6222N-IMA

Wi-Fi Dual-band 1X1 802.11a/b/g/n +BLE5.0

IoT Module Datasheet

6222N-IMA Module Datasheet

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_____ Title

_____ Signature

_____ Date

_____ Fn-Link

Revision History

Version	Date	Revision Content	Draft	Approved
1.0	2020/07/25	Initial release	Lxy	Lgp
1.1	2020/12/21	Update tx power limit	Lxy	SZS
1.2	2021/3/12	Update PCB to 0.8mm	Lxy	SZS
1.3	2021/7/8	Update BLE tx power	Lxy	QJP

CONTENTS

1 Overview

1.1 Introduction

6222N-IMA is a highly integrated IoT module with low power 802.11a/b/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 a/b/g/n) MAC, a 1T1R capable WLAN baseband, RF, Bluetooth.

High speed connectivity interfaces, SDIO and USB are provided. Also audio codec, key-scan and touch keys integrated. Flexible design configures GPIO to different functions.

6222N-IMA integrates internal memories for complete Wi-Fi protocol functions.

1.2 Features

27*37mm with PCB antenna version

System and memory

- Dual processor core
- KM4: Armv8-M with cortex-m33
- KM0: Armv8-M with cortex-m23
- 512kB SRAM@200MHz
- 4MB external flash
- 64 GPIO pins
- IPC: inter-processor communication

Wireless

- 802.11a/b/g/n 1x1 2.4G&5GHz
- 20MHz/40MHz up to MCS7
- Very low power suspends mode(DLPS)
- BLE5.0

Security

- Hardware engine: AES/DES/SHA hardware engine.
- Secure boot supported
- Debug port access protection and prohibition modes
- Secure efuse
- Flash decryption on the fly

Communication internaces

- SD/SDIO2.0 SDR25
- USB2.0

- SPI
- UART
- IR
- SGPIO
- I2C
- USI

Audio

- Sampling frequency:8/16/32/44.1/48/88.2/9KHz
- Integrates earphone driver 40mW on 16Ω load/ 20mW on 32Ω load
- Gain step: 0.375dB/step ,gain range: -64.5dB~0dB
- Audio output mode Line-out cap-less mode /differential mode/ single-ended mode
- I2S

Timer

- PWM
- RTC

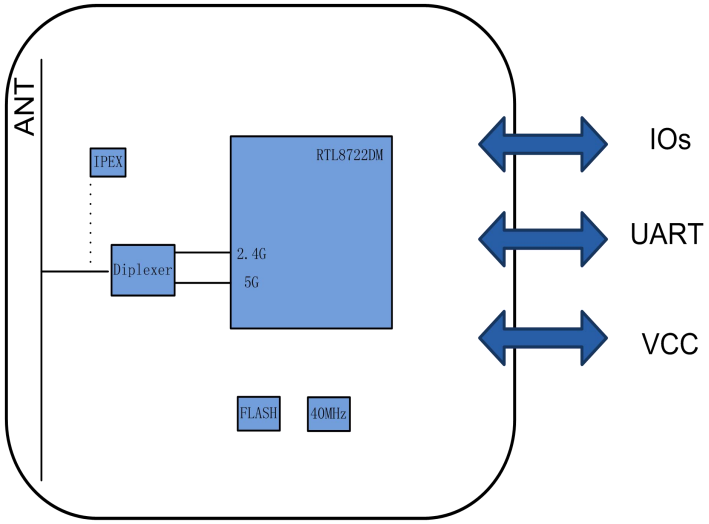
Human machine interaction

- Key-matrix
- Cap-touch
- LCD

Analog

- ADC

1.3 Block diagram



1.4 General specification

Model Name	6222N-IMA
Main Chipset	Realtek RTL8722DM
Host Interface	SD,SDIO,USB,UART, SPI,I2C, GPIO...
Wi-Fi Standards	802.11a/b/g/n
Bluetooth	BLE5.0
Dimension	L x W x H: 27mm*37mm*3.15mm
RoHS	All hardware components are fully compliant with EU RoHS directive

1.5 Operating Conditions

Operating Voltage	3.0-3.6 Vdc or 1.76-2.035Vdc
Operating Temperature	-20°C to +85°C
Storage Temperature	-40°C to +125°C

※1.6 EEPROM Information

Wi-Fi

Vendor ID	-

Device ID	-

BT

Vendor ID	-
Product ID	-

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[1]	802.11b /11Mbps : 18dBm ± 1.5 dB	EVM ≤ -10dB
	802.11g /54Mbps : 17dBm ± 1.5 dB	EVM ≤ -25dB
	802.11n /MCS7 : 16dBm ± 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		

Note:1.MCS7 HT40 is calibrated,other rate power all control by firmware driver.

2.2 5GHz RF Specification

Feature	**Description**			
WLAN Standard	IEEE 802.11 a/n Wi-Fi compliant			
Frequency Range	4.900 GHz ~ 5.845 GHz (5.0 GHz Band)			
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[1]	802.11a /54Mbps : 14dBm ± 1.5 dB			EVM ≤ -25dB
	802.11n HT20 /MCS7 : 13dBm ± 1.5 dB			EVM ≤ -28dB
	802.11n HT40 /MCS7 : 13dBm ± 1.5 dB			EVM ≤ -28dB
Test Items	**Test Value**			**Standard Value**
SISO Receive Sensitivity (11a,20MHz) @10% PER	- 6Mbps	PER @ -87 dBm		≤-85 dBm
	- 9Mbps	PER @ -86 dBm		≤-84 dBm
	- 12Mbps	PER @ -85 dBm		≤-82 dBm
	- 18Mbps	PER @ -84 dBm		≤-80 dBm

	- 24Mbps	PER @ -82 dBm	≤-77 dBm
	- 36Mbps	PER @ -78 dBm	≤-73 dBm
	- 48Mbps	PER @ -75 dBm	≤-69 dBm
	- 54Mbps	PER @ -73 dBm	≤-68 dBm
SISO Receive Sensitivity (11n,20MHz) @10% PER	- MCS=0	PER @ -87 dBm	≤-85 dBm
	- MCS=1	PER @ -84 dBm	≤-82 dBm
	- MCS=2	PER @ -82 dBm	≤-80 dBm
	- MCS=3	PER @ -80 dBm	≤-77 dBm
	- MCS=4	PER @ -77 dBm	≤-73 dBm
	- MCS=5	PER @ -74 dBm	≤-69 dBm
	- MCS=6	PER @ -72 dBm	≤-68 dBm
	- MCS=7	PER @ -70 dBm	≤-67 dBm
SISO Receive Sensitivity (11n ,40MHz) @10% PER	- MCS=0	PER @ -87 dBm	≤-82 dBm
	- MCS=1	PER @ -84 dBm	≤-79 dBm
	- MCS=2	PER @ -81 dBm	≤-77 dBm
	- MCS=3	PER @ -78 dBm	≤-74 dBm
	- MCS=4	PER @ -75 dBm	≤-70 dBm
	- MCS=5	PER @ -72 dBm	≤-66 dBm
	- MCS=6	PER @ -70 dBm	≤-65 dBm
	- MCS=7	PER @ -68 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		

Note:1.MCS7 HT40 is calibrated,other rate power all control by firmware driver.

2. all measurement is base on 3.3V power supply.

2.3 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

3 Bluetooth Specification

Feature	**Description**		
General Specification			
Bluetooth Standard	BLE 5.0		
Host Interface	UART		
Frequency Band	2402 MHz ~ 2480 MHz		
Number of Channels	40 channels for BLE		
Modulation	GFSK, π/4-DQPSK		
RF Specification			
	Min.	**Typical.**	**Max.**
Output Power		8±1.5 dBm	

Sensitive @PER=30.8%			-70 dBm
Maximum Input Level	-10 dBm		

4 Power Consumption

Operation Mode		Condition	Current		Unit
Power Mode	Scenario		3.3V	1.8V	
Deepsleep	Deepsleep	RTC timer 1KB retention RAM	7~8	7 8	uA
	Deepsleep with Key-Scan	RTC timer 1KB retention RAM Key-Scan	12~13	12~13	uA
	Deepsleep with Cap-Touch	RTC timer	20	16	uA
	(average current)	1KB retention RAM Cap-Touch			
Sleep	WoWLAN sleep power	KM4 power gate KM0 clock gate All RAM retained Wi-Fi retained	30~50	30~50	uA
Active	Wi-Fi Tx	CCK 18dBm @3.3V， and 15dBm @1.8V KM4 in active mode	257	224	mA
		OFDM 19dBm @3.3V， and 13dBm @1.8V KM4 in active mode	262	214	mA
	Wi-Fi Rx Idle	HT20 MCS0~7 normal mode KM4 in active mode Rx idle	50	81	mA
		HT20 MCS0~7 ultra-low power mode KM4 in active mode Rx idle	35	60	mA
	Wi-Fi Rx UDP	HT20 MCS0~7 ultra-low power mode KM4 in active mode UDP Rx @ 8Mbps	39	67	mA
WoWLAN	WoWLAN Rx Beacon	Rx beacon mode @ normal mode KM4 in sleep mode	28	45	mA
		Rx beacon mode @ ultra-low power mode KM4 in sleep mode	23	39	mA
	WoWLAN DTIM=1 (Average)	KM4 in sleep mode All SRAM retained Wi-Fi retained Shielding room	700~800	1100~1200	uA
		KM4 in sleep mode All SRAM retained Wi-Fi retained Open space	1~2	1.1~2	mA

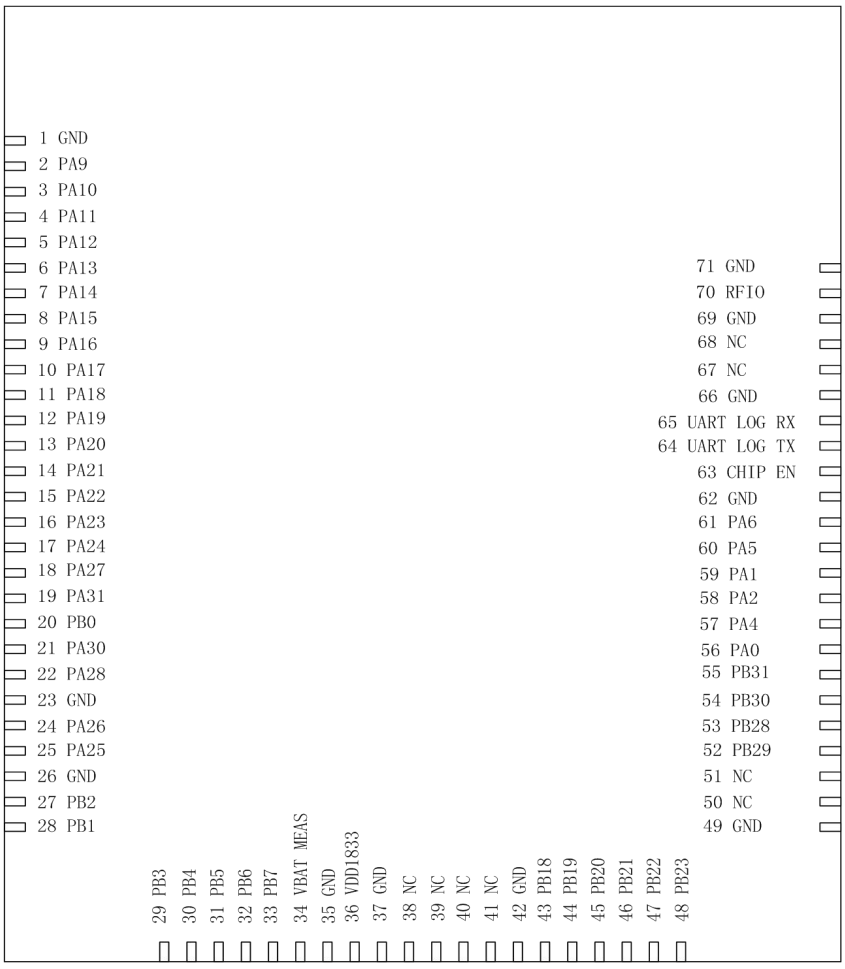
Note: Ultra-low power mode side effect:

- OFDM: Rx Sensitivity Degree 2~4dBm
- CCK: Rx Sensitivity Degree 1~2dBm

5 Pin Assignments

5.1 Pin outline

< TOP VIEW >



5.2 Pin Definition

Pin#	Name	Type	Description	Voltage
1	GND	-	Ground connection	
2	PA9	I/O	Muti function IO	
3	PA10	I/O	Muti function IO	
4	PA11	I/O	Muti function IO	
5	PA12	I/O	Muti function IO	
6	PA13	I/O	Muti function IO	
7	PA14	I/O	Muti function IO	
8	PA15	I/O	Muti function IO	
9	PA16	I/O	Muti function IO	
10	PA17	I/O	Muti function IO	
11	PA18	I/O	Muti function IO	
12	PA19	I/O	Muti function IO	
13	PA20	I/O	Muti function IO	
14	PA21	I/O	Muti function IO	
15	PA22	I/O	Muti function IO	
16	PA23	I/O	Muti function IO	
17	PA24	I/O	Muti function IO	
18	PA27	I/O	Muti function IO Normal mode sel: 1- normal operation, 0- enter into test mode. Not allowed to pull down when power on.	
19	PA31	I/O	Muti function IO	
20	PB0	I/O	Muti function IO	
21	PA30	I/O	Muti function IO SPS SEL: 1-SWR mode,(module pulled high) 0-LDO mode.	
22	PA28	I/O	Muti function IO	
23	GND	-	Ground connection	

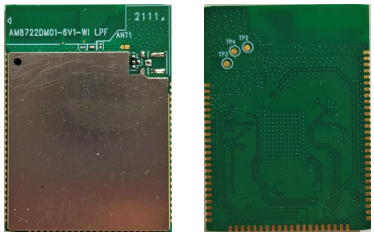
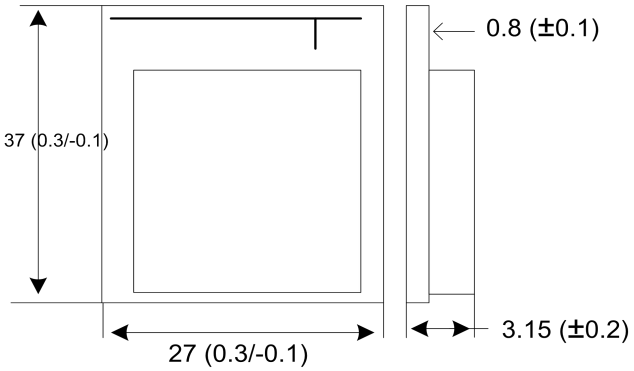
24	PA26	I/O	Muti function IO, USB DP	
25	PA25	I/O	Muti function IO, USB DM	
26	GND	-	Ground connection	
27	PB2	I/O	Muti function IO	
28	PB1	I/O	Muti function IO	
29	PB3	I/O	Muti function IO	
30	PB4	I/O	Muti function IO	
31	PB5	I/O	Muti function IO	
32	PB6	I/O	Muti function IO	
33	PB7	I/O	Muti function IO	
34	VBAT MEAS	I	ADC IN	
35	GND	-	Ground connection	
36	VDD1833	P	POWER IN	1.8v or 3.3v
37	GND	-	Ground connection	
38	NC	-	No connection	
39	NC	-	No connection	
40	NC	-	No connection	
41	NC	-	No connection	
42	GND	-	Ground connection	
43	PB18	I/O	Muti function IO	
44	PB19	I/O	Muti function IO	
45	PB20	I/O	Muti function IO	
46	PB21	I/O	Muti function IO	
47	PB22	I/O	Muti function IO	
48	PB23	I/O	Muti function IO	
49	GND	-	Ground connection	
50	NC	-	No connection	
51	NC	-	No connection	
52	PB29	I/O	Muti function IO	
53	PB28	I/O	Muti function IO	
54	PB30	I/O	Muti function IO	
55	PB31	I/O	Muti function IO	
56	PA0	I/O	Muti function IO	
57	PA4	I/O	Muti function IO	
58	PA2	I/O	Muti function IO	

59	PA1	I/O	Muti function IO	
60	PA5	I/O	Muti function IO	
61	PA6	I/O	Muti function IO	
62	GND	-	Ground connection	
63	CHIP EN	I	Default high, Low shut down chip	
64	UART LOG TX	O	PA7, UART LOG OUT Uart download control: 1-boot from flash, 0-download image from UART.	
65	UART LOG RX	I	PA8, UART LOG IN	
66	GND	-	Ground connection	
67	NC	-	No connection	
68	NC	-	No connection	
69	GND	-	Ground connection	
70	RFIO	I/O	RF port, is not used	
71	GND	-	Ground connection	

P:POWER I:INPUT O:OUTPUT

6 Dimensions

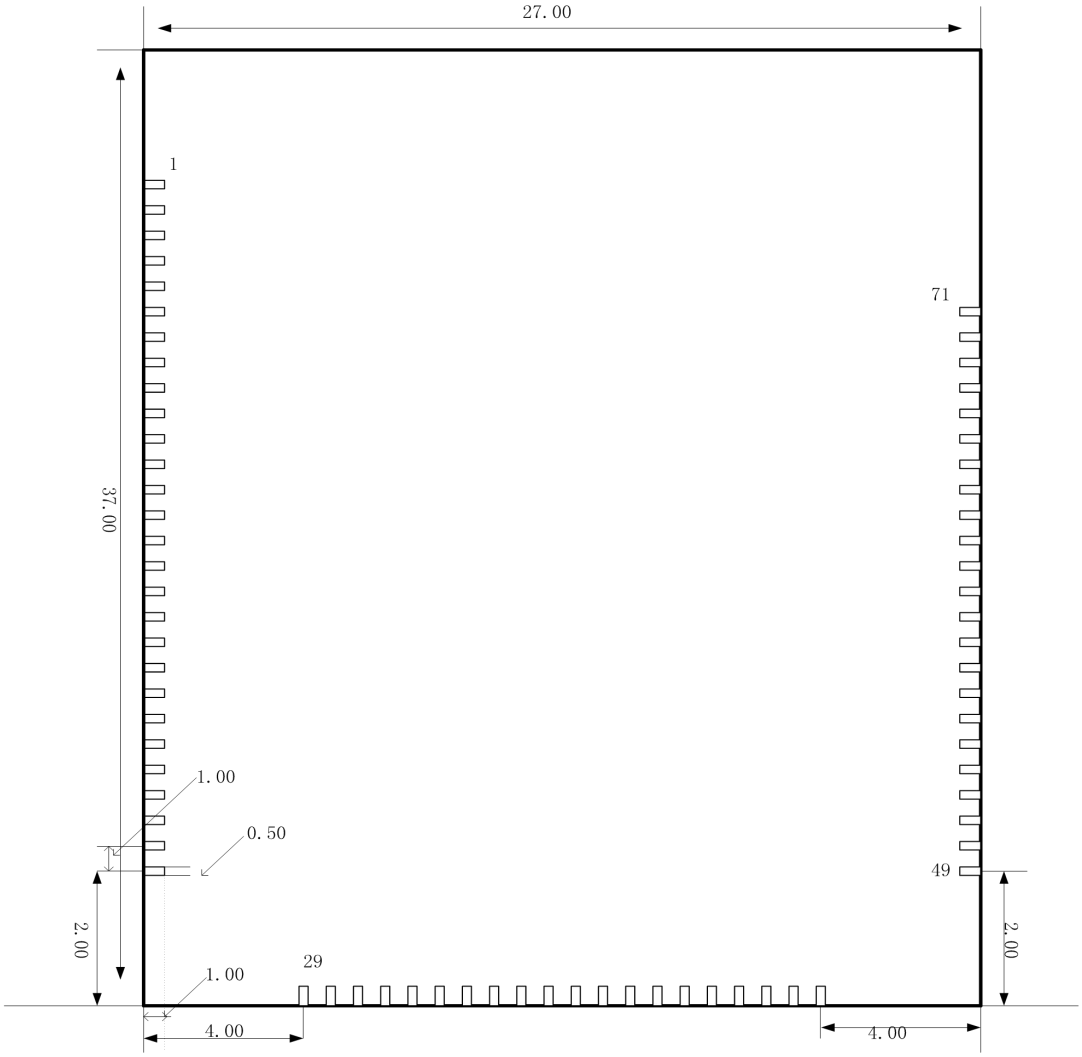
6.1 Module Picture

L x W: 27 x 37 (+0.3/-0.1) mm 	
H: 3.15 (±0.2) mm	
Weight	3.45 g

6.2 Physical Dimensions

(unit: mm)

< TOP VIEW >



6222N-IMA Physical Dimensions

6.3 Layout Recommendation

(unit: mm)

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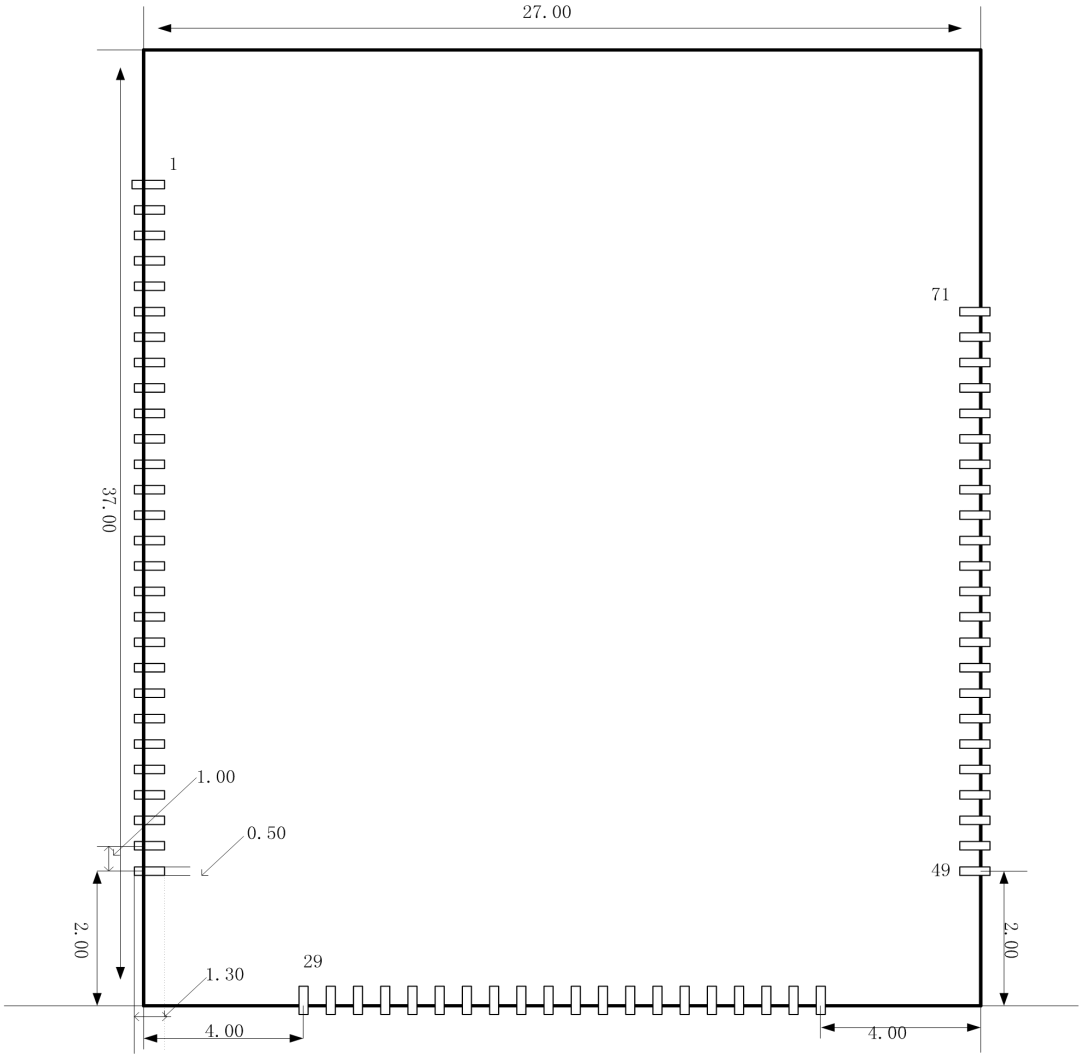


6222N-IMA Layout recommendation

7 Timing Information

Power on or Resuming from Deepsleep Sequence

The timing sequence of power on or resuming from deepsleep is given in Fig 7-1.

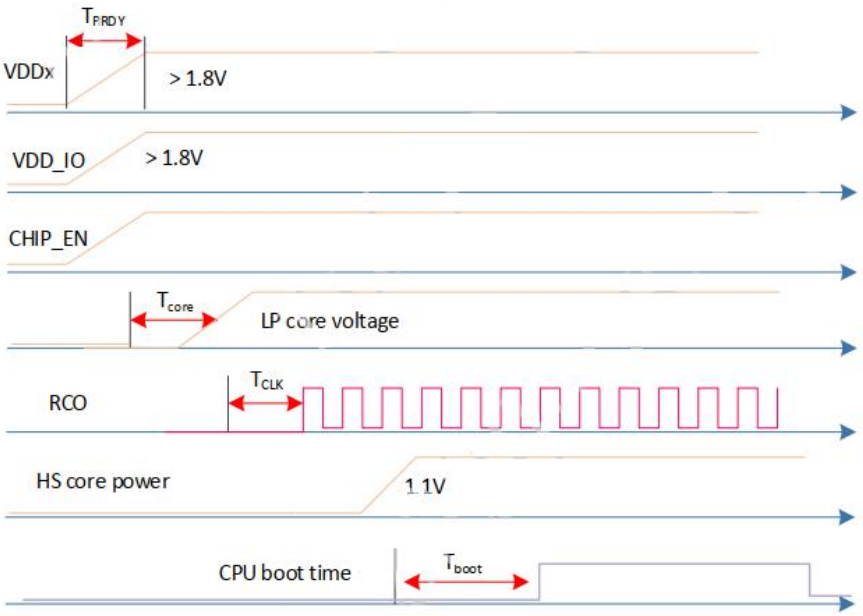


Fig 7-1 Timing sequence of power on or resuming from deepsleep

Shutdown Sequence

The timing sequence of shutdown is illustrated in Fig 7-2.

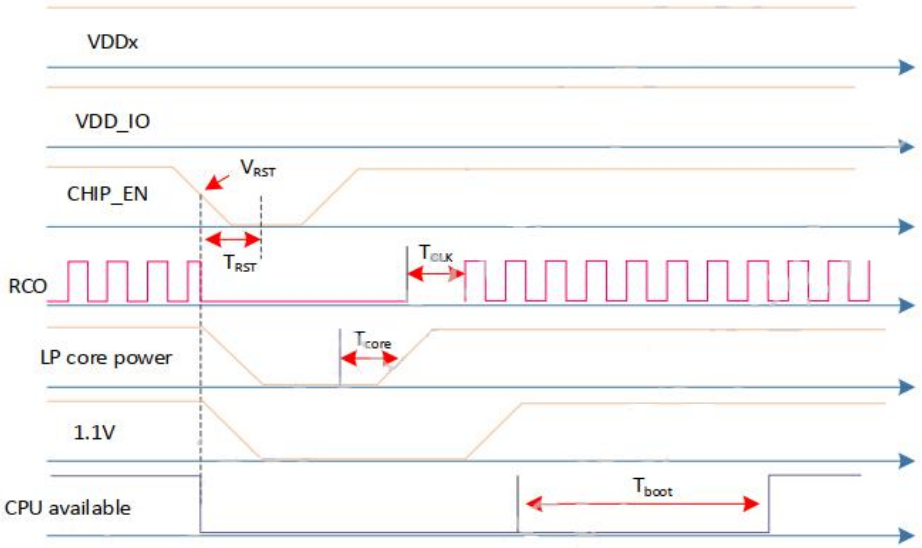
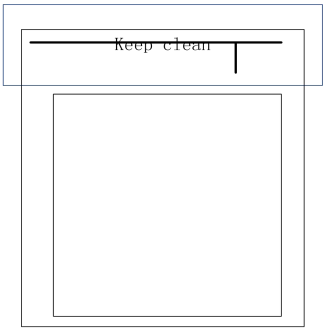
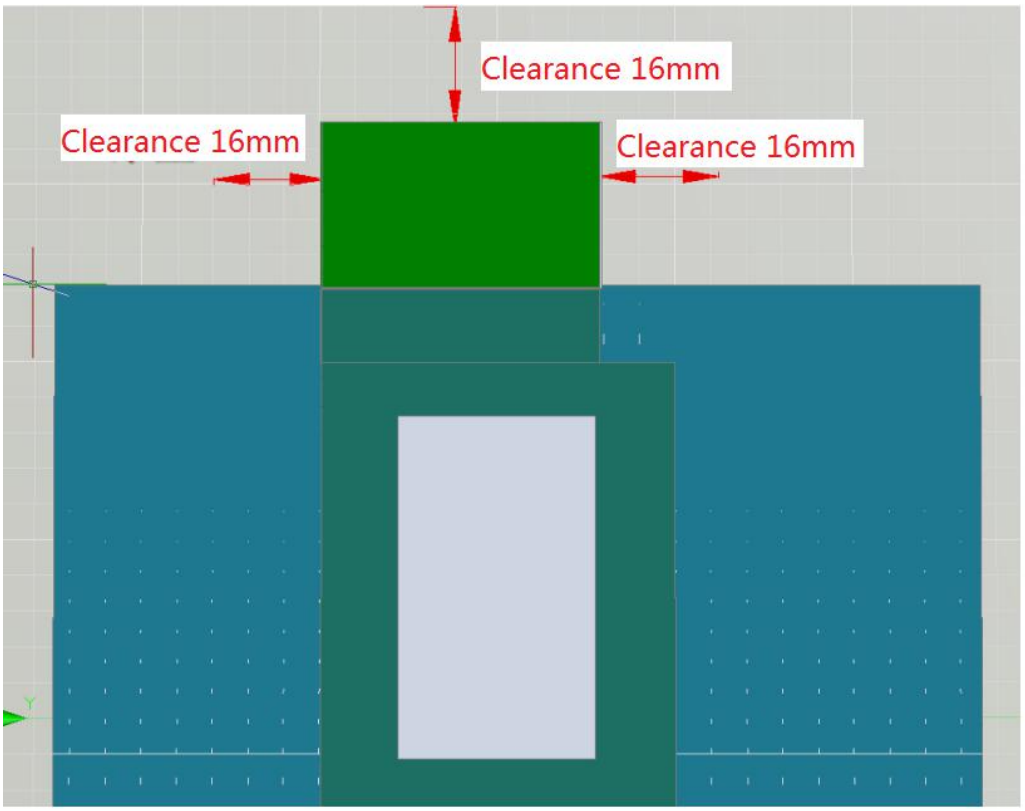


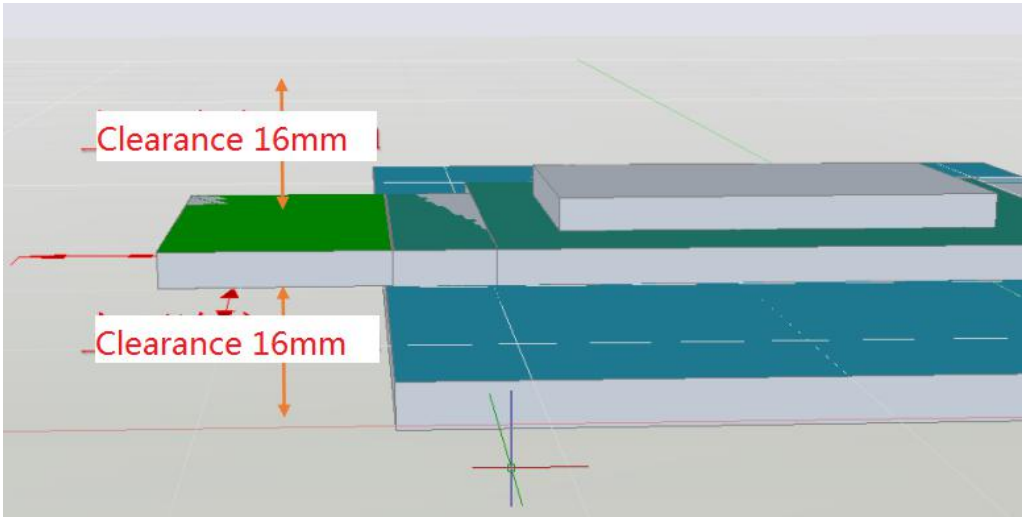
Fig 7-2 Timing sequence of shutdown

8 Reference Information

1. Pin mux detail list in other file named：RTL872xD-pinmux.xlsx
2. Details see chip datasheet file.
3. 6222N-IMA model antenna area please keep clean space,no metal no other material cover on it.







9 Ordering Information

Part NO.	Description
FG6222NIMA-00	RTL8722DM,b/g/n/a,Wi-Fi+BLE5.0,1T1R,27X37mm,Uart+USB,with shielding,PCB antenna ,PCB 6V1
FG6222NIMA-K0	RTL8722DM,b/g/n/a,Wi-Fi+BLE5.0,1T1R,27X37mm,Uart+USB,with shielding,PCB antenna ,PCB 6V1,客供 IC

10 The Key Material List

Inductor	0805,2.2UH,±20%,>800mA	Chilisin， sunlord， cenke，ceaiya，microgate
Crystal	2016,40MHz, 15pF,10ppm	TKD,ECEC,HOSONIC,JWT
Chipset	RTL8722DM-VA1-CG QFN88 10x10mm	Realtek
Dixplexer	1.6*0.8 RFDIP1606L248D1T	Walsin,TDK,GLEAD,MAGLAYER
Flash	SOP-8P,150MIL 4MB	MXIC,Winbond,Gigadevice,Boya
PCB	6222N-IMA 6V1 Green 2L FR4 Tg150 Au 27X37X0.8mm	Xy-pcb,kx-pcb,sl-pcb,sunlord

11 Recommended Reflow Profile

Refer to IPC/JEDEC standard.

Peak Temperature: <250°C

Number of Times: ≤2 times

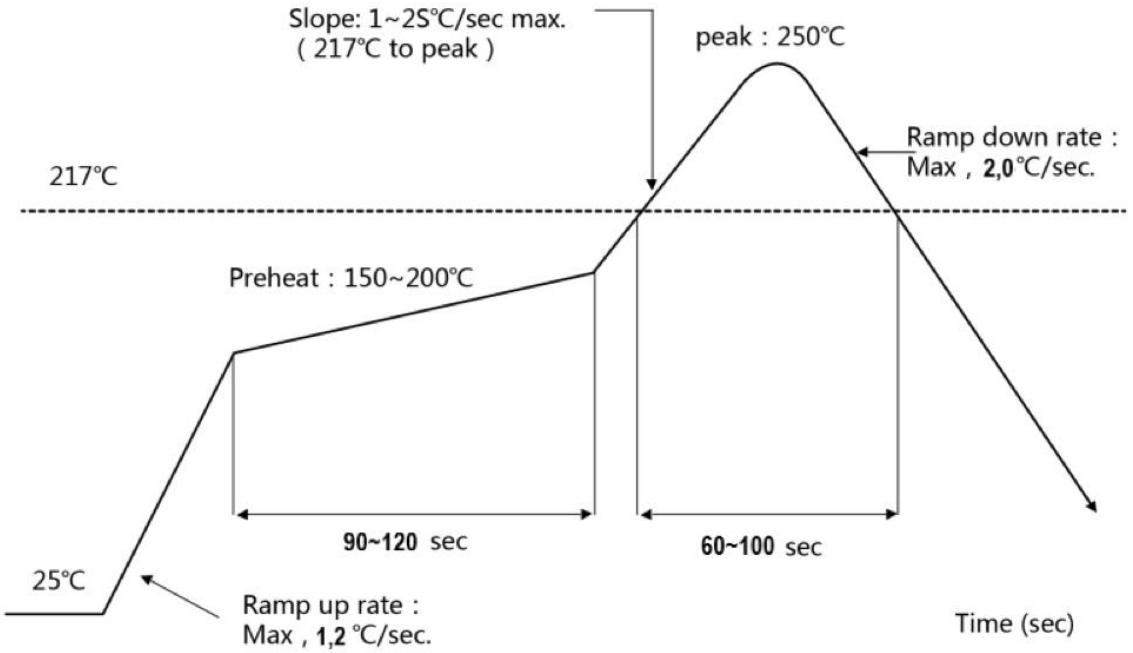
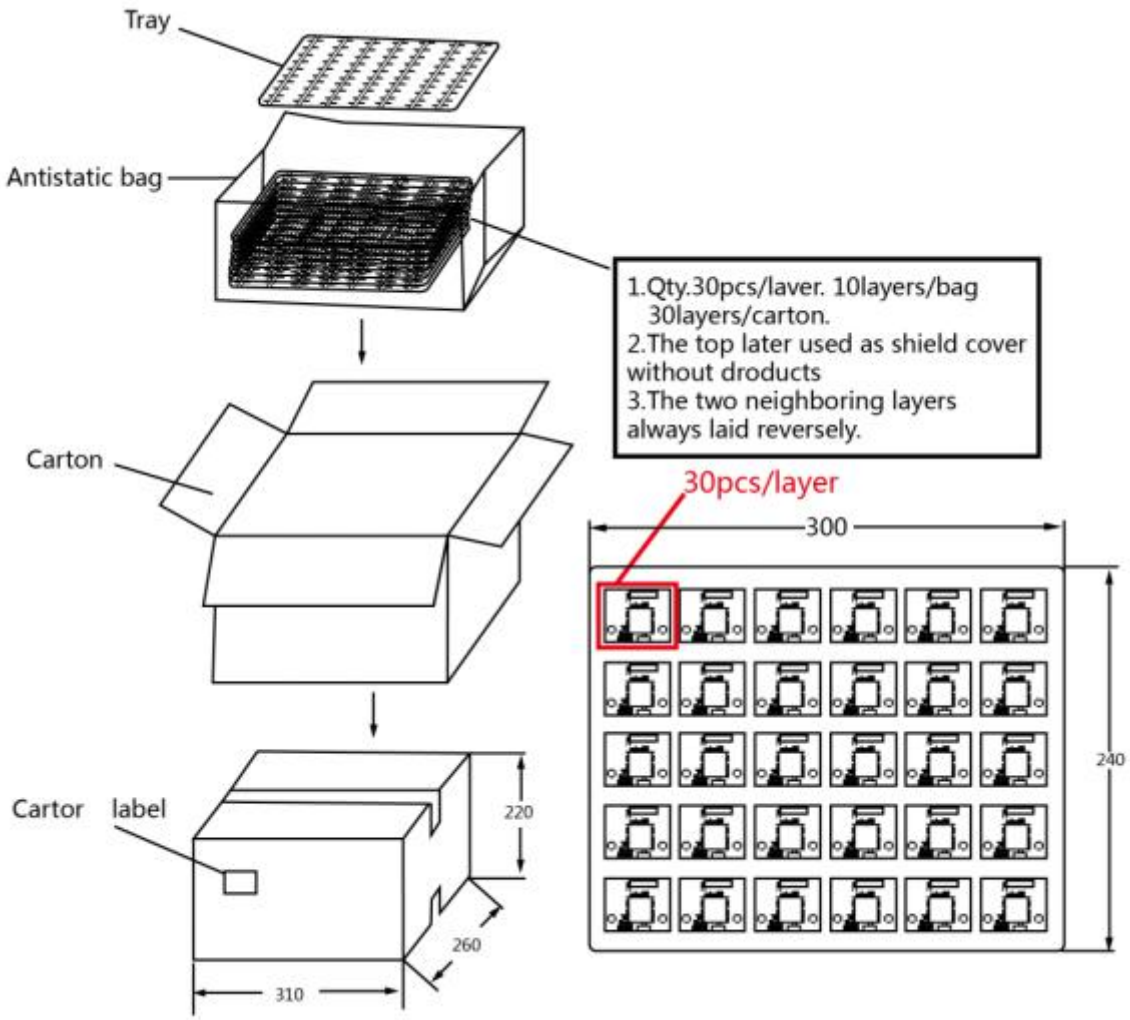


Figure11-1 Reference reflow profile

12 Package Information

12.1 Reel



The packing case size:335*255*360mm

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°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