

Smart EVB User Guide

Smart LTE Module Series

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About the Document

History

Revision	Date	Author	Description
1.0	2016-09-30	Vae LIU	Initial
1.1	2018-10-23	Jerry WANG	<ol style="list-style-type: none">1. Added a comment for the power supply of Smart EVB in Table 1.2. Updated the top view of Smart EVB in Figure 1.3. Added a comment for RESET in Chapter 2.2.4. Added the description of a separate battery interface in Chapter 3.1.5. Added the descriptions of touch panel interface, LCM interface, camera interfaces and SD card interface in Chapter 3.2~3.5.6. Added the description of flashlight, vibrator and sensors in Chapter 3.13~3.15.

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1 Introduction

This document describes the evaluation board (Smart EVB) for Quectel Smart module SC20. The smart evaluation board is an assistant tool to develop and test SC20.

1.1. Safety Information

The following safety precautions must be observed during all phases of the operation, such as usage, service or repair of any cellular terminal or mobile incorporating SC20 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 the 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 fuelling 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 General Overview

Quectel supplies Smart EVB for designers to develop applications based on Quectel SC20 module. This EVB can test basic functionalities of the module.

2.1. Key Features

The following table describes the key features of Smart EVB.

Table 1: Key Features of Smart EVB

Features	Implementation
Power Supply	<ul style="list-style-type: none"> ● DC power supply: 4.75V~6.0V (typical: 5.0V) ● VBAT: 3.5V~4.2V (typical: 3.8V)
(U)SIM Interfaces	<ul style="list-style-type: none"> ● Support (U)SIM card detection ● Support USIM/SIM cards: 2.95V and 1.8V
Audio Interfaces	<ul style="list-style-type: none"> ● Analog interfaces used for loudspeaker, microphone, earphone and headphone
Camera Interfaces	Support two cameras: <ul style="list-style-type: none"> ● Main camera supports 8M pixels with 2-lane CSI interface ● Sub camera supports 2M pixels with 1-lane CSI interface
LCM Interface	<ul style="list-style-type: none"> ● One 5-inch 1080 × 720 HD resolution LCD ● 4-lane MIPI DSI interface for LCD
Touch Panel Interface	<ul style="list-style-type: none"> ● One capacitive touch panel
SD Card Interface	<ul style="list-style-type: none"> ● Support 4-bit SD card with hot-plug detection
UART Interfaces	Two UART interfaces: <ul style="list-style-type: none"> ● Debug UART for debugging ● Main UART is not used by default
USB Interface	<ul style="list-style-type: none"> ● Compliant with USB 2.0 specifications ● Support high speed and OTG function
Signal Indication	<ul style="list-style-type: none"> ● 4 LEDs are available for signal indication
Buttons	<ul style="list-style-type: none"> ● 9 buttons

Switches	● 4 switches
Flashlight	● Support a flashlight LED
Vibrator	● A vibrator for testing the motor drive interface of the module
Sensors	● Support three sensors including ALS/PS, G-sensor/Gyroscopic sensor and compass sensor
Physical Characteristics	● Size: 24cm × 18cm

2.2. Interface Overview

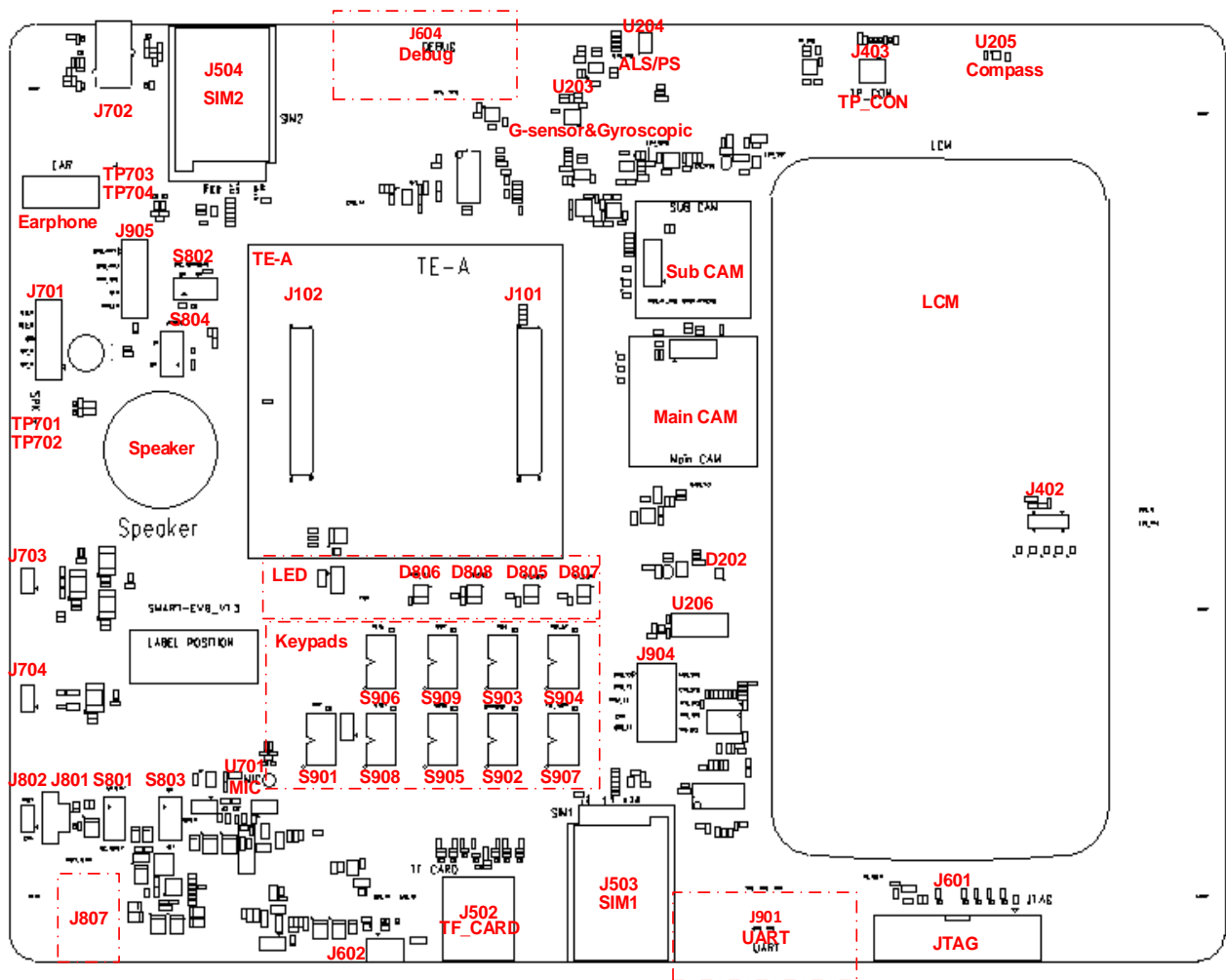


Figure 1: Smart EVB Interface Overview

Table 2: Interfaces of Smart EVB

Interface	Reference No.	Description
Power Supply Switches	S801	Used to select DC-DC power supply or battery power supply
	S802	Used to force the module to boot from USB port Turned off by default
	S803	Used to power on/off the EVB
	S804	Used to turn on/off battery charger Turned off by default

PWRKEY	S901	Power key (push button) Used to turn on/off the module
	J903	Used to connect PWRKEY to GND
RESET ¹⁾	S908	Reset push button Used to reset the module
Micro USB	J602	USB interface
Audio	Speaker	Used for loudspeaker
	EAR	Used for earphone
	MIC	Used for microphone
	J702	Used for headphone
(U)SIM	J503	(U)SIM1 card connector
	J504	(U)SIM2 card connector
SD Card	J502	SD card connector
Camera	J302	Main camera connector, support 8M CMOS sensor
	J301	Sub camera connector, support 2M CMOS sensor
LCM	J402	Connector for LCM
TP	J403	ZIF connector for touch panel
Sensors	U205	Compass sensor
	U204	Ambient light sensor and proximity sensor
	U203	G-sensor & gyroscopic sensor
Flashlight	D202	Flashlight LED
Vibrator	U206	Vibrator for customers to test the motor driver interface
UART	J901	Main UART port
	J604	Debug UART port
LEDs	D805, D806, D807, D808	D807: network registration status indicator D806: power supply status indicator D808/D805: disabled by default
TE-A	J101, J102	Connectors for connecting Smart TE-A and Smart EVB

DC interface	J807	Used to connect to DC power adapter
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NOTE

1) The “RESET” button does not work, because the RESET interface on SC20 module is disabled by default. Through enabling the RESET interface via software configuration, the “RESET” button can work properly.

2.3. Top and Bottom Views of Smart EVB

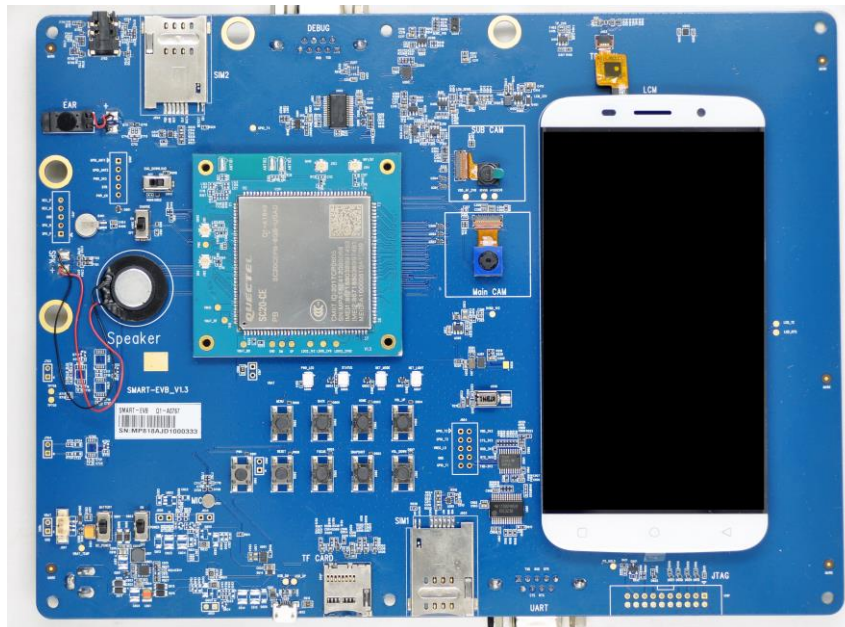


Figure 2: Smart EVB Top View

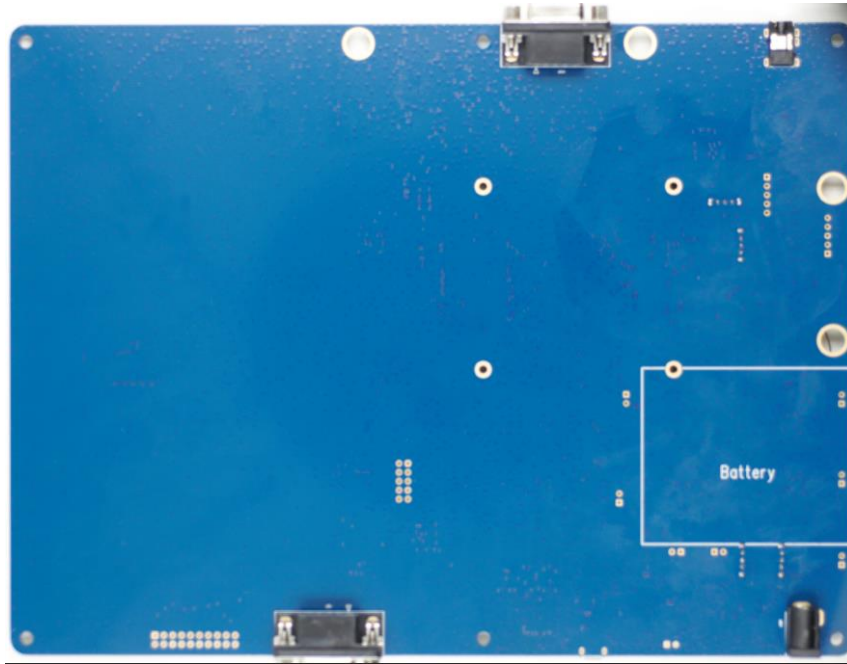


Figure 3: Smart EVB Bottom View

2.4. Smart EVB Kit Accessories

All accessories of the Smart EVB kit are listed as below. Please contact the supplier if there is something missing.



Figure 4: Smart EVB Kit Accessories

Table 3: Accessories List

Items	Description	Quantity
Cables	USB to UART converter cable	1
	USB cable	1
	RF cables	4
Antennas	Main antennas ¹⁾	2
	Wi-Fi antenna	1
	GNSS antenna (active)	1
Audio	Headphone	1
USB Flash Drive	USB2.0 to RS232 driver, USB driver, etc.	1
Others	Bolts and coupling nuts for fixing Smart EVB	4 for each

NOTE

¹⁾ The main antenna can also be used for diversity reception.

3 Interface Applications

This chapter describes the hardware interfaces of Smart EVB, shown as follows:

- Power supply interfaces
- Touch panel interface
- LCM interface
- Camera interfaces
- SD card interface
- USB interface
- Audio interfaces
- (U)SIM interfaces
- UART interfaces

It also provides information about LEDs, buttons, test points, flashlight, vibrator and sensors to help customers use the Smart EVB.

3.1. Power Supply Interfaces (S801/S803)

The Smart EVB can be powered by an external 5.0V DC power adapter. Connect the DC power adapter to the DC interface (J807) and then the step-down converter (DC-to-DC converter), which is used to provide the supply voltage required for operating the module.

A separate battery interface (J801) is provided, in case there are no other power options available. The following figures show the simplified power supply block diagram and power supply interfaces of Smart EVB.

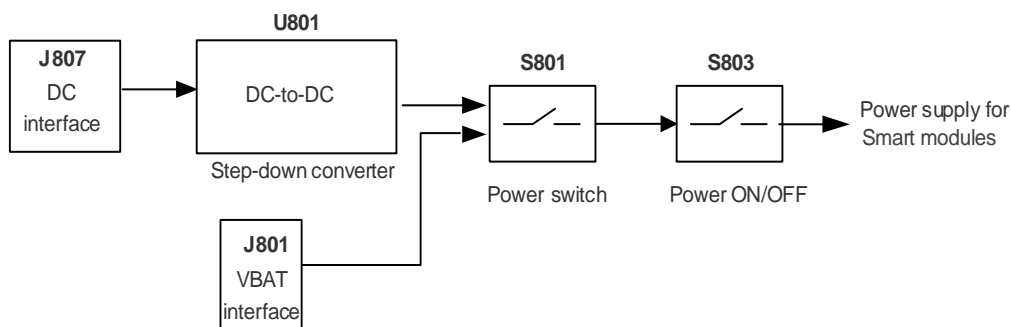


Figure 5: Simplified Power Supply Schematic of Smart EVB

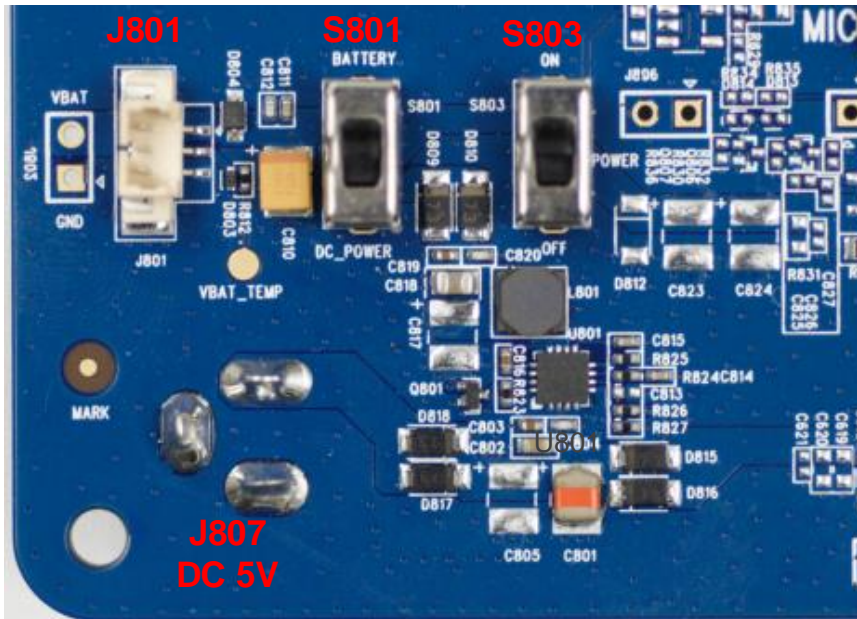


Figure 6: Power Supply Interfaces

3.2. Touch Panel Interface (J403)

Smart EVB provides a touch panel interface J403, which is used for the connection between touch panel of LCM and EVB. The following figure shows a reference design for touch panel interface.

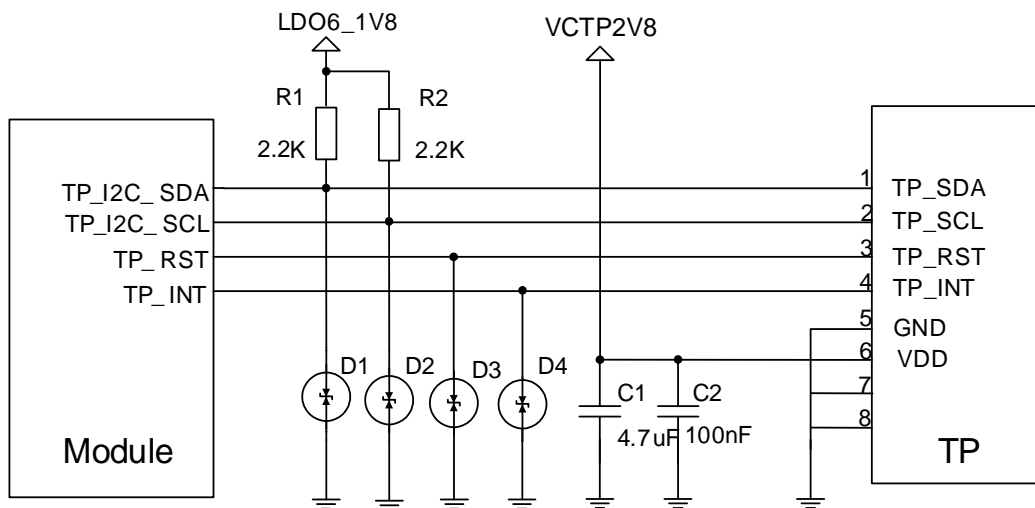


Figure 7: Reference Design for Touch Panel Interface

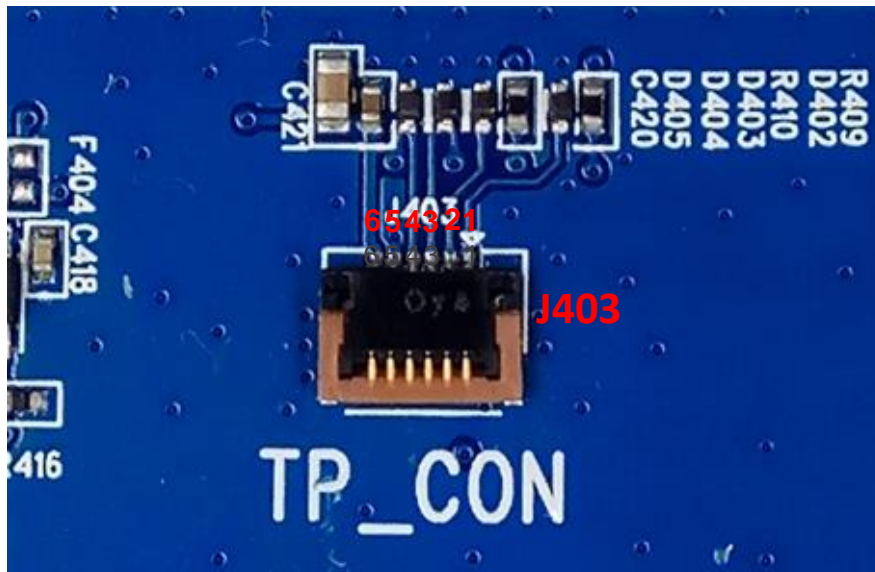


Figure 8: Pin Assignment of Touch Panel Interface

Table 4: Pin Assignment of Touch Panel Interface

Pin No.	Pin Name	Description
1	TP_SDA	I2C data signal of touch panel
2	TP_SCL	I2C clock signal of touch panel
3	TP_RST	Reset signal of touch panel
4	TP_INT	Interrupt signal of touch panel
5	GND	Ground
6	VDD	2.8V power supply for touch panel VDD power

3.3. LCM Interface (J402)

Currently the smart EVB provides a 5-inch 1080 x 720 high-definition resolution LCD display for customers to test. The following figure shows a reference circuit design for LCM interface of the Smart EVB.

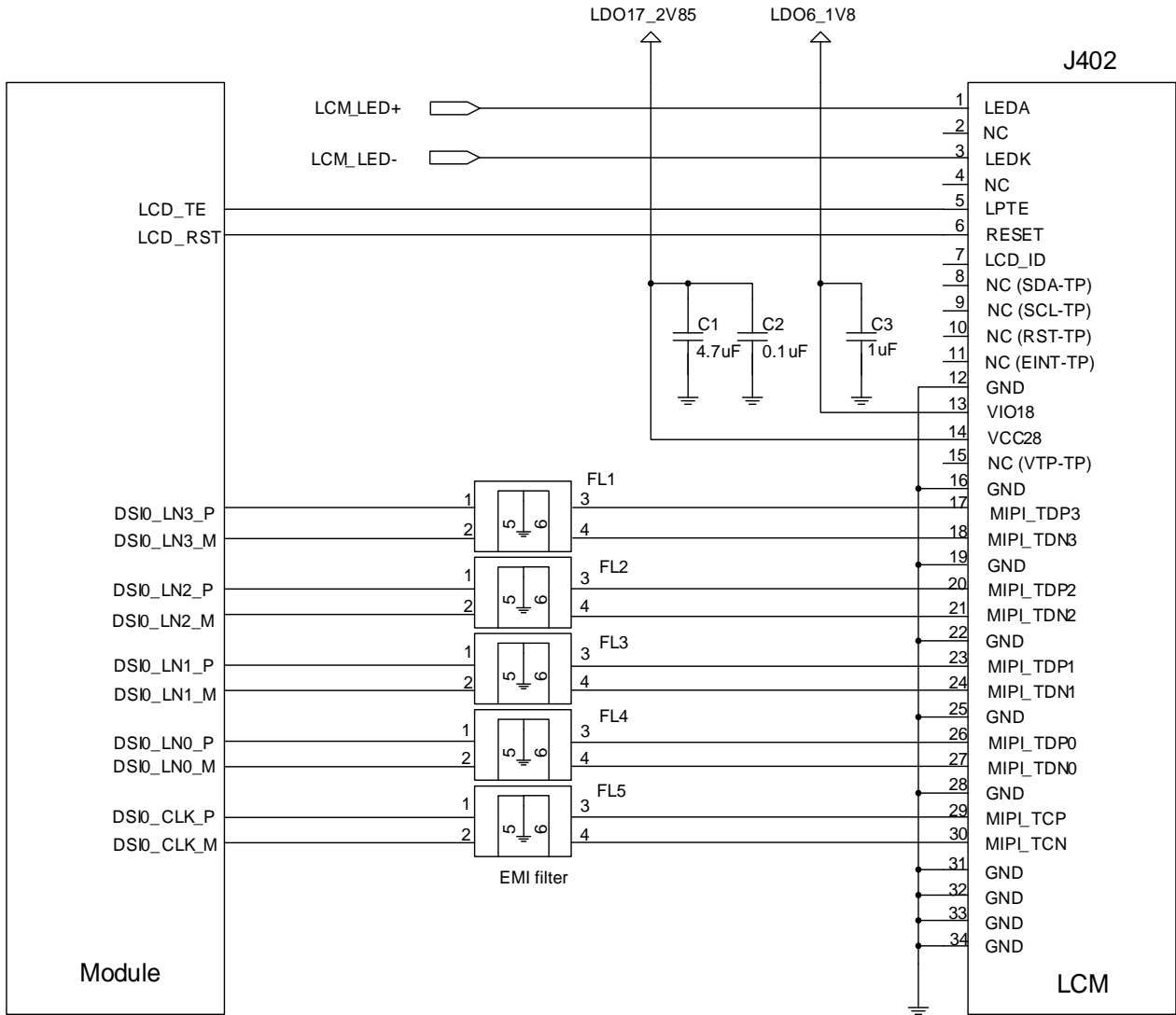


Figure 9: Reference Design for LCM Interface

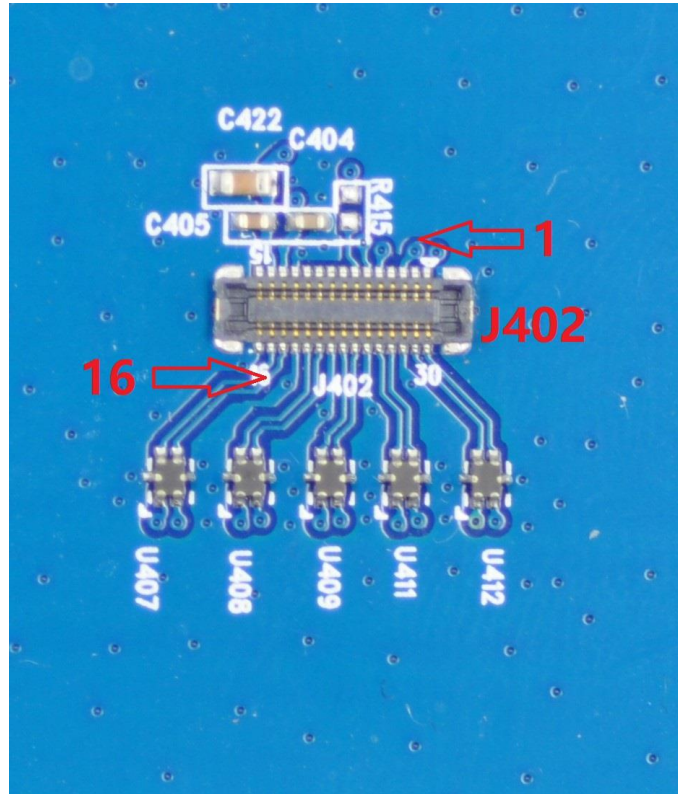


Figure 10: Pin Assignment of LCM Interface

3.4. Camera Interfaces (J301/J302)

Smart EVB provides two camera interfaces (2-lane+1-lane) with main camera and sub camera assembled.

- The main camera uses an 8M pixels digital CMOS sensor with auto-focusing function.
- The sub camera uses a 2M pixels CMOS sensor.

The following figure shows a reference circuit design for camera interfaces.

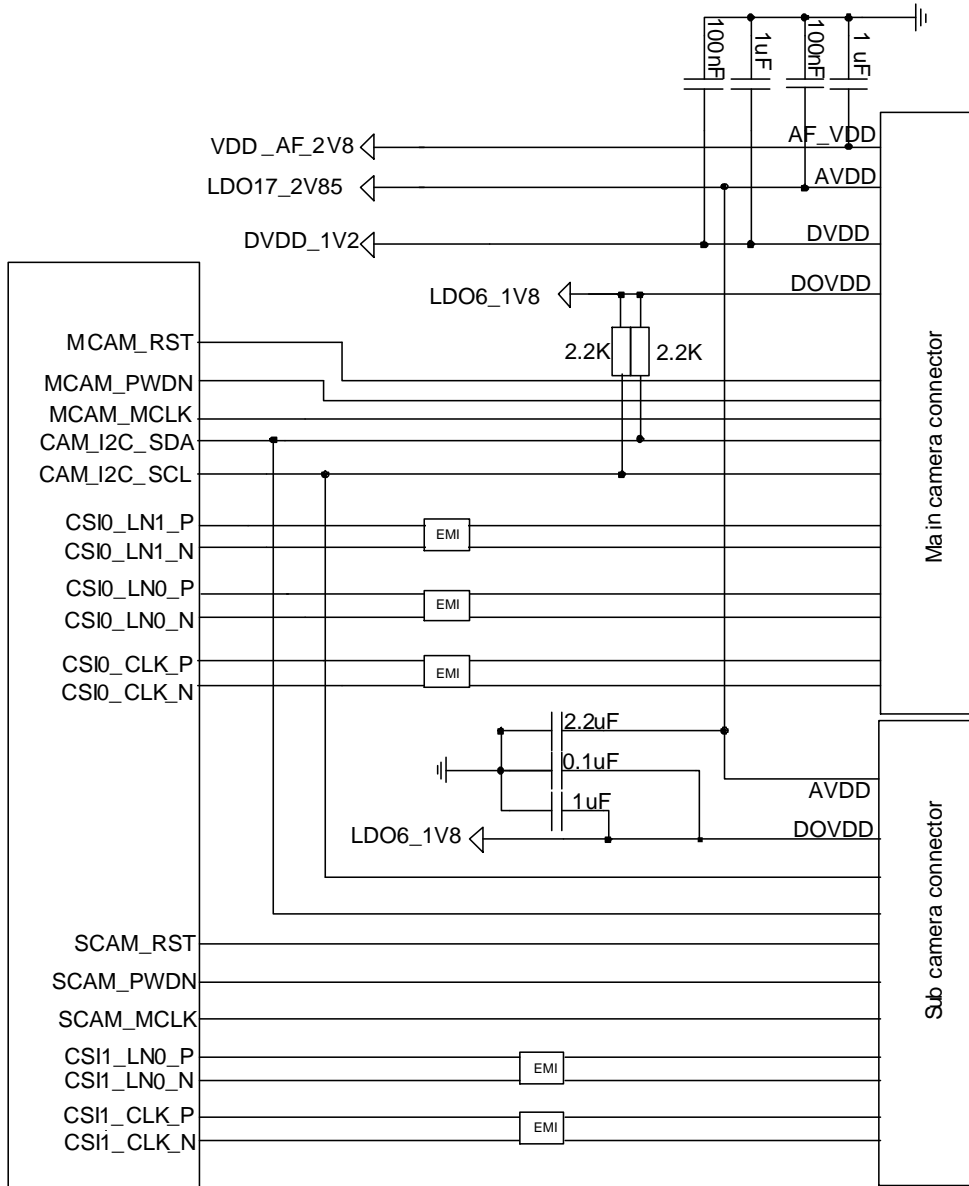


Figure 11: Reference Circuit Design for Camera Interfaces

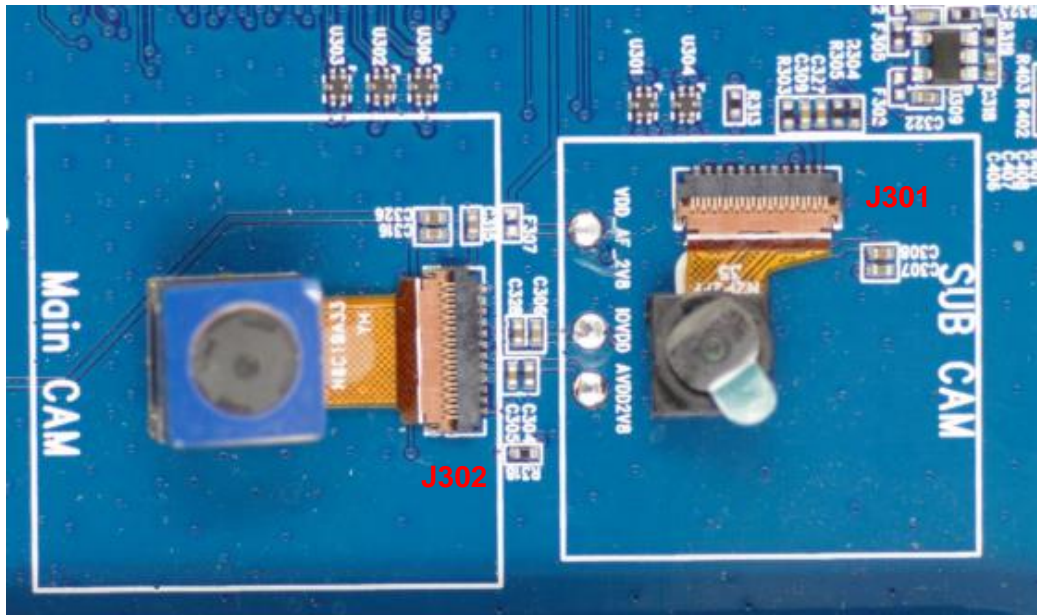


Figure 12: Camera Interfaces with Cameras Assembled

3.5. SD Card Interface (J502)

Smart EVB provides an SD card interface (J502) for customers to test the module's SD card interface. The following figure shows the simplified interface schematic for SD card interface on Smart EVB.

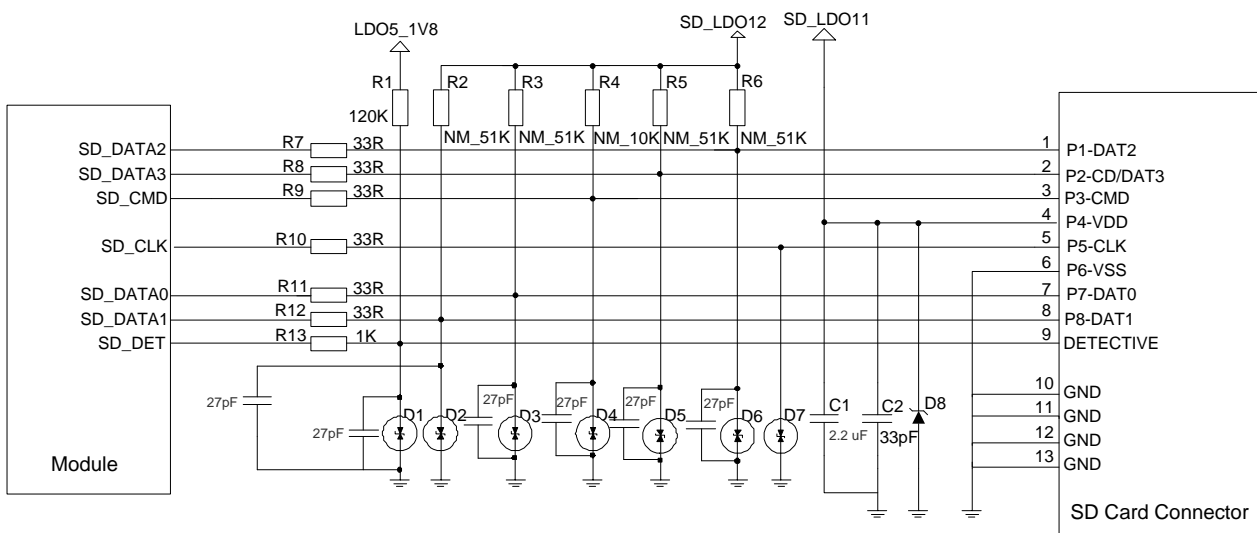


Figure 13: Simplified Interface Schematic for SD Card Interface

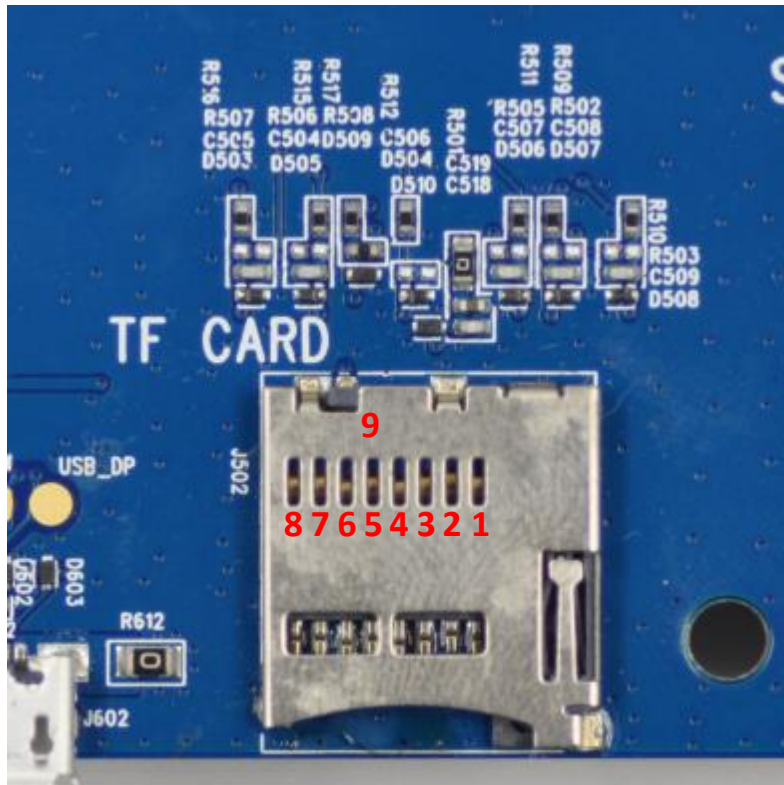


Figure 14: Pin Assignment of SD Card Interface

3.6. USB Interface (J602)

The Smart EVB provides a Micro USB interface (J602), which complies with USB 2.0 specifications and supports USB OTG function. This interface is used for AT command communication, data transmission and firmware upgrade.

The reference circuit design for Micro USB interface is shown in the following figure and the pin assignment of it is listed in the table below.

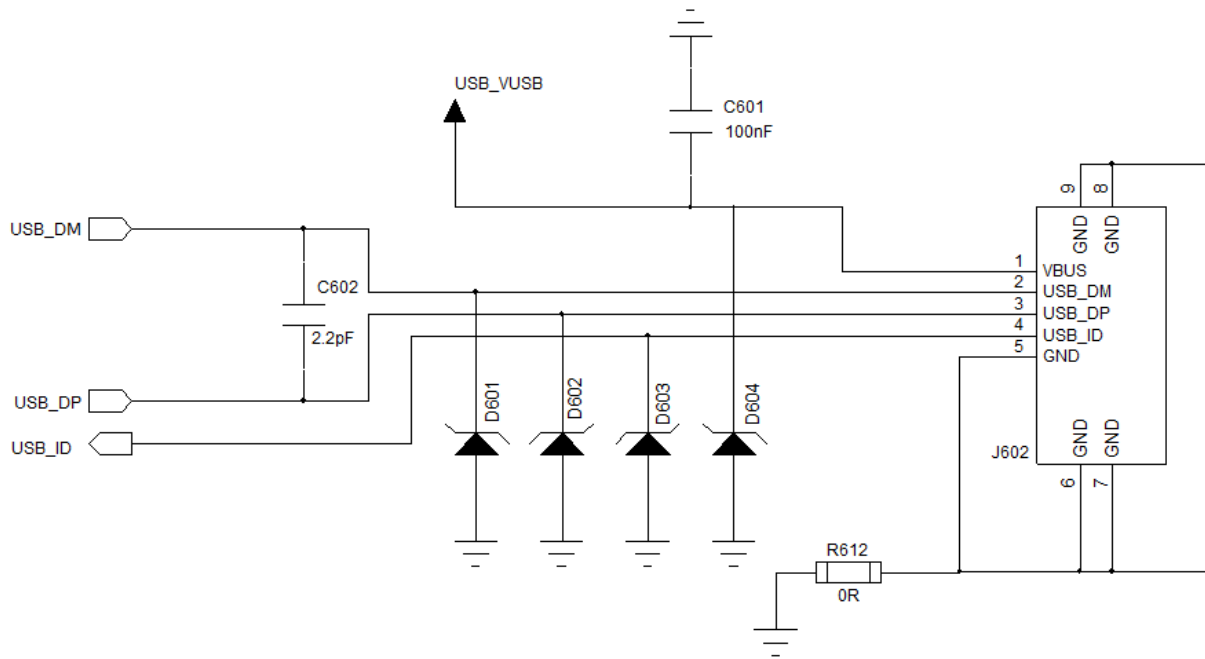


Figure 15: Reference Circuit Design for USB Interface

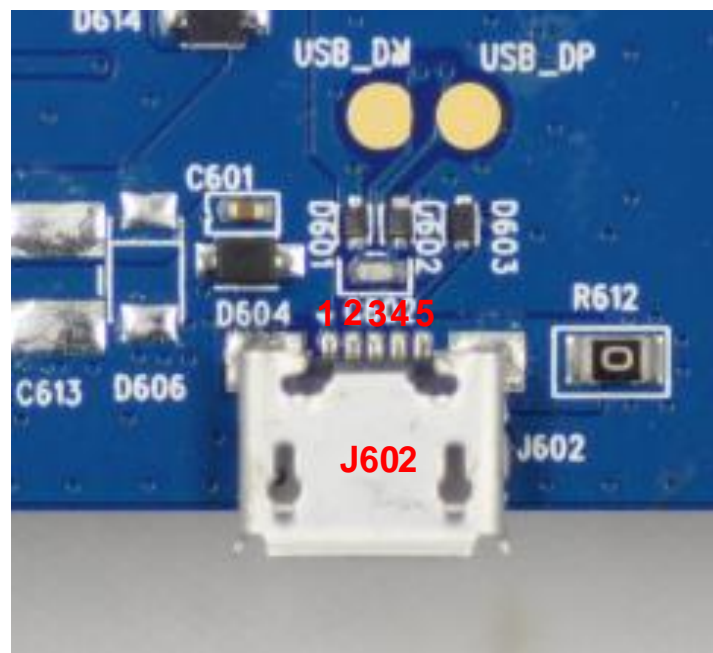


Figure 16: Pin Assignment of Micro USB Interface

Table 5: Pin Assignment of Micro USB Interface

Pin No.	Pin Name	Description
1	USB_VBUS	Used for USB detection and power supply of OTG equipment
2	USB_DM	USB serial differential bus (minus)
3	USB_DP	USB serial differential bus (plus)
4	USB_ID	USB serial ID signal
5	GND	GND for USB interface

NOTE

The USB_DP and USB_DM data lines are connected directly to the module.

3.7. Audio Interfaces (J702)

Smart EVB provides four audio interfaces, including loudspeaker, headphone, earphone and microphone interfaces.

3.7.1. Loudspeaker Interface

Loudspeaker is soldered onto the Smart EVB via TP701 and TP702. The following figure shows the reference circuit design for loudspeaker interface.

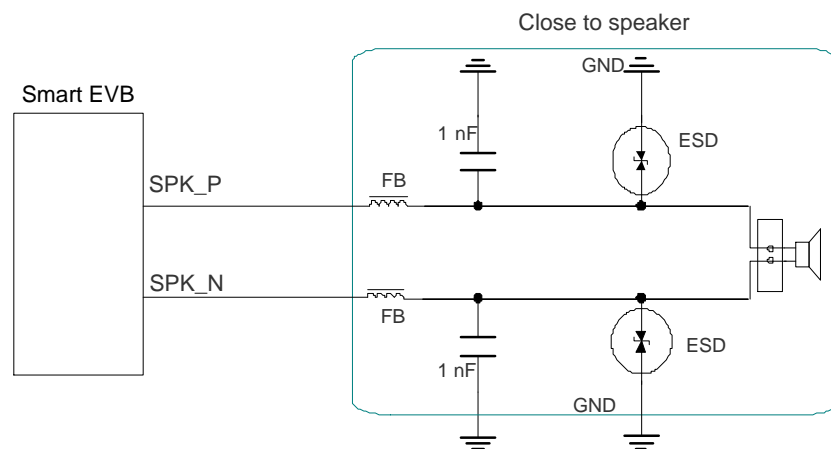


Figure 17: Reference Circuit Design for Loudspeaker Interface

3.7.2. Headphone Interface

The following figure shows the reference circuit design for headphone interface.

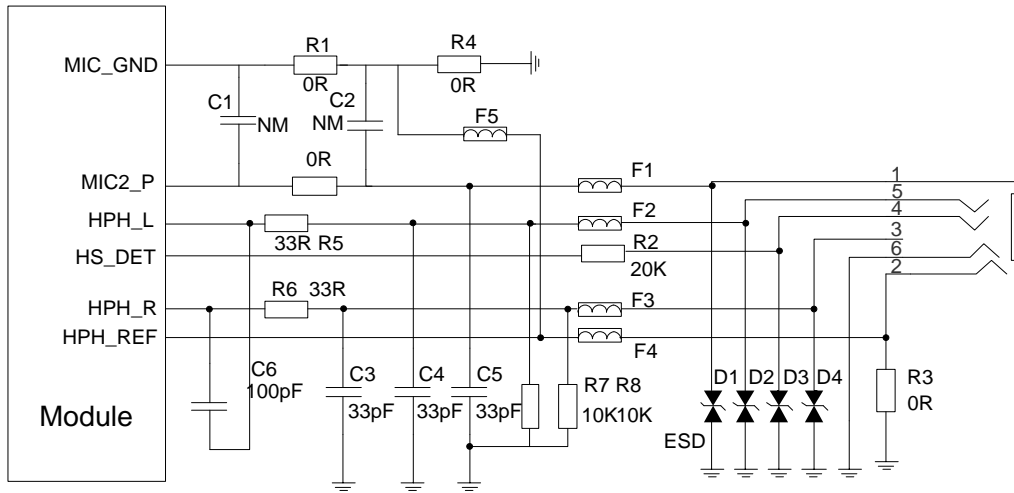


Figure 18: Reference Circuit Design for Headphone Interface

The following figure shows the pin assignment of headphone interface.

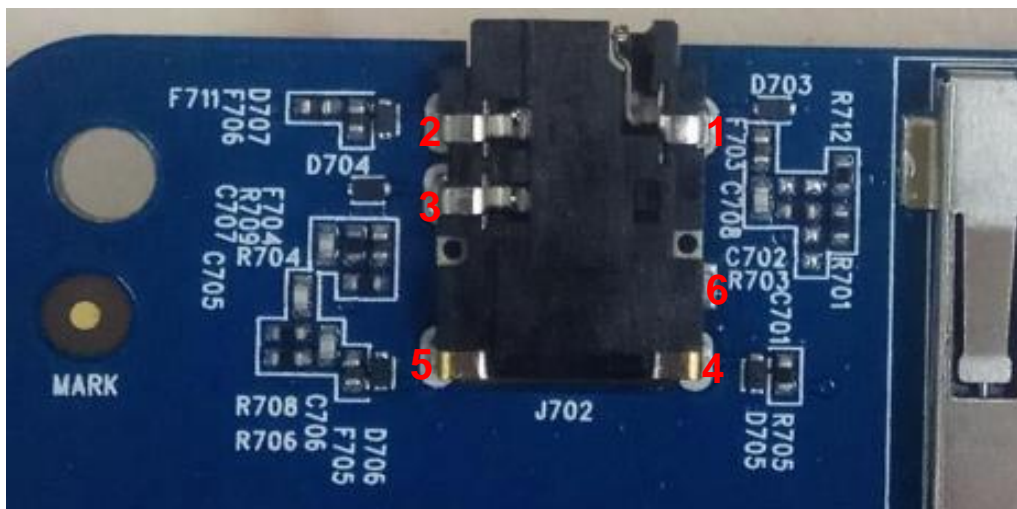


Figure 19: Pin Assignment of Headphone Interface

Table 6: Pin Assignment of Headphone Interface

Pin No.	Pin Name	Description
1	MIC	Positive microphone input
2	GND	Dedicated GND for audio
3	R-AUDIO	Headphone right channel
4	DETECT	Headphone detection
5	L-AUDIO	Headphone left channel
6	GND	Dedicated GND for audio

The following figure shows the sketch design of audio plug which suits for the audio jack on Smart EVB.

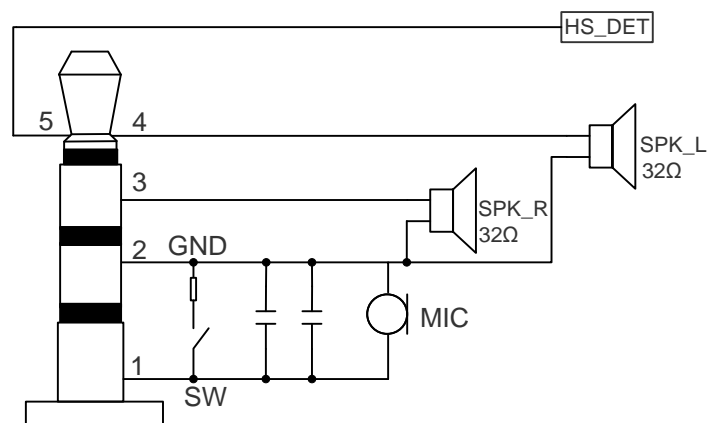


Figure 20: Sketch of Audio Plug

3.7.3. Microphone and Earphone Interfaces

Smart EVB provides a microphone interface and an earphone interface. The following figure shows the reference circuit design for microphone and earphone interfaces.

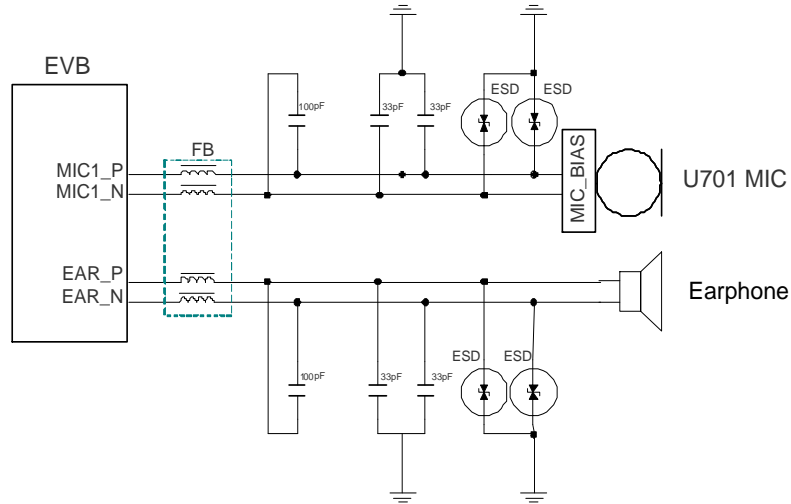


Figure 21: Reference Circuit Design for Microphone and Earphone Interfaces

3.8. (U)SIM Interfaces (J503/J504)

The Smart EVB provides the following two (U)SIM card (2.95V or 1.8V) connectors:

- J503: (U)SIM1 card connector
- J504: (U)SIM2 card connector

The following figure shows the simplified interface schematic for J503.

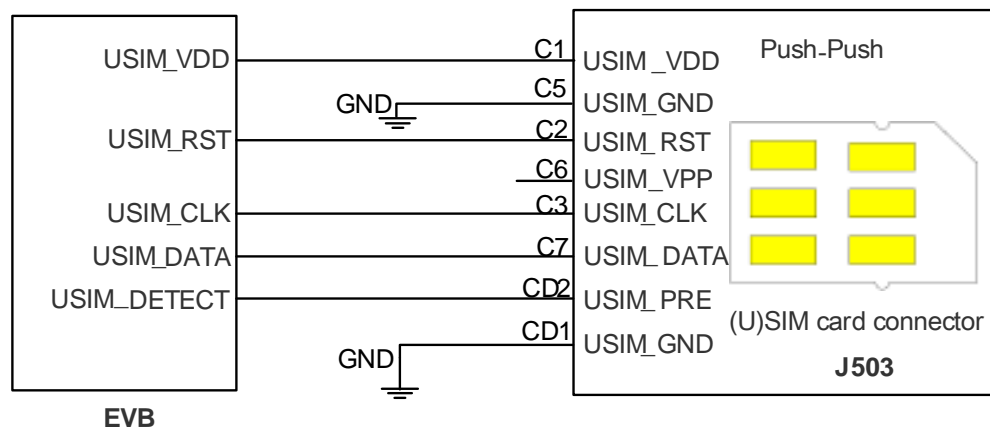


Figure 22: Simplified Interface Schematic for (U)SIM1 Card Connector (J503)

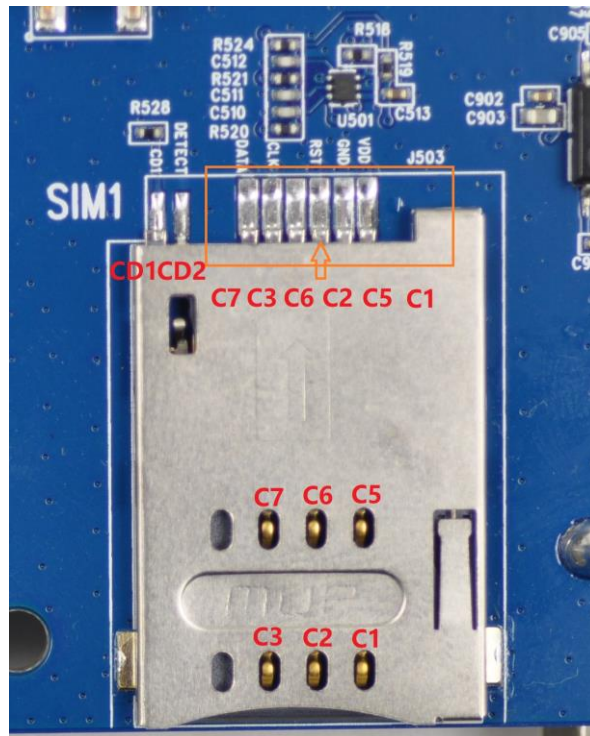


Figure 23: Pin Assignment of (U)SIM1 Card Connector (J503)

Table 7: Pin Assignment of (U)SIM1 Interface (J503)

Pin No.	Pin Name	I/O	Description
C1	USIM_VDD	O	(U)SIM1 card power supply
C2	USIM_RST	O	(U)SIM1 card reset signal
C3	USIM_CLK	O	(U)SIM1 card clock signal
C5	GND		Ground
C6	VPP		Not connected
C7	USIM_DATA	I/O	Bi-directional data line
CD1	GND	GND	Ground
CD2	USIM_DETECT	I	(U)SIM1 card detection

NOTE

The pin assignment of (U)SIM2 interface (J504) is the same as that of (U)SIM1 interface (J503).

3.9. UART Interfaces (J901/J604)

Smart EVB provides two UART interfaces: main UART port J901 and debug UART port J604. The debug UART interface is intended for data transmission and AT command communication. And the main debug UART interface is not used by default.

The following figure and table show the block diagram of debug UART port J604 and the pin assignment of it.

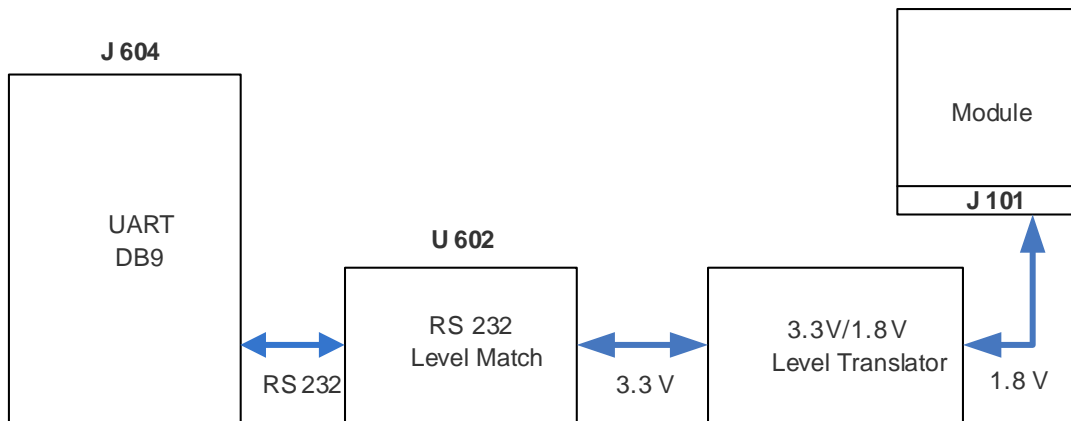


Figure 24: Block Diagram of Debug UART Port (J604)



Figure 25: Pin Assignment of Debug UART Port (J604)

Table 8: Pin Assignment of Debug UART Port (J604)

Pin No.	Pin Name	I/O	Description
1			Not connected
2	RS232_TXD	O	Transmit data
3	RS232_RXD	I	Receive data
4			Not connected
5	RS232_GND		Ground
6			Not connected
7			Not connected
8			Not connected
9			Not connected

3.10. Switches and Buttons

Smart EVB provides four switches (S801/S802/S803/S804) and nine buttons (S901/S902/S903/S904/S905/S906/S907/S908/S909).

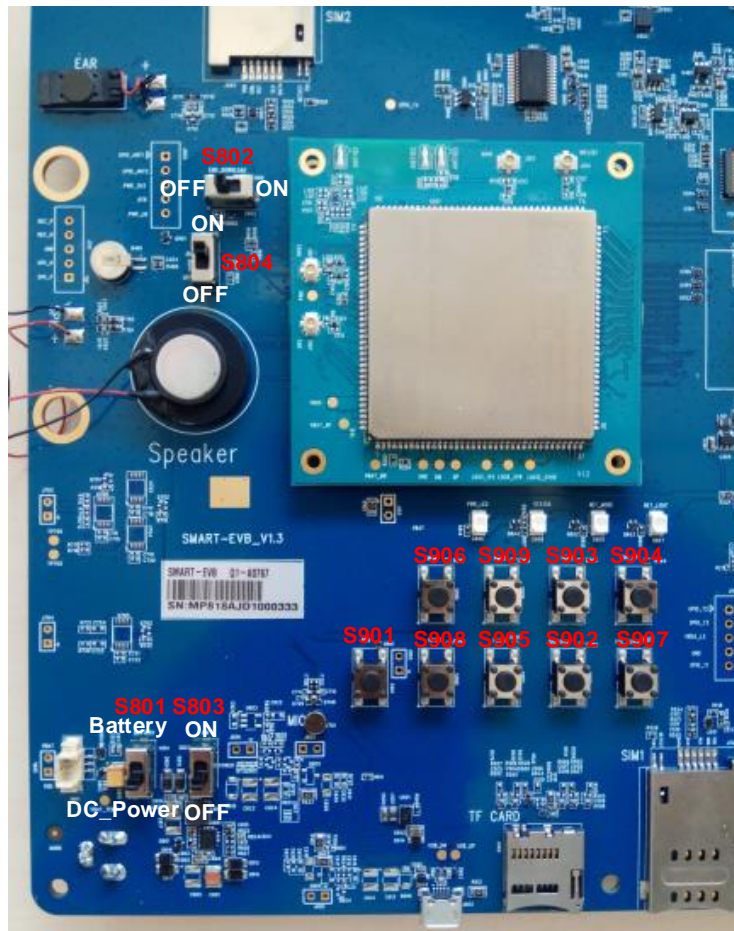


Figure 26: Switches and Buttons

Table 9: Description of Switches and Buttons

Items	Description
S801	Used to select DCDC power supply or battery power supply
S802	Used to force the module to boot from USB port Turned off by default
S803	Used to power on/off the module
S804	Used to turn on/off battery charger Turned off by default
S901	Power key (push button) Used to turn on/off the module
S902	Snapshot button Used to snapshot photos
S903	Home button

	Used to enter home page
S904	Volume up button Used to increase volume
S905	Focus button Used to focus during shooting photos
S906	Menu button
S907	Volume down button Used to lower volume
S908	Reset push button Used to reset the module
S909	Back button Used to return to the previous page

3.11. Status Indication LEDs

There are four LED status indication lights (D805, D806, D807 and D808) on the Smart EVB, which are shown as below.

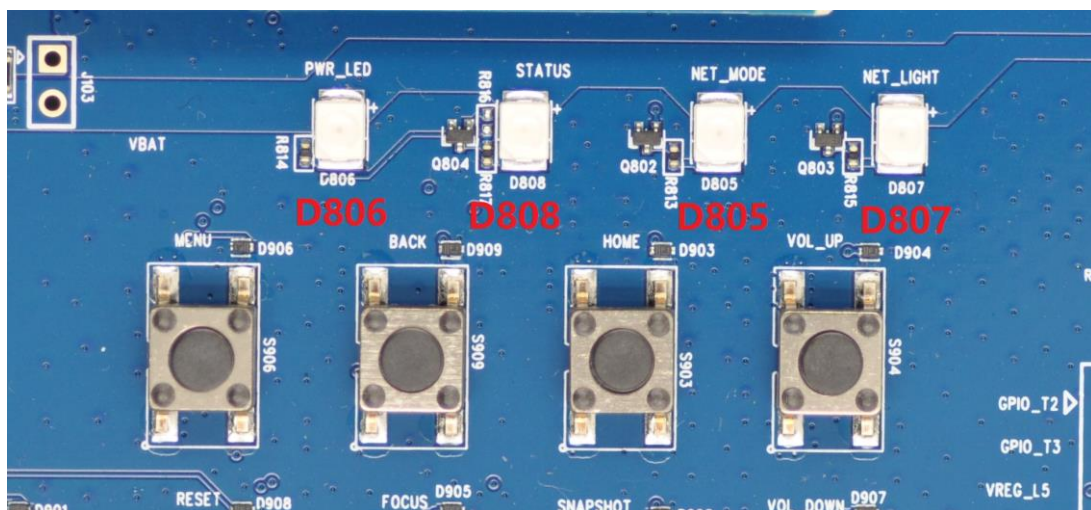


Figure 27: Status Indication LEDs

Table 10: Description of Status Indication LEDs

Items	Description
D806	Indicate the power supply status of SC20 module

	Bright: VBAT ON Extinct: VBAT OFF
D808, D805	Disabled by default
D807	Indicate the network registration status of SC20 Bright: Registered on Network Extinct: Not Registered on Network

3.12. Test Points

J904 consists of 10 test points. The details are shown in the following figure and table.

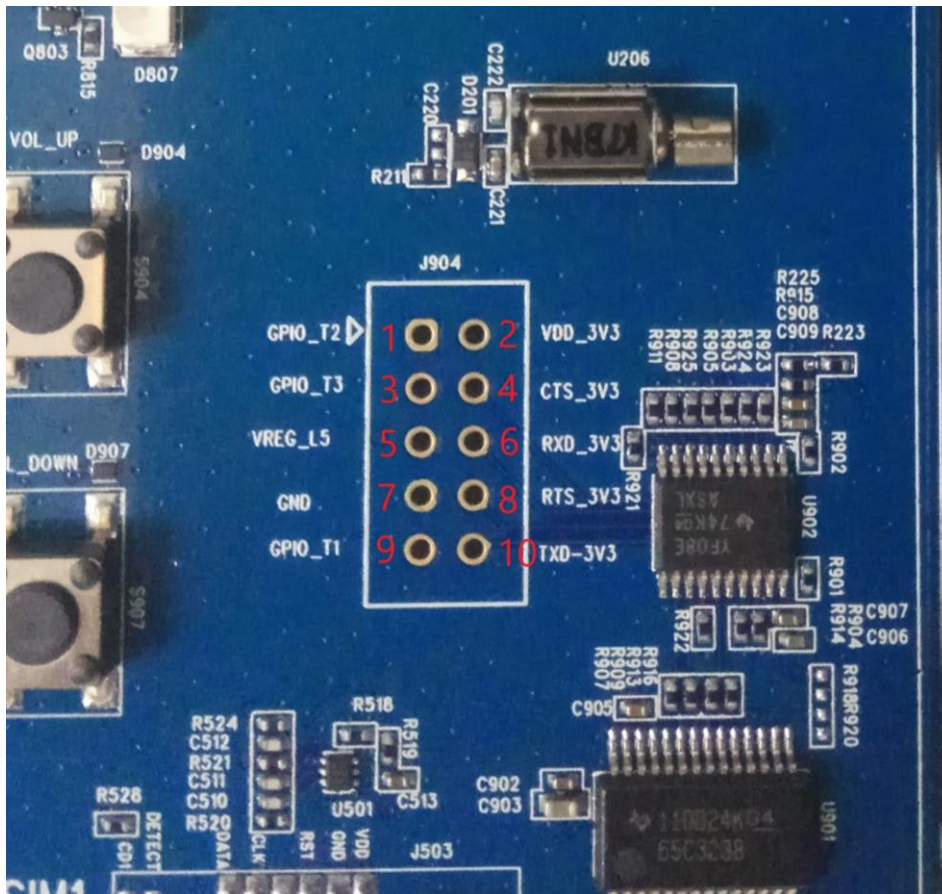


Figure 28: Pin Assignment of J904

Table 11: Details of Test Points

Pin No.	Pin Name	Description
1	GPIO_T2	GPIO_68 test point
2	VDD_3V3	3.3V power supply of EVB
3	GPIO_T2	GPIO_69 test point
4	CTS_3V3	3.3V CTS signal
5	VREG_L5	LDO5_1V8 power supply of the module
6	RXD_3V3	3.3V RXD signal
7	GND	Ground
8	RTS_3V3	3.3V RTS signal
9	GPIO_T1	GPIO_14 test point
10	TXD_3V3	3.3V TXD signal

3.13. Flashlight

The Smart EVB provides a flashlight LED D202, for testing the module's flashlight interface which supports flash mode and torch mode. The following figures show a reference circuit design for flashlight and its location on Smart EVB.

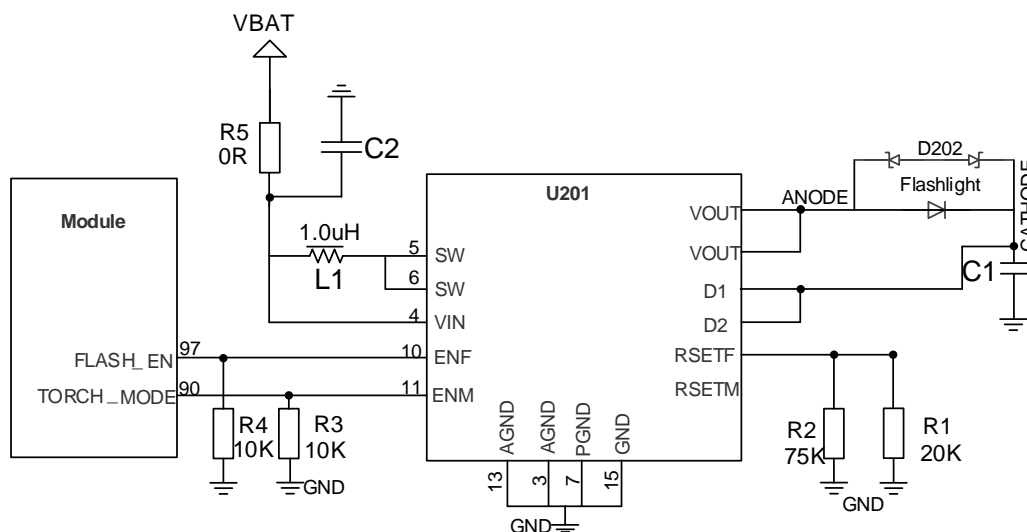


Figure 29: Reference Circuit Design for Flashlight Interface

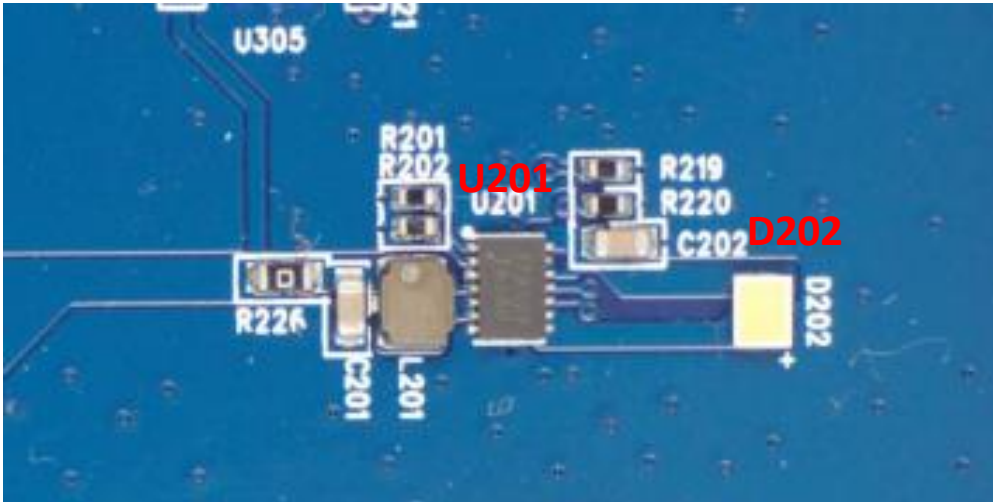


Figure 30: Flashlight

3.14. Vibrator

The Smart EVB provides an ERM-type vibrator for customers to test the motor driver interface of SC20 module. The following figures show the reference circuit design of the vibrator and its location on the board.

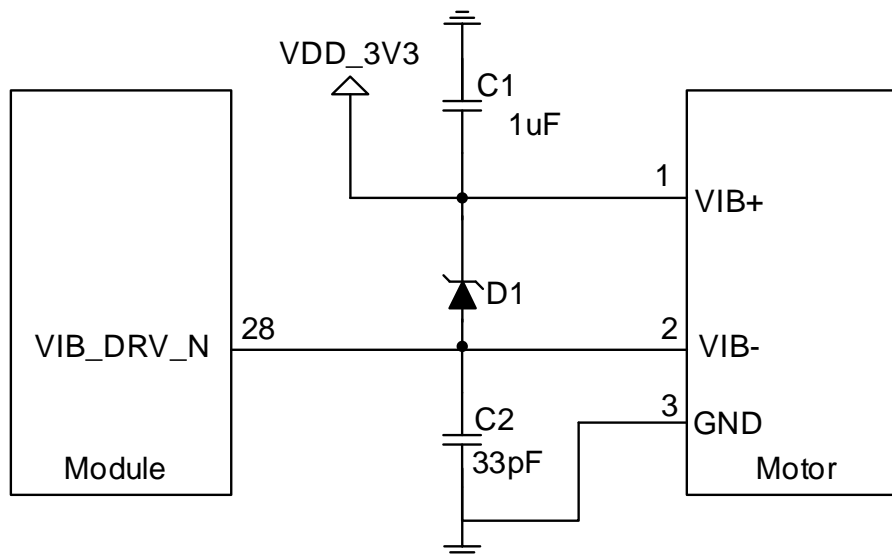


Figure 31: Reference Circuit Design for Vibrator

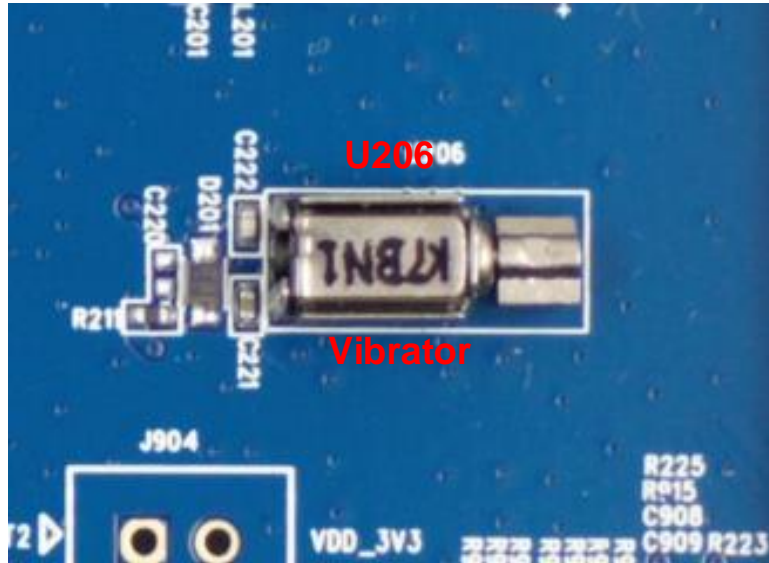


Figure 32: ERM-Type Vibrator

3.15. Sensors

Smart EVB provides three sensors for testing purpose, as shown in the figure below.



Figure 33: Sensors

4 Operation Procedures

This chapter introduces how to use the Smart EVB for testing and evaluating Quectel SC20 module.

4.1. Power on SC20 Module

The following are the procedures for powering on SC20 module.

1. Connect the TE-A to the connectors (J101 and J102) on smart EVB.
2. Connect the DC adapter and pull S801 to **DC POWER** state.
3. Pull S803 to **ON** state, and then D806 will be lighted.
4. Press the S901 (**PWRKEY**) for at least 2s to turn on the module. When the following interface is displayed on the LCD, it means the booting has been completed.



Figure 34: LCD Display Indicating Module's Power-on

4.2. Power off SC20 Module

There are two methods to power off the module. One is to operate via the system. The steps are shown as follows.

1. Press S901 (**PWRKEY**) for at least 1s under power on state, and then LCM will display a menu as shown in the following figure.

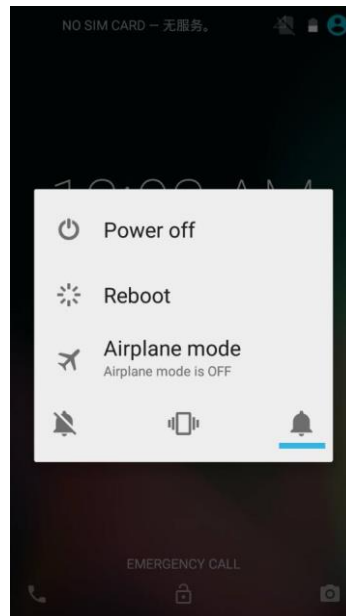


Figure 35: LCD Menu Display for Powering off Module

2. Choose "**Power off**".
3. The module will be powered off.

Another way is to press down S901 (**PWRKEY**) until the module is shut down.

4.3. Communication via USB or UART Interface

4.3.1. Communication via USB Interface

1. Power on the module according to the procedures mentioned in **Chapter 4.1**.
2. Connect Smart EVB and PC with USB cable through USB interface and install USB driver from the USB Flash drive. The USB port numbers can be viewed through the PC's Device Manager.

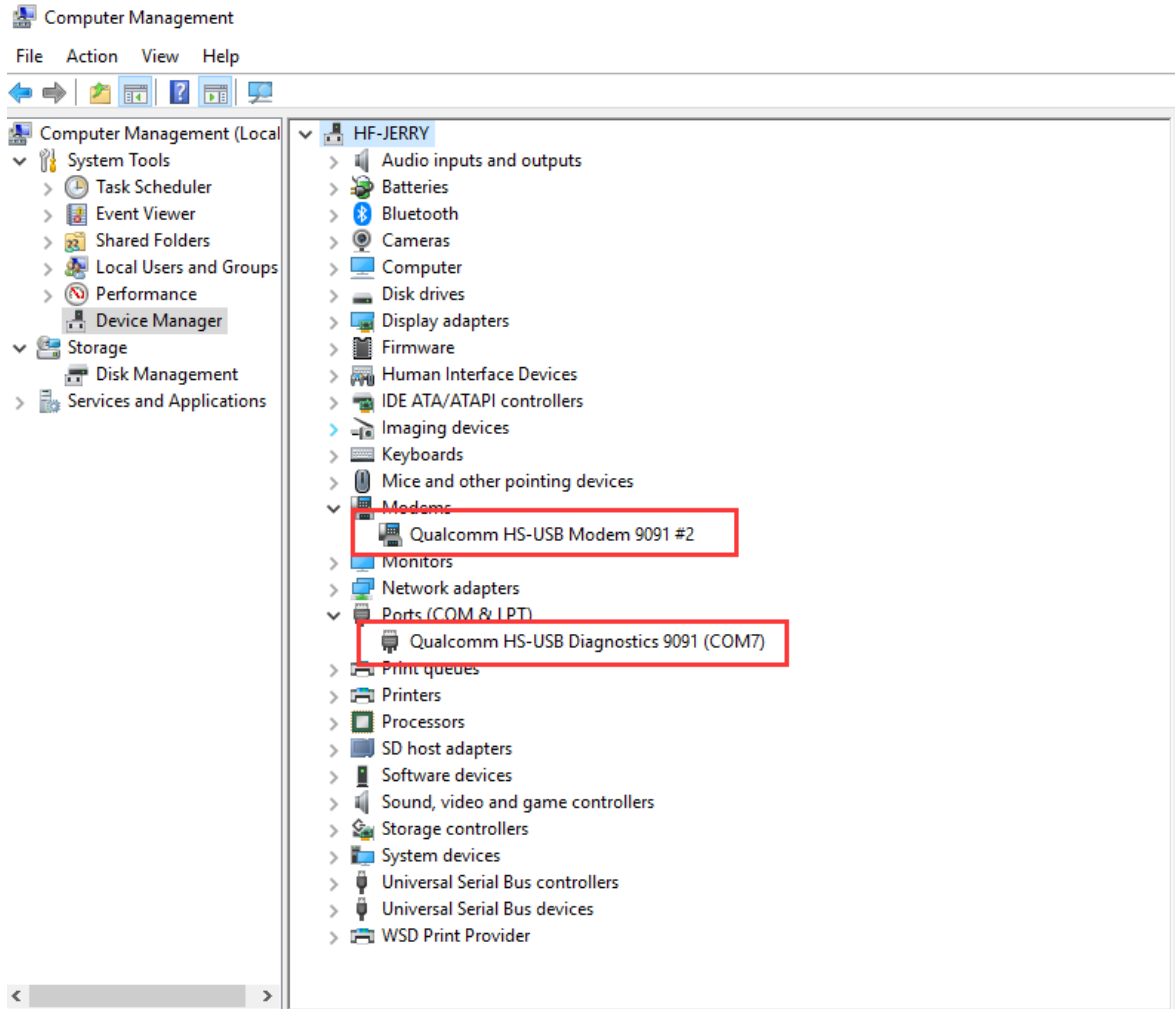


Figure 36: USB COM Ports

3. Install and then use the QCOM tool provided by Quectel to realize the communication between the smart module and the PC. The following figure shows the QCOM configuration: select correct “**COM port**” and set correct “**Baudrate**” (such as 115200bps). For more details about QCOM tool usage and configuration, please refer to *document [2]*.

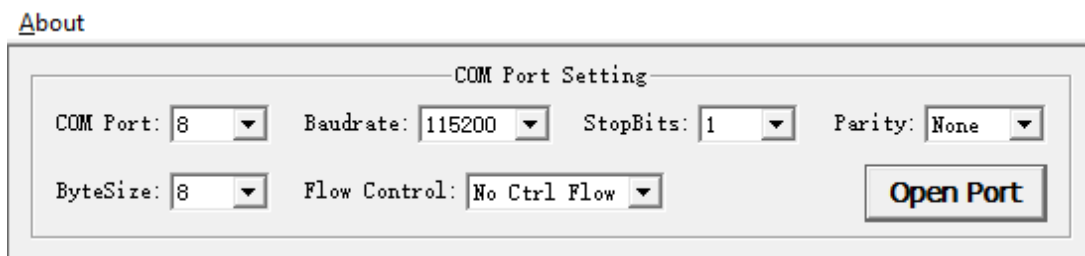


Figure 37: QCOM Configuration When Communicating via USB Interface

4.3.2. Communication via UART Interface

1. Run the driver disk on PC to install the USB-to-RS232 driver.
2. Connect the UART interface (main UART or debug UART) to the PC with USB-to-RS232 converter cable and then power on the module according to the procedures mentioned in **Chapter 4.1**. After that, the USB serial port number can be viewed through the PC Device Manager, shown as the following figure.

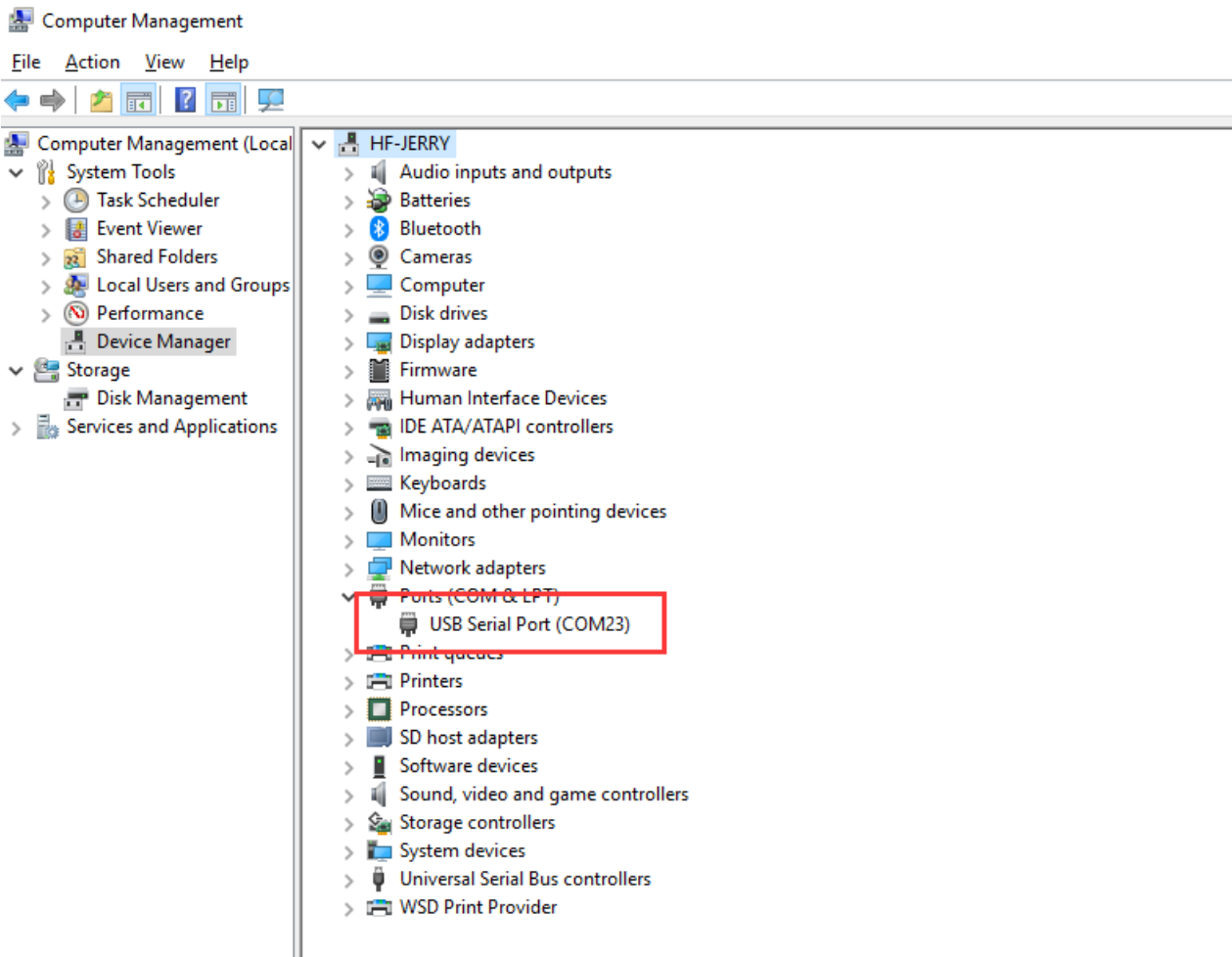


Figure 38: USB Serial Port

3. Install and then use the QCOM tool provided by Quectel to realize the communication between the smart module and the PC. The following figure shows the QCOM configuration: select correct “**COM port**” (USB Serial Port) and set correct “**Baudrate**” (such as 115200bps). For more details about QCOM tool usage and configuration, please refer to **document [2]**.

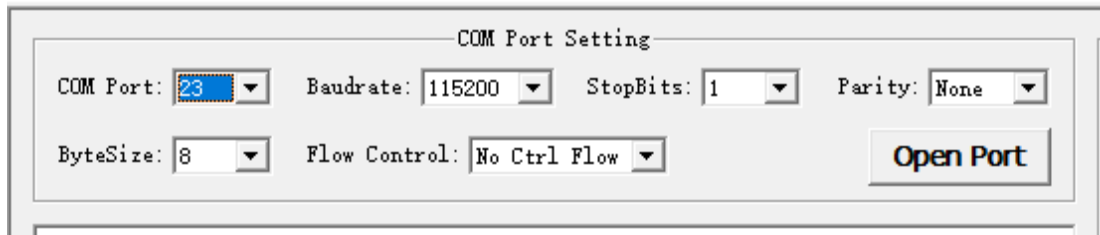


Figure 39: QCOM Configuration When Communicating via UART Interface

4.4. Firmware Upgrade

Quectel SC20 module upgrade firmware via USB port by default. Please follow the procedures below to upgrade firmware.

1. Open the firmware upgrade tool **QFIL** on PC and then power on SC20 module according to the procedures mentioned in **Chapter 4.1**.
2. Click the **"SelectPort"** and select the USB port **"Qualcomm HS-USB Diagnostics Modem 9091 (COM24)"**.
3. Select **"Flat Build"** in **"Select Build Type"** option.
4. Click **"Browse"** to select the firmware which needs to be upgraded in **"Select Programmer"** option.
5. Click **"Load XML"** to select the XML which needs to be upgraded in **"Select Build"** option.
6. Click **"Download"** to upgrade the firmware.

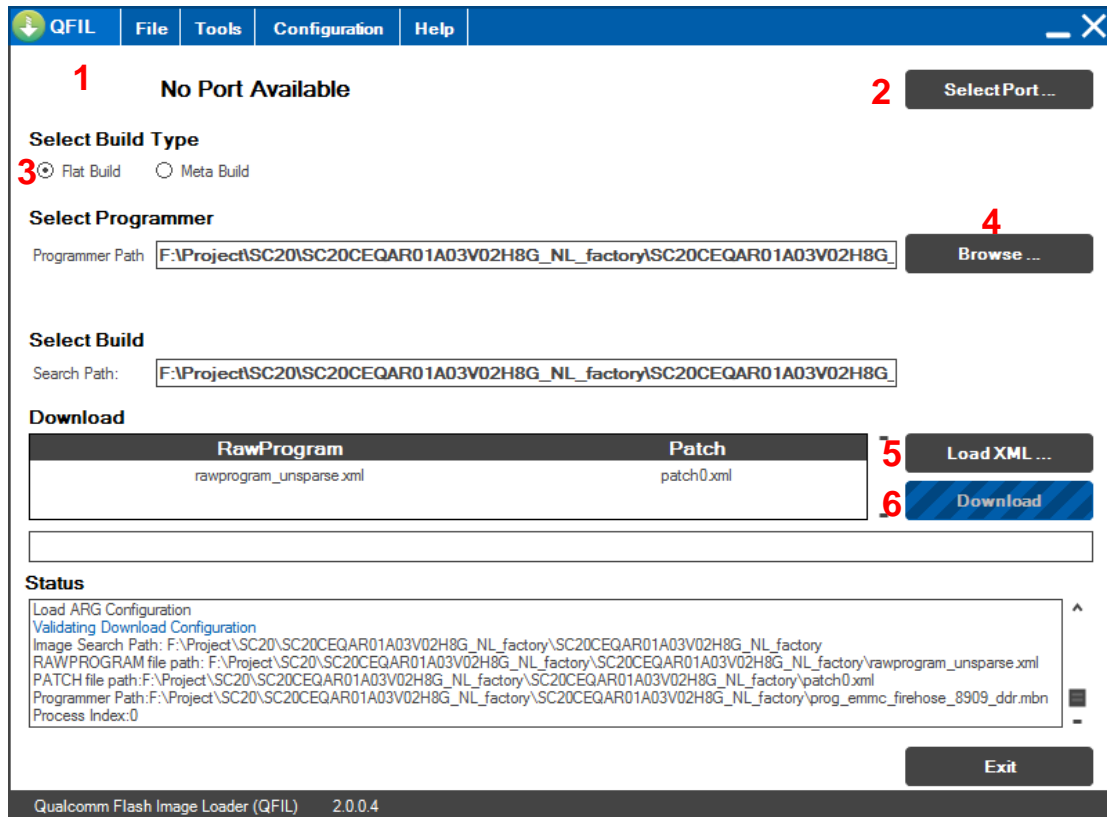


Figure 40: Firmware Upgrade Steps

5 EVB Accessories Assembly



Figure 41: Smart EVB and Accessories Assembly

6 Appendix A Reference

Table 12: Related Documents

SN	Document name	Remark
[1]	Quectel_SC20_Hardware_Design	SC20 hardware design
[2]	Quectel_QCOM_User_Guide	User guide for QCOM tool

Table 13: Terms and Abbreviations

Abbreviation	Description
EVB	Evaluation Board
OTG	On-The-Go
PC	Personal Computer
SIM	Subscriber Identity Module
USIM	Universal Subscriber Identity Module