MPT-7000R/RHV Series

Multi-Purpose Railway System

User's Manual

Version 1.3a
(Aug. 2018)

iBASE

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Disclaimer

Trademarks

Compliance

This product has passed CE Class A tests for environmental specifications and limits. This product is in accordance with the directives of the Union European (EU). If users modify and/or install other devices in this equipment, the CE conformity declaration may no longer apply.

This product has been tested and found to comply with the limits for a Class A device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses and can radiate radio frequency energy and, if not installed and used in accordance with manufacturer's instructions, may cause harmful interference to radio communications.

WEEE

This product must not be disposed of as normal household waste, in accordance with the EU directive of for waste electrical and electronic equipment (WEEE - 2012/19/EU). Instead, it should be disposed of by returning it to a municipal recycling collection point. Check local regulations for disposal of electronic products.

Green IBASE

This product is compliant with the current RoHS restrictions and prohibits use of the following substances in concentrations exceeding 0.1% by weight (1000 ppm) except for cadmium, limited to 0.01% by weight (100 ppm).

- Lead (Pb)
- Mercury (Hg)
- Cadmium (Cd)
- Hexavalent chromium (Cr6+)
- Polybrominated biphenyls (PBB)
- Polybrominated diphenyl ether (PBDE)

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Important Safety Information

Carefully read the precautions before using the device.

Environmental conditions:

- Lay the device horizontally on a stable and solid surface in case the device may fall, causing serious damage.
- Leave plenty of space around the device and do not block the openings for ventilation. NEVER DROP OR INSERT ANY OBJECTS OF ANY KIND INTO THE VENTIILATION OPENINGS.
- Slots and openings on the chassis are for ventilation. Do not block or cover these openings. Make sure you leave plenty of space around the device for ventilation. NEVER INSERT OBJECTS OF ANY KIND INTO THE VENTILATIN OPENINGS.
- Use this product in environments with ambient temperatures between -30°C and 55°C for SSD.
- DO NOT LEAVE THIS DEVICE IN AN ENVIRONMENT WHERE THE STORAGE TEMPERATURE MAY GO BELOW -35°C OR ABOVE 85°C. This could damage the device. The device must be used in a controlled environment.

Care for your IBASE products:

- Before cleaning the device, turn it off and unplug all cables such as power in case a small amount of electrical current may still flow.
- Use neutral cleaning agents or diluted alcohol to clean the device chassis with a cloth. Then wipe the chassis with a dry cloth.
- Vacuum the dust with a computer vacuum cleaner to prevent the air vent or slots from being clogged.

⚠ WARNING

Attention during use:

- Do not use this product near water.
- Do not spill water or any other liquids on your device.
- Do not place heavy objects on the top of the device.
- Operate this device from the type of power indicated on the marking label. If you are not sure of the type of power available, consult your distributor or local power company.
- Do not walk on the power cord or allow anything to rest on it.
- If you use an extension cord, make sure that the total ampere rating of the product plugged into the extension cord does not exceed its limits.

Avoid Disassembly

You are not suggested to disassemble, repair or make any modification to the device. Disassembly, modification, or any attempt at repair could generate hazards and cause damage to the device, even bodily injury or property damage, and will void any warranty.

⚠️ CAUTION

Danger of explosion if internal lithium-ion battery is replaced by an incorrect type. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

Warranty Policy

- **IBASE standard products:**

  24-month (2-year) warranty from the date of shipment. If the date of shipment cannot be ascertained, the product serial numbers can be used to determine the approximate shipping date.

- **3rd-party parts:**

  12-month (1-year) warranty from delivery for the 3rd-party parts that are not manufactured by IBASE, such as CPU, memory, SSD/HDD, power adapter, panel and touchscreen.

∗ PRODUCTS, HOWEVER, THAT FAILS DUE TO MISUSE, ACCIDENT, IMPROPER INSTALLATION OR UNAUTHORIZED REPAIR SHALL BE TREATED AS OUT OF WARRANTY AND CUSTOMERS SHALL BE BILLED FOR REPAIR AND SHIPPING CHARGES.

Technical Support & Services

1. Visit the IBASE website at www.ibase.com.tw to find the latest information about the product.
2. If you need any further assistance from your distributor or sales representative, prepare the following information of your product and elaborate upon the problem.

   - Product model name
   - Product serial number
   - Detailed description of the problem
   - The error messages in text or in screenshots if there is any
   - The arrangement of the peripherals
   - Software in use (such as OS and application software, including the version numbers)

3. If repair service is required, you can download the RMA form at http://www.ibase.com.tw/english/Supports/RMAService/. Fill out the form and contact your distributor or sales representative.

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Chapter 1
General Information

The information provided in this chapter includes:

- Features
- Packing List
- Specifications
- Overview
- Dimensions

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1.1 Introduction

The MPT-7000R is a product series of IBASE embedded computing system that is railway compliant. It is a robust, rugged and fanless design with an Intel® Core™ i7 / i3 U-series processor and an Intel® I210IT Ethernet controller. This product provides high-speed data transmission and reliable connection when subject to shock or vibration. It is able to be operated at the ambient operating temperature ranging from -30 ~ 55 °C if an SSD is used, and even from -35 ~ 85 °C for storage.

1.2 Features

- Intel® Core™ i7-6600U / i3-6100U processor and I210IT Ethernet Controller
- EN50155 certified
- Fanless design
- Robust M12 connection for dual Gigabit Ethernet, USB, and DC power input
- Dual SIM slots for WWAN redundancy
- Two removable 2.5" drive bays and a CFast card slot
- Ignition power control
- Wide-range voltage GPIO interface
- Rich I/O interfaces for wireless, SSD, GPS, plus WWAN and add-on card expansion
- One PCIe (x4) expansion slot

1.3 Packing List

Your MPT-7000R package should include the items listed below. If any of the items below is missing, contact the distributor or the dealer from whom you purchased the product.

Item	Q'ty	IBASE P/N
MPT-7000R / RHV	1	- -
Mounting Bracket	2	- -
GPIO Matching Connector (8 pins) (DINKLE EC350VM-08P, 8 pins)	1	C1216EC3508103000P
Thermal Pad (35 x 20 x 1.5 mm) * Thinner, for M.2 SSD module card	1	C1401035020150000P
Thermal Pad (20 x 20 x 5.5 mm) * Thicker, for M.2 WiFi module card	1	C1401020020055000P
Round Head Screw (4 for Mounting Bracket, 1 for M.2 network Module Card, 1 for spare)	6	H02306110122001N0P
Flat Head Screw for Mini PCIe Card	2	H02203511122000N0P
Screw for SSD (if not pre-installed)	4	H0230561B710BN000P

1.4 Optional Accessories

IBASE provide optional accessories as follows. Please contact us or your dealer if you need any.

Item	IBASE P/N
Thermal Pad (35 x 20 x 1.5 mm)	C1401035020150000P
Thermal Pad (20 x 20 x 5.5 mm)	C1401020020055000P
RTC Battery	C272113012020B100P
Fuse for MPT-7000R	C2309001151058000P
Fuse for MPT-7000RHV	C2313000501400100P
M12 Power Cable	C501PW39904121000P
M12 USB2.0 Cable	C501USB1130A32000P
M12 to RJ45 Cable	A012CB01200101000P
2.5" MLC SSD (64 GB)	A002SSDSA064G2524P
M.2 MLC SSD (128 GB)	A002SSDM2S128G200P
MLC CFast (8 GB)	A008CFG0080400200P

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1.5 Specifications

Product Name	MPT-7000R	MPT-7000RHV
System		
Motherboard	MBT-7001R	
Operating System	• Windows 10 (64-bit) • Windows Embedded Standard 7 (64-bit) • Linux Kernal 3.8.0 or above (64-bit)	
CPU	• Intel® 6th Gen. Core™ i7-6600U processor at 2.6 GHz • Intel® 6th Gen. Core™ i3-6100U processor at 2.3 GHz	
Cache	Level 2	
Chipset	Integrated	
Memory	2 x 4 GB DDR4-2133 SO-DIMM (default), upgradable to 32 GB (non-ECC)	
Graphics	Intel® HD graphics Gen. 9 LP with up to 72 EUs	
Network	2 x Intel® I210IT	
Super I/O	Fintek F81866AD-I	
Storage	2 x 2.5" SSD drive bay	
Audio Codec	Realtek ALC662, two channels of input and output	
Power Supply	DC 24V with IGN control	DC 72/110V with IGN control
Fuse	Littlefuse® TAC ATO® Style Blade 15A, 58V DC	Littelfuse® Time-lag Fuse 477 series 5A, 400V DC
RTC Battery	Panasonic BR2032 3V	
BIOS	AMI BIOS	
Watchdog	Watchdog Timer 256 segments, 0, 1, 2…255 sec/min	
Chassis	Aluminum, black	
Mounting	Custom mounting rail	
Dimensions (W x H x D)	256 x 83 x 182 mm (10.08" x 3.27" x 7.17")	
Net Weight	3.6 kg (7.94 lb)	
Certificate	EN50155:2007, EN50153:2014, EN50121-3-2:2015, EN45545-2:2013, CE, FCC Class A	
I/O Ports		
LAN	2 x GbE LAN (M12 male A-coded)	
USB	• 2 x USB 3.0 • 2 x USB 2.0 (M12 female D-coded)	

SSD	2 x 2.5" drive bay	
SATA	2 x SATA III ports	
Serial	3 x COM ports: • COM1: RS-232/422/485 • COM2 & COM3: RS-232 only * COM3 is optional with CAN.	3 x COM ports: • COM1: RS-232/422/485 • COM2 & COM3: RS-232 only * COM3 is optional with VGA.
Display	• 1 x DVI-D, up to 1920 x 1080 • 1 x VGA, up to 1920 x 1080 * VGA is optional with COM3 for MPT-7000RHV.	
Digital I/O	6 In/Out with 24V input tolerance * You can use IBASE's software development kit (SDK) to configure GPIO in the operating system. For further information about the SDK, refer to Appendix D Software Development Kit for WDT.DLL in this manual.	
CFast	1 x CFast connector	
SIM	2 x Micro-SIM card slot	
Audio Jack	2 x Microphone Input 2 x Line-out	
Expansion	• 1 x Mini PCIe slot (full-sized) with USB 2.0 & PCIe • 1 x Mini PCIe slot (half-sized) with USB2.0 • 1 x M.2 M2280 slot with SATA for SSD only • 1 x M.2 E2230 slot with PCIe & USB for WLAN • 1 x M.2 B3042 slot with PCIe & USB for WWAN	
Environment		

Temperature	• **Operating:**
	    SSD: -30 ~ 55 °C (-22 ~ 131 °F)
	    SSD: -40 ~ 70 °C (-40 ~ 158 °F) when there is no other cards installed in the system
	 • **Storage:** --35 ~ 85 °C (-31 ~ 185 °F)	

Relative Humidity	10 ~ 95% (non-condensing)	
Vibration Protection	• **Function:** 1 m/s^2, 5 ~ 150 Hz (EN 61373) • **Lifetime**: 5.72 m/s^2, 5 ~ 150 Hz (EN 61373)	
Shock Protection	50 m/s^2, 30 msec (EN61373)	

All specifications are subject to change without prior notice.

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1.6 Overview

Front View
(MPT-7000R & MPT-7000RHV)

No.	Name	No.	Name
1	LED Indicators	5	USB 3.0 Receptacles
2	Reset Button	6	CFast / SIM Card Slot Door
3	Secondary Microphone Input	7	Antenna Holes
4	Secondary Line-out	8	SSD Drive Bays

Rear View

MPT-7000R:

MPT-7000RHV:

No.	Name	No.	Name
1	GPIO Connector	7	VGA Port * Optional with COM3 for MPT-7000RHV only
2	LED Indicators for LAN Ports	8	COM3 / CAN * Optional for MPT-7000R only
3	DVI-D Port	9	USB 2.0 Port (M12)
4	First Microphone Input	10	COM 1 & COM2 Ports
5	First Line-out	11	PCIe (x16) Slot (with x4 signals)
6	DC Power Input (M12)	12	LAN Port (M12)

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Oblique View
(MPT-7000R & MPT-7000RHV)

1.7   Fuse Dimensions

Unit: mm
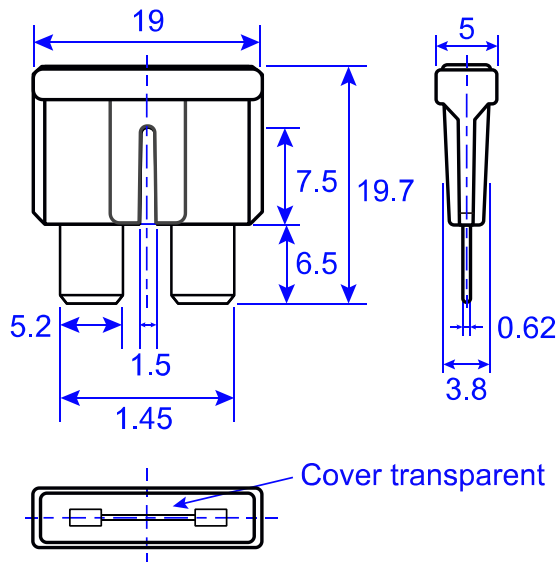
Fuse for MPT-7000R:	Fuse for MPT-7000RHV
Littlefuse® TAC ATO® Style Blade 15A, 58V DC	Littelfuse® Time-lag Fuse 477 series 5A, 400V DC
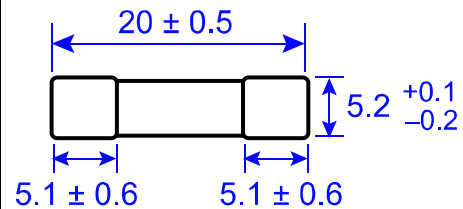
1.8   Device Dimensions

Unit: mm

MPT-7000R:

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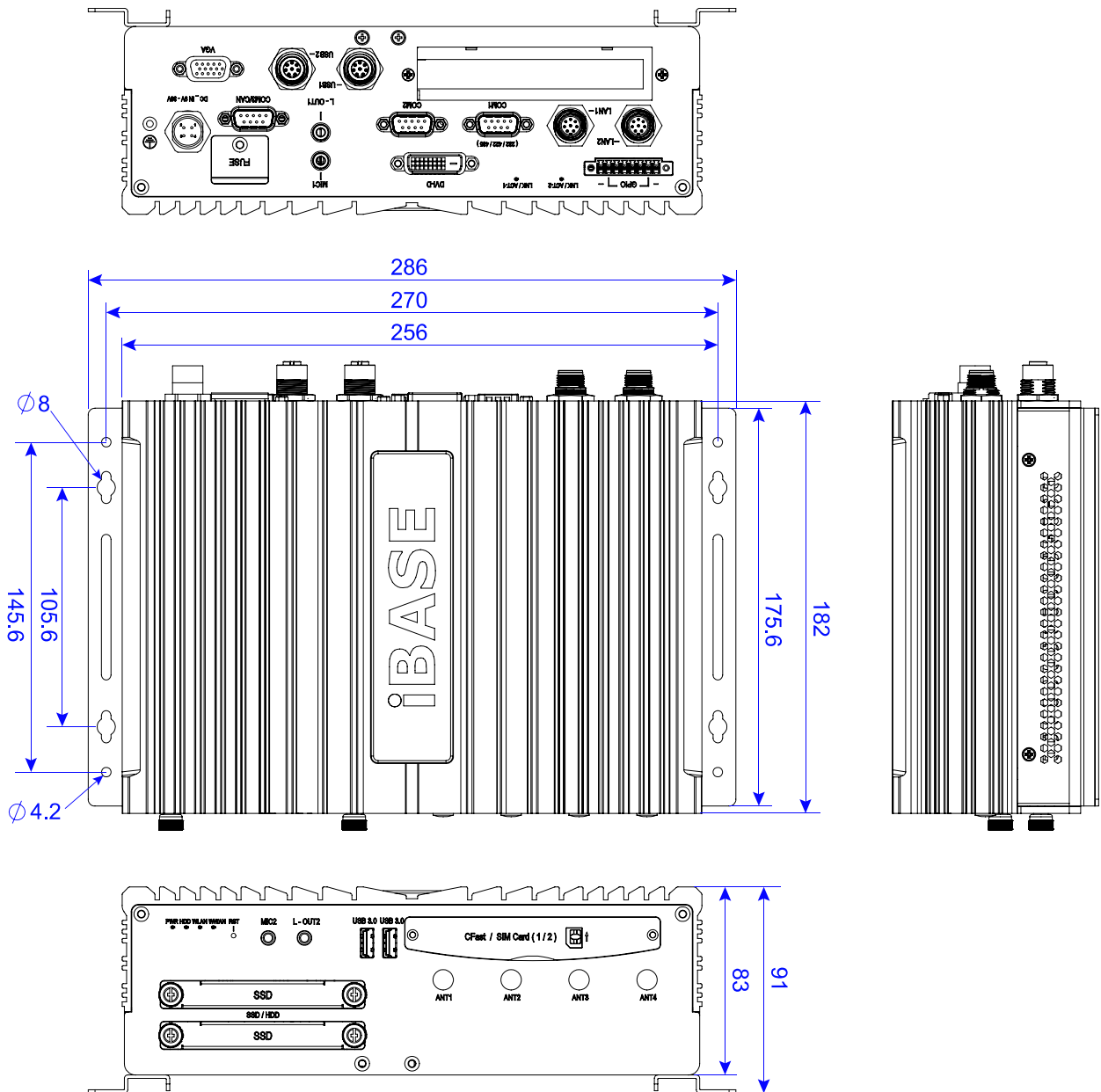
MPT-7000RHV:
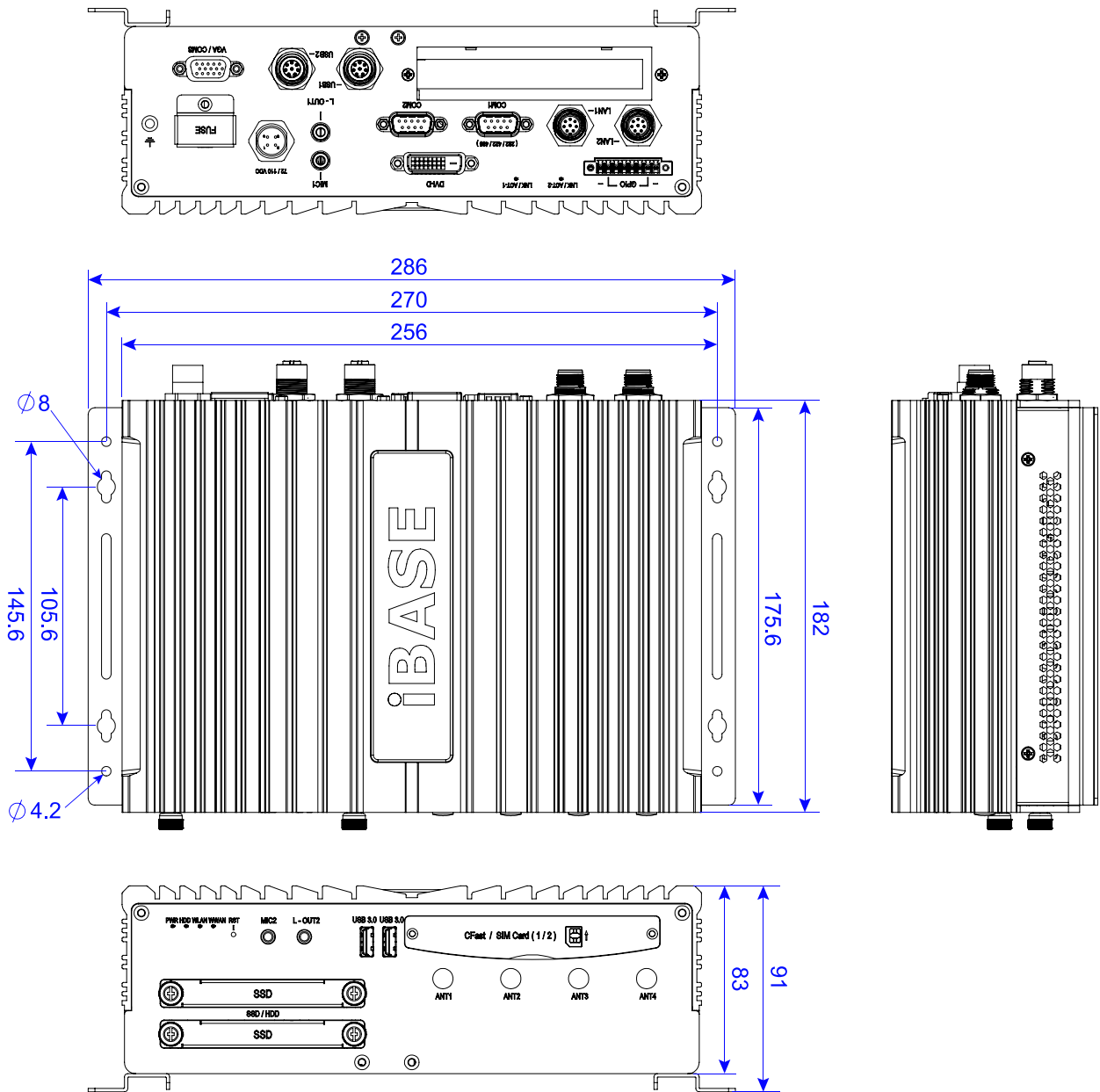
Chapter 2
Hardware Configuration

The information provided in this chapter includes:

- Essential installations
- Information and locations of connectors

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2.1 Essential Installations

2.1.1 Memory Installation

There are two SO-DIMM DDR4 memory slots inside MPT-7000R and the maximum memory supported is 32 GB. If you need to replace or install the modules, perform the following steps:

1. Release the following 6 screws to half open the bottom cover.

6 screws
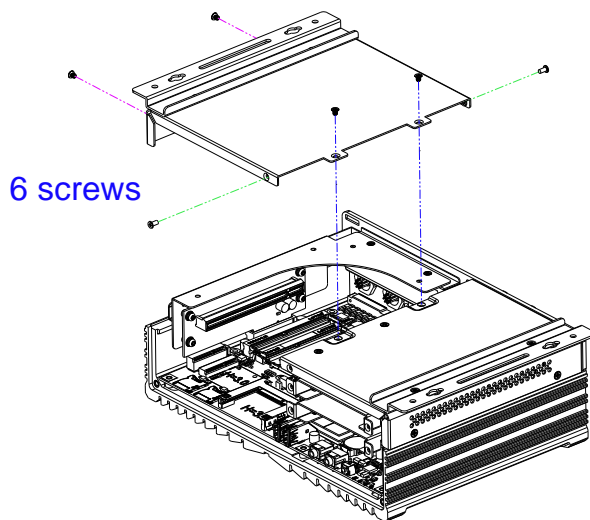
2. Locate the memory slot and align the key of the memory module with that on the memory slot.

3. Insert the module slantwise and gently push the module straight down until the clips of the slot close to hold the module in place when the module touches the bottom of the slot.

   To remove the module, press the clips outwards with both hands.
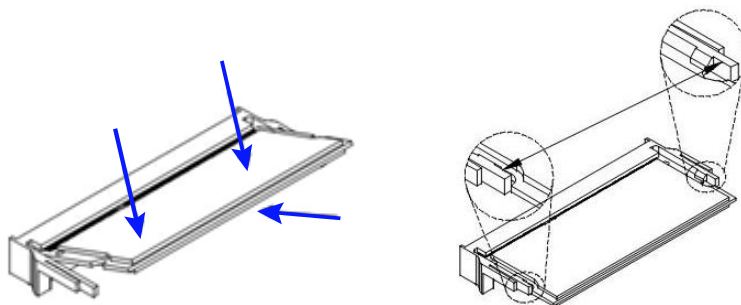
After installation, tighten 6 screws mentioned in Step 1 to secure the half bottom cover.

2.1.2   Storage Installation

You can use either SSD or M.2 SATA card, or use both for storage.
For SSD or M.2 SATA card replacement or installation, follow the instructions below.

Installation for 2.5" SSD

1. Release 2 screws to pull out an SSD tray (4 screws for 2 trays).
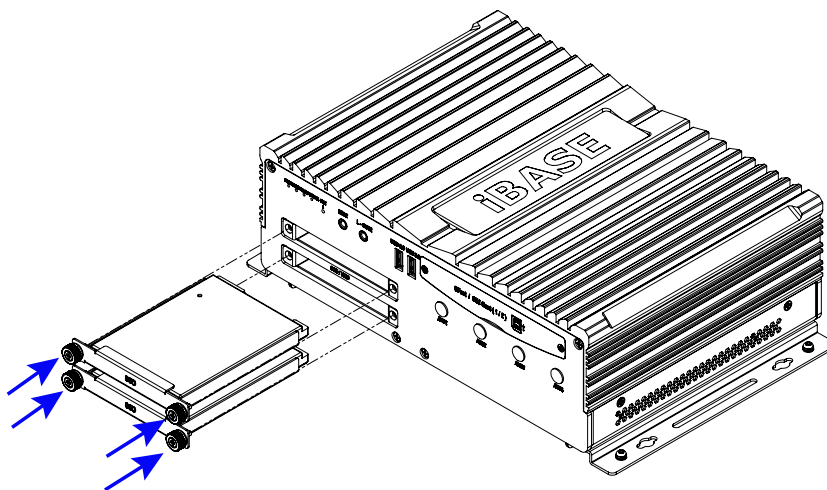
2. Put your 2.5" SSD onto the tray(s), and secure the SSD with the supplied 4 screws for each tray.
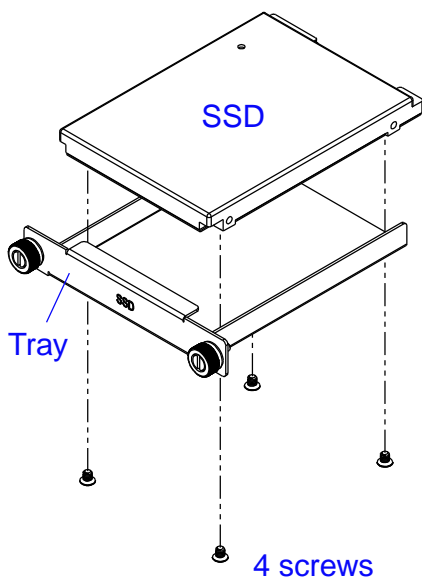
3. Put and secure the tray(s) back to the device.

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Installation for M.2 SATA Card

1. Release the following 4 screws to pull out the SSD trays.
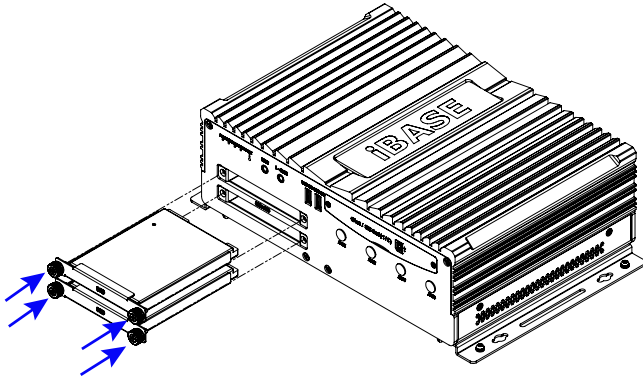
2. Release 4 screws to remove the front I/O cover and release 2 screws from the rear I/O cover.
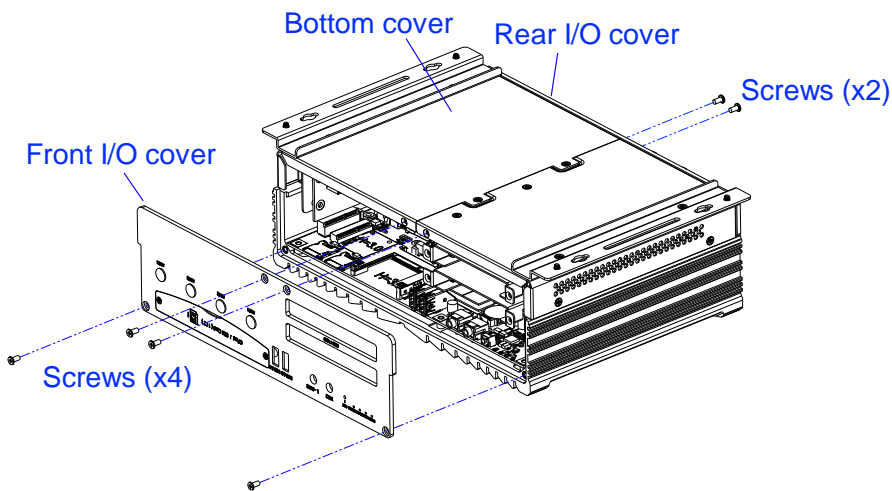
3. Release 4 screws below to remove the bottom cover of the device.
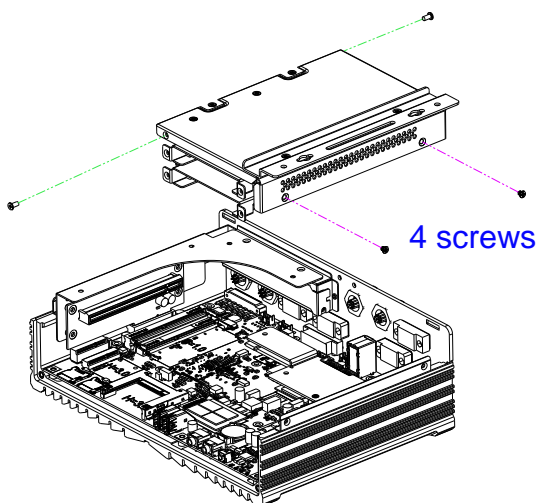
4. Install the M.2 SATA card .
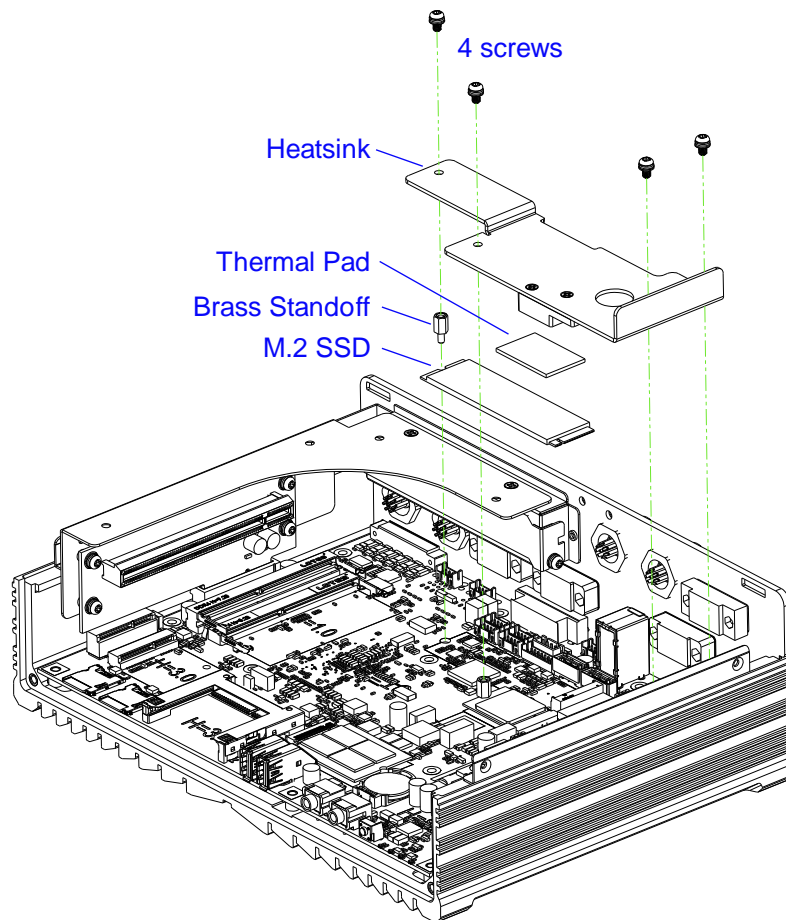
a.) Take out the heatsink by releasing 4 screws and remove the brass standoff as shown above.

b.) Align the key of the M.2 card to the M.2 interface, and insert the card slantwise.
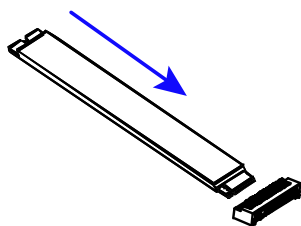
c.) Push the M.2 card down and fix the card with the brass standoff you just released.

d.) Put the supplied thermal pad (the thin one) onto the M.2 card and secure the heatsink back with 4 round head screws.

After installation, secure the bottom cover and front I/O cover and put back the SSD trays.

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2.1.3   CFast & Micro-SIM Card Installation

1. Release 2 screws as shown below to open the CFast & Micro-SIM card slot door.
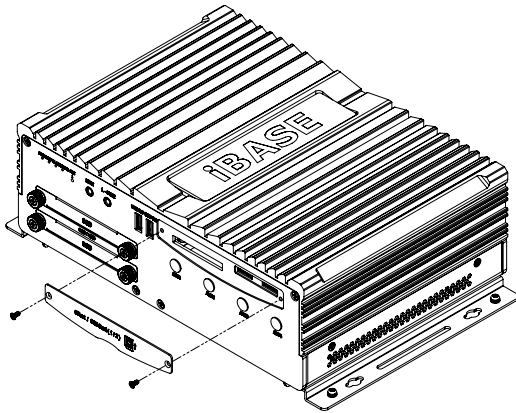
2. **For CFast card,** insert the card as below.
    To remove the CFast card, push the card again.
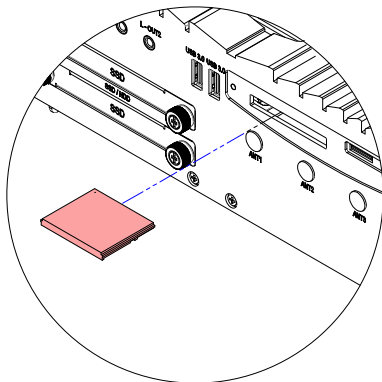
3. **For micro-SIM card,** insert the card to one of the micro-SIM card slot with the chip up and push the card by using your fingernail or a corner of the CFast & micro-SIM card door. Then refer to *2.1.4 Mini-PCIe & M.2 Network Cards Installation* for further installation.

    To remove the micro-SIM card, push the card again.
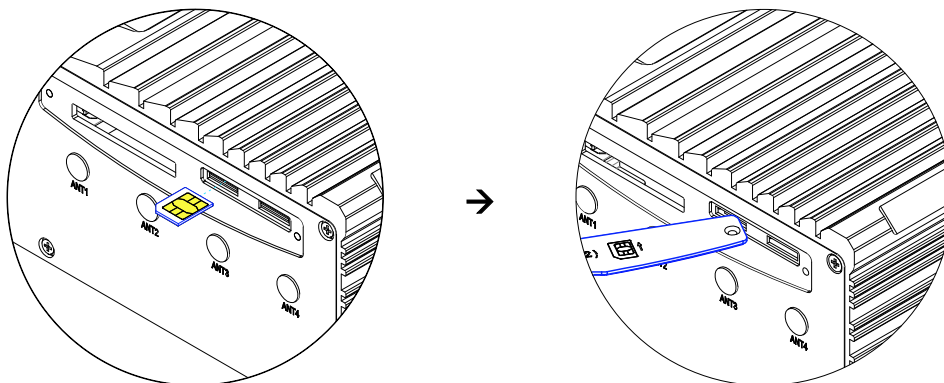
2.1.4   Mini-PCIe & M.2 Network Cards Installation

Before you start, firstly pay attention to the interrelation among the SIM card slots, mini-PCIe slot, and M.2 slot as below.

Full-Size Mini-PCIe Slot:
Interrelated with SIM Card Slot (2)

SIM Card Slot (1) (2)

SIM Card Slot (2) (1)

M.2 Slot:
Interrelated with SIM Card Slot (1)
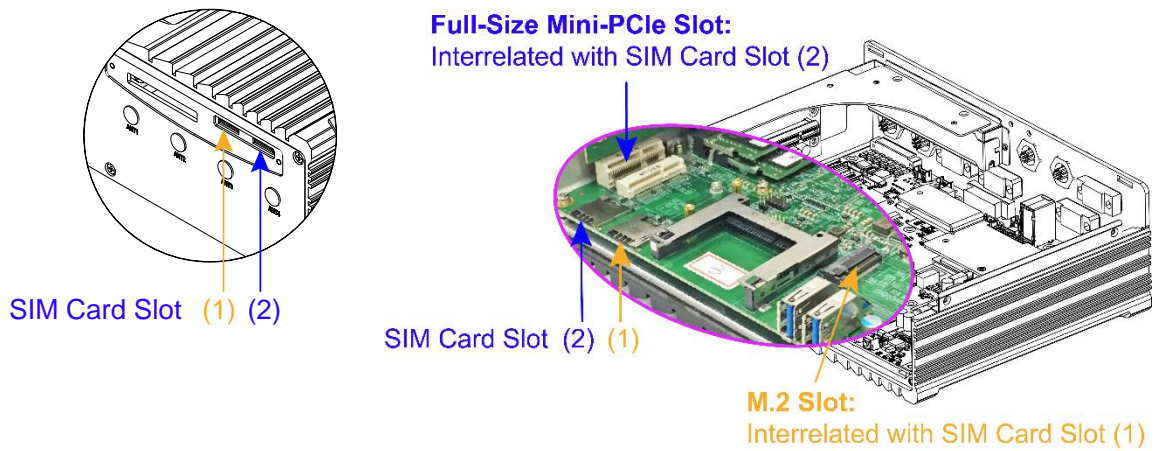
For mini-PCIe card installation, release the following 6 screws to half open the bottom cover.
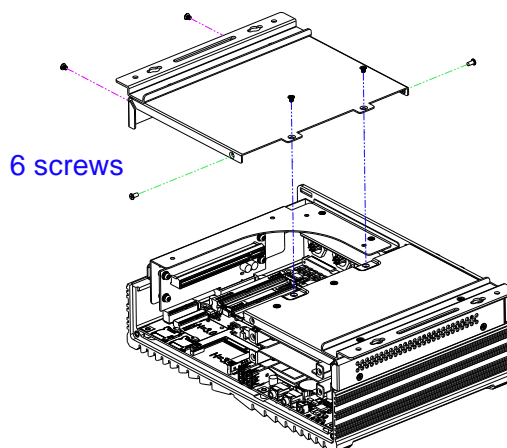
6 screws

For M.2 card installation, you need to remove the whole bottom cover by referring to the section *Installation for M.2 SATA Card* in *2.1.2 Storage Installation*. If the device is half open already, open the other half by loosening 4 screws below.
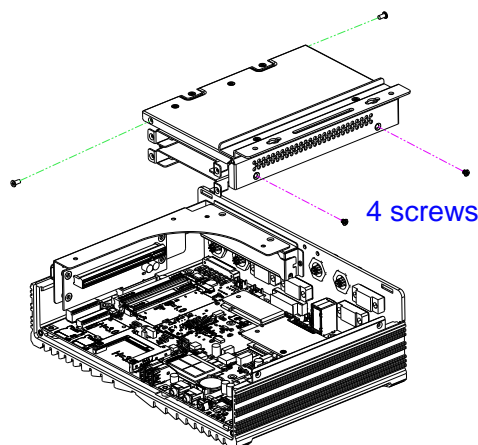
4 screws

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1. Locate the mini-PCIe slot, align the key of the mini-PCIe card to the interface, and insert the card slantwise.

   (Insert the M.2 network card in the same way.)
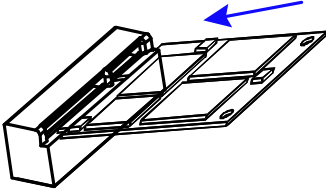
2. Push the mini-PCIe card down, fix it with the supplied 2 flat head screws for full-sized card and with one screw for half-sized card.

   (Fix the M.2 3G / 4G card with a supplied round head screw.)
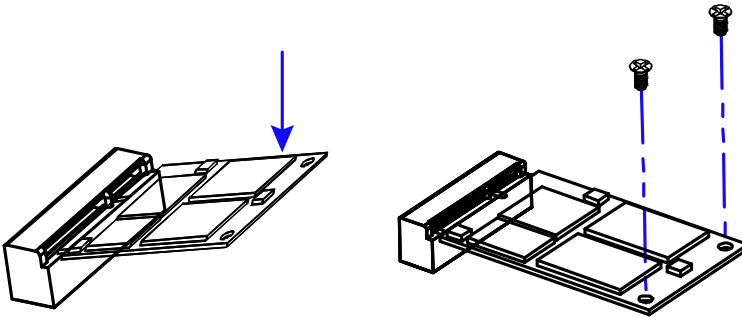
2.1.5 WiFi / 3G / 4G Antenna Installation

Thread the WiFi / 3G / 4G antenna extension cable through an antenna hole of the front I/O cover and fasten the antenna as shown below. Then apply adhesive to the edge of the hex nut behind the front I/O cover to prevent the extension cable from falling if the cable becomes loose.

1. Thread and fasten the hex nut and the washer. Then install the antenna.

2. Apply adhesive around here.

Info: The diameter of the nut is around 6.35 mm (0.25"-36UNC).

2.1.6   PCIe (x16) Expansion Card Installation

1. Release the following 6 screws to half open the bottom cover.
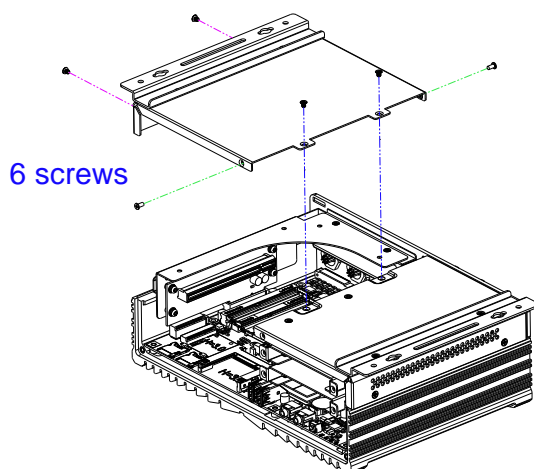
6 screws

2. Release two screws on the rear I/O cover to take out the PCIe expansion bracket. Then loosen a screw to separate the PCIe expansion bracket and its shield.

PCIe Expansion Bracket

Shield for
PCIe Expansion Bracket

Screw

Rear I/O Cover

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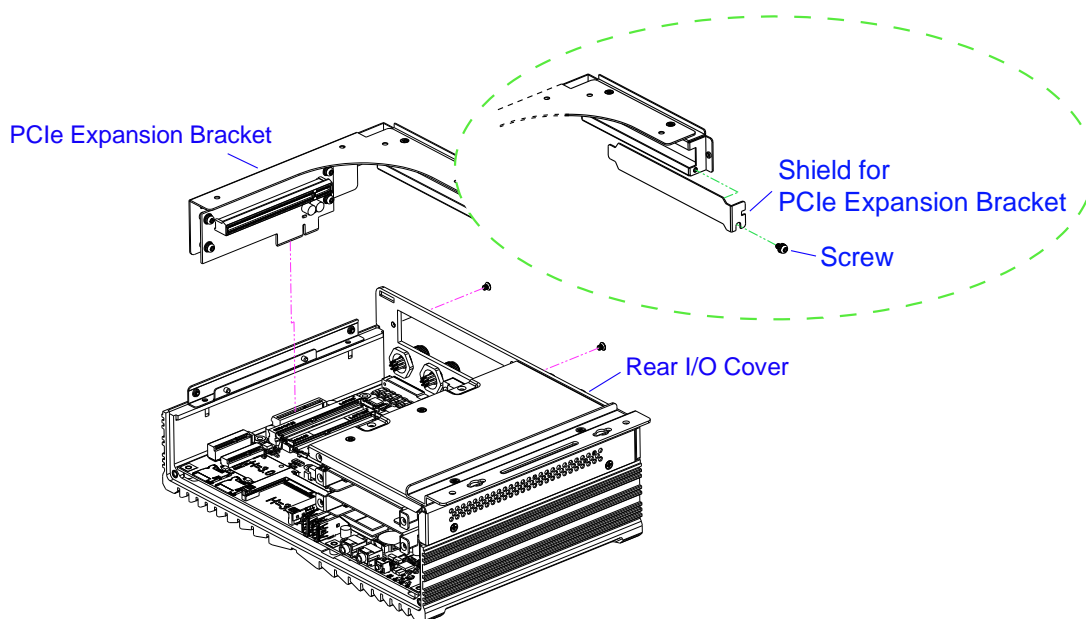
3. Install the PCIe (x16) expansion card and fix the card to the bracket by tightening the screw as below.

PCIe Expansion Card
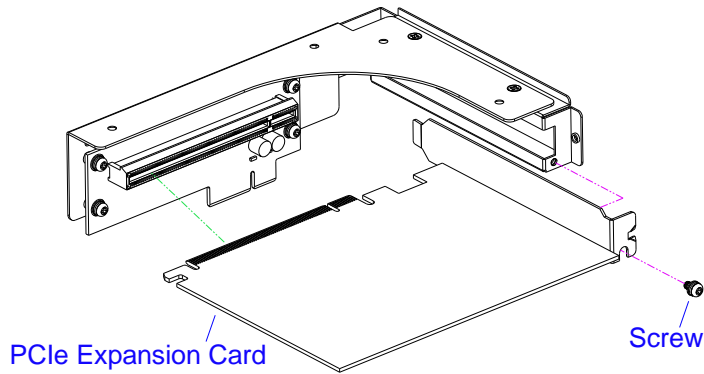
Screw

4. Install the bracket with the card back to the device and tighten 2 screws to fix the bracket.

PCIe Expansion Bracket

2 screws

Rear I/O Cover
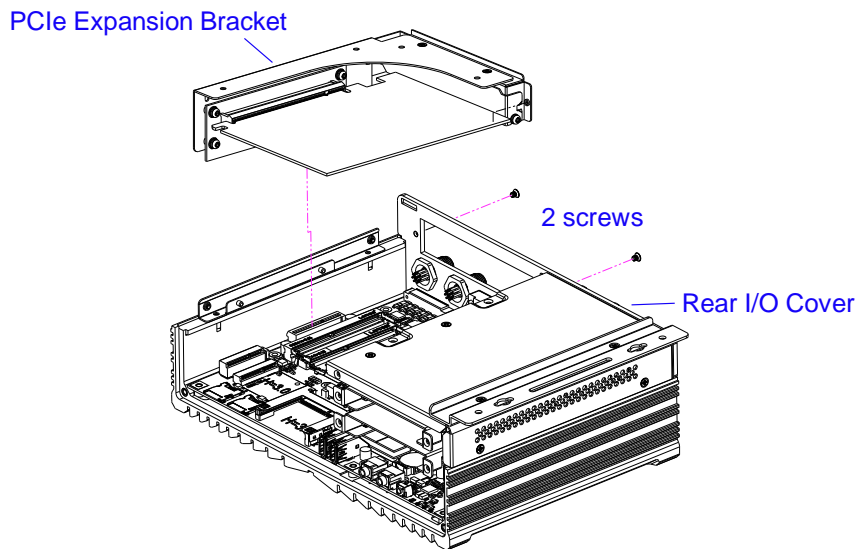
After installation, tighten 6 screws mentioned in Step 1 to secure the half bottom cover.

2.1.7   Mounting Brackets Installation

Note: Before mounting the system on wall, ensure that you are following all applicable building and electric codes.

Requirements

When mounting, ensure that you have enough room for power and signal cable routing. And have good ventilation for power adapter. The method of mounting must be able to support weight of the MPT-7000R plus the suspend weight of all the cables to be attached to the system. Use the following methods for mounting your system:

Selecting the Location

Plan the mounting location thoroughly. Locations such as walkway areas, hallways, and crowded areas are not recommended. Mount the product to a flat, sturdy, structurally sound column or wall surface.

The best mounting surface is a standard countertop, cabinet, table, or other structure that is minimally the width and length of the product. This will reduce the risk that someone may accidentally wall into and damage the product. Local laws governing the safety of individuals might require this type of consideration.

Selecting the type of wall construction

1. Mounting on a hollow wall

    - **Wood surface**
      Use construction-grade wood and the recommended minimum thickness is 38 x 25.4 mm (1.5" x 10").

      Note: This method provides the most reliable attachment for the product with little risk that the product may come loose or require ongoing maintenance.

    - **Drywall**
      Drywall over wood studs is acceptable.

2. Mounting on a solid concrete or brick wall with flat and smooth surface

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Installation instructions:

1. Turn your MPT-7000R upside down, attach the mounting brackets to MPT-7000R, and secure with the supplied 4 screws as below.
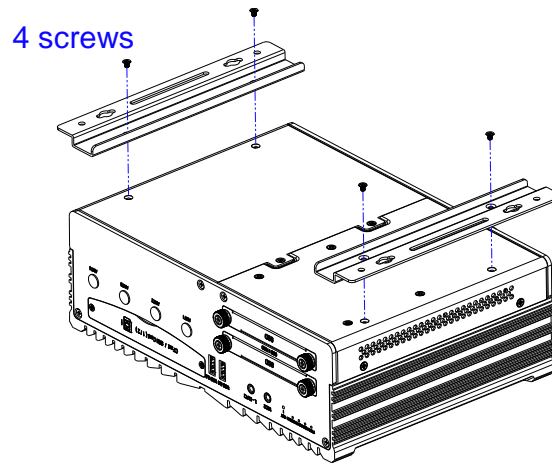
2. Prepare at least 4 screws (M3, 6 mm) to mount MPT-7000R on wall .
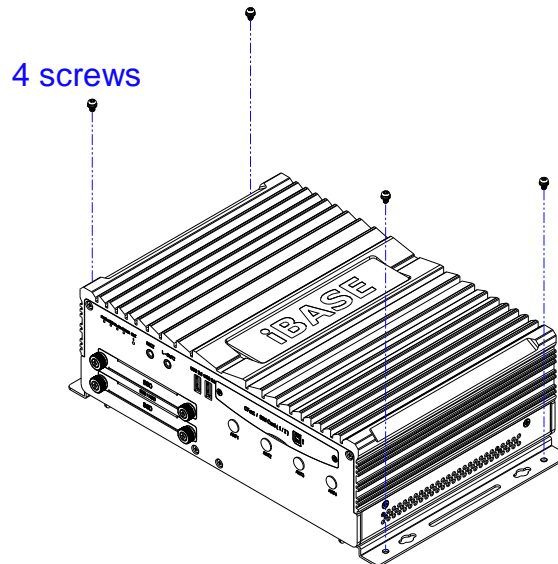
You can install MPT-7000R on plastic (LCD monitor), wood, drywall surface over studs, or a solid concrete or metal plane directly. The types of fasteners required are dependent on the type of wall construction.

Fasteners are not supplied in the product package. You will need to prepare the fasteners. Choose fasteners that are rated either **Medium Duty** or **Heavy Duty**. To assure proper fastener selection and installation, follow the fastener manufacturer's recommendations.

2.1.8   Pinout for M12 Connectors (Power Input, USB 2.0, LAN)

- **Power Input (M12, 4 pins, male A-coded)**
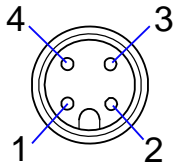
Pin	Assignment	Pin	Assignment
1	Ignition	3	Ground
2	Ground	4	DC-Input

- **USB 2.0 Port (M12, 4 pins, female D-coded)**
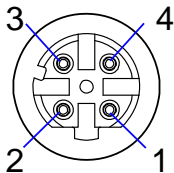
Pin	Assignment	Pin	Assignment
1	+5V	3	D+
2	Ground	4	D-

- **LAN Port (M12, 8 pins, male A-coded)**
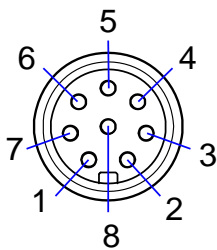
Pin	Assignment	Pin	Assignment
1	MX1+	5	MX2-
2	MX3-	6	MX4+
3	MX3+	7	MX1-
4	MX4-	8	MX2+

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2.1.9 Pinout for COM Ports & GPIO Connector

- **COM1 RS232/422/485 Port**
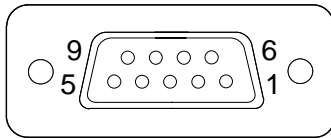
Pin	Assignment	Pin	Assignment
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	RI, Ring indicator
5	Ground		

Pin	Assignment		
	RS-232	**RS-422**	**RS-485**
1	DCD	TX-	DATA-
2	RX	TX+	DATA+
3	TX	RX+	NC
4	DTR	RX-	NC
5	Ground	Ground	Ground
6	DSR	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	RI	NC	NC

- **COM2 / COM3 RS-232 Ports**
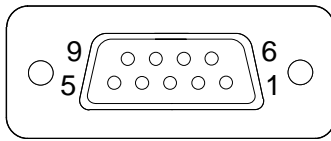
Pin	Assignment	Pin	Assignment
1	DCD, Data carrier detect	6	DSR, Data set ready
2	RXD, Receive data	7	RTS, Request to send
3	TXD, Transmit data	8	CTS, Clear to send
4	DTR, Data terminal ready	9	RI, Ring indicator
5	Ground		

- **GPIO Connector (terminal block)**
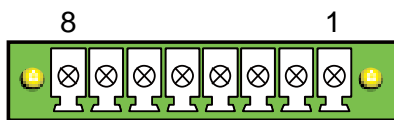
Pin	Assignment	Pin	Assignment
1	Ground	5	DIO4
2	DIO1	6	DIO5
3	DIO2	7	DIO6
4	DIO3	8	Ground

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2.2 Setting the Jumpers

Set up and configure your MPT-7000R by using jumpers for various settings and features according to your needs and applications. Contact your supplier if you have doubts about the best configuration for your use.

2.2.1 How to Set Jumpers

Jumpers are short-length conductors consisting of several metal pins with a non-conductive base mounted on the circuit board. Jumper caps are used to have the functions and features enabled or disabled. If a jumper has 3 pins, you can connect either PIN1 to PIN2 or PIN2 to PIN3 by shorting.

A 3-pin jumper   **A jumper cap**
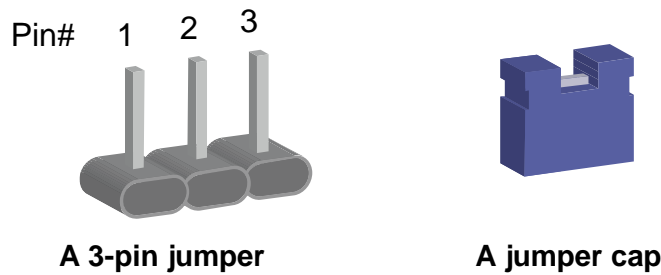
Refer to the illustration below to set jumpers.

Pin closed	Oblique view	Schematic illustration in the manual
Open		
1-2		
2-3		

When two pins of a jumper are encased in a jumper cap, this jumper is **closed**, i.e. turned **On**.

When a jumper cap is removed from two jumper pins, this jumper is **open**, i.e. turned **Off**.

2.3 Jumper & Connector Locations on Motherboard

Motherboard: MBT-7001R

MBT-7001R - top

iBASE

LED5 LED6

Intel®
6th Gen.
Core™
i7-6600U
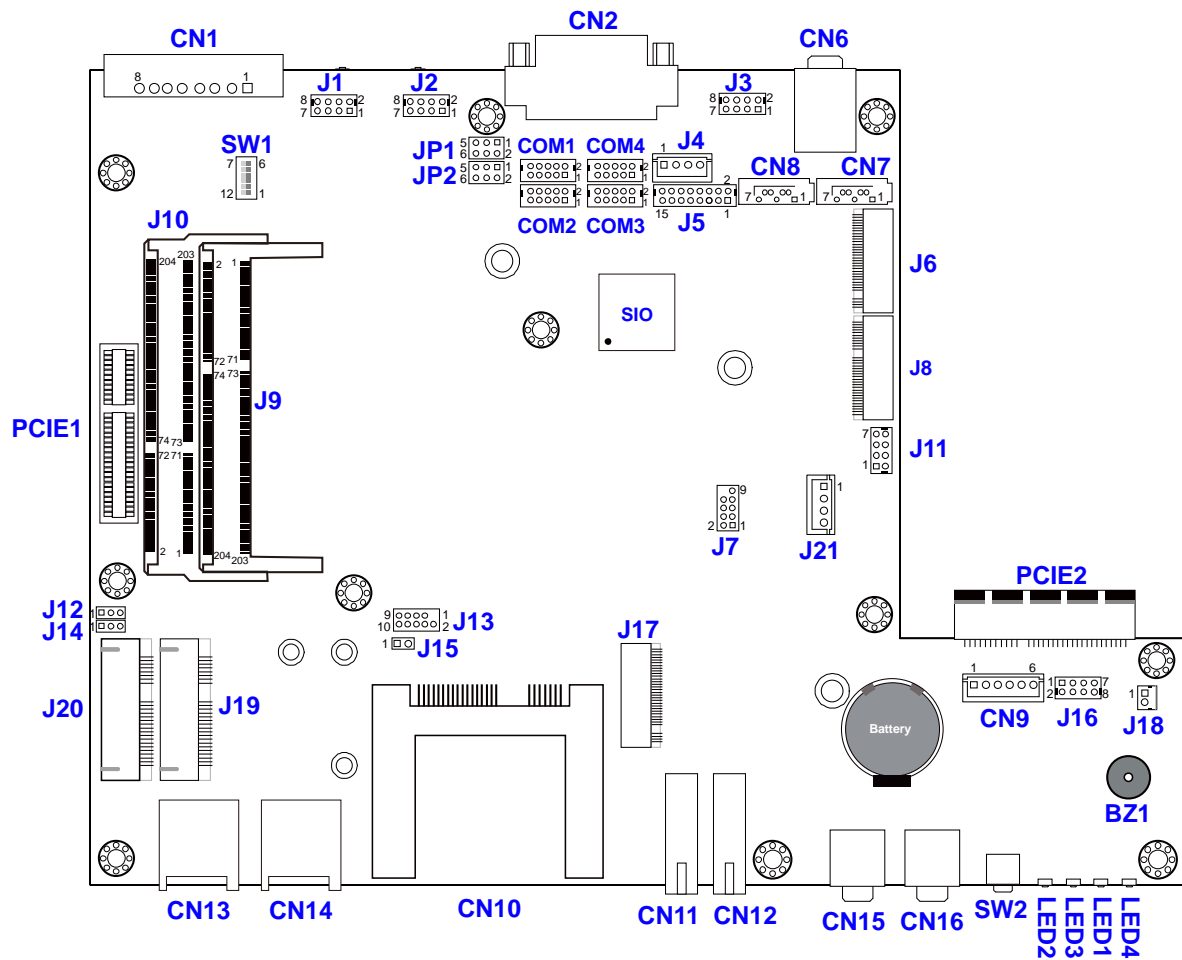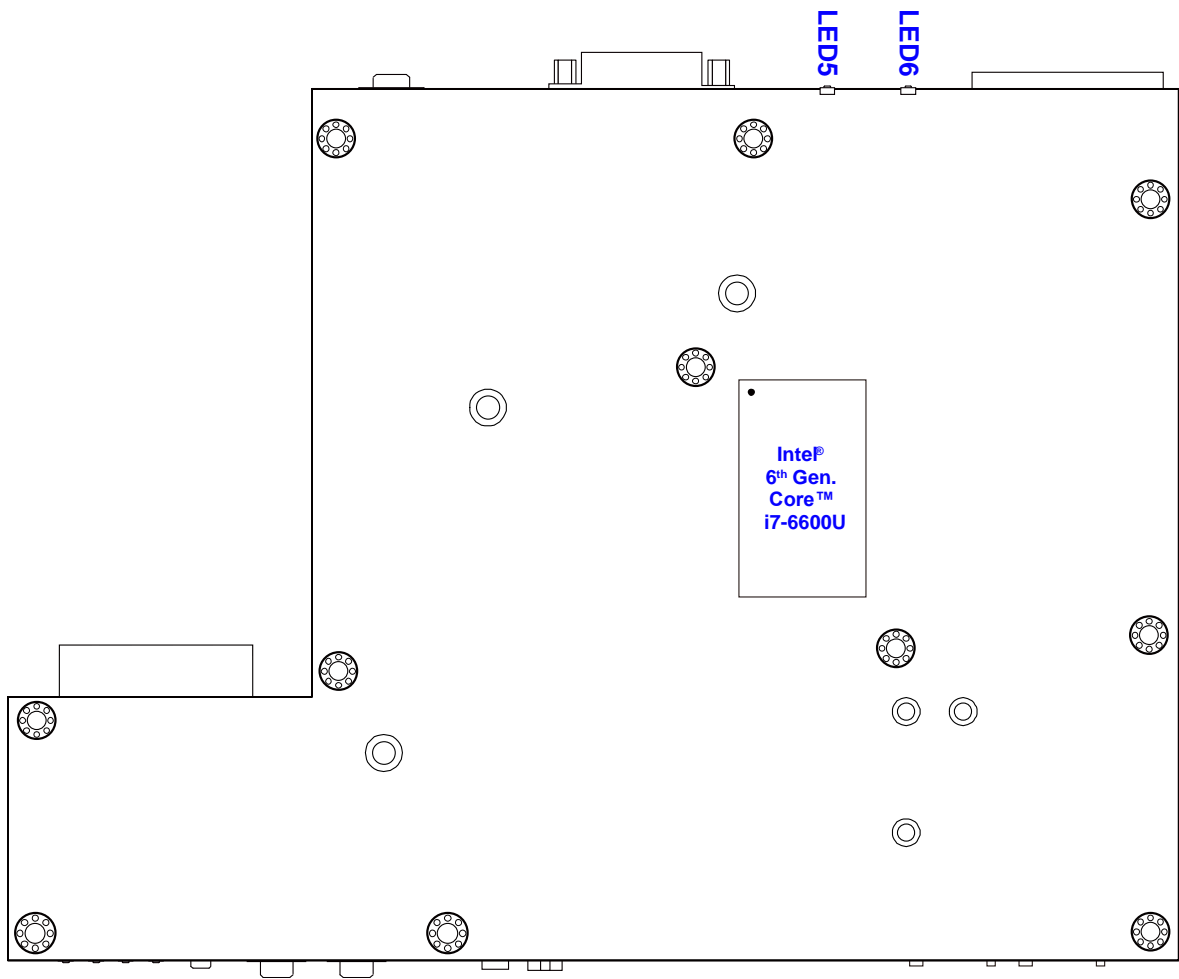
MBT-7001R - bottom

2.4 Jumpers Quick Reference

Function	Connector Name	Page
COM1 & COM2 Voltage Selection	JP1, JP2	29
ME Register Clearance	J12	30
CMOS Data Clearance	J14	30
Flash Descriptor Security Override Selection	J15	31
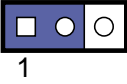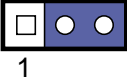
2.4.1 COM1 & COM2 Voltage Selection (JP1, JP2)

JP1
(for COM1)

JP2
(for COM2)
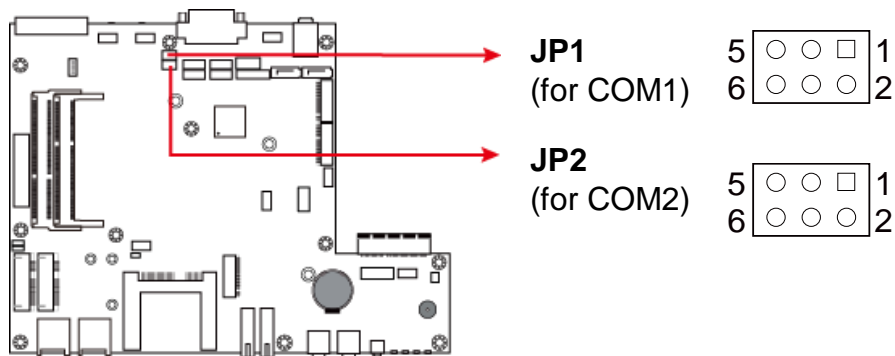
Function	Pin closed	Illustration
12V	1-3	
RI (default)	3-4	
5V	3-5	

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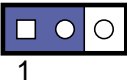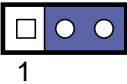
2.4.2   ME Register Clearance   (J12)
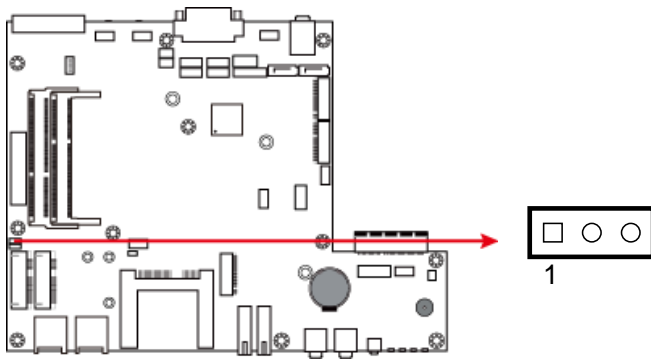
Function	Pin closed	Illustration
Normal (default)	1-2	
Clear ME Register	2-3	
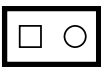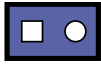
2.4.3   CMOS Data Clearance   (J14)
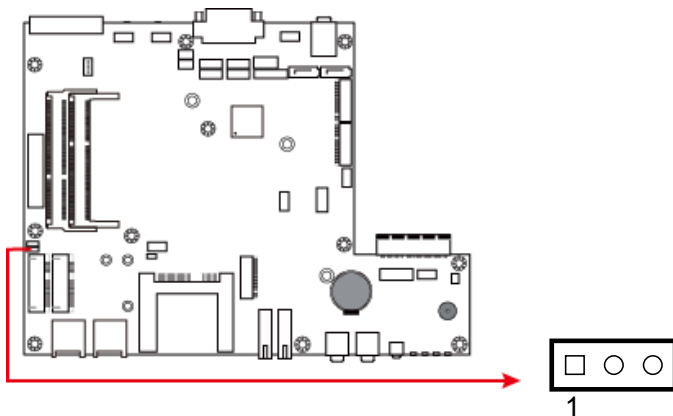
Function	Pin closed	Illustration
Normal (default)	1-2	
Clear CMOS	2-3	

2.4.4   Flash Descriptor Security Override Selection   (J15)
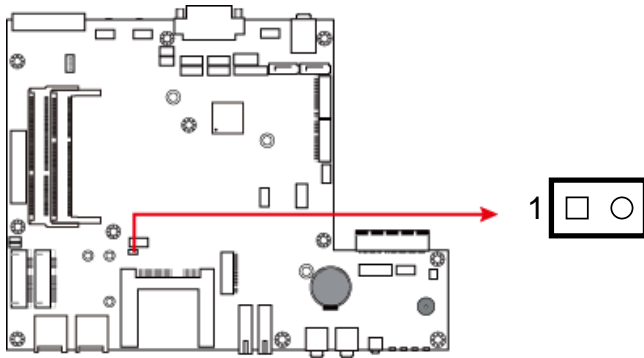
Function	Pin closed	Illustration
No override (default)	Open	1 ▢ ○
Override	Close	1 ▢ ○

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2.5 Connectors Quick Reference

Function	Connector Name	Page
PCIe (x4) Slot	PCIE1	34
DC Power Input 12V Connector	PCIE2	34
COM Port	COM1, COM2, COM3, COM4	35
Digital I/O Connector	CN1	35
DVI-D Port	CN2	36
Audio Jacks	CN6 (system rear), CN15, CN16 (system front)	36
SATA III Connector	CN7, CN8	36
CFast Connector	CN10	37
USB 3.0 Port	CN11, CN12	37
SIM Card Slot	CN13 (interrelated with J20), CN14 (interrelated with J17)	37
GbE LAN Port	J1, J2	38
USB 2.0 Port	J3	38
SATA HDD Power Connector	J4, J21	38
CRT Connector	J5	39
M.2 M2280 SATA Interface	J6	39
M.2 E2230 USB2.0 / PCIe (x1) Interface	J8	40
DDR4 SO-DIMM Socket	J9 (channel A), J10 (channel B)	40
Future Connector for CAN Module Connection	J11	41
M.2 B3042 USB2.0 Interface	J17 (interrelated with CN14)	41
Half-Size Mini-PCIe USB2.0 Connector	J19	42
Full-Size Mini-PCIe USB2.0 / PCIe (x1) Connector	J20 (interrelated with CN13)	42
Reset Button	SW2	42
Digital IO Pull High to +5V Switch	SW1	43

Function	Connector Name	Page
LED Indicators	LED1 (for storage, white), LED2 (for WWAN, amber) LED3 (for WLAN, blue) LED4 (for MB Power, green) LED5 (for LAN, green) LED6 (for LAN, green)	- -
Power Board +12V Connector (Reserved)	CN9	- -
Power Connector (Reserved)	J16	- -
Motherboard Power Button Connector	J18	- -
Factory Use Only	J7, J13	- -

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2.5.1   PCIe (x4) Slot   (PCIE1)
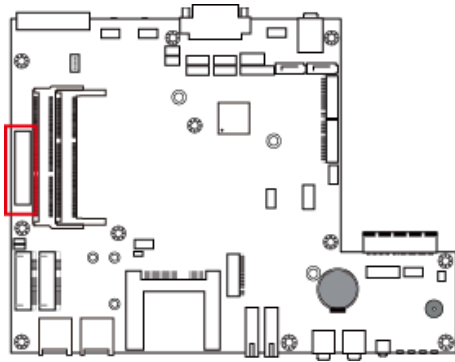
2.5.2   Power Module Interface   (PCIE2)
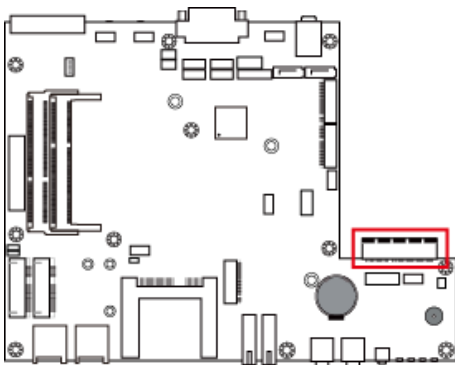
2.5.3   COM Port   (COM1, COM2, COM3, COM4)
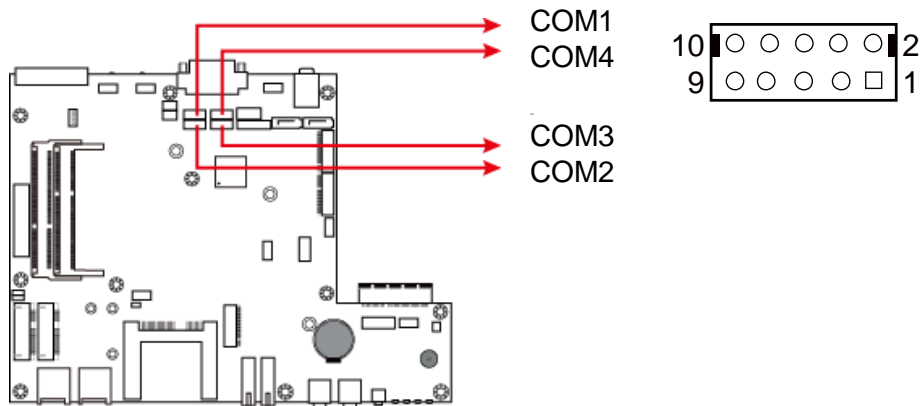
Pin	Assignment	Pin	Assignment
1	DCD	2	RXD
3	TXD	4	DTR
5	Ground	6	DSR
7	RTS	8	CTS
9	RI	10	NC

2.5.4   Digital I/O Connector   (CN1)
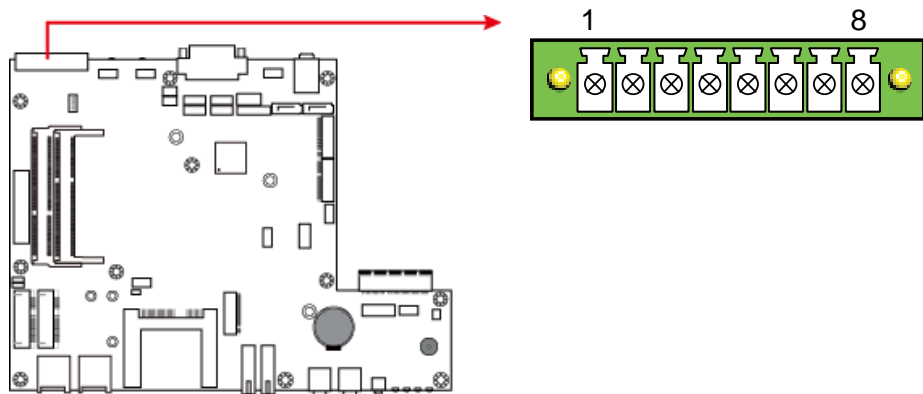
Pin	Assignment	Pin	Assignment
1	Ground	5	DIO4
2	DIO1	6	DIO5
3	DIO2	7	DIO6
4	DIO3	8	Ground

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2.5.5　DVI-D Port　(CN2)
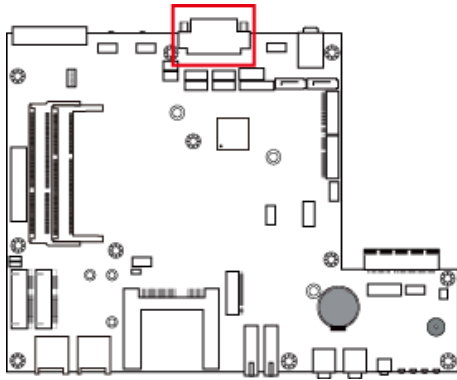
2.5.6　Audio Jack　(CN6, CN15, CN16)
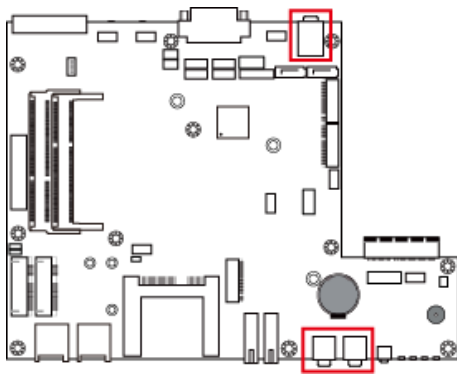
2.5.7　SATA III Connector　(CN7, CN8)
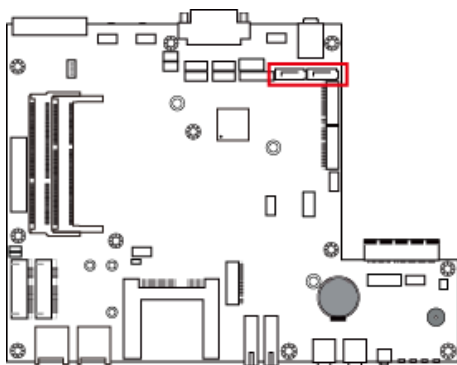
2.5.8 CFast Connector (CN10)
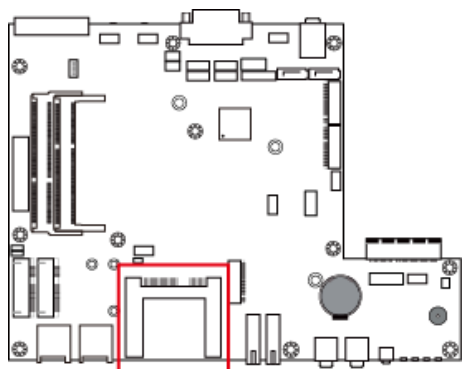
2.5.9 USB 3.0 Port (CN11, CN12)
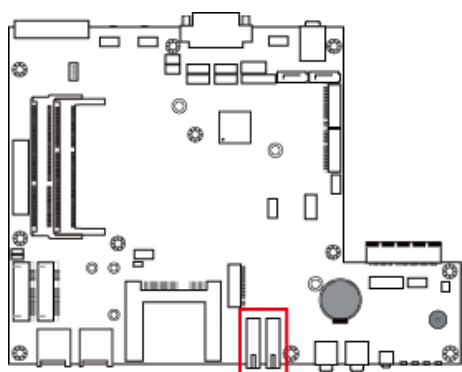
2.5.10 SIM Card Slot (CN13, CN14)
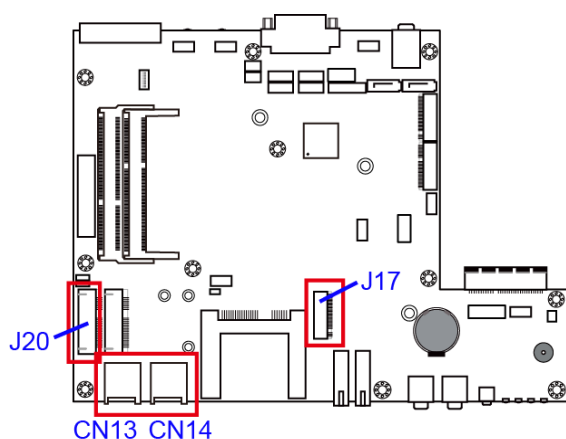
CN13 is interrelated with the mini-PCIe slot J20.
CN14 is interrelated with the M.2 slot J17.

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2.5.11 GbE LAN Port (J1, J2)
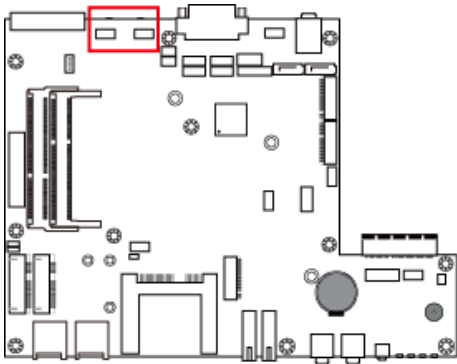
2.5.12 USB 2.0 Port (J3)
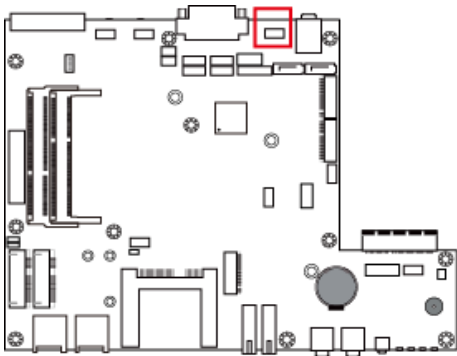
2.5.13 SATA HDD Power Connector (J4, J21)

J4:

J21:
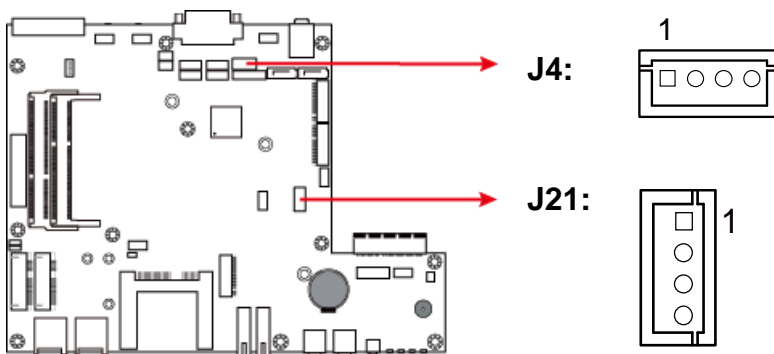
Pin	Assignment	Pin	Assignment
1	+5V	3	Ground
2	Ground	4	+12V

2.5.14 CRT Connector (J5)
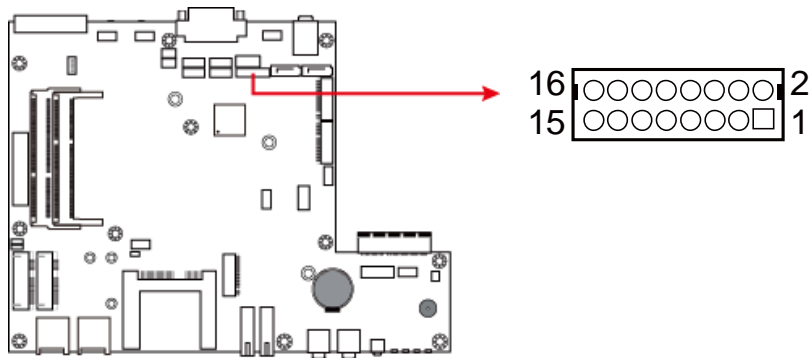
Pin	Assignment	Pin	Assignment
1	Red	2	VCC
3	Green	4	Ground
5	Blue	6	NC
7	NC	8	DDCDATA
9	Ground	10	HSYNC
11	Ground	12	VSYNC
13	Ground	14	DDCCLK
15	Ground	16	NC

2.5.15 M.2 M2280 SATA Interface (J6)

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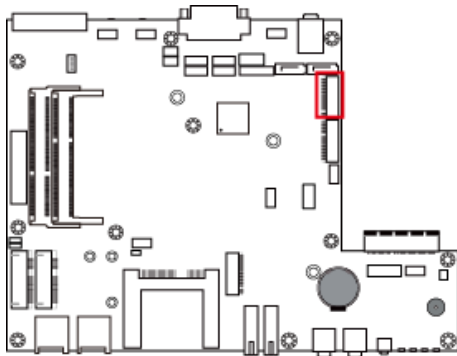
2.5.16 M.2 E2230 USB2.0 / PCIe (x1) Interface (J8)
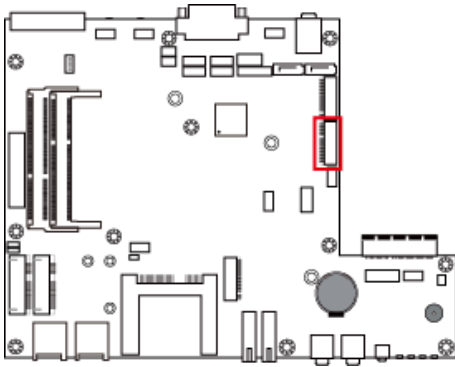
2.5.17 DDR4 SO-DIMM Socket (J9, J10)
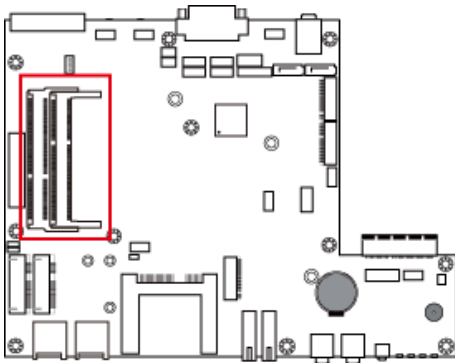
J9 (channel A)
J10 (channel B)

2.5.18 Future Connector for CAN Module Connection (J11)
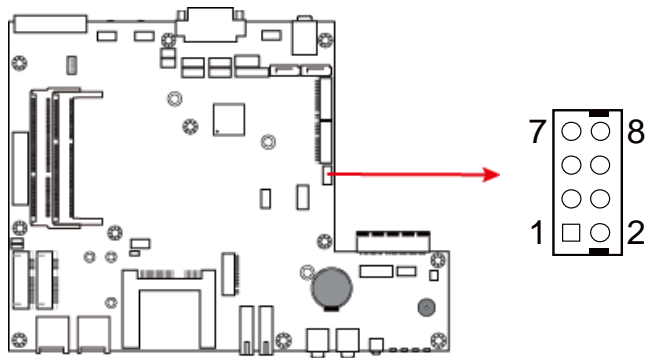
Pin	Assignment	Pin	Assignment
1	+5V	2	Ground
3	USB-	4	COM6_TX
5	USB+	6	COM6_RX
7	Ground	8	+5V

2.5.19 M.2 B3042 USB2.0 Interface (J17)
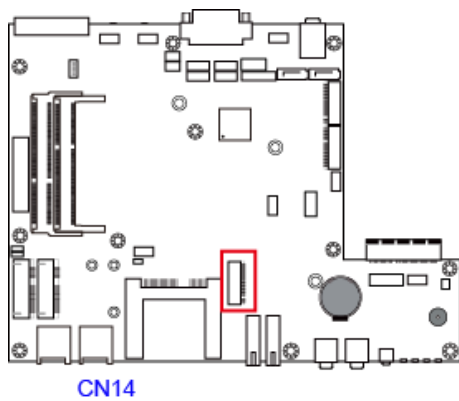
CN14

J17 is interrelated with the SIM card slot CN14.

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2.5.20 Half-Size Mini-PCIe USB2.0 Connector (J19)
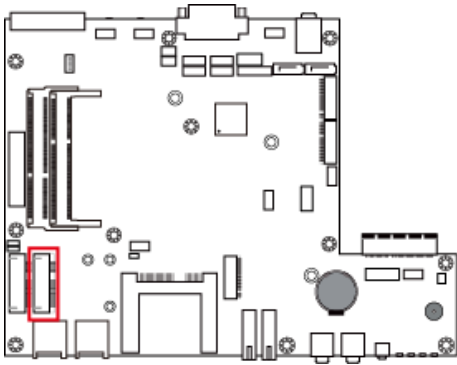
2.5.21 Full-Size Mini-PCIe USB2.0 / PCIe (x1) Connector (J20)
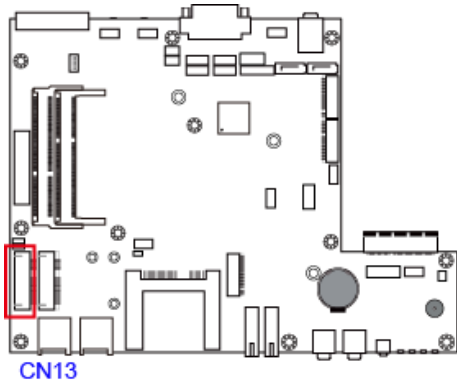
CN13

J20 is interrelated with the SIM card slot CN13.

2.5.22 Reset Button (SW2)
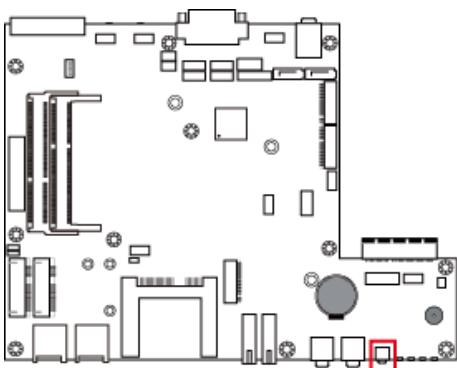
2.5.23   Digital IO Pull High to +5V Switch   (SW1)
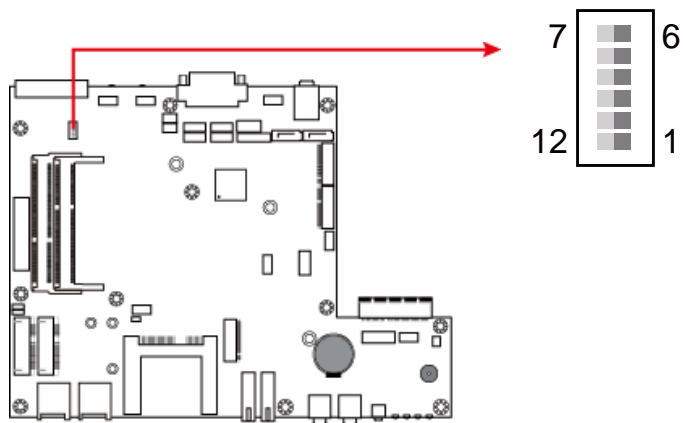
Switch to **ON** to pull high to 5V.
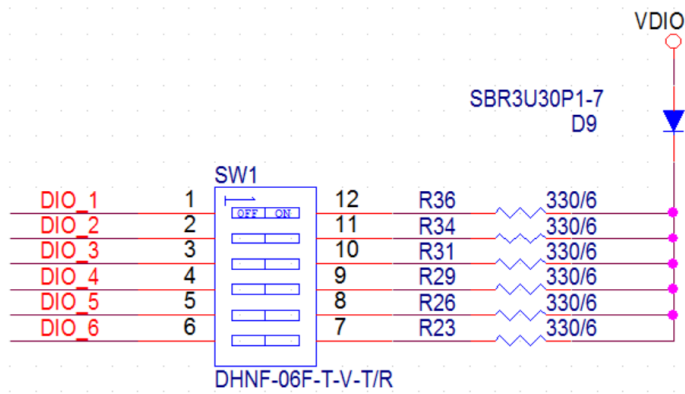
Pin	Assignment	Pin	Assignment
1	DIO1	7	5V
2	DIO2	8	5V
3	DIO3	9	5V
4	DIO4	10	5V
5	DIO5	11	5V
6	DIO6	12	5V

Chapter 3
Driver Installation

The information provided in this chapter includes:

- Intel® Chipset Software Installation Utility
- VGA Driver Installation
- HD Audio Driver Installation
- LAN Driver Installation
- Intel® Management Engine Driver Installation
- USB 3.0 Driver Installation
- G-Sensor Driver Installation

IBASE

3.1   Introduction

This section describes the installation procedures for software drivers. The software drivers are in a disk enclosed with the product package. If you find anything missing, please contact the distributor where you made the purchase.

Note: After installing your Windows operating system, you must install the Intel® Chipset Software Installation Utility first before proceeding with the drivers installation.

3.2   Intel® Chipset Software Installation Utility

The Intel® Chipset drivers should be installed first before the software drivers to install INF files for Plug & Play function for the chipset components. Follow the instructions below to complete the installation.

1. Insert the disk enclosed in the package. Click **Intel** and then **Intel(R) Skylake-U Chipset Drivers**.

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2. Click **Intel(R) Chipset Software Installation Utility**.

3. When the *Welcome* screen to the Intel® Chipset Device Software appears, click **Next** to continue.

4. Click **Yes** to accept the software license agreement and proceed with the installation process.

5. On the *Readme File Information* screen, click **Next** for installation.

6. The driver has been completely installed. You are suggested to restart the computer changes to take effect.

3.3 VGA Driver Installation

1. Click **Intel** and then **Intel(R) Skylake-U Chipset Drivers**.

2. Click **Intel(R) HD Graphics Driver**.

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3. When the *Welcome* screen appears, click **Next** to continue.
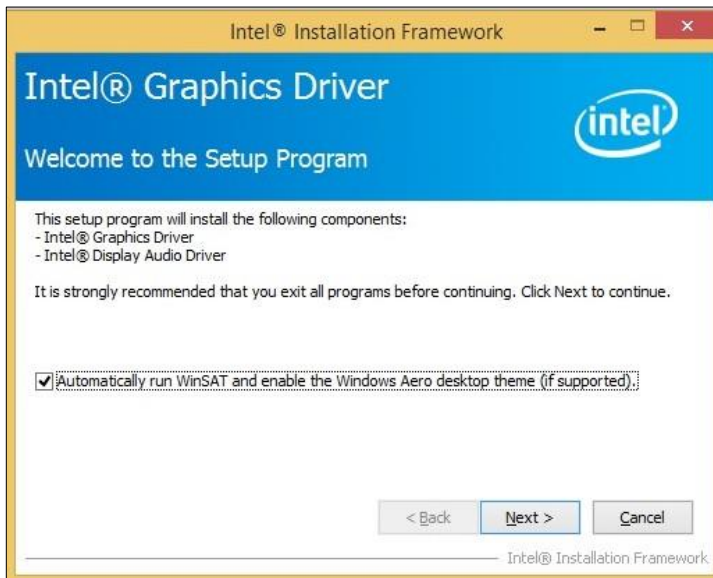
4. Click **Yes** to agree with the license agreement and then click **Install** for installation.

5. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

3.4   HD Audio Driver Installation

1. Click **Intel** and then **Intel(R) Skylate-U Chipset Drivers**.

2. Click **Realtek High Definition Audio Driver**.

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3. On the *Welcome* screen of the InstallShield Wizard, click **Next** for installation.
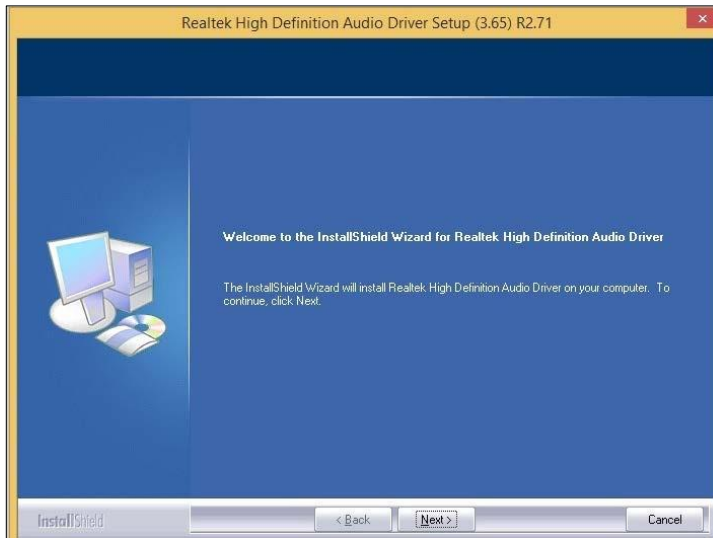
4. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

3.5   LAN Driver Installation

1. Click **LAN Card** and then **Intel(R) Skylake-U Chipset Drivers**

2. Click **Intel(R) PRO LAN Network Drivers.**.

3. On the screen of Intel® Network Connections, click **Install Drivers and Software.**.
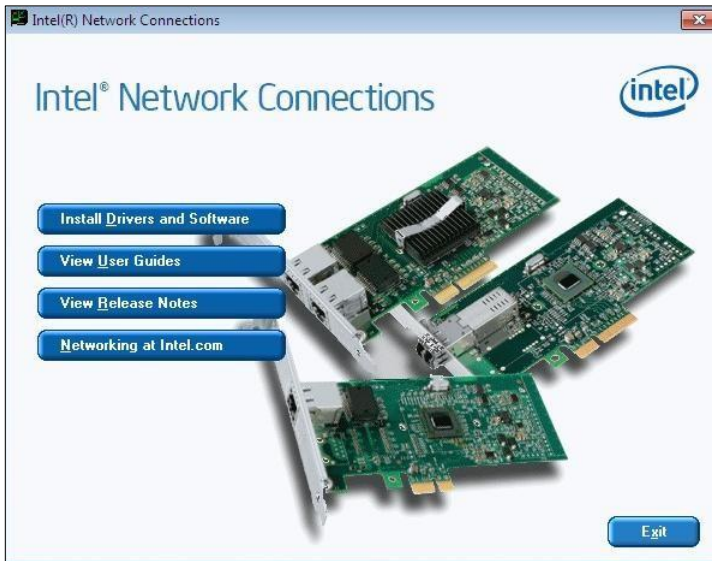
4. When the *Welcome* screen appears, click **Next** to continue.
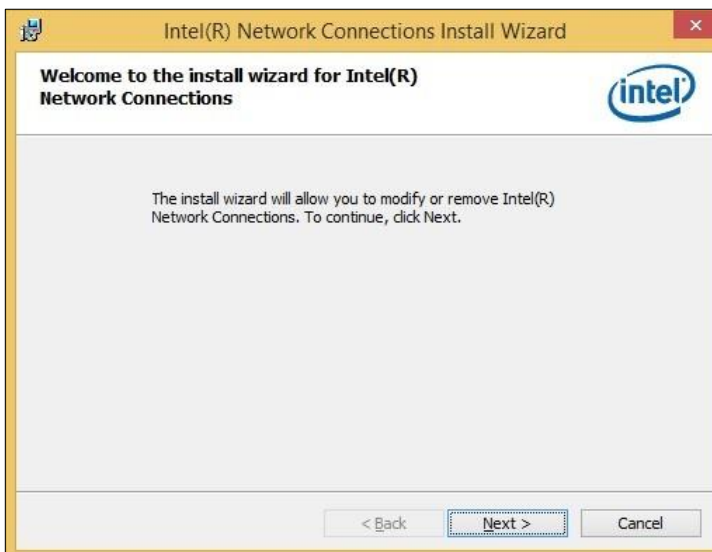
5. Accept the license agreement and click **Next** to continue.

6. Tick the checkbox for **Drivers** to select the related drivers and click **Next**.
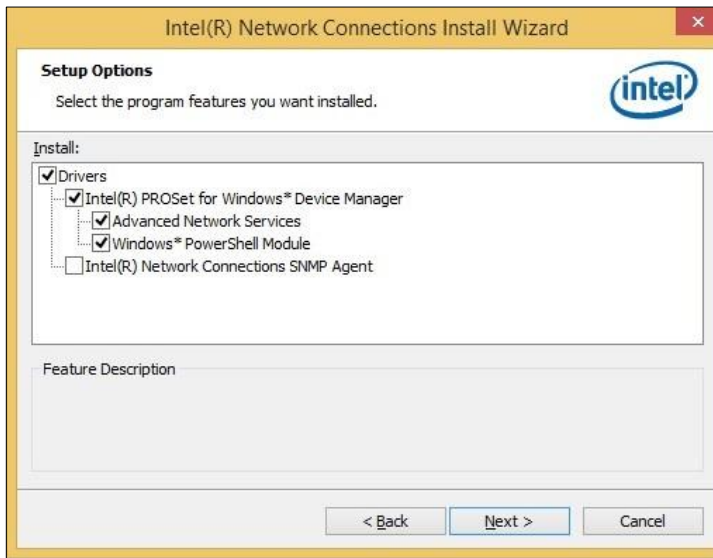
7. When the wizard is ready for installation, click **Install**.

8. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

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3.6 Intel® Management Engine Driver Installation

1. Click **Intel** and then **Intel(R) Skylake-U Chipset Drivers**.

2. Click **Intel(R) ME 11.x Drivers**.

3. When the *Welcome* screen appears, click **Next** to continue.
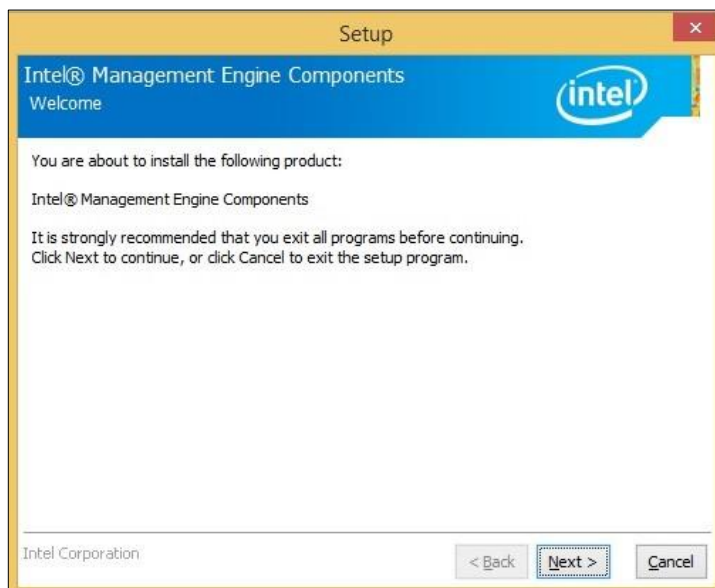
4. Accept the licence agreement and click **Next** until the installation starts.

5. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

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3.7 USB 3.0 Driver Installation

1. Click **Intel** and then **Intel(R) Skylake-U Chipset Drivers**.

2. Click **Intel(R) USB 3.0 Drivers**.

3. When the *Welcome* screen appears, click **Next** to continue.
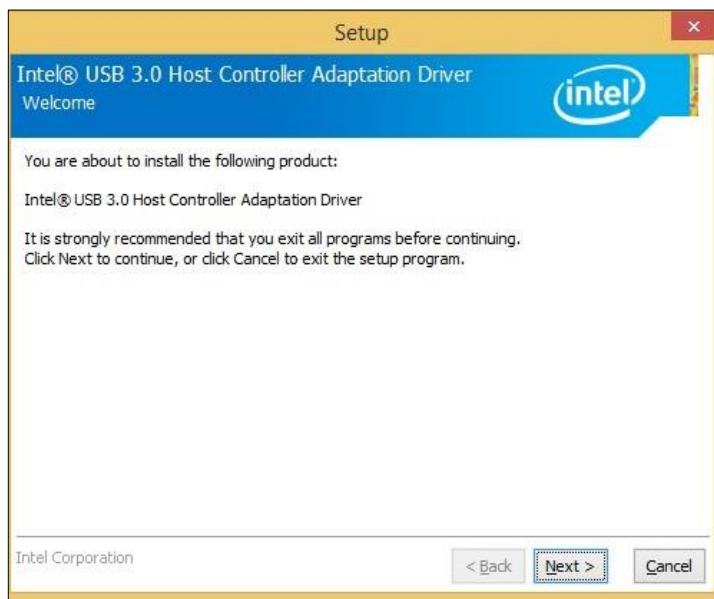
4. Accept the license agreement and click **Next** to continue.

5. On the *Readme File Information* screen, click **Next** for installation.

6. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

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3.8 G-Sensor Driver Installation

Note: The G-Sensor driver is only installable on Windows 10 (64bit).

Download this driver by logging into IBASE website. Select the tab **DRIVERS – SYSTEMS**, select **Transportation – Railway System** from the dropdown list, find G-Sensor and download it.

1. Run the **Setup.exe** file.

2. When the *Welcome* screen appears, click **Next** to contiune installation.
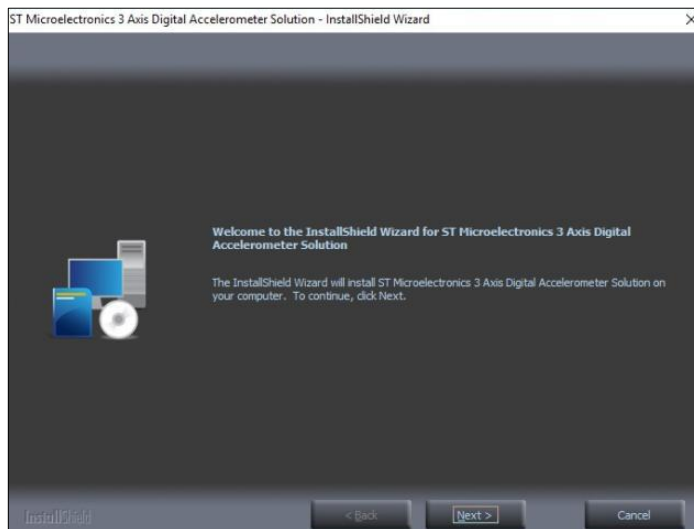
3. Accept the license agreement and click **Next** and then click **Install**.

4. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

Chapter 4
BIOS Setup

This chapter describes the different settings available in the AMI BIOS that comes with the board. The topics covered in this chapter are as follows:

- Main Settings
- Advanced Settings
- Security Settings
- Boot Settings
- Save & Exit

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4.1   Introduction

The BIOS (Basic Input/Output System) installed in the ROM of your computer system supports Intel® processors. The BIOS provides critical low-level support for standard devices such as disk drives, serial ports and parallel ports. It also provides password protection as well as special support for detailed fine-tuning of the chipset controlling the entire system.

4.2   BIOS Setup

The BIOS provides a Setup utility program for specifying the system configurations and settings. The BIOS ROM of the system stores the Setup utility. When you turn on the computer, the BIOS is immediately activated. Press the <Del>   key immediately allows you to enter the Setup utility. If you are a little bit late pressing the <Del> key, POST (Power On Self Test) will continue with its test routines, thus preventing you from invoking the Setup.

If you still need to enter Setup, restart the system by pressing the "Reset" button or simultaneously pressing the <Ctrl>, <Alt> and <Delete> keys. You can also restart by turning the system Off and back On again.

The following message will appear on the screen:

```
             Press  <DEL>  to  Enter  Setup
```

In general, press the arrow keys to highlight items, <Enter> to select, the <PgUp> and <PgDn> keys to change entries, <F1> for help, and <Esc> to quit.

When you enter the BIOS Setup utility, the *Main Menu* screen will appear on the screen. The Main Menu allows you to select from various setup functions and exit choices.

Warning: It is strongly recommended that you avoid making any changes to the chipset defaults.

These defaults have been carefully chosen by both AMI and your system manufacturer to provide the absolute maximum performance and reliability. Changing the defaults could make the system unstable and crash in some cases.

4.3   Main Settings

```
           Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
    Main  Advanced  Security  Boot  Save & Exit

                                                        Set the Date. Use Tab to
                                                        switch between Date elements.

   System Date                      [Fri 01/06/2017]
   System Time                      [05:54:05]

   Access Level                     Administrator




                                                        →←: Select Screen
                                                        ↑↓: Select Item
                                                        Enter: Select
                                                        +/–: Change Opt.
                                                        F1: General Help
                                                        F2: Previous Values
                                                        F3: Optimized Defaults
                                                        F4: Save & Exit
                                                        ESC: Exit



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```

BIOS Setting	Description
System Date	Sets the date. Use the <Tab> key to switch between the data elements.
System Time	Set the time. Use the <Tab> key to switch between the data elements.

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4.4 Advanced Settings

This section allows you to configure, improve your system and allows you to set up some system features according to your preference.

```
              Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Main   Advanced  Security   Boot   Save & Exit

  ▶ ACPI Settings                                      System ACPI Parameters.
  ▶ Power Board Configuration
  ▶ F81866 Super IO Configuration
  ▶ Hardware Monitor
  ▶ NVMe Configuration
  ▶ USB Configuration
  ▶ CPU Configuration
  ▶ SATA Configuration
  ▶ CSM Configuration


                                                       →←: Select Screen
                                                       ↑↓: Select Item
                                                       Enter: Select
                                                       +/-: Change Opt.
                                                       F1: General Help
                                                       F2: Previous Values
                                                       F3: Optimized Defaults
                                                       F4: Save & Exit
                                                       ESC: Exit




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```

4.4.1 ACPI Settings

```
             Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
  Advanced

  ACPI Settings                                          Enables or Disables System
                                                         ability to Hibernate (OS/S4
  Enable Hibernation              [Enabled]              Sleep State). This option may
                                                         be not effective with some OS.




                                                         →←: Select Screen
                                                         ↑↓: Select Item
                                                         Enter: Select
                                                         +/-: Change Opt.
                                                         F1: General Help
                                                         F2: Previous Values
                                                         F3: Optimized Defaults
                                                         F4: Save & Exit
                                                         ESC: Exit



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```

BIOS Setting	Description
Enable Hibernation	Enables or disables the System ability to Hibernate (OS/S4 Sleep State). This option may not be effective with some OS.

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4.4.2 Power Board Configuration

```
              Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Advanced

 Power Board Configuration                                        Allows to set the power board
                                                                  delay timer.
 Power Board Delay Control              [Enabled]
 Power On Delay (minutes)               0
 Power On Delay (seconds)               15
 Power Off Delay (minutes)              0
 Power Off Delay (seconds)              15




                                                                  →←: Select Screen
                                                                  ↑↓: Select Item
                                                                  Enter: Select
                                                                  +/-: Change Opt.
                                                                  F1: General Help
                                                                  F2: Previous Values
                                                                  F3: Optimized Defaults
                                                                  F4: Save & Exit
                                                                  ESC: Exit



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```

BIOS Setting	Description
Power Board Delay Control	Allows to set the delay timer for turning on or off the power board.
Power On Delay (minutes) / (seconds)	Sets the power-on-delay timer for minutes / seconds.
Power Off Delay (minutes) / (seconds)	Sets the power-off-delay timer for minutes / seconds.

4.4.3 Super IO Configuration

```
              Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
   Advanced

   F81866 Super IO Configuration                                Set Parameters of Serial Port
                                                                1 (COMA)
   Super IO Chip                          F81866
 ▶ Serial Port 1 Configuration
 ▶ Serial Port 2 Configuration
 ▶ Serial Port 3 Configuration
 ▶ Serial Port 4 Configuration
 ▶ Serial Port 5 Configuration
 ▶ Serial Port 6 Configuration

   Watch Dog Function
   Watch dog Mode                         [Sec]
   Watch dog Timer                        0
   Watch dog count                        N/A
                                                                →←: Select Screen
                                                                ↑↓: Select Item
                                                                Enter: Select
                                                                +/-: Change Opt.
                                                                F1: General Help
                                                                F2: Previous Values
                                                                F3: Optimized Defaults
                                                                F4: Save & Exit
                                                                ESC: Exit

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```

BIOS Setting	Description
Serial Port Configuration	Sets parameters of serial ports. You can enable / disable the serial port and select an optimal settings for the Super IO device. * COM5 is for internal use only. COM6 sigals come from the on-board connector J11, and is reserved for future use to connect to CAN module.
Watchdog Mode	Sets the Watchdog mode as Second or Miniute.
Watchdog Timer	Sets the Watchdog timer. 00 disables the timer.

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4.4.3.1. Serial Port 1 Configuration
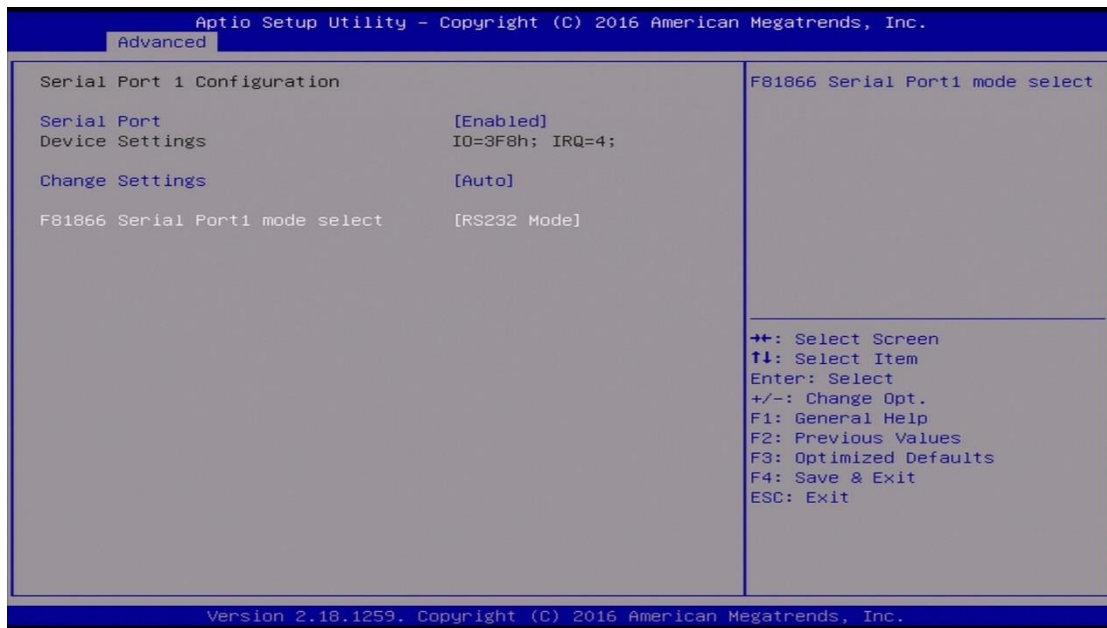
```
          Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
   Advanced

Serial Port 1 Configuration                                  F81866 Serial Port1 mode select

Serial Port                         [Enabled]
Device Settings                     IO=3F8h; IRQ=4;

Change Settings                     [Auto]

F81866 Serial Port1 mode select     [RS232 Mode]




                                                             →←: Select Screen
                                                             ↑↓: Select Item
                                                             Enter: Select
                                                             +/-: Change Opt.
                                                             F1: General Help
                                                             F2: Previous Values
                                                             F3: Optimized Defaults
                                                             F4: Save & Exit
                                                             ESC: Exit




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```

BIOS Setting	Description
Serial Port	Enables / Disables the serial port (COM).
Change Settings	Selects an optimal settings for the Super I/O device.
F81866 Serial Port1 Mode Seelct	Changes the mode of serial port.

4.4.3.2. Serial Port 2 Configuration
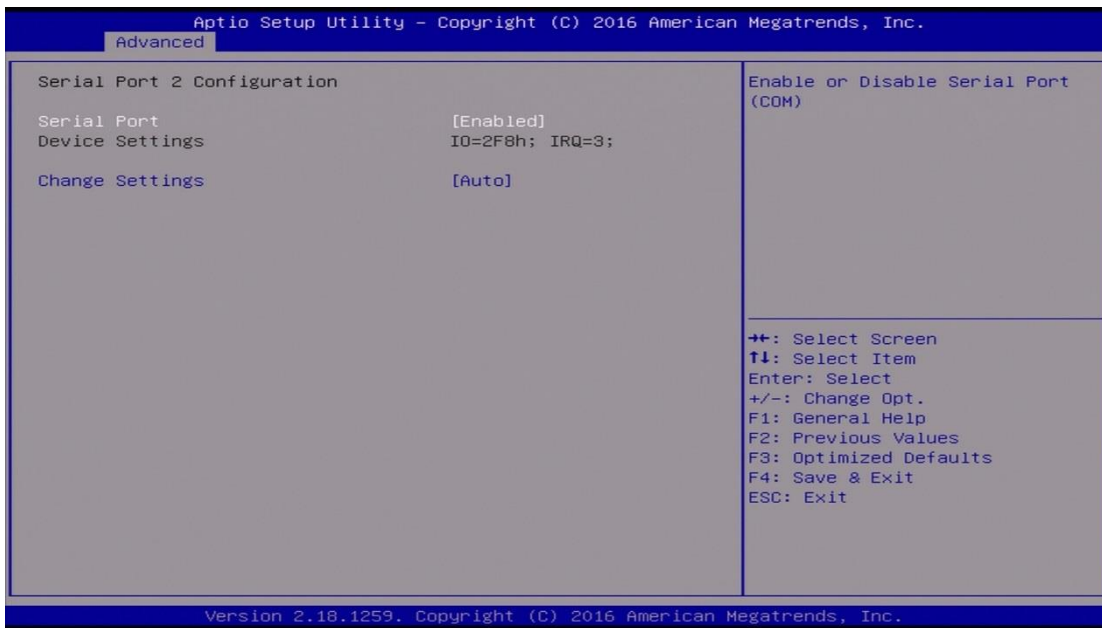
```
         Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
  Advanced

  Serial Port 2 Configuration                            Enable or Disable Serial Port
                                                         (COM)
  Serial Port                         [Enabled]
  Device Settings                     IO=2F8h; IRQ=3;

  Change Settings                     [Auto]



                                                         →←: Select Screen
                                                         ↑↓: Select Item
                                                         Enter: Select
                                                         +/-: Change Opt.
                                                         F1: General Help
                                                         F2: Previous Values
                                                         F3: Optimized Defaults
                                                         F4: Save & Exit
                                                         ESC: Exit




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```

BIOS Setting	Description
Serial Port	Enables / Disables the serial port (COM).
Change Settings	Selects an optimal settings for the Super I/O device.

4.4.3.3. Serial Port 3 Configuration
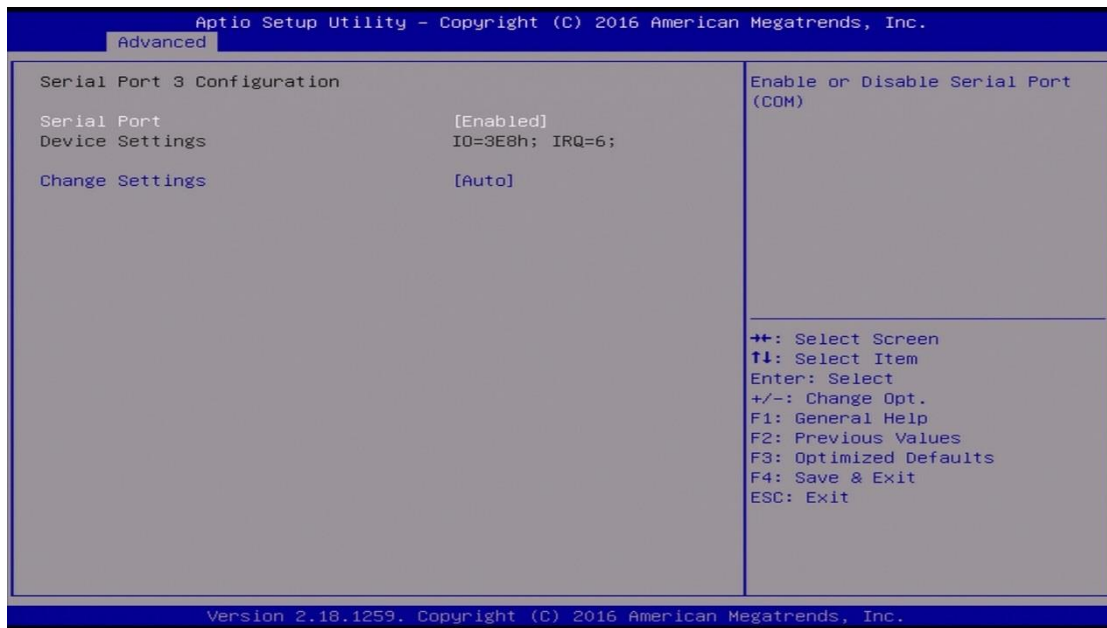
```
         Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
    Advanced

Serial Port 3 Configuration                               Enable or Disable Serial Port
                                                          (COM)
Serial Port                        [Enabled]
Device Settings                    IO=3E8h; IRQ=6;

Change Settings                    [Auto]




                                                          ➔←: Select Screen
                                                          ↑↓: Select Item
                                                          Enter: Select
                                                          +/-: Change Opt.
                                                          F1: General Help
                                                          F2: Previous Values
                                                          F3: Optimized Defaults
                                                          F4: Save & Exit
                                                          ESC: Exit




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```

BIOS Setting	Description
Serial Port	Enables / Disables the serial port (COM).
Change Settings	Selects an optimal settings for the Super I/O device.

4.4.3.4.   Serial Port 4 Configuration

```
           Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Advanced

 Serial Port 4 Configuration                                 Enable or Disable Serial Port
                                                             (COM)
 Serial Port                           [Enabled]
 Device Settings                       IO=2E8h; IRQ=5;

 Change Settings                       [Auto]




                                                             ++: Select Screen
                                                             ↑↓: Select Item
                                                             Enter: Select
                                                             +/-: Change Opt.
                                                             F1: General Help
                                                             F2: Previous Values
                                                             F3: Optimized Defaults
                                                             F4: Save & Exit
                                                             ESC: Exit




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```

BIOS Setting	Description
Serial Port	Enables / Disables the serial port (COM).
Change Settings	Selects an optimal settings for the Super I/O device.

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4.4.3.5. Serial Port 5 Configuration

```
            Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
      Advanced

   Serial Port 5 Configuration

   Serial Port                          [Enabled]
   Device Settings                      IO=2F0h; IRQ=10;



                                                              →←: Select Screen
                                                              ↑↓: Select Item
                                                              Enter: Select
                                                              +/-: Change Opt.
                                                              F1: General Help
                                                              F2: Previous Values
                                                              F3: Optimized Defaults
                                                              F4: Save & Exit
                                                              ESC: Exit



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```

4.4.3.6. Serial Port 6 Configuration

```
            Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
      Advanced

   Serial Port 6 Configuration                      Enable or Disable Serial Port
                                                    (COM)
   Serial Port                          [Enabled]
   Device Settings                      IO=2E0h; IRQ=7;

   Change Settings                      [Auto]
   Device Mode                          [Disable IR1 function]




                                                              →←: Select Screen
                                                              ↑↓: Select Item
                                                              Enter: Select
                                                              +/-: Change Opt.
                                                              F1: General Help
                                                              F2: Previous Values
                                                              F3: Optimized Defaults
                                                              F4: Save & Exit
                                                              ESC: Exit



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```

BIOS Setting	Description
Serial Port	Enables / Disables the serial port (COM).
Change Settings	Selects an optimal settings for the Super I/O device.
Device Mode	Changes the mode of serial port.

4.4.4 Hardware Monitor

```
                Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Advanced

  Pc Health Status

  ACPI Shutdown Temperature           [Disabled]

  CPU temperature                   : +54°C
  System temperature               : +45°C
  CPU VCore                        : +0.912 V
  +5V                              : +5.129 V
  +12V                             : +12.496 V
  VDDQ                             : +1.192 V

                                                    →←: Select Screen
                                                    ↑↓: Select Item
                                                    Enter: Select
                                                    +/-: Change Opt.
                                                    F1: General Help
                                                    F2: Previous Values
                                                    F3: Optimized Defaults
                                                    F4: Save & Exit
                                                    ESC: Exit

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```

BIOS Setting	Description
ACPI Shutdown Temperature	This field enables or disables the Shutdown Temperature Options: Disabled (default). 70 °C, 80 °C, 90 °C
Temperatures / Voltages	These fields are the parameters of the hardware monitoring function feature of the motherboard. The values are read-only values as monitored by the system and show the PC health status

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4.4.5 NVMe Configuration

```
          Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
   Advanced

NVMe controller and Drive information

Bus:1 Dev:0 Func:0                    INTEL SSDPEDMW400G4  ...
Nvme Size                            400.0GB




                                                      →←: Select Screen
                                                      ↑↓: Select Item
                                                      Enter: Select
                                                      +/-: Change Opt.
                                                      F1: General Help
                                                      F2: Previous Values
                                                      F3: Optimized Defaults
                                                      F4: Save & Exit
                                                      ESC: Exit



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```

4.4.6 USB Configuration

```
          Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
   Advanced

USB Configuration                                     Enables Legacy USB support.
                                                      AUTO option disables legacy
USB Module Version              16                    support if no USB devices are
                                                      connected. DISABLE option will
USB Controllers:                                      keep USB devices available
    1 XHCI                                            only for EFI applications.
USB Devices:
    1 Drive, 1 Keyboard

Legacy USB Support              [Enabled]
XHCI Hand-off                   [Enabled]
USB Mass Storage Driver Support [Enabled]

USB hardware delays and time-outs:                    →←: Select Screen
USB transfer time-out           [20 sec]              ↑↓: Select Item
Device reset time-out           [20 sec]              Enter: Select
Device power-up delay           [Auto]                +/-: Change Opt.
                                                      F1: General Help
Mass Storage Devices:                                 F2: Previous Values
Generic Flash Disk 8.07         [Auto]                F3: Optimized Defaults
                                                      F4: Save & Exit
                                                      ESC: Exit


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```

BIOS Setting	Description
Legacy USB Support	Enables / Disables Legacy USB support. • **Auto** disables legacy support if there is no USB device connected. • **Disable** keeps USB devices available only for EFI applications.

BIOS Setting	Description
XHCI Hand-pff	This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.
USB Mass Storage Driver Support	Enables / Disables USB mass storage driver support.
USB Transfer time-out	Sets the time-out value 1, 5, 10 or 20 sec(s) for Control, Bulk, and Interrupt transfers.
Device reset time-out	Sets the seconds (10, 20, 30, 40 secs) of delaying execution of start unit command to USB mass storage device.
Device power-up delay	The maximum time the device will take before it properly reports itself to the Host Controller. Auto uses default value. For a Root port, it is 100 ms. For a Hub port, the delay is taken from Hub descriptor.
Generic Flash Disk 8.07	Mass storage device emulation type. Auto enumerates devices according to their media format. Optical drivers are emulated as "CD-ROM", drives with no media will be emulated according to a drive type.

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4.4.7   CPU Configuration

```
              Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
         Advanced

    CPU Configuration                                            Enable/Disable Intel(R) Speed
                                                                 Shift Technology support.
    Intel(R) Core(TM) i7-6600U CPU @ 2.60GHz                     Enabling will expose the CPPC
    CPU Signature                  406E3                         v2 interface to allow for
    Microcode Patch                9E                            hardware controlled P-states.
    Max CPU Speed                  2600 MHz
    Min CPU Speed                  400 MHz
    CPU Speed                      2500 MHz
    Processor Cores                2
    Hyper Threading  Technology    Supported
    Intel VT-x Technology          Supported
    EIST Technology                Supported

    L1 Data Cache                  32 kB x 2                     →←: Select Screen
    L1 Code Cache                  32 kB x 2                     ↑↓: Select Item
    L2 Cache                       256 kB x 2                    Enter: Select
    L3 Cache                       4 MB                          +/-: Change Opt.
    L4 Cache                       Not Present                   F1: General Help
                                                                 F2: Previous Values
    Intel(R) Speed Shift Technology   [Enabled]                  F3: Optimized Defaults
    Intel(R) SpeedStep(tm)            [Enabled]                  F4: Save & Exit
      Turbo Mode                      [Enabled]                  ESC: Exit



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```

BIOS Setting	Description
Intel(R) Speed Shift Technology	Enables / Disables the support for Intel(R) Speed Shift Technology. If enabled, it will expose the CPPC v2 interface to allow for hardware controlled P states.
Intel(R) SpeedStep(tm)	Enables / Disables to support more than two frequency ranges.
Turbo Mode	Enables / Disables the turbo mode.

4.4.8   SATA Configuration

```
         Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Advanced

  SATA Controller(s)                   [Enabled]              Enable or disable SATA Device.
  SATA Mode Selection                  [AHCI]
  SATA Controller Speed                [Default]

  Serial ATA Port 0                    TS128XBTMM16-I (128.0...
    Software Preserve                  SUPPORTED
    Port 0                             [Enabled]
    Hot Plug                           [Disabled]
  Serial ATA Port 1                    Empty
    Software Preserve                  Unknown
    Port 1                             [Enabled]
    Hot Plug                           [Disabled]
  Serial ATA Port 2                    Empty
    Software Preserve                  Unknown               →←: Select Screen
    Port 2                             [Enabled]             ↑↓: Select Item
    Hot Plug                           [Disabled]            Enter: Select
                                                             +/-: Change Opt.
                                                             F1: General Help
                                                             F2: Previous Values
                                                             F3: Optimized Defaults
                                                             F4: Save & Exit
                                                             ESC: Exit


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```

BIOS Setting	Description
SATA Controller(s)	Enables / Disables SATA devices.
SATA Mode Selection	Selects AHCI / RAID Mode.
SATA Controller Speed	Indicates the maximum speed that the SATA controller supports.
Serial ATA Port 0/1/2	Enables / Disables Serial Port 0/1/2.
HotPlug	Designates the SATA port as hot pluggable.

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4.4.9   CSM Configuration

```
         Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
  Advanced

Compatibility Support Module Configuration          Controls the execution of UEFI
                                                    and Legacy PXE OpROM
Option ROM execution

Network                            [Do not launch]



                                                    →←: Select Screen
                                                    ↑↓: Select Item
                                                    Enter: Select
                                                    +/-: Change Opt.
                                                    F1: General Help
                                                    F2: Previous Values
                                                    F3: Optimized Defaults
                                                    F4: Save & Exit
                                                    ESC: Exit



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```

BIOS Setting	Description
Network	Controls the execution of UEFI and Legacy PXE OpROM.

4.5 Security Settings

```
                 Aptio Setup Utility – Copyright (C) 2016 American Megatrends, Inc.
     Main  Advanced  Security  Boot  Save & Exit

   Password Description                                  Set Administrator Password

   If ONLY the Administrator's password is set,
   then this only limits access to Setup and is
   only asked for when entering Setup.
   If ONLY the User's password is set, then this
   is a power on password and must be entered to
   boot or enter Setup. In Setup the User will
   have Administrator rights.
   The password length must be
   in the following range:
   Minimum length                    3
   Maximum length                   20
                                                         →←: Select Screen
                                                         ↑↓: Select Item
   Administrator Password                                Enter: Select
   User Password                                         +/-: Change Opt.
                                                         F1: General Help
                                                         F2: Previous Values
                                                         F3: Optimized Defaults
                                                         F4: Save & Exit
                                                         ESC: Exit



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```

BIOS Setting	Description
Administrator Password	Sets an administrator password for the setup utility.
User Password	Sets a user password.

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4.6   Boot Settings

```
                Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
      Main  Advanced  Security  Boot  Save & Exit

   Boot Configuration                                        Number of seconds to wait for
   Setup Prompt Timeout                   1                  setup activation key.
   Bootup NumLock State                  [On]                65535(0xFFFF) means indefinite
   Quiet Boot                            [Disabled]          waiting.

   Boot mode select                      [LEGACY]

   FIXED BOOT ORDER Priorities
   Boot Option #1                        [Hard Disk: TS128XBT...]
   Boot Option #2                        [CD/DVD]
   Boot Option #3                        [USB Hard Disk]
   Boot Option #4                        [USB CD/DVD]
   Boot Option #5                        [USB Key:Generic Fla...]
   Boot Option #6                        [USB Floppy]        →←: Select Screen
   Boot Option #7                        [USB Lan]           ↑↓: Select Item
   Boot Option #8                        [Network]           Enter: Select
                                                             +/-: Change Opt.
   ► Hard Disk Drive BBS Priorities                          F1: General Help
   ► USB Key Drive BBS Priorities                            F2: Previous Values
                                                             F3: Optimized Defaults
                                                             F4: Save & Exit
                                                             ESC: Exit



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```

BIOS Setting	Description
Setup Prompt Timeout	Number of seconds to wait for setup activation key. 65535 (0xFFFF) means indefinite waiting.
Bootup NumLock State	Selects the keyboard NumLock state.
Quiet Boot	Enables / Disables Quiet Boot option.
Boot Mode Select	Selects the boot mode as Legacy or UEFI.
Boot Option Priorities	Sets the system boot order.
Hard Disk Drive BBS Priorities	Specifies the boot device priority sequence from available Hard Disk Drives.
USB Key Drive BBS Priorities	Specifies the boot device priority sequence from available USB key drives.

4.7   Save & Exit Settings

```
            Aptio Setup Utility - Copyright (C) 2016 American Megatrends, Inc.
    Main  Advanced  Security  Boot  Save & Exit

  Save Options                                    Reset the system after saving
  Save Changes and Reset                          the changes.
  Discard Changes and Reset

  Default Options
  Restore Defaults




                                                  →←: Select Screen
                                                  ↑↓: Select Item
                                                  Enter: Select
                                                  +/-: Change Opt.
                                                  F1: General Help
                                                  F2: Previous Values
                                                  F3: Optimized Defaults
                                                  F4: Save & Exit
                                                  ESC: Exit



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```

BIOS Setting	Description
Save Changes and Reset	Resets the system after saving the changes.
Discard Changes and Reset	Resets system setup without saving any changes.
Restore Defaults	Restores the user defaults to all the setup options.

Appendix

This section provides the mapping addresses of peripheral devices and the sample code of watchdog timer configuration.

- I/O Port Address Map
- Interrupt Request Lines (IRQ)
- Watchdog Timer Configuration
- Software Development Kit for WDT.DLL

A. I/O Port Address Map

Each peripheral device in the system is assigned a set of I/O port addresses which also becomes the identity of the device. The following table lists the I/O port addresses used.

Address	Device Description
070h – 077h	Real Time Clock
2E0h – 2E7h	Serial Port #6(COM6) * COM6 sigals come from the on-board connector J11, and is reserved for future use to connect to CAN module.
2E8h – 2EFh	Serial Port #4(COM4)
2F0h – 2F7h	Serial Port #3(COM5) * COM5 is for internal use only.
2F8h – 2FFh	Serial Port #2(COM2)
3B0h – 3DFh	Intel(R) HD Graphics
3E8h – 3EFh	Serial Port #5(COM3)
3F8h – 3FFh	Serial Port #1(COM1)
0D00 – FFFF	PCI-e Root Complex

B. Interrupt Request Lines (IRQ)

Peripheral devices use interrupt request lines to notify CPU for the service required. The following table shows the IRQ used by the devices on board.

Level	Function
IRQ0	System Timer
IRQ3	Serial Port #2
IRQ4	Serial Port #1
IRQ5	Serial Port #4
IRQ6	Serial Port #3
IRQ7	Serial Port #6
IRQ8	System CMOS/real time clock
IRQ10	Serial Port #5
IRQ18	High Definition Audio Controller

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C. Watchdog Timer Configuration

The Watchdog Timer (WDT) is used to generate a variety of output signals after a user programmable count. The WDT is suitable for the use in the prevention of system lock-up, such as when software becomes trapped in a deadlock. Under these sorts of circumstances, the timer will count to zero and the selected outputs will be driven.

Under normal circumstance, you will need to restart the WDT at regular intervals before the timer counts to zero.

Sample Code:

```
//-------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-------------------------------------------------------------------------
#include <dos.h>
#include <conio.h>
#include <stdio.h>
#include <stdlib.h>
#include "F81866.H"
//-------------------------------------------------------------------------
int main (int argc, char *argv[]);  void EnableWDT(int);
void DisableWDT(void);
//-------------------------------------------------------------------------
int main (int argc, char *argv[])
{
unsigned char bBuf;  unsigned char bTime;  char **endptr;

char SIO;
printf("Fintek 81866 watch dog program\n");  SIO = Init_F81866();
if (SIO == 0)
{
printf("Can not detect Fintek 81866, program abort.\n");  return(1);
}//if (SIO == 0)

if (argc != 2)
{
printf(" Parameter incorrect!!\n");  return (1);
}

bTime = strtol (argv[1], endptr, 10);
printf("System will reset after %d seconds\n", bTime);

if (bTime)
{     EnableWDT(bTime);    } else
{     DisableWDT();    } return 0;
```

```
}
//-------------------------------------------------------------------------
void EnableWDT(int interval)
{
unsigned char bBuf;

bBuf = Get_F81866_Reg(0x2B); bBuf &= (~0x20);
Set_F81866_Reg(0x2B, bBuf);   //Enable WDTO

Set_F81866_LD(0x07);      //switch to logic device 7
Set_F81866_Reg(0x30, 0x01); //enable timer

bBuf = Get_F81866_Reg(0xF5); bBuf &= (~0x0F);
bBuf |= 0x52;
Set_F81866_Reg(0xF5, bBuf);         //count mode is second  Set_F81866_Reg(0xF6,
interval);    //set timer
bBuf = Get_F81866_Reg(0xFA); bBuf |= 0x01;
Set_F81866_Reg(0xFA, bBuf);   //enable WDTO output

bBuf = Get_F81866_Reg(0xF5); bBuf |= 0x20;
Set_F81866_Reg(0xF5, bBuf);   //start counting
}
//-------------------------------------------------------------------------
void DisableWDT(void)
{
unsigned char bBuf;
Set_F81866_LD(0x07);      //switch to logic device 7  bBuf = Get_F81866_Reg(0xFA);
bBuf &= ~0x01;
Set_F81866_Reg(0xFA, bBuf);   //disable WDTO output

bBuf = Get_F81866_Reg(0xF5); bBuf &= ~0x20;
bBuf |= 0x40;
Set_F81866_Reg(0xF5, bBuf);   //disable WDT
}
//-------------------------------------------------------------------------
```

```
//--------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//--------------------------------------------------------------------------
#include "F81866.H"
#include <dos.h>
//--------------------------------------------------------------------------
unsigned int F81866_BASE;  void Unlock_F81866 (void);  void Lock_F81866 (void);
//--------------------------------------------------------------------------
unsigned int Init_F81866(void)
{
unsigned int result;  unsigned char ucDid;

F81866_BASE = 0x4E;
result = F81866_BASE;

ucDid = Get_F81866_Reg(0x20);
if (ucDid == 0x07)      //Fintek 81866
{       goto Init_Finish; }

F81866_BASE = 0x2E;
result = F81866_BASE;

ucDid = Get_F81866_Reg(0x20);
if (ucDid == 0x07)      //Fintek 81866
{       goto Init_Finish; }

F81866_BASE = 0x00;
result = F81866_BASE;

Init_Finish:
return (result);
}
//--------------------------------------------------------------------------
void Unlock_F81866 (void)
{
outportb(F81866_INDEX_PORT, F81866_UNLOCK); outportb(F81866_INDEX_PORT,
F81866_UNLOCK);
}
//--------------------------------------------------------------------------
void Lock_F81866 (void)
{
outportb(F81866_INDEX_PORT, F81866_LOCK);
}
//--------------------------------------------------------------------------
void Set_F81866_LD( unsigned char LD)
{
Unlock_F81866();
outportb(F81866_INDEX_PORT, F81866_REG_LD);
outportb(F81866_DATA_PORT, LD);  Lock_F81866();
```

```
}
//-------------------------------------------------------------------------
void Set_F81866_Reg( unsigned char REG, unsigned char DATA)
{
Unlock_F81866(); outportb(F81866_INDEX_PORT, REG); outportb(F81866_DATA_PORT,
DATA); Lock_F81866();
}
//-------------------------------------------------------------------------
unsigned char Get_F81866_Reg(unsigned char REG)
{
unsigned char Result; Unlock_F81866();
outportb(F81866_INDEX_PORT, REG); Result = inportb(F81866_DATA_PORT);
Lock_F81866();
return Result;
}
//-------------------------------------------------------------------------
```

```
//-------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-------------------------------------------------------------------------
#ifndef       F81866_H
#define       F81866_H      1
//-------------------------------------------------------------------------
#defineF81866_INDEX_PORT   (F81866_BASE)
#defineF81866_DATA_PORT    (F81866_BASE+1)
//-------------------------------------------------------------------------
#defineF81866_REG_LD   0x07
//-------------------------------------------------------------------------
#define F81866_UNLOCK  0x87
#defineF81866_LOCK       0xAA
//-------------------------------------------------------------------------
unsigned int Init_F81866(void);
void Set_F81866_LD( unsigned char);
void Set_F81866_Reg( unsigned char, unsigned char);  unsigned char
Get_F81866_Reg( unsigned char);
//-------------------------------------------------------------------------
#endif  //      F81866_H
```

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D. Software Development Kit for WDT.DLL

1. OS Supported

Windows XP (32-bit / 64-bit) or above

2. Driver Installation

- **For 32-bit environment:**

  Step 1:
  Copy the file **KMUI32_1K.SYS** to <%WINDIR%>\SYSTEM32\DRIVERS.

  Step 2:
  The following parameters must be written to your registry.

  HKLM,"System\CurrentControlSet\Services\KMUI32_1K","ErrorControl",%REG_DWORD%,0x00000001

  HKLM,"System\CurrentControlSet\Services\KMUI32_1K","Type",%REG_DWORD%,0x00000001

  HKLM,"System\CurrentControlSet\Services\KMUI32_1K","Start",%REG_DWORD%,0x00000000

  HKLM,"System\CurrentControlSet\Services\KMUI32_1K","DisplayName",%REG_SZ%,"KMUI32_1K"

  Step 3:
  Restart the system.

● **For 64-bit environment:**

Step 1:
Copy "KMUI64_1K.SYS" file to <%WINDIR%>\SYSTEM32\DRIVERS

Step 2:
The following parameters must be written to your registry.

HKLM,"System\CurrentControlSet\Services\KMUI64_1K","ErrorControl",%REG_DWORD%,0x00000001

HKLM,"System\CurrentControlSet\Services\KMUI64_1K","Type",%REG_DWORD%,0x00000001

HKLM,"System\CurrentControlSet\Services\KMUI64_1K","Start",%REG_DWORD%,0x00000000

HKLM,"System\CurrentControlSet\Services\KMUI64_1K","DisplayName",%REG_SZ%,"KMUI64_1K"

Step 3:
Restart the system.

Note: Do not install both of the 32-bit and 64-bit drivers on an operating system.

---

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3. Exportion from IB_WDT.DLL / IB_WDT.64.DLL

extern "C" __declspec(dllexport) int __stdcall InstallDriver(void);
extern "C" __declspec(dllexport) int __stdcall RemoveDriver(void);
extern "C" __declspec(dllexport) char* __stdcall GetWDTInfo(void);
extern "C" __declspec(dllexport) int __stdcall EnableWDT(int);
extern "C" __declspec(dllexport) int __stdcall DisableWDT(int);
extern "C" __declspec(dllexport) int __stdcall IsDioAvailable(int);
extern "C" __declspec(dllexport) int __stdcall SetDioInputMask(int);
extern "C" __declspec(dllexport) int __stdcall SetDioOutputMask(int);
extern "C" __declspec(dllexport) int __stdcall GetDioInput(int);
extern "C" __declspec(dllexport) int __stdcall SetDioOutput(int);

Note:

1. The **IB_WDT.DLL** is of 32-bit and works on 32-bit and 64-bit Windows operating system. The "IB_WDT.64.DLL" is for 64bit Windows only.

2. The routines are not thread-safe. Your software engineers should take the responsibility to avoid multi-entry condition.

● **Driver Initialization & Deinitalization**

extern "C" __declspec(dllexport) int __stdcall InstallDriver(void);

Input   : None
Output   : Return 1 if device driver loads successfully; otherwise return 0.

Note: This function should be invoked before Watchdog and Digital I/O routines.

extern "C" __declspec(dllexport) int __stdcall RemoveDriver(void);

Input   : None
Output   : Always return 1.

Note: This function should be invoked before the program closes and it will release the device driver and memory for **ib_wdt.dll**. If the program is closed without calling this routine, resource leak may occur.

● **Watchdog**

extern "C" __declspec(dllexport) char * __stdcall GetWDTInfo(void);

Input   : None
Output   : Return a string that describes the module information.

extern "C" __declspec(dllexport) int __stdcall EnableWDT(int);

Input   : Timer interval, depending on the WDT chip
Output   : Always return "0"

For further information, refer to the datasheet for WDT or contact your sales representative.

extern "C" __declspec(dllexport) int __stdcall DisableWDT(int);

Input   : Dummy data and will be ignored.
Output   : Always return "0"

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● **Digital I/O**

extern "C" __declspec(dllexport) int __stdcall IsDioAvailable(int);

Input   : Dummy data and will be ignored

Output   : Return 1 if the digital I/O is available, otherwise return 0.

extern "C" __declspec(dllexport) int __stdcall SetDioInputMask(int);

Input: : Hardware parameter for digital I/O input function call.

For example, the 6 GPIO functions:
GPIO_0 to GPIO_2 are mapped as the input functions, and GPIO_4 to GPIO_6 are mapped as the output functions.

In this case, the parameter for "SetDioInputMask" is 0x07 and it indicates that GPIO_0 to GPIO_2 are the input functions.
The parameter for "SetDioOutputMask" is 0x70 and it indicates that GPIO_4 to GPIO_6 are the output functions.

Output   : Dummy data and should be ignored.

extern "C" __declspec(dllexport) int __stdcall SetDioOutputMask(int);

Input   : Hardware parameter for digital I/O output function call

For further information, refer to the following explanation of "SetDioInputMask" routine.

SetDioInputMask:

```
if ((*lpIsDioAvailable)(0))
        {
                int DioInput;
                printf(" Test for digital IO ....\n");

                //Please check digital IO setting in BIOS setup utility
                //Here example as follow:
                //   Digital GPIO [1..3] = Input
                //   Digital GPIO [4..6] = Output

                //set hardware information for GPIO chip
                //bit 0..2 : input for GPIO_0 to GPIO_2
                //bit 4..6 : output for GPIO_4 to GPIO_6
                (*lpSetDioInputMask)(0x07);
                (*lpSetDioOutputMask)(0x70);

                DioInput = (*lpGetDioInput)(0);
                printf(" Current GPIO_0 to GPIO_2 is 0x%X\n", DioInput);

        while(1)
        {
                                (*lpSetDioOutput)(0x00);
                                printf(" Set GPIO_4 to GPIO_6 to LOW\n");
                                (*lpSetDioOutput)(0x70);
                                printf(" Set GPIO_4 to GPIO_6 to HIGH\n");
                                (*lpSetDioOutput)(0x30);
                                printf(" Set GPIO_4 to GPIO_5 to HIGH\n");
                                (*lpSetDioOutput)(0x60);
                                printf(" Set GPIO_5 to GPIO_6 to HIGH\n");

                                Sleep(500);
                                if (_kbhit())
                                {
                break;
        }//if (kbhit())
                }//while(1)
        }//if ((*lpIsDioAvailable)(0))
```

Note: Be sure to set up the input / output for GPIO bits in BIOS identically with the GPIO hardware information above.

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E. Motherboard MCU ISP Specifications

1. Description

Security MCU provides following functionality

● **Getting Firmware Version**
Software can get the firmware version, MCU provides commands to get current Major Version, Minor version and build version.

● **Setting Power-On-Delay Timer**
MCU provides command to set power on delay timer, when arrived the setting time, MCU will send　power button to let the system power on.

● **Setting Power-Off-Delay Timer**
MCU provides command to set power off delay timer, when arrived the setting time, MCU will send　power button to let the system power off.

● **Getting Status**
MCU provides command to get current status which includes the power on delay timer setting value and　power off delay timer setting value.

Note: Before using the ISP, your software engineer has to make sure the firmware version (GET_FORMWARE_VERSION) MUST be as follows to make the ISP function workable.

Major version is 0.

Minor version is 0.

Build version is 1 (or above).

---

2. Protocol

- **Signal transmit format**

  Bandwidth
  Baud rate: 19200 bps

  Data Format
  Parity: No Parity
  1 start bit
  8 data bits
  1 stop bit

- **Packet Format**

Header	Size	Command	Data	CRC
2 bytes	1 byte	1 byte	0 – 64 bytes	2 bytes

  Header bytes indicate start of the packet.

  Size specifies number of bytes for data field.

  Command identifies action, which is required to be performed on the data.

  CRC verifies data integrity for header, size, command and data bytes.

- **CRC**

  Protocol uses 16-bit CCITT CRC to verify data integrity.
  $P(x) = X^{16}+X^{12}+X^5+1$

  ```
  unsigned calc_crc(unsigned char *data, unsigned n, unsigned start) {
      unsigned I, k, q, c, crcval;
      crcval=start;
      for (I=0; I<n; I++) {
          c=data(I) & 0xFF;
          q=(crcval^c) & 0x0F;
          crcval=(crcval>>4)^(q*0x1081);
          q=(crcval^(c>>4)) & 0x0F;
          crcval=(crcval>>4)^(q*0x1081);
      }
      return crcval;
  }
  ```

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● **Communications flow**

Communication between PC and Security MCU utilizes Master-Slave model, where PC is a master, and Security MCU is a slave. Master sends requests to the slave, and slave has to reply to them. Slave acts like a passive device and cannot send any requests to the master.

3. Command and Reply Codes

● **Summary**

Code	Value	Description
GET_FIRMWARE_VERSION	0x01	Get Firmware version
SET_POWER_ON_DELAY_TIMER	0x04	Power on delay timer setting
SET_POWER_OFF_DELAY_TIMER	0x05	Power off delay timer setting
GET_STATUS	0x10	Get Current Status

● **Getting Firmware Version**

Parameter: GET_FIRMWARE_VERSION

Reads version number of the security MCU firmware.

Request:

Header	Size	Command	Data	CRC
0xFF 0xEE	0x00	GET_FIRMWARE_VERSION	None	

Reply:

Header	Size	Command	Data	CRC
0xFF 0xEE	Size of Version structure	GET_FIRMWARE_VERSION	BSL Version Structure	

BSL Version Structure

Field	Type	Description
Major Version	Byte	Major version number
Minor Version	Byte	Minor version number
Build	Byte	Build version number

- **Setting Power-On Delay Timer**

  Parameter: SET_POWER_ON_DELAY_TIMER

  Sets power on delay timer.

  Request:

Header	Size	Command	Data0	Data1	CRC
0xFF 0xEE	0x02	SET_POWER_ON_DELAY_TIMER	N (mins)	N (secs)	

  Reply

Header	Size	Command	Data	CRC
0xFF 0xEE	0x00	SET_POWER_ON_DELAY_TIMER	None	

- **Setting Power-Off Delay Timer**

  Parameter: SET_POWER_OFF_DELAY_TIMER

  Sets power off delay timer.

  Request:

Header	Size	Command	Data0	Data1	CRC
0xFF 0xEE	0x02	SET_POWER_OFF_DELAY_TIMER	N (mins)	N (secs)	

  Reply

Header	Size	Command	Data	CRC
0xFF 0xEE	0x00	SET_POWER_OFF_DELAY_TIMER	None	

- **Getting Status**

  Get the power-on-delay timer and power-off-delay timer.

  Request:

Header	Size	Command	Data	CRC
0xFF 0xEE	0x00	GET_STATUS	None	

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Reply:

Header	Size	Command	Data	CRC
0xFF 0xEE	0x04	GET_STATUS	Status structure	

BSL Version Structure

Field	Type	Description
Power on delay timer	Word	Byte4+ Byte5
Power off delay timer	Word	Byte6+ Byte7