User Manual

AL-35 Disk Size Motherboard

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AL35 Motherboard

User Manual

(Version 1.0)

Version:		
NO.	Description	Issue Date:
V0.5	Initial Version	2023/03/22
V1.0	1. Change Intel i226 NIC to Intel i210 2. Change SODIMM-DDR5 to SODIMM-DDR4. 3. Modified the USB 2.0 pin/COM pin.	2024/02/29

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Chapter 1 Product Introduction

1.1 Brief Introduction

The AL-35 motherboard is a 3.5'' SBC (single board computer) based on the Intel Alder Lake-U series platform and features a small form factor with high computing power, great for energy saving.

1.2 Parameters

Intel Alder Lake U Series:

- Intel® Core™ i7-1255U Processor, 10Cores 12Threads. Max Turbo Frequency: 4.70GHz, 12 MB Intel® Smart Cache. Processor Base Power: 15W, Maximum Turbo Power: 55W.
- Intel® Core™ i5-1235U Processor, 10Cores 12Threads. Max Turbo Frequency: 4.40GHz, 12 MB Intel® Smart Cache. Processor Base Power: 15W, Maximum Turbo Power: 55W.
- Intel® Core™ i3-1215U Processor, 6Cores 8Threads. Max Turbo Frequency: 4.40GHz, 10 MB Intel® Smart Cache. Processor Base Power: 15W, Maximum Turbo Power: 55W.

Memory: 2x SO-DIMM DDR4-3200 slots, supports dual channel, up to 64GB for maximum capacity.

GPU: Integrated Graphics based on CPU, display via 2x HDMI2.0b,1x LVDs (eDP optional)

Storage: 1xM.2 Key_M slot, supports 2280 SSDs NVMe protocols at PCIe X4 speed. 1x M.2 Key_B slot, supports 2242 SSDs SATA 3.0 protocols or 3042 4G modules. 1x SATA3.0 interface.

USB: 4x USB3.2 Gen 2 interfaces, 4x USB2.0 interfaces.

Ethernet: Two Intel Gigabit Network Controllers, 1x Intel i210+1x Intel i219. Data Rate Per Port: 1.0Gbps

Audio: High-Definition Realtek Audio Codec,1xCTIA Audio Jack, supports Line-out and Mic-in. Supports one built-in stereo amplifier output socket for connecting passive speakers.

Serial I/O: 6x RS232 COM by default. The COM1 and COM2 can be set as RS232/RS485/RS422 through BIOS setting, and the COM5, COM6 are 3-wire RS232.

Expansion: 1x M.2_Key E Slot type 2230 for Wi-Fi and Bluetooth module (PCIE/USB2/CNVi).

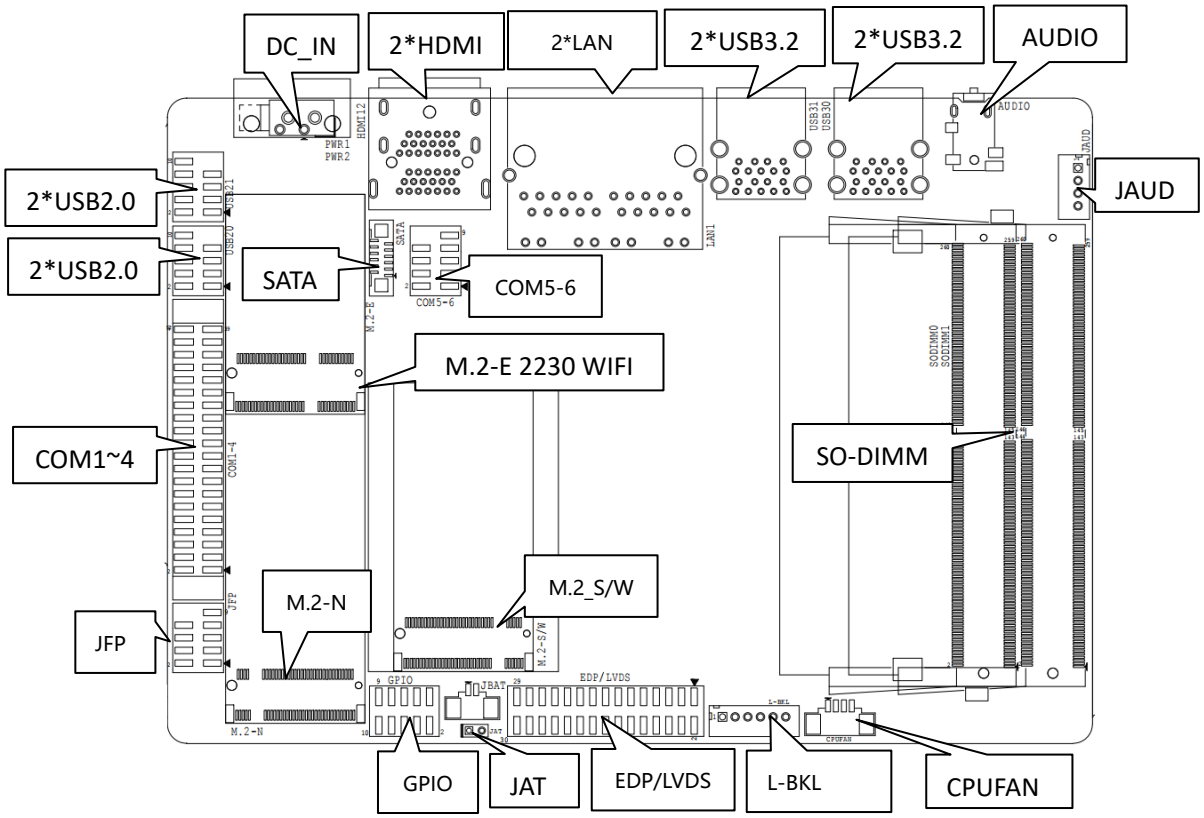
Other I/O: 1xSIM Card Slot, JFP, GPIO.

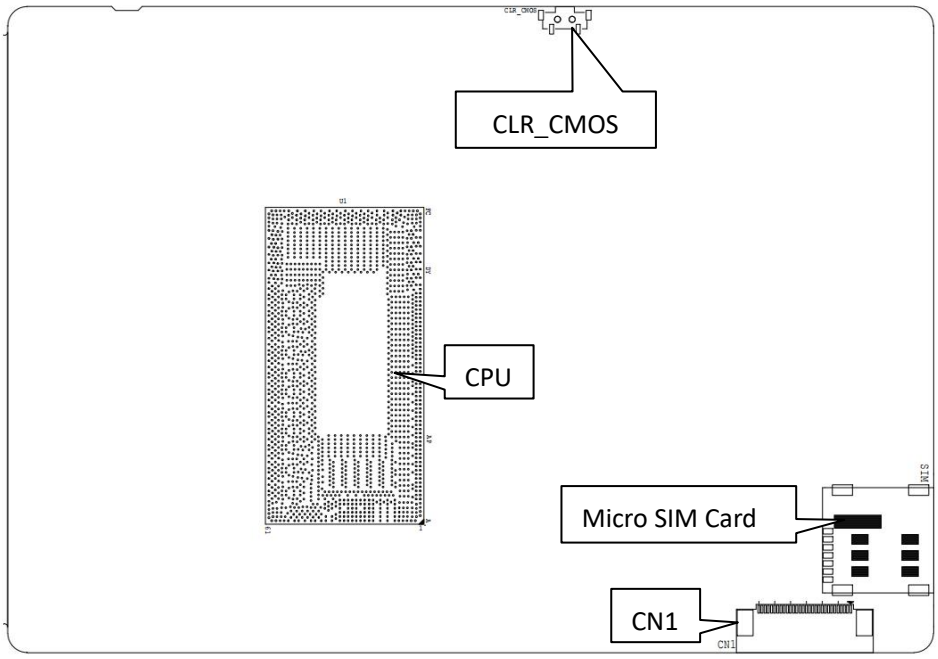
Dimension: 146mm x 102 mm

Power: 12V ~35V DC-in

Working Temperature: -20℃~60℃

1.3 Connector Diagram





Chapter 2 Hardware

2.1 Installations

Please refer to the following steps for installations:

1. Read the user manual carefully to make sure all the adjustments on the AL35 are correct.
2. Installing the Memory:
   - Press the ejector tab of the memory slot outwards with your fingertips.
   - Hold the memory module and align the key to the module with that on the memory slot.
   - Gently push the module into the slot until the ejector levers return completely to the closed position, holding the module in place when the module touches the bottom of the slot. To remove the module, press the ejector levers outwards to unseat the module.
3. Installing the expansion cards:
   - Locate the expansion slots and remove the screw, insert the cards into the slot at a 45-degree angle then attach the screw to the expansion cards, gently press down on it then install the screw back.
4. Connect all signal wires, cables, panel control wiring, and power supplies.
5. Start the computer and complete the setup of the BIOS program.

The board's components are integrated circuits and can easily be damaged by Electrostatic Discharge or ESD; therefore, please follow the instructions:

- Hold the board's edge when handing, and do not touch onboard pins, components, or plug sockets.
- When touching integrated circuit components (such as CPU, RAM, etc.), please wear an anti-static wrist strap/glove to avoid electrostatic discharge damage to the board or other sensitive components.
- Before installing the integrated circuits/sensitive components, place the sensitive components in anti-static bags to keep them safe from ESD.
- Please make sure the power switch is OFF before plugging the power plug.

2.2 Jumper Setting

Please configure the jumpers according to your requirements before installing the hardware.

How to identify the first header of jumpers and pins: Observe the mark beside the jumper or pins and find the header marked by “1” or bold line or triangular symbol. Or observe the rear panel and the header with a square solder pad is the first header.

2.3 Memory Slots

The board provide 2xSO-DIMM DDR4-3200 slots up to 64GB for maximum memory capacity.

Notes: Make sure to hold the memory module and align the key to the module with that on the memory slot. While choosing a memory module, please make sure the module matches the board’s specifications.

2.4 Display Interfaces (Screen Printing: HDMI12, EDP/LVDS)

The board features two HDMI2.0b interfaces (support HDCP2.3) for resolution at 4K 60Hz; and one 24bit LVDs interface (eDP optional) for resolution up to 1920x1080.

2.4.1 **LVDS** (Screen Printing: EDP/LVDS, L-BKL)

When it is configured as an LVDS function, the "EDP/LVDS" pin transmits LVDS signals, and the " L-BKL" pin is the backlight adjustment. The supported screen working voltage can be set at 3.3V or 5V, which needs to be determined at the time of manufacture. The screen's voltage is set through a modification process: modification of resistor positions, screen printing RE63 for 5V, and screen printing RE66 for 3.3V.

LVDS Data Pin (Screen printing: EDP/LVDS)

Signal	Pin		Signal
VCC	1	2	VCC
VCC	3	4	GND
GND	5	6	GND
A_DATA0_DN	7	8	A_DATA0_DP
A_DATA1_DN	9	10	A_DATA1_DP
A_DATA2_DN	11	12	A_DATA2_DP
GND	13	14	GND
A_CLK_DN	15	16	A_CLK_DP
A_DATA3_DN	17	18	A_DATA3_DP
B_DATA0_DN	19	20	B_DATA0_DP
B_DATA1_DN	21	22	B_DATA1_DP
B_DATA2_DN	23	24	B_DATA2_DP
GND	25	26	GND
B_CLK_DN	27	28	B_CLK_DP
B_DATA3_DN	29	30	B_DATA3_DP

LVDS Backlight Adjustment Pin (Screen printing: L-BKL)

Pin	Signal
1	GND
2	GND
3	LCD_BKL_ADJ
4	LCD_BKL_ON
5	12V
6	12V

2.4.2 **eDP** (Optional)

When it is configured as an eDP function, the "EDP/LVDS" pin transmits eDP signals, and the " L-BKL" pin is the backlight adjustment. The supported screen working voltage can be set at 3.3V or 5V, which needs to be determined at the time of manufacture. The screen's voltage is set through a modification process: modification of resistor positions, screen printing RE63 for 5V, and screen printing RE66 for 3.3V.

eDP Data Pin (Screen Printing: EDP/LVDS)

Signal	Pin		Signal
VCC	1	2	VCC

VCC	3	4	EDP_HPD
GND	5	6	GND
EDP_AUXN	7	8	EDP_AUXP
N/A	9	10	N/A
EDP_DATA0_P	11	12	EDP_DATA0_N
GND	13	14	GND
N/A	15	16	N/A
EDP_DATA1_P	17	18	EDP_DATA1_N
N/A	19	20	N/A
N/A	21	22	N/A
N/A	23	24	N/A
GND	25	26	GND
N/A	27	28	N/A
N/A	29	30	N/A

eDP Backlight Adjustment Pin (Screen Printing: L-BKL)

Pin	Signal
1	GND
2	GND
3	LCD_BKL_ADJ
4	LCD_BKL_ON
5	12V
6	12V

2.5 Storage Interfaces

The board provides 1xM.2 Key M 2280 slot (PCIe4.0 X4 Signal) for NVMe SSD, 1x SATA3.0 interface, 1xM.2 key B 2242 Slot for SATA SSD/4G module with SIM card slot.

FPC SATA Definition (Screen Printing: SATA)

Pin	Signal
1	GND
2	TX_N
3	TX_P
4	GND
5	RX_P
6	RX_N
7	GND
8	+5V
9	+5V
10	+5V

11	GND
12	GND

2.6 Expansion Slots

The board features 1x M.2_Key E 2230 slot for Wi-Fi Modules (supports PCIe/USB2/CNVi).

2.7 USB Interfaces

The board supports 4x USB 3.2 Gen2 rear ports and 4x USB 2.0 internal headers (2.0mm spacing).

Internal USB2.0 Pin (Screen Printing: USB20, USB21)

Signal	Pin		Signal
VCC 5V	1	2	VCC 5V
USB DATA-	3	4	USB DATA-
USB DATA+	5	6	USB DATA+
GND	7	8	GND
NC	9	10	(NULL)

2.8 LAN

The board features 2xRJ45 LANs interfaces with high-speed Intel network controllers (1x Intel i210+1x Intel i219), data rate per ports: 1.0Gbps. Both of the Ethernet interfaces supports network wake-up (Magic packet wake-up), and the LAN1 supports UEFI PXE network boot.

LED Status Indicators:

LI_LED Status (Green)	Function	ACT_LED Status (Orange)	Function
Always on	Network Connected	Flashing	Data transmission

2.9 COM

The board features six RS232 onboard serial port headers by default (2.0mm spacing), and the COM1, and COM2 can be set as RS232/RS485/RS422 through the BIOS setting. COM5, and COM6 are 3-wire RS232 serial ports. For every 10th pin between COM1 through COM4 serial ports, support 12V power out.

RS232 COM (Screen Printing: COM14)

Signal	Pin		Singal
DCD#	1	2	RXD
TXD	3	4	DTR#
GND	5	6	DSR#
RTS#	7	8	CTS#
RI#	9	10	+12V
DCD#	11	12	RXD
TXD	13	14	DTR#
GND	15	16	DSR#

RTS#	17	18	CTS#
RI#	19	20	+12V
DCD#	21	22	RXD
TXD	23	24	DTR#
GND	25	26	DSR#
RTS#	27	28	CTS#
RI#	29	30	+12V
DCD#	31	32	RXD
TXD	33	34	DTR#
GND	35	36	DSR#
RTS#	37	38	CTS#
RI#	39	40	+12V

COM5_6 Default Definition RS232 (Screen: COM5_6)

Singal	Pin		Signal
NC	1	2	NC
RX5	3	4	RX6
GND	5	6	GND
TX5	7	8	TX6
NC	9	10	(NC)

COM1, COM2 Optional Definition RS232/RS485/RS422 (Screen Printing: COM5_6)

Pin	RS232	RS485	RS422
1	DCD	DATA-	TX-
2	RXD	DATA+	TX+
3	TXD	(NC)	RX+
4	DTR	(NC)	RX-
5	GND	GND	GND
6	DSR	(NC)	(NC)
7	RTS	(NC)	(NC)
8	CTS	(NC)	(NC)
9	RI	(NC)	(NC)

2.10 GPIO (Screen Printing: GPIO)

The board provides a set of 2x5Pin GPIO header (2.0mm spacing), offering 8 programmable I/O lanes in total.

GPIO (Screen Printing: GPIO)

Signal	Pin	Signal

SIO_GP70	1	2	3.3V
SIO_GP71	3	4	SIO_GP74
SIO_GP72	5	6	SIO_GP75
SIO_GP73	7	8	SIO_GP76
GND	9	10	SIO_GP77

2.11 Board Power Supply (Screen printing: PWR1, PWR2)

The board feature one 12V-35V 2-Pin DC-IN phoenix connector.

PWR1 (Screen Printing: PWR1)

Pin	Signal
1	GND
2	VCC

PWR2 Optional Socket (Screen Printing: PWR2)

Pin	Signal
1	VCC
2	VCC
3	GND
4	GND

2.12 Switch Button/Light Indicator (Screen Printing: JFP)

The board has a set of 2.0mm spacing pins that can be connected to a switch button, a system reset button, a hard disk read/write indicator, and a power-on indicator.

Switch Button/Indicator Pin Definition (Screen Printing: JFP)

Signal	Pin		Signal
HDD_LED+	1	2	PWR_LED+
HDD_LED-	3	4	PWR_LED-
RSTBTN-	5	6	PWR_ON+
RSTBTN+	7	8	PWR_ON-
NC	9	10	(NC)

2.13 Audio Interface

The board features a Realtek ALC897 audio codec, supports a 3.5mm Line-out/MIC two-in-one combo jack (CTIA American standard), and a built-in dual-channel power amplifier output socket for connecting passive speakers.

Two-in-one headphone jack:



JAUD (Screen Printing: JAUD)

Pin	Signal
1	L+
2	L-
3	R-
4	R+

2.14 CPU Fan (Screen printing: CPUFAN)

The board provides one auxiliary CPU cooling fan socket with a 5V default power supply, 12V optional.

CPUFAN (Screen Printing: CPUFAN)

Pin	Signal
1	VCC
2	GND
3	TAC
4	CTL

2.15 Hardware Auto Start (Screen Printing: JAT)

The board features JAT (2.0mm spacing) for hardware auto start functions, which support automatic booting upon power connection.

JAT (Screen Printing: JAT)

Setting	JAT
Close	Hardware Auto Start

2.16 CMOS Clearance/Retention (Screen printing: CLR_CMOS)

CMOS is powered by onboard button batteries. Clearing CMOS will permanently remove the previous system settings and restore the board system to original settings (factory settings).

Step 1: Turn off the PC and disconnect the power.

Step 2: Press CLR_CMOS for 15 seconds then disconnect.

Step 3: Restart the device, press the <DEL> button to enter the BIOS, load the optimal default value, save, and exit the settings.

⚠ ATTENTION: Please do not clear COMS when the PC is connected to power in case board damages.

Chapter 3 BIOS Setup

3.1 Entering the BIOS

1. Turn on the computer and press <Delete> entering the BIOS
2. After the computer is turned on, keep pressing F11, select enter Setup
3. BIOS Hotkeys:

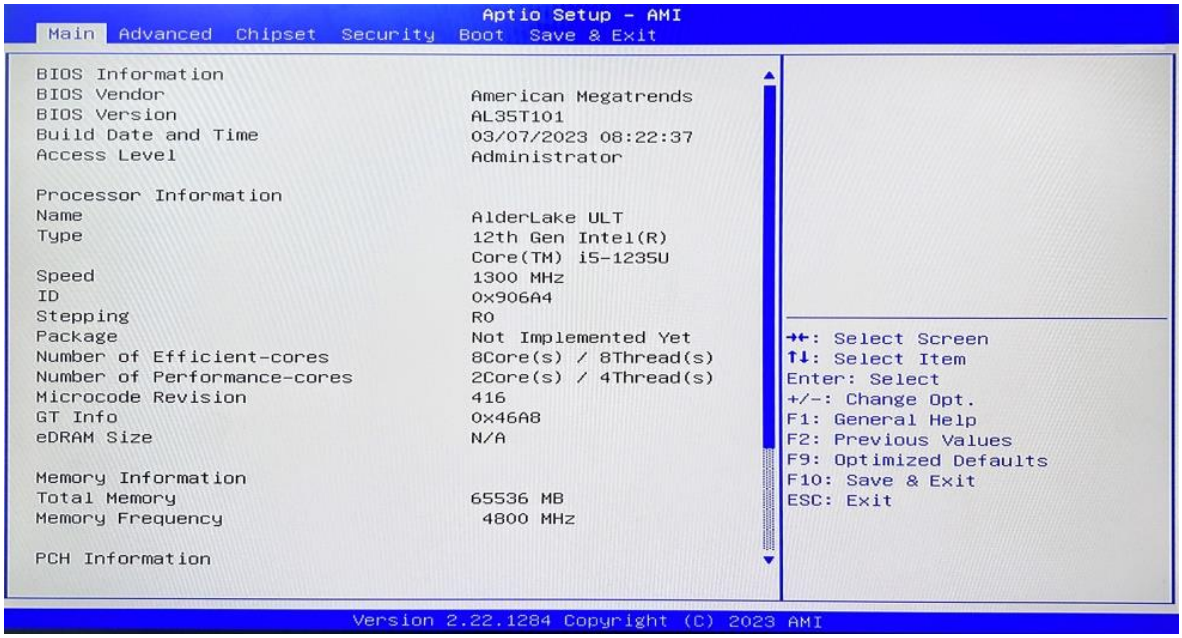
   F9: Restore to Factory setting.

   F10: Save and Exit.

   ESC: Exit

3.2 Main Setup (BIOS info, Date, Time）

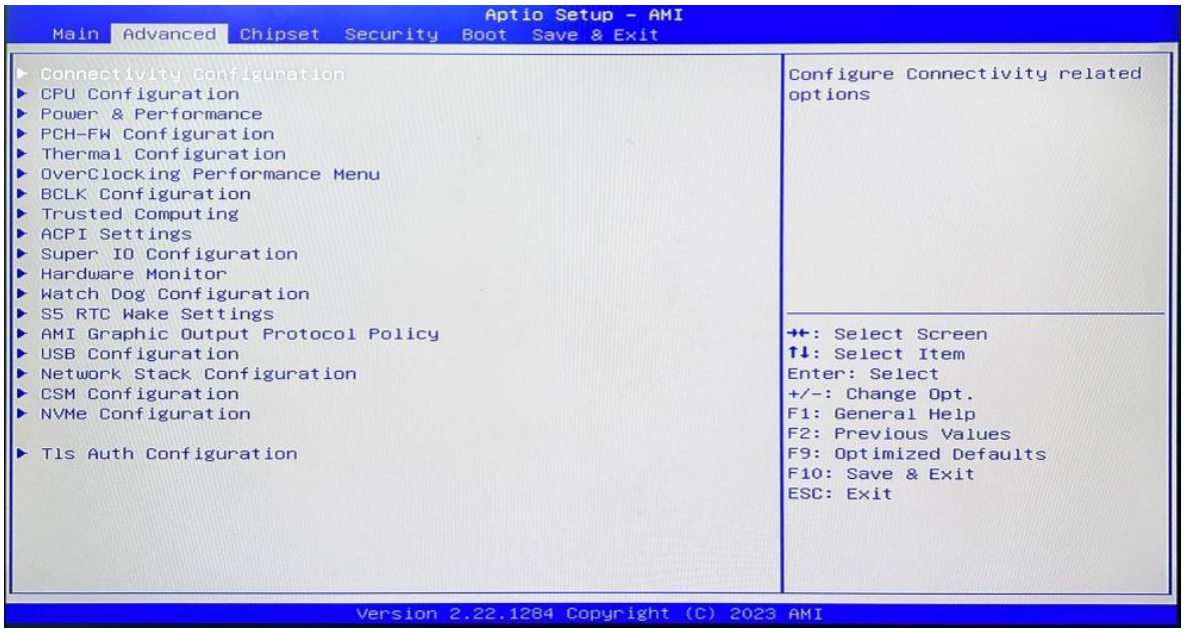
When you enter the BIOS Setup utility the first things you will encounter is the Main Setup screen. Shown below is the Main BIOS Setup screen. You can always return to the Main setup by selecting the Main tab.



System Date: Sets the date. MM/DD/YY format.

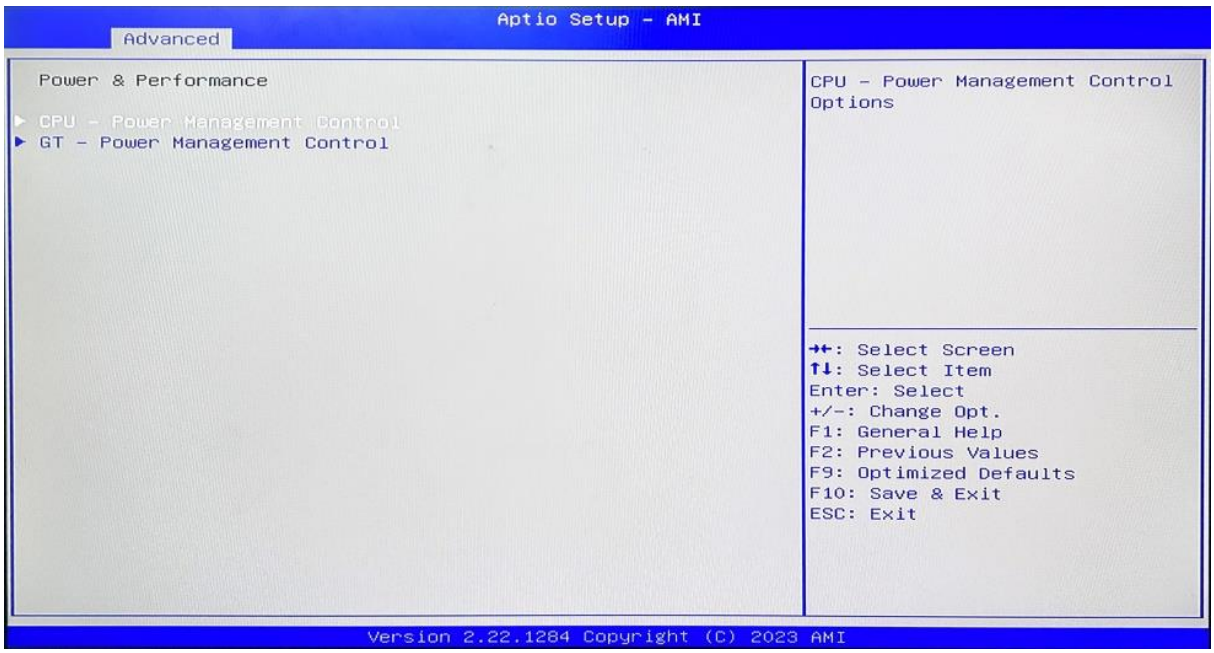
System Time: Set the time. HH:MM: SS format.

3.3 Advanced Settings



Select any of the items in the left frame of the screen. The advanced sections allow you to configure, improve and set up system features according to the preference of the CPU Configuration. All Advanced BIOS Setup options are described as follows.

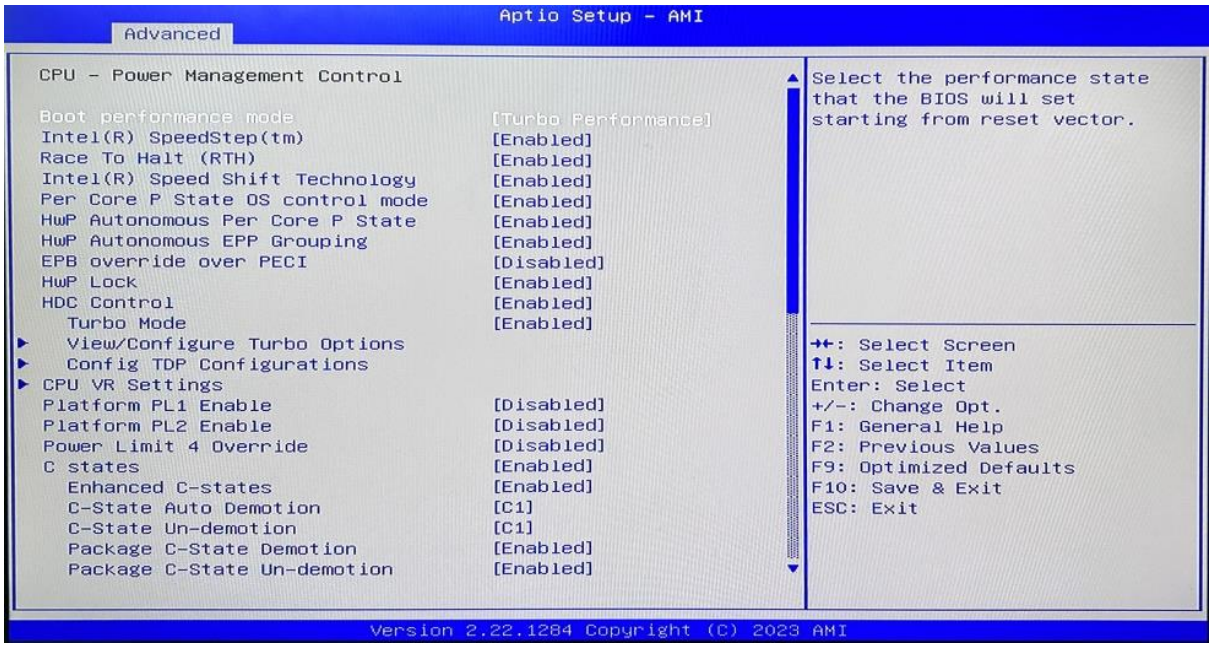
3.3.1 Power & Performance



CPU-Power Management Control

GT-Power Management Control

3.3.2 CPU-Power Management Control



Intel® SpeedStep®(TM):

Enhanced Intel SpeedStep® Technology enables the operating system to control multiple frequencies and voltage points for optimal performance and power efficiency.

Intel® Speed Shift Technology:

An energy-efficient frequency control method by the hardware rather than relying on OS control. Processor decision is based on the different system constraints for example Workload demand, and thermal limits while taking into consideration the minimum and maximum levels and activity window of performance requested by the operating system. Default enabled.

Turbo Mode

The Turbo mode refers to Nehalem's "Integrated Power Gate" power management technology, which allows running off some cores and adding power to the others so that they run at a higher frequency. The capacity of the entire CPU remains unchanged, and the efficiency of the CPU is optimized. Default enabled.

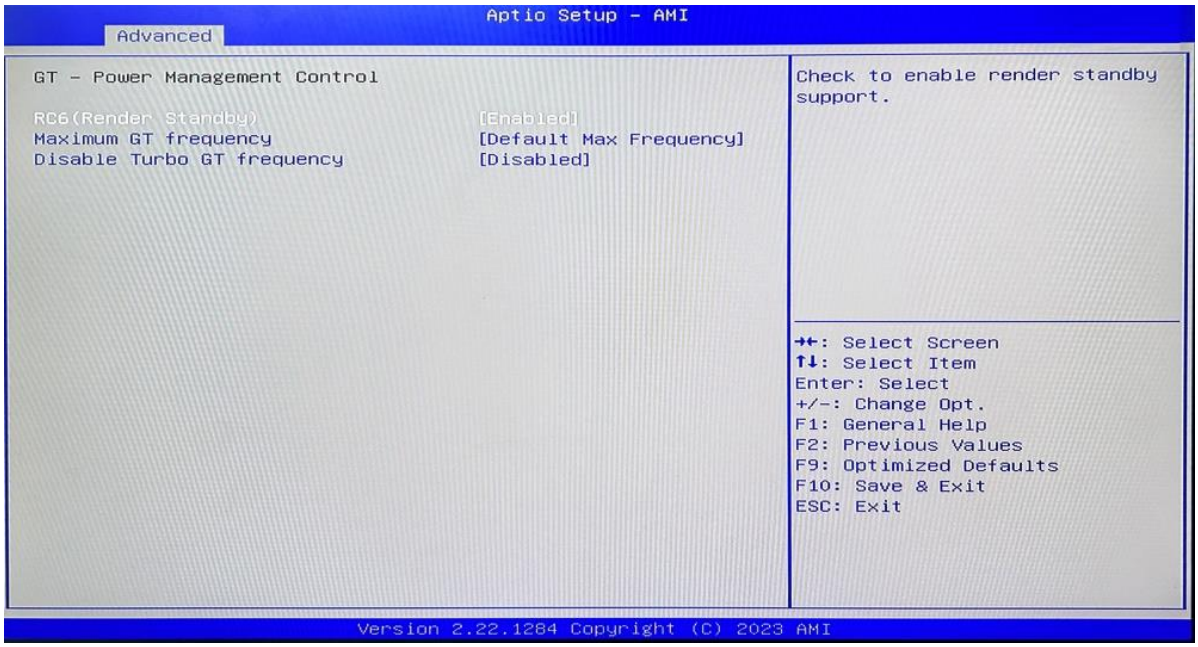
C states

Idle States (C-states) are used to save power when the processor is idle. C0 is the operational state, meaning that the CPU is doing useful work 100% load. C1 is the first idle state, C2 the second, and so on, where more power-saving actions are taken for numerically higher C-states. C1 to C3 cuts off the clock inside the CPU, and C4 to C6 reduces the CPU voltage. Default enabled.

Enhanced C states

C1 to C3 cuts the clock inside the CPU. C4 and C6 mode reduces CPU voltage. Features two way "Enhanced" mode, enable by default.

3.3.3 GT-Power Management Control



RC6(Render Standby)：

(Standby)Enable/disable integrated graphics standby, default Enabled.

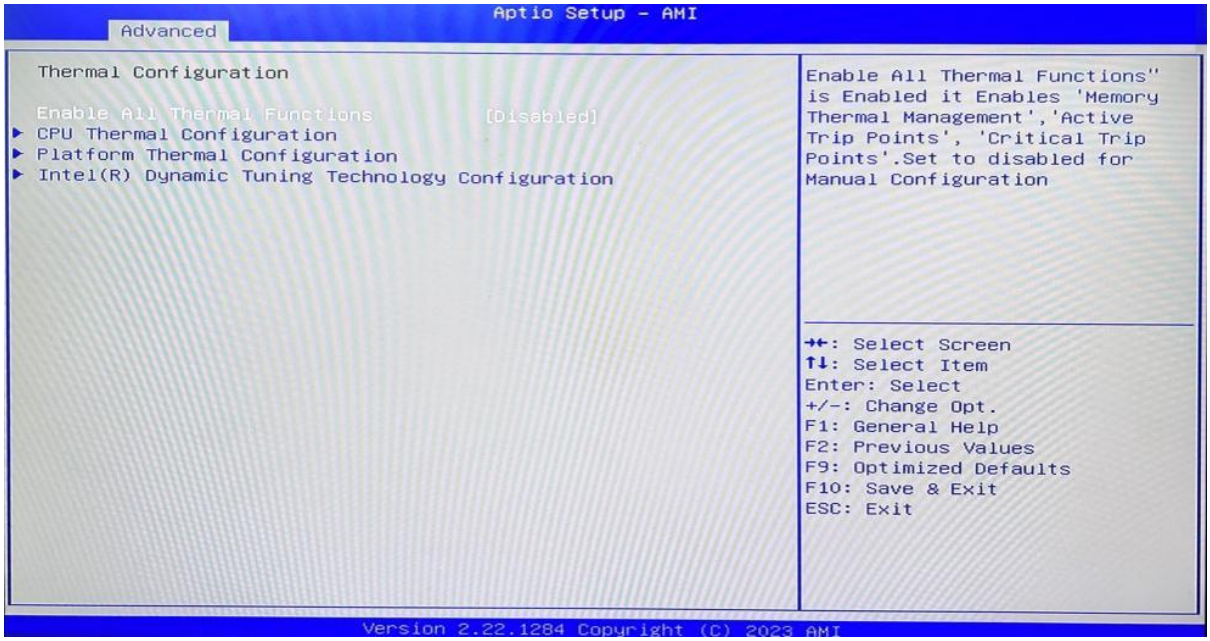
Maximum GT frequency：

Maximum GT Frequency, Default max frequency.

Disable Turbo GT frequency：

Disable Turbo GT Frequency mode, Default disabled.

3.3.4 Thermal Configuration



Enable All Thermal Functions

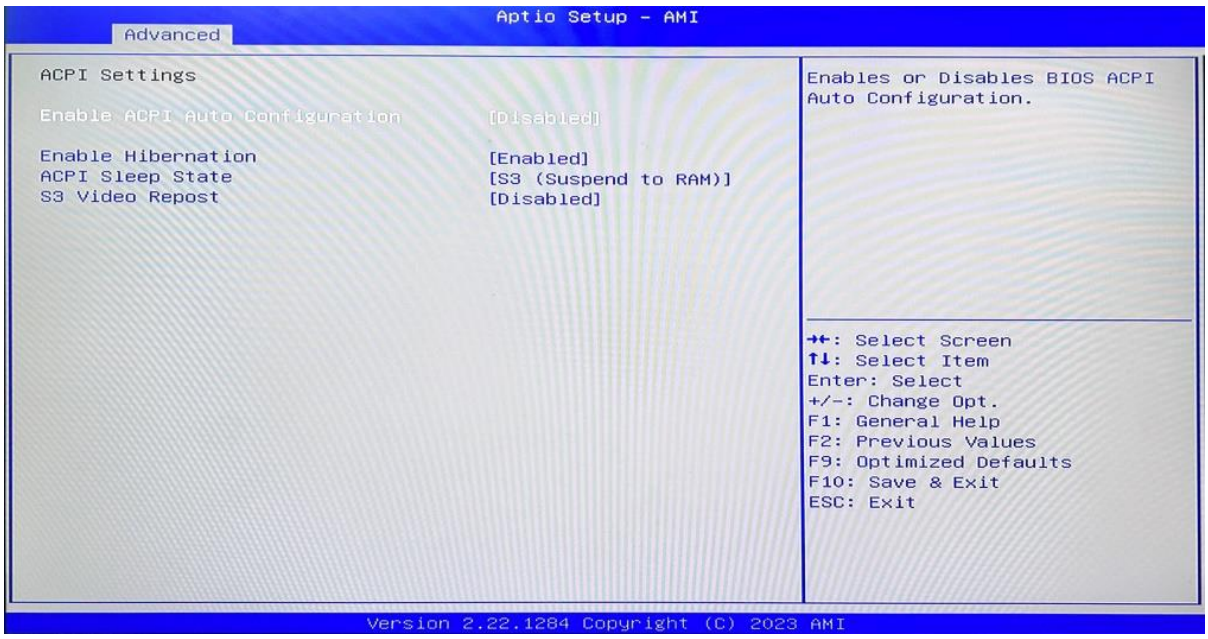
CPU Thermal Configuration:

Unlocks the temperature setting, the “Tcc Activation Offset” is the temperature adjustment option, the highest temperature is 100°C. Change the temperature by minus the number of degrees you wish to change. For example, minus 0(100-0) to set the temperature at 100°C, minus 20(100-20) to set the temperature at 80°C. (Please note the maximum supported temperature for the processor can be found on ark.intel.com.)

Platform Thermal Configuration

Intel(R) Dynamic Tuning Technology Configuration

3.3.5 ACPI Setting

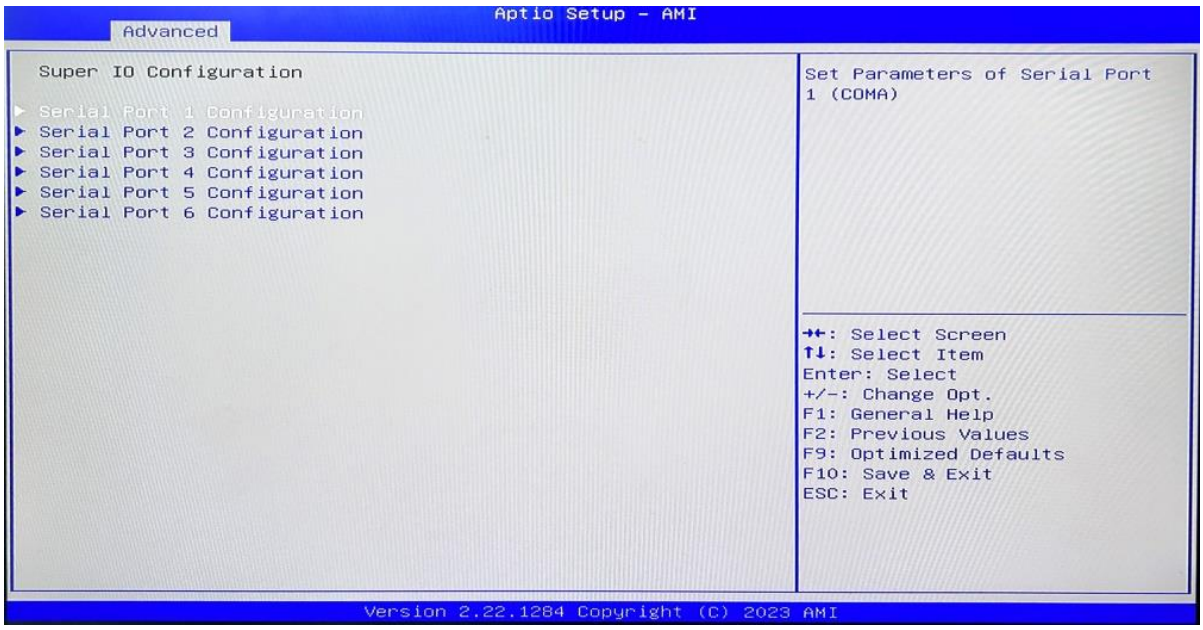


1. **Enabled ACPI Auto Configuration**
2. **Enabled Hibernation**
3. **ACPI Sleep State:**

   Configures ACPI power-saving modes in conjunction with the operating system to set different sleep functions.
4. **S3 Video Repost:**

   Enables the VGA BIOS POST function when waking from S3/STR sleep mode.

3.3.6 IT8786 Super IO Configuration



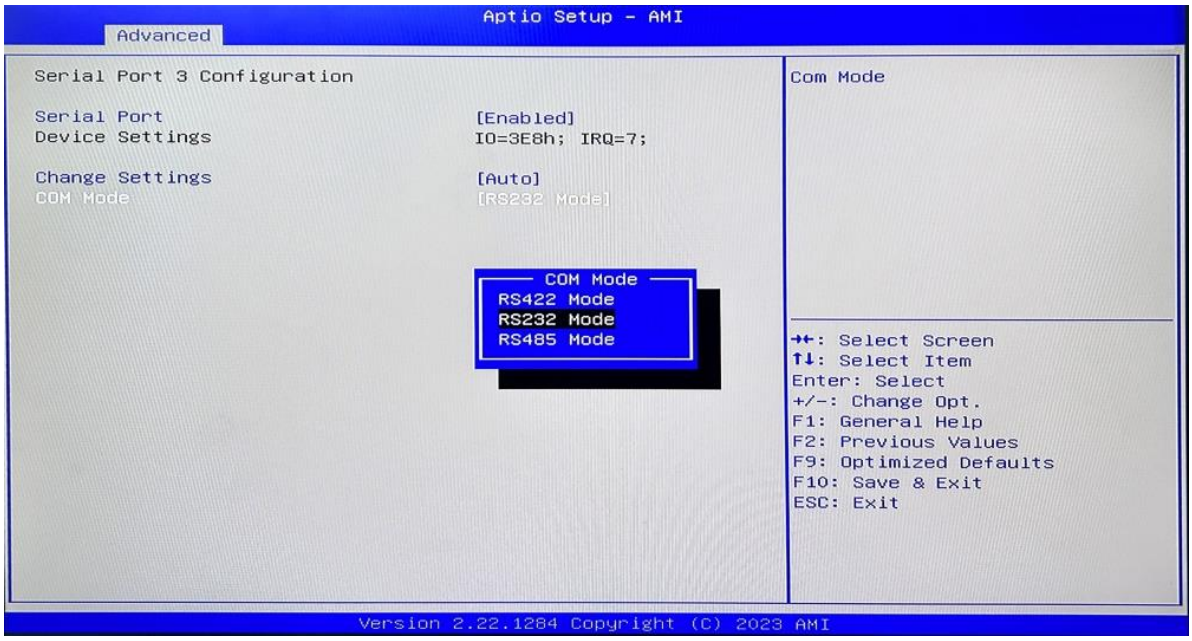
Serial Port 1~6 Configuration

Serial Port: Enable or disable serial port (COM).

Device Setting (Read-only): Displays serial ports' interrupt and location.

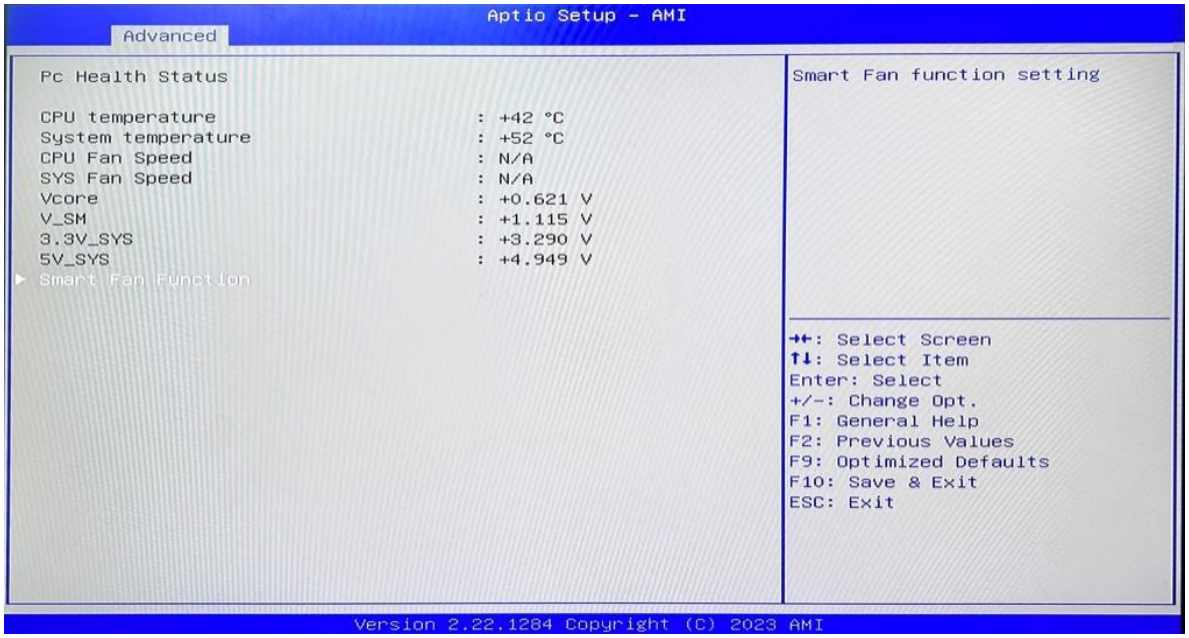
Change Setting: Change serial port settings and suggest setting "Auto" as default.

3.3.7 COM1, COM2 Protocols Switching RS232/RS485/RS422



Enter the “Serial Port 1/2 Configuration”, select the COM Mode option, and choose between RS422/RS232/RS485. The default selection is RS232 mode.

3.3.8 Hardware Monitor

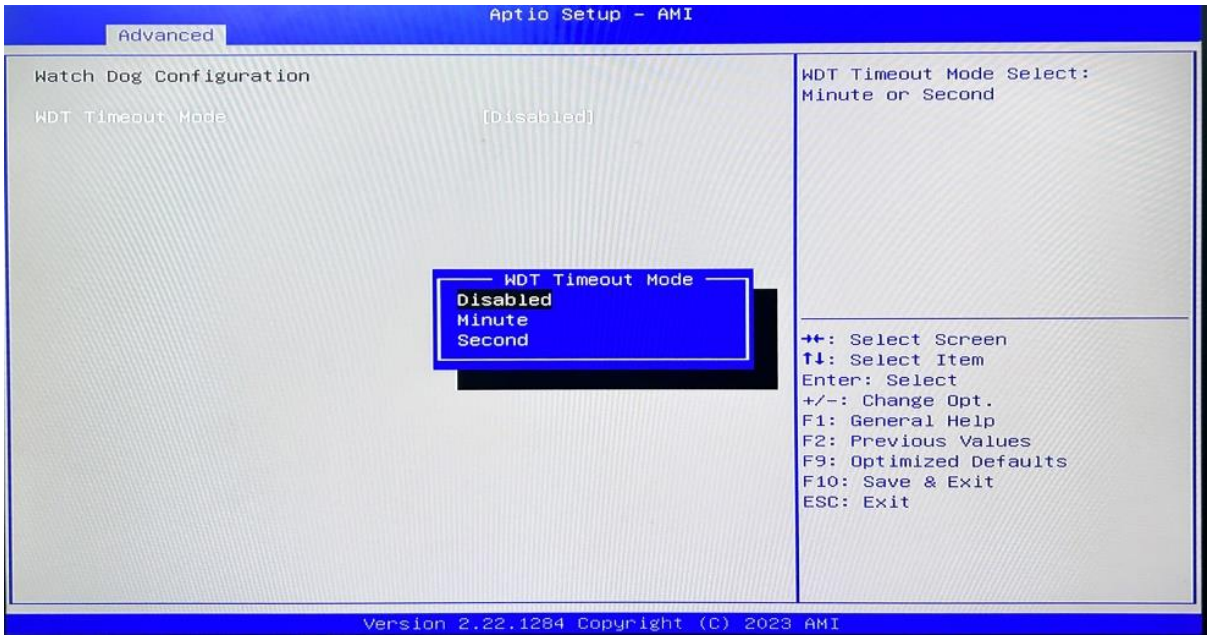


PC Health Status

The PC health status displays CPU temperature, system temperature, fan speed, and other relevant voltage values. The above parameters have a certain range, and the system cannot run beyond these ranges.

1. CPU Temperature
2. System Temperature
3. CPU Fan Speed
4. SYS Fan Speed
5. VCore: Core Voltage
6. V_SM: RAM Voltage
7. 3.3V_SYS: 3.3V
8. 5V_SYS: 5V
9. Smart Fan Function:
    i. Automatic Mode
    ii. Full on Mode
    iii. Manual Mode

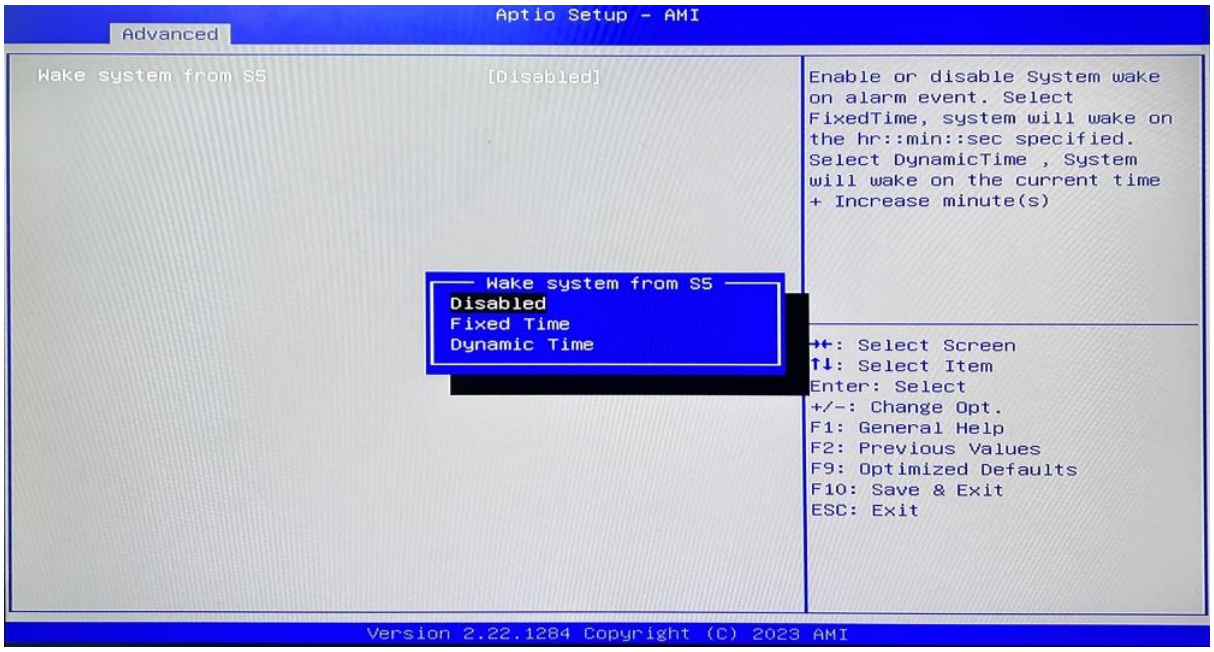
3.3.9 Watch Dog Configuration



Watch Dog Configuration

WDT Timeout Mode select: Minute or Second

3.3.10 S5 RTC Wake Settings

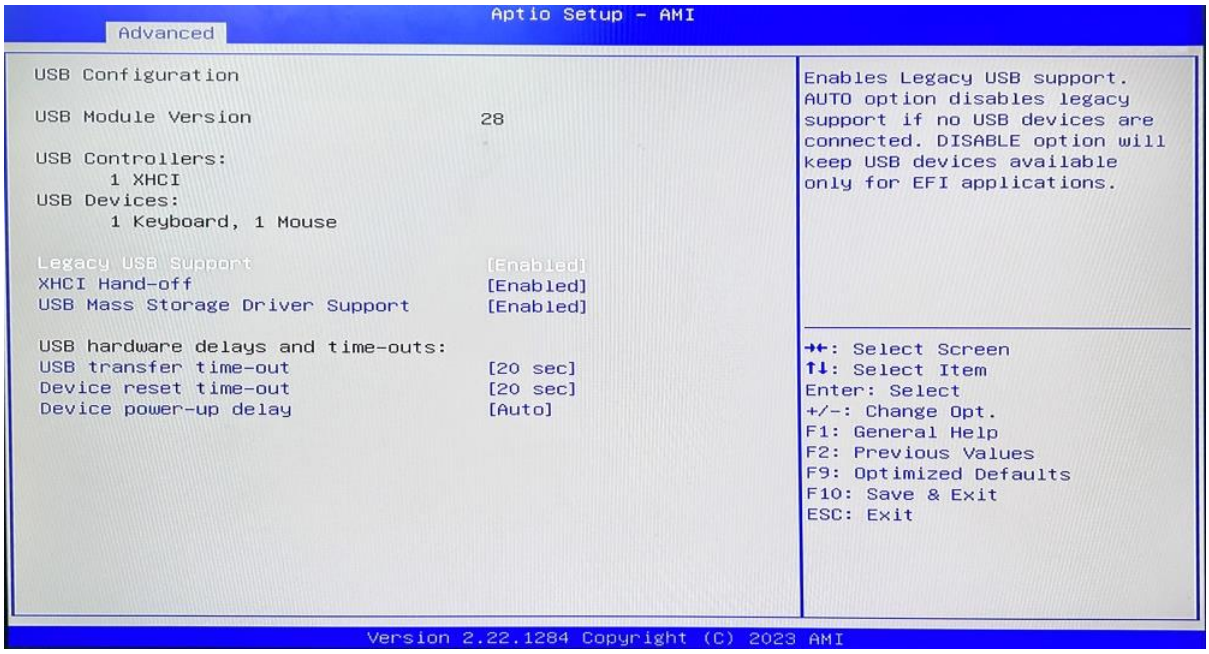


Wake system From S5: timing boot settings, disabled by default.

Fixed Time: Select Fixed Time and the system will wake on the Hr: Min: Sec specified.

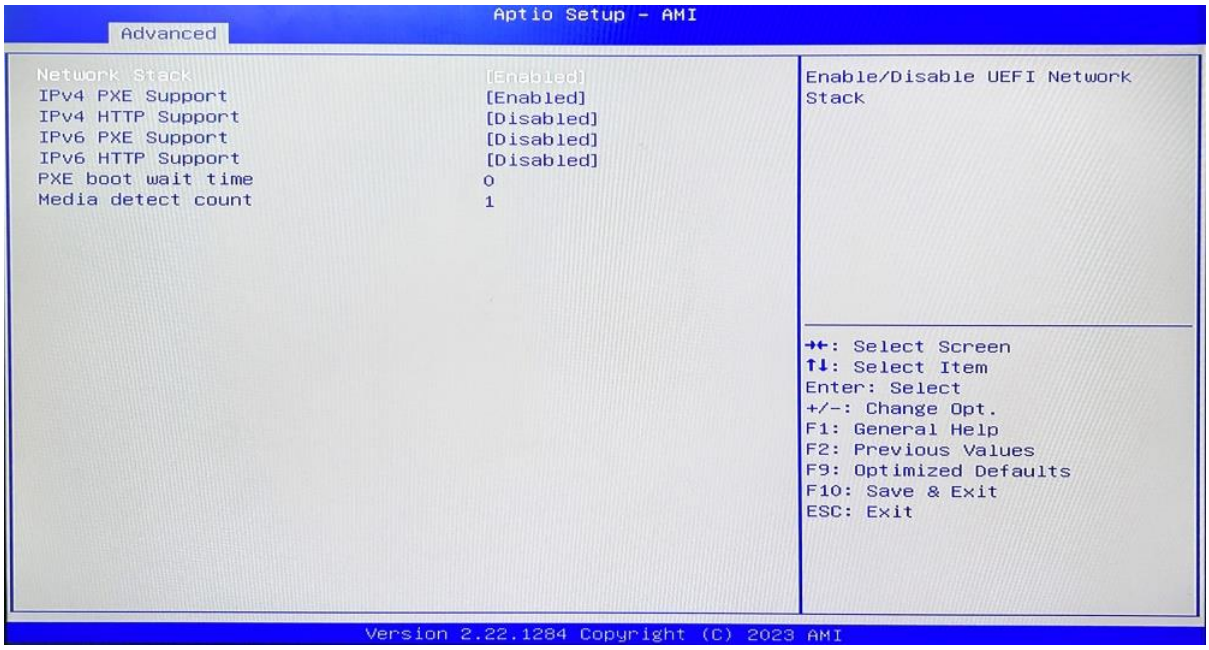
Dynamic Time: Select Dynamic Time and the system will wake on a dynamic time.

3.3.11 USB Configuration



1. **Legacy USB Support**
   a) Enable Legacy USB support. Disables legacy support if no USB devices are connected. Select enable will keep USB devices available under UEFI's support.
2. **XHCI Hand-off**
   a) A workaround for OS without XHCI hand-off support. The XHCI ownership change should be claimed by the USB XCHI driver.
3. **USB Mass Storage Driver Support**
   a) Enable(default) or disable USB Mass Storage Driver Support.
4. **USB transfer time-out**
   a) Time-out value for control, bulk, and interrupt transfers, default time:20 second.
5. **Device reset time-out**
   a) USB mass storage device start unit command time-out, default time:20 second.
6. **Device Power-up Delay**
   a) Maximum time the device will take before it properly reports itself to the host controller.

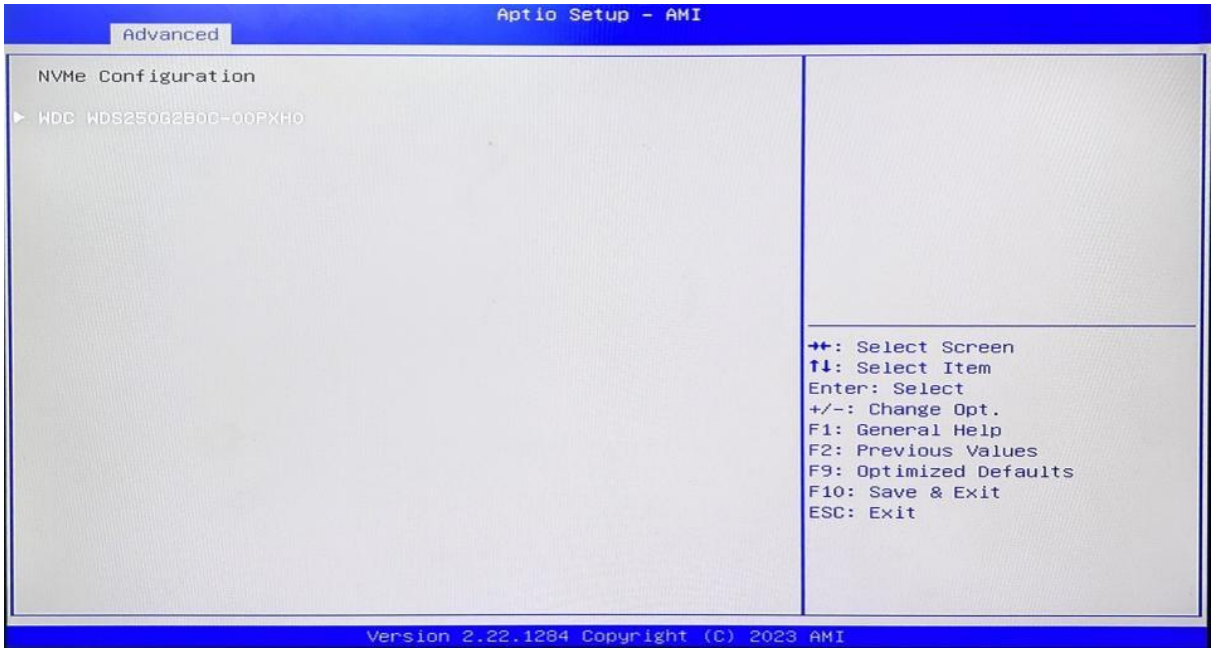
3.3.12 Network Stack Configuration



Network Stack

PXE Network boot setting, disabled by default.

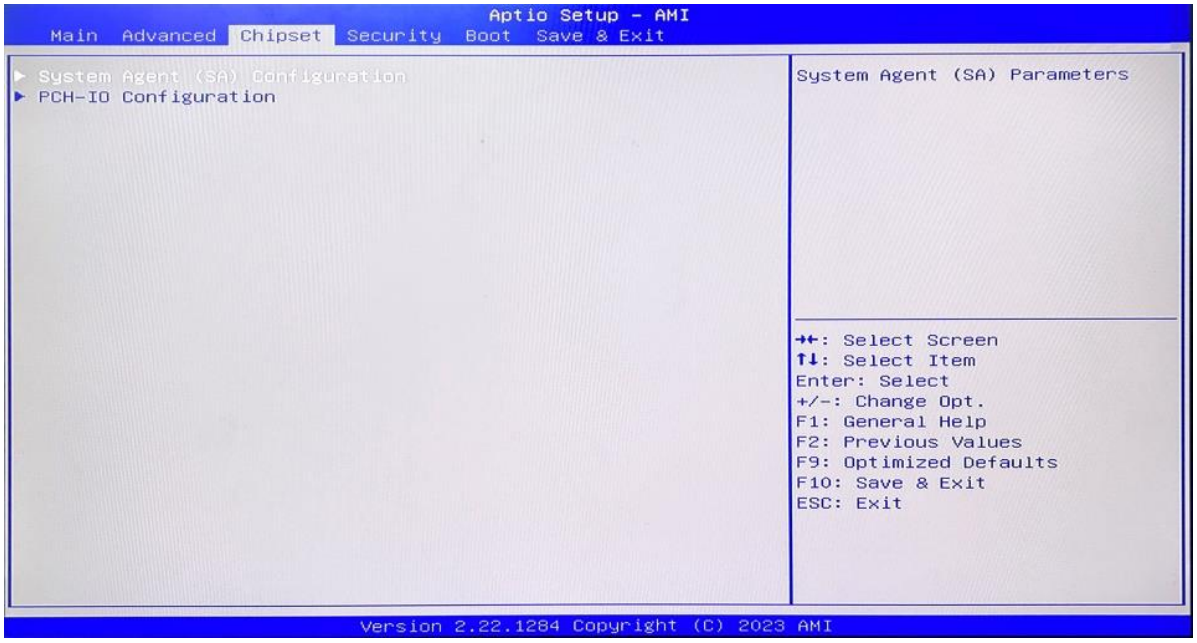
3.3.12 NVME Configuration



The capacity and model of the SSD will be displayed under the option after the NVMe protocol SSD has been installed.

3.4 Chipset

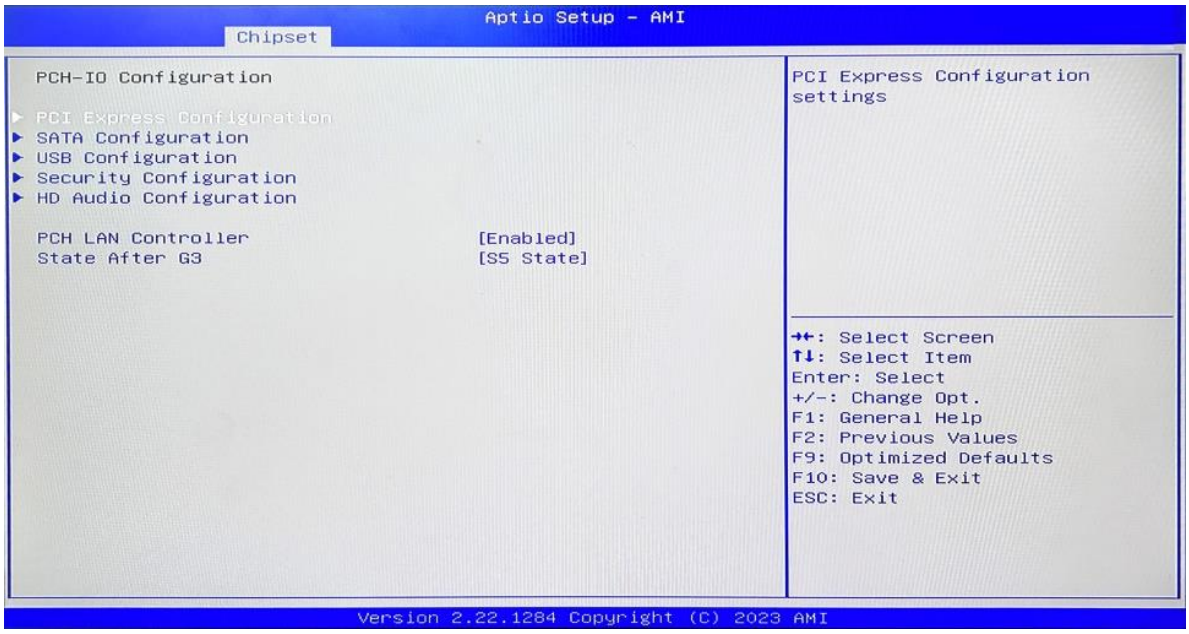
Select the chipset tab from the setup screen to enter the chipset BIOS Setup screen.



System Agent (SA) Configuration: Northbridge configuration options, including video memory, display devices, and other options.

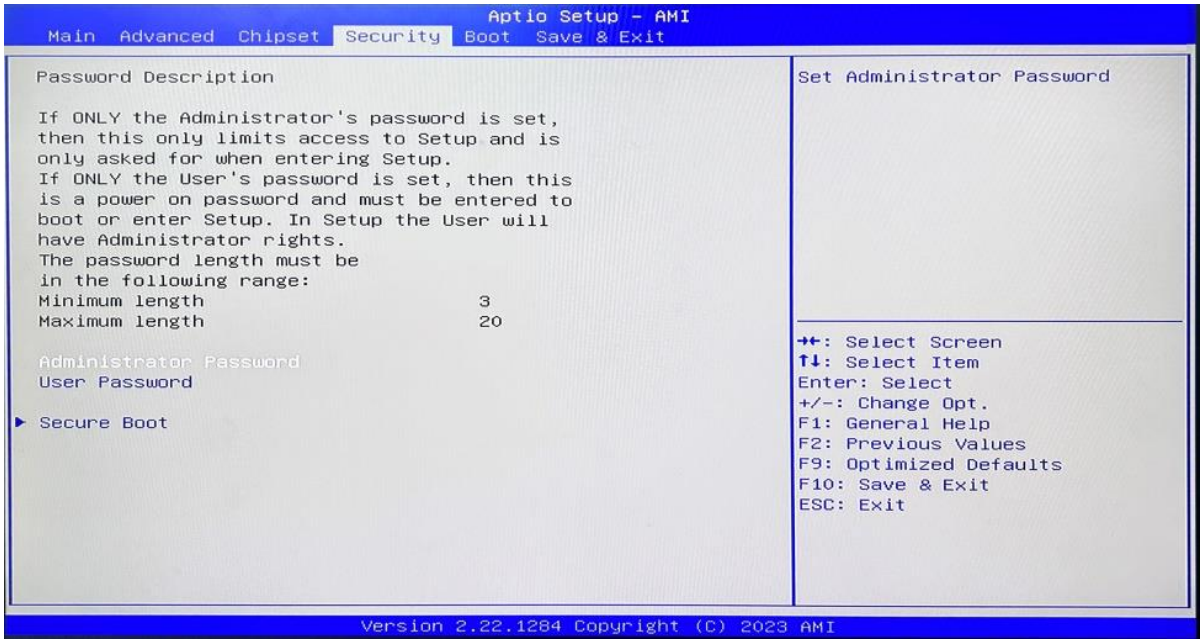
PCH-IO Configuration: Southbridge configuration options, including hard disk, sound card equipment, and other options

3.4.1 PCH-IO Configuration



1. **PCI Express Configuration**
2. **SATA Configuration**
3. **USB Configuration**
4. **Security Configuration**
5. **HD Audio Configuration**
6. **State After G3:**
   i. S0 State (power-on, self-start)
   ii. S5 State (power-on, shutdown). Set by default.

3.5 Security

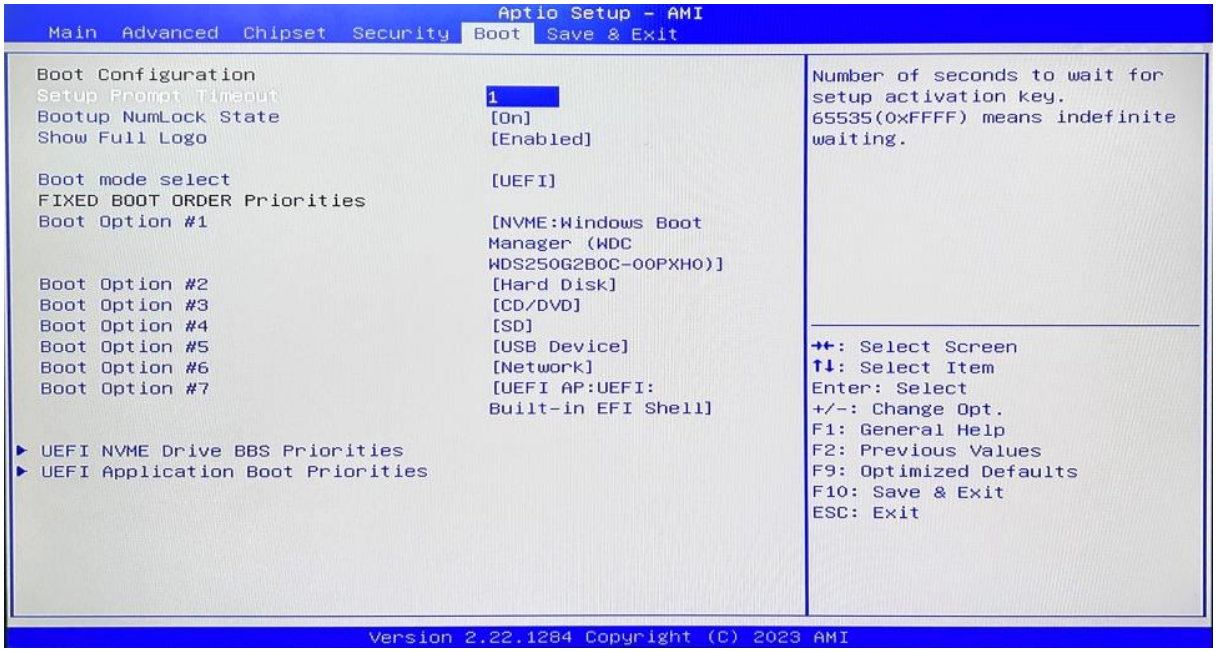


Administrator Password: Set the Administrator Password.

User Password: Set User Password.

Secure Boot: Secure boot

3.6 Boot



Setup Prompt Timeout:

Number of seconds that the firmware will wait before initiating the original default boot selection. A value of 0 indicates that the default boot selection is to be initiated immediately on boot. A value of 65535(0xFFFF) indicates that firmware will wait for user input before booting. This means the default boot selection is not automatically started by the firmware.

Bootup NumLock State:

Select the keyboard NumLock state

Show Full Logo:

Enabled/Disabled Displays customized boot logo.

Boot Option #1~#7:

Set the system boot order from Number 1 to Number 7.

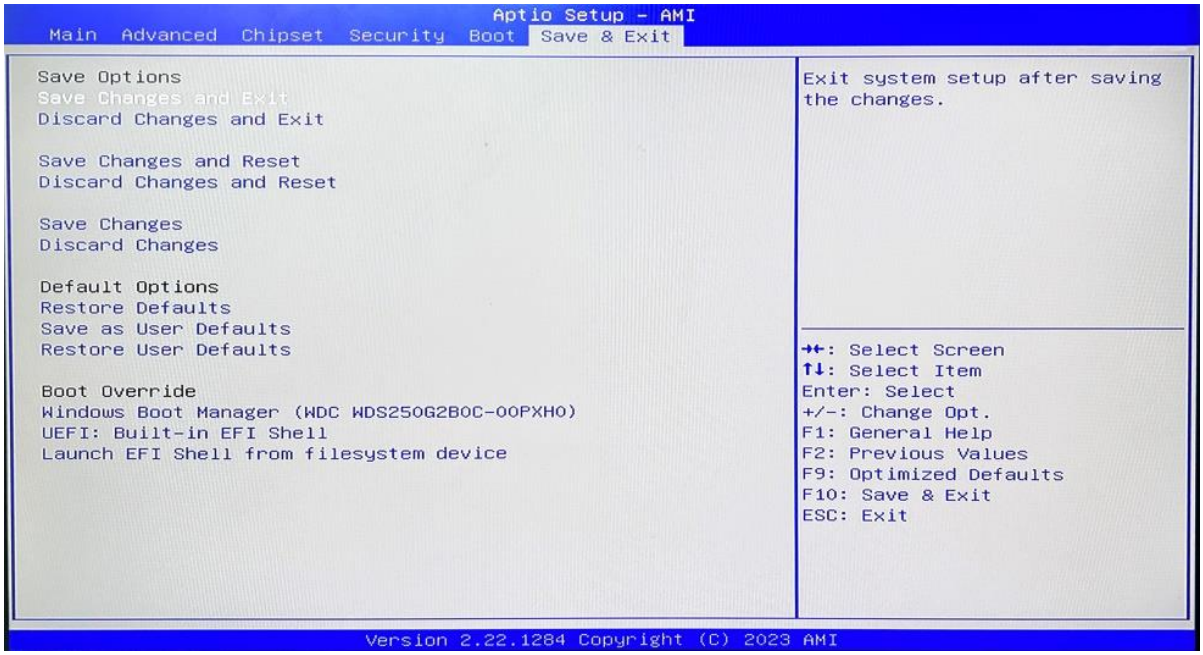
UEFI Hard Disk Drive BBS Priorities:

UEFI hard drive boot priorities setting.

UEFI Application boot Priorities:

UEFI application boot priority.

3.7 Save & Exit



Save Changes and Exit:

Exit the system setup after saving the changes and continue to start the computer.

Discard Changes and Exit:

Exit the system setup without saving any changes and continue to start the computer.

Save Changes and Reset:

Reset the system after saving the changes.

Discard changes and Reset:

Reset the system without saving any changes.

Save Changes:

Save changes done so far to any of the options.

Discard Changes:

Discard changes done so far to any of the options.

Restore Defaults:

Restore/load default values for all the options.

Save as User Defaults:

Save the changes done so far as the user defaults.

Restore User Defaults:

Restore the user defaults to all the options.

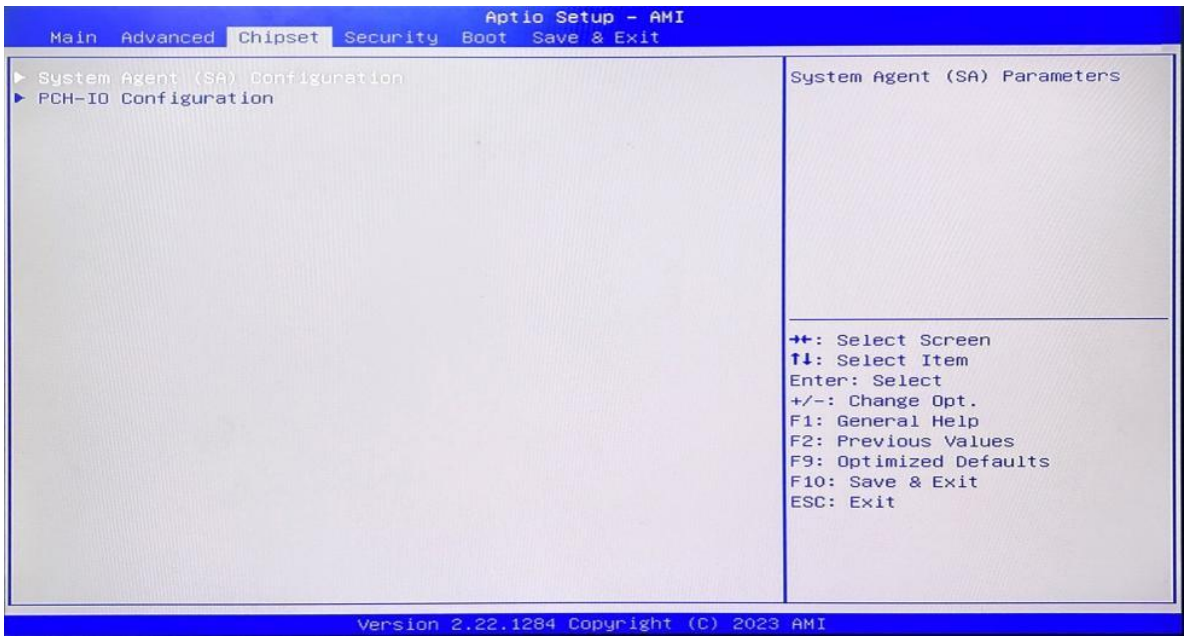
Boot Override:

Boot device selection can override your boot priority. Select the specified boot device such as SATA, USB Flash Disk, EFI Shell, PXE, etc., and boot directly. Or press F11 boot by selecting the specified boot device.

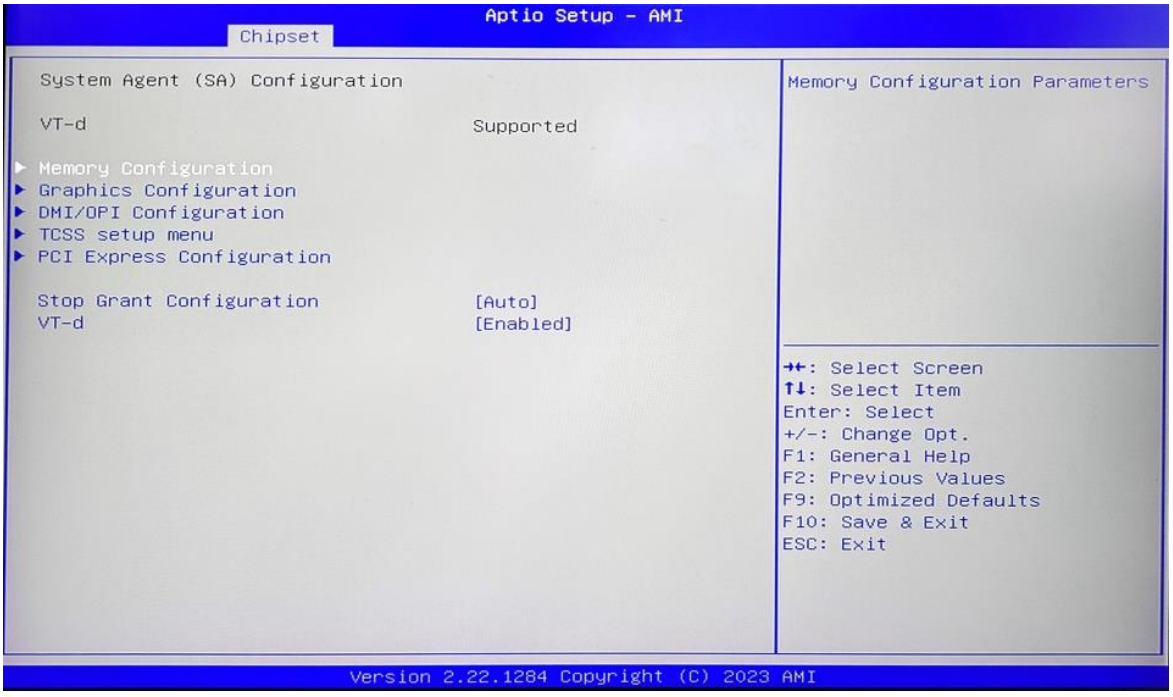
Pressing F11 during startup allows you to directly select a specific device to boot from.

3.8 Steps to debug LVDS under AL35 BIOS

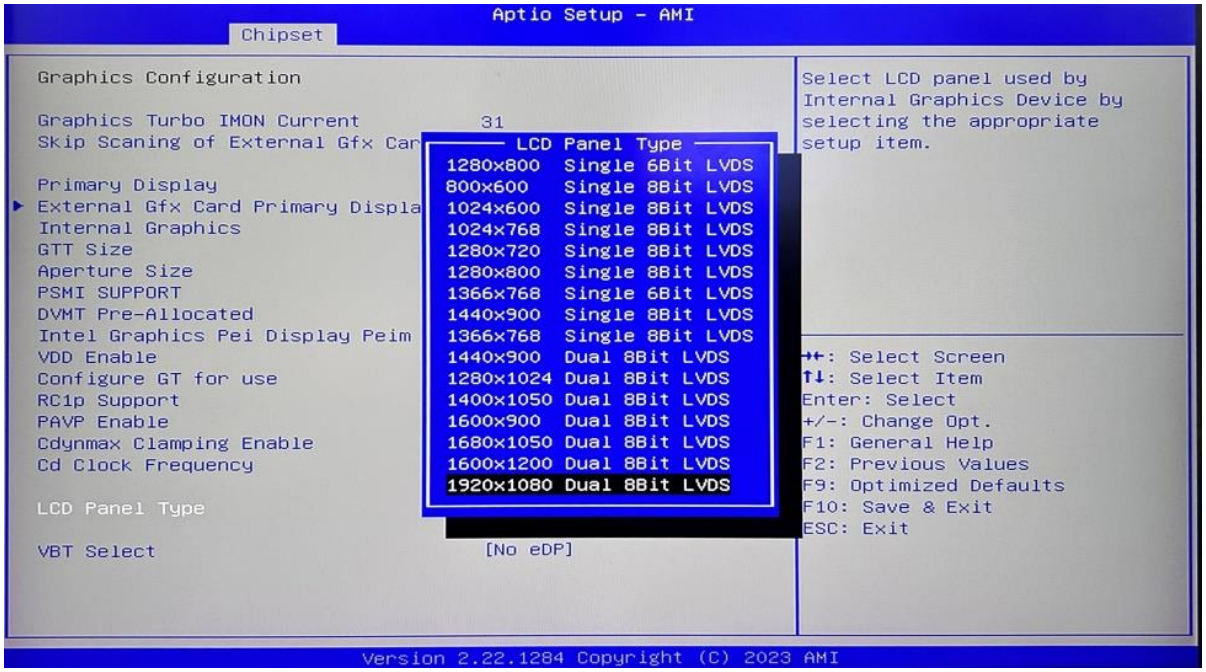
1. Press the DEL key to enter the bios interface, use the left and right arrow keys on the keyboard to get the Chipset section, select "System Agent (SA) Configuration" to enter, as shown below:



2. Select "Graphics Configuration" then press enter, as shown below:



3. Select "LCD Pane Type" press enter, then select the target resolution (each monitor's tech specification has the screen-supported resolution), reference as shown below:



4. After selecting the targeted screen resolution, press F10 to save and exit.

5. Select the "VBT Select" option to turn the LVDS ON or OFF (LVDS OFF: No eDP, LVDS ON: eDP) as shown below:

