N25

Product Specifications

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Notice

This document provides a guide for users to use N25.

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

THIS GUIDE PROVIDES INSTRUCTIONS FOR CUSTOMERS TO DESIGN THEIR APPLICATIONS. PLEASE FOLLOW THE RULES AND PARAMETERS IN THIS GUIDE TO DESIGN AND COMMISSION. NEOWAY WILL NOT TAKE ANY RESPONSIBILITY OF BODILY HURT OR ASSET LOSS CAUSED BY IMPROPER OPERATIONS.

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Sales@neoway.com

Support@neoway.com

Website: http://www.neoway.com

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About This Document

Scope

This document is applicable to the N25 series.

Audience

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

Change History

Issue	Date	Change	Author
1.0	2018-12	Initial draft.	Huang Jianlong
1.1	2020-02	• Updated the band definition in the product overview, that is, added CAT-NB2. • Updated AT command description and added 3GPP Rel-14. • Updated the operating temperature range.	Zhao Rongzhou
1.2	2020-05	• Updated the NB-IoT wireless network rate. • Updated the module size and tolerance information. • Updated the cloud platform, protocol, and certification approval information.	Zhao Rongzhou
1.3	2021-03	Updated the PCB package and application PCB package tolerance information.	Zhao Rongzhou

Conventions

Symbol	Description
!	Indicates danger or warning. This information must be followed. Otherwise, a catastrophic module or user device failure or bodily injury may occur.
!	Indicates caution. This symbol alerts the user to important points about using the module. If these points are not followed, the module or user device may fail.
i	Indicates instructions or tips. This symbol provides advices or suggestions that may be useful when using the module.

Related Documents

Neoway_N25_Datasheet

Neoway_N25_Hardware_User_Guide

Neoway_N25_AT_Command_Mannual

Neoway_N25_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 injuries or damages of the product or workplace:

- 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 warranty.

- 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 it is not powered off.

2 About N25

N25 is a highly integrated industrial-grade communication module based on the RDA8909B platform, and supports NB-IoT (CatNB1/CatNB2)+GPRS (850/900/1800/1900 MHz).

2.1 Product Overview

N25 series include multiple variants. Table 2-1 lists the variants and frequency bands supported.

Table 2-1 Variants and frequency bands

Module	Variant	Network Type	Frequency Band
N25	N25-CN-011AS1	Cat NB/GPRS	Cat NB1/Cat NB2: HD-FDD B3, B5, B8 GPRS: 900/1800 MHz
	N25-EU-011AS1	Cat NB/GPRS	Cat NB1/Cat NB2: HD-FDD B3, B5, B8, B20, B28 GPRS: 850/900/1800/1900 MHz

The N25 module is characterized by ultra-low power consumption, wide area coverage, simple peripheral circuits, and easy development for customers, and is suitable for low-speed and low power consuming IoT communication equipment. This module uses the 52-pin LGA package, and the dimensions are only 24 mm × 20 mm × 2.45 mm. The structure can meet most customers' requirements for space size.

2.2 Block Diagram

N25 consists of the following functional units:

- Baseband

- Flash
- RF front-end component
- External interfaces

Figure 2-1 Block diagram of the N25 module
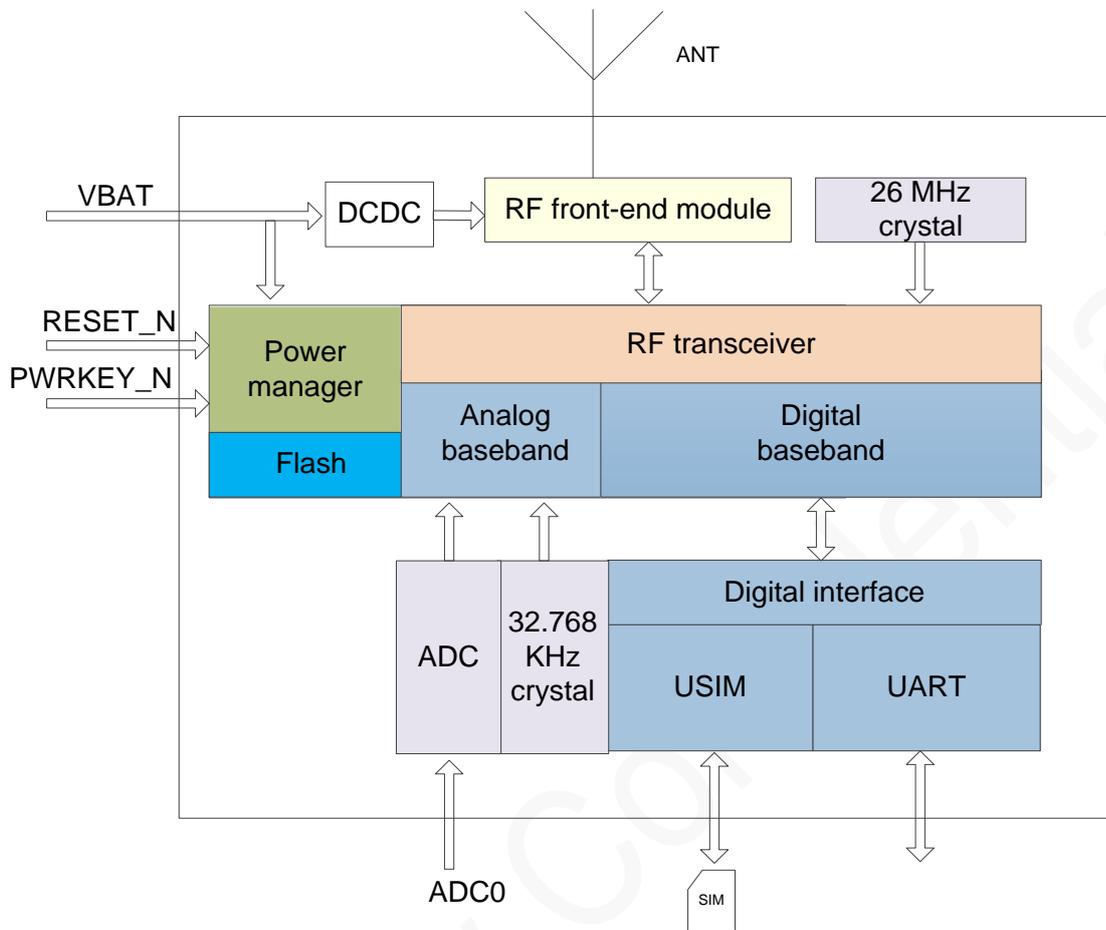
2.3 Basic Features

Table 2-2 Basic features of the N25 module

Feature	Description
Physical features	• Dimensions: (24±0.10) mm × (20±0.10) × (2.45±0.10) mm • Package: 52-pin LGA • Weight: about 1.8 g
Temperature range	Operating temperature range: -40°C to +85°C Storage temperature range: -45°C to +90°C
Operating voltage	VBAT: 3.4 V to 4.3 V, Typical value: 3.8 V
Current (LTE Cat NB1)	Idle mode: < 2 mA (@DRX = 1.28s) eDRX mode: < 1 mA (@eDRX = 40.96s, PTW = 10.24s) PSM mode: < 4.5 uA
Current (GPRS)	Idle mode: < 2 mA

Application processor	MIPS processor 192 MHz main frequency 16 KB L2 cache
Memory	ROM: 32 Mb RAM: 32 Mb
Frequency band	See Table 2-1.
Wireless rate	LTE Cat NB1: 26 kbps (DL)/62.5 kbps (UL) LTE Cat NB2: 126.8 kbps (DL)/158.5 kbps (UL) GPRS: 85.6 kbps (DL/UL)
Power class	LTE: +23 dBm+/-2 dB (Power Class 3) GPRS 850/900: 33 dBm+/-2 dB GPRS 1800/1900: 30 dBm+/-2 dB
Application interface	Antenna interface: 4G antenna, 50Ω characteristic impedance
	One UART interface (UART1) that supports hardware flow control, used in sending AT commands
	SIM card interface: one UIM interface, adaptive 1.8 V/3 V
	One ADC interface
	Built-in 2 mm x 2 mm eSIM (optional)
AT command	3GPP Rel-13 3GPP Rel-14 Neoway extended AT commands
Short message	Text/PDU Point to Point/Cell Broadcast
Cloud platform	China Mobile OneNet, China Telecom E-Cloud, Huawei OceanConnect platform
Protocol	CoAP/UDP/TCP/IP/PPP/DNS/FTP/HTTP/HTTPS/DTLS/SMS
Certification approval	CCC, SRRC, CTA, RoHS, CE, GCF*, FCC*

* indicates in development.

3 Reference Standards

The N25 module design references the following standards:

- 3GPP TS 51.010-1V13.11.0 Mobile Station (MS) conformance specification;Part 1:Conformance specification

- 3GPP TS 36.521-1 V16.2.1 User Equipment (UE) conformance specification;Radio transmission and reception;Part 1: Conformance Testing

- 3GPP TS 36.124 V16.1.0 ElectroMagnetic Compatibility (EMC) requirements for mobile terminals and ancillary equipment

- 3GPP TS 21.111 V16.0.0 USIM and IC card requirements

- 3GPP TS 51.011 V4.15.0 Specification of the Subscriber Identity Module Mobile Equipment (SIM-ME) interface

- 3GPP TS 31.102 V17.0.0 Characteristics of the Universal Subscriber Identity Module (USIM) application

- 3GPP TS 31.111 V17.0.0 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)

- 3GPP TS 27.007 V17.0.0 AT command set for User Equipment (UE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
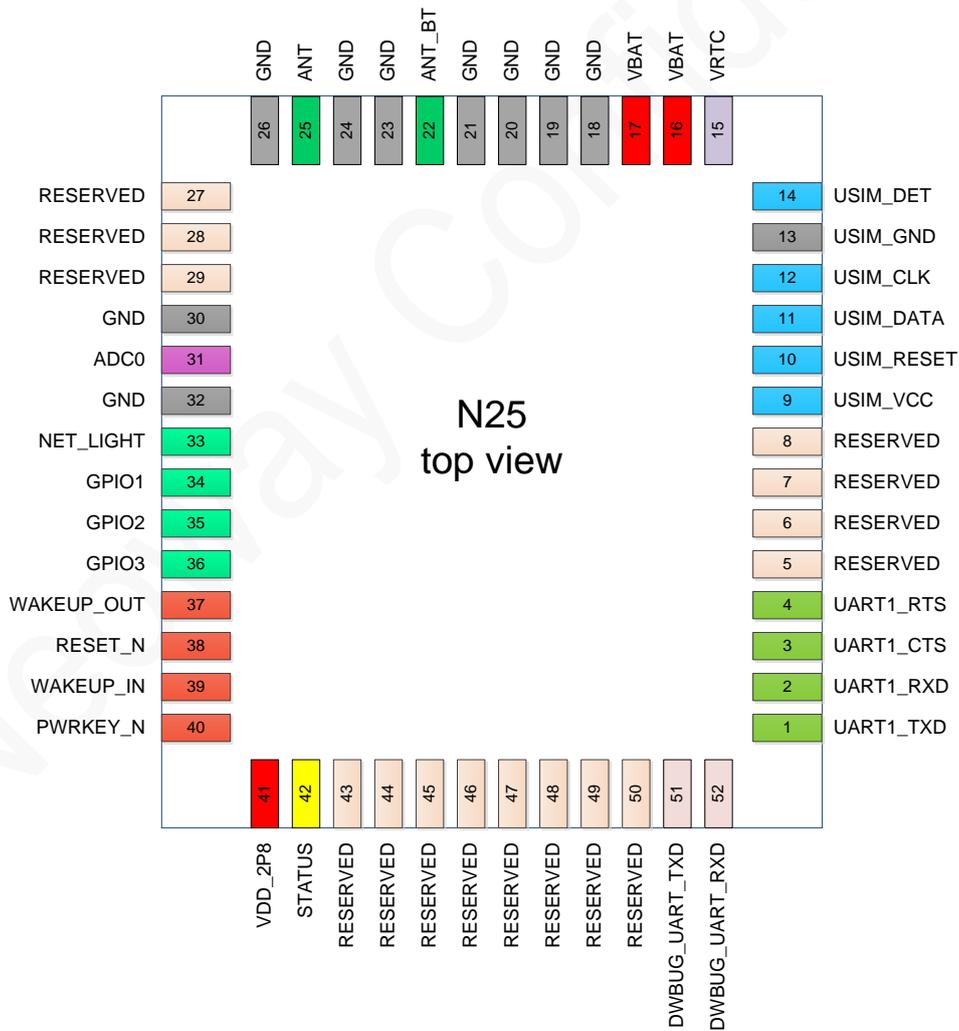
4 Module Pins

There are 52 pins on the N25 module and pads use the LGA package. The N25 module supports the functional interfaces, including the power, UART, USIM, status control, and RF interfaces.
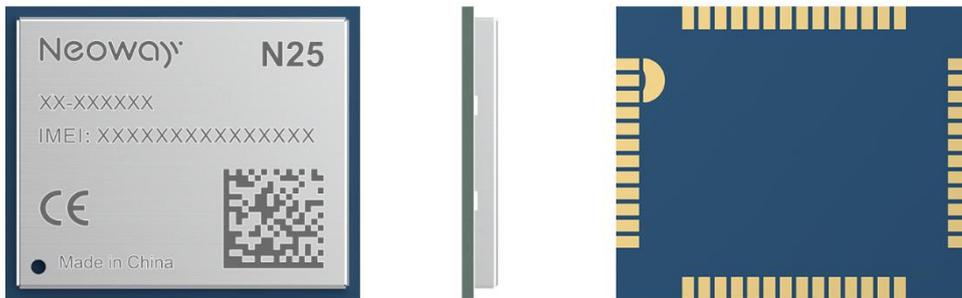
4.1 Pin Layout

Figure 4-1 shows the pin layout of the N25 module.

Figure 4-1 Pin layout of the N25 module (top view)

4.2 Module Appearance

5 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the N25 module, including the input and output voltage and current of the power supply, the current consumption of the module in different states, the operating and storage temperature ranges, and the ESD protection characteristics.

5.1 Electrical Characteristics

⚠️
- If the voltage is excessively low, the module might fail to start. If the voltage is excessively high or there is a voltage burst during the startup, the module might be damaged permanently.
- If you use LDO or DC-DC to supply power to the module, ensure that the output current is at least 2 A.

Table 5-1 Electrical characteristics of the N25 module

Model Status		Minimum Value (Limit)	Typical Value	Maximum Value (Limit)
VBAT	V_{in}	3.4 V	3.8 V	4.3 V
	I_{in}	-	-	2 A

5.2 Current Consumption Characteristics

Table 5-2 Current consumption of the N25 module (typical)

Frequency Band	Status	Power (dBm)	PSM (uA)	Idle (DRX/eDRX) (mA)	Active (mA)	
					TX	RX
Cat NB: 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 Characteristics

Table 5-3 Temperature characteristics of the N25 module

Module Status	Minimum Value	Typical Value	Maximum Value
Operating temperature	-40°C	25°C	85°C
Storage temperature	-45°C	25°C	90°C

> ℹ️ If the actual operating temperature exceeds the allowable operating temperature range of the module, certain RF performance of the module (such as frequency error or phase error) may deteriorate, but it will not have great impact on the use of the module.

5.4 ESD Protection Characteristics

Electronic products need to pass ESD tests. The following table shows the ESD capability of key pins of the module. It is recommended to add ESD protection based on the application industry of the product to ensure product quality when designing a product.

Test environment: humidity 45%; temperature 25°C

Table 5-4 ESD protection characteristics of the N25 module

Test Point	Contact Discharge	Air Discharge
VBAT	±8 kV	±15 kV
GND	±8 kV	±15 kV
ANT	±8 kV	±15 kV
Shielding cover	±8 kV	±15 kV
Others	±2 kV	±4 kV

6 RF Characteristics

This chapter describes the RF characteristics of the N25 module, including the operating bands, conducted TX power, and RX sensitivity.

6.1 Operating Bands

Table 6-1 Operating bands of the N25 module

	Operating Band	Uplink	Downlink
Cat-NB1/Cat-NB2	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
GPRS	GPRS850	824–849 MHz	869–894 MHz
	GPRS900	880–915 MHz	925–960 MHz
	GPRS1800	1710–1785 MHz	1805–1880 MHz
	GPRS1900	1850–1910 MHz	1930–1990 MHz

6.2 Power and Sensitivity

Table 6-2 N25 RF TX power

Band	Maximum Power	Minimum Power
HD-FDD LTE B3	23 dBm±2 dB	< -40 dBm
HD-FDD LTE B5	23 dBm±2 dB	< -40 dBm
HD-FDD LTE B8	23 dBm±2 dB	< -40 dBm
HD-FDD LTE B20	23 dBm±2 dB	< -40 dBm
HD-FDD LTE B28	23 dBm±2 dB	< -40 dBm
GSM850/EGSM900	33 dBm±2 dB	5 dBm±2 dB
DCS1800/PCS1900	30 dBm±2 dB	0 dBm±2 dB

Table 6-3 N25 conducted RX sensitivity (no retransmission)

| Band	REFSENS	Duplex Mode
LTE B3, B5, B8, B20, B28	≤ -113 dBm@200 kHz ≤-123dBm@15 kHz	HD-FDD
GSM850/EGSM900/DCS1800/PCS1900	< -108 dBm@200 kHz	FDD

> The TX power and RX sensitivity of the module are reference values obtained when an RF tester is connected in a laboratory and MT8821C is used for RF conduction tests.

7 Mechanical Characteristics

This chapter describes the mechanical characteristics of the N25 module.

7.1 Dimensions

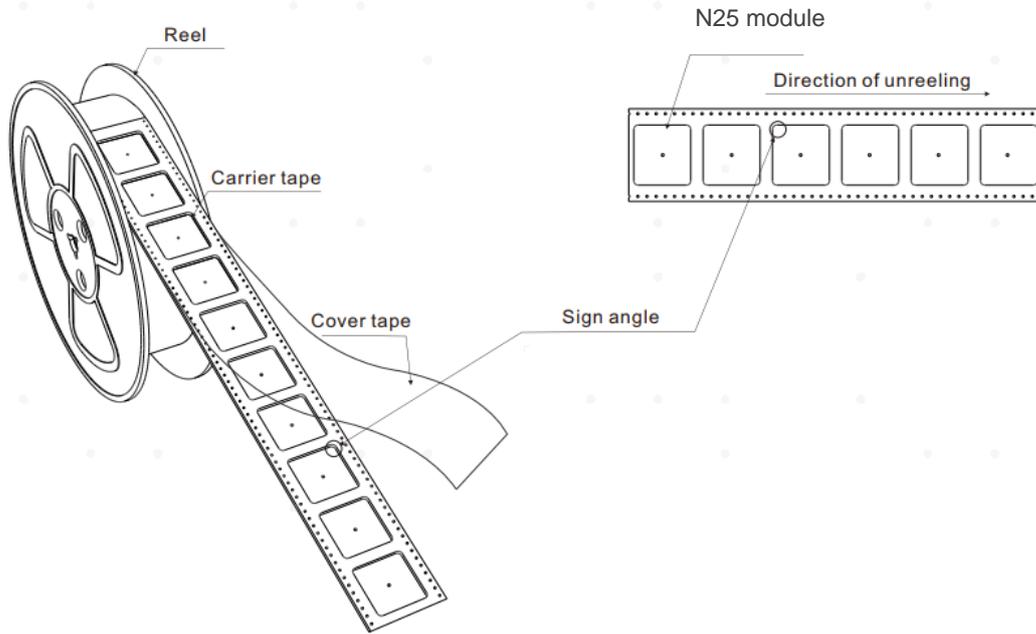Figure 7-1 N25 top and side dimensions (unit: mm)
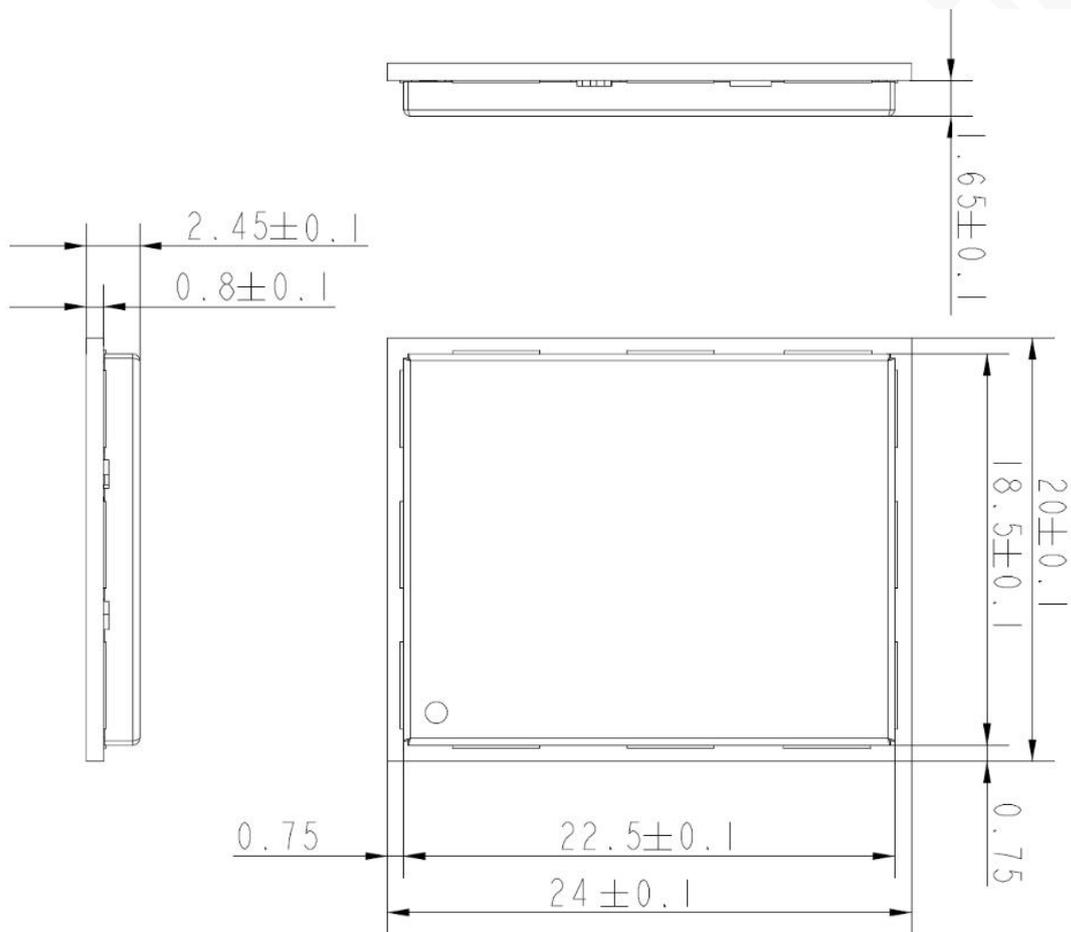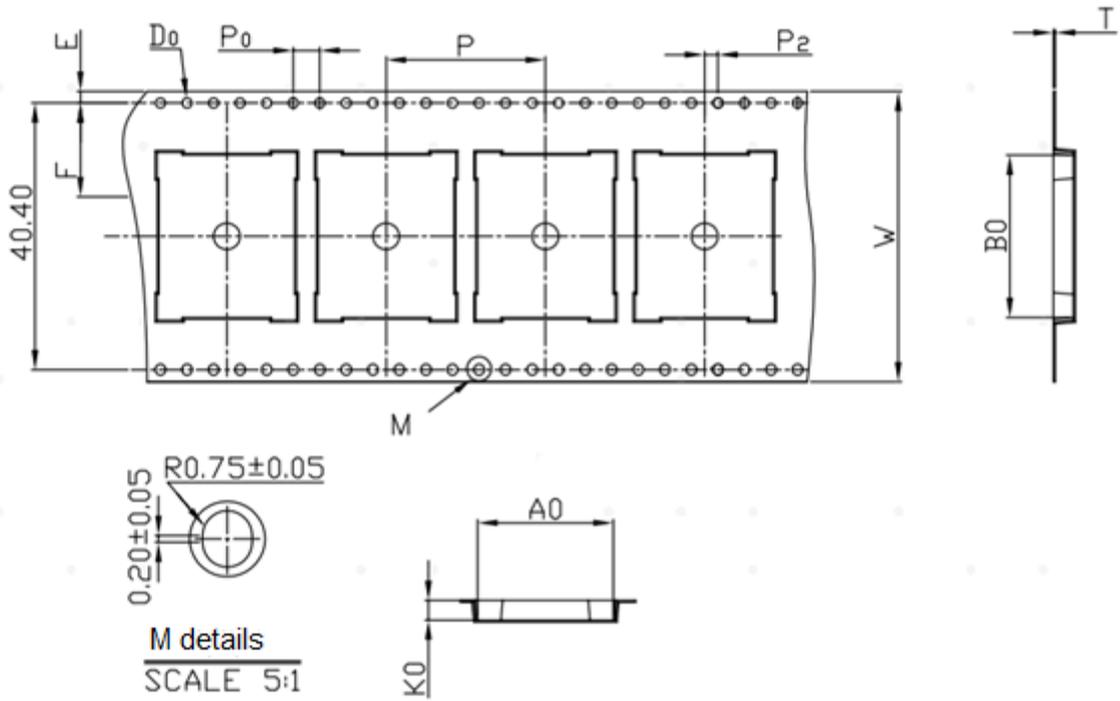
7.2 Label

7.3 Packaging

The N25 module uses a surface-mount method for furnace welding. A moisture-proof packaging method is used to prevent the product from being moist from production to customer use. That is, a processing method, such as using the aluminum foil bag, desiccant, humidity indicator card, vacuum-formed plastic tray, or vacuum, is used to ensure the dryness of the product and prolong the lifetime.

7.3.1 Reel and Tape

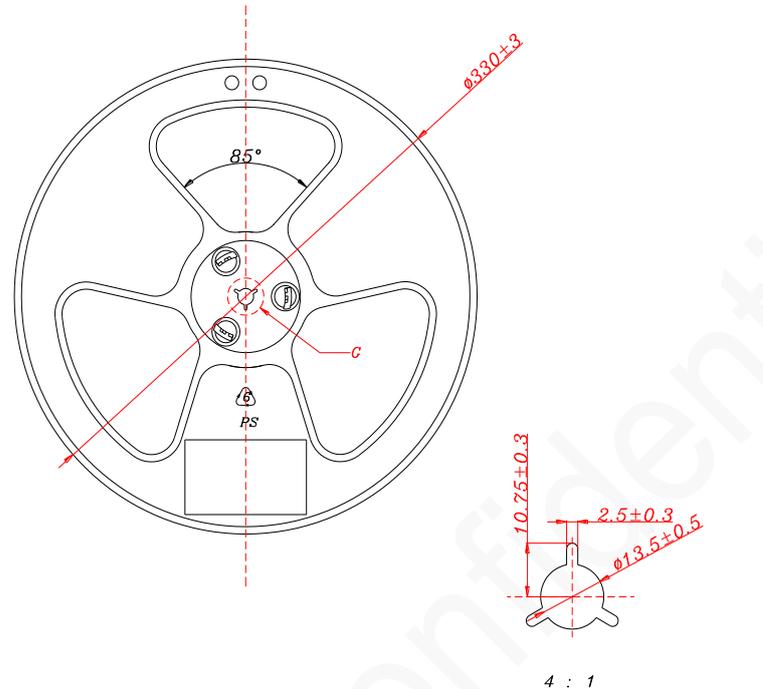N25 modules in mass production are delivered in the following packaging.

Tape details

R0.75±0.05

0.20±0.05

M details
SCALE 5:1

*Dimension

Item	W	A_0	B_0	K_0	K_1	P	F	E	D_0	D_1	P_0	P_2	T
Dimension	44.00±0.30	20.45±0.10	24.60±0.10	3.00 ±0.10		24.00±0.10	20.20±0.10	1.75±0.10	1.50+0.10 −0.00	0.00+0.10 −0.00	4.00±0.10	2.00±0.10	0.30±0.05

Reel details

7.3.2 Moisture

N25 is a level-3 moisture sensitive device, in compliance with standard IPC/JEDEC J-STD-020. Pay attention to all the related requirements for using this kind of components.

After the module is unpacked, if it is exposed to the air for a long time, the module will be moist, and the module may be damaged during reflow soldering or welding in a lab. It is recommended that the module exposed to the air for a long time must be baked before it can be used again. The baking conditions are determined based on the moisture condition. It is recommended to bake the module at a temperature higher than 90 degrees for more than 12 hours. In addition, since the carrier tape is of non-high temperature resistant material, the module cannot be baked directly on the vacuum-formed plastic tray.

7.4 Storage

The storage conditions of the N25 module are as follows:

- Storage temperature range: 20°C to 26°C

- Storage humidity range: 40% to 60%
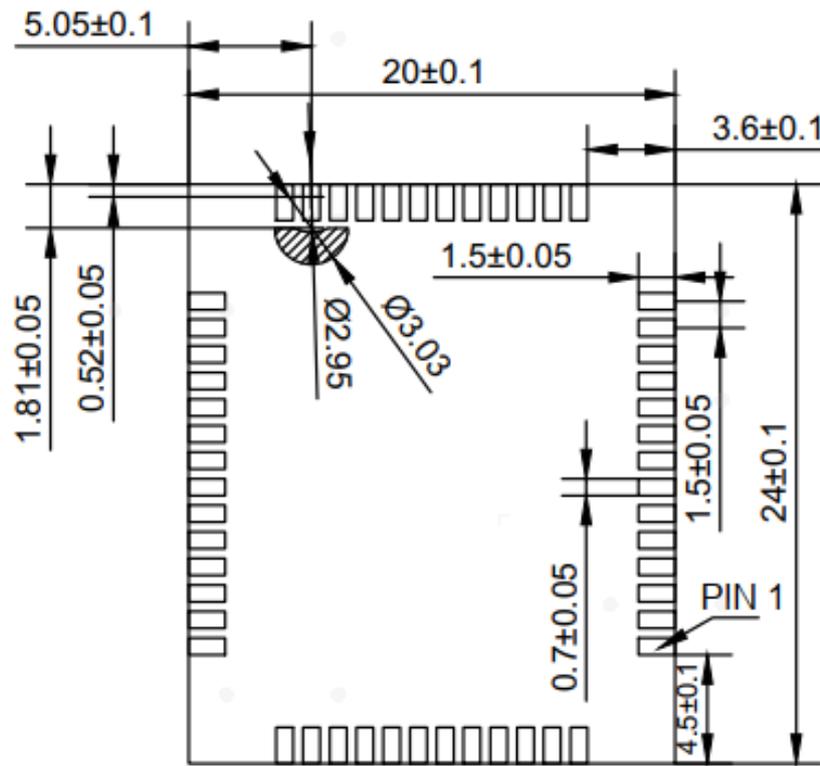
- Storage days: 120 days

8 Assembly

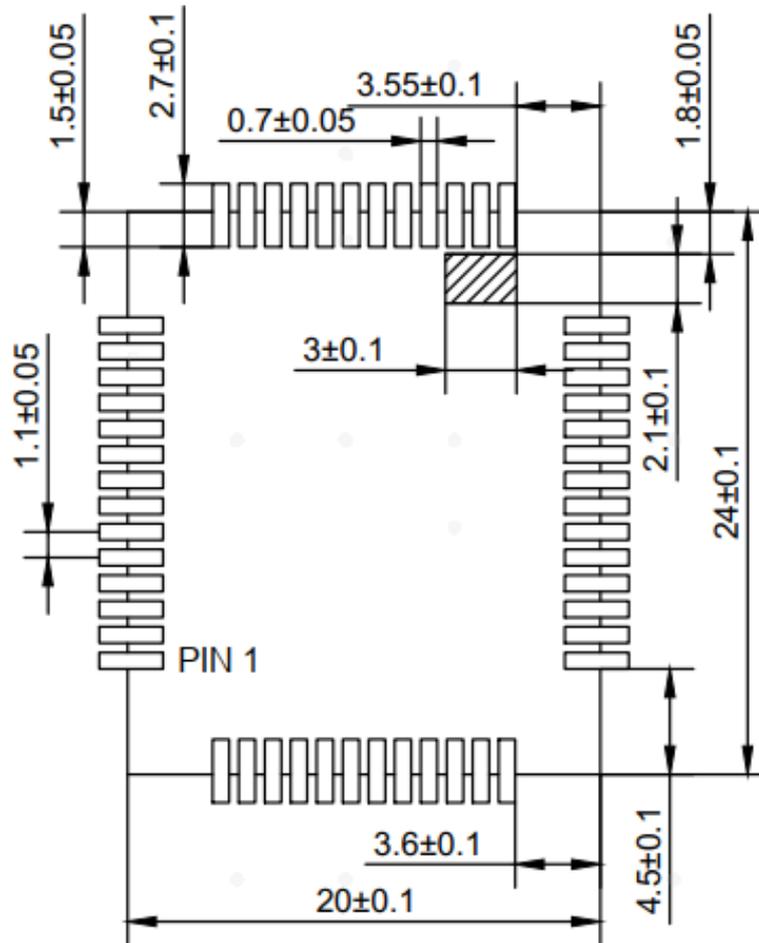The N25 module uses 52-pin LGA package and SMD welding method for assembly.

8.1 Module PCB Package

Figure 8-1 Bottom view of the N25 module PCB (unit: mm)

8.2 Application PCB Package

Figure 8-2 Recommended application PCB package of the N25 module (unit: mm)

> In the shaded area of the application package, signal cables and signal via holes are prohibited, and only GND cables and GND holes are allowed. Because this area of the module is for GND copper production, you need to avoid the risk of short circuit of signal cables.

8.3 Stencil

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

8.4 Solder Paste

The solder paste volume and the PCB flatness play key roles in the production yield.

Do not use solder pastes with lead that use a module technique that is different from Neoway module technique.

- The melting temperature of solder pastes with lead is 35°C lower than that of solder pastes without lead. The temperature in the reflow process parameters is also lower than that of solder pastes without lead, and less time is consumed correspondingly. It is easy to cause the pad in the module to be in the semi-melted state after the second reflow soldering, resulting in poor soldering.

- If customers must use solder pastes with lead, 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.

If the PCB is thin or slender, there is a potential risk of warpage during the SMT process. It is recommended to use a carrier in the SMT and reflow soldering process to prevent poor soldering caused by PCB warpage.

Figure 8-3 SMT furnace temperature curve
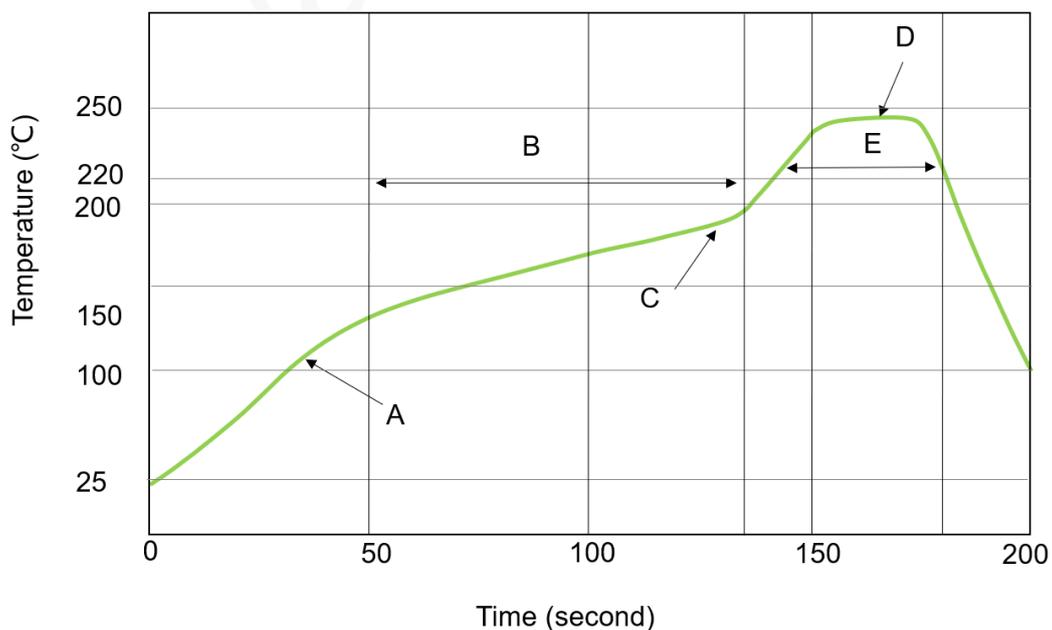
Technical parameters:

- Ramp-up rate: 1°C/sec to 4°C/sec

- Ramp-down rate: -3°C/sec to -1°C/sec

- Soaking zone: 150–180°C, time: 60–100s

- Reflow zone: > 220°C, time: 40–90s

- Peak temperature: 235–250°C

For information about important notes in N25 storage and mounting, refer to *Neoway Module Reflow Manufacturing Recommendations*.

When manually desoldering the module, use heat guns with great opening, adjust the temperature to about 250°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.

A Abbreviations

Abbreviation	Full Name
ADC	Analog-to-Digital Converter
bps	Bits per Second
FDD	Frequency Division Duplex
GPRS	General Packet Radio Service
LGA	Land Grid Array
LCC	Leadless Chip Carriers
LTE	Long Term Evolution
PCB	Printed Circuit Board
RF	Radio Frequency
UART	Universal Asynchronous Receiver-Transmitter
USIM	Universal Subscriber Identity Module