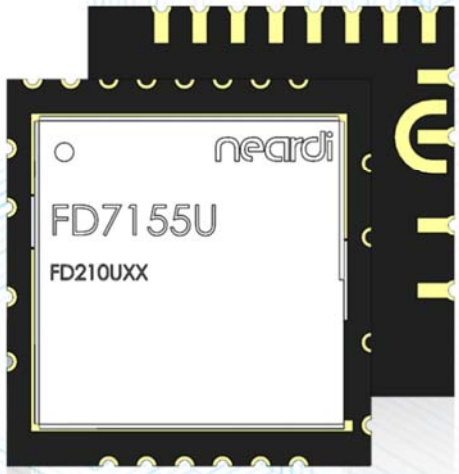
neardi

FD7155U WIFI Module

Datasheet

V2.1



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Version History

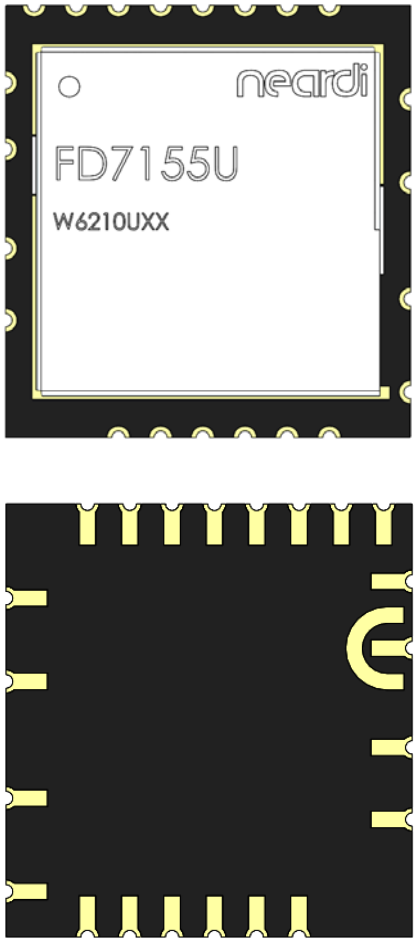
Version	Date	Illustrate
V1.0	2023/9/19	Initial Version
V2.0	2023/12/1	Update block diagram, electric performance, interface design notice, RF Characteristics, packing specifications
V2.1	2024/1/5	Update WiFi Receive Sensitivity Spec

Contents

1 Product Overview

1.1 Product Introduction

FD7155U 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 USB2.0, 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 CPE, IPC, tablet and IOT, and can also be used in fields with high reliability requirements such as industrial interconnection.



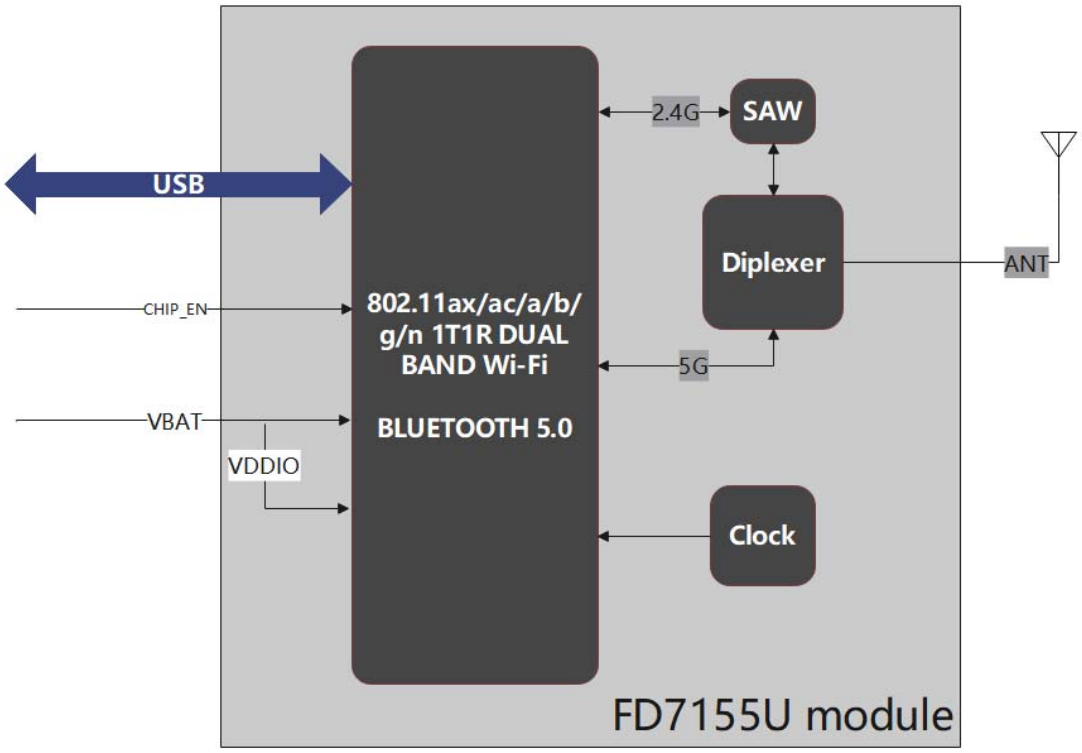
1.2 Wi-Fi Characteristics

- ✓ 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 286.8Mbps, Throughput rate up to 260Mbps
- ✓ Multiple modes such as Wi-Fi STA, AP, and P2P
- ✓ 40MHz 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, 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
- ✓ USB2.0 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

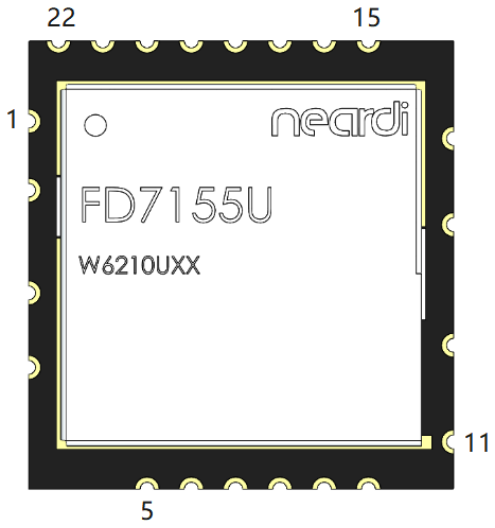


1.5 Parameters

Product Name	**FD7155U**
Product description	802.11ax/ac/a/b/g/n 1T1R dual band Wi-Fi and Bluetooth 5.0 comb module
Dimension	13(±0.1)mm*12.2(±0.1)mm*1.65(±0.2)mm
Power supply	VBAT：3.0~3.6V
Host interface	USB2.0
Footprint	LCC 22pin
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



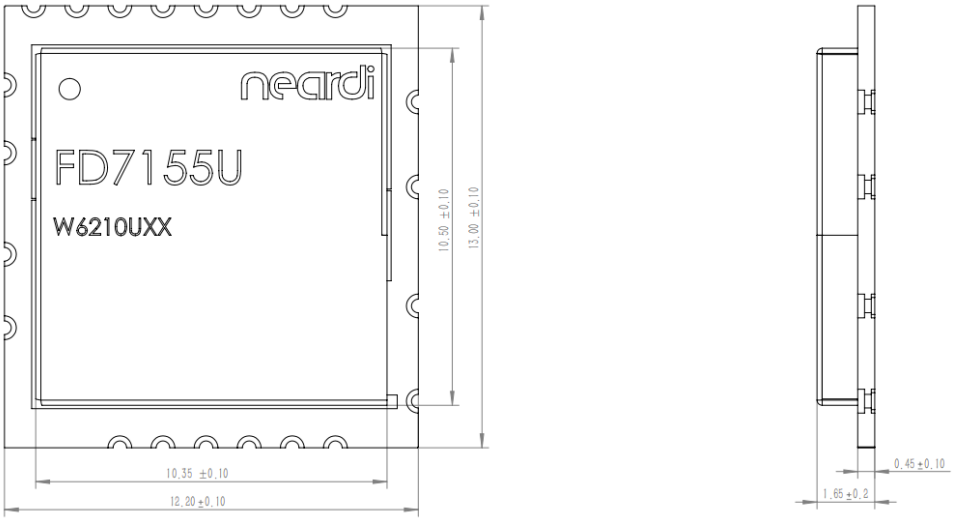
2.2 Pin Description

Pin Number	Pin Name	Pin Type	Pin Description
1	GND	G	Ground connections
2	WL_BT_ANT	RF	RF I/O port
3	NC	-	Floating (Don’ t connected to ground)
4	GND	G	Ground connections
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	NC	-	Floating (Don’ t connected to ground)
9	NC	-	Floating (Don’ t connected to ground)
10	NC	-	Floating (Don’ t connected to ground)
11	VBAT	P	Main power voltage source input
12	USB_DM	I/O	USB Transmitter/Receiver Differential Pair
13	USB_DP	I/O	USB Transmitter/Receiver Differential Pair
14	GND	G	Ground connections
15	NC	-	Floating (Don’ t connected to ground)
16	NC	-	Floating (Don’ t connected to ground)
17	NC	-	Floating (Don’ t connected to ground)
18	CHIP_EN	I	Module enable signal

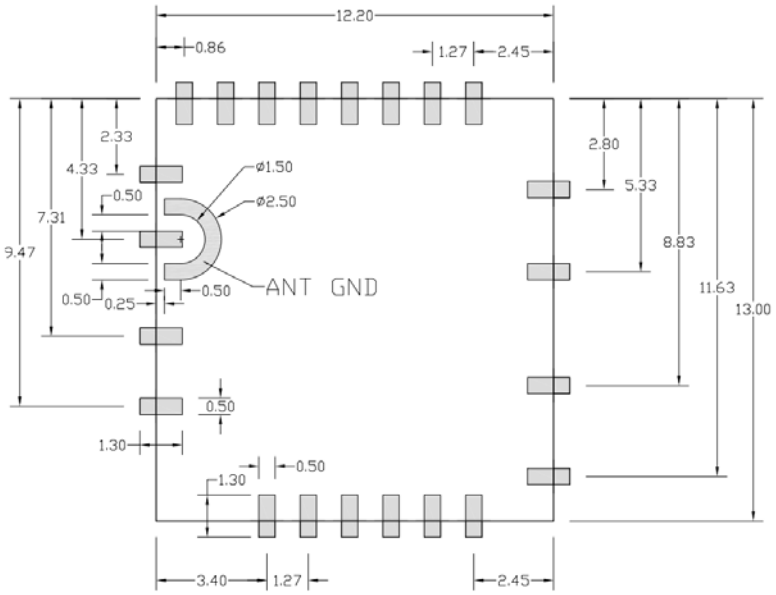
19	NC	-	Floating (Don’ t connected to ground)
20	NC	-	Floating (Don’ t connected to ground)
21	NC	-	Floating (Don’ t connected to ground)
22	NC	-	Floating (Don’ t connected to ground)

3 Mechanical Specifications

3.1 Mechanical Dimensions



3.2 Recommended PCB Layout Footprint



4 Electrical Performance and Reliability

4.1 Absolute Maximum Voltage Range

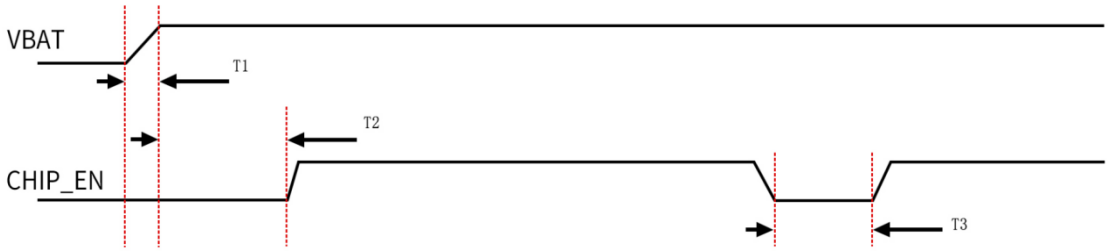
Symbol	Description	Min	Max	Unit
VBAT	Power Supply Voltage	-0.5	5.25 *	V

* 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

4.3 Power On/Off Sequence



Symbol	Description	Min	Type	Max	Unit
T1	VBAT Ramp up time	0.2	0.5	-	mS
T2	CHIP_EN should be powered on after VDDIO is powered on	0	-	-	mS
T3	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; 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	470
802.11b	11Mbps	17	≤35%	PASS	303
802.11g	6Mbps	17	≤-5	PASS	318
802.11g	54Mbps	15	≤-25	PASS	385
802.11n	HT20 MCS0	17	≤-5	PASS	305
802.11n	HT20 MCS7	14	≤-27	PASS	303
802.11n	HT40 MCS0	17	≤-5	PASS	302
802.11n	HT40 MCS7	14	≤-27	PASS	275
802.11ac	VHT20 MCS0	17	≤-5	PASS	305
802.11ac	VHT20 MCS8	13	≤-30	PASS	270

802.11ac	VHT40 MCS0	17	≤-5	PASS	296
802.11ac	VHT40 MCS9	12	≤-32	PASS	230
802.11ax	HE20 MCS0	17	≤-5	PASS	280
802.11ax	HE20 MCS11	11	≤-35	PASS	254
802.11ax	HE40 MCS0	17	≤-5	PASS	279
802.11ax	HE40 MCS11	11	≤-35	PASS	193

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%	118
802.11b	11Mbps	≤-87	-5	8%	118
802.11g	6Mbps	≤-92	-5	10%	118
802.11g	54Mbps	≤-75	-5	10%	117
802.11n	HT20 MCS0	≤-92	-5	10%	122
802.11n	HT20 MCS7	≤-72	-5	10%	120
802.11n	HT40 MCS0	≤-89	-5	10%	126
802.11n	HT40 MCS7	≤-70	-5	10%	121
802.11ac	VHT20 MCS0	≤-91	-5	10%	122
802.11ac	VHT20 MCS8	≤-68	-5	10%	119
802.11ac	VHT40 MCS0	≤-89	-5	10%	126
802.11ac	VHT40 MCS9	≤-63	-5	10%	122
802.11ax	HE20 MCS0	≤-92	-5	10%	123
802.11ax	HE20 MCS11	≤-60	-5	10%	119
802.11ax	HE40 MCS0	≤-89	-5	10%	126
802.11ax	HE40 MCS11	≤-58	-5	10%	121

5.2 5GHZ Wi-Fi RF Characteristics

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;
	802.11ax (HE20): MCS0~MCS11: 8~143.4Mbps;
	802.11ax (HE40): MCS0~MCS11: 16~286.8Mbps;
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	315
802.11a	54Mbps	15	≤-25	PASS	377
802.11n	HT20 MCS0	17	≤-5	PASS	312
802.11n	HT20 MCS7	14	≤-27	PASS	313
802.11n	HT40 MCS0	17	≤-5	PASS	281
802.11n	HT40 MCS7	14	≤-27	PASS	263
802.11ac	VHT20 MCS0	17	≤-5	PASS	313
802.11ac	VHT20 MCS8	13	≤-30	PASS	279
802.11ac	VHT40 MCS0	17	≤-5	PASS	286
802.11ac	VHT40 MCS9	12	≤-32	PASS	219
802.11ax	HE20 MCS0	17	≤-5	PASS	288
802.11ax	HE20 MCS11	11	≤-35	PASS	254
802.11ax	HE40 MCS0	17	≤-5	PASS	270
802.11ax	HE40 MCS11	11	≤-35	PASS	185

5G Receiver Specifications

Modulation	RX Rate	Min Input Level (dBm)	Max Input Level（dBm）	PER	VBAT current (mA)
802.11a	6Mbps	-91	-5	10%	125
802.11a	54Mbps	-74	-5	10%	123
802.11n	HT20 MCS0	-91	-5	10%	129
802.11n	HT20 MCS7	-71	-5	10%	125
802.11n	HT40 MCS0	-88	-5	10%	132
802.11n	HT40 MCS7	-69	-5	10%	127
802.11ac	VHT20 MCS0	-91	-5	10%	130
802.11ac	VHT20 MCS8	-67	-5	10%	125
802.11ac	VHT40 MCS0	-88	-5	10%	132
802.11ac	VHT40 MCS9	-63	-5	10%	136
802.11ax	HE20 MCS0	-91	-5	10%	130
802.11ax	HE20 MCS11	-60	-5	10%	125
802.11ax	HE40 MCS0	-89	-5	10%	131
802.11ax	HE40 MCS11	-58	-5	10%	127

5.3 Bluetooth Radio Frequency (RF) Characteristics

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	79
EDR_2M /3M	6	8	10	79
LE_125/500 K	6	8	10	79
LE_1M	6	8	10	79
LE_2M	6	8	10	79

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_125/500 K	TBD	TBD	TBD	TBD	TBD
LE_1M	TBD	TBD	TBD	TBD	TBD
LE_2M	TBD	TBD	TBD	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%, 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.

6.1.2 Current Requirement

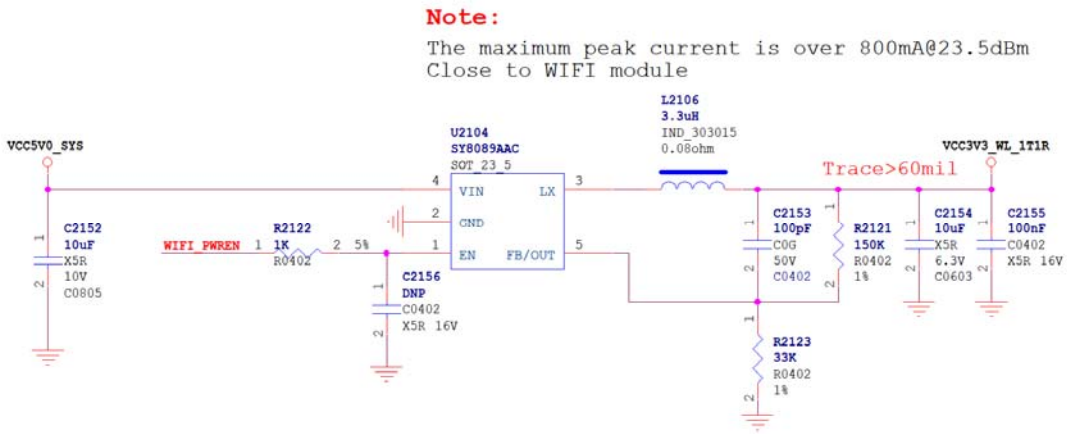
Under different standards, when Wi-Fi transmits continuously, the peak value and amplitude of the operating current on the main power supply are as shown in the table below. The 3.3V power converter must be able to provide 650mA RMS current and fast transient response (when the transient current change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

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

6.1.3 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:



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 USB2.0 as HCI (Host Controller Interface).

7 Storage,Production and Packaging

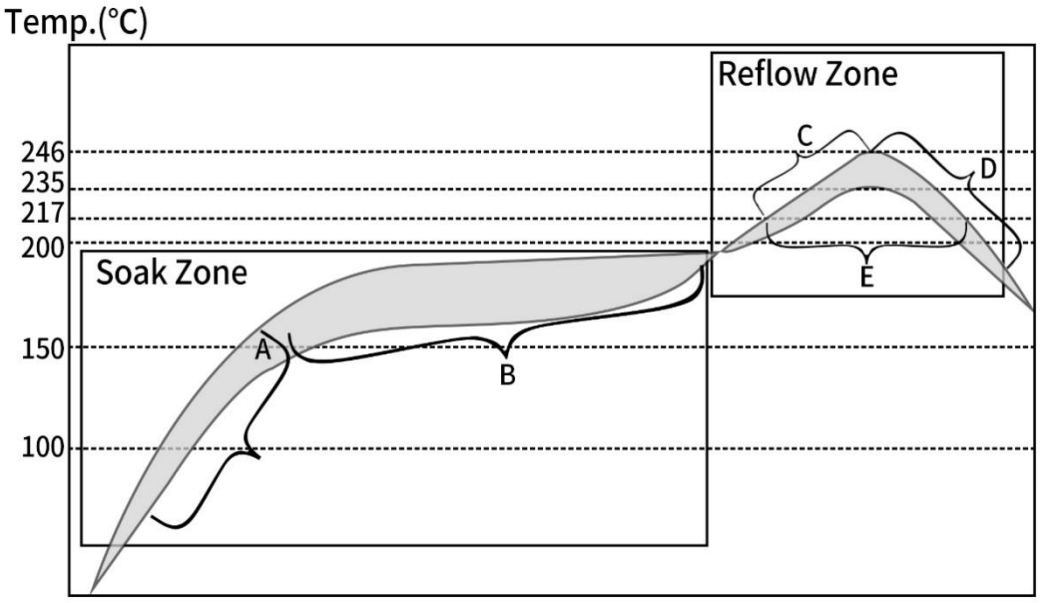
7.1 Storage Conditions

- FD7155U 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.
- FD7155U 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 FD7155U 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 FD7155U module, the thickness of the printed stencil is recommended to be 0.15~0.18mm; the recommended reflow curve is as follows:

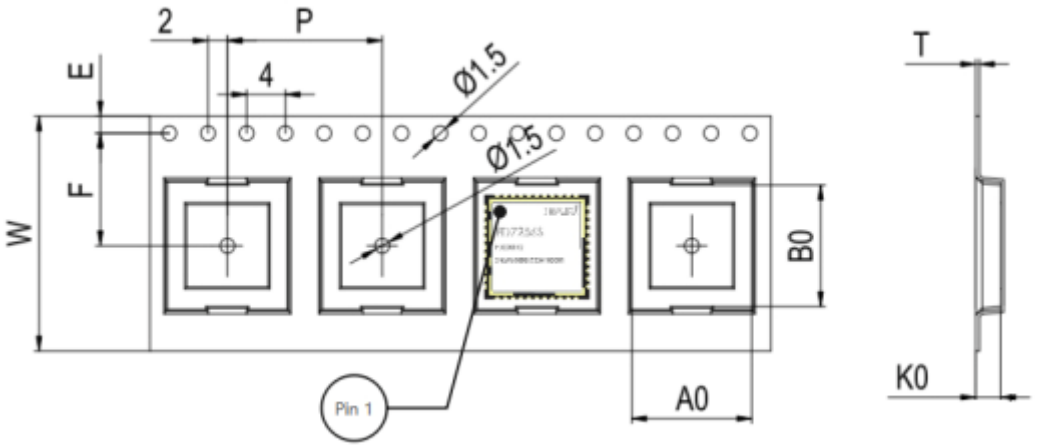


Item	Description	Value
Endothermic Zone Heating Rate	Interval A	≤3℃/s
Soak time	From the end of interval A to the beginning of interval B	60~120s
Reflow Zone Heating Rate	Interval C	≤3 ℃/s
Maximum Temperature	Highest point of the curve	246℃(+5/-0℃)
Cooling Rate	Interval D	＜6 ℃/s
Reflow Time	Interval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

7.3 Packing Specifications

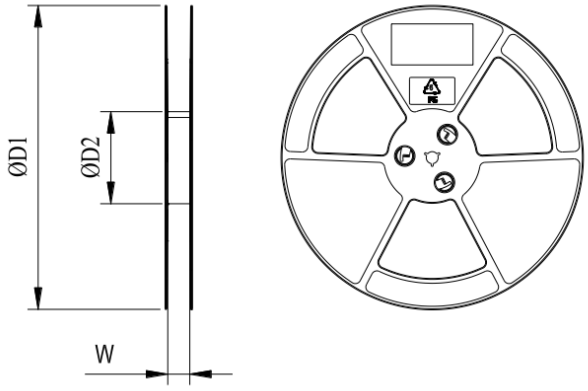
The key parameters and packaging processes described in this chapter are for reference only. The appearance and structure of the specific packaging materials are subject to actual delivery.

7.3.1 Tape Dimensions



W	P	T	A0	B0	K0	F	E.	Unit
24	16	0.35	12.6	13.4	2.5	11.5	1.75	mm

7.3.2 Plastic Reel Dimensions



ΦD1	φD2	W	unit
330	100	24	mm

7.3.3 Packaging Process