

N21

Product Specifications

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Notice

This document provides guide for users to use N21.

This document is intended for system engineers (SEs), development engineers, and test engineers.

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About This Document

Scope

This document is applicable to the N21 series.

It defines the features, indicators, and test standards of the N21 module.

Audience

This document is intended for [system engineers \(SEs\)](#), [development engineers](#), and [test engineers](#).

Change History

Issue	Date	Change	Changed By
1.0	2018-04	Initial draft	Huang Jianlong
1.1	2018-04	Changed SIM_SELECT to WAKEUP.	Huang Jianlong
1.2	2018-05	Changed BT_ANT to RESERVED and WAKEUP to RESET.	Huang Jianlong
1.3	2018-05	Changed the pin definition.	Huang Jianlong
1.4	2018-09	<ul style="list-style-type: none"> Updated voltage range Update temperature range Updated variants and bands Added compliant standards 	Huang Jianlong
1.5	2018-10	<ul style="list-style-type: none"> Deleted the AP variant Modified the bands of EU variant to B3,B5,B8,B20,B28 Modified current feature of N21 TX/RX 	Huang Jianlong
1.6	2019-11	<ul style="list-style-type: none"> Added the BLE antenna Added the operating frequency and transmission speed of BLE. 	Huang Jianlong
1.7	2020-06	<ul style="list-style-type: none"> Modified the NB speed rate Modified the dimensional tolerances 	Huang Jianlong
1.8	2020-09	<ul style="list-style-type: none"> Added the N21-CN-C11AS1 (LCC package). Deleted the label figure. 	Zhao Rongzhou

1.9	2022-04	Updated the supported protocols and the certificates in Table 2-2.	Zhao Rongzhou
2.0	2023-06	Added Cat NB2 to Table 2-1.	Rong Fang

Conventions

Symbol	Indication
	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
	Means note or tips for readers to use the module

Related Documents

Neoway_N21_Datasheet

Neoway_N21_HW_User_Guide

Neoway_N21_AT_Commands_Mannual

Neoway_N21_EVK_User_Guide

1 Safety Recommendations

Ensure that this product is used in compliance with the requirements of the country and environment. Read the following safety recommendations to avoid bodily injury or damage to the products or workplaces:

- Do not use this product at any places with a risk of fire or explosion.
If this product is used in a place with flammable gas or dust, such as propane gas, gasoline, and flammable spray, it will cause an explosion or a fire.
- Disable the wireless communication function in places where wireless communication is prohibited.
- Do not use this product that can interfere with other electronic devices in environments, such as hospitals and airplanes.

Follow the requirements below during the application design and use of this product:

- Do not disassemble this product without permission from Neoway. Otherwise, we are entitled to refuse to provide further warranties.
- Design your application correctly based on the hardware user guide. Connect this product to a stable power supply and route traces following fire safety standards.
- Avoid touching the pins of this product to prevent damages caused by ESD.
- Do not insert or remove a SIM card or mobile memory card when the module is still on.

2 About N21

2.1 Product Overview

N21 is an ultra-small industrial-grade NB-IoT module. It has several variants that support different bands.

Table 2-1 Variants and bands

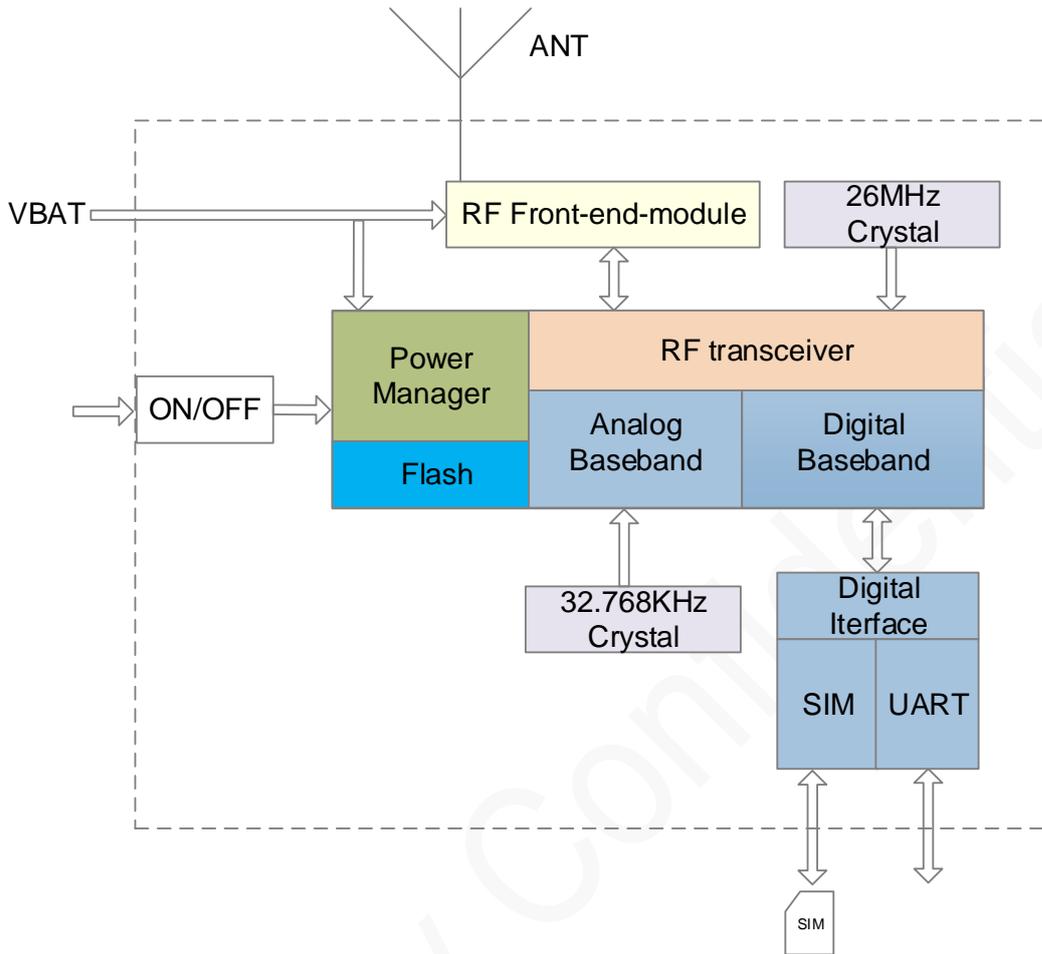
Module	Variant	Network	Band
N21	N21-CN-011AS1	Cat NB1/NB2	HD-FDD: B3,B5,B8
	N21-CN-C11AS1		
	N21-EU-011AS1	Cat NB1/NB2	HD-FDD: B3,B5,B8,B20,B28

Featured with ultra-low power consumption, extensive coverage, and simple peripheral circuits, N21 facilitates the development and is well applicable to IoT applications that require low rate and low power consumption. It has two forms of packaging, including the 22-pin LGA package (dimensions: 18 mm x 13.8 mm x 2.45 mm) and the 22-pin LCC package (dimensions: 18 mm x 14.8 mm x 2.45 mm), which can meet the size requirement of most customers.

2.2 Block Diagram

N21 provides the following functionality modules: baseband, Flash, crystal oscillator, power management, digital interfaces (USIM, UART, etc.), and RF section.

Figure 2-1 Block diagram



2.3 Features

Table 2-2 N21 baseband and wireless features

Specifications	Description
Physical features	LGA <ul style="list-style-type: none"> • Dimensions (H*W*D): 18±0.10 mm x 13.8±0.10 mm x 2.5±0.10 mm • Package: 22-Pin LGA • Weight: about 1.3 g
	LCC <ul style="list-style-type: none"> • Dimensions (H*W*D): 18±0.10 mm x 14.8±0.10 mm x 2.45±0.10 mm • Package: 22-Pin LCC • Weight: 1.4 g
Temperature ranges	Operating: -30 °C to +75 °C Extended: -40 °C to +85 °C

	Storage: -45 °C to +85 °C
Power supply	VBAT: 3.1 V to 4.3 V, typical: 3.6 V
Current	Idle: 2 mA(@DRX =1.28s)
	eDRX: <1mA(@eDRX =40.96s, PTW=10.24s)
	PSM: <4.5 μA
Processor	MIPS processor Main frequency: 192 MHz 16 KB L2 cache
Memory	RAM: 32 Mb ROM: 128 Mb
Frequency band	See Table 2-1.
Rate	LTE Cat NB1: 26 Kbps (DL)/ 62.5 Kbps (UL) LTE Cat NB2: 126.8 Kbps (DL)/158.5Kbps (UL)
Power grade	LTE: +23 dBm+/-2 dB(Power Class 3)
Antenna feature	4G antenna, 50 Ω impedance, BLE antenna
Application interfaces	1 UART interface, used to send AT commands
	1 USIM interface, 1.8 V/3 V dual-voltage adaptive
	eSIM, 2x2 mm eSIM (optional)
AT command	3GPP Rel-13/Rel-14 Neoway extended commands
SMS	TEXT/PDU Point to Point/Cell Broadcast
Protocol	TCP, UDP, HTTP, HTTPS, FTP, COAP
Certificate approval	CCC, SRRC, CTA, RoHS, CE, GCF, REACH, TIM*

* indicates in development

3 Compliant Standards

- 3GPP TS Cat NB1 Specification Set
- Ministry of Industry and Information Technology PRC, Measures for the Network Access Management of Telecommunication Equipment (2014 Amendment)
- GB4943.1-2011 Information technology equipment - Safety - Part 1: General requirements
- CNCA-O7C-031:2007 Rules for Compulsory Certification of Telecommunication Equipment Telecommunication Terminal Equipment

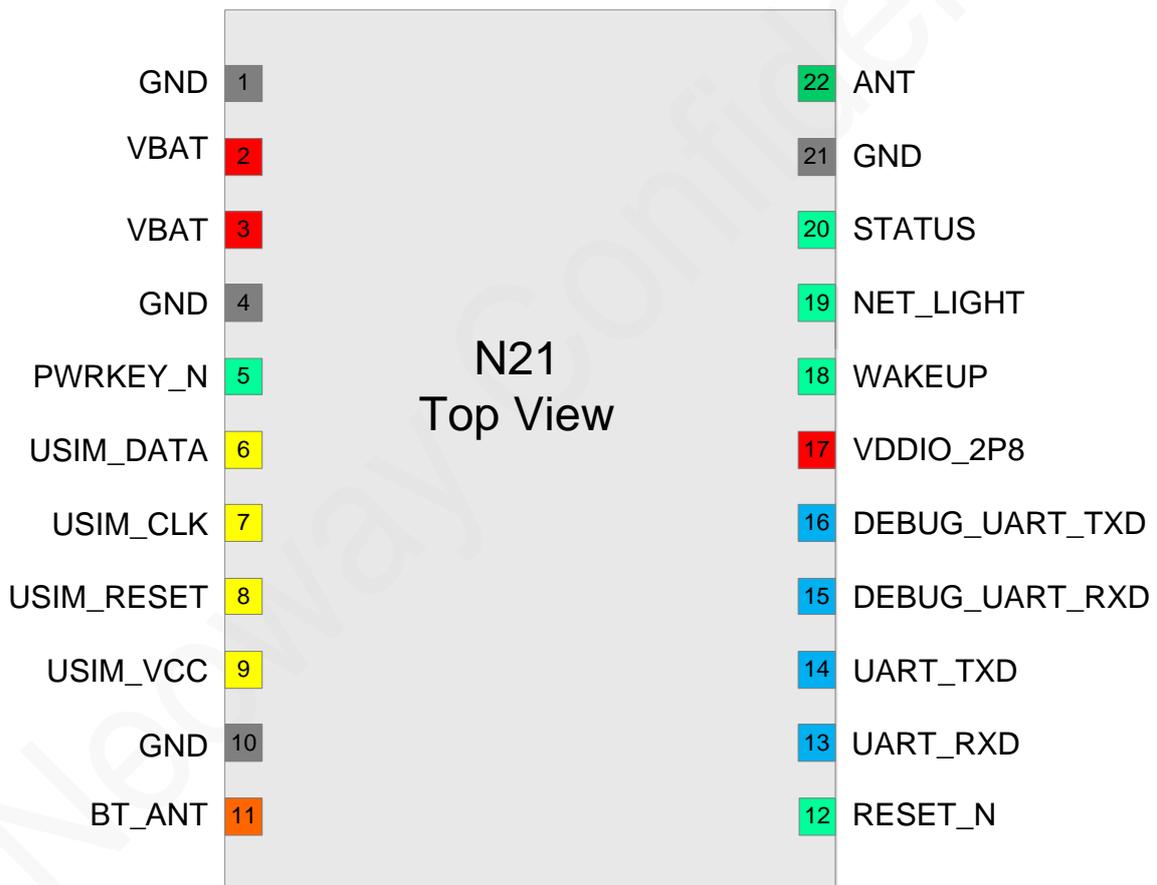
4 Pin and Appearance

There are 22 pins on N21, and their pads are introduced in the LGA package or LCC package.

4.1 Pad Layout

Figure 4-1 shows the pad layout of N21.

Figure 4-1 N21 pin definition (top view)

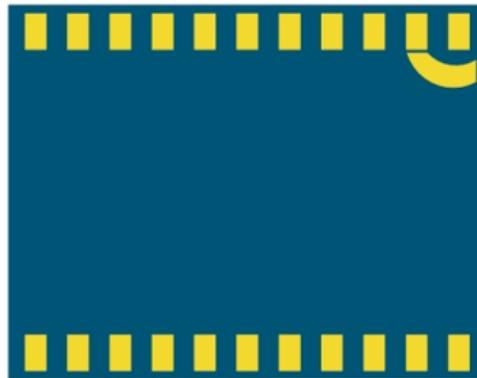


4.2 Appearance

Figure 4-2 Top view of N21



Figure 4-3 Bottom view of N21



5 Electrical Feature and Reliability

5.1 Electric Thresholds

Table 5-1 N21 electrical features

Status		Minimum Value	Typical Value	Maximum Value
VBAT	V_{in}	3.1 V	3.6 V	4.3 V
	I_{in}	/	/	500 mA



- If the input voltage is lower than the minimum value, the module might fail to start. If the voltage exceeds the high threshold or there is a voltage burst during the startup, the module might be damaged permanently.
- If LDO or DC-DC is used to supply power for the module, ensure that it outputs a current of at least 500 mA.

5.2 Current Feature

Table 5-2 N21 currents (Typical)

Band	State	Power (dBm)	PSM (uA)	Idle (DRX/eDRX) (mA)	Active (mA)	
					TX	RX
Cat NB1: B3, B5, B8, B20,B28	23		<4.5	1.7/1	180	30
	0		<4.5	1.7/1	51	30
	-10		<4.5	1.7/1	36	30

5.3 Temperature

Table 5-3 Temperature feature

Module Status	Minimum Value	Typical Value	Maximum Value
Operating	-30°C	25°C	75°C
Storage	-45°C	25°C	90°C



If the module works in an environment where the temperature exceeds the thresholds of the operating temperature range, some of its RF performance indicators might be worse, but it can still work properly.

5.4 ESD Protection

Humidity: 45% Temperature: 25 °C

Table 5-4 N21 ESD feature

Testing Point	Contact Discharge	Air Discharge
VBAT	±8 kV	±15 kV
GND	±8 kV	±15 kV
ANT	±8 kV	±15 kV
Cover	±8 kV	±15 kV
UART	±8 kV	±15 kV
Others	±2 kV	±4 kV

6 RF Features

6.1 Operating Bands

Table 6-1 N21 operating band

Operating Band	Uplink	Downlink
HD-FDD-LTE B3	1710 - 1785 MHz	1805 - 1880 MHz
HD-FDD-LTE B5	824 - 849 MHz	869 - 894 MHz
HD-FDD-LTE B8	880 - 915 MHz	925 - 960 MHz
HD-FDD-LTE B20	832 - 862 MHz	791 - 821 MHz
HD-FDD-LTE B28	703 - 748 MHz	758 - 803 MHz

6.2 TX Power and RX Sensitivity

Table 6-2 N21 RFTX power

Band	Max Power	Min Power
HD-FDD LTE B3	23 dBm+2/-2dB	<-40 dBm
HD-FDD LTE B5	23 dBm+2/-2dB	<-40 dBm
HD-FDD LTE B8	23 dBm+2/-2dB	<-40 dBm
HD-FDD LTE B20	23 dBm+2/-2dB	<-40 dBm
HD-FDD LTE B28	23 dBm+2/-2dB	<-40 dBm

Table 6-3 N21 receiving sensitivity

Band	REFSENS	Duplex Mode
LTE B3, B5, B8, B20, B28	≤-113 dBm	HD-FDD



The values were obtained by RF analyzers in a lab.

6.3 Transmission Speed of BLE

The BLE-GATT of N21 operates at a frequency of 2.4 GHz and the transmission rate reaches 4.77 Kbps(TX) and 5.328 kbps (RX).

The data in the following table was obtained from the test on the data interaction between the N21 module and the App of a mobile phone or common BT modules.

Table 6-4 Transmission speed of GATT

Test Content	Speed	Remarks
N21->APP	4.774 KBps	
N21->HM-16	4.774 KBps	Data sending
N21->E104-BT02	3.7 KBps	
APP->N21	5.328 KBps	
HM-16->N21	5.239 KBps	Data receiving
E104-BT02->N21	1.4 KBps	

7 Mechanical Features

7.1 Dimensions

Figure 7-1 N21 dimensions (LGA package, unit: mm)

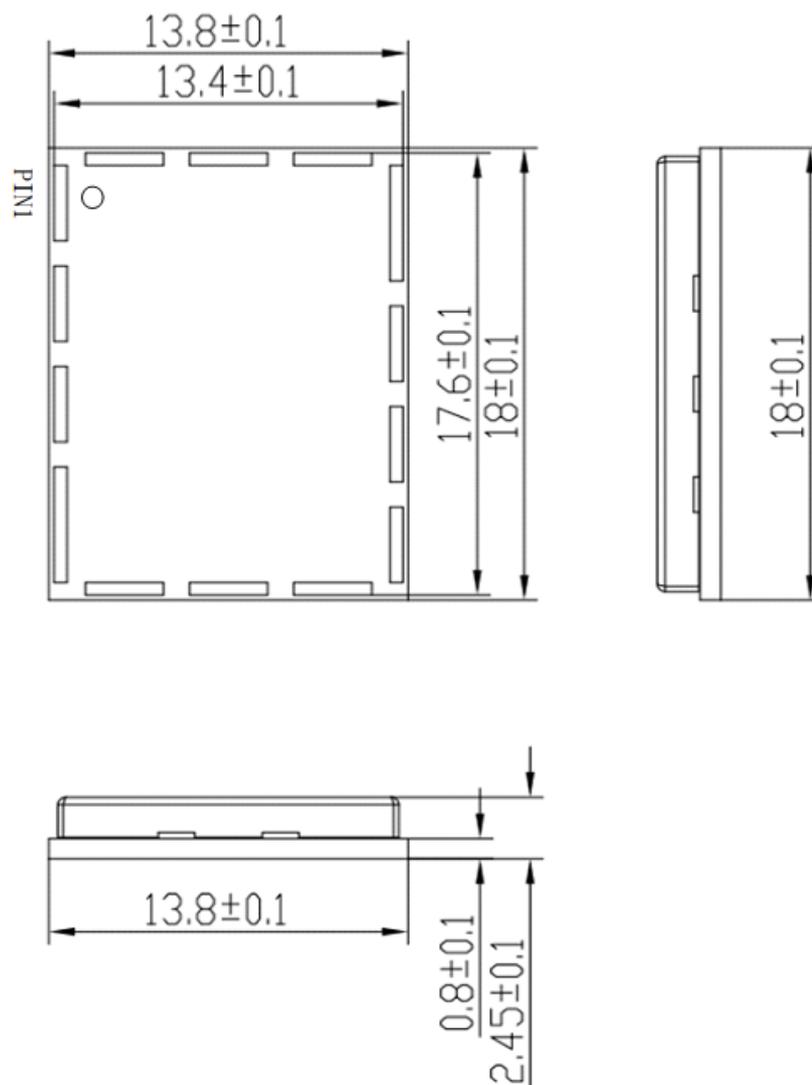
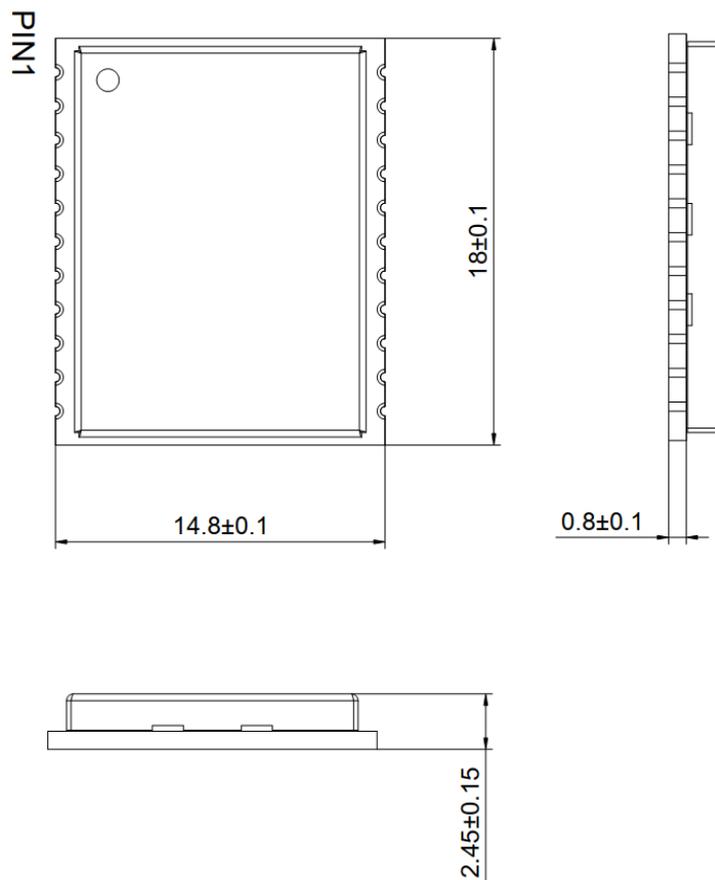


Figure 7-2 N21 dimensions (LCC package, unit: mm)



7.2 Packaging

N21 modules are packed in sealed bags on delivery to guarantee long shelf life. Follow the same package of the modules again in case of opened for any reasons.

If exposed to air for more than 48 hours at conditions not worse than $30^{\circ}\text{C}/60\% \text{RH}$, a baking procedure should be done before SMT. Or, if the indication card shows humidity greater than 20%, the baking procedure is also required. Do not bake modules with the package tray directly.

Figure 7-3 N21 tray



7.3 Storage Conditions

- Temperature: 20°C~ 26°C
- Humidity: 40%-60%
- Period: 120 days

8 Application Design and SMT

N21 is introduced in the 22-pin LGA package or in the LCC package. This chapter provides N21 foot print, recommended PCB design, and SMT information to guide users on how to mount the module onto the application PCB board.

8.1 N21 Foot Print

Figure 8-1 Bottom view of N21 foot print (LGA)

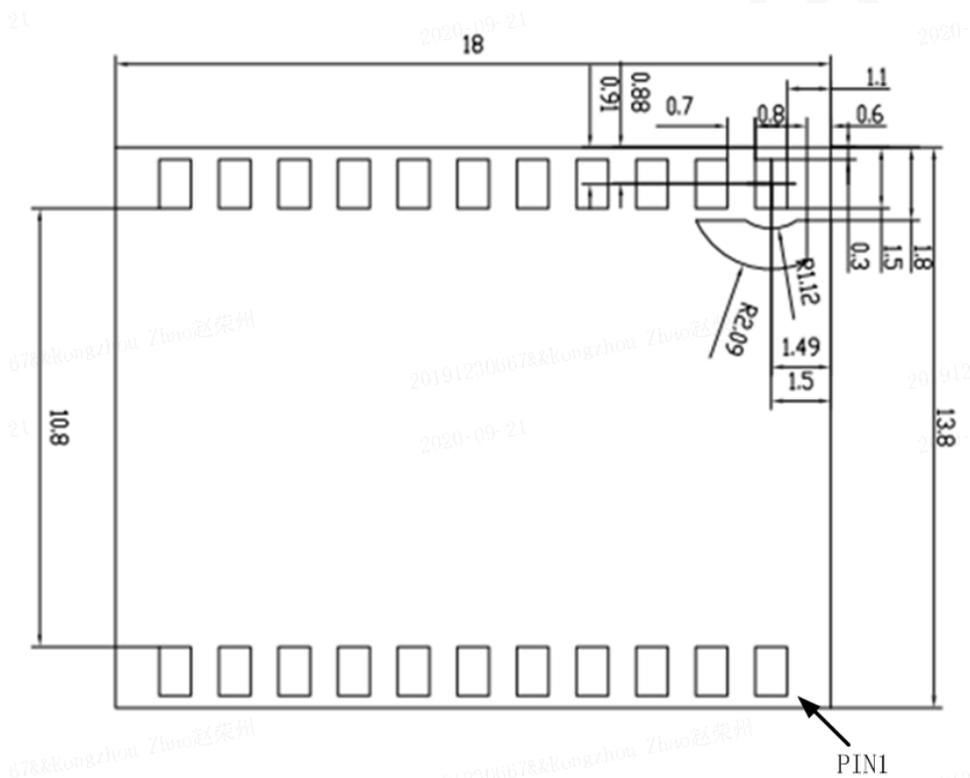
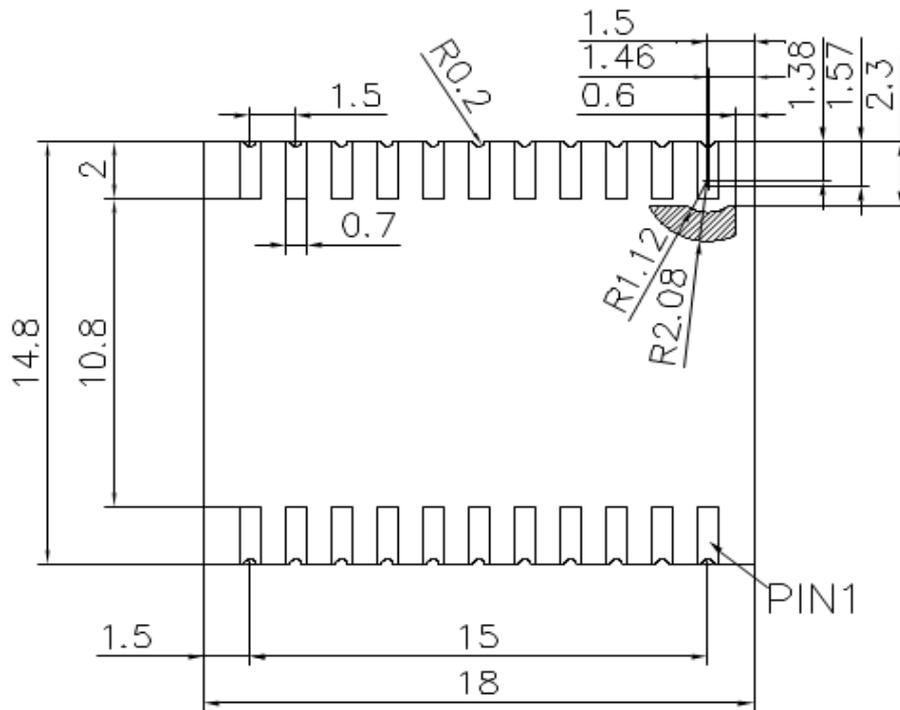


Figure 8-2 Bottom view of N21 foot print (LCC)



8.2 Application Foot Print

Figure 8-3 shows the recommended application PCB foot print. (Unit: mm)

Figure 8-3 Top view of N21 PCB foot print (LGA)

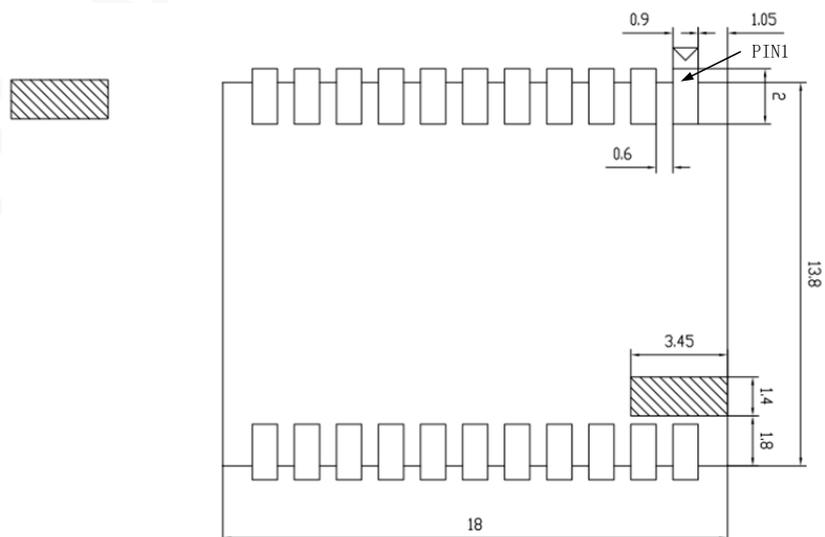
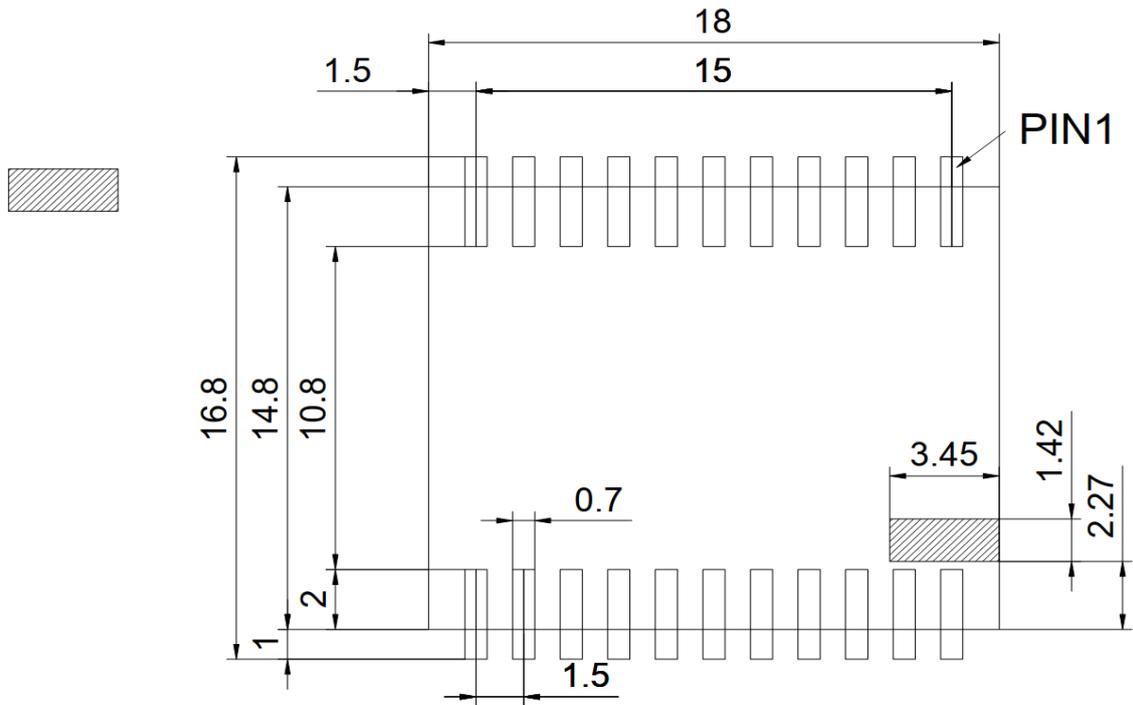


Figure 8-4 Top view of N21 PCB foot print (LCC)



The area on the module corresponding to the shade is GND copper foil for production. Do Not route any signal lines or drill signals via-holes in the shaded area of the application PCB.

Only GND traces and GND via-holes are allowed in this area. Otherwise, the signal lines might be short-circuited.

8.3 Stencil

The recommended stencil thickness is at least 0.15 mm to 0.20 mm.

8.4 Solder Paste

Do not use a kind of solder paste different from our module technique.

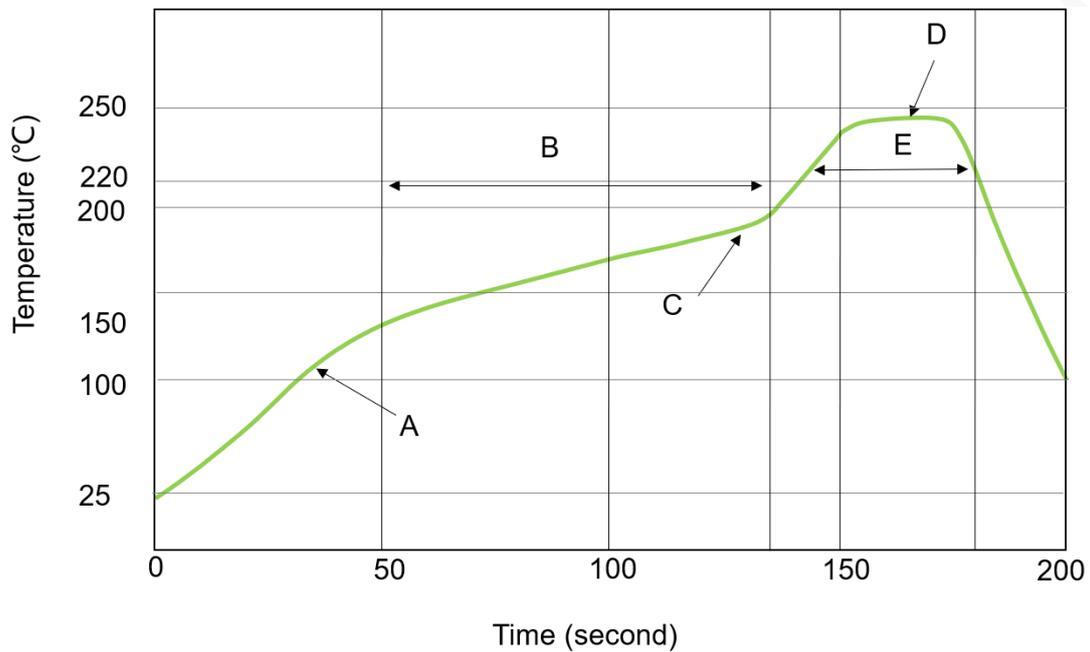
- The melting temperature of solder paste with lead is 35 °C lower than that of solder paste without lead. It is easy to cause faulty joints for LGA inside the module after second reflow soldering.
- When using only solder pastes with lead, please ensure that the reflow temperature is kept at 220 °C for more than 45 seconds and the peak temperature reaches 240 °C.

8.5 SMT Furnace Temperature Curve



Neoway will not provide a warranty for thermal component exceptions caused by improper temperature control.

Figure 8-5 Temperature curve



X: Time (s) Y: Temperature (°C)

Technical parameters:

- Ramp up rate: 1 to 4 °C/sec
- Ramp down rate: -3 to -1 °C/sec
- Soaking zone: 150-180 °C for 60-100 seconds
- Reflow zone: >220 °C for 40-90 seconds
- Peak temperature: 235-245°C

For information about important notes in N21 storage and mounting, refer to [Neoway_Reflow_Soldering_Guidelines_For_Surface-Mounted_Modules](#).

When manually desoldering the module, use heat guns with great opening, adjust the temperature to about 245°C (depending on the type of the solder paste), and heat the module till the solder paste is melt. Then gently remove the module using tweezers. Do not shake the module in high temperatures while removing it. Otherwise, the components inside the module might get misplaced and cannot be repaired.

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