MS-98L1

(v1.x) Industrial Computer Board

Copyright and Trademarks Notice

Revision History

Revision	Date
V1.0	2019/07

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-B Radio Frequency Interference Statement

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the measures listed below:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/television technician for help.

Notice 1

The changes or modifications not expressly approved by the party responsible for compliance could void the user's authority to operate the equipment.

Notice 2

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

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

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

WEEE Statement

Under the European Union ("EU") Directive on Waste Electrical and Electronic Equipment, Directive 2012/19/EU, 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.

CONTENTS

1 Overview

Thank you for choosing the MS-98L1, an excellent industrial computer board.

Based on the innovative Intel® Coffee Lake-S/ Coffee Lake-S Refresh Processor, the MS-98L1 is engineered to provide reliable performance for a wide variety of industrial applications.

Specifications

Processor

- SKU1 (C246) supports 8th Gen Intel® Coffee Lake-S Processors (Maximum 95W)
  - Intel® Xeon E-2176G/E-2124G
  - Intel® Core i3-8100
  - Intel® Pentium G5400
  - Intel® Celeron G4900
- SKU1 (C246) supports 9th Gen Intel® Coffee Lake-S Refresh Embedded IOTG Processors (Maximum 65W)
  - Intel® Xeon E-2278GEL
  - Intel® Core i7-9700E/i7-9700TE
  - Intel® Core i5-9500E/i5-9500TE
  - Intel® Core i3-9100E/i3-9100TE
- SKU2 (Q370), SKU3 (H310), SKU4 (H310) support 8th Gen Intel® Coffee Lake-S Processors (Maximum 95W)
  - Intel® Core i7-8700/i7-8700T
  - Intel® Core i5-8500/i5-8500T
  - Intel® Core i3-8100/i3-8100T
  - Intel® Pentium G5400/5400T
  - Intel® Celeron G4900/G4900T
- SKU2 (Q370), SKU3 (H310), SKU4 (H310) support 9th Gen Intel® Coffee Lake-S Refresh Embedded IOTG Processors (Maximum 65W)
  - Intel® Core i7-9700E/i7-9700TE
  - Intel® Core i5-9500E/i5-9500TE
  - Intel® Core i3-9100E/i3-9100TE

PCH

- Intel® C246/Q370/H310 Express Chipset

Memory

- 2 * DDR4 SO-DIMM slots
- Dual-Channel DDR4 ECC/Non ECC memory up to 2666MHz
- Max 32GB

Network

- SKU1 (C246)
  - 1 * Intel® I219-LM GbE
  - 3 * Intel® I210-AT GbE
- SKU2 (Q370)
  - 1 * Intel® I219-LM GbE
  - 1 * Intel® I210-AT GbE
- SKU3 (H310)
  - 1 * Intel® I219-LM GbE
  - 3 * Intel® I211-AT GbE
- SKU4 (H310)
  - 1 * Intel® I219-LM GbE
  - 1 * Intel® I211-AT GbE

Storage

- SKU1 (C246), SKU2 (Q370)
  - 3 * SATA 6Gb/s ports
  - 1 * M.2 M Key 2242/2280 slot (with SATA & PCIe x4 signal)
- SKU3 (H310), SKU4 (H310)
  - 3 * SATA 6Gb/s ports
  - 1 * M.2 M Key 2242/2280 slot (with SATA signal)

Audio

- Realtek ALC887 audio codec (Co-lay ALC888S)
- 1 * 3-port audio connector (Line-in/Line-Out/Mic-in)
- 1 * Amplifier box header (For SKU1 & SKU2)
- 1 * S/PDIF box header (For SKU1 & SKU2)

Graphics

- Integrated Intel® HD Graphics, support DirectX12
- 2 Independent displays or 3 Independent displays (For SKU1 & SKU2)
- 2 * DisplayPort: Max resolution 4096x2304@60Hz (DP++ supported)
- 1 * HDMI: Max resolution 4096x2160@24Hz (co-lay DP)
- 1 * LVDS 18/24-bit, Dual Channel: Max resolution 1920x1200@60Hz

Expansion Slot

- 1 * PCIe 3.0 x16 slot
- 1 * Mini-PCIe slot
- 1 * Nano SIM holder (For SKU1 & SKU2)
- 1 * M.2 E Key 2230 slot (with PCIe x1 & USB 2.0 signal) (For SKU1 & SKU2)

Rear Panel I/O

- 1 * 3-port audio connector (Line-in/Line-Out/Mic-in)
- 2 * DisplayPorts
- 1 * HDMI port
- LAN + USB
  - SKU1 (C246): 4 * GbE RJ45 ports, 4 * USB 3.1 Gen 1 ports, 4 * USB 3.1 Gen 2 ports
  - SKU2 (Q370): 2 * GbE RJ45 ports, 4 * USB 3.1 Gen 1 ports, 4 * USB 3.1 Gen 2 ports
  - SKU3 (H310): 4 * GbE RJ45 ports, 4 * USB 3.1 Gen 1 ports, 4 * USB 2.0 ports
  - SKU4 (H310): 2 * GbE RJ45 ports, 4 * USB 3.1 Gen 1 ports, 4 * USB 2.0 ports

Internal I/O

- 2 * ATX Power Connectors
- 1 * CPU Fan Connector
- 1 * System Fan Connector
- 1 * USB 2.0 Box Header (2 ports, for SKU1, SKU2)
- 3 * USB 3.1 Gen 1 Connectors (6 ports, for SKU1, SKU2)
- 3 * COM Port Box Headers (2 * RS232/422/485 Ports, 4 * RS232 Ports, for SKU1, SKU2)
- 2 * COM Port Box Headers (1 * RS232/422/485 Port, 3 * RS232 Ports, for SKU3)
- 1 * COM Port Box Header (1 * RS232/422/485 Port, 1 * RS232 Port, for SKU4)
- 1 * GPIO Box Header
- 1 * Front Panel Box Header
- 1 * Chassis Intrusion Header
- 1 * LVDS Box Header (for SKU1, SKU2)
- 1 * LVDS Inverter Box Header (for SKU1, SKU2)
- 1 * SMBus Box Header (for SKU1, SKU2)
- 1 * Amplifier Box Header (for SKU1, SKU2)
- 1 * S/PDIF Box Header (for SKU1, SKU2)
- 1 * LVDS Power Jumper (for SKU1, SKU2)
- 1 * LVDS Inverter Power Jumper (for SKU1, SKU2)
- 3 * COM Port Power Jumpers (for SKU1, SKU2, SKU3)
- 1 * COM Port Power Jumper (for SKU4)
- 1 * Clear CMOS Jumper
- 1 * AT/ATX Jumper
- 1 * USB Switch 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

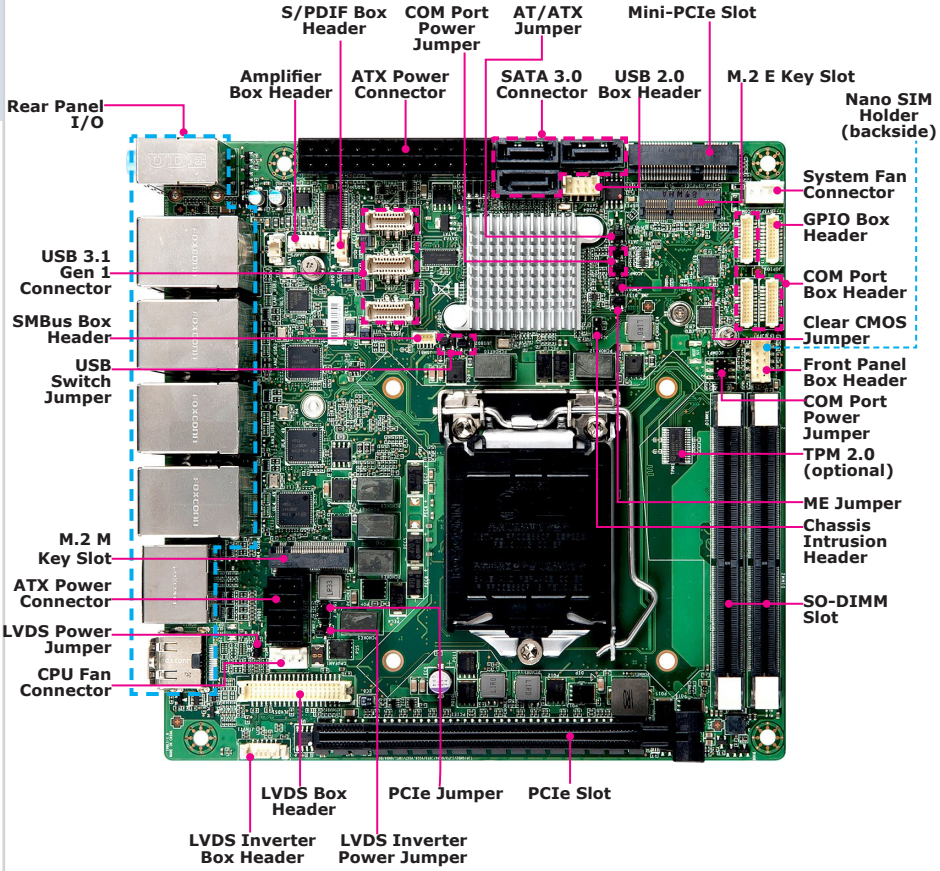
Accessories

- 1 * SATA 3.0 cable
- 1 * Dual COM port cable
- 1 * I/O shield

SKU Comparison

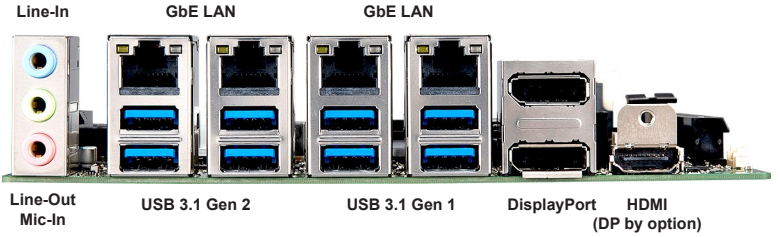
Features \ SKUs		SKU1 (C246)	SKU2 (Q370)	SKU3 (H310)	SKU4 (H310)
Chipset (PCH)		Intel® C246	Intel® Q370	Intel® H310	
Rear I/O	USB 2.0			4	
	USB 3.1 Gen 1	4		4	
	USB 3.1 Gen 2	4			
	GbE LAN	■ 1 * Intel® I219-LM ■ 3 * Intel® I210-AT	■ 1 * Intel® I219-LM ■ 1 * Intel® I210-AT	■ 1 * Intel® I219-LM ■ 3 * Intel® I211-AT	■ 1 * Intel® I219-LM ■ 1 * Intel® I211-AT
Internal I/O	LVDS	Yes			
	COM	■ 2 * RS232/422/485 ■ 4 * RS232		■ 1 * RS232/422/485 ■ 3 * RS232	■ 1 * RS232/422/485 ■ 1 * RS232
	USB 2.0	2			
	USB 3.1 Gen 1	2 + 4 (signal shared with Rear USB 3.1 Gen 1)			
	TPM2.0 Onboard	Expansion box header			
	SATA 3.0	3			
	M.2 M Key	with SATA & PCIe x4 signal		with SATA signal	
	M.2 E Key	■ with PCIe x1 & USB 2.0 signal; ■ Intel® AC9260/AC9560 WiFi-802.11ac & Bluetooth 5.0 CNVi supported		No Support for M.2 E Key	
	mPCIe	with Nano SIM Holder		without Nano SIM Holder	
	Amplifier	Yes			
	S/PDIF	Yes			
	SMBus	Yes			

Layout


S/PDIF Box Header
COM Port Power Jumper
AT/ATX Jumper
Mini-PCIe Slot
Amplifier Box Header
ATX Power Connector
SATA 3.0 Connector
USB 2.0 Box Header
M.2 E Key Slot
Nano SIM Holder (backside)
Rear Panel I/O
System Fan Connector
GPIO Box Header
USB 3.1 Gen 1 Connector
COM Port Box Header
SMBus Box Header
Clear CMOS Jumper
USB Switch Jumper
Front Panel Box Header
COM Port Power Jumper
TPM 2.0 (optional)
ME Jumper
Chassis Intrusion Header
M.2 M Key Slot
SO-DIMM Slot
ATX Power Connector
LVDS Power Jumper
CPU Fan Connector
LVDS Box Header
PCIe Jumper
PCIe Slot
LVDS Inverter Box Header
LVDS Inverter Power Jumper

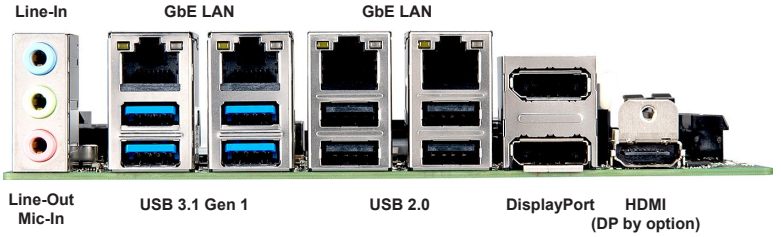
Rear Panel I/O Options

SKU1 (C246)

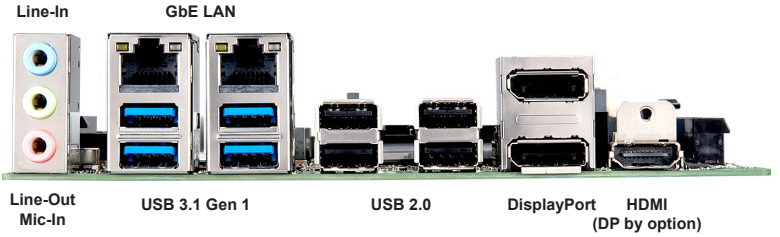


SKU2 (Q370)

SKU3 (H310)



SKU4 (H310)

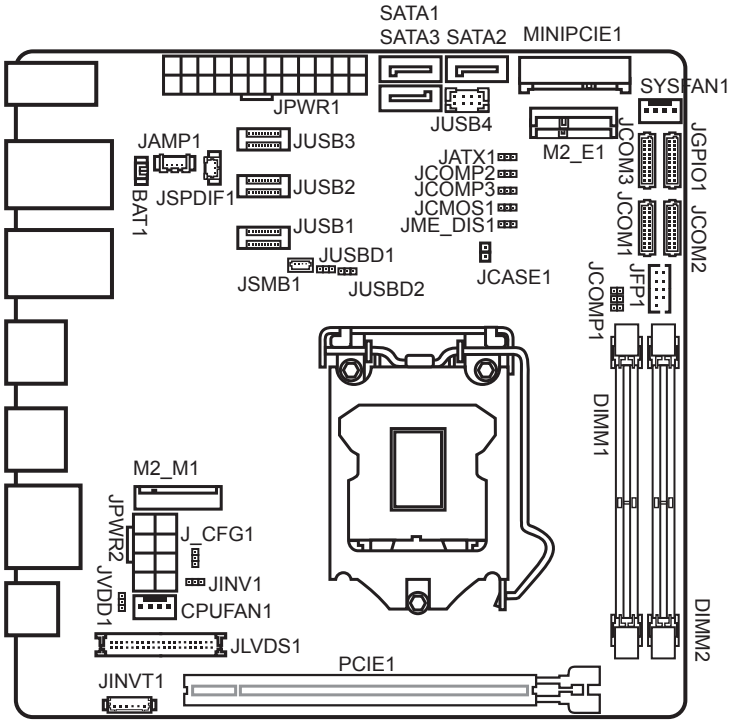


2 Hardware Setup

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



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

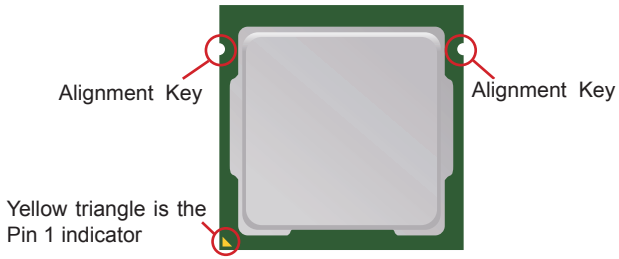
Overheating will seriously damage the CPU and system. Always make sure the cooling fan can work properly to protect the CPU from overheating. Make sure that you apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.

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

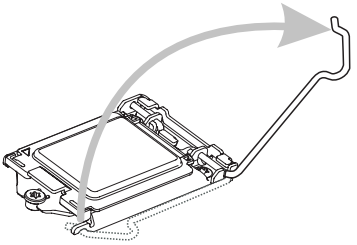
The surface of LGA 115x CPU. Remember to apply some thermal paste on it for better heat dispersion.



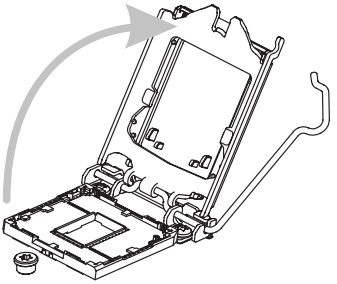
CPU Installation

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.

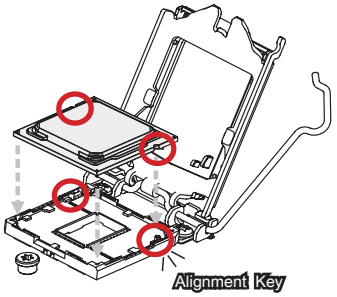
1. Open the load lever and remove the plastic cap.



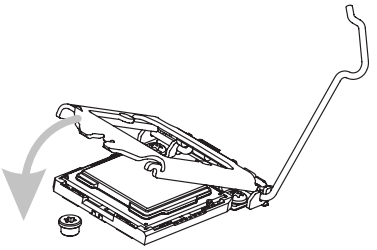
2. Lift the load lever up to fully open position.



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.



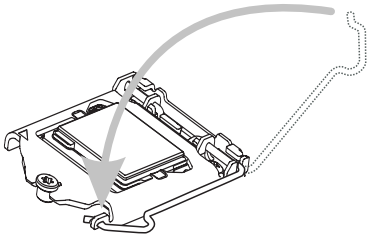
4. Engage the load lever while pressing down lightly onto the load plate.



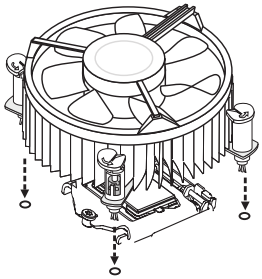
Important

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

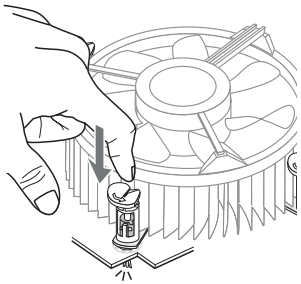
5. Secure the load lever with the hook under the retention tab.



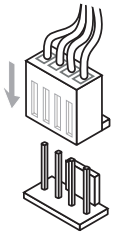
6. Make sure the four hooks are in proper position before you install the cooler. Align the holes on the motherboard with the cooler. Push down the cooler until its four clips get wedged into the holes of the motherboard.



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



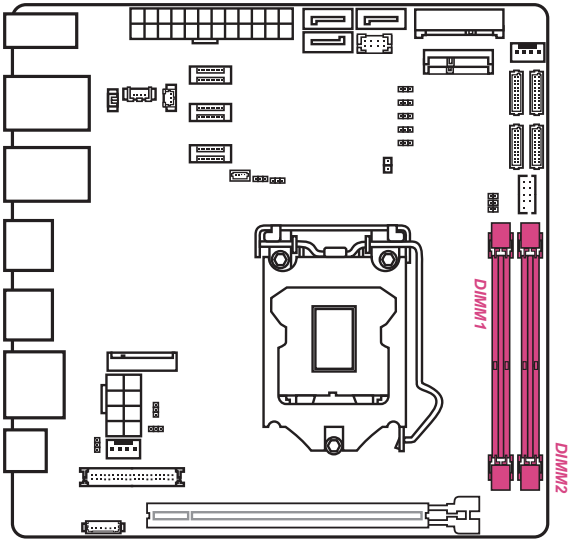
8. Finally, attach the CPU Fan cable to the CPU fan connector on the motherboard.



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.*

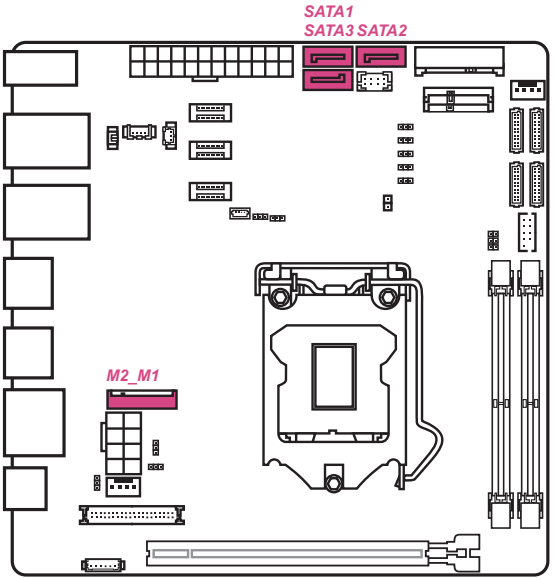
Installing Memory Modules

1. 1Unlock 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.

Storage

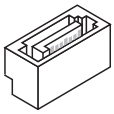


Storage Support

SKU / Storage	SKU1 (C246)	SKU2 (Q370)	SKU3 (H310)	SKU4 (H310)
SATA	3 * SATA 6Gb/s ports (RAID 0, 1, 5, 10 supported; RAID 10 should configured with M.2; AHCI Mode supported)		3 * SATA 6Gb/s ports (AHCI Mode supported)	
M.2 M Key	1 * M.2 M Key 2242/2280 slot (with SATA & PCIe x4 signal)		1 * M.2 M Key 2242/2280 slot (with SATA signal)	

Serial ATA Connector: SATA1, SATA2, SATA3

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

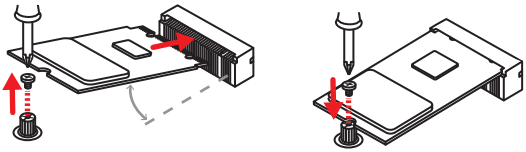


Important

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

M2_M1: M.2 M Key 2242/2260/2280 Slot for SSD

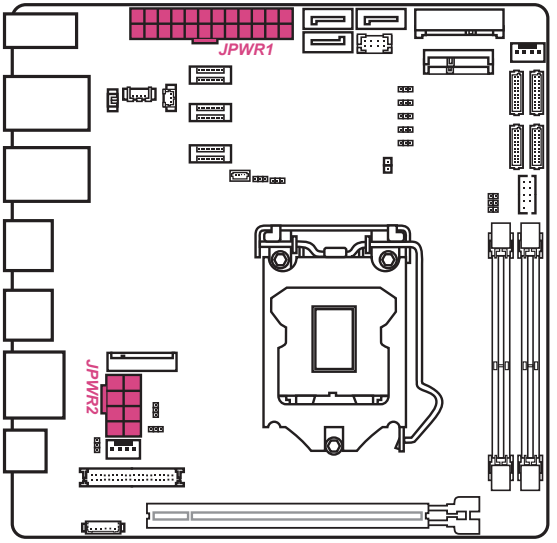
Please install the M.2 solid-state drive (SSD) into the M.2 slot as shown below.



Important

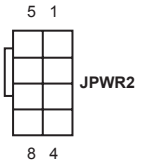
Intel® RST only supports PCIe M.2 SSD with UEFI ROM and does not support Legacy ROM.

Power Supply

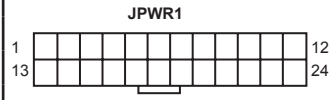


Power Connectors: JPWR1, JPWR2

These connectors allow you to connect a power supply.



1	Ground	5	+12V
2	Ground	6	+12V
3	Ground	7	+12V
4	Ground	8	+12V



1	+3.3V	13	+3.3V
2	+3.3V	14	-12V
3	Ground	15	Ground
4	+5V	16	PS-ON#
5	Ground	17	Ground
6	+5V	18	Ground
7	Ground	19	Ground
8	PWR OK	20	Res
9	5VSB	21	+5V
10	+12V	22	+5V
11	+12V	23	+5V
12	+3.3V	24	Ground

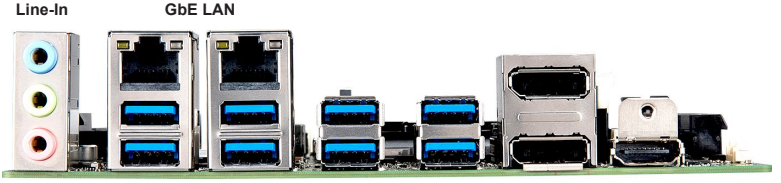
Important

- *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.*
- *To avoid some issues like system instability, reset and shutdown caused by energy-insufficient power supply, we suggest you should follow Intel Power Supply Design Guide Rev 1.4 list and Intel Document Number 595284 to choose your power supply unit.*

Rear Panel I/O

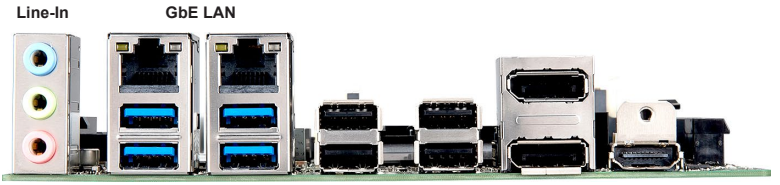
SKU1 (C246)

SKU2 (Q370)



SKU3 (H310)

SKU4 (H310)



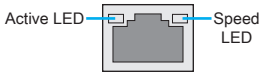
➤ Audio Ports

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, tape player or other audio devices.
- Line-Out (Green) - Line Out, is a connector for speakers or headphones.
- Mic (Pink) - Mic, is a connector for microphones.

➤ 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

➤ USB 3.1 Gen 2 Port

USB 3.1 Gen 2, the SuperSpeed USB 10Gbps, delivers high-speed data transfer for various devices, such as storage devices, hard drives, video cameras, etc.

➤ USB 3.1 Gen 1 Port

USB 3.1 Gen 1, the SuperSpeed USB, delivers up to 5Gbps high-speed data transfer for various devices, such as storage devices, hard drives, video cameras, etc.

➤ USB 2.0 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.

➤ DisplayPort

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

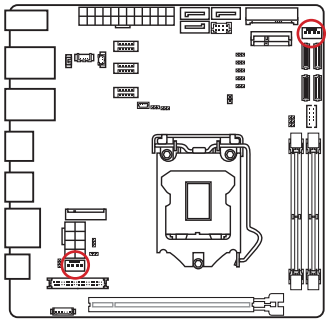
➤ HDMI Port

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.

Connectors

Fan Power Connectors: 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.

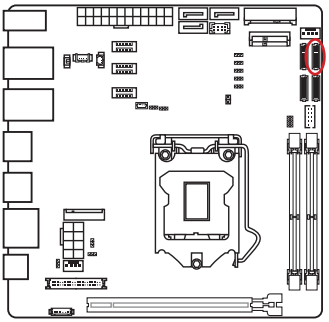


CPUFAN1
SYSFAN1

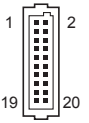
1	GND	2	FAN POWER
3	FAN SENSE	4	FAN_PWM

GPIO (DIO) Connector: JGPIO1

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



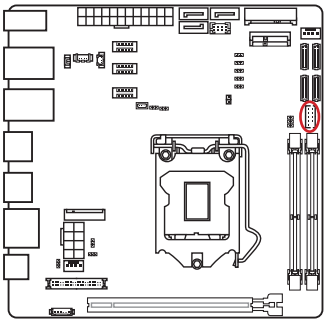
JGPIO1

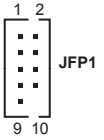


1	GND	2	GND
3	GPO0	4	GPI0
5	GPO1	6	GPI1
7	GPO2	8	GPI2
9	GPO3	10	GPI3
11	GPO4	12	GPI4
13	GPO5	14	GPI5
15	GPO6	16	GPI6
17	GPO7	18	GPI7
19	VCC5	20	VCC5

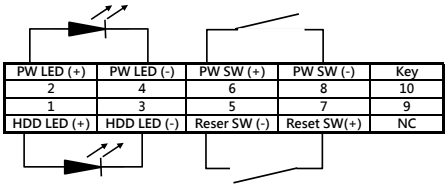
Front Panel Connector: JFP1

This front panel connector is provided for electrical connection to the front panel switches & LEDs.





1	HDD LED +	2	Power LED +
3	HDD LED -	4	Power LED -
5	Reset Switch -	6	Power Switch +
7	Reset Switch +	8	Power Switch -
9	Reserved	10	No Pin

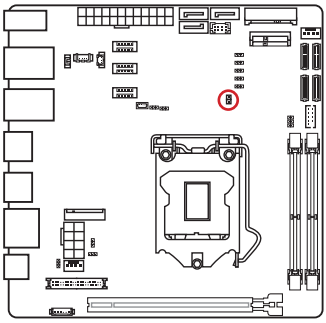


PW LED (+)	PW LED (-)	PW SW (+)	PW SW (-)	Key
2	4	6	8	10
1	3	5	7	9
HDD LED (+)	HDD LED (-)	Reser SW (-)	Reset SW(+)	NC

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

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.



Normal (default)

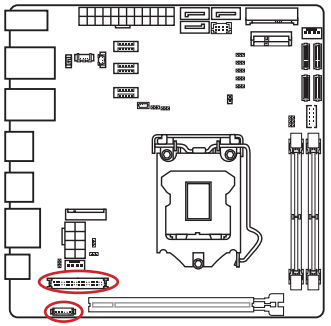
Trigger the chassis intrusion event

LVDS Box Header: JLVDS1 (For SKU1 & SKU2)

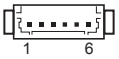
The LVDS (Low Voltage Differential Signal) connector provides a digital interface typically used with flat panels. After connecting an LVDS interface flat panel to the JLVDS1, be sure to check the panel datasheet and set the LVDS jumper to proper power voltage.

LVDS Inverter Box Header: JINVT1 (For SKU1 & SKU2)

The connector is provided for LCD backlight options.

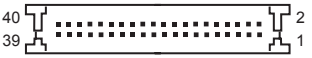


JINVT1



1	Back Light Power	4	BKLT_CTRL
2	Back Light Power	5	GND
3	BKLT_EN	6	GND

JLVDS1



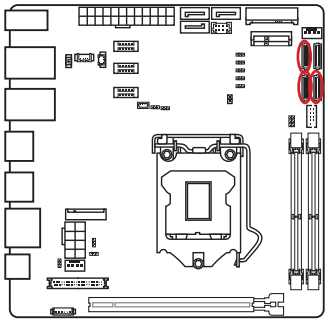
1	+12V	2	+12V
3	LCD_VDD	4	+12V
5	LCD_VDD	6	LCD_VDD
7	LVDS_DDC_CLK	8	LVDS_DDC_DATA
9	BKLT_CTRL	10	LVDS_VDD_EN
11	BKLT_EN	12	LVDS_DETECT#
13	LVDSA_DATA1+	14	LVDSA_DATA0+
15	LVDSA_DATA1-	16	LVDSA_DATA0-
17	GND	18	GND
19	LVDSA_DATA3+	20	LVDSA_DATA2+
21	LVDSA_DATA3-	22	LVDSA_DATA2-
23	GND	24	GND
25	LVDSB_DATA1+	26	LVDSB_DATA0+
27	LVDSB_DATA1-	28	LVDSB_DATA0-
29	GND	30	GND
31	LVDSB_DATA3+	32	LVDSB_DATA2+
33	LVDSB_DATA3-	34	LVDSB_DATA2-
35	GND	36	GND
37	LVDSB_CLK+	38	LVDSA_CLK+
39	LVDSB_CLK-	40	LVDSA_CLK-

Important

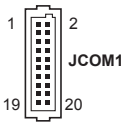
JLVDS1 Pin 12 is a detect pin. When using a customized LVDS cable, pin 12 should be a signal ground with a low impedance. Otherwise, LVDS will not function.

COM Port Box Headers: JCOM1, JCOM2, JCOM3 (Optional)

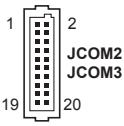
This connector allows you to connect optional serial ports through brackets.



SKU / COM	SKU1 (C246)	SKU2 (Q370)	SKU3 (H310)	SKU4 (H310)
COM Ports	■2 * RS232/422/485 ■4 * RS232		■1 * RS232/422/485 ■3 * RS232	■1 * RS232/422/485 ■1 * RS232
COM Port Box Header	JCOM1, JCOM2, JCOM3		JCOM1, JCOM2	JCOM1



RS232			RS422			RS485		
1	2	DCD	1	2	TXD-	1	2	TXD-
3	4	RXD	3	4	TXD+	3	4	TXD+
5	6	TXD	5	6	RXD+	5	6	NC
7	8	DTR	7	8	RXD-	7	8	NC
9	10	GND	9	10	GND	9	10	GND
11	12	DSR	11	12	NC	11	12	NC
13	14	RTS	13	14	NC	13	14	NC
15	16	CTS	15	16	NC	15	16	NC
17	18	RI/POWER	17	18	NC	17	18	NC
19	20	NC	19	20	NC	19	20	NC



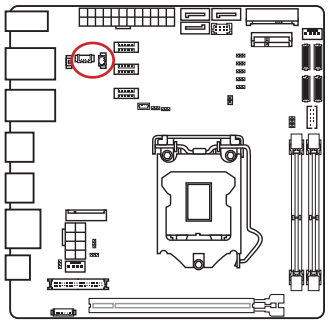
RS232		
1	2	DCD
3	4	RXD
5	6	TXD
7	8	DTR
9	10	GND
11	12	DSR
13	14	RTS
15	16	CTS
17	18	RI/POWER
19	20	NC

Amplifier Box Header: JAMP1 (For SKU1 & SKU2)

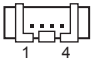
The JAMP1 is used to connect audio amplifiers to enhance audio performance.

S/PDIF Box Header: JSPDIF1 (For SKU1 & SKU2)

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



JAMP1



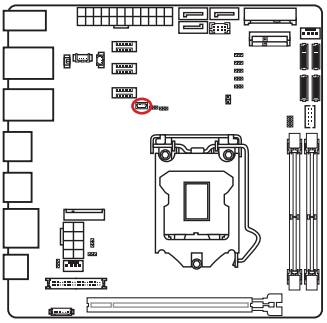
1	AMP_L-	2	AMP_L+
3	AMP_R-	4	AMP_R+

JSPDIF1

1	5V
2	SPDIF
3	GND

SMBus Box Header: JSMB1 (For SKU1 & SKU2)

This connector is provided for users to connect System Management Bus (SMBus) interface.



JSMB1

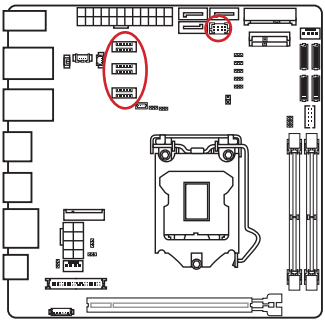
1	5V	2	CLK
3	DATA	4	GND

USB 2.0 Box Header: JUSB4 (For SKU1 & SKU2)

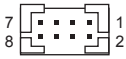
These connectors allow you to connect USB 2.0 ports on the front panel.

USB 3.1 Gen 1 Connector: JUSB1, JUSB2, JUSB3 (For SKU1 & SKU2)

This connector allows you to connect USB 3.1 Gen 1 ports on the front panel.

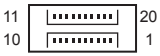


JUSB4



1	5V	2	GND
3	USB_D-	4	USB_D+
5	USB_D+	6	USB_D-
7	GND	8	5V

JUSB1/ JUSB2/ JUSB3



1	USB3_PWR	11	USB2_DP2
2	USB3_RX1N	12	USB2_DN2
3	USB3_RX1P	13	GND
4	GND	14	USB3_TX2P
5	USB3_TX1N	15	USB3_TX2N
6	USB3_TX1P	16	GND
7	GND	17	USB3_RX2P
8	USB2_DN1	18	USB3_RX2N
9	USB2_DP1	19	USB3_PWR
10	NA	20	NA

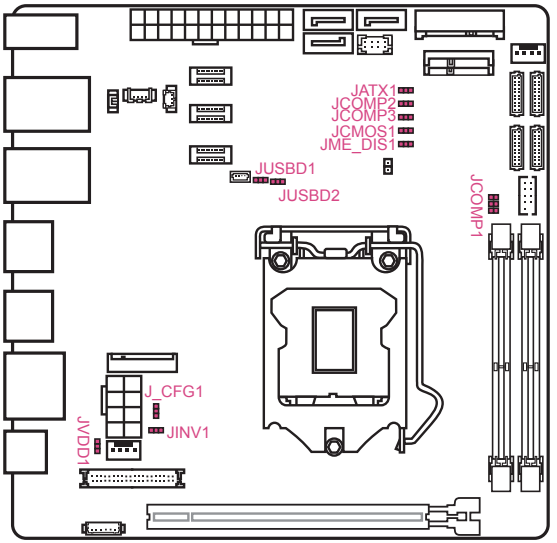
Important

- *Note that the pins of VCC and GND must be connected correctly to avoid possible damage.*
- *To use a USB3.1 device, you must connect the device to a USB3.1 port through an optional USB3.1 compliant cable.*

Jumpers

Important

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

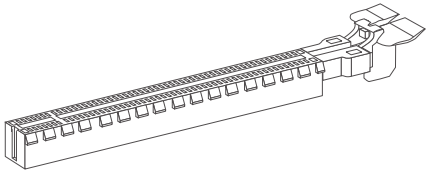


Jumper Name	Default Setting	Description	
JCMOS1	1	1-2: Normal	2-3: Clear CMOS
JATX1	1	1-2: ATX	2-3: AT
JME_DIS1	1	1-2: Normal	2-3: ME Disable
JCOMP1	6 5 2 1	1-2: 5V 3-4: 12V 5-6: RI	
JCOMP2, JCOMP3	1	1-2: 5V	2-3: 12V
J_CFG1	1	1-2: 1 x16 PCIe	2-3: 2 x8 PCIe
JVDD1	1	1-2: 3V	2-3: 5V
JINV1	1	1-2: 5V	2-3: 12V
JUSBD1, JUSBD2	1	1-2: Rear I/O	2-3: Internal I/O

Slots

PCIe (Peripheral Component Interconnect Express) Slot

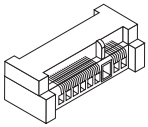
The PCI Express slot supports PCIe interface expansion cards.



PCIe x16 slot

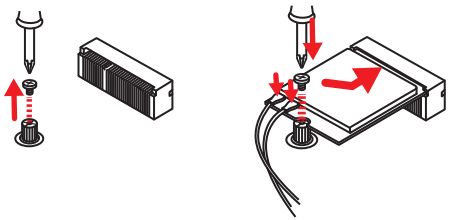
Mini-PCIe (Peripheral Component Interconnect Express) Slot

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



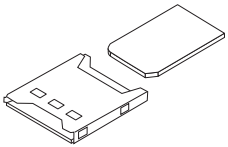
M2_E1: M.2 E Key 2230 Slot for WiFi/BT (For SKU1 & SKU2)

Please install the Wi-Fi/ Bluetooch card into the M.2 slot as shown below.



Nano SIM Holder (For SKU1 & SKU2)

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



Important

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

3 BIOS Setup

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

Users may need to run the Setup program when:

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

Important

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

Entering Setup

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

Press <DEL> or <F2> to enter SETUP

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

Important

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

Control Keys

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

Getting Help

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

Main Menu

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

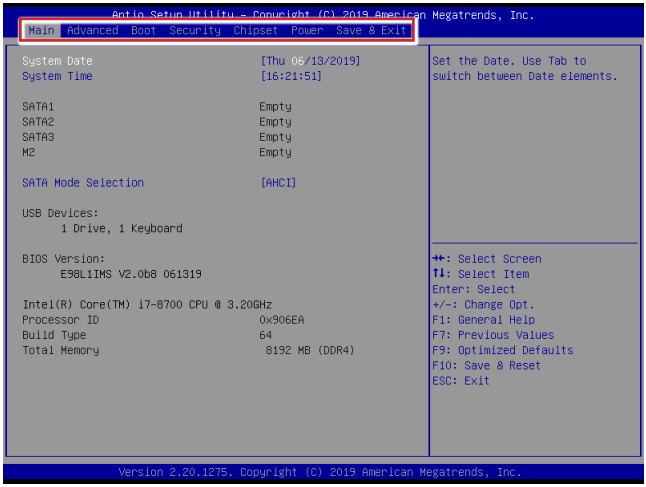
Sub-Menu

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

General Help <F1>

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

The Menu Bar



▸ **Main**

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

▸ **Advanced**

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

▸ **Boot**

Use this menu to specify the priority of boot devices.

▸ **Security**

Use this menu to set supervisor and user passwords.

▸ **Chipset**

This menu controls the advanced features of the onboard chipsets.

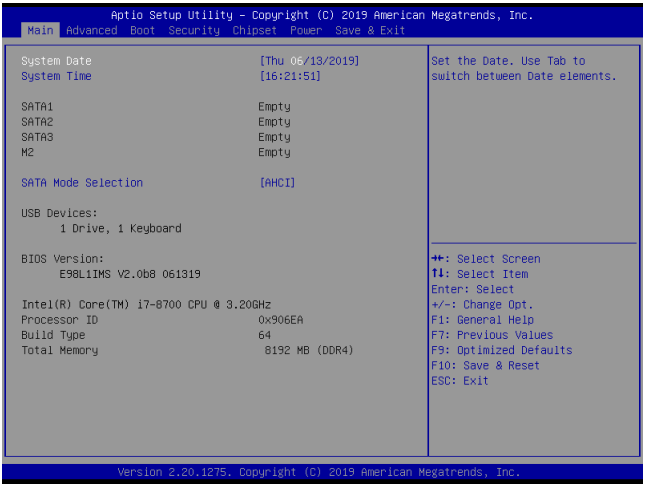
▸ **Power**

Use this menu to specify your settings for power management.

▸ **Save & Exit**

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

Main



▸System Date

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

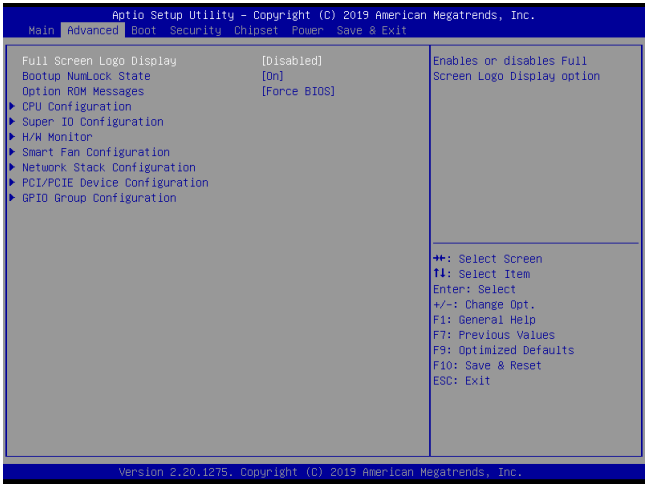
▸System Time

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

▸SATA Mode Selection

This setting specifies the SATA controller mode.

Advanced



▸Full Screen Logo Display

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

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

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

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

▸Bootup NumLock State

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

▸Option ROM Messages

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

▸CPU Configuration

▸Intel Virtualization Technology

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

▸Active Processor Cores

This setting specifies the number of active processor cores.

▸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.

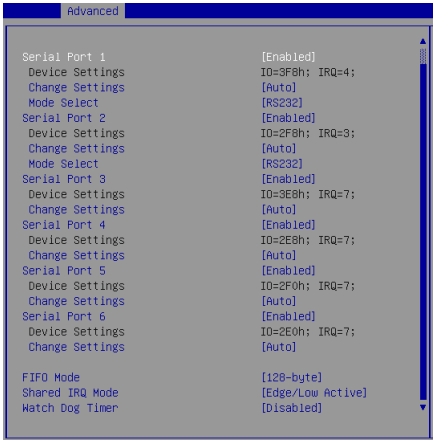
▸Intel(R) SpeedStep(tm)

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/ 5/ 6

This setting enables/disables the specified serial port.

▸Change Settings

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

▸Mode Select

Select an operation mode for the specified serial port.

▸ FIFO Mode

This setting controls the FIFO data transfer mode.

▸Shared IRQ Mode

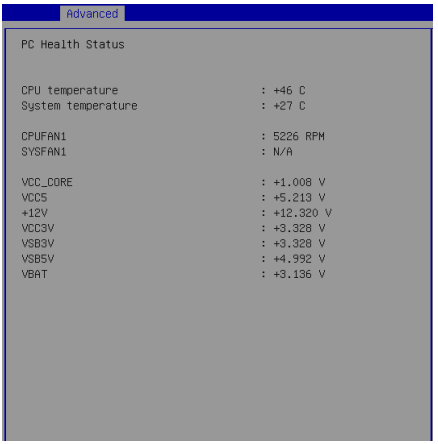
This setting provides the system with the ability to share interrupts among its serial ports.

▸Watch Dog Timer

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

▸H/W Monitor

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



▸Smart Fan Configuration

▸CPUFAN1, SYSFAN1

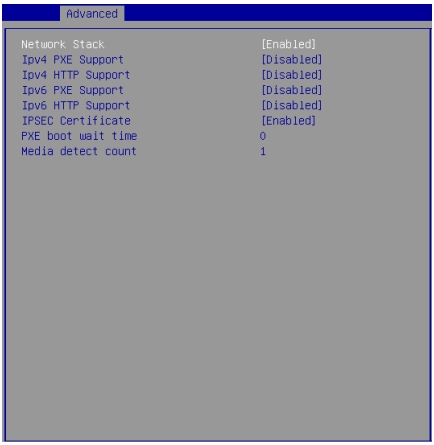
This setting enables/disables the Smart Fan function. Smart Fan is an excellent feature which will adjust the CPU/system fan speed automatically depending on the current CPU/system temperature, avoiding the overheating to damage your system.

▸Type

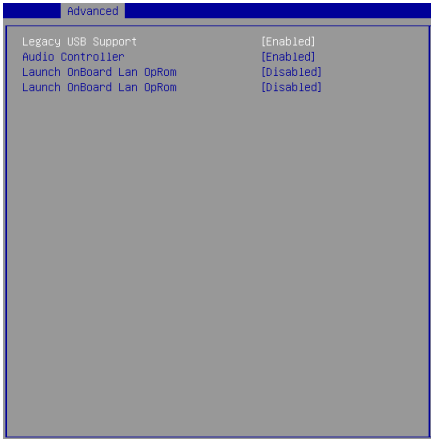
This setting specifies the fan type.

▸Network Stack Configuration

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS.



▸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.

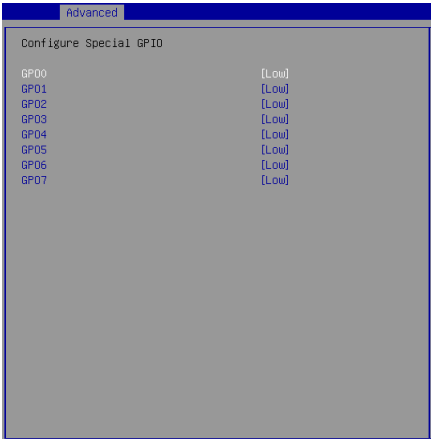
▸Audio Controller

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.

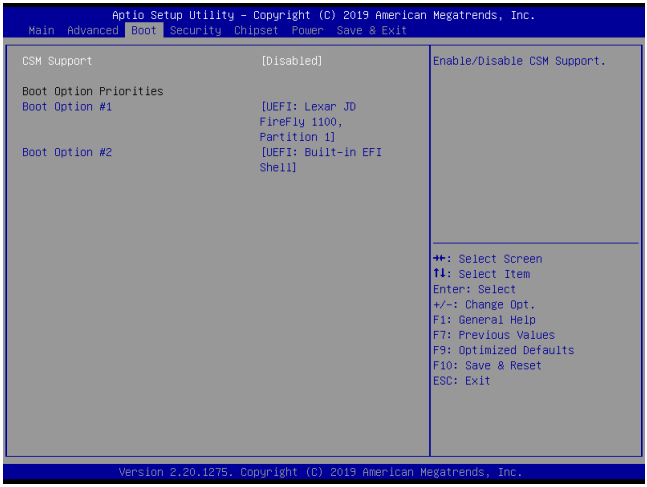
▸**GPIO Group Configuration**



▸**GPO0 ~ GPO7**

These settings control the operation mode of the specified GPIO.

Boot



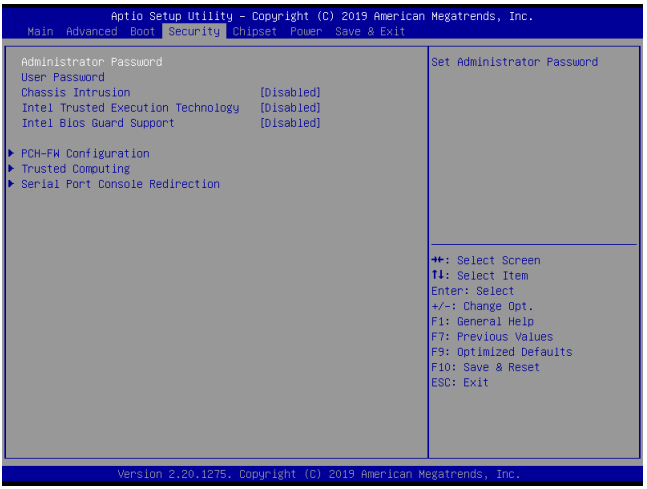
▸CSM Support

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.

▸Boot Option Priorities

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

Security



▸Administrator Password

Administrator Password controls access to the BIOS Setup utility.

▸User Password

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

▸Chassis Intrusion

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

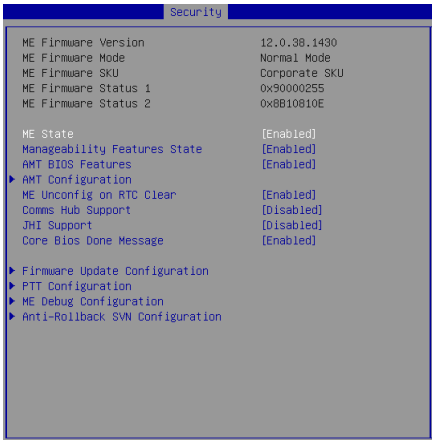
▸Intel Trusted Execution Technology

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

▸Intel BIOS Guard Support

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

▸PCH-FW Configuration



▸ME Firmware Version, ME Firmware Mode, ME Firmware SKU, ME Firmware Status 1, ME Firmware Status 2

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

▸ME State

This setting enables/disables the ME status.

▸Manageability Features State

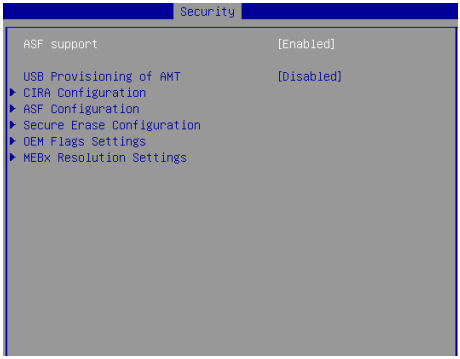
This setting enables/disables the Manageability Features State.

▸AMT BIOS Features

This setting enables/disables the AMT BIOS Features.

▸AMT Configuration

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



▸**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.

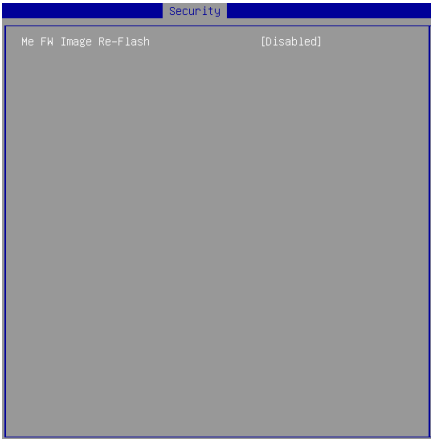
▸**JHI Support**

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**



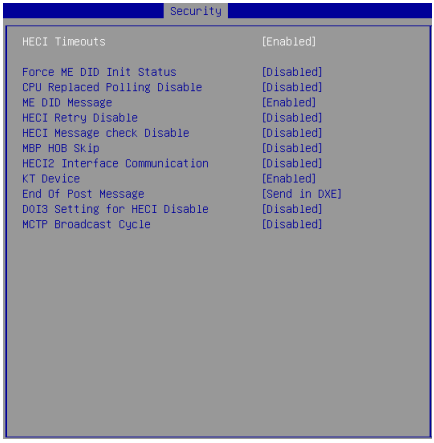
▸**ME FW Image Re-Flash**

This setting enables/disables the ME FW image reflash.

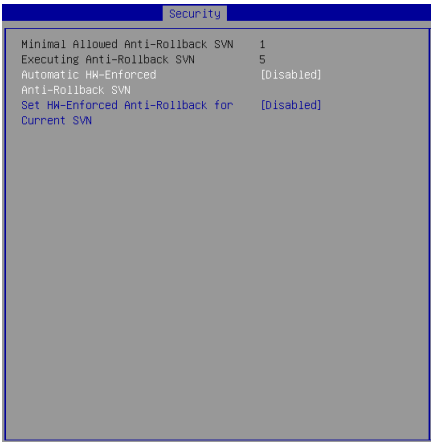
▸PTT Configuration

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

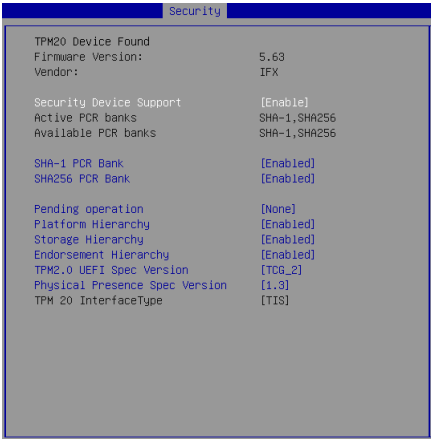
▸ME Debug Configuration



▸Anti-Rollback SVN 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.

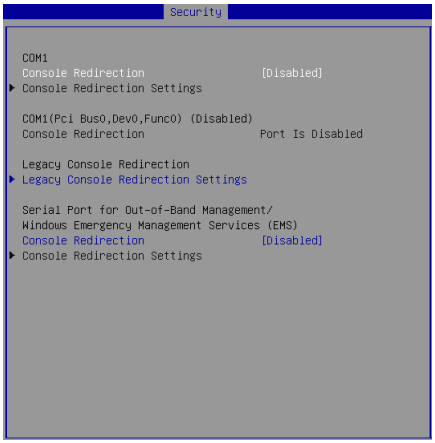
▸**TPM2.0 UEFI Spec Version, Physical Presence Spec Version**

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**

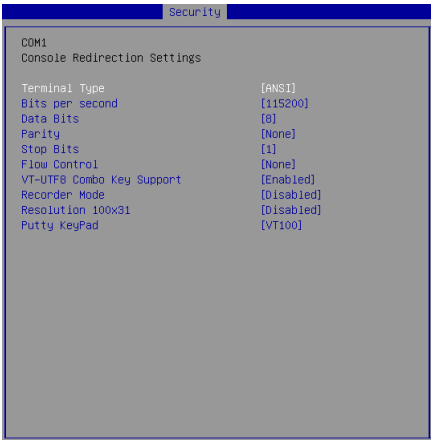


COM1

▸**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

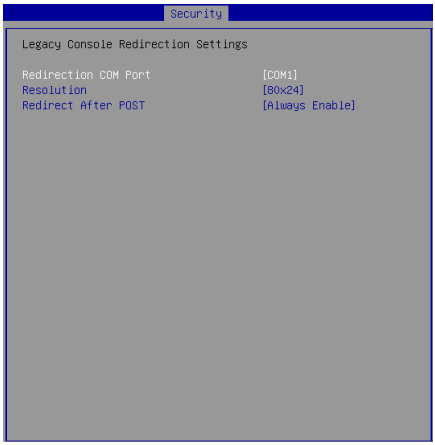
These settings enable/disable the recorder mode and the resolution 100x31.

▸ 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**

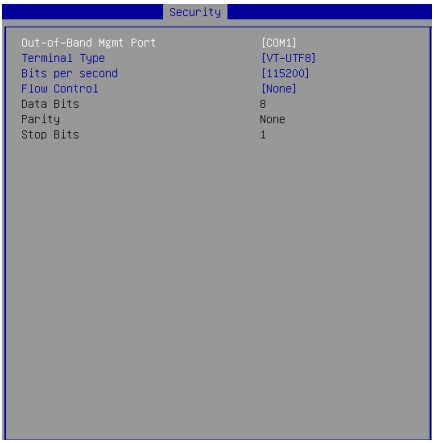
This setting determines whether or not to keep terminals' console redirection running after the POST has booted.

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

▸**Console Redirection**

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



▸Out-of-Band Mgmt Port

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

▸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.

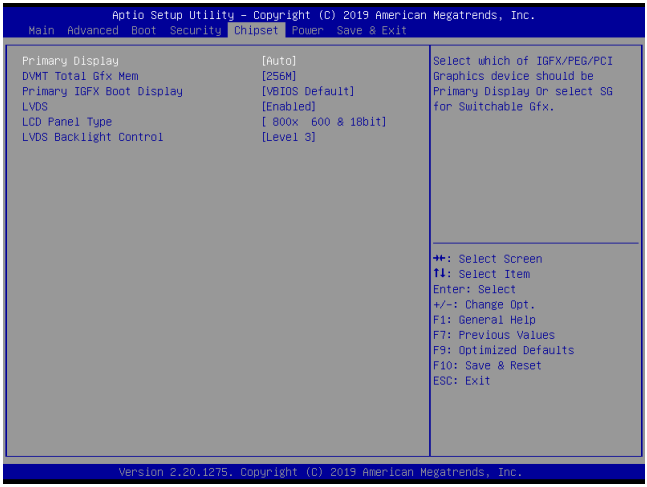
▸ Bits per second, Data Bits, Parity, Stop Bits

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.

Chipset



▸Primary Display

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

▸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.

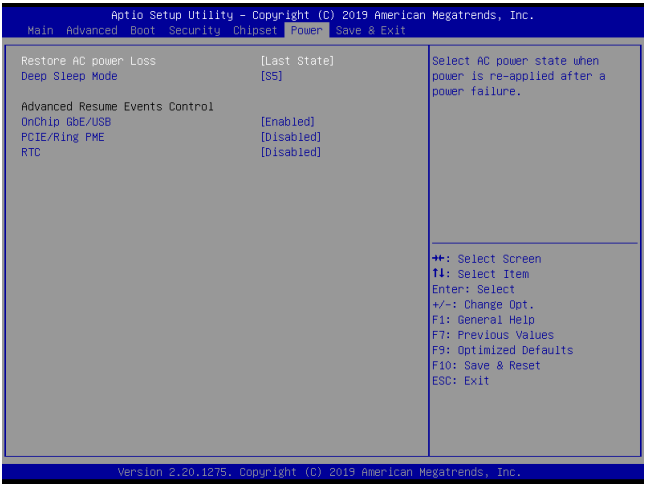
▸LCD Panel Type

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 ****

▸OnChip GbE/USB

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

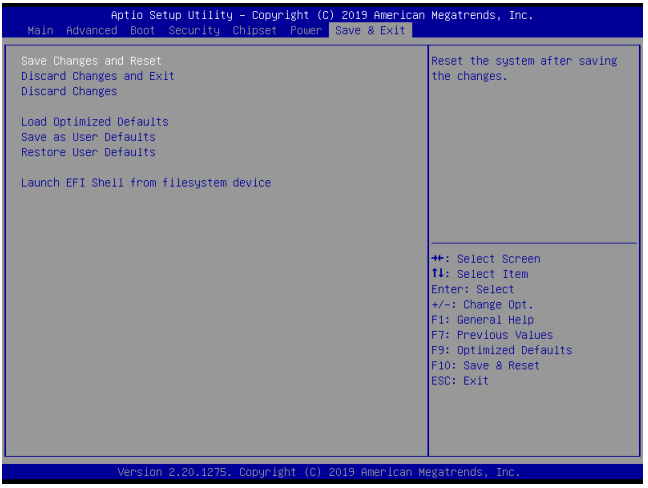
▸PCIE/Ring PME

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

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 are listed in the following table:

Name	IO Port	IO address	Name	IO Port	IO address
N_GPI0	0x42	Bit 0	**N_GPO0**	0x11	Bit 0
N_GPI1	0x42	Bit 1	**N_GPO1**	0x11	Bit 1
N_GPI2	0x42	Bit 2	**N_GPO2**	0x11	Bit 2
N_GPI3	0x42	Bit 3	**N_GPO3**	0x11	Bit 3
N_GPI4	0x42	Bit 4	**N_GPO4**	0x11	Bit 7
N_GPI5	0x42	Bit 5	**N_GPO5**	0x11	Bit 6
N_GPI6	0x42	Bit 6	**N_GPO6**	0x11	Bit 5
N_GPI7	0x42	Bit 7	**N_GPO7**	0x11	Bit 4

Note: GPIO should be accessed through controller device **0x6E** on SMBus. The associated access method in examples (**SMBus_ReadByte**, **SMBus_WriteByte**) are provided in part 4.

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 =SMBus_ReadByte (0x6E, 0x11);  // Read value from N_GPO0 port through SMBus.
val = val | (1<<0);                // Set N_GPO0address (bit 0) to 1 (output "high").
SMBus_WriteByte (0x6E, 0x11, val); // Write back to N_GPO0 port through SMBus.
```

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

```
val = SMBus_ReadByte (0x6E, 0x11); // Read value from N_GPO1 port through SMBus..
val = val & (~(1<<1));             // Set N_GPO1 address (bit 1) to 0 (output "low").
SMBus_WriteByte (0x6E, 0x11, val); // Write back to N_GPO1 port through SMBus.
```

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 = SMBus_ReadByte (0x6E, 0x42); // Read value from N_GPI2 port through SMBus.
val = val & (1<<2);                // Read N_GPI2 address (bit 2).
if (val)    printf ("Input of  N_GPI2  is High");
else        printf ("Input of  N_GPI2  is Low");
```

Example: Get **N_GPI6** input value.

```
val = SMBus_ReadByte (0x6E, 0x42); // Read value from N_GPI6 port through SMBus.
val = val & (1<<6);                // Read N_GPI6 address (bit 6).
if (val)    printf ("Input of  N_GPI6  is High");
else        printf ("Input of  N_GPI6  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
```