

USER'S MANUAL

BCO Series

Fanless Embedded Computers



BCO-3000-RPL



BCO-6000-RPL

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Prefaces

Revision

Revision	Description	Date
1.0	Manual Released	2024/04/22

Disclaimer

All specifications and information in this User's Manual are believed to be accurate and up to date. C&T Solution Inc. does not guarantee that the contents herein are complete, true, accurate or non-misleading. The information in this document is subject to change without notice and does not represent a commitment on the part of C&T Solution Inc.

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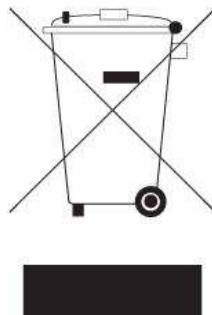
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Environmental Protection Announcement

Do not dispose this electronic device into the trash while discarding. Please recycle to minimize pollution and ensure environment protection.



Safety Precautions

Before installing and using the equipment, please read the following precautions:

- Put this equipment on a reliable surface during installation. Dropping it or letting it fall could cause damage.
- The power outlet shall be installed near the equipment and shall be easily accessible.
- Turn off the system power and disconnect the power cord from its source before making any installation. Be sure both the system and the external devices are turned OFF. Sudden surge of power could ruin sensitive components. Make sure the equipment is properly grounded.
- When the power is connected, never open the equipment. The equipment should be opened only by qualified service personnel.
- Make sure the voltage of the power source is correct before connecting the equipment to the power outlet.
- Disconnect this equipment from the power before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.
- Avoid the dusty, humidity and temperature extremes.
- Do not place heavy objects on the equipment.
- If the equipment is not used for long time, disconnect it from the power to avoid being damaged by transient over-voltage.
- The storage temperature shall be above -30°C and below 85°C.
- The computer is provided with a battery-powered real-time clock circuit. There is a danger of explosion if incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.
- If one of the following situation 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 it cannot work according the user's manual.
 - The equipment has been dropped and damaged.
 - The equipment has obvious signs of breakage.

Technical Support and Assistance

1. Visit the C&T Solution Inc website at <https://www.candtsolution.com> where you can find the latest information about the product.
2. Contact your distributor, our technical support team or sales representative for technical support if you need additional assistance. Please have following information ready before you call:
 - Model name and serial number
 - Description of your peripheral attachments
 - Description of your software (operating system, version, application software, etc.)
 - A complete description of the problem
 - The exact wording of any error messages

Conventions Used in this Manual



WARNING

This indication alerts operators to an operation that, if not strictly observed, may result in severe injury.



CAUTION

This indication alerts operators to an operation that, if not strictly observed, may result in safety hazards to personnel or damage to equipment.



NOTE

This indication provides additional information to complete a task easily.

Package Contents

Before installation, please ensure all the items listed in the following table are included in the package.

Item	Description	Q'ty
Choosing one :		
1	BCO-3000-RPL Small Form Factor Computer BCO-6000-RPL-1E AI Edge Computer BCO-6000-RPL-2E AI Edge Computer	1
2	Wall Mount Kit	1
3	Accessory Kit	1
4	- Adapter AC/DC 24V 5A 120W with 3pin Terminal Block Plug 5.0mm Pitch (1-E09A12002) for BCO-3000-RPL - Adapter AC/DC 24V 9.2A 220W with 3pin Terminal Block Plug 5.0mm Pitch (1-E09A22102) for BCO-6000-RPL	1
5	Power Cord, 3-pin US Type, 180cm (1-TPCD00005)	1

Ordering Information

Model No.	Product Description
BCO-3000-RPL	Small Form Factor Computer with Intel® 12th/13th/14th Gen Intel® IoTG Processor, 2x DP, 1x HDMI, 2x COM, 3x LAN
BCO-6000-RPL-1E16	AI Edge Computer with Intel® 12th/13th/14th Gen Intel® IoTG Processor, 2x DP, 1x HDMI, 2x COM, 3x LAN, 1x PCIe x16 Expansion
BCO-6000-RPL-2E8	AI Edge Computer with Intel® 12th/13th/14th Gen Intel® IoTG Processor, 2x DP, 1x HDMI, 2x COM, 3x LAN, 2x PCIe x8 Expansion

Optional Accessories

- **BCO-3000-RPL Series**

Model No.	Product Description
1-TPCD00002	Power Cord, European Type, 180cm
1-TPCD00001	Power Cord, 3-pin UK Type, 180cm
3-DINR-0004	Din Rail-2 Mounting Kit

- **BCO-6000-RPL Series**

Model No.	Product Description
1-TPCD00002	Power Cord, European Type, 180cm
1-TPCD00001	Power Cord, 3-pin UK Type, 180cm

Chapter 1

Product Introductions

1.1 Overview

The BCO Series is designed to take a robust approach to provide essential edge computing features into the rugged edge that will not compromise on performance or reliability. The BCO-3000-RPL and BCO-6000-RPL Series are designed with a semi-rugged chassis to shield against the harsh conditions at the edge.

Model No.	Rear Panel	Front Panel
BCO-3000-RPL		
BCO-6000-RPL		

Key Features

- Support 12th/13th/14th Gen Intel® IoTG Processor Core i9/i7/i5/i3, Pentium, Celeron (35W only)
- 2x DDR4 SODIMM. Max. up to 64GB (Default: 8GB)
- 2x Display Port, 1x HDMI, Triple Independent Display
- 3x 2.5GbE LAN
- 1x M.2 (M Key (Default: 128GB SSD)), 1x M.2 (E key), 1x M.2 (B key)
- 4x COM, 6x USB 3.2 Gen2, 2 USB 3.2 Gen1, x2 USB 2.0
- 9 to 36VDC Wide Range Power Input Supporting AT/ATX Mode
- Wide Operating Temperature 0°C to 50°C
- TPM 2.0 Supported
- CE, FCC Class A, UL 62368 Ed. 3
- 2x PCIe x8 Slot or 1x PCIe x16 Slot (BCO-6000-RPL Series Only)

1.2 Hardware Specification

System

Processor

Support 12th/13th/14th Gen Intel® ADL & RPL Processor (LGA 1700, 35W TDP)

- Intel® Core™ i9-14900T/i9-13900TE/i9-12900TE, 35W
- Intel® Core™ i7-14700T/i7-13700TE/i7-12700TE, 35W
- Intel® Core™ i5-14500T/i5-13500TE/i5-12500TE, 35W
- Intel® Core™ i3-14100T/i3-13100TE/i3-12100TE, 35W
- Intel® Core™ 300T, 35W- Intel® Pentium® G7400TE, 35W
- Intel® Celeron® G6900TE, 35W

System Chipset	Intel® Q670E Express Chipset
LAN Chipset	Intel® I226LM PCIe 2.5GbE LAN Intel® I226V PCIe 2.5GbE LAN Intel® I226V PCIe 2.5GbE LAN
Audio Codec	Realtek ALC897
System Memory	• BCO-3000-RPL 2x DDR4 3200MT/s SODIMM. Max. up to 64 GB (Default: 8GB) • BCO-6000-RPL 2x DDR4 3200MT/s SODIMM. Max. up to 64 GB (Default: 8GB & Non-ECC supported)
BIOS	AMI UEFI BIOS
Watchdog	Software Programmable Supports 1~255 sec. System Reset
TPM	TPM 2.0

Display

DisplayPort	2x Dual Mode DisplayPort 1.4a Max Resolution 4096 x 2304 @60Hz
HDMI	1x HDMI 1.4b Max Resolution 4096 x 2304 @24Hz
Multiple Display	3x Independent Displays

Storage

M.2	1x M.2 M key Type (2242/2280): • Support PCIe x4 Gen3 NVMe SSD • PCIe x4 Gen3 signal from PCH • Support B+M Key, AI/Storage Module • Default: 128GB SSD
-----	--

Expansion

M2	1x M.2 E key Type: 2230 (Support PCIe x1 + USB 2.0; Support CNVi) Devices Supported: Intel® AX210 Wi-Fi 6E & BT-5.1 (vPro Supported) 1x M.2 B key Type: 3042 with Nano SIM Holder (Support PCIe x1 + USB 3.2 Gen 2 x1 + USB 2.0, 5G/4G/LTE Module)
PCIe (BCO-6000-RPL Only)	2x PCIe x8 Slot or 1x PCIe x16 Slot 1x Default Industrial Fan Support A2000 GPU (optional)

1.2 Hardware Specification

I/O		
	BCO-3000-RPL	BCO-6000-RPL
Audio	Line-out/Mic-in	
COM	4x DB9 COM1: RS232/422/485 COM2: RS232/422/485 COM3: RS485 COM4: RS485	
DIO	8 in / 8 out (Isolated)	
LAN	3x RJ45 (2.5GbE)	
USB	6x USB 3.2 Gen2 2x USB 3.2 Gen1 2x USB 2.0 Type-A	
Others	5x Antenna Holes 1x Power button 1x HD LED 1x Power LED	

Operating System	
Windows	Windows 10/11
Linux	Linux kernel

Power		
	BCO-3000-RPL	BCO-6000-RPL
Power Adapter	AC/DC 24V/5A, 120W (Default)	AC/DC 24V/9.2A, 220W for CPU and GPU Expansion (Default)
Power Mode	AT, ATX (Default ATX)	
Power Supply Voltage	9~36VDC	9~36VDC Default 24~36VDC for add GPU Card
Power Connector	4-pin Terminal Block	

Environment	
Operating Temp.	0°C to 50°C (35W CPU) Tested according to: IEC60068-2-1:2007 (Cold test procedure) IEC60068-2-2:2007 (Dry heat test procedure) IEC60068-2-3:2007 (Damp heat, steady state, test procedure) IEC60068-2-14:2009 (Wide temperature range thermal shock)
Storage Temp.	-30°C to 85°C
Relative Humidity	10% to 95% (non-condensing)
Certification	EMC: • CE • FCC Class A (47 CFR part 15.109 and part 15.107) • ICES-003 • UKCA • UL 62368 Ed. 3 Green Product: • RoHS 3.0 (Directive 2015/863/EU) • REACH
Vibration	IEC60068-2-64:2008 With SSD: 5 Grms (5 - 500 Hz, 0.5 hr/axis) Designed to comply with MIL-STD-810G Method 514.7 Procedure I
Shock	IEC60068-2-27:2008 With SSD: 50G half-sin 11ms Designed to comply with MIL-STD-810G Method 514.7 Procedure I Package Drop Test: ISTA 2A

Physical		
	BCO-3000-RPL	BCO-6000-RPL
Dimensions (WxDxH)	192 x 240 x 69mm	330 x 240 x 69mm
Construction	Extruded Aluminum with Heavy Duty Metal	
Mounting Options	Wall Mounting, DIN-Rail Mounting (Optional)	Wall Mounting

*All specifications and photos are subject to change without notice.

1.3 System I/O

1.3.1 BCO-3000-RPL

Front Panel

USB 3.2 Gen 2 port (10 Gbps)

Used to connect USB 3.2 device

DisplayPort

Used to connect a DisplayPort monitor

HDMI port

Used to connect a HDMI monitor or connect optional split cable for dual display mode

COM port

COM1 ~ COM2 support RS232/422/485 serial device

Line-out

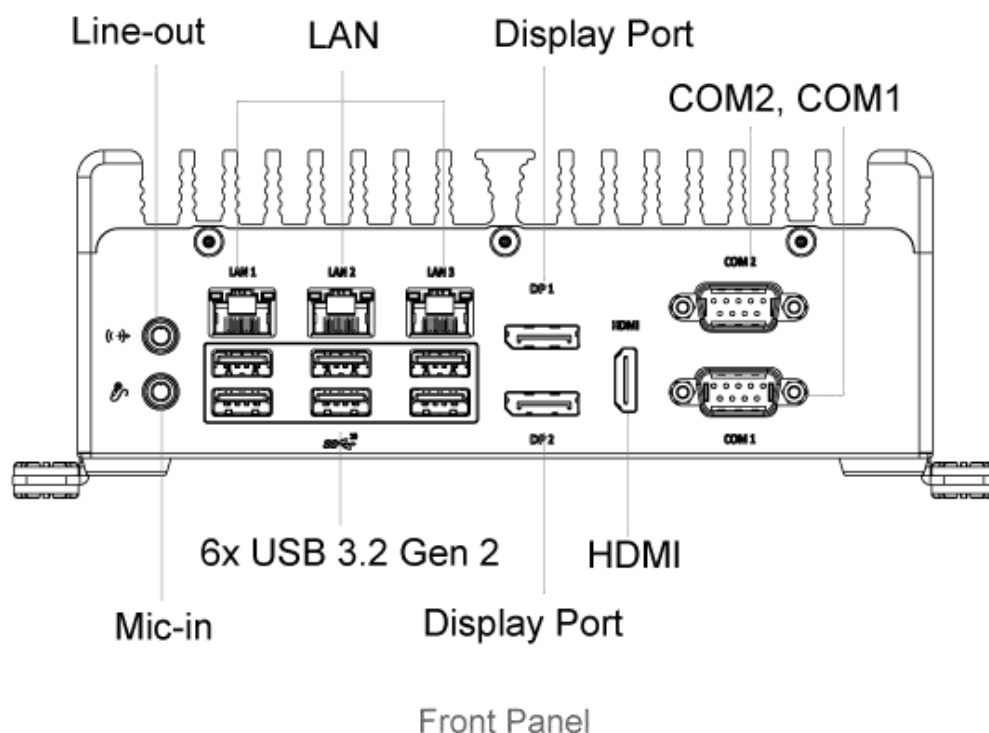
Used to connect a speaker

Mic-in

Used to connect a microphone

LAN port

Used to connect the system to a local area network



BCO-3000-RPL

Rear Panel

USB 2.0 port

Used to connect USB 2.0 device

USB 3.2 Gen 1 port (5 Gbps)

Used to connect USB 3.2 device

COM port

COM3 ~ COM4 support RS232/422/485 serial device

Antenna hole

Used to connect an antenna for optional Mini-PCIe WiFi module

Digital I/O

The Digital I/O terminal block supports 8 digital input and 8 digital output

DC IN

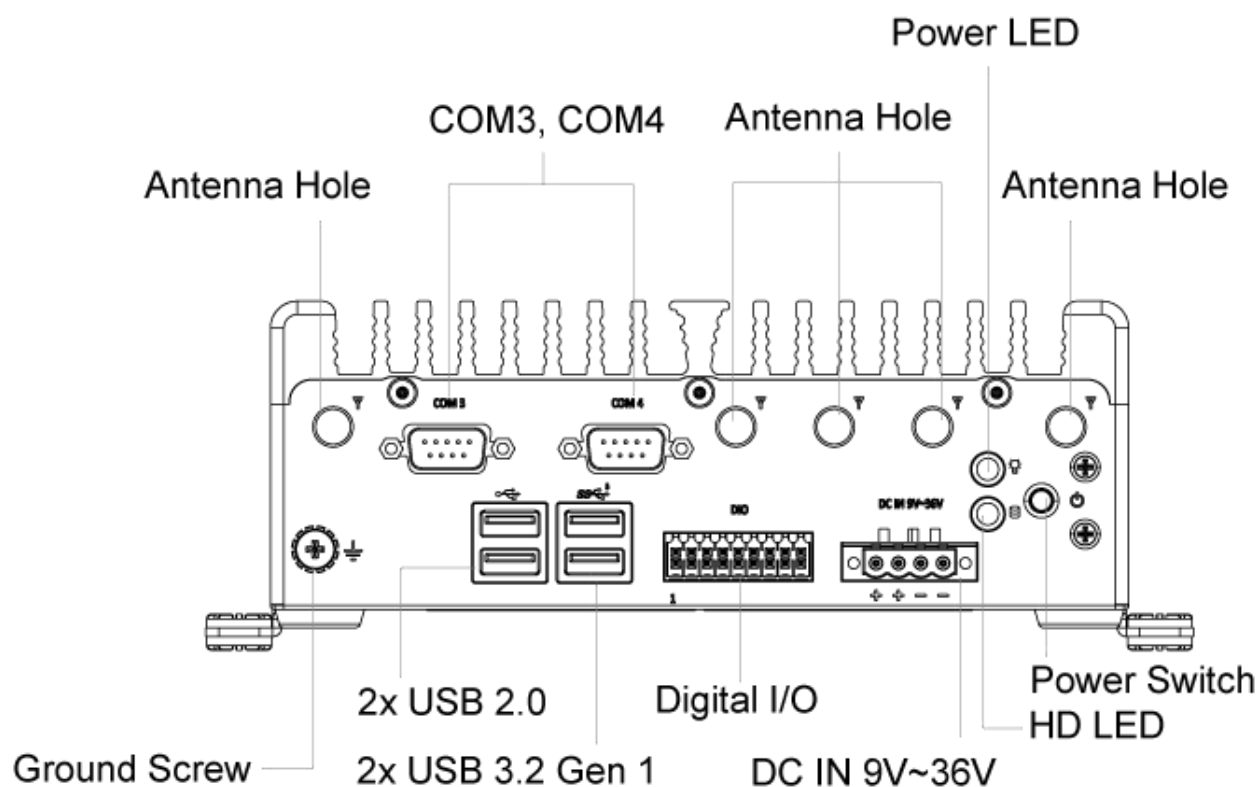
Used to plug a DC power input with terminal block

Power LED

Indicates the power status of the system

HDD LED

Indicates the status of the hard drive



Rear Panel

1.3.2 BCO-6000-RPL

Front Panel

USB 3.2 Gen 2 port (10 Gbps)

Used to connect USB 3.2 device

DisplayPort

Used to connect a DisplayPort monitor

HDMI port

Used to connect a HDMI monitor or connect optional split cable for dual display mode

COM port

COM1 ~ COM2 support RS232/422/485 serial device

Line-out

Used to connect a speaker

Mic-in

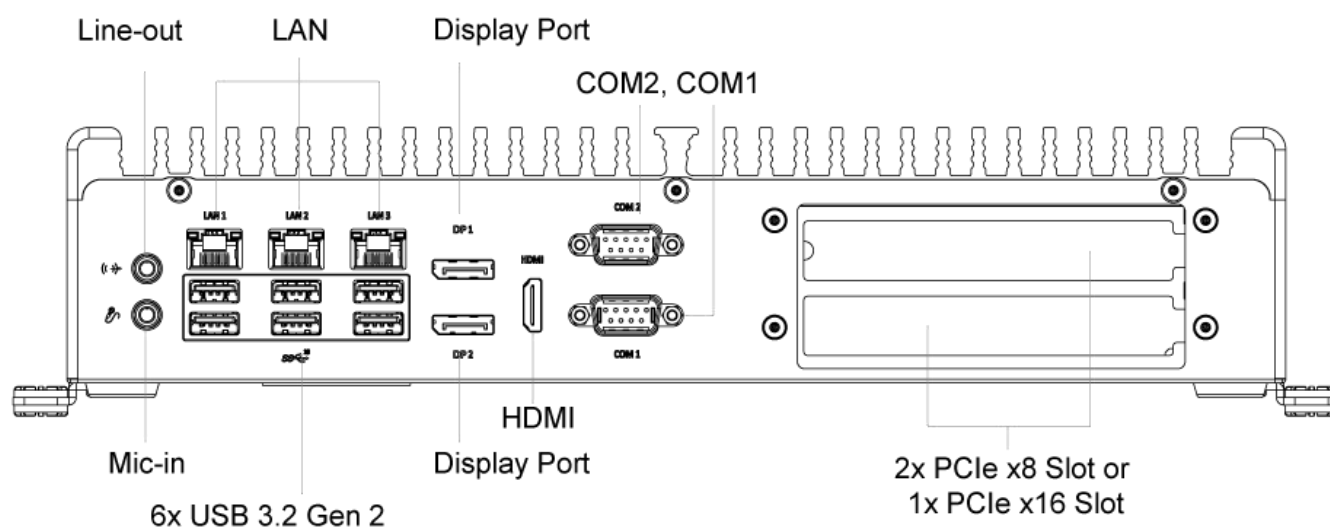
Used to connect a microphone

LAN port

Used to connect the system to a local area network

Expansion

PCIe Slot: 2x PCIe x8 or 1x PCIe x16 Slot



Front Panel

BCO-6000-RPL

Rear Panel

USB 2.0 port

Used to connect USB 2.0 device

USB 3.2 Gen 1 port (5 Gbps)

Used to connect USB 3.2 device

COM port

COM3 ~ COM4 support RS232/422/485 serial device

Antenna hole

Used to connect an antenna for optional Mini-PCIe WiFi module

Digital I/O

The Digital I/O terminal block supports 8 digital input and 8 digital output

DC IN

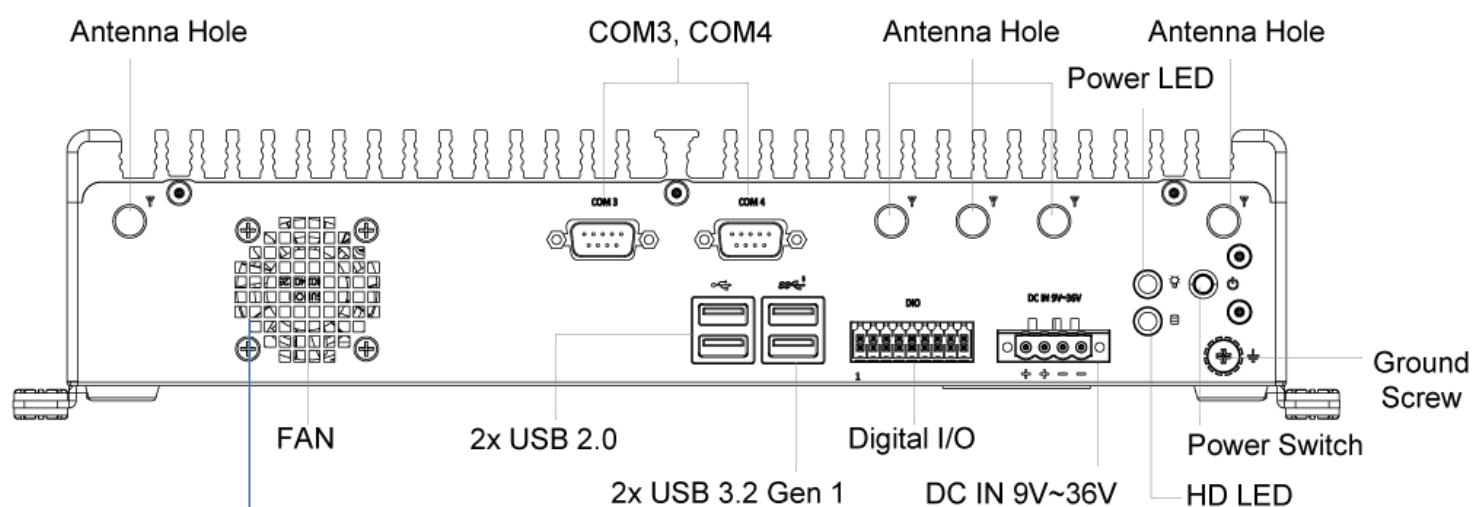
Used to plug a DC power input with terminal block

Power LED

Indicates the power status of the system

HDD LED

Indicates the status of the hard drive



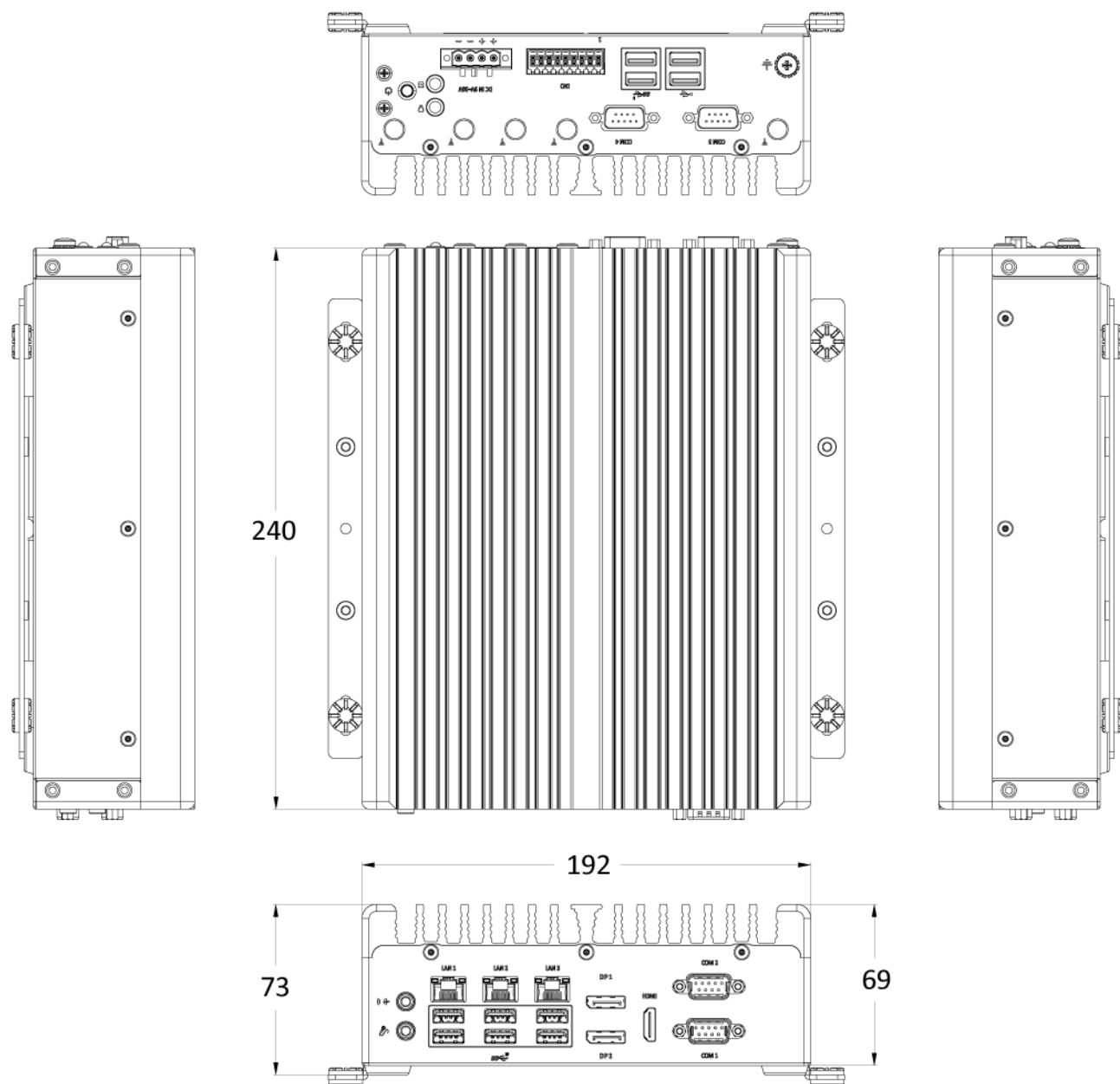
The wind direction
blows from outside to
inside.

Rear Panel

1.4 Mechanical Dimensions

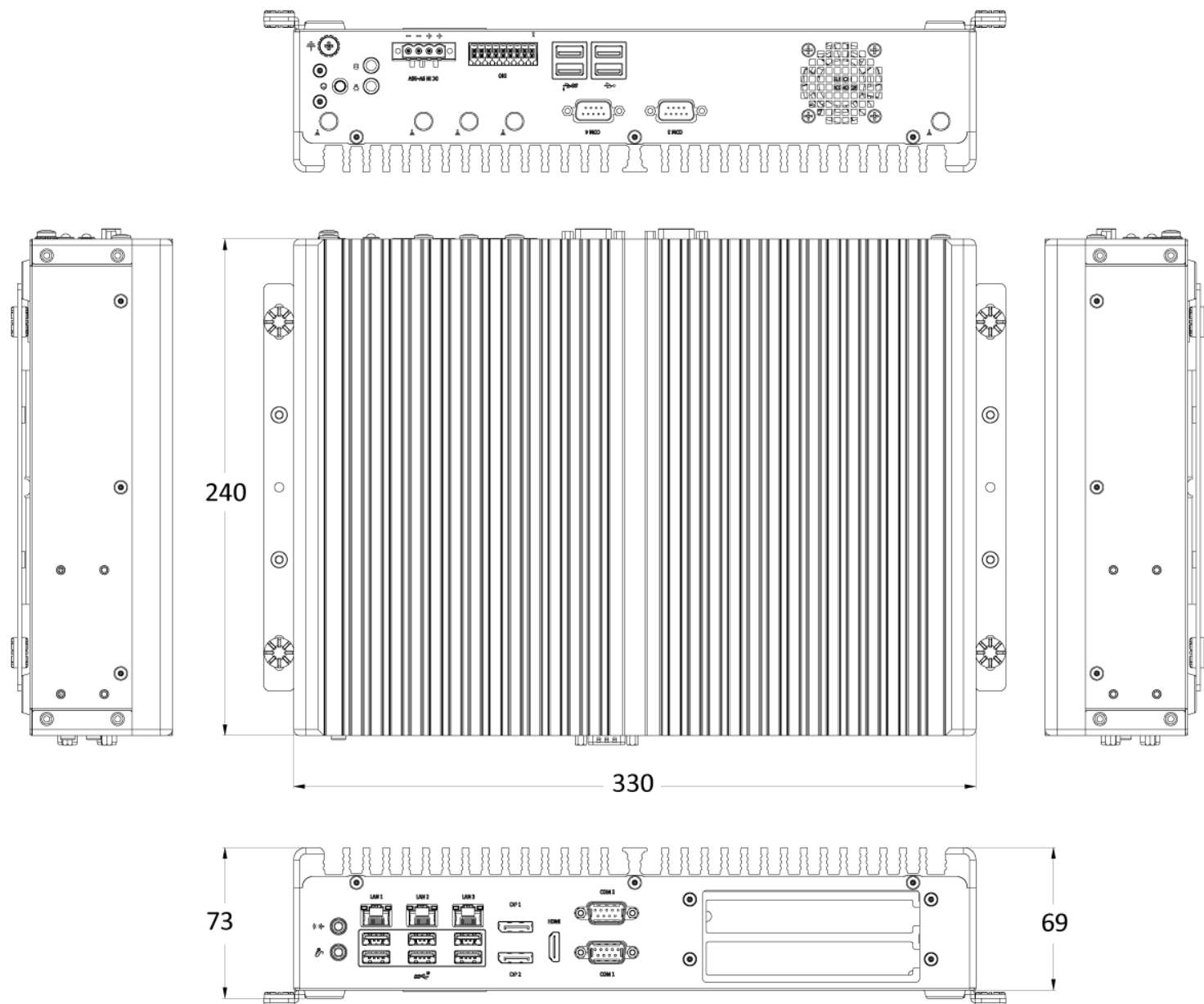
1.4.1 BCO-3000-RPL

Unit: mm



1.4.2 BCO-6000-RPL

Unit: mm

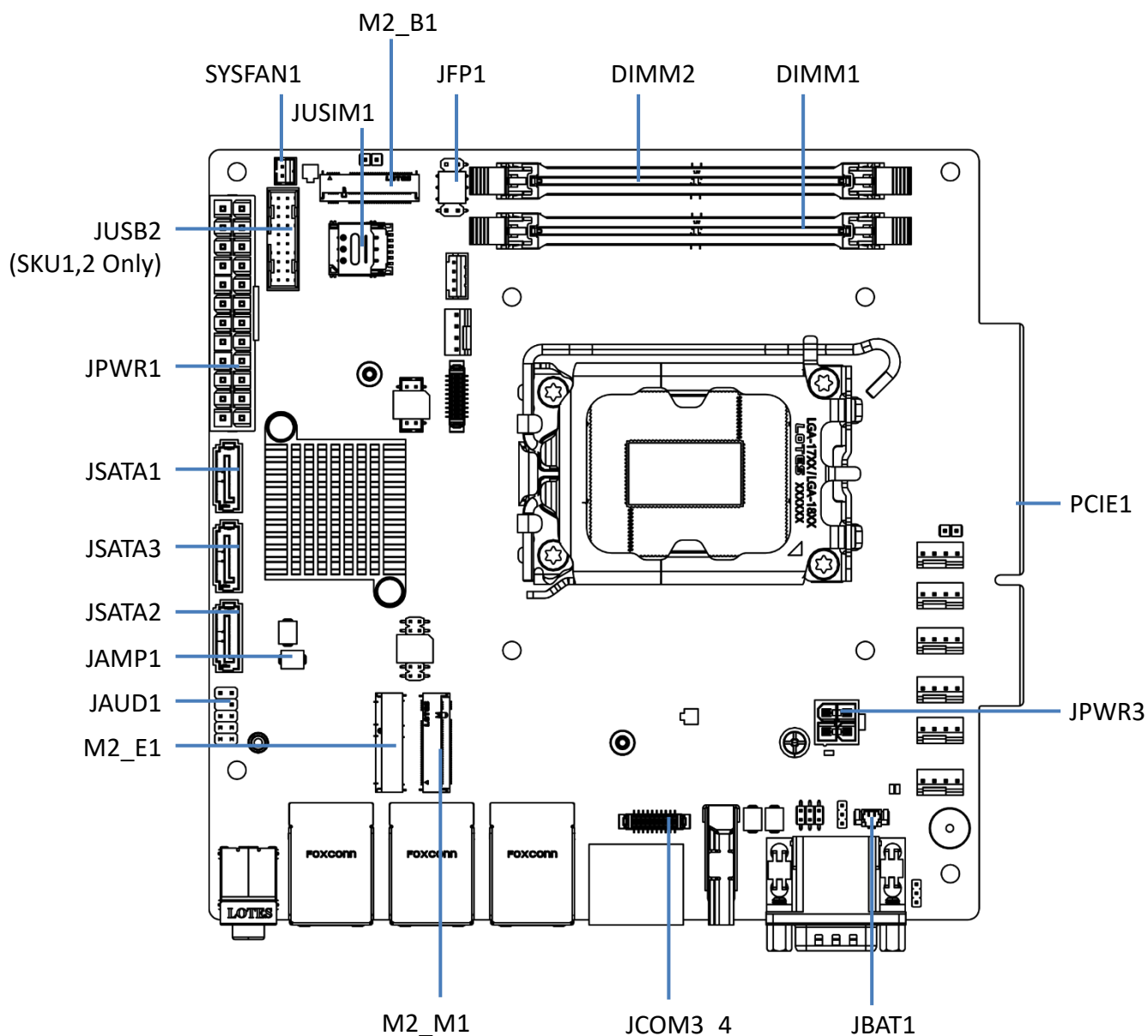


Chapter 2

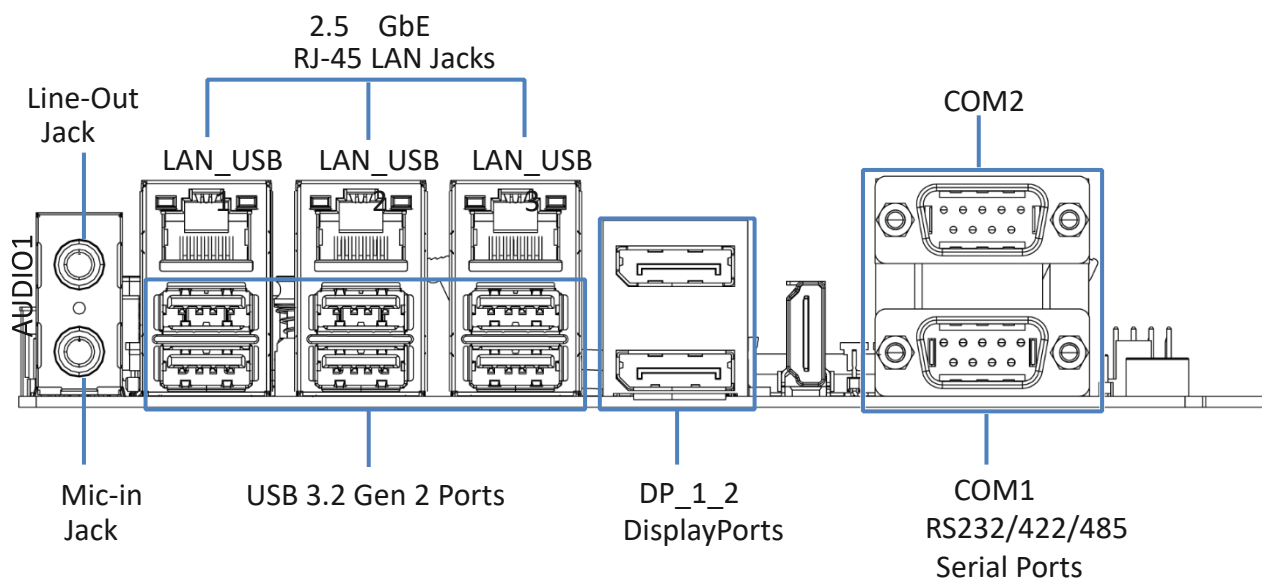
Mechanical Specifications

2.1 Switch and Connector Locations

2.1.1 SKU1/ SKU2



Rear I/O



Component Contents

Component

2.2 CPU Socket

2.3 CPU & Heatsink Installation

2.4 Memory

- DIMM1~2: DDR4 SO DIMM Slots

2.5 Storage

- JSATA1: SATA 3.0 6Gb/s Ports
- M2_M1: M.2 Slot (M Key, 2242, 2280)

2.6 Expansion Slots

- PCIE1: PCIe Expansion Slots
- JUSIM1: Nano SIM Holder (SKU1,2 Only)
- M2_E1: M.2 Slot (E Key, 2230)
- M2_B1: M.2 Slot (B Key, 3042) (SKU1,2 Only)

2.7 Connectors

Power Connectors

- JPWR1: ATX 24-Pin Power Connector
- JPWR3: ATX 4-Pin 12V Power Connector

Audio Connectors

- JAUD1: Front Audio Header
- JAMP1: Audio Amplifier Header

Graphics Connectors

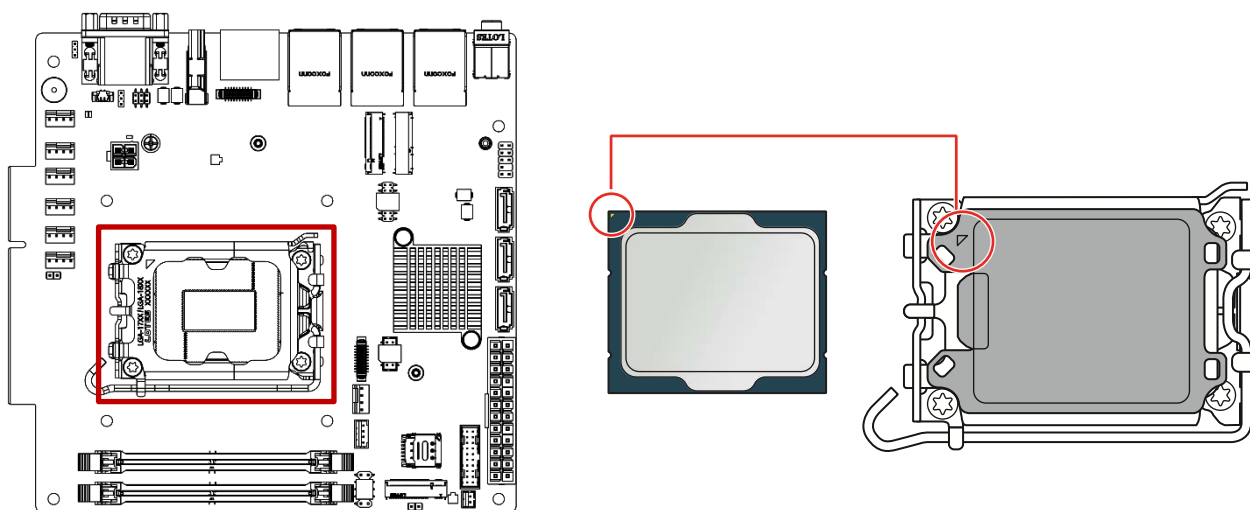
- JINV1: LVDS Inverter Box Header
- JLVDS1_EDP1: LVDS+eDP Wafer Connector

Other Connectors

- CPUFAN1, SYSFAN1: CPU/ System Fan Box Headers
- JFP1: Front Panel Connector
- JCOM3_4: COM Port Box Header
- JGPIO1: GPIO (DIO) Box Header
- JI2C1: I2C Box Header
- JUSB1: USB 2.0 Box Header
- JUSB2: USB 3.2 Gen 1 Box Header (SKU1,2 Only)
- JBAT1: CMOS Battery Header

2.8 Jumpers

2.2 CPU Socket



• Introduction to the LGA1700 CPU

The surface of the LGA1700 CPU has four notches and a golden triangle to assist in correctly lining up the CPU for motherboard placement. The golden triangle is the Pin 1 indicator.

• Important

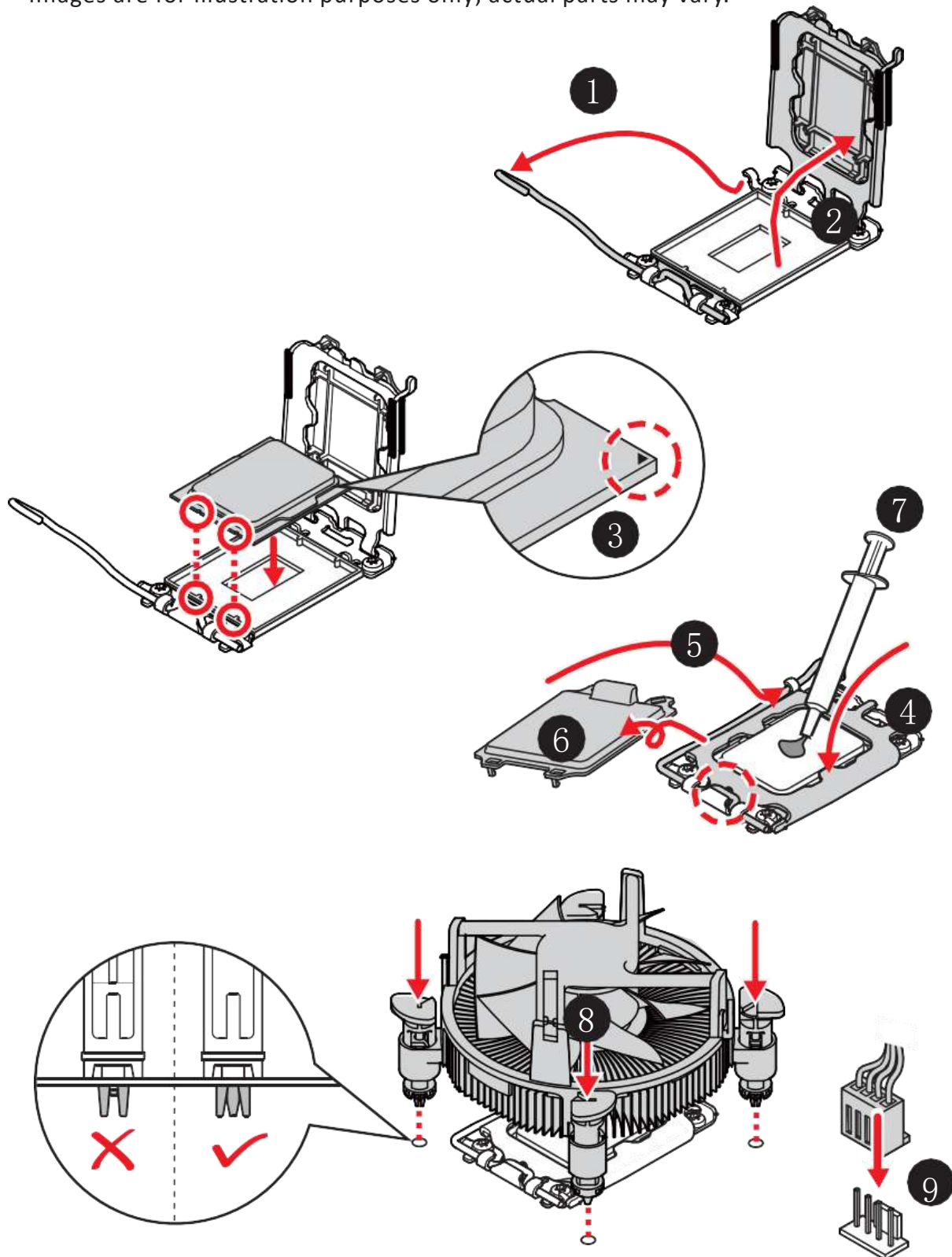
- Always unplug the power cord from the power outlet before installing or removing the CPU.
- When installing a CPU, always remember to install a CPU heatsink. A CPU heatsink is necessary to prevent overheating and maintain system stability.
- Confirm that the CPU heatsink has formed a tight seal with the CPU before booting your system.
- Overheating can seriously damage the CPU and motherboard. Always make sure the cooling fans work properly to protect the CPU from overheating. Be sure to apply an even layer of thermal paste (or thermal tape) between the CPU and the heatsink to enhance heat dissipation.
- Whenever the CPU is not installed, always protect the CPU socket pins by covering the socket with the plastic cap.
- If you purchased a separate CPU and heatsink/ cooler, Please refer to the documentation in the heatsink/ cooler package for more details about installation.

2.3 CPU & Heatsink Installation

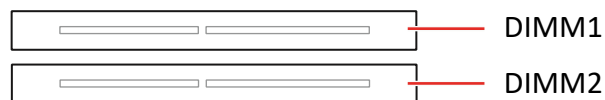
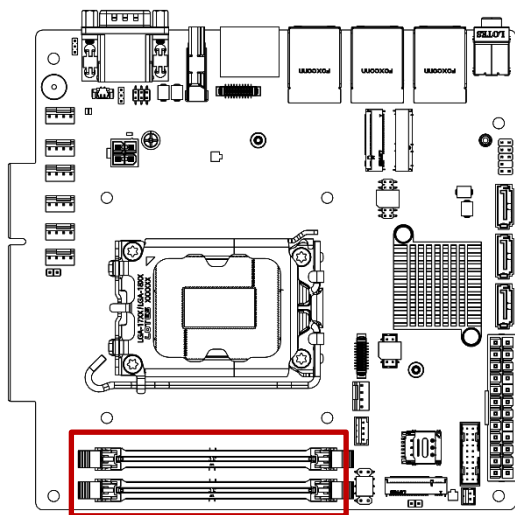
Use appropriate ground straps, gloves and ESD mats to protect yourself from electrostatic discharge (ESD) while installing the processor.



Images are for illustration purposes only; actual parts may vary.



2.4 Memory

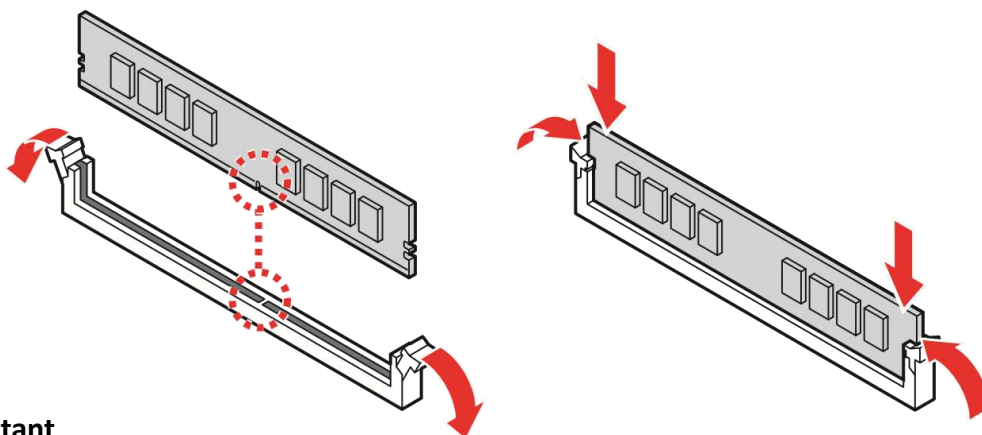


Installing DDR4 Memory

- **DIMM1~2: DDR4 SO DIMM Slots**

The SO-DIMM slots are intended for memory modules.

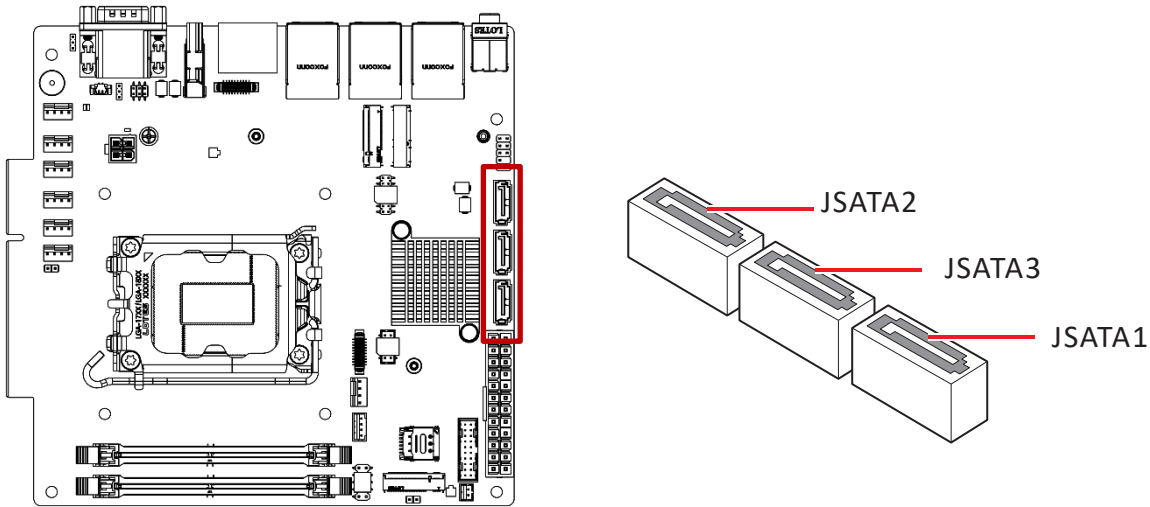
1. Open the side clips to unlock the DIMM slot.
2. Insert the DIMM vertically into the slot, ensuring that the off-center notch at the bottom aligns with the slot.
3. Push the DIMM firmly into the slot until it clicks and the side clips automatically close.
4. Verify that the side clips have securely locked the DIMM in place.



- **⚠ Important**

- Always insert memory modules in the DIMM2 slot first.
- You can barely see the golden finger if the DIMM is properly inserted in the DIMM slot.
- To ensure system stability for Dual channel mode, memory modules must be of the same type, number and density.

2.5 Storage



- **JSATA1: SATA 3.0 6Gb/s Ports**

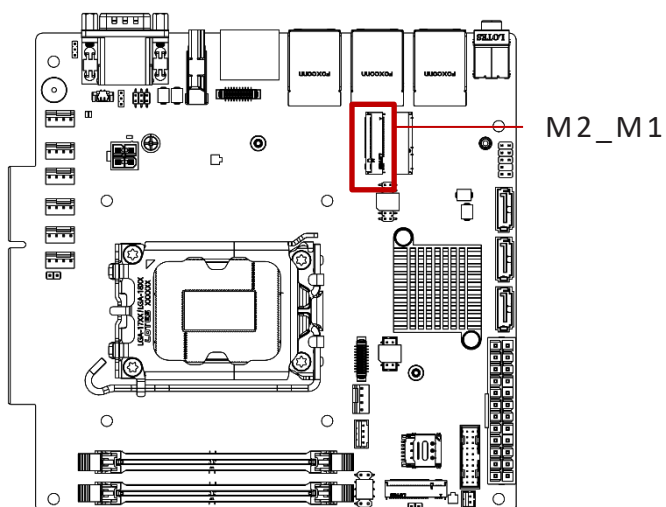
This connector is SATA 6Gb/s interface port, it can connect to one SATA device.

- **Important**

- This SATA port supports hot plug.
- Please do not fold the SATA cable at a 90-degree angle. Data loss may result during transmission otherwise.
- SATA cables have identical plugs on either side of the cable. However, it is recommended that the flat connector be connected to the motherboard for space saving purposes.

M2_M1: M.2 Slot (M Key, 2242, 2280)

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

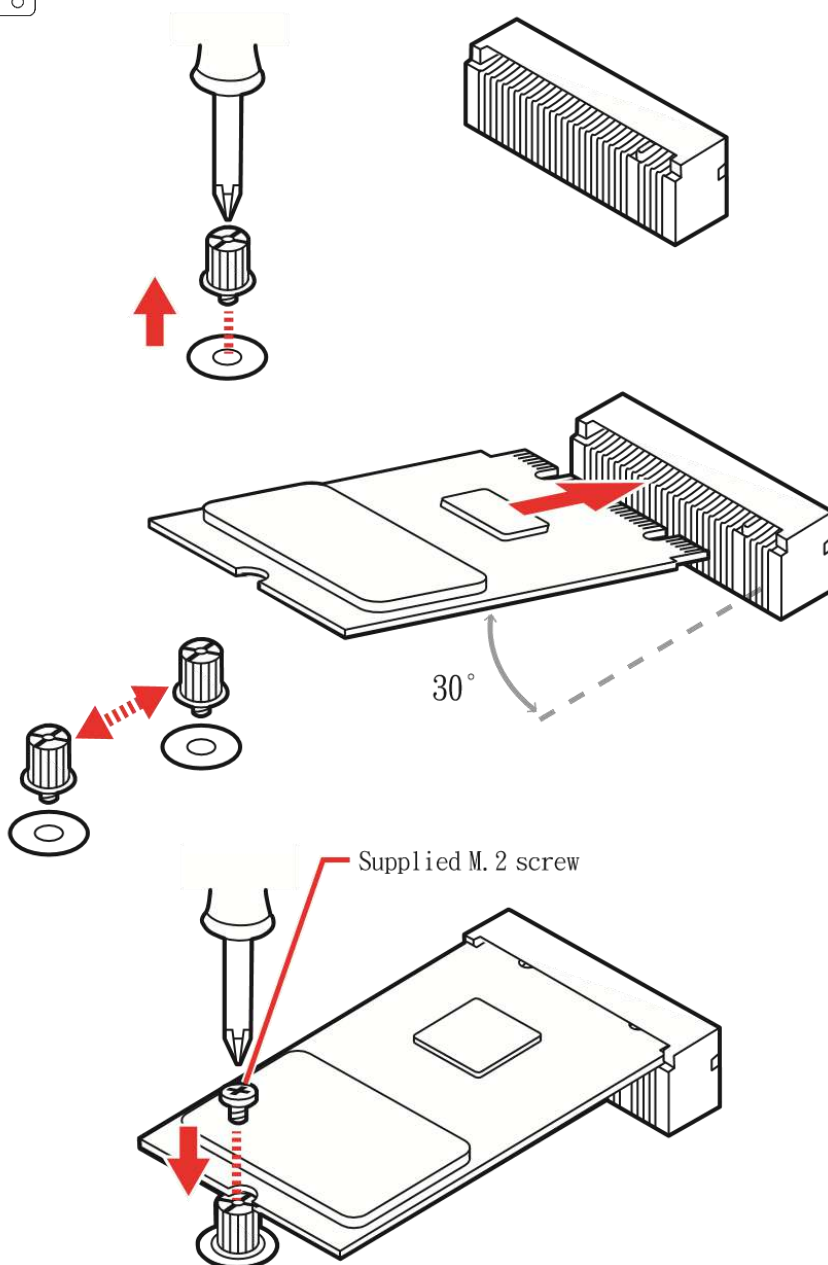


Feature

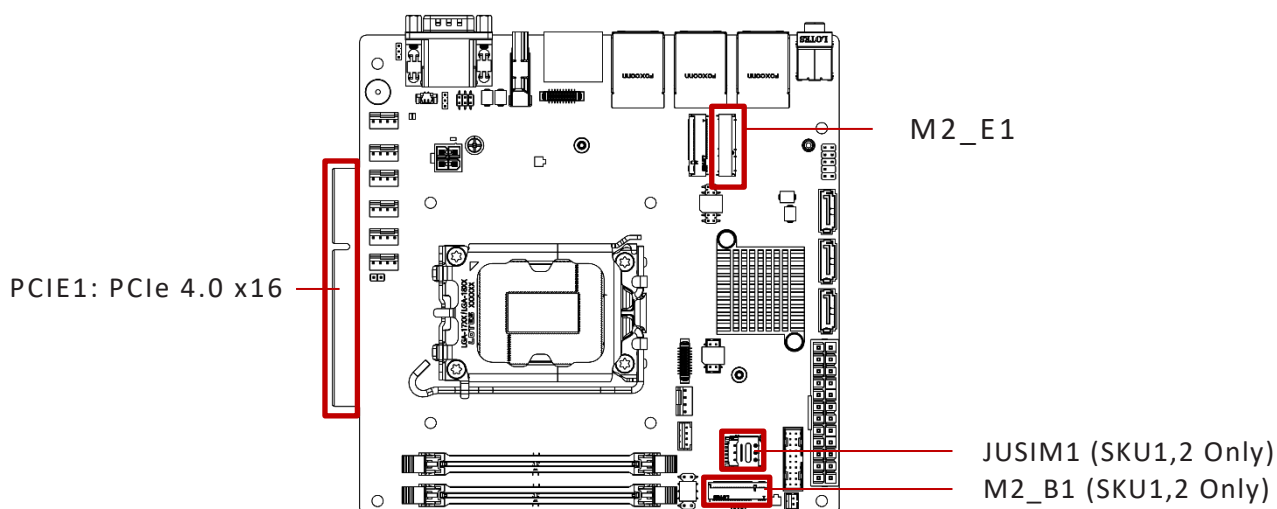
- Supports PCIe 3.0 x4 signal.
- Supports B+M key module.

Installing M.2 SSD

1. Loosen the M.2 riser screw from the motherboard.
2. Set the M.2 riser screw at the appropriate location based on the length of your M.2 SSD.
3. Insert your M.2 SSD into the M.2 slot at a 30-degree angle.
4. Secure the M.2 SSD in place with the supplied M.2 screw



2.6 Expansion Slots

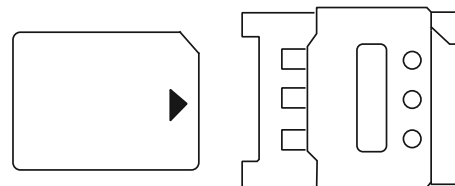


- **PCIE1: PCIe Expansion Slots**

The PCI Express(Peripheral Component Interconnect Express) slots support PCIe interface expansion cards.

- **JUSIM1: Nano SIM Holder (SKU1,2 Only)**

This holder is provided for 3G, 4G, LTE, 5G Nano SIM cards.

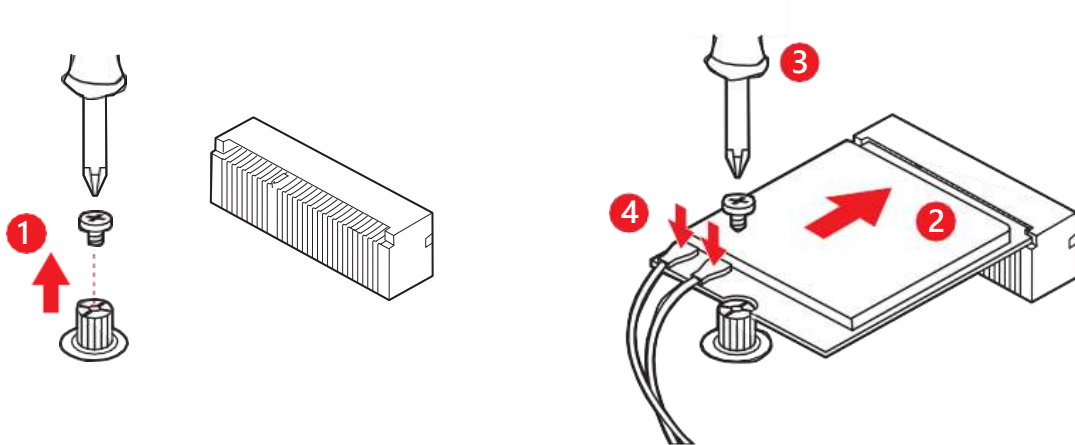


- **⚠ Important**

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.

M2_E1: M.2 Slot (E Key, 2230)

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

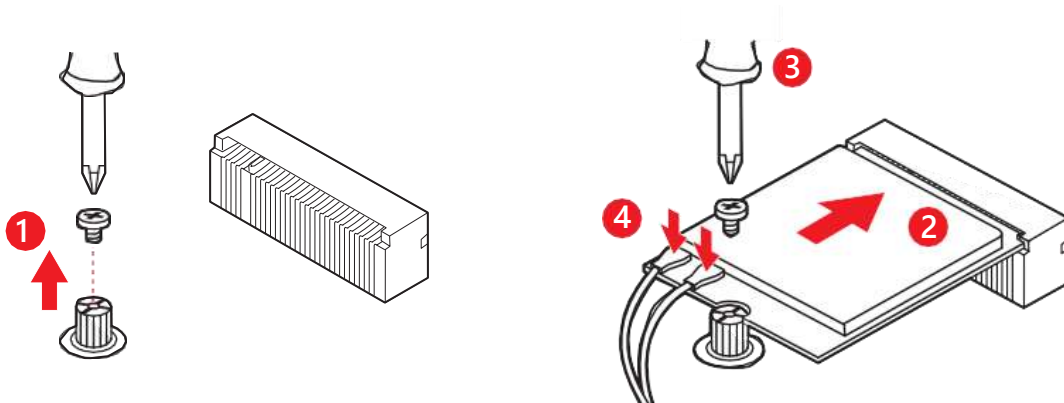


Feature

- Supports PCIe x 1 & USB 2.0 signal.
- Supports CNVi.

M2_B1: M.2 Slot (B Key, 3042) (SKU1,2 Only)

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

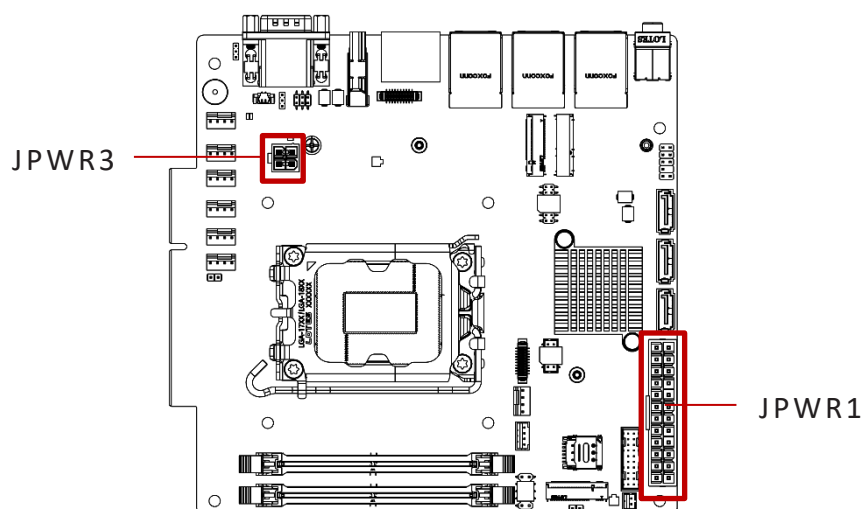


Feature

- Supports PCIe x 1, USB 3.2 Gen 2 x 1, USB 2.0 signal.
- Supports 5G modules.

2.7 Connectors

Power Connectors



JPWR1: ATX 24-Pin Power Connector

This connector allows you to connect an ATX power supply.

	1	+3.3V	2	+3.3V
	3	GND	4	+5V
	5	GND	6	+5V
	7	GND	8	PWROK
	9	5VSB	10	+12V
	11	+12V	12	+3.3V
	13	+3.3V	14	-12V
	15	GND	16	P-ON#
	17	GND	18	GND
	19	GND	20	-5V
	21	+5V	22	+5V
	23	+5V	24	GND

JPWR3: ATX 4-Pin 12V Power Connector

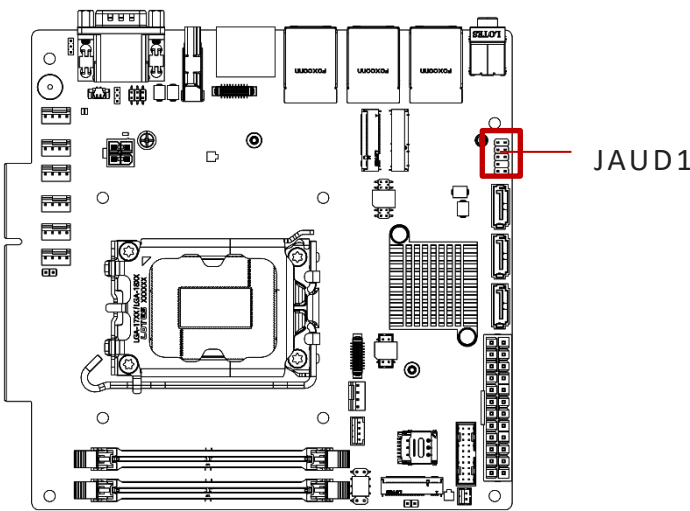
This connector is used to provide power to SATA devices.

JPWR3 3 1 4 2	1	GND	2	GND
	3	12V	4	12V

 Important

Make sure that all the power cables are securely connected to a proper power supply to ensure stable operation of the system.

Audio Connectors



JAUD1: Front Audio Header

This connector allows you to connect front panel audio.

JAUD1 1 2 9 10	1	MIC_L	2	GND
	3	MIC_R	4	PRESENCE#
	5	F_OUTR	6	MIC2_JD
	7	HPON	8	Nopin
	9	F_OUTL	10	LIN2_JD

- **JLVDS1_EDP1: LVDS+eDP Wafer Connector**

This connector is designed for use with LVDS/eDP interface flat panels. When connecting your flat panel to this connector, be sure to check the panel datasheet to ensure that you set the JVDD1 LVDS power jumper to the appropriate power voltage.

JLVDS1_EDP1 39 40 1 2	1	EDP_LINE3_DP	2	EDP_LINE2_DP
	3	EDP_LINE3_DN	4	EDP_LINE2_DN
	5	DDC0_CLK_7513_R	6	DDC0_DATA_7513_R
	7	LCD_VDD	8	LCD_VDD
	9	LCD_VDD	10	VCC3
	11	BKLT_EN	12	LVDS_DETECT#
	13	LVDSA_DATA1+	14	EHPDET/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	NC	36	GND
	37	LVDSB_CLK+	38	LVDSA_CLK+
	39	LVDSB_CLK-	40	LVDSA_CLK-

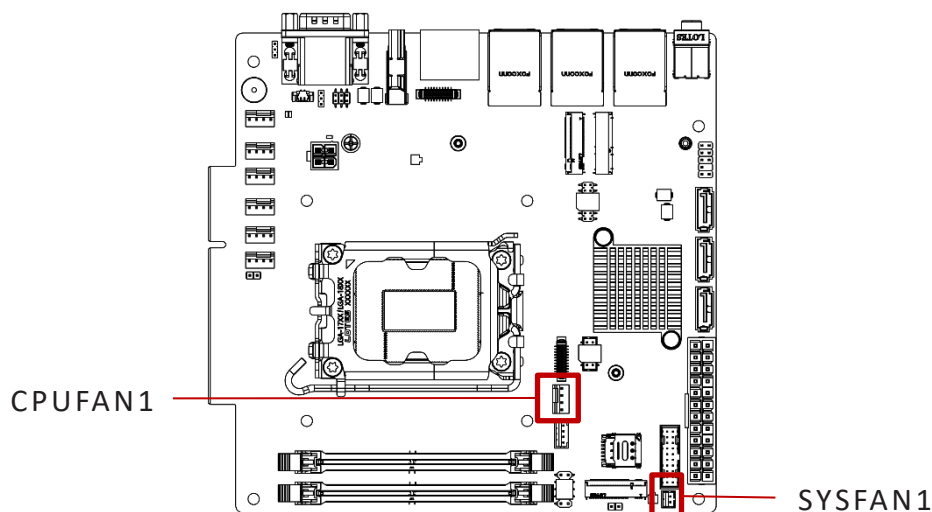
- **⚠ Important**

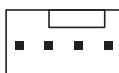
Pin 12 is a detective pin. When using a customized LVDS cable, pin 12 should be a signal ground with a low impedance. Otherwise, LVDS will not function.

Other Connectors

CPUFAN1, SYSFAN1: CPU/ System Fan Box Headers

The fan power connector supports CPU/ 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.



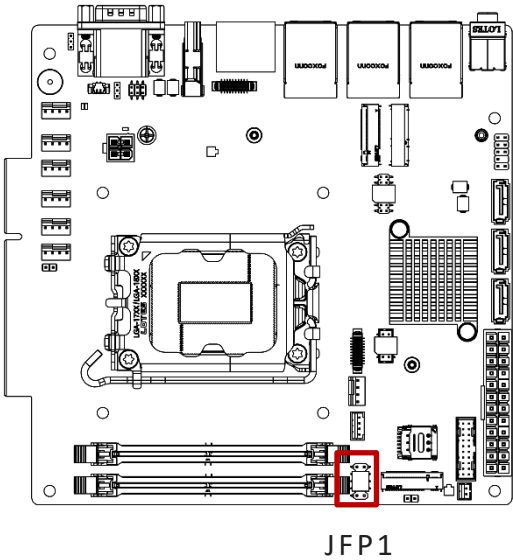
CPUFAN1	4		1	SYSFAN1	1	GND	2	FANPOWER
					3	FANSENSE	4	FAN_PWM

- ⚠ Important**

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

• **JFP1: Front Panel Connector**

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.

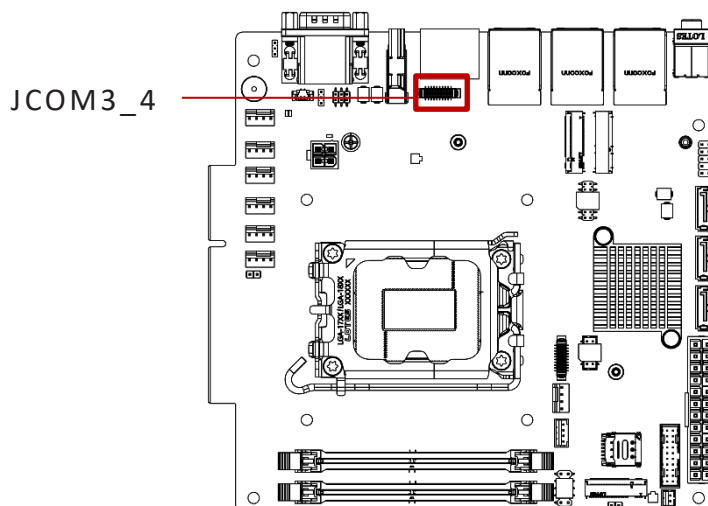


JFP1 1 2 9	1	HDDLED+	2	POWERLED
	3	HDDLED-	4	POWERLED
	5	RESETSWITCH-	6	POWERSWITCH+
	7	RESETSWITCH+	8	POWERSWITCH-
	9	NC	10	Nopin

• JCOM3_4: COM Port Box Header

This connector is a 16550A high speed communications port that sends/ receives 16 bytes FIFOs.

You can attach a serial device to it.



	1	ND3D3#	2	ND3D4#
	3	NSIN3	4	NSIN4
	5	NSOUT3	6	NSOUT4
	7	NDTR3	8	NDTR4
	9	GND	10	GND
	11	NDSR3#	12	NDSR4#
	13	NRTS3	14	NRTS4
	15	NCTS3#	16	NCTS4#
	17	VCC_COM3	18	VCC_COM4
	19	NC	20	NC

Important

After connect COM port box headers to printer, garbage can't be printed when power on/off.

Feature

- Support True RS-232
- Support TTL RS-232
- Support Auto flow control
- RS- 422/ 485 support TR 1000+ Meter
- RS- 232/ 422/ 485, selection by BIOS control

SKU1/ SKU2

- COM1 Connector (Rear I/O)
Supports RS-232/ 422/ 485, With Ring/ 0V/ 5V/ 12V (Default set to Ring).
- COM2 (Rear I/O), JCOM3_4 Connector
Supports RS-232/ 422/ 485, With 0V/ 5V/ 12V (Default set to 5V).

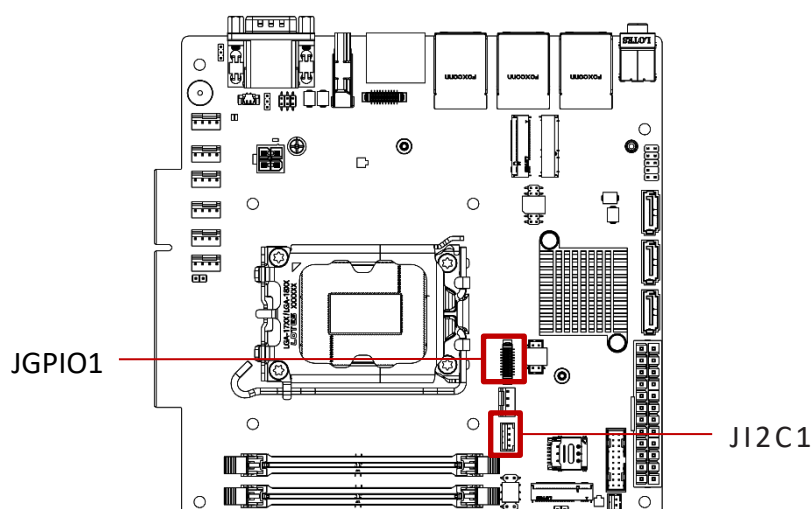
SKU3

- COM1 Connector (Rear I/O)
Supports RS-232/ 422/ 485, With Ring/ 0V/ 5V/ 12V (Default set to Ring).
- COM2 Connector (Rear I/O)
Supports RS-232/ 422/ 485, With 0V/ 5V/ 12V (Default set to 5V).
- JCOM3_4 Connector
Supports RS-232, With 0V/ 5V/ 12V (Default set to 5V)

RS232		
PIN	SIGNAL	DESCRIPTION
1	ND CD	Data Carrier Detect
2	NS IN	Signal In
3	NS OUT	Signal Out
4	ND TR	Data Terminal Ready
5	GND	Signal Ground
6	NDSR	Data Set Ready
7	NRTS	Request To Send
8	NCTS	Clear To Send
9	VCC_COM	VCC_COM
RS422		
PIN	SIGNAL	DESCRIPTION
1	422 TXD-	Transmit Data, Negative
2	422 TXD+	Receive Data, Positive
3	422 RXD+	Transmit Data, Positive
4	422 RXD-	Receive Data, Negative
5	RXD GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection
RS485		
PIN	SIGNAL	DESCRIPTION
1	TXD-	Transmit Data, Negative
2	NC	No Connection
3	TXD+	Transmit Data, Positive
4	NC	No Connection
5	GND	Signal Ground
6	NC	No Connection
7	NC	No Connection
8	NC	No Connection
9	NC	No Connection

- **JGPIO1: GPIO (DIO) Box Header**

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



	1	GND	2	GND
	3	N_GPO0	4	N_GPIO
	5	N_GPO1	6	N_GPIO1
	7	N_GPO2	8	N_GPIO2
	9	N_GPO3	10	N_GPIO3
	11	N_GPO4	12	N_GPIO4
	13	N_GPO5	14	N_GPIO5
	15	N_GPO6	16	N_GPIO6
	17	N_GPO7	18	N_GPIO7
	19	VCC5	20	VCC5

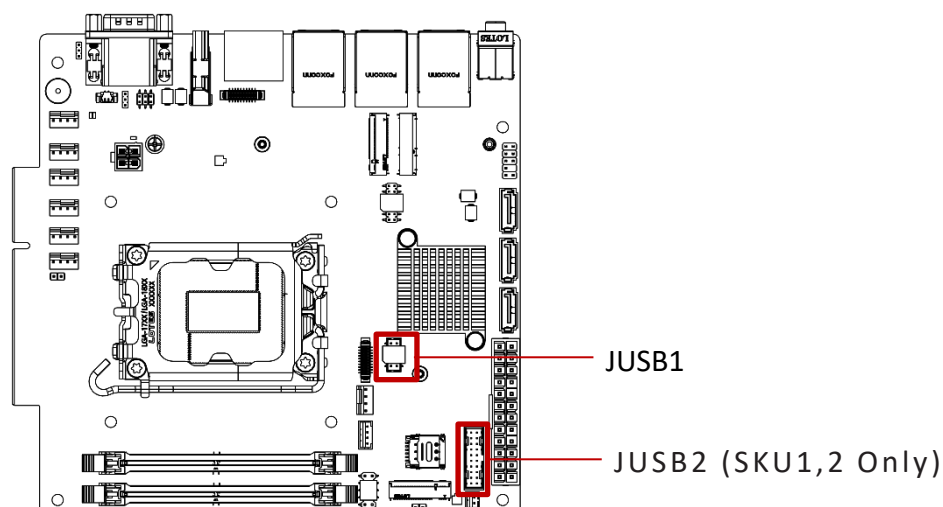
- **JI2C1: I2C Box Header**

This connector is used to connect to the System Management Bus (SMBus).

	1	3VSB	2	I2C_CLK
	3	I2C_DATA-	4	GND

- JUSB1: USB 2.0 Box Header**

These connectors are ideal for connecting USB devices such as keyboard, mouse, or other USB-compatible devices.



	1	5V	2	5V
	3	USB_D-	4	USB_D-
	5	USB_D+	6	USB_D+
	7	GND	8	GND
	9	Nopin	10	NC

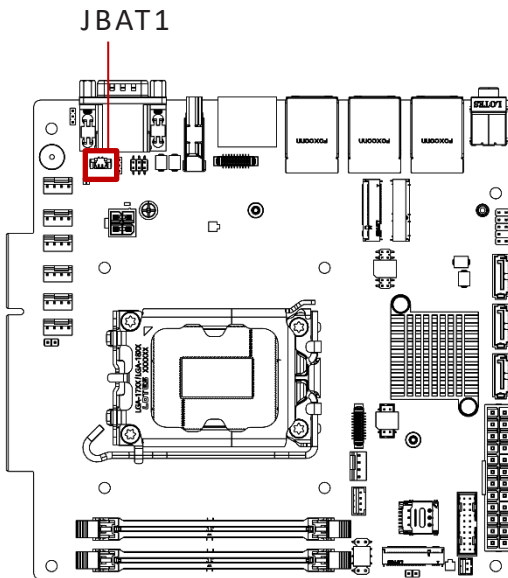
- JUSB2: USB 3.2 Gen 1 Box Header (SKU1,2 Only)**

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

	1	5V	2	USB_3.2 RX-
	3	USB_3.2 RX+	4	GND
	5	USB_3.2 TX-	6	USB_3.2 TX+
	7	GND	8	USB_D-
	9	USB_D+	10	NC
	11	USB_D+	12	USB_D-
	13	GND	14	USB_3.2 TX+
	15	USB_3.2 TX-	16	GND
	17	USB_3.2 RX+	18	USB_3.2 RX-
	19	5V	20	NoPin

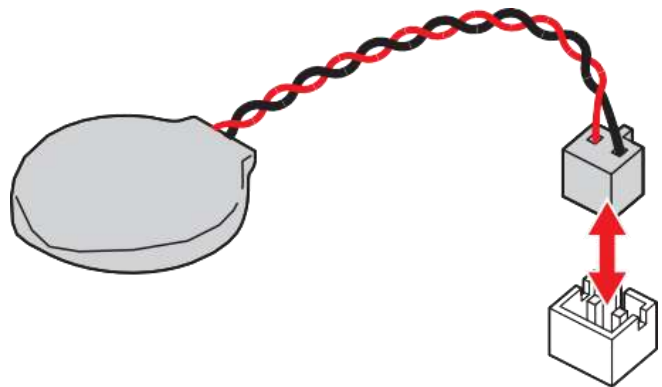
- **JBAT1: CMOS Battery Header**

If the CMOS battery is out of charge, the time in the BIOS will be reset and the data of system configuration will be lost. In this case, you need to replace the CMOS battery.



Replacing CMOS battery

1. Unplug the battery wire from the BAT1 connector and remove the battery.
2. Connect the new CR2032 battery with wire to the BAT1 connector.

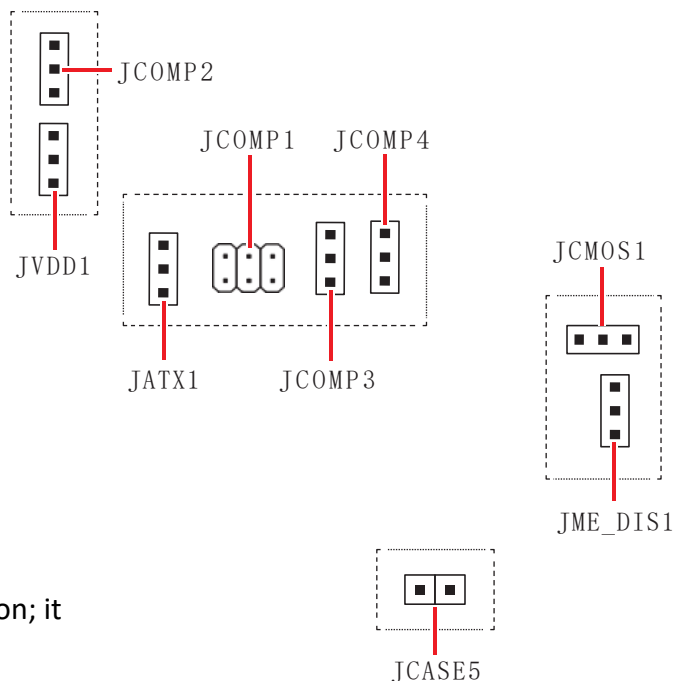
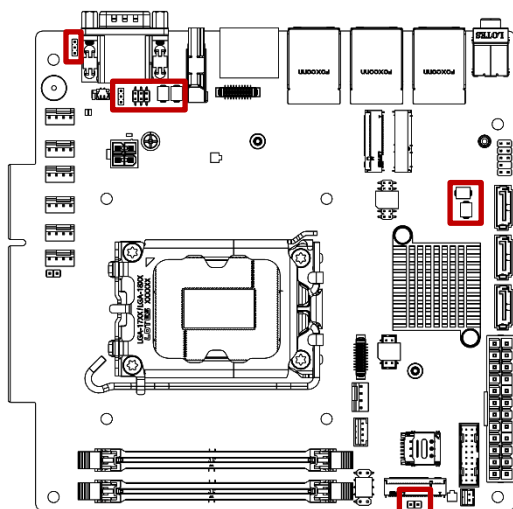


WARNING

KEEP OUT OF REACH OF CHILDREN

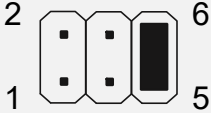
- Swallowing can lead to chemical burns, perforation of soft tissue, can death.
- Severe burns can occur within 2 hours of ingestion.
- If you think batteries might have been swallowed or placed inside any part of the body, seek immediate medical attention.

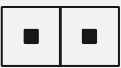
2.8 Jumpers



• Important

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

Jumper Name	Default Setting	Description
JCOMP1		COM Voltage Select Jumper
		1-2: 5V Power 3-4: 12V Power 5-6: NRI (Default)
JCOMP2		COM Voltage Select Jumper
JCOMP3		1-2: 5V Power (Default)
JCOMP4		2-3: 12V Power
JCMOS1		Clear CMOS Jumper
		1-2: Normal (Default)
		2-3: Clear CMOS
JME_DIS1		ME Jumper
		1-2: ME enabled (Default)
		2-3: ME disabled

Jumper Name	Default Setting	Description
JATX1		AT/ ATX Mode Select Jumper
		1-2: ATX (Default) 2-3: AT
JVDD1		LVDS Power Jumper
		1-2: 3.3V (Default) 2-3: 5V
JCASE5	 Normal (default)	Chassis Intrusion Jumper
		This connector connects to the chassis intrusion switch cable. If the chassis is opened, the chassis intrusion mechanism will be activated. The system will record this status and show a warning message on the screen. To clear the warning, you must enter the BIOS utility and clear the record.

Chapter 3

System Setup

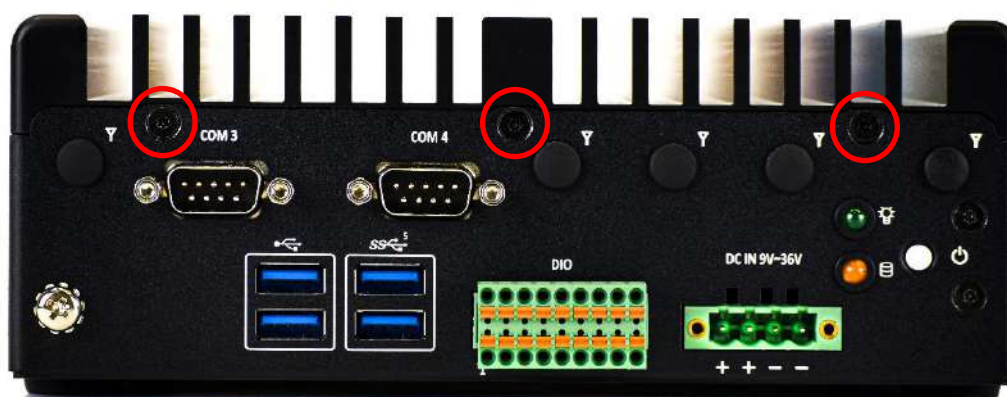
3.1 Set torque force to 3.5 kgf-cm to screw or unscrew system parts.

3.2 Separating the expansion module from main computer module.

**WARNING**

To ensure safety and prevent system damage, before disassembly, please switch off the system and disconnect the unit from its power source.

1. Remove the 3 screws on the front and rear side of the system as highlighted in the pictures below.



2. Remove the 3 screws on the left and right side of the system as highlighted in the pictures below

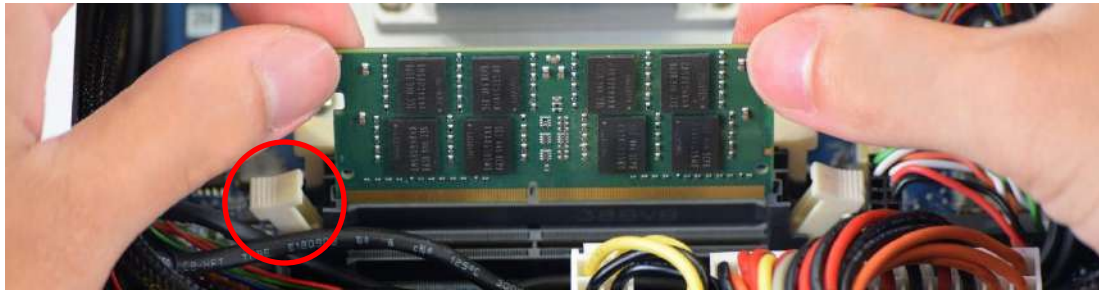


3. Now you can remove the bottom cover.

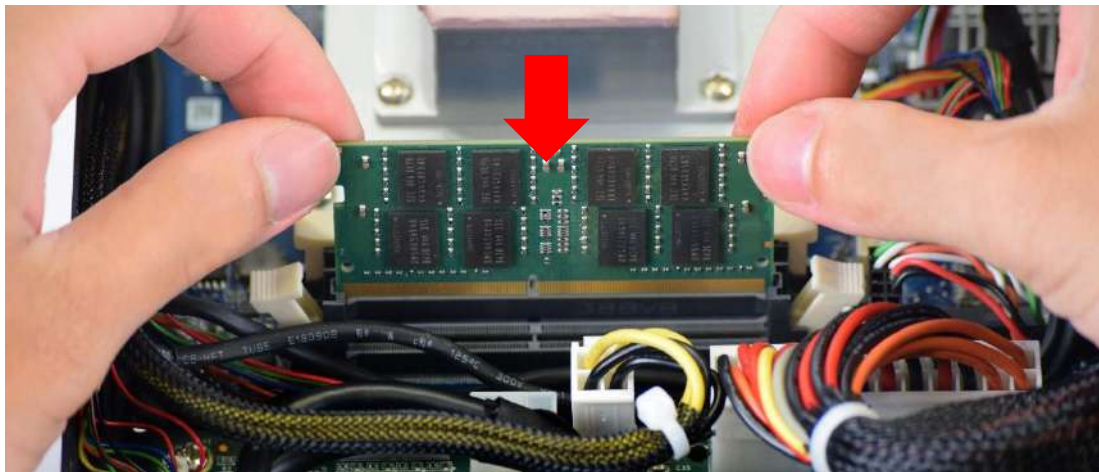


3.3 Install RAM

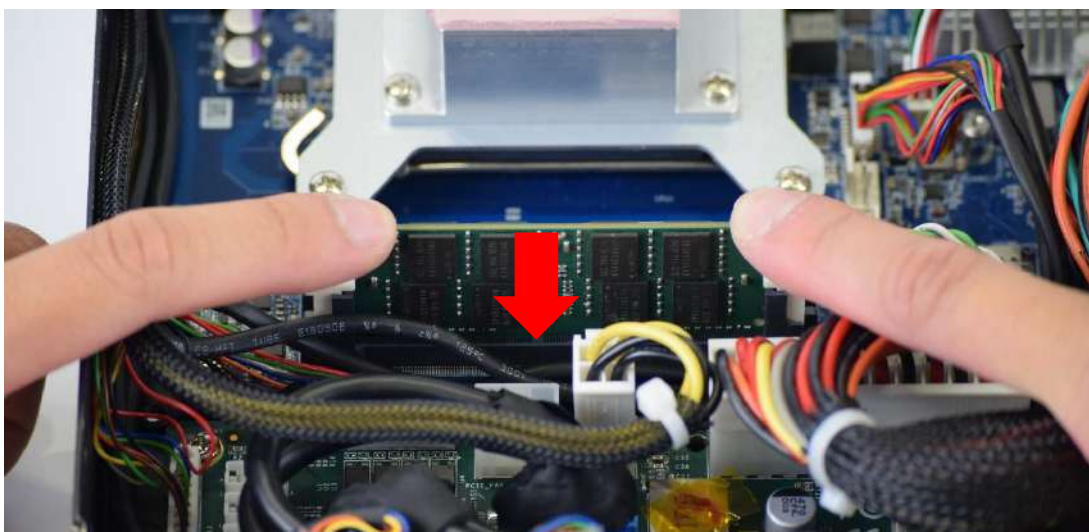
1. Push down the locking tab(s) at the end of each slot.



2. Line up the RAM stick with the slot, ensuring that the notch of the RAM stick matches that of the slots.



3. Push down the RAM stick straight down until it makes a clicking sound.

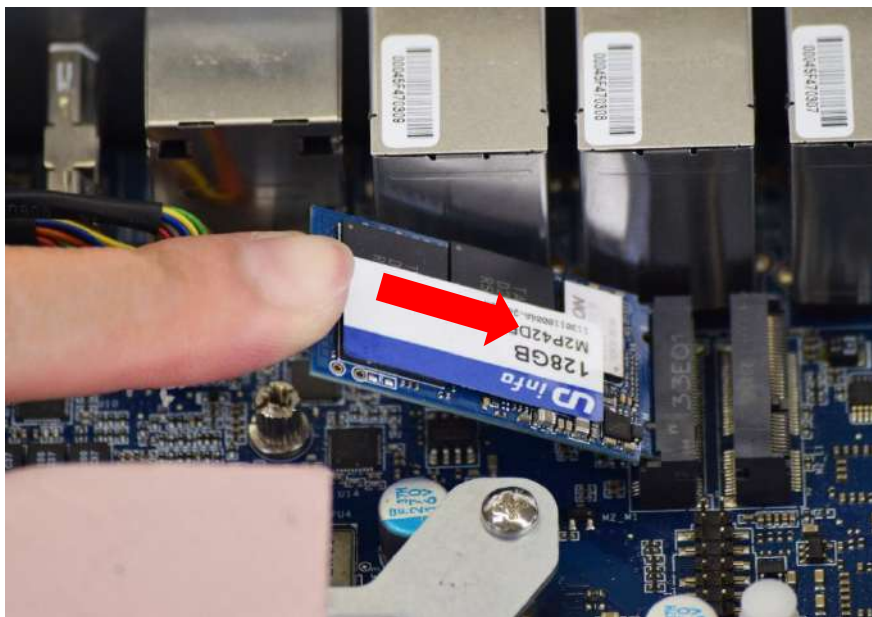


3.4 Install M.2

1. Remove the screws first



2. Insert M.2 card at a 45 degree angle.

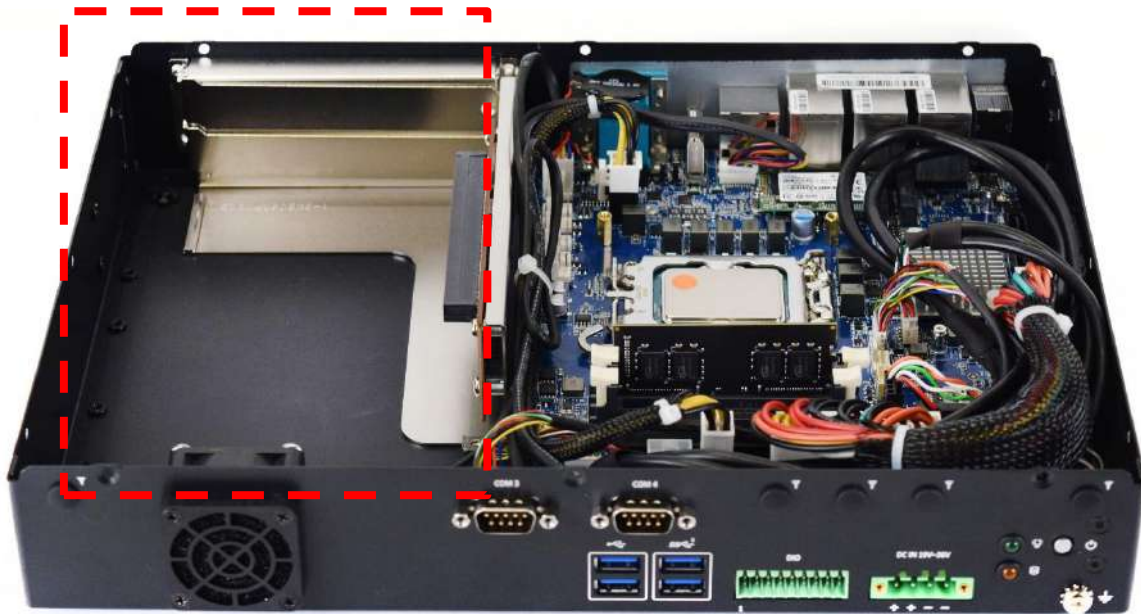


3. Gently press the Mini PCIe card down against the board and secure it with one screw (Round Spacer and M3x6L).

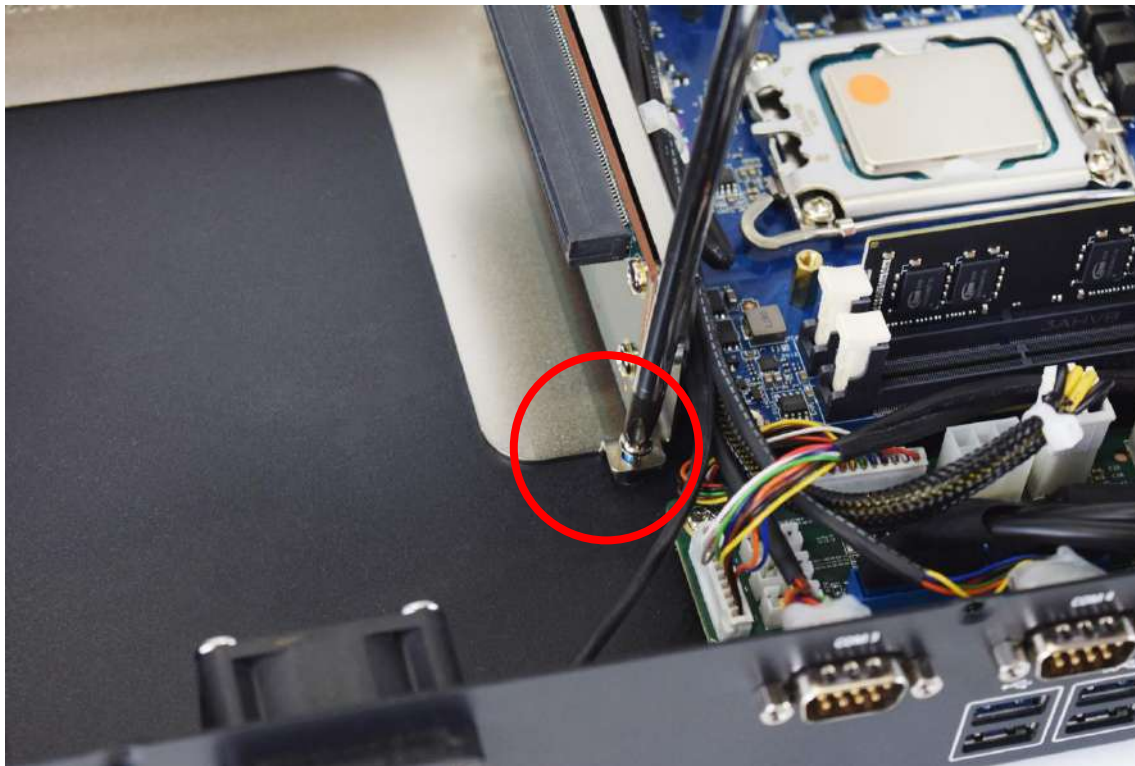


3.5 Graphics card slot installation

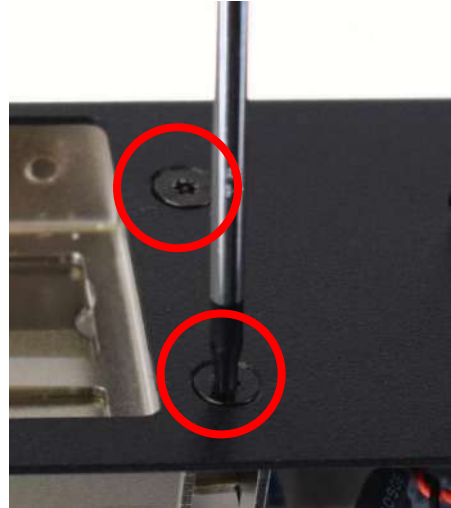
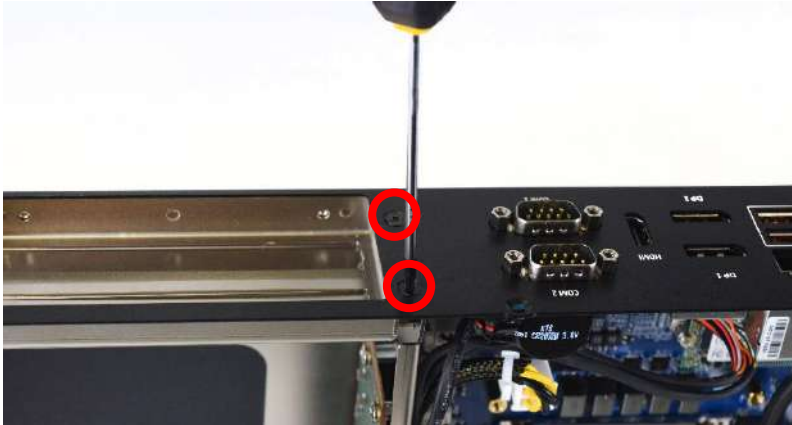
1. Install PCIe Card



2. Remove M3 screws



3. Remove the four rear screws



4. Remove the rear PCI blank



5. Install the PCIe card into the RiserCard in the direction of the arrow



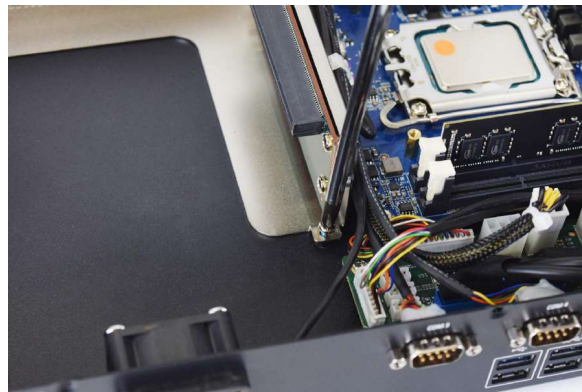
6. Secure the PCIe card to the bracket with screws



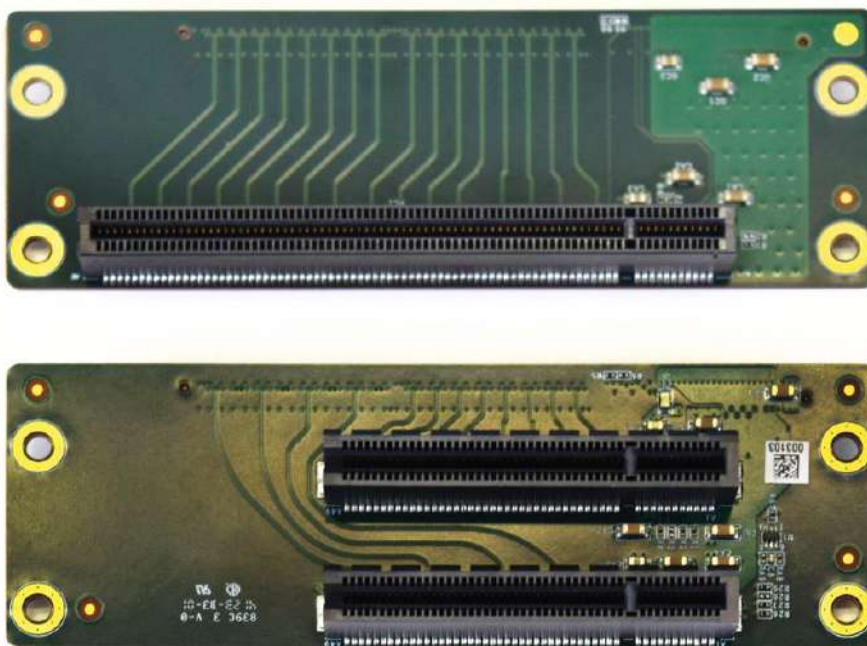
7. Install the bracket into the system in the direction of the arrow



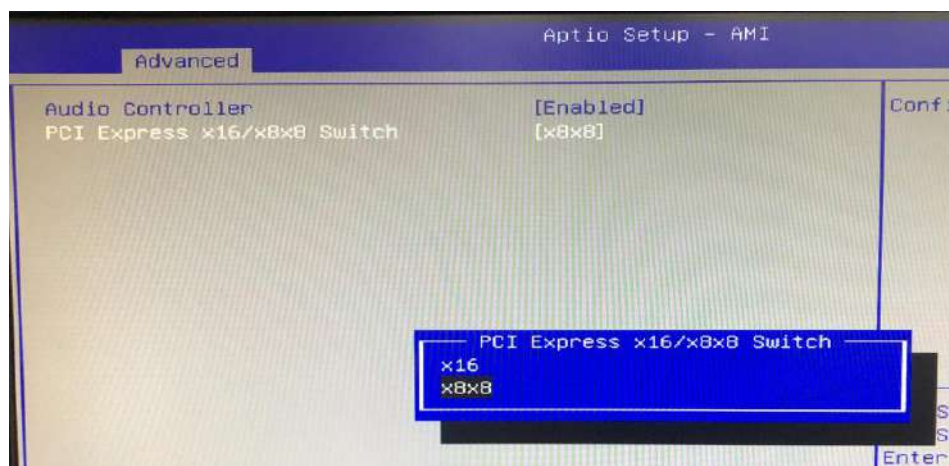
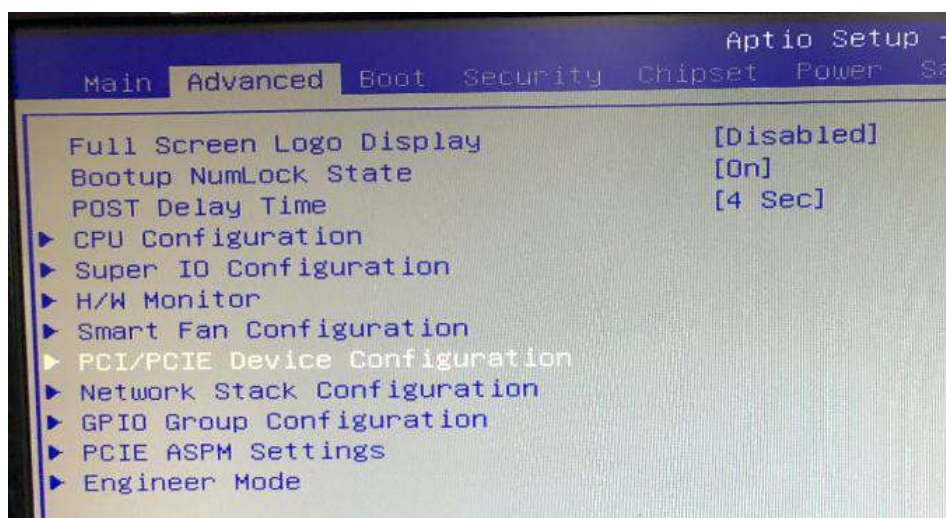
8. Follow the original removal steps to lock the bracket back onto the system



9. Both types are assembled in the same way.



8. Before entering the OS, please enter the BIOS to confirm whether the PCIe options are consistent with the system.



3.6 Installing wall mount kit

1. Wall mount kit is available for BCO-3000/6000 RPL included in the standard package.



2. Place the system upside down so you can see the bottom cover. The highlighted screw holes below will be used.



3. Lock the wall mount kit with eight screws (M3x5L, Nylok).

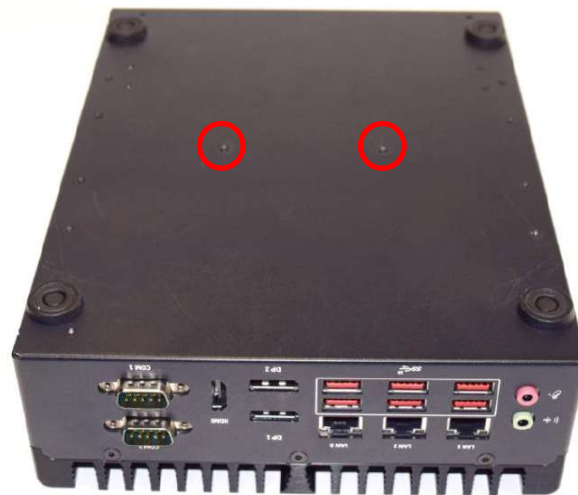


3.7 Installing DIN rail holder (BCO-3000-RPL only)

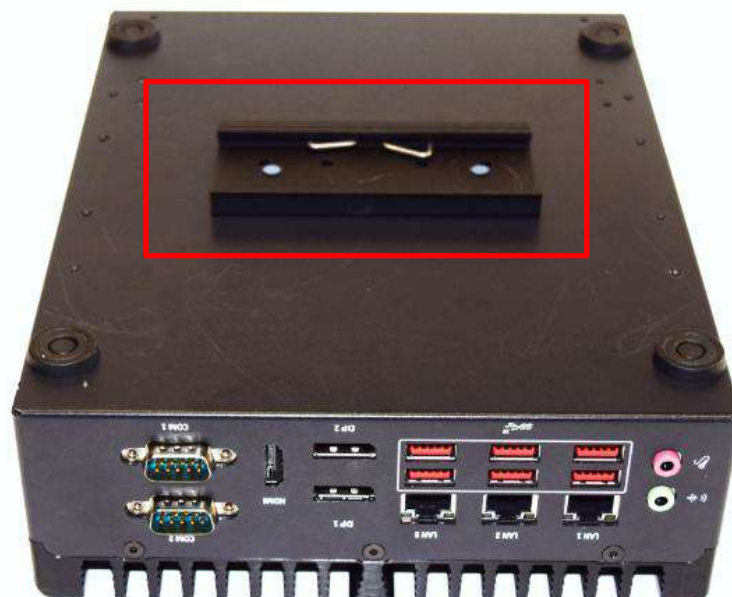
1. Din rail holder is available for BCO-3000-RPL as optional accessories.



2. Place the system upside down so you can see the bottom cover. The highlighted screw holes below will be used.



3. Place the din rail holder on top of the bottom cover and lock it with two screws (M4x5L, Nylok).



Chapter 4

BIOS Setup

4.1 BIOS Setup

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

Users may need to run the Setup program when:

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

Important

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

Entering Setup

Power on the computer and the system will start POST (Power On Self Test) process. When the message below appears on the screen, press or <F2> key to enter Setup, <F11> key to Boot Menu, <F12> key to PXE Boot .

Press or <F2> to enter SETUP

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

Important

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

4.1.1 Control Keys

← →	SelectScreen
↑ ↓	SelectItem
Enter	Select
+ -	ChangeValue
Esc	Exit
F1	GeneralHelp
F7	PreviousValues
F9	OptimizedDefaults
F10	Save&Reset*
F12	Screenshotcapture
<K>	Scrollhelpareaupwards
<M>	Scrollhelpareadownwards

* When you press <F10>, a confirmation window appears and it provides the modification information. Select between **Yes** or **No** to confirm your choice.

Getting Help

Upon entering setup, you will see 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.

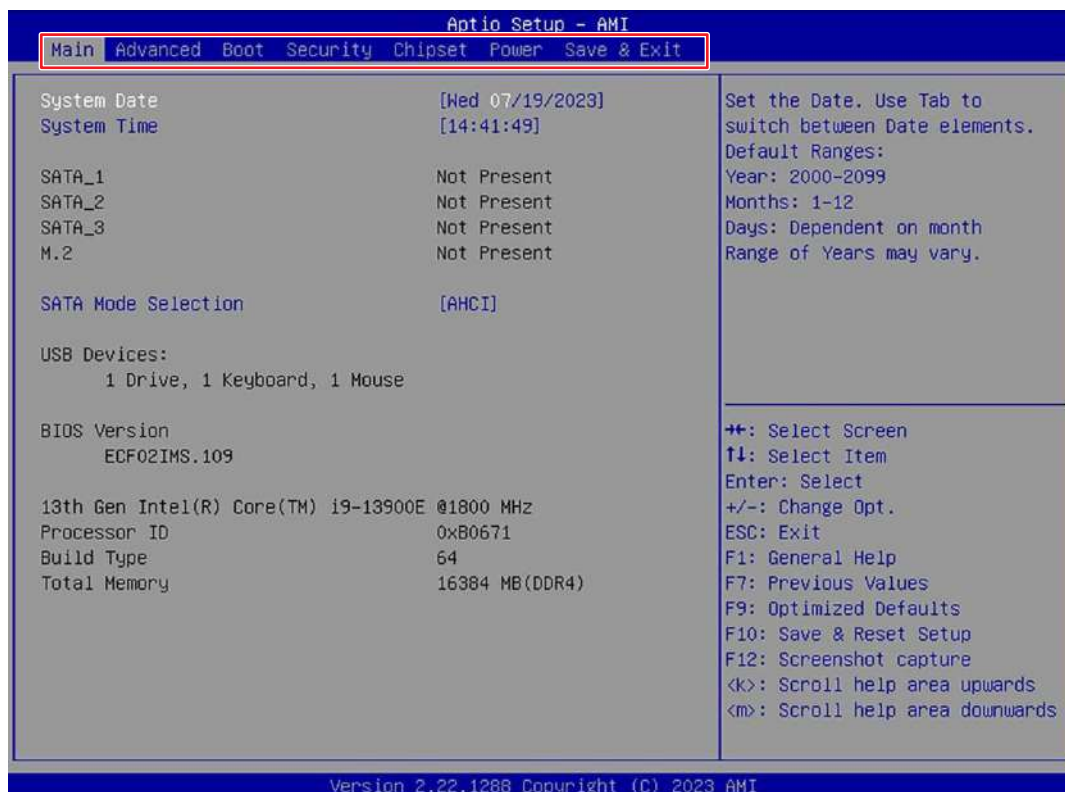
Sub-Menu

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.

4.1.2 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 on-board chipsets.

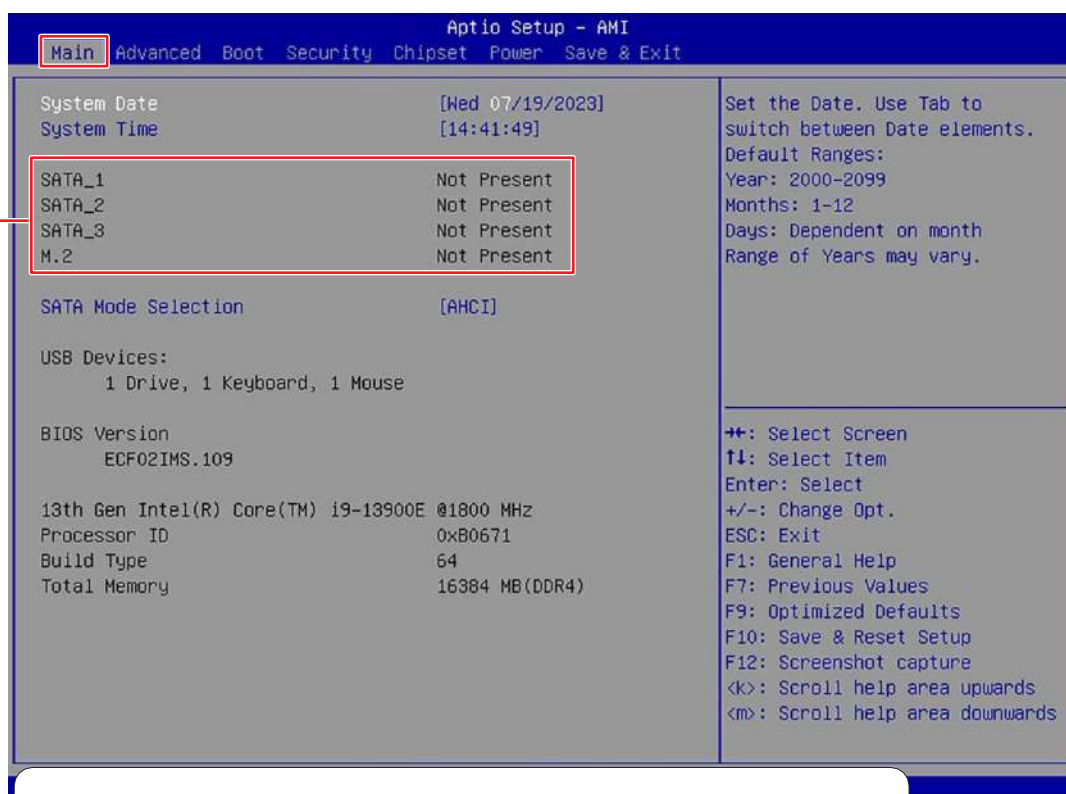
► Power

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.

4.2 Main



HDD Information

- **RAID (VMD) Disabled:** Display HDD information as plugging in status.
- **RAID (VMD) Enabled:** Display "Not Present" only.

► System Date

This setting allows you to set the system date.

Format: <Day> <Month> <Date> <Year>.

► System Time

This setting allows you to set the system time.

Format: <Hour> <Minute> <Second>.

► SATA Mode Selection

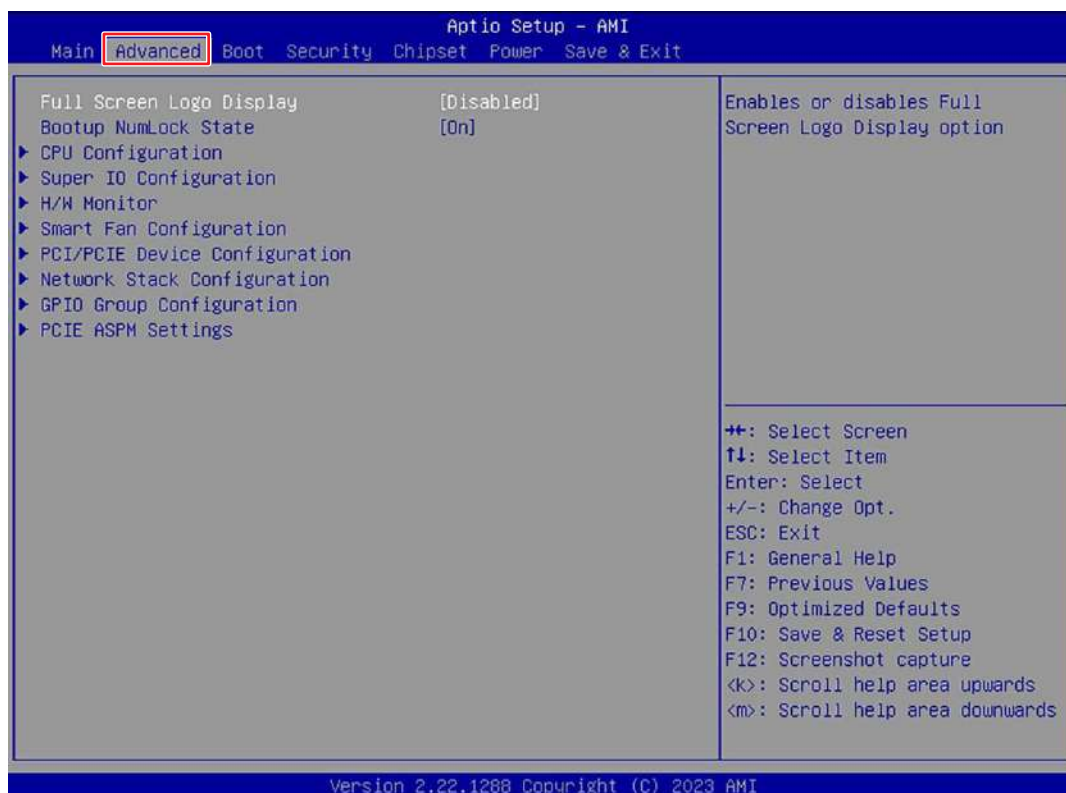
This setting specifies SATA controller mode.

[AHCI]	AHCI (Advanced Host Controller Interface), is a technical standard for an interface that allows the software to communicate with Serial ATA (SATA) devices. It offers advanced SATA features such as Native Command Queuing (NCQ) and hot-plugging.
[RAID]	RAID (Redundant Array of Independent Disks) is a virtual disk storage technology that combines multiple physical disks into one unit for data redundancy, performance improvement, or both.

⚠ Important

SKU3 (Intel® H610E) does not support M.2_2 (M.2 B Key) and SATA [RAID] mode.

4.3 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.

- | | |
|------------|--|
| [Enabled] | BIOS will display the full-screen logo during the boot-up sequence, hiding normal POST messages. |
| [Disabled] | BIOS will display the normal POST messages, instead of the full-screen logo. |

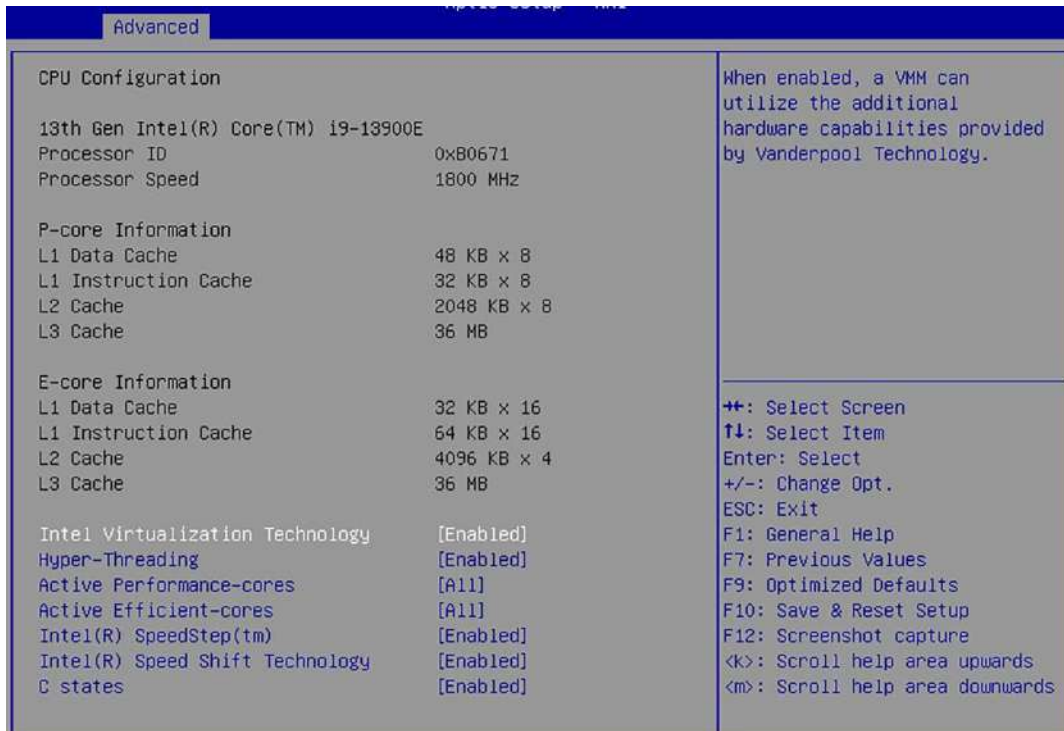
Please note that enabling this BIOS feature often adds 2-3 seconds to the booting sequence. This delay ensures that the logo is displayed for a sufficient amount of time. Therefore, **it is recommended to disable this BIOS feature for faster boot-up.**

► Bootup NumLock State

This setting is to set the state of the Num Lock key on the keyboard when the system is powered on.

- | | |
|-------|--|
| [On] | Turn on the Num Lock key when the system is powered on. |
| [Off] | Allow users to use the arrow keys on the numeric keypad. |

CPU Configuration



► Intel Virtualization Technology

Enables or disables Intel Virtualization technology.

[Enabled] Enables Intel Virtualization technology and allows a platform to run multiple operating systems in independent partitions. The system can function as multiple systems virtually.

[Disabled] Disables this function.

► Hyper-Threading (HT Function)

Enables or disables Intel Hyper-Threading technology.

The processor uses Hyper-Threading technology to improve utilization of the CPU resources and potentially increasing overall performance by allowing it to handle multiple threads simultaneously. If you disable the function, it will restricts the CPU to operate as a single-threaded processor, with only one logical core per physical core. **Please disable this item if your operating system does not support HT Function or unreliability and instability may occur.**

► Active Performance-cores

Select the number of active Performance-cores (P-cores).

► Active Efficient-cores

Select the number of active Efficient-cores (E-cores).

► Intel(R) SpeedStep(TM)

Enhanced Intel SpeedStep® Technology enables the OS to control and activate performance states (P-States) of the processor.

[Enabled] When enabled, Intel SpeedStep® technology is activated. This technology allows the processor to manage its power consumption via performance state (P-State) transitions.

[Disabled] Disables this function

► Intel(R) Speed Shift Technology

Intel® Speed Shift Technology is an energy-efficient method that allows frequency control by hardware rather than the OS.

[Enabled] When enabled, Intel® Speed Shift Technology is activated. The technology enables the management of processor power consumption via hardware performance state (P-State) transitions.

[Disabled] Disable this function.

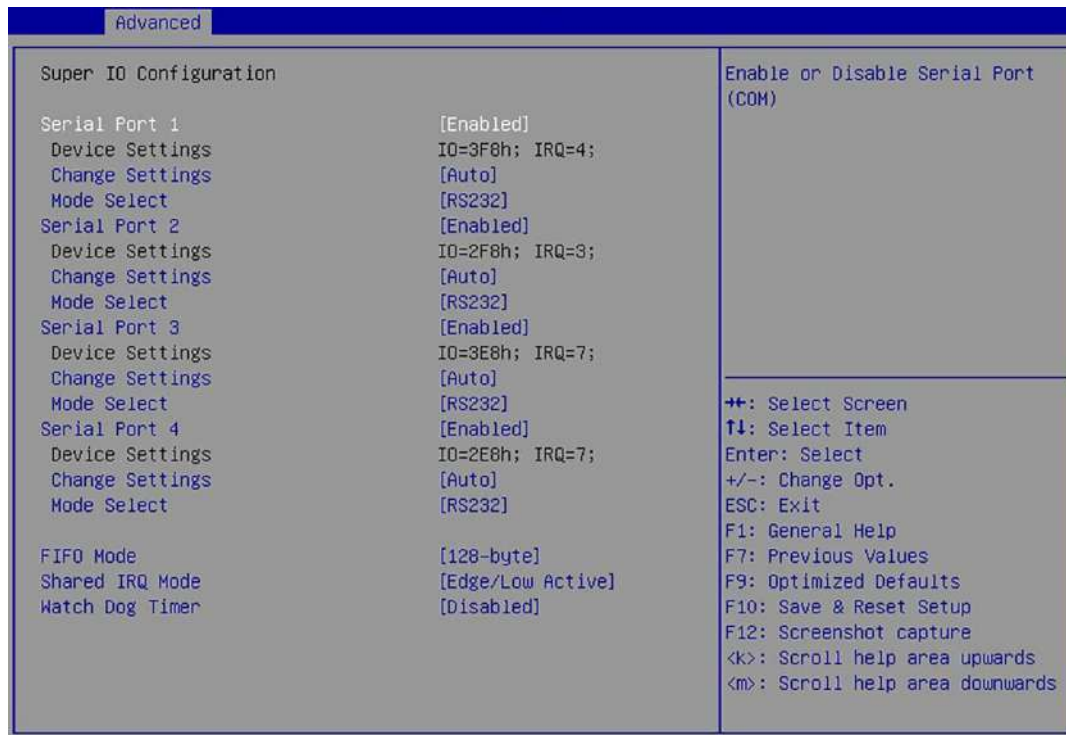
► C States

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

[Enabled] Detects the idle state of system and reduce CPU power consumption accordingly.

[Disabled] Disable this function.

Super IO Configuration



► Serial Port 1/ 2/ 3/ 4

This setting enables or disables the specified serial port.

» Change Settings

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

» Mode Select

Select an operation mode for Serial Port 1/ 2/ 3/ 4.

► FIFO Mode

This setting controls the FIFO (First In First Out) 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 watchdog timer, a hardware timer that generates a reset when the software that it monitors does not respond as expected each time the watchdog polls it.

► H/W Monitor (PC Health Status)

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

Advanced	
PC Health Status	Thermal Shutdown
CPU temperature : +45 C	
System temperature : +27 C	
CPUFAN : 3875 RPM	
SYSFAN : N/A	
VCC_CORE : +1.312 V	
VCC3 : +3.312 V	
VCC5 : +5.087 V	
+12V : +12.144 V	
VCC3V : +3.344 V	
VSBB3V : +3.312 V	
VSBB5V : +5.040 V	
VBAT : +3.120 V	
	++: Select Screen ↑↓: Select Item Enter: Select +/-: Change Opt. ESC: Exit F1: General Help F7: Previous Values F9: Optimized Defaults F10: Save & Reset Setup F12: Screenshot capture <k>: Scroll help area upwards <m>: Scroll help area downwards

► Thermal Shutdown

This setting determines the behavior of the system when the CPU temperature reaches a predefined threshold.

[Enabled] Initiate an automatic shutdown of the system to protect from potential damage due to overheating.

[Disabled] Disable this function.

► Smart Fan Configuration

Advanced	
Configuration Smart FAN	Disabled/Enabled Smart Fan Function
CPUFAN [Disabled]	
SYSFAN [Disabled]	

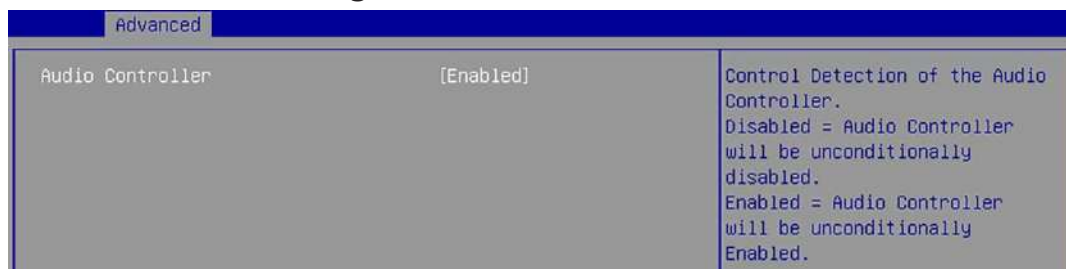
► CPUFAN/ SYSFAN

This setting enables or 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. The following item will display when **CPUFAN/ SYSFAN** is enabled.

» Min. Speed (%)

The beginning speed of the System fan.

► PCI/PCIE Device Configuration

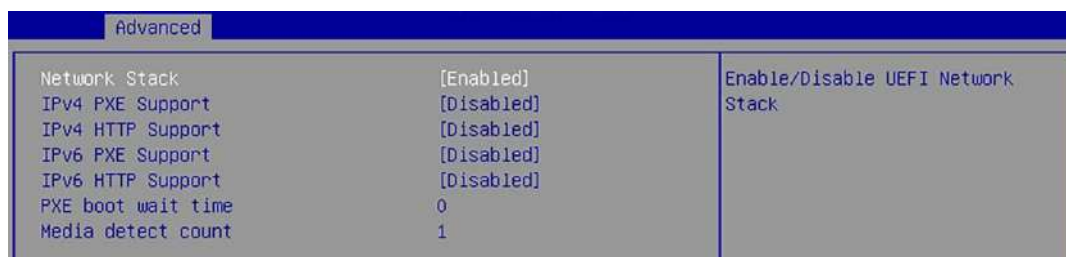


► Audio Controller

This setting enables or disables the detection of the onboard audio controller.

► Network Stack Configuration

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



► Network Stack

This menu provides Network Stack settings for users to enable network boot (PXE) from BIOS. The following items will display when **Network Stak** is enabled.

» IPv4 PXE Support

Enables or disables IPv4 PXE boot support.

» IPv4 HTTP Support

Enables or disables Ipv4 HTTP Support.

» IPV6 PXE Support

Enables or disables Ipv6 PXE Support.

» IPV6 HTTP Support

Enables or disables Ipv6 HTTP Support.

» PXE boot wait time

Use this option to specify the wait time to press the ESC key to abort the PXE boot. Press "+" or "-" on your keyboard to change the value. The default setting is 0.

» Media detect count

Use this option to specify the number of times media will be checked. Press "+" or "-" on your keyboard to change the value. The default setting is 1.

► GPIO Group Configuration

Advanced		
GP00	[Low]	Set GP00 to output High/Low
GP01	[Low]	
GP02	[Low]	
GP03	[Low]	
GP04	[Low]	
GP05	[Low]	
GP06	[Low]	
GP07	[Low]	

► GP00 ~ GP07

These settings control the operation mode of the specified GPIO.

► Intel(R) RST

Enables or disables Intel® RST. Intel® Rapid Storage Technology (Intel® RST) is a feature that combines the capabilities of both hardware and software to enhance storage performance, data protection, and flexibility.

Advanced		
Intel(R) RST 19.5.0.5676 RST VMD Driver	This page allows you to create a RAID volume	
▶ Create RAID Volume		
Non-RAID Physical Disks:		
▶ SATA 0.4, SanDisk SSD PLUS 240GB 23063J451313, 223.5GB		
▶ SATA 0.5, INTEL SSDSC2KW256G8 LA730401GL256CGN, 238.4GB		
▶ SATA 0.6, 2.5" SATA SSD 3TE7 0012305110090002, 447.1GB		



Important

SKU3 (Intel® H610E) does not support "Intel(R) RST".

► Create RAID Volume

This menu allows for the management of RAID volumes.

Advanced	
Create RAID Volume	Enter a unique volume name that has no special characters and is 16 characters or less.
Name: Volume1	
RAID Level: [RAID0 (Stripe)]	
Select Disks:	
SATA 0.4, SanDisk SSD PLUS 240GB 23063J451313, 223.5GB []	
SATA 0.5, INTEL SSDSC2KW256G8 LA730401GL256CGN, 238.4GB []	
SATA 0.6, 2.5" SATA SSD 3TE7 0012305110090002, 447.1GB []	
Strip Size: [64KB]	
Capacity (MB): 0	
► Create Volume	
Select at least two disks	

++: Select Screen
 ↑↓: Select Item
 Enter: Select
 +/-: Change Opt.
 ESC: Exit
 F1: General Help
 F7: Previous Values
 F9: Optimized Defaults
 F10: Save & Reset Setup
 F12: Screenshot capture
 <k>: Scroll help area upwards
 <m>: Scroll help area downwards

► PCIE ASPM settings

This menu provide settings for PCIe ASPM (Active State Power Management) level for different installed devices.

Advanced		
M2_B1	[Disabled]	PCI Express Active State Power Management settings.
M2_E1	[Disabled]	
M2_M1	[Disabled]	
PCIE1	[Disabled]	

► M2_B1/ M2_E1/ M2_M1/ PCIE1

Sets PCI Express ASPM (Active State Power Management) state for power saving.

[L0s]	Initiate an automatic shutdown of the system to protect from potential damage due to overheating.
[L1]	Higher latency, lower power “standby” state (optional) .
[L0sL1]	Activate both L0s and L1 support.
[Disabled]	Disable this function.

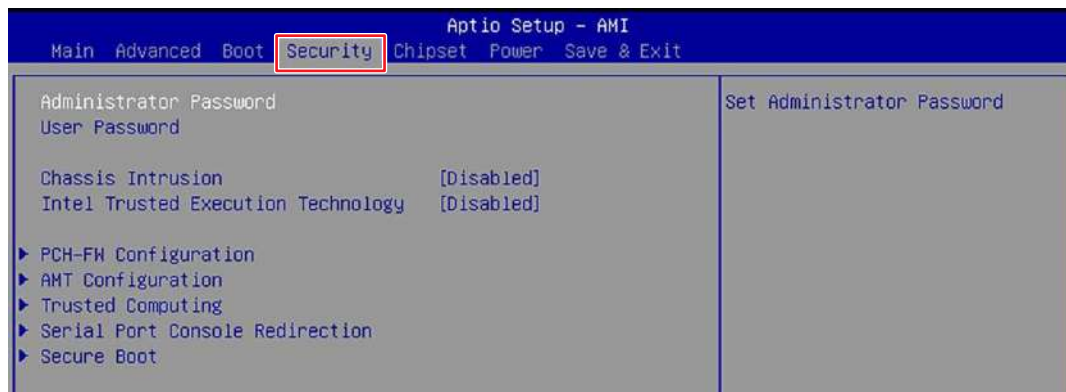
4.4 Boot



► Boot Option #1-2

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

4.5 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

Enables or disables recording messages while the chassis is opened. This function is ready for the chassis equips a chassis intrusion jumper (switch).

- | | |
|------------|---|
| [Enabled] | Once the chassis is opened , the system will record and issue a warning message. A beep sound will be emitted before this function is reset. |
| [Disabled] | Once the chassis is closed , the system will record and issue a warning message. |
| [Reset] | Clear the warning message. After clearing the message, please return to Enabled or Disabled. |

► Intel Trusted Execution Technology

Enables or disables the Intel Trusted Execution Technology. Intel® Trusted Execution Technology (Intel® TXT) is a security feature that provides hardware-based security to protect the system and maintain the confidentiality and integrity of data stored or created on the system.

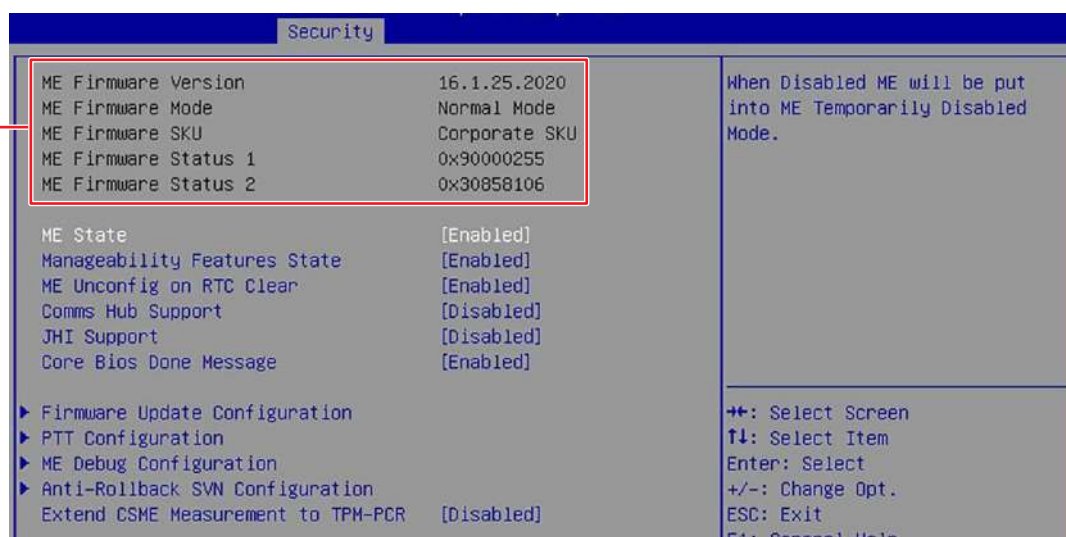


Important

- The following items **must be enabled** before “Intel Trusted Execution Technology” can be enabled:
 - All Intel processor cores
 - Hyper-threading
 - Intel Virtualization Technology (VT-x)
 - Trusted Platform Module (TPM)
 - Secure Boot
- **SKU3 (Intel® H610E)** does not support “Intel Trusted Execution Technology”.

► PCH-FW Configuration

This menu allows you to configure settings related to the PCH firmware.



Firmware Information

ME Firmware Version	ME Firmware SKU
ME Firmware Mode	ME Firmware Status 1-2

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

► ME State

This menu controls the Intel® Management Engine State (ME state) parameters, which provides various management and security capabilities. The following items will display when **ME State** is enabled.

» Manageability Feature State

Enables or disables Manageability Feature State. Enabling this item for remote management capabilities.

» ME Unconfig on RTC Clear

Enables or disables ME Unconfig on RTC Clear. Enabling this item resets the ME configuration to its default state, removing any customizations or settings applied.

» Comms Hub Support

Enables or disables the communications hub support.

» JHI Support

Enables or disables JHI Support. JHI stands for Intel® Dynamic Application Loader Host Interface Service (Intel® DAL HIS) and is the engineering name for this feature. Enabling JHI Support in the BIOS settings allows the system to utilize this interface for communication between trusted applications and host-based applications.

» Core BIOS Done Message

Enables or disables Core BIOS Done Message sent to ME.

► Firmware Update Configuration

Security		
Me FW Image Re-Flash	[Disabled]	Enable/Disable Me FW Image Re-Flash function.
Local FW Update	[Enabled]	

» ME FW Image Re-Flash

Enables or disables the ME Firmware Image Re-flashing.

» Local FW Update

Enables or disables the capability to perform a firmware update of the ME locally.

► PTT Configuration

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

Security		
PTT Capability / State	1 / 0	Selects TPM device: PTT or dTPM. PTT - Enables PTT in SkuMgr dTPM 1.2 - Disables PTT in SkuMgr Warning ! PTT/dTPM will be disabled and all data saved on it will be lost.
TPM Device Selection	[dTPM]	

» TPM Device Selection

Select TPM (Trusted Platform Module) devices from PTT or dTPM (Discrete TPM).

[PTT]	Enables PTT in SkuMgr.
[dTPM]	Disables PTT in SkuMgr. Warning! PTT/ dTPM will be disabled and all data saved on it will be lost.

► ME Debug Configuration

This menu allows you to configure debug-related options for the Intel® Management Engine (ME).

Security		
HECI Timeouts	[Enabled]	Enable/Disable HECI Send/Receive Timeouts.
Force ME DID Init Status	[Disabled]	
CPU Replaced Polling Disable	[Disabled]	
HECI Message check Disable	[Disabled]	
MBP HOB Skip	[Disabled]	
HECI2 Interface Communication	[Disabled]	
KT Device	[Enabled]	
End Of Post Message	[Send in DXE]	
DOI3 Setting for HECI Disable	[Disabled]	
MCTP Broadcast Cycle	[Disabled]	

» HECI Timeouts

This setting enables/ disables the HECI (Host Embedded Controller Interface) send/ receive timeouts.

» Force ME DID Init Status

Forces the ME Device ID (DID) initialization status value.

» CPU Replaced Polling Disable

Setting this option disables the CPU replacement polling loop.

» **HECI Message Check Disable**

This setting disables message check for BIOS boot path when sending messages.

» **MBP HOB Skip**

Setting this option will skip ME's Memory-Based Protection (MBP) HOB region.

» **HECI2 Interface Communication**

This setting Adds/ Removes HECI2 device from PCI space.

» **KT Device**

Enables or disables Key Transfer (KT) Device.

» **End of Post Message**

Enables or disables End of Post Message sent to ME.

» **DOI3 Setting for HECI Disable**

Setting this option disables setting DOI3 bit for all HECI devices.

» **MCTP Broadcast Cycle**

Enables or disables Management Component Transport Protocol (MCTP) Broadcast Cycle.

► **Anti-Rollback SVN Configuration**

Security		
Minimal Allowed Anti-Rollback SVN	0	When enabled, hardware-enforced Anti-Rollback mechanism is automatically activated: once ME FW was successfully run on a platform, FW with lower ARB-SVN will be blocked from execution
Executing Anti-Rollback SVN	4	
Automatic HW-Enforced Anti-Rollback SVN	[Disabled]	
Set HW-Enforced Anti-Rollback for Current SVN	[Disabled]	

» **Automatic HW-Enforced Anti-Rollback SVN**

Setting this item enables will automatically activate the hardware-enforced anti-rollback protection based on the Secure Version Number (SVN). Once enabled, the hardware will enforce that only firmware updates with an SVN equal to or higher than the current SVN can be installed.

» **Set HW-Enforced Anti-Rollback for Current SVN**

Enable HW ERB mechanism for current ARB SVN value. FW with lower ARB-SVN will be blocked from execution. The value will be restored to disable after the command is sent. This item will display when **Automatic HW-Enforced Anti-Rollback SVN** is enabled.

► **Extend CSME Measurement to TPM-PCR**

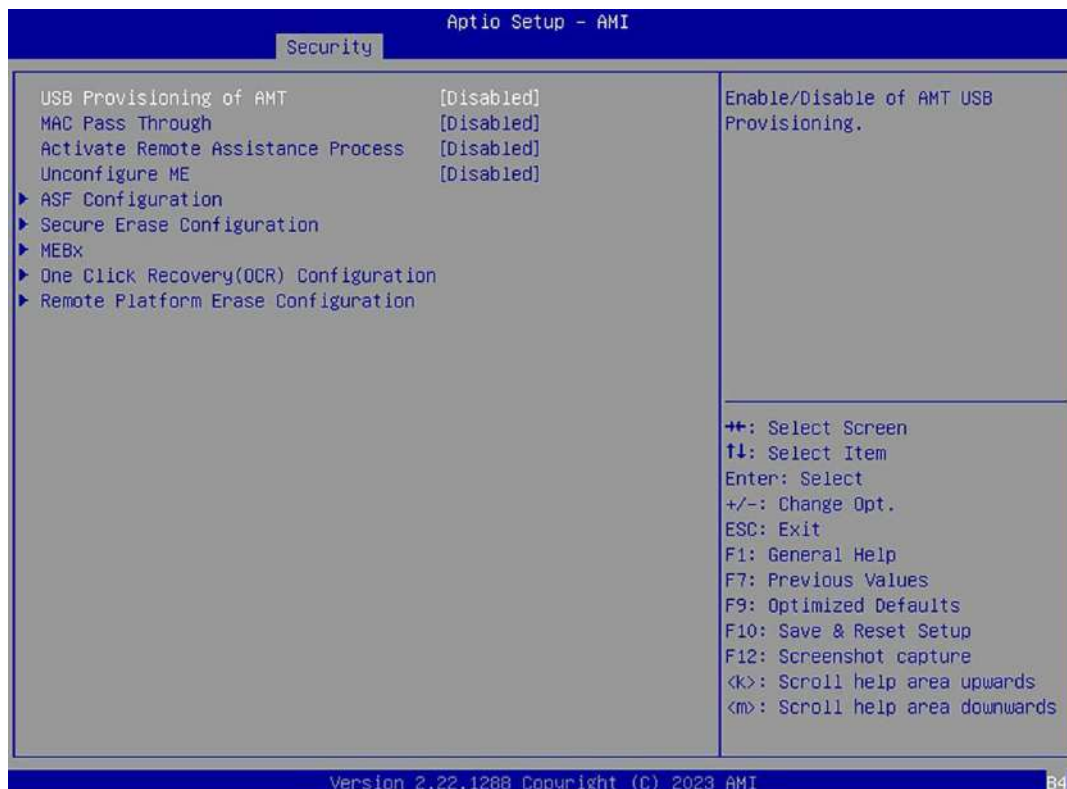
Enables or disables the Extend CSME Measurement to TPM-PCR. This item enables capturing and recording the Intel® Converged Security and Management Engine (Intel® CSME) firmware in the Trusted Platform Module Platform Configuration Registers (TPM-PCR). This enhances system security by protecting against unauthorized modifications.

**Important**

Please note that for “**Extend CSME Measurement to TPM-PCR**” function to work, your system should have a **TPM module** installed and enabled in the BIOS, which is a separate hardware component providing secure storage and cryptographic functions.

► AMT Configuration

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



► USB Provisioning of AMT

Enables or disables the ability to provision AMT using a USB device.

► Mac PASS Through

Enables or disables the ability of AMT to pass through network traffic without altering the original MAC (Media Access Control) addresses of the network interface. Enabling Mac PASS Through ensures that the network traffic appears to originate from the original MAC address of the system.

► Activate Remote Assistance Process

Enables or disables remote assistance sessions to be initiated on systems with AMT support.

► Unconfigure ME

Enables or disables the Unconfigure ME.

► ASF Configuration

Security		
PET Progress	[Enabled]	Enable/Disable PET Events Progress to receive PET Events.
WatchDog	[Disabled]	
OS Timer	0	
BIOS Timer	0	
ASF Sensors Table	[Disabled]	

» PET Progress

Enables or disable the this item to receive PET Events.

» WatchDog

Enables or disable the watchdog timer.

» OS Timer

This item displays OS Timer.

» BIOS Timer

This item displays BIOS Timer.

» ASF Sensor Table

Enables or disable the Alert Standard Format (ASF) Sensor Table.

► Secure Erase Configuration

Security		
Secure Erase mode	[Simulated]	Change Secure Erase module behavior: Simulated: Performs SE flow without erasing SSD Real: Erase SSD. *** If SATA device is used, OEM could use SECURE_ERASE_HOOK_PROTOCOL to remove SATA power to skip G3 cycle. ***
Force Secure Erase	[Disabled]	

» Secure Erase Mode

This setting change Secure Erase module behavior.

[Simulated] Performs SE flow without erasing SSD.

[Real] Erase SSD.

» Force Secure Erase

Enables or disables to force Secure Erase on next boot.

► MEBx (Management Engine BIOS Extension)

Security	
Intel(R) ME Password	MEBx Login

» Intel(R) ME Password

Set the Intel® ME Password for securing access to the ME configuration through the MEBx menu. Upon setting up Intel® ME Password for the first time, type “**admin**” as the default password, then enter your own.



Security	
Intel(R) AMT [Enabled]	
► Intel(R) AMT Configuration	
Change ME Password	

» Intel(R) AMT

Enables or disables Intel(R) AMT (Intel® Active Management Technology).



Important

The **MEBx menu** can be accessed only by pressing the **** or **<F2>** key during the process of booting up the system.

» Intel(R) AMT Configuration

Security	
► Redirection features	
► User Consent	
Password Policy	[Anytime]
► Network Setup	
Network Access State	[Network Inactive]
► Remote Setup And Configuration	
► Power Control	

» Redirection features

Security	
SOL [Enabled]	Enable FW SOL Interface
Storage Redirection [Enabled]	
KVM Feature Selection [Enabled]	

- **SOL**

Enables or disables SOL (Serial Over LAN).

- **Storage Redirection**

Enables or disables Storage Redirection.

- **KVM Feature Selection**

Enables or disables the ability to remotely control a system's keyboard, video, and mouse (KVM) by a distant management console.

» User consent

Security		
User Opt-in	[KVM]	Configure When User Consent
Opt-in Configurable from Remote IT	[Enabled]	Should be Required

• User Opt-in

- [None] Local user consent is **not required** for a remote console to establish KVM remote control session.
- [KVM] Local user consent is **required** for a remote console to establish KVM remote control session.
- [ALL] Local user consent is **required** for SOL, IDER and KVM.

• Opt-in Configurable from Remote IT

Enables or disables remote User's ability to set the User Opt-in.

» Password Policy

This feature determines when the user is allowed to change the Intel® MEBX password through the network.

- [Default Password Only] Allows changing the Intel® MEBx password through the network interface only if the default password has not been changed yet.
- [During Setup And Configuration] Allows changing the Intel® MEBx password via the network interface during setup and configuration but not afterward. **Once the setup and configuration process is complete, the Intel MEBX password cannot be changed via the network interface.**
- [Anytime] Allows changing the Intel® MEBx password through the network interface at any time.

**Important**

- The Password Policy involves 2 passwords: the **Intel® MEBX password (local)**, entered when physically at the system, and the **network password (remote)**, used for accessing an Intel ME enabled system through the network. By default, **they are the same until the network password is changed via the network**. Once changed over the network, the network password remains separate from the local Intel® MEBX password.
- The Intel MEBX password can always be changed via the Intel® MEBX user interface, regardless of the setting.

» Network Setup

Security	
▶ Intel(R) ME Network Name Settings	
▶ TCP/IP Settings	

• Intel® ME Network Name Settings

Security	
FQDN	Computer's FQDN
Shared/Dedicated FQDN	[Shared]
Dynamic DNS Update	[Disabled]

- Shared/Dedicated FQDN

Determines if the Intel® ME Fully Qualified Domain Name (FQDN, which is "HostName.DomainName") is **shared** with the host OS or **dedicated** exclusively to the Intel ME.

- Dynamic DNS Update

Enables or disables automatic registration of the firmware's IP addresses and FQDN in the Domain Name System (DNS) using the Dynamic DNS Update protocol. **To enable Dynamic DNS Update, the Host Name and Domain Name must be set.**

• TCP/IP Settings

Security	
▶ Wired LAN IPv4 Configuration	

• Wired Lan IPv4 Configuration

Security	
DHCP Mode	[Disabled]
IPv4 Address	0.0.0.0
Subnet Mask Address	255.255.255.254
Default Gateway Address	0.0.0.0
Preferred DNS Address	0.0.0.0
Alternate DNS Address	0.0.0.0
Enable/Disable IPv4 DHCP Mode	

- DHCP Mode

Enables or disables the DHCP (Dynamic Host Configuration Protocol) mode. The items shown above will display when **DHCP Mode** is set to **disabled**.

» Network Access State

[Network Active]

[Network Inactive]

[Full Unprovision]

The IPv6 Interface ID is automatically generated using a random number as described in RFC 3041.

» Remote Setup And Configuration

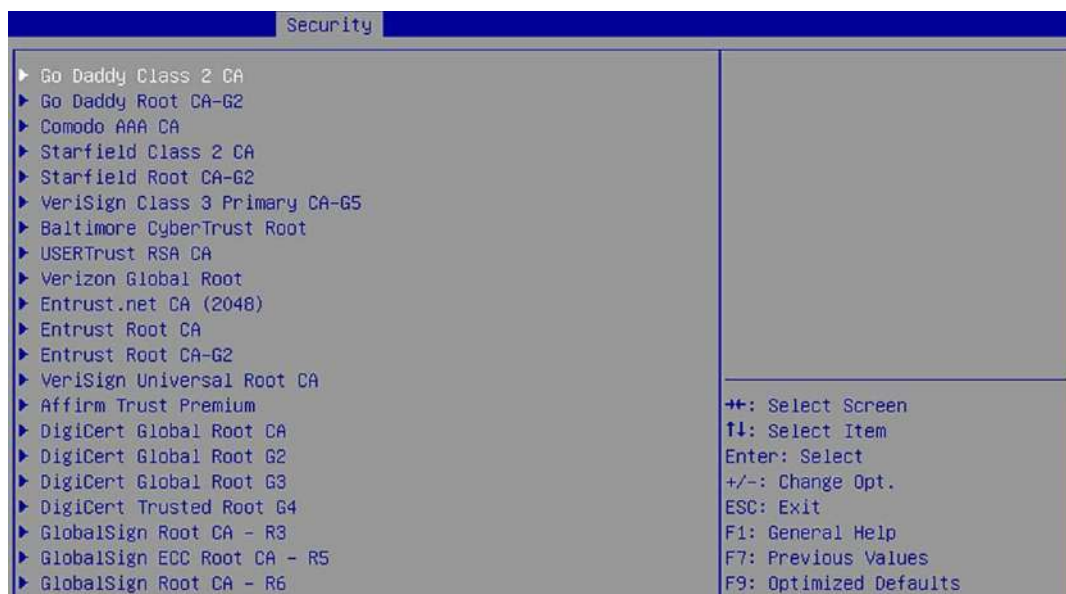
Security	
Provision Record is not present	Provisioning server address. Either host name or IPv4 or IPv6 address
Provisioning Server address	
Provisioning server port number	9971
Remote Configuration **	[Enabled]
PKI DNS Suffix	
▶ Manage Certificates	
Activate Remote Configuration	

• Remote Configuration**

Enables or disables the Remote Configuration**.

- **Manage Certificates**

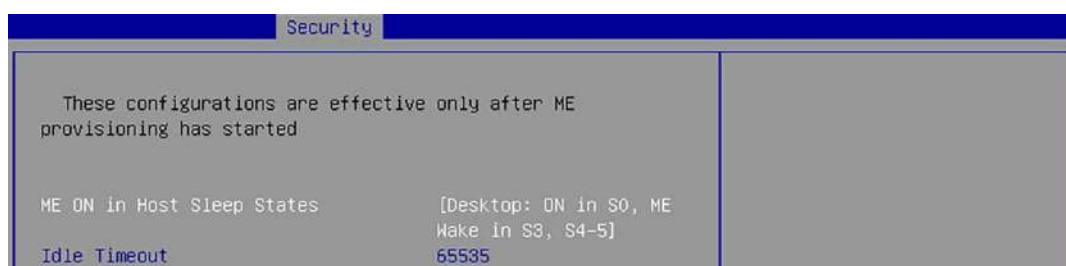
This item display when **Remote Configuration**** is disabled. After entering the Manage Certificates menu, the following screen will display:



The details of the selected certificate hash includes “Hash Name, Active State, Default State, Hash Type and Hash Data”.

» **Power control**

This menu configures the Intel ME platform power-related policies, and the configurations are effective only after ME provisioning has started.



► One Click Recovery (OCR) Configuration

Security		
OCR Htpps Boot	[Enabled]	Enable/Disable One Click Recovery Htpps Boot
OCR PBA Boot	[Enabled]	
OCR Windows Recovery Boot	[Enabled]	
OCR Disable Secure Boot	[Enabled]	

» OCR Htpps Boot

Enables or disables the use of HTTPS (Hypertext Transfer Protocol Secure) for the OCR boot process. When enabled, the OCR process will utilize HTTPS for enhanced security during the process of booting up the system.

» OCR PBA Boot

Enables or disables the PBA (Pre-Boot Authentication) for the OCR boot process. When enabled, users may be required to authenticate themselves before the OCR boot process begins, adding an extra layer of security.

» OCR Windows Recovery Boot

Enables or disables the Windows Recovery Boot for the OCR boot process. When enabled, the OCR boot process will prioritize Windows recovery options, allowing users to restore the system to a previous Windows state or initiate other Windows-specific recovery procedures.

» OCR Disable Secure Boot

Enabling this item will disable Secure Boot during the OCR process.

► Remote Platform Erase Configuration

Intel® Remote Platform Erase (Intel® RPE) Configuration provides settings for the remote erasure of the platform information or specific storage devices connected to the system.

Security		
Enable Remote Platform Erase Feature	[Enabled]	Enable/Disable Remote Platform Erase Feature
SSD Erase Mode	[Simulated]	

» Enable Remote Platform Erase Feature

Enables or disables the ability to initiate the remote erasure process for the system or selected storage devices.

» SSD Erase Mode

This setting determines the erase mode to be used specifically for solid-state drives (SSDs) during the erasure process.

[Simulated] **Simulates** the erasure process **without permanently** deleting SSD data to estimate the time and resources required.

[Real] **Actual** erasure process that **permanently** deletes the SSD data to ensure that the data is no longer accessible.

► Trusted Computing

Security		
TPM 2.0 Device Found		Enables or Disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.
Firmware Version:	7.85	
Vendor:	IFX	
Security Device Support	[Enable]	
Active PCR banks	SHA256	
Available PCR banks	SHA256	
SHA256 PCR Bank	[Enabled]	
Pending operation	[None]	
Platform Hierarchy	[Enabled]	++: Select Screen ↑↓: Select Item Enter: Select +/-: Change Opt. ESC: Exit F1: General Help F7: Previous Values F9: Optimized Defaults F10: Save & Reset Setup F12: Screenshot capture <k>: Scroll help area upwards <m>: Scroll help area downwards
Storage Hierarchy	[Enabled]	
Endorsement Hierarchy	[Enabled]	
Physical Presence Spec Version	[1.3]	
TPM 2.0 InterfaceType	[TIS]	
PH Randomization	[Enabled]	
Device Select	[TPM 2.0]	

► Security Device Support

This item enables or disables BIOS support for security device. When set to [Disable], the OS will not show security device.

► SHA256 PCR Bank

These settings enables or disables the SHA-1 PCR Bank and SHA256 PCR Bank.

► Pending Operation

When **Security Device Support** is set to [Enable], **Pending Operation** will appear. It is advised that users should routinely back up their TPM secured data.

[TPM Clear] Clear all data secured by TPM.

[None] Discard the se lection.

► Platform Hierarchy, Storage Hierarchy, Endorsement Hierarchy

These settings enables or disables the Platform Hierarchy, Storage Hierarchy and Endorsement Hierarchy.

► Physical Presence Spec Version

This settings show the Physical Presence Spec Version.

► TPM 2.0 Interface Type

This setting shows the TPM 2.0 Interface Type.

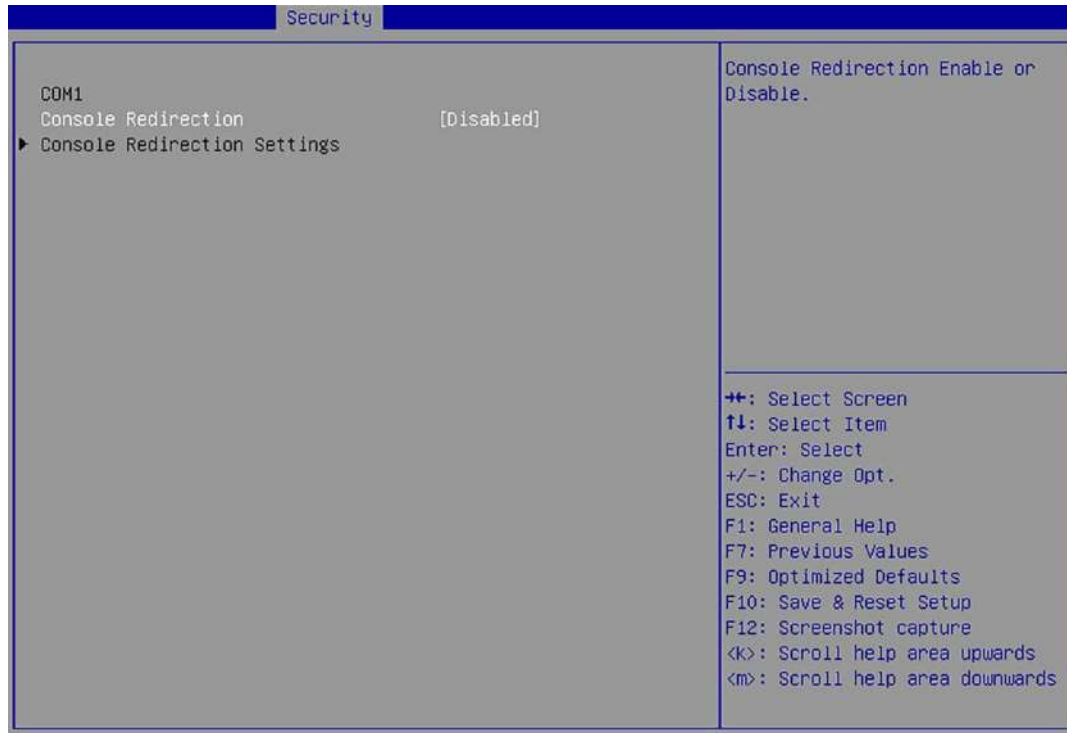
► PH Randomization

Enables or disables Platform Hierarchy (PH) Randomization.

► Device Select

Select your TPM device through this setting.

► Serial Port Console Redirection

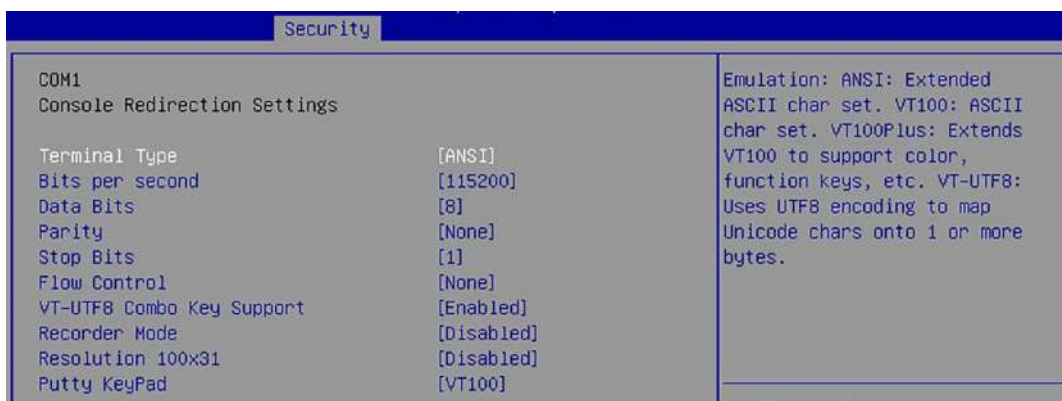


► Console Redirection

Console Redirection operates in host systems that do not have a monitor and keyboard attached. This setting enables or 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 (COM1)

This option appears when Console Redirection is **enabled**.



» 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). You can select emulation for the terminal from this setting.

- [ANSI] Extended ASCII character set.
- [VT100] ASCII character set.
- [VT100Plus] Extends VT100 to support color, function keys, etc.
- [VT-UTF8] Uses UTF8 encoding to map Unicode characters onto one or more bytes.

» Bits per second, Data Bits, Parity, Stop Bits

These 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 or disables the VT-UTF8 combination key support for ANSI/VT100 terminals.

» Recorder Mode, Resolution 100x31

These settings enables or disables 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.

► Secure Boot



► Secure Boot

Secure Boot function can be enabled only when the **Platform Key (PK)** is enrolled and running accordingly.

► Secure Boot Mode

Selects the secure boot mode. This item appears when **Secure Boot** is enabled.

[Standard] The system will automatically load the secure keys from BIOS.

[Custom] Allows user to configure the secure boot settings and manually load the secure keys.

► Restore Factory Keys

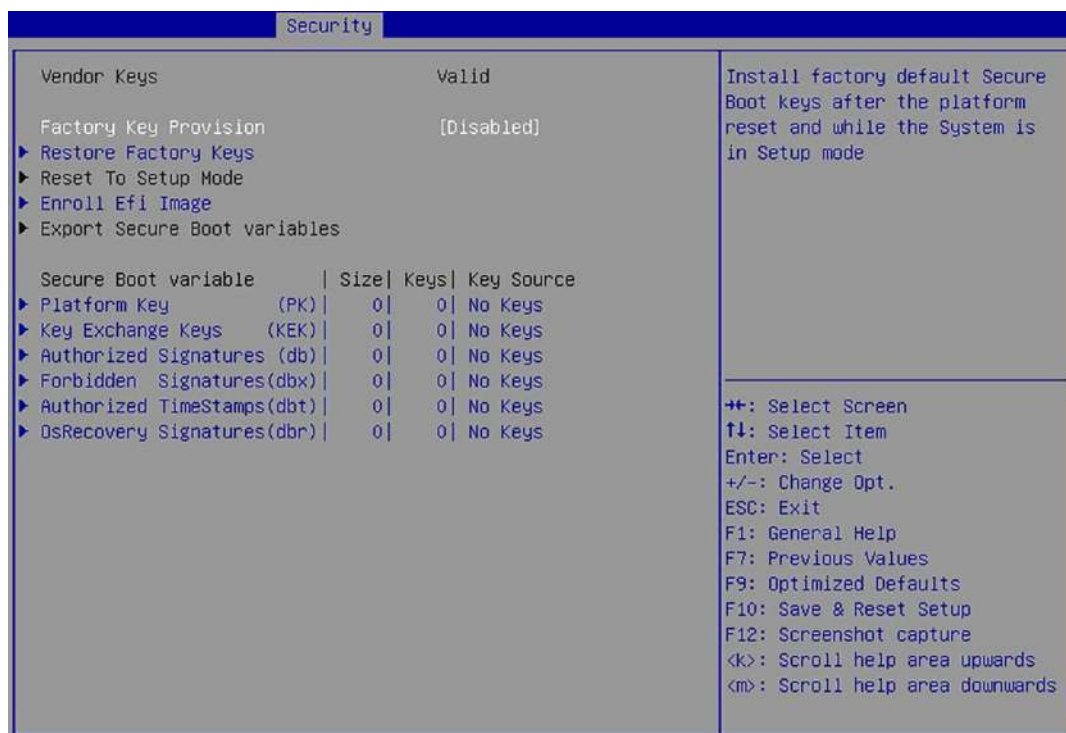
Allows you to restore all factory default keys. The settings will be applied after reboot or at the next reboot. This item appears when "**Secure Boot Mode**" sets to **[Custom]**.

► Reset to setup Mode

Allows you to delete all the Secure Boot keys (PK, KEK, db, dbt, dbx). The settings will be applied after reboot or at the next reboot. This item appears when "**Secure Boot Mode**" sets to **[Custom]**.

► Key Management

Press **Enter** key to enter the sub-menu. Manage the secure boot keys. This item appears when “**Secure Boot Mode**” sets to **[Custom]**.



» Platform Key (PK):

The Platform Key (PK) can protect the firmware from any un-authenticated changes. The system will verify the PK before your system enters the OS. Platform Key (PK) is used for updating KEK.

» Set New Key

Sets a new PK to your system.

» Delete Key

Deletes the PK from your system.

» Key Exchange Keys (KEK):

Key Exchange Key (KEK) is used for updating DB or DBX.

» Set New Key

Sets a new KEK to your system.

» Append Key

Loads an additional KEK from storage devices to your system.

» Delete Key

Deletes the KEK from your system.

» Authorized Signatures (db) :

Authorized Signatures (db) lists the signatures that can be loaded.

» Set New Key

Sets a new db to your system.

» **Append Key**

Loads an additional db from storage devices to your system.

» **Delete Key**

Deletes the db from your system.

» **Forbidden Signatures (dbx):**

Forbidden Signatures (dbx) lists the forbidden signatures that are not trusted and cannot be loaded.

» **Set New Key**

Sets a new dbx to your system.

» **Append Key**

Loads an additional dbx from storage devices to your system.

» **Delete Key**

Deletes the dbx from your system.

» **Authorized TimeStamps (dbt):**

Authorized TimeStamps (dbt) lists the authentication signatures with authorization time stamps.

» **Set New Key**

Sets a new DBT to your system.

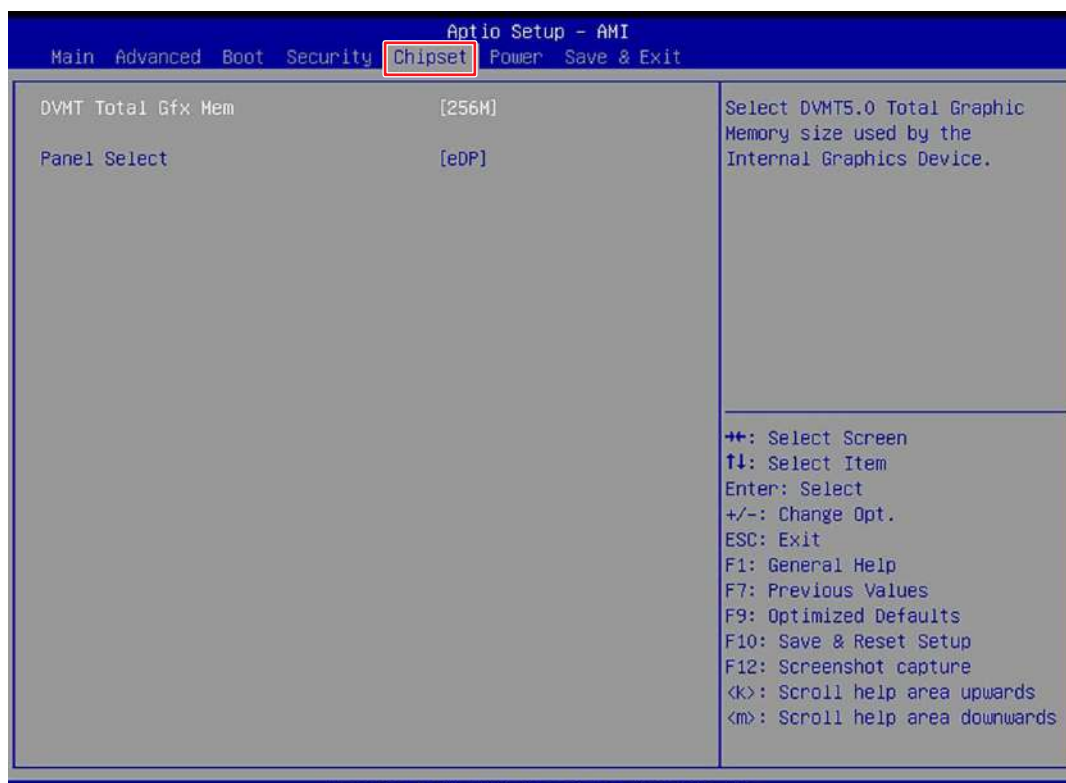
» **Append Key**

Loads an additional DBT from storage devices to your system.

» **OsRecovery Singnatures (dbr):**

Lists the available signatures for OS recovery.

4.6 Chipset



► DVMT Total Gfx Mem

This setting specifies the total graphics memory size for Dynamic Video Memory Technology (DVMT).

► Panel Select

Set your video signal interface as LVDs or eDP.

► LCD Panel Type

This setting specifies the LCD Panel's resolution and distribution formats. The item **will display when LVDS is enabled**.

► Panel 1/ 2 Backlight Control

This setting controls the intensity of the LED's backlight output. When lighting conditions are brighter, set it high for a clearer image and low when it is darker.

LED's backlight output	
[Level 1]	20%
[Level 2]	40%
[Level 3]	60%
[Level 4]	80%
[Level 5]	100%

4.7 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 or 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.

► OnChip USB

The item allows the activity of the OnChip USB device to wake up the system from S4/S5 sleep state.

► LAN

Enables or disables the system to be awakened from the power saving modes when activity or input signal of Intel LAN device is detected.

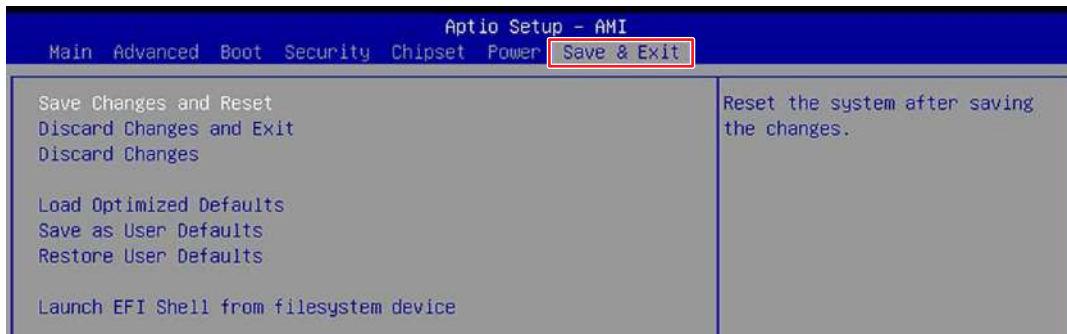
► PCIE PME/Ring

Enables or disables the system to be awakened from power saving modes when activity or input signal of onboard PCIE PME/Ring is detected.

► RTC

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

4.8 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 SMBus Access Programming

GPIO WDT BKL Programming

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

Abstract

In this section, 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 Purpose 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	0x22	Bit 4	N_GPO0	0x11	Bit 4
N_GPI1	0x22	Bit 5	N_GPO1	0x11	Bit 5
N_GPI2	0x22	Bit 6	N_GPO2	0x11	Bit 6
N_GPI3	0x22	Bit 7	N_GPO3	0x11	Bit 7
N_GPI4	0x42	Bit 0	N_GPO4	0x21	Bit 0
N_GPI5	0x42	Bit 1	N_GPO5	0x21	Bit 1
N_GPI6	0x42	Bit 2	N_GPO6	0x21	Bit 2
N_GPI7	0x42	Bit 3	N_GPO7	0x21	Bit 3

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. 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<<4); // Set N_GPO0address (bit 4) 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<<5); // Set N_GPO1 address (bit 5) to 0 (output “low”).
SMBus_WriteByte (0x6E, 0x11, val); // Write back to N_GPO1 port through SMBus.
```

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, 0x22); // Read value from N_GPI2 port through
SMBus. val = val & (1<<6);          // Read N_GPI2 address (bit 6).
if (val)    printf ("Input of N_GPI2 is High");
else       printf ("Input of N_GPI2 is Low");
```

Example: Get **N_GPI3** input value.

```
val = SMBus_ReadByte (0x6E,          // Read value from N_GPI3 port through SMBus.
0x22); val = val & (1<<7);          // Read N_GPI3 address (bit 7).
if (val)    printf ("Input of N_GPI3 is High");
else       printf ("Input of N_GPI3 is Low");
```

Watchdog Timer

2. Watchdog Timer – WDT

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

1. Set WDT Time Unit

```
val = Inportb (WDT_BASE + // Read current WDT setting
0x05); 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 + // Read current WDT_PME setting
0x0A); val = val | 0x01; // Enable WDT OUT: WDOUT_EN (bit 0) set to 1.
Outportb (WDT_BASE + 0x0A, // Write back WDT setting.
val); val = Inportb (WDT_BASE + // Read current WDT setting
0x05); 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 + // Read current WDT setting
0x05); 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 +           // Read current WDT setting.  
0x05); 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 +           // Read current WDT setting  
0x05); val = val | 0x40;           // Set 1 to WDTMOUT_STS (bit 6);  
Outportb (WDT_BASE + 0x05, val);    // Write back WDT setting
```

LVDS Backlight Control - BKL

3. LVDS Backlight Control – BKL

The controller support **LVDS** backlight level control from 0(0%) to 255(100%), the default backlight level is 100%. It must be controlled by SMBus access. The details of SMBus access (SMBus_ReadByte, SMBus_WriteByte) are provided in this document.

1. Set the Level of LVDS Backlight

1. Write **0x0D** into address **0x00** on SMBus device **0x42**.
2. Write desired backlight level from 0(0%) to 255(100%) into address **0x35** on SMBus device **0x42**.

Example 3: Set LVDS backlight level to “100%”

```
SMBus_WriteByte (0x42, 0x00, 0x0D)
```

```
SMBus_WriteByte (0x42, 0x35, 0xFF)
```

2. Read the Level of LVDS Backlight

4. Write **0x0D** into address **0x00** on SMBus device 0x42.
5. Read current backlight level from address **0x35** on SMBus device **0x42**.

Example 4: Get LVDS backlight level

```
SMBus_WriteByte(0x42, 0x00, 0x0D);
```

```
BKL_Value = SMBus_ReadByte(0x42, 0x35);
```

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) & 0xffffffff;
```

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
```

