SC20-W Hardware Design

Smart Wi-Fi Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2016-10-21	Vae LIU	Initial
1.1	2017-01-06	Vae LIU/ Mark ZHANG	1. Added camera sensor models that have been verified by Quectel. 2. Updated Wi-Fi transmitting performance parameters in Table 22. 3. Added a note for Figure 29. 4. Updated the description for RF layout reference design (Chapter 5.1.1)
1.2	2017-09-01	Tony GAO/ Beny ZHU	Added descriptions of Wi-Fi 5GHz frequency band (Table 1, 2, 22 and 23)
1.3	2018-08-02	Camphor DUAN	1. Added a comment for RESET_N (RESET_N is disabled by default, and can be enabled through software configuration) in Table 4. 2. Added the description that the GPIO_68 and GPIO_88 cannot be pulled up during start-up in Table 4 and Chapter 3.12. 3. Updated the turning on timing of the module (Figure 8). 4. Added the description of SPI interface in Chapter 3.13. 5. Added the description that the effective resolution of ADC interface is 12 bits in Chapter 3.15. 6. Updated the reflow soldering thermal profile in Chapter 8.2.
1.4	2018-10-19	Jeremy LI	1. Updated Wi-Fi transmitting performance parameters in Table 23. 2. Updated Wi-Fi receiving performance parameters in Table 24.

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1 Introduction

This document defines the SC20-W module, its air interface and hardware interface which are connected with customers' application.

This document can help customers quickly understand module interface specifications, electrical and mechanical details as well as other related information of SC20-W module. Associated with application notes and user guides, customers can use SC20-W module to design and set up mobile applications easily.

1.1. Safety Information

The following safety precautions must be observed during all phases of operation, such as usage, service or repair of any cellular terminal or mobile incorporating SC20-W module. Manufacturers of the cellular terminal should send the following safety information to users and operating personnel and incorporate these guidelines into all manuals supplied with the product. If not so, Quectel assumes no liability for customers' failure to comply with these precautions.

	Full attention must be given to driving at all times in order to reduce the risk of an accident. Using a mobile while driving (even with a handsfree kit) causes distraction and can lead to an accident. Please comply with laws and regulations restricting the use of wireless devices while driving.
	Switch off the cellular terminal or mobile before boarding an aircraft. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. If the device offers an Airplane Mode, then it should be enabled prior to boarding an aircraft. Please consult the airline staff for more restrictions on the use of wireless devices on boarding the aircraft.
	Wireless devices may cause interference on sensitive medical equipment, so please be aware of the restrictions on the use of wireless devices when in hospitals, clinics or other healthcare facilities.
	Cellular terminals or mobiles operating over radio signals and cellular network cannot be guaranteed to connect in all possible conditions (for example, with unpaid bills or with an invalid (U)SIM card). When emergent help is needed in such conditions, please remember using emergency call. In order to make or receive a call, the cellular terminal or mobile must be switched on in a service area with adequate cellular signal strength.
	The cellular terminal or mobile contains a transmitter and receiver. When it is ON, it receives and transmits radio frequency signals. RF interference can occur if it is used close to TV set, radio, computer or other electric equipment.
	In locations with potentially explosive atmospheres, obey all posted signs to turn off wireless devices such as your phone or other cellular terminals. Areas with potentially explosive atmospheres include fueling areas, below decks on boats, fuel or chemical transfer or storage facilities, areas where the air contains chemicals or particles such as grain, dust or metal powders, etc.

2 Product Concept

2.1. General Description

SC20-W is a series of Smart Wi-Fi module based on Qualcomm platform and Android operating system, and provides industrial grade performance. Its general features are listed below:

- Support short-range wireless communication via Wi-Fi 802.11a/b/g/n and BT4.2 LE.
- Support multiple audio and video codecs.
- Built-in high performance Adreno™ 304 graphics processing unit.
- Enable smooth play of 720P videos.
- Provide multiple audio and video input/output interfaces as well as abundant GPIO interfaces.

SC20-W module contains two variants: SC20-W R1.0 and SC20-W R1.1. Customers can choose the dedicated variant based on the supported wireless network standards. The following table shows the supported Wi-Fi/BT standards and frequency range of SC20-W series module.

Table 1: SC20-W Frequency Bands

Type	Network Standard	Frequency Range
SC20-W R1.0	IEEE 802.11b/g/n	2402MHz~2482MHz
	BT4.2 LE	2402MHz~2480MHz
SC20-W R1.1	IEEE 802.11b/g/n	2402MHz~2482MHz
	IEEE 802.11a/n	5180MHz~5825MHz
	BT4.2 LE	2402MHz~2480MHz

SC20-W is an SMD type module, which can be embedded into applications through its 210-pin pads including 146 LCC signal pads and 64 other pads. With a compact profile of 40.5mm × 40.5mm × 2.8mm, SC20-W can meet almost all requirements for M2M applications such as CPE, wireless POS, smart metering, automotive, digital signage, alarm panel, security and industrial PDA.

2.2. Key Features

The following table describes the detailed features of SC20-W module.

Table 2: SC20-W Key Features

Feature	Details
Applications Processor	ARM Cortex-A7 microprocessor cores (quad-core) up to 1.1 GHz 512KB L2 cache
Modem DSP	QDSP6 v5 core up to 691.2MHz 768KB L2 cache
Memory	8GB eMMC + 8Gb LPDDR3 16GB eMMC + 16Gb LPDDR3
Operating System	Android 5.1/6.0/7.1
Power Supply	Supply voltage: 3.5V~4.2V Typical supply voltage: 3.8V
WLAN Features	**SC20-W R1.0** 2.4GHz single frequency band Support 802.11b/g/n standards, with max data rate up to 150Mbps Support AP mode **SC20-W R1.1** 2.4GHz/5GHz double frequency bands Support 802.11a/b/g/n standards, with max data rate up to 150Mbps Support AP mode
Bluetooth Feature	BT4.2 LE
AT Commands	3GPP TS 27.007 and 3GPP TS 27.005 AT commands as well as Quectel enhanced AT commands
LCM Interface	4-lane MIPI_DSI, up to 1.5Gbps for each lane Support WVGA (2-lane MIPI_DSI), up to 720p (4-lane MIPI_DSI) 24-bit color depth
Camera Interfaces	Use MIPI_CSI, up to 1.5Gbps per lane Support two cameras: 2-lane MIPI_CSI for rear camera, max pixel up to 8MP 1-lane MIPI_CSI for front camera, max pixel up to 2MP
Video Codec	**Video encoding:** H.264 BP/MP – 720p @30fps MPEG-4 SP/H.263 P0 – WVGA @30fps VP8 – WVGA @30fps Video decoding:

	H.264 BP/MP/HP – 1080P @30fps MPEG-4 SP/ASP –1080P @30fps DivX 4x/5x/6x –1080P @30fps H.263 P0 – WVGA @30fps VP8 –1080P @30 fps (HEVC) H.265 MP 8 bit –1080P @30fps
Audio Interfaces	**Audio input:** 2 groups of analog microphone input, integrating internal bias voltage **Audio output:** Class AB stereo headphone output Class AB earpiece differential output Class D speaker differential amplifier output
Audio Codec	HR, FR, EFR, AMR, AMR-WB
USB Interface	Compliant with USB 2.0 specification; the data transfer rate can reach up to 480Mbps Used for AT command communication, data transmission, software debugging and firmware upgrade Support USB OTG (Need additional 5V power supply chip) USB Driver: Support Windows XP, Windows Vista, Windows 7/8/8.1, Linux 2.6 or later
UART Interfaces	2 UART interfaces: UART1 and UART2 ● UART1: 4-wire UART interface with RTS/CTS hardware flow control; baud rate up to 4Mbps ● UART2: 2-wire UART interface used for debugging
Motor Drive Interface	Drive ERM motor
SD Card Interface	Support SD 3.0, 4-bit SDIO Support hot-plug
I2C Interfaces	3 groups of I2C Used for peripherals such as camera, sensor, touch panel, etc.
ADC Interfaces	Support 3 ADC interfaces; Used for input voltage sense, battery temperature detection and general-purpose ADC
Real Time Clock	Supported
Antenna Interface	Wi-Fi/BT antenna
Physical Characteristics	Size: (40.5±0.15)mm × (40.5±0.15)mm × (2.8±0.2) mm Package: LCC Weight: approx. 9.8g
Temperature Range	Operation temperature range: -35°C~+65°C [1)] Extended temperature range : -40°C~+75°C [2)] Storage temperature range: -40°C ~ +90°C

Firmware Upgrade	Over USB interface
RoHS	All hardware components are fully compliant with EU RoHS directive

NOTES

1. [1)] Within operation temperature range, the module is IEEE specifications.
2. [2)] Within extended temperature range, the module remains the ability for data transmission. There is no unrecoverable malfunction. There are also no effects on radio spectrum and no harm to radio network. Only one or more parameters like P_{out} might reduce in their value and exceed the specified tolerances. When the temperature returns to the normal operation temperature levels, the module will meet IEEE specifications again.

2.3. Functional Diagram

The following figure shows a block diagram of SC20-W and illustrates the major functional parts.

- Power management
- Radio frequency
- Baseband
- LPDDR3+EMMC flash
- Peripheral interfaces
  -- USB interface
  -- UART interfaces
  -- SD card interface
  -- I2C interfaces
  -- ADC interfaces
  -- LCM (MIPI) interface
  -- Touch Panel interface
  -- Camera (MIPI) interfaces
  -- Audio interfaces

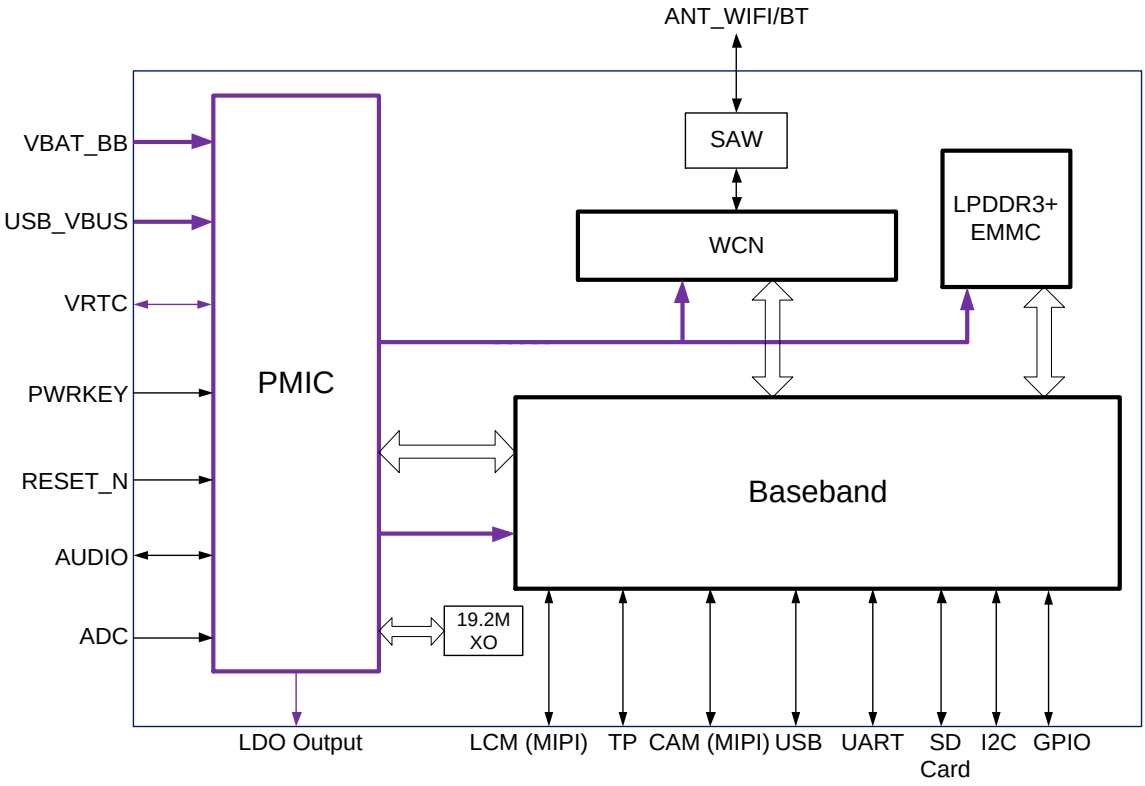


Figure 1: Functional Diagram

2.4. Evaluation Board

In order to help customers to develop applications with SC20-W, Quectel supplies the evaluation board (Smart-EVB), RS-232 to USB cable, USB data cable, earphone, antenna and other peripherals to control or test the module. For more details, please refer to ***document [1]***.

3 Application Interfaces

3.1. General Description

SC20-W is equipped with 146-pin 1.0mm pitch SMT pads plus 64-pin ground/reserved pads that can be embedded into wireless application platforms. The following chapters provide the detailed description of pins/interfaces listed below.

- Power supply
- VRTC interface
- USB interface
- UART interfaces
- SD card interface
- GPIO interfaces
- SPI interface
- I2C interfaces
- ADC interfaces
- Motor drive interface
- LCM interface
- TP interface
- Camera interfaces
- Sensor interfaces
- Audio interfaces
- Emergency download interface

3.2. Pin Assignment

The following figure shows the pin assignment of SC20-W module.

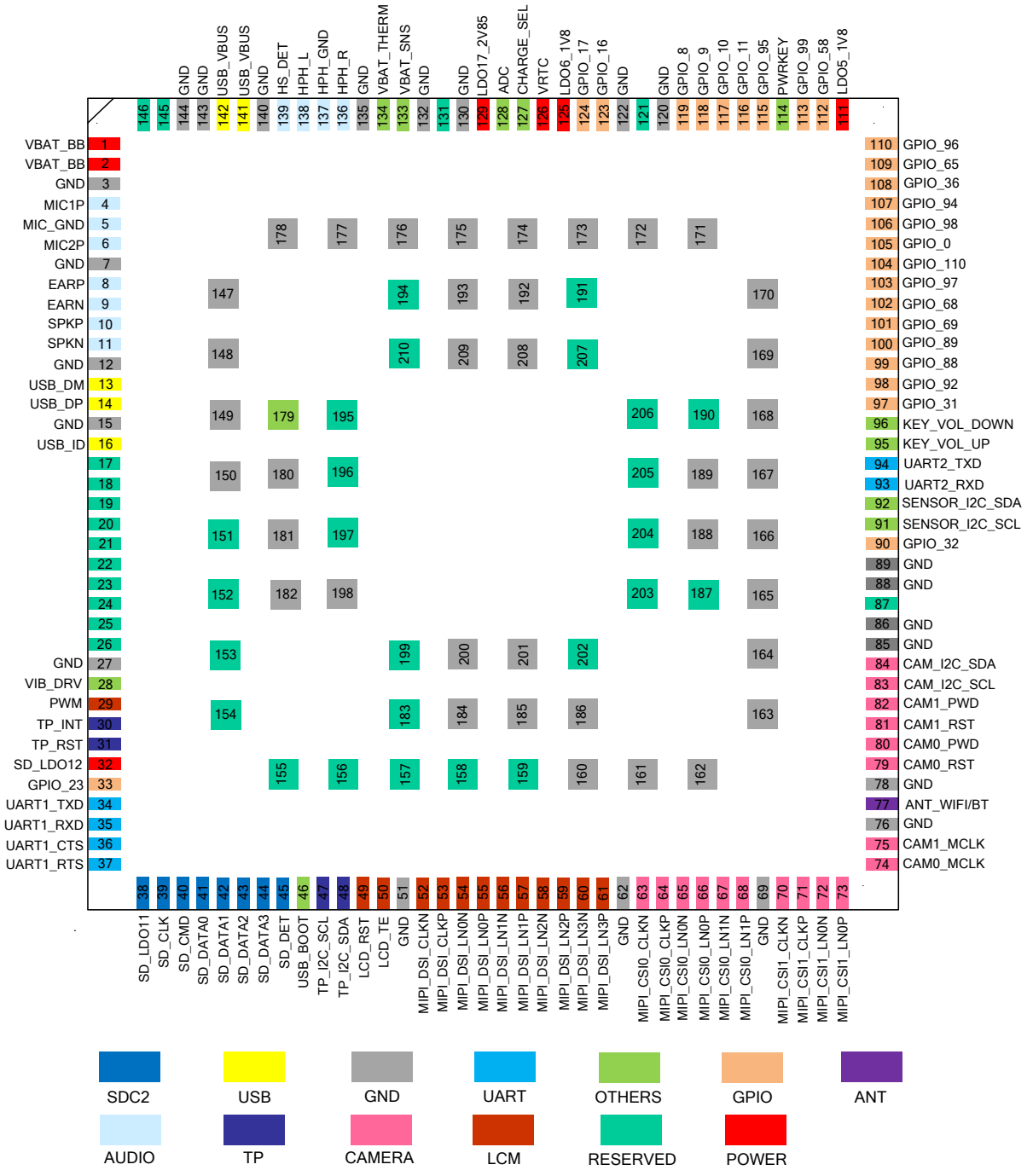


Figure 2: Pin Assignment (Top View)

3.3. Pin Description

The following tables show the SC20-W's pin definition.

Table 3: I/O Parameters Definition

Type	Description
IO	Bidirectional
DI	Digital input
DO	Digital output
PI	Power input
PO	Power output
AI	Analog input
AO	Analog output
OD	Open drain

The following tables show the SC20-W's pin definition and electrical characteristics.

Table 4: Pin Description

Power Supply					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VBAT_BB	1, 2	PI	Power supply for module's baseband part	Vmax=4.2V Vmin=3.5V Vnorm=3.8V	It must be able to provide sufficient current up to 3.0A. It is suggested to use a zener diode for voltage stabilization.
VRTC	126	PI/ PO	Power supply for internal RTC circuit	$V_O$max=3.2V V_I=2.0V~3.25V I_{IN} max=200uA	If unused, keep this pin open.
LDO5_1V8	111	PO	1.8V output power supply	Vnorm=1.8V $I_O$max=20mA	Power supply for external GPIO's

					pull up circuits and level conversion circuit.
LDO6_1V8	125	PO	1.8V output power supply	Vnorm=1.8V $I_O$max=100mA	Power supply for peripherals. 2.2uF~4.7uF capacitor is recommended to be applied to the LDO6_1V8 pin. If unused, keep this pin open.
LDO17_2V85	129	PO	2.85V output power supply	Vnorm=2.85V $I_O$max=300mA	Power supply for peripherals. 2.2uF~4.7uF capacitor is recommended to be applied to the LDO17_2V85 pin. If unused, keep this pin open.
SD_LDO11	38	PO	Power supply for SD card	Vnorm=2.95V $I_O$max=600mA	
SD_LDO12	32	PO	1.8V/2.95V output power supply	Vnorm=2.95V $I_O$max=50mA	Power supply for SD card's pull-up circuit.
GND	3, 7, 12, 15, 27, 51, 62, 69, 76, 78, 85, 86, 88, 89, 120, 122, 130, 132, 135, 140, 143, 144, 147~150, 160~178, 180~182, 184~186, 188, 189, 192, 193, 198, 200, 201, 208, 209		GND		

Audio Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
MIC1P	4	AI	Microphone positive input for channel 1		
MIC_GND	5		MIC reference ground		
MIC2P	6	AI	Microphone positive input for channel 2		
EARP	8	AO	Earpiece positive output		
EARN	9	AO	Earpiece negative output		
SPKP	10	AO	Speaker positive output		
SPKN	11	AO	Speaker negative output		
HPH_R	136	AO	Headphone right channel output		
HPH_GND	137		Headphone virtual ground		
HPH_L	138	AO	Headphone left channel output		
HS_DET	139	AI	Headset insertion detection		High level by default.
USB Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
USB_VBUS	141, 142	PI	USB power supply	Vmax=6.3V Vmin=4.35V Vnorm=5.0V	Used for USB 5V power input and USB detection.
USB_DM	13	IO	USB differential data bus (minus)	Compliant with USB 2.0 standard specification.	Require differential impedance of 90Ω.
USB_DP	14	IO	USB differential data bus (plus)		
USB_ID	16	AI	USB ID detection		High level by default.
UART Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**

UART1_TXD	34	DO	UART1 transmit data	V_{OL}max=0.45V V_{OH}min=1.35V	1.8V power domain. If unused, keep this pin open.
UART1_RXD	35	DI	UART1 receive data	V_{IL}max=0.63V V_{IH}min=1.17V	1.8V power domain. If unused, keep this pin open.
UART1_CTS	36	DI	UART1 clear to send	V_{IL}max=0.63V V_{IH}min=1.17V	1.8V power domain. If unused, keep this pin open.
UART1_RTS	37	DO	UART1 request to send	V_{OL}max=0.45V V_{OH}min=1.35V	1.8V power domain. If unused, keep this pin open.
UART2_RXD	93	DI	UART2 receive data. Debug port by default.	V_{IL}max=0.63V V_{IH}min=1.17V	1.8V power domain. If unused, keep this pin open.
UART2_TXD	94	DO	UART2 transmit data. Debug port by default.	V_{OL}max=0.45V V_{OH}min=1.35V	1.8V power domain. If unused, keep this pin open.
SD Card Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
SD_CLK	39	DO	High speed digital clock signal of SD card	**1.8V SD card:** V_{OL}max=0.45V V_{OH}min=1.4V **2.95V SD card:** V_{OL}max=0.37V V_{OH}min=2.2V	
SD_CMD	40	IO	Command signal of SD card	**1.8V SD card:** V_{IL}max=0.58V V_{IH}min=1.27V V_{OL}max=0.45V V_{OH}min=1.4V **2.95V SD card:** V_{IL}max=0.73V V_{IH}min=1.84V	

				V_{OL}max=0.37V V_{OH}min=2.2V	
SD_DATA0	41	IO	High speed bidirectional digital signal lines of SD card	**1.8V SD card:** V_{IL}max=0.58V V_{IH}min=1.27V V_{OL}max=0.45V V_{OH}min=1.4V **2.95V SD card:** V_{IL}max=0.73V V_{IH}min=1.84V V_{OL}max=0.37V V_{OH}min=2.2V	
SD_DATA1	42	IO			
SD_DATA2	43	IO			
SD_DATA3	44	IO			
SD_DET	45	DI	SD card insertion detection	V_{IL}max=0.63V V_{IH}min=1.17V	Active low
Touch Panel (TP) Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
TP_INT	30	DI	Interrupt signal of TP	V_{IL}max=0.63V V_{IH}min=1.17V	1.8V power domain.
TP_RST	31	DO	Reset signal of TP	V_{OL}max=0.45V V_{OH}min=1.35V	1.8V power domain. Active low.
TP_I2C_SCL	47	OD	I2C clock signal of TP		1.8V power domain.
TP_I2C_SDA	48	OD	I2C data signal of TP		1.8V power domain.
LCM Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
PWM	29	DO	Adjust the backlight brightness. PWM control signal.	V_{OL}max=0.45V V_{OH}max=VBAT_BB	
LCD_RST	49	DO	LCD reset signal	V_{OL}max=0.45V V_{OH}min=1.35V	1.8V power domain. Active low.
LCD_TE	50	DI	LCD tearing effect signal	V_{IL}max=0.63V V_{IH}min=1.17V	1.8V power domain.
MIPI_DSI_CLKN	52	AO	MIPI DSI clock signal (negative)		
MIPI_DSI_CLKP	53	AO	MIPI DSI clock signal (positive)		

MIPI_DSI_LN0N	54	AO	MIPI DSI data signal (negative)		
MIPI_DSI_LN0P	55	AO	MIPI DSI data signal (positive)		
MIPI_DSI_LN1N	56	AO	MIPI DSI data signal (negative)		
MIPI_DSI_LN1P	57	AO	MIPI DSI data signal (positive)		
MIPI_DSI_LN2N	58	AO	MIPI DSI data signal (negative)		
MIPI_DSI_LN2P	59	AO	MIPI DSI data signal (positive)		
MIPI_DSI_LN3N	60	AO	MIPI DSI data signal (negative)		
MIPI_DSI_LN3P	61	AO	MIPI DSI data signal (positive)		
Camera Interfaces					
Pin Name	**Pin No**	**I/O**	**Description**	**DC Characteristics**	**Comment**
MIPI_CSI0_CLKN	63	AI	MIPI CSI clock signal (negative)		
MIPI_CSI0_CLKP	64	AI	MIPI CSI clock signal (positive)		
MIPI_CSI0_LN0N	65	AI	MIPI CSI data signal (negative)		
MIPI_CSI0_LN0P	66	AI	MIPI CSI data signal (positive)		
MIPI_CSI0_LN1N	67	AI	MIPI CSI data signal (negative)		
MIPI_CSI0_LN1P	68	AI	MIPI CSI data signal (positive)		
MIPI_CSI1_CLKN	70	AI	MIPI CSI clock signal (negative)		
MIPI_CSI1_CLKP	71	AI	MIPI CSI clock signal (positive)		
MIPI_CSI1_LN0N	72	AI	MIPI CSI data signal (negative)		
MIPI_CSI1_LN0P	73	AI	MIPI CSI data signal (positive)		
CAM0_	74	DO	Clock signal of rear	V_{OL}max=0.45V	

MCLK			camera	V_{OH}min=1.35V	
CAM1_MCLK	75	DO	Clock signal of front camera	V_{OL}max=0.45V V_{OH}min=1.35V	
CAM0_RST	79	DO	Reset signal of rear camera	V_{OL}max=0.45V V_{OH}min=1.35V	
CAM0_PWD	80	DO	Power down signal of rear camera	V_{OL}max=0.45V V_{OH}min=1.35V	
CAM1_RST	81	DO	Reset signal of front camera	V_{OL}max=0.45V V_{OH}min=1.35V	
CAM1_PWD	82	DO	Power down signal of front camera	V_{OL}max=0.45V V_{OH}min=1.35V	
CAM_I2C_SCL	83	OD	I2C clock signal of camera		1.8V power domain.
CAM_I2C_SDA	84	OD	I2C data signal of camera		1.8V power domain.
Keypad Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
PWRKEY	114	DI	Turn on/off the module	V_{IL}max=0.63V V_{IH}min=1.17V	Pull-up to 1.8V internally. Active low.
KEY_VOL_UP	95	DI	Volume up	V_{IL}max=0.63V V_{IH}min=1.17V	If unused, keep this pin open.
KEY_VOL_DOWN	96	DI	Volume down	V_{IL}max=0.63V V_{IH}min=1.17V	If unused, keep this pin open.
SENSOR_I2C Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
SENSOR_I2C_SCL	91	OD	I2C clock signal of external sensor		1.8V power domain.
SENSOR_I2C_SDA	92	OD	I2C data signal of external sensor		1.8V power domain.
ADC Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
ADC	128	AI	General purpose ADC		Maximum voltage not exceeding 1.7V.
VBAT_SNS	133	AI	Input voltage sense		Maximum input voltage is 4.5V.

VBAT_THERM	134	AI	Battery temperature detection		
Antenna Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
ANT_Wi-Fi/BT	77	IO	Wi-Fi/BT antenna	50Ω impedance	
GPIO Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
GPIO_23	33	IO	GPIO		1.8V power domain
GPIO_32	90	IO	GPIO		1.8V power domain
GPIO_31	97	IO	GPIO		1.8V power domain
GPIO_92	98	IO	GPIO		1.8V power domain
GPIO_88 [1)]	99	IO	GPIO		1.8V power domain
GPIO_89	100	IO	GPIO		1.8V power domain
GPIO_69	101	IO	GPIO		1.8V power domain
GPIO_68 [1)]	102	IO	GPIO		1.8V power domain
GPIO_97	103	IO	GPIO	V_{IL}max=0.63V V_{IH}min=1.17V V_{OL}max=0.45V V_{OH}min=1.4V	1.8V power domain
GPIO_110	104	IO	GPIO		1.8V power domain
GPIO_0	105	IO	GPIO		1.8V power domain
GPIO_98	106	IO	GPIO		1.8V power domain
GPIO_94	107	IO	GPIO		1.8V power domain
GPIO_36	108	IO	GPIO		1.8V power domain
GPIO_65	109	IO	GPIO		1.8V power domain
GPIO_96	110	IO	GPIO		1.8V power domain
GPIO_58	112	IO	GPIO		1.8V power domain
GPIO_99	113	IO	GPIO		1.8V power domain

GPIO_95	115	IO	GPIO		1.8V power domain
GPIO_11	116	IO	GPIO		Multiplexed into SPI_CLK.
GPIO_10	117	IO	GPIO		Multiplexed into SPI_CS_N.
GPIO_9	118	IO	GPIO		Multiplexed into SPI_MISO.
GPIO_8	119	IO	GPIO		Multiplexed into SPI_MOSI
GPIO_16	123	IO	GPIO		1.8V power domain
GPIO_17	124	IO	GPIO		1.8V power domain
Other Interfaces					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
VIB_DRV	28	PO	Motor drive		Connected to the negative terminal of the motor.
RESET_N	179	DI	Reset the module		Disabled by default and can be enabled through software configuration.
USB_BOOT	46	DI	Force the module to boot from USB port		Set USB_BOOT to high level will force the module to enter into emergency download mode.
CHARGE_SEL	127	DI	Used for charger selection		If it is open, internal charger is used. If it is connected to GND, external charger is used.
Reserved Interface					
Pin Name	**Pin No.**	**I/O**	**Description**	**DC Characteristics**	**Comment**
RESERVED	17, 18, 19, 20, 21, 22, 23, 24, 25, 26, 87, 121, 131,		Reserved pins		Keep these pins open.

	145, 146, 151, 152, 153, 154, 155, 156, 157, 158, 159, 183, 187, 190, 191, 194, 195, 196, 197, 199, 202, 203, 204, 205, 206, 207, 210

NOTE

[1] GPIO_68 and GPIO_88 cannot be pulled up during start-up.

3.4. Power Supply

3.4.1. Power Supply Pins

SC20-W provides two VBAT pins dedicated to connection with the external power supply. The two VBAT_BB pins are used for module's baseband part. The power supply range of the module is 3.5V~4.2V, and the recommended value is 3.8V. VBAT performance, such as load capacity, ripple and spikes will directly affect the performance and stability of the module. If the voltage drops below 3.1V, the module will be turned off automatically.

3.4.2. Decrease Voltage Drop

Make sure the input voltage will never drop below 3.1V. If the voltage drops below 3.1V, the module will be turned off automatically.

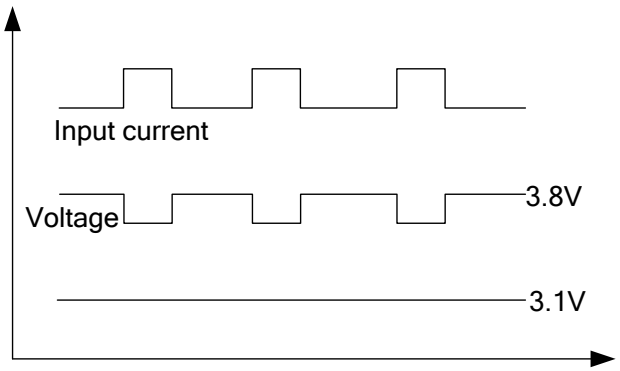


Figure 3: Voltage Drop Sample

To decrease voltage drop, a bypass capacitor of about 100μF with low ESR (ESR=0.7Ω) should be used, and a multi-layer ceramic chip (MLCC) capacitor should also be reserved due to its ultra-low ESR. It is recommended to use a ceramic capacitor (100nF) for the VBAT pins. The width of VBAT_BB trace should be no less than 1mm. In principle, the longer the VBAT trace is, the wider it will be.

In addition, in order to get a stable power source, it is suggested to use a 0.5W zener diode and place it as close to the VBAT pins as possible. The following figure shows the star structure of the power supply.

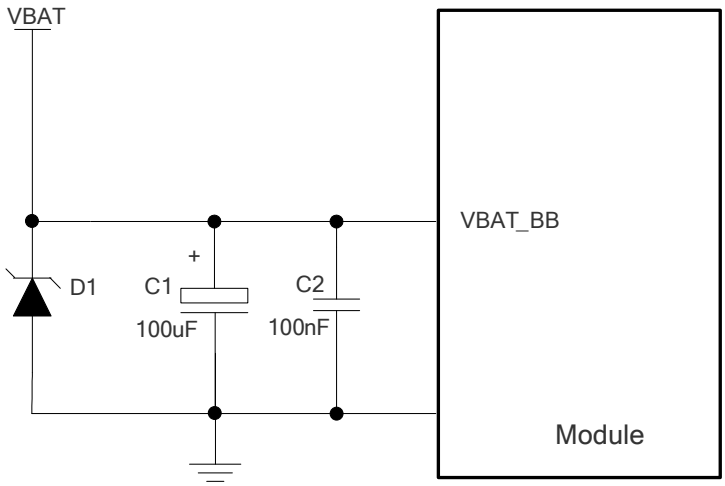


Figure 4: Power Supply

3.4.3. Reference Design for Power Supply

The power design for the module is very important, as the performance of module largely depends on the power source. The power supply of SC20-W should be able to provide sufficient current up to 3A at least. If the voltage drop between the input and output is not too high, it is suggested to use an LDO to supply power for the module. If there is a big voltage difference between the input source and the desired output (VBAT), a buck converter is preferred to be used as the power supply.

The following figure shows a reference design for +5V input power source which adopts an LDO (MIC29302WU) from MICREL. The typical output voltage is 3.8V and the maximum rated current is 3.0A.

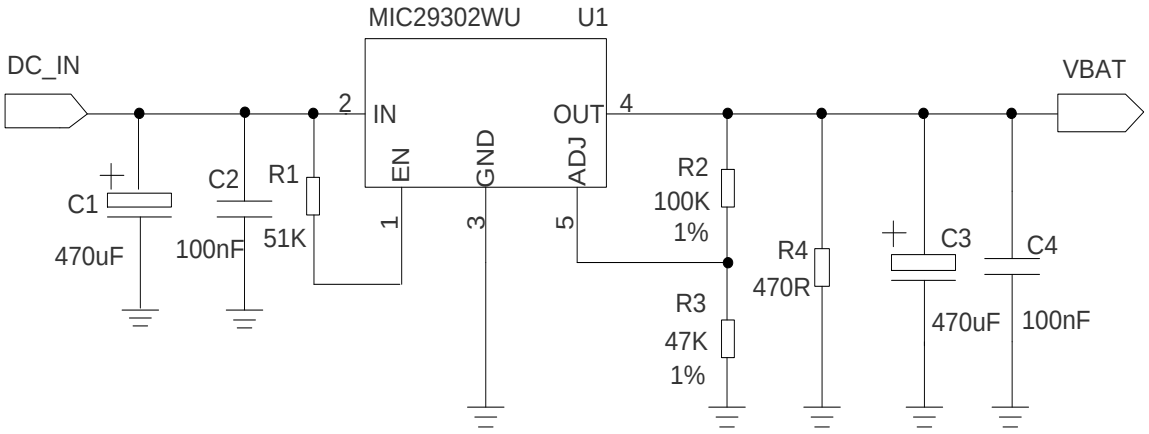


Figure 5: Reference Circuit of Power Supply

NOTES

1. It is suggested to switch off the power supply for module in abnormal state, and then switch on the power to restart the module.
2. The module supports battery charging function by default. If the above power supply design is adopted, please make sure the charging function is disabled by software or connect VBAT to Schottky diode in series to avoid the reverse current to the power supply chip.

3.5. Turn on and off Scenarios

3.5.1. Turn on Module Using the PWRKEY

The module can be turned on by driving PWRKEY pin to a low level for at least 1.6s. PWRKEY pin is pulled to 1.8V internally. It is recommended to use an open drain/collector driver to control the PWRKEY. A simple reference circuit is illustrated in the following figure.

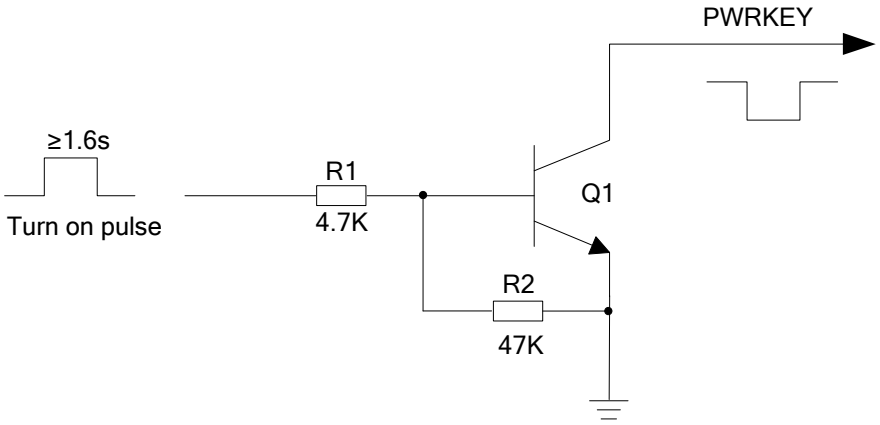


Figure 6: Turn on the Module Using Driving Circuit

The other way to control the PWRKEY is using a button directly. A TVS component is indispensable to be placed nearby the button for ESD protection. A reference circuit is shown in the following figure.

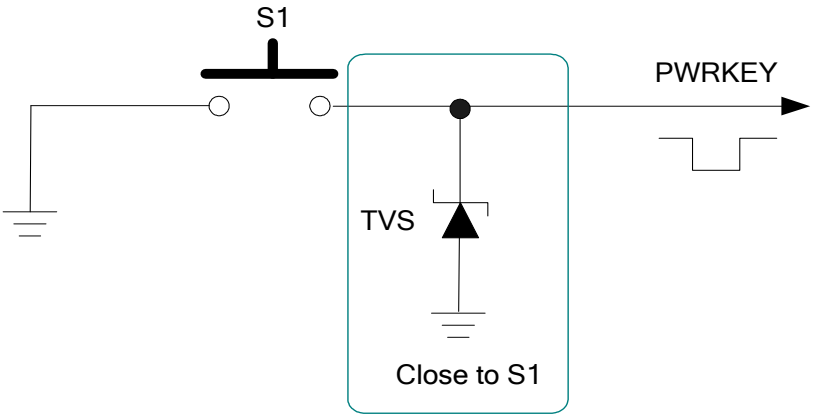


Figure 7: Turn on the Module Using Keystroke

The turn on scenario is illustrated in the following figure.

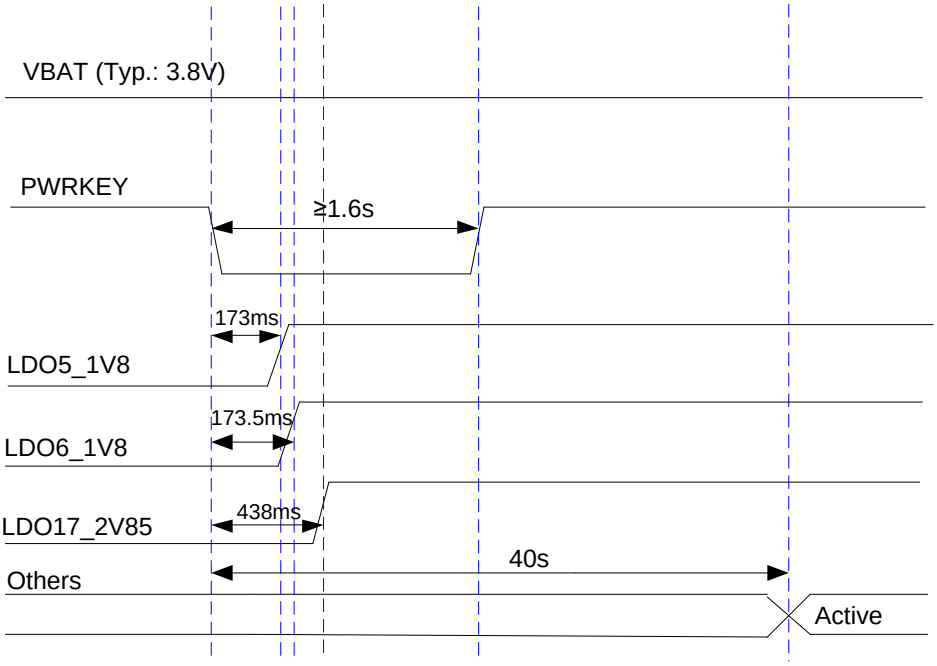


Figure 8: Timing of Turning on Module

NOTES

1. When the module is powered on for the first time, its timing of turning on will be 45ms longer than that shown above.
2. Make sure that VBAT is stable before pulling down PWRKEY pin. The recommended time between them is no less than 30ms. PWRKEY pin cannot be pulled down all the time.

3.5.2. Turn off Module

Set the PWRKEY pin low for at least 1s, and then choose to turn off the module when the prompt window comes up.

The other way to turn off the module is to drive PWRKEY to a low level for at least 8s. The module will execute forced shutdown. The forced power-down scenario is illustrated in the following figure.

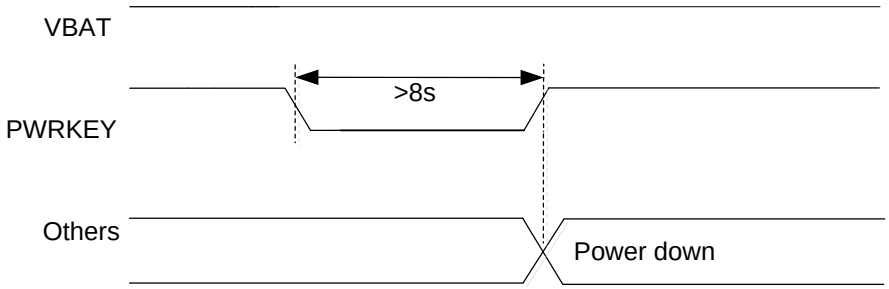


Figure 9: Timing of Turning off Module

3.6. VRTC Interface

The RTC (Real Time Clock) can be powered by an external power source through VRTC when the module is powered down and there is no power supply for the VBAT. The external power source can be capacitor or rechargeable battery (such as coil cells) according to application demands. The following are some reference circuit designs when an external battery or capacitor is utilized for powering RTC.

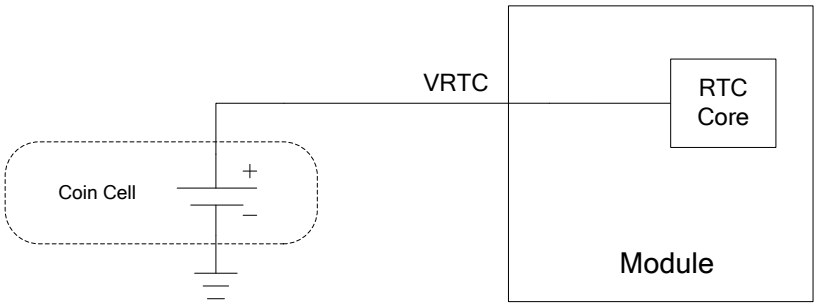


Figure 10: RTC Powered by Coin Cell

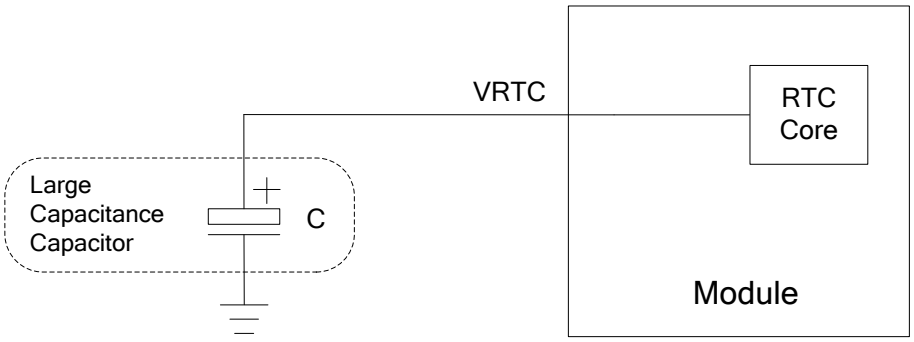


Figure 11: RTC Powered by Capacitor

If RTC is ineffective, it can be synchronized through network after the module is powered on.

- 2.0V~3.25V input voltage range and 3.0V typical value for VRTC. When VBAT is disconnected, the average consumption is typically 5uA.
- When powered by VBAT, the RTC error is 50ppm. When powered by VRTC, the RTC error is 200ppm.
- If the rechargeable battery is used, the ESR of the battery should be less than 2K, and it is recommended to use the MS621FE FL11E of SEIKO.
- If a large capacitance capacitor is selected, it is recommended to use a 100uF capacitor with low ESR. The capacitor is able to power the real-time clock for 45 seconds.

3.7. Power Output

SC20-W supports output of regulated voltages for peripheral circuits. During application, it is recommended to use parallel capacitors (33pF and 10pF) in the circuit to suppress high frequency noise.

Table 5: Power Description

Pin Name	Default Voltage (V)	Driving Current (mA)	Idle
LDO5_1V8	1.8	20	KEEP
LDO6_1V8	1.8	100	/
LDO17_2V85	2.85	300	/
SD_LDO12	2.95	50	/
SD_LDO11	2.95	600	/

3.8. Battery Charge and Management

SC20-W module can recharge over-discharged batteries. The battery charger in SC20-W module supports trickle charging, constant current charging and constant voltage charging modes, which optimizes the charging procedure for Li-ion batteries.

- **Trickle charging:** There are two steps in this mode. When the battery voltage is below 2.8V, a 90mA trickle charging current is applied to the battery. When the battery voltage is charged up and is between 2.8V and 3.2V, the charging current can be set to 450mA maximally.
- **Constant current mode (CC mode):** When the battery is increased to between 3.2V and 4.2V, the

system will switch to CC mode. The maximum charging current is 1.44A when adapter is used for battery charging; and the maximum charging current is 450mA while USB charging.

- **Constant voltage mode (CV mode):** When the battery voltage reaches the final value 4.2V, the system will switch to CV mode and the charging current will decrease gradually. When the battery level reaches 100%, the charging is completed.

SC20-W module supports battery temperature detection in the condition that the battery integrates a thermistor (47K 1% NTC thermistor with B-constant of 4050K by default; SDNT1608X473F4050FTF of SUNLORD is recommended) and the thermistor is connected to VBAT_THERM pin. The default battery temperature range is from -3.0°C~48.5°C. If VBAT_THERM pin is not connected, there will be malfunctions such as battery charging failure, battery level display error, etc.

A reference design for battery charging circuit is shown as below.

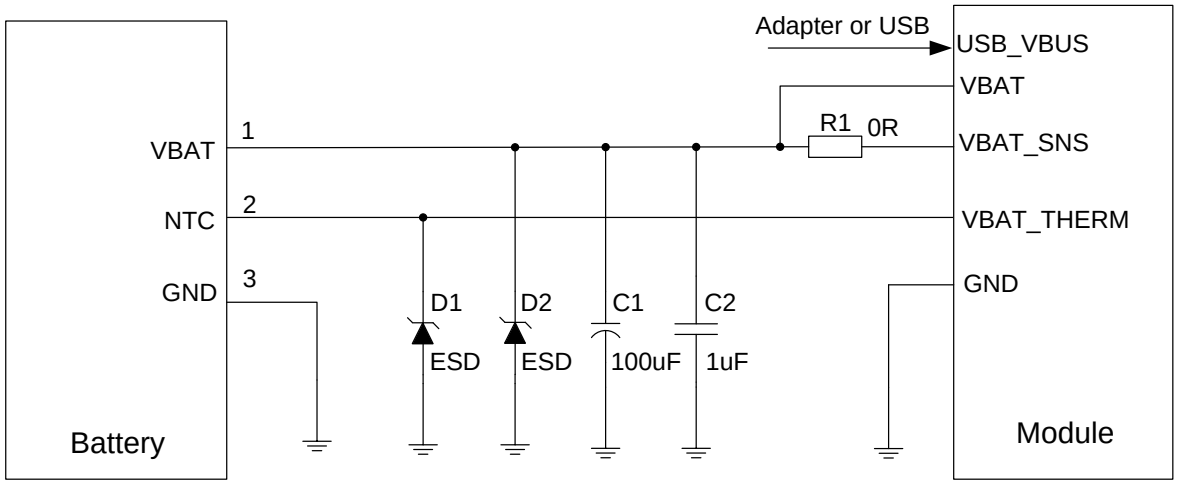


Figure 12: Reference Design for Battery Charging Circuit

Mobile devices such as mobile phones and handheld POS systems are powered by batteries. When different batteries are utilized, the charging and discharging curve has to be modified correspondingly so as to achieve the best effect.

If thermistor is not available in the battery, or adapter is utilized for powering module, then there is only a need for VBAT and GND connection. In this case, the system may mistakenly judge that the battery temperature is abnormal, which will cause battery charging failure. In order to avoid this, VBAT_THERM should be connected to GND with a 47KΩ resistor. If VBAT_THERM is unconnected, the system will be unable to detect the battery, making battery cannot be charged.

VBAT_SNS pin must be connected. Otherwise, the module will have abnormalities in voltage detection, as well as associated power on/off and battery charging/discharging issues.

3.9. USB Interface

SC20-W contains one integrated Universal Serial Bus (USB) interface which complies with the USB 2.0 specification and supports high speed (480 Mbps) and full speed (12 Mbps) modes. The USB interface is used for AT command communication, data transmission, software debugging and firmware upgrade.

The following table shows the pin definition of USB interface.

Table 6: Pin Definition of USB Interface

Pin Name	Pin No.	I/O	Description	Comment
USB_VBUS	141, 142	PI	USB power supply	4.35V~6.3V Typical 5.0V
USB_DM	13	IO	USB differential data bus (minus)	Require differential impedance of 90Ω
USB_DP	14	IO	USB differential data bus (plus)	
USB_ID	16	AI	USB ID detection	High level by default

USB_VBUS can be powered by USB power or adapter. It can also be used for detecting USB connection, as well as for battery charging via the internal PMU. The input voltage of power supply ranges from 4.35 to 6.3V, and the typical value is 5.0V. SC20-W module supports charging management for a single Li-ion battery, but varied charging parameters should be set for batteries with varied models or capacities. The module is available a built-in linear-charging circuit which supports maximally 1.44A charging current.

The following are two USB interface reference designs for customers to choose from.

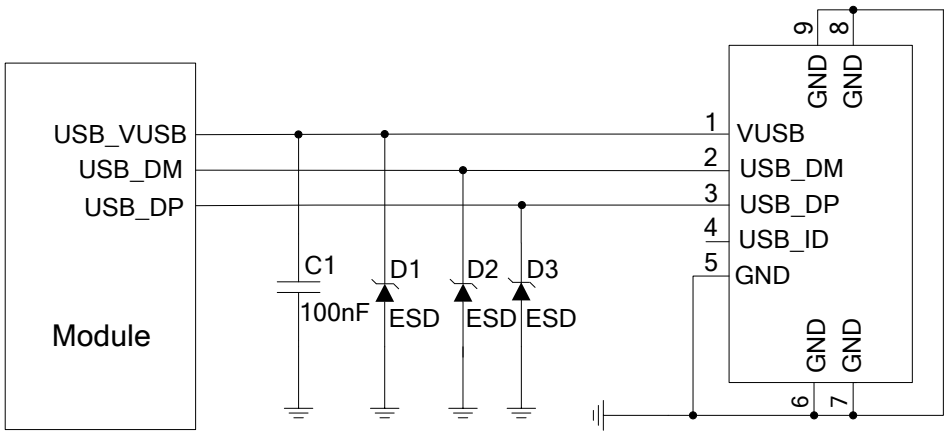


Figure 13: USB Interface Reference Design (OTG is not Supported)

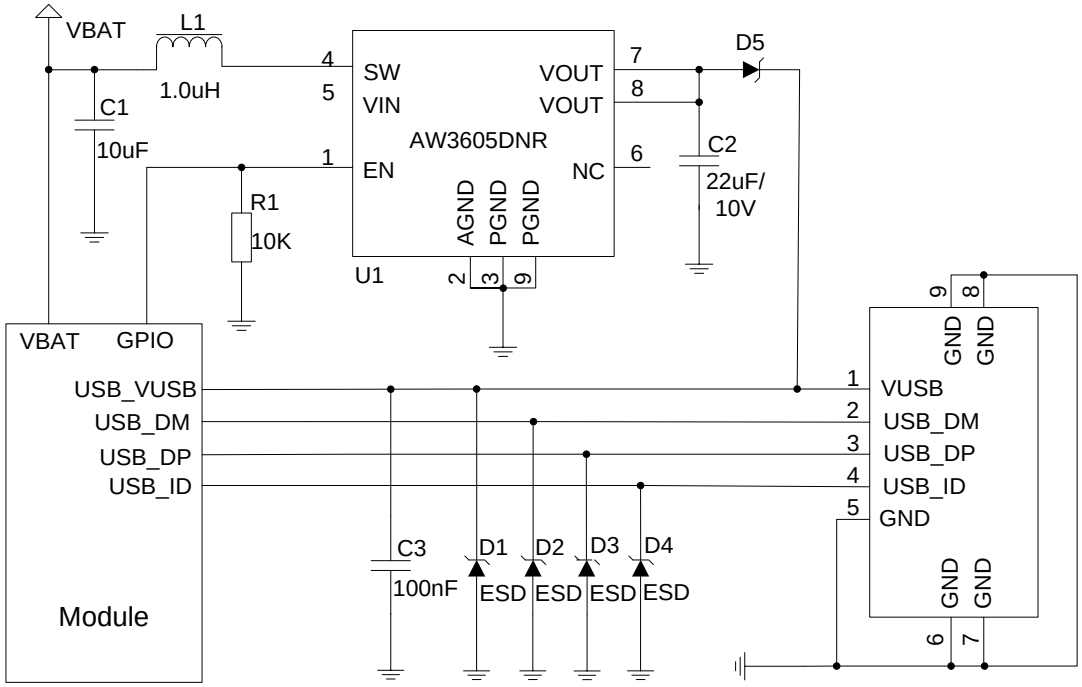


Figure 14: USB Interface Reference Design (OTG is Supported)

SC20-W supports OTG protocol. If OTG function is needed, please refer to the above figure for the reference design. AW3605DNR is a high efficiency DC-DC chip manufactured by AWINIC, and users can choose according to their own demands.

In order to ensure USB performance, please comply with the following principles while designing USB interface.

- It is important to route the USB signal traces as differential pairs with total grounding. The impedance of USB differential trace is 90Ω.
- Keep the ESD protection devices as close as possible to the USB connector. Pay attention to the influence of junction capacitance of ESD protection devices on USB data lines. Typically, the capacitance value should be less than 2pF.
- Do not route signal traces under crystals, oscillators, magnetic devices and RF signal traces. It is important to route the USB differential traces in inner-layer with ground shielding on not only upper and lower layers but also right and left sides.
- Make sure the trace length difference between USB_DM and USB_DP is not exceeding 6.6mm.

Table 7: USB Trace Length inside the Module

Pin	Signal	Length (mm)	Length Difference (DP-DM)
13	USB_DM	29.43	-0.07
14	USB_DP	29.36	

3.10. UART Interfaces

The module provides two UART interfaces:

- **UART1:** 4-wire UART interface which supports hardware flow control
- **UART2:** 2-wire UART interfaces and is used for debugging

Table 8: Pin Description of UART Interfaces

Pin Name	Pin No	I/O	Description	Comment
UART1_TXD	34	DO	UART1 transmit data	1.8V power domain. If it is unused, keep it open.
UART1_RXD	35	DI	UART1 receive data	1.8V power domain. If it is unused, keep it open.
UART1_CTS	36	DI	UART1 clear to send	1.8V power domain. If it is unused, keep it open.
UART1_RTS	37	DO	UART1 request to send	1.8V power domain. If it is unused, keep it open.
UART2_RXD	93	DI	UART2 receive data. Debug port by default.	1.8V power domain. If it is unused, keep it open.
UART2_TXD	94	DO	UART2 transmit data. Debug port by default.	1.8V power domain. If it is unused, keep it open.

UART1 provides 1.8V logic level. A level translator should be used if customers' application is equipped with a 3.3V UART interface. A level translator TXS0104EPWR provided by *Texas Instruments* is recommended. The following figure shows the reference design.

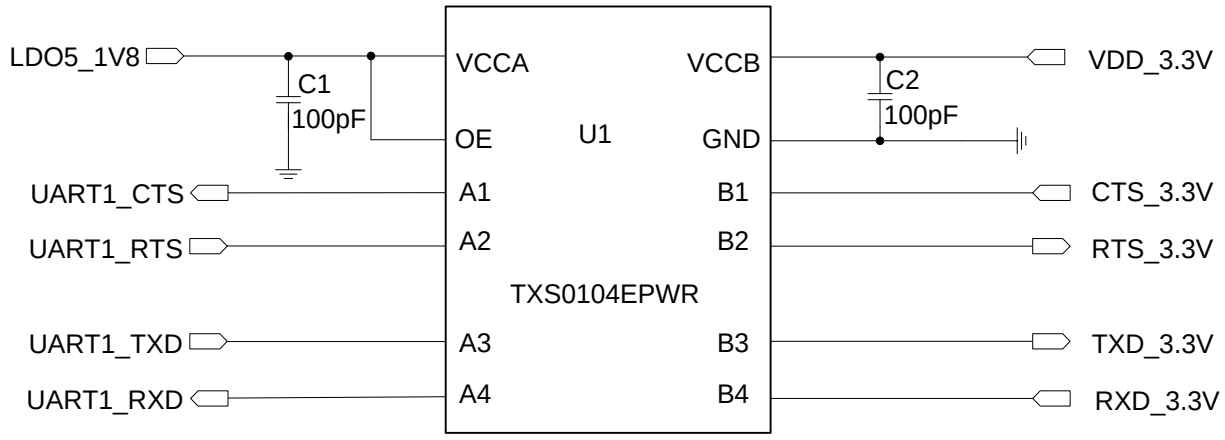


Figure 15: Reference Circuit with Level Translator Chip (for UART1)

The following figure is an example of connection between SC20-W and PC. A voltage level translator and a RS-232 level translator chip are also recommended to be added between the module and PC, as these two UART interfaces do not support the RS-232 level, while support the 1.8V CMOS level only.

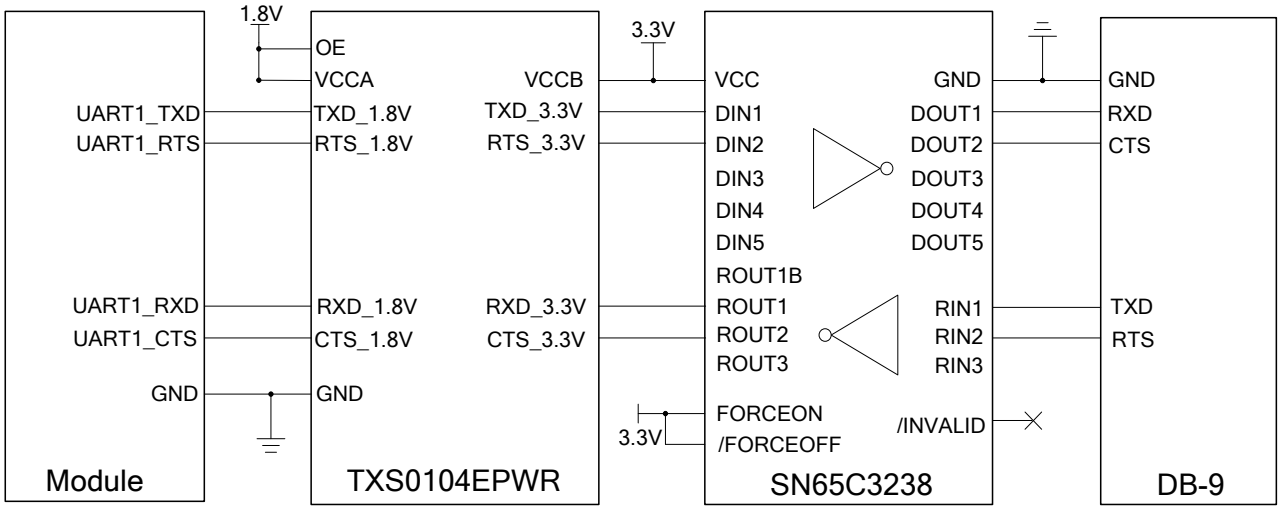


Figure 16: RS232 Level Match Circuit (for UART1)

NOTE

UART2 is similar to UART1. Please refer to UART1 reference circuit designs for UART2's.

3.11. SD Card Interface

SC20-W module supports SD cards with 4-bit data interfaces or SDIO devices. The pin definition of the SD card interface is shown below.

Table 9: Pin Definition of SD Card Interface

Pin Name	Pin No.	I/O	Description	Comment
SD_LDO11	38	PO	Power supply for SD card	Vnorm=2.95V $I_O$max=600mA
SD_LDO12	32	PO	1.8V/2.95V output power supply	Support 1.8V or 2.95V power supply. The maximum drive current is 50mA.
SD_CLK	39	DO	High speed digital clock signal of SD card	Control characteristic impedance as 50Ω.

SD_CMD	40	I/O	Command signal of SD card	
SD_DATA0	41	I/O	High speed bidirectional digital signal lines of SD card	
SD_DATA1	42	I/O		
SD_DATA2	43	I/O		
SD_DATA3	44	I/O		
SD_DET	45	DI	SD card insertion detection	Active low

A reference circuit for SD card interface is shown as below.

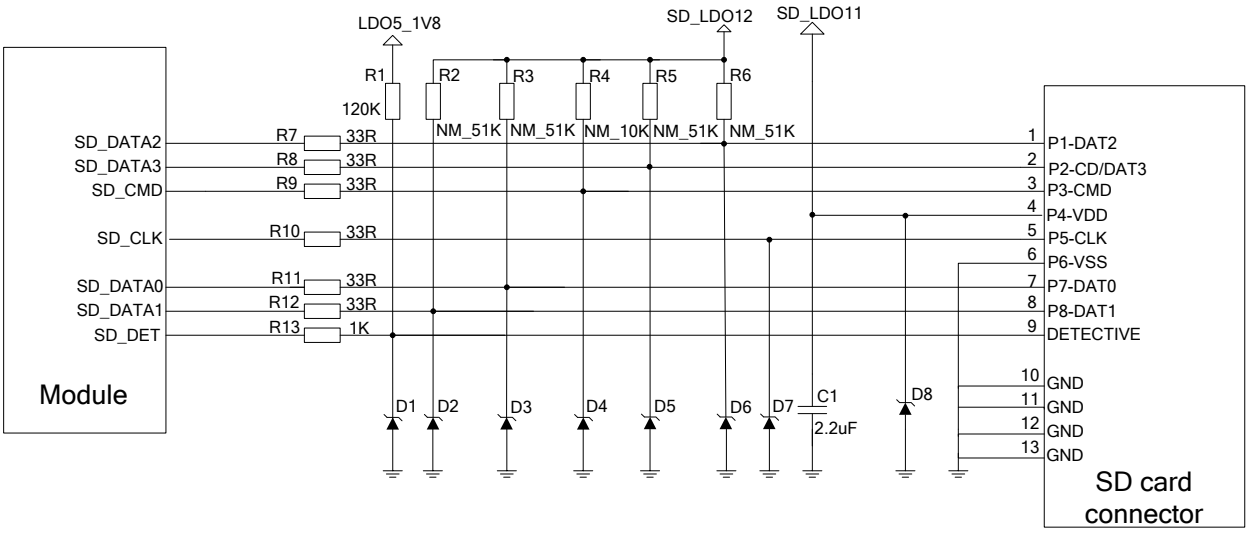


Figure 17: Reference Circuit for SD Card Interface

SD_LDO11 is a peripheral driver power supply for SD card. The maximum drive current is approx. 600mA. Because of the high drive current, it is recommended that the trace width is 0.5mm or more. In order to ensure the stability of drive power, a 2.2uF capacitor should be added in parallel near the SD card connector.

CMD, CLK, DATA0, DATA1, DATA2 and DATA3 are all high-speed signal lines. In PCB design, please control the characteristic impedance of them as 50Ω, and do not cross with other traces. It is recommended to route the trace on the inner layer of PCB, and keep the same trace length for CLK, CMD, DATA0, DATA1, DATA2 and DATA3. CLK additionally needs ground shielding.

Layout guidelines:

- Control impedance as 50Ω±10%, and ground shielding is required.
- The total trace length difference between CLK and other signal line traces should not exceed 1mm.

Table 10: SDIO Trace Length Inside the Module

Pin No.	Signal	Length (mm)	Comment
39	SD_CLK	14.60	
40	SD_CMD	14.55	
41	SD_DATA0	14.53	
42	SD_DATA1	14.56	
43	SD_DATA2	14.53	
44	SD_DATA3	14.57	

3.12. GPIO Interfaces

SC20-W has abundant GPIO interfaces with power domain of 1.8V. The pin definition is listed below.

Table 11: Pin Definition of GPIO Interfaces

PIN	Pin Name	GPIO	Default State	Comment
30	TP_INT	GPIO_13	B-PD: nppukp	Wakeup
31	TP_RST	GPIO_12	B-PD: nppukp	Wakeup
33	GPIO_23	GPIO_23	B-PD: nppukp	
34	UART1_TXD	GPIO_20	B-PD: nppukp	Wakeup
35	UART1_RXD	GPIO_21	B-PD: nppukp	UART1_RX Wakeup
36	UART1_CTS	GPIO_111	B-PD: nppukp	Wakeup
37	UART1_RTS	GPIO_112	B-PD: nppukp	Wakeup
45	SD_DET	GPIO_38	B-PD: nppukp	Wakeup
46	USB_BOOT	GPIO_37	B-PD: nppukp	Wakeup
47	TP_I2C_SCL	GPIO_19	B-PD: nppukp	
48	TP_I2C_SDA	GPIO_18	B-PD: nppukp	

49	LCD_RST	GPIO_25	B-PD: nppukp	Wakeup
50	LCD_TE	GPIO_24	B-PD: nppukp	
74	CAM0_CLK	GPIO_26	B-PD: nppukp	
75	CAM1_CLK	GPIO_27	B-PD: nppukp	
79	CAM0_RST	GPIO_35	B-PD: nppukp	Wakeup
80	CAM0_PWD	GPIO_34	B-PD: nppukp	Wakeup
81	CAM1_RST	GPIO_28	B-PD: nppukp	Wakeup
82	CAM1_PWD	GPIO_33	B-PD: nppukp	
83	CAM_I2C_SCL	GPIO_30	B-PD: nppukp	
84	CAM_I2C_SDA	GPIO_29	B-PD: nppukp	
90	GPIO_32	GPIO_32	B-PD: nppukp	
91	SENSOR_I2C_SCL	GPIO_7	B-PD: nppukp	
92	SENSOR_I2C_SDA	GPIO_6	B-PD: nppukp	
93	UART2_RXD	GPIO_5	B-PD: nppukp	Wakeup
94	UART2_TXD	GPIO_4	B-PD: nppukp	
95	KEY_VOL_UP	GPIO_90	B-PD: nppukp	Wakeup
96	KEY_VOL_DOWN	GPIO_91	B-PD: nppukp	Wakeup
97	GPIO_31	GPIO_31	B-PD: nppukp	Wakeup
98	GPIO_92	GPIO_92	B-PD: nppukp	Wakeup
99	GPIO_88 [1)]	GPIO_88	B-PD: nppukp	
100	GPIO_89	GPIO_89	B-PD: nppukp	
101	GPIO_69	GPIO_69	B-PD: nppukp	
102	GPIO_68 [1)]	GPIO_68	B-PD: nppukp	
103	GPIO_97	GPIO_97	B-PD: nppukp	Wakeup
104	GPIO_110	GPIO_110	B-PD: nppukp	Wakeup

105	GPIO_0	GPIO_0	B-PD: nppukp	
106	GPIO_98	GPIO_98	B-PD: nppukp	Wakeup
107	GPIO_94	GPIO_94	B-PD: nppukp	Wakeup
108	GPIO_36	GPIO_36	B-PD: nppukp	Wakeup
109	GPIO_65	GPIO_65	B-PD: nppukp	Wakeup
110	GPIO_96	GPIO_96	B-PD: nppukp	Wakeup
112	GPIO_58	GPIO_58	B-PD: nppukp	Wakeup
113	GPIO_99	GPIO_99	B-PD: nppukp	
115	GPIO_95	GPIO_95	B-PD: nppukp	Wakeup
116	GPIO_11	GPIO_11	B-PD: nppukp	Wakeup
117	GPIO_10	GPIO_10	B-PD: nppukp	
118	GPIO_9	GPIO_9	B-PD: nppukp	
119	GPIO_8	GPIO_8	B-PD: nppukp	
123	GPIO_16	GPIO_16	B-PD: nppukp	
124	GPIO_17	GPIO_17	B-PD: nppukp	

NOTES

- [1] GPIO_68 and GPIO_88 cannot be pulled up during start-up.
- Wakeup: interrupt pins that can wake up the system
- B: Bidirectional digital with CMOS input
- PD: nppukp = default pulldown with programmable options, followed by a colon (:)

3.13. SPI Interface

SC20-W provides one SPI interface multiplexed from GPIO interfaces. The interface only supports the master mode.

Table 12: Pin Definition of SPI Interface

Pin Name	Pin No	I/O	Comment	Description
GPIO_8	119	IO	GPIO by default. Can be multiplexed into SPI_MOSI.	Master out slave in of SPI
GPIO_9	118	IO	GPIO by default. Can be multiplexed into SPI_MISO.	Master in slave out of SPI
GPIO_10	117	DO	GPIO by default. Can be multiplexed into SPI_CS_N.	SPI chip select
GPIO_11	116	DO	GPIO by default. Can be multiplexed into SPI_CLK.	SPI clock

3.14. I2C Interfaces

SC20-W provides 3 groups of I2C interfaces which only support the master mode. As an open drain output, the I2C interfaces need a pull-up resistor on its external circuit, and the recommended logic level is 1.8V.

Table 13: Pin Definition of I2C Interface

Pin Name	Pin No	I/O	Description	Comment
TP_I2C_SCL	47	OD	I2C clock signal of touch panel	Used for touch panel
TP_I2C_SDA	48	OD	I2C data signal of touch panel	
CAM_I2C_SCL	83	OD	I2C clock signal of camera	Used for camera
CAM_I2C_SDA	84	OD	I2C data signal of camera	
SENSOR_I2C_SCL	91	OD	I2C clock signal for external sensor	Used for external sensor
SENSOR_I2C_SDA	92	OD	I2C data signal for external sensor	

3.15. ADC Interfaces

SC20-W provides three analog-to-signal converter (ADC) interfaces, and the pin definition is shown below.

Table 14: Pin Definition of ADC Interfaces

Pin Name	Pin No	I/O	Description	Comment
ADC	128	AI	General purpose ADC	Max input voltage is 1.7V
VBAT_SNS	133	AI	Input voltage sense	Max input voltage is 4.5V
VBAT_THERM	134	AI	Battery temperature detection	Internal pull-up. Externally connect to GND with a 47K NTC thermistor.

The resolution of the ADC is up to 16 bits and the effective resolution is 12 bits.

NOTE

When the input voltage exceeds the maximum input voltage of VBAT_SNS pin, resistor divider cannot be used in the circuit design. Instead, general purpose ADC with resistor divider input can be used.

3.16. Motor Drive Interface

The pin definition of motor drive interface is listed below.

Table 15: Pin Definition of Motor Drive Interface

Pin Name	Pin No	I/O	Description	Comment
VIB_DRV	28	PO	Motor drive	Connected to the negative terminal of motor

The motor is driven by an exclusive circuit, and a reference circuit design is shown below.

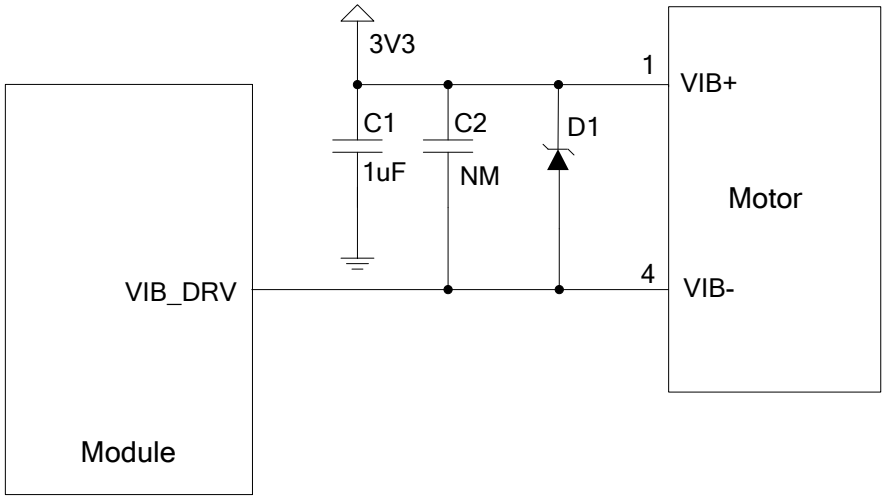


Figure 18: Reference Circuit for Motor Connection

When the motor stops, the redundant electricity can be discharged from the circuit loop formed by diodes, thus avoiding component damages.

3.17. LCM Interface

SC20-W module provides an LCM interface meeting MIPI DSI specification. The interface supports high speed differential data transmission, with up to four lanes and a transmission rate up to 1.5Gbps per lane. It supports maximally 720P resolution displays.

Table 16: Pin Definition of LCM Interface

Pin Name	Pin No	I/O	Description	Comment
LDO6_1V8	125	PO	1.8V output power supply for LCM logic circuit and DSI	1.8V normal voltage. Vnorm=1.8V $I_O$max=100mA
LDO17_2V85	129	PO	2.85V output power supply for LCM analog circuits	2.85V normal voltage. Vnorm=2.85V $I_O$max=300mA
PWM	29	DO	Adjust the backlight brightness. PWM control signal.	
LCD_RST	49	DO	LCD reset signal	Active low
LCD_TE	50	DI	LCD tearing effect signal	

MIPI_DSI_CLKN	52	AO	MIPI DSI clock signal (negative)
MIPI_DSI_CLKP	53	AO	MIPI DSI clock signal (positive)
MIPI_DSI_LN0N	54	AO	MIPI DSI data signal (negative)
MIPI_DSI_LN0P	55	AO	MIPI DSI data signal (positive)
MIPI_DSI_LN1N	56	AO	MIPI DSI data signal (negative)
MIPI_DSI_LN1P	57	AO	MIPI DSI data signal (positive)
MIPI_DSI_LN2N	58	AO	MIPI DSI data signal (negative)
MIPI_DSI_LN2P	59	AO	MIPI DSI data signal (positive)
MIPI_DSI_LN3N	60	AO	MIPI DSI data signal (negative)
MIPI_DSI_LN3P	61	AO	MIPI DSI data signal (positive)

Four-lane MIPI DSI is needed for connection with 720P displays. The following is a reference circuit design, by taking the connection with LCM interface on LHR050H41-00 (IC: ILI9881C) from HUARUI Lighting as an example.

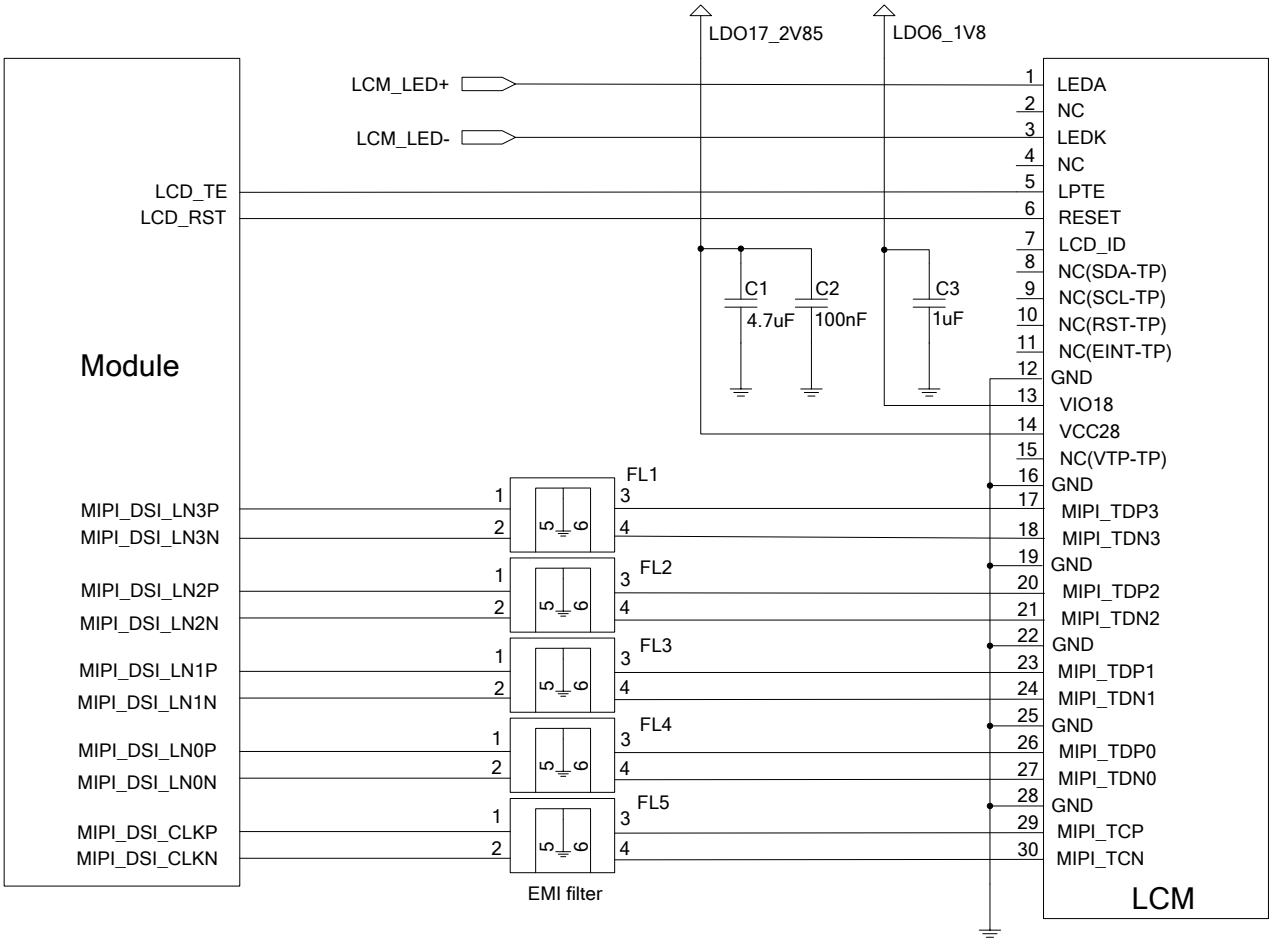


Figure 19: Reference Circuit Design for LCM Interface

MIPI are high speed signal lines. It is recommended that common-mode filters should be added in series near the LCM connector, so as to improve protection against electromagnetic radiation interference. ICMEF112P900MFR from ICT is recommended.

When compatible design with other displays is required, please connect the LCD_ID pin of LCM to the module's ADC pin, and please note that the output voltage of LCD_ID cannot exceed the voltage range of ADC pin.

Backlight driving circuit needs to be designed for LCM, and a reference circuit design is shown in the following figure. Backlight brightness adjustment can be realized by PWM pin of SC20-W module through adjusting the duty ratio.

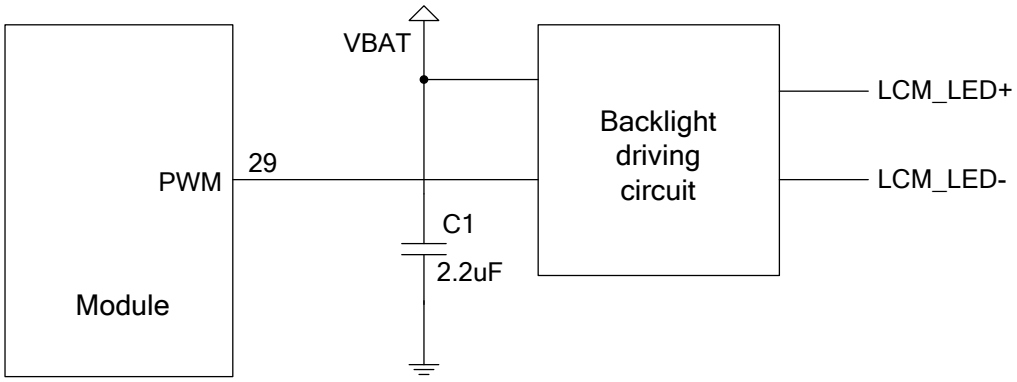


Figure 20: Reference Design for Backlight Dirving Circuit

3.18. Touch Panel Interface

SC20-W provides a set of I2C interface for connection with Touch Panel (TP), and also provides the corresponding power supply and interrupt pins. The definition of TP interface pins is illustrated below.

Table 17: Pin Definition of Touch Panel Interface

Pin Name	Pin No	I/O	Description	Comment
LDO6_1V8	125	PO	1.8V output power supply for TP I/O power	Pull-up power supply of I2C. 1.8V normal voltage.
LDO17_2V85	129	PO	2.85V output power supply for TP VDD power	TP power supply. 2.85V normal voltage.
TP_INT	30	DI	Interrupt signal of TP	
TP_RST	31	DO	Reset signal of TP	Active low
TP_I2C_SCL	47	OD	I2C clock signal of TP	
TP_I2C_SDA	48	OD	I2C data signal of TP	

The following illustrates a TP interface reference circuit, by taking the connection with TP interface on LHR050H41-00 (IC: GT9147) from HUARUI Lighting as an example.

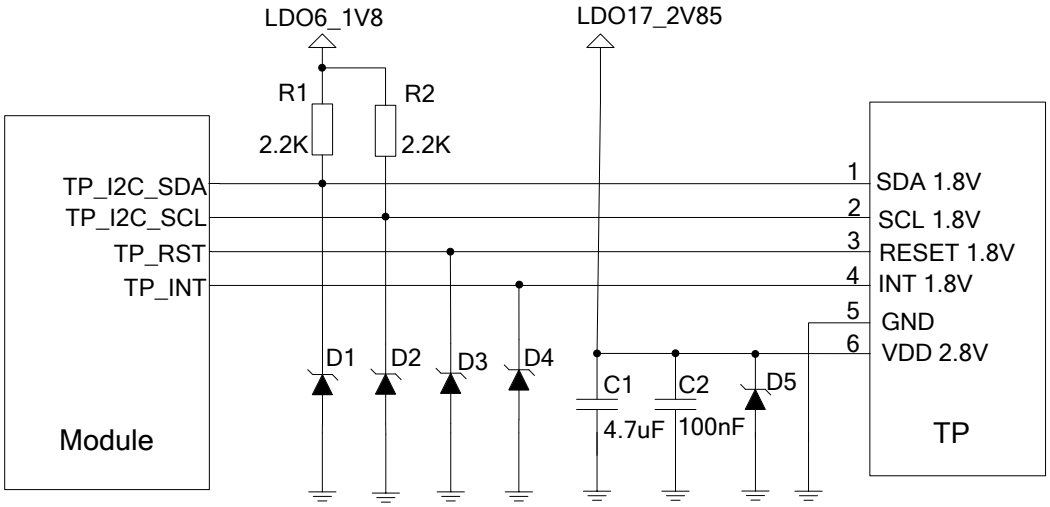


Figure 21: Reference Circuit Design for TP Interface

3.19. Camera Interfaces

Based on standard MIPI CSI video input interface, SC20-W module supports two cameras, and the maximum pixel of the rear camera can be up to 8MP. The video and photo quality is determined by various factors such as the camera sensor, camera lens quality, etc. It is recommended to select a proper camera model, according to the specification of cameras verified and recommended by Quectel.

The following models of camera sensors have been verified by Quectel:

- For rear camera: Hi843 of SK Hynix, T4KA3 of TOSHIBA
- For front camera: Hi259 of SK Hynix, SP2508 of SuperPix

3.19.1. Rear Camera Interface

The rear camera realizes transmission and control via its FPC and a connector which is connected to the module. SC20-W rear camera interface integrates a two-lane MIPI CSI for differential data transmission, and it maximally supports 8MP cameras.

The pin definition of rear camera interface is shown below.

Table 18: Pin Definition of Rear Camera Interface

Pin Name	Pin No	I/O	Description	Comment
LDO6_1V8	125	PO	1.8V output power supply for DOVDD of camera	1.8V normal voltage. Vnorm=1.8V $I_O$max=100mA
LDO17_2V85	129	PO	2.85V output power supply for auto focus circuit and AVDD of camera	2.85V normal voltage. Vnorm=2.85V $I_O$max=300mA
MIPI_CSI0_CLKN	63	AI	MIPI CSI clock signal (negative)	
MIPI_CSI0_CLKP	64	AI	MIPI CSI clock signal (positive)	
MIPI_CSI0_LN0N	65	AI	MIPI CSI data signal (negative)	
MIPI_CSI0_LN0P	66	AI	MIPI CSI data signal (positive)	
MIPI_CSI0_LN1N	67	AI	MIPI CSI data signal (negative)	
MIPI_CSI0_LN1P	68	AI	MIPI CSI data signal (positive)	
CAM0_MCLK	74	DO	Clock signal of rear camera	
CAM0_RST	79	DO	Reset signal of rear camera	
CAM0_PWD	80	DO	Power down signal of rear camera	
CAM_I2C_SCL	83	OD	I2C clock signal of camera	
CAM_I2C_SDA	84	OD	I2C data signal of camera	

The following is a reference circuit design for rear camera interface, by taking the connection with T4KA3 camera as an example.

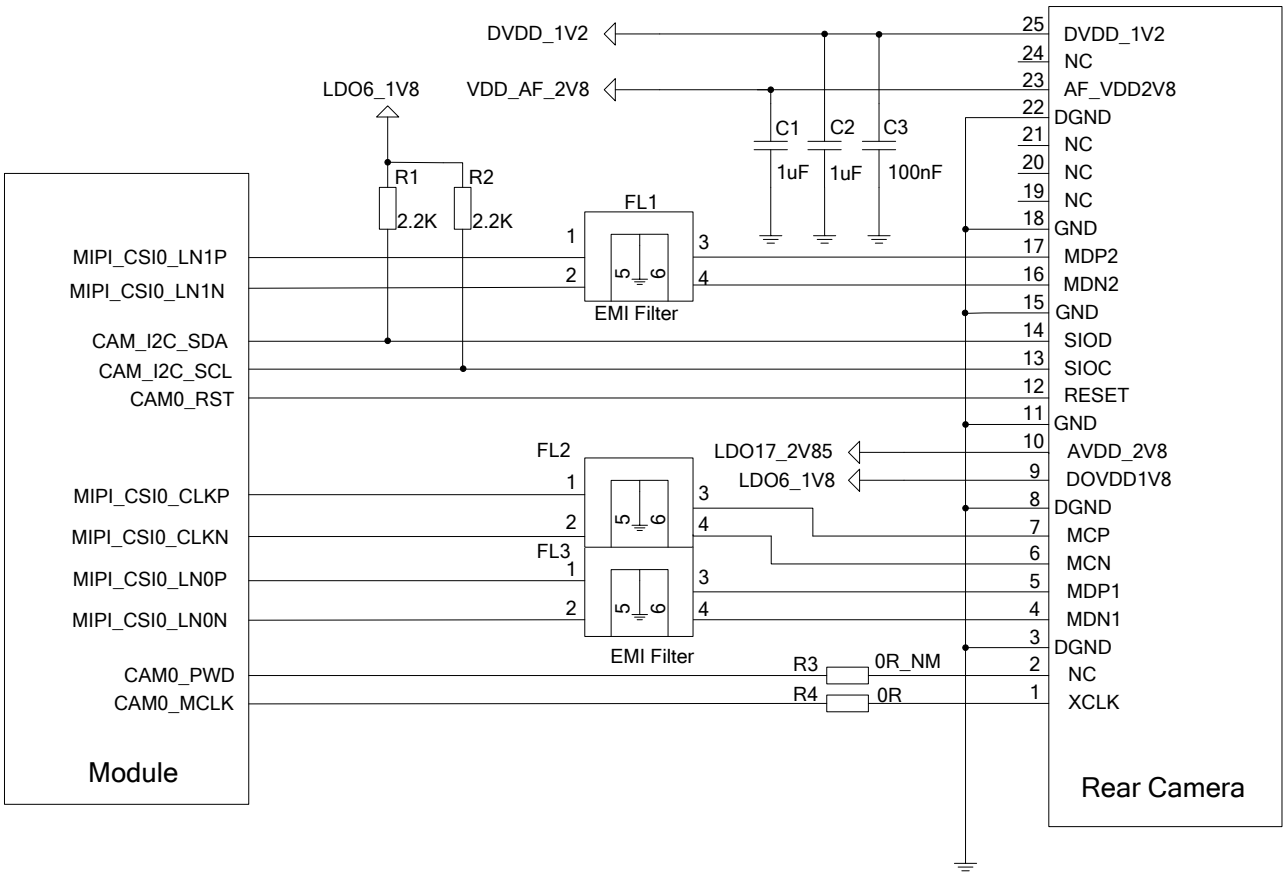


Figure 22: Reference Circuit Design for Rear Camera Interface

NOTE

DVDD_1V2 is used to power the rear camera core, and VDD_AF_2V8 is used to power the rear camera AF circuit. Both of them are powered by an external LDO.

3.19.2. Front Camera Interface

The front camera interface integrates a differential data interface meeting one-lane MIPI CSI standard, and is tested to support 2MP cameras.

The pin definition of rear camera interface is shown below.

Table 19: Pin Definition of Front Camera Interface

Pin Name	Pin No	I/O	Description	Comment
LDO6_1V8	125	PO	1.8V output power supply for DOVDD of camera	1.8V normal voltage. Vnorm=1.8V

				$I_O$max=100mA
LDO17_2V85	129	PO	2.85V output power supply for AVDD of camera	2.85V normal voltage. Vnorm=2.85V $I_O$max=300mA
MIPI_CSI1_CLKN	70	AI	MIPI CSI clock signal (negative)	
MIPI_CSI1_CLKP	71	AI	MIPI CSI clock signal (positive)	
MIPI_CSI1_LN0N	72	AI	MIPI CSI data signal (negative)	
MIPI_CSI1_LN0P	73	AI	MIPI CSI data signal (positive)	
CAM1_MCLK	75	DO	Clock signal of front camera	
CAM1_RST	81	DO	Reset signal of front camera	
CAM1_PWD	82	DO	Power down signal of front camera	
CAM_I2C_SCL	83	OD	I2C clock signal of camera	
CAM_I2C_SDA	84	OD	I2C data signal of camera	

The following is a reference circuit design for front camera interface, by taking the connection with SP2508 camera as an example.

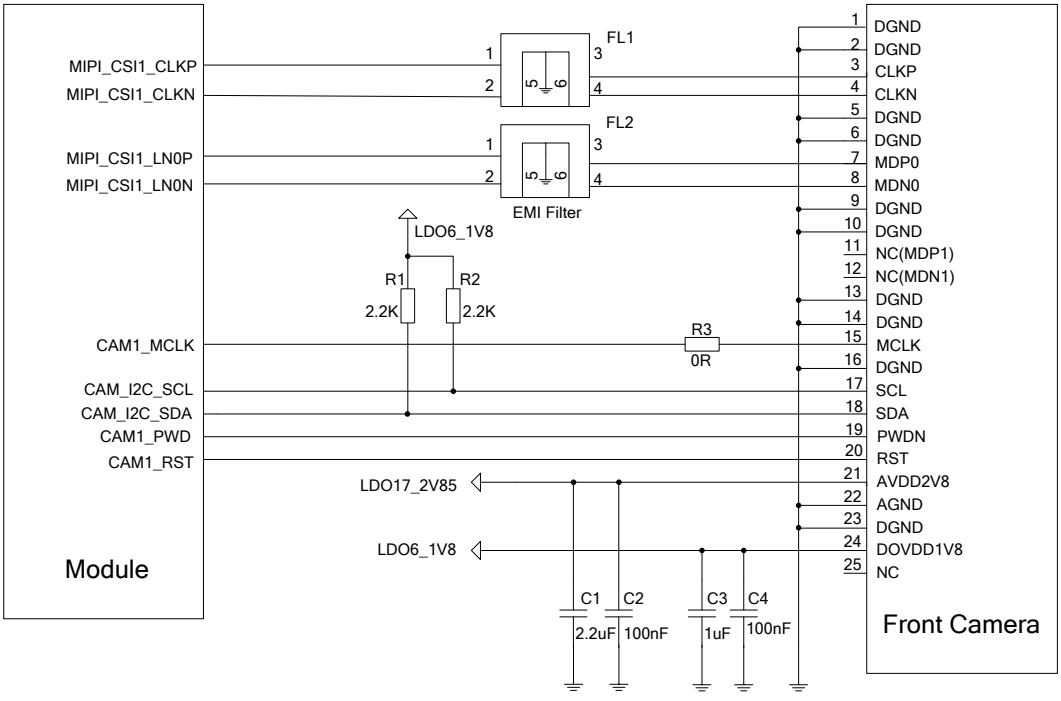


Figure 23: Reference Circuit Design for Front Camera Interface

3.19.3. Design Considerations

- Special attention should be paid to the definition of video device interface in schematic design. Different video devices will have varied definitions for their corresponding connectors. Assure the device and the connectors are correctly connected.
- MIPI are high speed signal lines, supporting maximum data rate up to 1.5Gbps. The differential impedance should be controlled as 100Ω. Additionally, it is recommended to route the trace on the inner layer of PCB, and do not cross it with other traces. For the same video device, all the MIPI traces should keep the same length. In order to avoid crosstalk, a distance of 1.5 times of the trace width is recommended to be maintained among MIPI signal lines. During impedance matching, do not connect GND on different planes so as to ensure impedance consistency.
- It is recommended to select a low capacitance TVS for ESD protection and the recommended parasitic capacitance is below 1pF.
- Route MIPI traces according to the following rules:
  a) The total trace length should not exceed 305mm;
  b) Control the differential impedance as 100Ω±10%;
  c) Control intra-lane length difference within 0.67mm;
  d) Control inter-lane length difference within 1.3mm.

Table 20: MIPI Trace Length inside the Module

PIN	Pin Name	Length (mm)	Length Difference (P-N)
52	MIPI_DSI_CLKN	7.08	-0.63
53	MIPI_DSI_CLKP	6.45	
54	MIPI_DSI_LN0N	6.15	-0.30
55	MIPI_DSI_LN0P	5.85	
56	MIPI_DSI_LN1N	6.64	-0.04
57	MIPI_DSI_LN1P	6.60	
58	MIPI_DSI_LN2N	8.20	0.74
59	MIPI_DSI_LN2P	8.94	
60	MIPI_DSI_LN3N	9.28	0.96
61	MIPI_DSI_LN3P	10.24	
63	MIPI_CSI0_CLKN	10.55	0.54
64	MIPI_CSI0_CLKP	11.09	

65	MIPI_CSI0_LN0N	12.13	0.40
66	MIPI_CSI0_LN0P	12.53	
67	MIPI_CSI0_LN1N	13.73	0.76
68	MIPI_CSI0_LN1P	14.49	
70	MIPI_CSI1_CLKN	17.32	0.13
71	MIPI_CSI1_CLKP	17.45	
72	MIPI_CSI1_LN0N	18.89	0.35
73	MIPI_CSI1_LN0P	19.24	

3.20. Sensor Interfaces

SC20-W module supports communication with sensors via I2C interface, and it supports ALS/PS, compass, G-sensor, and gyroscopic sensors.

Verified sensor models by Quectel include: BST-BMA223, STK3311-WV, MPU-6881 and MMC35240PJ.

Table 21: Pin Definition of Sensor Interfaces

Pin Name	Pin No	I/O	Description	Comment
SENSOR_I2C_SCL	91	OD	I2C clock signal for external sensor	
SENSOR_I2C_SDA	92	OD	I2C data signal for external sensor	
GPIO_88	99	DI	Gyroscope sensor interrupt signal 2	Default configuration; include but not limited to these GPIO pins.
GPIO_89	100	DI	Gyroscope sensor interrupt signal 1	
GPIO_94	107	DI	Proximity sensor interrupt signal	
GPIO_36	108	DI	Compass sensor interrupt signal	
GPIO_65	109	DI	Gravity sensor interrupt signal 2	
GPIO_96	110	DI	Gravity sensor interrupt signal 1	

3.21. Audio Interfaces

SC20-W module provides two analog input channels and three analog output channels. The following table shows the pin definition.

Table 22: Pin Definition of Audio Interfaces

Pin Name	Pin No	I/O	Description	Comment
MIC1P	4	AI	Microphone positive input for channel 1	
MIC_GND	5		MIC reference ground	
MIC2P	6	AI	Microphone positive input for channel 2	
EARP	8	AO	Earpiece positive output	
EARN	9	AO	Earpiece negative output	
SPKP	10	AO	Speaker positive output	
SPKN	11	AO	Speaker negative output	
HPH_R	136	AO	Headphone right channel output	
HPH_GND	137		Headphone virtual ground	
HPH_L	138	AO	Headphone left channel output	
HS_DET	139	AI	Headset insertion detection	High level by default

- The module offers two audio input channels which are both single-ended channels.
- The earpiece interface uses differential output.
- The loudspeaker interface uses differential output as well. The output channel is available with a Class-D amplifier whose output power is 879mW when VBAT is 4.2V and load is 8Ω.
- The headphone interface features stereo left and right channel output, and headphone insert detection function is supported.

3.21.1. Reference Circuit Design for Microphone

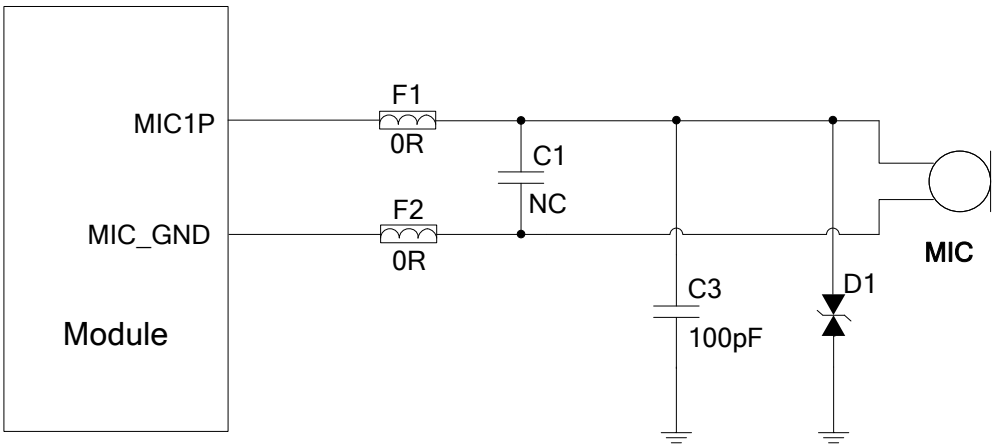


Figure 24: Reference Circuit Design for Microphone Interface

3.21.2. Reference Circuit Design for Receiver Interface

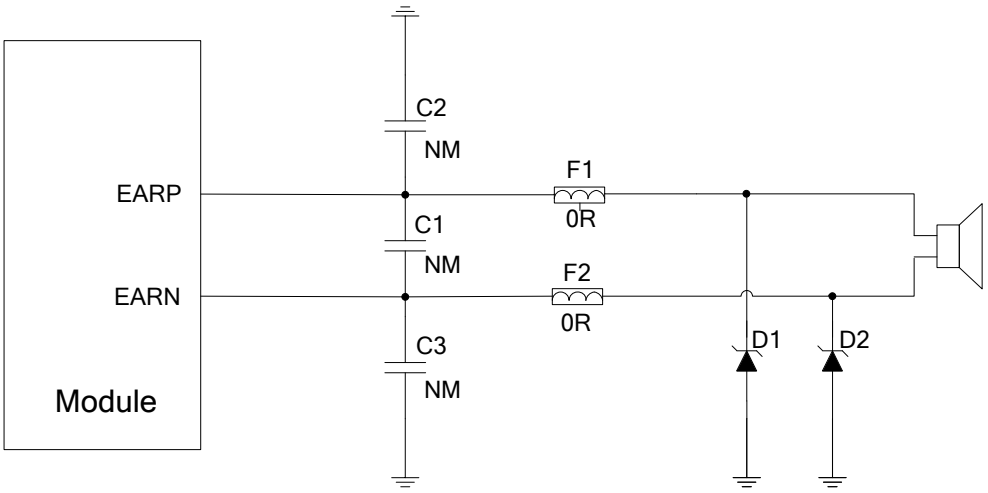


Figure 25: Reference Circuit Design for Receiver Interface

3.21.3. Reference Circuit Design for Headphone Interface

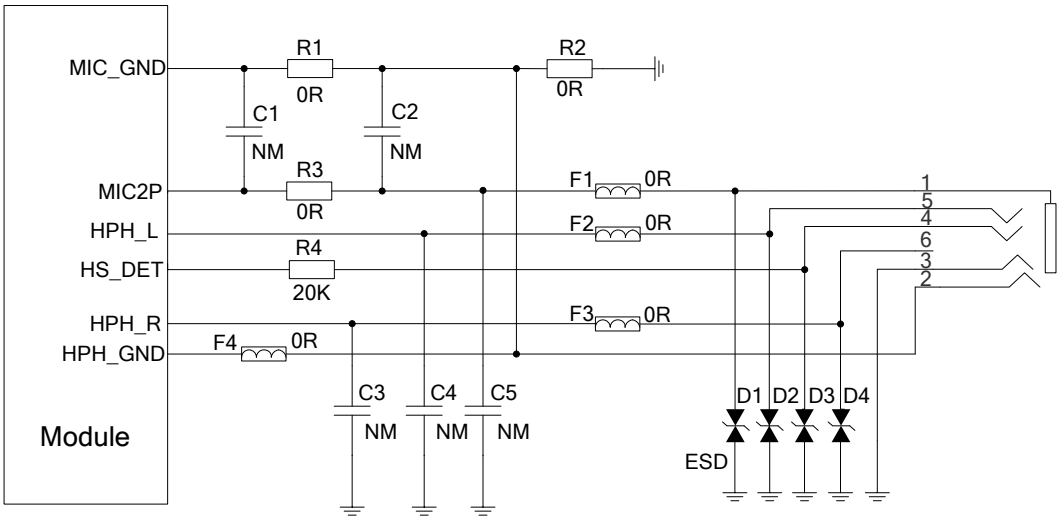


Figure 26: Reference Circuit Design for Headphone Interface

3.21.4. Reference Circuit Design for Loudspeaker Interface

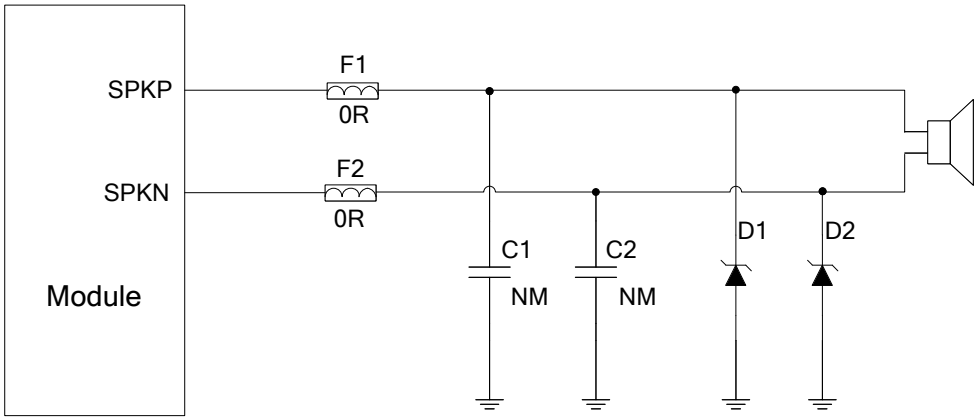


Figure 27: Reference Circuit Design for Loudspeaker Interface

3.21.5. Audio Interface Design Considerations

It is recommended to use the electret microphone. In order to decrease radio or other signal interference, the position of RF antenna should be kept away from audio interface and audio trace. Power trace cannot be parallel with audio trace and also should be far away from the audio trace.

The differential audio traces must be routed according to the differential signal layout rule.

3.22. Emergency Download Interface

USB_BOOT is an emergency download interface. Pull up to LDO5_1V8 during power-up will force the module enter into emergency download mode. This is an emergency option when there are failures such as abnormal startup or running. For convenient firmware upgrade and debugging in the future, please reverse this pin. The reference circuit design is shown as below.

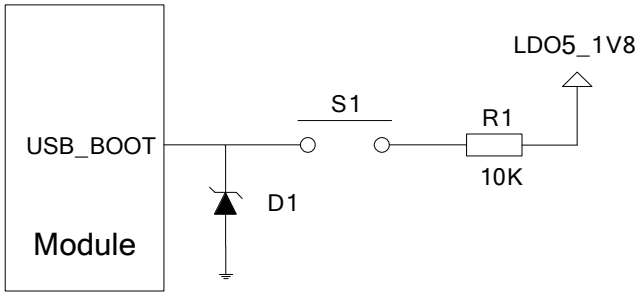


Figure 28: Reference Circuit Design for Emergency Download Interface

4 Wi-Fi and BT

SC20-W module provides a shared antenna interface ANT_WIFI/BT for Wi-Fi and Bluetooth (BT) functions. The interface impedance is 50Ω. External antennas such as PCB antenna and ceramic antenna can be connected to the module via the interface, so as to achieve Wi-Fi and BT functions.

4.1. Wi-Fi Overview

SC20-W series module supports 2.4GHz single frequency band or 2.4GHz/5GHz double-bands WLAN wireless communication based on IEEE 802.11a/b/g/n standard protocols. The maximum data rate is up to 150 Mbps.

The features are as below:

- Support Wake-on-WLAN (WoWLAN)
- Support ad hoc mode
- Support WAPI SMS4 hardware encryption
- Support AP mode
- Support Wi-Fi Direct
- Support MCS 0-7 for HT20 and HT40

4.1.1. Wi-Fi Performance

The following table lists the Wi-Fi transmitting and receiving performance of SC20-W module.

Table 23: Wi-Fi Transmitting Performance

	Standard	Data Rate	Output Power
2.4GHz	802.11b	1Mbps	16dBm±2.5dBm
	802.11b	11Mbps	16dBm±2.5dBm
	802.11g	6Mbps	16dBm±2.5dBm
	802.11g	54Mbps	14dBm±2.5dBm

	802.11n HT20	MCS0	15dBm±2.5dBm
	802.11n HT20	MCS7	13dBm±2.5dBm
	802.11n HT40	MCS0	14dBm±2.5dBm
	802.11n HT40	MCS7	13dBm±2.5dBm
5GHz	802.11a	6Mbps	15dBm±2.5dBm
	802.11a	54Mbps	13dBm±2.5dBm
	802.11n HT20	MCS0	14dBm±2.5dBm
	802.11n HT20	MCS7	12dBm±2.5dBm
	802.11n HT40	MCS0	14dBm±2.5dBm
	802.11n HT40	MCS7	12dBm±2.5dBm

Table 24: Wi-Fi Receiving Performance

	Standard	Data Rate	Sensitivity
2.4GHz	802.11b	1Mbps	-96dBm
	802.11b	11Mbps	-87dBm
	802.11g	6Mbps	-91dBm
	802.11g	54Mbps	-74dBm
	802.11n HT20	MCS0	-90dBm
	802.11n HT20	MCS7	-72dBm
	802.11n HT40	MCS0	-87dBm
	802.11n HT40	MCS7	-68dBm
5GHz	802.11a	6Mbps	-90dBm
	802.11a	54Mbps	-71dBm
	802.11n HT20	MCS0	-88dBm
	802.11n HT20	MCS7	-69dBm

	802.11n HT40	MCS0	-86dBm
	802.11n HT40	MCS7	-66dBm

Referenced specifications are listed below:

- 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

4.2. BT Overview

SC20-W module supports BT4.2 (BR/EDR+BLE) specification, as well as GFSK, 8-DPSK, π/4-DQPSK modulation modes.

- Maximally support up to 7 wireless connections.
- Maximally support up to 3.5 piconets at the same time.
- Support one SCO (Synchronous Connection Oriented) or eSCO connection.

The BR/EDR channel bandwidth is 1MHz, and can accommodate 79 channels. The BLE channel bandwidth is 2MHz, and can accommodate 40 channels.

Table 25: BT Data Rate and Version

Version	Data rate	Maximum Application Throughput	Comment
1.2	1 Mbit/s	> 80 Kbit/s	
2.0 + EDR	3 Mbit/s	> 80 Kbit/s	
3.0 + HS	24 Mbit/s	Reference 3.0 + HS	
4.0	24 Mbit/s	Reference 4.0 LE	

Referenced specifications are listed below:

- 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

4.2.1. BT Performance

The following table lists the BT transmitting and receiving performance of SC20-W module.

Table 26: BT Transmitting and Receiving Performance

Transmitter Performance			
Packet Types	DH5	2-DH5	3-DH5
Transmitting Power	10dBm±2.5dBm	8dBm±2.5dBm	8dBm±2.5dBm
Receiver Performance			
Packet Types	DH5	2-DH5	3-DH5
Receiving Sensitivity	-93dBm	-92dBm	-86dBm

5 Antenna Interface

SC20-W antenna interface includes a Wi-Fi/BT antenna. The antenna interface has an impedance of 50Ω.

5.1. Wi-Fi/BT Antenna Interface

The following tables show the Wi-Fi/BT antenna pin's definition and frequency specification.

Table 27: Pin Definition of Wi-Fi/BT Antenna

Pin Name	Pin No.	I/O	Description	Comment
ANT_WIFI/BT	77	IO	Wi-Fi/BT antenna	50Ω impedance

Table 28: Wi-Fi/BT Frequency

Type	Frequency	Unit
802.11a/b/g/n/ac	2402~2482 5180~5825	MHz
BT4.1 LE	2402~2480	MHz

A reference circuit design for Wi-Fi/BT antenna is shown as below. R1, C1 and C2 are mounted according to the actual debugging. C1 and C2 are not mounted and a 0Ω resistor is mounted on R1 by default.

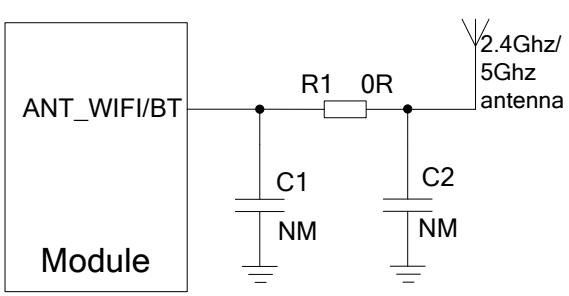


Figure 29: Reference Circuit Design for Wi-Fi/BT Anternna

NOTE

Place the π-type matching components (R1, C1, C2) as close to the antenna as possible.

5.1.1. Reference Design of RF Layout

For user's PCB, the characteristic impedance of all RF traces should be controlled to 50Ω. The impedance of the RF traces is usually determined by the trace width (W), the materials' dielectric constant, height from the reference ground to the signal layer (H), and the clearance between RF traces and grounds (S). Microstrip or coplanar waveguide is typically used in RF layout to control characteristic impedance. The following are reference designs of microstrip or coplanar waveguide with different PCB structures.

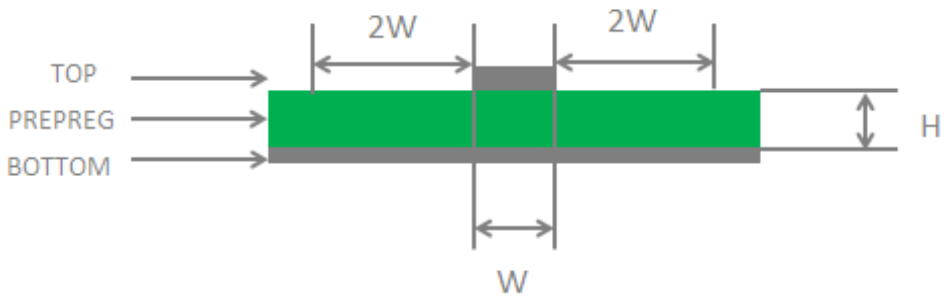


Figure 30: Microstrip Design on a 2-layer PCB

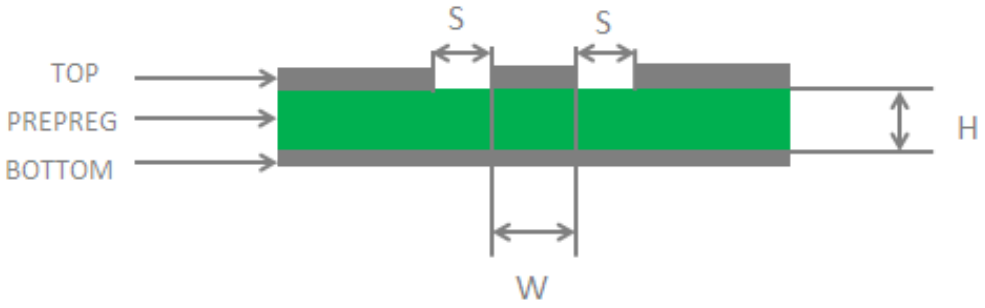


Figure 31: Coplanar Waveguide Design on a 2-layer PCB

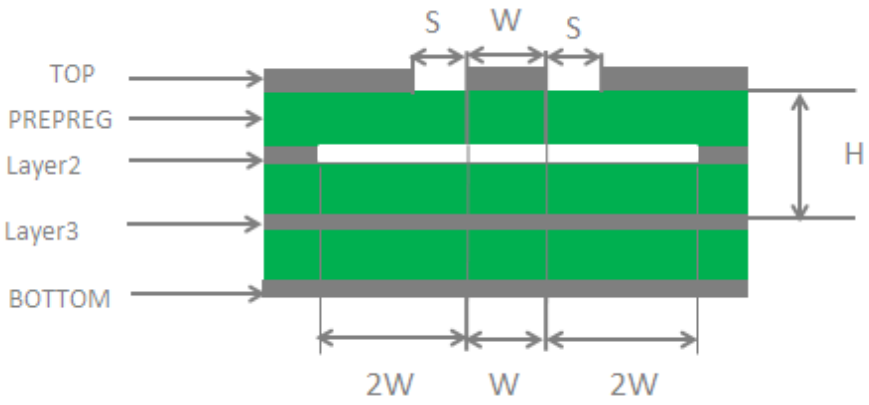


Figure 32: Coplanar Waveguide Design on a 4-layer PCB (Layer 3 as Reference Ground)

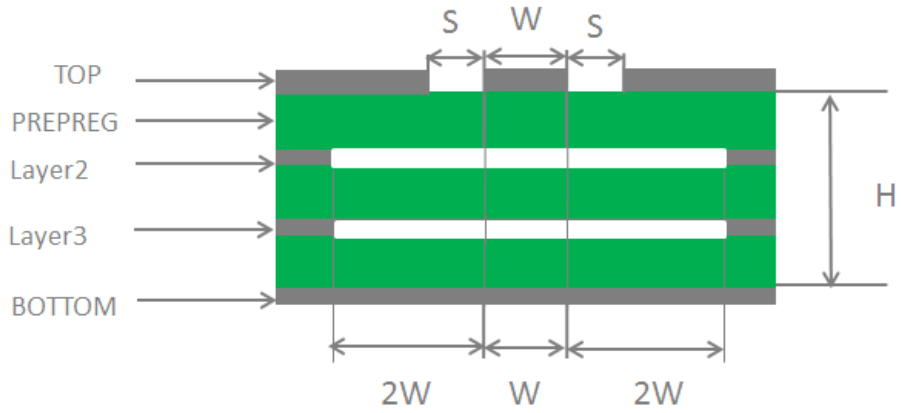


Figure 33: Coplanar Waveguide Design on a 4-layer PCB (Layer 4 as Reference Ground)

In order to ensure RF performance and reliability, the following principles should be complied with in RF layout design:

- Use an impedance simulation tool to accurately control the characteristic impedance of RF traces to 50Ω.
- The GND pins adjacent to RF pins should not be designed as thermal relief pads, and should be fully connected to ground.
- The distance between the RF pins and the RF connector should be as short as possible, and all the right-angle traces should be changed to curved ones.
- There should be clearance under the signal pin of the antenna connector or solder joint.
- The reference ground of RF traces should be complete. Meanwhile, adding some ground vias around RF traces and the reference ground could help to improve RF performance. The distance between the ground vias and RF traces should be no less than two times as wide as RF signal traces (2*W).

For more details about RF layout, please refer to ***document [3]***.

5.2. Antenna Installation

5.2.1. Antenna Requirements

The following table shows the requirements on Wi-Fi/BT antenna.

Table 29: Antenna Requirements

Type	Requirements
Wi-Fi/BT	VSWR: ≤ 2 Gain (dBi): 1 Max Input Power (W): 50 Input Impedance (Ω): 50 Polarization Type: Vertical Cable Insertion Loss: < 1dB

5.2.2. Recommended RF Connector for Antenna Installation

If RF connector is used for antenna connection, it is recommended to use the U.FL-R-SMT connector provided by HIROSE.

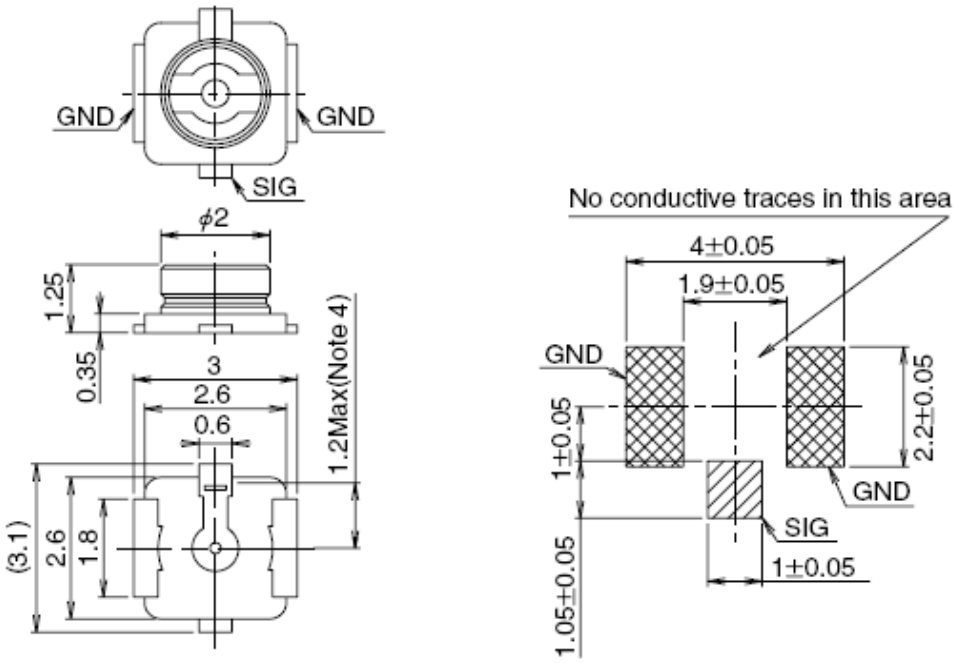


Figure 34: Dimensions of the U.FL-R-SMT Connector (Unit: mm)

U.FL-LP serial connector listed in the following figure can be used to match the U.FL-R-SMT.

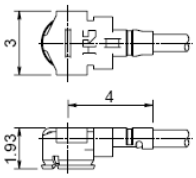
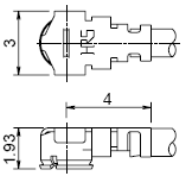
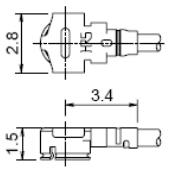
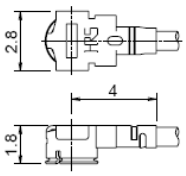
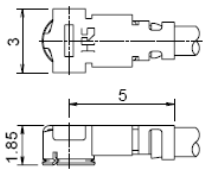
Part No.	U.FL-LP-040	U.FL-LP-066	U.FL-LP(V)-040	U.FL-LP-062	U.FL-LP-088
					
Mated Height	2.5mm Max. (2.4mm Nom.)	2.5mm Max. (2.4mm Nom.)	2.0mm Max. (1.9mm Nom.)	2.4mm Max. (2.3mm Nom.)	2.4mm Max. (2.3mm Nom.)
Applicable cable	Dia. 0.81mm Coaxial cable	Dia. 1.13mm and Dia. 1.32mm Coaxial cable	Dia. 0.81mm Coaxial cable	Dia. 1mm Coaxial cable	Dia. 1.37mm Coaxial cable
Weight (mg)	53.7	59.1	34.8	45.5	71.7
RoHS	YES				

Figure 35: Mechanical Parameters of U.FL-LP Connectors

The following figure describes the space factor of mated connectors.

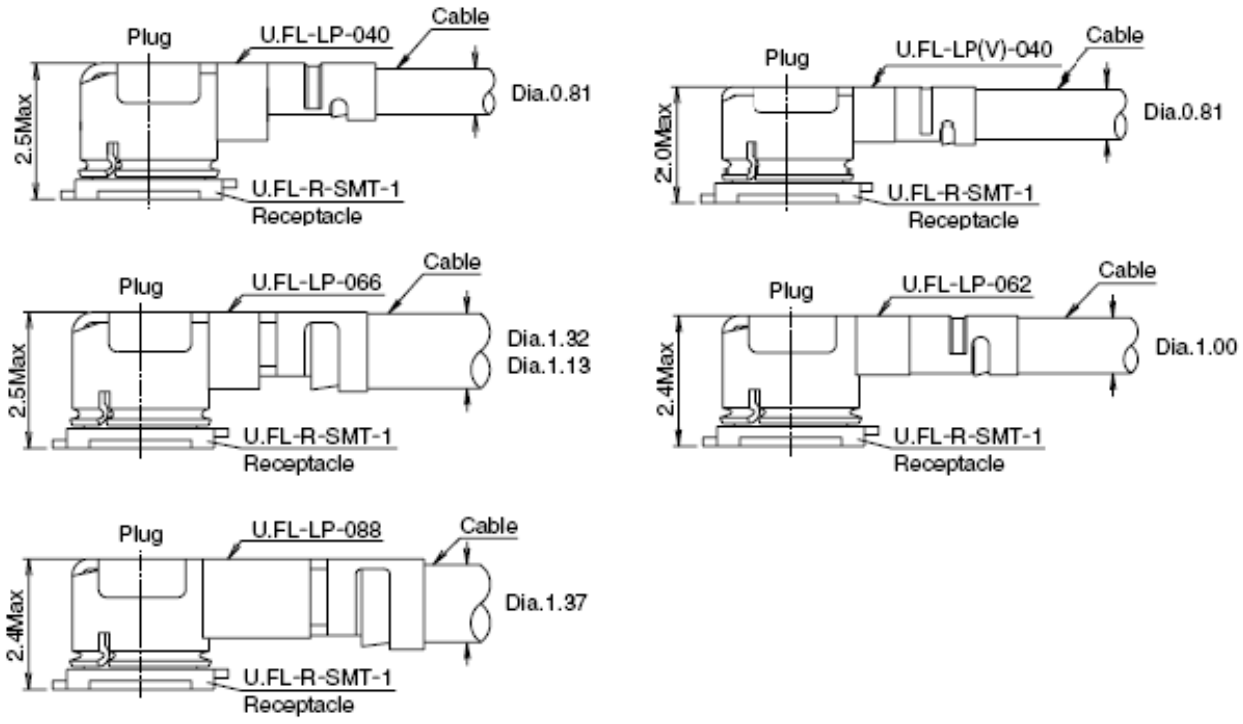


Figure 36: Space Factor of Mated Connectors (Unit: mm)

For more details, please visit http://www.hirose.com.

6 Electrical, Reliability and Radio Characteristics

6.1. Absolute Maximum Ratings

Absolute maximum ratings for power supply and voltage on digital and analog pins of the module are listed in the following table.

Table 30: Absolute Maximum Ratings

Parameter	Min.	Max.	Unit
VBAT	-0.5	6	V
USB_VBUS	-0.5	16	V
Voltage on Digital Pins	-0.3	2.3	V

6.2. Power Supply Ratings

Table 31: SC20-W Module Power Supply Ratings

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
VBAT	VBAT	The actual input voltages must stay between the minimum and maximum values.	3.5	3.8	4.2	V
USB_VBUS	USB detection		4.35	5.0	6.3	V
VRTC	Power supply voltage of backup battery		2.0	3.0	3.25	V

6.3. Charging Performance Specifications

Table 32: Charging Performance Specifications

Parameter	Min.	Typ.	Max.	Unit
Trickle charging-A current	81	90	99	mA
Trickle charging-A threshold voltage range (15.62mV stepping up)	2.5	2.796	2.984	V
Trickle charging-B threshold voltage range (18.75mV stepping up)	3.0	3.2	3.581	V
Charge voltage range (25mV stepping up)	4	4.2	4.775	V
Charge voltage accuracy			+/-2	%
Charge current range (90mA stepping up)	90		1440	mA
Charge current accuracy			+/-10	%
Charge termination current: when charge current is from 90 to 450mA		7		%
Charge termination current: when charge current is from 450 to 1440mA		7.4		%

6.4. Operation and Storage Temperatures

The operation temperature is listed in the following table.

Table 33: Operation Temperature

Parameter	Min.	Typ.	Max.	Unit
Operation temperature range	-35	+25	+65	°C
Extended temperature range	-40		+75	°C
Storage temperature range	-40		90	°C

6.5. Current Consumption

Table 34: SC20-W Current Consumption

Parameter	Description	Conditions	Min.	Typ.	Max.	Unit
I_{VBAT}	OFF state	Power down		20		uA
	Sleep state	RF sleep		1.4		mA
	Idle state	RF idle		42.7		mA
	Wi-Fi 11b TX	@1Mbps		298		mA
		@11Mbps		281		mA
	Wi-Fi 11g TX	@6Mbps		286		mA
		@54Mbps		188		mA
	Wi-Fi 11n TX	@6.5Mbps 20Mhz		275		mA
		@65Mbps 20Mhz		201		mA
		@13.5Mbps 40Mhz		269		mA
		@135Mbps 40Mhz		186		mA
	Wi-Fi 11b RX			120		mA
	Wi-Fi 11g RX			119		mA
	Wi-Fi 11n RX			117		mA
	BT Tx Channel 0			100		mA
	BT Tx Channel 38			100		mA
	BT Tx Channel 78			100		mA
	BT Rx Channel 38			80		mA

6.6. Electrostatic Discharge

The module is not protected against electrostatic discharge (ESD) in general. Consequently, it should be subject to ESD handling precautions that are typically applied to ESD sensitive components. Proper ESD handling and packaging procedures must be applied throughout the processing, handling and operation of any application that incorporates the module.

The following table shows the electrostatic discharge characteristics of SC20-W module.

Table 35: ESD Characteristics (Temperature: 25°C, Humidity: 45%)

Tested Points	Contact Discharge	Air Discharge	Unit
VBAT, GND	+/-5	+/-10	KV
All Antenna Interfaces	+/-5	+/-10	KV
USB Interfaces	+/-2	+/-4	KV
Other Interfaces	+/-0.5	+/-1	KV

7 Mechanical Dimensions

This chapter describes the mechanical dimensions of the module. All dimensions are measured in millimeter (mm), and the tolerances for dimensions without tolerance values are ±0.05mm.

7.1. Mechanical Dimensions of the Module

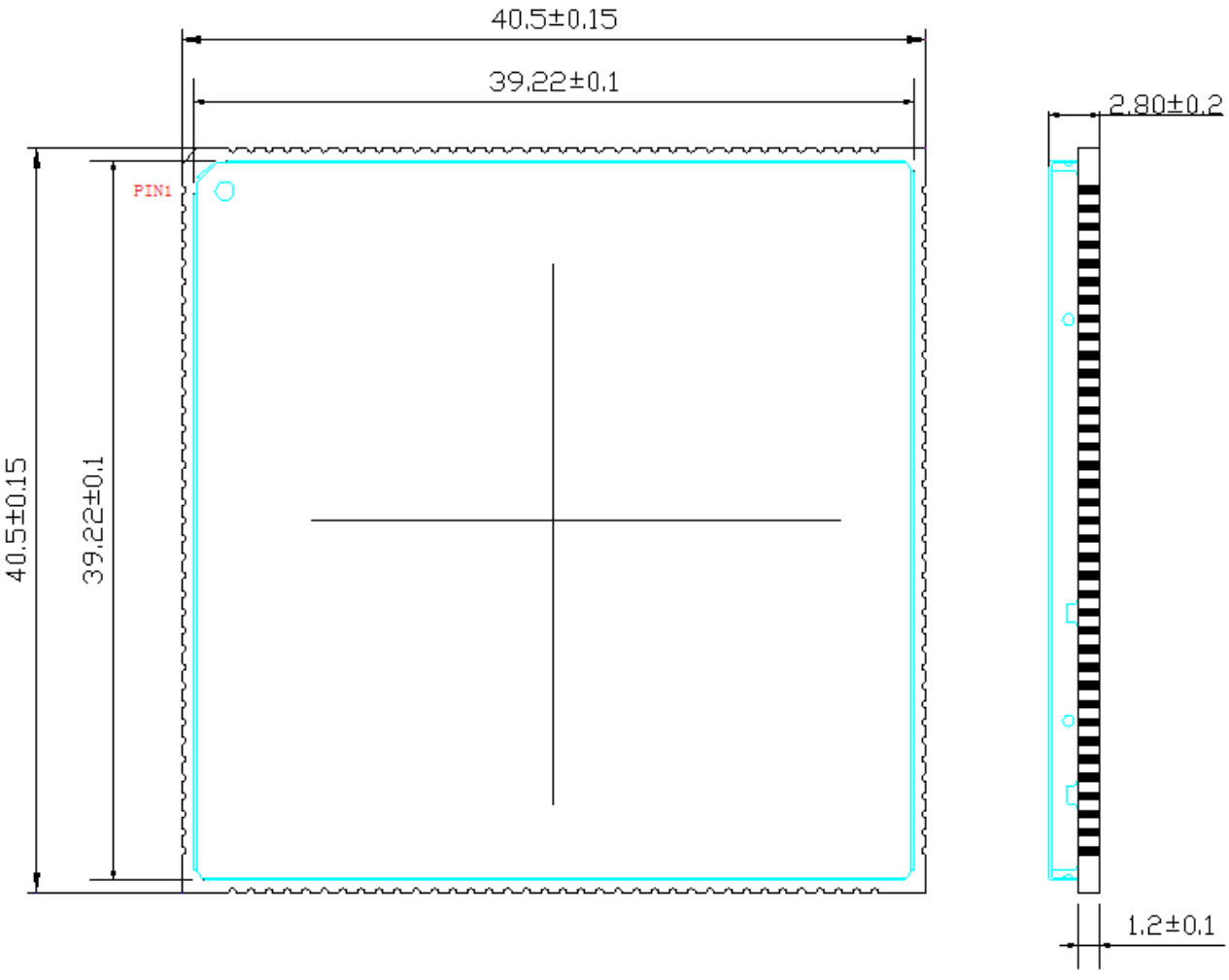


Figure 37: Module Top and Side Dimensions

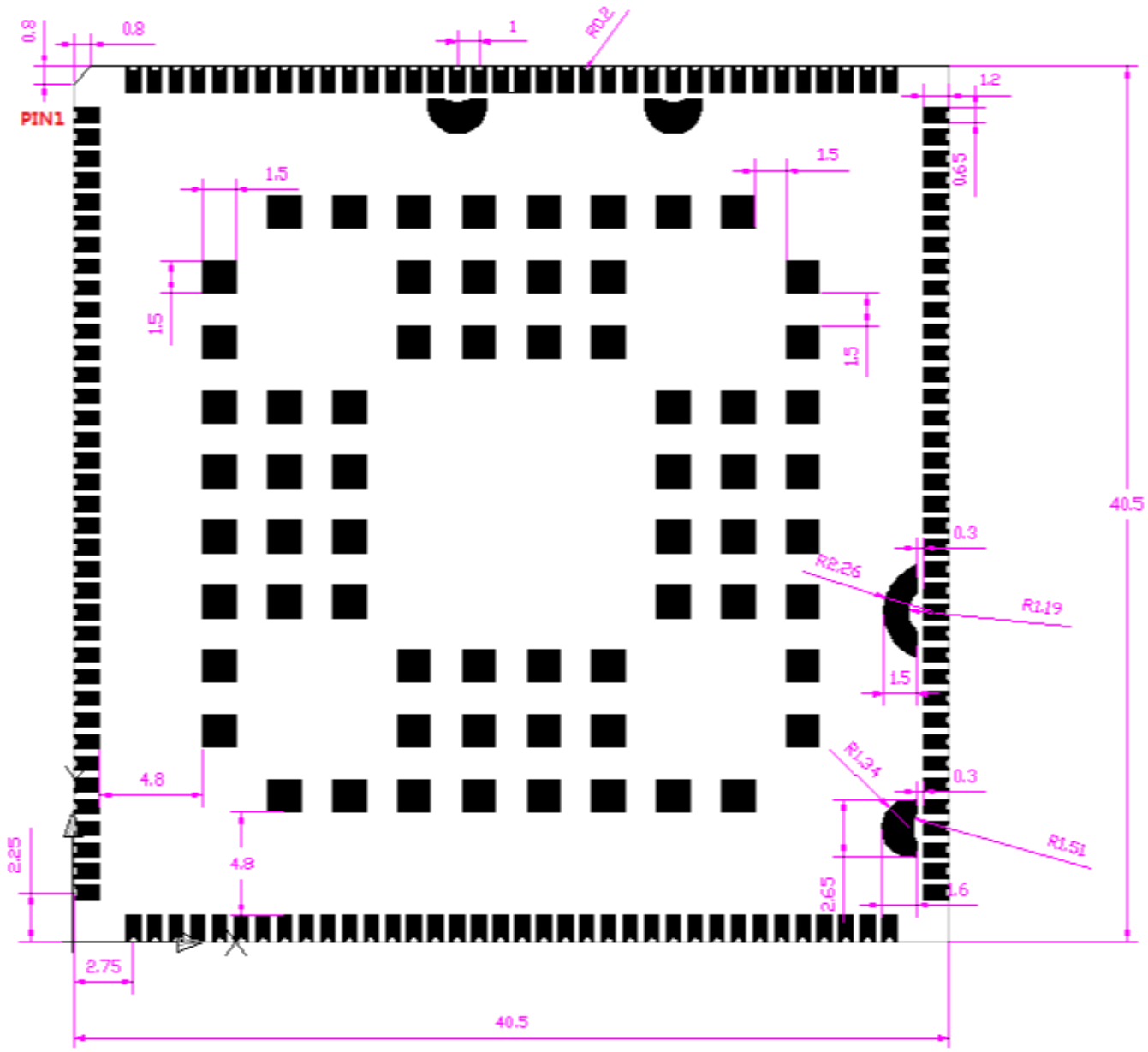


Figure 38: Module Bottom Dimensions (Top View)

7.2. Recommended Footprint

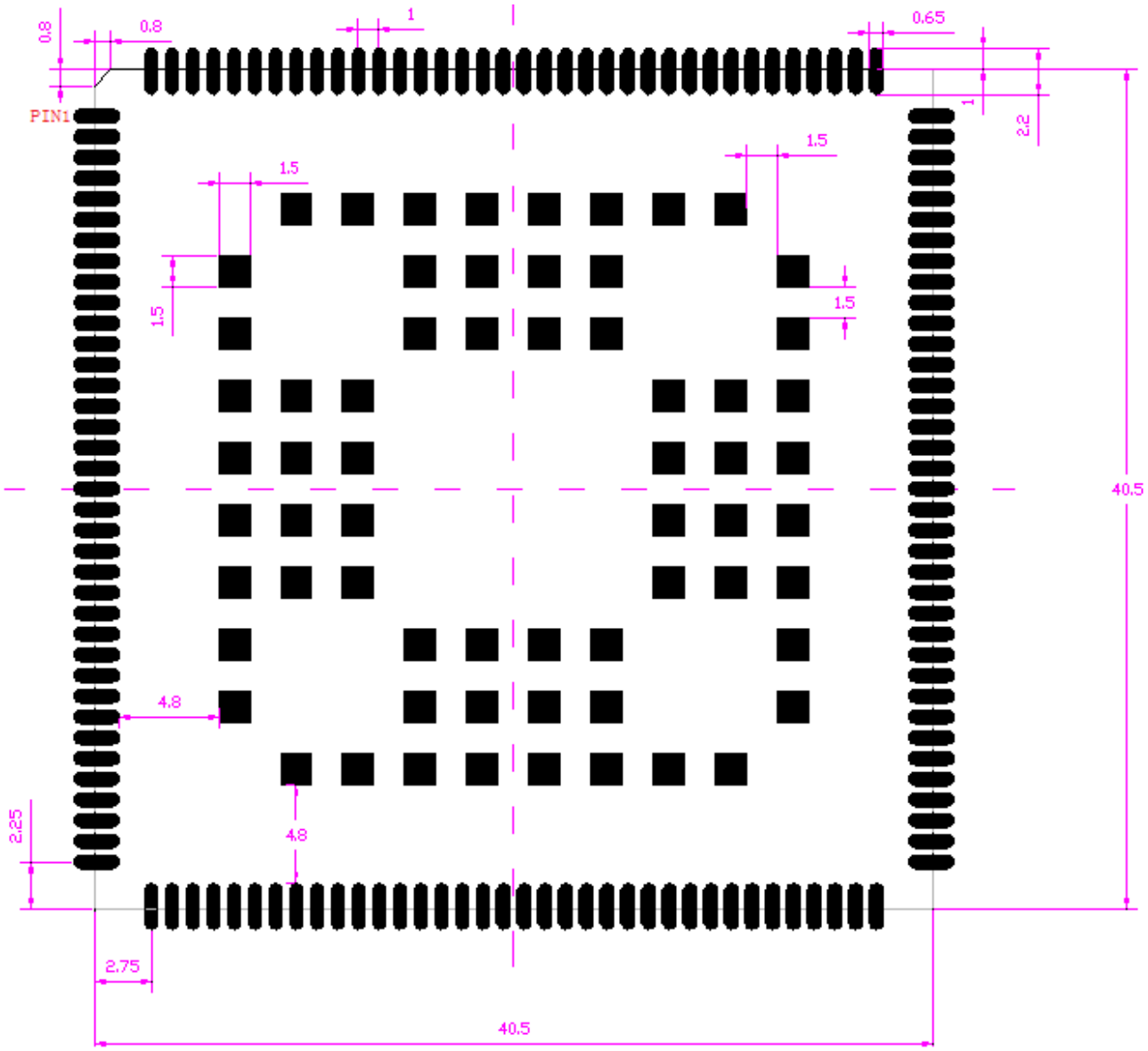


Figure 39: Recommended Footprint (Top View)

NOTES

1. For easy maintenance of the module, keep about 3mm between the module and other components on host PCB.
2. All RESERVED pins should be kept open and MUST NOT be connected to ground.

7.3. Top and Bottom Views of the Module

Figure 40: Top View of the Module

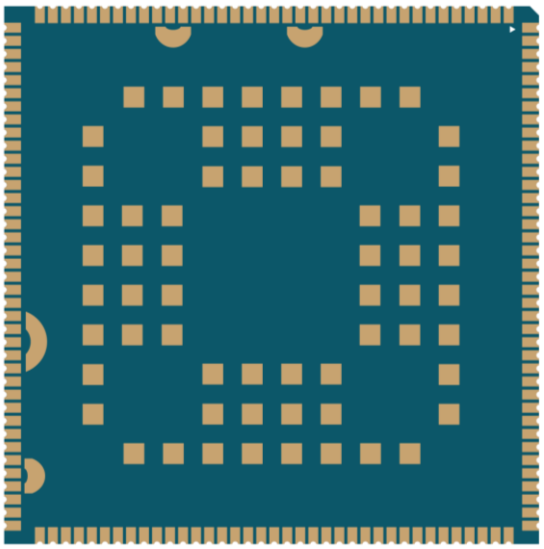


Figure 41: Bottom View of the Module

NOTE

These are renderings of SC20-W module. For authentic dimension and appearance, please refer to the module that you received from Quectel.

8 Storage, Manufacturing and Packaging

8.1. Storage

SC20-W is stored in a vacuum-sealed bag. It is rated at MSL 3, and its storage restrictions are shown as below.

1. Shelf life in the vacuum-sealed bag: 12 months at <40ºC/90%RH.

2. After the vacuum-sealed bag is opened, devices that will be subjected to reflow soldering or other high temperature processes must be:
   - Mounted within 168 hours at the factory environment of ≤30ºC/60%RH.
   - Stored at <10%RH.

3. Devices require baking before mounting, if any circumstance below occurs.
   - When the ambient temperature is 23ºC±5ºC and the humidity indication card shows the humidity is >10% before opening the vacuum-sealed bag.
   - Device mounting cannot be finished within 168 hours at factory conditions of ≤30ºC/60%.

4. If baking is required, devices may be baked for 8 hours at 120ºC±5ºC.

NOTE

Plastic packages shall be removed from the modules prior to high temperature baking (120°C). If shorter baking time is desired, please refer to *IPC/JEDECJ-STD-033* for baking procedure.

8.2. Manufacturing and Soldering

Push the squeegee blade to apply the solder paste on the surface of stencil, making the paste fill the stencil apertures and then letting it penetrate to the PCB. Downward squeegee pressure should be adjusted properly to ensure that the stencil is wiped clean without damaging the stencil. To ensure the module soldering quality, the recommended stencil thickness is 0.18mm~0.20 mm. As for LGA pads, less soldering paste volume is recommended to avoid short circuits. For more details, please refer to ***document [2]***.

It is suggested that the peak reflow temperature ranges from 240 to 245°C (for SnAg3.0Cu0.5 alloy). The absolute maximum reflow temperature is 245°C. To avoid damage to the module caused by repeated heating, remounting the module after finishing the reflow soldering of the first side of PCB is highly recommended. The recommended reflow soldering thermal profile is illustrated as follows.

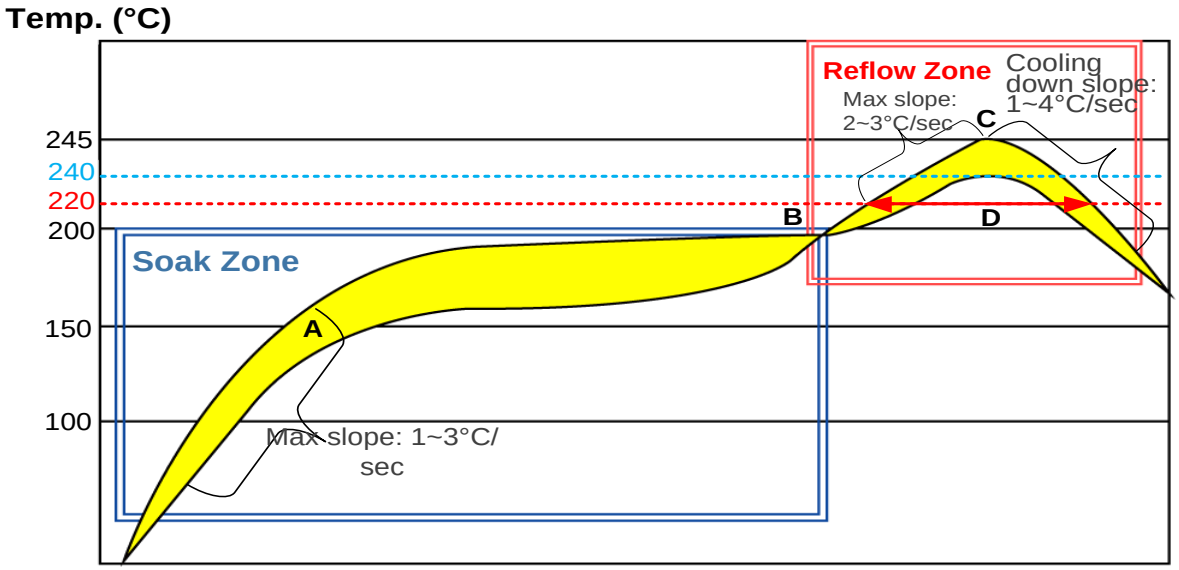


Figure 42: Recommended Reflow Soldering Thermal Profile

Table 36: Recommended Thermal Profile Parameters

Factor	Recommendation
Soak Zone	
Max slope	1 to 3°C/sec
Soak time (between A and B: 150°C and 200°C)	60 to 120 sec
Reflow Zone	

Max slope	2 to 3°C/sec
Reflow time (D: over 220°C)	40 to 60 sec
Max temperature	240°C ~ 245°C
Cooling down slope	1 to 4°C/sec
Reflow Cycle	
Max reflow cycle	1

8.3. Packaging

SC20-W is packaged in tape and reel carriers. Each reel is 12.32m long and contains 200 modules. The following figures show the package details, measured in mm.

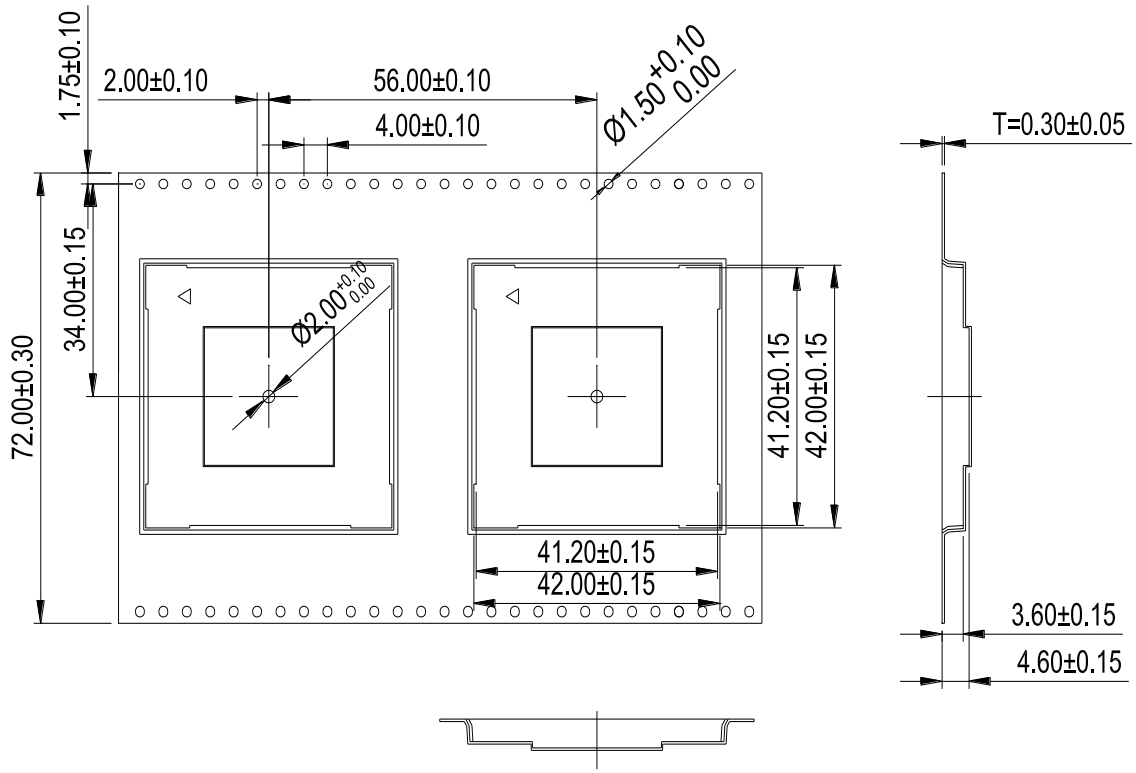


Figure 43: Tape Dimensions

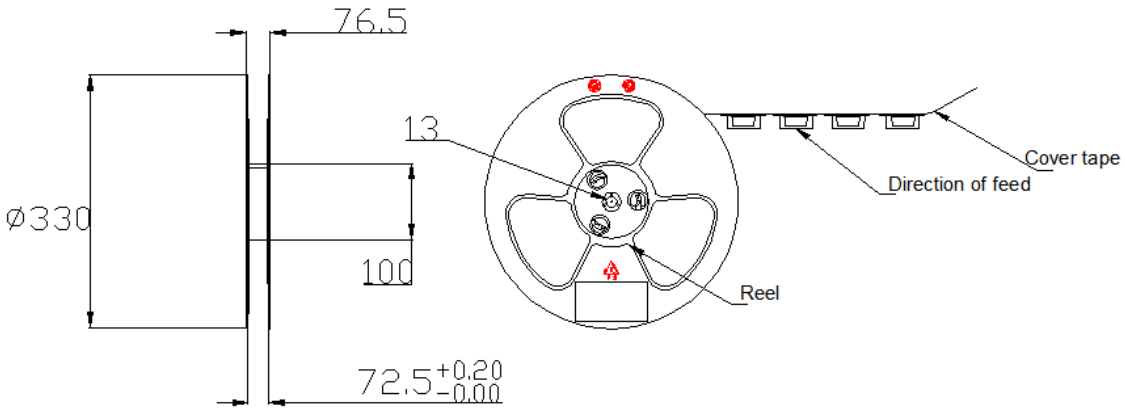


Figure 44: Reel Dimensions

Table 37: Reel Packaging

Model Name	MOQ for MP	Minimum Package: 200pcs	Minimum Package×4=800pcs
SC20-W	200	Size: 370mm × 350mm × 85mm N.W: 1.92kg G.W: 3.17kg	Size: 380mm × 365mm × 365mm N.W: 7.68kg G.W: 13.63kg

9 Appendix A References

Table 38: Related Documents

SN	Document Name	Remark
[1]	Quectel_Smart_EVB_User_Guide	Smart EVB User Guide
[2]	Quectel_Module_Secondary_SMT_User_Guide	Module Secondary SMT User Guide
[3]	Quectel_RF_Layout_Application_Note	RF Layout Application Note

Table 39: Terms and Abbreviations

Abbreviation	Description
ADC	Analog-to-Digital Converter
AMR	Adaptive Multi-rate
bps	Bits Per Second
BT	Bluetooth
CS	Coding Scheme
CTS	Clear to Send
EMMC	Embedded Multi Media Card
ESD	Electrostatic Discharge
FR	Full Rate
FPC	Flexible Printed Circuit
GND	Ground
HIC	Humidity Indicator Card

I/O	Input/Output
LCD	Liquid Crystal Display
LCM	Liquid Crystal Module
LPDDR	Low Power Double Data Rate
MIPI	Mobile Industry Processor Interface
MSL	Moisture Sensitivity Level
NTC	Negative Temperature Coefficient
OTG	On-The-Go
PC	Personal Computer
PCB	Printed Circuit Board
PDA	Personal Data Assistant
POS	Point Of Sales
RF	Radio Frequency
RH	Relative Humidity
RHCP	Right Hand Circularly Polarized
RTC	Real Time Clock
Rx	Receive
SAW	Surface Acoustic Wave
SDIO	Secure Digital Input and Output
SMD	Surface Mount Device
TP	Touch Panel
TV	Television
TVS	Transient Voltage Suppressors
TX	Transmitting Direction
USB	Universal Serial Bus

UART	Universal Asynchronous Receiver & Transmitter
Vmax	Maximum Voltage Value
Vnorm	Normal Voltage Value
Vmin	Minimum Voltage Value
V_{IH}max	Maximum Input High Level Voltage Value
V_{IH}min	Minimum Input High Level Voltage Value
V_{IL}max	Maximum Input Low Level Voltage Value
V_{IL}min	Minimum Input Low Level Voltage Value
$V_I$max	Absolute Maximum Input Voltage Value
$V_I$min	Absolute Minimum Input Voltage Value
V_{OH}max	Maximum Output High Level Voltage Value
V_{OH}min	Minimum Output High Level Voltage Value
V_{OL}max	Maximum Output Low Level Voltage Value
V_{OL}min	Minimum Output Low Level Voltage Value
VRTC	Voltage of Real Time Clock
VSWR	Voltage Standing Wave Ratio
WLAN	Wireless Local Area Network
Wi-Fi	Wireless Fidelity
WVGA	Wide Video Graphics Array