PRODUCT SPECIFICATION

6251C-PUB

Wi-Fi Dual-band 1x1 11ax + BT 5.3

PCIe Combo Module

Version:v1.2

Customer: _____

Customer P/N:_____

Signature:_____

Date:_____

Office: 14th floor, Block B, phoenix zhigu, Xixiang Street, Baoan District, Shenzhen

Factory: NO.8, Litong RD., Liuyang Economic & Technical Development Zone, Changsha, CHINA

TEL: +86-755-2955-8186 Website: www.fn-link.com

6251C-PUB Module Datasheet

	Part NO.	Description
Ordering Information	FG6251CPUB-00	RTL8851BE-CG/wifi6/1T1R+BT,802.11a/b/g/n/ac/ax+BT5.3,1T1R,PCIE+USB,12*16,PCIE port

Target power：

2.4G：19/18/17/15/13

5.8G：18/17/15/13

CONTENTS

Revision History

Version	Date	Contents of Revision Change	Draft	Checked	Approved
V1.0	2023/06/19	Initial Release	TZQ	TZQ	QJP
V1.1	2023/08/23	Update Module height	LXP	TZQ	QJP
V1.2	2023/11/1	Update antenna connector information	LXP	TZQ	QJP

1. General Description

1.2 Introduction

The Realtek 6251C-PUB is a highly integrated single-chip that support 1-stream 802.1lax solutions withMulti-user MIMO (Multiple-Input, Multiple-Output) with Wireless LAN (WLAN) PCI Express networkinterlace controller with integrated Bluetooth 5 USB interface controller. It combines a WLAN MAC. a1TIR capable WLAN baseband, and RF in a single chip. The 6251C-PUB provides a complete solutionfor a high-performance integrated wireless and Bluetooth device.

The 6251C-PUB baseband implements Multi-user Multiple Input, Multiple Output (MU-MIMOOrthogonal Frequency Division Multiplexing (OFDM) with one transmit and one receive paths (1TIR)Features include one spatial stream transmissions, short Guard Interval (Gl), spatial spreading, and supportfor variant channel bandwidth. Moreover, 6251C-PUB provides one spatial stream space-time block codeSTBC), Transmit Beamforming (TxBF) and Low Density Parity Check (LDPC) to extend the range oltransmission. At the receiver, extended range and good minimum sensitivity are achieved by havingreceiver from one antenna and up to two antennas with diversity. 6251C-PUB could support both singleantenna and two antennas. As the recipient, the RTL8851BE also supports explicit sounding packetfeedback that helps senders with beamforming capability.

For legacy compatibility, Direct Sequence Spread Spectrum (DSSS), Complementary Code Keying (CCKand OFDM baseband processing are included to support all IEEE 802.11b, 802.11g and 802.1la data rates.Differential phase shift keying modulation schemes, DBPSK and DOPSK with data scrambling capabilityare available, and CCK provides support for legacy data rates, with long or short preamble. The CCkprocessor can perform dual-receiver by providing diversity gain to extend range and improve the reception.The high speed FFT/IFFT paths, combined with BPSK, OPSK, 16OAM, 640AM, 2560AM, and up to1024QAM modulation of the individual subcarriers, and rate compatible coding rate of 1/2, 2/3, 3/4, and5/6, provide up to 600Mbps for IEEE 802.11ax MIMO OFDM

For advanced 1lax spec, 6251C-PUB can receive with OFDMA (OFDM Access) technology. The RU sizecan be supported form small unil, e.g., RU26, and RU52, 106, 242, 484, and finally up to RU996. The high-order modulation scheme, such as 1024-0AM, can also be handled very well. Meanwhile, diff number oftotal subcarrier in the HE-LTF. such as lx, 2x and 4x is considered. More networking efficiency can beachieved by lx, and better channel estimation performance provided by 4x.

The 6251C-PUB builds in an enhanced signal detector, an adaptive frequency domain equalizer, and a sofi-decision Viterbi decoder to alleviate severe multi-path eflects and mutual interference in the reception ofmultiple streams. Robust interference detection and suppression are provided to protect against Bluetoothcordless phone, and microwave ovem interlerence.

1.2 Description

Model Name	6251C-PUB
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 12x 16x 1.95 (typical) mm
Wi-Fi Interface	Support PCIe
BT Interface	USB
OS supported	Android /Linux/ Windows
Operating temperature	-10°C to 70°C
Storage temperature	-55°C to 125°C

2. Features

General

- Support the board designs with singleantenna or two antennas with diversity
- IEEE 802.11a/b/g/n/ac/axcompatible WLAN
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz
- Support 802.11ac 1x1,Wave-2 compliantwith RX MU-MIMO
- Maximum PHY data rate up to 150 Mbpsusing 20MHz bandwidth with 11n,433Mbps using 40MHz bandwidth with11ac, and 600Mbps using 80MHzbandwidth with 1lax
- Enhanced BT/WIFI Coexistence Control toimprove transmission quality in differentprofiles
- Integrated 32K oscillator for power management

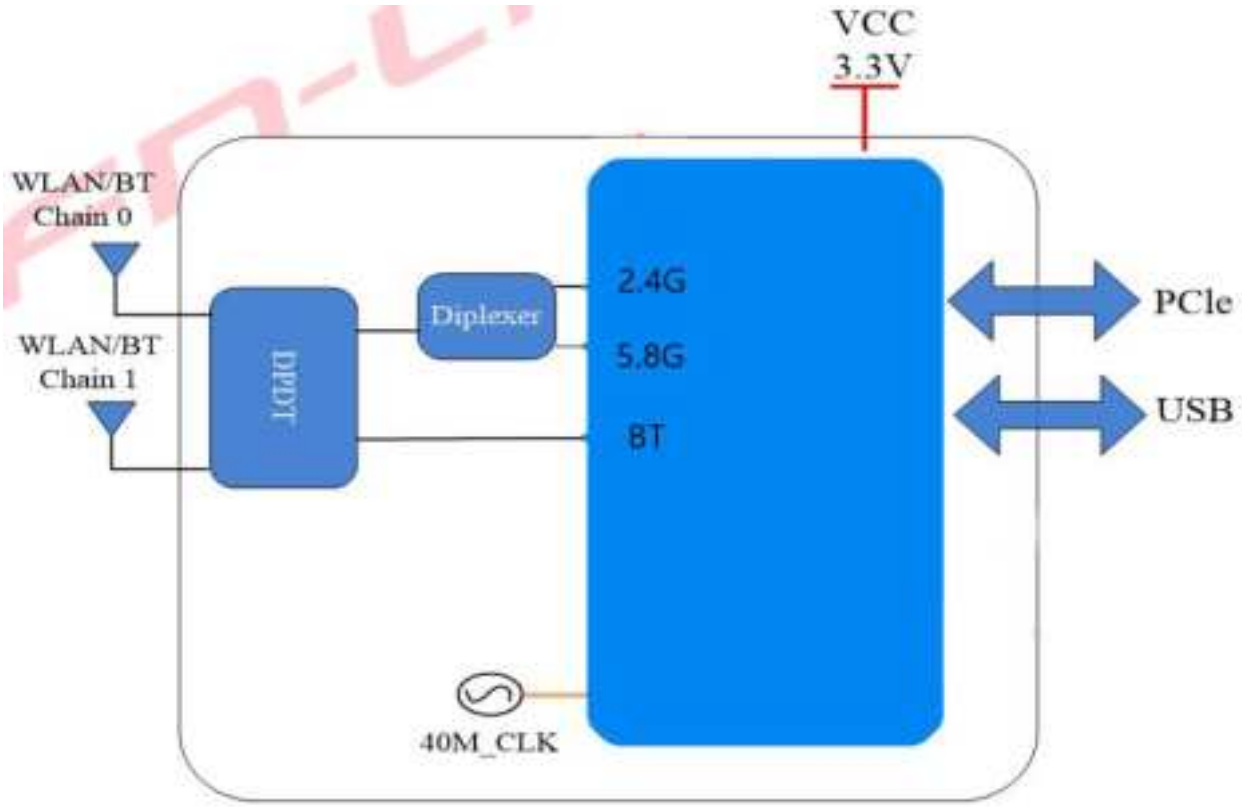
Host Interface

- Complies with PCI Express BaseSpecification Revision 1.1,Complies with USB2.0 FS-modeSpecification for Bluetooth

Bluetooth Features

- Support Bluetooth 5 system (BT 5.3 LogoCompliant)
- Compatible with Bluetooth v2.1+EDR
- Dual Mode support: Simultaneous LE andBREDR
- Integrated internal Class 1, Class 2, and Class3 PA

3. Block Diagram



4. General Specification

4.1 2.4G RF Specification

Conditions : VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	**Description**	
WLAN Standard	IEEE 802.11 b/g/n/ac/ax Wi-Fi compliant	
Frequency Range	2.400 GHz ~ 2.4835 GHz (2.4 GHz ISM Band)	
Number of Channels	2.4GHz：Ch1 ~ Ch14	
Test Items	**Typical Value**	**EVM**
Output Power[1]	802.11b /11Mbps : 19dBm ± 2 dB	EVM ≤ -9dB
	802.11g /54Mbps : 18dBm ± 2 dB	EVM ≤ -25dB
	802.11n /MCS7 : 17dBm ± 2 dB	EVM ≤ -28dB
	802.11ac VHT20/MCS8: 16dBm ± 2 dB	EVM ≤ -30dB
	802.11ac VHT40/MCS9: 15dBm ± 2 dB	EVM ≤ -32dB
	802.11ax HE20/MCS11: 13dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE40/MCS11: 13dBm ± 2 dB	EVM ≤ -35dB
Spectrum Mask	Meet with IEEE standard	
Freq. Tolerance	±20ppm	

SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps @ -94 dBm	≤-83 dBm
	- 11Mbps @ -85 dBm	≤-76 dBm
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps @ -90 dBm	≤-85 dBm
	- 54Mbps @ -71 dBm	≤-68 dBm
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-85 dBm
	- MCS=7 @ -69 dBm	≤-67 dBm
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-82 dBm
	- MCS=7 @ -66 dBm	≤-64 dBm
SISO Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤ -82 dBm
	- MCS=8 @ -64 dBm	≤ -60 dBm
SISO Receive Sensitivity (11ac ,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤ -79 dBm
	- MCS=9 @ -59 dBm	≤ -55 dBm
SISO Receive Sensitivity (11ax,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-74 dBm
	- MCS=11 @ -60 dBm	≤-52 dBm
SISO Receive Sensitivity (11ax ,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-71 dBm
	- MCS=11 @ -57 dBm	≤-49 dBm
Maximum Input Level	802.11b : -10 dBm	
	802.11g/n : -20 dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

4.2 5GHz RF Specification

Conditions : VBAT=3.3V ; VDDIO=3.3V ; Temp:25°C

Feature	**Description**	
WLAN Standard	IEEE 802.11a/n/ac/ax, Wi-Fi compliant	
Frequency Range	5.150 GHz ~ 5.850 GHz (5 GHz Band)	
Number of Channels	5.0GHz：Please see the table[1]	
Test Items	**Typical Value**	**EVM**
Output Power[2]	802.11a /54Mbps: 18 dBm ± 2 dB	EVM ≤ -25dB
	802.11n /MCS7: 17 dBm ± 2 dB	EVM ≤ -28dB
	802.11ac VHT20/MCS8: 16 dBm ± 2 dB	EVM ≤ -30dB
	802.11ac VHT40/MCS9: 15 dBm ± 2 dB	EVM ≤ -32dB
	802.11ac VHT80/MCS9: 15 dBm ± 2 dB	EVM ≤ -32dB
	802.11ax HE20/MCS11: 13 dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE40/MCS11: 13 dBm ± 2 dB	EVM ≤ -35dB
	802.11ax HE80/MCS11: 13 dBm ± 2 dB	EVM ≤ -35dB
Test Items	**Test Value**	**Standard Value**
SISO Receive Sensitivity	- 6Mbps @ -90 dBm	≤-85 dBm

(11a,20MHz) @10% PER	- 54Mbps @ -71 dBm	≤-68 dBm
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-85 dBm
	- MCS=7 @ -69 dBm	≤-67 dBm
SISO Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-82 dBm
	- MCS=7 @ -66 dBm	≤-64 dBm
SISO Receive Sensitivity (11ac,20MHz)@10% PER	- MCS=0, NSS1 @ 90 dBm	≤-82 dBm
	- MCS=8, NSS1 @ -64 dBm	≤-60 dBm
SISO Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0, NSS1 @ -87 dBm	≤-79 dBm
	- MCS=9, NSS1 @ -59 dBm	≤-55 dBm
SISO Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0, NSS1 @ -84 dBm	≤-79 dBm
	- MCS=9, NSS1 @ -56 dBm	≤-54 dBm
SISO Receive Sensitivity (11ax,20MHz) @10% PER	- MCS=0 @ -90 dBm	≤-74 dBm
	- MCS=11 @ -60 dBm	≤-52 dBm
SISO Receive Sensitivity (11ax,40MHz) @10% PER	- MCS=0 @ -87 dBm	≤-71 dBm
	- MCS=11 @ -57 dBm	≤-49 dBm
SISO Receive Sensitivity (11ax,80MHz) @10% PER	- MCS=0 @ -84 dBm	≤-68 dBm
	- MCS=11 @ -54 dBm	≤-46 dBm
Maximum Input Level	802.11a/n: -30 dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

1. 2. 2.4G,5G output power control by firmware power by rate table

[1]5GHz(20MHz) Channel table

Band range	Operating Channel Numbers	Channel center frequencies(MHz)
5150MHz~5250MHz	36	5180
	40	5200
	44	5220
	48	5240
5250MHz~5350MHz	52	5260
	56	5280
	60	5300
	64	5320
5470MHz~5725MHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580

	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
	140	5700
5725MHz~5850MHz	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

4.4 Bluetooth Specification

Feature	**Description**
General Specification	
Bluetooth Standard	BDR,EDR(1Mbps & 2Mbps & 3Mbps),LE(1Mbps),2LE(2Mbps)
Host Interface	USB
Frequency Band	2400 MHz ~ 2483.5MHz
Number of Channels	79 channels for classic,40 channels for BLE
Modulation	GFSK, π/4-DQPSK,8DPSK
RF Specification	
Output Power , tolerance ±3 dB	
	CL1(dBm)
BDR Output Power	5
EDR Output Power	5
BLE Output Power	5

Sensitivity, tolerance : /	
Sensitivity @ BER=0.1% for GFSK (1Mbps)	-70
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)	-70
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)	-70
Sensitivity @ BLE=30.8% for LE (1Mbps)	-70
Sensitivity @ BLE=30.8% for 2LE (2Mbps)	-70
Maximum Input Level	GFSK (1Mbps):-20dBm
	π/4-DQPSK (2Mbps) :-20dBm
	8DPSK (3Mbps) :-20dBm

5. ID setting information

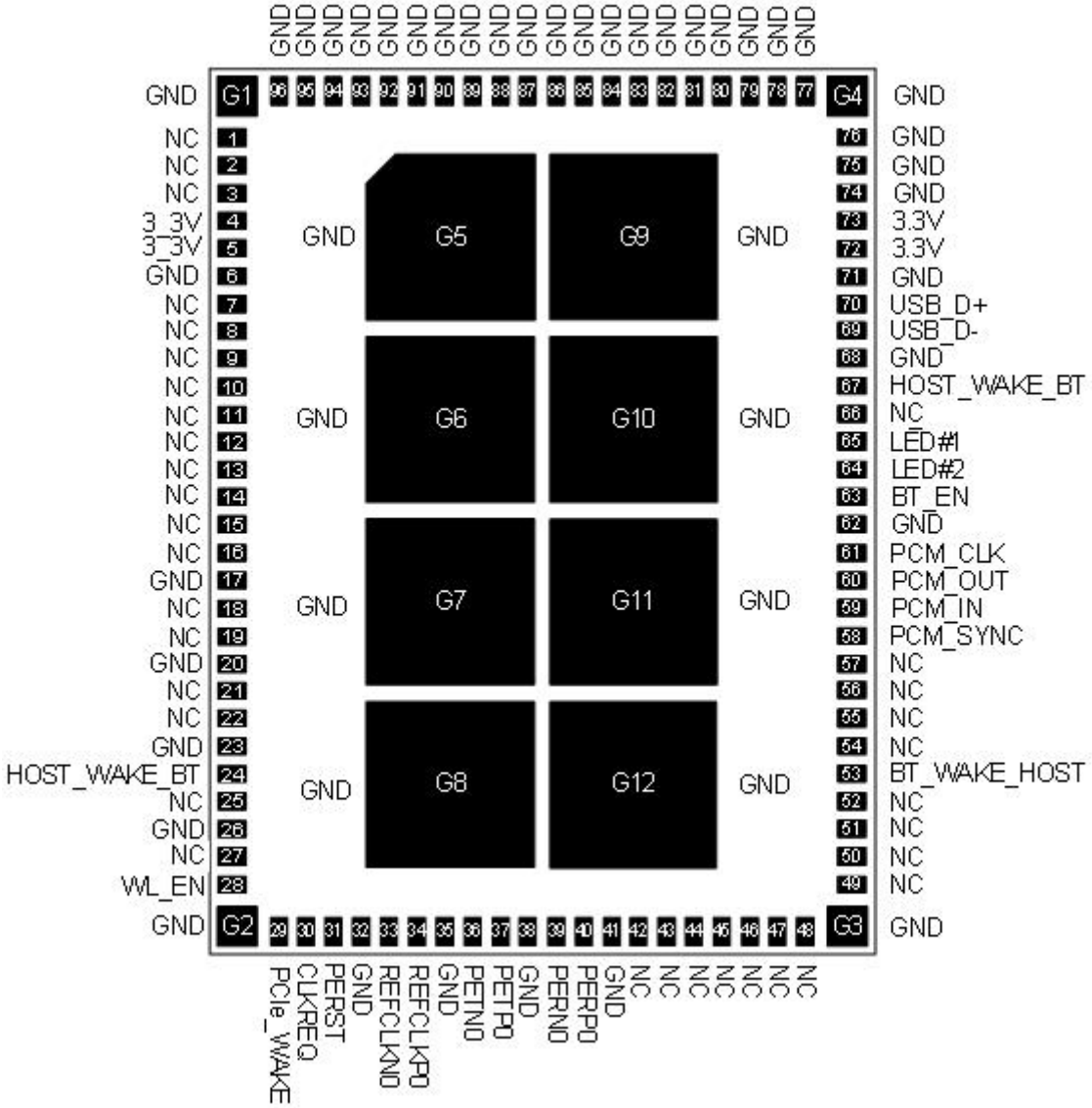
WI-FI

Vendor ID	10EC
Product ID	B851

6. Pin Definition

6.1 Pin Outline

< TOP VIEW >



6.2 Pin Definition details

TOP side

NO.	Name	Type	Description	Voltage
1	NC	—	No connect	
2	NC	—	No connect	
3	NC	—	No connect	
4	3_3V	P	Main power voltage source input 3.3V	3.3V
5	3_3V	P	Main power voltage source input 3.3V	3.3V
6	GND	—	Ground connections	
7	NC	—	No connect	

8	NC	—	No connect	
9	NC	—	No connect	
10	NC	—	No connect	
11	NC	—	No connect	
12	NC	—	No connect	
13	NC	—	No connect	
14	NC	—	No connect	
15	NC	—	No connect	
16	NC	—	No connect	
17	GND	—	Ground connections	
18	NC	—	No connect	
19	NC	—	No connect	
20	GND	—	Ground connections	
21	NC	—	No connect	
22	NC	—	No connect	
23	GND	—	Ground connections	
24	HOST_WAKE_BT	I	Host wake up BT	3.3V
25	NC	—	No connect	
26	GND	—	Ground connections	
27	NC	—	No connect	
28	WL_EN	—	WLAN enable pin; High: enable,Low:disable	3.3V
29	PCIe_WAKE	OD	PCIe wake up host, open drain, active low	3.3V
30	CLKREQ	OD	PCIe reference clock request signal	3.3V
31	PERST	PD	PCIe reset module	3.3V
32	GND	—	Ground connections	
33	REFCLKN0	I	PCIe CLK Difference -	
34	REFCLKP0	I	PCIe CLK Difference +	
35	GND	—	Ground connections	
36	PETN0	O	PCIe Data Out Difference -	
37	PETP0	O	PCIe Data Out Difference +	
38	GND	—	Ground connections	
39	PERN0	I	PCIe Data IN Difference -	
40	PERP0	I	PCIe Data IN Difference +	
41	GND	—	Ground connections	
42	NC	—	No connect	
43	NC	—	No connect	
44	NC	—	No connect	

45	NC	—	No connect	
46	NC	—	No connect	
47	NC	—	No connect	
48	NC	—	No connect	
49	NC	—	No connect	
50	NC	—	No connect	
51	NC	—	No connect	
52	NC	—	No connect	
53	BT_WAKE_HOST	O	Bluetooth wake up host	3.3V
54	NC	—	No connect	
55	NC	—	No connect	
56	NC	—	No connect	
57	NC	—	No connect	
58	PCM_SYNC	I/O	PCM sync signal	3.3V
59	PCM_IN	I	PCM data input	3.3V
60	PCM_OUT	O	PCM Data output	3.3V
61	PCM_CLK	I/O	PCM clock	3.3V
62	GND	—	Ground connections	
63	BT_EN	I	This pin can externally shut down the module BT function when BT_EN is pulled Low. When this pin is pulled low, USB interface will be also disabled.	3.3V
64	LED#2	O	BT link LED, active low.	3.3V
65	LED#1	O	WLAN link LED, active low.	3.3V
66	NC	—	No connect	
67	HOST_WAKE_BT	I	Host wake up BT, active high	3.3V
68	GND	—	Ground connections	
69	USB_D-	I/O	USB difference line for BT	
70	USB_D+	I/O	USB difference line for BT	
71	GND	—	Ground connections	
72	3.3V	P	Main power voltage source input 3.3V	3.3V
73	3.3V	P	Main power voltage source input 3.3V	3.3V
74-76	GND	—	Ground connections	
G1-G12	GND	—	Ground connections	

7. Electrical Specifications

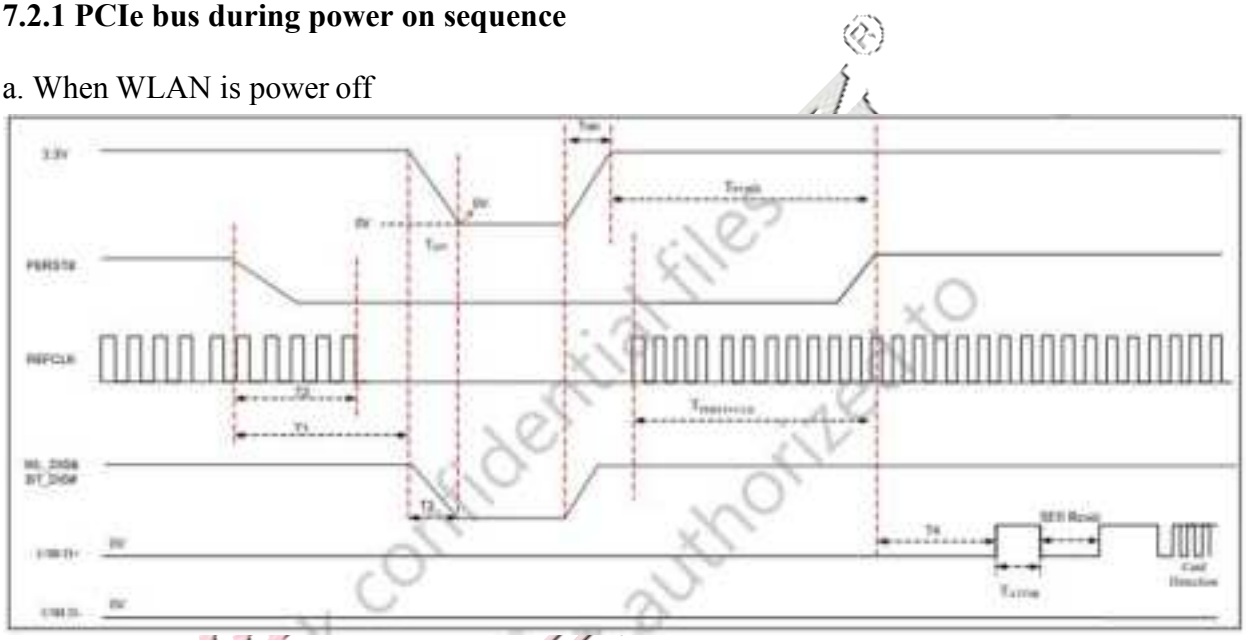
7.1 Power Supply DC Characteristics

	MIN	TYP	MAX	Unit
Operating Temperature	-10	25	70	deg.C
VDD33	3.0	3.3	3.6	V

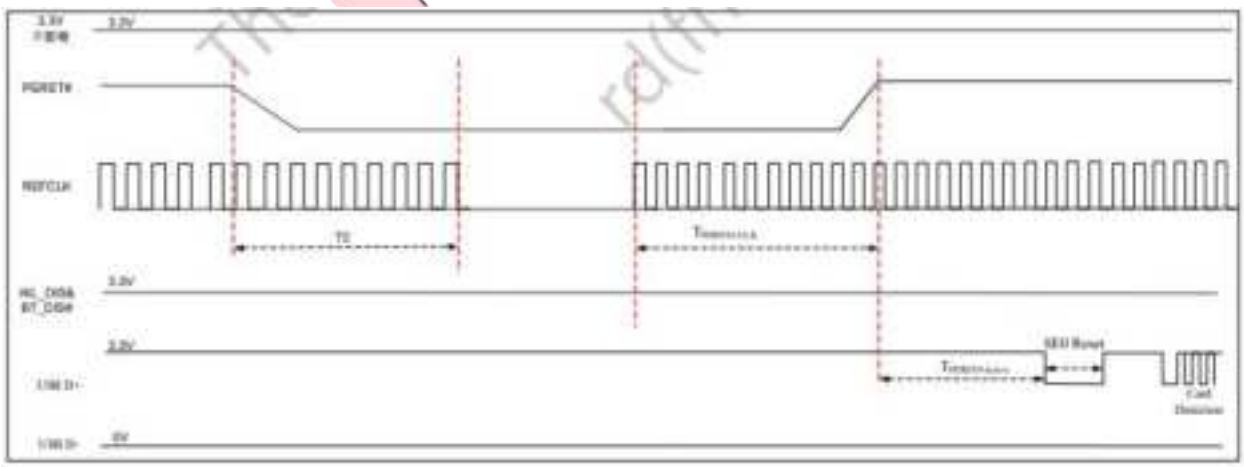
7.2 Interface Circuit time series

7.2.1 PCIe bus during power on sequence

a. When WLAN is power off



b. When WLAN is NOT power off



T_{PVPGL}: Power valid to PERST# input inactive

$T_{PERST\#-CLK}$: Reference clock stable before PERST# inactive

T_{attach}: The interval to turn on BT after PERST# de-asserted

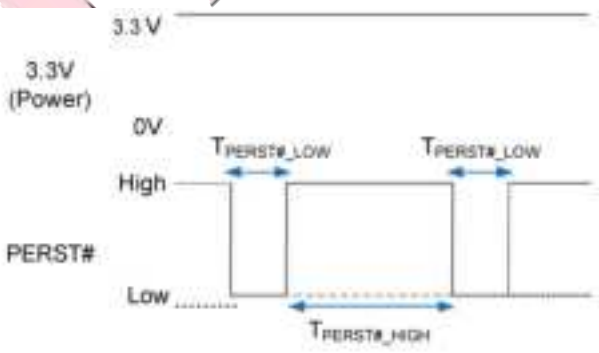
T_{ATTDB}: the debounce interval with a minimal duration of 100ms that provided by the USB system Software

Note:

1. T1: PERST# goes active before the power on the connector is removed.
2. T2: Clock to inactive after PERST# goes active.
3. T3: WL_DIS# and BT_DIS# goes asserted when the power on the connector is removed.
4. T4:USB D+ go active after PERST# goes inactive.
5. T1/T2/T3 timing value should large than 0.

Symbol	Unit	Min	Typical	Max
T_{on}	ms	0.5	1.5	5
T_{off}	ms	1.5		
T_{PVPGL}	ms	Implementation specific;recommended 50ms	--	--
$T_{PERST\#-CLK}$	us	100	--	--
T_{ATTDB}	ms	100	--	--
$T_{SE0\ Reset}$	ms	10	--	--
$T_{PERST\#-active}$	ms	10	--	--

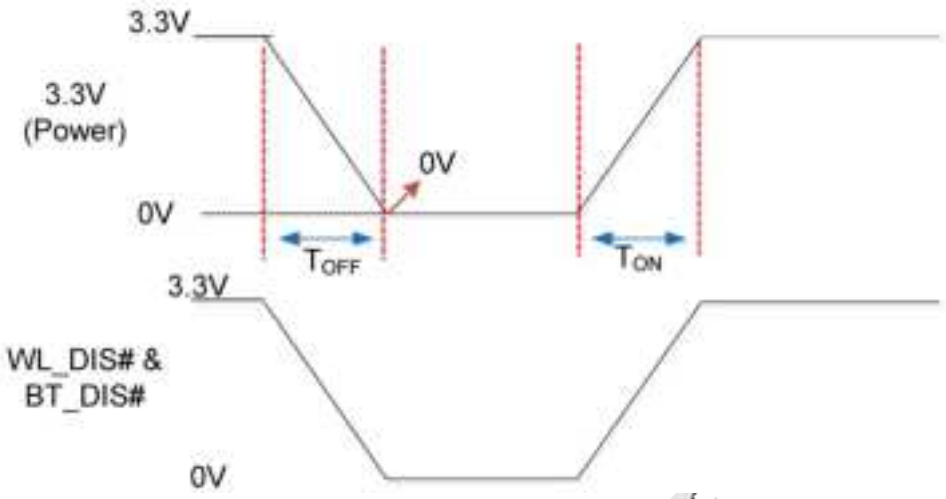
7.2.2 PCIe PERST# Timing sequence(if need at least twice)



RTL8852CE-VR-CG PCIE PERST# Timing Parameters

	Min	Typical	Max	Unit	Description
TPERST#_LOW	6	10	X	ms	PERST# low duration
TPERST#_HIGH	400	500	X	ms	PERST# high duration

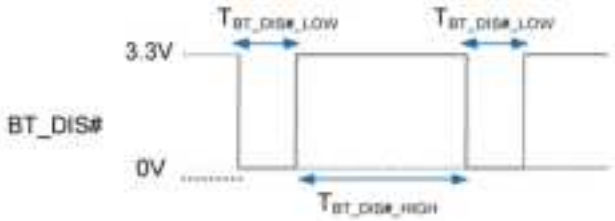
7.2.3 power off sequence



Symbol	Min	Typical	Max	Unit	Description
T_{OFF}	1.5	--	--	ms	Measure point start on 100% Measure point end on 0% (must be 0V)
T_{ON}	0.5	1.5	5	ms	Measure point start on 0% (must be 0V) Measure point end on 100%

Note: If BT_DIS# can't connect to the same power source with 3.3V, it need to be de-asserted before PERST# with 100ms in power on sequence.

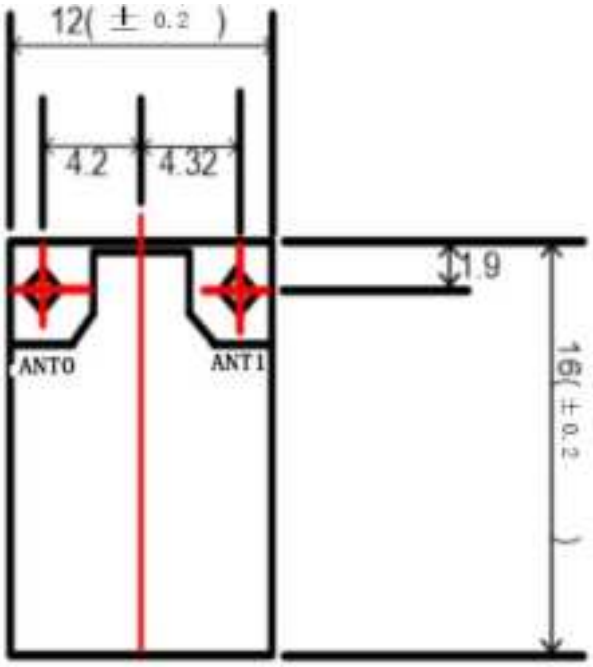
7.2.4 BT_DIS Timing sequence



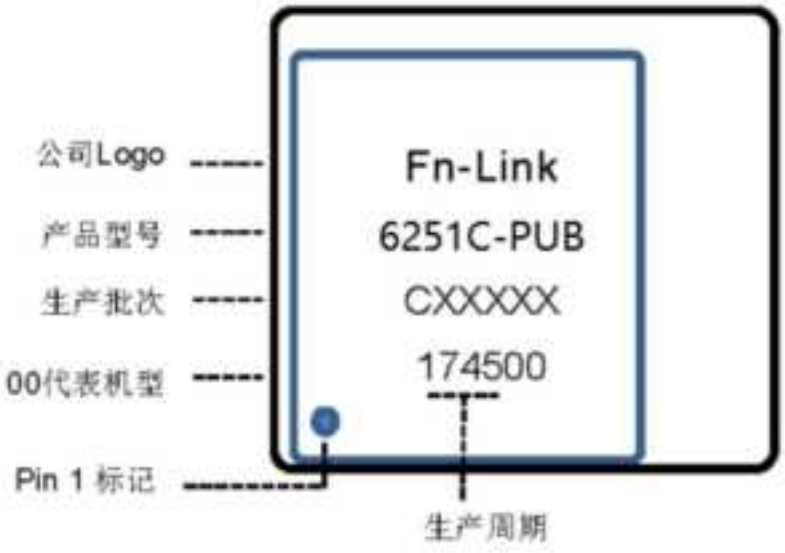
	Min	Typical	Max	Unit	Description
BT_DIS#_LOW	200	--	--	ms	BT_DIS# low duration
BT_DIS#_HIGH	500	--	--	ms	BT_DIS# high duration

8. Size reference

8.1 Module Picture

L x W : 12 x16mm  	
H: 1.95 mm	
Weight	0.807g

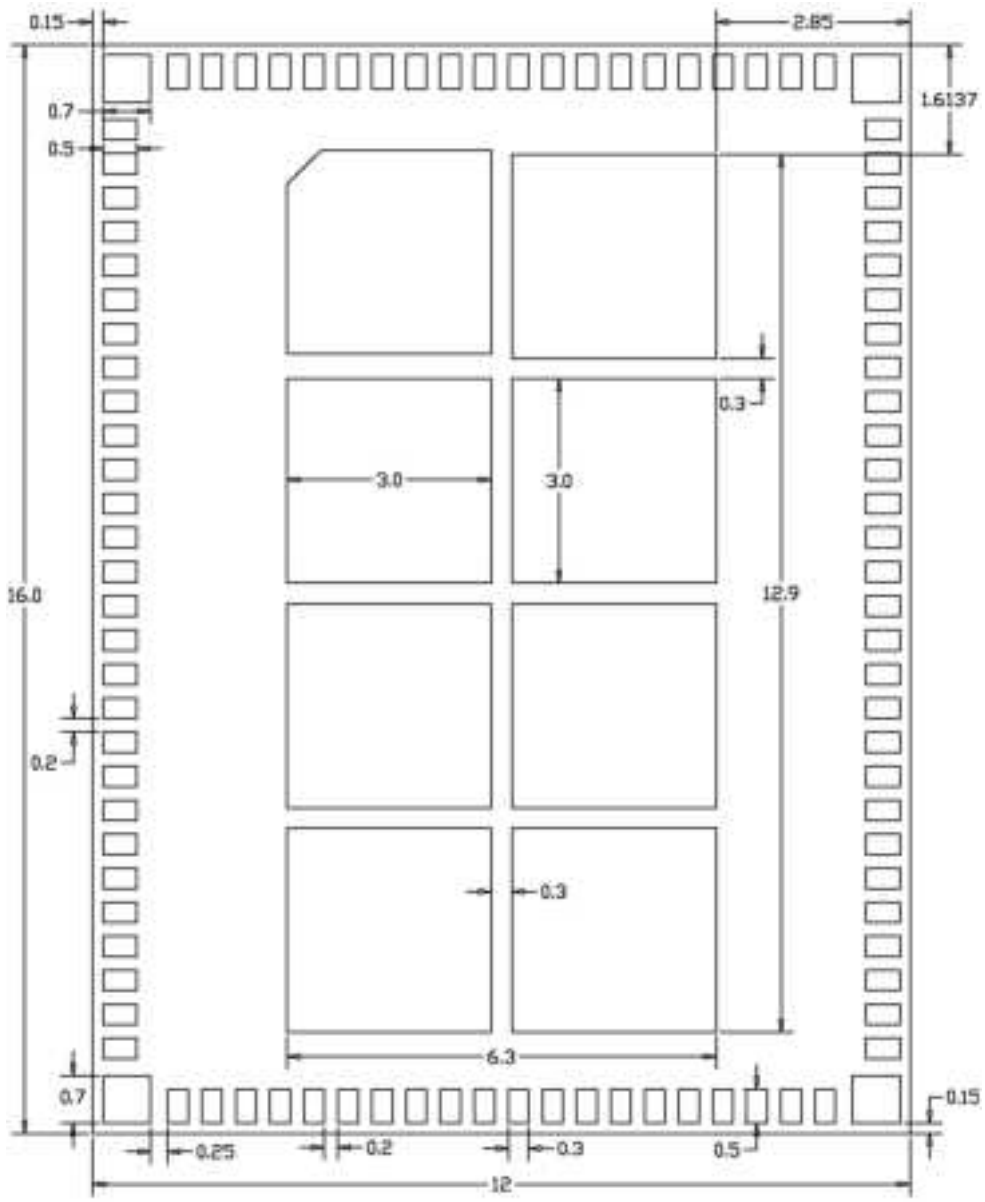
8.2 Marking Description



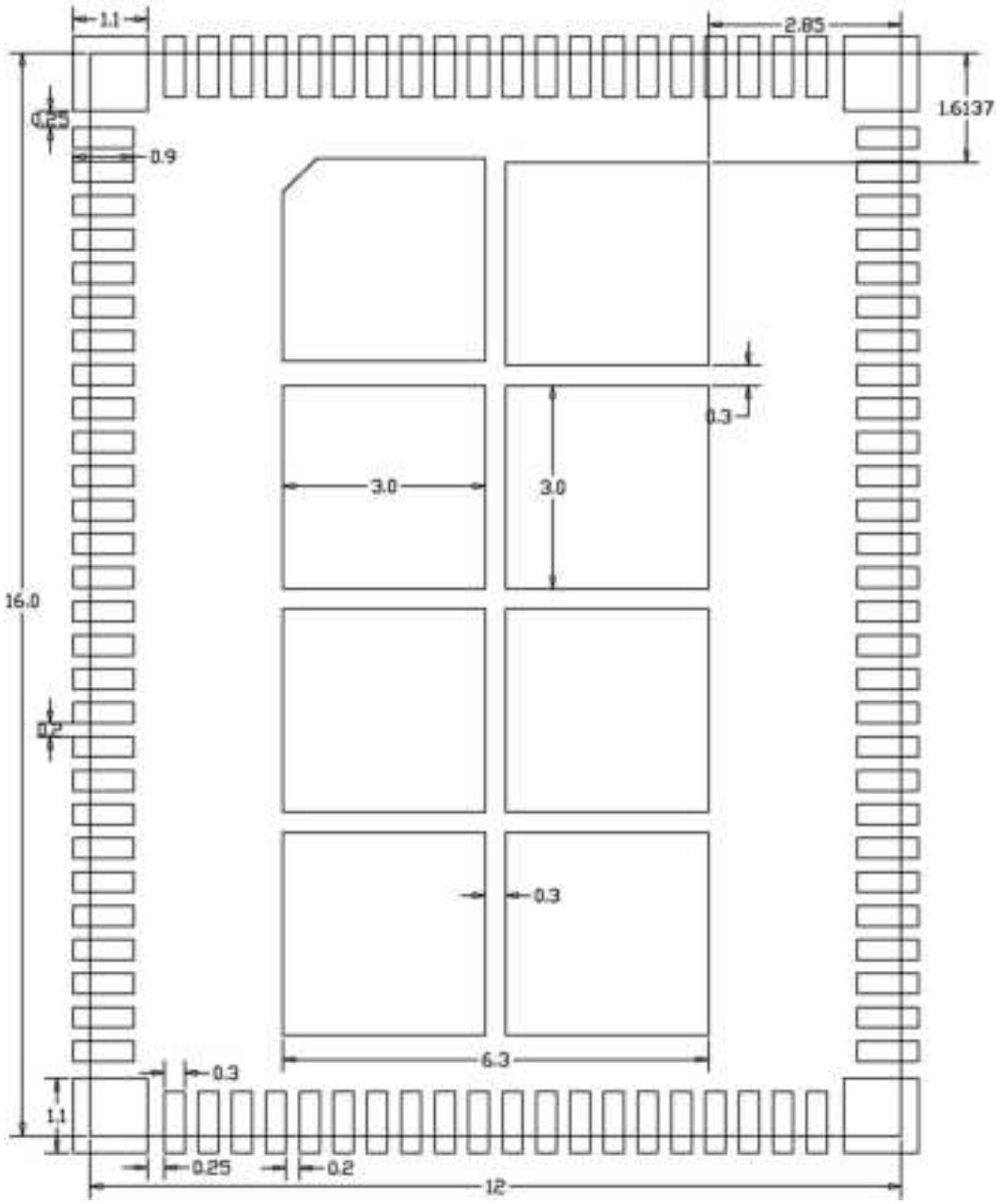
模组尺寸：12x16mm

8.3 Physical Dimensions

<TOP View>



8.4 Layout Recommendation



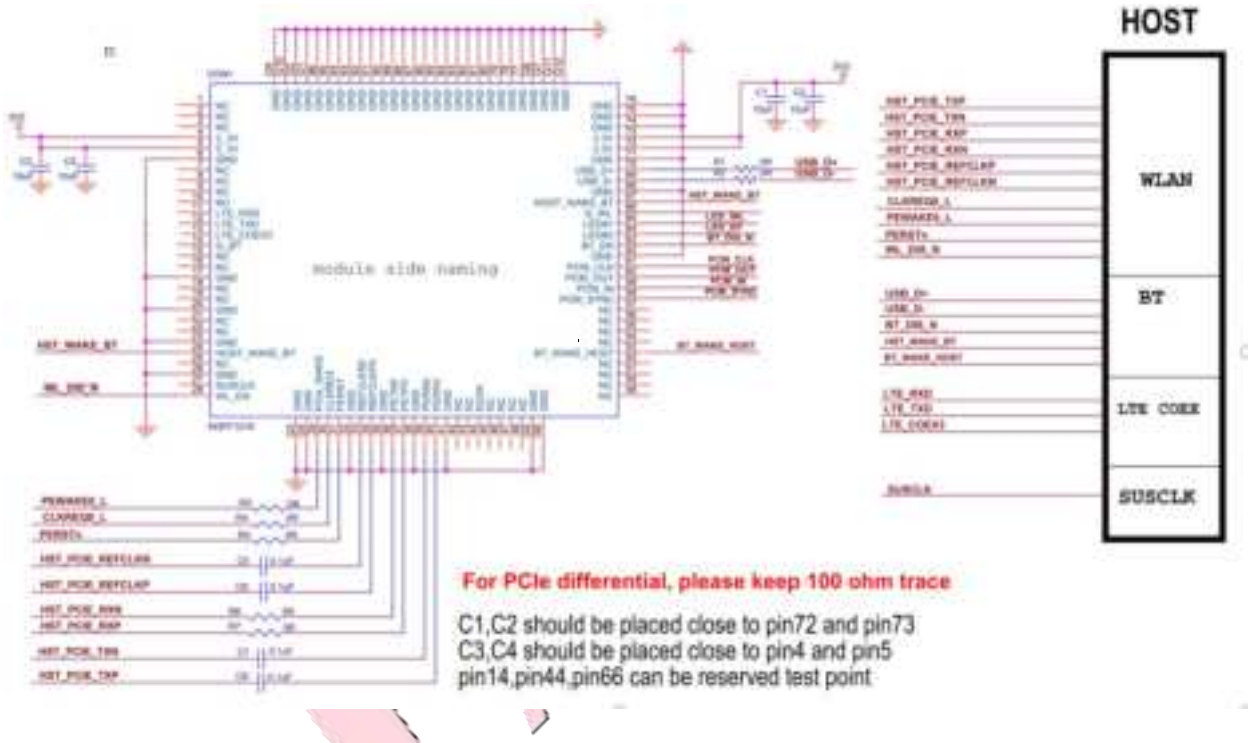
9. The Key Material List

Item	Part Name	Description	Manufacturer
1	Diplexer	FLT18D24254959D-3268B	Glead, Walsin, ACX, Murata, MAG.LAYERS,TDK,FTR
2	Crystal	2016 40MHZ,9PF,±10PPM	ECEC, TKD, Hosonic, JWT, TXC
3	Chipset	RTL8851BE-CG QFN-68	Realtek
4	PCB	6251C-PUB 4L,12X16X0.6mm	XY-PCB,GDKX,Sunlord, SL-PCB,TRULY

5	IPEX	4 代 TA-RF03-001-03-811,CD-ARF004-P01 K	创迪尔

10. Reference Design

10.1 Reference design



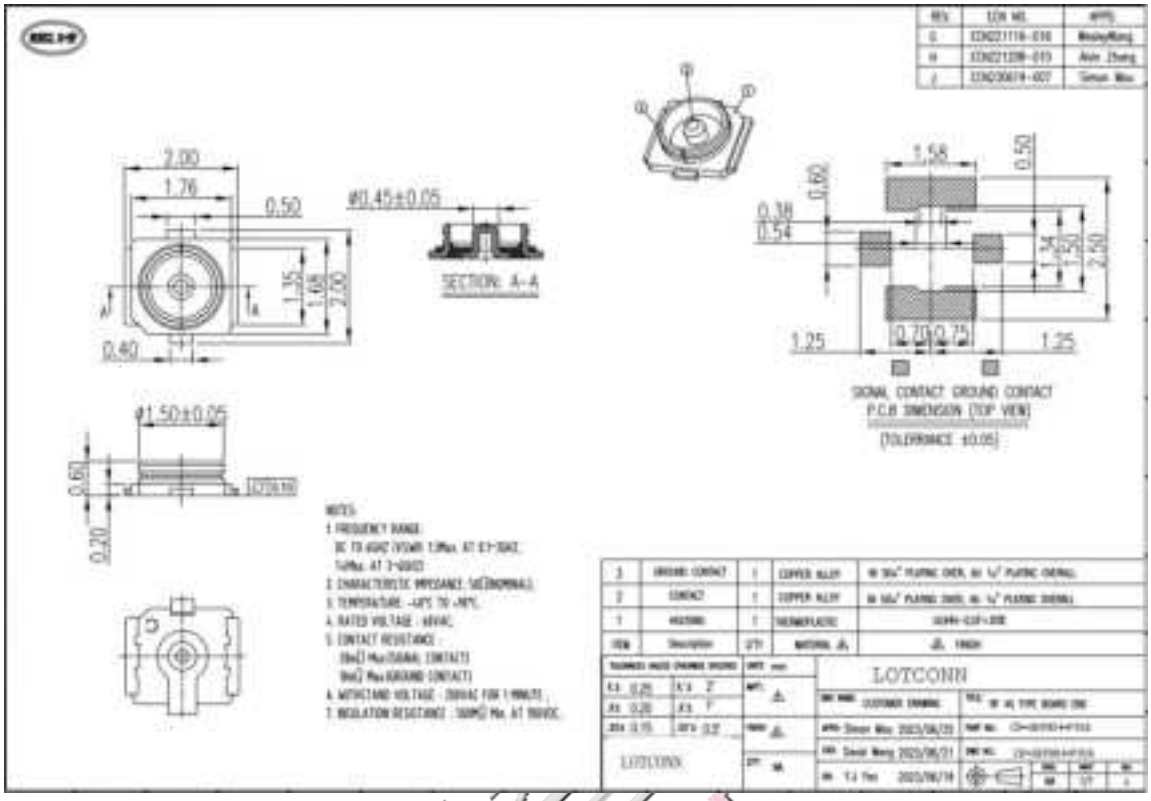
Note: 1. Both of the 2 ANTs are all support 2.4G/5G/BT function.

2. 6251C-PUB antenna port is control by driver if diversity function is enabled.

3. PCIe differential keep 100 ohm trace.

4. USB differential keep 90 ohm trace.

10.2 Connector Specification



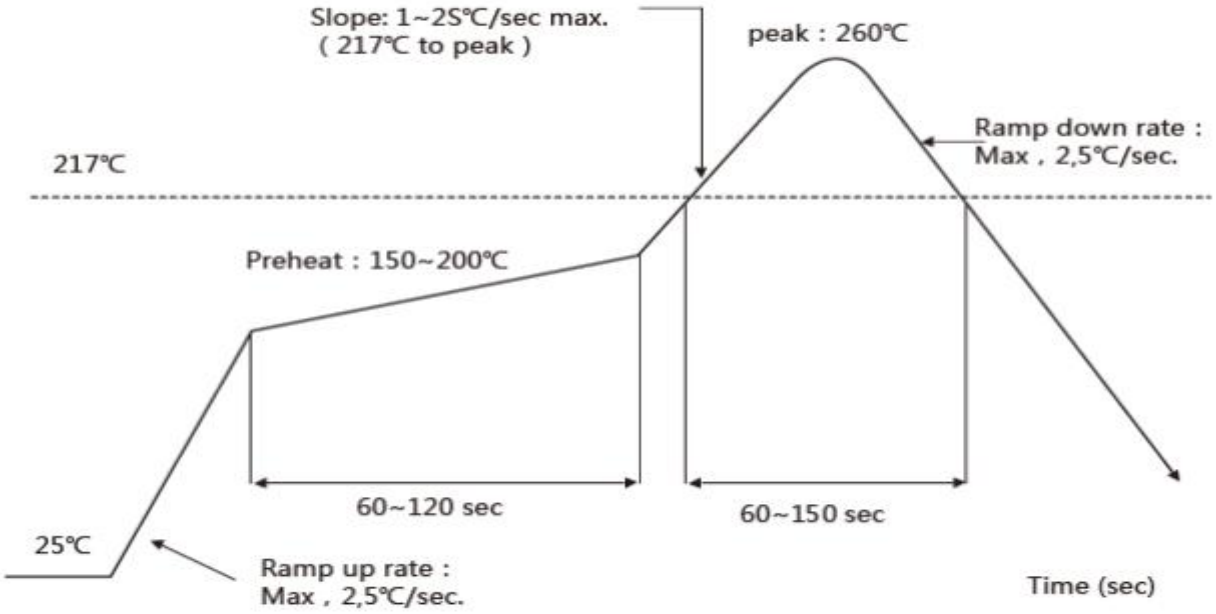
11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature: 260±5 °C

Time within 5° C of peak temperature：≥10s

Number of Times: 2 times



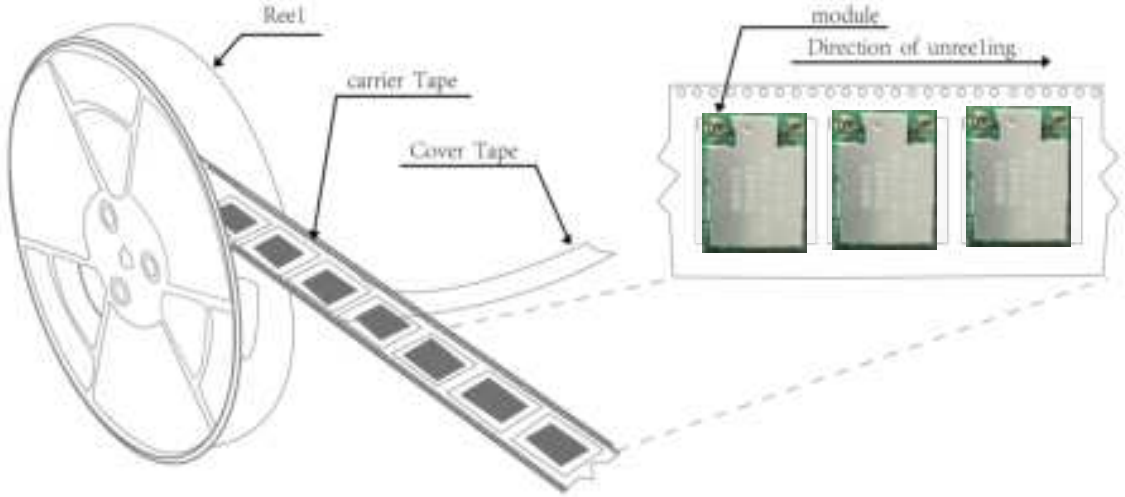
12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

13. Package

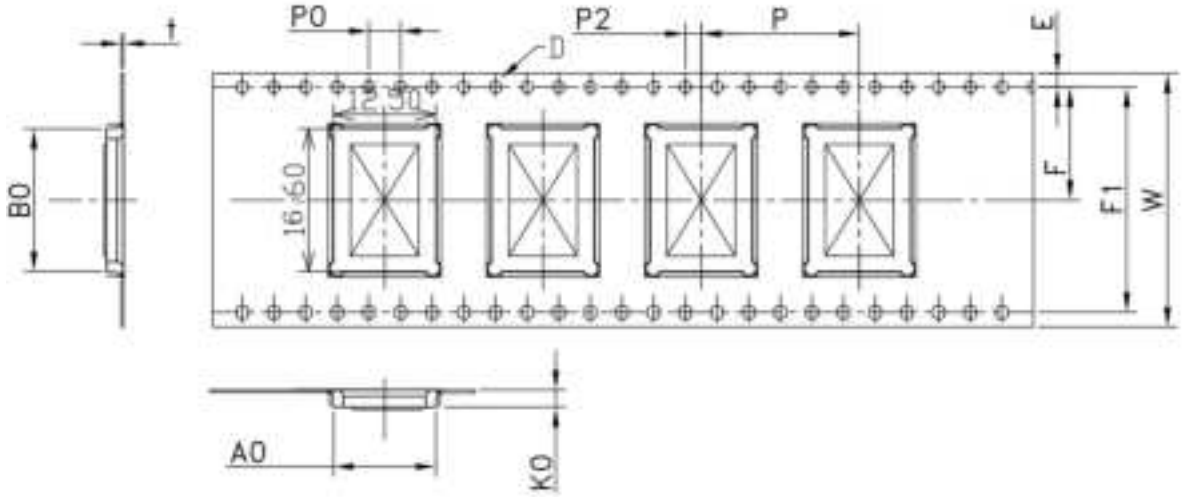
13.1 Reel

A roll of 2000pcs



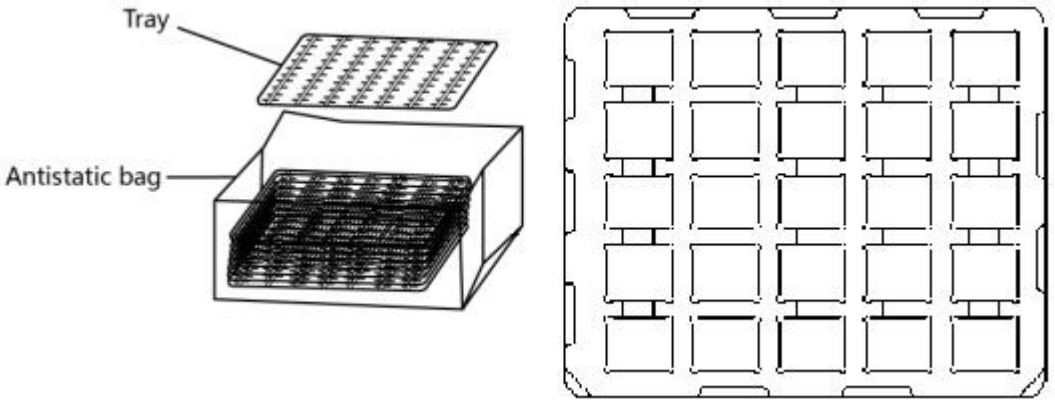
13.2 Carrier Tape Detail

ITEM	W	A0	B0	D	E	F	F1	K0	P0	P2	P	T
DIM	32	12.50	16.60	1.5	1.75	14.20	28.4	2.15	4.0	2.0	20.0	0.30
TOLE	+0.3 -0.1	±0.18	±0.18	+0.1 -0.0	±0.1	±0.15	±0.10	±0.10	±0.1	±0.15	±0.1	±0.05



13.3 Tray

Use pallet packaging for less than 300 pieces



13.4 Packaging Detail

the take-up package

Using self-adhesive tape

Size of black tape:24mm*32.6m　the cover tape　:2.13mm*32.6m

Color of plastic disc:blue

A roll of 2000pcs

NY bag size:460mm*385mm

size ： 350*350*35mm

The packing case size:350*210*370mm

14. Moisture sensitivity

The Modules is a Moisture Sensitive Device level 3, in according with standard IPC/JEDEC J-STD-020, take care
all the relatives requirements for using this kind of components.
Moreover, the customer has to take care of the following conditions:

a) Calculated shelf life in sealed bag: 12 months at <40°C and <90% relative humidity (RH)

b) Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5

c) The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition

d) “IPC/JEDEC J-STD-033A paragraph 5.2” is respected

e) Baking is required if conditions b) or c) are not respected

f) Baking is required if the humidity indicator inside the bag indicates 10% RH or more

Integration instructions for host product manufacturers according to KDB 996369 D03 OEMManual v01

Conditions on using FN-LINK TECHNOLOGY LIMITED regulatory approvals:
A. Customer must ensure that its product (The " Wi-Fi/BT module") is electrically identical to FN-LINK TECHNOLOGY LIMITED reference designs. Customer acknowledges that any modifications to FN-LINK TECHNOLOGY LIMITED reference designs may invalidate regulatory approvals in relation to the CUSTOMER Product, or may necessitate notifications to the relevant regulatory authorities.
B. Customer is responsible for ensuring that antennas used with the product are of the same type, with same or lower gains as approved and providing antenna reports to FN-LINK TECHNOLOGY LIMITED.
C. Customer is responsible for regression testing to accommodate changes to FN-LINK TECHNOLOGY LIMITED reference designs, new antennas, and portable RF exposure safety testing/approvals.
D. Appropriate labels must be affixed to the CUSTOMER Product that comply with applicable regulations in all respects.
E. A user's manual or instruction manual must be included with the customer product that contains the text as required by applicable law. Without limitation of the foregoing, an example (for illustration purposes only) of possible text to include is set forth below:

2.2 List of applicable FCC rules
FCC Part 15 Subpart C 15.247, FCC Part 15 Subpart E

2.3 Specific operational use conditions
Radio Technology: Bluetooth EDR
Operation frequency: 2402-2480MHz
Channel No.: 79 Channels
Channel spacing: 1MHz
Modulation type: GFSK, π/4 DQPSK, 8DPSK
Antenna Type: PIFA antenna 1, max gain 3.39dBi
PIFA antenna 2, max gain 3.39dBi
(Antenna information is provided by applicant.)

Radio Technology: Bluetooth BLE
Operation frequency: 2402-2480MHz
Channel No.: 40 channels
Data rate: 1Mbps/2Mbps
Channel Separation: 2MHz
Modulation: GFSK
Antenna Type: PIFA antenna 1, max gain 3.39dBi
PIFA antenna 2, max gain 3.39dBi
(Antenna information is provided by applicant.)

Radio Technology: 2.4G WIFI
Operation frequency: 2412MHz-2462MHz for IEEE 802.11 b, g. n/HT20, ax20,
2422MHz~2452MHz for IEEE802.11n/HT40, ax40
Channel No.: 802.11b/802.11g /802.11n (HT20)/802.11ax20: 11
802.11(HT40)/802.11ax40: 7
Modulation type: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)
IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ax: OFDMA
(64QAM, 16QAM, QPSK, BPSK, 256QAM, 1024QAM)
Antenna Type: PIFA antenna 1, max gain 3.39dBi
PIFA antenna 2, max gain 3.39dBi
(Antenna information is provided by applicant.)

Radio Technology: 5G WIFI
Operation Frequency: 802.11a/n (HT20)/ac (VHT20)/ax20: 5180~5240MHz; 5260-5320MHz; 5500-5700MHz; 5745~5825MHz
802.11n (HT40)/ac (VHT40)/ax40: 5190~5230MHz; 5270-5310MHz; 5510-5670MHz; 5755~5795MHz
802.11ac (VHT80)/ax80: 5210MHz, 5290MHz, 5530MHz, 5775MHz
Channel separation: 20MHz for 802.11a/ 802.11ac (VHT20)/ 802.11n (HT20)/ax20
40MHz for 802.11ac (VHT40)/ 802.11n (HT40)/ax40
80MHz for 802.11ac (VHT80)/ax80
Modulation technology: IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ax: OFDMA
(64QAM, 16QAM, QPSK, BPSK, 256QAM, 1024QAM)
Antenna Type: PIFA antenna 1, max gain 3.99dBi
PIFA antenna 2, max gain 3.99dBi
(Antenna information is provided by applicant.)

The module can be used for mobile or portable applications with a maximum 0.13dBi antenna. The host manufacturer installing this module into their product must ensure that the final composit product complies with the FCC requirements by a technical assessment or evaluation to the FCC rules, including the transmitter operation. The host manufacturer has to be aware not to provide informationto 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 end user manual shall include all required regulatory information/warning as show in this manual.

2.4 Limited module procedures
Not applicable. The module is a Single module and complies with the requirement of FCC Part 15.212.

2.5 Trace antenna designs
The antenna used is the PCB antenna on the module.

2.6 RF exposure considerations
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. Changes or modifications not expressly approved by the party responsible for compliance could void the user’s authority to operate the equipment.
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 radi-ate radio frequency energy and, if not in-stalled 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.
The antennas used for this transmitter must be installed to provide a separation distance of at least 20cm from all persons and must not be located or operating in conjunction with any other antenna or transmitter.

2.7 Antennas

Antenna Specification are as follows:
Antenna Type: PIFA antenna
Antenna Gain (Peak): BT&BLE&2.4GWIFI: 3.39dBi
5GWIFI: 3.99dBi (Provided by customer)
This device is intended only for host manufacturers under the following conditions:
The transmitter module may not be co-located with any other transmitter or antenna;

As long as the conditions above are met, further transmitter test will not be required. However, the host manufacturer is still responsible for testing their end-product for any additional compliance requirements required with this module installed (for example, digital device emissions, PC peripheralrequirements, etc.).

2.8 Label and compliance information

Host product manufacturers need to provide a physical or e-label stating “Contains FCC ID: 2AATL-6251C-PUB” With their finished product.

2.9 Information on test modes and additional testing requirements

Radio Technology: Bluetooth EDR
Operation frequency: 2402-2480MHz
Channel No.: 79 Channels
Channel spacing: 1MHz
Modulation type: GFSK, π/4 DQPSK, 8DPSK
Antenna Type: PIFA antenna 1, max gain 3.39dBi
PIFA antenna 2, max gain 3.39dBi
(Antenna information is provided by applicant.)

Radio Technology: Bluetooth BLE
Operation frequency: 2402-2480MHz
Channel No.: 40 channels
Data rate: 1Mbps/2Mbps
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Modulation: GFSK
Antenna Type: PIFA antenna 1, max gain 3.39dBi
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Radio Technology: 2.4G WIFI
Operation frequency: 2412MHz-2462MHz for IEEE 802.11 b, g. n/HT20, ax20,
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Channel No.: 802.11b/802.11g /802.11n (HT20)/802.11ax20: 11
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Modulation type: IEEE 802.11b: DSSS (CCK, DQPSK, DBPSK)
IEEE 802.11g: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ax: OFDMA
(64QAM, 16QAM, QPSK, BPSK, 256QAM, 1024QAM)
Antenna Type: PIFA antenna 1, max gain 3.39dBi
PIFA antenna 2, max gain 3.39dBi
(Antenna information is provided by applicant.)

Radio Technology: 5G WIFI
Operation Frequency: 802.11a/n (HT20)/ac (VHT20)/ax20: 5180~5240MHz; 5260-5320MHz; 5500-5700MHz; 5745~5825MHz
802.11n (HT40)/ac (VHT40)/ax40: 5190~5230MHz; 5270-5310MHz; 5510-5670MHz; 5755~5795MHz
802.11ac (VHT80)/ax80: 5210MHz, 5290MHz, 5530MHz, 5775MHz
Channel separation: 20MHz for 802.11a/ 802.11ac (VHT20)/ 802.11n (HT20)/ax20
40MHz for 802.11ac (VHT40)/ 802.11n (HT40)/ax40
80MHz for 802.11ac (VHT80)/ax80
Modulation technology: IEEE 802.11n: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11a: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ac: OFDM (64QAM, 16QAM, QPSK, BPSK)
IEEE 802.11ax: OFDMA
(64QAM, 16QAM, QPSK, BPSK, 256QAM, 1024QAM)
Antenna Type: PIFA antenna 1, max gain 3.99dBi
PIFA antenna 2, max gain 3.99dBi
(Antenna information is provided by applicant.)

Host manufacturer must perfom test of radiated & conducted emission and spurious emission, etcaccording to the actual test modes for a stand-alone modular transmitter in a host, as well as for multiple simultaneously transmitting modules or other transmitters in a host product.
Only when all the test results of test modes comply with FCC requirements, then the end product canbe sold legally.

2.10 Additional testing, Part 15 Subpart B disclaimer
The modular transmitter is only FCC authorized for FCC Part 15 Subpart C 15.247 that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuity), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.