

SNM932 Hardware Design Manual

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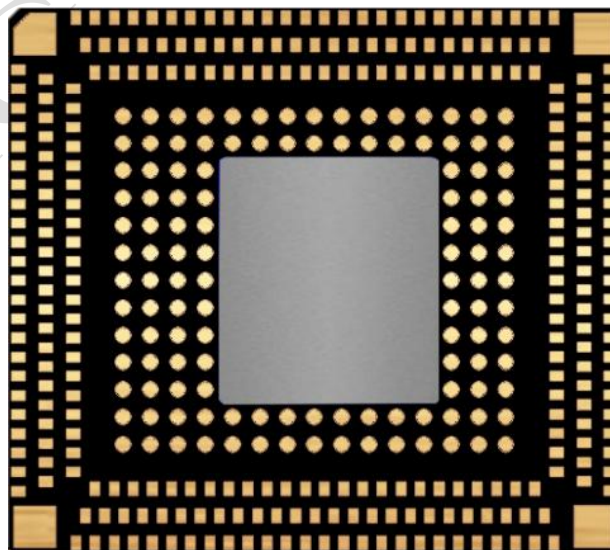
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Identification	Claim
	When you are at a hospital or medical facility, observe the restrictions on using your phone. If necessary, please turn off the terminal or mobile phone, otherwise the medical device may malfunction due to radio frequency interference.
	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.
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	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.

SNM932 Hardware Design Manual _V1.04



Foreword

Thank you for using the SNM932 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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Revision History

Date	Revision	Description	Modified By
2024-05	1.00	First edition	Hardware
2024-10	1.01	Update description of pin 64	Hardware
2024-11	1.02	Update the block diagram and 301PIN GPIO number	Hardware
2024-12	1.03	Update RF characteristic parameters	Hardware
2025-5	1.04	Delete EDP description	Hardware

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1 Introduction

This document describes the hardware application interface of the module, including the connection of the circuit and the RF 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 applications.

2 Module overview

The SNM932 module uses QCS6490 as the main chip, which is made with a 6nm manufacturing process and has an 8-core Kryo CPU 6xx (Kryo Gold plus: 2.7GHz high-performance core*1, Kryo Gold: 2.4GHz high-performance core*3, Kryo Silver: 1.9GHz low-power core*4).

The SNM932 is equipped with UFS2.1+LPDDR4X UMCP by default, with a capacity of 128GB+8GB.

SNM932 (WIFI Only) can provide WiFi and BT functions; Widely applicable to VR cameras, intelligent robots, video surveillance, security, in car devices, intelligent platform handheld terminals and other products

The physical interface of the module is the 491pin pad, providing the following hardware interfaces:

- Six 1.8V UART serial ports, supporting four or two wires (including Debug UART).
- 1 set of LCD interface (MIPI interface)
- 5 set of Camera interfaces (MIPI interface)
- 4 sets of Flashlight interfaces
- 2 set of USB interfaces (supports USB2.0 and USB3.1)
- 2 sets of digital MIC interfaces
- GPIO interfaces
- Built in expansion GPIO IC
- 9 sets of I2C interfaces (3 for sensor, 4 for Camera)
- 4 sets of SPI interface
- 1 set of TF card interface
- 1 set of PCIe 4.0 card interface
- Supports WiFi 2.4/5/6/7, Bluetooth 5.3 functions
- 3 sets of RGB interfaces
- 3 sets of I2S interfaces (supports 6 wires in 1 set)
- 4 sets of ADC interface

Note: 1. The number of functional interfaces is based on the default function of the pins

2. The “*” sign means that this information is to be confirmed.

2.1 Summary of features

Table 2.1: SNM932 features

Product characteristics		Description
Platform		Qualcomm QCS6490
CPU		8-core Kryo CPU 6xx Kryo Gold plus *1 @2.7GHz, Kryo Gold*3 @2.4GHz, Kryo Silver*4@1.9GHz
GPU		Adreno GPU 6XX@812MHz
System memory		128GB UFS + 12GB LPDDR5(optional)
OS		Android 13
Size		45.0*40.0*3.95mm, 491pin LGA
network band		No support
Wi-Fi		WCN6856: 2x2 IEEE 802.11a/b/g/n/ac/ax 2.4G&5G&6G
Bluetooth		BT 5.2
GNSS		No support
Data Access	TD-LTE	No support
	FDD-LTE	No support
	DC-HSPA+	No support
	TD-HSPA	No support
	EVDO Rev.A	No support
	EDGE	No support
	GPRS	No support
SIM		No support
Display		Maximum Resolution： FHD+ 144Hz QCLTM, HDR10+,WCG
		LCD Size: User defined
		Interface: LCM： MIPI DSI 4-lane
Camera		Interface: Support 5 sets of CSI, each set is 4-Lane, supporting D-PHY 1.2 and C-PHY 1.2;
		Triple 14-bit image signal processing (ISP) + two lite ISP 22 + 22 + 22MP, 64 MP/30 fps.
		(36 M + 36 M + 36 M) @ 30 fps - triple camera
		(64 M + 36 M) @ 30 fps - dual camera
		108 M @ 30 fps - single cameras
Video	Video decode	Up to 4K60 for H.264/H.265/VP9
	Video encode	Up to 4K30 for H.264/H.265
	Decode+Encode	4K60 Decode + 4K30 Encode
Input Device		Key (Power on/off, Reset, Home, Volume+, Volume-)
		Capacitive TP
Reset		Support HW reset
Application		Interface name Main function description

interface	VPH	6pin, Power input, 3.5V ~ 4.2V, Nominal value 3.8V
	SDIO *1	SD3.0
	USB2.0(3.1)	Support OTG USB_BOOT (Force USB boot for emergency downloads)
	BLSP ports	8 QUP ports+4 SSC_QUP ports, multiplexed serial interface functions
	ADC*4	Support
	Charge	Support (requires external expansion+charging IC+power meter)
	Motor	No support
	GPIO	40 GPIOs, Excluding QUP multiplexed GPIOs and GPIOs involved in LCM, TP, CAMERA
	VCOIN	Real time clock backup battery
	RF Interface	2.4G/5G/6G WiFi BT ANT0 2.4G/5G/6G WiFi BT ANT1
	Audio	2 sets of digital MIC 3 sets of I2S interfaces

2.2 Block diagram

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

QCS6490 Baseband chip

PM7325, PM7350C, PMK7325 Power management chip

WCN6856-WIFI/BT 2-in-1 chip

Antenna interface

LCD/CAM-MIPI interface

UMCP memory chip

AUDIO interface

USB, SD card interfaces, etc.

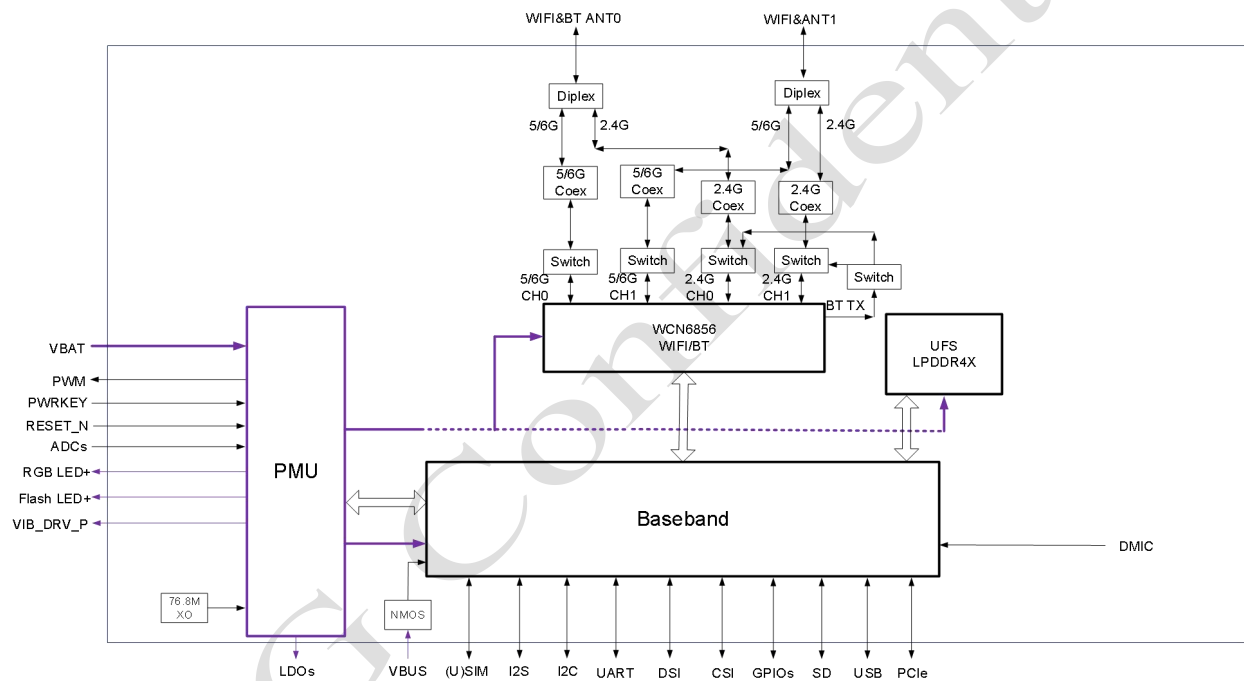


Figure 2.1: Module function block diagram

3 Module Package

3.1 Pin distribution diagram

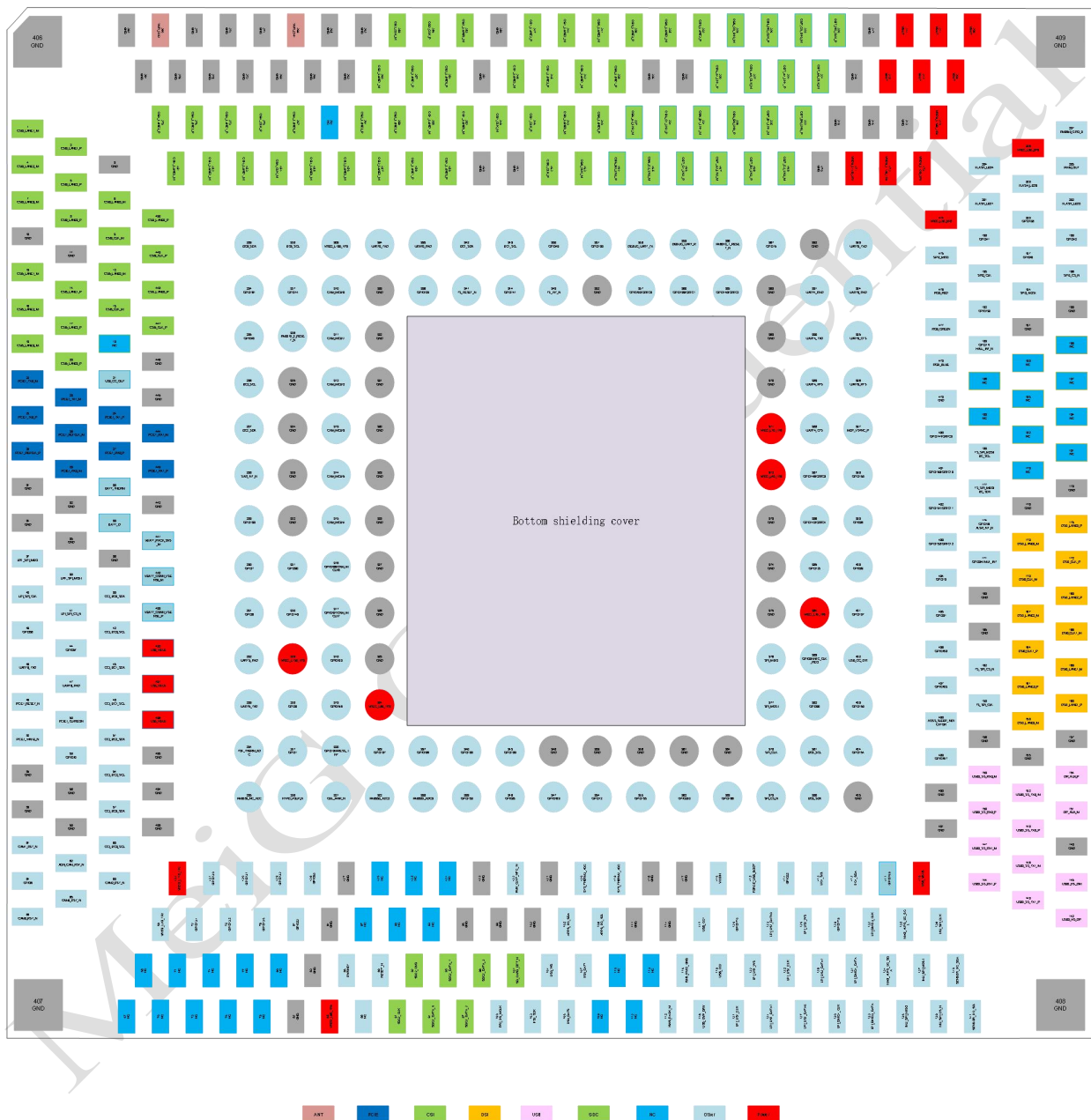


Figure 3.1: Module pin diagram (top view)

3.2 Pin definitions

Table 3.1: Pin description (GPIOs with ‘**’ support INT)

Pin name	Pin number	I/O	description	note
Power supply				
VPH	208、 209 211、 212 214、 215	PI	The module provides six VPH power pins. The SNM932 operates from a single supply with a voltage range from 3.5V to 4.2V for VPH.	Externally, large capacitors and Zener diodes must be added for surge protection.
USB_VBUS_DET	410、	PI	USB_VBUS with a voltage range from 3.7V to 6V.	VBUS insertion detection
VCOIN	416	AI/AO	When the VPH of the system power is absent, the external backup battery provides power to the system real-time clock. When VPH is present, the backup battery is charged.	VCOIN pins connect 3V button batteries or large capacitors.
VREG_L9C_2P96	206	PO	1.8/2.95V power output, used for SD card power supply	600mA
VREG_L6C_2P96	85	PO	1.8/2.95V power output, used for SD card signal pull-up power supply	50mA
VREG_L2C_1P8	210	PO	DMIC_VDD, Can be turned off.	100mA
VREG_L1F_1P2	69	PO	1.2V power output, used for powering CAM DVDD, can be turned off.	300mA

VREG_L14B_1P2	432	PO	1.2V power output, used for powering CAM DVDD, can be turned off.	300mA
VREG_L18B_1P8	309	PO	1.8V output, constant power supply upon startup, reserved.	150mA
VREG_L1C_1P8	371	PO	1.8V output, constant power supply upon startup, reserved.	150mA
VREG_L17B_1P8	372	PO	1.8V power output, can be turned off, used for CAM_SOVDD	250mA
VREG_S10B_1P8	299	PO	1.8V power output, constant power supply upon startup, used for signal pull-up source and level conversion circuit.	100mA
VREG_L8C_1P8	384	PO	1.8V power output, constant power supply upon startup, used for sensor I/O power supply.	200mA
VREG_L12C_1P8	472	PO	1.8V power output, can be turned off, used for LCD power supply_IOVDD.	100mA
VREG_L3C_2P8/3.0	471	PO	3.0V power output, can be turned off, used for touch screen power supply	150mA
VREG_L13C_2P8/3.0	473	PO	3.0V/2.8V power output, used for VCC power supply of LCD screen	150 mA
VREG_L7C_3P0	474	PO	3.0V power output, can be turned off, used for powering	250 mA

			Sensors VDD	
NC	1、2、4-9、 18、21、30、 33、67-68、 70、71、73、 74、76、77、 79-81 、88、90、 93、109、 110、112、 113、115- 119、129、 164、166、 179、181- 188、190、 200、220- 231、234、 237、264、 290-291、 294-295、 313、324、 429-431、 411、424- 425、436- 441、449、 450、464-469		NC	
GND	3、10-11、 31-32、34- 36、55-56、 58-59、82- 84、96、99、 102、111、 114、148、 155-157、 165、168、		GND	

	176、178、 191、193、 213、216- 219、233、 236、250- 251、262- 263、265- 266、269、 271-272、 274-275、 277-278、 281-282、 302-305、 325-333、 348、352- 353、356、 361、364、 368-369、 370、373- 375、392、 405-409、 417、418、 421、423、 427、433- 435、442、 445-446、 460-461、 470、479、 490-491			
Main Display Interface (MIPI)				
MIPI_DSI0_CLK_N	170	AO	MIPI_LCD clock	
MIPI_DSI0_CLK_P	172	AO		
MIPI_DSI0_LANE0_N	173	AO	MIPI_LCD data	
MIPI_DSI0_LANE0_P	175	AO		
MIPI_DSI0_LANE1_N	163	AO		

MIPI_DSI0_LANE1_P	160	AO		
MIPI_DSI0_LANE3_N	158	AO		
MIPI_DSI0_LANE3_P	161	AO		
MIPI_DSI0_LANE2_N	167	AO		
MIPI_DSI0_LANE2_P	169	AO		
GPIO10/DISP0_RESET_N	351	I/O	LCD reset	
GPIO80*_MDP_VSYNC_P	397	I/O	LCD frame sync signal	
Main display backlight interface				
PM7350C_PWM_OUT_GPIO9	205	I/O	Backlight chip PWM	
UART(1.8V)				
GPIO22_DEBUG_UART_TX	358	DI	UART data receive	DEBUG UART
GPIO23_DEBUG_UART_RX	359	DO	UART data transmit	
GPIO47*_UART0_RXD	335	DI	UART data receive	
GPIO46_UART0_TXD	334	DO	UART data transmit	
GPIO27*_UART5_RXD	292	DI	UART data receive	BOOTCONFIG, do not pull-up before power-on
GPIO26_UART5_TXD	293	DO	UART data transmit	
GPIO19*_UART6_RX	47	DI	UART data receive	
GPIO18*_UART6_TX	46	DO	UART data transmit	
GPIO43*_UART4_RXD	391	DI	UART data receive	
GPIO42_UART4_TXD	390	DO	UART data transmit	
GPIO40*_UART4_CTS	388	DI	UART data transmit	
GPIO41*_UART4_RTS	389	D0	UART data transmit	
GPIO63*_UART3_RXD	394	DI	UART data receive	BOOTCONFIG, do not pull-up before power-on
GPIO62_UART3_TXD	393	D0	UART data transmit	
GPIO60*_UART3_CTS	395	DI	UART data transmit	Reused for USB_ID
GPIO61*_UART3_RTS	396	D0	UART data	

			transmit	
Camera0				
MIPI_CSI0_CLK_N	463	AO	Camera0 MIPI clock	
MIPI_CSI0_CLK_P	462	AO		
MIPI_CSI0_LANE0_N	243	AI/AO	Camera0 MIPI data	
MIPI_CSI0_LANE0_P	240	AI/AO		
MIPI_CSI0_LANE1_N	242	AI/AO		
MIPI_CSI0_LANE1_P	239	AI/AO		
MIPI_CSI0_LANE2_N	235	AI/AO		
MIPI_CSI0_LANE2_P	232	AI/AO		
MIPI_CSI0_LANE3_N	241	AI/AO		
MIPI_CSI0_LANE3_P	238	AI/AO		
CAM_MCLK0	310	DO	Camera0 main clock	
GPIO111_CAM0_RST_N	66	DO	Camera0 reset	
GPIO134_CAM0_PWD_N	300	DO	Camera0 dormancy	
Camera1				
MIPI_CSI1_CLK_N	249	AO	Camera1 MIPI clock	
MIPI_CSI1_CLK_P	246	AO		
MIPI_CSI1_LANE0_N	252	AI/AO	Camera1 MIPI data	
MIPI_CSI1_LANE0_P	459	AI/AO		
MIPI_CSI1_LANE1_N	255	AI/AO		
MIPI_CSI1_LANE1_P	458	AI/AO		
MIPI_CSI1_LANE2_N	244	AI/AO		
MIPI_CSI1_LANE2_P	247	AI/AO		
MIPI_CSI1_LANE3_N	248	AI/AO		
MIPI_CSI1_LANE3_P	245	AI/AO		
CAM_MCLK1	311	DO	Camera1 main clock	
GPIO126_CAM1_RST_N	61	DO	Camera1 reset	
GPIO137_CAM1_PWD_N	301	DO	Camera1 dormancy	
Camera2				

MIPI_CSI2_CLK_N	259	AO	Camera2 clock	
MIPI_CSI2_CLK_P	256	AO		
MIPI_CSI2_LANE0_N	253	AI/AO	Camera2 data	
MIPI_CSI2_LANE0_P	254	AI/AO		
MIPI_CSI2_LANE1_N	260	AI/AO		
MIPI_CSI2_LANE1_P	257	AI/AO		
MIPI_CSI2_LANE2_N	457	AI/AO		
MIPI_CSI2_LANE2_P	258	AI/AO		
MIPI_CSI2_LANE3_N	456	AI/AO		
MIPI_CSI2_LANE3_P	261	AI/AO		
CAM_MCLK2	312	DO	Camera2 main clock	
GPIO64_CAM2_RST_N	63	DO	Camera2 reset	
GPIO125	385	DO	Camera2 dormancy	
Camera3				
MIPI_CSI3_CLK_N	15	AO	Camera3 clock	
MIPI_CSI3_CLK_P	447	AO		
MIPI_CSI3_LANE0_N	12	AI/AO	Camera3 MIPI data	
MIPI_CSI3_LANE0_P	448	AI/AO		
MIPI_CSI3_LANE1_N	13	AI/AO		
MIPI_CSI3_LANE1_P	14	AI/AO		
MIPI_CSI3_LANE2_N	16	AI/AO		
MIPI_CSI3_LANE2_P	17	AI/AO		
MIPI_CSI3_LANE3_N	19	AI/AO		
MIPI_CSI3_LANE3_P	20	AI/AO		
GPIO67_CAM_MCLK3	314	DO	Camera3 main clock	
GPIO78_CAM3_RST_N	65	DO	Camera3 reset	
GPIO106	308	DO	Camera3 dormancy	
Camera4				
MIPI_CSI4_CLK_N	454	AO	Camera4 clock	
MIPI_CSI4_CLK_P	270	AO		

MIPI_CSI4_LANE0_N	455	AI/AO	Camera4 MIPI data	
MIPI_CSI4_LANE0_P	267	AI/AO		
MIPI_CSI4_LANE1_N	453	AI/AO		
MIPI_CSI4_LANE1_P	273	AI/AO		
MIPI_CSI4_LANE2_N	452	AI/AO		
MIPI_CSI4_LANE2_P	276	AI/AO		
MIPI_CSI4_LANE3_N	451	AI/AO		
MIPI_CSI4_LANE3_P	279	AI/AO		
CAM_MCLK4	315	DO	Camera4 main clock	
CAM_RESET_N	62	DO	Camera4 reset	
GPIO40*_CAM4_PWD_N	197	DO	Camera4 dormancy	
PCIE				
PCIE1_TX0_M	22	AO	PCIE1 data differential signal	
PCIE1_TX0_P	25	AO		
PCIE1_RX0_M	29	AI		
PCIE1_RX0_P	27	AI		
PCIE1_TX1_M	23	AO		
PCIE1_TX1_P	24	AO		
PCIE1_RX1_M	444	AI		
PCIE1_RX1_P	443	AI		
PCIE1_REFCLK_M	26	AO	PCIE clock differential signal	
PCIE1_REFCLK_P	28	AO		
GPIO2/PCIE1_RESET_N	49	DO	PCIE1 reset signal	
GPIO79*/PCIE1_CLKREQN	50	DO	PCIE1 clock request	
GPIO3*/PCIE1_WAKE_N	52	AO	PCIE1 wake-up signal	
SD card interface				
GPIO91*_SD_CARD_DET_N	101	DI	SD card insertion detection, can't be used for GPIO	
SDC2_SDCARD_CMD	92	DO	SD CMD	
SDC2_SDCARD_CLK	91	DO	SD clock	

SDC2_SDCARD_D0	94	I/O	SD data	
SDC2_SDCARD_D1	95	I/O		
SDC2_SDCARD_D2	97	I/O		
SDC2_SDCARD_D3	98	I/O		
I2C				
CCI_I2C0_SDA	39	OD	CAM-specific I2C signals	For CSI0, require 2.2K pull-up
CCI_I2C0_SCL	42	OD		
CCI_I2C1_SDA	45	OD	CAM-specific I2C signals	For CSI1, require 2.2K pull-up
CCI_I2C1_SCL	48	OD		
CCI_I2C2_SDA	51	OD	CAM-specific I2C signals	For CSI2, require 2.2K pull-up
CCI_I2C2_SCL	54	OD		
GPIO75/CCI_I2C3_SDA	57	OD	CAM-specific I2C signals	For CSI3, require 2.2K pull-up
GPIO76/CCI_I2C3_SCL	60	OD		
APPS_I2C_SDA	105	OD	Generic I2C	require 2.2K pull-up
APPS_I2C_SCL	108	OD		require 2.2K pull-up
MAG_ALPS_I2C_SDA	134	OD	I2C for Sensor	For MAG/ALPS, require 2.2K pull-up
MAG_ALPS_I2C_SCL	135	OD		
SENSOR_I2C_SDA	140	OD	I2C for Sensor	For SAR/Pressure, require 2.2K pull-up
SENSOR_I2C_SCL	141	OD		
GPIO36/I2C3_SDA	380	OD	Generic I2C	require 2.2K pull-up
GPIO37/I2C3_SCL	381	OD		require 2.2K pull-up
I2C6_SDA	287	OD	Generic I2C	require 2.2K pull-up, can't be used for GPIO
I2C6_SCL	286	OD		require 2.2K pull-up, can't be used for GPIO
SPI				
GPIO48*/SPI1_MISO	376	DI	Generic SPI	
GPIO49/SPI1_MOSI	377	DO		
GPIO50/SPI1_CLK	378	DO		
GPIO51*/SPI1_CS_N	379	DO		
GPIO56/SPI2_MISO	475	DI	Generic SPI	

GPIO57/SPI2_MOSI	194	DO		
GPIO58/SPI2_CLK	195	DO		
GPIO59*/SPI2_CS_N	196	DO		
GPIO12/SPI3_SPI_MISO	37	DI	Generic SPI	
GPIO13/ SPI3_SPI_MOSI	38	DO		
GPIO14_SPI6_SCLK	40	DO		
GPIO15*_SPI6_CS	41	DO		
GPIO163_SPI_MISO	136	DI	Specific SPI	For ACCEL/GYRO
GPIO164_LPI_MOSI	137	DO		
GPIO165_LPI_SCLK	138	DO		
GPIO166*_LPI_CS	139	DO		
I2S				
GPIO97_MI2S0_SCK	103	DO	Generic I2S	
GPIO100_MI2S0_WS	104	DO		
GPIO98_MI2S0_DATA0	106	I/O		
GPIO99_MI2S0_DATA1	107	I/O		
GPIO144_QUA_MI2S_SCK	121	DO	Generic I2S	
GPIO145_QUA_MI2S_WS	122	DO		
GPIO146_QUA_DATA0	123	I/O		
GPIO147_QUA_DATA11	124	I/O		
GPIO96_EXT_MCLK1_C3	100	I/O	MCLK	
GPIO154_I2S2_CLK	125	DO	Generic I2S	
GPIO155_I2S2_WS	126	DO		
GPIO156_I2S2_DATA0	127	I/O		
GPIO157_I2S2_DATA1	128	I/O		
TP				
GPIO52*_TS_I2C_SDA_MISO	177	I/O	TP_I2C data	
GPIO53_TS_I2C_SCL_MOSI	180	I/O	TP_I2C clock	
GPIO81*_TS_INT_N	349	DI	TP interrupt	
GPIO105_TS_RST_N	341	DO	TP reset	
USB				

USB1_HS_DM	87	AI/AO	USB1 2.0 D-	HOST USB
USB1_HS_DP	426	AI/AO	USB1 2.0 D+	HOST USB
USB0_HS_DM	145	AI/AO	USB0 2.0 D-	Download USB port
USB0_HS_DP	142	AI/AO	USB0 2.0 D+	Download USB port
USB0_SS_TX0_P	149	AI/AO	USB super-speed 0 transmit – plus	
USB0_SS_TX0_M	152	AI/AO	USB super-speed 0 transmit – minus	
USB0_SS_TX1_M	146	AI/AO	USB super-speed 1 transmit – minus	
USB0_SS_TX1_P	143	AI/AO	USB super-speed 1 transmit – plus	
USB0_SS_RX0_M	153	AI/AO	USB super-speed 0 receive – minus	
USB0_SS_RX0_P	150	AI/AO	USB super-speed 0 receive – plus	
USB0_SS_RX1_P	144	AI/AO	USB super-speed 1 receive – plus	
USB0_SS_RX1_M	147	AI/AO	USB super-speed 1 receive – minus	
DP_AUX_M	151	AI/AO	DP auxiliary channel M	
DP_AUX_P	154	AI/AO	DP auxiliary channel P	
Antenna interface				
WIFI_CH0	268	AI/AO	WIFI/BT antenna	
WIFI_CH1	280	AI/AO	WIFI/BT antenna	
GPIO default function				
AW9523_P00	285	DO	Generic GPO(IO 3.3V)	PD
AW9523_P01	53	DO	Generic GPO(IO 3.3V)	PD
AW9523_P02	347	DO	Generic GPO(IO 3.3V)	PD
AW9523_P03	357	DO	Generic GPO(IO 3.3V)	PD
AW9523_P04	365	DO	Generic GPO(IO 3.3V)	PD
AW9523_P05	428	DO	Generic GPO(IO 3.3V)	PD
AW9523_P06	318	DO	Generic GPO(IO 3.3V)	PD
AW9523_P07	404	DO	Generic GPO(IO 3.3V)	PD

AW9523_P10	340	DO	Generic GPO(IO 3.3V)	PD
AW9523_P11	366	DO	Generic GPO(IO 3.3V)	PD
AW9523_P12	386	DO	Generic GPO(IO 3.3V)	PD
AW9523_P13	284	DO	Generic GPO(IO 3.3V)	PD
AW9523_P14	387	DO	Generic GPO(IO 3.3V)	PD
AW9523_P15	316	DO	Generic GPO(IO 3.3V)	PD
AW9523_P16	317	DO	Generic GPO(IO 3.3V)	PD
AW9523_P17	355	DO	Generic GPO(IO 3.3V)	PD
PM7350C interface and default functions				
PM7350C_GPIO1	484	DO	Generic GPIO	MAX=1.8V
PM7350C_GPIO2	485	DO	Generic GPIO	MAX=1.8V
PM7350C_GPIO_03_8010_REST	363	DO	Generic GPIO	MAX=1.8V
PM7350C_GPIO_04	306	DO	Generic GPIO	MAX=1.8V
PM7350C_AOSS_SLEEP_INDICATOR	488	DO	AOSS Sleep indicator	MAX=1.8V
PM 7350C_MV_GPIO6	486	DO	Generic GPIO	MAX= VPH
PM7350C_MV_EDP_BL_EN_07	489	DO	Generic GPIO	MAX= VPH
PM7350C_MV_EDP_PWM_08	207	DO	PWM_OUT	MAX= VPH
PM7350C_MV_GPIO9_PWM	205	DO	PWM_OUT	MAX= VPH
PM7325_GPIO and default functions				
PM7325_GPIO1_THERM1	419	I/O	ADC	MAX=1.8V
PM7325_GPIO2_ADC	338	I/O	ADC	MAX=1.8V
PM7350_GPIO4	403	I/O	Generic GPIO	MAX=1.8V
CBL_PWR_N	321	DI	Power on automatic startup signal, low effective	MAX=1.8V
GPIO24_HOME_KEY	487	DO	Generic GPIO	MAX=1.8V
PM7325_MV_KYPD_VOLP_N	296	I/O	Generic GPIO	MAX= VPH
PM7325_07	297	I/O	Generic GPIO	MAX= VPH
PM7325_08	298	I/O	Generic GPIO	MAX= VPH
PM7325_09	400	I/O	Generic GPIO	MAX= VPH

PM7325_AMUX2	322	DI	ADC	MAX=1.8V
PM7325_AMUX4	420	DI	ADC	MAX=1.8V
QCS6490_SPIO and default functions				
GPIO6	64	I/O	Generic GPIO	
GPIO8*	343	I/O	Generic GPIO	
GPIO9	342	I/O	Generic GPIO	
GPIO11 *	414	I/O	Generic GPIO	
GPIO20*	289	I/O	Generic GPIO	
GPIO21*	319	I/O	Generic GPIO	
GPIO25*	307	I/O	Generic GPIO	VOL_DOWN
GPIO34*	346	I/O	Generic GPIO	
GPIO38	382	I/O	Generic GPIO	NFC_EN
GPIO39*_NFC_CLK_REQ	383	I/O	Generic GPIO, Default as NFC clock request signal	
GPIO44*	336	I/O	Generic GPIO	
GPIO45*	337	I/O	Generic GPIO	
GPIO54*	159	I/O	Generic GPIO	
GPIO55*	162	I/O	Generic GPIO	
GPIO93	323	I/O	Generic GPIO	
GPIO149	120	I/O	Generic GPIO	
GPIO101*/HALL_INT_N	189	I/O	Generic GPIO, Default used as HALL interrupt signal	Default used as HALL interrupt signal
GPIO102*	399	I/O	Generic GPIO	GYRO_INT
GPIO103*	171	I/O	Generic GPIO, Default used as ACCL interrupt signal	ACCL_INT
GPIO104*	401	I/O	Generic GPIO	
GPIO107	412	I/O	Generic GPIO	
GPIO108	198	I/O	Generic GPIO	
GPIO109	480	I/O	Generic GPIO, Power alkaline PX6	

GPIO110	199	I/O	Generic GPIO, Power alkaline PX6	
GPIO112*/PRESS_INT	320	I/O	Generic GPIO, Default used as PRESS interrupt signal	
GPIO113	72	I/O	Generic GPIO, Power alkaline PX5	
GPIO114	75	I/O	Generic GPIO, Power alkaline PX5	
GPIO115	78	I/O	Generic GPIO, Power alkaline PX5	
GPIO116*	339	I/O	Generic GPIO	
GPIO117	354	I/O	Generic GPIO	
GPIO118	360	I/O	Generic GPIO	BOOTCONFIG, Do not pull up before starting up
GPIO119*	367	I/O	Generic GPIO	
GPIO120	345	I/O	Generic GPIO	BOOTCONFIG, Do not pull up before starting up
GPIO122	482	I/O	Generic GPIO	BOOTCONFIG, Do not pull up before starting up
GPIO124*	481	I/O	Generic GPIO	BOOTCONFIG, Do not pull up before starting up
GPIO129	344	I/O	Generic GPIO	
GPIO130	283	I/O	Generic GPIO	
GPIO131	413	I/O	Generic GPIO	
GPIO133 *	362	I/O	Generic GPIO	
GPIO138	350	I/O	Generic GPIO	
GPIO135 *	483	I/O	Generic GPIO	BOOTCONFIG, Do not pull up before starting up
GPIO140_USB_CC_DIR	402	I/O	Specific GPIO	Connect to CC- logic chip interrupt signal
GPIO141*/SAR_INT_N	288	I/O	Generic GPIO, Default used as	

			SAR interrupt signal	
GPIO142*/ALSP_INT_N	174	I/O	Generic GPIO, Default used as ALSP interrupt signal	ALSP_INT_N
GPIO148*	192	I/O	Generic GPIO	
GPIO149	120	I/O	Generic GPIO	
GPIO158	398	I/O	Generic GPIO	
LPI_DMIC4_CLK	130	I/O	LPI_DMIC4 clock	Reused as PDM CLK
LPI_DMIC4_DATA	131	I/O	LPI_DMIC4 data	Reused as PDM DATA
LPI_DMIC3_CLK	132	I/O	LPI_DMIC3 clock	Reused as PDM CLK
LPI_DMIC3_DATA	133	I/O	LPI_DMIC3 data	Reused as PDM DATA
Other functional pins				
PWRKEY	86	DI	Power on/off key	
RESET_N	89	DI	Reset key	
FLASH_LED1	201	DO	Flashlight 1 output positive pole	
FLASH_LED2	202	DO	Flashlight 2 output positive pole	
FLASH_LED3	203	DO	Flashlight 3 output positive pole	
FLASH_LED4	204	DO	Flashlight 4 output positive pole	
GPIO82_FORCE_USB_BOOT	415	I/O	Forced download port, high effective	BOOTCONFIG, Do not pull up before starting up
PMK_CLK_OUT	422	DO	NFC clock	
RGB_RED	476	DO	RGB red indicator light output positive pole	
RGB_GREEN	477	DO	RGB green indicator light output positive pole	
RGB_BLUE	478	DO	RGB blue indicator light output positive	

			pole	
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3.3 Mechanical Dimensions

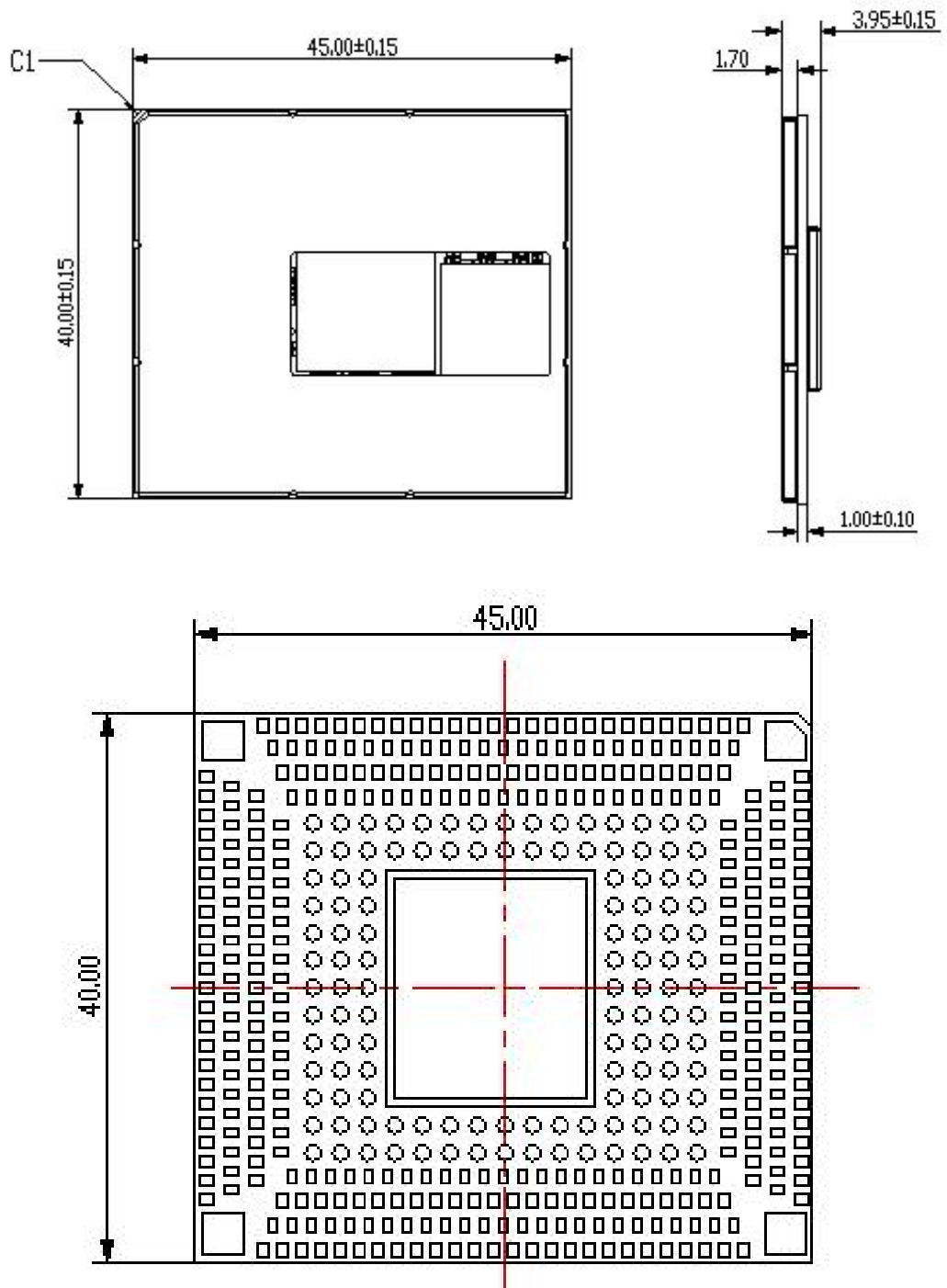


Figure 3.2: Module 3D size (unit: mm)

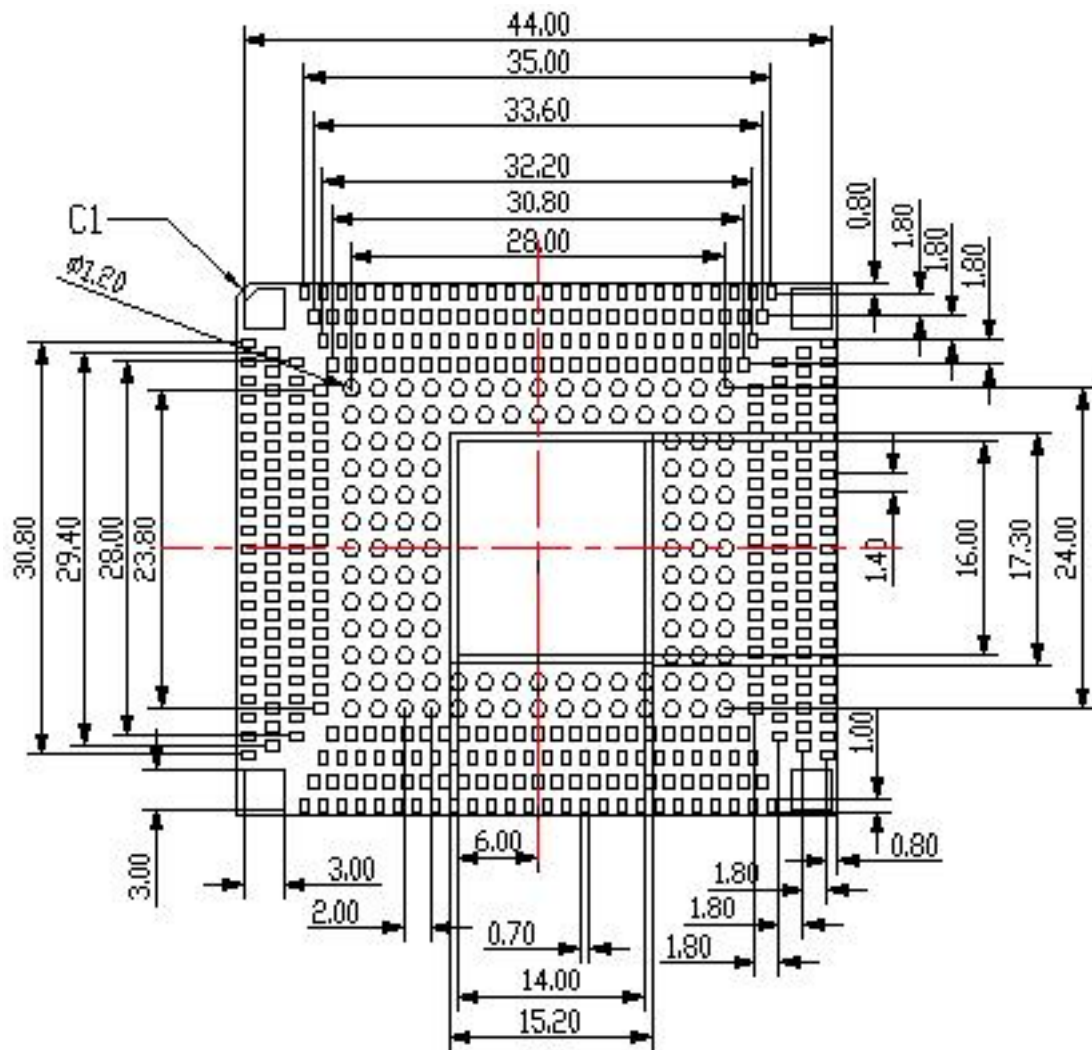


Figure 3.3: Recommended PCB package size (unit: mm)

Note: When designing the base plate, attention should be paid to the need for mirroring during packaging

4 Interface application

4.1 Power Supply

In the case of a battery device, the voltage input range of the module VPH is 3.5V to 4.2V, and the recommended voltage is 3.8V. In the GSM band, when the module is transmitting at maximum power, the peak current can reach up to 4A, resulting in a large voltage drop on VPH.

It is recommended to use a large capacitor regulator close to VPH. It is recommended to use two 47uF ceramic capacitors. Parallel 33PF and 10PF capacitors can effectively remove high frequency interference. To prevent damage to the chip due to ESD and surge, it is recommended to use a suitable TVS tube and a 5.1V/500mW Zener diode at the VPH pin of the module. For PCB layout, the capacitors and diodes should be as close as possible to the VPH pin of the module. The user can directly power the module with a 3.8V lithium-ion battery. When using the battery, the impedance between the VPH pin and the battery should be less than 150mΩ.

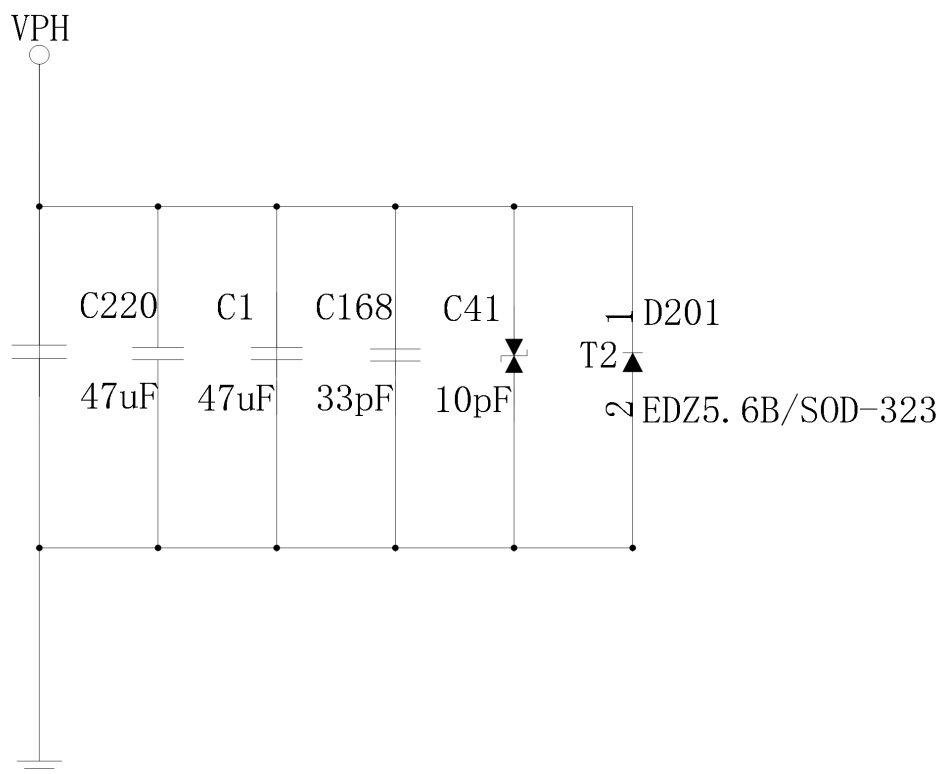


Figure 4.1: VPH input reference circuit

If it is a DC power supply device, the DC input voltage is 5V-12V. The recommended circuit that can be powered by DC-DC is shown below:

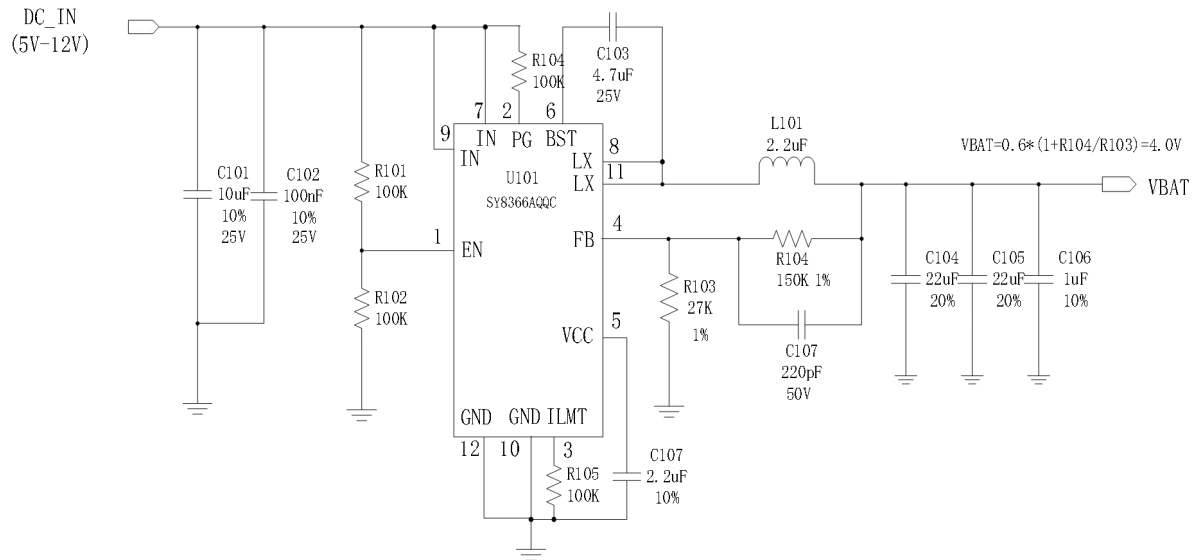


Figure 4.2: DC-DC power supply circuit

4.1.1 Power Pin

VPH pin (208, 209, 211, 212, 214, 215) is used for power input. In the user's design, pay special attention to the design of the power supply section to ensure that the VPH does not fall below 3.5V even when the module consumes 4A. If the voltage drops below 3.5V, the module may shut down. The PCB layout from the VPH pin to the power supply should be wide enough to reduce the voltage drop in the transmit burst mode.



Figure 4.3: VBAT lowest voltage drop

4.2 Power on and off

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

4.2.1 Module Boot

User can power on the module by pulling the PWRKEY pin (86) low. The pull-down time is at least 3 seconds. This pin has been pulled up to 1.8V in the module. The recommended circuit is as follows; or the CBL_PWR_N pin (321) is pulled low. CBL_PWR_N can be powered on by 1K pull-down resistor to GND. It does not need to release this signal after booting.

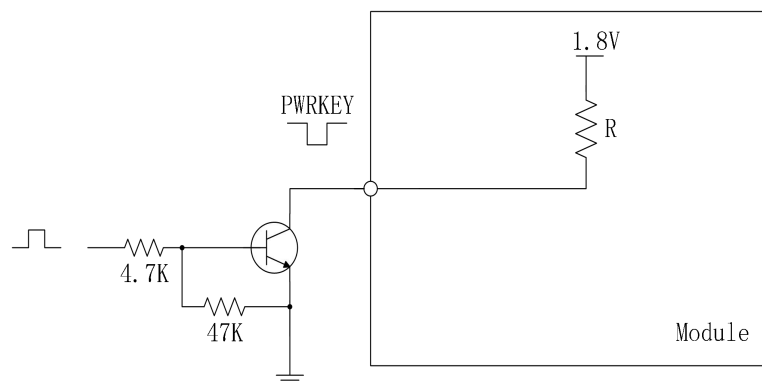


Figure 4.4: Using an external signal to drive the module to boot

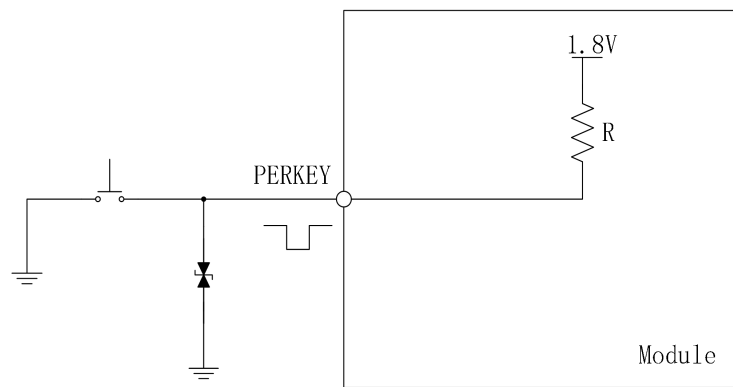


Figure 4.5: Booting with the button circuit

4.2.2 Module Shutdown

Users can use the PWRKEY pin to shut down.

4.2.2.1 PWRKEY Shutdown

The user can turn off the PWRKEY signal by pulling it down for at least 3 seconds. The shutdown circuit can refer to the design of the boot circuit. After the module detects the shutdown action, a prompt window pops up on the screen to confirm whether to perform the shutdown action.

The user can achieve a forced shutdown by pulling PWRKEY down for a long time, pulling down for at least 15 seconds.

4.2.3 Module Reset

The SNM932 module supports a reset function that allows the user to quickly restart the module by pulling the RESET_N pin (PIN89) of the module low. The recommended circuit is as follows:

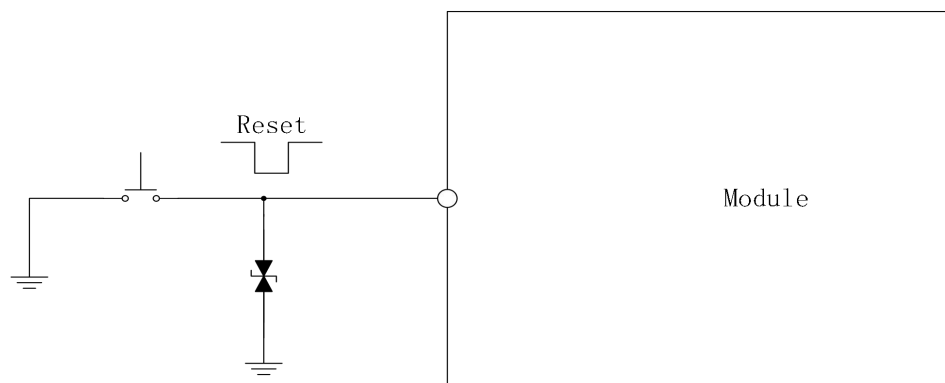


Figure 4.7: Reset using the key circuit

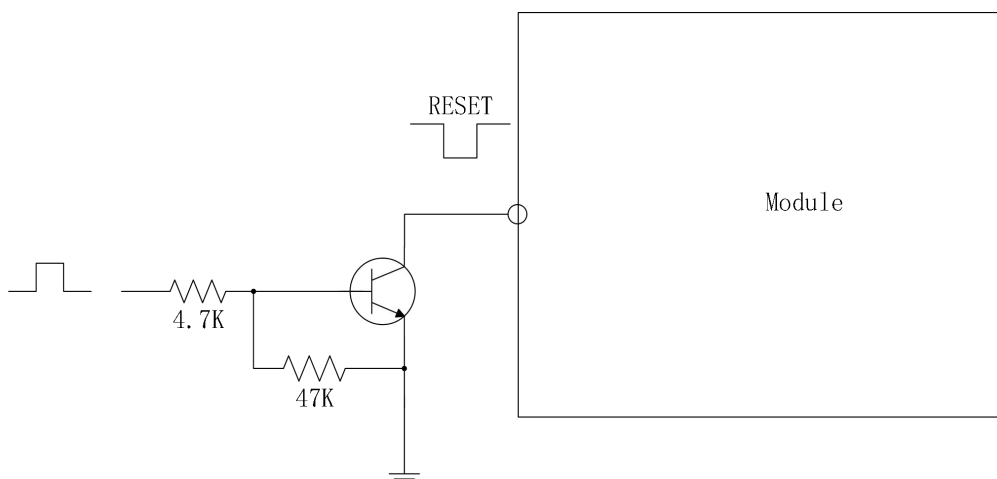


Figure 4.8: Reset Module Using External Signal

When the pin is high, the voltage is typically 1.8V. Therefore, for users with a level of 3V or 3.3V, it is not possible to directly use the GPIO of the MCU to drive the pin. An isolation circuit is required. The hardware parameters of the RESET can refer to the following table:

Table4.1: RESET Hardware Parameters

Pin	Description	Minimum	Typical	Maximum	Unit
RESET_N	Input high level	1.4	1.8	-	V
	Input low level	-	0	0.6	V
	Pull down effective time	500		-	ms

4.3 VCOIN Power

When the VPH is disconnected and the user needs to save the real-time clock, the VCOIN (PIN416) pin cannot be left hanging and should be connected to an external large capacitor or button battery. When an external large capacitor is connected, the recommended value is 10uF. When using an external large capacitor or battery to power the RTC inside the module, the reference design circuit is as follows:

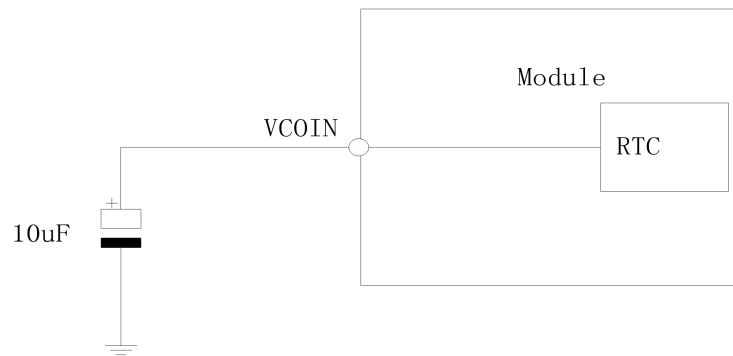


Figure 4.9: External Capacitor Powering the RTC

Rechargeable battery powered:

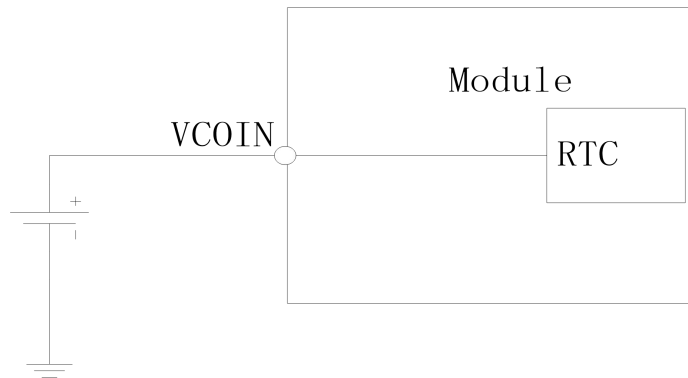


Figure 4.10: Rechargeable battery to power the RTC

Note:

This VCOIN supply has a typical value of 3.0V and consumes about 10uA of current when VBAT is disconnected.

4.4 Power Output

The SNM932 has multiple power outputs. For SD card, sensor, touch panel, USB 3.0, external LDO power supply, etc. In application, it is recommended to add parallel 33PF and 10PF capacitors to each power supply to effectively remove high frequency interference.

Table 4.2: Power Description

Signal	Range(V)	Default Voltage(V)	Drive Current(mA)
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VREG_L9C_2P96	1.65–3.3	2.96	600
VREG_L2C_1P8	1.65–3.54	1.8	100
VREG_L2G_1P2	1.1–1.3	1.2	300
VREG_L14B_1P2	1.1–1.3	1.2	300
VREG_L18B_1P8*	/	1.8	100
VREG_L1C_1P8*	/	1.8	150
VREG_L17B_1P8	1.71–1.95	1.8	100
VREG_S10B_1P8*	/	1.8	100
VREG_L8C_1P8*	/	1.8	100
VREG_L12C_1P8	1.71–1.95	1.8	100
VREG_L3C_2P8/3.0	2.7-3.3	2.8	150
VREG_L7C_3P0	2.7-3.3	3.0	250

“*”: cannot be turned off

4.5 Serial Port

The SNM932 provides six serial ports for communication.

Table 4.3: UART Pin Description

Name	Pin	Direction	Function
GPIO22_DEBUG_UART_TX	358	DI	UART Data Reception (DEBUG UART)
GPIO23_DEBUG_UART_RX	359	DO	UART Data Transmission (DEBUG UART)
GPIO47_UART0_RXD	335	DI	UART Data Reception
GPIO46_UART0_TXD	334	DO	UART Data Transmission
GPIO27*_UART5_RXD	292	DI	UART Data Reception
GPIO26_UART5_TXD	293	DO	UART Data Transmission
GPIO19*_UART6_RX	47	DI	UART Data Reception
GPIO18_UART6_TX	46	DO	UART Data Transmission
GPIO43*_UART4_RXD	391	DI	UART Data Reception
GPIO42_UART4_TXD	390	DO	UART Data Transmission
GPIO40*_UART4_CTS	388	DI	UART Data Transmission
GPIO41*_UART4_RTS	389	D0	UART Data Transmission
GPIO63*_UART3_RXD	394	DI	UART Data Reception
GPIO62_UART3_TXD	393	D0	UART Data Transmission
GPIO60*_UART3_CTS	395	DI	UART Data Transmission
GPIO61*_UART3_RTS	396	D0	UART Data Transmission

If you need to use a four-wire serial port, you can refer to Table 4.3 for multiplexing.
The serial port connection can be referred to the following connection:

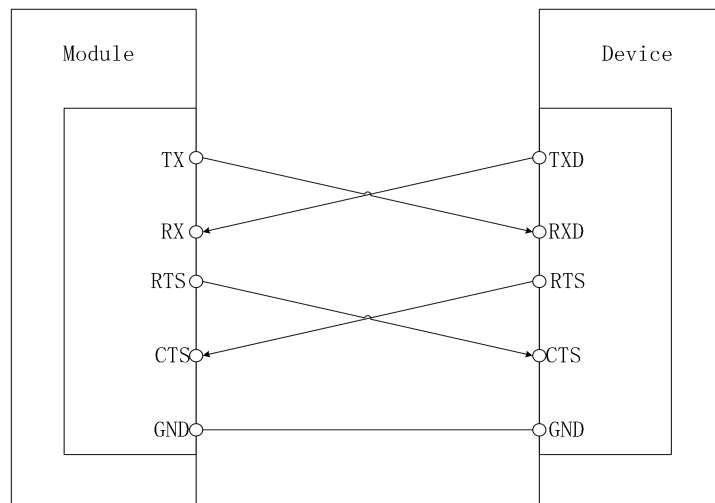


Figure 4.11: Serial Port Connection Diagram

When the serial level used by the user does not match the module, in addition to adding the level shifting IC, the following figure can also be used to achieve level matching. Only the matching circuits on TX and RX are listed here. Other low speed signals can refer to these two circuits.

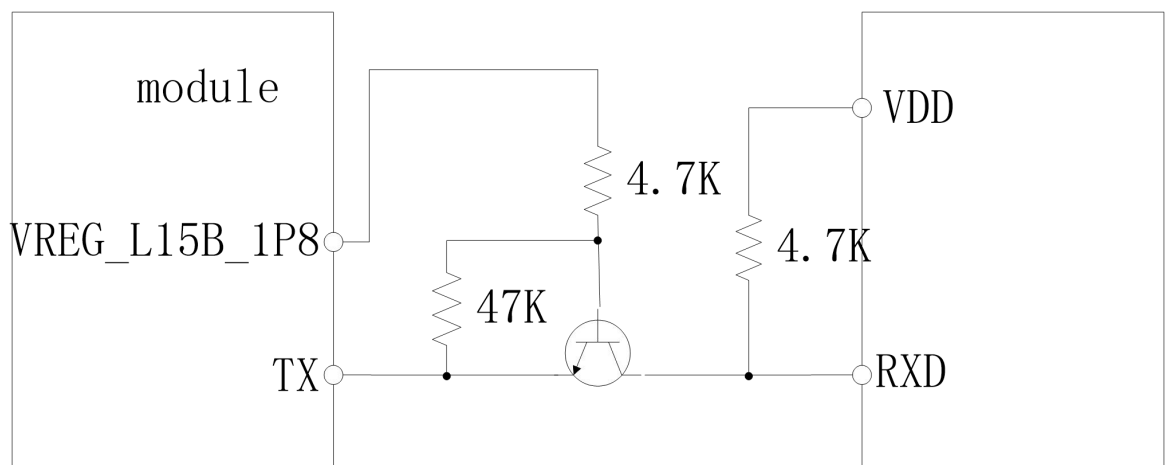


Figure 4.12: TX Connection Diagram

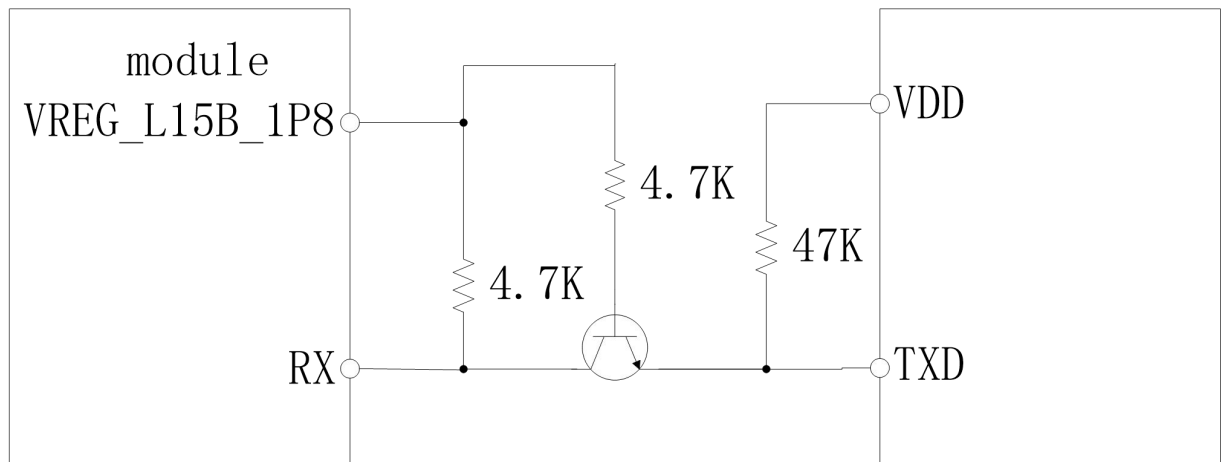


Figure 4.13: RX Connection Diagram

Note: When using Figures 4.14 、 4.15 for level isolation, it is recommended that VREG_L15B_1P8 be used as the pull-up supply.

Table 4.4: Serial Port Hardware Parameters

Description	Minimum	Maximum	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 a CMOS interface, and the RS232 signal cannot be directly connected. If necessary, please use the RS232 conversion chip.
2. If the 1.8V output of the module cannot meet the high-level range of the user terminal, please add a level shifting circuit.

4.6 MIPI Interface

SNM932 supports Mobile Industry Processor Interface (MIPI) interface used for Camera and LCD.

MIPI is a high-speed signal. In the Layout stage, please follow the impedance and length requirements strictly, and control the length of the differential pair within the group and the group length. The total length should be as short as possible.

4.6.1 LCD Interface

SNM932 supports Mobile Industry Processor Interface (MIPI) for Camera and LCD. The resolution of the screen can support up to $3480 \times 2160@120\text{Hz}$ Or $3360 \times 1600@144\text{Hz}$.

MIPI interfaces are high-speed signal lines. During the Layout phase, please strictly follow the impedance and length requirements for routing, control the length of differential pairs within and between groups, and keep the total length as short as possible.

Table 4.5: Screen interface definition

Main display interface			
MIPI_DSI0_CLK_N	170	AO	MIPI_LCD clock
MIPI_DSI0_CLK_P	172	AO	
MIPI_DSI0_LANE0_N	173	AO	MIPI_LCD data
MIPI_DSI0_LANE0_P	175	AO	
MIPI_DSI0_LANE1_N	163	AO	
MIPI_DSI0_LANE1_P	160	AO	
MIPI_DSI0_LANE3_N	158	AO	
MIPI_DSI0_LANE3_P	161	AO	
MIPI_DSI0_LANE2_N	167	AO	
MIPI_DSI0_LANE2_P	169	AO	
GPIO10_LCD_RST_N	351	I/O	LCD reset
GPIO80*_MDP_VSYNC_P	397	I/O	LCD frame sync signal

When customers need compatible screen design, the LCD_ID pin of the LCD should be connected to the ADC of the module, but it should be noted that the output voltage of the LCD_ID cannot exceed the voltage range of the ADC pin.

MIPI belongs to high-speed signal lines. To avoid EMI interference, it is recommended to place a common mode inductor near the LCD side.

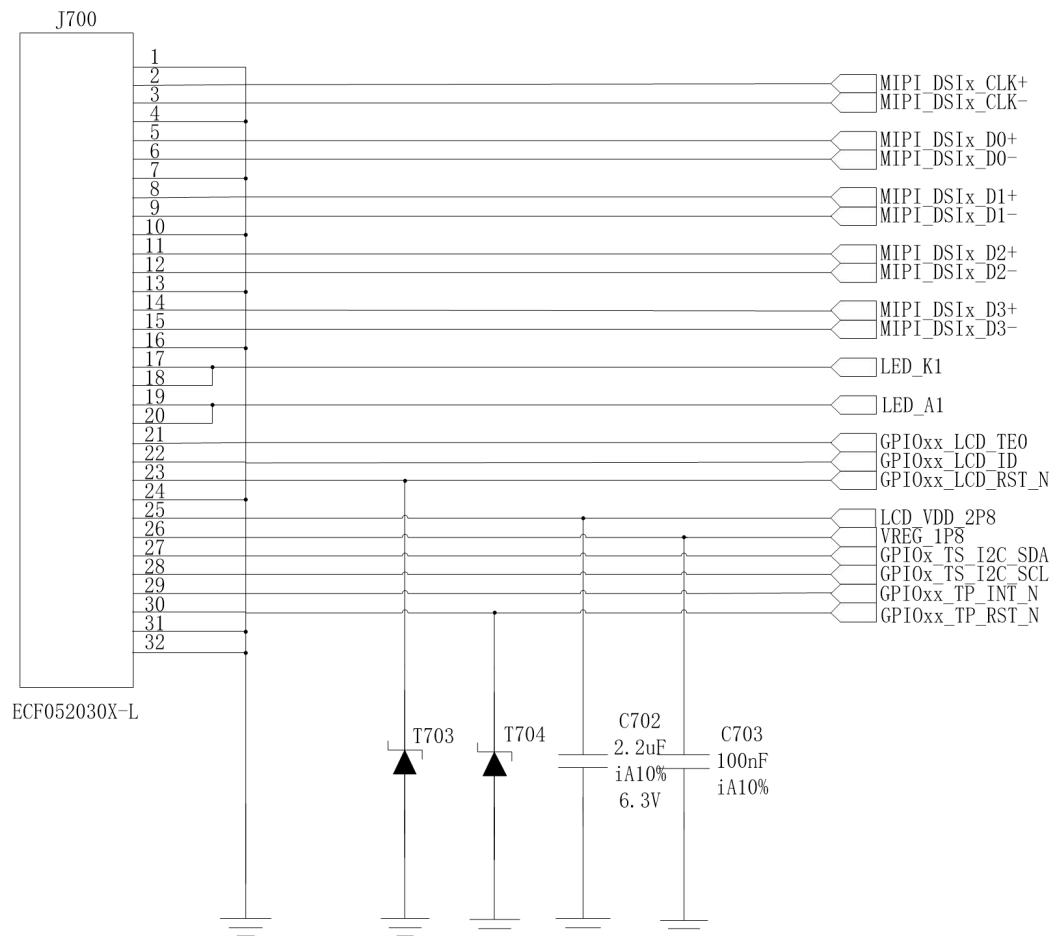


Figure 4.14: LCD interface circuit

The SNM932 module does not support backlight driver output, and the customer needs to use an external backlight driver. The backlight driving circuit can refer to Figure 4.15, and adjusting the backlight brightness can be achieved through the module's PWM_OUT_GPIO9 (PIN205), with PWM mode modulation.

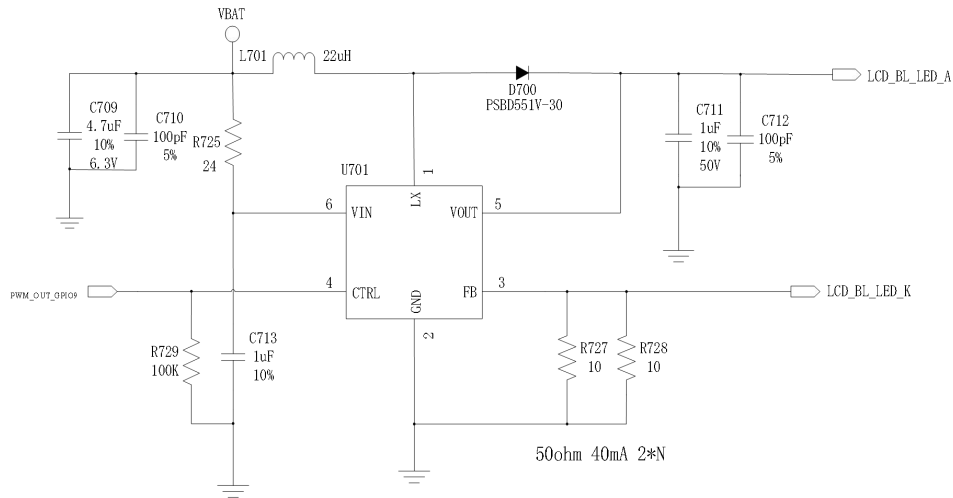


Figure 4.15: Backlight drive schematic

Note: The backlight circuit should be based on the LCD backlight circuit to select the chip, the user should carefully read the LCD document to select the correct driver chip. The reference circuit provided in this document is a series-type PWM dimming backlight driver circuit; if it is a series-type one-line dimming backlight driver circuit, it needs to be controlled by GPIO.

4.6.2 MIPI Camera Interface

SNM932 module supports 5 sets of MIPI camera interface. A single camera can support a maximum of 108 M @ 30 fps; Additionally, it supports three cameras (36 M+36 M+36 M) at 30 fps and dual cameras (64 M+36 M) at 30 fps. The module provides the power required by the Camera, including AVDD-2.8V, AFVDD-2.8V (powered by the focus motor) and D-VDD1.2V (CAM core voltage). D-VDD1.2V (CAM core Voltage) needs the customer to add an external LDO circuit.

Table 4.6: MIPI Camera Interface Definition

CSI0 interface			
Name	Pin	Input/output	Description
MIPI_CSI0_CLK_N	463	AO	Camera0 MIPI clock
MIPI_CSI0_CLK_P	462	AO	
MIPI_CSI0_LANE0_N	243	AI/AO	Camera0 MIPI data
MIPI_CSI0_LANE0_P	240	AI/AO	
MIPI_CSI0_LANE1_N	242	AI/AO	
MIPI_CSI0_LANE1_P	239	AI/AO	
MIPI_CSI0_LANE2_N	235	AI/AO	
MIPI_CSI0_LANE2_P	232	AI/AO	
MIPI_CSI0_LANE3_N	241	AI/AO	

MIPI_CSI0_LANE3_P	238	AI/AO	
CAM_MCLK0	310	DO	Camera0 main clock
GPIO111_CAM0_RST_N	66	PX6-DO	Camera0 reset
GPIO134_CAM0_PWD_N	300	DO	Camera0 dormancy

CSI1 interface			
Name	Pin	Input/output	Description
MIPI_CSI1_CLK_N	249	AO	Camera1 MIPI clock
MIPI_CSI1_CLK_P	246	AO	
MIPI_CSI1_LANE0_N	252	AI/AO	Camera1 MIPI data
MIPI_CSI1_LANE0_P	459	AI/AO	
MIPI_CSI1_LANE1_N	255	AI/AO	
MIPI_CSI1_LANE1_P	458	AI/AO	
MIPI_CSI1_LANE2_N	244	AI/AO	
MIPI_CSI1_LANE2_P	247	AI/AO	
MIPI_CSI1_LANE3_N	248	AI/AO	
MIPI_CSI1_LANE3_P	245	AI/AO	
CAM_MCLK1	311	DO	Camera1 main clock
GPIO126_CAM1_RST_N	61	DO	Camera1 reset
GPIO137_CAM1_PWD_N	301	DO	Camera1 dormancy

CSI2 interface			
Name	Pin	Input/output	Description
MIPI_CSI2_CLK_N	259	AO	Camera2 clock
MIPI_CSI2_CLK_P	256	AO	
MIPI_CSI2_LANE0_N	253	AI/AO	Camera2 data
MIPI_CSI2_LANE0_P	254	AI/AO	
MIPI_CSI2_LANE1_N	260	AI/AO	
MIPI_CSI2_LANE1_P	257	AI/AO	
MIPI_CSI2_LANE2_N	457	AI/AO	
MIPI_CSI2_LANE2_P	258	AI/AO	
MIPI_CSI2_LANE3_N	456	AI/AO	
MIPI_CSI2_LANE3_P	261	AI/AO	

CAM_MCLK2	312	DO	Camera2 main clock
GPIO118_CAM2_RST_N	63	DO	Camera2 reset
GPIO125	385	DO	Camera2 dormancy

CSI3 interface			
Name	Pin	Input/output	Description
MIPI_CSI3_CLK_N	15	AO	Camera3 clock
MIPI_CSI3_CLK_P	447	AO	
MIPI_CSI3_LANE0_N	12	AI/AO	Camera3 data
MIPI_CSI3_LANE0_P	448	AI/AO	
MIPI_CSI3_LANE1_N	13	AI/AO	
MIPI_CSI3_LANE1_P	14	AI/AO	
MIPI_CSI3_LANE2_N	16	AI/AO	
MIPI_CSI3_LANE2_P	17	AI/AO	
MIPI_CSI3_LANE3_N	19	AI/AO	
MIPI_CSI3_LANE3_P	20	AI/AO	
GPIO67_CAM_MCLK3	314	DO	Camera3 main clock
GPIO78_CAM3_RST_N	65	DO	Camera3 reset
GPIO106	308	DO	Camera3 dormancy

CSI4 interface			
Name	Pin	Input/output	Description
MIPI_CSI4_CLK_N	454	AO	Camera4 clock
MIPI_CSI4_CLK_P	270	AO	
MIPI_CSI4_LANE0_N	455	AI/AO	Camera4 data
MIPI_CSI4_LANE0_P	267	AI/AO	
MIPI_CSI4_LANE1_N	453	AI/AO	
MIPI_CSI4_LANE1_P	273	AI/AO	
MIPI_CSI4_LANE2_N	452	AI/AO	
MIPI_CSI4_LANE2_P	276	AI/AO	
MIPI_CSI4_LANE3_N	451	AI/AO	
MIPI_CSI4_LANE3_P	279	AI/AO	
CAM_MCLK4	315	DO	Camera4 main clock
GPIO7*_CAM3_RST_	62	DO	Camera4 reset

GPIO35_CAM4_PWD_N	197	DO	Camera4 dormancy
-------------------	-----	----	------------------

If the user designs to use the CAMERA module with autofocus function, please note that the I2C of the module cannot be directly connected to the AF device. The I2C of the AF device should be connected to the driver chip of CAMERA, and the correct connection is as follows:

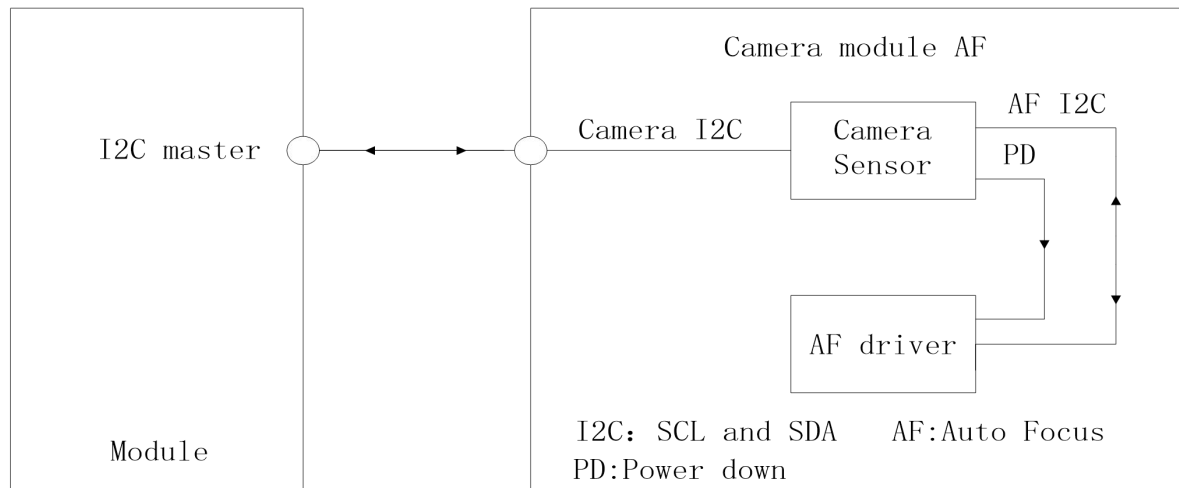


Figure 4.16: CAMERA connection diagram

The MIPI interface has a high rate. The user should control the impedance by $85(\pm 10\%)$ ohms during the routing. Please pay attention to the length of the trace. It is not recommended to add a small capacitor on the MIPI signal line. This may affect the rising edge of the MIPI data. This in turn causes the MIPI data to be invalid.

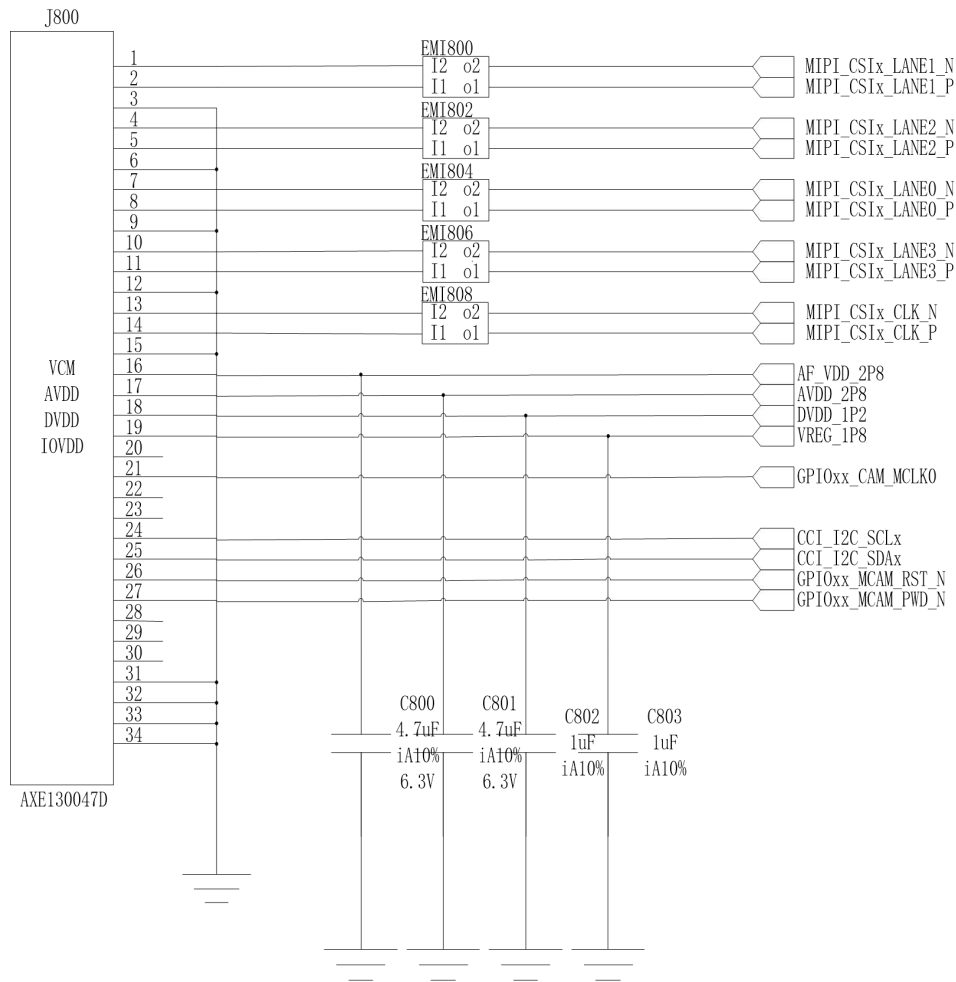


Figure 4.17: MIPI Camera Reference Circuit

MIPI is a high-speed signal line, users must pay attention to the protection of the layout stage, so that it is away from the signal line is easy to be interfered with, it must be done up and down the left and right packet GND processing, the alignment for the differential pair of ways to do the 85 ohm differential impedance matching, in order to ensure the consistency of the impedance as far as possible do not cross the different GND plane.

MIPI interface in the selection of ESD devices, please select a small capacitance TVS, it is recommended that the parasitic capacitance is less than 1pF.

The MIPI alignment requirements are as follows: :

- The total length of the alignment should not exceed 200mm.
- 85 ohm differential impedance control with ± 15 ohm error is required.
- Differential line length error within the group is controlled within 0.7mm.
- The length error between groups is controlled within 1.4mm.

4.7 Capacitive Touch Interface

The module provides a set of I2C interfaces that can be used to connect capacitive touches while providing the required power and interrupt pins. The default interface pins for capacitive touch software are defined as follows:

Table 4.7: Capacitive Touch Interface Definitions

Name	Pin	Input/Output	Description
GPIO52* /TS_SPI_MISO_I2C_SDA	177	I/O	TP_SPI clock, Multiplexing TP_I2C data
GPIO53 /TS_SPI_MOSI_I2C_SCL	180	I/O	TP_SPI chip-select, Multiplexing TP_I2C clock
GPIO54* /TS_SPI_CLK	159	DO	TP_SPI clock
GPIO55* /TS_SPI_CS_N	162	DO	TP_SPI chip-select
GPIO81* /TS_INT_N	349	DI	TP interrupt
GPIO105 /TS_RESET_N	341	DO	TP reset

Note:

The interface definition of the capacitive touch can be adjusted by software, and the user can change the GPIO and I2C according to the design needs.

4.8 PCIe Interface

The module provides a set of PCIe x2 interfaces that can be used to expand Ethernet or USB interfaces. The interface pins are defined in the following table:

Table 4.8: PCIe Interface Definition

Name	Pin	Input/ Output	Description
PCIE1_TX0_M	22	AO	PCIE1 data differential signal
PCIE1_TX0_P	25	AO	
PCIE1_RX0_M	29	AI	
PCIE1_RX0_P	27	AI	
PCIE1_TX1_M	23	AO	
PCIE1_TX1_P	24	AO	
PCIE1_RX1_M	444	AI	
PCIE1_RX1_P	443	AI	
PCIE1_REFCLK_M	26	AO	PCIE clock differential signal

PCIE1_REFCLK_P	28	AO	
GPIO2/PCIE1_RESET_N	49	DO	PCIE1 reset signal
GPIO79*/PCIE1_CLKREQN	50	DO	PCIE1 clock request
GPIO3*/PCIE1_WAKE_N	52	DO	PCIE1 wake-up signal

4.9 I2S Interface

There are 3 sets of I2S interfaces inside the module, and the pins used for this function are listed in the table below:

Table 4.9: I2S pin definitions

Name	Pin	Input/ Output	Description
GPIO97_MI2S0_SCK	103	DO	Generic I2S
GPIO100_MI2S0_WS	104	DO	
GPIO98_MI2S0_DATA0	106	I/O	
GPIO99_MI2S0_DATA1	107	I/O	
GPIO144_QUA_MI2S_SCK	121	DO	Generic I2S
GPIO145_QUA_MI2S_WS	122	DO	
GPIO146_QUA_DATA0	123	I/O	
GPIO147_QUA_DATA1	124	I/O	
GPIO154_I2S2_CLK	125	DO	Generic I2S
GPIO155_I2S2_WS	126	DO	
GPIO156_I2S2_DATA0	127	I/O	
GPIO157_I2S2_DATA1	128	I/O	
GPIO96_MI2S_MCLK	100	DO	Primary I2S main clock

4.10 USB Interface

SNM932 supports one USB 2.0 interface, one USB 3.0 interface, in the Layout must control the 90 ohm differential impedance, and control the external cable length.

The module also supports OTG function. If this function is required, please refer to Figure 4.19 to add an external +5 V power supply.

The VBUS voltage input range is shown in the table below:

Table 4.10: VBUS input range

Name	Description	Minimum	Typical	Maximum	Unit
USB_VBUS	Input range	3.7	-	6	V

The USB plug-in detection of the module is realized by the VBUS and DP/DM data lines. When the USB cable is inserted, the VBUS voltage is detected first, and then the DM/DP pull-up state is detected to determine whether the USB data line or the charger is inserted. Therefore, if you need to use the USB function, please be sure to connect VBUS to the 5V power supply on the data line.

USB is a high-speed mode. It is recommended to connect a common-mode inductor to the side of the USB connector to effectively suppress EMI interference. At the same time, the USB interface is an external interface. The DM/DP must add a TVS tube to prevent static damage caused by plugging and unplugging the data cable. When selecting the TVS, the user should pay attention to the load capacitance of less than 1pf. VBUS also needs to increase the TVS tube. If there is anti-surge demand, it is also necessary to increase the anti-surge tube. The connection diagram is as follows:

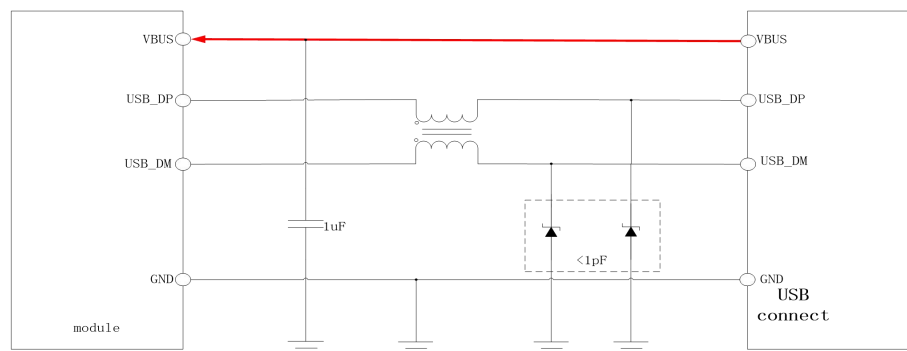


Figure 4.18: USB Connection Diagram

4.10.1. USB OTG

The SNM932 module can provide USB-OTG function. The module does not support external OTG power supply and requires external BUCK 5V output. The pins used for the module interface function are shown in the table below:

Table4.11: USB- OTG pin description

Pin name	Pin	Description
USB0_HS_DM	145	USB 2.0 DM
USB0_HS_DP	142	USB 2.0 DP
USB_ID	399	USB ID
USB1_HS_D_P	425	USB 2.0 DP
USB1_HS_DM	87	USB 2.0 DM

4.11 SD card Interface

SNM932 supports SD card interface.

The reference circuit is as follows:

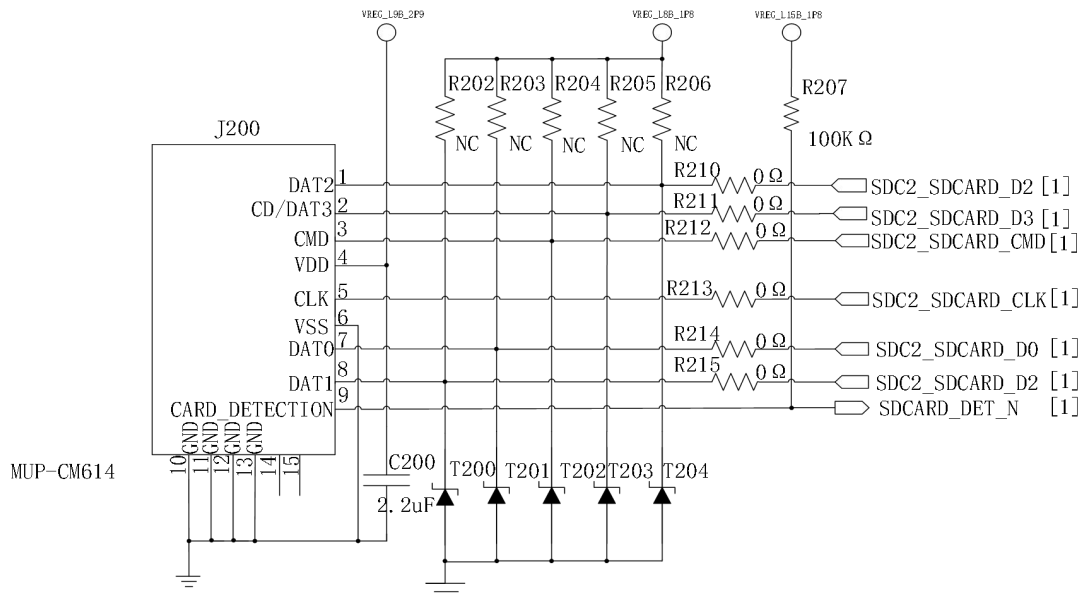


Figure 4.19: SD card interface circuit

4.12 I2C Interface

The SNM932 module supports seven hardware I2C bus interfaces, nine camera specific 4-channel CCI interfaces, two sensor I2C interfaces, and three universal I2C interfaces.

The pin definitions and default functions are shown in the following table:

Table 4.12: I2C interface pin description

Name	Pin	Default function
CCI_I2C0_SDA	39	CAM-specific I2C signals
CCI_I2C0_SCL	42	
CCI_I2C1_SDA	45	CAM-specific I2C signals
CCI_I2C1_SCL	48	
CCI_I2C2_SDA	51	CAM-specific I2C signals

CCI_I2C2_SCL	54	
GPIO75/CCI_I2C3_SDA	57	CAM-specific I2C signals
GPIO76/CCI_I2C3_SCL	60	
GPIO4*_APPS_I2C_SDA	105	Generic I2C
GPIO5_APPS_I2C_SCL	108	
MAG_ALPS_I2C_SDA	134	I2C for Sensor
MAG_ALPS_I2C_SCL	135	
SENSOR_I2C_SDA	140	I2C for Sensor
SENSOR_I2C_SCL	141	
GPIO36/I2C3_SDA	380	Generic I2C
GPIO37/I2C3_SCL	381	
GPIO0/I2C2_SDA	287	Generic I2C
GPIO1/I2C2_SCL	286	

Note: Connect a 2.2K Ω pull-up resistor to 1.8V when used as an I2C bus interface, refer to Table 3.1- I2C Interface.

4.13 Analog to Digital Converter (ADC)

The SNM932 module is provided with four ADC input ports ADC2 (PIN322) and ADC3 (PIN338) by the power management chip. Its performance parameters are shown in the following table:

Table 4.13: ADC performance parameters

Description	Minimum	Typical	Maximum	Unit
Input Voltage Range	0		1.875	V
Analog Input Bandwidth	-	500	-	kHz
Sampling Frequency	-	4.8	-	MHz

4.14 PWM

The PWM_oUT_GPIO9 (PIN205) pin can be used for LCD backlight adjustment, adjusting the backlight brightness by adjusting the duty cycle.

4.15 Antenna Interface

The module provides 2 antenna interfaces for WiFi_6G, WiFi/ BT_2.4G antenna. In order to ensure that the user's product has good wireless performance, the antenna selected by the user should meet the requirements of input impedance of 50 ohms and VSWR of less than 2 in the operating frequency band.

4.15.1 Wi-Fi/BT antenna

The module provides the Wi-Fi/BT antenna pin RF_WIFI/BT. The antenna on the user's motherboard should be connected to the antenna pin of the module using a 50ohm microstrip line or strip line.

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

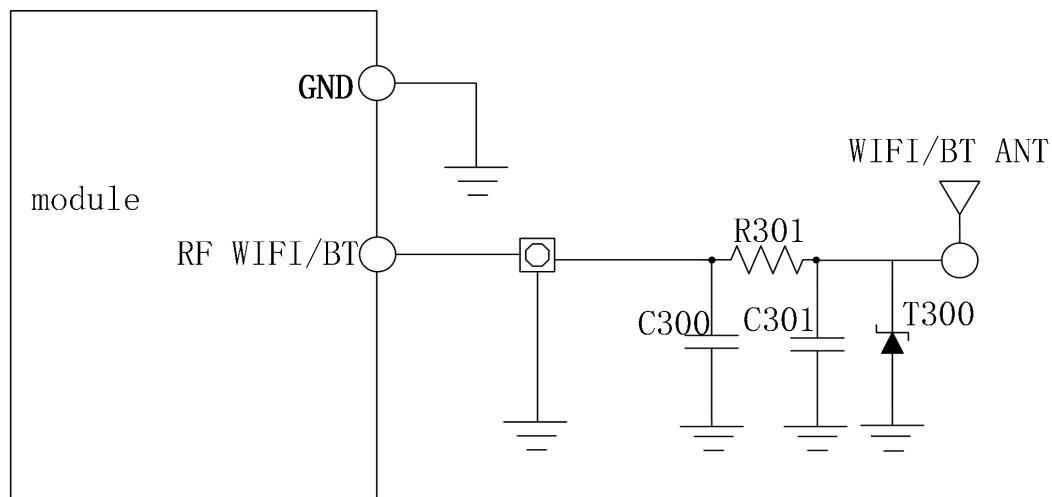


Figure 4.20: WiFi/BT antenna interface connection circuit

Note: In the figure, R301, C300, and C301 are antenna matching devices, and the specific component values can be determined after the antenna factory debugs the antenna. Among them, R301 defaults to 0R, C300 and C301 do not paste by default.

If there are fewer components between the antenna and the module output, or if the RF test head is not needed in the design, the antenna matching circuit can be simplified as shown below:

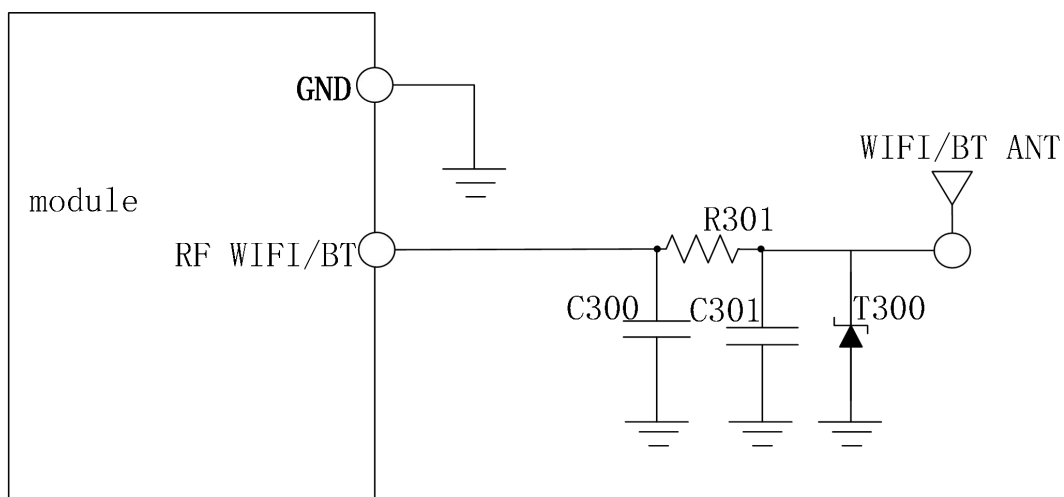


Figure 4.21: WIFI_BT antenna interface simplified connection circuit

Note: In the figure, R301 defaults to 0R, and C300 and C301 do not paste by default.

5 Electrical, Reliability

5.1 Absolute Maximum

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

Table 5.1: Absolute Maximum

Parameter	Minimum	Typical	Maximum	Unit
VPH	-0.3	-	5	V
VBUS	--0.3	-	14	V
Peak current	-	-	3	A

5.2 Working Temperature

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

Table 5.2: Module Operating Temperature

Parameter	Minimum	Typical	Maximum	Unit
Working temperature	-25	-	75	°C
Storage temperature	-40	-	90	°C

5.3 Working Voltage

Table 5.3: Module Operating Voltage

Parameter	Minimum	Typical	Maximum	Unit
VPH	3.5	3.8	4.2	V
VBUS	3.7	-	6	V
Hardware shutdown voltage		3.4	-	V

5.4 Digital Interface Features

Table 5.4: Digital Interface Features (1.8V)

Parameter	Description	Minimum	Typical	Maximum	Unit
V _{IH}	Input high level voltage	1.17	-	2.1	V
V _{IL}	Input low level voltage	-0.3	-	0.63	V
V _{OH}	Output high level voltage	1.35	-	1.8	V
V _{OL}	Output low level voltage	0	-	0.45	V

5.5 PWRKEY Feature

Table 5.5: PWRKEY Characteristics

Parameter	Description	Minimum	Typical	Maximum	Unit
PWRKEY	High level	1.4	1.8	1.96	V
	Low level	-	0	0.6	V
	Effective time	3000			ms

5.6 VCOIN Feature

Table 5.6: VCOIN Characteristics

Parameter	Description	Minimum	Typical	Maximum	Unit
VCOIN-IN	VCOIN input voltage	2	3	3.25	V
IRTC-IN	VCOIN Current consumption	-	TBD	-	uA
VCOIN-OUT	VCOIN Output voltage	2.5	3	3.2	V
IRTC-OUT	VCOIN Output current	-	TBD	-	uA

5.7 Electrostatic Protection

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

5.8 WIFI Main RF Performance

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

Table 5.7: Main RF performance parameters under WIFI conduction

Transmission performance			
	2.4G	5-7G	

	802.11B	802.11G	802.11N	802.11N	802.11A	802.11AC	802.11AX/BE	
Transmit power (minimum rate)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	dBm
Transmit power (maximum rate)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	dBm
EVM (maximum rate)	TBD	TBD	TBD	TBD	TBD	TBD	TBD	dB
Receiving performance								
	2.4G			5-7G				
Receiving sensitivity	802.11B	802.11G	802.11N	802.11N	802.11A	802.11AC	802.11AX/BE	
Minimum rate	TBD	TBD	TBD	TBD	TBD	TBD	TBD	dBm
Maximum rate	TBD	TBD	TBD	TBD	TBD	TBD	TBD	dBm

5.9 BT Main RF Performance

The table below lists the main RF performance under BT conduction.

Table 5.8: Main RF performance parameters under BT conduction

Transmission performance				
Transmit power	BR	EDR	BLE	
	TBD	TBD	TBD	dBm
Receiving performance				
Receiving sensitivity	BR	EDR	BLE	
	TBD	TBD	TBD	dBm

6 Production

6.1 Top and Bottom Views of The Module

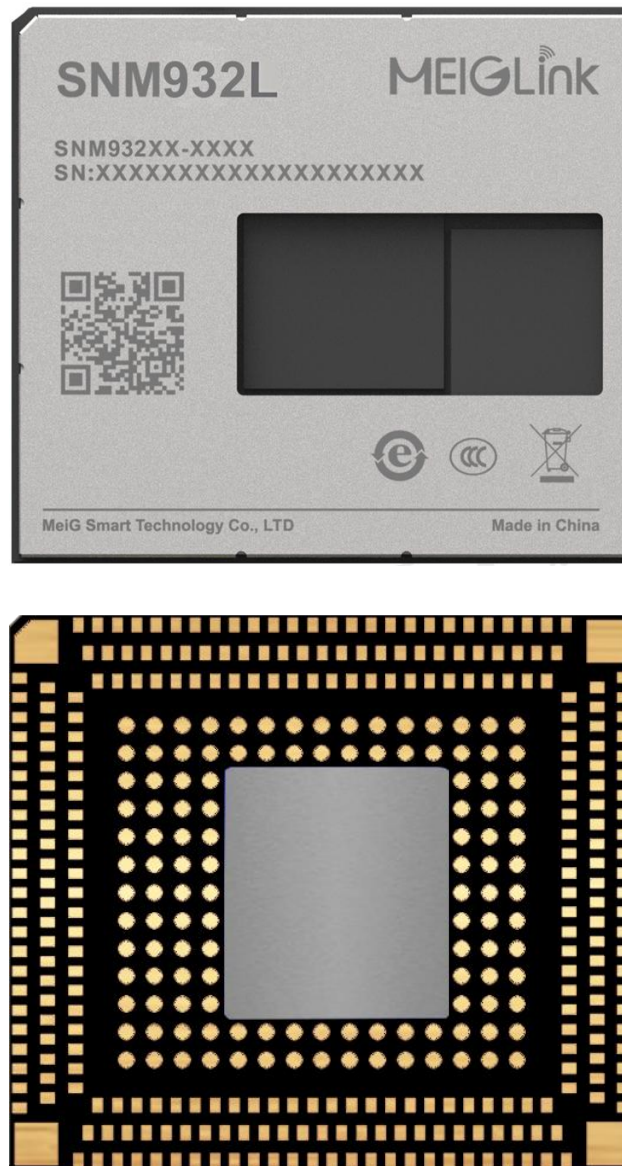


Figure 6.1: Module top
and bottom views

6.2 Recommended Soldering Furnace Temperature Curve

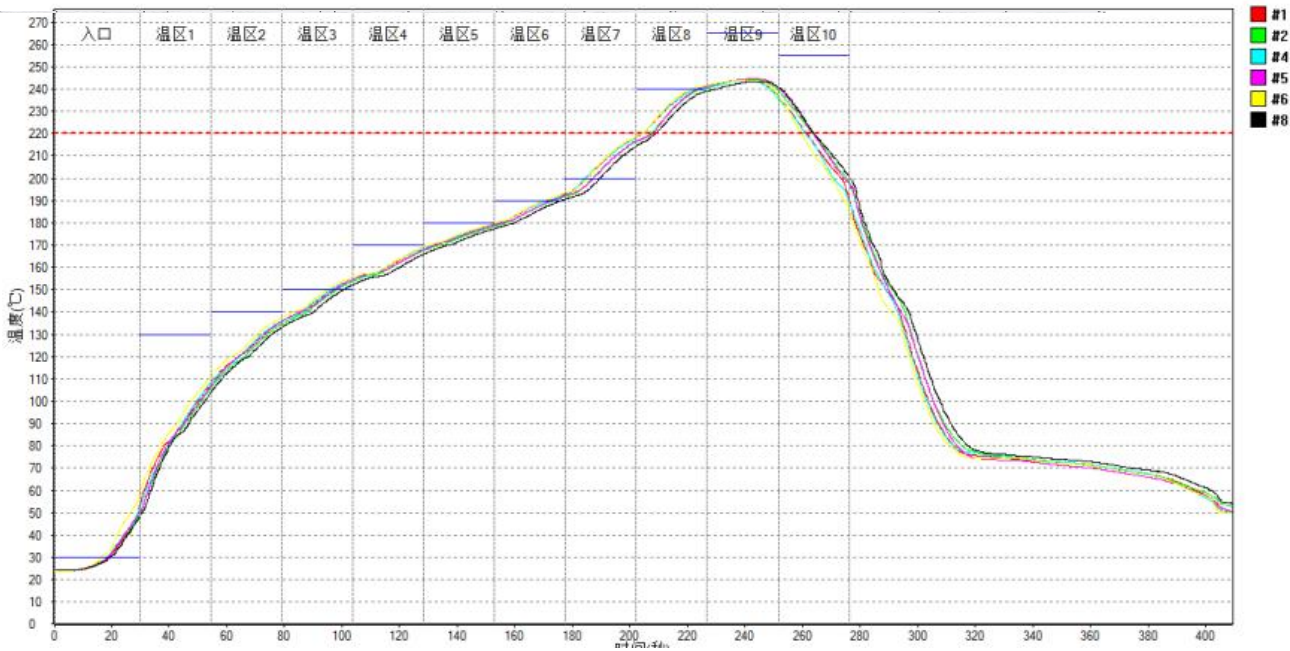


Figure 6.2: Module recommended soldering furnace temperature curve

6.3 Humidity Sensitivity (MSL)

The SNM932 module meets moisture sensitivity level 3. The dry package is subjected to the J-STD-020C specification in accordance with the IPC/JEDEC standard under ambient conditions of temperature $<30^{\circ}\text{C}$ and relative humidity $<60\%$. Under ambient conditions of temperature $<40^{\circ}\text{C}$ and relative humidity $<90\%$, the shelf life is at least 6 months without unpacking. After unpacking, the table below lists the shelf life of the modules for different moisture sensitivity levels.

Table6.1: Humidity sensitivity level distinction

Grade	Factory environment $\leq+30^{\circ}\text{C}/60\%\text{RH}$
1	Indefinite quality in the environment $\leq+30^{\circ}\text{C}/85\%\text{RH}$ Under conditions

2	1 year
2a	4 weeks
3	168 hours
4	72 hours
5	48 hours
5a	24 hours
6	Use it after forced baking. After baking, the module must be patched within the time limit specified on the label.

After unpacking, the SMT patch should be taken within 168 hours under ambient conditions of $<30^{\circ}\text{C}$ and relative humidity $<60\%$. If the above conditions are not met, baking is required. Note: Oxidation risk: Baking SMD packages can cause metal oxidation and, if excessive, can cause solderability problems during board assembly. The temperature and time of the SMD package are baked, thus limiting solderability considerations. The accumulation of baking time should be no more than 96 hours at temperatures above 90°C and as high as 125°C .

6.4 Baking Requirements

Due to the humidity sensitivity of the module, the SNM932 should be thoroughly baked prior to reflow soldering, otherwise the module may cause permanent damage during reflow soldering. The SNM932 should be baked for 192 hours in a cryogenic vessel at $40^{\circ}\text{C} +5^{\circ}\text{C}/-0^{\circ}\text{C}$ and a relative humidity of less than 5%, or in a high temperature vessel at $80^{\circ}\text{C}\pm 5^{\circ}\text{C}$. Bake for 72 hours. Users should note that the tray is not resistant to high temperatures. The user should take the module out of the tray for baking, otherwise the tray may be damaged by high temperature.

Table 6.2: Baking requirements

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

6.5 Description of module warping and measurement method

Module factory lifting control standard: $\leq 0.15\text{MM}$

7 Appendix

7.1 Related Documents

Table 7.1: Related documents

Serial number	File name	Comment
[1]	GSM 07.07:	Digital cellular telecommunications (Phase 2+); AT command set for GSM Mobile Equipment (ME)
[2]	GSM 07.10:	Support GSM 07.10 multiplexing protocol
[3]	GSM 07.05:	Digital cellular telecommunications(Phase 2+); Use of Data Terminal Equipment–Data Circuit terminating Equipment(DTE–DCE) interface for Short Message service(SMS)and Cell Broadcast Service(CBS)
[4]	GSM 11.14:	Digital cellular telecommunications system (Phase 2+);Specification of the SIM Application Toolkit for the Subscriber Identity Module–Mobile Equipment (SIM–ME) interface
[5]	GSM 11.11:	Digital cellular telecommunications system (Phase 2+);Specification of the Subscriber Identity Module – Mobile Equipment (SIM–ME) interface
[6]	GSM 03.38:	Digital cellular telecommunications system (Phase 2+); Alphabets and language-specific information
[7]	GSM 11.10	Digital cellular telecommunications system (Phase 2); Mobile Station (MS) conformance specification; Part 1: Conformance specification
[8]	AN_Serial Port	AN_Serial Port

7.2 Terms and Explanations

Table 7.2: Terms and explanations

Terms	Explanations
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-Rate
CS	Coding Scheme
CSD	Circuit Switched Data

CTS	Clear to Send
DTE	Data Terminal Equipment (typically computer, terminal, printer)
DTR	Data Terminal Ready
DTX	Discontinuous Transmission
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
ESD	Electrostatic Discharge
ETS	European Telecommunication Standard
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
IMEI	International Mobile Equipment Identity
Li-ion	Lithium-Ion
MO	Mobile Originated
MS	Mobile Station (GSM engine), also referred to as TE
MT	Mobile Terminated
PAP	Password Authentication Protocol
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PCL	Power Control Level
PCS	Personal Communication System, also referred to as GSM 1900
PDU	Protocol Data Unit
PPP	Point-to-point protocol
RF	Radio Frequency
RMS	Root Mean Square (value)
RX	Receive Direction
SIM	Subscriber Identification Module
SMS	Short Message Service
TDD	Time Division Distortion
TE	Terminal Equipment, also referred to as DTE

TX	Transmit Direction
UART	Universal Asynchronous Receiver & Transmitter
URC	Unsolicited Result Code
USSD	Unstructured Supplementary Service Data
Phone book abbreviation	Explanations
FD	SIM fix dialing phonebook
LD	SIM last dialing phonebook (list of numbers most recently dialed)
MC	Mobile Equipment list of unanswered MT calls (missed calls)
ON	SIM (or ME) own numbers (MSISDNs) list
RC	Mobile Equipment list of received calls
SM	SIM phonebook
NC	Not connect

8. Appendix B: Warning language

8.1 CE Warning Language

EU regulatory conformance:

RF exposure information: The Maximum Permissible Exposure (MPE) level has been calculated based on a distance of 20cm between the device and the human body. To maintain compliance with RF exposure requirement, use product that maintain a 20cm distance between the device and human body.

Hereby,[MeiG Smart Technology Co., Ltd] declares that the radio equipment type [model] is in compliance with Directive 2014/53/EU. The full text of the EU declaration of conformity is available at the following internet address:<https://www.meigsmart.com>.

Manufacturer information:

Company name: MeiG Smart Technology Co., Ltd

Address: 2nd Floor,Office Building,No.5 Lingxia Road,Fenghuang,Fuyong Street,Bao'an District,Shenzhen City. China

The 5150 to 5350 MHz and 5945 to 6425 frequency range is restricted to indoor use only in: AT, BE, BG, CH, CY,CZ, DE, DK, EE, EL, ES, FI, FR, HR, HU, IE, IS, IT, LI, LT, LU, LV, MT, NL, NO, PL, PT, RO, SE, SI, SK, TR, UK(NI).

Operation temperature: -30°C~ 75°C

Operation frequency(Max power)

Bluetooth: 2402-2480 (10.6dBm)

Wifi:

2412MHz-2472MHz(18dBm)

5150MHz-5250MHz(17.8dBm)

5250MHz-5350MHz(17.8dBm)

5470MHz-5725MHz(17.8dBm)

5745MHz-5850MHz(13.9dBm)

5945MHz-6425MHz(17.8dBm)

8.2 FCC& IC Warning Language

OEM INTEGRATION INSTRUCTIONS:

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

The module must be installed in the host equipment such that 20 cm is maintained between the antenna and users, and the transmitter module may not be co-located with any other transmitter or antenna. The module shall be only used with the internal on-board antenna that has been originally tested and certified with this module. External antennas are not supported. As long as these 3 conditions above are met, further transmitter test will not be required.

However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheral requirements, etc.). The end-product may need Verification testing, Declaration of Conformity testing, a Permissive Class II Change or new Certification. Please involve a FCC certification specialist in order to determine what will be exactly applicable for the end-product.

Validity of using the module certification:

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization for this module in combination with the host equipment is no longer considered valid and the FCC ID of the module cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization. In such cases, please involve a FCC certification specialist in order to determine if a Permissive Class II Change or new Certification is required.

Upgrade Firmware:

The software provided for firmware upgrade will not be capable to affect any RF parameters as certified for the FCC for this module, in order to prevent compliance issues.

End product labeling:

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: 2APJ4-SNM932”.

Information that must be placed in the end user manual:

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

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.

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

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

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

WARNING

Changes or modifications not expressly approved by the manufacturer could void the user' s authority to operate the equipment.

“CAUTION : Exposure to Radio Frequency Radiation.

Antenna shall be mounted in such a manner to minimize the potential for human contact during normal operation. The antenna should not be contacted during operation to avoid the possibility of exceeding

the FCC radio frequency exposure limit.

FCC Radiation Exposure Statement:

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

IC Information

This device complies with Industry Canada license-exempt RSS standard(s). Operation is subject to the following two conditions:

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

Cet appareil est conforme avec Industrie Canada exempts de licence standard RSS (s). L'operation est soumise aux deux conditions suivantes:

- (1) cet appareil ne peut causer d'interferences, et*
- (2) cet appareil doit accepter toute interference, y compris les interferences qui peuvent causer un mauvais fonctionnement de l'appareil.*

The end product must be labeled to display the Industry Canada certification number of the module.

Contains transmitter module IC: 23860-SNM932

Le dispositif d'accueil doivent etre etiquetes pour afficher le numero de certification d'Industrie Canada du module. Contient module emetteur IC: 23860-SNM932

*** This device is going to be operated in 5 150 MHz ~ 5 250 MHz frequency range, it is restricted in indoor environment only.**

Information for OEM Integrator

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

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

End product labelling

The label for end product must include

“Contains FCC ID: 2APJ4-SNM932, Contains IC: 23860-SNM932”.

“CAUTION: Exposure to Radio Frequency Radiation.

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment.

MeiG Smart Technology Co., Ltd

This equipment should be installed and operated with minimum distance of 20cm between the radiator and your body. This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users."

Requirement per KDB996369 D03

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 FCC part 15C(15.247). part 15E(15.407)

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 Dipole 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-SNM932.

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 a Dipole Antenna, and the antenna use a permanently attached antenna which is unique.

Frequency range (MHz)		Manufacturer	Peak gain (dBi)	Antenna type
BT	2400-2483.5	TOXU TECHNOLOGY CO., LTD.	3.95	Dipole Antenna
WIFI 2.4G	2412-2472	TOXU TECHNOLOGY CO., LTD.		Dipole Antenna
WIFI 5G	5151-5250	TOXU TECHNOLOGY CO., LTD.	2.7	Dipole Antenna
	5250-5350	TOXU TECHNOLOGY CO., LTD.	2.07	Dipole Antenna
	5470-5725	TOXU TECHNOLOGY CO., LTD.	1.48	Dipole Antenna
	5725-5850	TOXU TECHNOLOGY CO., LTD.	1.48	Dipole Antenna
WIFI 6G	5925-6425	TOXU TECHNOLOGY CO., LTD.	0.96	Dipole Antenna
	6425-6525	TOXU TECHNOLOGY CO., LTD.	0.75	Dipole Antenna
	6525-6875	TOXU TECHNOLOGY CO., LTD.	0.77	Dipole Antenna
	6875-7125	TOXU TECHNOLOGY CO., LTD.	1.56	Dipole Antenna

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-SNM932”

2.9 Information on test modes and additional testing requirements%

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.

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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.

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