

MS-98E1

(v1.x) Industrial Computer Board



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Trademarks

All trademarks are the properties of their respective owners.

Revision History

Revision	Date
V1.1	2020/09

Technical Support

If a problem arises with your system and no solution can be obtained from the user's manual, please contact your place of purchase or local distributor. Alternatively, please visit the MSI website for technical guide, BIOS updates, driver updates and other information, or contact our technical staff via <http://www.msi.com/support/>

Safety Instructions

- Always read the safety instructions carefully.
- Keep this User's Manual for future reference.
- Keep this equipment away from humidity.
- Lay this equipment on a reliable flat surface before setting it up.
- The openings on the enclosure are for air convection hence protects the equipment from overheating. **DO NOT COVER THE OPENINGS.**
- Make sure the voltage of the power source and adjust properly 110/220V before connecting the equipment to the power inlet.
- Place the power cord such a way that people can not step on it. Do not place anything over the power cord.
- Always Unplug the Power Cord before inserting any add-on card or module.
- All cautions and warnings on the equipment should be noted.
- Never pour any liquid into the opening that could damage or cause electrical shock.
- If any of the following situations arises, get the equipment checked by service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated into the equipment.
 - The equipment has been exposed to moisture.
 - The equipment does not work well or you can not get it work according to User's Manual.
 - The equipment has dropped and damaged.
 - The equipment has obvious sign of breakage.
- **DO NOT LEAVE THIS EQUIPMENT IN AN ENVIRONMENT UNCONDITIONED, STORAGE TEMPERATURE ABOVE 60°C (140°F), IT MAY DAMAGE THE EQUIPMENT.**

Chemical Substances Information

In compliance with chemical substances regulations, such as the EU REACH Regulation (Regulation EC No. 1907/2006 of the European Parliament and the Council), MSI provides the information of chemical substances in products at:

http://www.msi.com/html/popup/csr/evmtrptt_pcm.html

Battery Information



European Union:

Batteries, battery packs, and accumulators should not be disposed of as unsorted household waste. Please use the public collection system to return, recycle, or treat them in compliance with the local regulations.



廢電池請回收

Taiwan:

For better environmental protection, waste batteries should be collected separately for recycling or special disposal.



California, USA:

The button cell battery may contain perchlorate material and requires special handling when recycled or disposed of in California.

For further information please visit:

<http://www.dtsc.ca.gov/hazardouswaste/perchlorate/>

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.

CE Conformity

Hereby, Micro-Star International CO., LTD declares that this device is in compliance with the essential safety requirements and other relevant provisions set out in the European Directive.



FCC-B Radio Frequency Interference Statement



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 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 measures listed below:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and 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/television 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.

Notice 2

Shielded interface cables and AC power cord, if any, must be used in order to comply with the emission limits.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions:

- 1) this device may not cause harmful interference, and
- 2) this device must accept any interference received, including interference that may cause undesired operation.

WEEE Statement

Under the European Union ("EU") Directive on Waste Electrical and Electronic Equipment, Directive 2002/96/EC, which takes effect on August 13, 2005, products of "electrical and electronic equipment" cannot be discarded as municipal waste anymore and manufacturers of covered electronic equipment will be obligated to take back such products at the end of their useful life.



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1 Overview

Thank you for choosing the MS-98E1, an excellent industrial computer board.

Based on the innovative Intel® C236/ H110 chipset for optimal system efficiency, the MS-98E1 accommodates the Intel® Skylake-S processor and supports up to 2 DDR4 2133MHz SO-DIMM slots to provide the maximum of 32GB memory capacity.

Designed to withstand harsh industrial conditions, the MS-98E1 is engineered to provide reliable performance for a wide variety of industrial applications.

Motherboard Specifications

Processor

- Intel® Core™ i7/ i5/ i3 or Xeon®, Celeron series processor

Chipset

- SKU1: Intel® C236
- SKU2: Intel® H110

Memory

- 2 x SO-DIMM slots
- Dual channel DDR4, up to 2133MHz
- ECC for C236 (SKU1)
- Non ECC for H110 (SKU2)
- Up to 32GB

Network

- 1 x Intel® I211-AT GbE LAN
- 1 x Intel® I219-LM GbE LAN PHY

Storage

- SKU1
 - 4 x SATA 6Gb/s (RAID 0, 1, 5, 10)
 - 1 x mSATA
- SKU2
 - 3 x SATA 6Gb/s
 - 1 x mSATA

Expansion Slot

- 1 x PCIe x16 slot
- 1 x full-size Mini-PCIe slot
- 1 x M.2 slot ((M Key, PCIe x4, SATA 6Gb/s, SKU1 only)

Internal I/O

- 1 x 4-pin power connector
- 1 x 24-pin power connector
- 1 x System fan connector
- 1 x CPU fan connector
- 1 x USB2.0 connector (2 ports)
- 1 x USB2.0 port
- 1 x RS-232 COM port header (4 ports)
- 1 x GPIO header
- 1 x Front panel header
- 1 x S/PDIF connector
- 1 x Amplifier header
- 1 x TPM header
- 1 x LVDS connector
- 1 x LVDS inverter connector
- 1 x Chassis intrusion header
- 1 x Clear CMOS jumper
- 1 x AT/ATX select jumper
- 2 x COM port jumpers
- 1 x LVDS power jumper
- 1 x ME jumper

Rear I/O

- 1 x PS/2 mouse/keyboard combo port
- 2 x USB2.0 ports
- 1 x RS-232/422/485 serial port (0V/5V/12V)
- 1 x HDMI port
- 1 x VGA port
- 1 x DVI-D port
- 2 x RJ45 GbE LAN ports
- 4 x USB3.0 ports
- 3 x Audio jacks (Line-In, Line-Out, Mic-In)

Graphics

- Integrated Intel® HD Graphics
 - 1 x VGA (Max resolution 1920 x 1200)
 - 1 x DVI-D (Max resolution 1920 x 1200)
 - 1 x HDMI (Max resolution 3840 x 2160)
 - 1 x LVDS (18/24 bit, Dual Channel)
- SKU1: Up to 3 independent displays (VGA + DVI-D, HDMI, LVDS)
- SKU2: Up to 2 independent displays (VGA + DVI-D, HDMI, LVDS)

Audio

- Realtek® ALC887/888S HD Audio Codec
- 1 x Amplifier header
- 1 x S/PDIF connector
- 3 x Audio jacks (Line-In, Line-Out, Mic-In)

Environment

- Operating Temperature: -10 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 5 ~ 95% RH, non-condensing

Form Factor

- Mini-ITX: 170 mm x 170 mm

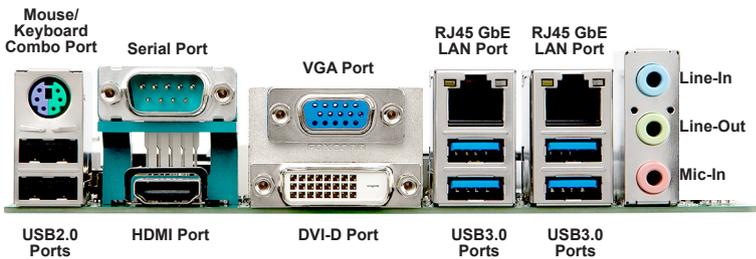
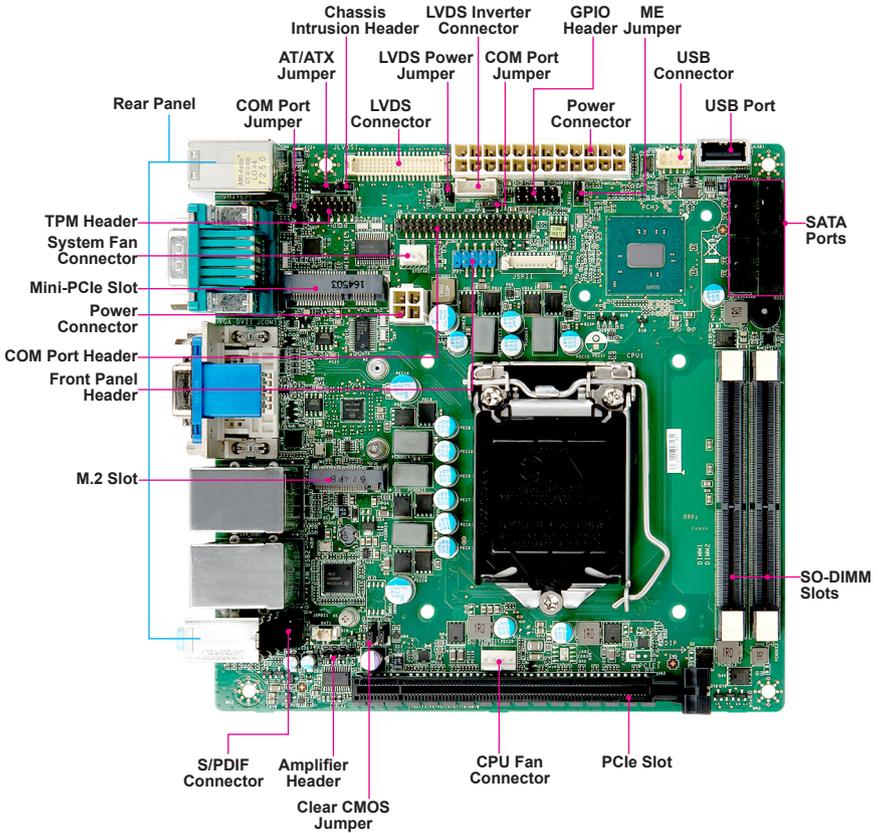
Certification

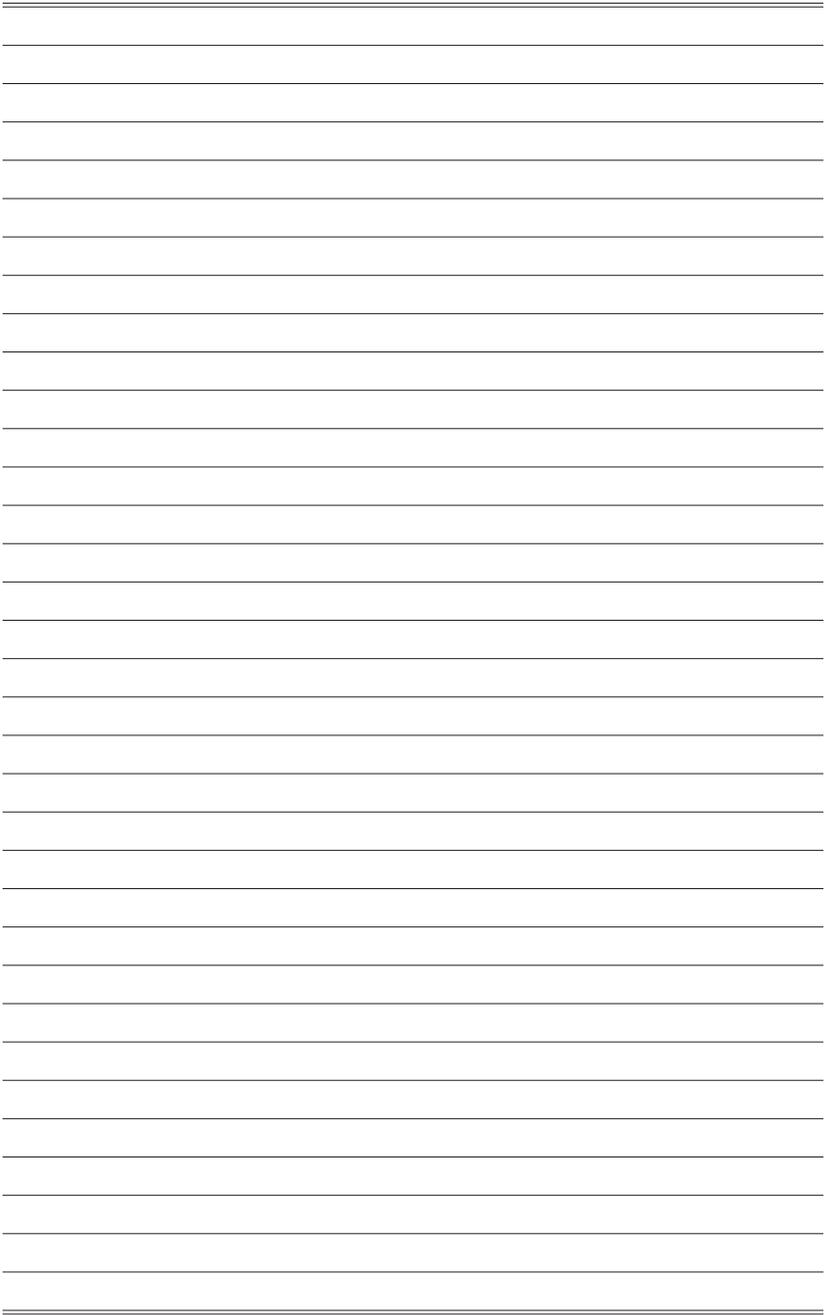
- CE, FCC, BSMI, VCCI, C-Tick

SKU Comparison

	SKUs	SKU1	SKU2
Features			
PCH		C236	H110
Memory		DDR4, support ECC	DDR4, non-ECC
SATA		4 x SATA 6Gb/s	3 x SATA 6Gb/s
M.2		Yes	No

Motherboard Layout





2 Hardware Setup

This chapter provides you with the information about hardware setup procedures. While doing the installation, be careful in holding the components and follow the installation procedures. For some components, if you install in the wrong orientation, the components will not work properly.

Use a grounded wrist strap before handling computer components. Static electricity may damage the components.

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CPU (Central Processing Unit)

When installing the CPU, make sure that you install the cooler to prevent overheating. If you do not have the CPU cooler, consult your dealer before turning on the computer.

Important!

Overheating

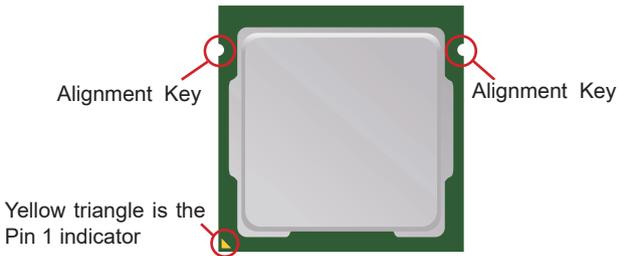
Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

Replacing the CPU

While replacing the CPU, always turn off the power supply or unplug the power supply's power cord from the grounded outlet first to ensure the safety of CPU.

Introduction to LGA 115x CPU

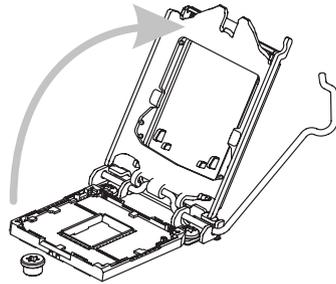
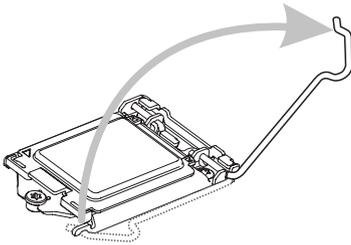
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



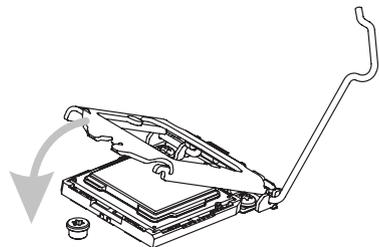
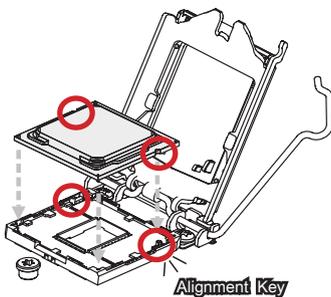
CPU Installation

When you are installing the CPU, make sure the CPU has a cooler attached on the top to prevent overheating. Meanwhile, do not forget to apply some thermal paste on CPU before installing the heat sink/cooler fan for better heat dispersion.

1. Open the load lever and remove the plastic cap.
2. Lift the load lever up to fully open position.



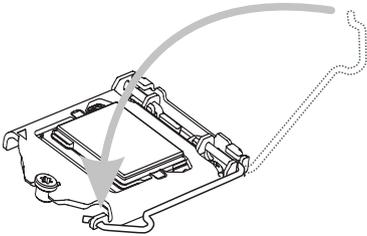
3. After confirming the CPU direction for correct mating, put down the CPU in the socket housing frame. Be sure to grasp on the edge of the CPU base. Note that the alignment keys are matched.
4. Engage the load lever while pressing down lightly onto the load plate.



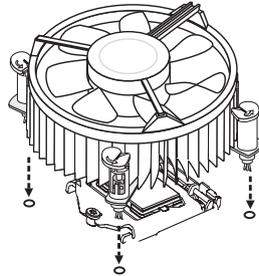
Important

Visually inspect if the CPU is seated well into the socket. If not, take out the CPU with pure vertical motion and reinstall.

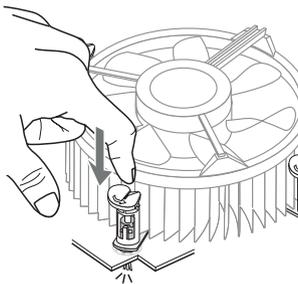
5. Secure the load lever with the hook under the retention tab.



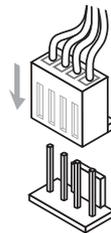
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



7. Press the four hooks down to fasten the cooler. Turn over the motherboard to confirm that the clip-ends are correctly inserted.



8. Finally, attach the CPU Fan cable to the motherboard.



Important

- Confirm if your CPU cooler is firmly installed before turning on your system.
- Do not touch the CPU socket pins to avoid damage.
- Whenever CPU is not installed, always protect your CPU socket pins with the plastic cap covered.
- Please refer to the documentation in the CPU cooler package for more details about the CPU cooler installation.
- Read the CPU status in BIOS.

Memory

Dual-Channel Mode

In Dual-Channel mode, make sure that you install memory modules of the **same type and density** in different channel DIMM slots.

Recommended Memory Population

Number of DIMMs installed	1	2
DIMM1 (ch A)	V	V
DIMM2 (ch B)		V

Important

- "V" indicates a populated DIMM slot.
- Paired memory installation for Max performance.
- Populate the same DIMM type in each channel, specifically: 1. Use the same DIMM size; 2. Use the same number of ranks per DIMM.

Installing Memory Modules

1. Unlock the SO-DIMM slot by flipping open its side clips.
2. Vertically insert the SO-DIMM into the slot. The SO-DIMM has an off-center notch at the bottom that will only allow it to fit one way into the slot. Push the SO-DIMM deeply into the slot. The side clips of the slot will automatically close when the SO-DIMM is properly seated and an audible click should be heard.
3. Manually check if the SO-DIMM has been locked in place by the slot's side clips.

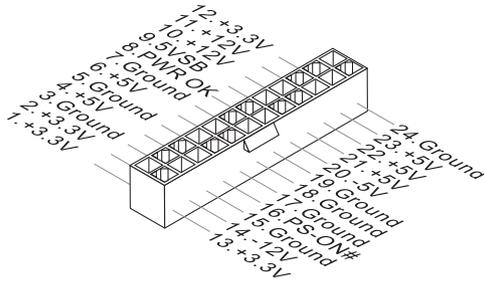
Important

You can barely see the golden finger if the SO-DIMM is properly inserted in the DIMM slot.

Power Supply

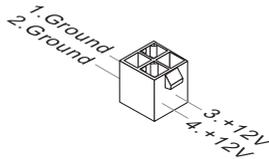
System Power Connector: PWRCONN1

This connector allows you to connect a power supply. To connect to the power supply, make sure the plug of the power supply is inserted in the proper orientation and the pins are aligned. Then push down the power supply firmly into the connector.



CPU Power Connector: JPWR2

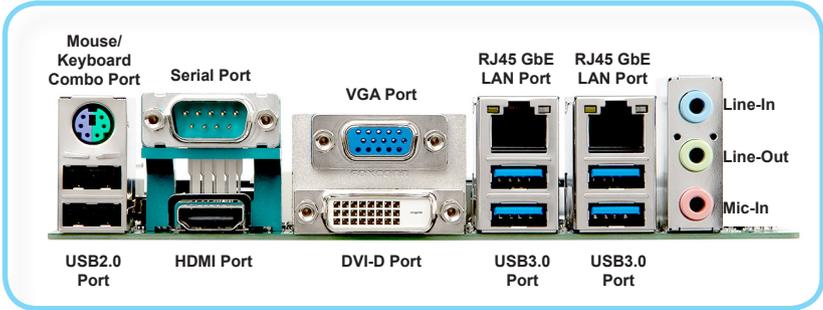
This connector is used to provide power to the CPU.



Important

Make sure that all power connectors are connected to the power supply to ensure stable operation of the motherboard.

Rear Panel I/O



➤ Mouse / Keyboard Combo Port

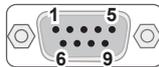
The standard PS/2[®] mouse/keyboard DIN connector is for a PS/2[®] mouse/keyboard.

➤ USB2.0 Port

The USB (Universal Serial Bus) port is for attaching USB devices such as keyboard, mouse, or other USB-compatible devices.

➤ RS-232/422/485 Serial Port: JCOM1

The serial port is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. With Auto-Flow Control and RI Function Support, it supports barcode scanners, barcode printers, bill printers, credit card machine, etc.



RS-232

PIN	SIGNAL	DESCRIPTION
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	POWER	5V or 12V selected by GPIO (BIOS)

RS-422

PIN	SIGNAL	DESCRIPTION
1	TXD-	Transmit Data, Negative
2	TXD+	Transmit Data, Positive
3	RXD+	Receive Data, Positive
4	RXD-	Receive Data, Negative
5	GND	Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

RS-485

PIN	SIGNAL	DESCRIPTION
1	D-	Data, Negative
2	D+	Data, Positive
3	NC	No Connection
4	NC	No Connection
5	GND	Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

➤ **HDMI Port**  HIGH-DEFINITION MULTIMEDIA INTERFACE

The High-Definition Multimedia Interface (HDMI) is an all-digital audio/video interface capable of transmitting uncompressed streams. HDMI supports all TV format, including standard, enhanced, or high-definition video, plus multi-channel digital audio on a single cable.

➤ **VGA Port**

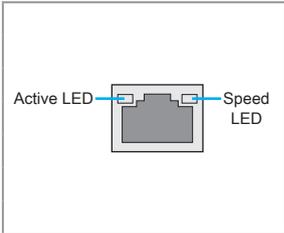
The DB15-pin female connector is provided for monitor.

➤ **DVI-D Port**

The DVI-D (Digital Visual Interface-Digital) connector allows you to connect an LCD monitor. It provides a high-speed digital interconnection between the computer and its display device. To connect an LCD monitor, simply plug your monitor cable into the DVI connector, and make sure that the other end of the cable is properly connected to your monitor (refer to your monitor manual for more information.)

➤ RJ45 GbE LAN Port

The standard single RJ45 LAN jack is provided for connection to the Local Area Network (LAN). You can connect a network cable to it.

	LED	LED Status	Description
	Active LED	Off	No link
		Yellow	Linked
		Blinking	Data activity
	Speed LED	Off	10 Mbps connection
		Green	100 Mbps connection
Orange		1 Gbps connection	

➤ USB3.0 Port

The USB 3.0 port is backward-compatible with USB 2.0 devices and supports data transfer rate up to 5 Gbit/s (SuperSpeed).

➤ Line-In Jack

For external CD player, tapeplayer or other audio devices.

➤ Line-Out Jack

For speakers or headphones.

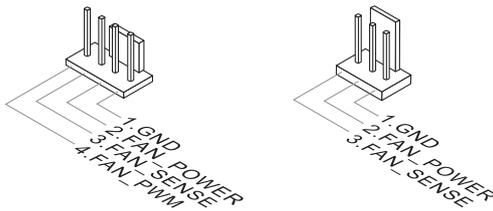
➤ Mic-In Jack

For microphones.

Connector

Fan Power Connector: CPUFAN1, SYSFAN1

The fan power connectors support system cooling fan with +12V. When connecting the wire to the connectors, always note that the red wire is the positive and should be connected to the +12V; the black wire is Ground and should be connected to GND. If the motherboard has a System Hardware Monitor chipset onboard, you must use a specially designed fan with speed sensor to take advantage of the CPU fan control.

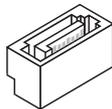


Important

- Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.
- Fan cooler sets with 3- or 4-pin power connector are both available.

Serial ATA Connector: SATA1, SATA2, SATA3, SATA4 (4 x SATA 6Gb/s for SKU1, 3 x SATA 6Gb/s for SKU2)

This connector is a high-speed Serial ATA interface port. Each connector can connect to one Serial ATA device.



Important

Please do not fold the SATA cable into a 90-degree angle. Otherwise, data loss may occur during transmission.

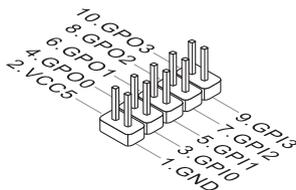
Chassis Intrusion Header: J1

This connector connects to the chassis intrusion switch cable. If the computer case is opened, the chassis intrusion mechanism will be activated. The system will record this intrusion and a warning message will flash on screen. To clear the warning, you must enter the BIOS utility and clear the record.



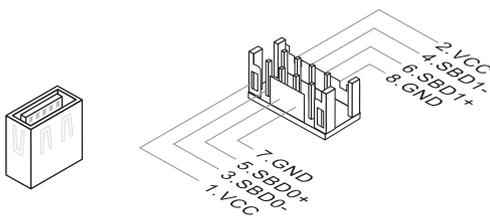
GPIO Connector: JGPIO1

This connector is provided for the General-Purpose Input/Output (GPIO) peripheral module.



USB2.0 Connector: JUSB1, JUSB2

This connector, compliant with Intel I/O Connectivity Design Guide, is ideal for connecting high-speed USB interface peripherals such as USB HDD, digital cameras, MP3 players, printers, modems and the like.

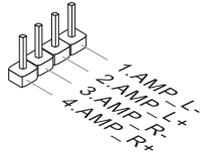


Important

Note that the pins of VCC and GND must be connected correctly to avoid possible damage.

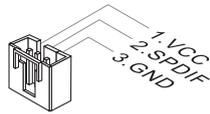
Audio Amplifier Connector: JSPK1

The connector is used to connect audio amplifiers to enhance audio performance.



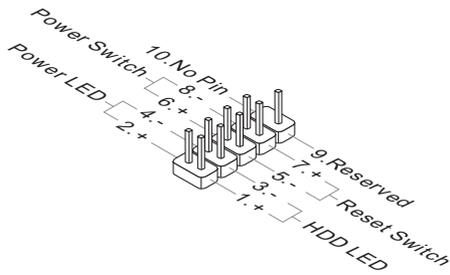
S/PDIF-Out Connector: JSPDI1

This header is used to connect S/PDIF (Sony & Philips Digital Interconnect Format) interface for digital audio transmission.



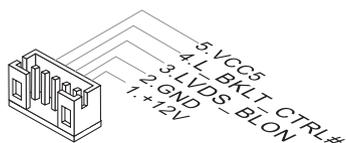
Front Panel Header: JFP1

This front panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.



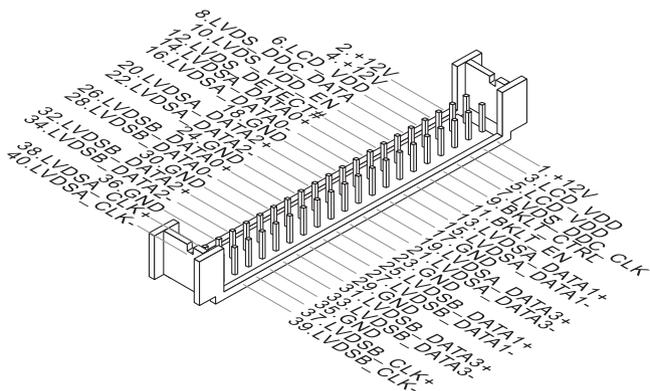
LVDS Inverter Connector: JINVDD1

The connector is provided for LCD backlight options.



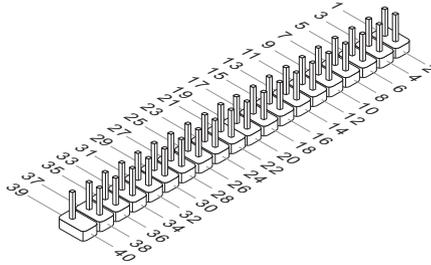
LVDS Connector: JLVDS1

The LVDS (Low Voltage Differential Signal) connector provides a digital interface typically used with flat panels. After connecting an LVDS interface flat panel to the JLVDS1, be sure to check the panel datasheet and set the LVDS jumper to proper power voltage.



RS-232 COM Port Header: JCOM3

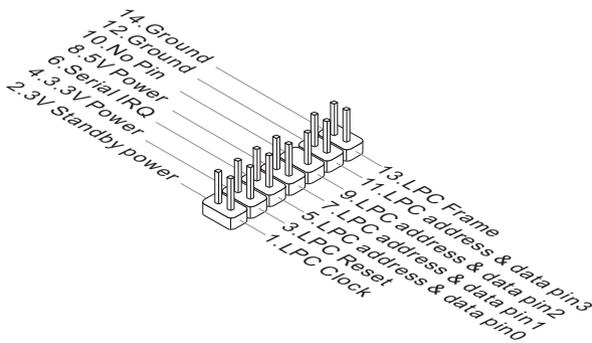
This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach serial devices to it through the optional serial port bracket.



PIN				SIGNAL	DESCRIPTION
1	11	21	31	DCD	Data Carrier Detect
2	12	22	32	RXD	Receive Data
3	13	23	33	TXD	Transmit Data
4	14	24	34	DTR	Data Terminal Ready
5	15	25	35	GND	Ground
6	16	26	36	DSR	Data Set Ready
7	17	27	37	RTS	Request To Send
8	18	28	38	CTS	Clear To Send
9	19	29	39	POWER	5V or 12V selected by Jumper
10	20	30	40	NC	No Connection

LPC Debug Port Connector: JTPM1 (With TPM Support)

This connector works as LPC debug port and supports TPM modules.



Jumper

Important

Avoid adjusting jumpers when the system is on; it will damage the motherboard.

Clear CMOS Jumper: J_CMOS1

There is a CMOS RAM onboard that has a power supply from an external battery to keep the data of system configuration. With the CMOS RAM, the system can automatically boot OS every time it is turned on. If you want to clear the system configuration, set the jumper to clear data.

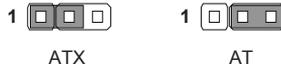


Important

You can clear CMOS by shorting 2-3 pin while the system is off. Then return to 1-2 pin position. Avoid clearing the CMOS while the system is on; it will damage the motherboard.

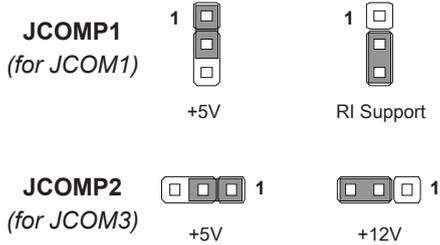
AT/ATX Select Jumper: JAT1

This jumper allows users to select between AT and ATX power.



COM Port Power Jumper: JCOMP1 (for JCOM1), JCOMP2 (for JCOM3)

These jumpers specify the operation voltage of the onboard serial ports.



LVDS Power Jumper: JVDD1

Use this jumper to specify the operation voltage of the LVDS display.



ME Jumper: ME_DIS1

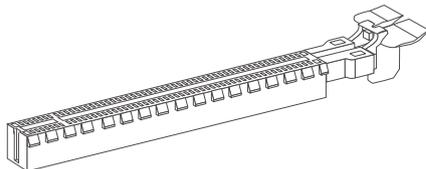
This jumper enables/disables ME.



Slot

PCIe (Peripheral Component Interconnect Express) Slot

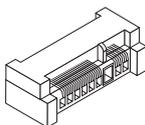
The PCI Express slot supports PCIe interface expansion cards.



PCIe x16 slot

Mini-PCIe (Peripheral Component Interconnect Express) Slot

The Mini-PCIe slot is provided for WiFi modules, Bluetooth modules, TV tuner cards and other Mini-PCIe cards.



Important

When adding or removing expansion cards, make sure that you unplug the power supply first. Meanwhile, read the documentation for the expansion card to configure any necessary hardware or software settings for the expansion card, such as jumpers, switches or BIOS configuration.

3 BIOS Setup

This chapter provides information on the BIOS Setup program and allows users to configure the system for optimal use.

Users may need to run the Setup program when:

- An error message appears on the screen at system startup and requests users to run SETUP.
- Users want to change the default settings for customized features.

Important

- *Please note that BIOS update assumes technician-level experience.*
- *As the system BIOS is under continuous update for better system performance, the illustrations in this chapter should be held for reference only.*

Entering Setup

Power on the computer and the system will start POST (Power On Self Test) process. When the message below appears on the screen, press or <F2> key to enter Setup.

Press or <F2> to enter SETUP

If the message disappears before you respond and you still wish to enter Setup, restart the system by turning it OFF and On or pressing the RESET button. You may also restart the system by simultaneously pressing <Ctrl>, <Alt>, and <Delete> keys.

Important

The items under each BIOS category described in this chapter are under continuous update for better system performance. Therefore, the description may be slightly different from the latest BIOS and should be held for reference only.

Control Keys

← →	Select Screen
↑ ↓	Select Item
Enter	Select
+ -	Change Option
F1	General Help
F7	Previous Values
F9	Optimized Defaults
F10	Save & Reset
Esc	Exit

Getting Help

After entering the Setup menu, the first menu you will see is the Main Menu.

Main Menu

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

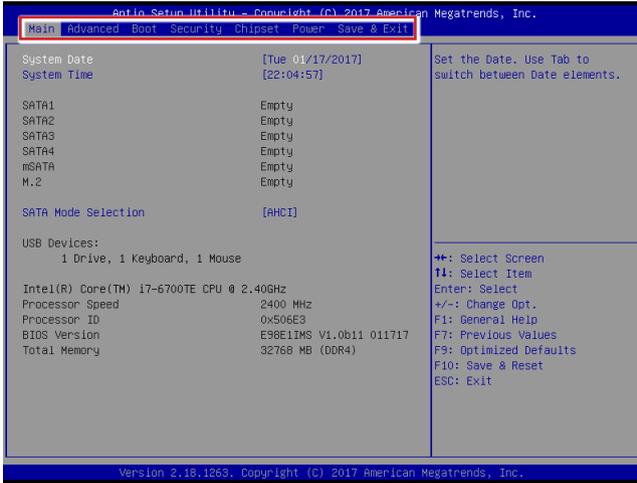
Sub-Menu

If you find a right pointer symbol appears to the left of certain fields that means a sub-menu can be launched from this field. A sub-menu contains additional options for a field parameter. You can use arrow keys (↑ ↓) to highlight the field and press <Enter> to call up the sub-menu. Then you can use the control keys to enter values and move from field to field within a sub-menu. If you want to return to the main menu, just press the <Esc >.

General Help <F1>

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

The Menu Bar



► Main

Use this menu for basic system configurations, such as time, date, etc.

► Advanced

Use this menu to set up the items of special enhanced features.

► Boot

Use this menu to specify the priority of boot devices.

► Security

Use this menu to set supervisor and user passwords.

► Chipset

This menu controls the advanced features of the onboard chipsets.

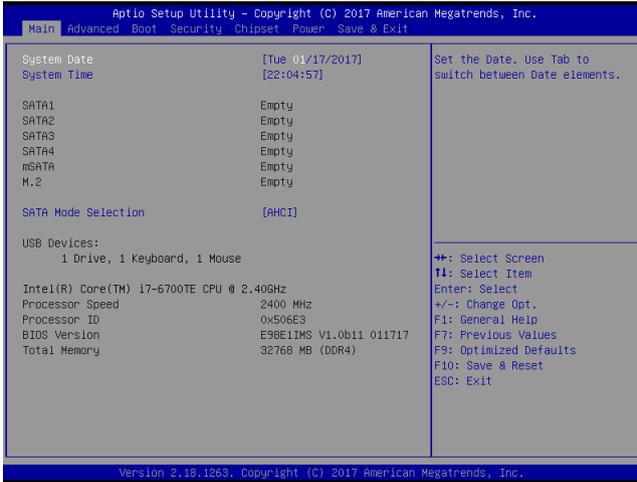
► Power

Use this menu to specify your settings for power management.

► Save & Exit

This menu allows you to load the BIOS default values or factory default settings into the BIOS and exit the BIOS setup utility with or without changes.

Main



► System Date

This setting allows you to set the system date. The date format is <Day>, <Month> <Date> <Year>.

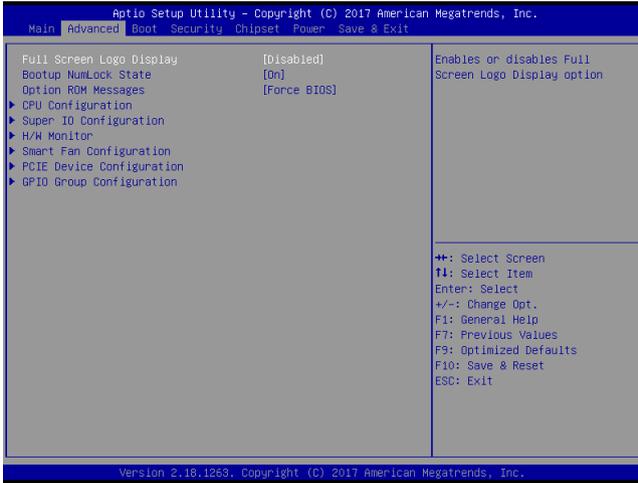
► System Time

This setting allows you to set the system time. The time format is <Hour> <Minute> <Second>.

► SATA Mode Selection

This setting specifies the SATA controller mode.

Advanced



► Full Screen Logo Display

This BIOS feature determines if the BIOS should hide the normal POST messages with the motherboard or system manufacturer's full-screen logo.

When it is enabled, the BIOS will display the full-screen logo during the boot-up sequence, hiding normal POST messages.

When it is disabled, the BIOS will display the normal POST messages, instead of the full-screen logo.

Please note that enabling this BIOS feature often adds 2-3 seconds of delay to the booting sequence. This delay ensures that the logo is displayed for a sufficient amount of time. Therefore, it is recommended that you disable this BIOS feature for a faster boot-up time.

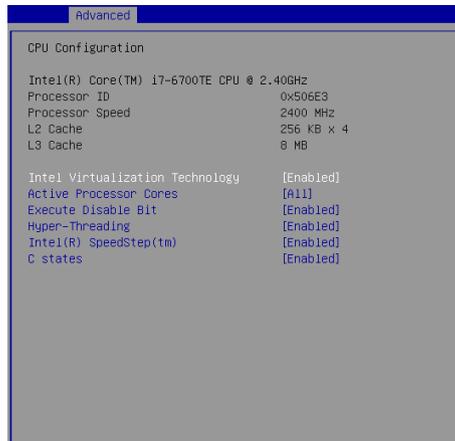
► Bootup NumLock State

This setting is to set the Num Lock status when the system is powered on. Setting to [On] will turn on the Num Lock key when the system is powered on. Setting to [Off] will allow users to use the arrow keys on the numeric keypad.

► Option ROM Messages

This item is used to determine the display mode when an optional ROM is initialized during POST. When set to [Force BIOS], the display mode used by AMI BIOS is used. Select [Keep Current] if you want to use the display mode of optional ROM.

► CPU Configuration



► Intel Virtualization Technology

Virtualization enhanced by Intel Virtualization Technology will allow a platform to run multiple operating systems and applications in independent partitions. With virtualization, one computer system can function as multiple “Virtual” systems.

► Active Processor Cores

This setting specifies the number of active processor cores.

► Execute Disable Bit

Intel's Execute Disable Bit functionality can prevent certain classes of malicious “buffer overflow” attacks when combined with a supporting operating system. This functionality allows the processor to classify areas in memory by where application code can execute and where it cannot. When a malicious worm attempts to insert code in the buffer, the processor disables code execution, preventing damage or worm propagation.

► Hyper-Threading

The processor uses Hyper-Threading technology to increase transaction rates and reduces end-user response times. The technology treats the two cores inside the processor as two logical processors that can execute instructions simultaneously. In this way, the system performance is highly improved. If you disable the function, the processor will use only one core to execute the instructions. Please disable this item if your operating system doesn't support HT Function, or unreliability and instability may occur.

► Intel(R) SpeedStep(TM)

EIST (Enhanced Intel SpeedStep Technology) allows the system to dynamically adjust processor voltage and core frequency, which can result in decreased average power consumption and decreased average heat production. When disabled, the processor will return the actual maximum CPUID input value of the processor when queried.

► C States

This setting controls the C-States (CPU Power states).

► Super IO Configuration



► Serial Port 1/ 2/ 3/ 4/ 5

This setting enables/disables the specified serial port.

► Change Settings

This setting is used to change the address & IRQ settings of the specified serial port.

► Mode Select

Select an operation mode for Serial Port 1.

► Power Voltage

Select the power voltage for Serial Port 1.

► Watch Dog Timer

You can enable the system watch-dog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watch dog polls it.

► FIFO Mode

This setting controls the FIFO data transfer mode.

► Shared IRQ Mode

This setting provides the system with the ability to share interrupts among its serial ports.

► H/W Monitor

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

Advanced	
PC Health Status	
Thermal Shutdown	[Disabled]
CPU temperature	: +34 C
System temperature	: +28 C
CPUFAN1	: 5494 RPM
SYSFAN1	: N/A
VCC_CORE	: +0.976 V
VCC3	: +3.288 V
VCC5	: +5.129 V
+12V	: +12.144 V
VCC3V	: +3.296 V
VSB3V	: +3.280 V
VSB5V	: +4.992 V
VBAT	: +3.168 V

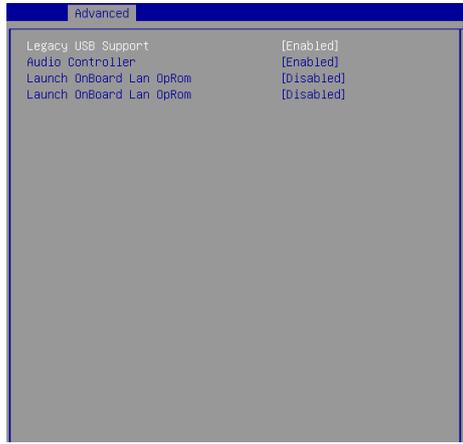
► Smart Fan Configuration

Advanced	
Configuration Smart FAN	
CPUFAN1	[Disabled]
SYSFAN1	[Disabled]

► CPUFAN1, SYSFAN1

These settings enable/disable the Smart Fan function. Smart Fan is an excellent feature which will adjust the CPU/system fan speed automatically depending on the current CPU/system temperature, avoiding the overheating to damage your system.

► **PCIe Device Configuration**



► **Legacy USB Support**

Set to [Enabled] if you need to use any USB 1.1/2.0 device in the operating system that does not support or have any USB 1.1/2.0 driver installed, such as DOS and SCO Unix.

► **Audio Controller**

This setting enables/disables the onboard audio controller.

► **Launch OnBoard LAN OpROM**

These settings enable/disable the initialization of the onboard/onchip LAN Boot ROM during bootup. Selecting [Disabled] will speed up the boot process.

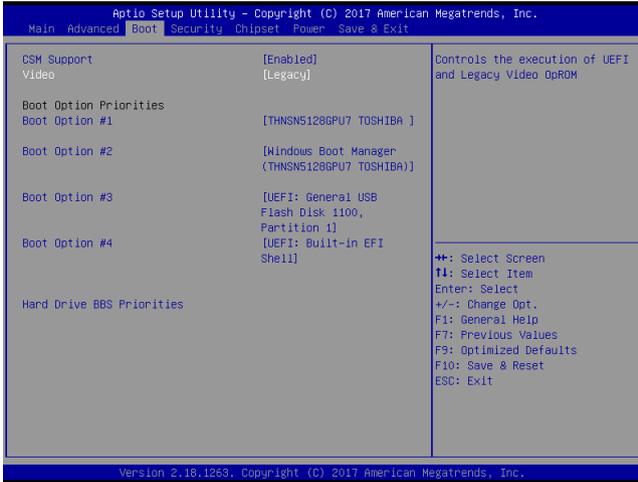
▶ GPIO Group Configuration

Advanced	
GPIO Group Configuration	
GPIO0	[Low]
GPIO1	[Low]
GPIO2	[Low]
GPIO3	[Low]

▶ GPIO0 ~ GPIO3 Data

These settings control the operation mode of the specified GPIO.

Boot



► CSM Support

This setting enables/disables the support for Compatibility Support Module, a part of the Intel Platform Innovation Framework for EFI providing the capability to support legacy BIOS interfaces.

Important

If the Operating System is going to boot in UEFI mode, disable CSM Support to speed up the boot process.

► Video

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

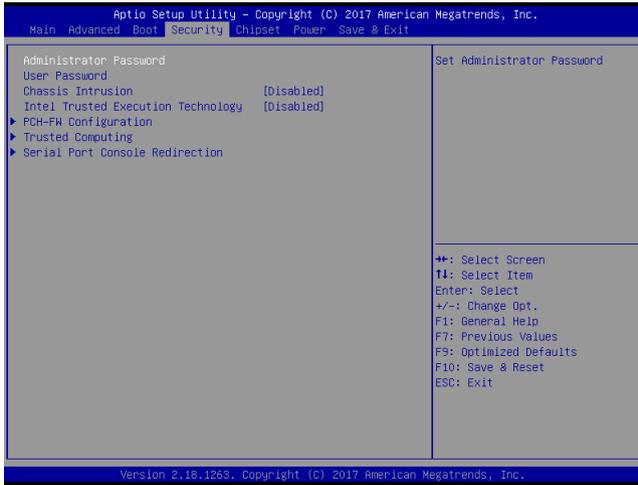
► Boot Option Priorities

This setting allows users to set the sequence of boot devices where BIOS attempts to load the disk operating system.

► Hard Drive BBS Priorities

This setting allows users to set the priority of the specified devices. First press <Enter> to enter the sub-menu. Then you may use the arrow keys (↑↓) to select the desired device, then press <+>, <-> or <PageUp>, <PageDown> key to move it up/down in the priority list.

Security



► Administrator Password

Administrator Password controls access to the BIOS Setup utility.

► User Password

User Password controls access to the system at boot and to the BIOS Setup utility.

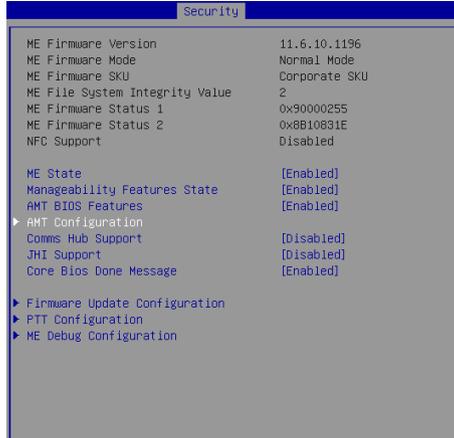
► Chassis Intrusion

The field enables or disables the feature of recording the chassis intrusion status and issuing a warning message if the chassis is once opened.

► Intel Trusted Execution Technology

Intel Trusted Execution Technology provides highly scalable platform security in physical and virtual infrastructures.

► PCH-FW Configuration



► **ME Firmware Version, ME Firmware Mode, ME Firmware SKU, ME File System Integrity Value, ME Firmware Status 1, ME Firmware Status 2**

These settings show the firmware information of the Intel ME (Management Engine).

► **ME State**

This setting specifies the Intel Management Engine state.

► **Manageability Features State**

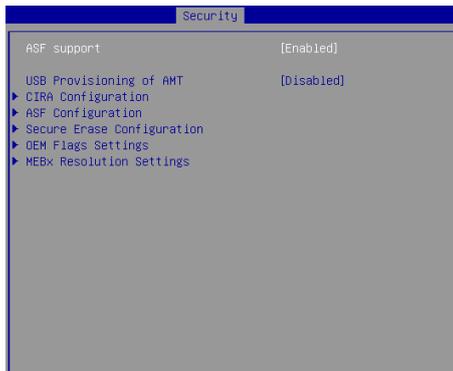
This setting specifies the Intel ME Manageability Features.

► **AMT BIOS Features**

This setting specifies the AMT BIOS Features.

► **AMT Configuration**

Intel Active Management Technology (AMT) is hardware-based technology for remotely managing and securing PCs out-of-band.



► **Comms Hub Support**

This setting enables/disables Comms Hub Support.

► **JHI Support**

This setting enables/disables JHI Support.

► **Core BIOS Done Message**

This setting enables/disables the Core BIOS Done Message.

► **Firmware Update Configuration**



► **ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

► **PTT Configuration**

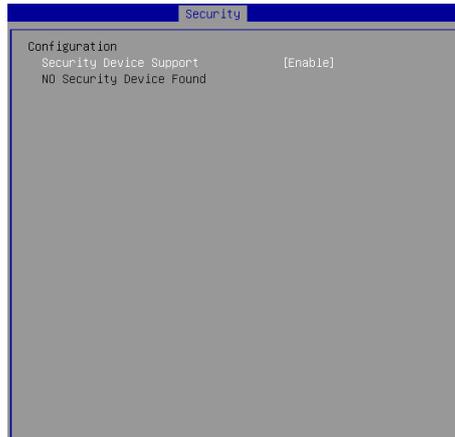
Intel Platform Trust Technology (PTT) is a platform functionality for credential storage and key management used by Microsoft Windows.



► ME Debug Configuration



► Trusted Computing



► Security Device Support

This setting enables/disables BIOS support for security device. When set to [Disable], the OS will not show security device. TCG EFI protocol and INT1A interface will not be available.

► Serial Port Console Redirection



► Console Redirection

Console Redirection operates in host systems that do not have a monitor and keyboard attached. This setting enables/disables the operation of console redirection. When set to [Enabled], BIOS redirects and sends all contents that should be displayed on the screen to the serial COM port for display on the terminal screen. Besides, all data received from the serial port is interpreted as keystrokes from a local keyboard.

► Console Redirection Settings



► Terminal Type

To operate the system's console redirection, you need a terminal supporting

ANSI terminal protocol and a RS-232 null modem cable connected between the host system and terminal(s). This setting specifies the type of terminal device for console redirection.

► **Bits per second, Data Bits, Parity, Stop Bits**

This setting specifies the transfer rate (bits per second, data bits, parity, stop bits) of Console Redirection.

► **Flow Control**

Flow control is the process of managing the rate of data transmission between two nodes. It's the process of adjusting the flow of data from one device to another to ensure that the receiving device can handle all of the incoming data. This is particularly important where the sending device is capable of sending data much faster than the receiving device can receive it.

► **VT-UTF8 Combo Key Support**

This setting enables/disables the VT-UTF8 combination key support for ANSI/VT100 terminals.

► **Recorder Mode, Resolution 100x31**

These settings enable/disable the recorder mode and the resolution 100x31.

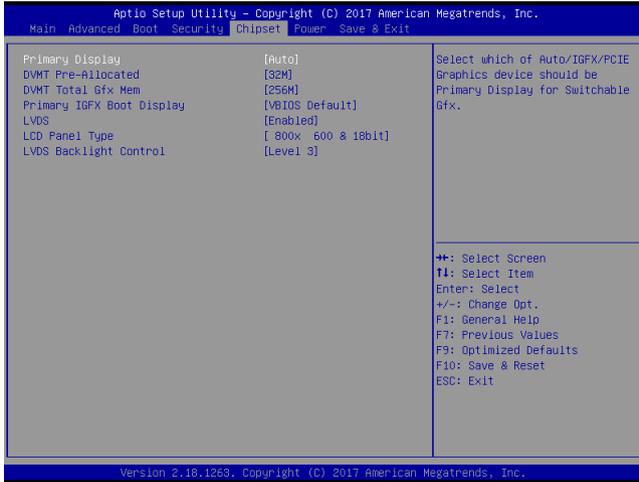
► **Legacy OS Redirection Resolution**

This setting specifies the redirection resolution of legacy OS.

► **Putty Keypad**

PuTTY is a terminal emulator for Windows. This setting controls the numeric keypad for use in PuTTY.

Chipset



► Primary Display

This setting specifies which is your primary graphics adapter.

► DVMT Pre-Allocated

This setting defines the DVMT pre-allocated memory. Pre-allocated memory is the small amount of system memory made available at boot time by the system BIOS for video. Pre-allocated memory is also known as locked memory. This is because it is "locked" for video use only and as such, is invisible and unable to be used by the operating system.

► DVMT Total Gfx Mem

This setting specifies the memory size for DVMT.

► Primary IGFX Boot Display

Use the field to select the type of device you want to use as the display(s) of the system.

► LVDS

This setting enables/disables LVDS.

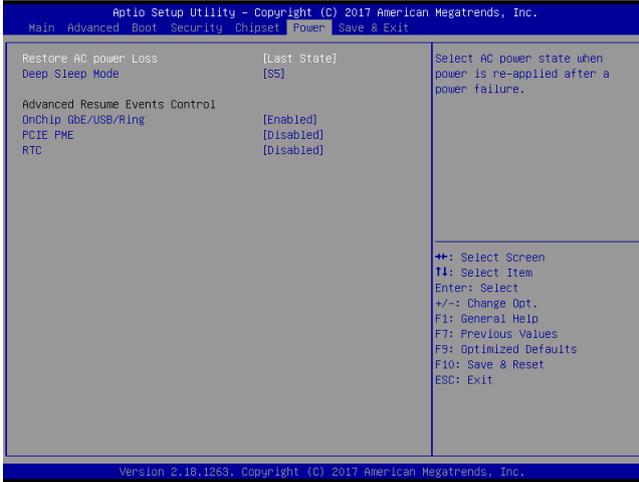
► LCD Panel Type

This setting allows you to select the LCD display type.

► LVDS Backlight Control

This setting controls the LVDS backlight.

Power



► **Restore AC Power Loss**

This setting specifies whether your system will reboot after a power failure or interrupt occurs. Available settings are:

[Power Off]	Leaves the computer in the power off state.
[Power On]	Leaves the computer in the power on state.
[Last State]	Restores the system to the previous status before power failure or interrupt occurred.

► **Deep Sleep Mode**

The setting specifies the deep sleep mode.

**** Advanced Resume Events Control ****

► **OnChip GbE/USB/Ring**

The item allows the activity of the OnChip GbE/USB/Ring device to wake up the system from S3/S4 sleep state.

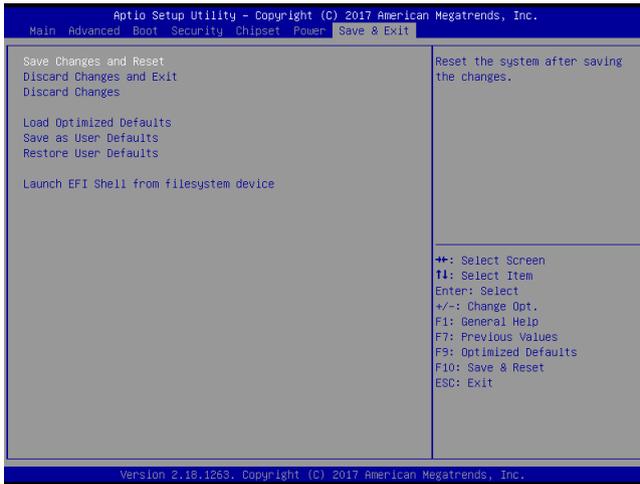
► **PCIE PME**

This field specifies whether the system will be awakened from power saving modes when activity or input signal of onboard PCIE PME is detected.

► **RTC**

When [Enabled], you can set the date and time at which the RTC (real-time clock) alarm awakens the system from suspend mode.

Save & Exit



► Save Changes and Reset

Save changes to CMOS and reset the system.

► Discard Changes and Exit

Abandon all changes and exit the Setup Utility.

► Discard Changes

Abandon all changes.

► Load Optimized Defaults

Use this menu to load the default values set by the motherboard manufacturer specifically for optimal performance of the motherboard.

► Save as User Defaults

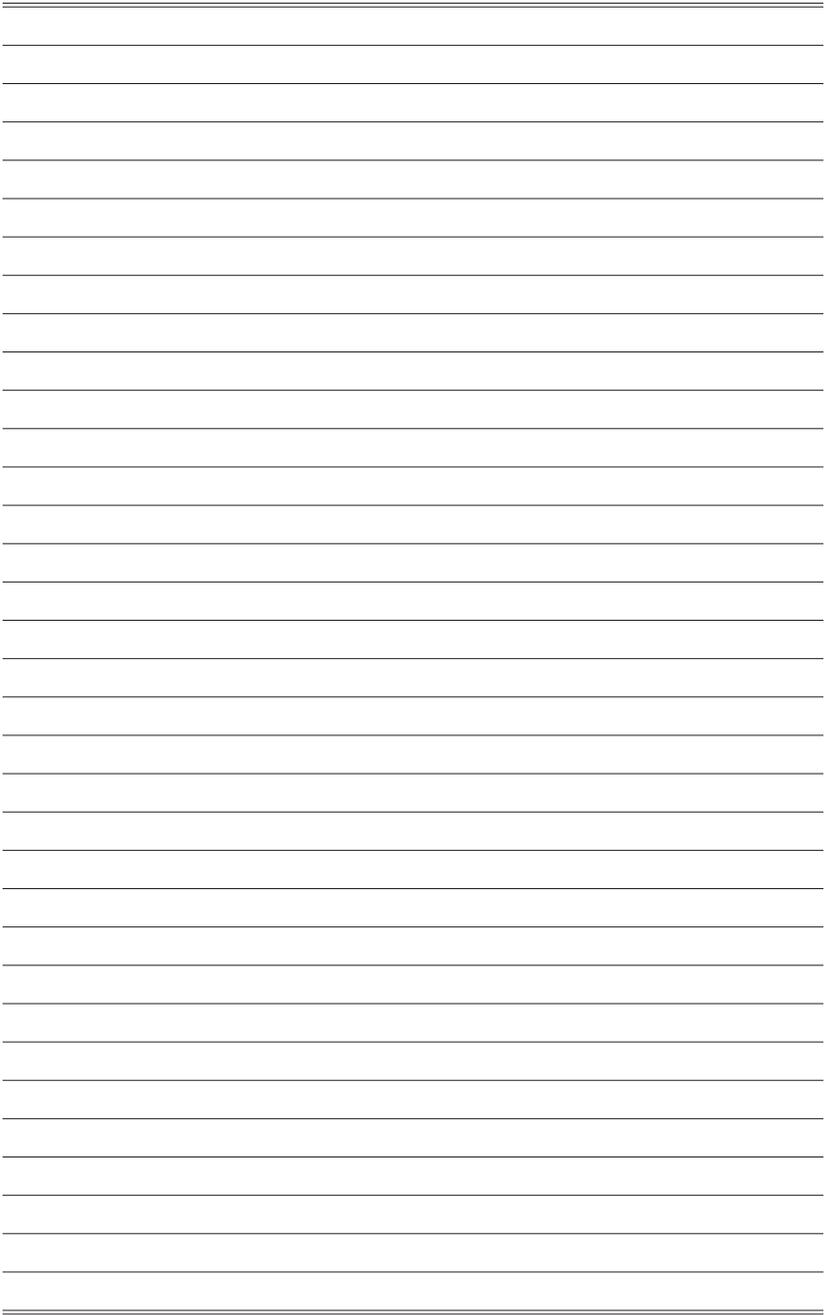
Save changes as the user's default profile.

► Restore User Defaults

Restore the user's default profile.

► Launch EFI Shell from filesystem device

This setting helps to launch the EFI Shell application from one of the available file system devices.



Appendix

WDT & GPIO



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

WDT Sample Code

```

SIO_INDEX_Port    equ 04Eh
SIO_DATA_Port     equ 04Fh
SIO_UnLock_Value  equ 087h
SIO_Lock_Value    equ 0AAh
WatchDog_LDN      equ 007h
WDT_UNIT          equ 60h    ;60h=second, 68h=minute, 40h=Disabled watchdog timer
WDT_Timer         equ 30     ;ex. 30 seconds

```

Sample code:

```

;Enable config mode
mov    dx, SIO_INDEX_Port
mov    al, SIO_UnLock_Value
out    dx, al
jmp    short $+2          ;Io_delay
jmp    short $+2          ;Io_delay
out    dx, al
;Change to WDT
mov    dx, SIO_INDEX_Port
mov    al, 07h
out    dx, al
mov    dx, SIO_DATA_Port
mov    al, WatchDog_LDN
out    dx, al
;Active WDT
mov    dx, SIO_INDEX_Port
mov    al, 30h
out    dx, al
mov    dx, SIO_DATA_Port
in     al, dx
or     al, 01h
out    dx, al
;set timer
mov    dx, SIO_INDEX_Port
mov    al, 0F6h
out    dx, al
mov    dx, SIO_DATA_Port
mov    al, WDT_Timer
out    dx, al
;set UINIT
mov    dx, SIO_INDEX_Port
mov    al, 0F5h
out    dx, al
mov    dx, SIO_DATA_Port
mov    al, WDT_UNIT
out    dx, al
;enable reset
mov    dx, SIO_INDEX_Port
mov    al, 0FAh
out    dx, al
mov    dx, SIO_DATA_Port
in     al, dx
or     al, 01h
out    dx, al
;close config mode
mov    dx, SIO_INDEX_Port
mov    al, SIO_Lock_Value
out    dx, al

```

GPIO Sample Code

- GPI 0 ~ GPI 3

	GPI 0	GPI 1	GPI 2	GPI 3				
IO Address								
SIO_GPIO_Register	8Ah	8Ah	8Ah	8Ah				
Bit	0	1	2	3				
Sample code	#1	#1	#1	#1				

- GPO 0 ~ GPO 3

	GPO 0	GPO 1	GPO 2	GPO 3				
IO Address								
SIO_GPIO_Register	82h	82h	82h	82h				
Bit	4	5	6	7				
Sample code	#2	#2	#2	#2				

```

SIO_INDEX_Port      equ    04Eh
SIO_DATA_Port       equ    04Fh
SIO_UnLock_Value    equ    087h
SIO_Lock_Value      equ    0AAh
SIO_LDN_GPIO        equ    06h
GPI_REG             equ    08Ah
GPO_REG             equ    082h
GPO_0               equ    00010000b

```

Sample Code:

#1 : Get GPI 0 status

```

; Enable config mode
mov  dx, SIO_INDEX_Port
mov  al, SIO_UnLock_Value
out  dx, al
jmp  short $+2          ;Io_delay
jmp  short $+2          ;Io_delay
out  dx, al

; Switch GPIO Configuration for SIO_LDN 0x06
mov  dx, SIO_INDEX_Port
mov  al, 07h
out  dx, al
mov  dx, SIO_DATA_Port
mov  al, SIO_LDN_GPIO
out  dx, al

; Get GPI 0 Pin Status Register
mov  dx, SIO_INDEX_Port

```

```

mov    al, GPI_REG
out    dx, al
mov    dx, SIO_DATA_Port
in     al, dx
;al bit0 = GPI 0 status
: Exit SIO
mov    dx, SIO_INDEX_Port
mov    al, SIO_Lock_Value
out    dx, al

```

#2 : Set GPO 0 status to high

```

: Enable config mode
mov    dx, SIO_INDEX_Port
mov    al, SIO_UnLock_Value
out    dx, al
jmp    short $+2           ;Io_delay
jmp    short $+2           ;Io_delay
out    dx, al
: Switch GPIO Configuration For SIO LDN 0x06
mov    dx, SIO_INDEX_Port
mov    al, 07h
out    dx, al
mov    dx, SIO_DATA_Port
mov    al, SIO_LDN_GPIO
out    dx, al
: Set GPO 0 Pin to High
mov    dx, SIO_INDEX_Port
mov    al, GPO_REG
out    dx, al
mov    dx, SIO_DATA_Port
in     al, dx
or     al, GPO_0
out    dx, al
;al bit4 = GPO 0 status
: Exit SIO
mov    dx, SIO_INDEX_Port
mov    al, SIO_Lock_Value
out    dx, al

```