

6222C-PUC

**Wi-Fi Dual-band 2T2R 11ac +Bluetooth 5
Combo Module Datasheet**



6222C-PUC Module Datasheet

Office: 6 Floor, Building U6, Junxiang U8 Park,
Hangcheng Avenue, Bao'an District,
Shenzhen City, CHINA

Factory: No.8, Litong Road, Liuyang Economic & Technical
Development Zone, Changsha, Hunan, CHINA

TEL: +86-755-2955-8186

Website: www.fn-link.com

Customer Approval : _____ Company _____

_____ Title _____

_____ Signature _____

_____ Date _____

_____ Fn-Link _____

Revision History

Version	Date	Revision Content	Draft	Approved
1.0	2021/02/04	Draf Version	Lgp	Szs
2.0	2021/03/13	Update power consumption data; Update EEPROM information; Update RF spec; Update host interface timing diagram	Lgp	Szs
3.0	2021/04/08	Update RF spec	Lgp	Szs

CONTENTS

1 Overview.....	1
1.1 Introduction.....	1
1.2 Features.....	1
1.4 General Specification.....	2
1.5 Recommended Operating Rating.....	3
※1.6 EEPROM Information.....	3
2 Wi-Fi RF Specification.....	4
2.1 2.4GHz RF Specification.....	4
2.2 5GHz RF Specification.....	5
3 Bluetooth Specification.....	7
3.1 Bluetooth Specification.....	7
4 Pin Assignments.....	8
4.1 Pin Outline.....	8
4.2 Pin Definition.....	9
5 Dimensions.....	12
5.1 Module Picture.....	12
5.2 Connector Specification.....	12
5.3 Marking Description.....	13
5.4 Module Physical Dimensions.....	13
5.5 Layout Recommendation.....	14
6 Host Interface Timing Diagram.....	15
6.1 PCIe Bus during Power On Sequence.....	15
6.2 PCIe PERST# Timing Sequence.....	15
6.3 Power Off Sequence.....	16
6.4 BT_DIS Timing Sequence.....	16
6.5 Platform state transitions.....	16
7 Reference Design.....	17
8 Ordering Information.....	18
9 The Key Material List.....	18
10 Recommended Reflow Profile.....	19
11 Package Information.....	20
11.1 Reel.....	20
11.2 Carrier Tape Detail.....	20
11.3 Packaging Detail.....	21
11.4 Moisture sensitivity.....	21

1 Overview

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 PCIe interface for Wi-Fi . The module provides simple legacy and 20MHz/40MHz/80MHz co-existence mechanisms to ensure backward and network compatibility

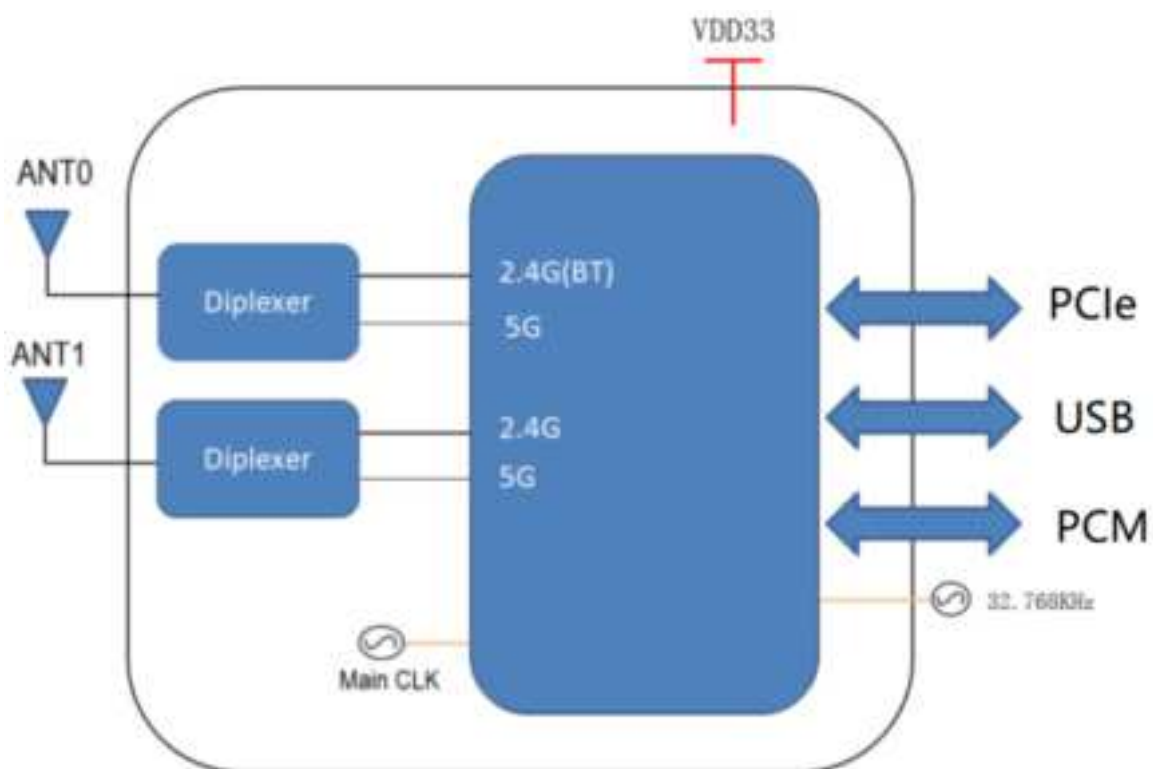
The wireless module complies with IEEE 802.11 a/b/g/n/ac 2x2 MIMO standard and it can achieve up to a speed of 866.7Mbps to connect the wireless LAN. The integrated module provides PCIe interface for Wi-Fi, USB/ PCM interface for Bluetooth.

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 Features

- IEEE 802.11a/b/g/n/ac compatible WLAN
- Supports 20/40MHz at 2.4GHz and supports 20/40/80MHz at 5GHz
- Supports 802.11ac 2x2, Wave-2 compliant with MU-MIMO
- Complete 802.11n MIMO solution for 2.4GHz and 5GHz band
- Supports low power PCIe(Base Specification Revision 1.1) interface for WLAN and USB(2.0 FS-mode)/PCM interface for Bluetooth
- Supports Bluetooth 5.0 system
- Compatible with Bluetooth v2.1+EDR
- Dual Mode support: Simultaneous LE and BR/EDR
- Enhanced BT/Wi-Fi Coexistence Control to improve transmission quality in different profiles
- Supports Bluetooth for class1, class2 and class3 power level transmissions without requiring an external PA
- Integrated 32K oscillator for power management

1.3 Block Diagram



1.4 General Specification

Model Name	6222C-PUC
Product Description	Support Wi-Fi/Bluetooth functionalities
Dimension	L x W x H: 16x 12x 1.8 (typical) mm
Wi-Fi Interface	Support PCIe
BT Interface	USB/ PCM
Operating temperature	0°C to 70°C
Storage temperature	-55°C to 85°C
RoHS	All hardware components are fully compliant with EU RoHS directive

1.5 Recommended Operating Rating

		Min.	Typ.	Max.	Unit
Operating Temperature		0	25	70	deg.C
VDD33		3.0	3.3	3.6	V
Power Consumption		VDD33 = 3.3V(Unit:mA)			
	Wi-Fi on Mode	175			
	TX (2.4G 1M)	710			
	TX (2.4G HT40)	280			
	RX (2.4G HT40)	204			
	TX (5G 6M)	650			
	TX (5G vHT80)	265			
	RX (5G vHT80)	208			
	BT on	20			
	BT Hopping	80			
	BT TX	130			
	BT RX	95			

※1.6 EEPROM Information

Wi-Fi

Vendor ID	10EC
Product ID	C822

2 Wi-Fi RF Specification

2.1 2.4GHz RF Specification

Feature	Description			
WLAN Standard	IEEE 802.11b/g/n Wi-Fi compliant			
Frequency Range	802.11b/g/n(HT20):2412MHz to 2462MHz 802.11n(HT40): 2422MHz to 2452MHz			
Number of Channels	802.11b/g/n(HT20):11 802.11n(HT40):7			
Output Power	802.11b /11Mbps : 17 dBm ± 1.5 dB @ EVM ≤ -9dB			
	802.11g /54Mbps : 16 dBm ± 1.5 dB @ EVM ≤ -25dB			
	802.11n /MCS7 : 15 dBm ± 1.5 dB @ EVM ≤ -28dB			
	Other data rates output power are defined by driver's power by rates mechanism			
Spectrum Mask	Min. b/g/n	Typ. b/g/n	Max. b/g/n	Unit b/g/n
1st side lobes(to fc ± 11MHZ)	-	-48/-33/-37	-	dBr
2st side lobes(to fc ± 22MHZ)	-	-59/-54/-56	-	dBr
Freq. Tolerance	-20/-20/-20	-	20/20/20	ppm
Test Items	Test Value			Standard Value
Receive Sensitivity (11b) @8% PER	- 1Mbps	PER ≤ -92dBm	≤-83dBm	
	- 11Mbps	PER ≤ -84dBm	≤-76dBm	
Receive Sensitivity (11g) @10% PER	- 6Mbps	PER ≤ -89dBm	≤-85dBm	
	- 54Mbps	PER ≤ -70dBm	≤-68dBm	
Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0	PER ≤ -88dBm	≤-85dBm	
	- MCS=7	PER ≤ -68dBm	≤-67dBm	
Receive Sensitivity (11n,40MHz) @10% PER	- MCS=0	PER ≤ -85dBm	≤-82dBm	
	- MCS=7	PER ≤ -65dBm	≤-64dBm	
Maximum Input Level	802.11b : -10 dBm			
	802.11g/n : -20 dBm			
Antenna Reference	Small antennas with 0~2 dBi peak gain			

2.2 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	Band 1 : 5180MHz-5240MHz; Band2:5260MHz~5320MHz Band3:5500MHz~5700MHz; Band 4 : 5745MHz-5825MHz		
Number of Channels	Band 1: 802.11a/802.11n(HT20)/802.11ac(HT20): 4, 802.11n(HT40)/802.11ac(HT40):2,802.11ac(HT80):1 Band2:802.11a/802.11n(HT20)/802.11ac(HT20):4, 802.11n(HT40)/802.11ac(HT40):2,802.11ac(HT80):1 Band3:802.11a/802.11n(HT20)/802.11ac(HT20):11, 802.11n(HT40)/802.11ac(HT40):5,802.11ac(HT80):3 Band4:802.11a/802.11(HT20)/802.11ac(HT20):5, 802.11n(HT40)/802.11ac(HT40): 2, 802.11ac(HT80): 1		
Output Power	802.11a /54Mbps : 16 dBm $\pm$ 1.5 dB @ EVM $\leq$ -25dB		
	802.11n /MCS7 : 15 dBm $\pm$ 1.5 dB @ EVM $\leq$ -28dB		
	802.11ac /MCS9 : 13 dBm $\pm$ 1.5 dB @ EVM $\leq$ -32dB		
	Other data rates output power are defined by driver's power by rates mechanism		
Test Items	Test Value		Standard Value
Receive Sensitivity (11a, 20MHz)@10% PER	- 6Mbps	PER $\leq$ -89dBm	$\leq$ -85dBm
	- 54Mbps	PER $\leq$ -70dBm	$\leq$ -68dBm
Receive Sensitivity (11n,20MHz)@10% PER	- MCS=0	PER $\leq$ -88dBm	$\leq$ -85dBm
	- MCS=7	PER $\leq$ -68dBm	$\leq$ -67dBm
Receive Sensitivity (11n,40MHz)@10% PER	- MCS=0	PER $\leq$ -85dBm	$\leq$ -85dBm
	- MCS=7	PER $\leq$ -65dBm	$\leq$ -65dBm
Receive Sensitivity (11ac,20MHz)@10% PER	- MCS=0	PER $\leq$ -86dBm	$\leq$ -83dBm
	- MCS=8	PER $\leq$ -63dBm	$\leq$ -60dBm
Receive Sensitivity (11ac,40MHz)@10% PER	- MCS=0	PER $\leq$ -83dBm	$\leq$ -80dBm
	- MCS=9	PER $\leq$ -59dBm	$\leq$ -55dBm
Receive Sensitivity (11ac,80MHz)@10% PER	- MCS=0	PER $\leq$ -82dBm	$\leq$ -79dBm
	- MCS=9	PER $\leq$ -56dBm	$\leq$ -54dBm
Maximum Input Level	802.11a/n : -30 dBm		
Antenna Reference	Small antennas with 0~2 dBi peak gain		

15GHz(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

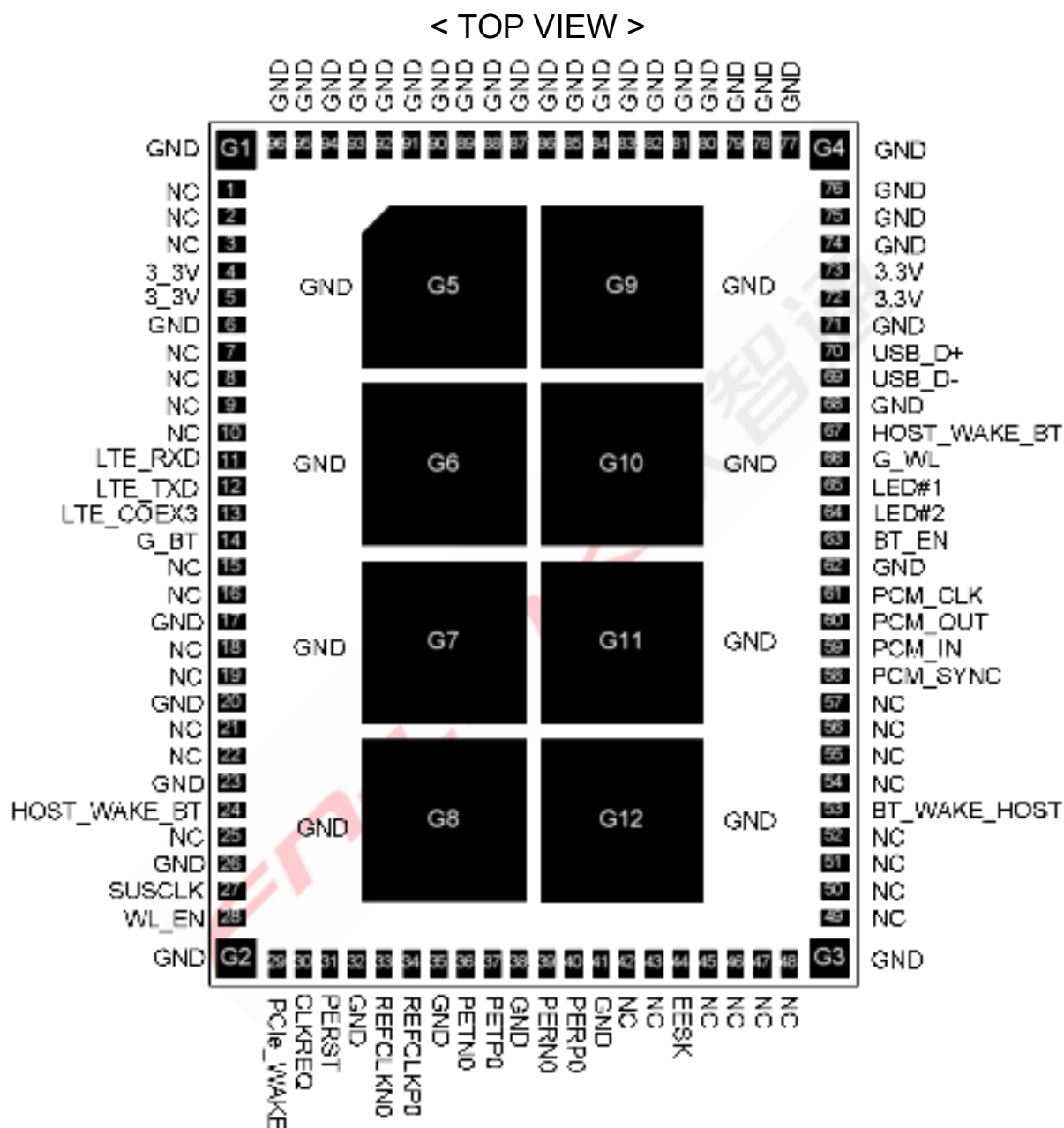
3 Bluetooth Specification

3.1 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, $\pi/4$ -DQPSK,8DPSK		
RF Specification			
	Min.	Typical.	Max.
Output Power		4 dBm	
Sensitivity @ BER=0.1% for GFSK (1Mbps)			-70 dBm
Sensitivity @ BER=0.01% for $\pi/4$ -DQPSK (2Mbps)			-70 dBm
Sensitivity @ BER=0.01% for 8DPSK (3Mbps)			-70 dBm
Maximum Input Level	GFSK (1Mbps):-20dBm		
	$\pi/4$ -DQPSK (2Mbps) :-20dBm		
	8DPSK (3Mbps) :-20dBm		

4 Pin Assignments

4.1 Pin Outline



4.2 Pin Definition

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_RXD	I	LTE coexist signal	3.3V
12	LTE_TXD	O	LTE coexist signal	3.3V
13	LTE_COEX3	I/O	LTE coexist signal	3.3V
14	G_BT/NC	—	G_BT or No connect, NC if not use, do not connect to GND	
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	SUSCLK	I	External sleep clock input(32.768KHz)	3.3V
28	WL_EN	—	WLAN enable pin, High: enable,Low:disable	3.3V
29	PCIe_WAKE	OD	PCIe wake up host	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 -	

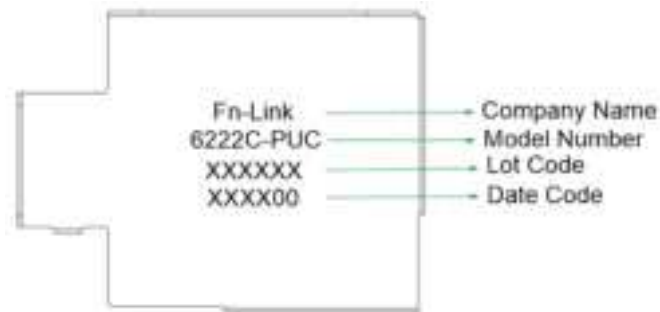
34	REFCLKP0	I	PCIe CLK Difference +	
35	GND	—	Ground connections	
36	PETN0	O	PCIe Data Out Difference -	
37	PETP0	O	PCIe Data Out Difference +	
38	GND	—	Ground connections	
39	PERN0	I	PCIe Data IN Difference -	
40	PERP0	I	PCIe Data IN Difference +	
41	GND	—	Ground connections	
42	NC	—	No connect	
43	NC	—	No connect	
44	EESK/NC	—	EESK or No connect, NC if not use, do not connect to GND	
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	G_WL/NC	—	G_WL or No connect, NC if not use, do not connect to GND	
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
74~96	GND	—	Ground connections	
G1-G12	GND	—	Ground connections	

P: POWER I: INPUT O: OUTPUT

5.3 Marking Description

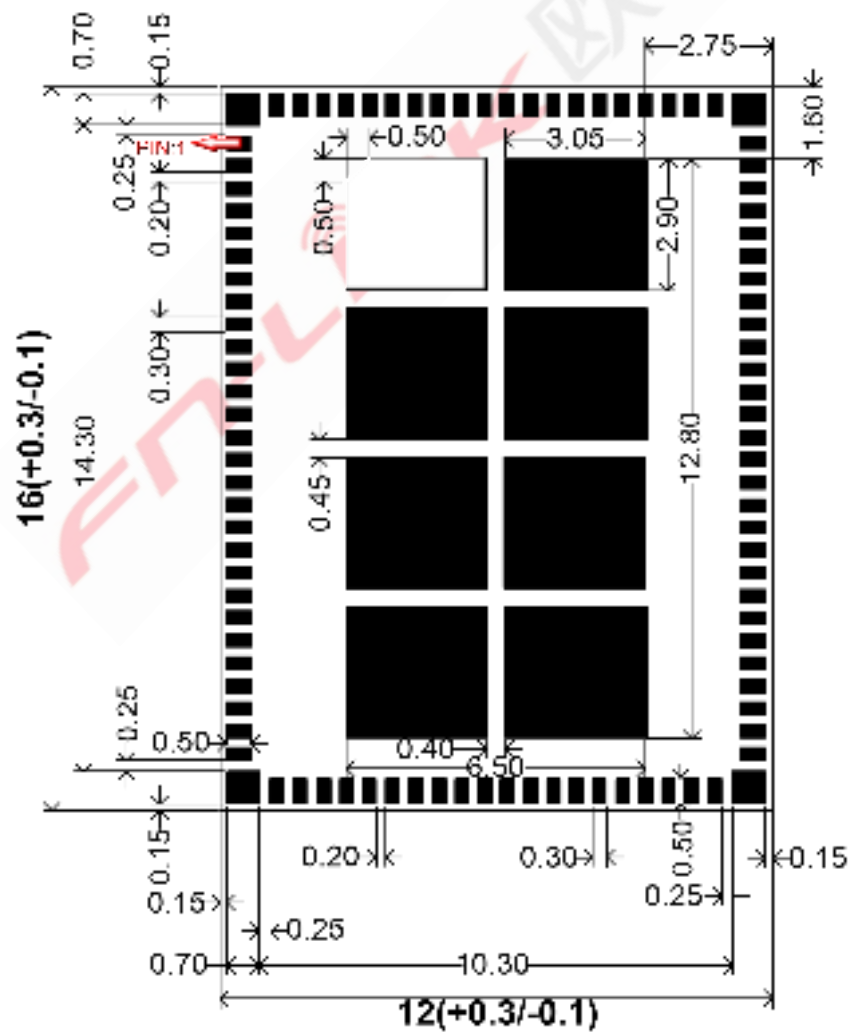
< TOP VIEW >



5.4 Module Physical Dimensions

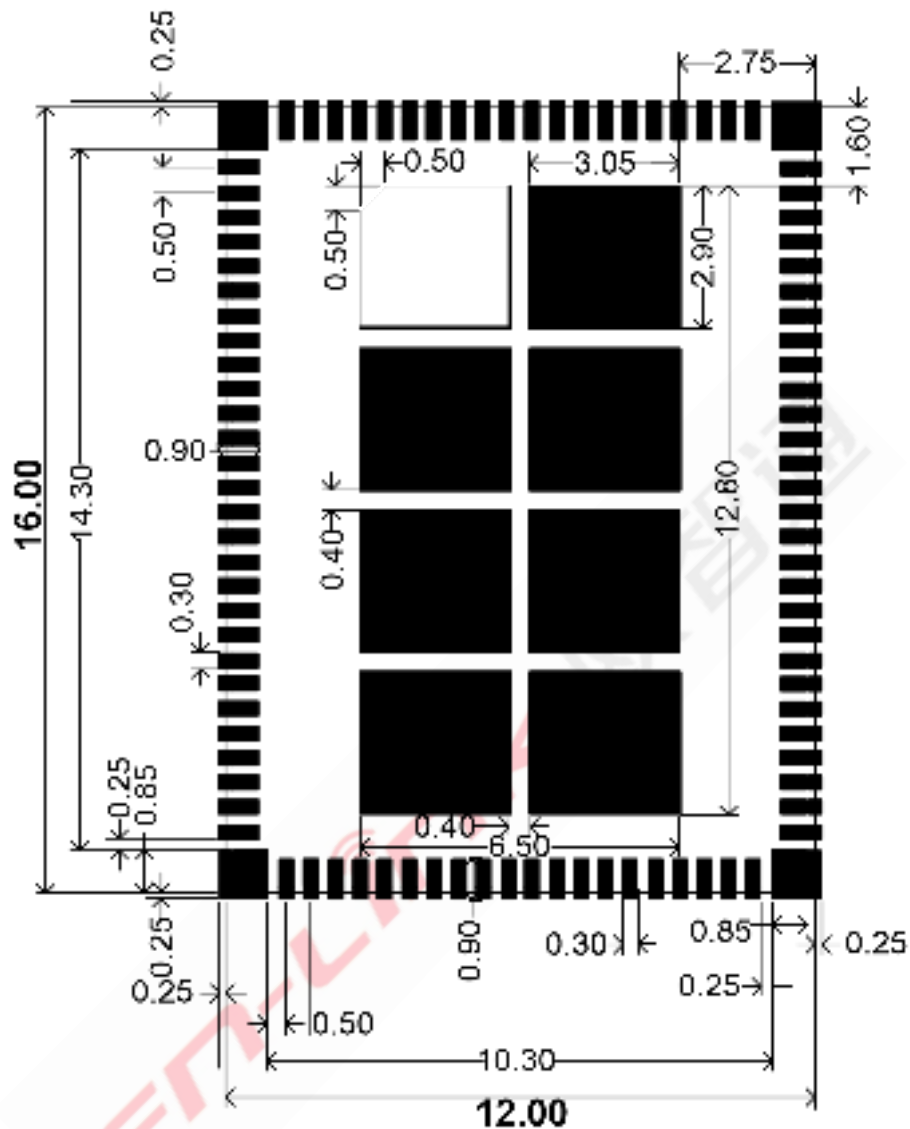
(Unit: mm)

< TOP VIEW >



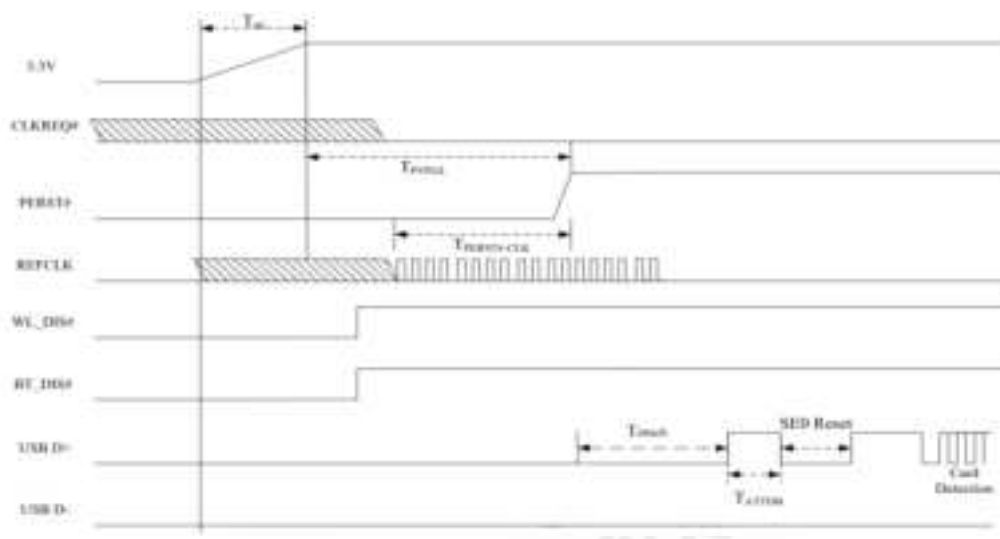
5.5 Layout Recommendation

(Unit: mm)



6 Host Interface Timing Diagram

6.1 PCIe Bus during Power On Sequence



T_{au} : The main power ramp up duration

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

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

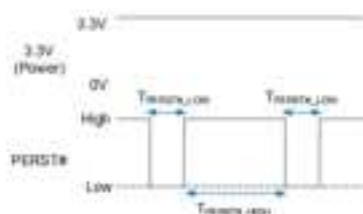
T_{attach} : The interval to turn on BT after PERST# de-asserted

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

$T_{SE0\ Reset}$: USB host send SE0 Reset duration

Symbol	Unit	Min	Typical	Max
T_{au}	ms	0.5	1.5	5
T_{PVGL}	ms	Implementation specific; recommended 50ms		—
$T_{PERST\#-CLK}$	us	100	—	—
T_{attach}	ms	0.5	2	5
T_{ATTB}	ms	100	—	—
$T_{SE0\ Reset}$	ms	10	—	—

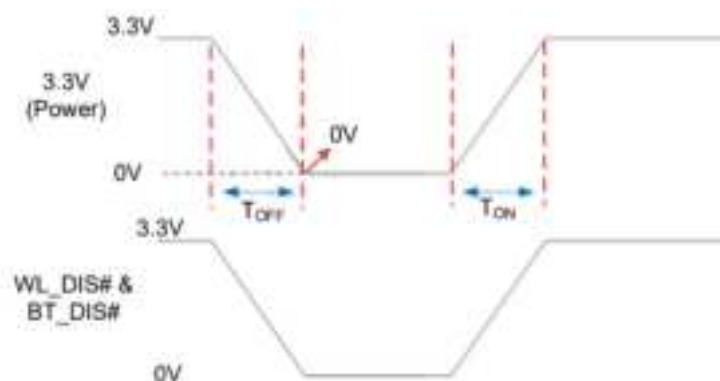
6.2 PCIe PERST# Timing Sequence



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

6.3 Power Off Sequence

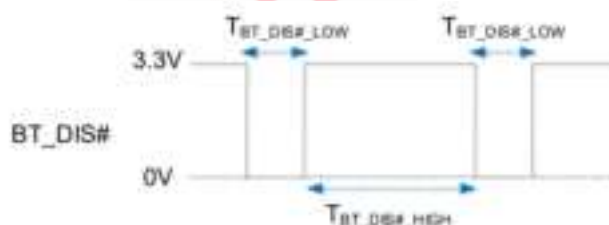


RTL8822CE-CG Power Off Timing Parameters

Symbol	Min	Typical	Max	Unit	Description
T_{off}	1.5ms	--	--	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,

6.4 BT_DIS Timing Sequence

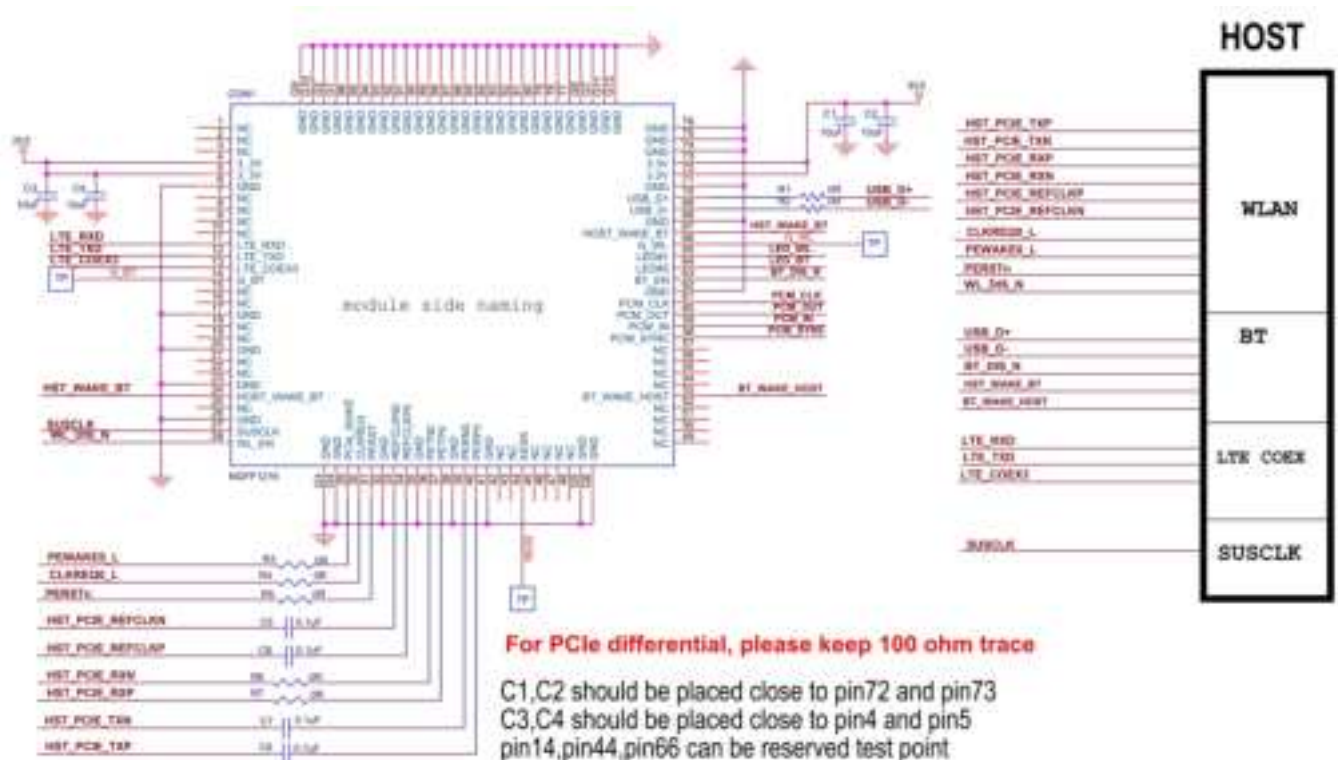


	Min	Typical	Max	Unit	Description
BT_DIS#_LOW	200	--	--	ms	BT_DIS# low duration
BT_DIS#_HIGH	500	--	--	ms	BT_DIS# high duration

6.5 Platform state transitions

3.3V Power range	3.3V Ripple	3.3V Noise	Rise time	
			Min	Max
+/-0.165V	300mVpp @ switching frequency > 100KHz		0.5ms	5ms

7 Reference Design



Note:

1. ANT_A, ANT_B are all support 2.4G/5G function, ANT_B is support Bluetooth also;
2. The module requires independent power supply, supply capacity $\geq 1000\text{mA}$ and ripple less than 150mV;
3. Do not share power with amplifier, camera, etc.

8 Ordering Information

Part No.	Description
FG6222CPUC-00	RTL8822CE-CG, a/b/g/n/ac, Wi-Fi+BT5.0, 2T2R, 12X16mm, PCIE+USB, PCB Version V1.0

9 The Key Material List

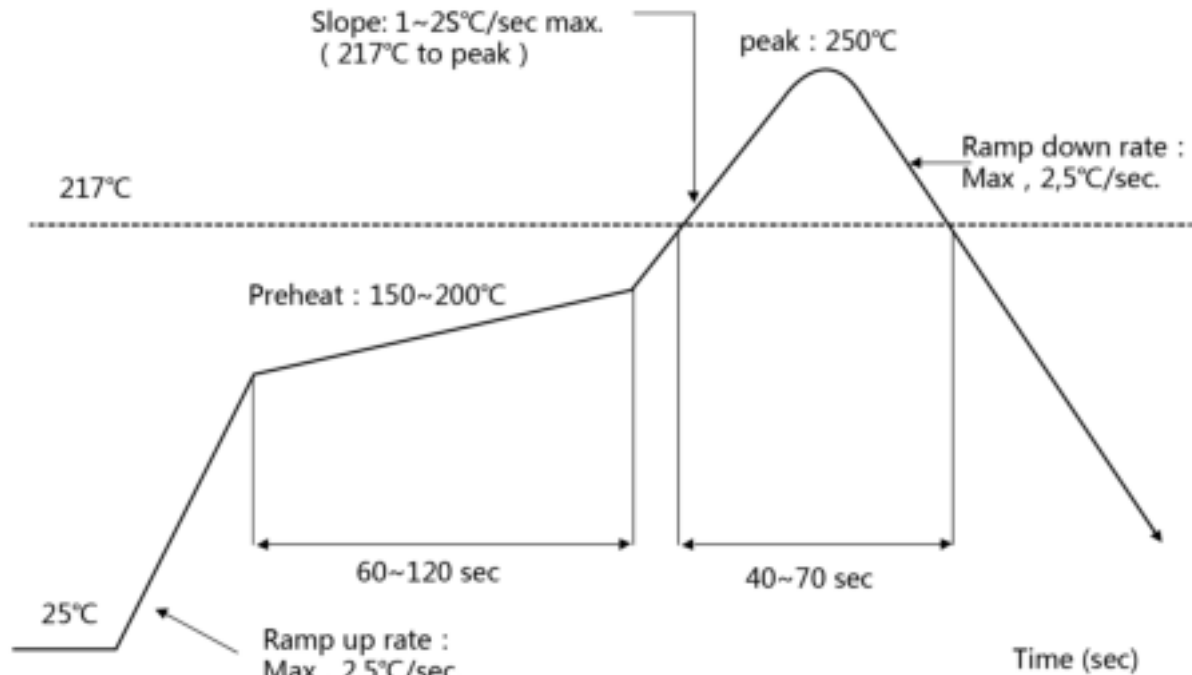
Item	Part Name	Description	Manufacturer
1	Inductor	2016 2.2UH $\pm 20\%$,	Sunlord, Ceaiya, Cenker
2	Diplexer	1608 Dual-band, dual-mode 2.4GHz/5GHz WLAN	Glead, Walsin, ACX, Murata, MAG.LAYERS
3	Crystal	1612 40MHz 12pF $\pm 10\text{ppm}$	ECEC, TKD, Hosonic, JWT, TXC
4	Chipset	RTL8822CE-CG	Realtek
5	PCB	6222C-PUC 12X16X0.5mm TG180	Brain-power, KX-pc, Sunlord, Piotek
6	Shielding Cover	6222C-PUC V1.0 Shielding cover	Suntech, JLitong

10 Recommended Reflow Profile

Referred to IPC/JEDEC standard.

Peak Temperature : $<250^{\circ}\text{C}$

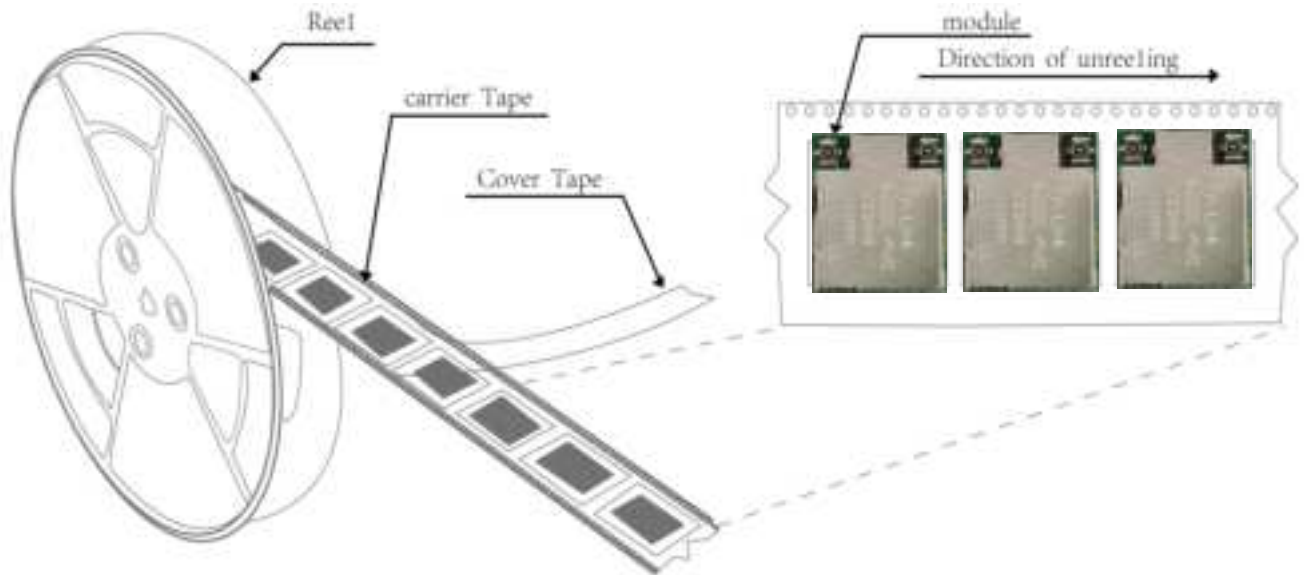
Number of Times : ≤ 2 times



11 Package Information

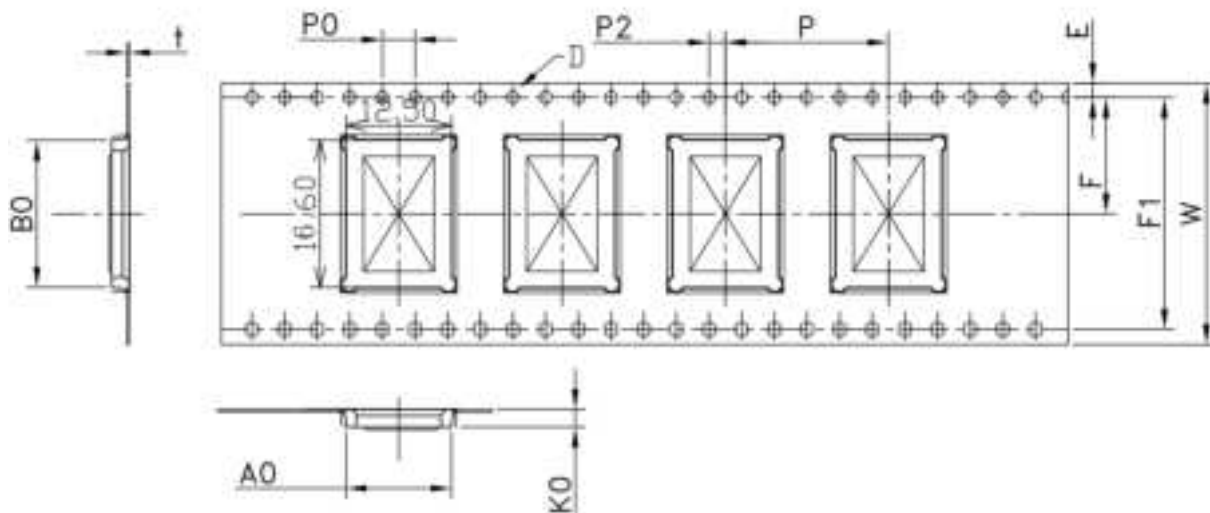
11.1 Reel

A roll of 2000pcs

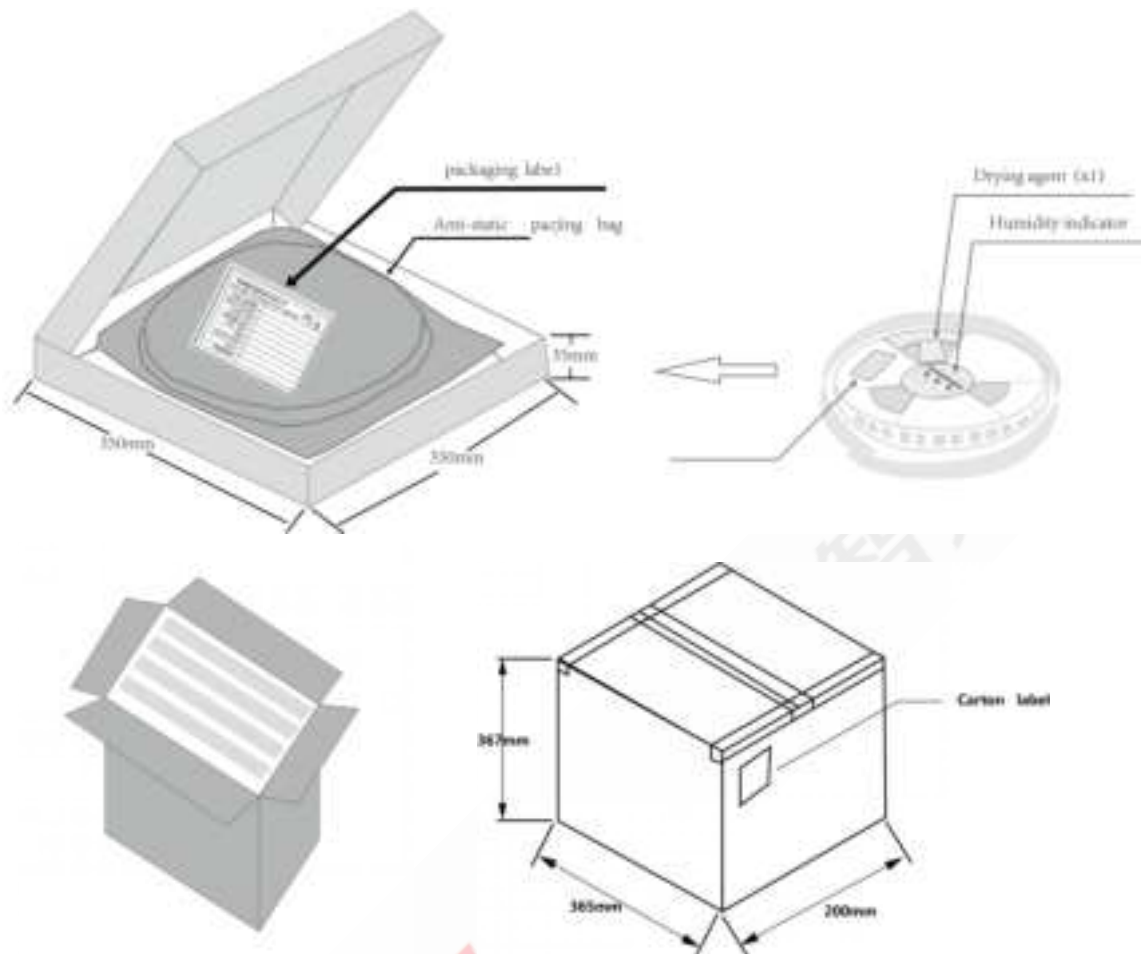


11.2 Carrier Tape Detail

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	$\begin{smallmatrix} +0.3 \\ -0.3 \end{smallmatrix}$	± 0.18	± 0.18	$\begin{smallmatrix} +0.1 \\ -0.0 \end{smallmatrix}$	± 0.1	± 0.15	± 0.10	± 0.10	± 0.1	± 0.15	± 0.1	± 0.05



11.3 Packaging Detail



11.4 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:

- Calculated shelf life in sealed bag: 12 months at $<40^{\circ}\text{C}$ and $<90\%$ relative humidity (RH).
- Environmental condition during the production: 30°C / 60% RH according to IPC/JEDEC J-STD-033A paragraph 5.
- The maximum time between the opening of the sealed bag and the reflow process must be 168 hours if condition
- "IPC/JEDEC J-STD-033A paragraph 5.2" is respected
- Baking is required if conditions b) or c) are not respected
- Baking is required if the humidity indicator inside the bag indicates 10% RH or more

FCC Statement

FCC standards: FCC CFR Title 47 Part 15 Subpart C Section 15.247

FPC Antenna , Antenna gain 2.35dBi

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. Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. Note: 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. FCC Radiation Exposure Statement This modular complies with FCC RF radiation exposure limits set forth for an uncontrolled environment. This transmitter must not be co-located or operating in conjunction with any other antenna or transmitter. If the FCC identification number is not visible when the module is installed inside another device, then the outside of the device into which the module is installed must also display a label referring to the enclosed module. This exterior label can use wording such as the following: “ Contains Transmitter Module FCC ID: 2AATL-6222C-PUC Or Contains FCC ID: 2AATL-6222C-PUC ” When the module is installed inside another device, the user manual of the host must contain below warning statements;

1. This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:
2. (1) This device may not cause harmful interference; (2) This device must accept any interference received, including interference that may cause undesired operation. Note: 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 radiofrequency 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.

2. Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment. The devices must be installed and used in strict accordance with the manufacturer's instructions as described in the user documentation that comes with the product. Any company of the host device which install this modular with modular approval should perform the test of radiated & conducted emission and spurious emission, etc. according to FCC part 15C : 15.247 and 15.209 & 15.207 , 15B Class B requirement, Only if the test result comply with FCC part 15C : 15.247 and 15.209 & 15.207 , 15B Class B requirement, then the host can be sold legally.