MS-98G5

(v1.x) Industrial Computer Board

Copyright Notice

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Trademarks

All trademarks are the properties of their respective owners.

Revision History

Revision	Date
V1.0	2015/03

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, 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.

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.

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-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.

Japan JIS C 0950 Material Declaration

A Japanese regulatory requirement, defined by specification JIS C 0950, mandates that manufacturers provide material declarations for certain categories of electronic products offered for sale after July 1, 2006.

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

http://tw.msi.com/html/popup/csr_tw/cemm_jp.html

日本JIS C 0950材質宣言

日本工業規格JIS　C　0950により、2006年7月1日以降に販売される特定分野の電気および電子機器について、製造者による含有物質の表示が義務付けられます。

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

http://tw.msi.com/html/popup/csr_tw/cemm_jp.html

India RoHS

This product complies with the "India E-waste (Management and Handling) Rule 2011" and prohibits use of lead, mercury, hexavalent chromium, polybrominated biphenyls or polybrominated diphenyl ethers in concentrations exceeding 0.1 weight % and 0.01 weight % for cadmium, except for the exemptions set in Schedule 2 of the Rule.

Turkey EEE Regulation

Conforms to the EEE Regulations of the Republic Of Turkey

Türkiye EEE yönetmeliği

Türkiye Cumhuriyeti: EEE Yönetmeliğine Uygundur

Ukraine Restriction of Hazardous Substances

The equipment complies with requirements of the Technical Regulation, approved by the Resolution of Cabinet of Ministry of Ukraine as of December 3, 2008 № 1057, in terms of restrictions for the use of certain dangerous substances in electrical and electronic equipment.

Україна обмеження на наявність небезпечних речовин

Обладнання відповідає вимогам Технічного регламенту щодо обмеження використання деяких небезпечних речовин в електричному та електронному обладнані, затвердженого постановою Кабінету Міністрів України від 3 грудня 2008 № 1057.

Vietnam RoHS

As from December 1, 2012, all products manufactured by MSI comply with Circular 30/2011/TT-BCT temporarily regulating the permitted limits for a number of hazardous substances in electronic and electric products.

Việt Nam RoHS

Kể từ ngày 01/12/2012, tất cả các sản phẩm do công ty MSI sản xuất tuân thủ Thông tư số 30/2011/TT-BCT quy định tạm thời về giới hạn hàm lượng cho phép của một số hóa chất độc hại có trong các sản phẩm điện, điện tử"

CONTENTS

Copyright Notice ii
Trademarks ii
Revision History ii
Technical Support ii
Safety Instructions iii
Chemical Substances Information iv
Battery Information iv
CE Conformity v
FCC-A Radio Frequency Interference Statement v
WEEE Statement v
Japan JIS C 0950 Material Declaration vi
India RoHS vi
Turkey EEE Regulation vi
Ukraine Restriction of Hazardous Substances vi
Vietnam RoHS vii

1. Overview 1-1
Motherboard Specifications 1-2
Motherboard Layout 1-5

2. Hardware Setup 2-1
Memory 2-3
Power Supply 2-5
Rear Panel I/O 2-6
Connector 2-9
Jumper 2-15
Slot 2-17

3. BIOS Setup 3-1
Entering Setup 3-2
The Menu Bar 3-4
Main 3-5
Advanced 3-7
Boot 3-13
Security 3-14
Chipset 3-19
Power 3-20
Save & Exit 3-22

Appendix WDT & GPIO A-1
WDT Sample Code A-2
GPIO Sample Code A-3

1 Overview

Thank you for choosing the MS-98G5, an excellent industrial computer board.

Based on the innovative Intel® HM86/ QM87 chipset for optimal system efficiency, the MS-98G5 accommodates the Intel® Haswell/ Broadwell processor and supports up to 2 DDR3L 1333/1600 MHz SO-DIMM slots to provide the maximum of 16 GB memory capacity.

In the advanced-level and mid-range market segment, MS-98G5 provides a high-performance solution for today's front-end and general purpose workstation, as well as in the future.

Motherboard Specifications

Processor

- Intel Mobile Core i3/ i5/ i7, Celeron processor (Haswell / Broadwell colay)

Chipset

- SKU1: Intel HM86
- SKU2, SKU3, SKU4: Intel QM87

Memory

- 2 x DDR3L 1333/1600 MHz SO-DIMM slots
- Up to 16 GB
- Dual-Channel mode

LAN

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

SATA

- SKU1:
  - 1 x SATA 3Gb/s port
  - 1 x SATA 6Gb/s port
  - 1 x mSATA slot (MINI_PCIE2)
- SKU2, SKU3, SKU4:
  - 2 x SATA 6Gb/s ports

Audio

- Realtek ALC887 HD audio codec
- 3 x audio jacks
- 1 x amplifier connector
- 1 x S/PDIF-Out header

Graphics

- Graphics integrated in Intel processor
  - LVDS: 24-bit Dual Channel (up to 1920 x 1200)
  - HDMI: up to 4096 x 2304
  - DVI-I: up to 1920 x 1200
  - DisplayPort: up to 3840 x 2160

Rear Panel I/O

- 1 x PS/2 mouse/keyboard combo port
- 1 x RS-232/422/485 serial port
- 1 x HDMI port
- 1 x DVI-I port
- 1 x DisplayPort
- 2 x RJ45 GbE LAN ports
- 2 x USB 2.0 ports
- 4 x USB 3.0 ports
- 3 x flexible audio ports

Onboard Headers/ Connectors/ Jumpers

- 1 x 4-pin power connector
- 1 x SATA power connector
- 1 x system fan connector
- 1 x CPU fan connector
- 2 x SATA 6Gb/s ports (1 x SATA 3Gb/s port and 1 x SATA 6Gb/s port for SKU1)
- 3 x USB 2.0 headers (6 ports)
- 4 x RS-232 serial port connectors
- 1 x GPIO connector
- 1 x front panel connector
- 1 x TPM header
- 1 x LVDS connector
- 1 x LVDS inverter connector
- 1 x amplifier connector
- 1 x S/PDIF-Out header
- 1 x chassis intrusion header
- 1 x clear CMOS jumper
- 1 x LVDS power jumper
- 1 x LVDS inverter power jumper
- 1 x PCIe jumper
- 1 x serial port power jumper
- 1 x AT/ATX select jumper

Expansion Slot

- SKU1:
  - 1 x PCIe x16 slot (speed adjustable via the PCIe jumper)
  - 1 x mSATA slot (MINI_PCIE2)
  - 1 x Mini-PCIe slot
    - » 1 x Half size
- SKU2, SKU3, SKU4:
  - 1 x PCIe x16 slot (speed adjustable via the PCIe jumper)
  - 2 x Mini-PCIe slots
    - » 1 x Full size colay mSATA (W/ SIM Holder)
    - » 1 x Half size

Form Factor

- Mini-ITX: 170 mm x 170 mm

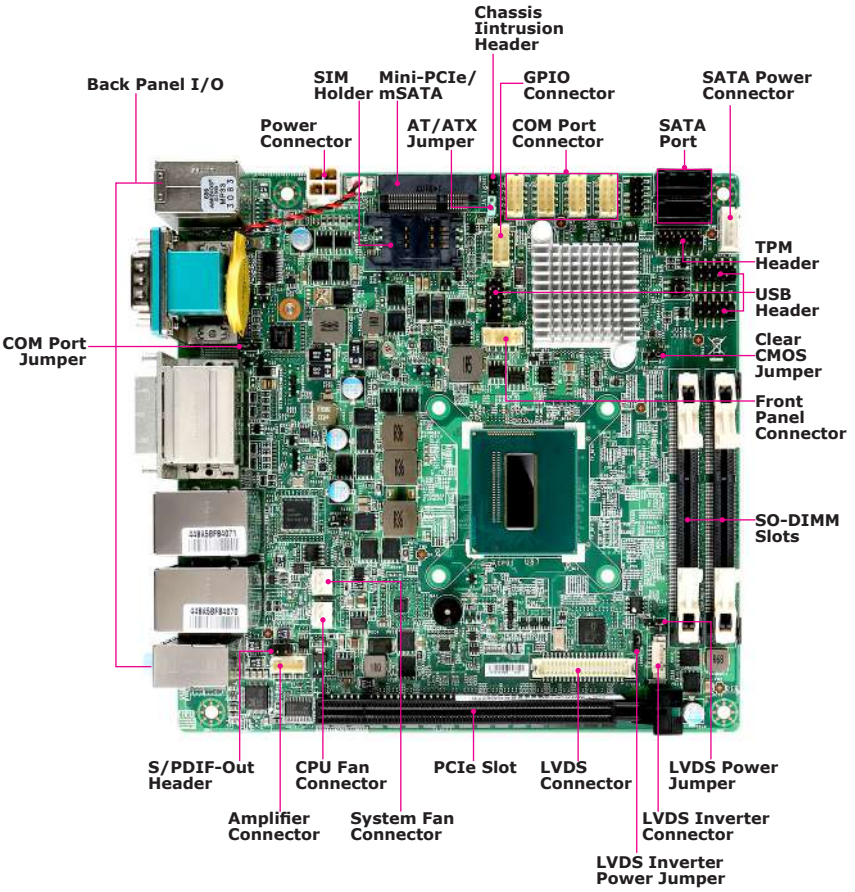
Environmental

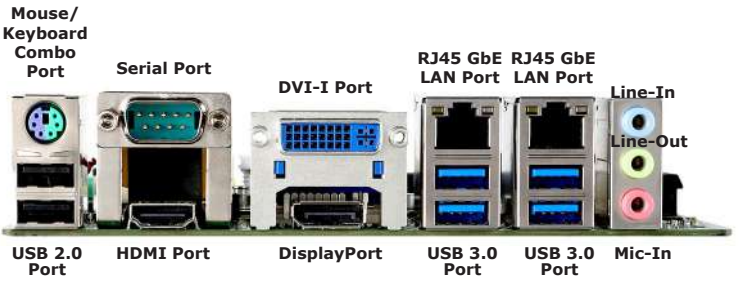
- Operating Temperature: 0 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 5 ~ 90% RH, non-condensing

SKU Comparison

Features \ SKUs	SKU1	SKU2	SKU3	SKU4
Processor	Haswell i5-4210H	Haswell i5-4410E	Haswell i7-4700EQ	Broadwell
PCH	HM86	QM87	QM87	QM87
Storage	1 x SATA 3.0 1 x SATA 2.0 1 x mSATA	2 x SATA 3.0	2 x SATA 3.0	2 x SATA 3.0
Expansion slot	■ 1 x Mini-PCIe - 1 x Half size	■ 2 x Mini-PCIe - 1 x Full size colay mSATA (W/ SIM Holder) - 1 x Half size	■ 2 x Mini-PCIe - 1 x Full size colay mSATA (W/ SIM Holder) - 1 x Half size	■ 2 x Mini-PCIe - 1 x Full size colay mSATA (W/ SIM Holder) - 1 x Half size

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.

Components Reference Guide

Memory **2-3**
Power Supply **2-5**
DC-In Power Connector: JPWR1 2-5
SATA Power Connector: JSATA_PWR1 2-5
Rear Panel I/O **2-6**
Connector **2-9**
Fan Power Connector: CPUFAN1, SYSFAN1 2-9
GPIO Connector: JGPIO1 2-10
Serial ATA Connector: SATA1, SATA2 2-10
S/PDIF-Out Pinheader: JSPDI1 2-11
Audio Amplifier Connector: JAMP1 2-11
Front Panel Header: JFP1 2-11
TPM Module Connector: JTPM1 2-12
Chassis Intrusion Header: JCASE1 2-13
RS-232 Serial Port Connector: COM2, COM3, COM4, COM5 2-13
USB 2.0 Header: JUSB2, JUSB3, JUSB4 2-13
LVDS Inverter Connector: JINVDD2 2-14
LVDS Connector: JLVDS1 2-14
Jumper **2-15**
Clear CMOS Jumper: JCMOS1 2-15
AT/ATX Select Jumper: JAT1 2-15
NVM LAN Jumper: JNVM1 2-15
Serial Port Power Jumper: JCOMP1 2-16
PCI Express Jumper: JPCIE1 2-16
LVDS Power Jumper: JVDD2 2-16
LVDS Inverter Power Jumper: JINV2 2-16
Slot **2-17**
PCIe (Peripheral Component Interconnect Express) Slot 2-17
Mini-PCIe (Peripheral Component Interconnect Express) Slot 2-17

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

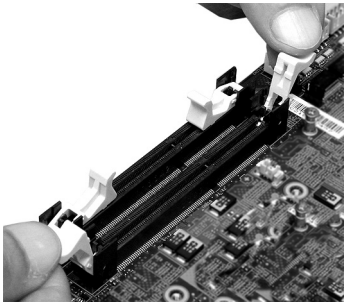
Number of DIMMs installed	1	2
DIMM1 (ch A)	V	V
DIMM2 (ch B)		V

Important

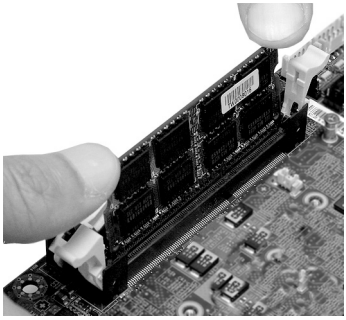
- *"V" indicates a populated DIMM slot.*
- *Paired memory installation for Max performance.*
- *Populate the same DIMM type in each channel, specifically: 1. Use the same DIMM size; 2. Use the same number of ranks per DIMM.*

Installing Memory Modules

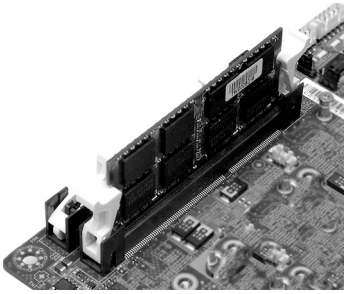
1. Unlock the DIMM slot by flipping open its side clips.



2. Vertically insert the DIMM into the DIMM slot. The DIMM has an off-center notch at the bottom that will only allow it to fit one way into the DIMM slot. Push the DIMM deeply into the DIMM slot. The side clips of the slot will automatically close when the DIMM is properly seated and an audible click should be heard.



3. Manually check if the DIMM has been locked in place by the DIMM slot's side clips.



Important

- *Motherboard photos shown in this section are for demonstration only and may differ from the actual look of your motherboard.*
- *You can barely see the golden finger if the DIMM is properly inserted in the DIMM slot.*

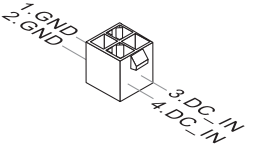
Important

*To enable successful system bootup, always insert the memory module into the **DIMM1 first**.*

Power Supply

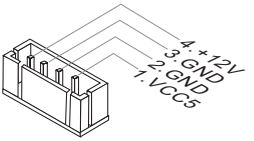
DC-In Power Connector: JPWR1

This connector is used to provide power to the motherboard.



SATA Power Connector: JSATA_PWR1

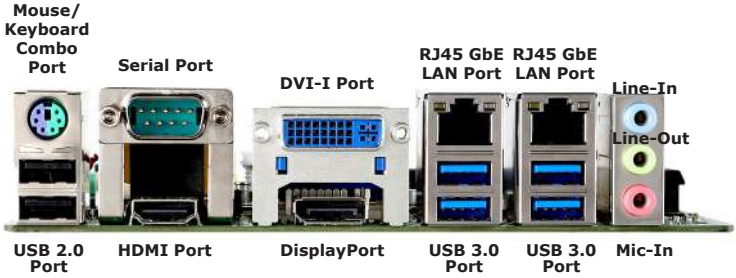
This connector is used to provide power to SATA devices.



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.

➤ 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

➤ HDMI Port

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.

➤ 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.

➤ USB 2.0 Port

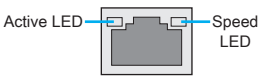
The USB (Universal Serial Bus) port is for attaching USB devices such as keyboard, mouse, or other USB-compatible devices.

➤ 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).

➤ RJ45 GbE LAN Port

The standard 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

➤ Audio Ports

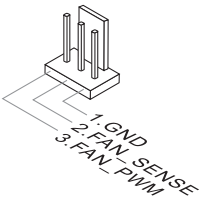
These audio connectors are used for audio devices. It is easy to differentiate between audio effects according to the color of audio jacks.

- 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

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.

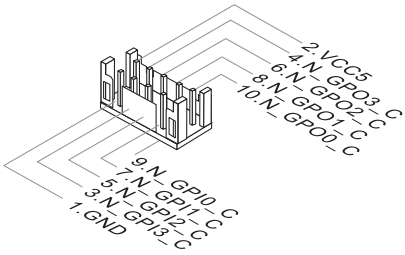


Important

Please refer to the recommended CPU fans at processor's official website or consult the vendors for proper CPU cooling fan.

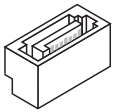
GPIO Connector: JGPIO1

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



Serial ATA Connector: SATA1, SATA2

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

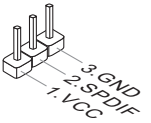


Important

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

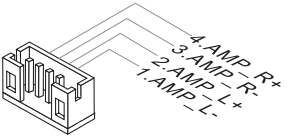
S/PDIF-Out Pinheader: JSPDI1

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



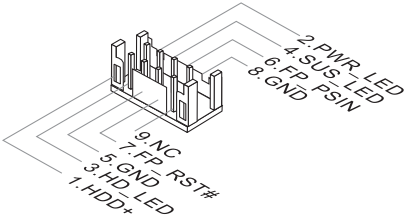
Audio Amplifier Connector: JAMP1

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



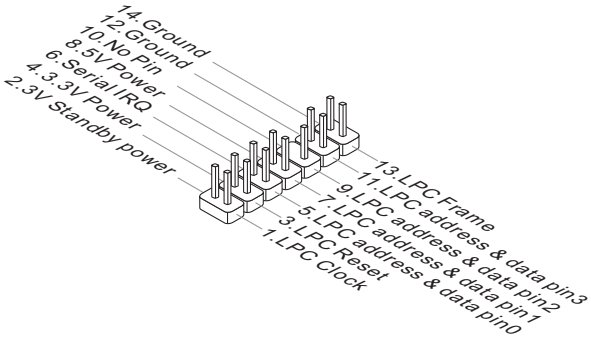
Front Panel Header: JFP1

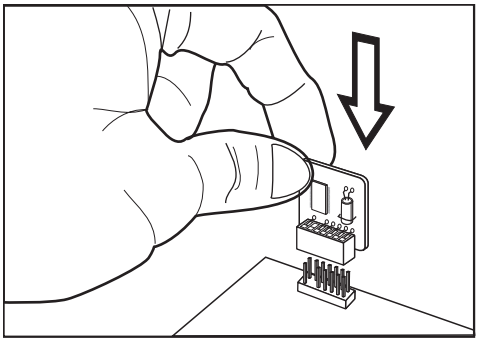
This front panel connector is provided for electrical connection to the front panel switches & LEDs and is compliant with Intel Front Panel I/O Connectivity Design Guide.



TPM Module Connector: JTPM1

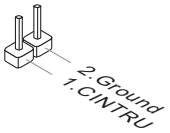
This connector connects to a TPM (Trusted Platform Module) module (optional). Please refer to the TPM security platform manual for more details.





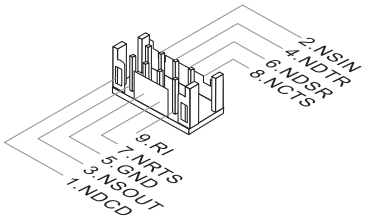
Chassis Intrusion Header: JCASE1

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.



RS-232 Serial Port Connector: COM2, COM3, COM4, COM5

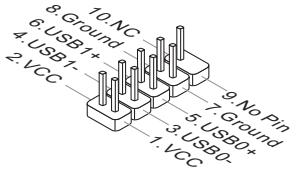
This connector is a 16550A high speed communications port that sends/receives 16 bytes FIFOs. You can attach serial devices to it through the optional serial port bracket.



PIN	SIGNAL	DESCRIPTION
1	NDCD	Data Carrier Detect
2	NSIN	Signal In
3	NSOUT	Signal Out
4	NDTR	Data Terminal Ready
5	GND	Signal Ground
6	NDSR	Data Set Ready
7	NRTS	Request To Send
8	NCTS	Clear To Send
9	RI	Ring Indicate
10	NC	No Connection

USB 2.0 Header: JUSB2, JUSB3, JUSB4

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.

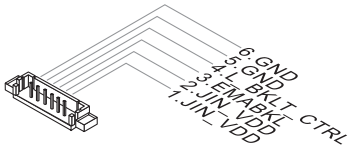


Important

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

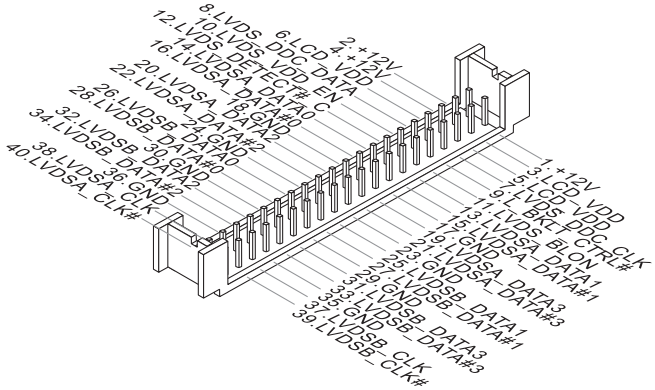
LVDS Inverter Connector: JINVDD2

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.



Jumper

Important

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

Clear CMOS Jumper: JCMOS1

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

NVM LAN Jumper: JNVM1

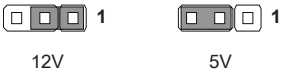
Use this jumper to specify the operation of LAN2 controlled by Intel I210-AT.

On: Enable security and the INVM lock

Off: Disable security and the INVM lock (Non-secure mode)

Serial Port Power Jumper: JCOMP1

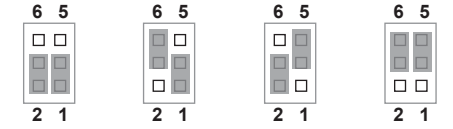
This jumper specifies the operation voltage of the COM1 serial port.



12V 5V

PCI Express Jumper: JPCIE1

This jumper specifies the operation speed of the PCI Express slot.



1 x16 PCIe 2 x8 PCIe reserved 1 x8, 2 x4 PCIe

LVDS Power Jumper: JVDD2

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

3V 5V

LVDS Inverter Power Jumper: JINV2

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

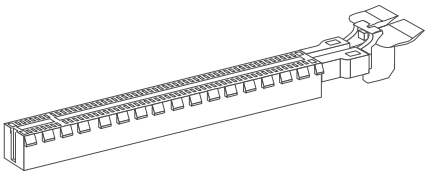
5V 12V

Slot

PCIe (Peripheral Component Interconnect Express) Slot

The PCI Express slot supports PCIe interface expansion cards.

- SKU1, SKU2, SKU3, SKU4:
  - 1 x PCIe x16 slot (speed adjustable via the PCIe jumper)

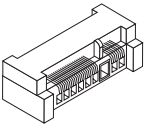


PCIe x16 slot

Mini-PCIe (Peripheral Component Interconnect Express) Slot

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

- SKU1:
  - 1 x mSATA slot (MINI_PCIE2)
  - 1 x Mini-PCIe slot
    - » 1 x Half size
- SKU2, SKU3, SKU4:
  - 2 x Mini-PCIe slots
    - » 1 x Full size colay mSATA (W/ SIM Holder)
    - » 1 x Half size



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.

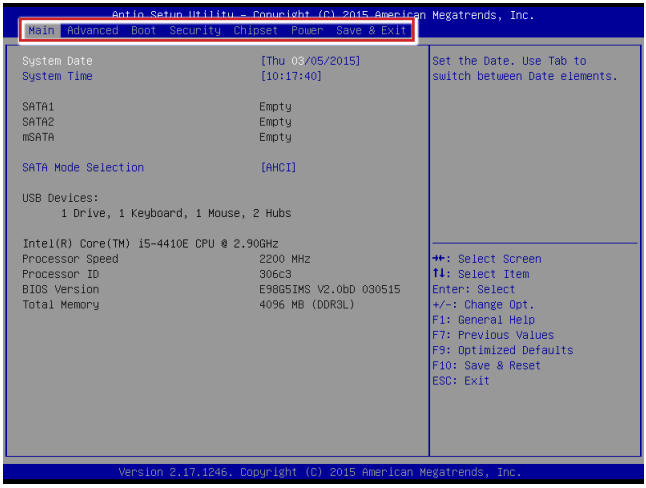
Sub-Menu

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.

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

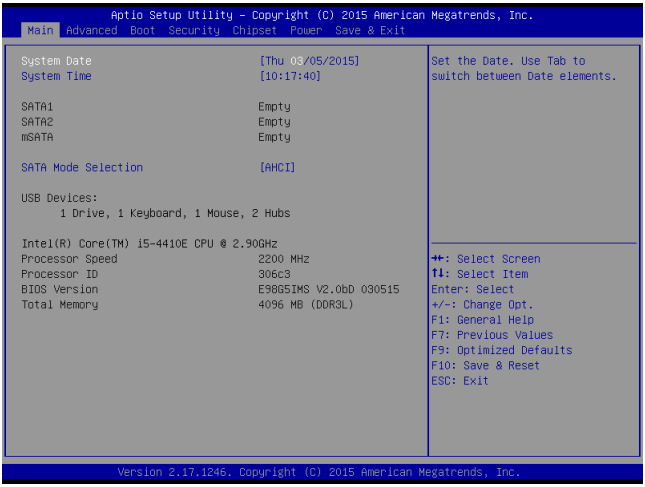
Use this menu to specify your settings for power management.

▸Save & Exit

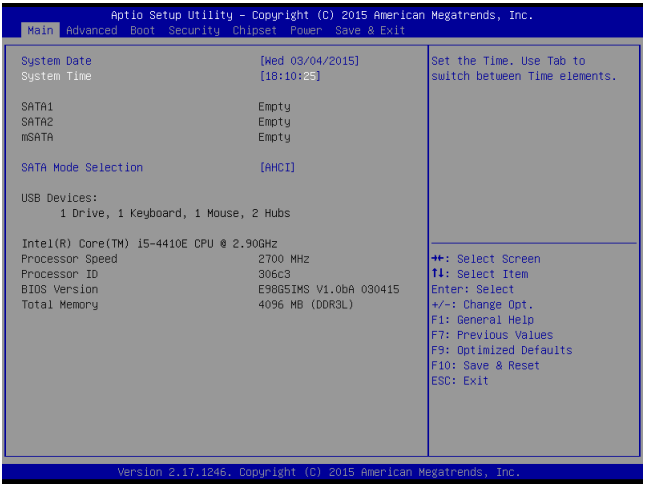
This menu allows you to load the BIOS default values or factory default settings into the BIOS and exit the BIOS setup utility with or without changes.

Main

HM86



QM87



▸ System Date

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

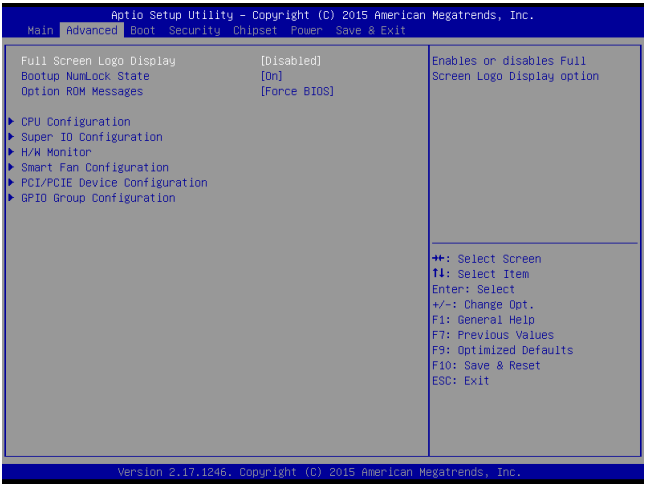
▸**System Time**

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.

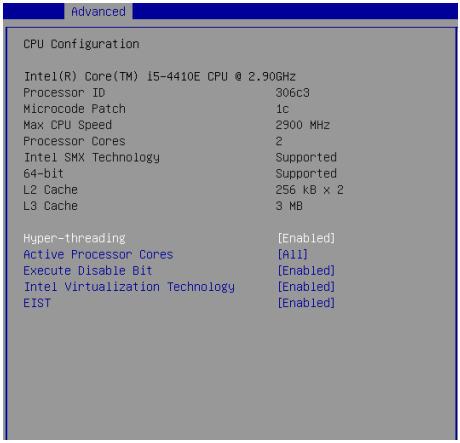
▸Bootup NumLock State

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



▸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.

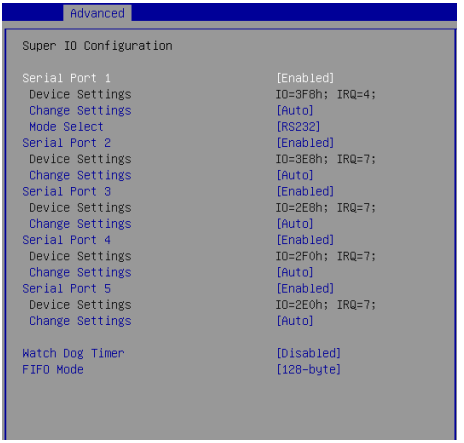
▸Intel Virtualization Technology

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

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.

▸Watch Dog Timer

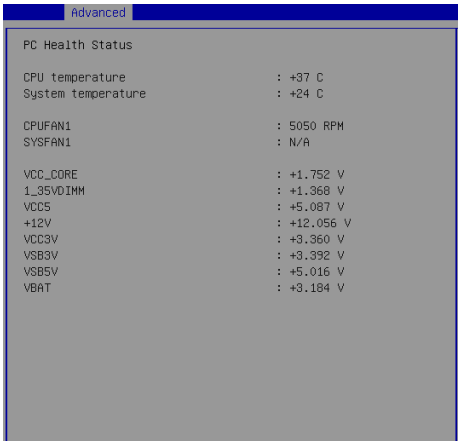
You can enable the system watch-dog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watch dog polls it.

▸FIFO Mode

This setting controls the FIFO data transfer mode.

▸H/W Monitor

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

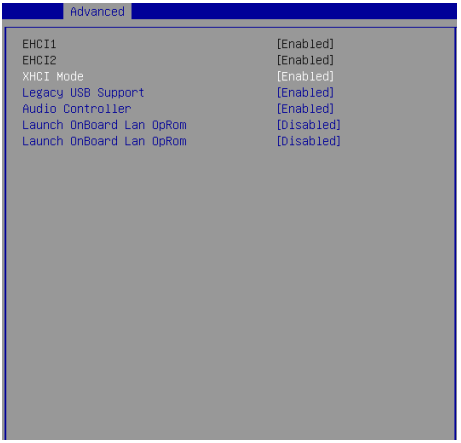


▸Smart Fan Configuration

▸CPUFAN, SYSFAN

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.

▸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.

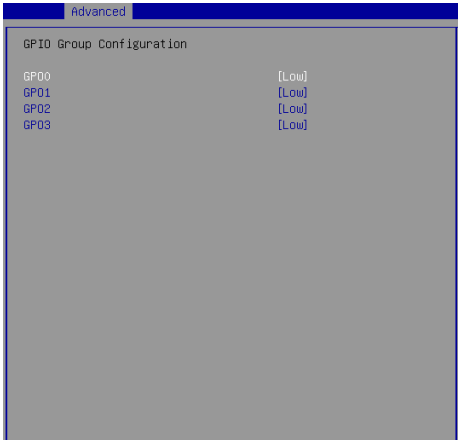
▸Audio Controller

This setting enables/disables the onboard audio controller.

▸Launch 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.

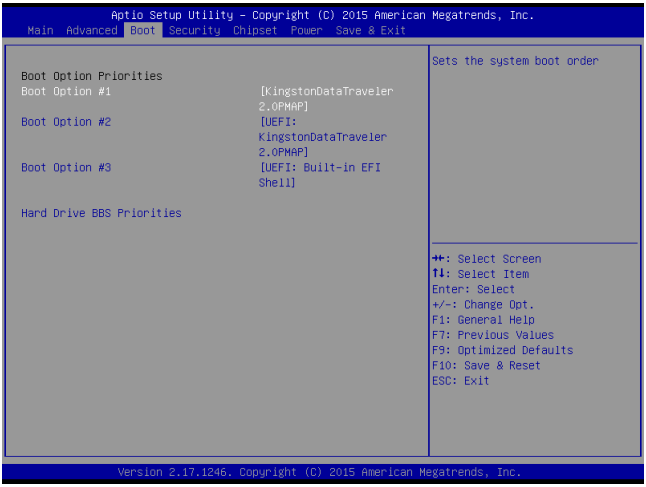
▸GPIO Group Configuration



▸GPO0 ~ GPO3

These settings control the operation mode of the specified GPIO.

Boot



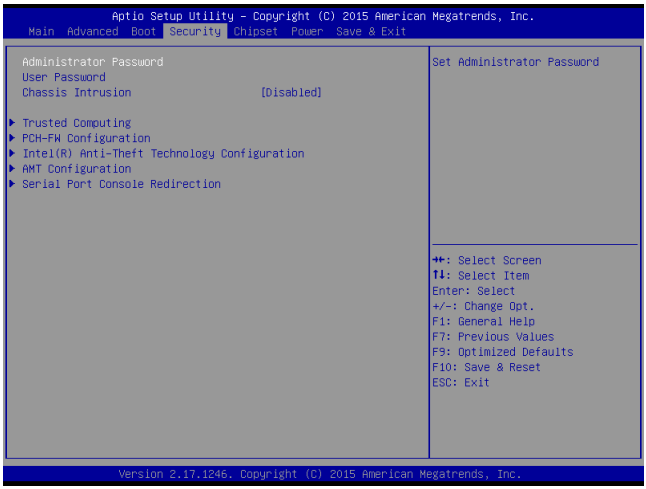
▸Boot Option Priorities

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.

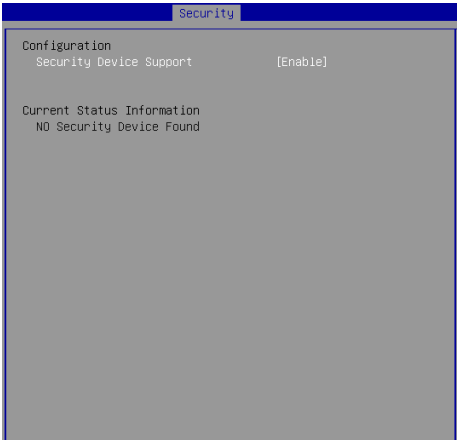
▸User Password

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.

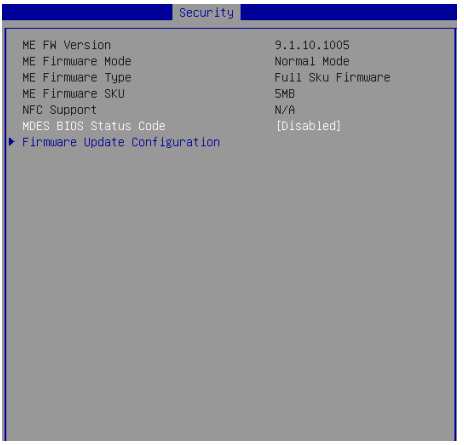
▸**Trusted Computing**



▸**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.

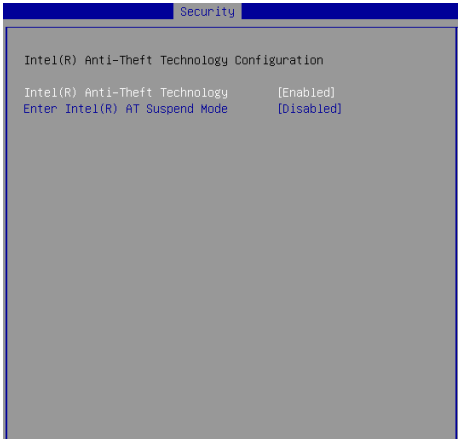
▸**Firmware Update Configuration**

▸**ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

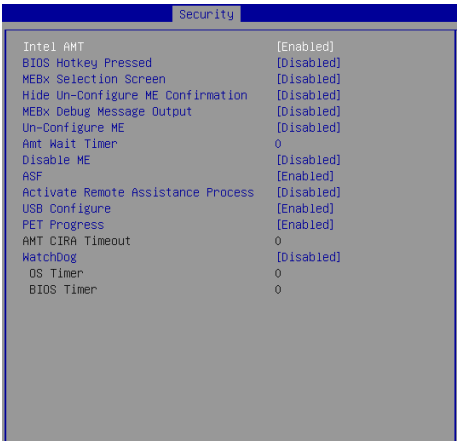
▸**Intel(R) Anti-Theft Technology Configuration**

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.

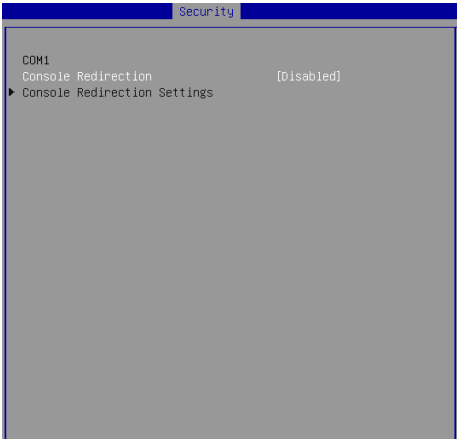


▸AMT Configuration

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



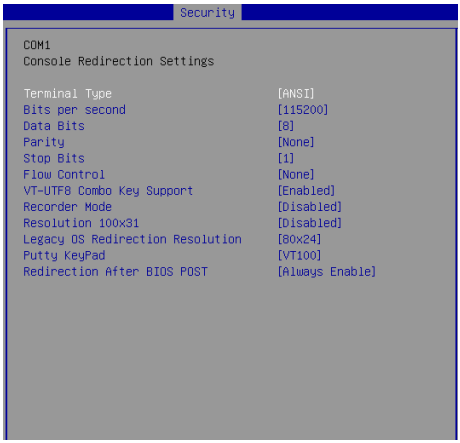
▸Serial Port Console Redirection



▸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 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.

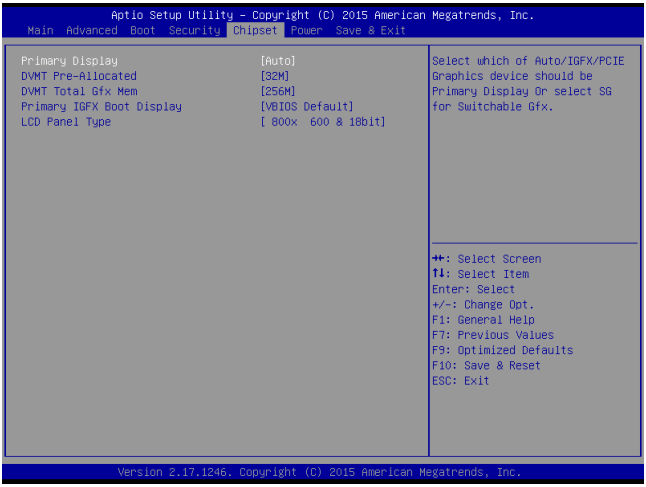
▸ Legacy OS Redirection Resolution

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.

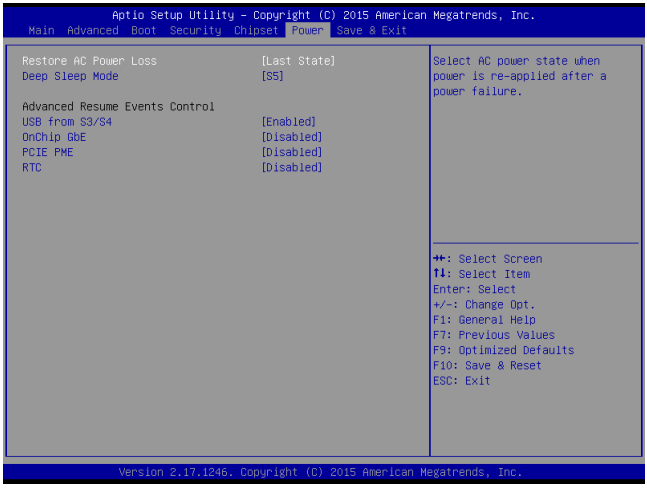
▸Primary IGFX Boot Display

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

▸LCD Panel Type

This setting specifies the LCD panel type.

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 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.

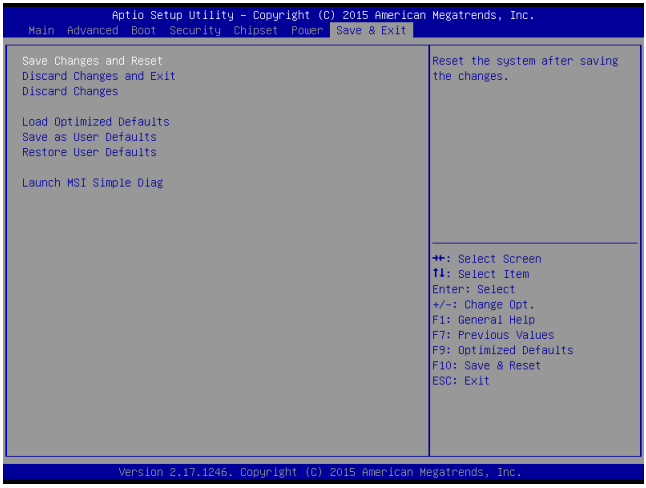
▸**PCIE PME**

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], 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.

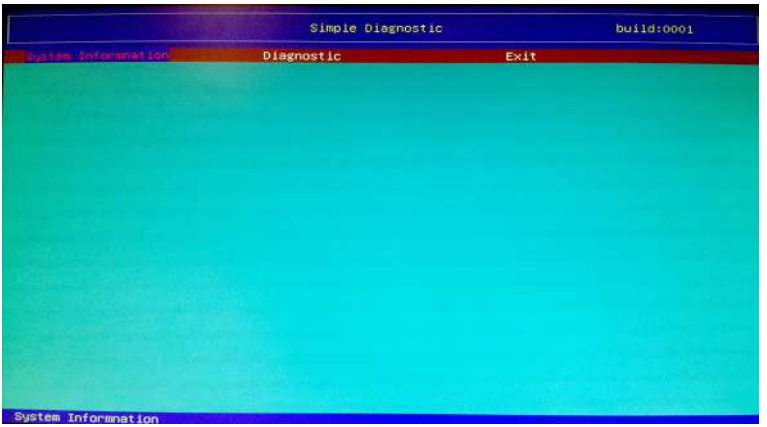
▸**Save as User Defaults**

Save changes as the user's default profile.

▸**Restore User Defaults**

Restore the user's default profile.

▸ **Launch MSI Simple Diag**



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								
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	8Ah	8Ah	8Ah	8Ah				
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
SIO_GPIO_Data         equ    089h
SIO_GPIO_Status       equ    08Ah
GPI_0                 equ    00000001b
GPO_0                 equ    00001000b
```

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, SIO_GPIO_Status
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 to high 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

; Set GPO 0 Register
mov  dx, SIO_INDEX_Port
mov  al, SIO_GPIO_Data
out  dx, al
mov  dx, SIO_DATA_Port
in   al, dx
and  al, not GPO_0
or   al, GPO_0
out  dx, al

; Set GPO 2 to high
```

```
mov dx, SIO_INDEX_Port
mov al, SIO_GPIO_Data
out dx, al
mov dx, SIO_DATA_Port
in al, dx
and al, not GPO_2
or al, GPO_2
out dx, al

; Exit SIO
mov dx, SIO_INDEX_Port
mov al, SIO_Lock_Value
out dx, al
```