MI993F

AMD Ryzen™ Embedded R-Series
Mini-ITX Motherboard

User's Manual

Version 1.0
(May 2023)

Compliance

CE

This is a class B product. In a domestic environment, this product may cause radio interference in which case users may be required to take adequate measures.

FC

This product has been tested and found to comply with the limits for a Class B 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 manufacturer's instructions, may cause harmful interference to radio communications.

WEEE

This product must not be disposed of as normal household waste, in accordance with the EU directive of for waste electrical and electronic equipment (WEEE - 2012/19/EU). Instead, it should be disposed of by returning it to a municipal recycling collection point. Check local regulations for disposal of electronic products.

Green IBASE

This product is compliant with the current RoHS restrictions and prohibits use of the following substances in concentrations exceeding 0.1% by weight (1000 ppm) except for cadmium, limited to 0.01% by weight (100 ppm).

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (Cr6+)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)

Important Safety Information

Carefully read the precautions before using the board.

Environmental conditions:

- Use this product in environments with ambient temperatures between 0˚C and 60˚C.
- Do not leave this product in an environment where the storage temperature may be below -20° C or above 80° C. To prevent from damages, the product must be used in a controlled environment.

Care for your IBASE products:

- Before cleaning the PCB, unplug all cables and remove the battery.
- Clean the PCB with a circuit board cleaner, degreaser, or use cotton swabs and alcohol.
- Vacuum the dust with a computer vacuum cleaner to prevent the fan from being clogged.

WARNING

Attention during use:

- Do not use this product near water.
- Do not spill water or any other liquids on this product.
- Do not place heavy objects on the top of this product.

Anti-static precautions

- Wear an anti-static wrist strap to avoid electrostatic discharge.
- Place the PCB on an anti-static kit or mat.
- Hold the edges of PCB when handling.
- Touch the edges of non-metallic components of the product instead of the surface of the PCB.
- Ground yourself by touching a grounded conductor or a grounded bit of metal frequently to discharge any static.

CAUTION

Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions or recycle them at a local recycling facility or battery collection point.

Warranty Policy

- **IBASE standard products:**

  24-month (2-year) warranty from the date of shipment. If the date of shipment cannot be ascertained, the product serial numbers can be used to determine the approximate shipping date.

- **3rd-party parts:**

  12-month (1-year) warranty from delivery for the 3rd-party parts that are not manufactured by IBASE, such as CPU, CPU cooler, memory, storage devices, power adapter, panel and touchscreen.

* PRODUCTS, HOWEVER, THAT FAIL DUE TO MISUSE, ACCIDENT, IMPROPER INSTALLATION OR UNAUTHORIZED REPAIR SHALL BE TREATED AS OUT OF WARRANTY AND CUSTOMERS SHALL BE BILLED FOR REPAIR AND SHIPPING CHARGES.

Technical Support & Services

1. Visit the IBASE website at www.ibase.com.tw to find the latest information about the product.
2. If you need any further assistance from your distributor or sales representative concerning problems that you may have encountered, please prepare the following information:
   - Product model name
   - Product serial number
   - Detailed description of the problem
   - The error messages in text or in screenshots if there is any
   - The arrangement of the peripherals
   - Software in use (such as OS and application software, including the version numbers)
3. If repair service is required, please log in to the RMA system of the website or and contact your distributor or sales representative for assistance.

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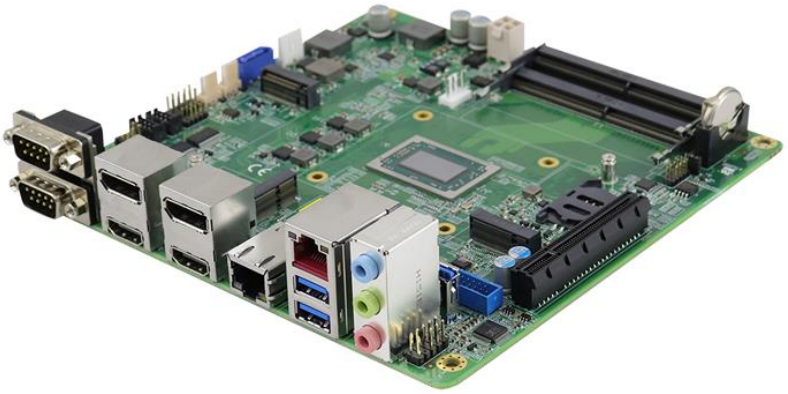
Chapter 1
General Information

The information provided in this chapter includes:

- Features
- Packing List
- Specifications
- Block Diagram
- Product View
- Board Dimensions

1.1 Introduction

MI993F is a mini-ITX motherboard based on the AMD Ryzen™ R-series APU (R2514/R2314/ R2312). The AMD Ryzen™ Embedded R2000 processor family is built on the groundbreaking “Zen 2” x86 core architecture with innovative 7nm process technology and optimized high-performance Radeon™ graphics in an SoC design. Featuring up to 8 cores and 16 threads, the R2000 Series provides unprecedented performance levels, significant design enhancements, and incredible power efficiency for embedded applications.



1.2 Features

- AMD Ryzen™ Next-Gen of R2000 Series on board
- 2x DDR4 SO-DIMM, Max. 32GB, ECC compatible
- Dual Intel® 2.5G LAN
- 2x HDMI (2.0b), 2x DisplayPort 1.4
- 5x USB 3.1, 2x USB 2.0, 4x COM, 1x SATA III
- 1x PCI-E (x8), 3x M.2 (B-Key, E-Key and M-Key)
- Watchdog timer, Digital I/O, TPM (2.0)

1.3 Packing List

Your product package should include the items listed below. If any of the items below is missing, contact the distributor or dealer from whom you have purchased the product.

- MI993F Motherboard
- I/O Shield
- SATA Cable (SATA-12B)
- Power Cable (PW129)

1.4 Optional Accessories

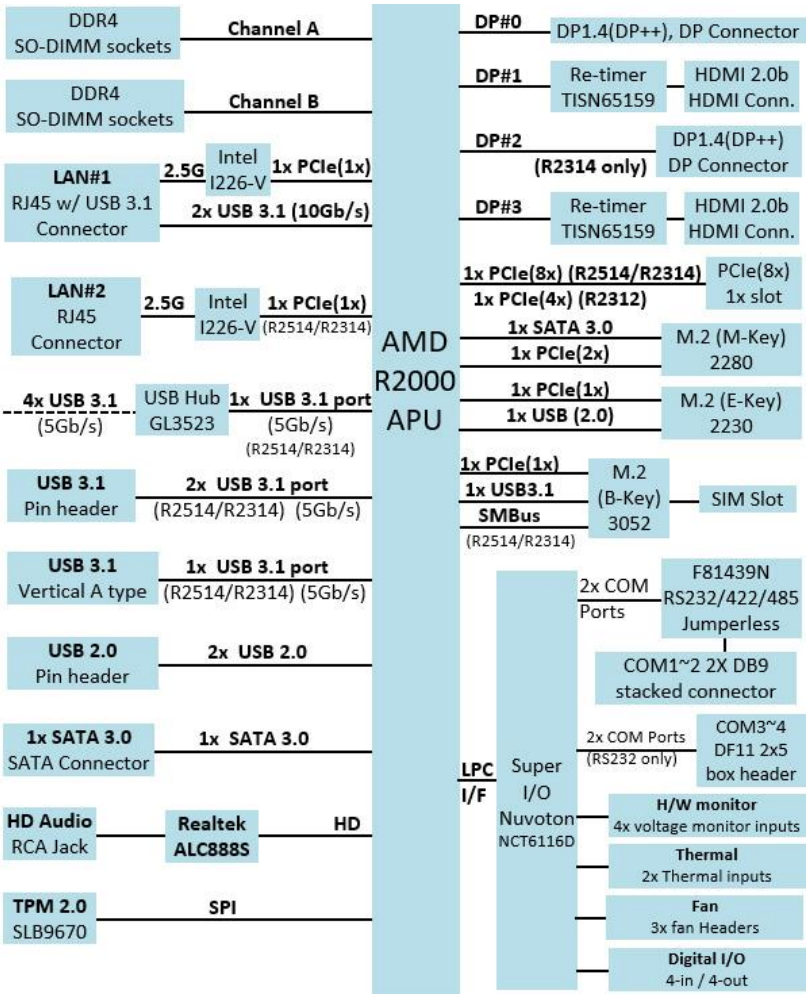
IBASE provides optional accessories as listed below.

- Power Adaptor (150W)
- COM Port Cable (PK1H)
- Audio Cable (Audio-34)

1.5 Specifications

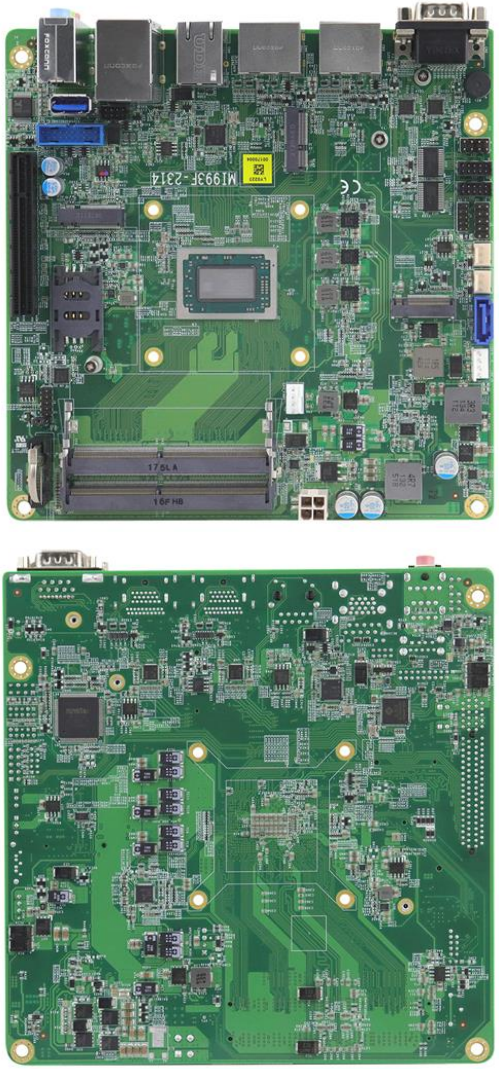
Product Name	MI993F
Form Factor	Mini-ITX motherboard
System	
Operating System	• Windows 10 (64-bit) • Linux
CPU & Chipset	AMD Ryzen™ Embedded R2000 APU onboard
Memory	2 x DDR4-2667 SO-DIMM, expandable up to 32 GB, ECC compatible
Storage	3x M.2 (B-Key/ M-key/ M-Key)
Graphics	AMD Vega GPU integrated
Ethernet	• LAN#1 1x Intel® I226-V PCI-E 2.5G (R2514/R2314/ R2312) • LAN#2 1x Intel® I226-V PCI-E 2.5G (R2514/ R2314)
Super I/O	Nuvoton NCT6116D
Serial Port	4x COM: 2x RS232/422/485, 2x RS232
USB 2.0	2x USB 2.0 via pin header
USB 3.1	2x USB3.1 @ edge connector; 2x USB3.1 via onboard box-header 1x USB3.1 thru onboard connector (R2514 & R2314)
Audio Codec	Built-in HD audio controller with ALC888S codec
TPM	2.0
Others	Digital I/O, SIM slot, Watchdog timer
SATA	1x SATA 3.0
Dimensions	170 x 170 mm (6.7” x 6.7”)
RoHS	Yes
Certification	CE, FCC Class B, LVD
Environment	
Temperature	• Operating: 0 ~ 60 °C (32 ~ 140 °F) • Storage: -20 ~ 80 °C (-4 ~ 176 °F)
Relative Humidity	0 ~ 90 %, non-condensing at 60 °C

1.6 Block Diagram



1.7 Product View

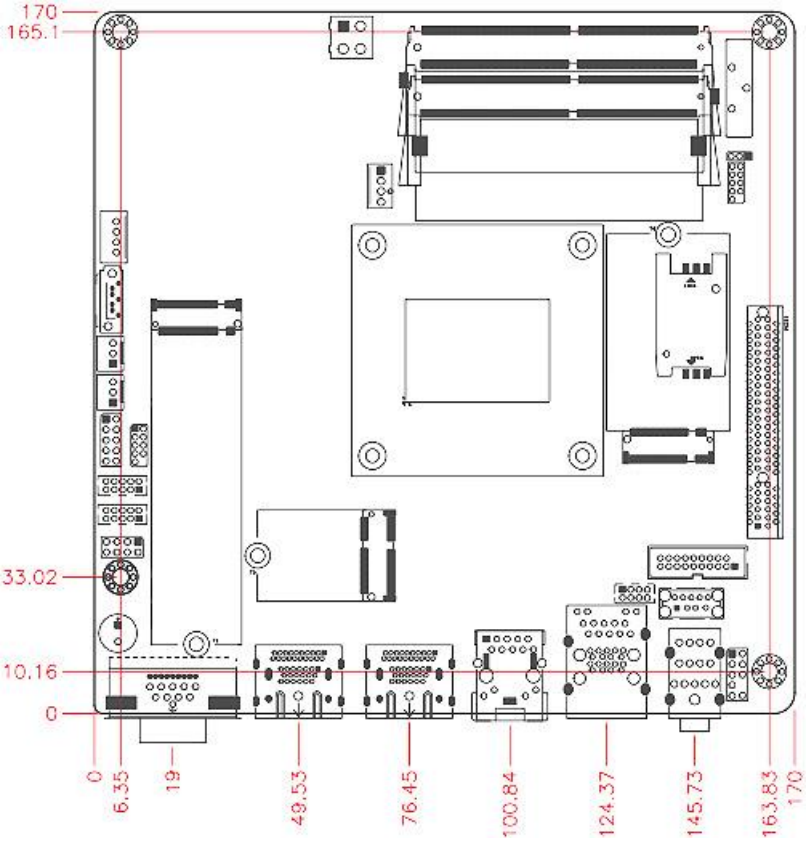
Top View



I/O View

No.	Name
1	COM1 & COM2 RS-232/422/485 Ports (CN2)
2	DisplayPort & HDMI Port (CN3)
3	DisplayPort & HDMI Port (CN4)
4	2.5 Gigabit LAN (Intel I226-V) (CN5)
5	2.5 Gigabit LAN (Intel I226-V) + USB3.1 (CN6)
6	HD Audio Connector (CN7)

1.8 Dimensions



Chapter 2
Hardware Configuration

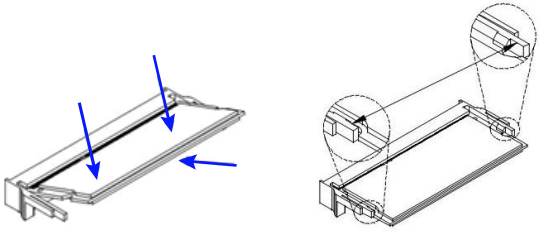
This section provides information on jumper settings and connectors on the board in order to set up a workable system. On top of that, you will also need to install crucial pieces such as the CPU and the memory before using the product. The topics covered are:

- Memory installation
- Jumper and connector locations
- Jumper settings and connectors information

2.1 Installations

2.1.1 Installing the Memory

To install the modules, locate the memory slot on the board and perform the following steps:



1. Align the key of the memory module with that on the memory slot and insert the module slantwise.
2. Gently push the module in an upright position until the clips of the slot close to hold the module in place when the module touches the bottom of the slot.

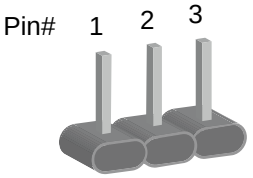
To remove the module, press the clips outwards with both hands, and the module will pop-up.

2.2 Setting the Jumpers

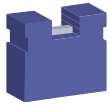
Set up and configure your board by using jumpers for various settings and features according to your needs and applications. Contact your supplier if you have doubts about the best configuration for your use.

2.2.1 How to Set Jumpers

Jumpers are short-length conductors consisting of several metal pins with a non-conductive base mounted on the circuit board. Jumper caps are used to have the functions and features enabled or disabled. If a jumper has 3 pins, you can connect either PIN1 to PIN2 or PIN2 to PIN3 by shorting.

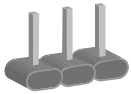
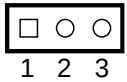
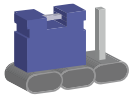
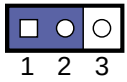
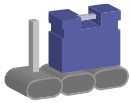
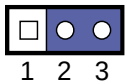


A 3-pin jumper



A jumper cap

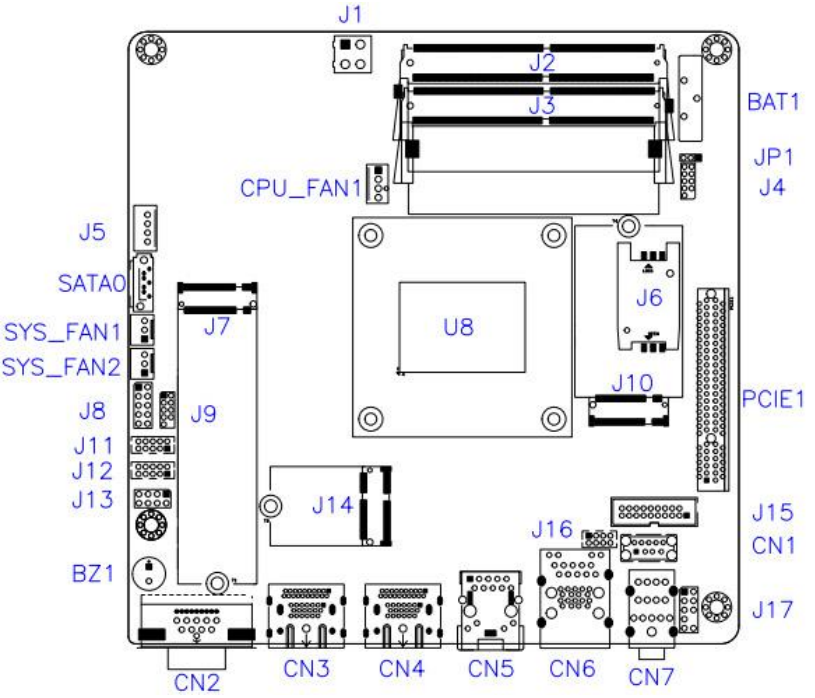
Refer to the illustration below to set jumpers.

Pin closed	Oblique view	Illustration
Open		
1-2		
2-3		

When two pins of a jumper are encased in a jumper cap, this jumper is **closed**, i.e. turned **On**.

When a jumper cap is removed from two jumper pins, this jumper is **open**, i.e. turned **Off**.

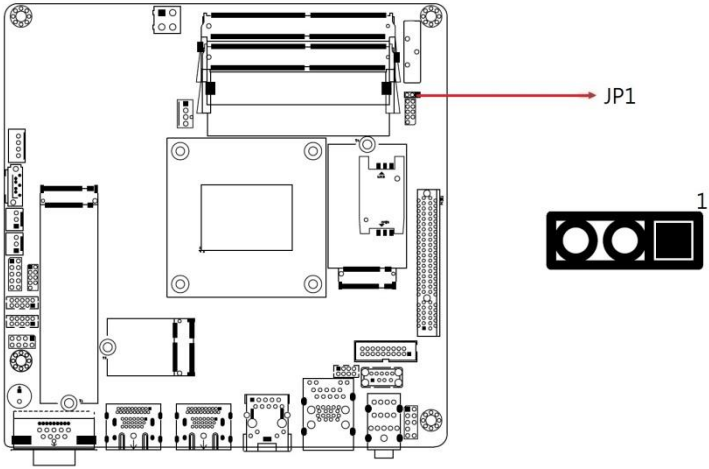
2.3 Jumper & Connector Locations on MI993F

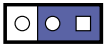


2.4 Jumpers Quick Reference

Function	Jumper	Page
Clear CMOS Data	JP1	13

2.4.1 Clear CMOS Data (JP1)



Function	Pin closed	Jumper
Normal (default)	1-2	 1
Clear CMOS	2-3	 1

2.5 Connector Quick Reference

Function	Connector	Page
DC-In Power Connector	J1	15
SPI Flash Connector (factory use only)	J4	15
SATA Power Connector	J5	16
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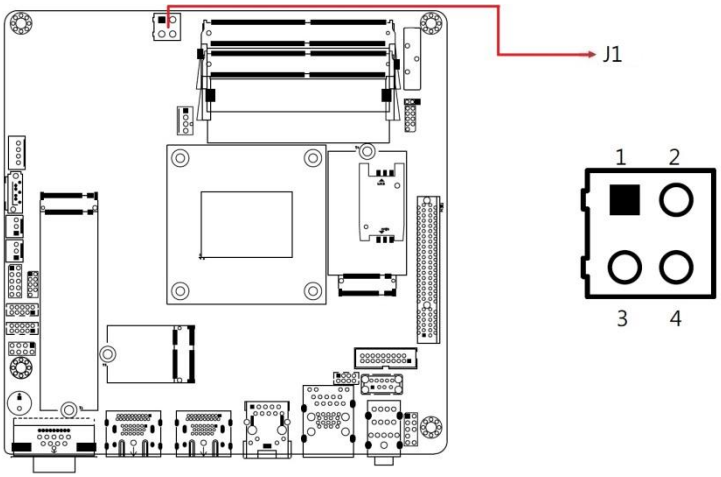
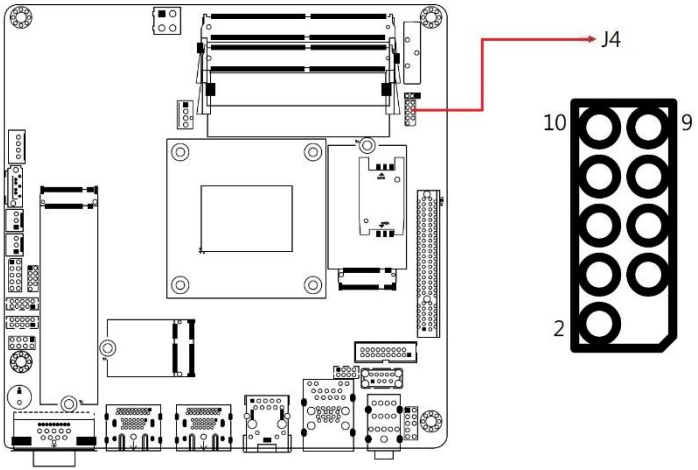
Digital I/O Connector	J8	17
80 Port Debug (factory use only)	J9	18
M.2 B-Key (3052) Slot	J10	18
COM3 & COM4 RS-232 Ports	J12, J11	19
Front Panel Settings Connector	J13	20
M.2 E-Key (2230) Slot	J14	21
USB 3.1 Connectors	J15	22
USB 2.0 Connector	J16	23
Audio Connector for Chassis Front Panel	J17	24
USB 3.1 Connector	CN1	24
COM1 & COM2 RS-232/422/485 Ports	CN2	7, 25
DisplayPort & HDMI Port	CN3	7, 26
DisplayPort & HDMI Port	CN4	7, 26
2.5 Gigabit LAN (Intel I226-V)	CN5	7, 27
2.5 Gigabit LAN (Intel I226-V) + USB3.1	CN6	7, 27
HD Audio Connector	CN7	7, 28
SATA III Connector	SATA0	28
Fan Power Connectors	CPU_FAN1, SYS_FAN1, SYS_FAN2	29
PCIe (x8) Slot	PCIE1	30

2.5.1 DC-In Power Connector (J1)

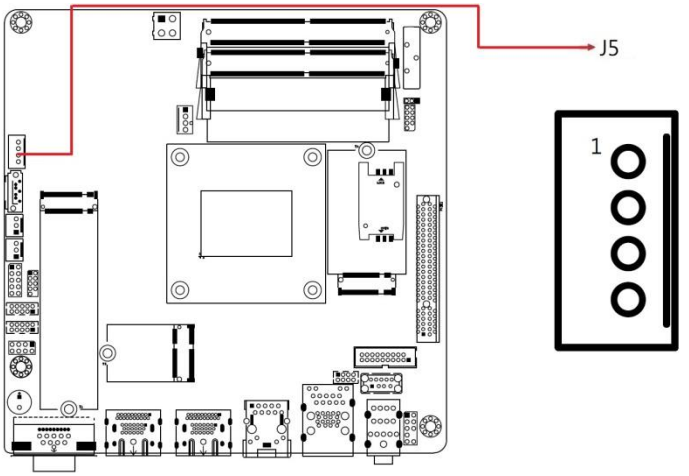


Pin	Signal Name	Pin	Signal Name
1	Ground	2	Ground
3	+12 ~ +24V	4	+12 ~ +24V

2.5.2 SPI Flash Connector (factory use only) (J4)

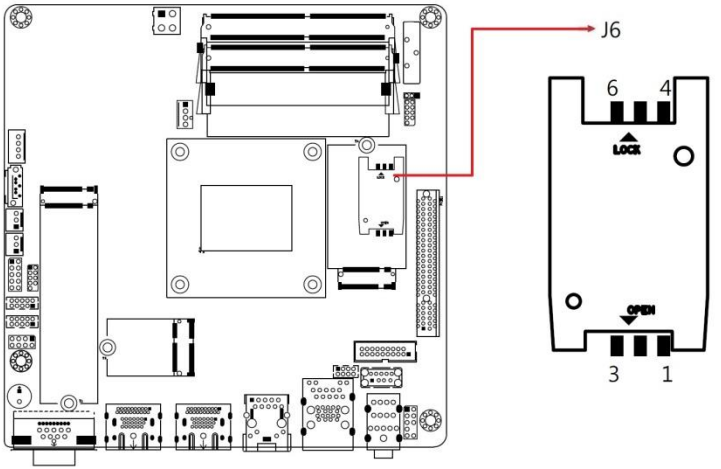


2.5.3 SATA Power Connector (J5)

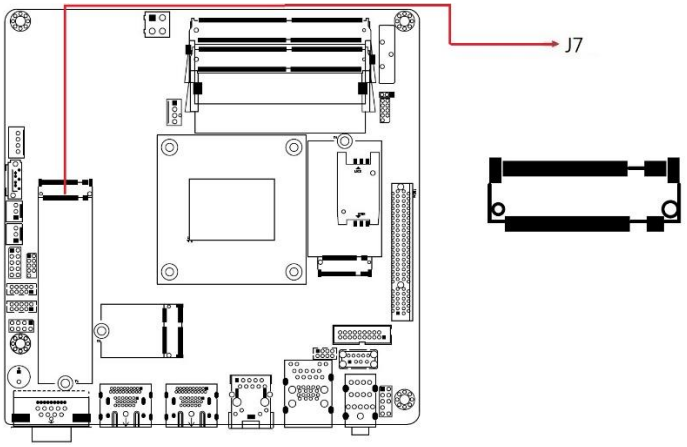


Pin	Signal Name	Pin	Signal Name
1	+5V	3	Ground
2	Ground	4	+12V

2.5.4 SIM Slot (J6)

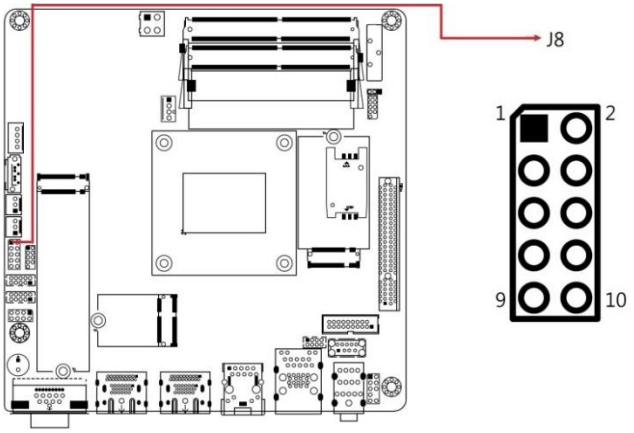


2.5.5 M.2 M-Key (2280) Slot (J7)



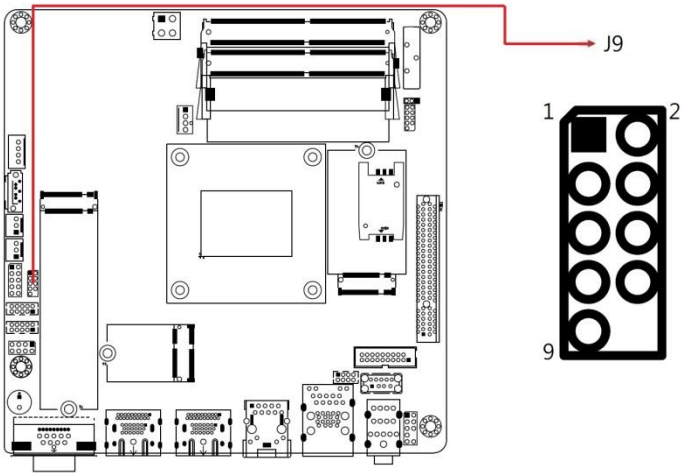
Note: J7 supports SATA & PCIE x2

2.5.6 Digital I/O Connector (J8)

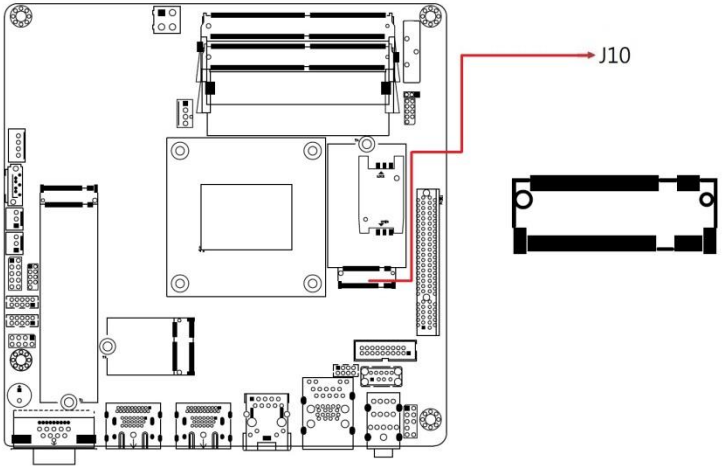


Pin	Signal Name	Pin	Signal Name
1	Ground	2	+5V
3	OUT3	4	OUT1
5	OUT2	6	OUT0
7	IN3	8	IN1
9	IN2	10	IN0

2.5.7 80 Port Debug (factory use only) (J9)

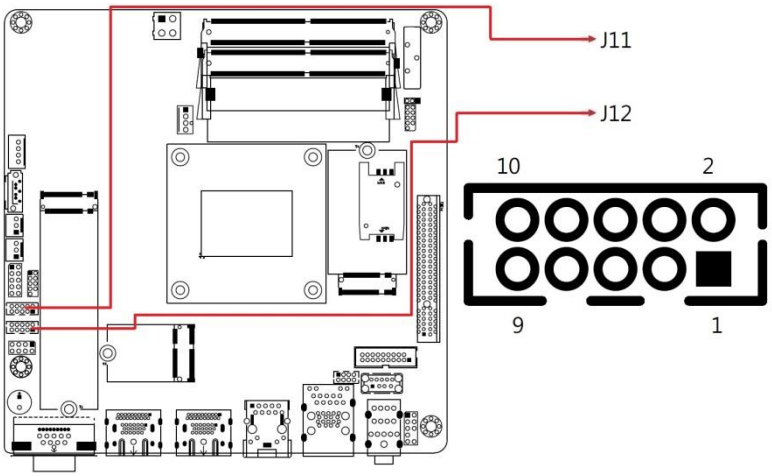


2.5.8 M.2 B-Key (3052) Slot (J10)



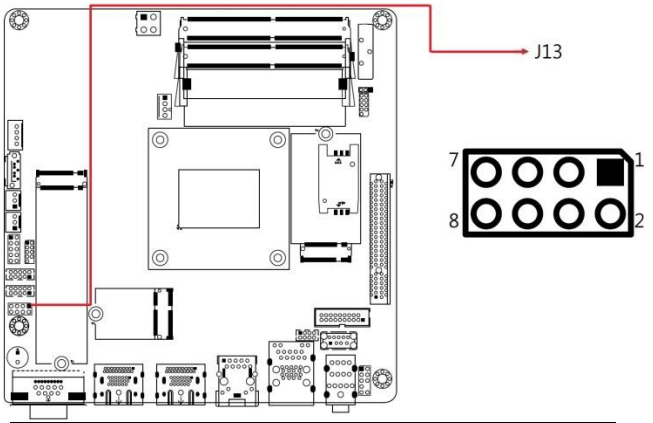
Note: J10 supports Sierra EM919X 5G module.

2.5.9 COM3 & COM4 RS-232 Ports (J12, J11)



Pin	Signal Name	Pin	Signal Name
1	DCD, Data carrier detect	2	RXD, Receive data
3	TXD, Transmit data	4	DTR, Data terminal ready
5	Ground	6	DSR, Data set ready
7	RTS, Request to send	8	CTS, Clear to send
9	RI, Ring indicator	10	Not Used

2.5.10 Front Panel Settings Connector (J13)



Pin	Signal Name	Pin	Signal Name
1	Power BTN-	2	Power BTN+
3	HDD LED+	4	HDD LED-
5	Reset BTN-	6	Reset BTN+
7	Power LED+	8	Power LED-

J13 is utilized for system indicators to provide light indication of the computer activities and switches to change the computer status. It provides interfaces for the following functions.

- **ATX Power ON Switch (Pins 1 and 2)**

  The 2 pins make an “ATX Power Supply On/Off Switch” for the system that connects to the power switch on the case. When pressed, the power switch will force the system to power on. When pressed again, it will power off the system.

- **Hard Disk Drive LED Connector (Pins 3 and 4)**

  This connector connects to the hard drive activity LED on control panel. This LED will flash when the HDD is being accessed.

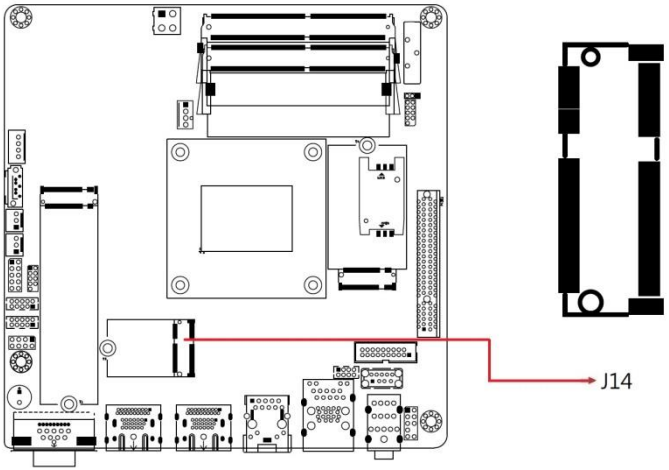
- **Reset Switch (Pins 5 and 6)**

  The reset switch allows you to reset the system without turning the main power switch off and then on again. Orientation is not required when making a connection to this header.

- **Power LED (Pins 7 and 8)**

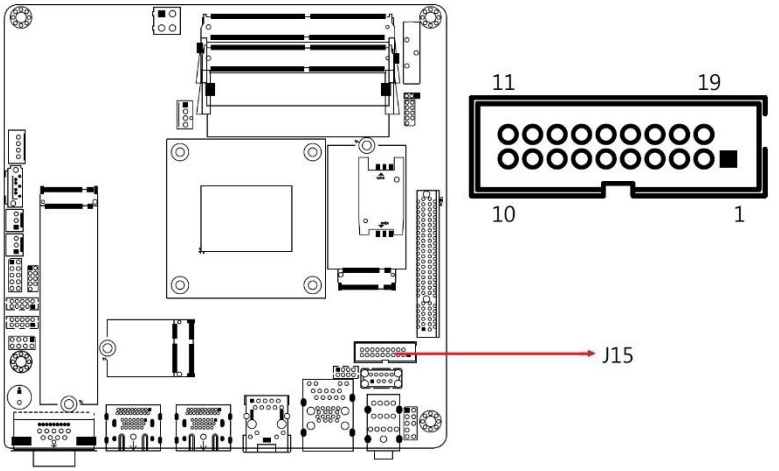
  This connector connects to the system power LED on control panel. This LED will light when the system turns on.

2.5.11 M.2 E-Key (2230) Slot (J14)



Note: J14 supports USB 2.0 & PCIE x1.

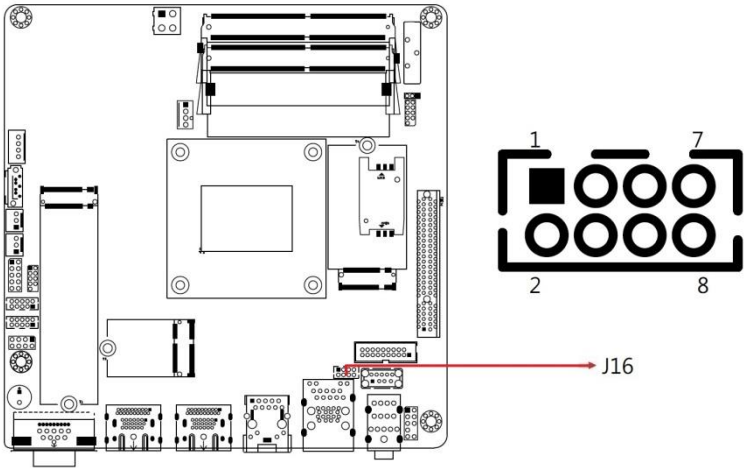
2.5.12 USB3.1 Connectors (J15)



Note: J15: PINREX_52X-40-20GU52

Pin	Signal Name	Pin	Signal Name
1	VCC(900mA)	X	
2	P1_SSRX-	19	VCC(900mA)
3	P1_SSRX+	18	P2_SSRX-
4	GND	17	P2_SSRX+
5	P1_SSTX-	16	GND
6	P1_SSTX+	15	P2_SSTX-
7	GND	14	P2_SSTX+
8	P1_U2_D-	13	GND
9	P1_U2_D+	12	P2_U2_D-
10	NC	11	P2_U2_D+

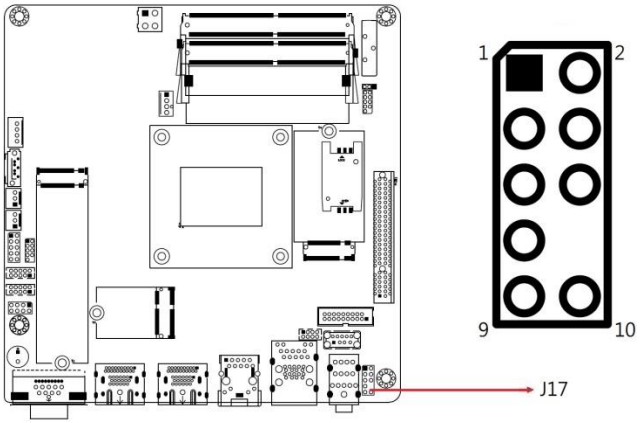
2.5.13 USB2.0 Connector (J16)



Note: J16: DF11-8S-PA66H

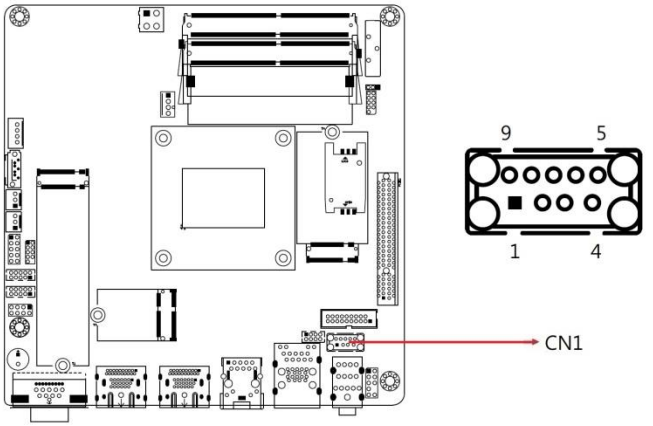
Pin	Signal Name	Pin	Signal Name
1	VCC(0.5A)	2	Ground
3	D0+	4	D1+
5	D0-	6	D1-
7	GND	8	Vcc(0.5A)

2.5.14 Audio Connector for Chassis Front Panel (J17)

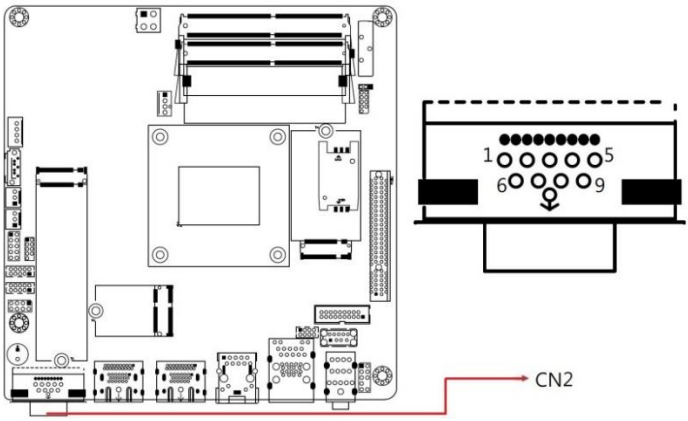


Pin	Signal Name	Pin	Signal Name
1	MIC IN_L	2	Ground
3	MIC IN_R	4	DET
5	LINE_IN_R	6	Sense Ground
7	Sense	8	KEY
9	LINE_IN_L	10	Sense Ground

2.5.15 USB 3.0 Connector (CN1)



2.5.16 COM1 & COM2 RS-232/422/485 Ports (CN2)

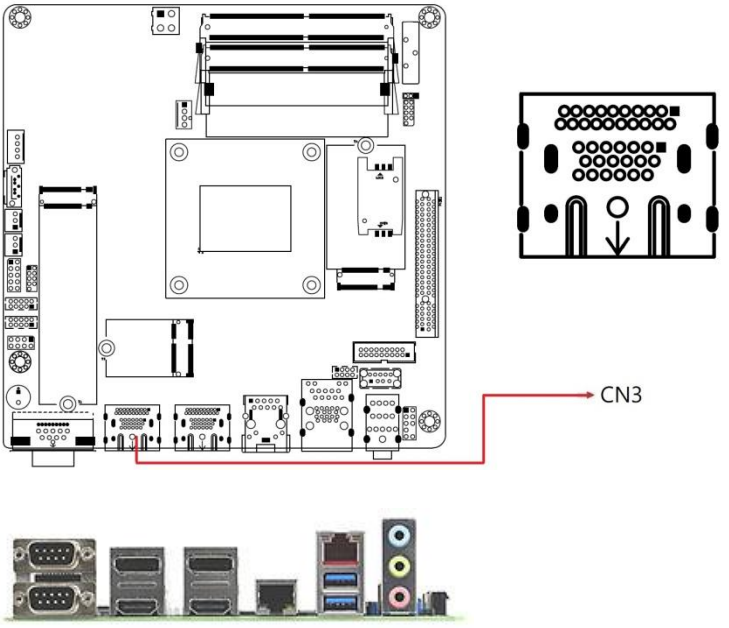


COM1 and **COM2** RS-232/422/485 ports are jumper-less and configurable in BIOS.

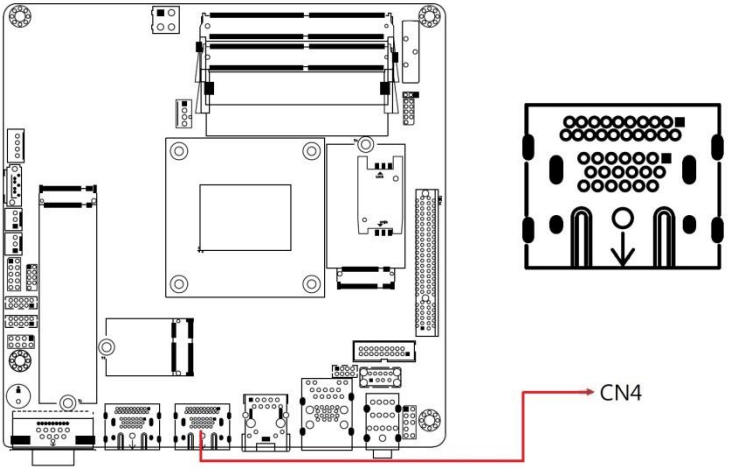
Pin	Signal Name	Pin	Signal Name
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	RI, Ring indicator
5	Ground		

Pin	Signal Name		
	RS-232	RS-422	RS-485
1	DCD	TX-	Data-
2	RXD	TX+	Data+
3	TXD	RX+	NC
4	DTR	RX-	NC
5	Ground	Ground	Ground
6	DSR	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	RI	NC	NC

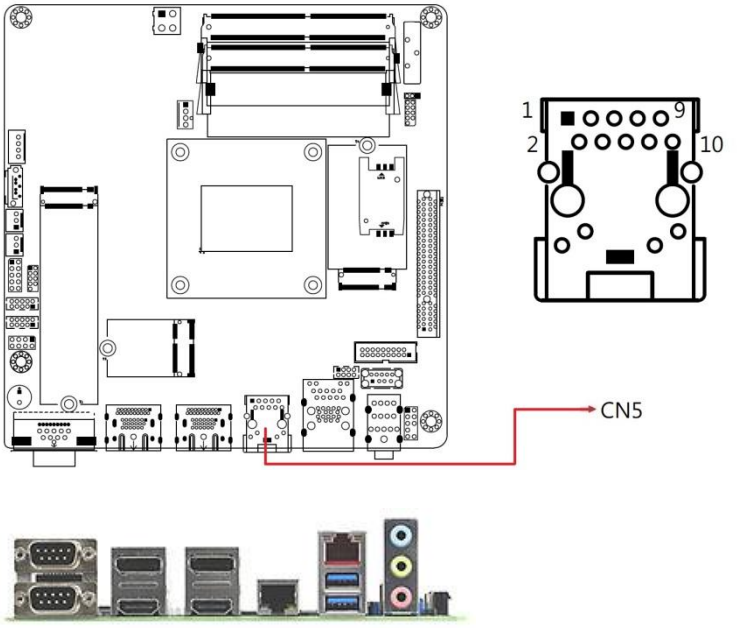
2.5.17 DisplayPort & HDMI Port (CN3)



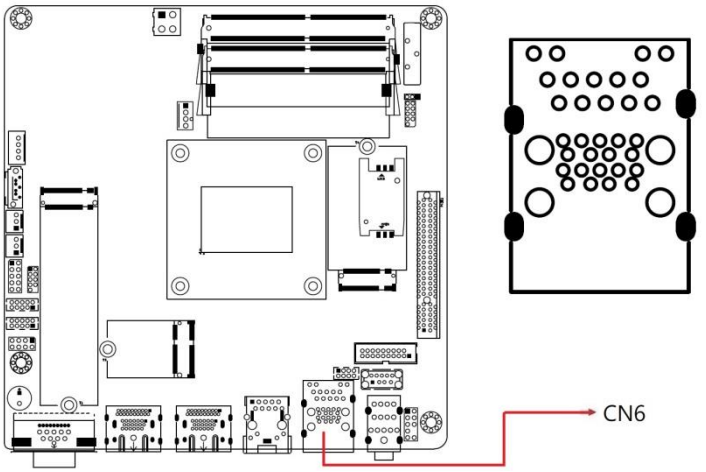
2.5.18 DisplayPort & HDMI Port (CN4)



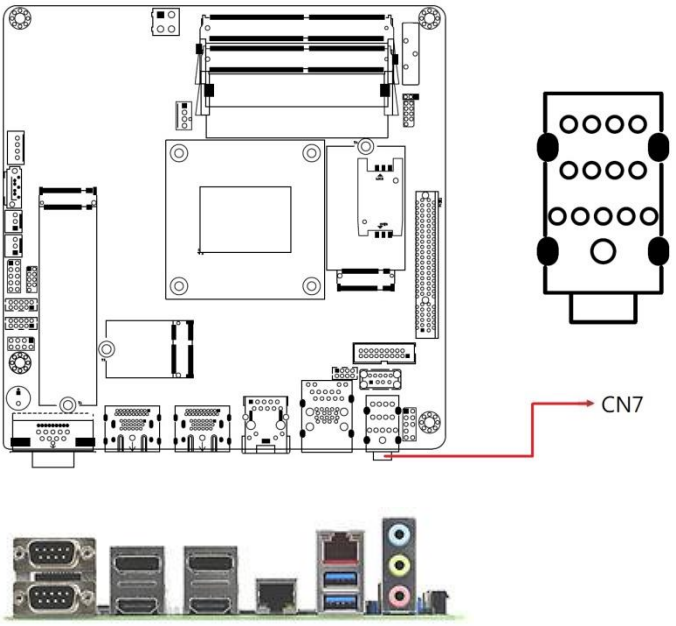
2.5.19 2.5 Gigabit LAN (Intel I226-V) (CN5)



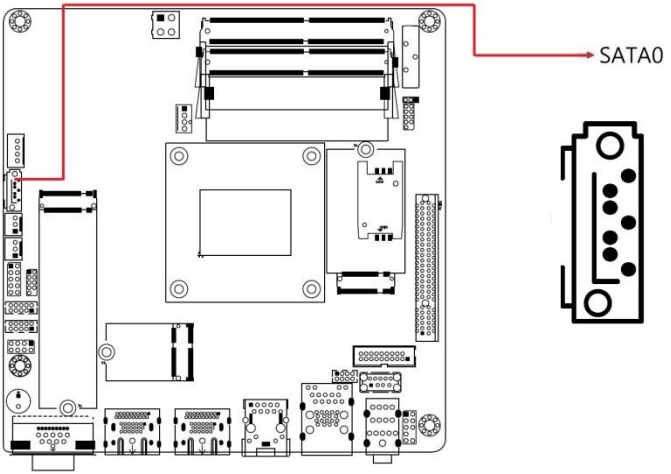
2.5.20 2.5 Gigabit LAN (Intel I226-V) + USB3.1 (CN6)



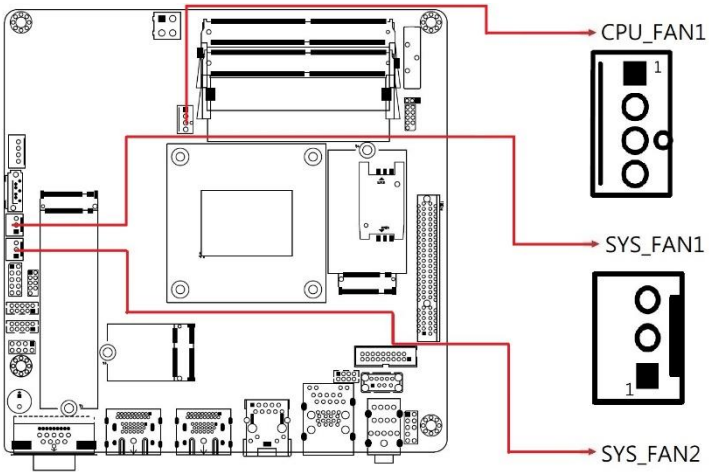
2.5.21 HD Audio Connector (CN7)



2.5.22 SATA III Connector (SATA0)



2.5.23 Fan Power Connectors (CPU_FAN1, SYS_FAN1, SYS_FAN2)



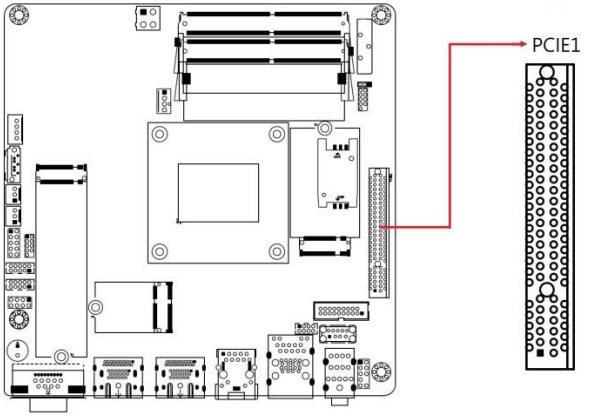
CPU_FAN1: CPU fan power connector

Pin	Signal Name	Pin	Signal Name
1	Ground	3	Rotation detection
2	+12V	4	Control

SYS_FAN1 & SYS_FAN2: System fan power connectors

Pin	Signal Name	Pin	Signal Name
1	Ground	3	Rotation detection
2	+12V		

2.5.24 PCIe (x8) Slot (PCIE1)



Chapter 3
Drivers Installation

This chapter introduces installation of the following drivers:

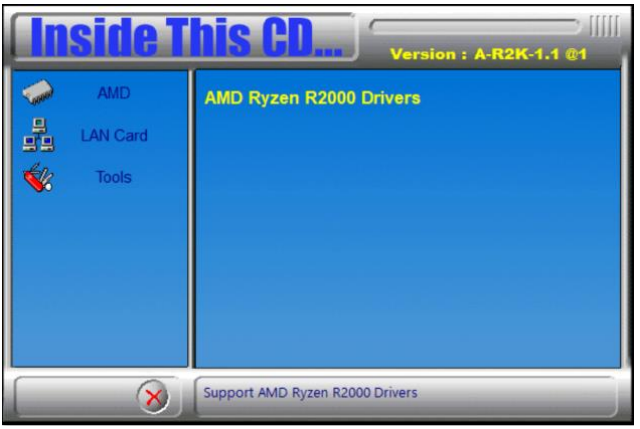
- AMD Ryzen™ R2000 Chipset Drivers
- AMD Ryzen™ R2000 Graphics Drivers
- Realtek High Definition Audio Driver
- Intel LAN Controller Drivers

3.1 Introduction

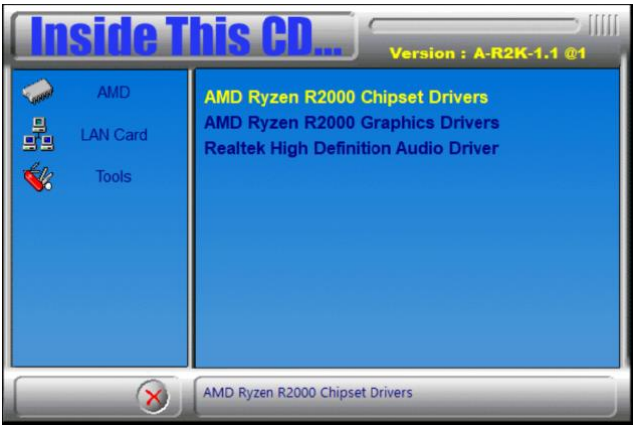
This section describes the installation procedures for software and drivers. The contents of this section include the following:

3.2 AMD Ryzen™ R2000 Chipset Drivers

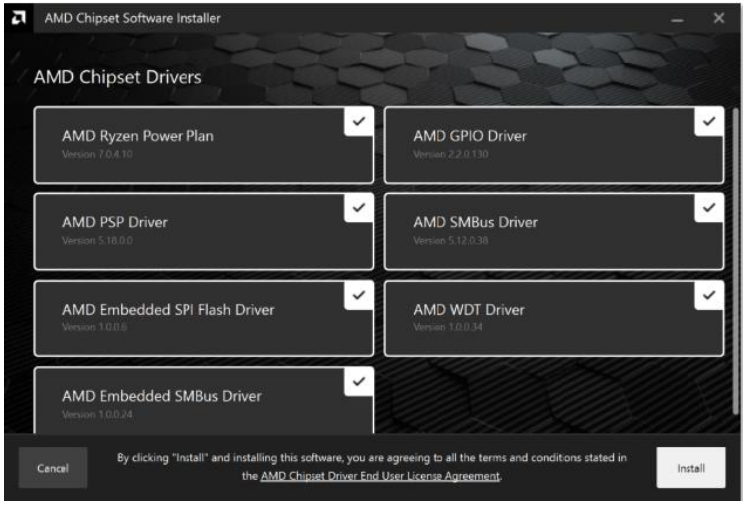
1. Go to the download page of the product. Copy the compressed drivers file to your computer. Double click the file to decompress it. Run "CDGuide" to go to the main drivers page as shown. Click **AMD** on the left pane and then **AMD Ryzen R2000 Drivers** on the right pane.



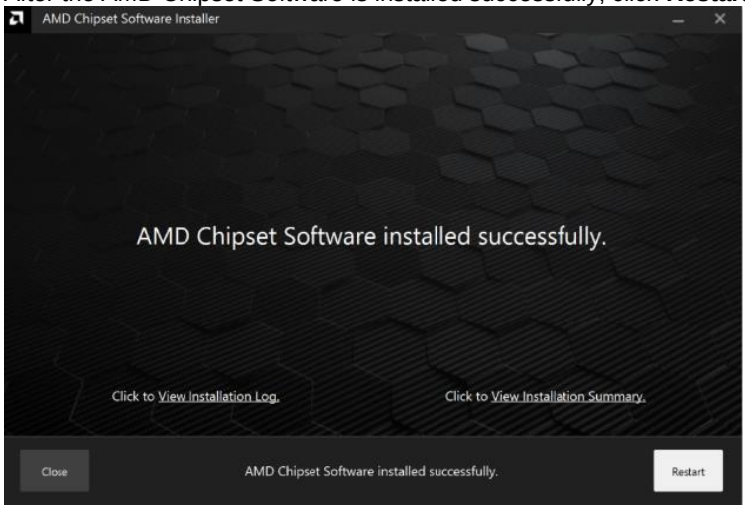
2. Click **AMD Ryzen R2000 Chipset Drivers**.



3. On the following screen (AMD Chipset Software Installer), click **Install.**

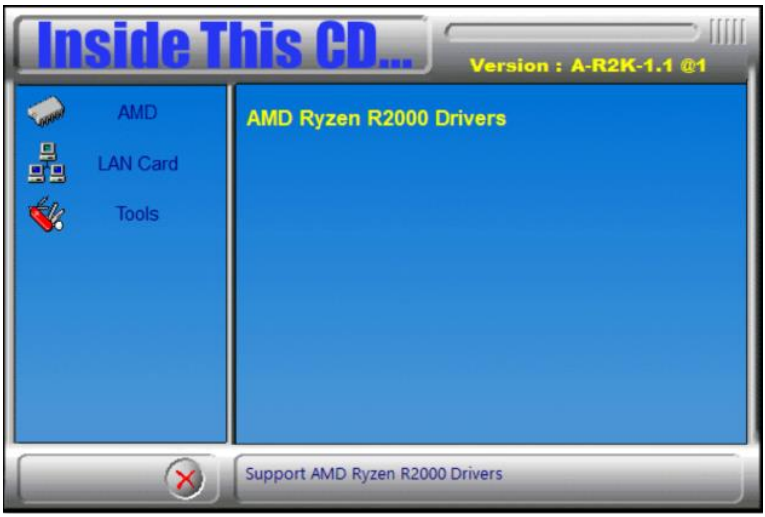


4. After the AMD Chipset Software is installed successfully, click **Restart**.

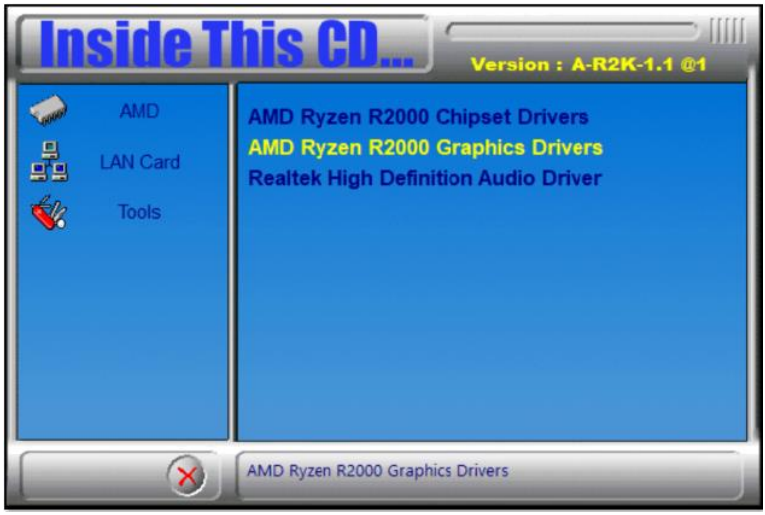


3.3 AMD Ryzen™ R2000 Graphics Drivers

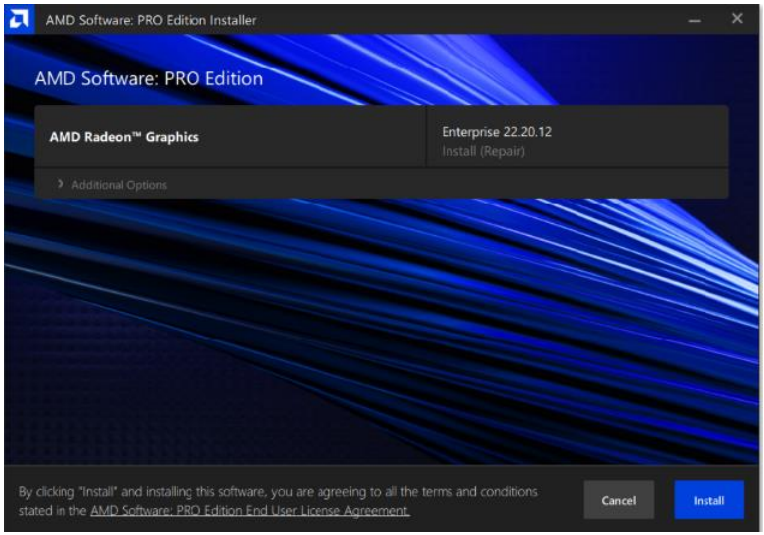
1. Click **AMD** on the left pane and then **AMD Ryzen R2000 Drivers** on the right pane.



2. Click **AMD Ryzen R2000 Graphics Drivers**.



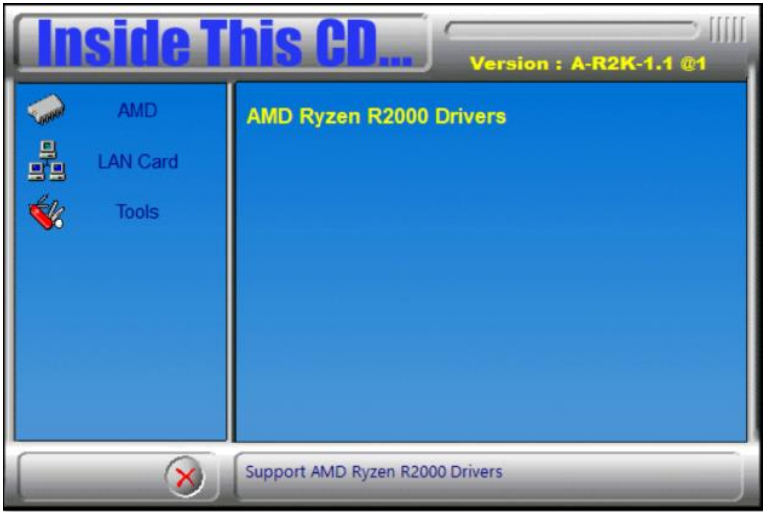
3. On the following screen (AMD Radeon PRO Software Installer), click **Install**.



4. To complete the installation process, click Restart.

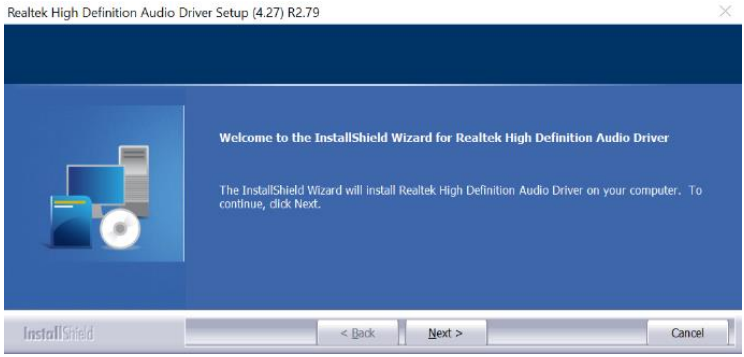
3.4 Realtek High Definition Audio Driver

1. Click **AMD** on the left pane and then **AMD Ryzen R2000 Drivers** on the right pane.

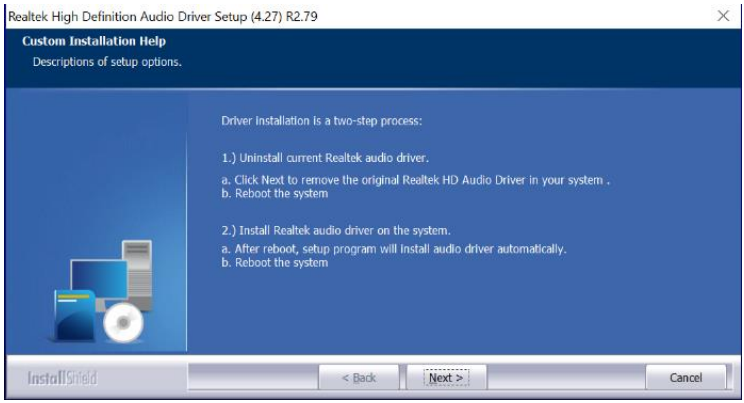


2. Click **Realtek High Definition Audio Driver**.

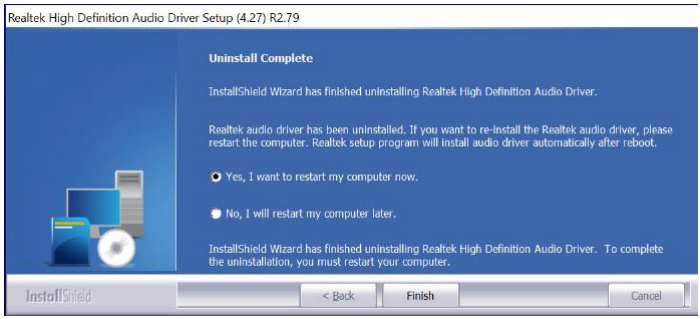
3. On the Welcome screen to the InstallShieldWizard for the audio driver, click **Next** to continue.



4. The next screen describes the setup options. Click **Next**.

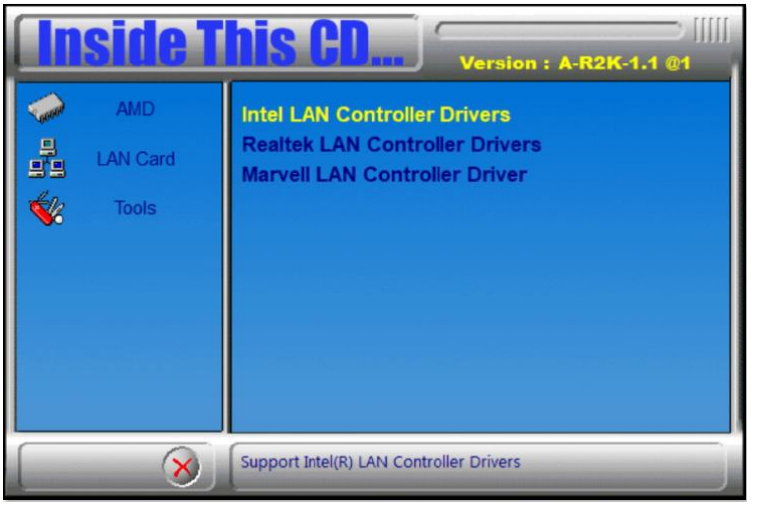


5. When the InstallShield Wizard has completed the audio driver installation, you must restart your computer.

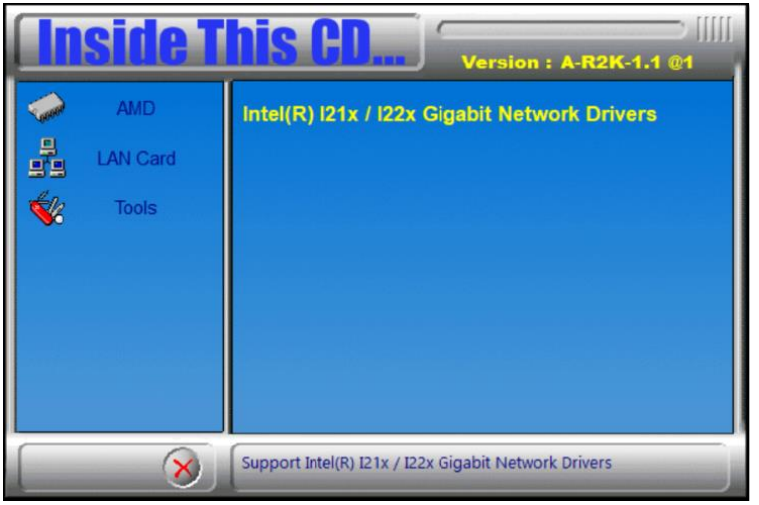


3.5 Intel LAN Controller Drivers

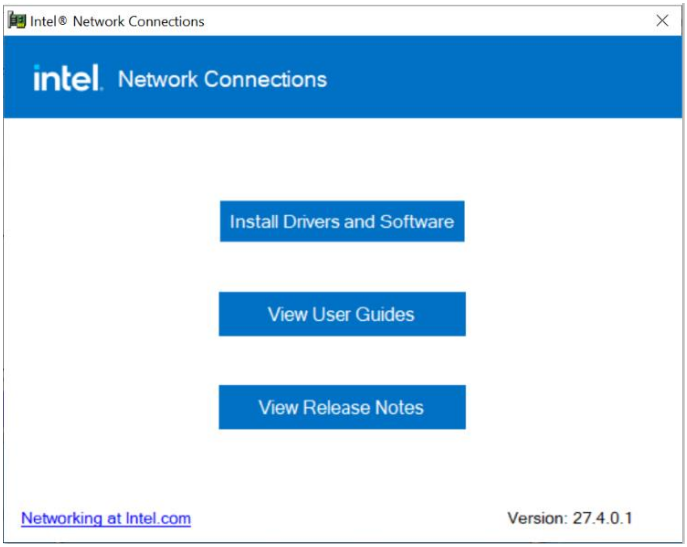
1. Click **LAN Card** on the left pane and then **Intel LAN Controller Drivers** on the right pane.



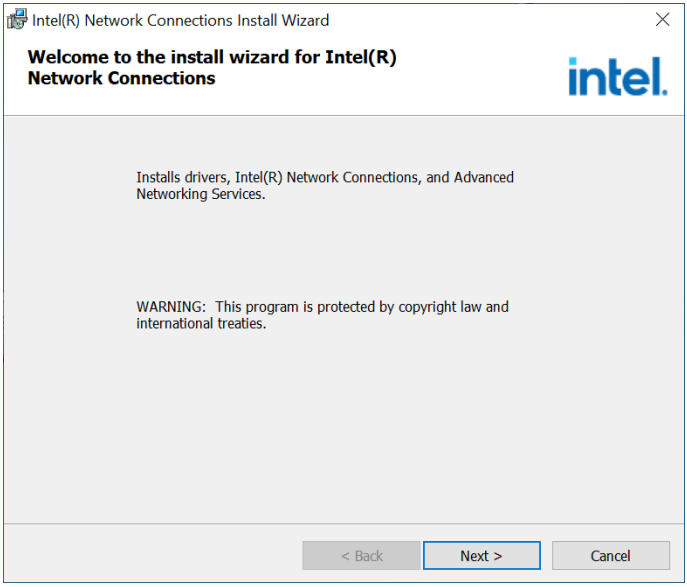
2. Click **Intel(R) I21x / I22x Gigabit Network Drivers**.



3. On the next screen, click **Install Drivers and Software** to continue.

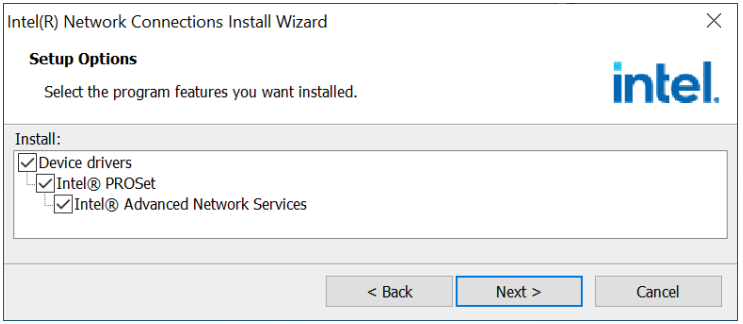


4. On the Welcome screen to the Install wizard for the Intel® Network Connections, click **Next**.

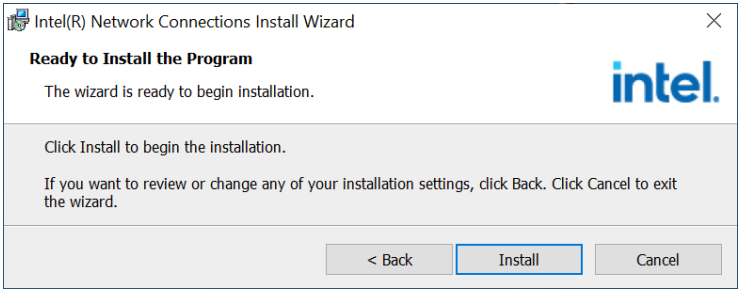


5. On the next screen, click Next to accept the terms in the license agreement.

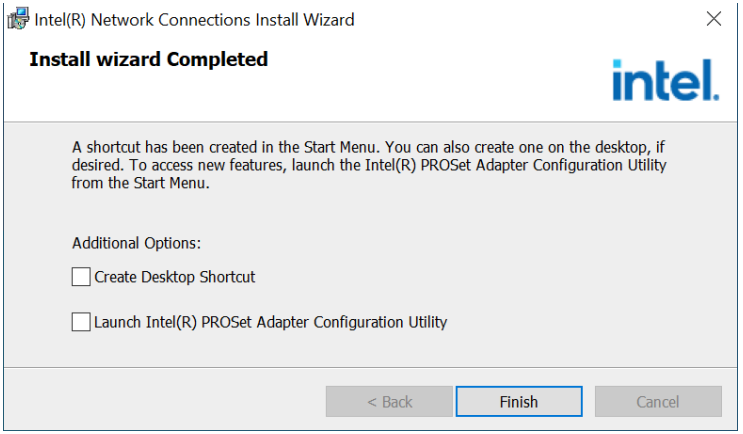
6. Select the program features to be **installed in the Setup Options** and click **Next**.



7. On the following screeen (Ready to Install the Program), click **Install** to begin the installation.



8. On the next screen (**Install wizard Completed**), click **Finish**.



Chapter 4
BIOS Setup

This chapter describes the different settings available in the AMI BIOS that comes with the board. The topics covered in this chapter are as follows:

- Main Settings
- Advanced Settings
- Chipset Settings
- Boot Settings
- Security Settings
- Save & Exit

4.1 Introduction

The BIOS (Basic Input/Output System) installed in the ROM of your computer system supports AMD APU. The BIOS provides critical low-level support for standard devices such as disk drives, serial ports and parallel ports. It also provides password protection as well as special support for detailed fine-tuning of the chipset controlling the entire system.

4.2 BIOS Setup

The BIOS provides a Setup utility program for specifying the system configurations and settings. The BIOS ROM of the system stores the Setup utility. When you turn on the computer, the BIOS is immediately activated. Press the <Del> key immediately allows you to enter the Setup utility. If you are a little bit late pressing the <Del> key, POST (Power On Self Test) will continue with its test routines, thus preventing you from invoking the Setup.

If you still need to enter Setup, restart the system by pressing the ”Reset” button or simultaneously pressing the <Ctrl>, <Alt> and <Delete> keys. You can also restart by turning the system Off and back On again.

The following message will appear on the screen:

```
Press  <DEL>  to  Enter  Setup
```

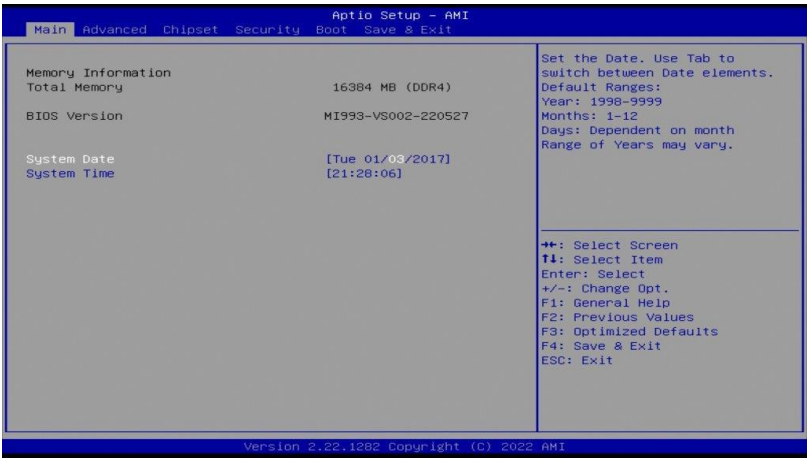
In general, press the arrow keys to highlight items, <Enter> to select, the <PgUp> and <PgDn> keys to change entries, <F1> for help, and <Esc> to quit.

When you enter the BIOS Setup utility, the *Main Menu* screen will appear on the screen. The Main Menu allows you to select from various setup functions and exit choices.

Warning: It is strongly recommended that you avoid making any changes to the chipset defaults.

These defaults have been carefully chosen by both AMI and your system manufacturer to provide the absolute maximum performance and reliability. Changing the defaults could make the system unstable and crash in some cases.

4.3 Main Settings

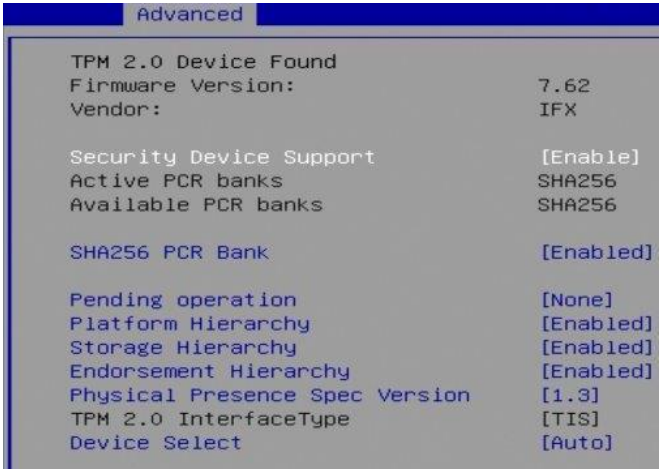


BIOS Setting	Description
System Date	Sets the date. Use the <Tab> key to switch between the date elements.
System Time	Set the time. Use the <Tab> key to switch between the time elements.

4.4 Advanced Settings

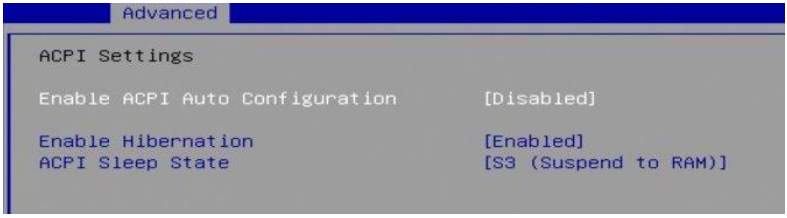
This section allows you to configure, improve your system and allows you to set up some system features according to your preference.

4.4.1 Trusted Computing



BIOS Setting	Description
Security Device Support	Enables / Disables BIOS support for security device. O.S. will not show security device. TCG EFI protocol and INT1A interface will not be available.
Pending operation	Schedule an operation for the security device. Note: Your computer will reboot during restart in order to change state of security device.
TPM2.0 UEFI Spec Version	Select the TCG2 Spec Version Support. TCG_1_2: the compatible mode for Win8/Win10. TCG_2: Support new TCG2 protocol and event format for Win10 or later.
Physical Presence Spec Version	Select to tell O.S. to support PPI Spec Version 1.2 or 1.3. Note: some HCK tests might not support 1.3.
Device Select	TPM 1.2 will restrict support to TPM 1.2 devices. TPM 2.0 will restrict support to TPM 2.0 devices. Auto will support both with the default set to TPM 2.0 devices. If not found, TPM 1.2 devices will be enumerated.

4.4.2 ACPI Settings

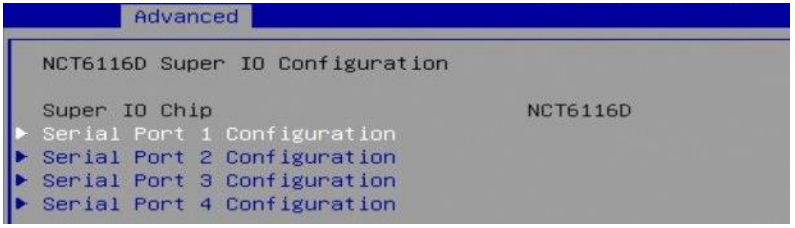


BIOS Setting	Description
Enable ACPI Auto Configuration	Enables / Disables BIOS ACPI auto configuration.
Enable Hibernation	Enables / Disables the system ability to hibernate (OS/S4 Sleep State). This option may be not effective with some OS.
ACPI Sleep State	Selects an ACPI sleep state where the system will enter when the Suspend button is pressed.

4.4.3 IDE Configuration

BIOS Setting	Description
SATA Ports	Detects the connection of SATA0 and SATA1.

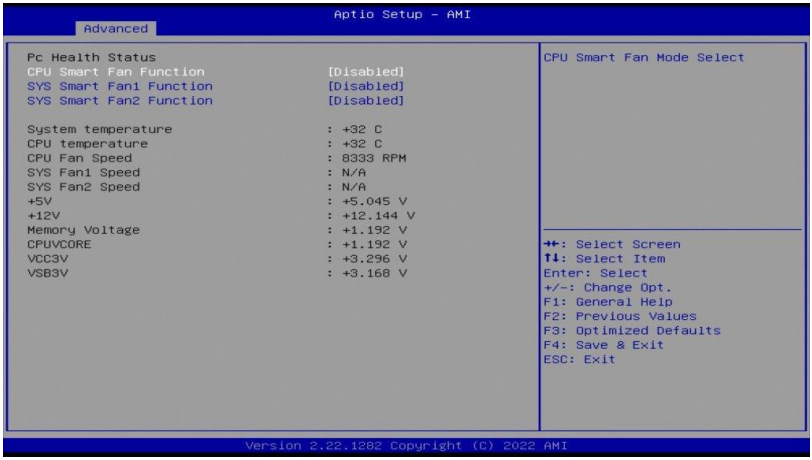
4.4.4 NCT6116D Super IO Configuration



BIOS Setting	Description
Serial Ports Configuration	Sets parameters of Serial Ports. Enables / Disables the serial port and select an optimal setting for the Super IO device.

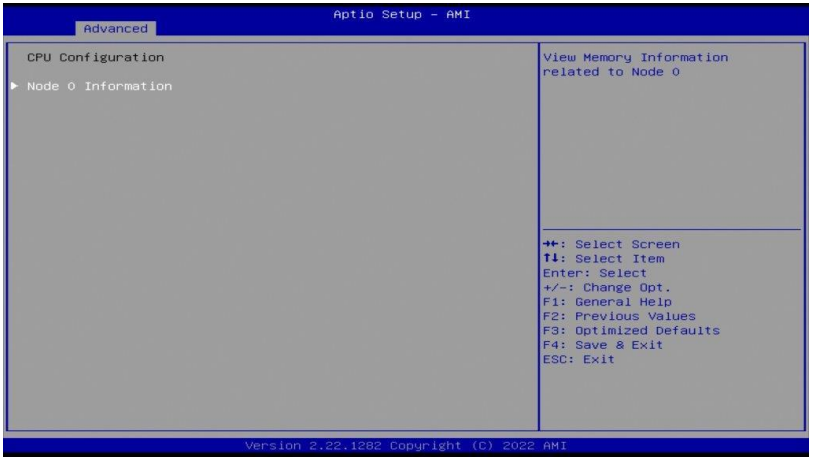
Serial Port 1~4 Configuration

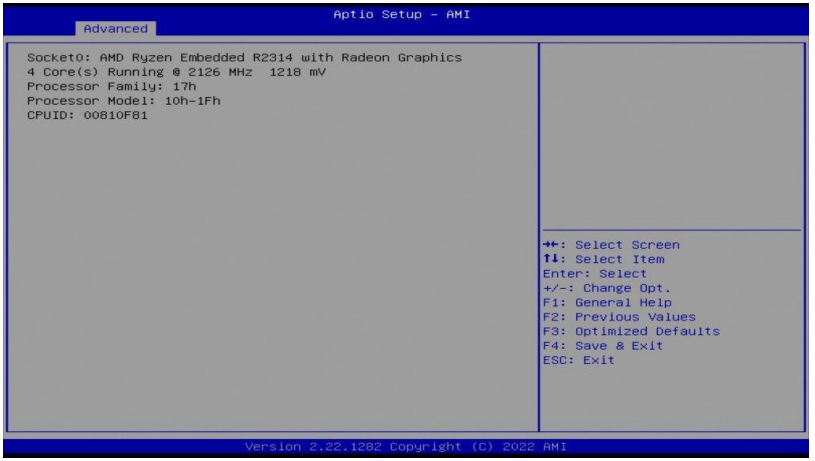
4.4.5 Hardware Monitor



BIOS Setting	Description
CPU Smart Fan Function	Enables / Disables the CPU smart fan feature.
System Smart Fans Function	Enables / Disables the system smart fans feature.
Temperatures / Voltages	These fields are the parameters of the hardware monitoring function feature of the motherboard. The values are read-only values as monitored by the system and show the PC health status.
CPU Shutdown Temperature	Enables / Disables the CPU shutdown temperature function.

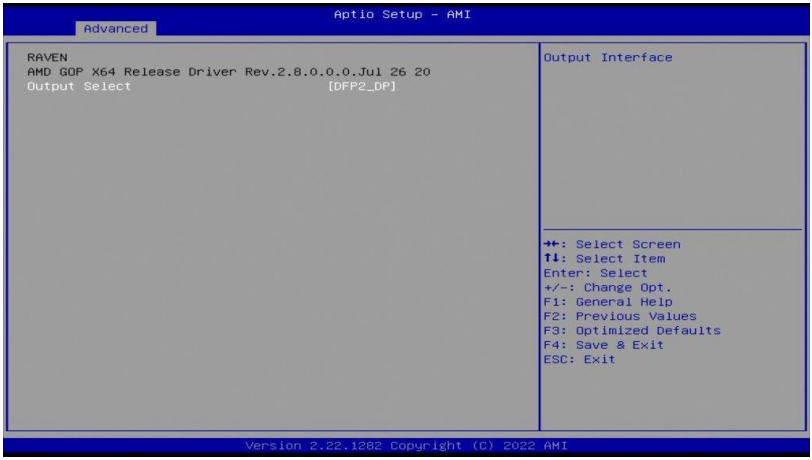
4.4.6 CPU Configuration





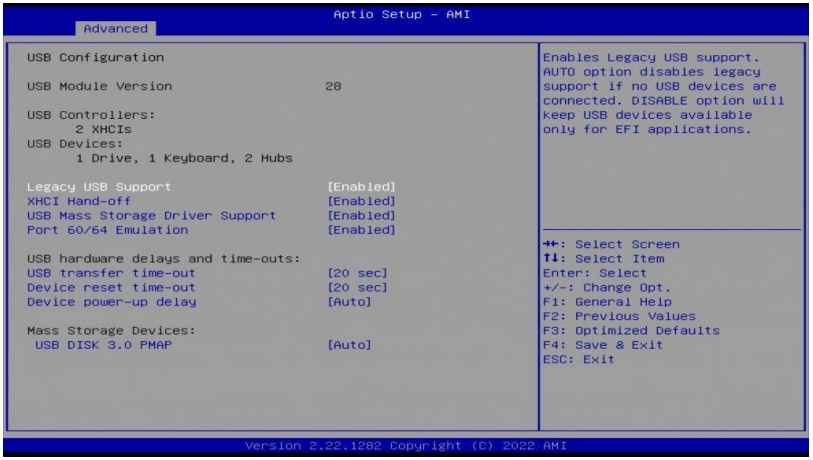
BIOS Setting	Description
Node 0 Information	Displays the memory information related to Node 0.

4.4.7 AMI Graphic Output Protocol Policy



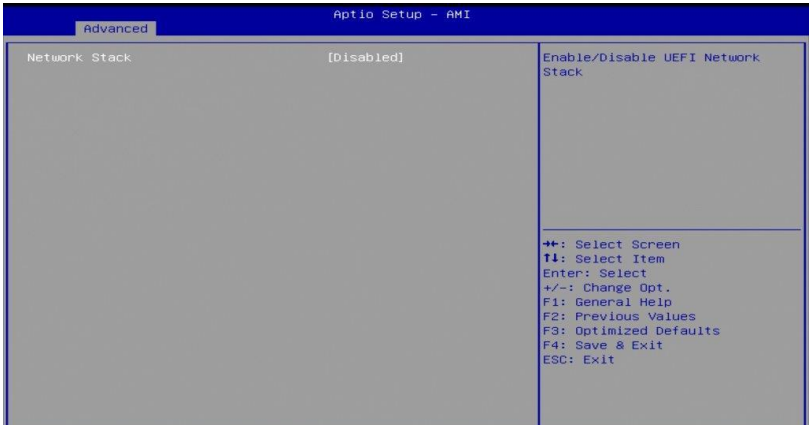
BIOS Setting	Description
Output Select	Allows you to select an output interface.

4.4.8 USB Configuration



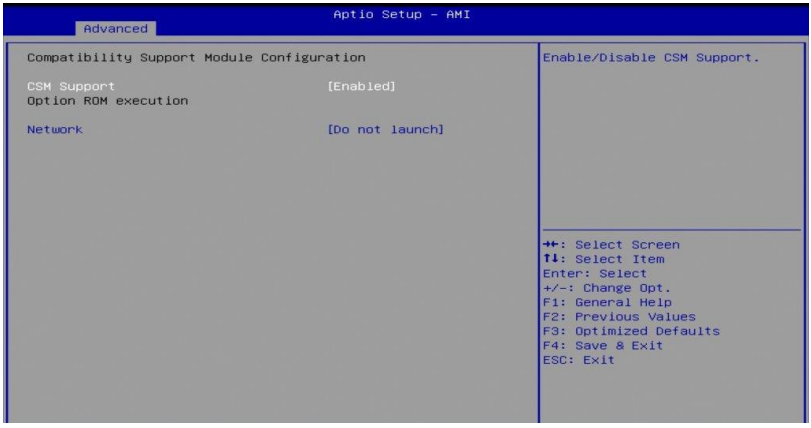
BIOS Setting	Description
Legacy USB Support	Enables Legacy USB support. • **Auto** disables legacy support if there is no USB device connected. • **Disable** keeps USB devices available only for EFI applications.
XHCI Hand-off	This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	Enables / Disables the support for USB mass storage driver.
Port 60/64 Emulation	Enables I/O port 50h/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OSes.
USB Transfer time-out	The time-out value for control, bulk, and Interrupt transfers. Options: 1 sec / 5 sec / 10 sec / 20 sec
Device reset time-out	Seconds of delaying execution of start unit command to USB mass storage device. Options: 10 sec / 20 sec / 30 sec / 40 sec
Device power-up delay	The maximum time the device will take before it properly reports itself to the Host Controller. **Auto** uses default value for a Root port it is 100ms. But for a Hub port, the delay is taken from Hub descriptor. Options: Auto / Manual

4.4.9 Network Stack Configuration



BIOS Setting	Description
Network Stack	Enables / Disables UEFI Network Stack

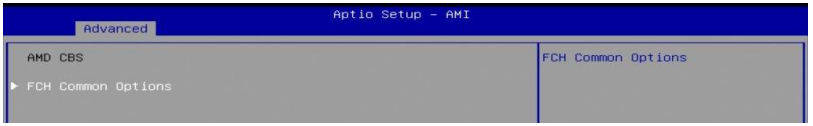
4.4.10 CSM Configuration

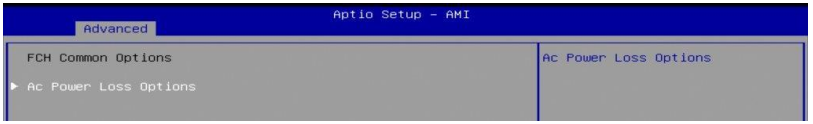


BIOS Setting	Description
CSM Support	Enables / Disables CSM support.
Network	Controls the execution of UEFI and Legacy PXE OpROM. Options: Do not launch / Legacy

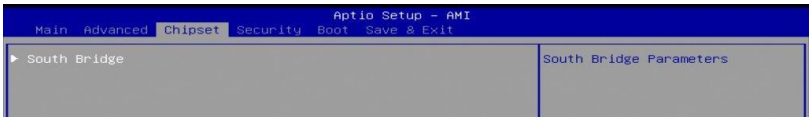
4.4.11 NVMe Configuration

4.4.12 AMD CBS

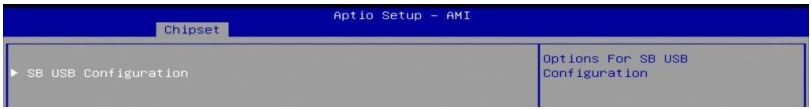




4.5 Chipset Settings

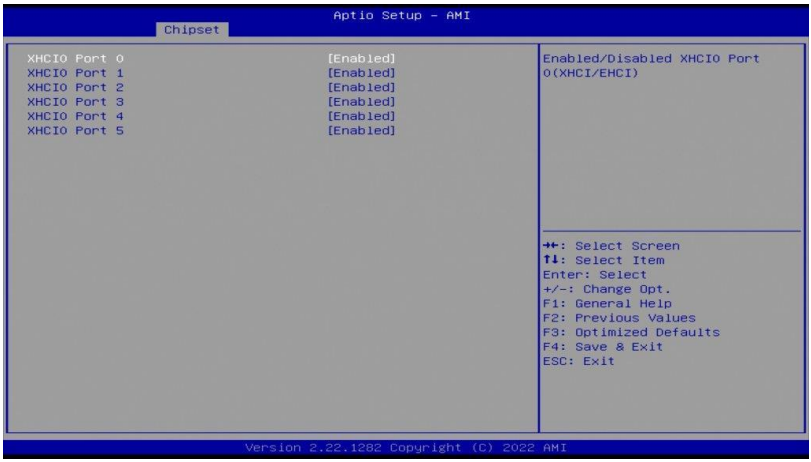


4.5.1 SB USB Configuration



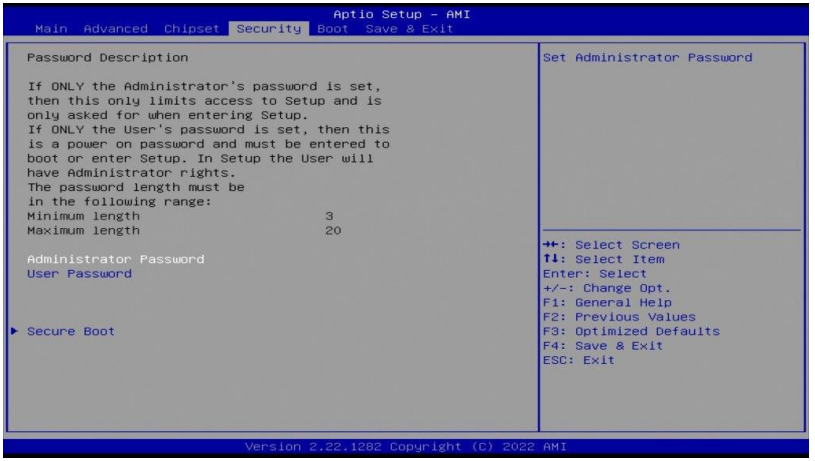
BIOS Setting	Description
SB USB Configuration	Options for SB USB Configuration.

4.5.1.1. XHCI Ports

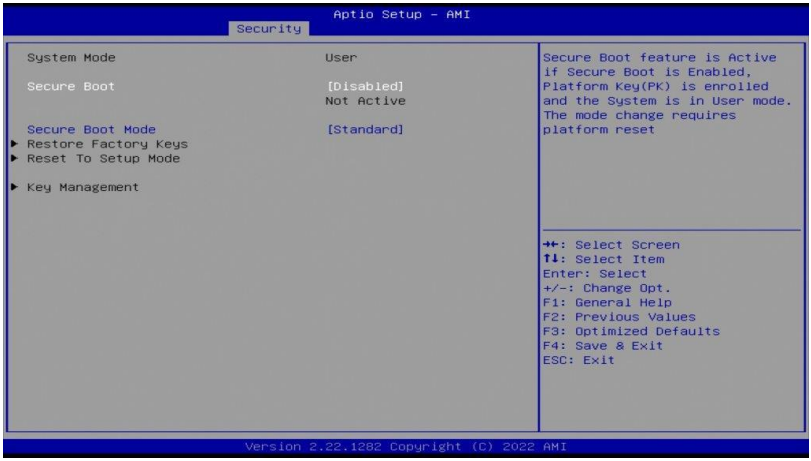


BIOS Setting	Description
XHCI 0 & XHCI 1 Ports	Enables / Disables the XHCI0 & XHCI1 ports (XHCI/EMCI).

4.6 Security Settings

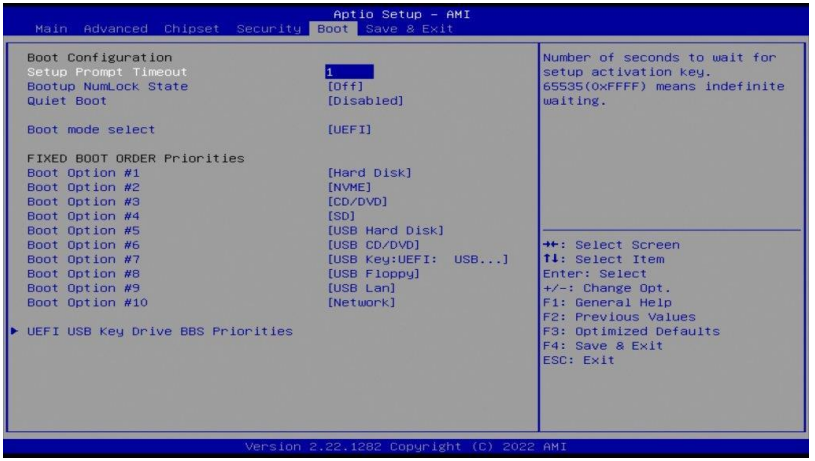


BIOS Setting	Description
Administrator Password	Sets an administrator password for the setup utility.
User Password	Sets a user password.



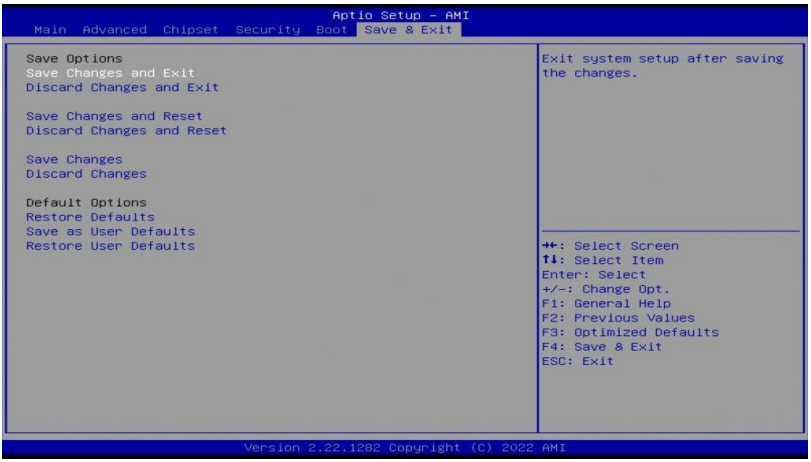
BIOS Setting	Description
Secure Boot	Secure Boot feature is active if Secure Boot enabled. Platform Key(PK) is enrolled and the system is in user mode. The mode change requires platform reset.
Secure Boot Mode	Secure Boot mode options: Standard or Custom. In Custom mode, Secure Boot Policy variables can be configured by a physically present user without full authentication.
Restore Factory Keys	Force System to User Mode. Install factory default Secure Boot key databases.
Reset To Setup Mode	Delete all Secure Boot key databases from NVRAM
Key Management	Enables expert users to modify Secure Boot Policy variables without full authentication

4.7 Boot Settings



BIOS Setting	Description
Setup Prompt Timeout	Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.
Bootup NumLock State	Selects the keyboard NumLock state.
Quiet Boot	Enables / Disables Quiet Boot option.
Boot mode select	Selects a Boot mode, Legacy / UEFI.
Boot Option Priorities	Sets the system boot order.
UEFI USB Key Drive BBS Priorities	Specifies the Bood Device Priority sequence from available UEFI USB Key Drives.

4.8 Save & Exit Settings



BIOS Setting	Description
Save Changes and Exit	Exits system setup after saving the changes.
Discard Changes and Exit	Exits system setup without saving any changes.
Save Changes and Reset	Resets the system after saving the changes.
Discard Changes and Reset	Resets system setup without saving any changes.
Save Changes	Saves changes done so far to any of the setup options.
Discard Changes	Discards changes done so far to any of the setup options.
Restore Defaults	Restores / Loads defaults values for all the setup options.
Save as User Defaults	Saves the changes done so far as User Defaults.
Restore User Defaults	Restores the user defaults to all the setup options.

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Appendix

This section provides the mapping addresses of peripheral
devices, the sample code of watchdog timer configuration, and types of onboard connectors.

A. I/O Port Address Map

Each peripheral device in the system is assigned a set of I/O port addresses which also becomes the identity of the device. The following table lists the I/O port addresses used.

Address	Device Description
0x00000A00-0x00000A0F	Motherboard resources
0x00000A10-0x00000A1F	Motherboard resources
0x00000A20-0x00000A2F	Motherboard resources
0x00000A30-0x00000A3F	Motherboard resources
0x00000A40-0x00000A4F	Motherboard resources
0x00000070-0x00000071	System CMOS/real time clock
0x0000F000-0x0000FFFF	PCI Express Root Port
0x0000F000-0x0000FFFF	AMD Radeon(TM) Graphics
0x000003F8-0x000003FF	Communications Port (COM1)
0x000002F8-0x000002FF	Communications Port (COM2)
0x000003E8-0x000003EF	Communications Port (COM3)
0x000002E8-0x000002EF	Communications Port (COM4)
0x00000020-0x00000021	Programmable interrupt controller
0x000000A0-0x000000A1	Programmable interrupt controller
0x00000000-0x000003AF	PCI Express Root Complex
0x00000000-0x000003AF	Direct memory access controller
0x000003E0-0x00000CF7	PCI Express Root Complex
0x000003B0-0x000003DF	PCI Express Root Complex
0x00000D00-0x0000FFFF	PCI Express Root Complex
0x00000040-0x00000043	System timer
0x00000010-0x0000001F	Motherboard resources
0x00000022-0x0000003F	Motherboard resources
0x00000063-0x00000063	Motherboard resources
0x00000065-0x00000065	Motherboard resources
0x00000067-0x0000006F	Motherboard resources
0x00000072-0x0000007F	Motherboard resources
0x00000080-0x00000080	Motherboard resources

Address	Device Description
0x00000084-0x00000086	Motherboard resources
0x00000088-0x00000088	Motherboard resources
0x0000008C-0x0000008E	Motherboard resources
0x00000090-0x0000009F	Motherboard resources
0x000000A2-0x000000BF	Motherboard resources
0x000000B1-0x000000B1	Motherboard resources
0x000000E0-0x000000EF	Motherboard resources
0x000004D0-0x000004D1	Motherboard resources
0x0000040B-0x0000040B	Motherboard resources
0x000004D6-0x000004D6	Motherboard resources
0x00000C00-0x00000C01	Motherboard resources
0x00000C14-0x00000C14	Motherboard resources
0x00000C50-0x00000C51	Motherboard resources
0x00000C52-0x00000C52	Motherboard resources
0x00000C6C-0x00000C6C	Motherboard resources
0x00000C6F-0x00000C6F	Motherboard resources
0x00000CD0-0x00000CD1	Motherboard resources
0x00000CD2-0x00000CD3	Motherboard resources
0x00000CD4-0x00000CD5	Motherboard resources
0x00000CD6-0x00000CD7	Motherboard resources
0x00000CD8-0x00000CDF	Motherboard resources
0x00000800-0x0000089F	Motherboard resources
0x00000B00-0x00000B0F	Motherboard resources
0x00000B20-0x00000B3F	Motherboard resources
0x00000900-0x0000090F	Motherboard resources
0x00000910-0x0000091F	Motherboard resources
0x00000061-0x00000061	System speaker
0x00000081-0x00000083	Direct memory access controller
0x00000087-0x00000087	Direct memory access controller
0x00000089-0x0000008B	Direct memory access controller
0x0000008F-0x0000008F	Direct memory access controller

B. Interrupt Request Lines (IRQ)

Peripheral devices use interrupt request lines to notify CPU for the service required. The following table shows the IRQ used by the devices on board.

Level	Function
IRQ 0	High precision event timer
IRQ 0	System timer
IRQ 3	Communications Port (COM2)
IRQ 4	Communications Port (COM1)
IRQ 5	Communications Port (COM3)
IRQ 5	Communications Port (COM4)
IRQ 8	High precision event timer
IRQ 7	AMD GPIO Controller
IRQ 53	High Definition Audio Controller
IRQ 53	AMD Audio CoProcessor
IRQ 54	High Definition Audio Controller
IRQ 55	AMD SFH KMDF I2C
IRQ 55~204	Microsoft ACPI-Compliant System
IRQ 256~511	Microsoft ACPI-Compliant System
IRQ 4294967275~77	AMD Radeon™ Graphics
IRQ 4294967278~79	AMD PSP 10.0 Device
IRQ 4294967290	Standard SATA AHCI Controller
IRQ 4294967291~94	PCI Express Root Port

C. Watchdog Timer Configuration

The Watchdog Timer (WDT) is used to generate a variety of output signals after a user programmable count. The WDT is suitable for use in the prevention of system lock-up, such as when software becomes trapped in a deadlock. Under these sorts of circumstances, the timer will count to zero and the selected outputs will be driven.

Under normal circumstance, you will need to restart the WDT at regular intervals before the timer counts to zero.

1. Sample Code: The file NCT6116D.H

```
//-----------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-----------------------------------------------------------------------------
#ifndef __NCT6116D_H
#define __NCT6116D_H                                    1
//-----------------------------------------------------------------------------
#define         NCT6116D_INDEX_PORT             (NCT6116D_BASE)
#define         NCT6116D_DATA_PORT              (NCT6116D_BASE+1)
//-----------------------------------------------------------------------------
#define         NCT6116D_REG_LD                         0x07
//-----------------------------------------------------------------------------
#define NCT6116D_UNLOCK                         0x87
#define         NCT6116D_LOCK                           0xAA
//-----------------------------------------------------------------------------
unsigned int Init_NCT6116D(void);
void Set_NCT6116D_LD( unsigned char);
void Set_NCT6116D_Reg( unsigned char, unsigned char);
unsigned char Get_NCT6116D_Reg( unsigned char);
//-----------------------------------------------------------------------------
#endif          //__NCT6116D_H
```

2. Sample Code: The file MAIN.CPP

```
//---------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//---------------------------------------------------------------------------
#include <dos.h>
#include <conio.h>
#include <stdio.h>
#include <stdlib.h>
#include "NCT6116D.H"
//---------------------------------------------------------------------------
int main (void);

void WDTInitial(void);
void WDTEnable(unsigned char);
void WDTDisable(void);

//---------------------------------------------------------------------------
int main (void)
{
        char SIO;

        SIO = Init_NCT6116D();
        if (SIO == 0)
        {
                printf("Can not detect Nuvoton NCT6116D, program abort.\n");
                return(1);
        }

        WDTInitial();

        WDTEnable(10);

        WDTDisable();

        return 0;
}
//---------------------------------------------------------------------------
void WDTInitial(void)
{
        unsigned char bBuf;
        Set_NCT6116D_LD(0x08);                                  //switch
to logic device 8
        bBuf = Get_NCT6116D_Reg(0x30);
        bBuf &= (~0x01);
        Set_NCT6116D_Reg(0x30, bBuf);                           //Enable
WDTO
}
//---------------------------------------------------------------------------
```

```
void WDTEnable(unsigned char NewInterval)
{
        unsigned char bBuf;

        Set_NCT6116D_LD(0x08);                                  //switch
to logic device 8
        Set_NCT6116D_Reg(0x30, 0x01);                           //enable
timer

        bBuf = Get_NCT6116D_Reg(0xF0);
        bBuf &= (~0x08);
        Set_NCT6116D_Reg(0xF0, bBuf);                           //count
mode is second

        Set_NCT6116D_Reg(0xF1, NewInterval);        //set timer
}
//-----------------------------------------------------------------------
void WDTDisable(void)
{
        Set_NCT6116D_LD(0x08);                                  //switch
to logic device 8
        Set_NCT6116D_Reg(0xF1, 0x00);                           //clear
watchdog timer
        Set_NCT6116D_Reg(0x30, 0x00);
        //watchdog disabled
}
//-----------------------------------------------------------------------
```

3. Sample Code: The file NCT6116D.CPP

```
//---------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//---------------------------------------------------------------------------
#include "NCT6116D.H"
#include <dos.h>
//---------------------------------------------------------------------------
unsigned int NCT6116D_BASE;
void Unlock_NCT6116D (void);
void Lock_NCT6116D (void);
//---------------------------------------------------------------------------
unsigned int Init_NCT6116D(void)
{
        unsigned int result;
        unsigned char ucDid;

        NCT6116D_BASE = 0x4E;
        result = NCT6116D_BASE;

        ucDid = Get_NCT6116D_Reg(0x20);
        if (ucDid == 0xC4)
        //NCT6116D??
        {       goto Init_Finish;       }

        NCT6116D_BASE = 0x2E;
        result = NCT6116D_BASE;

        ucDid = Get_NCT6116D_Reg(0x20);
        if (ucDid == 0xC4)
        //NCT6116D??
        {       goto Init_Finish;       }

        NCT6116D_BASE = 0x00;
        result = NCT6116D_BASE;

Init_Finish:
        return (result);
}
//---------------------------------------------------------------------------
void Unlock_NCT6116D (void)
{
        outportb(NCT6116D_INDEX_PORT, NCT6116D_UNLOCK);
        outportb(NCT6116D_INDEX_PORT, NCT6116D_UNLOCK);
}
//---------------------------------------------------------------------------
```

```
void Lock_NCT6116D (void)
{
		outportb(NCT6116D_INDEX_PORT, NCT6116D_LOCK);
}
//-----------------------------------------------------------------------------
void Set_NCT6116D_LD( unsigned char LD)
{
		Unlock_NCT6116D();
		outportb(NCT6116D_INDEX_PORT, NCT6116D_REG_LD);
		outportb(NCT6116D_DATA_PORT, LD);
		Lock_NCT6116D();
}
//-----------------------------------------------------------------------------
void Set_NCT6116D_Reg( unsigned char REG, unsigned char DATA)
{
		Unlock_NCT6116D();
		outportb(NCT6116D_INDEX_PORT, REG);
		outportb(NCT6116D_DATA_PORT, DATA);
		Lock_NCT6116D();
}
//-----------------------------------------------------------------------------
unsigned char Get_NCT6116D_Reg(unsigned char REG)
{
		unsigned char Result;
		Unlock_NCT6116D();
		outportb(NCT6116D_INDEX_PORT, REG);
		Result = inportb(NCT6116D_DATA_PORT);
		Lock_NCT6116D();
		return Result;
}
//-----------------------------------------------------------------------------
```

D. Onboard Connector Types

Function	Connector	Onboard Type	Compatible Mating Type for Reference
DC-In Power Connector	J1	Hao Guo Xing Ye ATX4PT-NY46	Molex 39-01-2040
USB 2.0 Connector	J16	Hao Guo Xing Ye DF11-8S-PA66H	Hirose DF11-8DS-2C
USB 3.1 Ports	J15	PINREX 52X-40-20GU52	USB 3.0 IDC 19-pin
SATA Power Connector	J5	Hao Guo Xing Ye WAFER25-104S-2442-ST	AMP 171822-4
Digital I/O Connector	J8	E-call 0126-01-203-100	Dupont 10P 2.54 mm-pitch (female)
Front Panel Settings Connector	J13	E-call 0126-01-203-080	Dupont 8P 2.54 mm-pitch (female)
COM3 & COM4 RS-232 Port	J18, J16	Hao Guo Xing Ye DF11-10S-PA66H	HRS DF11-10DS-2C
Audio Connector	J19	E-Call 0126-01-2821009	Dupont 10P 2.54 mm-pitch (female)
Fan Power Connectors	CPU_FAN1	TechBest W2-03I104132S1WT(A)-L	Molex 47054-1000
	SYS_FAN1, SYS_FAN2	E-Call 0110-02-111-030	Molex 22-01-2031

E. USB Power Control Bit

Function	Connector	Software Mapping
USB 3.0	CN6	bit_5