

## WL053

2.5" Pico-ITX Motherboard  
User's Manual

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## FCC and DOC Statement on Class B

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio TV technician for help.

## Notice:

1. The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.
2. Shielded interface cables must be used in order to comply with the emission limits.

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## About this Manual

This manual can be downloaded from the website.

The manual is subject to change and update without notice, and may be based on editions that do not resemble your actual products. Please visit our website or contact our sales representatives for the latest editions.

## Warranty

1. Warranty does not cover damages or failures that arise from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.
2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.
3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.
4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

## Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.
2. Wear an antistatic wrist strap.
3. Do all preparation work on a static-free surface.
4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.
5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.



### Important:

Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

## Safety Measures

- To avoid damage to the system, use the correct AC input voltage range.
- To reduce the risk of electric shock, unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging the power cord.

## About the Package

The package contains the following items. If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

- 1 WL053 board
- 1 Heat spreader (Height: 11mm) A71-808331-000G

Note: The items are subject to change in the developing stage.

The board and accessories in the package may not come similar to the information listed above. This may differ in accordance with the sales region or models in which it was sold. For more information about the standard package in your region, please contact your dealer or sales representative.

## Optional Items

Note: The items are subject to change in the developing stage.

<b>2 pole terminal to DC Jack cable</b>	A81-004013-000G
<b>USB 2.0 cable (Length: 200mm, 2 ports)</b>	A81-001084-016G
<b>COM cable (Length: 300mm, 1 port)</b>	A81-015050-016G
<b>Heat spreader for -5 to 65°C (Height: 37.8mm)</b>	A71-008153-010G
<b>DIO cable (Length: 160mm)</b>	A81-009203-018G
<b>SMBus cable (Length: 240mm)</b>	A81-009353-016G
<b>Front Panel cable (Length: 200mm)</b>	A81-020047-016G
<b>Cooler (Height: 23mm)</b>	A71-108144-000G

## Before Using the System Board

When installing the system board in a new system, you will need at least the following internal components.

- Memory module
- Storage device
- Power adaptor

External system peripherals may also be required for navigation and display, including at least a keyboard, a mouse and a video display monitor.

## Chapter 1 - Introduction

### ► Specifications

<b>System</b>	<b>Processor</b>	8th Generation Intel® Core™ Processors, BGA 1528 Intel® Core™ i7-8665UE, Quad Core, 8M Cache, 1.7GHz (4.4GHz), 15W Intel® Core™ i5-8365UE, Quad Core, 6M Cache, 1.6GHz (4.1GHz), 15W Intel® Core™ i3-8145UE, Dual Core, 4M Cache, 2.2GHz (3.9GHz), 15W Intel® Core™ Celeron® 4305UE, Dual Core, 2M Cache, 2.0GHz (2.0GHz), 15W	
	<b>Memory</b>	One 260-pin SODIMM up to 32GB Single Channel DDR4 up to 2400MHz	
	<b>BIOS</b>	AMI SPI 128Mbit	
	<b>Graphics</b>	<b>Controller</b>	Intel® UHD Graphics 620/ Intel® UHD Graphics 610 (for Celeron 4305UE)
	<b>Feature</b>	OpenGL 4.5, DirectX 12, OpenCL 2.1 HW Decode: AVC/H.264, MPEG2, VC1/WMV9, JPEG/MJPEG, HEVC/H265, VP8, VP9 HW Encode: AVC/H.264, MPEG2, JPEG, HEVC/H265, VP8, VP9	
	<b>Display</b>	1 x DP++/HDMI	DP++: resolution up to 4096x2304 @ 60Hz HDMI: resolution up to 4096x2160 @30Hz
	<b>Dual Displays</b>	DP++ + HDMI	
<b>Expansion</b>	<b>Interface</b>	1 x M.2 E key 2230 (PCIe x2/USB 2.0) 2 x M.2 B key 3042/2242 (PCIe x1 or SATA 3.0/USB 3.1 Gen1/USB 2.0)	
<b>Ethernet</b>	<b>Controller</b>	1 x Intel® I219V/I219LM (only Core i7/i5 supports iAMT)	
<b>Rear I/O</b>	<b>Ethernet</b>	1 x GbE (RJ-45)	
	<b>USB</b>	2 x USB 3.1 Gen 2	
	<b>Display</b>	1 x COMBO port (DP++/HDMI)	
<b>Internal I/O</b>	<b>Serial</b>	1 x RS-232/422/485 (1.27mm pitch)	
	<b>USB</b>	2 x USB 2.0 (1.27mm pitch)	
	<b>DIO</b>	1 x 8-bit DIO	
	<b>SMBus</b>	1 x SMBus	
<b>Watchdog Timer</b>	<b>Output &amp; Interval</b>	System Reset, Programmable via Software from 1 to 255 Seconds	
<b>Security</b>	<b>TPM</b>	fTPM2.0	

<b>Power</b>	<b>Type</b>	Wide Range 9~36V
	<b>Connector</b>	2-pin Terminal Block
	<b>Consumption</b>	Typical: 8665UE:12V @ 0.43A (5.16Watt) Max.: 8665UE:12V @ 2.91A (34.92Watt)
	<b>RTC Battery</b>	CR2032 Coin Cell
<b>OS Support</b>	<b>OS Support (UEFI Only)</b>	Windows 10 IoT Enterprise (64-bit) Linux
<b>Environment</b>	<b>Temperature</b>	Operating: 0 to 60°C, -30 to 80 °C Storage: -40 to 85°C
	<b>Humidity</b>	Operating: 5 to 90% RH Storage: 5 to 90% RH
	<b>MTBF</b>	8665UE : 569,616 hrs @ 25°C; 410,391 hrs @ 45°C ; 301,279 hrs @ 60°C; 187,893 hrs @ 80°C Calculation model: Telcordia Issue 4 Environment: GB, GC – Ground Benign, Controlled
<b>Mechanism</b>	<b>Dimensions</b>	2.5" Pico-ITX Form Factor 100mm (3.94") x 72mm (2.83")
	<b>Height</b>	PCB: 1.6mm Top Side: 15mm Bottom Side: 8mm
<b>Standards and Certifications</b>	<b>Certifications</b>	CE, FCC, RoHS

## ► Features

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### Watchdog Timer

The Watchdog Timer function allows your application to regularly “clear” the system at the set time interval. If the system hangs or fails to function, it will reset at the set time interval so that your system will continue to operate.

### DDR4

DDR4 delivers increased system bandwidth and improves performance. The advantages of DDR4 provide an extended battery life and improve the performance at a lower power than DDR3/DDR2.

### Graphics

The integrated Intel® HD graphics engine delivers an excellent blend of graphics performance and features to meet business needs. It provides excellent video and 3D graphics with outstanding graphics responsiveness. These enhancements deliver the performance and compatibility needed for today's and tomorrow's business applications.

### Gigabit LAN

The Gigabit Ethernet Controllers support data transmission at 1Gbps.

### Audio

The audio codec provides 5.1 channel High Definition audio output.

### Wake-On-LAN

This feature allows the network to remotely wake up a Soft Power Down (Soft-Off) PC. It is supported via the onboard LAN port or via a PCI LAN card that uses the PCI PME (Power Management Event) signal. However, if your system is in the Suspend mode, you can power-on the system only through an IRQ or DMA interrupt.

### Wake-On-USB

This function allows you to use a USB keyboard or USB mouse to wake up a system from the S3 (STR - Suspend To RAM) state.

### ACPI STR

The system board is designed to meet the ACPI (Advanced Configuration and Power Interface) specification. ACPI has energy saving features that enables PCs to implement Power Management and Plug-and-Play with operating systems that support OS Direct Power Management. ACPI when enabled in the Power Management Setup will allow you to use the Suspend to RAM function.

With the Suspend to RAM function enabled, you can power-off the system at once by pressing the power button or selecting “Standby” when you shut down Windows® without having to go through the sometimes tiresome process of closing files, applications and operating system. This is because the system is capable of storing all programs and data files during the entire operating session into RAM (Random Access Memory) when it powers-off. The operating session will resume exactly where you left off the next time you power-on the system.

### Power Failure Recovery

When power returns after an AC power failure, you may choose to either power-on the system manually or let the system power-on automatically.

### USB

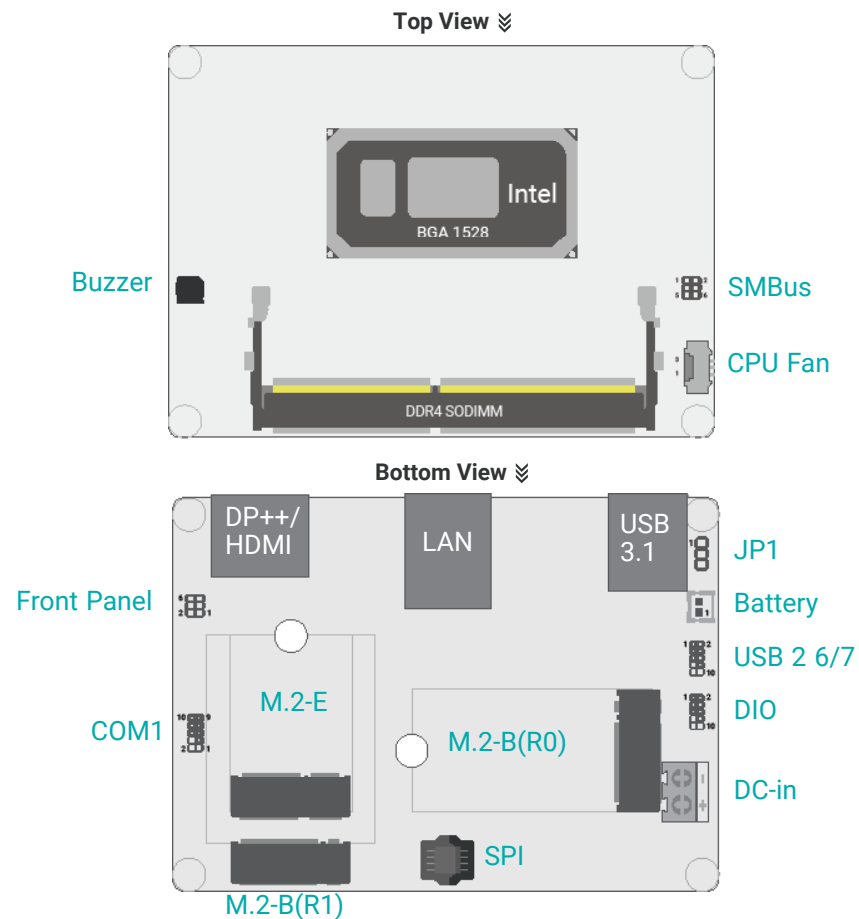
The system board supports the new USB 3.1 Gen 2. It is capable of running at a maximum transmission speed of up to 10 Gbit/s (1.2 GB/s) and is faster than USB 3.1 Gen 1 (5 Gbit/s, or 625 MB/s), USB 2.0 (480 Mbit/s, or 60 MB/s) and USB 1.1 (12Mb/s). USB 3.1 reduces the time required for data transmission, reduces power consumption, and is backward compatible with USB 2.0. It is a marked improvement in device transfer speeds between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

### RTC Timer

The Real Time Clock (RTC) installed on the system board allows your system to automatically power-on on the set date and time.

## Chapter 2 - Hardware Installation

### ► Board Layout



**Note:**

Some components are optional and only available upon request.

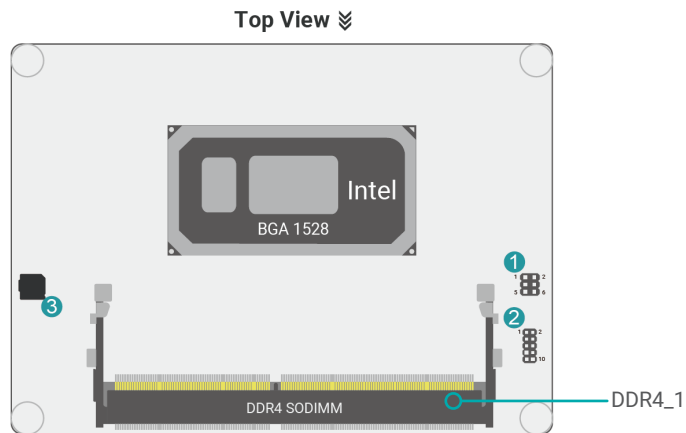


**Important:**

Electrostatic discharge (ESD) can damage your board, processor, disk drives, add-in boards, and other components. Perform installation procedures at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.



► System Memory



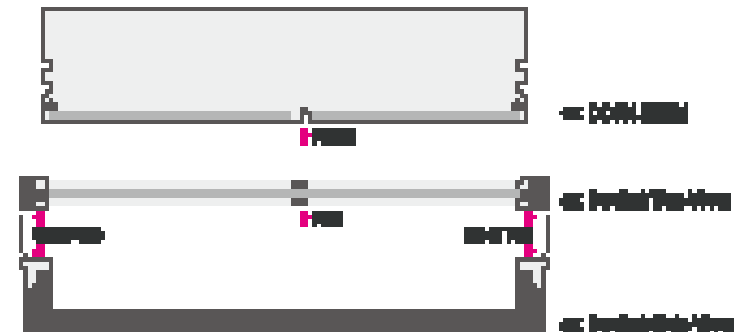
The system board supports the following memory interface.

► System Memory

Installing the Memory Module

Before installing the memory module, please make sure that the following safety cautions are well-attended.

1. Make sure the PC and all other peripheral devices connected to it has been powered down.
2. Disconnect all power cords and cables.
3. Locate the socket on the system board
4. Make sure the notch on memory card is aligned to the key on the socket.



► System Memory ► Installing the Memory Module

Please follow the steps below to install the memory card into the socket.

**Step 1:**

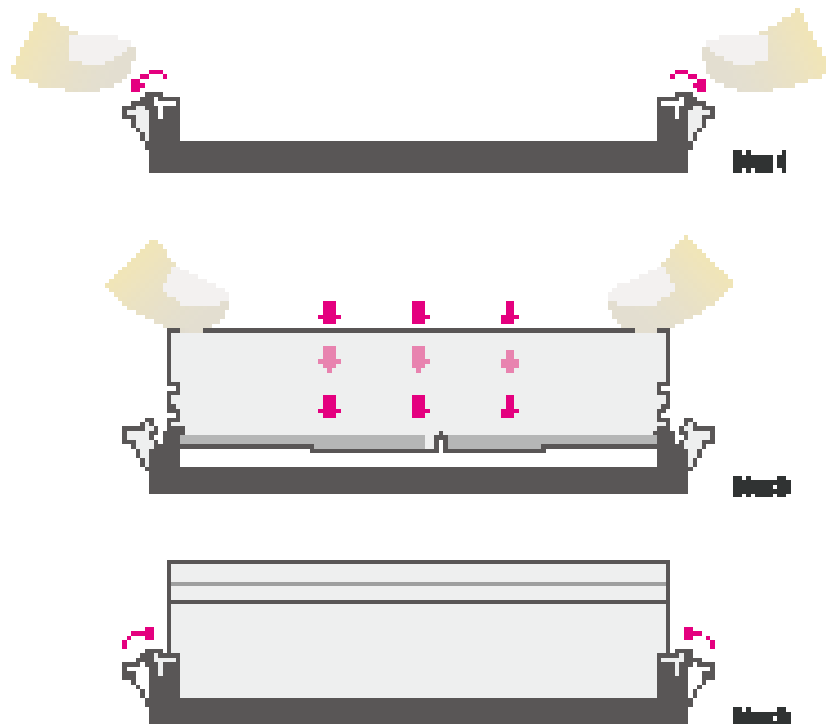
Press the eject tabs at both ends of the socket outward and downward to release them from the locked position.

**Step 2:**

Insert the memory card into the slot while making sure the notch and the key are aligned. Press the card down firmly with fingers while applying and maintaining even pressure on both ends.

**Step 3:**

The tabs snap automatically to the edges of the card and lock the card in place.



► System Memory

**Removing the Memory Module**

Please follow the steps below to remove the memory card from the socket.

**Step 1:**

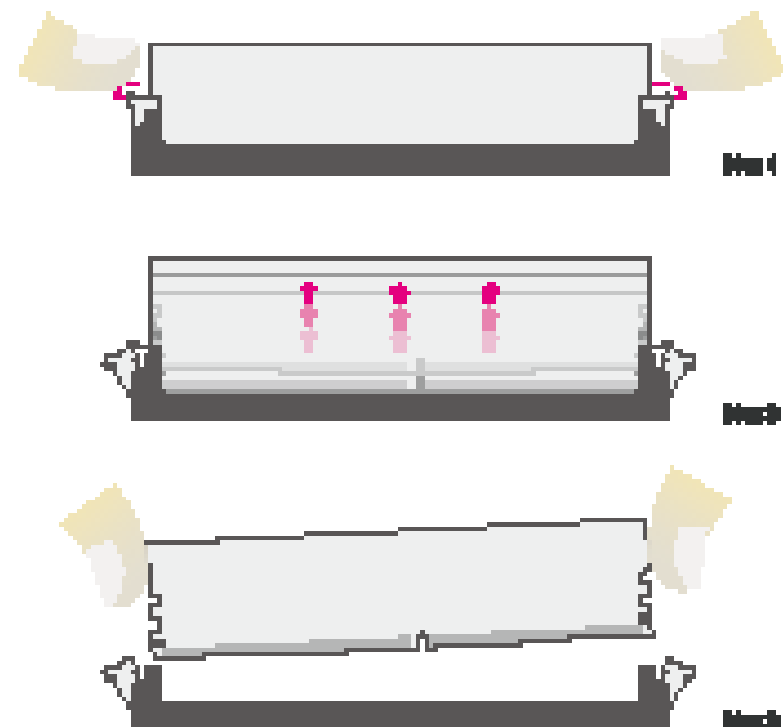
Press the eject tabs at both ends of the socket outward and downward to release them from the locked position.

**Step 2:**

The memory card ejects from the slot automatically.

**Step 3:**

Hold the card by its edges and remove it from the slot.



► CPU

**Installing the Heat spreader**

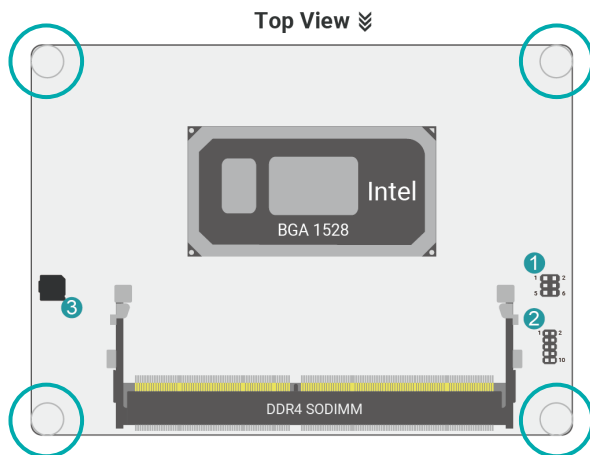
The CPU must be kept cool by using a heat spreader, otherwise the CPU will overheat damaging both the CPU and system board.

1. Before you install the fan / heat spreader, you must apply a thermal paste onto the top of the CPU. The thermal paste is usually supplied when you purchase the fan / heat spreader assembly. Do not spread the paste all over the surface. When you later place the heat spreader on top of the CPU, the compound will disperse evenly.

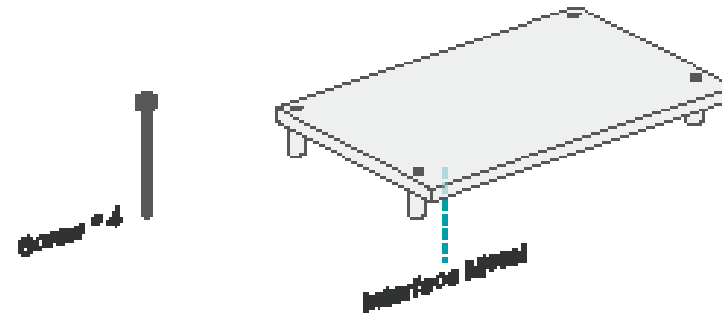
Some heat spreaders come with a patch of pre-applied thermal paste. Do not apply thermal paste if the fan / heat spreader already has a patch of thermal paste on its underside. Peel the strip that covers the paste before you place the fan / heat spreader on top of the CPU.

2. Place the heat spreader on top of the CPU. The 4 spring screws around the heat spreader, which are used to secure the heat spreader onto the system board, must match the 4 mounting holes around the board.
3. Screw tight two of the spring screws at opposite corners into the mounting holes. And then proceed with the other two spring screws.

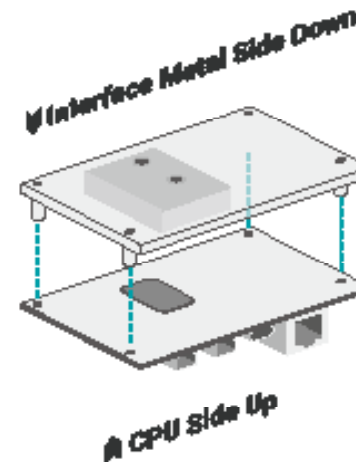
Mounting holes



A heat spreader is included in the standard package. The heat spreader and components required for mounting are illustrated below.



The heat spreader is designed to be mounted onto the module as illustrated below. Please make sure the contacting sides of the heat spreader and the module are correct – the CPU side of the module shall be facing the interface metal side and legs of the heat spreader. Rotate horizontally so the interface metal sits right on top of the CPU. Remove any plastic cover on the interface metal and apply thermal paste/adhesive if it is required.

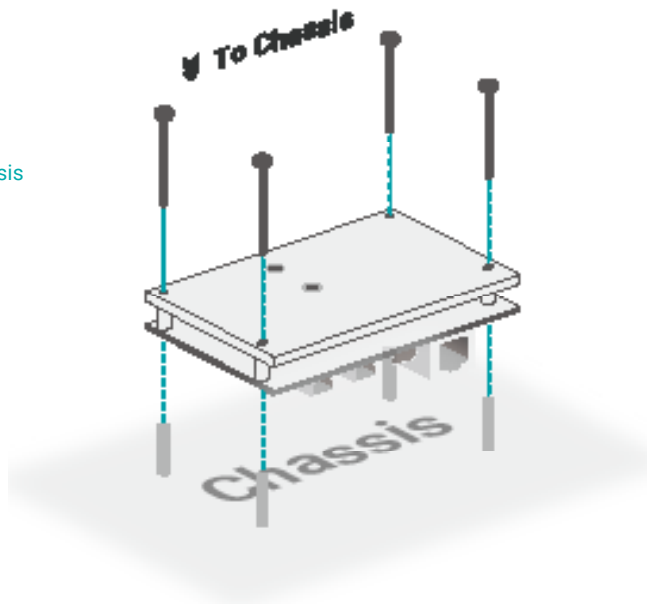


Rotate the module and heat spreader combo so that the I/O is facing the desired side, and place the combo in the position of the chassis reserved for your module.

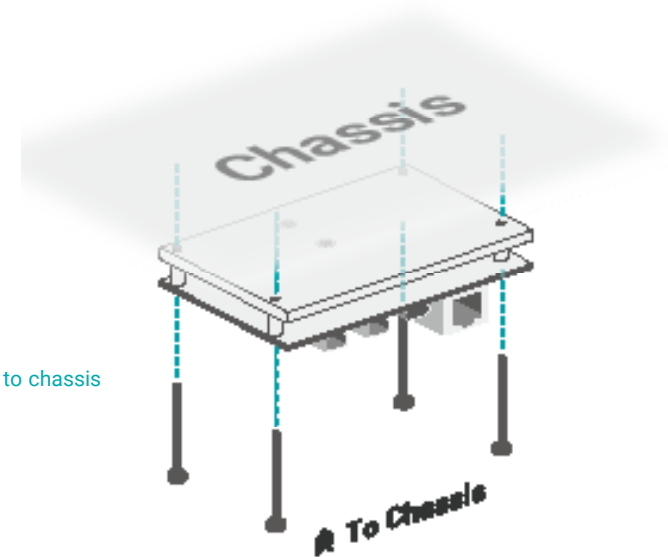
Align the screw holes of the combo to those on the chassis. The combo can be mounted onto the chassis in two manners — 1) module side to the chassis, or 2) heat spreader side to the chassis as illustrated below. This shall depend entirely on the design of the chassis with regard to interior spacing, thermal, and I/O.

Place the screws that come with the standard package into the screw holes, and use a screw driver to fasten the screws until the combo is securely fixed onto the chassis.

■ Module side to chassis

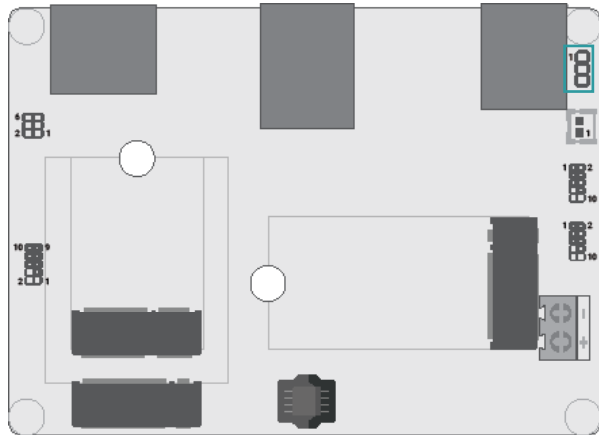


■ Heat spreader side to chassis



## ► Jumper Settings

### Clear CMOS



If any anomaly of the followings is encountered –

- a) CMOS data is corrupted;
- b) you forgot the supervisor or user password;
- c) failure to start the system due to BIOS mis-configuration

– it is suggested that the system be reconfigured with default values stored in the ROM BIOS. To load the default values stored in the ROM BIOS, please follow the steps below.

1. Power-off the system and unplug the power cord.
2. Put a jumper cap on JP5's pin 2 and pin 3. Wait for a few seconds and set JP5 back to its default setting, i.e. jumper cap on pin 1 and pin 2.
3. Plug the power cord and power-on the system.



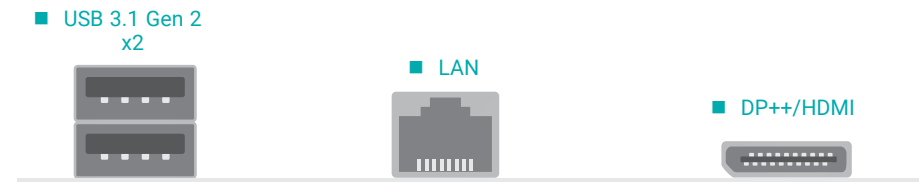
■ 1-2 On: Normal (default)



■ 2-3 On: Clear CMOS

## ▶ Rear I/O Ports

Rear

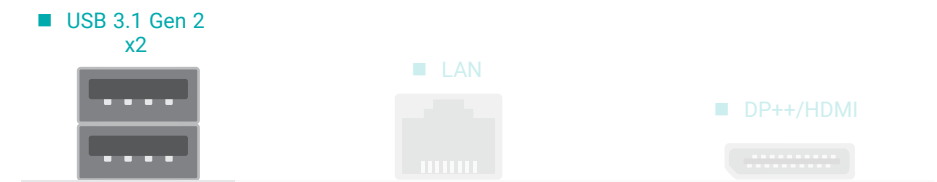
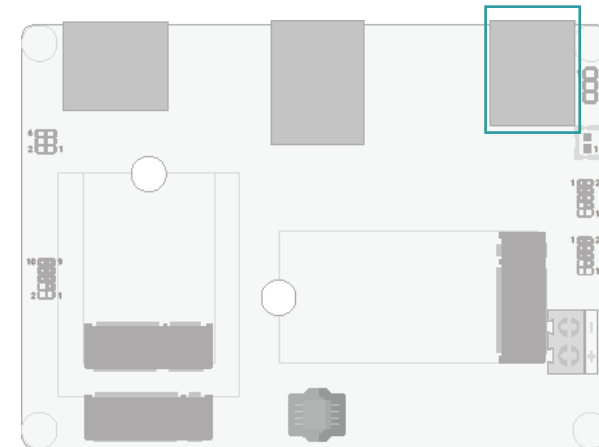


The rear panel I/O ports consist of the following:

- 1 HDMI / DP++ port
- 1 RJ45 LAN ports
- 2 USB 3.1 Gen2 ports

## ▶ Rear I/O Ports

### USB Ports



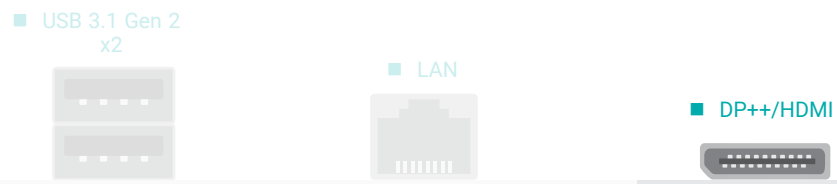
USB allows data exchange between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

#### Wake-On-USB Keyboard/Mouse

The Wake-On-USB Keyboard/Mouse function allows you to use a USB keyboard or USB mouse to wake up a system from the S3 (STR - Suspend To RAM) state.

► Rear I/O Ports

Graphics Display



DisplayPort ++

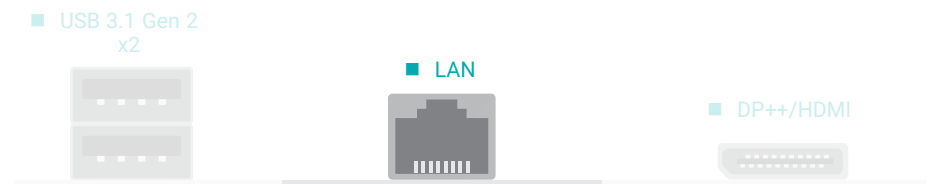
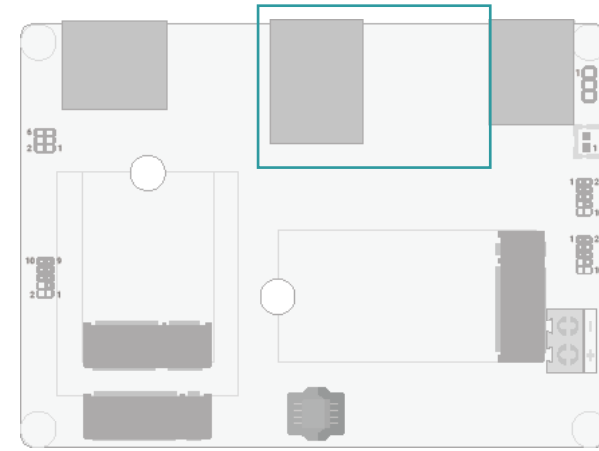
The DisplayPort (DP) is a digital display interface used to connect a display device such as a computer monitor. It is used to transmit audio and video simultaneously. The interface, which is developed by VESA, delivers higher performance features than any other digital interface. DP++ is supported by the system board for converting to DVI and HDMI signals.

HDMI

The HDMI port which carries both digital audio and video signals is used to connect a LCD monitor or digital TV that has the HDMI port.

► Rear I/O Ports

LAN

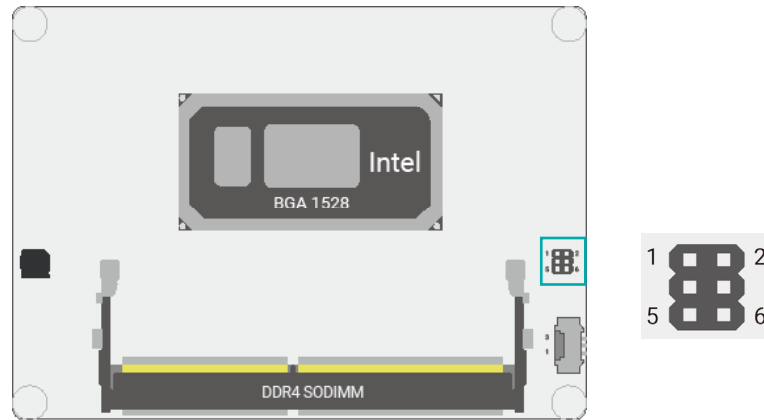


LAN (RJ45)

The onboard RJ45 LAN port allows the system board to connect to a local area network by means of a network hub.

► **Internal I/O Connectors**

**SMBus**

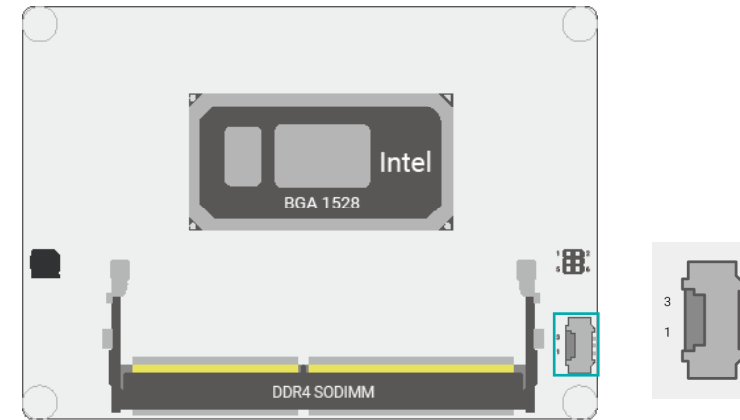


The SMBus (System Management Bus) connector is used to connect the SMBus device. It is a multiple device bus that allows multiple chips to connect to the same bus and enable each one to act as a master by initiating data transfer.

■ **SMBus Pin Assignment**

Pin	Assignment	Pin	Assignment
1	3V3SB	2	GND
3	SMBus_Clock	4	SMBus_SDA
5	SMBus_Alert	6	N.C.

**CPU Fan**



The CPU Fan connector is used to connect the CPU fan.

■ **CPU Fan Pin Assignment**

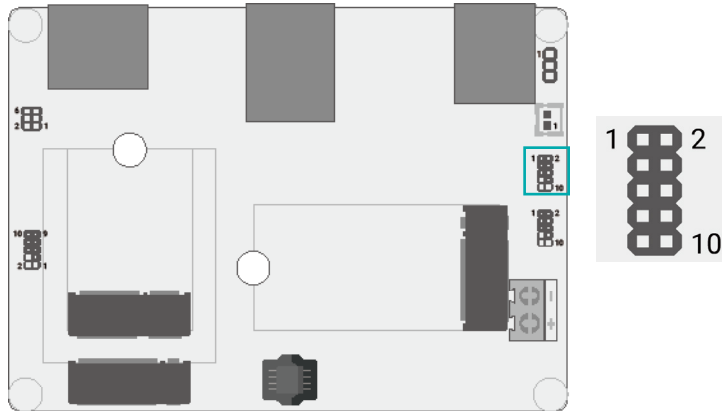
Pin	Assignment
1	Sense
2	Power
3	GND



► Internal I/O Connectors

USB Ports

■ USB 6/7 (USB 2.0)



The USB device allows data exchange between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

The internal USB pin headers may be connected to a card-edge bracket. Install the card-edge bracket to an available slot at the rear of the system chassis and then insert the USB port cables to a connector.

Wake-On-USB Keyboard/Mouse

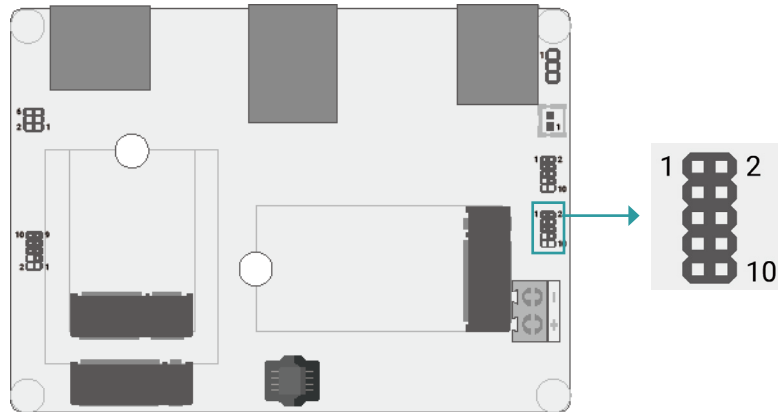
The Wake-On-USB Keyboard/Mouse function allows you to use a USB keyboard or USB mouse to wake up the system from the S state(s).

■ USB2.0 Pin Assignment

Pin	Assignment	Pin	Assignment
1	5V_USB6_7	2	5V_USB6_7
3	USB2_6_C_N	4	USB2_7_C_N
5	USB2_6_C_P	6	USB2_7_C_P
7	GND	8	GND
9	N.C.	10	N.C.

▶ Internal I/O Connectors

Digital I/O



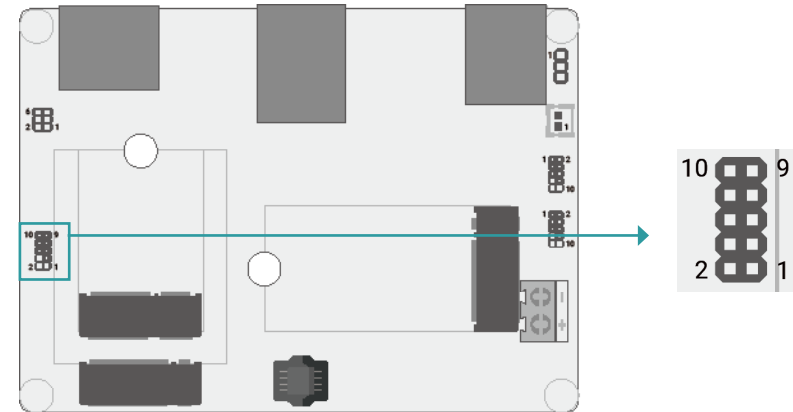
The Digital I/O (DIO) connector allows for input/output signals of digital logical states defined by voltage levels.

■ Digital I/O Pin Assignment

Pin	Assignment	Pin	Assignment
1	DIO_7	2	DIO_6
3	DIO_5	4	DIO_4
5	DIO_3	6	DIO_2
7	DIO_1	8	DIO_0
9	5V	10	GND

▶ Internal I/O Connectors

COM1



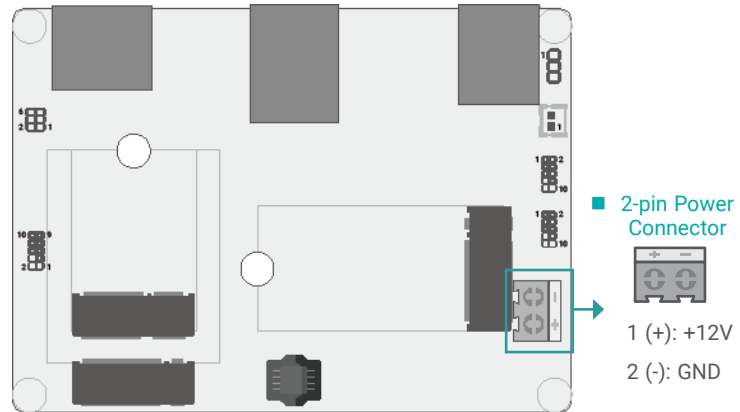
The Digital I/O (DIO) connector allows for input/output signals of digital logical states defined by voltage levels.

■ Digital I/O Pin Assignment

Pin	Assignment	Pin	Assignment
1	DIO_7	2	DIO_6
3	DIO_5	4	DIO_4
5	DIO_3	6	DIO_2
7	DIO_1	8	DIO_0
9	5V	10	GND

► Internal I/O Connectors

Power Connector



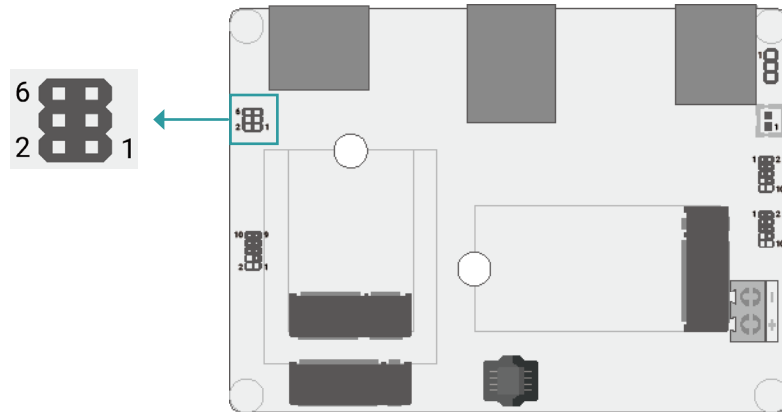
This 2-pin terminal block is considered a low power solution.

Connect a DC power cord to this terminal block by inserting the wire into the block and then screw tight the screw on top to secure the wire in place. Please make sure the positive and negative wires are installed correctly.

Using a voltage more than the recommended range may fail to boot the system or cause damage to the system board.

► Internal I/O Connectors

Front Panel



■ Front Panel Pin Assignment

Pin	Assignment	Pin	Assignment
1	PWSIN	2	3V3SB
3	GND	4	SUS_LED
5	RESET	6	HD_LED

■ Front Panel Pin Combination

	Pin	Name		Pin	Name
PWR-LED	2	3V3SB	PWR-SW	1	PWSIN
	4	SUS_LED		3	GND
HD-LED	2	3V3SB	RESET	3	GND
	6	HD_LED		5	RESET

**PWR-LED - Power/Standby LED**

When the system's power is on, this LED will light. When the system is in the S1 (POS - Power On Suspend) state, it will blink every second. When the system is in the S3 (STR - Suspend To RAM) state, it will blink every 4 seconds.

**HD-LED - Hard Drive LED**

This LED will light when the hard drive is being accessed.

**PWR-SW - Power Switch**

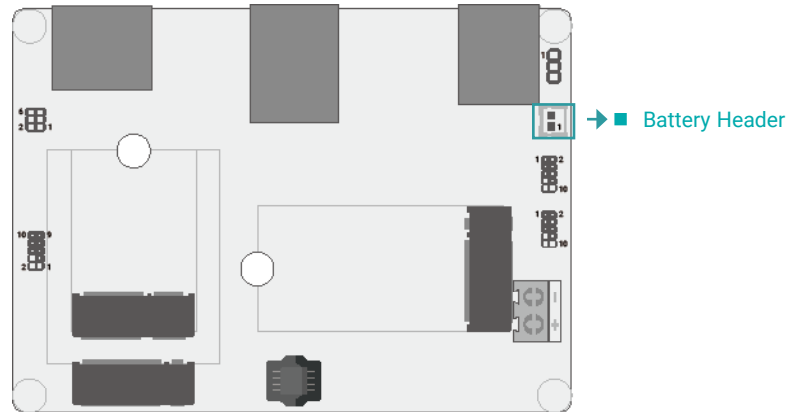
This switch is used to power on or off the system.

**RESET - Reset Switch**

This switch allows you to reboot without having to power off the system.

► Internal I/O Connectors

Battery Header



The lithium ion battery powers the real-time clock and CMOS memory. It is an auxiliary source of power when the main power is shut off.

A battery wrapped with an adhesive tape connects to the header, the tape helps position the battery at a proper place in the case.

**Safety Measures**

- Danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent type recommended by the manufacturer.
- Dispose of used batteries according to local ordinance.
- Higher temperature or harsh environment may limit the functionality of the tape wrapped on battery.

## Chapter 3 - BIOS Settings

### ► Overview

---

The BIOS is a program that takes care of the basic level of communication between the CPU and peripherals. It contains codes for various advanced features found in this system board.

The BIOS allows you to configure the system and save the configuration in a battery-backed CMOS so that the data retains even when the power is off. In general, the information stored in the CMOS RAM of the EEPROM will stay unchanged unless a configuration change has been made such as a hard drive replaced or a device added.

It is possible that the CMOS battery will fail causing CMOS data loss. If this happens, you need to install a new CMOS battery and reconfigure the BIOS settings.



#### Note:

The BIOS is constantly updated to improve the performance of the system board; therefore the BIOS screens in this chapter may not appear the same as the actual one. These screens are for reference purpose only.

#### Default Configuration

Most of the configuration settings are either predefined according to the Load Optimal Defaults settings which are stored in the BIOS or are automatically detected and configured without requiring any actions. There are a few settings that you may need to change depending on your system configuration.

#### Entering the BIOS Setup Utility

The BIOS Setup Utility can only be operated from the keyboard and all commands are keyboard commands. The commands are available at the right side of each setup screen.

The BIOS Setup Utility does not require an operating system to run. After you power up the system, the BIOS message appears on the screen and the memory count begins. After the memory test, the message "Press DEL to run setup" will appear on the screen. If the message disappears before you respond, restart the system or press the "Reset" button. You may also restart the system by pressing the <Ctrl> <Alt> and <Del> keys simultaneously.

#### Legends

Keys	Function
Right / Left arrow	Move the highlight left or right to select a menu
Up / Down arrow	Move the highlight up or down between submenus or fields
<Enter>	Enter the highlighted submenu
+ (plus key)/F6	Scroll forward through the values or options of the highlighted field
- (minus key)/F5	Scroll backward through the values or options of the highlighted field
<F1>	Display general help
<F2>	Display previous values
<F9>	Optimized defaults
<F10>	Save and Reset
<Esc>	Exit

#### Scroll Bar

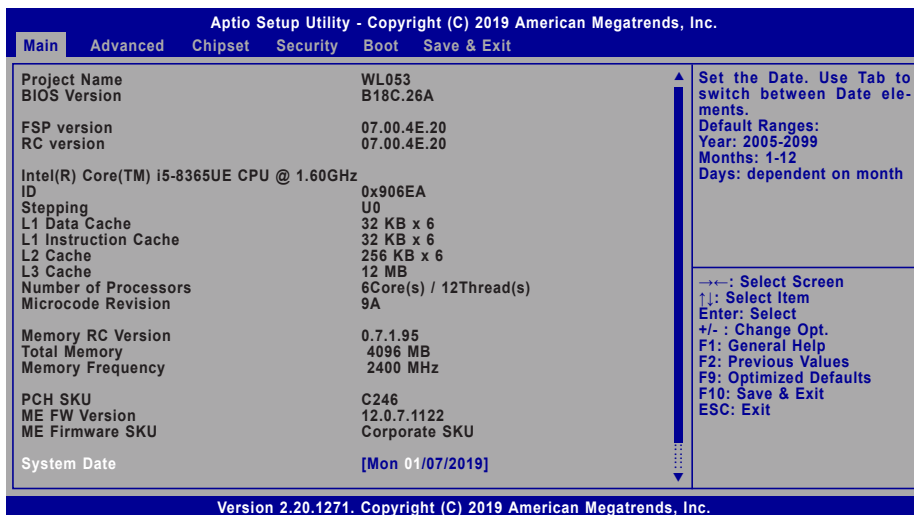
When a scroll bar appears to the right of the setup screen, it indicates that there are more available fields not shown on the screen. Use the up and down arrow keys to scroll through all the available fields.

#### Submenu

When "►" appears on the left of a particular field, it indicates that a submenu which contains additional options are available for that field. To display the submenu, move the highlight to that field and press <Enter>.

► Main

The Main menu is the first screen that you will see when you enter the BIOS Setup Utility.



**System Date**


The date format is <month>, <date>, <year>. Press "Tab" to switch to the next field and press "-" or "+" to modify the value.

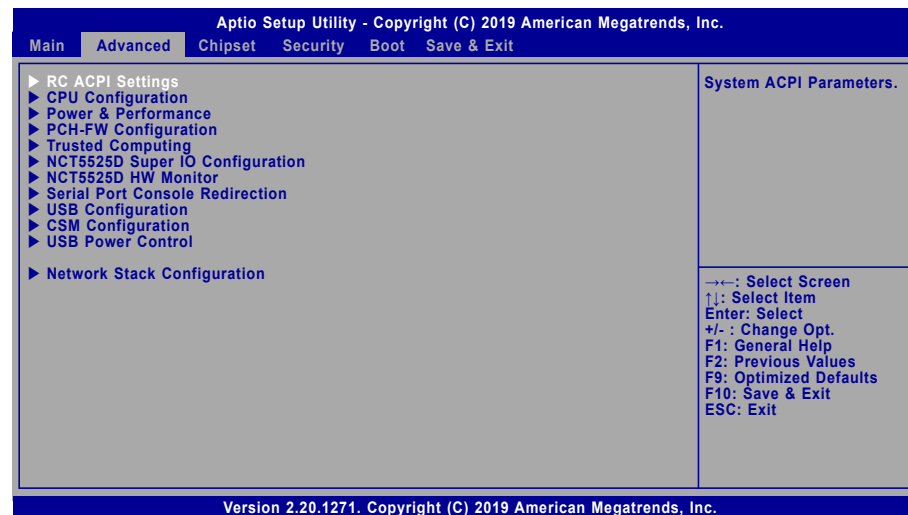
**System Time**

The time format is <hour>, <minute>, <second>. The time is based on the 24-hour military-time clock. For example, 1 p.m. is 13:00:00. Hour displays hours from 00 to 23. Minute displays minutes from 00 to 59. Second displays seconds from 00 to 59.

► Advanced

The Advanced menu allows you to configure your system for basic operation. Some entries are defaults required by the system board, while others, if enabled, will improve the performance of your system or let you set some features according to your preference.

 **Important:**  
Setting incorrect field values may cause the system to malfunction.



▶ Advanced

RC ACPI Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
RC ACPI Configuration		Enable or disable System wake on alarm event. When enabled, System will wake on the hr:min:sec specified
Wake system from S5	[Enabled]	
Wake up hour	0	→←: Select Screen ↑↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit
Wake up minute	0	
Wake up second	0	
State After G3	[S0 State]	
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.		

**Wake system from S5**

When Enabled, the system will automatically power up at a designated time every day. Once it's switched to [Enabled], please set up the time of day including hour, minute, and second for the system to wake up.

**State After G3**

To choose a re-applied state (S0,S5,Last State) after a power-failure (G3 State).

▶ Advanced

CPU Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
CPU Configuration		When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.
Intel (VMX) Virtualization Technology	[Enable]	
Active Processor Cores	[All]	→←: Select Screen ↑↓: Select Item Enter: Select +/-: Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit
Hyper-Threading	[Enable]	
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.		

**Intel (VMX) Virtualization Technology**

When this field is set to Enabled, the VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.

**Active Processor Cores**

Select number of cores to enable in each processor package.



**Note:**

Some of the fields may not be available when the features are not supported by the equipped CPU.



▶ Advanced

Power & Performance

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
<b>Power &amp; Performance</b>		Allows more than two frequency ranges to be supported.
Intel(R) SpeedStep(tm)	[Enabled]	
C states	[Enabled]	
<b>Configurable TDP Settings</b>		
Power Limit 1	15.0W (MSR:15.0)	
Power Limit 2	0	
Power Limit 1	29.0W (MSR:29.0)	
Power Limit 2	0	
		→←: Select Screen ↑↓: Select Item Enter: Select +/- : Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.		

**Intel(R) SpeedStep(tm)**

This field is used to enable or disable the Intel SpeedStep® Technology, which helps optimize the balance between system's power consumption and performance. After it is enabled in the BIOS, EIST features can then be enabled via the operating system's power management.

**C states**

Enable or disable CPU Power Management. It allows CPU to enter "C states" when it's idle and no process is running.

**Configurable TDP Settings**

Determine the power limits of PL1 and PL2 in milli-watts. BIOS will round to the nearest 1/8W when programming. 0=no custom override. For 12.50W, enter 12500.

**Overclocking SKU:**

Value must be between Max and Min power limits(specified by PACKAGE\_POWER\_SKU\_MSR).

**Other SKUs:**

This value must be between Min Power and TDP Limit.

For PL2, the processor applies control policies if package power does not exceed this limit.

▶ Advanced

PCH-FW Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.		
Advanced		
ME State	[Enabled]	When Disabled ME will be put into ME Temporarily Disabled Mode.
▶ Firmware Update Configuration		
		→←: Select Screen ↑↓: Select Item Enter: Select +/- : Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.		

**ME State**

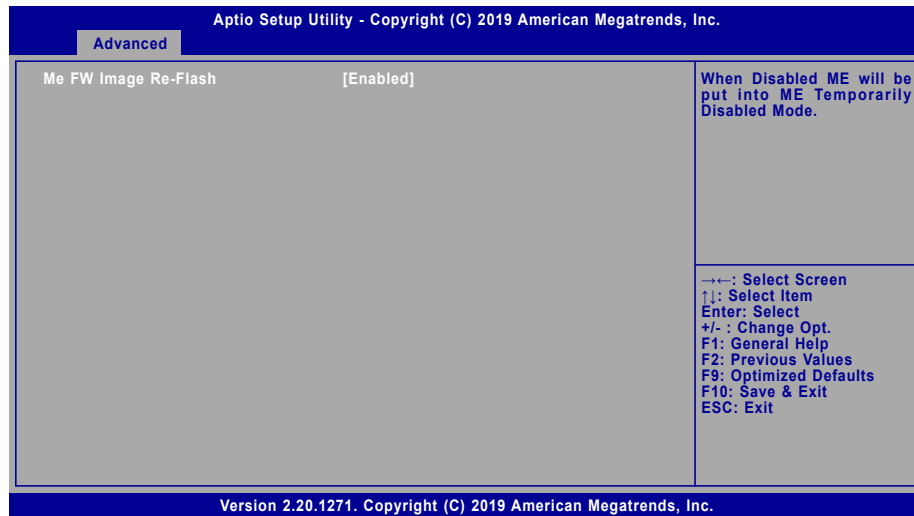
When this field is set to Disabled, ME will be put into ME Temporarily Disabled Mode.



**Note:**

The sub-menus are detailed in following sections.

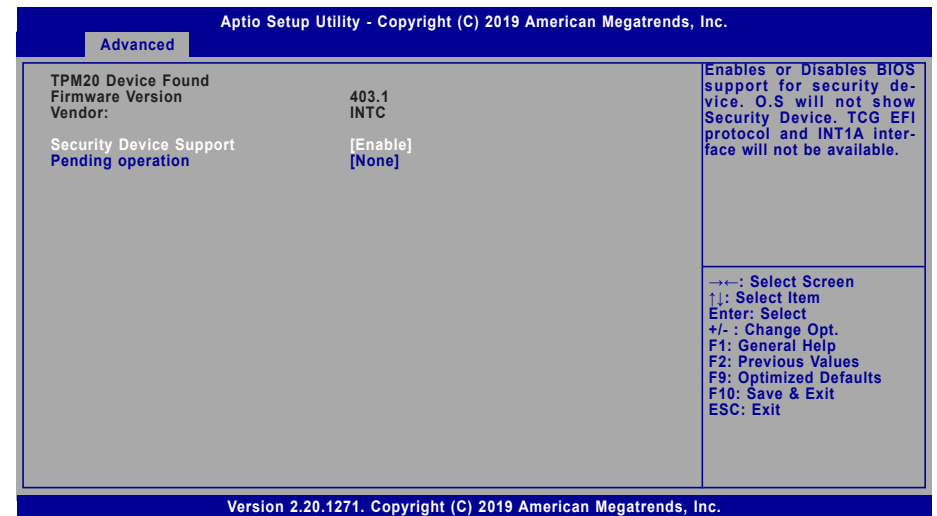
▶ Firmware Update Configuration



**Me FW Image Re-Flash**

This field is used to enable or disable the ME FW Image Re-Flash function, which allows the user to update the ME firmware.

Trusted Computing



**Security Device Support**

This field is used to enable or disable BIOS support for the security device such as TPM 2.0 to achieve hardware-level security via cryptographic keys.

**Pending operation**

Schedule an operation for the Security Device, the change of state needs a reboot.

▶ Advanced

NCT5525D Super IO Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.	
Advanced	
NCT5525D Super IO Configuration	
Super IO Chip	NCT5525D
WatchDog Timer Unit	[Second]
SuperIO WatchDog Timer	0
▶ Serial Port 1 Configuration	
→←: Select Screen ↑↓: Select Item Enter: Select +/- : Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit	
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.	

**WatchDog Timer Unit**

Select WatchDog Timer Unit – Second or Minute.

**SuperIO WatchDog Timer**

Set SuperIO WatchDog Timer Timeout value. The range is from 0 (disabled) to 255.



**Note:**

The sub-menus are detailed in following sections.

▶ Advanced ▶ NCT5525D Super IO Configuration

▶ Serial Port Configuration

Aptio Setup Utility - Copyright (C) 2019 American Megatrends, Inc.	
Advanced	
Serial Port 1 Configuration	
Serial Port	[Enabled]
Device Settings	IO=3F8h; IRQ=4;
Electrical Interface Mode	[RS232]
→←: Select Screen ↑↓: Select Item Enter: Select +/- : Change Opt. F1: General Help F2: Previous Values F9: Optimized Defaults F10: Save & Exit ESC: Exit	
Version 2.20.1271. Copyright (C) 2019 American Megatrends, Inc.	

**Serial Port**

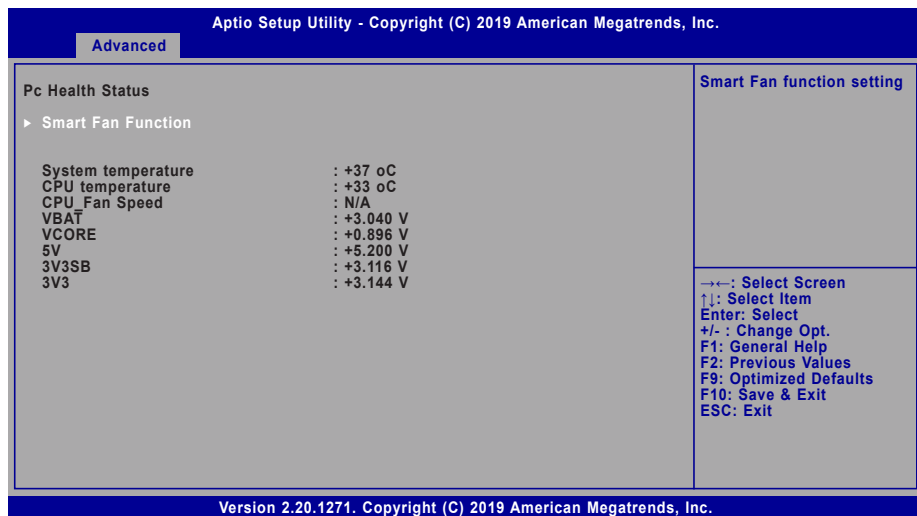
Enable or disable the current serial COM port.

**Electrical Interface Mode**

Choose mode between RS232 / RS485 / RS422

▶ Advanced

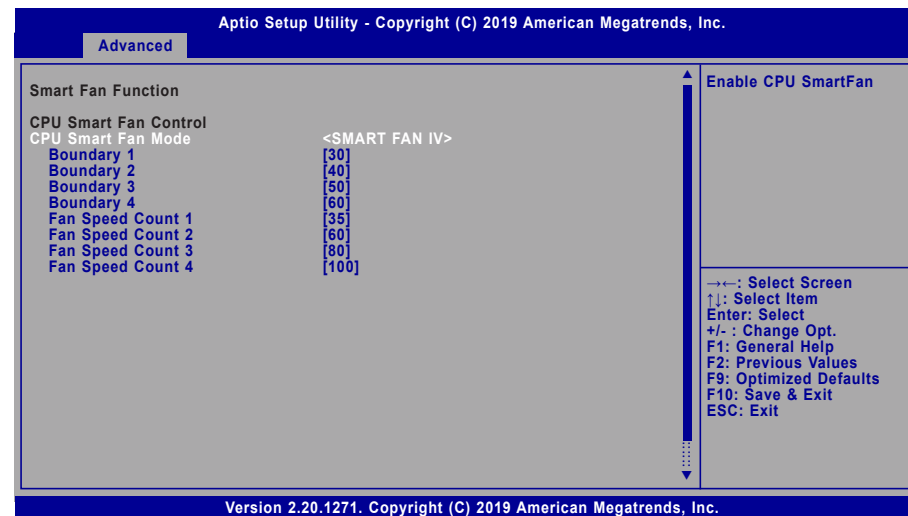
NCT5525D HW Monitor



This section displays the system's health information, i.e. voltage readings, CPU and system temperatures.

▶ Advanced ▶ NCT5525D HW Monitor

▶ Smart Fan Function



Smart Fan is a fan speed moderation strategy dependent on the current system temperature. When the system temperature goes higher than the Boundary setting, the fan speed will be turned up to the setting of the Fan Speed Count that bears the same index as the Boundary field.

▼ CPU Smart Fan Mode = [SMART FAN IV]

Boundary 1 to Boundary 4

Set the boundary temperatures that determine the fan speeds accordingly, the value ranging from 0-127°C. For example, when the system temperature reaches Boundary 1 setting, the fan speed will be turned up to the designated speed of the Fan Speed Count 1 field.

Fan Speed Count 1 to Fan Speed Count 4

Set the fan speed, the value ranging from 1-100%, 100% being full speed. The fans will operate according to the specified boundary temperatures above-mentioned.

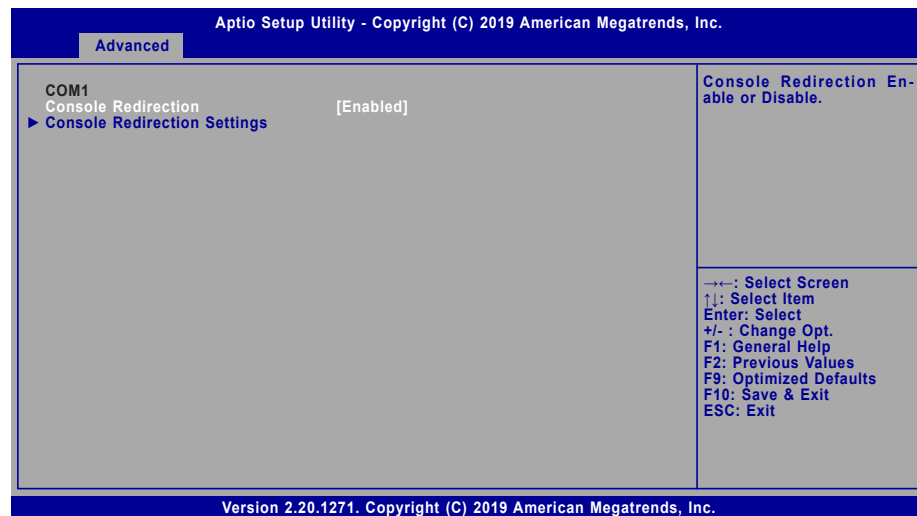
▼ CPU Smart Fan Control = [Manual]

Fix Fan Speed Count

Set the fan speed, the value ranging from 1-100%, 100% being full speed. The fans will always operate at the specified speed regardless of gauged temperatures.

▶ Advanced

Serial Port Console Redirection

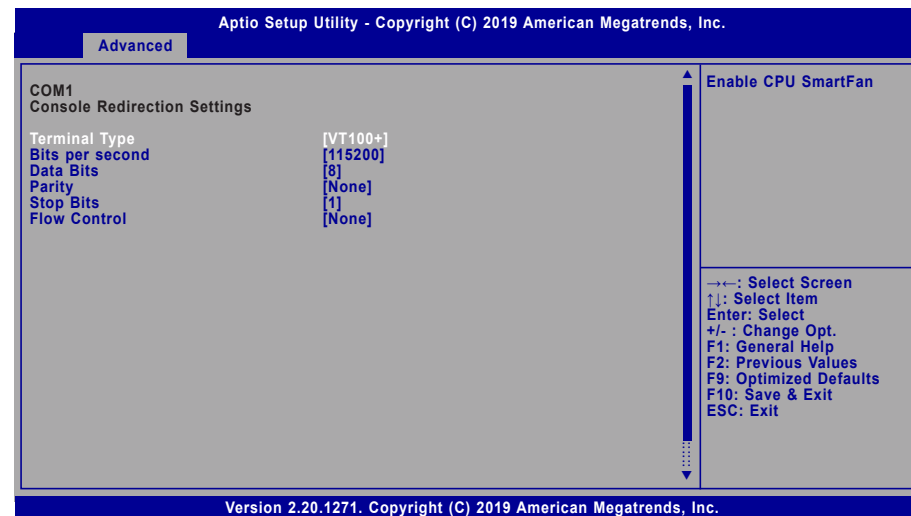


**Console Redirection**

By enabling Console Redirection of a COM port, the sub-menu of console redirection settings will become available for configuration as detailed in the following.

▶ Advanced ▶ Serial Port Console Redirection

▶ Console Redirection Settings



Configure the serial settings of the current COM port.

**Terminal Type**

Select terminal type: VT100, VT100+, VT-UTF8 or ANSI.

**Bits per second**

Select serial port transmission speed: 9600, 19200, 38400, 57600 or 115200.

**Data Bits**

Select data bits: 7 bits or 8 bits.

**Parity**

Select parity bits: None, Even, Odd, Mark or Space.

**Stop Bits**

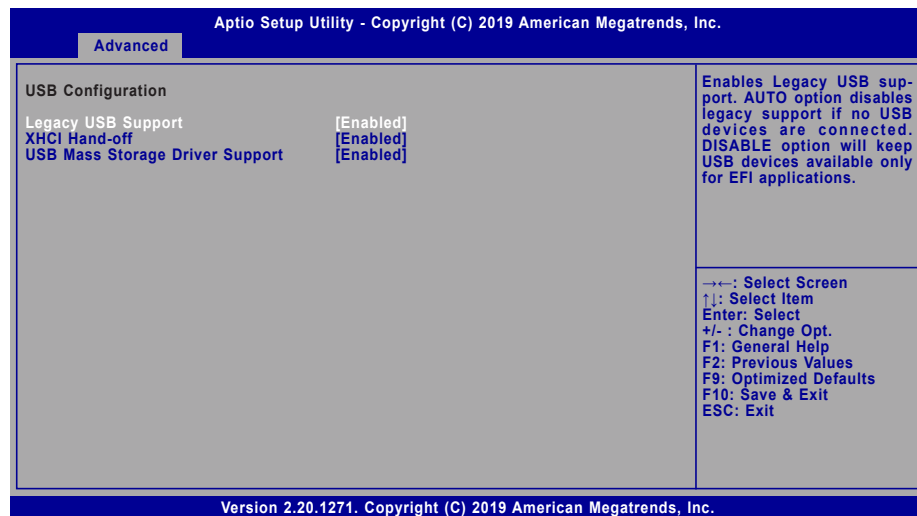
Select stop bits: 1 bit or 2 bits.

**Flow Control**

Select flow control type: None or Hardware RTS/CTS.

► Advanced

### USB Configuration



#### Legacy USB Support

- Enabled** Enable Legacy USB support.
- Disabled** Keep USB devices available only for EFI applications.
- Auto** Disable Legacy support if no USB devices are connected.

#### XHCI Hand-off

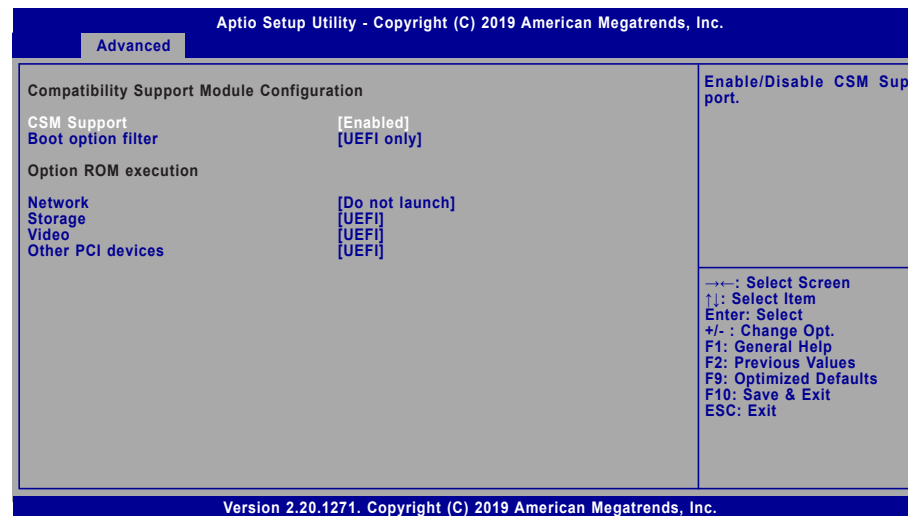
Enable or disable XHCI Hand-off.

#### USB Mass Storage Driver Support

Enable or disable USB Mass Storage Driver Support.

► Advanced

### CSM Configuration



#### CSM Support

This section is used to enable or disable CSM Support. The following fields are only available when "CSM Support" is enabled.

#### Boot option filter

This field controls Legacy/UEFI ROMs priority.

#### Network

This field controls the execution of UEFI and Legacy Network OpROM.

#### Storage

This field controls the execution of UEFI and Legacy Storage OpROM.

#### Video

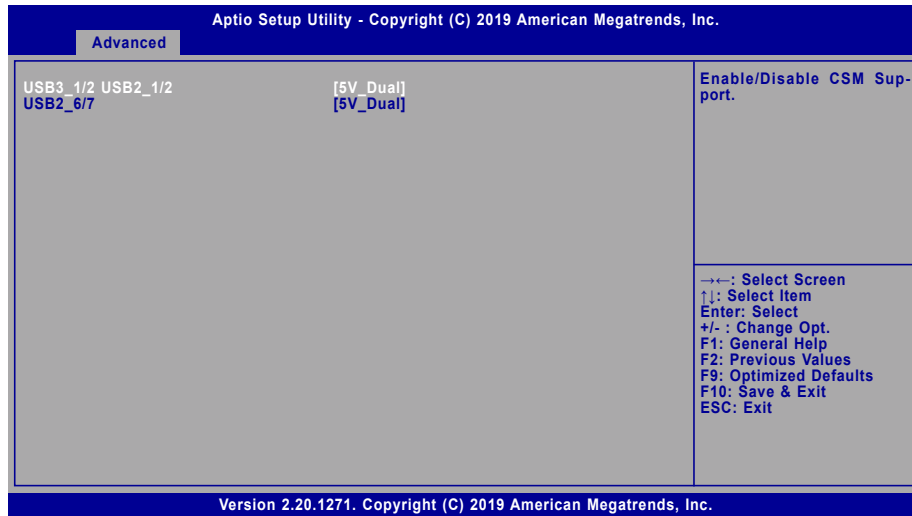
This field controls the execution of UEFI and Legacy Video OpROM.

#### Other PCI devices

This field determines OpROM execution policy for devices other than Network, Storage or Video.

▶ Advanced

USB Power Control

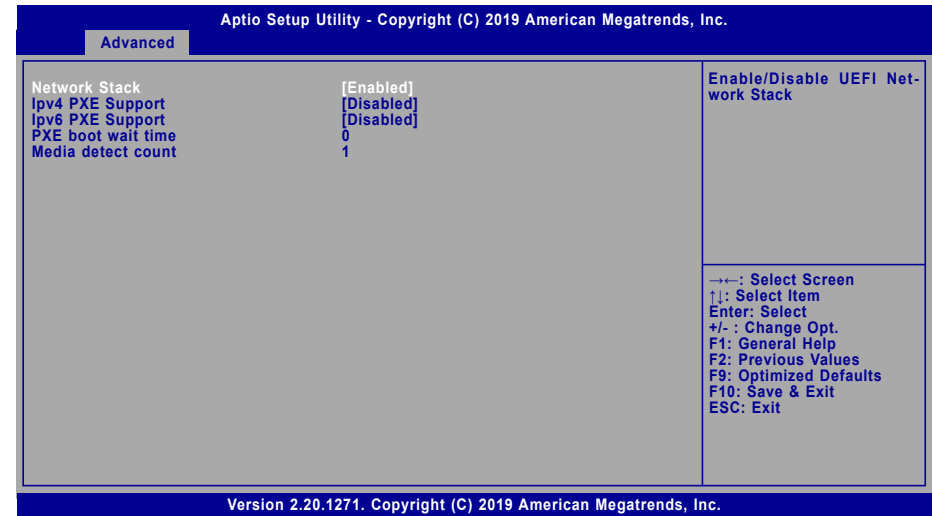


**5V / 5V\_DUAL**

5V Dual supports wake up from S3/S4 state by USB keyboard or mouse while 5V does not.

▶ Advanced

Network Stack Configuration



**Network Stack**

Enable or disable UEFI network stack. The following fields will appear when this field is enabled.

**Ipv4 PXE Support**

Enable or disable IPv4 PXE boot support. If disabled, IPv4 PXE boot support will not be available.

**Ipv6 PXE Support**

Enable or disable IPv6 PXE boot support. If disabled, IPv6 PXE boot support will not be available.

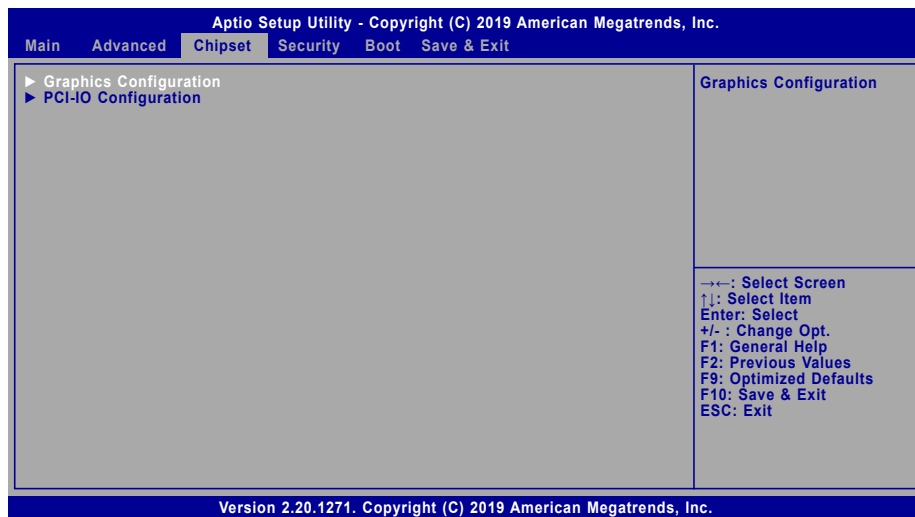
**PXE boot wait time**

Set the 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**

Set the number of times the presence of media will be checked. Use either +/- or numeric keys to set the value.

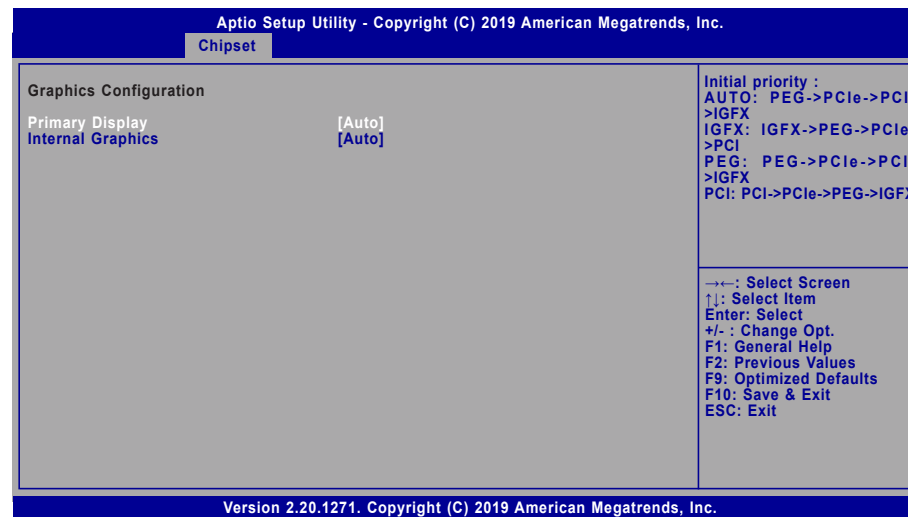
► Chipset



To configure graphics and PCH-IO relevant settings.

► Chipset

Graphics Configuration



**Primary Display**

Select which of AUTO/IGFX/PCI Graphics device to be the primary display.

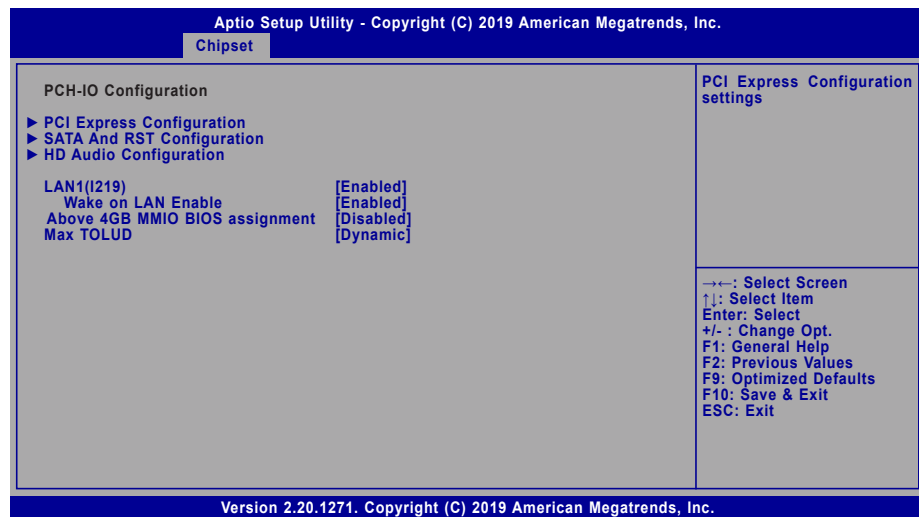
**Internal Graphics**

Keep Auto enabled based on the setup options.



► Chipset

PCH-IO Configuration



**LAN1(I219)**

Enable or disable onboard LAN.

**Wake on LAN Enable**

Enable or disable the wake on lan function.

**Above 4GB MMIO BIOS assignment**

Enable or disable MemoryMappedIO BIOS assignment above 4GB.

This option is enabled by default if Aperture Size is set to 2048MB.

**Max TOLUD**

Adjust the maximum value of TOLUD or set it to Dynamic to vary based on largest MMIO length of installed graphic controller.

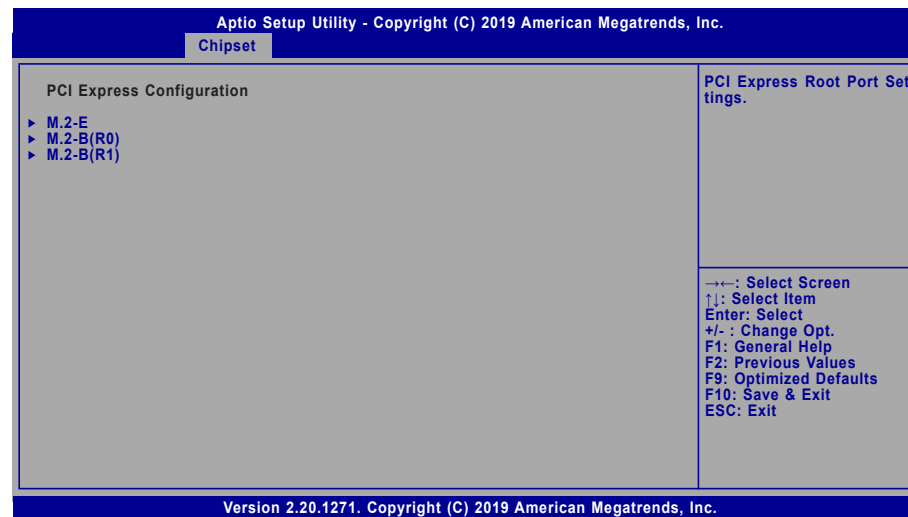


**Note:**

The sub-menus are detailed in following sections.

► Chipset ► PCH-IO Configuration

PCI Express Configuration



Select one of the PCI Express channels and press enter to configure the following settings.

**PCI Express Devices**

Enable or disable the PCI Express Root Port.

**PCIe Speed**

Select PCIe Speed of the current port – AUTO, Gen1, Gen 2, or Gen3. Gen 3 is only available for the PCIe1 port. This field may not appear when the speed of the port is not configurable.

**Hot Plug**

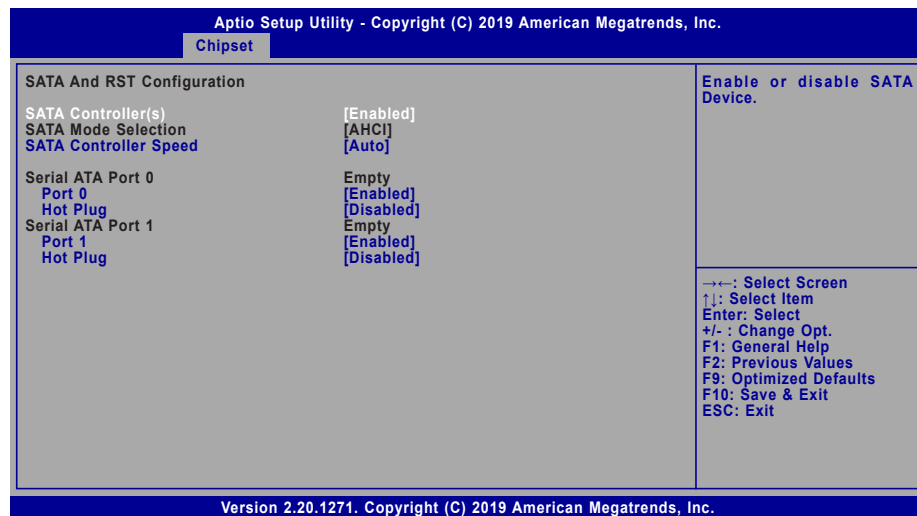
Enable or disable hot plug function of the port. This field may not appear when the port does not support hot plug.

**Detect Non-Compliance Device**

Enable to detect non-Compliance PCI Express Device by consuming more POST time.

► Advanced

SATA And RST Configuration



**SATA Controller(s)**

This field is used to enable or disable the Serial ATA controller.

**SATA Speed**

This field is used to select SATA speed generation limit: Auto, Gen1, Gen2 or Gen3.

**SATA Mode Selection**

The mode selection determines how the SATA controller(s) operates.

**AHCI** This option allows the Serial ATA controller(s) to use AHCI (Advanced Host Controller Interface).

**Intel RST Premium With Intel Optane System Acceleration** This option allows you to create RAID or Intel Rapid Storage configuration along with Intel® Optane™ system acceleration on Serial ATA devices.

**Use RST Legacy OROM**

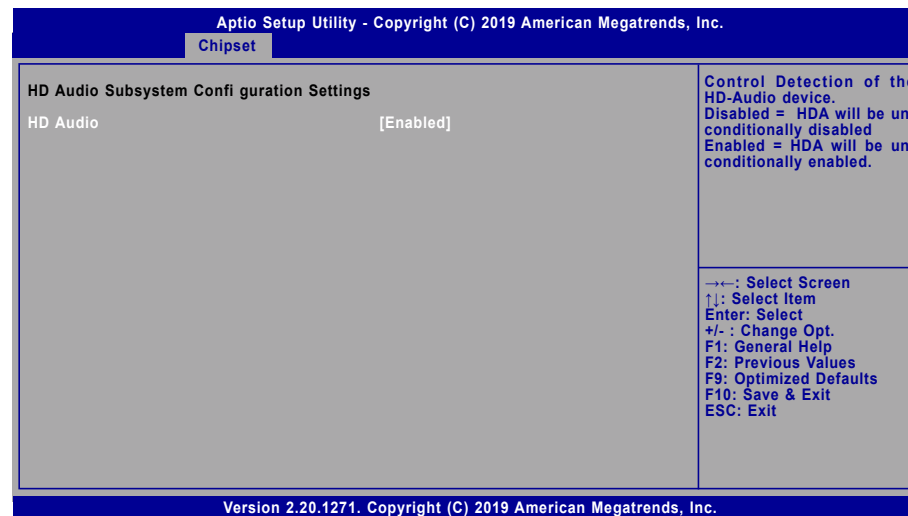
This field shows up when SATA Mode Selection is set to Intel RST Premium With Intel Optane System Acceleration.

**Port and Hot Plug**

Enable or disable the Serial ATA port and its hot plug function.

► Chipset ► PCH-IO Configuration

HD Audio Configuration



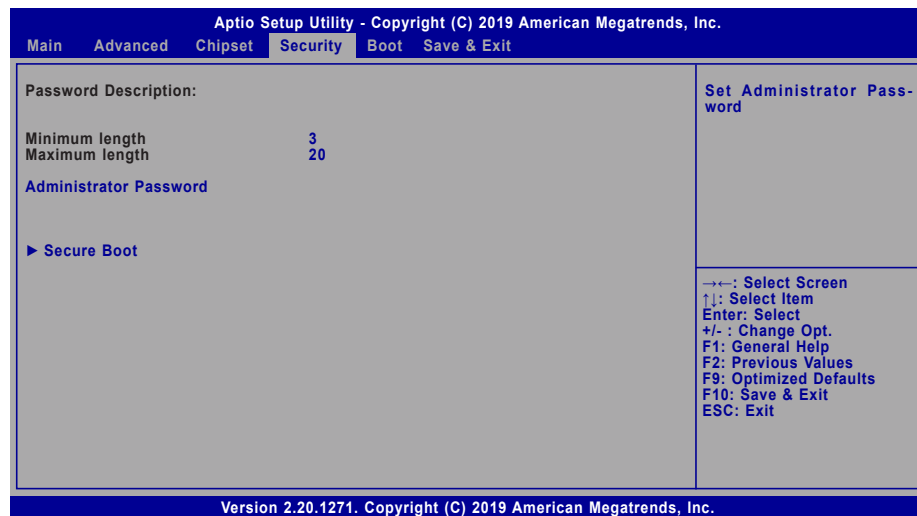
**HD Audio**

Control the detection of the HD Audio device.

**Disabled** HDA will be unconditionally disabled.

**Enabled** HDA will be unconditionally enabled.

► Security

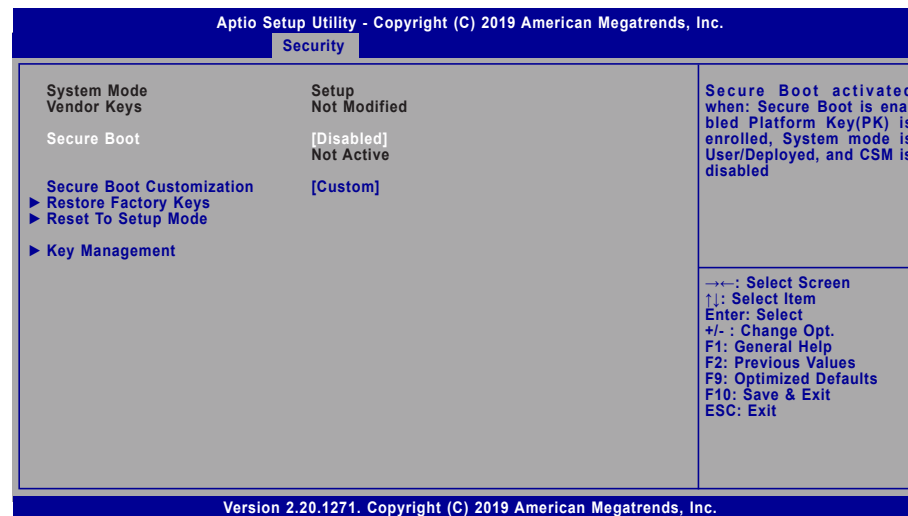


**Administrator Password**

Set the administrator password. To clear the password, input nothing and press enter when a new password is asked. Administrator Password will be required when entering the BIOS.

► Security

Secure Boot



**Secure Boot**

The Secure Boot store a database of certificates in the firmware and only allows the OSe with authorized signatures to boot on the system. To activate Secure Boot, please make sure that "Secure Boot" is "[Enabled]", Platform Key (PK) is enrolled, "System Mode" is "User", and CSM is disabled. After enabling/disabling Secure Boot, please save the configuration and restart the system. When configured and activated correctly, the Secure Boot status will be "Active".

**Secure Boot Customization**

Select the secure boot mode – Standard or Custom. When set to Custom, the following fields will be configurable for the user to manually modify the key database.

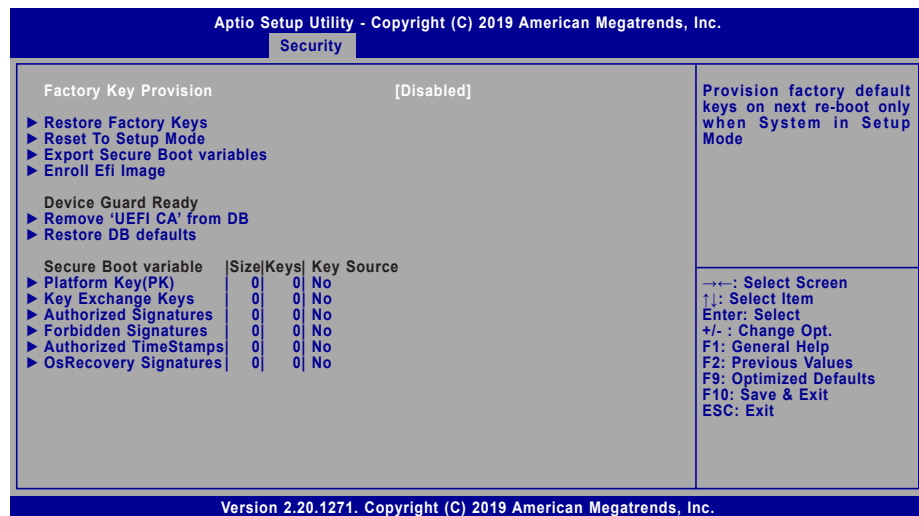
**Restore Factory Keys**

Force system to User Mode. Load OEM-defined factory defaults of keys and databases onto the Secure Boot. Press Enter and a prompt will show up for you to confirm.

**Reset To Setup Mode**

Clear the database from the NVRAM, including all the keys and signatures installed in the Key Management menu. Press Enter and a prompt will show up for you to confirm.

► Key Management



**Factory Key Provision**

Enable or disable the provision factory default keys on next re-start. This will only take place when the “System Mode” in the previous menu is in “Setup”, which can be achieved by moving the cursor to the “Reset To Setup Mode” and press Enter.

**Restore Factory Keys**

Force system to User Mode. Configure NVRAM to contain OEM-defined factory default Secure Boot keys.

**Reset To Setup Mode**

Clear the database from the NVRAM, including all the keys and signatures installed in the Key Management menu. Press Enter and a prompt will show up for you to confirm.

**Export Secure Boot variables**

Export the Secure Boot settings (i.e. all keys and signatures) as files to the root directory of a file system device. Press Enter and select a storage device listed in the pop-up menu. The saved files will be named automatically according to the type of key/signature as listed below.

- “PK” for Platform Keys
- “KEK” for Key Exchange Keys
- “db” for Authorized Signatures
- “dbx” for Forbidden Signatures

**Enroll Efi Image**

Allow the image to run in Secure Boot mode. Enroll SHA256 Hash certificate of a PE image into Authorized Signature Database (db). Press Enter and select a storage device listed in the pop-up menu, select a directory, and then select the EFI Image document.

**Remove ‘UEFI CA’ from DB**

Remove Microsoft UEFI CA from the Authorized Signature database. For systems that support Device Guard, Microsoft UEFI CA must NOT be included in the Authorized Signature database.

**Restore DB defaults**

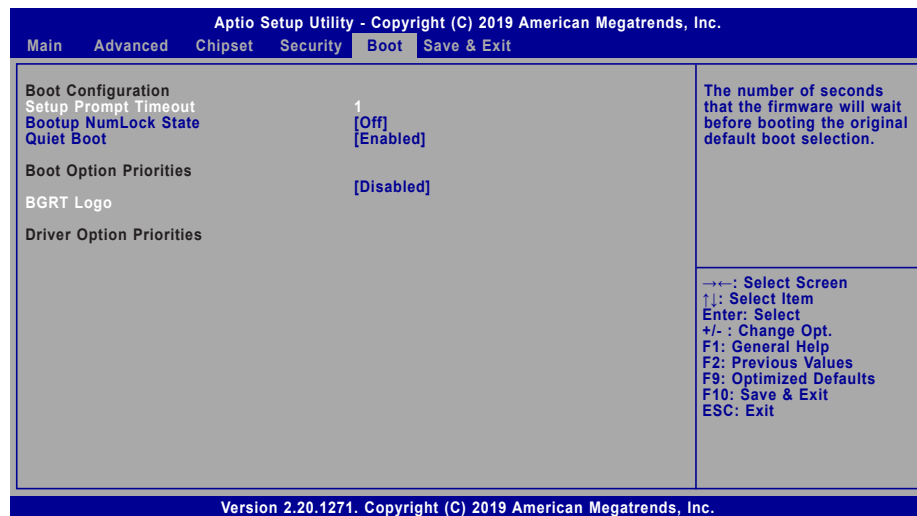
Press Enter to restore the database variable to factory defaults.

Manually configure the following keys and signatures. Move the cursor to the field and press Enter, and then a pop-up menu will show up.

**Platform Key(PK), Key Exchange Keys, Authorized Signatures, Forbidden Signatures, Authorized TimeStamps, OsRecovery Signatures**

<b>Details</b>	List the information of enrolled keys and signatures
<b>Export</b>	Save the key or signature as a file to the root directory of a file system. The saved files will be named automatically according to the type of key/signature as previously listed in the “Export Secure Boot Variables”.
<b>Update</b>	Load factory default database
<b>Append</b>	Enroll keys and signatures from a file system
<b>Delete</b>	Delete keys and signatures

► **Boot**



**Setup Prompt Timeout**

Set the number of seconds to wait for the setup activation key. 65535 (0xFFFF) denotes indefinite waiting.

**Bootup NumLock State**

Select the keyboard NumLock state: On or Off.

**Quiet Boot**

This section is used to enable or disable quiet boot option.

**Boot Option Priorities**

Rearrange the system boot order of available boot devices.

**BGRT Logo**

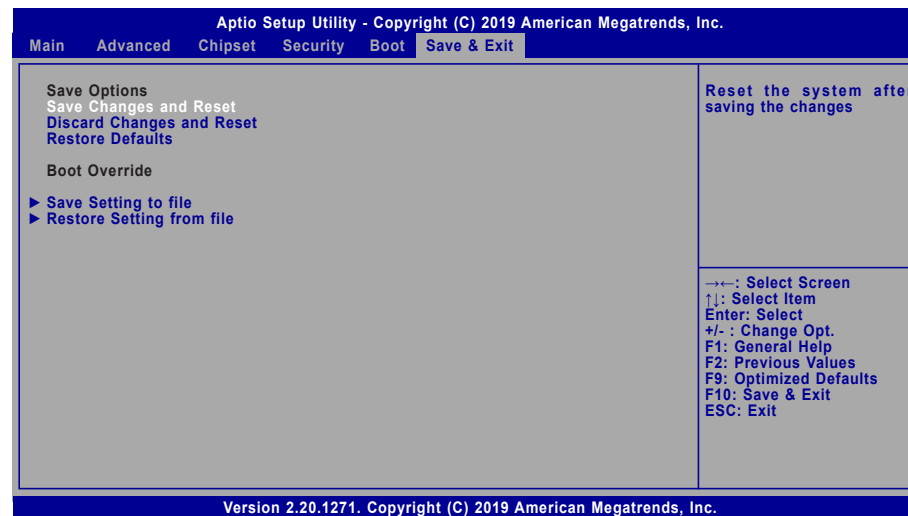
It is used to enable or disable to support display logo with ACPI BGRT table.



**Note:**

If “Boot option filter” of “CSM Configuration” is set to “UEFI and Legacy” or “UEFI only” and “Quiet Boot” is set to enabled, “BGRT Logo” will show up for configuration. Refer to the Advanced > CSM Configuration for more information.

► **Save & Exit**



**Save Changes and Reset**

To save the changes, select this field and then press <Enter>. A dialog box will appear. Select Yes to reset the system after saving all changes made.

**Discard Changes and Reset**

To discard the changes, select this field and then press <Enter>. A dialog box will appear. Select Yes to reset the system setup without saving any changes.

**Restore Defaults**

To restore and load the optimized default values, select this field and then press <Enter>. A dialog box will appear. Select Yes to restore the default values of all the setup options.

**Boot Override**

Move the cursor to an available boot device and press Enter, and then the system will immediately boot from the selected boot device. The Boot Override function will only be effective for the current boot. The “Boot Option Priorities” configured in the Boot menu will not be changed.

► **Save Setting to file**

Select this option to save BIOS configuration settings to a USB flash device.

► **Restore Setting from file**

This field will appear only when a USB flash device is detected. Select this field to restore setting from the USB flash device.

## ► Updating the BIOS

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To update the BIOS, you will need the new BIOS file and a flash utility. Please contact technical support or your sales representative for the files and specific instructions about how to update BIOS with the flash utility. For updating AMI BIOS in UEFI mode, you may refer to the how-to video at <https://www.dfi.com/Knowledge/Video/5>.

## ► Notice: BIOS SPI ROM

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1. The Intel® Management Engine has already been integrated into this system board. Due to the safety concerns, the BIOS (SPI ROM) chip cannot be removed from this system board and used on another system board of the same model.
2. The BIOS (SPI ROM) on this system board must be the original equipment from the factory and cannot be used to replace one which has been utilized on other system boards.
3. If you do not follow the methods above, the Intel® Management Engine will not be updated and will cease to be effective.



**Note:**

- a. You can take advantage of flash tools to update the default configuration of the BIOS (SPI ROM) to the latest version anytime.
- b. When the BIOS IC needs to be replaced, you have to populate it properly onto the system board after the EEPROM programmer has been burned and follow the technical person's instructions to confirm that the MAC address should be burned or not.