

PRODUCT SPECIFICATION

6221BB-UUC

Wi-Fi Dual-band 1x1 11ac + Bluetooth 5.0

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

6221BB-UUC Module Datasheet

Ordering Information	Part NO.	Description
	FG6221BBUU-00	RTL8821CU-VB-CG, a/b/g/n/ac +BT5.0, 1T1R+BT, 13x15mm, USB2.0, dual antenna



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1. General Description

1.1 Introduction

The 6221BB-UUC is a low-cost and low-power consumption module which has all of the Wi-Fi functionalities. It is based on Realtek RTL8821CU chipset, a highly-integrated IEEE 802.11a/b/g/n/ac MAC/Baseband/RF WLAN and Bluetooth Baseband/RF single chip. For Wireless LAN (WLAN) operation, this module supports 1-stream 802.11ac solution with USB2.0 network interface controller. For Bluetooth operation, it supports Bluetooth 5.0.

6221BB-UUC complies with IEEE 802.11a/b/g/n/ac standard and it can achieve up to a speed of 433.3Mbps with single stream in 802.11ac to connect to the WLAN.

This compact module is a total solution for a combination of Wi-Fi and BT technologies.

1.2 Description

Model Name	6221BB-UUC
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 15 x 13 x 2.35 mm
Wi-Fi Interface	USB 2.0
BT Interface	USB 2.0
OS supported	Android /Linux/ Win CE /XP/WIN7/WIN10
Operating temperature	0°C to 70°C
Storage temperature	-40°C to 125°C

2. Features

General

- Highly-integrated module for 5G 802.11ac, or 2.4G/5G 802.11n WLAN applications
- Backward compatible with 802.11a/b/g device
- Support IEEE 802.11e QoS Enhancement and 802.11i (WPA, WPA2)
- Support IEEE 802.11h DFS
- Wi-Fi Direct supports wireless peer to peer applications
- Single external power source 3.3V only

PHY Features

- Maximum PHY data rate up to 86.7MHz using 20MHz bandwidth, 200Mbps using 40Mhz bandwidth and 433.3Mbps using 80Mhz bandwidth

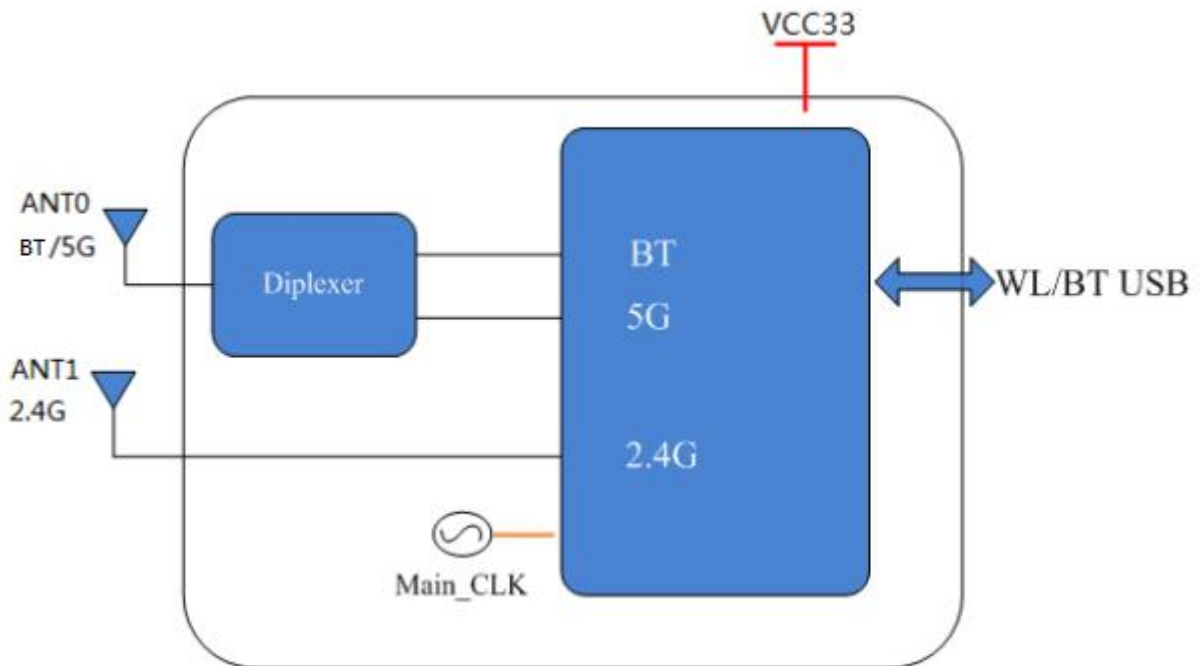
Host Interface

- USB Multi-Function for both BT and WLAN

Bluetooth Features

- Supports Bluetooth 4.2 and backward compatible with Bluetooth 2.1 + EDR
- Bluetooth 4.0 Dual Mode support: Simultaneous LE and BR/EDR
- Supports Bluetooth Low Energy
- Integrated internal Class 1, Class 2 and Class 3 PA for Bluetooth
- Support Bluetooth5.0 high duty cycle Non-connectable advertising.

3. Block Diagram



4. General Specification

4.1 2.4GHz WI-FI Specification

Feature	Description	
WLAN Standard	IEEE 802.11 b/g/n 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 : 16dBm ± 2 dBm 1M bps: 17 dBm± 2 dBm	EVM ≤ -10dB MASK compliant
	802.11g /54Mbps : 15dBm ± 2 dBm 6Mbps : 17dBm± 2 dBm	EVM ≤ -26dB MASK compliant
	802.11n /MCS7 : 14dBm ± 2 dBm MCS0 : 17dBm ± 2 dBm	EVM ≤ -28dB MASK compliant

Spectrum Mask	Meet with IEEE standard		
Freq. Tolerance	± 20ppm		
Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps	PER @ -92 dBm	≤-83
	- 11Mbps	PER @ -85 dBm	≤-76
Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps	PER @ -89 dBm	≤-85
	- 54Mbps	PER @ -71 dBm	≤-68
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0	PER @ -89 dBm	≤-85
	- MCS=7	PER @ -69 dBm	≤-67
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0,	PER @ -87 dBm	≤-82
	- MCS=7,	PER @ -67 dBm	≤-64

1.low rate power controlled by firmware driver;

4.2 5GHz WI-FI Specification

Feature	Description	
WLAN Standard	IEEE 802.11a/n/ac, Wi-Fi compliant	
Frequency Range	5.150 GHz ~ 5.850 GHz (5.0 GHz ISM Band)	
Number of Channels	5.0GHz: Please refer to the table ¹	
Modulation	802.11a/n: 64-QAM,16-QAM, QPSK, BPSK 802.11ac: 256-QAM, 64-QAM,16-QAM, QPSK, BPSK	
Test Items	Typical Value	EVM
Output Power ²	802.11g /54Mbps : 14dBm ± 2 dBm 6Mbps : 16dBm± 2 dBm	EVM ≤ -27dB MASK compliant
	802.11n /MCS7 : 13dBm ± 2 dBm MCS0 : 16dBm ± 2 dBm	EVM ≤ -29dB MASK compliant
	802.11ac /MCS7 : 13dBm ± 2 dBm MCS0 : 16dBm ± 2 dBm	EVM ≤ -29dB MASK compliant
	802.11ac/MCS9: 10 dBm ± 2 dBm	EVM ≤ -33dB
Receive Sensitivity (11a) @10% PER	- 6Mbps: PER ≤ -86 dBm	
	- 54Mbps: PER ≤ -70 dBm	
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0: PER ≤ -85 dBm	
	- MCS=7: PER ≤ -67 dBm	
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0: PER ≤ -83 dBm	
	- MCS=7: PER ≤ -64 dBm	
Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0: PER ≤ -86 dBm	
	- MCS=8: PER ≤ -63 dBm	

Receive (11ac,40MHz) @10% PER	Sensitivity	- MCS=0:	PER ≤ -83 dBm
		- MCS=9:	PER ≤ -59 dBm
Receive (11ac,80MHz) @10% PER	Sensitivity	- MCS=0:	PER ≤ -80 dBm
		- MCS=9:	PER ≤ -56 dBm

2.low rate power controlled by firmware driver;

15GHz Channel table

Band (GHz)	Operating Channel Number	Channel Center Frequency(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
5725MHz~5850MHz	140	5700
	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

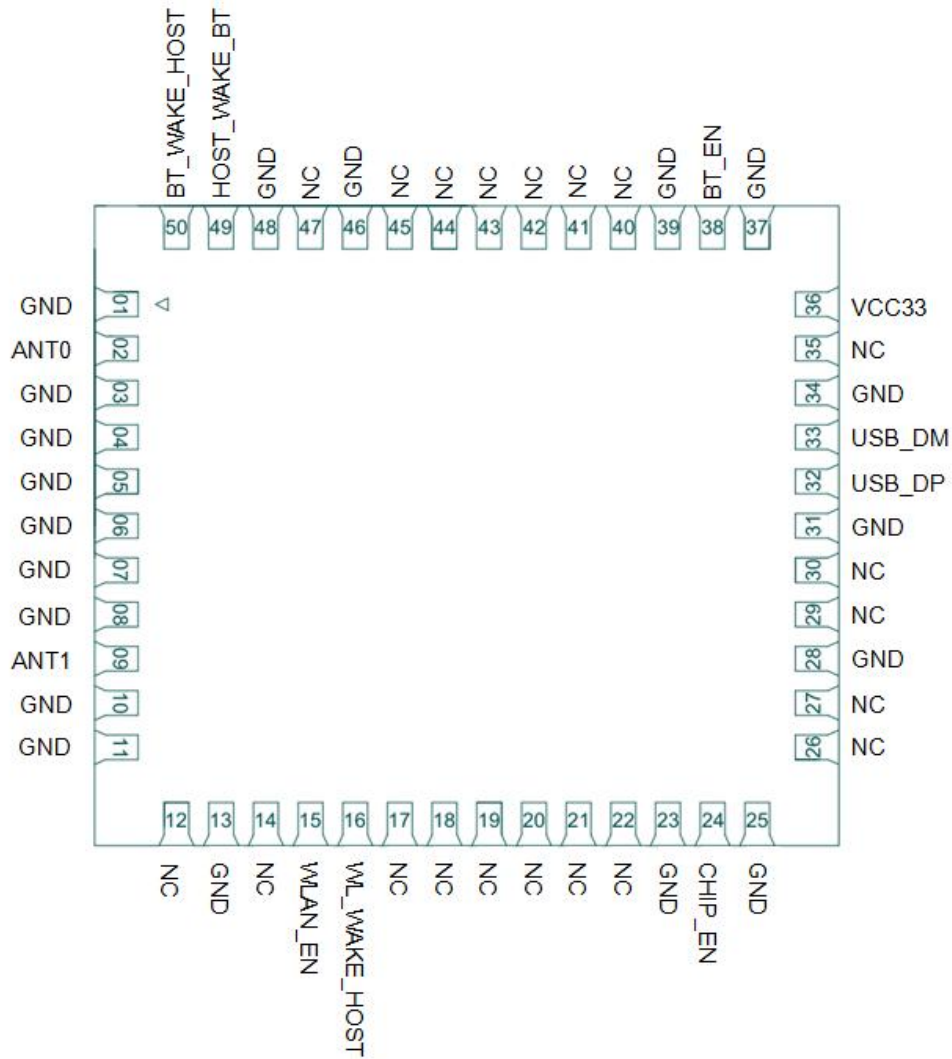
4.3 Bluetooth Specification

Feature	Description		
General Specification			
Bluetooth Standard	Bluetooth V5.0		
Host Interface	USB 2.0		
Antenna Reference	Small antennas with 0~2 dBi peak gain		
Frequency Band	2400 MHz ~ 2483.5 MHz		
Number of Channels	79 channels for classic,40 channels for BLE		
Modulation	GFSK, $\pi/4$ -DQPSK, 8-DPSK		
RF Specification			
	Min(dBm)	Typical(dBm)	Max(dBm)
Output Power (Class 1)	4	8	12
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-88	
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)		-85	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-81	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

5. Pin Definition

5.1 Pin Outline

< TOP VIEW



5.2 Pin Definition details

NO.	Name	Type	Description	Voltage
1	GND	—	Ground connections	
2	ANT0	I/O	RF I/O chain0, Wi-Fi 5GHz and BT	
3~8	GND	—	Ground connections	

9	ANT1	I/O	RF I/O chain1, Wi-Fi 2.4GHz	
10~11	GND	—	Ground connections	
12	NC	—	Not connected	
13	GND	—	Ground connections	
14	NC	—	Not connected	
15	WLAN_EN	I	Enable pin for WLAN device ON: pull high ; OFF: pull low	3.3V
16	WL_WAKE_HOST	O	WLAN to wake-up HOST	3.3V
17~22	NC	—	Not connected	
23	GND	—	Ground connections	
24	CHIP_EN	I/O	Enable pin for chipset. Pull low to shut down RTL8821CU. (Internal 47Kohm pull-high to 3.3V)	3.3V
25	GND	—	Ground connections	
26~27	NC	—	Not connected	
28	GND	—	Ground connections	
29~30	NC	—	Not connected	
31	GND	—	Ground connections	
32	USB_DP	I/O	USB2.0 differential pair D+ for WLAN and Bluetooth	
33	USB_DM	I/O	USB2.0 differential pair D- for WLAN and Bluetooth	
34	GND	—	Ground connections	
35	NC	—	Not connected	
36	VCC33	P	Main power input 3.3V	3.3V
37	GND	—	Ground connections	
38	BT_EN	I	Enable pin for Bluetooth device ON: pull high ; OFF: pull low	3.3V
39	GND	—	Ground connections	
40~45	NC	—	Not connected	
46	GND	—	Ground connections	
47	NC	I	Not connected	
48	GND	—	Ground connections	
49	HOST_WAKE_BT	I	HOST to wake-up Bluetooth device	3.3V
50	BT_WAKE_HOST	O	Bluetooth device to wake-up HOST	3.3V

P:POWER I:INPUT O:OUTPUT VDDIO:3.3V

6. Electrical Specifications

6.1 Power Supply DC Characteristics

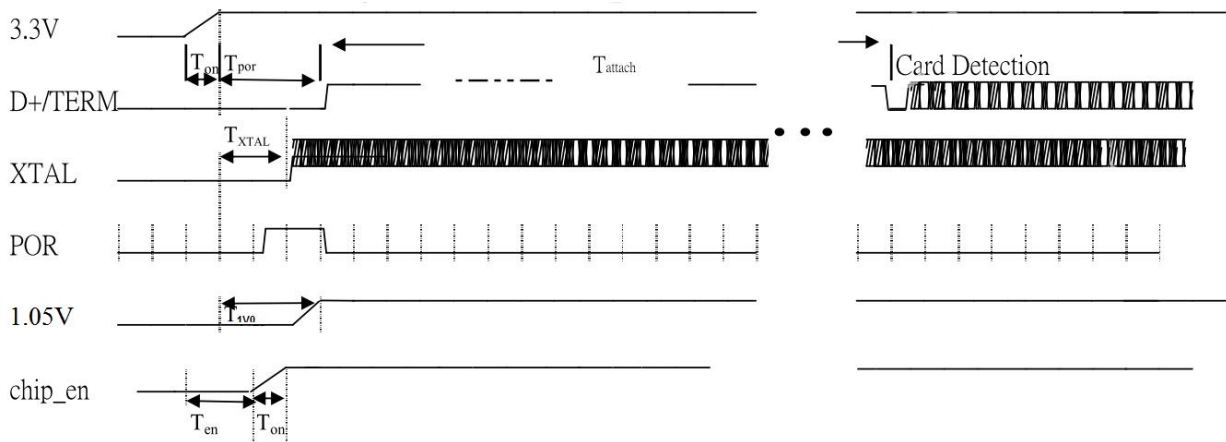
	MIN	TYP	MAX	Unit
Operating Temperature	0	25	70	deg.C
Power Supply (VCC)	3.0	3.3	3.6	V

6.2 Power Consumption

	Condition	Current Consumption(mA)
Typical Power Consumption (VCC=3.3V; BT on if no other statement)	Wi-Fi 5G associated	93
	TX throughput (5G 11ac VHT80)	264
	RX throughput (5G 11ac VHT80)	136
	TX throughput (5G 11n HT20)	320
	RX throughput (5G 11n HT20)	107
	TX throughput (5G 11a OFDM54)	266
	RX throughput (5G 11a OFDM54)	130
	TX throughput (2.4G 11n HT40)	291
	RX throughput (2.4G 11n HT40)	115
	TX throughput (2.4G 11b CCK11)	283
	RX throughput (2.4G 11b CCK11)	141

6.3 Interface Circuit time series

6.3.1 USB Bus Timing during Power On Sequence



T_{on} : the main power ramp on duration

T_{por} : the power on reset releases and power management unit executes power on tasks

T_{attach} : USB attach state

T_{xtal} : XTAL starts

T_{en} : interval between the rising point of 3.3V and chip_en

The power on flow description:

After main 3.3V ramp up, the internal power on reset is released by power ready detection circuit and the power management unit will be enabled. The power management unit enables the internal regulator and clock circuits.

The power management unit also enables the USB circuits.

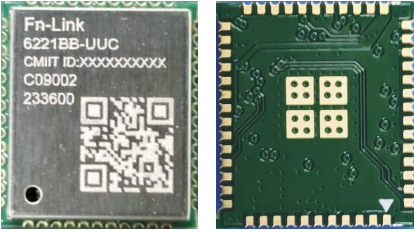
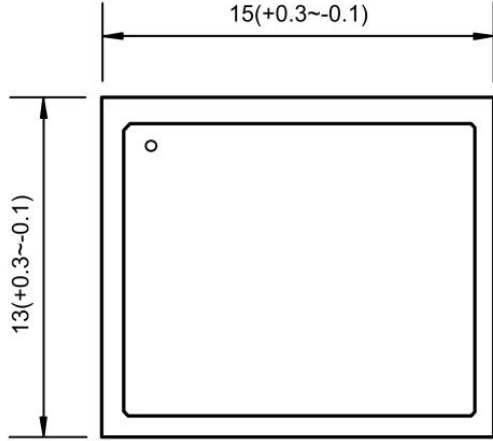

USB analog circuits attach resistors to indicate the insertion of the USB device.

The typical timing range:

	Unit	Min	Typical	Max
T_{on}	ms	--	1.5	5
T_{por}	ms	--	2	20
T_{xtal}	ms	--	1.5	8
T_{attach}	ms	100	250	--
T_{1V0}	ms	--	3	11
T_{en}	ms	0	0	5

7. Size reference

7.1 Module Picture

<p>L x W : 15 x 13(+0.3/-0.1) mm</p> 	
<p>H: 2.35 (±0.2) mm</p>	
<p>Weight</p>	<p>0.92g</p>

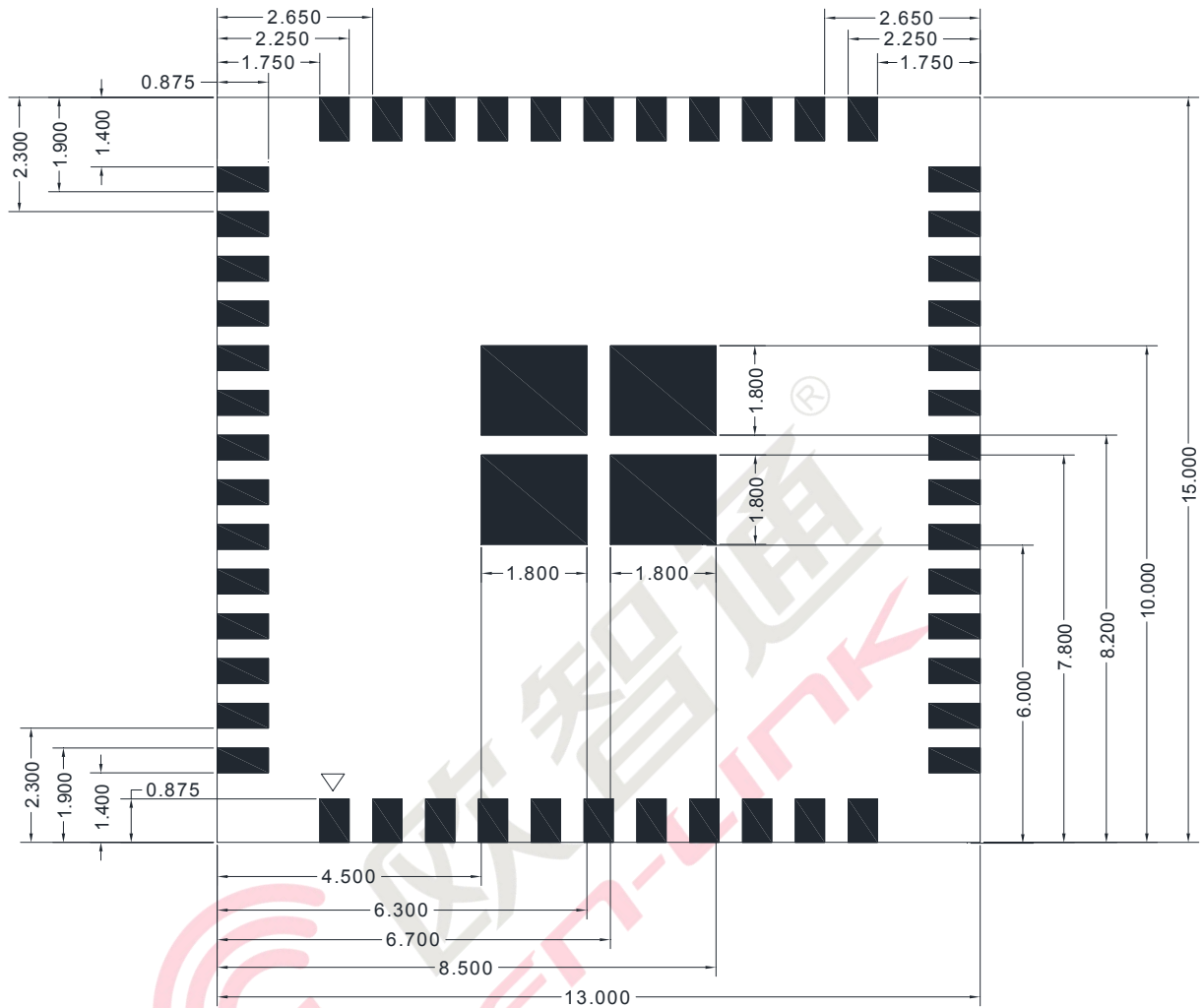
7.2 Marking Description

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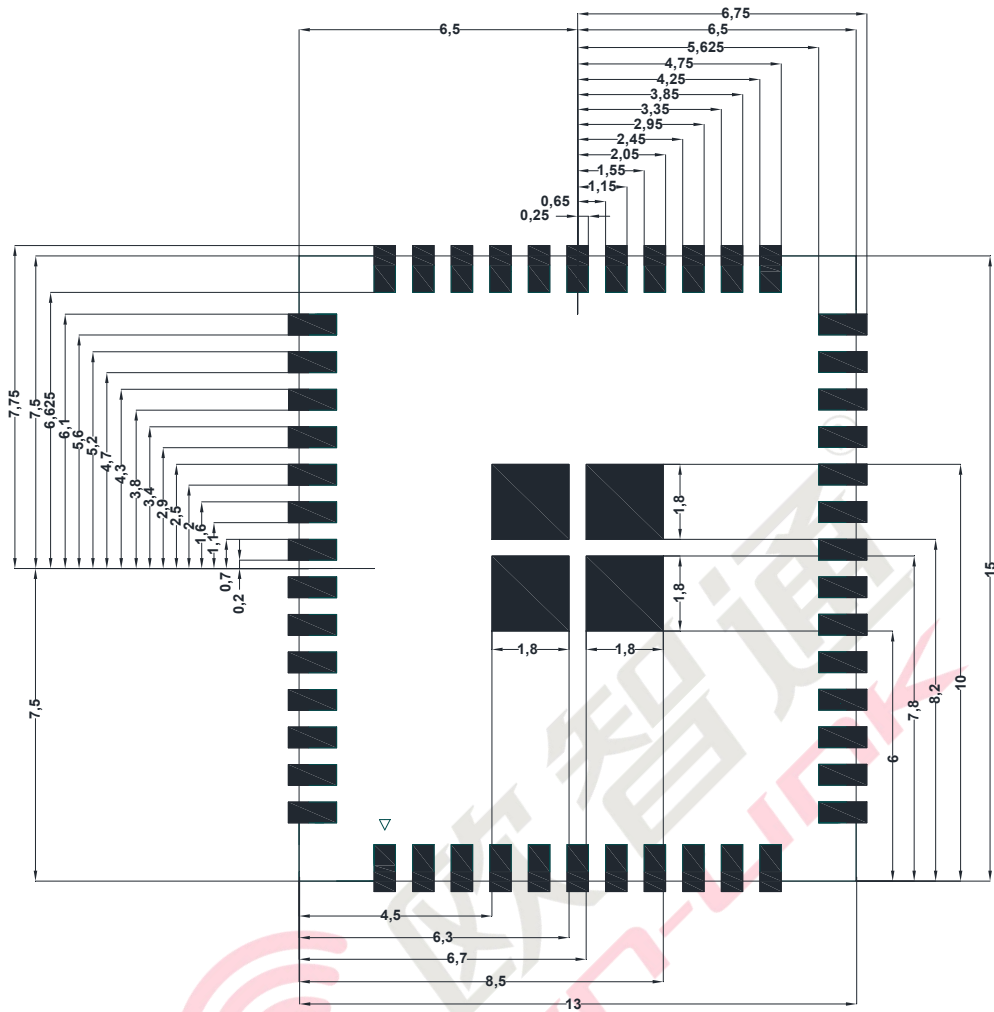


7.3 Physical Dimensions

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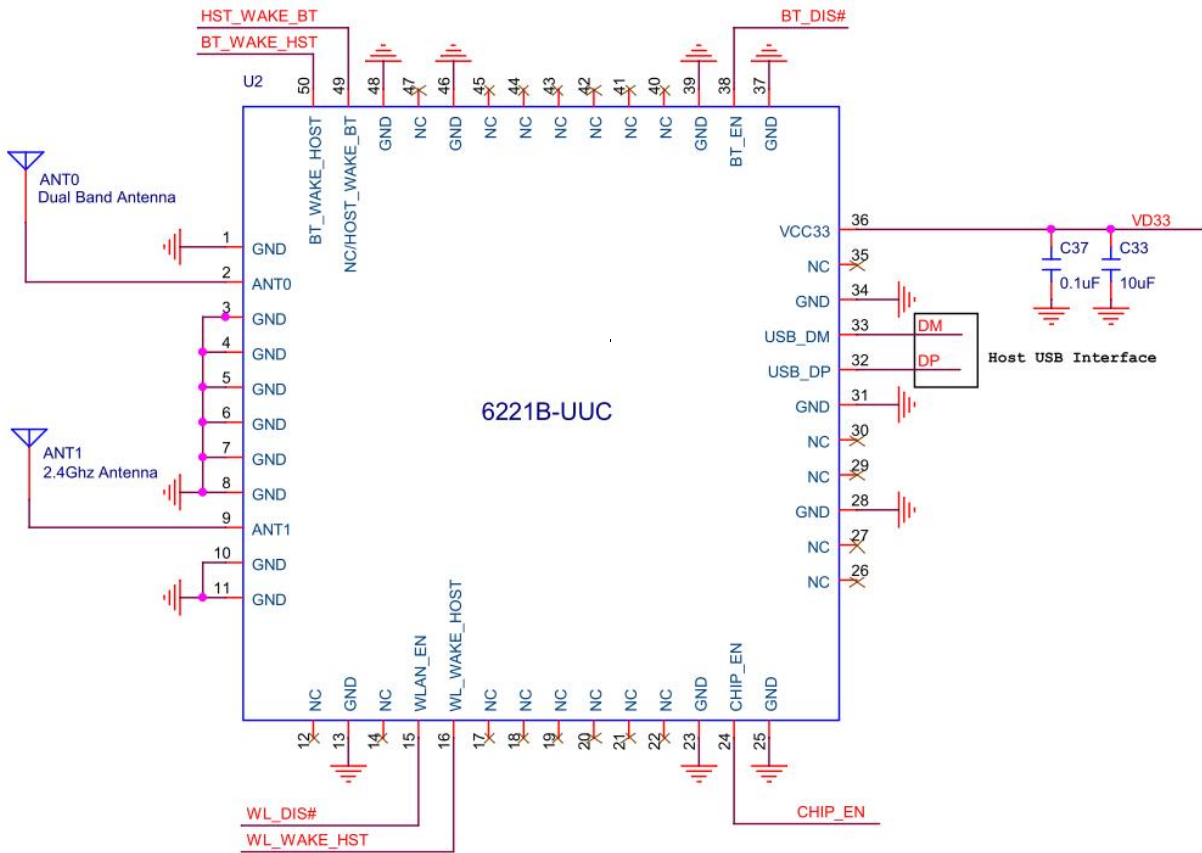
7.4 Layout Recommendation



8. The Key Material List

Chipset	RTL8821CU-VB	Realtek
PCB	6221B-UUC 15x13x0.8mm 4L	XY-PCB,KX-PCB,SL-PCB,Sunlord
TVS	0201 4V 0.05pF 15KV TVS	Murata, way-on
DPX	Multilayer Chip Diplexers,Dual-band 2.4GHz/5GHz,3W,1.0×0.5-0.45mm	ACX,walsin,Glead,murata,TDK
Crystal	2520 40MHZ 15PF, 10ppm	TST,HOSONIC,TKD,ECEC,JWT
Inductor	0603 2.2UH, ±20% 850mA	Microgate,sunlord,cenke,ceaiya
Shielding	6221B-UUC shielding	信太,精力通,卓益

9. Reference Design



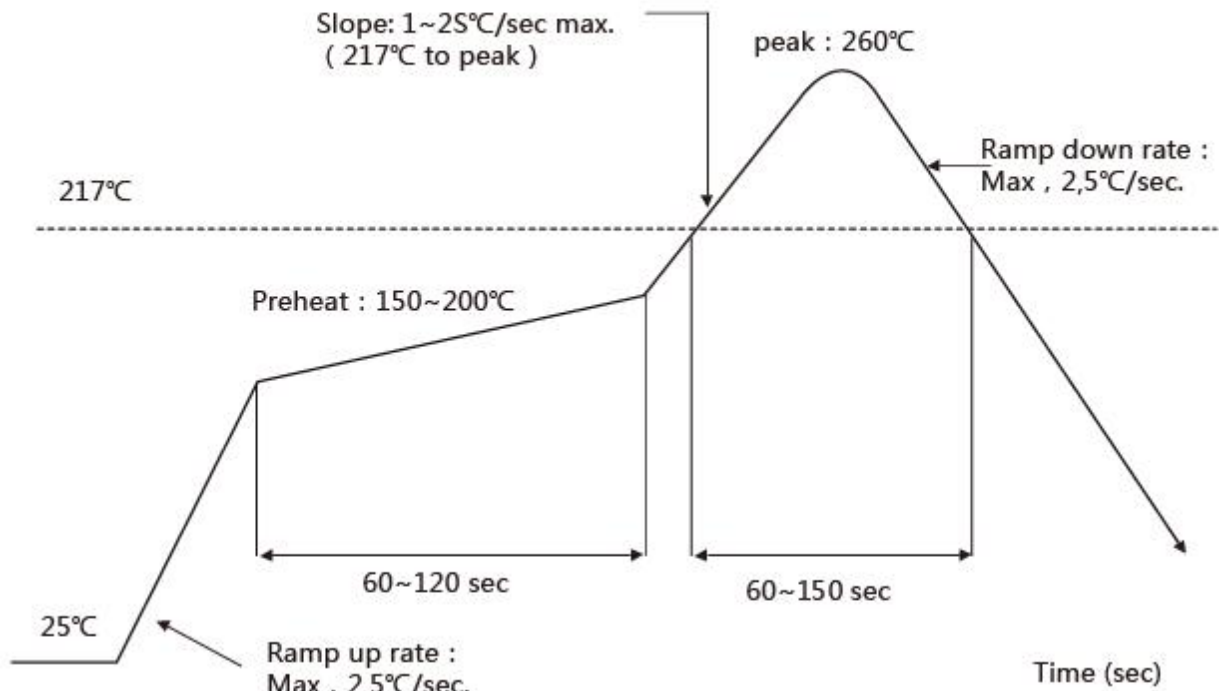
Note: Module requires independent power supply , supply capacity $\geq 600\text{mA}$ and ripple less than 100mV ;
 Do not share power with amplifier, infrared device, camera, etc.
 RF port between module and antenna better implement pi circuit for matching.

10. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <math><260^{\circ}\text{C}</math>

Number of Times : ≤ 2 times



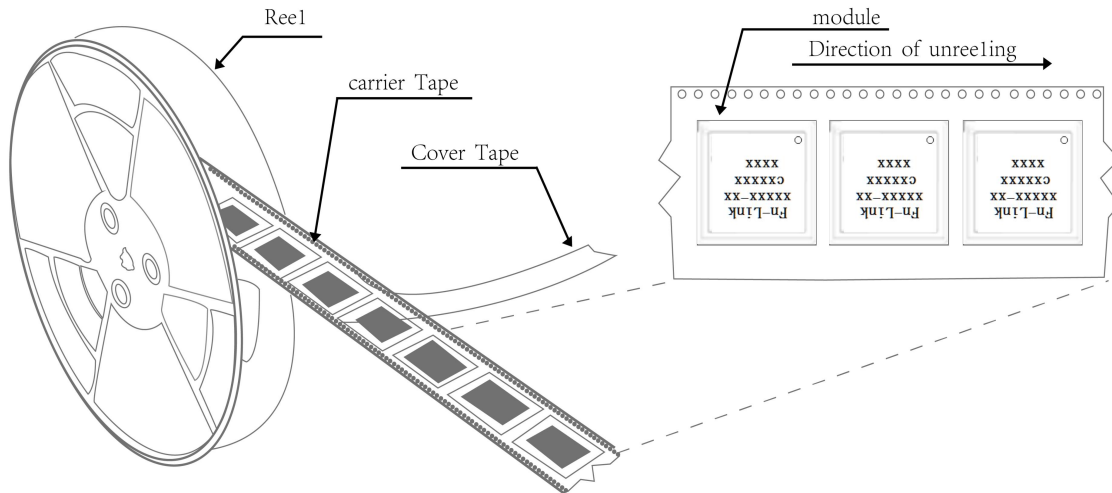
11. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

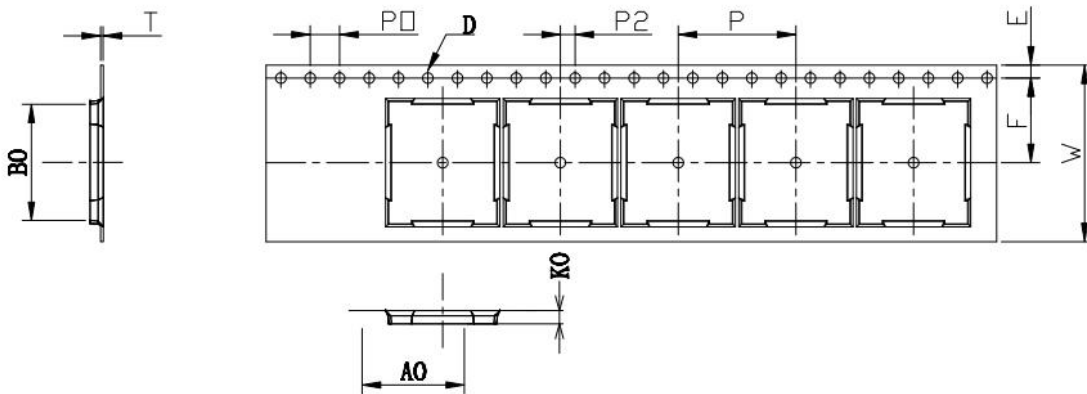
12. Package

12.1 Reel

A roll of 1500pcs



ITEM	W	A0	B0	D	F	E	K0	P0	P2	P	T
DIM	24	13.40	15.40	1.50	11.5	1.75	2.65	4.0	2.0	16.0	0.30
TOLE	+0.3 -0.3	±0.15	±0.15	+0.1 -0.0	+0.1 -0.1	±0.1	±0.10	±0.1	±0.1	±0.1	±0.05



12.2 Packaging Detail

the take-up package



Using self-adhesive tape

Color of plastic disc: blue

Size of black tape: 24mm*32.6m the cover tape :21.3mm*32.6m



NY bag size:460mm*385mm



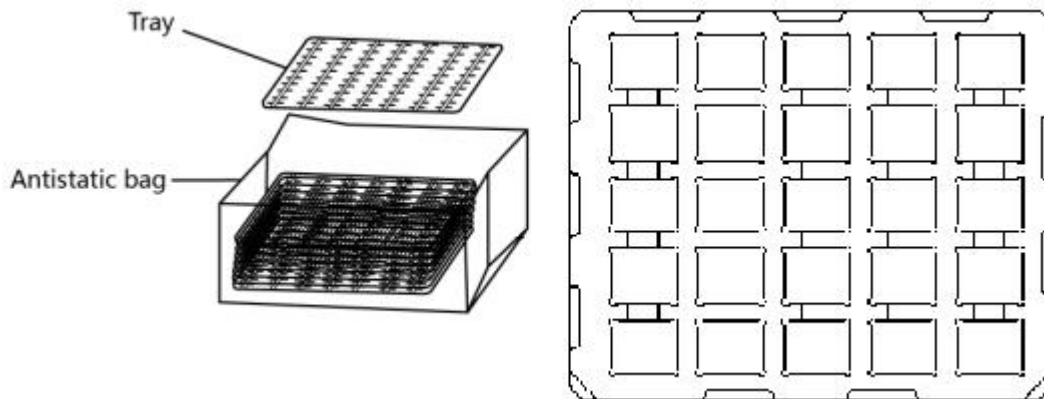
Internal boxsize : 350*350*35mm



The packing case size:350*210*370mm

12.3 Tray

Use pallet packaging for less than 300 pieces



13. 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 $<40^{\circ}\text{C}$ 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 b) "IPC/JEDEC J-STD-033A paragraph 5.2" is respected
- d) Baking is required if conditions b) or c) are not respected
- e) Baking is required if the humidity indicator inside the bag indicates 10% RH or more