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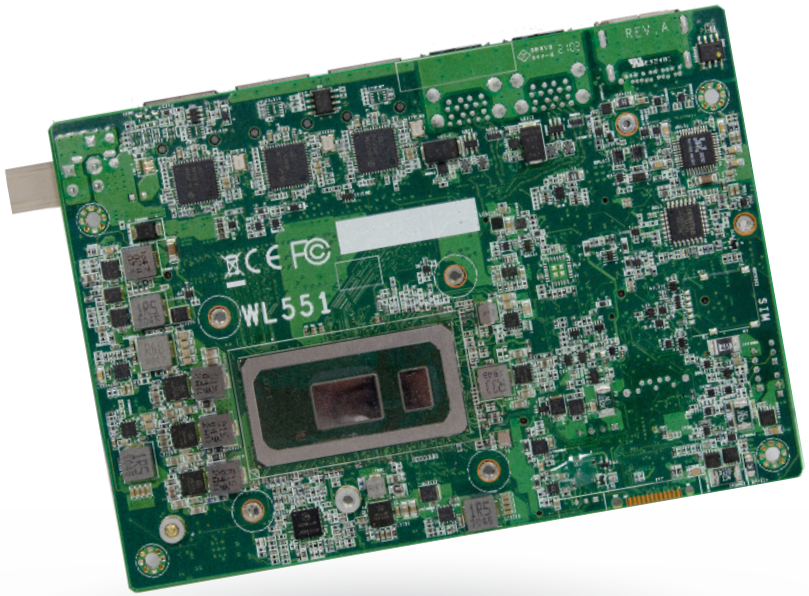

WL551

3.5" SBC Motherboard
User's Manual

ver.A_-_6-1021_16-11

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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 WL551 board
- 1 SATA cable (Length: 300mm) 332-553001-205G
- 1 SATA power cable (Length: 250mm) A81-004041-016G
- 1 COM cable (Length: 250mm) 332-753040-000G
- 1 Heatsink -5~65°C/ -20 to 80°C (Height: 35.5mm) A71-008152-000G

Note: The combination is subject to change at mass production.

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.

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

WL551

SYSTEM	Processor	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
	Memory	One 260-pin SODIMM up to 32GB Single Channel DDR4 up to 2400MHz
	BIOS	AMI SPI 128Mbit
GRAPHICS	Controller	Intel® UHD Graphics 620/ Intel® UHD Graphics 610 (for Celeron 4305UE)
	Feature	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
	Display	1 x DP++/HDMI 1 x LVDS or 1 x eDP (opt.) DP++: resolution up to 4096*2160@60Hz HDMI1.4: resolution up to 3840*2160@30Hz LVDS: resolution up to 1920x1200 @60Hz eDP: resolution up to 3840x2160 @ 60Hz
	Dual Displays	1x COMBO port (DP++/HDMI) + 1 x LVDS 1x COMBO port (DP++/HDMI) + 1 x eDP (opt.)
EXPANSION	Interface	1 x M.2 M key 2280/2242 (PCIe x4/SATA 3.0) 1 x M.2 B key 3042/2242 (USB 3.1 Gen2/USB 2.0/SATA 3.0 or PCIe x1) Support Nano SIM slot (opt.) 1 x M.2 E key 2230 (PCIe x2/USB 2.0) Support Innodisk InnoAGE™ SSD
AUDIO	Audio Codec	Realtek ALC888S-VD2-GR
ETHERNET	Controller	3 x Intel® I211AT PCIe (10/100/1000Mbps) or 3 x Intel® I210IT PCIe (10/100/1000Mbps)
REAR I/O	Ethernet	3 x GbE (RJ-45)
	USB	4 x USB 3.1 Gen 2
	Display	1 x COMBO port (DP++/HDMI)
INTERNAL I/O	Serial	1 x RS-232/422/485 (2.00mm pitch) RS485 support auto flow control
	USB	2 x USB 2.0 (2.00mm pitch)
	Display	1 x LVDS LCD Panel connector or 1 x eDP LCD panel connector 1 x LCD/Intverter Power
	Audio	1 x Audio (Line-out/Mic-in)
	SATA	1 x SATA 3.0 (up to 6Gb/s) 1 x SATA Power
	DIO	1 x 8-bit DIO
	SMBus	1 x SMBus
WATCHDOG TIMER	Output & Interval	System Reset, Programmable via Software from 1 to 255 sec/min
SECURITY	TPM	fTPM2.0 (default) dTPM2.0 (opt.)
POWER	Type	Single 12V +/-10% DC
	Connector	4-pin Right Angle Type Connector (default) DC Jack (available upon request) 4-pin Vertical Type Connector (available upon request)
	RTC Battery	CR2032 Coin Cell
	Consumption	Typical: 8665UE, 12V @ 0.64A (7.68W) Max: 8665UE, 12V @ 2.5A (30W)
OS SUPPORT (UEFI Only)		Windows 10 IoT Enterprise 64-bit Linux
ENVIRONMENT	Temperature	Operating: -5 to 65°C, -20 to 80°C Storage: -40 to 85°C
	Humidity	Operating: 5 to 90% RH Storage: 5 to 90% RH
	MTBF	495,295 hrs @ 25°C; 326,059 hrs @ 45°C; 223,300 hrs @ 60°C; 128,660 hrs @ 80°C
MECHANICAL	Dimensions	3.5" SBC Form Factor 146mm (5.75") x 102mm (4.02")
	Height	PCB: 1.6mm Top Side: 15mm Bottom Side: 4mm
CERTIFICATIONS		CE, FCC, RoHS

▶ Features

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

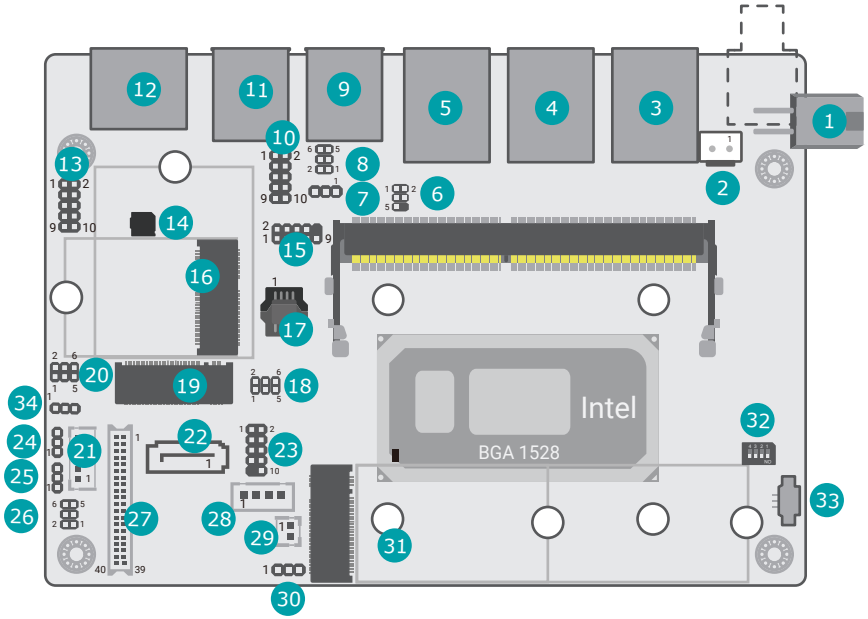
The system board supports the new USB 3.1 Gen 2. It is capable of running at a maximum transmission speed of up to 10 Gbit/s (1.2 GB/s) and is faster than USB 3.1 Gen 1 (5 Gbit/s, or 625 MB/s), USB 2.0 (480 Mbit/s, or 60 MB/s) and USB 1.1 (12Mb/s). USB 3.1 reduces the time required for data transmission, 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



1. 12V DC-In
2. Heater
3. LAN 1
4. LAN 2
5. LAN 3
6. SMBus
7. DIO POWER Select
8. DIO PU/PD Select
9. USB 1/2
10. DIO
11. USB 3/4
12. DP++/HDMI
13. Front Audio
14. Buzzer
15. COM1
16. M.2 E Key 2230
17. SPI Flash BIOS
18. InnoAGE HDR1
19. M.2 B Key 3042/2242
20. Front Panel
21. LVDS Backlight
22. SATA
23. USB 7/8 (USB 2.0)
24. Backlight Switch & Voltage
25. Inverter Power Select
26. Panel Power Select
27. LVDS
28. SATA Power
29. Battery
30. Clear CMOS
31. M.2 M Key 2242/2280
32. DIP switch
33. CPU Fan
34. Power On Select

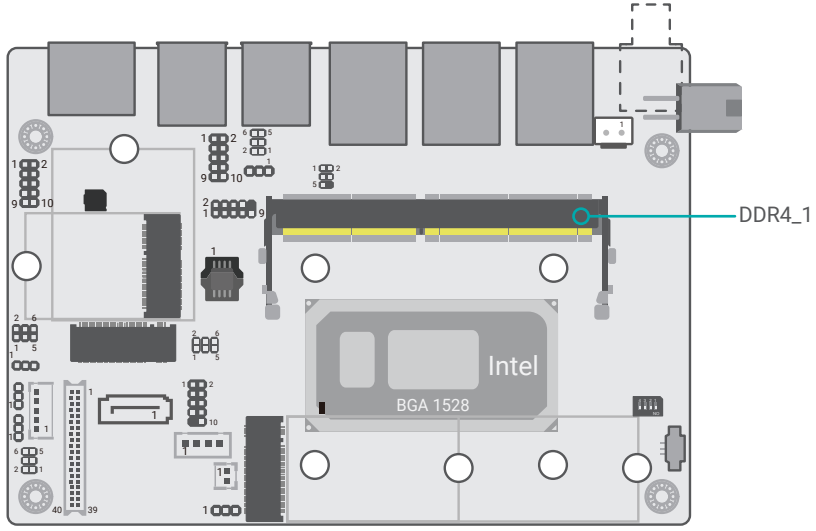
Note:

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

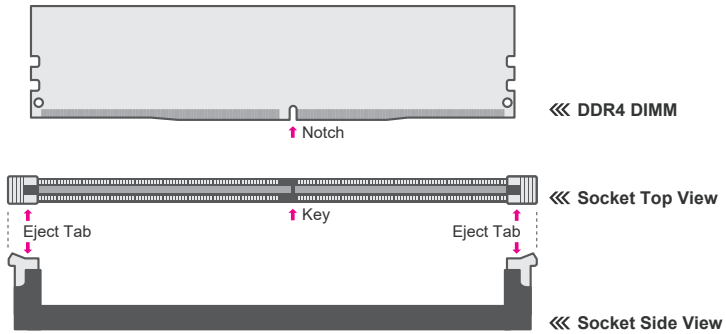


The system board supports the following memory interface.

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.



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

Step 1:

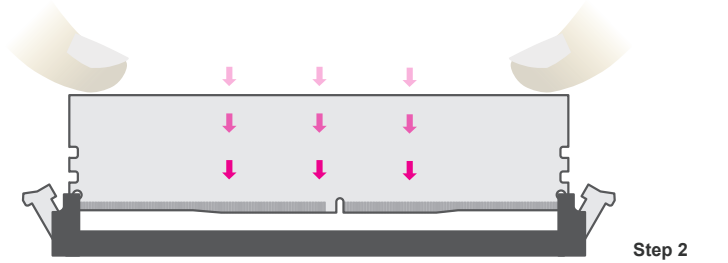
Press the eject tabs at both ends of the socket outward and downward to release them from the locked position.

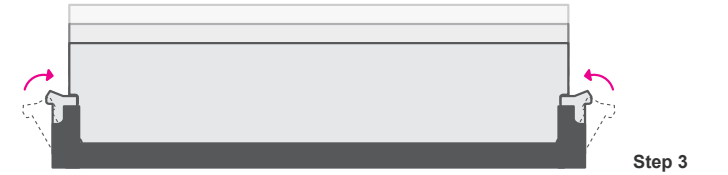
Step 2:

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.





Removing the Memory Module

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

Step 1:

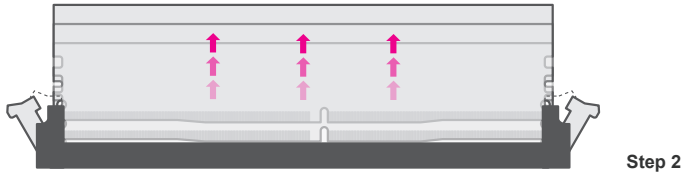
Press the eject tabs at both ends of the socket outward and downward to release them from the locked position.

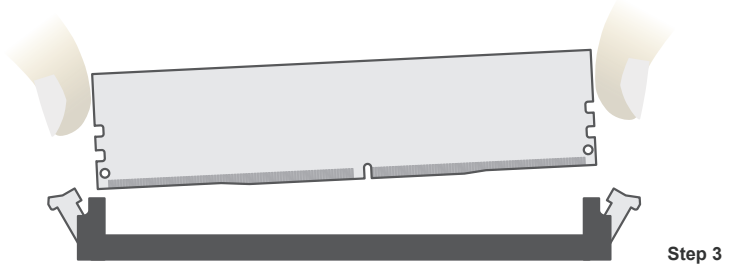
Step 2:

The memory card ejects from the slot automatically.

Step 3:

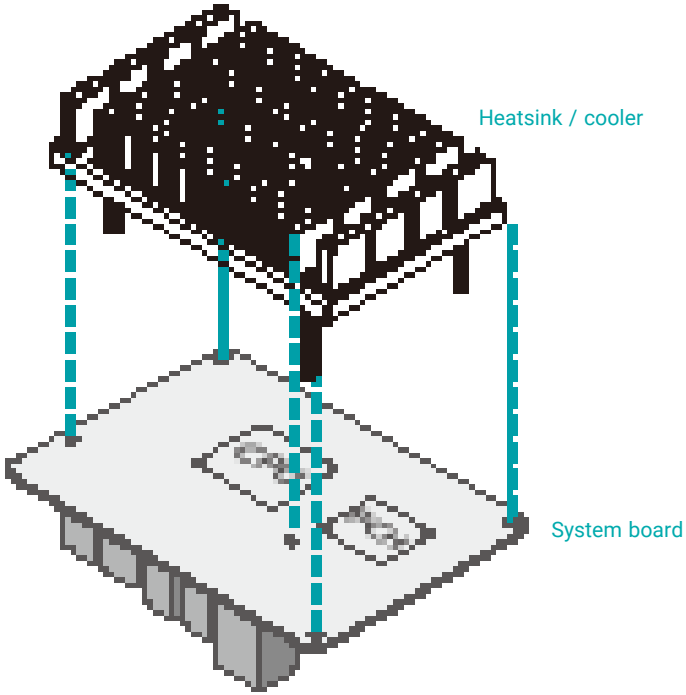
Hold the card by its edges and remove it from the slot.





Installing the Heatsink or Fan

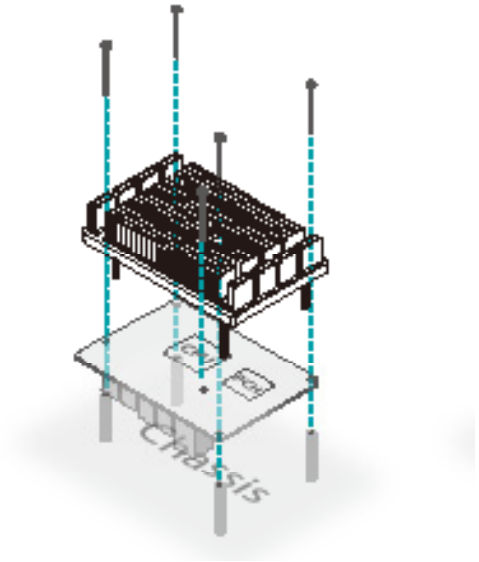
The system board may come with a heatsink or a cooler (heatsink with fan), including four stand-offs and four stand-off screws to secure the board and heatsink onto the chassis. The assembly is expected to be installed in the manners as illustrated below.



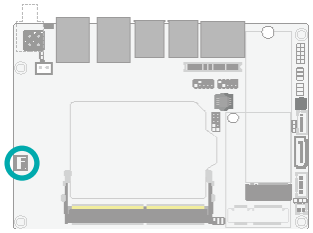
Note:

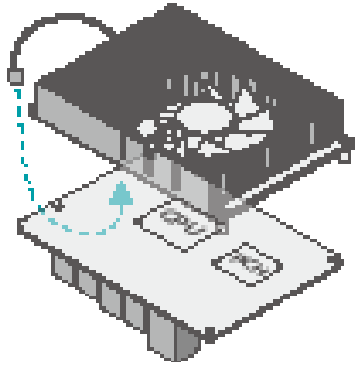
The standard package includes a fanless heatsink. The heatsink with fan is an optional item available upon request.

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 sink. Rotate horozontally so the interface metal sits right on top of the CPU, and align the screw holes on the heatsink to those on the module. Remove any plastic cover on the interface metal and apply thermal paste/adhesive if it is required.



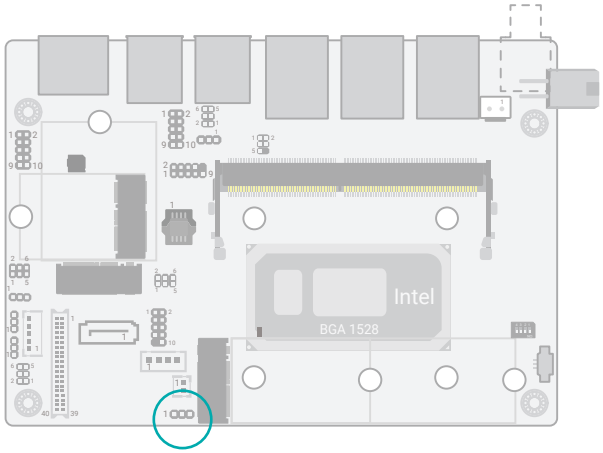
Optional: Connect the CPU fan cable to the CPU fan connector on the top side of the module. This step can be omitted if it is a fanless heatsink.





Screw the stand-offs onto the chassis. This step can be omitted if there exist pre-installed stand-offs on the chassis.

▶ Jumper Settings



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

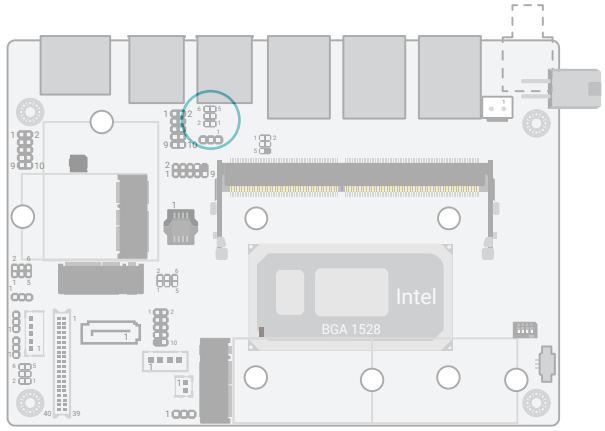
— it is suggested that the system be reconfigured with default values stored in the ROM BIOS. To load the default values stored in the ROM BIOS, please follow the steps below.

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.

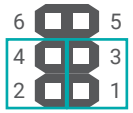
1-2 On:
Normal (default)

2-3 On:
Clear CMOS

DIO PU/PD Select (JP3)



To switch DIO PU/PD type.

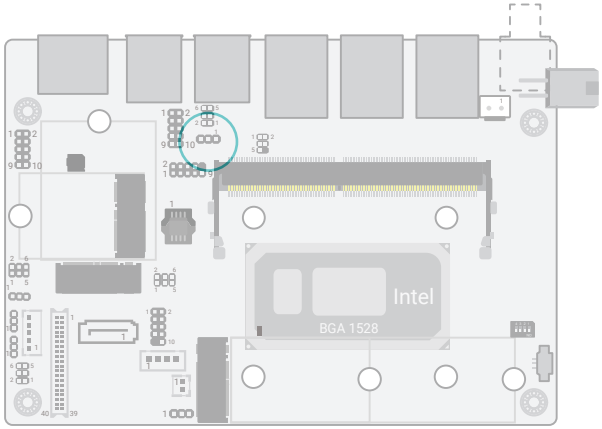


1-3 On: DIO Power (DIO4-7)
2-4 On: DIO Power (DIO0-3)

3-5 On: GND (DIO4-7)
4-6 On: GND (DIO0-3)

▶ **Jumper Settings**

DIO Power Select (JP2)

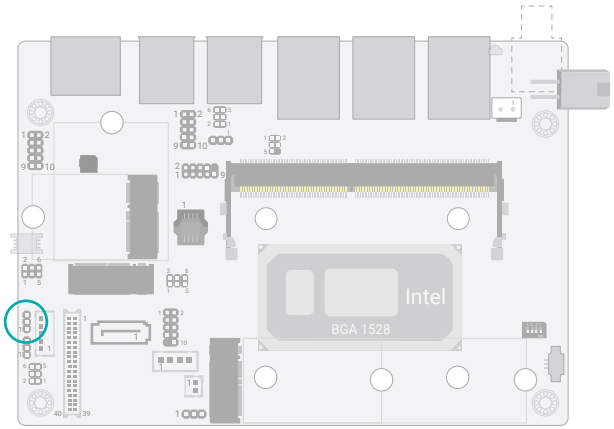


JP2 is used to select the power of DIO (Digital I/O) signal.

1-2 On:
5VSB (default)

2-3 On: 5V

Panel Backlight Selection (DPJP604)

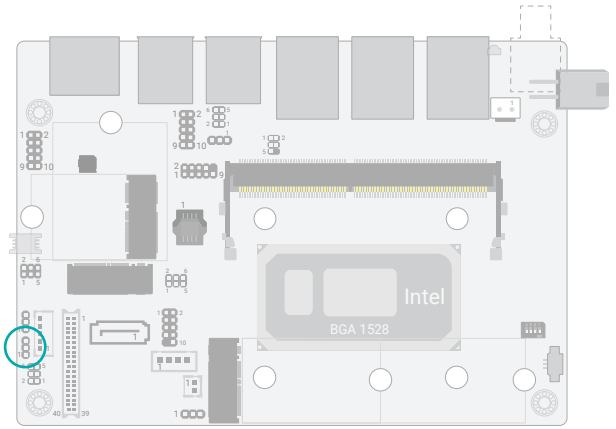


DPJP604 is used to select the panel backlight power.

1-2 On:
3V3 (default)

2-3 On:
5V

Panel Inverter Power Selection (DPJP602)

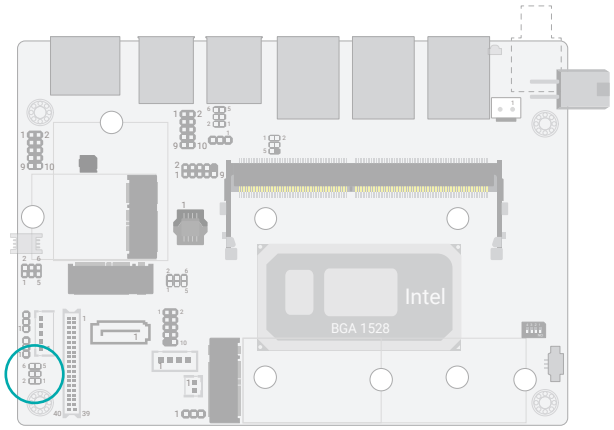


DPJP602 is used to select the panel inverter power.

1-2 On:
+12V (default)

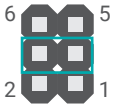
2-3 On:
5V

Panel Power Selection (DPJP603)

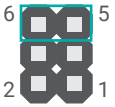


DPJP603 is used to select the panel power.

1-2 On:
+12V (default)

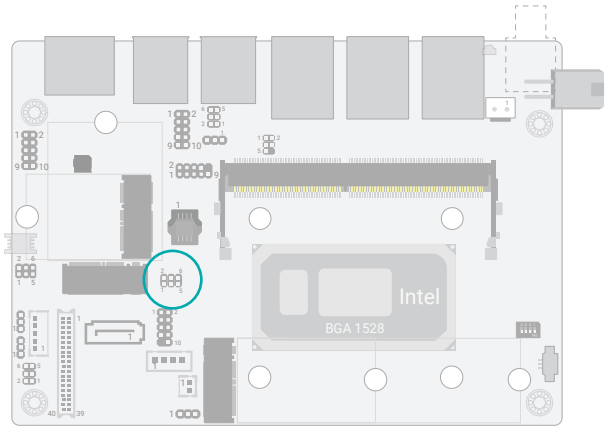


3-4 On:
+5V



5-6 On:
+3.3V

InnoAGE Remote Management (JP6)

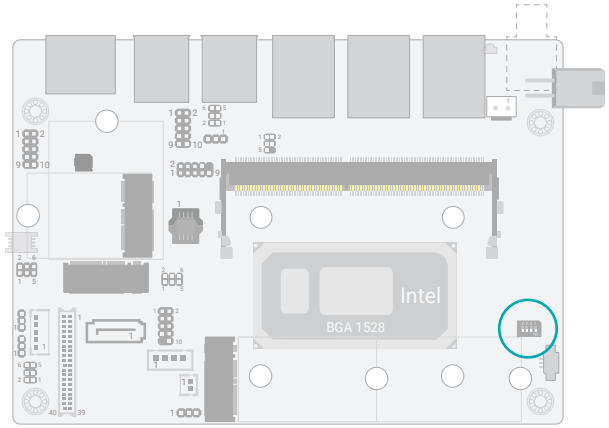


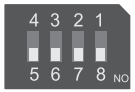
JP6 is used to configure the InnoAGE Remote Management.

InnoAGE Remote Management

Pin	Assignment	Pin	Assignment
1	PC Reset	2	Recovery
3	Power LED	4	HDD LED
5	Power Button	6	GND

▶ Switch Settings

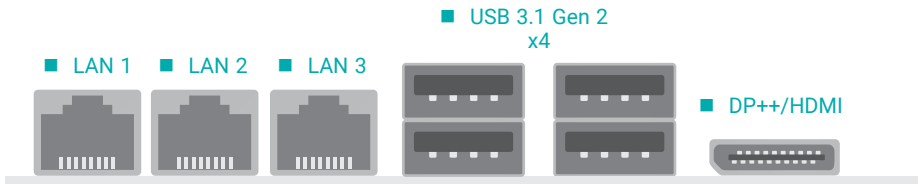




SKUs		M.2 E-Key	M.2 B-Key	M.2 M-Key	SATA_5V
000G~800G	SW1	1-8 ON	2-7 ON	3-6 ON	4-5 ON
		+3V3SB	+3V3SB	+3V3SB	+5VSB
900G	SW2	1-8 OFF	2-7 OFF	3-6 OFF	4-5 OFF
		+3.3V	+3.3V	+3.3V	+5V

▶ Rear I/O Ports

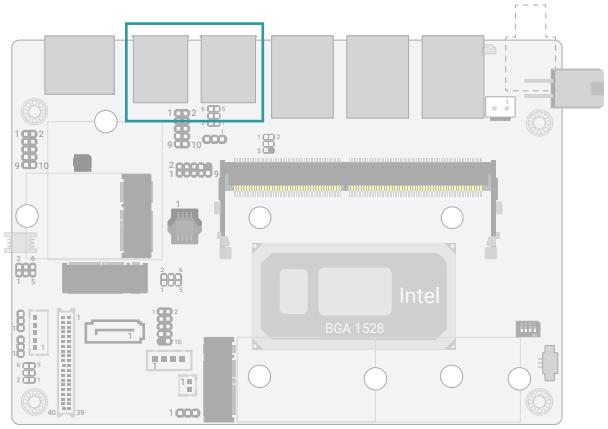
Rear

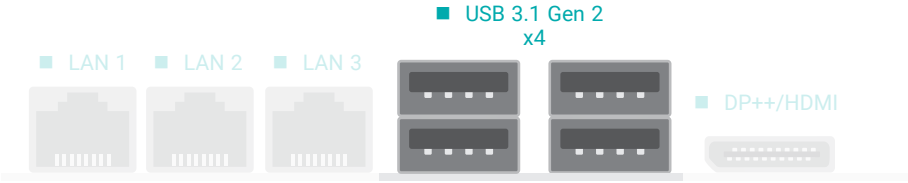


The rear panel I/O ports consist of the following:

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

USB Ports



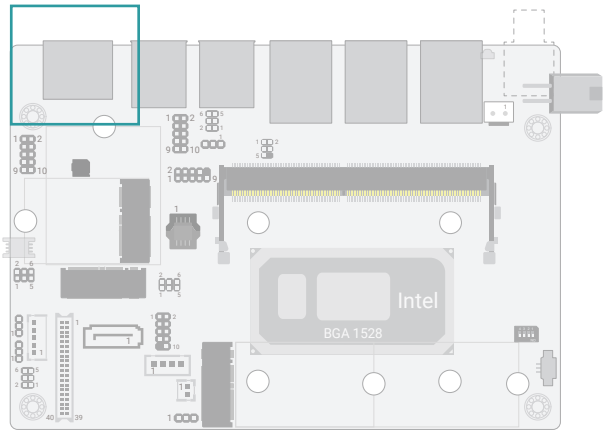


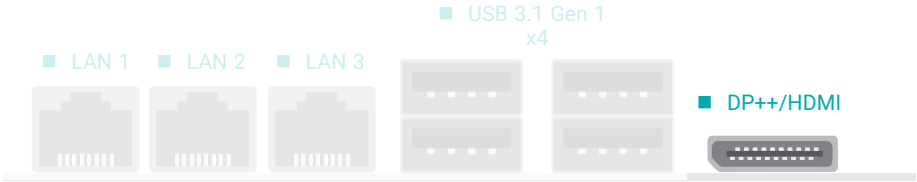
USB allows data exchange between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

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.

Graphics Display





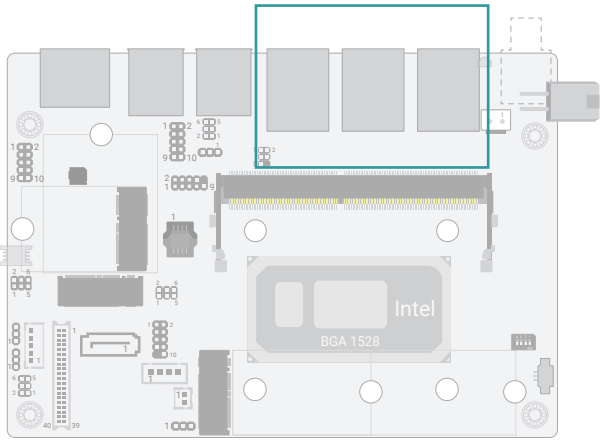
DisplayPort ++

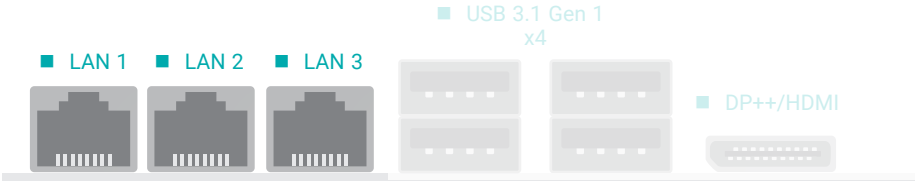
The DisplayPort (DP) is a digital display interface used to connect a display device such as a computer monitor. It is used to transmit audio and video simultaneously. The interface, which is developed by VESA, delivers higher performance features than any other digital interface. DP++ is supported by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

LAN



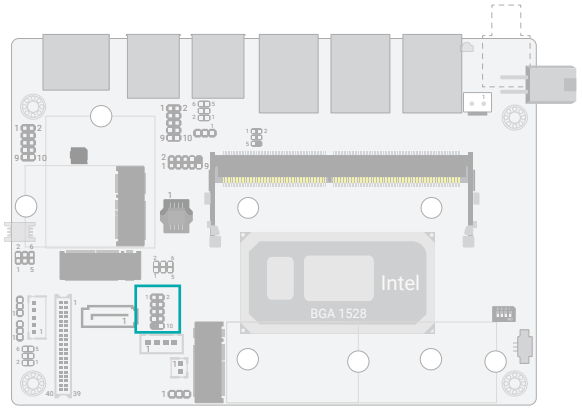


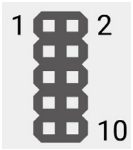
LAN1/LAN2/LAN3 (RJ45)

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

USB Ports

■ USB 7/8
(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.

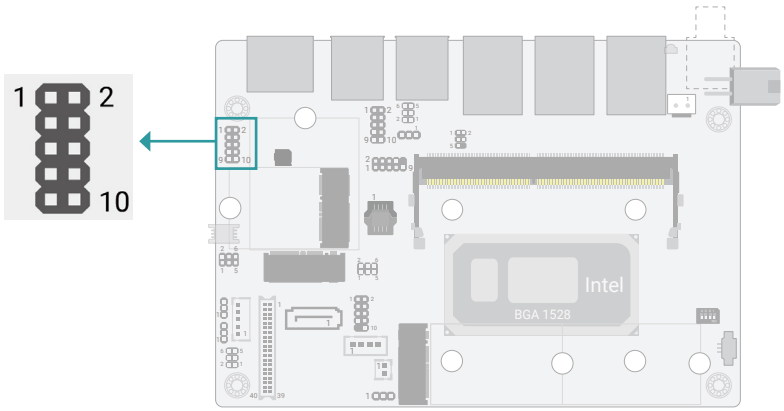
Wake-On-USB Keyboard/Mouse

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	VCC	2	VCC
3	-DATA	4	-DATA
5	+DATA	6	+DATA
7	GND	8	GND
9	Key	10	N.C.

Front Audio

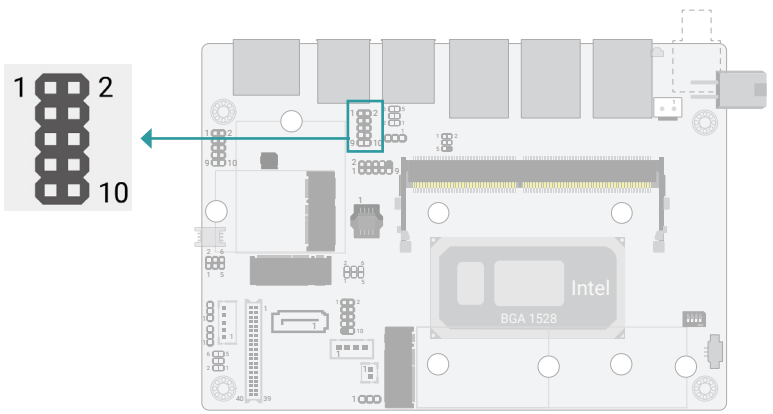


The Front Audio internal connector allows you to connect to the second line-out and mic-in jacks that are at the front panel of your system.

■ Front Audio Pin Assignment

Pin	Assignment	Pin	Assignment
1	Mic-L	2	GND
3	Mic-R	4	N.C.
5	Line-Out-R	6	Mic-JD (sense)
7	GND	8	N.C.
9	Line-Out-L	10	Line-JD (sense)

Digital I/O

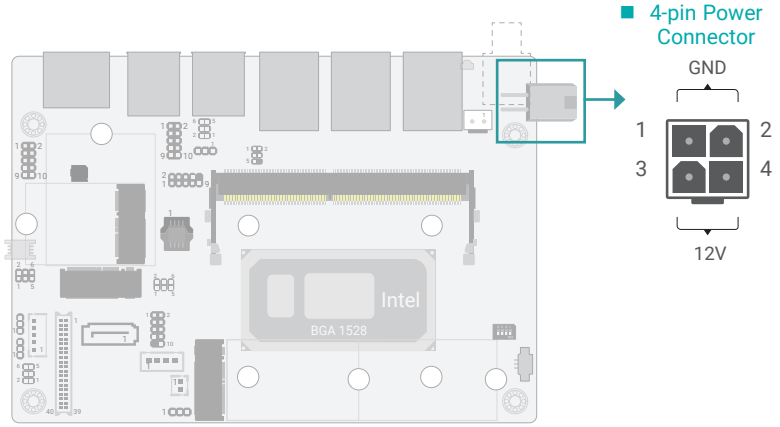


The Digital I/O (DIO) connector allows for input/output signals of digital logical states defined by voltage levels.

■ 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	DIO Power	10	GND

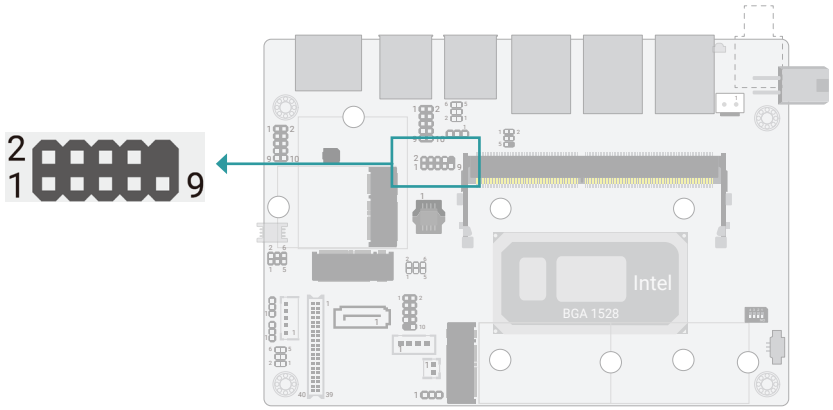
Power Connector



Connect a 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.

COM1



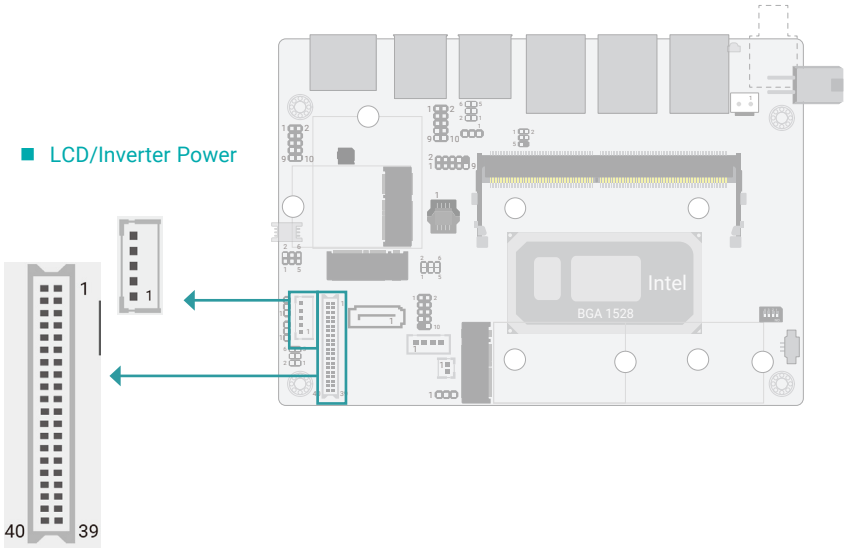
The serial ports are asynchronous communication ports with 16C550A-compatible UARTs that can be used with modems, serial printers, remote display terminals, and other serial devices.

■ COM1 Pin Assignment

Pin	RS232	RS422	RS485
1	DCD-	TXD-	Data-
2	SIN	TXD+	Data+
3	SOUT	RXD+	N.C.
4	DTR-	RXD-	N.C.
5	GND	GND	GND
6	DSR-	N.C.	N.C.
7	RTS-	N.C.	N.C.
8	CTS-	N.C.	N.C.
9	RI-	N.C.	N.C.

LVDS Panel

■ LCD/Inverter Power



The system board allows you to connect a LCD Display Panel by means of the LVDS LCD panel connector and the LCD/Inverter power connector. These connectors transmit video signals and power from the system board to the LCD Display Panel.

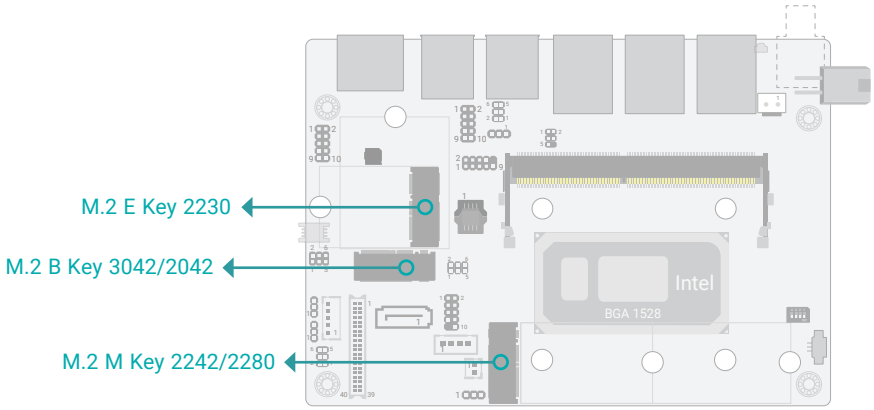
■ LVDS LCD Panel Pin Assignment

Pin	Function	Pin	Function
1	GND	2	GND
3	LVDSA_Out3+	4	LVDSB_Out3+
5	LVDSA_Out3-	6	LVDSB_Out3-
7	GND	8	GND
9	LVDSA_Out2+	10	LVDSB_Out2+
11	LVDSA_Out2-	12	LVDSB_Out2-
13	GND	14	GND
15	LVDSA_Out1+	16	LVDSB_Out1+
17	LVDSA_Out1-	18	LVDSB_Out1-
19	GND	20	GND
21	LVDSA_Out0+	22	LVDSB_Out0+
23	LVDSA_Out0-	24	LVDSB_Out0-
25	GND	26	GND
27	LVDSA_CLK1+	28	LVDSB_CLK1+
29	LVDSA_CLK1-	30	LVDSB_CLK1-
31	GND	32	GND
33	LVDS_DDC_CLK	34	NC
35	LVDS_DDC_DATA	36	+3.3V
37	Panel Power	38	Panel Power
39	Panel Power	40	Panel Power

■ LVDS Backlight Control

Pin	Function	Pin	Function
1	+12V/+5V via jumper	5	5V
2	GND		
3	Backlight On/Off		
4	PWM Brightness Control		

Expansion Slots



M.2 Sockets

The M.2 socket is the Next Generation Form Factor (NGFF) which is designed to support multiple modules and make the M.2 more suitable in application for solid-state storage. The board preserves space and two standoffs for the M.2 E key socket (22mm x 30mm) and an M.2 M Key socket (22mm x 42mm or 22mm x 80mm).

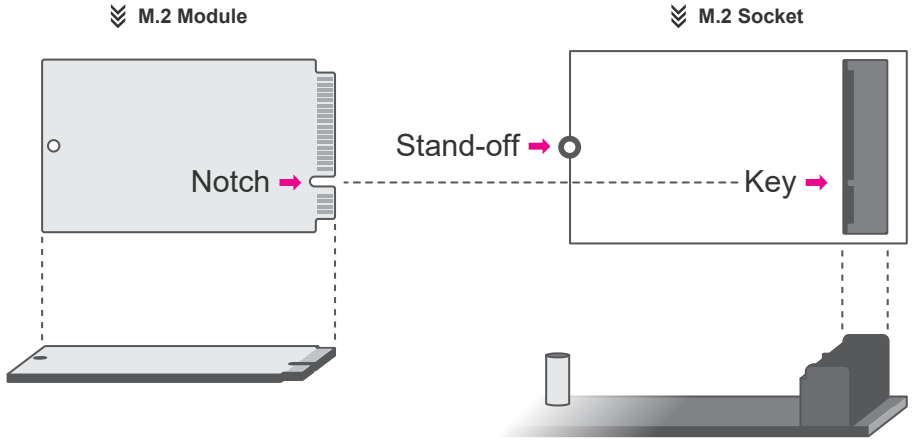
Mini PCIe (optional)

The Mini PCIe socket allows for a full-size Mini PCIe module, and supports PCIe 2.0 or USB 2.0 signals.

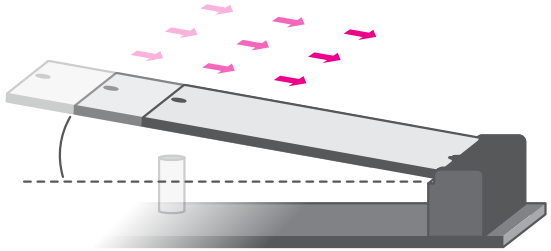
Installing the M.2 Module

Before installing the M.2 module into the M.2 socket, 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 M.2 socket on the system board
4. Make sure the notch on card is aligned to the key on the socket.
5. Make sure the standoff screw is removed from the standoff.

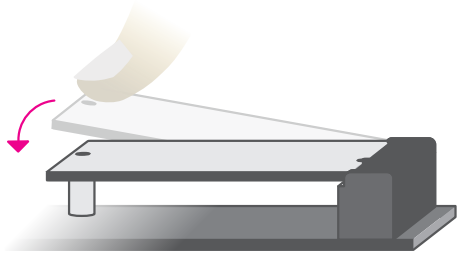


Please follow the steps below to install the card into the socket.



Step 1:

Insert the card into the socket at an angle while making sure the notch and key are perfectly aligned.



Step 2:

Press the end of the card far from the socket down until against the stand-off.

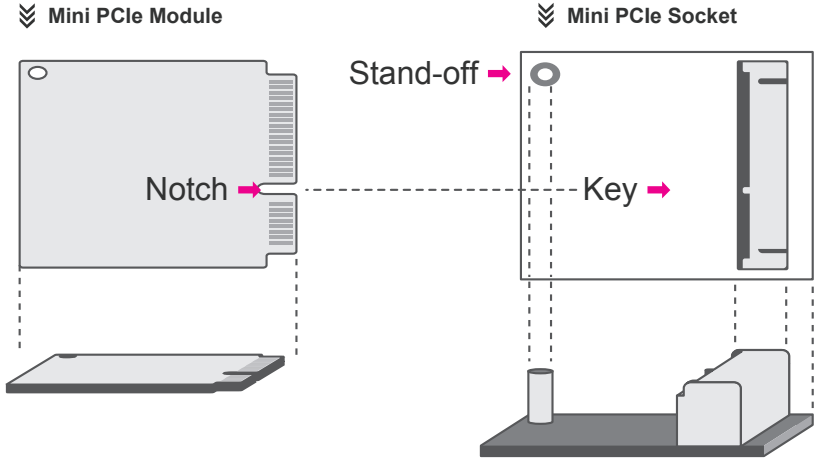
Step 3:

Screw tight the card onto the stand-off with a screw driver and a stand-off screw until the gap between the card and the stand-off closes up. The card should be lying parallel to the board when it's correctly mounted.

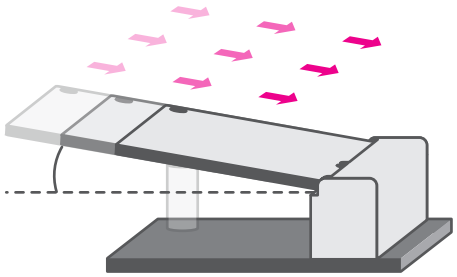
Installing the Mini PCIe Module

Before installing the Mini PCIe module into the Mini PCIe socket, 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 Mini PCIe socket on the system board
4. Make sure the notch on card is aligned to the key on the socket.

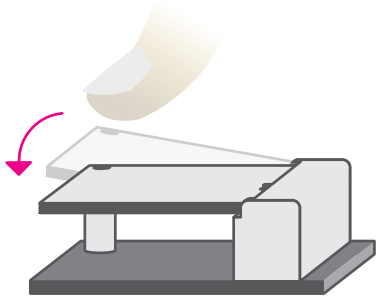


Please follow the steps below to install the card into the socket.



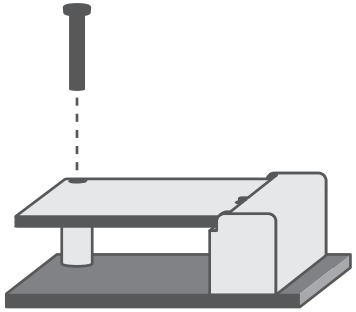
Step 1:

Insert the card into the socket at an angle while making sure the notch and key are perfectly aligned.



Step 2:

Press the end of the card far from the socket down until against the stand-off.

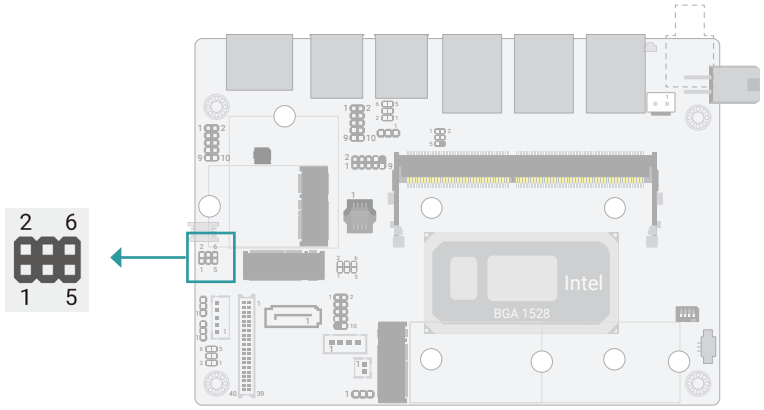


Step 3:

Screw tight the card onto the stand-off with a screw driver and a stand-off screw until the gap between the card and the stand-off closes up. The card should be lying parallel to the board when it's correctly mounted.

▶ **Internal I/O Connectors**

Front Panel



■ Front Panel Pin Assignment

Pin	Assignment	Pin	Assignment
1	Power Button	2	SUS LED PWR
3	GND	4	SUS LED
5	Reset	6	HDD 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.

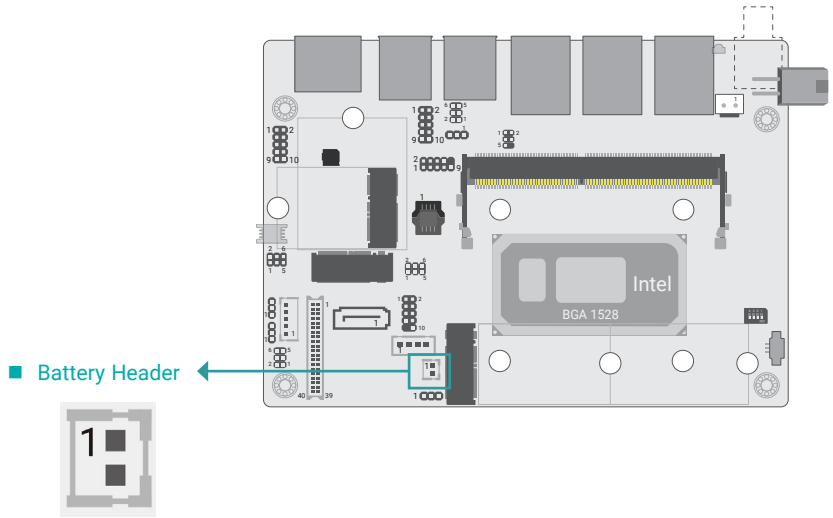
PWR-SW - Power Switch

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.

Battery Header



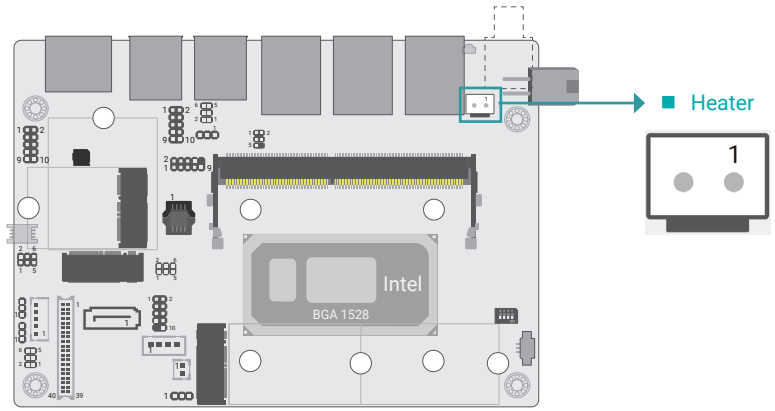
The lithium ion battery powers the real-time clock and CMOS memory. It is an auxiliary source of power when the main power is shut off.

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.

Heater



The heater box header provides 12V power to the external heater with a 2-pin pin header for On/Off switch.

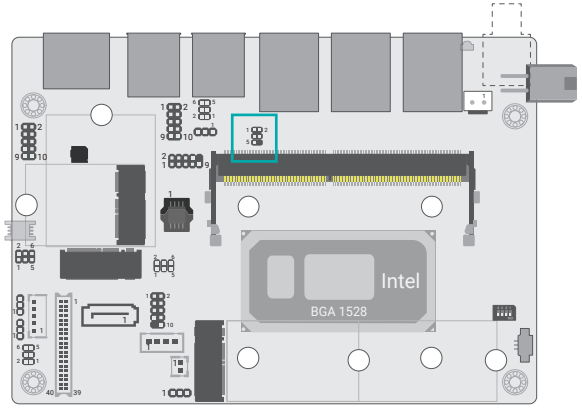
Heater Box Header

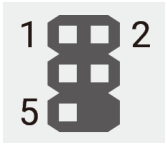
Pin	Assignment	Pin	Assignment
1	12V	2	12VSB_PG_SW

Heater Switch Pin Header

Pin	Assignment	Pin	Assignment
1	Manual Reset	2	12VSB_PG_SW

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.

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

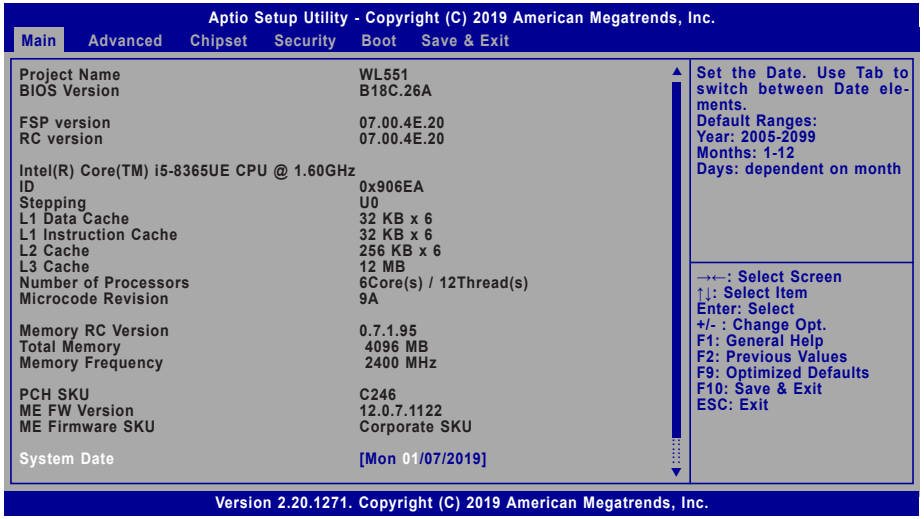
When a scroll bar appears to the right of the setup screen, it indicates that there are more available fields not shown on the screen. Use the up and down arrow keys to scroll through all the available fields.

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

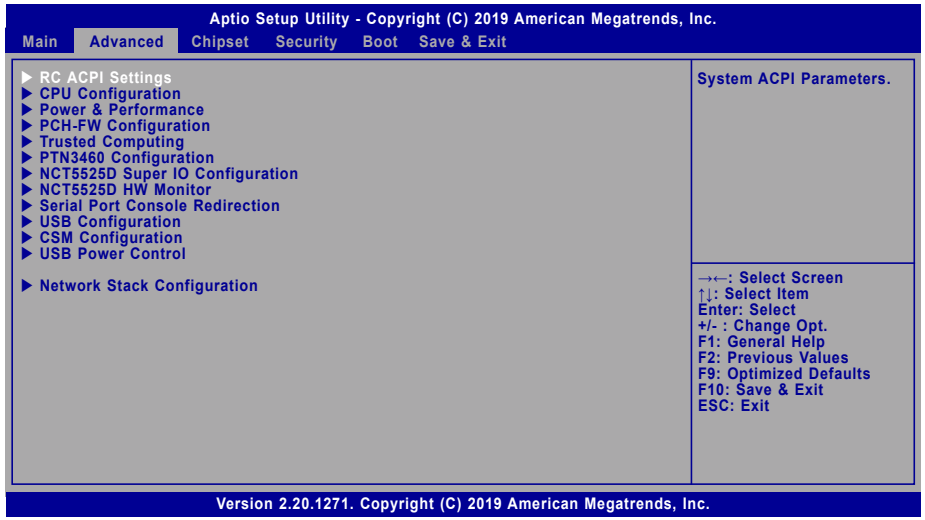
The time format is <hour>, <minute>, <second>. The time is based on the 24-hour military-time clock. For example, 1 p.m. is 13:00:00. Hour displays hours from 00 to 23. Minute displays minutes from 00 to 59. Second displays seconds from 00 to 59.

▶ 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.

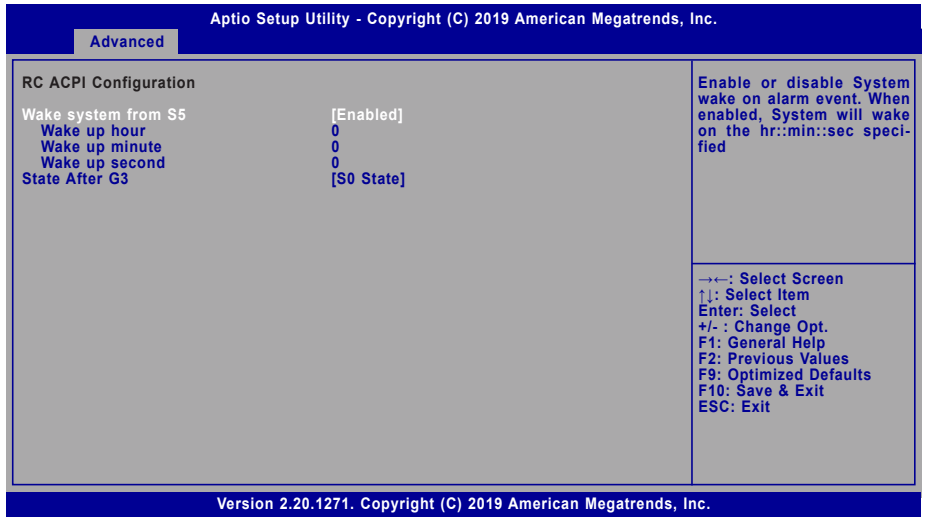
Important:

Setting incorrect field values may cause the system to malfunction.



▶ Advanced

RC ACPI Configuration



Wake system from S5

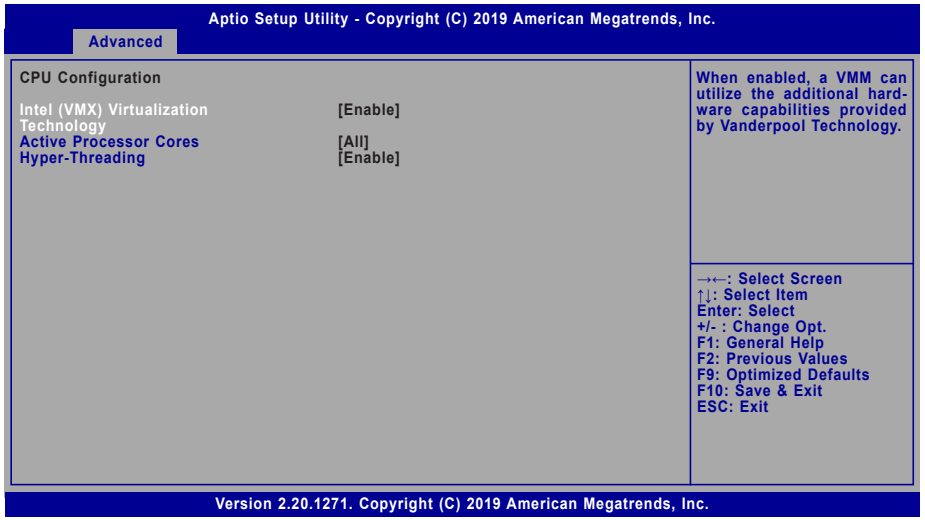
When Enabled, the system will automatically power up at a designated time every day. Once it's switched to [Enabled], please set up the time of day including hour, minute, and second for the system to wake up.

State After G3

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

▶ Advanced

CPU Configuration



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.

Hyper-threading

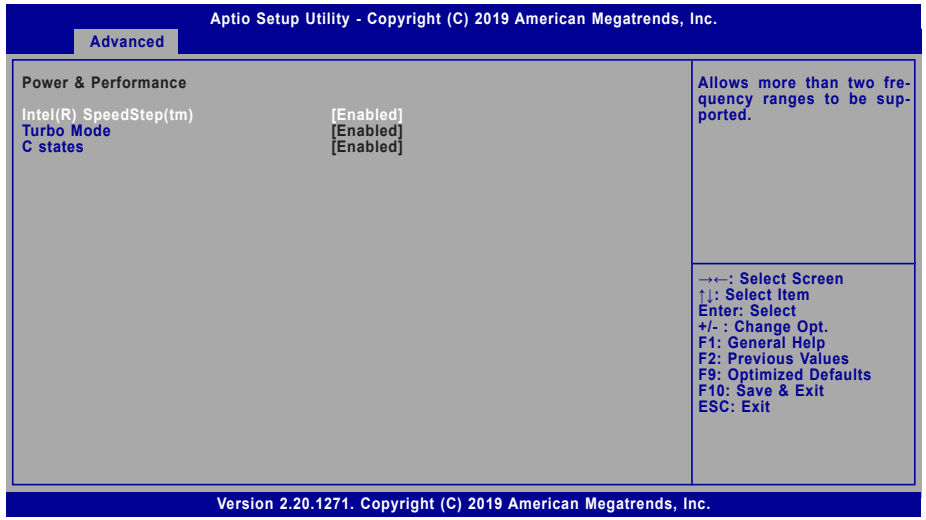
Enables this field for Windows and Linux which are optimized for Hyper-Threading technology. Select disabled for other OSes not optimized for Hyper-Threading technology. When disabled, only one thread per enabled core is enabled.

Note:

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

▶ Advanced

Power & Performance



Intel(R) SpeedStep(tm)

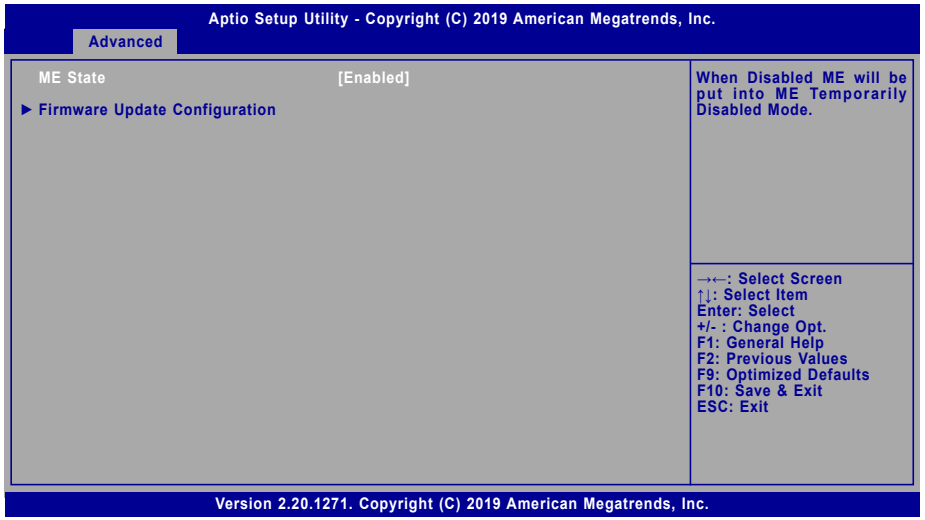
This field is used to enable or disable the Intel SpeedStep® Technology, which helps optimize the balance between system's power consumption and performance. After it is enabled in the BIOS, EIST features can then be enabled via the operating system's power management.

C states

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

▶ Advanced

PCH-FW Configuration



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.

▶ Advanced ▶ PCH-FW Configuration

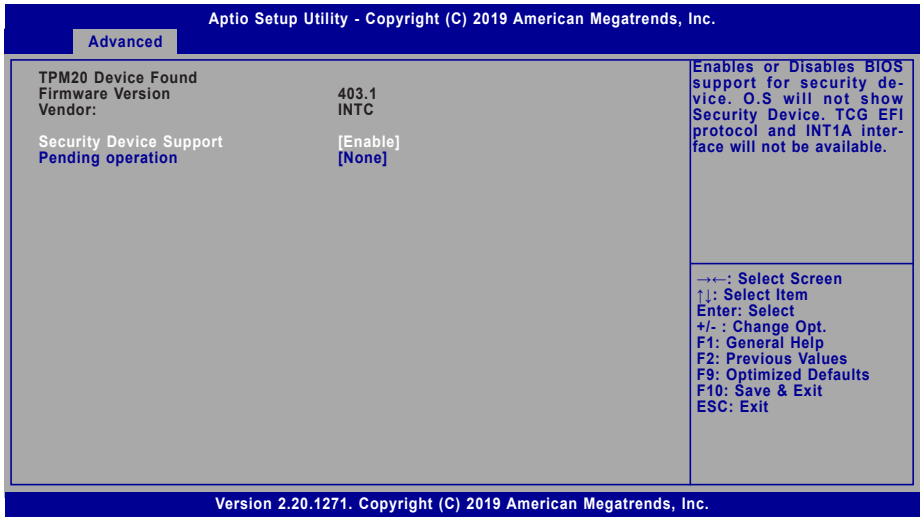
▶ Firmware Update Configuration

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.

▶ Advanced

Trusted Computing



Security Device Support

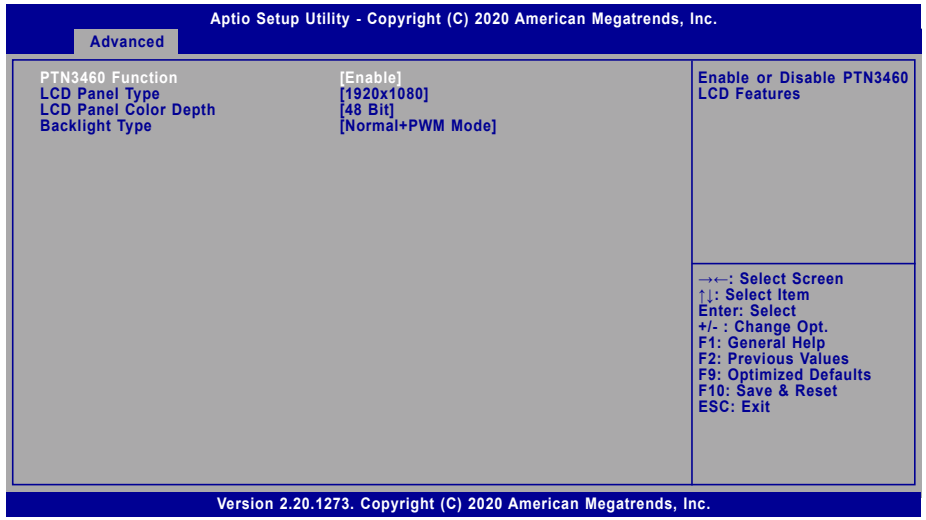
This field is used to enable or disable BIOS support for the security device such as TPM 2.0 to achieve hardware-level security via cryptographic keys.

Pending operation

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

▶ Advanced

PTN3460 Config



PTN3460 Function

Enable or Disable PTN3460 LCD Features. When this field is disabled, the following fields will remain hidden.

LCD Panel Type

Select the resolution of the LCD Panel — 800X480, 800X600, 1024X768, 1366X768, 1280X1024, 1920X1080, or 1920X1200.

LCD Panel Color Depth

Select the color depth of the LCD Panel — 18 Bit, 24 Bit, 36 Bit, 48 Bit.

Backlight Type

Select the backlight type of the LCD Panel —

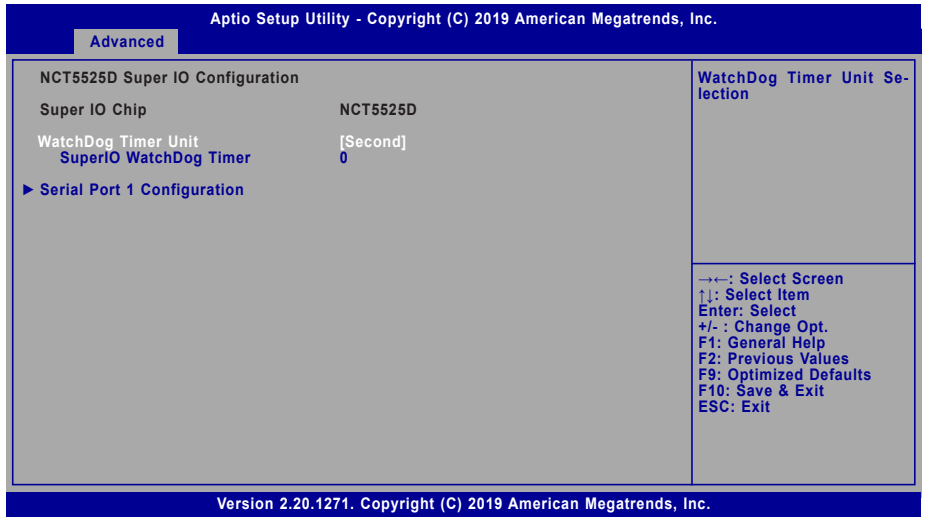
Normal + PWM
Normal + DC
Invert + PWM
Invert + DC

Note:

The configuration must match the specifications of your LCD Panel in order for the LCD Panel to display properly.

▶ Advanced

NCT5525D Super IO Configuration



WatchDog Timer Unit

Select WatchDog Timer Unit — Second or Minute.

SuperIO WatchDog Timer

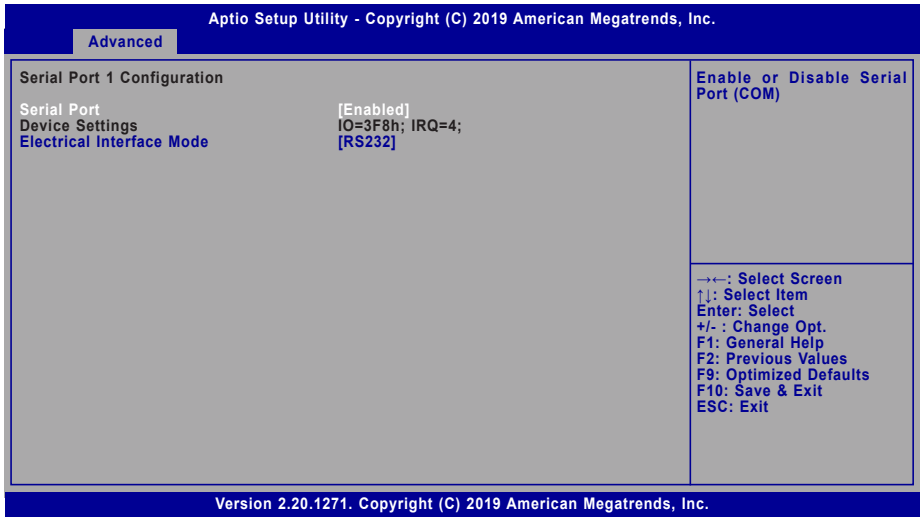
Set SuperIO WatchDog Timer Timeout value. The range is from 0 (disabled) to 255.

Note:

The sub-menus are detailed in following sections.

▶ Advanced ▶ NCT6116D Super IO Configuration

▶ Serial Port Configuration



Serial Port

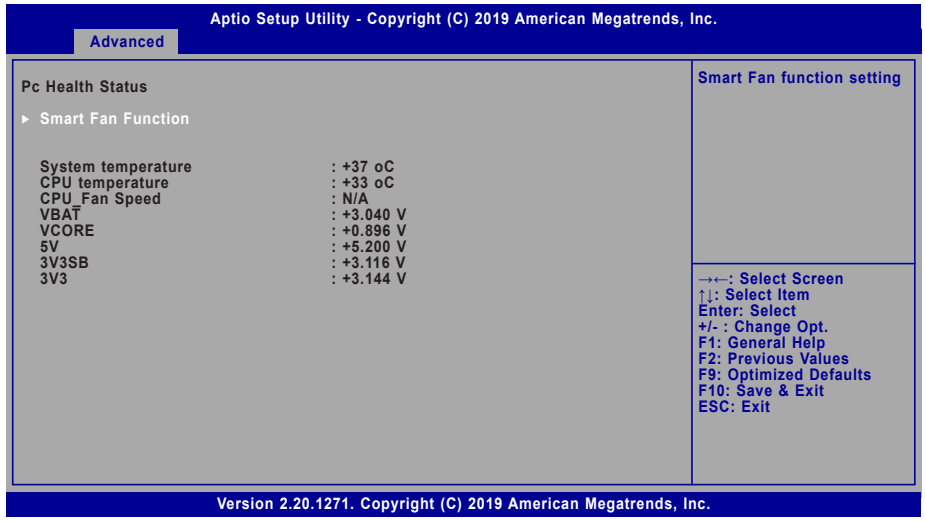
Enable or disable the current serial COM port.

Electrical Interface Mode

Choose mode between RS232 / RS485 / RS422

▶ Advanced

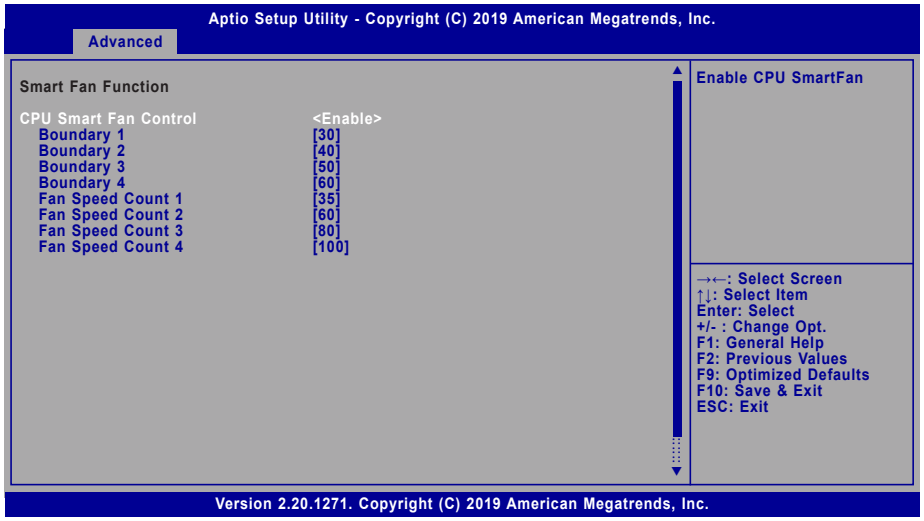
NCT5525D HW Monitor



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 Control = [Enabled]**

Boundary 1 to Boundary 4

Set the boundary temperatures that determine the fan speeds accordingly, the value ranging from 0-127℃. 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.

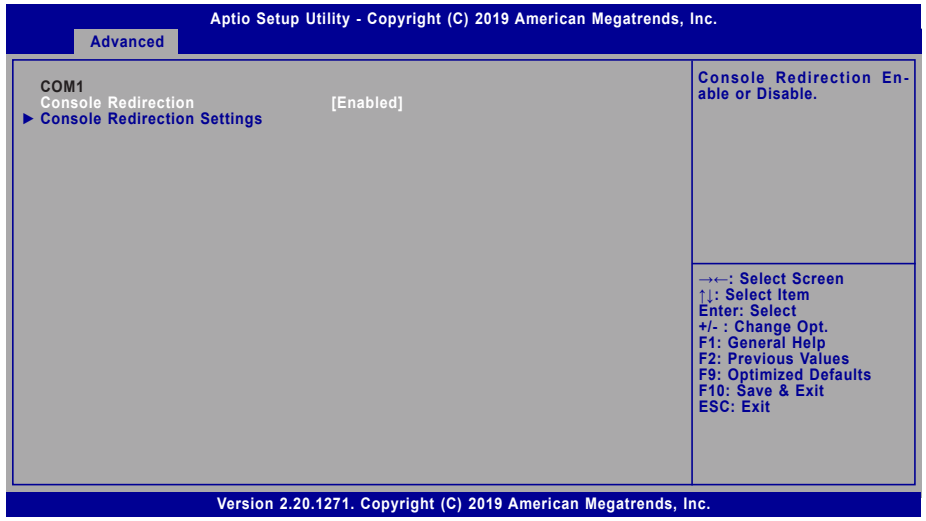
▼ **SYS Smart Fan/CPU Smart Fan Control = [Disabled]**

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

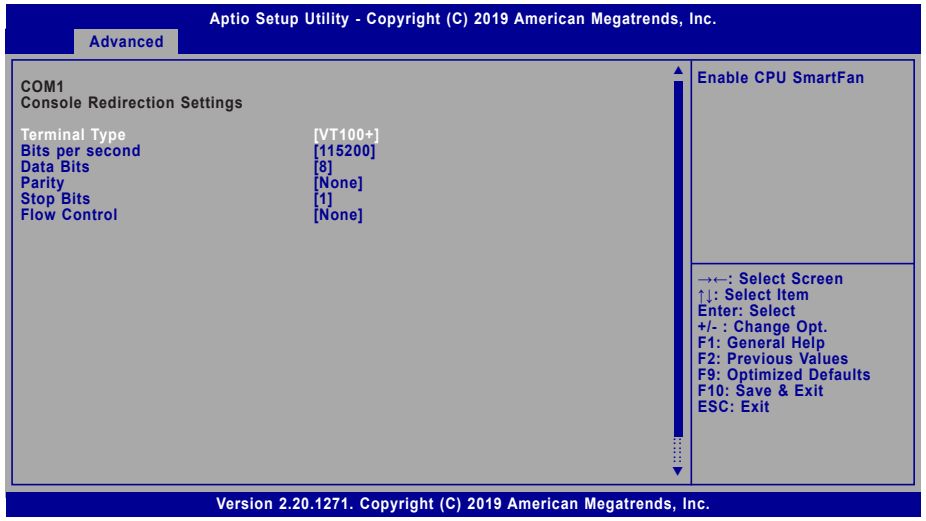


Console Redirection

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

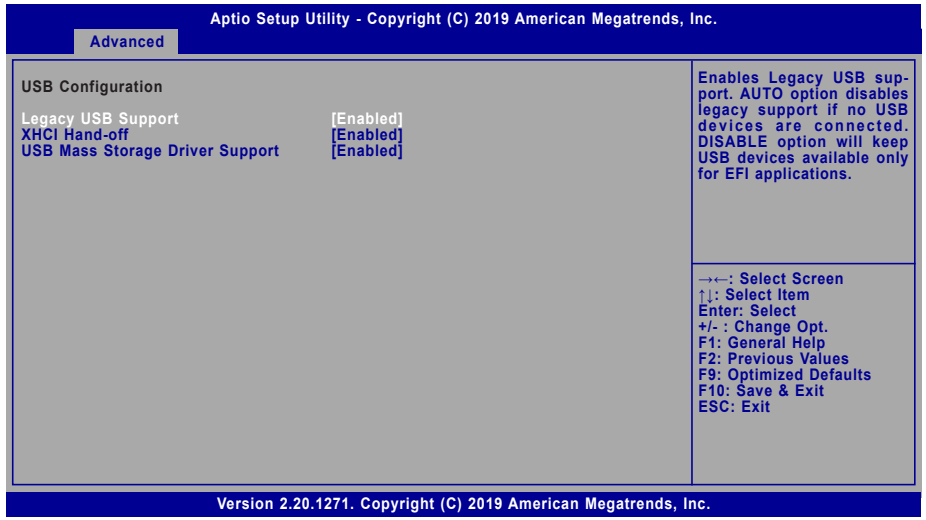
Select stop bits: 1 bit or 2 bits.

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

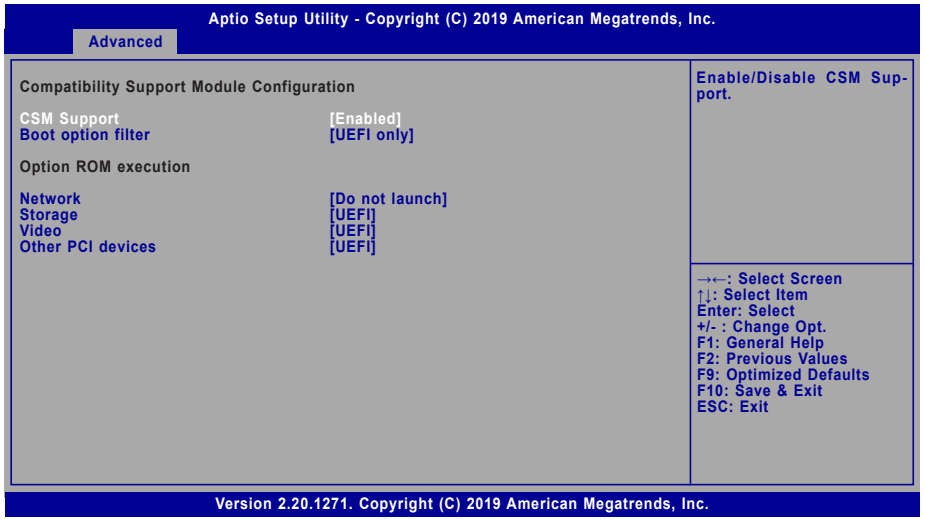
Enable or disable XHCI Hand-off.

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

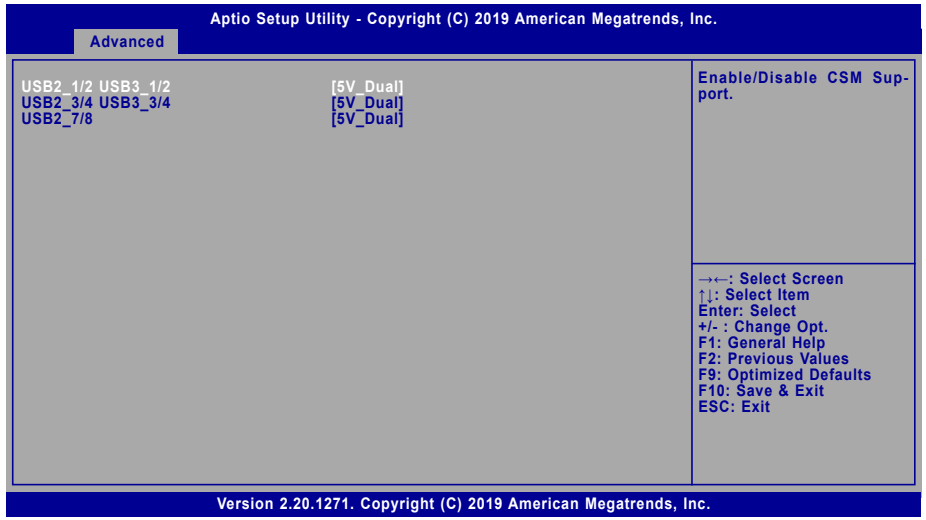
This field controls the execution of UEFI and Legacy Video OpROM.

Other PCI devices

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

▶ Advanced

USB Power Control

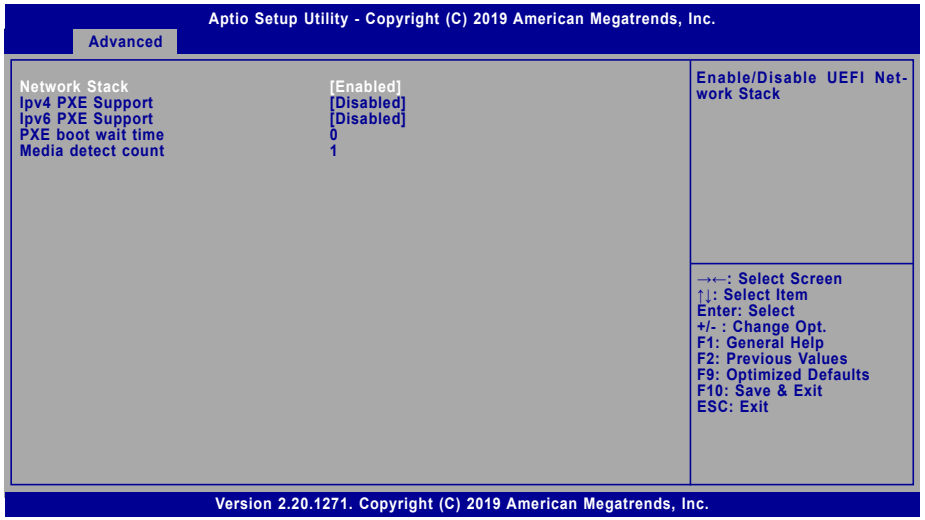


5V / 5V_DUAL

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.

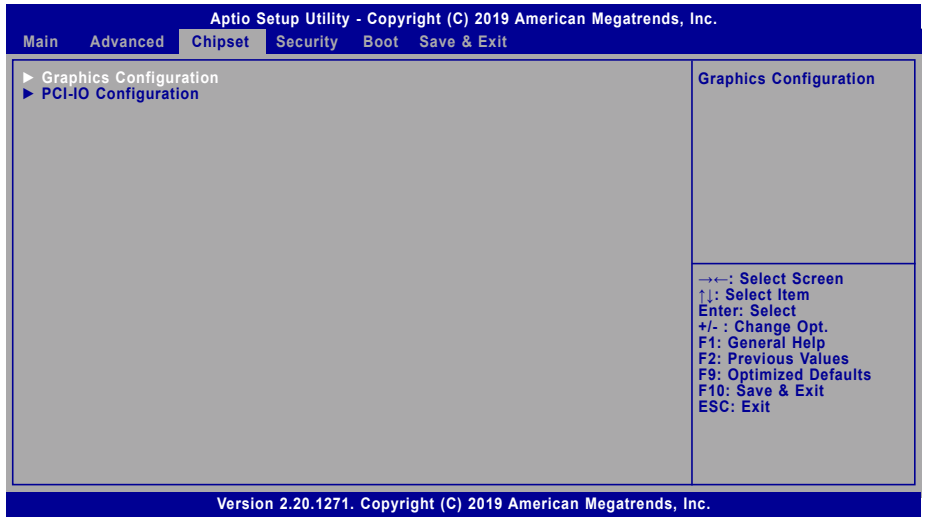
PXE boot wait time

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.

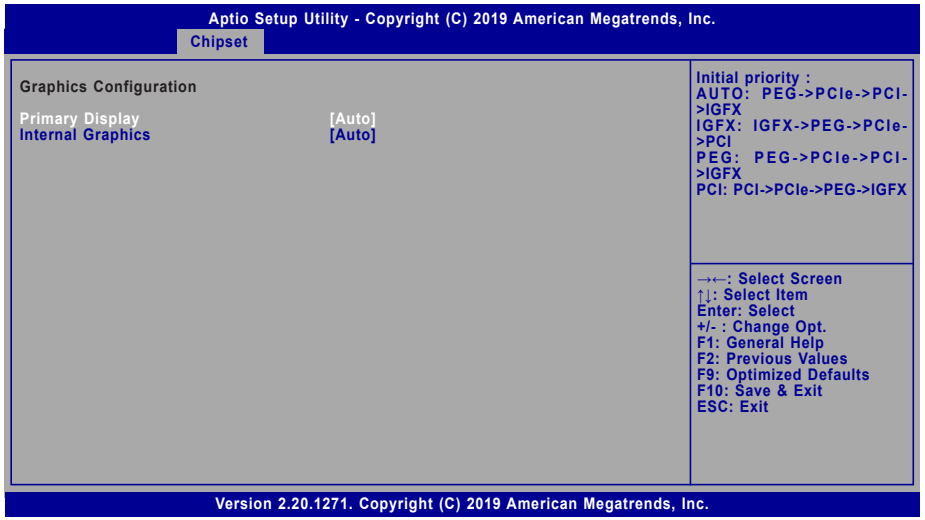
▶ Chipset



To configure graphics and PCH-IO relevant settings.

▶ Chipset

Graphics Configuration



Primary Display

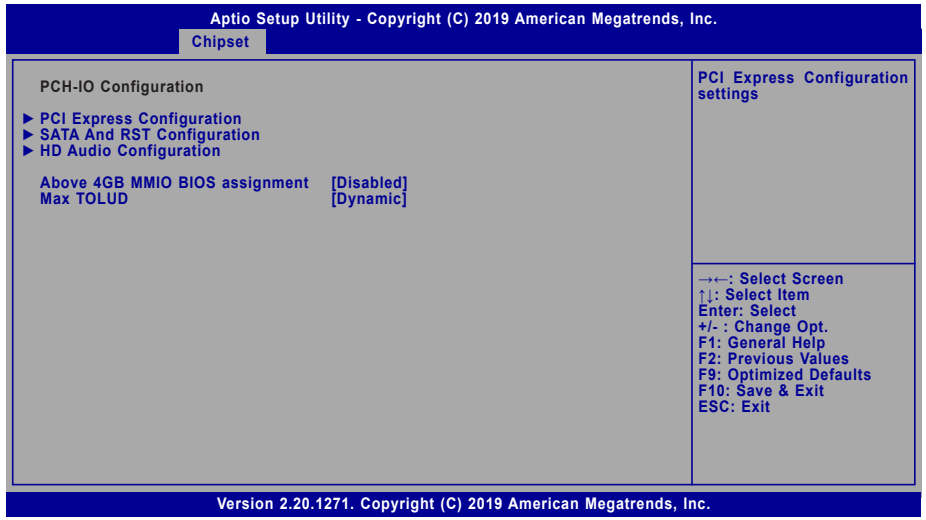
Select which of IGFX/PEG/PCI Graphics device to be the primary display.

Internal Graphics

Keep IGFX enabled based on the setup options.

▶ Chipset

PCH-IO Configuration



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

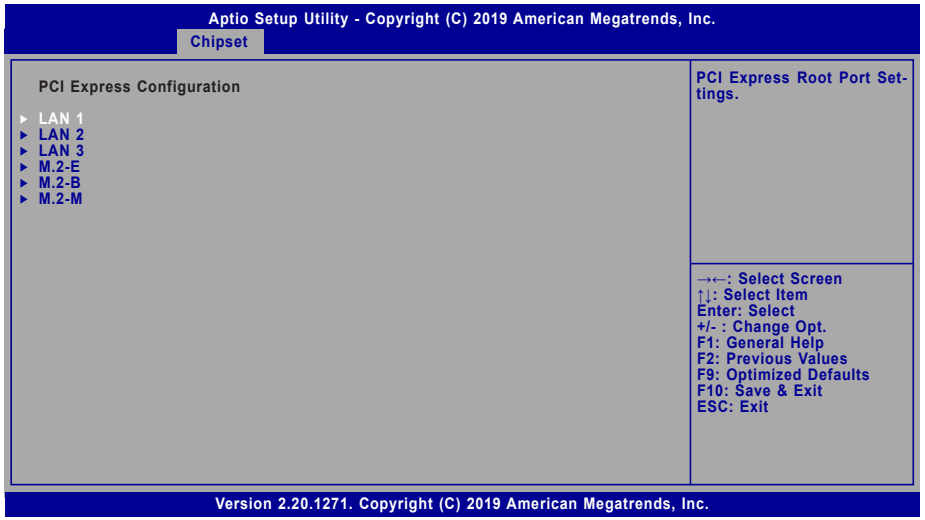
Adjust the maximum value of TOLUD or set it to Dynamic to vary based on largest MMIO length of installed graphic controller.

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

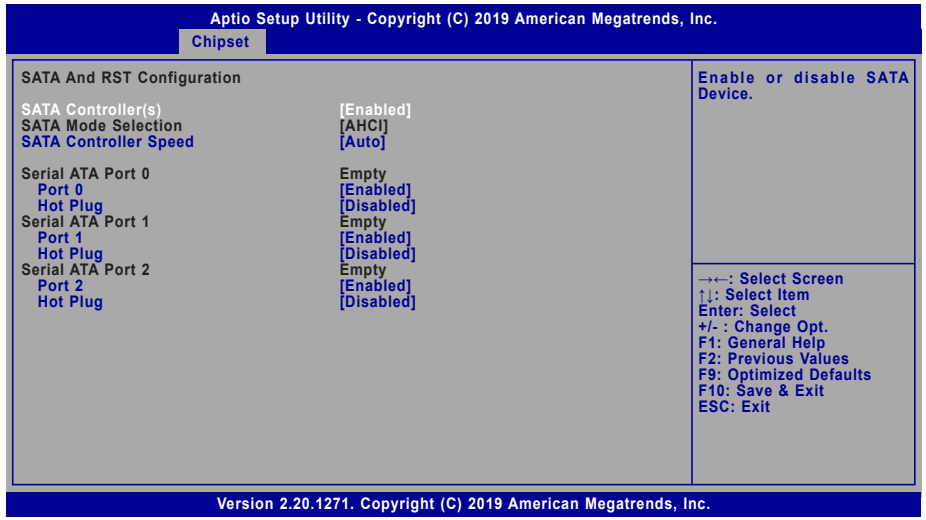
Enable or disable hot plug function of the port. This field may not appear when the port does not support hot plug.

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

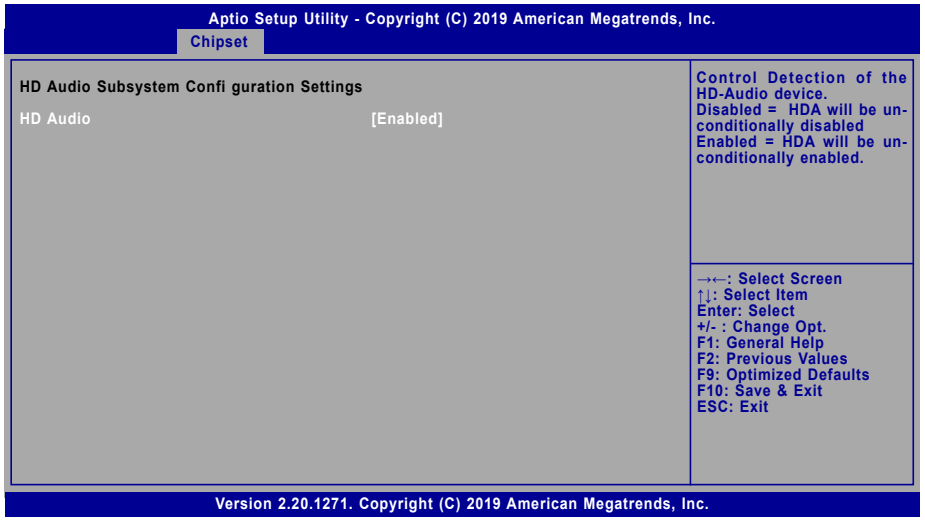
This field shows up when SATA Mode Selection is set to Intel RST Premium With Intel Optane System Acceleration.

Port and Hot Plug

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

▶ Chipset ▶ PCH-IO Configuration

HD Audio Configuration



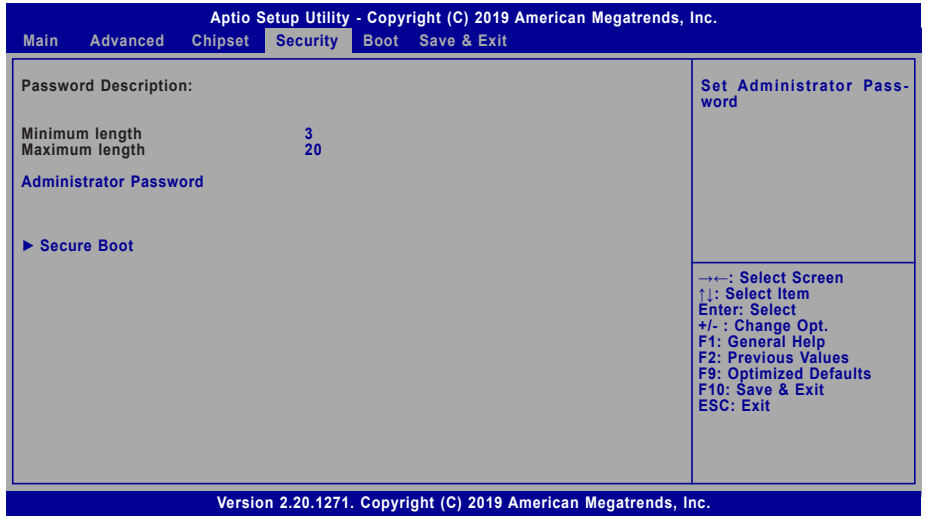
HD Audio

Control the detection of the HD Audio device.

Disabled HDA will be unconditionally disabled.

Enabled HDA will be unconditionally enabled.

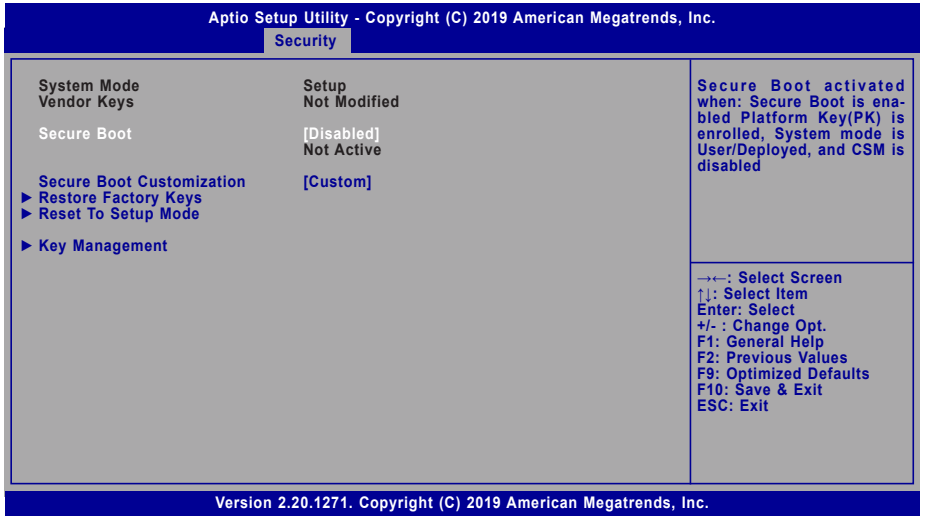
▶ Security



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.

Secure Boot



Secure Boot

The Secure Boot store a database of certificates in the firmware and only allows the OSes 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

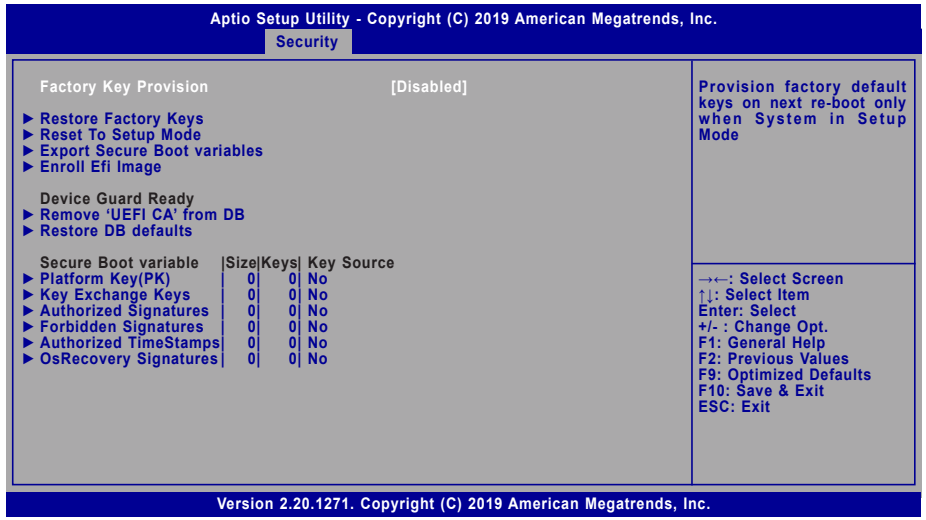
Force system to User Mode. Load OEM-defined factory defaults of keys and databases onto the Secure Boot. Press Enter and a prompt will show up for you to confirm.

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.

▶ Security ▶ Secure Boot

▶ 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

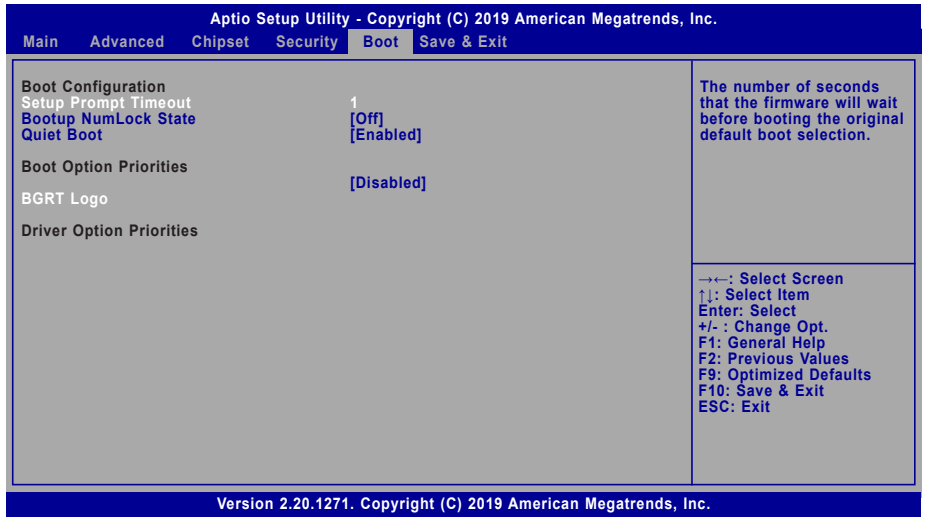
Press Enter to restore the database variable to factory defaults.

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

Details	List the information of enrolled keys and signatures
Export	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".
Update	Load factory default database
Append	Enroll keys and signatures from a file system
Delete	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.

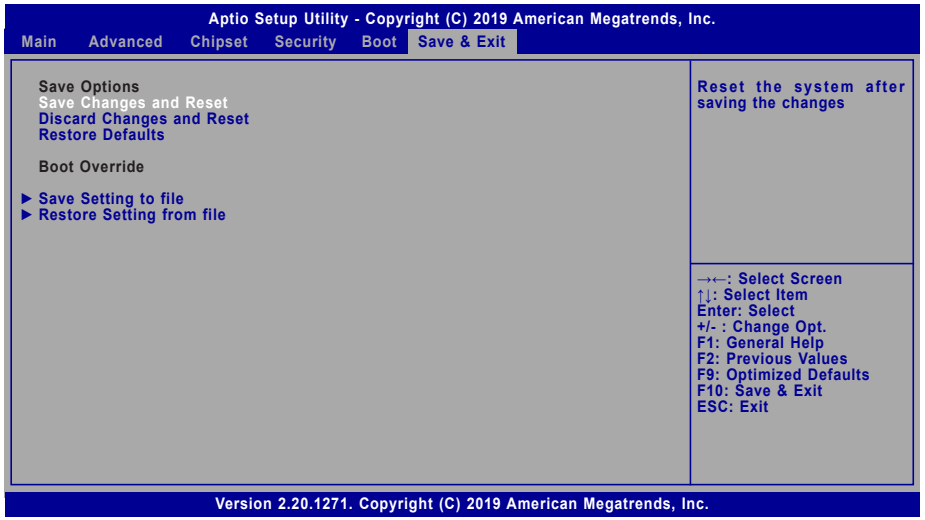
BGRT Logo

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

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

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.