MPT-3000RP

Multi-Purpose Railway System

User's Manual

Version 1.0
(Apr. 2019)

iBASE

draft

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Compliance

CE

This product has passed CE 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.

FC

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)

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.
- 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 ventilation openings.
- Use this product in environments with ambient temperatures between -40˚C and 70˚C for SSD.
- Do not leave this device in an environment where the storage temperature may go below -40˚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.

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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, 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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Table of Contents

Compliance iii

Important Safety Information iv

WARNING iv

CAUTION v

Warranty Policy v

Technical Support & Services v

Chapter 1 General Information 1

1.1 Introduction 2
1.2 Features 3
1.3 Packing List 3
1.4 Optional Accessories 4
1.5 Specifications 4
1.6 Overview 6
1.7 Fuse Dimensions 7
1.8 Dimensions 8

Chapter 2 Hardware Configuration 9

2.1 Installations 10
2.1.1 Memory Installation 10
2.1.2 Storage Installation 11
2.1.3 CFast & Micro-SIM Card Installation 12
2.1.4 Mini-PCIe & M.2 Network Cards Installation 13
2.1.5 WiFi / 3G / 4G Antenna Installation 14
2.1.6 Wall Mounting Installation 14
2.1.7 Pinout for M12 Connectors (Power Input, VGA, GPIO) 15
2.2 Setting the Jumpers 17
2.2.1 How to Set Jumpers 17
2.3 Jumper & Connector Locations on Motherboard 18
2.4 Jumpers Quick Reference 19
2.4.1 COM1, COM2 Port RS-232 Selection (JP1, JP2) 19
2.4.2 ME Register Clearance (JP3) 20
2.4.3 CMOS Data Clearance (JP4) 21
2.5 Connectors Quick Reference 22

Draft

2.5.1 Digital I/O Port (CN1) 23
2.5.2 COM Port Connector (COM1 ~ COM4) 23
2.5.3 CRT Connector (J5) 24
2.5.4 CAN Module Connection (J11) 25
2.5.5 M.2 B2280 USB2.0 Interface (J13) 25
2.5.6 Full Mini PCIe USB2.0 / PCIe (x1) Connector (J19) 26
2.5.7 Digital IO Pull High to +5V Switch (SW1) 26

Chapter 3 Driver Installation 27

3.1 Introduction 28
3.2 Intel® Chipset Software Installation Utility 28
3.3 VGA Driver Installation 29
3.4 HD Audio Driver Installation 30
3.5 LAN Driver Installation 31
3.6 Intel® Trusted Execution Engine Installation 33
3.7 Intel® Serial I/O Driver Installation 34
3.8 G-Sensor Driver Installation 35

Chapter 4 BIOS Setup 36

4.1 Introduction 37
4.2 BIOS Setup 37
4.3 Main Settings 38
4.4 Advanced Settings 39
4.4.1 CSM Configuration 39
4.4.2 ACPI Settings 40
4.4.3 Digital I/O Configuration 41
4.4.4 Power Board Configuration 41
4.4.5 Super IO Configuration 42
4.4.6 Hardware Monitor 43
4.4.7 CPU Configuration 44
4.4.8 CPU PPM Configuration 44
4.4.9 SATA Configuration 45
4.4.10 USB Configuration 46
4.5 Chipset Settings 47
4.5.1 North Bridge 47
4.6 Security Settings 48
4.7 Boot Settings 49
4.8 Save & Exit Settings 50

Appendix 51

Draft

A. I/O Port Address Map.....52
B. Interrupt Request Lines (IRQ) 52
C. Watchdog Timer Configuration.....53
D. Software Development Kit for WDT.DLL 57
E. Motherboard MCU ISP Specifications 63

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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-3000RP fanless embedded PC is developed especially for railway applications. This EN50155-TX-certified and IP67-rated system, which recently received the Taiwan Excellence award, offers water and shock resistance for outdoor applications and meets IIoV, Intelligent Internet of Vehicle requirements.

The system comes with rugged and reliable design, featuring robust M12 connectors for fail-safe connection and fault-free data transmission for rolling stock operating environment. It supports -40 to 70° C operating temperature and a variety of power input to meet railway standards and deployment harsh conditions, as well as industrial applications.

The MPT-3000RP is powered by an Intel® Atom™ E3845 processor with 4GB DDR3L-1333 memory onboard. Built-in M12 connectors accommodate 2x GbE, 1x VGA, 3x COM, 1x power, 1x GPIO and 1x CAN Bus. The computer platform operates reliably with full vehicle battery power control and employs interchangeable modular power supplies supporting 9V~36V DC / 72V / 110V to meet various requirements. The unit is built with a GPS module and high computing performance to provide the most accurate position coordinates and data about the surroundings while the vehicle is moving. It is also packed with a rich set of connectivity including dual SIM sockets with WWAN redundancy, half-size Mini PCIe, full-size Mini PCIe, and three M.2 sockets for 2230, 3042, and 2280 modular card types.

Photo of MPT-3000RP

1.2 Features

- EN50155 certification and IP67 rating
- Fanless and ruggedized design
- Robust M12 connectors for dual GbE, USB and power input
- Rich I/O interfaces for wireless, SSD, GPS, WWAN
- Dual SIM sockets for WWAN redundancy
- Ignition power control
- Wide-range voltage GPIO interface
- Intel® Atom™ E3845 processor and I210 Ethernet Controller

1.3 Packing List

Your product 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-3000RP	1	- -
Mounting Bracket	2	- -
GPIO Matching Connector (8 pins) (DINKLE EC350VM-08P, 8 pins)	1	C1216EC3508103000P
Thermal Pad (70 x 20 x 5.5 mm) * Bigger, for M.2 SSD module card	1	C1401070020055000P
Thermal Pad (20 x 20 x 5.5 mm) * Smaller, for M.2 WiFi module card	1	C1401020020055000P
Round Head Screw (4 for Mounting Bracket, 1 for M.2network 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 (70 x 20 x 1.5 mm)	C1401070020055000P
Thermal Pad (20 x 20 x 5.5 mm)	C1401020020055000P
RTC Battery	C272113012020B100P
Fuse for MPT-3000R	C2309001151058000P
Fuse for MPT-3000RHV	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

1.5 Specifications

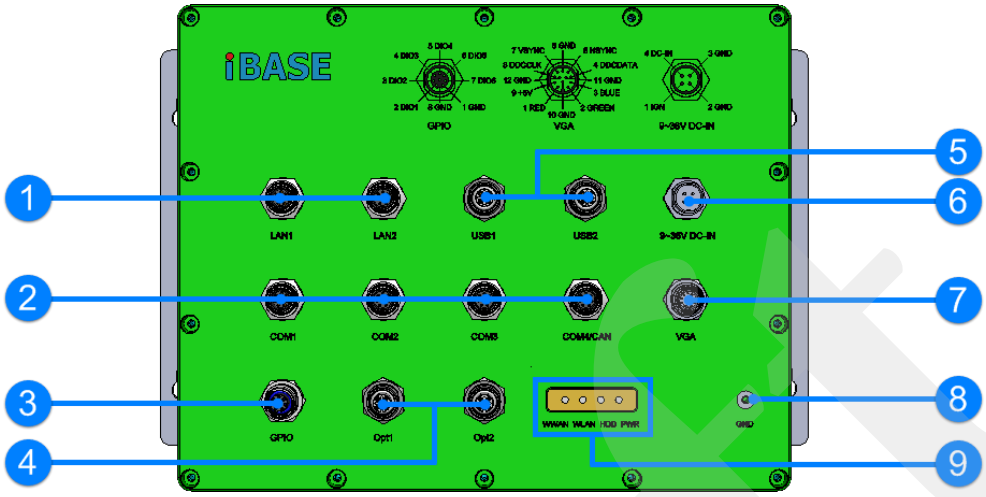
Product Name	MPT-3000RP
System	
Motherboard	MBT-3001P
Operating System	• Windows 7 / 8.1 (32-bit & 64-bit) • Windows Embedded 8 • Linux Fedora
CPU	Intel® Atom™ E3845 processor (2 MB L2, 1.91 GHz)
Chipset	Integrated
Memory	2 x DDR3L-1333 SO-DIMM 2GB, upgradable to 8 GB
Graphics	Intel® HD graphics Gen. 7 with 4EU Supports DX 11, OGL 3.0, OCL 1.2, OGLES 2.0
Super I/O	Fintek F81866AD
Storage	M.2 M2280 slot
Audio Codec	Realtek ALC662
Power Supply	DC 9~36V / 72 / 110V with IGN control
Fuse	Littlefuse® TAC ATO® Style Blade 15A, 58V DC
BIOS	AMI BIOS
Watchdog	Watchdog Timer 256 segments, 0, 1, 2…255 sec/min
Chassis	Aluminum, black

Mounting	Wall mounting / VESA mounting
Dimensions (W x H x D)	270 x 210 x 63 mm (10.63” x 8.27” x 2.48”)
Net Weight	3.5 kg (7.72 lb)
Certificate	EN50155:2007, EN50153:2014, EN50121-3-2:2015, EN45545 CE Class A, FCC Class A
I/O Ports (All are M12 type.)	
LAN	2 x GbE LAN
USB	2 x USB 2.0
SATA	1 x SATA II port
Serial	4 x COM ports: • COM1: RS-232/422/485 • COM2 & COM4: RS-232 * COM4 is optional with CAN.
Display	1 x VGA, up to 1920 x 1080
Digital I/O	6 digital I/O with 24V input tolerance * Define the I/O direction in **BIOS** > **Advanced Settings** > **Digital IO Configuration**. * 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	N/A
Expansion	• 1 x Mini PCIe slot (full-sized) with USB 2.0 & PCIe • 1 x Mini PCIe slot (half-sized) with USB 2.0 • 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:** -40 ~ 70 °C (-40 ~ 158 °F) for SSD • **Storage:** --40 ~ 85 °C (-40 ~ 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.

1.6 Overview

Front View



No.	Name	No.	Name
1	LAN Port	6	DC Power Input
2	COM Ports (COM1 RS232/422/485, COM2~COM4 RS-232) * COM4 is optional with CAN.	7	VGA Port
3	GPIO Port	8	Chassis Ground
4	Reserved Ports	9	LED Indicators
5	USB Port		

Oblique View

Top View

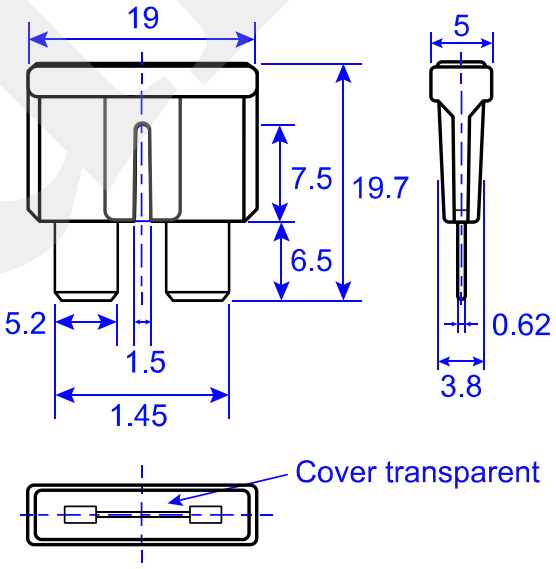
Bottom View

No.	Name	No.	Name
1	Antenna Holes	3	Wall Mounting Kit
2	CFast / SIM Card Slot Door	4	

1.7 Fuse Dimensions

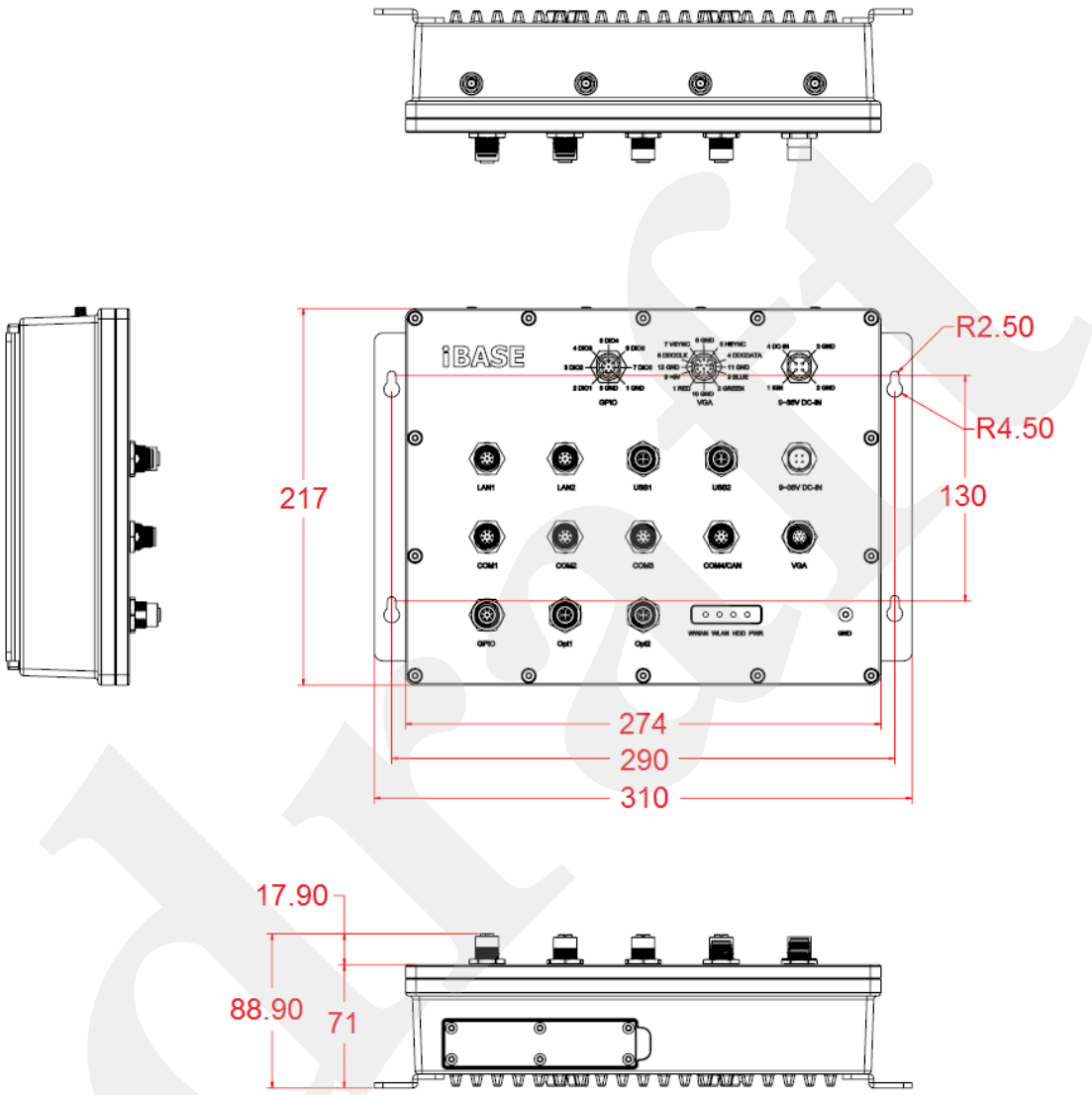
Unit: mm

Fuse for MPT-3000RP: Littlefuse® TAC ATO® Style Blade 15A, 58V DC



1.8 Dimensions

Unit: mm



Chapter 2
Hardware Configuration

The information provided in this chapter includes:

- Installations
- Information and locations of connectors

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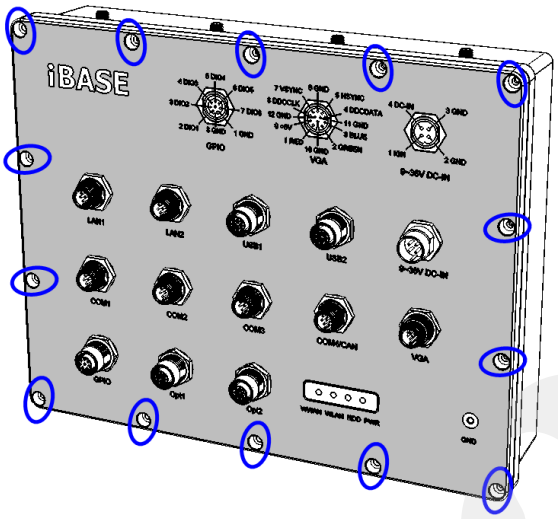
2.1 Installations

2.1.1 Memory Installation

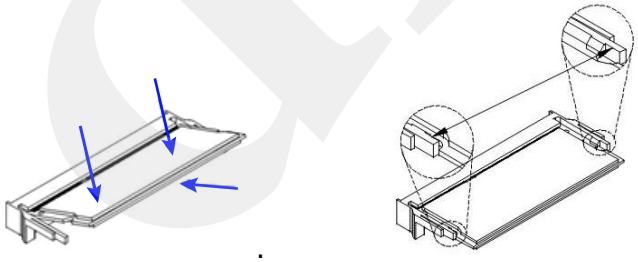
To install or replace the memory modules, you need to remove the device front cover first. Perform the following steps below:

1. Unscrew the 12 screws as shown below and open the device front cover carefully.



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 12 screws mentioned in Step 1 to secure the cover.

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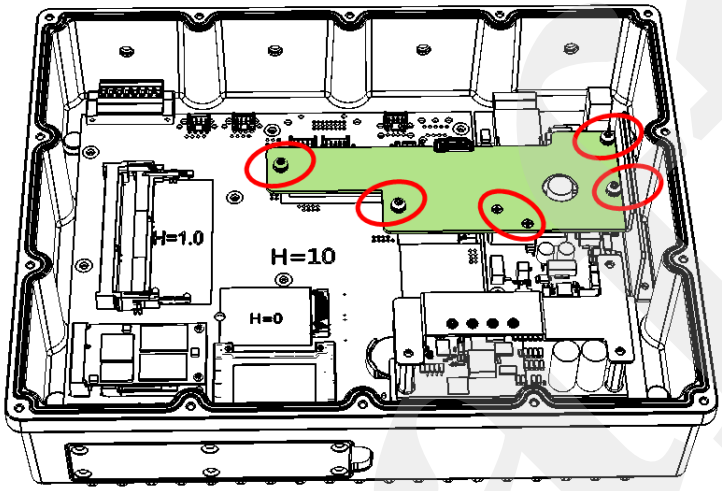
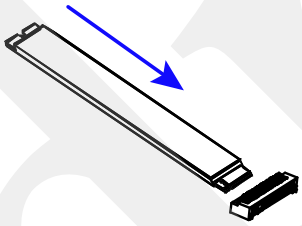
2.1.2 Storage Installation

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

1. Remove the device front cover by releasing 12 screws.
2. If you are about to replace an existing M.2 card, remove the heatsink along with thermal pad by releasing the 6 screws (4 round head screws and 2 flat head screws) as shown below.
   Then remove the standoff on the existing M.2 card and remove the card.



3. Align the key of the new M.2 card to the M.2 interface, and insert the card slantwise.

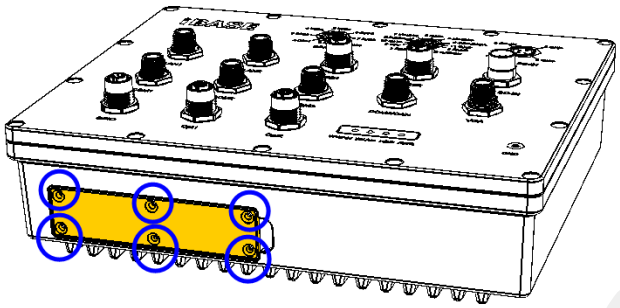


4. Push the new M.2 card down and fix the card with brass standoff you released.
5. Put the thermal pad onto the M.2 card and secure the heatsink back..

After installation, secure the front cover back.

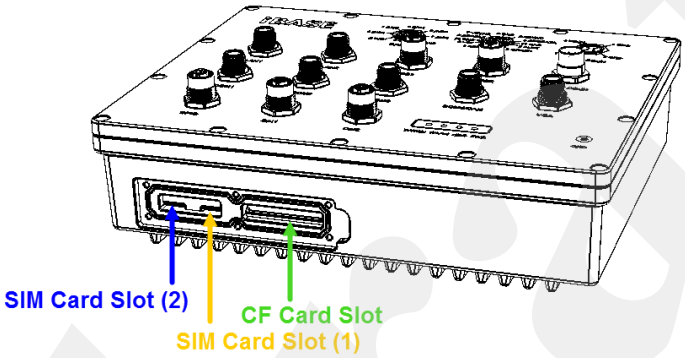
2.1.3 CFast & Micro-SIM Card Installation

1. Release 6 screws to open the CFast & Micro-SIM card door as shown below.



2. The CFast slot and two SIM card slots are indicated below.

   For CFast car, insert the card directly. To remove the CFast card, push the card again.



   For micro-SIM card, insert the card to one of the micro-SIM card slots with the chip down and push the card by using your fingernail or the tip of a pen. 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.

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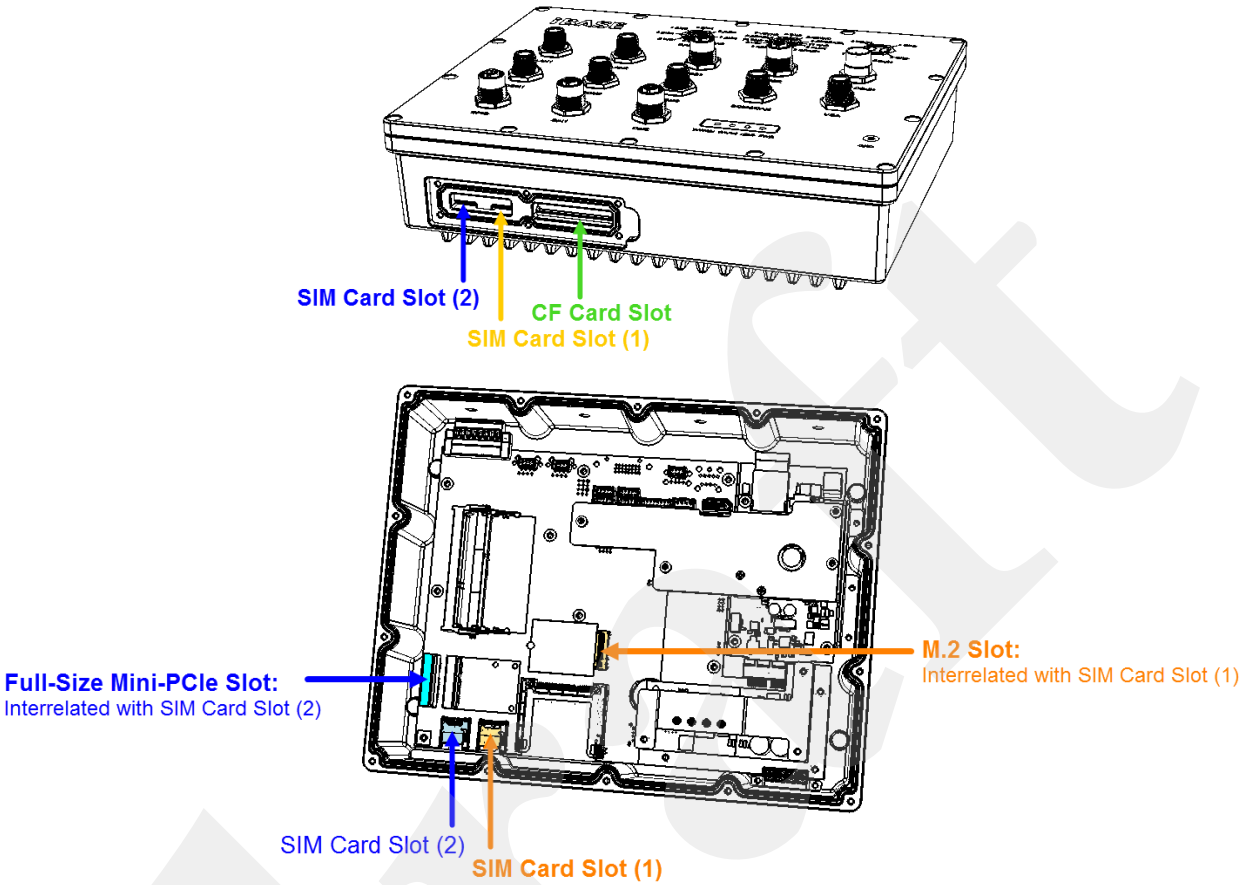
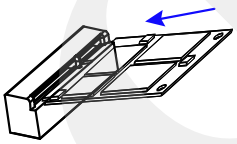
2.1.4 Mini-PCIe & M.2 Network Cards Installation

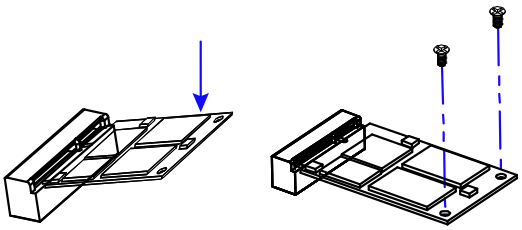
Before installation, firstly pay attention to the interrelation among the SIM card slots, mini-PCIe slot, and M.2 slot as below. Then you need to remove the front cover.



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.)



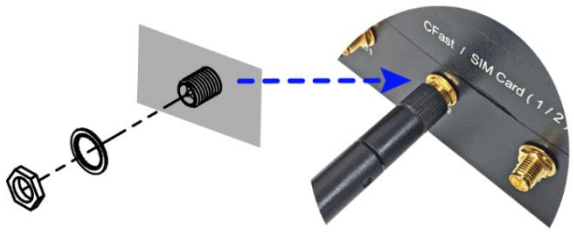
2. Push the mini-PCIe card down, fix it with the supplied 2 flat head screws for a full-sized card and with one screw for a half-sized card. (Fix the M.2 network card with the brass standoff.)



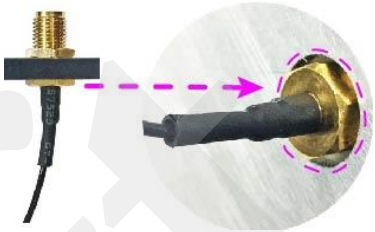
2.1.5 WiFi / 3G / 4G Antenna Installation

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.



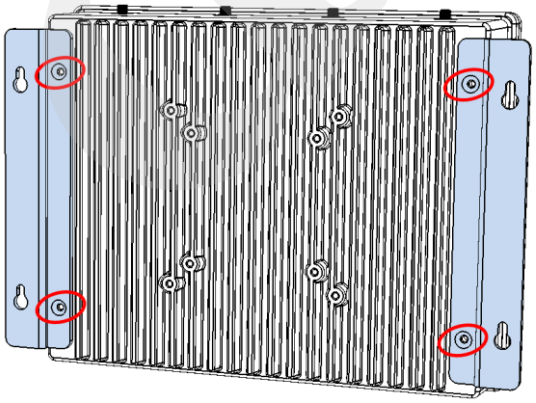
Info: The diameter of the nut is around 6.35 mm (0.25”-36UNC).

2.1.6 Wall Mounting Installation

Requirements

Before mounting the system, ensure that you have enough room for power and signal cable routing, and have good ventilation for the power adaptor. The method of mounting must be able to support the weight of the device plus the weight of the suspending cables to be attached to the system. Use the following methods for mounting your system:

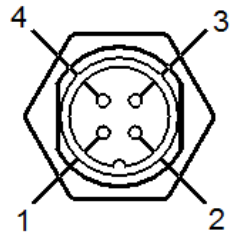
1. Turn your MPT-3000RP upside down, attach the mounting brackets to MPT-3000R, and secure with the supplied four screws as below.



2. Prepare at least four screws (M3, 6 mm) to mount MPT-3000RP on wall .

2.1.7 Pinout for M12 Connectors (Power Input, VGA, GPIO)

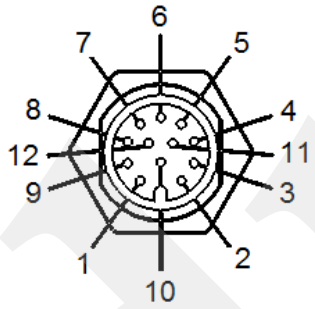
- **Power Input (M12, 4 pins, male)**



When you connect the connector to the automotive power, the ignition output shall be expected as +12 VDC. The DC-In and Ground leads can be directly connected to the automotive battery.

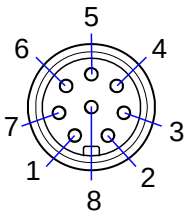
Pin	Assigment	Pin	Assigment
1	Ignition	3	Ground
2	Ground	4	DC Input

- **VGA Port (M12, 12 pins, male, A-code)**



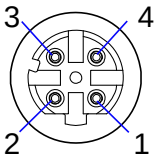
Pin	Assigment	Pin	Assigment
1	Red	7	VSYNC
2	Green	8	DDCCLK
3	Blue	9	+5V
4	DDCDATA	10	Ground
5	HSYNC	11	Ground
6	Ground	12	Ground

- **LAN Connector (M12, 8 pins, male, A-code)**



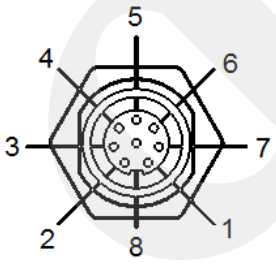
Pin	Assignment	Pin	Assignment
1	MX1+	5	MX2-
2	MX3-	6	MX4+
3	MX3+	7	MX1-
4	MX4-	8	MX2+

- **USB Connector (M12, 4 pins, female, D-code)**



Pin	Assignment	Pin	Assignment
1	+5V	3	D+
2	Ground	4	D-

- **GPIO Connector (M12, 8 pins, female, A-code)**



Pin	Assignment	Pin	Assignment
1	Ground	5	DIO4
2	DIO1	6	DIO5
3	DIO2	7	DIO6
4	DIO3	8	Ground

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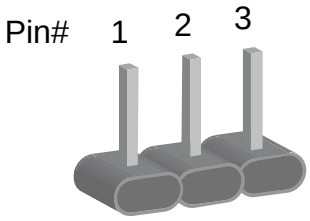
2.2 Setting the Jumpers

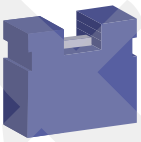
Set up and configure your MPT-3000R by using jumpers for various settings and features according to your needs and applications. Contact your supplier if you have doubts about the best configuration for your use.

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.

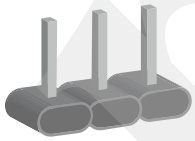
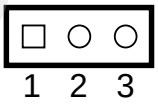
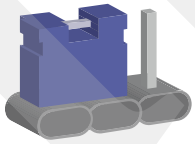
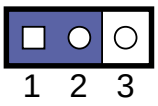
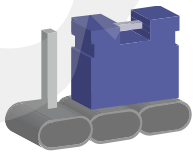
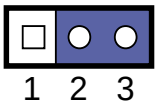


A 3-pin jumper



A jumper cap

Refer to the illustration below to set jumpers.

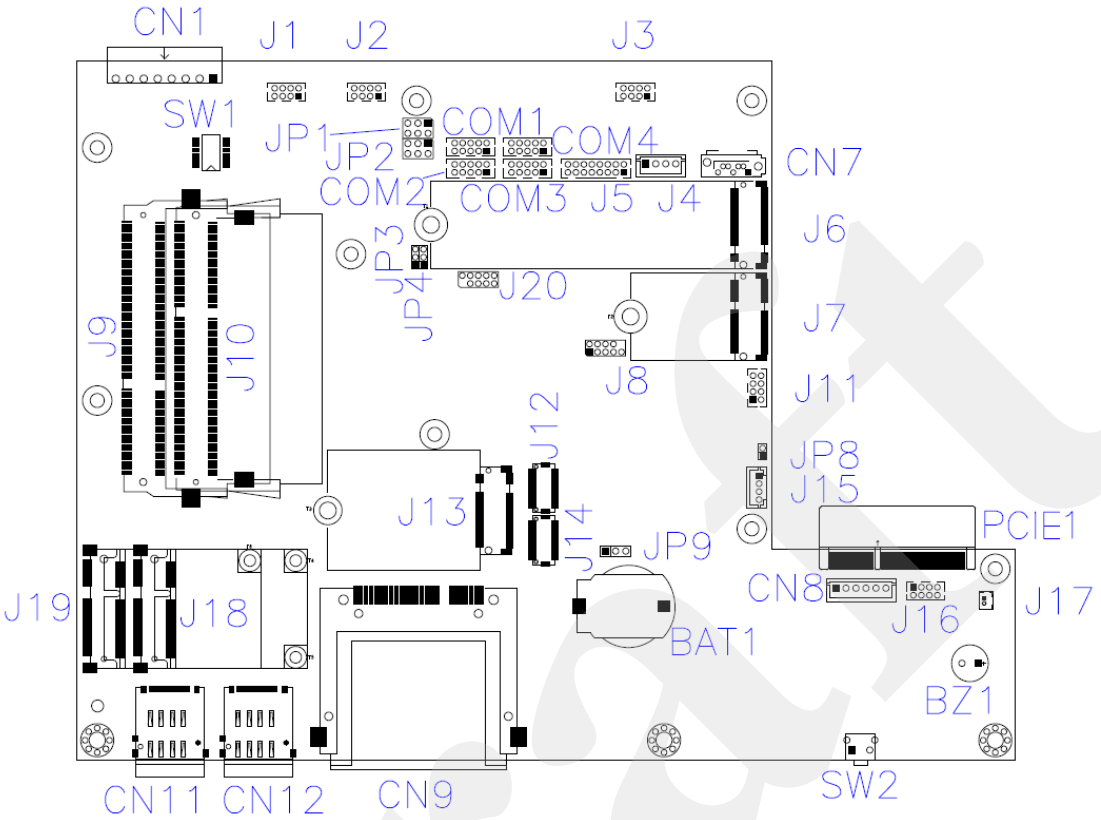
Pin closed	Oblique view	Schematic illustration in the manual
Open		
1-2		
2-3		

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-3001P



MBT-3001P - top

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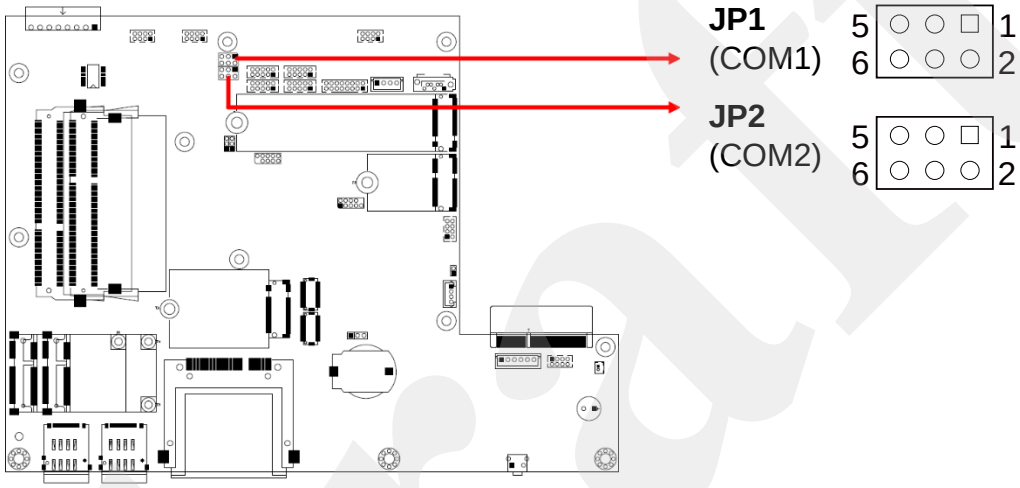
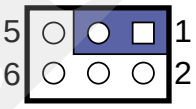
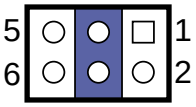
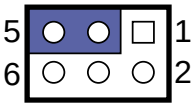
2.4 Jumpers Quick Reference

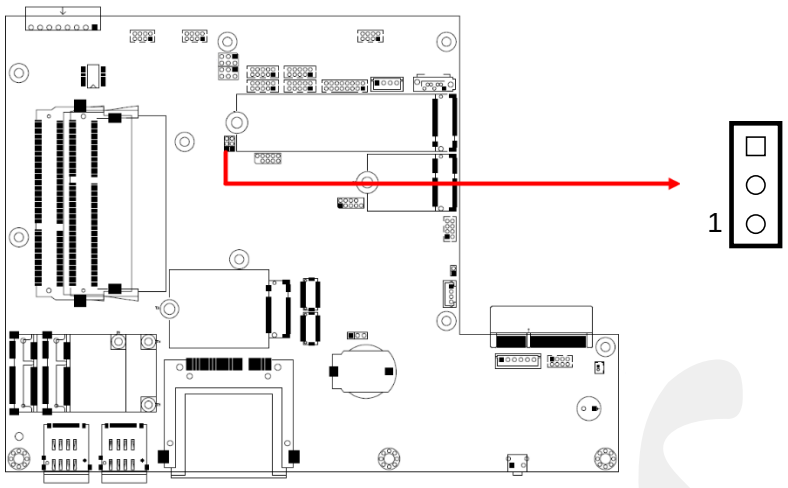
Function	Connector Name	Page
COM1, COM2 Port RS-232 Selection	JP1, JP2	19
ME Register Clearance	JP3	20
CMOS Data Clearance	JP4	21

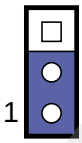
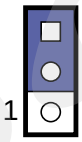
2.4.1 COM1, COM2 Port RS-232 Selection (JP1, JP2)



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

2.4.2 ME Register Clearance (JP3)



Function	Pin closed	Illustration
Normal (default)	1-2	
Clear ME Register	2-3	

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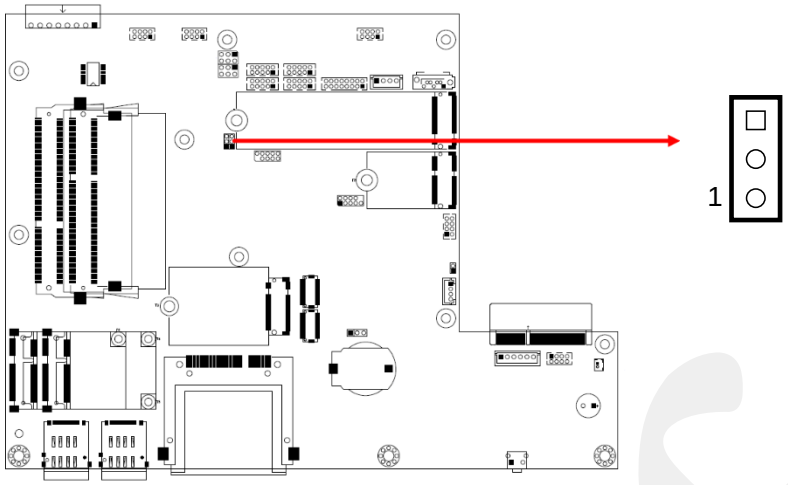
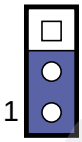
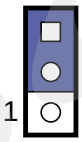
2.4.3 CMOS Data Clearance (JP4)



Function	Pin closed	Illustration
Normal (default)	1-2	
Clear CMOS	2-3	

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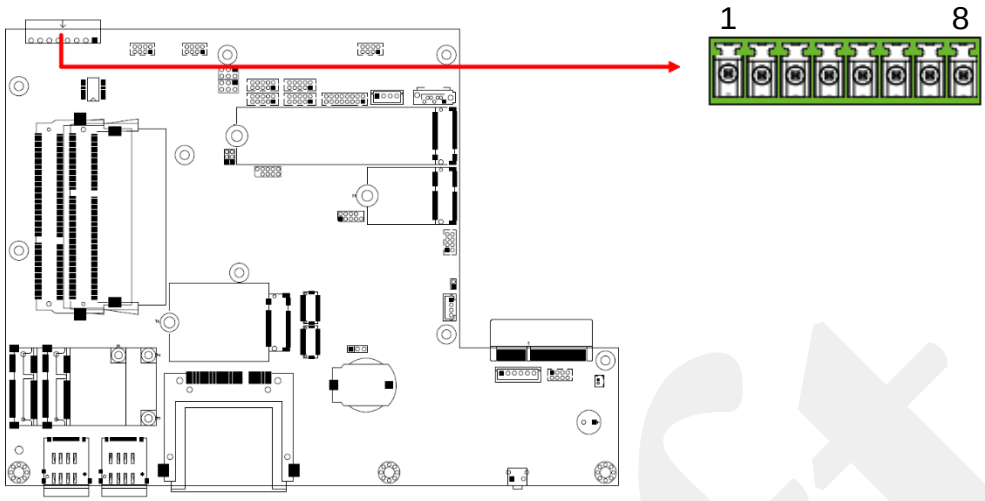
2.5 Connectors Quick Reference

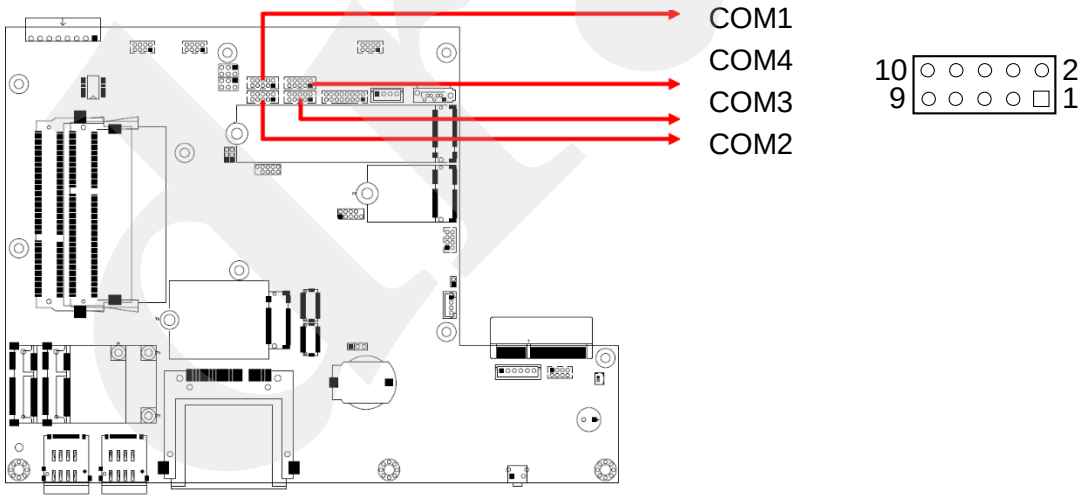
Function	Connector Name	Page
Digital I/O Port	CN1	23
COM Port Connector	COM1, COM2, COM3, COM4	23
CRT Connector	J5	24
CAN Module Connection	J11	25
M.2 B3042 USB2.0 Interface (interrelated wtih CN12)	J13	25
Full Mini PCIe USB2.0 / PCIe (x1) Connector (interrelated with CN11)	J19	26
Digital IO Pull High to +5V Switch	SW1	26
DVI-D Port	CN2	--
LAN Port	J1, J2	--
USB 2.0 Port	J3	--
SATA HDD Power Connector	J4	--
SATA II Connector	CN7	--
CFast Connector	CN9	--
SIM Card Slot	CN11, CN12	--
M.2 M2280 SATA Interface	J6	--
M.2 E2230 USB2.0 / PCIe (x1) Interface	J7	--
DDR3L SO-DIMM Socket	J9, J10	--
Half Mini PCIe USB2.0 Connector	J18	--
Power Module Interface	PCIE1	--
Reset Button	SW2	--
Power Button Connector (Reserved)	CN8	--
Power Connector (Reserved)	J16	--

2.5.1 Digital I/O Port (CN1)



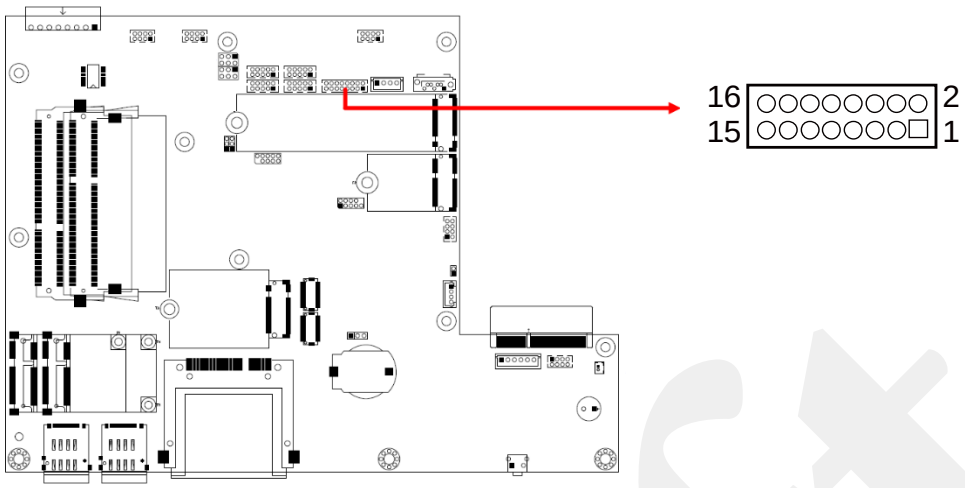
Pin	Assigment	Pin	Assigment
1	GND	5	DIO4
2	DIO1	6	DIO5
3	DIO2	7	DIO6
4	DIO3	8	GND

2.5.2 COM Port Connector (COM1 ~ COM4)



Pin	Assigment	Pin	Assigment
1	DCD	6	DSR
2	SIN	7	RTS
3	SOUT	8	CTS
4	DTR	9	RI
5	GND	10	N/C

2.5.3 CRT Connector (J5)



Pin	Assigment	Pin	Assigment
1	Red	9	GND
2	VCC	10	HSYNC
3	Green	11	GND
4	GND	12	VSYNC
5	Blue	13	GND
6	N.C.	14	DDCCLK
7	N.C.	15	GND
8	DDCDATA	16	N.C.

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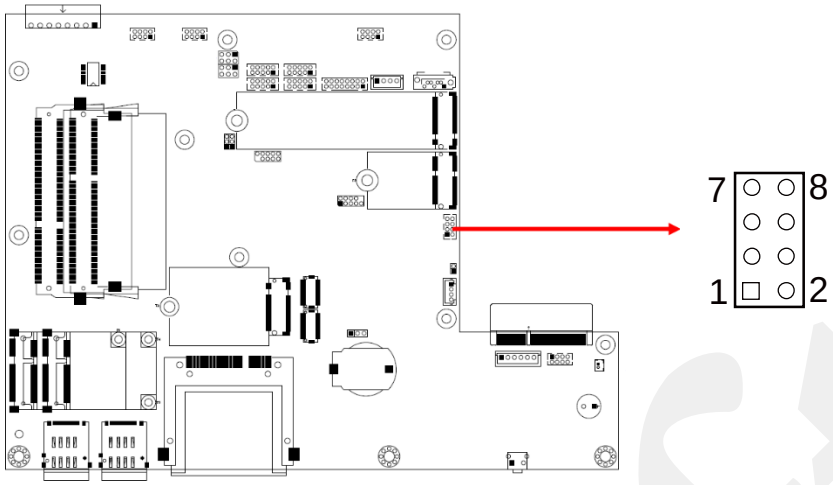
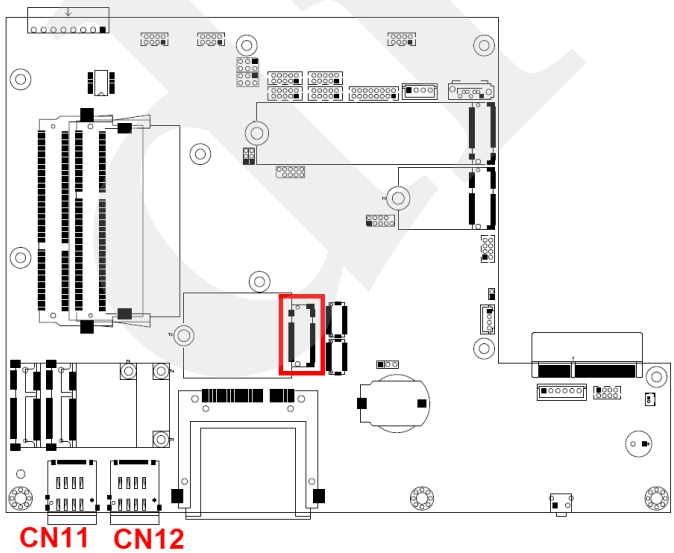
2.5.4 CAN Module Connection (J11)



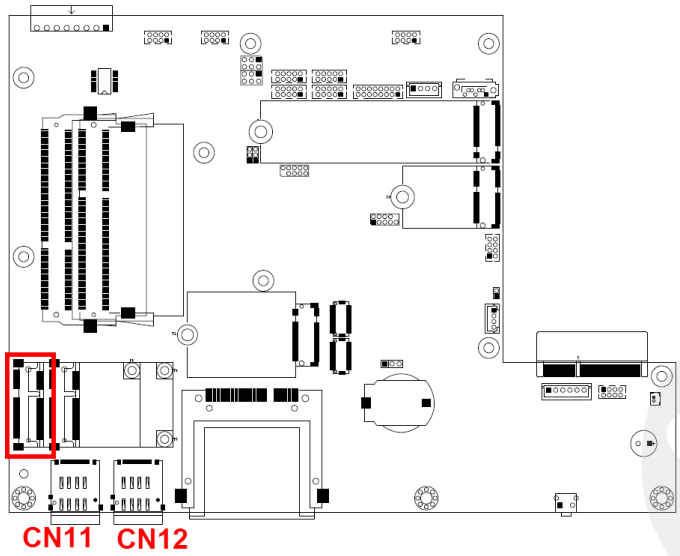
Pin	Assigment	Pin	Assigment
1	+5V	5	USB+
2	GND	6	COM6-RX
3	USB-	7	GND
4	COM6-TX	8	+5V

2.5.5 M.2 B2280 USB2.0 Interface (J13)



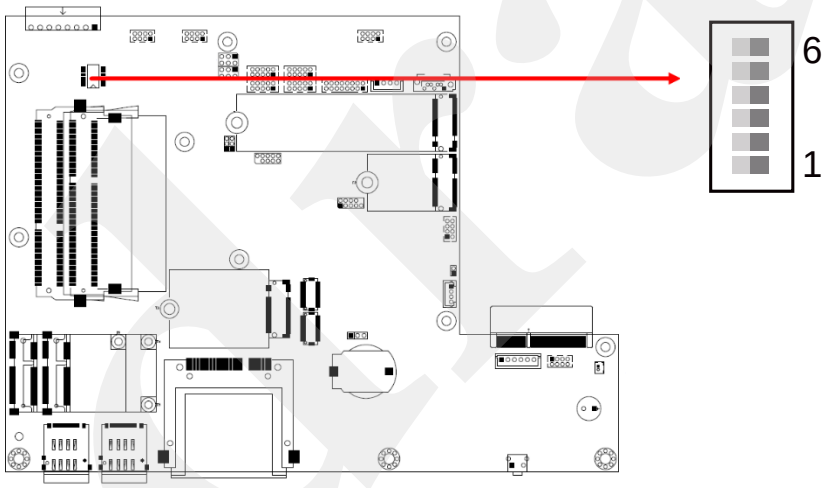
J13 is interrelated with the SIM card slot CN12.

2.5.6 Full Mini PCIe USB2.0 / PCIe (x1) Connector (J19)



J19 is interrelated with the SIM card slot CN11.

2.5.7 Digital IO Pull High to +5V Switch (SW1)



Switch to **ON** to pull high to 5V.

Pin	Assigment	Pin	Assigment
1	DIO1	4	DIO4
2	DIO2	5	DIO5
3	DIO3	6	DIO6

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® Trusted Execution Engine Installation
- Intel® Serial I/O Driver Installation
- G-Sensor Driver Installation

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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 DVD enclosed in the package. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

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

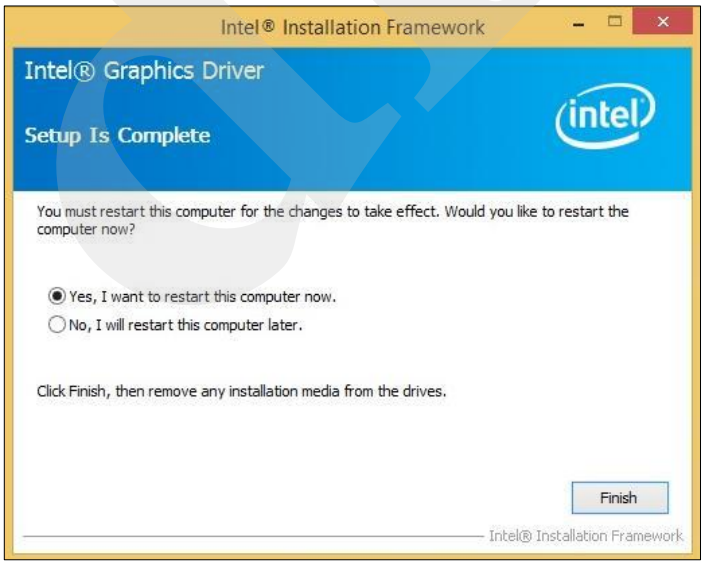
3. When the *Welcome* screen to the Intel® Chipset Device Software appears, click **Next** to continue.
4. Click **Yes** to accept the software license agreement and proceed with the installation process.
5. When the driver has been completely installed, restart the computer for changes to take effect.

3.3 VGA Driver Installation

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

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

3. When the *Welcome* screen appears, click **Next** to continue.
4. Click **Yes** to agree with the license agreement and continue the installation.
5. When the driver has been completely installed, restart the computer for changes to take effect.



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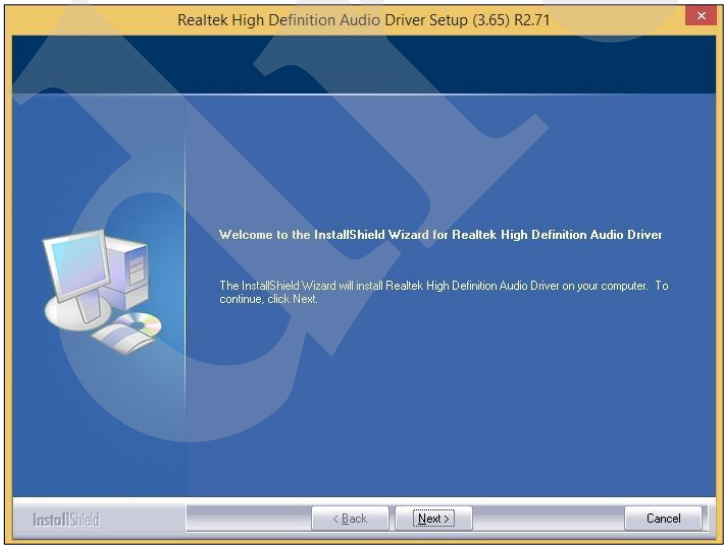
3.4 HD Audio Driver Installation

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

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

3. On the *Welcome* screen of the InstallShield Wizard, click **Next** for installation.

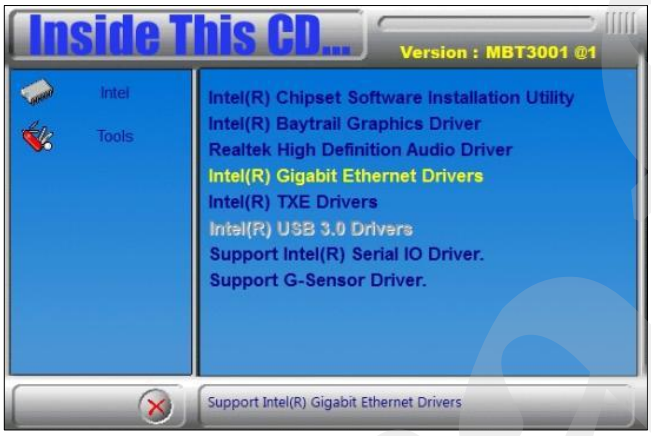


4. The driver has been completely installed. You are suggested to restart the computer and for changes to take effect.

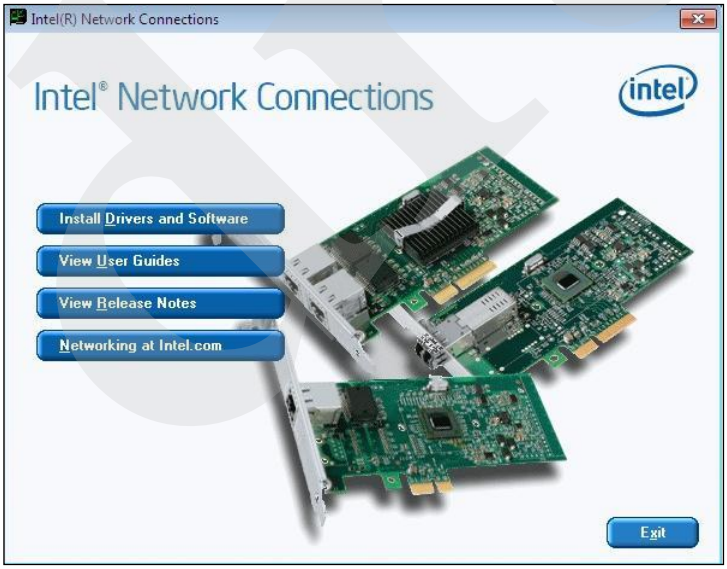
3.5 LAN Driver Installation

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

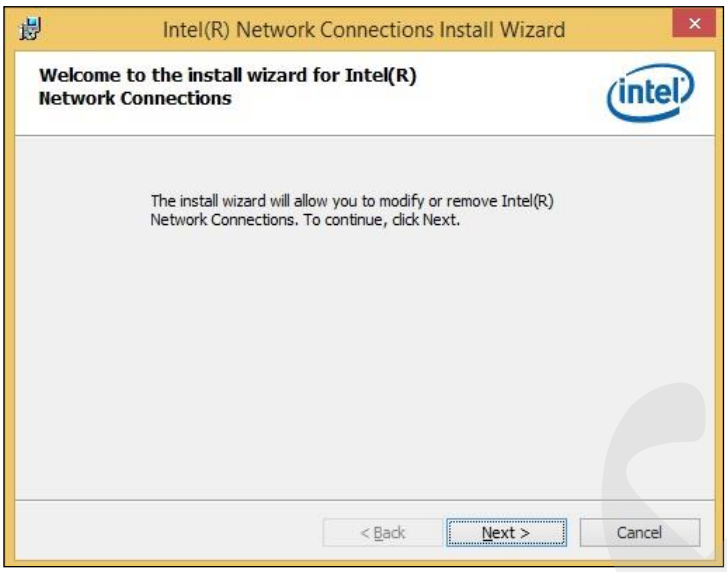
2. Click **Intel(R) Gigabit Ethernet Drivers**.



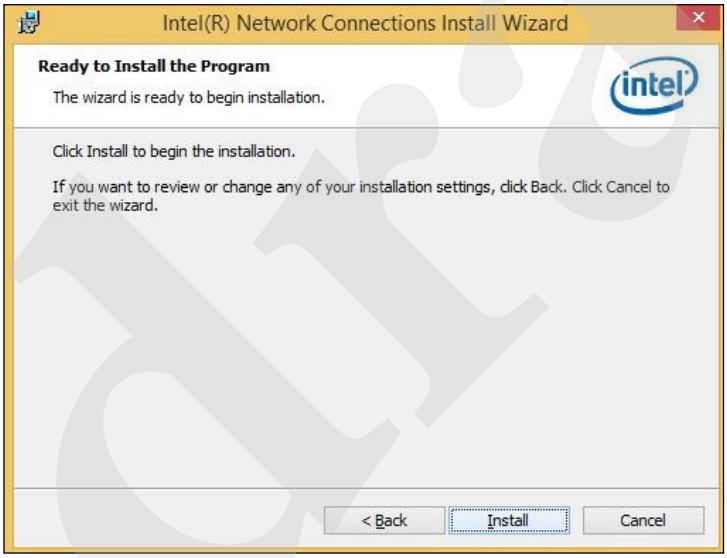
3. On the screen of *Intel® Network Connections*, click **Install Drivers and Software**.



4. When the *Welcome* screen appears, click **Next**.



5. Accept the license agreement and click **Next** for installation..
6. On the *Setup Options* screen, click the checkbox to select the desired driver(s) for installation. Then click **Next** to continue.
7. 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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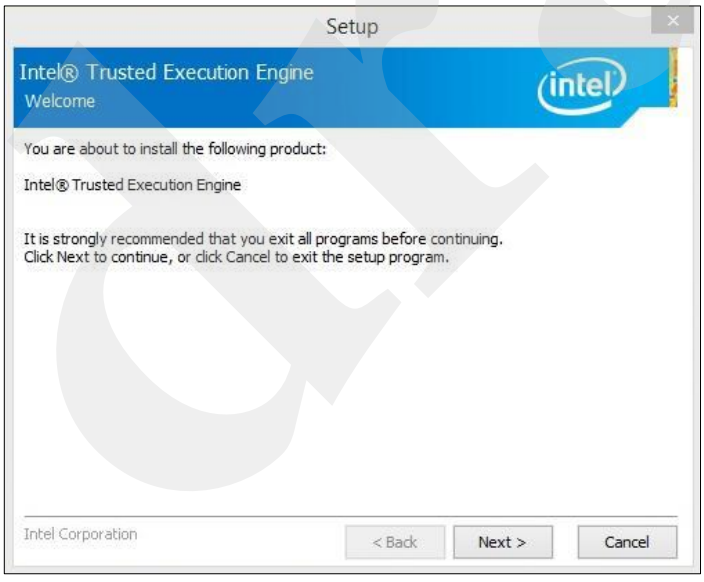
3.6 Intel® Trusted Execution Engine Installation

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

2. Click **Intel** and then **Intel(R) TXE Drivers**.

3. When the *Weocome* screen appears, click **Next** to contiune installation.



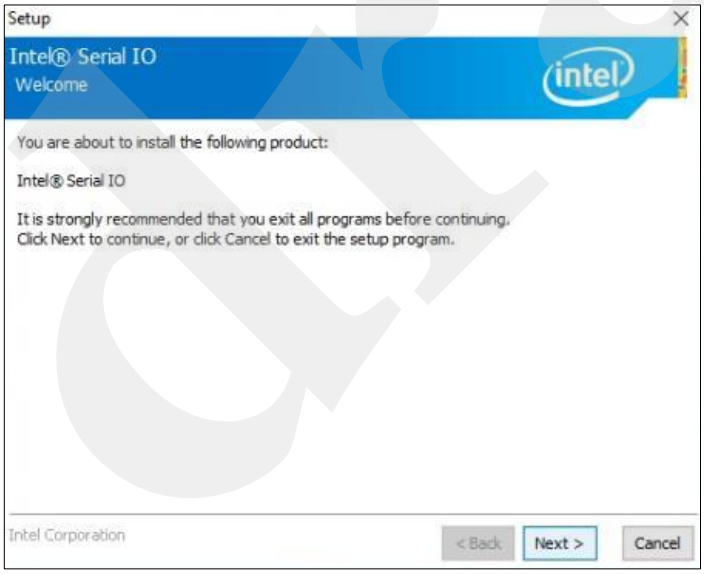
4. Accept the license agreement and click **Next** for installation.
5. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

3.7 Intel® Serial I/O Driver Installation

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

2. Click **Intel** and then **Support Intel(R) Serial IO Driver**.

3. When the *Weocome* screen appears, click **Next** to contiune installation.



4. Accept the license agreement and click **Next** for installation.
5. The driver has been completely installed. You are suggested to restart the computer for changes to take effect.

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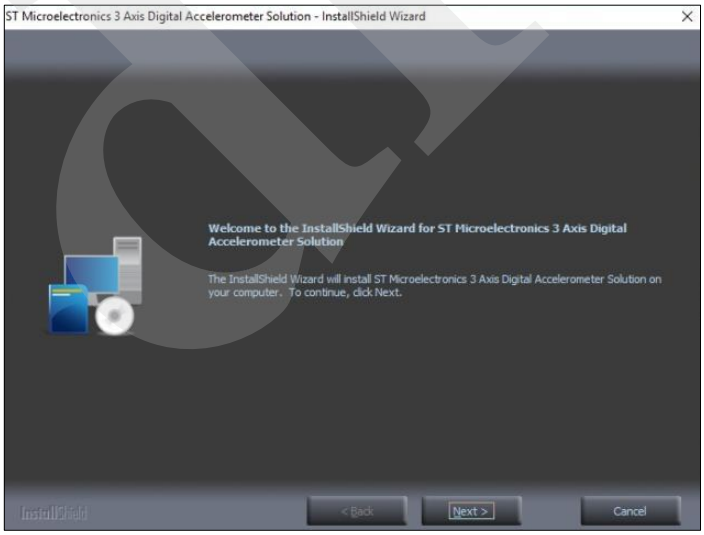
3.8 G-Sensor Driver Installation

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

1. Click **Intel** and then **Intel(R) Baytrail Chipset Drivers**.

2. Click **Intel** and then **Support G-Sensor Driver**.

3. When the *Weocome* screen appears, click **Next** to contiune installation.



4. Accept the license agreement and click **Next** and then click **Install**.
5. 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
- Chipset 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
```

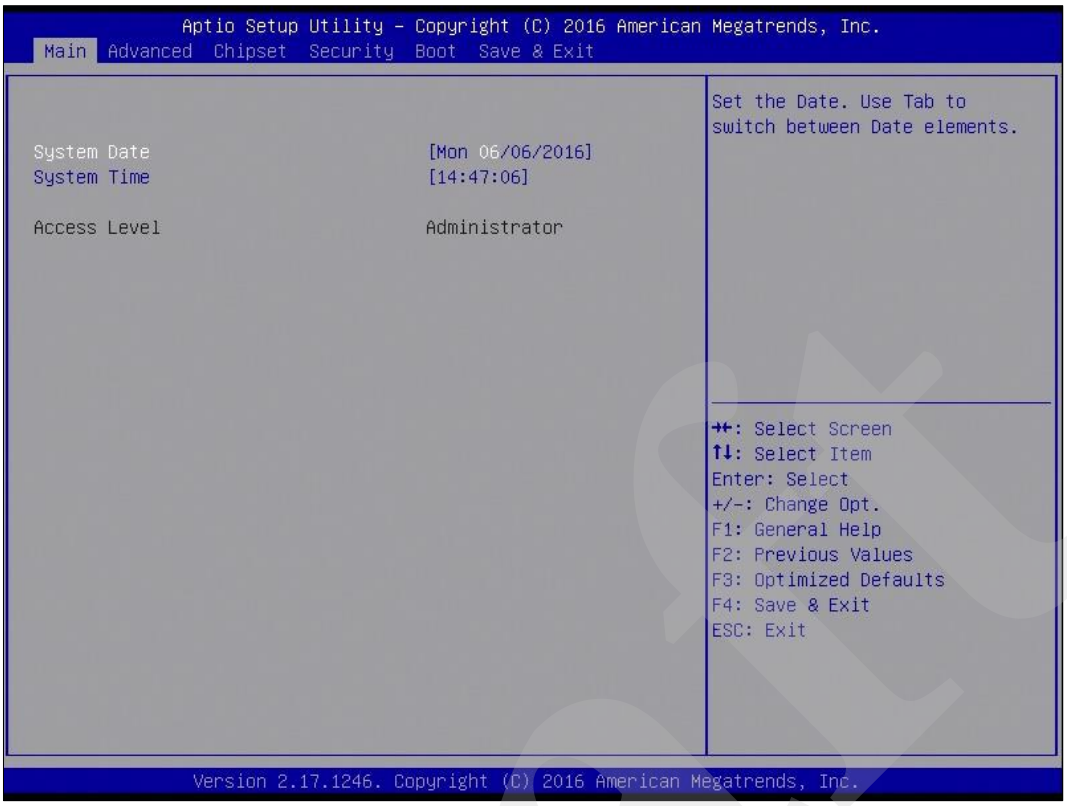
In general, press the arrow keys to highlight items, <Enter> to select, the <PgUp> and <PgDn> keys to change entries, <F1> for help, and <Esc> to quit.

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.

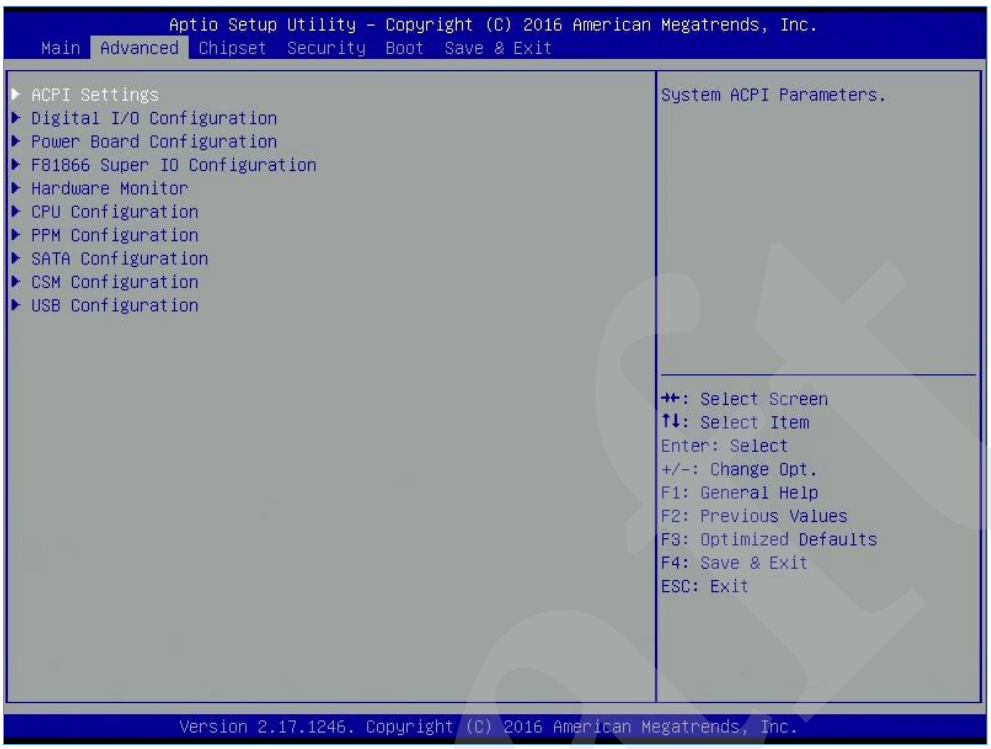
4.3 Main Settings



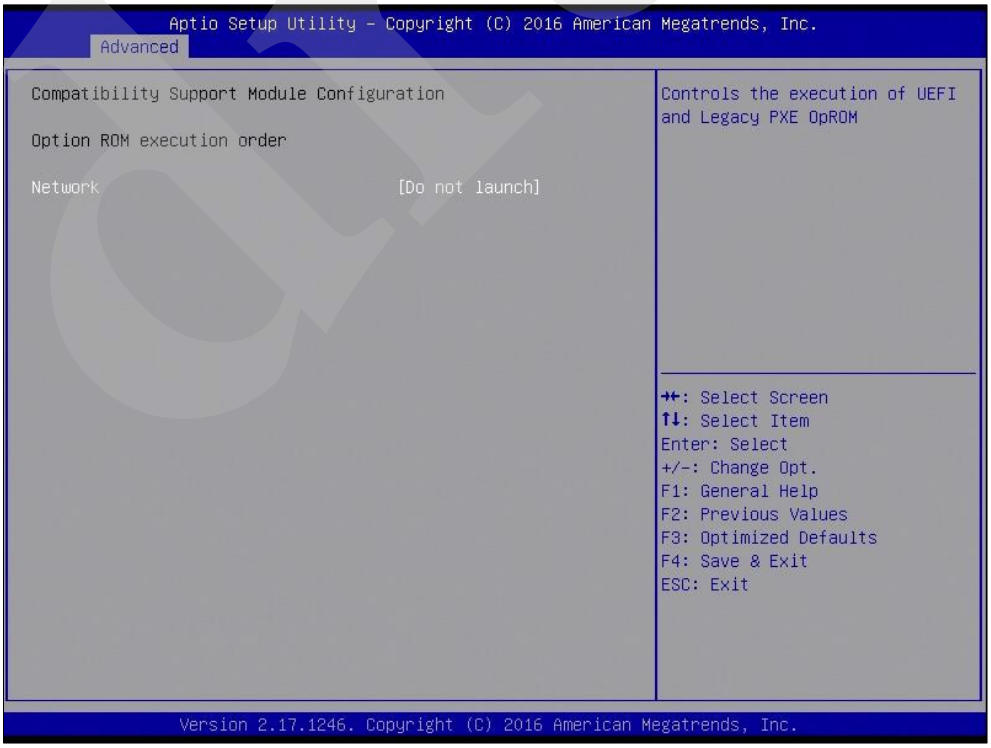
BIOS Setting	Description
System Date	Sets the date. Use the <Tab> key to switch between the data elements.
System Time	Set the time. Use the <Tab> key to switch between the data elements.

4.4 Advanced Settings

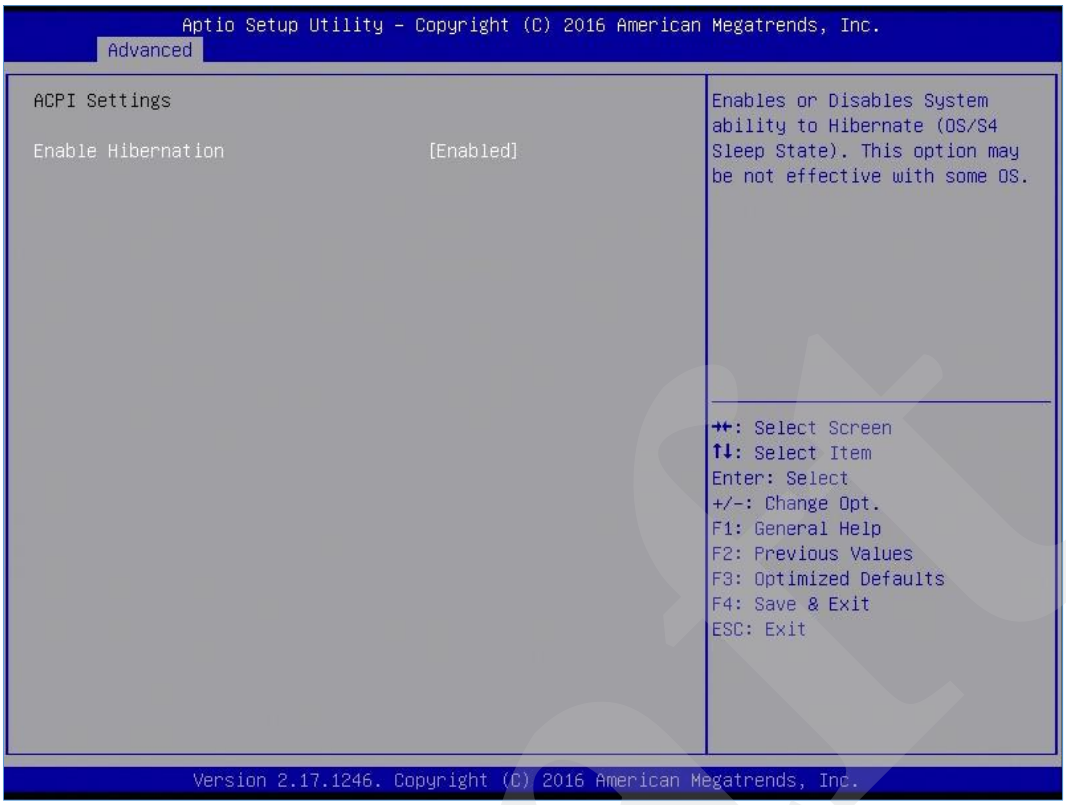
This section allows you to configure, improve your system and allows you to set up some system features according to your preference.



4.4.1 CSM Configuration

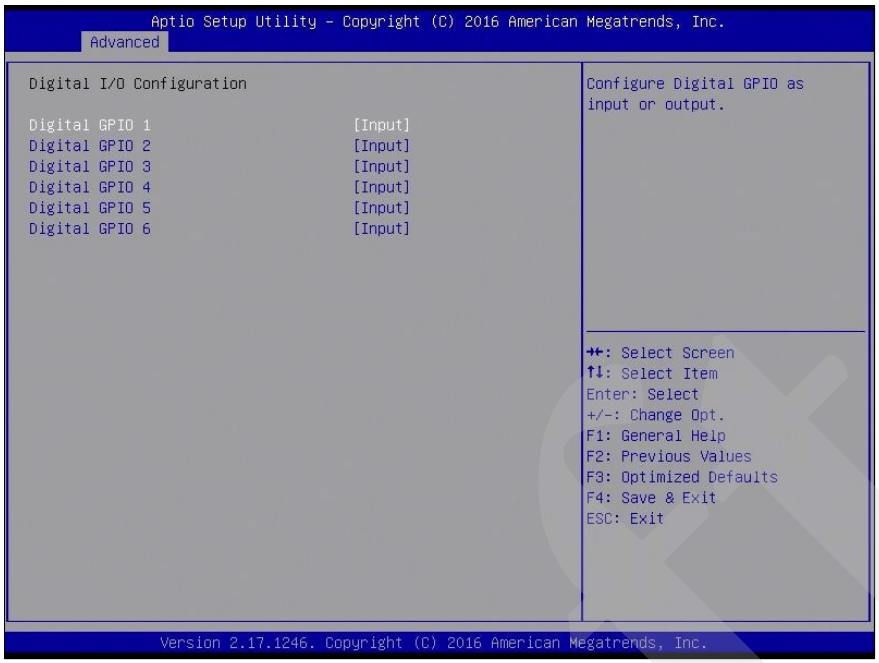


4.4.2 ACPI Settings



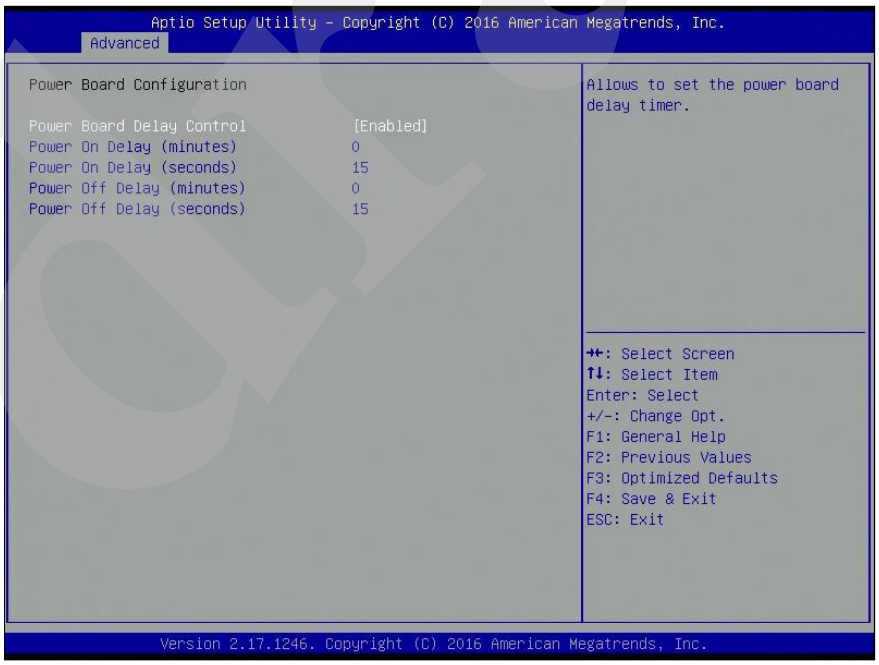
BIOS Setting	Description
Enable Hibernation	Enables or disables the System ability to Hibernate (OS/S4 Sleep State). This option may not be effective with some OS.
ACPI Sleep State	Selects ACPI sleep state that the system will enter when the SUSPEND button is pressed.

4.4.3 Digital I/O Configuration



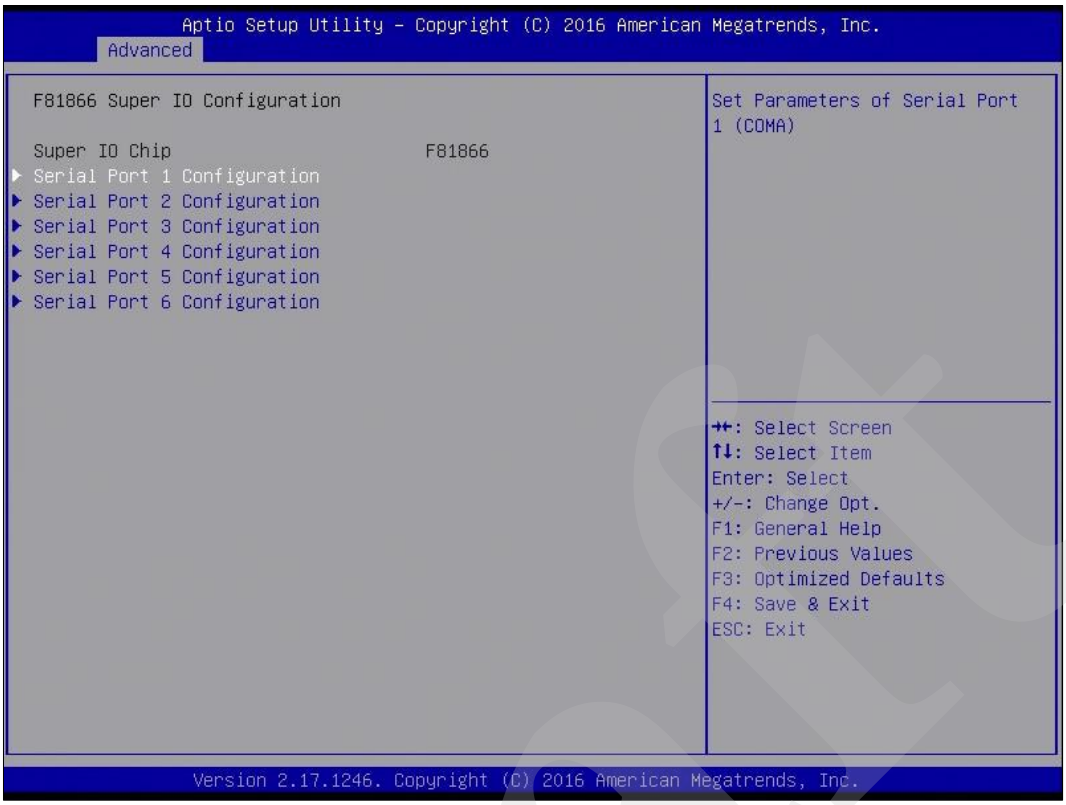
BIOS Setting	Description
Digital GPIO 1 ~ 6	Configure Digital GPIO as input or output.

4.4.4 Power Board Configuration



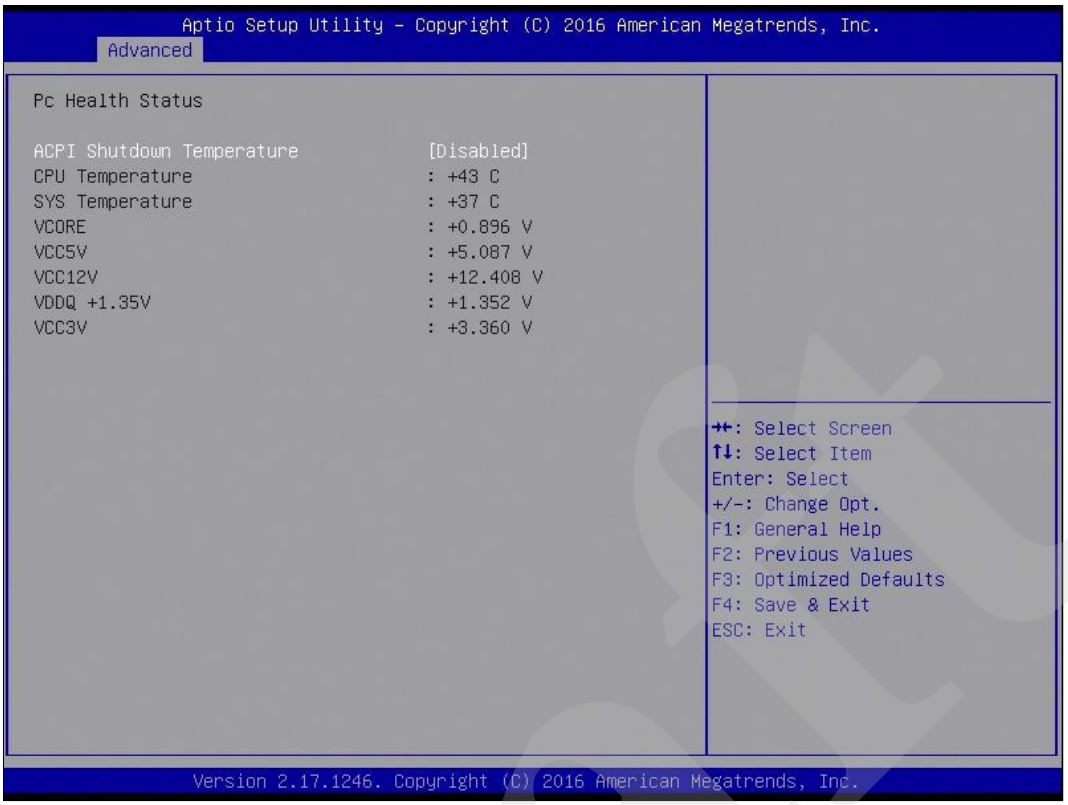
BIOS Setting	Description
Power Board Delay Control	Allows to set the delay timer for turning on or off the power board.

4.4.5 Super IO Configuration



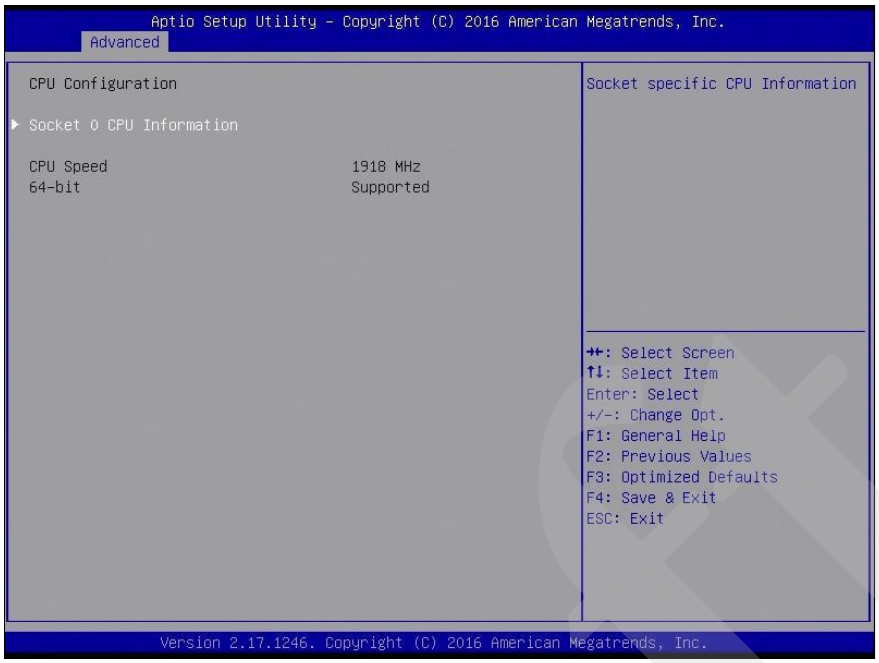
BIOS Setting	Description
Serial Port Configuration	Sets Parameters of Serial Ports. You can enable / disable the serial port and select an optimal settings for the Super IO device. * COM5 is for internal use only. COM6 sigals come from the on-board connector J11, and is reserved for future use to connect to CAN module.

4.4.6 Hardware Monitor



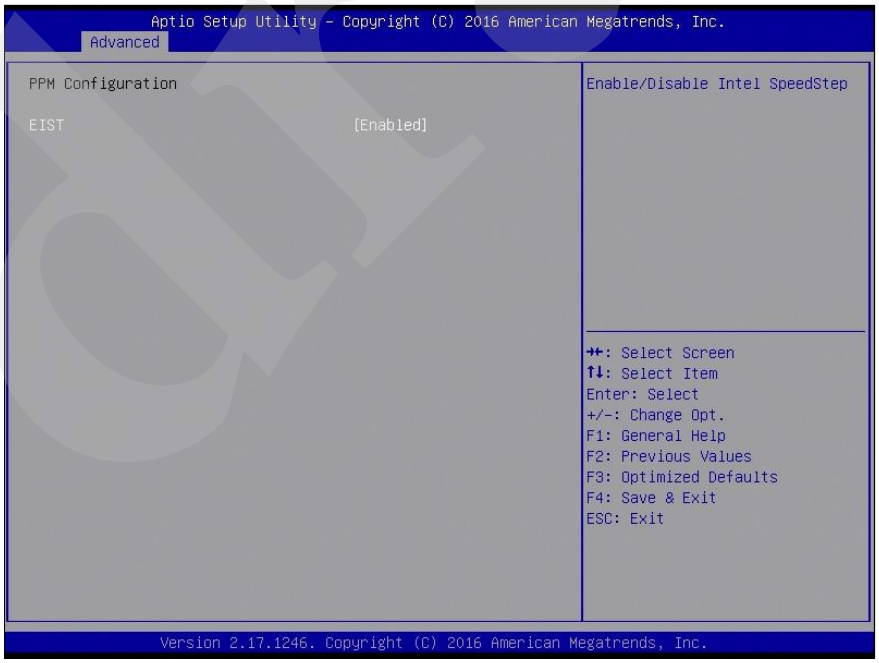
BIOS Setting	Description
Smart Fan Function	This field enables or disables the smart fan feature. Options: Disabled (default), 50°C, 60°C, 70°C, 80°C, 90°C
Shutdown Temperature	This field enables or disables the Shutdown Temperature Options: Disabled (default). 70°C, 75°C, 80°C, 85°C, 90°C, 95°C
Temperatures / 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

4.4.7 CPU Configuration



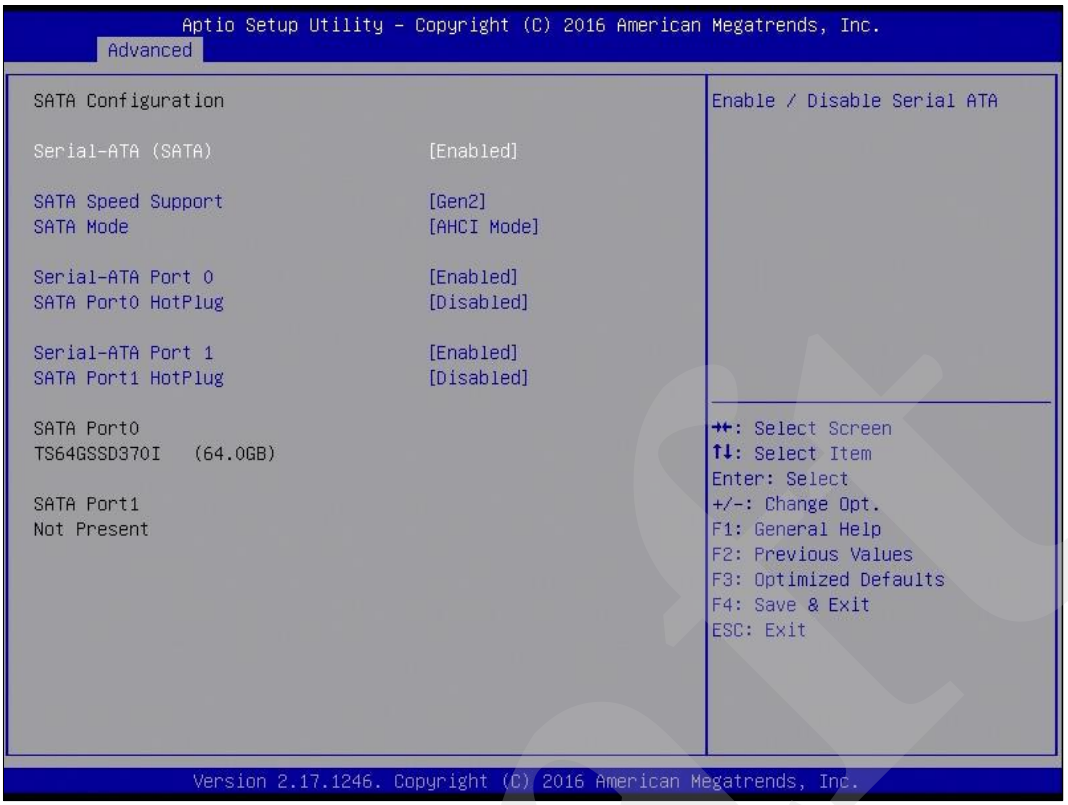
BIOS Setting	Description
Socket 0 CPU Information	Displays the specific socket CPU Information.

4.4.8 CPU PPM Configuration



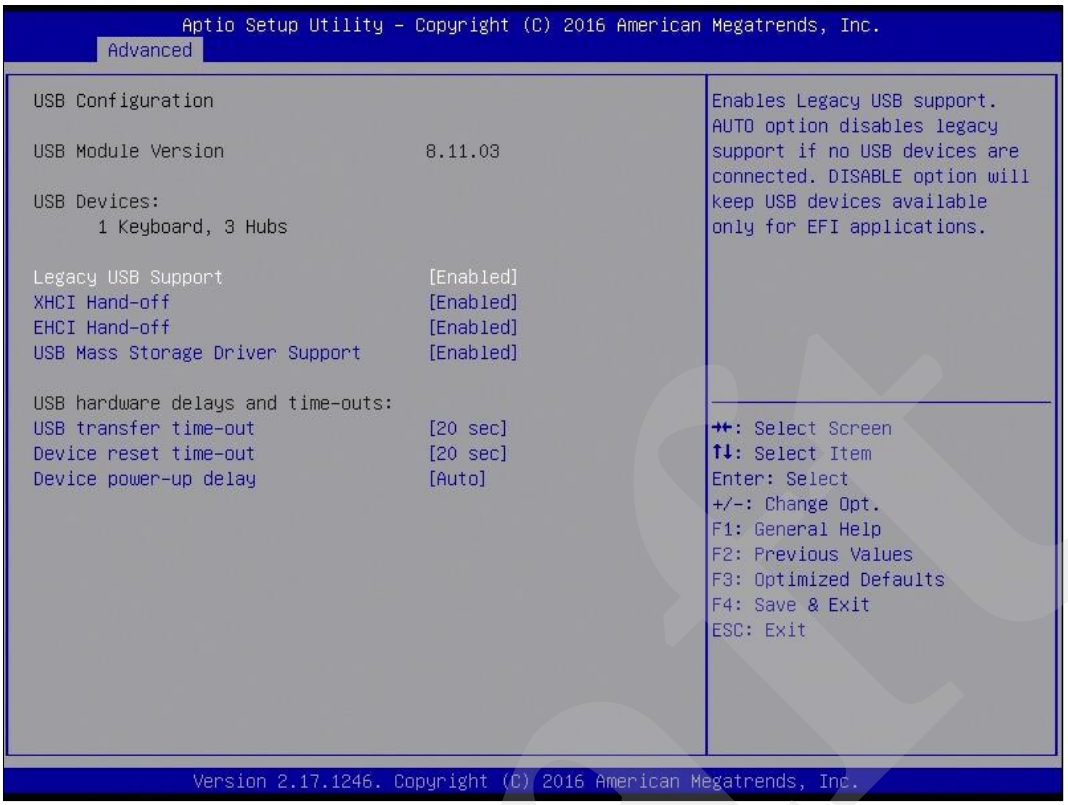
BIOS Setting	Description
EIST	Enables / Disables Intel SpeedStep.

4.4.9 SATA Configuration



BIOS Setting	Description
Serial-ATA (SATA)	Enables / Disables the Serial ATA.
SATA Mode	Selects IDE / AHCI Mode.
Serial –ATA Port 0	Enables / Disables Serial Port 0.
SATA Port0 HotPlug	Enables / Disables SATA Port 0 HotPlug.
Serial –ATA Port 1	Enables / Disables Serial Port 1.
SATA Port1 HotPlug	Enables / Disables SATA Port 1 HotPlug.

4.4.10 USB Configuration



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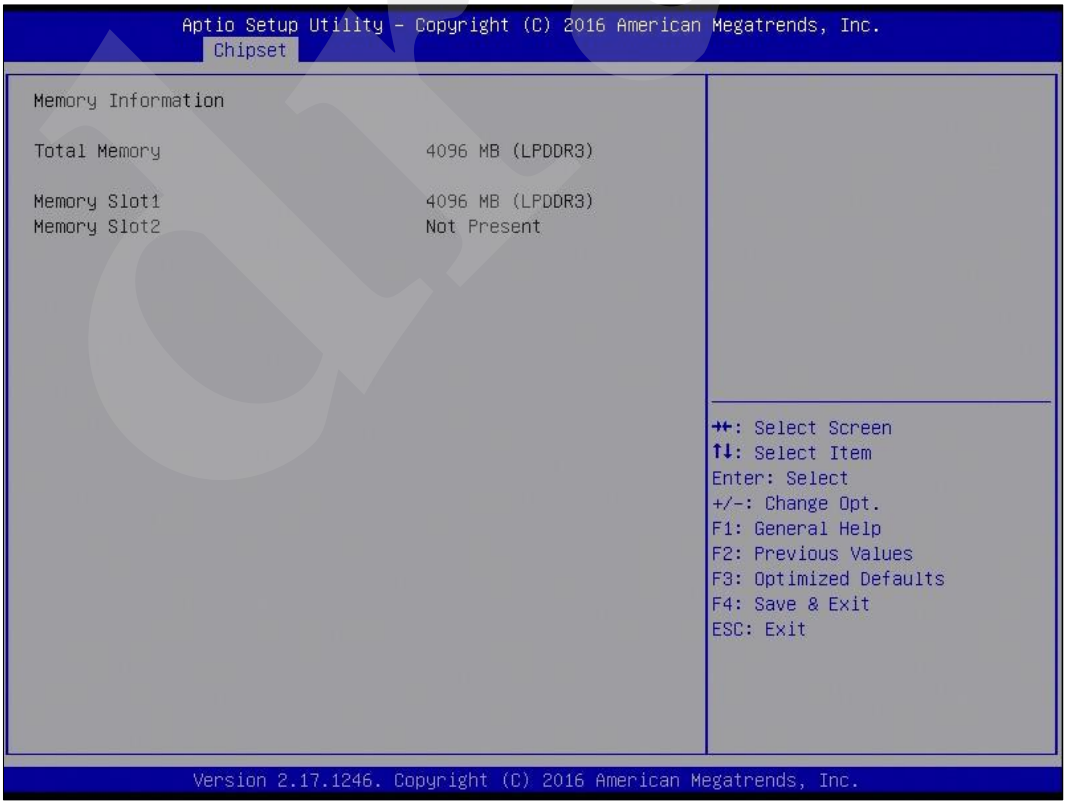
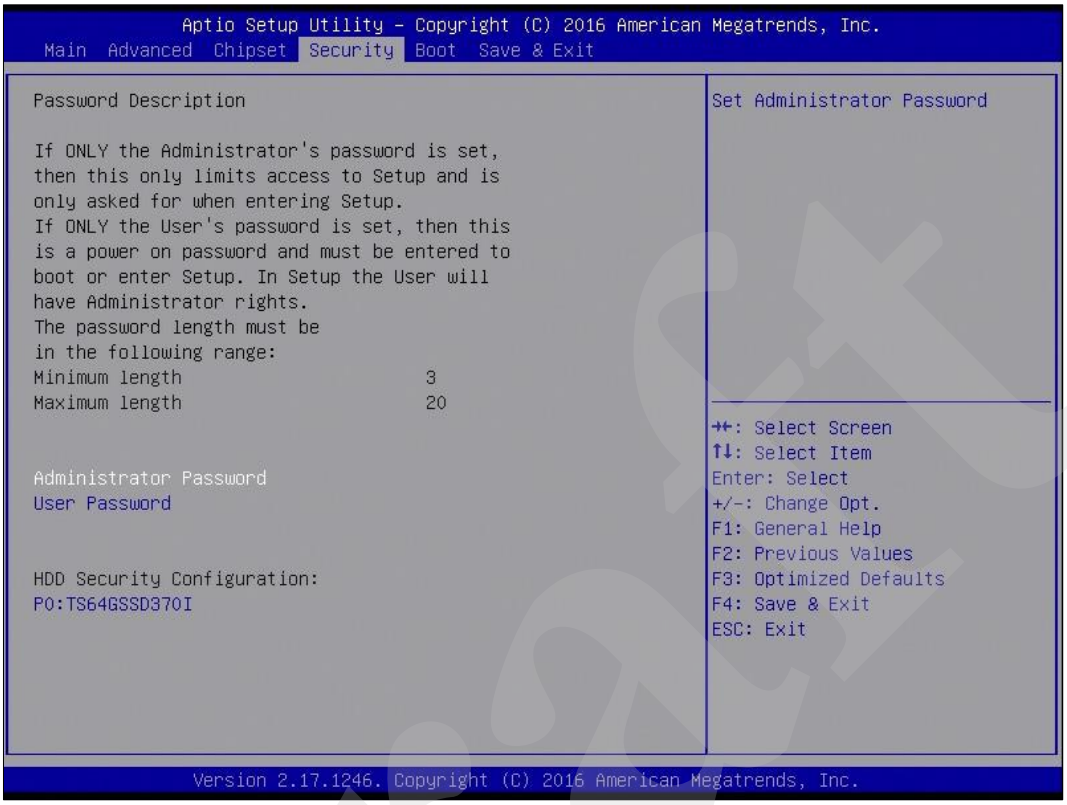
4.5 Chipset Settings

4.5.1 North Bridge



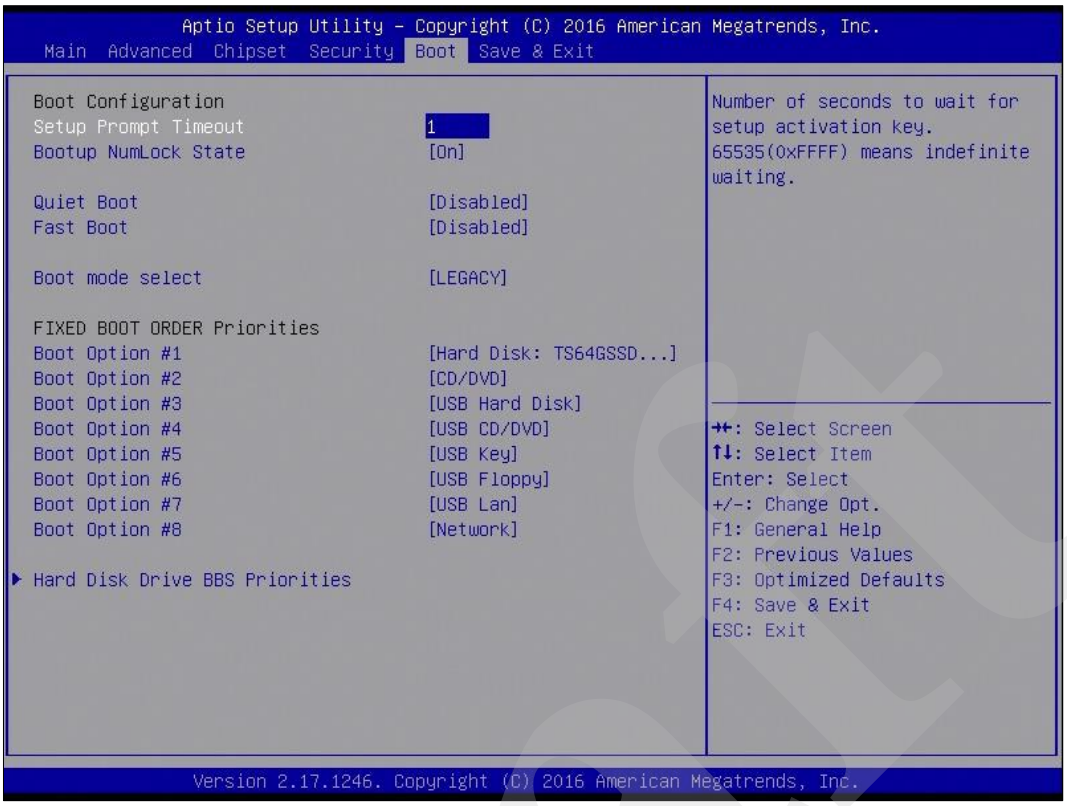
4.6 Security Settings

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



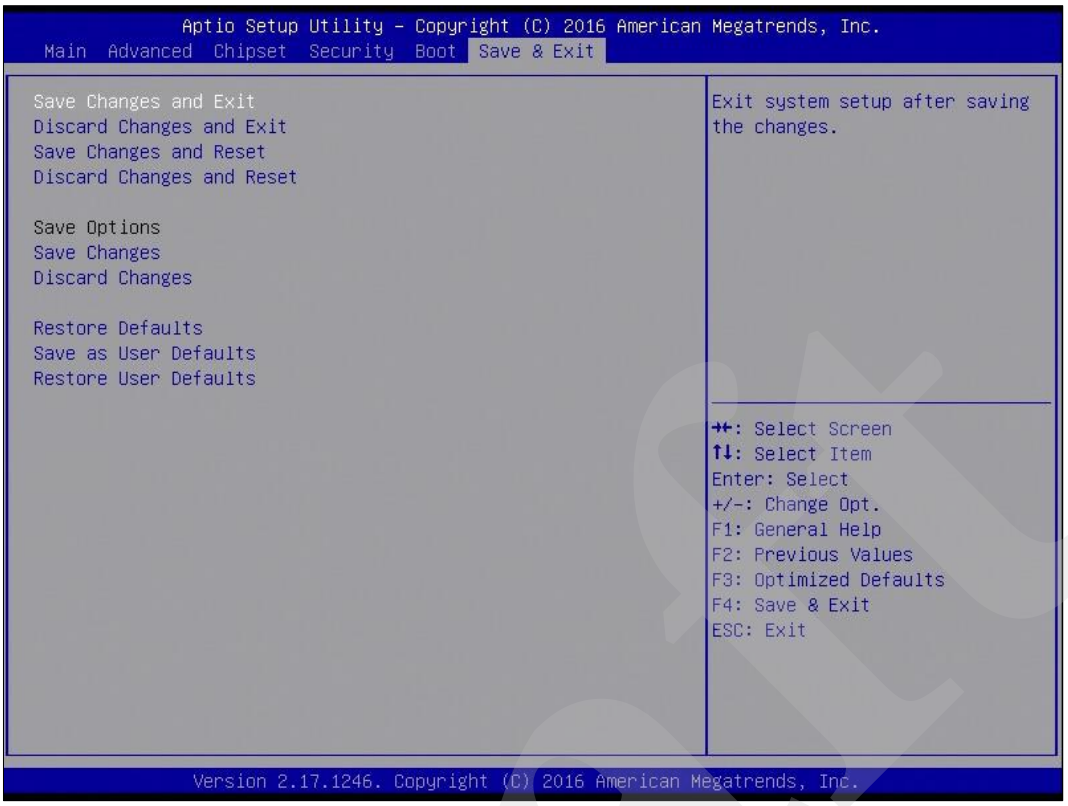
BIOS Setting	Description
Administrator Password	Sets an administrator password for the setup utility.
User Password	Sets a user password.

4.7 Boot Settings



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.
Fast Boot	Enables / Disables boot with initialization of a minimal set of devices required to launch the active boot option. Has no effect for BBS boot options.
Boot Option Priorities	Sets the system boot order.

4.8 Save & Exit Settings



BIOS Setting	Description
Save Changes and Exit	Exits system setup after saving the changes.
Discard Changes and Exit	Exits system setup without saving any changes.
Save Changes and Reset	Resets the system after saving the changes.
Discard Changes and Reset	Resets system setup without saving any changes.
Save Changes	Saves changes done so far to any of the setup options.
Discard Changes	Discards changes done so far to any of the setup options.
Restore Defaults	Restores / Loads defaults values for all the setup options.
Save as User Defaults	Saves the changes done so far as user defaults.
Restore User 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

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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 – 07Fh	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 (COM3)
2F8h – 2FFh	Serial Port #2 (COM2)
3B0h – 3DFh	Intel(R) HD Graphics
3E8h – 3EFh	Serial Port #5 (COM5) * COM5 is for internal use only.
3F8h – 3FFh	Serial Port #1 (COM1)
0000 – 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
IRQ6	Serial Port #5
IRQ7	Serial Port #4
IRQ8	High precision event timer
IRQ10	Serial Port #3
IRQ11	Serial Port #6
IRQ22	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;
```

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```
}
//---------------------------------------------------------------------------
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
}
//---------------------------------------------------------------------------
```

draft

```
//---------------------------------------------------------------------------
//
// 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();
```

draft

```
}
//---------------------------------------------------------------------------
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
```

D. Software Development Kit for WDT.DLL

1. OS Supported

Windows SP (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","ErrorCo
  ntrol",%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.

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- **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.

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- **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.

draft

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).

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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**

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

  Request:

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

  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

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