PRODUCT SPECIFICATION

6220N-IS

Wi-Fi Dual-band 1x1 802.11a/b/g/n +BLE5.0

IOT Module Datasheet

Version:v6.3

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

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6220N-IS Module Datasheet

	Part NO.	Description
Ordering Information	FG6220NISX-00	RTL8720CS-VA1, b/g/n, Wi-Fi+BLE5.0, 1T1R, UART, PCB ANT, 29*20 mm
	FG6220NISX-01	RTL8720CS-VA1, b/g/n, Wi-Fi+BLE5.0, 1T1R, UART, PCB ANT, 29*20 mm

Revision History

Version	Date	Revision Content	Draft	Approved
1.0	2019/07/11	Initial release	Lgp	Stone
2.0	2019/09/17	Update figure 1-1; Update operating temperature; Update reference schematic; Add flash and PCB in key material list; Update package information; Correct typing error	Lgp	Stone
3.0	2019/11/11	Update operating temperature; Update key material list; Update logo; Add BLE power consumption	Lgp	Stone
4.0	2019/11/25	Add certification information; Update BLE typical output power; Update package information; Update crystal description	Lgp	Stone
5.0	2020/04/14	Add new footprint module information and part number	Lgp	Stone
6.0	2023/08/02	Modify the frequency band range Modify the output power Increase the antenna clearance area	Lxp	Zzq
6.1	2023/08/17	Delete Recommended Reflow Profile	Lxp	Lxy
6.2	2024/08/14	Add Certificate No	Lxp	Lxy
6.3	2024/11/05	Update -01 Marking Description	Lxp	Lxy

CONTENTS

1 Overview

1.1 Introduction

6220N-IS is a highly integrated IoT module with low power 802.11b/g/n Wireless LAN (WLAN) and Bluetooth Low Energy communication controller. It combines a high-performance KM4 MCU, a low power KM0 MCU, WLAN (802.11 b/g/n) MAC, a 1T1R capable WLAN baseband, RF, Bluetooth. It also provides a bunch of configurable GPIOs which are configured as digital peripherals for different applications and control usage.

6220N-IS integrates internal memories for complete Wi-Fi protocol functions. The embedded memory configuration also provides simple application developments.

1.2 Features

Wi-Fi General

- 802.11b/g/n compatible WLAN
- 150Mbps transmit and receive PHY rate using 40MHz bandwidth
- Compatible with 802.11n specification
- Backward compatible with 802.11b/g devices while operating in 802.11n mode

Wi-Fi Standards Supported

- 802.11b/g/n compatible WLAN
- 802.11e QoS Enhancement (WMM)
- 802.11i (WPA, WP2). Open, shared key, and pair-wise key authentication services
- Wi-Fi Direct support

WLAN PHY Features

- 802.11n OFDM
- One Transmit and one Receive path(1T1R)
- 40MHz bandwidth transmission
- DSSS with DBPSK and DQPSK, CCK modulation with long and short preamble

Bluetooth Features

- Supports Bluetooth 5.0 Low Energy (BLE)

Host Interface

- UART
- I2C
- GPIO

1.3 General specification

Model Name	6220N-IS
Main Chipset	Realtek RTL8720CS
Host Interface	UART, I2C, GPIO
Wi-Fi Standards	802.11b/g/n
Bluetooth	BLE5.0
Dimension	L x W x H: 29.00mm*20.00mm*3.60mm
RoHS	All hardware components are fully compliant with EU RoHS directive

1.4 Operating Conditions

Operating Voltage	3.3±0.3 Vdc
Operating Temperature	-30°C to +65°C
Storage Temperature	-40°C to +125°C

2 Wi-Fi RF Specification

2.1 2.4GHz RF Specification

Feature	Description			
WLAN Standard	IEEE 802.11 b/g/n Wi-Fi compliant			
Frequency Range	2.400~2.4835GHz			
Number of Channels	**Wi-Fi:** USA/Canada: channel 1~11; Europe/China/Australia: channel 1~13; Japan: channel 1~14			
Spectrum Mask	Min. b/g/n	Typ. b/g/n	Max. b/g/n	Unit b/g/n
1st side lobes(to fc ± 11MHZ)	-	-43/-30/-40	-	dBr
2st side lobes(to fc ± 22MHZ)	-	-52/-33/-58	-	dBr
Freq. Tolerance	-20/-20/-20	-	20/20/20	ppm

Test Items	Typical Value	EVM
Output Power	802.11b /11Mbps : 17dBm ± 1.5 dB	EVM ≤ -10dB
	802.11g /54Mbps : 15dBm ± 1.5 dB	EVM ≤ -25dB
	802.11n /MCS7 : 14dBm ± 1.5 dB	EVM ≤ -28dB

Test Items	Test Value		Standard Value
SISO Receive Sensitivity (11b,20MHz) @8% PER	- 1Mbps	PER @ -94 dBm	≤-83 dBm
	- 2Mbps	PER @ -92 dBm	≤-80 dBm
	- 5.5Mbps	PER @ -89 dBm	≤-79 dBm
	- 11Mbps	PER @ -87 dBm	≤-76 dBm
SISO Receive Sensitivity (11g,20MHz) @10% PER	- 6Mbps	PER @ -89 dBm	≤-85 dBm
	- 9Mbps	PER @ -88 dBm	≤-84 dBm
	- 12Mbps	PER @ -87 dBm	≤-82 dBm
	- 18Mbps	PER @ -86 dBm	≤-80 dBm
	- 24Mbps	PER @ -84 dBm	≤-77 dBm
	- 36Mbps	PER @ -80 dBm	≤-73 dBm
	- 48Mbps	PER @ -77 dBm	≤-69 dBm
	- 54Mbps	PER @ -75 dBm	≤-68 dBm
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0	PER @ -89 dBm	≤-85 dBm
	- MCS=1	PER @ -86 dBm	≤-82 dBm
	- MCS=2	PER @ -84 dBm	≤-80 dBm
	- MCS=3	PER @ -82 dBm	≤-77 dBm

	- MCS=4	PER @ -79 dBm	≤-73 dBm
	- MCS=5	PER @ -76 dBm	≤-69 dBm
	- MCS=6	PER @ -74 dBm	≤-68 dBm
	- MCS=7	PER @ -72 dBm	≤-67 dBm
SISO Receive Sensitivity (11n ,40MHz) @10% PER	- MCS=0	PER @ -89 dBm	≤-82 dBm
	- MCS=1	PER @ -86 dBm	≤-79 dBm
	- MCS=2	PER @ -83 dBm	≤-77 dBm
	- MCS=3	PER @ -80 dBm	≤-74 dBm
	- MCS=4	PER @ -77 dBm	≤-70 dBm
	- MCS=5	PER @ -74 dBm	≤-66 dBm
	- MCS=6	PER @ -72 dBm	≤-65 dBm
	- MCS=7	PER @ -70 dBm	≤-64 dBm
Maximum Input Level	802.11b: -10 dBm		
	802.11g/n: -20 dBm		
Antenna Reference	PCB antenna with 0~2 dBi peak gain		

3 Bluetooth Specification

Feature	Description
General Specification	
Bluetooth Standard	BLE 5.0
Host Interface	UART
Frequency Band	2400 MHz ~ 2483.5 MHz
Number of Channels	40 channels for BLE
Modulation	GFSK
RF Specification	

	Min.	Typical.	Max.
Output Power	1	4dBm	7
Sensitivity @ BER=0.1% for GFSK (1Mbps)		TBD	
Sensitivity @ BER=0.01% for π/4-DQPSK (2Mbps)		TBD	
Maximum Input Level		-10 dBm	
Sensitive @PER=30.8%		-90 dBm	

4 Power Consumption

Power consumption current Test condition: Power supply @3.3Vdc	Wi-Fi only: TX (typical): 19 dBm @1Mbps 240mA 17 dBm @11Mbps 226mA 15 dBm @54Mbps 164mA 14 dBm @HT20 MCS7 159mA 14 dBm @HT40 MCS7 136mA RX (typical): 58mA
	BLE only: TX (typical): 6dBm @1Mbps 103mA RX (typical):52mA
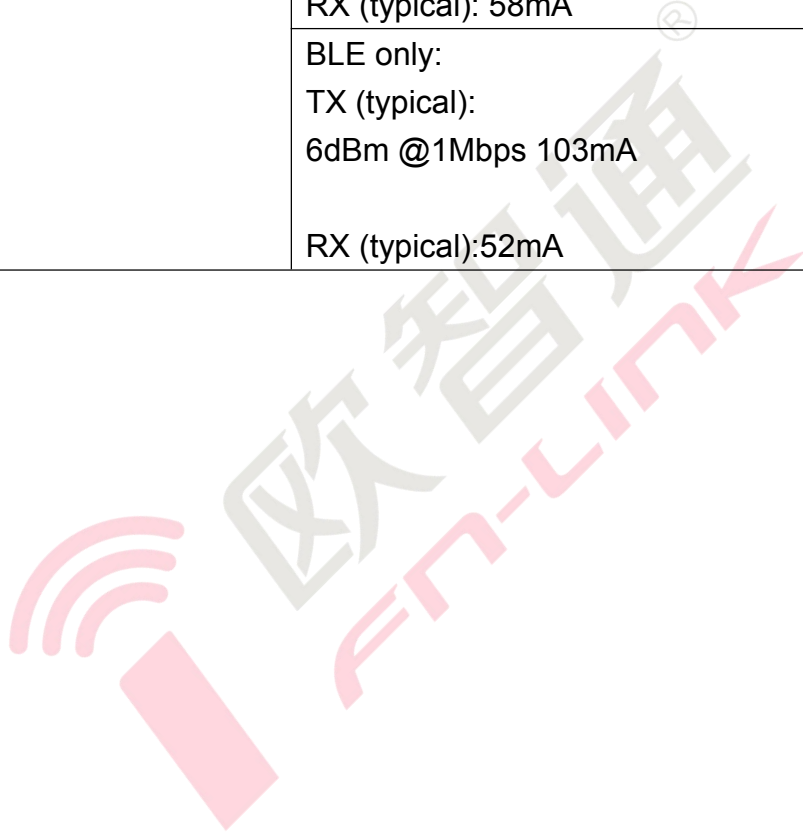
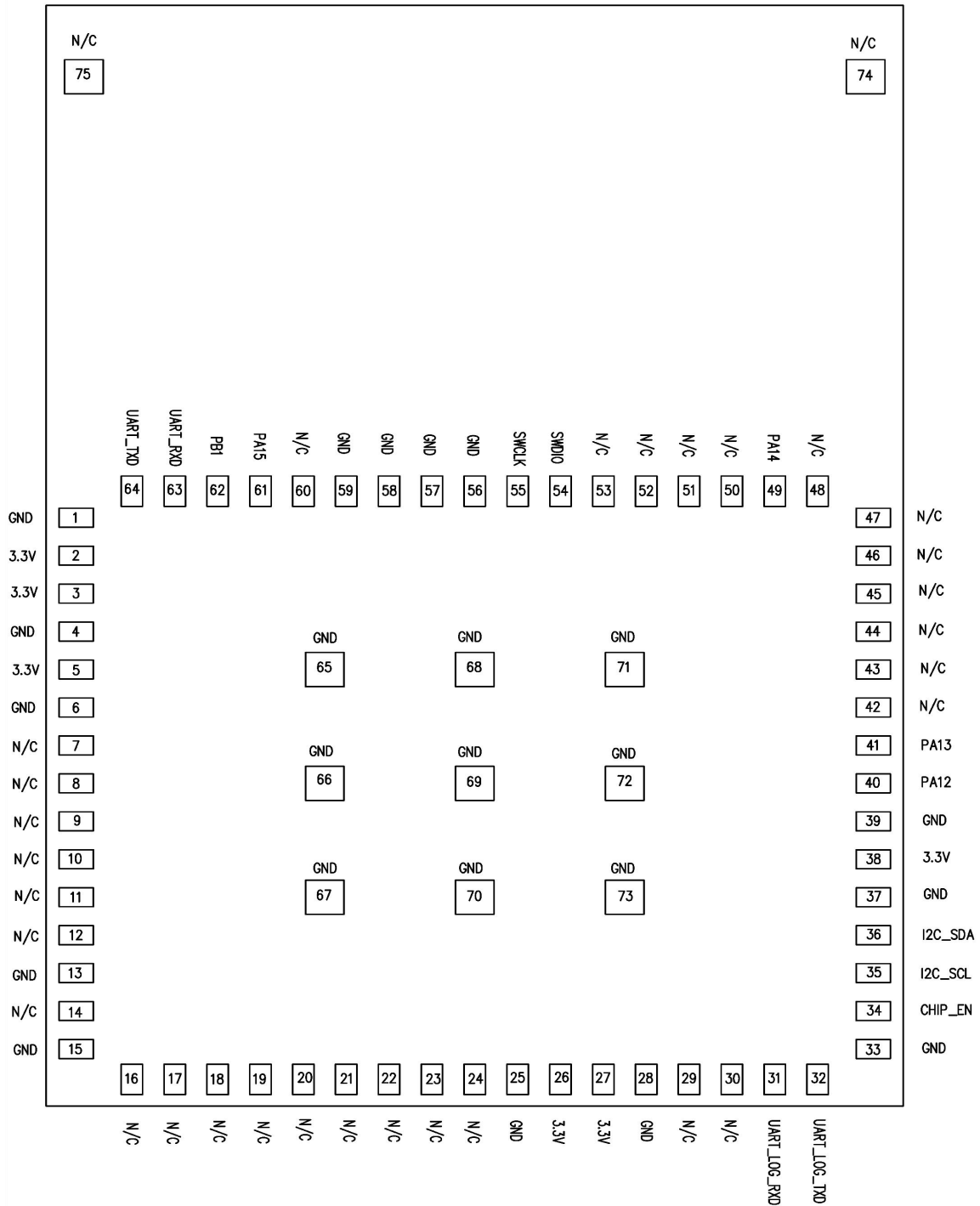# 5 Pin Assignments

5.1 Pin outline
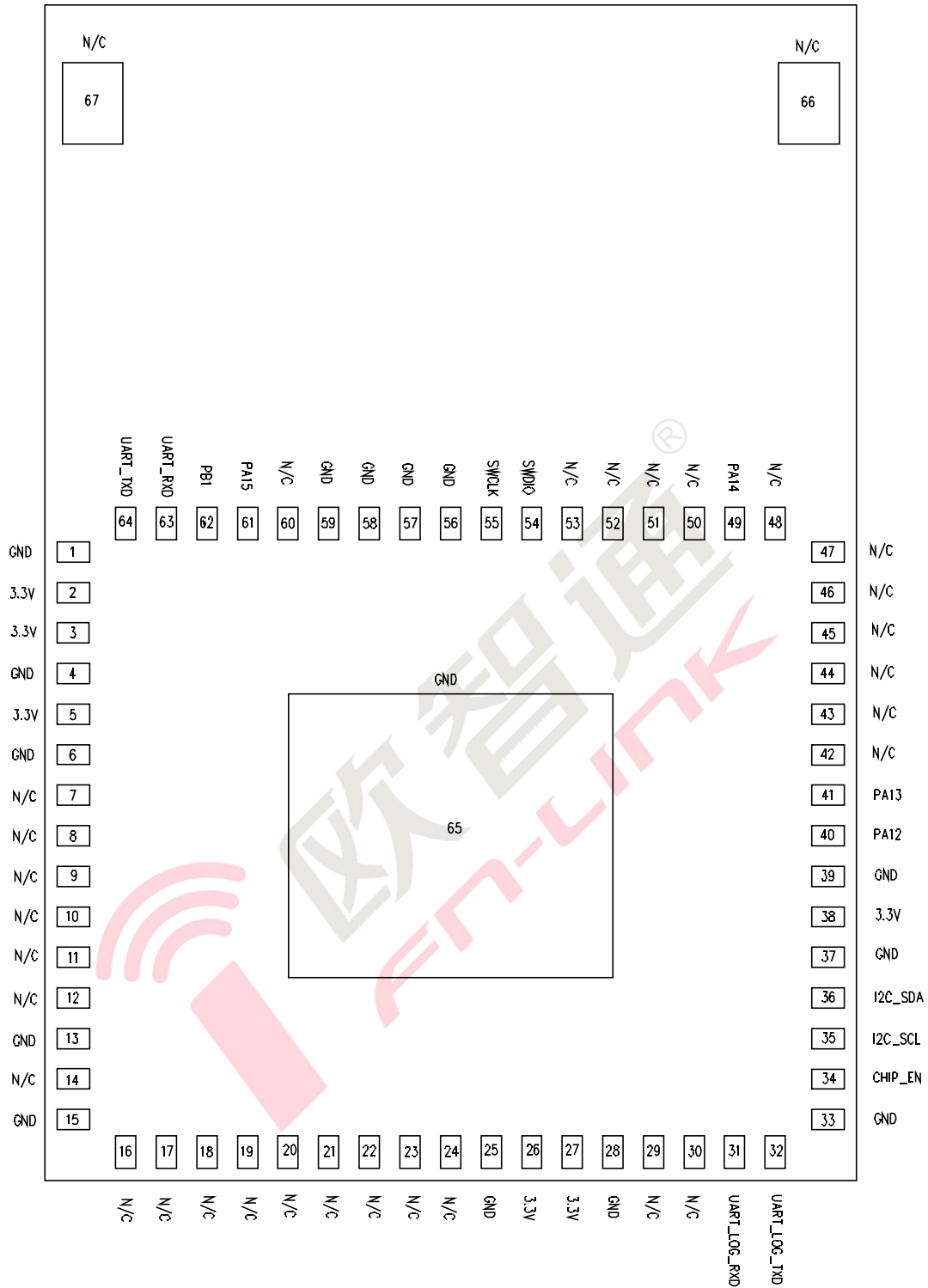
< TOP VIEW >

Figure 5-1 Pin Outline (FG6220NISX-00)

Figure 5-2 Pin Outline FG6220NISX-01

5.2 Pin Definition

Pin#		Name	Type	Description	Voltage
FG6220N ISX-00	FG6220N ISX-01				
1	1	GND		Ground connections	
2	2	3.3V	P	3.3V±10% input	3.3V
3	3	3.3V	P	3.3V±10% input	3.3V
4	4	GND		Ground connections	
5	5	3.3V	P	3.3V±10% input	3.3V
6	6	GND		Ground connections	
7	7	N/C		Not connected	
8	8	N/C		Not connected	
9	9	N/C		Not connected	
10	10	N/C		Not connected	
11	11	N/C		Not connected	
12	12	N/C		Not connected	
13	13	GND		Ground connections	
14	14	N/C		Not connected	
15	15	GND		Ground connections	
16	16	N/C		Not connected	
17	17	N/C		Not connected	
18	18	N/C		Not connected	
19	19	N/C		Not connected	
20	20	N/C		Not connected	
21	21	N/C		Not connected	
22	22	N/C		Not connected	
23	23	N/C		Not connected	
24	24	N/C		Not connected	
25	25	GND		Ground connections	
26	26	3.3V	P	3.3V±10% input	3.3V
27	27	3.3V	P	3.3V±10% input	3.3V
28	28	GND		Ground connections	
29	29	N/C		Not connected	
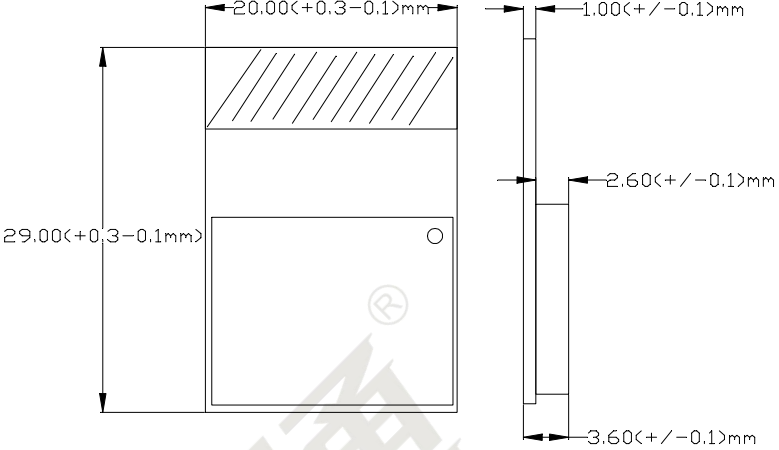
30	30	N/C		Not connected	
31	31	UART_LOG_RXD	I	Log UART RXD	
32	32	UART_LOG_TXD	O	Log UART TXD	
33	33	GND		Ground connections	
34	34	CHIP_EN	I	Enable chip 1: Enable chip 0: Shut down chip Default pull high internal	3.3V
35	35	I2C_SCL	I/O	I2C Clock	
36	36	I2C_SDA	I/O	I2C Data	
37	37	GND		Ground connections	
38	38	3.3V	P	3.3V±10% input	3.3V
39	39	GND		Ground connections	
40	40	PA12	I/O	General Purpose Input/Output	
41	41	PA13	I/O	General Purpose Input/Output	
42	42	N/C		Not connected	
43	43	N/C		Not connected	
44	44	N/C		Not connected	
45	45	N/C		Not connected	
46	46	N/C		Not connected	
47	47	N/C		Not connected	
48	48	N/C		Not connected	
49	49	PA14	I/O	General Purpose Input/Output	
50	50	N/C		Not connected	
51	51	N/C		Not connected	
52	52	N/C		Not connected	
53	53	N/C		Not connected	
54	54	SWDIO	I/O	Serial Wire Debug interface; data	
55	55	SWCLK	I/O	Serial Wire Debug interface; clock	
56	56	GND		Ground connections	
57	57	GND		Ground connections	
58	58	GND		Ground connections	
59	59	GND		Ground connections	

60	60	N/C		Not connected	
61	61	PA15	I/O	General Purpose Input/Output	
62	62	PB1	I/O	General Purpose Input/Output	
63	63	UART_RXD	I	Communication UART RXD	
64	64	UART_TXD	O	Communication UART TXD	
65	65	GND		Ground connections	
66	/	GND		Ground connections	
67	/	GND		Ground connections	
68	/	GND		Ground connections	
69	/	GND		Ground connections	
70	/	GND		Ground connections	
71	/	GND		Ground connections	
72	/	GND		Ground connections	
73	/	GND		Ground connections	
74	66	N/C		Not connected	
75	67	N/C		Not connected	

P:POWER   I:INPUT   O:OUTPUT

6 Dimensions

6.1 Module Picture

L x W: 29 x 20 (+0.3-0.1) mm	
H: 3.6 (±0.1) mm	
Weight	2.40(±0.1) g

6.2 Marking Description

备注：

二维码内容：112233445566;FG6220NISX-01

1. Fn-Link 商标 logo
2. 机型：6220N-IS
3. 二维码："wifi mac 地址;成品料号"

例如：112233445566;FG6220NISX-01（MAC 地址以实际为准）

-----BT MAC 在 WIFI MAC 基础上+1（WIFI 地址需跳 1，不能与 BT 地址重复），二维码中不显示此内容。

4. V/N　01(V/N 到 01 之间是两个空格，01 为成品料号后缀，与二维码右对齐。

6.3 List of certified information

Certification project	Certificate number
SRRC	TBD
FCC	2AATL-6220N-IS
CE	TBD
IC	TBD
NCC	TBD
KCC	TBD
TELEC	TBD
Brazil	TBD
Argentina	TBD
Japan	TBD
BQB	WFA93321

6.3 Physical Dimensions

(unit: mm)

< TOP VIEW >
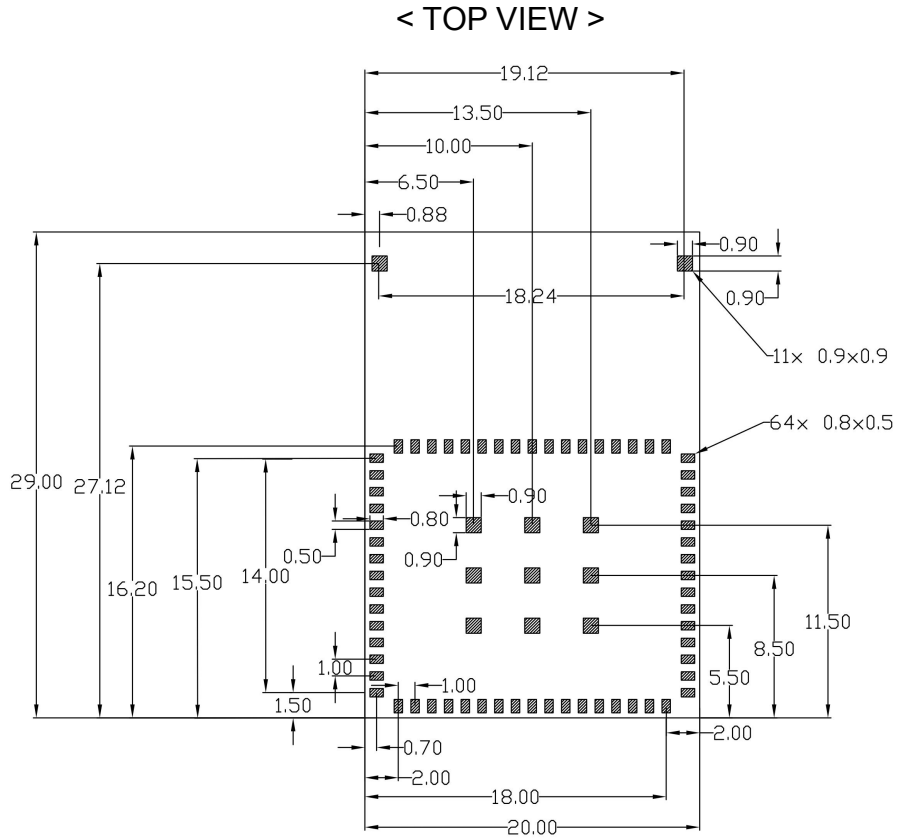
Figure 6-1 Physical Dimensions (FG6220NISX-00)

< TOP VIEW >
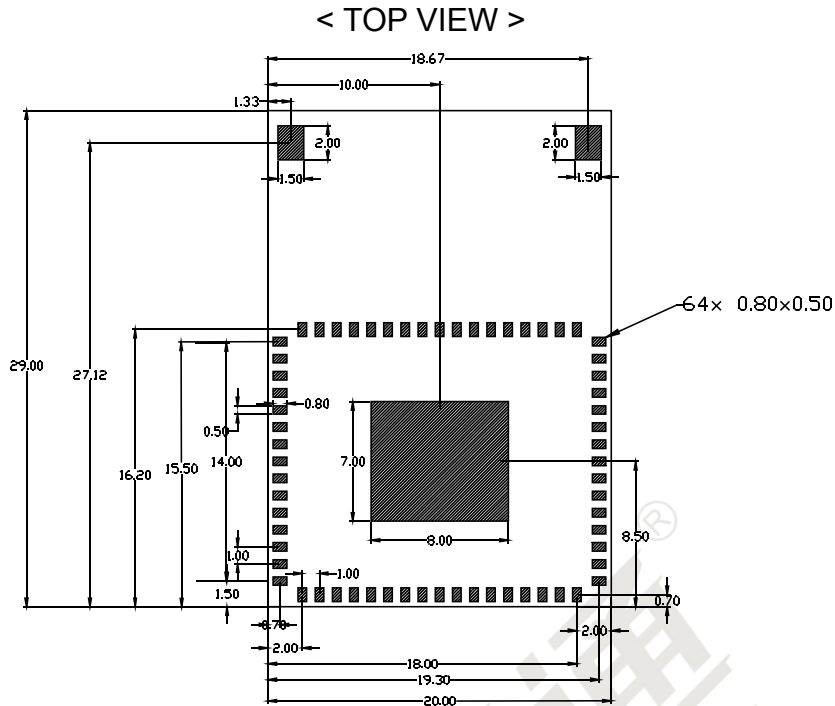
Figure 6-2 Physical Dimensions (FG6220NISX-01)
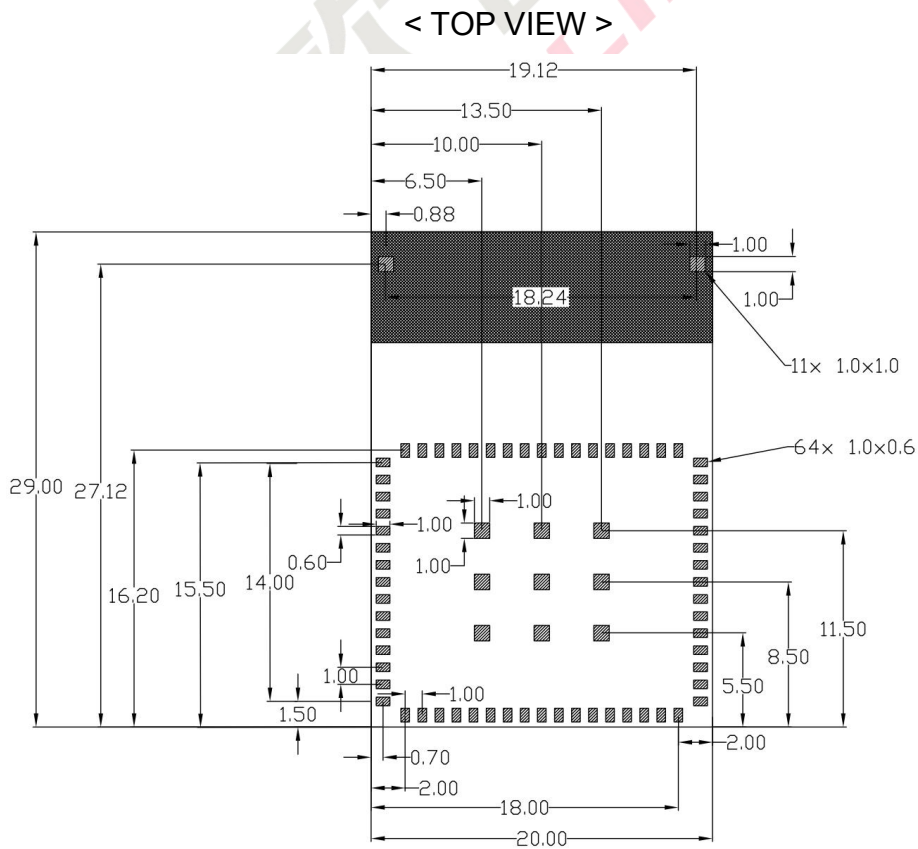
6.4 Layout Recommendation

(unit: mm)

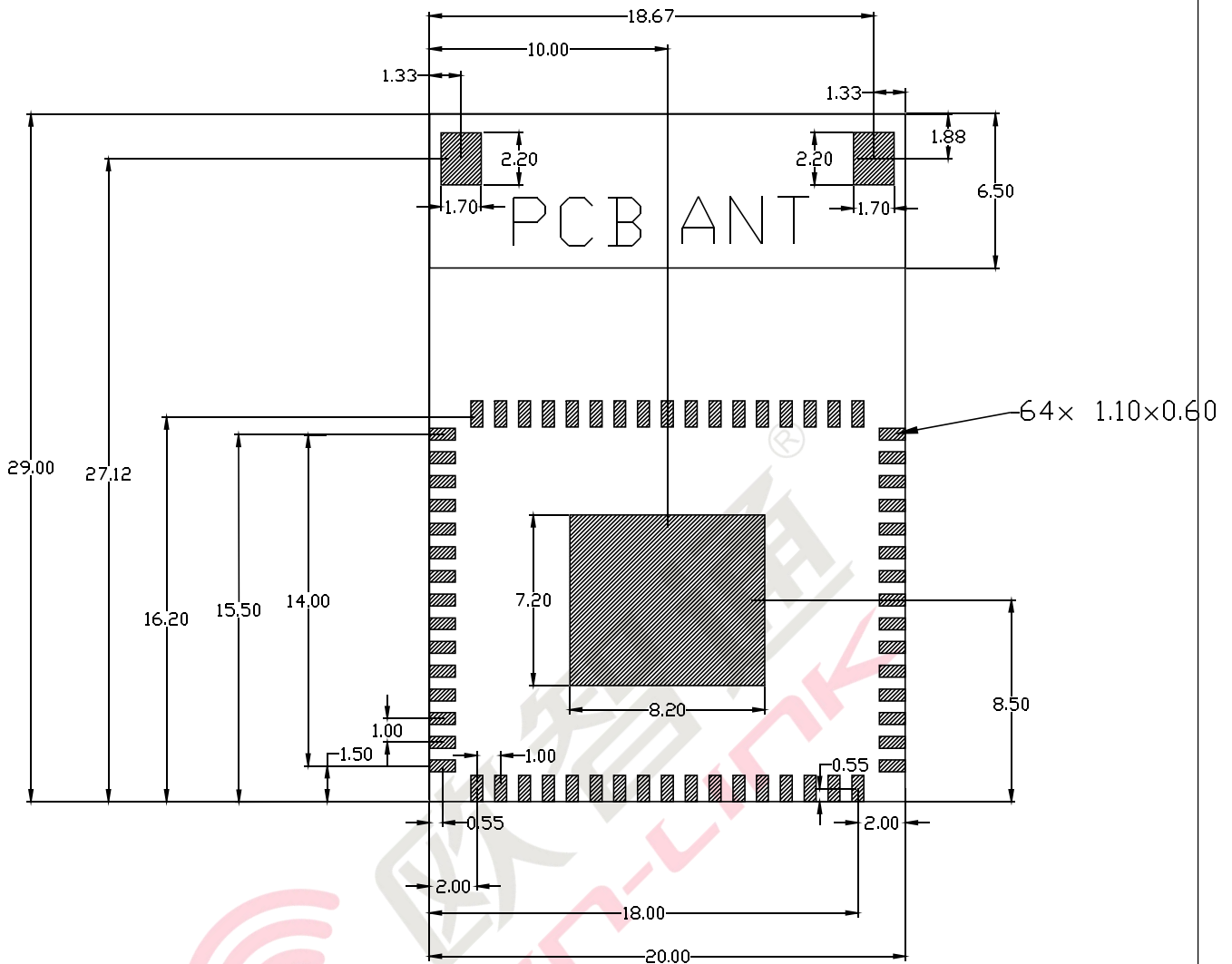< TOP VIEW >

Figure 6-3 Layout recommendation(FG6220NISX-00)

Figure 6-4 Layout recommendation(FG6220NISX-01)

6.5 Antenna clearance area requirements

When using PCB antenna on Wi-Fi module, make sure the distance between PCB on motherboard and other metal devices is at least 16mm.The shaded areas in the figure below need to be marked away from metal devices, sensors, interference sources, and other materials that may interfere with the signal.
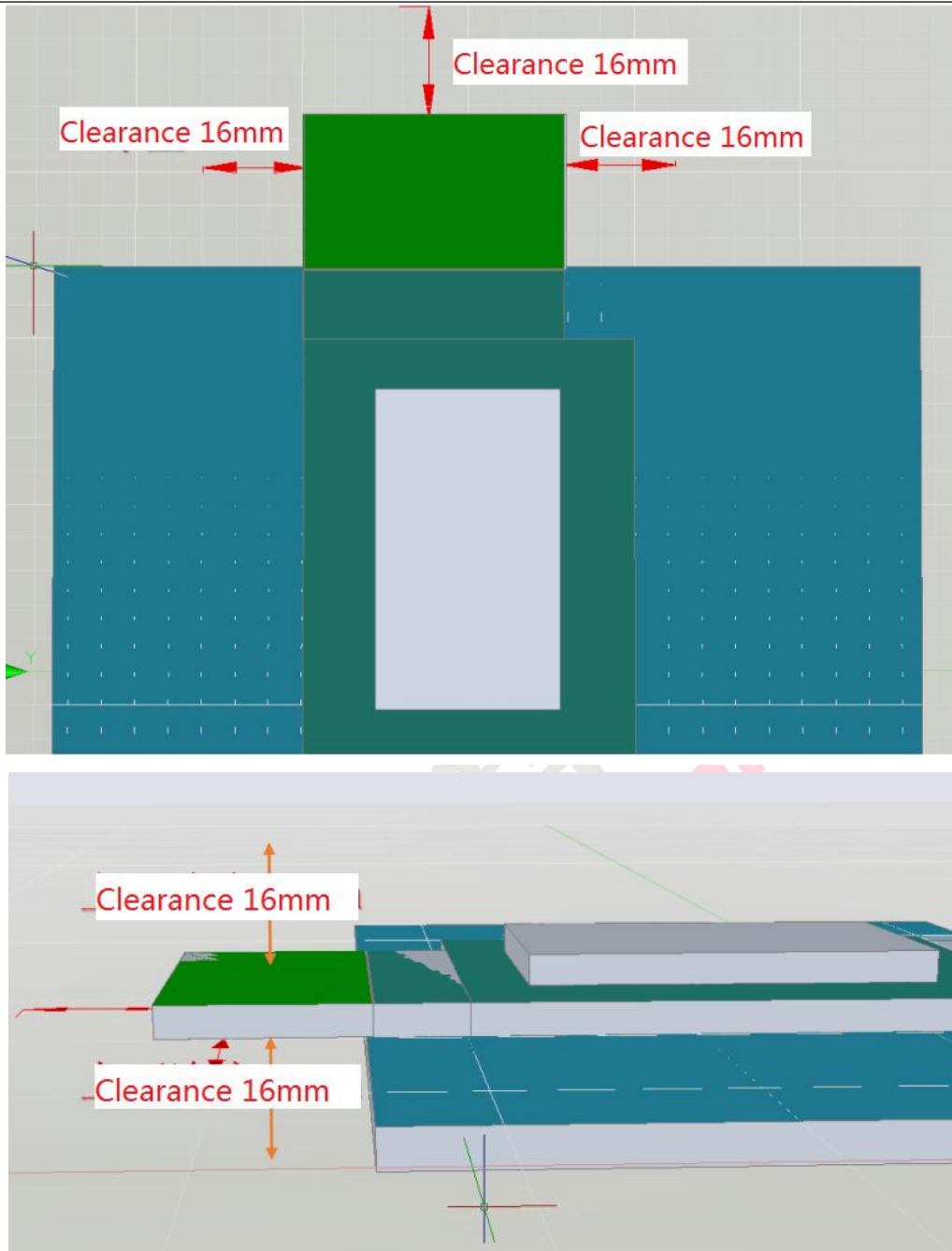
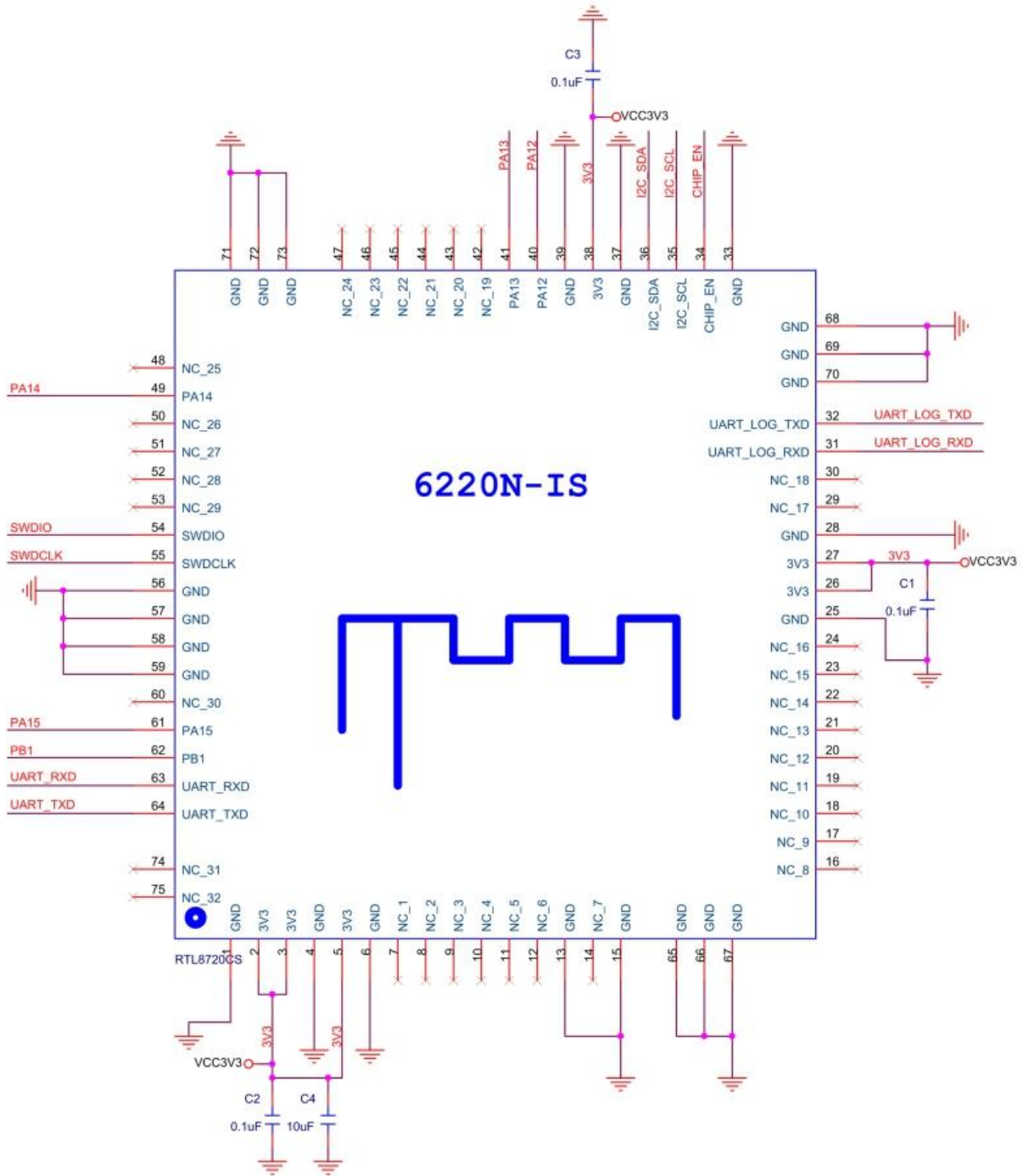Figure 6-2 Antenna clearance reference

7 Reference Design

Figure 7-1 Reference schematic design

Note: The reference schematic is based on FG6220NISX-00, for FG6220NISX-01, please refer to the pin definition for schematic design.

8 The Key Material List

FG6220NISX-00

Main	Shielding Cover	6220N-IS Shielding cover (material: copper)
Main	Crystal	2520 40MHz 12PF, 15ppm(-30°C-85°C) Q40000E098 (ECEC)
Main	Chipset	RTL8720CS-VA1, QFN-48 (Realtek)
Main	PCB	6220N-IS-V1.0 GREEN PCB, FR4, 4 LAYER, 29*20mm, T=1.0mm, ENIG
Main	Flash	8MB GD25Q64CSIG, SOP8, 208MIL (GigaDevice)
Alternative	Flash	8MB MX25L6433FM2I-08G, SOP8, 209mil (MXIC)

FG6220NISX-01

Main	Shielding Cover	6220N-IS Shielding cover (material: copper)
Main	Crystal	2520 40MHz 12PF, 15ppm(-30°C-85°C) Q40000E098 (ECEC)
Main	Chipset	RTL8720CS-VA1, QFN-48 (Realtek)
Main	PCB	6220N-IS-V2.0 GREEN PCB, FR4, 4 LAYER, 29*20mm, T=1.0mm, ENIG
Main	Flash	8MB GD25Q64CSIG, SOP8, 208MIL (GigaDevice)
Alternative	Flash	8MB MX25L6433FM2I-08G, SOP8, 209mil (MXIC)

9 Recommended Reflow Profile

Refer to IPC/JEDEC standard.

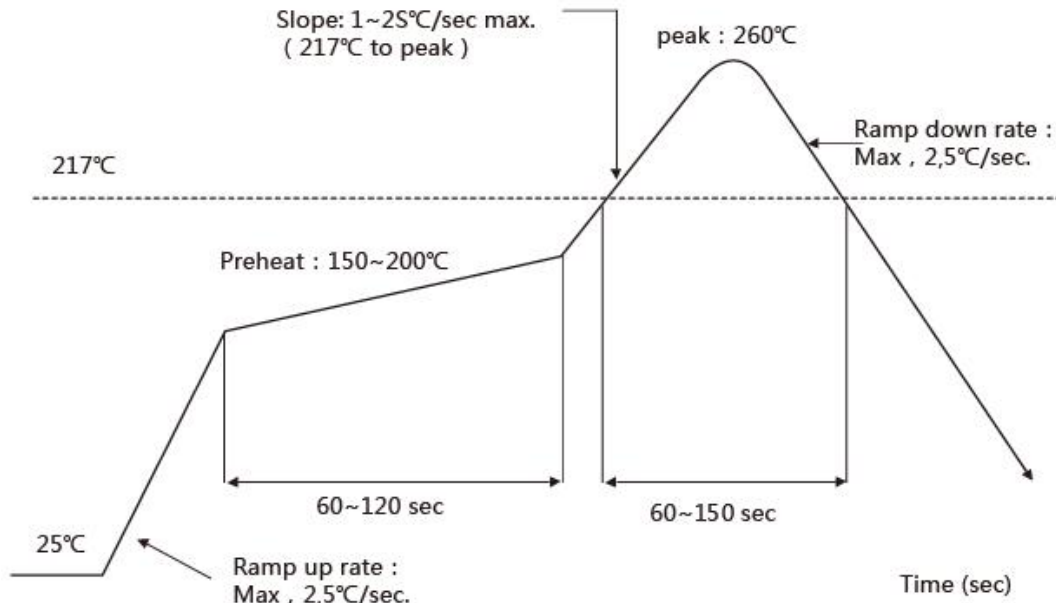Peak Temperature: <260°C

Number of Times: ≤2 times

Figure 10-1 Reference reflow profile
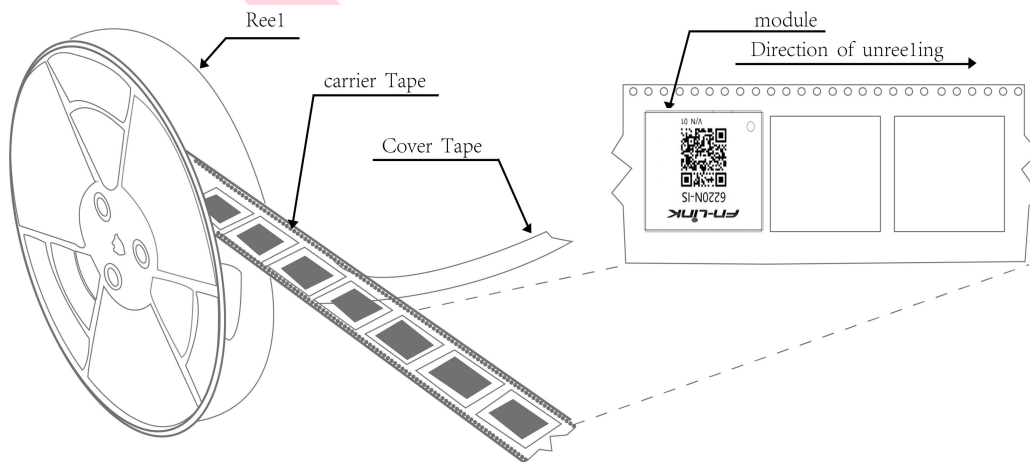
10 Package Information

10.1 Reel

A roll of 500pcs

Figure 11-1 Package reel Reference

10.2 Carrier Tape Detail

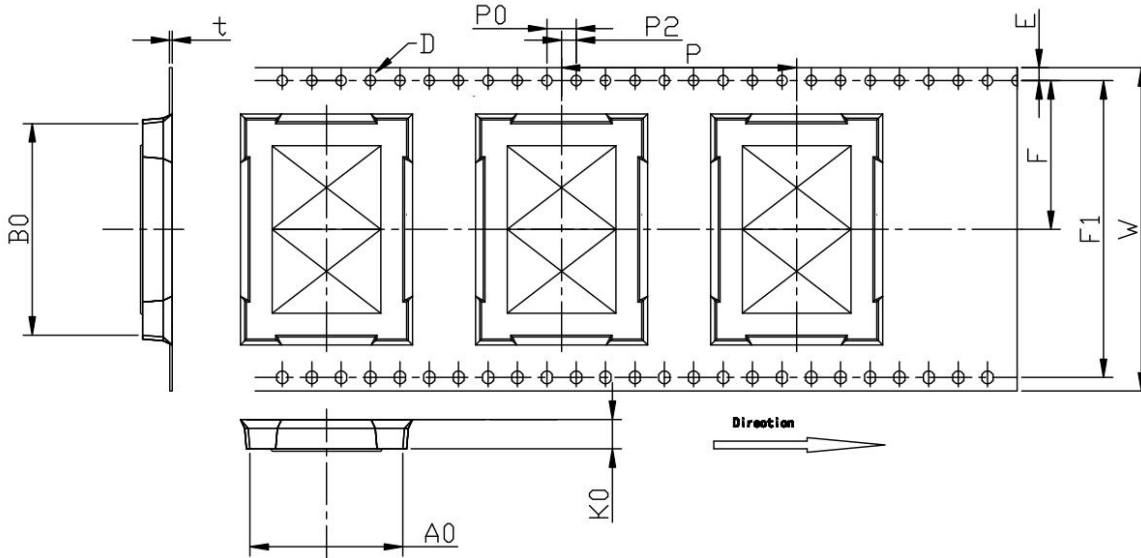| ITEM	W	A0	B0	D	E	F	F1	K0	P0	P2	P	T
DIM	44	20.45	29.50	1.5	1.75	20.2	40.4	4.10	4.0	2.0	32.0	0.30
TOLE	+0.3 −0.3	±0.15	±0.15	+0.1 −0.0	±0.1	±0.15	±0.10	±0.10	±0.1	±0.15	±0.1	±0.05

Figure 11-2 Carrier tape detail

10.3 Packaging Detail
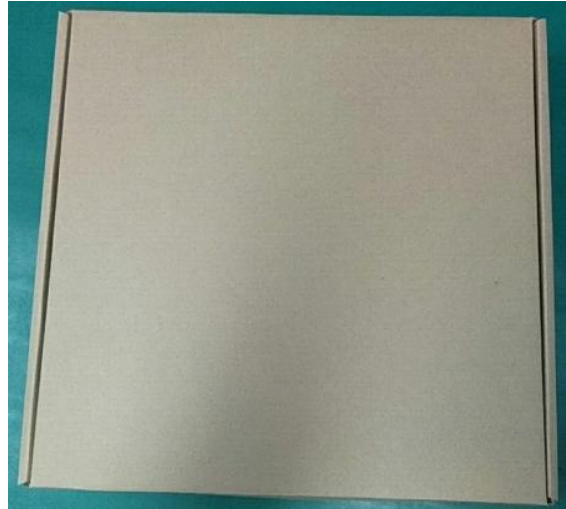
the take-up package

Using self-adhesive tape

Size of black tape:44mm*16.5m   the cover tape :37.5mm*16.5m

Color of plastic disc: blue

A roll of 500pcs

NY bag size:420mm*450mm
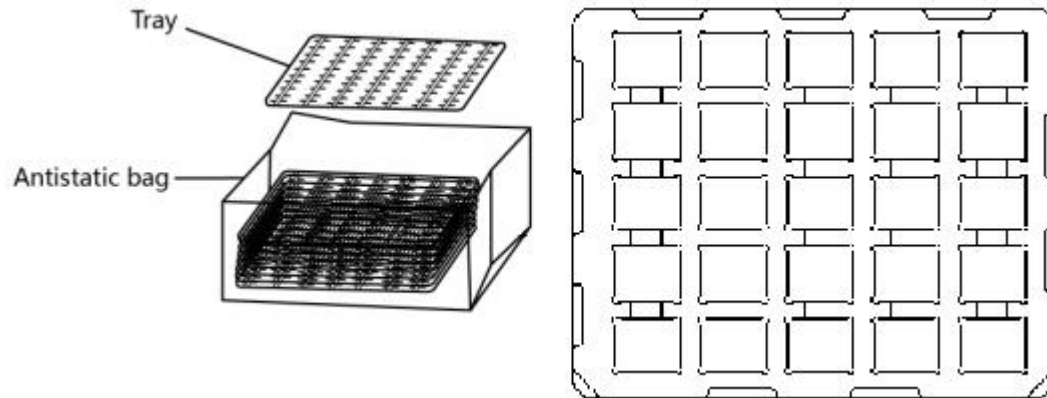

size ：335*335*55mm

The packing case size:335*255*370mm

10.4 Tray

Use pallet packaging for less than 300 pieces

11 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

Regulatory Module Integration Instructions

This module has been granted modular approval for mobile applications. OEM integrators for host products may use the module in their final products without additional FCC / IC (Industry Canada) certification if they meet the following conditions. Otherwise, additional FCC / IC approvals must be obtained.

- The host product with the module installed must be evaluated for simultaneous transmission requirements.

- The users manual for the host product must clearly indicate the operating requirements and conditions that must be observed to ensure compliance with current FCC / IC RF exposure guidelines.

- To comply with FCC / IC regulations limiting both maximum RF output power and human exposure to RF radiation, the maximum antenna gain including cable loss in a mobile-only exposure condition must not exceed 2dBi.

- A label must be affixed to the outside of the host product with the following statements:

This device contains FCCID: 2AATL-6220N-IS
This equipment contains equipment certified under ICID: 24844-6220NIS

The final host / module combination may also need to be evaluated against the FCC Part 15B criteria for unintentional radiators in order to be properly authorized for operation as a Part 15 digital device.

If the final host / module combination is intended for use as a portable device (see classifications below) the host manufacturer is responsible for separate approvals for the SAR requirements from FCC Part 2.1093 and RSS-102.

Device Classifications

Since host devices vary widely with design features and configurations module integrators shall follow the guidelines below regarding device classification and simultaneous transmission, and seek guidance from their preferred regulatory test lab to determine how regulatory guidelines will impact the device compliance. Proactive management of the regulatory process will minimize unexpected schedule delays and costs due to unplanned testing activities.

The module integrator must determine the minimum distance required between their host device and the user's body. The FCC provides device classification definitions to assist in making the correct determination. Note that these classifications are guidelines only; strict adherence to a device classification may not satisfy the regulatory requirement as near-body device design details may vary widely. Your preferred test lab will be able to assist in determining the appropriate device category for your host product and if a KDB or PBA must be submitted to the FCC.

Note, the module you are using has been granted modular approval for mobile applications. Portable applications may require further RF exposure (SAR) evaluations. It is also likely that the host / module combination will need to undergo testing for FCC Part 15 regardless of the device classification. Your preferred test lab will be able to assist in determining the exact tests which are required on the host / module combination.

FCC Definitions

Portable: (§2.1093) — A portable device is defined as a transmitting device designed to be used so that the radiating structure(s) of the device is / are within 20 centimeters of the body of the user.

Mobile: (§2.1091) (b) — A mobile device is defined as a transmitting device designed to be used in other than fixed locations and to generally be used in such a way that a separation distance of at least 20 centimeters is normally maintained between the transmitter's radiating structure(s) and the body of the user or nearby persons. Per §2.1091d(d)(4) In some cases (for example, modular or desktop transmitters), the potential conditions of use of a device may not allow easy classification of that device as either Mobile or Portable. In these cases, applicants are responsible for determining minimum distances for compliance for the intended use and installation of the device based on evaluation of either specific absorption rate (SAR), field strength, or power density, whichever is most appropriate.

Simultaneous Transmission Evaluation

This module has **not** been evaluated or approved for simultaneous transmission as it is impossible to determine the exact multi-transmission scenario that a host manufacturer may choose. Any simultaneous transmission condition established through module integration into a host product **must** be evaluated per the requirements in KDB447498D01(8) and KDB616217D01,D03 (for laptop, notebook, netbook, and tablet applications).

These requirements include, but are not limited to:

- Transmitters and modules certified for mobile or portable exposure conditions can be incorporated in mobile host devices without further testing or certification when:

- The closest separation among all simultaneous transmitting antennas is $\geq$20 cm,

Or

- Antenna separation distance and MPE compliance requirements for **ALL** simultaneous transmitting antennas have been specified in the application filing of at least one of the certified transmitters within the host device. In addition, when transmitters certified for portable use are incorporated in a mobile host device, the antenna(s) must be $\geq$5 cm from all other simultaneous transmitting antennas.

- All antennas in the final product must be at least 20 cm from users and nearby persons.

If Canadian approval is requested for devices incorporating 6220N-IS modules the below notes will have to be provided in the English and French language in the final user documentation. Manufacturers/OEM Integrators must ensure that the final user documentation does not contain any information on how to install or remove the module from the final product.

Notes (IC):

(EN) This Class B digital apparatus complies with Canadian ICES-003 and RSS-210. Operation is subject to the following two conditions: (1) this device may not cause interference, and

(2) this device must accept any interference, including interference that may cause undesired operation of the device.

(FR) Cet appareil numérique de classe B est conforme aux normes canadiennes ICES-003 et RSS-210. Son fonctionnement est soumis aux deux conditions suivantes: (1) cet appareil nedoit pas causer d'interférence et (2) cet appareil doit accepter toute interférence, notamment les interférences qui peuvent affecter son fonctionnement.

(EN) Radio frequency (RF) Exposure Information

The radiated output power of the Wireless Device is below the Industry Canada (IC) radio frequency exposure limits. The Wireless Device should be used in such a manner such that the potential for human contact during normal operation is minimized.

This device has also been evaluated and shown compliant with the IC RF Exposure limits under mobile exposure conditions. (antennas at least 20cm from a person's body).

(FR) Informations concernant l'exposltion aux fréquences radio (RF)

La puissance de sortie émise par l'appareil de sans fil est inférieure à la limite d'exposition aux fréquences radio d'Industry Canada (IC). Utilisez l'appareil de sans fil de façon à minimiser les contacts humains lors du fonctionnement normal.

Ce périphérique a également été évalué et démontré conforme aux limites d'exposition aux RF d'IC dans des conditions d'exposition à des appareils mobiles (les antennes se situent à moins de 20cm du corps d'une personne).

CAN ICES-3(B)/NMB-3(B)

L'émetteur/récepteur exempt de licence contenu dans le présent appareil est conforme aux CNR d'Innovation, Sciences et

Développement économique Canada applicables aux appareils radio exempts de licence. L'exploitation est autorisée aux deux conditions

suivantes : (1)L'appareil ne doit pas produire de brouillage;(2)L'appareil doit accepter tout brouillage radioélectrique subi, même si le

brouillage est susceptible d'en compromettre le fonctionnement.

CAN ICES-3(B)/NMB-3(B)

This device contains licence-exempt transmitter(s)/receiver(s) that comply with Innovation, Science and Economic Development Canada's

licence-exempt RSS(s). Operation is subject to the following two conditions:(1)This device may not cause interference.(2)This device must

accept any interference, including interference that may cause undesired operation of the device.

FCC Warnning:

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.

Caution: Any changes or modifications to this device not explicitly approved by

manufacturer could void your authority to operate this equipment.

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.

RF Exposure Statement

This equipment complies with FCC RF radiation exposure limits set forth for an

uncontrolled environment. This equipment should be installed and operated with a minimum distance of 20 centimeters between the radiator and your body.