# N728-LA

## Product Specifications

Cat.4 Module
Issue 1.0
Date 2023-08-04

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## Notice

This document is specifically for N728-LA.

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

Any Changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

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

(1) this device may not cause harmful interference, and

(2) this device must accept any interference received, including interference that may cause undesired operation.

Note: 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.

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.

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# About This Document

## Scope

This document is applicable to N728-LA.

## Audience

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

## Change History

| Issue | Date | Change | Changed By |
|---|---|---|---|
| 1.0 | 2023-05 | Initial draft | Zou Shiqiang |

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## 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. |
| ℹ | Means note or tips for readers to use the module |

# 1 Safety Recommendations

Please read carefully and strictly adhere to the following safety recommendations to ensure that the product complies with national and environmental requirements, and to avoid potential threats to personal safety and protect the product and work environment from damage:

- Do not use in areas where there is a risk of fire or explosion.

  Using the product in areas with flammable gases, such as propane, gasoline, or combustible sprays, or dust, can result in explosions or fires.
- In places where wireless communication is prohibited, please turn off the wireless communication function.

  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 product without authorization, otherwise, the product's after-sales warranty service cannot be provided.
- Please design the product correctly according to the Hardware User Guide. Please connect the product to a stable power supply voltage, and the wiring should comply with safety and fire prevention management requirements.
- Avoid touching the pins of the module directly in case of damages caused by ESD.
- Do not insert or remove the SIM card or mobile storage card while the product is not turned off.

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# 2 About N728-LA

This chapter introduces product overview, block diagram, and basic features of N728-LA.

## 2.1 Product Overview

N728-LA is an industrial-grade cellular module that supports LTE-FDD, LTE-TDD, WCDMA, and GSM. Measuring (30.00±0.10) mm × (28.00±0.10) mm × (2.75±0.20) mm, the module supports PHY chip with external RMII interface, WLAN chip with SDIO interface, and Codec chip with PCM / I2S interface. It is suitable for developing IoT communication devices such as wireless meter reading terminals, vehicle/handheld POS, industrial routers and so on.

N728-LA has the following features:

- ARM Cortex-R5 processor, with CPU clock speed up to 832 MHz, 32 KB L1 cache.
- Supported network modes: LTE Cat. 4, WCDMA, GSM.
- Supported interfaces: USIM, USB2.0, UART, I2C, I2S/PCM, SPI, SDIO, SDC, RMII, 1PPS, GPIO.

Table 2-1 lists the frequency bands that N728-LA supports.

Table 2-1 Supported frequency bands

| Region | Category | Frequency band | GNSS[1] | Diversity antenna[2] |
|---|---|---|---|---|
| Latin America | Cat4 | FDD-LTE: B2, B4, B5, B7, B66<br>TDD-LTE: B38, B41<br>WCDMA: B2, B5<br>GSM/GPRS/EDGE: 850/1900 MHz | Supported | Not supported |

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GNSS[1] indicates that GNSS is an optional configuration.

Diversity antenna[2] indicates that the diversity antenna is an optional configuration.

## 2.2 Block Diagram

N728-LA consists of the following functionality units:

- Baseband chip
- 26 MHz crystal
- Power management
- Radio frequency unit
- Supported interfaces: USIM, USB2.0, UART, I2C, I2S/PCM, SPI, SDIO, SDC, RMII, 1PPS, GPIO.

## 2.3 Basic Features

| Features | Description |
|---|---|
| Physical features | • Dimensions: (30.00±0.10) mm × (28.00±0.10) mm × (2.75±0.20) mm<br>• Package: LGA<br>• Weight: about 5.10 g |
| Temperature ranges | Operating: -30°C to +75°C<br>Extended[3]: -40°C to +85°C<br>Storage: -40°C to +90°C |
| Operating voltage | VBAT: 3.4 V to 4.2 V, typical value: 3.8 V |
| Operating current | Sleep mode4): ≤ 4.5 mA |
| | Idle mode5): ≤ 36 mA (GNSS disabled) |
| | Operating mode6) (LTE mode): TBD |
| Application processor | ARM Cortex-R5 processor, with CPU clock speed up to 832 MHz, 32 KB L1 cache |

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[3] Extended: the module can be registered on the network, but some indicators cannot meet 3GPP standards.

[4] Sleep mode: 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.

[5] Idle mode: means the current drawn by the module in a normal operating mode, but no data service is being processed.

[6] Operating mode: current drawn by the module while it is in the state of data communication.

| | |
|---|---|
| Memory | RAM: 32 MB<br>ROM: 16 MB |
| Band | See Table 2-1. |
| 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>LTE-FDD: Cat4, With-DRX, Max 150 Mbps (DL)/Max 50 Mbps (UL)<br>LTE-TDD: Cat4, With-DRX, Max 130 Mbps (DL)/Max 30 Mbps (UL)<br>LTE-FDD: Cat4, Without-DRX, Max 75 Mbps (DL)/Max 50 Mbps (UL)<br>LTE-TDD: Cat4, Without-DRX, Max 65 Mbps (DL)/Max 30 Mbps (UL) |
| Transmit power | EGSM900: +33 dBm (Power Class 4)<br>DCS1800: +30 dBm (Power Class 1)<br>EDGE 900 MHz: +27 dBm (Power Class E2)<br>EDGE1800 MHz: +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>GNSS antenna, the characteristic impedance of each antenna is 50 Ω. |
| | One USIM interface, supporting 1.8 V/3.0 V USIM cards. |
| | One USB2.0 interface. |
| | Three UART (one of which is a Debug UART) |
| | One I2C interface, for master mode only |
| | One I2S / PCM interface |
| | One SPI interface, host mode only |
| | One SDIO interface, for WLAN |
| | One RMII interface |
| | One 1PPS interface |
| | GPIO interfaces |
| AT commands | 3GPP Release 9<br>Neoway extended AT commands |
| SMS | PDU, TXT |
| Data | PPP, RNDIS |
| Protocol | TCP/TCPS, UDP, HTTP/HTTPS, FTP, MQTT |
| Authentication | TBD |

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# 3 Reference Standard

N728-LA 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 27.005 V9.0.1 Use of Data Terminal Equipment – Data Circuit terminating Equipment (DTE - DCE) interface for Short Message Service (SMS) and Cell Broadcast Service (CBS)

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# 4 RF Interface Designs

| Signal | Pin SN | I/O | Function description | Remarks |
|---|---|---|---|---|
| ANT_MAIN | 76 | AI | 2G/3G/4G main antenna pin | Requiring 50 Ω impedance characteristic. |
| ANT_DIV | 94 | AI | 4G diversity antenna pin | |
| ANT_GNSS | 92 | - | GNSS antenna pin | |

## 4.1.1 ANT_MAIN/ANT_DIV Antenna Interfaces

The MAIN/DIV antenna interface of the N728-LA module requires the 50Ω impedance characteristic. The impedance of the cable from the module interface to the antenna needs to be kept within the impedance range to ensure RF performance. Therefore, you should control the impedance of the traces between the pins and antenna to ensure the RF performance. An impedance matching circuit, such as the L network, split capacitor network, and pi network is mandatory in between. Pi network is recommended.

Figure 4-1 L-type RF matching schematics

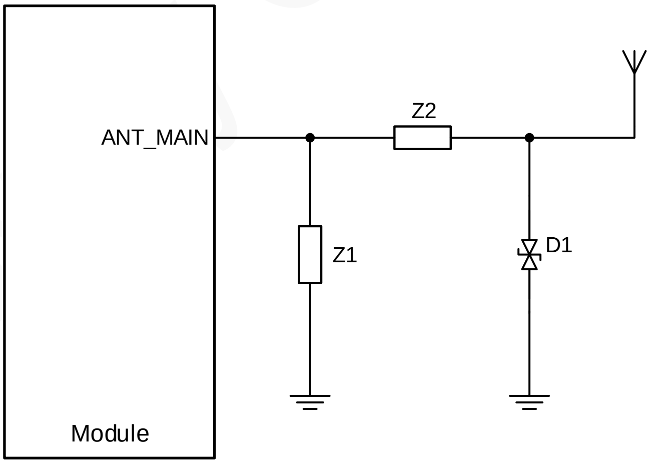

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Figure 4-2 T-type RF matching schematics

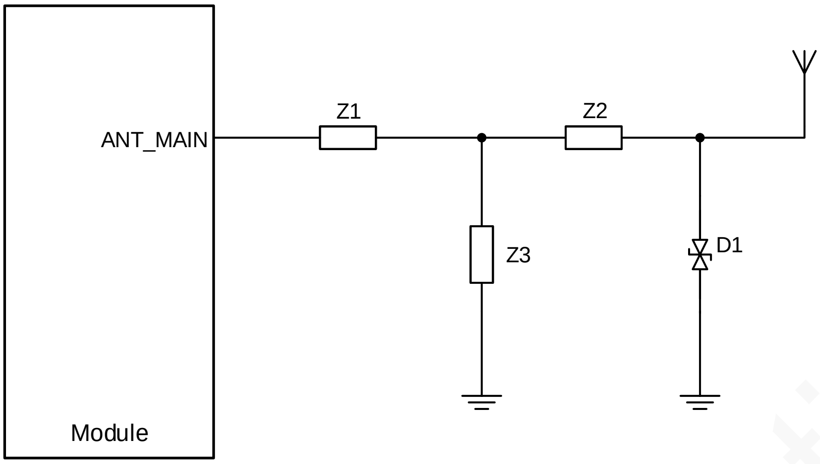
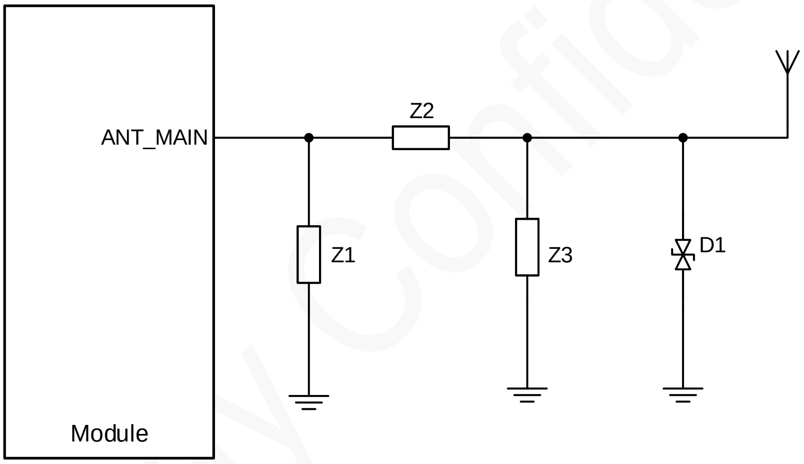


Figure 4-3 π-type RF matching schematics



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Schematic Design Guidelines

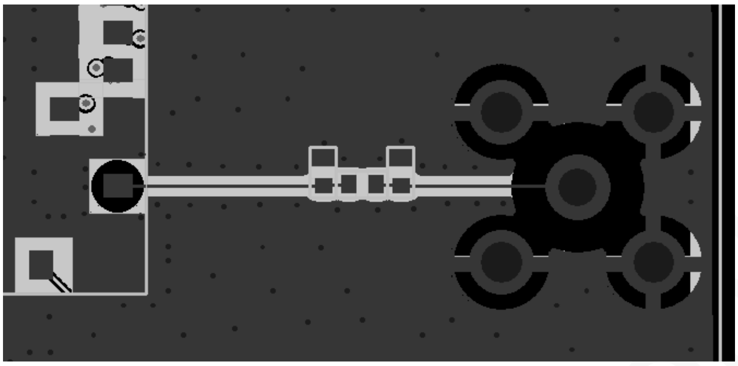
- Element components in the above figures are capacitors, inductors, and 0 Ω resistors. Place these RLC components as close to the antenna interface as possible.
- If static electricity may be introduced through the antenna, it is recommended to add TVS components with ultra-low junction capacitance for static electricity protection. TVS diodes with junction capacitance less than 0.5 pF are preferred. Besides, it is necessary to ensure that the reverse breakdown voltage of TVS diodes is greater than 10 V, and TVS diodes with reverse breakdown voltage above 15 V are preferred.

PCB Design Guidelines:

- Lay copper foil around the RF connector. Dig as many ground holes as possible on the copper and the characteristic impedance of all RF traces should be controlled to 50 Ω.
- Keep the traces as short as possible and control their characteristic impedance at 50 Ω

- To avoid antenna performance being affected significantly by the parasitic capacitance of a large RF pad when using SMA connector, remove the copper on the first and fourth layers or all layers of a multiple-layer PCB under the RF solder pad. The following is the recommended RF PCB design.

Figure 4-4 Recommended RF PCB design



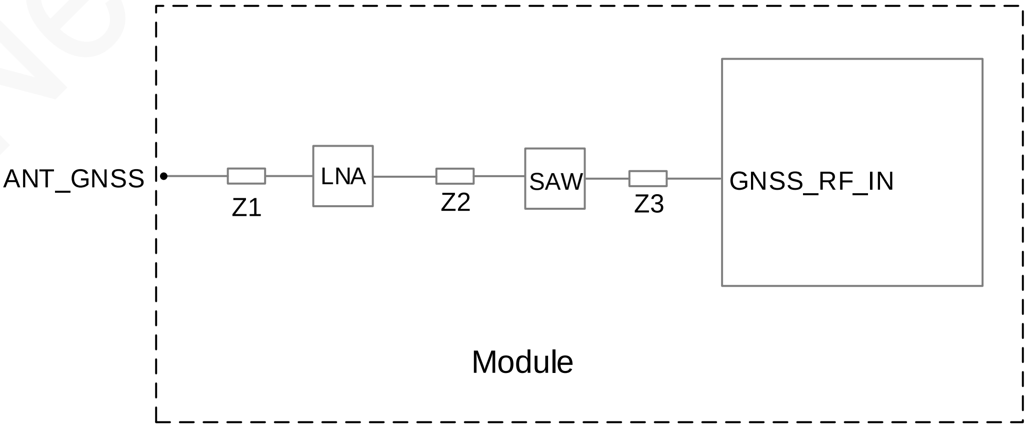
- A reasonable distance should be kept between ANT_MAIN and ANT_DIV to avoid mutual interference that may affect reception performance.
- On the PCB, keep the RF signals and components far away from high-speed circuits, power supplies, transformers, great inductors, the clock, etc.

## 4.1.2 ANT_GNSS Antenna Interface

### GNSS Impedance Control

ANT_GNSS (pin #92) is the GNSS antenna interface of the module, which requires a characteristic impedance of 50 Ω. The following shows the GNSS structure inside the module.

Figure 4-5 GNSS RF structure



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Schematic Design Guidelines

- For the matching circuitry between the module interface and GNSS antenna, please refer to the schematic design in section 4.1.1 ANT_MAIN/ANT_DIV Antenna Interfaces.
- There is an LNA inside the module; if a passive GNSS antenna is adopted, do not add an LNA.

## Reference design of active GNSS antenna

After the GNSS antenna receives GNSS satellite signals, the signals are amplified by the front LNA (Low Noise Amplifier) inside the active antenna and then sent to the ANT_GNSS pin of the module through the feeder and PCB traces. The following figure shows the reference design of the active GNSS antenna.

Figure 4-6 Reference design of active GNSS antenna 11

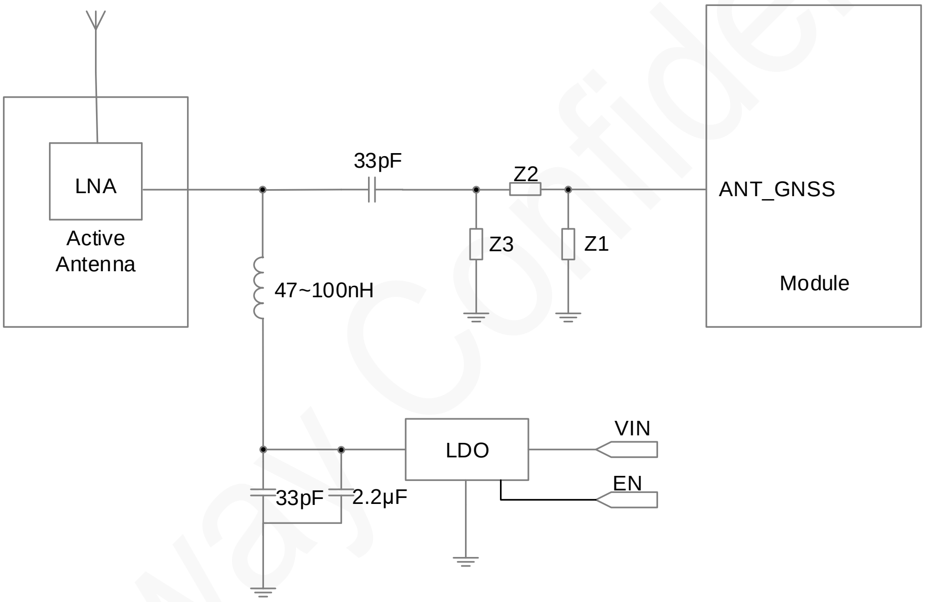

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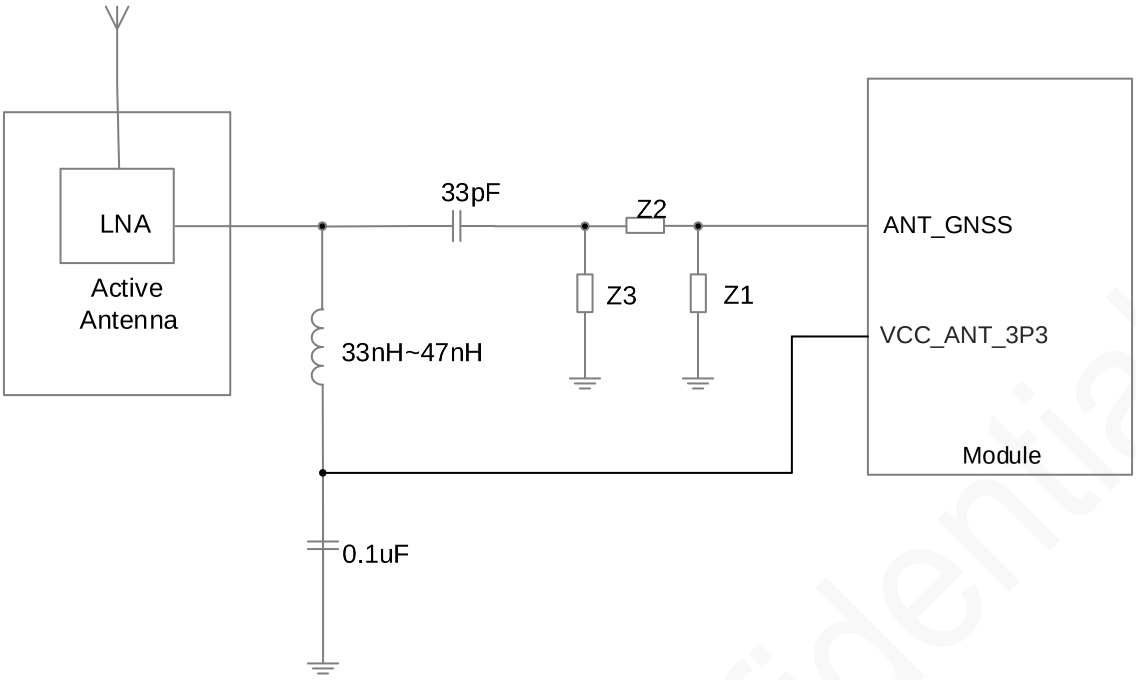
Figure 4-7 Reference design of active GNSS antenna 2



Schematic Design Guidelines

- If using an active GNSS antenna due to the presence of an LNA within the module, please verify the specifications of the active antenna with Neoway FAEs.

PCB Design Guidelines:

- For cautions of PCB design between GNSS interface and antenna, refer to the PCB design guidelines in section 4.1.1 ANT_MAIN/ANT_DIV Antenna Interfaces.
- 50 Ω impedance control is required for both antenna feeders and the PCB traces between the antenna interface and LNA, and the traces should not be too long. The power supply of the active antenna is fed via an inductor of 47 nH - 100 nH from the signal line of the antenna.
- The common active antenna requires a 3.3 V to 5 V power supply. The active antenna itself consumes less power, but it requires LDO with a low noise coefficient to supply power to the antenna through an inductor of 100NH, as shown in the figure above.
- Keep the GNSS RF circuit away from the main and BT antenna circuits as far as possible on PCB. Otherwise, the RF performance may be affected.

## Reference design of passive GNSS antenna

After the GNSS antenna receives the GNSS satellite signal, it is transmitted to the ANT_GNSS pin of the N728-LA odule through the PCB traces. The following figure shows a reference design of the

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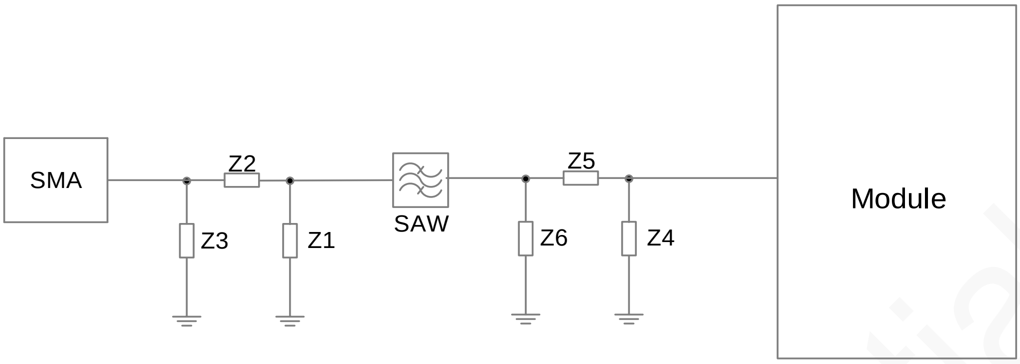
passive GNSS antenna.

Figure 4-8 Reference design of passive GNSS antenna



Schematic Design Guidelines

- In general, when using a passive antenna, there is no need to add an external SAW filter. If there is significant interference around the GNSS antenna, it is recommended to add a SAW filter.

  PCB Design Guidelines:

- For cautions of PCB design between the GNSS interface and the antenna, refer to the PCB design guidelines in 4.1.1 .
- Keep the GNSS RF circuit away from the main and BT antenna circuits as far as possible on your application PCB. Otherwise, the RF performance may be affected.
- There is an LNA inside the module; if a passive GNSS antenna is adopted, do not add an LNA.

### 4.1.3 Antenna Assembling

The antenna used by the module must comply with the mobile device standard. The standing wave ratio should be between 1.1 and 1.5, and the input impedance should be 50 Ω. Requirements for antenna gain vary according to the application environment. In general, the greater the in-band gain and the smaller the out-of-band gain, the better the performance of the antenna.

Antenna interfaces can be connected to a rubber ducky antenna, magnet antenna, or embedded Planar Inverted F Antenna (PIFA). While using an external RF antenna, keep the external RF cables far away from all interference sources, especially digital signals and switching power supply.

The following methods are commonly used to assemble antennas:

- Reference design for external antennas (GSC RF connector)
  MM9329-2700RA1 from Murata is recommended. The following figure shows its encapsulation specifications.

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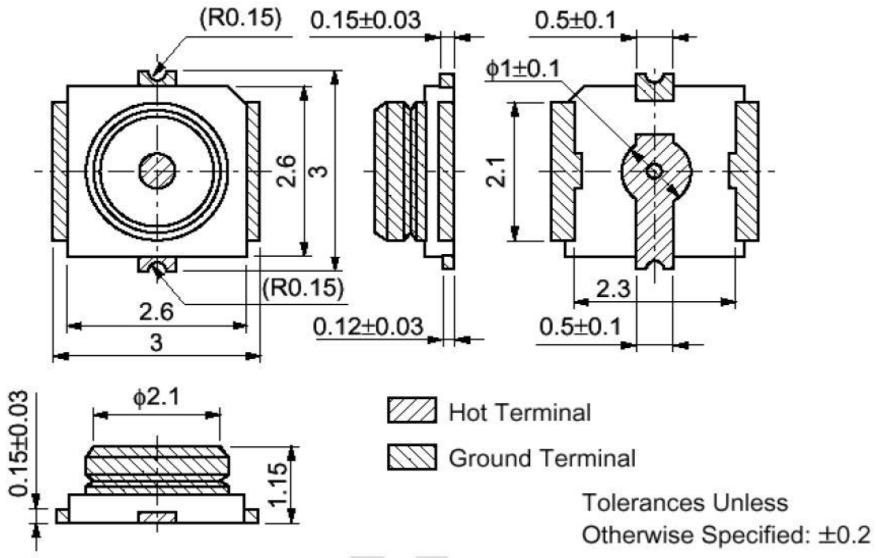
Figure 4-9 Murata RF connector encapsulation specifications



- Connecting to an external antenna by soldering
  It is not recommended to solder the RF cables to the module directly since the stability, consistency, and RF performance are not good.

  The following show the two types of connections.

Figure 4-10 RF cable connections

- PCB printing or SMT

  The module works in a wide frequency range, but it is difficult for PCB antennas or ceramic antennas to cover a wide frequency. Therefore, this connection method is recommended only for 2.4 GHz Wi-Fi or BT/ BLE antennas.

The following figure shows the layout of the 2.4 GHz ceramic chip antenna. SLDA52-2R540G-S1TF is used as an example.

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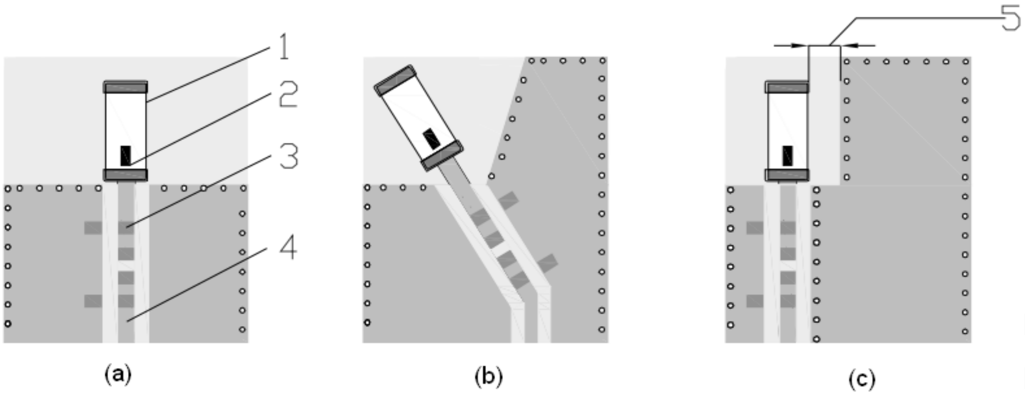
Figure 4-11 Antenna layout

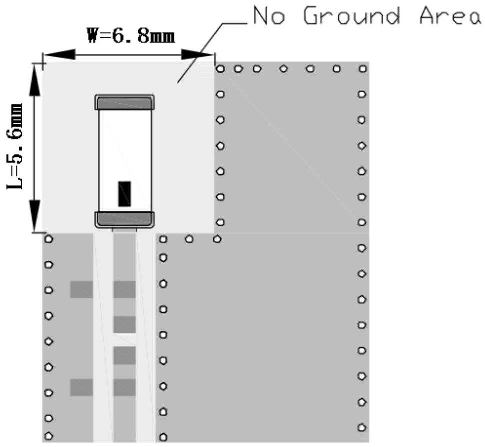


If your PCB is large enough, you can adopt the layout shown in Figure 4-11 (a).

- 1 Chip antenna
- 2 Feeding mark
- 3 Solder pad of the matching circuitry
- 4 50 Ω characteristic impedance RF trace

Figure 4-12 shows the layout for the area between the antenna and ground that is marked as "5" in Figure 4-11.

Figure 4-12 Layout around the antenna



For more details, refer to the antenna manuals and other documents.

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# 5 Electrical Characteristics and Reliability

## 5.1 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 at least 2.5 A current. 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 VBAT 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 5-1 N728-LA electrical characteristics

| Parameter | | Minimum value | Typical value | Max. value |
|---|---|---|---|---|
| VBAT | $V_{in}$ | 3.4 V | 3.8 V | 4.2 V |
| | $I_{in}$ | N/A | N/A | TBD |
| VBACKUP | $V_{in}$ | 1.4 V | 3.3 V | 3.6 V |
| | $I_{in}$ | N/A | 8uA | N/A |

## 5.2 Temperature Characteristics

Table 5-2 N728-LA temperature characteristics

| Parameter | Minimum value | Typical value | Max. value |
|---|---|---|---|
| Operating | -30℃ | 25℃ | 75℃ |
| Extended | -40℃ | 25℃ | 85℃ |
| Storage | -40℃ | 25℃ | 90℃ |

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In the event that the temperature in the operating environment surpasses the designated thresholds, certain RF performance indicators of the module may deteriorate and fall short of the 3GPP specification requirements. However, despite this, the module's regular functionality will not be significantly affected. It is possible for the RF performance to return to the required 3GPP standards once the temperature is normalized.

## 5.3 ESD Protection Characteristics

To guarantee quality, electronic products are required to undergo comprehensive electrostatic discharge (ESD) testing. Therefore, it is crucial to take into account the electrostatic protection capabilities of the primary module pins during the design of related products. The following is the ESD protection characteristic data of this module. When designing related products, you need to add appropriate ESD protection according to the industry, depending on the industry in which the product will be used to prevent damage and ensure optimal performance.

Test environment: humidity 45%; temperature 25℃

Table 5-3 N728-LA ESD protection characteristics

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

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# 6 RF Characteristics

N728-LA provides connectivity on GSM, WCDMA, FDD-LTE, TDD-LTE (Cat4) networks. This chapter introduces the RF characteristics of N728-LA.

## 6.1 Operating Frequency Bands

Table 6-1 N728-LA operating bands

| **Operating bands** | **Uplink** | **Downlink** |
|---|---|---|
| GSM850 | 824.2 - 848.8 MHz | 869.2 - 893.8 MHz |
| EGSM900 | 880 - 915 MHz | 925 - 960 MHz |
| DCS1800 | 1710 - 1785 MHz | 1805 - 1880 MHz |
| PCS1900 | 1850.2 - 1909.8 MHz | 1930.2 - 1989.8 MHz |
| WCDMA B1 | 1920 - 1980 MHz | 2110 - 2170 MHz |
| WCDMA B2 | 1852.4 - 1907.6 MHz | 1932.4 - 1987.6 MHz |
| WCDMA B4 | 1712.4 - 1752.6 MHz | 2112.4 - 2152.6 MHz |
| WCDMA B5 | 824 - 849 MHz | 869 - 894 MHz |
| WCDMA B8 | 880 - 915 MHz | 925 - 960 MHz |
| LTE-FDD B1 | 1920 - 1980 MHz | 2110 - 2170 MHz |
| LTE-FDD B2 | 1850 - 1910 MHz | 1930 - 1990 MHz |
| LTE-FDD B1 | 1710 - 1785 MHz | 1805 - 1880 MHz |
| LTE-FDD B4 | 1710 - 1755 MHz | 2110 - 2155 MHz |
| LTE-FDD B5 | 824 - 849 MHz | 869 - 894 MHz |
| LTE-FDD B7 | 2500 - 2570 MHz | 2620 - 2690 MHz |
| LTE-FDD B8 | 880 - 915 MHz | 925 - 960 MHz |
| LTE-FDD B10 | 1710 - 1770 MHz | 2110 - 2170 MHz |
| LTE-FDD B28 | 703 - 748 MHz | 758 - 803 MHz |
| LTE-FDD B66 | 1710 - 1780 MHz | 2110 - 2180 MHz |
| LTE-TDD B38 | 2570 - 2620 MHz | 2570 - 2620 MHz |
| LTE-TDD B40 | 2300 - 2400 MHz | 2300 - 2400 MHz |

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| | | |
|---|---|---|
| LTE-TDD B41 | 2535 - 2655 MHz | 2535 - 2655 MHz |

## 6.2 TX Power and RX Sensitivity

Table 6-2 N728-LA RF transmitting power

| Band | Max power | Min. power |
|---|---|---|
| 850 | 33 dBm±2 dB | 5 dBm±5 dB |
| EGSM900 | 33 dBm±2 dB | 5 dBm±5 dB |
| DCS1800 | 30 dBm±2 dB | 0 dBm±5 dB |
| 1900 | 30 dBm±2 dB | 0 dBm±5 dB |
| WCDMA B1 | 24 dBm +1/-3 dB | < -50 dBm |
| WCDMA B2 | 24 dBm +1/-3 dB | < -50 dBm |
| WCDMA B4 | 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 |
| LTE-FDD B1 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B2 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B1 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B4 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B5 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B7 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B8 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B10 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B28 | 23 dBm±2 dB | < -39 dBm |
| LTE-FDD B66 | 23 dBm±2 dB | < -39 dBm |
| LTE-TDD B38 | 23 dBm±2 dB | < -39 dBm |
| LTE-TDD B40 | 23 dBm±2 dB | < -39 dBm |
| LTE-TDD B41 | 23 dBm±2 dB | < -39 dBm |

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Table 6-3 N728-LA GSM RX sensitivity

| Band | RX sensitivity |
|---|---|
| GSM900 | TBD |
| EGSM900 | TBD |
| DCS1800 | TBD |
| PCS1900 | TBD |

Table 6-4 N728-LA WCDMA RX sensitivity

| Band | RX sensitivity |
|---|---|
| WCDMA B1 | TBD |
| WCDMA B2 | TBD |
| WCDMA B4 | TBD |
| WCDMA B5 | TBD |
| WCDMA B8 | TBD |

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Table 6-5 N728-LA LTE RX sensitivity

| Band | RX sensitivity | Duplex mode |
|---|---|---|
| LTE-FDD B1 | TBD | FDD |
| LTE-FDD B2 | TBD | FDD |
| LTE-FDD B3 | TBD | FDD |
| LTE-FDD B4 | TBD | FDD |
| LTE-FDD B5 | TBD | FDD |
| LTE-FDD B7 | TBD | FDD |
| LTE-FDD B8 | TBD | FDD |
| LTE-FDD B10 | TBD | FDD |
| LTE-FDD B28 | TBD | FDD |
| LTE-FDD B66 | TBD | FDD |
| LTE-TDD B38 | TBD | TDD |
| LTE-TDD B40 | TBD | TDD |
| LTE-TDD B41 | TBD | TDD |

## 6.3 GNSS Technical Parameters

Table 6-6 GNSS technical parameters

| Parameter | Notice |
|---|---|
| GPS L1 operating frequency | 1575.42±1.023 MHz |
| BDS operating frequency | 1559.1 - 1563.1 MHz |
| Tracking sensitivity | -146 dBm |
| Acquisition sensitivity | -157 dBm |
| Positioning precision (open space) | < 3 m (CEP50) |
| Hot start (open space) | < 3s |
| Cold start (open space) | < 40s |
| Update frequency | < 10 Hz |
| GNSS data type | NMEA-0183 |
| GNSS antenna type | Passive/active antenna |

The preceding indexes are test data in a laboratory environment. The test results of LTE (Cat 4) in a bandwidth of 10 MHz will have a certain deviation due to the influence of the network environment.

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# 7 Considerations for N728-LA Module Usage

When using an LA module for system design, it is important to retest all RF indicators based on the entire system to ensure they meet the required specifications.

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# 8 Mechanical Characteristics

This chapter describes mechanical characteristics of the N728-LA module.

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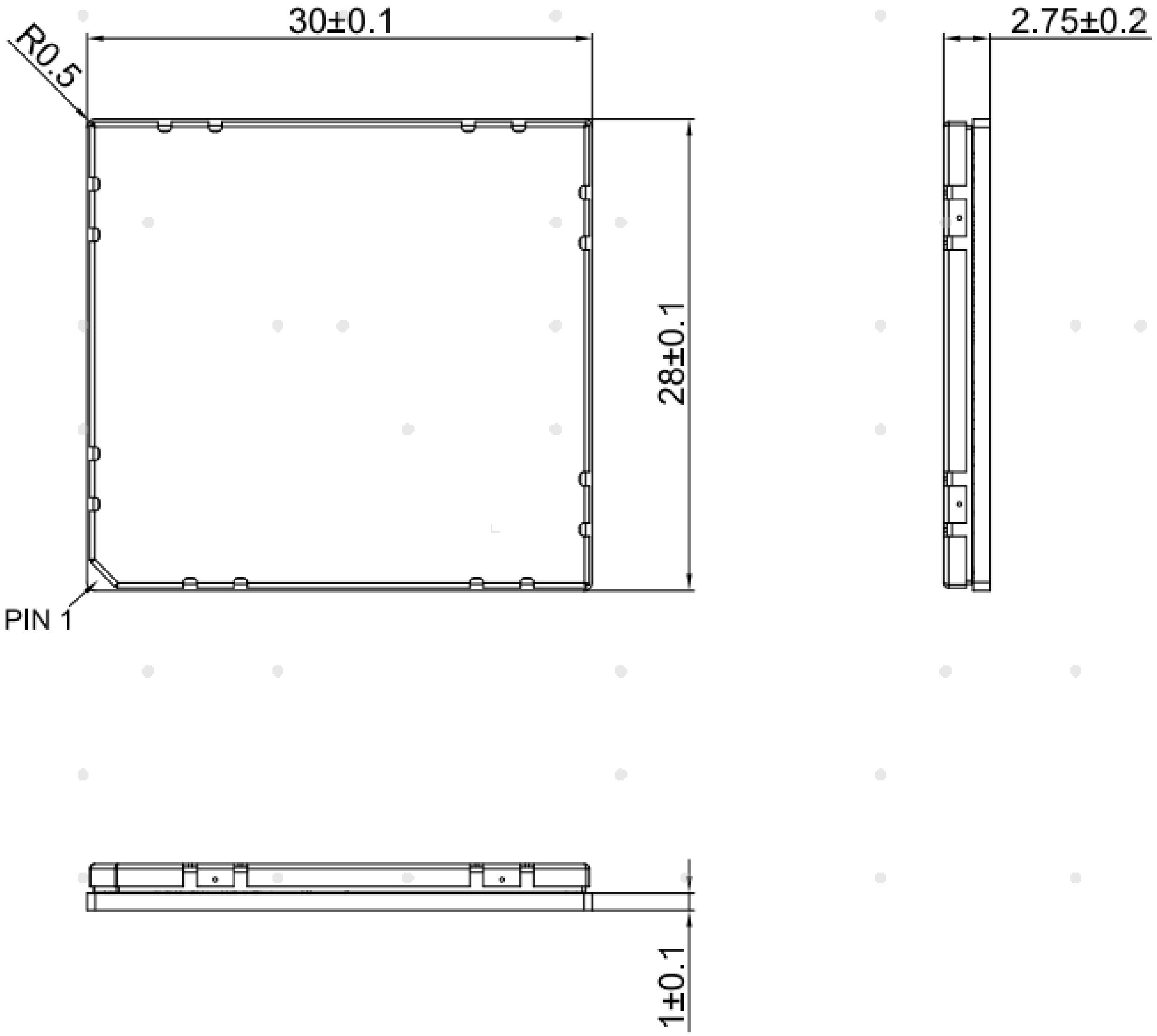
## 8.1 Dimensions

Figure 8-1 N728-LA top and side view dimensions (unit: mm)



## 8.2 Labeling

The label information is laser carved on the cover. The following figure shows the label of N728-LA.

- The picture above is only for reference.
- The material and surface finishing must comply with RoHS directives.

## 8.3 Packaging

N728-LA 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.

### 8.3.1 Tray

Neoway modules are delivered on trays as shown below:

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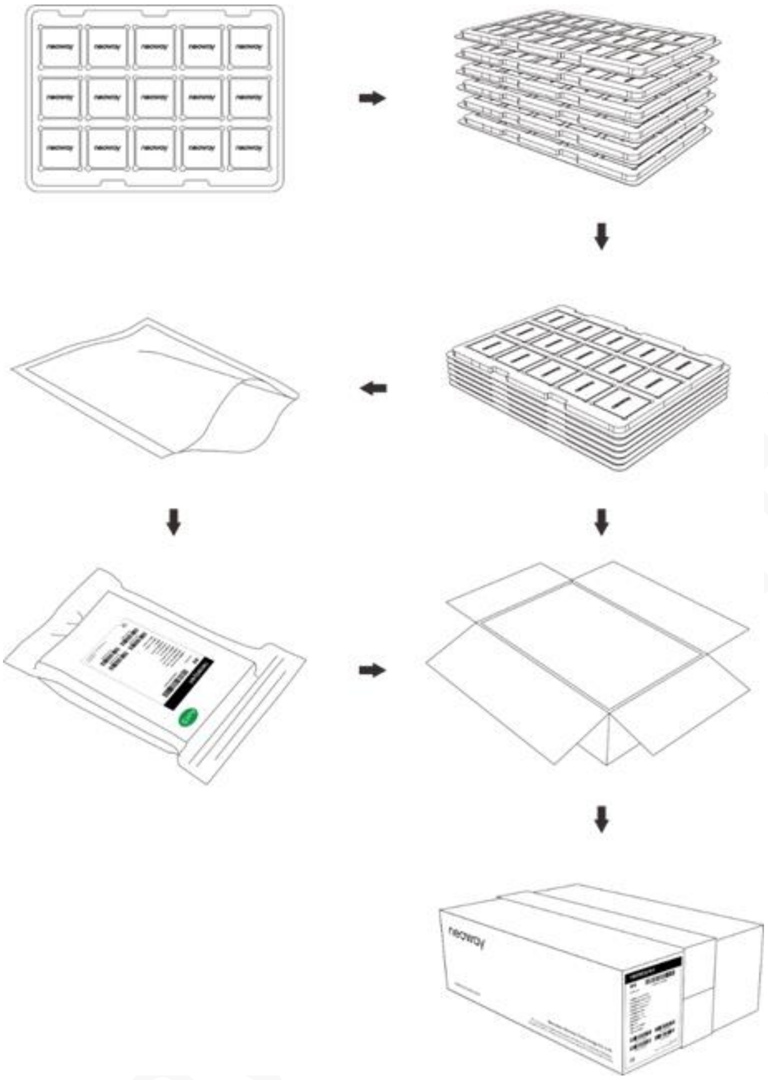
Figure 8-2 N728-LA packaging



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

## 8.3.2 Moisture Sensitivity Level

N728-LA is a level 3 moisture-sensitive electronic element, in compliance IPC/ JEDEC J-STD-020 standard.

After unpacking, avoid leaving the module exposed to air for too long. If exposed to air for a prolonged period, the module could become damp, increasing the risk of damage 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 temperatures higher than 90 degrees for more than 12 hours. In addition, since the package tray is made of non-high temperature resistant material, do not bake modules with the package tray directly.

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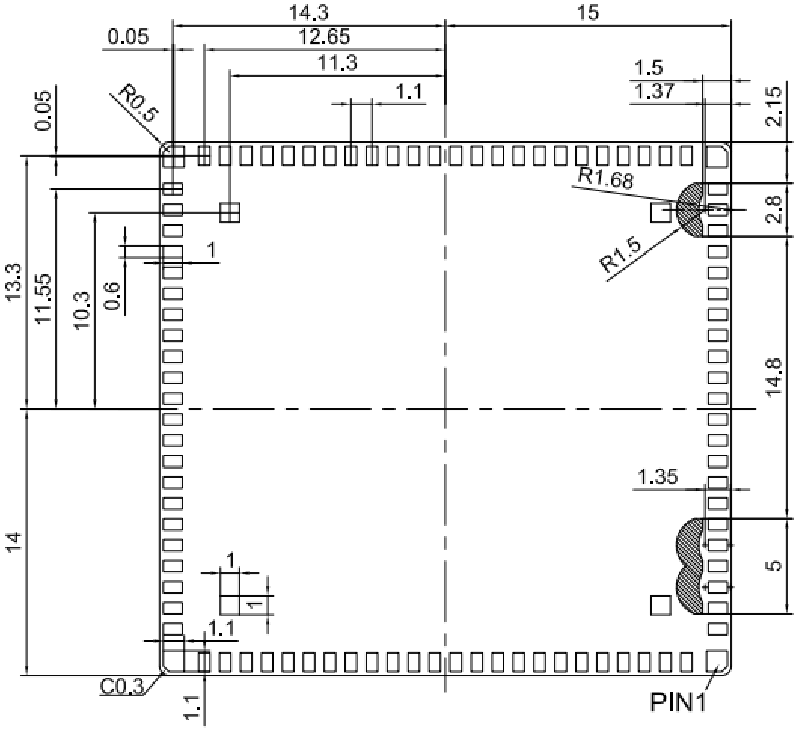
# 9 Mounting N728-LA onto Application Board

The N728-LA module is assembled using the 100-pin LGA package and SMT soldering method.

## 9.1 PCB Package

To ensure proper operation of the module, only GND via-holes and copper pouring are allowed within the shaded area "▨" of the PCB package.

Figure 9-1 Bottom view of N728-LA PCB package (unit: mm)



## 9.2 Stencil

It is recommended to use stencil thickness of at least 0.15 mm to 0.20 mm (0.18 mm recommended), which can be adjusted as per the actual SMT situation.

## 9.3 Solder Paste

The thickness of solder paste and the flatness of 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.

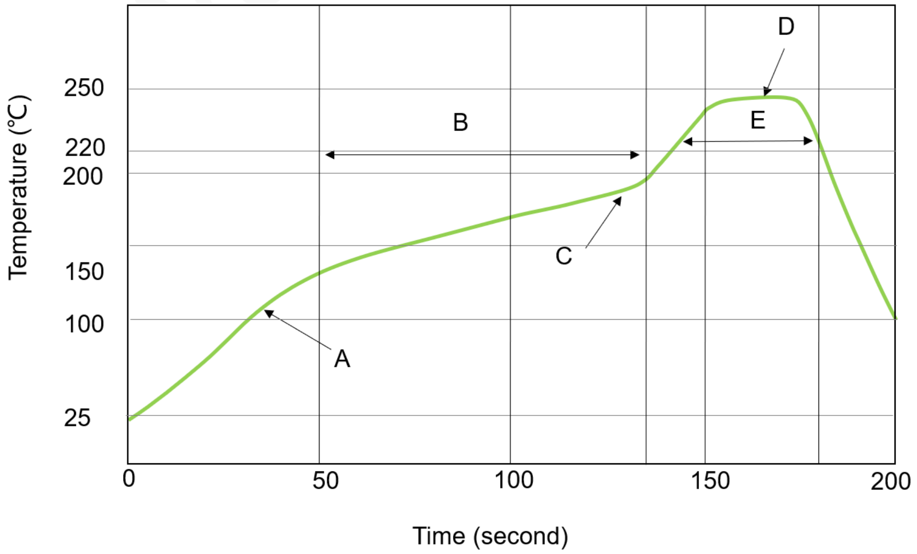
- The melting point of the leaded solder paste is 35℃ lower than that of the lead-free solder paste, and the temperature in the reflow process parameters is also lower than that of the lead-free solder paste. Therefore, the soldering time is shorter accordingly, which easily causes a false solder because 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 time above 220°C (reflow temperature) exceeds 45 seconds and the peak temperature does not exceed 240°C.

## 9.4 Oven Temperature Profile

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

If the PCB is large, it is important to avoid bending of the printed circuit material during an SMT process. So a bending prevention tool must be placed on the bottom of the printed circuit board. It is recommended to use loading tools during the SMT and reflow soldering process to avoid poor solder joint caused by PCB bending.

Figure 9-2 Oven temperature profile



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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 removing a module from your application PCB board, it is important to use heat guns with large openings. Adjust the temperature to about 245°C (depending on the type of solder paste used) and heat the module until the solder paste melts. Use tweezers to remove the module, being careful not to shake it at high temperatures. Shaking the module may cause components inside to become misplaced.

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# A Abbreviations

| Abbreviation | Full name |
|---|---|
| AI | Analog Input |
| AO | Analog Output |
| ARM | Advanced RISC Machine |
| bps | Bits per Second |
| CCC | China Compulsory Certification |
| CS | Chip Select |
| CTS | Clear to Send |
| DC | Direct Current |
| DCS | Digital Cellular System |
| DI | Digital Input |
| DL | Downlink |
| DO | Digital Output |
| DRX | Discontinuous Reception |
| EGSM | Enhanced GSM |
| ESD | Electronic Static Discharge |
| ESR | Equivalent Series Resistance |
| EVK | Evaluation Kit |
| FDD | Frequency Division Duplexing |
| GNSS | Global Navigation Satellite System |
| GPIO | General Purpose Input Output |
| 3GPP | 3rd Generation Partnership Project |
| GPRS | General Packet Radio Service |
| GSM | Global System for Mobile Communications |
| I2C | Inter-Integrated Circuit |
| IO | Input/Output |
| LCC | Leadless Chip Carriers |
| LED | Light Emitting Diode |

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| | |
|---|---|
| LGA | Land Grid Array |
| LTE | Long Term Evolution |
| MCLK | Main Clock |
| MCU | Microcontroller Unit |
| PCB | Printed Circuit Board |
| PWM | Pulse Width Modulation |
| RAM | Random Access Memory |
| RF | Radio Frequency |
| ROM | Read-only Memory |
| SDIO | Secure Digital Input Output |
| SPI | Serial Peripheral Interface |
| TDD | Time Division Duplex |
| UART | Universal Asynchronous Receiver-Transmitter |
| UL | Uplink |
| USB | Universal Serial Bus |
| USIM | Universal Subscriber Identity Module |
| VBAT | Battery Voltage |
| WiFi | Wireless Fidelity |
| WCDMA | Wide-band Code Division Multiple Access |
| WLAN | Wireless Local Area Network |

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