FIBOCOM

Perfect Wireless Connection

H380 M.2 Series Module Hardware User Manual

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Revision History

Version	Date	Remarks
V1.0.0	2014-03-20	Initial version
V1.0.1	2014-04-18	1.Change current part. 2.Change GPS part. 3.Change temperature .
V1.0.2	2014-06-04	Add support spec of Win 8 / android dual system switch .

Applicability Table

No.	Type	Note
1	H380-Q50-00	

The difference M.2 wireless communication module of H380 series as listed below:

Model No.	GSM/GPRS/EDGE Band(MHz)	WCDMA Band(MHz)	HSDPA (Mbps)	HSUPA (Mbps)
H380-Q50-00	850/900/1800/1900	850/900/1900/2100	21	5.76

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1 Preface

1.1 Outline

The document outlines the electrical, RF performance, mechanical size and application environment of H380 series M.2 wireless communication module. Under the help of the document and others application notice, the application developer could understand quickly the performance of H380 series M.2 wireless communication module,and developing the product.

1.2 Standards

The products`reference design standard as listed below:

- 3GPP TS 27.007 -v6.9.0: AT command set for User Equipment (UE)
- 3GPP TS 27.005 -v6.0.1: Use of Data Terminal Equipment -Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- 3GPP TS 23.040 -v6.9.0: Technical realization of Short Message Service (SMS)
- 3GPP TS 24.011 -v6.1.0: Point- to - Point (PP) Short Message Service (SMS) support on mobile radio interface.
- 3GPP TS 27.010 -v6.0.0: Terminal Equipment to User Equipment (TE-UE) multiplexer protocol
- 3GPP TS 27.060 -v6.0.0: Packet domain; Mobile Station (MS) supporting Packet Switched services
- 3GPP TS 25.304-v6.10.0: User Equipment (UE) procedures in idle mode and procedures for cell reselection in connected mode.
- 3GPP TS 25.308 -v6.4.0: High Speed Downlink Packet Access (HSDPA); Overall description;Stage 2.
- 3GPP TS 25.309 -v6.6.0: FDD enhanced uplink; Overall description; Stage 2.
- 3GPP TS 23.038 -v6.1.0: Alphabets and language - specific information
- 3GPP TS 21.111 -v6.3.0: USIM and IC card requirements.
- 3GPP TS 31.111 -v6.11.0 "USIM Application Toolkit (USAT)".
- 3GPP TS 45.002 -v6.12.0: Multiplexing and multiple access on the radio path.
- 3GPP TS 51.014 -v4.5.0: Specification of the SIM Application Toolkit for the Subscriber Identity Module - Mobile Equipment (SIM-ME) interface.
- 3GPP TS 51.010 -1 -v6.7.0: Mobile Station (MS) conformance specification; Part 1: Conformance specification.
- 3GPP TS 22.004 -v6.0.0: General on supplementary services.
- 3GPP TS 23.090 -v6.1.0: Unstructured Supplementary Service Data (USSD); Stage 2
- 3GPP TS 24.008 v6.19, Mobile radio interface Layer 3 specification;

- PCIe_M.2_Electromechanical_Spec_Rev0.9-3_07312013_RS_Clean[1]

2 Introduction

2.1 Description

H380 M.2 series modules are highly integrated 3G wireless communication modules, support GSM / GPRS / EDGE and UMTS / HSDPA / HSUPA / HSPA+ , GPS/GNSS(follow-up support).

2.2 Specifications

Specifications	
Bands	UMTS (WCDMA/FDD): 850/900/1900/2100MHz
	GSM/GPRS/EDGE: 850/900/1800/1900MHz
Data	UMTS/HSDPA/HSUPA 3GPP release 7
	HSUPA 5.76Mbps (Cat 6)
	HSDPA 21Mbps (Cat 14) or 7.2Mbps (Cat 8)
	GSM 3GPP release 7
	EDGE (E-GPRS) multi-slot class 33(296kbps DL, 236.8kbps UL)
	GPRS multi-slot class 33(107kbps DL, 85.6kbps UL)
GPS	GPS/GNSS(follow-up support)
Physical	Dimension: 22mm x 42mm x 2.35mm
	Interface: M.2
	Weight: 5.0 grams
Environment	Operating Temperature: -30℃ ~ +75℃
	Storage Temperature: -40℃ ~ +85℃
Performance	
Operating Voltage	Voltage: 3.135V ~ 4.4V Normal: 3.3V
Operating Current (Typical Value)	3mA (Sleep Mode)
	3G Talk: 660mA
	2G Talk: 270mA (GSM PCL5)
Transmit Power (Typical Value)	Class 4 (2W): 850/900 MHz, GSM
	Class 1 (1W): 1800/1900 MHz, GSM
	Class E2 (0.6W): 850/900 MHz, EDGE
	Class E2 (0.5W): 1800/1900 MHz, EDGE

	Class 3 (0.25W): 900/850/1900/2100 MHz, WCDMA
Rx Sensitivity (Typical Value)	UMTS/HSPA: -109dBm
	GSM: -108dBm
Interfaces	
RF Interface	Main Antenna, Diversity Antenna(RF diversity and GPS Aux)
Connectivity	1 x USB 2.0,Multiple Profiles over USB
	I2C Support,I2S/PCM Support
	GPIO Connectivity
Data Features	
Protocol Stack	Embedded TCP/IP and UDP/IP protocol stack
EDGE	Multi-slot class 33(5 Down; 4 Up; 6 Total)
	Coding Scheme MCS1~9
GPRS	Multi-slot class 33(5 Down; 4 Up; 6 Total)
	Coding Scheme CS1~4
CSD	UMTS(14.4kbps), GSM(9.6kbps)
USSD	Support
SMS	MO / MT Text and PDU modes
	Cell broadcast
Voice Features	Digital Audio
	Voice coders: EFR/HR/FR/AMR
Audio Control	Gain Control
Character Set	IRA
	GSM
	UCS2
	HEX
AT Commands	FIBOCOM proprietary AT commands
	GSM 07.05
	GSM 07.07
Accessories	Firmware Loader Tool over USB/UART
	User Manual
	Developer Kit

2.3 Appearance

The following picture shows the H380 M.2 WWAN Module.

Top view:

Figure 2- 1 Top View

Bottom view:

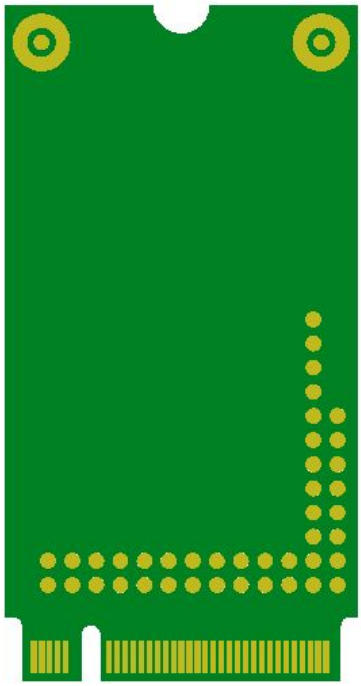


Figure 2- 2 Bottom View

3 Mechanical

3.1 Size

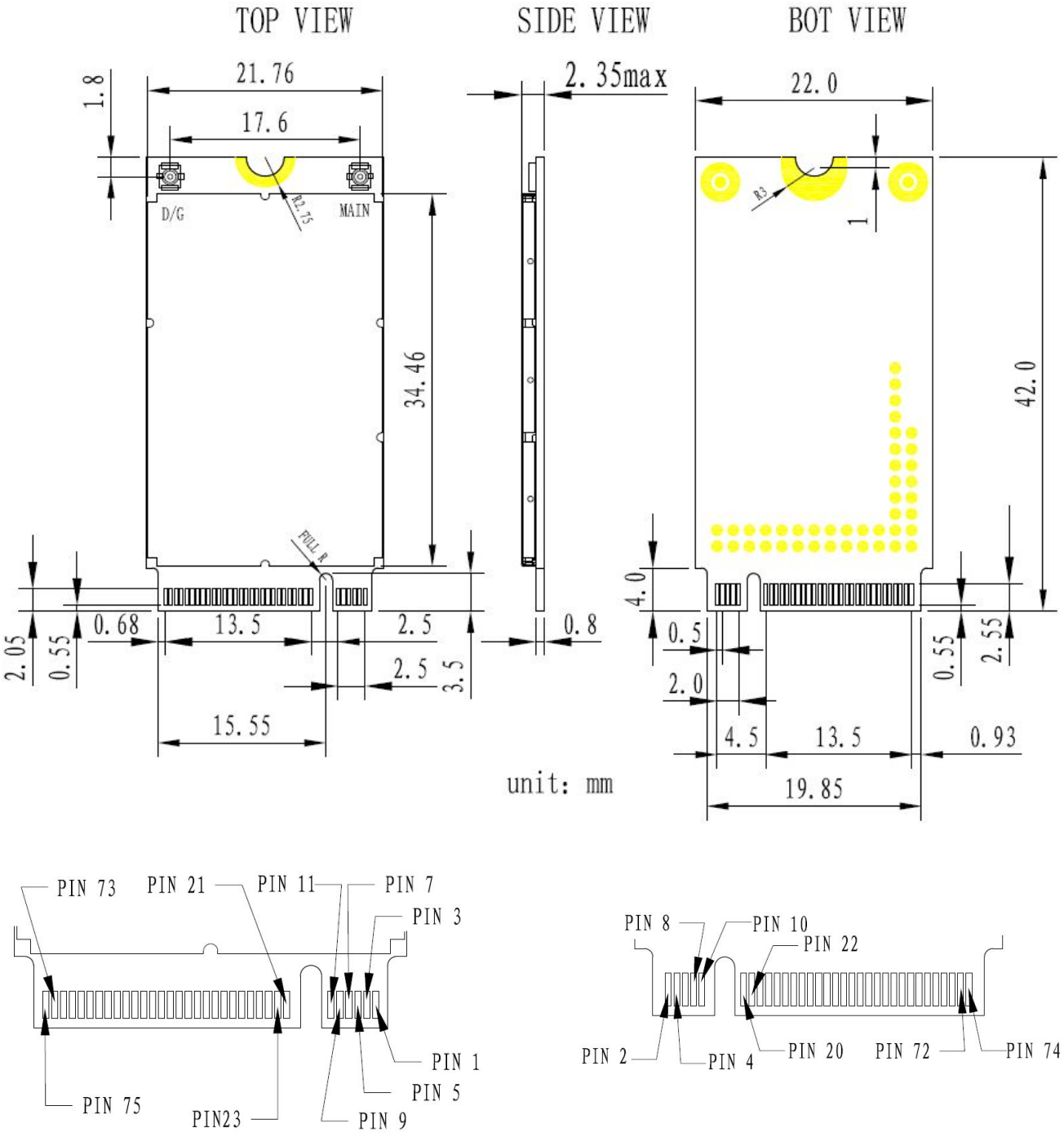


Figure 3- 1 Mechanical size

3.2 Application Interface Description

H380 M.2 module uses 75-pin gold fingers as the external interface,the size of the module please refer to the Section3.1.

As shown in Figure 4-2, H380 M.2 module uses the 75-pin fingers interface(67 pin is signal interface and 8 is notch).

About the naming rules of M.2, H380 uses the Type 2242-S3-B (22mmx42mm,Top surface element layer maximum thickness is 1.5mm, the thickness of PCB is 0.8mm, Key ID is B)

Module Nomenclature
Sample Type 2242-D2-B-M

Type XX XX - XX - X - X[0]

Width (mm)
12
16
22
30

Length (mm)
16
26
30
42
60
80
110

Lable**	Component Max Ht (mm)	
	Top Max	Bottom Max
S1	1.2	0****
S2	1.35	0****
S3	1.5	0****
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	2x PCIe x1 / USB 2.0 / I2C / DP x4
B	12-19	PCIe x2/SATA/USB 2.0/USB 3.0/HSIC/SSIC/Audio/UIM/I2C
C	16-23	Reserved for Future Use
D	20-27	Reserved for Future Use
E	24-31	2x PCIe x1 / USB 2.0 / I2C / 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 intended for custom use. Devices with this key will not be M.2-compliant. Use at your own risk!
**** Insulating label allowed on connector-based designs

3.3 M.2 Connector

Recommended to use the M.2 connector from LOTES, type is APCI0026-P001A,the Connector package design please refer to the relevant specifications and design.

As shown in Figure 3-2::

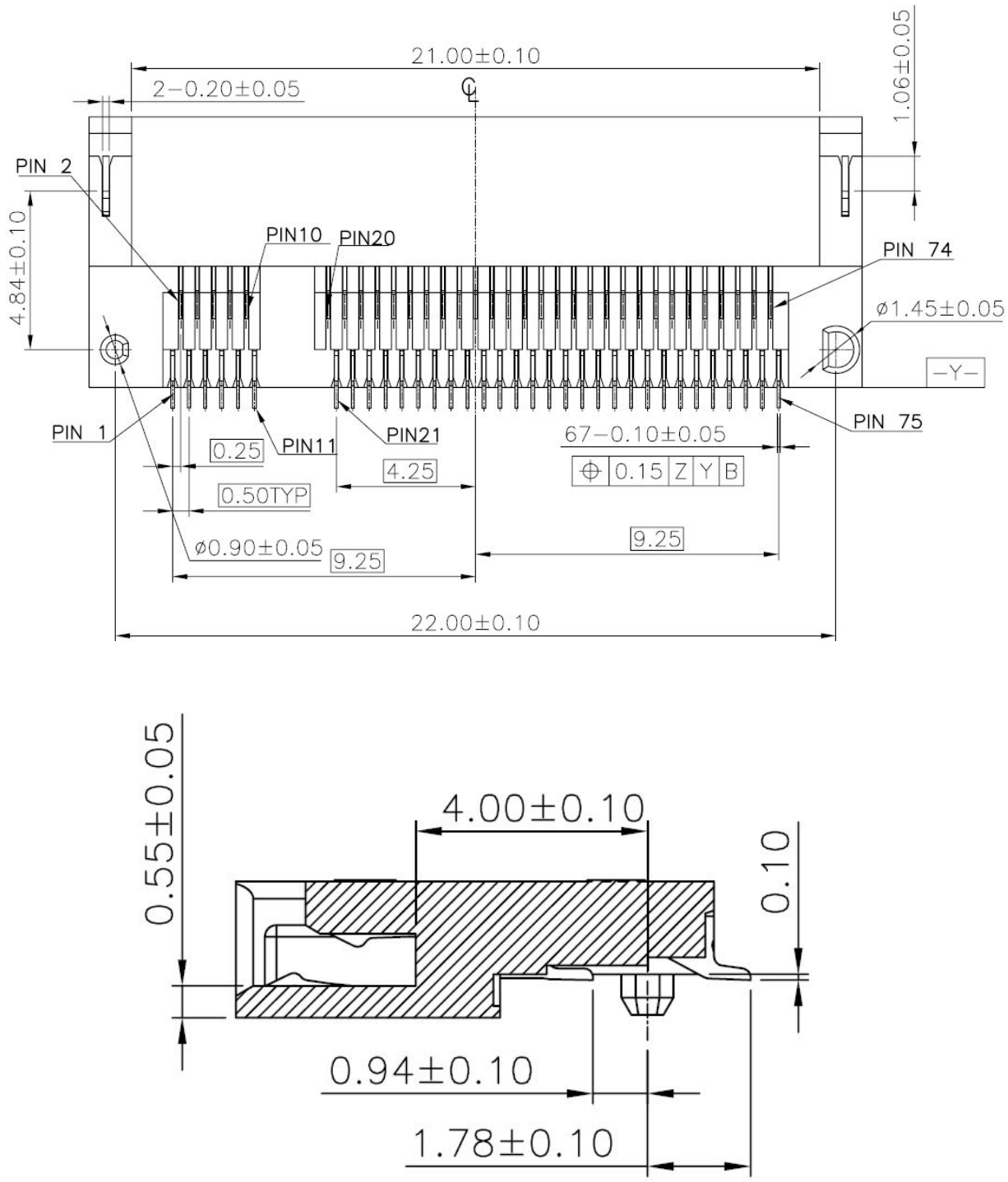


Figure 3- 2 APCI0026-P001A M.2 connector dimension

4 Hardware Overview

4.1 Block Diagram

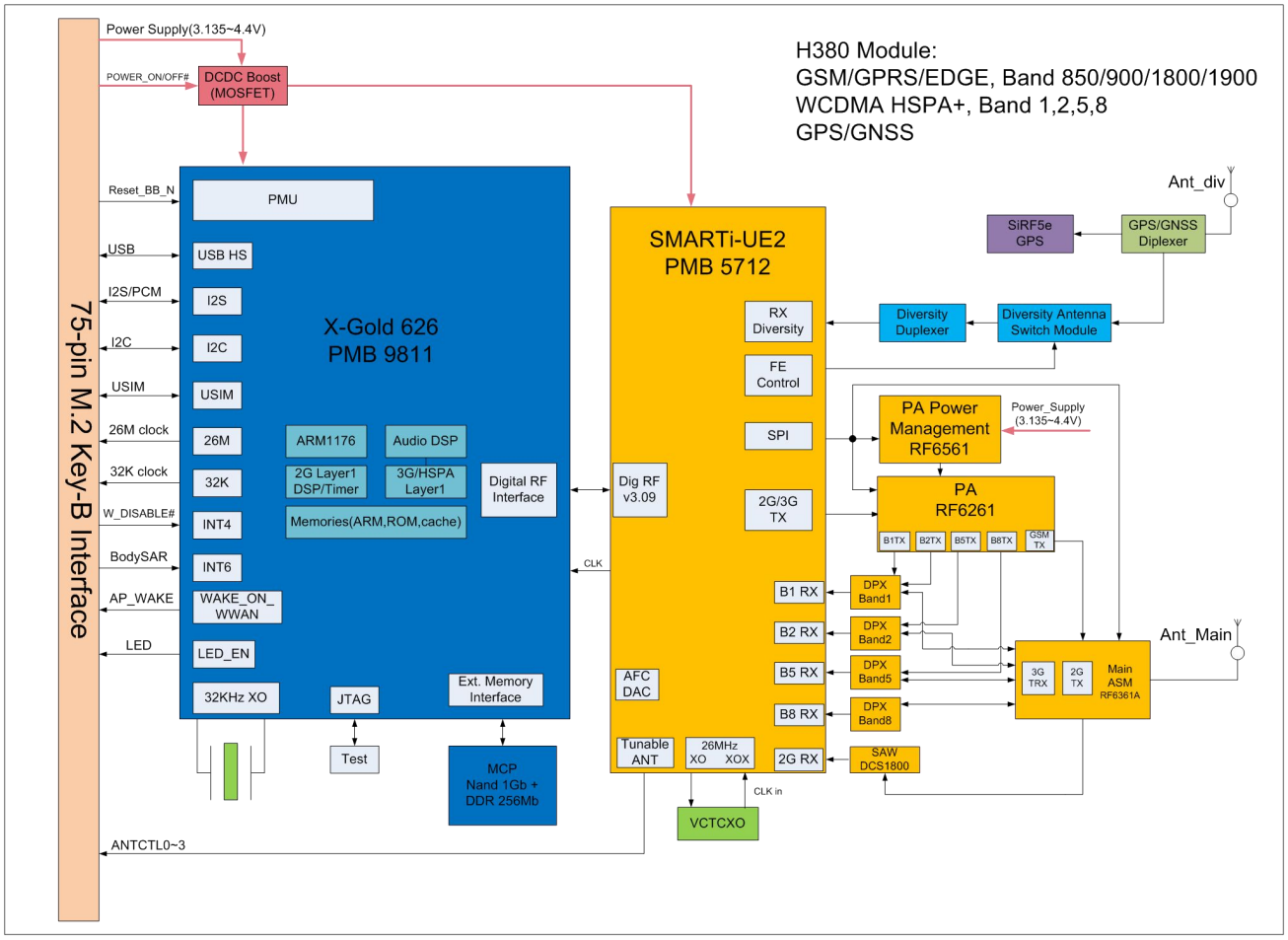


Figure 4- 1 Block Diagram

4.2 Pin Definition

Pin Map

74	+3.3V	CONFIG_2	75
72	+3.3V	GND	73
70	+3.3V	GND	71
68	CLK32K	CONFIG_1	69
66	SIM_DETECT	RESET#	67
64	NC	ANTCTL3	65
62	NC	ANTCTL2	63
60	NC	ANTCTL1	61
58	NC	ANTCTL0	59
56	NC	GND	57
54	NC	NC	55
52	NC	NC	53
50	NC	GND	51
48	TX_BLANKING	NC	49
46	SYSCLK	NC	47
44	GNSS_IRQ	GND	45
42	GNSS_SDA	NC	43
40	GNSS_SCL	NC	41
38	NC	GND	39
36	UIM_PWR	NC	37
34	UIM_DATA	NC	35
32	UIM_CLK	GND	33
30	UIM_RESET	NC	31
28	I2S_WA	NC	29
26	W_DISABLE2#	GND	27
24	I2S_RX	DPR	25
22	I2S_TX	WOWWAN#	23
20	I2S_CLK	CONFIG_0	21
	Notch	Notch	
	Notch	Notch	
	Notch	Notch	
	Notch	Notch	
10	LED1#(3.3V)	GND	11
8	W_DISABLE1#(3.3V)	USB D-	9
6	FUL_CARD_POWER_OFF#(1.8V)	USB D+	7
4	+3.3V	GND	5
2	+3.3V	GND	3
		CONFIG_3	1

Figure 4- 2 Pin Definition

4.2.1 Pin Description

The description of pin-out of H380 as listed below:

No	Name	I/O	Reset Value	Idle Value	Description
1	CONFIG_3	O	L	L	Connected to Ground internally, H380 is configured as a WWAN-SSIC0 interface module
2	+3.3V	PI			Power Supply, voltage range: 3.135V ~ 4.4V
3	GND				GND
4	+3.3V	PI			Power Supply, voltage range: 3.135V ~ 4.4V
5	GND				GND
6	FUL_CARD_POWER_OFF#	I	PU	PU	The control signal of power off, internal pull- up(47K ohms), CMOS 1.8V
7	USB D+	I/O			USB signal (+)
8	W_DISABLE1#	I	PU	PU	WWAN Disable, Low active, CMOS 3.3V
9	USB D-	I/O			USB signal(-)
10	LED1#	O	OD	OD	System status LED, open-drain output, low level is available, CMOS 3.3V
11	GND				GND
12	Notch				Notch
13	Notch				Notch
14	Notch				Notch
15	Notch				Notch
16	Notch				Notch
17	Notch				Notch
18	Notch				Notch
19	Notch				Notch
20	I2S_CLK	O	T	T	I2S serial clock, CMOS 1.8V

No	Name	I/O	Reset Value	Idle Value	Description
21	CONFIG_0				NC
22	I2S_TX	O	T	T	I2S serial data output, CMOS 1.8V
23	WOWWAN#	O	PU	PU	The signal of module wake up the Host device, low level is available, CMOS 1.8V
24	I2S_RX	I	T	T	I2S serial data input, CMOS 1.8V
25	DPR	I			Body SAR Detect,CMOS 1.8V
26	W_DISABLE2#	I	PU	PU	GPS Disable,active low,CMOS 1.8V (not support now)
27	GND				GND
28	I2S_WA	O	T	T	I2S Left/Right clock signal,CMOS 1.8V
29	NC				NC
30	UIM_RESET	O	PP	PP	USIM card reset
31	NC				NC
32	UIM_CLK	O	PP	PP	USIM card clock
33	GND				GND
34	UIM_DATA	I/O	PU	PU	USIM card data, internal 4.7K resistor pull up
35	NC				NC
36	UIM_PWR	O			SIM Card power output,1.8V/3.0V
37	NC				NC
38	NC				NC
39	GND				GND
40	GNSS_SCL	O	PD	PD	Android/Win8 system can switch INTIN signal, internal resistance was pulled-up10K, CMOS 1.8V
41	NC				NC
42	GNSS_SDA	I/O	PU	PU	I2C serial data,internal pull-up(4.7K ohms),CMOS 1.8V
43	NC				NC

No	Name	I/O	Reset Value	Idle Value	Description
44	GNSS_IRQ	I	PU	PU	Android/Win8 I2C interrupt request (not support now), CMOS 1.8V
45	GND				GND
46	SYSCLK	O	L	L	26MHz clock output
47	NC				NC
48	TX_BLANKING	O	L	L	GSM TDMA Timer output signal, external GPS control signal, CMOS 1.8V
49	NC				NC
50	NC				NC
51	GND				GND
52	NC				NC
53	NC				NC
54	NC				NC
55	NC				NC
56	NC				NC
57	GND				GND
58	NC				NC
59	ANTCTL0	O	L	L	Tunable antenna control signal, bit0,CMOS 1.8V(not support now)
60	NC				NC
61	ANTCTL1	O	L	L	Tunable antenna control signal, bit1, CMOS 1.8V (not support now)
62	NC				NC
63	ANTCTL2	O	L	L	Tunable antenna control signal, bit2,CMOS 1.8V(not support now)
64	NC				NC
65	ANTCTL3	O	L	L	Tunable antenna control signal, bit3,CMOS 1.8V(not support now)
66	SIM_DETECT	I			SIM Detect ,CMOS 1.8V
67	RESET#	I	PU	PU	External reset signal input, CMOS

No	Name	I/O	Reset Value	Idle Value	Description
					1.8V
68	CLK32K	O			32KHz Clock output
69	CONFIG_1	O	L	L	Connected to Ground internally, H380 is configured as a WWAN-SSIC0 interface module
70	+3.3V	PI			The main power supply, voltage range: 3.135V ~ 4.4V
71	GND				GND
72	+3.3V	PI			The main power supply, voltage range: 3.135V ~ 4.4V
73	GND				GND
74	+3.3V	PI			The main power supply,voltage range: 3.135V ~ 4.4V
75	CONFIG_2	O	L	L	Connected to Ground internally, H380 is configured as a WWAN-SSIC0 interface module

PI: Power Input

H: High Voltage Level

L: Low Voltage Level

PD: Pull-Down

PU: Pull-Up

T: Tristate

OD: Open Drain

PP: Push-Pull

5 Hardware Interface

5.1 Power Interface

5.1.1 Power Supply

H380 module requires a 3.135 V~ 4.4V DC power supply to provide 2A current during the GSM transmitting burst.

Input power supply requirements as listed below:

Parameter	Minimum	Typical	Maximum	Unit
+3.3V	3.135	3.3	4.4	V

Note:

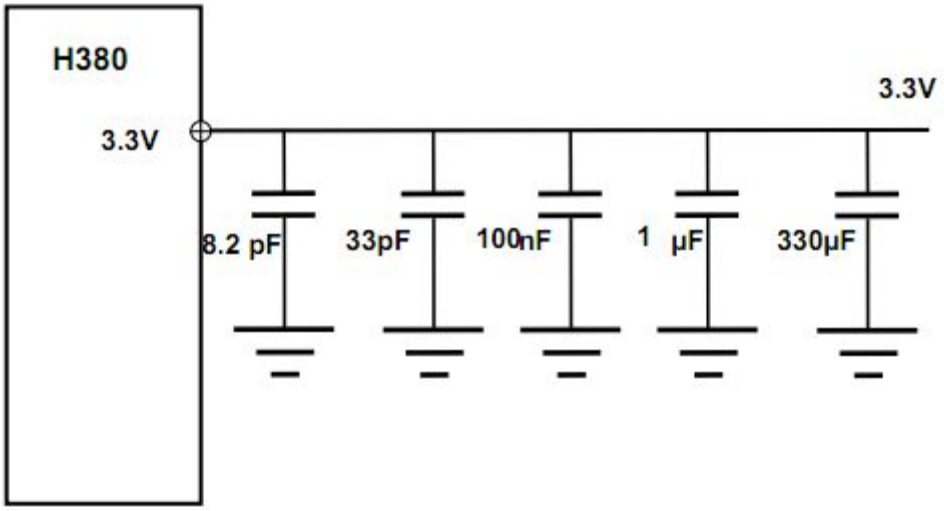
1. The ripple of Power supply must be lower than 200mV.

2. Power supply voltage does not drops below 3.135V during the 2G transmitting burst.

The filter capacitor of the supply circuit design are as follows:

Recommended capacitor	Application	Description
300uF	Supply capacitor	Reduce power wave in call. The value of capacitor is more bigger more better.
10nF, 100nF	Digital signal noise	Filtering interference from clock and digital signal.
8.2pF, 10pF	1800/1900/2100 MHz bands	Filtering the RF reference.
33pF, 39pF	850/900 MHz bands	Filtering the RF reference.

Recommended design:



5.1.2 Power Consumption

Parameter	Description	Condition		Typical Value (3.3V power supply)	Unit
I OFF	RTC mode			100	uA
I SLEEP	Low power mode (GSM)	DRX	2	2.86	mA
			5	2.56	
			9	2.26	
	Low power mode (WCDMA)	DRX	6	3.16	mA
			8	2.46	
			9	2.36	
I GSM-RMS	GSM voice - 1 TX slot 1 RX slot Peak current During TX slot	GSM850 PCL	5	265.4	mA
			10	104.2	
			15	73.6	
			19	69.2	
		EGSM900 PCL	5	270.2	
			10	107.0	
			15	73.9	
			19	69.2	
		DCS1800 PCL	0	185.8	
			5	94.1	
			10	71.4	
			15	67.7	
		PCS1900 PCL	0	187.8	
			5	97.3	
			10	72.7	
			15	69.7	
I GSM-MAX		GSM850 PCL	5	1999.9	mA
			10	507.5	
			15	177.6	
			19	141.3	
		EGSM900 PCL	5	2189.2	
			10	503.9	
			15	194.1	

Parameter	Description	Condition		Typical Value (3.3V power supply)	Unit
			19	157.2	
		DCS1800 PCL	0	1335.8	
			5	394.6	
			10	165.3	
			15	140.9	
		PCS1900 PCL	0	1473.1	
			5	395.7	
			10	178.9	
			15	149.7	
I GPRS	GSM850 PCL=5	GSM voice - 1RX slot TX slot	1	271.8	mA
			4	408.3	
	GSM850 PCL=10		1	91.8	
			4	232.4	
	EGSM900 PCL=5		1	251.7	
			4	428.1	
	EGSM900 PCL=10		1	90.6	
			4	234.3	
	DCS1800 PCL=0		1	175.7	
			4	305.3	
	DCS1800 PCL=10		1	78.8	
			4	123.0	
	PCS1900 PCL=0		1	205.2	
			4	326.1	
	PCS1900 PCL=10		1	78.8	
			4	124.1	
I EGPRS-RMS	GSM850 PCL=8	GSM voice - 1RX slot TX slot	1	216.5	mA
			4	581.1	
	GSM850 PCL=15		1	82.2	
			4	130.6	
	EGSM900 PCL=8		1	213.2	
			4	578.9	

Parameter	Description	Condition		Typical Value (3.3V power supply)	Unit
	EGSM900 PCL=15		1	88.7	
			4	156.7	
	DCS1800 PCL=2		1	230.7	
			4	565.6	
	DCS1800 PCL=10		1	87.9	
			4	134.0	
	PCS1900 PCL=2		1	234.7	
			4	582.7	
	PCS1900 PCL=10		1	87.1	
			4	133.1	
I WCDMA-RMS	WCDMA	Band1	24dBm	639.4	mA
			10dBm	202.3	
			1dBm	148.0	
		Band2	24dBm	662.4	
			10dBm	200.4	
			1dBm	148.7	
		Band5	24dBm	442.9	
			10dBm	180.8	
			1dBm	142.7	
		Band8	24dBm	492.0	
			10dBm	183.0	
			1dBm	148.4	

5.2 The signal of on/off and reset

5.2.1 Pin Definition

H380 wireless communication module has two control signals: power on/off and reset.

Pin Definition as listed below:

Pin No	Pin Name	Electrical Level	Description
6	FUL_CARD_POWER_OFF#	CMOS 1.8V	Power on/off signal
67	RESET#	CMOS 1.8V	External reset signal input

5.2.2 ON/OFF Signal

After power supply on H380 M.2 module, pull up FUL_CARD_POWER_OFF# signal and keep it more than 300ms,then module startup.

The Figure 5-1 shows the startup timing control :

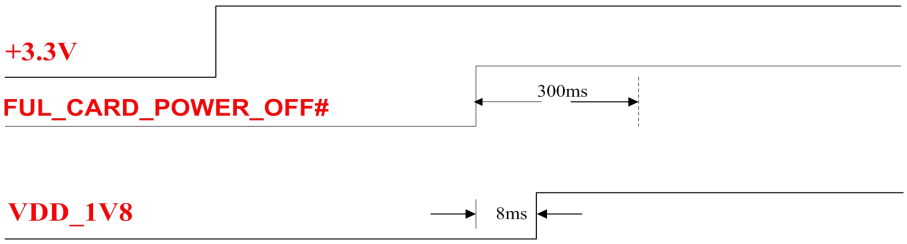


Figure 5-1 Power ON Timing

Pull down FUL_CARD_POWER_OFF# signal and keep more than 100ms, the H380 M.2 module will shut down.

The Figure 5-2 shows the shutdown timing:

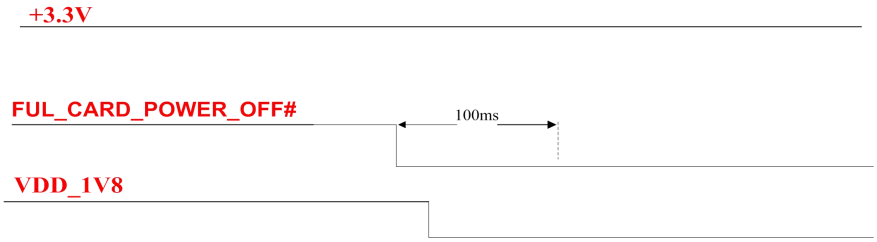


Figure 5-2 Power OFF Timing

Reference design of the FUL_CARD_POWER_OFF#:

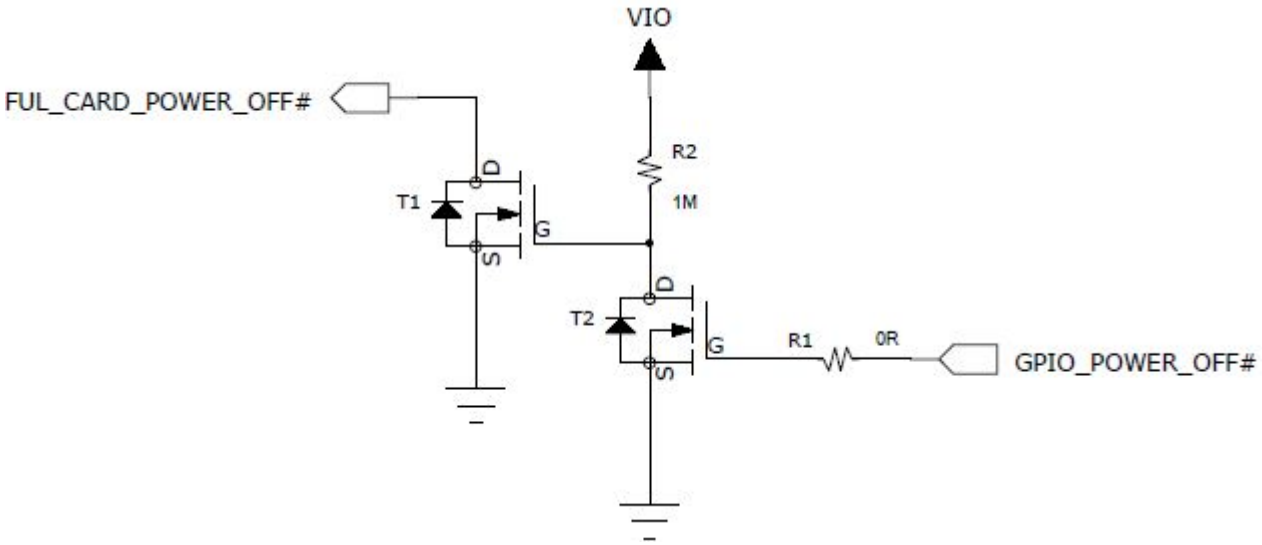


Figure 5-3 FUL_CARD_POWER_OFF# Reference design

5.2.3 Reset Signal

H380 wireless communication module supports external reset. Module will reset to initial state through Reset signal.

When Reset signal is active low and keep 100ms, the module will reset and restart. The module PMU internal is still on during reset.

Note: Reset signal is sensitive, when PCB layout, please keep it away from RF noise, adding decoupling capacitor near the module is recommended. Don't trace the Reset signal in PCB edge or surface, avoid ESD causing system reset.

Pulse Timing requirements as listed below:

Parameters	Condition	Minimum	Typical	Maximum	Unit
Pulse Width		100	300	3000	ms

Recommended design:

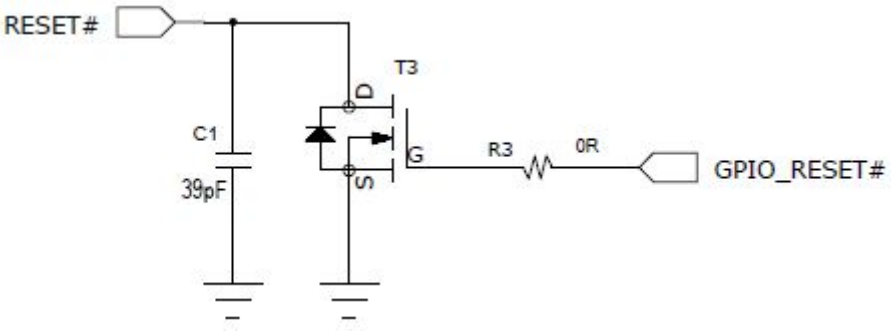


Figure 5-4 Reset Recommended Design

5.3 Indicator Signal

5.3.1 Pin Description

The H380 M.2 module provides an open drain output signal for indicating RF status.

Pin No	Pin Name	Description
10	LED1#	Open/close RF network indicator, CMOS 3.3V

LED1# signal description:

No	M.2 Module status	LED1#
1	RF function is turned on	Outputs Low
2	RF function is turned off	Output High

Recommended design:

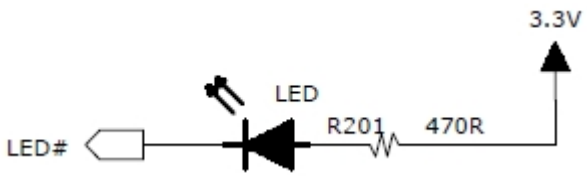


Figure 5-5 LED Status Indicator Recommended Design

5.4 USB Interface

5.4.1 USB Interface definition

Pin No	Pin Name	I/O	Description
7	USB_DP	I/O	USB differential Data (+)
9	USB_DM	I/O	USB differential Data (-)

H380 wireless communication module supports USB 2.0. It should install USB driver before use on PC. After H380 module plugged into the PC, the USB can enumerate seven ports:

- One 3G Modem/AT port for data transmission
- Three ports for sending AT Command
- One port for trace LOG information
- Two ports reserved currently.

5.4.2 USB Interface Application

Reference Design as follow:

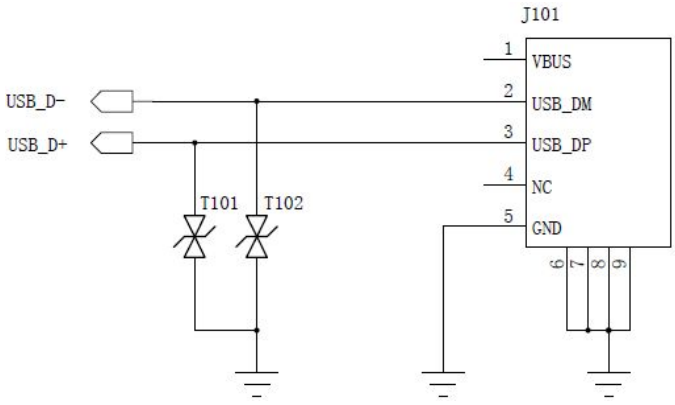


Figure 5-6 USB Interface Reference Design

The capacitor of TVS(T101 and T102) must be less than 1pF. VUSB power supply has been connected internal, so the VBUS pin of HOST can float.USB_D+ and USB_D- are high speed differential serial signals, the highest transmit speed is up to 480 Mbps.

PCB Layout note:

- USB_D+ and USB_D- signals trace same length, parallel, as short as possible.
- USB_D+ and USB_D- should be isolated by Ground in same and adjacent layer. It is better for USB performance when adding more GND VIA.
- USB2.0 signal should trace near the Ground layer of PCB.
- Impedance control of USB differential signals is 90 ohm.
- USB signal should keep away from any strong noise signal like power supply etc.

5.5 USIM Interface

H380 WIRELESS COMMUNICATION module supports USIM and high speed SIM card, does not support 8 line smart USIM yet.

5.5.1 USIM pin-out

Pin No	Name	Type	Description
36	UIM_PWR	O	USIM POWER
30	UIM_RESET	O	USIM Reset
32	UIM_CLK	O	USIM clock
34	UIM_DATA	I/O	USIM data
66	SIM_DETECT	I	The detection signal for SIM inserting. The interior of M.2 module has pulled up. H: SIM is present. L: SIM is absent

5.5.2 USIM

5.5.2.1 Normally Closed SIM Circuit Design

Reference Design:

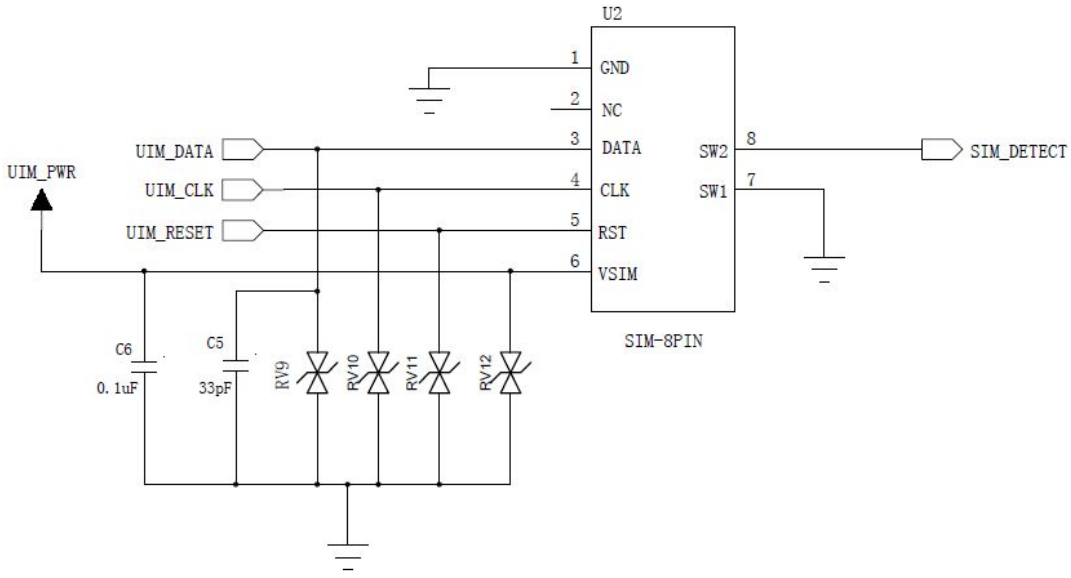


Figure 5-7 Normally Closed SIM Circuitr Reference Design

Normally closed SIM Connector:

1）Pull out SIM card, pin 7 and pin 8 short.

2）Insert SIM card, pin 7 and pin 8 disconnect.

5.5.2.2 Normally Open SIM Circuit Design

Reference Design:

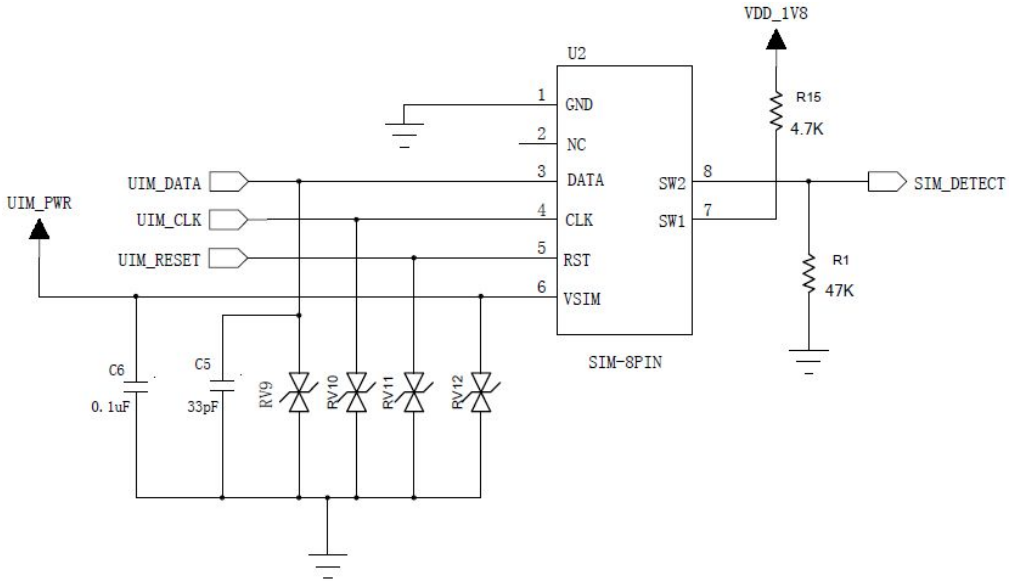


Figure 5-8 Normally Open SIM Connector Reference Design

Normally Open SIM Connector:

1）Pull out SIM card, pin 7 and pin 8 disconnect.

2）Inset SIM card, pin 7 and pin 8 short.

Note:

- For improving EMC performance, SIM card connector should be closed to module
- Filtering capacitor should be closed to SIM card pin
- The interface need ESD protection, ESD should be closed to SIM card pin
- USIM_DATA is already pulled up(4.7K ohms) inside the module

  SIM_DETECT support SIM hot plug, high level activated default (detect level can be changed by AT command). If high level is detected, it means SIM card is inserted.

5.5.3 USIM Design Notice

The SIM interface and signals design is extremely important.

There are several design guidelines that must be followed:

- The signals of the SIM card layout should be away from any possible EMI noise, such as RF antenna and digital switching signals.
- To ensure signal integrity, the length between SIM interface signals and module should not exceed 100 mm
- To avoid crosstalk between USIM_CLK and USIM_IO, it is recommended to route them separately on the application board, and preferably isolated by Ground layer.

- The SIM card signals should be protected by ESD component(low capacitance capacitor, such as Zener diode). The recommended part no of ESD component is AVR-M1005C080MTAAB (TDK). ESD component should layout with SIM connector closely.

5.5.4 USIM Hot Plug

H380 supports the detection function of SIM status,and this function can realize SIM hot plug.

5.5.4.1 Hardware Connection

SIM hot plug function need support of SIM_DETECT signal.

When no SIM card, SIM_DETECT is low level; insert SIM, SIM_DETECT is high level.

Explanation:

1) For normally closed SIM connector circuit, as shown in Figure 5-7.SIM_DETECT connects Pin8 (SW2) of U2, Pin7 (SW1) short GND. When there is no SIM card, SW2 and SW1 short, SW2 is low level. When SIM card inserted, SW1 and SW2 disconnect, SIM_DETECT is pulled high.

2) For normally open SIM connector circuit, as shown in Figure 5-8. SIM_DETECT connects Pin8 (SW2) of U2, and it also be pulled low by 47K ohms resistor. Pin 7 is pulled high by 4.7K ohms resistor. When no SIM card, SW2 and SW1 disconnect, SW2 is low. After SIM inserted, SW2 and SW1 short, SIM_DETECT is pulled high.

5.5.4.2 Software Configuration

"+MSMPD" AT command control SIM card hot plug function on/off.

AT+MSMPD=0, SIM card hot plug deactivated. Module does not detect SIM_DETECT signal.

AT+MSMPD=1, SIM card hot plug activated. Module support SIM hot plug by SIM_DETECT pin signal status.

SIM_DETECT High level, SIM card is present, module registers the network automatically.

SIM_DETECT Low level, SIM card is absent, module drops out the network.

Note: The "+MSMPD" default value is "1". SIM_DETECT is only used for SIM card hot plug detection, Module don't detect SIM_DETECT signal at the first startup(it means the module will read SIM card data and register network at the first startup, no matter pin SIM_DETECT is high or low).

5.6 Digital Audio

H380 M.2 supports digital audio I2S interface. It can support normal I2S mode or PCM mode. The voltage level of I2S interface is 1.8V.

I2S signal description as listed below:

Pin #	Name	Type	Description
20	I2S_CLK	O	Clocked

28	I2S_WA	O	Left/Right clock
22	I2S_TX	O	data output
24	I2S_RX	I	data input
42	GNSS_SDA	I/O	I2C control signal input/output
40	GNSS_SCL	O	I2C control clock

5.6.1 I2S Interface Description

H380	Signal Direction	Audio CODEC I2S Port
I2S2_CLK	→	I2S_CLK
I2S2_WA	→	I2S_LRCK
I2S2_RX	←	I2S_SDIN
I2S2_TX	→	I2S_SDOUT
SYSCLK	→	I2S_MCLK

5.6.2 I2C Interface Description

H380	Signal Direction	Audio CODEC I2C Port
GNSS_SDA	↔	I2C_SDA
GNSS_SCL	→	I2C_SCL

Note:

- I2S support master or slave mode
- It supports various audio sample rates (48 KHz, 44.1 KHz, 32 KHz, 24 KHz, 22.5 KHz, 16 KHz, 12 KHz, 11.025 KHz and 8 KHz).

5.6.3 PCM Mode Interface Description

H380	Signal Direction	Audio CODEC PCM Port
I2S_CLK (PCM_CLK, PCM clock signal)	→	PCM_CLK (PCM clock signal)
I2S_WA (PCM_SYNC, PCM frame synchronization signal)	→	PCM_SYNC (PCM frame synchronization signal)
I2S_RX (PCM_DIN, PCM data input)	←	PCM_DOUT (PCM data output)
I2S_TX (PCM_DOUT, PCM data output)	→	PCM_DIN (PCM data input)

Note:

- PCM support master or slave mode
- PCM support master or slave mode
- It supports short frame synchronization of 16 bit, 32bit, 48bit and 64bit.
- Supports sending data in burst mode and continuous mode
- It supports various audio sample rates (48 KHz, 44.1 KHz, 32 KHz, 24 KHz, 22.5 KHz, 16 KHz, 12 KHz, 11.025 KHz and 8 KHz).

* * The software not support PCM function now!

5.7 Win8/Android Dual System Switch

H380 module supports Win8/Android dual system switch, check and achieve the system switch through interrupt signal ”GNSS_IRQ”.

NO.	Name	Type	Description
29	GNSS_IRQ	I	Win8/Android dual system switch detection signal , CMOS 1.8V

Definition of GNSS_IRQ signal function as listed below :

No.	GNSS_IRQ	Functions
1	Low/Floating	Support Win8 system, the module`s USB ports shall set as MBIM modes.
2	High	Support Android system, the module`s `USB ports shall set as 7ACM modes.

Description:

1. Check and achieve the Win8/Android system switch through GNSS_IRQ level when module boot. Keep the GNSS_IRQ level stability during booting.
2. Check and achieve the Win8/Android system switch through GNSS_IRQ rising edge/ falling edge, set ting the de-bouncing time as 100ms. the module will reboot after meeting the requirements and can switch different system supports.
3. Note:Need high level when switching GNSS_IRQ to android system. Due to internal resistance of GNSS_IPQ was pulled-up 10K, for achieving high level ,external resistance can not be pulled-up over 20Kohm while circuit design.

5.8 W_DISABLE# Interface

5.8.1 WWAN_DISABLE# Interface Description

H380 module uses the hardware to open / close WWAN RF function signal , the function is also could

controlled by AT command.(please refer to AT manual)

Pin No	Name	Type	Description
8	W_DISABLE1#	I	WWAN open/close signal, CMOS 3.3V

W_DISABLE# signal function as defined below:

No	W_DISABLE#	Function
1	Low	WWAN function close
2	High	WWAN function open
3	Floating	WWAN function is defined by AT command , turned on by default

5.8.2 GPS_DISABLE# Interface Description

H380 module uses the hardware to open / close GPS function, the function is also controlled by AT command.

No	Name	Type	Description
26	W_DISABLE2#	I	GPS open/close signal, CMOS 1.8V

GPS_DISABLE# function definitions as follow:

No	GPS_DISABLE#	Function
1	Low	GPS function close
2	High	GPS function open
3	Floating	GPS function is defined by AT command , turned on default

Note: Not support this function now.

5.9 TX_BLANKING

The default value(output) is low. When module works with GSM network, TX Blanking outputs as same pulse as GSM transmitting burst. To avoid interference with GPS, AP will close GPS or stop GPS reception when AP detected TX_BLANKING signal.

No	Name	Type	Description
48	TX_BLANKING	O	External GPS device control signal

5.10 Wakeup Host Interface

H380 M.2 module support wake up the host. Module output low(high default) when need to wake up the host.

No	Name	Type	Description

23	WOWWAN#	O	Module wake up the Host signal ,1.8V signal, Input low level when wake up Host signal.

5.11 BODY_SAR Interface

H380 M.2 support BODY_SAR function.

BODY_SAR is an input signal (comes from AP output), high default, low active. AP can detect the closing human body and output BODY_SAR low through proximity sensor. Module will reduce RF transmitting power by BODY_SAR interrupt.

The threshold transmitting power can be configured by AT command.

No	Name	Type	Description
25	DPR	I	BODY_SAR detection

5.12 Clock Interface

H380 M.2 support a 26MHz clock output, a 32KHz clock output.

No	Name	Type	Description
46	SYSCLK	O	26MHz clock output(for GPS device, as audio codec MCLK)
68	CLK32K	O	32KHz clock output

5.13 Config

H380 M.2 provides 4 configuration pins, the module is configured as WWAN-SSIC 0.

No	Name	Type	Description	Value
1	CONFIG_3	O	Connected to Ground internally	0
21	CONFIG_0	O	NC	-
69	CONFIG_1	O	Connected to Ground internally	0
75	CONFIG_2	O	Connected to Ground internally	0

H380 M.2 Socket 2 Module type configuration as follows:

Config_0 (pin21)	Config_1 (pin69)	Config_2 (pin75)	Config_3 (pin1)	Module Type and Main Host Interface	Port Configuration
GND	GND	GND	GND	SSD-SATA	N/A
GND	GND	N/C	GND	WWAN-PCIe	N/A
N/C	GND	GND	GND	WWAN-SSIC	0

5.14 RF Interface

5.14.1 RF Connector Interface Description

H380 provides two RF interfaces for connecting to the external antenna. D/G is Diversity/GPS Aux RF antenna, MAIN is RF main antenna.

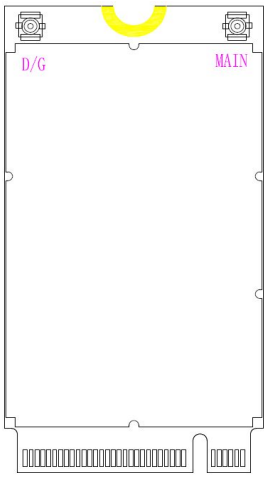


Figure 5-9 RF connector diagram

5.14.2 RF Connector Description

H380 M.2 use Murata MM4829-2702 RF connector, 2*2*0.6mm dimension. The connector's dimension is as follow:

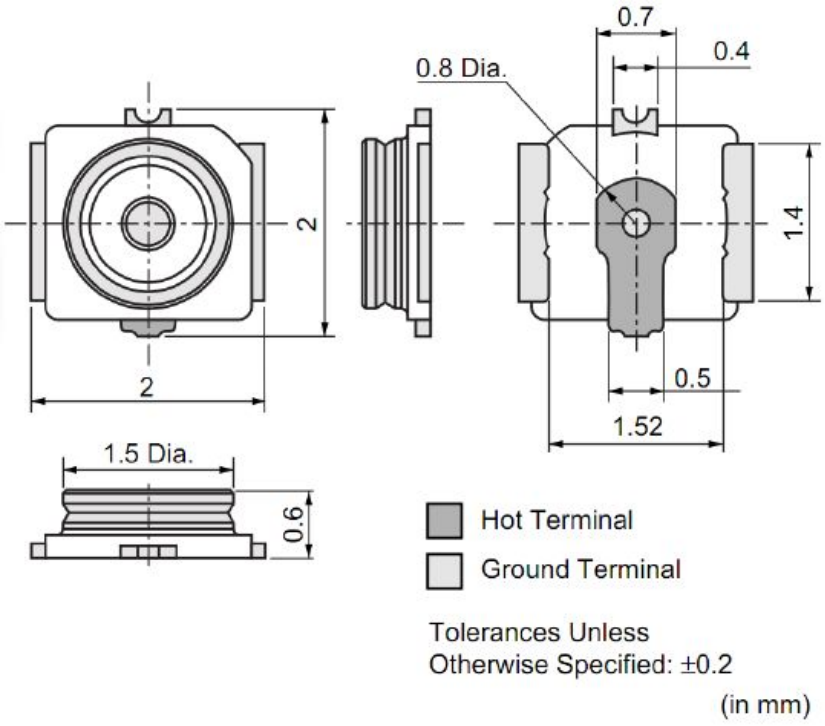


Figure 5-10 RF connector dimension

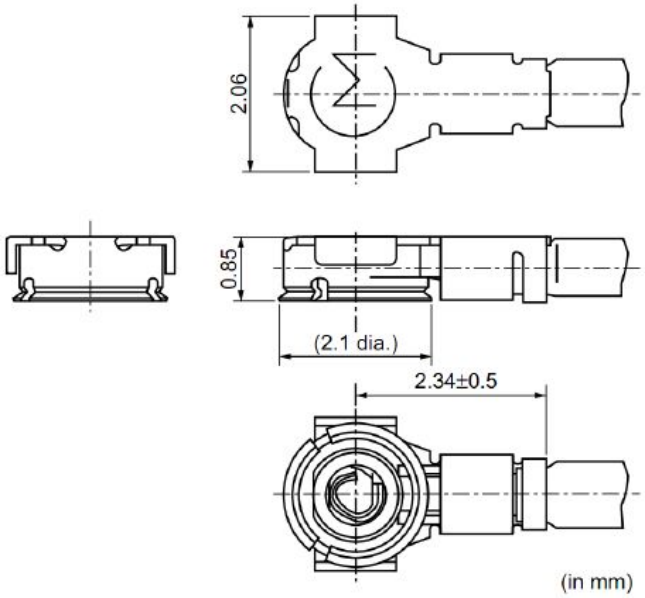


Figure 5-11 0.81mm coaxial cable matching RF connector

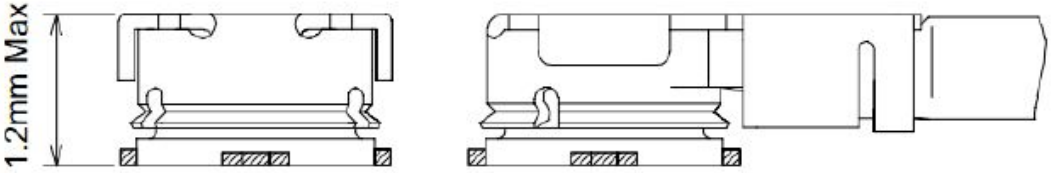


Figure 5-12 the connection between the RF connector and the 0.81 mm cable

5.14.3 RF Connector main performance index

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

5.15 Others

The interface of GPIO and Tunable ANT of the M.2 module does not support yet..

6 Electrical and Environmental

6.1 Electrical

This table shows the electrical features range of H380 M.2.

Parameter	Minimum Value	Maximum Value	Unit
Power supply	0	4.4	V
Digital Signal	0	1.9	V

6.2 Environmental

This table shows the environmental features of H380 M.2.

Parameter	Minimum Value	Maximum Value	Unit
Operational Temperature	-30	+75	°C
Storage Temperature	-40	+85	°C

7 RF Interface

7.1 Operating Band

7.1.1 Antenna Band

Operating Band	Tx	Rx
UMTS 2100 (Band I IMT)	1920–1980 MHz	2110–2170 MHz
UMTS 1900 (Band II IMT)	1850–1910 MHz	1930–1990 MHz
UMTS 850 (Band V IMT)	824–849 MHz	869–894 MHz
UMTS 900 (Band VIII IMT)	880–915 MHz	925–960 MHz
GSM 850	824–849 MHz	869–894 MHz
GSM 900	880–915 MHz	925–960 MHz
DCS 1800	1710–1785 MHz	1805–1880 MHz
PCS 1900	1850–1910 MHz	1930–1990 MHz

7.1.2 Diversity Antenna Band

Operating Band	Rx
UMTS 2100 (Band I IMT)	2110–2170 MHz
UMTS 1900 (Band II PCS)	1930–1990 MHz
UMTS 850 (Band V CLR)	869–894 MHz
UMTS 900 (Band VIII GSM)	925–960 MHz

7.2 RF PCB Design

7.2.1 Impedance Design

The impedance of RF should be matched 50 ohm.

7.3 Antenna Design

7.3.1 Main Antenna Design Requirements

(1) Antenna Efficiency

Antenna efficiency is the ratio between antenna input power and radiation power. The radiation power of an antenna is always lower than the input power due to the following factors: return loss, material loss,

and coupling loss.

Efficiency of the master antenna > 40% (–4dB)

(2) S11 or VSWR

S11 (return loss) indicates the degree to which the input impedance of an antenna matches the reference impedance (50 ohm). 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 by vector analyzer.

S11 of the master antenna < –10 dB

(3) Polarization

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

Linear polarization is recommended: it would be better if the polarization direction of diversity antenna is different from main antenna.

(4) Radiation Pattern

Radiation pattern refers to the directional dependence of the strength of radio waves from the antenna or other source.

The radiation pattern of half wave dipole antennas is the best for wireless terminals. If it is built-in antenna, PIFA antenna is recommended:

Antenna area (H x W x L): 6mm x 10mm x 100mm. PIFA or IFA antenna is recommended.

Radiation Pattern: Omni-directional

(5) Gain and Directivity

The directivity of the antenna is the electromagnetic field strength of the electromagnetic wave in each direction. An antenna's power gain is a key performance Figure which combines the antenna’s directivity and electrical efficiency.

Recommended antenna gain ≤ 2.5dBi

(6) Interference

Besides the antenna performance, the interference on the PCB 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 PCB board, there are various interference sources that can affect the module, such as the speaker, LCD, CPU, FPC trace and audio circuits, the power supply should be far away from antenna, notice isolation, shield and filtering processing issues.

(7) TRP/TIS

TRP (Total Radiated Power):

- W900/W850/W1900/W2100>19dBm
- GSM850/GSM900>28dBm
- DCS1800/PCS1900>25dBm

TIS (Total Isotropic Sensitivity) :

- W900/W850<-102dBm
- W1900/W2100<-103dBm
- GSM850/GSM900<-102dBm
- DCS1800/PCS1900<-102dBm

7.3.2 Diversity Antenna Design

Diversity reception function of H380 M.2 is optional, Please add a diversity antenna if necessary.

The design methods of diversity antenna and main antenna are the same, its efficiency indicators allows to reduce 3dB.

The isolation between main antenna and diversity antenna should be higher than 12dB.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is still responsible for the FCC compliance requirement of the end product, which integrates this module.20cm minimum distance has to be able to be maintained between the antenna and the users for the host this module is integrated into.

Under such configuration, the FCC radiation exposure limits set forth for an population/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment.

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed to keep at least 20cm separation with the antenna while this end product is installed and operated. The end user has to be informed that the FCC radio-frequency exposure guidelines for an uncontrolled environment can be satisfied.

The end user has to also be informed that any changes or modifications not expressly approved by the manufacturer could void the user's authority to operate this equipment. If the size of the end product is smaller than 8x10cm, then additional FCC part 15.19 statement is required to be available in the users manual:

This device complies with Part 15 of 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.

To comply with FCC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 2.5dBi in the cellular band and 2.5dBi in the PCS band.

A user manual with the end product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC RF exposure guidelines. The end product with an embedded H380.

Module may also need to pass the FCC Part 15 unintentional emission testing requirements and be properly authorized per FCC Part 15.

Note: If this module is intended for use in a portable device, you are responsible for separate approval to satisfy the SAR requirements of FCC Part 2.1093.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following " Contains TX FCC ID: ZMOH38F ". If the size of the end product is larger than 8x10cm, then the following FCC part 15.19 statement has to also be available on the label: This device complies with Part 15 of 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.