MS-98B5

(v1.x) Industrial Computer Board

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Revision History

Revision	Date
V1.0	2014/02

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 try the following help resources for further guidance.

Visit the MSI website for technical guide, BIOS updates, driver updates, and other information:
http://www.msi.com/service/download/

Contact our technical staff at:
http://support.msi.com/

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.

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

警告使用者:

這是甲類資訊產品，在居住的環境中使用時，可能會造成無線電干擾，在這種情況下，使用者會被要求採取某些適當的對策。

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/evmtprtt_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.

Taiwan:

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

廢電池請回收

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-A Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class A 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 commercial environment. 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. Operation of this equipment in a residential area is likely to cause harmful interference, in which case the user will be required to correct the interference at his own expense.

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.

VOIR LA NOTICE D'INSTALLATION AVANT DE RACCORDER AU RESEAU.

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. MSI will comply with the product take back requirements at the end of life of MSI-branded products that are sold into the EU. You can return these products to local collection points.

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1 Overview

Thank you for choosing the MS-98B5, an excellent industrial computer board.

Based on the innovative Intel® H81/ Q87 chipset for optimal system efficiency, the MS-98B5 accommodates the Intel® Haswell processor and supports up to 4 DDR3/DDR3L 1333/1600 UDIMM slots to provide the maximum of 32GB memory capacity.

In the advanced-level and mid-range market segment, MS-98B5 provides a high-performance solution for today's front-end and general purpose workstation, as well as in the future.

Mainboard Specifications

Processor

- 4th generation Intel Core i3/ i5/ i7 processor (LGA1150)

Chipset

- Q87 SKU
  - Intel Q87 chipset
- H81 SKU
  - Intel H81 chipset

Memory

- Q87 SKU
  - 4 DDR3/DDR3L 1333/1600 UDIMM slots
  - Supports the maximum of 32GB
  - Supports dual-channel mode
- H81 SKU
  - 2 DDR3/DDR3L 1333/1600 UDIMM slots
  - Supports the maximum of 16GB
  - Supports dual-channel mode

LAN

- Intel I217-LM Gigabit Fast Ethernet controller (LAN1)
- Intel I210-AT Gigabit Fast Ethernet controller (LAN2)

SATA

- Q87 SKU
  - 6 SATA 6Gb/s ports (SATA1, SATA2, SATA3, SATA4, SATA5_3, SATA6_4)
- H81 SKU
  - 2 SATA 6Gb/s ports (SATA1, SATA2)
  - 2 SATA 3Gb/s ports (SATA5_3, SATA6_4)

Audio

- Realtek ALC887 audio codec
- 3 audio jacks

Graphics

- Graphics integrated in Intel processor

Rear Panel I/O

- Q87 SKU
  - 1 PS/2 mouse/keyboard combo port
  - 2 RS-232/422/485 serial ports
  - 2 Gigabit LAN jacks
  - 4 USB 3.0 ports
  - 2 USB 2.0 ports
  - 1 DVI-I port
  - 1 DisplayPort
  - 3 flexible audio ports
- H81 SKU
  - 1 PS/2 mouse/keyboard combo port
  - 2 RS-232/422/485 serial ports
  - 2 Gigabit LAN jacks
  - 2 USB 3.0 ports
  - 4 USB 2.0 ports
  - 1 DVI-I port
  - 1 DisplayPort
  - 3 flexible audio ports

Onboard Pin Headers/ Connectors/ Jumpers

- Q87 SKU
  - 6 SATA 6Gb/s ports
  - 3 USB 2.0 connectors (6 ports)
  - 4 RS-232 serial port connectors
  - 1 TPM connector
  - 1 parallel port connector
  - 1 front panel connector
  - 1 front audio connector
  - 1 GPIO pin header
  - 1 SMBus connector
  - 1 DisplayPort connector
  - 1 chassis intrusion pin header
  - 1 clear CMOS jumper
  - 6 serial port power jumpers
  - 1 AT/ATX select jumper
  - 1 non-volatile memory jumper
- H81 SKU
  - 2 SATA 6Gb/s ports
  - 2 SATA 3Gb/s ports
  - 2 USB 2.0 connectors (4 ports)
  - 4 RS-232 serial port connectors
  - 1 TPM connector
  - 1 parallel port connector
  - 1 front panel connector
  - 1 front audio connector
  - 1 GPIO pin header
  - 1 SMBus connector
  - 1 DisplayPort connector
  - 1 chassis intrusion pin header
  - 1 clear CMOS jumper
  - 6 serial port power jumpers
  - 1 AT/ATX select jumper
  - 1 non-volatile memory jumper

Slot

- Q87 SKU
  - 1 PCIe x16 slot (Gen 3)
  - 3 PCIe x1 slots
  - 2 full-size Mini-PCIe slots
  - 3 PCI slots
- H81 SKU
  - 1 PCIe x16 slot (Gen 2)
  - 3 PCIe x1 slots
  - 3 PCI slots

Form Factor

- ATX form factor: 12” x 9.6”

Environmental

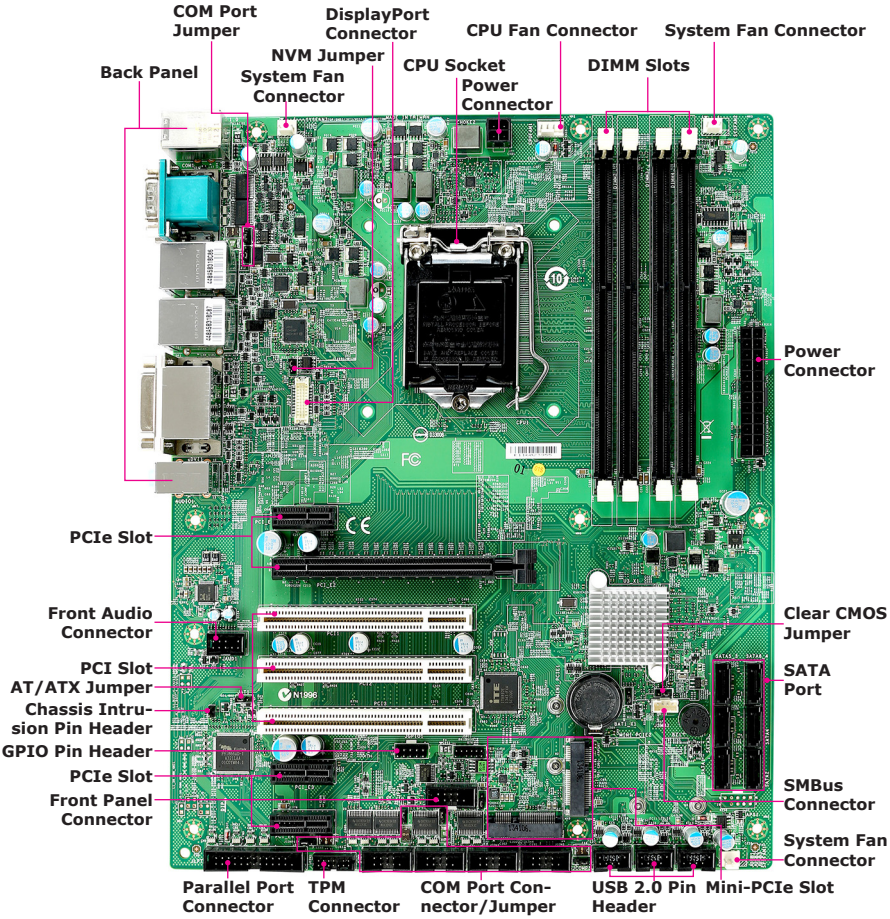
- Operating Temperature: 0°C ~ 60°C
- Storage Temperature: -20°C ~ 80°C
- Humidity: 5% ~ 90% RH, Non-Condensing

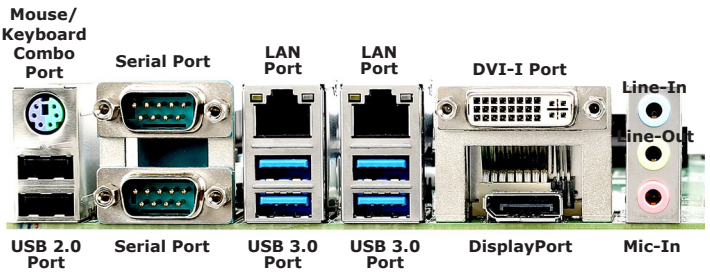
SKU Comparison

SKUs / Features	Q87 SKU	H81 SKU
PCH	Q87	H81
DIMM slot	4	2
SATA 6 G/bs qty	6	2
SATA 3 G/bs qty	0	2
Rear panel USB	4 USB 3.0 2 USB 2.0	2 USB 3.0 4 USB 2.0
Onboard USB pin header	3 USB 2.0 (6 Ports)	2 USB 2.0 (4 Ports)
Mini-PCIe slot	2	0

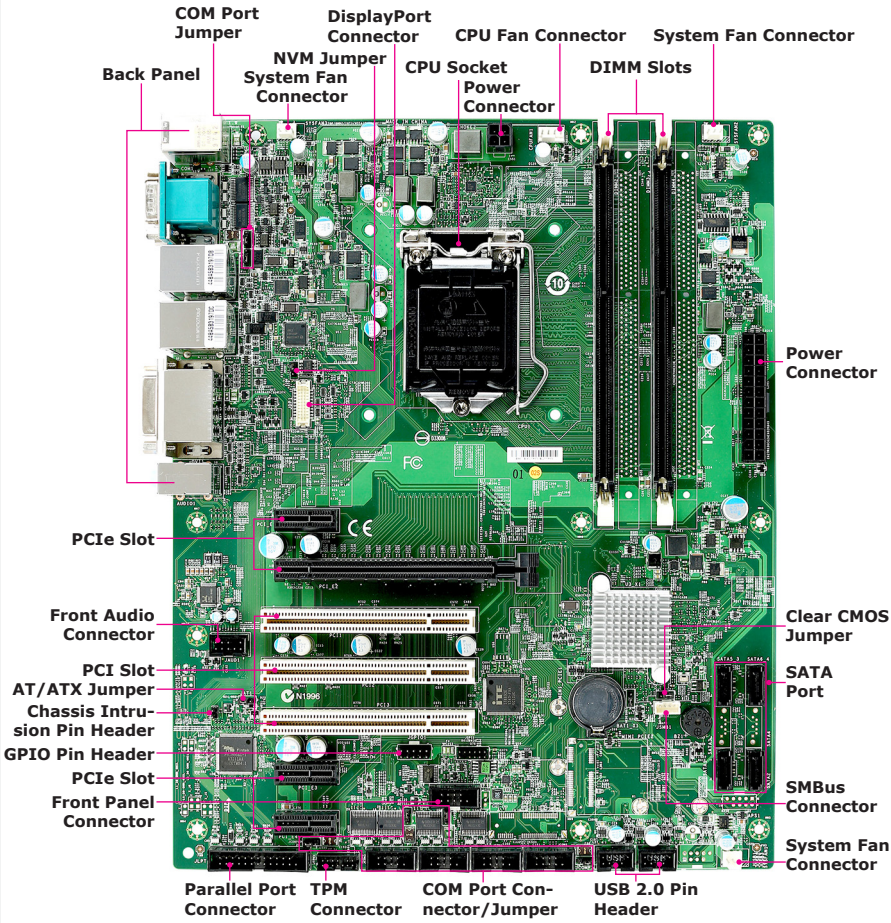
Mainboard Layout

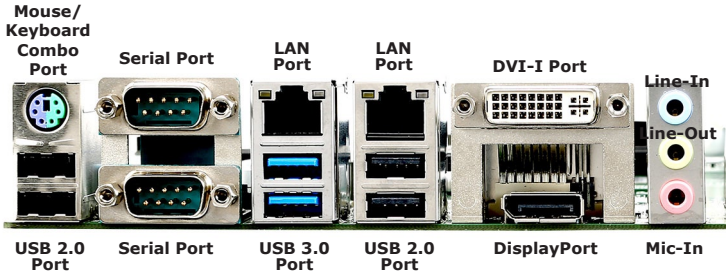
MS-98B5 Q87 SKU





MS-98B5 H81 SKU





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

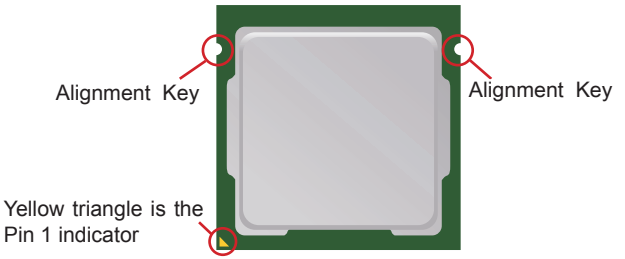
Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

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

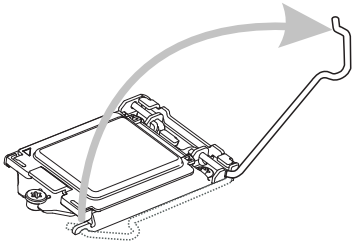
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



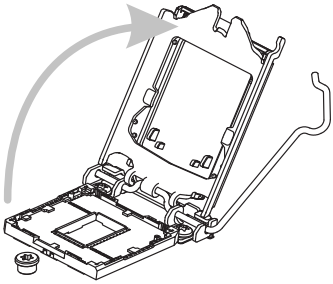
CPU Installation

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.

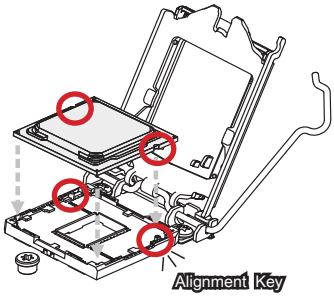
1. Open the load lever and remove the plastic cap.



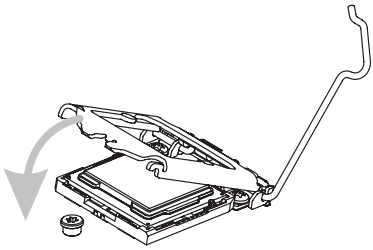
2. Lift the load lever up to fully open position.



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.



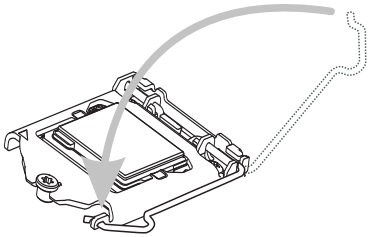
4. Engage the load lever while pressing down lightly onto the load plate.



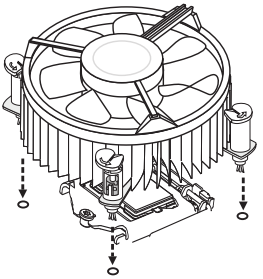
Important

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

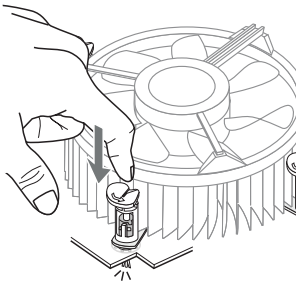
5. Secure the load lever with the hook under the retention tab.



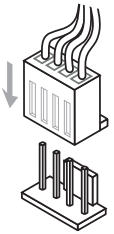
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



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 CPU fan connector on the motherboard.



Important

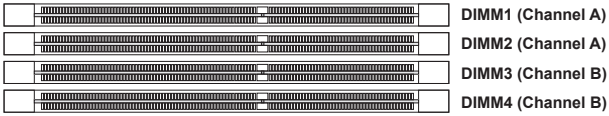
- *Confirm if your CPU cooler is firmly installed before turning on your system.*
- *Do not touch the CPU socket pins to avoid damage.*
- *Whenever CPU is not installed, always protect your CPU socket pins with the plastic cap covered.*
- *Please refer to the documentation in the CPU cooler package for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

Memory

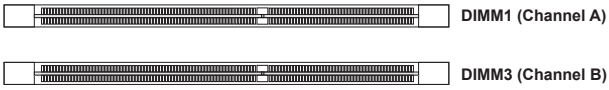
Dual-Channel Mode

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

Q87 SKU



H81 SKU



Recommended Memory Population

Q87 SKU

Number of DIMMs installed	1	2	3	4
DIMM1 (ch A)	V	V	V	V
DIMM2 (ch A)			V	V
DIMM3 (ch B)		V	V	V
DIMM4 (ch B)				V

H81 SKU

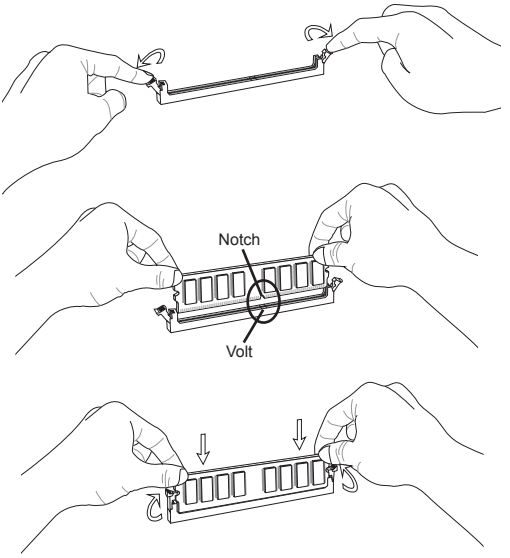
Number of DIMMs installed	1	2
DIMM1 (ch A)	V	V
DIMM3 (ch B)		V

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. The memory module has only one notch on the center and will only fit in the right orientation.
2. Insert the memory module vertically into the DIMM slot. Then push it in until the golden finger on the memory module is deeply inserted in the DIMM slot. The plastic clip at each side of the DIMM slot will automatically close when the memory module is properly seated.
3. Manually check if the memory module has been locked in place by the DIMM slot clips at the sides.



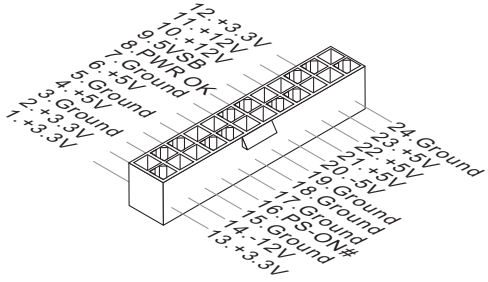
Important

- *You can barely see the golden finger if the memory module is properly inserted in the DIMM slot.*
- *To enable successful system bootup, always insert the memory module into the **DIMM1 first**.*

Power Supply

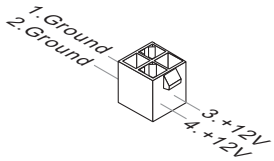
System Power Connector: JPWR1

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.

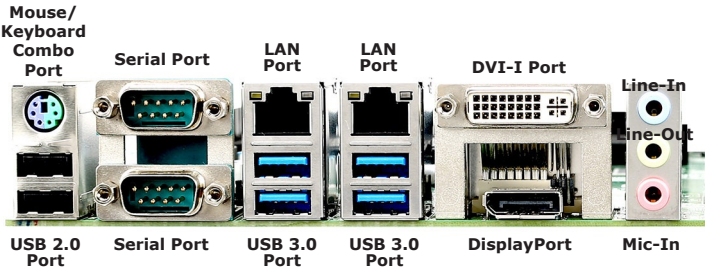


Important

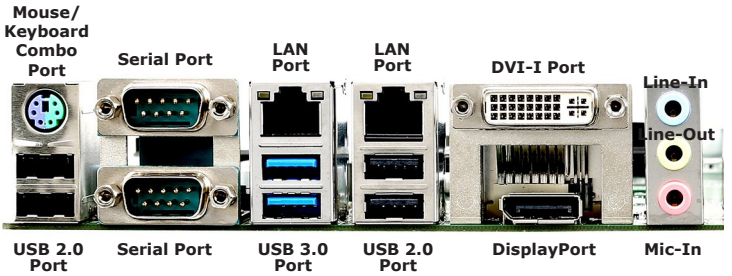
Make sure that all power connectors are connected to the power supply to ensure stable operation of the motherboard.

Rear Panel I/O

Q87 SKU



H81 SKU



➤ Keyboard / Mouse Combo Port

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

➤ USB 2.0 Port

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

➤ USB 3.0 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).

➤ RS-232/422/485 Serial Port

The serial port is a 16550A high speed communications port that sends/ receives 16 bytes FIFOs. You can attach a serial mouse or other serial devices directly to the connector.

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	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	VCC_COM1	Voltage select setting by jumper

RS-422

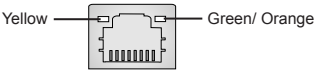
PIN	SIGNAL	DESCRIPTION
1	422 TXD-	Transmit Data, Negative
2	422 RXD+	Receive Data, Positive
3	422 TXD+	Transmit Data, Positive
4	422 RXD-	Receive Data, Negative
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

RS-485

PIN	SIGNAL	DESCRIPTION
1	485 TXD-	Transmit Data, Negative
2	NC	No Connection
3	485 TXD+	Transmit Data, Positive
4	NC	No Connection
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

➤ LAN Jack

The standard RJ-45 LAN jack is for connection to the Local Area Network (LAN). You can connect a network cable to it.



LED	Color	LED State	Condition
Left	Yellow	Off	LAN link is not established.
		On (steady state)	LAN link is established.
		On (blinking)	The computer is communicating with another computer on the LAN.
Right	Green	Off	10 Mbit/sec data rate is selected.
		On	100 Mbit/sec data rate is selected.
	Orange	On	1000 Mbit/sec data rate is selected.

➤ DVI-I Port

The DVI-I (Digital Visual Interface-Integrated) 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.)

➤ DisplayPort

DisplayPort is a digital display interface standard. This connector is used to connect a monitor with DisplayPort inputs.

➤ Audio Ports

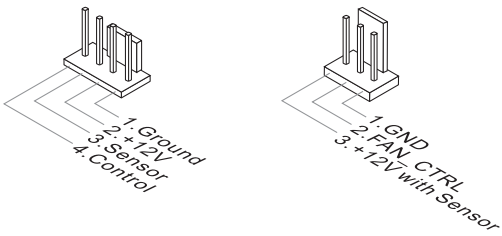
These audio connectors are used for audio devices. It is easy to differentiate between audio effects according to the color of audio jacks.

- Line-In (Blue) - Line In, is used for external CD player, tapeplayer or other audio devices.
- Line-Out (Green) - Line Out, is a connector for speakers or headphones.
- Mic (Pink) - Mic, is a connector for microphones.

Connector

Fan Power Connector: CPUFAN1, SYSFAN1 ~ SYSFAN3

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.

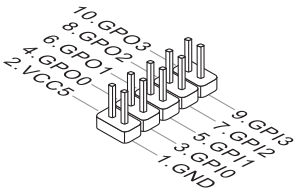


Important

- *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.*

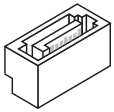
GPIO Pin Header: JGPIO1

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



Serial ATA Connector: SATA1 ~ SATA6

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



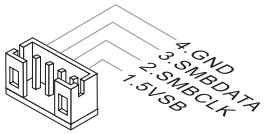
Speed / SKU	SATA 6 Gb/s	SATA 3 Gb/s
Q87 SKU	SATA1, SATA2, SATA3, SATA4, SATA5_3, SATA6_4	
H81 SKU	SATA1, SATA2	SATA5_3, SATA6_4

Important

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

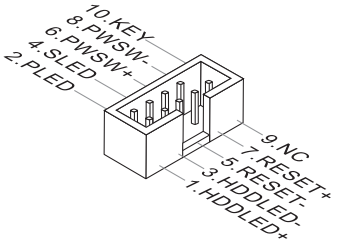
I2C Bus Connector: JSMB1

This connector, known as I2C, is for users to connect System Management Bus (SMBus) interface.



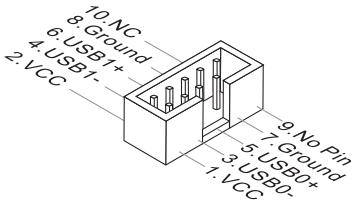
Front Panel Connector: JFP1

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.



USB 2.0 Connector: JUSB1, JUSB2, JUSB3

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.



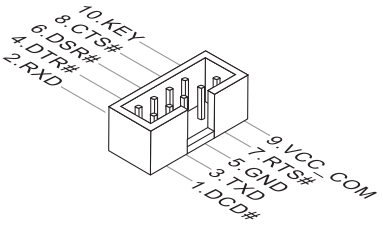
Speed / SKU	USB 2.0
Q87 SKU	JUSB1, JUSB2, JUSB3
H81 SKU	JUSB1, JUSB2

Important

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

RS-232 Serial Port Connector: JCOM3 ~ JCOM6

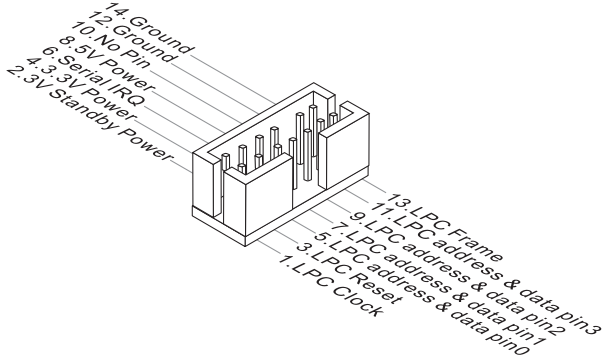
This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach a serial device to it.

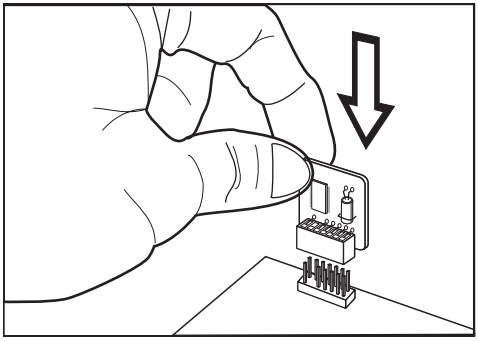


PIN	SIGNAL	DESCRIPTION
1	DCD	Data Carrier Detect
2	RXD	Receive Data
3	TXD	Transmit Data
4	DTR	Data Terminal Ready
5	GND	Signal Ground
6	DSR	Data Set Ready
7	RTS	Request To Send
8	CTS	Clear To Send
9	VCC_COM	12V or 5V power output, selected by jumper

TPM Module Connector: JTPM1

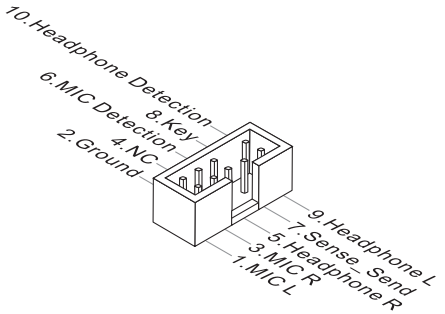
This connector connects to a TPM (Trusted Platform Module) module (optional). Please refer to the TPM security platform manual for more details.





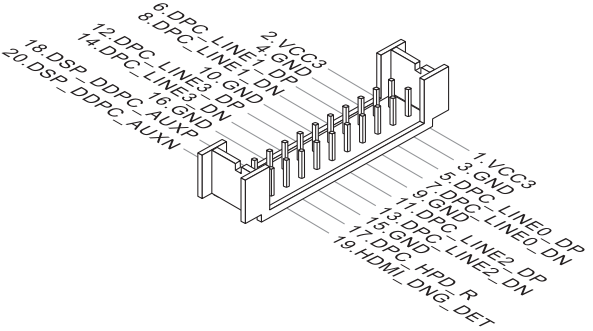
Front Audio Connector: JAUD1

This connector allows you to connect the front panel audio and is compliant with Intel Front Panel I/O Connectivity Design Guide.



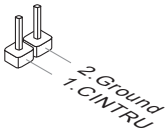
DisplayPort Connector: JDP1

DisplayPort is a digital display interface standard. This connector is used to connect a monitor with DisplayPort inputs.



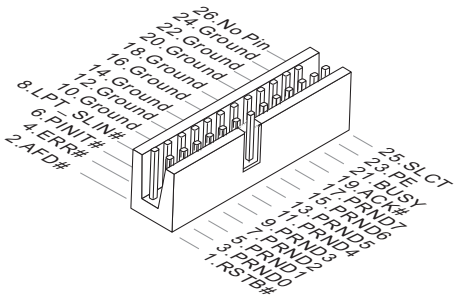
Chassis Intrusion Pin Header: JCI1

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.



Parallel Port Connector: JLPT1

The mainboard provides a 26-pin header for connection to an optional parallel port bracket. The parallel port is a standard printer port that supports Enhanced Parallel Port (EPP) and Extended Capabilities Parallel Port (ECP) mode.



Jumper

Important

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

Clear CMOS Jumper: JBAT1

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.

Normal Clear CMOS

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.

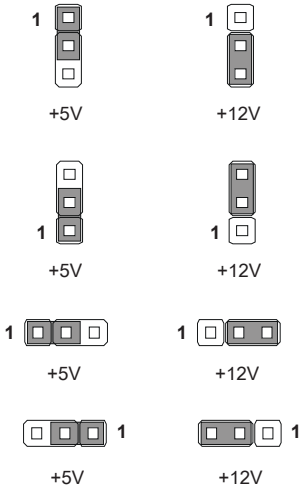
AT/ATX Select Jumper: JAT1

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

ATX AT

Serial Port Power Jumper: JCOMP1 ~ JCOMP6

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



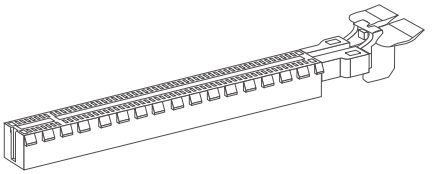
Non-Volatile Memory Jumper: JNVM1

This jumper is used to enable/disable the BIOS flash. When you intend to update the BIOS code, short connect pin#2-3 first. Under normal operation, we suggest that you enable the BIOS flash protection by short connecting pin#1-2 to protect the system BIOS from virus infection.

Slot

PCIe (Peripheral Component Interconnect Express) Slot

The PCI Express slot supports PCIe interface expansion cards.

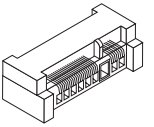


PCIe x16 slot

PCIe x1 slot

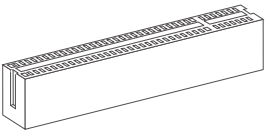
Mini-PCIe (Peripheral Component Interconnect Express) Slot (Q87 SKU only)

The Mini-PCIe slot is provided for wireless LAN cards, TV tuner cards, Robson NAND Flash cards and other Mini-PCIe cards.



PCI (Peripheral Component Interconnect) Slot

The PCI slot supports PCI interface expansion 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 <DEL> or <F2> key to enter Setup.

Press <DEL> 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 & Exit
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

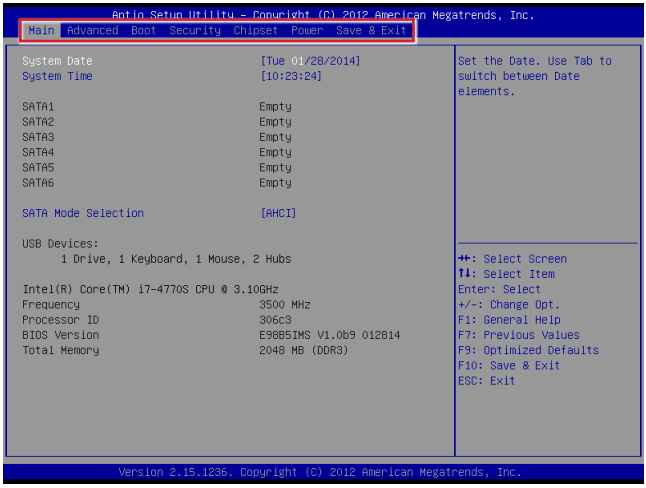
If you find a right pointer symbol appears to the left of certain fields that means a sub-menu can be launched from this field. A sub-menu contains additional options for a field parameter. You can use arrow keys (↑↓) to highlight the field and press <Enter> to call up the sub-menu. Then you can use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

MS-98B5 Q87 SKU

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.

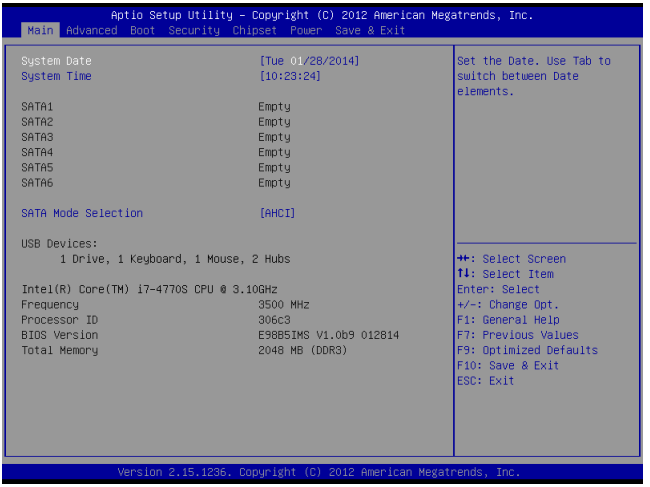
▸ **Power**

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>.

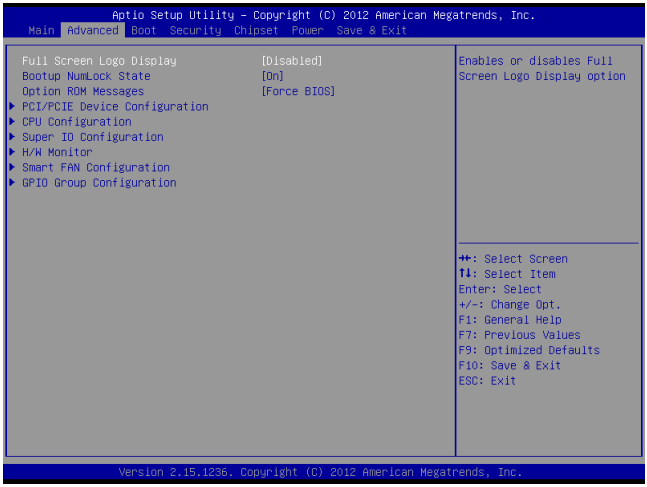
▸System Time

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.

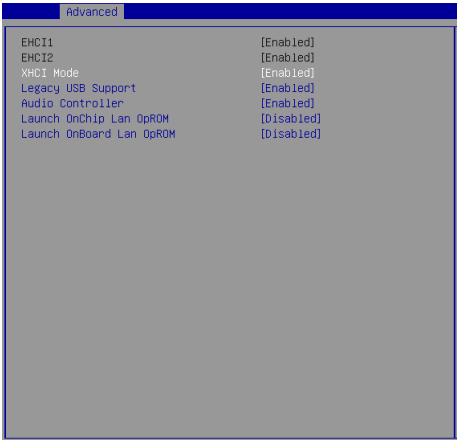
▸Bootup NumLock State

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.

▸PCI/PCIE Device Configuration



▸EHCI1, EHCI2

This setting disables/enables the USB EHCI controller. The Enhanced Host Controller Interface (EHCI) specification describes the register-level interface for a Host Controller for the Universal Serial Bus (USB) Revision 2.0.

▸XHCI Mode

This setting disables/enables the USB XHCI controller. The eXtensible Host Controller Interface (XHCI) is a computer interface specification that defines a register-level description of a Host Controller for Universal Serial bus (USB), which is capable of interfacing to USB 1.0, 2.0, and 3.0 compatible devices. The specification is also referred to as the USB 3.0 Host Controller specification.

▸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.

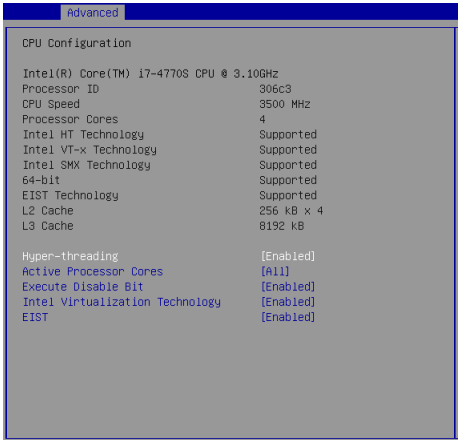
▸Audio Controller

This setting enables/disables the onboard audio controller.

▸Launch OnChip/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.

▸CPU Configuration



▸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.

▸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.

▸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.

▸EIST

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.

▸Super IO Configuration

▸Serial Port 1/ 2/ 3/ 4/ 5/ 6

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 the serial port 1 and 2.

▸Parallel Port

This setting enables/disables the parallel port.

▸Change Settings

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

▸Device Mode

Select an operation mode for the parallel port.

▸FIFO Mode

This setting controls the FIFO data transfer mode.

▸Shared IRQ Mode

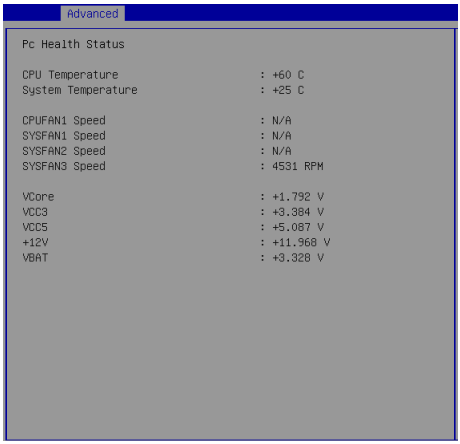
This setting provides the system with the ability to share interrupts among its serial ports.

▸ Watch Dog Timer

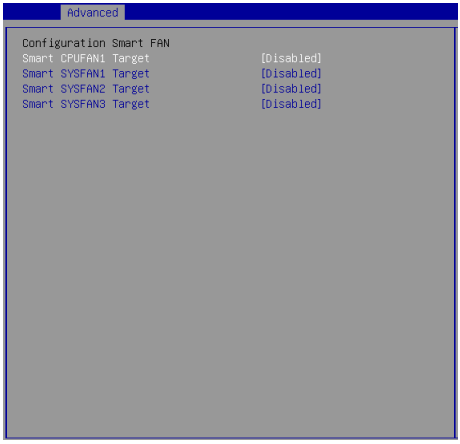
You can enable the system watch-dog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watch dog polls it.

▸H/W Monitor

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



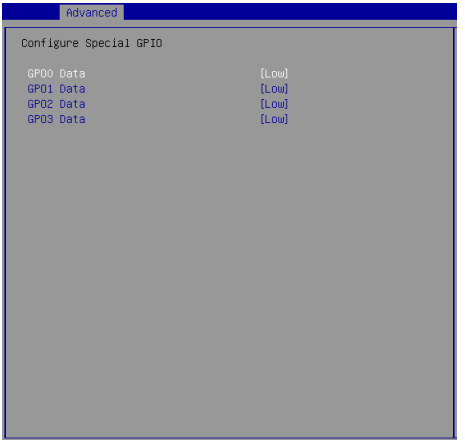
▸Smart Fan Configuration



▸Smart CPUFAN1, SYSFAN1, SYSFAN2, SYSFAN3 Target

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.

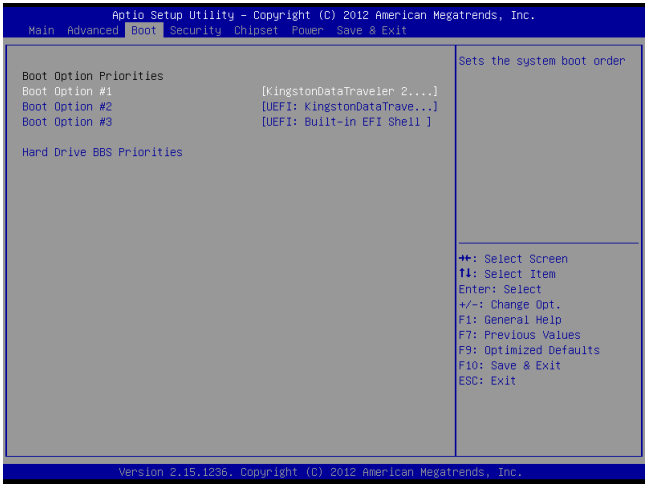
▸GPIO Group Configuration



▸GPO0 ~ GPO3 Data

These settings control the operation mode of the specified GPIO.

Boot



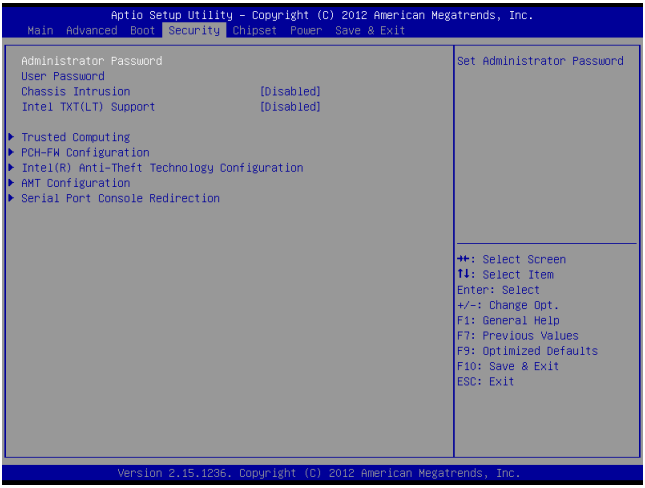
▸Boot Option Priorities

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.

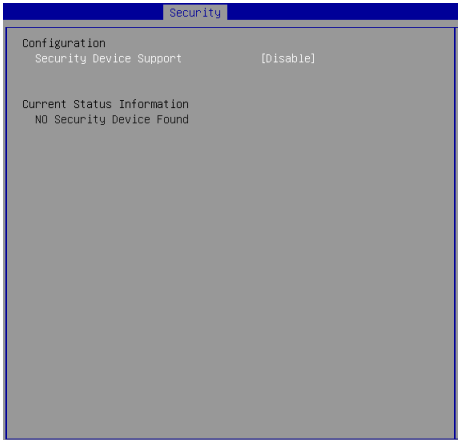
▸Chassis Intrusion

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 TXT(LT) Support

Intel TXT (Trusted Execution Technology) can only be enabled/disabled if SMX is enabled. VT and VT-d support must also be enabled prior to TXT.

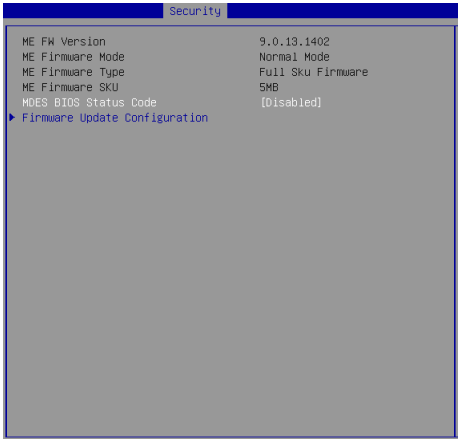
▸Trusted Computing



▸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.

▸PCH-FW Configuration



▸ME FW Version, ME Firmware Mode/ Type/ SKU

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

▸**MDES BIOS Status Code**

This setting enables/disables the MDES BIOS status code.

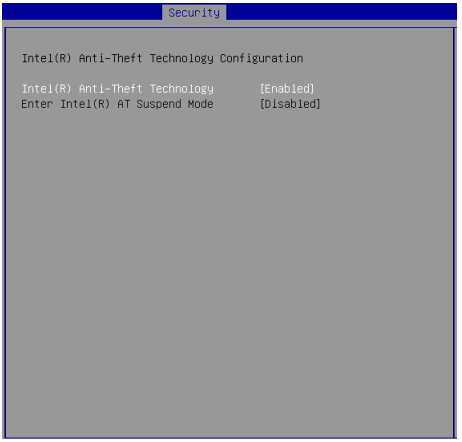
▸**Firmware Update Configuration**

▸**ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

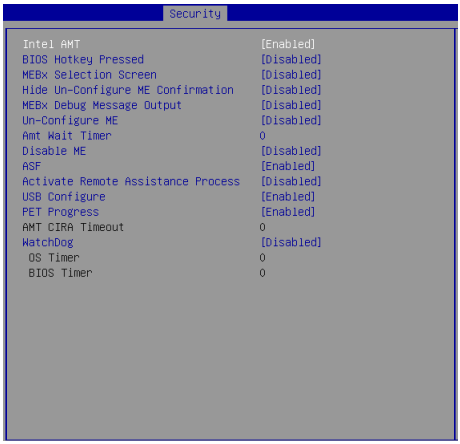
▸**Intel(R) Anti-Theft Technology Configuration**

Intel Anti-Theft Technology is hardware-based technology that can lock a lost or stolen system so that personal confidential information is protected and inaccessible by unauthorized users.

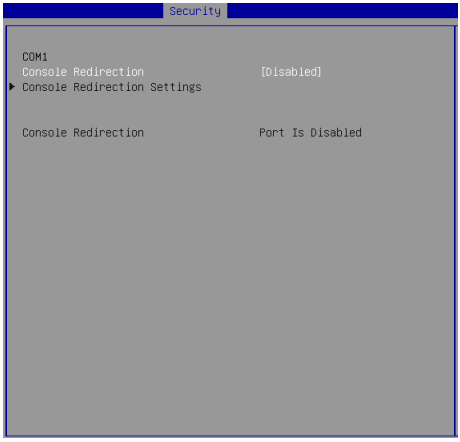


▸AMT Configuration

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



▸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 re-direction. 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.

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

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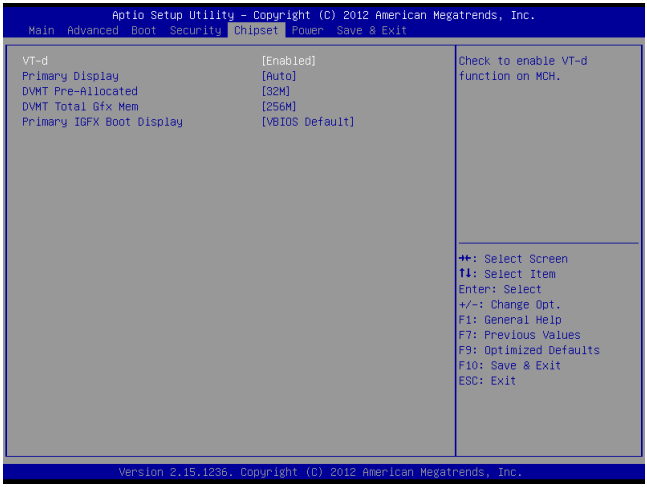

▸VT-d

Intel Virtualization Technology for Directed I/O (Intel VT-d) provides the capability to ensure improved isolation of I/O resources for greater reliability, security, and availability.

▸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.

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

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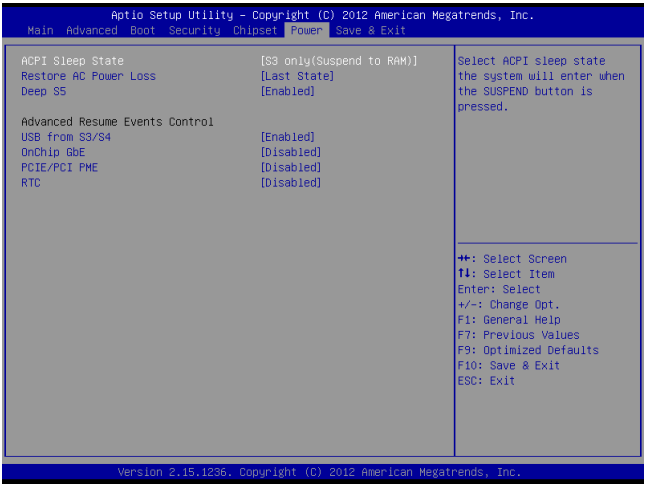

▸ACPI Sleep State

This item specifies the power saving modes for ACPI function. If your operating system supports ACPI, you can choose to enter the Standby mode in S1 (POS) or S3 (STR) fashion through the setting of this field.

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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.
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▸Deep S5

The setting enables/disables the Deep S5 power saving mode. S5 is almost the same as G3 Mechanical Off, except that the PSU still supplies power, at a minimum, to the power button to allow return to S0. A full reboot is required. No previous content is retained. Other components may remain powered so the computer can “wake” on input from the keyboard, clock, modem, LAN, or USB device.

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

▸USB from S3/S4

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

▸OnChip GbE

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

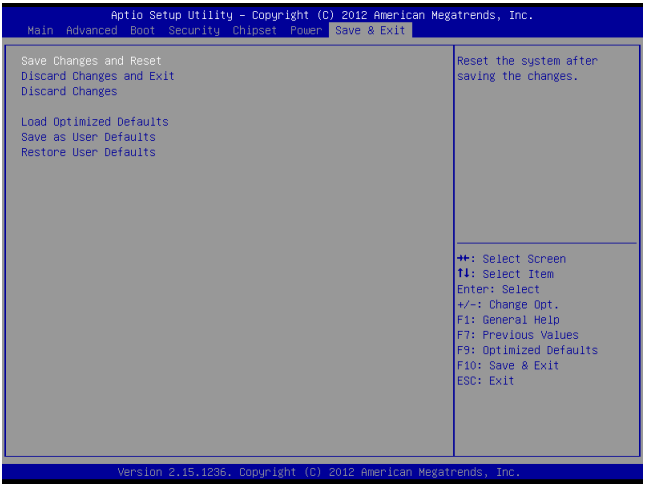
▸PCIE/PCI PME

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

▸RTC

When [Enabled], your 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**

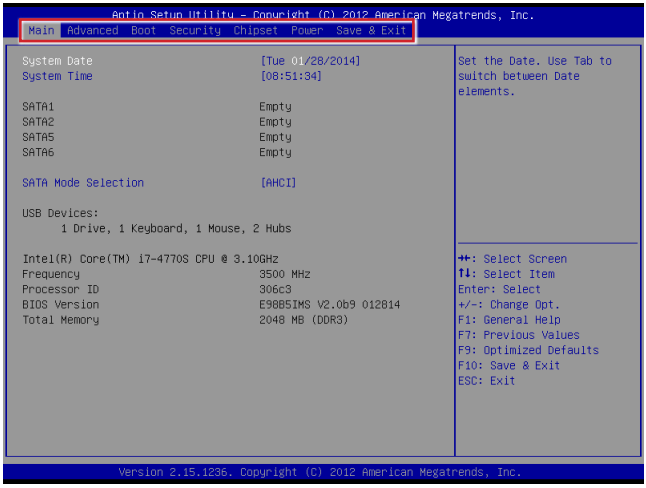
Save changes as the user's default profile.

▸**Restore User Defaults**

Restore the user's default profile.

MS-98B5 H81 SKU

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.

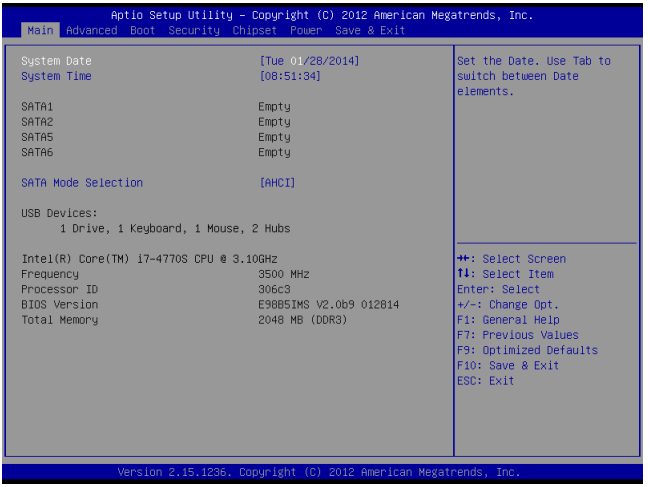
▸ **Power**

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>.

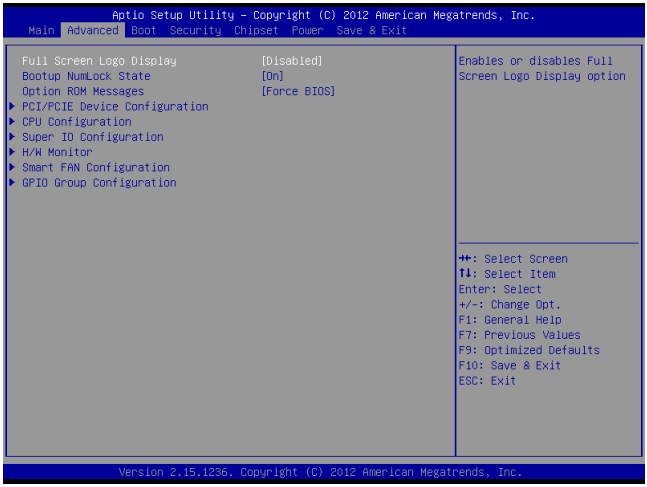
▸System Time

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.

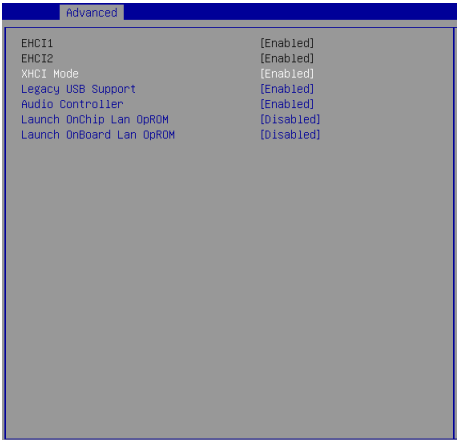
▸Bootup NumLock State

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.

▸PCI/PCIE Device Configuration



▸EHCI1, EHCI2

This setting disables/enables the USB EHCI controller. The Enhanced Host Controller Interface (EHCI) specification describes the register-level interface for a Host Controller for the Universal Serial Bus (USB) Revision 2.0.

▸XHCI Mode

This setting disables/enables the USB XHCI controller. The eXtensible Host Controller Interface (XHCI) is a computer interface specification that defines a register-level description of a Host Controller for Universal Serial bus (USB), which is capable of interfacing to USB 1.0, 2.0, and 3.0 compatible devices. The specification is also referred to as the USB 3.0 Host Controller specification.

▸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.

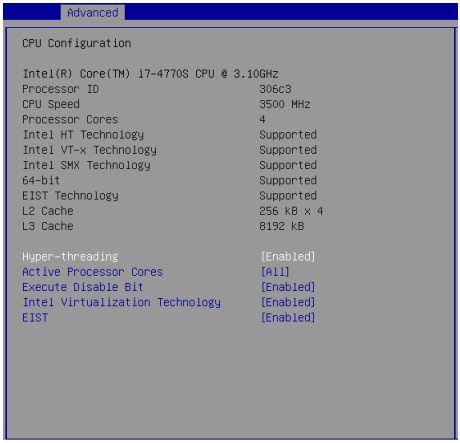
▸Audio Controller

This setting enables/disables the onboard audio controller.

▸Launch OnChip/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.

▸CPU Configuration



▸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.

▸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.

▸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.

▸EIST

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.

▸Super IO Configuration

▸Serial Port 1/ 2/ 3/ 4/ 5/ 6

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 the serial port 1 and 2.

▸Parallel Port

This setting enables/disables the parallel port.

▸Change Settings

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

▸Device Mode

Select an operation mode for the parallel port.

▸FIFO Mode

This setting controls the FIFO data transfer mode.

▸Shared IRQ Mode

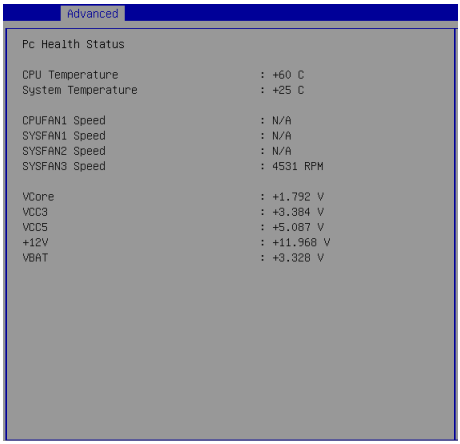
This setting provides the system with the ability to share interrupts among its serial ports.

▸ Watch Dog Timer

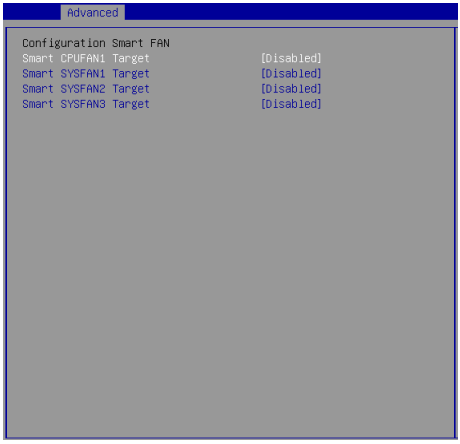
You can enable the system watch-dog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watch dog polls it.

▸H/W Monitor

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



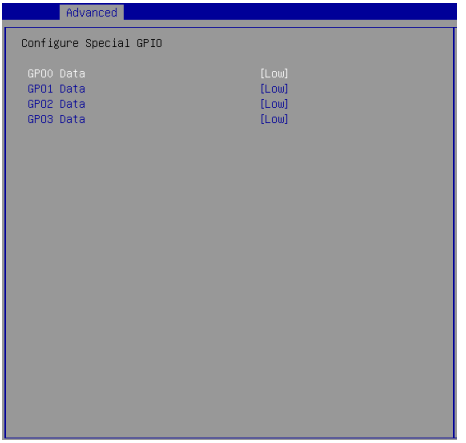
▸Smart Fan Configuration



▸Smart CPUFAN1, SYSFAN1, SYSFAN2, SYSFAN3 Target

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.

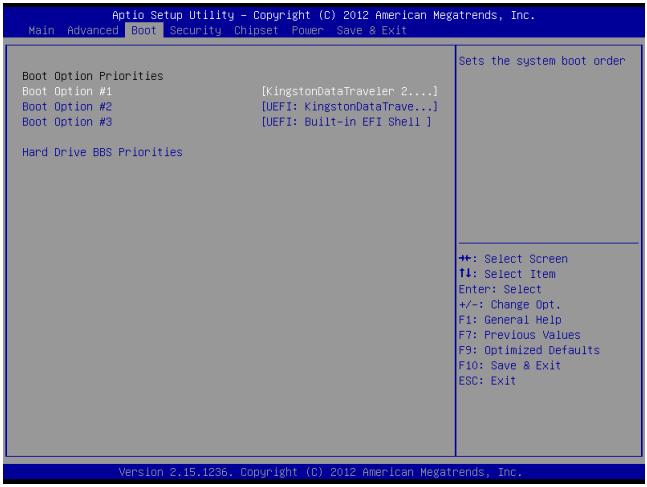
▸GPIO Group Configuration



▸GPO0 ~ GPO3 Data

These settings control the operation mode of the specified GPIO.

Boot



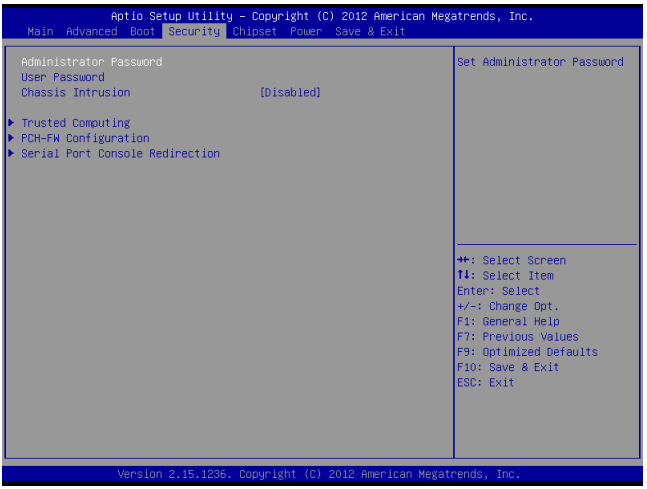
▸**Boot Option Priorities**

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.

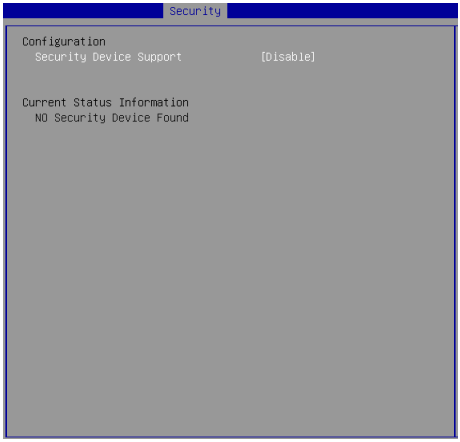
▸User Password

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.

▸Trusted Computing



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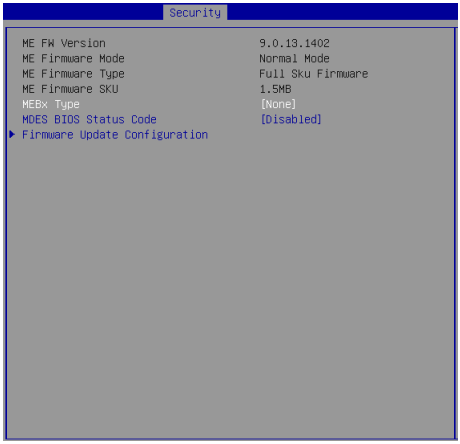

▸ME FW Version, ME Firmware Mode/ Type/ SKU

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

▸**MEBx Type**

This setting specifies the Intel Management Engine BIOS Extension (MEBx) type.

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This setting enables/disables the MDES BIOS status code.

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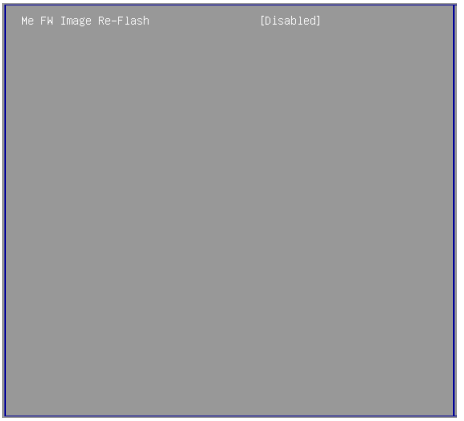

▸**ME FW Image Re-Flash**

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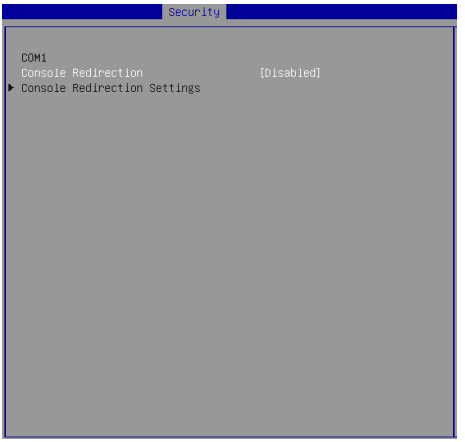
▸**Serial Port Console Redirection**



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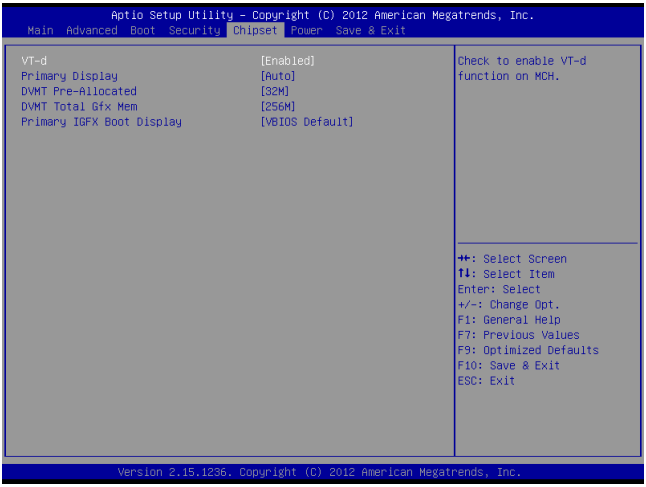

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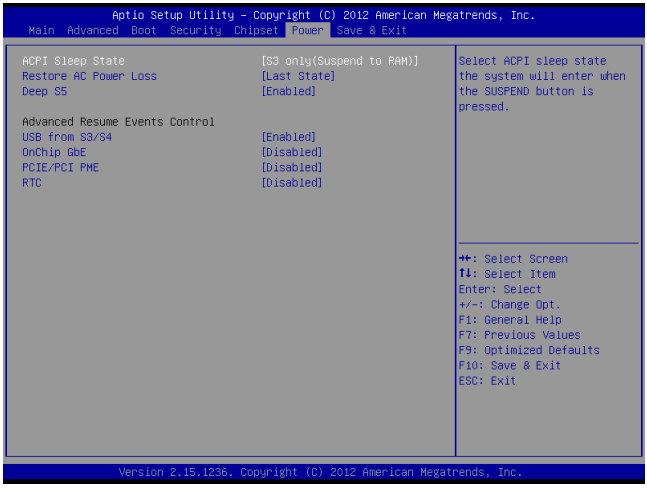

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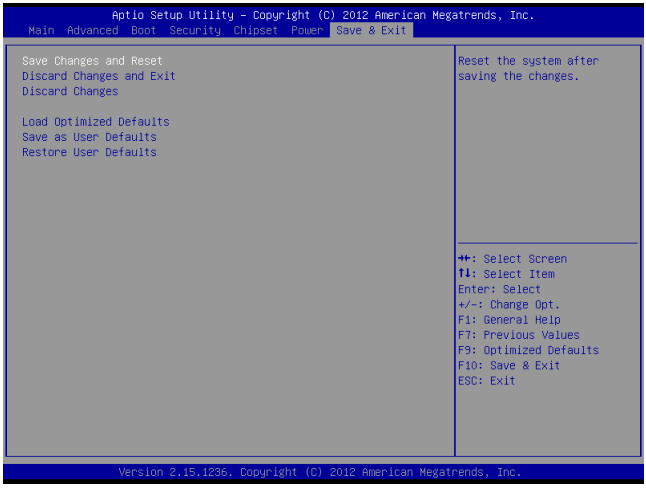
Save & Exit



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▸Restore User Defaults

Restore the user's default profile.

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
;Acive 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 UINT
    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	53Ah	50Eh	538h	538h				
SIO GPIO Register								
Bit	0	6	2	3				
Sample code	#1	#1	#1	#1				

- GPO 0 ~ GPO 3

	GPO 0	GPO 1	GPO 2	GPO 3				
IO Address	50Ch	50Ch	50Ch	50Eh				
SIO GPIO Register								
Bit	1	6	7	1				
Sample code	#2	#2	#2	#2				

```
GPI_ADD                 equ     50Eh
GPI_ADD1                equ     538h
GPI_ADD2                equ     53Ah

GPO_ADD                 equ     50Ch
GPO_ADD1                equ     50Eh
GPO_0                   equ     00000010b
```

Sample Code:

Sample Code:

#1 : Get GPI 0 status

```
in      al, GPI_ADD2
    ;al bit0 = GPI 3 status
```

#2 : Set GPO 0 to high status

```
    mov     dx, GPO_ADD
    in      al, dx
    and     al, Not GPO_0
    or      al, GPO_0
    out     dx, al
```