

SNM6690 Hardware Design Manual

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Foreword

Thank you for using the SNM6690 module from MeiG Smart. This product can provide data communication services. Please read the user manual carefully before use, you will appreciate its perfect function and simple operation method.

The company does not assume responsibility for property damage or personal injury caused by improper operation of the user. Users are requested to develop the corresponding products according to the technical specifications and reference designs in the manual. Also pay attention to the general safety issues that mobile products should focus on.

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Version History

Time	Revision	Change Description	Author
2024-11	1.00	The first edition	Hardware Department
2025-3	1.01	Increase the radio frequency band of SNM6690;	Hardware Department
2025-4	1.02	Add descriptions of differences between FP1 and FP4; Update the pin description of GPIO13 and gpio113; Add sim _ det and SD _ det pin descriptions; Update pin descriptions of PIN439 and Pin299; Add pin descriptions of PIN64 and pin 65; Update PIN pin distribution map	Hardware Department
2025-6	1.03	Modify the description of VCOIN, and modify the RESERVED PIN foot diagram and PIN foot description. Modify the description of PIN269、270、310、345、346、495、517.	Hardware Department

1.Introduction

This document describes the hardware application interface of the module, including the connection of the circuit and the functional interface. It can help users quickly understand the interface definition, electrical performance, and structural dimensions of the module. Combining this document with other application documents, users can quickly use modules to design mobile communication application solutions.

2.Module Overview

SNM6690 have the same package size. At present, only the ADC function of PIN45 is different, as shown in Table 3.1. Other PIN definitions are the same, mainly due to the difference in RF frequency band.

SNM6690 Integrates a wide range of functional interfaces. It can be widely used in video recorders, smart cockpits, intelligent POS cash registers, logistics terminals, VR cameras, intelligent robots, video surveillance, security monitoring, intelligent information collection equipment, intelligent handheld terminals, drones and other products under the 5G network.

The physical interface of the module is a 608-pin LGA pad, and the following hardware interfaces are provided:

- One LCD interface (MIPI-DSI)
- Four Camera Interfaces (MIPI-CSI)
- Four flash interfaces
- Three indicator light interfaces
- One USB2.0/USB3.1 interface
- Four analog MIC input interfaces
- Three digital MIC interfaces
- Two I2S interfaces (multiplexed physical interface with digital MIC)
- Three analog audio output interfaces (earphone, receiver, AUX)
- Two UIM card interfaces
- GPIO interface
- Three 1.8V UART interfaces, support four-line or two-line
- nine I2C interfaces
- One I3C interface
- Two SPI interfaces
- One PCIe interface(2-lane Gen3)
- One SD card interface
- Support GNSS, WiFi, Bluetooth 6.0 function

2.1.Main Features of the Module

Table 2.1:Main features of the module

Product Feature	Description
Platform	Qualcomm QCS6690
CPU	8-core Kryo CPU 7xx
GPU	Adreno GPU 7XX
System memory	UMCP, 256GB UFS2.2+8GB LPDDR4
OS	Android 15.0
Size	55*45*3.95mm, LGA 608pin
Wi-Fi	WCN7861: 2x2 IEEE 802.11a/b/g/n/ac/ax/be 2.4G/5G/6E/7(SNM6690DBS)
Bluetooth	BT 6.0
FM	NO Support
SIM	DSDS
	3.0/1.8V
	Support SIM card hotplug
Display	WFHD+ 144Hz, Low-Power Picture Enhancement display
	LCD Size: User defined
	Interface: LCM: MIPI DSI 4-lane;
Camera	Interface: Supports 4 x CSI, each group is 4-lane, and supports D-PHY v1.2
	Real-time sensor input resolution: 21 + 21 + 21 MP/32 + 21 MP/64 MP at 30 fps; 200 MP non-ZSL, HW sHDR (4K30), 4K60
	Video decode 4K120 for H.264/HEVC/VP9
	Video encode 4K60 for H.264/HEVC
Input devices	Keypads (Power on/off、Home、Reset、volume+、volume-)
	Capacitance TP
Reset	Support hard reset
Application interface	Interface Main Function
	VBAT 4pin, Module power input, 3.5V ~ 4.2V, typical value3.8V
	SDIO SD Card
	USB2.0 Support OTG

	(3.0)	USB_BOOT (Forced USB boot for emergency download)
	BLSP ports	QUP0(SE0~SE6)、QUP1(SE1~SE6), multiplexed serial interface functions
	UART	x 3 (can be extended through QUP interface)
	I2C	X 9, where 6 is dedicated I2C (can be extended through QUP interface)
	SPI(master only)	x 2 (can be extended through QUP interface)
	ADC	x 5
	Charging function	QC4.0+USB PD support
	Motor	Support ERM
	GPIO	x 13 GPIOs (without multiplexing)
	VCOIN	Real-time clock backup battery, Support voltages 2.5V, 3.0V, 3.1V and 3.2V.
Audio		4 analog MIC interfaces 3 digital MIC interfaces 2 I2S interfaces (multiplexed physical interface with digital MIC) 1 AUX signal (requires external audio PA) 1 earpiece 1 stereo headset (including headphone MIC)

2.2.Module Function Block Diagram

The following figure lists the main functional parts of the module:

- QCS6690 baseband chips
- PMK7635、PM8550VS、PM7550 power management chip
- WCN7861-WIFI/BT 2-in-1 chip
- The antenna interface
- LCD/CAM - MIPI interface
- EMCP memory chip
- AUDIO interface
- USB, SD card interface, SIM card interface so on

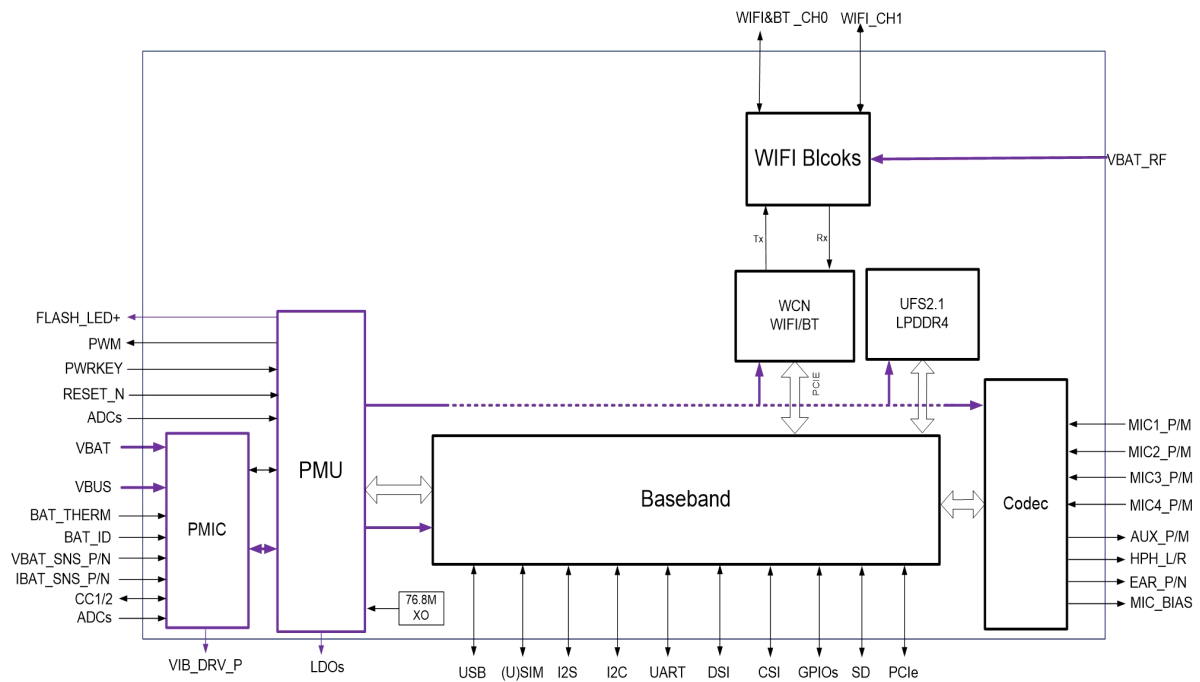


Fig2.1: Module function block diagram

3.1.Pin Distribution Diagram



Note: The yellow PIN represents the antenna interface, the orange PIN represents the high-speed signal interface, the blue PIN represents the analog signal interface such as audio and ADC, the red PIN represents the power interface, the green PIN represents the general signal interface, and the gray PIN represents GND.

3.2.Module Pin Description

Table 3.1: Pin description

Pin Name	Pin Number	I/O	Description	Comment
The power supply				
VBAT	460、461、462、463	I/O	The module provides 4 VBAT power pins. The voltage range is 3.5V to 4.2V.	External capacitance and surge tube protection are required
VPH_PWR	456、457、458、458	O	System power supply output, with a typical value of 3.8V. Can supply power to the peripherals.	
USB_VBUS	466、467、468、469	I/O	Charging input interface and OTG power output interface. It supports USB plugging and unplugging detection, and supports up to 12V charging.	
VCOIN	471	I/O	When the system power supply VBAT is not in place, an external backup battery provides power to the system real-time clock. The backup battery is charged while the VBAT is in place.	The VCOIN pin is connected to a 3V coin cell battery or a large capacitor.
VREG_S1B_1P856(RESERVE D)	416	O	1.8V power output, DMIC reserved power supply, default NC	150mA
VREG_L22B_3P2(TPVDD)	501	O	3.0V power output, can be used for TP VDD power supply	100mA
VREG_L20B_1P8(VSIM1)	338	O	1.8/3.0V power supply output, UIM1 power pin	100mA
VREG_L21B_1P8(VSIM2)	350	O	1.8/3.0V power supply output, UIM2 power pin	100mA
VREG_L23B_2P96(SDVIO)	413	O	3V power output for SD card signal pull-up	100mA

VREG_L16B_3P0(SENSOR_VDD)	417	O	The 3V power output, which will be turned off when standby, can be used for ALPS power supply.	200mA
VREG_L10B_1P8(SENSOR_VDDIO)	504	O	The 1.8V power output will be turned off when standby, and it is used as the IO power supply of the sensor	150mA
VREG_L13B_2P96(SD_VDD)	414	O	3V power output for SD card VCC power supply	150mA
VREG_L18B_2P8(WCN_VDD)	415	O	2.8V power output for WCN_VDD power supply	100mA
VREG_L9B_1P8(LCD VDDIO)	418	O	1.8V power output, which will be turned off when standby, can be used for OLED IO power supply.	200mA
VREG_L19B_3P0(OLED VCI)	427	O	The 3V power output will be turned off when standby, and can be used for OLED VCI power supply.	100mA
VREG_L17B_3P104(USBHS_VIO)	492	O	3.1V power output for PMU, VDD, PHY, etc	100mA
VREG_L10F_1P776(SDR_VDD)	125	O	1.776V power output, which can be used for RF SDR, QPM and other related power supply	100mA
VREG_L7B_1P8	419	O	1.8V power output, often powered on at startup, used for CPU, Memory, IO pull-up and other power supply	200mA
VREG_L1B_1P8_BONEFISH(RF_VDDIO)	532	O	1.8V power supply output for RF loads.	150mA
VREG_SYS_1P8	424	O	1.8V power output, only used for SMB parallel charging chips.	/
GND	8、11、12、29、30、32、36、37、38、39、40、41、49、51、52、57、58、63、66、68、73、78、91、98、99、101、103、105、107、108、109、110、111、112、113、115、117、118、119、120、121、122、123、124、127、132、134、			GND

	137、138、140、142、144、145、147、148、 152、165、168、171、175、176、178、181、 184、189、192、197、198、201、202、205、 206、207、209、212、216、221、224、229、 230、235、236、237、238、243、244、245、 246、250、254、256、265、267、268、271、 275、276、277、282、284、289、290、293、 294、295、296、300、301、302、306、307、 308、315、325、339、341、342、347、357、 360、363、368、371、374、378、385、386、 389、392、395、400、408、431、440、441、 448、449、454、455、464、465、470、472、 477、478、479、480、481、482、483、484、 485、486、487、488、494、496、497、503、 510、511、512、513、533、534、535、536、 537~608			
Main display interface(MIPI)				
MIPI_DSI0_CLK_N	406	O	MIPI_DSI clock	
MIPI_DSI0_CLK_P	407	O		
MIPI_DSI0_LANE0_N	390	O	MIPI_DSI data	
MIPI_DSI0_LANE0_P	391	O		
MIPI_DSI0_LANE1_N	396	O		
MIPI_DSI0_LANE1_P	397	O		
MIPI_DSI0_LANE2_N	398	O		
MIPI_DSI0_LANE2_P	399	O		
MIPI_DSI0_LANE3_N	404	O		
MIPI_DSI0_LANE3_P	405	O		
LCD_RST_N/GPIO124*	393	I/O		LCD reset pin
LCD_TE/GPIO129*	401	I/O	LCD frame synchronization signal	
LCD_ID/GPIO424	394	I/O	LCD_ID signal	
BL_PWM/PM7550_GPIO8	412	I/O	Backlight chip PWM control	

			signal	
UART(1.8V)				
DBG_UART_TX/GPIO25	528	O	UART data transmit	system debug UART
DBG_UART_RX/GPIO26*	529	I	UART data receive	
UART2_TX/GPIO38*	507	O	UART data transmit	
UART2_RX/GPIO39*	506	I	UART data receive	
UART1_TX/GPIO17	157	O	UART data transmit	
UART1_RX/GPIO18*	158	I	UART data receive	
UIM card interface				
UIM1_DATA	344	I	UIM1 data signal	
UIM1_CLK	343	O	UIM1 clock signal	
UIM1_RESET_N	337	O	UIM1 reset signal	
UIM1_PRESENT/GPIO99*	336	I/O	UIM1 insert monitoring	The level range is 0~1.2V, and the module has 100K pull-up.
UIM2_DATA	349	I	UIM2 data signal	
UIM2_CLK	348	O	UIM2 clock signal	
UIM2_RESET_N	346	O	UIM2 reset signal	BOOT_CONFIG, it is forbidden to pull high before starting, otherwise it will not be started.
UIM2_PRESENT/GPIO103*	345	I/O	UIM2 insert monitoring	The level range is 0~1.2V, and the module has 100K pull-up. BOOT_CONFIG, it is forbidden to pull high before starting,

				otherwise it will not be started.
REAR CAM				
MIPI_CSI0_CLK_P	232	O	REAR CAM MIPI clock	
MIPI_CSI0_CLK_N	231	O		
MIPI_CSI0_LANE0_P	228	I	REAR CAM MIPI data	
MIPI_CSI0_LANE0_N	227	I		
MIPI_CSI0_LANE1_P	226	I		
MIPI_CSI0_LANE1_N	225	I		
MIPI_CSI0_LANE2_P	220	I		
MIPI_CSI0_LANE2_N	219	I		
MIPI_CSI0_LANE3_P	218	I		
MIPI_CSI0_LANE3_N	217	I		
CCI_I2C0_SCL/GPIO89	223	I/O	REAR CAM I2C_SCL	
CCI_I2C0_SDA/GPIO88	222	I/O	REAR CAM I2C_SDA	
MCAM_PWD_N/GPIO166*	215	I/O	REAR CAM sleep signal	
CAM_MCLK0/GPIO83	214	I/O	REAR CAM main clock	
CAM0_RST_N/GPIO23*	213	I/O	REAR CAM reset signal	
FRONT CAM				
MIPI_CSI3_CLK_P	86	O	FRONT CAM MIPI clock	
MIPI_CSI3_CLK_N	85	O		
MIPI_CSI3_LANE0_P	87	I	FRONT CAM MIPI data	
MIPI_CSI3_LANE0_N	84	I		
MIPI_CSI3_LANE1_P	88	I		
MIPI_CSI3_LANE1_N	83	I		
MIPI_CSI3_LANE2_P	89	I		
MIPI_CSI3_LANE2_N	82	I		
MIPI_CSI3_LANE3_P	90	I		
MIPI_CSI3_LANE3_N	81	I		
CCI_I2C3_SCL/GPIO95*	94	I/O	FRONT CAM/RESERVED CAM I2C_SCL	
CCI_I2C3_SDA/GPIO94	93	I/O	FRONT CAM/I2C_SDA	

SCAM_PWD_N/GPIO158*	96	I/O	FRONT CAM sleep signal	
CAM_MCLK3/GPIO86	97	I/O	FRONT CAM main clock	
CAM3_RST_N/GPIO43*	95	I/O	FRONT CAM reset signal	
DEPTH CAM				
MIPI_CSI1_CLK_P	80	O	DEPTH CAM MIPI clock	
MIPI_CSI1_CLK_N	79	O		
MIPI_CSI1_LANE0_P	72	I	DEPTH CAM MIPI data	
MIPI_CSI1_LANE0_N	71	I		
MIPI_CSI1_LANE1_P	70	I		
MIPI_CSI1_LANE1_N	69	I		
MIPI_CSI1_LANE2_P	62	I		
MIPI_CSI1_LANE2_N	61	I		
MIPI_CSI1_LANE3_P	60	I		
MIPI_CSI1_LANE3_N	59	I		
CCI_I2C1_SCL/GPIO91*	77	I/O	DEPTH CAM I2C_SCL	
CCI_I2C1_SDA/GPIO90	76	I/O	DEPTH CAM I2C_SDA	
DCAM_PWD_N/GPIO157	75	I/O	DEPTH CAM sleep signal	
CAM_MCLK1/GPIO84	74	I/O	DEPTH CAM main clock	
CAM1_RST_N/GPIO150*	67	I/O	DEPTH CAM reset signal	
RESERVED CAM1				
MIPI_CSI2_CLK_P	180	O	RESERVED CAM MIPI clock	
MIPI_CSI2_CLK_N	179	O		
MIPI_CSI2_LANE0_P	186	I	RESERVED CAM MIPI data	
MIPI_CSI2_LANE0_N	185	I		
MIPI_CSI2_LANE1_P	188	I		
MIPI_CSI2_LANE1_N	187	I		
MIPI_CSI2_LANE2_P	194	I		
MIPI_CSI2_LANE2_N	193	I		
MIPI_CSI2_LANE3_P	196	I		
MIPI_CSI2_LANE3_N	195	I		
CCI_I2C2_SCL/GPIO93	183	I/O	RESERVED CAM I2C_SCL	
CCI_I2C2_SDA/GPIO92*	182	I/O	RESERVED CAM I2C_SDA	

FP_RST/GPIO74*	313	I/O	RESERVED CAM sleep signal	
CAM_MCLK2/GPIO85	190	I/O	RESERVED CAM main clock signal	
CAM2_RST_N/GPIO42	191	I/O	RESERVED CAM reset signal	
Audio interface				
AMIC1_INM	26	I	Main MIC -	
AMIC1_INP	25	I	Main MIC +	
WCD_AMIC2_P	21	I	Headphone MIC +	
WCD_AMIC2_M	22	I	Headphone MIC -	
AMIC3_INM	23	I	Noise-reducing MIC -	
AMIC3_INP	24	I	Noise-reducing MIC +	
WCD_MIC_BIAS1	33	O	BIAS voltages for the main and secondary mics for silicon-microphone design	
WCD_MIC_BIAS2	34	O	BIAS voltage of the headphone MIC	
WCD_MIC_BIAS3	35	O	BIAS voltage of mic4, for silicon-microphone design	
AMIC4_INP	28	I	MIC4 +	
AMIC4_INM	27	I	MIC4 -	
WCD_HPH_R	16	O	Headphone right channel	
WCD_HPH_L	15	O	Headphone left channel	
WCD_HS_DET_L	13	I	Headphone plugging and unplugging detection	
WCD_HPH_REF	14	I	Headphone reference ground	
WCD_EAR_OUT_P	17	O	Earpiece output +	
WCD_EAR_OUT_M	18	O	Earpiece output -	
WCD_AUX_OUT_P	19	O	External amplifier input +	External amplifier input
WCD_AUX_OUT_M	20	O	External amplifier input -	
I2S1_DATA1/GPIO141/DMIC2_DATA/MCLK1	56	I	Digital MIC2 data signal	
I2S1_DATA0/GPIO140/DMIC2_CLK	55	O	Digital MIC2 clock signal	

I2S1_CLK/GPIO138/DMIC1_CLK	53	O	Digital MIC1 clock signal	
I2S1_WS/GPIO139/DMIC1_DATA	54	I	Digital MIC1 data signal	
I2S2_DATA0/GPIO144*/DMIC3_CLK	287	O	Digital MIC3 clock signal	
I2S2_DATA1/GPIO145*/DMIC3_DATA	288	I	Digital MIC3 data signal	
SD card interface				
SDCARD_DET_N/GPIO65*	498	I/O	SD card plugging and unplugging detection signal	The level range is 0~1.2V, and the module has 100K pull-up.
SDC2_CLK	379	I/O	SD card clock signal	
SDC2_CMD	380	I/O	SD card CMD signal	
SDC2_DATA_0	381	I/O	SD card data signal	
SDC2_DATA_1	382	I/O		
SDC2_DATA_2	383	I/O		
SDC2_DATA_3	384	I/O		
I2C				
SENSOR_I2C_SDA/GPIO153*	47/476	I/O	SENSOR_I2C signal	Pull-up to VREG_L10B_1P8;Directly connected with PIN476 and 475 internally, compatible for use.
SENSOR_I2C_SCL/GPIO154	48/475	I/O		
NFC_I2C_SDA/GPIO4*	524	I/O	Universal I2C signal	Pull-up to VREG_L7B_1P8
NFC_I2C_SCL/GPIO5	525	I/O		
HDMI_I2C_SDA/GPIO55*	515	I/O	Universal I2C signal	Pull-up to VREG_L7B_1P8
HDMI_I2C_SCL/GPIO56*	514	I/O		
TS_I2C_SDA/GPIO40*	409	I/O	TP_I2C signal	Pull-up to VREG_L9B_1P8
TS_I2C_SCL/GPIO41	410	I/O		

APPS_I2C_SDA/GPIO32*	252	I/O	Universal I2C signal	Pull-up to VREG_L7B_1 P8
APPS_I2C_SCL/GPIO33	251	I/O		
CCI_I2C0_SCL/GPIO89	223	I/O	R-CAM I2C signal	Pull-up to CAM_IOVDD_1P8(External LDO)
CCI_I2C0_SDA/GPIO88	222	I/O		
CCI_I2C2_SCL/GPIO93	183	I/O	F-CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C2_SDA/GPIO92*	182	I/O		
CCI_I2C1_SCL/GPIO91*	77	I/O	D-CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C1_SDA/GPIO90	76	I/O		
CCI_I2C3_SCL/GPIO95*	94	I/O	RESERVED CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C3_SDA/GPIO94	93	I/O		
TP				
TS_I2C_SDA/GPIO40*	409	I/O	I2C signal	Pull-up to VREG_L9B_1 P8
TS_I2C_SCL/GPIO41	410	I/O	I2C signal	
TS_INT_N/GPIO19*	402	I/O	TP interrupt signal	
TS_RST_N/GPIO20	403	I/O	TP reset signal	
USB				
USB0_HS_DP	375	I/O	USB 2.0 DP signal	
USB0_HS_DM	376	I/O	USB 2.0 DM signal	
USB0_SS_TX1_P	366	O	USB super-speed 1 transmit – plus	
USB0_SS_TX1_M	367	O	USB super-speed 1 transmit – minus	
USB0_SS_RX1_P	372	I	USB super-speed 1 receive – plus	
USB0_SS_RX1_M	373	I	USB super-speed 1 receive – minus	
USB0_SS_TX0_P	364	O	USB super-speed 0 transmit – plus	
USB0_SS_TX0_M	365	O	USB super-speed 0 transmit – minus	
USB0_SS_RX0_P	358	I	USB super-speed 0 receive – plus	

USB0_SS_RX0_M	359	I	USB super-speed 0 receive – minus	
USB_CC1	5	I/O	CC1 pin for the Type-C	
USB_CC2	6	I/O	CC2 pin for the Type-C	
PMB_USB_SBU1	3	I	Type-C side band signal SBU1; protected to 22 V max	
PMB_USB_SBU2	4	O	Type-C side band signal SBU2; protected to 22 V max	
USB_CONN_THERM	442	I	USB Type-C connector temperature sensor.	
USB_ID/GPIO12*	377	I	USB ID signal	
DP_AUX_P	361	I/O	DP_AUX_P signal	
DP_AUX_M	362	I/O	DP_AUX_M signal	
USB_CC_DIR	426	O	The 1.8V three-state output indicates the CC connection direction	Type-C: This pin is connected to the 518 pin Micro-USB: resistor NC connected with pin 426 and pin 518, reserved position.
USB_OPTION	425	I	Select different PON items according to the resistance of the pull-down resistor	Type-C: This pin NC Micro-USB: 0R resistor is reserved for the pin to be grounded, and the 0R resistor position is NC.
USB_PHY_PS	518	I/O	USB_PHY_PS	Type-C: This pin is connected to the 426 pin Micro-USB: This pin is connected to a 1K resistor to

				the ground
Antenna interface				
2.4G/5G/6G_CH1_ANT	116	I/O	WIFI/BT antenna	
2.4G/5G/6G_CH0_ANT	100	I/O	WIFI/BT antenna	
GPIO (*port for support interrupt wake-up) with other functional pins				
GPIO159*	173	I/O	Universal GPIO, with no default function	
GPIO160	172	I/O	Universal GPIO, with no default function	
PCIE1_RESET_N/GPIO69	204	I/O	Universal GPIO, the default is PCIE1_RESET_N	
PCIE1_WAKE_N/GPIO71*	203	I/O	Universal GPIO, the default is PCIE1_WAKE_N	
EDP_CABC_EN/GPIO165	253	I/O	Universal GPIO, with no default function	
GPIO54*	257	I/O	Universal GPIO, with no default function	
ELNA_EN0/GPIO59*	128	I/O	Universal GPIO, the default function is ELNA enabled	
ELNA_EN1/GPIO60*	133	I/O	Universal GPIO, the default function is ELNA enabled	
GPIO8*	499	I/O	Universal GPIO, with no default function	
GPIO9	261	I/O	Universal GPIO, with no default function	
GPIO10	262	I/O	Universal GPIO, with no default function	
GPIO11*	160	I/O	Universal GPIO, with no default function	
GPIO15*	502	I/O	Universal GPIO, with no default function	
GPIO16	159	I/O	Universal GPIO, with no default function	
HOME_KEY/GPIO36*	530	I/O	Universal GPIO, the default is HOME_KEY	
VOL_DOWN/GPIO37	531	I/O	Universal GPIO, the default	

			is VOL_DOWN	
FP_INT/GPIO75*	314	I/O	Universal GPIO, with no default function	
NFC_EN/GPIO7*	474	I/O	Universal GPIO, with no default function	
NFC_CLK_REQ/GPIO6*	321	I/O	Universal GPIO, with no default function	
NFC_DWL_REQ/GPIO113*	323	I/O	Universal GPIO, with no default function	This PIN was changed from GPIO13 to GPIO113 in SNM6690_V1.02 and SRM 6690_v1.01.
NFC_INT/GPIO31*	473	I/O	Universal GPIO, with no default function	
GPIO81*	318	I/O	Universal GPIO, with no default function	
GPIO125*	324	I/O	Universal GPIO, with no default function	
NFC_SPI_MISO/GPIO27*	320	I/O	Universal GPIO, with no default function	
NFC_SPI_MOSI/GPIO28	319	I/O	Universal GPIO, with no default function	
NFC_SPI_SCLK/GPIO29	312	I/O	Universal GPIO, with no default function	
NFC_SPI_CS/GPIO30*	311	I/O	Universal GPIO, with no default function	
GPIO161*	309	I/O	Universal GPIO, with no default function	
AUDIO_PA_EN/GPIO107*	310	I/O	Universal GPIO, the default is external audio PA enabled	BOOT_CONFIG, it is forbidden to pull high before starting, otherwise it will not be started.
SPI1_MISO/GPIO0*	522	I/O	Universal GPIO, with no default function	

SPI1_MOSI/GPIO1	523	I/O	Universal GPIO, with no default function	
SPI1_SCK/GPIO2	521	I/O	Universal GPIO, with no default function	
SPI1_CS/GPIO3*	520	I/O	Universal GPIO, with no default function	
FP_WAKE_UP/GPIO76*	322	I/O	Universal GPIO, with no default function	
WSA0_EN/GPIO149*	114	I/O	Universal GPIO, with no default function	
CAM_MCLK4/GPIO87*	151	I/O	Universal GPIO, the default is CAM_MCLK4	
PCIE1_CLK_REQ_N/GPIO70*	527	I/O	Universal GPIO, the default is PCIE1_CLK_REQ_N	
GPIO80*	174	I/O	Universal GPIO, with no default function	
MI2S_MCLK/GPIO146	283	I/O	Universal GPIO, with no default function	
GYRO_INT/GPIO77*	508	I/O	Universal GPIO, the default is GYRO_INT	
ACCL_INT/GPIO72*	516	I/O	Universal GPIO, the default is ACCL_INT	
PRESSURE_INT/GPIO78*	526	I/O	Universal GPIO, the default is PRESSURE_INT	
RFFE1_CLK/GPIO116	269	I/O	Dedicated GPIO, RF reserved	BOOT_CONFIG, it is forbidden to pull high before starting, otherwise it will not be started.
RFFE1_DATA/GPIO117	270	I/O	Dedicated GPIO, RF reserved	BOOT_CONFIG, it is forbidden to pull high before starting, otherwise it

				will not be started.
SAR_INT_N/GPIO82*	146	I/O	Universal GPIO, with no default function	
ALSP_INT_N/GPIO73*	317	I/O	Universal GPIO, the default is ALSP_INT_N	
I2S2_CLK/GPIO142	285	I/O	Universal GPIO, with no default function	
I2S2_WS/GPIO143*	286	I/O	Universal GPIO, with no default function	
SNS_I3C0_SDA/GPIO151*	490	I/O	Universal GPIO, with no default function	
SNS_I3C0_SCL/GPIO152	489	I/O	Universal GPIO, with no default function	
FORCED_USB_BOOT	517	I	Pull it up to 1.8V(VREG_L7B_1P8) before starting, and enter the emergency download mode.	
VIB_DRV_P	7	O	Motor output +, support for ERM	
PM7550_GPIO3/ADC1	42	I/O	PM7550_GPIO, it is used as ADC by default	
PM7550_GPIO7/ADC2	43	I/O	PM7550_GPIO, it is used as ADC by default	
PM7550_GPIO10/ADC3	44	I/O	PM7550_GPIO, it is used as ADC by default	
PM7550_GPIO4/ADC4	45	I/O	PM7550_GPIO, it is used as ADC by default	This pin is not available for SNM6690_V1.01 module.
PMIV0102_GPIO08/ADC5	46	I/O	PM7550_GPIO, it is used as ADC by default	
PMIV0102_GPIO2/ADC	434	I/O	PM7550_GPIO, it is used as ADC by default	
PM7550_AMUX5	436	I	Analog multiplexer (AMUX) input	
SMB_STAT/GPIO79*	432	I/O	GPIO79, the default is SMB1355_INT	

PMIV0102_GPIO5/DISPLAY_BIAS_DRIVER_EN	437	I/O	PMIV0102_GPIO5, the default is DISPLAY_BIAS_DRIVER_EN	
PM7550_GPIO11	411	I/O	PM7550_GPIO11	By default, it is used as a GPIO function. If PIN351~353 are not used, it can be reused as PWM. The scheme of removing PMI from SNM6690L is still being debugged, and there is a risk that this PIN will be occupied and cannot be used.
FLASH_LED1	421	O	Flash +, 1.5A	Subject to actual debugging
FLASH_LED2	422	O	Flash +, 1.5A	
FLASH_LED3	423	O	Flash +, 1.5A	
FLASH_LED4	420	O	Flash +, 1.5A	
IRIS_RED	351	O	RED_LED indicator light +	
IRIS_GREEN	352	O	GREEN_LED indicator light +	
IRIS_BLUE	353	O	BLUE_LED indicator light +	
SMB_SPMI_CLK	387	O	SMB_SPMI_CLK	It is used for communication between parallel charging chips
SMB_SPMI_DATA	388	I/O	SMB_SPMI_CLK	
SMB_ICHG_SNS	438	I	Current sense plus from the external parallel charger.	
SMB_EN_CHG	439	O	Enable/disable control pin for parallel SMB (slave) charger.	Do not use SMB1393,

				please leave it hanging.
SMB_THERM	444	I	Inductor temperature sensor.	When using SMB1393, pull down the 100K resistor
PMK_CLK7_NFC	519	O	PMK_CLK7_NFC (19.2MHz clock , for NFC)	
KPD_PWR_N	509	I	Power on/off	
PM_RESIN_N	505	I	Hardware reset	
KYPD_VOLP_N	493	I	Control volume +	
CBL_PWR_N	491	I	Power-on auto-power control pin	
WCD_RESET_N	495	I/O	Internal audio chip reset signal	NC
AOSS_SLEEP_INDICATOR	500	I/O	AOSS_SLEEP_INDICATOR	
CHARGER_SKIN_THERM	443	I	Analog multiplexer (AMUX) input, the default is used for charging-related temperature detection	
BATT_ID	445	I	Battery ID detection input	To fake presence of battery and have charging enabled, use a 100 kΩ pull-down to GND on BATT_ID.
BATT_THERM	446	I	Battery temperature detection input	To fake a good battery temperature, connect a 100 kΩ pull-down to GND on BATT_THERM.
VBATT_PACK_SNS_M	447	I	Battery voltage detection input -	Connect the battery -
VBATT_CONN_VSENSE_M	450	I	Battery voltage detection	Connect the

			input -	battery -
VBATT_CONN_VSENSE_P	451	I	Battery voltage detection input +	Connect the battery +
ISNS_PMIC_GND	64	I	Battery current detection input	Connect the battery -
ISNS_PACK_M	65	I	Battery current detection input	Connect the battery -
PCIE1_TX0_P	334	O	PCle TX0	
PCIE1_TX0_M	327	O		
PCIE1_TX1_P	332	O	PCle TX1	
PCIE1_TX1_M	329	O		
PCIE1_RX0_P	333	I	PCle RX0	
PCIE1_RX0_M	328	I		
PCIE1_RX1_P	331	I	PCle RX1	
PCIE1_RX1_M	330	I		
PCIE1_REFCLK_P	335	O	PCle REFCLK	
PCIE1_REFCLK_M	326	O		
RESERVED	1、2、9、10、92、 102、104、106、 126、129、131、 135、136、141、 143、149、150、 153、154、155、 156、161、162、 163、164、166、 167、169、170、 177、199、200、 208、210、211、 233、234、239、 240、241、242、 247、248、249、 258、259、260、 263、264、272、		RESERVED	

	273、274、278、 279、280、281、 291、292、297、 298、299、303、 304、305、340、 354、355、356、 369、370、428、 429、430、433、 435、452、453			
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GPIO*: Indicates an interrupt pin that wakes up the system

3.3.Mechanical Dimensions

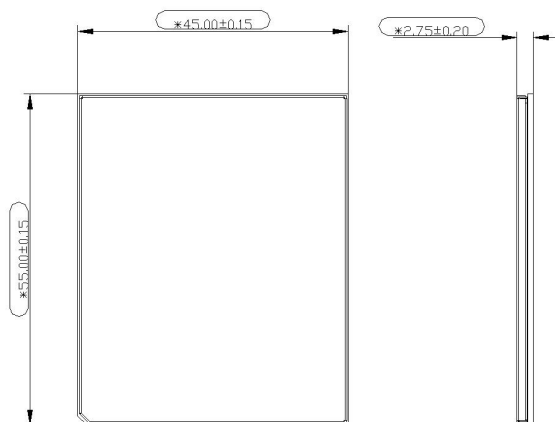


Fig3.2: TOP View&Side View

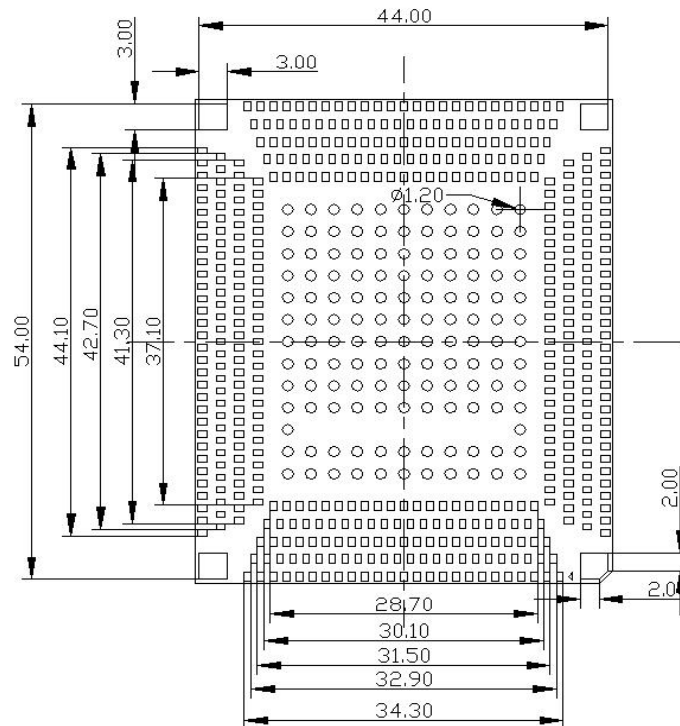


Fig3.3: BOTTOM View

3.4.Recommended encapsulation

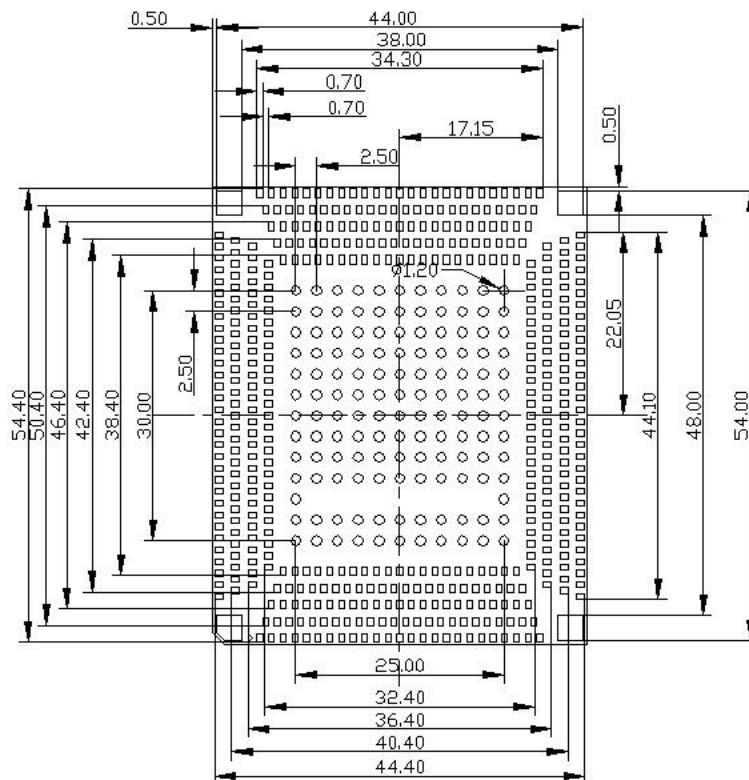


Fig3.4: Recommended encapsulation

4.Interface Application

4.1.Power supply

For devices with batteries, the voltage input range of the module VBAT is 3.5 V to 4.2 V. In the 5G band, when the module transmits at maximum power, the peak current can reach up to 4A instantaneously, resulting in a large voltage drop in the VBAT. It is recommended to use a large capacitor near the VBAT, and it is recommended to use two 47uF ceramic capacitors, and the parallel connection of 33PF and 10PF capacitors can effectively remove high-frequency interference. At the same time, in order to prevent ESD and surge damage to the chip, it is recommended to use a suitable TVS transistor and a 5.1V/500mW Zener diode in the VBAT pin of the module. When laying out the PCB, the capacitors and diodes should be as close to the VBAT pins of the module as possible. The user can directly power the module with a 3.8V lithium-ion battery, and the impedance between the VBAT pin and the battery should be less than 150mΩ when the battery is used.

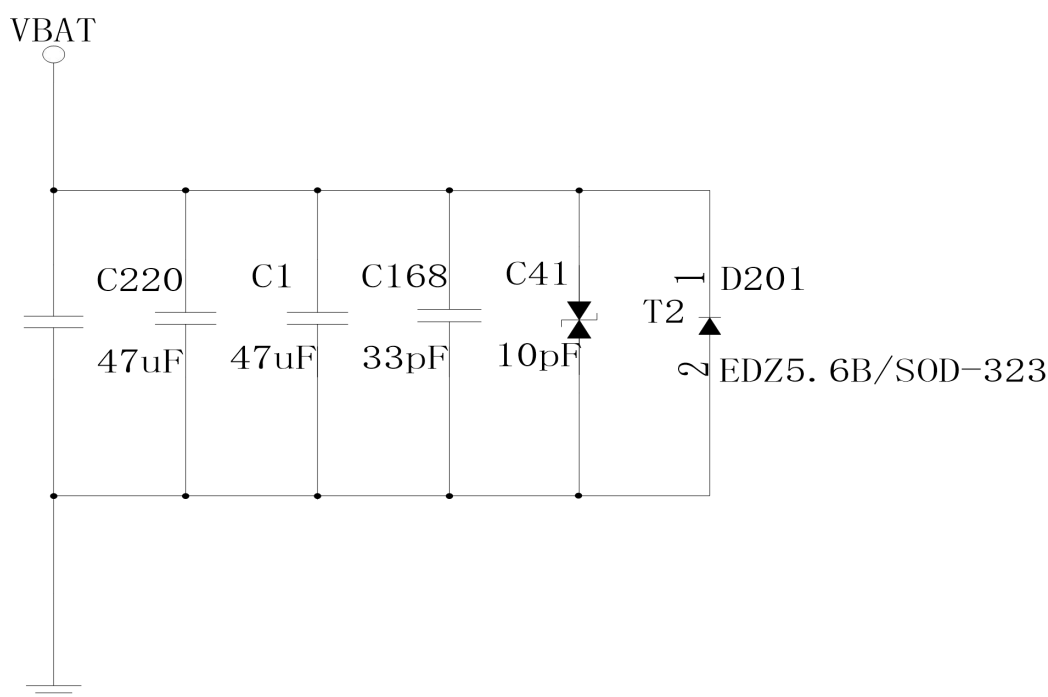


Fig4.1: VBAT input reference circuit

If it is a DC power supply device and the DC input voltage is 5V-12V, the recommended circuit that can be used for DC-DC power supply is shown in the following figure:

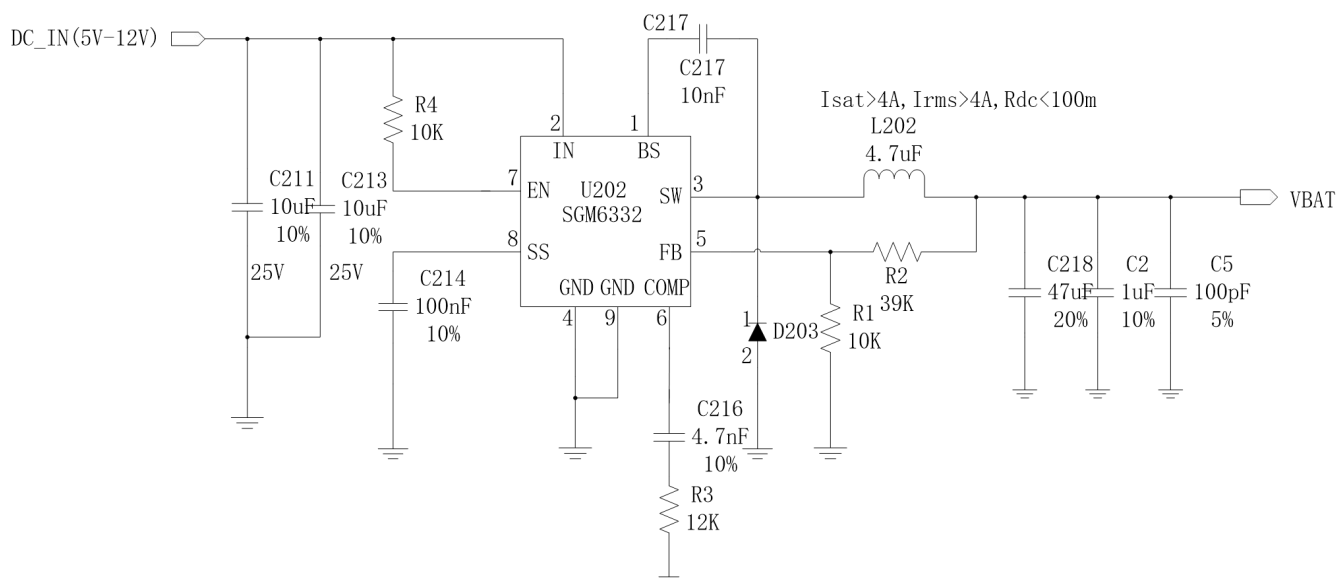


Fig4.2: DC-DC power supply circuit

4.1.1.Power Supply Pins

The VBAT pins (460、461、462、463) are used for power input. In the user's design, please pay special attention to the design of the power supply part to ensure that the drop of VBAT is not less than 3.5V even when the module consumption reaches 4A. If the voltage drop is less than 3.5V, the module may shut down. PCB wiring from VBAT pins to the power supply should be wide enough to reduce voltage sags in transmission burst mode.

VBAT



Fig4.3: VBAT lowest voltage sag

4.2.Power on/off

Do not turn on the module when the temperature and voltage upper limits of the module are exceeded. In extreme cases such operations can cause permanent damage to the module.

4.2.1.Power on

The user can power on the module by pulling down the KPD_PWR_N pin (509) for at least 3 seconds, and the pin has been pulled up to the 1.8V power supply inside the module, and the recommended circuit is as follows, or pull down the CBL_PWR_N pin (491), CBL_PWR_N can realize the function of automatic power-on by pulling down the 1K pull-down resistor to ground, and this signal

does not need to be released after powering on.

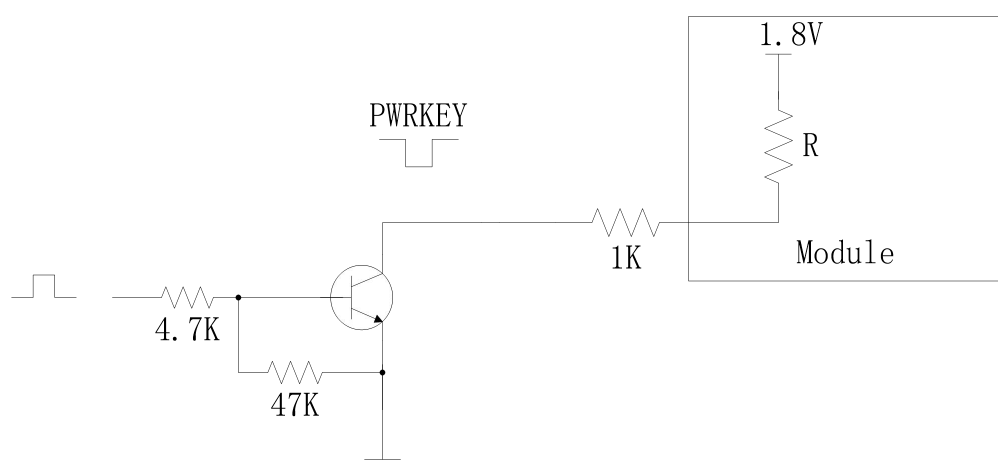


Fig4.4: Power on using external signal driver module

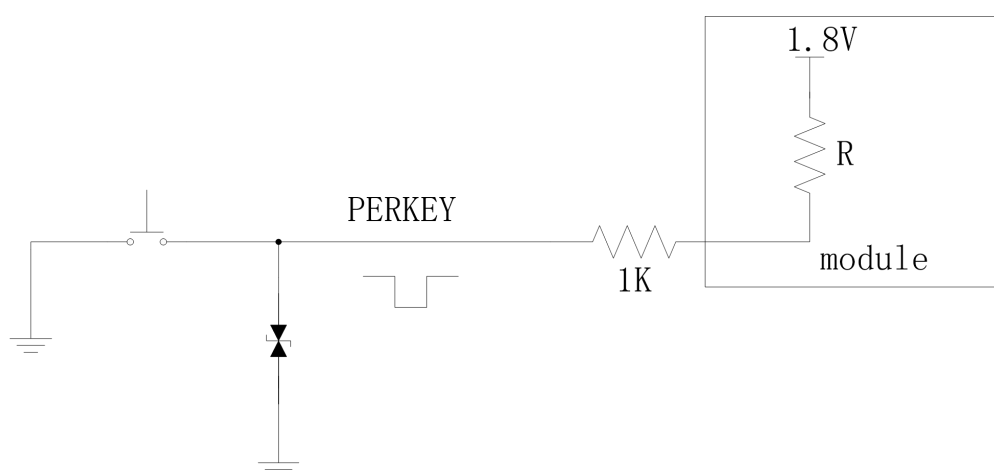


Fig4.5: Use the button circuit to boot

4.2.2..Module Shutdown

The user can shut down the machine using the KPD_PWR_N pin.

4.2.2.1.PWRKEY Shutdown

The user can power off the device by lowering the KPD_PWR_N signal for at least 3 seconds. Power off circuit can refer to the design of power on circuit. After the module detects the shutdown action, a prompt window will pop up on the screen to confirm whether to execute the shutdown action.

You can forcibly shut down the KPD_PWR_N by holding it down for at least 15 seconds.

4.2.3.Module Reset

The SNM6690 module supports the reset function. Users can quickly restart the module by pulling down the PM_RESIN_N(pin505) pin of the module. Recommended circuits are as follows:

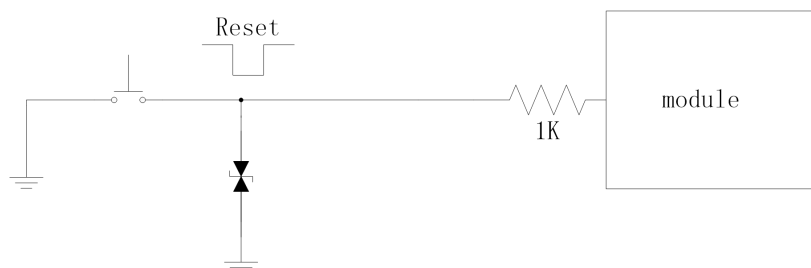


Fig4.6: Use the button circuit to reset

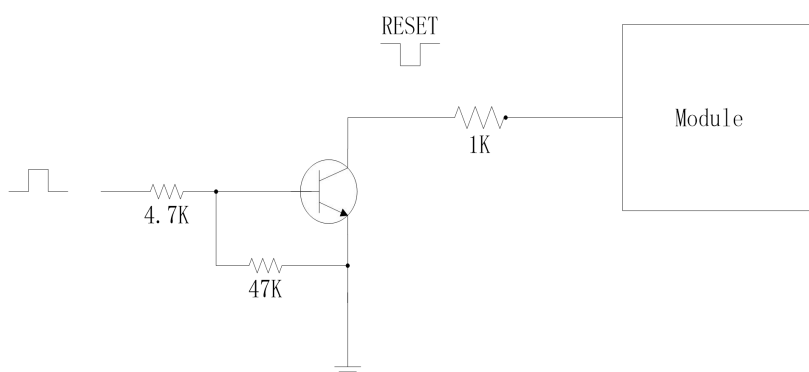


Fig4.7: Reset module using external signal

The typical voltage of the pin is 1.8V at high current level, so the user with 3V or 3.3V level can not directly use GPIO of MCU to drive the pin, and an isolation circuit is required. The hardware parameters of the PM_RESIN_N can be referred to the following table:

Table 4.1: PM _ RESSIN _ N hardware parameters

PIN	Description	Minimum	Typical	Maximum	Unit
PM_RESIN_N	Input high level	1.17	-	-	V
	Input low level	-	-	0.63	V
	Pull down the effective time	500	-	-	ms

4.3.VCOIN

When the VBAT is disconnected and the user needs to save the real-time clock, the VCOIN(PIN471) pin should not be suspended and should be connected to a large external capacitor or battery. When the external capacitor is connected, the recommended value is 100uF, which can keep the real-time clock for 20 seconds. The RTC power module uses an external capacitor or battery to supply power to the RTC inside the module.

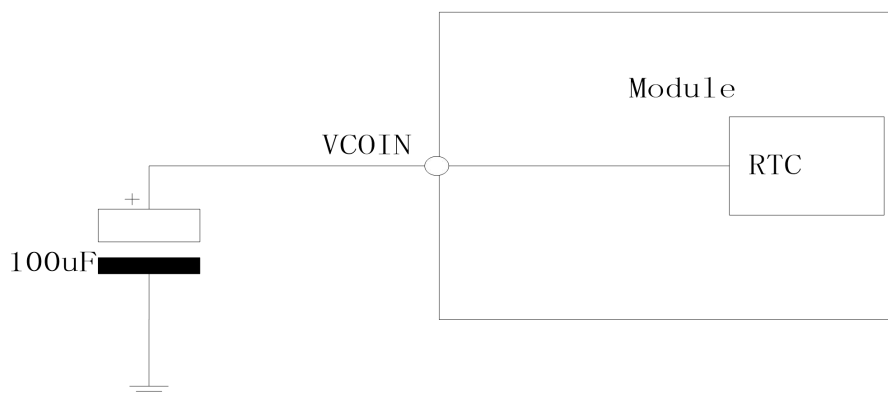


Fig4.8: The external capacitor supplies power to the RTC

Chargeable battery power:

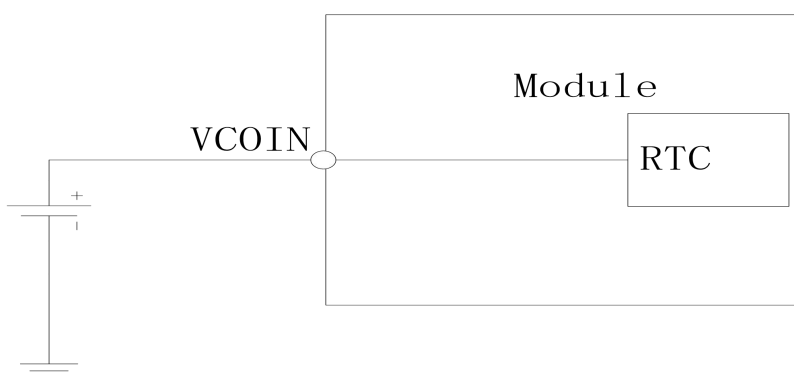


Fig4.9: Chargeable batteries power the RTC

Notes: The typical value of the VCOIN power supply is 3.0V.

4.4.Power Output

The SNM6690 has multiple power outputs. Used for SD card, SIM card, sensor, touch panel, outside LDO and so on. In application, it is recommended to add parallel 33PF and 10PF capacitors in each power supply to effectively remove high-frequency interference.

Table 4.2:The power to describe

PIN name	Voltage	Drive current
VREG_S1B_1P856(RESERVED)	1.8	150mA
VREG_L22B_3P2(TPVDD)	3.2	100mA
VREG_L20B_1P8(VSIM1)	1.8/3.0	100mA

VREG_L21B_1P8(VSIM2)	1.8/3.0	100mA
VREG_L23B_2P96(SDVIO)	2.96	100mA
VREG_L16B_3P0(SENSOR_VDD)	3.0	200mA
VREG_L10B_1P8(SENSOR_VDDIO)	1.8	150mA
VREG_L13B_2P96(SD_VDD)	2.96	150mA
VREG_L18B_2P8(WCN_VDD)	2.8	100mA
VREG_L9B_1P8(LCD_VDDIO)	1.8	200mA
VREG_L19B_3P0(OLED_VCI)	3.0	100mA
VREG_L17B_3P104(USBHS_VIO)	3.104	100mA
VREG_L10F_1P776(SDR_VDD)	1.776	100mA
VREG_L7B_1P8	1.8	200mA
VREG_L1B_1P8_BONEFISH(RF_VDDIO)	1.8	150mA
VREG_SYS_1P8	1.8	/
VPH_PWR	3.8	1.5A

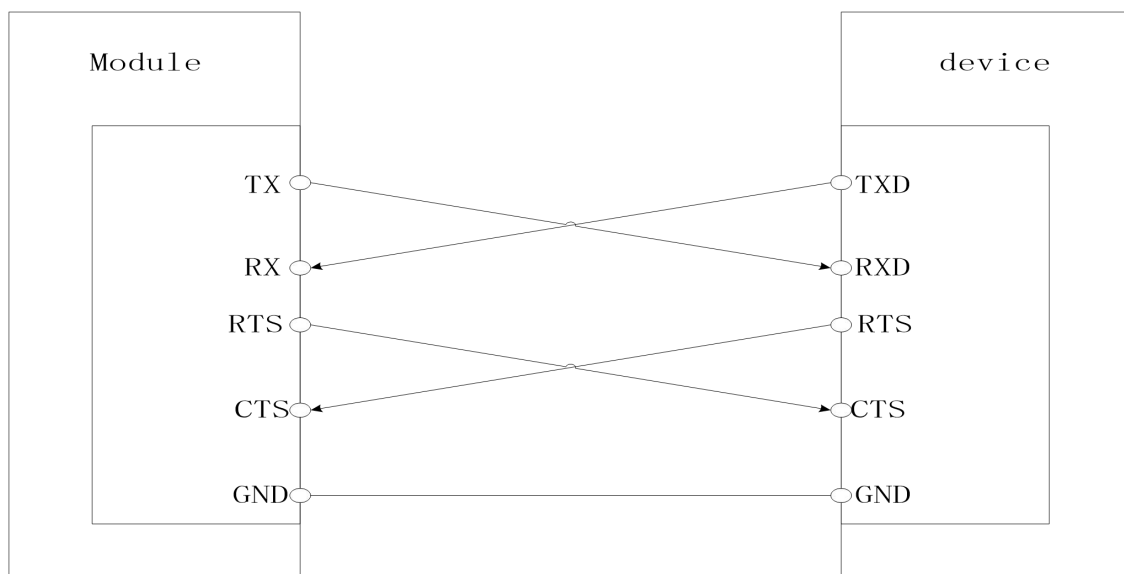
4.5.Serial Port

The SNM6690 provides 3 serial ports for communication, of which 2 groups of interfaces support four-wire serial ports. The number of serial ports can also be expanded through the QUP interface.

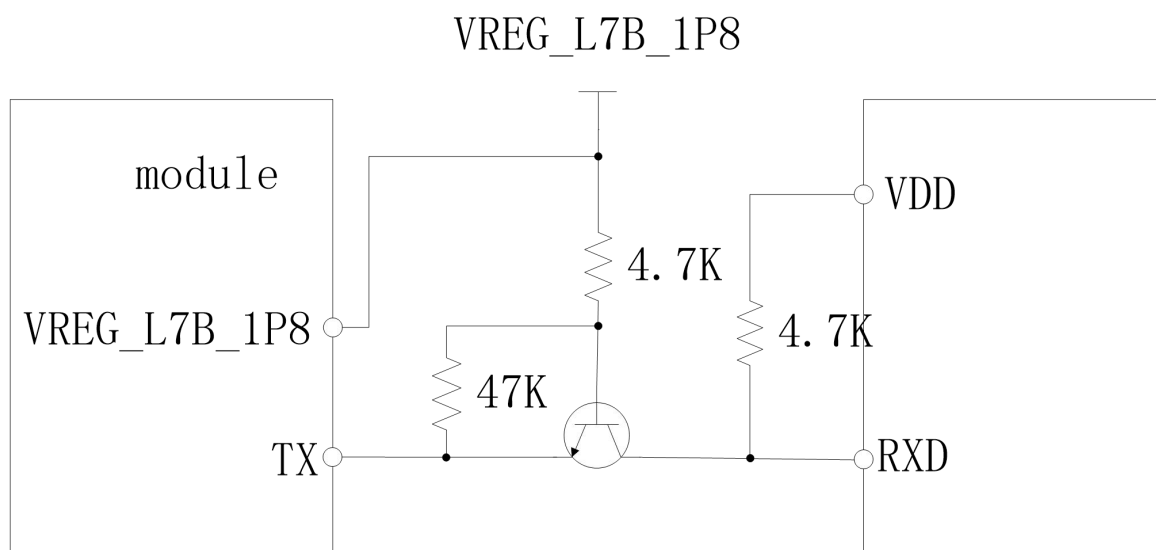
Table 4.3: UART Pin description

PIN name	Pin	I/O	Function
GPIO15*	502	I	UART1_CTS
GPIO16	159	O	UART1_RTS
UART1_TX/GPIO17	157	O	UART1_TX
UART1_RX/GPIO18*	158	I	UART1_RX
DBG_UART_TX/GPIO25	528	O	Debug UART data sent
DBG_UART_RX/GPIO26*	529	I	Debug UART data receive
HOME_KEY/GPIO36*	530	I	UART2_CTS
VOL_DOWN/GPIO37	531	O	UART2_RTS
UART2_TX/GPIO38*	507	O	UART2_TX
UART2_RX/GPIO39*	506	I	UART2_RX

You can refer to the following connection mode:

**Fig4.10: Serial port connection diagram**

When the serial port level used by the user does not match the module, in addition to increasing the level conversion IC, the figure below can also be used to achieve level matching. Here, only TX and RX matching circuits are listed, and other low-speed signals can refer to these two circuits.

**Fig4.11: TX connection diagram**

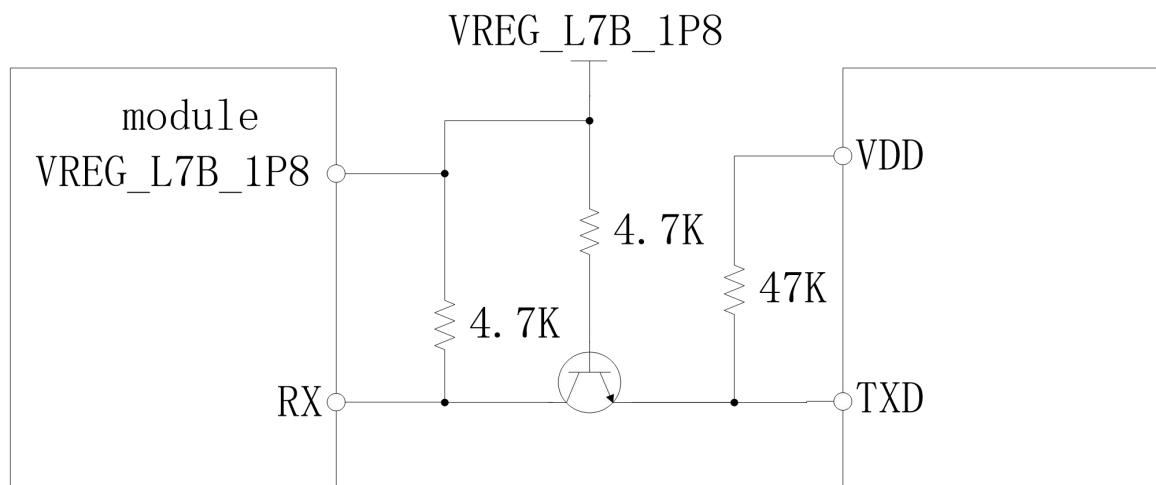


Fig4.12: RX connection diagram

Note: When using Figures 4.11 and 4.12 for level isolation, it is important to note that using VREG_L7B_1P8 as a pull-up power supply, VREG_L9B_1P8 or VREG_L10B_1P8 will enter a low-power mode when hibernating, and is not recommended.

Table 4.4: Serial Port Hardware Parameters

Description	MIN	MAX	Unit
Input low level	-	0.63	V
Input high level	1.17	-	V
Output low level	-	0.45	V
Output high level	1.35	-	V

Note:

1. The serial port of the module is CMOS interface, which cannot be directly connected to RS232 signal. Use an RS232 converter chip if necessary.
2. If the 1.8V output of the module cannot meet the high level range of the client, please add a level conversion circuit.

4.6.MIPI Interface

The SNM6690 supports MIPI interface for Camera and LCD. MIPI is a high-speed signal line, in the layout stage, please strictly follow the impedance and length requirements to trace the line, control the difference pair within the group and between groups equal length, and the total length should be as short as possible.

4.6.1.LCD Interface

The SNM6690 module supports the MIPI interface of one LCD display and has the identification signal of the compatible screen. The resolution of the screen can support up to WFHD+.As shown in the MeiG Smart Product Technical Information

following table, the MIPI signal line should be strictly controlled by the differential 90 ohm impedance and the equal length of the signal line within and between groups.

The MIPI interface of the module is a 1.2V power domain, when the user needs a compatible screen design, the LCD_ID pins of the module can be used, and the LCD VCC power supply can be powered by VREG_L19B_3P0 or external LDO, and the specific solution can be selected according to the current consumption.

Table 4.5: Screen interface definition

Screen interface			
PIN name	Pin	I/O	Description
MIPI_DSI0_CLK_N	406	O	MIPI_LCD clock line
MIPI_DSI0_CLK_P	407	O	
MIPI_DSI0_LANE0_N	390	O	MIPI_LCD data line
MIPI_DSI0_LANE0_P	391	O	
MIPI_DSI0_LANE1_N	396	O	
MIPI_DSI0_LANE1_P	397	O	
MIPI_DSI0_LANE2_N	398	O	
MIPI_DSI0_LANE2_P	399	O	
MIPI_DSI0_LANE3_N	404	O	
MIPI_DSI0_LANE3_P	405	O	
LCD_RST_N/GPIO124*	393	I/O	LCD reset pin
LCD_TE/GPIO129*	401	I/O	LCD frame sync signal
LCD_ID/GPIO24	394	I/O	LCD_ID signal

The GPIO of the module can be used as the LCD_ID. If the GPIO is used as the LCD_ID, please confirm the internal circuit of the LCD. If the resistor divider mode is used in the LCD, please note that the voltage must meet the voltage range of GPIO.

MIPI is a high-speed signal cable. To avoid EMI interference, you are advised to place a common-mode inductance near the LCD.

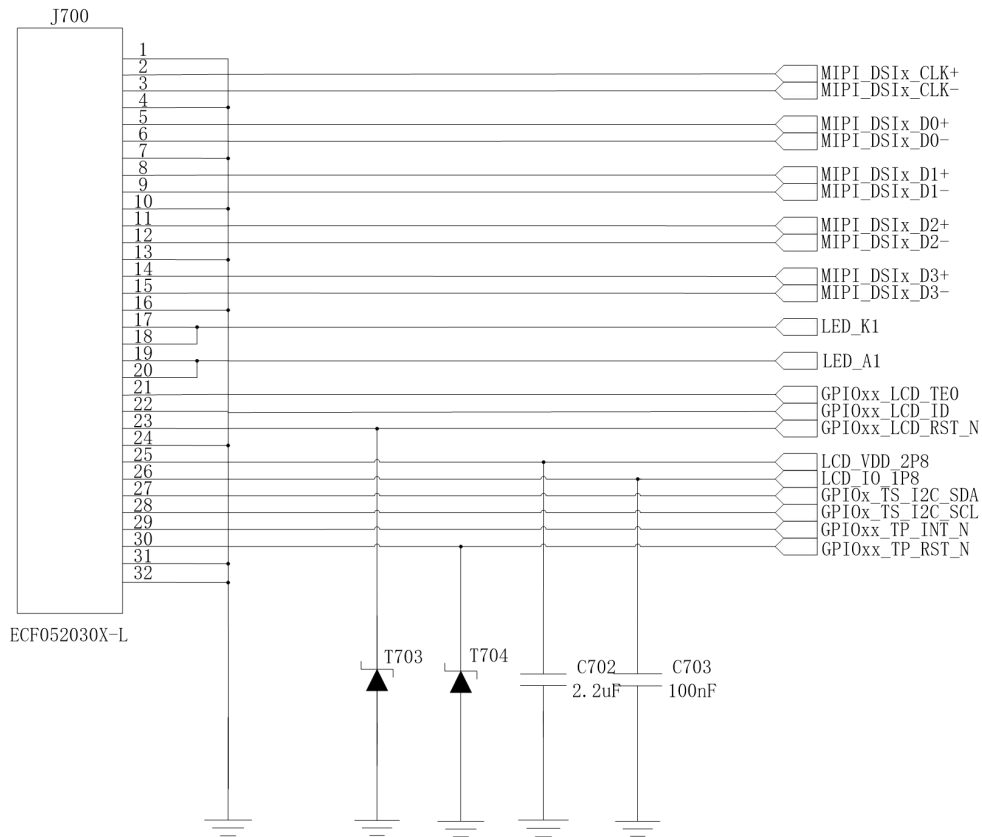


Fig4.13: LCD interface circuit

SNM6690 can control the external backlight chip through the module's BL_PWM/PM7550_GPIO8 signal to adjust the backlight brightness, and the modulation mode is PWM mode.

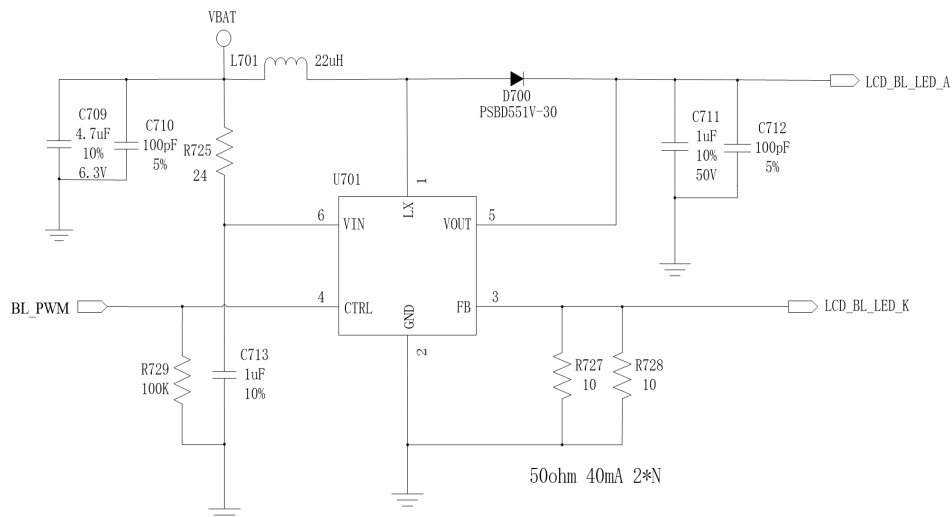


Fig4.14: LCD backlight drive circuit

Note: 1. The backlight circuit should select the chip according to the backlight circuit of the LCD, and the user should read the LCD document carefully to choose the correct driver chip. The reference circuit provided in this document is a series PWM dimming backlight driver circuit; If it is a series series dimming backlight driver circuit, it needs to be controlled by GPIO.

4.6.2.MIPI Camera Interface

The SNM6690 module supports 4 sets of MIPI interface cameras, and each group supports 4 lane data lines. It can be used as the main camera, secondary camera, depth of field camera and other designs; It can also be used for the design of MIPI interface scan heads. The module does not provide the power required for the camera, including AVDD-2.8V, AFVDD-2.8V (focus motor powered), and DVDD-1.2V (CAM core voltage), all of which require external LDO generation.

Table 4.6: MIPI Camera Interface

Rear Camera Interface			
Name	Pin	I/O	Description
MIPI_CSI0_CLK_P	232	O	Rear camera MIPI CLK
MIPI_CSI0_CLK_N	231	O	
MIPI_CSI0_LANE0_P	228	I	Rear camera MIPI DATA
MIPI_CSI0_LANE0_N	227	I	
MIPI_CSI0_LANE1_P	226	I	
MIPI_CSI0_LANE1_N	225	I	
MIPI_CSI0_LANE2_P	220	I	
MIPI_CSI0_LANE2_N	219	I	
MIPI_CSI0_LANE3_P	218	I	
MIPI_CSI0_LANE3_N	217	I	
CCI_I2C0_SCL/GPIO89	223	I/O	REAR CAM I2C_SCL
CCI_I2C0_SDA/GPIO88	222	I/O	REAR CAM I2C_SDA
MCAM_PWD_N/GPIO166*	215	I/O	REAR CAM sleep signal
CAM_MCLK0/GPIO83	214	I/O	REAR CAM master clock
CAM0_RST_N/GPIO23*	213	I/O	REAR CAM reset signal
Front Camera Interface			
Name	Pin	I/O	Description
MIPI_CSI3_CLK_P	86	O	Front Camera MIPI CLK
MIPI_CSI3_CLK_N	85	O	
MIPI_CSI3_LANE0_P	87	I	Front Camera MIPI DATA
MIPI_CSI3_LANE0_N	84	I	
MIPI_CSI3_LANE1_P	88	I	
MIPI_CSI3_LANE1_N	83	I	
MIPI_CSI3_LANE2_P	89	I	
MIPI_CSI3_LANE2_N	82	I	
MIPI_CSI3_LANE3_P	90	I	
MIPI_CSI3_LANE3_N	81	I	
CCI_I2C3_SCL/GPIO95*	94	I/O	FRONT CAM I2C_SCL
CCI_I2C3_SDA/GPIO94	93	I/O	FRONT CAM I2C_SDA

SCAM_PWD_N/GPIO158*	96	I/O	FRONT CAM sleep signal
CAM_MCLK3/GPIO86	97	I/O	FRONT CAM master clock
CAM3_RST_N/GPIO43*	95	I/O	FRONT CAM reset signal
Depth Camera Interface			
Name	Pin	I/O	Description
MIPI_CSI1_CLK_P	80	O	Depth Camera MIPI CLK
MIPI_CSI1_CLK_N	79	O	
MIPI_CSI1_LANE0_P	72	I	Depth Camera MIPI DATA
MIPI_CSI1_LANE0_N	71	I	
MIPI_CSI1_LANE1_P	70	I	
MIPI_CSI1_LANE1_N	69	I	
MIPI_CSI1_LANE2_P	62	I	
MIPI_CSI1_LANE2_N	61	I	
MIPI_CSI1_LANE3_P	60	I	
MIPI_CSI1_LANE3_N	59	I	
CCI_I2C1_SCL/GPIO91*	77	I/O	Depth CAM I2C_SCL
CCI_I2C1_SDA/GPIO90	76	I/O	Depth CAM I2C_SDA
DCAM_PWD_N/GPIO157	75	I/O	Depth CAM sleep signal
CAM_MCLK1/GPIO84	74	I/O	Depth CAM master clock
CAM1_RST_N/GPIO150*	67	I/O	Depth CAM reset signal
RESERVED Camera Interface			
Name	Pin	I/O	Description
MIPI_CSI2_CLK_P	180	O	RESERVED Camera MIPI CLK
MIPI_CSI2_CLK_N	179	O	
MIPI_CSI2_LANE0_P	186	I	RESERVED Camera MIPI DATA
MIPI_CSI2_LANE0_N	185	I	
MIPI_CSI2_LANE1_P	188	I	
MIPI_CSI2_LANE1_N	187	I	
MIPI_CSI2_LANE2_P	194	I	
MIPI_CSI2_LANE2_N	193	I	
MIPI_CSI2_LANE3_P	196	I	
MIPI_CSI2_LANE3_N	195	I	
CCI_I2C2_SCL/GPIO93	183	I/O	RESERVED CAM I2C_SCL
CCI_I2C2_SDA/GPIO92*	182	I/O	RESERVED CAM I2C_SDA
FP_RST/GPIO74*	313	I/O	RESERVED CAM sleep signal
CAM_MCLK2/GPIO85	190	I/O	RESERVED CAM master clock
CAM2_RST_N/GPIO42	191	I/O	RESERVED CAM reset signal

If the user designs and uses the CAMERA module with autofocus function, please note that the I2C of the module cannot be directly connected to the AF device, and the I2C of the AF device should be connected to the driver chip of the CAMERA, which is correctly connected as shown in the following figure:

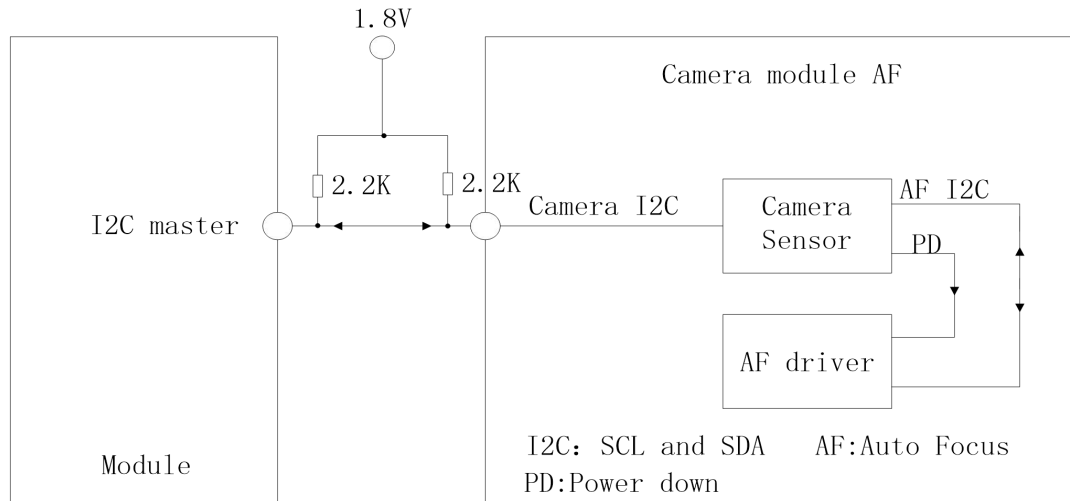


Fig4.15: Schematic diagram of the correct camera connection

The MIPI interface rate is high, please control the differential impedance of 90 ohms in the routing stage, and pay attention to the requirements of the trace length, it is not recommended to add a small capacitor on the MIPI signal line, which may affect the rising edge time of the MIPI data, and then cause the MIPI data to be invalid.

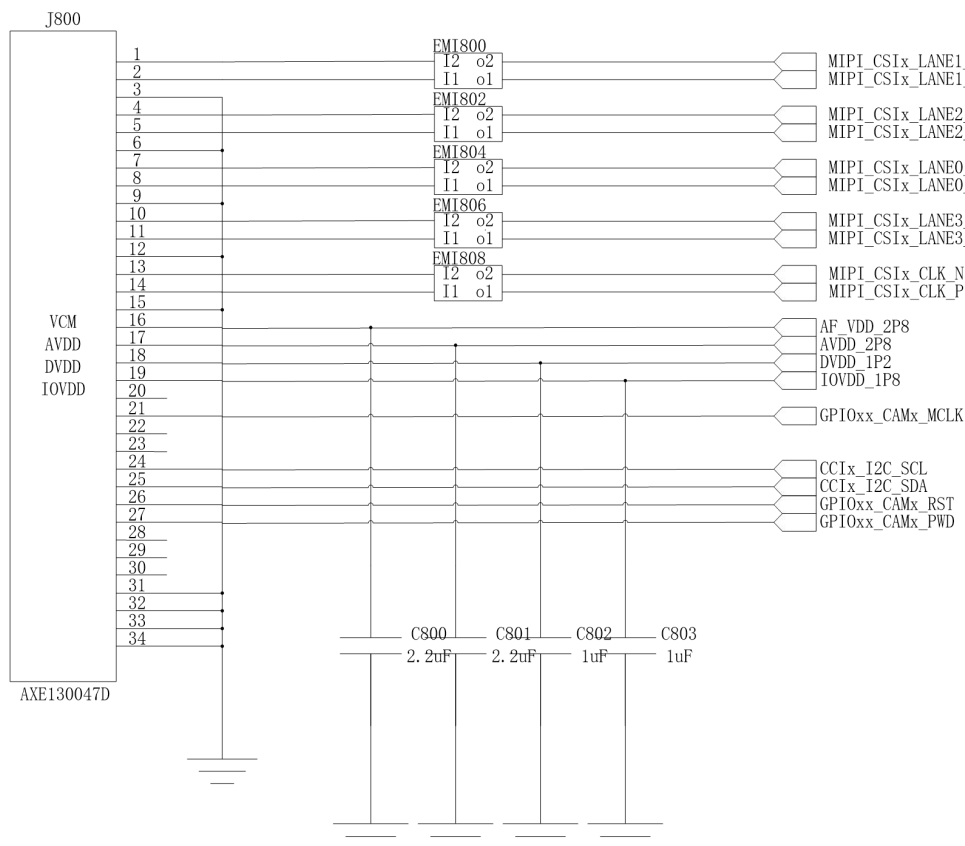


Fig4.16: MIPI Camera reference circuit

4.7.Capacitive Touch Interface

The module provides a set of I2C interfaces that can be used to connect to a capacitive touch screen, and the default interface pins of the capacitive touch screen are defined in the following table.

Table 4.7: Capacitive touch interface definition

Name	Pin	I/O	Description
TS_I2C_SDA/GPIO40*	409	I/O	I2C data signal
TS_I2C_SCL/GPIO41	410	I/O	I2C clock signal
TS_INT_N/GPIO19*	402	I/O	TP interrupt signal
TS_RST_N/GPIO20	403	I/O	TP reset signal
VREG_L9B_1P8(LCD VDDIO)	418	PO	VDDIO_1.8V power supply
VREG_L22B_3P2(TPVDD)	501	PO	VDD_3.0V power supply

Note: The interface definition for capacitive touch can be adjusted by software, and users can change GPIO and I2C according to design needs.

4.8.Audio Interface

The module provides 4 analog audio inputs, MIC1_IN_P/M for connecting to the main microphone; WCD_AMIC2_P/M can be used to connect the headphone microphone, AMIC3_INP/M can be used to connect the noise-canceling microphone, and the AMIC4_INP/M is reserved. The module also provides three analog audio outputs (WCD_HPH_L/R, WCD_EAR_OUT_P/M, and WCD_AUX_OUT_P/M), and the audio pin is defined in the following table:

Table 4.8: Audio pin

Name	Pin	I/O	Description
AMIC1_INM	26	I	Main MIC -
AMIC1_INP	25	I	Main MIC +
WCD_AMIC2_P	21	I	Headphone MIC +
WCD_AMIC2_M	22	I	Headphone MIC -
AMIC3_INM	23	I	Noise-reducing MIC -
AMIC3_INP	24	I	Noise-reducing MIC +
WCD_MIC_BIAS1	33	O	BIAS voltages for the main and secondary
WCD_MIC_BIAS2	34	O	BIAS voltage of the headphone MIC
WCD_MIC_BIAS3	35	O	BIAS voltage of mic4, for
AMIC4_INP	28	I	MIC4 +
AMIC4_INM	27	I	MIC4 -
WCD_HPH_R	16	O	Headphone right channel
WCD_HPH_L	15	O	Headphone left channel

WCD_HS_DET_L	13	I	Headphone plugging and unplugging detection
WCD_HPH_REF	14	I	Headphone reference ground
WCD_EAR_OUT_P	17	O	Earpiece output +
WCD_EAR_OUT_M	18	O	Earpiece output -
WCD_AUX_OUT_P	19	O	External amplifier input +
WCD_AUX_OUT_M	20	O	External amplifier input -
I2S1_DATA1/GPIO141/DMIC2_DATA/MCLK1	56	I	Digital MIC2 data signal
I2S1_DATA0/GPIO140/DMIC2_CLK	55	O	Digital MIC2 clock signal
I2S1_CLK/GPIO138/DMIC1_CLK	53	O	Digital MIC1 clock signal
I2S1_WS/GPIO139/DMIC1_DATA	54	I	Digital MIC1 data signal
I2S2_DATA0/GPIO144*/DMIC3_CLK	287	O	Digital MIC3 clock signal
I2S2_DATA1/GPIO145*/DMIC3_DATA	288	I	Digital MIC3 data signal

It is recommended that users choose the following circuit according to the actual application situation to get better sound effect.

4.8.1.Receiver Interface Circuit

The receiver interface circuit places the following devices close to the REC terminal, and B302 and B303 can be changed to beads according to the actual effect.

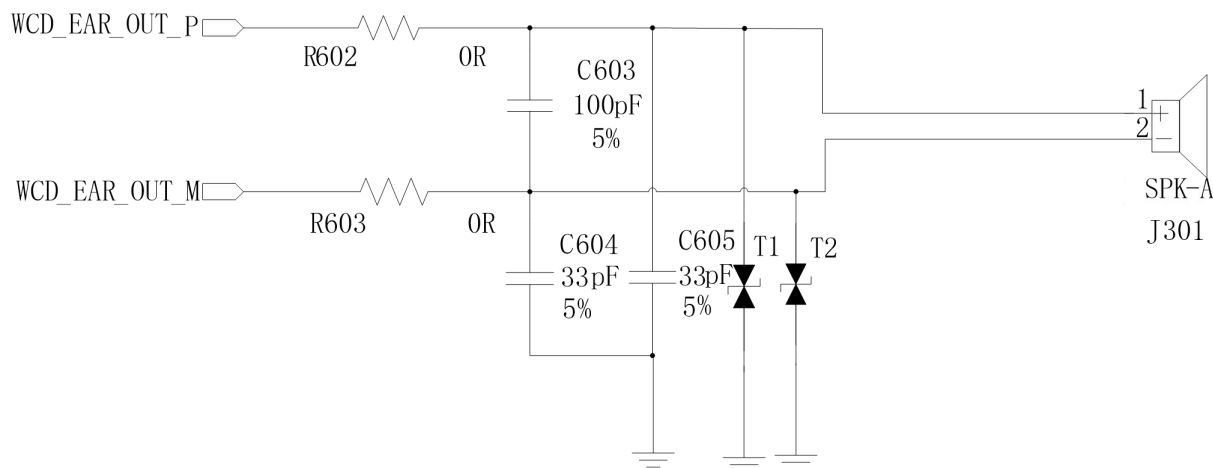


Fig4.17: Receiver interface circuit

4.8.2.Microphone Receiving Circuit

The figure below shows the electret microphone and MEMS microphone interface circuit.

Please select according to the different types of user microphones, and strictly follow the reference circuit design in the figure below.

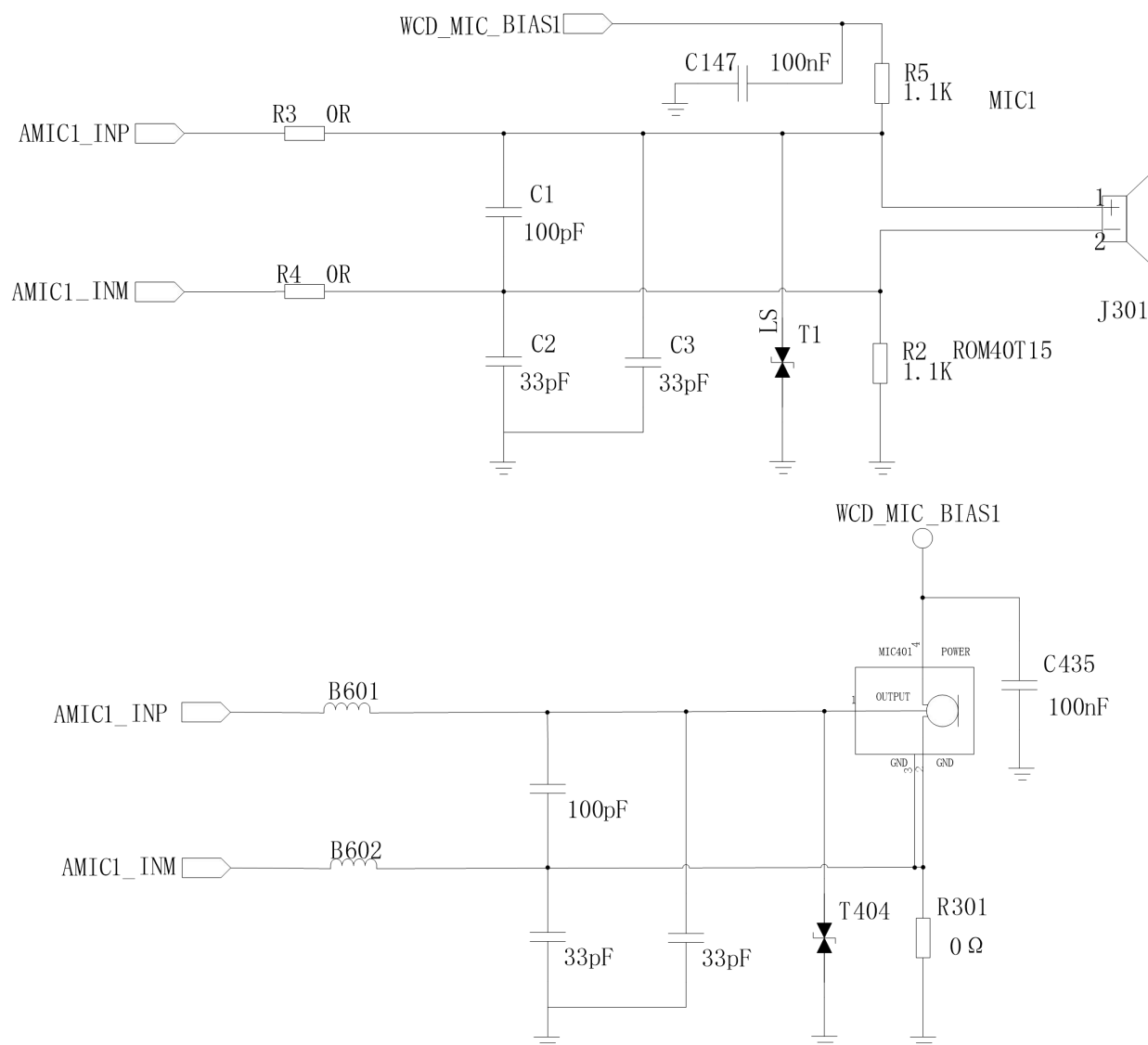


Fig4.18: Electret microphone, analog silicon microphone interface circuit

4.8.3.Headphone Interface Circuit

The module integrates a stereo headphone jack. You are advised to reserve ESD devices during the design phase to prevent ESD damage. The HSJ_HS_DET pin of the module can be set as interrupt. By default, this pin is headset interrupt in the software. Users can use this pin to detect the plug and unplug of the headset.

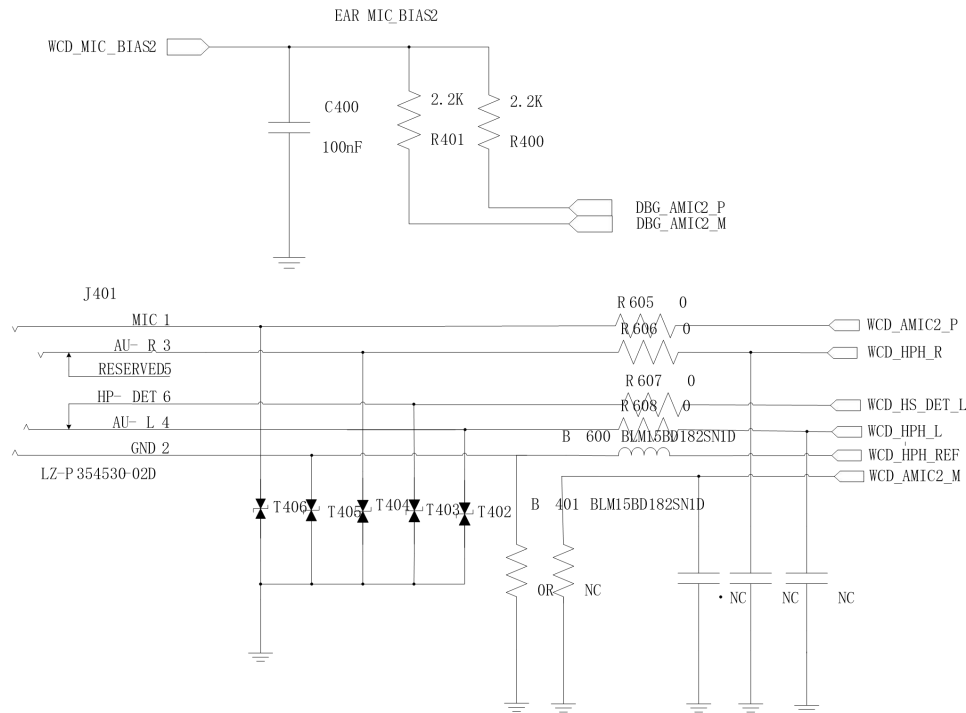


Fig4.19: Headphone interface circuit

Note:

1. The headset socket in Figure 4.19 is normally closed, if the user is using the normally open headphone socket, please modify the detection circuit according to the actual pin and modify the software accordingly.
2. We recommend that the headphone detection pins WCD_HS_DET_L form a detection circuit with the WCD_HPH_L (the connection method in the figure above), because there is a pull-down resistor WCD_HPH_L inside the chip, which can ensure that the WCD_HS_DET_L is low when connected to the WCD_HPH_L, if the user connects the WCD_HS_DET_L to the WCD_HPH_R, please reserve the position of the 1K pull-down resistor on the WCD_HPH_R.
3. The standard of the headphone interface shown in the figure is the European standard OMPT, if you need to design the American standard CTIA interface, you need to switch the GND and MIC signals to the network. If you want to be compatible with both headphone standards, you need an external dedicated chip, such as TI-TS3A226AE.

4.8.4. Speaker Interface Circuit

There is no built-in audio power amplifier inside the module, and an audio power amplifier needs to be added externally, using WCD_AUX_OUT_P and WCD_AUX_OUT_M as differential input signals, and the reference circuit is shown in the figure below.



There are two sets of GPIO compliant I2S interfaces inside the module. The pins used for this function are listed as below

Name	Pin	I/O	Description
I2S1_CLK/GPIO138/DMIC1_CLK	53	O	I2S1_SLK
I2S1_WS/GPIO139/DMIC1_DATA	54	O	I2S1_WS
I2S1_DATA0/GPIO140/DMIC2_CLK	55	I/O	I2S1_DATA0
I2S1_DATA1/GPIO141/DMIC2_DATA/MCLK1	56	I/O	I2S1_DATA1
I2S2_CLK/GPIO142	285	O	I2S2_SLK
I2S2_WS/GPIO143*	286	O	I2S2_WS
I2S2_DATA0/GPIO144*/DMIC3_CLK	287	I/O	I2S2_DATA0
I2S2_DATA1/GPIO145*/DMIC3_DATA	288	I/O	I2S2_DATA1

SNM6690 supports 1 USB 2.0 port and 1 USB 3.1 port. Be sure to control the 90 ohm differential impedance when layouting, follow the differential equal-length traces, and control the external trace length. The voltage input range during charging is as follows:

Table 4.10:USB interface switch pin definition

Name	PIN	I/O	Description	Comment
USB0_HS_DP	375	I/O	USB 2.0 DP signal	
USB0_HS_DM	376	I/O	USB 2.0 DM signal	
USB0_SS_TX1_P	366	O	USB super-speed 1 transmit – plus	
USB0_SS_TX1_M	367	O	USB super-speed 1 transmit – minus	
USB0_SS_RX1_P	372	I	USB super-speed 1 receive – plus	
USB0_SS_RX1_M	373	I	USB super-speed 1 receive – minus	
USB0_SS_TX0_P	364	O	USB super-speed 0 transmit – plus	
USB0_SS_TX0_M	365	O	USB super-speed 0 transmit – minus	
USB0_SS_RX0_P	358	I	USB super-speed 0 receive – plus	
USB0_SS_RX0_M	359	I	USB super-speed 0 receive – minus	
USB_CC1	5	I/O	CC1 pin for the Type-C	
USB_CC2	6	I/O	CC2 pin for the Type-C	
PMB_USB_SBU1	3	I	Type-C side band signal SBU1; protected to 22 V max	
PMB_USB_SBU2	4	O	Type-C side band signal SBU2; protected to 22 V max	
USB_CONN_THERM	442	I	USB Type-C connector temperature sensor.	
USB_ID/GPIO12*	377	I	USB ID signal	
DP_AUX_P	361	I/O	DP_AUX_P signal	
DP_AUX_M	362	I/O	DP_AUX_M signal	
USB_CC_DIR	426	O	The 1.8V three-state output indicates the CC connection direction	Type-C: This pin is connected to the 518 pin Micro-USB: resistor NC connected with pin 426 and pin 518, reserved position.
USB_OPTION	425	I	Select different PON items according to the resistance of the pull-down resistor	Type-C: This pin NC Micro-USB: 0R resistor is reserved for the pin to be grounded, and the 0R resistor position is NC.
USB_PHY_PS	518	I/O	USB_PHY_PS	Type-C: This pin is connected to the 426 pin

				Micro-USB: This pin is connected to a 1K resistor to the ground
--	--	--	--	---

The module also supports the OTG function.

The USB insertion detection of the module is realized by VBUS and DP/DM data cable. When the USB cable is inserted, the VBUS voltage is detected first, and then the USB cable or charger is determined by detecting the pull up and down state of DM/DP. Therefore, if the user needs to use USB function, please be sure to connect VBUS to the 5V power supply on the data line.

USB is in high-speed mode. You are advised to connect a serial common-mode inductor close to the USB connector to effectively suppress EMI interference. At the same time, THE USB interface is an external interface. It is recommended to add TVS to prevent electrostatic damage caused by plugging and unplugging data cables. Users should pay attention to the load capacitance of TVS should be less than 1PF when selecting TVS. VBUS also needs to add TVS tubes, and if there is a need for surge protection, surge prevention pipes should be added. The connection diagram is as follows:

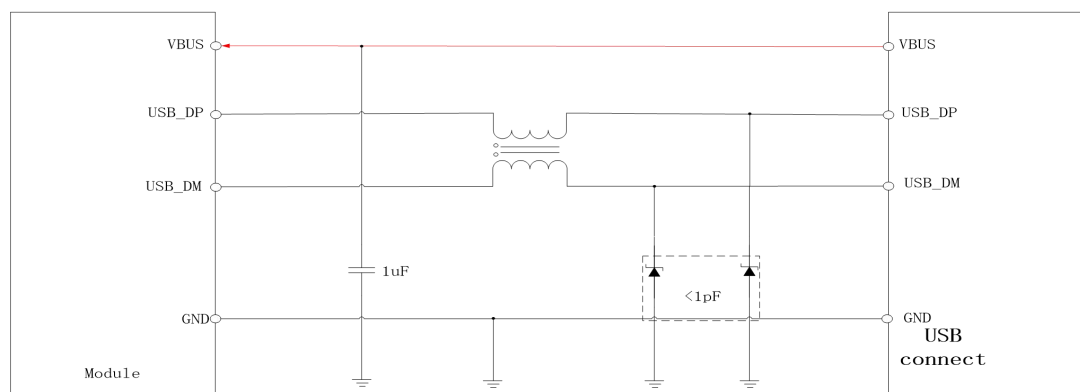


Fig4.21: USB Connection diagram

4.9.1.DP screen interface

The USB3.0 interface and the DP screen interface share the relevant PIN pin, and the multiplexing combination relationship is as follows:

Phy_mode	Port select		QMP lane	Type-C Receptacle pins	Connector pin lable
	0	1			
USB 3 only	Tx		lane _0_0	Tx1±	A2、 A3
	Rx		lane _0_1	Rx1±	B11、 B10
(Both Tx/Rx pairs assigned,but		Tx	lane _1_0	Tx2±	B2、 B3
		Rx	lane _1_1	Rx2±	A11、 A10
DisplayPort only	DisplayPort MI 2	DisplayPort MI 1	lane _0_0	Tx1±	A2、 A3
(All four lanes as Tx assigned to	DisplayPort MI 3	DisplayPort MI 0	lane _0_1	Rx1±	B11、 B10
	DisplayPort MI 1	DisplayPort MI 2	lane _1_0	Tx2±	B2、 B3

	DisplayPort MI 0	DisplayPort MI 3	lane _1_1	Rx2±	A11、 A10
Concurrent DP/USB	Tx	DisplayPort MI 1	lane _0_0	Tx1±	A2、 A3
	Rx	DisplayPort MI 0	lane _0_1	Rx1±	B11、 B10
(Two lanes assigned to USB and two to	DisplayPort MI 1	Tx	lane _1_0	Tx2±	B2、 B3
	DisplayPort MI 0	Rx	lane _1_1	Rx2±	A11、 A10

USB Type-C receptacle pins

GND	TX1+	TX1-	VBUS	CC1	D+	D-	SBU1	VBUS	RX2-	RX2+	GND
GND	RX1+	RX1-	VBUS	SBU2	D-	D+	CC2	VBUS	TX2-	TX2+	GND

Figure 4.22: The combination relationship between USB3.1 interface and DP screen interface

4.10.UIM Interface

The SNM6690 supports two SIM card interfaces to achieve dual-card dual-standby. It supports hot swap of SIM cards and automatically identifies 1.8V and 3.0V cards. Below is the recommended SIM interface circuit. To protect SIM cards, TVS devices are recommended for static protection. The peripheral circuit of the SIM card should be close to the SIM card holder. The level range of UIM_DET is 0~1.2V, and there is 100K pull-up inside the module.

The reference circuit is as follows:

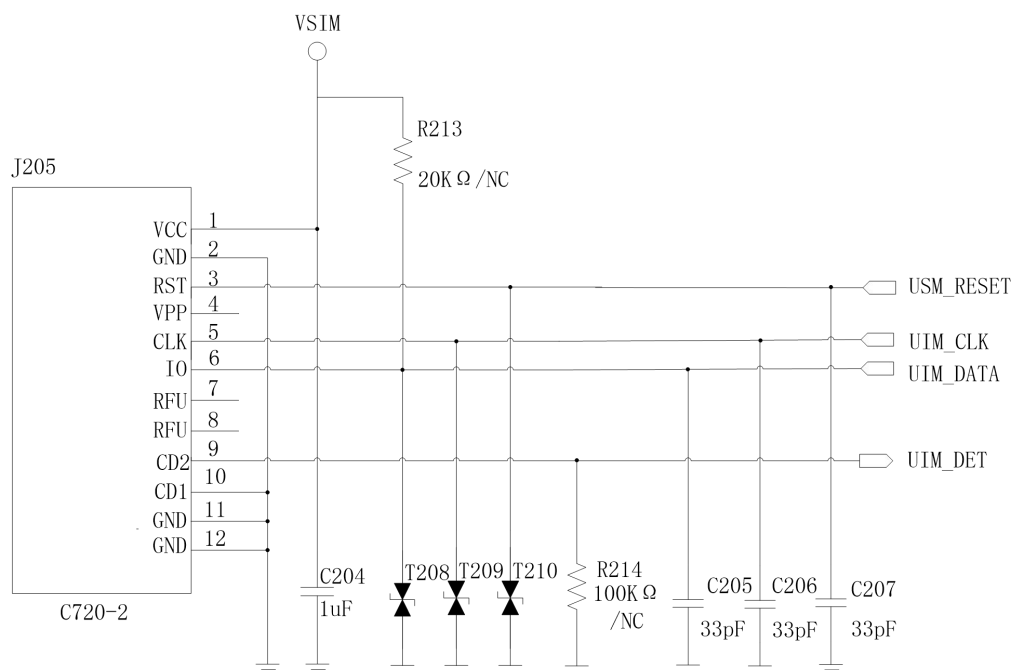


Fig4.23: UIM card interface circuit

4.11.SD Interface

The SNM6690 supports SD card interfaces. The level range of SD_DET is 0~1.2V, and there is 100K pull-up inside the module.

The reference circuit is as follows:

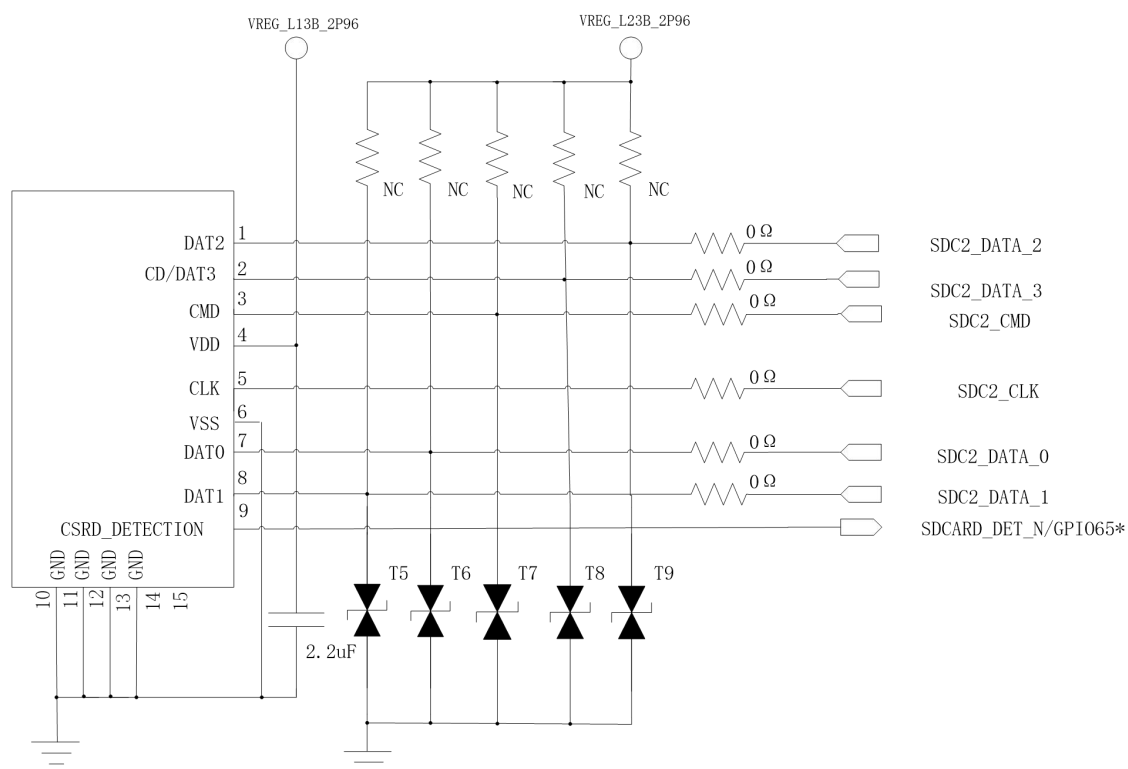


Fig4.24: SD interface circuit

4.12.I2C bus interface

The SNM6690 module supports 9 hardware I2C bus interfaces and 4 camera-specific CCI interfaces. Pin definitions and default functions are as follows:

Table 4.11:I2C interface

PIN name	PIN number	I/O	Description	Comment
SENSOR_I2C_SDA/GPIO153*	47/476	I/O	SENSOR_I2C signal	Pull-up to VREG_L10B_1P8
SENSOR_I2C_SCL/GPIO154	48/475	I/O		
NFC_I2C_SDA/GPIO4*	524	I/O	Universal I2C signal	Pull-up to VREG_L7B_1P8
NFC_I2C_SCL/GPIO5	525	I/O		
HDMI_I2C_SDA/GPIO55*	515	I/O	Universal I2C signal	Pull-up to VREG_L7B_1P8
HDMI_I2C_SCL/GPIO56*	514	I/O		
TS_I2C_SDA/GPIO40*	409	I/O	TP_I2C signal	Pull-up to VREG_L9B_1P8

TS_I2C_SCL/GPIO41	410	I/O		
APPS_I2C_SDA/GPIO32*	252	I/O	Universal I2C signal	Pull-up to VREG_L7B_1P8
APPS_I2C_SCL/GPIO33	251	I/O		
CCI_I2C0_SCL/GPIO89	223	I/O	R-CAM I2C signal	Pull-up to CAM_IOVDD_1P8(External LDO)
CCI_I2C0_SDA/GPIO88	222	I/O		
CCI_I2C2_SCL/GPIO93	183	I/O	F-CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C2_SDA/GPIO92*	182	I/O		
CCI_I2C1_SCL/GPIO91*	77	I/O	D-CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C1_SDA/GPIO90	76	I/O		
CCI_I2C3_SCL/GPIO95*	94	I/O	RESERVED CAM I2C signal	Pull-up to CAM_IOVDD_1P8
CCI_I2C3_SDA/GPIO94	93	I/O		

Note: When used as an I2C bus interface, a 2.2K Ω pull-up resistor should be connected to 1.8V.

4.13.ADC

The SNM6690 module is provided with multi-channel ADC by the internal power management chip, and supports 0~1.8V input with 14bit accuracy. See the table below.

Table 4.12:ADC performance parameters

PIN name	PIN number	I/O	Description	comment
PM7550_GPIO3/ADC1	42	I/O	PM7250B_GPIO, it is used as ADC by default	
PM7550_GPIO7/ADC2	43	I/O	PM7250B_GPIO, it is used as ADC by default	
PM7550_GPIO10/ADC3	44	I/O	PM7250B_GPIO, it is used as ADC by default	
RESERVED(PM7550_GPIO4/ADC4)	45	I/O	PM7250B_GPIO, it is used as ADC by default	SNM6690 this PIN is not available, and SNM6690L is used as ADC by default
PMIV0102_GPIO08/ADC5	46	I/O	PM7250B_GPIO, it is used as ADC by default	

PMIV0102_GPIO2/ADC	434	I/O	PM7325_GPIO, it is used as ADC by default
PM7550_AMUX5	436	I	Analog multiplexer (AMUX) input

4.14.PWM

BL_PWM/PM7550_GPIO8(PIN412) can be used to do LCD backlight adjustment, by adjusting the duty ratio to adjust the backlight brightness.

4.15.Antenna Interface

The module provides 9 antenna interfaces, including ANT_0, ANT_1, ANT_2, ANT_3, ANT_4, GNSS_ANT5, GNSS_ANT6, WIFI_ANT7, and WIFI_ANT8. In order to ensure that the user's product has good wireless performance, the antenna selected by the user should meet the requirements of an input impedance of 50 ohms and a standing wave coefficient of less than 2 in the working frequency band.

4.15.1.WiFi/BT Antenna

The module provides Wifi ANT_7/8 antenna pins, and the antenna on the user's motherboard should be connected to the module's antenna pins using a microstrip line or stripline with a characteristic impedance of 50 ohms.

To facilitate antenna debugging and certification testing, an RF connector and antenna matching network should be added. The recommended circuit diagram is as follows:

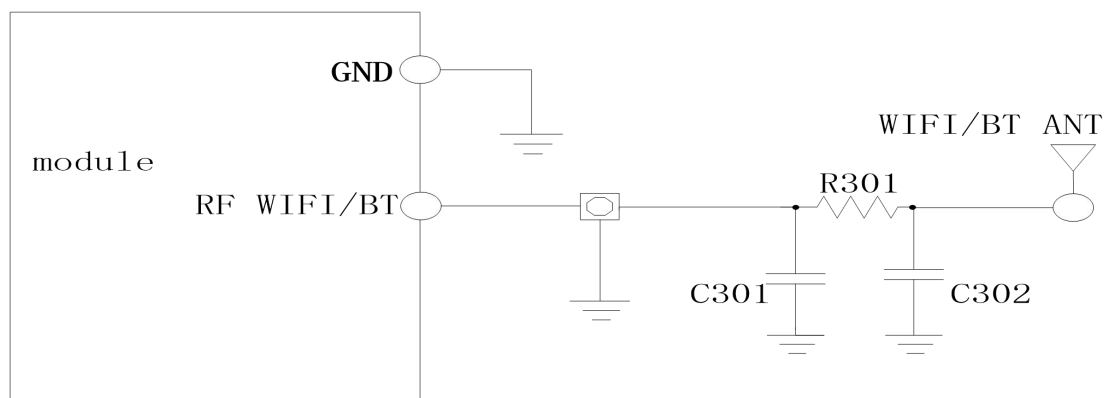


Fig4.28: WiFi_BT antenna interface connection circuit

Note: R301, C301, C302 are antenna matching devices. The specific component values can be determined after the antenna is debugging in the antenna factory. 0R is displayed by default for R301, C301 and C302 are not displayed by default.

If there are fewer components that can be placed between the antenna and the output end of the module, or RF test head is not required in the design, the antenna matching circuit can be simplified as shown in the figure below:

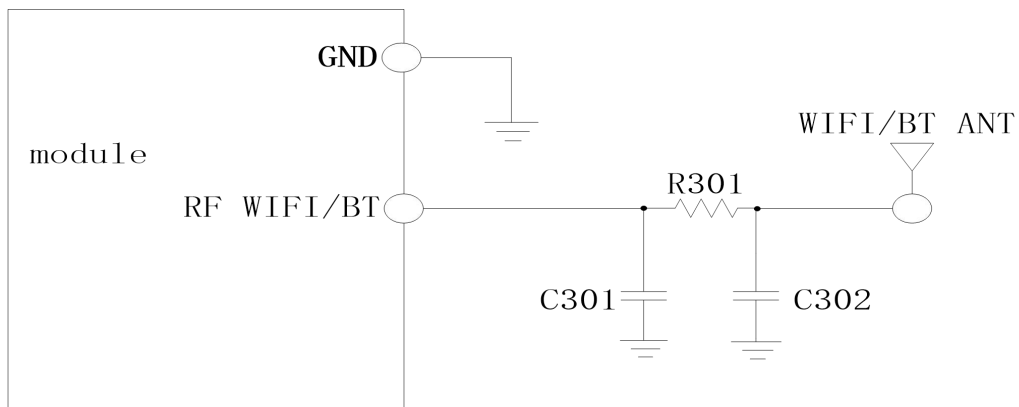


Fig4.29: WIFI_BT antenna interface simplifies connection circuit

Note: 0R is displayed by default for R301, C301 and C302 are not pasted by default.

5.PCB layout

The performance of a product depends largely on the PCB wiring. If a good PCB layout can be planned in the early stage, so that the PCB wiring is smooth, you can save a lot of time, of course, you can also save a lot of costs, this chapter mainly introduces some matters that users should pay attention to in the PCB layout stage, minimize the interference problem, and shorten the user's R & D cycle.

The SNM6690 module is an intelligent module with Android operating system, which includes high-speed USB, MIPI and other sensitive data cables, and has strict requirements for the length and impedance of the signal line, if the high-speed signal processing is not good, it will cause serious EMI problems, and more serious will also affect the identification of USB, LCD display, so the requirements for PCB design when using the SNM6690 module are much higher than the previous 4G module, please read this chapter carefully, Reduce subsequent hardware debugging cycles.

When using the SNM6690 module, the user requires the PCB to use at least 6 layers of 1st stage design, which is convenient for impedance control and signal line shielding.

5.1.Module PIN distribution

Before the PCB layout, it is necessary to understand the pin distribution of the module, and reasonably layout the relevant devices and interfaces according to the distribution defined by the pin, please refer to Figure 3.1 to determine the distribution of the module's function pins.

5.2.PCB Layout Principles

The main aspects to pay attention to in the PCB layout stage:

5.2.1.Antenna

The antenna part is designed, and the SNM6690 module has a total of 2 antenna interfaces, which are: WIFI_ANT7, and WIFI_ANT8. When placing components and routing RF cables, it is important to pay attention to:

- The RF test head is used to test the conducted RF performance, and should be placed as close to the antenna pin of the module as possible;
- The antenna matching circuit needs to be placed close to the antenna end.
- The antenna pins of the module to the antenna matching circuit must be controlled with a 50 ohm impedance;
- The device and connection between the antenna pin of the module and the antenna connector must be kept away from high-speed signal lines and strong interference sources, and avoid crossing or parallel to any signal lines in adjacent layers.
- The length of the RF line between the module's antenna pins and the antenna connector should be as short as possible, and the situation should never cross the entire PCB.
- If the antenna is connected in the form of coaxial RF lines, care should be taken to avoid making the coaxial RF lines span the SIM card, power supply circuits, and high-speed digital circuits to minimize the influence on each other.

5.2.2.Power supply

Power supply routing should consider not only VBAT, but also the reflow GND of the power supply. The traces of the positive electrode of VBAT must be short and thick, and the traces must first pass through the large capacitor, the Zener diode, and then the power PIN of the module. There are multiple PADs exposed copper at the bottom of the module, and it is necessary to ensure that the GND path from these exposed copper areas to the power supply is the shortest and smoothest. This ensures that the current path of the entire power supply is minimized and interference is minimized.

5.2.3.T card

The CLK signal (SDC2_CLK) of the T card should be separately three-dimensional, and the ground wire of the grounding path should be appropriately added; The rest of the data lines are combined together to wrap the ground in three dimensions; The total load capacitance of each signal line is less than 5pF (including TVS capacitance and filter capacitance).

5.2.4.MIPI

MIPI is a high-speed signal line, users must pay attention to protection in the layout stage, so that it is far away from the signal line that is easy to be interfered with, must do the upper and lower left and right packet GND processing, the routing is a differential pair, do 90 ohm differential impedance matching, in order to ensure the consistency of impedance, as far as possible do not cross different GND planes.

When selecting ESD devices for MIPI interfaces, please select TVS with small capacitance, and it is recommended that the parasitic capacitance be less than 1pF.

The MIPI routing requirements are as follows:

- The total length of the cable shall not exceed 130mm
- Requires 90 ohm differential impedance control with a $\pm 10\%$ error.
- The length error of the differential line in the group is controlled within 0.7mm.
- The length error between groups is controlled within 1.4mm.

5.2.5.USB

The module supports high-speed USB interface, the rate reaches 480Mbps, the user is recommended to add a common-mode inductor in the schematic design stage, which can effectively suppress EMI interference, if the user needs to increase electrostatic protection, please be sure to choose a TVS tube with parasitic capacitance less than 1pF. Please refer to the following precautions when using Layout:

- For common-mode inductors, please keep them close to the side of the USB connector.
- Requires 90 ohm differential impedance control with a $\pm 10\%$ error.
- The length error of USB2.0 differential line is controlled within 0.7mm, and the length error of

USB3.1 differential line is controlled within 0.7mm.

- If the Type-C over DP function exists, the length error between different differential pairs of USB3.1 is required to be controlled within 10mm, and the length error between DP_AUX differential pairs is controlled within 7mm.
- If the USB has a charging function, please note that the VBUS cable is as wide as possible.
- If there are test points, try to avoid bifurcation of the traces and put the test points on the path of the traces.

Table 5.1: USB trace length inside the module

Signal	length(mm)	Length error (P-N)
USB0_HS_DP	59.6171	0.6mm
USB0_HS_DM	58.1748	
USB0_SS_TX1_P	21.5089	0.0688mm
USB0_SS_TX1_M	21.4401	
USB0_SS_RX1_P	21.5123	0.0038mm
USB0_SS_RX1_M	21.5161	
USB0_SS_TX0_P	21.5465	0.2563mm
USB0_SS_TX0_M	21.2902	
USB0_SS_RX0_P	21.4933	0.0095mm
USB0_SS_RX0_M	21.4838	

5.2.6.Other

The serial interface of the module should also be kept as short as possible, and it is best to walk in a group when routing the cables, and do not scatter the cables.

6. Electrical, Reliability

6.1. Absolute Maximum

The table below shows the absolute maximum values that the module can withstand. Exceeding these limits may cause permanent damage to the module.

Table 6.1: Absolute maximum

Parameter	Minimum	Typical	Maximum	Unit
VBAT	-0.3	-	6	V
VBUS	-0.3	-	16	V
Peak current	-	-	4	A

6.2. Working Temperature

The following table shows the operating temperature range of the module:

Table 6.2: Module operating temperature

Parameter	Minimum	Typical	Maximum	Unit
Working temperature	-30	-	75	°C
Storage temperature	-40	-	90	°C

6.3. Working voltage

Table 6.3: Module operating voltage

Parameter	Minimum	Typical	Maximum	Unit
VBAT	3.5	3.8	4.2	V
VBUS	3.7	5	13.2	V

6.4. Digital Interface Features

Table 6.4: Digital Interface Features (1.8V)

Parameter	Description	Minimum	Typical	Maximum	Unit
V _{IH}	Input high level voltage	1.17	1.8	2.1	V

V_{IL}	Input low level voltage	-0.3	0	0.63	V
V_{OH}	Output high level voltage	1.35	-	1.8	V
V_{OL}	Output low level voltage	0	-	0.45	V

6.5.PWRKEY Features

Table 6.5:PWRKEY features

Parameter	Description	Minimum	Typical	Maximum	Unit
PWRKEY	High level	1.4	-	-	V
	Low level	-	-	0.6	V
	Valid time	2000			ms

6.6.VCOIN Features

Table 6.6:VCOIN features

Parameter	Description	Minimum	Typical	Maximum	Unit
VCOIN-IN	VCOIN Input voltage	2.5	3.0	3.2	V
VCOIN-OUT	VCOIN Output voltage	-	3.0	-	V

6.7.Electrostatic Protection

The module is not protected against electrostatic discharge. Therefore, you must pay attention to ESD protection when producing, assembling, and operating modules.

6.8.WIFI Main RF Performance

The following table lists the main RF performance under WIFI conduction.

Table 6.13:WIFI Main RF performance parameters under conduction

Launch Performance 2.4G					
	802.11B	802.11G	802.11N	802.11AX	
Transmitted power (minimum rate)	20	18	18(20M)	18.5(20M)	dBm

Transmitted power (maximum rate)	20	17	16(20M)	13.5(20M)	dBm
EVM (Maximum rate)	13%	-30	-30(20M)	-36(20M)	dB
Receiving Performance 2.4G					
Reception sensitivity	802.11B	802.11G	802.11N	802.11AX	
Minimum speed	-97	-94	-93(20M)	-93(20M)	dBm
Maximum speed	-89	-76	-73.5(20M)	-63(20M)	dBm
Launch Performance 5G					
	802.11A	802.11N	802.11AC	802.11AX	
Transmitted power (minimum rate)	18	18(20M)	18(20M)	18(20M)	dBm
Transmitted power (maximum rate)	16	16(20M)	15(20M)	12(20M)	dBm
EVM (Maximum rate)	-31	-33(20M)	-35(20M)	-38(20M)	dB
Receiving Performance 5G					
Reception sensitivity	802.11A	802.11N	802.11AC	802.11AX	
Minimum speed	-91	-90.5(20M)	-91(20M)	-91(20M)	dBm
Maximum speed	-75.5	-74(20M)	-70(20M)	-65(20M)	dBm
Launch Performance 5G					
	802.11A	802.11AX			
Transmitted power (minimum rate)	/	17.5(20M)			
Transmitted power (maximum rate)	/	12(20M)			
EVM (Maximum rate)	/	-36(20M)			
Receiving Performance 6G					
Reception sensitivity	802.11A	802.11AX			
Minimum speed	/	-90(20M)			dBm
Maximum speed	/	-61(20M)			dBm

6.9.BT Main RF Performance

The following table lists the main rf properties under BT conduction.

Table 6.9:Main RF performance parameters under BT conduction

Launch Performance			
Transmission power	DH5	2DH5	3DH5

	7	7	7	dBm
Receiving Performance				
	DH5	2DH5	3DH5	
Reception sensitivity	-93	-91	-90	dBm

6.10.Main RF Performance of GNSS

The main RF performance under GNSS conduction is listed in the following table.

Table 6.10:Main RF performance parameters under GNSS conduction

GNSS Working Band:1575.42MHZ				
GNSS carrier-to-noise ratio CN0: 40dB/Hz				
GNSS Sensitivity:	Capture (cold start)	Capture (hot start)	tracking	
	-	-	-	dBm
GNSS Startup time	hot start	start	cold start	
	-	-	-	s

7. Production

7.1. Top and Bottom Views of Modules

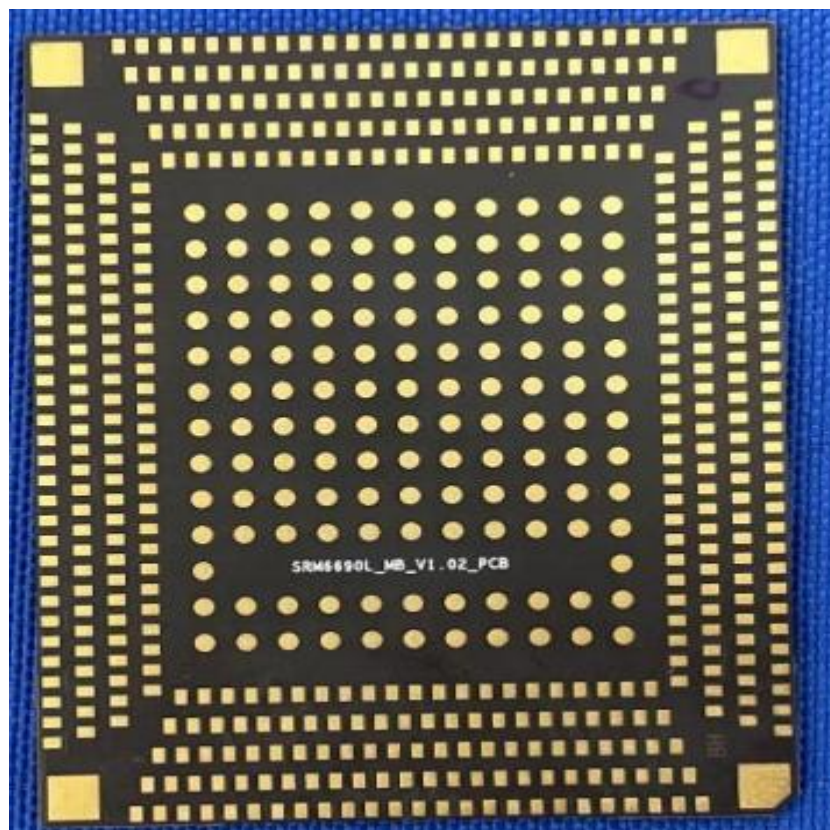


Fig7.1: Top and bottom views of modules

7.2.Recommended Welding Furnace Temperature Curve

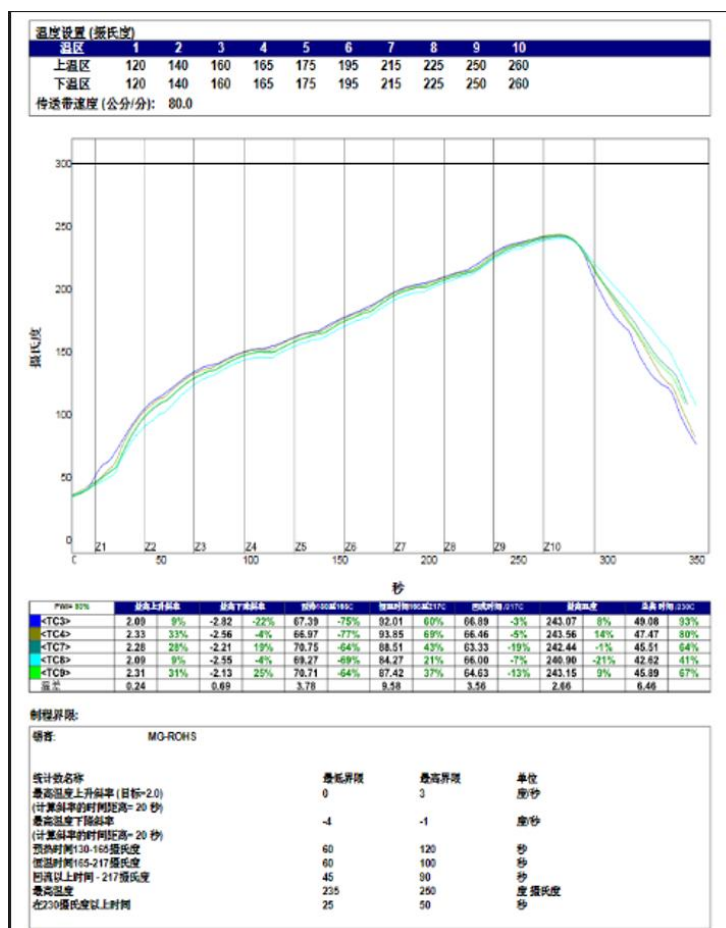


Fig7.2: Recommended welding furnace temperature curve

7.3.Humidity Sensitive Characteristic (MSL)

The SNM6690 meets humidity sensitivity level 3. The temperature < 30 degrees and relative humidity < 60% of the environmental conditions, dry packaging according to IPC/JEDEC standard J-STD-020C specification. Under the environmental conditions of temperature < 40 degrees and relative humidity < 90%, the shelf life is at least 6 months without unpacking. After unpacking, table 22 lists the shelf life of modules corresponding to different moisture sensitivity levels.

Table 7.1: Humidity sensitivity level differentiation

Level	Factory environment $\leq 30^{\circ}\text{C}/60\%\text{RH}$
1	Indefinite quality at ambient $\leq 30^{\circ}\text{C}/85\% \text{ RH}$
2	1 year
2a	4 weeks

3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	Force bake before use. After baking, the module must be fitted within the time limit specified on the label.

After unpacking, under the environmental conditions of temperature $< 30^{\circ}\text{C}$ and relative humidity $< 60\%$, SMT patch should be carried out within 168 hours. Bake if the above conditions are not met. Note: Oxidation risk: Baking SMD packaging can cause metal oxidation and, if excessive, can lead to solder ability problems during circuit board assembly. Baking SMD packages for temperature and time, thus limiting solder ability considerations. The accumulated baking time at temperatures greater than 90°C and up to 125°C should not exceed 96 hours.

7.4.Baking Requirements

Due to the moisture sensitive nature of the modules, the SNM6690 should be fully baked before reflow soldering, otherwise the modules may be permanently damaged during reflow soldering. The SNM6690 should be baked for 192 hours at $40^{\circ}\text{C}+5^{\circ}\text{C}/-0^{\circ}\text{C}$ with relative humidity less than 5%, or the module should be baked for 72 hours at $80^{\circ}\text{C}+5^{\circ}\text{C}$. The user should be aware that the tray is not resistant to high temperatures and should remove the module from the tray for baking, otherwise the tray may be damaged by high temperatures.

Table 7.2: Baking needs:

Baking Temperature	Humidity	Baking Time
$40^{\circ}\text{C}\pm 5^{\circ}\text{C}$	$< 5\%$	192 hours
$120^{\circ}\text{C}\pm 5^{\circ}\text{C}$	$< 5\%$	4 hours

8. Appendix

8.1. Safety warning

Pay attention to the following security precautions in the process of using or repairing any terminal or mobile phone. Terminal devices should be informed of the following security information. Otherwise, MeiG will not bear any consequences that the user does not follow these warning operations.

Table 8.3: Safety warning

Logo	Requirement
	When you are at a hospital or medical facility, observe the restrictions on using your phone. If necessary, please turn off the terminal or mobile phone, otherwise the medical device may malfunction due to radio frequency interference.
	Turn off the wireless terminal or mobile phone before boarding. To prevent interference with the communication system, wireless communication equipment is prohibited on the aircraft. Ignoring the above will violate local laws and may result in a flight accident.
	Do not use mobile terminals or mobile phones in front of flammable gases. Turn off the mobile terminal when you are near an explosion, chemical factory, fuel depot, or gas station. It is dangerous to operate a mobile terminal next to any potentially explosive electrical equipment.
	The mobile terminal receives or transmits radio frequency energy when it is turned on. It can interfere with TV, radio, computer or other electrical equipment.
	Road safety first! Do not use a handheld terminal or mobile phone while driving, please use a hands-free device. Stop before using your handheld terminal or mobile phone.
	GSM mobile terminals operate under RF signals and cellular networks, but are not guaranteed to be connected in all situations. For example, there is no credit or invalid SIM card. When in this situation and need emergency services, remember to use an emergency call. In order to be able to call and receive calls, the mobile terminal must be powered on and in a service area where the mobile signal is strong enough. Emergency calls are not allowed when certain network services or telephony features are in use, such as feature locks, keyboard locks. These functions should be removed before using an emergency call. Some networks require effective SIM card support.

8.2.Warning Language

CE Warning Language

RF Exposure

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

RED Declaration of Conformity

Hereby, MeiG Smart Technology Co., Ltd, declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014 / 53 / EU. The full text of the EU declaration of conformity is available at the following internet address: <https://www.meigsmart.com>.

Shenzhen MeiG Smart Technology Co., Ltd. Shanghai Branch

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[Http://www.meigchina.com](http://www.meigchina.com)

2.2 List of applicable FCC rules

List the FCC rules that are applicable to the modular transmitter. These are the rules that specifically establish the bands of operation, the power, spurious emissions, and operating fundamental frequencies. DO NOT list compliance to unintentional-radiator rules (Part 15 Subpart B) since that is not a condition of a module grant that is extended to a host manufacturer. See also Section 2.10 below concerning the need to notify host manufacturers that further testing is required.³

Explanation: This module meets the requirements of 47 CFR Part 24 Subpart E, 47 CFR Part 15, Subpart C, RSS-Gen Issue 5, RSS-247 Issue 4, RSS-248 Issue 3

2.3 Summarize the specific operational use conditions

Describe use conditions that are applicable to the modular transmitter, including for example any limits on antennas, etc. For example, if point-to-point antennas are used that require reduction in power or compensation for cable loss, then this information must be in the instructions. If the use condition limitations extend to professional users, then instructions must state that this information also extends to the host manufacturer's instruction manual. In addition, certain information may also be needed, such as peak gain per frequency band and minimum gain, specifically for master devices in 5 GHz DFS bands.

Explanation: The EUT has a External Antenna, and the antenna use a permanently attached antenna which is not replaceable.

2.4 Limited module procedures

If a modular transmitter is approved as a "limited module," then the module manufacturer is responsible for approving the host environment that the limited module is used with. The manufacturer of a limited module must describe, both in the filing and in the installation instructions, the alternative means that the limited module manufacturer uses to verify that the host meets the necessary requirements to satisfy the module limiting conditions.

A limited module manufacturer has the flexibility to define its alternative method to address the conditions that limit the initial approval, such as: shielding, minimum signaling amplitude, buffered modulation/data inputs, or power supply regulation. The alternative method could include that the limited module manufacturer reviews detailed test data or host designs prior to giving the host manufacturer approval.

This limited module procedure is also applicable for RF exposure evaluation when it is necessary to demonstrate compliance in a specific host. The module manufacturer must state how control of the product into which the modular transmitter will be installed will be maintained such that full compliance of the product is always ensured. For additional hosts other than the specific host originally granted with a limited module, a Class II permissive change is required on the module grant to register the additional host as a specific host also approved with the module.

Explanation: The module is not a limited module.

2.5 Trace antenna designs

For a modular transmitter with trace antenna designs, see the guidance in Question 11 of KDB Publication 996369 D02 FAQ – Modules for Micro-Strip Antennas and traces. The integration information shall include for the TCB review the integration instructions for the following aspects:

layout of trace design, parts list (BOM), antenna, connectors, and isolation requirements.

- a) Information that includes permitted variances (e.g., trace boundary limits, thickness, length, width, shape(s), dielectric constant, and impedance as applicable for each type of antenna);
- b) Each design shall be considered a different type (e.g., antenna length in multiple(s) of frequency, the wavelength, and antenna shape (traces in phase) can affect antenna gain and must be considered);
- c) The parameters shall be provided in a manner permitting host manufacturers to design the printed circuit (PC) board layout;
- d) Appropriate parts by manufacturer and specifications;
- e) Test procedures for design verification; and
- f) Production test procedures for ensuring compliance.

The module grantee shall provide a notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify the module grantee that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the grantee, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

Explanation: Yes, The module with trace antenna designs, and This manual has been shown the layout of trace design, antenna, connectors, and isolation requirements.

2.6 RF exposure considerations

It is essential for module grantees to clearly and explicitly state the RF exposure conditions that permit a host product manufacturer to use the module. Two types of instructions are required for RF exposure information: (1) to the host product manufacturer, to define the application conditions (mobile, portable – xx cm from a person's body); and (2) additional text needed for the host product manufacturer to provide to end users in their end-product manuals. If RF exposure statements and use conditions are not provided, then the host product manufacturer is required to take responsibility of the module through a change in FCC ID (new application).

Explanation: This module complies with FCC RF radiation exposure limits set forth for an uncontrolled environment, This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body." This module is designed to comply with the FCC statement, FCC ID is: 2APJ4-SNM6690

2.7 Antennas

A list of antennas included in the application for certification must be provided in the instructions. For modular transmitters approved as limited modules, all applicable professional installer instructions must be included as part of the information to the host product manufacturer. The antenna list shall also identify the antenna types (monopole, PIFA, dipole, etc. (note that for example an “omni-directional antenna” is not considered to be a specific “antenna type”)).

For situations where the host product manufacturer is responsible for an external connector, for example with an RF pin and antenna trace design, the integration instructions shall inform the installer that unique antenna connector must be used on the Part 15 authorized transmitters used in the host product. The module manufacturers shall provide a list of acceptable unique connectors.

Explanation: The EUT has External Antenna, and the antenna use a permanently attached antenna which is unique.

2.8 Label and compliance information

Grantees are responsible for the continued compliance of their modules to the FCC rules. This includes advising host product manufacturers that they need to provide a physical or e-label stating “Contains FCC ID” with their finished product. See Guidelines for Labeling and User Information for RF Devices – KDB Publication 784748.

Explanation: The host system using this module, should have label in a visible area indicated the following texts: “Contains FCC ID: 2APJ4-SNM6690, Contains IC: 23860-SNM6690”

2.9 Information on test modes and additional testing requirements⁵

Additional guidance for testing host products is given in KDB Publication 996369 D04 Module Integration Guide. Test modes should take into consideration different operational conditions for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.

The grantee should provide information on how to configure test modes for host product evaluation for different operational conditions for a stand-alone modular transmitter in a host, versus with multiple, simultaneously transmitting modules or other transmitters in a host.

Grantees can increase the utility of their modular transmitters by providing special means, modes, or instructions that simulates or characterizes a connection by enabling a transmitter. This can greatly simplify a host manufacturer’s determination that a module as installed in a host complies with FCC requirements.

Explanation: Top band can increase the utility of our modular transmitters by providing instructions that simulates or characterizes a connection by enabling a transmitter.

2.10 Additional testing, Part 15 Subpart B disclaimer

The grantee should include a statement that the modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, 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 circuitry), 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.

Explanation: The module without unintentional-radiator digital circuitry, so the module does not require an evaluation by FCC Part 15 Subpart B. The host should be evaluated by the FCC Subpart B.

2.11 Note EMI Considerations

Note that a host manufacturer is recommended to use D04 Module Integration Guide recommending as "best practice" RF design engineering testing and evaluation in case non-linear interactions generate additional non-compliant limits due to module placement to host components or properties

For standalone mode, reference the guidance in D04 Module Integration Guide and for simultaneous mode⁷; see D02 Module Q&A Question 12, which permits the host manufacturer to confirm compliance

2.12 How to make changes

Since only Grantees are permitted to make permissive changes, it is recommended that module manufacturers provide contact information and some guidance to host providers in the integration instructions if they expect their module will be used differently than granted.

Explanation:- Contact information: sundejing@meigsmart.com / Tel: 86-13482142936

Information for antenna type(s), antenna models(s), and worst-case tilt angle(s) necessary to remain compliant with the e.i.r.p. elevation mask requirement set forth in section 4.5.4 (c) shall be clearly indicated.

The antenna height shall be determined by the installer or operator of the standard-power access point or fixed client device, or by automatic means. This information shall be stored internally in the device. Provision of accurate device information is mandatory

IC labeling requirement for the final end product:

The final end product must be labeled in a visible area with the following “Contains IC: 23860-SNM6690”

The Host Marketing Name (HMN) must be indicated at any location on the exterior of the host product or product packaging or product literature, which shall be available with the host product or online.

This radio transmitter [IC:23860-SNM6690] has been approved by Innovation, Science and Economic Development Canada to operate with the antenna types listed below, with the maximum permissible gain indicated. Antenna types not included in this list that have a gain greater than the maximum gain indicated for any type listed are strictly prohibited for use with this device.

Frequency range	Manufacturer	Peak gain(dBi)	Impedance	Antenna type
2400-2483.5	TOXU TECHNOLOGY CO., LTD.	3.95	50Ω	External Antenna
2412-2472	TOXU TECHNOLOGY CO., LTD.	2.7	50Ω	External Antenna
5151-5250	TOXU TECHNOLOGY CO., LTD.	2.07	50Ω	External Antenna
5250-5350	TOXU TECHNOLOGY CO., LTD.	1.48	50Ω	External Antenna
5470-5725	TOXU TECHNOLOGY CO., LTD.	1.48	50Ω	External Antenna
5725-5850	TOXU TECHNOLOGY CO., LTD.	0.96	50Ω	External Antenna
5925-6425	TOXU TECHNOLOGY CO., LTD.	0.96	50Ω	External Antenna
6425-6525	TOXU TECHNOLOGY CO., LTD.	0.47	50Ω	External Antenna
6525-6875	TOXU TECHNOLOGY CO., LTD.	0.77	50Ω	External Antenna
6875-7125	TOXU TECHNOLOGY CO., LTD.	1.56	50Ω	External Antenna

FCC regulatory conformance:

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.
- (2) This device must accept any interference received, including interference that may cause undesired operation.

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

NOTE: The manufacturer is not responsible for any radio or TV interference caused by unauthorized modifications to this equipment. Such modifications could void the user's authority to operate the equipment.

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

RF Exposure

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Dual Client 6CD

Transmitters in the 5.925-7.125 GHz band are prohibited from operating to control or communicate with unmanned aircraft systems

IC regulatory conformance

This device complies with CAN ICES (B)/NMB(B)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's licence-exempt RSS(s). Operation is subject to the following two conditions:

- (1) This device may not cause interference.
- (2) This device must accept any interference, including interference that may cause undesired operation of the device.

Cet appareil est conforme à la norme CAN ICES (B)/NMB-003 (B)

Cet appareil contient des émetteurs / récepteurs exempt (s) de licence qui sont conformes aux RSS exemptes de licence d'Innovation, Sciences et Développement économique Canada. Son fonctionnement est soumis aux deux conditions suivantes:

- (1) Cet appareil ne doit pas provoquer d'interférences.
- (2) Cet appareil doit accepter toute interférence, y compris les interférences susceptibles de provoquer un fonctionnement indésirable de l'appareil.

The device is restricted to indoor use when operated in the Canada using frequency 5150MHz-5250MHz to reduce the potential for interference.

Lors de l'utilisation au Canada d'un appareil dont la fréquence est de 5150 MHz à 5250 MHz, l'appareil est limité à un usage intérieur afin de réduire les risques de brouillage.

RF Exposure

This equipment complies with IC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance of 20 cm between the radiator and your body. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

Cet équipement est conforme aux limites d'exposition aux rayonnements de la IC établies pour un environnement non contrôlé. Cet équipement doit être installé et fonctionner à au moins 20cm de distance d'un radiateur ou de votre corps. Cet émetteur ne doit pas être co-localisé ni fonctionner en conjonction avec une autre antenne ou un autre émetteur.

WIFI 6E&WIFI 7:

Devices shall not be used for control of or communications with unmanned aircraft systems.

Devices shall not be used on oil platforms.

Devices shall not be used on aircraft, except for the low-power indoor access points, indoor subordinate devices, low-power client devices, and very low-power devices operating in the 5925-7125 MHz band, that may be used on large aircraft as defined in the Canadian Aviation Regulations, while flying above 3,048 metres (10,000 feet).

Devices shall not be used on automobiles.

Devices shall not be used on trains.

Devices shall not be used on maritime vessels.

L'équipement ne doit pas être utilisé pour contrôler ou communiquer avec les systèmes d'aéronefs sans pilote.

L'équipement ne doit pas être utilisé sur une plate - forme pétrolière.

L'équipement ne doit pas être utilisé à bord d'un aéronef, à l'exception des points d'accès intérieurs de faible puissance, de l'équipement esclave intérieur, de l'équipement client de faible puissance et de l'équipement de très faible puissance fonctionnant dans la bande 5925-7125 MHz qui peuvent être utilisés sur de gros aéronefs tels que définis dans le règlement de l'aviation canadien et volant à des altitudes supérieures à 3048 m (10 000 FT).

L'équipement ne doit pas être utilisé dans la voiture.

L'équipement ne doit pas être utilisé à bord du train.

L'équipement ne doit pas être utilisé à bord des navires en mer.

The OEM must certify the final end product to comply with unintentional radiators (FCC Sections 15.107 and 15.109) before declaring compliance of the final product to Part 15 of the FCC rules and regulations. Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change.

The OEM must comply with the FCC labeling requirements. If the module's label is not visible when installed, then an additional permanent label must be applied on the outside of the finished product which states: "Contains transmitter module FCC ID: 2APJ4-SRM6690". Additionally, the following statement should be included on the label and in the final product's user manual: "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 interferences, and
- (2) this device must accept any interference received, including interference that may cause undesired operation."

The module is limited to installation in mobile or fixed applications. Separate approval is required for all other operating configurations, including portable configuration with respect to Part 2.1093 and different antenna configurations.

A module or modules can only be used without additional authorizations if they have been tested and granted under the same intended end - use operational conditions, including simultaneous transmission operations.

When they have not been tested and granted in this manner, additional testing and/or FCC application filing may be required. The most straightforward approach to address additional testing conditions is to have the grantee responsible for the certification of at least one of the modules submit a permissive change application.

When having a module grantee file a permissive change is not practical or feasible, the following guidance provides some additional options for host manufacturers. Integrations using modules where additional testing and/or FCC application filing(s) may be required are: (A) a module used in devices requiring additional RF exposure compliance information (e.g., MPE evaluation or SAR testing); (B) limited and/or split modules not meeting all of the module requirements; and (C) simultaneous transmissions for independent collocated transmitters not previously granted together.

This Module is full modular approval, it is limited to OEM installation ONLY.

Integration into devices that are directly or indirectly connected to AC lines must add with Class II Permissive Change. (OEM) Integrator has to assure compliance of the entire end product include the integrated Module. Additional measurements (15B) and/or equipment authorizations (e.g. Verification) may need to be addressed depending on co-location or simultaneous transmission

issues if applicable. (OEM) Integrator is reminded to assure that these installation instructions will not be made available to the end user