MS-98K1

(v1.x) Industrial Computer Board

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Revision History

Revision	Date
V1.1	2018/09

Technical Support

If a problem arises with your product and no solution can be obtained from the user's manual, please contact your place of purchase or local distributor. Alternatively, please visit https://www.msi.com/support/ for further guidance.

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, IT MAY DAMAGE THE EQUIPMENT.

Chemical Substances Information

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

https://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:

https://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.

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-98K1, an excellent industrial computer board.

Based on the innovative Intel® Kaby Lake-S / Sky Lake-S Processor, the MS-98K1 is engineered to provide reliable performance for a wide variety of industrial applications.

Specifications

Processor

- Intel® Kaby Lake-S Core™ i7, Core™ i5, Core™ i3, Pentium®, Celeron® Series Processor
- Intel® Sky Lake-S Core™ i7, Core™ i5, Core™ i3, Pentium®, Celeron® Series Processor

PCH

- Intel® Q170 / H110

Memory

- 2 * DDR4 SO-DIMM slots
- Dual-Channel DDR4 Non-ECC memory up to 2400MHz
- Max 32GB

Network

- Intel® I210AT GbE LAN (Co-lay I211AT)

Storage

- 2 * SATA 6Gb/s ports
- 1 * M.2 M Key 2242/2280 slot

Audio

- Realtek ALC887 audio codec (Co-lay ALC888S)
- 1 * Audio connector (Line-in/Line-Out/Mic-in)
- 1 * Amplifier connector

Graphics

- Integrated Intel® HD Graphics, support DirectX12
- 2 * DVI-D: Max resolution 1920x1200@60Hz
- 1 * DP: Max resolution 4096x2160@60Hz, Default (Co-lay HDMI)
- 1 * HDMI: Max resolution 4096x2160@24Hz, Optional (Co-Lay DP)
- 1 * LVDS 18/24 bit, Dual Channel: Max resolution 1920x1200@60Hz

Expansion Slot

- 1 * PCIe x16 slot (Max 75W supported)
- 1 * Mini-PCIe slot
- 1 * Nano SIM holder

Rear Panel I/O

- 1 * DisplayPort (Co-lay HDMI)
- 2 * DVI-D ports
- LAN + USB
  - SKU1: 4 * GbE RJ45 ports, 8 * USB3.0 ports
  - SKU2: 4 * GbE RJ45 ports, 4 * USB3.0 ports, 4 * USB2.0 ports
  - SKU3: 2 * GbE RJ45 ports, 4 * USB3.0 ports, 4 * USB2.0 ports

Internal I/O

- 1 * DC power connector
- 1 * CPU PWM fan connector
- 1 * System PWM fan connector
- 2 * SATA 6Gb/s ports
- 2 * SATA power connectors
- 1 * 4-pin USB2.0 box-header (1 port)
- 1 * 2x4-pin USB2.0 box-header (2 ports, SKU1 only)
- 1 * Front panel connector
- 1 * Front audio connector
- 1 * Amplifier connector
- 1 * GPIO (DIO) connector
- 1 * Chassis intrusion header
- 2 * Front LAN LED connectors (SKU1, SKU2)
- 1 * Front LAN LED connector (SKU3)
- 1 * LPC connector
- 2 * Serial port connectors (4 ports)
- 1 * LVDS connector
- 1 * LVDS inverter connector
- 2 * Serial port power jumpers
- 1 * LVDS power jumper
- 1 * LVDS inverter power jumper
- 1 * Clear CMOS jumper
- 1 * AT/ATX jumper
- 1 * PCIe jumper
- 1 * ME jumper

Form Factor

- 170 mm x 170 mm (6.7 x 6.7 inches, mini-ITX)

Environment

- Operating Temperature: -10 ~ 60°C
- Storage Temperature: -20 ~ 80°C
- Humidity: 10 ~ 90% RH, non-condensing

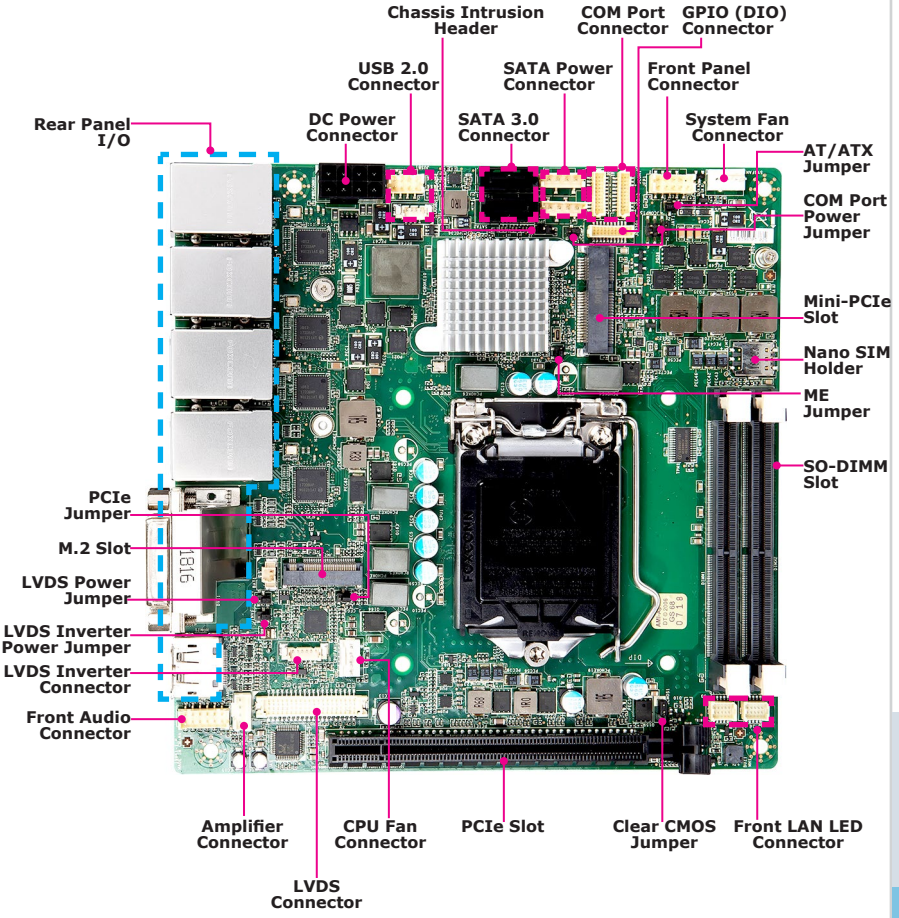
Accessories

- 1 * DC-in power cable (Max 12A supported)
- 1 * I/O shield

SKU Comparison

Features \ SKUs		SKU1	SKU2	SKU3
Chipset (PCH)		Intel Q170	Intel H110	Intel H110
Rear I/O	**USB2.0**		4	4
	USB3.0	8	4	4
	LAN	4 * Intel I210AT GbE	4 * Intel I211AT GbE	2 * Intel I211AT GbE
Internal I/O	**COM**	4 * RS232/422/485	■ 1 * RS232/422/485 ■ 3 * RS232	
	USB2.0	■ 1 * 2x4-pin box-header (2 ports) ■ 1 * 4-pin box-header (1 port)	1 * 4-pin box-header (1 port)	
	TPM2.0 Onboard	Yes		
	M.2 M Key	PCIe x4 & SATA3.0	SATA3.0	
	Front LAN LED	2	2	1

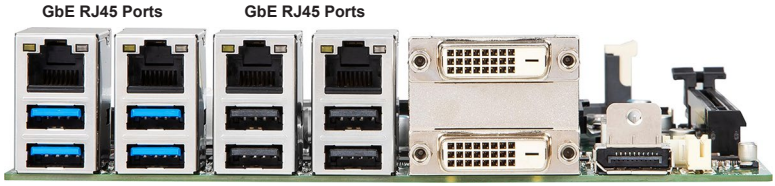
Layout


Chassis Intrusion Header
COM Port Connector
GPIO (DIO) Connector
USB 2.0 Connector
SATA Power Connector
Front Panel Connector
Rear Panel I/O
DC Power Connector
SATA 3.0 Connector
System Fan Connector
AT/ATX Jumper
COM Port Power Jumper
Mini-PCIe Slot
Nano SIM Holder
ME Jumper
SO-DIMM Slot
PCIe Jumper
M.2 Slot
LVDS Power Jumper
LVDS Inverter Power Jumper
LVDS Inverter Connector
Front Audio Connector
Amplifier Connector
CPU Fan Connector
PCIe Slot
Clear CMOS Jumper
Front LAN LED Connector
LVDS Connector

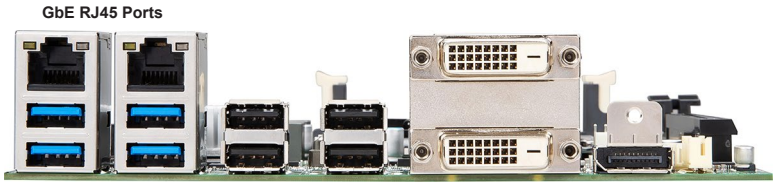
Rear Panel I/O Options

SKU1

SKU2



SKU3



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

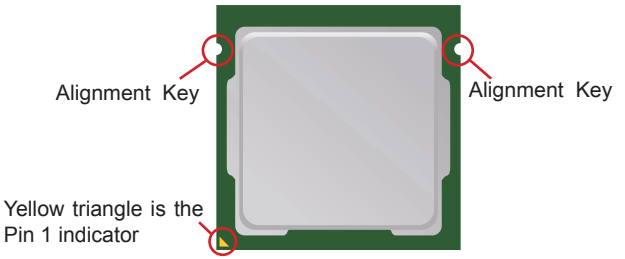
Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

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

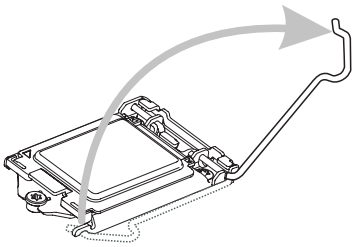
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



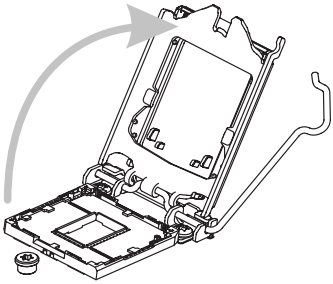
CPU Installation

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.

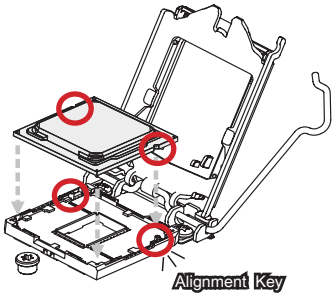
1. Open the load lever and remove the plastic cap.



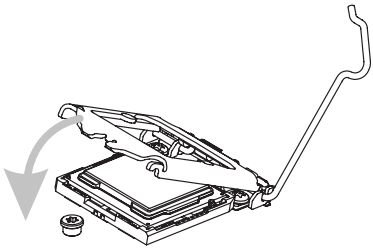
2. Lift the load lever up to fully open position.



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.



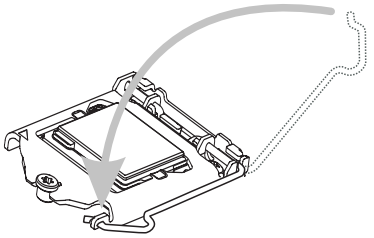
4. Engage the load lever while pressing down lightly onto the load plate.



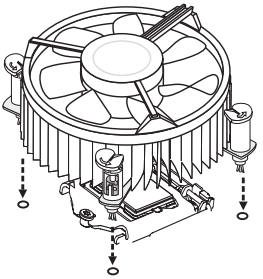
Important

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

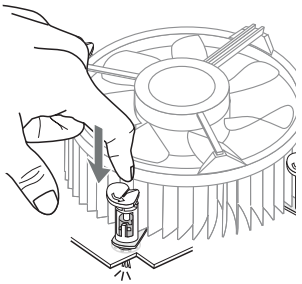
5. Secure the load lever with the hook under the retention tab.



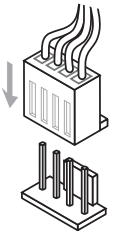
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



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.

Recommended Memory Population

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

Important

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

Installing Memory Modules

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

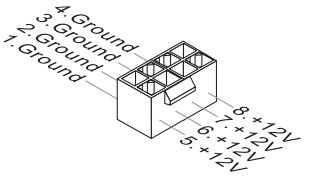
Important

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

Power Supply

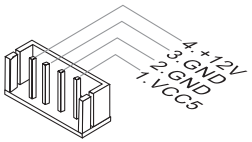
DC Power Connector: PWRCONN1

This connector allows you to connect a DC-in power cable.



SATA Power Connector: JPW1, JPW2

This connector is used to provide power to SATA devices.



Important

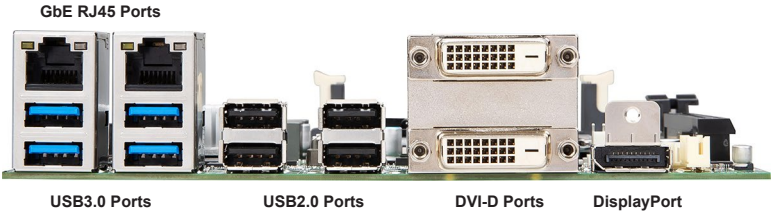
- *Make sure all power connectors are connected to the power supply to ensure stable operation of the motherboard.*
- *Make sure that you hold the onboard power connector firmly before disconnecting the power cable.*

Rear Panel I/O

SKU1

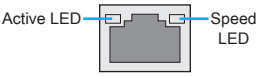
SKU2

SKU3



➤ GbE RJ45 Port

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



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

➤ USB3.0 Port

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

➤ USB2.0 Port

The USB (Universal Serial Bus) port is for attaching USB devices such as keyboard, mouse, or other USB-compatible devices. It supports up to 480Mbit/s (Hi-Speed) data transfer rate.

➤ DVI-D Port

The DVI-D (Digital Visual Interface-Digital) connector allows you to connect a monitor. It provides a high-speed digital interconnection between the computer and its display device.

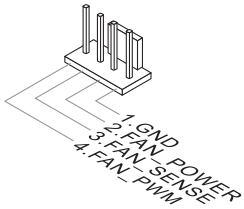
➤ DisplayPort

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

Connector

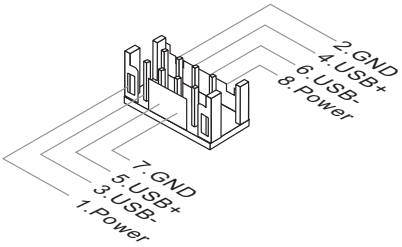
Fan Power Connector: CPUFAN1, SYSFAN1

The fan power connector supports system cooling fans 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 fan control.



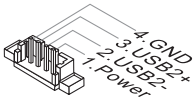
USB2.0 Connector: JUSB1 (SKU1 only)

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.



USB2.0 Connector: JUSB2

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

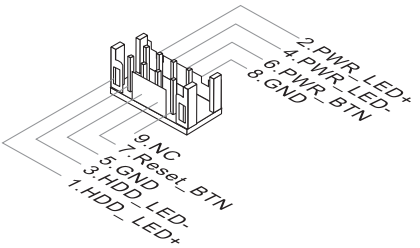


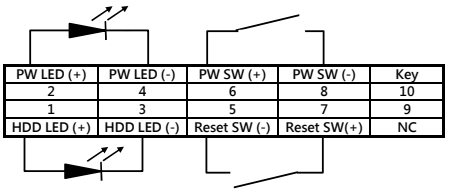
Important

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

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.



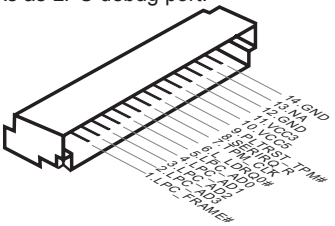


PW LED (+)	PW LED (-)	PW SW (+)	PW SW (-)	Key
2	4	6	8	10
1	3	5	7	9
HDD LED (+)	HDD LED (-)	Reset SW (-)	Reset SW(+)	NC

LED(+)	Voltage(V)	Current(mA)
Power	5	18.51
HDD	5	18.51

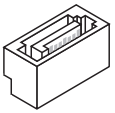
LPC Debug Port Connector: JTPM1

This connector works as LPC debug port.



Serial ATA Connector: SATA1, SATA2

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

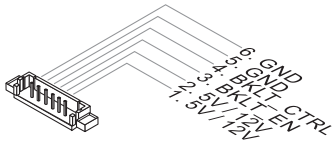


Important

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

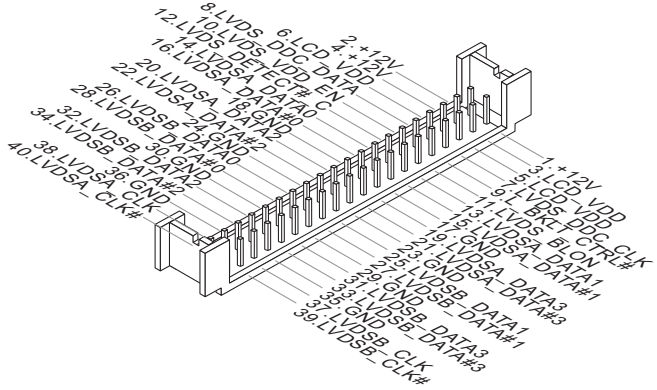
LVDS Inverter Connector: JINVDD1

The connector is provided for LCD backlight options.



LVDS Connector: JLVDS1

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

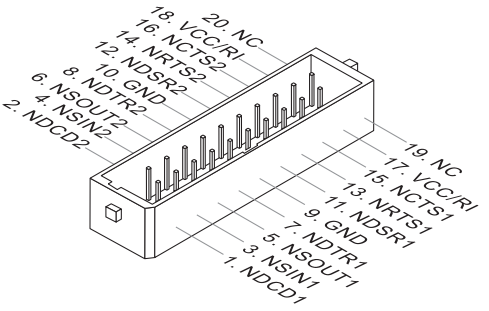


Important

Pin 12 is a detect pin. When using a customized LVDS cable, pin 12 should be a signal ground with a low impedance. Otherwise, LVDS will not function.

Serial Port Connector: JCOM1, JCOM2

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.



Feature \ SKUs	SKU1	SKU2	SKU3
COM	4 x RS232/422/485 ■ COM1: RS232/422/485, RI/5V/12V ■ COM2~4: RS232/422/485, 0V/5V/12V	1 x RS232/422/485, 3 x RS232 ■ COM1: RS232/422/485, RI/5V/12V ■ COM2~4: RS232, 0V/5V/12V	

RS232

PIN		SIGNAL	DESCRIPTION
1	2	DCD	Data Carrier Detect
3	4	SIN	Signal In
5	6	SOUT	Signal Out
7	8	DTR	Data Terminal Ready
9	10	GND	Signal Ground
11	12	DSR	Data Set Ready
13	14	RTS	Request To Send
15	16	CTS	Clear To Send
17	18	VCC/RI	Voltage select setting by jumper/Ring Indicator

RS422

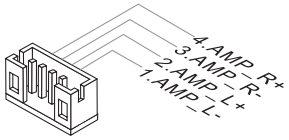
PIN		SIGNAL	DESCRIPTION
1	2	422 TXD-	Transmit Data, Negative
3	4	422 TXD+	Transmit Data, Positive
5	6	422 RXD+	Receive Data, Positive
7	8	422 RXD-	Receive Data, Negative
9	10	GND	Signal Ground
11	12	NC	No Connection
13	14	NC	No Connection
15	16	NC	No Connection
17	18	NC	No Connection

RS485

PIN		SIGNAL	DESCRIPTION
1	2	485 TXD-	Transmit Data, Negative
3	4	485 TXD+	Transmit Data, Positive
5	6	NC	No Connection
7	8	NC	No Connection
9	10	GND	Signal Ground
11	12	NC	No Connection
13	14	NC	No Connection
15	16	NC	No Connection
17	18	NC	No Connection

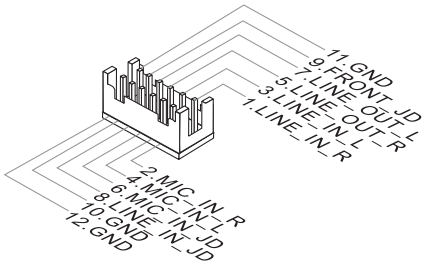
Audio Amplifier Pinheader: JAMP1

The JAMP1 is used to connect audio amplifiers to enhance audio performance.



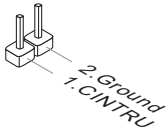
Front Audio Connector: JAUD1

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



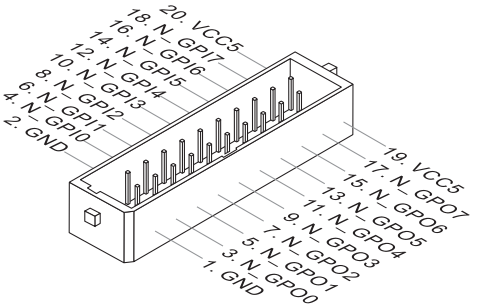
Chassis Intrusion Header: J2

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



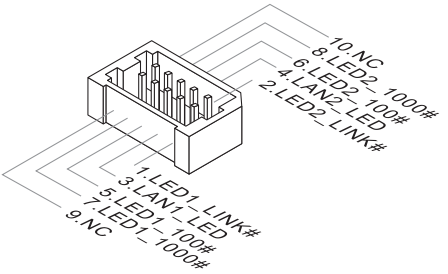
GPIO (DIO) Connector: JGPIO1

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



LAN LED Connector: J3, J4

This connector is provided for electrical connection to the LAN LEDs.



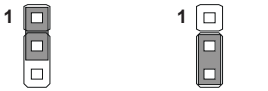
Jumper

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 Jumper: JAT1

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

ATX AT

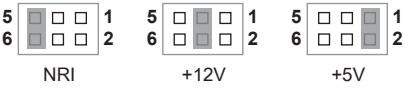
ME Jumper: ME_DIS1

This jumper is used to enable/disable the Intel ME function.

Normal ME Disable

COM1 Power Jumper: JCOMP1

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



COM2~4 Power Jumper: JCOMP2

This jumper specifies the operation voltage of the COM2~4 serial ports.

LVDS Power Jumper: JVDD1

Use this jumper to specify the operation voltage of the LVDS interface flat panel.

LVDS Inverter Power Jumper: JINV1

Use this jumper to specify the operation voltage of the interver interface flat panel.

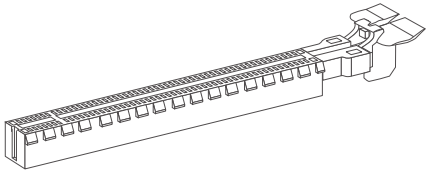
PCI Express Jumper: J_CFG1

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

Slot

PCIe (Peripheral Component Interconnect Express) Slot

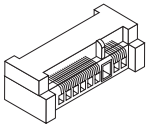
The PCI Express slot supports PCIe interface expansion cards.



PCIe x16 slot

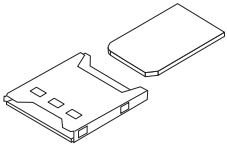
Mini-PCIe (Peripheral Component Interconnect Express) Slot

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



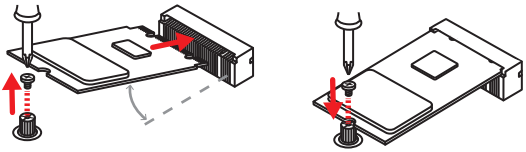
Nano SIM Holder

This holder is provided for 3G, 4G, LTE, WiFi, BT, CANBus Nano SIM cards.



M.2 Slot (Key M, 2280 & 2242)

Please install the M.2 solid-state drive (SSD) into the M.2 slot as shown below.



Important

- *Intel® RST only supports PCIe M.2 SSD with UEFI ROM and does not support Legacy ROM.*
- *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 & Reset
Esc	Exit

Getting Help

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

Main Menu

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

Sub-Menu

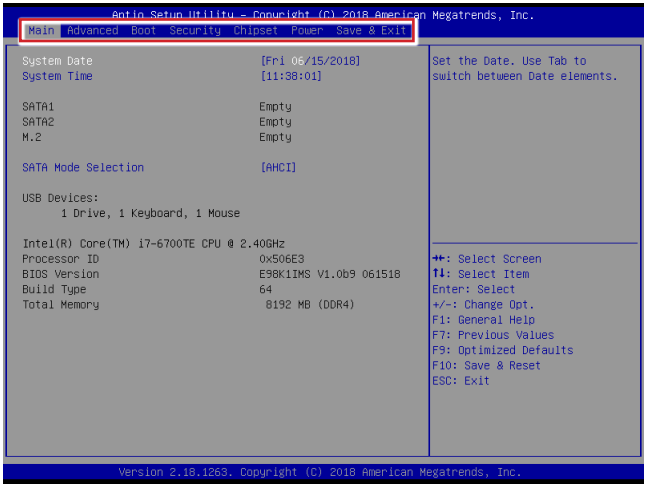
If you find a right pointer symbol appears to the left of certain fields that means a sub-menu can be launched from this field. A sub-menu contains additional options for a field parameter. You can use arrow keys (↑↓) to highlight the field and press <Enter> to call up the sub-menu. Then you can use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

General Help <F1>

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

Q170 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.

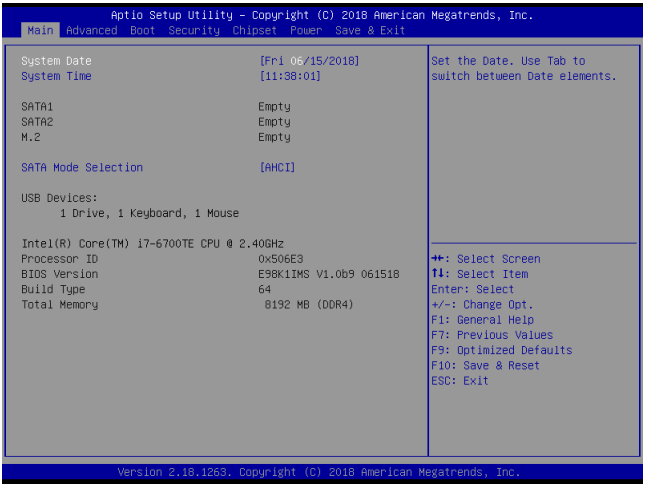
▸Power

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>.

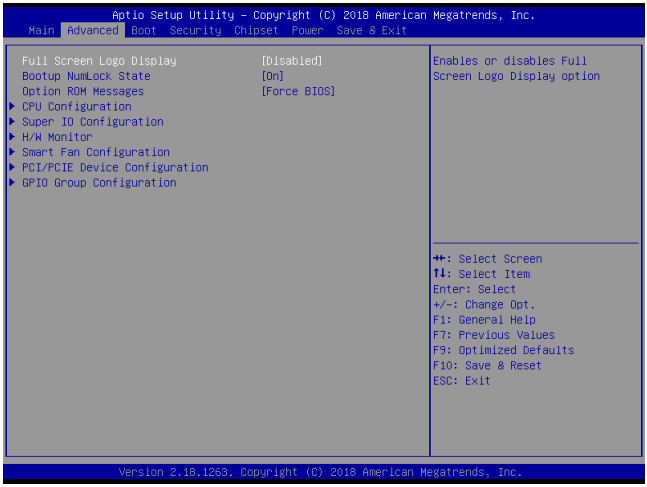
▸System Time

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.

▸CPU Configuration

▸Intel Virtualization Technology

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

▸Active Processor Cores

This setting specifies the number of active processor cores.

▸Execute Disable Bit

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

▸Hyper-Threading

The processor uses Hyper-Threading technology to increase transaction rates and reduces end-user response times. The technology treats the two cores inside the processor as two logical processors that can execute instructions simultaneously. In this way, the system performance is highly improved. If you disable the function, the processor will use only one core to execute the instructions. Please disable this item if your operating system doesn□ support HT Function, or unreliability and instability may occur.

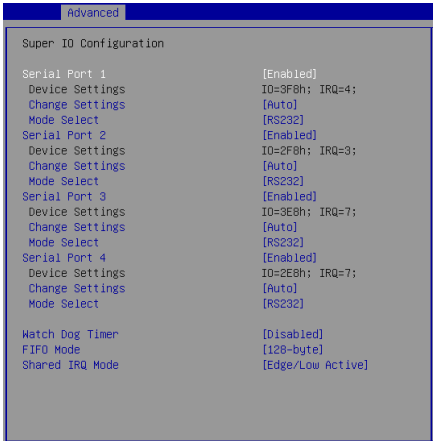
▸Intel(R) SpeedStep(tm)

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

▸C States

This setting controls the C-State (CPU Power state). C-State performance indicates the ability to run the processor in lower power states when the PC is idle. This setting enables/disables the C-State Configuration for power saving purposes.

▸Super IO Configuration



▸Serial Port 1/ 2/ 3/ 4

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 specified serial port.

▸ Watch Dog Timer

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

▸FIFO Mode

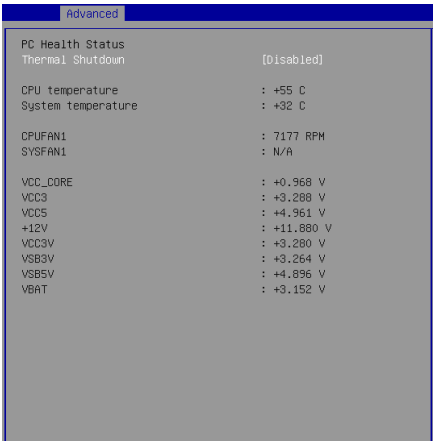
This setting controls the FIFO data transfer mode.

▸Shared IRQ Mode

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

▸H/W Monitor

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



▸Thermal Shutdown

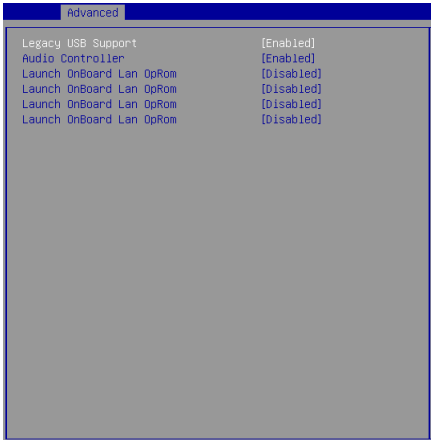
This setting enables/disables the thermal shutdown function for system thermal protection.

▸Smart Fan Configuration

▸CPUFAN1, SYSFAN1

This setting enables/disables 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



▸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.

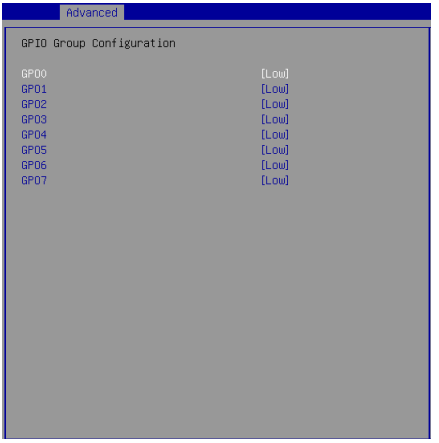
▸Audio Controller

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.

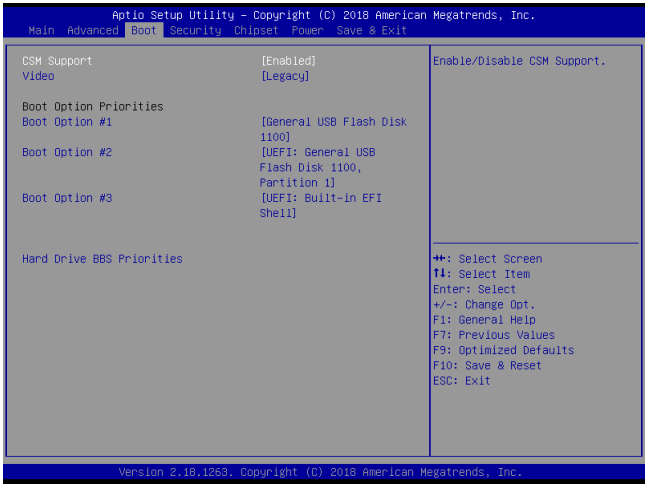
▸GPIO Group Configuration



▸GPO0 ~ GPO7

These settings control the operation mode of the specified GPIO.

Boot



▸CSM Support

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

▸Video

This setting selects the video mode.

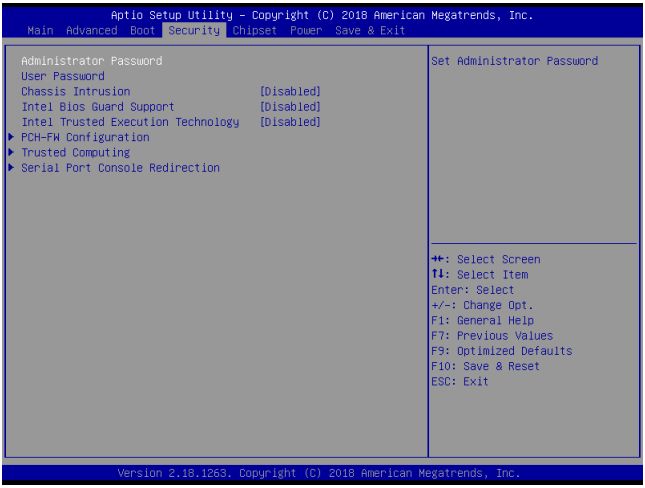
▸Boot Option Priorities

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.

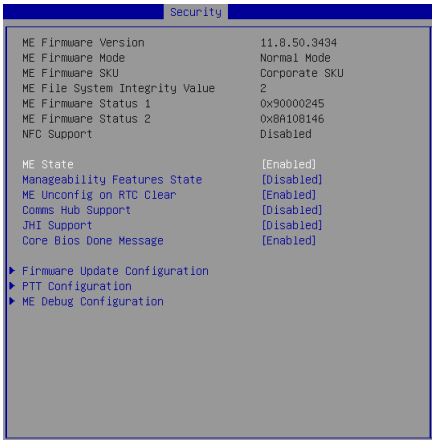
▸Intel BIOS Guard Support

Intel BIOS Guard Support ensures that updates to system BIOS flash are secure.

▸Intel Trusted Execution Technology

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

▸PCH-FW Configuration



▸ME Firmware Version, ME Firmware Mode, ME Firmware SKU, ME File System Integrity Value, ME Firmware Status 1, ME Firmware Status 2, NFC Support

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

▸ME State

This setting enables/disables the ME status.

▸Manageability Features State

This setting enables/disables the Manageability Features State.

▸ME Unconfig on RTC Clear

This setting enables/disables ME firmware unconfigure on RTC clear.

▸Comms Hub Support

This setting enables/disables Communications Hub Support.

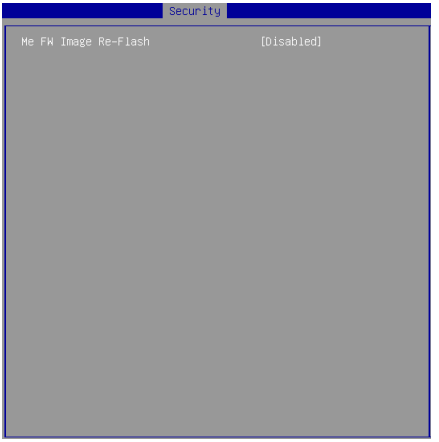
▸JHI Support

This setting enables/disables support for Intel Dynamic Application Loader Host Interface (JHI).

▸Core BIOS Done Message

This setting enables/disables Core BIOS Done Message sent to ME.

▸**Firmware Update Configuration**



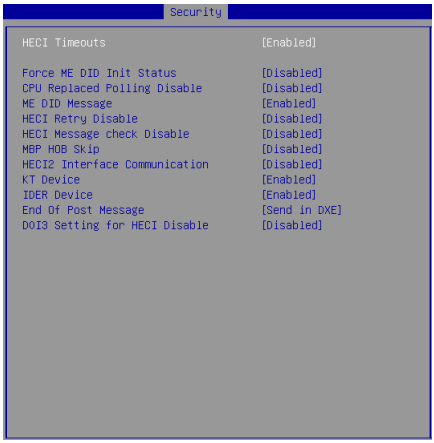
▸**ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

▸**PTT Configuration**

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

▸ME Debug Configuration



▸Trusted Computing

▸Security Device Support

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

▸SHA-1 PCR Bank, SHA256 PCR Bank

These settings enable/disable the SHA-1 PCR Bank and SHA256 PCR Bank.

▸Pending Operation

When ***Security Device Support*** is set to [Enable], ***Pending Operation*** will appear. Set this item to [TPM Clear] to clear all data secured by TPM or [None] to discard the selection. It is advised that users should routinely back up their TPM secured data.

▸**Platform Hierarchy, Storage Hierarchy, Endorsement Hierarchy**

These settings enable/disable the Platform Hierarchy, Storage Hierarchy and Endorsement Hierarchy.

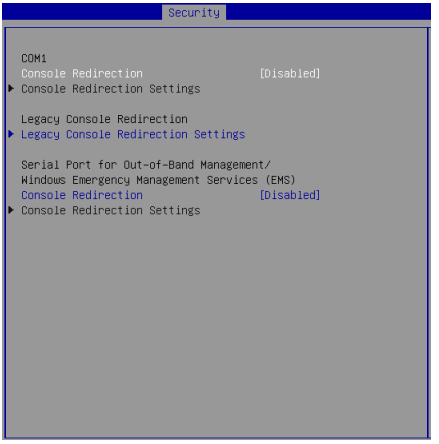
▸**TPM2.0 UEFI Spec Version, Physical Presence Spec Version**

This settings show the TPM2.0 UEFI Spec Version and Physical Presence Spec Version.

▸**TPM2.0 Interface Type**

This setting shows the TPM2.0 Interface Type.

▸**Serial Port Console Redirection**

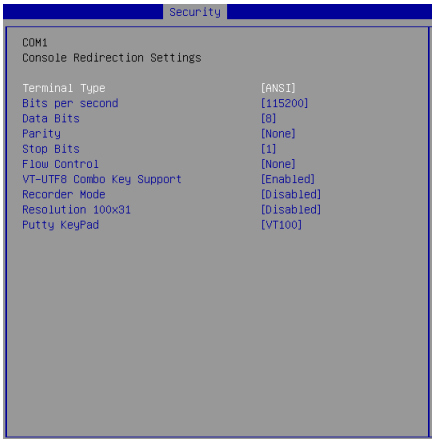


COM1

▸**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.

▸ Putty Keypad

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

Legacy Console Redirection

▸Legacy Console Redirection Settings

▸Redirection COM Port

This setting specifies the COM port for redirection.

▸Resolution

This setting specifies the redirection resolution of legacy OS.

▸Redirect After POST

This setting determines whether or not to keep terminals' console redirection running after the POST has booted.

Serial Port for Out-of-Band Management/ Windows Emergency Management Services (EMS)

▸**Console Redirection**

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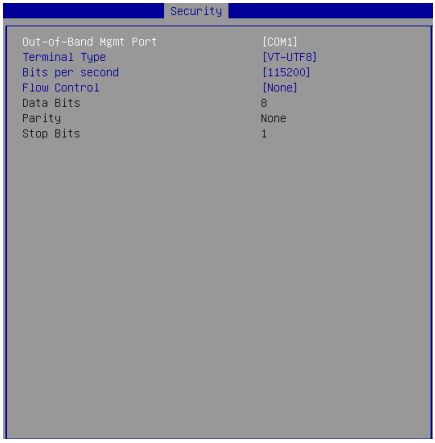

▸**Out-of-Band Mgmt Port**

This setting specifies the Out-of-Band Management Port.

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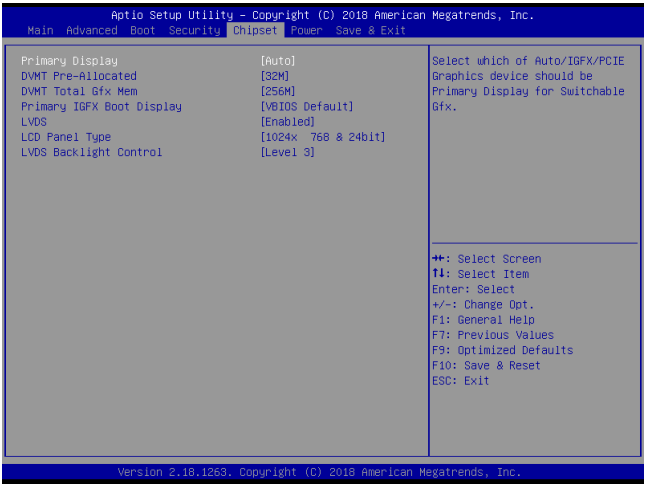
Chipset



▸Primary Display

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

▸DVMT Pre-Allocated

This setting selects DVMT 5.0 Pre-Allocated (Fixed) Graphics Memory size used by the Internal Graphics Device.

▸DVMT Total Gfx Mem

This setting specifies the memory size for DVMT.

▸Primary IGFX Boot Display

Use the field to select the primary IGFX boot display of the system.

▸LVDS

This setting enables/disables the LVDS interface.

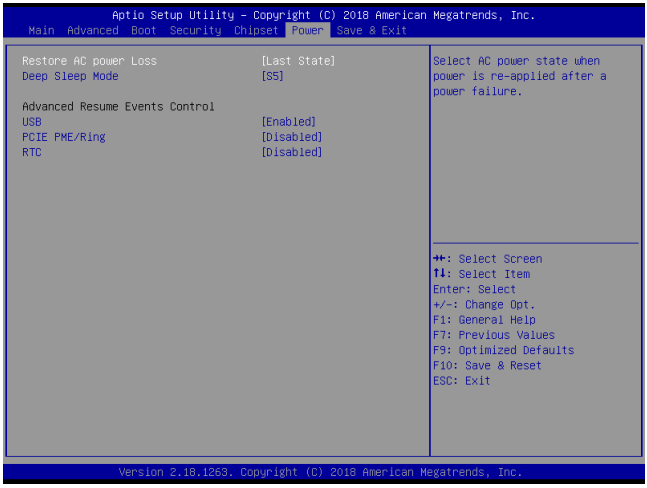
▸LCD Panel Type

This setting allows you to set the resolution of the LCD display.

▸LVDS Backlight Control

This setting controls the intensity of the LVDS backlight.

Power



▸Restore AC Power Loss

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

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

▸Deep Sleep Mode

The setting 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

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

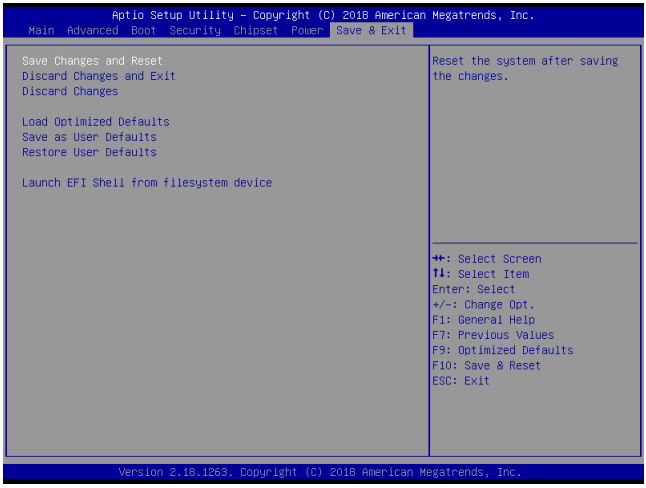
▸PCIE PME/Ring

This field specifies whether the system will be awakened from power saving modes when activity or input signal of onboard PCIE PME/Ring 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**

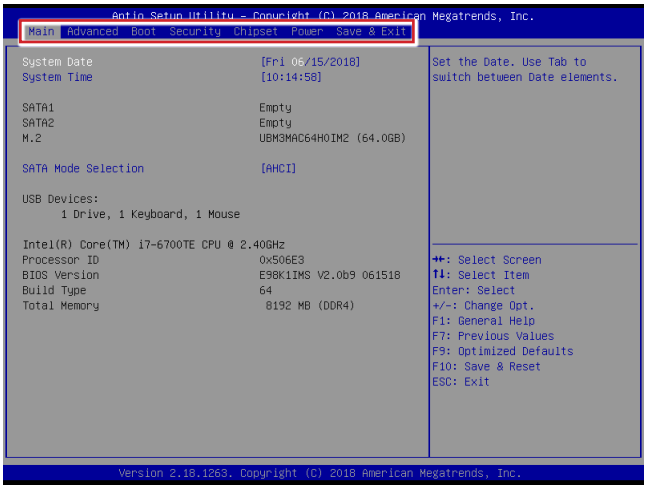
Restore the user's default profile.

▸**Launch EFI Shell from filesystem device**

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

H110 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.

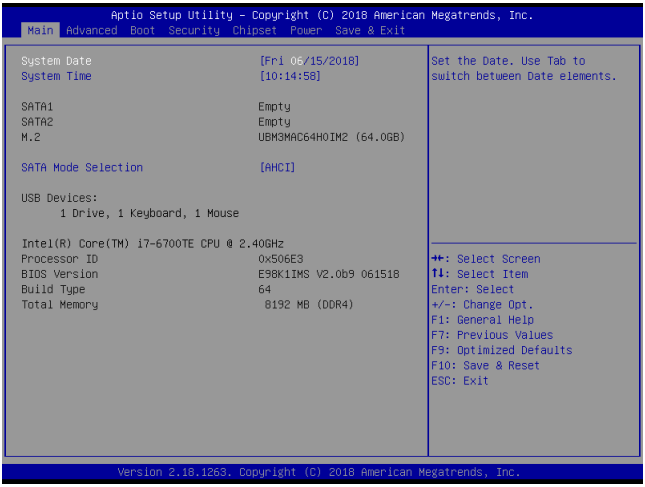
▸Power

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>.

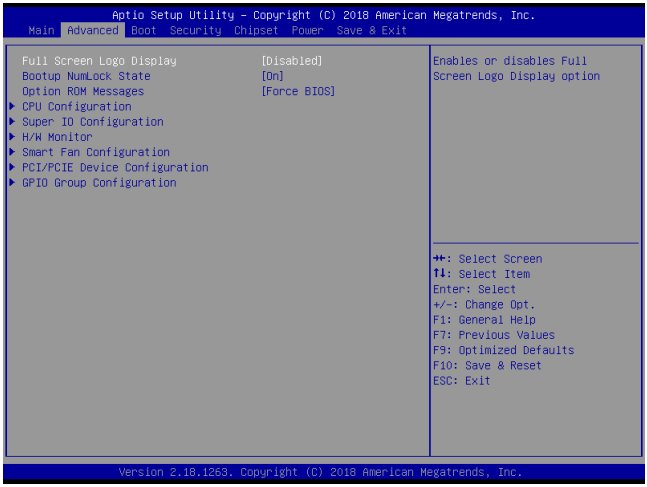
▸System Time

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.

▸CPU Configuration

▸Intel Virtualization Technology

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

▸Active Processor Cores

This setting specifies the number of active processor cores.

▸Execute Disable Bit

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

▸Hyper-Threading

The processor uses Hyper-Threading technology to increase transaction rates and reduces end-user response times. The technology treats the two cores inside the processor as two logical processors that can execute instructions simultaneously. In this way, the system performance is highly improved. If you disable the function, the processor will use only one core to execute the instructions. Please disable this item if your operating system doesn□ support HT Function, or unreliability and instability may occur.

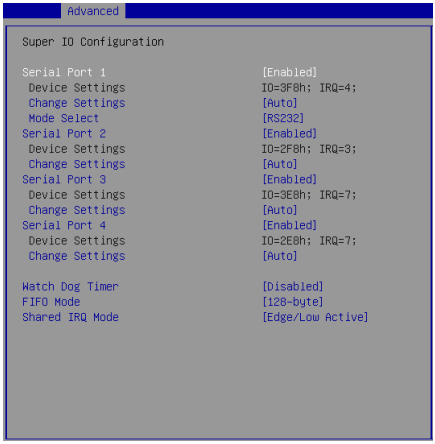
▸Intel(R) SpeedStep(tm)

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

▸**C States**

This setting controls the C-State (CPU Power state). C-State performance indicates the ability to run the processor in lower power states when the PC is idle. This setting enables/disables the C-State Configuration for power saving purposes.

▸**Super IO Configuration**



▸**Serial Port 1/ 2/ 3/ 4**

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 specified serial port.

▸ **Watch Dog Timer**

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

▸**FIFO Mode**

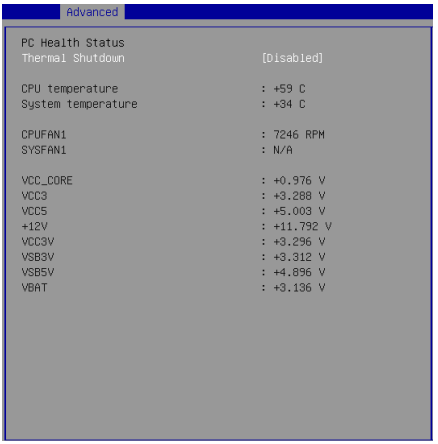
This setting controls the FIFO data transfer mode.

▸**Shared IRQ Mode**

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

▸H/W Monitor

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



▸Thermal Shutdown

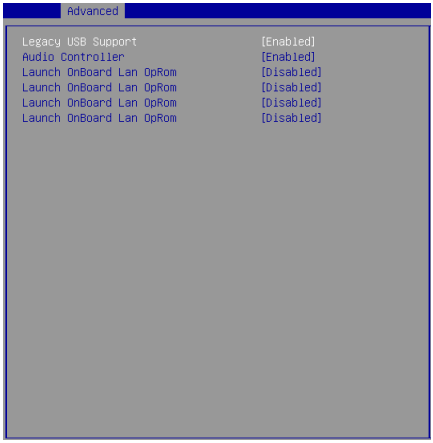
This setting enables/disables the thermal shutdown function for system thermal protection.

▸Smart Fan Configuration

▸CPUFAN1, SYSFAN1

This setting enables/disables 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



▸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.

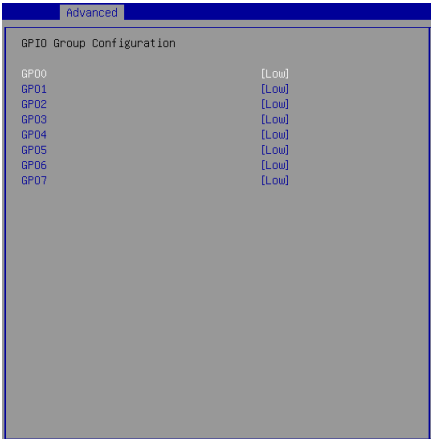
▸Audio Controller

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.

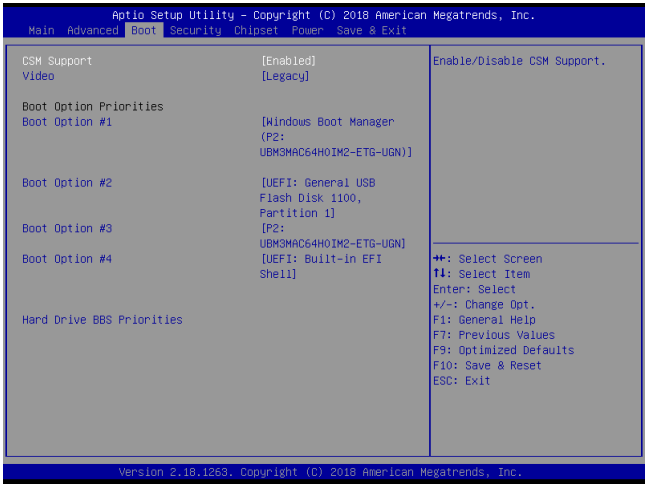
▸GPIO Group Configuration



▸GPO0 ~ GPO7

These settings control the operation mode of the specified GPIO.

Boot



▸CSM Support

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

▸Video

This setting selects the video mode.

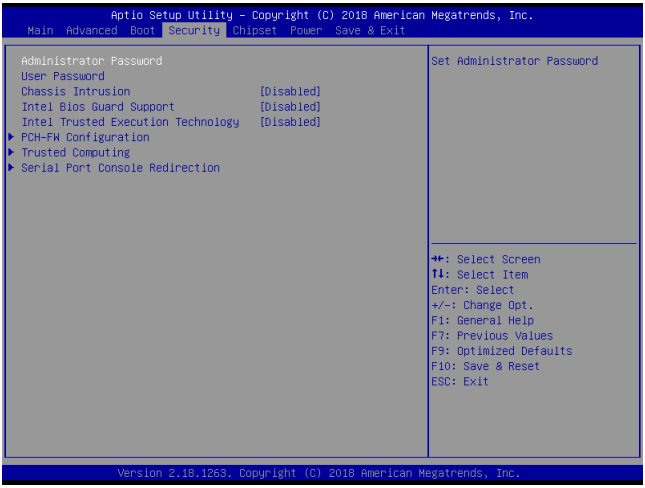
▸Boot Option Priorities

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.

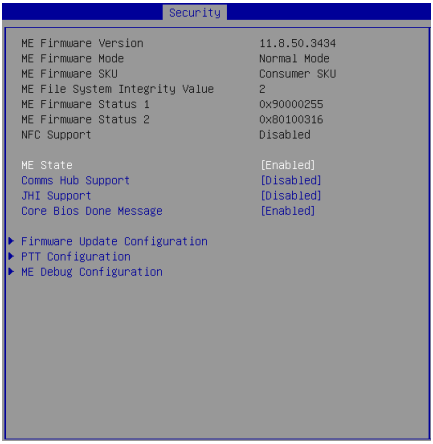
▸Intel BIOS Guard Support

Intel BIOS Guard Support ensures that updates to system BIOS flash are secure.

▸Intel Trusted Execution Technology

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

▸PCH-FW Configuration



▸ME Firmware Version, ME Firmware Mode, ME Firmware SKU, ME File System Integrity Value, ME Firmware Status 1, ME Firmware Status 2, NFC Support

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

▸ME State

This setting enables/disables the ME status.

▸Comms Hub Support

This setting enables/disables Communications Hub Support.

▸JHI Support

This setting enables/disables support for Intel Dynamic Application Loader Host Interface (JHI).

▸Core BIOS Done Message

This setting enables/disables Core BIOS Done Message sent to ME.

▸Firmware Update Configuration

▸ME FW Image Re-Flash

This setting enables/disables the ME FW image reflash.

▸Local FW Update

This setting enables/disables the local firmware update.

▸PTT Configuration

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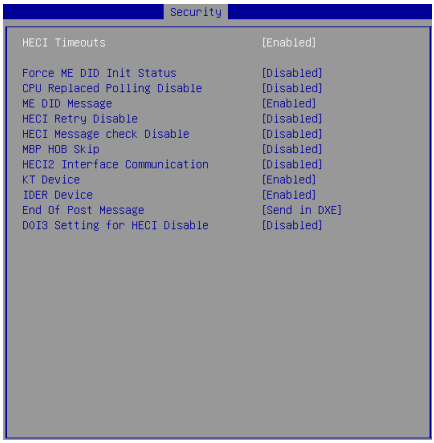
▸ME Debug Configuration



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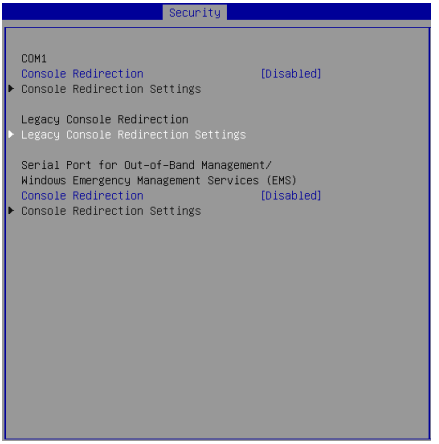

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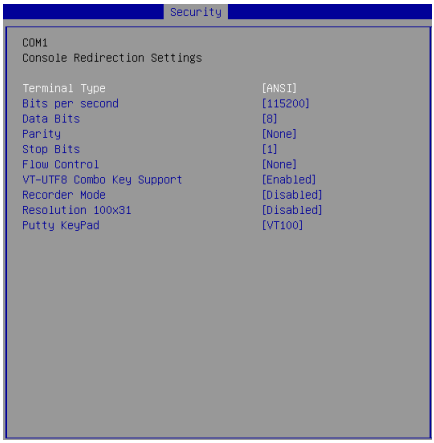

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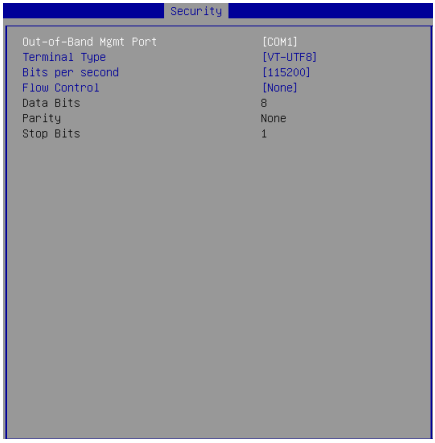

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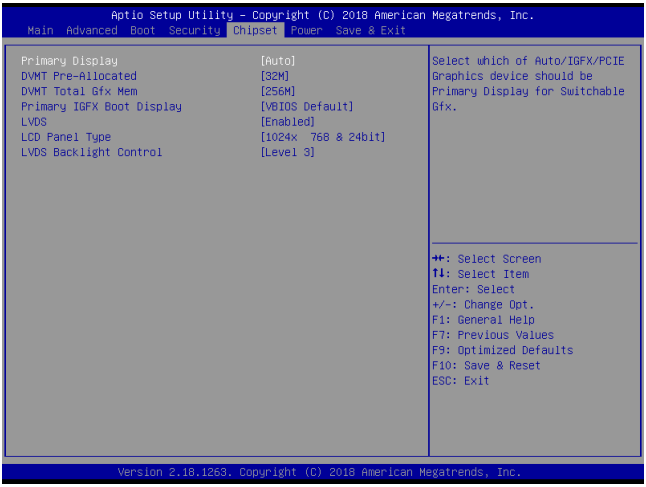
Chipset



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▸DVMT Total Gfx Mem

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▸LVDS

This setting enables/disables the LVDS interface.

▸LCD Panel Type

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▸LVDS Backlight Control

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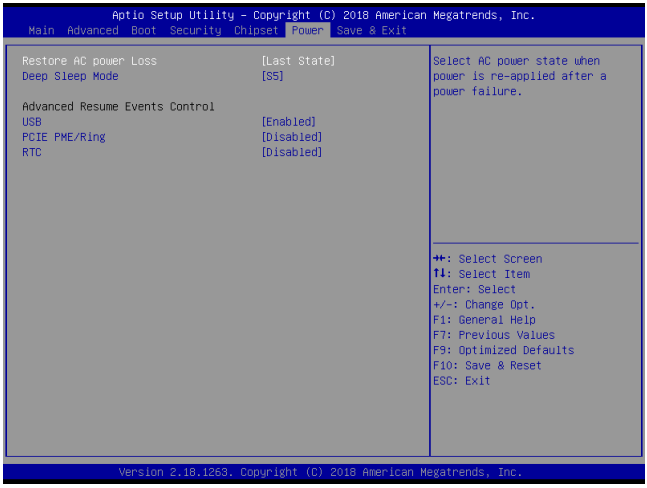
Power



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[Last State]	Restores the system to the previous status before power failure or interrupt occurred.

▸Deep Sleep Mode

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

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

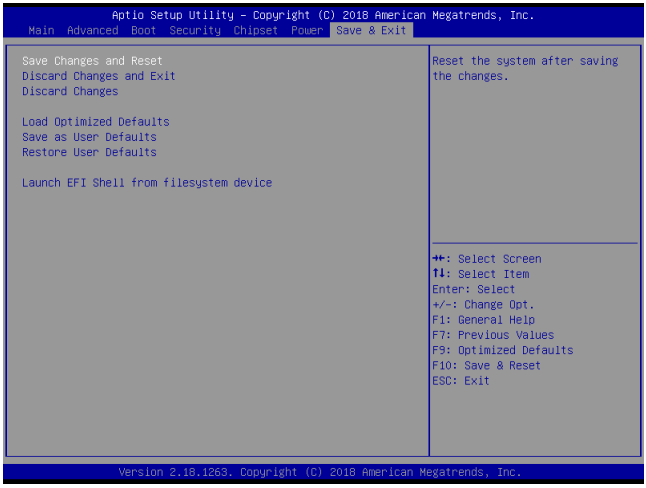
▸PCIE PME/Ring

This field specifies whether the system will be awakened from power saving modes when activity or input signal of onboard PCIE PME/Ring 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 EFI Shell from filesystem device

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

Appendix
GPIO WDT BKL Programming

This appendix provides WDT (Watch Dog Timer), GPIO (General Purpose Input/ Output) and LVDS Backlight programming guide.

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Abstract

In this document, code examples based on C programming language provided for customer interest. **Inportb**, **Outportb**, **Inportl** and **Outportl** are basic functions used for access IO ports and defined as following.

Inportb: Read a single 8-bit I/O port.
Outportb: Write a single byte to an 8-bit port.
Inportl: Reads a single 32-bit I/O port.
Outportl: Write a single long to a 32-bit port.

General Purposed IO

1. General Purposed IO – GPIO/DIO

The GPIO port configuration addresses listed in the following table:

Name	IO Port	IO address	Name	IO Port	IO address
N_GPI0	0xA05	Bit 3	N_GPO0	0xA04	Bit 0
N_GPI1	0xA05	Bit 4	N_GPO1	0xA04	Bit 1
N_GPI2	0xA05	Bit 5	N_GPO2	0xA04	Bit 2
N_GPI3	0xA05	Bit 6	N_GPO3	0xA04	Bit 3
N_GPI4	0xA05	Bit 0	N_GPO4	0xA06	Bit 7
N_GPI5	0xA05	Bit 7	N_GPO5	0xA04	Bit 4
N_GPI6	0xA05	Bit 2	N_GPO6	0xA06	Bit 5
N_GPI7	0xA05	Bit 1	N_GPO7	0xA06	Bit 6

1.1 Set output value of GPO

1. Read the value from GPO port.
2. Set the value of GPO address.
3. Write the value back to GPO port.

Example: Set **N_GPO0** output "high"

```
val = Inportb (0xA04);          // Read value from N_GPO0 port.
val = val | (1<<0);             // Set N_GPO0 address (bit 0) to 1 (output "high").
Outportb (0xA04, val);          // Write back to N_GPO0 port.
```

Example: Set **N_GPO1** output "low"

```
val = Inportb (0xA04);          // Read value from N_GPO1 port.
val = val & (~(1<<1));          // Set N_GPO1 address (bit 1) to 0 (output "low").
Outportb (0xA04, val);          // Write back to N_GPO1 port.
```

1.2 Read input value from GPI

1. Read the value from GPI port.
2. Get the value of GPI address.

Example: Get **N_GPI2** input value.

```
val = Inportb (0xA05);          // Read value from N_GPI2 port.
val = val & (1<<5);             // Read N_GPI2 address (bit 5).
if (val)    printf ("Input of  N_GPI2  is High");
else        printf ("Input of  N_GPI2  is Low");
```

Watchdog Timer

2. Watchdog Timer – WDT

The base address (WDT_BASE) of WDT configuration registers is 0xA10.

2.1 Set WDT Time Unit

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x08;                       // minute mode. val = val & 0xF7 if second mode
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting
```

2.2 Set WDT Time

```
Outportb (WDT_BASE + 0x06, Time);       // Write WDT time, value 1 to 255.
```

2.3 Enable WDT

```
val = Inportb (WDT_BASE + 0x0A);        // Read current WDT_PME setting
val = val | 0x01;                       // Enable WDT OUT: WDOUT_EN (bit 0) set to 1.
Outportb (WDT_BASE + 0x0A, val);        // Write back WDT setting.
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x20;                       // Enable WDT by set WD_EN (bit 5) to 1.
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting.
```

2.4 Disable WDT

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val & 0xDF;                       // Disable WDT by set WD_EN (bit 5) to 0.
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting.
```

2.5 Check WDT Reset Flag

If the system has been reset by WDT function, this flag will set to 1.

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting.
val = val & 0x40;                       // Check WDTMOUT_STS (bit 6).
if (val)    printf ("timeout event occurred");
else        printf ("timeout event not occurred");
```

2.6 Clear WDT Reset Flag

```
val = Inportb (WDT_BASE + 0x05);        // Read current WDT setting
val = val | 0x40;                       // Set 1 to WDTMOUT_STS (bit 6);
Outportb (WDT_BASE + 0x05, val);        // Write back WDT setting
```

LVDS Backlight Brightness Control

3. LVDS Backlight Brightness Control

The LVDS controller support 17 level of backlight brightness value from 0 (30%) to 16 (100%) and it is accessible through SMBus. The associated access method (**SMBus_ReadByte**, **SMBus_WriteByte**) provided in part 4.

3.1 Set the Level of LVDS Backlight

1. Write **0xED** into address **0x7F** on SMBus device **0x42**.
2. Write desired backlight level from 0x0 (30%) to 0x10 (100%) into address **0x6E** on SMBus device **0x42**.

Example: Set LVDS backlight level to 0x10 (100%)

```
SMBus_WriteByte (0x42, 0x7F, 0xED);
SMBus_WriteByte (0x42, 0x6E, 0x10); // Set brightness to 100%
```

3.2 Read the Level of LVDS Backlight

1. Write **0xED** into address **0x7F** on SMBus device **0x42**.
2. Read current backlight level from address **0x6E** on SMBus device **0x42**.

Example: Get LVDS backlight level

```
SMBus_WriteByte (0x42, 0x7F, 0xED);
BKL_Value = SMBus_ReadByte (0x42, 0x6E);
```

SMBus Access

4. SMBus Access

The base address of SMBus must know before access. The relevant bus and device information are as following.

```
#define IO_SC                0xCF8
#define IO_DA                0xCFC
#define PCIBASEADDRESS       0x80000000
#define PCI_BUS_NUM          0
#define PCI_DEV_NUM          31
#define PCI_FUN_NUM          4
```

4.1 Get SMBus Base Address

```
int SMBUS_BASE;
int DATA_ADDR = PCIBASEADDRESS + (PCI_BUS_NUM<<16) +
                                 (PCI_DEV_NUM<<11) +
                                 (PCI_FUN_NUM<<8);

Outportl (DATA_ADDR + 0x20, IO_SC);
SMBUS_BASE = Inportl (IO_DA) & 0xfffffff0;
```

4.2 SMBus_ReadByte (char DEVID, char offset)

Read the value of OFFSET from SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);
Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID + 1); //out Base + 04, (DEVID + 1)
Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET);   //out Base + 03, OFFSET
Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48);     //out Base + 02, 48H
mdelay (20);                                     //delay 20ms to let data ready
while ((Inportl (SMBUS_BASE) & 0x01) != 0);      //wait SMBus ready
SMB_DATA = Inportb (LOWORD (SMBUS_BASE) + 0x05); //input Base + 05
```

4.3 SMBus_WriteByte (char DEVID, char offset, char DATA)

Write DATA to OFFSET on SMBus device DEVID.

```
Outportb (LOWORD (SMBUS_BASE), 0xFE);
Outportb (LOWORD (SMBUS_BASE) + 0x04, DEVID);    //out Base + 04, (DEVID)
Outportb (LOWORD (SMBUS_BASE) + 0x03, OFFSET);   //out Base + 03, OFFSET
Outportb (LOWORD (SMBUS_BASE) + 0x05, DATA);     //out Base + 05, DATA
Outportb (LOWORD (SMBUS_BASE) + 0x02, 0x48);     //out Base + 02, 48H
mdelay (20);                                     //wait 20ms
```