

# N715-EA

## Product Specifications

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**Notice**

This document provides guide for users to use N715-EA.

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

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Sales@neoway.com

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# About This Document

## Scope

This document is applicable to N715-EA.

## Audience

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

## Change History

Issue	Date	Change	Changed By
1.0	2022-11	Initial draft	Guo Shilei

## 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

# 1 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, and so on.

If the product is used in a place with flammable gas or dust such as propane gas, gasoline, or flammable spray, the product will cause an explosion or fire.

- Do not use this product in environments such as hospital or airplane where it might interfere with other electronic equipment.

If the product is used in medical institutions or on airplanes, electromagnetic waves emitted by this product may interfere with surrounding equipment.

Follow the requirements below in design and use of the application for this module:

- Do not disassemble the module without permission from Neoway. Otherwise, we are entitled to refuse to provide further warranty.
- Design your application correctly by referring to the HW design guide document and our review feedback on your PCB design. Connect the product to a stable power supply and lay out traces following fire safety standards.
- Please avoid touching the pins of the module directly in case of damages caused by ESD.
- Do not insert/remove a SIM card or memory card into/from the module while it is not powered off.

## 2 About N715-EA

N715-EA is a 4G industrial-grade cellular module developed based on UIS8910DM and its dimensions are  $(23.80 \pm 0.1)$  mm  $\times$   $(22.80 \pm 0.1)$  mm  $\times$   $(2.5 \pm 0.15)$  mm. The module supports GSM, FDD-LTE (Cat.1), and TDD-LTE (Cat.1). With rich hardware interfaces and support for audio, video, Wi-Fi positioning, and BT/BLE, the module is applicable to developing IoT communications devices including wireless meter reading terminals, shared bikes, industrial smart communications device, and cloud horn.

### 2.1 Product Overview

Table 2-1 lists the bands that N715-EA supports.

Table 2-1 Variants and frequency bands

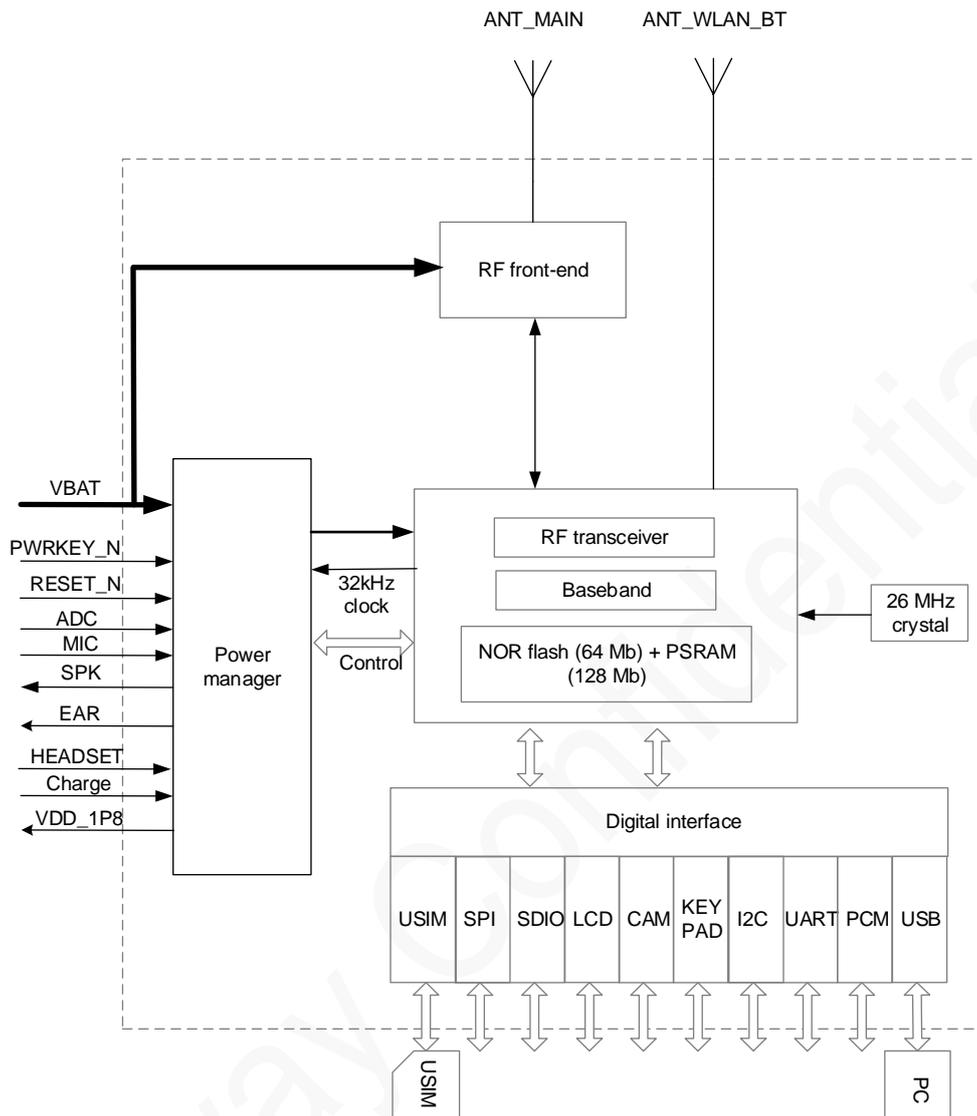
Region	Category	Band	GNSS	Codec
Europe	Cat1	FDD-LTE: B1, B3, B5, B7, B8, B20, B28 TDD-LTE: B38, B40, B41 GSM/GPRS: 900/1800 MHz	Not supported	Supported

### 2.2 Block Diagram

N715-EA consists of the following functionality units:

- Baseband chip
- 26 MHz crystal
- Power management unit
- Radio frequency unit
- Digital interfaces (USIM, I2C, SPI, KEYPAD, UART, USB, SDIO, PCM, and LCD)
- Analog interfaces (ADC, MIC, ERA, SPK, HEADSET)

Figure 2-1 Block diagram



## 2.3 Basic Features

Parameter	Description
Physical features	<ul style="list-style-type: none"> <li>Dimensions: (23.80±0.1) mm × (22.80±0.1) mm × (2.5±0.15) mm</li> <li>Package: 76-pin LCC + 72-pin LGA</li> <li>Weight: TBD</li> </ul>
Temperature ranges	<ul style="list-style-type: none"> <li>Operating: -30°C ~ +75°C</li> <li>Extended: -40°C ~ +85°C</li> <li>Storage: -40°C ~ +90°C</li> </ul>
Operating voltage	VBAT: 3.4 V - 4.2 V, typical value: 3.6 V

(DC)	
Operating current (DC)	Sleep mode <sup>1</sup> : TBD
	Standby mode <sup>2</sup> : TBD
	Operating mode <sup>3</sup> (LTE mode): TBD
Application processor	ARM Cortex-A5 processor, 500 MHz main frequency, 32 kB L1 cache.
Memory	RAM: 128 Mb ROM: 64 Mb
Band	See Table 2-1.
Wireless rate	GPRS: Max 85.6 kbps (DL)/Max 85.6 kbps (UL) FDD-LTE: Cat1, Max 10 Mbps (DL)/Max 5 Mbps (UL) TDD-LTE: Cat1, Max 8 Mbps (DL)/Max 2 Mbps (UL)
Transmit power	EGSM900: +33 dBm (Power Class 4) DCS1800: +30 dBm (Power Class 1) LTE: +23 dBm (Power Class 3)
Application interfaces	2G/4G antenna, BT/Wi-Fi antenna All of them have a characteristic impedance of 50 Ω.
	Three UART interfaces including UART1, UART2 and a debug UART interface Maximum baud rate supported: 961200 bps
	Two USIM interfaces, 1.8 V/3.0 V self-adaptive. Note: Using the USIM2 interface and the 52 <sup>nd</sup> to 54 <sup>th</sup> pins simultaneously are not allowed, that is, when connecting the USIM2 interface, you should leave the 52 <sup>nd</sup> to 54 <sup>th</sup> pins floating.
	One USB2.0 interface, slave mode only
	Three SPI interfaces <ul style="list-style-type: none"> <li>• One standard SPI interface supports only master mode</li> <li>• One LCD-dedicated SPI interface</li> <li>• One camera-dedicated SPI interface</li> </ul>
	Four 12-bit ADC interfaces, can detect voltages ranging from 0 V to VBAT.
	Two SDIO interfaces SDIO2 for WLAN

Sleep mode<sup>1</sup>: the module enters a low power consumption state. In this state, the peripheral interface of the module is disabled, but the radio frequency (RF) is functioning properly. The module will exit the sleep mode when there is an incoming call or SMS message, and will re-enter the sleep mode at the end of the incoming call or conversation.

Standby mode<sup>2</sup>: the module is in normal working state, but there is no on-going data service.

Operating mode<sup>3</sup>: operating current of the module when there is data communication. Only the currents LTE mode are listed here. For details about currents under other network standards, see current test report.

	<p>SDIO1 is a multiplexing signal for SD card connection; before the connection, a proper configuration by reference to the pin multiplexing table is required.</p> <p>One PCM interface</p> <p>One I2C interface, master mode only</p> <p>One headset interface</p> <p>One MIC interface, bias voltage ranging from 2.2 V to 3 V, <math>V_{norm}=2.2</math> V</p> <p>One SPK interface, supporting differential output only, with built-in class-AB or class-D power amplifier. Maximum output power:</p> <ul style="list-style-type: none"> <li>• Class AB: 600 Mw@4.2 V, with electrical load of 8 <math>\Omega</math>.</li> <li>• Class D: 800 mW@4.2V, with electrical load of 8 <math>\Omega</math>.</li> </ul> <p>One EAR interface, for a maximum of 50 mV power when loading 32 <math>\Omega</math> If the output power is not enough, connect this interface to an external power amplifier.</p> <p>6x6 matrix keyboard interface</p>
AT commands	<p>3GPP Release 13 Neoway extended commands</p>
SMS	PDU, TXT
Data	PPP, RNDIS, ECM
Protocol	TCP, UDP, MQTT, FTP, HTTP/HTTPS, SSL, TLS
Certification approval	RoHS*, CE*

\* indicates in development

## 3 Compliant Standards

N715-EA is designed by referring to the following standards:

- 3GPP TS 36.521-1 V13.0.0 User Equipment (UE) conformance specification; Radio transmission and reception; Part 1: Conformance Testing
- 3GPP TS 21.111 V13.0.0 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 V13.0.0 Characteristics of the Universal Subscriber Identity Module (USIM) application
- 3GPP TS 31.111 V13.0.0 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
- 3GPP TS 27.007 V13.0.0 AT command set for User Equipment (UE)
- 3GPP TS 27.005 V13.0.0 Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)
- 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
- GSM/GPRS/EDGE 2G Communication Protocol

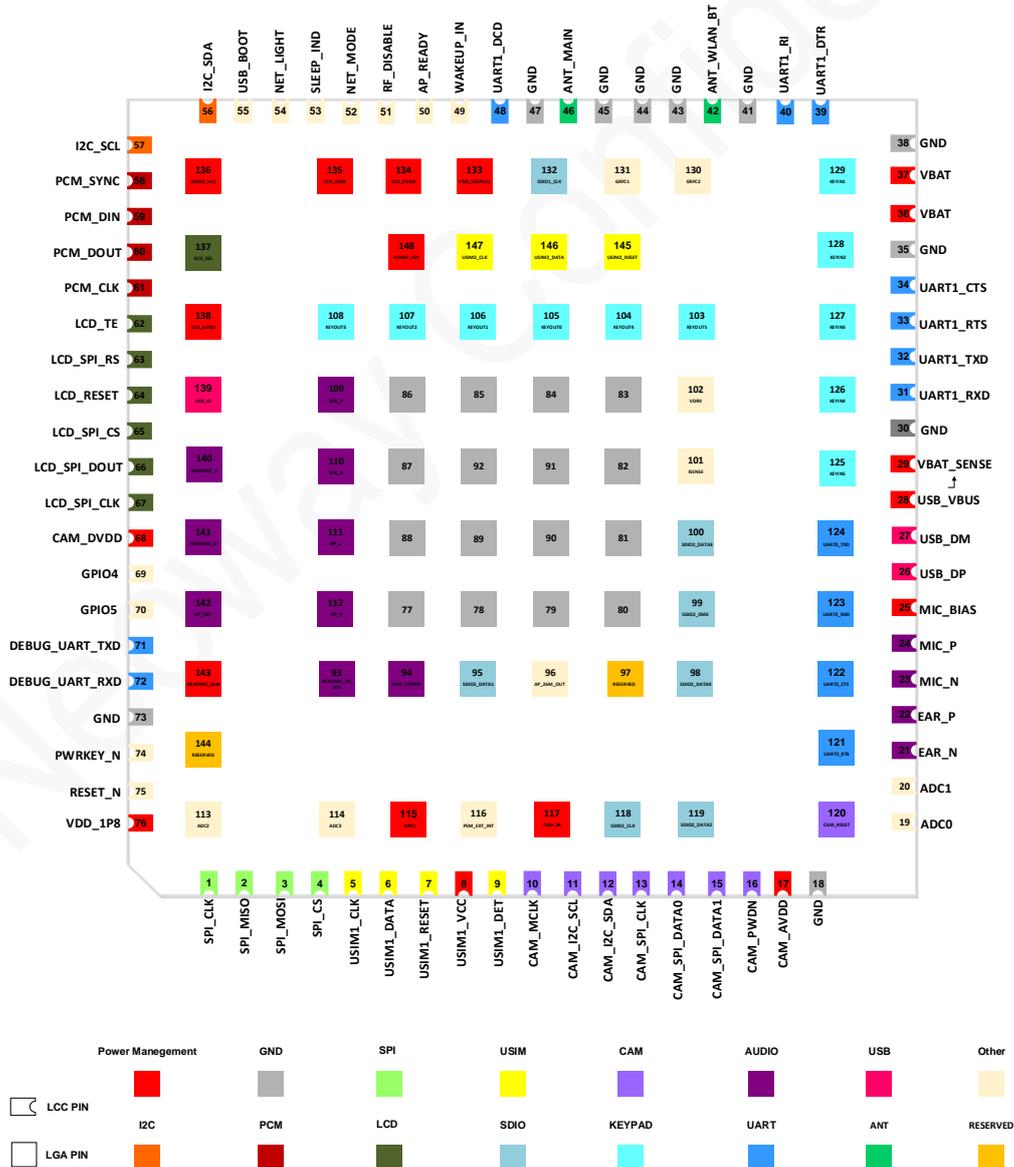
# 4 Module Appearance

There are 148 pins on N715-EA and their pads are introduced in 76-pin LCC + 72-pin LGA package. It supports interfaces including power supply, USB, UART, USIM, PCM, ADC, I2C, and SDIO.

## 4.1 Pin Layout

The following figure shows the pad layout of N715-EA.

Figure 4-1 N715-EA pin definition (top view)

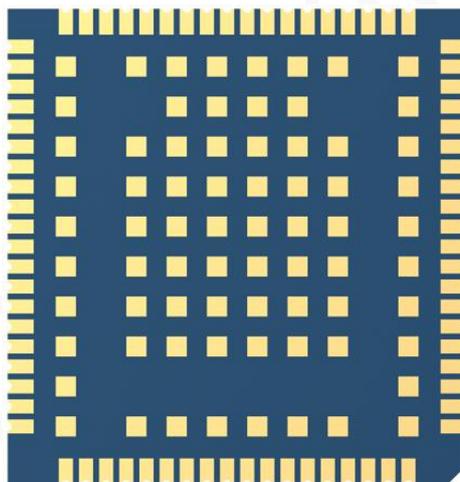


## 4.2 Module Appearance

Figure 4-2 Top view of N715-EA



Figure 4-3 Bottom view of N715-EA



The label and bottom views of the N715-EA module in the above picture are for reference only. Detailed information is in accordance with the final product.

## 5 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the N715-EA module, including the input and output voltage and current of the power supply, current consumption of the module in different states, operating and storage temperature range, and ESD protection characteristics.

### 5.1 Electrical Characteristics



- If the voltage is lower than threshold, the module might fail to start. If the voltage is higher than threshold 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 for the module, ensure that it outputs at least 2.5 A current. The 2.5 A current occurs when the module is working at the maximum power level of the GSM mode. The peak current during burst transmission has a short duration. Placing a large capacitor on the VBAT pin of the module can effectively enhance the flyback capability of the power supply and avoid excessive voltage drops that may cause exceptions, such as module shutdown.

Table 5-1 N715-EA operating conditions

Parameter		Minimum value	Typical value	Maximum value
VBAT	$V_{in}$	3.4 V	3.6 V	4.2 V
	$I_{in}$	N/A	N/A	2.5 A

Table 5-2 N715-EA current consumption (Typical)

Network standard and band	Status	Power (dBm)	Sleep (mA)	Idle (DRX) (mA)	Active (mA)@max power
FDD-LTE: B1, B3, B5, B7, B8, B20, B28		23	TBD	TBD	TBD
TDD-LTE: B38, B40, B41		23	TBD	TBD	TBD
EGSM 900		33	TBD	TBD	TBD
DCS 1800		30	TBD	TBD	TBD

## 5.2 Temperature Characteristics

Table 5-3 N715-EA temperature characteristics

Parameter	Minimum value	Typical value	Maximum value
Operating	-30°C	25°C	75°C
Extended	-40°C	25°C	85°C
Storage	-40°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.

## 5.3 ESD Protection

Electronic products generally need to undergo strict ESD testing. The following is the ESD protection capability of the main pins of the module. When designing related products, customers need to add corresponding ESD protection according to the industry where the product is used to ensure product quality.

Test environment: humidity 45%; temperature 25°C

Table 5-4 ESD characteristics

Testing point	Contact discharge	Air discharge
GND	TBD	TBD
ANT interface	TBD	TBD
Cover	TBD	TBD



Test data in the above table is obtained from tests performed using a N715-EA EVB.

## 6 RF Characteristics

N715-EA supports GSM, FDD-LTE (Cat.1), TDD-LTE (Cat.1) network modes and the Wi-Fi, RX, and BT wireless connection function.

### 6.1 Operating Band

Table 6-1 N715-EA operating bands

Operating band	Uplink	Downlink
FDD-LTE B1	1920 - 1980 MHz	2110 - 2170 MHz
FDD-LTE B3	1710 - 1785 MHz	1805 - 1880 MHz
FDD-LTE B5	824 - 849 MHz	869 - 894 MHz
FDD-LTE B7	2500 - 2570 MHz	2620 - 2690 MHz
FDD-LTE B8	880 - 915 MHz	925 - 960 MHz
FDD-LTE B20	832 - 862 MHz	791 - 821 MHz
FDD-LTE B28	703 - 748 MHz	758 - 803 MHz
TDD-LTE B38	2570 - 2620 MHz	2570 - 2620 MHz
TDD-LTE B40	2300 - 2400 MHz	2300 - 2400 MHz
TDD-LTE B41	2535 - 2655 MHz	2535 - 2655 MHz
EGSM900	880 - 915 MHz	925 - 960 MHz
DCS1800	1710 - 1785 MHz	1805 - 1880 MHz

### 6.2 TX Power and RX Sensitivity

Table 6-2 N715-EA RF transmit power

Band	Max Power	Min. Power
FDD-LTE B1	23 dBm $\pm$ 2 dB	<-40 dBm
FDD-LTE B3	23 dBm $\pm$ 2 dB	<-40 dBm
FDD-LTE B5	23 dBm $\pm$ 2 dB	<-40 dBm
FDD-LTE B7	23 dBm $\pm$ 2 dB	<-40 dBm
FDD-LTE B8	23 dBm $\pm$ 2 dB	<-40 dBm
FDD-LTE B20	23 dBm $\pm$ 2 dB	<-40 dBm

FDD-LTE B28	23 dBm±2 dB	<-40 dBm
TDD-LTE B38	23 dBm±2 dB	<-40 dBm
TDD-LTE B40	23 dBm±2 dB	<-40 dBm
TDD-LTE B41	23 dBm±2 dB	<-40 dBm
EGSM900	33 dBm±2 dB	5 dBm±5 dB
DCS1800	30 dBm±2 dB	0 dBm±5 dB

Table 6-3 RF sensitivity of N715-EA

Band	Receiving sensitivity
FDD-LTE B1	≤ -97 dBm
FDD-LTE B3	< -97 dBm
FDD-LTE B5	≤ -97 dBm
FDD-LTE B7	≤ -96 dBm
FDD-LTE B8	≤ -97 dBm
FDD-LTE B20	< -97 dBm
FDD-LTE B28	≤ -97 dBm
TDD-LTE B38	≤ -97 dBm
TDD-LTE B40	≤ -97 dBm
TDD-LTE B41	≤ -97 dBm
EGSM900	≤ -108 dBm
DCS1800	≤ -107 dBm



The preceding indicators are tested in a shielded environment in the laboratory. The LTE band indicators are the test results when the bandwidth is 10 MHz, the modulation mode is QPST and RB is set according to the protocol. On no-shielded environments, deviations may exist in the receiver sensitivity of some individual bands due to the interference.

## 6.3 WLAN/BT Characteristics

Table 6-4 WLAN/BT TX power and RX sensitivity

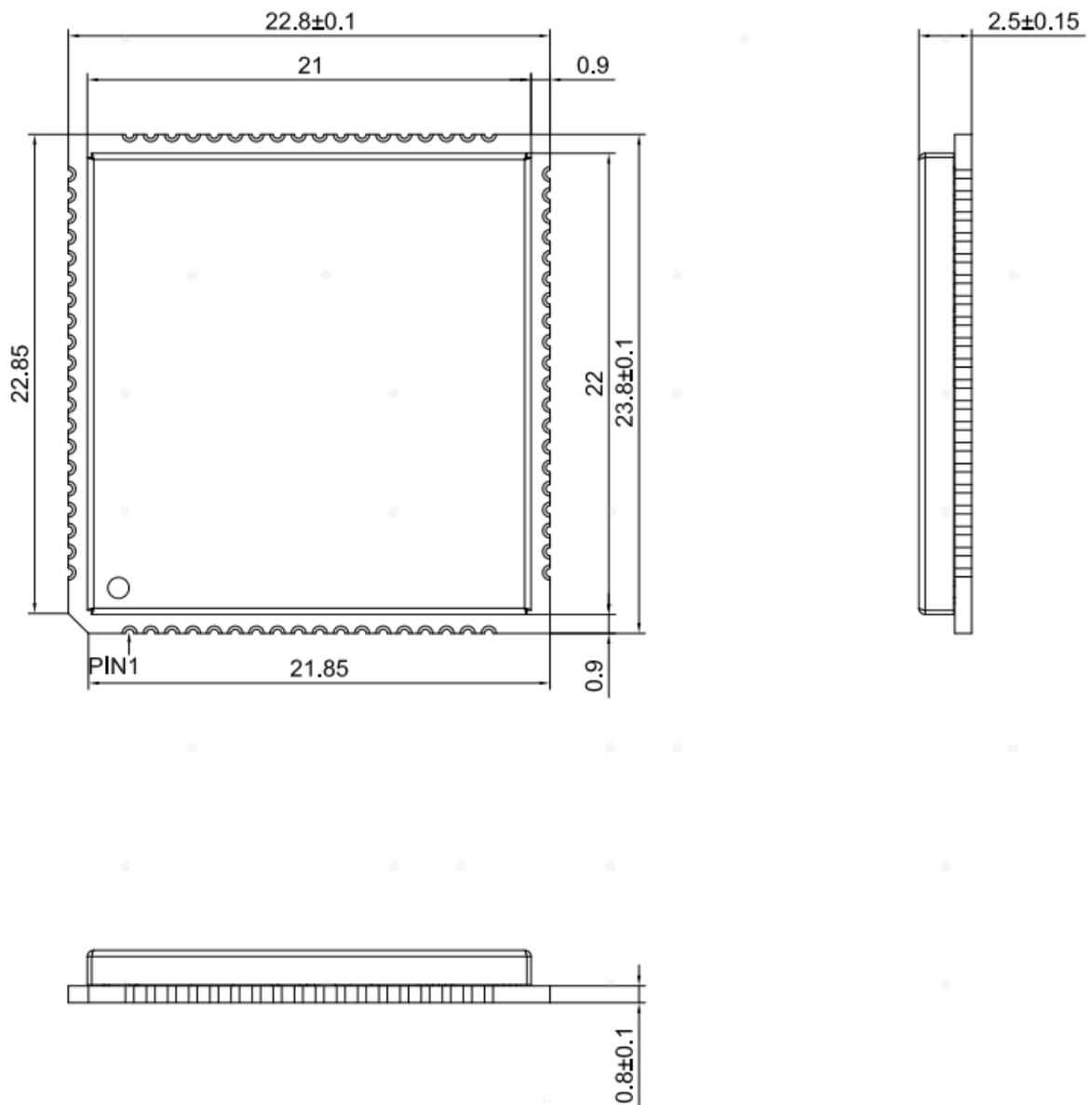
Operating band	Rate	Transmit power	Receiving sensitivity
802.11b (2.4G)	1/2/5.5/11 Mbps	N/A	≤ -88 dBm
Bluetooth	DH5	3.2 dBm	≤ -88 dBm
	2HD5	1 dBm	≤ -88 dBm
	3DH5	1 dBm	≤ -80 dBm
	BLE/1 Mbps	TBD	≤ -94 dBm

# 7 Mechanical Characteristics

This chapter describes mechanical characteristics of the N715-EA module.

## 7.1 Dimensions

Figure 7-1 Top and side view dimensions N715-EA (unit: mm)



## 7.2 Label

The N715-EA label is laser etched, and can withstand a high temperature of 260°C. Figure 7-2 shows the label format of N715-EA.

Figure 7-2 N715-EA label



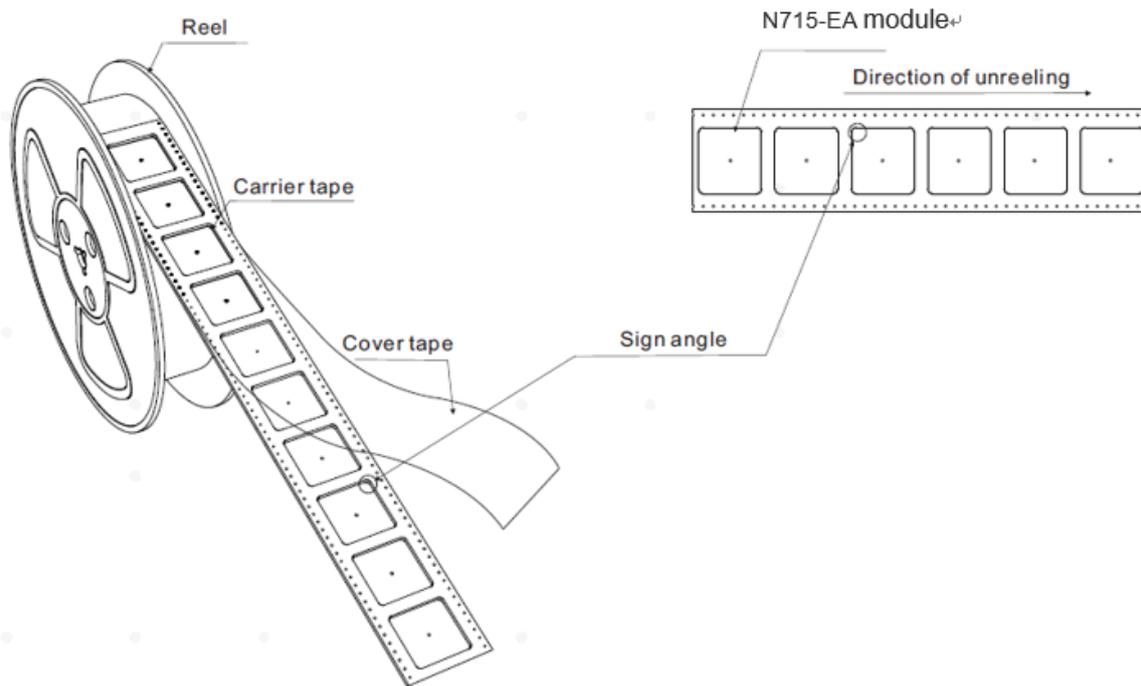
The picture above is only for reference.

## 7.3 Packaging

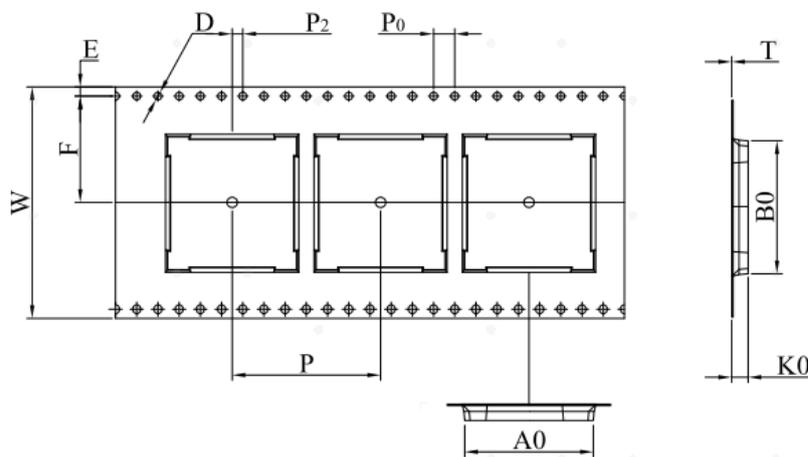
N715-EA modules are packed in sealed bags on delivery to guarantee long shelf life. Follow the same package of the modules again in case of opened for any reason.

### 7.3.1 Reels

N715-EA in mass production is delivered in the following packaging.



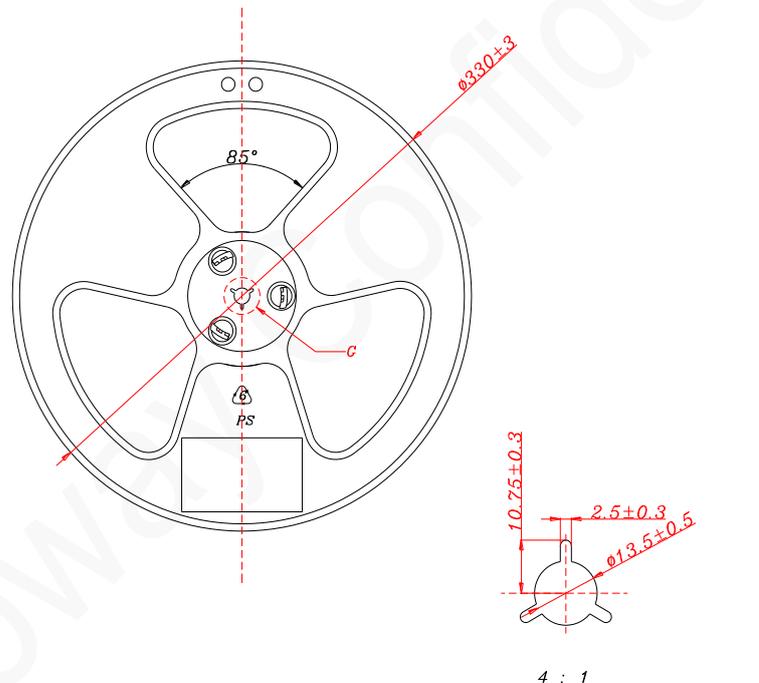
### Tape Dimensions



EIA DIMENSIONS	
W	44.0 <sup>+0.30</sup> <sub>-0.30</sub>
E	1.75 <sup>+0.10</sup> <sub>-0.10</sub>
F	20.2 <sup>+0.15</sup> <sub>-0.15</sub>
P	28.0 <sup>+0.10</sup> <sub>-0.10</sub>
P <sub>0</sub>	4.00 <sup>+0.10</sup> <sub>-0.10</sub>
P <sub>2</sub>	2.00 <sup>+0.15</sup> <sub>-0.15</sub>
D	1.50 <sup>+0.10</sup> <sub>-0.10</sub>
T	0.30 <sup>+0.05</sup> <sub>-0.05</sub>
A <sub>0</sub>	23.2 <sup>+0.10</sup> <sub>-0.10</sub>
B <sub>0</sub>	24.2 <sup>+0.10</sup> <sub>-0.10</sub>
K <sub>0</sub>	3.10 <sup>+0.10</sup> <sub>-0.10</sub>

1. 10 sprocket hole pitch cumulative tolerance  $\pm 0.20\text{mm}$ .
2. Carrier camber not to exceed 1mm in 100mm.
3.  $A_0$  and  $B_0$  measured on a plane 0.3mm above the bottom of the pocket.
4.  $K_0$  measured from a plane on the inside bottom of the pocket to the top surface of the carrier.
5. All dimensions meet EIA-481-C requirements.
6. Material: Black Anti-Static Polystyrene.
7. Packing length per 13" reel : 17.64 Meters.
8. Component load per 13" reel : 630 pcs.
9. This Product Must Comply With HSF Standard

## Reel Dimensions



### 7.3.2 Moisture

N715-EA is a level 3 moisture-sensitive electronic element, in compliance IPC/ JEDEC standard.

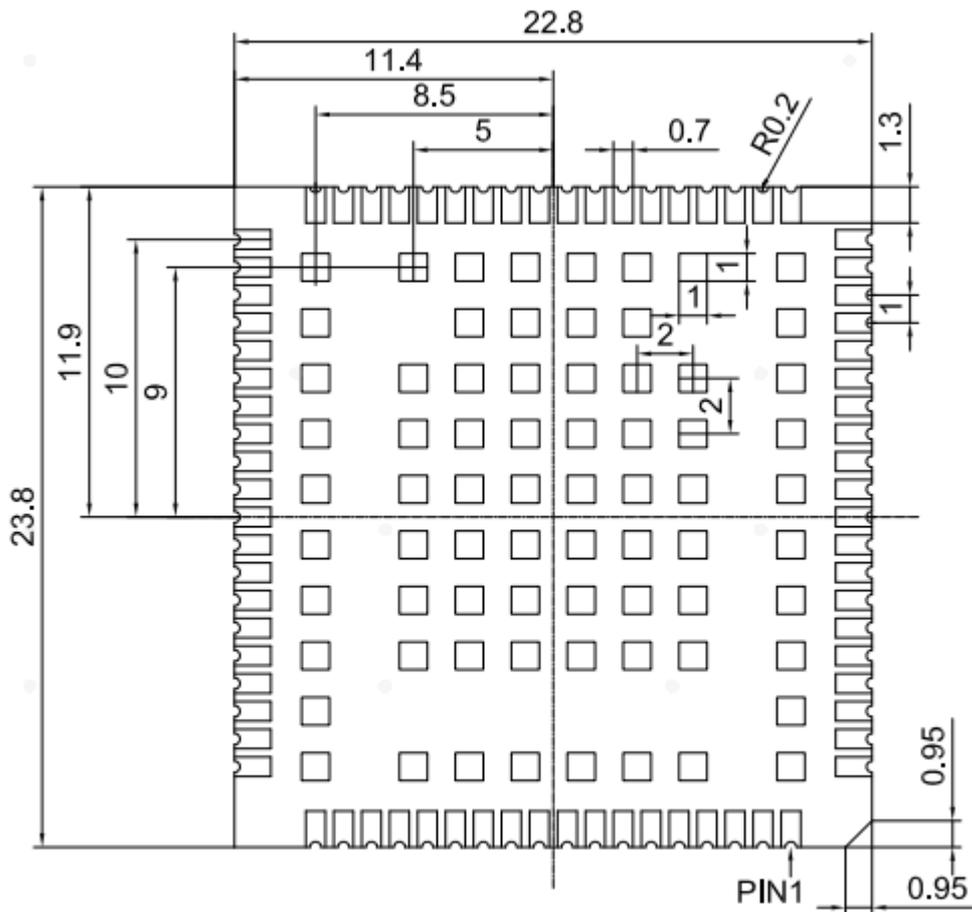
After the module is unpacked, if it is exposed to the air for a long time, the module will get damped, and may be damaged during reflow soldering or laboratory soldering. Bake it before mounting the module. The baking conditions depend on the moisture degree. It is recommended to bake the module at a temperature higher than 120 degrees for more than 6 hours.

# 8 Mounting

This chapter describes the module PCB package and application PCB package of N715-EA, as well as the key points of SMT related technology.

## 8.1 PCB Package

Figure 8-1 PCB package (bottom view, unit: mm)



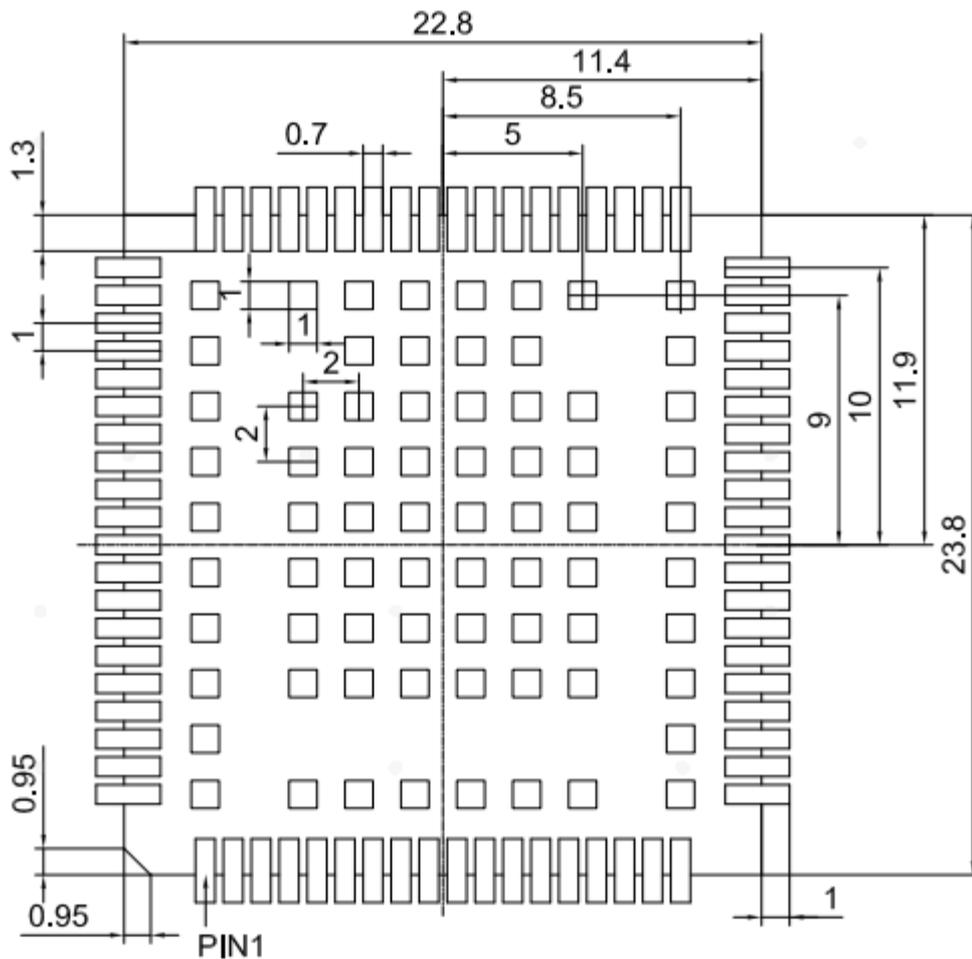
## 8.2 PCB Footprint



To achieve higher yield during module production, it is recommended that the distance between other components on the PCB board and the module pads be at least 3 mm to avoid the risk of tin connection when using stepped stencil.

N715-EA adopts the 76-pin LCC + 72-pin LGA form package. The recommended PCB footprint of the module is as follows:

Figure 8-2 PCB footprint (top view, unit: mm)



## 8.3 Stencil

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

## 8.4 Solder Paste

The thickness of the solder paste and the flatness of the PCB are essential for the production yield.

It is recommended to use the same kind of leaded solder paste used during the production process of Neoway.

- The melting point of the leaded solder paste is 35°C lower than that of the lead-free solder paste, and the temperature in the reflow process parameters is also lower than that of the lead-free solder paste. Therefore, the soldering time is shorter accordingly, which easily causes a false solder because LCC/LGA in the module is in a semi-melted state during the secondary reflow.
- 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.

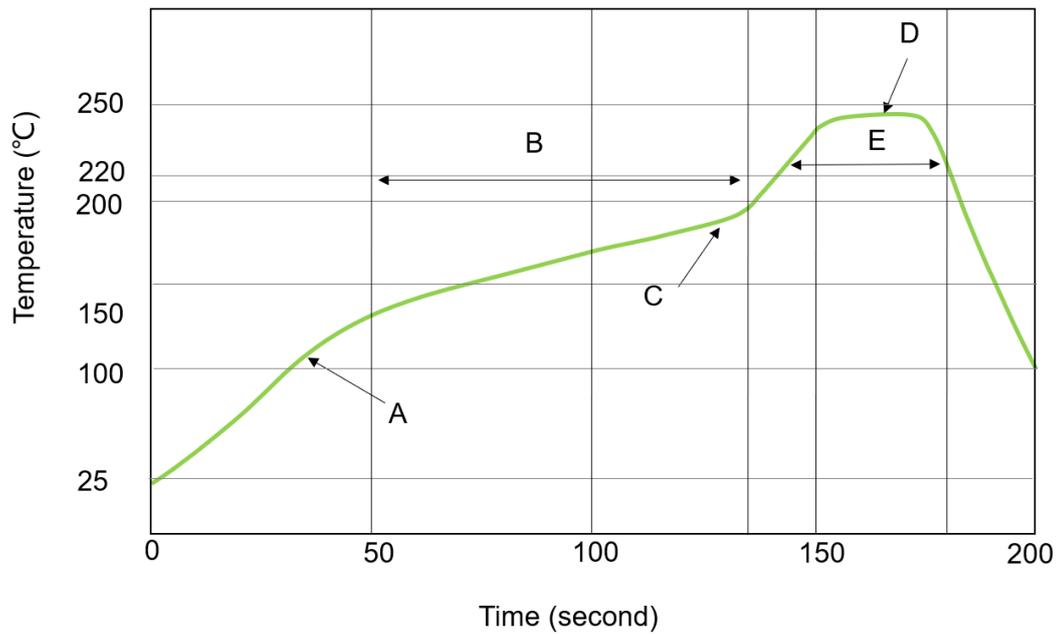
## 8.5 SMT Oven Temperature Profile



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

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 8-3 Oven temperature profile



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 - 100s
- Reflow zone: >220°C, Time: 40 - 90s
- Peak temperature: 235 - 245°C

For information about cautions in 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 245°C (depending on the type of the solder paste), and heat the module till the solder paste is melted. Then remove the module using tweezers. Do not shake the module at high temperatures while removing it. Otherwise, the components inside the module might get misplaced.

## A Abbreviations

Abbreviation	Full name
AI	Analog Input
AO	Analog Output
AIO	Analog Input /Output
ARM	Advanced RISC Machine
bps	Bits per Second
CCC	China Compulsory Certification
CTS	Clear to Send
DC	Direct Current
DI	Digital Input
B	Digital Input/Output
DL	Downlink
DO	Digital Output
DRX	Discontinuous Reception
DTR	Data Terminal Ready
ESD	Electronic Static Discharge
ESR	Equivalent Series Resistance
EVK	Evaluation Kit
FDD	Frequency Division Duplexing
FTP	File Transfer Protocol
FTPS	FTP Secure
GPIO	General Purpose Input Output
GPRS	General Packet Radio Service
EGSM	Enhanced GSM
3GPP	3rd Generation Partnership Project
IO	Input/Output
ISP	Image Signal Processor
LCC	Leadless Chip Carriers

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LED	Light Emitting Diode
LGA	Land Grid Array
LTE	Long Term Evolution
PCB	Printed Circuit Board
PCS	Personal Communications Service
PWM	Pulse Width Modulation
QVGA	Quarter Video Graphics Array
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-only Memory
RTC	Real Time Clock
SPK	Speaker
TDD	Time Division Duplex
UART	Universal Asynchronous Receiver-Transmitter
UL	Uplink
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
VBAT	Battery Voltage

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