Fibocom

Perfect Wireless Experience
完美无线体验

SC806 Hardware User Manual

Version: V2.0.0

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Version history

Version	Update date	Description
V1.0.0	02-23-2017	Initial version
V1.0.1	06-19-2017	1. Modify SD card power L12 description 2. Modify the PMU_GPIO voltage description 3. Modify the LED charging indicator pin description 4. Modify motor drive pin description 5. Modify the mandatory download pin description 6. Modify WIFI reception sensitivity 802.11g rate 7. Add SC806-CN-02 product description
V1.0.2	01-12-2018	Add headphone MIC design note
V2.0.0	04-27-2018	Optimized version Add supported band descriptions of other sc806 models

Copyright

Notice

The document is subject to update from time to time owing to the product version upgrade or other reasons. Unless otherwise specified, the document only serves as the user guide. All the statements, information and suggestions contained in the document do not constitute any explicit or implicit guarantee.

The statements should be displayed in the user manual:
changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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.
This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.
This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.
This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.

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 the Max allowed antenna gain is as following table showed:

Operating Band	Antenna Gain (dBi)
WCDMA BAND II	8.05
WCDMA BAND IV	5.50
WCDMA BAND V	12.1
LTE BAND 2	8.55
LTE BAND 4	6.00
LTE BAND 5	12.6
LTE BAND 12	12.6
LTE BAND 13	12.6
LTE BAND 17	12.6
BT/WIFI Test Gain	Antenna Gain (dBi)
2.4G WiFi	2.5
WIFI 5G	2.1

2) The transmitter module may not be co-located with any other transmitter or antenna. As long as 2 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

Host manufacturer is responsible for ensuring that the host continues to be compliant with the Part 15 subpart B unintentional radiator requirements after the module is installed and operational.

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

End Product Labeling

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: ZMOSC806AM**".The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

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

Trademark

The trademark is registered and owned by Fibocom Wireless Inc.

Applicable model

S/N	Product model	Description
1	SC806-CN-00	NA
2	SC806-CN-02	Do not support LTE diversity reception. Others are the same as SC806-CN-00.
3	SC806-AM-00	support 5G WIFI
4	SC806-AB-00	support 5G WIFI
5	SC806-AE-00	support 5G WIFI
6	SC806-CN-01	NA

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1 Foreword

1.1 Introduction

This document describes the electrical characteristics, RF performance, structure size, application environmentand other information ofSC806 module. With the help of this document and other related documents, application developers can quickly understand the hardware functions of SC806 module and implement the hardware development of products..

1.2 Reference Standards

This design of the product complies with the following standards:

- 3GPP TS 51.010-1 V10.5.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification
- 3GPP TS 34.121-1 V10.8.0: User Equipment (UE) conformance specification;Radio transmission and reception (FDD);Part 1: Conformance specification
- 3GPP TS 34.122 V10.1.0: Technical Specification Group Radio Access Network; Radio transmission and reception (TDD)
- 3GPP TS 36.521-1 V10.6.0: User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance testing
- 3GPP TS 21.111 V10.0.0: USIM and IC card requirements
- 3GPP TS 51.011 V4.15.0: Specification of the Subscriber Identity Module -Mobile Equipment (SIM-ME) interface
- 3GPP TS 31.102 V10.11.0: Characteristics of the Universal Subscriber Identity Module (USIM) application
- 3GPP TS 31.11 V10.16.0: Universal Subscriber Identity Module (USIM) Application Toolkit(USAT)
- 3GPP TS 36.124V10.3.0: ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment
- 3GPP TS 27.007 V10.0.8: AT command set for User Equipment (UE)
- 3GPPTS27.005 V10.0.1: Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)

1.3 Related documents

N/A

2 Product Overview

2.1 Description

Fibocom's SC806 module is a smart module based on the Qualcomm MSM8909 platform. The SC806 integrates core components such as Baseband, EMCP, PMU, Transceiver, and PA to support multi-standard long-distance communication modes such as FDD/TDD-LTE, WCDMA, TD-SCDMA, CDMA, CDMA2000-EVDO, GSM, and WIFI/BT short-distance wireless transmission technology. It supports GNSS wireless positioning technology. SC806 is embedded with Android operating system, and has various interfaces such as MIPI/USB/UART/SPI/I2C. It is the optimal solution for the core system of wireless smart products.

The SC806 module supports multiple formats and frequency bands. The corresponding standard and frequency band are as follows:

Table1SC806-AM-00 Supported band

Mode	Band
WCDMA	Band 2/4/5
FDD-LTE	Band2/4/5/12/13/17
WIFI802.11 a/b/g/n	2412-2462 MHz，5180-5825 MHz
BT4.1 LE	2402-2480 MHz
GNSS	GPS /GLONASS /BeiDou

The SC806 is a module with 210 pins, including 146 LCC pins and 64 LGA pins. The size is 40.5mm × 40.5mm × 2.8mm. It can be embedded in various M2M products through welding plate. It is very suitable for the development of mobile devices such as on-board computers, multimedia devices, smart homes, and Internet of Things devices.

2.2 Main Performance

The following table describes the detailed performance parameters of the SC806

Table2Main performance parameters

Performance	Description
Power	DC 3.3-4.5V, typical voltage: 3.8V
Application CPU	Qualcomm's® MSM8909:Quad-ARM®Cortex™-A7application processors up to 1.1GHz + 512KB L2 cache
Multimedia CPU	QDSP6 v5 Core Operating frequency691.2MHz 768KB L2

Memory	8Gb LPDDR3+ 8 GB eMMC Flash
Operating system	Android　Lollipop
Power class	Class 3 (24dBm+1/-3dB) for WCDMA bands Class 3 (23dBm±2dB) for LTE FDD bands
GSM/GPRS/EDGE characteristics	R99： CSD transmission rate: 9.6kbps, 14.4kbps GPRS： Support GPRS multi-slot class 33 Coding formats: CS-1/CS-2/CS-3 and CS-4 frame maximum 5Rx time slots EDGE： Support EDGE multi-slot class 33 Support GMSK and 8-PSK Uplink encoding format:CS 1-4 and MCS 1-9 Downlink encoding format:CS 1-4 and MCS 1-9
WCDMAcharacteristics	Support3GPP R8 DC-HSPA+ Support16-QAM，64-QAM and QPSK modulation 3GPP R6 CAT6 HSUPA: Maximum uplink rate 5.76Mbps 3GPP R8 CAT24 DC-HSPA+: Maximum downlink rate 42Mbps
CDMA/EVDOcharacteristics	Support CDMA 1X Advanced，1XEV-DOr0/-DOrA Maximum uplink rate 1.8Mbps, maximum downlink rate3.1Mbps
TD-SCDMAcharacteristics	Support CCSA Release 4 Maximum uplink rate 2.2Mbps, maximum downlink rate 4.2Mbps
LTEcharacteristics	Support FDD/TDD CAT4 Support 1.4-20MRF bandwidth Downlink support multi-userMIMO Maximum uplink rate50Mbps, maximum downlink rate 150Mbps
WLANcharacteristics	2.4G wifiSupport802.11b/g/n，5G wifiSupport802.11a/n Maximum rate 150Mbps Support AP mode
Bluetoothcharacteristics	BT4.1（BR/EDR+BLE)
Satellite positioning	GPS/GLONASS/BeiDou
Short Message（SMS）	Text and PDU modes Point to point MO and MT SMS cell broadcast SMS storage: stored by default in the module
LCMinterface	4 sets MIPI_DSI, each set supports up to 1.5Gbps SupportWVGA（2 sets MIPI_DSI）, up to 720P (4 sets MIPI_DSI) 24bit color depth
Camera interface	Use MIPI_CSI, each set supports up to 1.5Gbps and supports 2 cameras Rear camera uses 2 sets MIPI_CSI, up to 8MP pixels Front camera uses 1 set MIPI_CSI, up to 5MP pixels
Audio Interface	Audio Input: 3 analog microphone inputs with integrated internal bias Audio output: Class AB stereo headphone output Class AB differential handset output Class D differential speaker amplifier output

USBinterface	Support USB2.0 high speed mode, data transmission rate up to 480 Mbps Support USB OTG (add 5V power supply chip)
SIMinterface	2 sets USIM card interface Support USIM/SIM card: 1.8V and 2.95V Support dual card dual standby (software support required)
UARTinterface	2 sets serial ports A set four-wire serial port supporting RTS and CTS hardware flow control A set two-wire serial port for Debug Maximum speed to 4Mbps
SDIOinterface	Support SD3.0, 4bit SDIO; SD card supports hot plug
I2Cinterface	3 sets I2C, high speed up to 3.4Mbps for TP, Camera, Sensor and other peripherals
ADCinterface	3 sets for input voltage detection, battery temperature detection, and universal ADC
Real-time clock	Support
Antennainterface	MAIN antenna, DRX antenna, GNSS antenna, WIFI/BT antenna interface
Physical characteristics	Size: 40.5mm * 40.5mm * 2.85mm Package: 146 LCC pin + 64 LGA pin Weight: about 9.2g
Temperature range	Operating temperature: -30°C - 70°C [1)] Storage temperature: -40°C - 85°C
Software update	Via USB/OTA/SD
RoHS	RoHS Compliant

Note:

1）When the module is operating in this temperature range, the functions of the module are normal, and the relevant performance of the module meets the 3GPP standard.

2.3 Hardware Diagram

The following hardware diagram shows the main hardware functions of the SC806 module, including the following:

- Baseband
- Wireless transceiver
- PMU
- Storage
- Peripheral interface

-- Communication expansion interface (USB/UART/I2C/SDIO)

--USIM card interface

--MIPI DSI interface

--MIPI CSI interface

-- Analog audio interface

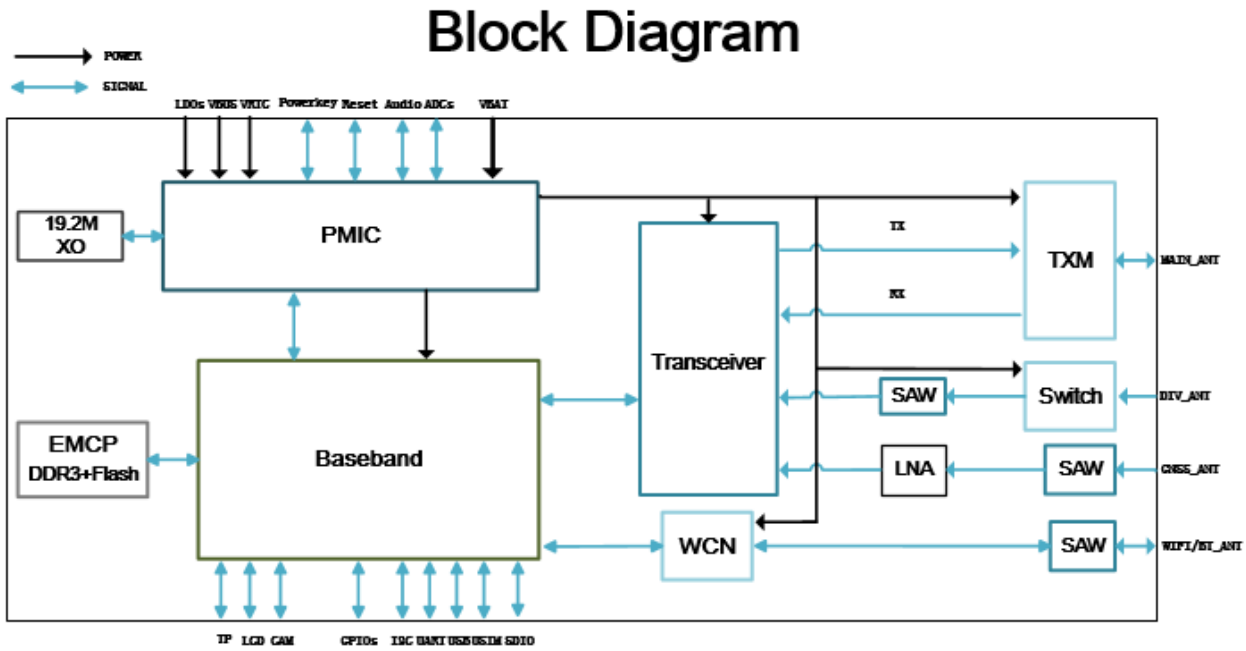


Figure1Hardware Block Diagram

3 Application Interface

3.1 LCC+LGAInterface

SC806module adopts LCC+LGA packaging, with a total of 210 pins, including 146 LCC pins and 64 LGA pins.

3.1.1Pin Distribution

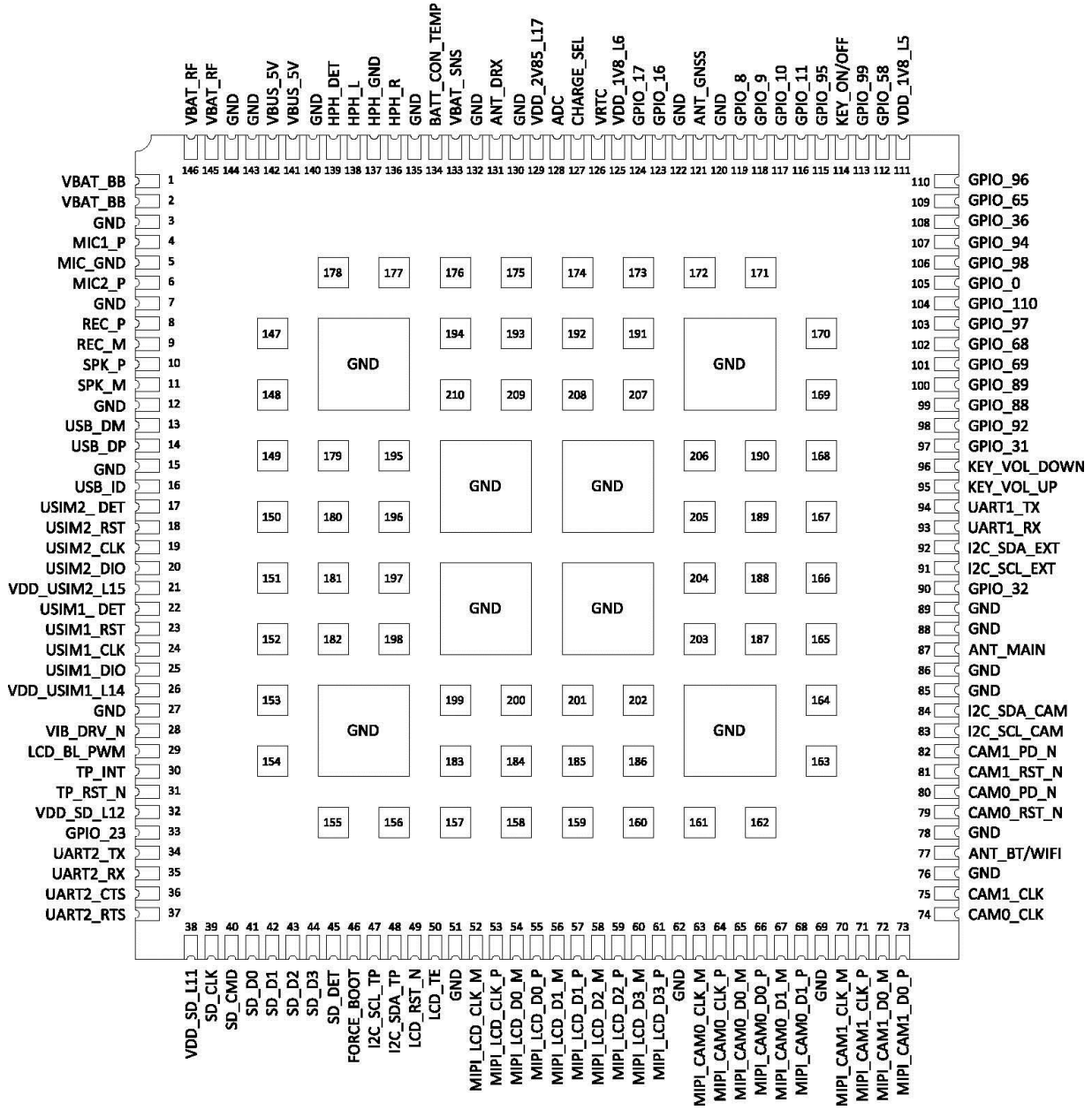


Figure2Pin Distribution (TOP perspective)

Note: The pin “NC” stands for No connect, ie the pin for this position is a reserved pin and does not need to be connected.

3.1.2Pin Definition

Table3I/O parameter definition

Type	Description
IO	input/output

DI	Digital input
DO	Digital output
PI	Power input
PO	Power output
AI	Analog input
AO	Analog output
OD	Open drain

The SC806's pin functions and electrical characteristics are described in the following table:

Table4Pin description

Power				
Pin Name	Pin No.	I/O	Pin Description	Note
VBAT_BB	1,2	PI	Baseband power input	Input voltage range: 3.3 ~ 4.5V, recommend 3.8V
VBAT_RF	145,146	PI	RF power input	Voltage range: 3.3 ~ 4.5V, recommend 3.8V
VDD_1V8_L5	111	PO	1.8Vvoltage output	Drive current200mA
VDD_1V8_L6	125	PO	1.8V voltage output	Drive current200mA
VDD_2V85_L17	129	PO	2.85V voltage output	Drive current420mA
VDD_SD_L12	32	PO	SD card pull-up resistor power supply, 2.95V	Drive current50mA
VDD_SD_L11	38	PO	SD card power supply, 2.95V	Drive current600mA
VDD_USIM1_L14	26	PO	SIM card 1 power supply	2.95/1.8 Vadjustable, 55mA
VDD_ USIM2_L15	21	PO	SIM card 2 power supply	2.95/1.8 Vadjustable, 55mA
VRTC	126	I/O	RTC clock power supply pin	Voltage range: 2.0 ~3.25V, recommend 3.0 V
GND	3,7,12,15,27,51,62,		Ground	

	69,76,78,85,86,88, 89,120,122,130, 132,135,140,143, 144,147,148,149, 150,160,161,162, 163,164,165,166, 167,168,169,170, 171,172,173,174, 175,176,177,178, 180,181,182,184, 185,186,188,189, 192,193,198,200, 201,208,209			
Battery				
Pin Name	Pin No.	I/O	Pin Description	Note
BATT_CON_TEMP	134	AI	Battery temperature detection pin	NTC resistor connected to battery
VBAT_ SNS	133	AI	Battery voltage detection pin	
BATT_ID	194	AI	Battery position detection	
CHARGE_SEL	127	DI	Charge scheme selection pin	Grounding uses the module's external charge scheme, and floating uses the module's built-in charge scheme. Default is floating
VREF_BATT_THERM	187	AO	Battery temperature detection circuit reference voltage	
LED_CHARGE_N	191	DI	Charge status indicator pin	Connect indicator negative
Button				
Pin Name	Pin No.	I/O	Pin Description	Note
KEY_ON/OFF	114	DI	Analog switch button	Low effect

KEY_VOL_UP	95	DI	Volume +	Low effect
KEY_VOL_DOWN	96	DI	Volume -	Low effect
KEY_RST_N	179	DI	Reset pin	PMIC reset input, low effect
USIM interface				
Pin Name	Pin No.	I/O	Pin Description	Note
USIM1_DIO	25	I/O	SIM card 1 data signal	
USIM1_CLK	24	DO	SIM card 1 clock signal	
USIM1_RST	23	DO	SIM card 1 reset signal	
USIM1_ DET	22	DI	SIM card 1 plug detection	Fixed level when not in use
USIM2_DIO	20	I/O	SIM card 2 data signal	
USIM2_CLK	19	DO	SIM card 2 clock signal	
USIM2_RST	18	DO	SIM card 2 reset signal	
USIM2_ DET	17	DI	SIM card 2 plug detection	Fixed level when not in use
SDcard interface				
Pin Name	Pin No.	I/O	Pin Description	Note
SD_D3	44	I/O	SD card data interface	
SD_D2	43	I/O	SD card data interface	
SD_D1	42	I/O	SD card data interface	
SD_D0	41	I/O	SD card data interface	
SD_CLK	39	DO	SD card clock	
SD_CMD	40	I/O	SD cardcommand interface	
SD_DET	45	DI	SD card detection	Low level is effective
I2Cinterface				

Pin Name	Pin No.	I/O	Pin Description	Note
I2C_SCL_EXT	91	I/O	I2Cclock	Sensor or other peripherals use
I2C_SDA_EXT	92	I/O	I2C data trace	Sensor or other peripherals use
I2C_SCL_TP	47	I/O	I2C clock	Default TP use
I2C_SDA_TP	48	I/O	I2C data trace	Default TP use
I2C_SCL_CAM	83	I/O	I2C clock	Default camera use
I2C_SDA_CAM	84	I/O	I2C data trace	Default camera use
USBinterface				
Pin Name	Pin No.	I/O	Pin Description	Note
VBUS_5V	141,142	PI	Device mode, 5V input	
USB_DM	13	I/O	USB signal -	
USB_DP	14	I/O	USB signal +	
USB_ID	16	AI	USB OTG detection pin	
UARTinterface				
Pin Name	Pin No.	I/O	Pin Description	Note
UART2_TX	34	DO	UART2 data transmission	
UART2_RX	35	DI	UART2 data reception	
UART2_CTS	36	DI	UART2clear transmission	
UART2_RTS	37	DO	UART2request	
UART1_TX	94	DO	UART1 data transmission	Debug port
UART1_RX	93	DI	UART1 data reception	Debugport
MIPI-DSIinterface				
Pin Name	Pin No.	I/O	Pin Description	Note

MIPI_LCD_CLK_P	53	AO	MIPI differential clock signal	
MIPI_LCD_CLK_M	52	AO		
MIPI_LCD_D3_P	61	AI/AO	MIPI differential data signal	
MIPI_LCD_D3_M	60	AI/AO		
MIPI_LCD_D2_P	59	AI/AO		
MIPI_LCD_D2_M	58	AI/AO		
MIPI_LCD_D1_P	57	AI/AO		
MIPI_LCD_D1_M	56	AI/AO		
MIPI_LCD_D0_P	55	AI/AO		
MIPI_LCD_D0_M	54	AI/AO		
LCD_TE	50	DI	LCD refresh	Floating when not in use
LCD_RST_N	49	DO	LCD reset signal	
LCD_BL_PWM	29	DO	LCD backlight PWM control signal	

MIPI-CSIinterface				
Pin Name	Pin No.	I/O	Pin Description	Note
MIPI_CAM0_CLK_P	64	AI	Main camera MIPI differential clock signal	
MIPI_CAM0_CLK_M	63	AI		
MIPI_CAM0_D1_P	68	AI/AO	Main camera MIPI differential clock signal	
MIPI_CAM0_D1_M	67	AI/AO		
MIPI_CAM0_D0_P	66	AI/AO		
MIPI_CAM0_D0_M	65	AI/AO		

CAM0_CLK	74	DO	Main Camera main clock	
CAM0_RST_N	79	DO	Main camera reset signal	
CAM0_PD_N	80	DO	Main camera shutdown	
MIPI_CAM1_CLK_P	71	AI	Auxiliary camera MIPI differential clock signal	
MIPI_CAM1_CLK_M	70	AI		
MIPI_CAM1_D0_P	73	AI/AO	Auxiliary camera MIPI differential data signal	
MIPI_CAM1_D0_M	72	AI/AO		
CAM1_CLK	75	DO	Auxiliary camera main	
CAM1_RST_N	81	DO	Auxiliary camera reset	
CAM1_PD_N	82	DO	Auxiliary camera	
Touch interface				
Pin Name	Pin No.	I/O	Pin Description	Note
TP_INT	30	DI	TP interruption signal	
TP_RST_N	31	DO	TP reset signal	
Audiointerface				
Pin Name	Pin No.	I/O	Pin Description	Note
SPK_P	10	AO	External differential output; class D power amplifier	
SPK_M	11	AO		
REC_P	8	AO	Receiver differential output	
REC_M	9	AO		
HPH_L	138	AO	Headphone left channel	
HPH_R	136	AO	Headphone right channel	

MIC2_P	6	AI	Headphone MIC input	
HPH_DET	139	AI	Headphone plug detect	
HPH_GND	137		Headphone ground	
MIC1_P	4	AI	Main MIC input	
MIC_GND	5	GND	MIC ground	
MIC3_P	195	AI	Auxiliary MIC input	
MIC_BIAS1	210	AO	MIC offset reference	Only digital MIC uses it, so keep it floating
Antenna interface				
Pin Name	Pin No.	I/O	Pin Description	Note
ANT_MAIN	87	I/O	2G/3G/4G main antenna	
ANT_DRX	131	AI	Diversity receiving	
ANT_BT/WIFI	77	I/O	WIFI/BTantenna	
ANT_GNSS	121	AI	GNSS antenna	Module has built-in LNA with passive
Other interfaces				
Pin Name	Pin No.	I/O	Pin Description	Note
VIB_DRV_N	28	PO	Motor drive pin	Connect to motor negative
FORCE_BOOT	46	DI	Forced pin	High level (1.8V) effect
ADC	128	AI	ADC detection pin	Input voltage range 0.1~4.5V
GPIO interface				
Pin Name	Pin No.	I/O	Pin Description	Note
GPIO_0	105	I/O	Ordinary GPIO, 1.8V power domain	B-PD:nppukp
GPIO_8	119	I/O		B-PD:nppukp
GPIO_9	118	I/O		B-PD:nppukp
GPIO_10	117	I/O		B-PD:nppukp

GPIO_11	116	I/O	B-PD:nppukp
GPIO_14	153	I/O	B-PD:nppukp
GPIO_15	197	I/O	B-PD:nppukp
GPIO_16	123	I/O	B-PD:nppukp
GPIO_17	124	I/O	B-PD:nppukp
GPIO_22	207	I/O	BH-PD:nppukp
GPIO_23	33	I/O	BH-PD:nppukp
GPIO_31	97	I/O	B-PD:nppukp
GPIO_32	90	I/O	B-PD:nppukp
GPIO_36	108	I/O	B-PD:nppukp
GPIO_58	112	I/O	B-PD:nppukp
GPIO_65	109	I/O	B-PD:nppukp
GPIO_68	102	I/O	B-PD:nppukp
GPIO_69	101	I/O	B-PD:nppukp
GPIO_88	99	I/O	B-PD:nppukp
GPIO_89	100	I/O	B-PD:nppukp
GPIO_92	98	I/O	B-PD:nppukp
GPIO_93	159	I/O	B-PU:nppdkp
GPIO_94	107	I/O	B-PD:nppukp
GPIO_95	115	I/O	B-PD:nppukp
GPIO_96	110	I/O	B-PD:nppukp
GPIO_97	103	I/O	B-PD:nppukp
GPIO_98	106	I/O	B-PD:nppukp
GPIO_99	113	I/O	B-PD:nppukp

GPIO_110	104	I/O		B-PD:nppukp
GPIO_1	190	I/O		B-PD:nppukp
GPIO_2	205	I/O		B-PD:nppukp
GPIO_3	203	I/O		B-PD:nppukp
PMU_GPIO_1	183	I/O	Ordinary GPIO, adjustable power domain 1.2/1.8V	
PMU_GPIO_2	202	I/O		
PMU_GPIO_4	204	I/O	Ordinary GPIO, adjustable power domain 1.2/1.8V/VBAT	
Reserved pin				
NC	151,152,154,155,156,157,158,196,199,206		Reserved pin	Floating by design

3.2 Power

The SC806 provides four VBAT pins for connecting to an external power: two VBAT_RF pins are used for the RF power supply of the module, and two other VBAT_BB pins are used for baseband power supply of the module. The power input range is from 3.3V to 4.5V, and the recommended value is 3.8V. The performance of the VBAT power, such as load capacity, and ripple size, etc., will directly affect the performance and stability of the module. In extreme cases, the module's operating current can reach 2A, and if the power supply capacity is insufficient, the voltage will drop. If the power voltage drops below 3.3V, the module may be powered off or restarted.

3.2.1Power Supply

The SC806 module needs to be powered by the VBAT_BB/VBAT_RF pin

Table5Power supply parameters

Parameters	Minimum	Recommended	Maximum	Unit
VBAT_BB/VBAT_RF（DC）	3.3	3.8	4.5	V

Power design is shown as follows:

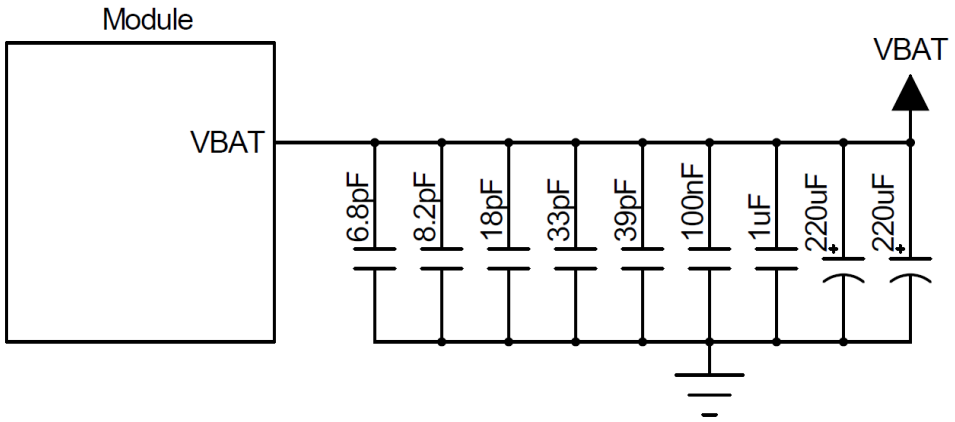


Figure 3Power Design

Power supply filter capacitor design is shown in the following table:

Table6Power supply filter capacitor design

Recommended capacitor	Application	Description
220uF x 2	Regulating capacitor	Reduce power fluctuations during module operation, requiring low ESR capacitor LDO or DCDC power requires not less than 440uF capacitor Battery power can be properly reduced to 100 ~ 220uF capacitor
1uF,100nF	Digital signal noise	Filter clock and digital signal interference
39pF,33pF	700, 850/900 MHz	Filter low band radio frequency interference
18pF,8.2pF, 6.8pF	1700/1800/1900,2100/2300,2500/2600MH	Filter middle/high band radio frequency interference

The power voltage drop example is shown in the figure:

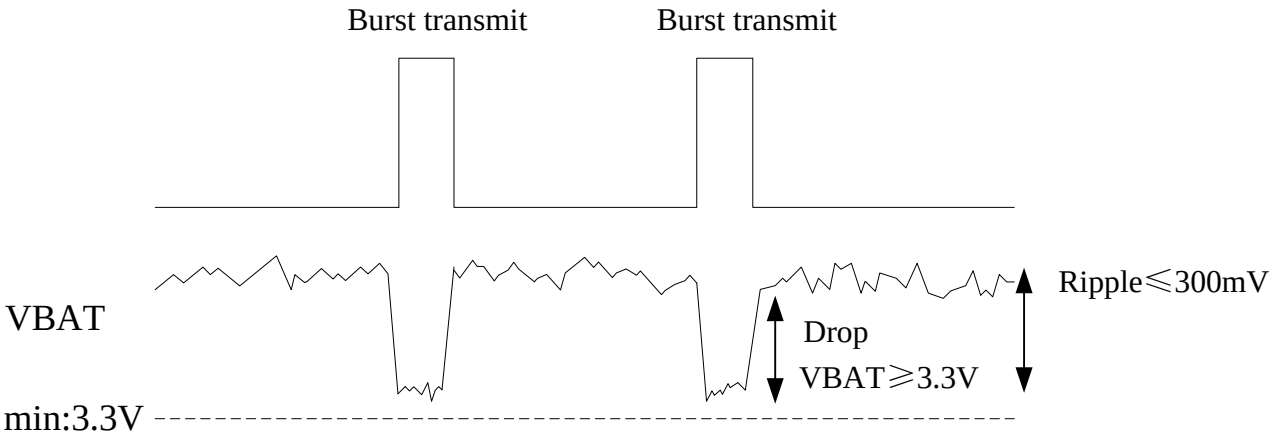


Figure 4Power Voltage Drop Example

To ensure that the power voltage is not lower than 3.3V, it is recommended to connect two 220μF tantalum capacitors with low ESR and filter capacitors of 1uF, 100nF, 39pF, and 33pF in parallel to the VBAT input of the module. It is recommended that the PCB trace of VBAT be as short and wide as possible. Reduce the equivalent impedance of the VBAT trace to ensure that at maximum output power, significant voltage drop will not occur at high currents. It is recommended that the width of the VBAT trace should not be less than 2mm, and the longer and the wider the trace, the ground plane of the power section should be more complete.

3.2.2Lithium Battery Charge and Battery Management

If the SC806 is powered by a battery, it uses a lithium battery with temperature detection function. The SC806 has a battery temperature detection function. The battery requires internal integration of a thermistor (default is 47K±1%, B=4050 NTC), and the battery temperature detection pin is connected to the BATT_CON_TEMP pin (PIN 134). SC806 has built-in linear charge management circuit that supports the charge of 3.7V lithium battery, and the use of standard charger and non-standard charger for charge, with software automatic identification, standard charger maximum charge current 1.44A, and non-standard charger limited charge current less than 500mA. The charge process includes trickle charge, constant current charge, and constant voltage charge.

- Trickle charge: it is divided into two parts. Trickle charge-A: charge current 90mA when the battery voltage is lower than 2.8V; trickle charge-B: charge current 450mA when the battery voltage is between 2.8V~3.2V;
- Constant current charge: constant current charge when the battery voltage is between 3.2V~4.2V. The current is 1.44A when adapter is charging. The current is t 450mA when USB is charging;
- Constant voltage charge: constant voltage charge when the battery voltage reaches 4.2V. The charge current is gradually reduced, when the charge current is reduced to about 100mA, the charge is cut off.

3.2.3RTC Power

VRTC is the power supply for the internal RTC clock of the module and can be used as a backup power for the RTC clock. When the module power VBAT is powered on, the VRTC will output voltage. When there is no VBAT,

it needs to be powered by the external power. The button battery is generally used for power supply. The VRTC parameters are as follows:

Table7VRTC parameters

Parameters	Minimum	Typical	Maximum	Unit
VRTC output voltage	2.5	3.1	3.2	V
VRTC input voltage (clock normal)	2.0	3.0	3.25	V
VRTC input current (clock normal)		5	10	uA

VRTC as RTC clock backup power reference design circuit is shown as follows:

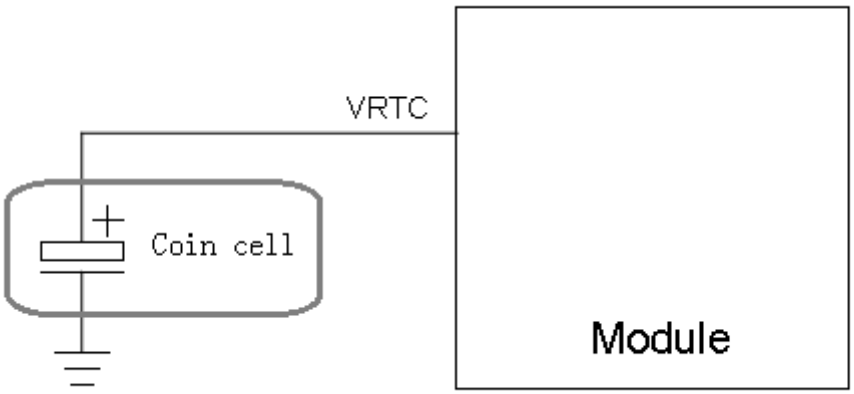


Figure 5VRTC Reference Design Circuit Diagram

3.2.4Power Output

The SC806 has multiple power outputs for peripheral circuits.

When applied, 33pF and 10pF capacitors can be connected in parallel to effectively remove high frequency interference.

Table8Power description

Pin Name	Programmable Range (V)	Default Voltage (V)	Drive Current (mA)
VDD_1V8_L5	-	1.8	200
VDD_1V8_L6	-	1.8	200
VDD_2V85_L17	-	2.85	420
VDD_SD_L12	-	2.95	50

VDD_SD_L11	1.75~3.337	2.95	600
VDD_USIM1_L14	1.75~3.337	1.8/2.95	55
VDD_ USIM2_L15	1.75~3.337	1.8/2.95	55

3.3 Control Signal

The SC806 uses one control signal to startup/shutdown, restart, and sleep/wakeup the module.

Table9startup/shutdown pin definition

Pin No.	Pin name	I/O	Description	Note
114	KEY_ON/OFF	DI	The default is high, and low is effective. This pin can be used to startup/shutdown, restart, and sleep/wakeup the module	

3.3.1Module Startup

After VBAT is powered on, the module can be turned on by setting the KEY_ON/OFF signal low for more than 2 seconds. The KEY_ON/OFF control reference diagram is as follows:

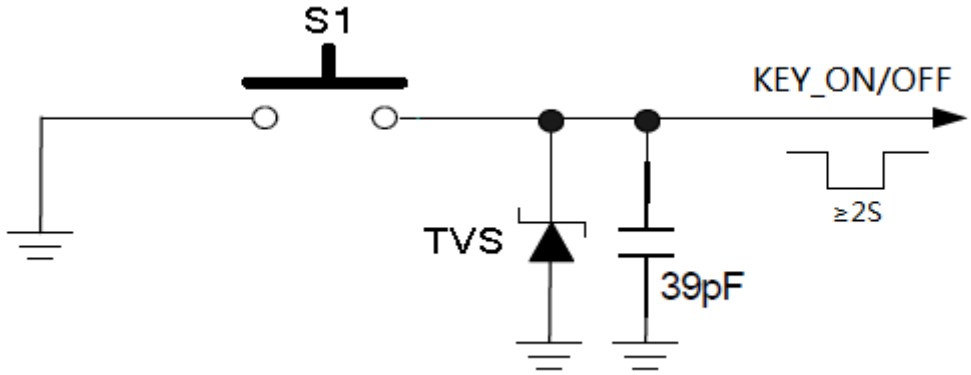


Figure 6Button Startup Circuit

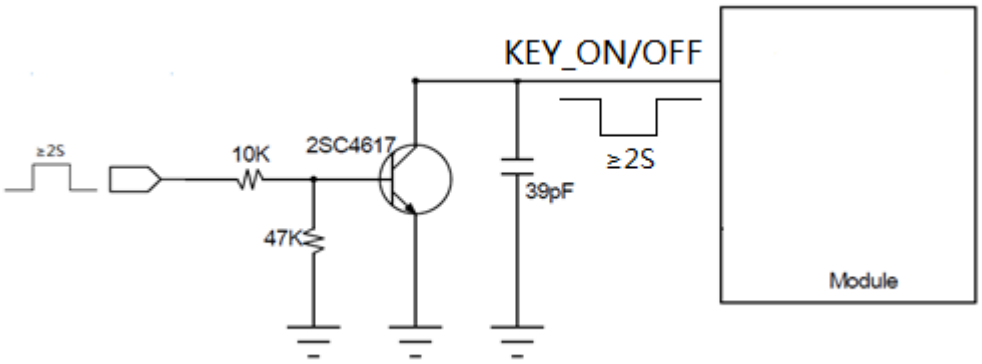


Figure 7Drive Circuit Startup

Startup time slot is shown as follows:

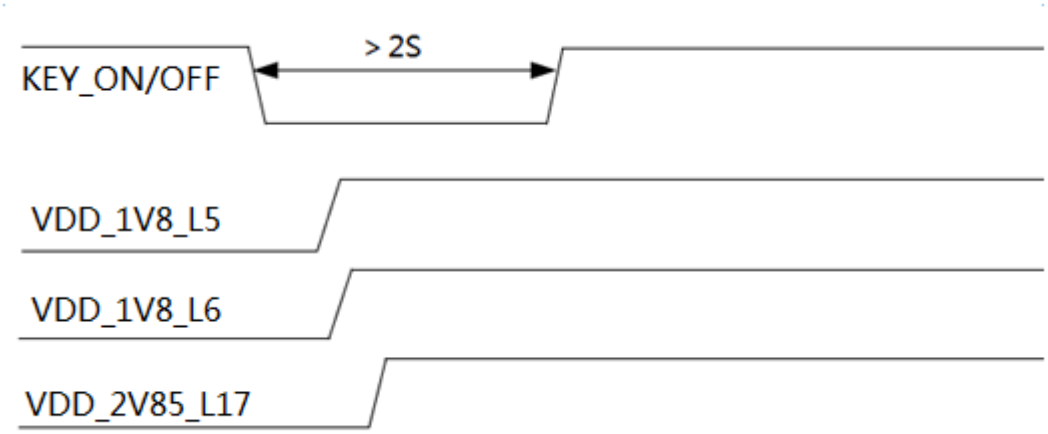


Figure 8Startup Time Slot

3.3.2Module Shutdown and Restart

After the SC806 is powered on, set the low KEY_ON/OFF signal to more than 500ms, the display interface will pop up a selection box (select shutdown or restart). If it is greater than 10s, the system will be forced to shutdown. Shutdown time slot is shown as follows:

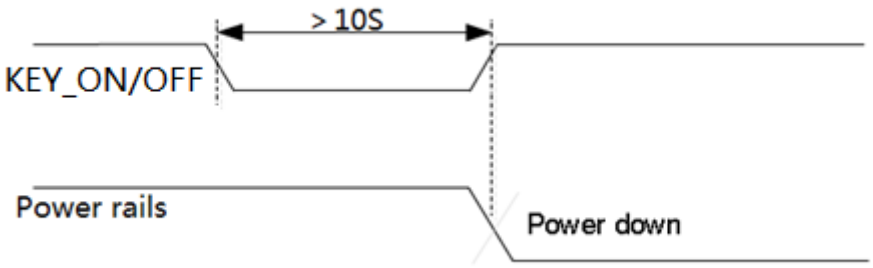


Figure 9Shutdown Time Slot

3.3.3Sleep/wakeup

During standby, set the KEY_ON/OFF signal low (100ms) and the system will go to sleep. The system supports automatic sleep. The time from standby to sleep can be configured via software.

In sleep mode, the low KEY_ON/OFF signal can wake up the system.

3.3.4Reset

KEY_RST_N is the reset output of the module PMIC. When the system crashes or other abnormalities occur, the low KEY_RST_N signal is greater than 300ms, and the system will be forced to restart.

3.4 USBInterface

The SC806 supports one USB 2.0 interface, and supports two speed modes, full-speed (12Mbps) and high-speed mode (480Mbps). USB supports OTG function and HUB expansion interface.

USB pin definition is shown in the following table:

Table10USB pin definition

Pin No.	Pin Name	I/O	Description	Note
141,142	VBUS_5V	PI	Device mode, 5V input	
13	USB_DM	I/O	USB signal negative	
14	USB_DP	I/O	USB signal positive	
16	USB_ID	AI	USB OTG detection pin	

The USB_VBUS power is a USB power or an adapter. It can be used as a USB plug-in detection and charge the

battery through the module's internal PMU. The power input voltage range is 4.35~6.0V, and the recommended value is 5V. The module supports single-cell lithium battery charge management. Different capacity models require different charge parameters. The module's built-in linear charge circuit supports up to 1.44A charge current.

The following is the USB interface circuit design:

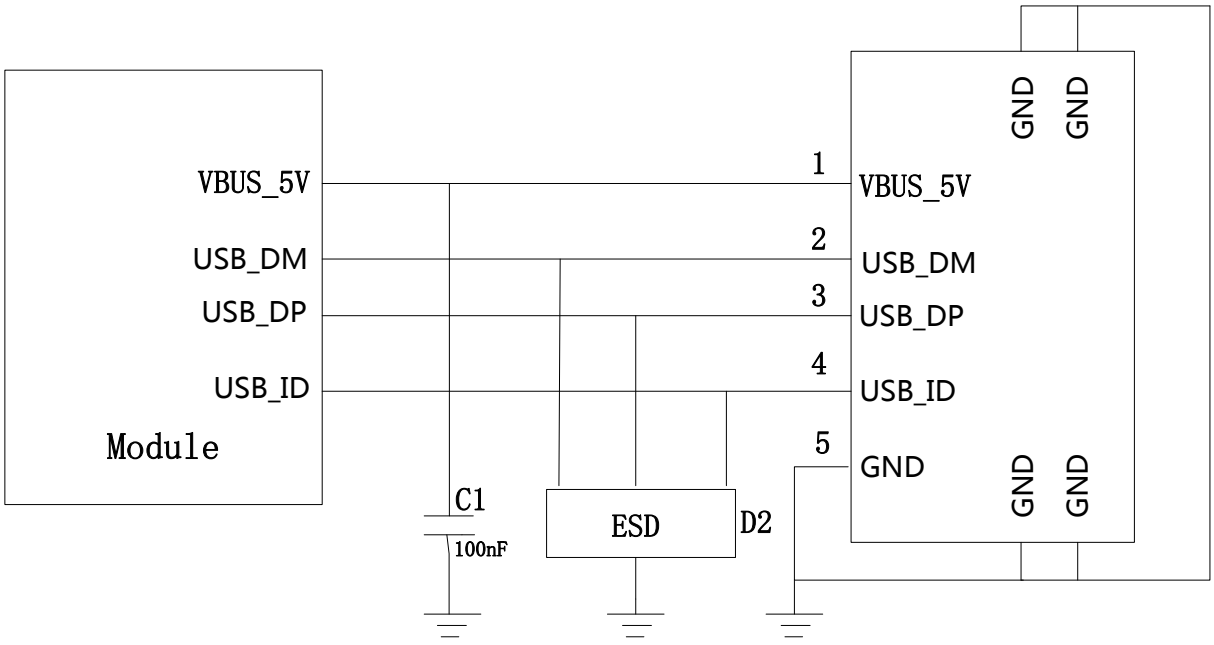


Figure 10USB Interface Circuit Diagram

Note:

1) SC806 cannot output 5V DC internally, and 5V DC is required when USB is used as HOST.

2) ESD protection device for USB_DP/DM requires junction capacitance less than 1pF

3) USB_DP and USB_DM are high-speed differential signal traces. The highest transmission rate is 480Mbps.

Please pay attention to the following requirements in PCB layout:

- USB_DP and USB_DM signal traces are required to be equal length and parallel, avoiding right-angle route, and doing differential 90Ω impedance control
- USB2.0 differential signal trace is laid on the nearest signal layer from the ground, and wrap ground

Table11module internal USB trace length

Pin No.	Pin name	Length (mm)	Length error (DP-DM)
13	USB_DM	28.70	-0.51
14	USB_DP	28.19	

3.5 UARTInterface

The SC806 defines two UART interfaces and three I2Cs. It also supports multiplexed SPI. Please contact our technical support when you need it.

The SC806 serial interface is 1.8V level. If the peripheral is at other levels, level shift is required.

Table12UART interface pin definition

Pin No.	Pin Name	I/O	Description	Note
34	UART2_TX	DO	UART2 data transmission	
35	UART2_RX	DI	UART2 data reception	
36	UART2_CTS	DI	UART2 clear transmission	
37	UART2_RTS	DO	UART2 request transmission	
94	UART1_TX	DO	UART1 data transmission, the default is debug interface	
93	UART1_RX	DI	UART1 data reception, the default is debug interface	

3.6 USIMInterface

The SC806 supports two SIM cards, dual-card dual standby (the software defaults is one card standby), and both are hot pluggable (requires software configuration).

Table13USIM pin definition

Pin No.	Pin Name	I/O	Description	Note
26	VDD_USIM1_L14	PO	USIM1 power supply, 1.8V/2.95V	
25	USIM1_DIO	I/O	USIM1 data signal	
24	USIM1_CLK	DO	USIM1 clock signal	
23	USIM1_RST	DO	USIM1 reset signal	

22	USIM1_ DET	DI	USIM1 plug detection pin
20	USIM2_DIO	I/O	USIM2 data signal
19	USIM2_CLK	DO	USIM2 clock signal
18	USIM2_RST	DO	USIM2 reset signal
17	USIM2_ DET	DI	USIM2 detection pin
21	VDD_ USIM2_L15	PO	USIM2 power supply, 1.8V/2.95V

The USIM card interface reference circuit is as follows:

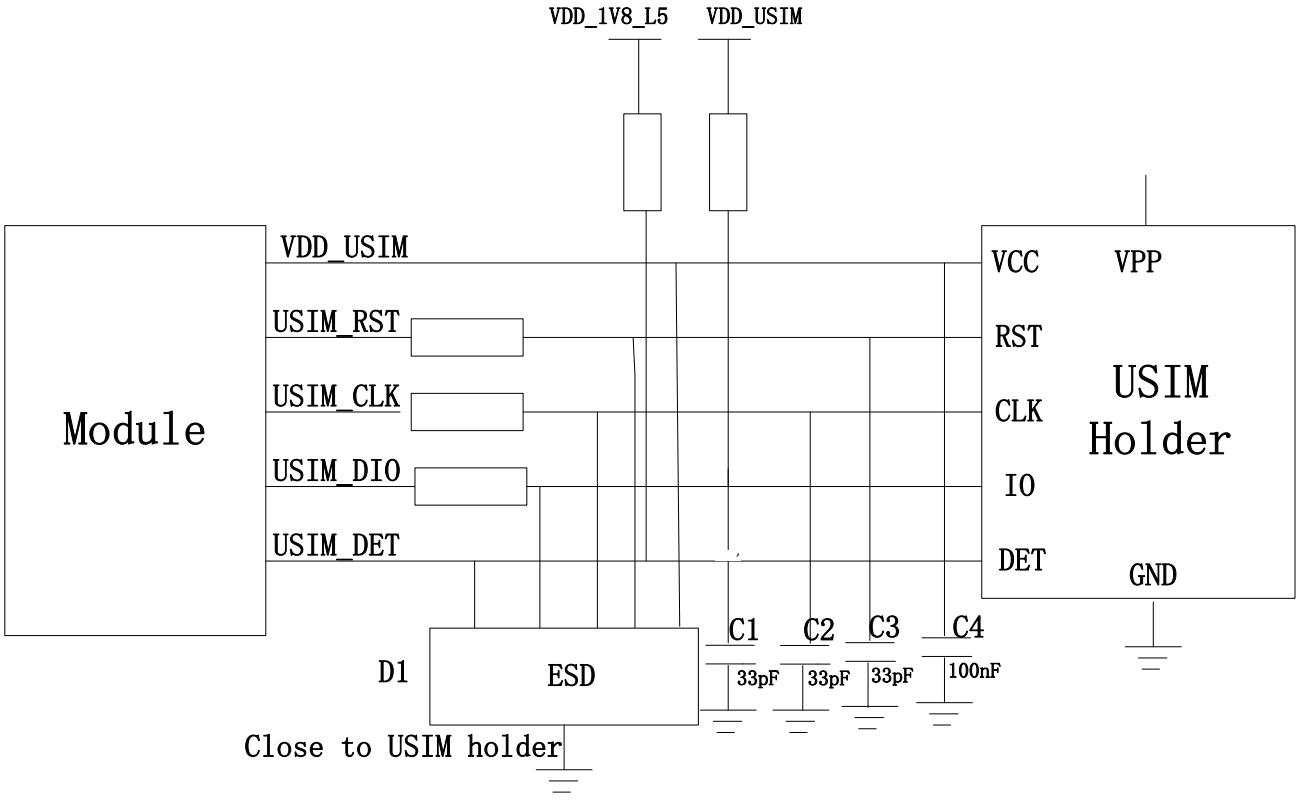


Figure 11USIM Card Interface Circuit Diagram

Note:

1) The length of the SC806 to the SIM card holder should be less than 100mm.

2) The layout and route of the SIM card must be kept away from EMI interference sources such as RF antenna and digital switch signal.

3) The filter capacitance of the SIM card signal and the ESD device should be placed close to the card holder.

3.7 SDIO Interface

The SC806 supports one SDIO interface. The pin definition is as follows:

Table14SDIO pin definition

Pin No.	Pin Name	I/O	Description	Note
44	SD_D3	I/O	SD card data interface	
43	SD_D2	I/O	SD card data interface	
42	SD_D1	I/O	SD card data interface	
41	SD_D0	I/O	SD card data interface	
39	SD_CLK	DO	SD card clock	
40	SD_CMD	I/O	SD card command interface	
45	SD_DET	DI	SD card detection signal input	
32	VDD_SD_L12	PO	as pull-up power for SD card data, clock, and command trace, 1.8V/2.95V variable	
38	VDD_SD_L11	PO	SD card power, 1.8V/2.95V variable	

Note:

1) VDD_SD_L11 is the SD card peripheral driving power, and can provide about 600mA current. Pay attention to the width of control trace.

2) Pull up SD card data, clock and command trace with VDD_SD_L12, and pull up SD_DET with VDD_SD_L5

3) SDIO, a high-speed digital signal trace needs to be shielded.

3.8 GPIO Interface

SC806 has many GPIO, and the interface level is 1.8V. The pin definition is as follows:

Table15GPIO list

Pin No.	Pin Name	Reset Status	Interruption Function	Wakeup Function
105	GPIO_0	B-PD:nppukp	Yes	No
119	GPIO_8	B-PD:nppukp	Yes	No
118	GPIO_9	B-PD:nppukp	Yes	No
117	GPIO_10	B-PD:nppukp	Yes	No
116	GPIO_11	B-PD:nppukp	Yes	Yes
153	GPIO_14	B-PD:nppukp	Yes	No
197	GPIO_15	B-PD:nppukp	Yes	No
123	GPIO_16	B-PD:nppukp	Yes	No
124	GPIO_17	B-PD:nppukp	Yes	No
207	GPIO_22	BH-PD:nppukp	Yes	No
33	GPIO_23	BH-PD:nppukp	Yes	No
97	GPIO_31	B-PD:nppukp	Yes	Yes
90	GPIO_32	B-PD:nppukp	Yes	No
108	GPIO_36	B-PD:nppukp	Yes	Yes
112	GPIO_58	B-PD:nppukp	Yes	Yes
109	GPIO_65	B-PD:nppukp	Yes	Yes
102	GPIO_68	B-PD:nppukp	Yes	No
101	GPIO_69	B-PD:nppukp	Yes	No
99	GPIO_88	B-PD:nppukp	Yes	No
100	GPIO_89	B-PD:nppukp	Yes	No

98	GPIO_92	B-PD:nppukp	Yes	Yes
159	GPIO_93	B-PU:nppdkp	Yes	No
107	GPIO_94	B-PD:nppukp	Yes	Yes
115	GPIO_95	B-PD:nppukp	Yes	Yes
110	GPIO_96	B-PD:nppukp	Yes	Yes
103	GPIO_97	B-PD:nppukp	Yes	Yes
106	GPIO_98	B-PD:nppukp	Yes	Yes
113	GPIO_99	B-PD:nppukp	Yes	No
104	GPIO_110	B-PD:nppukp	Yes	Yes
190	GPIO_1	B-PD:nppukp	Yes	No
205	GPIO_2	B-PD:nppukp	Yes	No
203	GPIO_3	B-PD:nppukp	Yes	No

Note

B： Bidirectional digital with CMOS input

H： High-voltage tolerant

NP：pdpukp = default no-pull with programmable options following the colon (:)

PD：nppukp = default pulldown with programmable options following the colon (:)

PU：nppdkp = default pullup with programmable options following the colon (:)

KP：nppdpu = default keeper with programmable options following the colon (:)

3.9 I2C Interface

The SC806 provides three I2Cs for TP, CAMERA, SENSOR, etc.. The I2C interface has a pull-up resistor of 10K to VDD_1V8_L6 inside the module.

Table16I2C pin definition

Pin No.	Pin Name	I/O	Description	Note

91	I2C_SCL_EXT	I/O	Sensor or other peripheral
92	I2C_SDA_EXT	I/O	Sensor or other peripheral
47	I2C_SCL_TP	I/O	Default is TP
48	I2C_SDA_TP	I/O	Default is TP
83	I2C_SCL_CAM	I/O	Default is camera
84	I2C_SDA_CAM	I/O	Default is camera

3.10 ADC Interface

Table17ADC pin definition

Pin No.	Pin Name	I/O	Description	Note
128	ADC	AI	ADC detection pin	Input voltage range 0.1~4.5V
133	VBAT_ SNS	AI	Battery voltage detection pin	
134	BATT_CON_TEMP	AI	Battery temperature detection	Connect to battery NTC resistor

3.11 Motor Drive Interface

The SC806 motor pin definition is as follows:

Table18Motor pin definition

Pin No.	Pin Name	I/O	Description	Note
28	VIB_DRV_N	PO	Motor drive pin	Connect to motor negative

3.12 LCM Interface

The SC806 video output interface is based on the MIPI_DSI standard and supports 4 sets high-speed differential

data transmission. The maximum speed of each set is up to 1.5Gbps, and it supports 720P.

Table19LCM pin definition

Pin No.	Pin Name	I/O	Description	Note
125	VDD_1V8_L6	PO	Power output	1.8V
129	VDD_2V85_L17	PO	Power output	2.85V
29	LCD_BL_PWM	DO	LCD backlight drive	
49	LCD_RST_N	DO	LCD reset signal	
50	LCD_TE	DI	LCD scan sync signal	
52	MIPI_LCD_CLK_M	AO	LCD clock signal -	
53	MIPI_LCD_CLK_P	AO	LCD clock signal +	
61	MIPI_LCD_D3_P	AI/AO	LCD Lane 3 +	
60	MIPI_LCD_D3_M	AI/AO	LCD Lane 3 -	
59	MIPI_LCD_D2_P	AI/AO	LCD Lane 2 +	
58	MIPI_LCD_D2_M	AI/AO	LCD Lane 2 -	
57	MIPI_LCD_D1_P	AI/AO	LCD Lane 1 +	
56	MIPI_LCD_D1_M	AI/AO	LCD Lane 1 -	
55	MIPI_LCD_D0_P	AI/AO	LCD Lane 0 +	
54	MIPI_LCD_D0_M	AI/AO	LCD Lane 0 -	

3.13 Touch Screen Interface

The SC806 provides one set I2C interface that can be used to connect the touch screen (TP), and provides power and interruption pin. The TP pin definition of the module is shown in the following table:

Table20TP pin definition

Pin No.	Pin Name	I/O	Description	Note

125	VDD_1V8_L6	PO	Power output	1.8V
129	VDD_2V85_L17	PO	Power output	2.85V
30	TP_INT	DI	TP interruption signal	
31	TP_RST_N	DO	TP reset signal	
47	I2C_SCL_TP	I/O	Touch screen I2C clock	
48	I2C_SDA_TP	I/O	Touch screen I2C data	

3.14 Camera Interface

The SC806 video input interface is based on the MIPI_CSI standard, and supports two cameras, and up to 8MP pixel cameras.

MIPI-CSI0 is 2 Lane interface, and supports up to 8M Camera

MIPI-CSI1 is 1 Lane interface, and supports up to 5M Camera

3.14.1 Front camera

The front camera uses 1 set MIPI_CSI differential signal, and has been tested to support 2MP camera. The SC806 front camera pin definition is as follows:

Table21Front camera pin definition

Pin No.	Pin Name	I/O	Description	Note
125	VDD_1V8_L6	PO	Power output	1.8V
129	VDD_2V85_L17	PO	Power output	2.85V
71	MIPI_CAM1_CLK_P	AI	Front camera MIPI clock signal +	
70	MIPI_CAM1_CLK_M	AI	Front camera MIPI clock signal -	
73	MIPI_CAM1_D0_P	AI/AO	Front camera data signal	
72	MIPI_CAM1_D0_M	AI/AO	Front camera data signal	
75	CAM1_CLK	DO	Front camera main clock	
81	CAM1_RST_N	DO	Front camera reset signal	

82	CAM1_PD_N	DO	Front camera off signal
83	I2C_SCL_CAM	I/O	Camera I2C clock signal
84	I2C_SDA_CAM	I/O	Camera I2C data signal

3.14.2 Rear camera

Rear camera achieves transmission and control via the FPC and connector. The rear camera uses 2 sets MIPI_CSI differential data trace interface, and has been tested to support 5MP camera. The SC806 rear camera pin definition is as follows:

Table22Rear camera pin definition

Pin No.	Pin Name	I/O	Description	Note
125	VDD_1V8_L6	PO	Power output	1.8V
129	VDD_2V85_L17	PO	Power output	2.85V
64	MIPI_CAM0_CLK_P	AI	Rear camera MIPI Clock Signal +	
63	MIPI_CAM0_CLK_M	AI	Rear camera MIPI Clock Signal -	
68	MIPI_CAM0_D1_P	AI/AO	Rear camera data signal	
67	MIPI_CAM0_D1_M	AI/AO	Rear camera data signal	
66	MIPI_CAM0_D0_P	AI/AO	Rear camera data signal	
65	MIPI_CAM0_D0_M	AI/AO	Rear camera data signal	
74	CAM0_CLK	DO	Rear camera main clock signal	
79	CAM0_RST_N	DO	Rear camera reset signal	
80	CAM0_PD_N	DO	Rear camera off signal	
83	I2C_SCL_CAM	I/O	Camera I2C clock signal	
84	I2C_SDA_CAM	I/O	Camera I2C data signal	

3.14.3 Design note

MIPI DSI/CSI is a high-speed data trace. It has a relatively high requirement for routing, so priority should be

given to layout

- The MIPI differential trace group must maintain parallel, equal length and impedance control of 100 ohms.
- Do not use the ground trace in the MIPI trace group. The length is less than 100 mm. Ground wrap is needed.

Table23Module internal MIPI trace length

Pin No.	Pin Name	Length (mm)	Length Error (P-N)
53	MIPI_LCD_CLK_P	7.68	0
52	MIPI_LCD_CLK_M	7.68	
61	MIPI_LCD_D3_P	9.05	0.57
60	MIPI_LCD_D3_M	8.48	
59	MIPI_LCD_D2_P	7.72	0.09
58	MIPI_LCD_D2_M	7.63	
57	MIPI_LCD_D1_P	7.74	0.21
56	MIPI_LCD_D1_M	7.53	
55	MIPI_LCD_D0_P	7.79	-0.14
54	MIPI_LCD_D0_M	7.93	
64	MIPI_CAM0_CLK_P	12.43	-0.06
63	MIPI_CAM0_CLK_M	12.49	
68	MIPI_CAM0_D1_P	13.70	0.25
67	MIPI_CAM0_D1_M	13.45	
66	MIPI_CAM0_D0_P	12.74	-0.16
65	MIPI_CAM0_D0_M	12.90	
71	MIPI_CAM1_CLK_P	16.41	-0.10
70	MIPI_CAM1_CLK_M	16.51	
73	MIPI_CAM1_D0_P	17.64	0.51
72	MIPI_CAM1_D0_M	17.13	

3.15 Sensor Design

The SC806 communicates with sensors via I2C, and can support various types of sensors.

Table24Sensor control pin description

Pin No.	Pin Name	I/O	Description	Note
91	I2C_SCL_EXT	I/O	Sensor I2C clock signal	
92	I2C_SDA_EXT	I/O	Sensor I2C data signal	

3.16 Audio

3.16.1 Audio interface definition

SC806 supports analog audio interface, 3 inputs, 3 outputs, and does not support digital audio.

Table25Audio interface definition

Pin No.	Pin Name	I/O	Description	Note
10	SPK _P	AO	Out differential output; Class D amplifier output	Maximum output 1W
11	SPK _M	AO		
8	REC_P	AO	Handset differential output	
9	REC_M	AO		
138	HPH_L	AO	Headphone left channel output	
136	HPH_R	AO	Headphone right channel output	
6	MIC2_P	AI	Headphone MIC single-end input	
139	HPH_DET	AI	Headphone detection signal input	
137	HPH_GND	GND	Headphone ground	
4	MIC1_P	AI	Main MIC single-end input	
5	MIC_GND	GND	MIC ground	

195	MIC3_P	AI	Auxiliary MIC single-end input
210	MIC_BIAS1	AO	MIC bias voltage

Note:

1) The MIC bias circuit has been added to the SC806 and no external addition is required.

2) Add 100K resistor to ground for MIC2_P

3) The SPK is a configured class D amplifier and cannot be connected to an external amplifier. It is recommended to connect 8 ohm speakers. There is a high requirement for sound amplitude of loud speaker, and the amplifier can be connected to the headphone for output.

4) Reduce noise and improve audio quality. The following approaches are recommended:

- Keep audio PCB route away from the antenna and high-frequency digital signal
- Reserve LC filter circuit in audio circuit to prevent EMC
- Audio route need to be masked

4 Antenna Interface

The SC806 supports 2/3/4G main antenna/diversity receiving antenna, WIFI/BT antenna, and GNSS antenna.

4.1 MAIN/DRXAntenna

The SC806 provides two 2G/3G/4G antenna interfaces. The ANT_MAIN is used to receive and transmit RF signal, and the ANT_DRX is used for diversity reception.

Table26MAIN/DRX antenna interface definition

Pin No.	Pin Name	I/O	Description	Note
87	ANT_MAIN	I/O	2G/3G/4G antenna interface	
131	ANT_DRX	AI	Diversity reception antenna	

4.1.1Operating bands

Table27Module operating band

Band	Mode	Tx (MHz)	Rx (MHz)
Band 2	LTE FDD/WCDMA/GSM	1850-1910	1930-1990
Band 4	LTE FDD/WCDMA	1710-1755	2110-2155

Band 5	LTE FDD/WCDMA/GSM	824 - 849	869 - 894
Band 7	LTE FDD	2500-2570	2620-2690
Band 12	LTE FDD	699-716	729-746
Band 13	LTE FDD	746-756	777-787
Band 17	LTE FDD	704-716	734-746

4.1.2Reference Design

For use of the SC806,the antenna pin and the RF connector or antenna feed point on the main board should be connected via an RF trace. Microstrip trace is recommended for RF trace, with insertion loss within 0.2dB, and impedance at 50ohm.

A π-type circuit is reserved between the SC806 and the antenna connector (or feed point) for antenna debugging. Two parallel devices are directly connected across the RF trace and should not pull out a branch as the diagram shows:

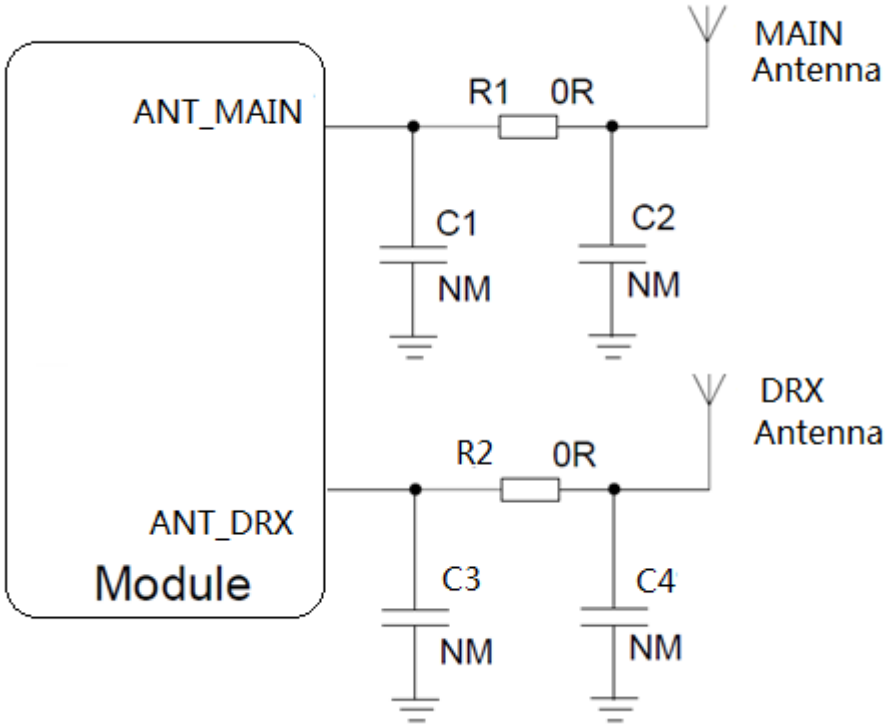


Figure 12MAIN/DRX Antenna Connection

4.2 WIFI/BTAntenna

Microstriptrace is recommended for the WIFI/BT RF route, with insertion loss within 0.2dB, and impedance at 50 ohms.

Table28WIFI/BT antenna interface definition

Pin No.	Pin Name	I/O	Description	Note
77	ANT_BT/WIFI	I/O	WIFI/BTantenna interface	

4.2.1Operating band

Table29WIFI/BT operating band

Mode	Frequency	unit
WIFI	2412~2472 /5180~5825	MHz
BT4.1	2402~2480	MHz

4.2.2Reference design

WIFI/BT antenna connection reference design is shown as follows

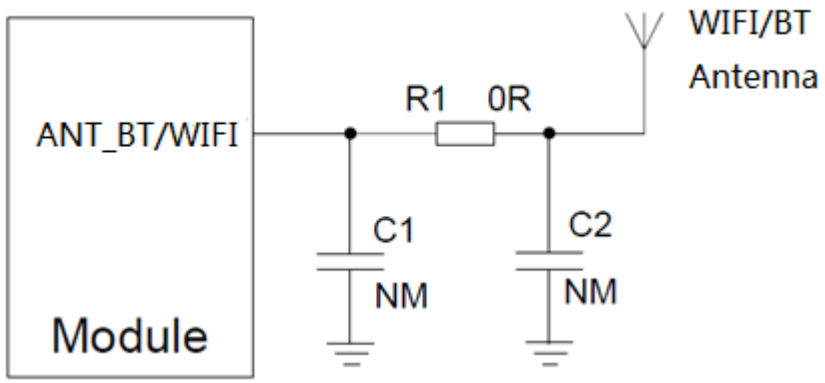


Figure 13WIFI/BT Antenna Connection

4.3 GNSSAntenna

The following describes GNSS related information.

Table30GNSS antenna interface definition

Pin No.	Pin Name	I/O	Description	Note
121	ANT_GNSS	AI	GNSSantenna interface	

4.3.1Operating band

Table31GNSS operating band

Mode	Frequency	Unit
GPS	1575.42±1.023	MHz
GLONASS	1597.42-1605.8	MHz
BeiDou	1561.098±2.046	MHz

4.3.2Reference design

4.3.2 Reference design

The SC806 has a built-in LNA. The passive antenna is used in the design of the device.

Microstriptrace is recommended for the GNSS RF route, with insertion loss within 0.2dB, and impedance at 50 ohms.

The connection reference design is shown as follows:

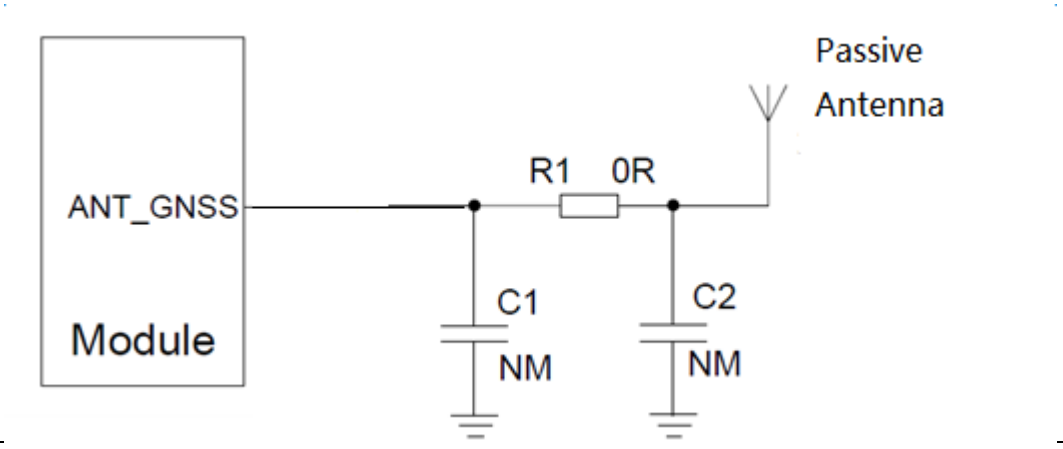


Figure 14GNSS Antenna Connection

4.4 Antenna Requirement

The SC806 module provides two antenna interfaces for the main set and diversity set. The antenna requirement is shown in the following table:

Table32Module antenna requirement

SC806Module antenna requirement	
Standard	Antenna requirements
GSM/WCDMA/CDMA/TDSCDMA/LTE	VSWR: ≤ 2 Gain (dBi)：1 Max input power (W)：50 Input impedance (Ω)：50 Polarization type: vertical direction Insertion loss:<1dB (700-900MHZ) Insertion loss:< 1.5dB(1700-2100MHZ) Insertion loss:< 2dB (2300-2600MHZ)
WIFI/BT	VSWR: ≤ 2 Gain (dBi)：1 Max input power (W)：50 nput impedance (Ω)：50 Polarization type: vertical direction Insertion loss:< 1dB
GNSS	frequency range:1559MHz~1607MHz Polarization type: right-circular or linear polarization VSWR: < 2 (typical) Passive antenna gain: > 0dBi

5 Other Interfaces

For the application of other interfaces, please refer to the recommended design. If the application scenario and the recommended design do not meet the requirements, please contact our technical personnel for confirmation.

6 RF PCB Layout Design Guide

For user PCB, the characteristic impedance of all RF signal traces should be at 50Ω. In general, the impedance of the RF signal trace is determined by the dielectric constant of the material, the trace width (W), the ground clearance (S), and the height of the reference ground plane (H). The control of the characteristic impedance of the PCB is usually in two ways: microstriptrace and coplanar waveguide. To illustrate the design principles, the following figures show the structure design of microstriptrace and coplanar waveguide when the impedance trace is at 50Ω.

Microstriptrace complete structure

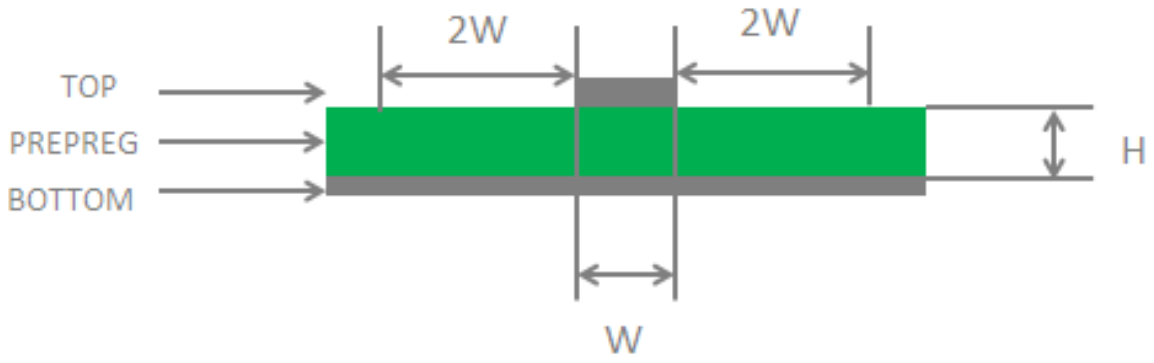
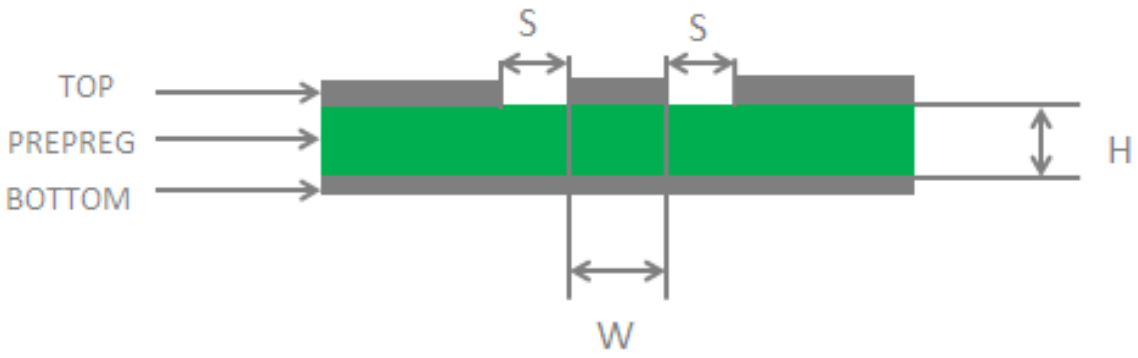


Figure 15Two-layer PCB Microstrip Structure

- Coplanar waveguide complete structure



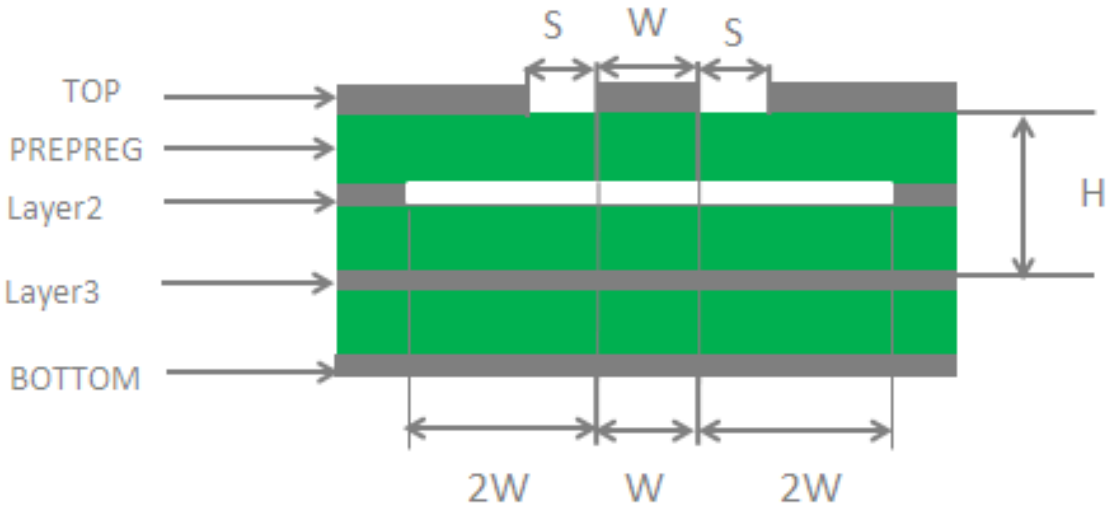


Figure 16Two-layer PCB Coplanar Waveguide Structure

Figure 17Four-layer PCB Coplanar Waveguide Structure (reference ground layer3)

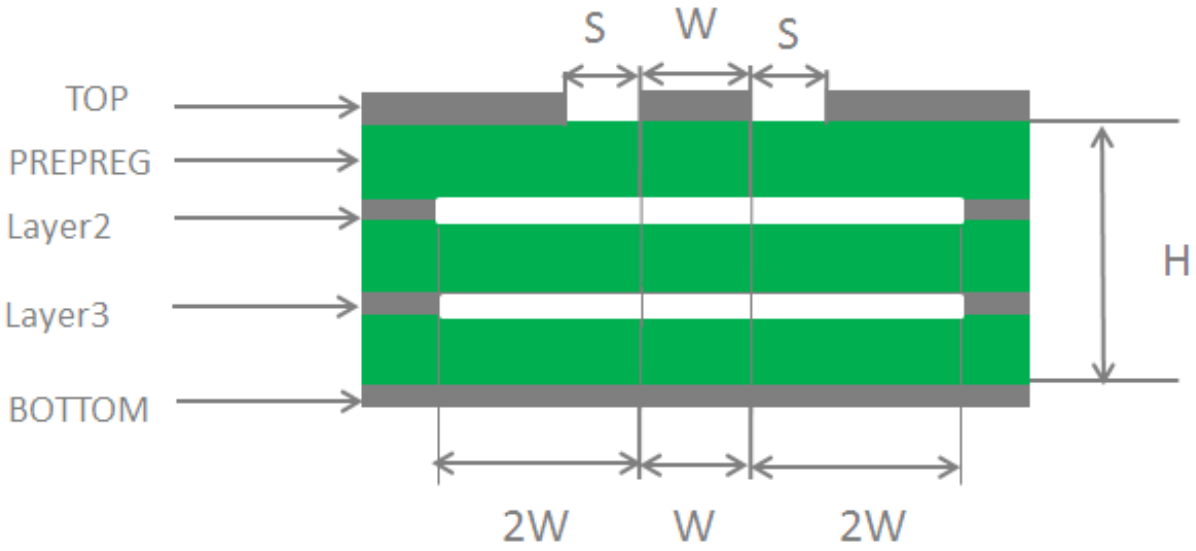


Figure 18Four-layer PCB Coplanar Waveguide Structure (reference ground layer4)

In the design of RF antenna interface circuit, in order to ensure good performance and reliability of the RF signal, it is recommended to follow the following principles in the circuit design:

- The impedance simulation tool should be used to accurately control the RF signal trace at 50Ω impedance.

- The GND pin adjacent to the RF pin should not have thermal welding plate and should be in full contact with the ground.
- The distance between the RF pin and the RF connector should be as short as possible. At the same time, avoid the right-angle route. The recommended route angle is 135 degrees.
- When connecting the device package, it should be noted that the signal pin must be kept away from the ground.
- The reference ground plane of the RF signal trace should be complete; adding a certain amount of ground holes around the signal and the reference ground can help improve the RF performance; the distance between the ground hole and the signal trace should be at least 2 times the line width (2*W).

7 WIFI and Bluetooth

7.1.1 WIFI overview

The SC806 module supports 2.4G single-frequency WLAN wireless communication and 802.11b, 802.11g, and 802.11n standards, with a maximum speed up to 150 Mbps. Its characteristics are as follows:

- Support Wake-on-WLAN (WoWLAN)
- Support ad hoc mode
- Support WAPI
- Support AP mode
- Support Wi-Fi Direct
- Support MCS 0-7 for HT20 and HT40

7.1.2 WIFI performance parameters

Table33WIFI transmission power table

Frequency	Mode	Date Rate	Bandwidth(MHZ)	TXPower（dBm）	EVM(dB)	IEEE Spec(dB)	Mask Margin(dB)
2.4G	802.11b	1Mbps	20	17.0±2	-21	-9	>5
		11Mbps	20	17.0±2	-21	-9	>5
	802.11g	6Mbps	20	16.0±2	-22	-5	>5

		54Mbps	20	14.0±2	-31	-25	>5
	802.11n	MCS0	20	15.0±2	-20	-5	>5
		MCS7	20	13.0±2	-30	-27	>5
5G	802.11a	6Mbps	20	16.0±2	-22	-5	>5
		54Mbps	20	13.0±2	-31	-25	>5
	802.11n	MCS0	20	14.0±2	-23	-5	>5
		MCS7	20	12.0±2	-30	-27	>5

Table34WIFI reception sensitivity

Frequency	Mode	Date Rate	Bandwidth(MHZ)	Sensitivity(dBm)	IEEE Spec（dBm）	Note
2.4G	802.11b	1Mbps	20	-91.0	-80	PER<8%
		11Mbps	20	-90.0	-76	PER<8%
	802.11g	6Mbps	20	-92.0	-82	PER<10%
		54Mbps	20	-74.0	-65	PER<10%
	802.11n	MCS0	20	-90.0	-82	PER<10%
		MCS7	20	-72.0	-64	PER<10%
5G	802.11a	6Mbps	20	-89	-82	PER<10%
		54Mbps	20	-72.0	-65	PER<10%
	802.11n	MCS0	20	-88.0	-82	PER<10%
		MCS7	20	-68.0	-64	PER<10%

The reference standards are as follows:

IEEE 802.11n WLAN MAC and PHY, October 2009 + IEEE 802.11-2007 WLAN MAC and PHY,June 2007

IEEE Std 802.11b, IEEE Std 802.11d, IEEE Std 802.11e, IEEE Std 802.11g, IEEE Std 802.11i:

IEEE 802.11-2007 WLAN MAC and PHY, June 2007

7.1.3Bluetooth overview

The SC806 module supports BT4.1 (BR/EDR+BLE) standards. The modulation method supports GFSK, 8-DPSK and π/4-DQPSK.BR/EDR. Channel bandwidth is 1MHz and can accommodate 79 channels. The BLE channel bandwidth is 2MHz and can accommodate 40 channels. Its main characteristics are as follows:

- BT 4.1 + BR/EDR + BLE
- Support for ANT protocol
- Support for BT-WLAN coexistence operation, including optional concurrent receive
- Up to 3.5 piconets (master, slave, and page scanning)

Table35BT rate and version information

Version	Date Rate	Throughput	Note
BT1.2	1Mb/s	> 80Kbit/s	
BT2.0+EDR	2Mb/s	> 80Kbit/s	
BT3.0+HS	24Mbps	See3.0+HS	
BT4.1 LE	24Mbps	See4.1 LE	

The reference standards are as follows:

Bluetooth Radio Frequency TSS and TP Specification 1.2/2.0/2.0 + EDR/2.1/2.1+ EDR/3.0/3.0 + HS, August 6, 2009

Bluetooth Low Energy RF PHY Test Specification, RF-PHY.TS/4.0.0, December 15, 2009

7.1.4Bluetooth performance parameters

Table36BT performance parameters

Type	DH-5	2-DH5	3-DH5	Unit
Transmitter	11±1	10±1	10±1	dBm
Sensitivity	-93	-90	-86	dBm

8 GNSS

8.1.1 Overview

The SC806 smart module uses Qualcomm's IZatTM engine. The GEN 8C also supports multi-positioning systems, GPS, GLONASS and Beidou. The module is embedded with LNA, which can effectively improve the sensitivity of GNSS.

8.1.2 Performance parameters

Table37GNSS positioning performance

Parameter	Description	Result	Unit
Sensitivity	Acquisition	-146	dBm
	Tracking	-158	dBm
C/No	-130dBm	40	dB-Hz
TTFF	Cold Start	30	S
	Warm Start	30	S
	Hot Start	2	S
CEP	Static accuracy	5	m

9 Electrical Characteristics and Reliability

9.1 Recommended Parameters

Table38Recommended parameters

Parameter	Min	Nominal	Max	Unit
Vbat	3.3	3.8	4.5	V
USB_VBUS	4.35	5	6.0	V
VRTC	2.0	3.0	3.25	V
Operating Temperature	-30	25	70	℃
Storage Temperature	-40	25	85	℃

9.2 Charge Parameters

Table39Charge parameters

Parameter	Min	Nominal	Max	Unit
Trickle Charge - A Current	81	90	99	mA
Trickle Charge - A threshold voltage (15.62mV Stepping)	2.5	2.796	2.984	V
Trickle Charge - B threshold voltage (18.75mV Stepping)	3.0	3.2	3.581	V
Charge voltage setting range (25mV stepping)	4	4.2	4.775	V
Charge voltage accuracy	/	/	+/-2	%
Charge current setting range (90mA stepping)	90	/	1440	mA
Charge current accuracy	/	/	+/-10	%
Charge cut-off current: when the charge current is set to 90mA to 450mA	/	7	/	%
Charge cut-off current: when the charge current is set to 450mA to 1440mA	/	7.4	/	%

9.3 Operating Current

Table40Operating current

Parameter	Description	Condition	Result	Unit
Ioff	Power Off	Power Off	10	uA
Isleep	WCDMA	DRX=8	3.44	mA
	FDD LTE	DPC(DefaultPaging Cycle)=#256	2.33	
	Radio Off	AT+CFUN=4 Flight Mode	1.66	

IWCDMA-RMS	WCDMA RMS Current	Band2@ max power	463	
		Band4@ max power	479	
		Band5@ max power	432	
ILTE-RMS	FDD data RMS Current	Band2@max power(10MHz,1RB)	641	mA
		Band4@max power(10MHz,1RB)	615	
		Band5@max power(10MHz,1RB)	557	
		Band12@max power(10MHz,1RB)	618	mA
		Band13@max power(10MHz,1RB)	629	
		Band17@max power(10MHz,1RB)	622	

9.4 RF Transmitting Power

The power transmitted by each frequency band of the SC806 module is shown in the following table:

Table41Module RF transmitting power

Mode	Band	Max Power(dBm)	Min Power(dBm)
WCDMA	Band II	23.5±1	<-50
	Band IV	23.5±1	<-50
	Band V	23.5±1	<-50
	Band 2	23.0±1	<-44

Mode	Band	Max Power(dBm)	Min Power(dBm)
LTE FDD	Band 4	23.0±1	<-44
	Band 5	23.0±1	<-44
	Band 12	23.0±1	<-44
	Band 13	23.0±1	<-44
	Band 17	23.0±1	<-44

9.5 RF Receiver Sensitivity

The sensitivity of each frequency band of the SC806 module is shown in the following table:

Table42Module RF receiver sensitivity

Mode	Band	Primary	Diversity	PRX+Div	3GPP Requirement	Unit
WCDMA	Band II	-110	NA	NA	-104.7	dBm
	Band IV	-110	NA	NA	-106.7	dBm
	Band V	-110	NA	NA	-104.7	dBm
LTE FDD(10M)	Band 2	-98	-99	-102	-95	dBm
	Band 4	-98	-99	-102	-97	dBm
	Band 5	-98	-99	-102	-95	dBm
	Band 12	-98	-99	-102	-94	dBm
	Band 13	-98	-99	-102	-94	dBm
	Band 17	-98	-99	-102	-94	dBm

9.6 Electrostatic Protection

In the application of the module, due to static electricity generated by human body static electricity, and charged

friction between micro-electronics, etc., discharging to the module through various channels may cause certain damage to the module, so ESD protection should be taken seriously. In the process of R&D, production assembly and testing, and especially in product design, ESD protection measures should be taken. For example, anti-static protection should be added at the interface of the circuit design and at the points susceptible to electrostatic discharge or impact. Anti-static gloves should be worn during production.

ESD performance parameters Table 1-6 (Temperature: 25°C, Humidity: 45%)

Table43ESD performance

Test Point	Contact Discharge	Air Discharge	Unit
VBAT, GND	±5	±10	kV
Antenna interface	±4	±8	kV
Other interface	±0.5	±1	kV

10 Structural specification

10.1 Product appearance

The SC806 module appearance is shown in the figure:

Figure 19Module Product Appearance

10.2 Structural Dimension

The structural dimension of the SC806 module is shown in the figure:

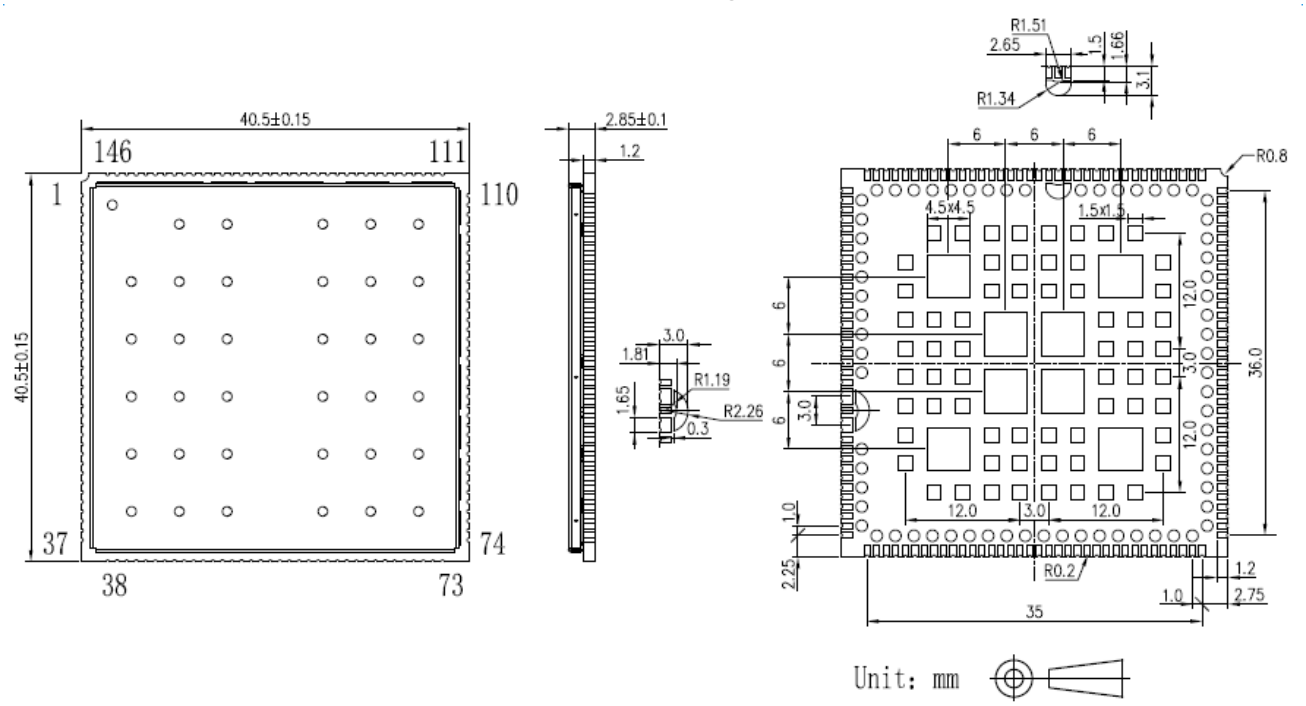


Figure 20Structural Dimension

10.3 Recommended PCB Welding Plate Design

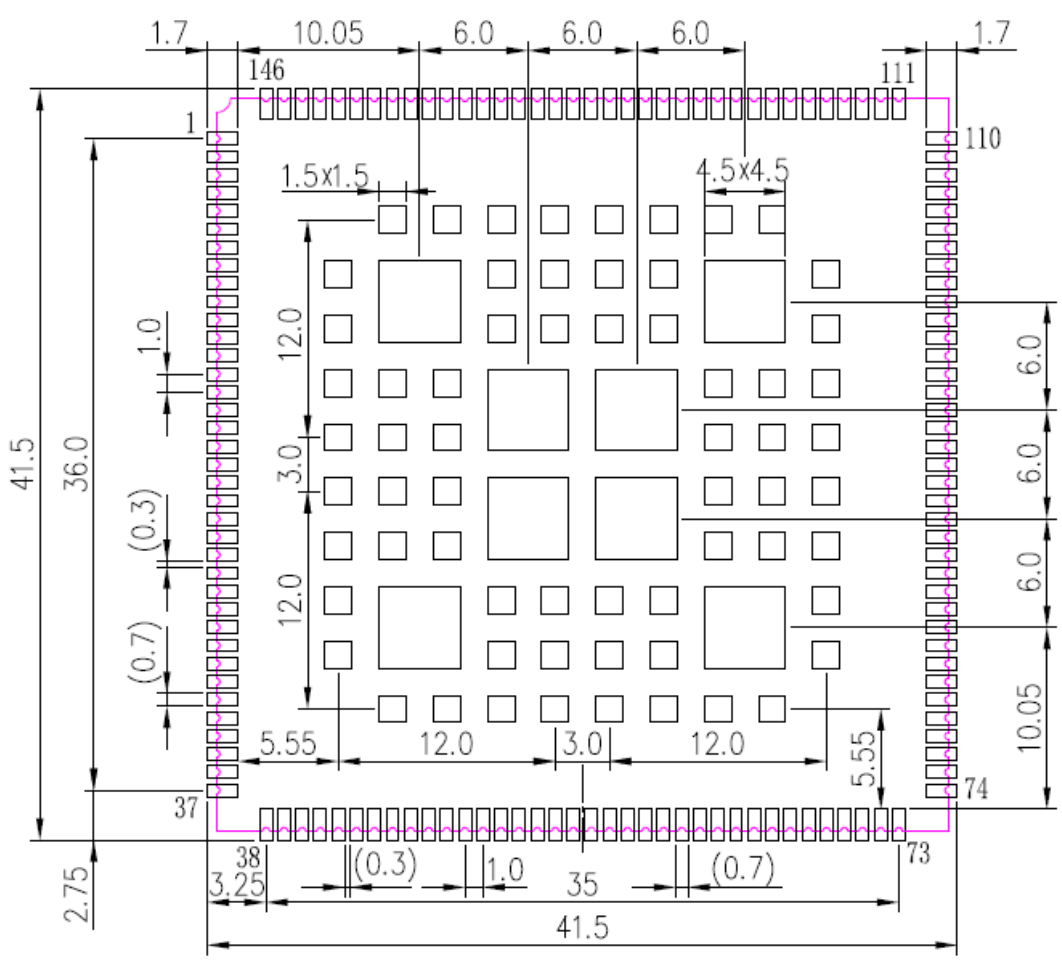


Figure 21Recommended PCB Welding Plate Design (Unit: mm)

10.4 SMT Patch

For module steel net design, please refer to SMT Application Design Instructions for the solder paste and furnace temperature control.

10.5 Storage

10.5.1 Storage life

Storage conditions (recommended): temperature 23 ± 5 °C, relative humidity RH 35-70%.

Storage life (seal vacuum packaging): The Storage life is 12 months under the recommended storage conditions.

10.5.2 Workshop life

The workshop life of Level 3 moisture sensitive product is 72 hours. After unpacking, in the environment of 23±5℃ workshop temperature and relative humidity less than 60%, the product should be returned to production or other high-temperature operation within 72 hours, or stored in an environment with relative humidity less than 10% to maintain dryness of the product.

10.5.3 Baking

- Temperature:125±5℃
- Continuous baking time: 24hours
- Oven: convective heat exchange oven

10.6 Packaging

SC806module adopts tray sealed vacuum packaging, combined with the outer packaging method using the hard carton box, so that the storage, transportation and the usage of modules can be protected to the greatest extent.

Note:

The vacuum bag contains humidity card and desiccant. The module is a moisture-sensitive device, with moisture sensitive level 3, and it is in line with the standards of theJEDEC. Please avoid permanent damage to the product caused by moisture.

The module is a precision electronic product, and may suffer permanent damage if no correct electrostatic protection measures are taken.

10.6.1 Tray packaging

The SC806 module is packaged in trays, 15 PCS per tray, 6 trays per box, 6 boxes per package. 1 tray of 10 PCS modules is at above, and 1 empty tray is at the bottom, a tray with a total of 8 PCS. The tray packaging is shown in the figure:

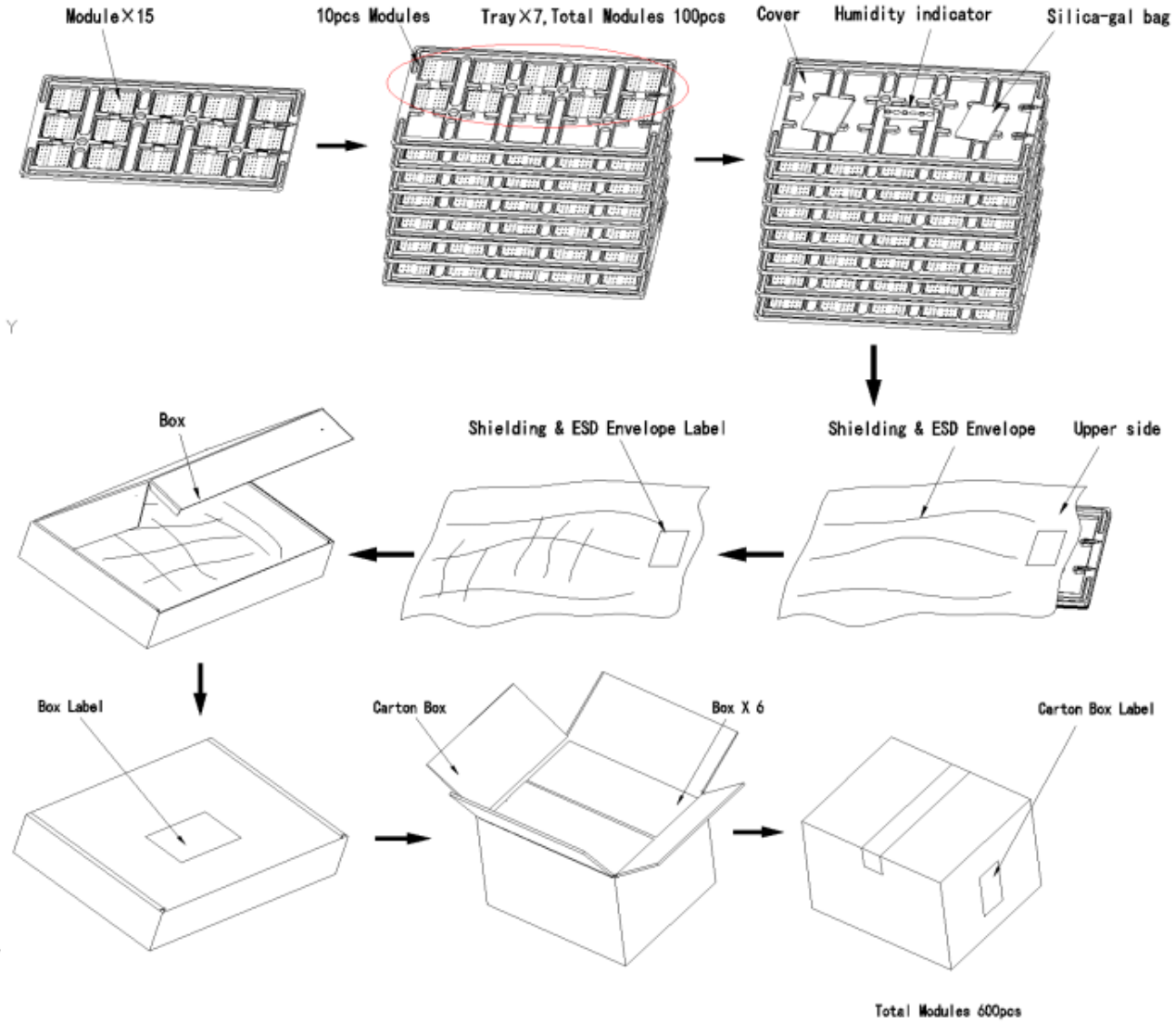


Figure 22Tray Packaging

10.6.2 Tray dimension

The tray dimension is 315*170*6.5mm, as shown in the figure:

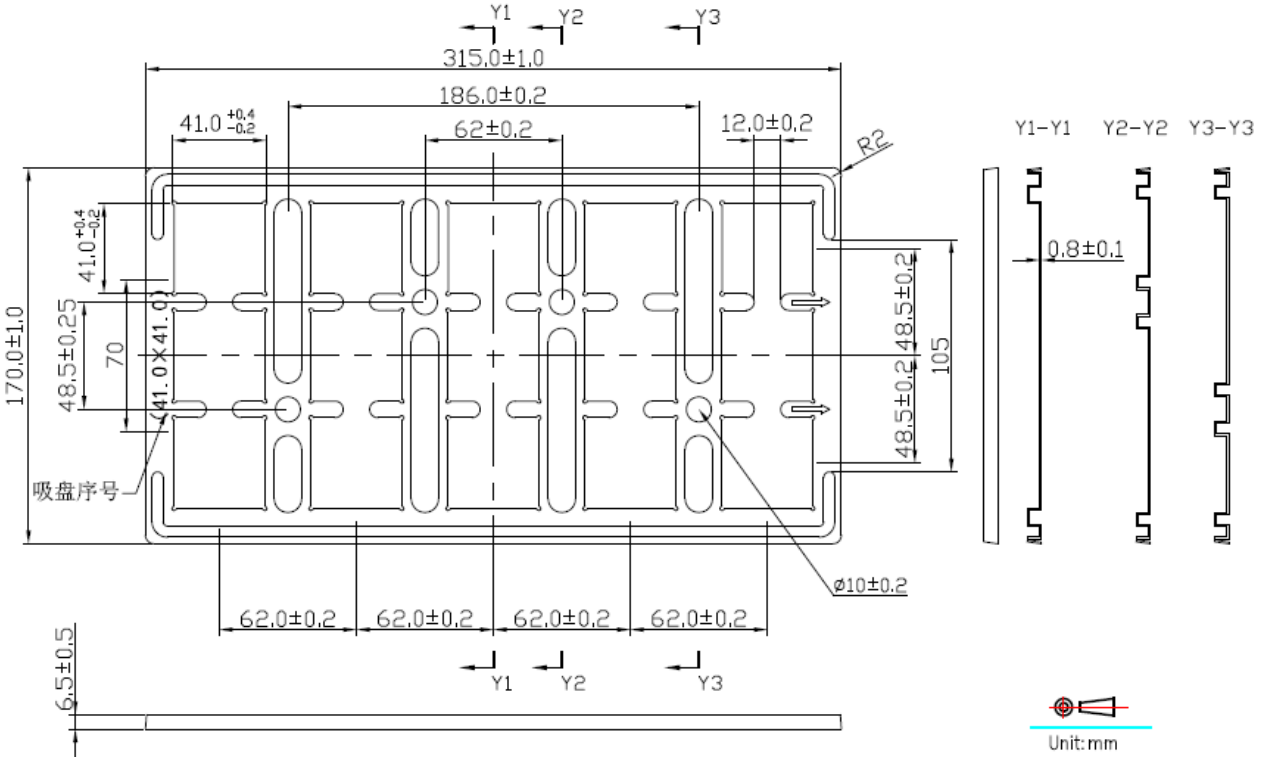


Figure 23Tray Dimension

11 Appendix A Term Abbreviations

Terms	Description
AMR	Adaptive Multi-rate
bps	Bits Per Second
CS	Coding Scheme
DRX	Discontinuous Reception
EGSM	Extended GSM900 Band
FDD	Frequency Division Duplexing
GMSK	Gaussian Minimum Shift Keying
GSM	Global System for Mobile Communications
HSDPA	High Speed Down Link Packet Access
IMEI	International Mobile Equipment Identity
Imax	Maximum Load Current
LED	Light Emitting Diode
LSB	Least Significant Bit
LTE	Long Term Evolution
ME	Mobile Equipment
MS	Mobile Station
MT	Mobile Terminated
PCB	Printed Circuit Board
PDU	Protocol Data Unit
PSK	Phase Shift Keying
QAM	Quadrature Amplitude Modulation

QPSK	Quadrature Phase Shift Keying
RF	Radio Frequency
RHCP	Right Hand Circularly PolarizedRMS
RMS	Root Mean Square
RTC	Real Time Clock
Rx	Receive
SMS	Short Message Service
TDMA	Time Division Multiple Access
TE	Terminal Equipment
TX	Transmitting Direction
TDD	Time Division Duplexing
UART	Universal Asynchronous Receiver & Transmitter
UMTS	Universal Mobile Telecommunications System
URC	Unsolicited Result Code
(U)SIM	(Universal) Subscriber Identity Module
USSD	Unstructured Supplementary Service Data
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
VIHmax	Maximum Input High Level Voltage Value
VIHmin	Minimum Input High Level Voltage Value
VILmax	Maximum Input Low Level Voltage Value
VILmin	Minimum Input Low Level Voltage Value

VImax	Absolute Maximum Input Voltage Value
VImin	Absolute Minimum Input Voltage Value
VOHmax	Maximum Output High Level Voltage Value
VOHmin	Minimum Output High Level Voltage Value
VOLmax	Maximum Output Low Level Voltage Value
VOLmin	Minimum Output Low Level Voltage Value
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access

12 Appendix B GPRS Encoding Scheme

Table44GPRS encoding scheme

Encoding method	CS-1	CS-2	CS-3	CS-4
Rate	1/2	2/3	3/4	1
USF	3	3	3	3
Pre-coded USF	3	6	6	12
Radio Block excl.USF and BCS	181	268	312	428
BCS	40	16	16	16
Tail	4	4	4	-
Coded Bits	456	588	676	456
Punctured Bits	0	132	220	-
Data rate Kb/s	9.05	13.4	15.6	21.4

13 Appendix C GPRS Multislot

In the GPRS standard, 29 types of GPRS multislot modes are defined for use by mobile stations. The multislots class defines the maximum rate of uplink and downlink. The expression is 3+1 or 2+2, the first number indicates the number of downlink timeslots, and the second number indicates the number of uplink timeslots. Active timeslots indicates the total number of timeslots that the GPRS device can use for both uplink and downlink communications.

Table45Multilevel multislot allocation

Multislot Class	Downlink Slots	Uplink Slots	Active Slots
1	1	1	2
2	2	1	3
3	2	2	3
4	3	1	4
5	2	2	4
6	3	2	4
7	3	3	4
8	4	1	5
9	3	2	5
10	4	2	5
11	4	3	5
12	4	4	5
33	5	4	6

14 Appendix D EDGE Modulation and Encoding Method

Table46EDGE modulation and encoding method

Coding Scheme	Modulation	Coding Family	1 Timeslot	2 Timeslot	4 Timeslot
CS-1	GMSK	/	9.05kbps	18.1kbps	36.2kbps
CS-2	GMSK	/	13.4kbps	26.8kbps	53.6kbps
CS-3	GMSK	/	15.6kbps	31.2kbps	62.4kbps
CS-4	GMSK	/	21.4kbps	42.8kbps	85.6kbps
MCS-1	GMSK	C	8.80kbps	17.6kbps	35.2kbps
MCS-2	GMSK	B	11.2kbps	22.4kbps	44.8kbps
MCS-3	GMSK	A	14.8kbps	29.6kbps	59.2kbps
MCS-4	GMSK	C	17.6kbps	35.2kbps	70.4kbps
MCS-5	8-PSK	B	22.4kbps	44.8kbps	89.6kbps
MCS-6	8-PSK	A	29.6kbps	59.2kbps	118.4kbps
MCS-7	8-PSK	B	44.8kbps	89.6kbps	179.2kbps
MCS-8	8-PSK	A	54.4kbps	108.8kbps	217.6kbps
MCS-9	8-PSK	A	59.2kbps	118.4kbps	236.8kbps