neardi

FD7256S WIFI Module

Datasheet

V2.1

Shanghai Neardi Technology Co., Ltd.
www.neardi.com

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Shanghai Neardi Technology Co., Ltd.
www.neardi.com
Tel: +86 21 20952021
Email: sales@neardi.com

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Version History

Version	Date	Illustrate
V1.0	2023/05/17	Initial Version
V1.1	2023/09/15	Add hardware design guide
V1.2	2023/09/22	Update pin description
V2.0	2023/12/01	Update Mechanical Specifications, RF Characteristics, Interface Design Notice
V2.1	2024/01/05	Update WiFi Receive Sensitivity Spec

Contents

1 Product Overview

1.1 Product Introduction

FD7256S is a highly integrated, low-cost combo module with high-performance and low-power. It supports Wi-Fi 6 and Bluetooth 5.0 protocol, supports Wi-Fi MAC of the final version of Wi-Fi 6 Wave2 protocol, Wi-Fi Baseband of 1T1R, and high-performance RF. It also supports SDIO3.0, HS-UART and PCM interfaces for connection with the main control. 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.

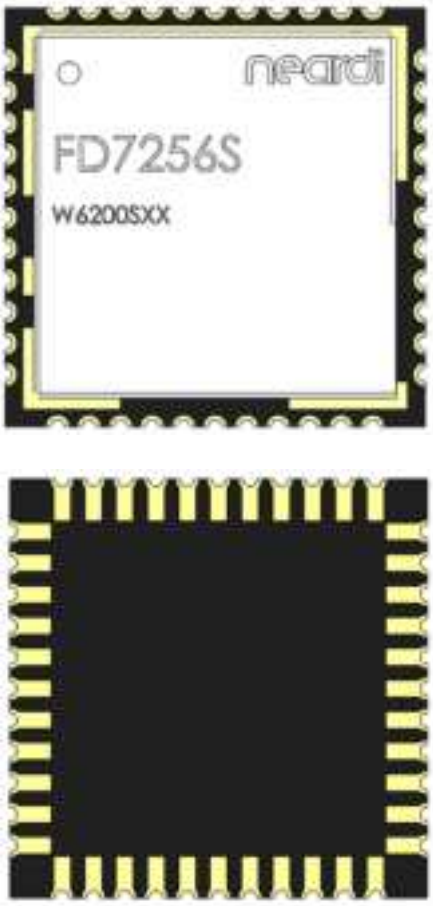


Figure 1-1

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
- ✓ Phy rate up to 600.5Mbps, Throughput rate up to 520Mbps
- ✓ Multiple modes such as Wi-Fi STA, AP, and P2P
- ✓ 2.4G 40MHZ, 5G 80MHz bandwidth, 1T/1R
- ✓ Up to 1024QAM modulation, supports LDPC and STBC
- ✓ UL/DL OFDMA, DL MU-MIMO
- ✓ QoS, WFA WMM, WMM PS
- ✓ RSSI and CSI Reporting
- ✓ Beamformee and 4*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, Intra-PPDU PS, VHT TXOP PS to optimize dynamic power consumption in small bandwidth and multi-BSS environment

1.3 Bluetooth Characteristics

- ✓ Support Bluetooth (Classic BT+BLE) v2.1, v3.0, v4.2, v5.0 features
- ✓ SDIO interface for BT data transmission
- ✓ PCM/IIS interface for audio 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

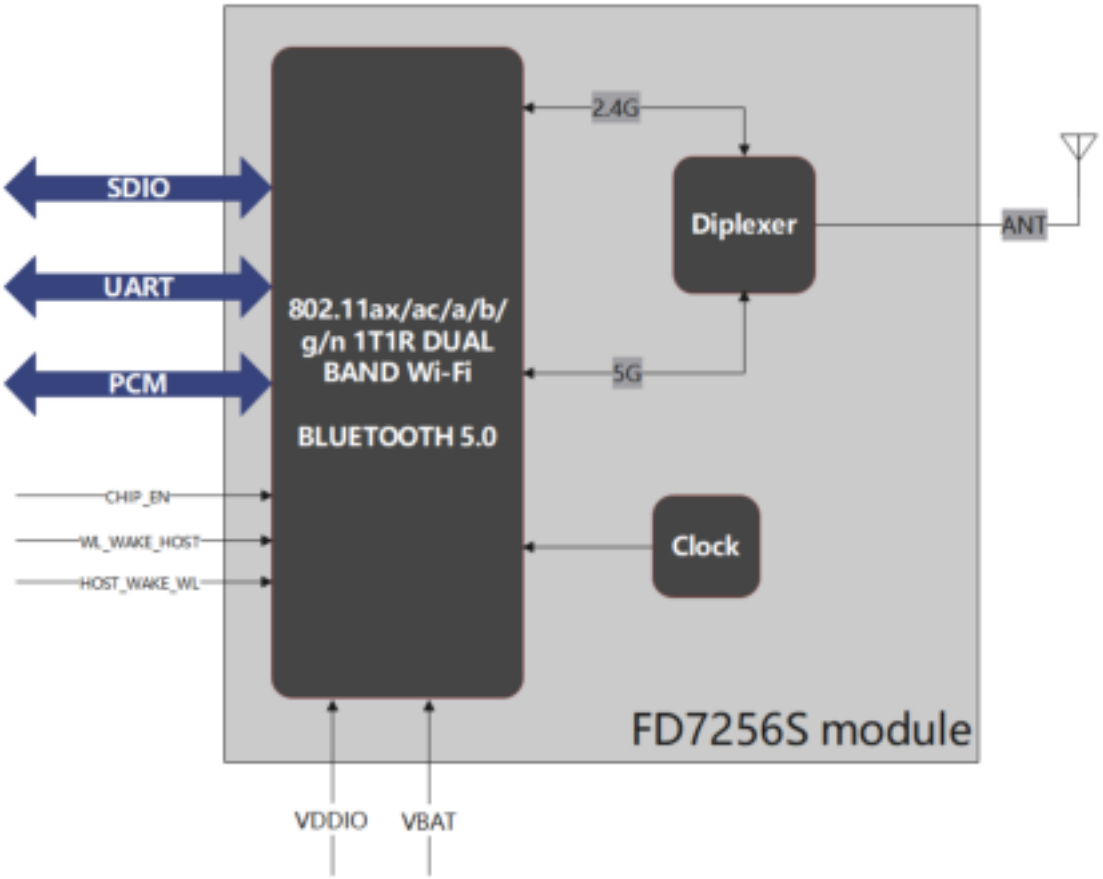


Figure 1-4

1.5 Parameters

Table 1-5

Product Name	FD7256S
Product description	802.11ax/ac/a/b/g/n 1T1R dual band Wi-Fi and Bluetooth 5.0 comb module
Dimension	12.0(±0.1)mm*12.0(±0.1)mm*1.65(±0.2)mm
Power supply	VBAT：3.0~3.6V；VDDIO：1.62V~1.92V/3.0V~3.6V
Host interface	SDIO3.0 + UART + PCM
Footprint	LCC 44pin
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

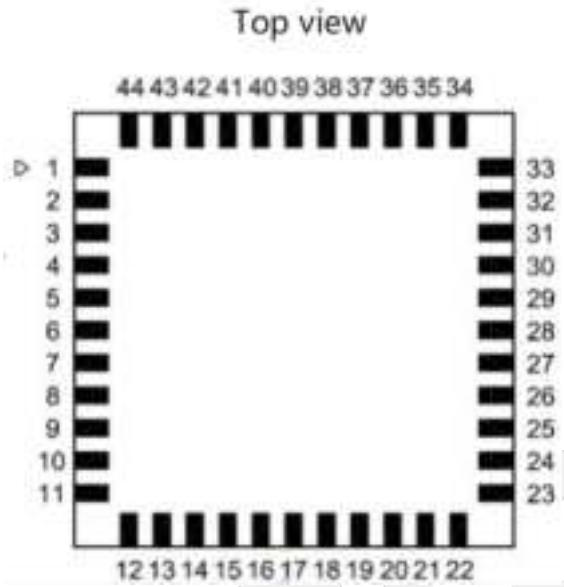


Figure 2-1

2.2 Pin Description

Table 2 -2

Pin Number	Pin Name	Pin Type	Pin Description
1	GND	G	Ground connections
2	WL_BT_ANT	RF	Wi-Fi & BT antenna I/O port
3	GND	G	Ground connections
4	NC	-	Floating (Don't connected to ground)
5	NC	-	Floating (Don't connected to ground)
6	NC	-	Floating (Don't connected to ground)
7	NC	-	Floating (Don't connected to ground)
8	GND	-	Ground connections
9	VBAT	P	Main power voltage source input
10	NC	-	Floating (Don't connected to ground)
11	NC	-	Floating (Don't connected to ground)
12	CHIP_EN	I	Module enable signal

13	HOST_WAKE_WL	I/O	Wake up signal with auto negotiation
14	SDIO_DATA_2	I/O	SDIO data line 2
15	SDIO_DATA_3	I/O	SDIO data line 3
16	SDIO_DATA_CMD	I/O	SDIO command line
17	SDIO_DATA_CLK	I/O	SDIO clock line
18	SDIO_DATA_0	I/O	SDIO data line 0
19	SDIO_DATA_1	I/O	SDIO data line 1
20	GND	G	Ground connections
21	NC	-	Floating (Don't connected to ground)
22	VDDIO	P	I/O Voltage supply input
23	NC	-	Floating (Don't connected to ground)
24	NC	-	Floating (Don't connected to ground)
25	PCM_OUT	O	PCM Data output
26	PCM_CLK	I/O	PCM clock
27	PCM_IN	I	PCM data input
28	PCM_SYNC	I/O	PCM sync signal
29	NC	-	Floating (Don't connected to ground)
30	NC	-	Floating (Don't connected to ground)
33	GND	G	Ground connections
32	NC	-	Floating (Don't connected to ground)
33	GND	G	Ground connections
33	WL_WAKE_HOST	I/O	Wake up signal with auto negotiation
35	NC	-	Floating (Don't connected to ground)
36	GND	G	Ground connections
37	NC	-	Floating (Don't connected to ground)
38	NC	-	Floating (Don't connected to ground)
39	NC	-	Floating (Don't connected to ground)
40	NC	-	Floating (Don't connected to ground)
41	UART_RTS_N	I/O	UART DCE request send signal
42	UART_TXD	I/O	UART TX signal
43	UART_RXD	I/O	UART RX signal
44	UART_CTS_N	I/O	UART DEC clear send signal

3 Mechanical Specifications

3.1 Mechanical Dimensions

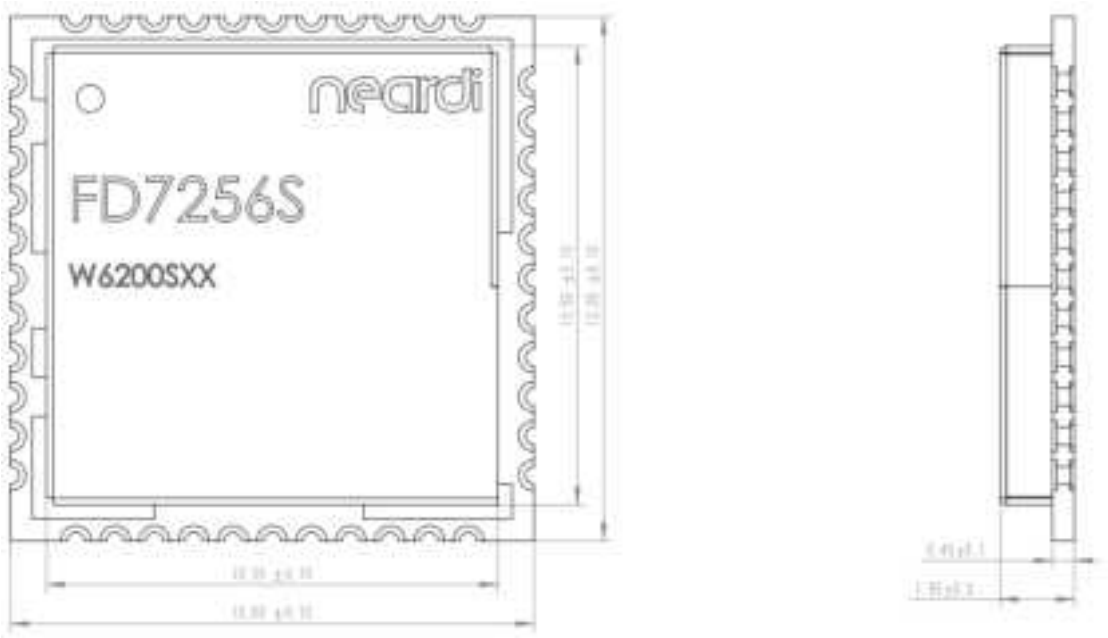


Figure 3-1

3.2 Recommended PCB Layout Footprint

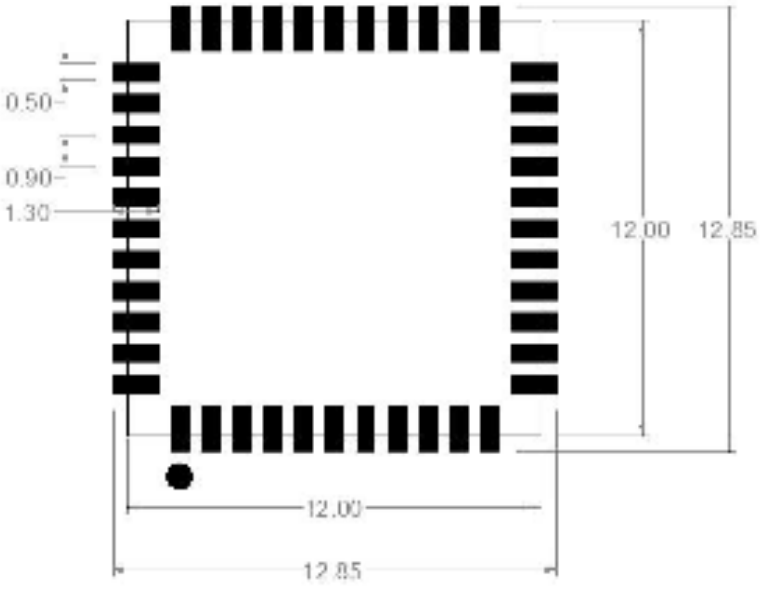


Figure 3-2

4 Electrical Performance and Reliability

4.1 Absolute Maximum Voltage Range

Table 4-1

Symbol	Description	Min	Max	Unit
VBAT	Power Supply Voltage	-0.5	5.25[1]	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	-0.5	5.25	V

4.2 Recommended Operation Conditions

Table 4-2

Symbol	Description	Min	Type	Max	Unit
Ta	Ambient Operating Temperature	-30	25	70	℃
Antenna	External Antenna VSWR		1.92:1	2:1	
VBAT	Power Supply Voltage	3.0	3.3	3.6	V
VDDIO	Digital/Bluetooth/SDIO/ I/O Voltage	1.62	1.8	1.92	V
		3.0	3.3	3.6	V

4.3 Power On/Off Sequence

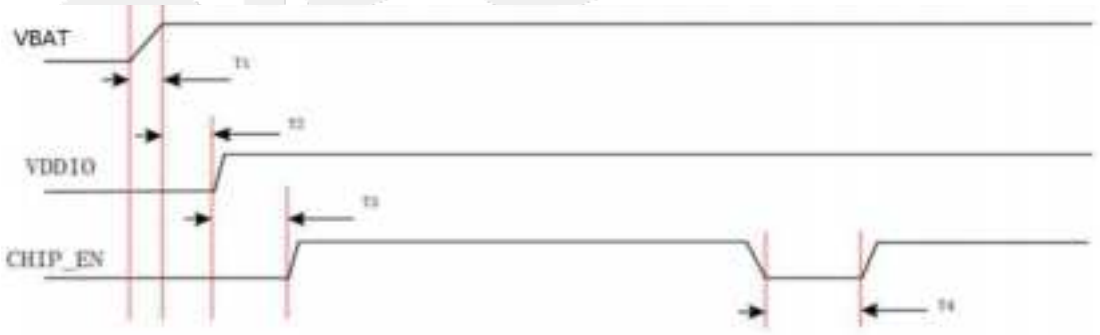


Figure 4 -3

Table 4-3

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

[1] If the voltage exceeds this value, the chip will be irreversibly damaged.

4.4 Reliability

Table 4-4

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 Interface Timing Parameters

5.1 SDIO Interface Timing

5.1.1 Default Speed Mode

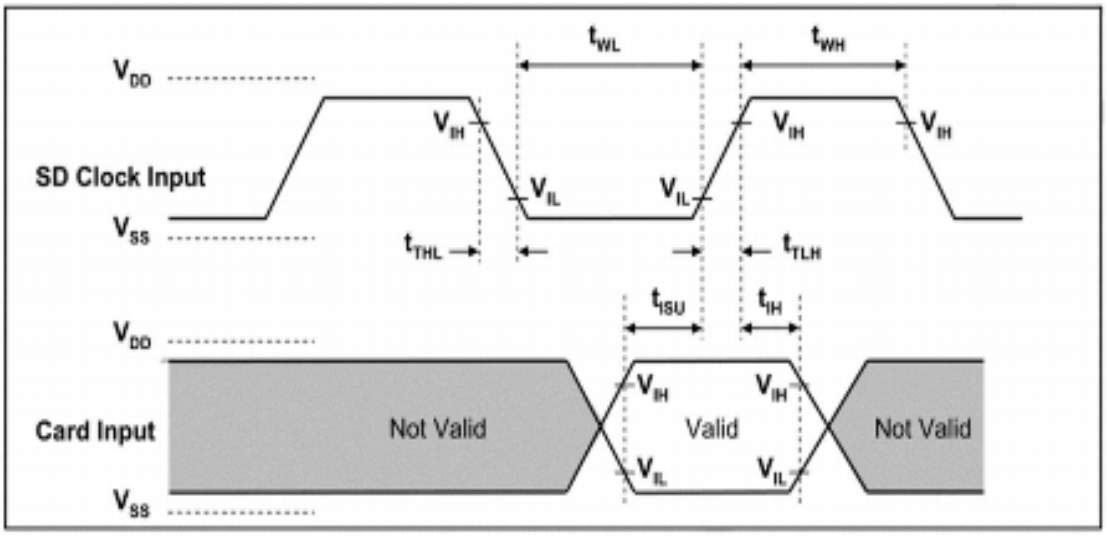


Figure 5 -1-1-1 SDIO device input timing (Default Speed Mode)

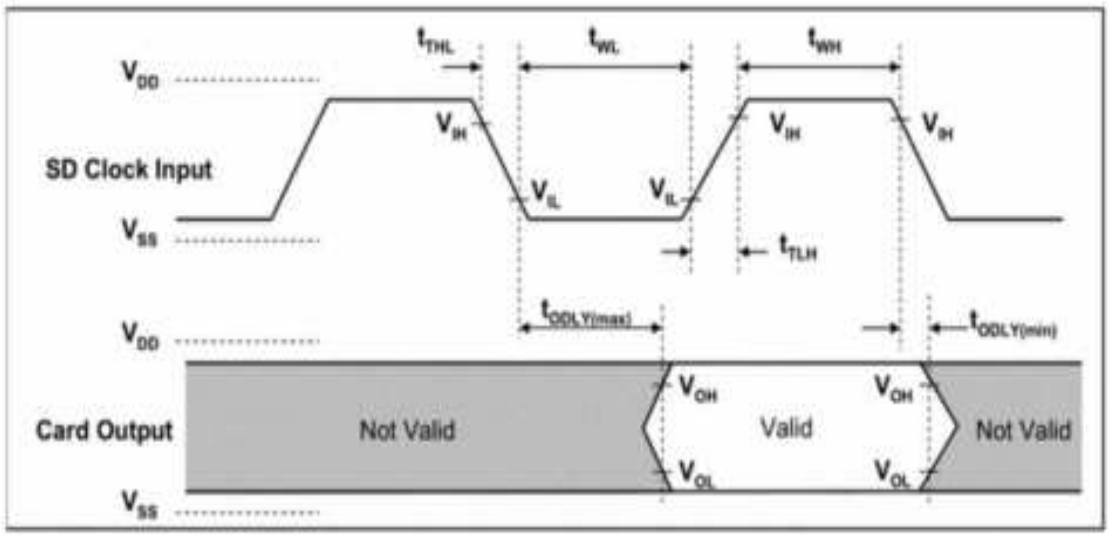


Figure 5 -1-1-2 SDIO device output timing (Default Speed Mode)

Table 5 -1-1 SDIO Bus Timing Parameters (Default Speed Mode)

Parameter	Symbol	Min	Max	Unit	Remark
Clock					
Clock Freq Data Transfer Mode	fPP	0	25	MHZ	Cload ≤ 10 pF
Clock Freq Identification Mode	fO	0	400	KHZ	Cload ≤ 10 pF
Clock low time	wxya	10		ns	Cload ≤ 10 pF
Clock high time	tWH	10		ns	Cload ≤ 10 pF
Clock rise time	tTLH		10	ns	Cload ≤ 10 pF
Clock fall time	tTHL		10	ns	Cload ≤ 10 pF
Inputs CMD,DAT(referenced to CLK)					
Input set-up time	tISU	5		ns	Cload ≤ 10 pF
Input hold time	tIHU	5		ns	Cload ≤ 10 pF
Outputs CMD,DAT(referenced to CLK)					
Output Delay time during Data Transfer Mode	tODLY	0	14	ns	Cload ≤ 40 pF
Output Delay time during Identification Mode	tODLY	0	50	ns	Cload ≤ 40 pF

5.1.2 High-Speed Mode

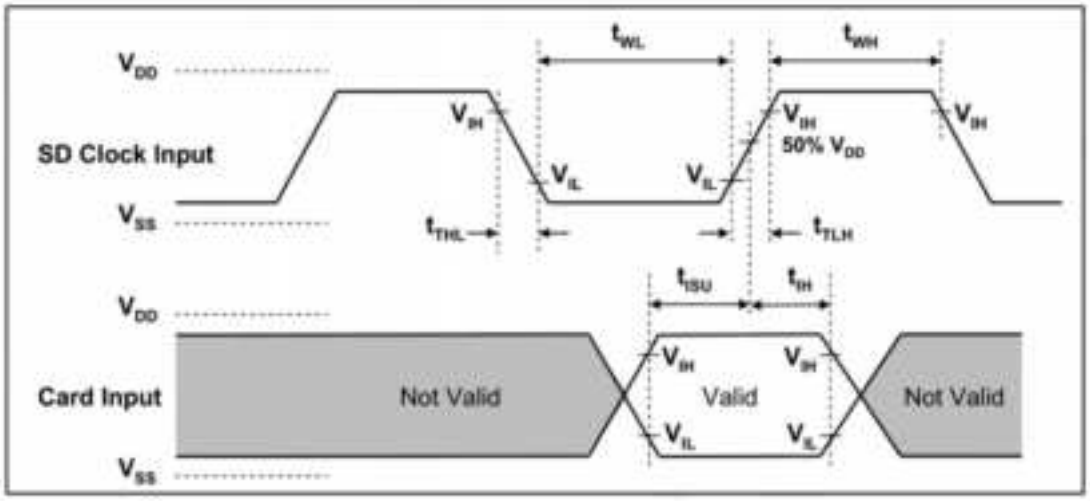


Figure 5-1-2-1 SDIO device input timing (High Speed Mode)

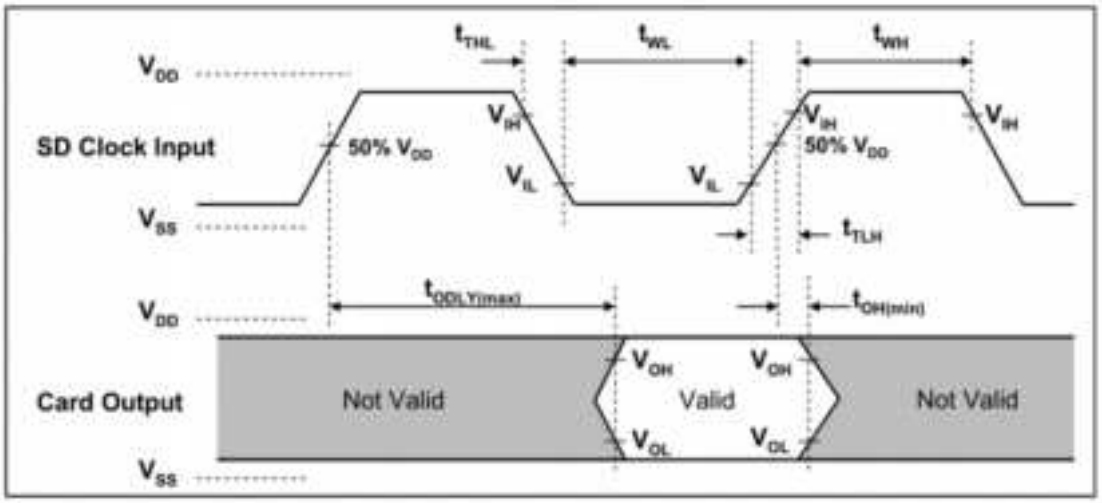


Figure 5-1-2-2 SDIO device output timing (High Speed Mode)

Table 5 -1- 2 SDIO Bus Timing Parameters (High Speed Mode)

Parameter	Symbol	Min	Max	Unit	Remark
Clock					
Clock Freq Data Transfer Mode	fPP	0	50	MHZ	Cload ≤ 10 pF
Clock Freq Identification Mode	fO	0	400	KHZ	Cload ≤ 10 pF
Clock low time	wxya	7		ns	Cload ≤ 10 pF
Clock high time	tWH	7		ns	Cload ≤ 10 pF
Clock rise time	tTLH		3	ns	Cload ≤ 10 pF
Clock fall time	tTHL		3	ns	Cload ≤ 10 pF
Inputs CMD,DAT(referenced to CLK)					
Input set-up time	tISU	6		ns	Cload ≤ 10 pF
Input hold time	tIHU	2		ns	Cload ≤ 10 pF
Outputs CMD,DAT(referenced to CLK)					
Output Delay time during Data Transfer Mode	tODLY	0	14	ns	Cload ≤ 4 0 pF
Output Delay time during Identification Mode	tODLY	2.5		ns	Cload ≤ 15 pF

5.2 PCM Interface Timing

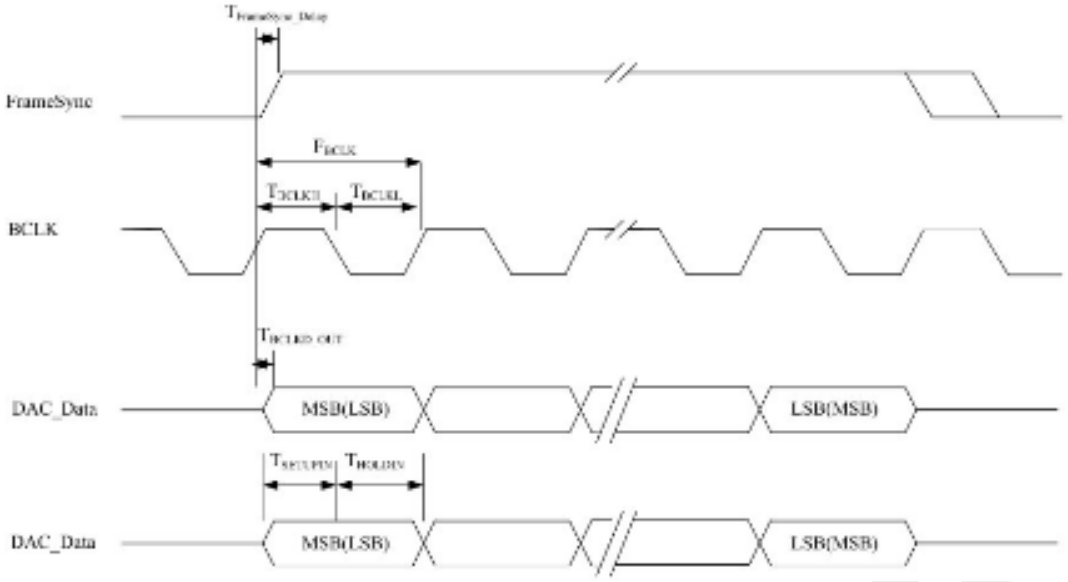


Figure 5 -2 PCM Bus Timing

6 RF Characteristics

6.1 2.4GHZ Wi-Fi Radio Frequency (RF) Characteristics

Table 6 -1

Conditions: VBAT=3.3V; VDDIO=1.8V; 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	17	≤35%	PASS	413
802.11b	11Mbps	17	≤35%	PASS	253
802.11g	6Mbps	17	≤-5	PASS	256
802.11g	54Mbps	15	≤-25	PASS	317
802.11n	HT20 MCS0	17	≤-5	PASS	251
802.11n	HT20 MCS7	14	≤-27	PASS	253
802.11n	HT40 MCS0	17	≤-5	PASS	254
802.11n	HT40 MCS7	14	≤-27	PASS	231
802.11ac	VHT20 MCS0	17	≤-5	PASS	247
802.11ac	VHT20 MCS8	13	≤-30	PASS	220
802.11ac	VHT40 MCS0	17	≤-5	PASS	251
802.11ac	VHT40 MCS9	12	≤-32	PASS	188
802.11ax	HE20 MCS0	17	≤-5	PASS	224

802.11ax	HE20 MCS11	11	≤-35	PASS	210
802.11ax	HE40 MCS0	17	≤-5	PASS	234
802.11ax	HE40 MCS11	11	≤-35	PASS	150
2.4G Receiver Specifications					
Modulation	RX Rate	Min Input Level（dBm）	Max Input Level（dBm）	PER	VBAT current（mA）
802.11b	1Mbps	≤-96	-5	8%	77.8
802.11b	11Mbps	≤-87	-5	8%	77.8
802.11g	6Mbps	≤-92	-5	10%	80.4
802.11g	54Mbps	≤-75	-5	10%	80.7
802.11n	HT20 MCS0	≤-92	-5	10%	82.8
802.11n	HT20 MCS7	≤-72	-5	10%	84.5
802.11n	HT40 MCS0	≤-89	-5	10%	86.7
802.11n	HT40 MCS7	≤-70	-5	10%	89.7
802.11ac	VHT20 MCS0	≤-91	-5	10%	83.1
802.11ac	VHT20 MCS8	≤-68	-5	10%	84.9
802.11ac	VHT40 MCS0	≤-89	-5	10%	87.2
802.11ac	VHT40 MCS9	≤-63	-5	10%	90.6
802.11ax	HE20 MCS0	≤-92	-5	10%	83.6
802.11ax	HE20 MCS11	≤-60	-5	10%	83.6
802.11ax	HE40 MCS0	≤-89	-5	10%	87.6
802.11ax	HE40 MCS11	≤-58	-5	10%	88.5

6.2 5GHZ Wi-Fi RF Characteristics

Table 6 -2

Conditions: VBAT=3.3V; VDDIO=1.8V; 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):
Frequency Tolerance	≤±5ppm

5G Transmitter Specifications

Modulation	TX Rate	TX Power（±2dBm）	TX EVM（dB）	TX Mask	VBAT current（mA）
802.11a	6Mbps	17	≤-5	PASS	276
802.11a	54Mbps	15	≤-25	PASS	342
802.11n	HT20 MCS0	17	≤-5	PASS	273
802.11n	HT20 MCS7	14	≤-27	PASS	276
802.11n	HT40 MCS0	17	≤-5	PASS	258
802.11n	HT40 MCS7	14	≤-27	PASS	232
802.11ac	VHT20 MCS0	17	≤-5	PASS	273
802.11ac	VHT20 MCS8	13	≤-30	PASS	242
802.11ac	VHT40 MCS0	17	≤-5	PASS	258
802.11ac	VHT40 MCS9	12	≤-32	PASS	186
802.11ac	VHT80 MCS0	17	≤-5	PASS	256
802.11ac	VHT80 MCS9	12	≤-32	PASS	285
802.11ax	HE20 MCS0	17	≤-5	PASS	247
802.11ax	HE20 MCS11	11	≤-35	PASS	221
802.11ax	HE40 MCS0	17	≤-5	PASS	243
802.11ax	HE40 MCS11	11	≤-35	PASS	149
802.11ax	HE80 MCS0	17	≤-5	PASS	246
802.11ax	HE80 MCS11	11	≤-35	PASS	267

5G Receiver Specifications

Modulation	RX Rate	Min Input Level（dBm）	Max Input Level（dBm）	PER	VBAT current（mA）
802.11a	6Mbps	-91	-5	10%	87.5
802.11a	54Mbps	-74	-5	10%	88.1
802.11n	HT20 MCS0	-91	-5	10%	90.5
802.11n	HT20 MCS7	-71	-5	10%	92.7
802.11n	HT40 MCS0	-88	-5	10%	94.1
802.11n	HT40 MCS7	-69	-5	10%	98.2
802.11ac	VHT20 MCS0	-91	-5	10%	90.9
802.11ac	VHT20 MCS8	-67	-5	10%	92.4
802.11ac	VHT40 MCS0	-88	-5	10%	95.6
802.11ac	VHT40 MCS9	-63	-5	10%	98.7
802.11ac	VHT80 MCS0	-85	-5	10%	102.5
802.11ac	VHT80 MCS9	-59	-5	10%	109.2
802.11ax	HE20 MCS0	-91	-5	10%	92.1
802.11ax	HE20 MCS11	-60	-5	10%	92.5
802.11ax	HE40 MCS0	-89	-5	10%	96.7
802.11ax	HE40 MCS11	-58	-5	10%	96.6

802.11ax	HE80 MCS0	-86	-5	10%	105.3
802.11ax	HE80 MCS11	-53	-5	10%	106.5

6.3 Bluetooth Radio Frequency (RF) Characteristics

Table 6 -3

Conditions: VBAT=3.3V; VDDIO=1.8V; Ta:25℃	
Features	Description
Bluetooth Standard	Bluetooth v2.1+EDR/3.0+HS/4.2/5. 0
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 current（mA）
	Min	Type	Max	
BR_1M	6	8	10	33
EDR_2M /3M	6	8	10	33
LE_125/500K	6	8	10	33
LE_1M	6	8	10	33
LE_2M	6	8	10	33

Bluetooth Receiver Specifications

Item	Sensitivity（dBm）		Max Input Level（dBm）		VBAT current（mA）
	Input Level (Typ)	BER	Input Level (Typ)	BER	
BR_1M	TBD	TBD	TBD	TBD	TBD
EDR_2M /3M	TBD	TBD	TBD	TBD	TBD
LE_125/500K	TBD	TBD	TBD	TBD	TBD
LE_1M	TBD	TBD	TBD	TBD	TBD
LE_2M	TBD	TBD	TBD	TBD	TBD

7 Hardware Design Guide

7.1 Power Design Notice

7.1.1 Voltage Requirement

The main power supply (VBAT) input range of the module is 3.3V+/-10%, and the interface VDDIO supports two level ranges, 1.8V+/-10% or 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.

7.1.2 Current Requirement

Under different standards, when Wi-Fi transmits continuously, the peak value and amplitude of the operating current on the main power supply are as shown in the table below. The 3.3V power converter must be able to provide 650mA RMS current and fast transient response (when the transient current change rate is 80mA/us, the voltage drop is less than 100mV).

Table 7-1-2

Mode	Burst power (dBm)	Peak current (mA)	RMS current (mA)
11b 11M long	23.5	833	607
2.4G ch1	21.8	753	573
	19.6	647	473
	17.4	593	440
	15.5	566	407
11ax MCS0	22	720	500
2.4G CH1	20	640	427
	18	587	420
	16	553	393
11ax MCS0	22	827	560
5G CH36	19.9	667	433
	18	620	380
	16	540	307

7.1.3 Power Supply Reference

It is recommended to use a separate power regulator to power the module. The ripples caused by other current loads will affect the RF performance of the module. Therefore, it is not recommended to share the power supply with other devices in the system. It is recommended to use SILERGY's Synchronous Step-down Regulator SY8089AAC as the main power supply VBAT of the module. The circuit schematic is as follows:

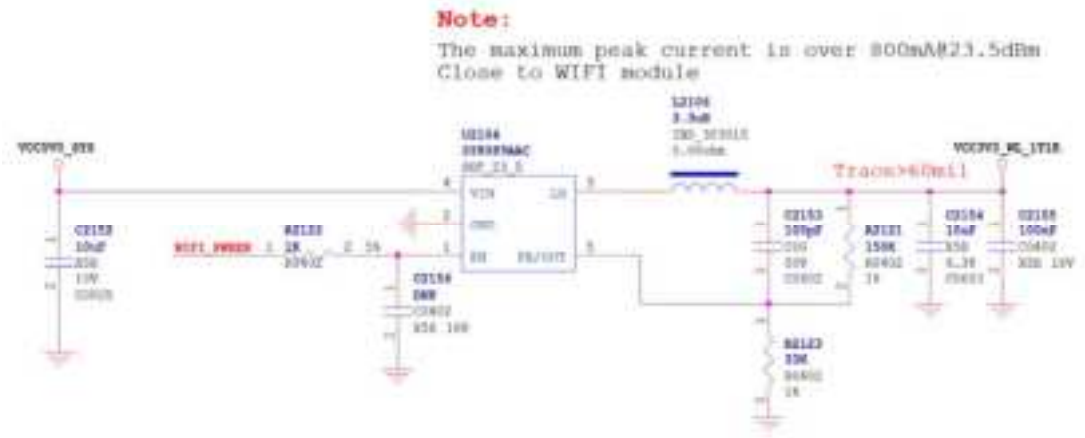


Figure 7-1-3

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

7.2 Interface Design Notice

7.2.1 Wake-up Signals

This module require two GPIOs as handshake signals with the host controller, the wake up direction of these two GPIOs support auto negotiation. As default, for example, WL_ WAKE_ HOST is the output signal "CP wakes up the main control", and HOST_ WAKE_ WL is the input signal "Master wakes up CP", also we can swap then when connect with the host. Wi-Fi and Bluetooth use the same handshake signal. The working mechanism is as follows.

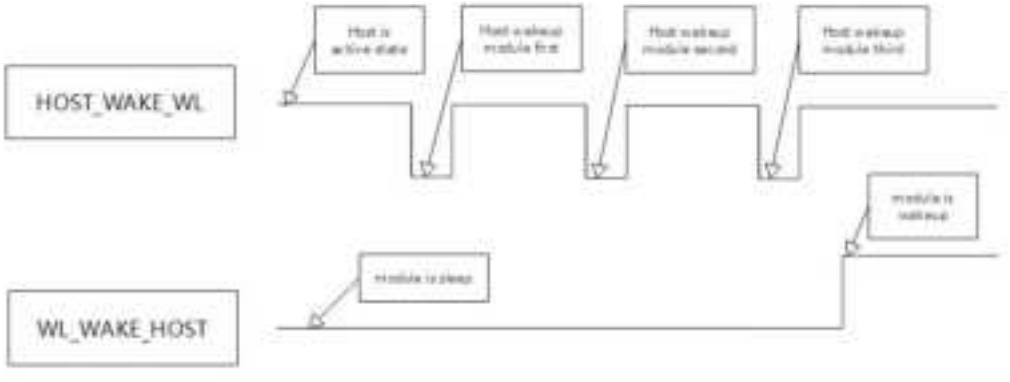


Figure 7-2-1

7.2.2 HCI Commend Interface

The Bluetooth supports SDIO3.0 and HS-UART (4Mbps) as HCI (Host Controller Interface). SDIO3.0 is used as HCI by default, which means the HS-UART port does not need in the HOST controller.

7.2.3 SDIO Interface

This module supports SDIO3.0. When the input level of VDDIO is 3.3v, SDIO supports the clock frequencies of 25MHz and 50MHz.When the input level of VDDIO is 1.8v, SDIO supports SDR25, SDR50 and SDR104, and the clock frequency of SDR104 is 208MHz.

The clock frequency of the SDIO3.0 interface is up to 208MHz. The SDIO bus needs to be controlled with a single-ended 50 ohm impedance. The maximum length of the bus routing is 15cm. The SDIO signal group needs to be controlled to be of equal length with 100mil.

7.2.4 PCM and UART Interface

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

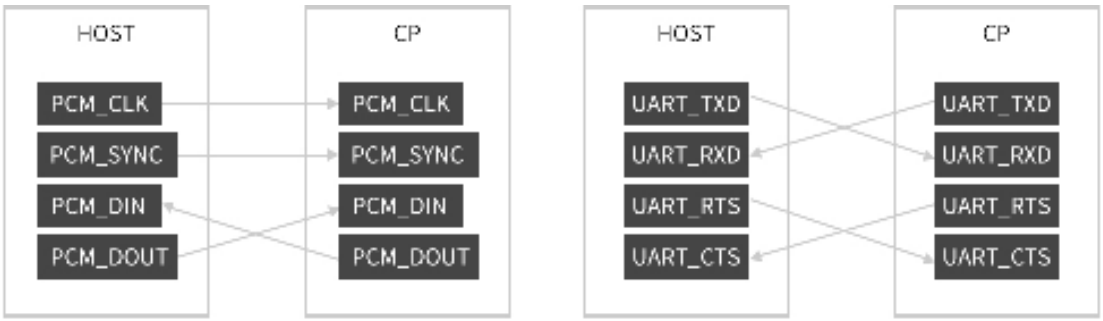

HOST
PCM_CLK
PCM_SYNC
PCM_DIN
PCM_DOUT
CP
PCM_CLK
PCM_SYNC
PCM_DIN
PCM_DOUT
HOST
UART_TXD
UART_RXD
UART_RTS
UART_CTS
CP
UART_TXD
UART_RXD
UART_RTS
UART_CTS

Figure 7-2-4

8 Storage,Production and Packaging

8.1 Storage Conditions

- FD7256S 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.
- FD7256S 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.

8.2 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 FD7256S 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 FD7256S module, the thickness of the printed stencil is recommended to be 0.15~0.18mm; the recommended reflow curve is as follows:

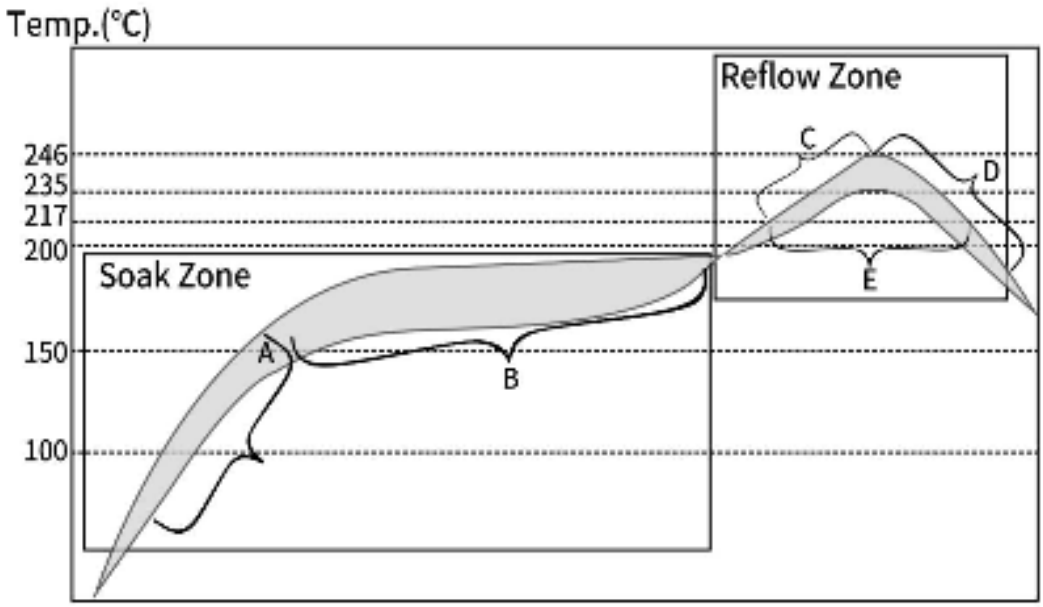


Figure 8 -2 Recommended reflow curve

Table 8 -2

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

8.3 Packing Specifications

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.

8.3.1 Tape Dimensions

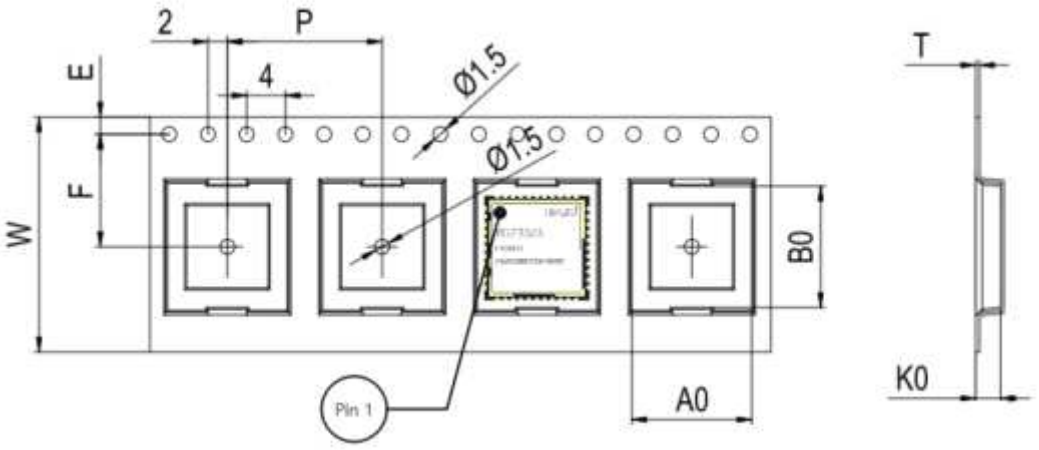


Figure 8-3-1 Tape dimensions

Table 8-3-1

W	P	T	A0	B0	K0	F	E.	Unit
24	16	0.35	12.4	12.4	2.5	11.5	1.75	mm

8.3.2 Plastic Reel Dimensions

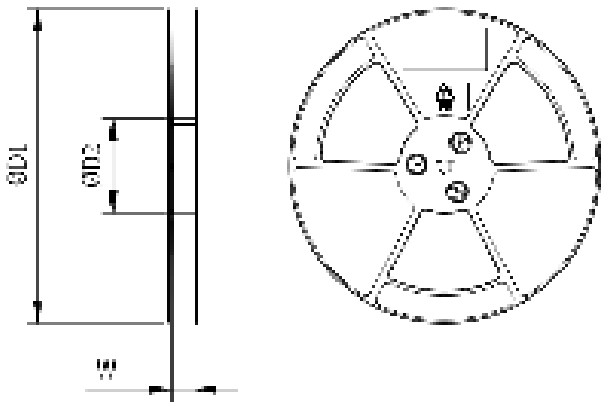


Table 8-3-2

ΦD1	φD2	W	unit
330	100	24	mm

7.3.3 Packaging Process

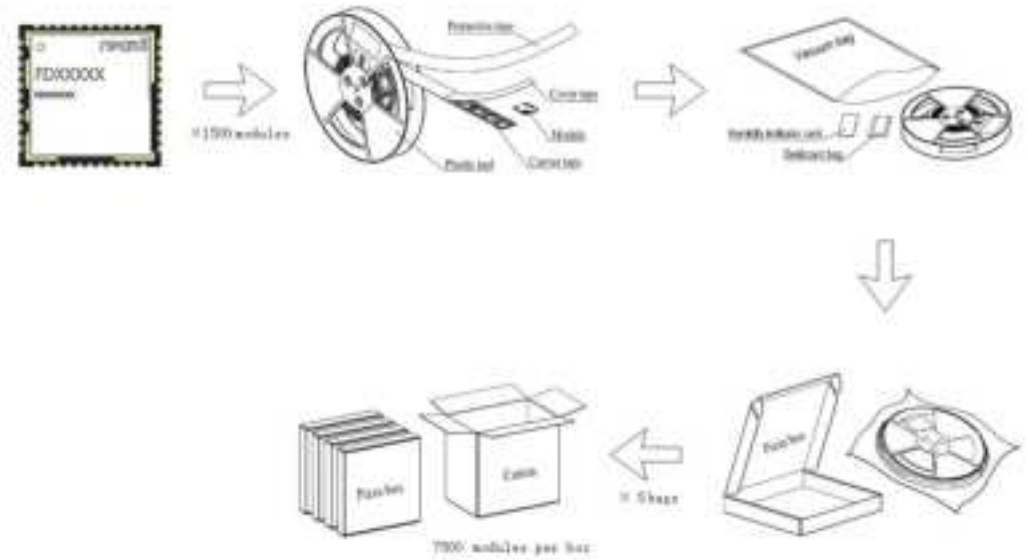


Figure 8-3-3 Package specification

9 Antenna Design

9.1 Summarize

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.
This equipment 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 equipment 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 equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This modular has been tested and found to comply with part 15 requirements for Modular Approval.

- FCC Caution: Any changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter.
- Integration instructions for host product manufacturers according to KDB 996369 D03 OEM Manual v01r01

9.2 List of applicable FCC rules

CFR 47 FCC Part 15 Subpart C and Subpart F has been investigated. It is applicable to the modular transmitter

9.3 Specific Operational Use Conditions - Antenna Placement Within the Host Platform

The module is tested for standalone mobile RF exposure use condition.

● The antenna must be installed such that 20cm is maintained between the antenna and users,

● The transmitter module may not be co-located with any other transmitter or antenna.

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

9.4 Limited Module Procedures

Not applicable

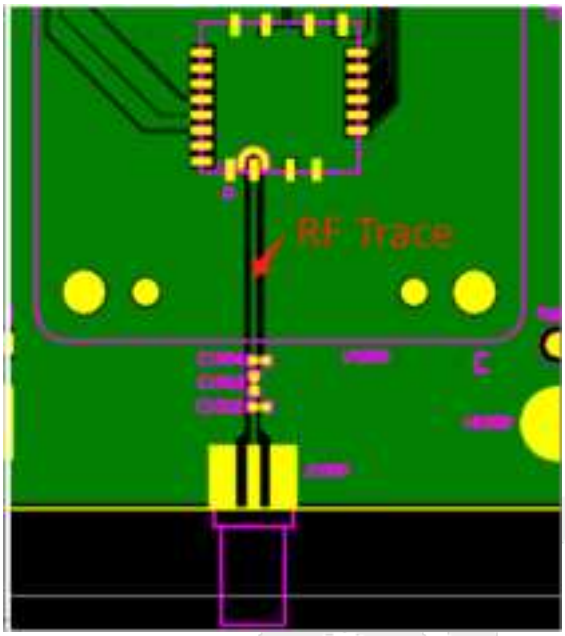
9.5 Trace Antenna Designs

Users should connect antennas to half hole pad through copper tube structure or FP types of RF trace and the trace impedance must be controlled in 50Ω.recommends that the total insertion loss between the antenna pads and antennas should meet

the following requirements:

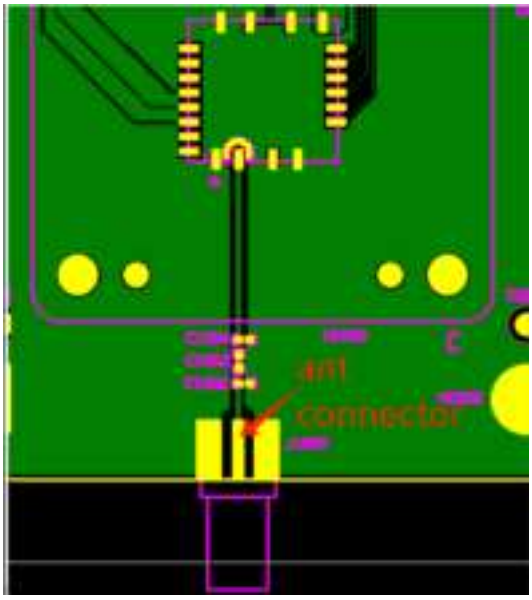
Frequency	Loss
2400MHz-2500MHz	＜0.6dB
5150MHz-5850MHz	＜1.2dB

To facilitate the antenna tuning and certification test, a RF connector and an antenna matching circuit should be added. The following figure is the recommended circuit.



The module needs to be attached to the PCB board and connected to the external antenna
through the solder joint of the circuit on the PCB. The gain of the external antenna is 2dB（i Max.）,the internal structure is copper tube structure or FPC. A resistance of 0R is added between the module and the antenna at C1003 to ensure that the impedance of the connection between the module and the antenna reaches 50R.The J0800 position on the PCB is where the external antenna is connected.

RF traces layout
1.Keep the RF trace from module ant pin to antenna as short as possible
2.RF trace should be 50 Ω either on the top layer or in the inner layer
3.RF trace should be avoided right angle and sharp angle.
4.Put enough GND vias around RF traces.
5.RF trace should be far away from other high speed signal lines.



External Antenna VSWR

Parameters	Min	Typ	Max
External Antenna VSWR		1.6	2.0

9.6 RF Exposure Considerations

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

9.7 Antenna Type and Gain

The following antennas have been certified for use with this module.
Only antennas of the same type with equal or lower gain may also be used with this module.
Other types of antennas and/or higher gain antennas may require the additional authorization for operation.
Antenna Specification list below:

Model	Type	Connector	Peak gain (dBi)				
			2400-2483.5 MHz	5150-5250 MHz	5250-5350 MHz	5470-5725 MHz	5725-5850 MHz
FD200S	External Antenna	/	2.00dBi	2.00dBi	2.00dBi	2.00dBi	2.00dBi

9.8 End Product Labelling Compliance Information

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily removed. If not, a second label must be placed on the outside of the final device that contains the following text: “Contains FCC ID: **2BFAK-FD200S**”. The FCC ID can be used only when all FCC compliance requirements are met.

9.9 Information on Test Modes and Additional Testing Requirements

This transmitter is tested in a standalone mobile RF exposure condition and any co-located or simultaneous transmission with other transmitter(s) class II permissive change re-evaluation or new FCC authorization.
Host manufacturer installed this modular with single modular approval should perform the test of radiated emission and spurious emission according to FCC part 15C, Part 15E, 15.209, 15.207 requirement, only if the test result comply with FCC part 15C, Part 15E, 15.209, 15.207 requirement, then the host can be sold legally.

9.10 Additional testing, Part 15 Subpart B Disclaimer

This transmitter modular us tested as a subsystem and its certification does not cover the FCC Part 15 Subpart B rules requirement applicable to the final host. The final host will still need to be reassessed for compliance to this portion of rules requirements if applicable.

As long as all conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this modular installed.

9.11 Manual Information to The End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module.

The host integrator must follow the integration instructions provided in this document and ensure that the composite system end product complies with the requirements by a technical assessment or evaluation to the rules and to KDB Publication 996369.

The host integrator installing this module into their product must ensure that the final composite product complies with the requirements by a technical assessment or evaluation to the rules, including the transmitter operation and should refer to guidance in KDB Publication 996369.

OEM/Host Manufacturer Responsibilities

OEM/Host manufacturers are ultimately responsible for the compliance of the Host and Module. The final product must be reassessed against all the essential requirements of the FCC rule such as FCC Part 15 Subpart B before it can be placed on the US market. This includes reassessing the transmitter module for compliance with the Radio and RF Exposure essential requirements of the FCC rules.

9.12 How to Make Changes - Important Note

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.