FN-LINK欧智通

PRODUCT SPECIFICATION

6221C-PUC

Wi-Fi Dual-band 1T1R 11ac + Bluetooth 5.0

Combo Module

Version:v1.9

6221C-PUC Module Datasheet

	Part NO.	Description
Ordering Information	FG6221CPUC-00	RTL8821CE-VC,802.11a/b/g/n/ac +BLE5.0, 1T1R, 12*16, PCIe/USB
	FG6221CPUC-01	RTL8821CE-CG,802.11a/b/g/n/ac+BT5.0,1T1R,12*16, PCIe/USB

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

CONTENTS

Revision History

Version	Date	Contents of Revision Change	Draft	Checked	Approved
V1.0	2018/12/14	New version	Lzm	Lzm	Jacky
V1.1	2018/12/18	Modify the telephone number	Lzm	Lzm	Lxy
V1.2	2018/12/25	Modify the office and TEL	Lzm	Lzm	Lxy
V1.3	2019/07/08	Update timing information	Lxy	Lxy	Szs
V1.4	2020/07/16	Delete '2x2' information	Lxy	Lxy	Lgp
V1.5	2020/11/17	Update material list	Lxy	Lxy	Szs
V1.6	2021/03/05	Update BT feature	Lxy	Lxy	Szs
V1.7	2021/06/09	Added -VC chipset version	Lxy	Lxy	Szs
V1.8	2022/01/05	1.Update the specification format 2.The RF index was changed to ±2dbm 3.Update the list of critical materials 4.Changed Bluetooth support to V5.0	FC	LXY	QJP
V1.9	2022/03/29	Add - 01 P/N	FC	LXY	QJP

1. General Description

1.1 Introduction

Fn-Link Technology would like to announce a low-cost and low-power consumption module which has all of the Wi-Fi functionalities. It is a highly-integrated IEEE 802.11 a/b/g/n/ac MAC/Baseband/RF WLAN single chip. For Wireless LAN(WLAN)operation. The integrated module provides PCI-e interface for Wi-Fi . The module provides simple legacy and 20MHz/40MHz/80MHz co-existence mechanisms to ensure backward and network compatibility

The wireless module complies with IEEE 802.11 a/b/g/n/ac 1x1 SISO standard and it can achieve up to a speed of 433Mbps to connect the wireless LAN. The integrated module provides PCI-e interface for Wi-Fi, USB/ PCM interface for Bluetooth.

This compact module is a total solution for a combination of Wi-Fi and Bluetooth V5.0 technologies. The module is specifically developed for all portable devices.

1.2 Description

Model Name	6221C-PUC
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 16x 12x 1.8 (typical) mm
Wi-Fi Interface	Support PCI-e
BT Interface	USB / PCM
OS supported	Android /Linux/ Win CE /iOS /XP/WIN7/WIN10
Operating temperature	0°C to 70°C
Storage temperature	-55°C to 85°C

2. Features

General

- Highly integrated wireless local area network(WLAN) system-on-chip (SOC) for 5 GHZ 802.11ac, or 2.4G/5G 802.11n WLAN applications
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz
- Supports Bluetooth for class1 and class2 power level transmissions without requiring an external PA
- -VC chipset support Mordern standby feature

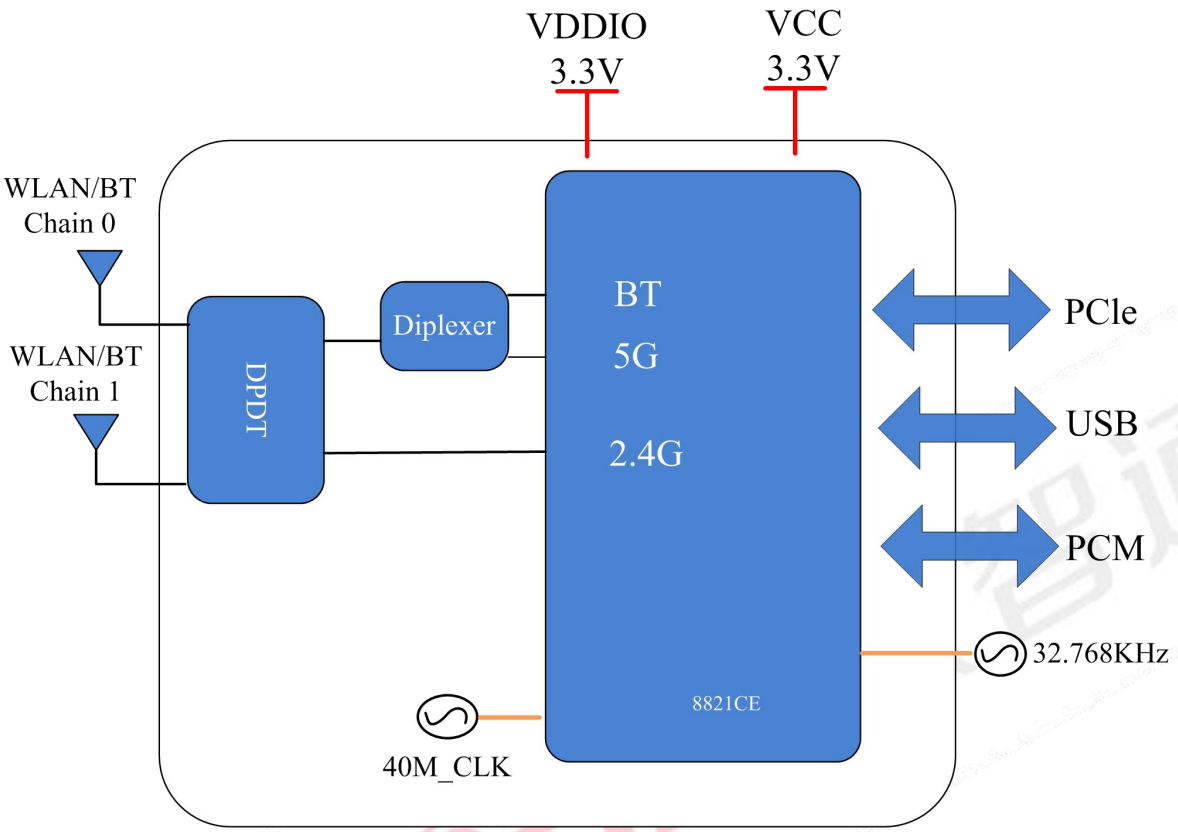
Host Interface

- Supports low power PCI-e interface for WLAN and USB/PCM interface for Bluetooth

Bluetooth Features

- Supports Bluetooth V5.0
- Support bluetooth 4.2system, compatible with BT v2.1+EDR
- support BT5.0 High duty cycle non-connectable advertising
- support BT 4.0 dual mode:simultaneous LE and BR/EDR
- Supports WLAN-Bluetooth coexistence and ISM-LTE coexistence.
- BT host digital interface:
  -USB1.1
  -PCM for audio data

3. Block Diagram



4. General Specification

4.1 2.4GHz RF 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 ~ Ch13	
Test Items	**Typical Value**	**EVM**
Output Power	802.11b /11Mbps : 17dBm ± 2 dB	EVM ≤ -9dB
	802.11g /54Mbps : 15dBm ± 2 dB	EVM ≤ -25dB
	802.11n /MCS7 : 14dBm ± 2 dB	EVM ≤ -28dB

Spectrum Mask	Meet with IEEE standard		
Freq. Tolerance	±20ppm		
Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps	PER @ -97dBm	≤-83
	- 2Mbps	PER @ -93dBm	≤-80
	- 5.5Mbps	PER @ -91dBm	≤-79
	- 11Mbps	PER @ -88dBm	≤-76
Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps	PER @ -92dBm	≤-85
	- 9Mbps	PER @ -91dBm	≤-84
	- 12Mbps	PER @ -88dBm	≤-82
	- 18Mbps	PER @ -87dBm	≤-80
	- 24Mbps	PER @ -83dBm	≤-77
	- 36Mbps	PER @ -80dBm	≤-73
	- 48Mbps	PER @ -76dBm	≤-69
	- 54Mbps	PER @ -75dBm	≤-68
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0	PER @ -91dBm	≤-85
	- MCS=1	PER @ -88dBm	≤-82
	- MCS=2	PER @ -85dBm	≤-80
	- MCS=3	PER @ -82dBm	≤-77
	- MCS=4	PER @ -79dBm	≤-73
	- MCS=5	PER @ -75dBm	≤-69
	- MCS=6	PER @ -74dBm	≤-68
	- MCS=7	PER @ -72dBm	≤-67
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0	PER @ -88dBm	≤-82
	- MCS=1	PER @ -85dBm	≤-79
	- MCS=2	PER @ -82dBm	≤-77
	- MCS=3	PER @ -79dBm	≤-74
	- MCS=4	PER @ -76dBm	≤-70
	- MCS=5	PER @ -72dBm	≤-66
	- MCS=6	PER @ -70dBm	≤-65
	- MCS=7	PER @ -69dBm	≤-64
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, Wi-Fi compliant	
Frequency Range	4.900 GHz ~ 5.850 GHz (5.0 GHz ISM Band)	
Number of Channels	5.0GHz：Please see the table1	
Output Power	802.11a /54Mbps : 13 dBm ± 2 dB	EVM ≤ -25dB
	802.11n /MCS7 : 12 dBm ± 2 dB	EVM ≤ -28dB
	802.11ac /MCS9 : 11 dBm ± 2 dB	EVM ≤ -32dB
Test Items	**Test Value**	**Standard Value**
Receive Sensitivity (11a, 20MHz) @10% PER	- 6Mbps PER @ -91dBm	≤-85
	- 9Mbps PER @ -88dBm	≤-84
	- 12Mbps PER @ -85dBm	≤-82
	- 18Mbps PER @ -84dBm	≤-80
	- 24Mbps PER @ -81dBm	≤-77
	- 36Mbps PER @ -78dBm	≤-73
	- 48Mbps PER @ -75dBm	≤-69
	- 54Mbps PER @ -74dBm	≤-68
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0 PER @ -89dBm	≤-85
	- MCS=1 PER @ -85dBm	≤-82
	- MCS=2 PER @ -83dBm	≤-80
	- MCS=3 PER @ -80dBm	≤-77
	- MCS=4 PER @ -77dBm	≤-73
	- MCS=5 PER @ -72dBm	≤-69
	- MCS=6 PER @ -71dBm	≤-68
	- MCS=7 PER @ -69dBm	≤-67
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0 PER @ -87dBm	≤-85
	- MCS=1 PER @ -82dBm	≤-82
	- MCS=2 PER @ -81dBm	≤-80
	- MCS=3 PER @ -77dBm	≤-76
	- MCS=4 PER @ -74dBm	≤-73
	- MCS=5 PER @ -71dBm	≤-68
	- MCS=6 PER @ -69dBm	≤-67
	- MCS=7 PER @ -69dBm	≤-65
Receive Sensitivity (11ac,20MHz) @10% PER	- MCS=0 PER @ -88dBm	≤-83
	- MCS=1 PER @ -85dBm	≤-82
	- MCS=2 PER @ -83dBm	≤-80

	- MCS=3 PER @ -81dBm	≤-75
	- MCS=4 PER @ -78dBm	≤-72
	- MCS=5 PER @ -73dBm	≤-68
	- MCS=6 PER @ -72dBm	≤-67
	- MCS=7 PER @ -71dBm	≤-62
	- MCS=8 PER @ -66dBm	≤-60
Receive Sensitivity (11ac,40MHz) @10% PER	- MCS=0 PER @ -86dBm	≤-80
	- MCS=1 PER @ -83dBm	≤-77
	- MCS=2 PER @ -81dBm	≤-74
	- MCS=3 PER @ -78dBm	≤-70
	- MCS=4 PER @ -74dBm	≤-69
	- MCS=5 PER @ -71dBm	≤-65
	- MCS=6 PER @ -70dBm	≤-64
	- MCS=7 PER @ -68dBm	≤-59
	- MCS=8 PER @ -64dBm	≤-57
	- MCS=9 PER @ -63dBm	≤-55
Receive Sensitivity (11ac,80MHz) @10% PER	- MCS=0 PER @ -83dBm	≤-79
	- MCS=1 PER @ -80dBm	≤-76
	- MCS=2 PER @ -78dBm	≤-74
	- MCS=3 PER @ -75dBm	≤-71
	- MCS=4 PER @ -72dBm	≤-67
	- MCS=5 PER @ -68dBm	≤-63
	- MCS=6 PER @ -67dBm	≤-62
	- MCS=7 PER @ -65dBm	≤-61
	- MCS=8 PER @ -60dBm	≤-56
	- MCS=9 PER @ -57dBm	≤-54
Maximum Input Level	802.11a/n : -30 dBm	
Antenna Reference	Small antennas with 0~2 dBi peak gain	

[1]5GHz(20MHz) Channel table

Band range	Operating Channel Numbers	Channel center frequencies(MHz)
5180MHz~5240MHz	36	5180
	40	5200
	44	5220
	48	5240
5260MHz~5320MHz	52	5260
	56	5280
	60	5300
	64	5320

5550MHz~5700MHz	100	5500
	104	5520
	108	5540
	112	5560
	116	5580
	120	5600
	124	5620
	128	5640
	132	5660
	136	5680
	140	5700
5745MHz~5825MHz	149	5745
	153	5765
	157	5785
	161	5805
	165	5825

4.3 Bluetooth Specification

Feature	**Description**
General Specification	
Bluetooth Standard	Bluetooth V5.0 of 1, 2 and 3 Mbps.
Host Interface	USB
Antenna Reference	Small antennas with 0~2 dBi peak gain
Frequency Band	2402 MHz ~ 2480 MHz
Number of Channels	79 channels
Modulation	GFSK, π/4-DQPSK, 8-DPSK
RF Specification	

	Min(dBm)	**Typical**(dBm)	**Max**(dBm)
Output Power (Class 1)	2	5	8
Sensitivity @ BER=0.1% for GFSK (1Mbps)		-92	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)		-92	
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)		-85	
Maximum Input Level	GFSK (1Mbps):-20dBm		
	π/4-DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

5. ID setting information

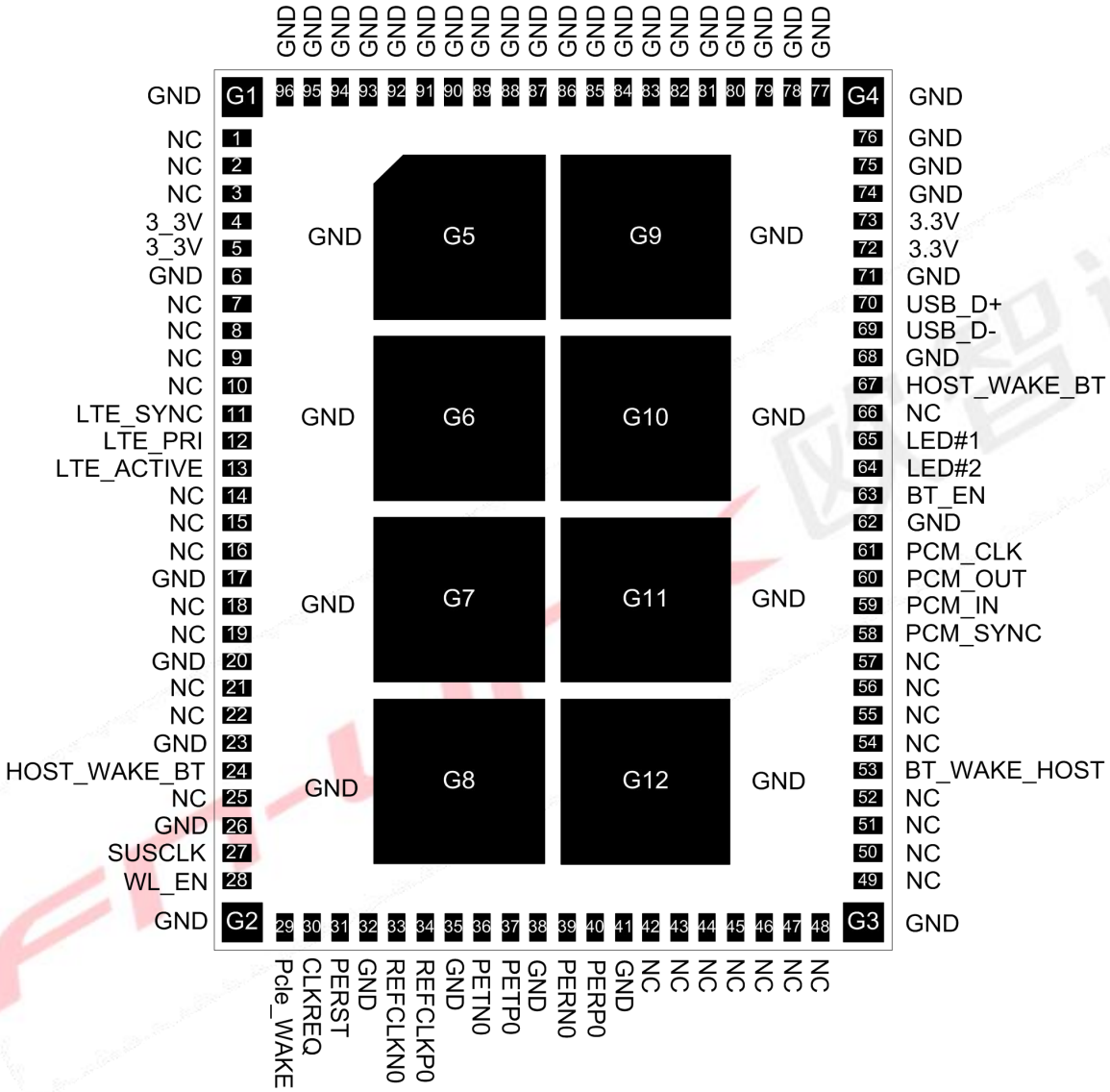
WI-FI

Vendor ID	10EC
Product ID	C821

6. Pin Definition

6.1 Pin Outline

< TOP VIEW >



6.2 Pin Definition details

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	LTE_SYNC	I	LTE coexist signal	3.3V
12	LTE_PRI	O	LTE coexistence signal	3.3V
13	LTE_ACTIVE	I/O	LTE coexistence signal	3.3V
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	PD	Host wake up BT	3.3V
25	NC	—	No connect	
26	GND	—	Ground connections	
27	SUSCLK	PD	External sleep clock input(32.768kHz),internal weak pull down.	3.3V
28	WL_EN	—	WLAN enable pin, High: enable,Low:disable	3.3V
29	PCIe_WAKE	OD	PCI-e wake up host	3.3V
30	CLKREQ	OD	PCI-e reference clock request signal	3.3V
31	PERST	PD	PCI-e reset module	3.3V
32	GND	—	Ground connections	
33	REFCLKN0	I	PCI-E CLK Difference -	
34	REFCLKP0	I	PCI-E CLK Difference +	

35	GND	—	Ground connections	
36	PETN0	O	PCI-E Data Out Difference -	
37	PETP0	O	PCI-E Data Out Difference +	
38	GND	—	Ground connections	
39	PERN0	I	PCI-E Data IN Difference -	
40	PERP0	I	PCI-E 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	PD	Bluetooth enable signal, internal pull up 100KΩ resistor and pull down 0.1uF capacitor,active high.	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	PD	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
74~96	GND	—	Ground connections	
G1-G12	GND	—	Ground connections	

P:POWER I:INPUT O:OUTPUT

7. Electrical Specifications

7.1 Power Supply DC Characteristics

The digital IO supports VDD33 or VDD18 application.

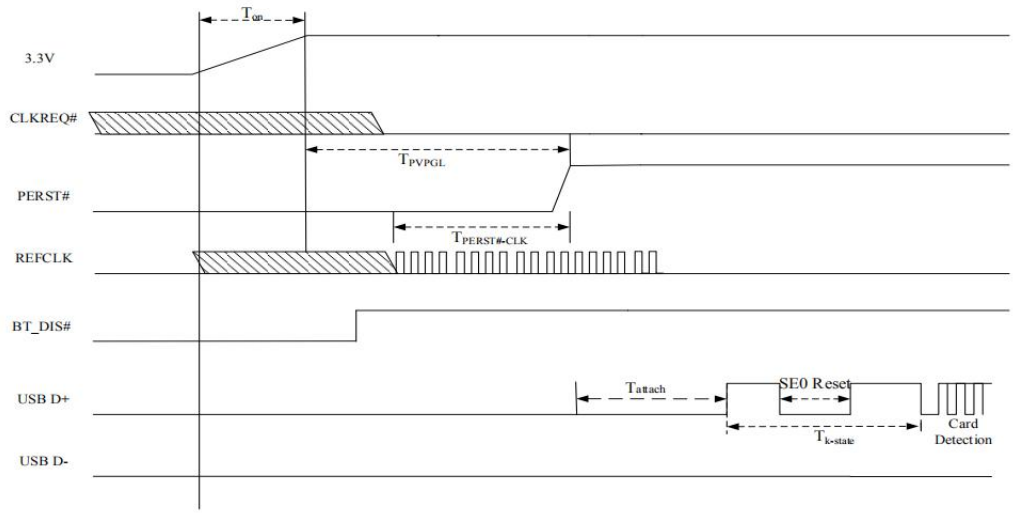
	MIN	TYP	MAX	Unit
Operating Temperature	0	25	70	deg.C
VCC33	3.0	3.3	3.6	V
VDDIO	3.0	3.3	3.6	V

7.2 Power Consumption

		VCC33 = 3.3V(Unit:mA)
Power Consumption	Wi-Fi on Mode	25
	TX (2.4G HT40)	275
	RX (2.4G HT40)	134
	TX (5G HT80)	264
	RX (5G HT80)	139
	BT on	23

7.3 Interface Circuit time series

7.3.1 PCIe Bus during Power On Sequence



Ton: The main power ramp up duration;

TPVPGL: Power valid to PERST# input inactive;

TPERST#-CLK: Reference clock stable before PERST# inactive;

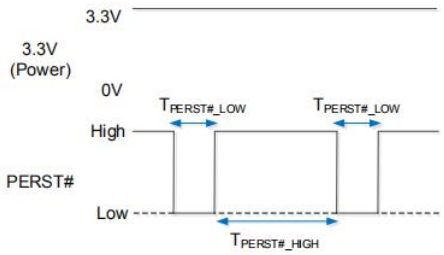
Tattach: The interval to turn on BT after PERST# de-asserted;

Tk-state: the duration from resister attached to USB host starting card detection procedure;

The typical timing range

Symbol	Unit	Min	Typical	Max
T_{on}	ms	0.5	1.5	5
T_{PVPGL}	ms	Implementation specific;recommended		--
		50ms		
$T_{PERST\#-CLK}$	us	100		--
T_{attach}	ms	0.5	2	5
$T_{k-state}$	ms	50	250	--

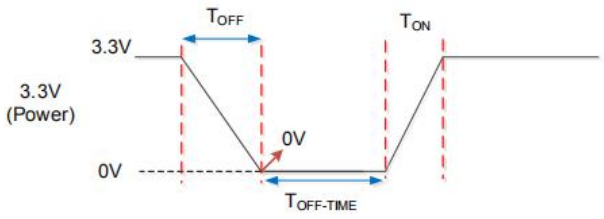
7.3.2 PCIe PERST# Timing Sequence



RTL8821CE-CG PCIE PERST# Timing Parameters

	Min	Typical	Max	Unit	Description
$T_{PERST\#\_LOW}$	6	10	X	ms	PERST# low duration
$T_{PERST\#\_HIGH}$	400	500	X	ms	PERST# high duration

7.3.3 Power Off Sequence



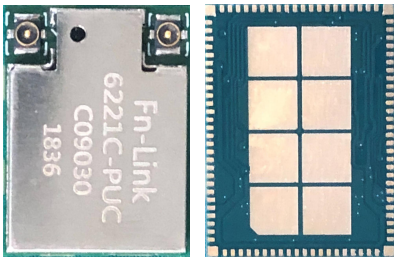
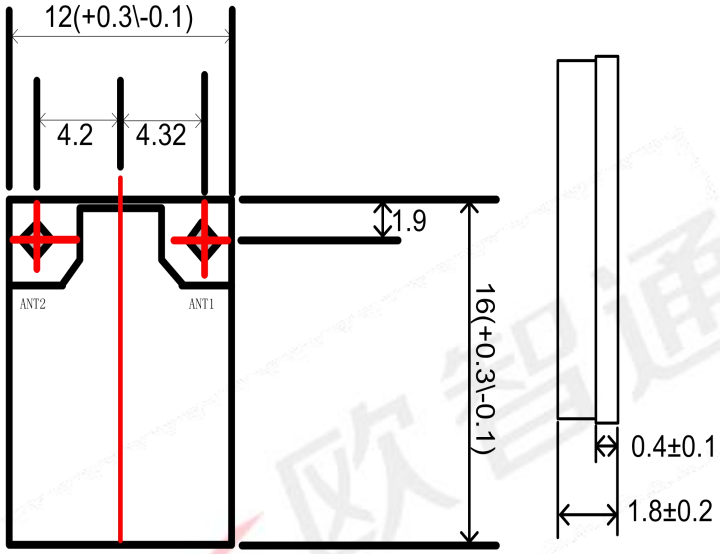
RTL8821CE-CG Power Off Sequence

RTL8821CE-CG Power Off Timing Parameters

Symbol	Unit	Min	Typical	Max
T_{OFF}	ms	5	20	50
$T_{OFF-TIME}$	ms	500	--	--
T_{ON}	ms	0.5	1.5	5

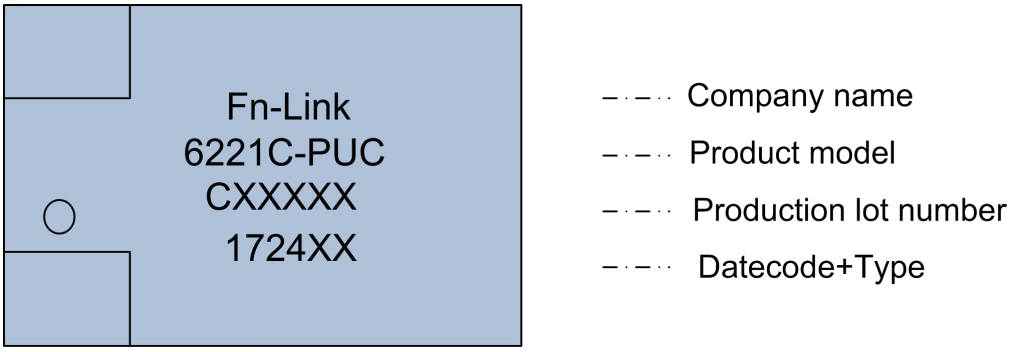
8. Size reference

8.1 Module Picture

<table>
<tr><td>L x W : 16 x 12 (+0.3/-0.1) mm
 
</td><td rowspan="2"> 
</td></tr>
<tr><td>H: 1.8 (±0.2) mm</td></tr>
<tr><td>Weight</td><td>0.64g</td></tr>
</table>

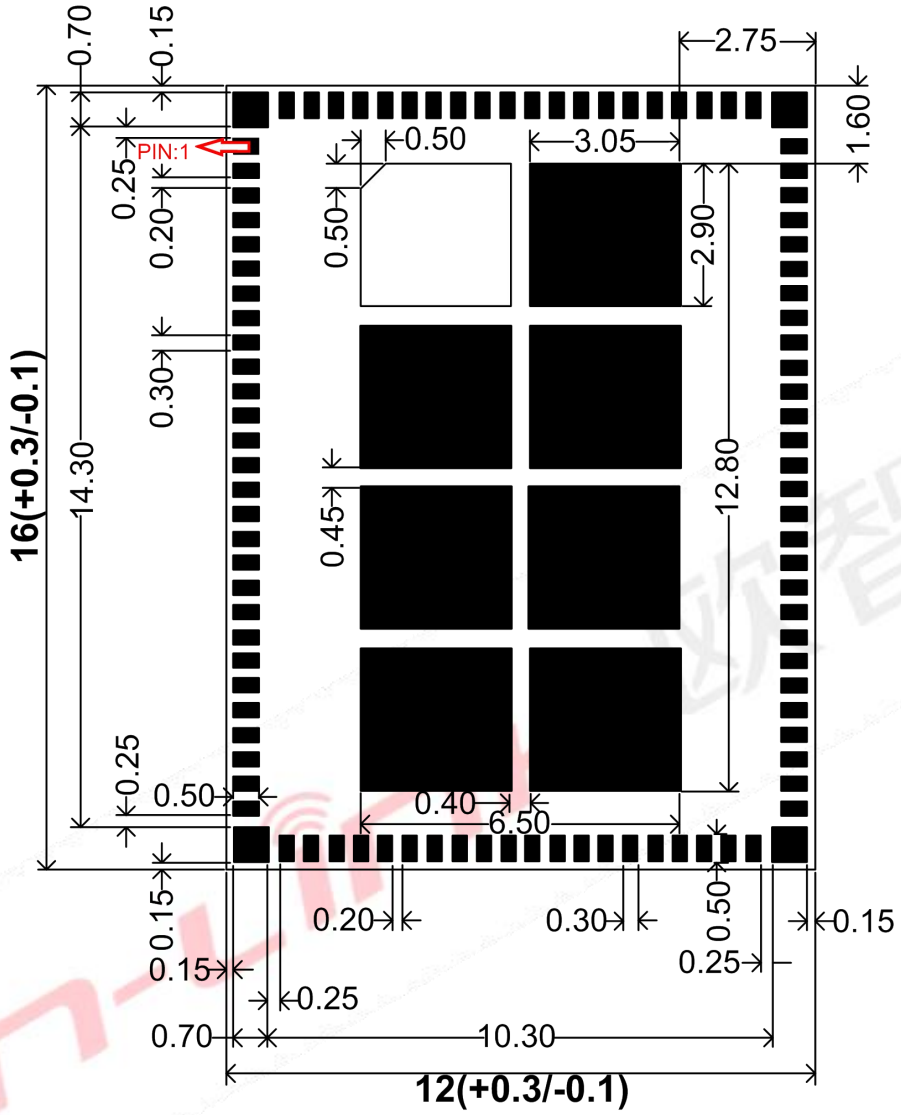
8.2 Marking Description

< TOP VIEW >

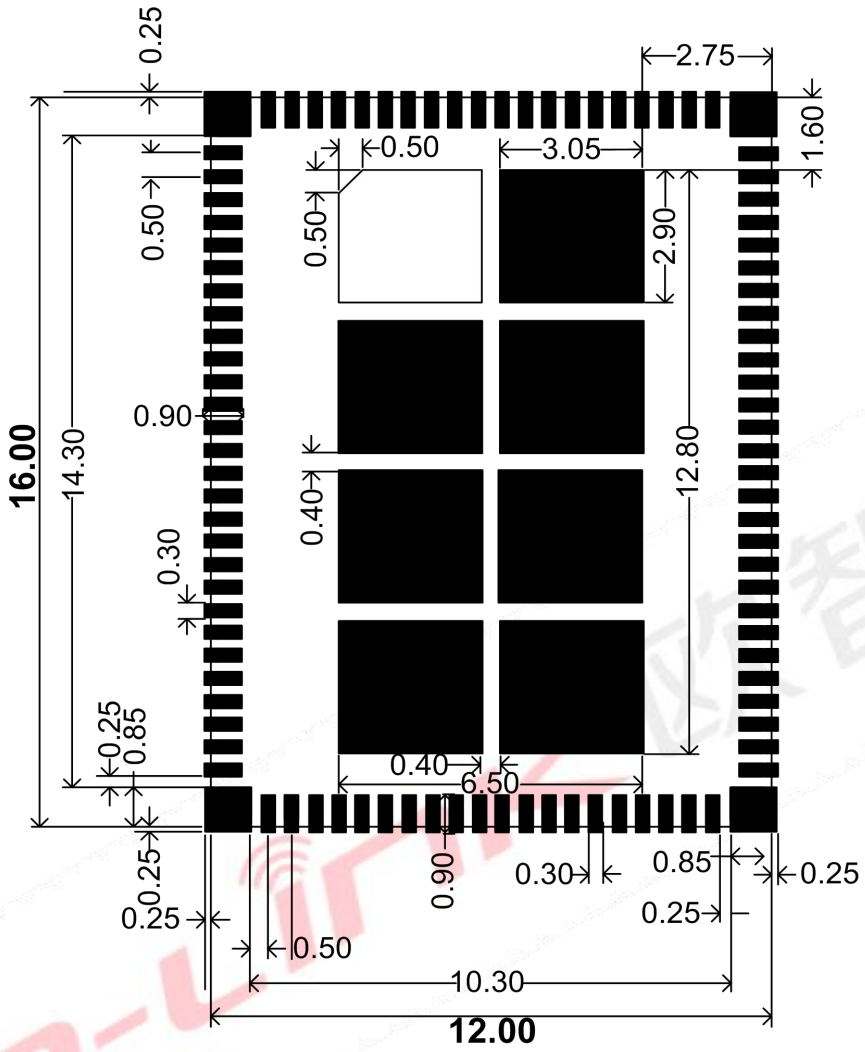


8.3 Physical Dimensions

<TOP View>



8.4 Layout Recommendation

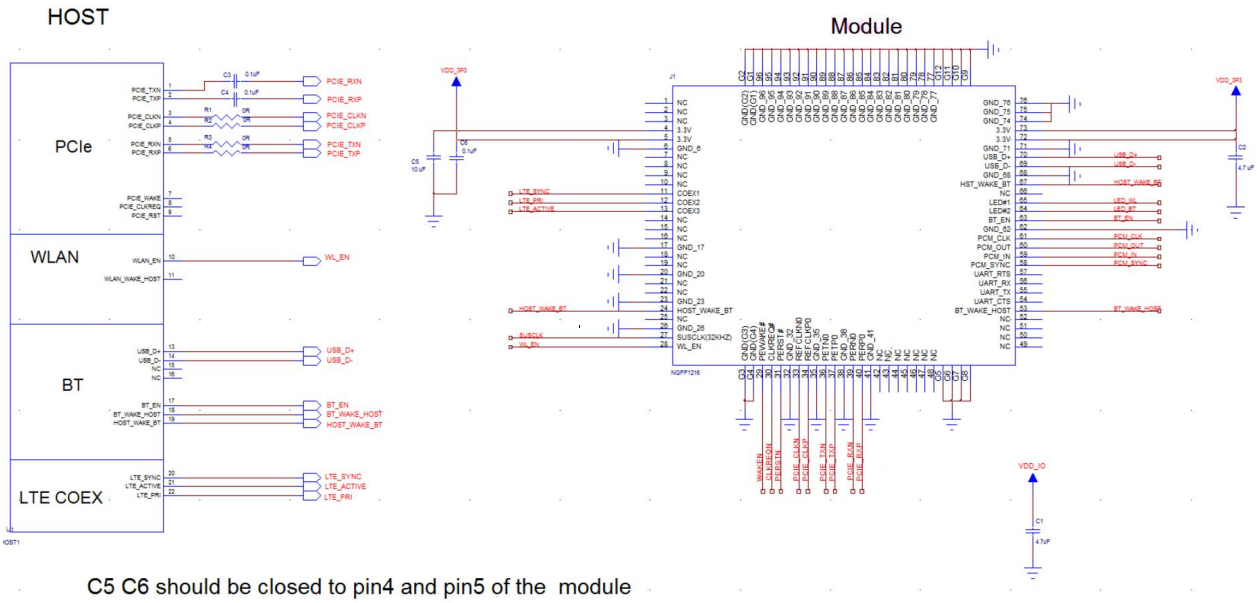


9. The Key Material List

Item	Part Name	Description	Manufacturer
1	PCB	6221C-PUC 12X16X0.4mm TG180	Brain-power, KX-pcb，Sunlord
2	Crystal	40MHz 2016 15pF 10ppm	ECEC, Hosonic, TKD, JWT
3	Chipset	RTL8821CE	Realtek
4	Shielding	6221C-PUC V2.0 Shielding cover	SUNTECH，JLitong
5	Inductor	2016 2.2UH ±20%, 1200mA	Microgate,Sunlord,Ceaiya,ckcoil
6	Diplexer	DP1005 2.4G&5G	ACX,Murata
7	Diversity Switch	DPDT Diversity Switch DC~6.0GHz DFN 1.5mmx1.5mm 6pin	Qwave

10. Reference Design

10.1 Reference Design



C5 C6 should be closed to pin4 and pin5 of the module

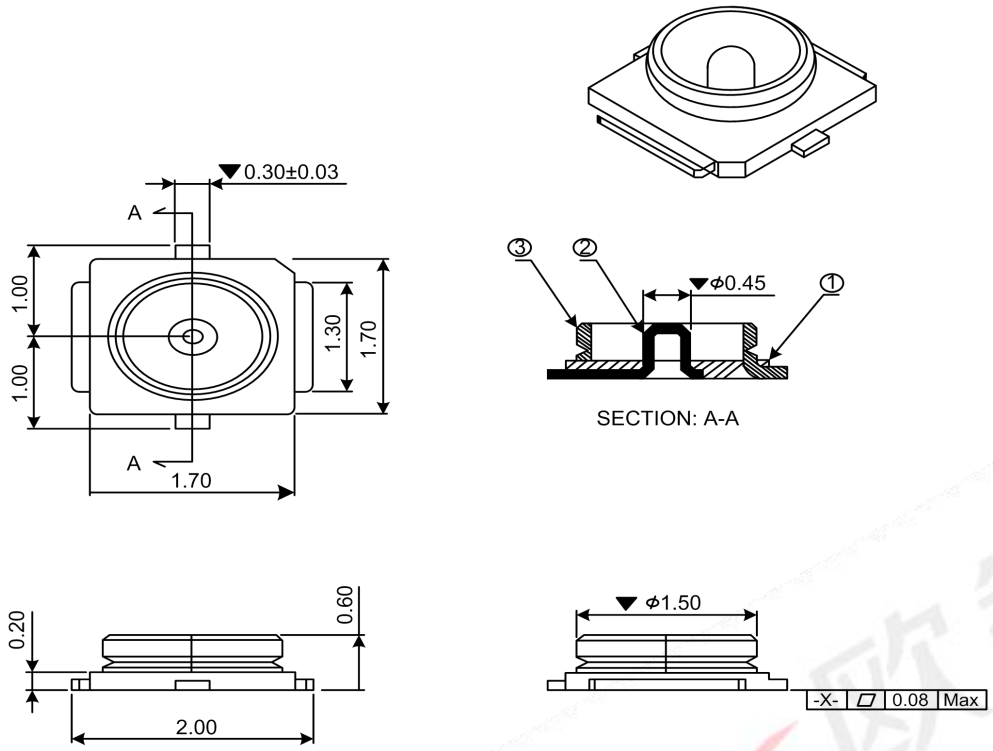
C1 should be cosed to pin43 of the module

PCIe layout should be followed to end impedence 50 Ohm and difference impedence 100 Ohm.

Note:

1. ANT1 ,ANT2 all support 2.4G/5G/BT function.
2. 6221C-PUC antenna port is control by driver if diversity function is enabled.
3. If diversity function is disabled, ANT1 is 5G & BT port, ANT2 is 2.4G port.

10.2 Connector Specification

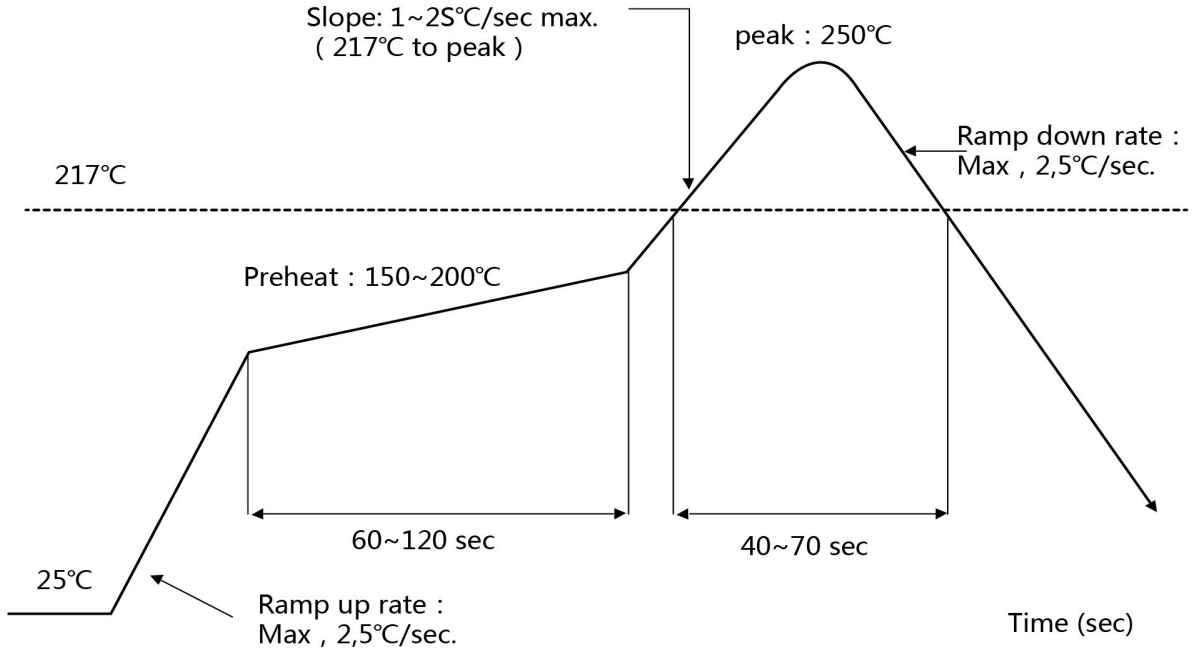


11. Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : <250°C

Number of Times : ≤2 times



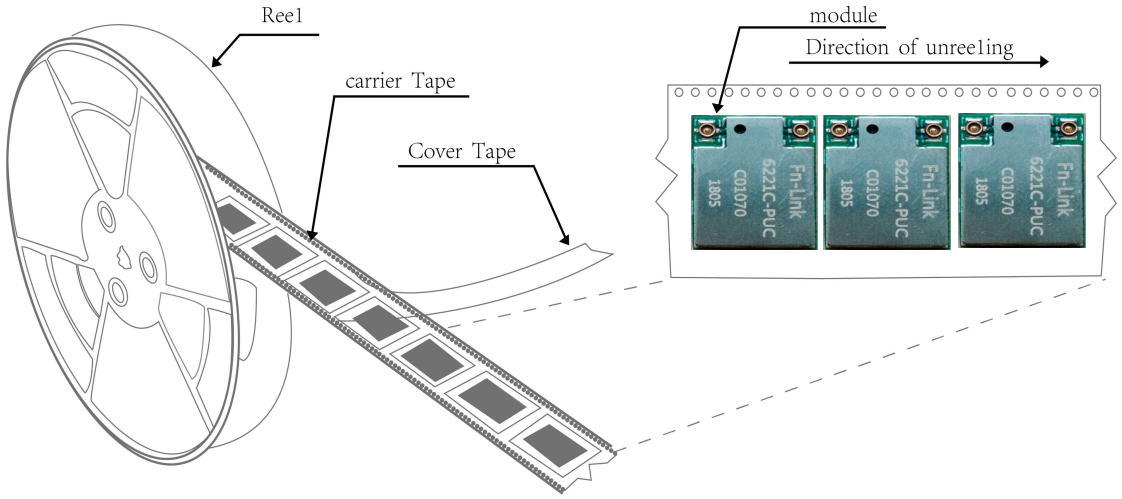
12. RoHS compliance

All hardware components are fully compliant with EU RoHS directive

13. Package

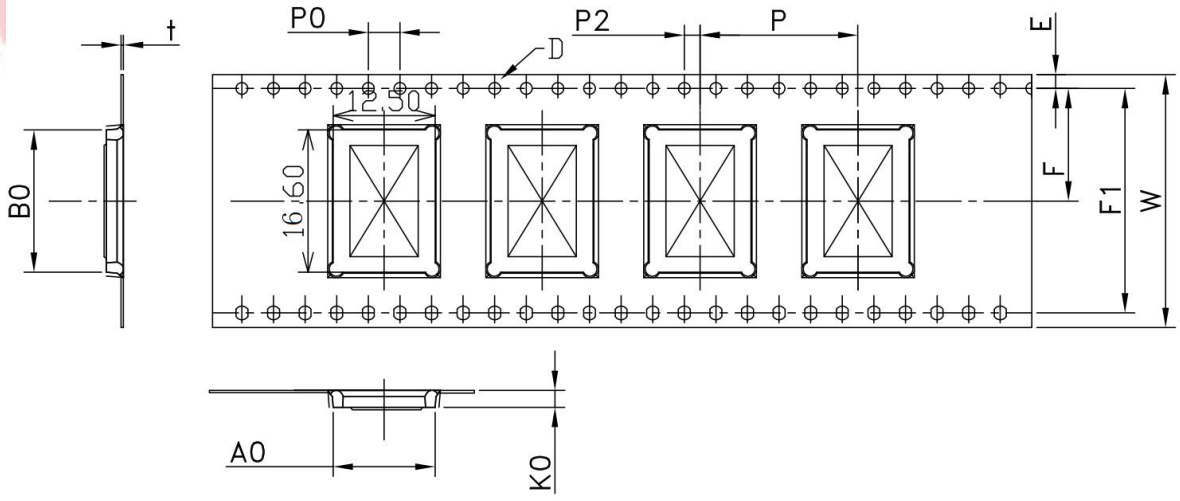
13.1 Reel

A roll of 2000pcs

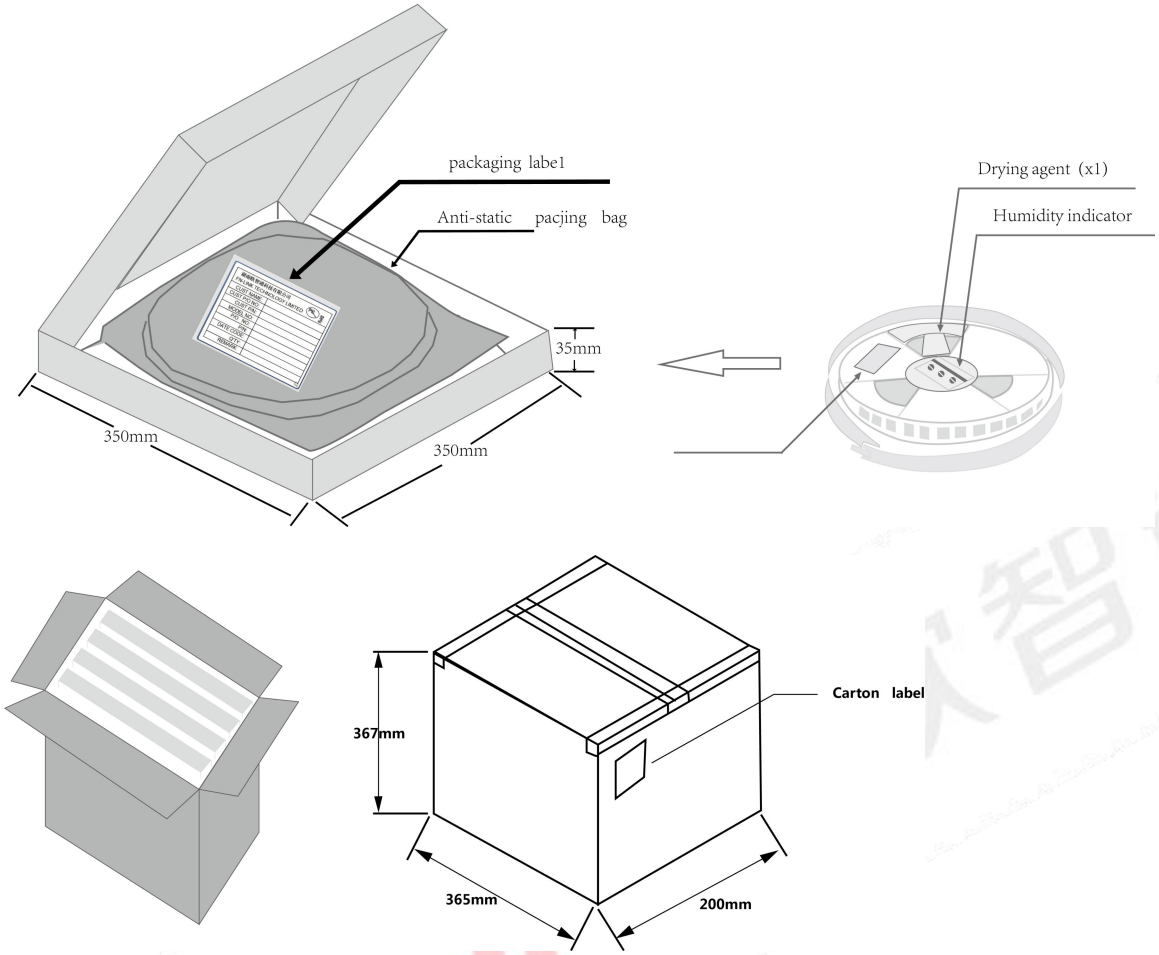


13.2 Carrier Tape Detail

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 −0.3	±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 Packaging Detail



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

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