USER'S MANUAL

SDM510L

Intel® Smart Display Module (SDM-L) with Intel® Core™ Alder Lake H/P/U Processor

User's Manual

Version:1.0

AXIOMTEK

www.axiomtek.com

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CAUTION

If you replace wrong batteries, it causes the danger of explosion. It is recommended by the manufacturer that you follow the manufacturer's instructions to only replace the same or equivalent type of battery, and dispose of used ones.

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Printed in Taiwan

ESD Precautions

Computer boards have integrated circuits sensitive to static electricity. To prevent chipsets from electrostatic discharge damage, please observe the following precautions:

- Do not remove modules or integrated circuits from their anti-static packaging until you are ready to install them.
- Before holding the module or any integrated circuit, touch an unpainted portion of the system unit chassis for a few seconds. Doing so will help discharge static electricity from your body.
- When handling modules and components, wear a wrist-grounding strap, available from most electronic component stores.

Trademarks Acknowledgments

Table of Contents

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Section 1
Introduction

The SDM510L is a new Intel® Smart Display Module (SDM-L) supporting the Intel® Core™ Alder Lake H/P/U processor. It delivers outstanding system performance and supports a diverse range of multiple I/Os such as one 2.5 GbE Ethernet port, three HDMI 2.0 ports and four USB. The SDM510L measures only 100 x 175mm and delivers 8K output with streaming content through the SDM edge connector.

The SDM510L reserves two SO-DIMM slots, two types of M.2 sockets, plus one standard PCIex8 (through the SDM edge connector). It also features built-in I/O interfaces including USB 3.2 Gen 2, HDMI 2.1, DisplayPort 1.4, Serial TX/RX and I^2C. In addition, for maximum integration flexibility, the SDM510L can be built-in or externally plugged into a display, which allows this cost-effective smart display module to fit into even the sleekest all-in-one designs.

1.1 Features

- Intel® Core™ Alder Lake H/P/U processor
- Two SO-DIMM memory slots supporting memory capacity up to 32GB
- One M.2 E Key 2230 for Wi-Fi/BT, one M.2 M Key for storage options
- Three HDMI ports and one 2.5 GbE LAN port
- Easily integrates into slim designs

1.2 Specifications

- **CPU**
  - Intel® Core i3/i5/i7 Celeron® processor.
  - Intel® Core™ i5-12600HE processor.
  - Intel® Core™ i3-1215UE processor.
  - Intel® Celeron® processor 7305E.

- **BIOS**
  - American Megatrends Inc. BIOS.
  - 64Mbit SPI Flash, DMI, Plug and Play.
  - PXE Ethernet Boot ROM; customized default saving features; LPC-free supported; uses SPI type Flash memory.

- **System Memory**
  - Two SO-DIMM DDR4-3200MHz memory slots, supporting maximum capacity up to 32GB (optional).

- **Expansion Interface**
  - One M.2 E Key 2230 socket for Wi-Fi/Bluetooth option.
  - One M.2 M Key 2242 socket for storage.

- **USB Interface**
  - Three USB 3.2 Gen 2 ports and one USB 2.0 port in Type A on rear I/O.
  - One USB 3.2 Gen 2 port (through SDM edge connector).

- **Graphics**
  - Intel® Iris® XeGraphics (Core™ i7/i5), Intel® UHD Graphics (Core™ i3 and Celeron®).
  - One DP 1.4 (through SDM edge connector), with resolution up to 4096x2160.
  - One HDMI 2.1 (through SDM edge connector), with resolution up to 7680x4320.
  - Three HDMI 2.0b (4096x2160 @60p) (on rear I/O), with voice, no support hot pluggable.

- **Ethernet**
  - One 2.5 GbE provided by Intel® I225AT support Wake-on-LAN.

- **WatchDog Timer**
  - Timeout value range is 1~255 sec/min.

- **SDM Edge Connector**
  - 98-pin golden finger, supporting DP, HDMI, PCI-Express x1, USB 3.2 Gen 2, Serial TX/RX, I^2C and SPI.

- **Power Management**
  - ACPI (Advanced Configuration and Power Interface).

- **Form Factor**
  - 175mm x 60mm.

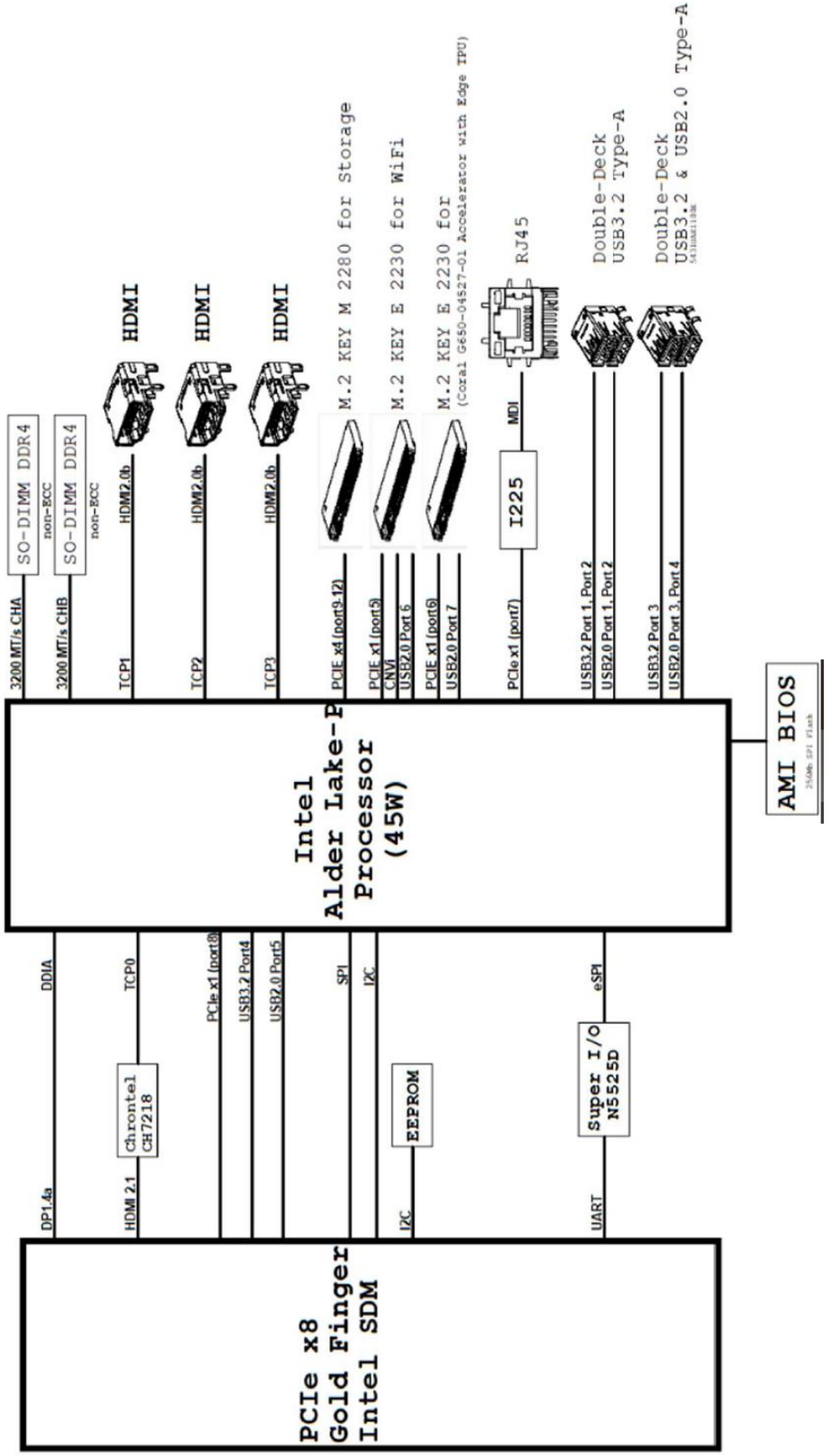
1.3 Utilities Supported

- Chipset driver
- Graphics driver
- TXE driver
- Serial IO driver
- Ethernet utility and driver

Note

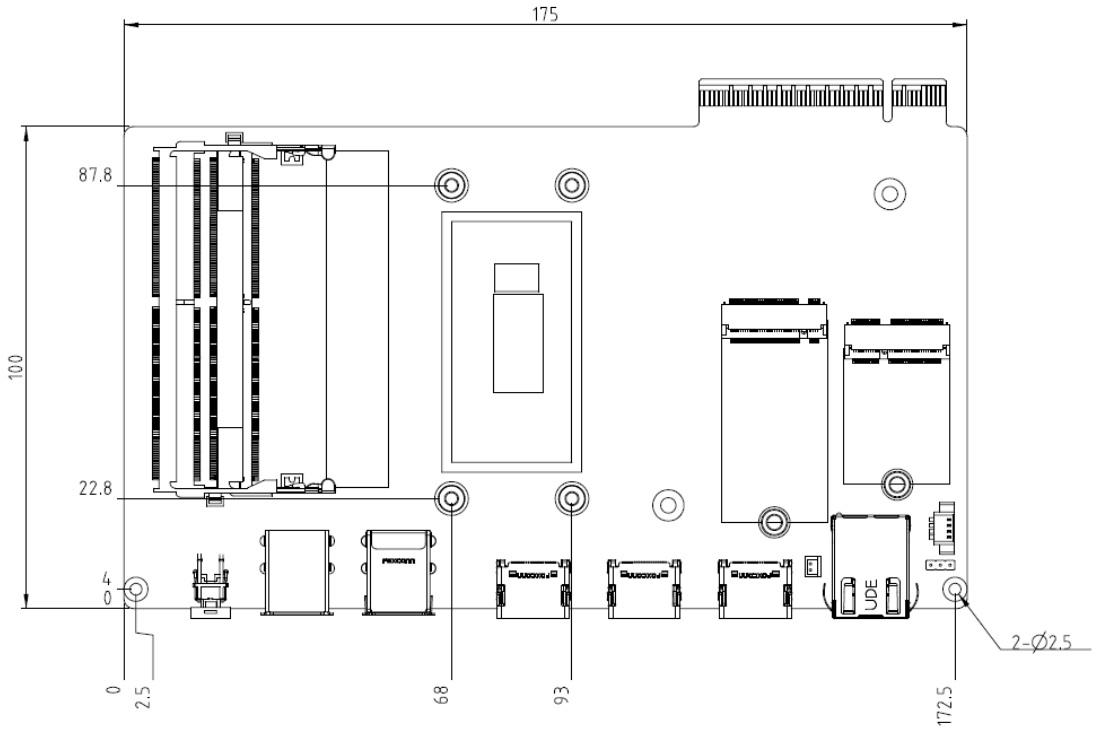
All specifications and images are subject to change without notice.

1.4 Block Diagram

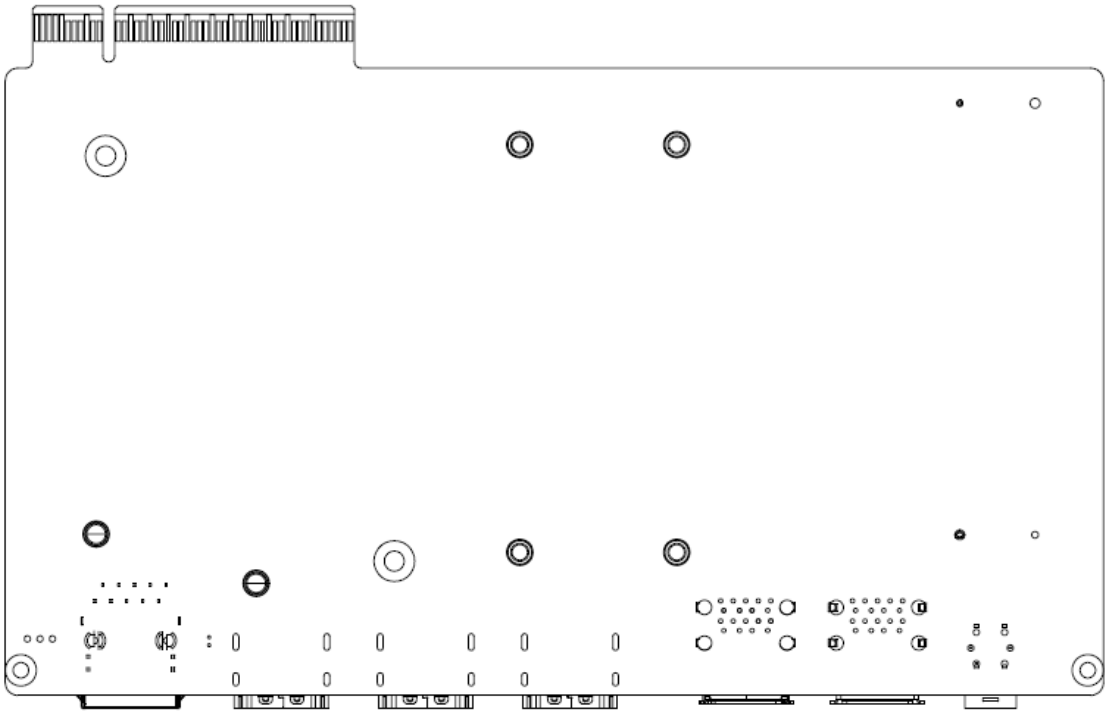


Section 2
Module and Pin Assignments

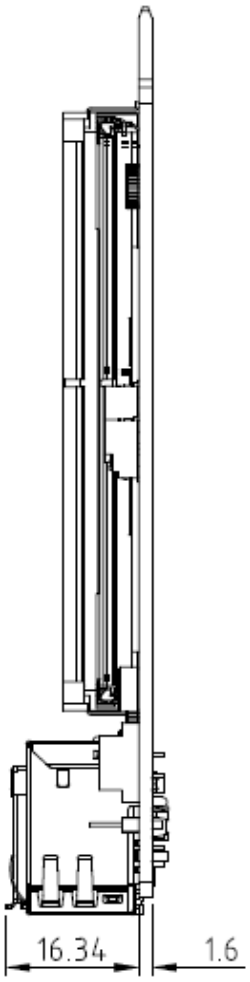
2.1 Module Dimensions and Fixing Holes



Top View

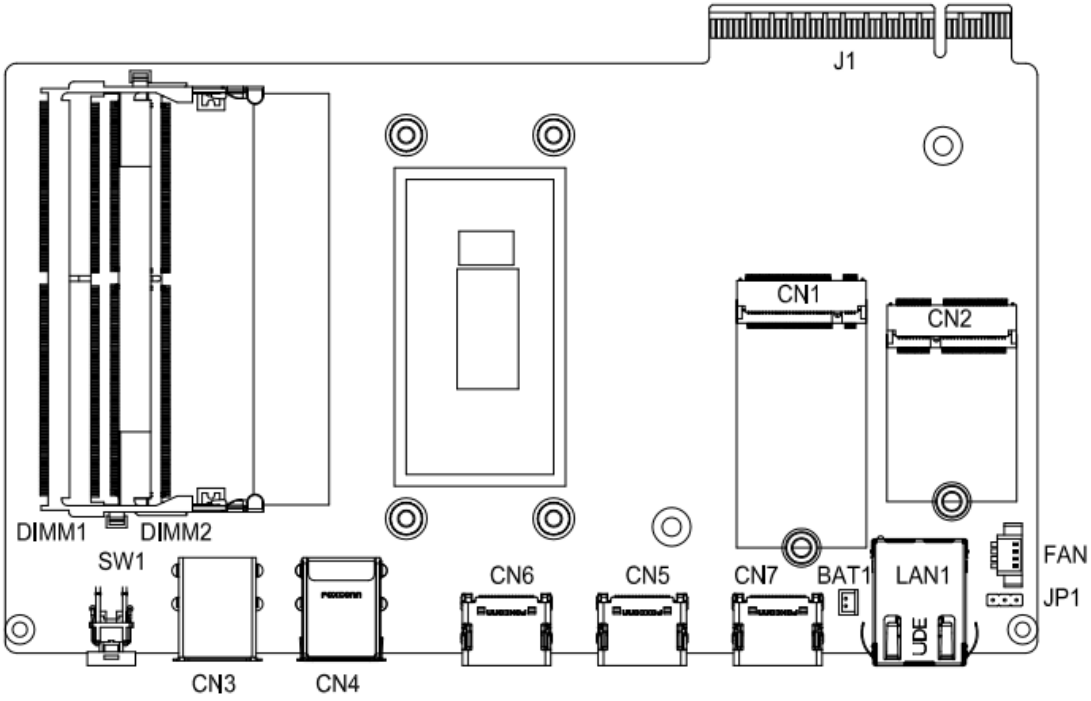


Bottom View

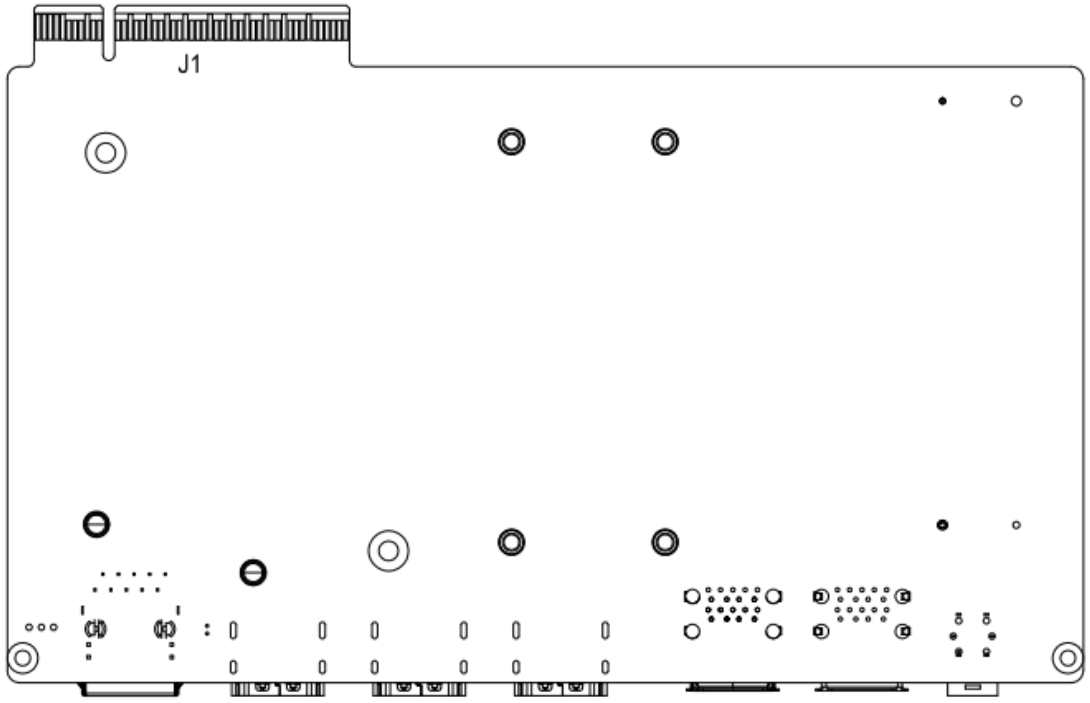


Side View

2.2 Module Layout



Top View

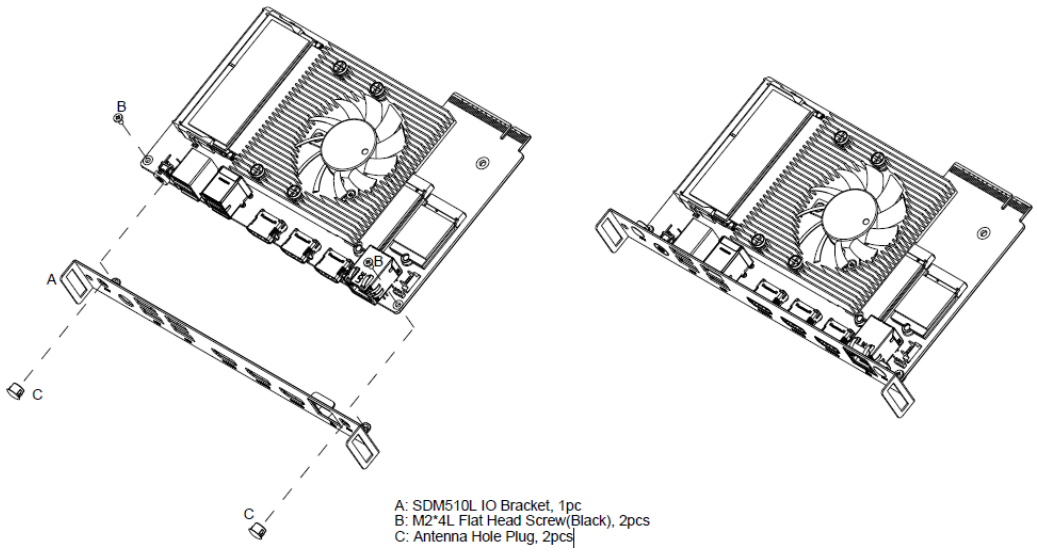


Bottom View

2.3 Bracket and Heatsink Installation

2.3.1 Bracket Assembly

SDM510L i3-1215UE and Celeron 7305E SKU bracket assembly.



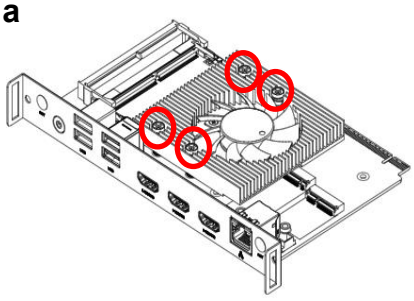
A: SDM510L IO Bracket, 1pc
B: M2*4L Flat Head Screw(Black), 2pcs
C: Antenna Hole Plug, 2pcs

2.3.2 Heatsink Installation

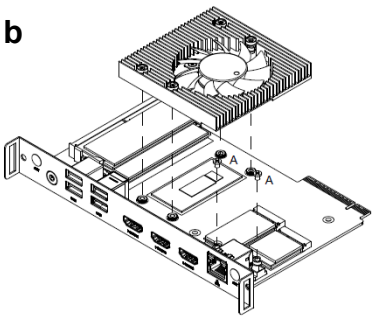
- **15W Heatsink Installation**

Below chart is for 15W heatsink installation of SDM510L i3-1215UE and Celeron 7305E **"Barebone SKU"**. The screw already fixed as circled in image "a" when you received SDM510L module. Please remove screw as circled in image "b", then start installation M.2 SSD. When you finish M.2 SSD installation, please apply retention screws of heatsink to secure as image "a". Please noted that the screws (M3*3L) of M.2 module are in the accessory package.

a



b

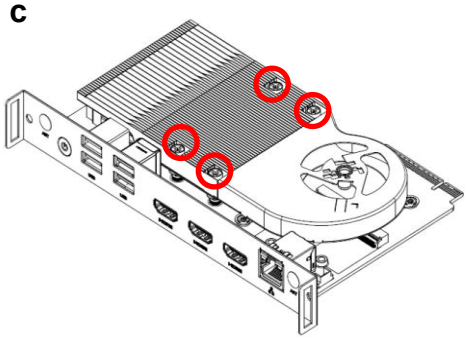


A: M3*3L Flat Head Screw(Silver), 2pcs

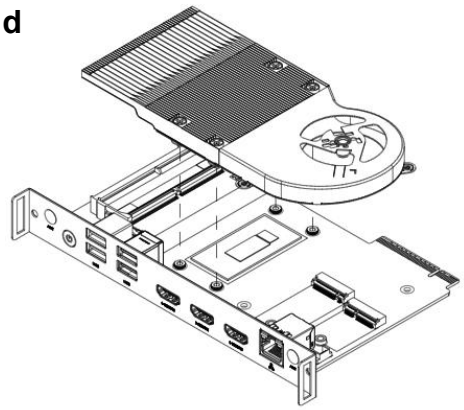
- **45W Heatsink Installation.**

Below chart is for 45W heatsink installation of SDM510L i5-12600HE **"Barebone SKU"**. The screw already fixed as circled in image "c" when you received SDM510L module. Please remove the 4 screws and remove heatsink temporary as image "d". Then you can start installation of M.2 SSD/ WIFI module.

c

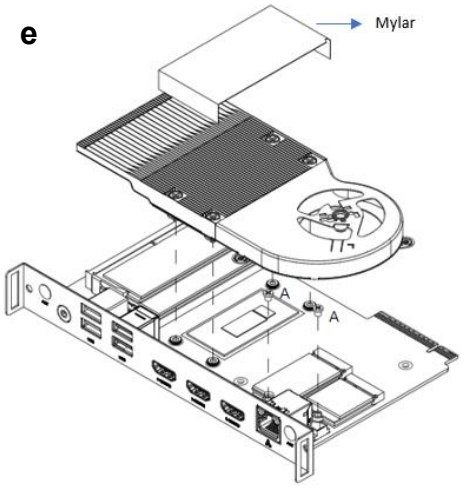


d



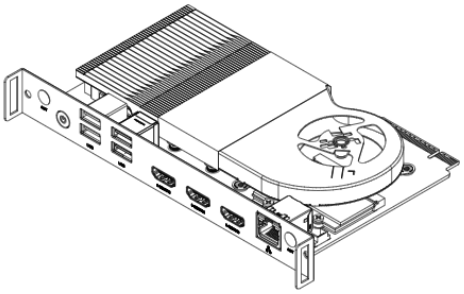
Please noted that the screws (M3*3L) of M.2 module are in the accessory package and finish M.2 SSD and WIFI module installation. Then you can apply retention screws of heatsink to secure it as the image "e" and stick the mylar on top of heatsink like below "f" chart.

e



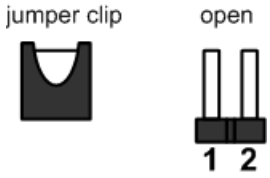
A: M3*3L Flat Head Screw(Silver), 2pcs

f



2.4 Jumper Settings

A jumper is a small component consisting of a set of jumper pins with a jumper clip. Place a jumper clip on two jumper pins to close; remove a jumper clip from two jumper pins to open. The following illustration shows how to set up a jumper.



Properly configure jumper settings on the SDM510L to meet your application purpose. Below you can find a summary table of jumpers and their default onboard settings.

Note

Once the default jumper setting needs to be changed, please do it under power-off condition.

2.4.1 Auto Power on (JP1)

If JP1 is enabled for power input, the system will be automatically power on without the need to press the soft power button. If JP1 is disabled for power input, it is necessary to manually press the soft power button to power on the system.

Function	Setting
Enable auto power on (Default)	1-2 close
Disable auto power on	2-3 close

2.5 Connectors

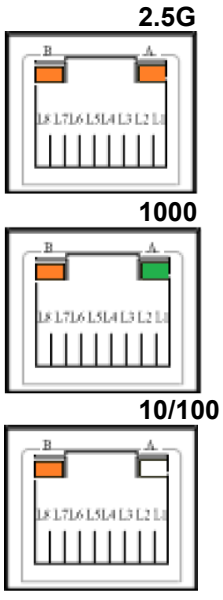
Signals go to the other parts of the system through connectors. Loose or improper connection might cause problems. Please make sure all connectors are properly and firmly connected. Here is a table summarizing the connectors on the hardware.

Connector	Description
LAN1	2.5G Ethernet Port
CN1	M.2 M Key 2242 Socket
CN2	M.2 E Key 2230 Socket
CN3	USB 3.2 Gen2 Type A Stack Connector
CN4	USB 3.2 Gen2 with USB 2.0 Type A Stack Connector
CN5	HDMI Type A
CN6	HDMI Type A
CN7	HDMI Type A
SW1	Power Button
BAT1	Battery Header
FAN1	Fan Header
J1	SDM Edge Connector

2.5.1 Ethernet Port (LAN1)

The board has one RJ-45 Ethernet connector (LAN1). Connection can be established by plugging one end of the Ethernet cable into this connector and the other end (phone jack) to a 2500/1000/100/10-Base-T hub.

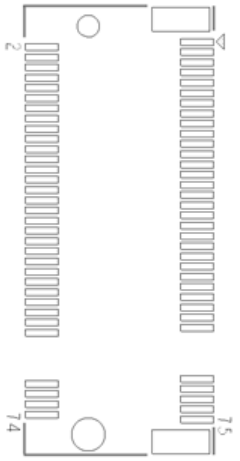
Pin	2500 Base-T
L1	MDI0+
L2	MDI0-
L3	MDI1+
L4	MDI1-
L5	MDI2+
L6	MDI2-
L7	MDI3+
L8	MDI3-
B	Active Link LED (Orange) Off: No link Blinking: Data activity detected
A	Speed LED 2.5G: Orange 1000: Green 100/10: OFF



2.5.2 M.2 M Key 2242 Socket (CN1)

This system has one M.2 M Key socket for inserting the M.2 2242 NVMe / SATA SSD module.

Pin	Signal	Pin	Signal
1	GND	2	+3.3V
3	GND	4	+3.3V
5	PERn9	6	NC
7	PERp9	8	NC
9	GND	10	LED1#
11	PETn9	12	+3.3V
13	PETp9	14	+3.3V
15	GND	16	+3.3V
17	PERn10	18	+3.3 V
19	PERp10	20	NC
21	GND	22	NC
23	PETn10	24	NC
25	PETp10	26	NC
27	GND	28	NC
29	PERn11	30	NC
31	PERp11	32	NC
33	GND	34	NC
35	PETn11	36	NC
37	PETp11	38	DEVSLP
39	GND	40	NC
41	SATA_RXP /PERn12	42	NC
43	SATA_RXN /PERp12	44	NC
45	GND	46	NC
47	SATA_TXN /PETn12	48	NC
49	SATA_TXP /PETp12	50	PERST#
51	GND	52	CLKREQ#
53	REFCLKN	54	PEWAKE#
55	REFCLKP	56	NC
57	GND	58	NC
59	NC	60	NC
61	NC	62	NC
63	NC	64	NC
65	NC	66	NC
67	NC	68	NC
69	PEDET	70	+3.3V
71	GND	72	+3.3V
73	GND	74	+3.3V
75	GND		



2.5.3 M.2 E Key 2230 Socket (CN2)

The module has one M.2 E Key 2230 socket on the top side supporting PCI-Express x1 and USB 2.0

Pin	Signal	Pin	Signal
1	GND	2	+3.3V
3	USB2_DP_6	4	+3.3V
5	USB2_DN_6	6	NC
7	GND	8	NC
9	NC	10	NC
11	NC	12	NC
13	GND	14	NC
15	NC	16	NC
17	NC	18	GND
19	GND	20	NC
21	NC	22	NC
23	NC	24	NC
25	NC	26	NC
27	NC	28	NC
29	NC	30	NC
31	NC	32	NC
33	GND	34	NC
35	PETn5	36	NC
37	PETp5	38	CLINK_RST
39	GND	40	CLINK_DAT
41	PERn5	42	CLINK_CLK
43	PERp5	44	NC
45	GND	46	NC
47	REFCLKN	48	NC
49	REFCLKP	50	SUSCLK
51	GND	52	PLTRST#
53	CLKREQ	54	BT_DISABLE#
55	PEWAKE#	56	WLAN_DISABLE#
57	GND	58	NC
59	NC	60	NC
61	NC	62	NC
63	GND	64	NC
65	NC	66	NC
67	NC	68	NC
69	GND	70	NC
71	NC	72	+3.3V
73	NC	74	+3.3V
75	GND		

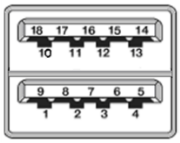
2.5.4 USB 3.2 Gen2 Stack Connectors (CN3，CN4)

The Universal Serial Bus (compliant with USB 3.2 Gen2 (10Gb/s)) connectors are on the rear I/O side. It is commonly used for installing USB peripherals such as a keyboard, mouse, scanner, etc.

The CN3 carries USB port 1 and 2 signals.

Pin	Signal	Pin	Signal
1	USB_VCC (+5V_SBY)	10	USB_VCC (+5V_SBY)
2	USB_Data1-	11	USB_Data2-
3	USB_Data1+	12	USB_Data2+
4	GND	13	GND
5	SSRX1-	14	SSRX2-
6	SSRX1+	15	SSRX2+
7	GND	16	GND
8	SSTX1-	17	SSTX2-
9	SSTX1+	18	SSTX2+

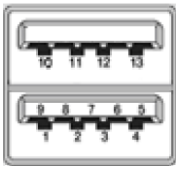
CN3



The CN4 carries USB port 3 and 5 signals:

Pin	Signal	Pin	Signal
1	USB_VCC (+5V_SBY)	10	USB_VCC (+5V_SBY)
2	USB_Data3-	11	USB_Data5-
3	USB_Data3+	12	USB_Data5+
4	GND	13	GND
5	SSRX3-		
6	SSRX3+		
7	GND		
8	SSTX3-		
9	SSTX3+		

CN4



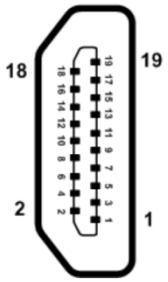
Note

CN4 connector, one is USD 3.2 Gen2, the other is USB 2.0.

2.5.5 HDMI Connector (CN5,CN6,CN7)

The HDMI (High-Definition Multimedia Interface) is an interface source that requires the single cable to be inserted before booting the system

Pin	Signal	Pin	Signal
1	HDMI OUT_DATA2+	2	GND
3	HDMI OUT_DATA2-	4	HDMI OUT_DATA1+
5	GND	6	HDMI OUT_DATA1-
7	HDMI OUT_DATA0+	8	GND
9	HDMI OUT_DATA0-	10	HDMI OUT_Clock+
11	GND	12	HDMI OUT_Clock-
13	N.C.	14	N.C.
15	HDMI OUT_SCL	16	HDMI OUT_SDA
17	GND	18	+5V
19	HDMI_HTPLG		



2.5.6 Power On/Off button (SW1)

The power button is on rear I/O side. It allows users to control system power on/off.

Power Button	Description
On	Turn on/off system
Off	Keep system status

2.5.7 SDM Edge Connector (J1)

The following table shows pin assignments of the 98-pin SDM PCIEx8 edge connector.

Pin	Side B (Top)	Pin	Side A (Bottom)
1	+12V	1	+12V
2	+12V	2	+12V
3	+3.3VSB	3	+12V
4	GND	4	GND
5	GND	5	GND
6	PWRBTN#	6	PWRGD#
7	RESET#	7	SLP_S4
8	SYSFAN#	8	SDM_DET#
9	GND	9	CEC/NC
10	I2C1_SDA	10	I2C0_SDA
11	I2C1_SCL	11	I2C0_SCL
12	GSPI_MOSI	12	GSPI_CLK
13	GSPI_MISO	13	GSPI_CS0#
14	GND	14	GND
15	UART_TXD	15	PCIe_TX+
16	UART_RXD	16	PCIe_TX-
17	GND	17	GND
18	USB_SSTX+	18	PCIe_RX+
19	USB_SSTX-	19	PCIe_RX-
20	GND	20	GND
21	USB_SSRX+	21	PCIe_Clk+
22	USB_SSRX-	22	PCIe_Clk-
23	GND	23	GND
24	USB+	24	PCIE_WAKE#
25	USB-	25	PCIE_CLKREQ#
26	USB_OC#	26	PCIE_RST#
27	GND	27	GND
28	DP3-	28	TMDS_CLK-
29	DP3+	29	TMDS_CLK+
30	GND	30	GND
31	DP2-	31	TMDS0-
32	DP+	32	TMDS0+
33	GND	33	GND
34	DP1-	34	TMDS1-
35	DP1+	35	TMDS1+
36	GND	36	GND
37	DP0-	37	TMDS2-
38	DP0+	38	TMDS2+
39	GND	39	GND
40	DP_AUX-	40	DDC_DATA
41	DP_AUX+	41	DDC_CLK
42	DP_HPD	42	TMDS_HPD
43	GND	43	GND
44	RSVD	44	RSVD
45	RSVD	45	RSVD
46	RSVD	46	RSVD
47	RSVD	47	RSVD
48	RSVD	48	RSVD
49	RSVD	49	RSVD

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Section 3
Hardware Description

3.1 Microprocessor

The SMD510L supports Intel® Core™ i3-1215UE / i5-12600HE and Celeron® 7305E processors, which enable your system to operate under Windows® 10, Windows® 11 and Linux environments. The system performance depends on the microprocessor. Make sure all correct settings are arranged for the installed microprocessor to prevent the CPU from damage.

3.2 BIOS

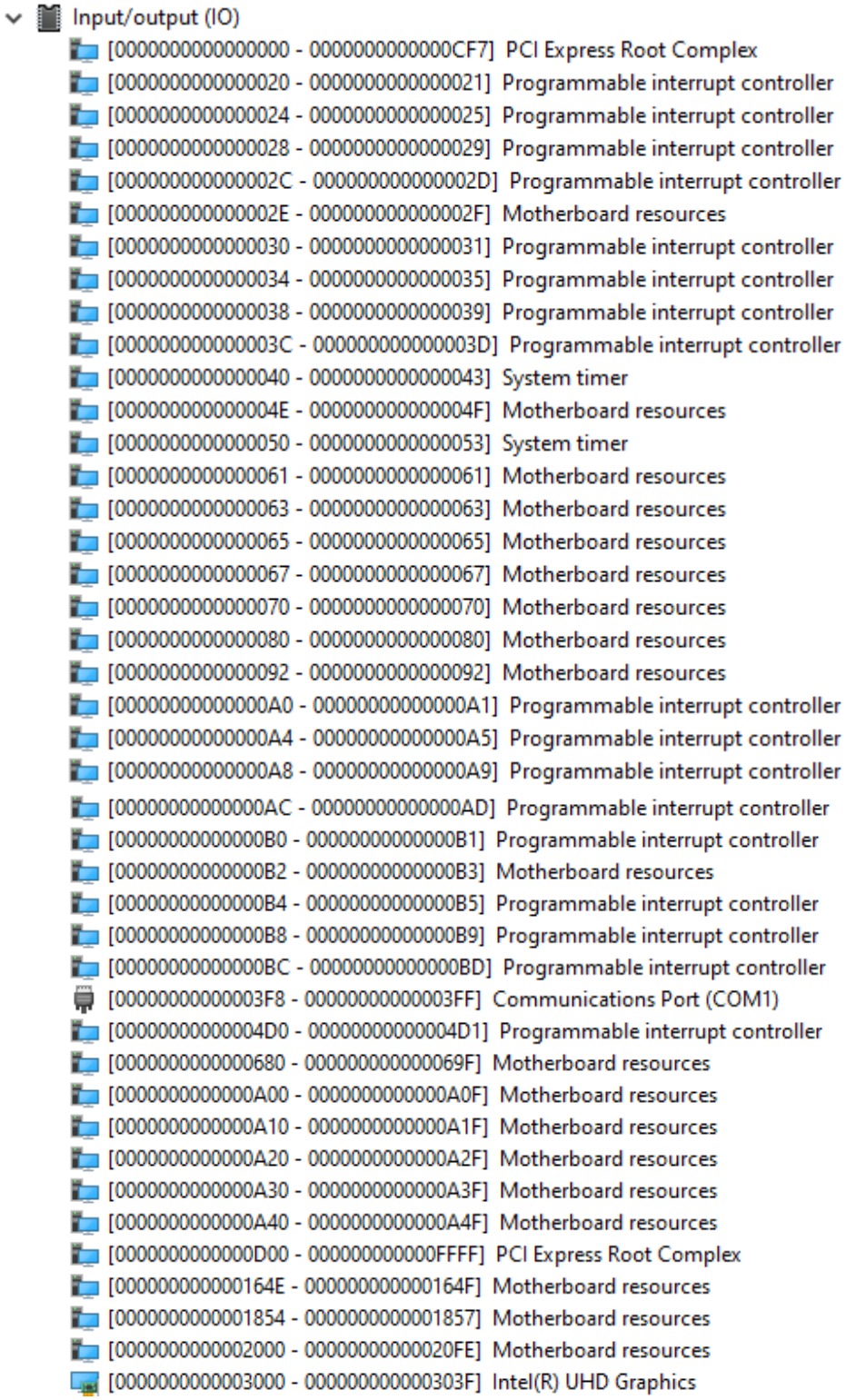
The SDM510L uses AMI Plug and Play BIOS with a single 256Mbit SPI Flash.

3.3 System Memory

Two 260-pin DDR4-3200 SO-DIMM slots, up to 32GB at the maximum.

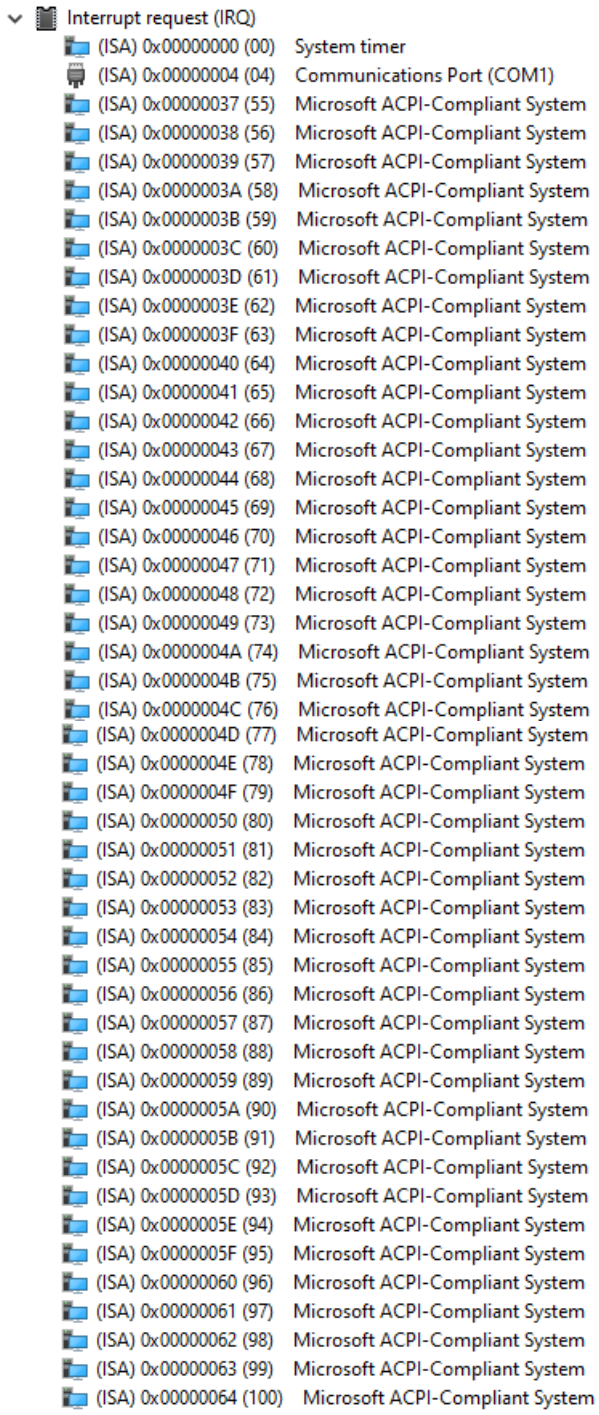
3.4 I/O Port Address Map

The I/O port address mapping list is shown as follows:



3.5 Interrupt Controller (IRQ) Map

The interrupt controller (IRQ) mapping list is shown as follows:



(ISA) 0x00000065 (101) Microsoft ACPI-Compliant System
(ISA) 0x00000066 (102) Microsoft ACPI-Compliant System
(ISA) 0x00000067 (103) Microsoft ACPI-Compliant System
(ISA) 0x00000068 (104) Microsoft ACPI-Compliant System
(ISA) 0x00000069 (105) Microsoft ACPI-Compliant System
(ISA) 0x0000006A (106) Microsoft ACPI-Compliant System
(ISA) 0x0000006B (107) Microsoft ACPI-Compliant System
(ISA) 0x0000006C (108) Microsoft ACPI-Compliant System
(ISA) 0x0000006D (109) Microsoft ACPI-Compliant System
(ISA) 0x0000006E (110) Microsoft ACPI-Compliant System
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(ISA) 0x00000070 (112) Microsoft ACPI-Compliant System
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(ISA) 0x00000072 (114) Microsoft ACPI-Compliant System
(ISA) 0x00000073 (115) Microsoft ACPI-Compliant System
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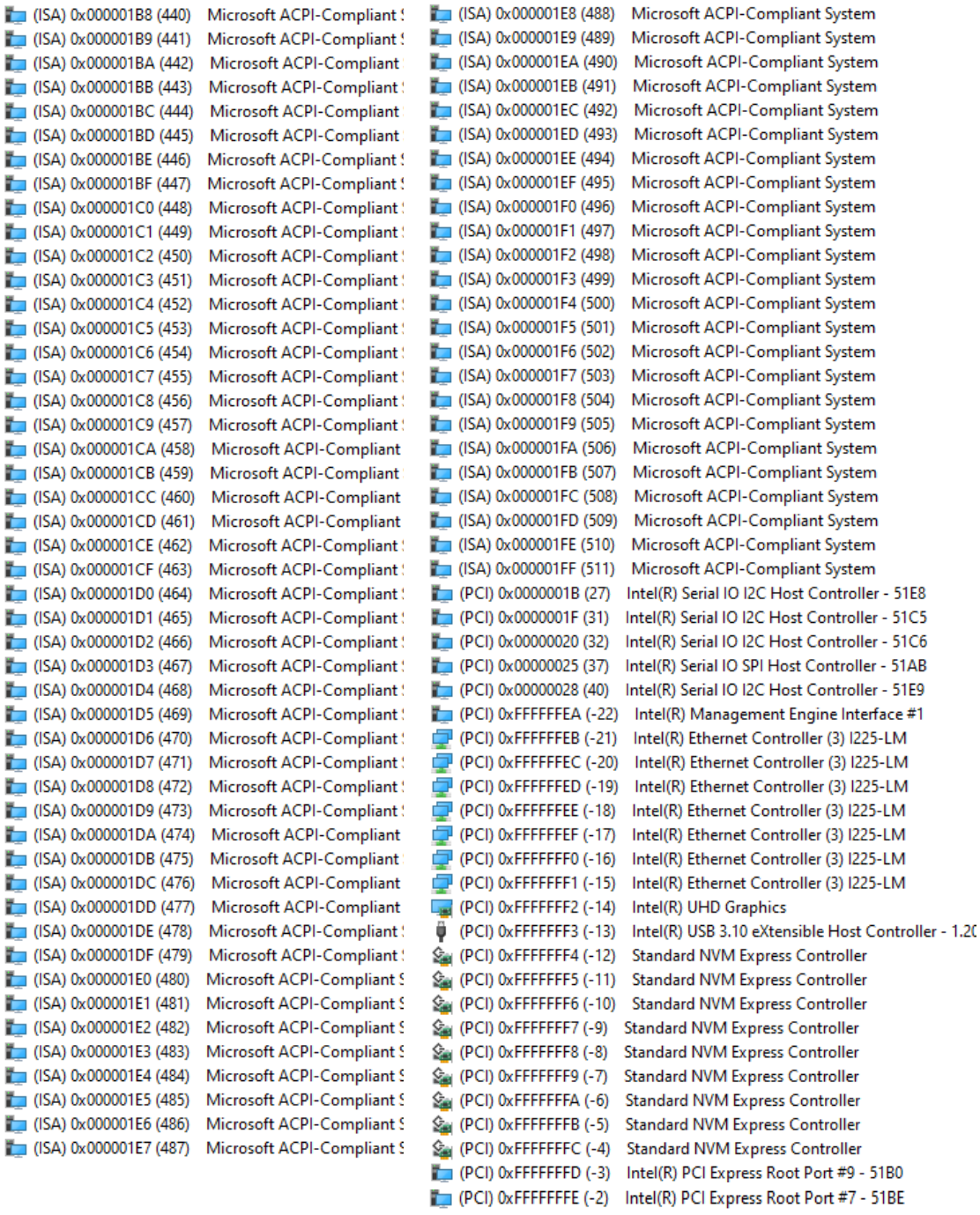
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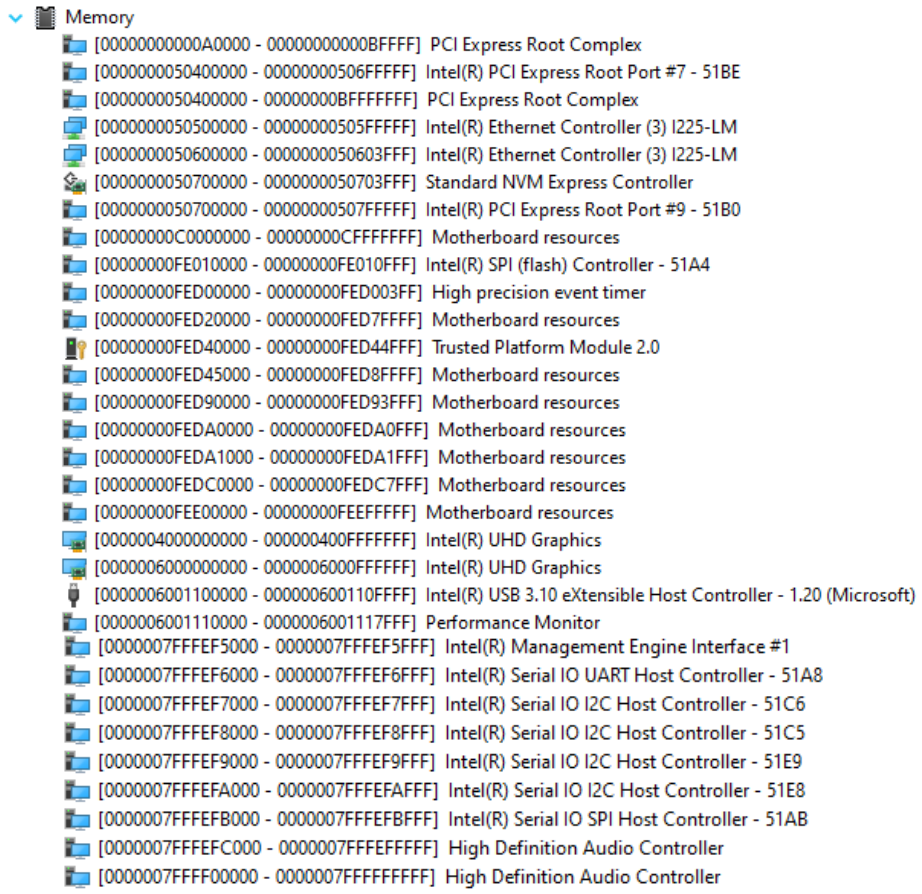
3.6 Memory Map

The memory mapping list is shown as follows:



Section 4
AMI BIOS Setup Utility

The AMI UEFI BIOS provides users with a built-in setup program to modify basic system configuration. All configured parameters are stored in a flash chip to save the setup information whenever the power is turned off. This section provides users with detailed description about how to set up basic system configuration through the AMI BIOS setup utility.

4.1 Starting

To enter the setup screens, follow the steps below:

1. Turn on the computer and press the <Del> key immediately.
2. After you press the <Del> key, the main BIOS setup menu displays. You can access the other setup screens, such as the Advanced and Chipset menus, from the main BIOS setup menu.

It is strongly recommended that you should avoid changing the chipset's defaults. Both AMI and your system manufacturer have carefully set up these defaults that provide the best performance and reliability.

4.2 Navigation Keys

The BIOS setup/utility uses a key-based navigation system called hot keys. Most of the BIOS setup utility hot keys can be used at any time during the setup navigation process. These keys include <F1>, <F2>, <Enter>, <ESC>, <Arrow> keys, and so on.

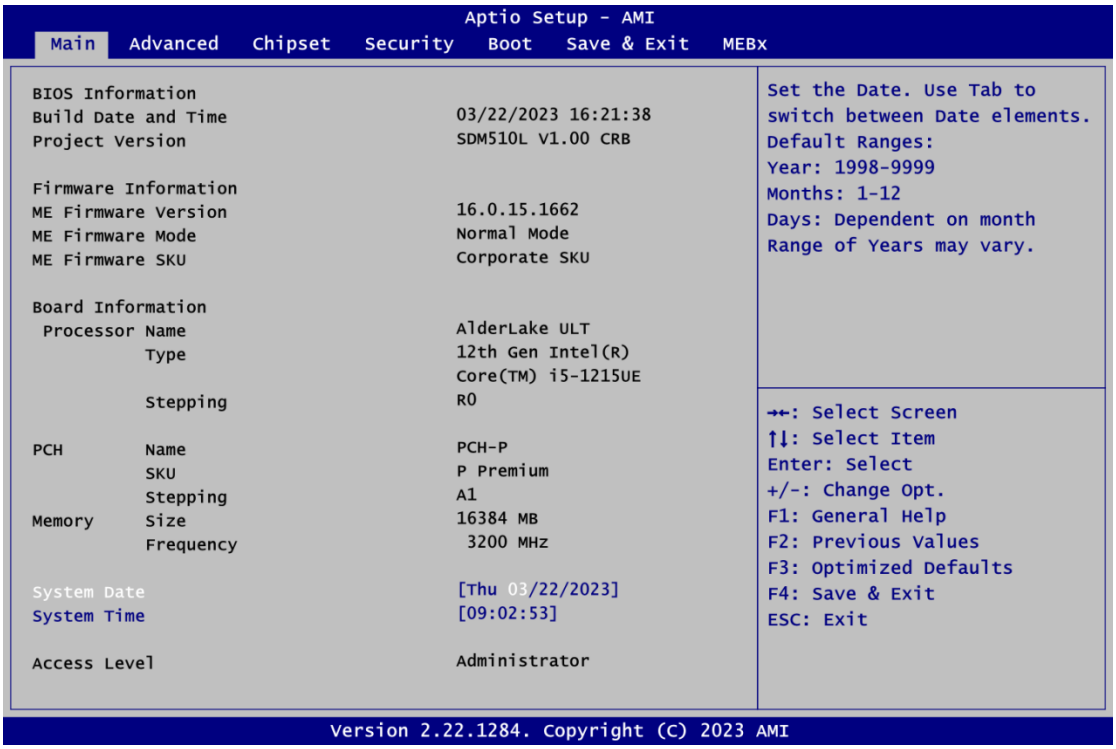
Note

Some of the navigation keys differ from one screen to another.

Hot Keys	Description
→← **Left/Right**	The Left and Right <Arrow> keys allow you to select a setup screen.
↑↓ **Up/Down**	The Up and Down <Arrow> keys allow you to select a setup screen or sub-screen.
+– Plus/Minus	The Plus and Minus <Arrow> keys allow you to change the field value of a particular setup item.
Tab	The <Tab> key allows you to select setup fields.
F1	The <F1> key allows you to display the General Help screen.
F2	The <F2> key allows you to load previous values.
F3	The <F3> key allows you to load optimized defaults.
F4	The <F4> key allows you to save any changes you have made and exit Setup. Press the <F4> key to save your changes.
Esc	The <Esc> key allows you to discard any changes you have made and exit the Setup. Press the <Esc> key to exit the setup without saving your changes.
Enter	The <Enter> key allows you to display or change the setup option listed for a particular setup item. The <Enter> key can also allow you to display the setup sub-screens.

4.3 Main Menu

The Main BIOS setup screen is the first screen you see when entering the setup utility. You can always return to the Main BIOS setup screen by selecting the Main tab. System Time/Date can be set up as described below. The Main BIOS setup screen is also shown below.



BIOS Information
Display BIOS and EC firmware information.

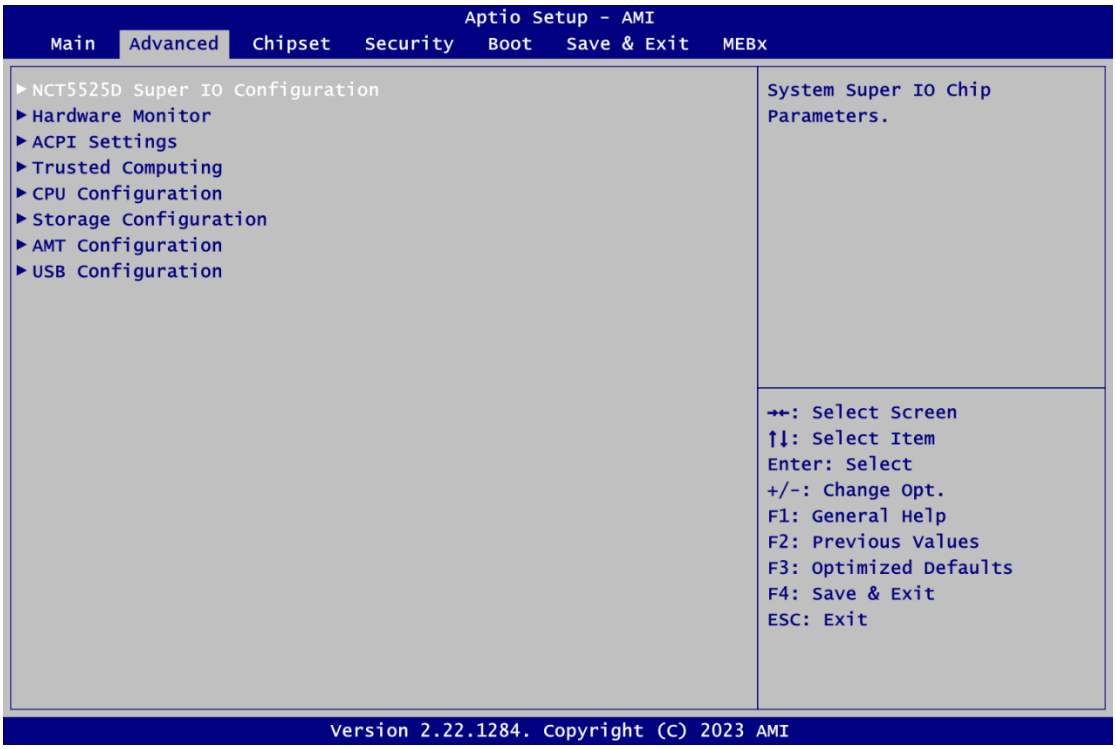
System Date/Time
Use this option to change the system time and date. Highlight System Time or System Date using the <Arrow> keys. Enter new values through the keyboard. Press the <Tab> key or the <Arrow> keys to move between fields. The date must be entered in MM/DD/YY format. The time is entered in HH:MM:SS format.

4.4 Advanced Menu

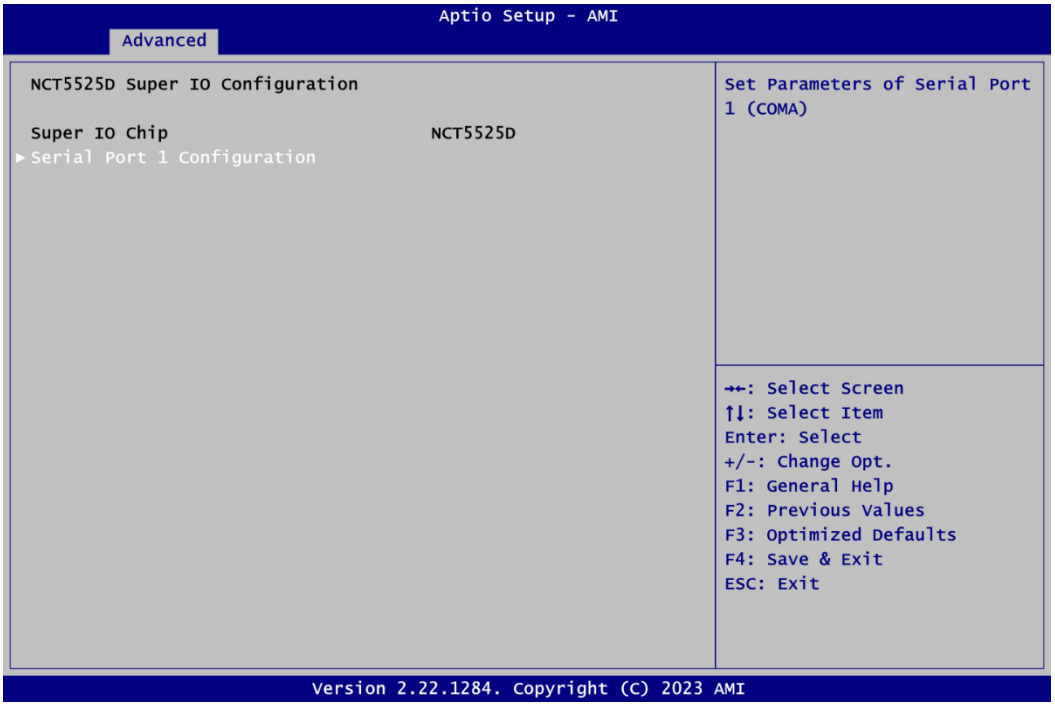
The Advanced menu also allows users to set configuration of the CPU and other system devices. You can select any of the items in the left frame of the screen to go to the sub menus:

- ▶ NCT5525D Super IO Configuration
- ▶ Hardware Monitor
- ▶ ACPI Settings
- ▶ Trusted Computing
- ▶ CPU Configuration
- ▶ Storage Configuration
- ▶ AMT Configuration
- ▶ USB Configuration

For items marked with "▶", please press <Enter> for more options.

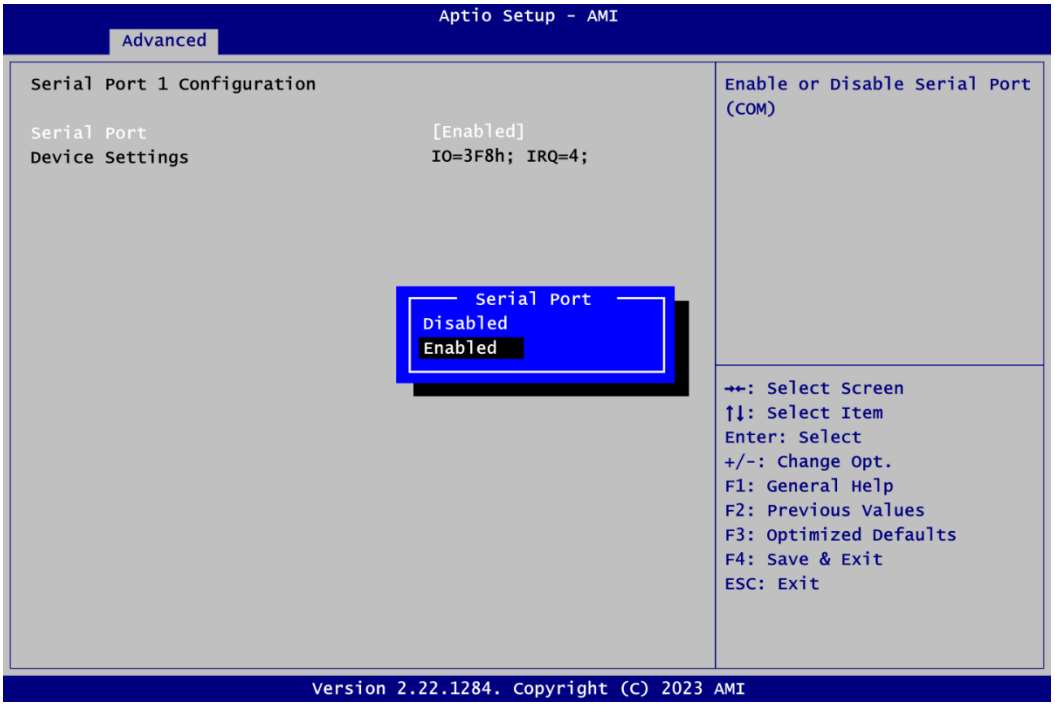


- **NCT5525D Super IO Configuration**
  You can use this screen to select options for the Super IO Configuration, and change the value of the selected option. A description of the selected item appears on the right side of the screen. For items marked with "▶", please press <Enter> for more options.



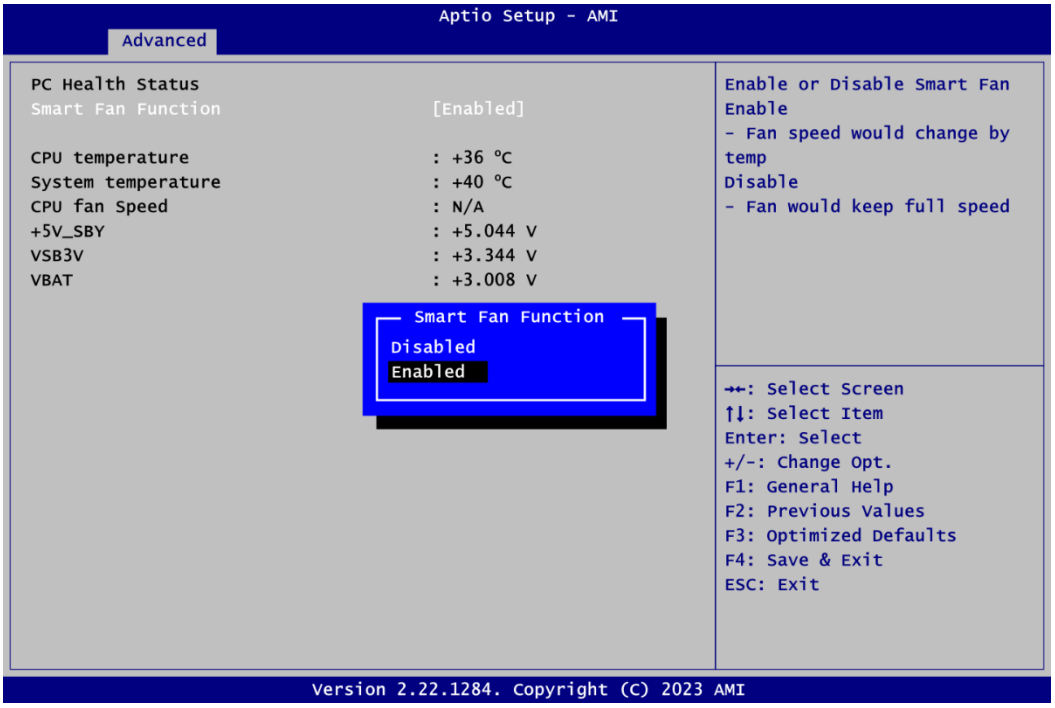
Serial Port 1 Configuration
Use this item to set parameters related to serial port 1.

- **Serial Port 1 Configuration**



Serial Port
Enable or disable serial port 1. The optimal setting for base I/O address is 3F8h and for interrupt request line is IRQ4. The default setting is Enabled.

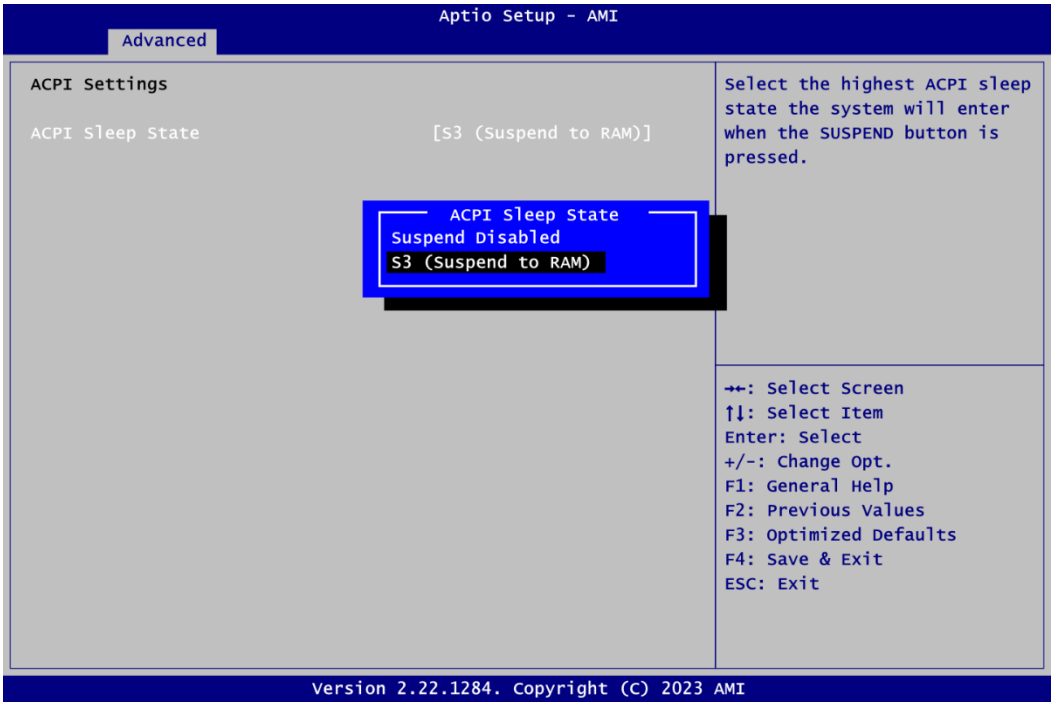
- **Hardware Monitor**
  This menu allows the user to monitor hardware health status as well as enable or disable the Smart Fan function.



This screen displays the temperature of system and CPU, fan speed, system voltages (+5V_SBY, VSB3V and VBAT).

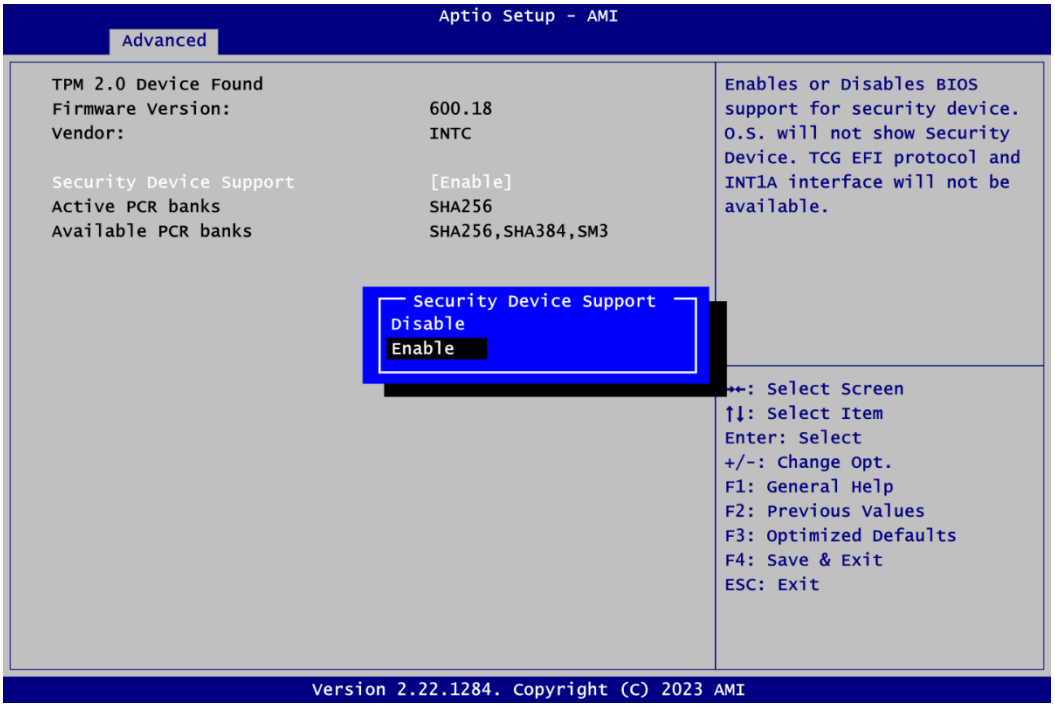
Smart Fan
Enable or disable Smart Fan function.
- Enable: Fan speed would change according to temperature. The higher the temperature, the faster the fan spins.
- Disable: The fan always runs at full speed.
- The default setting is Enabled.

- **ACPI Settings**
  You can use this menu to select options for system ACPI configuration, and then change the value of the selected option. A description of the selected item appears on the right side of the screen.



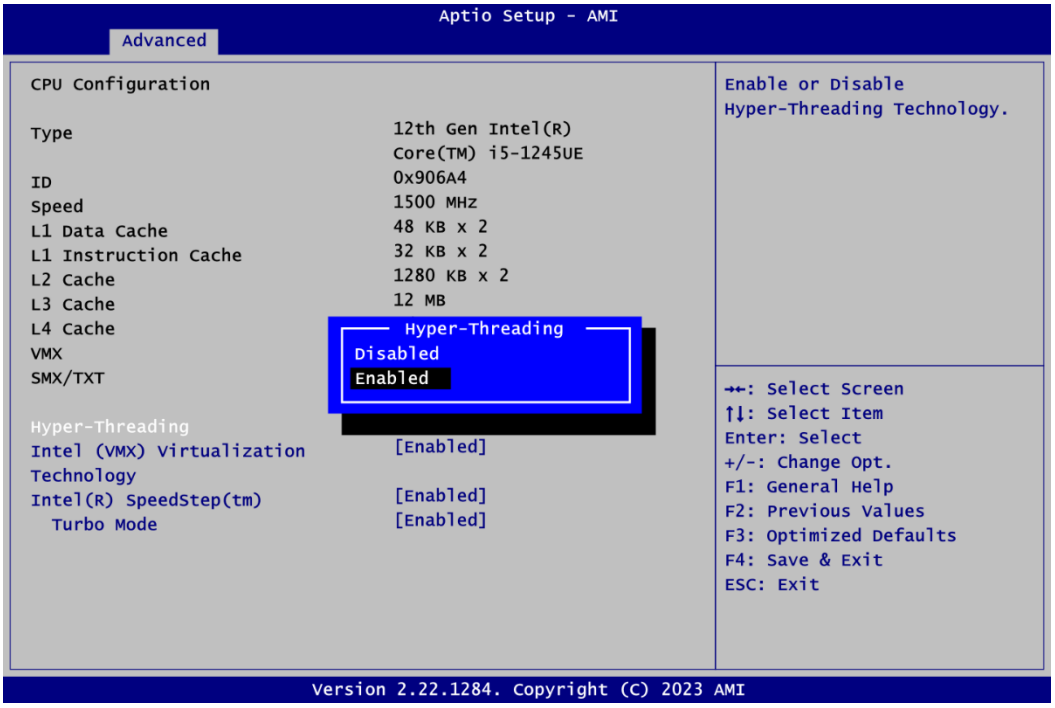
ACPI Sleep State
Select the ACPI (Advanced Configuration and Power Interface) sleep state. Configuration options are Suspend Disabled and S3 (Suspend to RAM). The S3 (Suspend to RAM) option selects ACPI sleep state the system will enter when suspend button is pressed.S3 (Suspend to RAM) is default setting.

- **Trusted Computing**
  In terms of Trusted Platform Module Device, users can choose between disabling TPM and enabling Platform Trust Technology.



Security Device Support
Enable or disable BIOS support for security device. OS will not show security device. TCG EFI protocol and INT1A interface will not be available. The default setting is Enabled.

- **CPU Configuration**
  This screen shows the CPU Configuration, and you can change the value of the selected option.



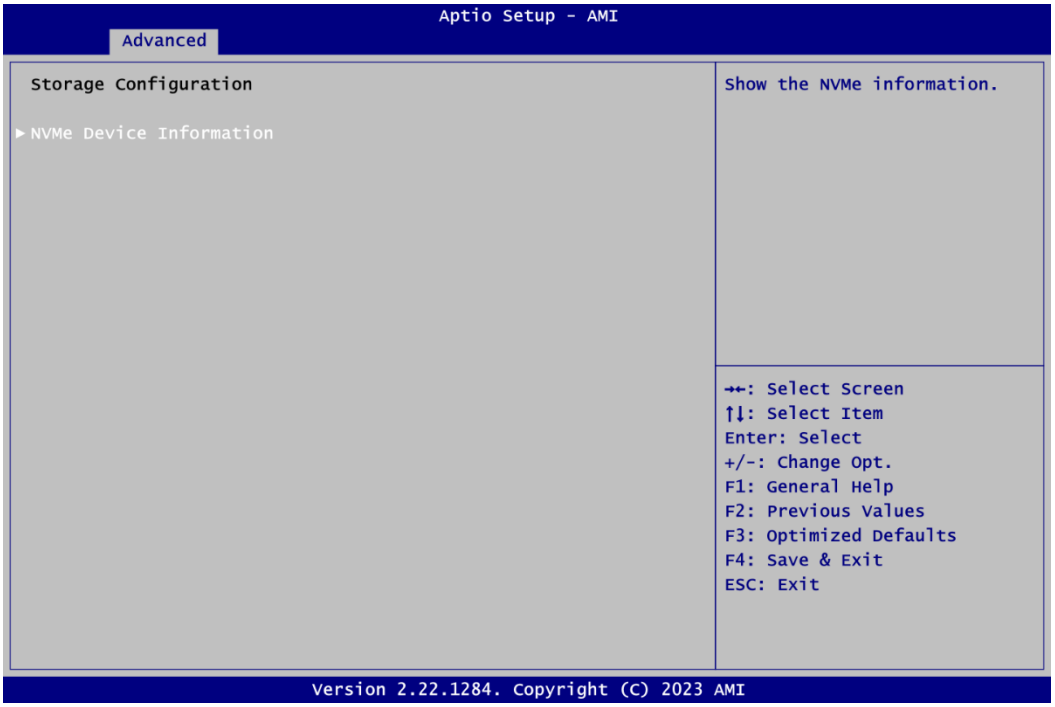
Hyper-Threading
Enable or disable Hyper-Threading Technology. When enabled, it allows a single physical processor to multitask as multiple logical processors. When disabled, only one thread per enabled core is enabled. The default setting is Enabled.

Intel (VMX) Virtualization Technology
Enable or disable Intel Virtualization Technology. When enabled, a VMM (Virtual Machine Mode) can utilize the additional hardware capabilities. It allows a platform to run multiple operating systems and applications independently, hence enabling a single computer system to work as several virtual systems. The default setting is Enabled.

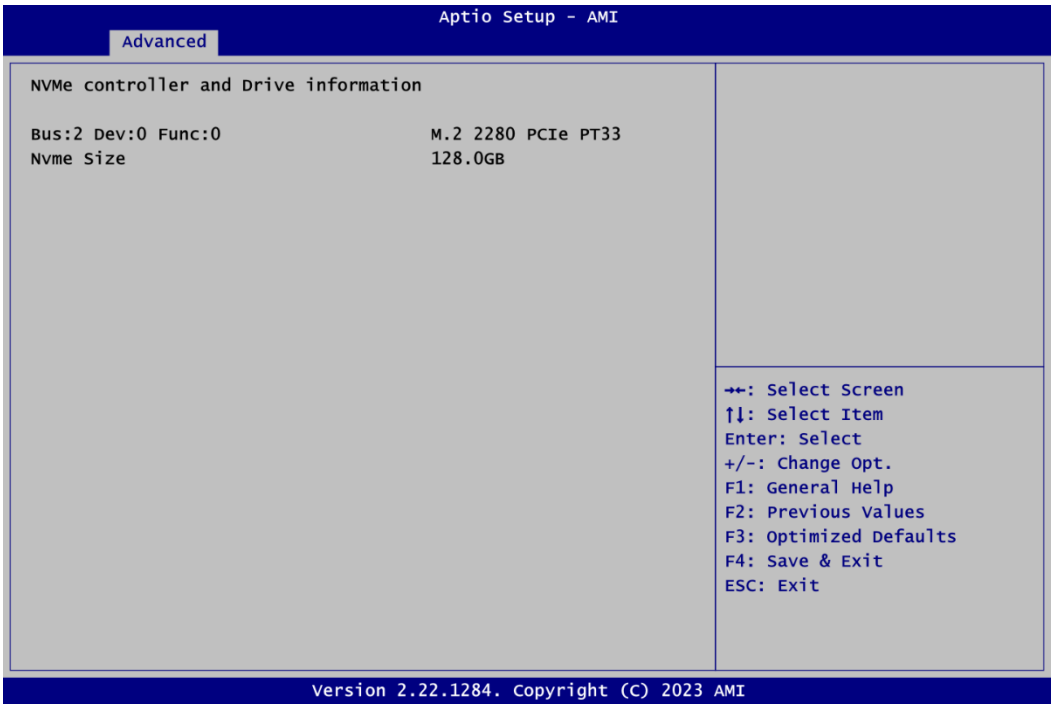
Intel® SpeedStep™
Enable or disable Intel SpeedStep mode. The default setting is Enabled.

Turbo Mode
Enable or disable processor Turbo Mode. The processor can be up to maximum turbo frequency when the system loading becomes higher. The default setting is Enabled.

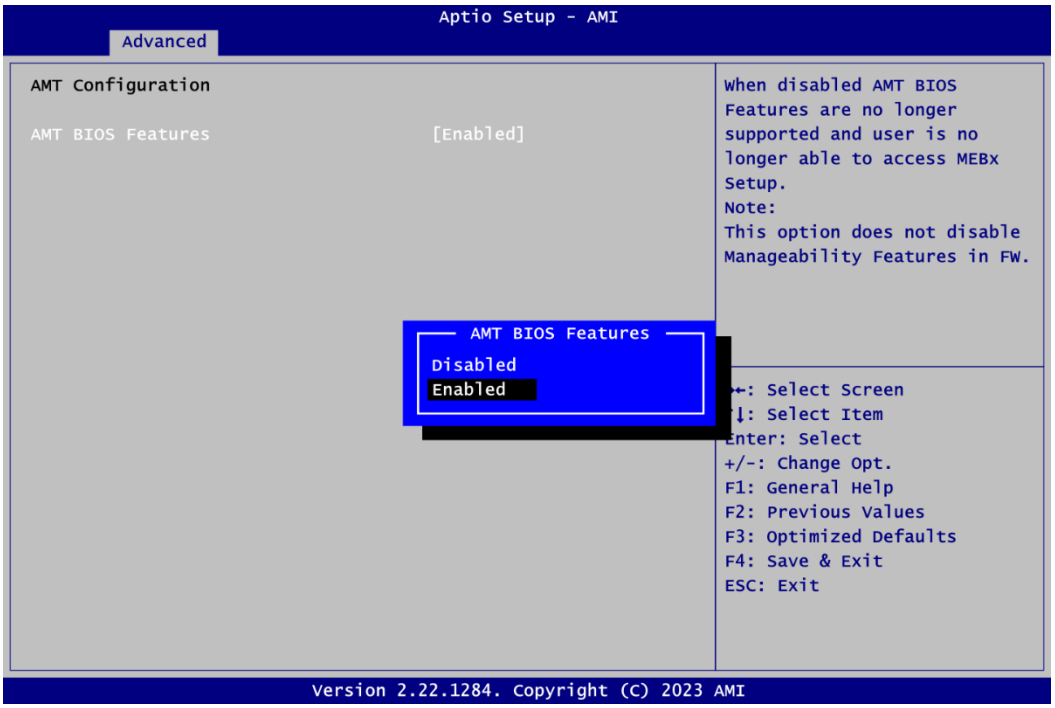
- **Storage Configuration**
  This screen specifies storage information. For items marked with "▸", please press <Enter> for more options.



- **NVMe Device Information**
  This menu specifies NVMe storage information.

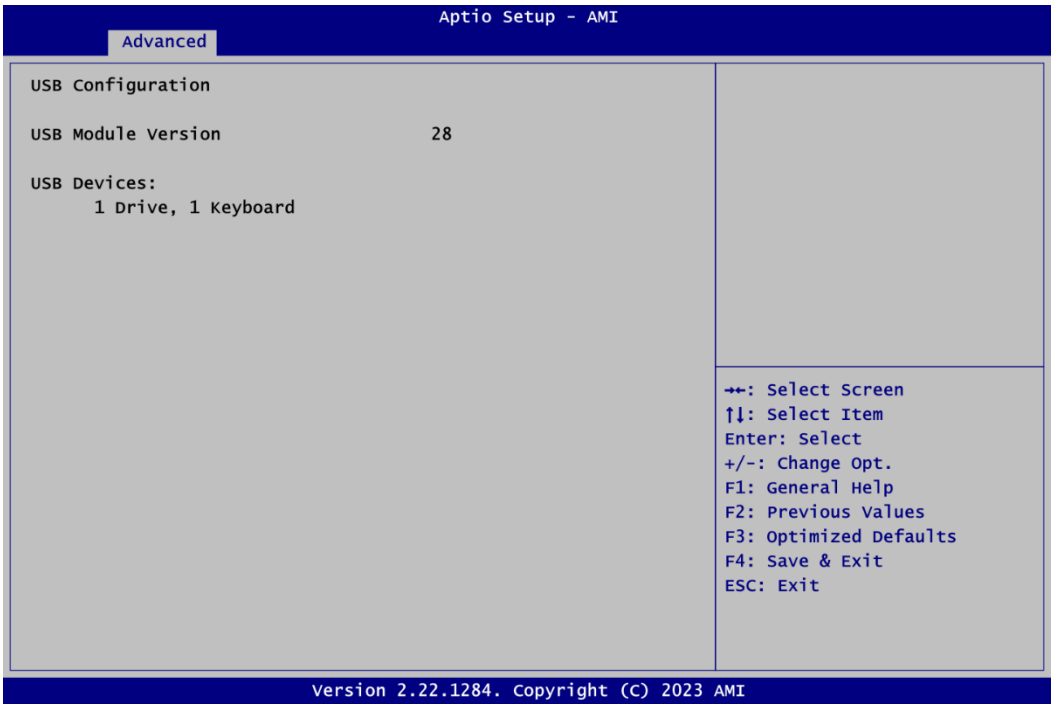


- **AMT Configuration**
  Use this screen to configure AMT parameters.



AMT BIOS Features
Enable or disable Active Management Technology BIOS features. The default setting is Enabled.

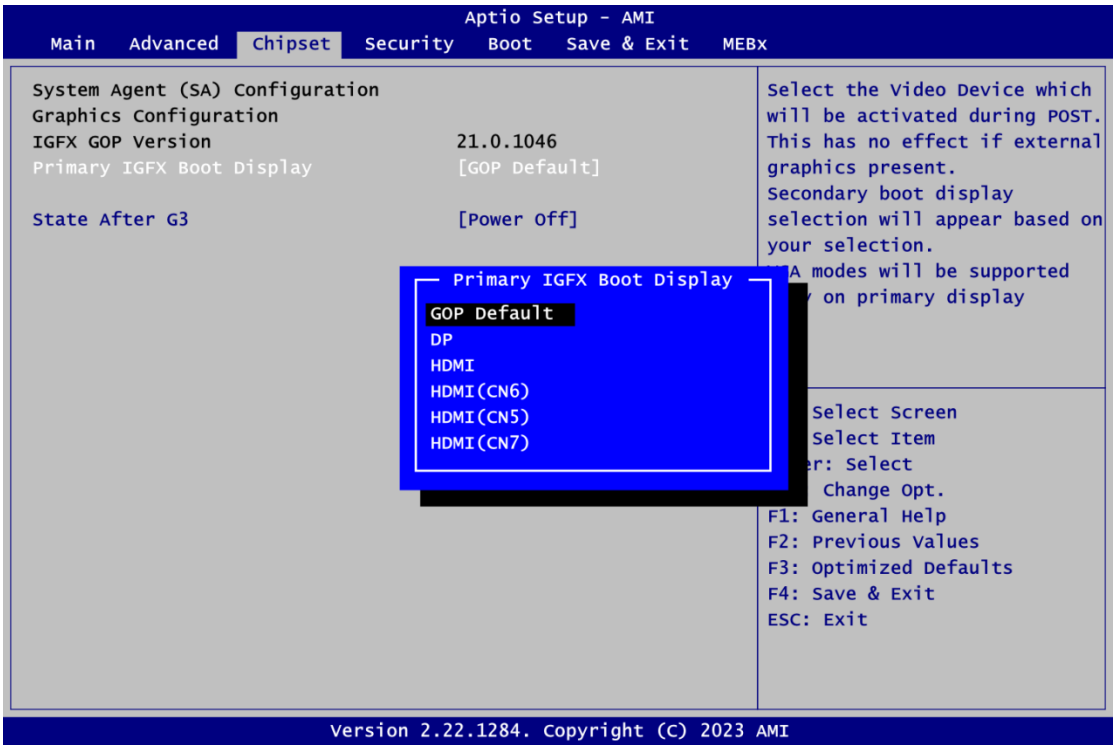
- **USB Configuration**
  This screen specifies USB settings.



USB Devices
Display all detected USB devices.

4.5 Chipset Menu

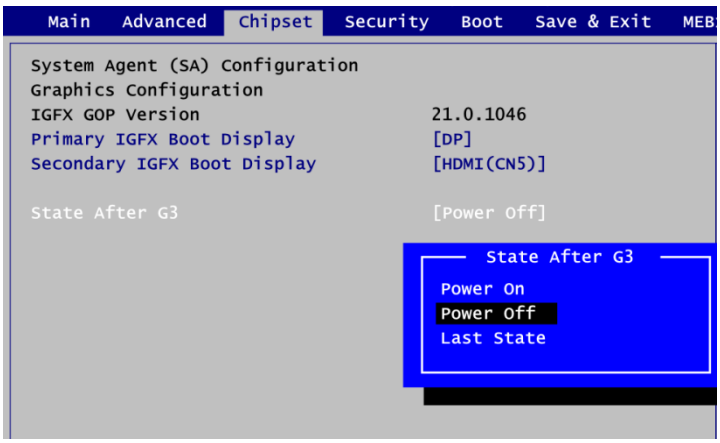
The Chipset menu allows users to change the advanced chipset settings.



Primary IGFX Boot Display
Select the video device which will be activated during POST (Power-On Self Test).The default setting is GOP.

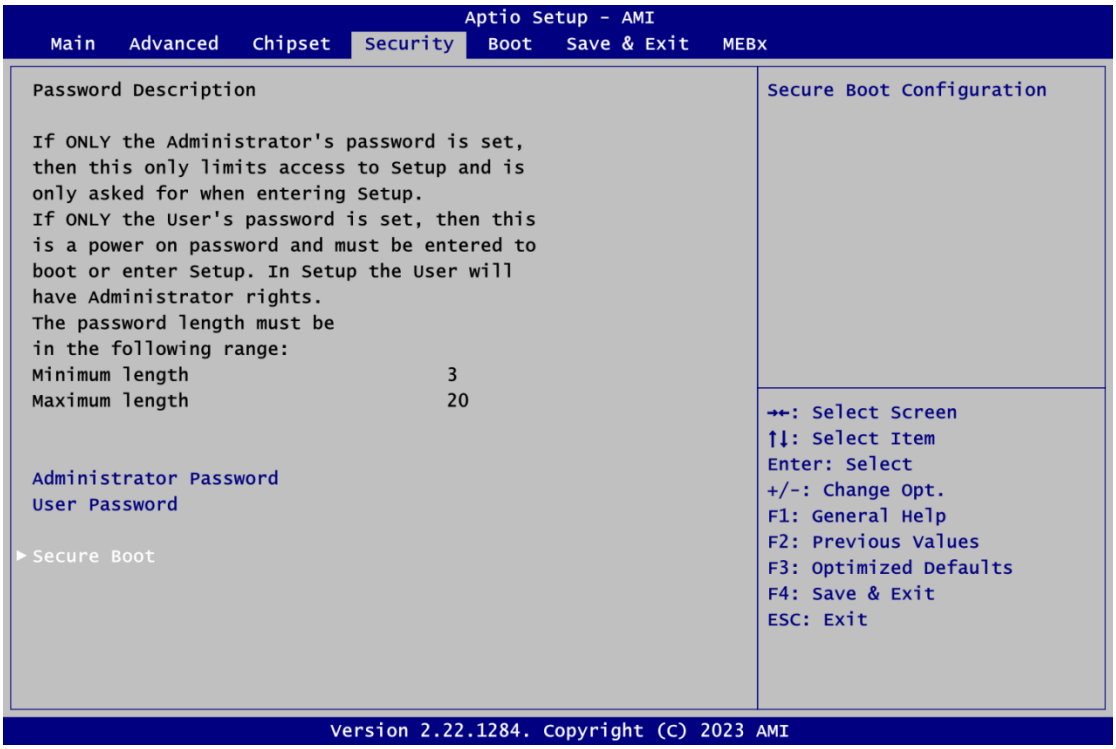
Secondary IGFX Boot Display
Select secondary display device.

State After G3
Specify what state to go to when power is re-applied after a power failure (G3 state). The default setting is power off.



4.6 Security Menu

The Security menu allows users to enhance system security by creating an administrator password to limit system access.



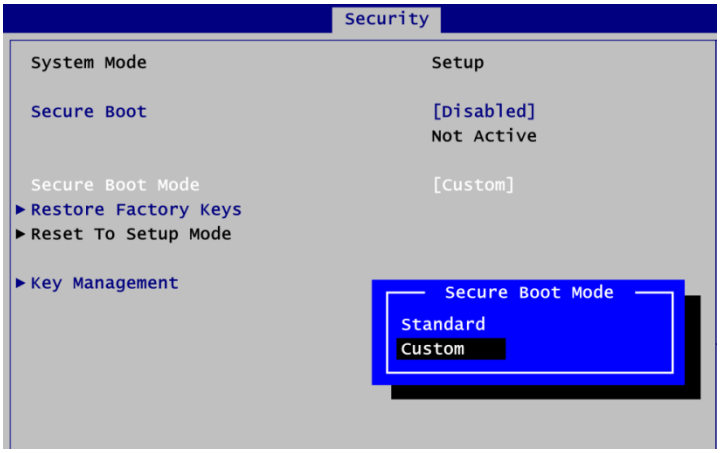
Administrator Password
This item indicates whether an administrator password has been set (installed or uninstalled).

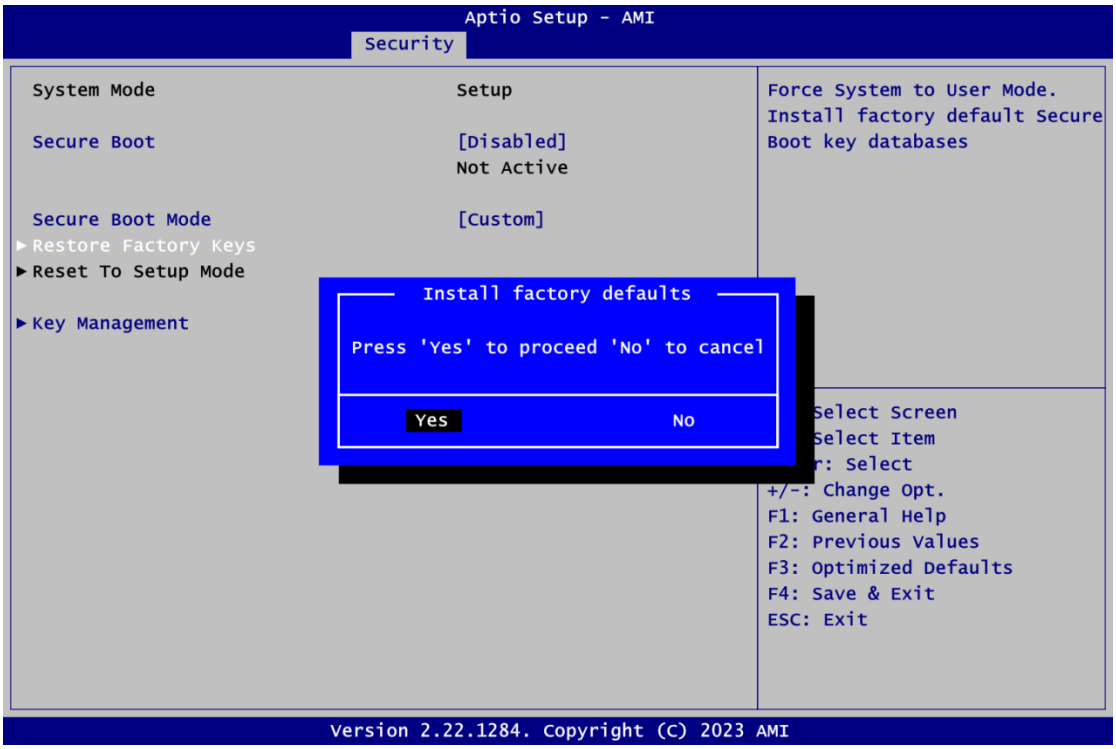
User Password
This item indicates whether a user password has been set (installed or uninstalled).

- **Secure Boot**

Secure Boot
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 ensures that the system only boots from trusted software, preventing malicious software from loading and compromising the device. It checks the digital signatures of boot loaders, firmware, and operating systems to verify that they are from trusted sources and have not been tampered with. Users can choose to enable it or not, between standard and custom mode. The default setting is secure boot.

Secure Boot Mode
Secure Boot mode options: Standard or Custom. In Custom mode, the policy of Secure Boot variables can be configured by a physically present user without full authentication. The default setting is custom.



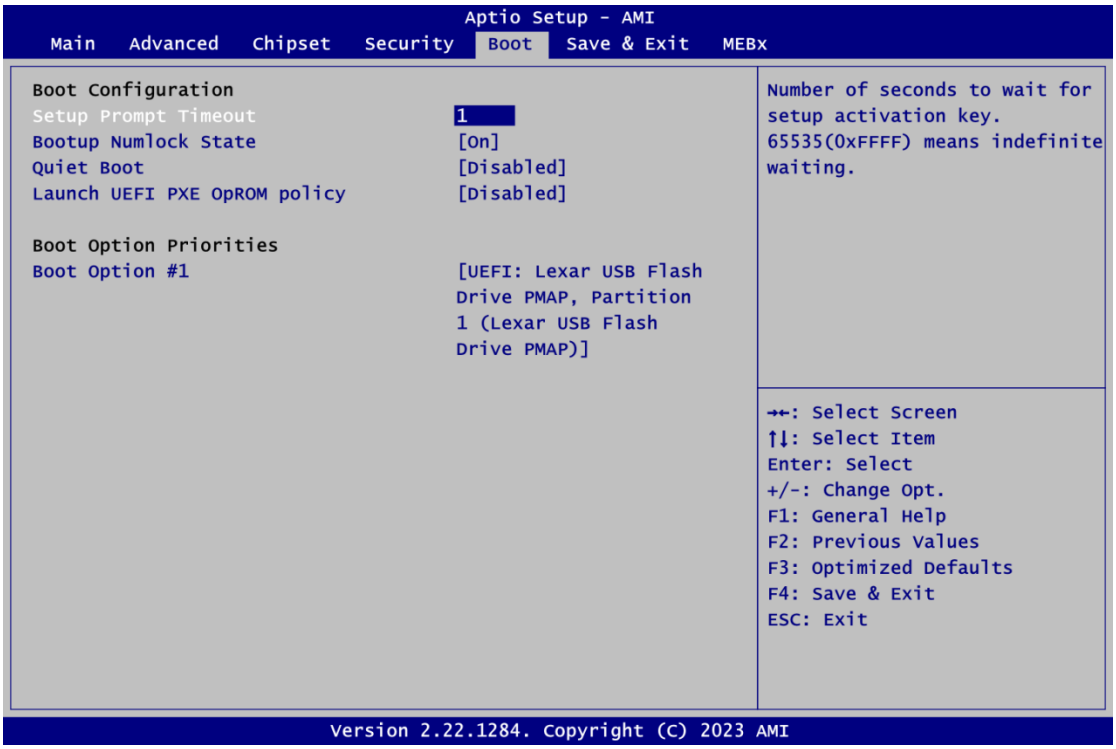


The Factory Key Provision

The Factory Key Provision ensures that the device has secure access to encrypted resources, such as data storage or communication. The keys are often unique to each device and can be used to secure firmware updates, secure boot processes, and to encrypt data at rest. The factory key provisioning process is an important step in securing devices and maintaining the confidentiality of sensitive information.

4.7 Boot Menu

The Boot menu allows users to change boot options of the system.



- **Setup Prompt Timeout**
  Setup Prompt Timeout is to delay the BIOS post before entering the operating system for a period of seconds according to user's setting. The default setting is 1.

- **Bootup NumLock State**
  Use this item to select the power-on state for the keyboard NumLock. The default setting is On.

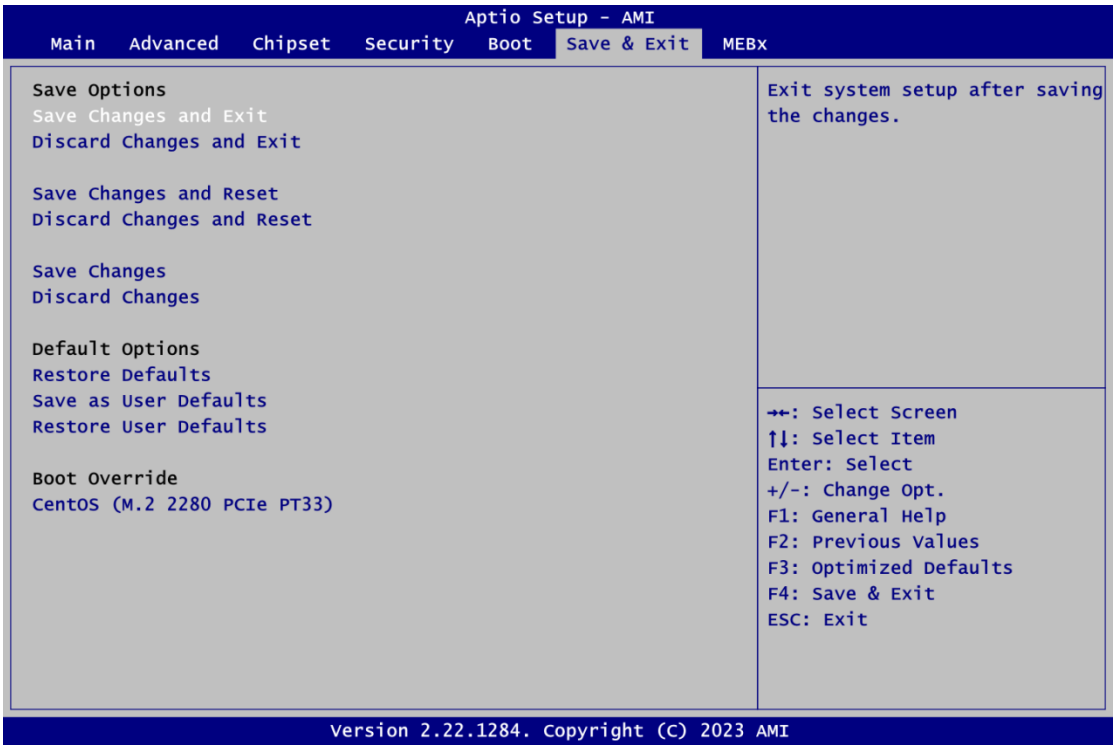
- **Quiet Boot**
  Quiet boot is a boot process that is performed without displaying diagnostic or status information on the screen. The default setting is On. The default setting is disable.

- **Launch UEFI PXE OpROM policy**
  Control the execution of UEFI PXE OpROM. The default setting is disable.

- **Boot Option Priorities [Boot Option #1]**
  These are settings for boot priority. Specify the boot device priority sequence from the available devices.

4.8 Save & Exit Menu

The Save & Exit menu allows users to load system configurations with optimal or fail-safe default values.



- **Save Changes and Exit**
  When you have completed the system configuration changes, select this option to leave Setup and return to Main Menu". Select Save Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to save changes and exit.

- **Discard Changes and Exit**
  Select this option to quit Setup without making any permanent changes to the system configuration and return to Main Menu". Select Discard Changes and Exit from the Save & Exit menu and press <Enter>. Select Yes to discard changes and exit.

- **Save Changes and Reset**
  When you have completed the system configuration changes, select this option to leave Setup and reboot the computer so the new system configuration parameters can take effect. Select Save Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to save changes and reset.

- **Discard Changes and Reset**
  Select this option to quit Setup without making any permanent changes to the system configuration and reboot the computer. Select Discard Changes and Reset from the Save & Exit menu and press <Enter>. Select Yes to discard changes and reset.

- **Save Changes**
  When you have completed the system configuration changes, select this option to save changes. Select Save Changes from the Save & Exit menu and press <Enter>. Select Yes to save changes.

- **Discard Changes**
  Select this option to quit Setup without making any permanent changes to the system configuration. Select Discard Changes from the Save & Exit menu and press <Enter>. Select Yes to discard changes.

- **Restore Defaults**
  It automatically sets all Setup options to a complete set of default settings when you select this option. Select Restore Defaults from the Save & Exit menu and press <Enter>.

- **Save as User Defaults**
  Select this option to save system configuration changes done so far as User Defaults. Select Save as User Defaults from the Save & Exit menu and press <Enter>.

- **Restore User Defaults**
  It automatically sets all Setup options to a complete set of User Defaults when you select this option. Select Restore User Defaults from the Save & Exit menu and press <Enter>.

- **Boot Override**
  Select a drive to immediately boot that device regardless of the current boot order.

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Appendix A
Watchdog Timer

A.1 About Watchdog Timer

Software stability is a major issue in most application. Some embedded systems are not watched by human for 24 hours. It is usually too slow to wait for someone to reboot when computer hangs. The systems need to be able to reset automatically when things go wrong. The watchdog timer gives us solutions in this regard.

The watchdog timer is a counter that triggers a system reset when it counts down to zero from a preset value. The software starts the counter with an initial value and must reset it periodically. If the counter ever reaches zero which means the software has crashed, the system will reboot.

A.2 How to Use Watchdog Timer

```
#include <stdio.h>
#include <conio.h>
#include <bios.h>

#define UINT unsigned int
#define NCT5104IO           0x2E

int main()
{
    UINT WDT_mode = 0;        // 00H for second, 08h for minute
    UINT WDT_Count = 0;       // Range from 00 to FF

    //Un-lock super I/O
    outp( NCT5104IO, 0x87 );
    outp( NCT5104IO, 0x87 );

    //Select Logic device
    outp( NCT5104IO, 0x07 );
    outp( NCT5104IO+1, 0x08 );

    //Enable WDT
    outp( NCT5104IO, 0x30 );
    outp( NCT5104IO+1, 0x01 );

    //Set Count mode
    outp( NCT5104IO, 0xF0 );
    outp( NCT5104IO+1, WDT_mode );

    //WDT counting re-set timer
```

```
    outp( NCT5104IO, 0xF1 );
    outp( NCT5104IO+1, WDT_Count );

    // IF to disable WDT:
    //outp( NCT5104IO, 0x30 );
    //outp( NCT5104IO+1, 0x00 );

    return 0;
}
```