

N75-NA User Manual

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Neoway Product Document
OEM/Integrators Installation Manual



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Notice

This document provides guide for users to use N75-NA.

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

THIS GUIDE 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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About This Document

Scope

This document is applicable to N75-NA series.

It defines the features, indicators, and test standards of the N75-NA module and provides reference for the hardware design of each interface.

Reference designs in this document are only for reference. Customers should design applications based on the actual scenarios and conditions. Please contact Neoway FAE if you have any question or doubt.

Audience

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

Change History

Issue	Date	Change	Changed By
1.0	2019-03	Initial draft	WangQiang

Conventions

Symbol	Indication
 Warning	This warning symbol means danger. You are in a situation that could cause fatal device damage or even bodily damage.
 Caution	Means reader be careful. In this situation, you might perform an action that could result in module or product damages.
 Note	Means note or tips for readers to use the module

Related Documents

Neoway_N75-NA_Datasheet

Neoway_N75-NA_Product_Specifications

Neoway_N75-NA_AT_Command_Manual

Neoway_N75-NA_EVK_User_Guide

Neoway Module Reflow Manufacturing Recommendations

1 About N75-NA

N75-NA is an industrial-grade 4G module developed on Qualcomm platform. It supports GSM/GPRS/EDGE, WCDMA R99 to DC-HSPA+, and LTE Cat4. With various hardware interfaces and optional GNSS functions, N75-NA is well applicable to wireless metering terminals, in-vehicle terminals, POS, industrial routers, and other IoT terminals.

1.1 Product Overview

N75-NA series include multiple variants. Table 1-1 lists the variants and frequency bands supported.

Table 1-1 Variant and frequency bands

Version	Region	Category	Band	GNSS ¹
NA	North America	Cat4	FDD-LTE: B2, B4, B5, B7, B12, B13, B25, B26, B66, B71 UMTS: B2, B4, B5 GSM/GPRS/EDGE: 850/1900 MHz	support

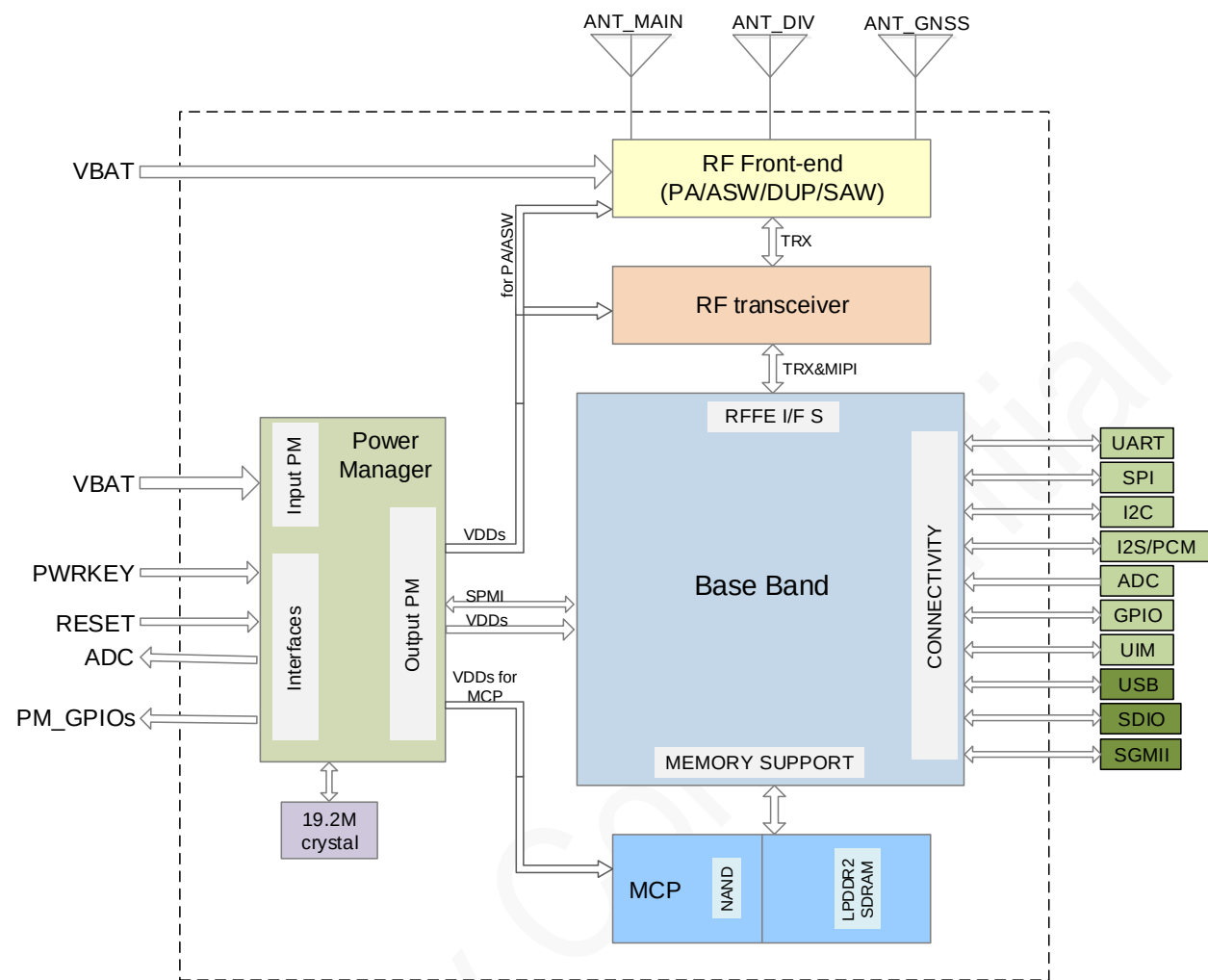
1.2 Block Diagram

N75-NA consists of the following functionality units:

- Baseband
- MCP
- Power management unit
- 19.2MHz crystal oscillator
- RF section
- Digital interfaces (UIM, SPI, I2C, SGMII, SDIO, ADC, GPIO, UART, USB)

¹ GNSS optional for all above variants

Figure 1-1 Block Diagram



1.3 Basic Features

Parameter	Description
Physical features	Dimensions: 30 mm * 28 mm * 2.8 mm Weight: around 5.1g
Temperature ranges	Operating: -35°C to +75°C Extended: -40°Cto +85°C Storage: -45°C to +90°C
Operating voltage	VBAT: 3.3V to 4.3V, TYP: 3.8V

	Sleep ² : < 4 mA
	Idle ³ : < 20 mA
Operating Current	Operating mode ⁴ (LTE networks) Current in data service: about 250 mA Current in max. RX power: about 580 mA (FDD-LTE B1), 380mA (TDD-LTE Band41)
MIPS processor	ARM Cortex-A7 processor, 1.3 GHz main frequency
Memory	ROM+RAM: 2Gb+1Gb
Operating Bands	See Table 1-1.
Wireless rate	GPRS: Max 85.6 Kbps(DL) / Max 85.6 Kbps(UL) EDGE: Max 236.8Kbps(DL) / Max 236.8Kbps(UL) WCDMA: DC-HSPA+, Max 42Mbps (DL)/Max 5.76Mbps (UL) FDD-LTE: non-CA cat4, Max 150 Mbps(DL)/Max 50 Mbps (UL)
Transmit power	GSM850: +33dBm (Power Class 4) PCS1900: +30dBm (Power Class 1) EDGE 850MHz: +27dBm (Power Class E2) EDGE1900MHz: +26dBm (Power Class E2) UMTS: +23dBm (Power Class 3) LTE: +23dBm (Power Class 3)
	2G/3G/4G antenna, diversity antenna, GNSS antenna 50Ω impedance
Application Interfaces	Two UART interfaces: one is an ordinary serial port, and one is used for Bluetooth by default One I2C interface, supporting only host mode One SPI interface, supporting only host mode and max. 50 Mbp One USIM interface, 1.8V/2.85V One USB2.0 interface, OTG function requires external 5V DC-DC

² Sleep mode is the low power consumption state the module enters. In this mode, peripheral interfaces of the module are disabled but the RF function works. If a call or SMS message incomes, the module exits from sleep mode. After the call or voice is end, the module enters sleep mode again.

³ Idle mode indicates the status of no service when the module is running.

⁴ Current in operating mode indicates the current during data communication. For currents of other network modes and bands, see N75-NA Current Test Report.

Two 15-bit ADC interfaces, detectable voltage ranging from 0.1 to 1.7V

One I2S/PCM interface, used to connect to CODEC chipset

One SDIO interface, used to control WLAN

One SGMII/MDIO interface, used for Ethernet

Four GPIO interfaces

AT Command	Neoway extended commands
Data	PPP, RNDIS, ECM, RMNET
Protocol	TCP, UDP, MQTT, FTP/FTPS, HTTP/HTTP(S), SSL, TLS
Certification approval	FCC, PTCRB, AT&T, CE-R, GCF, RoHS, NCC*, RCM*

2 Compliant Standards

- 3GPP TS 07.07AT 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 1215-2006Testing Methods of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations
- YD 1032-2000Limits 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-031:2007Rules for Compulsory Certification of Telecommunication Equipment Telecommunication Terminal Equipment
- FCC Part 22H/24E/27/90
- 3GPP TS GSM Specification Set
- 3GPP TS WCDMA Specification Set
- 3GPP TS LTE Cat4 4GSpecification Set

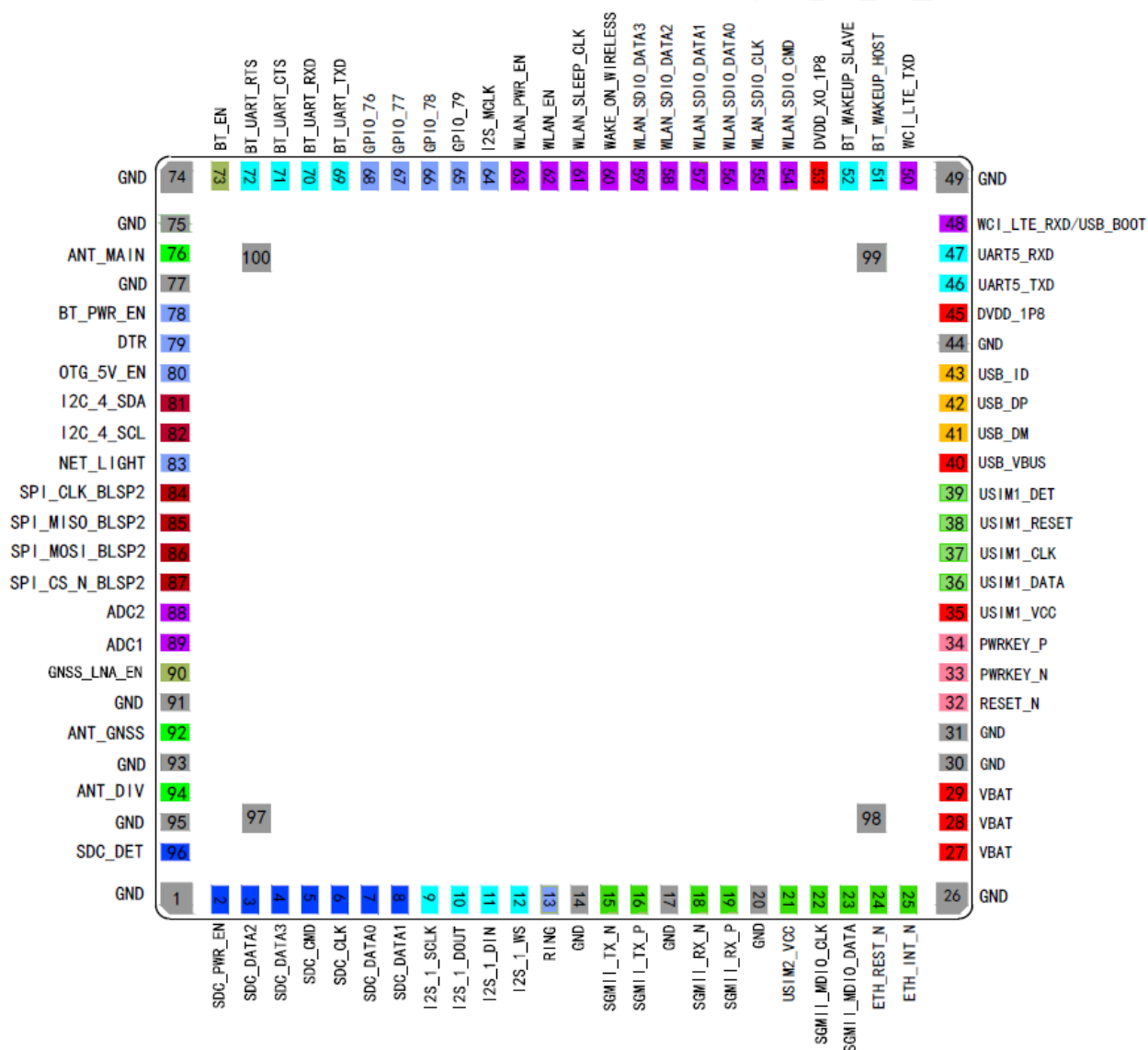
3 Pins and Appearance

There are 100 pins on N75-NA and their pads are introduced in LGA package.

3.1 Pad Layout

Figure 2-1 shows the pad layout of N75-NA.

Figure 3-1 N75-NA pin definition (Top View)

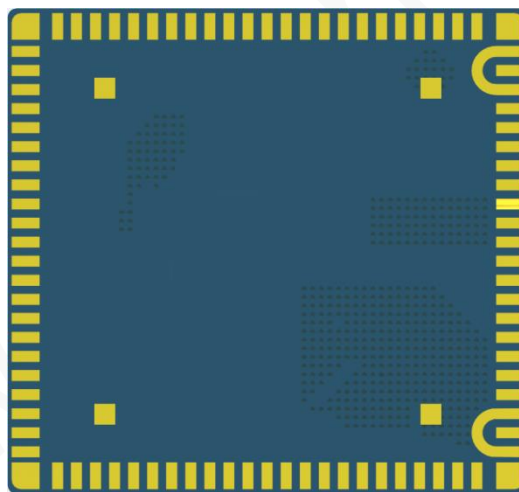


3.2 Appearance

Figure 3-1 Top view of N75-NA



Figure 3-1 Bottom view of N75-NA



Note

Label in the above figure indicates N75-NA NA variant. Labels of other variants are similar.

4 Electric Feature and Reliability

This chapter describes the electric features and reliability of N75-NA, including current and voltage of each power pin, operating and storage temperature ranges, and ESD protection features.

4.1 Electric Features

Table 4-1 Electric features

Parameter		Minimum Value	Typical Value	Maximum Value
VBAT	V _{in}	3.3V	3.8V	4.3V
	I _{in}	/	/	2A



Caution

- If the voltage is lower than threshold, the module might fail to start. If the voltage is higher than threshold or there is a voltage burst during the startup, the module might be damaged permanently.
- If you use LDO or DC-DC to supply power for the module, ensure that it outputs at least 2 A current. When the module works at maximum power in GSM mode, the peak current might reach 2A. Add a large capacitor to the VBAT pin to enhance the capability to output continuous current and avoid voltage drop.

4.2 Temperature Features

Table 4-2 Temperature features

Status	Minimum Value	Typical Value	Maximum Value
Operating	-35℃	25℃	75℃
Extended	-40℃		85℃
Storage temperature	-45℃		90℃



Note

If the module works in an environment of -35℃ to -40℃ or 75℃ to 85℃, RF performance might be worse. This does not affect the running of the module. The RF performance will meet the 3GPP standard after the temperature reaches the operating range.

4.3 ESD Protection

Electronics need to pass ESD tests. Table 4-3 shows the ESD capability of key pins of this module. It is recommended to add ESD protection based on the application scenarios to ensure product quality when designing a product.

Humidity 45% Temperature 25℃

Table 4-3 ESD protection features

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

5 RF Features

N75-NA supports 2G/3G/4G network modes and frequency bands as well as GNSS function. This chapter describes the RF features of N75-NA.

5.1 Operating Bands

Table 5-1 Operating Bands

Operating Bands	Uplink	Downlink
GSM850	824~849MHz	869~894MHz
PCS1900	1850~1910MHz	1930~1990MHz
UMTS B2	1850~1910MHz	1930~1990MHz
UMTS B4	1710~1755MHz	2110~2155MHz
UMTS B5	824~849MHz	869~894MHz
FDD-LTE B2	1850~1910MHz	1930~1990MHz
FDD-LTE B4	1710~1755MHz	2110~2155MHz
FDD-LTE B5	824~849MHz	869~894MHz
FDD-LTE B7	2500~2570MHz	2620~2690MHz
FDD-LTE B12	699~716MHz	728~746MHz
FDD-LTE B13	777~787MHz	746~757MHz
FDD-LTE B25	1850~1915MHz	1930~1995MHz
FDD-LTE B26	814~849MHz	859~894MHz
TDD-LTE B66	1710~1780MHz	2110~2200MHz
TDD-LTE B71	617~652MHz	663~698MHz

5.2 TX Power and RX Sensitivity

Table 5-2 RF TX power

Band	TX Power	RX Sensitivity
GSM850	33dBm+2/-2dBm	<-110dBm
PCS1900	30dBm+2/-2dBm	<-110dBm
UMTS B2	24dBm +1/-3dBm	<-110dBm
UMTS B4	24dBm +1/-3dBm	<-110dBm
UMTS B5	24dBm +1/-3dBm	<-110dBm
FDD-LTE B2	23dBm+2/-2dBm	<-98dBm
FDD-LTE B4	23dBm+2/-2dBm	<-98dBm
FDD-LTE B5	23dBm+2/-2dBm	<-98dBm
FDD-LTE B7	23dBm+2/-2dBm	<-96dBm
FDD-LTE B12	23dBm+2/-2dBm	<-95dBm
FDD-LTE B13	23dBm+2/-2dBm	<-95dBm
FDD-LTE B25	23dBm+2/-2dBm	<-98dBm
FDD-LTE B26	23dBm+2/-2dBm	<-98dBm
TDD-LTE B66	23dBm+2/-2dBm	<-98dBm
TDD-LTE B71	23dBm+2/-2dBm	<-95dBm



Note

5.3 GNSS Feature

Changes	Parameter
GPS L1 operating frequency	1575.42±1.023MHz
GLONASS operating frequency	1597.5~1605.9 MHz
BDS operation frequency	1559.1~1563.1 MHz
Tracking sensitivity	-160dBm (GPS)/-159.5 dBm (GLONASS)/TBD (BDS)
Acquisition sensitivity	-144dBm (GPS)/-143.5 dBm (GLONASS)

Positioning precision (in air)	< 3m (CEP50)
Hot start (in air)	<2.5s
Cold start (in air)	<35s
Update frequency	1Hz by default
CNRin/CNRout	3dB
Max. positioning altitude	18000m
Max. positioning speed	515m/s
Max. positioning acceleration	4g
GNSS data type	NMEA-0183
GNSS antenna type	Passive/active antenna



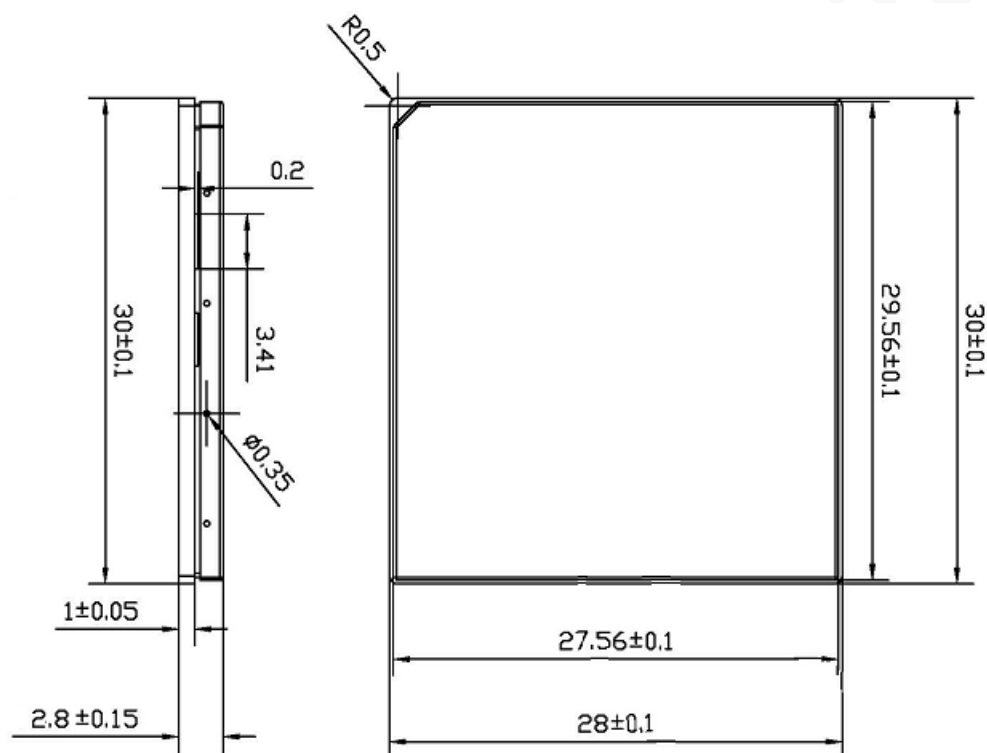
Tracking sensitivity, acquisition sensitivity, and re-acquisition sensitivity were obtained in signaling test on SPIRENT6300 and they are the maximum values of multiple tests on samples. No external LNA or active antenna was used in the test.

6 Mechanical Features

This chapter describes the mechanical features of N75-NA.

6.1 Dimensions

Figure 6-1 N75-NA dimensions



The unit is mm.

6.2 Label

The label is made of materials that are deformation-resistant, fade-resistant, and high-temperature-resistant and it can endure high temperature up to 260 °C.

Figure 6-2 N75-NA label



Note

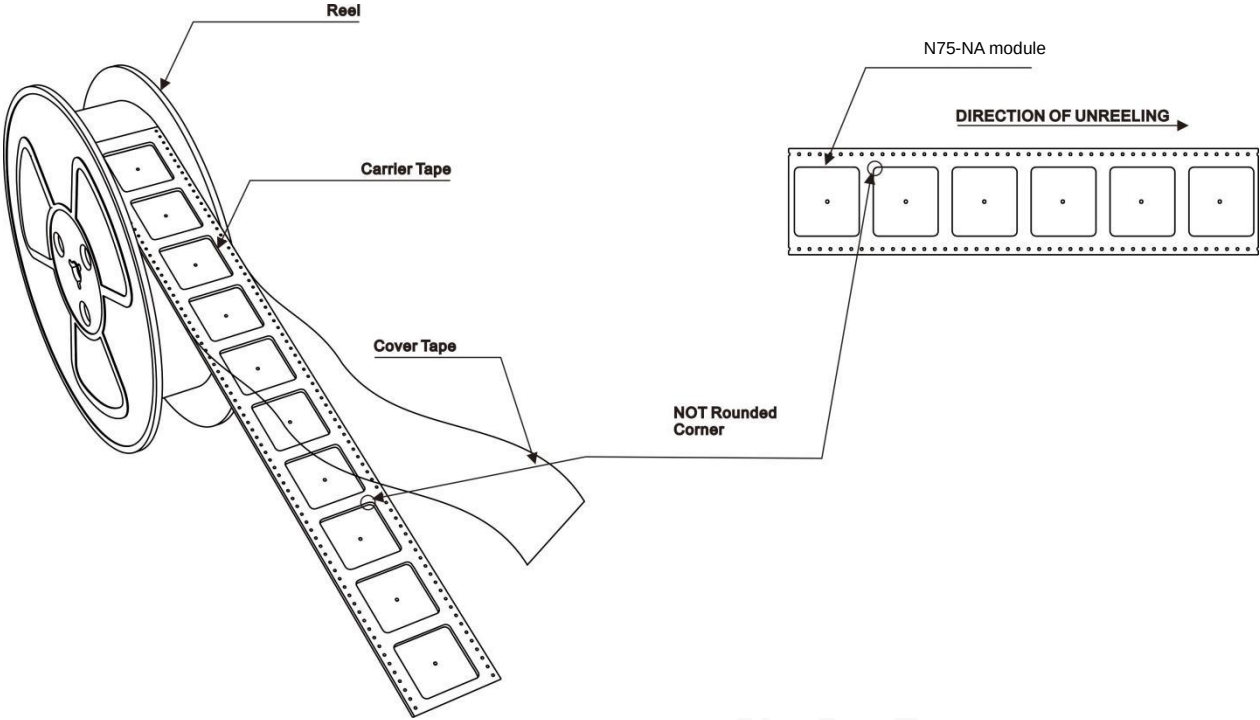
- The picture above is only for reference.
- The silk-screen printing must be clear. No blur is allowed.
- The material and surface finishing must comply with RoHS directives.

6.3 Pack

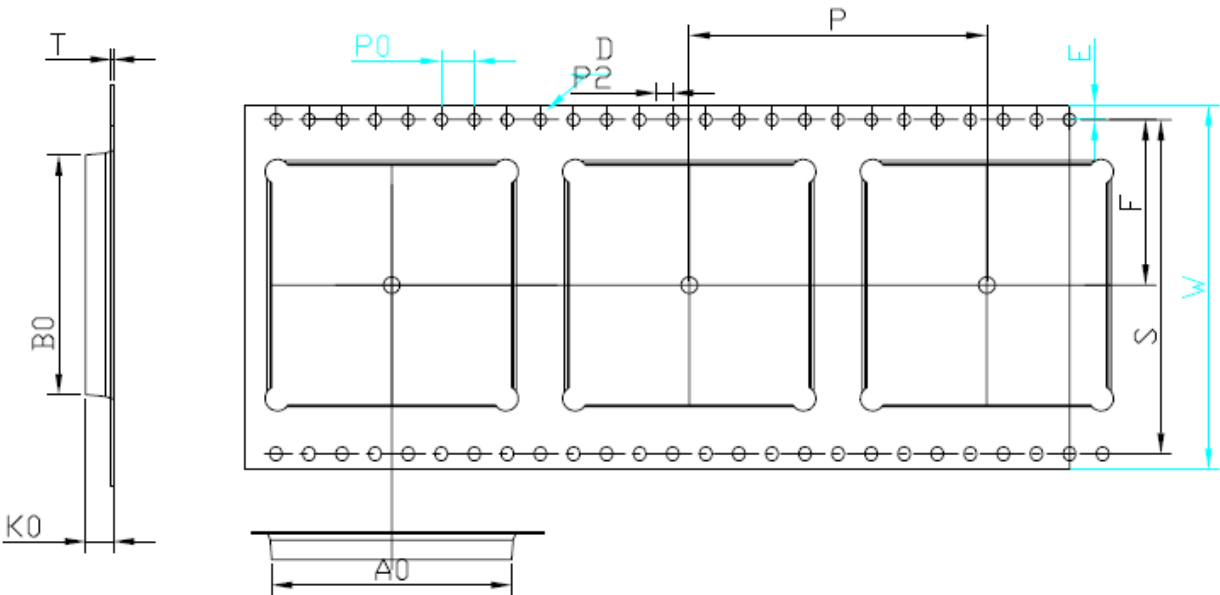
N75-NA modules are packaged in sealed vacuum bags with dryer, humidity card, and tray on delivery to guarantee a long shelf life. Follow the same package method again in case of opened for any reasons.

6.3.1 Reel&Tape

N75-NA in mass production are shipped in the following package.

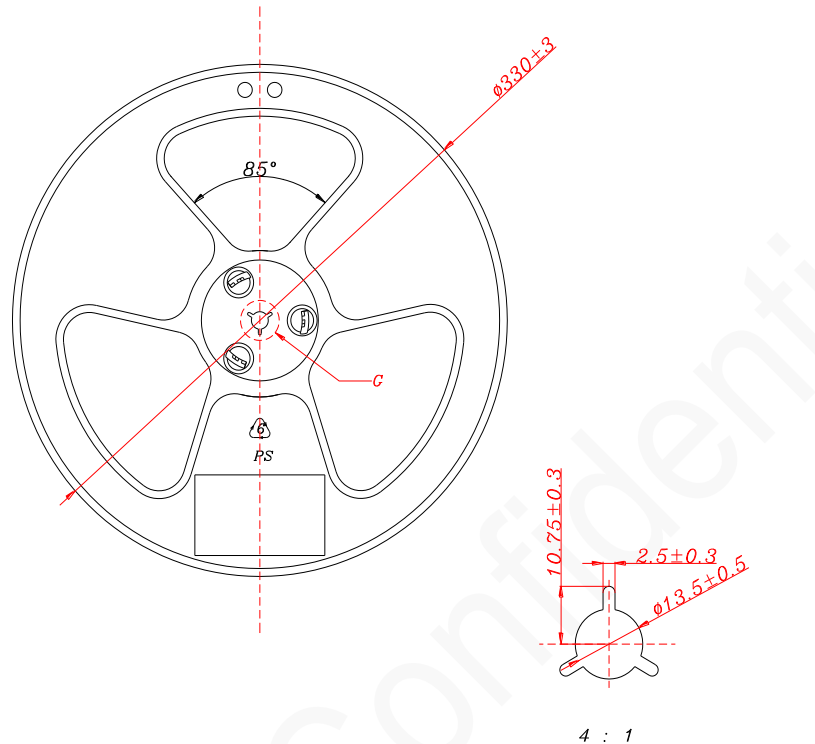


Tape



ITEM	W	A0	B0	S	D	E	F	K0	P0	P2	P	T
DIM	44.0	28.7	28.70	40.4	1.5	1.75	20.2	3.55	4.0	2.0	36.0	0.30
TOLE	+0.3 -0.3	+0.1 -0.1	+0.1 -0.1	+0.1 -0.0	+0.1 -0.0	±0.1	±0.10	+0.1 -0.1	±0.1	±0.1	±0.1	±0.05

Reel



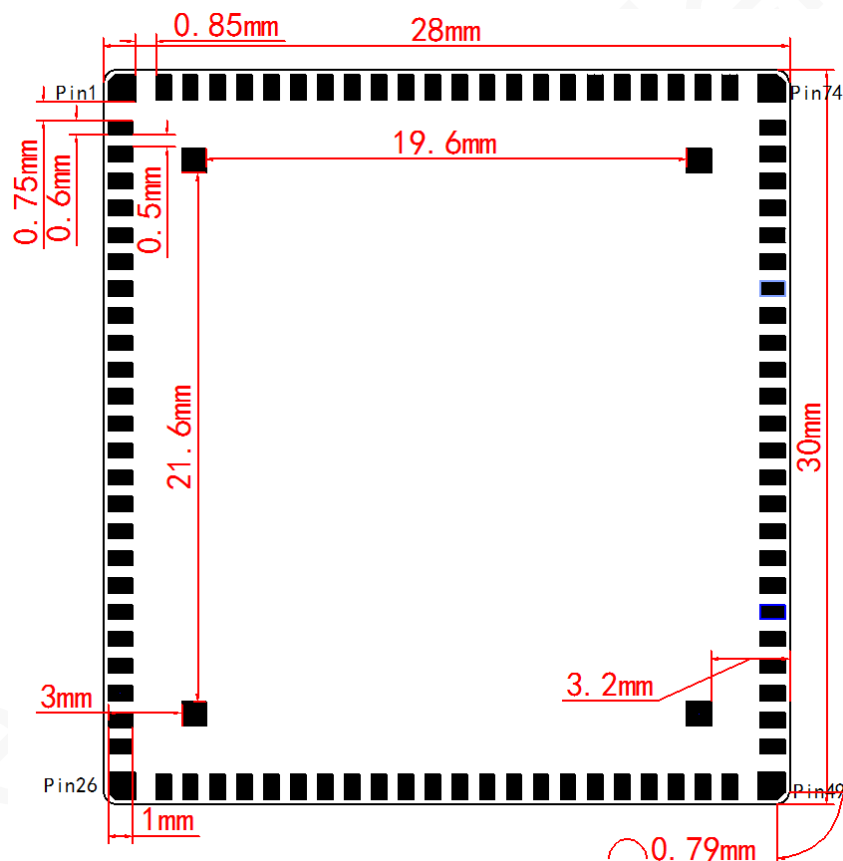
6.3.2 Moisture

N75-NA 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 $30^\circ\text{C}/60\% \text{ RH}$, bake it at a temperature higher than 90°C 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.

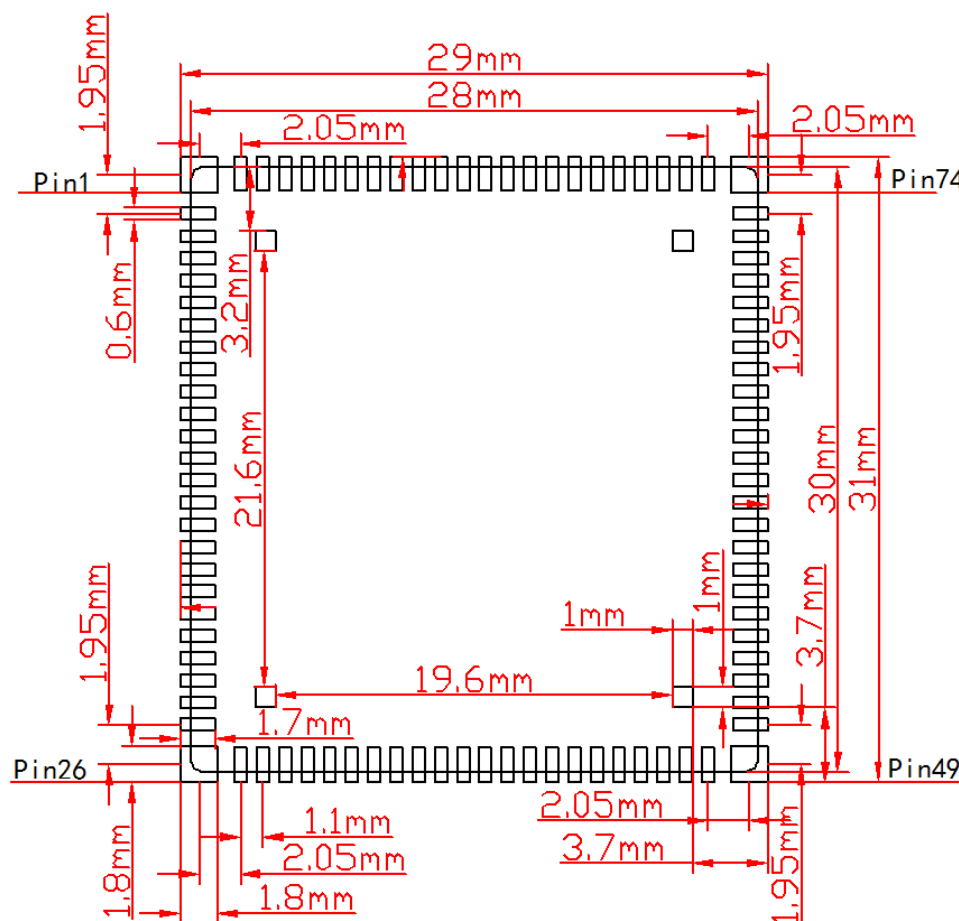
N75-NA is introduced in 100-pin LGA package. This chapter describes N75-NAV5 foot print, recommended PCB design and SMT information to guide users how to mount the module onto application PCB board.

Figure 7-1 Bottom view



7.2 Application Foot Print

Figure 7-2 Recommended Application Foot Print (Top View)



7.3 Stencil

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

7.4 Solder Paste

The quality of the solder joint depends on the solder paste volume and the PCB flatness.

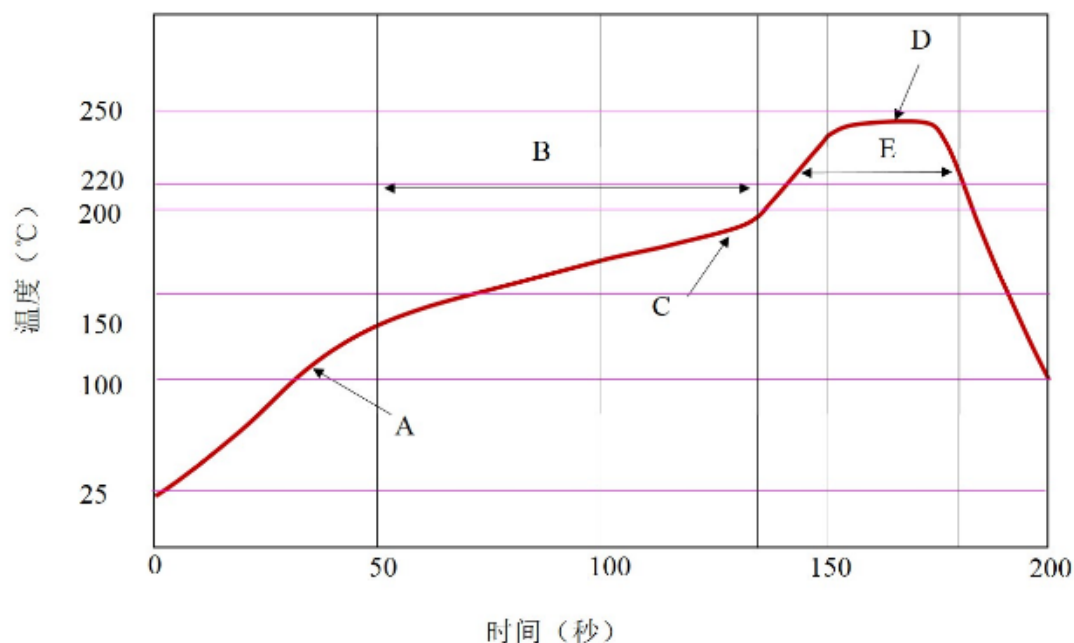
Do not use the kind of solder paste different from our module technique.

- 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 for LGA and LCC 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: -3 to -1 °C/sec
- Soaking zone: 150-180 °C, Time: 60-100 s
- Reflow zone: >220 °C, Time: 40-90 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 N75-NA 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 if the module does not support hot plugging.

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 A Digital Device Notice

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

A.2.3 FCC Class B Digital Device 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.

This device 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 radiated 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.

Important Notice to OEM integrators

1. This module is limited to OEM installation ONLY.
2. This module is limited to installation in mobile or fixed applications, according to Part 2.1091(b).
3. The separate approval is required for all other operating configurations, including portable configurations with respect to Part 2.1093 and different antenna configurations
4. For FCC Part 15.31 (h) and (k): The host manufacturer is responsible for additional testing to verify compliance as a composite system. When testing the host device for compliance with Part 15 Subpart B, the host manufacturer is required to show compliance with Part 15 Subpart B while the transmitter module(s) are installed and operating. The modules should be transmitting and the evaluation should confirm that the module's intentional emissions are compliant (i.e. fundamental and out of band emissions). The host manufacturer must verify that there are no additional unintentional emissions other than what is permitted in Part 15 Subpart B or emissions are compliant with the transmitter(s) rule(s).

The Grantee will provide guidance to the host manufacturer for Part 15 B requirements if needed.

Important Note

notice that any deviation(s) from the defined parameters of the antenna trace, as described by the instructions, require that the host product manufacturer must notify to 20cm that they wish to change the antenna trace design. In this case, a Class II permissive change application is required to be filed by the USI, or the host manufacturer can take responsibility through the change in FCC ID (new application) procedure followed by a Class II permissive change application.

End Product Labeling

When the module is installed in the host device, the FCC ID label must be visible through a window on the final device or it must be visible when an access panel, door or cover is easily re-moved. If not, a second label must be placed on the outside of the final device that contains the following text:
"Contains FCC ID: PJ7-N75NA "

The FCC ID can be used only when all FCC compliance requirements are met.

Antenna Installation

- (1) The antenna must be installed such that 20 cm is maintained between the antenna and users,
- (2) The transmitter module may not be co-located with any other transmitter or antenna.
- (3) Only antennas of the same type and with equal or less gains as shown below may be used with this module. Other types of antennas and/or higher gain antennas may require additional authorization for operation.

Band	GSM850	GSM1900	WCDMA B2	WCDMA B4	WCDMA B5
Antenna type	External antenna	External antenna	External antenna	External antenna	External antenna
Peak Gain (dBi)	3	3	3	3	3

Band	LTE B2	LTE B4	LTE B5	LTE B7	LTE B12
Antenna type	External antenna	External antenna	External antenna	External antenna	External antenna
Peak Gain (dBi)	3	3	3	3	3

Band	LTE B13	LTE B25	LTE B26	LTE B66	LTE B71
Antenna type	External antenna	External antenna	External antenna	External antenna	External antenna
Peak Gain (dBi)	3	3	3	3	3

In the event that these conditions cannot be met (for example certain laptop configurations or co-location with another transmitter), then the FCC authorization is no longer considered valid and the FCC ID cannot be used on the final product. In these circumstances, the OEM integrator will be responsible for re-evaluating the end product (including the transmitter) and obtaining a separate FCC authorization.

Manual Information to the End User

The OEM integrator has to be aware not to provide information to the end user regarding how to install or remove this RF module in the user's manual of the end product which integrates this module. The end user manual shall include all required regulatory information/warning as show in this manual.

List of applicable FCC rules

This module has been tested and found to comply with part 22, part 24, part 27, and part 90 requirements for Modular Approval.

The modular transmitter is only FCC authorized for the specific rule parts (i.e., FCC transmitter rules) listed on the grant, and that the host product manufacturer is responsible for compliance to any other FCC rules that apply to the host not covered by the modular transmitter grant of certification. If the grantee markets their product as being Part 15 Subpart B compliant (when it also contains unintentional-radiator digital circuitry), then the grantee shall provide a notice stating that the final host product still requires Part 15 Subpart B compliance testing with the modular transmitter installed.

This device is intended only for OEM integrators under the following conditions: (For module device use)

- 1) The antenna must be installed such that 20 cm is maintained between the antenna and users, and
- 2) The transmitter module may not be co-located with any other transmitter or antenna.

As long as 2 conditions above are met, further transmitter test will not be required. However, the OEM integrator is still responsible for testing their end-product for any additional compliance requirements required with this module installed.

Radiation Exposure Statement

This equipment complies with FCC radiation exposure limits set forth for an uncontrolled environment. This equipment should be installed and operated with minimum distance 20 cm between the radiator & your body.

B Abbreviation

Abbreviation	English Full Name
ADC	Analog-Digital Converter
bps	Bits per second
BLSP	BAM low-speed peripheral
DC-HSPA+	Dual-carrier HSPA+
EDGE	Enhanced GSM
EV-DO	Evolution Data Optimized
FDD	Frequency Division Duplex
GNSS	Global Navigation Satellite System
GPIO	General-Purpose Input/Output
GPRS	General Packet Radio Service
HSPA+	High-Speed Packet Access
I2C	Interintegrated Circuit
I2S	Inter-IC Sound
LGA	Land Grid Array
LTE	Long-Term Evolution
MDIO	Management Data Input/Output
PCB	Printed Circuit Board
PCM	Pulse-Coded Modulation
PM	Power management unit
RF	Radio Frequency
SDC	Secure Digital Controller
SGMII	Serial Gigabit Media Independent Interface
SPI	Serial Peripheral Interface
TD-SCDMA	Time Division-Synchronous Code Division Multiple Access

UART	Universal asynchronous receiver-transmitter
USIM	Universal Subscriber Identity Module
UMTS	Universal Mobile Telecommunications System
USB	Universal Serial Bus
USB-OTG	Universal serial bus on-the-go
WCDMA	Wide-band Code Division Multiple Access
WCI	Wireless Coexistence Interface
WLAN	Wireless Local Area Network