SE150A4-EVB_User_Guide

Smart Module

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Document Title	SE150A4 Series-EVB_User_Guide
Version	1.01
Date	2021-1-28
Status	Released
Document Control ID	SE150A4 Series-EVB_User_Guide_V1.01

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Ce matériel est complété par une exposition de rayonnements IC pour un environnement naturel. Ce matériel doit être installé et se faire avec une distance minimale de 20cm entre les radiateurs et les autresYour body shop.

For a host manufacture's using a certified modular, if (1) the module's IC number is not visible when installed in the host, or (2) if the host is marketed so that end users do not have straightforward commonly used methods for access to remove the module so that the IC number of the module is visible; then an additional permanent label referring to the enclosed module: "Contains Transmitter Module IC: 5131A-SE150A4NA" or "Contains IC: 5131A-SE150A4NA" must be used.

This radio transmitter IC: 5131A-SE150A4NA has been approved by Imovation,Science and Economic Development Canada to operate with the antenna types listed below,with the maximm permissible gain indicated.Antenna types not included in this list that have gain greater than the maximm gain indicated for any type listed are strictly prohibilted for use with this device.

Antenna List:
Type: vehicle antenna with standard SMA connector(50ohm);
Model: MF25D
Antenna Gain: WCDMA850:0.64dBi, WCDMA1900:1.87dBi, WCDMA1700:3.12dBi, LTE:B2:1.87dBi, B4:3.12dBi, B5:0.91dBi, B7:1.55dBi, B12:0.95dBi, B13:2.23dBi, B14:2.18dBi, B17:0.95dBi; B25:1.87dBi, B26:1.40dBi, B66:3.12dBi, B71:-0.48dBi, B41:3.20dBi, WIFI/BT 2.4G : 3.39dBi,WIFI 5G : 2.1dBi

Single Module

FCC Statement
This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference, and
(2) this device must accept
any interference received, including interference that may cause undesired operation.

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

The modular can be installed or integrated in mobile or fix devices only. This modular cannot be installed in any portable device.

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

If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following:
"Contains Transmitter Module FCC ID: RI7SE150A4NA Or Contains FCC ID: RI7SE150A4NA"

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When the module is installed inside another device, the user manual of the host must contain below warning statements;
1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
(1) This device may not cause harmful interference.
(2) This device must accept any interference received, including interference that may cause undesired operation.

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

The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product.

Any company of the host device which install this modular with Single modular approval should perform the test of radiated emissionand spurious emission according to FCC part 15C : 15.247 and 15.209 requirement,Only if the test result comply with FCC part 15C : 15.247 and 15.209 requirement, then the host can be sold legally.

Operations in the 5.15-5.25GHz band are restricted to indoor usage only.

This device is intended only for OEM integrators under the following conditions: (For module device use)
1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
2) The transmitter module may not be co-located with any other transmitter or antenna.
As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their endproduct for any additional compliance requirements required with this module installed.

Cet appareil est conçu uniquement pour les intégrateurs OEM dans les conditions suivantes:(Pour utilisation de dispositif module)
1) L'antenne doit être installée de telle sorte qu'une distance de 20 cm est respectée entre l'antenne et les utilisateurs, et
2) Le module émetteur peut ne pas être coïmplanté avec un autre émetteur ou antenne.
Tant que les 2 conditions ci-dessus sont remplies, des essais supplémentaires sur l'émetteur ne seront pas nécessaires. Toutefois, l'intégrateur OEM est toujours responsable des essais sur son produit final pour toutes exigences de conformité supplémentaires requis pour ce module installé.

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Version History

Revision	Date	Author	Description
1.01	2021-1-28	Zhu Yu	Origin

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1. Introduction

SE150A4 module is a smart module based on QCM2150. It has Android operating system, customers could use this module for the development of the hand devices.

The functions the module supports include LCM, touch panel, camera, audio, charging, dual USIM, etc. For the fast understanding of the module's characters, we developed an EVB （SE150A4-EVB）for customers. By operation of the EVB, the customers could complete the development and advanced research for SE150A4.

This document shows the usage of SE150A4-EVB, the users can get useful information about SE150A4 quickly through this document, and develop quickly and independently. This document applies to SE150A4-EVB.

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2. General Overview

SE150A4-EVB used for designers to develop applications based on SE150A4 module. This EVB can test basic functionalities of the module.

2.1 Functional Block Diagram

The following figure shows block diagram of SEA150A4 EVB. The device includes of three parts: EVB board、SEA150A4 TE board and SEA150A4-XX Module.

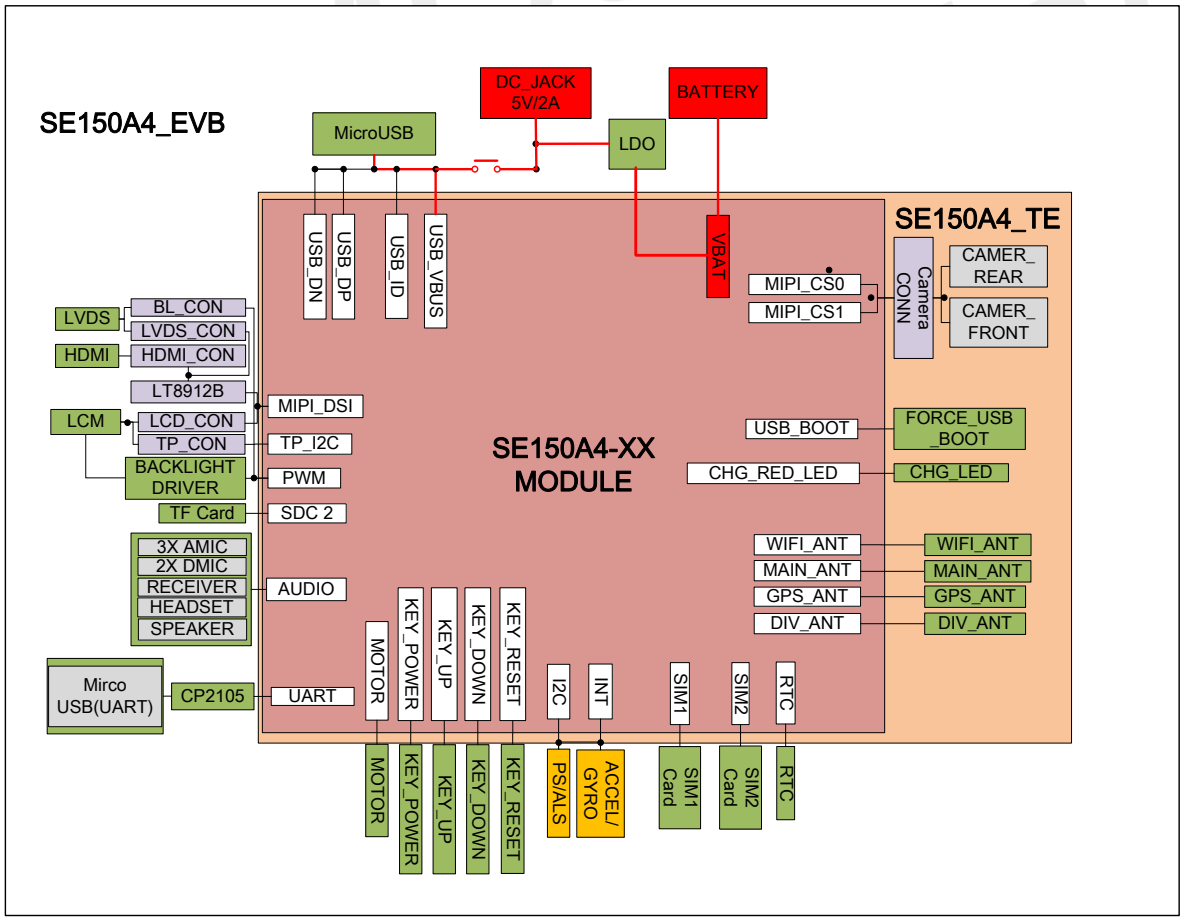

Figure 1: Module / TE / EVB functional block diagram

The device has fool-proof design, The EVB's assembly as following:

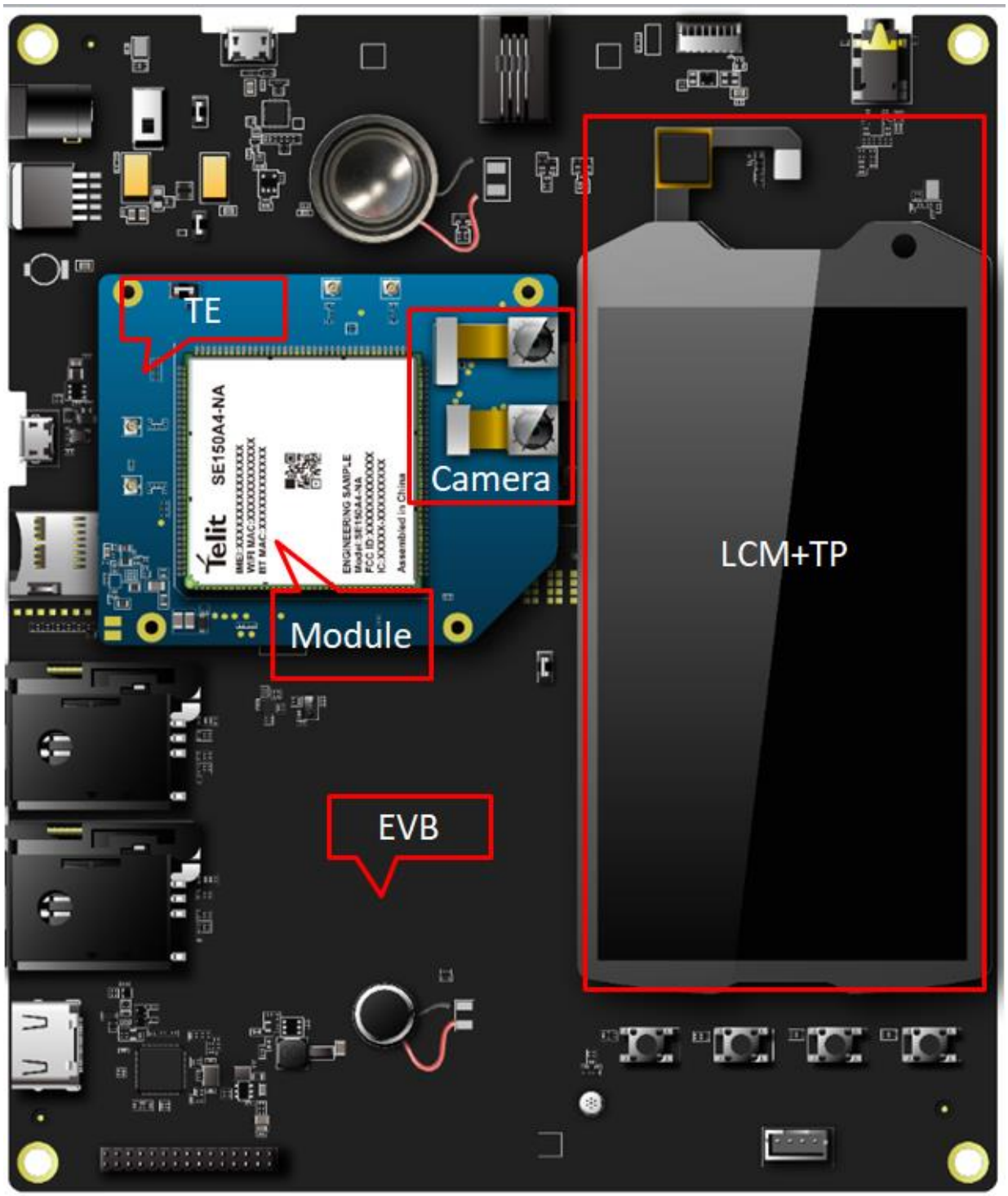

Figure 2: EVB assembly picture

2.2 Key Features

Table 1: Key Features

	Features	Description
SEA150A4 EVB	**Power Supply**	● DC Power Supply:4.8V~6V (typical:5V) ● VBAT:3.4V~4.4V (typical:3.8V)
	LCM Interface	● One 5.5-inch 1440×720 HD resolution LCD with 60 fps ● 4-lane DSI MIPI interface
	LVDS Interface	● Support a LVDS interface ● Support LVDS backlight up to 30V/200mA
	HDMI Interface	Support a HDMI interface
	Touch Panel Interfaces	One capacitive touch panel
	USB Interface	● One Mirco-USB used for charging, data transmission, software debugging and firmware upgrade ● Support USB OTG
	Audio Interfaces	**Analog Input:** 3 groups of analog microphone inputs, integrating internal bias voltage. ● Handset MIC1 ● Earphone MIC2 ● De-noising MIC3 **Analog Output:** 3 groups of analog audio outputs, including: ● Receiver: EAR_+, EAR_- ● Earphone: HPH_R, HPH_L ● Speaker: SE150A4 internal Class-D SPK_P, SPK_N(1.2W/8ohm/5V) **Digital audio interface:** ● A set of digital audio interface I2S: both master and slave modes are supported ● 2 digital microphone inputs
	(U)SIM Interfaces	● Support USIM/SIM cards: 1.8V and 2.95V ● Support dual SIM dual standby
	UART Interface	CP2105 USB to UART supports 2 UART ports An enhanced COM port A standard COM port
	SD Card Interface	Support 4-bit SD card with hot-plug detection

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	Sensors	Support two sensors including ALS/PS, accelerometer
	Vibrator	A vibrator for testing the motor drive interface of the module
	RTC	Yes
	Buttons	RESET PWRKEY VOL_UP VOL_DOWN;
	others	TE connectors
	Physical Characteristics	Size: 200mm*168mm
	Features	**Description**
SEA150A4 TE	**Antenna interface**	Main antenna Diverse antenna GPS antenna BT/WIFI antenna
	Force USB boot	Force USB boot and LDO5_1P8 interface
	Camera Interfaces	Support two cameras: ● Rear camera supports 13M pixels with 4-lane CSI interface ● Front camera supports 5M pixels with 2-lane CSI interface
	Physical Characteristics	Size: 78mm*63mm

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2.3 Interface Overview

Table 2: Interfaces of SE150A4 EVB

Interface	Reference Number	Description
VBAT	J101 J105	●The power jack on the EVB. Typical power supply: +5.0V ●Li-polymer battery connector
Power Supply Switches	S101 J102 J104	●Used to power on/off the EVB ●Used to select the way of charging between DC power supply and Mirco-USB power supply ●Used to power on/off the TE board
PWRKEY	S701	Power key (push button) Used to turn on/off the module
RESET	S702	Reset key (push button) Used to return on the module
VOL_UP	S716	Used to turn the volume up
VOL_DOWN	S715	Used to turn the volume down
USB	J301	Micro USB connector
Audio	J401 J411, J412 MIC401 J400 J403	●Used for loudspeaker ●Used for Digital microphone ●Used for denoising microphone ●Used for headset ●Used for handle
(U)SIM	J601, J602	●(U)SIM1 card connector ●(U)SIM2 card connector
UART	J612	UART port（with CP2105 chip）
SD	J603	SD card connector
LEDs	LED101	D0501 indicates the power supply of the module
LCM and TP	J201 J202	ZIF connector for main touch panel ZIF connector for main LCM

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LVDS and BL	J1202 J1204	Connector for LVDS Connector for LVDS' backlight
HDMI	J1201	The HDMI Jack
Display switch	J204	Used to select LCM or HDMI/LVDS port
Sensors	U501 U502	Accelerometer and gyroscope sensor Ambient light sensor and proximity sensor
Coin Cell	B501	Coin cell battery for RTC power supply
MOTOR	J405	Used for motor
TE-Connector	J901, J902	Used to connect the TE board
TE-Cameras	J204 J203	Rear camera connector, support 13M CMOS sensor Front camera connector, support 5M CMOS sensor

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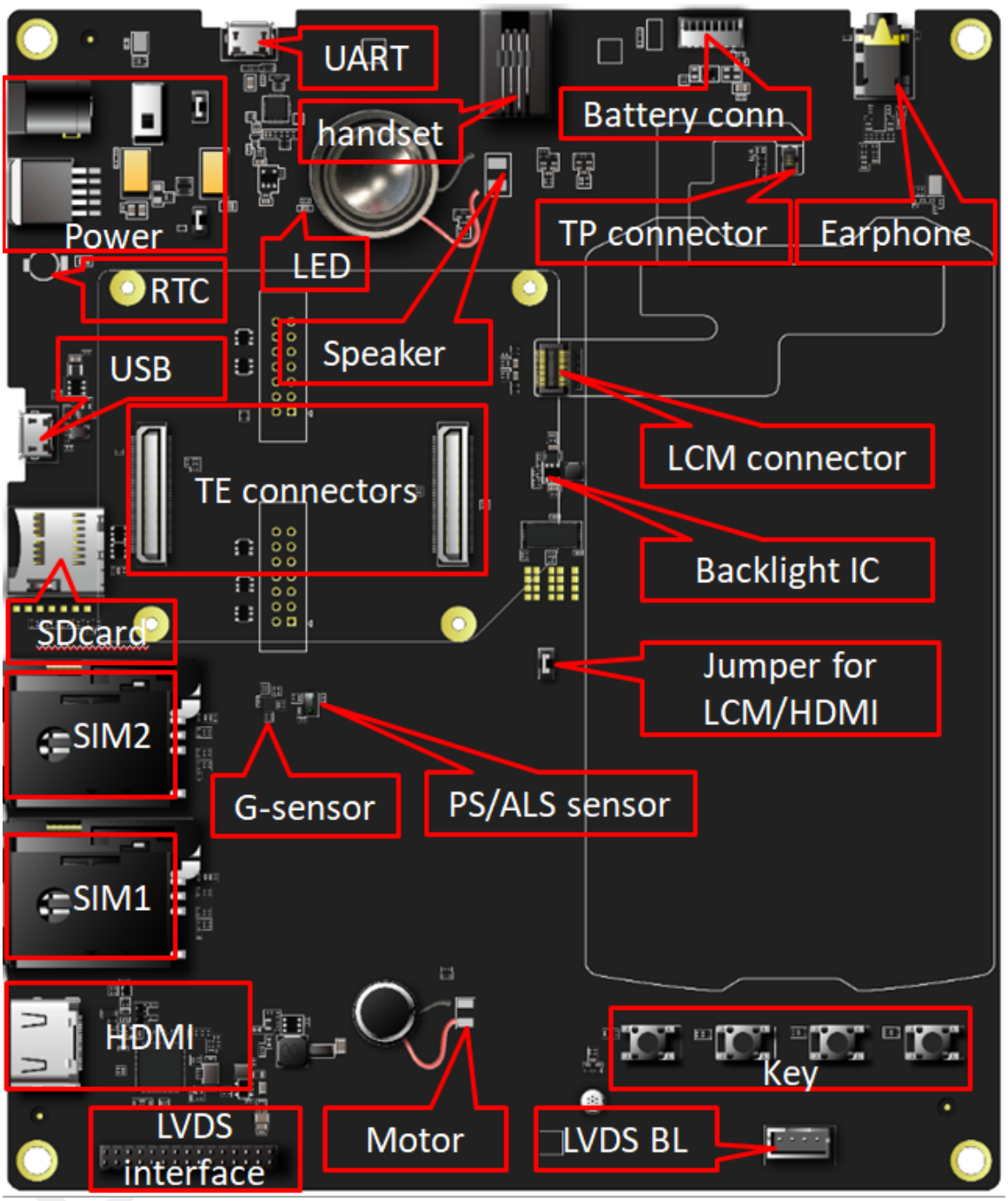

Figure 3：EVB functional blocks introduction（1）

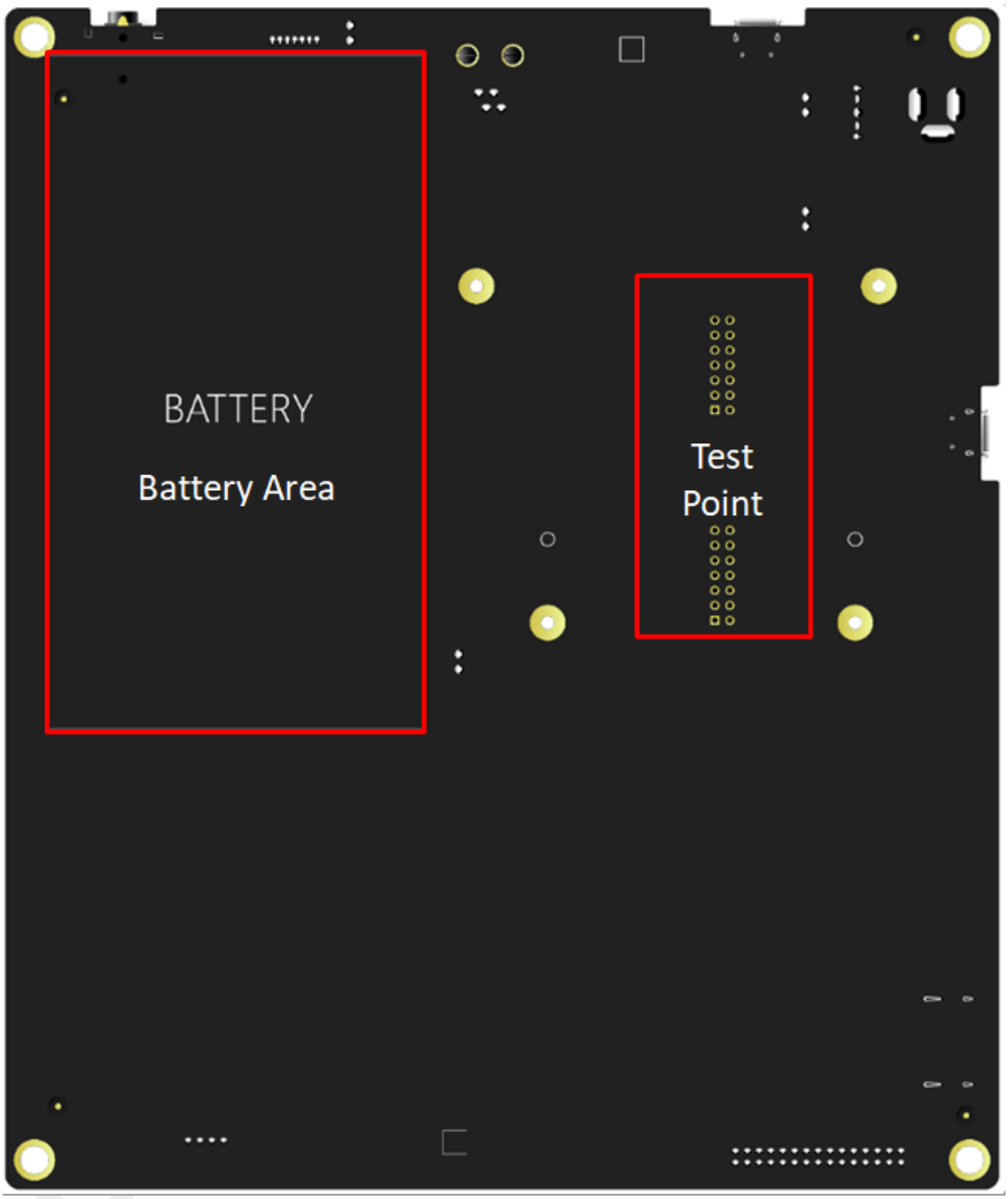

Figure 4：EVB functional blocks introduction（2）

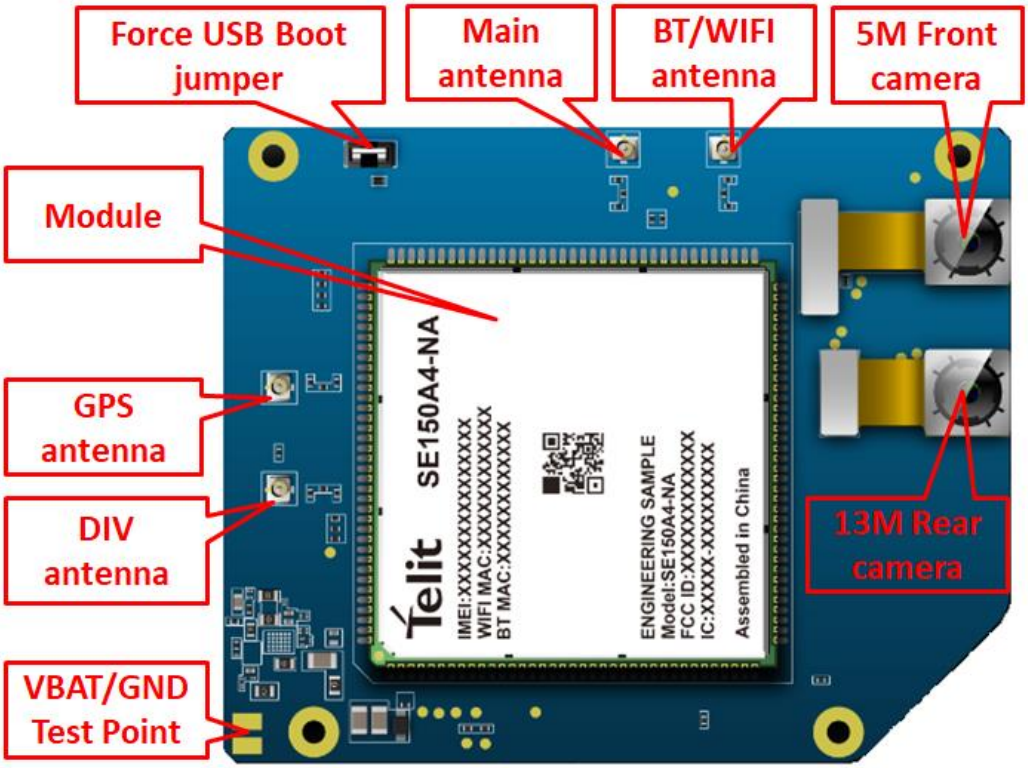

Figure 5：TE functional blocks introduction

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2.4 SE150A4 EVB Kit Accessories

All accessories of the SE150A4 EVB kit are listed as below. Please contact the supplier if there is something missing.

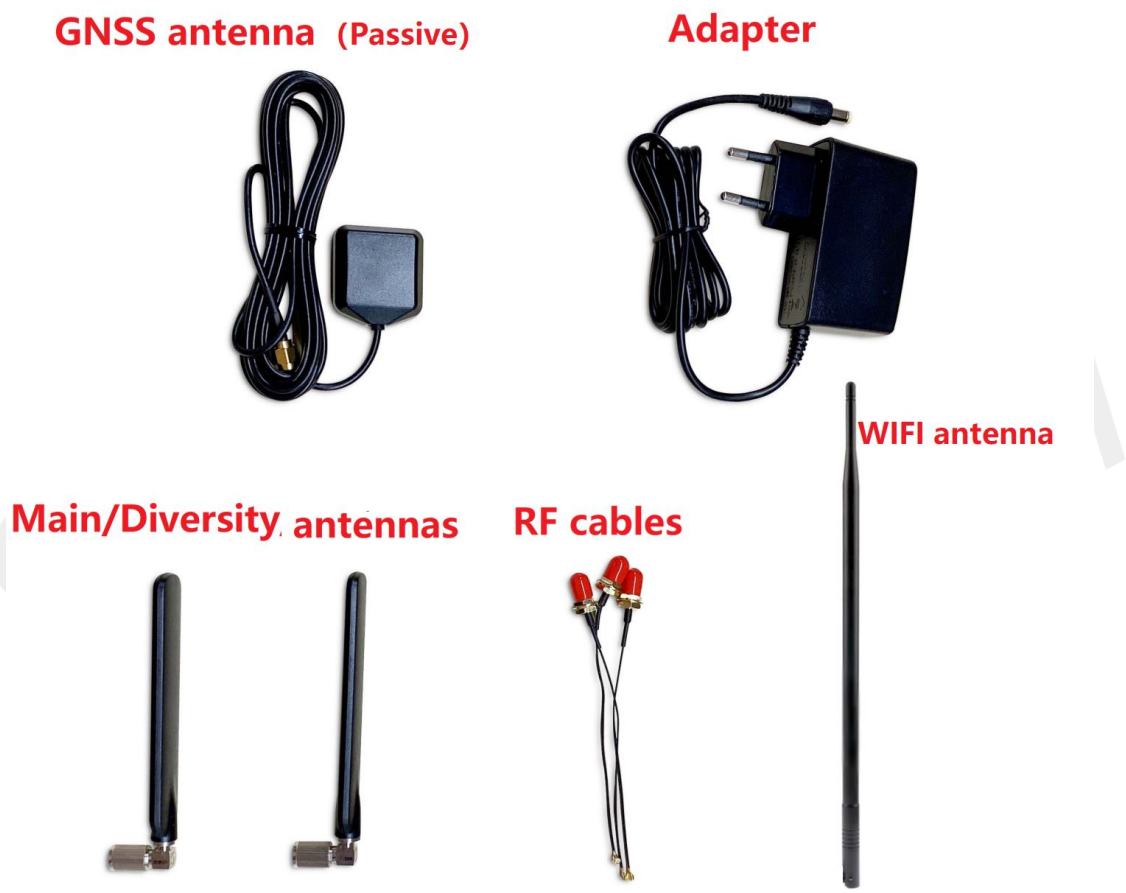

Figure 6: SE150A4 EVB Kit Accessories

Table 3: Accessories List

Items	Description	Quantity
Adapter	DC 5V Output	1
Cable	RF cables	4
Antennas	Main/Diversity antennas	2
	Wi-Fi antenna	1
	GNSS antenna (Passive)	1
Cameras	13M Rear Camera Module	1
	5M Front Camera Module	1
LCM	5.0’ TP+LCD module	1

3. SE150A4 EVB Kit Accessories Assembly

Figure 7: SE150A4 EVB Kit Accessories Assembly

4. Interface Applications

This chapter describes the hardware interfaces of SE150A4 EVB, shown as follows:

- Power supply interfaces (J101,J105)
- TE-Connector interface (J901,J902)
- Display interface
- Touch panel interface
- Camera interfaces
- USB interfaces
- Audio interfaces
- (U)SIM interfaces
- UART interface
- SD card interface

It also provides information about sensors, vibrator, buttons, status indication LED and test points to help customers use the SE150A4 EVB.

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4.1 Power Supply Interface (J101, J105)

There are two power supply methods for SE150A4-EVB:

Method 1

It is powered by a 5V adapter (**J101**), which is powered down by the LDO on the EVB board to 4.1V to supply power to the SE150A4 module. When the adapter is used for power supply, the switch **S101** needs to be switched to VBAT to ensure the conduction of the path.

The function of S101 here is to avoid the inconvenience of frequently plugging and unplugging the adapter, only need to toggle S101 to VCHG and short connect J102 to realize the charging function when charging with the adapter.

Method 2:

The module is powered by the battery (**J105**) : In order to prevent the adapter and the battery from being connected at the same time, the MOS tube control (**Q102**) is added to the battery power supply path. When the adapter is inserted, the MOS tube (Q102) disconnects the battery powered by.

In order to facilitate the user to test the current consumption of the module, the VBAT and GND test points added on the TE board either. Customers can test the power consumption of the module by powering the VBAT test point on TE and disconnecting the jumper **J104**.

Jumper **J103** need to be connected when the device is powered by an adapter. It is necessary to pull down BATT_THERM (Pin 134) to GND with a 47K resistor, otherwise charging and power supply will be abnormal.

When the module uses battery power supply (the BATT_ID PIN 100K resistance is designed to be pulled down to GND inside the module, the ID pin detection function is not needed externally), the value of R106 is equal to the resistance value of the internal NTC resistance of the battery at normal temperature. NTC resistance, so R106 = 47K OHM.

The priority selection of EVB adapter or battery power supply is as follows:

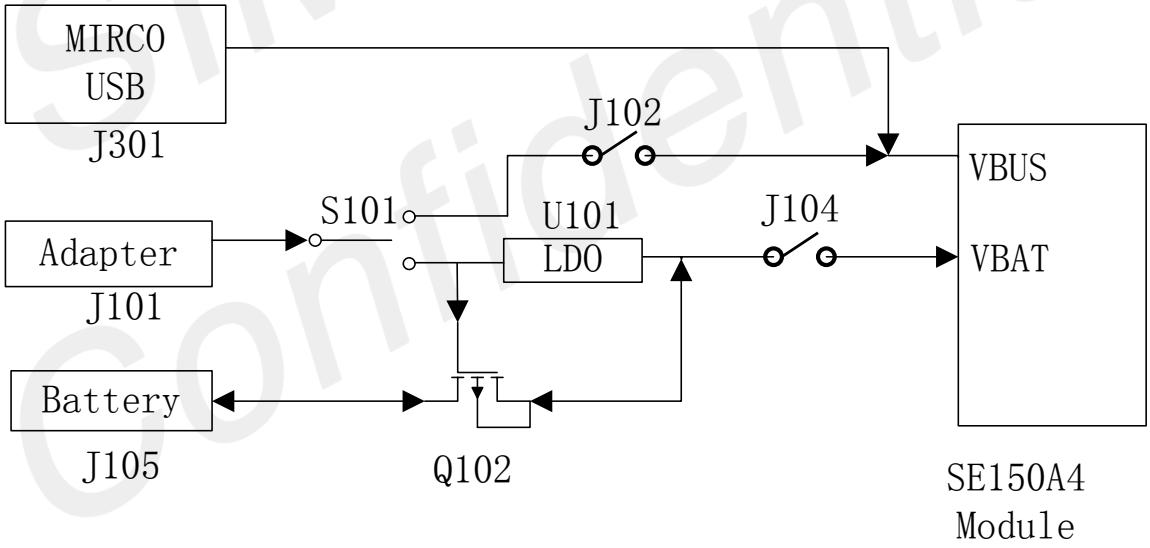

Figure 8: Power Supply Diagram

Customer can choose to use S101 to select charge function or not.

If the customers do not want to use charge function, they may disconnect jumper J102, then S101 will be the switch for the power control.

4.1.1 Adapter Interface

The following figure shows the DC power jack of the SE150A4 EVB.

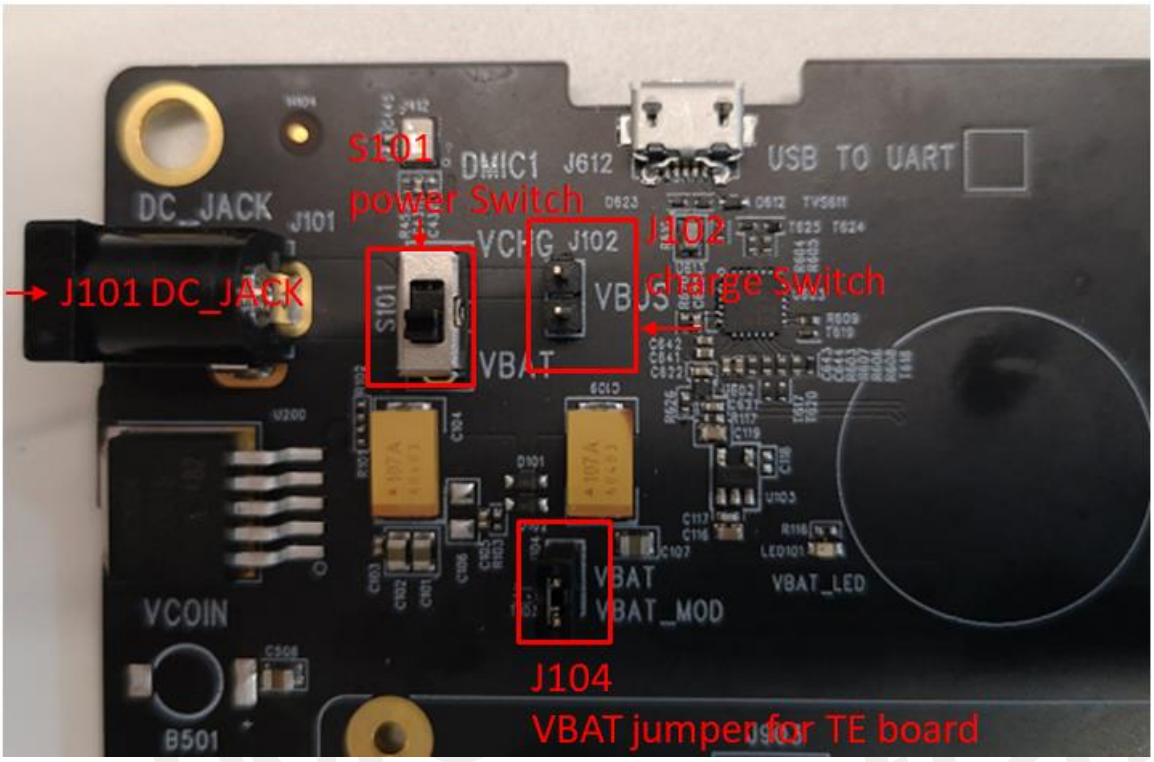

Figure 9: Placement of EVB power supply

Before connecting the power supply, customers must select a proper +5V DC power adapter to supply power for the SE150A4 EVB, and the power plug design of the adapter is shown as below.

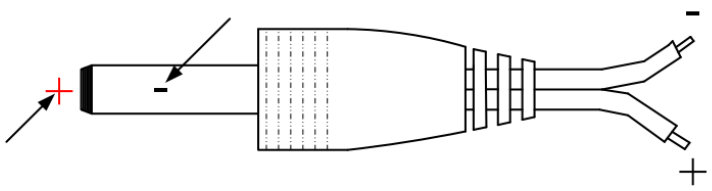

Figure 10: Power Plug Design

4.1.2 Battery Interface

The following figure shows a reference circuit design for battery interface.

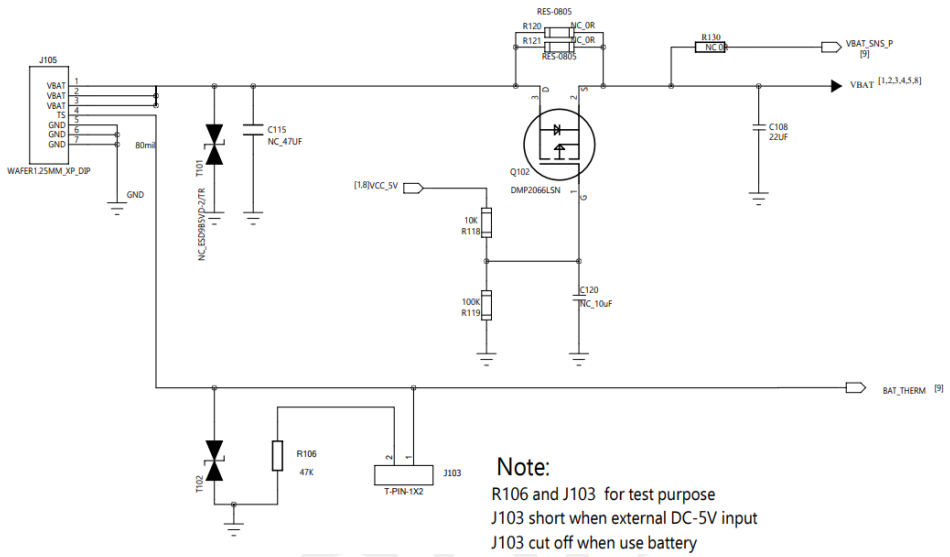

Figure 11: Reference Design for Battery Interface

The following figure shows the pin assignment of battery interface, and the following table shows the pin definition of battery connector.

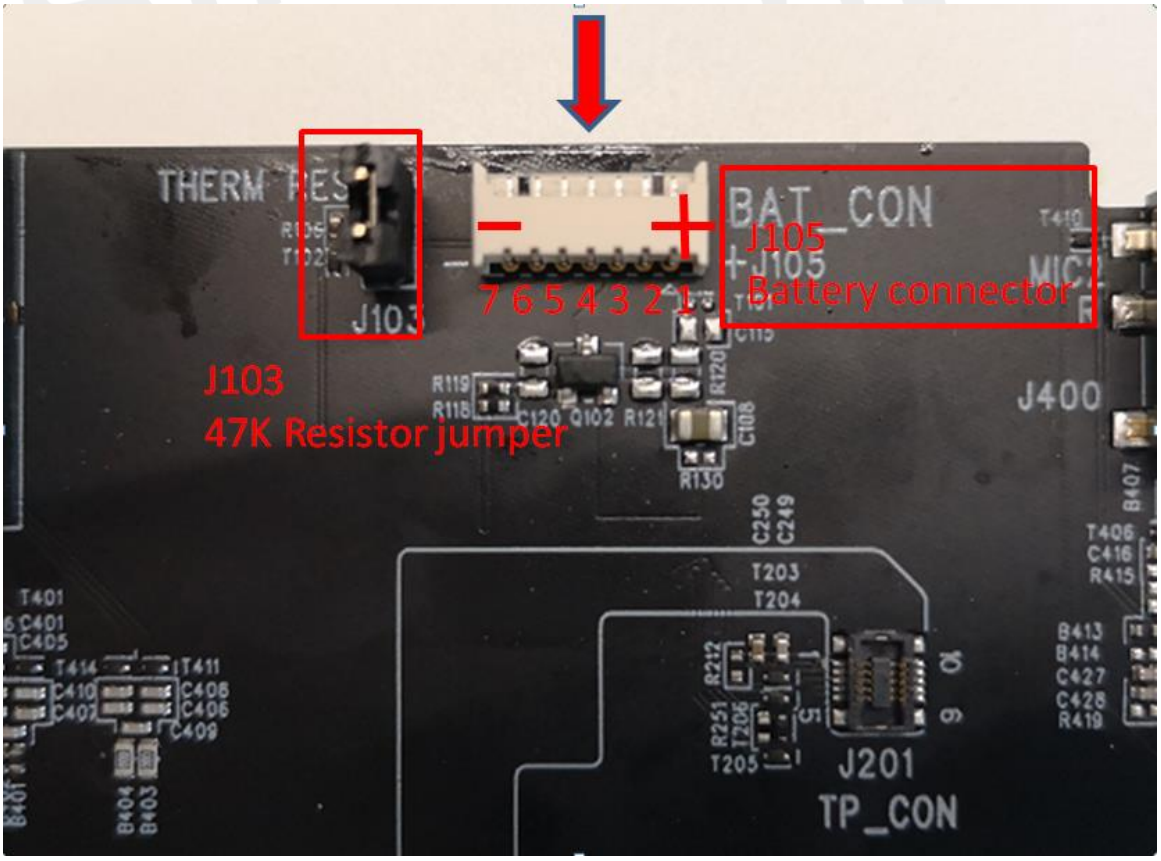

Figure 12: Pin Assignment of Battery Interface

Table 4: Pin Definition of Battery Interface

Pin No.	Pin Name	Description
5,6,7	GND	Ground pins. Connected to the negative pole of the battery.
4	THERM	Used for battery temperature detection. A 47K thermistor is used for the battery protection circuit.
1,2,3	VBAT	Power input pins. Connect to the positive pole of the battery.

4.1.3 Switches for Power Supply

J102 is used to select the way of charging between DC power supply and Mirco USB power supply.

J104 is used to power on/off the TE board.

J103 is used to add 47K resistor for BAT_THERM.

Table 5: Description of Power Supply Switches

Switch No.	ON	OFF
J102	Charging from DC-5V （S101 need toggle to VCHG side）	charging from Micro USB 5V
J104	Connect VBAT supply for TE board	Disconnect VBAT supply for TE board
J103	Use DC-Jack for power supply ,47Kohm external resistor instead of NTC thermistor	Use battery for power supply and an NTC thermistor already inside battery pack.

4.2 TE Interface (J901, J902)

The TE interface supports SE150A4 module, and includes two B2B connectors named J901 and J902.The TE board is connected to the EVB via the two connectors.

With the Smart module, customers can easily design wireless communication products.

The following two figures show the two B2B connectors.

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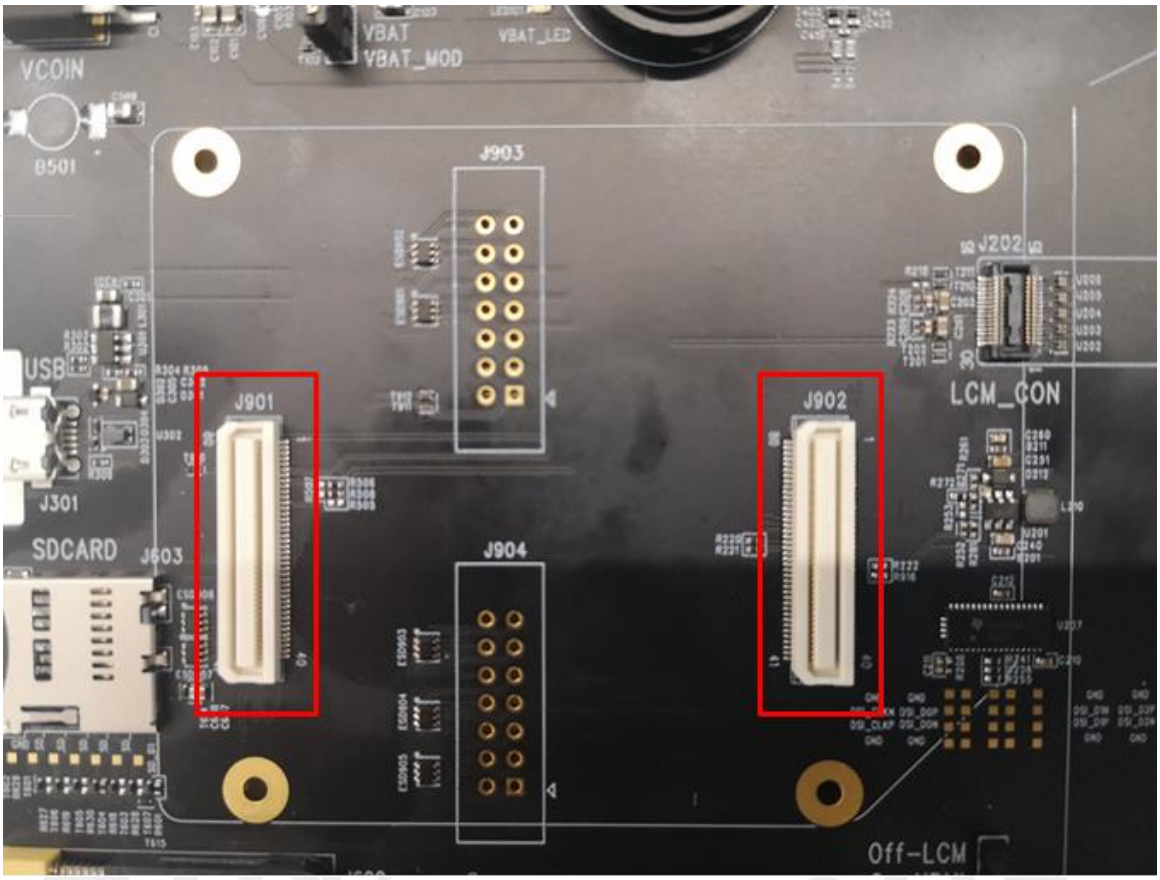

Figure 13: B2B Connectors

The following table describes the pin definition of the two B2B connectors J901 and J902.

Table 6: Pin Definition of B2B Connectors

J901	Pin Name of J901	J902	Pin Name of J902
1	VBAT_MOD	1	NC
2	VBAT_MOD	2	NC
3	VBAT_MOD	3	NC
4	VBAT_MOD	4	NC
5	VBAT_MOD	5	UIM1_DET
6	BAT_THERM	6	UIM2_DET
7	GND	7	NC
8	ADC	8	NC
9	GND	9	GND
10	RESET	10	EXT_MIC_BIAS1
11	PWRKEY	11	EXT_MIC_BIAS2
12	ADC2	12	GPIO_61
13	GPIO_94-LCD_BIAS_DRV_EN	13	GND
14	SENSOR_I2C_SDA	14	NC

15	SENSOR_I2C_SCL	15	NC
16	GPIO_19-UART5_RTS	16	NC
17	GPIO_18-UART5_CTS	17	NC
18	GPIO_17-UART5_RX	18	NC
19	GPIO_16-UART5_TX	19	NC
20	UART2_RX	20	GND
21	UART2_TX	21	NC
22	NC	22	LDO17_2P85
23	NC	23	LDO17_2P85
24	GPIO_25-CAM_DVDD_EN	24	GPIO60_LCD_RST
25	GPIO_23	25	NC
26	GPIO_22	26	LCD_TE
27	GPIO_21	27	PWM
28	GPIO_20	28	GND
29	NC	29	MIPI_DSI_D3N
30	SD_LDO12	30	MIPI_DSI_D3P
31	GND	31	MIPI_DSI_D2P
32	SD_DATA3	32	MIPI_DSI_D2N
33	SD_DATA2	33	MIPI_DSI_D1P
34	SD_DATA1	34	MIPI_DSI_D1N
35	SD_DATA0	35	MIPI_DSI_D0P
36	SD_CLK	36	MIPI_DSI_D0N
37	GND	37	GND
38	SD_LDO11_2P95	38	MIPI_DSI_CLKP
39	SD_DET	39	MIPI_DSI_CLKN
40	SD_CMD	40	GND
41	GPIO_43_ALSP_INT_N	41	USIM1_CLK
42	GPIO_34-REAR_CAMERA_ENF	42	USIM1_DATA
43	GPIO_33-REAR_CAMERA_ENM	43	USIM1_RST
44	GPIO_42_ACCL_INT1_N	44	USIM1_VDD
45	GPIO_46_ACCL_INT2_N	45	GND
46	GPIO_8	46	USIM2_CLK
47	GPIO_9	47	USIM2_DATA
48	GPIO_44_MAG_INT_N	48	USIM2_RST
49	NC	49	USIM2_VDD
50	GPIO_6 _I2C2_SDA	50	GND

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51	GPIO_7 _I2C2_SCL	51	NC
52	NC	52	NC
53	NC	53	VIB_DRV_N
54	VOL_UP	54	LDO6_1P8
55	VOL_DOWN	55	NC
56	VBUS	56	NC
57	VBUS	57	NC
58	VBUS	58	GND
59	USB_DN	59	GPIO_64-TP_RST_N
60	USB_DP	60	GPIO_65-TP_INT_N
61	USB_ID	61	GPIO_10_TP_I2C_SDA
62	GND	62	GPIO_11_TP_I2C_SCL
63	GPIO_89_DMIC0_CLK	63	GND
64	GPIO_90_DMIC0_DATA	64	HS_DET
65	NC	65	SPK_N
66	NC	66	SPK_P
67	GPIO_87	67	EAR_N
68	GPIO_88	68	EAR_P
69	GPIO_108	69	HPH_L
70	GPIO_107	70	HPH_GND
71	GPIO_85	71	HPH_R
72	GPIO_86	72	MIC3P
73	VCOIN	73	MIC2P
74	NC	74	MIC1P
75	VBAT_SNS_P	75	MIC_GND
76	GND	76	GND
77	GND	77	NC
78	GND	78	NC
79	GND	79	GND
80	GND	80	NC

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4.3 Display

The SE150A4 EVB supports LCM、HDMI and LVDS interface. It provides an LCM connector J201, a HDMI connector J1201 and a LVDS interface J1202. The three kinds of display cannot use at the same time. The Jumper J204 is used to switch the MIPI path, OFF is for LCM display, and ON is for HDMI/LVDS display.

4.3.1 LCM Interface

The SE150A4 EVB provides an LCM interface J202 and can be equipped with an LCD module. Currently the SE150A4 EVB provides a 5-inch 1280*720 HD resolution liquid crystal display.

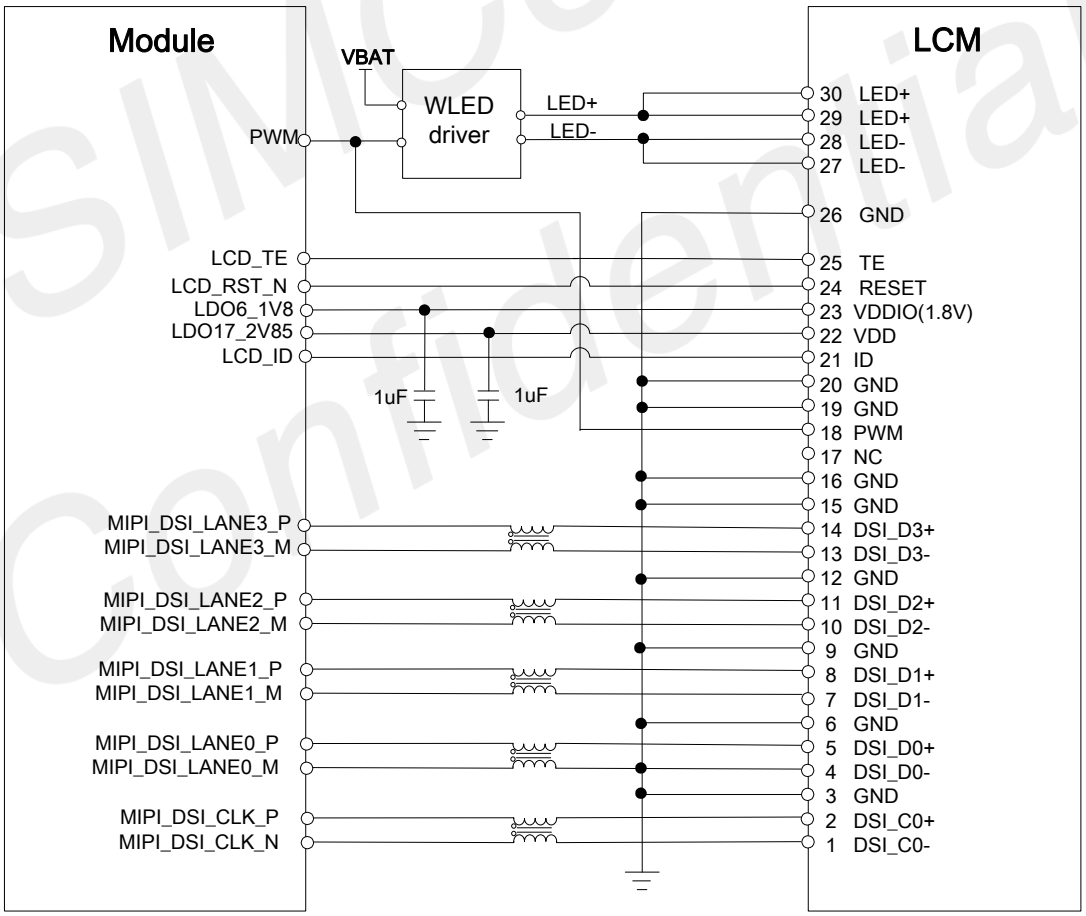

Figure 14: Reference Design for Main LCM Interface

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4.3.2 Backlight Driver for LCM Interface

The LED inside the LCM for backlight is 2P6S, an external backlight driver U201 (a PWM dimming step-up LED driver) added to support LCM backlight. The output voltage is 19.2V (Typ.), the output current set to 40mA.

The following figure shows a reference circuit design for the backlight driver.

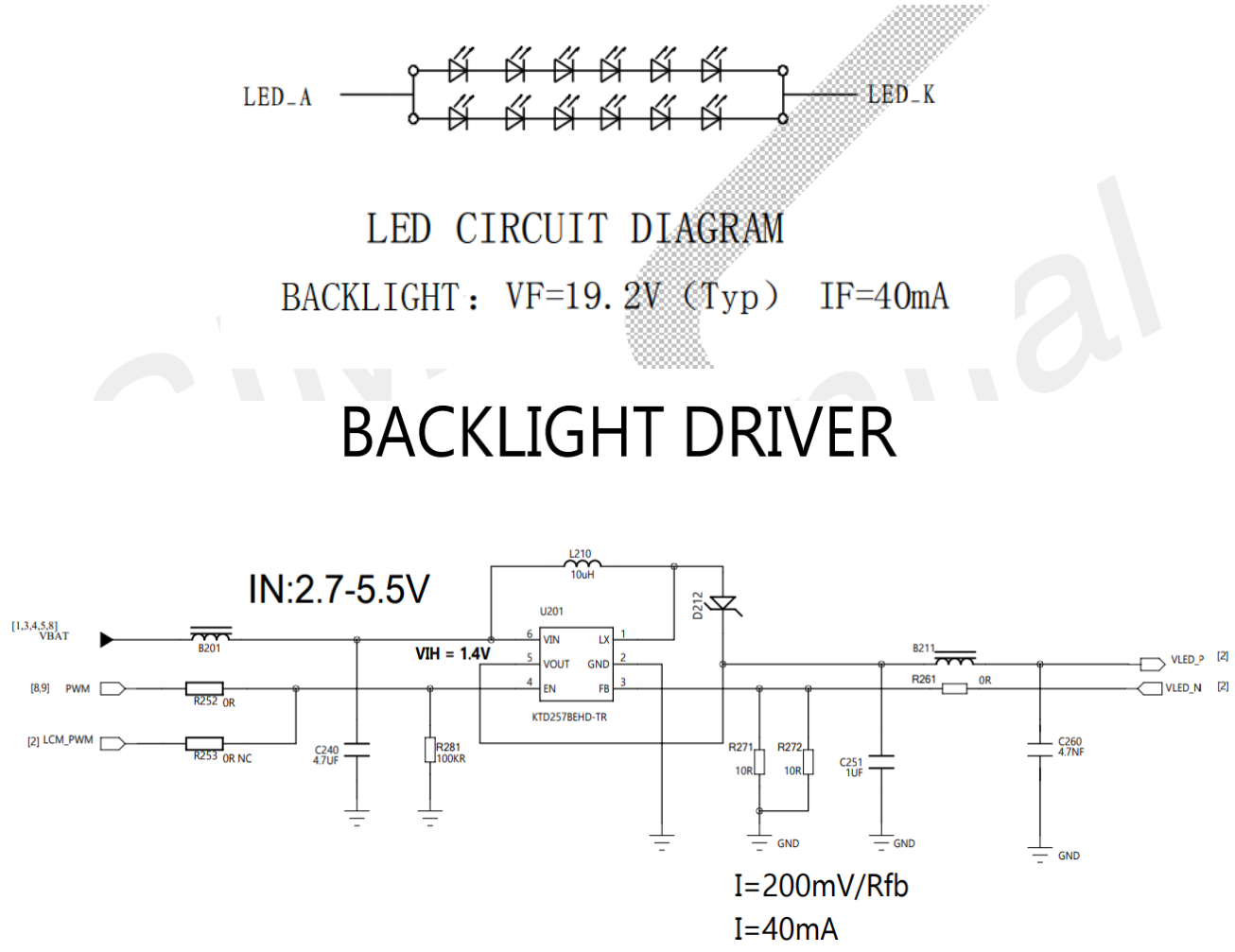


Figure 15: Reference Design for Backlight Driver

4.3.3 HDMI/LVDS interface

SE150A4 EVB have HDMI/LVDS display interface.

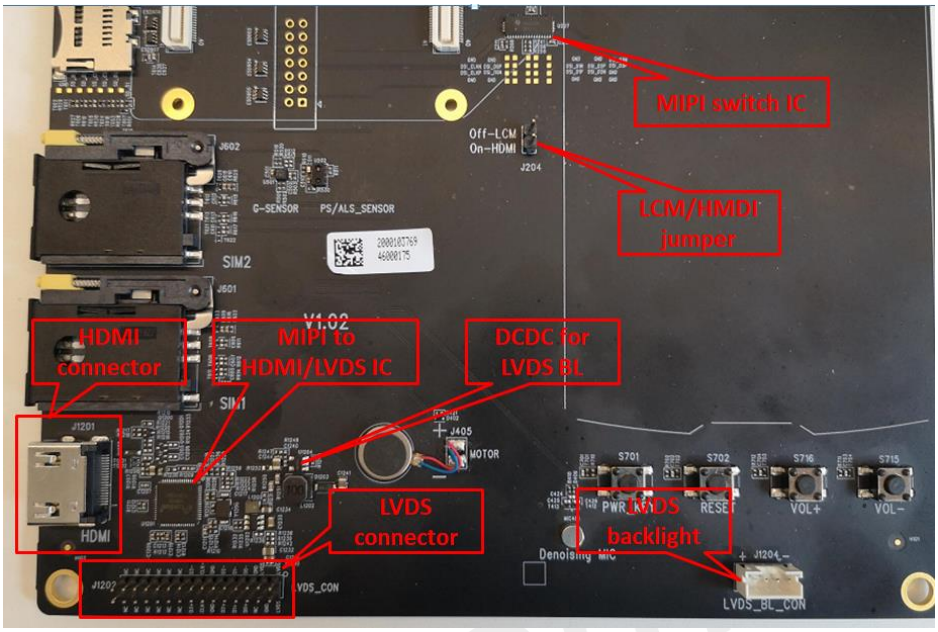
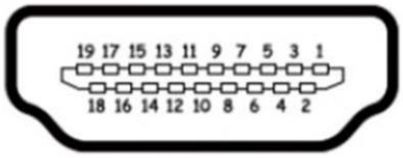


Figure 16: HDMI/LVDS Connectors

U207 is a MIPI to HDMI/LVDS transfer IC, it transfers DSI to two paths, one path for LCM interface, the other path is for HDMI/LVDS interface.

J1201 is a HDMI TYPE-A connector, the pin definition is as following picture：



Pin#	Signal	Pin#	Signal
1	TMDS data 2+	11	TMDS clock shield
2	TMDS data 2 shield	12	TMDS clock-
3	TMDS data 2-	13	CEC
4	TMDS data 1+	14	No connected
5	TMDS data 1 shield	15	DDC clock
6	TMDS data 1-	16	DDC data
7	TMDS data 0+	17	Ground
8	TMDS data 0 shield	18	+5V power
9	TMDS data 0-	19	Hot plug detect
10	TMDS clock+		

Figure 17: HDMI TYPE-A PIN definition

J1202 is a LVDS connector, and J1204 is a connector for LVDS backlight, U1204 is the DCDC component, it can output voltage up to 30V, and the output current set about to 200mA.

NOTE

HDMI、LVDS、LCM cannot use at the same time.
Jumper J204 is used for the function switch. When use LCM, the jumper keeps OFF status, when use HDMI/LVDS, the jumper keeps ON status.

4.4 Touch Panel Interface

The SE150A4 EVB provides a touch panel interfaces: J201

J201 is used for the connection between touch panel interfaces of LCM and EVB.

The following figure shows a reference design for touch panel interfaces.

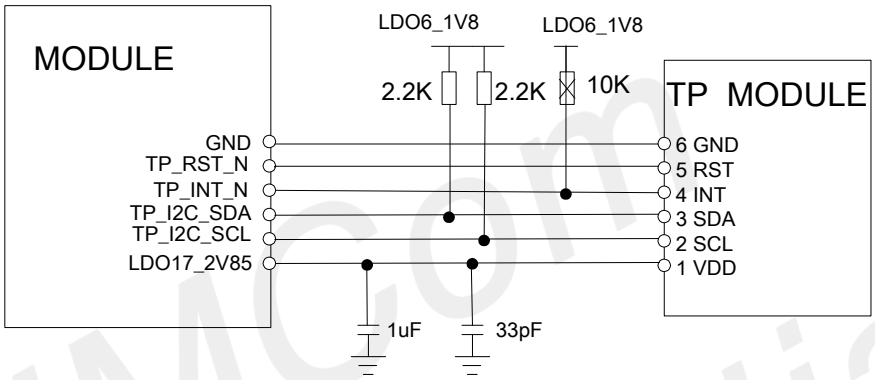


Figure 18: Reference Design for Touch Panel Interfaces

The following figure shows the pin assignments of touch panel interfaces, and the following table shows the pin definition of touch panel interfaces.

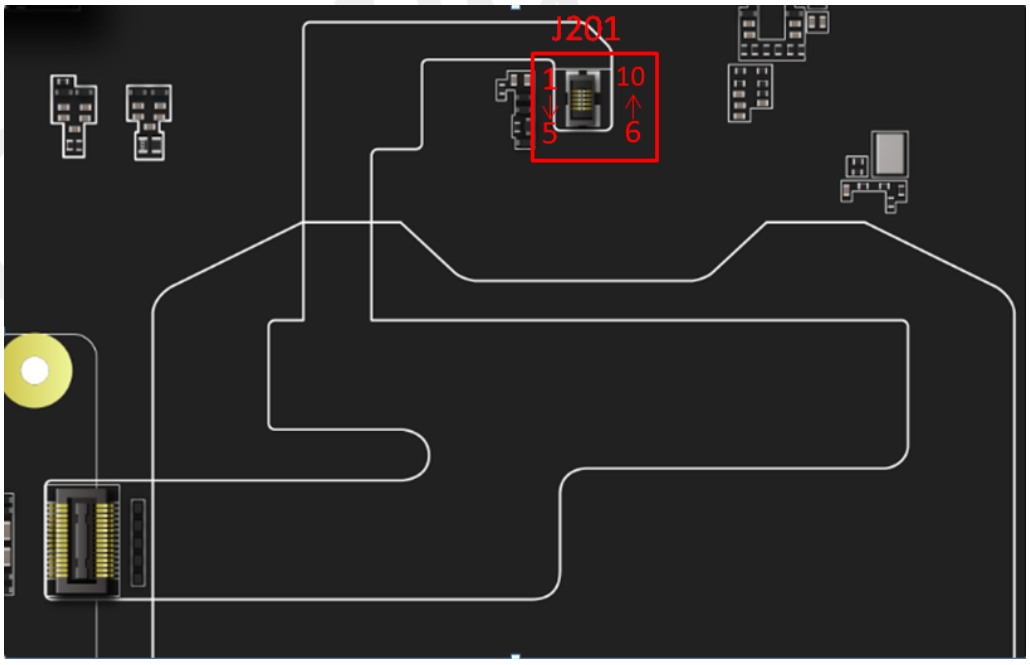


Figure 19: Pin Assignments of Touch Panel Interfaces

Table 7: Pin Definition of Touch Panel Interfaces

Pin No.	Pin Name	Description	Comment
1	VDD	2.85V power supply for touch panel VDD power	
2	SCL	I2C clock signal of touch panel	
3	SDA	I2C data signal of touch panel	
4	INT	Interrupt signal of touch panel	
5	RESET	Reset signal of touch panel	Active low
Others	GND	Ground	

4.5 Camera Interfaces

SE150A4 EVB provides two camera interfaces (4-lane+2-lane): 13M rear camera and 5M front camera. Cameras assembled on TE board.

J204（on TE board）：The rear camera uses a 13M pixels digital CMOS sensor with auto-focusing function.

J203（on TE board）：The front camera uses a 5M pixels digitals CMOS sensor with auto-focusing function.

The following figure shows a reference design for camera interfaces.

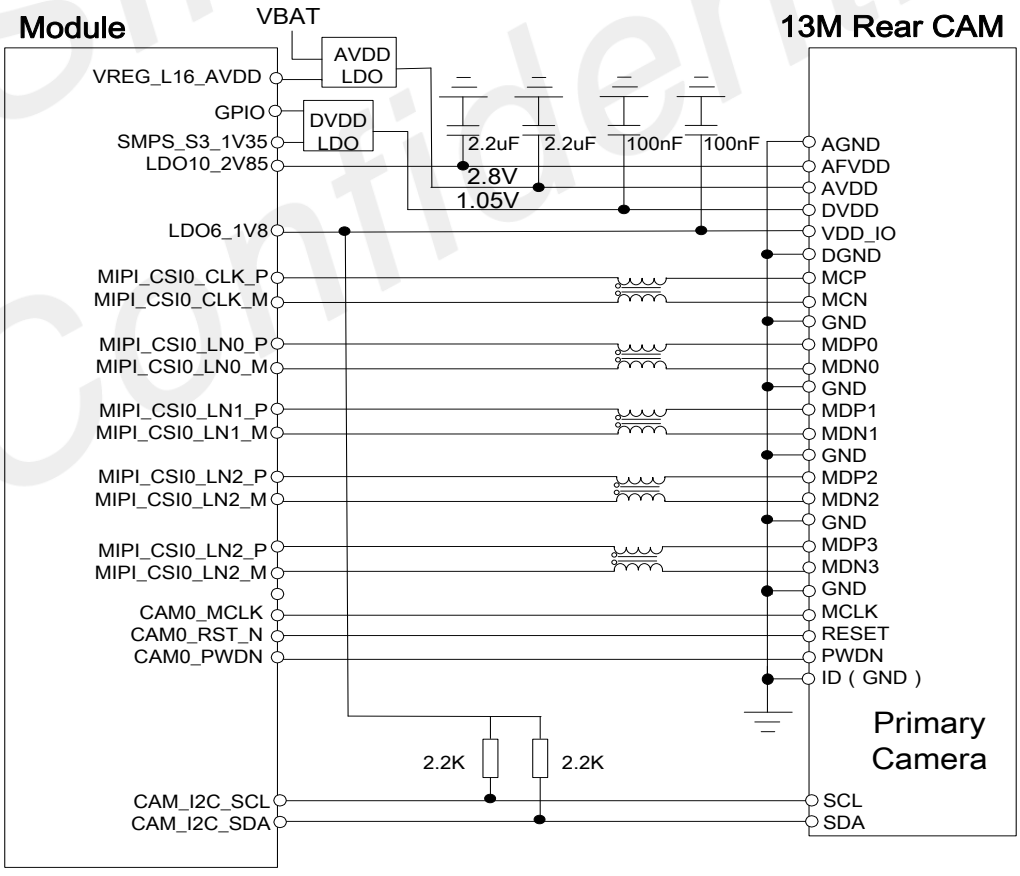


Figure 20: Reference Design for 13M Camera Interfaces

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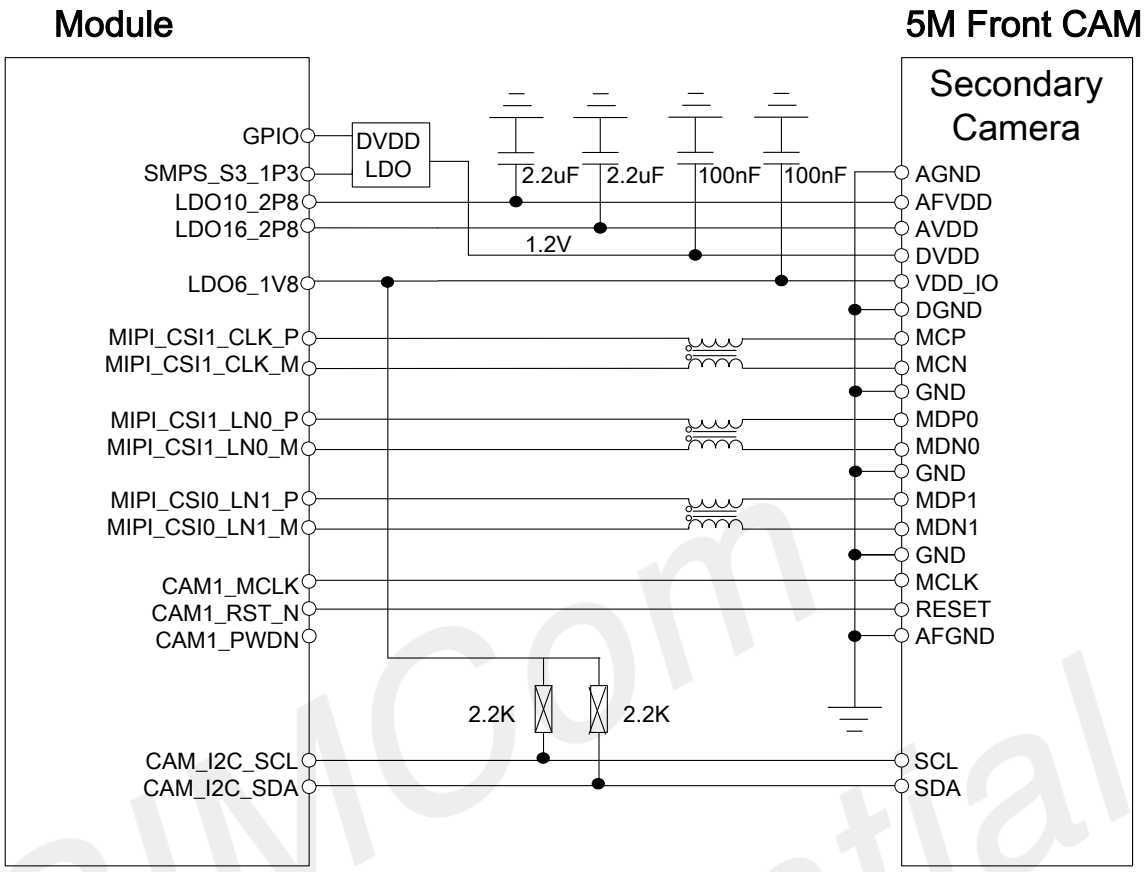

Figure 21: Reference Design for 5M Camera Interfaces

The following figure shows the camera interfaces with cameras assembled.

Figure 22: Camera Interfaces with Cameras Assembled

4.6 USB Interfaces (J301)

The SE150A4 EVB provides Micro USB interface **J301** for charging, data transmission, software debugging and firmware update.

- The Micro USB interface complies with the USB 2.0 specifications and supports high speed (480 Mbps) on USB 2.0 and full speed (12 Mbps) modes.
- Support USB OTG，an external boost U301 on EVB output 5V/1A for VBUS.

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

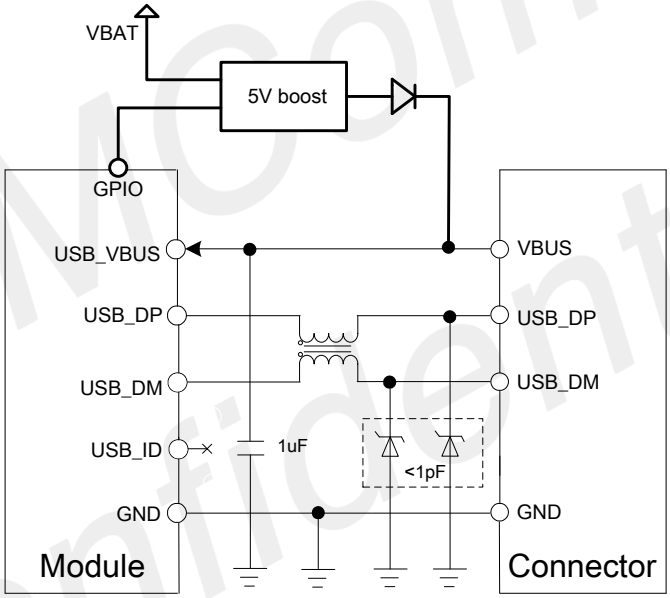

Figure 23: Reference Design for USB Interfaces

4.7 Audio Interfaces

SE150A4 EVB provides three analog audio interfaces including one mono loudspeaker, one mono handset, and one stereo headset.

The audio interface provided by SE150A4-EVB board is as follows:

- Speaker (J401)

  Internal Class-D audio PA output (SPK_P & SPK_N)

Max. power: 1.2W/8Ω.

- Earphones (J400)

  3.5mm 4-segment earphone on EVB, Support both OMTP and CTIA standard. Default CTIA standard.

- Handle (J403)

  Standard 4-wire interfaces; supports main MIC and handset functions.

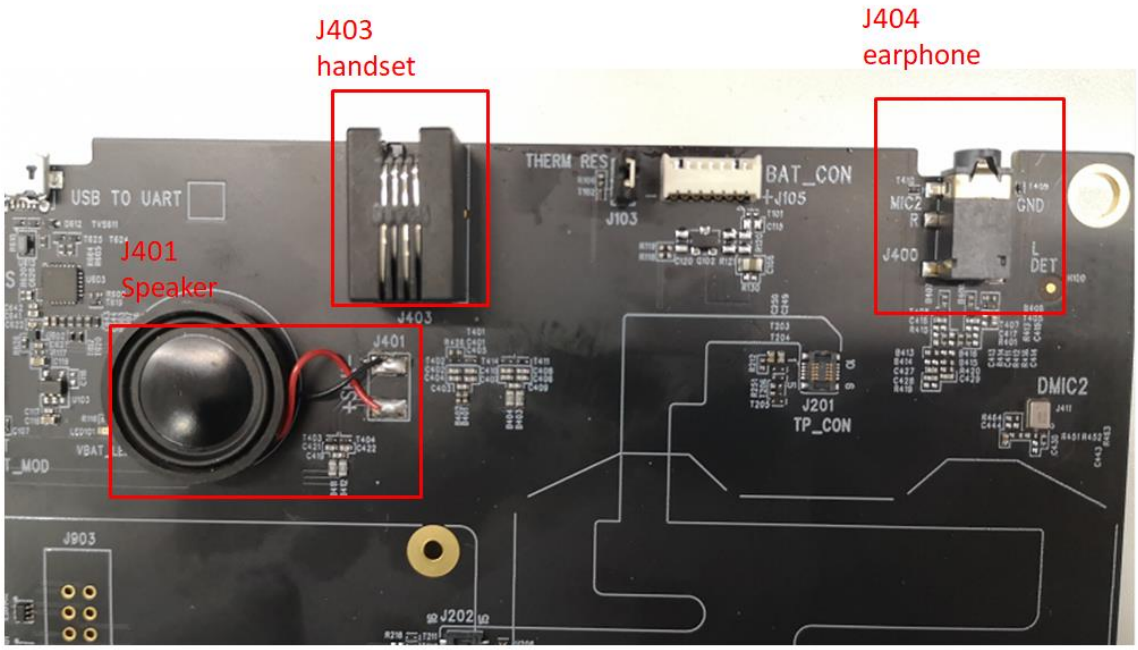

Figure 24: audio Interfaces

4.7.1 Loudspeaker Interface

SE150A4 EVB provides one loudspeaker interface. The following figure shows a reference circuit design for loudspeaker interface.

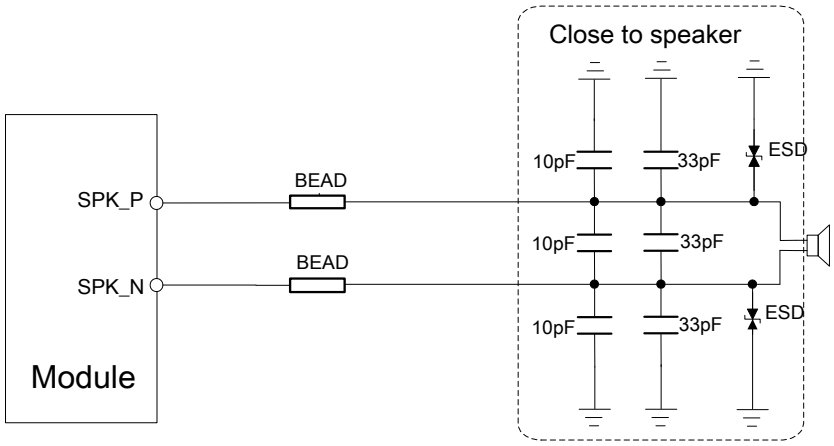

Figure 25: Reference Design for Loudspeaker Interface``

4.7.2 Earphone Interface

The following figure shows a reference circuit design for earphone/headset interface.

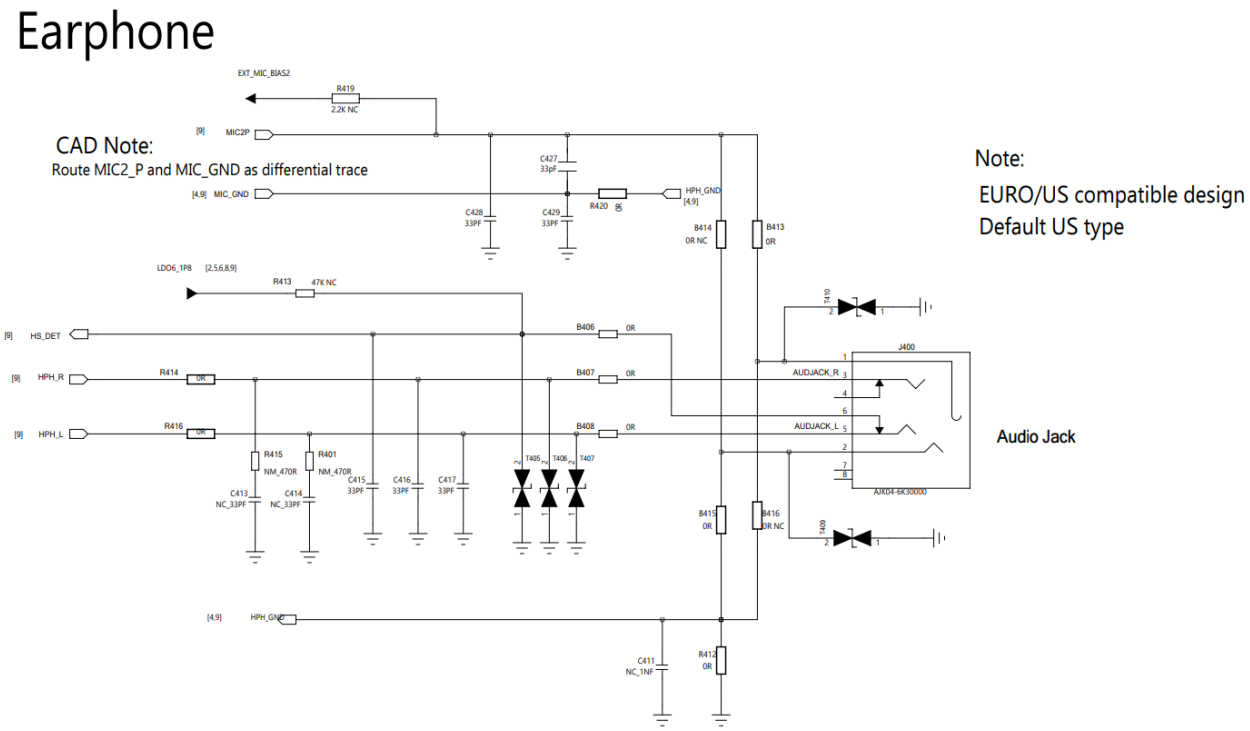

Figure 26: Reference Design for earphone Interface

The following figure shows the pin assignment of earphone interface.

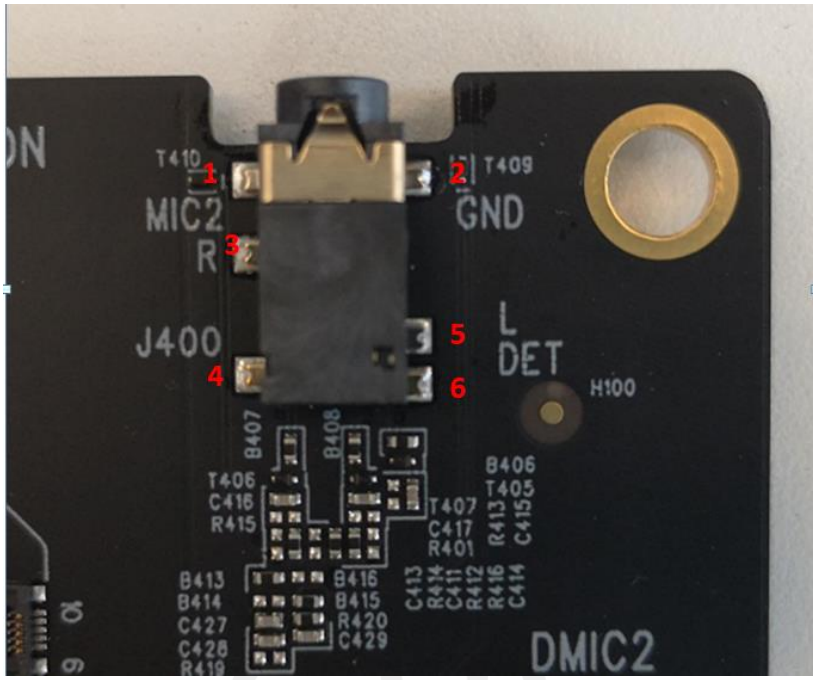

Figure 27: Pin Assignment of Headset Interface

Table 8: Pin Definition of earphone Interface

Pin No.	Pin Name	Function
1	MIC2_P	headphone MIC input
2	HPH_GND	Headphone Ground
3	HPH_R	Headphone Right channel output
4	NC	NC
5	HPH_L	Headphone Left channel output
6	Detect	Headphone plug in detect

3.5mm 4-segment earphone on EVB, Support both OMTP and CTIA standard.

CTIA is the default standard, you can choose the standard by set B413、B414、B415、B416 with different values.

Table 9: Value setting for standard

B413 & B415	B414 & B416	standard
0ohm	NC	CTIA
NC	0ohm	OMTP

4.7.3 Handle Interface

SE150A4 EVB provides a handle interface (J403), it includes main MIC(MIC1_P/N) and receiver (EAR_P , EAR_N) signals.

Figure 28: Handle photo show

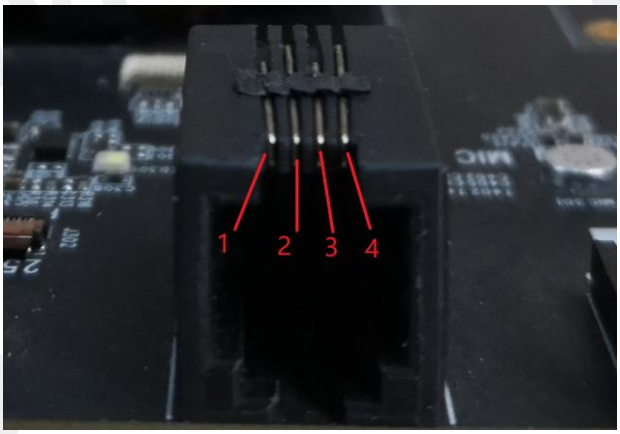

Figure 29: Handle Interface

Table 10: Pin Definition of Handle Interface

Pin No.	Pin Name	Function
1	MIC_GND	Dedicated GND for audio
2	EAR_N	Earpiece output, negative
3	EAR_P	Earpiece output, positive
4	MIC1P	Microphone input

SE150A4 EVB provides one receiver interface. The following figure shows a reference circuit design for receiver interface.

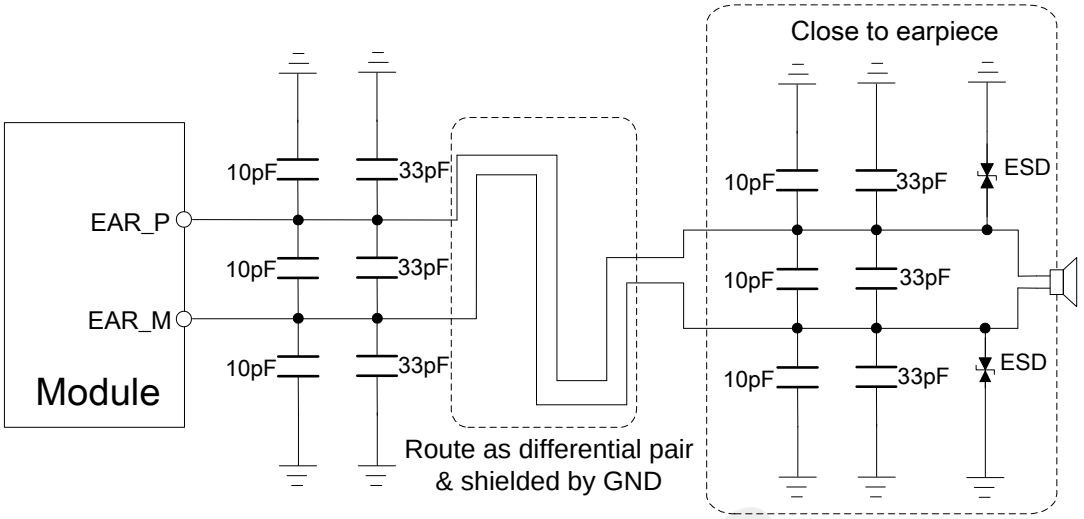

Figure 30: Reference Design for Earphone Interface

SE150A4 EVB provides one differential microphone inputs for microphone interfaces. The differential microphone input is for ECM-Type microphone. The following figures show a reference circuit design for microphone interfaces.

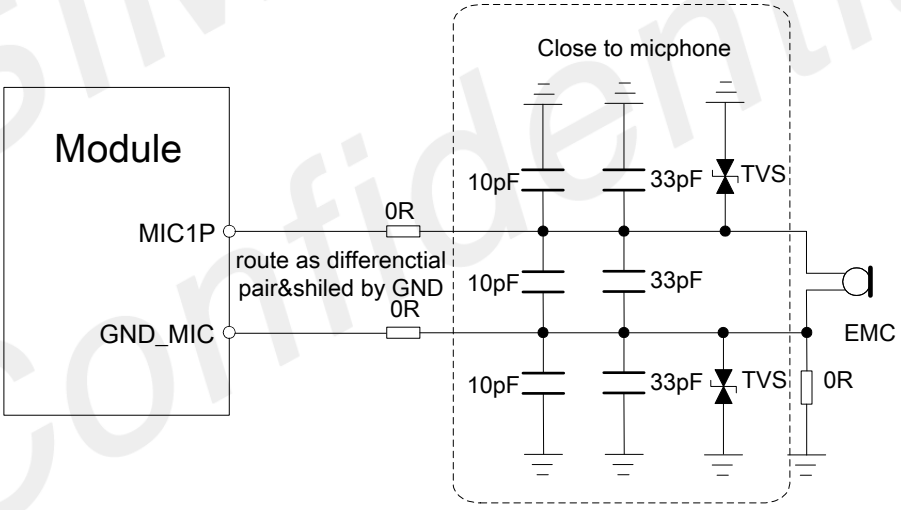

Figure 31: EMC microphone reference circuit

4.7.4 Secondary MIC （MIC3_P）

Except for MIC1 and MIC2, SE150A4 provides another single-ended microphone-- MIC3, it can be used as de-noise MIC or secondary MIC

NOTE

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1. Internal MIC_BIAS pull-up is used to reduce BOM cost and PCB routing.
2. There are two digital microphones (J411, J412) designed on the EVB for further development.
3. The analogue MICs and the digital MICs can only be either way or different types of MICs cannot be mixed.

4.8 USIM Interfaces

The SE150A4 EVB provides two USIM card (2.95V or 1.8V) connectors J601 (USIM1 card connector) and J602 (USIM2 card connector). The following figure shows the reference design.

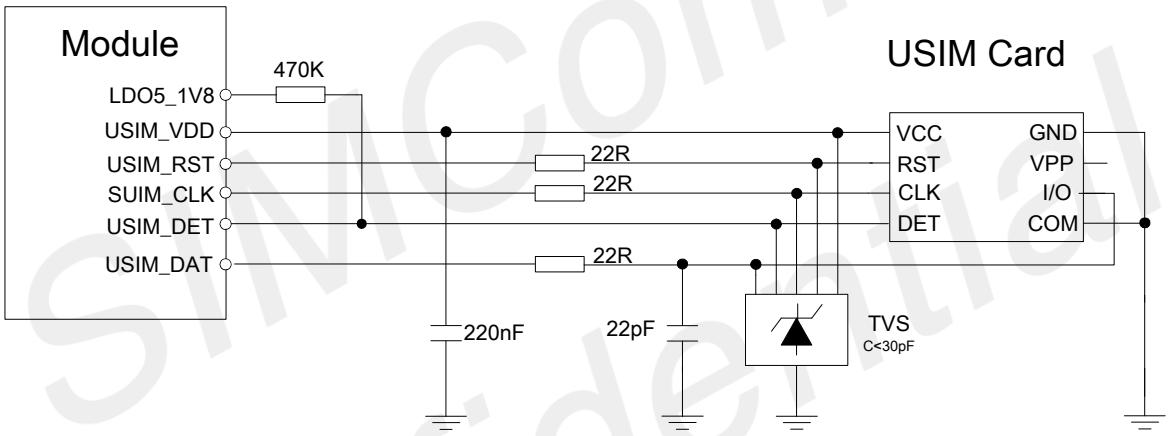

Figure 32: Reference Design for USIM Card Interface

The following figure shows the pin assignment of USIM1 card connector (J601).

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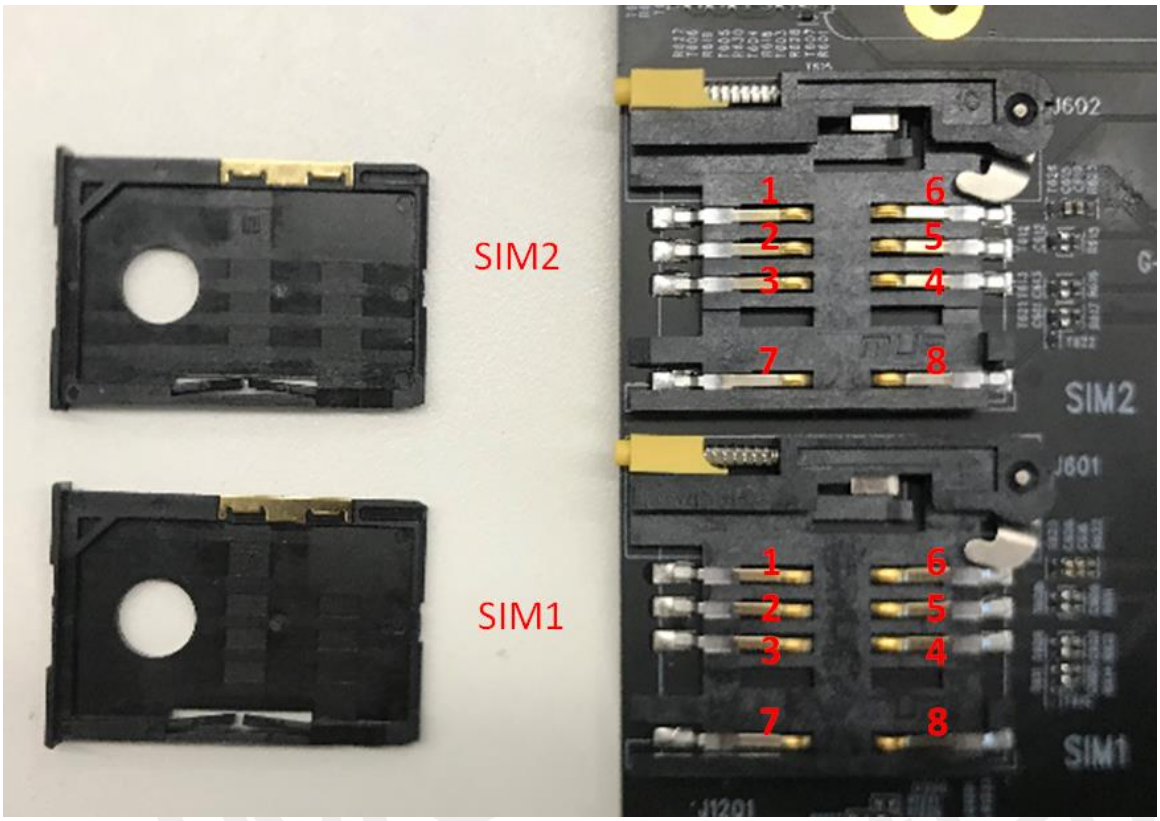

Figure 33: Pin Assignment of SIM Card Connector

Table 11: Pin Definition of SIM Card Connector

Pin No.	Pin Name	Function
1	GND	Ground
2	VPP	NC
3	I/O	SIM card data signal; Bi-directional
4	CLK	SIM card clock signal
5	RST	SIM card reset signal
6	VCC	SIM card power supply
7	GND	Ground
8	PRESENCE	SIM card detection

4.9 USB to UART Interfaces (J612)

SE150A4 EVB provides a UART interface: UART Port J612 (with CP2105 chip). The UART interface can be used for data transmission. Users can get the serial log via debug UART, which is shown as ‘Standard COM Port’ on PC’s COM port list.

Enhanced COM Port support hardware flow control, connected to SE150A4 UART5（PIN34/35/36/37）.

Standard COM Port is standard 3-line UART port, connected to SE150A4 UART2（PIN93/94）

The following figure shows the block diagram of UART on SE150A4 EVB.

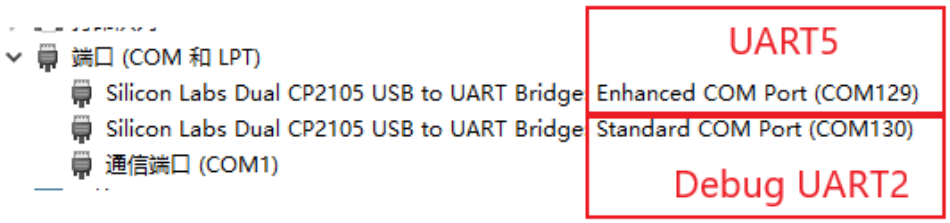

Figure 34: USB to UART Bridge

4.10 SD Card Interface

SE150A4 EVB provides an SD card interface J603 for customers to test the module's SD card interface. The following figure shows the simplified interface schematic for SD card interface on SE150A4 EVB.

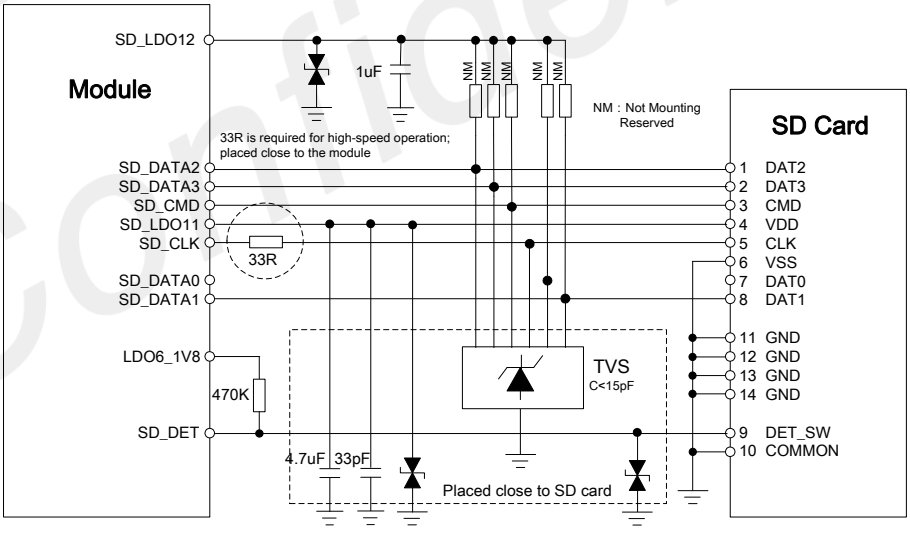

Figure 35: SD card reference circuit

NOTE

1、SDC signal cannot be pulled up to SD_LDO11

4.11 Sensors

SE150A4 EVB provides two sensors for testing purpose, as shown in the figure below

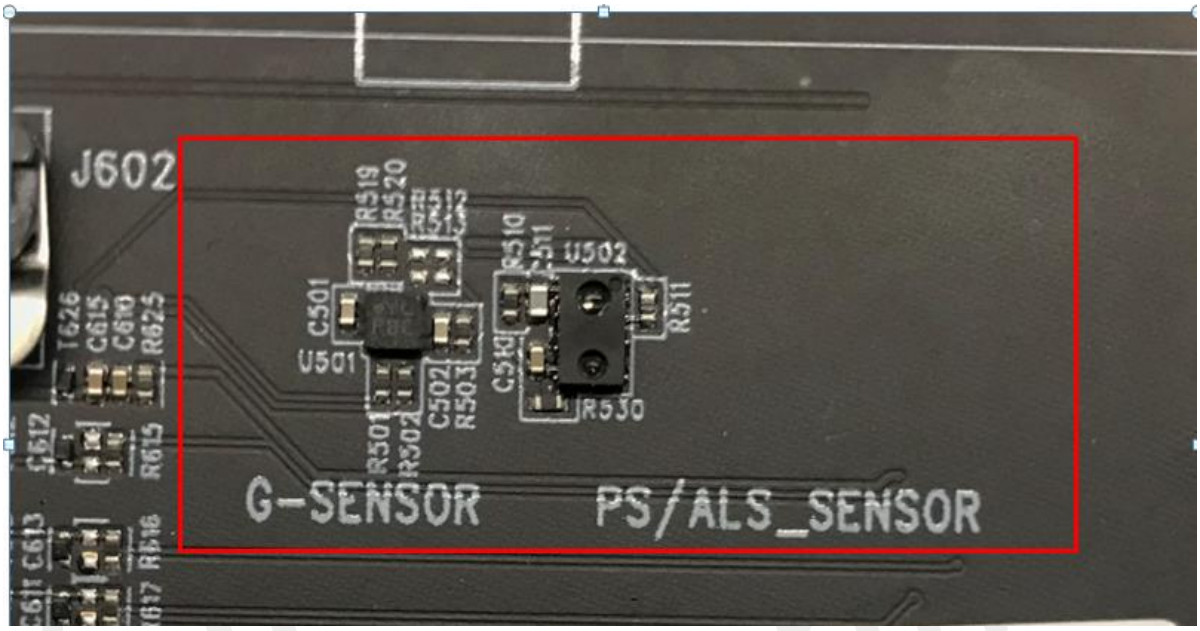

Figure 36: Sensors

Table 12: information of sensor on EVB

Sensor	Part number	Vendor
PS/ALS U502	STK3311-X	SENSORTEK
G-sensor U501	BMA421	BOSCH

4.12 Vibrator

SE150A4 EVB provides a vibrator (J405) for customers to test the motor driver interface of Smart module. The following figures show a reference circuit design and the vibrator on the board.

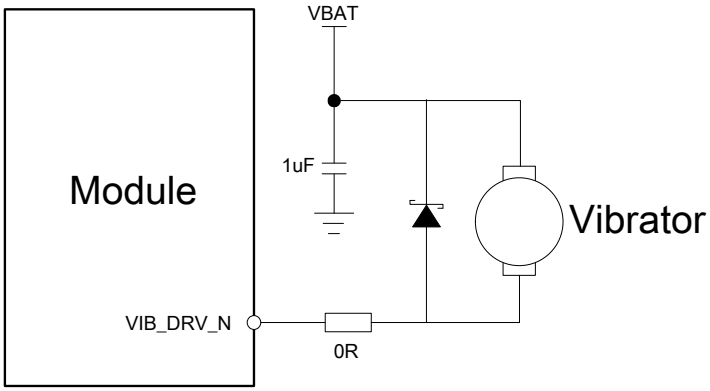

Figure 37: Vibrator reference circuit

4.13 Buttons

Four buttons including RESET、 PWRKEY、 VOL_UP and VOL_DOWN, which are shown in the following figure.

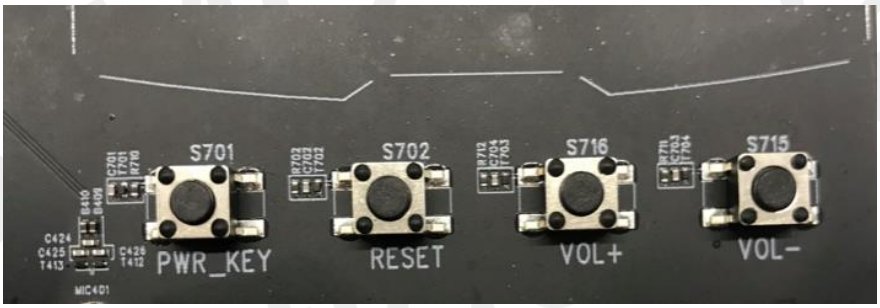

Figure 38: Buttons

Press PWRKEY and VOL + / VOL- in combination to have specific functions, as shown in the table below

Table 13: PWRKEY / VOL + / VOL key combination

PIN NO.	PWRKEY	VOL+	VOL-	Function
Key combination before starting	Y	N	Y	Enter engineering mode

After the customer connects the power supply and the module correctly, press the power button until the screen displays normally, then release the button to start the computer normally.

4.14 Status Indication LEDs

There is a status indication light (LED101) for signal indication on SE150A4 EVB, The LED is used to indicate the power on or power off.

4.15 Forced USB BOOT Interface

FORCED_USB_BOOT is the emergency download interface.

FORCED_USB_BOOT is pulled up to LDO5_1P8, and the module can enter the emergency download mode. Used when the product does not start properly. To facilitate subsequent software upgrades and debugging, please reserve test points.

Table 14: FORCED USB BOOT definitions

Pin Name	I/O	Description	Note
FORCED_USB_BOOT	DI	USB forced download signal, short-circuit to LDO5_1P8 then press PWRKEY to enter forced download mode.	
LDO5 _1P8	PO	1.8V power supply of GPIO port, normally open, voltage is not adjustable	

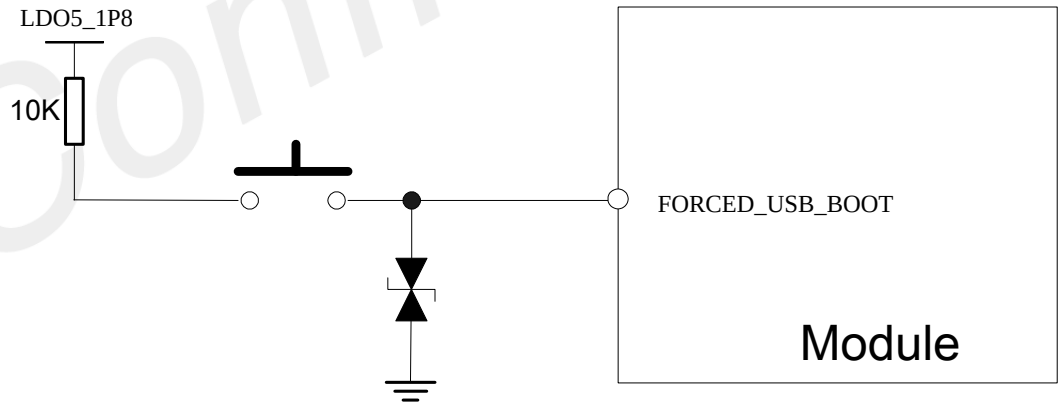

Figure 39: Emergency download reference circuit

The test points of FORCED_USB_BOOT and LDO5_1P8 are on the TE board, Short the two test point of J105, SE150A4 module enter forced boot mode after power on.

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The test points(J105) on TE board position as following picture:

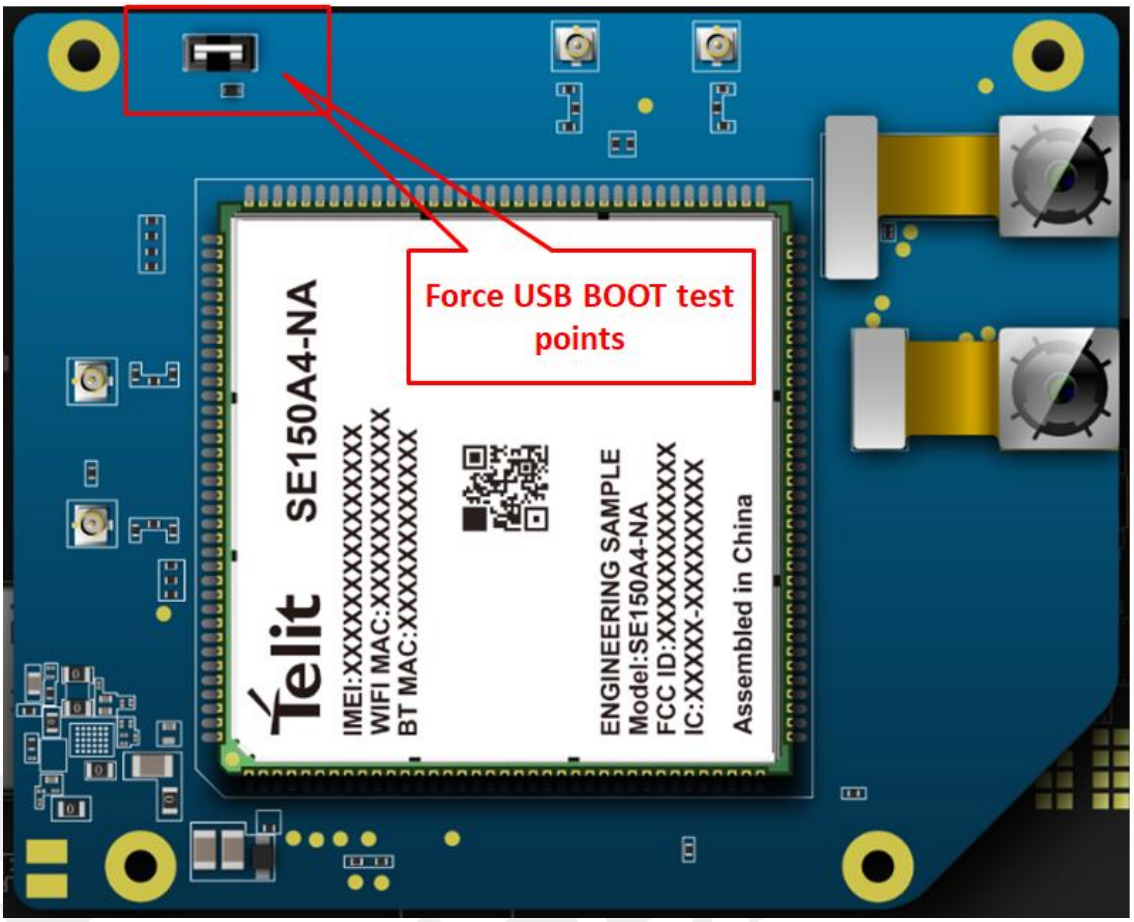

Figure 40: Emergency download

5. Operation Procedures Illustration

This chapter introduces how to use the SE150A4 EVB for testing and evaluating SE150A4 module.

5.1 Power ON Smart Modules

The following are the procedures for powering on the smart module.

1. Install the TE board to the connectors (J901 and J902) on SE150A4 EVB.
2. If use the battery, install a Li-polymer battery on J105；If use 5.0V DC power supply, then switch S101 to "***VBAT***" side.
3. Switch S101 to "***VBAT***" side or the battery is used, and then LED101 will be lighted.
4. Press S701 (PWRKEY) for at least 2s to turn on the module. When the following interface is displayed on the utilized LCD, it means the booting has been completed.

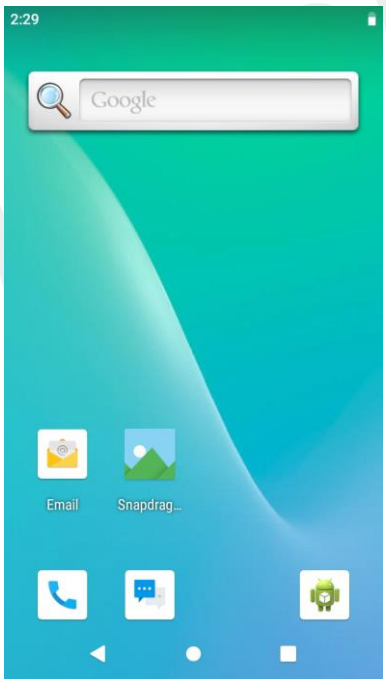

Figure 41: LCD Display Indicating Module's Power-on

NOTE

Inserting USB into USB interface after power supply is provided can also turn on the module

5.2 Communication via USB or UART Interface

5.2.1 Communication via USB Interface

1. Power on the module according to the procedures mentioned in Chapter 5.1.
2. Connect SE150A4 EVB and the PC with USB cable through USB interface and then run the USB flash drive on PC to install the USB driver and ADB driver. The USB port numbers can be viewed through the PC's Device Manager, shown as below.

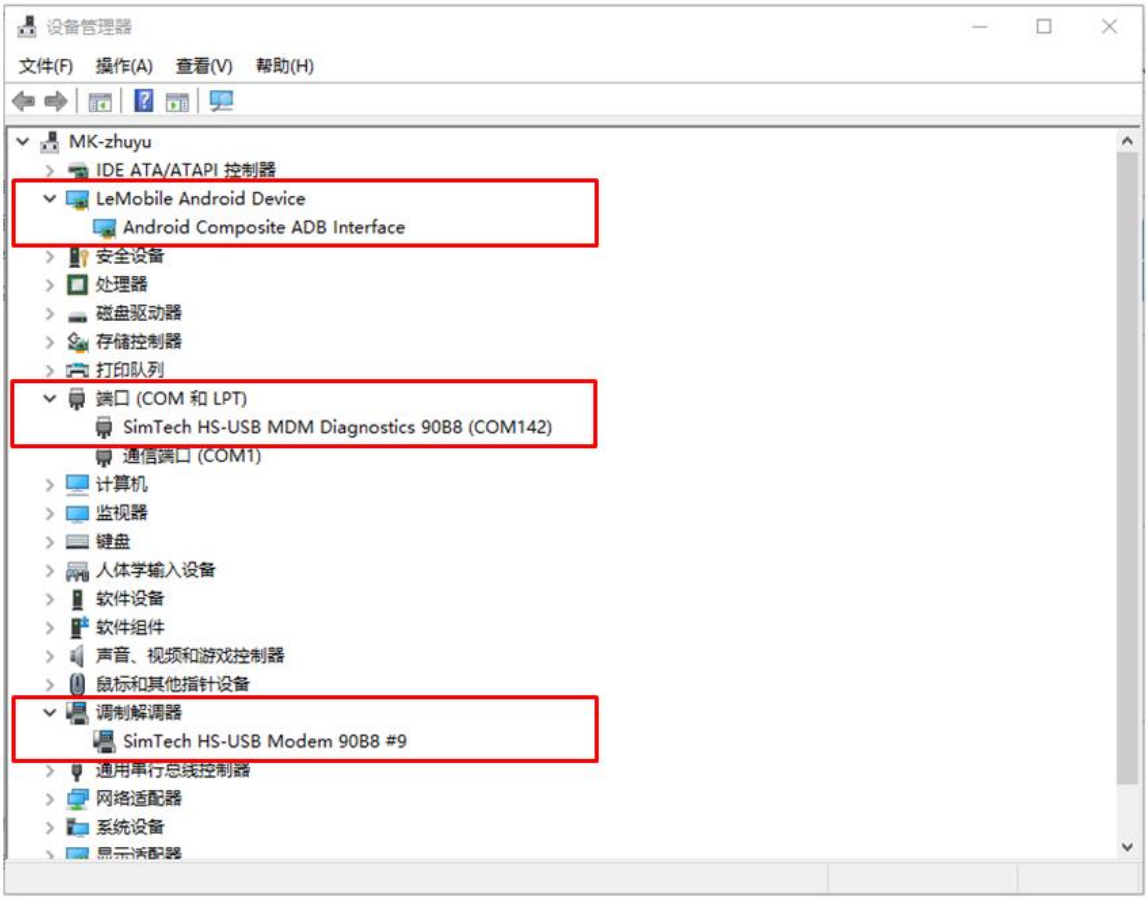

Figure 42: USB COM Ports

3. Open CMD tool: "**START**" "**All Programs**" "**Accessory**" "**Command Prompt**".
4. Use the "**adb shell**" command to make the module enter ADB mode. Then customers can use USB ADB interface for test.

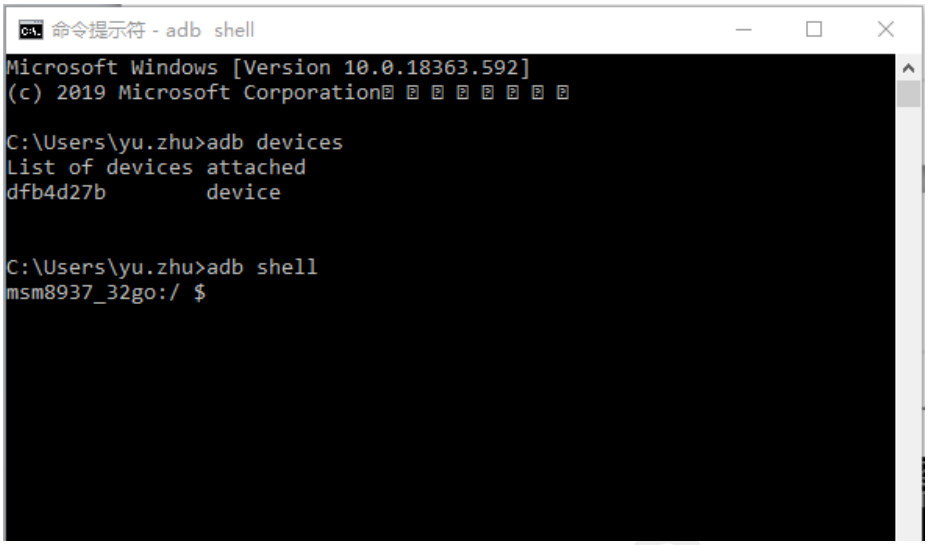

Figure 43: “adb shell” Command

5.2.2 Communication via UART Interface

1. Connect the UART interface to the PC and then power on the module

2. Install the USB-to-RS232 driver. After that, the USB serial port number can be viewed through the PC Device Manager, shown as the following figure.

Enhanced COM port supports hardware flow control.

Standard COM port is a 3-line UART port.

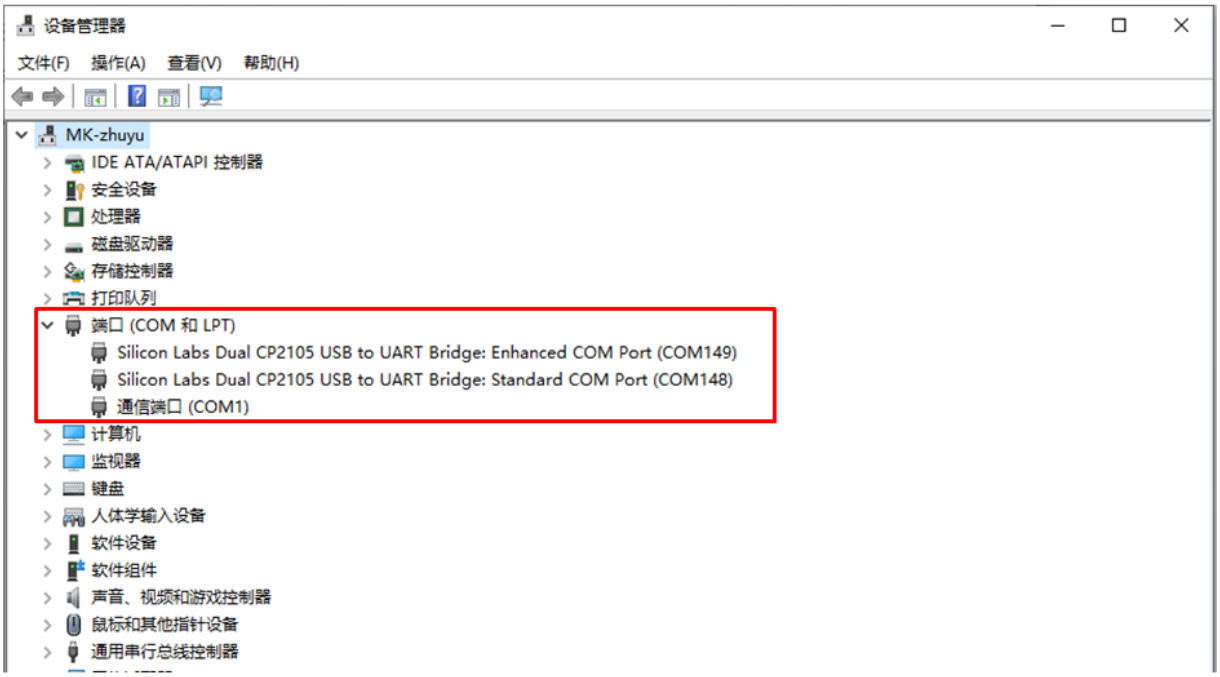

Figure 44: USB Serial Port

3.Then use the serial port tool to use the serial port to achieve related functions

5.3 Firmware Upgrade

TELIT modules upgrade firmware via USB port by default. Please follow the procedures below to upgrade firmware.

1. Install and open the firmware upgrade tool QFIL on PC and then power on the smart module according to the procedures mentioned in Chapter 5.1.
2. Click the "**Select Port**" and select the USB port "**SimTech HS-USB MDM Diagnostics 90B8 (COM142)**".
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.

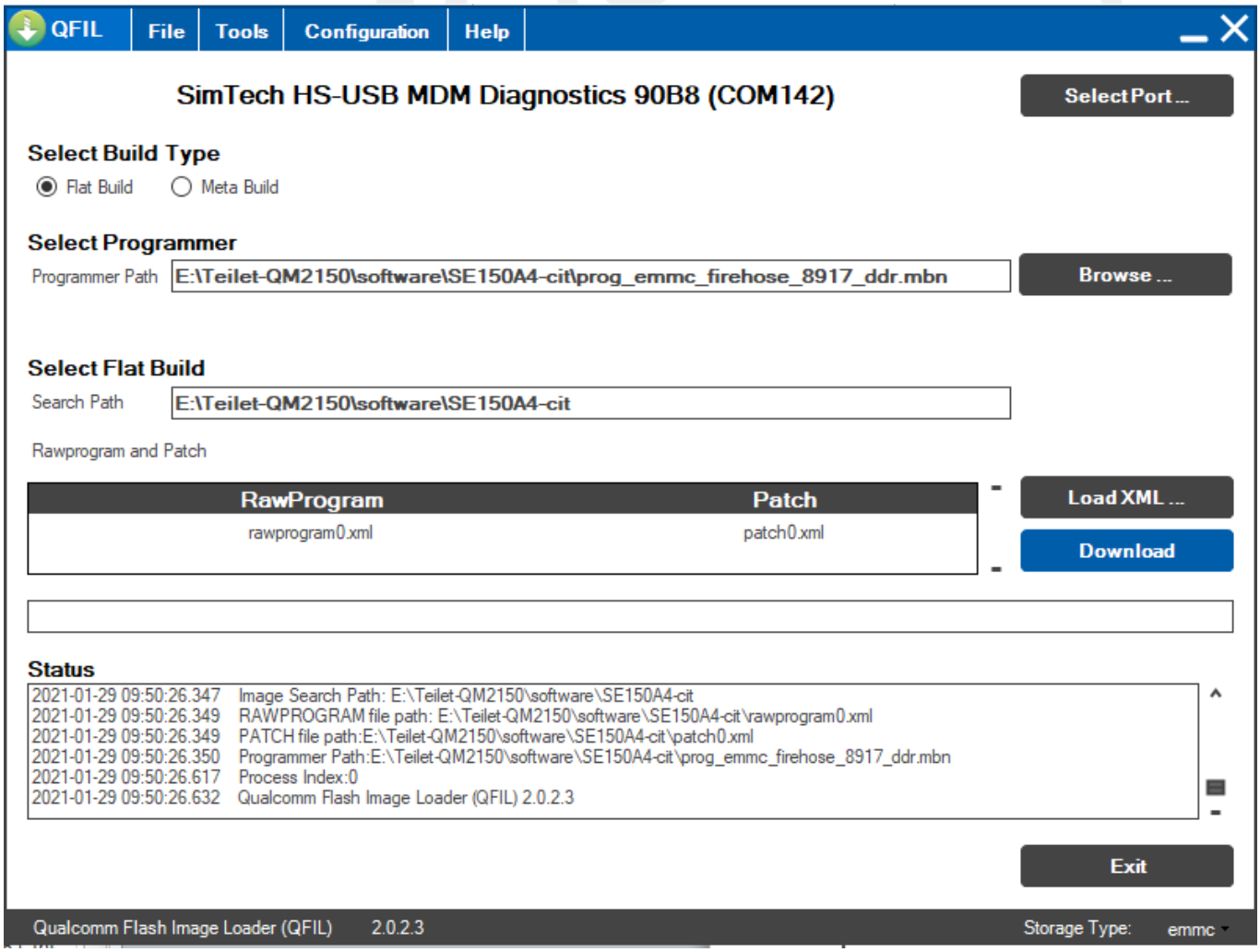

Figure 45: Firmware Upgrade Steps

5.4 Power OFF Smart Modules

There are two methods to power off the module.

The steps for the first method are as follows:

1. Press S701 (PWRKEY) for at least 1s under the power-on state of the module, and then LCD will display a menu for selection
2. Choose “Power off” option.
3. The module will be powered off normally.

The other method is to press down PWRKEY for at least 8s until the module is shut down completely

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6. Appendix References

6.1 References

Table 15: Related Documents

SN	Document name	Remark
[1]	SE150A4_Hardware_Design_V1.01	SE150A4 series hardware design

6.2 Terms and Abbreviations

Table 16: Terms and Abbreviations

Abbreviation	Description
ALS	Ambient Light Sensor
CMOS	Complementary Metal Oxide Semiconductor
ECM	Electret Microphone
SE150A4 EVB	SE150A4 Evaluation Board
LCM	LCD Module
LED	Light Emitting Diode
MEMS	Micro-Electro-Mechanical System
MIPI	Mobile Industry Processor Interface
OTG	On-The-Go
PC	Personal Computer
PS	Proximity Sensor
PWM	Pulse Width Modulation
UART	Universal Asynchronous Receiver & Transmitter
USB	Universal Serial Bus
(U)SIM	(Universal) Subscriber Identity Module
WLED	White LED
ZIF	Zero Insert Force

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6.3 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 SIM8950 module. Manufacturers of the cellular terminal should send the following safety information to customs and operating personnel, and incorporate these guidelines into all manuals supplied with the product. If not so, Telit assumes no liability for customers' failure to comply with these precautions.

Table 17: Safety Caution

Marks	Requirements
	When in a hospital or other health care facility, observe the restrictions about the use of mobiles. Switch the cellular terminal or mobile off, medical equipment may be sensitive and not operate normally due to RF energy interference.
	Switch off the cellular terminal or mobile before boarding an aircraft. Make sure it is switched off. The operation of wireless appliances in an aircraft is forbidden to prevent interference with communication systems. Forgetting to think much of these instructions may impact the flight safety, or offend local legal action, or both.
	Do not operate the cellular terminal or mobile in the presence of flammable gases or fumes. Switch off the cellular terminal when you are near petrol stations, fuel depots, chemical plants or where blasting operations are in progress. Operation of any electrical equipment in potentially explosive atmospheres can constitute a safety hazard.
	Your cellular terminal or mobile receives and transmits radio frequency energy while switched on. RF interference can occur if it is used close to TV sets, radios, computers or other electric equipment.
	Road safety comes first! Do not use a hand-held cellular terminal or mobile when driving a vehicle, unless it is securely mounted in a holder for hands free operation. Before making a call with a hand-held terminal or mobile, park the vehicle.
	GSM cellular terminals or mobiles operate over radio frequency signals and cellular networks and cannot be guaranteed to connect in all conditions, especially with a mobile fee or an invalid SIM card. While you are in this condition and need emergent help, please remember to use emergency calls. In order to make or receive calls, the cellular terminal or mobile must be switched on and in a service area with adequate cellular signal strength. Some networks do not allow for emergency call if certain network services or phone features are in use (e.g. lock functions, fixed dialing etc.). You may have to deactivate those features before you can make an emergency call. Also, some networks require that a valid SIM card be properly inserted in the cellular terminal or mobile.