neoway

Get connected Get smart

N27

Product Specifications

Issue 1.0 Date 2020-04-21

Notice

This document provides a guide for users to use N27.

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.

THE INFORMATION IN THIS DOCUMENT IS SUBJECT TO CHANGE WITHOUT NOTICE DUE TO PRODUCT VERSION UPDATE OR OTHER REASONS.

EVERY EFFORT HAS BEEN MADE IN PREPARATION OF THIS DOCUMENT TO ENSURE ACCURACY OF THE CONTENTS, BUT ALL STATEMENTS, INFORMATION, AND RECOMMENDATIONS IN THIS DOCUMENT DO NOT CONSTITUTE A WARRANTY OF ANY KIND, EXPRESS OR IMPLIED.

Neoway provides customers complete technical support. If you have any question, please contact your account manager or email to the following email addresses:

Sales@neoway.com

Support@neoway.com

Website: http://www.neoway.com

Contents

Table of Figures

Table of Tables

About This Document

Scope

This document is applicable to N27 series.

It defines the features, indicators, and test standards of the N27 module.

Audience

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

Change History

Issue	Date	Change	Changed By
1.0	2019-12	Initial draft	Longsigh Huang

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_N27_Datasheet

Neoway_N27_Product_Specifications

Neoway_N27_AT_Command_Mannual

Neoway_N27_EVK_User_Guide

1 About N27

N27 is an industrial-grade LTE-Cat M/Cat NB1/Cat NB2 module that is developed on Qualcomm MDM9205 and supports FDD LTE, GPRS, and GPS.

1.1 Product Overview

The N27 series includes multiple variants. The following table lists the variants and frequency bands supported. * indicates that the variant or function is in the development phase.

Table 1-1 Variant and frequency bands

Variant	Category	Band	GNSS
WW	CATM1/ GPRS	CATM: B1, B2,B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85 GPRS: 850/900/1800/1900 MHz	Support
W1*	CATM1/ GPRS	CATM1: B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, **B31**, B66, B85 GPRS: 850/900/1800/1900 MHz	Support
W2*	CATM1/CATNB1/CATNB2 GPRS	CATM1: B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, **B31**, B66, B85 CATNB1/NB2: B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, **B31**, B66, B85 GPRS: 850/900/1800/1900 MHz	Support
W3*	CATM1/CATNB1/CATNB2 GPRS	CATM1: B1, B2,B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B66, B85 CATNB1/NB2: B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, **B71**, B85 GPRS: 850/900/1800/1900 MHz	Support

N27 adopts a 76-pin package with a square GND pad at each corner. Its dimensions are only 18 mm x24 mm. With industrial-grade performance, it is well applicable to electrical terminals, tracker, POS,

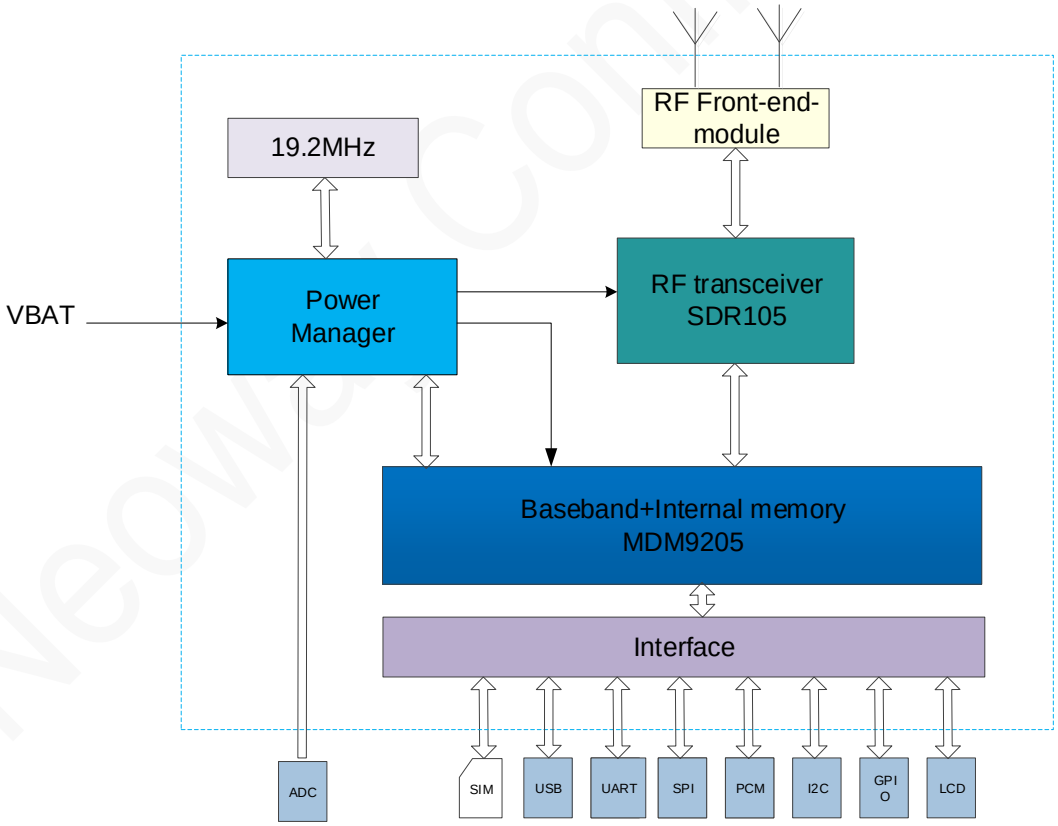
and other IoT terminals.

1.2 Block Diagram

N27consists of the following functionality units:

- Baseband
- Internal memory
- 19.2MHz crystal oscillator
- Power management unit
- RF section
- Digital interfaces (SIM, I2C, UART, PCM*, USB, LCD, SPI)
- Analog interfaces (ADC)

Figure 1-1 Block Diagram



* indicates the function is in the development phase.

1.3 Basic Features

Parameter	Description
Physical features	• Dimensions: (24.0±0.15) mm × (18.0±0.15) mm × (2.3±0.2) mm • Package: LGA • Weight: TBD
Temperature ranges	Operating: -35°C to +75°C Extended: -40°C to +85°C[1] Storage: -40°C to +90°C
Operating voltage	VBAT: 3.1V to 4.3V, TYP: 3.6V
Current	PSM: TBD Idle: TBD Working: 250 mA@ Cat M
MIPS processor	ARM Cortex-A7 processor, 800 MHz main frequency, 256 KB L2 cache
Memory	32 MB LPDDR2 + 64MB NAND Flash
Band	See Table 1-1.
Wireless rate	GPRS: Max 85.6 Kbit/s(DL) / Max 85.6 Kbit/s(UL) FDD LTE: CatM1, Max 588Kbps(DL)/Max 1.119Mbps(UL) CatNB1, Max 34Kbps(DL)/Max 19.7(single-tone)/66.6(muti-tone)Kbps(UL) CatNB2, Max 127Kbps(DL)/Max 158.5Kbps(UL)
Transmit power	EGSM900: +33dBm (Power Class 4) DCS1800: +30dBm (Power Class 1) LTE CAT-M/CAT-NB: +23dBm (Power Class 3)
Application interfaces	2G/4G antenna, GNSS antenna, 50Ω characteristic impedance
	Three UART interfaces, at most 4 Mbit/s
	One SIM interface, 1.8V only
	One USB2.0 interface, device mode only
	Two ADC interfaces, detectable voltage ranging from 0.1 to 1.7V
	One I2C interface, master mode only
	One SPI interface, maximum frequency of 50 MHz
	One PCM interface, MUX as I2S interface
	One LCD interface, in development phrase
AT commands	3GPP Release 13

[1] Some RF indicators might not meet 3GPP/3GPP2 standards in extended temperature but it does not affect functioning.

	Neoway extended commands
SMS	PDU, TXT
Protocol	TCP, UDP, HTTP, FTP, MQTT, LWM2M, COAP
Certification approval	CCC, FCC, RoSH

2 Compliant Standards

N27 complies with the following standards:

- 3GPP TS 07.07 *AT command set for GSM Mobile Equipment (ME)*
- YD 1214-2006 *Technical requirement of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
- YD 1215-2006 *Testing Methods of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
- YD 1032-2000 *Limits and Measurement Methods of Electromagnetic Compatibility for 900/1800MHz Digital Cellular Telecommunications System Part1: Mobile Station and Ancillary Equipment*
- 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*
- GB/T22450.1-2008 *Limits and measurement methods of electromagnetic compatibility for 900/1800MHz TDMA digital cellular telecommunications system - Part 1: Mobile station and ancillary equipment*
- CNCA-O7C-031:2007 *Rules for Compulsory Certification of Telecommunication Equipment Telecommunication Terminal Equipment*
- 3GPP *TS GSM Specification Set*

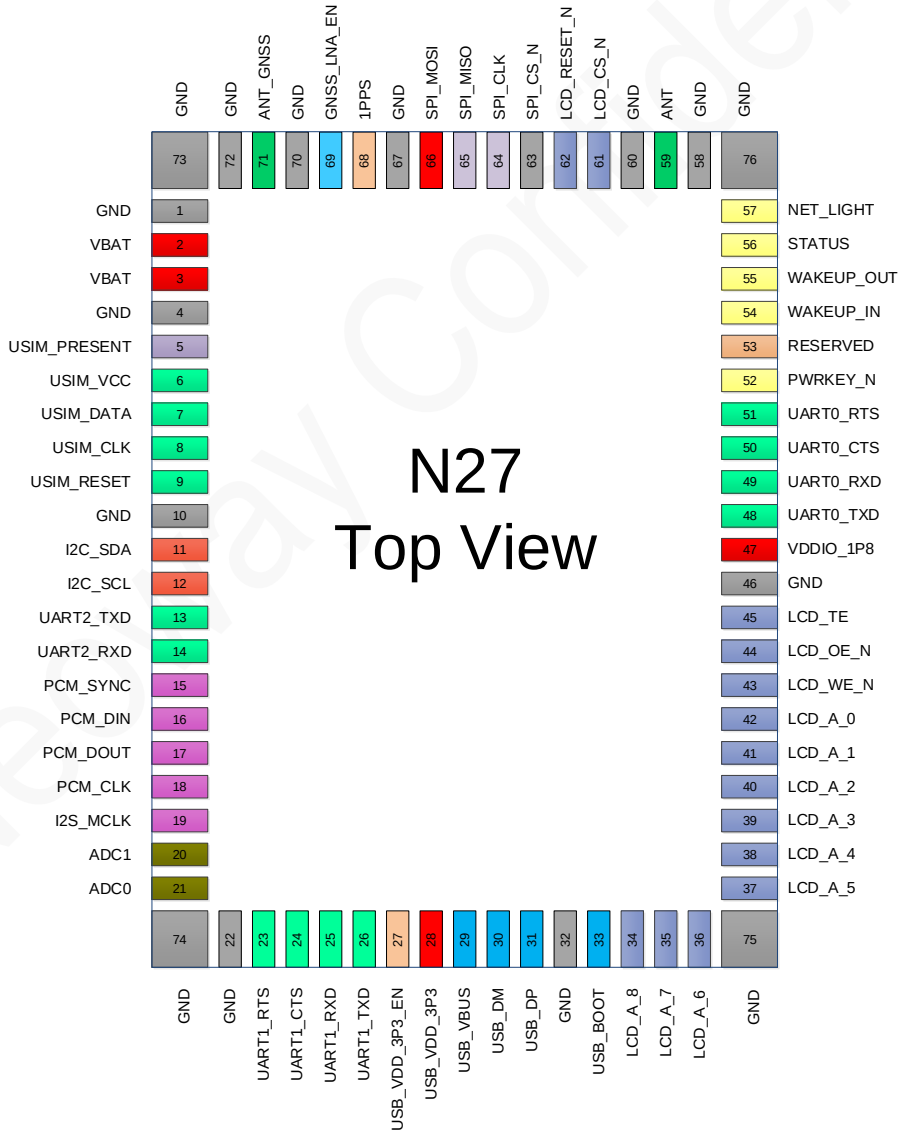
3 Module Pins

There are 76 pins on N27 and their pads are introduced in the LGA package.

3.1 Pad Layout

Figure 2-1 shows the pad layout of the N27.

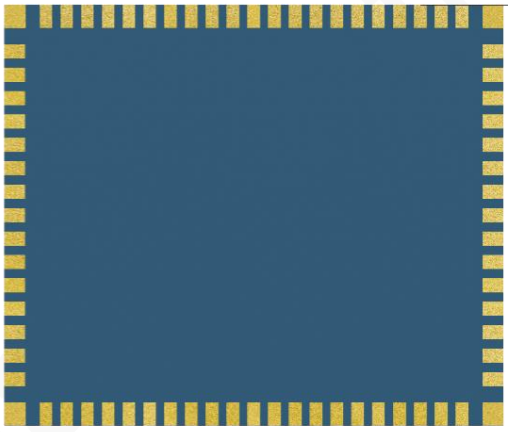
Figure 3-1 N27 Pin definition



3.2 Module Apperance

Figure 3-1 Top view of N27

Figure 3-2 Bottom view of N27



4 Electric Features and Reliability

This chapter describes the electric feature and reliability of the N27 module.

4.1 Electric Features

Table 4-1 Operating conditions of N27

Pin	Parameter	Minimum Value	Typical Value	Maximum Value
VBAT	V_{in}[2]	3.1V	3.6V	4.3V
	I_{in}	/	/	3A
	$V_{in(ext)}$[3]	-0.5 V	/	6.0 V

Table 4-2 Current consumption of N27 (typical)

Status / Frequency Band	Power (dBm)	PSM/Sleep (mA)	Idle (DRX/eDRX) (mA)	Active (mA)	
				TX	RX
LTE FDD-CATM: B1, B2, B3, B4, B5, B8, B12, B13, B14, B18, B19, B20, B25, B26, B27, B28, B31, B66, B85	23	TBD	x	250	x
	10	TBD	x	160	x
	0	TBD	x	124	x
	-10	TBD	x	120	x
LTE FDD-CATNB: B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B31, B66, B71, B85	23	TBD	x	x	x
	10	TBD	x	x	x
	0	TBD	x	x	x
	-10	TBD	x	x	x
GSM 800/900	33	TBD	x	x	x
GSM1800/1900	30	TBD	x	x	x

[2] indicates that the module can operate properly within this temperature range.

[3] indicates the module might fail to operate but will not be damaged within this temperature range. The module will be damaged if it works at a temperature beyond the range.

4.2 Temperature Features

Table 4-3 Temperature feature of N27

Status	Minimum Value	Typical Value	Maximum Value
Operating[4]	-35°C	+25°C	+75°C
Extended[5]	-40°C		+85°C
Storage	-45°C		+90°C

4.3 ESD Protection

The following table shows the ESD capability of key pins of this module. It is recommended to add ESD protection based on the application scenarios to ensure product quality when designing a product.

Humidity 45% Temperature 25°C

Table 4-4 ESD protection of N27

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

[4]When the module works at a temperature within the range, its performance can meet the 3GPP standards.

[5]Some RF indicators might not meet 3GPP/3GPP2 standards in extended temperature but it does not affect functioning.

5 RF Features

This chapter describes the frequency range, TX power, and RX sensitivity.

5.1 Operating Bands

Table 5-1 Operating Bands of N27

Operating Bands	Uplink	Downlink
GSM850	824~849MHz	869~894MHz
GSM900	880~915MHz	925~960MHz
DCS1800	1710~1785MHz	1805~1880MHz
PCS1900	1850~1910MHz	1930~1990MHz
FDD-LTE B1	1920~1980MHz	2110~2170MHz
FDD-LTE B2	1850~1910MHz	1930~1990MHz
FDD-LTE B3	1710~1785MHz	1805~1880MHz
FDD-LTE B4	1710~1755MHz	2110~2155MHz
FDD-LTE B5	824~849MHz	869~894MHz
FDD-LTE B8	880~915MHz	925~960MHz
FDD-LTE B12	698~716MHz	728~746MHz
FDD-LTE B13	777~787MHz	746~756MHz
FDD-LTE B14(CATM-only)	788~798MHz	758~768MHz
FDD-LTE B18	815~830MHz	860~875MHz
FDD-LTE B19	830~845MHz	875~890MHz
FDD-LTE B20	832~862MHz	791~821MHz
FDD-LTE B25	1850~1915MHz	1930~1995MHz
FDD-LTE B26	814~849MHz	859~894MHz
FDD-LTE B27(CATM-only)	807~824MHz	852~869MHz
FDD-LTE B28	703~748MHz	758~803MHz
FDD-LTE B31	452.5~457.5MHz	462.5~467.5MHz
FDD-LTE B66	1710~1780MHz	2110~2180MHz
FDD-LTE B71*(no supported)	617~652MHz	663~698MHz

FDD-LTE B85	698~716MHz	728~746MHz

5.2 TX Power and RX Sensitivity

Table 5-2 RF transmit power of N27

Band	Max Power	Min. Power
GSM850/900	33dBm+2/-2dB	5dBm+2/-2dB
DCS1800/PCS1900	30dBm+2/-2dB	0dBm+2/-2dB
HD-FDD LTE B1	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B2	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B3	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B4	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B5	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B8	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B12	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B13	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B14 (CATM only)	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B18	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B19	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B20	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B25	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B26	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B27(CATM only)	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B28	23dBm+2/-2.5dB(CATM1) 23dBm+2/-2dB(CATNB)	<-40 dBm
HD-FDD LTE B31	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B66	23dBm+2/-2dB	<-40 dBm
HD-FDD LTE B71(CATNB only)	20dBm+2/-2dB	<-40 dBm
HD-FDD LTE B85	23dBm+2/-2dB	<-40 dBm

Table 5-3 RX sensitivity of N27 GSM

Band	Sensitivity
EGSM800/900	≤-108dBm@200KHz
DCS1800/1900	≤-108dBm@200KHz

Table 5-4 RX sensitivity of N27 Cat M1

Band	Sensitivity (dBm/1.08M)	Duplex Mode
LTE B1	≤-107	HD-FDD
LTE B2	≤-107	HD-FDD
LTE B3	≤-107	HD-FDD
LTE B4	≤-107	HD-FDD
LTE B5	≤-107	HD-FDD
LTE B8	≤-107	HD-FDD
LTE B12	≤-107	HD-FDD
LTE B13	≤-107	HD-FDD
LTE B14	≤-107	HD-FDD
LTE B18	≤-107	HD-FDD
LTE B19	≤-107	HD-FDD
LTE B20	≤-107	HD-FDD
LTE B25	≤-107	HD-FDD
LTE B26	≤-107	HD-FDD
LTE B27	≤-107	HD-FDD
LTE B28	≤-107	HD-FDD
LTE B31*	≤-104	HD-FDD
LTE B66	≤-107	HD-FDD
LTE B85	≤-107	HD-FDD

All values above were obtained in the lab. In actual applications, there might be a difference because of network environments.

Table 5-5 RX sensitivity of N27 Cat NB1 (without retransmission)

Band	Sensitivity(dBm/180KHz)	Duplex Mode
LTE B1	≤-114	HD-FDD

LTE B2	≤-114	HD-FDD
LTE B3	≤-114	HD-FDD
LTE B4	≤-114	HD-FDD
LTE B5	≤-114	HD-FDD
LTE B8	≤-114	HD-FDD
LTE B12	≤-114	HD-FDD
LTE B13	≤-114	HD-FDD
LTE B18	≤-114	HD-FDD
LTE B19	≤-114	HD-FDD
LTE B20	≤-114	HD-FDD
LTE B25	≤-114	HD-FDD
LTE B26	≤-114	HD-FDD
LTE B28	≤-114	HD-FDD
LTE B31*	≤-114	HD-FDD
LTE B66	≤-114	HD-FDD
LTE B71*	≤-114	HD-FDD
LTE B85	≤-114	HD-FDD

Table 5-6 RX sensitivity of N27 Cat NB1 (with retransmission)

Band	Sensitivity
LTE B1, B2, B3, B4, B5, B8, B12, B13, B18, B19, B20, B25, B26, B28, B66, B71, B85	≤TBD
LTE B31	≤TBD

The LTE_NB1/LTE_NB2 might be supported by future variants.

5.3 GNSS Feature

Changes	Parameter
GPS L1 operating frequency	1575.42±1.023MHz

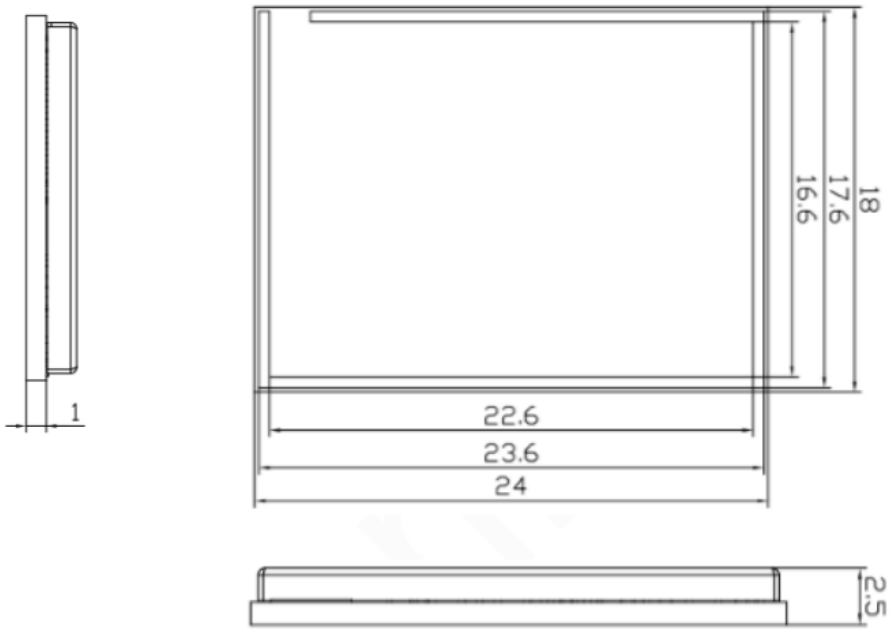
GLONASS operating frequency	1597.5~1605.9 MHz
BDSB1 operating frequency	1559.1~1563.1 MHz
Galileo E1/GPS L1C/BDS B1-BOC	1573.4~1577.5 MHz
Tracking sensitivity	TBD
Acquisition sensitivity	TBD
Positioning precision (in air)	TBD (CEP50)
Hot start (in air)	TBD
Cold start (in air)	TBD
Update frequency	1Hz by default
CNRin/CNRout	3dB
Max. positioning altitude	TBD
Max. positioning speed	TBD
Max. positioning acceleration	TBD
GNSS data type	TBD
GNSS antenna type	Passive

6 Mechanical Features

This chapter describes the mechanical features of N27.

6.1 Dimensions

Figure 6-1 N27 dimensions (Unit: mm)



6.2 Label

The label information is curved on the shell.

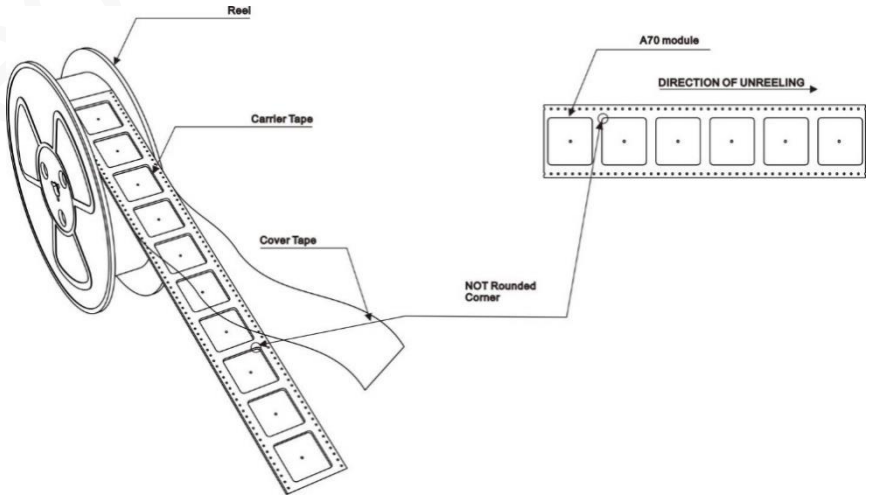
- The picture above is only for reference.
- The silk-screen printing must be clear. No blur is allowed.
- The material and surface finishing must comply with RoHS directives.

6.3 Packing

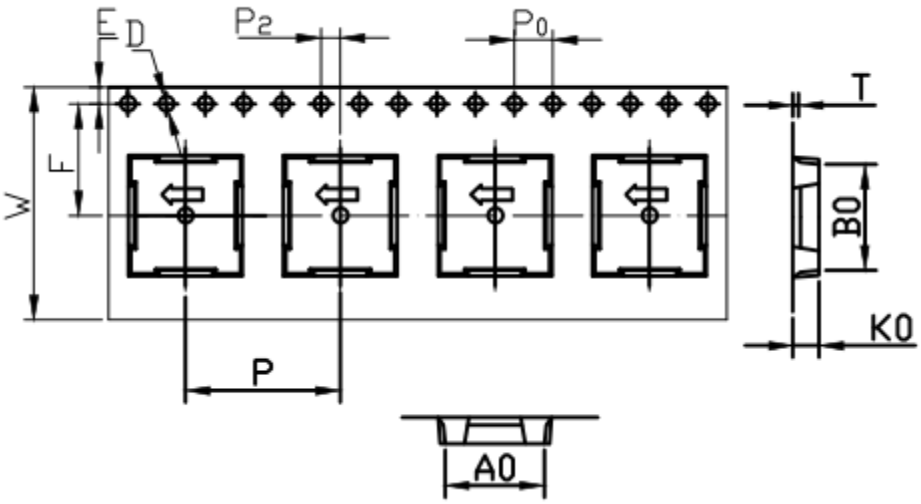
N27 modules are packed in sealed bags on delivery to guarantee a long shelf life. Follow the same package of the modules again in case of opened for any reason.

6.3.1 Reel Package

N27 in mass production is delivered in the following packaging.

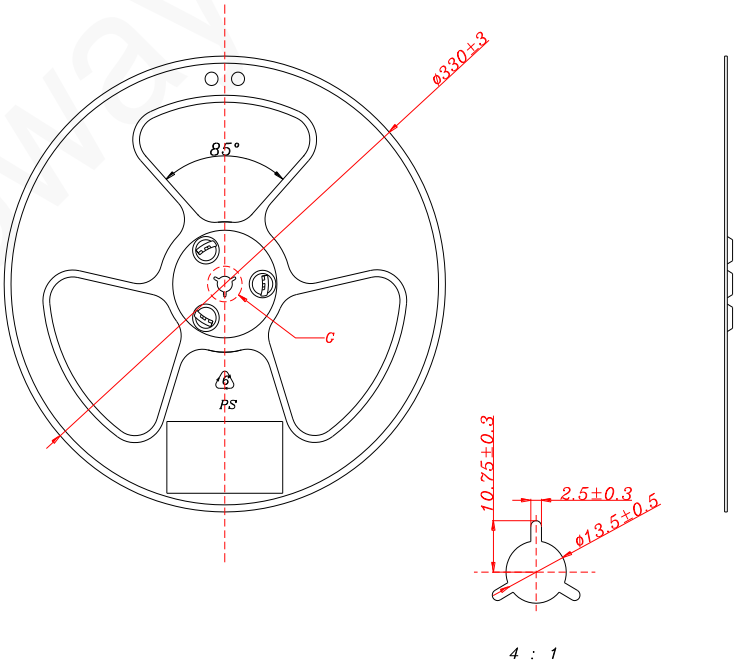


Tape



ITEM	W	A0	B0	K0	K1	P	F	E	D	D1	P0	P2
DIM	24.0 +0.30 -0.10	10.1 +0.10 -0.10	11.0 +0.10 -0.10	2.7 +0.10 -0.10	0.00 +0.10 -0.10	16.0 +0.10 -0.10	11.5 +0.10 -0.10	1.75 +0.10 -0.10	1.50 +0.10 -0.00	0.00 +0.25 -0.00	4.00 +0.10 -0.10	2.00 +0.10 -0.10

Reel



6.3.2 Moisture

N27 is a level 3 moisture-sensitive electronic elements, in compliance with IPC/JEDEC J-STD-020 standard.

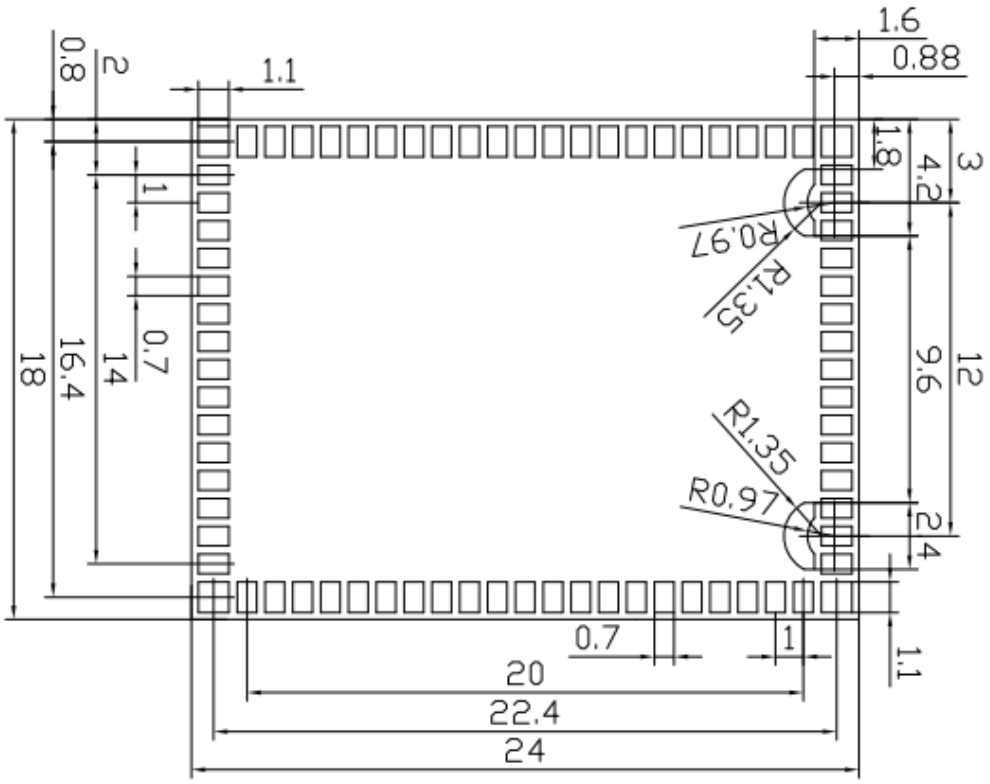
If the module is exposed to air for more than 48 hours at conditions not worse than 30°C/60% RH, bake it at a temperature higher than 90 degrees for more than 12 hours before SMT. Or, if the indication card shows humidity greater than 20%, the baking procedure is also required. Do not bake modules with the package tray directly.

7 Mounting N27 onto Application PCB

N27 is introduced in a 76-pin LGA package. This chapter describes the N27 footprint, recommended PCB design and SMT information to guide users on how to mount the module onto the application PCB board.

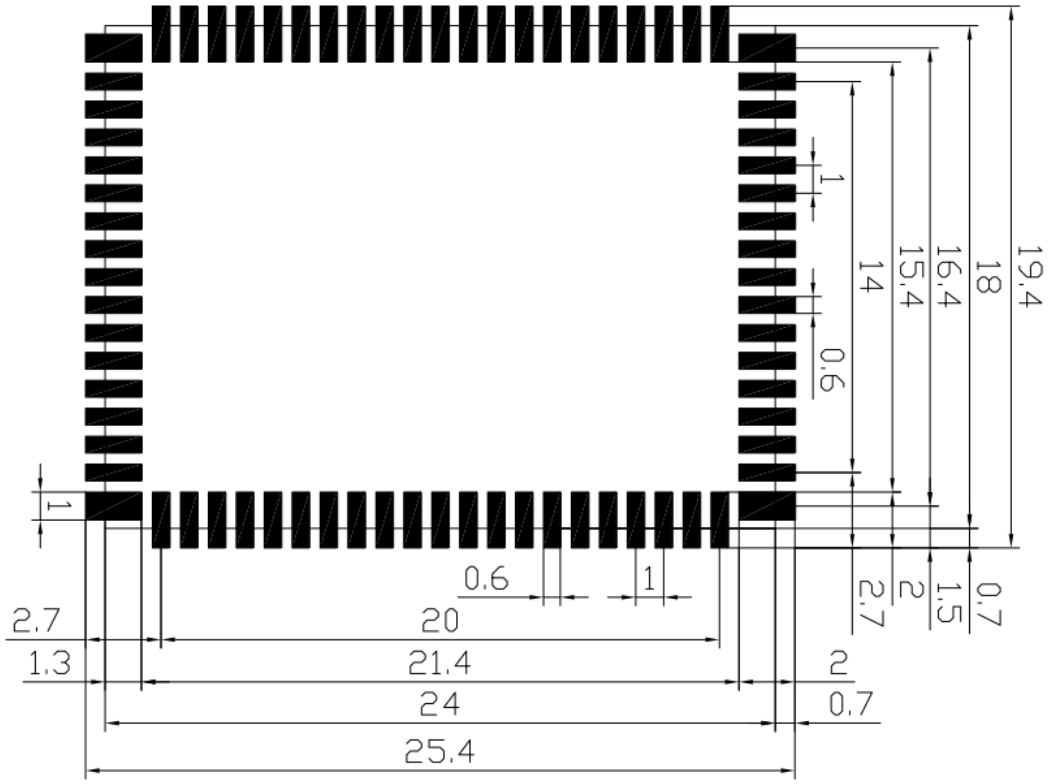
7.1 Bottom Dimensions

Figure 7-1 Bottom dimensions of N27 (Unit: mm)



7.2 Application Foot Print

Figure 7-2 Recommended footprint of N27 application PCB (Unit: mm)



7.3 Stencil

The recommended stencil thickness is at least 0.12 mm to 0.15 mm.

7.4 Solder Paste

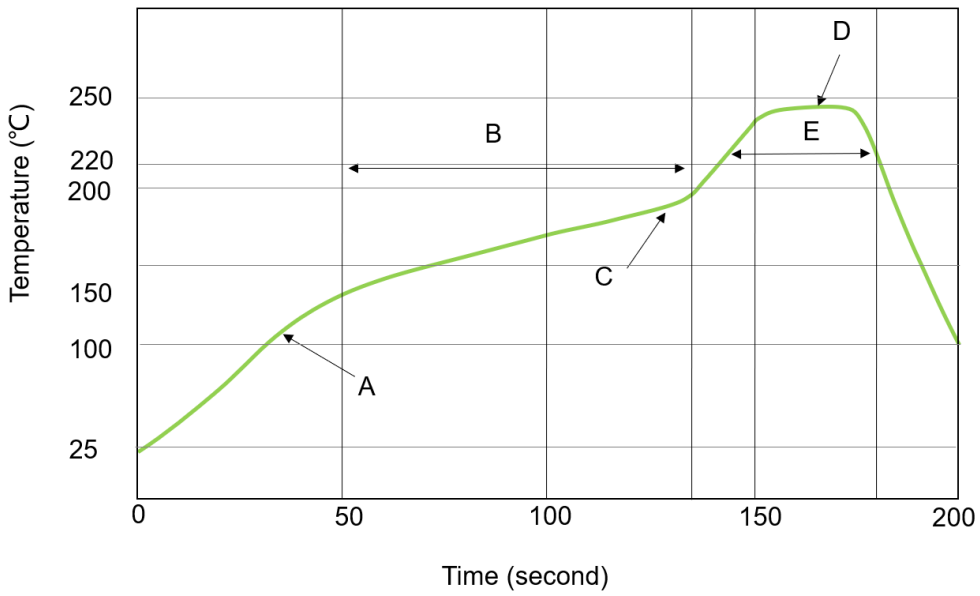
Do not use the kind of solder paste different from our module technique.

- The melting temperature of solder paste with lead is 35°C lower than that of solder paste without lead. It is easy to cause voiding for LGA inside the module after the 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.

7.5 SMT Furnace Temperature Curve

Thin or long PCB might bend during SMT. So, use loading tools during the SMT and reflow soldering process to avoid poor solder joint caused by PCB bending.

Figure 7-3 SMT furnace temperature curve



Technical parameters:

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

Neoway will not provide a warranty for heat-responsive element abnormalities caused by improper temperature control.

For information about cautions in N27 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 245 degrees (depending on the type of the solder paste), and heat the module till the solder paste is melt. Then 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.

8 Safety Recommendations

Ensure that this product is used in compliance with the requirements of the country and the environment. Please read the following safety recommendations to avoid body hurts or damages of product or workplace:

- Do not use this product at any places with a risk of fire or explosion such as gasoline stations, oil refineries, etc.
- Do not use this product in environments such as hospitals or airplanes where it might interfere with other electronic equipment.

Please follow the requirements below in application design:

- Do not disassemble the module without permission from Neoway. Otherwise, we are entitled to refuse to provide further warranty.
- Please design your application correctly by referring to the HW design guide document and our review feedback on your PCB design.
- Please connect the product to a stable power supply and route traces following fire safety standards.
- Please avoid touching the pins of the module directly in case of damages caused by ESD.
- Do not remove the USIM card in idle mode if the module does not support hot-plugging.

A Conformity and Compliance

A.1 Approvals

- CCC
- RoHS
- FCC

A.2 Chinese Notice

A.2.1 CCC Class A Digital Device Notice

This product has been tested and found to comply with the limits for class A digital devices. These limits are designed to provide reasonable protection against harmful interference in a residential installation.

A.2.2 Environmental Protection Notice

This product is compliant with China RoHS directives and does not contain any hazardous substances as per the above-referenced standard. Follow the regulations of the countries when storing, applying, and discarding it.

A.3 American Notice

This device complies with part 15 of the FCC Rules. Operation is subject to the following two conditions:

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

A.3.1 Modify

Changes or modifications made to this equipment, not expressly approved by us or parties authorized by us could void the user's authority to operate the equipment.

A.3.2 FCC Class A Digital Device Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

A.3.3 FCC Class B Digital Device Notice

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.

.A.3.4 Radiation Exposure Statement:

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20cm between the radiator & your body.

This device is intended only for OEM integrators under the following conditions:

1) The antenna must be installed such that 20 cm is maintained between the antenna and

users, and the maximum antenna gain allowed for use with this device is 2 dBi.

2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed

IMPORTANT NOTE: In the event that these conditions can not be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID can not be used on the final product. In these circumstances, the

OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

End Product Labeling

This transmitter module is authorized only for use in device where the antenna may be installed such that 20 cm may be maintained between the antenna and users. The final end product must be labeled in a visible area with the following: “Contains FCC ID: PJ7-N27-W3”. The grantee's FCC ID can be used only when all FCC compliance requirements are met.

Manual Information To the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user’s manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

B Abbreviation

Abbreviation	English Full Name
ADC	Analog-Digital Converter
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AMR	Acknowledged multi-rate (speech coder)
CPU	Central Processing Unit
DAI	Digital Audio interface
DAC	Digital-to-Analog Converter
DCE	Data Communication Equipment
DSP	Digital Signal Processor
DTE	Data Terminal Equipment
DTMF	Dual Tone Multi-Frequency
DTR	Data Terminal Ready
EFR	Enhanced Full Rate
EGSM	Enhanced GSM
EMC	Electromagnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electronic Static Discharge
ETS	European Telecommunication Standard
FDMA	Frequency Division Multiple Access
FR	Full Rate
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
HR	Half Rate
IC	Integrated Circuit
IMEI	International Mobile Equipment Identity
LCD	Liquid Crystal Display
LED	Light Emitting Diode

MS	Mobile Station
PCB	Printed Circuit Board
PCS	Personal Communication System
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-only Memory
RMS	Root Mean Square
RTC	Real-Time Clock
USIM	Subscriber Identification Module
SMS	Short Message Service
SRAM	Static Random Access Memory
TA	Terminal adapter
TDMA	Time Division Multiple Access
UART	Universal asynchronous receiver-transmitter
USSD	Unstructured Supplementary Service Data
VSWR	Voltage Standing Wave Ratio

