N51

Product Specifications

Issue 1.1

Date 2019-12-19

Neoway Product Document

Notice

This document provides guide for users to use N51.

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

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Contents

Table of Figures

Table of Tables

About This Document

Scope

This document is applicable to N51 series.

It defines the features, indicators, and test standards of the N51 module.

Audience

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

Change History

Issue	Date	Change	Changed By
1.0	2018-10	Initial draft	Ye Wei
1.1	2019-02	Added sleep mode and idle current	Ye Wei

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_N51_Datasheet

Neoway_N51_Hardware_User_Guide

Neoway_N51_AT_Command_Mannual

Neoway_N51_EVK_User_Guide

1 About N51

N51 is an industrial WCDMA module that is developed on UNISOC platform. It supports GSM and WCDMA cellular networks.

1.1 Product Overview

Table 1-1 lists the variant and frequency bands supported.

Table 1-1 Variant and frequency bands

Function	Version	Band
N51	WW	UMTS: B1, B2, B5, B8 GSM/GPRS: 850/900/1800/1900 MHz

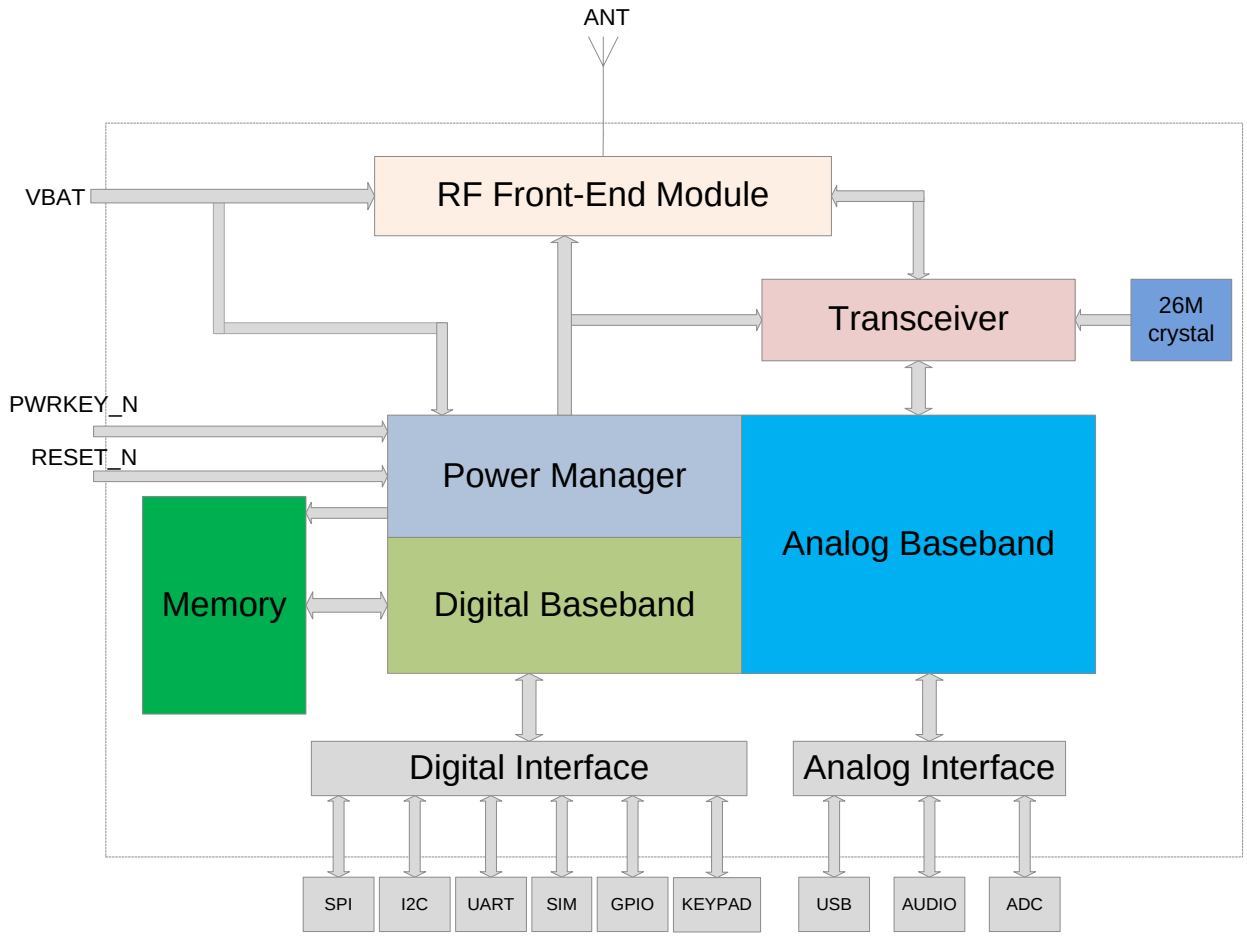
N51 adopts 100-pin LGA package and its dimensions are 30 mm x 28 mm x 2.45 mm. With industrial-grade performance, this module is well applicable to electrical terminals, industrial control, POS, and other IoT terminals.

1.2 Block Diagram

N51 consists of the following functionality modules:

- Baseband
- Crystal oscillator
- Power management unit
- Memory
- Digital interfaces (USIM/UART/SPI/I2C/GPIO/KEYPAD)
- Analog interfaces (USB/Audio/ADC)
- RF unit (2G/3G antenna)

Figure 1-1 Block Diagram



1.3 Basic Features

Table 1-2 N51 baseband and wireless features

Parameter	Description
Physical features	Dimensions: (30.0±0.15) mm × (28.0±0.15) mm × (2.45±0.15) mm Weight: 4.6g Package: 100-pin LGA
Temperature ranges	Operating: -30°C to 75 °C Extended: -40°C to 85 °C Storage: -45°C to 90 °C
Power supply	VBAT: 3.3V to 4.3V, TYP: 3.8V
Current	See Table 4-2
MIPS processor	ARM926EJ 32bit RISC processor, 460.8 MHz main frequency

Memory	ROM: 128MB RAM: 64MB, LPDDR1
Band	See Table 1-1.
Wireless data rate	GPRS: Max 85.6 Kbit/s(DL) / Max 85.6 Kbit/s(UL) EDGE: Downlink, Max 236.8 Kbit/s(DL) WCDMA: HSDPA/HSUPA, Max 7.2Mbit/s (DL)/Max 1.92Mbit/s(UL)
Transmit power	GSM850: 33±2dBm (Power Class 4) EGSM900: 33±2dBm (Power Class 4) DCS1800: 30±2dBm (Power Class 1) PCS1900: 30±2dBm (Power Class 1) WCDMA: 24+1/-3 dBm (Power Class 3)
Application Interfaces	2G/3G antenna, 50Ω characteristic impedance
	Two UART interfaces, one of which supports hardware flow control
	Two USIM interfaces, compatible with 1.8V/3V USIM cards, 2 mm * 2 mm eSIM optional
	One USB2.0 high-speed interface
	One 10-bit ADC interface, detectable voltage ranging from 0.1 to 1.7V.
	One SPI interface
	Four GPIOs with interrupt
	One I2C interface
	One set of 3*3 key pads
	One audio input and one audio output
Antenna Type Antenna Gain	Glue stick antenna 824MHz~849MHz: 1dBi 1850MHz~1910MHz: 1dBi

2 Compliant Standards

N51 complies with the following standards:

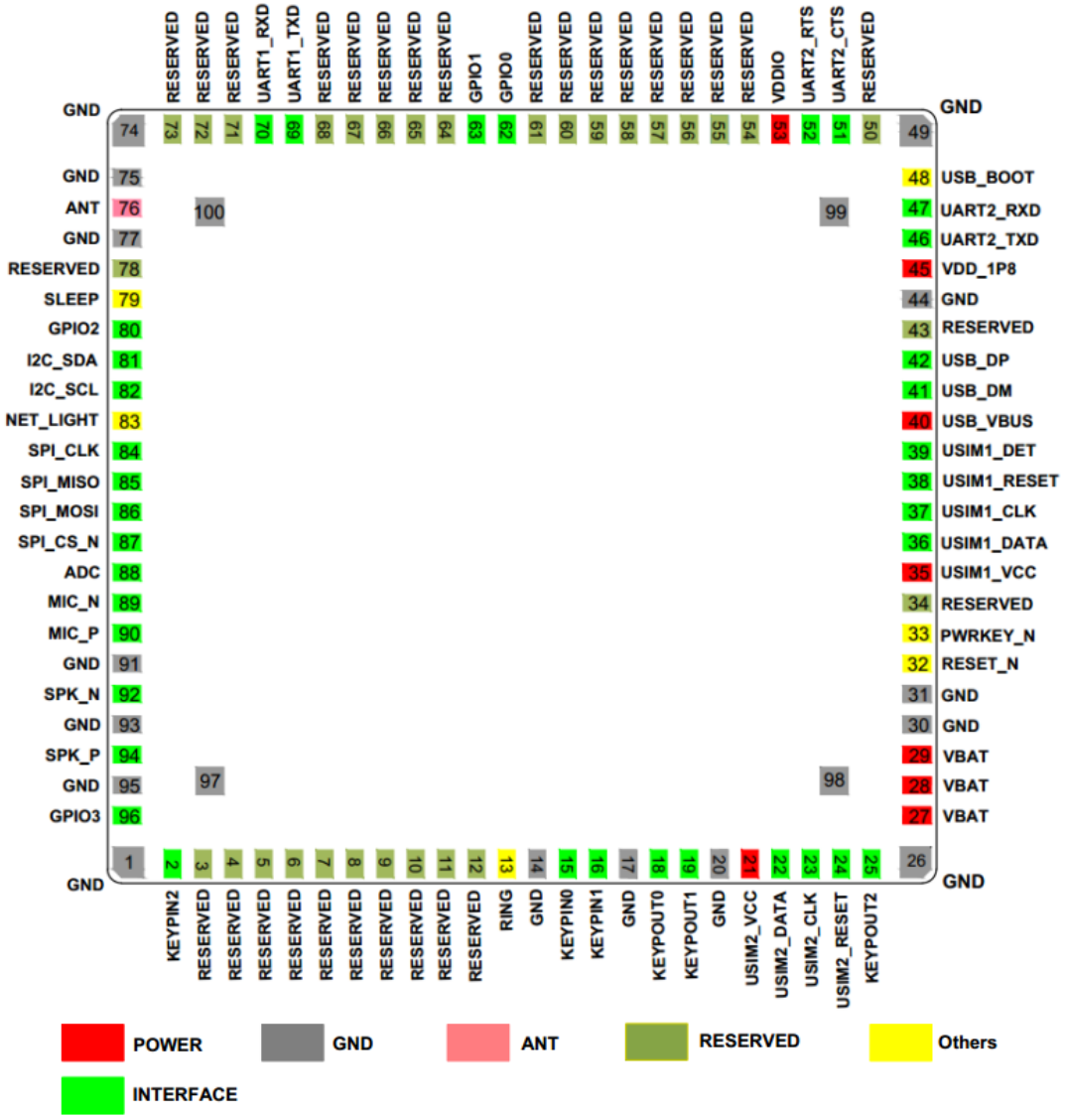
- 3GPP TS 07.07 *AT command set for GSM Mobile Equipment (ME)*
- YD 1214-2006 *Technical requirement of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
- YD 1215-2006 *Testing Methods of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
- YD 1032-2000 *Limits and Measurement Methods of Electromagnetic Compatibility for 900/1800MHz Digital Cellular Telecommunications System Part1:Mobile Station and Ancillary Equipment*
- YD/T 2220-2011 *Technical Requirement and test method of WCDMA/GSM(GPRS) dual mode digit mobile user equipment (phase 4)*
- Ministry of Industry and Information Technology PRC, *Measures for the Network Access Management of Telecommunication Equipment (2014 Amendment)*
- GB4943.1-2011 *Information technology equipment - Safety - Part 1: General requirements*
- GB/T22450.1-2008 *Limits and measurement methods of electromagnetic compatibility for 900/1800MHz TDMA digital cellular telecommunications system - Part 1: Mobile station and ancillary equipment*
- CNCA-O7C-031:2007*Rules for Compulsory Certification of Telecommunication Equipment Telecommunication Terminal Equipment*
- 3GPP TS GSM Specification Set

3 Pin and Appearance

There are 100 pins on N51 and their pads are introduced in LGA package.

3.1 Pad Layout

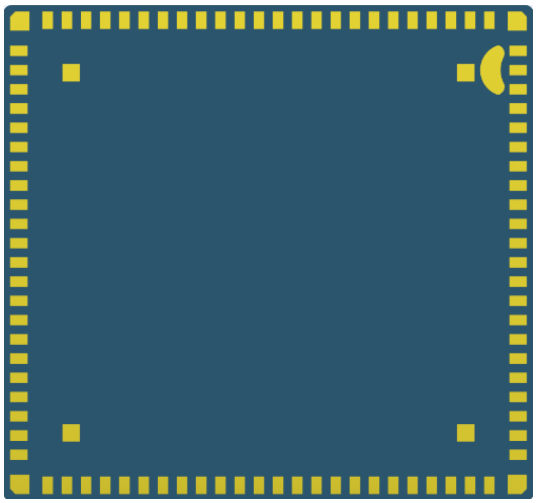
Figure 3-1 N51 pin description (Top View)



3.2 Appearance

Figure 3-1 Top view of N51

Figure 3-2 Bottom view of N51



Note

Label in the above figure is for reference only.

4 Electric Feature and Reliability

This chapter describes the electrical features and reliability of N51.

4.1 Electric Features

Table 4-1 Electric features of N51

Status		Minimum Value	Typical Value	Maximum Value
VBAT	V_{in}	3.3V	3.8V	4.3V
	I_{in}	/	/	2A

Caution

- If the voltage is too low, the module might fail to start. If the voltage is too high 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 A current.

Table 4-2 Current consumption of N51 (Typical)

Working Status / Network Mode	Sleep (mA)	Idle (mA)	Active (mA)	
			Band	TX (@max TX Power)
UMTS	3.2	35	B1	480
			B2	TBD
			B5	TBD
			B8	460
GSM	2	34	GSM850	TBD
			GSM900	230
			DCS1800	165
			PCS1900	TBD
GPRS(4up1dn)	2	34	GSM850	TBD
			GSM900	406
			DCS1800	272

	PCS1900	TBD

4.2 Temperature Feature

Table 4-3 Temperature features of N51

Status	Minimum Value	Typical Value	Maximum Value
Operating	-30°C	25°C	75°C
Extended	-40°C		85°C
Storage	-45°C		90°C

Note

If the module works in an environment where the temperature exceeds the thresholds of the operating temperature range, RF performance might be worse.

4.3 ESD Protection

Testing environment:

Humidity 45% Temperature 25°C

Table 4-4 ESD feature of N51

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

5 RF Features

This chapter describes the RF features of N51.

5.1 Operating Bands

Table 5-1 Operating bands of N51

Operating Bands	Uplink	Downlink
GSM850	824~849MHz	869~894MHz
EGSM900	880~915MHz	925~960MHz
DCS1800	1710~1785MHz	1805~1880MHz
PCS1900	1850~1910MHz	1930~1990MHz
UMTS B1	1920~1980MHz	2110~2170MHz
UMTS B2	1850~1910MHz	1930~1990MHz
UMTS B5	824~849MHz	869~894MHz
UMTS B8	880~915MHz	925~960MHz

5.2 TX Power and RX Sensitivity

Table 5-2 TX power and RX sensitivity of N51

Band	TX Power	RX Sensitivity
GSM850	33dBm+2/-2dBm	≤-108 dBm
EGSM900	33dBm+2/-2dBm	≤-108 dBm
DCS1800	30dBm+2/-2dBm	≤-108 dBm
PCS1900	30dBm+2/-2dBm	≤-108 dBm
UMTS B1	24dBm +1/-3dBm	≤-107 dBm
UMTS B2	24dBm +1/-3dBm	≤-107 dBm
UMTS B5	24dBm +1/-3dBm	≤-108 dBm

UMTS B8	24dBm +1/-3dBm	≤-108 dBm


Note

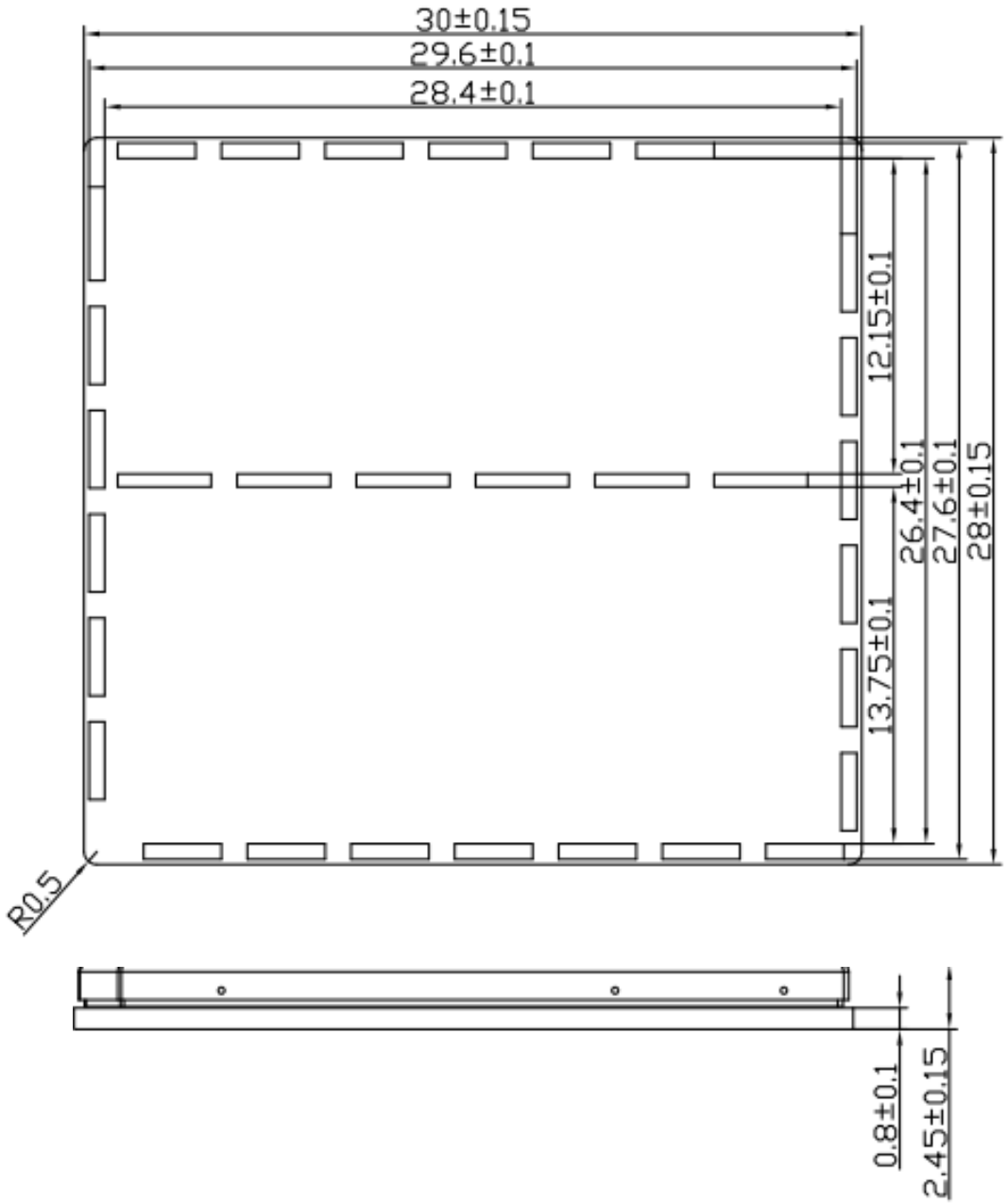
All values above were obtained in the lab. In actual applications, there might be a difference because of network environments.

6 Mechanical Features

This chapter describes the mechanical features of N51.

6.1 Dimensions

Figure 6-1 N51 dimensions (Unit: mm)



6.2 Packing

N51 modules are packaged in sealed vacuum bags with dryer, humidity card, and tray on delivery to guarantee a long shelf life. Follow the same package method again in case of opened for any reasons.

6.2.1 Tray

TBD

6.2.2 Moisture

N51 is a level 3 moisture-sensitive electronic elements, in compliance with IPC/JEDEC J-STD-020 standard.

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

6.3 Storage

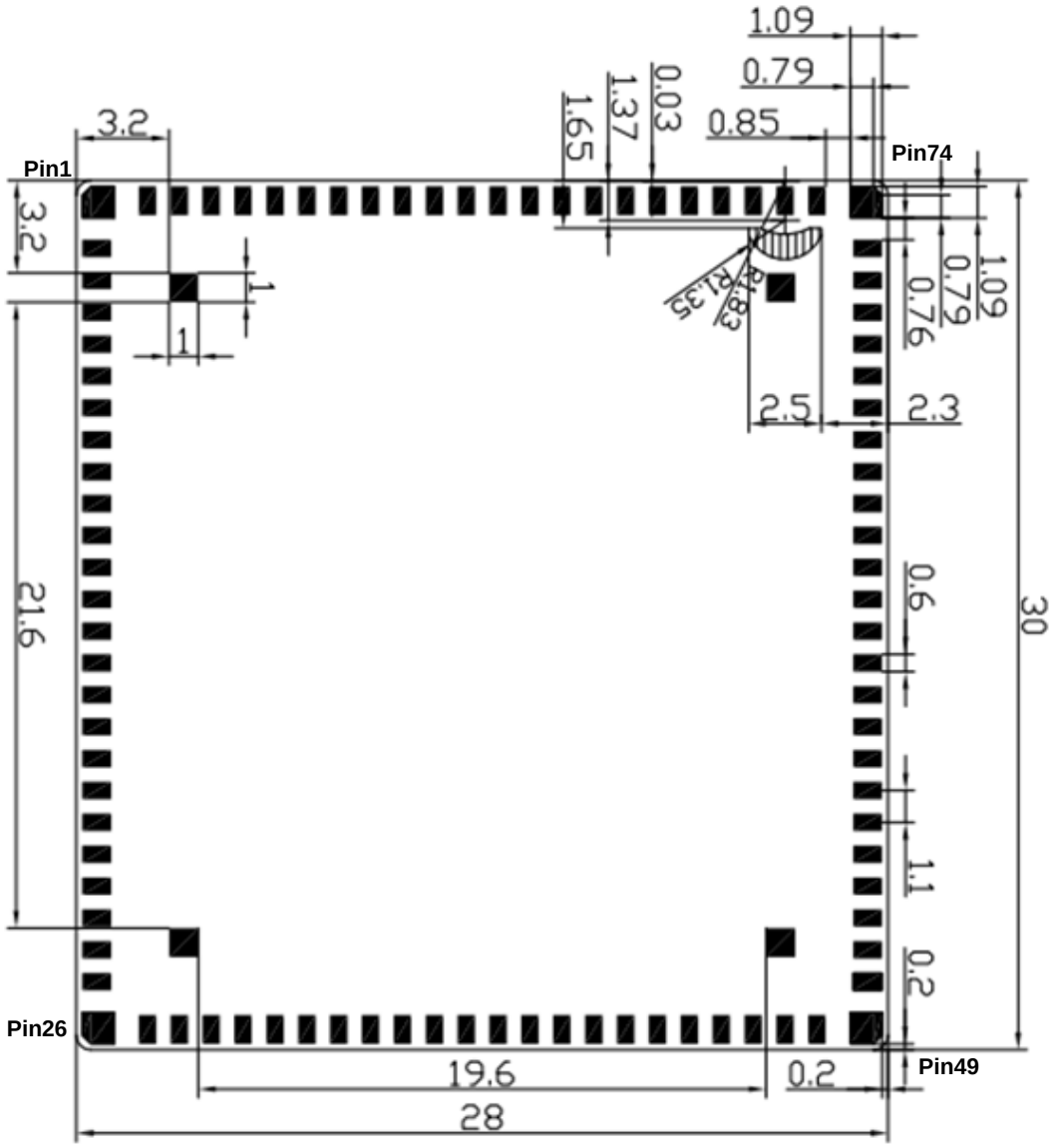
- Temperature: 20°C～26°C
- Humility: 40% to 60%
- Period: 120 days

7 Mounting N51 onto the Application Board

N51 is introduced in 100-pin LGA package. This chapter describes N51 foot print, recommended PCB design and SMT information to guide users how to mount the module onto application PCB board.

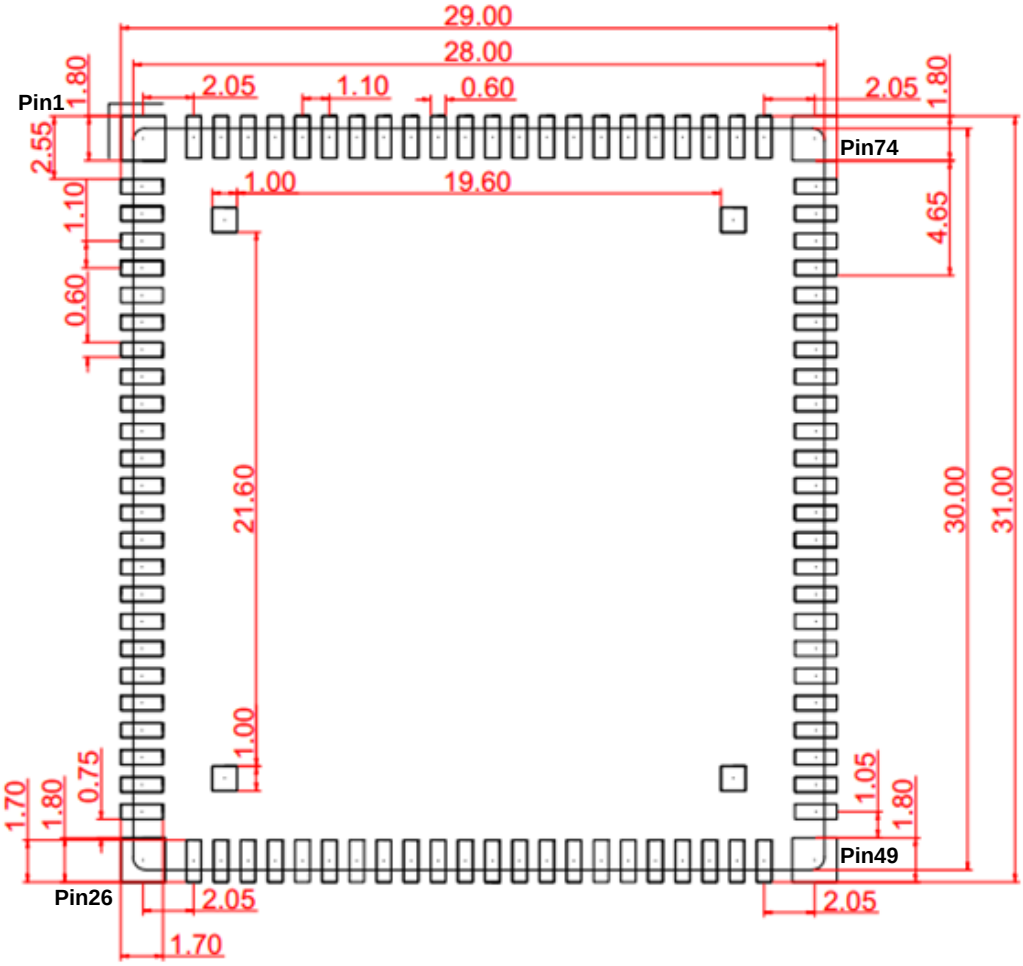
7.1 Bottom Dimensions

Figure 7-1 N51 bottom dimensions (Unit: mm)



7.2 Application Foot Print

Figure 7-2 Recommended PCB foot print (Unit: mm)



7.3 Stencil

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

7.4 Solder Paste

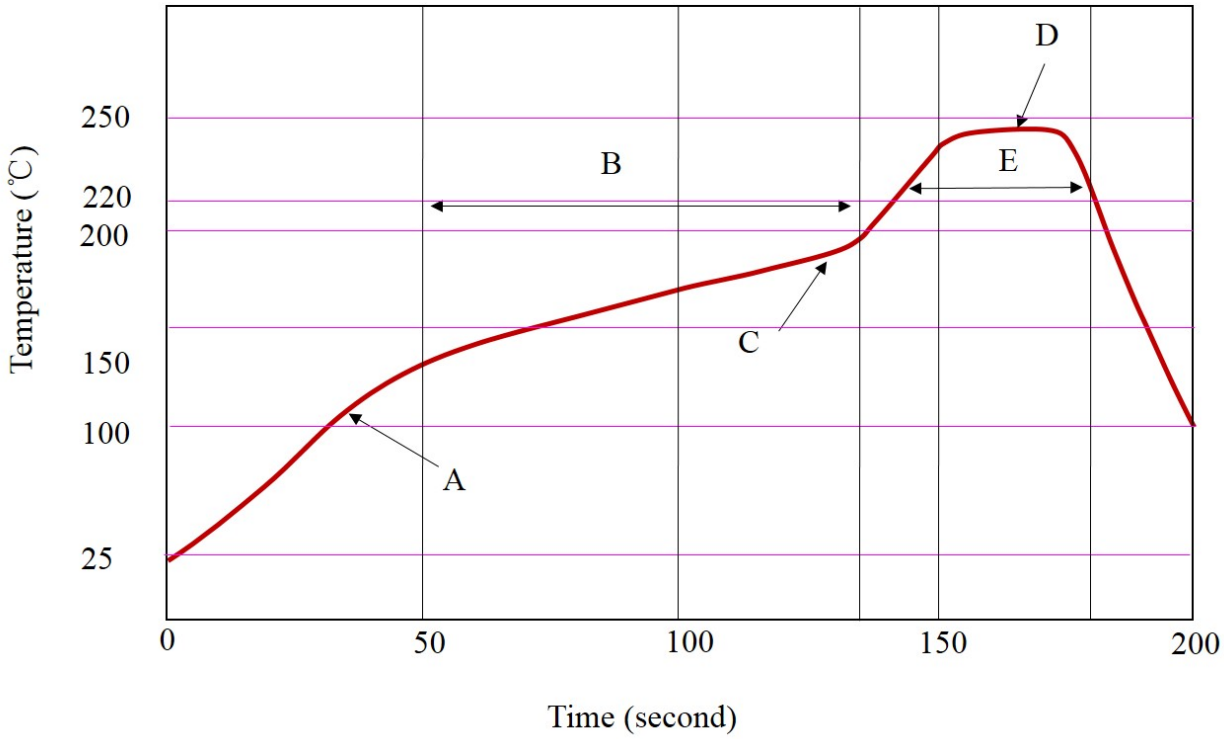
Do not use the kind of solder paste different from our module technique.

- The melting temperature of solder paste with lead is 35 °C lower than that of solder paste without lead. It is easy to cause voiding inside the module after second reflow soldering.
- When using only solder pastes with lead, please ensure that the reflow temperature is kept at 220 °C for more than 45 seconds and the peak temperature reaches 240 °C.

7.5 SMT Furnace Temperature Curve

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

Figure 7-3 SMT furnace temperature curve



Technical parameters:

- Ramp up rate: 1 to 4 °C/sec
- Ramp down rate: 1 to 3 °C/sec
- Soaking zone: 150 to 180 °C, Time: 60 to 100 s
- Reflow zone: >220 °C, Time: 40 to 90 s
- Peak temperature: 235-250 °C

Warning

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

For information about cautions in N51 storage and mounting, refer to *Neoway Module Reflow Manufacturing Recommendations*.

When manually desoldering the module, use heat guns with great opening, adjust the temperature to 250 degrees (depending on the type of the solder paste), and heat the module till the solder paste is melt. Then remove the module using tweezers. Do not shake the module in high temperatures while removing it. Otherwise, the components inside the module might get misplaced.

8 Safety Recommendations

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

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

Please follow the requirements below in application design:

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

A Abbreviation

Abbreviation	English Full Name
ADC	Analog-Digital Converter
EGSM	Enhanced GSM
EMC	Electro-Magnetic Compatibility
EMI	Electro-Magnetic Interference
ESD	Electronic Static Discharge
eSIM	Embedded SIM
GPIO	General Purpose Input/Output
GPRS	General Packet Radio Service
GSM	Global Standard for Mobile Communications
IC	Integrated Circuit
I2C	Inter-Integrated Circuit
IMEI	International Mobile Equipment Identity
LED	Light Emitting Diode
LGA	Land Grid Array
MCU	Micro-Controller Unit
MS	Mobile Station
PCB	Printed Circuit Board
PCS	Personal Communication System
POS	Point of Sale
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-Only Memory
RTC	Real Time Clock
SMD	Surface Mounted Devices

SMS	Short Message Service
SMT	Surface Mounted Technology
SPI	Series Peripheral Interface
TVS	Transient Voltage Suppressor
UART	Universal Asynchronous Receiver/Transmitter
UMTS	Universal Mobile Telecommunications System
USIM	Universal Subscriber Identification Module
USB	Universal Serial Bus
VSWR	Voltage Standing Wave Ratio
WCDMA	Wideband Code Division Multiple Access

A Conformity and Compliance

A.1 Approvals

- FCC
- PTCRB
- AT&T
- CE-R
- GCF
- RoHS
- NCC*
- RCM*

A.2 American Notice

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.

A.2.1 Modify

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

A.2.2 FCC Class B Digital Device Notice

FCC Regulations:

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.

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

"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."

RF Exposure Information

This device complies with FCC radiation exposure limits set forth for an uncontrolled environment. In order to avoid the possibility of exceeding the FCC radio frequency exposure limits, human proximity to the antenna shall not be less than 20cm (8 inches) during normal operation.

IMPORTANT NOTE:

This module is intended for OEM integrator. The OEM integrator is stillresponsible for the FCC compliance requirement of the end product, whichintegrates this module.20cm minimum distance has to be able to be maintained between the antennaand the users for the host this module is integrated into. Undersuch configuration, the FCC radiation exposure limits set forth for anpopulation/uncontrolled environment can be satisfied.

Any changes or modifications not expressly approved by themanufacturer could void the user's authority to operate this equipment.

Antenna warnings:

The moudule is not designed for use with high-gain directional antennas.

To reduce potential radio interference to other users, the antenna type and its gain should be so chosen that the equivalent isotropically radiated power (e.i.r.p.) is not more than that necessary for successful communication.

Only antennas of the same type and with equal or less gains as 1dBi for the cell band and pcs band shall be used with the module. Other types of antennas and/or higher gain antennas may require additional authorization for operation

USERS MANUAL OF THE END PRODUCT:

In the users manual of the end product, the end user has to be informed tokeep at least 20cm separation with the antenna while this end product isinstalled and operated. The end user has to be informed that the FCCradio-frequency exposure guidelines for an uncontrolled environment can besatisfied. The end user has to also be informed that any changes ormodifications not expressly approved by the manufacturer could void theuser's authority to operate this equipment. If the size of the end product issmaller than 8x10cm, then additional FCC part 15.19 statement is required tobe available in the users manual: This device complies with Part 15 of FCCrules. Operation is subject to the following two conditions: (1) this device maynot cause harmful interference and (2) this device must accept anyinterference received, including interference that may causeundesired operation.

LABEL OF THE END PRODUCT:

The final end product must be labeled in a visible area with the following "Contains Transmitter Module FCC ID: PJ7-1712 ". If the size of the end product is largerthan 8x10cm, then the following FCC part 15.19 statement has to also beavailable on the label: This device complies with Part 15 of FCC rules.

Operation is subject to the following two conditions: (1) this device maynot cause harmful interference and (2) this device must accept anyinterference received, including interference that may causeundesired operation.