

# N723-EA PCIe

## Product Specifications

Issue 1.0

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This document provides a guide for users to use N723-EA PCIe.

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 N723-EA PCIe.

## Audience

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

## Change History

| Issue | Date    | Change          | Author       |
|-------|---------|-----------------|--------------|
| 1.0   | 2023-01 | Initial release | Feng Yongxiu |

# 1 Safety Recommendations

Please carefully read and strictly abide by the following safety requirements to ensure that the product application meets the national laws and environmental regulations, avoid risks to personal safety, and protect the product and application scenario from possible damage:

- Do not use the module in places where fire and explosion may occur.

If the module is used in places filled with flammable gases and dust such as propane gas, gasoline and combustible spray, it will lead to explosion or fire.

- In places where wireless communication is prohibited, please disable the wireless communication function.

In medical facilities or aircraft, the electromagnetic waves emitted by the module may interfere with the operation of surrounding equipment.

During the product application design and use of this module, the following requirements should be met:

- Do not disassemble the product of this module without permission. Otherwise, after-sales warranty service will not be available for the product.
- 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 or remove (U)SIM card or mobile device memory card if the product is not in power-off mode.

# 1 About N723-EA PCIe

This chapter introduces product overview, block diagram and basic features of N723-EA PCIe.

## 1.1 Product Overview

N723-EA PCIe is an LTE industrial-grade cellular module developed based on ASR, providing connectivity on LTE-FDD, LTE-TDD, WCDMA, and GSM networks. The module has dimensions of (51.0±0.10) mm × (30.2±0.10) mm × (5.3±0.15) mm with PCI Express Mini Card 1.2 standard interface. Rich hardware interfaces make N723-EA PCIe suited for use kinds of IoT communications equipment, such as wireless meter reading terminals, in-vehicle or handheld POS, industrial routers, and so on.

N723-EA PCIe has the following features:

- ARM Cortex-R5 processor, 832 MHz CPU clock speed, 32 KB L1 I-cache, and 32 KB L1 D-cache.
- Supported network mode: LTE Cat 4, WCDMA, GSM.
- Supported interfaces: USB2.0/USIM/UART

Table 1-1 lists the frequency bands that N723-EA PCIe supports.

Table 1-1 Supported frequency bands

| Region | Category | Frequency band  | GNSS          | Codec         |
|--------|----------|---|---------------|---------------|
| Europe | Cat.4    | FDD-LTE: B1, B3, B5, B7, B8, B20, B28<br>TDD-LTE: B38, B40, B41<br>WCDMA: B1, B5, B8<br>GSM/GPRS/EDGE: 900/1800 MHz | Not supported | Not supported |

## 1.2 Block Diagram

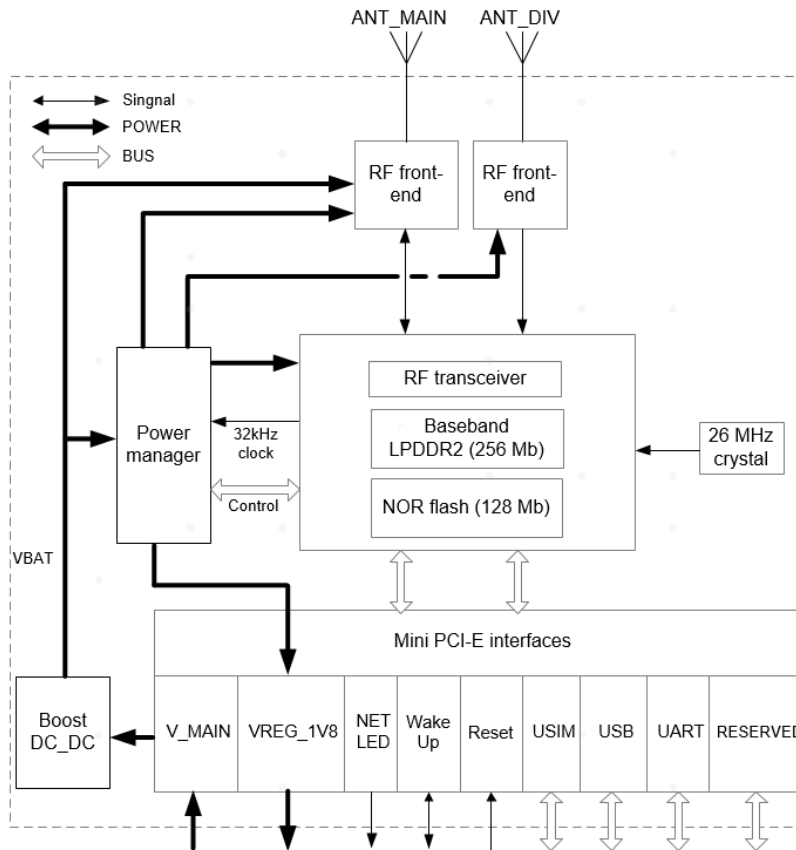
N723-EA PCIe includes the following functional units:

- Baseband chip
- 26 MHz crystal
- Power management
- RF function



- Flash
- Digital interfaces (USIM, UART, USB)

Figure 1-1 Block diagram



### 1.3 Basic Features

| Features               | Description  |
|------------------------|--|
| Physical features      | <ul style="list-style-type: none"> <li>• Dimensions: (51.0±0.1) mm × (30.2±0.15) mm × (5.3±0.15) mm</li> <li>• Package: 52-pin Mini PCIe</li> <li>• Weight: about 11.28 g</li> </ul> |
| Temperature ranges     | <ul style="list-style-type: none"> <li>• Operating: - 30°C to + 75°C</li> <li>• Extended: - 40°C to + 85°C</li> <li>• Storage: - 40°C to +90°C</li> </ul>                            |
| Operating voltage (DC) | V_MAIN: 3.0 V - 3.6 V, typical value: 3.3 V  |

|                        |  |
|------------------------|--|
| Operating current (DC) | Sleep mode <sup>1</sup> : ≤10mA@3.3V   |
|                        | Idle mode <sup>2</sup> : ≤65mA@3.3V  |
|                        | Operating mode <sup>3</sup> (LTE system): 670mA@3.3V   |
| Application processor  | ARM Cortex-R5 processor, with CPU clock speed up to 832 MHz , 32 KB L1 cache   |
| Memory                 | RAM: 256 Mbit<br>ROM: 128 Mbit   |
| Frequency band         | See Table 1-1.   |
| Wireless rate          | GPRS: Max 85.6 kbps (DL)/Max 85.6 kbps (UL)<br>EDGE: Max 236.8 Kbps (DL) / Max 236.8 Kbps(UL)<br>WCDMA: HSPA+, Max 21 Mbps (DL)/Max 5.76 Mbps (UL)<br>FDD-LTE: Cat4, non-CA, Max 150 Mbps (DL)/Max 50 Mbps (UL)<br>TDD-LTE: Cat4, non-CA, Max 130 Mbps (DL)/Max 30 Mbps (UL) |
| Transmit power         | EGSM900: +33 dBm (Power Class 4)<br>DCS1800: +30 dBm (Power Class 1)<br>EDGE 900MHz: +27 dBm (Power Class E2)<br>EDGE1800MHz: +26 dBm (Power Class E2)<br>WCDMA: +23 dBm (Power Class 3)<br>LTE: +23 dBm (Power Class 3)   |
| Application Interfaces | 2G/3G/4G antenna<br>4G diversity receiving antenna<br>The characteristic impedance of each antenna is 50 Ω.  |
|                        | One UART interface   |
|                        | One USIM interface, supporting 1.8 V/3.0 V USIM cards.   |
|                        | One USB2.0 interface.  |
| AT command             | 3GPP Release 9<br>Neoway extended AT commands  |
| SMS                    | PDU, TXT   |
| Data                   | PPP, RNDIS   |

Current in sleep mode<sup>1</sup>: means the current drawn by the module in sleep mode, a low power consumption state, in which its RF function is functioning properly but its peripheral interfaces are disabled. If there is an incoming call or SMS, the module will exit from the sleep mode, and after the incoming call or voice instant messaging has ended, the module will re-enter the sleep mode.

Current in standby mode<sup>2</sup>: means the current drawn by the module in a normal operating mode, but no data service is being processed.

Current in operating mode<sup>3</sup>: means the current drawn by the module when there are on-going data services. In the operating mode, only the current value on LTE network is exemplified. For other current values on other network modes, please refer to the current test report.

---

|                        |                                      |
|------------------------|--------------------------------------|
| Protocol               | TCP/TCPs, UDP, HTTP/HTTPS, FTP, MQTT |
| Certification approval | CE, RoHS                             |

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## 2 Reference Standard

N723-EA PCIe 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 V9.19.0 Characteristics of the Universal Subscriber Identity Module (USIM) application
- 3GPP TS 31.111 V9.12.2 Universal Subscriber Identity Module (USIM) Application Toolkit (USAT)
- 3GPP TS 27.007 V9.9.0 AT command set for User Equipment (UE)
- 3GPP TS 27.007 V9.9.0 AT command set for User Equipment (UE)
- 3GPP TS 34.123-1 V8.3.0 User Equipment (UE) conformance specification; Part 1: Protocol conformance specification
- 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

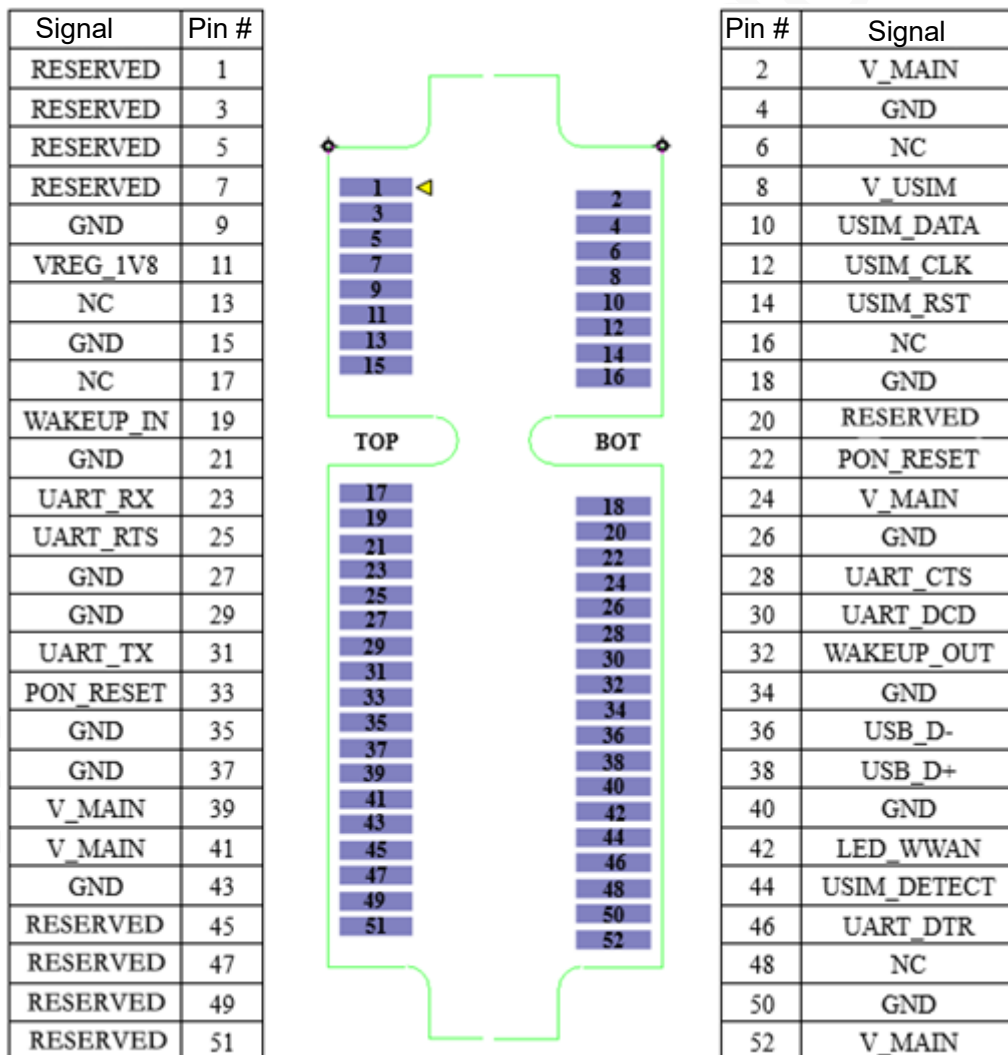
### 3 Pin Definitions

N723-EA PCIe modules are equipped with 52 pins, which are introduced in Mini PCIe package. The module provides rich functional interfaces include: power supply, reset, USB, UART, USIM, etc.

#### 3.1 Pin Definitions

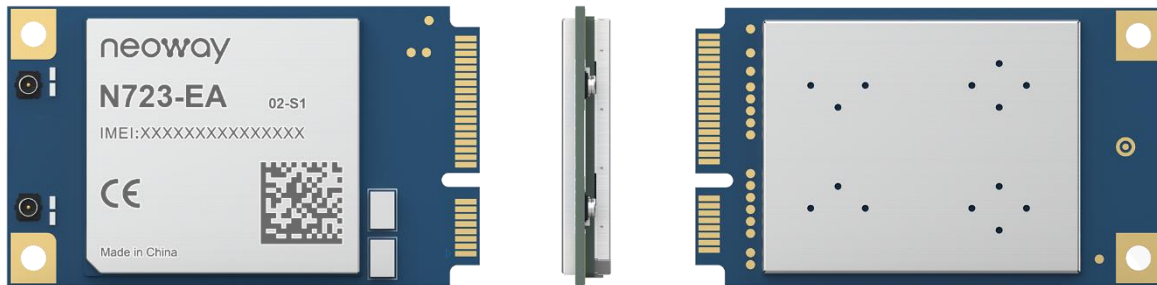
The following figure shows the pad layout of N723-EA PCIe.

Figure 3-1 N723-EA PCIe interface pin-outs



### 3.2 Module Appearance

Figure 3-2 Three dimensions of N723-EA PCIe module



The above figure is for reference only. For authentic appearance, please refer to the module that you receive from Neoway.

## 4 Electrical Characteristics and Reliability

This chapter describes the electrical characteristics and reliability of the module, including the input and output voltage and current of the power supply, operating and storage temperature range, and ESD protection characteristics.

### 4.1 Electrical Characteristics



- If the voltage is lower than the 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 a current not less than 2.5 A. The 2.5 A current corresponds to the maximum power level of the module at GSM mode, and the peak current during burst transmission lasts for a short time. Placing a large capacitor at the V\_MAIN pin of the module can effectively enhance the freewheeling current of the power supply and avoid abnormalities such as module shutdown caused by excessive voltage drop.

Table 4-1 N723-EA PCIe electrical characteristics

| Parameter |                 | Minimum value | Typical value | Max. value |
|-----------|-----------------|---------------|---------------|------------|
| V_MAIN    | V <sub>in</sub> | 3.0 V         | 3.3 V         | 3.6 V      |
|           | I <sub>in</sub> | N/A           | N/A           | 2.5 A      |

### 4.2 Temperature Characteristics

Table 4-2 N723-EA PCIe temperature characteristics

| Parameter | Minimum value | Typical value | Max. 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 and cannot meet the requirements of 3GPP specification, but it will not have a great impact on the normal use of the module. After the temperature is restored, the RF performance can be restored to meet the 3GPP specification.

## 4.3 ESD Protection Characteristics

As electronic products need to undergo strict ESD testing, the following items are the electrostatic protection capabilities of the main pins of the module. When designing related products, you 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 4-3 N723-EA PCIe ESD protection characteristics

| Test point      | Contact discharge | Air discharge |
|-----------------|-------------------|---------------|
| GND             | ±8 kV             | ±15 kV        |
| ANT interface   | ±8 kV             | ±15 kV        |
| Shielding cover | ±8 kV             | ±15 kV        |



The above test data are obtained from the test using a N723-EA PCIe\_EVB of Neoway.



## 5 RF Characteristics

N723-EA PCIe provides connectivity on GSM, WCDMA, FDD-LTE, TDD-LTE (Cat.4) networks.

This chapter introduces the RF characteristics of N723-EA PCIe.

### 5.1 Operating Frequency Bands

Table 5-1 N723-EA PCIe operating bands

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

## 5.2 TX Power and RX Sensitivity

Table 5-2 N723-EA PCIe RF transmitting power

| Operating frequency band | Max power           | Min. power       |
|--------------------------|---------------------|------------------|
| EGSM900                  | 33 dBm $\pm$ 2.7 dB | 5 dBm $\pm$ 5 dB |
| DCS1800                  | 30 dBm $\pm$ 2.7 dB | 5 dBm $\pm$ 5 dB |
| WCDMA B1                 | 24 dBm+1/-3 dB      | < -50 dBm        |
| WCDMA B5                 | 24 dBm+1/-3 dB      | < -50 dBm        |
| WCDMA B8                 | 24 dBm+1/-3 dB      | < -50 dBm        |
| FDD-LTE B1               | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B3               | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B5               | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B7               | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B8               | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B20              | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| FDD-LTE B28              | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| TDD-LTE B38              | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| TDD-LTE B40              | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |
| TDD-LTE B41              | 23 dBm $\pm$ 2.7 dB | < -39 dBm        |

Table 5-3 N723-EA PCIe GSM RX sensitivity

| Operating frequency band | Receiving sensitivity (dBm) |
|--------------------------|-----------------------------|
| EGSM900                  | $\leq$ -102.4               |
| DCS1800                  | $\leq$ -102.4               |

Table 5-4 N723-EA PCIe WCDMA RX sensitivity

| Operating frequency band | Receiving sensitivity (dBm) |
|--------------------------|-----------------------------|
| WCDMA B1                 | $\leq$ -106.7               |
| WCDMA B5                 | $\leq$ -104.7               |
| WCDMA B8                 | $\leq$ -103.7               |

Table 5-5 N723-EA PCIe LTE RX sensitivity

| Operating frequency band | Receiving sensitivity (dBm) | Duplex mode |
|--------------------------|-----------------------------|-------------|
| LTE B1                   | $\leq -96.3$                | HD-FDD      |
| LTE B3                   | $\leq -93.3$                | HD-FDD      |
| LTE B5                   | $\leq -94.3$                | HD-FDD      |
| LTE B7                   | $\leq -94.3$                | HD-FDD      |
| LTE B8                   | $\leq -94.3$                | HD-FDD      |
| LTE B20                  | $\leq -93.3$                | HD-FDD      |
| LTE B28                  | $\leq -94.8$                | HD-FDD      |
| LTE B38                  | $\leq -96.3$                | HD-TDD      |
| LTE B40                  | $\leq -96.3$                | HD-TDD      |
| LTE B41                  | $\leq -94.3$                | HD-TDD      |



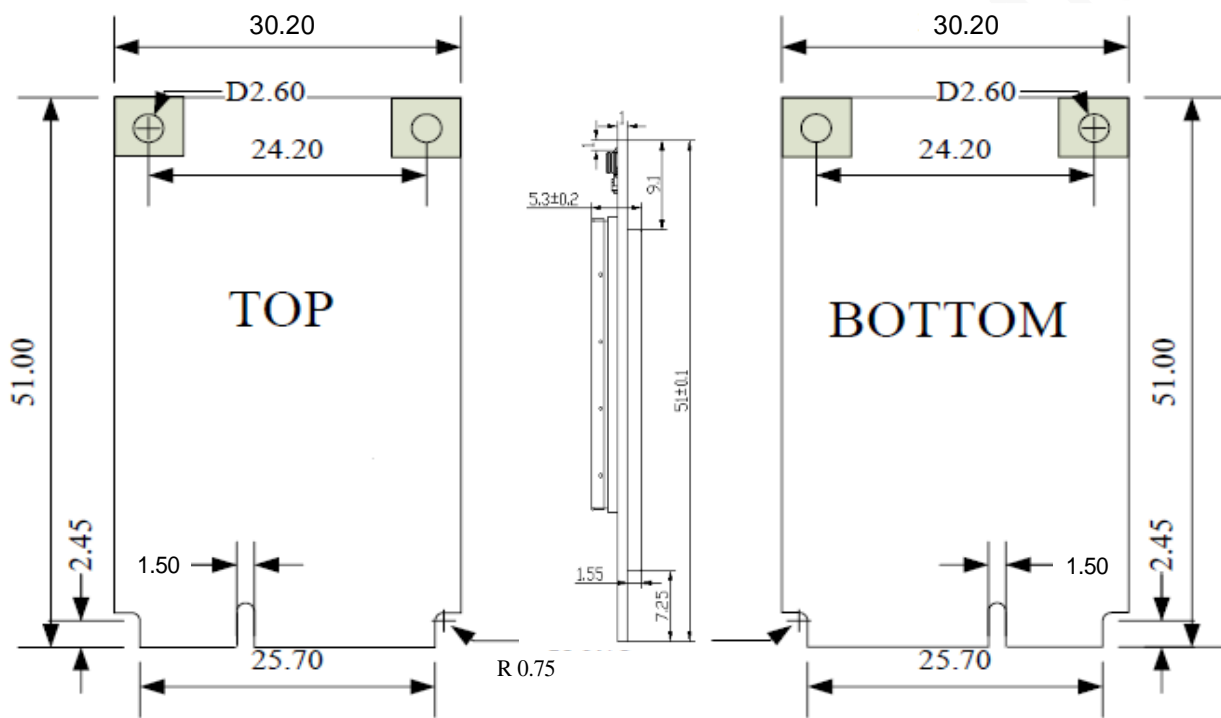
The preceding indicators are tested in a shielded environment in a laboratory. The LTE band indicators are the test results when the bandwidth is 10 MHz, the modulation mode is QPST and RB is set according to the protocol. On no-shielded environments, deviations may exist in the receiver sensitivity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

# 6 Mechanical Characteristics

This chapter describes mechanical characteristics of the N723-EA PCIe module.

## 6.1 Dimensions

Figure 6-1 N723-EA PCIe top and side view dimensions (unit: mm)



## 6.2 Labeling

The label of N723-EA PCIe modules include important product information as described in the following figure.



The above figure is for reference only. For authentic appearance, please refer to the module that you receive from Neoway.

## 6.3 Packaging

N723-EA PCIe adopts the SMD reflow soldering process for electronics assembly. The modules are delivered in trays, which are packed in vacuumed moisture-proof aluminium foil bag. To ensure the dryness of the product and prolong their service life, the bag also holds desiccant and a humidity indicator card.

### 6.3.1 Tray

Neoway modules are packed in the following method, which enables efficient production.

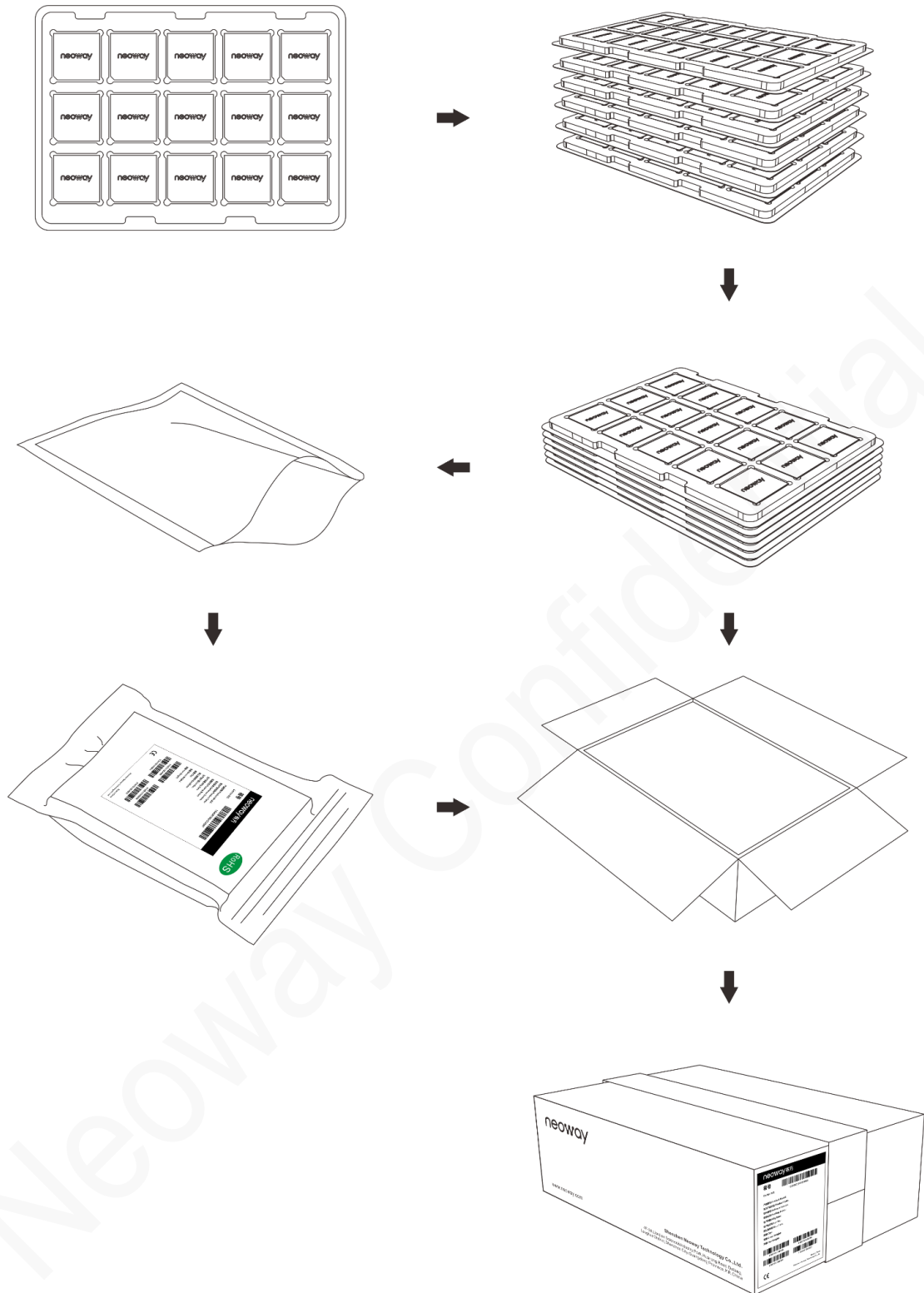
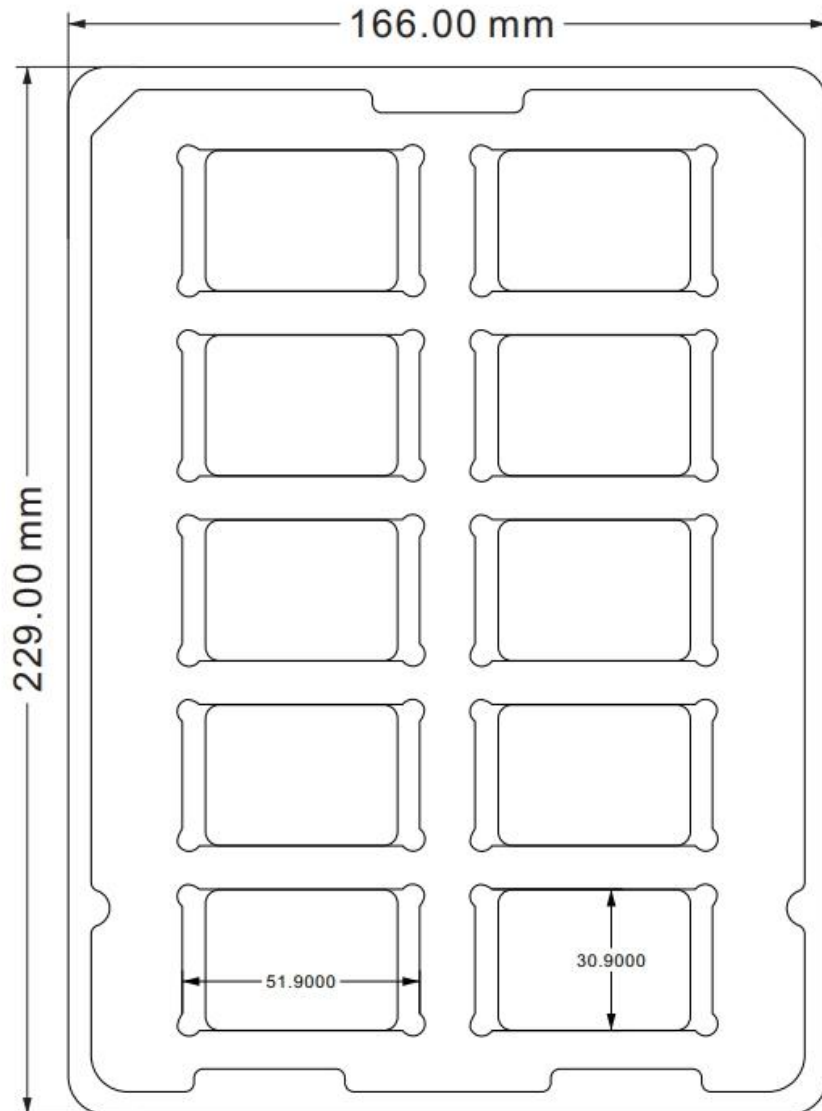


Figure 6-2 Tray



## 7 Mounting

This chapter describes the module footprint of N723-EA PCIe, the recommended footprint of the application PCB, and SMT specifications.

### 7.1 Application PCB Package

N723-EA PCIe adopts a standard Mini PCI Express connector that has 52 pins and complies with *PCI Express Mini Card Electromechanical Specification Revision 1.2*. The module tail is fixed with a Mini PCI Express lock or copper post, and the connector is recommended to use Foxconn brand, model: AS0B221-S40Q-7H connector (optional Mini PCI Express lock), with the dimensions shown in the figure below.



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

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Figure 7-1 Recommended Mini PCIe connector (unit: mm)

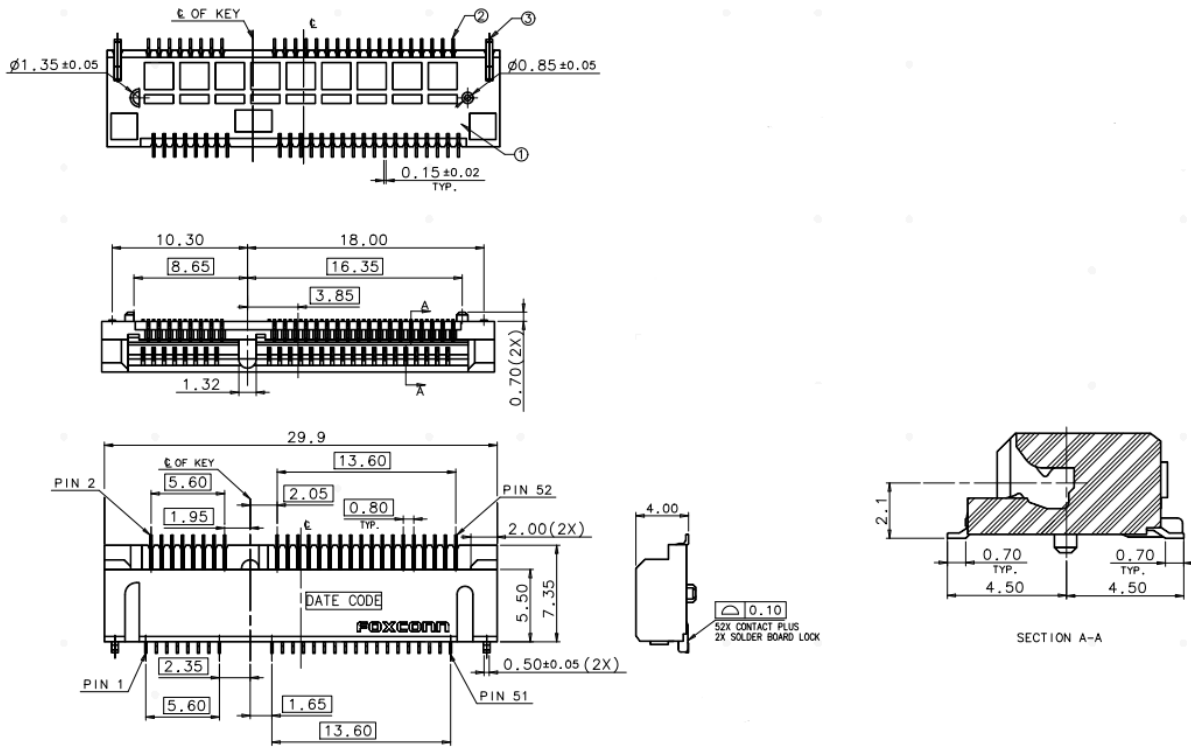
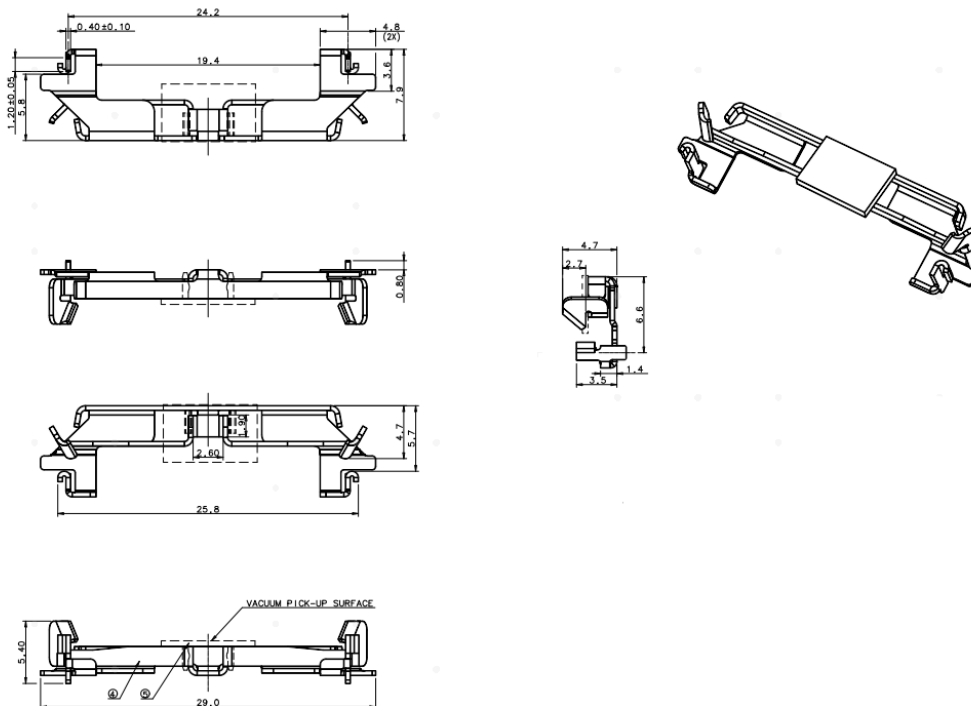


Figure 7-2 Recommended optional Mini PCI express lock (unit: mm)



## A Abbreviations

| Abbreviation | Full name                                   |
|--------------|---|
| CPU          | Central Processing Unit                     |
| EGSM         | Enhanced GSM                                |
| EMC          | Electromagnetic Compatibility               |
| EMI          | Electro Magnetic Interference               |
| ESD          | Electronic Static Discharge                 |
| GPRS         | General Packet Radio Service                |
| GSM          | Global System for Mobile Communications     |
| IC           | Integrated Circuit                          |
| PCB          | Printed Circuit Board                       |
| RAM          | Random Access Memory                        |
| RF           | Radio Frequency                             |
| ROM          | Read-only Memory                            |
| SMS          | Short Message Service                       |
| UART         | Universal Asynchronous Receiver-Transmitter |
| 3GPP         | 3rd Generation Partnership Project          |
| EVK          | Evaluation Kit                              |
| USB          | Universal Serial Bus                        |
| LTE          | Long Term Evolution                         |
| WCDMA        | Wide-band Code Division Multiple Access     |
| FDD          | Frequency Division Duplexing                |
| TDD          | Time Division Duplex                        |
| DCS          | Digital Cellular System                     |