HUAWEI ME906s LTE M.2 Module

Hardware Guide

Issue 04
Date 2017-12-11

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About This Document

Revision History

Document Version	Date	Chapter	Descriptions
01	2015-06-10		Creation
02	2015-07-23	2.2	Updated dimensions in Table 2-1 Features
		3.4.2	Updated the maximum value of the pull-up resistor
		4.3.1	Updated the test instrument
		4.4.2	Updated Table 4-4 Conducted Tx power
		5.4.1	Updated Table 5-4 Requirements for input current
		5.5	Updated test duration of temperature cycle in Table 5-10 Test conditions and results of the reliability
		6.2	Updated the dimensions
03	2017-06-23	9.13.1	Updated section 9.13.1 EU Regulatory Conformance
04	2017-12-11		Deleted privacy policy

Contents

1 Introduction

This document describes the hardware application interfaces and air interfaces that are provided when HUAWEI ME906s LTE M.2 Module (hereinafter referred to as the ME906s module) is used.

M.2 is the new name for NGFF (Next Generation Form Factor), which is the specification of PCI-SIG (Peripheral Component Interconnect Special Interest Group).

This document helps you to understand the interface specifications, electrical features and related product information of the ME906s module.

2 Overall Description

2.1 About This Chapter

This chapter gives a general description of the ME906s module and provides:

- Function Overview
- Circuit Block Diagram

2.2 Function Overview

Table 2-1 Features

Feature	Description
Physical Features	Dimensions (L × W × H): 42 mm × 30 mm × 2.22 mm Weight: about 6 g
Operating Bands	FDD LTE: Band 1, Band 2, Band 3, Band 5, Band 7, Band 8, Band 20, Band 28, all bands with diversity WCDMA/HSDPA/HSUPA/HSPA+: Band 1, Band 2, Band 5, Band 8, all bands with diversity GSM/GPRS/EDGE: 850 MHz/900 MHz/1800 MHz/1900 MHz GPS/GLONASS: L1
Operating Temperature	Normal operating temperature: –10°C to +55°C Extended operating temperature[1]: –20°C to +70°C
Storage Temperature	–40°C to +85°C
Power Voltage	3.135 V to 4.4 V (3.3 V is typical)
Application Interface (75-pin Gold Finger)	USIM (3.0 V or 1.8 V)
	USIM_DET pin (USIM Hot Swap Detection)
	USB 2.0 (High-Speed)

Feature	Description
	Power_On_Off pin
	RESET# pin
	LED# pin
	W_DISABLE# pin
	GPS_DISABLE# pin
	Tunable Antenna control (4 GPIOs)
	Wake_On_WWAN# pin
	BodySAR_N pin
	Power supply (5 pins)
Antenna Connectors	MAIN and AUX (supports Diversity and GPS simultaneously)
SMS	Supports MO and MT Supports formats of PDU Point-to-point and cell broadcast
Data Services	GPRS: DL 85.6 kbit/s; UL 85.6 kbit/s
	EDGE: DL 236.8 kbit/s; UL 236.8 kbit/s
	WCDMA CS: DL 64 kbit/s; UL 64 kbit/s
	WCDMA PS: DL 384 kbit/s; UL 384 kbit/s
	HSPA+: DL 21.6 Mbit/s; UL 5.76 Mbit/s
	DC-HSPA+: DL 42 Mbit/s; UL 5.76 Mbit/s
	LTE FDD: DL 150 Mbit/s; UL 50 Mbit/s @20M BW cat3
Operating System	Windows 7/8/8.1/10, Android 4.0 or later

NOTE

[1]: When the ME906s module works at –20°C to –10°C or +55°C to +70°C, **NOT** all its RF specifications comply with the 3GPP specifications.

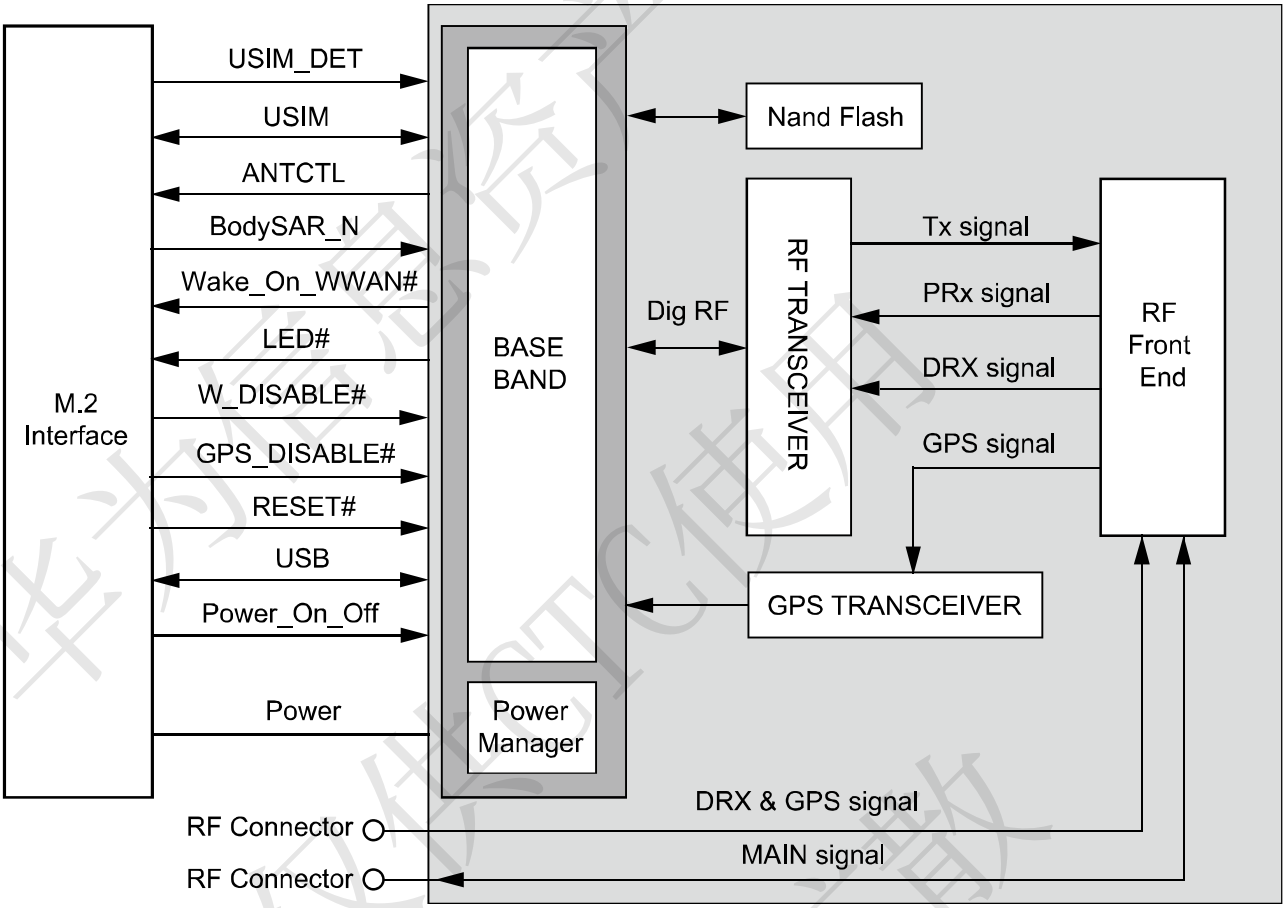
2.3 Circuit Block Diagram

The ME906s module is developed based on Huawei's Balong Hi6921M platform. Figure 2-1 shows the circuit block diagram of the ME906s module. The application block diagram and major functional units of the ME906s module contain the following parts:

- Baseband controller

- Power manager
- Nand Flash
- Radio Frequency (RF) transceiver
- RF Front End

Figure 2-1 Circuit block diagram



3 Description of the Application Interfaces

3.1 About This Chapter

This chapter mainly describes the application interfaces of the ME906s module, including:

- 75-pin Gold Finger
- Power Interface
- Signal Control Interface
- USB Interface
- USIM Card Interface
- Tunable Antenna Control
- Config Pins
- Reserved Pins
- NC Pins
- RF Antenna Interface

3.2 75-pin Gold Finger

The ME906s module uses a 75-pin Gold Finger as its external interface. For details about the module dimensions, see 6.2 Dimensions.

Figure 3-1 shows the sequence of pins on the 75-pin signal interface of the ME906s module.

Figure 3-1 TOP view of gold finger interface pins

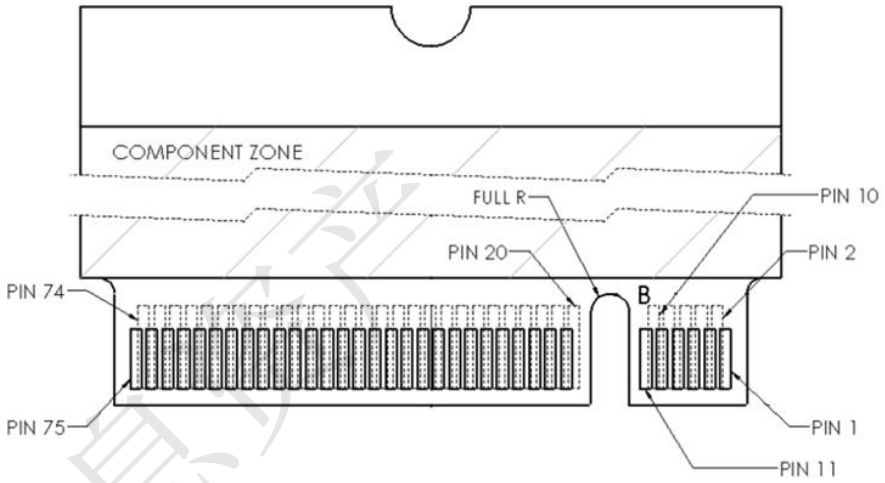


Table 3-1 shows the definitions of the 75-pin interface (67 for signals and 8 for notch) of the ME906s module.

As M.2 Nomenclature, ME906s is Type 3042-S3-B (30 mm × 42 mm, Max. Component Height on Top is 1.5 mm and single-sided, Key ID is B).

Module Nomenclature

Type XX XX - XX - X - X*

Width (mm)
12
16
22
30

Length (mm)
16
26
30
38
42
60
80
110

	Component Max Ht(mm)	
	T Max**	B Max**
S1	1.2	0τ
S2	1.35	0τ
S3	1.5	0τ
D1	1.2	1.35
D2	1.35	1.35
D3	1.5	1.35
D4	1.5	0.7
D5	1.5	1.5

Key ID	Pin	Interface
A	8-15	PCIe x2 / USB / I2C / DP x4
B	12-19	PCIe x2 / SATA / USB / PCM / IUM / SSIC / UART-I2C
C	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	PCIe / USB / I2C-ME / SDIO / UART / PCM
F	28-35	Future Memory Interface (FMI)
G	39-46	Generic (Not used for M.2)^
H	43-50	Reserved for Future Use
J	47-54	Reserved for Future Use
K	51-58	Reserved for Future Use
L	55-62	Reserved for Future Use
M	59-66	PCIe x4 / SATA

* Use ONLY when a double slot is being specified
** Label included in height dimension
^ Key G is designed for Non-M.2 compliant devices. Intended for custom use. Use at your own risk!
τ Insulating label allowed on connector-based designs

Table 3-1 Definitions of pins on the M.2 interface

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
1	CONFIG_3	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.
2	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
3	Ground	PI	Ground	-	-	0	-	-
4	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
5	Ground	PI	Ground	-	-	0	-	-
6	Power_On_Off	I	A single control to turn On/Off WWAN. When it is Low, WWAN is powered off. When it is High, WWAN is powered on. It is internally pulled to Low. It is 3.3 V tolerant but can be driven by either 1.8 V or 3.3 V GPIO.	V_{IH}	1.26	-	3.6	The module is pulled down inside by a 1 MΩ resistor.
				V_{IL}	–0.3	-	0.3	
7	USB_D+	I/O	USB Data + defined in the USB 2.0 specification	-	-	-	-	-
8	W_DISABLE#	I	WWAN disable function When it is High, WWAN function is determined by software AT command. Default enabled. When it is Low, WWAN function will be turned off.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
9	USB_D-	I/O	USB Data - defined in the USB 2.0 specification	-	-	-	-	-
10	LED#	O	It is an open drain, active low signal, used to allow the M.2 card to provide status indicators via LED devices that will be provided by the host.	V_{OL}	0	-	0.48	The maximum I_{OL} is 40 mA.
11	Ground	PI	Ground	-	-	0	-	-
12	Notch	-	-	-	-	-	-	-
13	Notch	-	-	-	-	-	-	-

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
14	Notch	-	-	-	-	-	-	-
15	Notch	-	-	-	-	-	-	-
16	Notch	-	-	-	-	-	-	-
17	Notch	-	-	-	-	-	-	-
18	Notch	-	-	-	-	-	-	-
19	Notch	-	-	-	-	-	-	-
20	Reserved	-	Reserved for future use, please keep it not connected in the host side.	-	-	-	-	-
21	CONFIG_0	O	Not Connected internally.	-	-	-	-	The module is configured as WWAN-SSIC 0.
22	Reserved	-	Reserved for future use, please keep it not connected in the host side.	-	-	-	-	-
23	Wake_On_WWAN#	O	It is open drain and active low. WWAN to wake up the host.	V_{OL}	0	-	0.48	The maximum I_{OL} is 40 mA.
24	Reserved	-	Reserved for future use, please keep it not connected in the host side.	-	-	-	-	-
25	BodySAR_N	I	Hardware pin for BodySAR detection. When it is High, No TX power backoff (default). When it is Low, TX power backoff.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
26	GPS_DISABLE#	I	GPS disable function When it is High, GPS function is determined by software AT command. When it is Low, GPS is turned off.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
27	Ground	PI	Ground	-	-	0	-	-
28	Reserved	-	Reserved for future use, please keep it not connected in the host side.	-	-	-	-	-

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
29	NC	-	Not Connected	-	-	-	-	-
30	USIM_RESET	O	USIM Reset	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR=1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	
31	NC	-	Not Connected	-	-	-	-	-
32	USIM_CLK	O	USIM Clock	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR=1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	
33	Ground	PI	Ground	-	-	0	-	-
34	USIM_DATA	I/O	USIM DATA	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR=1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	
				V_{IH}	0.7 x USIM_PWR	-	3.3	
				V_{IL}	0	-	0.2 x USIM_PWR	
35	NC	-	Not Connected	-	-	-	-	-
36	USIM_PWR	PO	USIM POWER	-	1.75	1.8	1.98	USIM_PWR=1.8 V
				-	2.75	3	3.3	USIM_PWR=3.0 V
37	NC	-	Not Connected	-	-	-	-	-

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
38	NC	-	Not Connected	-	-	-	-	-
39	Ground	PI	Ground	-	-	0	-	-
40	I2C_SCL	I/O	I2C clock, slave.	V_{IH}	1.26	1.8	2.1	The current firmware does not support this function.
				V_{IL}	–0.3	-	0.63	
41	NC	-	Not Connected	-	-	-	-	-
42	I2C_SDA	I/O	I2C data, slave.	V_{OH}	1.35	1.8	-	The current firmware does not support this function.
				V_{OL}	0	-	0.45	
				V_{IH}	1.26	1.8	2.1	
				V_{IL}	–0.3	-	0.63	
43	NC	-	Not Connected	-	-	-	-	-
44	I2C_IRQ	I	Interrupt signal to wake up the module.	V_{IH}	1.26	1.8	2.1	The current firmware does not support this function.
				V_{IL}	–0.3	-	0.63	
45	Ground	PI	Ground	-	-	0	-	-
46	SYSCLK	O	System clock output for external GNSS module.	V_{OH}	1.6	1.8	-	The current firmware does not support this function.
				V_{OL}	0	-	0.45	
47	NC	-	Not Connected	-	-	-	-	-
48	TX_BLANKING	O	TX blanking signal for external GNSS module.	V_{OH}	1.6	1.8	-	The current firmware does not support this function.
				V_{OL}	0	-	0.45	
49	NC	-	Not Connected	-	-	-	-	-
50	NC	-	Not Connected	-	-	-	-	-

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
51	Ground	PI	Ground	-	-	0	-	-
52	NC	-	Not Connected	-	-	-	-	-
53	NC	-	Not Connected	-	-	-	-	-
54	NC	-	Not Connected	-	-	-	-	-
55	NC	-	Not Connected	-	-	-	-	-
56	NC	-	Not Connected	-	-	-	-	-
57	Ground	PI	Ground	-	-	0	-	-
58	NC	-	Not Connected	-	-	-	-	-
59	ANTCTL0	O	Tunable antenna control signal, bit 0. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
60	COEX3	I/O	For coexistence.	V_{OH}	1.35	1.8	1.9	The current firmware does not support this function.
				V_{OL}	0	-	0.45	
				V_{IH}	1.26	1.8	2.1	
				V_{IL}	–0.3	-	0.63	
61	ANTCTL1	O	Tunable antenna control signal, bit 1. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
62	COEX_UART_RXD	I/O	UART transmit signal from other wireless coexistence solution to the module.	V_{OH}	1.35	1.8	1.9	-
				V_{OL}	0	-	0.45	-
				V_{IH}	1.26	1.8	2.1	-
				V_{IL}	–0.3	-	0.63	-
63	ANTCTL2	O	Tunable antenna control signal, bit 2. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
64	COEX_UART_TXD	I/O	UART transmit signal from the module to other wireless coexistence solution.	V_{OH}	1.35	1.8	1.9	-
				V_{OL}	0	-	0.45	-
				V_{IH}	1.26	1.8	2.1	-
				V_{IL}	–0.3	-	0.63	-
65	ANTCTL3	O	Tunable antenna control signal, bit 3. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
66	USIM_DET	I	USIM hot swap detection pin. Rising edge for insertion; falling edge for removal. When it is High, USIM is present. When it is Low, USIM is absent.	V_{IH}	1.26	1.8	2.1	The module is pulled up inside.
				V_{IL}	–0.3	-	0.3	
67	RESET#	I	System reset, active low.	V_{IH}	1.26	-	2.1	The module is pulled up inside.
				V_{IL}	–0.3	-	0.3	
68	NC	-	Not Connected	-	-	-	-	-
69	CONFIG_1	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.
70	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
71	Ground	PI	Ground	-	-	0	-	-
72	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
73	Ground	PI	Ground	-	-	0	-	-
74	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
75	CONFIG_2	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.

NOTE

- **I** indicates pins for digital signal input; **O** indicates pins for digital signal output; **PI** indicates power input pins; **PO** indicates power output pins.
- **V_{IL}**: Low-level Input voltage; **V_{IH}**: High-level Input voltage; **V_{OL}**: Low-level Output voltage; **V_{OH}**: High-level Output voltage.
- The **NC** pins are not connected, therefore, before you deal with these pins, please refer to the corresponding hardware guide.
- The **Reserved** pins are internally connected to the module. Therefore, these pins should not be used, otherwise they may cause problems. Please contact with us for more details about this information.

3.3 Power Interface

3.3.1 Overview

The power supply part of the ME906s module contains:

- 3.3V pin for the power supply
- USIM_PWR pin for USIM card power output

Table 3-2 lists the definitions of the pins on the power supply interface.

Table 3-2 Definitions of the pins on the power supply interface

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
2, 4, 70, 72, 74	3.3V	PI	Power supply	-	3.135	3.3	4.4	-
36	USIM_PWR	PO	USIM POWER	-	1.75	1.8	1.98	USIM_PWR=1.8 V
				-	2.75	3	3.3	USIM_PWR=3.0 V
3, 5, 11, 27, 33, 39, 45, 51, 57, 71, 73	Ground	PI	Ground	-	-	0	-	-

3.3.2 Power Supply 3.3V Interface

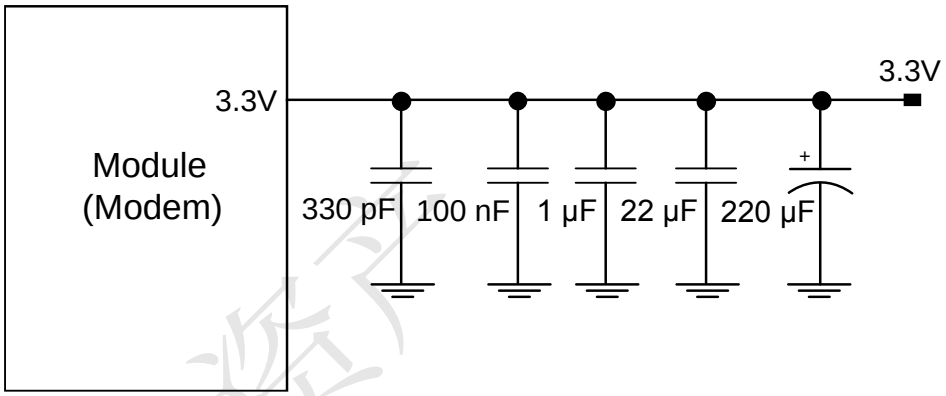
The ME906s module power is supplied through the 3.3V pins and the voltage ranges from 3.135 V to 4.4 V (typical value is 3.3 V). The ME906s provides 5 power pins and 11 GND pins. To ensure that the ME906s module works normally, all the pins must be connected. The M.2 connector pin is defined as that should support 500 mA/Pin continuously.

When the ME906s module works at GSM mode, the module transmits at the maximum power, the transient peak current may reach 2.5 A@3.3 V. In this case, the power pin voltage will drop. Make sure that the voltage does not drop below 3.135 V in any case.

The traces of the power supply should be as short and wide as possible. It is recommended that at least one 220 µF capacitance is added onto the 3.3V power rails and as close to the M.2 connector as possible. Customers can reduce the capacitance if it can be guaranteed that the 3.3V pin does not drop below 3.135 V in any case.

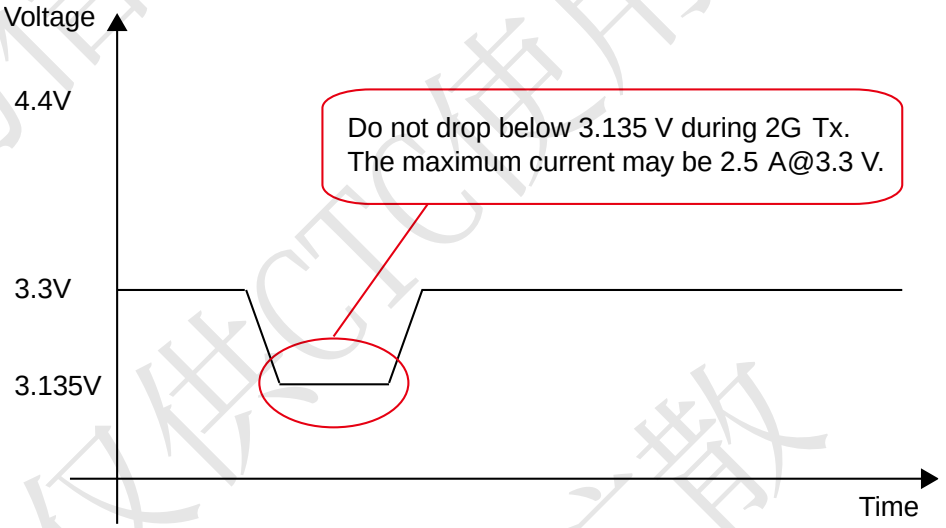
Figure 3-2 shows the recommended power circuit of ME906s module.

Figure 3-2 Recommended power circuit



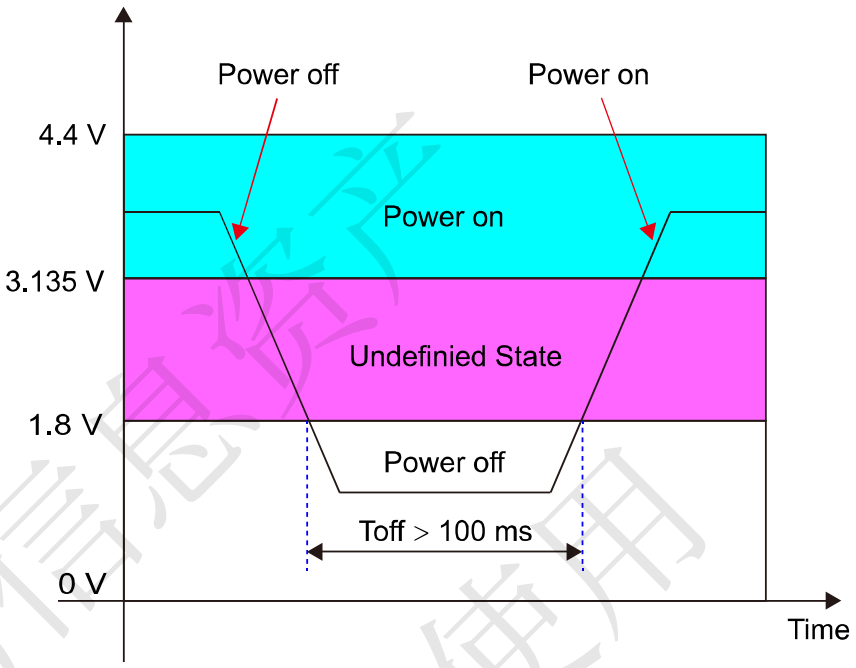
NOTE

3.135 V is the minimum voltage supplied to ME906s by the host, and 3.3V pin must never be under 3.135 V in any case, which is shown as the following figure.



If the customer wants to power cycle ME906s, the 3.3V pin must stay below 1.8 V for more than 100 ms. Figure 3-3 shows the power supply timing sequence between power cycling.

Figure 3-3 Power supply timing sequence between power cycling



Parameter	Remarks	Time (Min.)	Unit
T_{off}	Power off time	100	ms

3.3.3 USIM Power Output USIM_PWR

Through the USIM_PWR power supply interface, the ME906s module can supply 1.8 V or 3.0 V power to USIM card. The transient current can reach 200 mA, so special attention should be taken on PCB design at the host side.

3.4 Signal Control Interface

3.4.1 Overview

The signal control part of the interface in the ME906s module consists of the following:

- Power On/Off (Power_On_Off) pin
- Module reset (RESET#) pin
- LED control (LED#) pin
- WWAN disable control (W_DISABLE#) pin
- GPS disable control (GPS_DISABLE#) pin
- Wake signal out from module (Wake_On_WWAN#) pin

- BodySAR detection (BodySAR_N) pin
- USIM detection (USIM_DET) pin

Table 3-3 lists the pins on the signal control interface.

Table 3-3 Pins on the signal control interface

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
6	Power_On_Off	I	A single control to turn On/Off WWAN. When it is Low, WWAN is powered off. When it is High, WWAN is powered on. It is internally pulled to Low. It is 3.3 V tolerant but can be driven by either 1.8 V or 3.3 V GPIO.	V_{IH}	1.26	-	3.6	The module is pulled down inside by a 1MΩ resistor.
				V_{IL}	–0.3	-	0.3	
67	RESET#	I	System reset, active low.	V_{IH}	1.26	-	2.1	The module is pulled up inside.
				V_{IL}	–0.3	-	0.3	
10	LED#	O	It is an open drain, active low signal, used to allow the M.2 card to provide status indicators via LED devices that will be provided by the host.	V_{OL}	0	-	0.48	The maximum I_{OL} is 40 mA.
8	W_DISABLE#	I	WWAN disable function When it is High, WWAN function is determined by software AT command. Default enabled. When it is Low, WWAN function will be turned off.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
26	GPS_DISABLE#	I	GPS disable function When it is High, GPS function is determined by software AT command. When it is Low, GPS is turned off.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
23	Wake_On_WWAN#	O	It is open drain and active low. WWAN to wake up the host.	V_{OL}	0	-	0.48	The maximum I_{OL} is 40 mA.

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
25	BodySAR_N	I	Hardware pin for BodySAR Detection. When it is High, No TX power backoff (default). When it is Low, TX power backoff.	V_{IH}	1.26	-	3.6	-
				V_{IL}	–0.3	-	0.3	
66	USIM_DET	I	USIM hot swap detection pin. Rising edge for insertion; falling edge for removal. When it is High, USIM is present. When it is Low, USIM is absent.	V_{IH}	1.26	1.8	2.1	The module is pulled up inside.
				V_{IL}	–0.3	-	0.3	

3.4.2 Power_On_Off Control Pin

The ME906s module can be controlled to be powered on/off by the Power_On_Off pin.

Table 3-4 Two States of Power_On_Off

Item.	Pin state	Description
1	High	The module is powered on. **NOTE: If the module needs to be powered on automatically, the Power_On_Off pin must be pulled up to 3.3 V.**
2	Low	The module is powered off. **It is internally pulled low with a weak pull-down resistor.**

If the module is powered by the regulator with 3.3 V

If ME906s is powered by 3.3 V voltage regulator (such as notebook or Ultrabook), Power_On_Off should be pulled up to 3.3 V through a resistor.

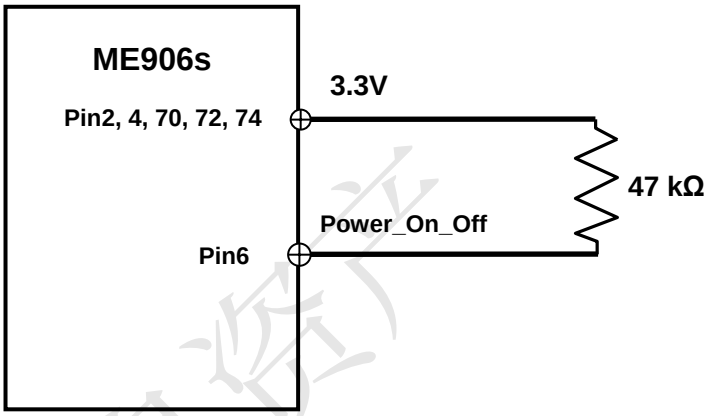
The pull-up resistor should be **not greater than 47 kΩ**.

Following is the power on/off sequence:

1. The module gets 3.3 V when supply for the module is switched on.
2. The module is turned on since Power_On_Off is pulled up to 3.3 V by the host.
3. Host cuts off 3.3 V supply to power off the module.

The recommended circuit is shown as in Figure 3-4 .

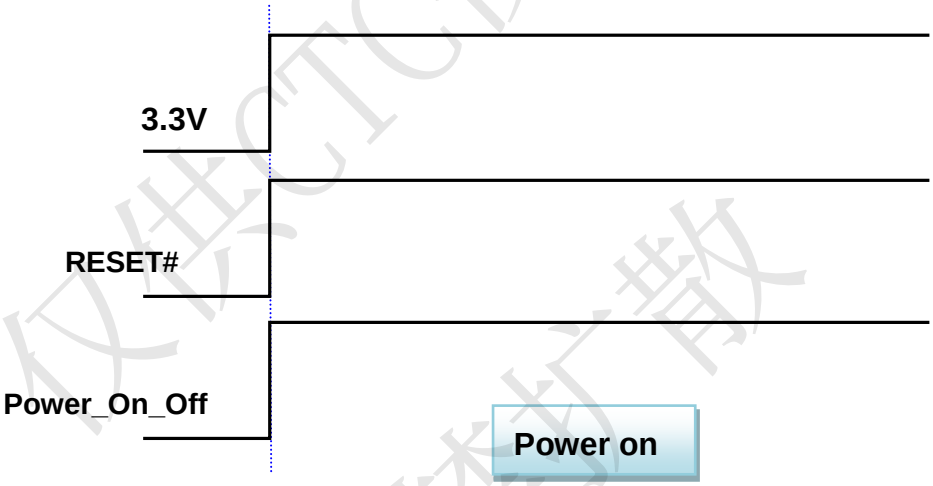
Figure 3-4 Recommended connections of Power_On_Off pin (auto power)



- Power on sequence

Do not toggle RESET# during power on sequence. Pulling RESET# low will extend time for module startup. Recommended power on timing sequence is shown as Figure 3-5 .

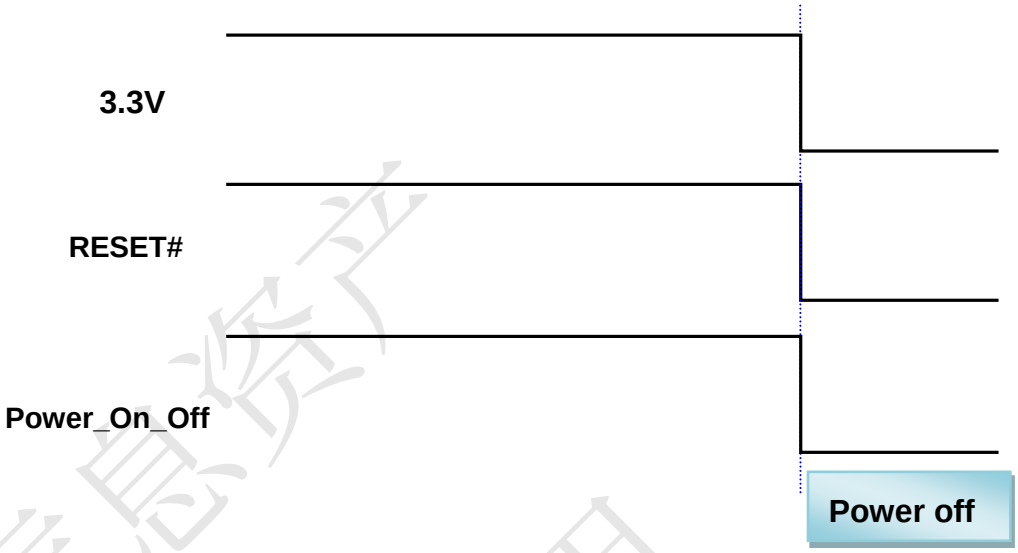
Figure 3-5 Recommended power on timing sequence



- Power off sequence

Cutting off 3.3 V will power off the module.

Figure 3-6 Recommended power off timing sequence (cut off 3.3 V)



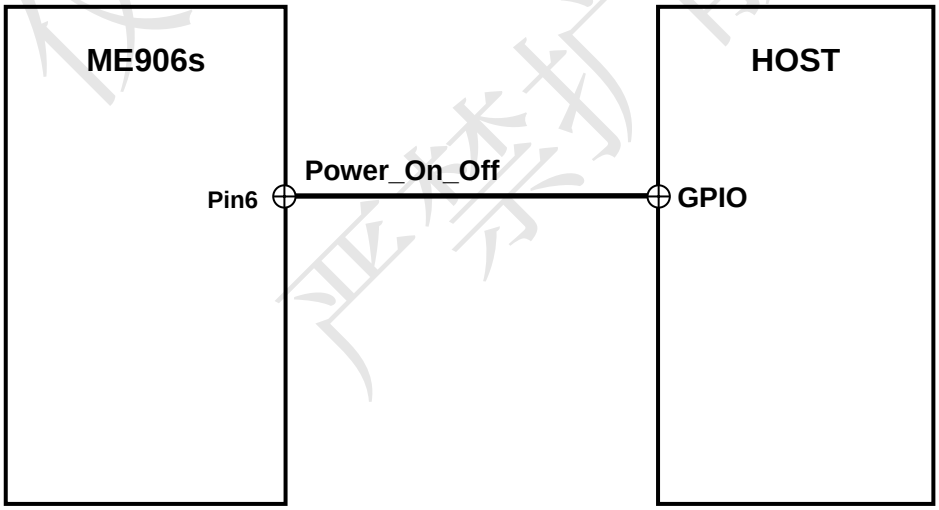
If ME906s is powered directly to battery

For use case ME906s is connected directly to battery, such as tablet platforms, Power_On_Off should be controlled by a GPIO from the host to control ME906s to be powered on/off.

It is critical to make sure the module is safely shut off when the tablet SoC is shut off. There will be current leakage if the module is not shut off properly. So it is important to keep Power_On_Off logic low for more than **500 ms** to shut off the module.

The recommended connection is shown as Figure 3-7 .

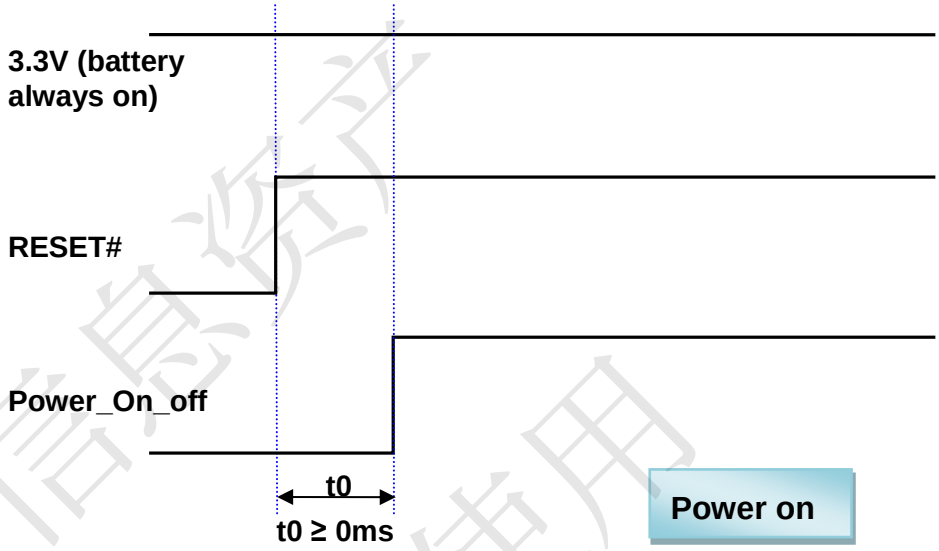
Figure 3-7 Recommended connection of Power_On_Off pin (control)



- Power on sequence

Do not toggle RESET# during power on sequence, pulling RESET# low will extend time for module startup. The recommended power on timing sequence is shown as Figure 3-8 .

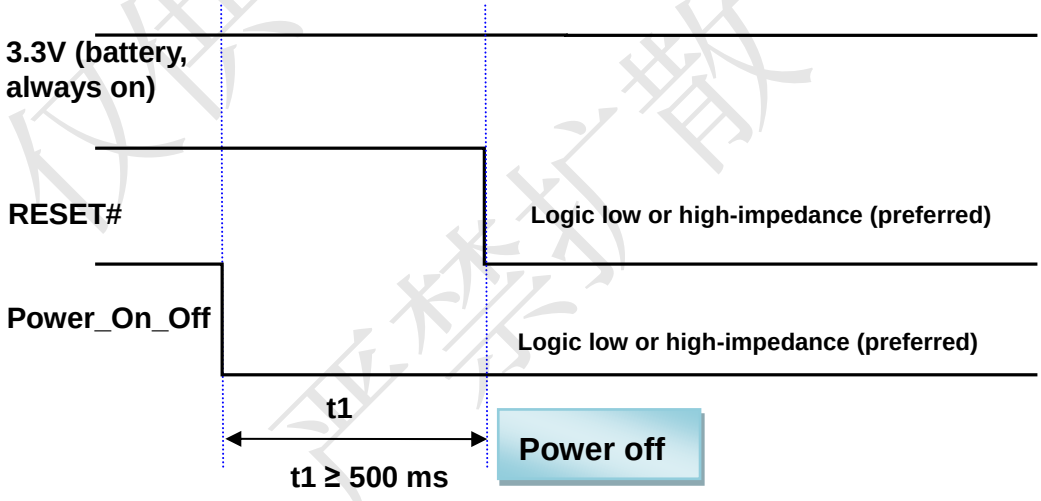
Figure 3-8 Recommended power on timing sequence



- Power off sequence

Keep Power_On_Off logic low for more than 500 ms to shut off the module.

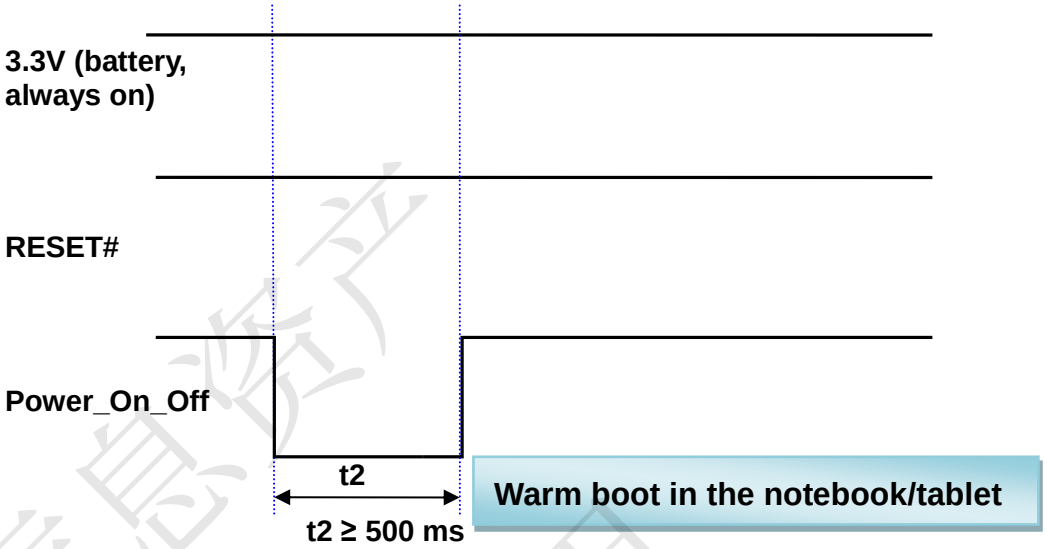
Figure 3-9 Recommended power off timing sequence (connect to battery)



- Warm boot (restart) sequence

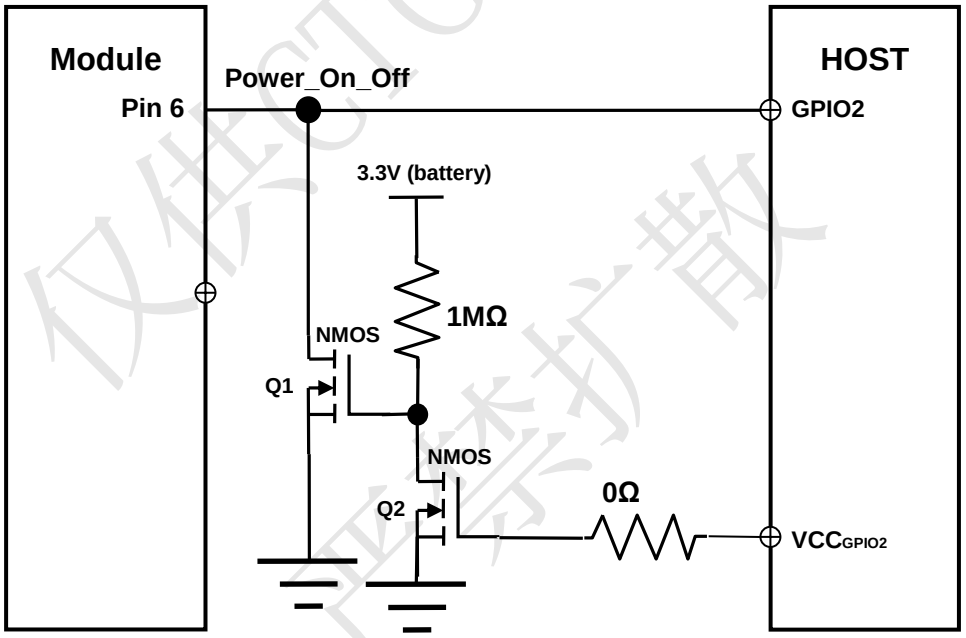
In the notebook/tablet when using the warm boot, the followed sequence is recommended.

Figure 3-10 Recommended warm boot timing in the notebook/tablet



If there is a limitation on the controlling GPIO to be programmable 500 ms, the hardware solution as shown in Figure 3-11 can be used.

Figure 3-11 Power on off circuit (hardware solution)



VCC$_{GPIO2}$ is the power domain of the GPIO2.
When **VCC**$_{GPIO2}$ is **ON**, Q2 is on and Q1 is off. So the Pin 6 is controlled by GPIO2 of host.
When **VCC**$_{GPIO2}$ is **Off**, Q2 is off and Q1 is on. So the Pin 6 is pulled low, then the module is powered off.

3.4.3 RESET# Pin

The ME906s module can be reset through the RESET# pin asynchronous, active low. Whenever this pin is active, the module will immediately be placed in a Power On reset condition. Care should be taken for this pin unless there is a critical failure and all other methods of regaining control and/or communication with the WWAN sub-system have failed.

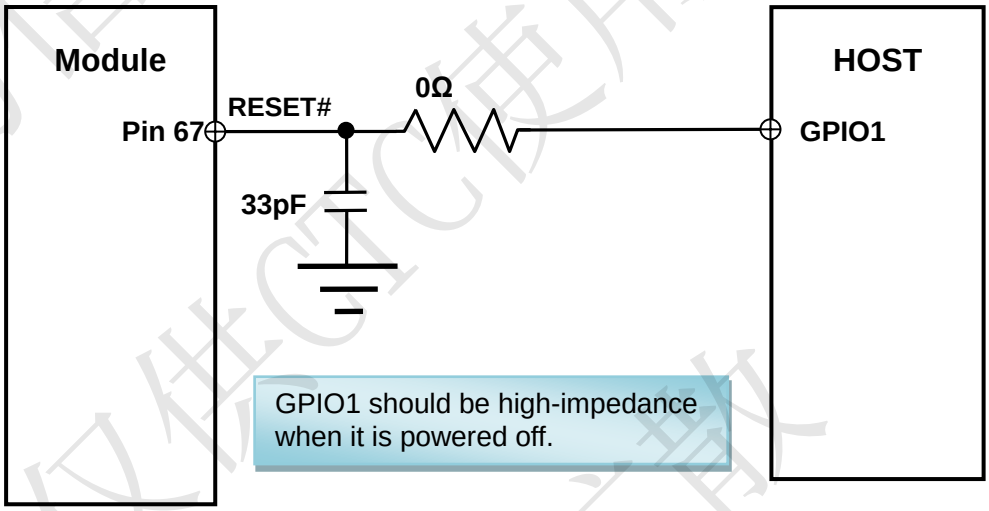
Pulling low RESET# more than **20 ms** and then pulling high will reset the module.

RESET# is optional, which can be not connected. Pulling low Power_On_Off for more than **500 ms and then pulling high** can also work as a reset.

RESET# is internally pulled up to 1.8 V, which is automatically on when 3.3 V is applied even though Power_On_Off is low. Cautions should be taken on circuit design or else there may be back driving issue.

Hardware circuit for RESET# (option 1)

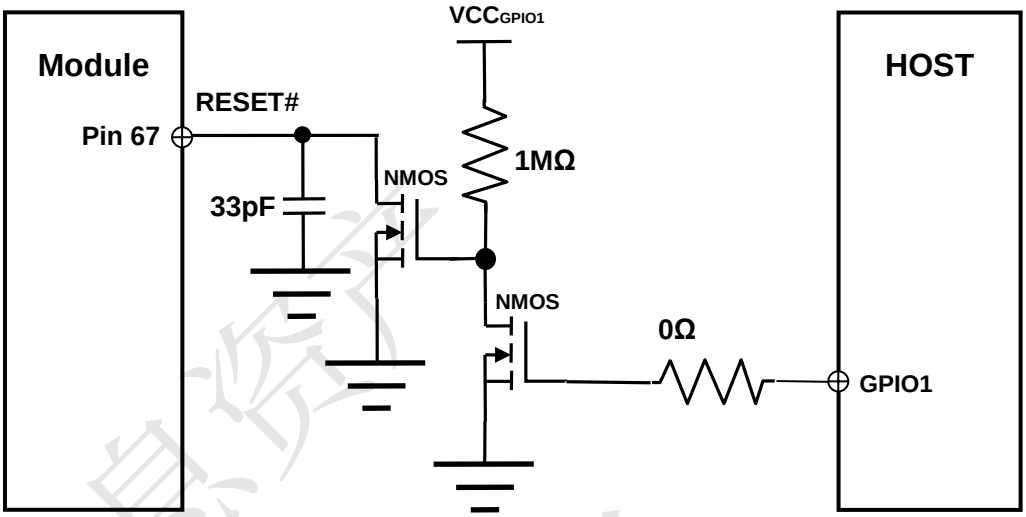
GPIO is high-impedance when the host is powered off.



Hardware circuit for RESET# (option 2)

GPIO is not high-impedance when the host is powered off.

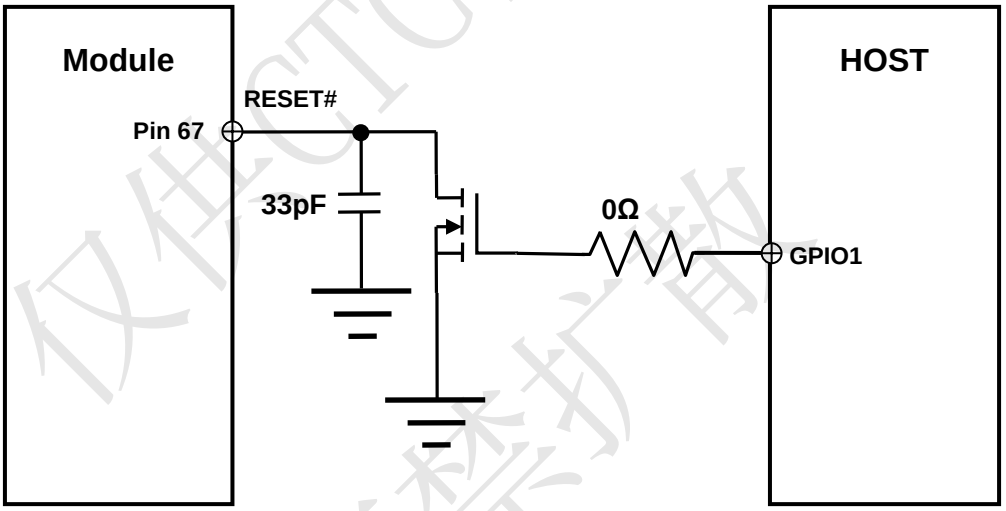
Use 2 N-MOSFET so that the logic of RESET# and GPIO are the same.



Hardware circuit for RESET# (option 3)

GPIO is not high-impedance when the host is powered off.

Use only one N-MOSFET, in this case the logic of RESET# and GPIO1 is reversed.



CAUTION

- As the RESET# signal is relatively sensitive, it is recommended to install a 33 pF capacitor near to the M.2 pin.
- **Triggering the RESET# signal will lead to loss of all data in the module. It will also disconnect the module from the network resulting in a call drop.**

3.4.4 LED# Pin

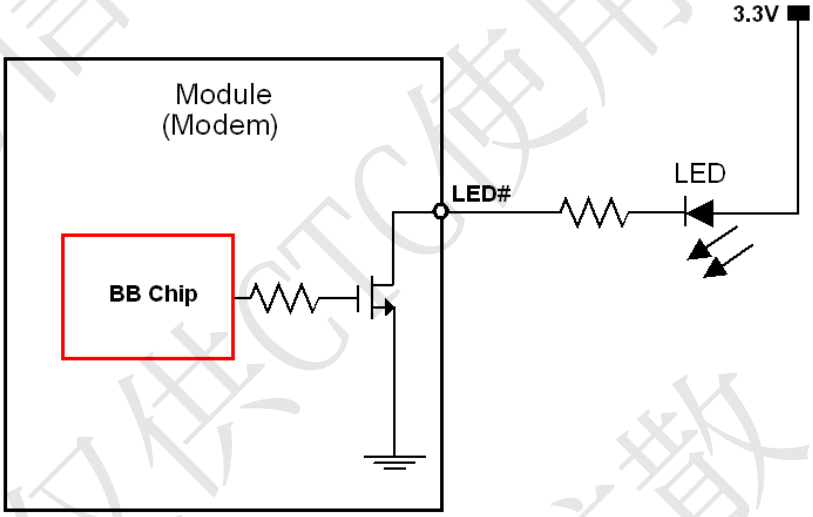
ME906s provides an open drain signal to indicate the RF status.

Table 3-5 State of the LED# pin

No.	Operating Status	LED#
1	RF function is turned on	Output Low, current sink
2	RF function is turned off	Output High

Figure 3-12 shows the recommended circuits of the LED# pin. The brightness of LED can be adjusted by adjusting the resistance of the series resistor, and the maximum sink current is 40 mA.

Figure 3-12 Driving circuit



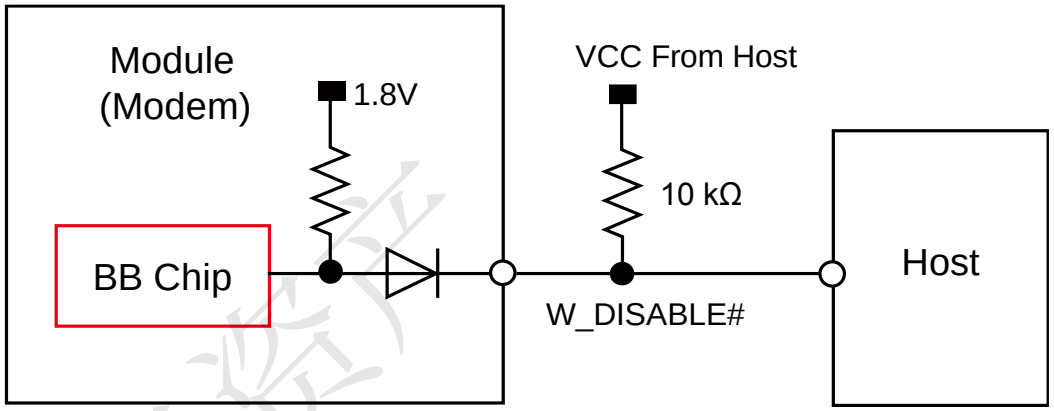
3.4.5 W_DISABLE# Pin

ME906s provides a hardware pin (W_DISABLE#) to disable or enable the radio. In addition, the radio can also be enabled or disabled through software AT commands.

Table 3-6 Function of the W_DISABLE# pin

No.	W_DISABLE#	Function
1	Low	WWAN function will be turned off.
2	High	WWAN function is determined by software AT command. Default enabled.
3	Floating	WWAN function is determined by software AT command. Default enabled.

Figure 3-13 Connections of the W_DISABLE# pin



CAUTION

It is recommended not to add a diode on the W_DISABLE# pin outside the module.

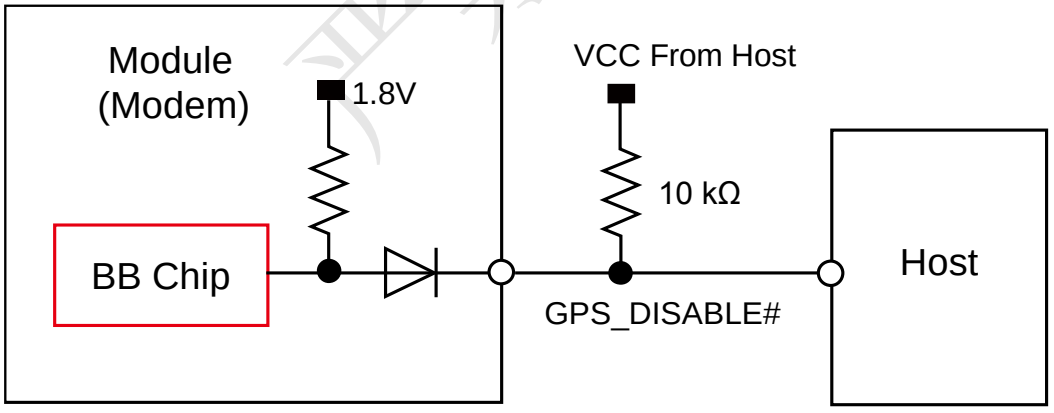
3.4.6 GPS_DISABLE# Pin

ME906s provides a hardware pin (GPS_DISABLE#) to disable or enable the GPS. In addition, the GPS can also be enabled or disabled through software AT commands.

Table 3-7 Function of the GPS_DISABLE# pin

No.	GPS_DISABLE#	Function
1	Low	GPS function is disabled.
2	High	GPS function is determined by software AT command. Default enabled.
3	Floating	GPS function is determined by software AT command. Default enabled.

Figure 3-14 Connections of the GPS_DISABLE# pin



CAUTION

It is recommended not to add a diode on the GPS_DISABLE# pin outside the module.

3.4.7 Wake_On_WWAN# Pin

ME906s provides an open drain output Wake_On_WWAN# pin to wake up the host, which is low active.

Figure 3-15 Wave form of the Wake_On_WWAN# pin

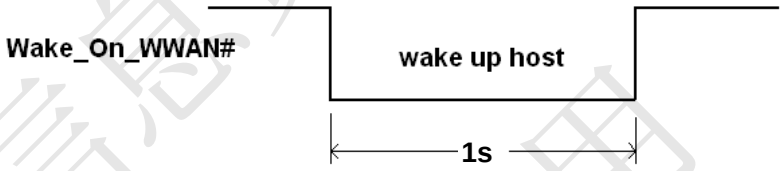
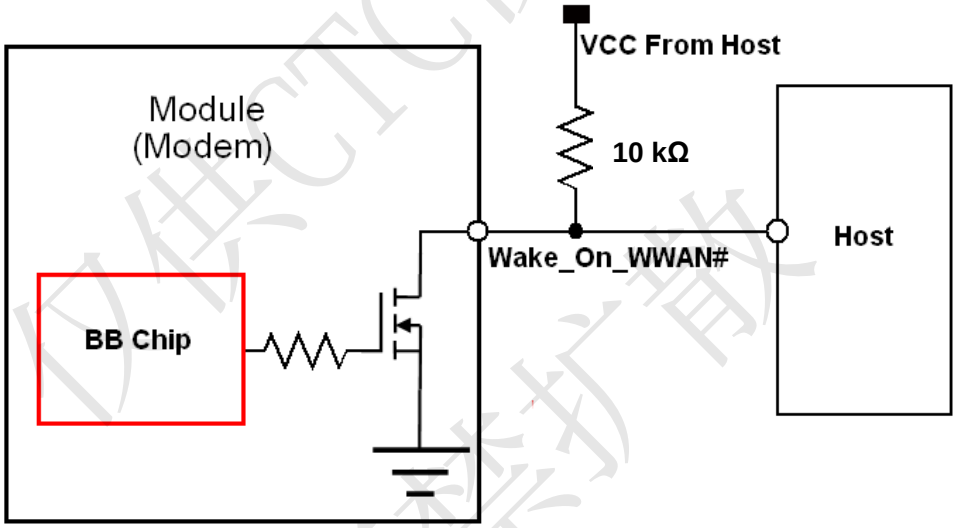


Figure 3-16 Connections of the Wake_On_WWAN# pin



3.4.8 BodySAR_N Pin

ME906s provides an input pin BodySAR_N for BodySAR detection.

Table 3-8 Function of the BodySAR_N pin

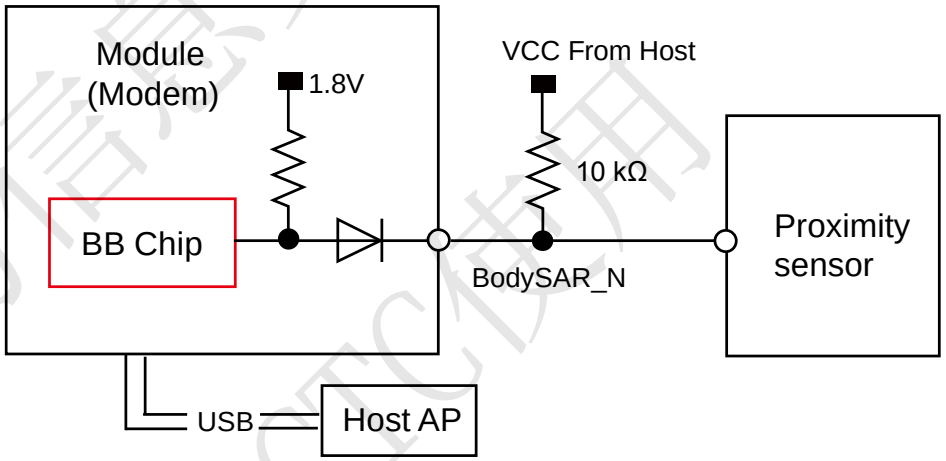
No.	BodySAR_N	Function
1	Low	Max. TX power will be backed off by setting through AT command.

No.	BodySAR_N	Function
2	High	Max. TX power will **NOT** be backed off (default).
3	Floating	Max. TX power will **NOT** be backed off.

If BodySAR_N pin is used to monitor the proximity sensor output directly, there are some essential preconditions for this hardware solution.

ME906s cannot provide any control signal for the proximity sensor, and any control or programming required by the proximity sensor should be handled by the host side.

Figure 3-17 Connections of the BodySAR_N pin



CAUTION

It is recommended not to add a diode on the BodySAR_N pin outside the module.

3.4.9 USIM_DET Pin

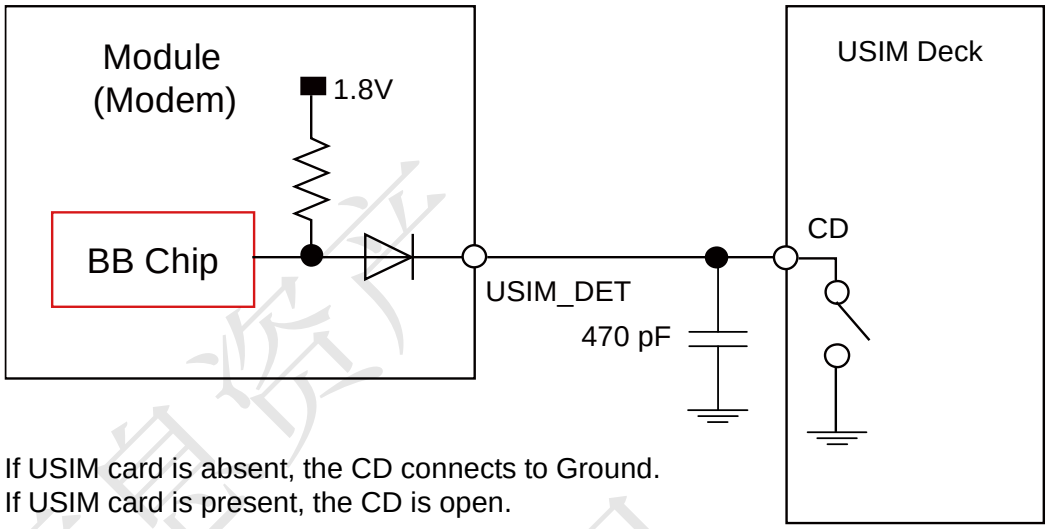
ME906s supports USIM hot swap function.

ME906s provides an input pin (USIM_DET) to detect whether the USIM card is present or not. This pin is a level trigger pin.

Table 3-9 Function of the USIM_DET pin

No.	USIM_DET	Function
1	High level	USIM card insertion. If the USIM card is present, USIM_DET should be High.
2	Low level	USIM card removal. If the USIM card is absent, USIM_DET should be Low.

Figure 3-18 Connections of the USIM_DET pin



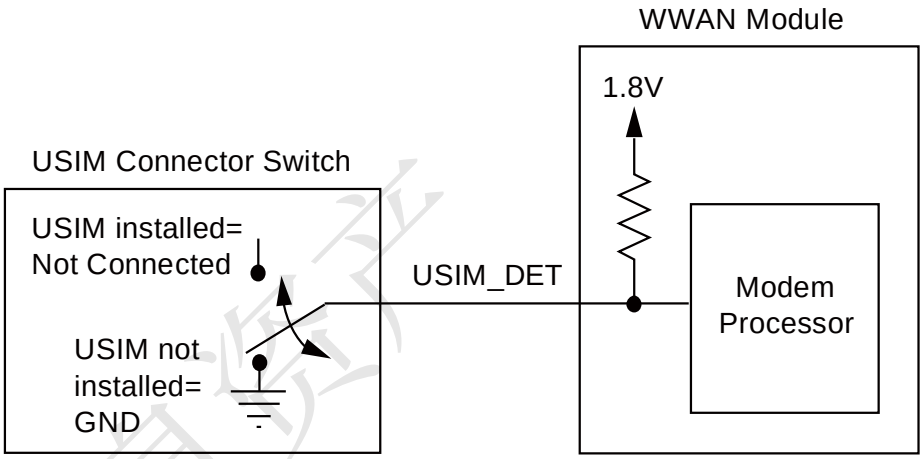
If USIM card is absent, the CD connects to Ground.
If USIM card is present, the CD is open.

CD is a pin detecting of USIM in the USIM socket, in normal, there will be a detect pin in the USIM socket.

CAUTION

- It is recommended not to add a diode on the USIM_DET pin outside the module.
- The normal SHORT USIM connector should be employed. The logic of USIM_DET is shown as Figure 3-19 . High represents that USIM is inserted; Low represents that USIM is removed.
- When USIM is inserted (hot), USIM_DET will change from Low to High;
- When USIM is removed (hot), USIM_DET will change from High to Low;
- The module will detect the level of USIM_DET to support the hot swap.

Figure 3-19 Logic of USIM_DET



3.5 USB Interface

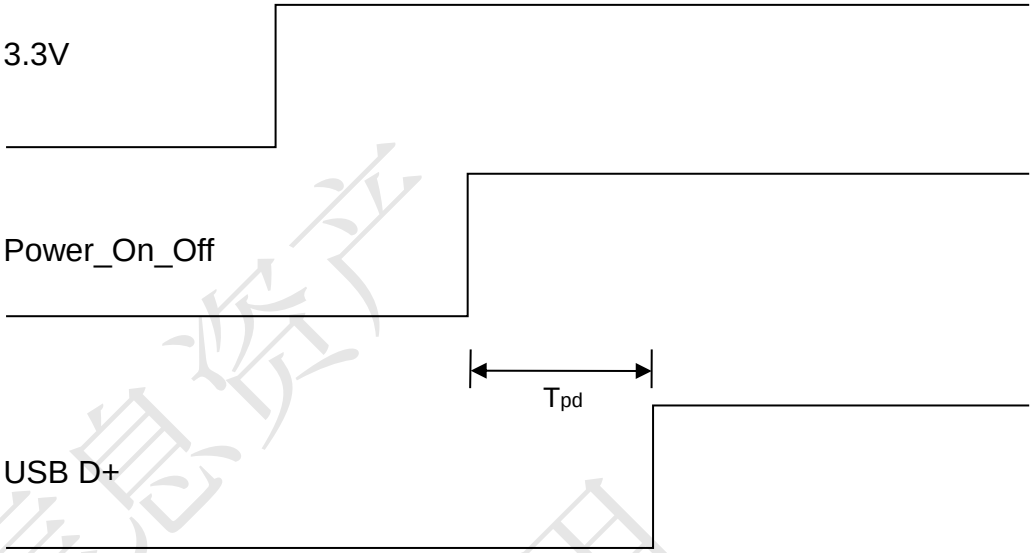
The ME906s is compliant with USB 2.0 high speed protocol. The USB input/output lines are following USB 2.0 specifications. Definition of the USB interface:

Pin No.	Pin Name	I/O	Description
7	USB_D+	I/O	USB data signal D+
9	USB_D-	I/O	USB data signal D-

Figure 3-20 Recommended circuit of USB interface

Figure 3-21 shows the timing sequence between 3.3V and USB D+.

Figure 3-21 USB D+ and 3.3V power on timing sequence



Parameter	Remarks	Time (Nominal value)	Unit
T_{pd}	Power valid to USB D+ high	6	s

NOTE
The layout design of this circuit on the host board should comply with the USB 2.0 high speed protocol, with differential characteristic impedance of 90 Ω.

3.6 USIM Card Interface

3.6.1 Overview

The ME906s module provides a USIM card interface complying with the ISO 7816-3 standard and supports both 1.8 V and 3.0 V USIM cards.

Table 3-10 USIM card interface signals

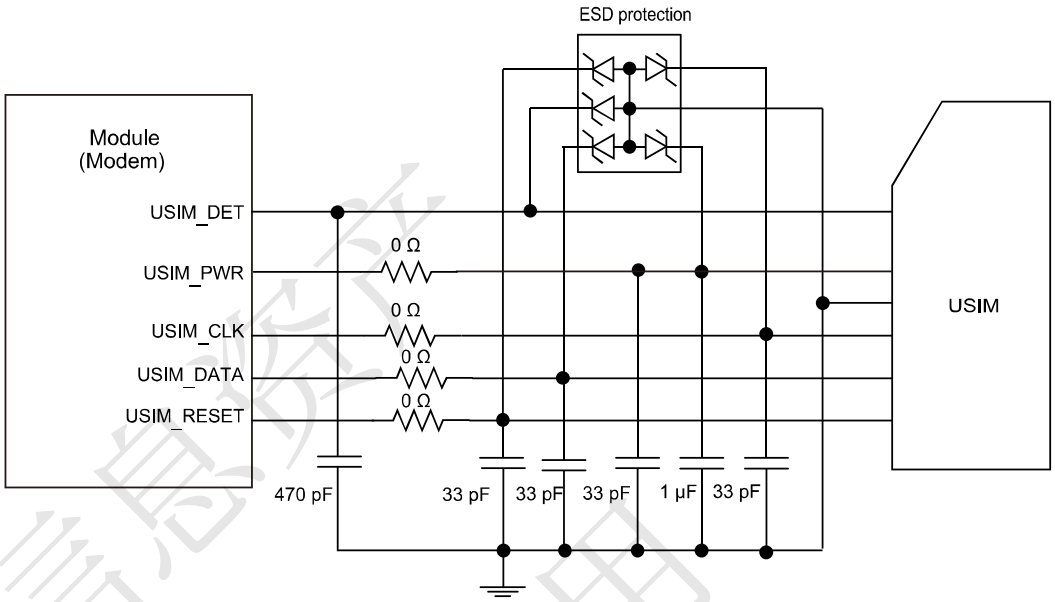
Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
30	USIM_RESET	O	USIM Reset	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR =1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
32	USIM_CLK	O	USIM Clock	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR=1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	
34	USIM_DATA	IO	USIM DATA	V_{OH}	0.7 x USIM_PWR	-	3.3	USIM_PWR=1.8 V or 3.0 V
				V_{OL}	0	-	0.2 x USIM_PWR	
				V_{IH}	0.7 x USIM_PWR	-	3.3	
				V_{IL}	0	-	0.2 x USIM_PWR	
36	USIM_PWR	P	USIM POWER	-	1.75	1.8	1.98	USIM_PWR=1.8 V
				-	2.75	3	3.3	USIM_PWR=3.0 V
66	USIM_DET	I	USIM hot swap detection pin. Rising edge for insertion; falling edge for removal. When it is High, USIM is present. When it is Low, USIM is absent.	V_{IH}	1.26	1.8	2.1	The module is pulled up inside.
				V_{IL}	–0.3	-	0.3	

3.6.2 Circuit Recommended for the USIM Card Interface

As the ME906s module is not equipped with a USIM socket, you need to place a USIM socket on the user interface board. Figure 3-22 shows the circuit of the USIM card interface.

Figure 3-22 Circuit of the USIM card interface



CAUTION

- The ESD protection component should choose low capacitance. The capacitance of the component should be lower than **10 pF**.
- To meet the requirements of 3GPP TS 51.010-1 protocols and electromagnetic compatibility (EMC) authentication, the USIM socket should be placed near the M.2 interface (it is recommended that the PCB circuit connects the M.2 interface and the USIM socket does not exceed 100 mm), because a long circuit may lead to wave distortion, thus affecting signal quality.
- It is recommended that you wrap the area adjacent to the USIM_CLK and USIM_DATA signal wires with ground. The Ground pin of the USIM socket and the Ground pin of the USIM card must be well connected to the power Ground pin supplying power to the ME906s module.
- A 100 nF capacitor (0402 package is recommended so that greater capacitance such as 1 uF can be employed if necessary) and a 33 pF capacitor are placed between the USIM_PWR and Ground pins in parallel. Three 33 pF capacitors are placed between the USIM_DATA and Ground pins, the USIM_RESET and Ground pins, and the USIM_CLK and Ground pins in parallel to filter interference from RF signals.
- It is recommended to take electrostatic discharge (ESD) protection measures near the USIM card socket. Transient voltage suppressor diode should be placed as close as possible to the USIM socket, and the Ground pin of the ESD protection component is well connected to the power Ground pin that supplies power to the ME906s module.

3.7 Tunable Antenna Control

The module provides 4 tunable antenna control pins.

Table 3-11 List of ANTCTL pins

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
59	ANTCTL0	O	Tunable antenna control signal, bit 0. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
61	ANTCTL1	O	Tunable antenna control signal, bit 1. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
63	ANTCTL2	O	Tunable antenna control signal, bit 2. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-
65	ANTCTL3	O	Tunable antenna control signal, bit 3. It is a push-pull type GPIO.	V_{OH}	1.37	1.8	2.1	-
				V_{OL}	0	-	0.45	-

The mapping of each band to ANTCTL outputs is configurable, and the default output is 0 V.

3.8 Config Pins

The module provides 4 config pins.

Table 3-12 List of CONFIG pins

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
1	CONFIG_3	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.
21	CONFIG_0	O	Not Connected internally.	-	-	-	-	The module is configured as WWAN-SSIC 0.
69	CONFIG_1	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.
75	CONFIG_2	O	Connected to Ground internally.	-	-	0	-	The module is configured as WWAN-SSIC 0.

In the M.2 spec, the 4 pins are defined as shown in Table 3-13 .

Table 3-13 List of Config pins

Config_0 (Pin 21)	Config_1 (Pin 69)	Config_2 (Pin 75)	Config_3 (Pin 1)	Module type and Main host interface	Port Configuration
NC	Ground	Ground	Ground	WWAN-SSIC	0

The GPIO0–7 pins have configurable assignments. There are 4 possible functional pin out configurations. These 4 configurations are called Port Config 0–3. In each Port Configuration each GPIO is defined as a specific functional pin. The GPIO pin assignment can be seen in Table 3-14 . ME906s supports Config 0. But the audio function is not implemented in ME906s.

Table 3-14 GPIO pin function assignment per port configuration (not supported by default)

GPIO Pin	Port Config 0 (GNSS+Audio ver1)
GPIO_0 (Pin40)	GNSS_SCL
GPIO_1 (Pin 42)	GNSS_SDA
GPIO_2 (Pin 44)	GNSS_IRQ
GPIO_3 (Pin 46)	SYSCLK
GPIO_4 (Pin 48)	TX_Blanking
GPIO_5 (Pin 20)	Audio_0 (not supported)
GPIO_6 (Pin 22)	Audio_1 (not supported)
GPIO_7 (Pin 24)	Audio_2 (not supported)

3.9 Reserved Pins

The module provides some reserved pins. All of reserved pins cannot be used by the customer. **All of them should be Not Connected (NC).** If the customer wants to have other special functions, please contact us.

Table 3-15 List of reserved pins

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
20, 22, 24, 28	Reserved	-	Reserved for future use, please keep it not connected in the host side.	-	-	-	-	-

3.10 NC Pins

The module has some NC pins. All of NC pins are not connected in the module.

Table 3-16 List of NC pins

Pin No.	Pin Name	Pad Type	Description	Parameter	Min. (V)	Typ. (V)	Max. (V)	Comments
29, 31, 35, 37, 38, 41, 43, 47, 49, 50,52, 53, 54, 55, 56, 58, 68	-	Not Connected	-	-	-	-	-	-

3.11 RF Antenna Interface

3.11.1 RF Connector location

ME906s module provides 2 antenna connectors for connecting the external antennas.

Figure 3-23 RF antenna connectors

3.11.2 Coaxial RF Connector Guidelines

- The antenna interface must be used with coaxial cables with characteristic impedance of 50 Ω.
- The ME906s module supports the buckled RF connector antenna connection methods: buckled RF connector 818000500 by ECT, RFC43-1K2600 by ACON or other equivalent connectors.

Figure 3-24 shows the RF connector dimensions.

Figure 3-24 RF connector dimensions

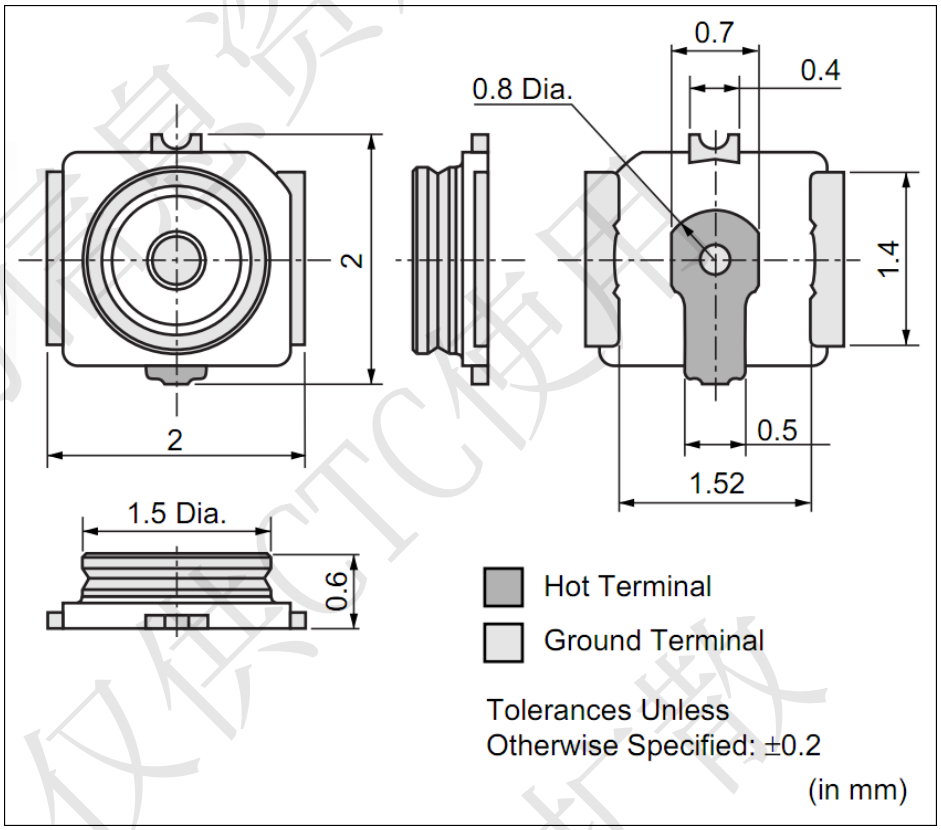


Table 3-17 The major specifications of the RF connector

Rated Condition		Environmental Condition
Frequency range	DC to 6 GHz	Temperature range: –40°C to +85°C
Characteristic impedance	50 Ω	

There are two kinds of coaxial cables (0.81 mm and 1.13 mm) mating the RF connector in the ME906s. 1.13 mm cable is recommended.

Figure 3-25 Specifications of 0.81 mm coaxial cable mating with the RF connector

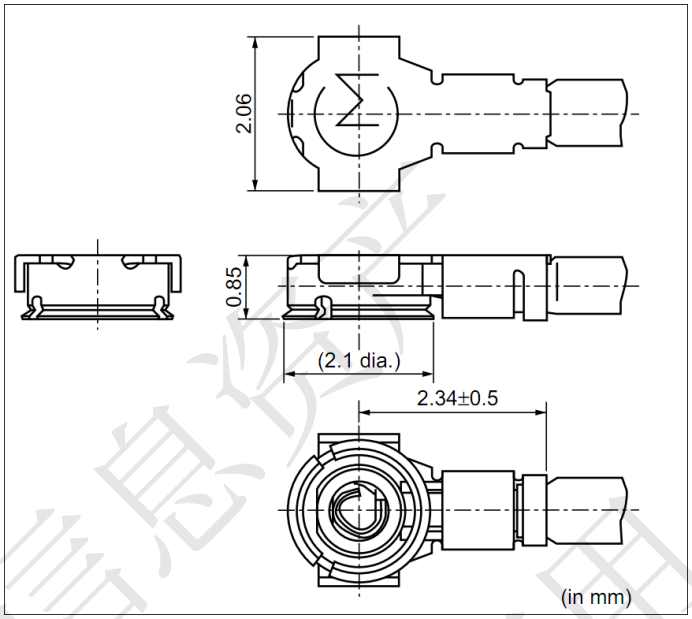


Figure 3-26 Connection between the RF connector and the 0.81 mm cable

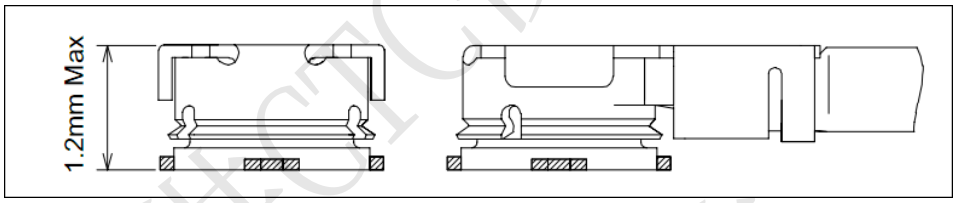


Figure 3-27 Specifications of 1.13 mm coaxial cable mating with the RF connector

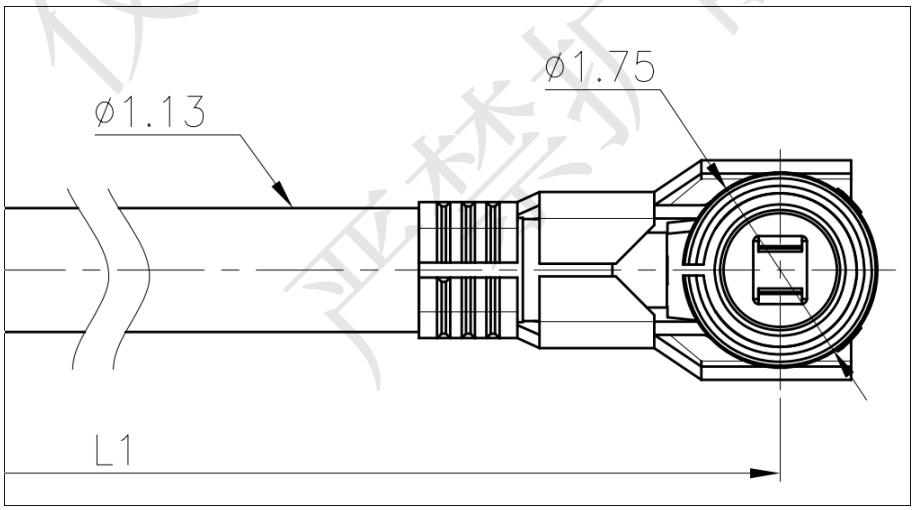
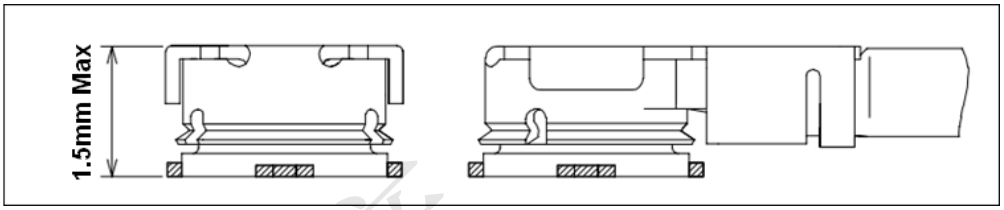


Figure 3-28 Connection between the RF connector and the 1.13 mm cable



4 RF Specifications

4.1 About This Chapter

This chapter describes the RF specifications of the ME906s module, including:

- Operating Frequencies
- Conducted RF Measurement
- Conducted Rx Sensitivity and Tx Power
- Antenna Design Requirements

4.2 Operating Frequencies

Table 4-1 shows the RF bands supported by ME906s.

Table 4-1 RF bands

Operating Band	Tx	Rx
UMTS Band 1	1920 MHz–1980 MHz	2110 MHz–2170 MHz
UMTS Band 2	1850 MHz–1910 MHz	1930 MHz–1990 MHz
UMTS Band 5	824 MHz–849 MHz	869 MHz–894 MHz
UMTS Band 8	880 MHz–915 MHz	925 MHz–960 MHz
GSM 850	824 MHz–849 MHz	869 MHz–894 MHz
GSM 900	880 MHz–915 MHz	925 MHz–960 MHz
GSM 1800	1710 MHz–1785 MHz	1805 MHz–1880 MHz
GSM 1900	1850 MHz–1910 MHz	1930 MHz–1990 MHz
LTE Band 1	1920 MHz–1980 MHz	2110 MHz–2170 MHz
LTE Band 2	1850 MHz–1910 MHz	1930 MHz–1990 MHz
LTE Band 3	1710 MHz–1785 MHz	1805 MHz–1880 MHz

Operating Band	Tx	Rx
LTE Band 5	824 MHz–849 MHz	869 MHz–894 MHz
LTE Band 7	2500 MHz–2570 MHz	2620 MHz–2690 MHz
LTE Band 8	880 MHz–915 MHz	925 MHz–960 MHz
LTE Band 20	832 MHz–862 MHz	791 MHz–821 MHz
LTE Band 28	703 MHz–748 MHz	758 MHz–803 MHz
GPS L1	-	1574.42 MHz–1576.42 MHz
GLONASS L1	-	1597.55 MHz–1605.89 MHz

4.3 Conducted RF Measurement

4.3.1 Test Environment

Test instrument	R&S CMU200, R&S CMW500, Agilent 8960, Anritsu MT8820C
Power supply	Keithley 2303, Agilent 66319
RF cable for testing	Rosenberger Precision Microwave Cable
Murata coaxial cable	MXHP32HP1000

NOTE

- The compensation for different frequency bands relates to the cable and the test environment.
- The instrument compensation needs to be set according to the actual cable conditions.

4.3.2 Test Standards

Huawei modules meet 3GPP test standards. Each module passes strict tests at the factory and thus the quality of the modules is guaranteed.

4.4 Conducted Rx Sensitivity and Tx Power

4.4.1 Conducted Receive Sensitivity

The conducted receive sensitivity is a key parameter that indicates the receiver performance of ME906s.

Table 4-2 Conducted Rx sensitivity

Band	Typical Value (Unit: dBm)	Note
GSM 850	–109	BER Class II < 2.44%
GSM 900	–109	BER Class II < 2.44%
GSM 1800	–109	BER Class II < 2.44%
GSM 1900	–109	BER Class II < 2.44%
UMTS Band 1	–111	BER < 0.1%
UMTS Band 2	–111	BER < 0.1%
UMTS Band 5	–111.5	BER < 0.1%
UMTS Band 8	–111.5	BER < 0.1%
LTE Band 1	–102	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 2	–101	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 3	–101	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 5	–101	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 7	–100	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 8	–101	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 20	–101	Throughput ≥ 95%, 10 MHz Bandwidth
LTE Band 28	–102	Throughput ≥ 95%, 10 MHz Bandwidth

Table 4-3 GPS specifications

TTFF@–130 dBm	Cold start	36s
	Warm start	35s
	Hot Start	3s
Sensitivity	Cold start	–148 dBm
	Tracking	–159 dBm

NOTE

- The test values are the average of some test samples.
- LTE sensitivity is tested in SIMO (Main + AUX).
- The circular error probability for GPS value is 50%.

4.4.2 Conducted Transmit Power

The conducted transmit power is another indicator that measures the performance of ME906s. The conducted transmit power refers to the maximum power that the module tested at the antenna port can transmit. According to the 3GPP protocol, the required transmit power varies with the power class.

Table 4-4 lists the required ranges of the conducted transmit power of ME906s.

Table 4-4 Conducted Tx power

Band		Typical Value (Unit: dBm)	Note (Unit: dB)
GSM 850	GMSK(1Tx Slot)	32.5	±1
	8PSK(1Tx Slot)	27	±1
GSM 900	GMSK(1Tx Slot)	32.5	±1
	8PSK(1Tx Slot)	27	±1
GSM 1800	GMSK(1Tx Slot)	29.5	±1
	8PSK(1Tx Slot)	26	±1
GSM 1900	GMSK(1Tx Slot)	29.5	±1
	8PSK(1Tx Slot)	26	±1
UMTS Band 1		23.5	±1
UMTS Band 2		23.5	±1
UMTS Band 5		23.5	±1
UMTS Band 8		23.5	±1
LTE Band 1		23	±1
LTE Band 2		23	±1
LTE Band 3		23	±1
LTE Band 5		23	±1
LTE Band 7		23	±1
LTE Band 8		23	±1
LTE Band 20		23	±1
LTE Band 28		23	±1

NOTE
Maximum Power Reduction (MPR and AMPR) of LTE is according to 3GPP TS 36.521-1.

4.5 Antenna Design Requirements

4.5.1 Antenna Design Indicators

Antenna Efficiency

Antenna efficiency is the ratio of the input power to the radiated or received power of an antenna. The radiated power of an antenna is always lower than the input power due to the following antenna losses: return loss, material loss, and coupling loss. The efficiency of an antenna relates to its electrical dimensions. To be specific, the antenna efficiency increases with the electrical dimensions. In addition, the transmission cable from the antenna port of ME906s to the antenna is also part of the antenna. The cable loss increases with the cable length and the frequency. It is recommended that the cable loss is as low as possible, for example, MXHP32HP1000 made by Murata or equivalent.

The following antenna efficiency (free space) is recommended for ME906s to ensure high radio performance of the module:

- Efficiency of the primary antenna: ≥ 40% (working frequency below 960 MHz); ≥ 50% (working frequency above 1420 MHz)
- Efficiency of the secondary antenna: ≥ half of the efficiency of the primary antenna in receiving band (≥ 50% @ 1574.42 MHz–1605.89 MHz)

In addition, the efficiency should be tested with the transmission cable.

S11(VSWR) and S21

S11 indicates the degree to which the input impedance of an antenna matches the reference impedance (50 Ω). S11 shows the resonance feature and impedance bandwidth of an antenna. Voltage standing wave ratio (VSWR) is another expression of S11. S11 relates to the antenna efficiency. S11 can be measured with a vector analyzer.

The following S11 values are recommended for the antenna of ME906s:

- S11 of the primary antenna ≤ –6 dB
- S11 of the secondary antenna ≤ –6 dB (≤ –10 dB @ 1574.42 MHz–1605.89 MHz)

In addition, S11 is less important than the efficiency, and S11 has not strong correlation to wireless performance.

S21 indicates the isolation between two antennas.

Isolation

For a wireless device with multiple antennas, the power of different antennas is coupled with each other. Antenna isolation is used to measure the power coupling. The power radiated by an antenna might be received by an adjacent antenna, which decreases the antenna radiation efficiency and affects the running of other devices.

To avoid this problem, evaluate the antenna isolation as sufficiently as possible at the early stage of antenna design.

Antenna isolation depends on the following factors:

- Distance between antennas
- Antenna type
- Antenna direction

The primary antenna must be placed as near as possible to the ME906s to minimize the cable length. The secondary antenna needs to be installed perpendicularly to the primary antenna. The secondary antenna can be placed farther away from the ME906s. Antenna isolation can be measured with a two-port vector network analyzer.

The following S21 values are recommended for the antenna on laptops:

- Isolation between the primary and secondary antennas ≤ –12 dB(≤ –15 dB @ 1574.42 MHz–1605.89 MHz)
- Isolation between the primary (secondary) antenna and the Wi-Fi antenna ≤ –15 dB

Polarization

The polarization of an antenna is the orientation of the electric field vector that rotates with time in the direction of maximum radiation.

The linear polarization is recommended for the antenna of ME906s.

Radiation Pattern

The radiation pattern of an antenna reflects the radiation features of the antenna in the remote field region. The radiation pattern of an antenna commonly describes the power or field strength of the radiated electromagnetic waves in various directions from the antenna. The power or field strength varies with the angular coordinates (θ and φ), but is independent of the radial coordinates.

The radiation pattern of half wave dipole antennas is omnidirectional in the horizontal plane, and the incident waves of base stations are often in the horizontal plane. For this reason, the receiving performance is optimal.

The following radiation patterns are recommended for the antenna of ME906s.
Primary antenna: omnidirectional.

Secondary antenna: omnidirectional (Upper Hem Partial Radiated Power ≥ 40% @ 1574.42 MHz–1605.89 MHz)

In addition, the secondary antenna's pattern should be complementary with the primary antenna's pattern.

Gain and Directivity

The radiation pattern of an antenna represents the field strength of the radiated electromagnetic waves in all directions, but not the power density that the antenna radiates in the specific direction. The directivity of an antenna, however, measures the power density that the antenna radiates.

Gain, as another important parameter of antennas, correlates closely to the directivity. The gain of an antenna takes both the directivity and the efficiency of the

antenna into account. The appropriate antenna gain prolongs the service life of relevant batteries.

The following antenna gain is recommended for ME906s.

- Gain of the primary antenna ≤ 2.5 dBi
- Gain of the secondary antenna ≤ 2.5 dBi

ECC of the antenna

ECC is short for Envelope Correlation Coefficient. It is the cross-correlation value of the complex patterns of the master and diversity antenna. It indicates how similar the magnitude and the phase patterns of the two antennas are. If two antennas have no similarity, the ECC should be zero. Actually, the less ECC, the better diversity performance.

The following ECC is recommended for ME906s.

- ECC ≤ 0.5 (working frequency below 0.96 GHz)
- ECC ≤ 0.3 (working frequency above 1.4 GHz)

NOTE

- The antenna consists of the antenna body and the relevant RF transmission cable. Take the RF transmission cable into account when measuring any of the preceding antenna indicators.
- Huawei cooperates with various famous antenna suppliers who are able to make suggestions on antenna design, for example, Amphenol, Skycross, etc.

4.5.2 Interference

Besides the antenna performance, the interference on the user board also affects the radio performance (especially the TIS) of the module. To guarantee high performance of the module, the interference sources on the user board must be properly controlled.

On the user board, there are various interference sources, such as the LCD, CPU, audio circuits, and power supply. All the interference sources emit interference signals that affect the normal operation of the module. For example, the module sensitivity can be decreased due to interference signals. Therefore, during the design, need to consider how to reduce the effects of interference sources on the module. You can take the following measures: Use an LCD with optimized performance; shield the LCD interference signals; shield the signal cable of the board; or design filter circuits.

Huawei is able to make technical suggestions on radio performance improvement of the module.

4.5.3 Antenna Requirements

The antenna for ME906s must fulfill the following requirements:

Table 4-5 Antenna Requirements

Antenna Requirements	
Frequency range	Depending on frequency band(s) provided by the network operator, the customer must use the most suitable antenna for that/those band(s)
Bandwidth of primary antenna	70 MHz in GSM 850 80 MHz in GSM 900 170 MHz in GSM 1800 140 MHz in GSM 1900 250 MHz in UMTS Band 1/LTE Band 1 140 MHz in UMTS Band 2/LTE Band 2 70 MHz in UMTS Band 5/LTE Band 5 80 MHz in UMTS Band 8/LTE Band 8 170 MHz in LTE Band 3 190 MHz in LTE Band 7 71 MHz in LTE Band 20 55 MHz in LTE Band 28
Bandwidth of secondary antenna	25 MHz in GSM 850 35 MHz in GSM 900 75 MHz in GSM 1800 60 MHz in GSM 1900 60 MHz in UMTS Band 1/LTE Band 1 60 MHz in UMTS Band 2/LTE Band 2 25 MHz in UMTS Band 5/LTE Band 5 35 MHz in UMTS Band 8/LTE Band 8 75 MHz in LTE Band 3 70 MHz in LTE Band 7 30 MHz in LTE Band 20 55 MHz in LTE Band 28 35 MHz in GNSS
Gain	≤ 2.5 dBi
Impedance	50 Ω
VSWR absolute max.	≤ 3:1 (≤ 2:1 @ 1574.42 MHz–1605.89 MHz)
VSWR recommended	≤ 2:1 (≤ 1.5:1 @ 1574.42 MHz–1605.89 MHz)

5 Electrical and Reliability Features

5.1 About This Chapter

This chapter describes the electrical and reliability features of the interfaces in the ME906s module, including:

- Absolute Ratings
- Operating and Storage Temperatures
- Power Supply Features
- Reliability Features
- EMC and ESD Features

5.2 Absolute Ratings

WARNING

Table 5-1 lists the absolute ratings for the ME906s module. Using the ME906s module beyond these conditions may result in permanent damage to the module.

Table 5-1 Absolute ratings

Symbol	Specification	Min.	Max.	Unit
3.3V	External power voltage	–0.5	4.5	V

5.3 Operating and Storage Temperatures

Table 5-2 lists the operating and storage temperatures for the ME906s module.

Table 5-2 Operating and storage temperatures

Specification	Min.	Max.	Unit
Normal operating temperature	–10	+55	°C
Extended operating temperature[1]	–20	+70	°C
Ambient storage temperature	–40	+85	°C

NOTE
[1]: When the ME906s module works at –20°C to –10°C or +55°C to +70°C, **NOT** all its RF specifications comply with the 3GPP specifications.

5.4 Power Supply Features

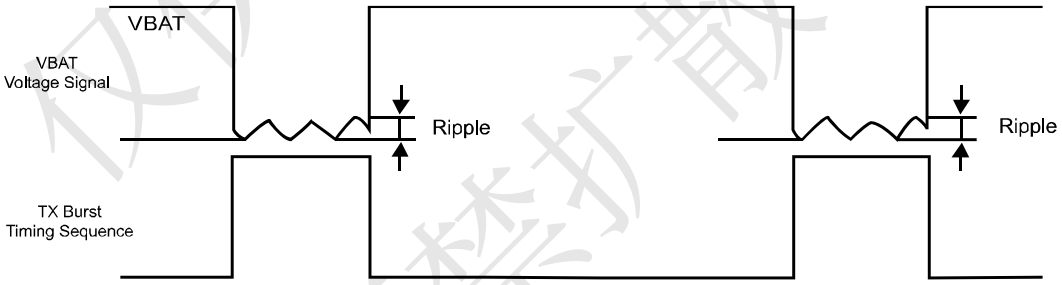
5.4.1 Input Power Supply

Table 5-3 lists the requirements for input power of the ME906s module.

Table 5-3 Requirements for input power

Parameter	Min.	Typ.	Max.	Ripple	Unit
3.3V	3.135	3.3	4.4	0.05	V

Figure 5-1 Power supply during burst emission



NOTE
The minimum value of the power supply must be guaranteed during the burst (with 2.5 A@3.3 V peak in GSM, GPRS or EGPRS mode).

Table 5-4 Requirements for input current

Power	Peak (GSM 1 slot)	Normal (WCDMA)	Normal (LTE 23 dBm)
3.3 V	2.5 A	1.1 A	1.25 A

5.4.2 Power Consumption

The power consumption of ME906s in different scenarios are respectively listed in Table 5-5 to Table 5-9 .

The power consumption listed in this section are tested when the power supply of ME906s module is normal voltage (3.3 V), and all of test values are measured at room temperature.

Table 5-5 Averaged power off DC power consumption

Description	Test Value (Unit: uA)	Notes/Configuration
	Typical	
Power off	70	Normal voltage (3.3 V) is ON and Power_On_Off pin is pulled low.

Table 5-6 Averaged standby DC power consumption (WCDMA/HSDPA/LTE/GSM)

Description		Bands	Test Value (Unit: mA)	Notes/Configuration
			Typical	
Sleep	LTE	LTE bands	2.08	Module is powered up. DRX cycle=8 (2.56s) Module is registered on the network. USB is in suspend.
	HSPA+/WCDMA	UMTS bands	1.46	Module is powered up. DRX cycle=8 (2.56s) Module is registered on the network. USB is in suspend.
	GPRS/EDGE	GSM bands	1.94	Module is powered up. MFRMS=5 (1.175s) Module is registered on the network. USB is in suspend.
	Radio Off	All bands	1.07	Module is powered up. RF is disabled. USB is in suspend.

Description		Bands	Test Value (Unit: mA)	Notes/Configuration
			Typical	
Idle	LTE	LTE bands	55	Module is powered up. DRX cycle=8 (2.56s) Module is registered on the network, and no data is transmitted. USB is in active.
	HSPA+/WCDMA	UMTS bands	60	Module is powered up. DRX cycle=8 (2.56s) Module is registered on the network, and no data is transmitted. USB is in active.
	GPRS/EDGE	GSM bands	60	Module is powered up. MFRMS=5 (1.175s) Module is registered on the network, and no data is transmitted. USB is in active.
	Radio Off	All bands	55	Module is powered up. RF is disabled. USB is in active.

Table 5-7 Averaged Data Transmission DC power consumption (WCDMA/HSDPA/LTE)

Description	Band	Test Value (Unit: mA)	Notes/Configuration
		Typical	
WCDMA	Band 1 (IMT2100)	198	1 dBm Tx Power
		247	10 dBm Tx Power
		682	23.5 dBm Tx Power
	Band 2 (PCS 1900)	204	1 dBm Tx Power
		246	10 dBm Tx Power
		714	23.5 dBm Tx Power
	Band 5 (850 MHz)	198	1 dBm Tx Power
		231	10 dBm Tx Power
		672	23.5 dBm Tx Power

Description	Band	Test Value (Unit: mA)	Notes/Configuration
		Typical	
	Band 8 (900 MHz)	200	1 dBm Tx Power
		260	10 dBm Tx Power
		679	23.5 dBm Tx Power
HSDPA	Band 1 (IMT2100)	212	1 dBm Tx Power
		260	10 dBm Tx Power
		695	23.5 dBm Tx Power
	Band 2 (PCS 1900)	214	1 dBm Tx Power
		261	10 dBm Tx Power
		730	23.5 dBm Tx Power
	Band 5 (850 MHz)	212	1 dBm Tx Power
		243	10 dBm Tx Power
		685	23.5 dBm Tx Power
	Band 8 (900 MHz)	214	1 dBm Tx Power
		243	10 dBm Tx Power
		701	23.5 dBm Tx Power
LTE	Band 1	350	1 dBm Tx Power
		422	10 dBm Tx Power
		864	23dBm Tx Power
	Band 2	339	1 dBm Tx Power
		422	10 dBm Tx Power
		822	23 dBm Tx Power
	Band 3	335	1 dBm Tx Power
		410	10 dBm Tx Power
		789	23 dBm Tx Power
	Band 5	333	1 dBm Tx Power
		419	10 dBm Tx Power
		771	23 dBm Tx Power
	Band 7	349	1 dBm Tx Power

Description	Band	Test Value (Unit: mA)	Notes/Configuration
		Typical	
		433	10 dBm Tx Power
		830	23 dBm Tx Power
	Band 8	333	1 dBm Tx Power
		411	10 dBm Tx Power
		739	23 dBm Tx Power
	Band 20	342	1 dBm Tx Power
		420	10 dBm Tx Power
		846	23 dBm Tx Power
	Band 28	327	1 dBm Tx Power
		396	10 dBm Tx Power
		790	23 dBm Tx Power

Table 5-8 Averaged DC power consumption (GSM/GPRS/EDGE)

Description	Test Value (Unit: mA)	PCL	Notes/Configuration
	Typical		
GPRS 850	349	5	1 Up/1 Down
	530		2 Up/1 Down
	714		4 Up/1 Down
	185	10	1 Up/1 Down
	288		2 Up/1 Down
	491		4 Up/1 Down
GPRS 900	352	5	1 Up/1 Down
	503		2 Up/1 Down
	679		4 Up/1 Down
	181	10	1 Up/1 Down
	273		2 Up/1 Down
	460		4 Up/1 Down
GPRS 1800	230	0	1 Up/1 Down

Description	Test Value (Unit: mA)	PCL	Notes/Configuration
	Typical		
	313		2 Up/1 Down
	418		4 Up/1 Down
	119	10	1 Up/1 Down
	147		2 Up/1 Down
	205		4 Up/1 Down
GPRS 1900	271	0	1 Up/1 Down
	384		2 Up/1 Down
	520		4 Up/1 Down
	121	10	1 Up/1 Down
	151		2 Up/1 Down
	224		4 Up/1 Down
EDGE 850	230	8	1 Up/1 Down
	312		2 Up/1 Down
	430		4 Up/1 Down
	133	15	1 Up/1 Down
	174		2 Up/1 Down
	258		4 Up/1 Down
EDGE 900	222	8	1 Up/1 Down
	301		2 Up/1 Down
	409		4 Up/1 Down
	131	15	1 Up/1 Down
	171		2 Up/1 Down
	256		4 Up/1 Down
EDGE 1800	178	2	1 Up/1 Down
	245		2 Up/1 Down
	317		4 Up/1 Down
	118	10	1 Up/1 Down
	146		2 Up/1 Down
	203		4 Up/1 Down
EDGE 1900	207	2	1 Up/1 Down

Description	Test Value (Unit: mA)	PCL	Notes/Configuration
	Typical		
	275		2 Up/1 Down
	373		4 Up/1 Down
	120	10	1 Up/1 Down
	151		2 Up/1 Down
	218		4 Up/1 Down

NOTE

All power consumption test configuration can be referenced by GSM Association Official Document TS.09: Battery Life Measurement and Current Consumption Technique.

- LTE test condition: 10/20 MHz bandwidth, QPSK, 1 RB when testing max. Tx power and full RB when testing 0 dBm or 10 dBm;
- Test condition: for max. Tx. power, see 4.4.2 Conducted Transmit Power, which is listed in Table 4-4 ; for max. data throughput, see 2.2 Function Overview, which are listed in Table 2-1 Features.

Table 5-9 Averaged GPS operation DC power consumption

Description	Test Value (Unit: mA)	Notes/Configuration
	Typical	
GPS fixing	100	RF is disabled; USB is in active; The Rx power of GPS is –130 dBm.
GPS tracking	100	

5.5 Reliability Features

Table 5-10 lists the test conditions and results of the reliability of the ME906s module.

Table 5-10 Test conditions and results of the reliability

Item		Test Condition	Standard	Sample size	Results
Stress	Low-temperature storage	• Temperature: –40ºC • Operation mode: no power, no package • Test duration: 24 h	JESD22-A119-C	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok

Item		Test Condition	Standard	Sample size	Results
	High-temperature storage	• Temperature: 85ºC • Operation mode: no power, no package • Test duration: 24 h	JESD22-A103-C	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Low-temperature operating	• Temperature: –20ºC • Operation mode: working with service connected • Test duration: 24 h	IEC60068-2-1	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	High-temperature operating	• Temperature: 70ºC • Operation mode: working with service connected • Test duration: 24 h	JESD22-A108-C	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Damp heat cycling	• High temperature: 55ºC • Low temperature: 25ºC • Humidity: 95%±3% • Operation mode: working with service connected • Test duration: 6 cycles; 12 h+12 h/cycle	JESD22-A101-B	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Thermal shock	• Low temperature: –40º • High temperature: 85ºC • Temperature change interval: < 20s • Operation mode: no power • Test duration: 100 cycles; 15 min+15 min/cycle	JESD22-A106-B	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Salty fog test	• Temperature: 35°C • Density of the NaCl solution: 5%±1% • Operation mode: no power, no package • Test duration: Spraying interval: 8 h Exposing period after removing the salty fog environment: 16 h	JESD22-A107-B	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok

Item		Test Condition	Standard	Sample size	Results
	Sine vibration	• Frequency range: 5 Hz to 200 Hz • Acceleration: 1 Grms • Frequency scan rate: 0.5 oct/min • Test duration: 3 axial directions. 2 h for each axial direction. • Operation mode: working with service connected	JESD22-B103-B	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Shock test	• Half-sine wave shock • Peak acceleration: 30 Grms • Shock duration: 11 ms • Test duration: 6 axial directions. 3 shocks for each axial direction. • Operation mode: working with service connected	JESD-B104-C	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	Drop test	• 0.8 m in height. Drop the module on the marble terrace with one surface facing downwards, six surfaces should be tested. • Operation mode: no power, no package	IEC60068-2-32	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
Life	High temperature operating life	• Temperature: 70ºC • Operation mode: working with service connected • Test duration: 168 h, 336 h, 500 h, 1000 h for inspection point	JESD22-A108-B	50 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	High temperature & high humidity	• High temperature: 85ºC • Humidity: 85% • Operation mode: powered on and no working • Test duration: 168 h, 336 h, 500 h, 1000 h for inspection point	JESD22-A110-B	50 pcs/group	Visual inspection: ok Function test: ok RF specification: ok Cross section: ok

Item		Test Condition	Standard	Sample size	Results
	Temperature cycle	• High temperature: 85ºC • Low temperature: –40ºC • Temperature change slope: 6ºC/min • Operation mode: no power • Test duration: 168 h, 336 h, 500 h, 668 h for inspection point	JESD22-A104-C	50 pcs/group	Visual inspection: ok Function test: ok RF specification: ok Cross section: ok
ESD	HBM (Human Body Model)	• 1 kV (Class 1 B) • Operation mode: no power	JESD22-A114-D	3 pcs/group	Visual inspection: ok Function test: ok RF specification: ok
	ESD with DVK (or embedded in the host)	• Contact Voltage: ±2 kV, ±4 kV • Air Voltage : ±2 kV, ±4 kV, ±8 kV • Operation mode: working with service connected	IEC61000-4-2	2 pcs	Visual inspection: ok Function test: ok RF specification: ok
NOTE Groups ≥ 2					

5.6 EMC and ESD Features

The following are the EMC design comments:

- Attention should be paid to static control in the manufacture, assembly, packaging, handling, and storage process to reduce electrostatic damage to HUAWEI module.
- RSE (Radiated Spurious Emission) may exceed the limit defined by EN301489 if the antenna port is protected by TVS (Transient Voltage Suppressor), which is resolved by making some adjustments on RF match circuit.
- TVS should be added on the USB port for ESD protection, and the parasitic capacitance of TVS on D+/D- signal should be less than 2 pF. Common-mode inductor should be added in parallel on D+/D- signal.
- TVS should be added on the USIM interface for ESD protection. The parasitic capacitance of TVS on USIM signal should be less than 10 pF.
- Resistors in parallel and a 10 nF capacitor should be added on RESET# and Power_On_Off signal to avoid shaking, and the distance between the capacitor and the related pin should be less than 100 mil.
- PCB routing should be V-type rather than T-type for TVS.
- An integrated ground plane is necessary for EMC design.

The following are the requirements of ESD environment control:

- The electrostatic discharge protected area (EPA) must have an ESD floor whose surface resistance and system resistance are greater than 1 x 10^4 Ω while less than 1 x 10^9 Ω.
- The EPA must have a sound ground system without loose ground wires, and the ground resistance must be less than 4 Ω.
- The workbench for handling ESD sensitive components must be equipped with common ground points, the wrist strap jack, and ESD pad. The resistance between the jack and common ground point must be less than 4 Ω. The surface resistance and system resistance of the ESD pad must be less than 1 x 10^9 Ω.
- The EPA must use the ESD two-circuit wrist strap, and the wrist strap must be connected to the dedicated jack. The crocodile clip must not be connected to the ground.
- The ESD sensitive components, the processing equipment, test equipment, tools, and devices must be connected to the ground properly. The indexes are as follows:
  - Hard ground resistance < 4 Ω
  - 1 x 10^5 Ω ≤ Soft ground resistance < 1 x 10^9 Ω
  - 1 x 10^5 Ω ≤ ICT fixture soft ground resistance < 1 x 10^{11} Ω
  - The electronic screwdriver and electronic soldering iron can be easily oxidized. Their ground resistance must be less than 20 Ω.
- The parts of the equipment, devices, and tools that touch the ESD sensitive components and moving parts that are close to the ESD sensitive components must be made of ESD materials and have sound ground connection. The parts that are not made of ESD materials must be handled with ESD treatment, such as painting the ESD coating or ionization treatment (check that the friction voltage is less than 100 V).
- Key parts in the production equipment (parts that touch the ESD sensitive components or parts that are within 30 cm away from the ESD sensitive components), including the conveyor belt, conveyor chain, guide wheel, and SMT nozzle, must all be made of ESD materials and be connected to the ground properly (check that the friction voltage is less than 100 V).
- Engineers that touch IC chips, boards, modules, and other ESD sensitive components and assemblies must wear ESD wrist straps, ESD gloves, or ESD finger cots properly. Engineers that sit when handling the components must all wear ESD wrist straps.
- Noticeable ESD warning signs must be attached to the packages and placement areas of ESD sensitive components and assemblies.
- Boards and IC chips must not be stacked randomly or be placed with other ESD components.
- Effective shielding measures must be taken on the ESD sensitive materials that are transported or stored outside the EPA.

NOTE
HUAWEI ME906s module does not include any protection against overvoltage.

6 Mechanical Specifications

6.1 About This Chapter

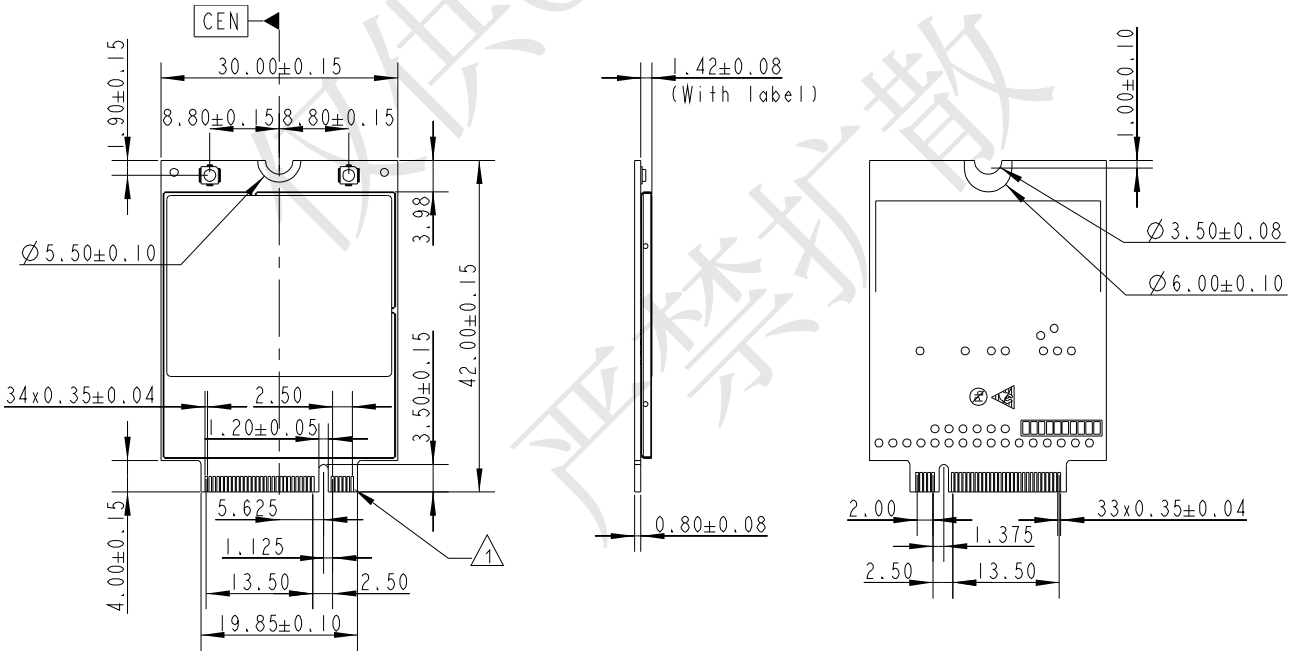
This chapter describes the following aspects of the ME906s module:

- Dimensions
- Packing System

6.2 Dimensions

Figure 6-1 shows the dimensions of ME906s in details.

Figure 6-1 Dimensions (Unit: mm)

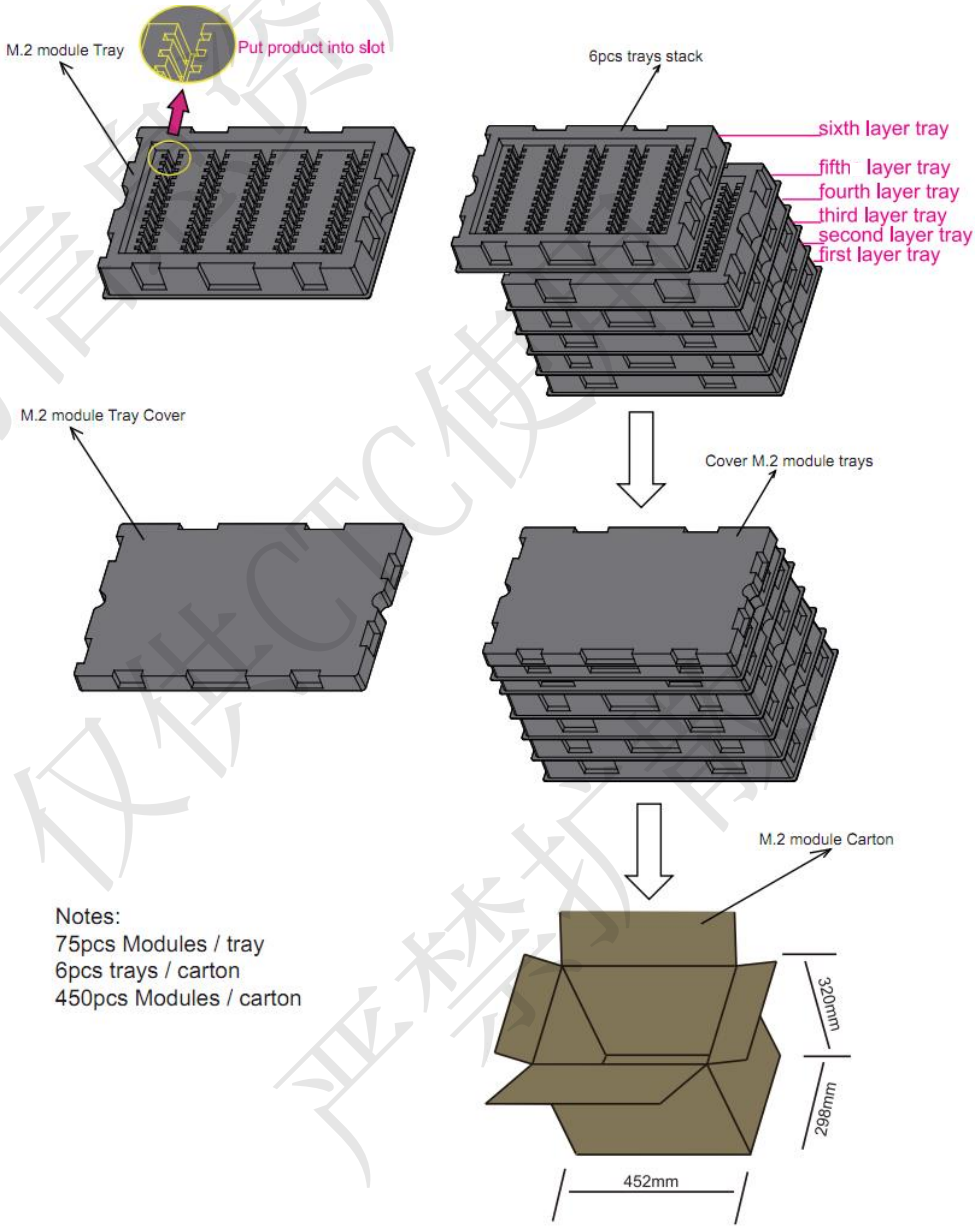


6.3 Packing System

ME906s package includes the blister tray, the blister tray cover, and the carton (with bottom and top clapboard).

The blister tray of the ME906s module package is as shown in the following figure. There are 75 pcs modules for every tray, 6 pcs trays in one carton, and 450 pcs modules for every carton. And the blister tray cover covers the top tray.

Figure 6-2 Package assembly



7 Installation

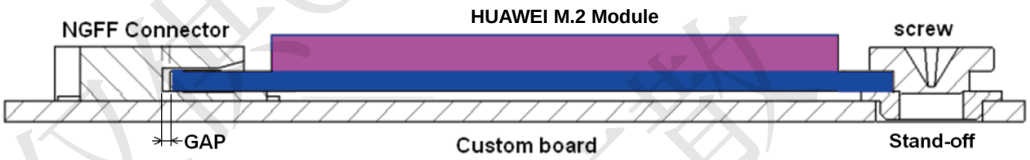
7.1 About This Chapter

This chapter describes the assembly of ME906s, including:

- Connect ME906s to board
- Thermal Management
- Antenna Plug

7.2 Connect ME906s to board

Figure 7-1 Install the module



It refers to M.2 specification.

The module will need a mechanical retention at the end of the board. The module specifies a 5.5 mm Dia. keep out zone at the end for attaching a screw.

The module Stand-off and mounting screw also serve as part of the module Electrical Ground path. The Stand-off should be connected directly to the ground plane on the platform. So that when the module is mounted and the mounting screw is screwed on to hold the module in place, this will make the electrical ground connection from the module to the platform ground plane.

CAUTION

The module could not be installed or removed when the host is powered on. Otherwise, it may result in permanent damage to the module.

7.3 Thermal Management

Because ME906s is very small, the dissipating heat is very important to it.

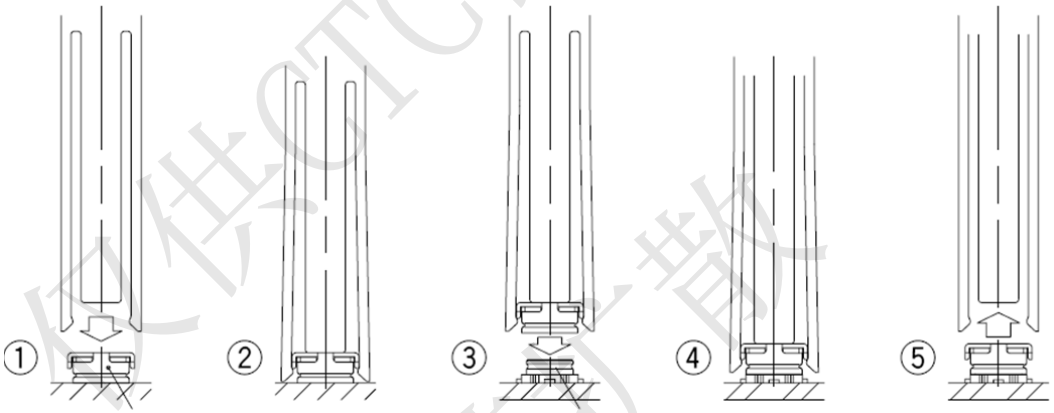
It has to take several means to ensure ME906s to meet the specification.

The methods described as follow:

- The mounting screw is to hold the module in place, and connect the heat source to the platform ground plane of the custom board.
- About the custom board, it can afford larger and much more area of grounding layers to enhance cooling of the PCB and ensure that the heat spreads evenly in the PCB.
- The stand-off provides a thermal ground path. The design requirements for thermal are a material with a minimum conductivity of 50 watts per meter Kelvin and surface area of 22 Sq mm.
- The customer can add a heat sink on the model top surface, and this method can bring out much heat source of the module.

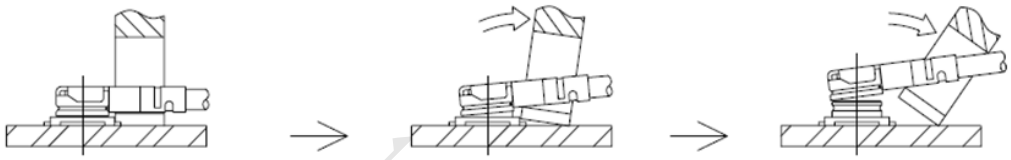
7.4 Antenna Plug

Figure 7-2 Mating the plug



1. Align the mating tool or the mating end of the tool over the plug end of the cable assembly.
2. Firmly place the tool over the plug until it is secured in the tool.
3. Place the plug cable assembly (held in the tool) over the corresponding receptacle.
4. Assure that the plug and receptacle are aligned press-down perpendicular to the mounting surface until both connectors are fully mated.
5. Remove the mating tool by pulling it up carefully.

Figure 7-3 Unmating the plug

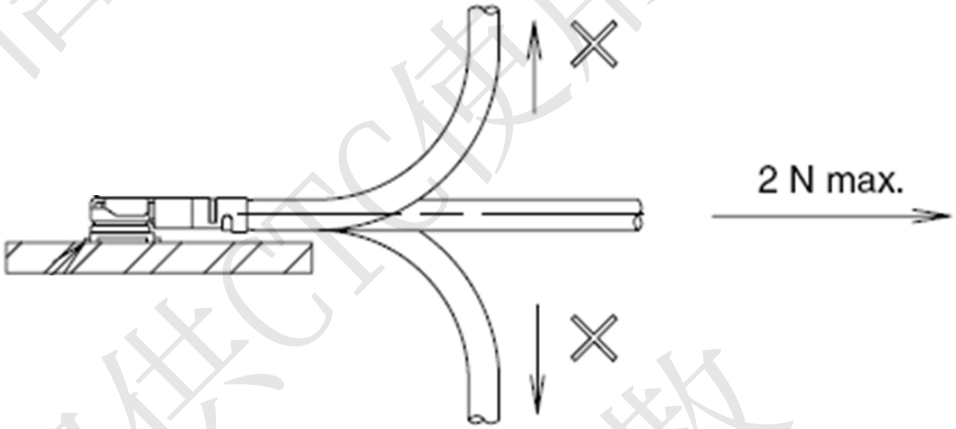


NOTE

- The extraction tool is recommended.
- Any attempt of unmating by pulling on the cable may result in damage and influence the mechanical / electrical performance.

It is recommended not to apply any pull forces after the bending of the cable, as described in Figure 7-4 .

Figure 7-4 Do not apply any pull forces after the bending of the cable



8 Certifications

This chapter gives a general description of certifications of ME906s.

Table 8-1 Product certifications

Certification	ME906s-158
CE	√
FCC	√
NCC	√
RCM	√
EU RoHS	√
PVC-Free	√
GCF	√
Halogen-free	√

NOTE

Table 8-1 shows certifications the module has been implemented. For more demands, please contact us for more details about this information.

9 Safety Information

Read the safety information carefully to ensure the correct and safe use of your wireless device. Applicable safety information must be observed.

9.1 Interference

Power off your wireless device if using the device is prohibited. Do not use the wireless device when it causes danger or interference with electric devices.

9.2 Medical Device

- Power off your wireless device and follow the rules and regulations set forth by the hospitals and health care facilities.
- Some wireless devices may affect the performance of the hearing aids. For any such problems, consult your service provider.
- Pacemaker manufacturers recommend that a minimum distance of 15 cm be maintained between the wireless device and a pacemaker to prevent potential interference with the pacemaker. If you are using an electronic medical device, consult the doctor or device manufacturer to confirm whether the radio wave affects the operation of this device.

9.3 Area with Inflammables and Explosives

To prevent explosions and fires in areas that are stored with inflammable and explosive devices, power off your wireless device and observe the rules. Areas stored with inflammables and explosives include but are not limited to the following:

- Gas station
- Fuel depot (such as the bunk below the deck of a ship)
- Container/Vehicle for storing or transporting fuels or chemical products
- Area where the air contains chemical substances and particles (such as granule, dust, or metal powder)
- Area indicated with the "Explosives" sign

- Area indicated with the "Power off bi-direction wireless equipment" sign
- Area where you are generally suggested to stop the engine of a vehicle

9.4 Traffic Security

- Observe local laws and regulations while using the wireless device. To prevent accidents, do not use your wireless device while driving.
- RF signals may affect electronic systems of motor vehicles. For more information, consult the vehicle manufacturer.
- In a motor vehicle, do not place the wireless device over the air bag or in the air bag deployment area. Otherwise, the wireless device may hurt you owing to the strong force when the air bag inflates.

9.5 Airline Security

Observe the rules and regulations of airline companies. When boarding or approaching a plane, power off your wireless device. Otherwise, the radio signal of the wireless device may interfere with the plane control signals.

9.6 Safety of Children

Do not allow children to use the wireless device without guidance. Small and sharp components of the wireless device may cause danger to children or cause suffocation if children swallow the components.

9.7 Environment Protection

Observe the local regulations regarding the disposal of your packaging materials, used wireless device and accessories, and promote their recycling.

9.8 WEEE Approval

The wireless device is in compliance with the essential requirements and other relevant provisions of the Waste Electrical and Electronic Equipment Directive 2012/19/EU (WEEE Directive).

9.9 RoHS Approval

The wireless device is in compliance with the restriction of the use of certain hazardous substances in electrical and electronic equipment Directive 2011/65/EU (RoHS Directive).

9.10 Laws and Regulations Observance

Observe laws and regulations when using your wireless device. Respect the privacy and legal rights of the others.

9.11 Care and Maintenance

It is normal that your wireless device gets hot when you use or charge it. Before you clean or maintain the wireless device, stop all applications and power off the wireless device.

- Use your wireless device and accessories with care and in clean environment. Keep the wireless device from a fire or a lit cigarette.
- Protect your wireless device and accessories from water and vapour and keep them dry.
- Do not drop, throw or bend your wireless device.
- Clean your wireless device with a piece of damp and soft antistatic cloth. Do not use any chemical agents (such as alcohol and benzene), chemical detergent, or powder to clean it.
- Do not leave your wireless device and accessories in a place with a considerably low or high temperature.
- Use only accessories of the wireless device approved by the manufacture. Contact the authorized service center for any abnormity of the wireless device or accessories.
- Do not dismantle the wireless device or accessories. Otherwise, the wireless device and accessories are not covered by the warranty.
- The device should be installed and operated with a minimum distance of 20 cm between the radiator and your body.

9.12 Emergency Call

This wireless device functions through receiving and transmitting radio signals. Therefore, the connection cannot be guaranteed in all conditions. In an emergency, you should not rely solely on the wireless device for essential communications.

9.13 Regulatory Information

The following approvals and notices apply in specific regions as noted.

9.13.1 EU Regulatory Conformance

Statement

Hereby, Huawei Technologies Co., Ltd. declares that this device is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU.

The most recent, effective version of the DoC (Declaration of Conformity) can be viewed at http://consumer.huawei.com/certification.

This device may be operated in all member states of the EU.

Observe national and local regulations where the device is used.

This device may be restricted for use, depending on the local network.

Frequency Bands and Power

(a) Frequency bands in which the radio equipment operates: Some bands may not be available in all countries or all areas. Please contact the local carrier for more details.

(b) Maximum radio-frequency power transmitted in the frequency bands in which the radio equipment operates: The maximum power for all bands is less than the highest limit value specified in the related Harmonized Standard.

The frequency bands and transmitting power (radiated and/or conducted) nominal limits applicable to this radio equipment are as follows: GSM 900: 37 dBm, GSM 1800: 34 dBm, WCDMA 900/2100: 25.7 dBm, LTE Band 1/3/7/8/20/28: 25.7 dBm.

Software Information

Software updates will be released by the manufacturer to fix bugs or enhance functions after the product has been released. All software versions released by the manufacturer have been verified and are still compliant with the related rules.

All RF parameters (for example, frequency range and output power) are not accessible to the user, and cannot be changed by the user.

For the most recent information about accessories and software, please see the DoC (Declaration of Conformity) at http://consumer.huawei.com/certification.

9.13.2 FCC Statement

Federal Communications Commission Notice (United States): Before a wireless device model is available for sale to the public, it must be tested and certified to the FCC that it does not exceed the limit established by the government-adopted requirement for safe exposure.

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.

Warning: Changes or modifications made to this equipment not expressly approved by HUAWEI may void the FCC authorization to operate this equipment.

The Statement of host device which inherited the module:

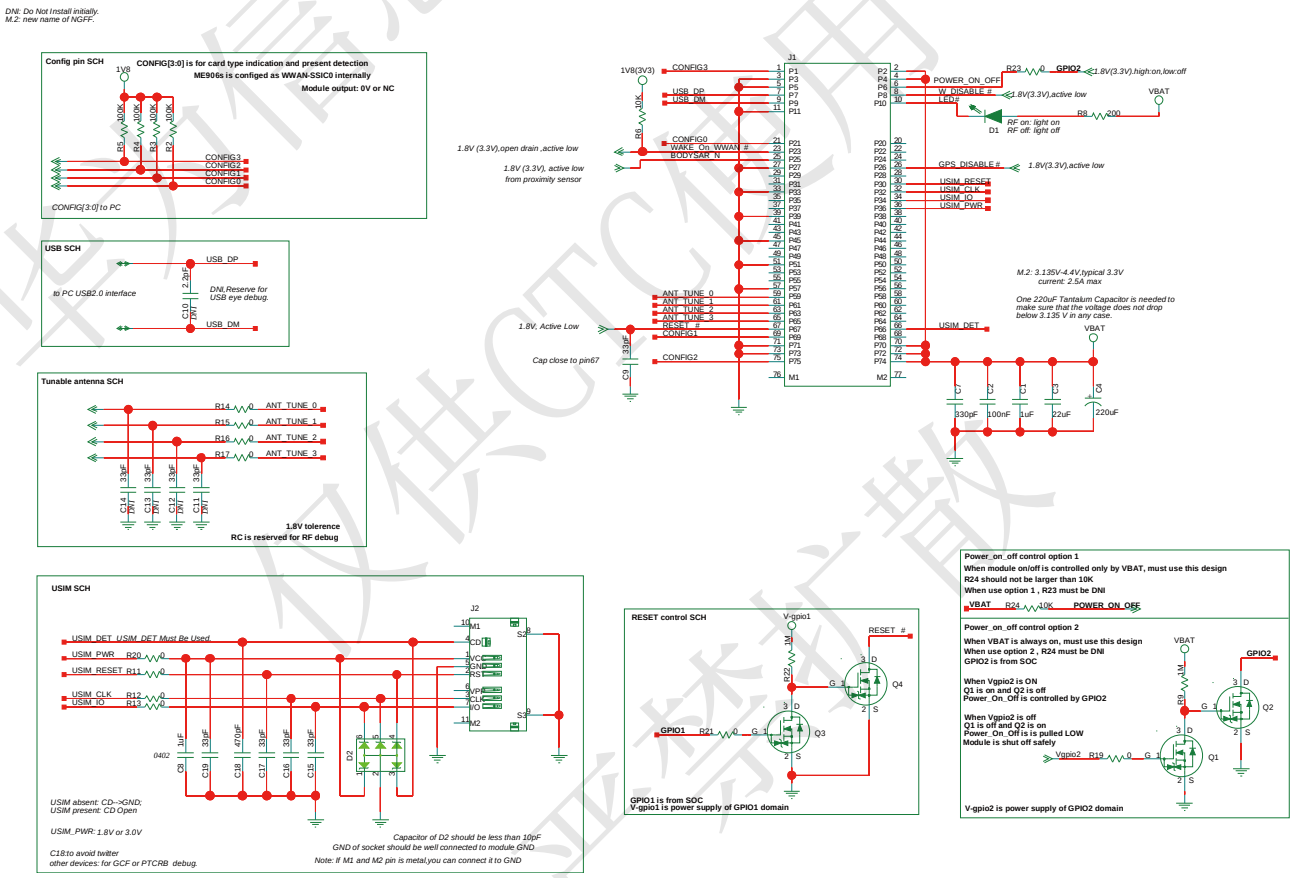
The main host device can be HP PC, which inherited the ME906s-158 module for data exchange and network service.

NOTE:

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

- Reorient or relocate the receiving antenna.
- Increase the distance between the device and the receiver.
- Connect the device to an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio or TV technician for help.
- This device is intended for OEM integrators only.
- Host system must be labeled with "Contains FCC ID: QISME906S-158", FCC ID displayed on label.

10 Appendix A Circuit of Typical Interface



11 Appendix B Acronyms and Abbreviations

Acronym or Abbreviation	Expansion
3GPP	3rd Generation Partnership Project
CCC	China Compulsory Certification
CPU	Central Processing Unit
CS	Coding Scheme
CSD	Circuit Switched Data
DC	Direct Current
DMA	Direct Memory Access
DVK	Development Kit
EBU	External Bus Unit
EDGE	Enhanced Data for GSM Evolution
EIA	Electronic Industries Association
EMC	Electromagnetic Compatibility
EPA	Electrostatic Discharge Protected Area
ESD	Electrostatic Discharge
EU	European Union
FCC	Federal Communications Commission
FDD-TDMA	Frequency Division Duplexing-Time Division Multiple Access
GMSK	Gaussian Minimum Shift Keying
GPIO	General-purpose I/O
GPRS	General Packet Radio Service

Acronym or Abbreviation	Expansion
GSM	Global System for Mobile communication
HBM	Human Body Model
HSIC	High Speed Inter-Chip Interface
HSDPA	High-Speed Downlink Packet Access
HSPA+	Enhanced High Speed Packet Access
HSUPA	High Speed Up-link Packet Access
IPC	Inter Processor Communications
ISO	International Standards Organization
I2S	I2C Sound
LCD	Liquid Crystal Display
LCP	Liquid Crystal Polyester
LDO	Low-Dropout
LED	Light-Emitting Diode
LTE	Long Term Evolution
MCP	Multi-chip Package
MIPI	Mobile Industry Processor Interface
NGFF	Next Generation Form Factor
NTC	Negative Temperature Coefficient
PA	Power Amplifier
PBCCH	Packet Broadcast Control Channel
PCB	Printed Circuit Board
PDU	Protocol Data Unit
PMU	Power Management Unit
RF	Radio Frequency
RoHS	Restriction of the Use of Certain Hazardous Substances
RSE	Radiated Spurious Emission
RTC	Real-time Clock
SIMO	Single Input Multiple Output
TTL	Transistor-transistor Logic
TVS	Transient Voltage Suppressor

Acronym or Abbreviation	Expansion
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access