N717-EA

Product Specifications

LTE Cat.1
Issue 1.0
Date 2022-12-02

Notice

This document provides guide for users to use N717-EA.

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

THIS DOCUMENT 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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Contents

Table of Figures

Table of Tables

About This Document

Scope

This document is applicable to N717-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	Zhang Ni

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_N717-EA_Hardware_User_Guide

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 N717-EA

N717-EA is an industrial-grade LTE cellular module, with dimensions of (29.0 ± 0.10) mm × (25.0 ± 0.10) mm × (2.35 ± 0.15) mm. It supports LTE Cat 1 FDD and LTE Cat 1 TDD (especially on B31) radio access technology, with GSM fallback. With rich hardware interfaces, the N717-EA modules are targeted to a wide variety of IoT applications, such as wireless meter reading terminals and industrial routers in power and industrial markets.

2.1 Product Overview

The following table lists the frequency bands that N717-EA supports.

Table 2-1 Supported frequency bands

Region	Category	Band
Europe	Cat1	FDD-LTE: B1, B3, B5, B7, B8, B20, B28, B31 TDD-LTE: B38, B40, B41 GSM: 900/1800 MHz

2.2 Block Diagram

N717-EA consists of the following functionality units:

- Baseband chip

- 26 MHz crystal

- Power management unit

- Radio frequency unit

- Digital interfaces (USIM, I2C, UART, USB, PCM, and so on)

- Analog interfaces (MIC and SPK)

Figure 2-1 Block diagram
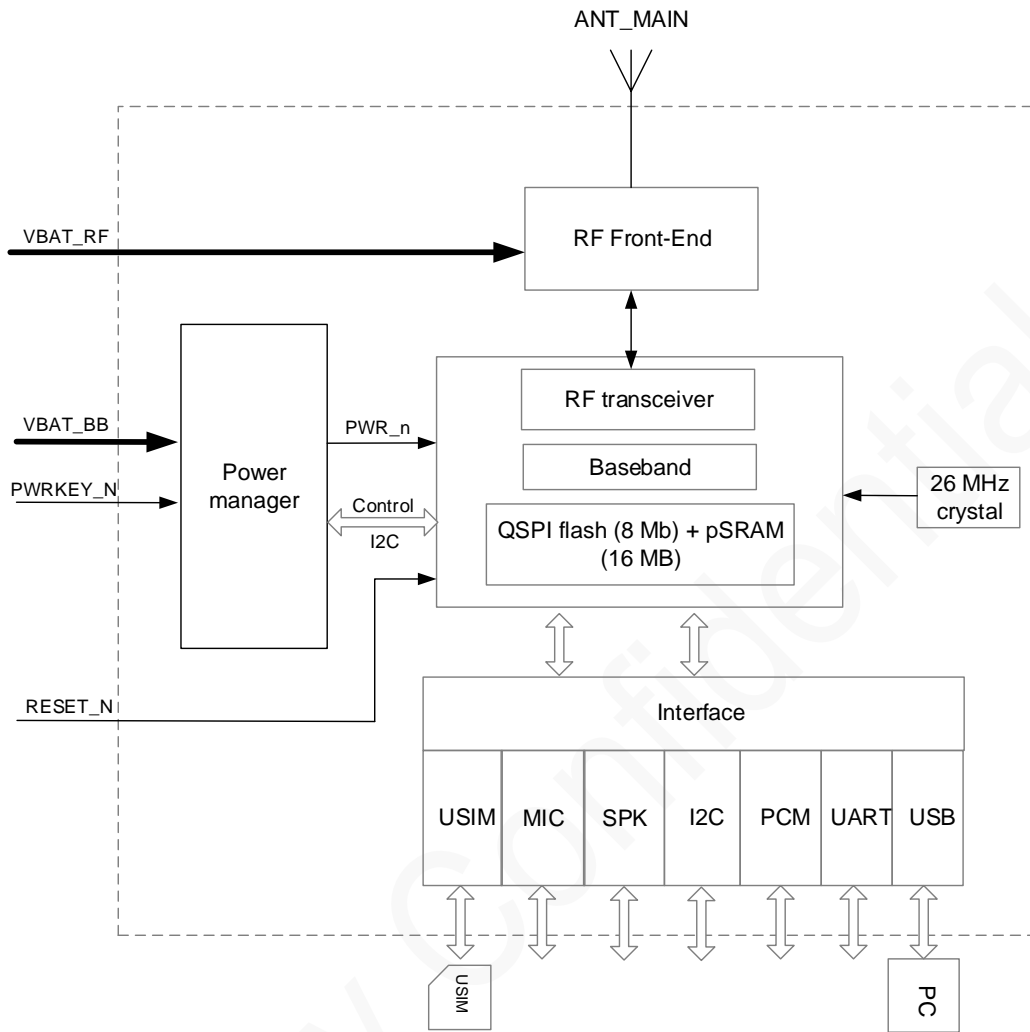
2.3 Basic Features

Table 2-2 N717-EA baseband and wireless features

Parameter	Description
Physical features	• Dimensions: (29.0±0.10) mm × (25.0±0.10) mm × (2.35±0.15) mm • Package: 126-pin LGA • Weight: TBD
Temperature ranges	• Operating: -30°C ~ +75°C • Extended: -40°C ~ +85°C • Storage: -40°C to +90°C
Operating voltage (DC)	VBAT: 3.4 V - 4.2 V, typical value: 3.6 V

Operating current (DC)	Sleep mode[1]: TBD
	Standby mode[2]: TBD
	Operating mode[3] (LTE mode): TBD
Application processor	ARM Cortex-R5 processor, 614 MHz main frequency, 32 kB L1 cache.
Memory	RAM: 16 MB ROM: 8 MB
Band	See Table 2-1.
Wireless rate	GPRS: Max 85.6 Kbps (DL)/Max 85.6 Kbps (UL) EDGE: Max 236.8 Kbps (DL)/Max 236.8 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 ±2 dB (Power Class 4) DCS1800: 30 dBm ±2 dB (Power Class 1) EGSM900 8-PSK: 27 dBm ±3 dB (Power Class E2) DCS1800 8-PSK: 26 dBm ±3 dB (Power Class E2) LTE: 23 dBm ±2 dB (Power Class 3)
Application Interfaces	2G/4G antenna, with characteristic impedance of 50 Ω.
	Two UART interfaces (one of which is a Debug UART). Maximum baud rate supported: 961200 bps
	Two USIM interfaces at 1.8 V/3.0 V. USIM 2 is not supported currently.
	One USB2.0 interface, slave mode only
	One PCM interface
	One I2C interface, master mode only
	One MIC interface
	One SPK interface, for a maximum of 50 mW power when loading 32 Ω If the output power is not enough, connect this interface to an external power amplifier.
AT commands	3GPP Release 9 Neoway extended commands

Sleep mode[1]: In sleep mode, the module enters a low power consumption state. In this state, the radio frequency (RF) is functioning properly but the peripheral interface of the module is disabled. 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[2]: In standby mode, the module is in normal working state and there is no on-going data service.

Operating mode[3]: refers to the operating current of the module when there is data communication. Only the currents in LTE mode are listed here. For details about currents under other network standards, see the current test report.

SMS	PDU, TXT
Data	PPP
Protocol	TCP, UDP, FTP/FTPS
Certification approval	RoHS*, CE*

* means under development.

3 Compliant Standards

N717-EA is designed by referring to the following standards:

- 3GPP TS 36.521-1 V9.10.0 User Equipment (UE) conformance specification; Radio transmission and reception; Part 3: Radio Resource Management (RRM) conformance testing

- 3GPP TS 21.111 V9.0.0 USIM and IC card requirements

- 3GPP TS 31.102 V9.10.0 Characteristics of the Universal Subscriber Identity Module (USIM) application

- 3GPP TS 31.111 V9.11.0 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)

- 3GPP TS 27.007 V9.4.0 AT command set for User Equipment (UE)

- 3GPP TS 27.005 V9.0.0 Use of Data Terminal Equipment - Data Circuit terminating Equipment (DTE-DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)

4 Module Appearance

There are 126 pins on N717-EA and their pads are introduced in LGA package. It supports interfaces including power supply, USB, UART, USIM, PCM, ADC, and I2C.

4.1 Pin Layout

The following figure shows the pad layout of N717-EA.

Figure 4-1 N717-EA pad layout (top view)
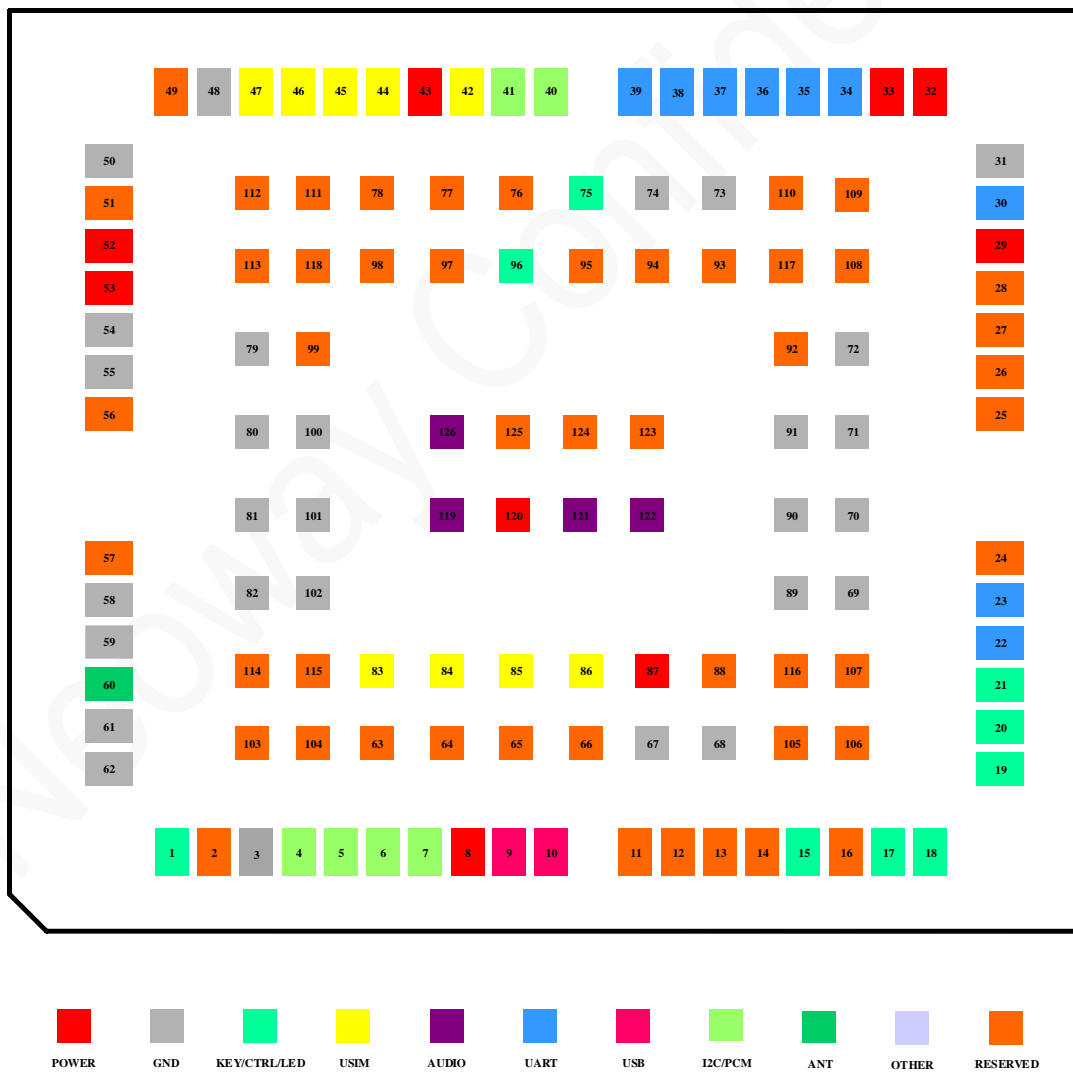
4.2 Module Appearance

Figure 4-2 Top view of N717-EA

Figure 4-3 Bottom view of N717-EA
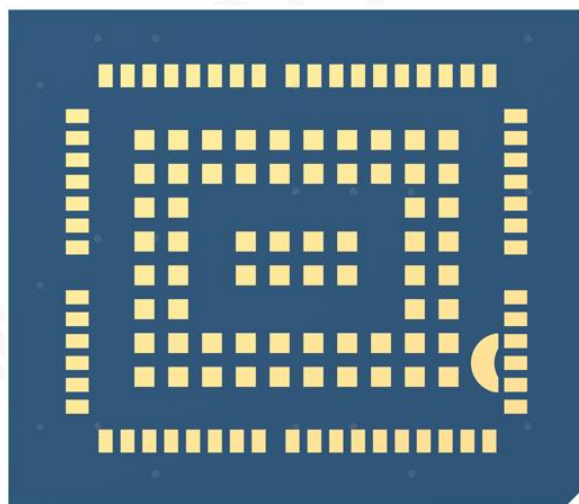
The label and bottom views of the N717-EA module in the above picture are for reference only. Detailed information is in accordance with the final product.

5 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the N717-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 3 A current. The 3 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 N717-EA operating conditions

Pin	Parameter	Minimum value	Typical value	Maximum value
VBAT_BB	V_{in}	3.4 V	3.6 V	4.2 V
	I_{in}	N/A	N/A	0.8 A
VBAT_RF	V_{in}	3.4 V	3.6 V	4.2 V
	I_{in}	N/A	N/A	2.2 A

Table 5-2 N717-EA current consumption (Typical)

Status Network standard and band	Power (dBm)	PSM/Sleep (mA)	Idle (mA)	Active(mA)@max powe
LTE-FDD: B1, B3, B5, B7, B8, B20, B28, B31	23	TBD	TBD	TBD
LTE-TDD: B38, B40, B41	23	TBD	TBD	TBD
GSM900	33	TBD	TBD	TBD
GSM1800	30	TBD	TBD	TBD

5.2 Temperature Characteristics

Table 5-3 N717-EA temperature characteristics

Status	Minimum value	Typical value	Maximum value
Operating	-30℃	25℃	75℃
Extended	-40℃	25℃	85℃
Storage	-40℃	25℃	90℃

> ℹ️ 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 after the temperature is restored, the RF index can be restored to meet the 3GPP standard.

5.3 ESD Protection Characteristics

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.

Humidity 45%   Temperature 25°C

Table 5-4 N717-EA ESD characteristics

Testing point	Contact discharge	Air discharge
VBAT, GND	±8 kV	±15 kV
ANT	±8 kV	±15 kV
Cover	±8 kV	±15 kV

> ℹ️ Test data in the above table is obtained from tests performed using an N717-EA EVB.

6 RF Characteristics

N717-EA supports GSM, FDD-LTE, and TDD-LTE (Cat1) radio access technology. This chapter describes the RF characteristics of N717-EA.

6.1 Operating bands

Table 6-1 N717-EA operating bands

Operating bands	Uplink	Downlink
EGSM900	880 - 915 MHz	925 - 960 MHz
DCS1800	1710 - 1785 MHz	1805 - 1880 MHz
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
FDD-LTE B31	452.5 - 457.5 MHz	462.5 - 467.5 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

6.2 TX Power and RX Sensitivity

Table 6-2 N717-EA RF transmit power

Band	Max power	Min. power
EGSM900	33 dBm±2 dB	5 dBm±5 dB
DCS1800	30 dBm±2 dB	0 dBm±5 dB
EGSM900 (8-PSK)	27 dBm±3 dB	5 dBm±5 dB
DCS1800 (8-PSK)	26 dBm±3 dB	0 dBm±5 dB
FDD-LTE B1	23 dBm±2 dB	< -39 dBm

FDD-LTE B3	23 dBm±2 dB	< -39 dBm
FDD-LTE B5	23 dBm±2 dB	< -39 dBm
FDD-LTE B7	23 dBm±2 dB	< -39 dBm
FDD-LTE B8	23 dBm±2 dB	< -39 dBm
FDD-LTE B20	23 dBm±2 dB	< -39 dBm
FDD-LTE B28	23 dBm±2 dB	< -39 dBm
FDD-LTE B31	23 dBm±2 dB	< -39 dBm
TDD-LTE B38	23 dBm±2 dB	< -39 dBm
TDD-LTE B40	23 dBm±2 dB	< -39 dBm
TDD-LTE B41	23 dBm±2 dB	< -39 dBm

Table 6-3 GSM RX sensitivity of N717-EA

Band	Receiving sensitivity
EGSM900	≤ -108 dBm
DCS1800	≤ -107 dBm

Table 6-4 N717-EA LTE RX sensitivity

Band	Receiving sensitivity	Duplex mode
FDD-LTE B1	≤ -96.3 dBm	FDD
FDD-LTE B3	≤ -96 dBm	FDD
FDD-LTE B5	≤ -97 dBm	FDD
FDD-LTE B7	≤ -95.5 dBm	FDD
FDD-LTE B8	≤ -97 dBm	FDD
FDD-LTE B20	≤ -97 dBm	FDD
FDD-LTE B28	≤ -97.5 dBm	FDD
FDD-LTE B31	≤ -97 dBm	FDD
TDD-LTE B38	≤ -97 dBm	TDD
TDD-LTE B40	≤ -97 dBm	NR-TDD:
TDD-LTE B41	≤ -97 dBm	TDD

The preceding indicators are tested in a shielded environment in the laboratory. On no-shielded environments, deviations may exist in the receiver sensitivity of some individual bands due to the interference.

- Test condition for the above all bands except for LTE B31: 10 MHz bandwidth, QPSK, x RB (x is set according to the protocol).

- Test condition for LTE B31: 5 MHz bandwidth, QPSK, x RB (x is set according to the protocol).
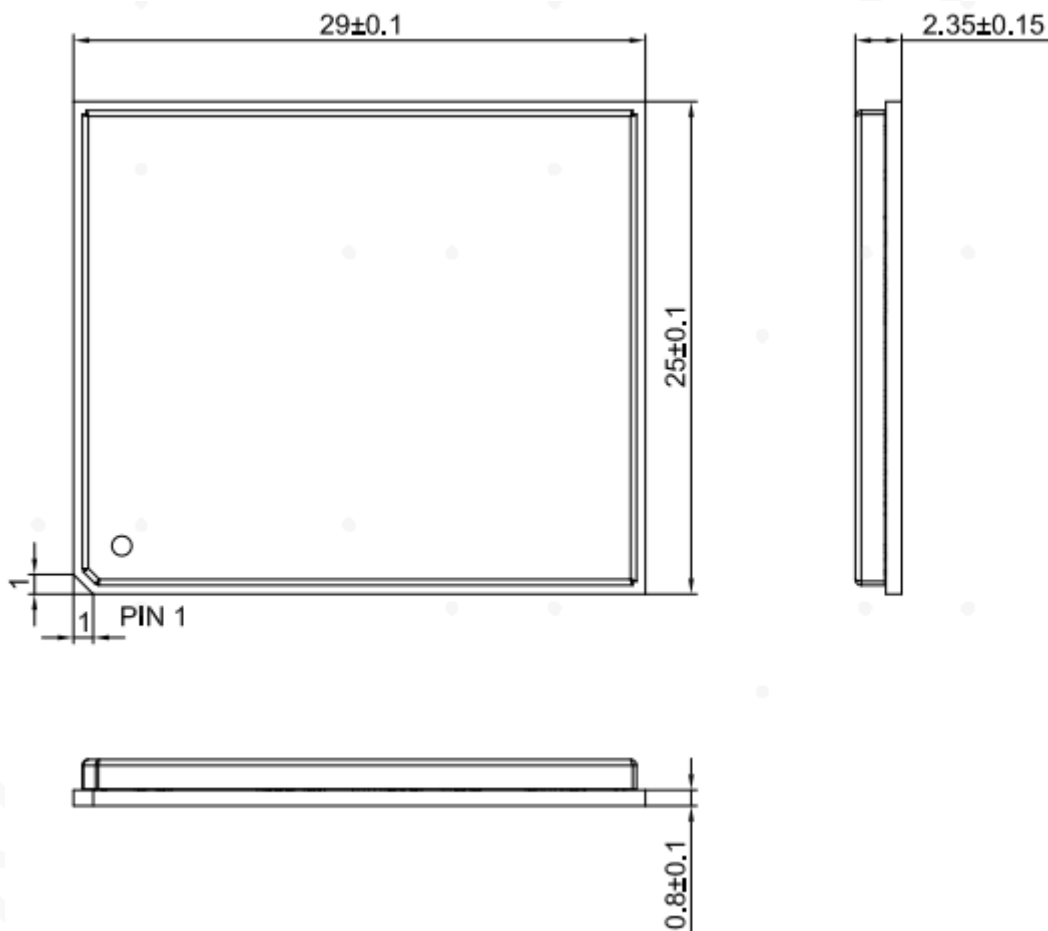
7 Mechanical Characteristics

This chapter describes the mechanical characteristics of N717-EA such as dimensions, labels, and packaging.

7.1 Dimensions

Figure 7-1 Top and side view dimensions N717-EA (unit: mm)

7.2 Label

The N717-EA label is laser etched, and can withstand a high temperature of 260°C. The following

shows the label format of N717-EA.

	The picture above is only for reference.

7.3 Packaging

N717-EA adopts the SMT method for oven soldering. To enable efficient production, production lot set-up and tear-down, the modules are delivered as hermetically sealed reeled tapes for moisture-proof packaging and use the aluminum foil bag, desiccant, humidity indicator card, vacuum and other processing methods to ensure the dryness of the product and extend its service life.

7.3.1 Reels

N717-EA in mass production is delivered in the following packaging.
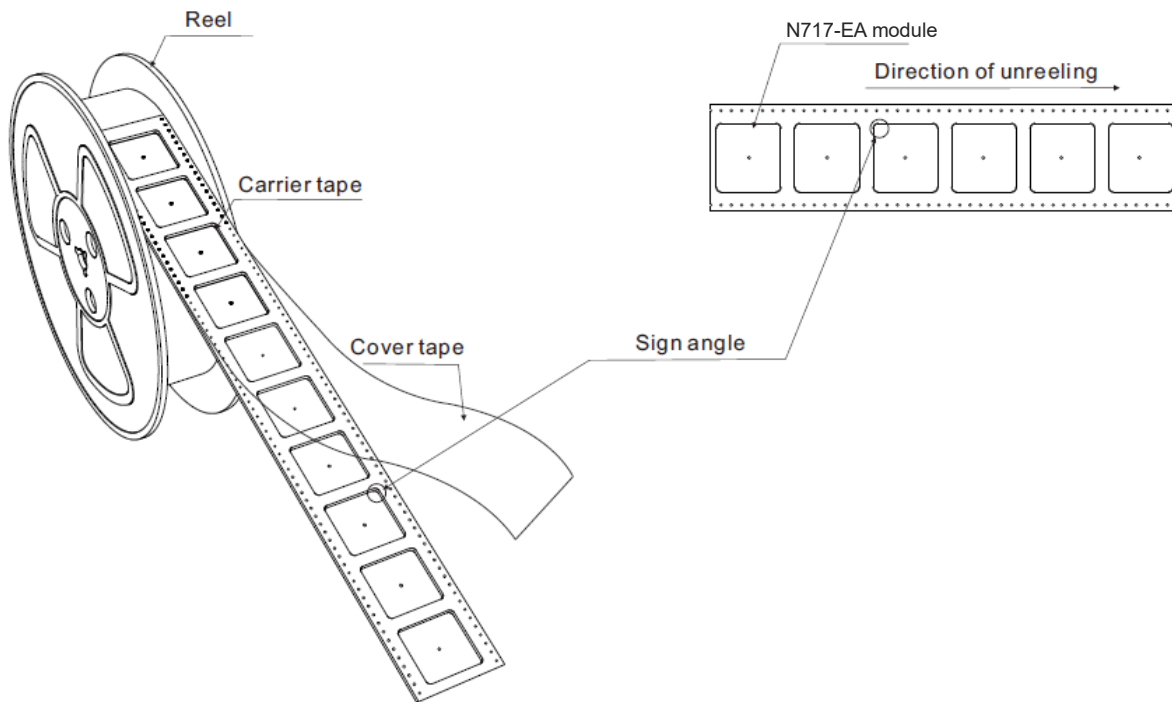
7.3.2 Moisture

N717-EA is a level 3 moisture-sensitive electronic element, in compliance IPC/ JEDEC J-STD-020 standard.

- Recommended storage condition: the temperature should be less than 40°C and the relative humidity should be less than 90%.

- The storage life (in vacuum-sealed packaging): 12 months in Recommended Storage Condition.

- Production environment condition: 30°C/60%

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°C for more than 6 hours.

The module should be pre-baked under the following circumstances:

- 48 hours after the vacuum-sealed packaging is removed.

- The relative humidity is greater than 10% (you can see the humidity card that comes with the package).

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8 Mounting

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

8.1 PCB Package

Figure 8-1 N717-EA PCB package (bottom view, unit: mm)
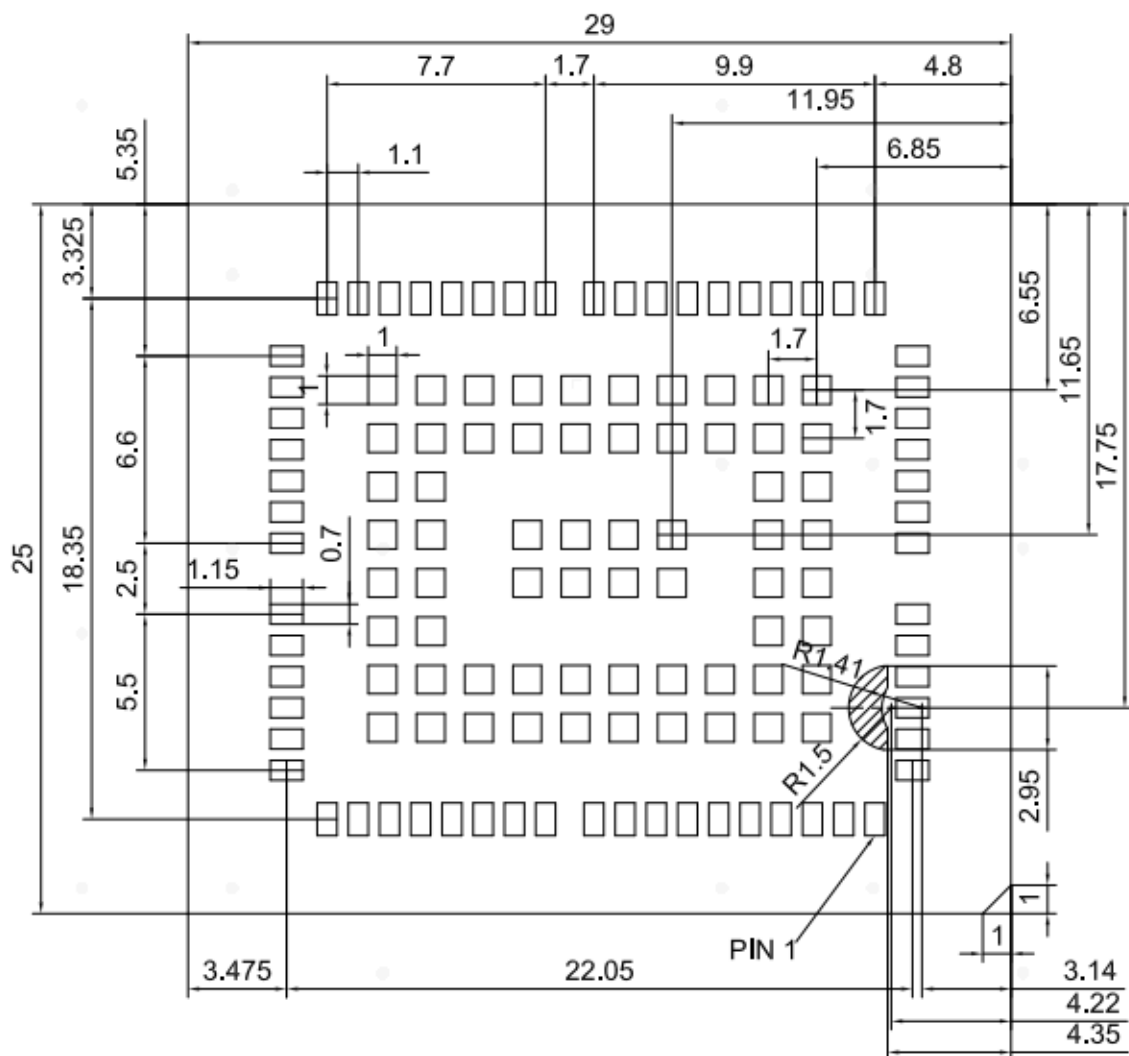
8.2 Application PCB Package

N717-EA adopts the 126-pin LGA form package. The recommended application PCB package is as follows:

⚠️ Only GND via-holes and pour coppers are allowed in the shaded area "▱" of the PCB package to ensure the proper operation of the module.

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.

Figure 8-2 N717-EA application PCB package (top view, unit: mm)
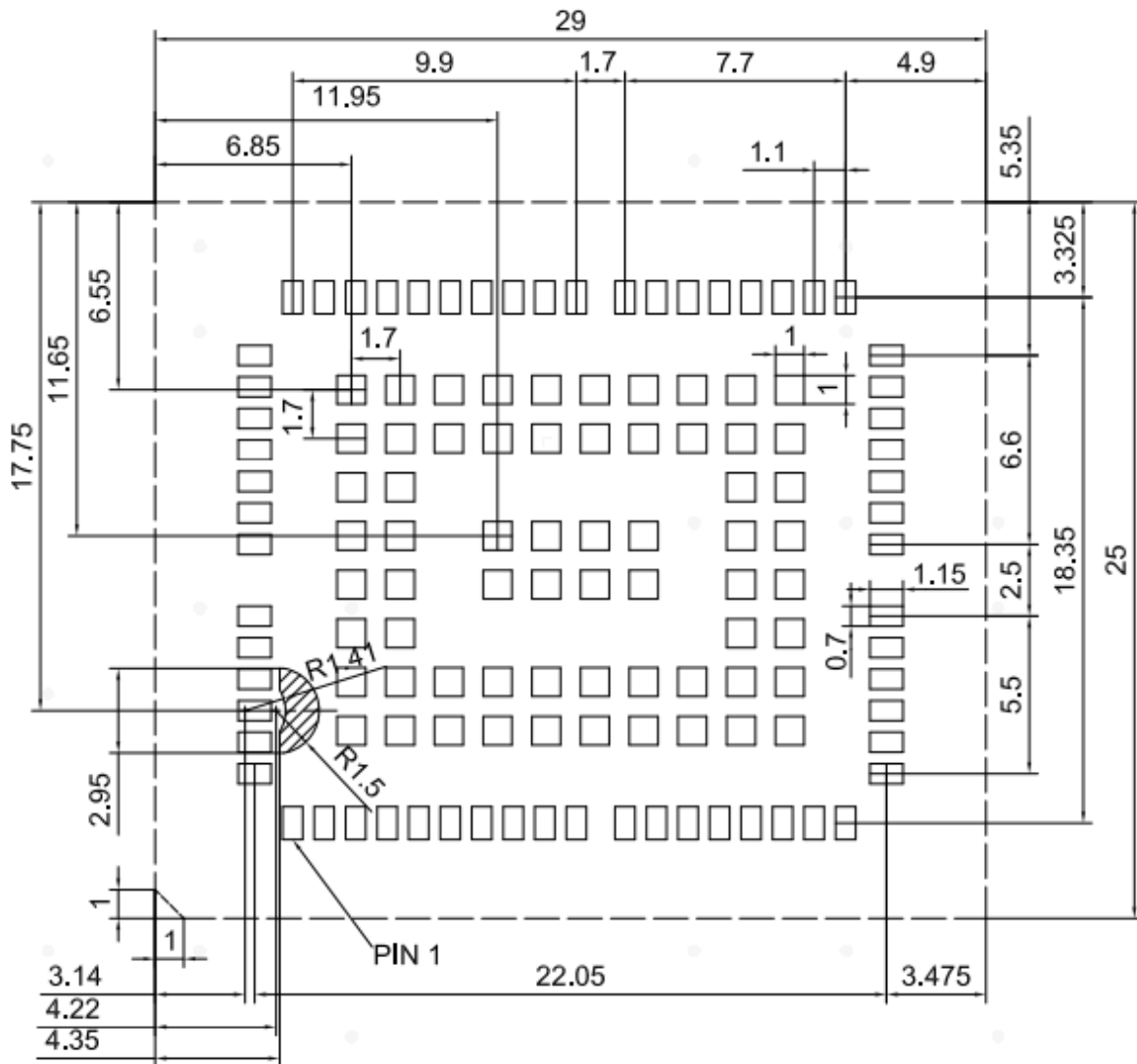
8.3 Stencil

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℃ 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 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.
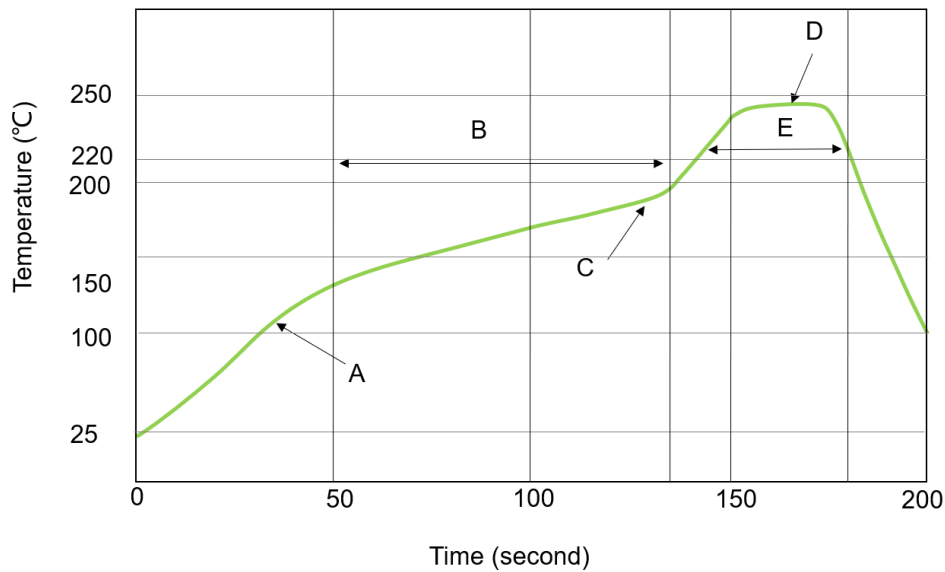
8.5 SMT Oven Temperature Profile

> ⚠ 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 to 180°C, Time: 60 to 100s

- Reflow zone: > 220°C, Time: 40 to 90s

- Peak temperature: 235 - 245°C

For information about N717-EA 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
ADC	Analog-to-digital converter
bps	Bits per second
FDD	Frequency division duplex
I2C	Inter-Integrated Circuit
I2S	Inter-IC sound
LGA	Land Grid Array
LTE	Long-Term Evolution
PCB	Printed Circuit Board
PCM	Pulse-coded modulation
PM	Power management
RF	Radio Frequency
UART	Universal Asynchronous Receiver-Transmitter
USIM	Universal Subscriber Identity Module
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
WCI	Wireless Coexistence Interface
WLAN	Wireless local area network