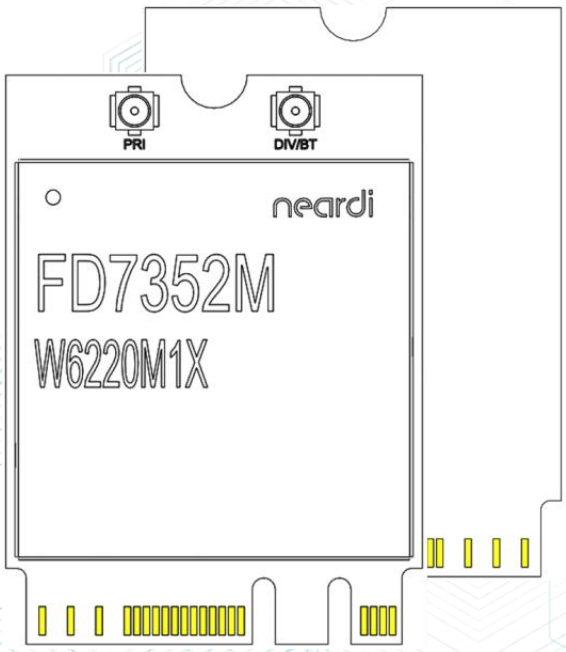
neardi

FD7352M WIFI Module

Datasheet

V1.1



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Version History

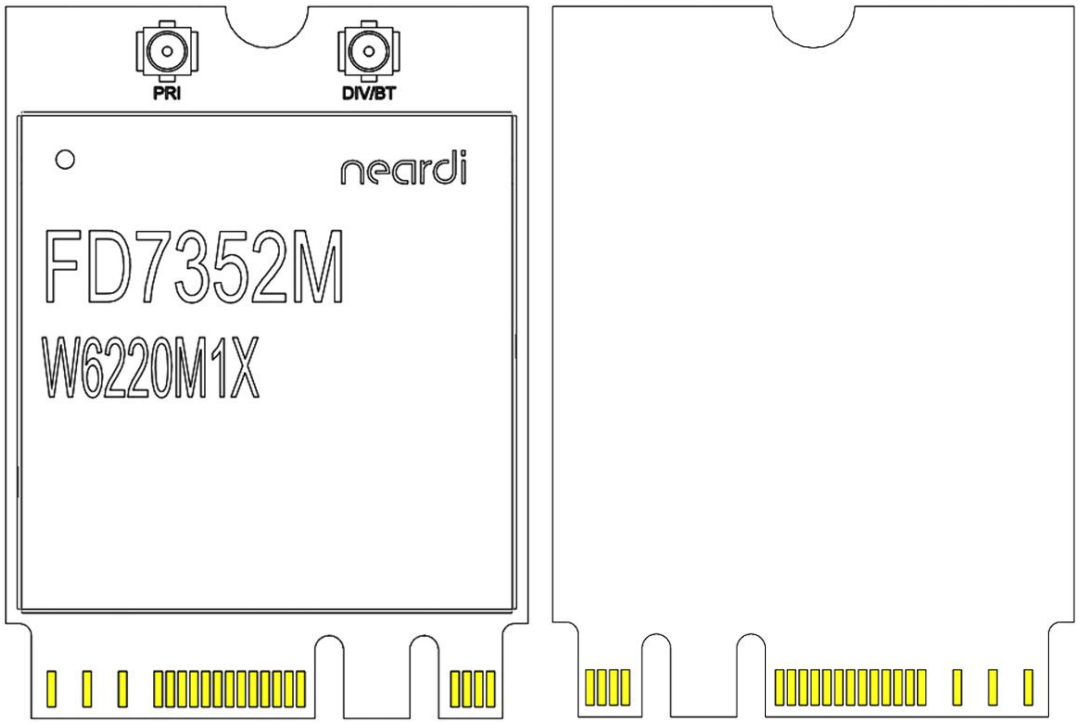
Version	Date	Illustrate
V1.0	2024/08/23	Initial Version
V1.1	2024/8/28	Alter Printed Legends

Contents

1 Product Overview

1.1 Product Introduction

FD7352M(M.2 2230 Key-A/E) is a highly integrated, low-cost combo module with high-performance and low-power. It supports Wi-Fi 6 and Bluetooth 5.4 protocol, supports Wi-Fi MAC of the final version of Wi-Fi 6 Wave2 protocol, Wi-Fi Baseband of 2T2R, and high-performance RF. It also supports PCIE, HS-UART interfaces for connection with the Host. This module also supports BT and Wi-Fi to work in coexistence mode. It is suitable for consumer electronics such as IPC, tablet and IOT, and can also be used in fields with high reliability requirements such as industrial interconnection.



M.2 Key A/E

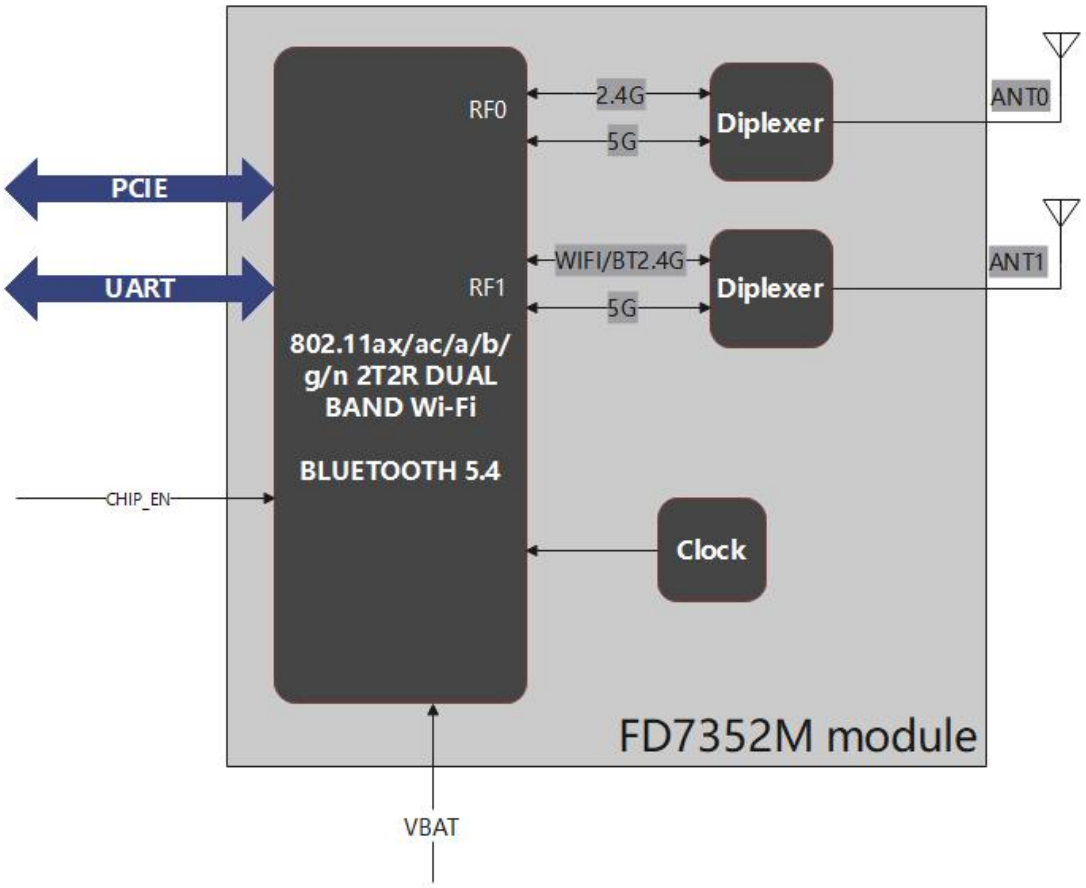
1.2 Wi-Fi Characteristics

- ✓ IEEE 802.11a/b/g/n/ac/ax (supports wave-2) wireless LAN communication protocol
- ✓ IEEE 802.11 d/e/h/i/k/mc/r/v/w
- ✓ 2.4G Phy rate up to 572.4Mbps, 5G Phy rate up to 1.2Gbps； Throughput 1Gbps
- ✓ Multiple modes such as Wi-Fi STA, AP, and P2P
- ✓ Support DBDC、DBSC
- ✓ 2.4G 40MHZ, 5G 80MHz bandwidth, 2T/2R
- ✓ Up to 1024QAM modulation, supports LDPC and STBC
- ✓ UL/DL OFDMA, UL/DL MU-MIMO
- ✓ QoS, WFA WMM, WMM PS
- ✓ RSSI and CSI Reporting
- ✓ Beamformee and 4*2 Tx Beamforming、2*2/2*1 Tx Beamforming
- ✓ WPA, WPA2, WPA3 encryption and decryption, WAPI and WPS2.0
- ✓ ER, DCM to improve transceiver gain
- ✓ 20in40/80/160, 80in160 HE PPDU, Partial band MU MIMO to improve air interface utilization
- ✓ BSS Color, Spatial Reuse to improve air interface utilization
- ✓ TWT, to optimize dynamic power consumption in multi-BSS environment

1.3 Bluetooth Characteristics

- ✓ Support Bluetooth (Classic BT+BLE) v2.1, v3.0, v4.2, v5.4 features
- ✓ PCIE interface for BT data transmission
- ✓ BR/EDR/LE 1M/LE 2M/LE LR
- ✓ Support sco and esco link
- ✓ SSP/Secure Connection
- ✓ Low power mode (sniff, sniff sub-rating)
- ✓ Support BT/Wi-Fi coexistence

1.4 Block Diagram

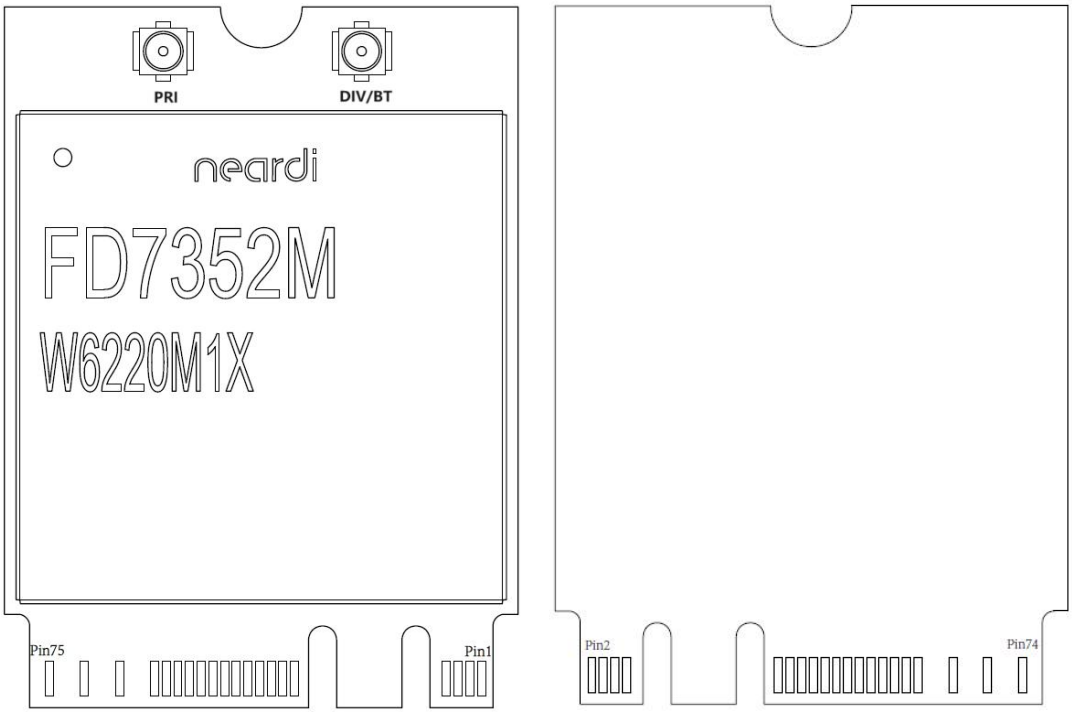


1.5 Parameters

Product Name	**FD7352M**
Product description	802.11ax/ac/a/b/g/n 2T2R dual band Wi-Fi and Bluetooth 5.4 comb module
Dimension	30.0(±0.1) mm*20.0(±0.1) mm*2.0(±0.2) mm
Power supply	VBAT：3.0~3.6V
Host interface	PCIE2.0 + UART
Footprint	PCIE M.2 Key（A-E）
Operating temperature	-30°C to 70°C
Operating humidity	10% to 90% (Non-Condensing)
Storage temperature	- 40°C to 85°C

2 Pin Definition

2.1 Pin Number



2.2 Pin Description

TOP

Pin Number	Pin Name	Pin Type	Pin Description
1	GND	G	Ground connections
3	USB_DP	I/O	USB Transmitter/Receiver Differential Pair
5	USB_DM	I/O	USB Transmitter/Receiver Differential Pair
7	GND	G	Ground connections
9	NC	-	Floating
11	NC	-	Floating
13	NC	-	Floating
15	NC	-	Floating
17	NC	-	Floating
19	NC	-	Floating
21	NC	-	Floating

23	NC	-	Floating
25	NC	-	Floating
27	NC	-	Floating
29	NC	-	Floating
31	NC	-	Floating
33	GND	G	Ground connections
35	PERP0	I	PCIe receive data-Positive
37	PERN0	I	PCIe receive data-Negative
39	GND	G	Ground connections
41	PETP0	O	PCIe receive data-Positive
43	PETN0	O	PCIe transmit data-Negative
45	GND	G	Ground connections
47	REFCLKP0	I	PCIe differential clock input-Positive
49	REFCLKN0	I	PCIe differential clock input-Negative
51	GND	G	Ground connections
53	CLKREQ0#(3.3V)	O	PCIe clock request
55	PEWAKE0#(3.3V)	O	PCIE wake-up signal
57	GND	G	Ground connections
59	NC	-	Floating
61	NC	-	Floating
63	GND	G	Ground connections
65	NC	-	Floating
67	NC	-	Floating
69	GND	G	Ground connections
71	NC	-	Floating
73	NC	-	Floating
75	GND	G	Ground connections

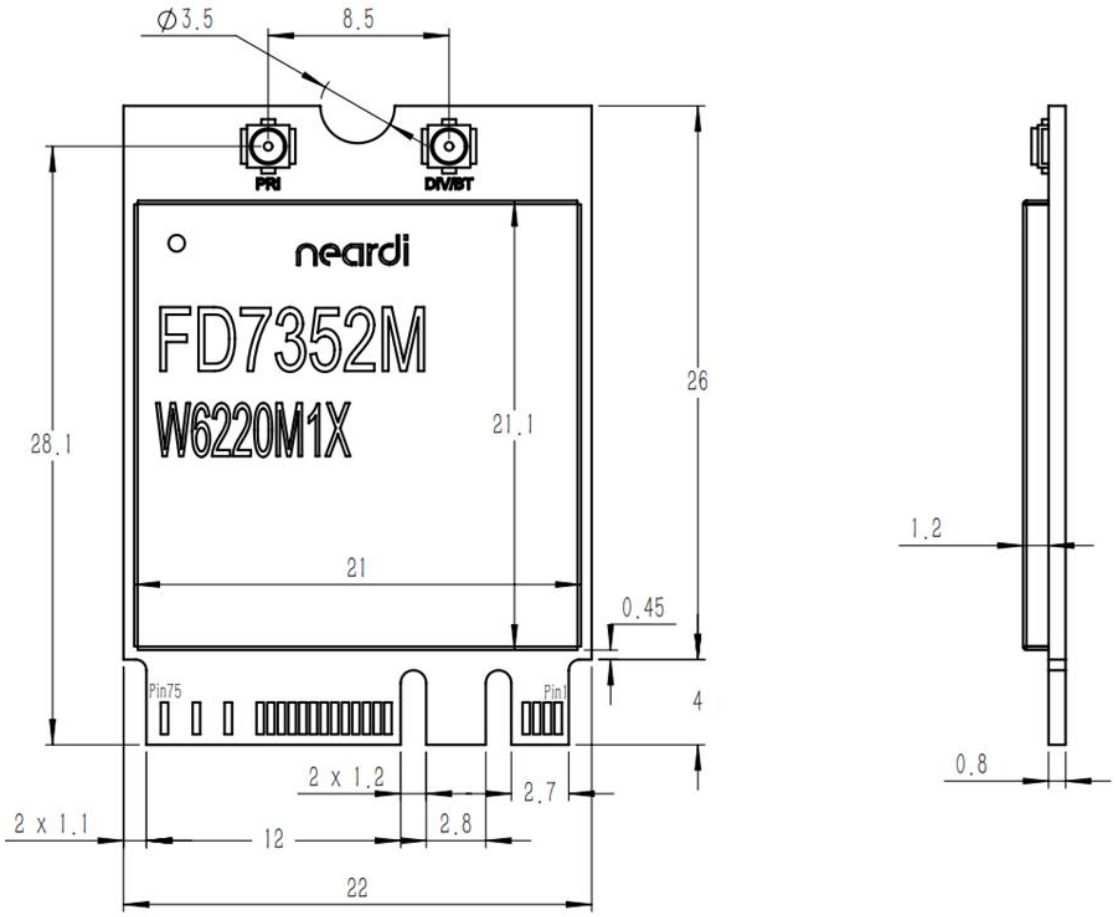
BOTTOM

Pin Number	Pin Name	Pin Type	Pin Description
2	3.3 V	P	Main power voltage source input
4	3.3 V	P	Main power voltage source input
6	GPIO2(3.3V)	I/O	RESERVED
8	NC	-	Floating
10	NC	-	Floating
12	NC	-	Floating
14	NC	-	Floating
16	GPIO1(3.3V)	I/O	RESERVED
18	GND	G	接地连接
20	NC	-	Floating (Don’t connected to ground)
22	UART_TX(3.3V)	I/O	UART TX signal
24	NC	-	Floating

26	NC	-	Floating
28	NC	-	Floating
30	NC	-	Floating
32	UART_RX(3.3V)	I/O	UART RX signal
34	UART_RTS(3.3V)	I/O	UART DCE request to send signal
36	UART_CTS(3.3V)	I/O	UART DEC clear to send signal
38	CHIP_EN	I	Module enable signal(Internal 10K pull-up)
40	NC	-	Floating
42	NC	-	Floating
44	NC	-	Floating
46	NC	-	Floating
48	NC	-	Floating
50	NC	-	Floating
52	PERSTN#(3.3V)	I	PCIe host indication to reset the device
54	NC	-	Floating
56	NC	-	Floating
58	NC	-	Floating
60	NC	-	Floating
62	NC	-	Floating
64	NC	-	Floating
66	NC	-	Floating
68	NC	-	Floating
70	NC	-	Floating
72	3.3 V	P	Main power voltage source input
74	3.3 V	P	Main power voltage source input

3 Mechanical Specifications

3.1 Mechanical Dimensions



M.2 Key-A/E

4 Electrical Performance and Reliability

4.1 Absolute Maximum Voltage Range

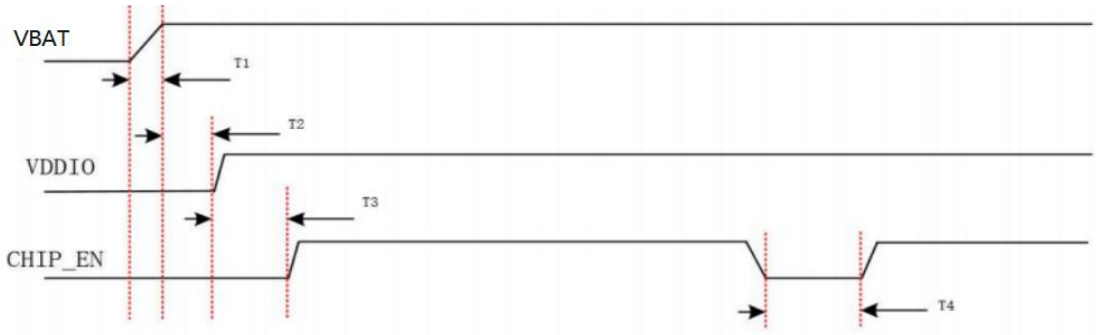
Symbol	Description	Min	Max	Unit
VBAT	Power Supply Voltage	-0.5	5.25*	V
VDDIO	Internal Use	-0.5	5.25	V

* If the voltage exceeds this value, the chip will be irreversibly damaged.

4.2 Recommended Operation Conditions

Symbol	Description	Min	Type	Max	Unit
Ta	Ambient Operating Temperature	-30	25	70	℃
Antenna	External Antenna VSWR		1.92:1	2:01	
VBAT	Power Supply Voltage	3	3.3	3.6	V
	Power Supply Current	-	-	2	A
VDDIO	Digital I/O Voltage	3	3.3	3.6	V

4.3 Power On/Off Sequence



Symbol	Description	Min	Type	Max	Unit
1	VBAT Ramp up time	0.2	0.5	-	mS
2	VDDIO should be powered on after VBAT is powered on	0	-	-	mS
3	CHIP_EN should be powered on after VDDIO is powered on	0	-	-	mS
4	CHIP_EN reset time	50	-	-	mS

4.4 Reliability

Item	Test Model	Class	Level	Criteria
ESD	HBM	2	2000V	ANSI/ESDA/JEDEC JS-001-2017
	CDM	C2a	500V	ANSI/ESDA/JEDEC JS-002-2018
Latch-up	Current	II A	200mA	JEDEC STANDARD NO.78F JANUARY 2022
	Voltage	II A	1.5xVmax	JEDEC STANDARD NO.78F JANUARY 2022

5 RF Characteristics

5.1 2.4GHZ Wi-Fi Radio Frequency (RF) Characteristics

Conditions: VBAT=3.3V; Ta:25℃	
Features	Description
Wi-Fi Standard	IEEE 802.11b/g/n/ac/ax
Frequency Range	2.4~2.4835GHz(2.4GHz ISM Band)
Channels	Ch1~Ch13
Modulation	802.11b (DSSS): CCK, DQPSK, DBPSK;
	802.11g (OFDM): BPSK, QPSK, QAM16, QAM64;
	802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;
	802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256;
	802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024;
Date Rate	802.11b: 1, 2, 5.5, 11Mbps;
	802.11g: 6, 9, 12, 18, 24, 36, 48, 54Mbps;
	802.11n (HT20): MCS0~MCS7 6.5~72.2Mbps;
	802.11n (HT40): MCS0~MCS7 13.5~150Mbps;
	802.11ac(VHT20): MCS0~MCS8 6.5~86.7Mbps;
	802.11ac(VHT40): MCS0~MCS9 13.5~200Mbps;
	802.11ax (HE20): MCS0~MCS11 8~143.4Mbps;
	802.11ax (HE40): MCS0~MCS11 16~286.8Mbps;
Frequency Tolerance	≤±5ppm

2.4G Transmitter Specifications

Modulation	TX Rate	TX Power (±2dBm)	TX EVM (dB)	TX Mask	VBAT current (mA)
802.11b	1Mbps	22	≤35%	PASS	TBD
802.11b	11Mbps	22	≤35%	PASS	TBD
802.11g	6Mbps	20	≤-5	PASS	TBD
802.11g	54Mbps	18	≤-25	PASS	TBD
802.11n	HT20 MCS0	20	≤-5	PASS	TBD
802.11n	HT20 MCS7	18	≤-27	PASS	TBD
802.11n	HT40 MCS0	20	≤-5	PASS	TBD
802.11n	HT40 MCS7	14	≤-27	PASS	TBD
802.11ac	VHT20 MCS0	20	≤-5	PASS	TBD
802.11ac	VHT20 MCS8	15	≤-30	PASS	TBD
802.11ac	VHT40 MCS0	20	≤-5	PASS	TBD

802.11ac	VHT40 MCS9	15	≤-32	PASS	TBD
802.11ax	HE20 MCS0	20	≤-5	PASS	TBD
802.11ax	HE20 MCS11	14	≤-35	PASS	TBD
802.11ax	HE40 MCS0	20	≤-5	PASS	TBD
802.11ax	HE40 MCS11	14	≤-35	PASS	TBD

2.4G Receiver Specifications

Modulation	RX Rate	Min Input Level (dBm)	Max Input Level (dBm)	PER	VBAT current (mA)
802.11b	1Mbps	≤-96	-20	8%	TBD
802.11b	11Mbps	≤-87	-20	8%	TBD
802.11g	6Mbps	≤-92	-20	10%	TBD
802.11g	54Mbps	≤-75	-20	10%	TBD
802.11n	HT20 MCS0	≤-92	-20	10%	TBD
802.11n	HT20 MCS7	≤-72	-20	10%	TBD
802.11n	HT40 MCS0	≤-89	-20	10%	TBD
802.11n	HT40 MCS7	≤-70	-20	10%	TBD
802.11ac	VHT20 MCS0	≤-91	-20	10%	TBD
802.11ac	VHT20 MCS8	≤-68	-20	10%	TBD
802.11ac	VHT40 MCS0	≤-89	-20	10%	TBD
802.11ac	VHT40 MCS9	≤-63	-20	10%	TBD
802.11ax	HE20 MCS0	≤-92	-20	10%	TBD
802.11ax	HE20 MCS11	≤-60	-20	10%	TBD
802.11ax	HE40 MCS0	≤-89	-20	10%	TBD
802.11ax	HE40 MCS11	≤-58	-20	10%	TBD

5.2 5GHZ Wi-Fi RF Characteristics

Conditions: VBAT=3.3V; Ta:25℃	
Features	Description
Wi-Fi Standard	IEEE 802.11a/n/ac/ax
Frequency Range	5.15~5.25GHz; 5.25~5.35GHz; 5.47~5.73GHz; 5.735~5.835GHz (5GHz ISM Band)
Channels	Ch36,Ch40, Ch44, Ch48; Ch52~Ch64; Ch100~Ch140; Ch149~Ch165
Modulation	802.11a (OFDM): BPSK, QPSK, QAM16, QAM64;
	802.11n (OFDM): BPSK, QPSK, QAM16, QAM64;
	802.11ac (OFDM): BPSK, QPSK, QAM16, QAM64, QAM256;
	802.11ax (OFDMA): BPSK, BPSK_DCM, QPSK, QPSK_DCM, QAM16, QAM16_DCM, QAM64, QAM256, QAM1024;
Date Rate	802.11a: 6, 9, 12, 18, 24, 36, 48, 54Mbps;

	802.11n (HT20): MCS0~MCS7: 6.5~72.2Mbps;
	802.11n (HT40): MCS0~MCS7: 13.5~150Mbps;
	802.11ac (VHT20): MCS0~MCS8: 6.5~86.7Mbps;
	802.11ac (VHT40): MCS0~MCS9: 13.5~200Mbps;
	802.11ac (VHT80): MCS0~MCS9: 29.3~433.3Mbps;
	802.11ax (HE20): MCS0~MCS11: 8~143.4Mbps;
	802.11ax (HE40): MCS0~MCS11: 16~286.8Mbps;
	802.11ax (HE80): MCS0~MCS11: 34~600.5Mbps;
Frequency Tolerance	≤±5ppm

5G Transmitter Specifications

Modulation	TX Rate	TX Power（±2dBm）	TX EVM（dB）	TX Mask	VBAT current (mA)
802.11a	6Mbps	19	≤-5	PASS	TBD
802.11a	54Mbps	17	≤-25	PASS	TBD
802.11n	HT20 MCS0	19	≤-5	PASS	TBD
802.11n	HT20 MCS7	17	≤-27	PASS	TBD
802.11n	HT40 MCS0	19	≤-5	PASS	TBD
802.11n	HT40 MCS7	17	≤-27	PASS	TBD
802.11ac	VHT20 MCS0	19	≤-5	PASS	TBD
802.11ac	VHT20 MCS8	14	≤-30	PASS	TBD
802.11ac	VHT40 MCS0	19	≤-5	PASS	TBD
802.11ac	VHT40 MCS9	14	≤-32	PASS	TBD
802.11ac	VHT80 MCS0	18	≤-5	PASS	TBD
802.11ac	VHT80 MCS9	13	≤-32	PASS	TBD
802.11ax	HE20 MCS0	19	≤-5	PASS	TBD
802.11ax	HE20 MCS11	12	≤-35	PASS	TBD
802.11ax	HE40 MCS0	19	≤-5	PASS	TBD
802.11ax	HE40 MCS11	12	≤-35	PASS	TBD
802.11ax	HE80 MCS0	18	≤-5	PASS	TBD
802.11ax	HE80 MCS11	11	≤-35	PASS	TBD

5G Receiver Specifications

Modulation	RX Rate	Min Input Level(dBm)	Max Input Level (dBm)	PER	VBAT current (mA)
802.11a	6Mbps	-91	-20	10%	TBD
802.11a	54Mbps	-74	-20	10%	TBD
802.11n	HT20 MCS0	-91	-20	10%	TBD
802.11n	HT20 MCS7	-71	-20	10%	TBD
802.11n	HT40 MCS0	-88	-20	10%	TBD
802.11n	HT40 MCS7	-69	-20	10%	TBD
802.11ac	VHT20 MCS0	-91	-20	10%	TBD
802.11ac	VHT20 MCS8	-67	-20	10%	TBD
802.11ac	VHT40 MCS0	-88	-20	10%	TBD

802.11ac	VHT40 MCS9	-63	-20	10%	TBD
802.11ac	VHT80 MCS0	-85	-20	10%	TBD
802.11ac	VHT80 MCS9	-59	-20	10%	TBD
802.11ax	HE20 MCS0	-91	-20	10%	TBD
802.11ax	HE20 MCS11	-60	-20	10%	TBD
802.11ax	HE40 MCS0	-89	-20	10%	TBD
802.11ax	HE40 MCS11	-58	-20	10%	TBD
802.11ax	HE80 MCS0	-86	-20	10%	TBD
802.11ax	HE80 MCS11	-53	-20	10%	TBD

5.3 Bluetooth Radio Frequency (RF) Characteristics

Conditions: VBAT=3.3V; Ta:25℃	
Features	Description
Bluetooth Standard	Bluetooth v2.1+EDR/3.0+HS/4.2/5. 4
Frequency Range	2.4~2.4835GHz
Channels	Bluetooth Classic: Ch0~Ch78 (For 1MHz Channels);
	Bluetooth Low Energy: Ch0~Ch39 (For 2MHz Channels);
Power class	Bluetooth Classic: Class1;
	Bluetooth Low Energy: Class1.5;
Modulation	BR_1Mbps: GFSK;
	EDR_2Mbps: π/4-DQPSK;
	EDR_3Mbps: 8DPSK;
	LE_125Kbps: GFSK (Coded_S=8);
	LE_500Kbps: GFSK (Coded_S=2);
	LE_1Mbps: GFSK (Uncoded);
	LE_2Mbps: GFSK (Uncoded);

Bluetooth Transmitter Specifications

Item	TX Power（dBm）			VBAT
	Min	Type	Max	current（mA）
BR_1M	7	9	11	TBD
EDR_2M	7	9	11	TBD
EDR_3M	7	9	11	TBD
LE_125	7	9	11	TBD
LE_500	7	9	11	TBD
LE_1M	7	9	11	TBD
LE_2M	7	9	11	TBD

Bluetooth Receiver Specifications

Item	Sensitivity（dBm）	Max Input Level	VBAT

			(dBm)		current (mA)
	Input Level (Typ)	PER	Input Level (Typ)	BER	
BR_1Mbps	< -92	0.10%	> -20	TBD	TBD
EDR_2Mbps	< -90	0.01%	> -20	TBD	TBD
EDR_3Mbps	< -84	0.01%	> -20	TBD	TBD
LE_125	< -103	30.80%	> -20	TBD	TBD
LE_500	< -100	30.80%	> -20	TBD	TBD
LE_1M	< -95	30.80%	> -20	TBD	TBD
LE_2M	< -92	30.80%	> -20	TBD	TBD

6 Hardware Design Guide

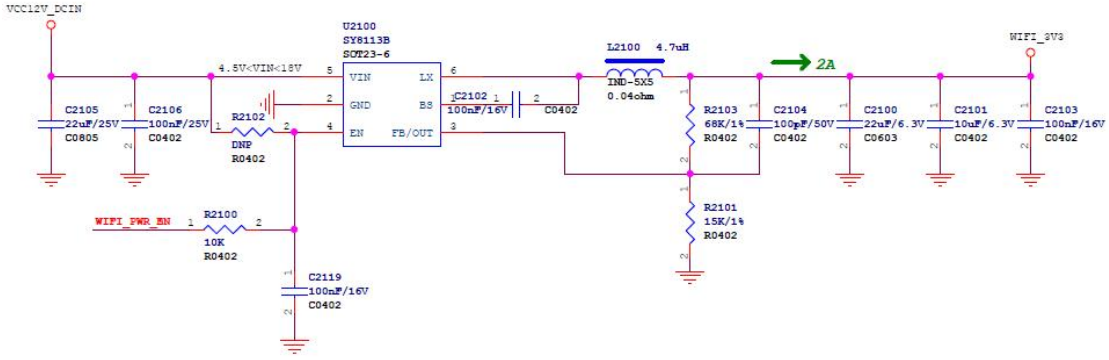
6.1 Power Design Notice

6.1.1 Voltage Requirement

The main power supply (VBAT) input range of the module is 3.3V+/-10%. Due to the ripple of the main power can affect the RF performance of Wi-Fi and Bluetooth, therefore the power supply ripple VPP is required to be less than 50mV.

6.1.2 Current/Power Supply Reference Requirement

Under different standards, when Wi-Fi transmits continuously, The 3.3V power converter must be able to provide 1.7A current and fast transient response (when the transient current change rate is 80mA/us, the voltage drop is less than 100mV).



For the power on/off sequence of the module, please refer to the requirements in the "4.3 Power On/Off Sequence" chapter.

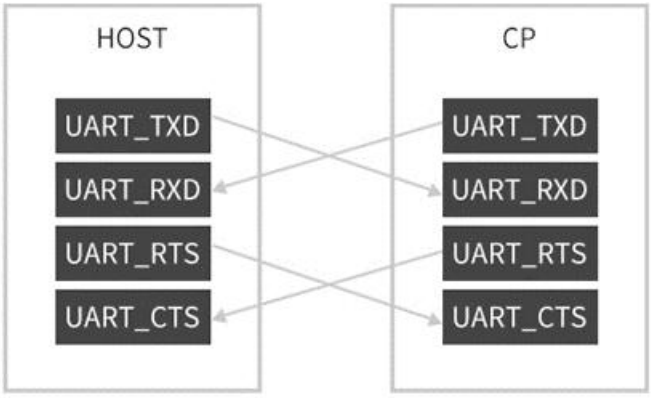
6.2 Interface Design Notice

6.2.1 HCI Commend Interface

The Bluetooth supports PCIE and HS-UART (4Mbps) as HCI (Host Controller Interface). PCIE is used as HCI by default, which means the HS-UART port does not need in the HOST controller.

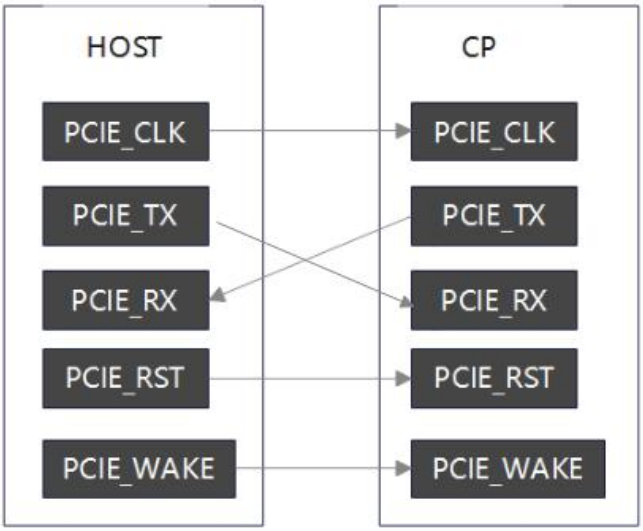
6.2.2 UART Interface

As shown in the figure below, the UART bus and data lines between the Host and the module need to be cross-connected.



6.2.3 PCIe Interface

PCIe data lines need to be cross-connected between HOST and CP.



7 Storage,Production and Packaging

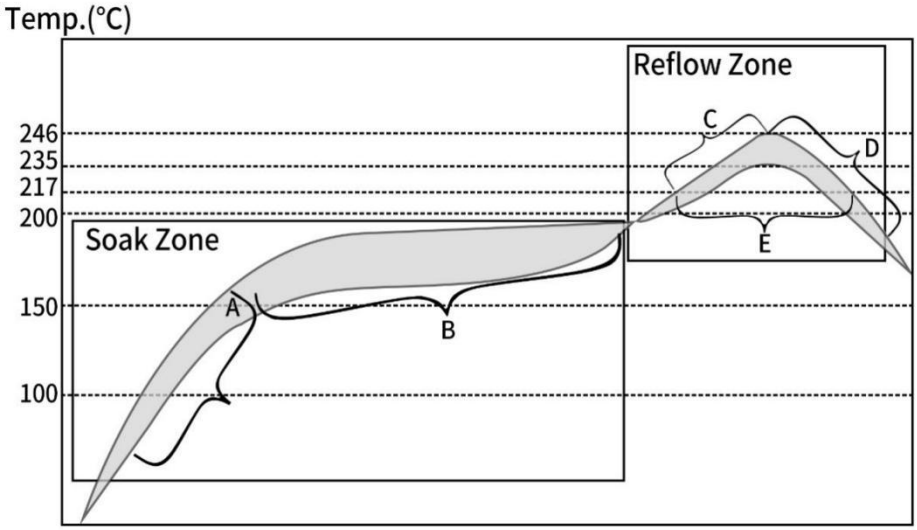
7.1 Storage Conditions

- FD7352M module is 3 (MSL3) and packed in a vacuum-sealed bag when shipped, the recommended storage temperature is 25±5°C, and the relative humidity is 35%~60%. Under this condition, the module can be stored for 12 months.
- The Module shall be stored without opening the packing. After the packing opened, the module shall be completed the patch soldering within 24 hours.
- FD7352M module can be stored for no more than 168 hours in a workshop environment with a temperature of 25±5°C, a relative humidity below 60% and in compliance with IPC/JEDEC J-STD-033. It is not recommended to expose the module unpacked to the air for a long time. If not immediately patch soldering, it is recommended to store the module in a moisture-proof cabinet with a relative humidity of less than 10% to keep the module dry.
- If the module is not stored according to the above recommended method, it needs to be baked at high temperature (120±5°C) for 8 hours. The re-baked module shall be patched within 24 hours.
- Please pay attention to ESD protection when unpacking and handling modules.

7.2 Production Welding

During the production welding process, please do not use any organic solvents (such as alcohol, isopropanol, acetone, trichloroethylene, etc.) to wipe the shield of the FD7352M module, otherwise it may cause the shield to rust. Please do not ultrasonically clean the module, it may cause damage to the crystal inside the module. Please make sure that the spray material used will not chemically react with the module shield or PCB and will not flow into the module when spraying modules.

In order to ensure the welding quality and reliability of the FD7352M module, the thickness of the printed stencil is recommended to be 0.15~0.18mm; the recommended reflow curve is as follows:



Recommended reflow curve

Item	Description	Value
Endothermic Zone Heating Rate	Interval A	≤3℃/s
Soak time	From the end of interval A to the beginning of interval B	60~120s
Reflow Zone Heating Rate	Interval C	≤3 ℃/s
Maximum Temperature	Highest point of the curve	246℃(+5/-0℃)
Cooling Rate	Interval D	＜6 ℃/s
Reflow Time	Interval E	60~150 seconds

7.3 Packing Specifications(TBD)

The key parameters and packaging processes described in this chapter are for reference only. The appearance and structure of the specific packaging materials are subject to actual delivery.