DI	Acceleration Interruption	
GPIO_82	58	DI	Geomagnetism Interruption	
VREG_L9A_1P8	10,12	PO	Sensor I2C Pull Up VDD or VDDIO Power Supply	
VREG_L21A_2P704	5 ,6	PO	AVDD3.0V Power Supply	

3.16 Motor Interface

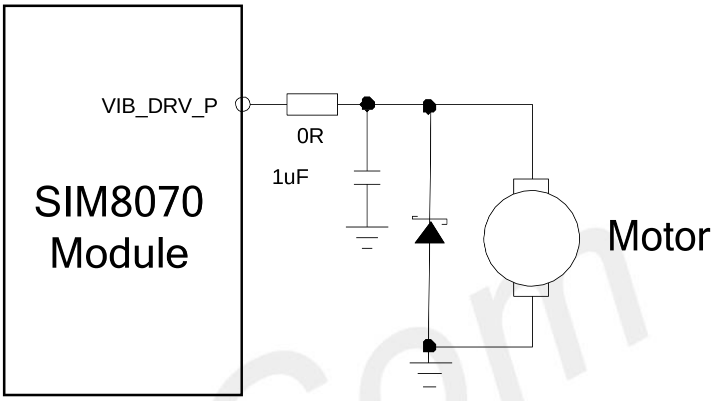


Figure 31: Motor Interface Reference Design

3.17 LED Interface

SIM8070x series module supports RGB tri-color indicator. Selecting a LED chip with the common cathode is needed. The maximum current on each channel is 12mA, and it supports PWM debugging.

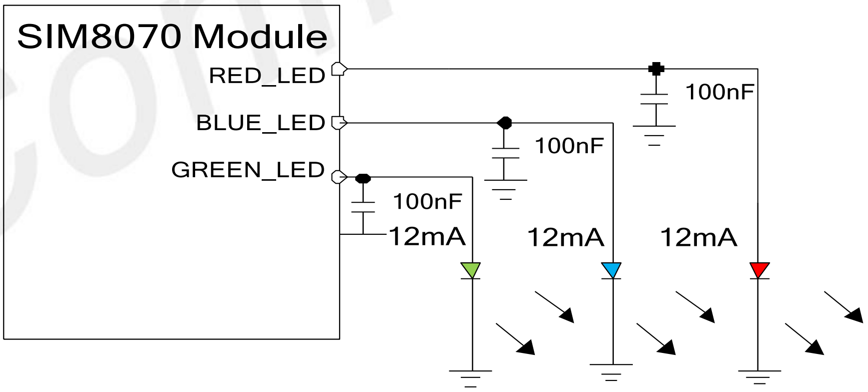


Figure 32: RGB Interface Reference Design

3.18 Flash LED Interface

SIM8070x series module offers two channels of efficient FLASH_LED interface. The maximum current on each channel is 1.5A.

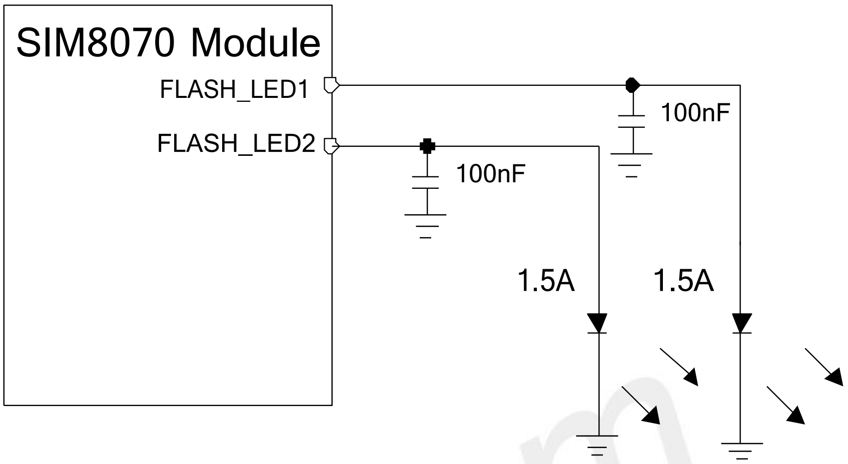


Figure 33: Flash LED Interface Reference Design

3.19 Forced Emergency Download Interface

SIM8070x series module offers a FORCED_USB_BOOT Pin, which is an emergency download interface. Pulling up the FORCED_USB_BOOT to the VREG_L9A_1P8 before powering on enables the module to run into the emergency download mode, which is also applying for the treatment when the product starts abnormally. Highly recommend reserved the testing points for software upgrading and debugging.

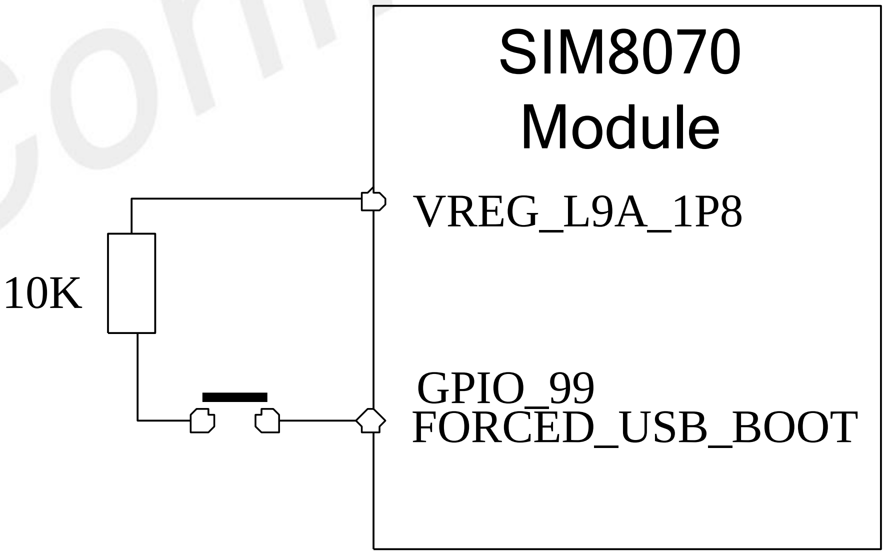


Figure 34: Emergency Download Interface Reference Design

4 WIFI & BT

SIM8070x series module offers a common antenna interface combining the WIFI and the BT function. The customers could connect the external WIFI and BT two in one antenna via this interface. In the TDD mode, the WIFI and the BT coexist.

4.1 WIFI Outline

SIM8070x series module supports the 2.4GHz and the 5GHz dual bands WLAN wireless communication. It supports multiple modes, including the 802.11a, the 802.11b, the 802.11g, the 802.11n, and the 802.11ac. The highest rate is 433Mbps. The characteristics are as follows.

- Support the 2.4GHz and the 5GHz dual frequency bands, with the frequencies of 2400MHz~2483.5MHz and 5180MHz~5825MHz respectively.
- Support the Wake-on-WLAN.
- Support the WAPI SMS4 hardware encryption.
- Support the AP mode and the STATION mode.
- Support the WIFI Direct.
- Support the 2.4G MCS 0~7 for HT20 and VHT20.
- Support the 2.4G MCS 0~8 for HT40 and HT80.
- Support the 5G MCS 0~7 for HT20, HT40 and HT80.
- Support the 5G MCS 0~8 for VHT20.
- Support the 5G MCS 0~9 for VHT40 and VHT80.

4.1.1 WIFI Feature

Table 24: WIFI Emitter Feature

	Standard	Speed	Bandwidth	Output Power [1]
2.4GHz	802.11b	CCK 1Mbps	--	17dBm±2dB
	802.11b	CCK 11Mbps	--	17dBm±2dB
	802.11g	6Mbps	20M	16dBm±2dB
	802.11g	54Mbps	20M	14dBm±2dB
	802.11n HT20	MCS0	20M	16dBm±2dB

	802.11n HT20	MCS7	20M	14dBm±2dB
	802.11n HT40	MCS0	40M	15dBm±2dB
	802.11n HT40	MCS7	40M	14dBm±2dB
	802.11ac VHT20	MCS0	20M	15dBm±2dB
	802.11ac VHT20	MCS8	20M	13dBm±2dB
	802.11ac VHT40	MCS0	40M	15dBm±2dB
	802.11ac VHT40	MCS9	40M	10dBm±2dB
5GHz	802.11a	OFDM 6Mbps	20M	16dBm±2dB
	802.11a	OFDM 54Mbps	20M	13dBm±2dB
	802.11n HT20	MCS0	20M	16dBm±2dB
	802.11n HT20	MCS7	20M	12dBm±2dB
	802.11n HT40	MCS0	40M	13dBm±2dB
	802.11n HT40	MCS7	40M	11dBm±2dB
	802.11n HT80	MCS0	80M	13dBm±2dB
	802.11n HT80	MCS7	80M	11dBm±2dB
	802.11ac VHT20	MCS0	20M	16dBm±2dB
	802.11ac VHT20	MCS8	20M	11dBm±2dB
	802.11ac VHT40	MCS0	40M	13dBm±2dB
	802.11ac VHT40	MCS9	40M	9dBm±2dB
	802.11ac VHT80	MCS0	80M	12dBm±2dB
	802.11ac VHT80	MCS9	80M	9dBm±2dB

NOTE

The output power value is testing based on the standards of Mask and EVM.

Table 25: WIFI Receiver Feature

	Standard	Speed	Bandwidth	Receiving Sensitivity
2.4GHz	802.11b	CCK 1Mbps	--	< -89dBm
	802.11b	CCK 11Mbps	--	< -79dBm
	802.11g	6Mbps	20M	< -85dBm
	802.11g	54Mbps	20M	< -68dBm
	802.11n HT20	MCS0	20M	< -85dBm
	802.11n HT20	MCS7	20M	< -67dBm
	802.11n HT40	MCS0	40M	< -82dBm
	802.11n HT40	MCS7	40M	< -64dBm
	802.11ac VHT20	MCS0	20M	< -85dBm
	802.11ac VHT20	MCS8	20M	< -62dBm
	802.11ac VHT40	MCS0	40M	< -82dBm
	802.11ac VHT40	MCS9	40M	< -57dBm

5GHz	802.11a	OFDM 6Mbps	20M	< -85dBm
	802.11a	OFDM 54Mbps	20M	< -68dBm
	802.11n HT20	MCS0	20M	< -85dBm
	802.11n HT20	MCS7	20M	< -67dBm
	802.11n HT40	MCS0	40M	< -82dBm
	802.11n HT40	MCS7	40M	< -64dBm
	802.11n HT80	MCS0	80M	< -79dBm
	802.11n HT80	MCS7	80M	< -54dBm
	802.11ac VHT20	MCS0	20M	< -85dBm
	802.11ac VHT20	MCS8	20M	< -62dBm
	802.11ac VHT40	MCS0	40M	< -82dBm
	802.11ac VHT40	MCS9	40M	< -57dBm
	802.11ac VHT80	MCS0	80M	< -79dBm
	802.11ac VHT80	MCS9	80M	< -54dBm

4.2 BT Outline

SIM8070x series module supports the BT5.0. It supports multiple modes, including the GFSK, the 8-DPSK, and the π/4-DQPSK. The performance indexes are showing as follows.

Table 26: BT RF Feature

Emission Feature			
Mode	DH5	2DH5	3DH5
Emission Power	11dBm±2dB	10dBm±2dB	10dBm±2dB
Receiving Feature			
Mode	DH5	2DH5	3DH5
Receiving Sensitivity	< -90dBm	< -90dBm	< -80dBm

5 Antenna Interface

SIM8070x series module has the WIFI/BT antenna. To ensure the well RF performance of the products, the RF lines wiring through the antenna pin to the antenna interfaces must meet the following requirements.

- Ensure the RF lines are wiring with the 50Ω differential impedance.
- The RF lines must have a complete stereo ground plane.
- The RF lines must away from the other interference sources, including the high-speed signals, the clock signals, the sound sensing devices, and the motor, etc.
- The RF lines shall be as short as possible to avoid loss and interference.

5.1 WIFI/BT Antenna Interface

SIM8070x series module's WIFI/BT antenna interface feature is showing as follows.

Table 27: WIFI/BT Antenna Feature

PIN Name	PIN Num	I/O	Description	Feature
ANT_WIFI/BT	2	AI/AO	WIFI/BT Antenna Interface	50Ω Impedance

SIM8070x series module's WIFI/BT operating frequency bands are showing as follows.

Table 28: WIFI/BT Operating Frequency Band

Type	Frequency Band	Unit
802.11a/b/g/n/ac	2412~2472 5180~5825	MHz
BT 5.0	2402~2480	MHz

SIM8070x series module's WIFI/BT antenna reference design is showing as follows.

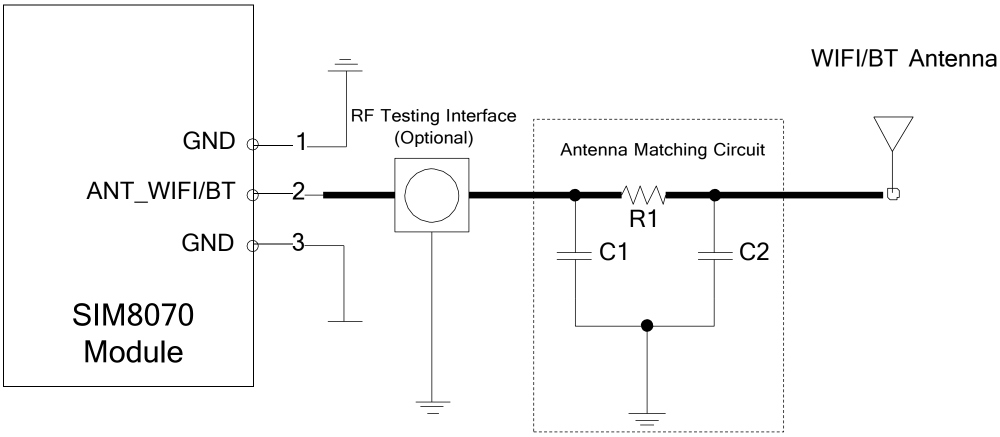


Figure 35: WIFI/BT Antenna Reference Design

In Figure 35, R1, C1 and C2 are the antenna matching components. All these three components are adjustable to match the efficient and effective communication quality based on the interface debugging result. Selecting R1 with 0R resistor by default, and reserved C1 and C2 with disconnection by default. Highly recommend reserved an RF testing interface to modify accurately and conveniently. Considering the low cost, recommend ensure 50Ω impedance for the RF lines and cancel the RF testing interface.

5.2 RF Signals PCB Wiring Guideline

Highly recommend the characteristic impedance of all RF signal lines shall be controlled at 50Ω when the customers route their PCB. Generally, the impedance of RF signal lines is determined by the dielectric constant (ER), the wiring width (W), the ground clearance (S), the height of the reference ground plane (H), and other factors.

RF routing characteristic impedance control usually adopts the microstrip-slot line and the coplanar waveguide-slot line. The reference designs of 50Ω impedance are showing as follows.

- **Microstrip-slot Line Structure**

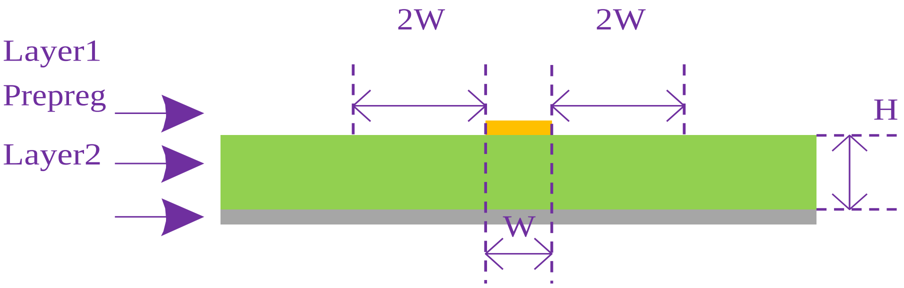


Figure 36: Two Layers PCB Microstrip-slot Line Structure

Table 29: Two Layers PCB Microstrip-slot Line Structure Impedance Control Feature

Thickness	Er	Signal Thickness	Signal Layer	Reference Layer	Impedance	Width
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-slot Line**

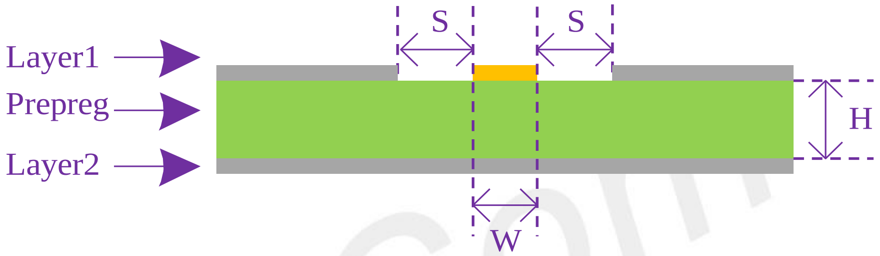


Figure 37: Two Layers PCB Coplanar Waveguide-slot Line Structure

Table 30: Two Layers PCB Coplanar Waveguide-slot Line Structure Impedance Control Feature

Thickness	Er	Signal Thickness	Signal	Reference	Impedance	S	W
1mm	4.2	0.035mm	Layer1	Layer2	50 ohm	0.65mm (25.6 mil)	0.2mm (7.8 mil)
1.6mm	4.2	0.035mm	Layer1	Layer2	50 ohm	0.65mm (25.6 mil)	0.15mm (5.9 mil)

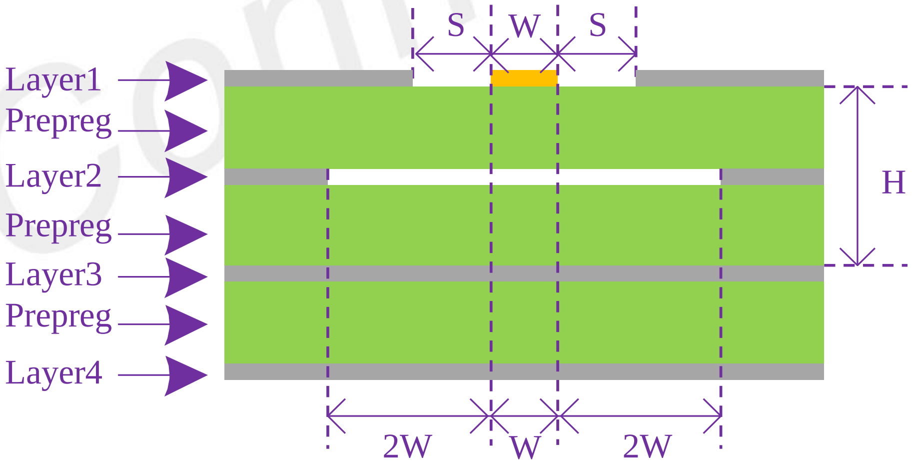


Figure 38: Four Layers PCB Coplanar Waveguide-slot Line Structure (Reference Layer Three)

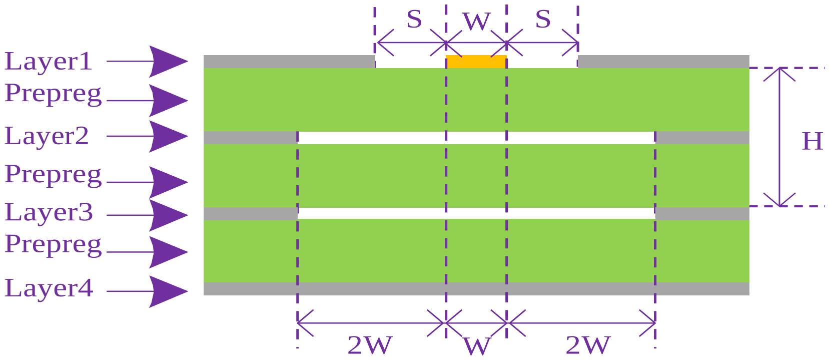


Figure 39: Four Layers PCB Coplanar Waveguide-slot Line Structure (Reference Layer Four)

To ensure the well RF performance of the products, the RF lines wiring through the antenna pin to the antenna interfaces must meet the following requirements.

- Ensure the RF lines are wiring with the 50Ω impedance.
- The RF lines must have a complete stereo ground plane.
- Add more ground holes around the RF signal lines and the reference ground to enhance the RF performance.
- The RF lines must away from the other interference sources, including the high-speed signals, the clock signals, the sound sensing devices, and the motor, etc.
- The RF lines shall be as short as possible to avoid loss and interference.
- The GND pin adjacent to the RF interface pin of the module is not subject to thermal pad treatment and is in full contact with the ground.
- Avoid wiring crossing the whole PCB. Avoid the right-angle routing. Highly recommend wiring with a circular arc or a 135-degree routing.
- Be aware of the distance between the components and the lower PCB ground, especially for the RF connecting device package.
- Digging out the GND copper foil on the surface of the PCB below the connector if necessary.
- The distance between the ground hole and the signal line shall be at least 2 times the line width(2*W).

5.3 Antenna Installation

5.3.1 Passive Antenna Reference Design

SIM8070x series module’s antenna interface installation requirements are showing as follows.

Table 31: Antenna Installation Requirements

Antenna	Parameters’ Requirements
Wi-Fi/BT	Standing wave ratio: ≤ 2 Gain (dBi): (2.4G:4.01dBi; 5G:4.32dBi) Maximum Input Power (W): 50 Input Impedance (Ω): 50 Polarization Type: Vertical Insertion Loss: < 1dB

5.3.2 RF Connector

Highly recommend pick the Hirose U.FL-R-SMT's RF connector.

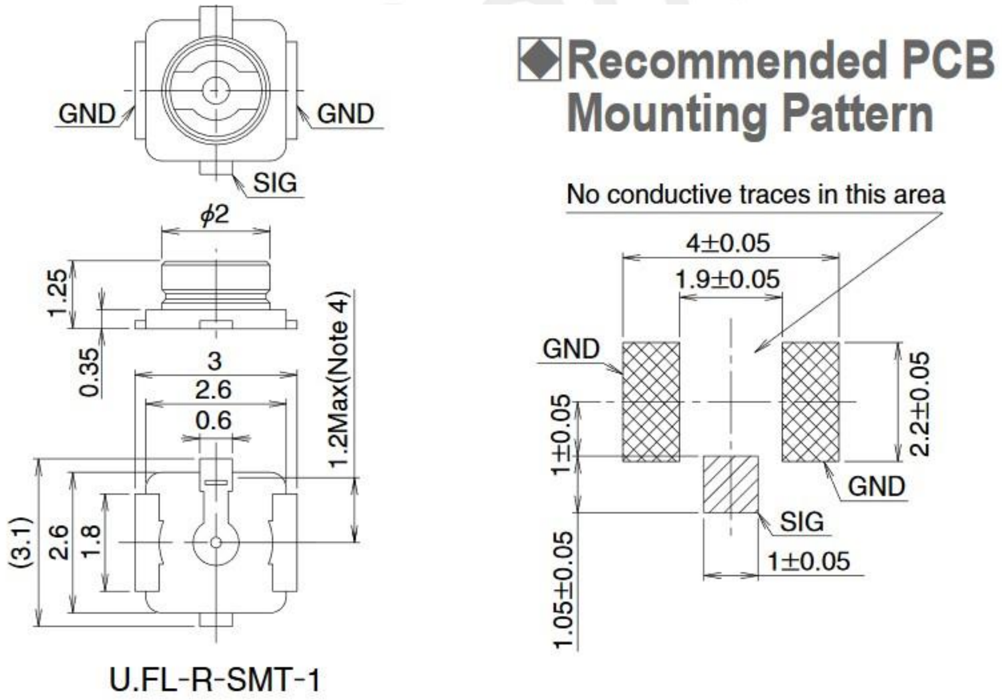


Figure 40: Hirose U.FL-R-SMT Connector's Size and Package

6 PCB Wiring

This chapter mainly introduces the requirements in PCB layout wiring. The purpose is to minimize the interference issue, to optimize the product performance, and to shorten the Research and Development (R&D) cycle.

6.1 Stack Selection

Highly recommend at least a four-layer through holes PCB layout design to facilitate impedance control and signal line shielding.

6.2 PCB Routing Guidelines

Highly recommend considering the following aspects in PCB layout design.

6.2.1 Antenna

SIM8070x series modules has the ANT_WIFI/BT. The requirements for the RF components are showing as follows.

- Ensure the RF lines are wiring with the 50Ω impedance.
- The RF lines must have a complete stereo ground plane.
- Add more ground holes around the RF signal lines and the reference ground to enhance the RF performance.
- The RF lines must away from the other interference sources, including the high-speed signals, the clock signals, the sound sensing devices, and the motor, etc.
- The RF lines shall be as short as possible to avoid loss and interference.
- Avoid wiring crossing the whole PCB. Avoid the right-angle routing. Highly recommend wiring with a circular arc or a 135-degree routing.
- Be aware of the distance between the components and the lower PCB ground, especially for the RF connecting device package.

6.2.2 Power Supply & Ground

Highly recommend wiring the VBAT positive electrode as short and thick as possible. Highly recommend wiring through large capacitors and zener diodes before connecting to the power supply pin of the module. Considering the backflow ground of the power supply is necessary when routing. Wiring the VBAT to the ground path as shore as possible to ensure the lower impedance.

6.2.3 UIM Card

The requirements for the UIM card are showing as follows.

- Highly recommend the UIM card receptacle interface is away from the RF antennas.
- Highly recommend wiring the UIM card signals away from the RF signal lines, the VBAT, and the high-speed signal lines as far as possible.
- Highly recommend the ground of the UIM card is well connecting to the main ground of the module.
- Notice that well protect the UIM_CLK signal to prevent the interference from other signals.
- Highly recommend wiring the UIM card signals away from the return path of the VBAT because there is a large current passing through the return path on VBAT.

6.2.4 MIPI

The requirements for the MIPI signal are showing as follows.

- Two-phase differential pair routings with 85Ω differential impedance and the error at ±15Ω.
- Three-phase differential pair routings with 44Ω single ended and the error at ±15Ω.
- Highly recommend a complete stereo ground plane and the full reference ground.
- Highly recommend minimizing the number of vias.
- Highly recommend the total length of wiring is less than 305mm.
- Highly recommend the length difference in the group is less than 0.7mm.
- Highly recommend the length difference between groups is less than 1.4mm.

Table 32: SIM8070CE MIPI Lane Wiring Difference

PIN Num	PIN Name	Length (mm)	Difference (mm)
135	MIPI_DSI0_CLK_P	22.09228	-0.04413
136	MIPI_DSI0_CLK_N	22.13641	
137	MIPI_DSI0_LANE0_P	22.60134	-0.02353

138	MIPI_DSI0_LANE0_N	22.62487	
139	MIPI_DSI0_LANE1_P	24.58209	0.05437
140	MIPI_DSI0_LANE1_N	24.52772	
141	MIPI_DSI0_LANE2_P	23.8138	-0.00801
142	MIPI_DSI0_LANE2_N	23.82181	
143	MIPI_DSI0_LANE3_P	26.20781	0.10733
144	MIPI_DSI0_LANE3_N	26.10048	
124	MIPI_DSI1_CLK_P	38.36899	-0.022
125	MIPI_DSI1_CLK_N	38.39099	
113	MIPI_CSI0_CLK_P	43.49614	0.03677
112	MIPI_CSI0_CLK_N	43.45937	
111	MIPI_CSI0_LANE0_P	43.19501	-0.02627
110	MIPI_CSI0_LANE0_N	43.22128	
109	MIPI_CSI0_LANE1_P	41.48986	0.09991
108	MIPI_CSI0_LANE1_N	41.38995	
107	MIPI_CSI0_LANE2_P	40.84356	-0.06422
106	MIPI_CSI0_LANE2_N	40.90778	
105	MIPI_CSI0_LANE3_P	41.45114	0.03401
104	MIPI_CSI0_LANE3_N	41.41713	
238	MIPI_CSI1_CLK_P	15.27005	-0.01274
239	MIPI_CSI1_CLK_N	15.28279	
242	MIPI_CSI1_LANE0_P	10.15489	0.04806
243	MIPI_CSI1_LANE0_N	10.10683	
240	MIPI_CSI1_LANE1_P	12.49584	-0.01607
241	MIPI_CSI1_LANE1_N	12.51191	
244	MIPI_CSI1_LANE2_P	10.98103	0.05357
245	MIPI_CSI1_LANE2_N	10.92746	
246	MIPI_CSI1_LANE3_P	16.96772	-0.03457
247	MIPI_CSI1_LANE3_N	17.00229	
102	MIPI_CSI2_CLK_P	37.21922	-0.01538
101	MIPI_CSI2_CLK_N	37.2346	
100	MIPI_CSI2_LANE0_P	37.59314	0.02985
99	MIPI_CSI2_LANE0_N	37.56329	
98	MIPI_CSI2_LANE1_P	35.21007	-0.09983
97	MIPI_CSI2_LANE1_N	35.3099	
280	MIPI_CSI2_LANE2_P	38.24629	-0.00324
279	MIPI_CSI2_LANE2_N	38.24953	
278	MIPI_CSI2_LANE3_P	36.58696	0.02569
277	MIPI_CSI2_LANE3_N	36.56127	

Notice that the SIM8070CE module and the SIM8070EU module has different MIPI wiring routes.

Table 33: SIM8070EU EMMC Memory MIPI Lane Wiring Difference

PIN Num	PIN Name	Length (mm)	Difference (mm)
135	MIPI_DSI0_CLK_P	22.09228	-0.04413
136	MIPI_DSI0_CLK_N	22.13641	
137	MIPI_DSI0_LANE0_P	22.60134	-0.02353
138	MIPI_DSI0_LANE0_N	22.62487	
139	MIPI_DSI0_LANE1_P	24.58209	0.05437
140	MIPI_DSI0_LANE1_N	24.52772	
141	MIPI_DSI0_LANE2_P	23.8138	-0.00801
142	MIPI_DSI0_LANE2_N	23.82181	
143	MIPI_DSI0_LANE3_P	26.20781	0.10733
144	MIPI_DSI0_LANE3_N	26.10048	
124	MIPI_DSI1_CLK_P	38.36899	-0.022
125	MIPI_DSI1_CLK_N	38.39099	
113	MIPI_CSI0_CLK_P	43.49614	0.03677
112	MIPI_CSI0_CLK_N	43.45937	
111	MIPI_CSI0_LANE0_P	43.19501	-0.02627
110	MIPI_CSI0_LANE0_N	43.22128	
109	MIPI_CSI0_LANE1_P	41.48986	0.09991
108	MIPI_CSI0_LANE1_N	41.38995	
107	MIPI_CSI0_LANE2_P	40.84356	-0.06422
106	MIPI_CSI0_LANE2_N	40.90778	
105	MIPI_CSI0_LANE3_P	41.45114	0.03401
104	MIPI_CSI0_LANE3_N	41.41713	
238	MIPI_CSI1_CLK_P	15.48576	0.27287
239	MIPI_CSI1_CLK_N	15.21289	
242	MIPI_CSI1_LANE0_P	10.15489	0.04806
243	MIPI_CSI1_LANE0_N	10.10683	
240	MIPI_CSI1_LANE1_P	12.39204	-0.23611
241	MIPI_CSI1_LANE1_N	12.62815	
244	MIPI_CSI1_LANE2_P	10.98103	0.05357
245	MIPI_CSI1_LANE2_N	10.92746	
246	MIPI_CSI1_LANE3_P	16.96772	-0.03457
247	MIPI_CSI1_LANE3_N	17.00229	
102	MIPI_CSI2_CLK_P	37.35032	0.19401
101	MIPI_CSI2_CLK_N	37.15631	
100	MIPI_CSI2_LANE0_P	37.7103	0.23511
99	MIPI_CSI2_LANE0_N	37.47519	
98	MIPI_CSI2_LANE1_P	35.21007	-0.09983
97	MIPI_CSI2_LANE1_N	35.3099	

280	MIPI_CSI2_LANE2_P	38.24629	-0.52278
279	MIPI_CSI2_LANE2_N	38.76907	
278	MIPI_CSI2_LANE3_P	36.58696	0.02569
277	MIPI_CSI2_LANE3_N	36.56127	

Table 34: SIM8070EU UFS Memory MIPI Lane Wiring Difference

PIN Num	PIN Name	Length (mm)	Difference (mm)
135	MIPI_DSI0_CLK_P	22.09228	-0.04413
136	MIPI_DSI0_CLK_N	22.13641	
137	MIPI_DSI0_LANE0_P	22.60134	-0.02353
138	MIPI_DSI0_LANE0_N	22.62487	
139	MIPI_DSI0_LANE1_P	24.5562	0.01613
140	MIPI_DSI0_LANE1_N	24.54007	
141	MIPI_DSI0_LANE2_P	23.8037	-0.02543
142	MIPI_DSI0_LANE2_N	23.82913	
143	MIPI_DSI0_LANE3_P	26.20781	0.10733
144	MIPI_DSI0_LANE3_N	26.10048	
124	MIPI_DSI1_CLK_P	38.36899	-0.022
125	MIPI_DSI1_CLK_N	38.39099	
113	MIPI_CSI0_CLK_P	43.49614	0.03677
112	MIPI_CSI0_CLK_N	43.45937	
111	MIPI_CSI0_LANE0_P	43.19501	-0.02627
110	MIPI_CSI0_LANE0_N	43.22128	
109	MIPI_CSI0_LANE1_P	41.48986	0.09991
108	MIPI_CSI0_LANE1_N	41.38995	
107	MIPI_CSI0_LANE2_P	40.84356	-0.06422
106	MIPI_CSI0_LANE2_N	40.90778	
105	MIPI_CSI0_LANE3_P	41.45114	0.03401
104	MIPI_CSI0_LANE3_N	41.41713	
238	MIPI_CSI1_CLK_P	15.48576	0.27287
239	MIPI_CSI1_CLK_N	15.21289	
242	MIPI_CSI1_LANE0_P	10.15489	0.04806
243	MIPI_CSI1_LANE0_N	10.10683	
240	MIPI_CSI1_LANE1_P	12.39204	-0.23611
241	MIPI_CSI1_LANE1_N	12.62815	
244	MIPI_CSI1_LANE2_P	10.98103	0.05357
245	MIPI_CSI1_LANE2_N	10.92746	
246	MIPI_CSI1_LANE3_P	16.96772	-0.03457
247	MIPI_CSI1_LANE3_N	17.00229	
102	MIPI_CSI2_CLK_P	37.35032	0.19401

101	MIPI_CSI2_CLK_N	37.15631	
100	MIPI_CSI2_LANE0_P	37.7103	0.23511
99	MIPI_CSI2_LANE0_N	37.47519	
98	MIPI_CSI2_LANE1_P	35.21007	-0.09983
97	MIPI_CSI2_LANE1_N	35.3099	
280	MIPI_CSI2_LANE2_P	38.24629	-0.52278
279	MIPI_CSI2_LANE2_N	38.76907	
278	MIPI_CSI2_LANE3_P	36.58696	0.02569
277	MIPI_CSI2_LANE3_N	36.56127	

6.2.5 USB

The requirements for the USB signal are showing as follows.

- Highly recommend place the common mode inductance close to the USB connector.
- Differential pair routings with 90Ω differential impedance and the error at ±10%.
- Highly recommend the length difference of HS differential pair is less than 2.0mm.
- Highly recommend the length difference of SS differential pair is less than 0.7mm.
- If SS lanes need to be compatible with DP function, the spacing between the groups of the USB0_SS_RX0_M/P, the USB0_SS_TX0_M/P, the USB0_DP_AUX_M/P, the USB0_SS_RX1_M/P, and the USB0_SS_TX1_M/P is less than 9mm.
- If no DP function, it is unnecessary to consider the equal length of the USB0_SS_TX and the USB0_SS_RX.
- Highly recommend wiring the VBUS as wide as possible if the USB integrates the charging function.
- Highly recommend placing the testing points on the routing path to minimize the branch length.
- Place the data line of the USB signal away from sensitive circuits or signals because they are high-frequency signals. The sensitive signals include the RF signals, the audio signals, and the 38.4MHZ XO signals.
- Highly recommend reserved the RX and the TX at least 3 times the linewidth, and other signals 4 times the linewidth.

Table 35: SIM8070CE USB Wiring Length

PIN Num	PIN Name	Length (mm)	Difference (mm)
146	USB_DP	50.14393	-0.01602
147	USB_DM	50.15995	
193	USB0_SS_RX0_P	19.16962	0.04253
194	USB0_SS_RX0_M	19.12709	
196	USB0_SS_TX0_P	22.45001	-0.03752
197	USB0_SS_TX0_M	22.48753	
324	USB0_SS_RX1_P	13.85793	0.03858

323	USB0_SS_RX1_M	13.81935	
325	USB0_SS_TX1_P	17.5102	0.01076
326	USB0_SS_TX1_M	17.49944	
321	USB0_DP_AUX_P	8.99155	0.02566
320	USB0_DP_AUX_M	8.96589	

Notice that the SIM8070CE module and the SIM8070EU module has different USB wiring routes.

Table 36: SIM8070EU EMMC Memory USB Wiring Length

PIN Num	PIN Name	Length (mm)	Difference (mm)
146	USB_DP	50.14393	-0.01602
147	USB_DM	50.15995	
193	USB0_SS_RX0_P	19.64355	0.41783
194	USB0_SS_RX0_M	19.22572	
196	USB0_SS_TX0_P	22.37591	-0.11162
197	USB0_SS_TX0_M	22.48753	
324	USB0_SS_RX1_P	13.86048	0.29023
323	USB0_SS_RX1_M	13.57025	
325	USB0_SS_TX1_P	17.62767	-0.05816
326	USB0_SS_TX1_M	17.68583	
321	USB0_DP_AUX_P	8.99155	0.02566
320	USB0_DP_AUX_M	8.96589	

Table 37: SIM8070EU UFS Memory USB Wiring Length

PIN Num	PIN Name	Length (mm)	Difference (mm)
146	USB_DP	50.14393	-0.01602
147	USB_DM	50.15995	
193	USB0_SS_RX0_P	19.64355	0.41783
194	USB0_SS_RX0_M	19.22572	
196	USB0_SS_TX0_P	22.37591	-0.11162
197	USB0_SS_TX0_M	22.48753	
324	USB0_SS_RX1_P	13.86048	0.29023
323	USB0_SS_RX1_M	13.57025	
325	USB0_SS_TX1_P	17.62767	-0.05816
326	USB0_SS_TX1_M	17.68583	
321	USB0_DP_AUX_P	8.99155	0.02566
320	USB0_DP_AUX_M	8.96589	

6.2.6 SD Card

The requirements for the SD card signal are showing as follows.

- Highly recommend a complete stereo ground plane and the full reference ground.
- Differential pair routings with 50Ω differential impedance and the error at ±10%.
- Highly recommend the length difference between the CLK and the DATA/CMD is less than 1mm.
- Highly recommend the line spacing at least 2 times the linewidth.
- Highly recommend the total capacitance on the 50MHz signal line shall be less than 22pF, and the wiring length is less than 40mm.
- Highly recommend the total capacitance on the 208MHz signal line shall be less than 5pF, and the wiring length is less than 20mm.

Table 38: SIM8070CE SD Card Wiring Length

PIN Num	PIN Name	Length (mm)
150	SDCARD_DET_N	34.02518
151	SDC2_DAT3	58.98352
152	SDC2_DAT2	57.87215
153	SDC2_DAT1	57.70412
154	SDC2_DAT0	56.87189
155	SDC2_CMD	55.6423
156	SDC2_CLK	53.48923

Notice that the SIM8070CE module and the SIM8070EU module has different USB wiring routes.

Table 39: SIM8070EU EMMC Memory SD Card Wiring Length

PIN Num	PIN Name	Length (mm)
150	SDCARD_DET_N	34.02518
151	SDC2_DAT3	58.98352
152	SDC2_DAT2	57.87381
153	SDC2_DAT1	57.70412
154	SDC2_DAT0	56.87189
155	SDC2_CMD	55.6423
156	SDC2_CLK	53.32648

Table 40: SIM8070EU UFS Memory SD Card Wiring Length

PIN Num	PIN Name	Length (mm)
150	SDCARD_DET_N	34.02518
151	SDC2_DAT3	58.98352

152	SDC2_DAT2	57.87381
153	SDC2_DAT1	57.70412
154	SDC2_DAT0	56.87189
155	SDC2_CMD	55.6423
156	SDC2_CLK	53.32648

6.2.7 Audio

The requirements for the audio signal are showing as follows.

- Highly recommend wiring the audio signal lines away from the antennas, the RF signal lines, and other high-speed signal lines.
- Highly recommend all the audio signal lines are wiring with a complete stereo ground plane and the full reference ground, and away from the return VBAT.
- Highly recommend wiring the MIC1_P/N, the EAR_P/ N, and the SPK_P/N as differential pairs.
- Highly recommend isolating the HPH_L and the HPH_R with the HPH_REF in the middle to decrease the crosstalk interference.
- Highly recommend wiring the 25mil line width for the SPKR signal when picking an 8Ω load.
- Highly recommend wiring the 30mil line width for the SPKR signal when picking a 4Ω load.

7 Electrical & Reliability

7.1 Absolute Maximum Value

Table 41: Absolute Maximum Value

Parameter	Description	Minimum	Maximum	Unit
VBAT	DC Supply Voltage	-0.3	5	V
VBUS	USB 5V Supply Voltage	-0.3	12	V
VRTC	Backup Battery Supply Voltage	-	3.5	V

7.2 Temperature Range

Table 42: Temperature Range

Parameter	Minimum	Typical	Maximum	Unit
Operating Temperature	-30	25	+75	℃
Storage Temperature	-40		+90	℃

7.3 Operating Voltage

Table 43: Operating Voltage

Parameter	Minimum	Typical	Maximum	Unit
VBAT	3.5	3.8	4.4	V
VBUS	4.35	-	10	V
VRTC	2.1	3.0	3.25	V

7.4 Digital Interface Feature

Table 44: SDC2 Interface Electrical Feature (1.8V)

Parameter	Description	Minimum	Typical	Maximum	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 45: SDC2 Interface Electrical Feature (2.96V)

Parameter	Description	Minimum	Typical	Maximum	Unit
V_{IH}	High Level Input Voltage	1.85	-	3.25	V
V_{IL}	Low Level Input Voltage	-0.3	-	0.74	V
V_{OH}	High Level Output Voltage	2.21	-	2.96	V
V_{OL}	Low Level Output Voltage	0	-	0.37	V

Table 46: UIM Card Interface Electrical Feature (VREG_UIM = 1.8V or 2.95V)

Parameter	Description	Minimum	Typical	Maximum	Unit
V_{IH}	High Level Input Voltage	0.7* VREG_UIM	-	VREG_UIM+0.3	V
V_{IL}	Low Level Input Voltage	-0.3	-	0.2* VREG_UIM	V
V_{OH}	High Level Output Voltage	0.8*VREG_UIM	-	VREG_UIM	V
V_{OL}	Low Level Output Voltage	0	-	0.4	V

Table 47: GPIO Electrical Feature

Parameter	Description	Minimum	Typical	Maximum	Unit
V_{IH}	High Level Input Voltage	1.17	-	-	V
V_{IL}	Low Level Input Voltage	-	-	0.6	V
V_{OH}	High Level Output Voltage	1.3	-	-	V
V_{OL}	Low Level Output Voltage	-	-	0.45	V

7.5 Current Consumption (VBAT = 3.9V)

Table 48: Current Consumption

Parameter	Condition	Minimum	Typical	Maximum	Unit
Shutdown Leakage Current	Shutdown Leakage Current	-	121	150	uA
Flight Mode	Flight Mode	-	3.1	3.7	mA
Standby Current	GSM/GPRS				
	BS-PA-MFRMS=2	-	4.10	5	
	BS-PA-MFRMS=5	-	3.87	5	
	BS-PA-MFRMS=9	-	3.78	5	
	WCDMA, 2.56sec,DRX=8	-	3.305	5	
	LTE-FDD, standby 2.56s, DRX=8	-	3.56	5	
	LTETDD, standby 2.56s, DRX=8	-	3.598	5	
Peak Current	RF Burst			3.0	A

Note: SIM8070 hardware does not support 2G, 3G, 4G and GNSS.

7.6 Electrostatic Protection

Notice that the electrostatic protection is very important when producing, assembling and operating modules. The performance parameters of the module test results are as follows:

Table 49: ESD Feature (Temperature: 25℃, Humidity: 45%)

PIN Name	Contact Discharge	Air Discharge
VBAT	±5KV	±10KV
GND	±6KV	±12KV
Antenna Interface	±5KV	±10KV

8 Manufacture & Production

8.1 Top- and Bottom-View of the Module

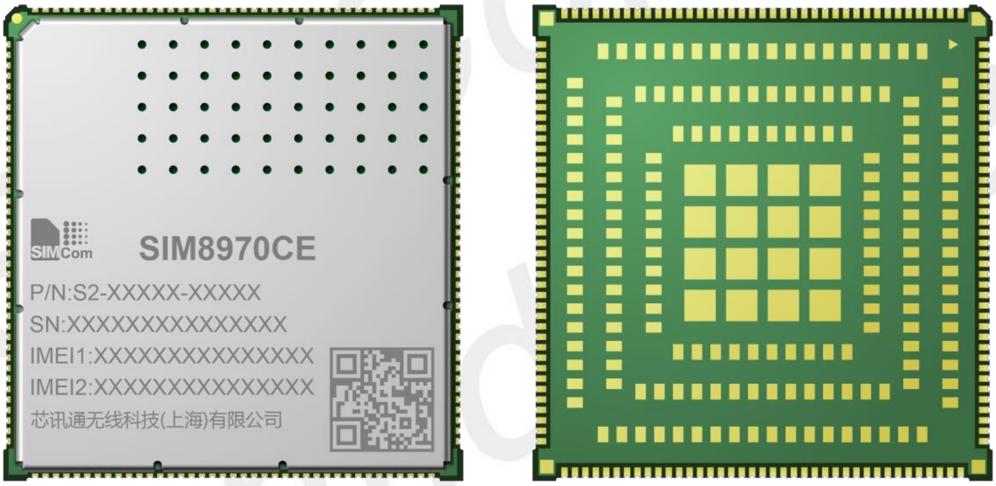


Figure 41: Top- and Bottom-View of the Module

NOTE

This picture is the effect drawing of the module design.

8.2 Mechanical Dimensional Size

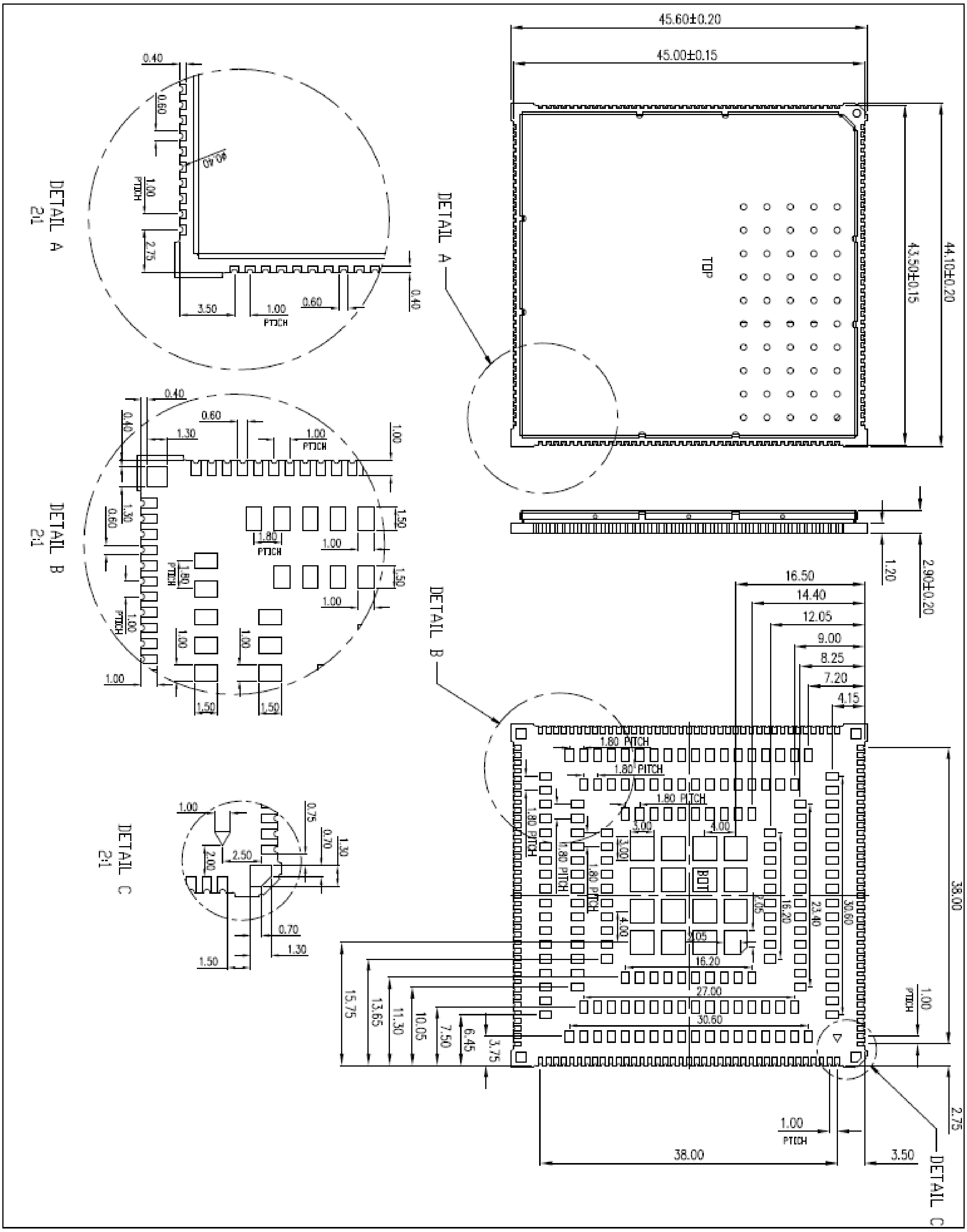


Figure 42: Three-Dimensional Size (Unit: mm)

8.3 Recommend Physical Outline Drawing

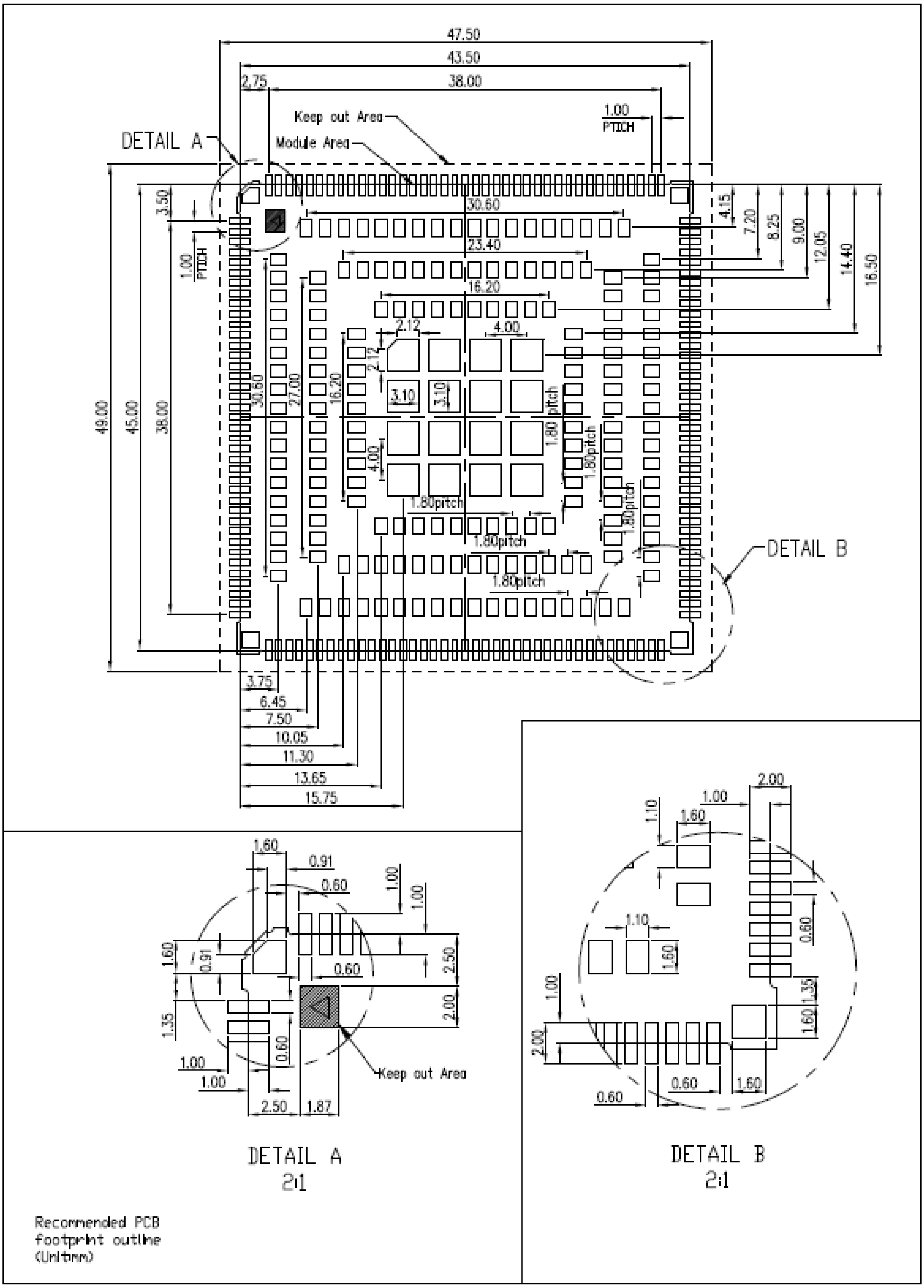


Figure 43: Recommend Physical Outline Drawing (Unit: mm)

8.4 Recommend Physical SMT Stencil Drawing

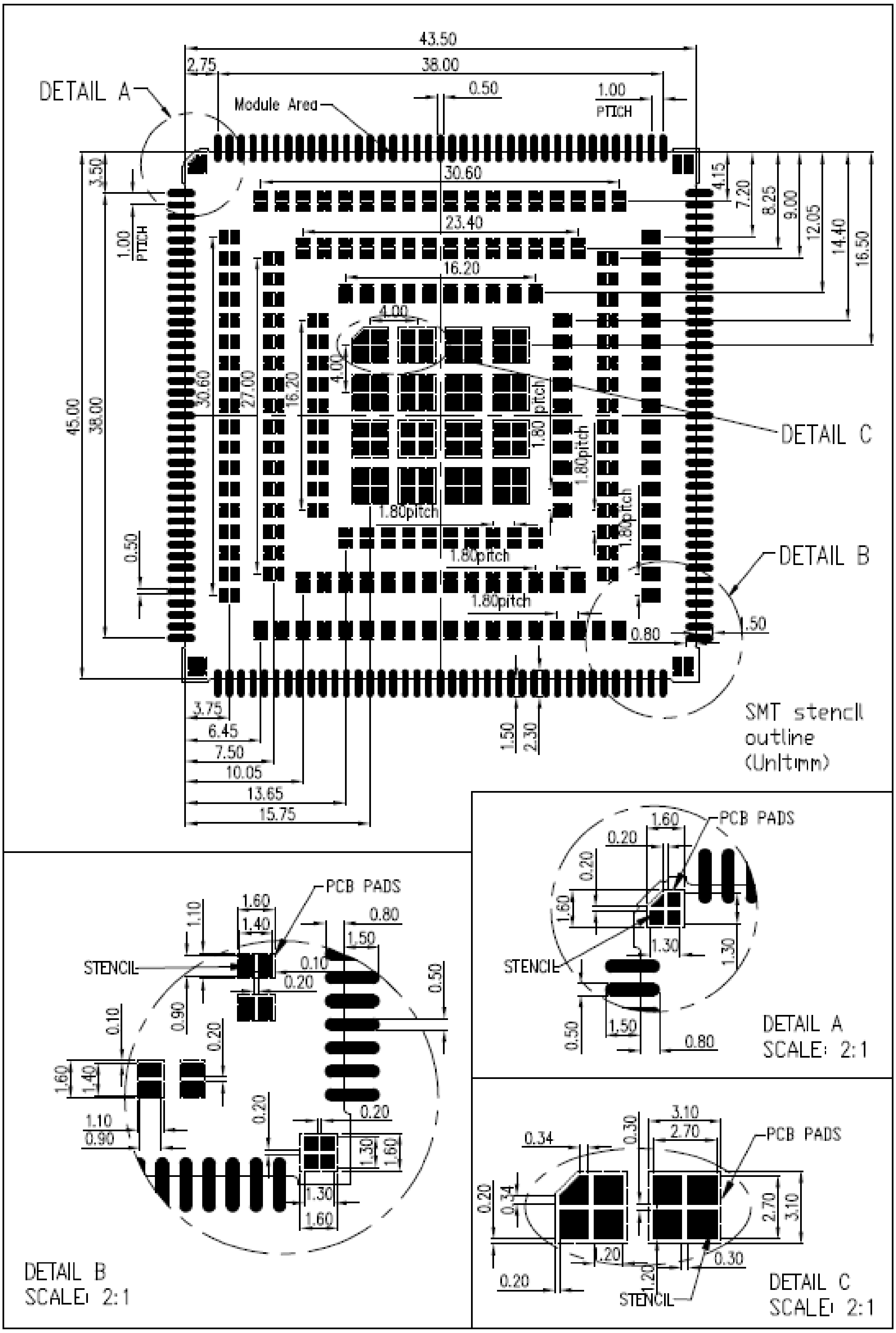
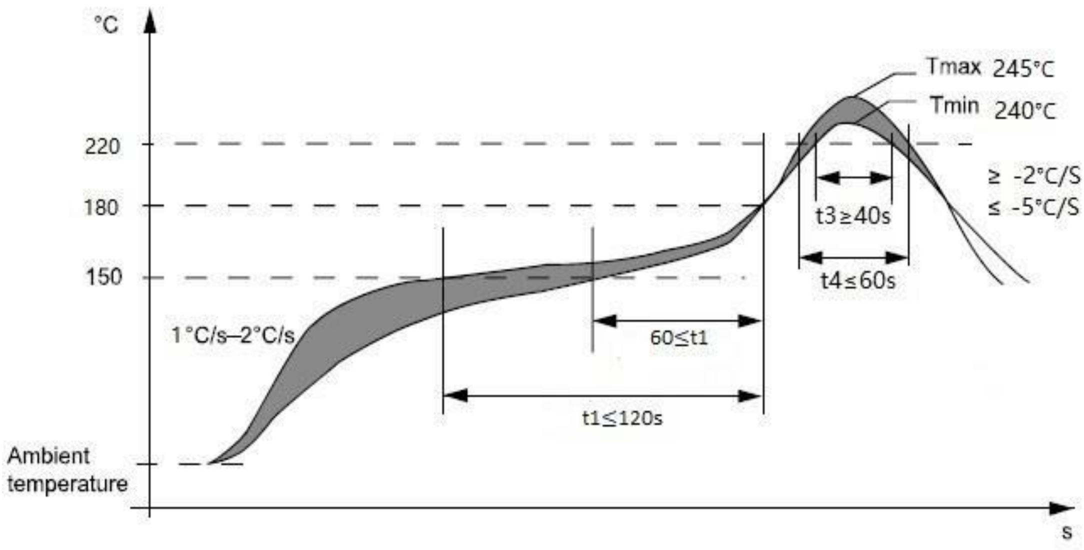


Figure 44: Recommend Physical SMT Stencil Drawing (Unit: mm)

8.5 Recommend Temperature Curve of Reflow Furnace



Reflow profile		
Temperature	**Time**	**Key Parameters**
Preheat zone (room temperature~150°C)	NA	Temperature rise slope:1~2°C
Constant temperature 1 (150~180°C)	60-120s	/
Constant temperature 2 (180~220°C)	15-20s	/
Reflow (≥220℃)	50-70s	Maximum Temperature:240~245°C
Cooling Zone	Cooling Slope:-2~-5°C/s	
Note:Test position contains welding spots of MCU,LGA and LCC.		

Figure 45: Recommend Temperature Curve of Reflow Furnace

NOTE

Please review the “Module Secondary-SMT-UGD” for detailed information on the module transmission, manufacture, and production.

8.6 Moisture Sensitivity Level (MSL)

Modules are shipped in vacuum-sealed aluminum foil bag bags, vacuum-packed according to IPC/JEDEC specification J-STD-020C

- Recommended storage Range: temperature of 23±5 ° C, and the relative humidity is 35% ~ 60%
- Storage period (vacuum-sealed packed) : The recommended storage period is 12 months

The SIM8070x module meets the Moisture sensitivity level 3. The following table lists the shelf life of the module after unpacking.

The workshop life of the product with MSL 3 is 168 hours. When the temperature of the workshop is 23± 5 ° C and the relative humidity is lower than 60%, the module shall start the reflow soldering or high-temperature operations after unpanking in 168 hours. Otherwise, the module shall be stored in an environment with relative humidity less than 10% (such as a moisture-proof cabinet) to keep dry.

Table 50: Moisture Sensitivity Level Classification

Classification	Factory Environment ≦ +30℃/60%RH
1	Indefinite Shelf Life Environment ≦+30℃/85% RH
2	1 Year
2a	4 Weeks
3	168 Hours
4	72 Hours
5	48 Hours
5a	24 Hours
6	Attaching after forced baking After baking, the module must be pasted within the time limit specified on the label

The following situations also require baking treatment:

- The storage temperature and humidity do not meet the recommended storage conditions
- Vacuum sealed packaging bags leak and materials are loose
- Before module repair
- It fails to complete production or storage according to the humidity sensor level 3 control after the module is unpacked

8.7 Baking Requirements

SIM8070 series module should be full baked before reflow welding due to the moisture sensitivity level. Otherwise, the module may be permanently damaged during reflow welding. The module shall be baked for 8 hours in a high-temperature container with a temperature of 120°C±5°C. Note that the tray could not resistant to high temperature. The user should take the module out of the tray for baking, otherwise the tray may be damaged by high temperature.

Table 51: Baking Requirements

Optional Baking Condition	Baking Period
120°C±5°C, <5% RH	8 Hours

NOTE

1. It is not recommended to expose the module to the air for a long time after disassembling the vacuum packaging.
2. Before baking, it is necessary to take the module out of its packaging and place the bare module on a high-temperature resistant appliance to avoid high-temperature damage to the plastic tray or reel; The module for secondary baking must be welded within 24 hours after baking, otherwise it needs to be vacuum packaged again for storage or stored in a drying box.
3. Please pay attention to ESD protection when unpacking and placing modules, such as wearing anti-static gloves.

8.8 Packaging

The SIM8070x module offers the following packaging size.

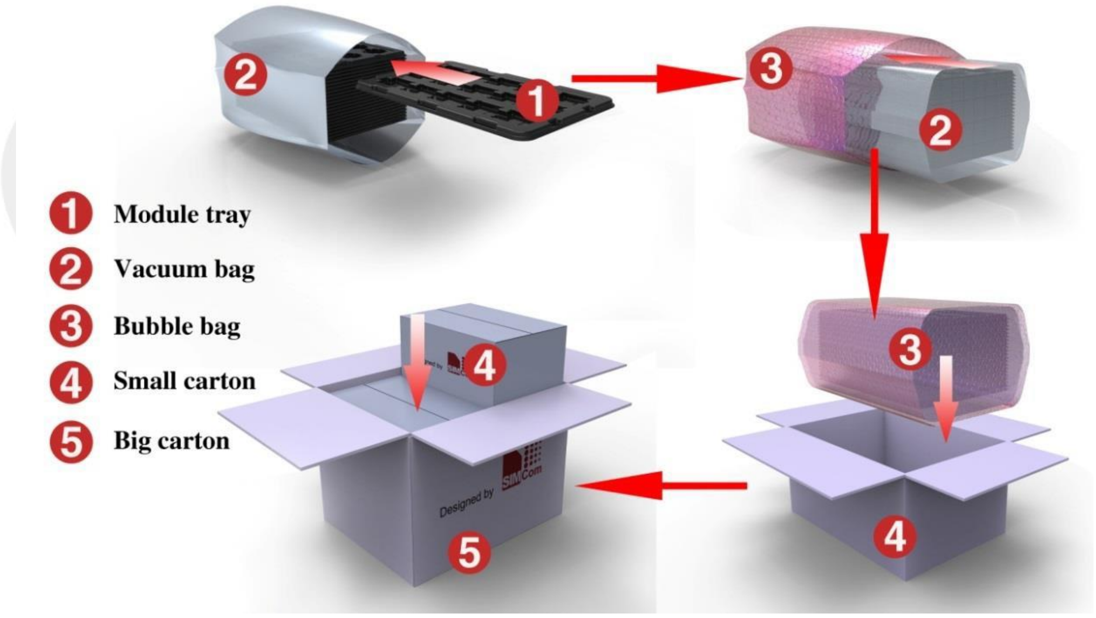


Figure 46: Packaging Diagram

The module tray of the SIM8070x series module is showing as follows.

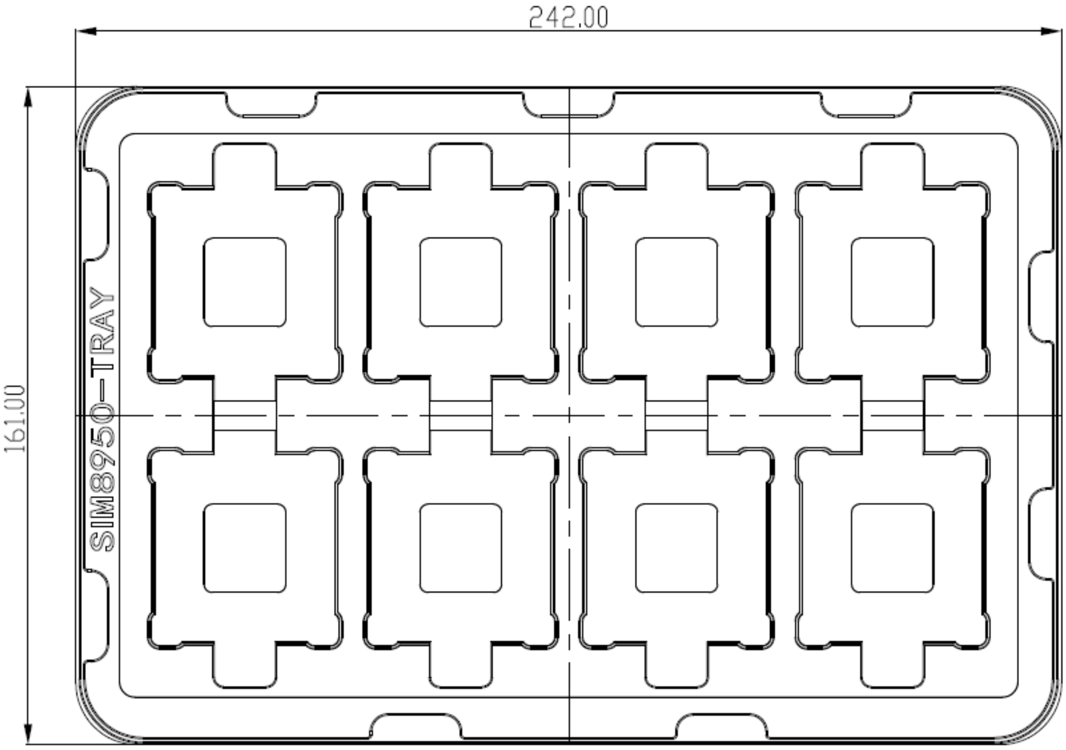


Figure 47: Module Tray Size

Table 52: Module Tray Size

Length（±3mm）	Width（±3mm）	Standard Packaging Num
242.0	161.0	8

The small carton size of the SIM8070x series module is showing as follows.

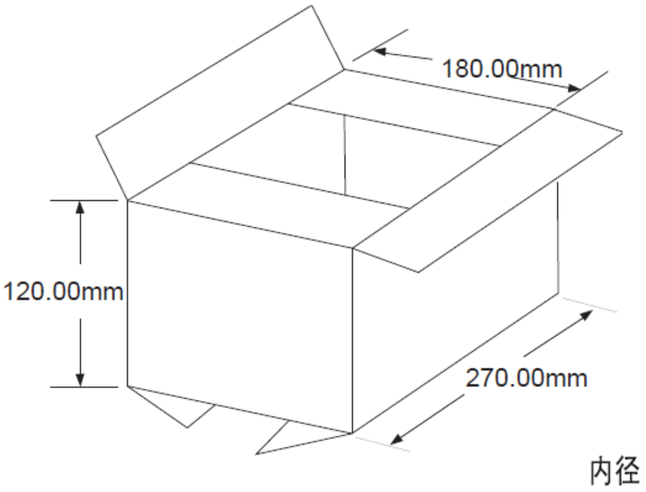


Figure 48: Small Carton Size

Table 53: Small Carton Size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Standard Packaging
270	180	120	8*19-2=150

The big carton size of the SIM8070x series module is showing as follows.

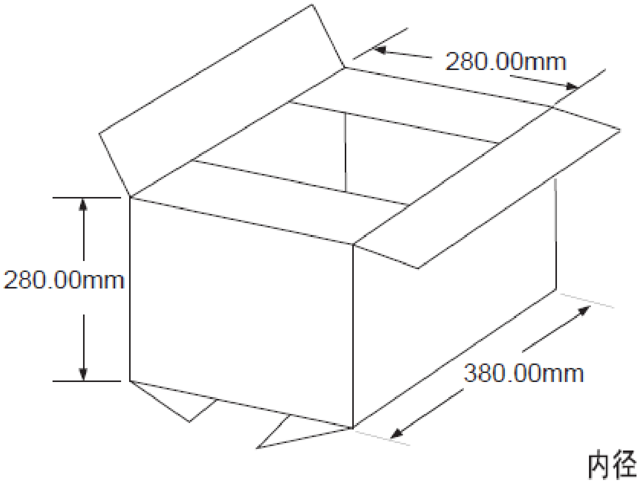


Figure 49: Big Carton Size

Table 54: Big Carton Size

Length（±10mm）	Width（±10mm）	Height（±10mm）	Standard Packaging
380	280	280	150*4=600

9 Recommend Devices

Table 55: Recommend Cameras Lists

Direction	Resolution	Model	Vendor
Front/Back	2M	GC2145	GALAXYCORE
Front	5M	OV5675	OmniVision
		OV5695	OmniVision
		S5K5E9	SAMSUNG
	8M	OV8856	OmniVision
Back	12M	OV12A	OmniVision
		S5K2L7SA03	SAMSUNG
		IMX362	SONY
		MX486	SONY
	13M	AR1337	ON Semiconductor
		OV13855	OmniVision
		OV13880	OmniVision
		S5K3L6	SAMSUNG
		S5K3M3SM24	SAMSUNG
		IMX258(PDAF)	SONY
	16M	HR1630	Huai'an imaging equipment manufacturing Co., Ltd
		OV16B10	OmniVision
		OV16885	OmniVision
Front		OV16885-4C	OmniVision
		S5K3P8SP	SAMSUNG
Back		S5K3P8SX	SAMSUNG
		IMX351	SONY
		IMX499	SONY
Front	20M	OV20880-4C	OmniVision
		S5K2T7SP	SAMSUNG
Back		IMX350	SONY
		IMX376	SONY
	23M	IMX318	SONY

Table 56: Recommend Screen

Model	Vendor	Resolution	Glass	Size
ST7703 -TDO-0545F71958	Truly	FHD	TFT	5.45”

Table 57: Recommend Gyroscope Sensors Lists

No.	Part Number	Vendor	Accelerometer	Gyroscope
1	BMA222E	Bosch	√	√
2	BMA250E	Bosch	√	√
3	BMA253	Bosch	√	√
4	BMA255	Bosch	√	√
5	BMG160	Bosch		√
6	BMI120	Bosch	√	√
7	BMI160	Bosch	√	√
8	BMI260	Bosch	√	√
9	BMI27	Bosch	√	√
10	BMX160	Bosch	√	√
11	ICM-20600	InvenSense	√	√
12	ICM-20602	InvenSense	√	√
13	ICM-20607	InvenSense	√	√
14	ICM-20608-D	InvenSense	√	√
15	ICM-20609	InvenSense	√	√
16	ICM-20621	InvenSense	√	√
17	ICM-20622	InvenSense	√	√
18	ICM-20626	InvenSense	√	√
19	ICM-20690	InvenSense	√	√
20	ICM-40602	InvenSense	√	√
21	ICM-40604	InvenSense	√	√
22	ICM-40605	InvenSense	√	√
23	ICM-42602	InvenSense	√	√
24	ICM-42605	InvenSense	√	√
25	ICM-42605-M	InvenSense	√	√
26	ICM-42608	InvenSense	√	√
27	LSM6DS3TR	ST	√	√
28	LSM6DS3TR-C	ST	√	√
29	LSM6DSLTR	ST	√	√
30	LSM6DSM	ST	√	√
31	LSM6DSMTR	ST	√	√

Table 58: Recommend Geomagnetism Sensors Lists

No.	Part Number	Vendor
1	AK09911C	AKM
2	AK09915C	AKM

3	AK09915D	AKM
4	AK09916C	AKM
5	AK09918C	AKM
6	HSCDTD008A	Alps
7	BMM150	Bosch
8	BMM160	Bosch
9	GMC306	Globalmems
10	IST8305	iSentek
11	IST8306	iSentek
12	IST8307	iSentek
13	IST8310	iSentek
14	MXG4300	MagnaChip
15	MMC3530	MEMSIC
16	MMC3630	MEMSIC
17	MMC3630KJ	MEMSIC
18	MMC5603NJ	MEMSIC
19	STM350MC	Senodia
20	STM480MW	Senodia
21	LIS2MDL	ST
22	AF6133	Voltafield
23	AF6133E	Voltafield
24	AF8133J	Voltafield
25	AF9133	Voltafield
26	YAS539	Yamaha

Table 59: Recommend Light Sensors Lists

No.	Part Number	Vendor	Proximity	Ambient Light
1	TMD26203	ams	√	
2	TMG49033	ams	√	√
2	CM36686	Capella	√	√
3	AP3426	Dyna Image	√	√
4	EPL2590KTWJP	Elan	√	√
5	MN66213	Elan	√	√
6	LTR-578ALS	Lite-On	√	√
7	RPR-0521RS	ROHM	√	√
8	RPR-0531	ROHM	√	√
9	RPR-0531RS	ROHM	√	√
10	STK2232	Sensortek	√	√
11	STK3311	Sensortek	√	√
12	STK3321	Sensortek	√	√

13	STK3327	Sensortek	√	√
14	STK3328	Sensortek	√	√
15	STK3332	Sensortek	√	√
16	STK3335	Sensortek	√	√
17	STK3338	Sensortek	√	√
18	V2000	Sensortek	√	√
19	PA22401001	TXC	√	
20	PA22A00001	TXC	√	√

Table 60: Recommend Pressure Sensors Lists

No.	Part Number	Vendor
1	BME680	Bosch
2	BMP280	Bosch
3	BMP285	Bosch
4	BMP380	Bosch
5	ICP-10100	InvenSense
6	ICP-10101	InvenSense
7	ICP-10110	InvenSense
8	ICP-10111	InvenSense
9	2SMPB-02B	omron
10	2SMPB-02E	omron
11	BM1383AGLV	ROHM
12	LPS22HB	ROHM
13	LPS22HBTR	ROHM
14	LPS22HH	ROHM

10 Appendix

10.1 Relative Documents

Table 61: Relative Documents

No.	Document Name	Description
[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]	IEC/EN60950-1(2001)	Safety of information technology equipment (2000)
[15]	GCF-CC V3.23.1	Global Certification Forum - Certification Criteria
[16]	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)

10.2 Terms & Abbreviations

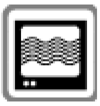
Terms	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
BOM	Bill of materials
bps	Bits per second
BT	Bluetooth
CDMA	Code division multiple access
CS	Coding Scheme
CSD	Circuit Switched Data
CSI	Camera serial interface
CTS	Clear to Send
DAC	Digital-to-analog converter
DDR	Double data 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
PWM1	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
UIM	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

10.3 Safety Caution

Table 63: 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.

SOS	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.

CE Statement

Extreme temperature: -30-75℃

This product can be used across EU member states.

Declaration of Conformity
Hereby, SIMCom Wireless Solutions Limited declares that this Wireless Data Module product is in compliance with essential requirements and other relevant provisions of RED 2014/53/EU. A copy of the Declaration of conformity can be found at www.simcom.com

Declaration of Conformity
Hereby, SIMCom Wireless Solutions Limited declares that the radio equipment type Wireless Data Module with BT&WIFI is in compliance with Directive 2014/53/EU.
The full text of the EU declaration of conformity is available at the following internet address: www.simcom.com

Restrictions in the 5 GHz band:
According to Article 10 (10) of Directive 2014/53/EU, the packaging shows that this radio equipment will be subject to some restrictions when placed on the market in Belgium (BE), Bulgaria (BG), the Czech Republic (CZ),Denmark (DK), Germany (DE), Estonia (EE), Ireland (IE), Greece (EL), Spain(ES), France (FR), Croatia (HR), Italy (IT), Cyprus (CY), Latvia (LV), Lithuania(LT), Luxembourg (LU), Hungary (HU), Malta (MT), Netherlands (NL), Austria(AT), Poland (PL), Portugal (PT), Romania (RO), Slovenia (SI), Slovakia (SK),Finland (FI), Sweden (SE), the United Kingdom (Northern Ireland) (UK(NI))., Turkey (TR), Norway(NO), Switzerland (CH), Iceland (IS), and Liechtenstein (LI).
The WLAN function for this device is restricted to indoor use only when operating in the 5150 to 5250MHz frequency range.

⚠				
BE	BG	CZ	DK	DE
EE	IE	EL	ES	FR
HR	IT	CY	LV	LT
LU	HU	MT	NL	AT
PL	PT	RO	SI	SK
FI	SE	UK(NI)		

Operating Frequencies And Maximum Power

WIFI 2.4GHz (802.11b, g, n20,n40): 17.04dBm
WIFI 5.2GHz (802.11a, ac20,ac40,ac80, n20,n40): 17.34dBm
WIFI 5.8GHz (802.11a, ac20,ac40,ac80, n20,n40): 13.98dBm
Bluetooth: 9.60dBm / BLE: 9.64dBm

Under normal use of condition, this device has a separation distance of at least 20cm between the antenna and the body of the user.

FCC Statement

This device complies with part 15 of the FCC 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.

Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

NOTE: This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates uses and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Important Note:

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator and your body.

This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Country Code selection feature to be disabled for products marketed to the US/Canada.

This device is intended only for OEM integrators under the following conditions:

1. The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2. The transmitter module may not be co-located with any other transmitter or antenna,
3. For all products market in US, OEM has to limit the operation channels in CH1 to CH11 for 2.4G band by supplied firmware programming tool. OEM shall not supply any tool or info to the end-user regarding to Regulatory Domain change. (if modular only test Channel 1-11)

As long as the three conditions above are met, further transmitter testing will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Important Note:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

The final end product must be labeled in a visible area with the following" Contains FCC ID: 2AJYU-8XK0002 ".

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The end user manual shall include all required regulatory information/warning as show in this manual.

Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01

2.2 List of applicable FCC rules

FCC Part 15 Subpart C 15.247 & 15.207 & 15.209
FCC Part 15, Subpart E 15.407& 15.207 & 15.209

2.3 Specific operational use conditions

Wireless Data Module with BT Dual mode, 2.4G WiFi and 5G WiFi
Frequency Range:

Band	Frequency (MHz)
802.11b/g/n(HT20/HT40)	2400~2483.5
802.11a/n(20M/40M)/ac(20M/40M/80M)	5150~5250
	5725~5850
Bluetooth	2400~2483.5

Modulation Type:
DSSS/OFDM for WLAN 2.4GHz and OFDM for WLAN 5GHz
GFSK/8DPSK/Π/4DQPSK for Bluetooth

Antenna Type: External Antenna
Antenna Gain: BT/WLAN 2.4G: 4.01dBi and WLAN 5G: 4.32dBi

The module can be used only for mobile and fixed applications. This module can only be used with the antenna design in strict compliance with the OEM instructions provided. The module antenna(s) must be installed to meet the RF exposure compliance separation distance of 20 cm and any additional testing and authorization process as required. Co-location of this module with other transmitters that operate simultaneously is required to be evaluated using the FCC multi-transmitter procedures. OEM integrators and end-Users must be provided with transmitter operating conditions for satisfying RF exposure compliance.

2.4 Limited module procedures

Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs

External R-SMA Antenna, BT/WLAN 2.4G: 4.01dBi and WLAN 5G: 4.32dBi.

2.6 RF exposure considerations

The module must be installed in the host equipment such that at least 20cm is maintained between the antenna and users’ body; and if RF exposure statement or module layout is changed, then the host product manufacturer required to take responsibility of the module through a change in FCC ID or new application. The FCC ID of the module cannot be used on the final product. In these circumstances, the host manufacturer will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

2.7 Antennas

Antenna Specification are as follows:
Type: External Antenna
Antenna Gain: BT/WLAN 2.4G: 4.01dBi and WLAN 5G: 4.32dBi
This device is intended only for host manufacturers under the following conditions:
The transmitter module may not be co-located with any other transmitter or antenna;
The module shall be only used with external antenna(s) that has been originally tested and certified with this module. The antenna must be either permanently attached or employa ‘unique’ antenna coupler.
As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains FCC ID: 2AJYU-8XK0002” with their finished product.

2.9 Information on test modes and additional testing requirements

Host manufacturer must perfom test of radiated & conducted emission and spurious emission, etc according to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.
Only when all the test results of test modes comply with FCC requirements, then the end product can be sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer

The modular transmitter is **only** FCC authorized for FCC Part 15 Subpart C 15.247 & FCC Part 15 Subpart E 15.407& 15.207 & 15.209 and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.