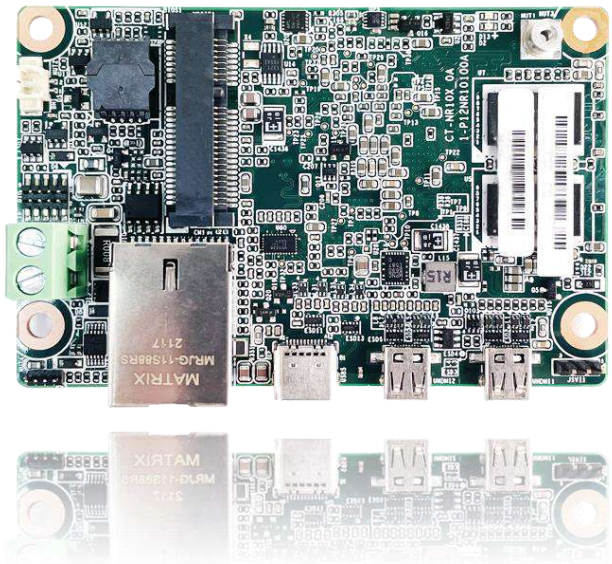
USER'S MANUAL



CT-NR101

1.8" SBC Industrial Motherboard with
AMD Ryzen™ Embedded R1000 Series Processor

Table of Contents

Prefaces

Revision

Revision	Description	Date
1.0	Initial release	2022/07/14

Disclaimer

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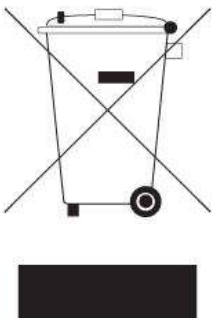
Environmental Protection Announcement

Do not dispose this electronic device into the trash while discarding. Please recycle to minimize pollution and ensure environment protection.



Safety Precautions

Before installing and using the equipment, please read the following precautions:

- Put this equipment on a reliable surface during installation. Dropping it or letting it fall could cause damage.
- The power outlet shall be installed near the equipment and shall be easily accessible.
- Turn off the system power and disconnect the power cord from its source before making any installation. Be sure both the system and the external devices are turned OFF. Sudden surge
- of power could ruin sensitive components. Make sure the equipment is properly grounded.
- When the power is connected, never open the equipment. The equipment should be opened only by qualified service personnel.
- Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
- Disconnect this equipment from the power before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
- Avoid the dusty, humidity and temperature extremes.
- Do not place heavy objects on the equipment.
- If the equipment is not used for long time, disconnect it from the power to avoid being damaged by transient over-voltage.
- The storage temperature shall be above -40°C and below 85°C.
- The computer is provided with a battery-powered real-time clock circuit. There is a danger of explosion if incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.
- If one of the following situation arises, get the equipment checked be service personnel:
    - The power cord or plug is damaged.
    - Liquid has penetrated into the equipment.
    - The equipment has been exposed to moisture.
    - The equipment does not work well or it cannot work according the user's manual.
    - The equipment has been dropped and damaged.
    - The equipment has obvious signs of breakage.

Technical Support and Assistance

1. Visit the Premio Inc website at premioinc.com where you can find the latest information about the product.
2. Contact your distributor, our technical support team or sales representative for technical support if you need additional assistance. Please have following information ready before you call:
   - Model name and serial number
   - Description of your peripheral attachments
   - Description of your software (operating system, version, application software, etc.)
   - A complete description of the problem
   - The exact wording of any error messages

Conventions Used in this Manual

WARNING This indication alerts operators to an operation that, if not strictly observed, may result in severe injury.

CAUTION This indication alerts operators to an operation that, if not strictly observed, may result in safety hazards to personnel or damage to equipment.

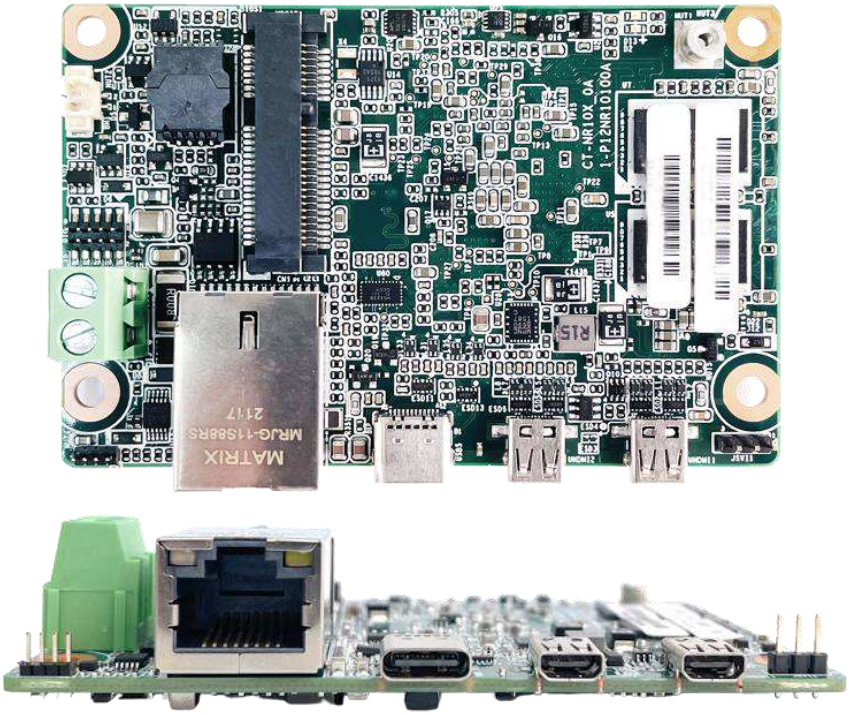
NOTE This indication provides additional information to complete a task easily.

Chapter 1

Product Introductions

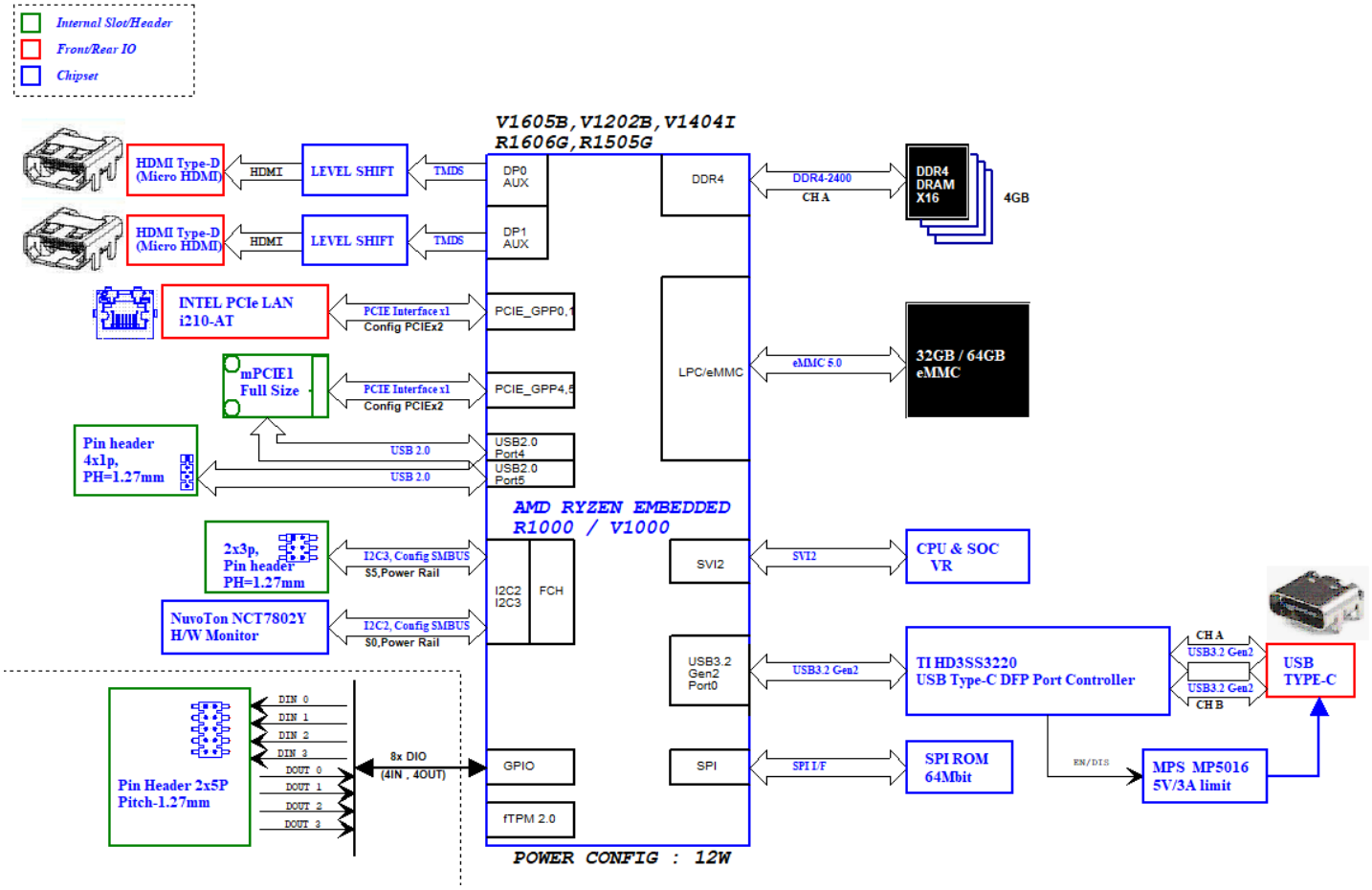
1.1 Product Description

The CT-NR101 is a single board computer in 1.8“ SBC Industrial Motherboard with AMD Ryzen™ Embedded R1000 Series Processor



- Femto-ITX form factor 1.8" SBC for space-limited applications
- AMD Ryzen™ Embedded R1000 Series
- Single Channel DDR4 Memory Down 4GB upto 8GB
- HDMI 1.4 resolution supports up to 4096x2160 @ 24Hz
- Rear I/O: 1x Intel GbE, 1x USB 3.1 Gen 1, 2x Micro HDMI
- Expansion I/O: 1x Mini PCIe, 1x SMBus

1.2 Block Diagram



1.3 Specifications

System

Processor
Support AMD Ryzen™ Embedded R1000 Series
- AMD Ryzen™ Embedded R1606G with Radeon™ Vega 3 Graphics, 4M Cache, 2 Cores, 4 Threads, Up to 3.5 GHz

System Chipset	SoC
LAN Chipset	GbE1: Intel i210 (Support Wake-on-LAN and PXE)
System Memory	On board DDR4-2400 Single-Channel Memory 4GB
Graphics	AMD RadeonTM Vega 3 (R1606G)
BIOS	AMI SPI 64 Mbit
TPM	fTPM 2.0

Display

HDMI	2x Micro HDMI 1.4, resolution up to 4096x2160, 24Hz
Multiple Display	2x Independent display (1x playback)

Storage

SSD/HDD	eMMC up to 64GB

Expansion

Mini PCI Express	1x Full-size Mini PCIe (PCIe x1, USB 2.0)

I/O

DIO	2x 5-pin header (4 In/4 Out)
LAN	1x RJ45
USB	1x USB 3.2 Gen 1 Type C (5V/3A) 1x USB 2.0 (4-pin header, internal)

Internal I/O

Others	1x RTC battery cable

Operating System

Windows	Windows 10
Linux	Linux Kernel 5.x (Fedora 30 or above / Ubuntu 19.04 or above)

Power

Power Management	ACPI
Power Mode	DC 12V
Power Connector	2-pin Terminal Block Pitch=5.0mm

Environment

Form Factor	1.8" Embedded SBC
Operating Temperature	0°C ~ 60°C, 90% (non-condensing), operating
Storage Temperature	-40°C ~ 85°C, 90% (non-condensing) , Non-operating
Relative Humidity	5% ~ 90% relative humidity, non-condensing

Physical

Dimensions	84 mm x 55 mm

1.4 Available Models

Ordering Information	DESCRIPTION
CT-NR101-R1606G	1.8" SBC with AMD Ryzen™ Embedded R1606G, 2x Micro HDMI, 1x USB 3.2 Gen 1 Type-C

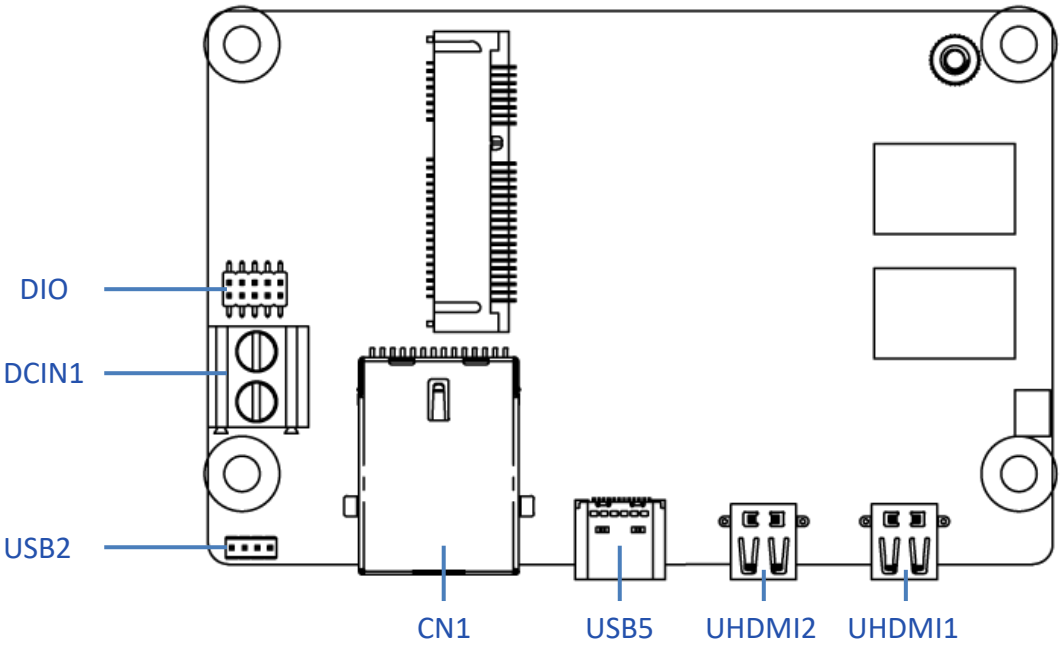
Packing List
• 1x CT-NR10x Main Board • 1x Heat Sink and screws • 1x Front Panel Cable w/ 2x switch & 2x LED • 1x Screw for Mini PCIe

Chapter 2

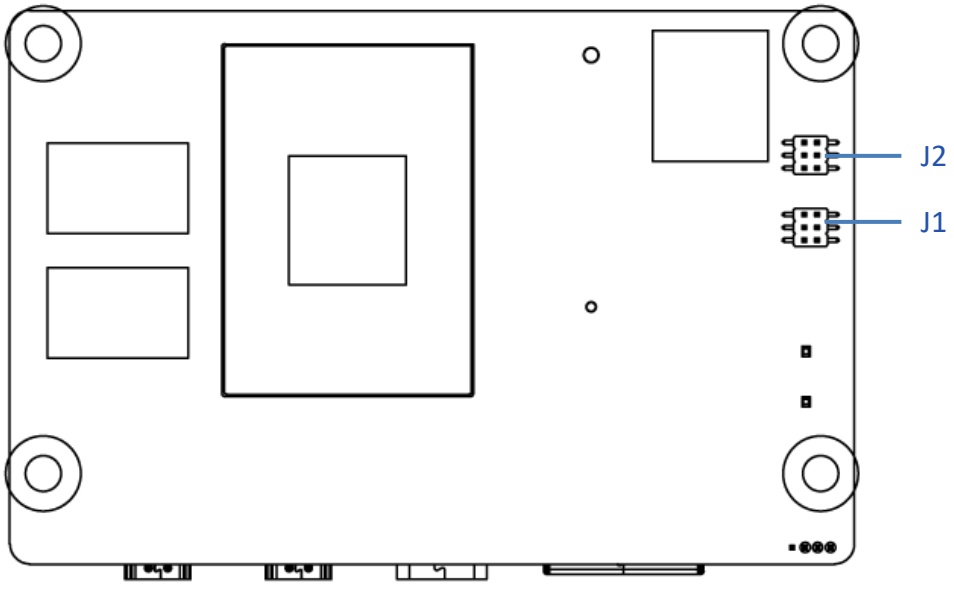
Mechanical Specifications

2.1 Switch and Connector Locations

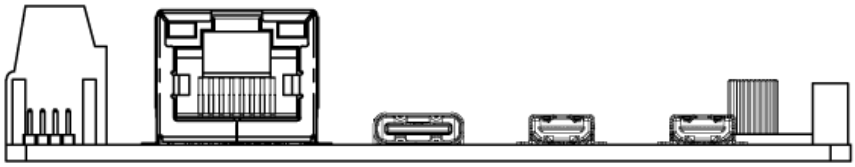
2.1.1 Top View



2.1.2 Bottom view



2.1.3 Rear I/O

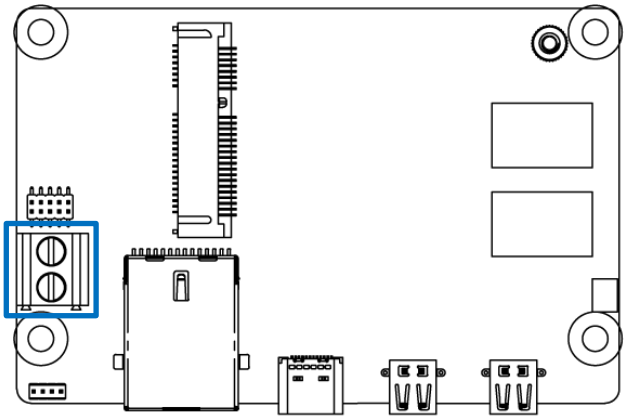


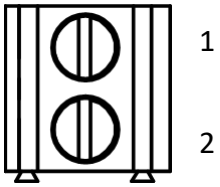
2.2 Connector / Switch Definition

Connector Location	Definition
DCIN1	DC_IN
DIO	Digital-I/O
USB2	USB 2.0 header
J1	Front Panel
J2	SM BUS
CN1	LAN RJ45
USB5	USB header
UHDMI2 / UHDMI1	HDMI signal connector

2.3 I/O Interface Descriptions

2.3.1 DC_IN

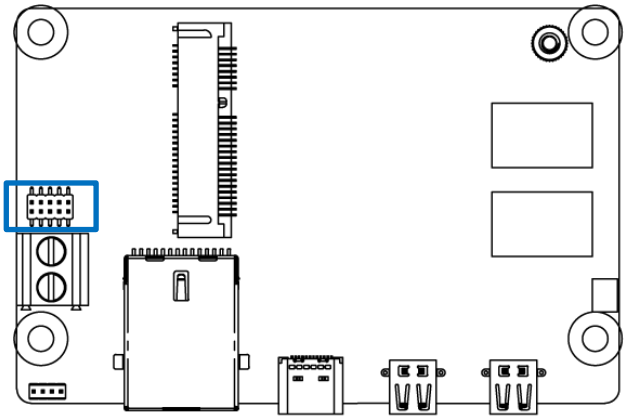


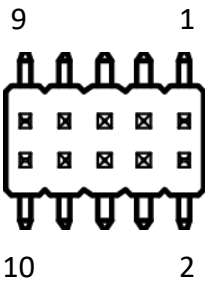


DCIN1

Pin	Signal
1	+12V
2	GND

2.3.2 Digital-I/O



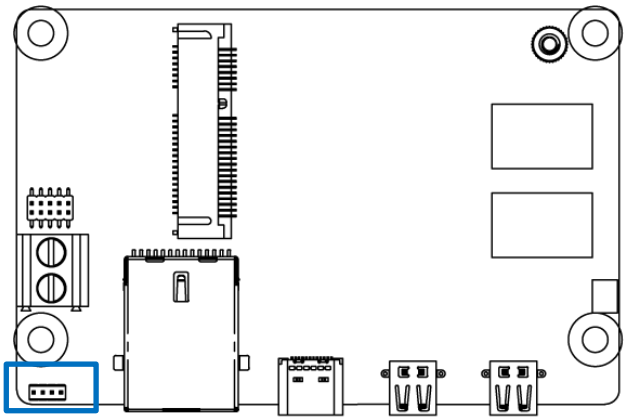


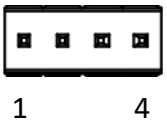
DIO

Pin	Signal	Pin	Signal
1	GND	2	+5V
3	DI0	4	DO0
5	DI1	6	DO1
7	DI2	8	DO2
9	DI3	10	DO3

2.3 I/O Interface Descriptions

2.3.3 USB2.0

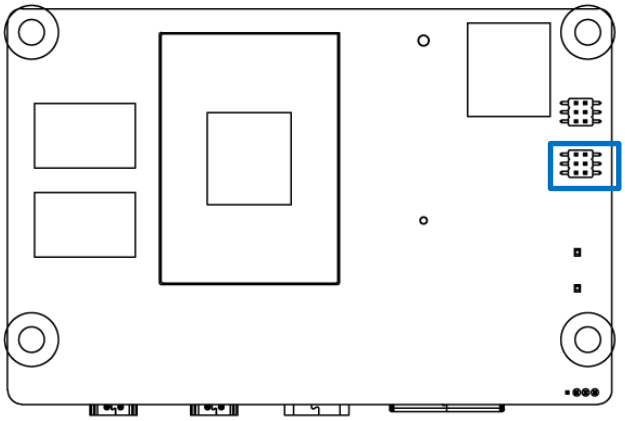


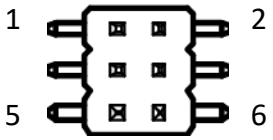


USB2

Pin	Signal	Pin	Signal
1	+5V	3	USB2.0_DP
2	USB2.0_DM	4	GND

2.3.4 Front panel



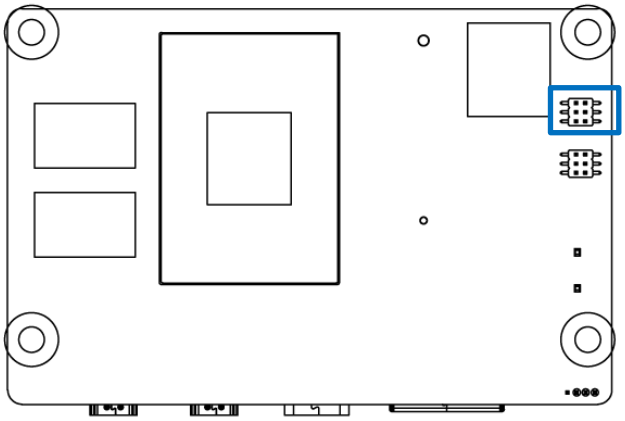


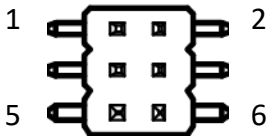
J1

Pin	Signal	Pin	Signal
1	N/A	2	SYSRST_IN#
3	SYS_LED+	4	GND
5	STBY_LED+	6	PB_IN#

2.3 I/O Interface Descriptions

2.3.5 SM BUS

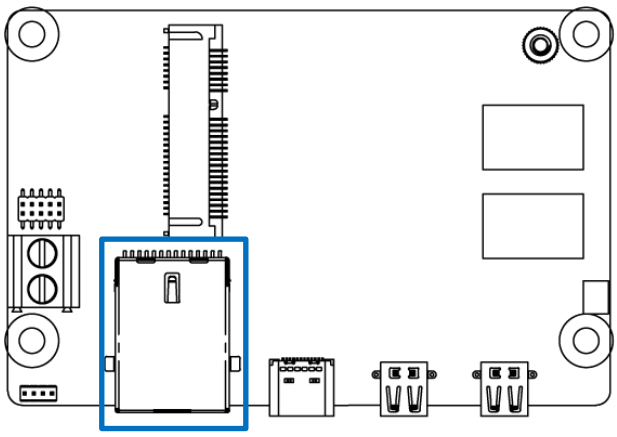


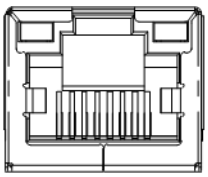


J2

Pin	Signal	Pin	Signal
1	N/A	2	N/A
3	SDATA1_SMB	4	SCLK1_SMB
5	GND	6	3VSB

2.3.6 LAN RJ45



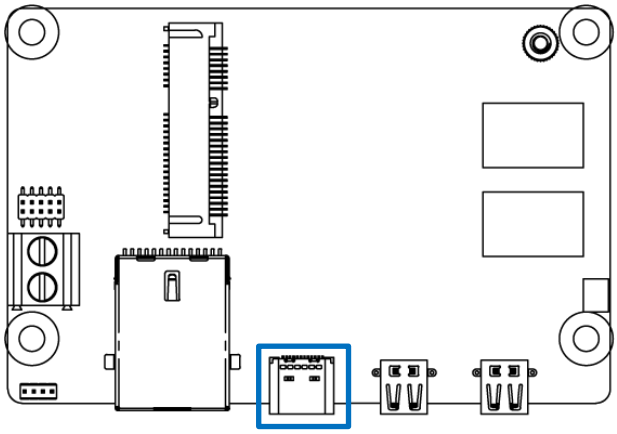


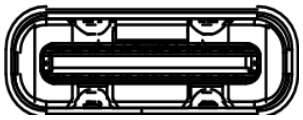
CN1

Pin	Signal	Pin	Signal
1	BI_DA+	5	BI_DC-
2	BI_DA-	6	BI_DB-
3	BI_DB+	7	BI_DD+
4	BI_DC+	8	BI_DD-

2.3 I/O Interface Descriptions

2.3.7 USB Type C



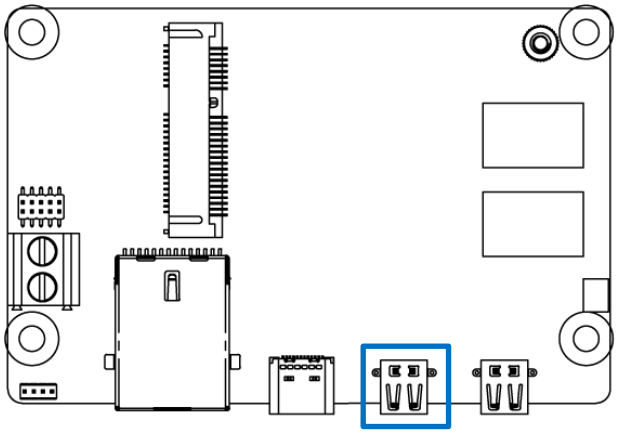


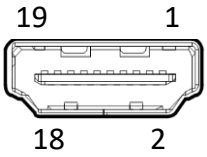
USB5

Pin	Signal	Pin	Signal
A1	GND	B12	GND
A2	TX1+	B11	RX1+
A3	TX1-	B10	RX1-
A4	VBUS	B9	VBUS
A5	CC1	B8	SBU2
A6	D+	B7	D-
A7	D-	B6	D+
A8	SBU1	B5	CC2
A9	VBUS	B4	VBUS
A10	RX2-	B3	TX2-
A11	RX2+	B2	TX2+
A12	GND	B1	GND

2.3 I/O Interface Descriptions

2.3.8 MICRO HDMI_TYPE-D



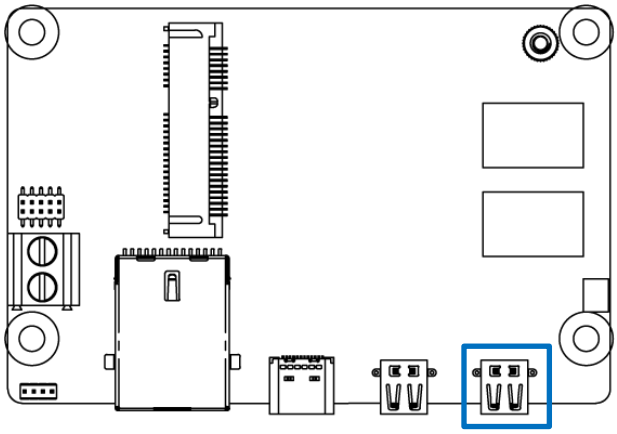


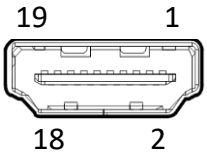
UHDMI2

Pin	Signal	Pin	Signal
1	Hot Plug Detect	2	N/C
3	TMDS DATA2+	4	GND
5	TMDS DATA2-	6	TMDS DATA1+
7	GND	8	TMDS DATA1-
9	TMDS DATA0+	10	GND
11	TMDS DATA0-	12	TMDS CLOCK+
13	GND	14	TMDS CLOCK-
15	N/C	16	GND
17	DDC_SCL	18	DDC_SDA
19	HDMI_5V		

2.3 I/O Interface Descriptions

2.3.9 MICRO HDMI_TYPE-D





UHDMI1

Pin	Signal	Pin	Signal
1	Hot Plug Detect	2	N/C
3	TMDS DATA2+	4	GND
5	TMDS DATA2-	6	TMDS DATA1+
7	GND	8	TMDS DATA1-
9	TMDS DATA0+	10	GND
11	TMDS DATA0-	12	TMDS CLOCK+
13	GND	14	TMDS CLOCK-
15	N/C	16	GND
17	DDC_SCL	18	DDC_SDA
19	HDMI_5V		

Chapter 3

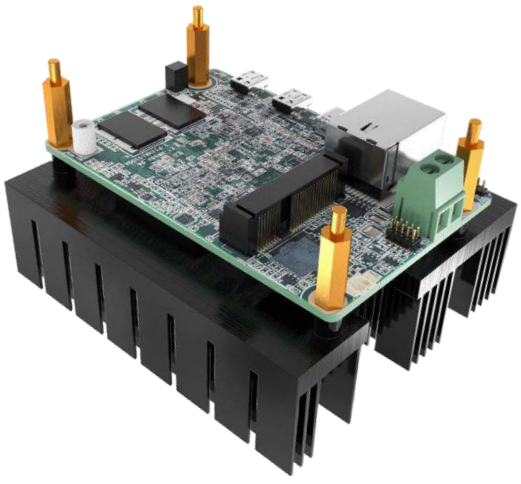
System Setup

3.1 Heat Sink Installation (Standard)

Heat sink x1	Board x1	Screw x4	Bolt x4
			

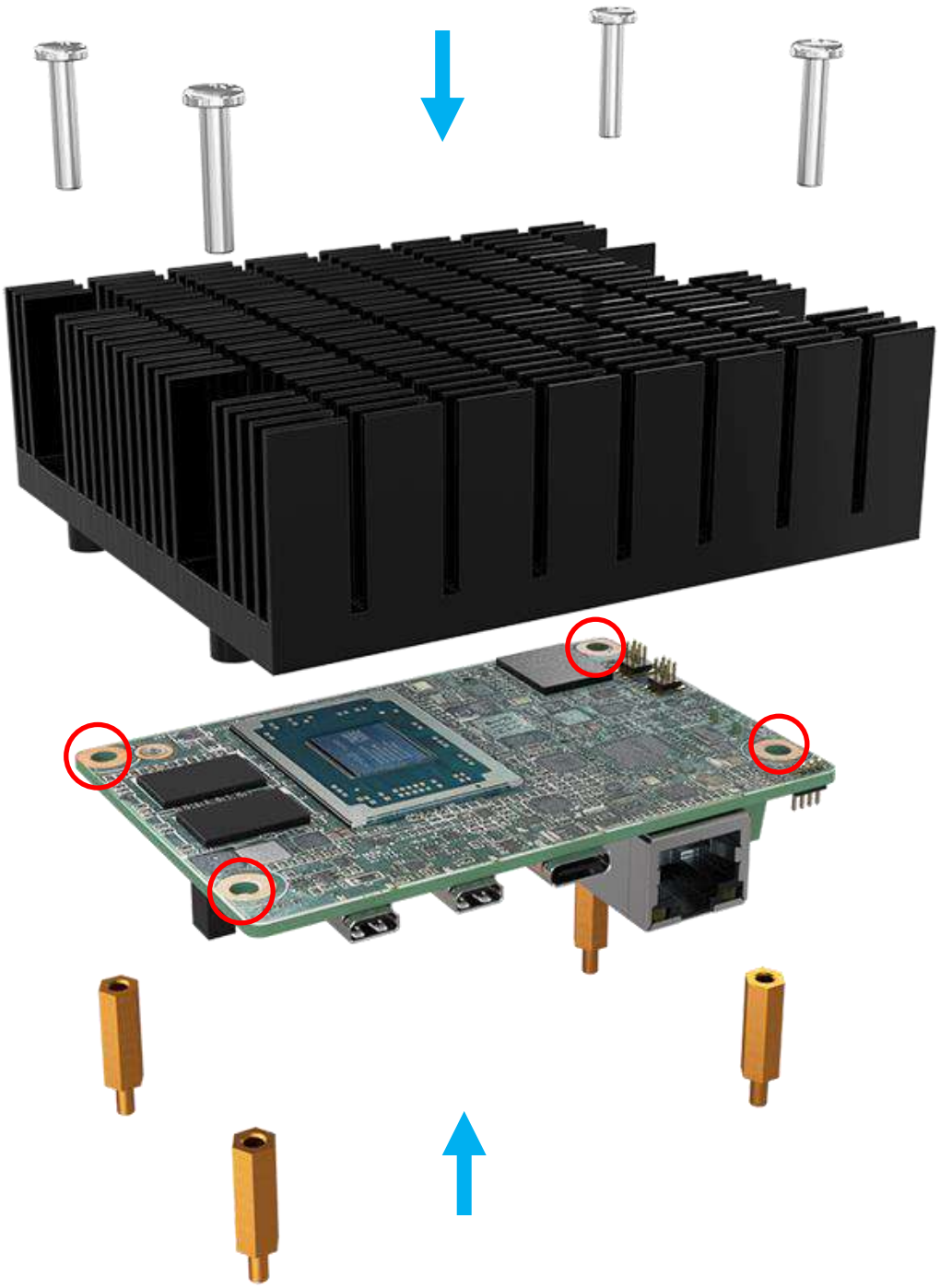
Top view

Bottom view



Heat Sink Installation (Standard)

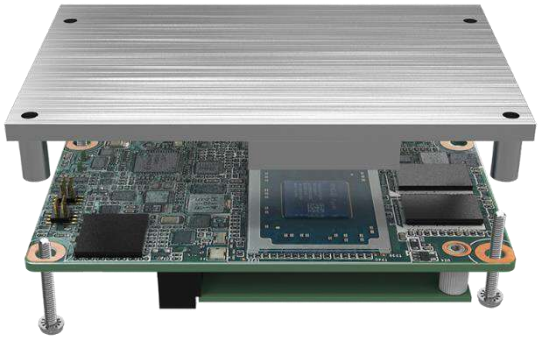
Fasten the four screws on top and below to lock the heat sink.



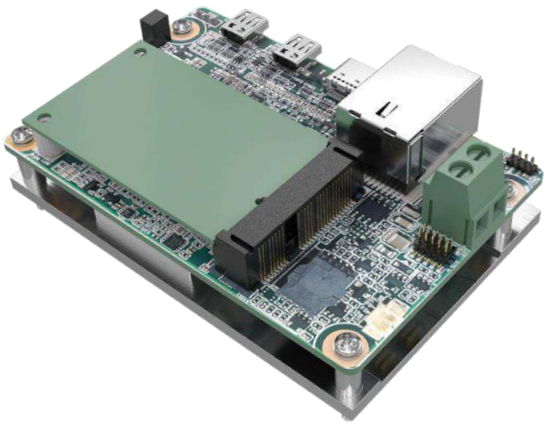
3.2 Heat Sink Installation (Customized)

Heat sink x1	Board x1	Screw x4
		

Top view

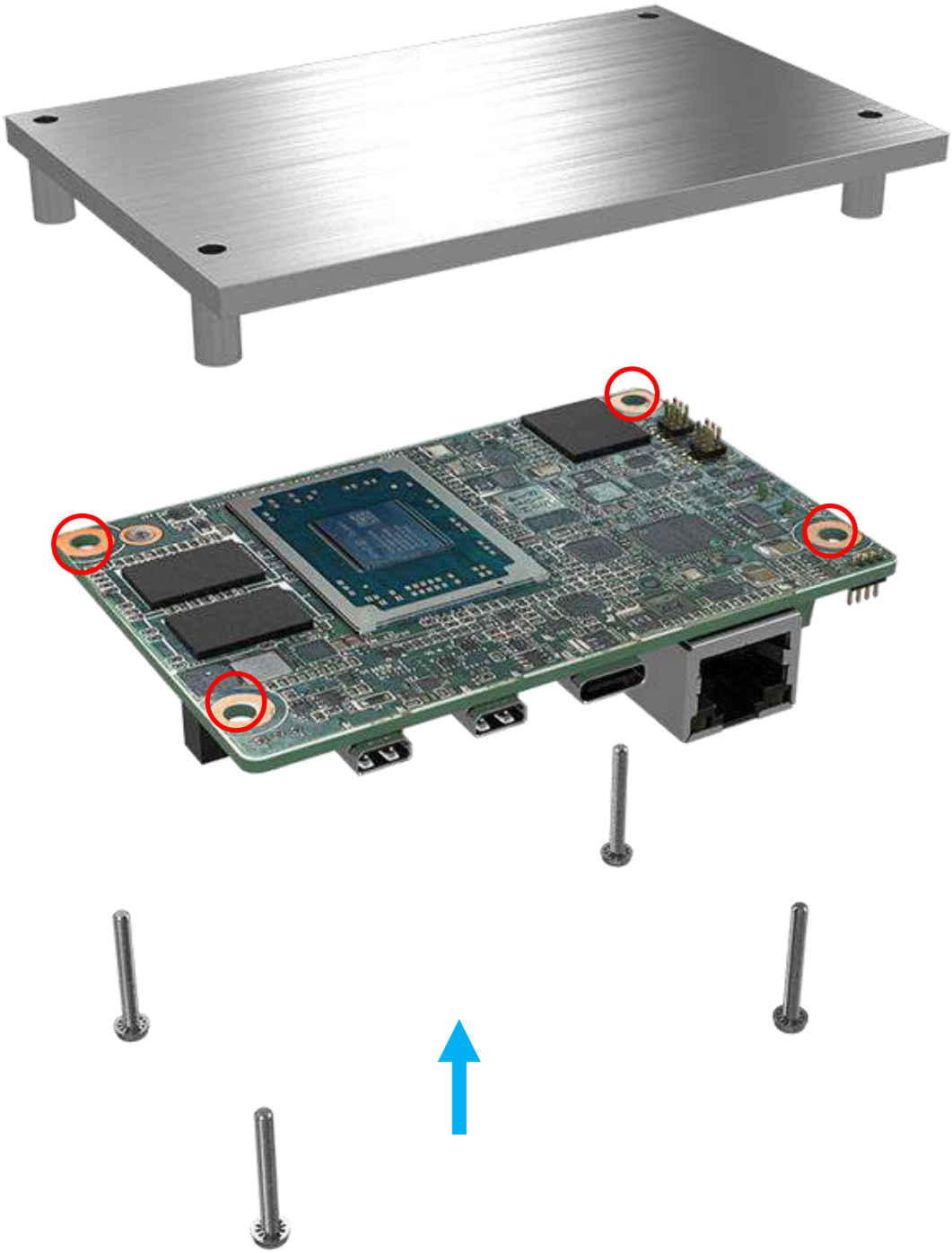


Bottom view



Heat Sink Installation (Customized)

Fasten the four screws below to lock the heat sink.



Chapter 4

System BIOS

4.1 BIOS Introduction

The BIOS provides an interface to modify the configuration. When the battery is removed, all the parameters will be reset.

BIOS Setup
Power on the embedded system and by pressing <Del> immediately allows you to enter the setup screens. If the message disappears before you respond and you still wish to enter the Setup, restart the system by turning it OFF and ON or pressing the RESET button.
You may also restart the system by simultaneously pressing <Ctrl>, <Alt>, and <Delete> keys.

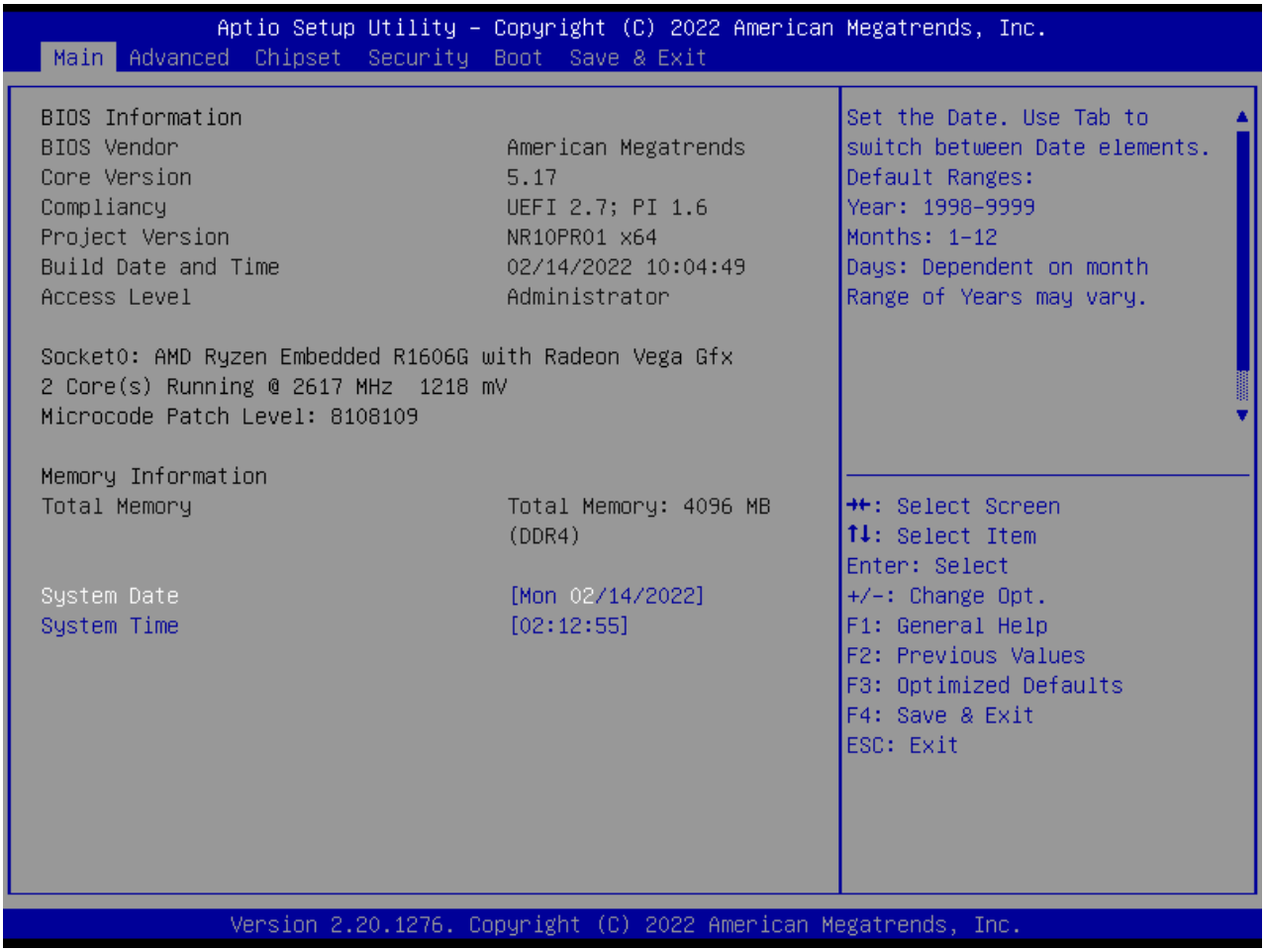
Control Keys	
<→> <←>	Select Screen
<↑> <↓>	Select Item
<Enter>	Select
<Page Up/+>	Increases the numeric value or makes changes
<Page Down/->	Decreases the numeric value or makes changes
<F1>	General Help
<F2>	Previous Value
<F3>	Load Optimized Defaults
<F4>	Save Configuration and Exit
<Tab>	Select Setup Fields
<Esc>	Exit BIOS Setup

Main Setup
The main menu lists the setup functions you can make changes to. You can use the arrow keys (↑↓) to select the item. The on-line description of the highlighted setup function is displayed at the bottom of the screen.

General Help <F1>
The BIOS setup program provides a General Help screen. You can call up this screen from any menu by simply pressing <F1>. The Help screen lists the appropriate keys to use and the possible selections for the highlighted item. Press <Esc> to exit the Help screen.

4.2 Main Setup

Press <Del> to enter BIOS CMOS Setup Utility. The Main setup screen is showed as following when the setup utility is entered. System Date/Time is set up in the Main Menu.



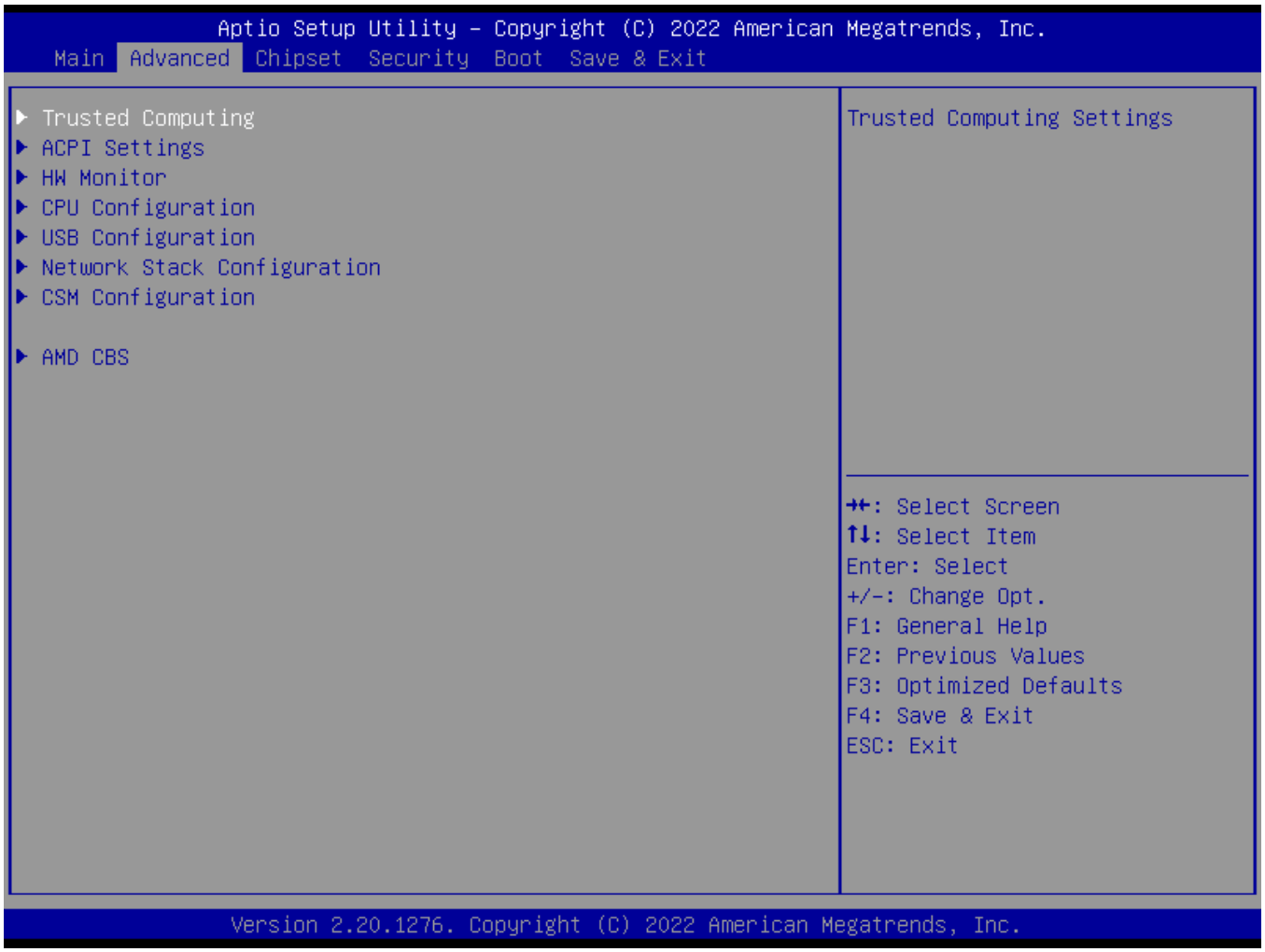
■ System Date

Set the system date. Please use <Tab> to switch between data elements.

■ System Time

Set the system time. Please use <Tab> to switch between time elements.

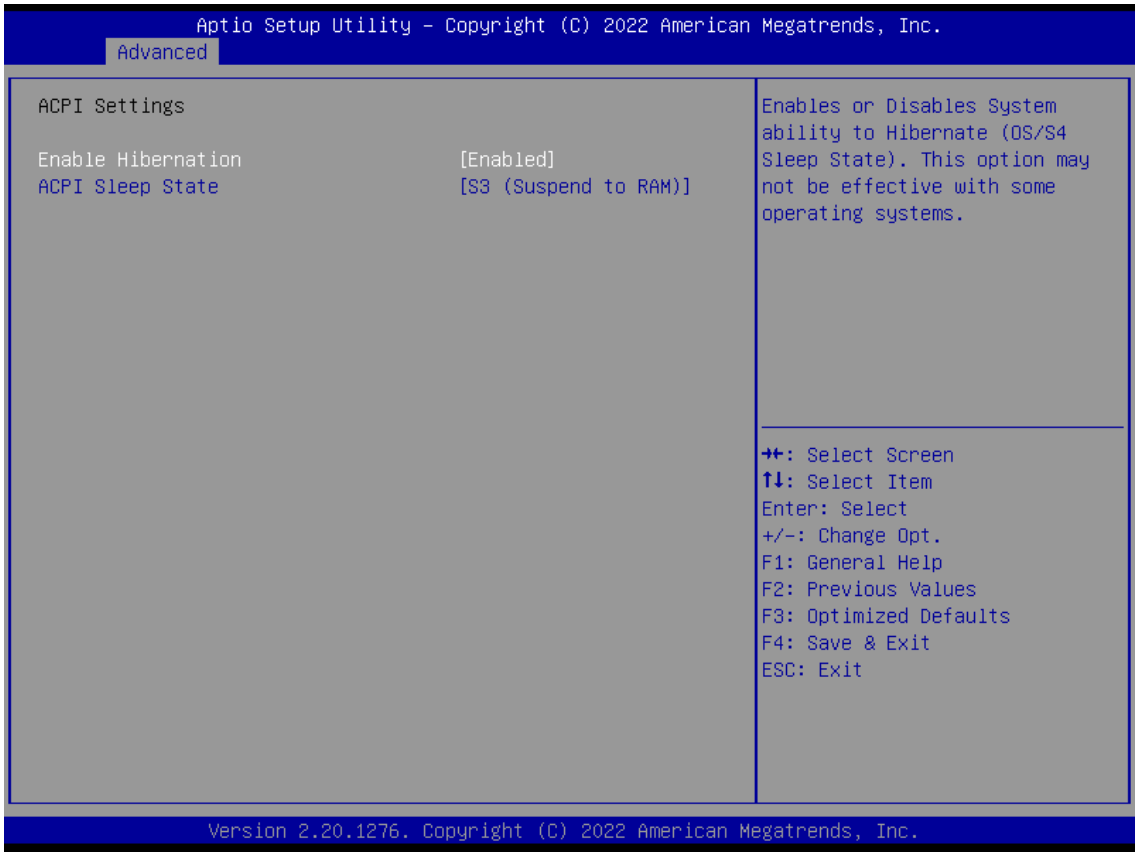
4.3 Advanced Setup



4.3.1 Trusted Computing

Item	Options	Description
Security Device Support	Enabled, Disabled**[Default]** ,	Enable/Disable BIOS support for security device. O.S. will not show Security Device.TCG EFI protocol and INT1A interface will not be available.
Pending operation	None**[Default]** , TPM Clear	Schedule an Operation for the Security Device. NOTE: Your Computer will reboot during restart in order to change State of Security Device.

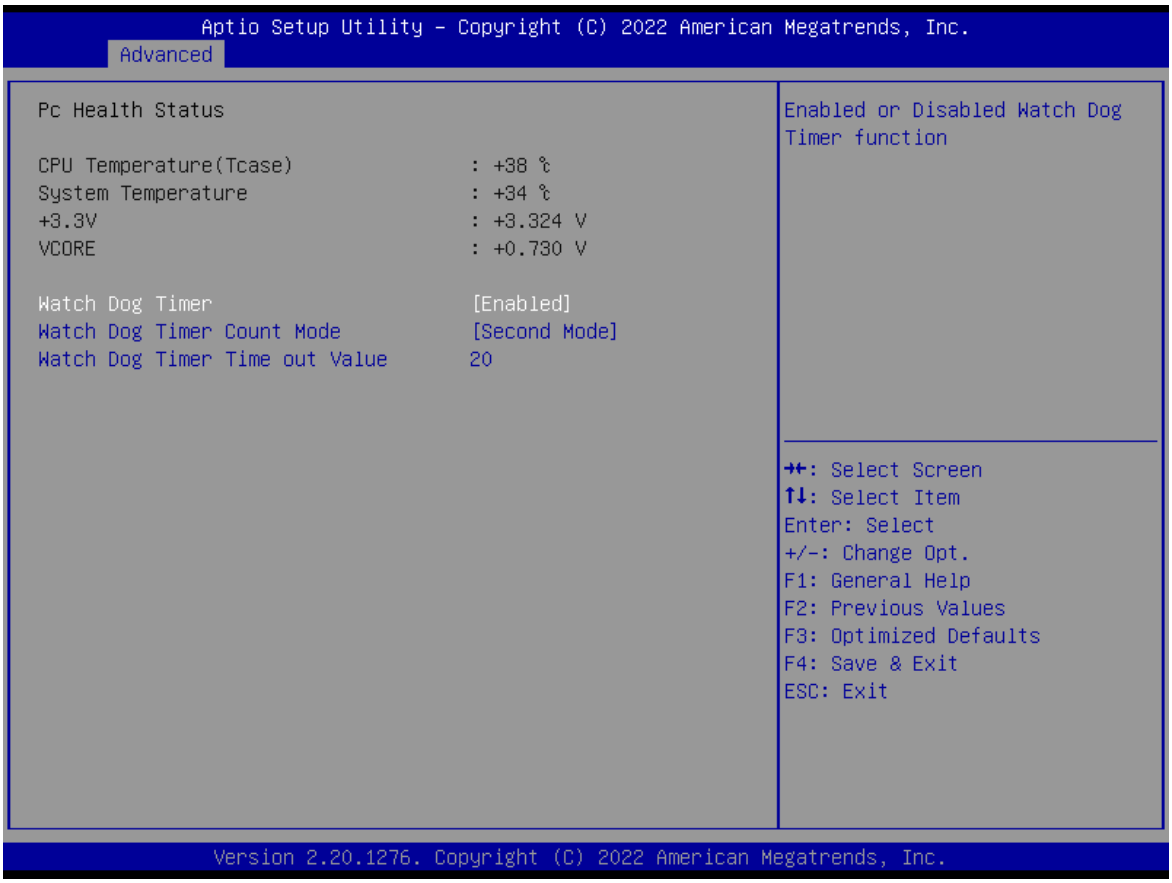
4.3.2 ACPI Settings



Item	Options	Description
Enable Hibernation	Disabled , Enabled**[Default],**	Enables or Disables System ability to Hibernate (OS/S4 Sleep State). This option may not be effective with some operating systems.
ACPI Sleep State	Suspend Disabled, S3 (Suspend to RAM)**[Default]**	Select the highest ACPI sleep state the system will enter when the SUSPEDN button is pressed.

4.3.3 Hardware Monitor

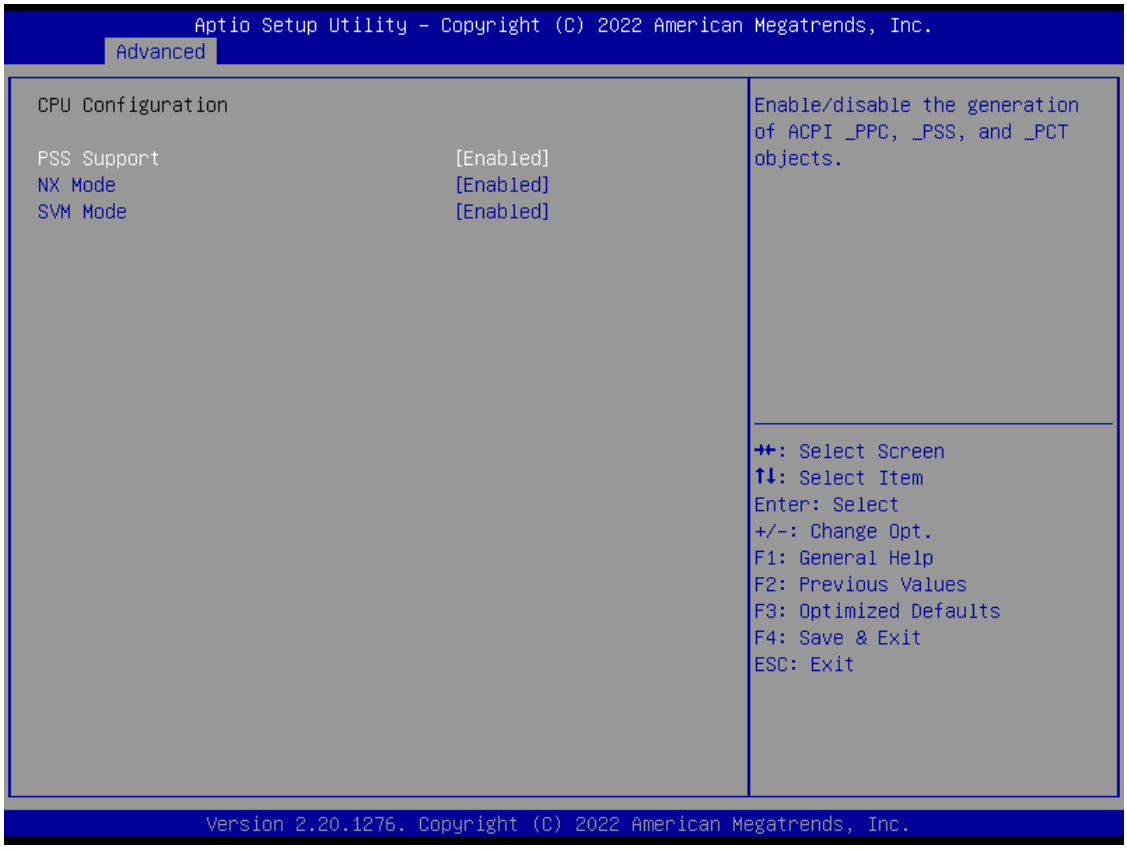
These items display the current status of all monitored hardware devices/ components such as voltages and temperatures.



Item	Options	Description
Smart Fan Function	Disabled**[Default],** Enabled	Enabled or Disable Smart Fan

Watch Dog Timer	Disabled [Default], Enabled	Enabled or Disabled Watch Dog Timer function.
Watch Dog Timer Count Mode	Second Mode**[Default]**, Minute Mode	Select Second Mode or Minute Mode.
Watch Dog Timer Time out Value	20~255(Second)**[Default],** 1~255(Minute)	Watch Dog Timer Time out Value.

4.3.4 CPU Configuration

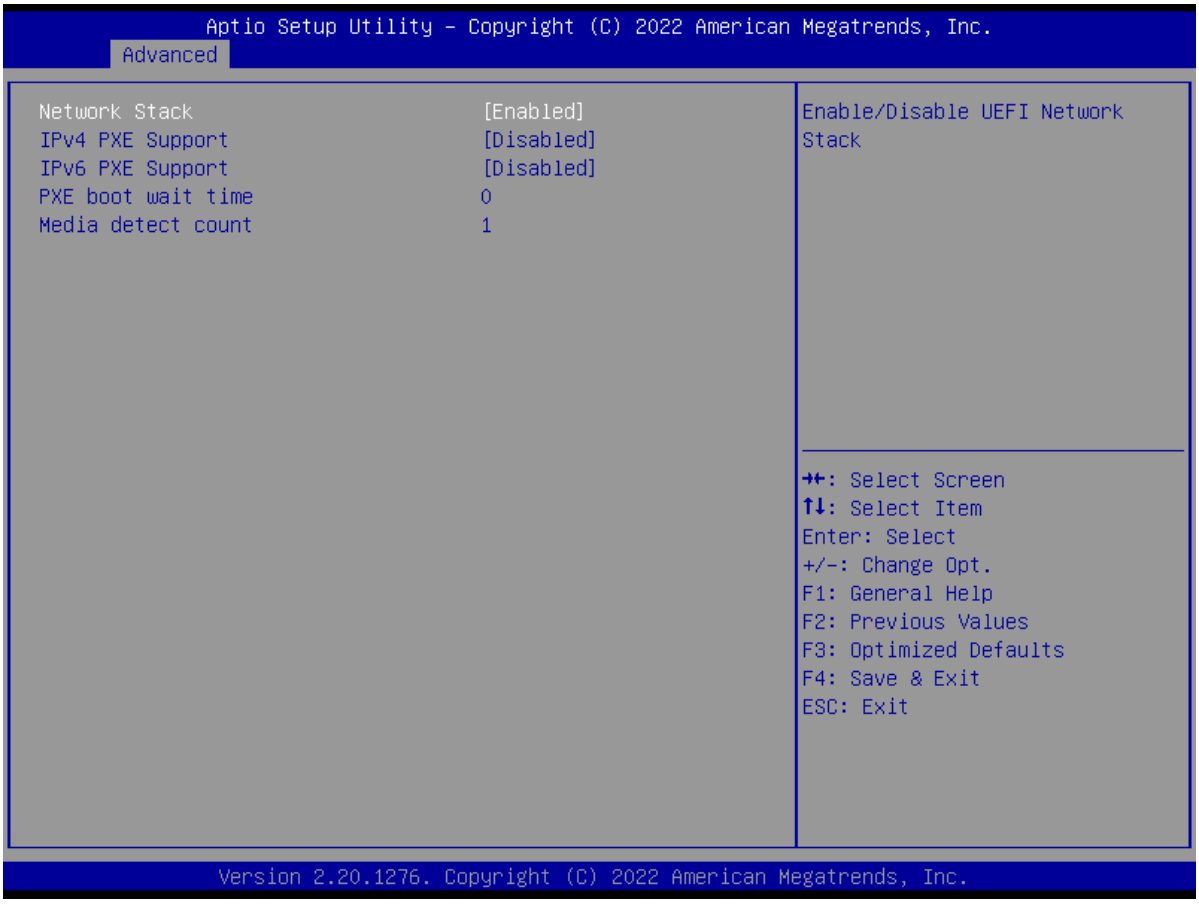


Item	Options	Description
PSS Support	Disabled, Enabled**[Default]**	Enable/disable the generation of ACPI _PPC, _PSS, and _PCT objects.
NX Mode	Disabled, Enabled**[Default]**	Enable/disable No-execute page protection Function
SVM Mode	Disabled, Enabled**[Default]**	Enable/disable CPU Virtualization

4.3.5 USB Configuration

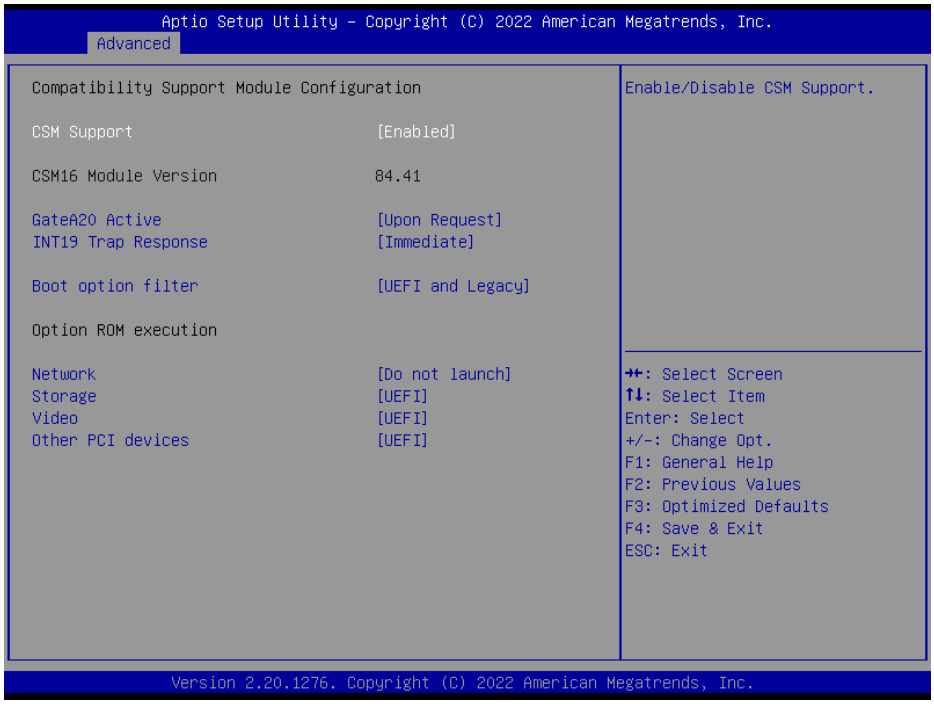
Item	Options	Description
Legacy USB Support	Enabled**[Default]** Disabled Auto	Enables Legacy USB support. AUTO option disables legacy support if no USB devices are connected. DISABLE option will keep USB devices available only for EFI applications.
XHCI Hand-off	Enabled**[Default]** Disabled	This is a workaround for OSew without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB transfer time-out	1 sec , 5 sec , 10 sec , 20 sec**[Default]**	The time-out value for Control, Bulk, and Interrupt transfers.
Device reset time-out	10 sec , 20 sec**[Default] ,** 30 sec, 40 sec	USB mass storage device Start Unit command time-out.
Device power-up delay	Auto**[Default]** Manual	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, for a Hub port the delay is taken form Hub descriptor.

4.3.6 Network Stack Configuration



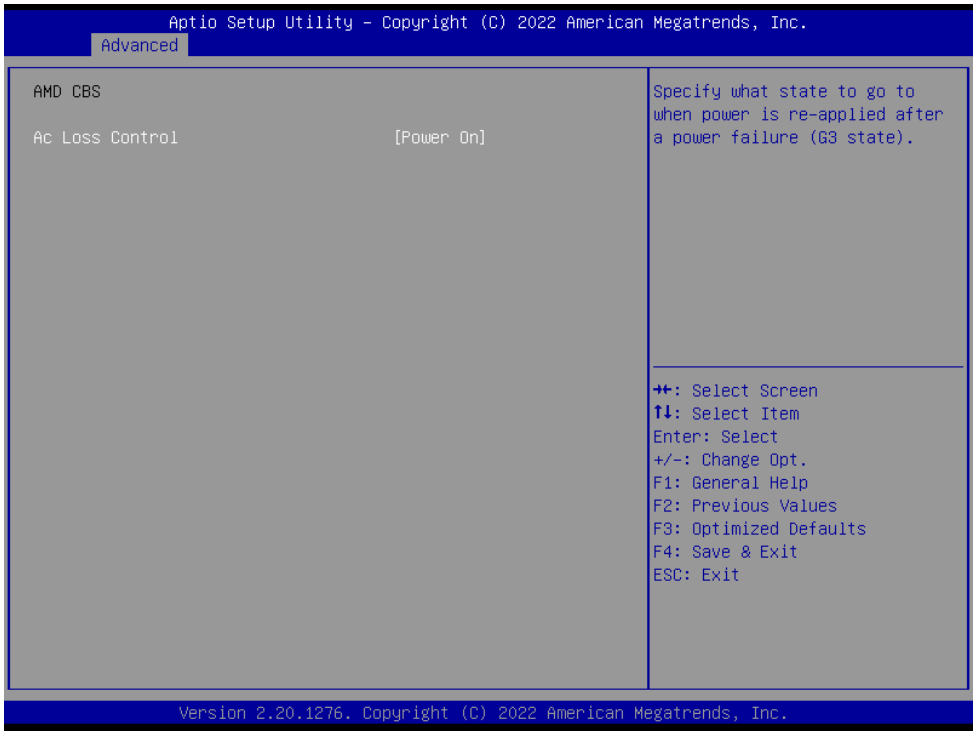
Item	Options	Description
Network Stack	Disabled**[Default]** , Enabled	Enable/Disable UEFI Network Stack.
IPv4 PXE Support	Disabled**[Default]** , Enabled	Enable/Disable IPv4 PXE boot support. If disabled, IPv4 PXE boot support will not be available.
IPv6 PXE Support	Disabled**[Default]** , Enabled	Enable/Disable IPv6 HTTP boot support. If disabled, IPv6 HTTP boot support will not be available.
PXE boot wait time	**0[Default]**	Wait time in seconds to press ESC key to abort the PXE boot. Use either +/- or numeric keys to set the value.
Media detect count	**1[Default]**	Number of times the presence of media will be checked. Use either +/- or numeric keys to set the value.

4.3.7 CSM Configuration



Item	Options	Description
CSM Support	Disabled**[Default]** , Enabled	This item allows users to enable or disable for "CSM Support".
GateA20 Active	Upon Request**[Default] ,** Always	This item allows users to set Upon Request or Always for "GateA20 Active".
Option ROM Messages	Force BIOS**[Default]** , Keep Current	Set display mode for Option ROM
INT19 Trap Response	Immediate**[Default] ,** Postponed	This item allows users to set the BIOS reaction to INT19 trapping by Option ROM: "Immediate" - execute the trap right away; "postponed" - execute the trap during legacy boot.
Boot option filter	UEFI and Legacy**[Default] ,** Legacy only, UEFI only	This item allows users to select which type of operating system to boot by option. This item is configurable only when CSM Support is set to Enabled.
Network	Do not launch**[Default]** , UEFI, Legacy	Controls the execution of UEFI and Legacy Video OpROM.
Storage	Do not launch, UEFI**[Default]** , Legacy	Controls the execution of UEFI and Legacy Storage OpROM.
Video	Do not launch, UEFI**[Default]** , Legacy	Controls the execution of UEFI and Legacy Video OpROM
Other PCI devices	Do not launch, UEFI**[Default]** , Legacy	Determines OpROM execution policy for devices other than Network, Storage, or Video.

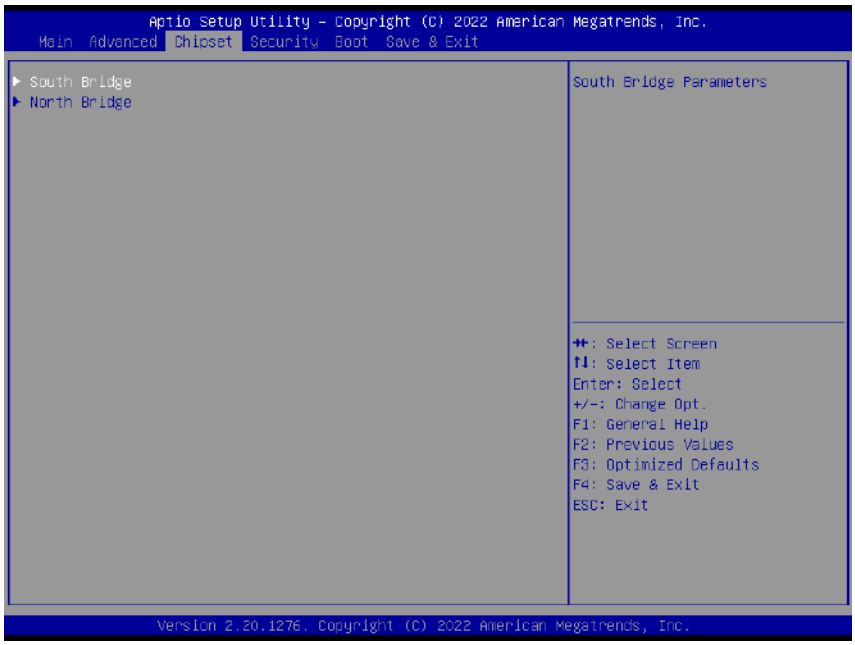
4.3.8 AMD CBS



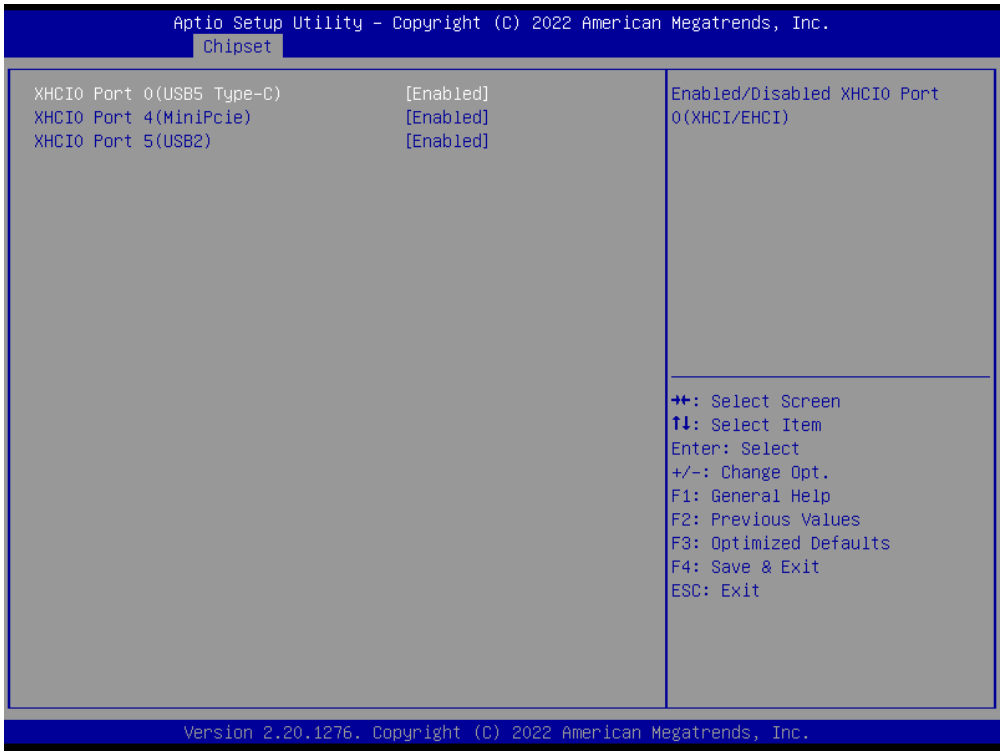
Item	Options	Description
AC Loss Control	Power Off, Power On**[Default]** , Last State	Specify what state to go to when power is re-applied after a power failure (G3 state).

4.4 Chipset

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

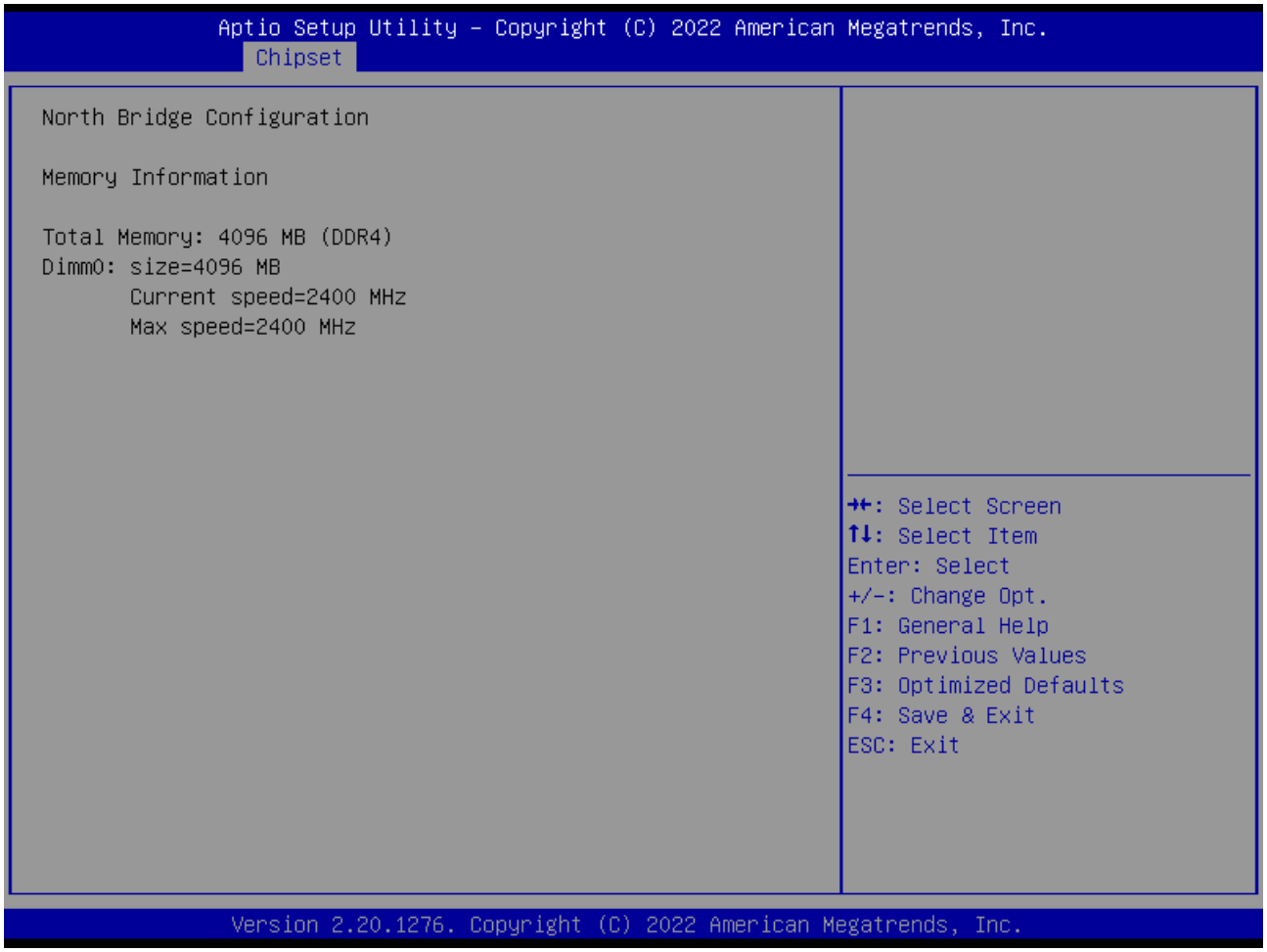


4.4.1 SB USB Configuration



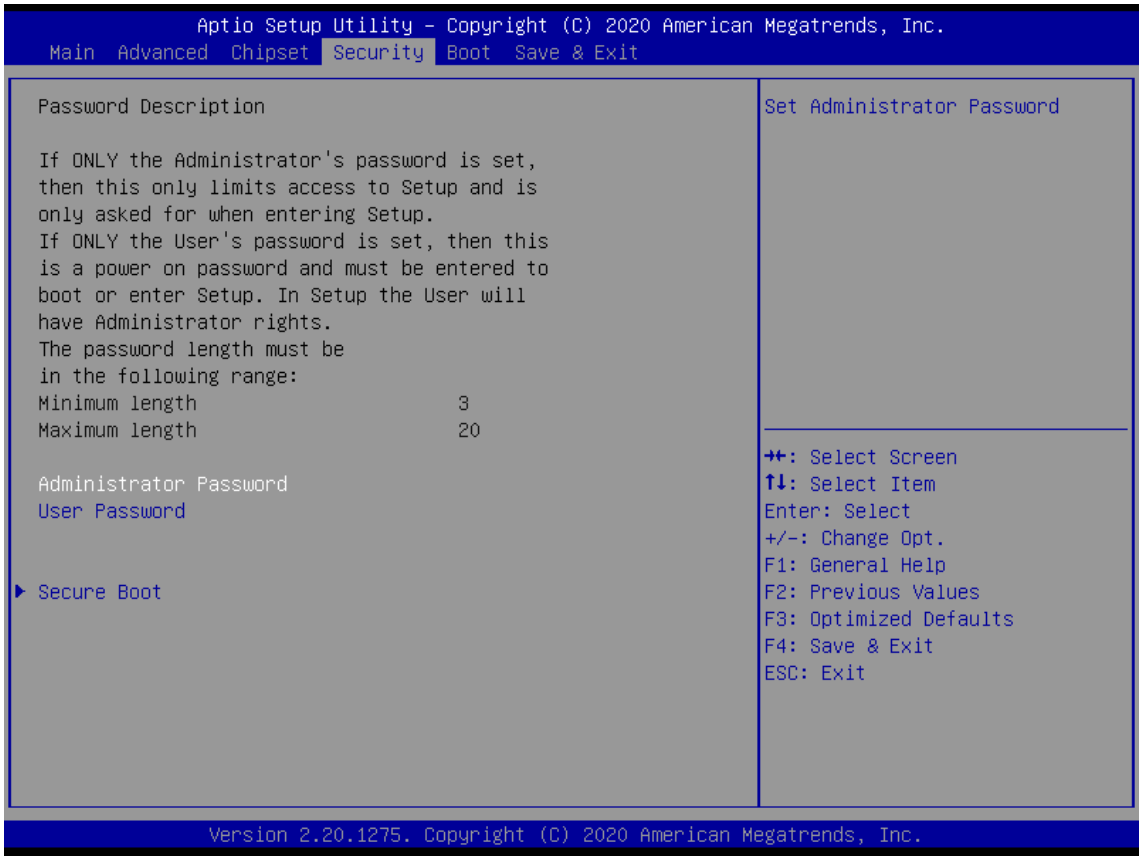
Item	Options	Description
XHCI0 Port X	Disabled, Enabled**[Default]** ,	Enabled/Disabled XHCIO Port

4.4.2 North Bridge Configuration



4.5 Security

Security menu allow users to change administrator password and user password settings.



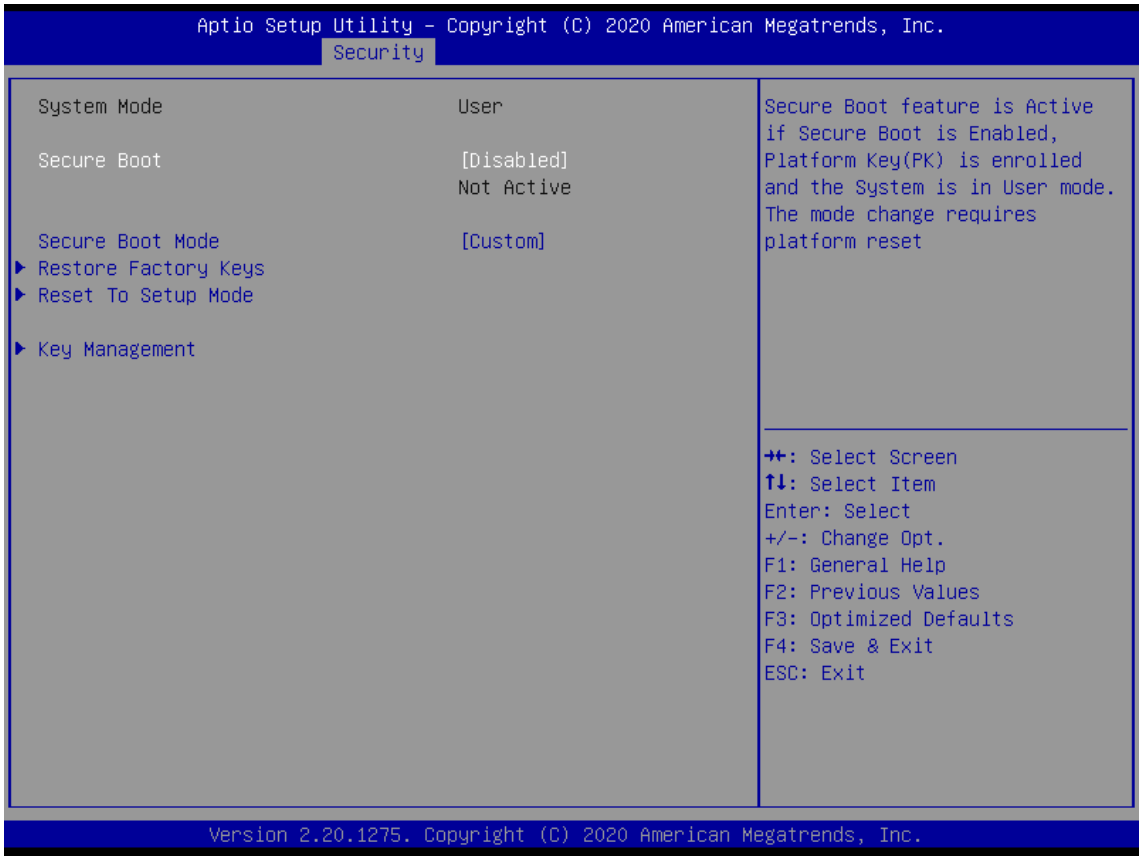
■ Administrator Password

This item allows you to set Administrator Password.

■ User Password

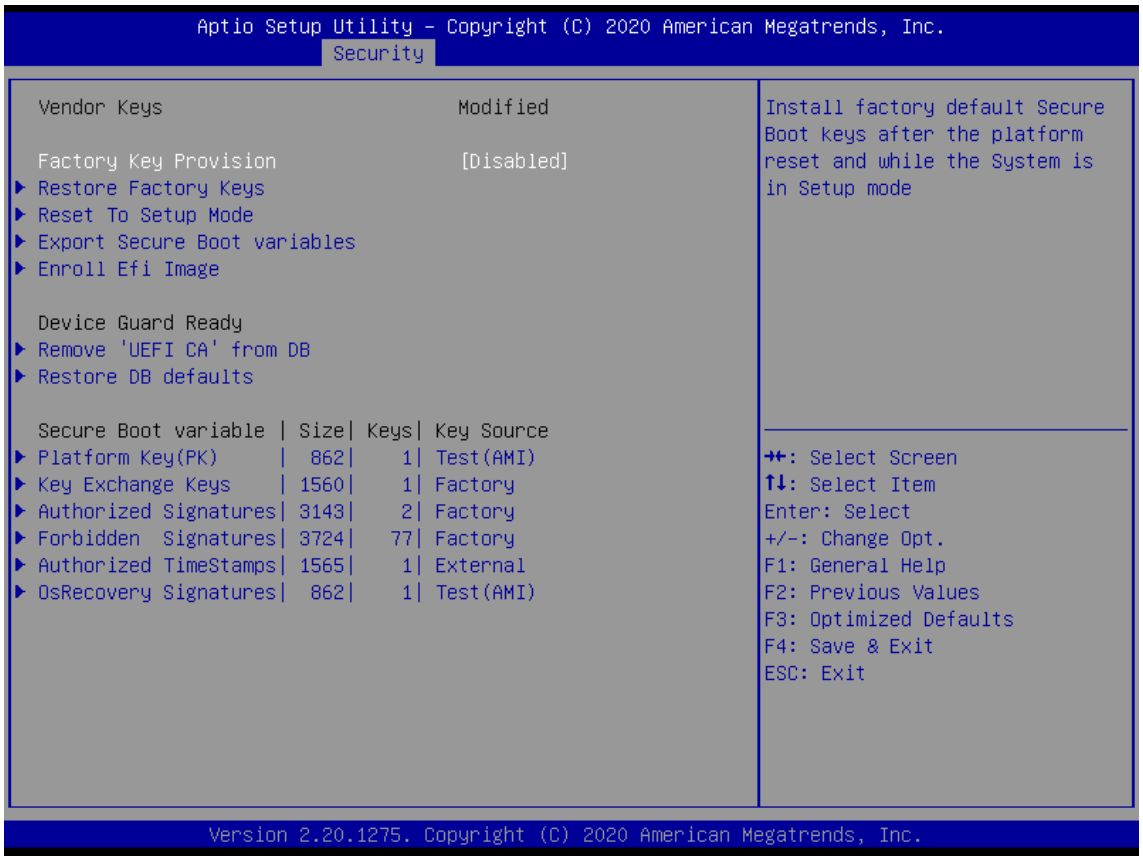
This item allows you to set User Password.

Security Boot



Item	Options	Description
Secure Boot	Disabled **[Default] ,** Enabled	Secure Boot feature is Active if Secure Boot is Enabled,Platform Key(PK) is enrolled and the System is in User mode. The mode change requires platform reset
Secure Boot Mode	Standard, Custom**[Default]**	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

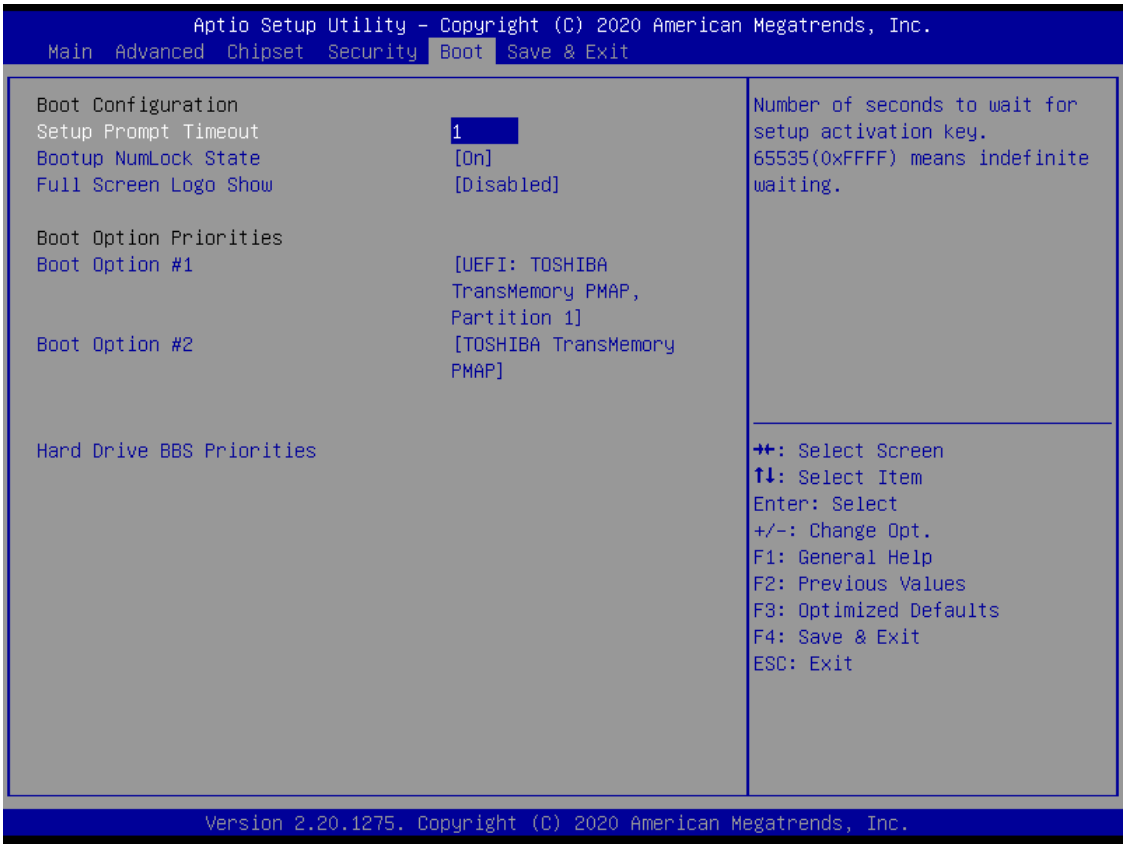
Key Management



Item	Options	Description
Factory Key Provision	Disabled **[Default] ,** Enabled	Install factory default Secure Boot keys after the platform reset and while the System is in Setup mode

4.6 Boot

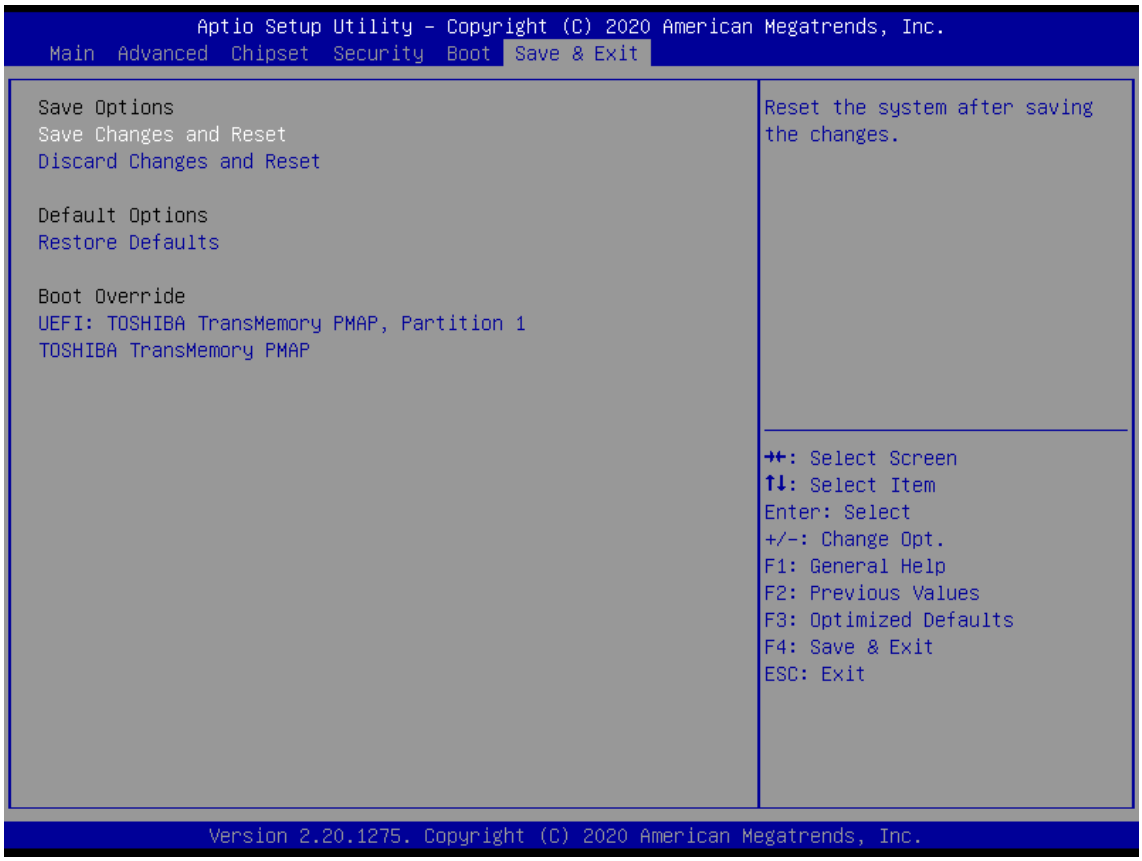
This menu allows you to setup the system boot options.



Item	Options	Description
Setup Prompt Timeout	1**[Default]**	Number of seconds to wait for setup activation key. 65535(0xFFFF) means indefinite waiting.
Bootup NumLock State	On**[Default]** , Off	Select the Keyboard NumLock state.
Full Screen Logo Show	Disabled**[Default]** , Enabled	Enables or disables Full Screen Logo Show option.
Boot Option #1		Set the system boot order.

4.7 Save & Exit

This setting allows users to configure the boot settings.



■ Save Changes and Reset

This item allows user to reset the system after saving the changes. This item allows user to reset the system after saving the changes.

■ Discard Changes and Reset

This item allows user to reset the system without saving any changes.

■ Restore Defaults

Use this item to restore /load default values for all the setup options.

Appendix

WDT & GPIO

This appendix provides the sample codes of WDT (Watch Dog Timer) and GPIO (General Purpose Input/ Output).

WDT Sample Code

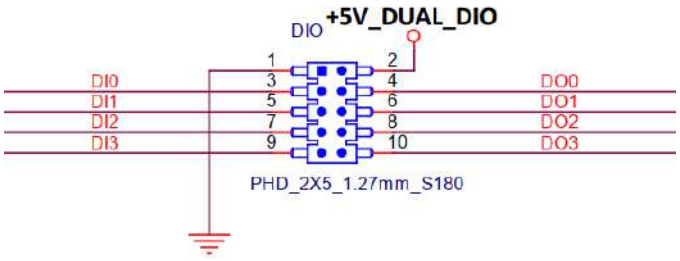
Psuedo Code

```
UINT8     WDT_TimeOut_Sec=2;                          //Second value

//Set Second Number
*(volatile UINT32 *)0xFEB00000= 0x03;                 //Initialization WatchdogControl
    IoWrite8(0x80,0xFF);                              //Delay time
    *(volatile UINT32 *)0xFEB00004= WDT_TimeOut_Sec;  //Set watch dog time value(Bit15~Bit0)
    IoWrite8(0x80,0xFF);
    *(volatile UINT32 *)0xFEB00000= 0xFB;             //Start watch dog
    IoWrite8(0x80,0xFF);
}
```

GPIO Sample Code

GPIO Setting



PIN#	GPIO#	Default Configuration
1	GND	+GND
2	VCC	+5V
3	IN1	DIO Input1
4	OUT1	DIO Output1
5	IN2	DIO Input2
6	OUT2	DIO Output2
7	IN3	DIO Input3
8	OUT3	DIO Output3
9	IN4	DIO Input4
10	OUT4	DIO Output4

Psuedo Code

```
UINT32      GPIO0_Value;
UINT32      GPIO1_Value;
UINT32      GPIO2_Value;
UINT32      GPIO3_Value;

#define AGPIO5_DI0     0xFED81514
#define AGPIO6_DI1     0xFED81524
#define AGPIO7_DI2     0xFED8151C
#define AGPIO8_DI3     0xFED81520

#define AGPIO16_DO0     0xFED81540
#define AGPIO17_DO1     0xFED81544
#define AGPIO18_DO2     0xFED81548
#define AGPIO24_DO3     0xFED81560
//Set DO0~DO3Value
//Set AGPIO16_DO0 = high
//Bit 23 = Output Enable, Bit22 =Output Value ,Bit16 = PinState
 *(volatile UINT32 *) (UINTN) (AGPIO16_DO0)  = 0x00D50000;

//Set AGPIO17_DO1 = low
//Bit 23 = Output Enable, Bit22 =Output Value ,Bit16 = PinState
 *(volatile UINT32 *) (UINTN) (AGPIO17_DO1)  = 0x00940000

//Set AGPIO18_DO2 = high
//Bit 23 = Output Enable, Bit22 =Output Value ,Bit16 = PinState
 *(volatile UINT32 *) (UINTN) (AGPIO18_DO2)  = 0x00D50000;

//Set AGPIO24_DO3 = low
//Bit 23 = Output Enable, Bit22 =Output Value ,Bit16 = PinState
 *(volatile UINT32 *) (UINTN) (AGPIO24_DO3)  = 0x00940000;

// Read In0~In3 value
// Read In0, Bit16 = PinState
GPIO0_Value = (*(volatile UINT32 *) (UINTN) (AGPIO5_DI0))& 0x00010000;
// Read In1, Bit16 = PinState

GPIO1_Value = (*(volatile UINT32 *) (UINTN) (AGPIO6_DI1))& 0x00010000;

// Read In2, Bit16 = PinState
GPIO2_Value = (*(volatile UINT32 *) (UINTN) (AGPIO7_DI2))& 0x00010000;

// Read In3, Bit16 = PinState
GPIO3_Value = (*(volatile UINT32 *) (UINTN) (AGPIO8_DI3))& 0x00010000;
```

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