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N720 Mini PCIe Specifications

(AUDIO)

Version 1.1

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

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Revision Record			
Version	**Changes**	**Revised By**	**Date**
V1.0	Initial draft	Dong Liuting	2017-07
V1.1	• Updated variants and bands • Added GNSS parameters • Modified the packaging of N720 PCIe • Modified some description	Dong Liuting	2018-01

Contents

1 Overview

N720 is an industrial-grade 4G module developed on Qualcomm platform. This module has an ultra-wide operating temperature range of -40 °C to +85 °C and electrostatic capacity of 8 kV. N720 Mini PCIe complies with the PCI Express Mini Card 1.2 standard and provides various application interfaces in addition to standard interfaces. It is well applicable to video surveillance, notebook, in-vehicle devices, wireless routers, and other IoT terminals with the following features:

- ARM Cortex-A7 processor, 1.3 GHz main frequency, 256 KB L2 cache, 28 nm process technology
- GSM/GPRS/EDGE & CDMA2000 1x/1xAdvanced/1xEV-DOrA &&WCDMA R99 to DC-HSPA+&&TD-SCDMA&LTE Cat4
- USB2.0/ UIM/ UART/PCM/GNSS (optional)/AUDIO

This document describes the bands, features, pin description, reliability, mounting packaging, and storage. N720 Mini PCIe series include the following variants to meet the band requirements in different areas.

Table 1-1 Variants and bands

Module	Version	Area	Category	Band
N720 Mini PCIe	CA	China	Cat4	FDD-LTE: B1, B3, B5, B8 TDD-LTE: B38, B39, B40, B41 TD-SCDMA: B34, B39 UMTS: B1, B8 EV-DO: BC0 CDMA 1x: BC0 GSM/GPRS/EDGE: 900/1800 MHz
	CB	China/India	Cat4	FDD-LTE: B1, B3, B5, B8 TDD-LTE: B38, B39, B40, B41 TD-SCDMA: B34, B39 UMTS: B1, B8 GSM/GPRS/EDGE: 900/1800 MHz
	CC	China	Cat4	FDD-LTE: B1, B3, B8, B28 TDD-LTE: B38, B39, B40, B41 TD-SCDMA: B34, B39 UMTS: B1, B8 GSM/GPRS/EDGE: 900/1800 MHz
	EA	Europe	Cat4	FDD-LTE: B1, B3, B5, B7, B8, B20 TDD-LTE: B40 UMTS: B1, B8 GSM/GPRS/EDGE: 900/1800 MHz
	EB	Europe	Cat4	FDD-LTE: B1, B3, B5, B7, B8, B20 TDD-LTE: B38 UMTS: B1, B8

				GSM/GPRS/EDGE: 900/1800 MHz
	NA	North America	Cat4	FDD-LTE: B2, B4, B5, B7, B12, B17 UMTS: B2, B4, B5 GSM/GPRS/EDGE: 850/900/1800/1900 MHz
	A	US ATT	Cat4	FDD-LTE: B2, B4, B12, B17 UMTS: B2, B4, B5
	V	US Verizon	Cat4	FDD-LTE: B4, B13
	AU	Australia/New Zealand/the Philippines	Cat4	FDD-LTE: B1, B3, B5, B7, B28 TDD-LTE: B40 UMTS: B1, B5
	TWN	Taiwan	Cat4	FDD-LTE: B1, B3, B7, B8, B28 UMTS: B1, B8 GSM/GPRS/EDGE: 900/1800 MHz
	IN	India	Cat4	FDD-LTE: B3, B5 TDD-LTE: B40

2 Compliant Standards

1. 3GPP TS 07.07*AT command set for GSM Mobile Equipment (ME)*
2. YD 1214-2006 *Technical requirement of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
3. YD 1215-2006*Testing Methods of 900/1800MHz TDMA Digital Cellular Mobile Telecommunication Network General Packet Radio Service (GPRS)Equipment: Mobile Stations*
4. YD 1032-2000*Limits and Measurement Methods of Electromagnetic Compatibility for 900/1800MHz Digital Cellular Telecommunications System Part1:Mobile Station and Ancillary Equipment*
5. YD/T 2220-2011 *Technical Requirement and test method of WCDMA/GSM(GPRS) dual mode digit mobile user equipment (phase 4)*
6. Ministry of Industry and Information Technology PRC, *Measures for the Network Access Management of Telecommunication Equipment (2014 Amendment)*
7. GB4943.1-2011 *Information technology equipment - Safety - Part 1: General requirements*
8. 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*
9. CNCA-O7C-031:2007*Rules for Compulsory Certification of Telecommunication Equipment Telecommunication Terminal Equipment*
10. 3GPP TS GSM *Specification Set*
11. 3GPP TS WCDMA *Specification Set*
12. CDMA2000@1x,1xAdvanced,1xEV-DOrA *Specification Set*
13. 3GPP TS LTE Cat4 4G *Specification Set*

3 Features

Table 3-1 N720 Mini PCIe baseband and wireless features

Specifications	Description
Power supply	3.0V to 3.8V
Current in sleep mode	<4 mA
Idle current	<25 mA
Operating temperature	-40 °C to +85 °C
Processor	ARM Cortex-A7 processor Main frequency: 1.3 GHz 256 kB L2 cache
Memory	RAM: 256 MB ROM: 256 MB
Band	See Table 1-1.
Rate	GPRS: Max 85.6 Kbps(DL) / Max 85.6 Kbps(U) CDMA: Max 3.1 Mbps (DL) / Max 1.8 Mbps (UL) WCDMA: DC-HSPA+, Max 42 Mbps(DL)/Max 5.76 Mbps(UL) TD-SCDMA: Max 4.2 Mbps(DL)/Max 2.2 Mbps(UL) FDD-LTE: non-CA cat4, Max 150 Mbps(DL)/Max 50 Mbps(UL) TDD-LTE: non-CA cat4, Max 130 Mbps(DL)/Max 35 Mbps(UL)
Transmit power	GSM850: +33 dBm (Power Class 4) EGSM900: +33 dBm (Power Class 4) DCS1800: +30 dBm (Power Class 1) PCS1900: +30 dBm (Power Class 1) EDGE 850 MHz: +27 dBm (Power Class E2) EDGE 900 MHz: +27 dBm (Power Class E2) EDGE 1800 MHz: +26 dBm (Power Class E2) EDGE 1900 MHz: +26 dBm (Power Class E2) TD-SCDMA:+23 dBm (Power Class 3) CDMA 1X/EVDO:+23 dBm(Power Class 3) UMTS: 23 dBm (Power Class 3) LTE: +23 dBm (Power Class 3)
Antenna feature	2G/3G/4G main antenna, 4G diversity antenna, GNSS antenna, 50 Ω impedance
UART	At most 4 Mbps, 1 UART interface
UIM	1 UIM interface, 1.8V/3V dual-voltage adaptive
USB	1 USB2.0 high-speed interface
PCM	1 PCM interface

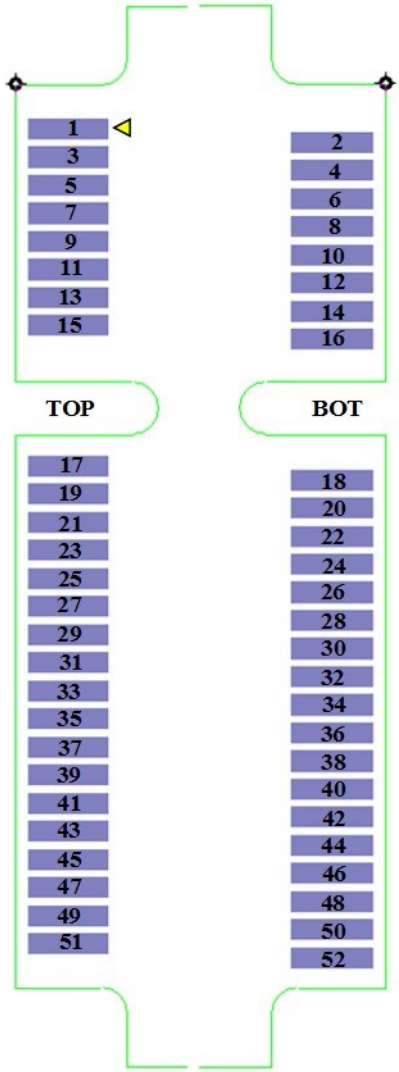
AUDIO	MIC/ SPK differential analog audio interface The I/O volume is adjustable.

4 Application Interfaces

N720 Mini PCIe has 52 pins, including general function pins and other pins. Figure 4-1 defines the pins.

Figure 4-1 N720 Mini PCIe pin description

Pin Name	No.
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_OUT	49
PCM_SYNC	51



No.	Pin Name
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	UART_DCD
32	WAKEUP_OUT
34	GND
36	USB_D-
38	USB_D+
40	GND
42	LED_WWAN
44	USIM_DETECT
46	UART_DTR
48	NC
50	GND
52	V_MAIN

NOTE

IO: input/output
DO: Digital output
PO: Power output
AO: Analog output
DI: Digital input
PI: Power input
AI: Analog input
OC: Open collector

Table 4-1 N720 Mini PCIe pin description

Name	Pin	I/O	Function	Level Feature (V)	Power Domain	Remarks
Power Supply						
V_MAIN	2, 24, 39, 41, 52	PI	Main power supply	Vmin=3.0 V Vmax=3.8 V		Maximum supply current of 2A peak.
VREG_1P8	11	PO	1.8 V power supply	Vnorm=1.8 V; Imax=50 mA;	1.8 V	Supply power for IO level shifting circuit. Leave this pin unconnected if it is not used.
GND	4, 9, 15, 18 21, 26, 27, 29, 34, 35, 37, 40, 43, 50		GND			
PON RESET	22, 33	DI	Reset input			Low level triggers the reset.
UART						
UART_TX	31	DO	UART data transmit	V_{OL} max=0.45 V; V_{OH} min=1.35 V;	1.8 V	Data transmission Leave these pins unconnected if they are not used.
UART_RX	23	DI	UART data receive	V_{IL} min=-0.3 V; V_{IL} max=0.45 V; V_{IH} min=1.35 V; V_{IH} max=2.1 V	1.8 V	

UART_CTS	28	DI	Clear to send	V_{IL} min=-0.3 V; V_{IL} max=0.45 V; V_{IH} min=1.35 V; V_{IH} max=2.1 V	1.8 V	Leave these pins unconnected if they are not used.
UART_RTS	25	DO	Request to send	V_{OL} max=0.45 V; V_{OH} min=1.35 V	1.8 V	
UART_DTR	46	DI	Data terminal is ready	V_{IL} min=-0.3V; V_{IL} max=0.45V; V_{IH} min=1.35V; V_{IH} max=2.1V	1.8V	Leave this pin unconnected if it is not used.
UART_DCD	30	DO	Data carrier detect	V_{OL} max=0.45V; V_{OH} min=1.35V	1.8V	Leave this pin unconnected if it is not used.
UIM						
V_USIM	8	PO	UIM power supply output	1.8V USIM: Vmax = 1.9 V ; Vmin = 1.7 V 3V USIM: Vmax = 3.05 V; Vmin = 2.7 V; IO max =50 mA	1.8 V/3 V	Compatible with 1.8/3V UIM card
USIM_RST	14	DO	UIM reset	1.8 V USIM: V_{OL} max = 0.45 V; V_{OH} min = 1.35 V 3 V USIM: V_{OL} max = 0.4 V; V_{OH} min = 2.6V	1.8 V/3 V	

USIM_DATA	10	IO	UIM data input/output	1.8V USIM: V_{IL} max = 0.6 V; V_{IH} min = 1.2 V; V_{OL} max = 0.45 V; V_{OH} min = 1.35 V 3V USIM: V_{IL} max = 0.8 V V_{IH} min = 1.95 V V_{OL} max = 0.45 V V_{OH} min = 2.6 V	1.8 V/3 V	
USIM_CLK	12	DO	UIM clock output	1.8 V USIM: V_{OL} max = 0.45 V; V_{OH} min = 1.35 V 3V USIM: V_{OL} max = 0.4 V V_{OH} min = 2.6 V	1.8 V/3 V	
USIM_DETECT	44	DI	UIM detect	V_{IL} min = -0.3 V; V_{IL} max = 0.63 V	1.8 V	
USB						
USB_D-	36	IO	Negative signal of USB data	USB2.0		
USB_D+	38	IO	positive signal of USB data	USB2.0		
PCM						
PCM_CLK	45	IO	PCM clock signal	V_{OL} max=0.45V; V_{OH} min=1.35V	1.8V	

PCM_DIN	47	DI	PCM data input	V_{IL} min=-0.3V; V_{IL} max=0.45V; V_{IH} min=1.6V; V_{IH} max=2.1V	1.8V	
PCM_DOUT	49	DO	PCM data output	V_{OL} max=0.45V; V_{OH} min=1.35V	1.8V	
PCM_SYNC	51	IO	PCM synchronize signal	V_{OL} max=0.45V; V_{OH} min=1.35V; V_{IL} min=-0.3V; V_{IL} max=0.45V; V_{IH} min=1.6V; V_{IH} max=2.1V	1.8V	
Audio						
MIC_P	1	AI	Positive of audio input	Differential input	1.8 V	Leave them unconnected if it is not used.
MIC_N	3	AI	Negative of audio input			
SPK_P	5	AO	Positive of audio output	Differential output		Leave them unconnected if it is not used.
SPK_N	7	AO	Negative of audio output			
Other Pins						
LED_WWAN	42	OC	Network status indicator			Leave this pin unconnected if it is not used.
WAKEUP_IN	19	DI	Sleep mode control	V_{IL} min=-0.3V; V_{IL} max=0.45V; V_{IH} min=1.35V; V_{IH} max=2.1V	1.8V	Leave this pin unconnected if it is not used.
WAKEUP_OUT	32	DO	Sleep mode status	V_{OL} max=0.45V;	1.8V	Leave this pin unconnected if it is not

			indicator	V_{OH} min=1.35V		used.
W_DISABLE	20	DI	Disable RF communication	V_{IL} min=-0.3V; V_{IL} max=0.45V; V_{IH} min=1.35V; V_{IH} max=2.1V	1.8V	Leave this pin unconnected if it is not used.
NC	6, 13, 16, 17, 48		NC			Leave them unconnected. Do not use them.

5 Electrical Features and Reliability

5.1 Electrical Features

Table 5-1 N720 PCIe electric features

Module Status		Minimum Value	Typical Value	Maximum Value
VBAT	Vin	3.0 V	/	3.8 V
	Iin	/	/	2 A

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 LDO or DC-DC is used to supply power for the module, ensure that it outputs at least 2A current.

5.2 Temperature Features

Table 5-2 Temperature feature

Module Status	Minimum Value	Typical Value	Maximum Value
Work	-40 °C	25 °C	85 °C
Storage	-45 °C		90 °C

CAUTION

If the module works in temperature exceeding the thresholds, some of its RF performance indicators might be worse but it can still work properly.

5.3 Operating Band

Table 5-3 N720 Mini PCIe operating band

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	1930~1990MHz
CDMA BC0	824~849 MHz	869~894 MHz
UMTS B1	1920~1980 MHz	2110~2170 MHz

UMTS B2	1850~1910 MHz	1930~1990MHz
UMTS B4	1710~1755 MHz	2110~2155 MHz
UMTS B5	824~849 MHz	869~894 MHz
UMTS B8	880~915 MHz	925~960 MHz
UMTS B9	1749.9~1784.9 MHz	1844.9~1879.9 MHz
UMTS B19	869~894 MHz	869~894 MHz
TD-SCDMA B34	2010~2025 MHz	2010~2025 MHz
TD-SCDMA B39	1880~1920 MHz	1880~1920 MHz
FDD-LTE B1	1920~1980 MHz	2110~2170 MHz
FDD-LTE B2	1850~1910 MHz	1930~1990 MHz
FDD-LTE B3	1710~1785 MHz	1805~1880 MHz
FDD-LTE B4	1710~1755 MHz	2110~2155 MHz
FDD-LTE B5	824~849 MHz	869~894 MHz
FDD-LTE B7	2500~2570 MHz	2620~2690 MHz
FDD-LTE B8	880~915MHz	925~960 MHz
FDD-LTE B9	1749.9~1784.9MHz	1844.9~1879.9 MHz
FDD-LTE B12	699~716 MHz	728~746 MHz
FDD-LTE B17	704~716 MHz	734~746 MHz
FDD-LTE B19	830~845 MHz	875~890 MHz
FDD-LTE B20	832~862 MHz	791~821 MHz
FDD-LTE B28	703~748 MHz	758~803 MHz
TDD-LTE B38	2570~2620 MHz	2570~2620 MHz
TDD-LTE B39	1880~1920 MHz	1880~1920 MHz
TDD-LTE B40	2300~2400 MHz	2300~2400 MHz
TDD-LTE B41	2555~2655 MHz	2555~2655 MHz

5.4 TX Power and RX Sensitivity

Table 5-4 N720 Mini PCIe RF power and RX sensitivity

Band	Transmitting Power	Receiving Sensitivity
GSM850	33dBm+2/-2 dBm	<-108 dBm
EGSM900	33dBm+2/-2 dBm	<-108 dBm
DCS1800	30dBm+2/-2 dBm	<-108 dBm
PCS1900	30dBm+2/-2 dBm	<-108 dBm

CDMA BC0	24dBm +1/-1 dBm	<-107 dBm
UMTS B1	24dBm +1/-3 dBm	<-108 dBm
UMTS B2	24dBm +1/-3 dBm	<-108 dBm
UMTS B4	24dBm +1/-3 dBm	<-108 dBm
UMTS B5	24dBm +1/-3 dBm	<-108 dBm
UMTS B8	24dBm +1/-3 dBm	<-108 dBm
UMTS B9	24dBm +1/-3 dBm	<-108 dBm
UMTS B19	24dBm +1/-3 dBm	<-108 dBm
TD-SCDMA B34	24dBm +1/-3 dBm	<-109 dBm
TD-SCDMA B39	24dBm +1/-3 dBm	<-109 dBm
FDD-LTE B1 (10MHz)	23dBm+2/-2 dBm	<-97 dBm
FDD-LTE B2 (10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B3 (10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B4(10MHz)	23dBm+2/-2 dBm	<-97 dBm
FDD-LTE B5(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B7(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B8(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B9(10MHz)	23dBm+2/-2 dBm	<-96 dBm
FDD-LTE B12(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B17(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B20(10MHz)	23dBm+2/-2 dBm	<-95 dBm
FDD-LTE B28(10MHz)	23dBm+2/-2 dBm	<-95 dBm
TDD-LTE B38(10MHz)	23dBm+2/-2 dBm	<-97 dBm
TDD-LTE B39(10MHz)	23dBm+2/-2 dBm	<-97 dBm
TDD-LTE B40(10MHz)	23dBm+2/-2 dBm	<-97 dBm
TDD-LTE B41(10MHz)	23dBm+2/-2 dBm	<-95 dBm

NOTE

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

5.5 GNSS Features

Table 5-5 GNSS parameters

Parameter	Value
GPS L1 operating frequency	1575.42±1.023MHz
GLONASS operating frequency	1597.5~1605.9 MHz
BDS operating frequency	1559.1~1563.1 MHz
Tracking sensitivity	-160dBm (GPS)/-159.5 dBm (GLONASS)/TBD (Beidou)
Capturing sensitivity	-144 dBm (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	3 dB
Max. positioning altitude	18000 m
Max. positioning speed	515 m/s
Max. positioning acceleration	4 g
GNSS data type	NMEA-0183
GNSS antenna type	Passive/active antenna

5.6 EMI/EMC Features

Table 5-6 ESD features

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

NOTE

When using the N720 Mini PCIe module, ensure that the ground near the fixing holes connects to that of the device to avoid module damage caused by ESD.

6 Mechanical Feature

6.1 Dimensions

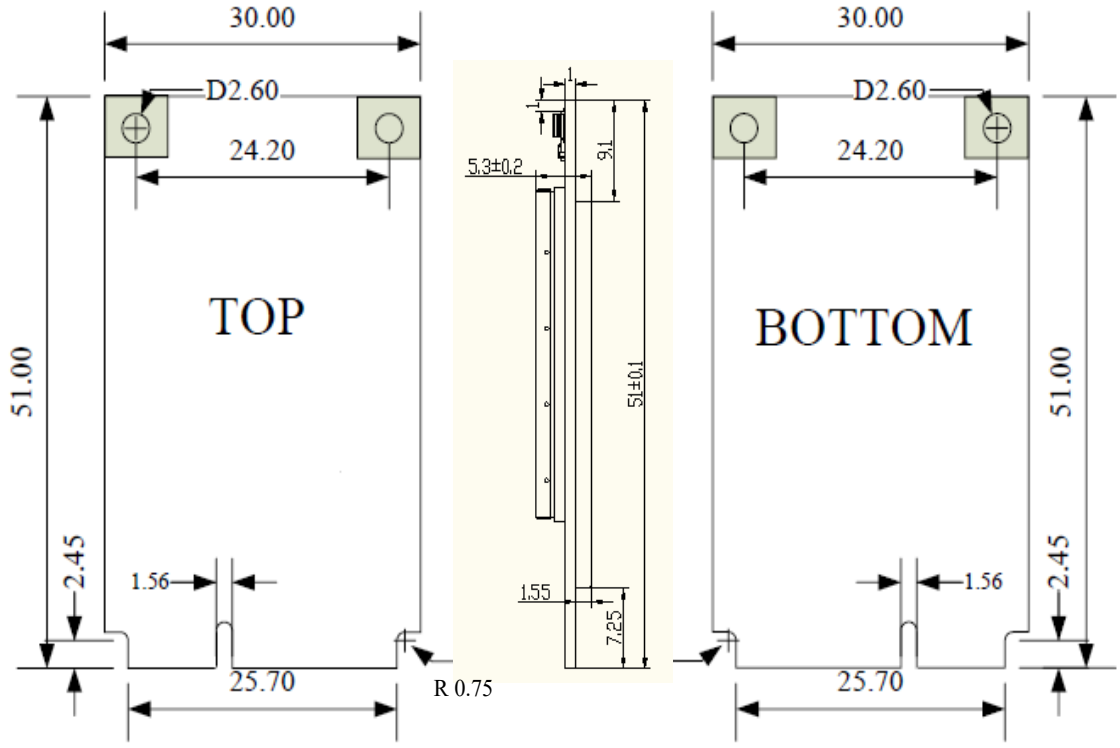
Table 6-1 N720 dimensions

Specifications	**N720**
Dimensions (H x W x D)	(28±0.1) mm x (30±0.1) mm x (2.8±0.1) mm
Weight	5.1g
Package	100-Pin LGA

Table 6-2 N720 Mini PCIe dimensions

Specifications	**N720 Mini PCIe**
Dimensions (H * W * D)	(30±0.1)mm* (51±0.1) mm* (5.3±0.15)mm
Weight	11.2g
Package	52-Pin Mini PCIe

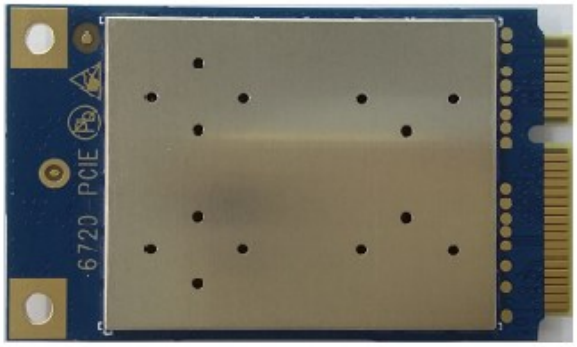
Figure 6-1 N720 Mini PCIe dimensions



6.2 N720 Mini PCIe Pictures

Figure 6-2 Top view of N720 Mini PCIe

Figure 6-3 Bottom view of N720 Mini PCIe



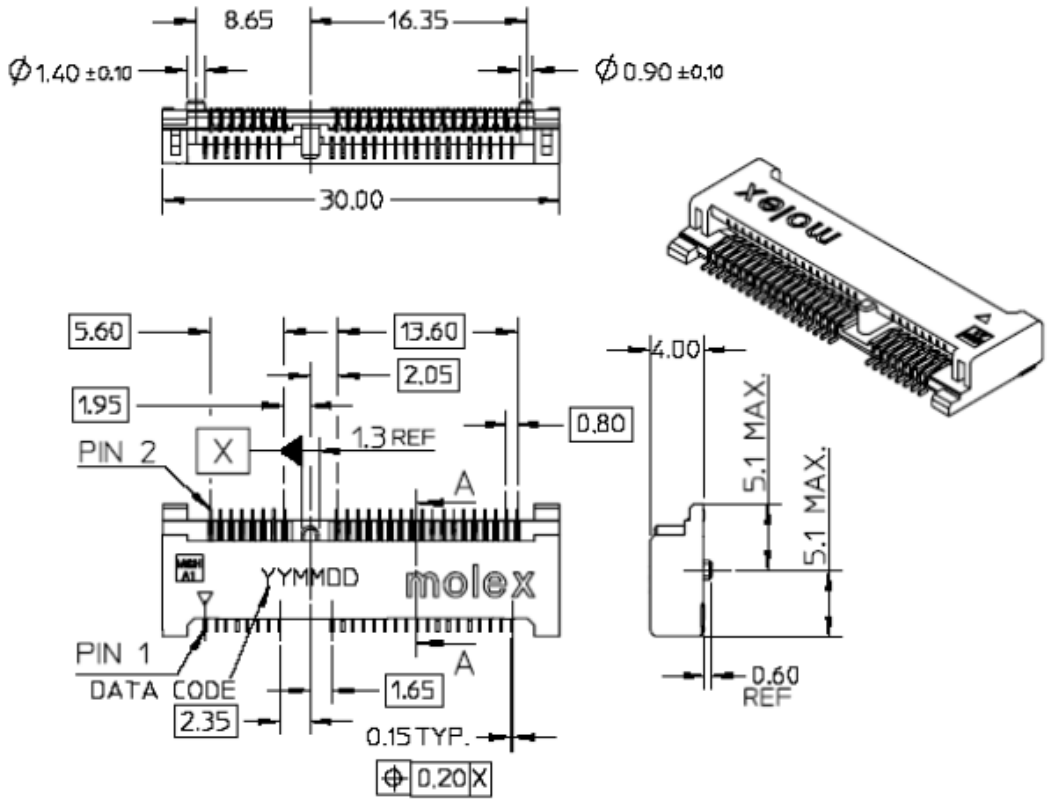
CAUTION

The color of the PCB board in the above figures will not be the acceptance criteria.

7 Mounting

The N720 Mini PCIe module complies with PCI Express Mini Card 1.2 standard. It is mounted onto the Mini PCIe card connector by plugging in directly. The following figure shows the dimensions of Mini PCIe connector 679100002 from Molex.

Figure 7-1 Mini PCIe card connector



8 Packaging and Storage

8.1 Packaging

N720 Mini PCIe modules are packaged in vacuum tin foil bags using trays together with desiccant and humidity indicating card on delivery to guarantee a long shelf life.

Figure 8-1 N720 Mini PCIe packaging

8.2 Storage

Storage temperature: 20°C~26°C
Storage humidity: 40%-60%
Storage date: 120 days

