N58 Mini PCIe (Audio)

Product Specifications

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Notice

This document provides a guide for users to use N58 Mini PCIe (Audio).

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 N58 Mini PCIe.

Audience

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

Change History

Issue	Date	Change	Changed By
1.0	2020-05	Initial draft	Wu Wentao
1.1	2021-05	Deleted the SIM2 connector related content	Wu Yongqiang

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

Related Documents

Neoway_N58 Mini PCIe (Audio)_Hardware_User_Guide

Neoway_N58_AT_Commands_Mannual

1 Introduction

N58 is an industrial 4G module that is developed on UNISOC chipset. Its dimensions are 30.0 mm x 28.0 mm x 2.6 mm. This high-performance cellular module supports GSM, LTE-FDD, LTE-TDD (Cat 1) network modes and provides various hardware interfaces. It facilitates the application development for customers and applies to various IoT communication devices such as AMR, POC, POS, etc.

N58 Mini PCIe is implemented on N58 and complies with PCI Express Mini Card 1.2 standard. It provides multiples functional interfaces to simplify customers' development. N58 Mini PCIe applies to various kinds of IoT communication devices such as video surveillance, laptops, in-vehicle devices, and wireless routers.

1.1 Overview

N58 Mini PCIe provides different hardware variants   with the optional functions such as AUDIO and GNSS. You can choose one based on your demands. Table 1-1 lists the bands that each variant supports.

Table 1-1 Variant and frequency bands

Variant	Category	Band	GNSS[1]	CODEC
N58-CA	Cat1	FDD-LTE: B1, B3, B5, B8, TDD-LTE: B34, B39, B40, B41 GSM/GPRS: 900/1800 MHz	Optional	Supported
N58-EA	Cat1	FDD-LTE: B1, B3, B5, B7, B8, B20, B28 TDD-LTE: B38, B40, B41 GSM/GPRS: 900/1800 MHz	Optional	Supported
N58-LA	Cat1	FDD-LTE: B1, B2, B3, B4, B5, B7, B8, B28, B66 TDD-LTE: B38, B40, B41 GSM/GPRS: 850/900/1800/1900 MHz	Optional	Supported

1.2 Block Diagram

N58 Mini PCIe consists of the following functionality modules:

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[1]GNSS is optional for all above variants.

- N58 module

- Power management unit

- RF section

- Digital interfaces (USIM, PCM*, UART, USB, VREG_1V8, Wake up*, etc)

- Analog interfaces (MIC, SPK)

Figure 1-1 Block Diagram
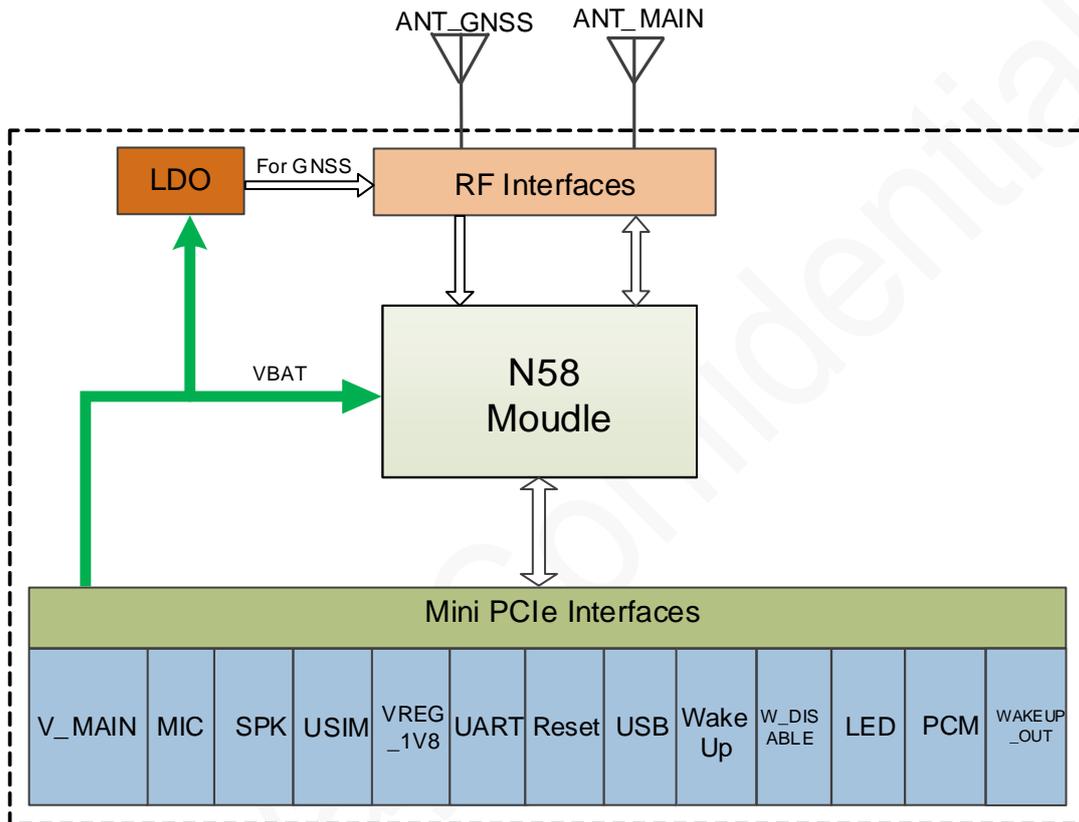
* indicates functions that will be developed in the future.

LDO supplies 3.3V for external active GNSS antenna.

1.3 Basic Features

Parameter	Description
Dimensions	51.0 mm x 30.2 mm x 5.3mm

Temperature ranges	Operating: -30°C to +75°C Extended: -35°C to +85°C Storage: -40°C to +90°C
Operating voltage	V_MAIN: 3.4 V to 4.2 V input, Typ. 3.8 V
	VREG_1V8: 1.8 V output, 50 mA at most
Operating current[2]	Sleep[3]<TBD
	Idle<TBD
	Operating mode (LTE networks) Current in data service: TBD Current in max. RX power: TBD
Processor	ARM Cortex-A5 processor, 500 MHz main frequency, 32KB L1 cache
Memory	RAM: 128 Mb ROM: 64 Mb
Band	See Table 1-1.
Wireless rate	GPRS: Max 85.6Kbps(DL) / Max 85.6Kbps(UL) FDD-LTE: Cat1, Max 10Mbps(DL)/Max 5Mbps(UL) TDD-LTE: Cat1, Max 8.96Mbps(DL)/Max2Mbps(UL)
Transmit power	GSM85c0:+33dBm (Power Class 4) EGSM900:+33dBm (Power Class 4) DCS1800:+30dBm (Power Class 1) PCS1900:+30dBm (Power Class 1) LTE:+23dBm (Power Class 3)
Application interfaces	2G/4G antenna, GNSS antenna 50 Ω impedance
	One UART interface, 2 Mbps
	One USIM interface, 1.8 V/3.0 V
	One USB2.0 high-speed interface
	One PCM interface*
	One WAKEUP_IN interface, used to control sleep mode of the module.
	One W_DISABLE interface, used to disable RF communication of the module.
	One WAKEUP_OUT interface, used to indicate whether the module is in sleep mode.
	One PON_RESET interface, used to reset the module.

[2] The table above only lists the operating currents of LTE band1 and band41, for the operating currents of the other network modes in different states, see the N58 Mini PCIe Current Test Report.

[3] Sleep mode needs to supported by software and hardware simultaneously.

	One network indicator control interface, used to control the network indicator.
	One MIC differential analog audio interface
	One SPK differential analog audio interface
AT Command	• 3GPP Release 13 • Neoway extended commands
Data	PPP, RNDIS, ECM
Protocol	TCP*, UDP*, MQTT, FTP/FTPS, HTTP/HTTP(S), SSL, TLS
Certification approval	CCC, SRRC, RoHS, CE

* indicates functions that will be supported in the future.

2 Compliant Standards

N58 Mini PCIe complies with the following 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 1215-2006 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

- 3GPP TS WCDMA Specification Set

- CDMA2000@1x,1xAdvanced,1xEV-DOrA Specification Set

- 3GPP TS LTE Cat1 4G Specification Set

3 Module Pins

3.1 Pin Layout

N58 Mini PCIe provides 52 pins and their definitions meet the standard of Mini PCI Express. Figure 3-1 shows the pin definitions.

Figure 3-1 N58 Mini PCIe pin definition

Signal	Pin
MIC_P	1
MIC_N	3
SPK_P	5
SPK_N	7
GND	9
VREG_1V8	11
NC	13
GND	15
NC	17
WAKEUP_IN	19
GND	21
UART_RX	23
UART_RTS	25
GND	27
GND	29
UART_TX	31
PON_RESET	33
GND	35
GND	37
V_MAIN	39
V_MAIN	41
GND	43
PCM_CLK	45
PCM_DIN	47
PCM_DOUT	49
PCM_SYNC	51

| Pin	Signal
2	V_MAIN
4	GND
6	NC
8	V_USIM
10	USIM_DATA
12	USIM_CLK
14	USIM_RST
16	NC
18	GND
20	W_DISABLE
22	PON_RESET
24	V_MAIN
26	GND
28	UART_CTS
30	NC
32	WAKEUP_OUT
34	GND
36	USB_D-
38	USB_D+
40	GND
42	LED_WWAN
44	USIM_DETECT
46	NC
48	NC
50	GND
52	V_MAIN

TOP BOT

3.2 Appearance

Figure 3-2 Top view of the N58 Mini PCIe

Figure 3-3 Bottom view of the N58 Mini PCIe
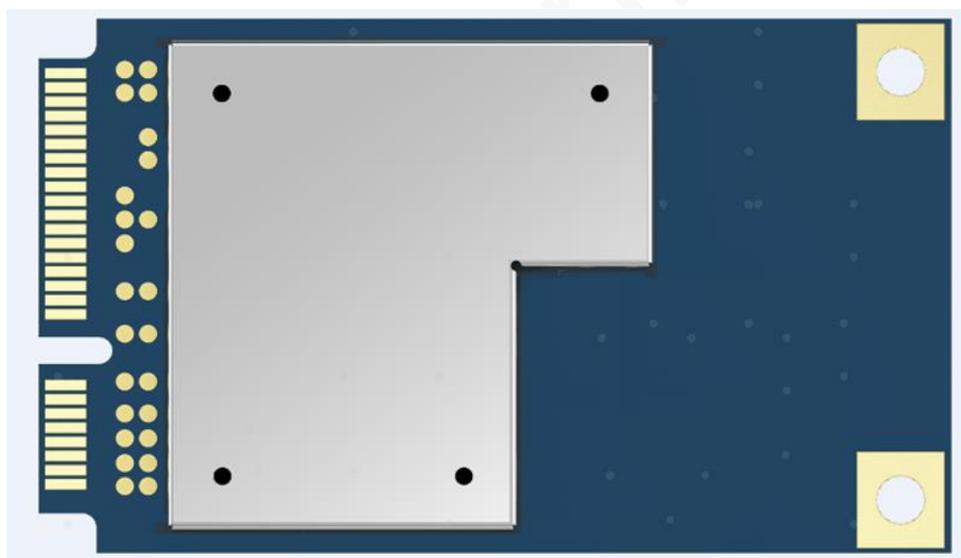
- The actual products might be a little bit different from the above figures.
- The figure above shows the N58 Mini PCIe that supports GNSS function.

4 Electric Feature and Reliability

This chapter describes the electric features and reliability of N58, including the current and voltage of each power pin, operating and storage temperature ranges, and ESD protection features.

4.1 Electric Features

Table 4-1 Operating conditions of N58 Mini PCIe

Pin	Parameter	Minimum Value	Typical Value	Maximum Value
V_MAIN	V_{in}	3.4 V	3.8 V	4.2 V
	I_{in}	/	/	3.0 A

⚠ If the voltage is lower than the threshold, the module might fail to start. If the voltage is higher than the threshold or there is a voltage burst during the startup, the module might be damaged permanently.

If you use LDO or DC-DC to supply power for the module, ensure that it outputs at least 3.0 A current.

Table 4-2 Current consumption of N58 Mini PCIe (Typical)

Frequency band	State	PSM/Sleep (mA)	Idle (DRX/eDRX) (mA)	Active power	(mA)@max
FDD-LTE: B1, B2, B3, B4, B5, B7, B8, B20, B28, B66		TBD	TBD	TBD	
TDD-LTE: B34, B38, B39, B40, B41		TBD	TBD	TBD	
GSM 900/850		TBD	TBD	TBD	
GSM1800/1900		TBD	TBD	TBD	

4.2 Temperature Features

Table 4-3 Temperature feature of N58 Mini PCIe

Status	Minimum Value	Typical Value	Maximum Value
Operating	-30°C	25°C	75°C
Extended	-35°C	25°C	85°C
Storage	-40°C	25°C	90°C

⚠️ If the module works in an environment of -30°C to -35°C or 75°C to 85°C, RF performance might be beyond the requirements of 3GPP. 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. The following table 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°C

Table 4-4 N58 Mini PCIe ESD protection

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

5 RF Features

N58 supports network modes including GSM, FDD-LTE, TDD-LTE(Cat 1), and optionally supports GNSS. This chapter describes the RF features of N58.

5.1 Operating Bands

Table 5-1 Operating bands of N58 Mini PCIe

Operating band	Uplink	Downlink
GSM850	824~849 MHz	869~894 MHz
EGSM900	880~915 MHz	925~960 MHz
DCS1800	1710~1785 MHz	1805~1880 MHz
PCS1900	1850~1910 MHz	1930~1990 MHz
FDD-LTEB1	1920~1980 MHz	2110~2170 MHz
FDD-LTEB2	1850~1910 MHz	1930~1990 MHz
FDD-LTEB3	1710~1785 MHz	1805~1880 MHz
FDD-LTEB4	1710~1755 MHz	2110~2155 MHz
FDD-LTEB5	824~849 MHz	869~894 MHz
FDD-LTEB7	2500~2570 MHz	2620~2690 MHz
FDD-LTEB8	880~915 MHz	925~960 MHz
FDD-LTEB20	832~862 MHz	791~821 MHz
FDD-LTEB28	703~748 MHz	758~803 MHz
FDD-LTEB66	1710~1780 MHz	2110~2200 MHz
TDD-LTEB34	2010-2025 MHz	2010-2025 MHz
TDD-LTEB38	2570~2620 MHz	2570~2620 MHz
TDD-LTEB39	1880~1920 MHz	1880~1920 MHz
TDD-LTEB40	2300~2400 MHz	2300~2400 MHz
TDD-LTEB41	2555~2655 MHz	2555~2655 MHz

5.2 TX Power and RX Sensitivity

Table 5-2 RF TX power of N58 Mini PCIe

Band	Max Power	Min. Power
GSM850	33 dBm+2/-2 dB	5 dBm+2/-2 dB
EGSM900	33 dBm+2/-2 dB	5 dBm+2/-2 dB
DCS1800	30 dBm+2/-2 dB	0 dBm+2/-2 dB
PCS1900	30 dBm+2/-2 dB	0 dBm+2/-2 dB
FDD-LTEB1	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB2	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB3	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB4	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB5	23 dBm+2/-2 dB	<-40 dBM
FDD-LTE B7	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB8	23 dBm+2/-2 dB	<-40 dBM
FDD-LTE B20	23 dBm+2/-2 dB	<-40 dBM
FDD-LTE B28	23 dBm+2/-2 dB	<-40 dBM
FDD-LTEB66	23 dBm+2/-2 dB	<-40 dBM
TDD-LTEB34	23 dBm+2/-2 dB	<-40 dBM
TDD-LTEB38	23 dBm+2/-2 dB	<-40 dBM
TDD-LTE B39	23 dBm+2/-2 dB	<-40 dBM
TDD-LTE B40	23 dBm+2/-2 dB	<-40 dBM
TDD-LTE B41	23 dBm+2/-2 dB	<-40 dBM

Table 5-3 N58 Mini PCIe GSM RX sensitivity

Band	Sensitivity
GSM850	≤-108 dBm
EGSM900	≤-108 dBm
DCS1800	≤-108 dBm
PCS1800	≤-108 dBm

Table 5-4 N58 Mini PCIe LTE RX sensitivity

Band	Sensitivity
LTE-FDD B1	≤-96 dBm
LTE-FDD B2	≤-96 dBm
LTE-FDD B3	≤-96 dBm
LTE-FDD B4	≤-96 dBm
LTE-FDD B5	≤-96 dBm
LTE-FDD B7	≤-95 dBm
LTE-FDD B8	≤-96 dBm
LTE-FDD B20	≤-96 dBm
LTE-FDD B28	≤-96 dBm
LTE-FDD B66	≤-96 dBm
LTE-TDD B34	≤-96 dBm
LTE-TDD B38	≤-96 dBm
LTE-TDD B39	≤-96 dBm
LTE-TDD B40	≤-96 dBm
LTE-TDD B41	≤-96 dBm

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

5.3 GNSS Features

Table 5-5 GNSS Feature

Parameter	Value
GPS L1 operating frequency	1575.42±1.023 MHz
GLONASS operating frequency	1597.5~1605.9 MHz
BDS operating frequency	1559.1~1563.1 MHz
Tracking sensitivity	-161 dBm
Acquisition sensitivity	-147 dBm
Positioning precision (in air)	< 3m (CEP50)

|	
Hot start (in air)	<2.0s
Cold start (in air)	<35s
Update frequency	<10 Hz
CNRin/CNRout	3 dB
Max. positioning altitude	TBD
Max. positioning speed	TBD
Max. positioning acceleration	TBD
GNSS data type	NMEA-0183
GNSS antenna type	aActive antenna

6 Mechanical Features

This chapter describes the mechanical features of N58.

6.1 Dimensions

Specifications	N58 Mini PCIe
Dimensions	51.0 ± 0.1 mm x 30.2±0.1 mm 5.3±0.15 mm (H*W*D)
Weight	TBD
Packaging	52-Pin Mini PCIe

Figure 6-1 N58 Mini PCIe dimensions (Unit: mm)
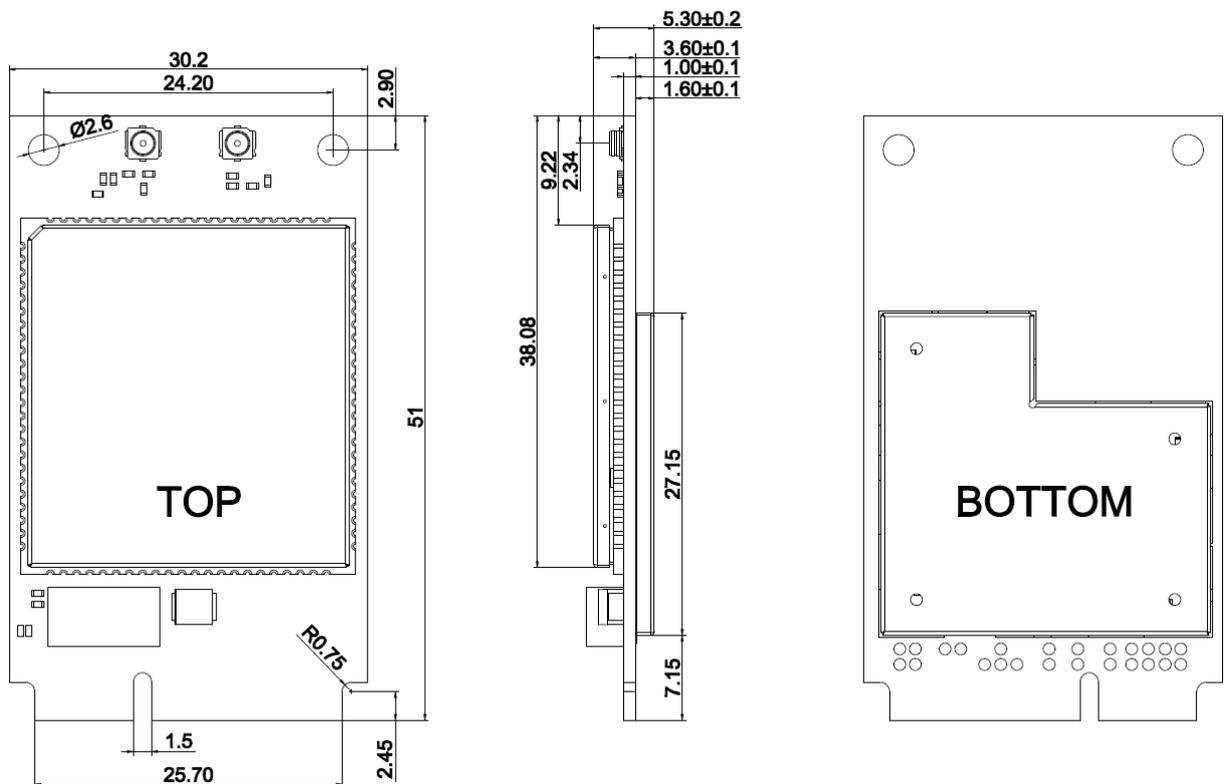
6.2 Label

The label information is laser carvevd on the cover of the N58 module. The following figure shows the label of N58.

Figure 6-2 N58 label

- 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 Packing

N58 Mini PCIe modules are packed in sealed bags on delivery to guarantee a long shelf life. Follow the same package of the modules again in case of opened for any reason.

Figure 6-3 Packaging process

6.4 Storage

- Temperature: 20°C to +26°C

- Humility: 40% to 60%

- Period: 120 days

7 Mounting

N58 Mini PCIe adopts the standard PCI Express Mini Card 1.2 interfaces and can be mounted to a Mini PCIe connector. It is recommended to use 679100002 from Molex. The following figure shows its dimensions.

Figure 7-1 Mini PCIe connector
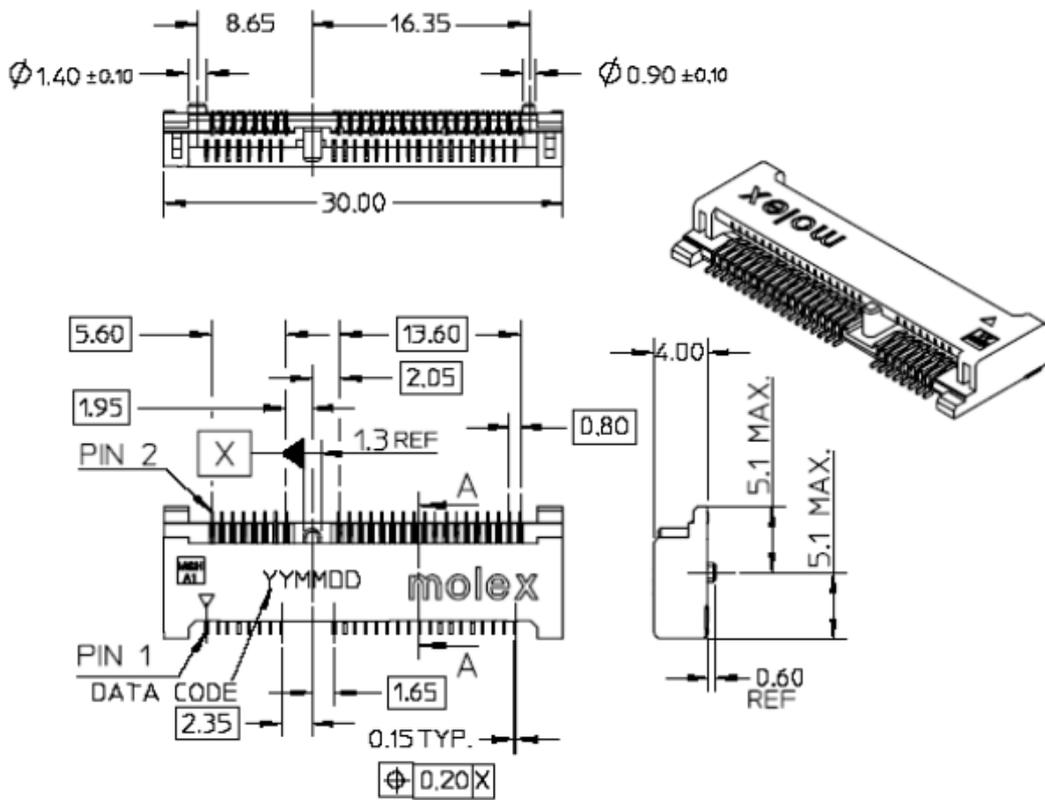
8 Safety Recommendations

Ensure that this product is used 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 workplace:

- 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 hospitals or airplanes 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 route traces following fire safety standards.

- Please avoid touching 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 Abbreviation

Abbreviation	English Full Name
ADC	Analog-Digital Converter
AFC	Automatic Frequency Control
AGC	Automatic Gain Control
AI	Analog Input
AMR	Acknowledged multirate (speech coder)
AO	Analog Output
AP	Access Point
ARM	Advanced RISC Machine
BDS	The BeiDou Navigation Satellite System
BOM	Bill of Material
BT	Bluetooth
CCC	China Compulsory Certification
CEP	Circular Error Probable
CNR	Carrier to Noise Rate
CPU	Central Processing Unit
CS	Chip Select
CTS	Clear to Send
DC	Direct Current
DCS	Digital Cellular System
DI	Digital Input
DIO	Digital Input/Output
DL	Downlink
DO	Digital Output
DPSK	Differential Phase Shift Keying
DQPSK	Differential Quadrature Phase Shift Keying
DRX	Discontinuous Reception
DTR	Data Terminal Ready

ECM	Ethernet Control Model
eDRX	Extended DRX
EGSM	Enhanced GSM
ESD	Electronic Static Discharge
ESR	Equivalent Series Resistance
EVK	Evaluation Kit
FCC	Federal Communications Commission
FDD	Frequency Division Duplexing
FPC	Flexible Printed Circuit
FTP	File Transfer Protocol
FTPS	FTP Secure
GFSK	Gauss frequency Shift Keying
GLONASS	GLOBAL NAVIGATION SATELLITE SYSTEM
GNSS	Global Navigation Satellite System
GPIO	General Purpose Input Output
3GPP	3rd Generation Partnership Project
GPRS	General Packet Radio Service
GPS	Global Positioning System
GSM	Global System for Mobile Communications
I2C	Inter-Integrated Circuit
IO	Input/Output
ISP	Image Signal Processor
LCC	Leadless Chip Carriers
LCD	Liquid Crystal Display
LED	Light Emitting Diode
LGA	Land Grid Array
LTE	Long Term Evolution
MCLK	Main Clock
MCU	Microcontroller Unit
MIPI	Mobile Industry Processor Interface
PCB	Printed Circuit Board
PCS	Personal Communications Service
PWM	Pulse Width Modulation

QVGA	Quarter Video Graphics Array
RAM	Random Access Memory
RF	Radio Frequency
ROM	Read-only Memory
RTC	Real Time Clock
SD	Secure Digital
SDIO	Secure Digital Input Output
SIM	Subscriber Identification Module
SPI	Serial Peripheral Interface
SRAM	Static Random Access Memory
TDD	Time Division Duplex
UART	Universal asynchronous receiver-transmitter
UL	Uplink
USB	Universal Serial Bus
USIM	Universal Subscriber Identity Module
VBAT	Battery Voltage
VSWR	Voltage Standing Wave Ratio
Wi-Fi	Wireless Fidelity
WLAN	Wireless Local Area Networks