



BMAL

Modular-Designed Box IPC

User's Manual

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Trademarks

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FCC and DOC Statement on Class A

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a 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 following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the 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 TV 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.
2. Shielded interface cables must be used in order to comply with the emission limits.

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About this Manual

An electronic file of this manual can be obtained from the DFI website at www.dfi.com. To download the user's manual from our website, please go to Support > Download Center. On the Download Center page, select your product or type the model name and click "Search" to find all technical documents including the user's manual for a specific product.

Warranty

1. Warranty does not cover damages or failures that arised from misuse of the product, inability to use the product, unauthorized replacement or alteration of components and product specifications.
2. The warranty is void if the product has been subjected to physical abuse, improper installation, modification, accidents or unauthorized repair of the product.
3. Unless otherwise instructed in this user's manual, the user may not, under any circumstances, attempt to perform service, adjustments or repairs on the product, whether in or out of warranty. It must be returned to the purchase point, factory or authorized service agency for all such work.
4. We will not be liable for any indirect, special, incidental or consequential damages to the product that has been modified or altered.

Static Electricity Precautions

It is quite easy to inadvertently damage your PC, system board, components or devices even before installing them in your system unit. Static electrical discharge can damage computer components without causing any signs of physical damage. You must take extra care in handling them to ensure against electrostatic build-up.

1. To prevent electrostatic build-up, leave the system board in its anti-static bag until you are ready to install it.
2. Wear an antistatic wrist strap.
3. Do all preparation work on a static-free surface.
4. Hold the device only by its edges. Be careful not to touch any of the components, contacts or connections.
5. Avoid touching the pins or contacts on all modules and connectors. Hold modules or connectors by their ends.



Important:

Electrostatic discharge (ESD) can damage your processor, disk drive and other components. Perform the upgrade instruction procedures described at an ESD workstation only. If such a station is not available, you can provide some ESD protection by wearing an antistatic wrist strap and attaching it to a metal part of the system chassis. If a wrist strap is unavailable, establish and maintain contact with the system chassis throughout any procedures requiring ESD protection.

Safety Measures

To avoid damages to the system:

- Use the correct AC input voltage range.

To reduce the risk of electric shock:

- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging the power cord.

Battery:

- Danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent type recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.

Safety Precautions

- Use the correct DC input voltage range.
- Unplug the power cord before removing the system chassis cover for installation or servicing. After installation or servicing, cover the system chassis before plugging the power cord.
- Danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent type recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.
- Keep this system away from humidity.
- Place the system on a stable surface. Dropping it or letting it fall may cause damage.
- The openings on the system are for air ventilation to protect the system from overheating. DO NOT COVER THE OPENINGS.
- Place the power cord in such a way that it will not be stepped on. Do not place anything on top of the power cord. Use a power cord that has been approved for use with the system and that it matches the voltage and current marked on the system's electrical range label.
- If the system will not be used for a long time, disconnect it from the power source to avoid damage by transient overvoltage.
- If one of the following occurs, consult a service personnel:
 - The power cord or plug is damaged.
 - Liquid has penetrated the system.
 - The system has been exposed to moisture.
 - The system is not working properly.
 - The system dropped or is damaged.
 - The system has obvious signs of breakage.
- The unit uses a three-wire ground cable which is equipped with a third pin to ground the unit and prevent electric shock. Do not defeat the purpose of this pin. If your outlet does not support this kind of plug, contact your electrician to replace the outlet.
- Disconnect the system from the DC outlet before cleaning. Use a damp cloth. Do not use liquid or spray detergents for cleaning.

About the Package

The package contains the following items. If any of these items are missing or damaged, please contact your dealer or sales representative for assistance.

- 1 Single box
- 1 3 pin Terminal Block Connector
- 1 2 pin Terminal Block Connector
- 2 Mini PCIe screw
- 4 SATA screw

The board and accessories in the package may not come similar to the information listed above. This may differ in accordance to the sales region or models in which it was sold. For more information about the standard package in your region, please contact your dealer or sales representative.

Chapter 1 - Introduction

Overview

Top View



Bottom View



Key Features

- Support Adaptive Display Platform
- Supports 24V / 9~48V Power Board Module
- Accessible 2.5" SATA Drive Bay
- 12V/24V/48V Ignition Power Control
- Wide Operating Temperature: -40 to 70°C

Specifications

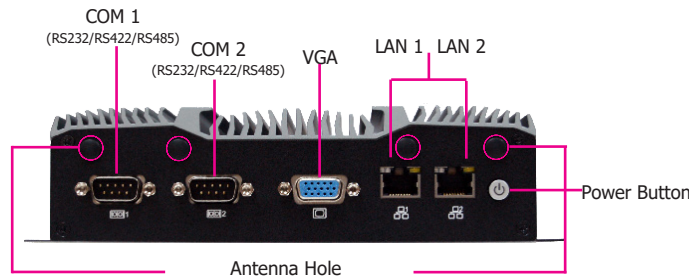
Box Modules

Processor	Intel Atom® Processor E3900 Series, BGA 1296 Intel Atom® x5-E3940 Processor, Quad Core, 2M Cache, 1.6GHz (1.8GHz), 9.5W Intel® Celeron® Processor N3350, Dual Core, 2M Cache, 1.1GHz (2.4GHz), 6W
Memory	One 204-pin SODIMM up to 8GB Single Channel DDR3L 1866MHz
BIOS	Insyde SPI 128Mbit (supports UEFI support only)
Graphics	<ul style="list-style-type: none"> Intel® HD Graphics Display port: DP++ & VGA or DVI-D (DVI-D available upon request) DP++: resolution up to 4096x2160 @ 60Hz VGA: resolution up to 2560x1600 @ 60Hz DVI-D: resolution up to 1920x1200 @ 60Hz Triple Display: Panel Module, DP++, VGA or DVI-D Supported applications: OpenGL 4.2, DirectX 11.1, OpenCL 1.2, OpenGL ES 3.0 Supported Codecs: HW Decode: H.264, MPEG2, VC1, VP8, H.265, MPEG4 HW Encode: H.264, MPEG2, MPEG4
Audio	Realtek ALC262
Storage	1 x 2.5" SATA 3.0 Drive Bay (externally accessible) 1 x mini-mSATA (shared by half-size mini-PCIe socket)
Expansion	1 x Full-size Mini PCIe (USB/PCIe) 1 x Half-size Mini PCIe (USB/PCIe/mSATA) 1 x SIM Slot
Audio Controller	Realtek ALC262
Ethernet Controller	2 x Intel® I210AT PCIe (10/100/1000Mbps)
Top I/O Ports	2 x RS-232/422/485 (DB-9) 2 x RS-232/422/485 (available upon request); support 5V/12V Power 2 x GbE (RJ-45) (10/100/1000Mbps) Support Jumbo Frame, IEEE1588v2, WOL, PXE 802.3 af PoE (PSE), Individual Port 15.4W (available upon request)
	1 x Power button
	4 x Wi-Fi module antenna holes
	4 x DI / 4 x DO (10-pin terminal block) (available upon request)
Bottom I/O Ports	Distant power switch & reset switch Power management switch 2 x USB 3.0 (type A) 2 x USB 2.0 (type A) 2 x USB 2.0 (available upon request) 1 x Line-out & 1 x Mic-in port 1 x DC-in connector (terminal block) 1 x SATA Drive Bay 1 x DP++ & 1 x VGA or DVI-D port (DVI-D available upon request)
Watchdog Timer	System Reset, Programmable via Software from 1 to 255 Seconds
Power	24 VDC Input (available upon request) 9~48 VDC Input (available upon request) Power Management Includes Ignition On/Off and System On/Off Delay Time Control
OS Support (UEFI only)	Windows 10 IoT Enterprise 64-bit

Mechanism	Construction: sheet metal IP Rating: IP65 front panel protection Mounting: VESA mount (This is optional. Please contact your sales representative for more information.)
Mounting	VESA Mount
Dimensions (W x H x D)	180*119.4*51
Weight	1.1KG
Environment	<ul style="list-style-type: none"> Operating Temperature Please refer to Panel Modules Specifications next page Storage Temperature Please refer to Panel Modules Specifications next page Relative Humidity 5 to 90% RH (non-condensing)
Tests and Certification	Shock: Non-operation: 50G, 20ms, half sine wave, 1 time for ± X, ± Y, ± Z direction Vibration: Non-operation: 1.5G, 10~200 Hz random, x, y, z each axis/30 min
Certifications	CE / FCC Class A
Patent No. (Taiwan)	I670589

Product Overview

Top View



Power Button

Press to power on or power off the system.

COM Ports

COM 1 and COM 2 can be an RS232, RS422 or RS485 port.

LAN Ports

Connect a network device or a Ethernet cable for network connectivity.

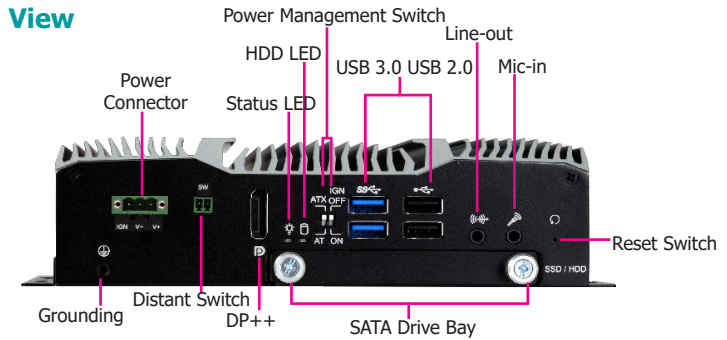
VGA Port

Connects the VGA port of a display.

Wireless Antenna Holes

Reserved for installing wireless antennas.

Bottom View



DC-in Power Connector

Plug a power adapter into this 3-pin terminal block (or optional DC-in jack).

Line-out & Mic-in

Connects a speaker and a microphone.

USB 3.0 & USB 2.0 Ports

Connect USB 3.0 devices as well as devices from previous version such as USB 2.0 or USB 1.1.

DP++ Port

Connects to the dual-mode DisplayPort of a display.

VGA Port

Connects to the VGA port of a display.

Power Management Switch

AT Mode: The system powers on when power is applied.

ATX Mode: The system powers on via the power button or the auto power-on setting in the BIOS.

IGN Mode: The system powers on via the ignition control with settings of on/off delay in the BIOS, plus low-voltage protection (i.e. the system will not power on if the car battery's voltage is below 10.5, 21V and 42V for 12V input, 24V and 48V input respectively). Note that for this mode to work, please switch the AT/ATX mode to ATX. Also note this mode is not available for systems with a DC-in jack (optional).

Remote Switch

Connects distant power switch.

Reset Switch

Press to reset the system without powering off the system first.

SATA Drive Bay

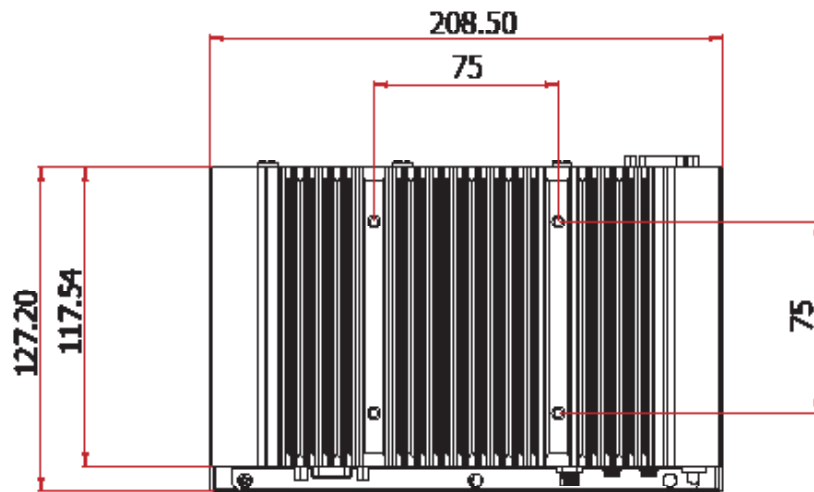
Insert a SATA drive.

HDD LED (Yellow)/ Status LED (Green)

Indicates the status of hard disk drives/system operation.

HDD LED			Status LED			
HDD State	Disk access activity	Disk drives present or not present	System Status	Powered on	Power-on Power-off Delay enabled in the BIOS	S4, S5 Power States
LED Behavior	Blink	Off	LED Behavior	Always ON	Blinking	Off

Mechanical Dimensions



Chapter 2 - Getting Started

Preparing the System

Before you start using the system, you need the following items:

- SATA HDD or mini-mSATA card
- AC power adapter

Installing Devices

The following devices can be installed in the system.

- SODIMM
- mini-mSATA cards
- Mini PCIe cards

Configuring the BIOS

To get you started, you may need to change configurations such as the date, time and the type of hard disk drive.

1. Power on the system.
2. After the memory test, the message "Press DEL to run setup" will appear on the screen. Press the Delete key to enter the BIOS setup utility.

Installing an Operating System

Depending on the method you choose to install your system, you may use a USB flash drive or install a CD-ROM drive to run the Operating System CD.

Make sure that a SATA HDD or mini-mSATA card is already installed.

1. Refer to the following chapters for information on installing a SATA HDD or mini-mSATA card.
2. Refer to your operating system manual for instructions on installing an operating system.

Installing the Drivers

The system requires you to install drivers for some devices to operate properly. Refer to the Supported Software chapter for instructions on installing the drivers.

Chapter 3 - Installing Devices

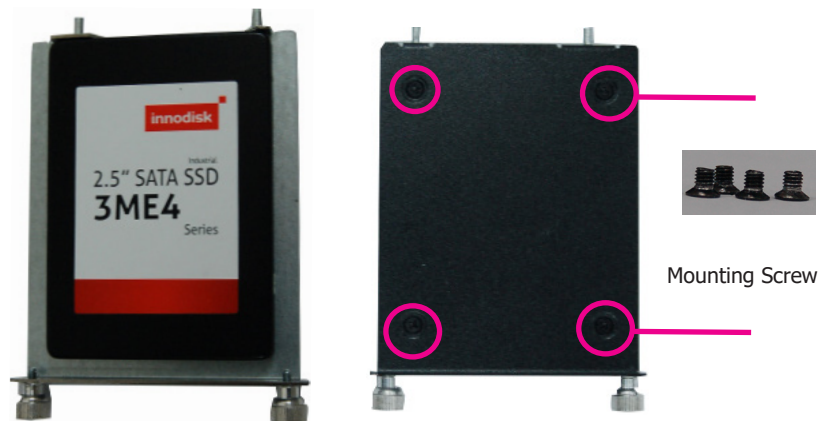
Installing a SATA Drive

The SATA drive tray can be easily accessed without opening the system. However, the system does not support hot-swapping hard drives; turn off the system first.

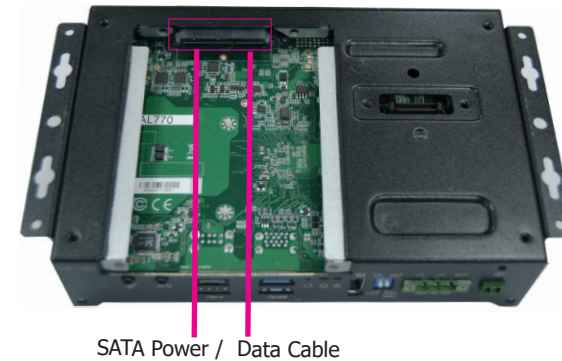
1. Locate the drive tray on the bottom box IPC and open it by releasing the thumbscrews.



2. Position the HDD on the drive tray and align the mounting holes of the HDD with the mounting holes of the drive tray. Then fasten the HDD with the provided mounting screws.



3. Slide the HDD into the drive bay by aligning the HDD's data and power connectors with the system's SATA data and power connectors. Then close the drive tray and secure the drive in place with the thumbscrews.



Installing a SIM Card

The SIM card socket can be accessed without opening the chassis. It is located on the side of the box module.

1. Remove the screw to open the slot.

Side View



SIM Card Slot Screw

2. Insert the SIM card into the slot. Please place the card with the IC facing down and the angled corner facing toward the socket so that it will be in contact with the system board.



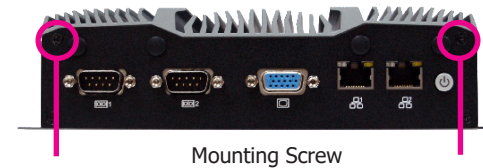
Note:

Be sure to insert the SIM card completely into the socket; you should feel a force of the spring that locks the card in place. To release the card, push it inward to unlock it.

Removing the Chassis Cover

Installing internal components requires you to remove the chassis. Please use the following procedure to open the chassis cover.

1. Make sure the system and all other peripheral devices connected to it have been powered-off.
2. Disconnect all power cords and cables.
3. The 4 mounting screws on the rear side of the system are used to secure the cover to the chassis. Remove these screws and put them in a safe place for later use.

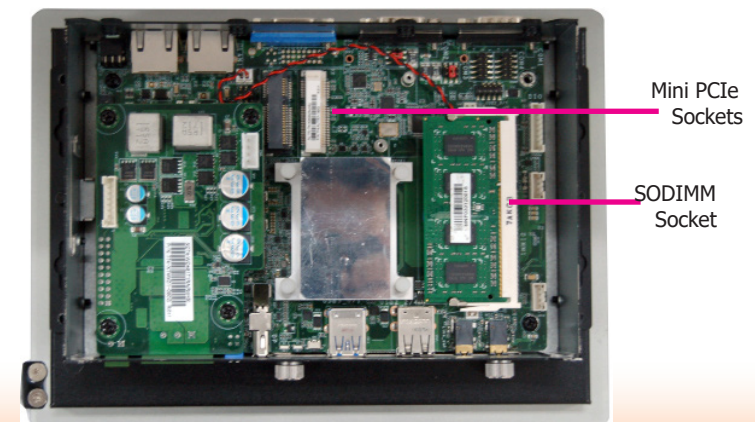


Mounting Screw



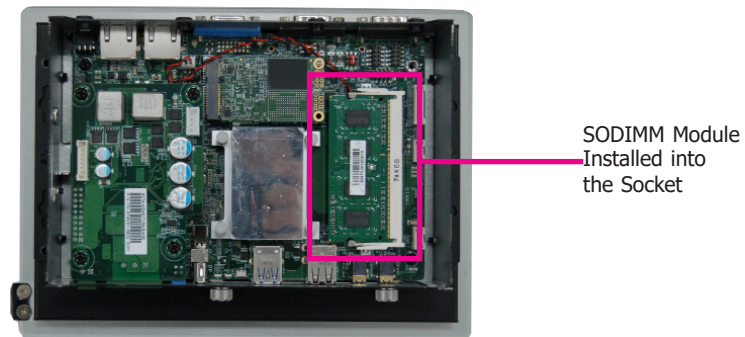
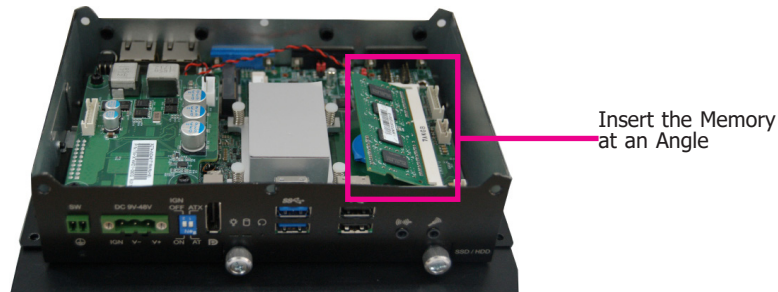
Mounting Screw

4. Lift the cover to open the system.
5. The Mini PCIe and the SODIMM slots are readily accessible after removing the chassis cover.



Installing a SODIMM

The system supports one DDR3L SODIMM socket. To install a memory module, grasp the memory module by its edges and align the module's notch with the socket's notch; then insert the memory into the socket at an angle and push it down until you feel a click.



Note:

The system can only accept DDR3L SODIMM modules. Please do not install any other types of memory modules.

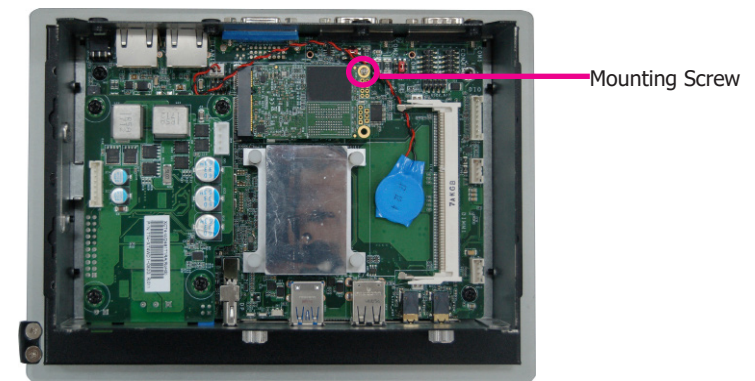
Installing a Mini PCIe Card/mini-mSATA

The system board is equipped with 2 Mini PCIe slots: one full-size (black) and one half-size (white) slots. Here we will demonstrate the installation of a full-size Mini PCIe card (working in conjunction with a SIM card) for 3G/4G connectivity.

1. Grasp the Mini PCIe card by its edges and align the notch in the connector of the PCIe card with the notch in the connector on the system board.



2. Push the Mini PCIe card down and use the provided mounting screws to secure the card on the system board.

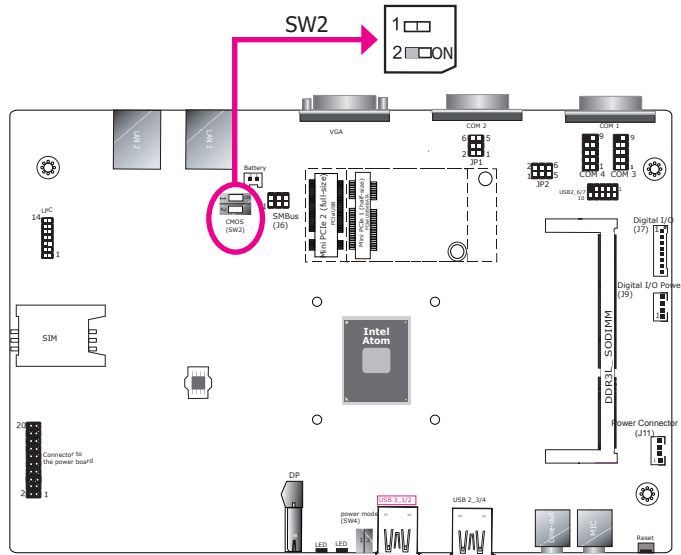


Note:

The system has one additional half-size Mini PCIe slot that supports Mini PCIe and SATA interfaces. You can switch between these interfaces via the BIOS setup utility.

Chapter 4 - Jumper Settings

Clear CMOS Data



You can reconfigure the system with the default values stored in the ROM BIOS if you encounter the following situations:

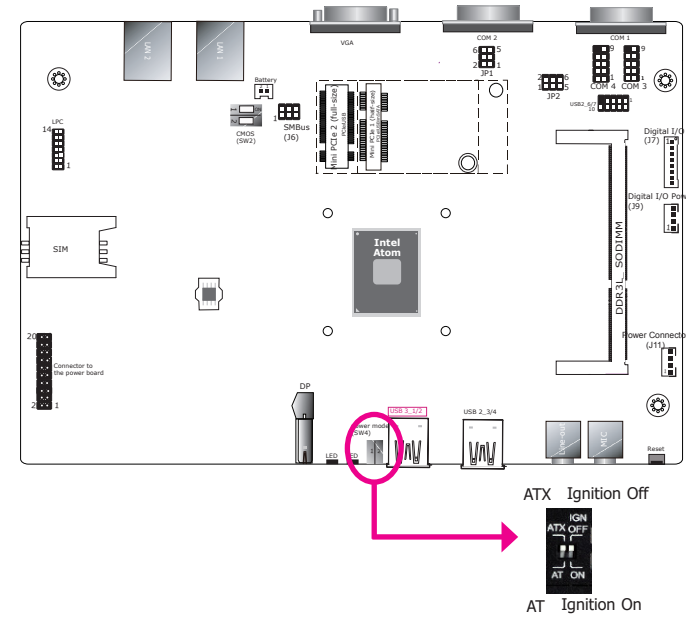
- a) CMOS data becomes corrupted.
- b) You forgot the supervisor or user password.

To load the default values stored in the ROM BIOS, please follow these steps below:

1. Power off the system and unplug the power cord.
2. Adjust SW2-2 to "On". Wait for a few seconds and set the switch back to its default position "Off".
3. Now plug the power cord and power on the system.

Clear CMOS Data	SW2-2
Normal (default)	SW2-2 Off
Clear CMOS	SW2-2 On

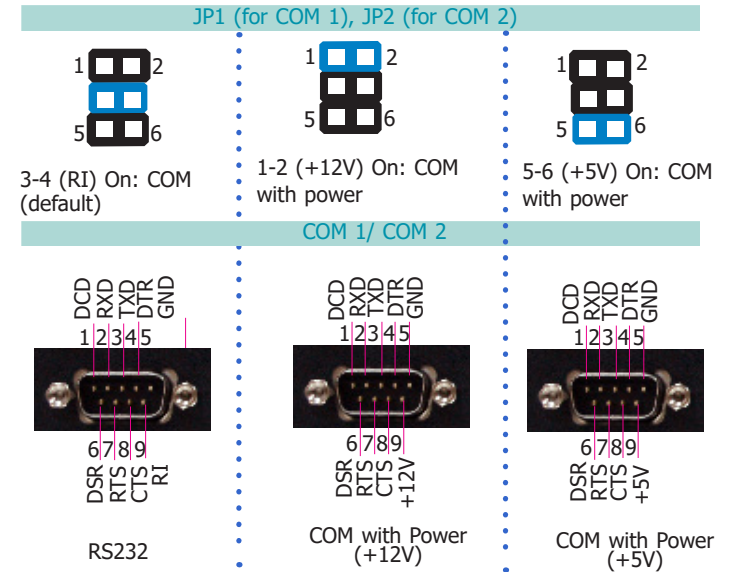
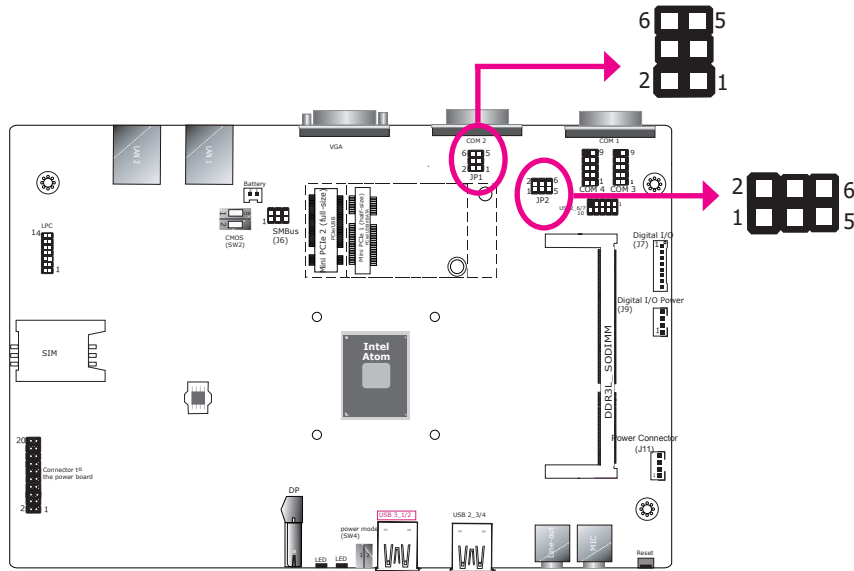
Power-on Mode Select



Switch 4 is used to select the power-on mode.

Power-on Mode Select	SW4
Power-on via AT/ATX power	On (AT)/Off (ATX, default)
Power on via Ignition	On/Off (default)

Power over Serial

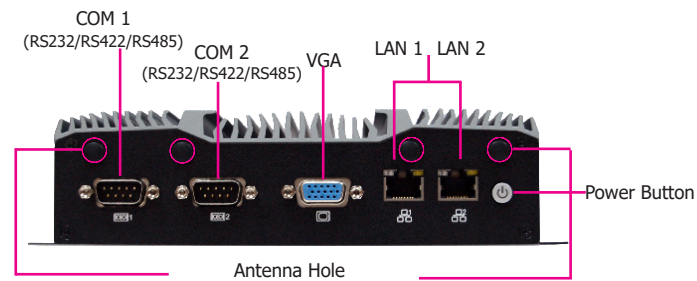


JP1 (for COM 1) and JP2 (for COM 2) are designed to configure the Serial COM ports to provide power. The pin functions of COM 1 and COM 2 will vary according to the jumpers' settings.

COM Power Select: COM1 (JP1), COM2 (JP2)	
COM (default)	3-4 (RI: No.9 pin)
COM with power	5-6 (+5V), 1-2 (+12V) On

Chapter 5 - Ports and Connectors

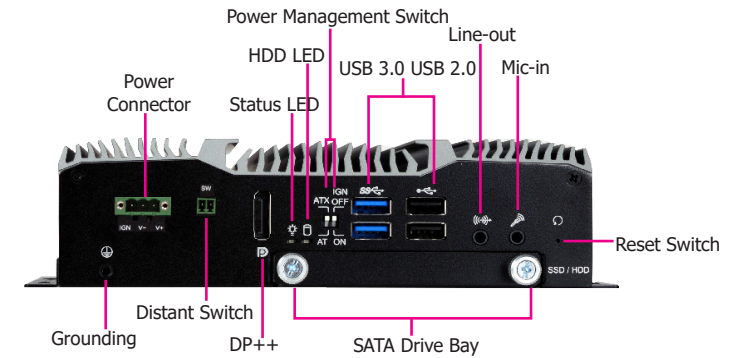
Top I/O Ports



The top I/O consists of the following ports and connectors:

- Buttons & LEDs:
Power button with LED (Green)
- Serial Communication Ports:
COM 1 and COM 2 can be an RS232, RS422 or RS485 port.
- Display Ports:
VGA
- Ethernet Ports:
LAN 1 & LAN 2

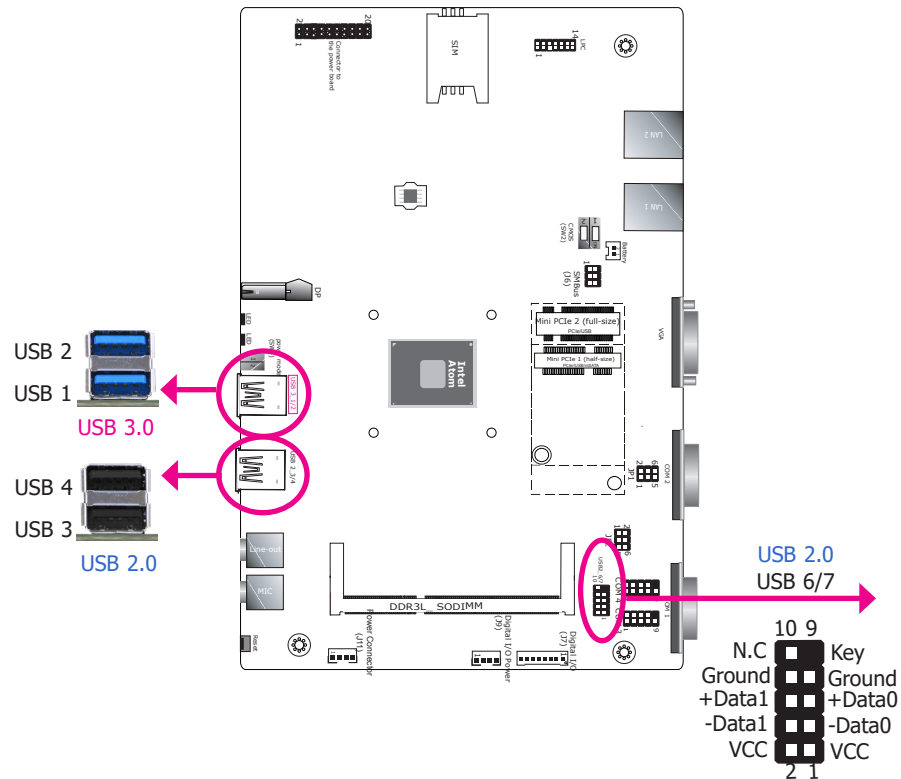
Bottom I/O Ports



The bottom I/O consists of the following ports and connectors:

- Buttons, Switches & LEDs:
Reset switch
Power management switch (ignition on/off control & AT/ATX mode)
Remote power-on switch
HDD LED (Yellow) and status LED (Green)
- Audio Ports:
Line-out & microphone ports
- Power Connector:
3-pin terminal block with ignition control
- Display Ports:
DP++ port
- USB Ports:
2 USB 3.0 ports & 2.0 ports
- SATA Drive Bay

USB Ports



The USB device allows data exchange between your computer and a wide range of simultaneously accessible external Plug and Play peripherals.

The system board is equipped with 2 onboard USB 3.0 ports (USB 1 & USB 2) and 2 onboard USB 2.0 ports (USB 3 & USB 4). The 10-pin connector allows you to connect 2 additional USB 2.0 ports (USB 6-7).

BIOS Setting

Configure the onboard USB in the Advanced menu ("USB Configuration" submenu) of the BIOS. Refer to Chapter 7 for more information.

Driver Installation

You may need to install the proper drivers in your operating system to use USB devices. Refer to Chapter 8 for more information.

Wake-On-USB Keyboard/Mouse

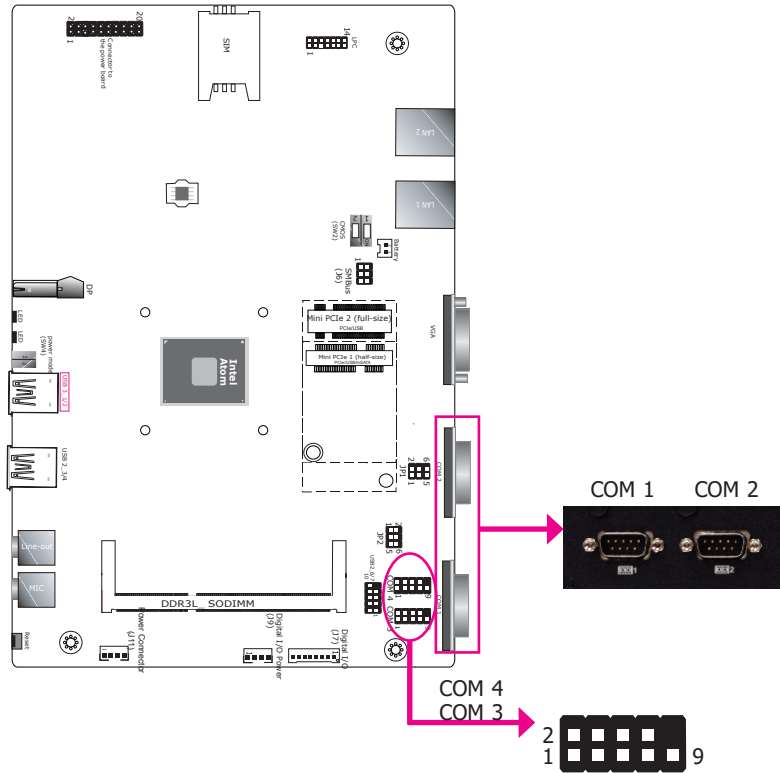
The Wake-On-USB Keyboard/Mouse function allows you to use a USB keyboard or USB mouse to wake up a system from the S3 (STR - Suspend To RAM) state.



Important:

If you are using the Wake-On-USB Keyboard/Mouse function for 2 USB ports, the +5V_standby power source of your power supply must support $\geq 1.5A$. For 3 or more USB ports, the +5V_standby power source of your power supply must support $\geq 2A$.

COM (Serial) Ports



COM 1 to COM 4 can be selected among RS232, 422 and 485. In addition, COM 1 and COM 2 can be selected to supply +12V or +5V power on Pin 9 (default: RI).

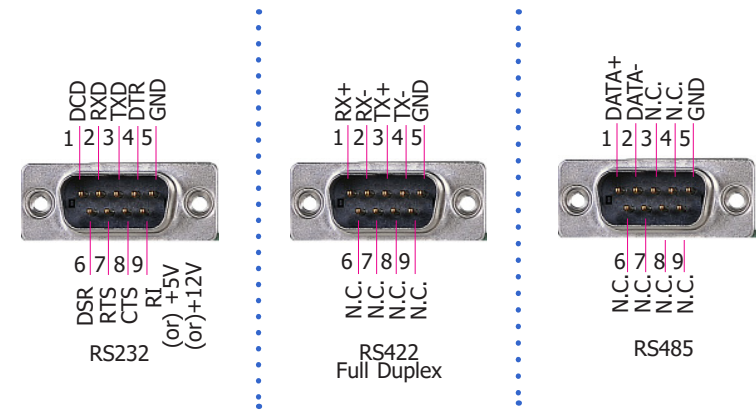
Please use the BIOS setup utility to configure serial port communication mode for COM 1 to COM 4.

BIOS Setting

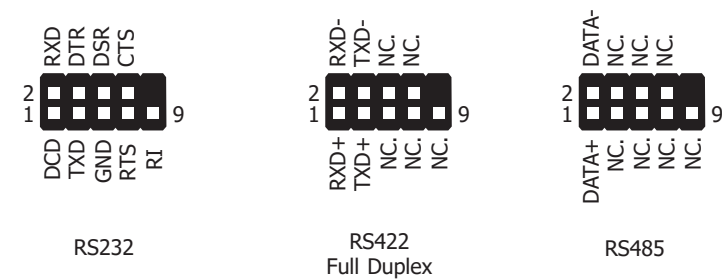
Configure the serial ports including the serial communication mode in the Advanced Configuration ("Super I/O Configuration" submenu) of the BIOS. Refer to Chapter 7 for more information.

COM Port Connector

COM 1/ COM 2 (RS232 with Power /422/485) / COM 2 (RS232 with power/422/485)



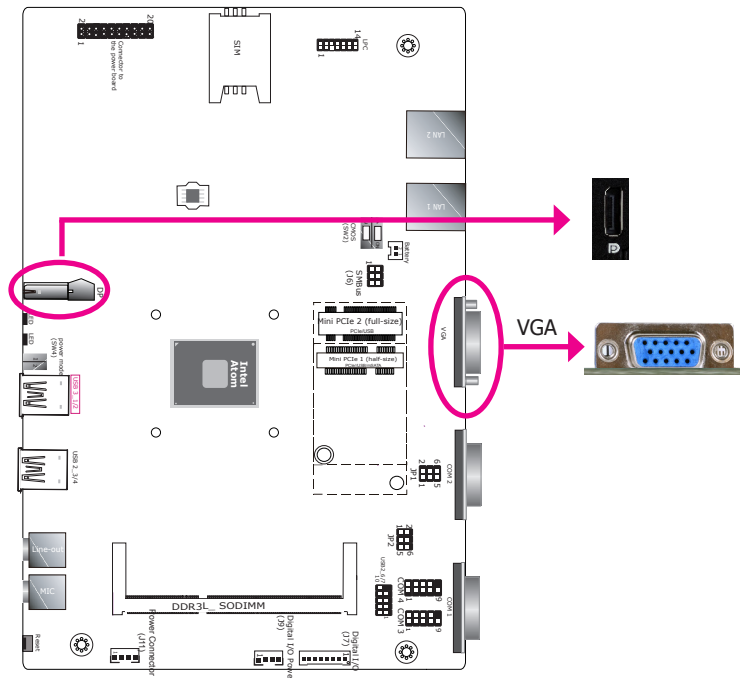
COM 3/ COM 4 (RS232/422/485)



Graphics Interfaces

The display ports consist of the following:

- 1 VGA port
- 1 DP++ port



VGA Port

The VGA port is used for connecting a VGA monitor. Connect the monitor's 15-pin D-shell cable connector to the VGA port. After you plug the monitor's cable connector into the VGA port, gently tighten the cable screws to hold the connector in place.

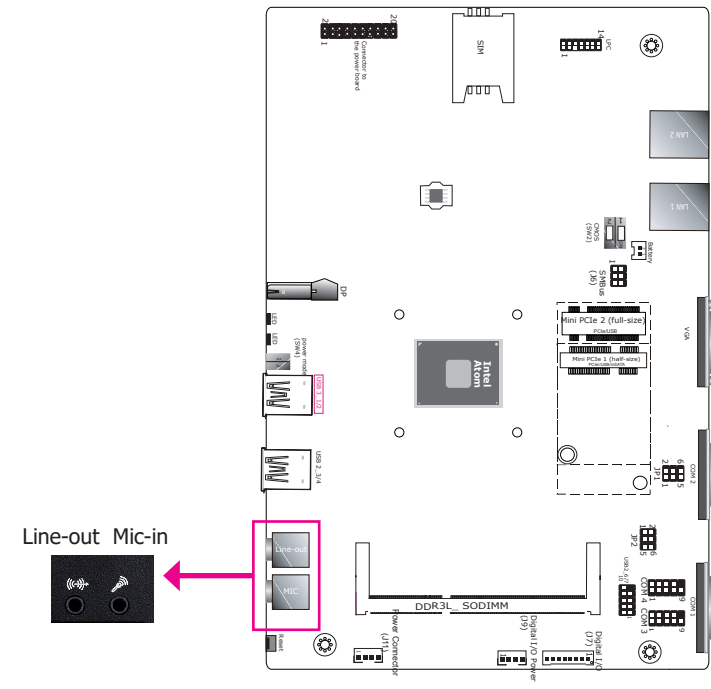
DP++ Port

The DisplayPort is a digital display interface used to connect a display device such as a computer monitor. It is used to transmit audio and video simultaneously. The interface, which is developed by VESA, delivers higher performance features than any other digital interfaces.

Driver Installation

Install the graphics driver. Refer to Chapter 8 for more information.

Audio Output



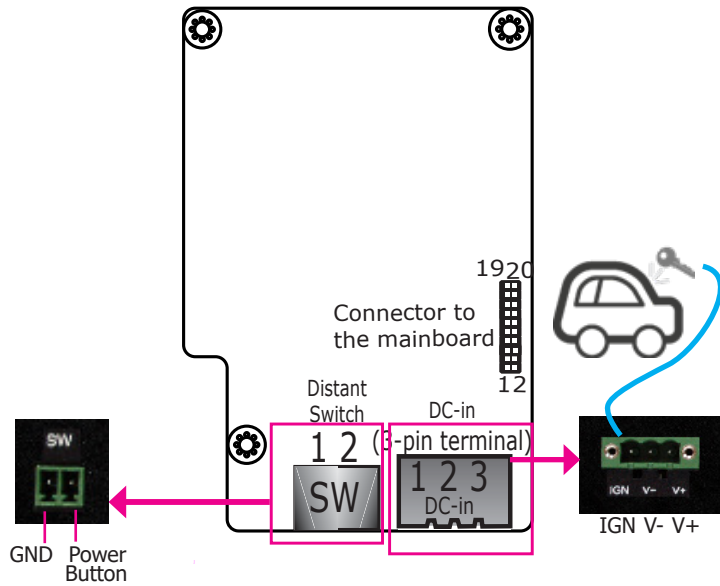
Front Audio

This Line-out jack is used to connect a headphone or external speakers. And the MIC-in connector is used to connect an external microphone.

Driver Installation

Install the audio drivers. Refer to Chapter 8 for more information.

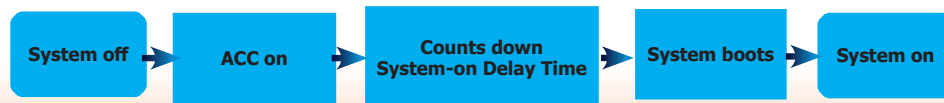
DC-in Power Connector & Remote Power-on Switch (Power board)



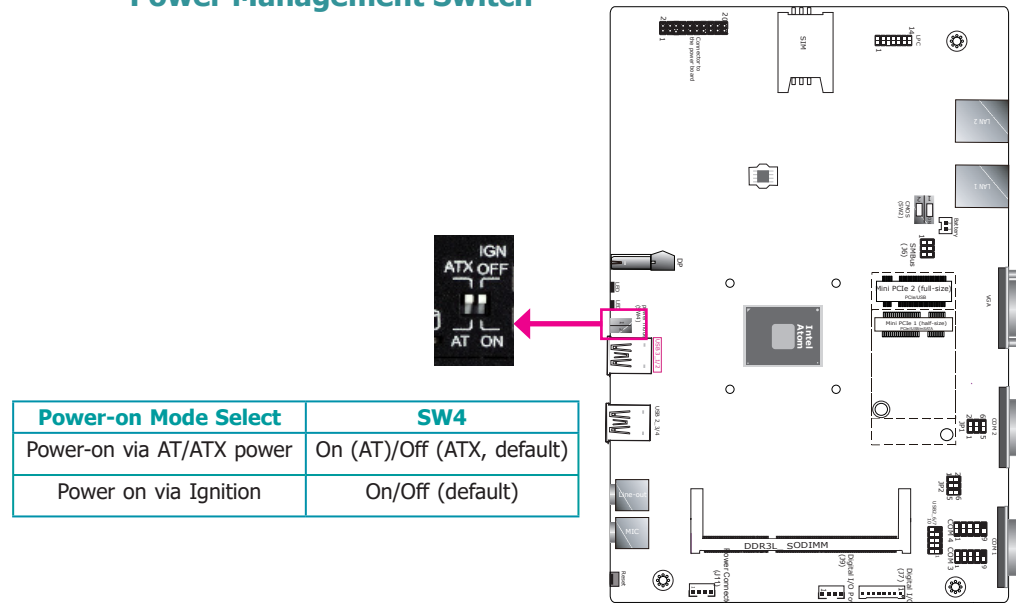
The 3-pole power connector connects to a car battery for power supply. Note that the system accepts a wide power range of 9 to 48V with in-vehicle power management that includes Battery Low-Voltage Protection and System on/off Delay Time control; please refer to the "Advanced" menu ("Advanced" > "IGN Configuration") in the BIOS. Refer to "IGN Configuration" in Chapter 7.

Using car ignition to power on or power off the system, you can power on or power off the system with a specific on/off delay time. These flowcharts below and on the right illustrate the startup and shutdown processes that the system goes through using ignition power control.

System startup with power management setting set to IGN mode

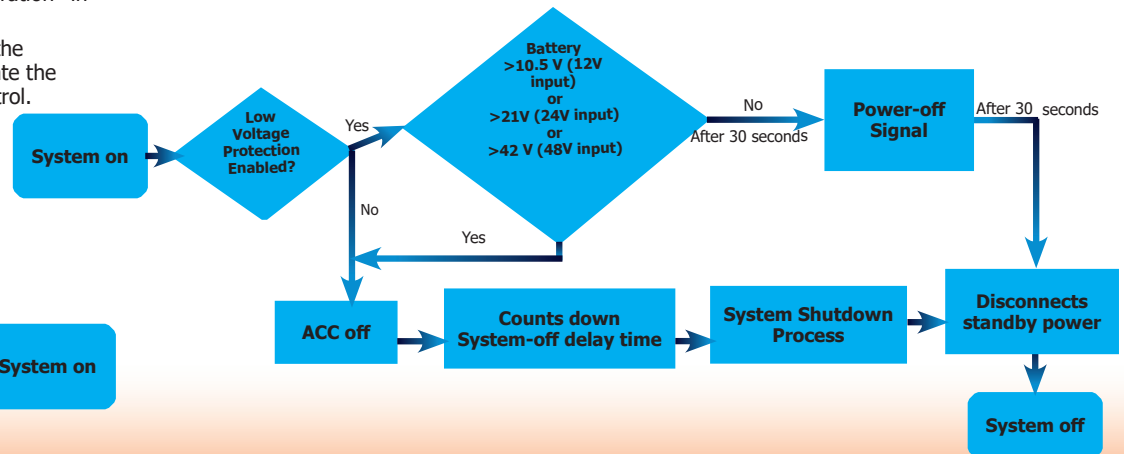


Power Management Switch

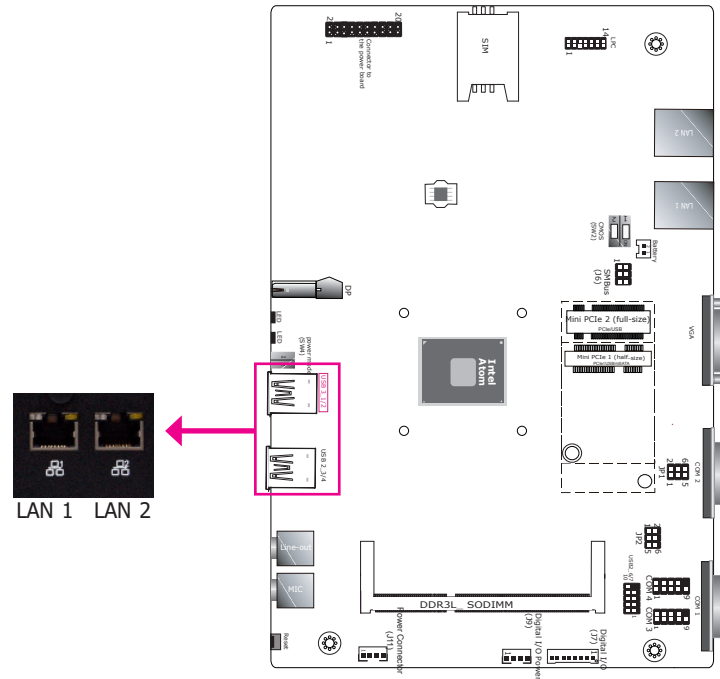


The system powers on via the ignition control with settings of power on/off delay in the BIOS, plus protection from low voltage (i.e. the system will not power on if the car battery's voltage is below 10.5, 21V and 42V for 12V input, 24V and 48V input respectively). Note that for this mode to work, please switch the adjacent AT/ATX mode to ATX first. Also note this mode is not available for systems with a DC-in jack (optional).

System shutdown with power management setting set to IGN mode



RJ45 LAN Ports



Features

- 2 Intel® I210IT PCI Express Gigabit Ethernet controllers
- Supports Jumbo frames, WoL (Wake on LAN), PXE (Preboot eXecution Environment), and IEEE1588v2 packet-based timing technology for real-time control applications.
- Optionally supports (Power over Ethernet) ports. With PoE (Power over Ethernet) support, the ports carry power to connected devices without the need for individual power supplies. Each port delivers up to 15.4 Watts of power to the connected devices that comply with IEEE 802.3af, for example, access points and IP cameras.

The LAN ports allow the system to connect to a local area network for Ethernet connectivity.

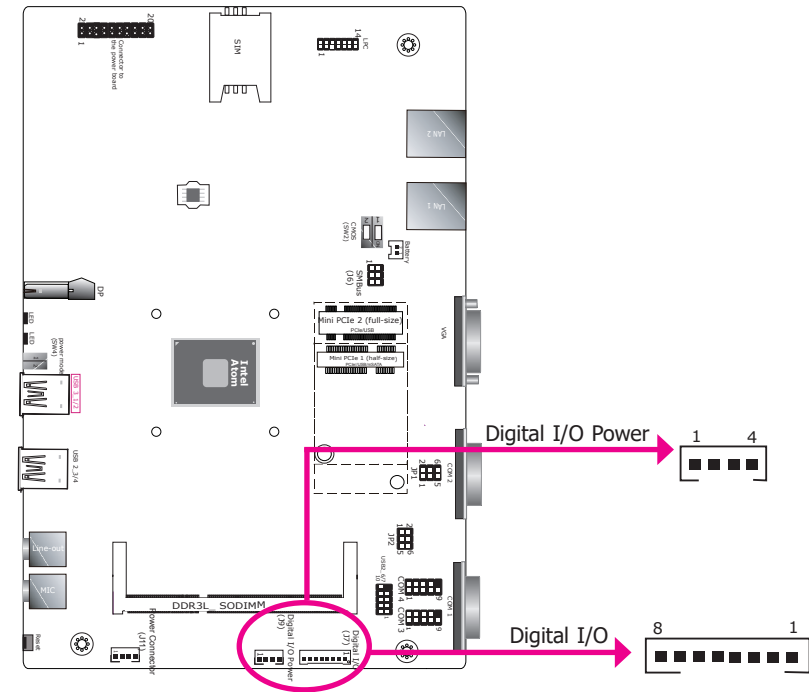
BIOS Setting

Configure the onboard LAN in the Advanced menu ("ACPI Configuration" submenu) of the BIOS. Refer to Chapter 3 for more information.

Driver Installation

Install the LAN drivers. Refer to Chapter 7 for more information.

Digital I/O & Power Connector



The 8-bit Digital I/O connector provides monitoring and control function to external devices connected to the connector.

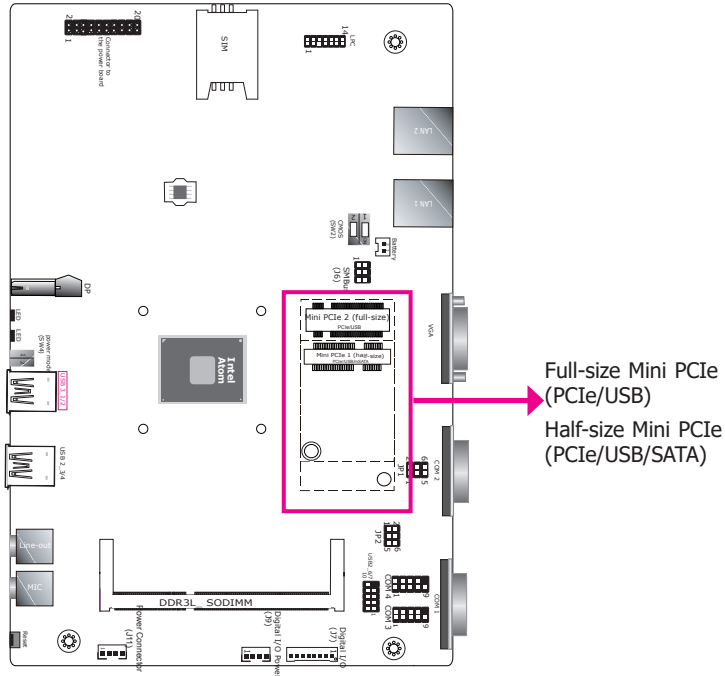
Digital I/O Connector

Pins	Function
1	DIO7
2	DIO6
3	DIO5
4	DIO4
5	DIO3
6	DIO2
7	DIO1
8	DIO0

Digital I/O Power Connector

Pins	Function
1	+12V
2	GND
3	5V_Standby
4	+5V

Expansion Slots



Mini PCI Express Slots

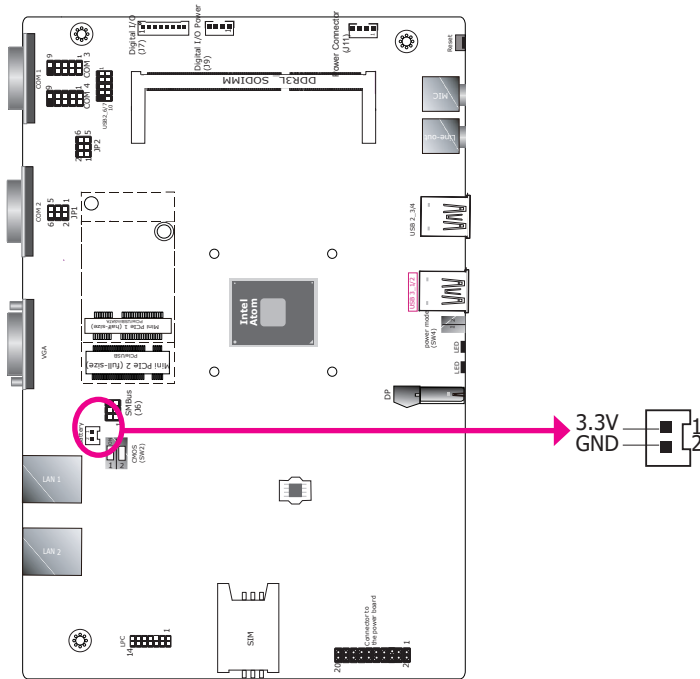
The full-size Mini PCIe socket (Mini PCIE1, black) supports PCIe and USB signals and is used to install a Mini PCIe card.

The half-size Mini PCIe socket (Mini PCIE2, white) supports PCIe, USB and SATA signals and is used to install a Mini PCIe or a mini-mSATA card.

BIOS Setting

Configure the Mini PCIe slots including the designated interface for half-size Mini PCIe socket (Mini PCIE2; PCIe or SATA) in the Advanced Configuration ("PCI Express Configuration" sub-menu) of the BIOS. Refer to Chapter 7 for more information.

Battery



Connect to the battery connector

The lithium ion battery powers the real-time clock and CMOS memory. It is an auxiliary source of power when the main power is shut off.

Safety Measures

- Danger of explosion if battery incorrectly replaced.
- Replace only with the same or equivalent type recommend by the manufacturer.
- Dispose of used batteries according to local ordinance.

Chapter 6 - Assembling and Mounting

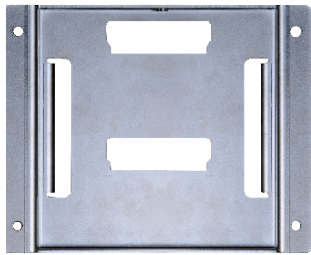
VESA/Wall Mount


Note:

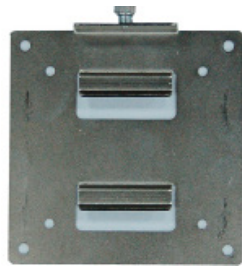
The system unit used in the following illustrations may not resemble the actual one. These illustrations are for reference only.

The wall mount kit includes the following:

- 2 wall mount brackets
- Bracket screws

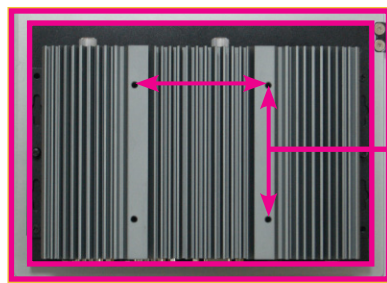


Wall mount bracket 1



Wall mount bracket 2

1. Before starting any installation procedure, attach the poron foam to the box IPC.



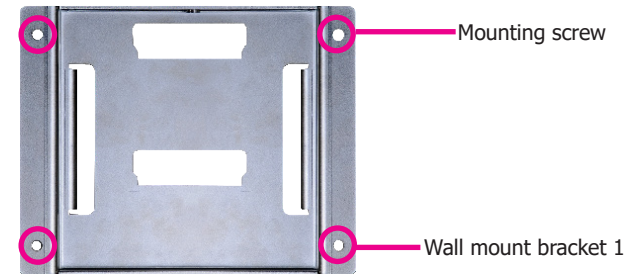
Poron Foam

75 x 75 mm

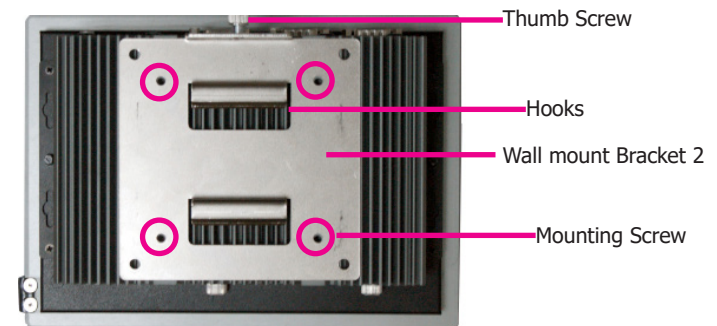

Note:

The VESA mount specifications for this device is 75 x 75 (mm). Please use a compatible VESA mount kit that can sustain the weight and size of the device.

2. Select a place on the wall where you will mount the box IPC.
3. Use the provided mounting screws to attach "wall mount bracket 1" to the wall.



4. Attach the other bracket (wall mount bracket 2) to the rear of the box IPC.



- Slide the box IPC to "wall mount bracket 1" to attach the two brackets with the hooks. Then tighten the thumb screw to secure the assembly in place. Note that the following diagram is for illustration only and may not resemble the actual product.

