IEI Integration Corp.

MODEL:

# TANK-870AI series

**Embedded System with 6th/7th Generation Intel® Core™/Xeon® Processor, 8GB DDR4 Pre-installed Memory, VGA/HDMI/DP/iDP, Two Gigabit Ethernet, RS-232/422/485, RoHS Compliant**

# User Manual

Rev. 1.02 – May 7, 2019

RoHS Lead Free

# Revision

| Date | Version | Changes |
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| May 7, 2019 | 1.02 | Update Section 2.3: Unpacking Checklist<br>Update Section 3.1: Installation Precautions |
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| June 12, 2018 | 1.00 | Initial release |

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# Manual Conventions

**WARNING**

Warnings appear where overlooked details may cause damage to the equipment or result in personal injury. Warnings should be taken seriously.

**CAUTION**

Cautionary messages should be heeded to help reduce the chance of losing data or damaging the product.

**NOTE**

These messages inform the reader of essential but non-critical information. These messages should be read carefully as any directions or instructions contained therein can help avoid making mistakes.

**HOT SURFACE**

This symbol indicates a hot surface that should not be touched without taking care.

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Chapter

1

# Introduction

## 1.1 Overview

**Figure 1-1: TANK-870AI series**

The TANK-870AI series is an embedded system for wide range temperature environments. It is powered by the 6th/7th generation Intel® Core™/Xeon® processor, uses the Intel® Q170/C236 chipset and supports two 260-pin DDR4 SDRAM SO-DIMM modules up to 32 GB (8GB memory preinstalled). The TANK-870AI series includes one VGA port, one HDMI/DP port, one iDP port (optional), two GbE LAN ports, four USB 3.0 ports, four USB 2.0 ports, four RS-232 connectors and two RS-232/422/485 connectors.

## 1.2 Model Variations

The model variations of the TANK-870AI series are listed below.

| Model No. | CPU | Memory | System Fan |
|---|---|---|---|
| TANK-870AI-E3/32G/2A | Intel® Xeon® E3-1268LV5 2.4GHz, (up to 3.4 GHz, Quad Core, TDP 35W) | 32 GB | Default |
| TANK-870AI-i7KBL/16G/2A | Intel® Core™ i7-7700T 2.9GHz, (up to 3.8 GHz, Quad Core, TDP 35W) | 16 GB | Default |
| TANK-870AI-i5KBL/8G/2A | Intel® Core™ i5-7500T 2.7GHz, (up to 3.3 GHz, Quad Core, TDP 35W) | 8 GB | Default |
| TANK-870AI-i7/8G/2A | Intel® Core™ i7-6700TE 2.4GHz, (up to 3.4 GHz, Quad Core, TDP 35W) | 8 GB | Default |
| TANK-870AI-i5/8G/2A | Intel® Core™ i5-6500TE 2.3GHz, (Up to 3.3 GHz, Quad Core, TDP 35W) | 8 GB | Default |

**Table 1-1: TANK-870AI series Model Variations**

## 1.3 Features

The TANK-870AI series features are listed below:

- 6th/7th Gen Intel® Core™/Xeon® processor platform with Intel® Q170/C236 chipset and DDR4 memory
- Dual independent display with high resolution support
- Rich high-speed I/O interfaces on one side for easy installation
- On-board internal power connector for providing power to add-on cards
- Great flexibility for hardware expansion
- Pre-installed Ubuntu 16.04 LTS
- Pre-installed Intel® Distribution of Open Visual Inference & Neural Network Optimization (OpenVINO™) toolkit, Intel® Media SDK, Intel® System Studio and Arduino® Create

## 1.4 Technical Specifications

The TANK-870AI series technical specifications are listed in **Table 1-2**.

| Specifications | |
|---|---|
| **Chassis** | |
| **Color** | Black C + Silver |
| **Dimensions (WxHxD)** | 121.5 mm x 255.2 mm x 205 mm |
| **System Fan** | Smart fan |
| **Chassis Construction** | Extruded aluminum alloy |
| **Motherboard** | |
| **CPU** | Intel® Xeon® E3-1268LV5 2.4GHz (up to 3.4 GHz, quad-core, TDP 35W)<br>Intel® Core™ i7-7700T 2.9GHz (up to 3.8 GHz, quad-core, TDP 35W)<br>Intel® Core™ i5-7500T 2.7GHz (up to 3.3 GHz, quad-core, TDP 35W)<br>Intel® Core™ i7-6700TE 2.4 GHz (up to 3.4GHz, quad-core, TDP 35W)<br>Intel® Core™ i5-6500TE 2.3 GHz (up to 3.3GHz, quad-core, TDP 35W) |
| **BIOS** | AMI UEFI BIOS<br>BIOS Version: SJ18ARxx is for TANK-870AI-E3<br>BIOS Version: V2RMARxx is for TANK-870AI-i7/TANK-870AI-i5 |
| **Chipset** | Intel® Q170/C236 |
| **System Memory** | 2 x 260 pin DDR4 SO-DIMM,<br>8 GB pre-installed (for i5/i5KBL/i7 SKU)<br>16 GB pre-installed (for i7KBL SKU)<br>32 GB pre-installed (for E3 SKU) |
| **IPMI** | |
| **iRIS Solution** | 1 x iRIS-2400 (optional) |
| **Storage** | |
| **Hard Drive** | 2 x 2.5'' SATA 6Gb/s HDD/SSD bay, RAID 0/1 support<br>(1 x 2.5” 1TB HDD pre-installed) |

| Specifications | |
|---|---|
| **I/O Interfaces** | |
| **USB 3.0** | 4 |
| **USB 2.0** | 4 |
| **Ethernet** | 2 x RJ-45<br>LAN1: Intel® I219LM PCIe controller with Intel® vPro™ support<br>LAN2 (iRIS): Intel® I210 PCIe controller |
| **COM Port** | 4 x RS-232 (2 x RJ-45, 2 x DB-9 w/2.5KV isolation protection)<br>2 x RS-232/422/485 (DB-9) |
| **Digital I/O** | 8-bit digital I/O, 4-bit input/4-bit output |
| **Display** | 1 x VGA<br>1 x HDMI/DP<br>1 x iDP (optional) |
| **Resolution** | VGA: Up to 1920 x 1200 @ 60Hz<br>HDMI/DP: Up to 3840 x 2160 @ 30Hz / 4096 x 2304 @ 60Hz |
| **Audio** | 1 x Line-out, 1 x Mic-in |
| **TPM** | 1 x Infineon TPM 2.0 Module |
| **Wireless** | 1 x 802.11 a/b/g/n/ac |
| **Expansions** | |
| **Backplane** | 2 x PCIe x8 |
| **PCIe Mini** | 1 x Half-size PCIe Mini slot<br>1 x Full-size PCIe mini slot (supports mSATA, colay with SATA) |
| **Power** | |
| **Power Input** | DC Jack: 9 V~36 V DC<br>Terminal Block: 9 V~36 V DC |
| **Power Consumption** | 19 V@3.78 A (Intel® Xeon® E3-1268LV5 with 8 GB memory)<br>19 V@3.68 A (Intel® Core™ i7-6700TE with 8 GB memory) |
| **Internal Power** | 5V@3A or 12V@3A |

| Specifications | |
|---|---|
| **Reliability** | |
| **Mounting** | Wall mount |
| **Operating Temperature/Humidity** | Xeon® E3: -20°C ~ 60°C with air flow (SSD), 10% ~ 95%, non-condensing<br>i7-7700T: -20°C ~ 35°C with air flow (SSD), 10% ~ 95%, non-condensing<br>i5-7500T: -20°C ~ 45°C with air flow (SSD), 10% ~ 95%, non-condensing<br>i7-6700TE: -20°C ~ 45°C with air flow (SSD), 10% ~ 95%, non-condensing<br>i5-6500TE: -20°C ~ 60°C with air flow (SSD), 10% ~ 95%, non-condensing |
| **Storage Temperature** | -40°C ~ 85°C with air flow (SSD),<br>10% ~ 90%, non-condensing |
| **Operating Shock** | Half-sine wave shock 5G; 11ms; 100 shocks per axis |
| **Operating Vibration** | MIL-STD-810G 514.6 C-1 (with SSD) |
| **Weight (Net/Gross)** | 4.2 kg/6.3 kg |
| **Safety/EMC** | CE/FCC/RoHS |
| **OS** | |
| **Supported OS** | Windows 10 / Linux Ubuntu 16.04 |

**Table 1-2: Technical Specifications**

## 1.5 Front Panel

The front panel of the TANK-870AI series has the following features (**Figure 1-3**):

**Figure 1-2: TANK-870AI series Front Panel**

Connectors on the front panel include the following:

- 2 x Wi-Fi antenna connectors

## 1.6 Rear Panel

The rear panel of the TANK-870AI series has the following features (**Figure 1-3**):

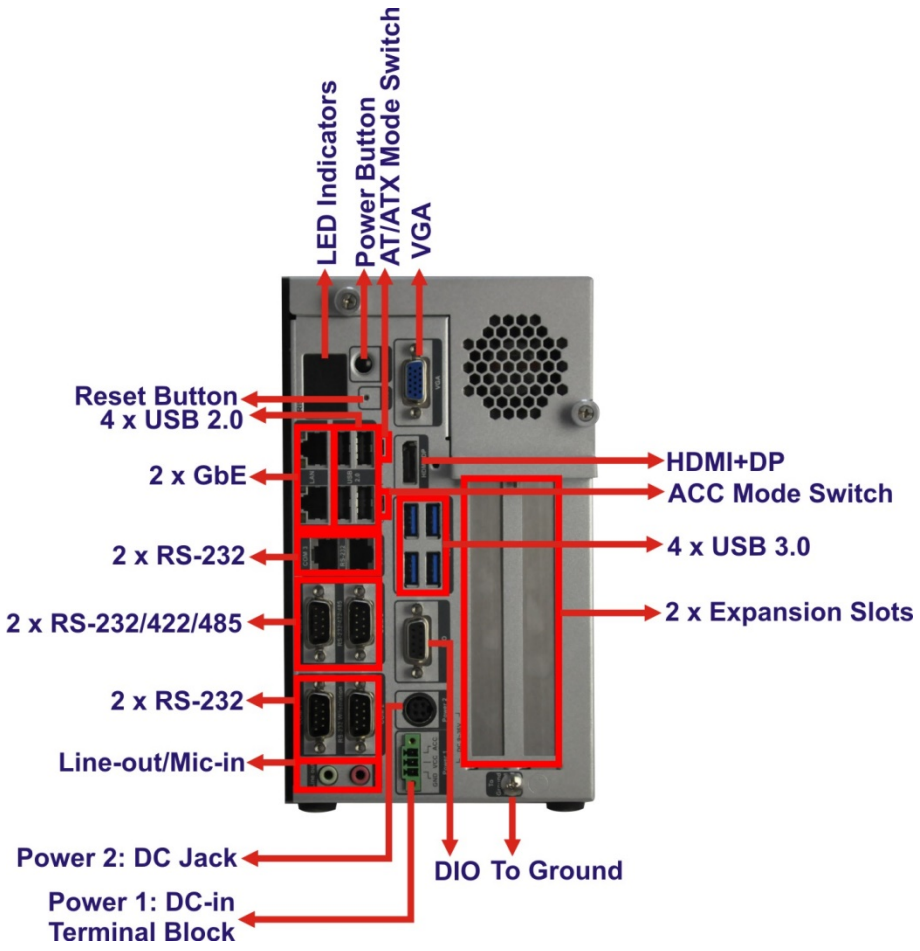



**Figure 1-3: TANK-870AI series Rear Panel**

Connectors and buttons on the rear panel include the following:

- 1 x 4-pin power DC jack for 9 V ~ 36 V power input
- 1 x Power terminal block for 9 V ~ 36 V power input
- 1 x Mic-in port (pink)
- 1 x Line-out port (green)
- 2 x RS-232 serial ports (DB-9)
- 2 x RS-232 serial ports (RJ-45)
- 2 x RS-232/422/485 serial ports (DB-9)
- 2 x Gigabit Ethernet ports (RJ-45)

- 4 x USB 3.0 ports
- 4 x USB 2.0 ports
- 1 x Reset button
- 6 x LED indicators (**Section 1.7**)
- 1 x Power button
- 1 x VGA port
- 1 x HDMI+DP port
- 1 X DIO port
- 1 x To Ground
- 2 x Expansion slots
- 1 x ACC mode switch
- 1 x AT/ATX mode switch

## 1.7 LED Indicators

There are several indicators on the rear panel of the TANK-870AI series as shown in **Figure 1-4**.

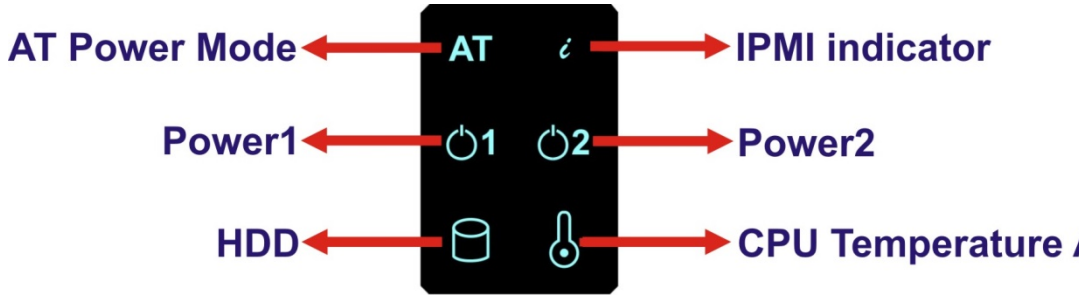



**Figure 1-4: TANK-870AI series LED Indicators**

The descriptions of each LED indicator are listed below.

| LED Indicator | Description |
|---|---|
| AT Power Mode | The current power mode status is AT mode.<br>Controlled by the AT/ATX power mode switch. |
| i | Shows IPMI status. |
| Power LED1 | **Breathing Orange:** Standby mode. |
| Power LED2 | **Solid blue:** Power-on mode. |

| LED Indicator | Description |
|---|---|
| HDD | Shows HDD status. |
| CPU Temperature Alert | BLUE: CPU temperature is normal.<br>RED: CPU temperature is too high. |

**Table 1-3: LED Indicators Description**

**WARNING:**

The CPU Temperature Alert LED turns red when the CPU temperature is too high. If this situation occurs, lower the environment temperature or close some running applications to cool down the CPU.

## 1.8 Backplane Options

The backplane options of the TANK-870AI series are shown below.

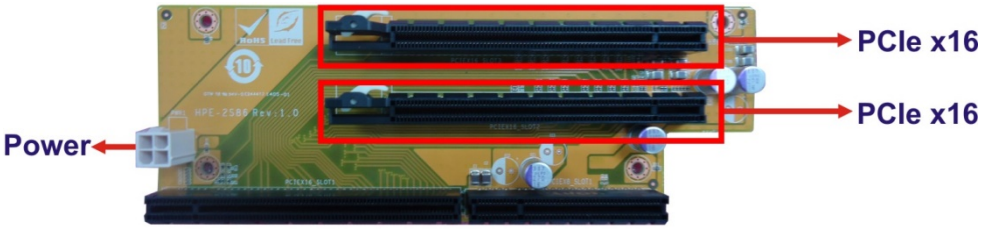
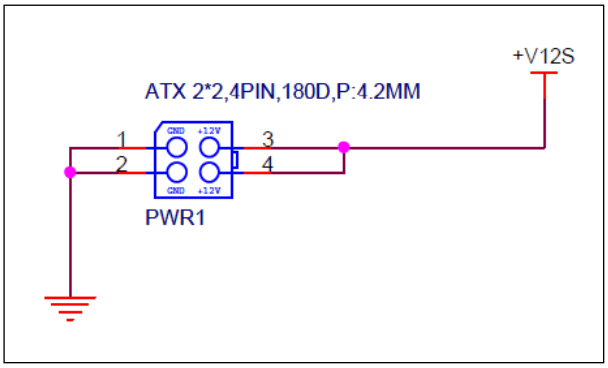



**Figure 1-5: HPE-2S86 (for 2A model)**

**PWR1:**




| Pin | Description |
|---|---|
| 1 | GND |
| 2 | GND |
| 3 | +12 V |
| 4 | +12 V |

The supported signals of the backplane slots are listed below.

| Backplane | Slot | Signal |
|---|---|---|
| **HPE-2S86** | PCIe x16 | PCIe x8 |
| **(for 2A model)** | PCIe x16 | PCIe x8 |

**Table 1-4: Supported Signals**

The rated voltage and current of the backplanes are listed below.

| Rated Voltage | Rated Current |
|---|---|
| +5 V | 4.0 A |
| +12 V | 2.5 A |
| -12 V | 0.1 A |
| +3.3 V | 5.0 A |

**Table 1-5: Rated Voltage and Current**

**WARNING:**

The system default power is 150 W. The maximum total power of the backplane to support expansion cards is 70 W. The power of the selected expansion cards can not exceed the max. power (70 W), otherwise, the system may be unstable.

**NOTE:**

When using an expansion card with high power consumption, it is recommended to install an external power supply to the power input connector on the backplane.

The backplane support standard PCI/PCIe cards with maximum dimensions (WxL):110 x 230 mm.

The TANK-870AI provides the most convenient 4-pin internal power connector for add-on card usage, adding more flexibility to the embedded system in industrial environment. The internal power connector supports 5V@3A or 12V@3A power supply.

## 1.9 Physical Dimensions

The physical dimensions of the TANK-870AI slot are shown in **Figure 1-6**.

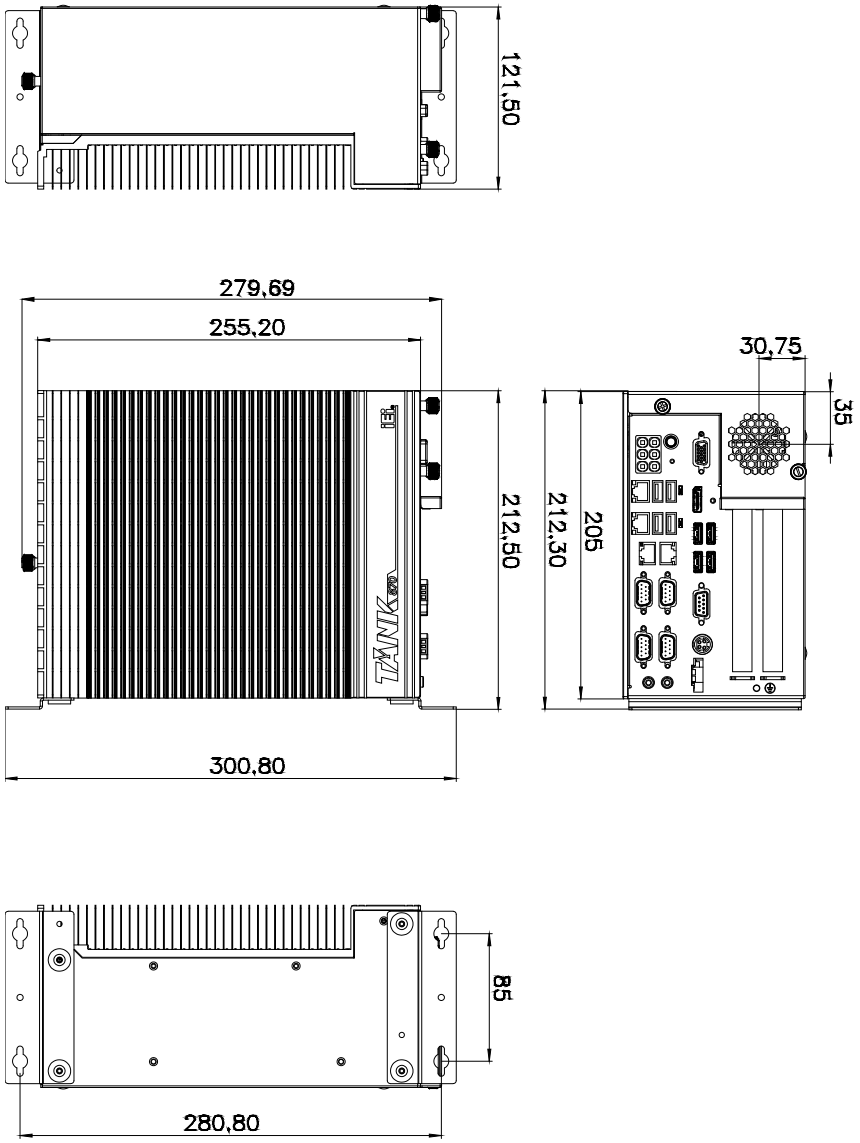



**Figure 1-6: TANK-870AI slot Physical Dimensions (millimeters)**

Chapter

2

# Unpacking

## 2.1 Anti-static Precautions

**WARNING:**

Failure to take ESD precautions during installation may result in permanent damage to the TANK-870AI series and severe injury to the user.

Electrostatic discharge (ESD) can cause serious damage to electronic components, including the TANK-870AI series. Dry climates are especially susceptible to ESD. It is therefore critical that whenever the TANK-870AI series or any other electrical component is handled, the following anti-static precautions are strictly adhered to.

- ***Wear an anti-static wristband***: Wearing a simple anti-static wristband can help to prevent ESD from damaging the board.
- ***Self-grounding***: Before handling the board touch any grounded conducting material. During the time the board is handled, frequently touch any conducting materials that are connected to the ground.
- ***Use an anti-static pad***: When configuring the TANK-870AI series, place it on an antic-static pad. This reduces the possibility of ESD damaging the TANK-870AI series.

## 2.2 Unpacking Precautions

When the TANK-870AI series is unpacked, please do the following:

- Follow the anti-static precautions outlined in **Section 2.1**.
- Make sure the packing box is facing upwards so the TANK-870AI series does not fall out of the box.
- Make sure all the components shown in **Section 2.3** are present.

## 2.3 Unpacking Checklist

**NOTE:**

If some of the components listed in the checklist below are missing, please do not proceed with the installation. Contact the IEI reseller or vendor you purchased the TANK-870AI series from or contact an IEI sales representative directly. To contact an IEI sales representative, please send an email to sales@ieiworld.com.

The TANK-870AI series is shipped with the following components:

| Quantity | Item and Part Number | Image |
|---|---|---|
| **Standard** | | |
| 1 | TANK-870AI series | |
| 2 | Mounting Brackets | |
| 1 | Chassis Screw | |

| Quantity | Item and Part Number | Image |
|---|---|---|
| **Standard** | | |
| 1 | HDMI Security Holder | |
| 2 | RJ-45 to DB-9 COM port cable | |
| 2 | Wi-Fi antenna | |
| 1 | Power cord (EU) | |
| 1 | Power adapter | |

The following table lists the optional items that can be purchased separately.

| Optional | |
|---|---|
| Mustang-F100-A10 AI acceleration card | |
| Mustang-V100-MX8 AI acceleration card | |

| Optional | |
|---|---|
| IPMI 2.0 adapter card with AST2400 BMC chip for DDR3 SO-DIMM socket interface<br>(**P/N**: iRIS-2400-R10) | |
| DisplayPort to DisplayPort converter board (For iEi IDP connector)<br>(**P/N**: DP-DP-R10) | |
| DisplayPort to HDMI converter board (For iEi IDP connector)<br>(**P/N**: DP-HDMI-R10) | |
| DisplayPort to 24 bit dual channel LVDS converter board (For iEi IDP connector)<br>(**P/N**: DP-LVDS-R10) | |
| DisplayPort to VGA converter board (For iEi IDP connector)<br>(**P/N**: DP-VGA-R10) | |
| DisplayPort to DVI-D converter board (For iEi IDP connector)<br>(**P/N**: DP-DVI-R10) | |
| PCI Express Power over Ethernet frame grabber card, 4-port 1000 Base(T), 802.3af compliant, RoHS<br>*Note: * The operating Temperature can be support up to 40 degrees when installing IPCIE-4POE-R10.*<br>(**P/N**: IPCIE-4POE-R10) | |

Chapter

3

# Installation

## 3.1 Installation Precautions

**WARNING:**

DO NOT install the add-on card into the TANK-870AI series before shipment. It is recommended to ship them with their original boxes to prevent the add-on card from being damaged.

**CAUTION:**

The TANK-870AI series has more than one power supply connection point.

To reduce the risk of electric shock, disconnect all power sources before installing or servicing the TANK-870AI series.

During installation, be aware of the precautions below:

- **Read the user manual**: The user manual provides a complete description of the TANK-870AI series, installation instructions and configuration options.
- **DANGER! Disconnect Power**: Power to the TANK-870AI series must be disconnected during the installation process, or before any attempt is made to access the rear panel. Electric shock and personal injury might occur if the rear panel of the TANK-870AI series is opened while the power cord is still connected to an electrical outlet.
- **Qualified Personnel**: The TANK-870AI series must be installed and operated only by trained and qualified personnel. Maintenance, upgrades, or repairs may only be carried out by qualified personnel who are familiar with the associated dangers.
- **Air Circulation**: Make sure there is sufficient air circulation when installing the TANK-870AI series. The TANK-870AI series's cooling vents must not be obstructed by any objects. Blocking the vents can cause overheating of the TANK-870AI series. Leave at least 5 cm of clearance around the TANK-870AI series to prevent overheating.

- **Grounding**: The TANK-870AI series should be properly grounded. The voltage feeds must not be overloaded. Adjust the cabling and provide external overcharge protection per the electrical values indicated on the label attached to the back of the TANK-870AI series.

### 3.1.1 High Surface Temperature

**WARNING:**

Some surfaces of the equipment may become hot during operation.

The surface temperature may be up to several tens of degrees hotter than the ambient temperature. Under these circumstances, the equipment needs to be protected against accidental contact.

The equipment is intended for installation in a RESTRICTED ACCESS LOCATION.

- Access can only be gained by SERVICE PERSONS or by USERS who have been instructed about the reasons for the restrictions applied to the location and about any precautions that shall be taken.
- Access is through the use of a TOOL or lock and key, or other means of security, and is controlled by the authority responsible for the location.

## 3.2 Hard Disk Drive (HDD) Installation

To install the hard drive, please follow the steps below:

**Step 1:** Loosen the two thumbscrews on the front panel, slide the cover outward, and then lift the top cover up gently (**Figure 3-1**).

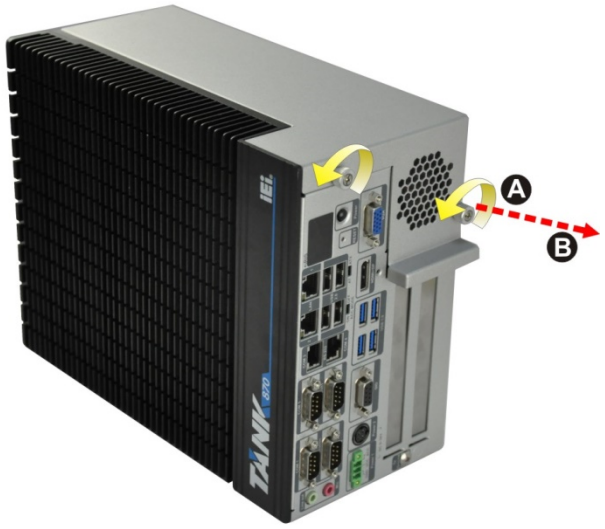



**Figure 3-1: Unscrew the Cover**

**Step 2:** Unplug the SATA signal and power cables connected to the TANK-870AI series, and then put the cover on a flat surface (**Figure 3-2**).

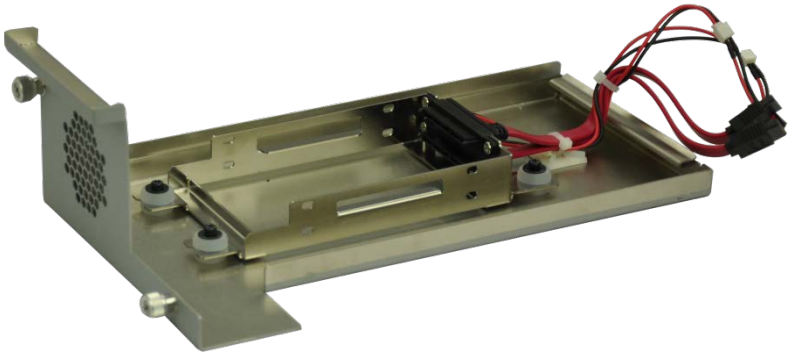


**Figure 3-2: Remove the Cover from TANK-870AI series**

**Step 3:** Attach the HDD to the HDD bracket, and then slide the HDD to connect with the SATA connector (**Figure 3-3**).

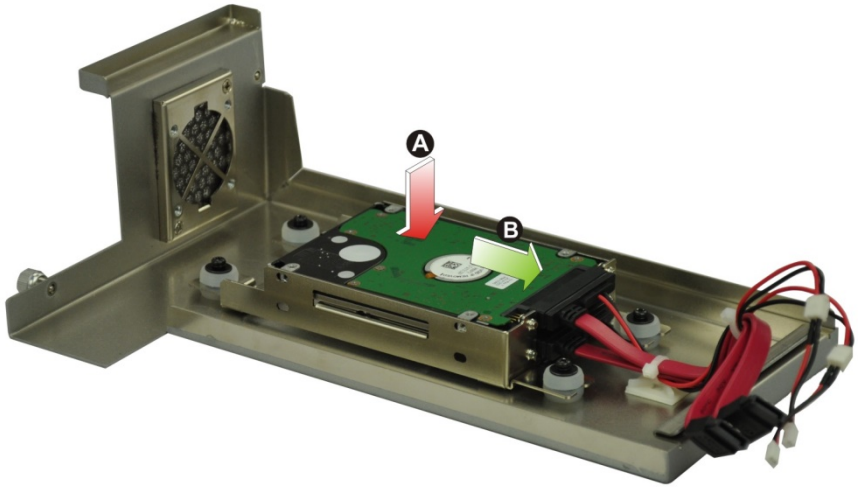



**Figure 3-3: HDD Installation**

**Step 4:** Secure the HDD with the HDD bracket by four retention screws (**Figure 3-4**).

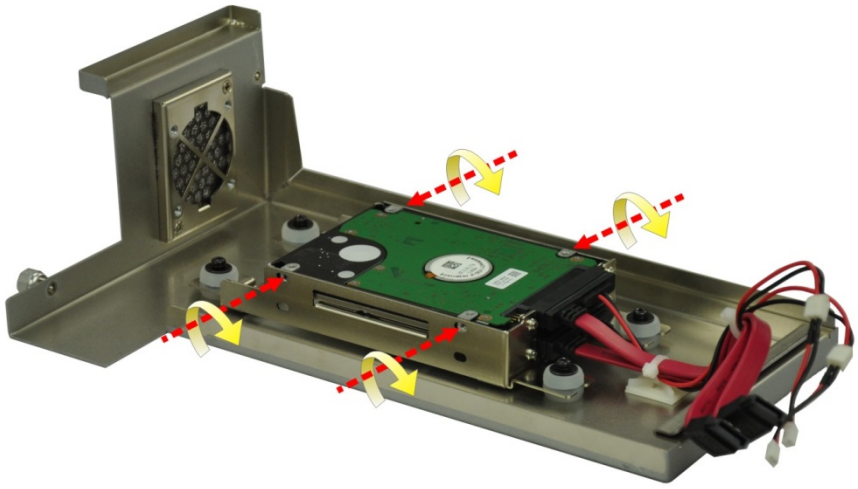


**Figure 3-4: HDD Retention Screws**

**Step 5:** Reconnect the SATA signal and power cables to the TANK-870AI series.

**Step 6:** Reinstall the cover.

## 3.3 System Fan Installation

### 3.3.1 System Fan Installation (P/N: 31100-000431-RS)

To install the optional system fan (**P/N**: 31100-000431-RS), please follow the steps below:

**Step 1:** Loosen the two thumbscrews on the front panel, slide the top cover outward, and then lift the top cover up gently (**Figure 3-1**).

**Step 2:** Unplug the SATA signal and power cables connected to the TANK-870AI series, and then place the cover on a flat surface (**Figure 3-2**).

**Step 3:** Attach the system fan to the TANK-870AI series and secure it by four retention screws (**Figure 3-8**).

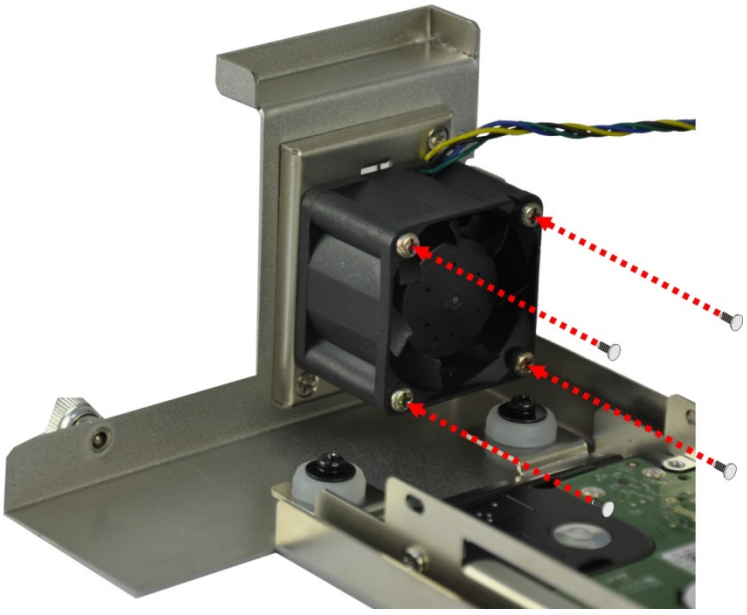


**Figure 3-5: System Fan Installation (P/N: 32128-002900-100-RS)**

**WARNING:**

Please install the system fan in the correct direction as shown above.

**Step 4:** Connect the system fan to the **CPU_FAN1** connector on the motherboard of TANK-870AI series via the system fan wire cable (**P/N**: 32128-002900-100-RS).

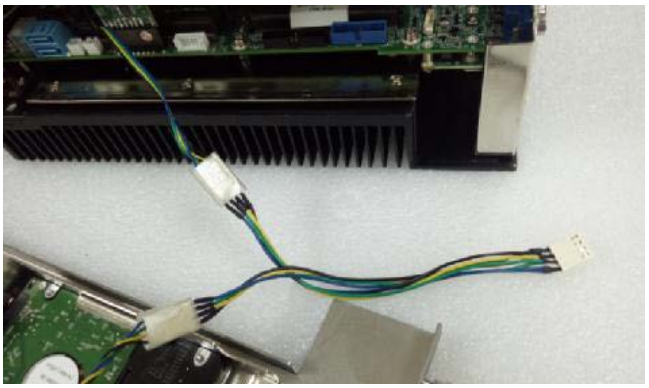


**Figure 3-6: System Fan Wire Cable**

**Step 5:** Reconnect the SATA signal and power cables to the TANK-870AI series.

**Step 6:** Reinstall the cover.

### 3.3.2 System Fan Installation (P/N: 31100-000434-RS)

To install the optional system fan (**P/N**: 31100-000434-RS), please follow the steps below:

**Step 1:** Loosen the two thumbscrews on the front panel, slide the top cover outward, and then lift the top cover up gently (**Figure 3-1**).

**Step 2:** Unplug the SATA signal and power cables connected to the TANK-870AI series, and then place the cover on a flat surface (**Figure 3-2**).

**Step 3:** Remove the side cover by removing the three retention screws from the rear panel and two retention screws from the bracket.

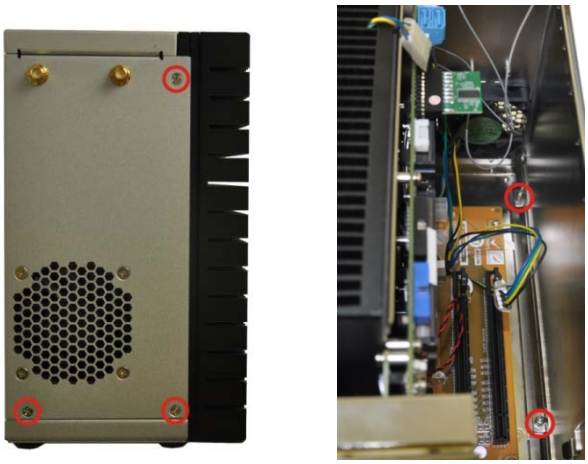


**Figure 3-7: Remove the Side Panel**

**Step 4:** Attach the system fan to the TANK-870AI series and secure it by four retention screws (**Figure 3-8**).

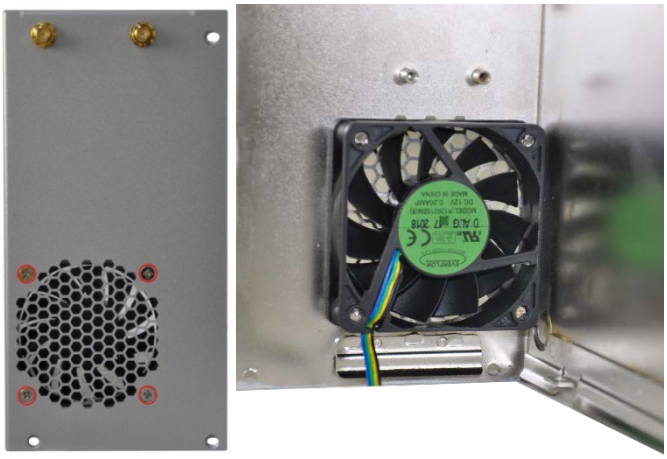


**Figure 3-8: System Fan Installation (P/N: 32128-002900-100-RS)**

**WARNING:**

Please install the system fan in the correct direction as shown above.

**Step 5:** Connect the system fan to the **CPU_FAN1** connector on the motherboard of TANK-870AI series via the system fan wire cable (**P/N**: 32128-002900-100-RS). See **Figure 3-6.**

**Step 6:** Reconnect the SATA signal and power cables to the TANK-870AI series.

**Step 7:** Reinstall the cover.

## 3.4 Wi-Fi Antenna Installation

To install the Wi-Fi antennas to the TANK-870AI series for efficient wireless network transmission, follow the steps below.

**Step 1:** Locate the antenna connectors on the rear panel of the embedded system.

**Step 2:** Install the antennas to the antenna connectors (**Figure 3-9**).

**Figure 3-9: Wi-Fi Antenna Installation**

## 3.5 Mounting the System with Mounting Brackets

To mount the embedded system onto a wall or some other surface using the two mounting brackets, please follow the steps below.

**Step 1:** Turn the embedded system to the left side panel.

**Step 2:** Align the two retention screw holes in each bracket with the corresponding retention screw holes on the bottom surface or the left side panel (**Figure 3-10**).

**Left Side Panel**

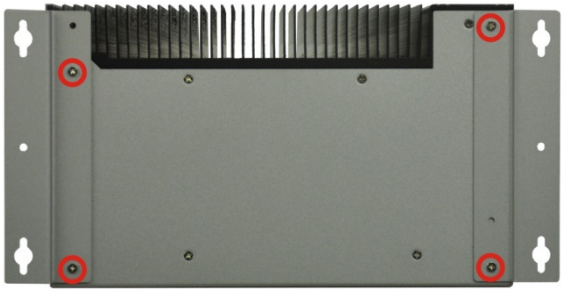


**Figure 3-10: Mounting Bracket Retention Screws**

**Step 3:** Secure the brackets to the system by inserting two retention screws into each bracket (**Figure 3-10**).

**Step 4:** Drill holes in the intended installation surface.

**Step 5:** Align the mounting holes in the sides of the mounting brackets with the predrilled holes in the mounting surface.

**Step 6:** Insert four retention screws, two in each bracket, to secure the system to the wall.

## 3.6 External Peripheral Interface Connectors

Detailed descriptions of the connectors can be found in the subsections below.

### 3.6.1 ACC Mode Selection

The ACC mode is designed for vehicle applications. The TANK-870AI series allows turning the ACC mode on or off. The setting can be made through the ACC mode switch on the external peripheral interface panel as shown below.

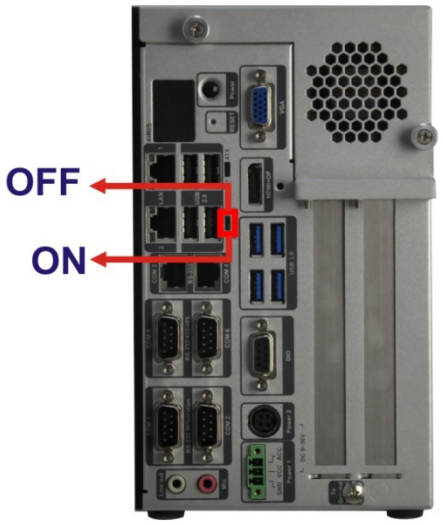



**Figure 3-11: ACC Mode Switch**

### 3.6.2 AT/ATX Power Mode Selection

The TANK-870AI series supports AT and ATX power modes. The setting can be made through the AT/ATX power mode switch on the external peripheral interface panel as shown below.

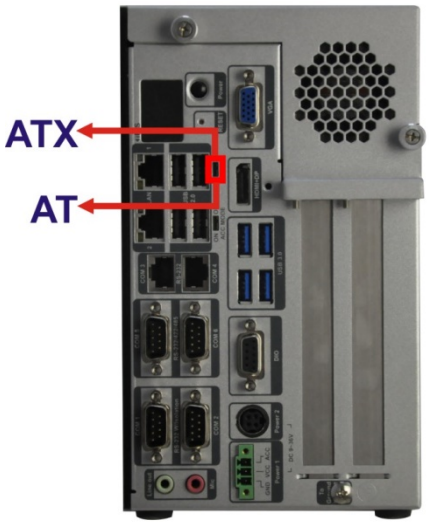



**Figure 3-12: AT/ATX Power Mode Switch**

### 3.6.3 Audio Connector

The audio jacks connect to external audio devices.

- **Line Out port (Green):** Connects to a headphone or a speaker. With multi-channel configurations, this port can also connect to front speakers.
- **Microphone (Pink):** Connects a microphone.

**Figure 3-13: Audio Connector**

### 3.6.4 Digital Input/Output Connector

The digital I/O connector provides programmable input and output for external devices. The pinouts for the digital I/O connector are listed in the table below.

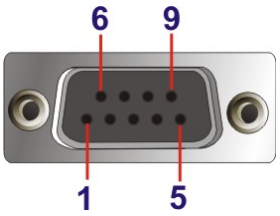



**Figure 3-14: DIO Connector**

### 3.6.5 HDMI/DP Connector

To connect the HDMI/DP devices, please plug in HDMI/DP connector in the right direction as shown below:

**Figure 3-15: HDMI/DP Connection**

### 3.6.6 LAN Connectors

The LAN connectors allow connection to an external network.

**Step 1:** **Locate the RJ-45 connectors**. The locations of the RJ-45 connectors are shown in **Figure 1-3**.

**Step 2:** **Align the connectors.** Align the RJ-45 connector on the LAN cable with one of the RJ-45 connectors on the TANK-870AI series. See **Figure 3-16**.

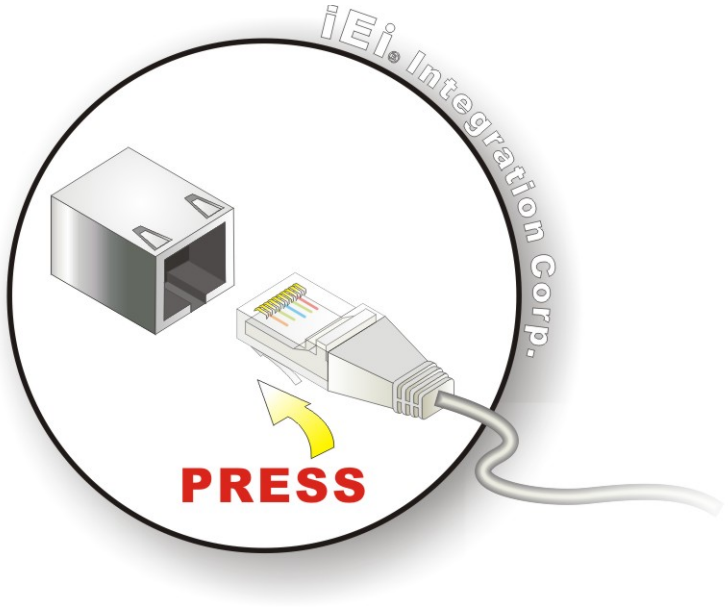



**Figure 3-16: LAN Connection**

**Step 3:** **Insert the LAN cable RJ-45 connector.** Once aligned, gently insert the LAN cable RJ-45 connector into the on-board RJ-45 connector.

**Figure 3-17: RJ-45 Ethernet Connector**

The RJ-45 Ethernet connector has two status LEDs, one green and one yellow. The green LED indicates activity on the port and the yellow LED indicates the port is linked. See **Table 3-1**.

| Activity/Link LED | | Speed LED | |
|---|---|---|---|
| **STATUS** | **DESCRIPTION** | **STATUS** | **DESCRIPTION** |
| Off | No link | Off | 10 Mbps connection |
| Yellow | Linked | Green | 100 Mbps connection |
| Blinking | TX/RX activity | Orange | 1 Gbps connection |

**Table 3-1: RJ-45 Ethernet Connector LEDs**

### 3.6.7 Power Input, 3-pin Terminal Block

The power connector connects the leads of a 9 V~36 V DC power supply into the terminal block. Make sure that the power and ground wires are attached to the correct sockets of the connector.

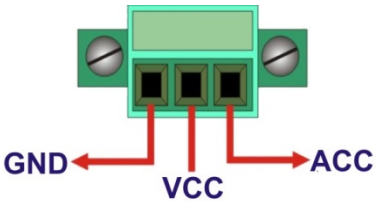



**Figure 3-18: 3-pin Terminal Block**

### 3.6.8 Power Input, 4-pin DIN Connector

The power connector connects to the 9 V~36 V DC power adapter.

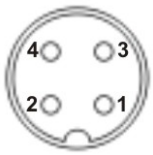



**Figure 3-19: Power Input Connector**

| PIN NO. | POLARITY |
|---|---|
| P2 | V0(+) |
| P4 | |
| P1 | GND(-) |
| P3 | |

**Table 3-2: Power Input Connector Pinouts**

### 3.6.9 RJ-45 RS-232 Serial Ports

RS-232 serial port devices can be attached to the RJ-45 RS-232 serial ports on the rear panel.

**Step 1:** **Locate the RJ-45 RS-232 connectors**. The locations of the RJ-45 RS-232 connectors are shown in **Figure 1-3**.

**Step 2:** **Insert the RJ-45 connector.** Insert the RJ-45 connector on the RJ-45 to DB-9 COM port cable to one of the RJ-45 RS-232 connectors on the TANK-870AI series. See **Figure 3-20**.

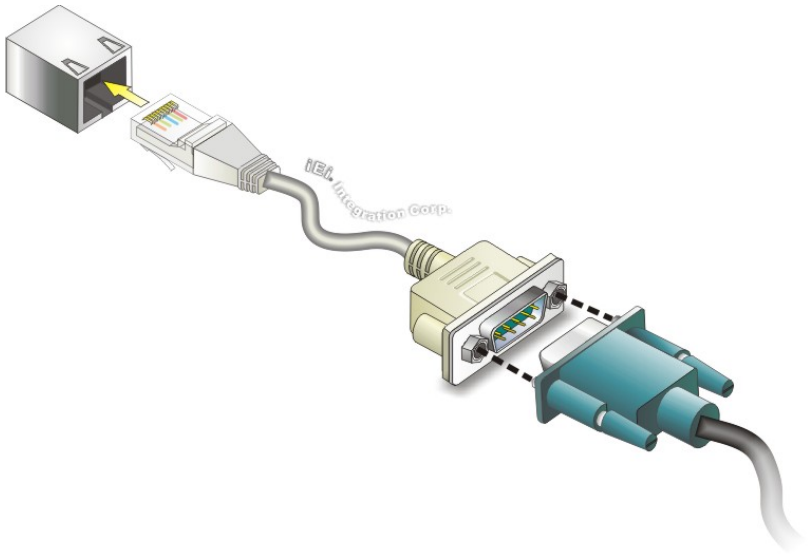


**Figure 3-20: RJ-45 RS-232 Serial Device Connection**

**Step 3:** **Insert the serial connector**. Insert the DB-9 connector of a serial device into the DB-9 connector on the RJ-45 to DB-9 COM port cable.

**Step 4:** **Secure the connector**. Secure the serial device connector to the external interface by tightening the two retention screws on either side of the connector.

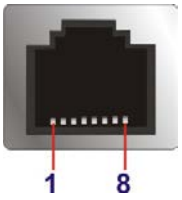



**Figure 3-21: RJ-45 RS-232 Serial Port Connector**

### 3.6.10 DB-9 RS-232/422/485 Serial Port Connectors

DB-9 RS-232/422/485 serial port devices can be attached to the DB-9 ports on the rear panel.

**Step 1:** **Locate the DB-9 connector**. The locations of the DB-9 connectors are shown in **Figure 1-3**.

**Step 2:** **Insert the serial connector**. Insert the DB-9 connector of a serial device into the DB-9 connector on the external peripheral interface. See **Figure 3-22**.

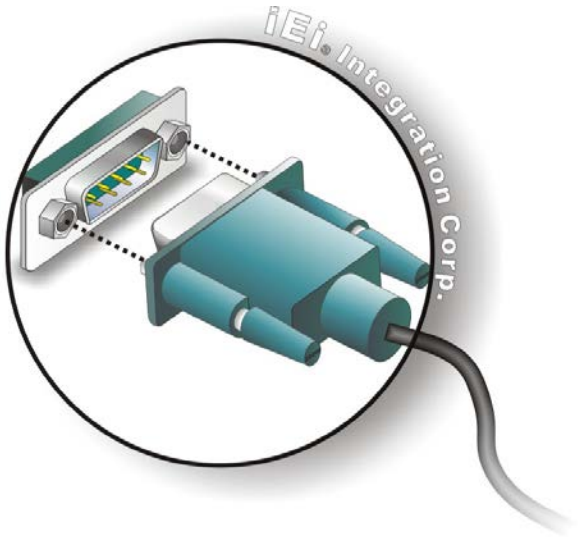


**Figure 3-22: Serial Device Connector**

**Step 3:** **Secure the connector**. Secure the serial device connector to the external interface by tightening the two retention screws on either side of the connector.

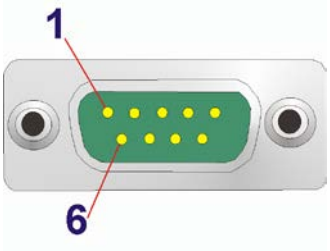



**Figure 3-23: DB-9 RS-232/422/485 Serial Port Connector**

### 3.6.11 USB Connectors

The USB ports are for connecting USB peripheral devices to the system.

**Step 1:** **Locate the USB connectors**. The locations of the USB connectors are shown in **Figure 1-3**.

**Step 2:** **Align the connectors.** Align the USB device connector with one of the connectors. See **Figure 3-24**.

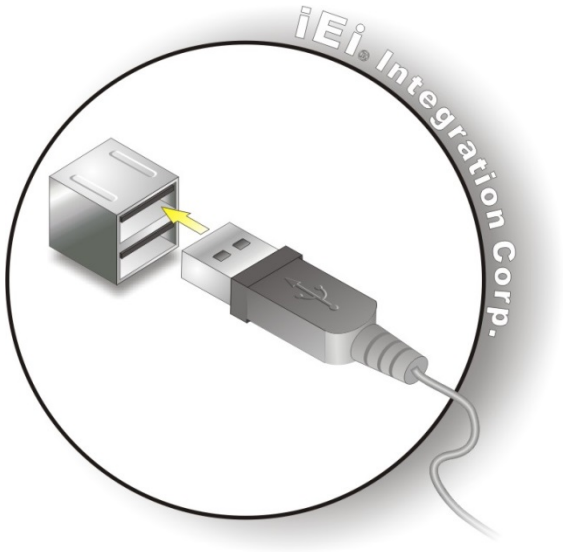


**Figure 3-24: USB Device Connection**

**Step 3:** **Insert the device connector.** Once aligned, gently insert the USB device connector into the on-board connector.

### 3.6.12 VGA Connector

The VGA connector connects to a monitor that accepts VGA video input.

**Step 1:** **Locate the female DB-15 connector**. The location of the female DB-15 connector is shown in **Figure 1-3**.

**Step 2:** **Align the VGA connector**. Align the male DB-15 connector on the VGA screen cable with the female DB-15 connector on the external peripheral interface.

**Step 3:** **Insert the VGA connector** Once the connectors are properly aligned with, insert the male connector from the VGA screen into the female connector on the TANK-870AI series. See **Figure 3-25**.

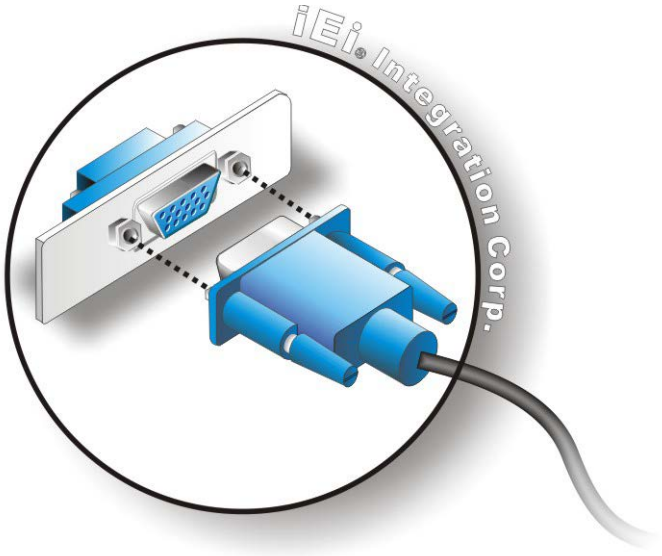


**Figure 3-25: VGA Connector**

**Step 4:** **Secure the connector**. Secure the DB-15 VGA connector from the VGA monitor to the external interface by tightening the two retention screws on either side of the connector.

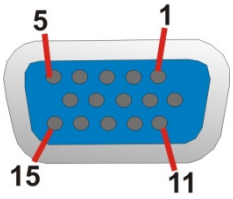



**Figure 3-26: VGA Connector**

## 3.7 Internal Peripheral Interface Connectors

### 3.7.1 TPM Module Installation

To install the TPM module, please follow the steps below:

**Step 1:** Remove the two retention screws on the rear panel and loosen the two thumbscrews on the front panel, slide the cover inwards, and then lift the cover up gently (**Figure 3-1**).

**Step 2:** Locate the TPM connector. The location of the TPM connector is shown in **Figure 3-27**.

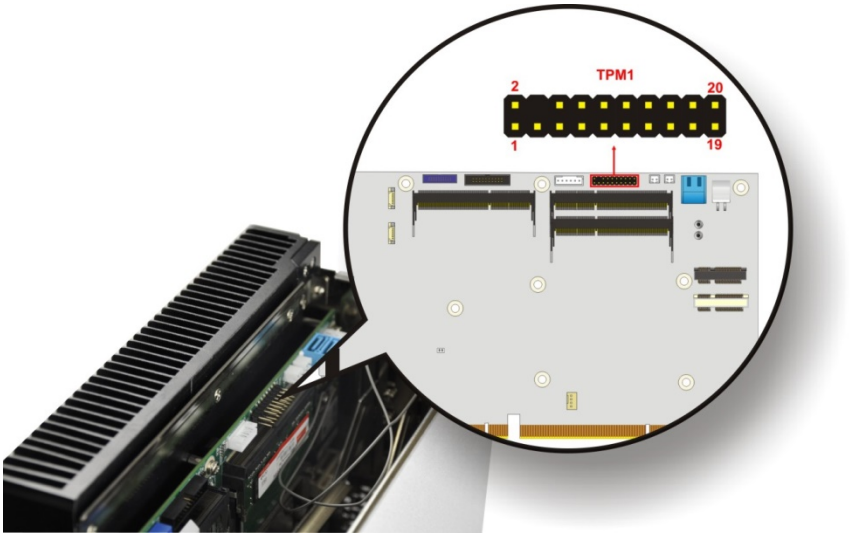



**Figure 3-27: TPM Connector Location**

**Step 3:** Insert the TPM module. Make sure that pin 1 on the TPM module corresponds to pin 1 on the TPM connector (**Figure 3-28**).

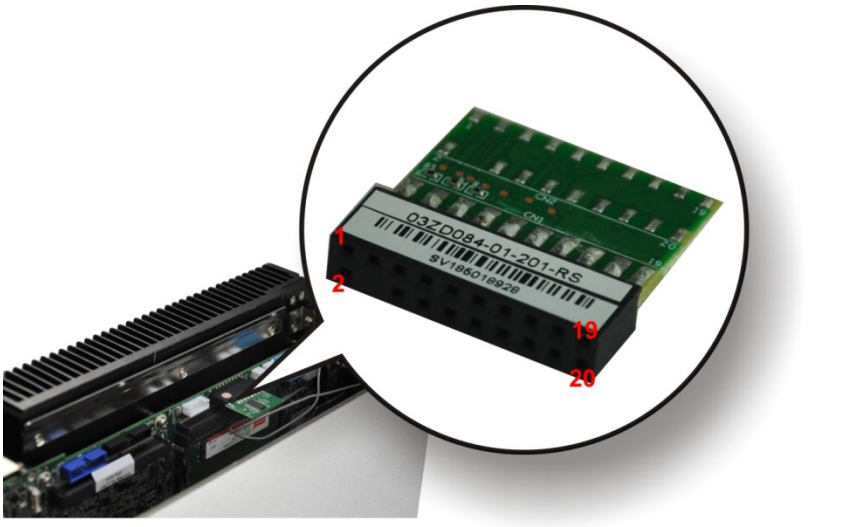



**Figure 3-28: TPM Module Installation**

TPM connector pinouts are shown in **Table 3-3.**

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | LCLK | 2 | GND |
| 3 | LFRAME# | 4 | KEY |
| 5 | LRESET# | 6 | +5V |
| 7 | LAD3 | 8 | LAD2 |
| 9 | +3V | 10 | LAD1 |
| 11 | LAD0 | 12 | GND |
| 13 | SCL | 14 | SDA |
| 15 | SB3V | 16 | SERIRQ |
| 17 | GND | 18 | GLKRUN# |
| 19 | LPCPD# | 20 | LDRQ# |

**Table 3-3: TPM Connector Pinouts**

### 3.7.2 iDP Module Installation

Through the IEI iDP converter cards, the iDP connector can support different display specifications, such as VGA, HDMI, DVI-D, LVDS and DisplayPort. To connect an iDP module to TANK-870AI series please follow the instructions below.

**Step 1:** Loosen the two thumbscrews on the front panel, slide the cover outward, and then lift the cover up gently (**Figure 3-1**).

**Step 2:** Locate the internal DisplayPort connector. The location of the internal DisplayPort connector is shown in **Figure 3-29**.

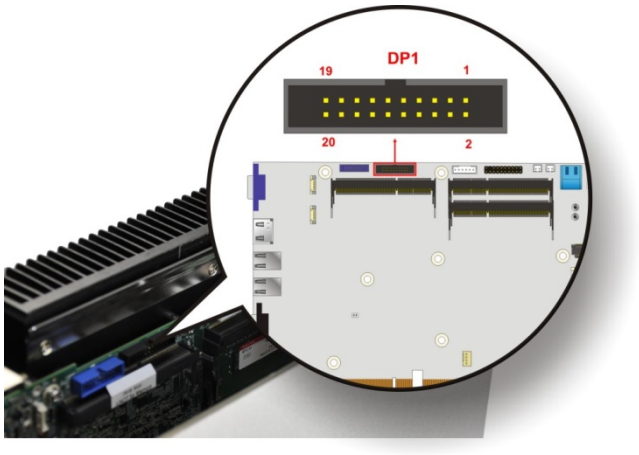



**Figure 3-29: Internal DisplayPort Connector Location**

**Step 3:** Secure the iDP module with the bracket by tightening the two retention screws on either side of the iDP module.

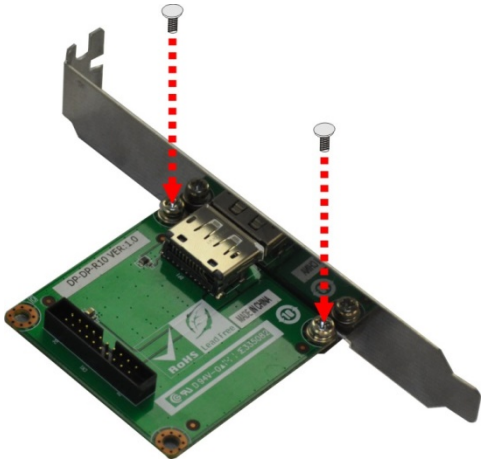


**Figure 3-30: iDP Module with Bracket**

**Step 4:** Connect the iDP module to the DisplayPort connector on the motherboard. See **Figure** 3-27.

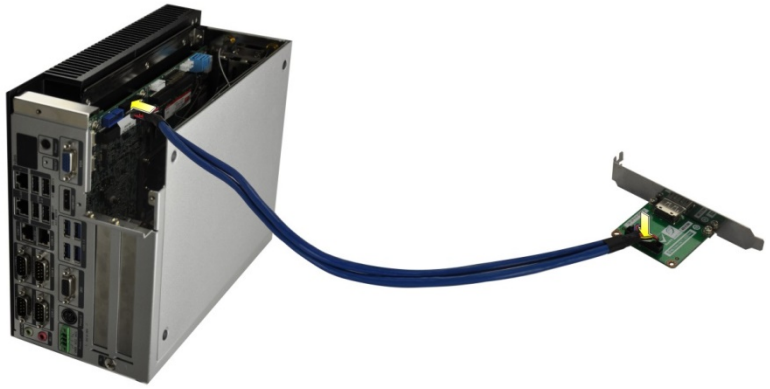


**Figure 3-31: iDP Module Installation**

**Step 5:** Remove the retention screws on the expansion slot bracket. See **Figure** 3-28.

**Figure 3-32: Remove Expansion Slot Bracket**

**Step 6:** Secure the iDP module with bracket to the system.

**Step 7:** Reinstall the cover.

**WARNING:**

Installing the iDP module will occupy one expansion slot.

The following table lists the iDP converter cards that can be installed to the system.

| | |
|---|---|
| DisplayPort to HDMI converter board (for IEI iDP connector)<br>(**P/N**: DP-HDMI-R10) | |
| DisplayPort to LVDS converter board (for IEI iDP connector)<br>(**P/N**: DP-LVDS-R10) | |
| DisplayPort to VGA converter board (for IEI iDP connector)<br>(**P/N**: DP-VGA-R10) | |
| DisplayPort to DVI-D converter board (for IEI iDP connector)<br>(**P/N**: DP-DVI-R10) | |
| DisplayPort to DisplayPort converter board (for IEI iDP connector)<br>(**P/N**: DP-DP-R10) | |

**Table 3-4: iDP Converter Cards**

## 3.8 Powering On/Off the System

**WARNING:**

Make sure a power supply with the correct input voltage is being fed into the system. Incorrect voltages applied to the system may cause damage to the internal electronic components and may also cause injury to the user.

- **Power on** the system: press the power button for 3 seconds
- **Power off** the system: press the power button for 6 seconds

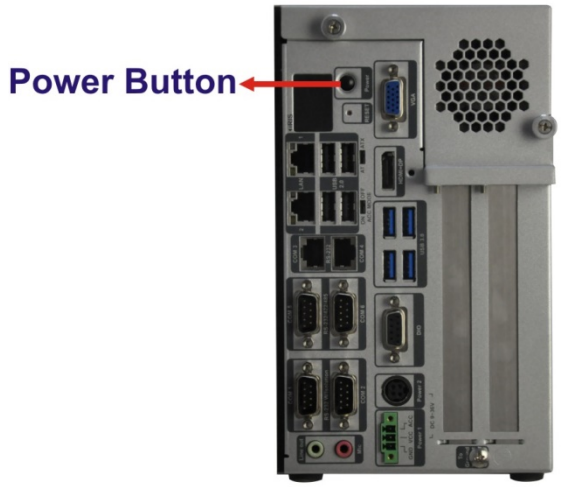



**Figure 3-33: Power Button**

## 3.9 Power

There are two power connectors on the rear panel. Power 1 connector is a 3-pin terminal block that supports ACC On signal. Power 2 connector is a DIN connector that can directly connect to a power adapter. The supported power input voltages are:

- **Power 1 (terminal block)**: 9 V~ 36 V
- **Power 2 (DC jack)**: 9 V ~ 36 V

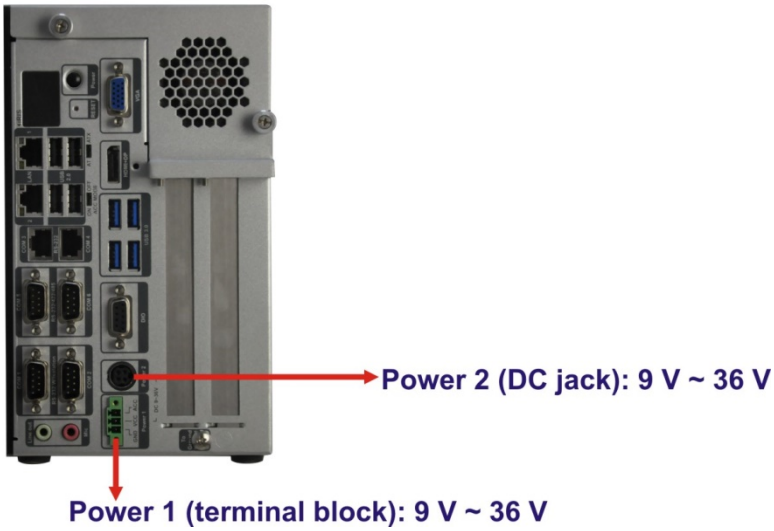



**Figure 3-34: Power Connectors**

| LED Indicator | Description |
|---|---|
| **Power LED1 (Breathing Orange)** | Standby mode. |
| **Power LED2 (Solid blue)** | Power-on mode. |

**Table 3-5: Power LED Indicators Description**

**NOTE:**

The power LED turns off when the power cable is unplugged from the system.

### 3.9.1 ACC ON Mode

1. The TANK-870AI series supports single power input and also can be simultaneously connected to two power sources. When both power connectors are connected to power sources with 9 V~36 V power input, the one with higher voltage will supply power to the system.

2. If ACC signal is low, the system will not boot up. If ACC ON signal is high (9 V~36 V), the system will boot up and work normally.

3. If ACC signal jumps from high to low during the power on process, the system will soft shut down and shut down the system power after 10s.

4. When Power 1 < 9 V and Power 2 < 9 V, the system will soft shut down and shut down the system power after 10s.

### 3.9.2 ACC OFF Mode

1. The TANK-870AI series supports single power input and also can be simultaneously connected to two power sources. When both power connectors are connected to power sources with 9 V~36 V power input, the one with higher voltage will supply power to the system.

2. When Power 1 < 9 V and Power 2 < 9 V, the system will soft shut down and shut down the system power after 10s.

Chapter

4

# System Motherboard

## 4.1 Overview

This chapter details all the jumpers and connectors of the system motherboard.

### 4.1.1 Layout

The figures below show all the connectors and jumpers of the system motherboard. The Pin 1 locations of the on-board connectors are also indicated in the diagram below.

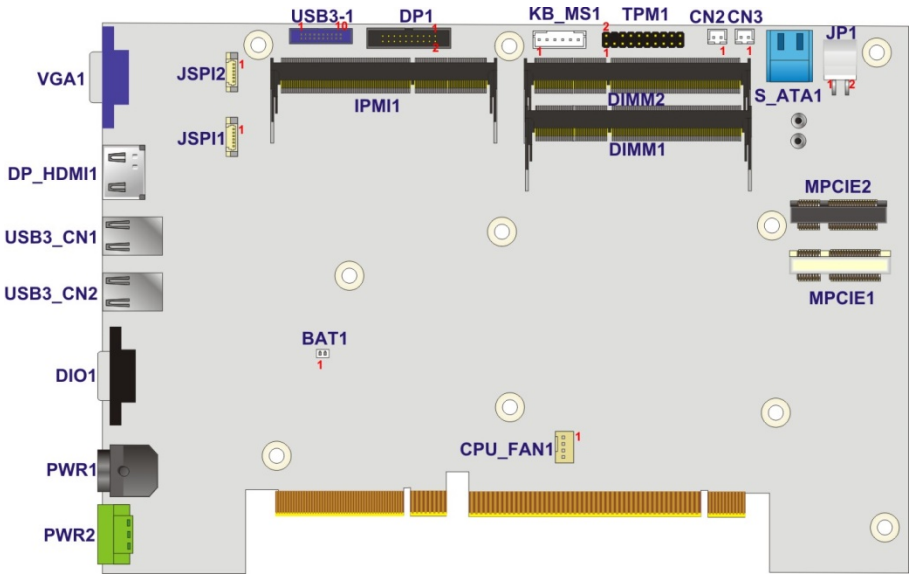



**Figure 4-1: System Motherboard (Front)**

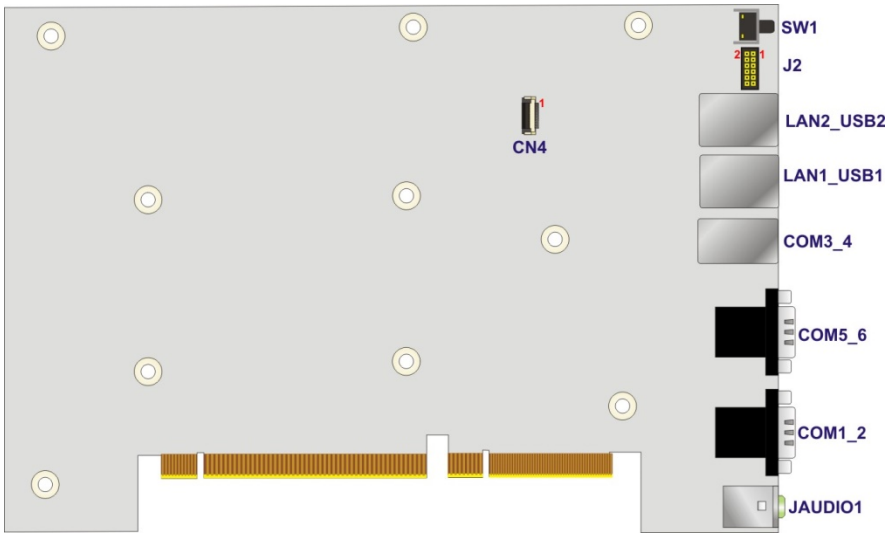



**Figure 4-2: System Motherboard (Rear)**

## 4.2 Internal Peripheral Connectors

The table below shows a list of the internal peripheral interface connectors on the system motherboard. Pinouts of these connectors can be found in the following sections.

| Connector | Type | Label |
|---|---|---|
| Backplane power connector | 4-pin wafer | JP1 |
| Battery connector | 2-pin wafer | BAT1 |
| BIOS programming connector | 6-pin wafer | JSPI1 |
| CPU fan connector | 4-pin wafer | CPU_FAN1 |
| DDR4 SO-DIMM slots | DDR4 SO-DIMM slot | DIMM1, DIMM2 |
| DisplayPort connector | 20-pin box header | DP1 |
| EC debug connector | 20-pin FPC connector | CN4 |
| EC programming connector | 6-pin wafer | JSPI2 |
| iRIS-2400 module slot | iRIS-2400 module slot | IPMI1 |
| Keyboard and mouse connector | 6-pin wafer | KB_MS1 |
| LED connector | 12-pin header | J2 |
| PCIe mini Card | Full size | MPCIE1 |
| PCIe mini Card | Half size | MPCIE2 |
| SATA 6Gb/s drive connectors | 14-pin SATA connector | S_ATA1 |
| SATA power connectors | 2-pin wafer | CN2, CN3 |
| TPM connector | 20-pin header | TPM1 |
| USB 3.0 connectors | 19-pin box header | USB3-1 |

**Table 4-1: Peripheral Interface Connectors**

### 4.2.1 Backplane Power Connector (JP1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | GND | 2 | GND |
| 3 | +12V | 4 | +5V |

**Table 4-2: Backplane Power Connector Pinouts (JP1)**

### 4.2.2 Battery Connector (BAT1)

| PIN NO. | DESCRIPTION |
|---|---|
| 1 | VBATT |
| 2 | GND |

**Table 4-3: Battery Connector Pinouts (BAT1)**

### 4.2.3 BIOS Programming Connector (JSPI1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | +V3.3M_SPI_CON | 2 | SPI_CS |
| 3 | SPI_SO_SW | 4 | SPI_CLK_SW |
| 5 | SPI_SI_SW | 6 | GND |

**Table 4-4: BIOS Programming Connector Pinouts (JSPI1)**

### 4.2.4 CPU Fan Connector (CPU_FAN1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | GND | 2 | +V12S |
| 3 | FANIO | 4 | FANOUT |

**Table 4-5: CPU Fan Connector Pinouts (CPU_FAN1)**

### 4.2.5 DisplayPort Connector (DP1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | DDI1_HPD# | 2 | DPD_AUX_CTRL_P2 |
| 3 | GND | 4 | DPD_AUX_CTRL_N2 |
| 5 | AUX_CTRL_DET_D | 6 | GND |
| 7 | GND | 8 | DPD_OB_LANE2_P_C |
| 9 | DPD_OB_LANE3_P_C | 10 | DPD_OB_LANE2_N_C |
| 11 | DPD_OB_LANE3_N_C | 12 | GND |
| 13 | GND | 14 | DPD_OB_LANE0_P_C |
| 15 | DPD_OB_LANE1_P_C | 16 | DPD_OB_LANE0_N_C |

| | | | |
|---|---|---|---|
| 17 | DPD_OB_LANE1_N_C | 18 | VCC3 |
| 19 | GND | 20 | NC |

**Table 4-6: DisplayPort connector Pinouts (DP1)**

### 4.2.6 EC Debug Connector (CN4)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | KSI0 | 11 | KSO9 |
| 2 | KSO0 | 12 | KSO10 |
| 3 | KSO1 | 13 | KSO12 |
| 4 | KSO2 | 14 | KSI1 |
| 5 | KSO3 | 15 | KSO11 |
| 6 | KSO4 | 16 | KSI2 |
| 7 | KSO5 | 17 | KSI3 |
| 8 | KSO6 | 18 | GND |
| 9 | KSO7 | 19 | GND |
| 10 | KSO8 | 20 | GND |

**Table 4-7: EC Debug Connector Pinouts (CN4)**

### 4.2.7 EC Programming Connector (JSPI2)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | +V3.3M_SPI_CON_EC | 2 | SPI_CS#0_CN_EC |
| 3 | SPI_SO_SW_EC | 4 | SPI_CLK_SW_EC |
| 5 | SPI_SI_SW_EC | 6 | GND |

**Table 4-8: EC Programming Connector Pinouts (JSPI2)**

### 4.2.8 Keyboard and mouse connector (KB_MS1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | VCC5_KBMS | 2 | MSDATA |
| 3 | MSCLK | 4 | KBDATA |
| 5 | KBCLOCK | 6 | KBGND |

**Table 4-9: Keyboard and mouse connector Pinouts (KB_MS1)**

### 4.2.9 LED Connector (J2)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | +V3.3S_IO | 2 | +V3.3A_EC_IO |
| 3 | IRST_PD# | 4 | IATX_LED# |
| 5 | IPWRLED01# | 6 | IPWRLED02# |
| 7 | IIPMI_LED# | 8 | ICPU_LED# |
| 9 | IDISKLED# | 10 | N/A |
| 11 | GND | 12 | GND |

**Table 4-10: LED Connector Pinouts (J2)**

### 4.2.10 SATA Power Connectors (CN2, CN3)

| PIN NO. | DESCRIPTION |
|---|---|
| 1 | +V5S |
| 2 | GND |

**Table 4-11: SATA Power Connectors Pinouts (CN2, CN3)**

### 4.2.11 TPM Connector (TPM1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | CLK | 2 | GND |
| 3 | LPC_FRAME# | 4 | NC |
| 5 | PLT_GATED_RST# | 6 | VCC5 |
| 7 | LPC_AD3 | 8 | LPC_AD2 |
| 9 | VCC3 | 10 | LPC_AD1 |
| 11 | LPC_AD0 | 12 | GND |
| 13 | SMB_CLK | 14 | SMB_DATA |
| 15 | V3P3A | 16 | INT_SERIRQ |
| 17 | GND | 18 | PM_CLKRUN# |
| 19 | LPCPD_N | 20 | TPM_DRQ#0 |

**Table 4-12: TPM Connector Pinouts (TPM1)**

### 4.2.12 USB 3.0 connectors (USB3-1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | VCC_USB3_56 | 2 | USB3_RX5_N_C |
| 3 | USB3_RX5_P_C | 4 | GND |
| 5 | USB3P1_TXDN5_C | 6 | USB3P1_TXDP5_C |
| 7 | GND | 8 | USB2P5_DM1_L |
| 9 | USB2P5_DP1_L | 10 | NC |
| 11 | USB2P6_DP2_L | 12 | USB2P6_DM2_L |
| 13 | GND | 14 | USB3P1_TXDP6_C |
| 15 | USB3P1_TXDN6_C | 16 | GND |
| 17 | USB3_RX6_P_C | 18 | USB3_RX6_N_C |
| 19 | VCC_USB3_56 | | |

**Table 4-13: USB 3.0 connectors Pinouts (USB3-1)**

## 4.3 External Interface Panel Connectors

The table below shows a list of the external interface panel connectors on the system motherboard. Pinouts of these connectors can be found in the following sections.

| Connector | Type | Label |
|---|---|---|
| Audio jack (mic, line-out) | Audio jack | JAUDIO1 |
| DIO connector | DB-9 | DIO1 |
| Ethernet and USB 2.0 connectors | RJ-45, USB 2.0 port | LAN1_USB1, LAN2_USB2 |
| Power connector | 4-pin DC jack | PWR1 |
| Power connector | 3-pin terminal block | PWR2 |
| RS-232 serial port connectors | DB-9 w/isolation | COM1_2 |
| RS-232 serial port connectors | Dual RJ-45 | COM3_4 |
| RS-232/422/485 serial port connectors | DB-9 | COM5_6 |
| USB 3.0 connectors | USB 3.0 port | USB3_CN1, USB3_CN2 |
| VGA connector | DB-15 | VGA1 |

**Table 4-14: Rear Panel Connectors**

### 4.3.1 Audio Jack (JAUDIO1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | GND | 2 | ILMIC1-CONN-L |
| 3 | GND | 4 | IJD_MIC |
| 5 | ILMIC1-CONN-R | 22 | ILFRONT-L |
| 23 | GND | 24 | IJD_FRONT |
| 25 | ILFRONT-R | | |

**Table 4-15: Audio Jack Pinouts (JAUDIO1)**

### 4.3.2 DIO connector (DIO1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | DIN0 | 2 | DOUT0 |
| 3 | DIN1 | 4 | DOUT1 |
| 5 | DIN2 | 6 | DOUT2 |
| 7 | DIN3 | 8 | DOUT3 |
| 9 | +5V | | |

**Table 4-16: DIO connector Pinouts (DIO1)**

### 4.3.3 Ethernet and USB 2.0 Connectors (LAN1_USB1)

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | USBV7L | 2 | DATA7_N |
| 3 | DATA7_P | 4 | IO_GND |
| 5 | USBV7L | 6 | DATA8_N |
| 7 | DATA8_P | 8 | IO_GND |

**Table 4-17: USB 2.0 Port Pinouts (USB1)**

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| R1 | GND | R2 | ILAN_MDI0_DP |
| R3 | ILAN_MDI0_DN | R4 | ILAN_MDI1_DP |
| R5 | ILAN_MDI1_DN | R6 | ILAN_MDI2_DP |
| R7 | ILAN_MDI2_DN | R8 | ILAN_MDI3_DP |

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| R9 | ILAN_MDI3_DN | R10 | GND |
| L1 | ILAN1_1000- | L2 | ILAN1_100- |
| L3 | ILAN1_LINK_ACT- | L4 | ILAN1_LINK_PWR |

**Table 4-18: LAN Pinouts (LAN1)**

### 4.3.4 Ethernet and USB 2.0 Connectors (LAN2_USB2)

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| 1 | USBV9L | 2 | DATA9_N |
| 3 | DATA9_P | 4 | IO_GND |
| 5 | USBV9L | 6 | DATA10_N |
| 7 | DATA10_P | 8 | IO_GND |

**Table 4-19: USB 2.0 Port Pinouts (USB2)**

| PIN | DESCRIPTION | PIN | DESCRIPTION |
|---|---|---|---|
| R1 | GND | R2 | ITRD2P0 |
| R3 | ITRD2N0 | R4 | ITRD2P1 |
| R5 | ITRD2N1 | R6 | ITRD2P2 |
| R7 | ITRD2N2 | R8 | ITRD2P3 |
| R9 | ITRD2N3 | R10 | GND |
| L1 | ILANEXT_1000- | L2 | ILANEXT_100- |
| L3 | ILANEXT_LINK_ACT- | L4 | ILANEXT_LINK_PWR |

**Table 4-20: LAN Pinouts (LAN2)**

### 4.3.5 Power Connector (PWR1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | VIN1 | 2 | GND |
| 3 | VIN1 | 4 | GND |
| 5 | GND | | |

**Table 4-21: Power Connector Pinouts (PWR1)**

### 4.3.6 Power Connector (PWR2)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | ACCON | 2 | +VIN |
| 3 | GND | | |

**Table 4-22: Power Connector Pinouts (PWR2)**

### 4.3.7 RS-232 Serial Port Connector (COM1_2)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1(10) | DCD | 6(15) | DSR |
| 2(11) | RX | 7(16) | RTS |
| 3(12) | TX | 8(17) | CTS |
| 4(13) | DTR | 9(18) | RI |
| 5(14) | GND | | |

**Table 4-23: RS-232 Serial Port Connector Pinouts (COM1_2)**

### 4.3.8 RS-232 Serial Port Connectors (COM3_4)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | DCD | 5 | RTS |
| 2 | DTR | 6 | RX |
| 3 | DSR | 7 | DSR |
| 4 | TX | 8 | DCD |

**Table 4-24: RS-232 Serial Port Connectors Pinouts (COM3_4)**

### 4.3.9 RS-232/422/485 Serial Port Connector (COM5_6)

| PIN NO. | RS-232 | RS-422 | RS-485 |
|---|---|---|---|
| 1(10) | DCD | TXD422# | TXD485# |
| 2(11) | RX | TXD422+ | TXD485+ |
| 3(12) | TX | RXD422+ | -- |
| 4(13) | DTR | RXD422# | -- |
| 5(14) | GND | -- | -- |
| 6(15) | DSR | -- | -- |

| | | | |
|---|---|---|---|
| 7(16) | RTS | -- | -- |
| 8(17) | CTS | -- | -- |
| 9(18) | RI | -- | -- |

**Table 4-25: RS-232/422/485 Serial Port Connector Pinout (COM5_6)**

### 4.3.10 USB 3.0 Connectors (USB3_CN1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | VCC_USB12 | 2 | USB_PN1_C |
| 3 | USB_PP1_C | 4 | GND |
| 5 | USB3_RX1_N_C | 6 | USB3_RX1_P_C |
| 7 | GND | 8 | USB3_TX1_N_C |
| 9 | USB3_TX1_P_C | 10 | VCC_USB12 |
| 11 | USB_PN2_C | 12 | USB_PP2_C |
| 13 | GND | 14 | USB3_RX2_N_C |
| 15 | USB3_RX2_P_C | 16 | GND |
| 17 | USB3_TX2_N_C | 18 | USB3_TX2_P_C |

**Table 4-26: USB 3.0 Connectors Pinouts (USB3_CN1)**

### 4.3.11 USB 3.0 Connectors (USB3_CN2)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | VCC_USB34 | 2 | USB_PN3_C |
| 3 | USB_PP3_C | 4 | GND |
| 5 | USB3_RX3_N_C | 6 | USB3_RX3_P_C |
| 7 | GND | 8 | USB3_TX3_N_C |
| 9 | USB3_TX3_P_C | 10 | VCC_USB34 |
| 11 | USB_PN4_C | 12 | USB_PP4_C |
| 13 | GND | 14 | USB3_RX4_N_C |
| 15 | USB3_RX4_P_C | 16 | GND |
| 17 | USB3_TX4_N_C | 18 | USB3_TX4_P_C |

**Table 4-27: USB 3.0 Connectors Pinouts (USB3_CN2)**

### 4.3.12 VGA Connector (VGA1)

| PIN NO. | DESCRIPTION | PIN NO. | DESCRIPTION |
|---|---|---|---|
| 1 | Red | 2 | Green |
| 3 | Blue | 4 | NC |
| 5 | GND | 6 | GND |
| 7 | GND | 8 | GND |
| 9 | VGAVCC | 10 | HOTPLUG |
| 11 | NC | 12 | DDCDAT |
| 13 | HSYNC | 14 | VSYNC |
| 15 | DDCCLK | | |

**Table 4-28: VGA Connector Pinouts (VGA1)**

Chapter

5

# BIOS

## 5.1 Introduction

The BIOS is programmed onto the BIOS chip. The BIOS setup program allows changes to certain system settings. This chapter outlines the options that can be changed.

**NOTE:**

Some of the BIOS options may vary throughout the life cycle of the product and are subject to change without prior notice.

### 5.1.1 Starting Setup

The UEFI BIOS is activated when the computer is turned on. The setup program can be activated in one of two ways.

1. Press the **DEL** or **F2** key as soon as the system is turned on or
2. Press the **DEL** or **F2** key when the "**Press DEL or F2 to enter SETUP**" message appears on the screen.

If the message disappears before the **DEL or F2** key is pressed, restart the computer and try again.

### 5.1.2 Using Setup

Use the arrow keys to highlight items, press **ENTER** to select, use the PageUp and PageDown keys to change entries, press **F1** for help and press **ESC** to quit. Navigation keys are shown in.

| Key | Function |
|---|---|
| Up arrow | Move to previous item |
| Down arrow | Move to next item |
| Left arrow | Move to the item on the left hand side |
| Right arrow | Move to the item on the right hand side |
| + | Increase the numeric value or make changes |
| - | Decrease the numeric value or make changes |

| Key | Function |
|---|---|
| Page Up key | Increase the numeric value or make changes |
| Page Dn key | Decrease the numeric value or make changes |
| Esc key | Main Menu – Quit and not save changes into CMOS<br>Status Page Setup Menu and Option Page Setup Menu -- Exit current page and return to Main Menu |
| F1 | General help, only for Status Page Setup Menu and Option Page Setup Menu |
| F2 | Previous values |
| F3 | Load optimized defaults |
| F4 | Save changes and Exit BIOS |

**Table 5-1: BIOS Navigation Keys**

### 5.1.3 Getting Help

When **F1** is pressed a small help window describing the appropriate keys to use and the possible selections for the highlighted item appears. To exit the Help Window press **Esc** or the **F1** key again.

### 5.1.4 Unable to Reboot after Configuration Changes

If the computer cannot boot after changes to the system configuration is made, CMOS defaults. Use the jumper described in Chapter 2.

### 5.1.5 BIOS Menu Bar

The **menu bar** on top of the BIOS screen has the following main items:

- Main – Changes the basic system configuration.
- Advanced – Changes the advanced system settings.
- Chipset – Changes the chipset settings.
- Boot – Changes the system boot configuration.
- Security – Sets User and Supervisor Passwords.
- Save & Exit – Selects exit options and loads default settings.

The following sections completely describe the configuration options found in the menu items at the top of the BIOS screen and listed above.

## 5.2 Main

The **Main** BIOS menu (**BIOS Menu 1**) appears when the **BIOS Setup** program is entered.

The **Main** menu gives an overview of the basic system information.

```
Aptio Setup Utility – Copyright (C) 2018 American Megatrends, Inc.
  Main   Advanced   Chipset   Security    Boot    Save & Exit    Server Mgmt
BIOS Information                                  Set the Date. Use Tab to
BIOS Vendor                    American Megatrends switch between Data
Core Version                   5.12                elements.
Compliency                     UEFI 2.5; PI 1.4
Project Version                V2RMAR15.bin
Build Date and Time            12/03/2018 15:39:44
Access Level                   Administrator
iWDD Vendor                    iEi
iWDD Version                   SER0ER11.bin
IPMI Module                    Not Present
IEI QTS/IPC Status             IPC

Board Information
Board ID                       SAF3
Fab ID                         V1.04
LAN PHY Revision               A6 (B2 Stepping)

Processor Information
Name                           Kabylake DT
Type                           Intel(R) Core(TM)
                               i7-7700T CPU @ 2.90GHz
Speed                          2900 MHz
ID                             0x906E9
Stepping                       B0/S0/M0
Package                        Not Implemented Yet
Number of Processors           4Core(s) / 8Thread(s)
Microcode Revision             84
GT Info                        GT2 (0x5912)

IGFX VBIOS Version             1049
IGFX GOP Version               N/A
Memory RC Version              1.6.0.2
Total Memory                   16384 MB
Memory Frequency               2133 MHz

PCH Information
Name                           SKL PCH-H
PCH  SKU                       Q170
Stepping                       D1
Hsio Revision                  52                  ----------------------
Package                        Not Implemented Yet
TXT Capability of Platform/PCH Supported
Production Type                Production          →←: Select Screen
                                                   ↑ ↓: Select Item
Dual Output Fast Read Support  Not Supported       EnterSelect
Read ID/Status Clock Freq      17 MHz              +/-: Change Opt.
Write and Erase Clock Freq     48 MHz              F1:  General Help
Fast Read Clock Freq           48 MHz              F2:  Previous Values
Fast Read Support              Supported           F3:  Optimized Defaults
Read Clock Freq                17 MHz              F4:  Save & Exit
Number of Components           1 Component         ESC: Exit
SPI Component 0 Density        16 MB
ME FW Version                  11.8.50.3425
ME Firmware SKU                Corporate SKU
System Date                    [Fri 12/21/2018]
System Time                    [15:43:27]
Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

**BIOS Menu 1: Main**

The Main menu has two user configurable fields:

➔ **System Date [xx/xx/xx]**

Use the **System Date** option to set the system date. Manually enter the day, month and year.

➔ **System Time [xx:xx:xx]**

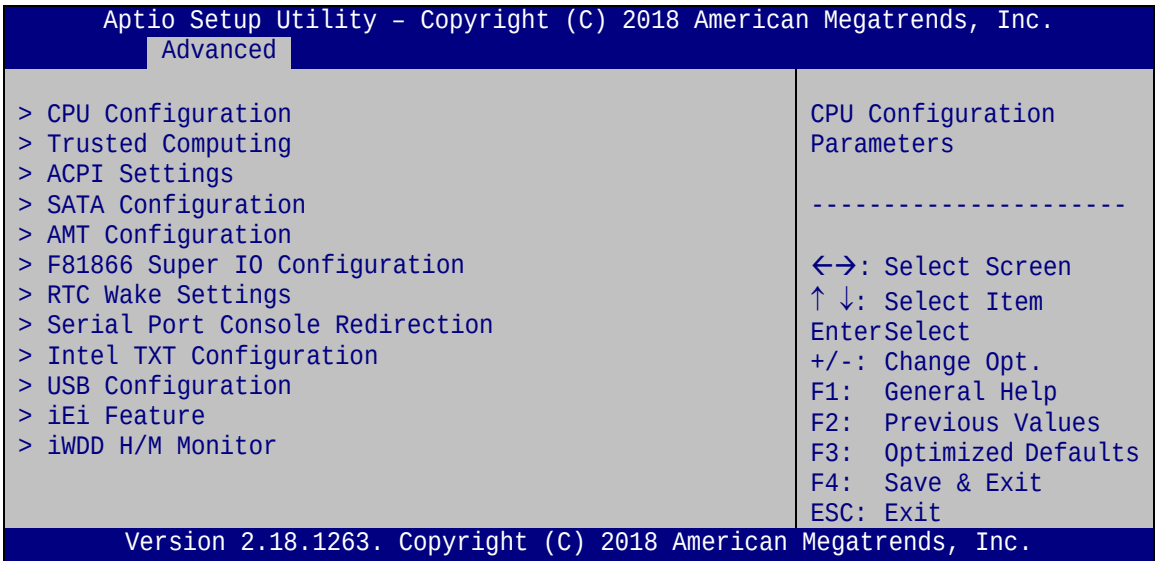
Use the **System Time** option to set the system time. Manually enter the hours, minutes and seconds.

## 5.3 Advanced

Use the **Advanced** menu (**BIOS Menu 2**) to configure the CPU and peripheral devices through the following sub-menus:

**WARNING!**

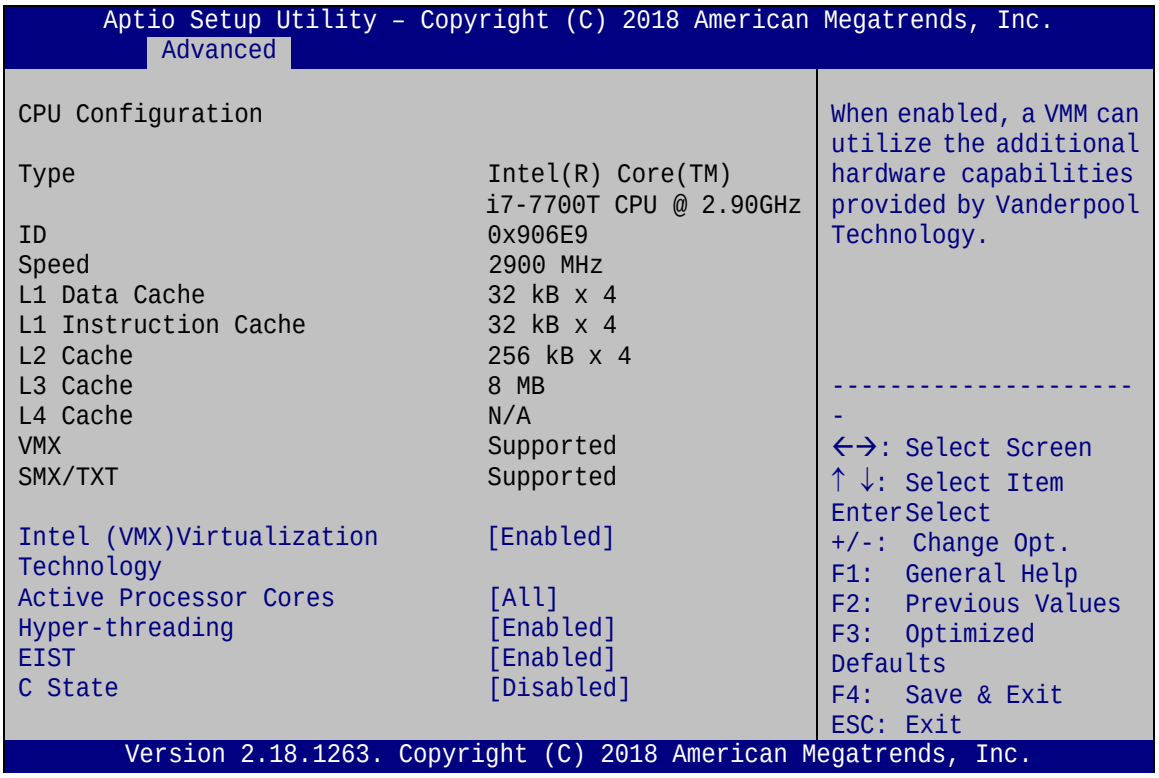
Setting the wrong values in the sections below may cause the system to malfunction. Make sure that the settings made are compatible with the hardware.




**BIOS Menu 2: Advanced**

### 5.3.1 CPU Configuration

Use the **CPU Configuration** menu (**BIOS Menu 3**) to enter the **CPU Information** submenu or enable Intel Virtualization Technology.




**BIOS Menu 3: CPU Configuration**

The CPU Configuration menu (**BIOS Menu 3**) lists the following CPU details:

- Type: Lists the brand name of the CPU being used
- ID: Lists the CPU signature value.
- Speed: Lists the CPU processing speed.
- L1 Data Cache: Lists the amount of data storage space on the L1 cache.
- L1 Instruction Cache: Lists the amount of instruction storage space on the L1 cache.
- L2 Cache: Lists the amount of storage space on the L2 cache.
- L3 Cache: Lists the amount of storage space on the L3 cache.
- L4 Cache: Lists the amount of storage space on the L4 cache.
- VMX: Indicates if Intel VMX Technology is supported by the CPU.
- SMX/TXT: Indicates if Intel SMX/TXT Technology is supported by the CPU.

➔ **Intel (VMX) Virtualization Technology [Enabled]**

Use the **Intel (VMX) Virtualization Technology** option to enable or disable virtualization on the system. When combined with third party software, Intel Virtualization technology allows several OSs to run on the same system at the same time.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | | Disables Intel Virtualization Technology. |
| ➔ | **Enabled** | **DEFAULT** | Enables Intel Virtualization Technology. |

➔ **Active Processor Cores [All]**

Use the **Active Processor Cores** option to configure the number of the active processor cores.

| | | | |
|---|---|---|---|
| ➔ | **All** | **DEFAULT** | Active all of the processor cores |
| ➔ | **1** | | Active one of the processor cores |
| ➔ | **2** | | Active two of the processor cores |
| ➔ | **3** | | Active three of the processor cores |

➔ **Hyper-threading [Enabled]**

Use the **Hyper-threading** BIOS option to enable or disable the Intel Hyper-Threading Technology.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | | Disables the Intel Hyper-Threading Technology. |
| ➔ | **Enabled** | **DEFAULT** | Enables the Intel Hyper-Threading Technology. |

➔ **EIST [Enabled]**

Use the **EIST** option to enable or disable the Intel Speed Step Technology.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | | Disables the Intel Speed Step Technology. |
| ➔ | **Enabled** | **DEFAULT** | Enables the Intel Speed Step Technology. |

➔ **C State [Disabled]**

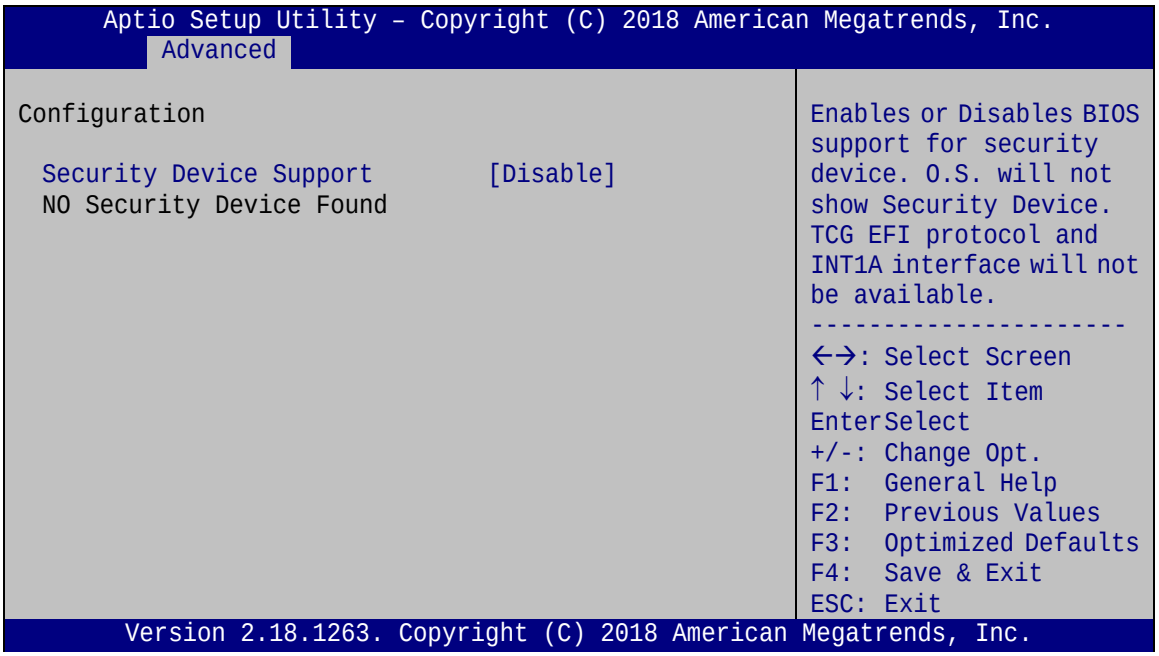
Use the **C State** option to enable or disable CPU C State.

➔ **Disabled** **DEFAULT** Disables CPU C State.

➔ **Enabled** Enables CPU C State.

### 5.3.2 Trusted Computing

Use the **Trusted Computing** menu (**BIOS Menu 4**) to configure settings related to the Trusted Computing Group (TCG) Trusted Platform Module (TPM).




**BIOS Menu 4: Trusted Computing**

➔ **Security Device Support [Disable]**

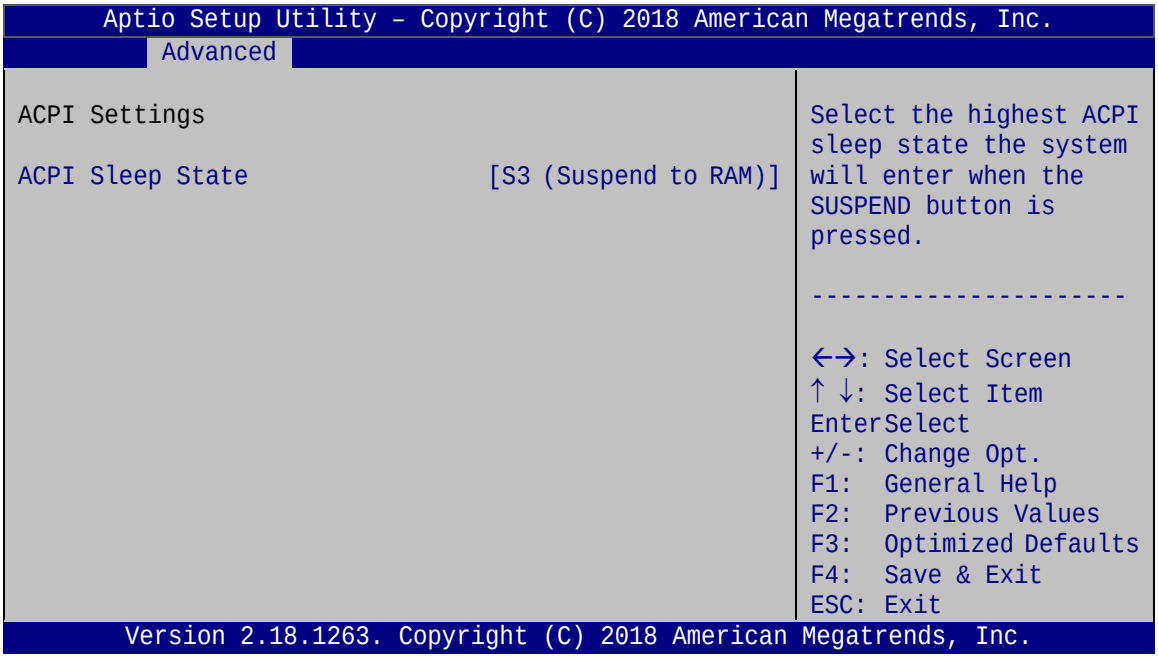
Use the **Security Device Support** option to configure support for the security device.

➔ **Disable** **DEFAULT** Security device support is disabled.

➔ **Enable** Security device support is enabled.

### 5.3.3 ACPI Settings

The **ACPI Settings** menu (**BIOS Menu 5**) configures the Advanced Configuration and Power Interface (ACPI) options.




**BIOS Menu 5: ACPI Configuration**

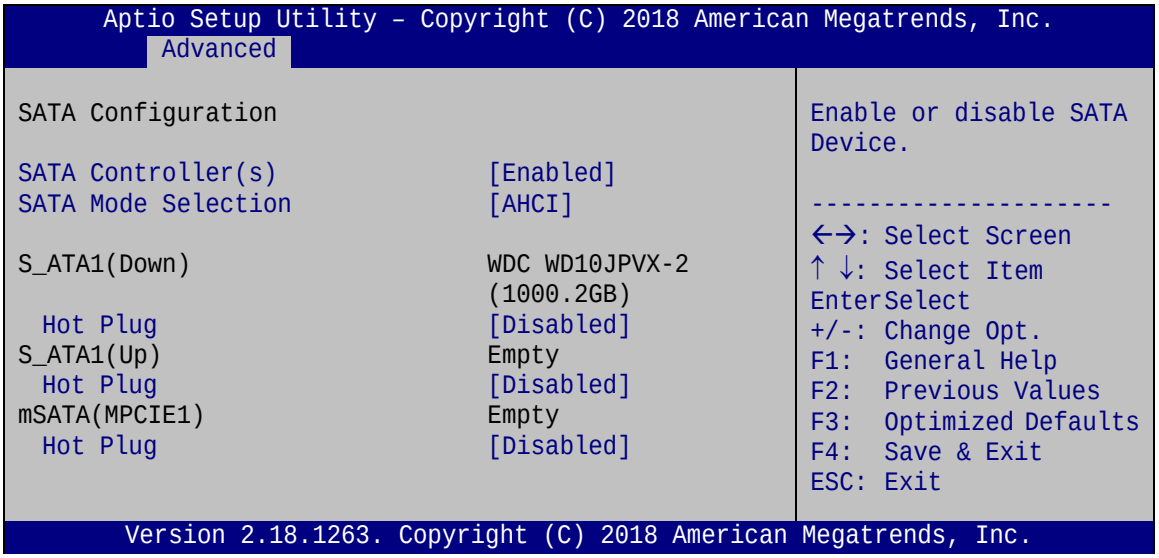
➔ **ACPI Sleep State [S3 (Suspend to RAM)]**

Use the **ACPI Sleep State** option to specify the sleep state the system enters when it is not being used.

| | |
|---|---|
| ➔ **S3 (Suspend to RAM)** | The caches are flushed and the CPU is powered off. Power to the RAM is maintained. The computer returns slower to a working state, but more power is saved. |

### 5.3.4 SATA Configuration

Use the **SATA Configuration** menu (**BIOS Menu 6**) to change and/or set the configuration of the SATA devices installed in the system.




**BIOS Menu 6: SATA Configuration**

➔ **SATA Controller(s) [Enabled]**

Use the **SATA Controller(s)** option to configure the serial ATA controller.

- ➔ **Enabled** **DEFAULT** Enables the on-board SATA controller.
- ➔ **Disabled** Disables the on-board SATA controller.

➔ **SATA Mode Selection [AHCI]**

Use the **SATA Selection Mode** option to configure SATA devices.

- ➔ **AHCI** **DEFAULT** Configures SATA devices as AHCI device.
- ➔ **RAID** Configures SATA devices as RAID device.

➔ **Hot Plug [Disabled]**

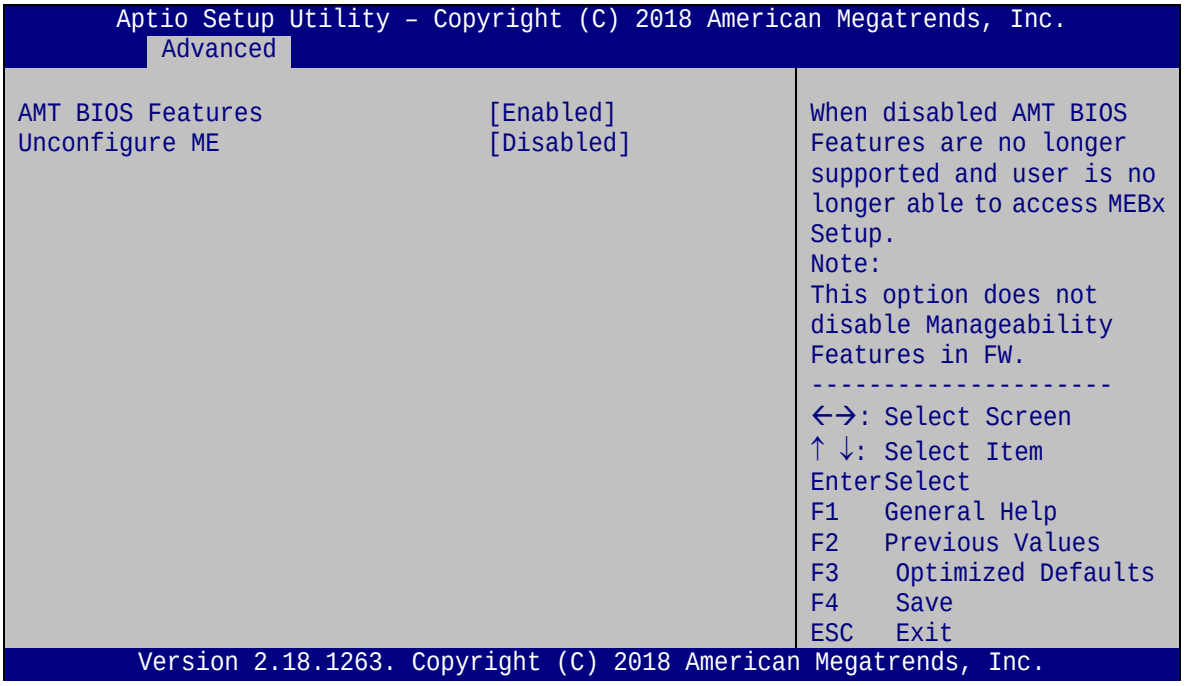
Use the **Hot Plug** option to enable or disable the hot plug function.

➔ **Disabled** **DEFAULT** Disables the hot plug function.

➔ **Enabled** Enables the hot plug function.

### 5.3.5 AMT Configuration

The **AMT Configuration** menu (**BIOS Menu 7**) allows the advanced power management options to be configured.




**BIOS Menu 7: AMT Configuration**

➔ **AMT BIOS Features [Enabled]**

Use **AMT BIOS Features** option to enable or disable the AMT BIOS features.

➔ **Disabled** AMT BIOS features are disabled

➔ **Enabled** **DEFAULT** AMT BIOS features are enabled

➔ **Unconfigure ME [Disabled]**

Use the **Unconfigure ME** option to perform ME unconfigure without password operation.

➔ **Disabled** **DEFAULT** Not perform ME unconfigure

➔ **Enabled** To perform ME unconfigure

### 5.3.6 F81866 Super IO Configuration

Use the **F81866 Super IO Configuration** menu (**BIOS Menu 8**) to set or change the configurations for the serial ports.

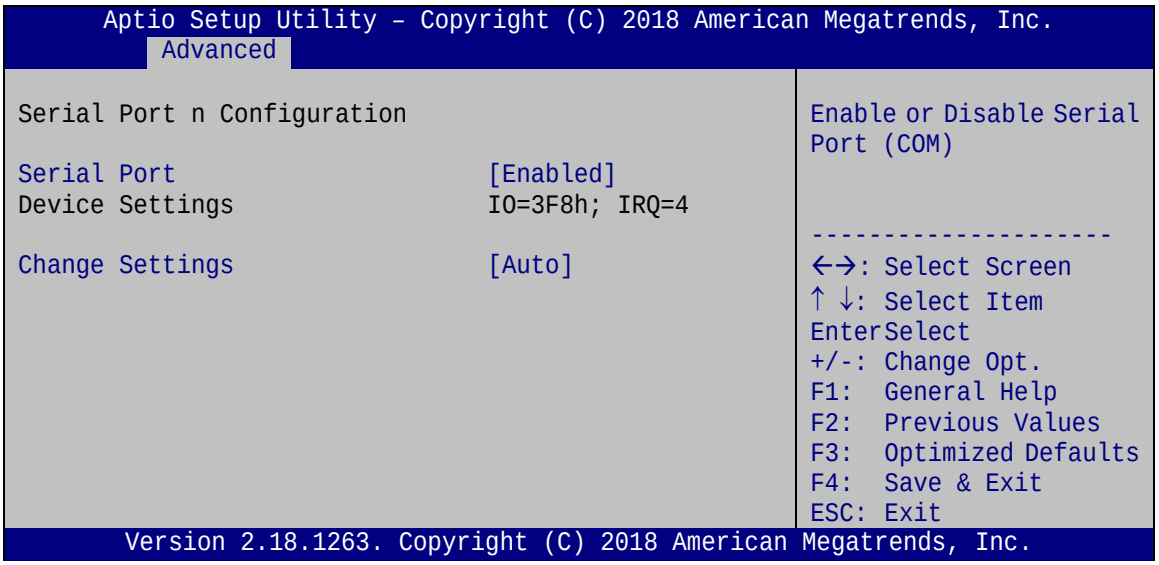
```
      Aptio Setup Utility – Copyright (C) 2018 American Megatrends, Inc.
          Advanced
 F81866 Super IO Configuration                  Set Parameters of Serial
                                                Port 1 (COMA)
 F81866 Super IO Chip              F81866

 > Serial Port 1 Configuration                  ---------------------
 > Serial Port 2 Configuration                  ←→: Select Screen
 > Serial Port 3 Configuration                  ↑ ↓: Select Item
 > Serial Port 4 Configuration                  EnterSelect
 > Serial Port 5 Configuration                  +/-: Change Opt.
 > Serial Port 6 Configuration                  F1:  General Help
                                                F2:  Previous Values
                                                F3:  Optimized Defaults
                                                F4:  Save & Exit
                                                ESC: Exit
      Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

**BIOS Menu 8: F81866 Super IO Configuration**

### 5.3.6.1 Serial Port n Configuration

Use the **Serial Port n Configuration** menu (**BIOS Menu 9**) to configure the serial port n.




**BIOS Menu 9: Serial Port n Configuration Menu**

#### 5.3.6.1.1 Serial Port 1 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

- ➔ **Disabled** — Disable the serial port
- ➔ **Enabled** **DEFAULT** — Enable the serial port

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

- ➔ **Auto** **DEFAULT** — The serial port IO port address and interrupt address are automatically detected.
- ➔ **IO=3F8h; IRQ=4** — Serial Port I/O port address is 3F8h and the interrupt address is IRQ4

- ➔ **IO=3F8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 3F8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=2F8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 2F8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11

#### 5.3.6.1.2 Serial Port 2 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

- ➔ **Disabled** — Disable the serial port
- ➔ **Enabled** DEFAULT — Enable the serial port

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

- ➔ **Auto** DEFAULT — The serial port IO port address and interrupt address are automatically detected.
- ➔ **IO=2F8h; IRQ=3** — Serial Port I/O port address is 2F8h and the interrupt address is IRQ3
- ➔ **IO=3F8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 3F8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=2F8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 2F8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** — Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11

| | | |
|---|---|---|
| ➔ **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |

#### 5.3.6.1.3 Serial Port 3 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

| | | |
|---|---|---|
| ➔ **Disabled** | | Disable the serial port |
| ➔ **Enabled** | **DEFAULT** | Enable the serial port |

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

| | | |
|---|---|---|
| ➔ **Auto** | **DEFAULT** | The serial port IO port address and interrupt address are automatically detected. |
| ➔ **IO=3E8h; IRQ=10** | | Serial Port I/O port address is 3E8h and the interrupt address is IRQ10 |
| ➔ **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=3E0h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 3E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=2E0h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 2E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |

### 5.3.6.1.4 Serial Port 4 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

| | | |
|---|---|---|
| ➔ **Disabled** | | Disable the serial port |
| ➔ **Enabled** | **DEFAULT** | Enable the serial port |

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

| | | |
|---|---|---|
| ➔ **Auto** | **DEFAULT** | The serial port IO port address and interrupt address are automatically detected. |
| ➔ **IO=2E8h; IRQ=10** | | Serial Port I/O port address is 2E8h and the interrupt address is IRQ10 |
| ➔ **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=3E0h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 3E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |
| ➔ **IO=2E0h; IRQ=3, 4, 7, 9, 10, 11** | | Serial Port I/O port address is 2E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11 |

### 5.3.6.1.5 Serial Port 5 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

| | | |
|---|---|---|
| ➔ **Disabled** | | Disable the serial port |

- **Enabled** **DEFAULT** Enable the serial port

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

- **Auto** **DEFAULT** The serial port IO port address and interrupt address are automatically detected.
- **IO=3E0h; IRQ=10** Serial Port I/O port address is 3E0h and the interrupt address is IRQ10
- **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- **IO=3E0h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 3E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- **IO=2E0h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 2E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11

➔ **Device Mode [RS232]**

Use the **Device Mode** option to select the serial port mode.

- **RS232** **DEFAULT** Enables serial port RS-232 support.
- **RS422** Enables serial port RS-422 support.
- **RS485** Enables serial port RS-485 support.

### 5.3.6.1.6 Serial Port 6 Configuration

➔ **Serial Port [Enabled]**

Use the **Serial Port** option to enable or disable the serial port.

- ➔ **Disabled** Disable the serial port
- ➔ **Enabled** **DEFAULT** Enable the serial port

➔ **Change Settings [Auto]**

Use the **Change Settings** option to change the serial port IO port address and interrupt address.

- ➔ **Auto** **DEFAULT** The serial port IO port address and interrupt address are automatically detected.
- ➔ **IO=2E0h; IRQ=10** Serial Port I/O port address is 2E0h and the interrupt address is IRQ10
- ➔ **IO=3E8h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 3E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=2E8h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 2E8h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=3E0h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 3E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11
- ➔ **IO=2E0h; IRQ=3, 4, 7, 9, 10, 11** Serial Port I/O port address is 2E0h and the interrupt address is IRQ3, 4, 7, 9, 10, 11

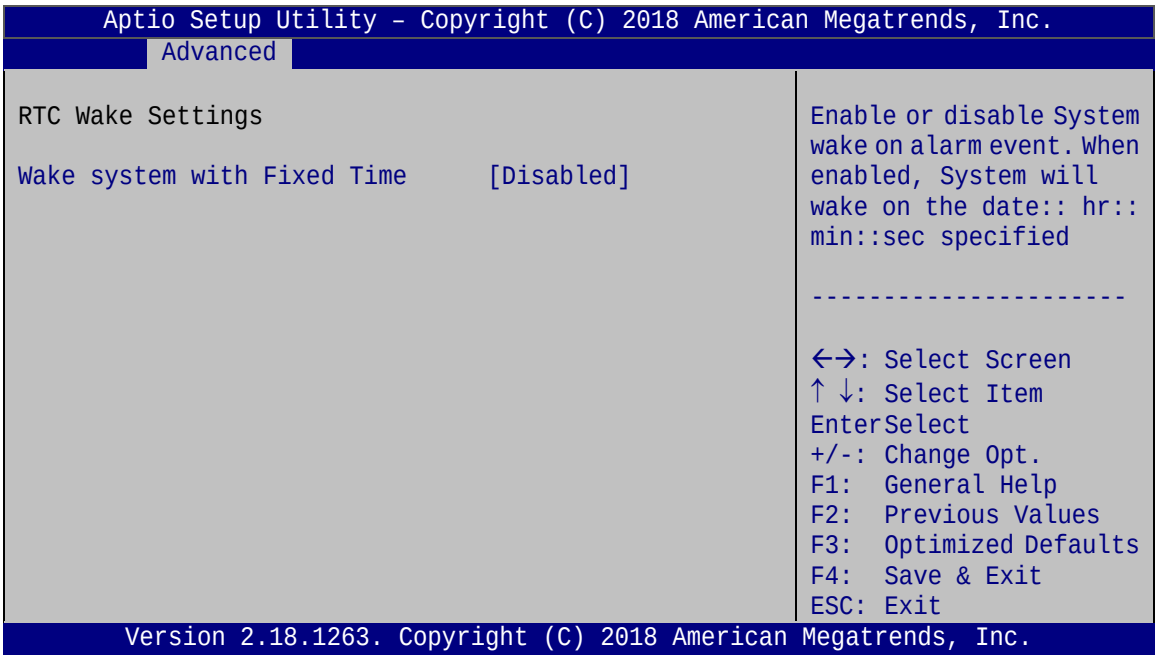
➔ **Device Mode [RS232]**

Use the **Device Mode** option to select the serial port mode.

- ➔ **RS232** **DEFAULT** Enables serial port RS-232 support.
- ➔ **RS422** Enables serial port RS-422 support.
- ➔ **RS485** Enables serial port RS-485 support.

### 5.3.7 RTC Wake Settings

The **RTC Wake Settings** menu (**BIOS Menu 10**) configures RTC wake event.




**BIOS Menu 10: RTC Wake Settings**

➔ **Wake System with Fixed Time [Disabled]**

Use the **Wake System with Fixed Time** option to specify the time the system should be roused from a suspended state.

➔ **Disabled** **DEFAULT** The real time clock (RTC) cannot generate a wake event

➔ **Enabled** If selected, the following appears with values that can be selected:

*Wake up every day

*Wake up date

*Wake up hour

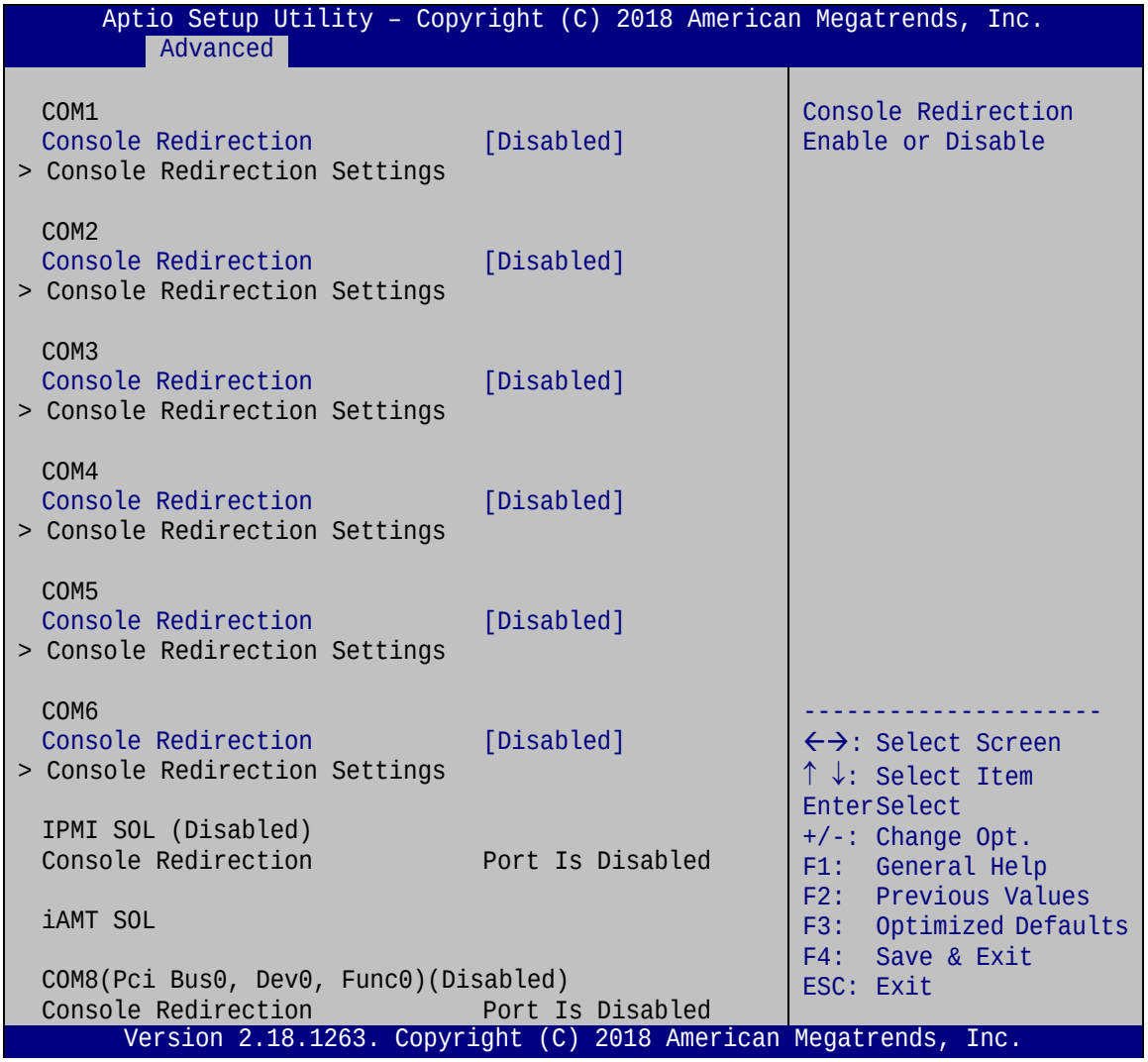
*Wake up minute

*Wake up second

After setting the alarm, the computer turns itself on from a suspend state when the alarm goes off.

### 5.3.8 Serial Port Console Redirection

The **Serial Port Console Redirection** menu (**BIOS Menu 11**) allows the console redirection options to be configured. Console redirection allows users to maintain a system remotely by re-directing keyboard input and text output through the serial port.




**BIOS Menu 11: Serial Port Console Redirection**

➔ **Console Redirection [Disabled]**

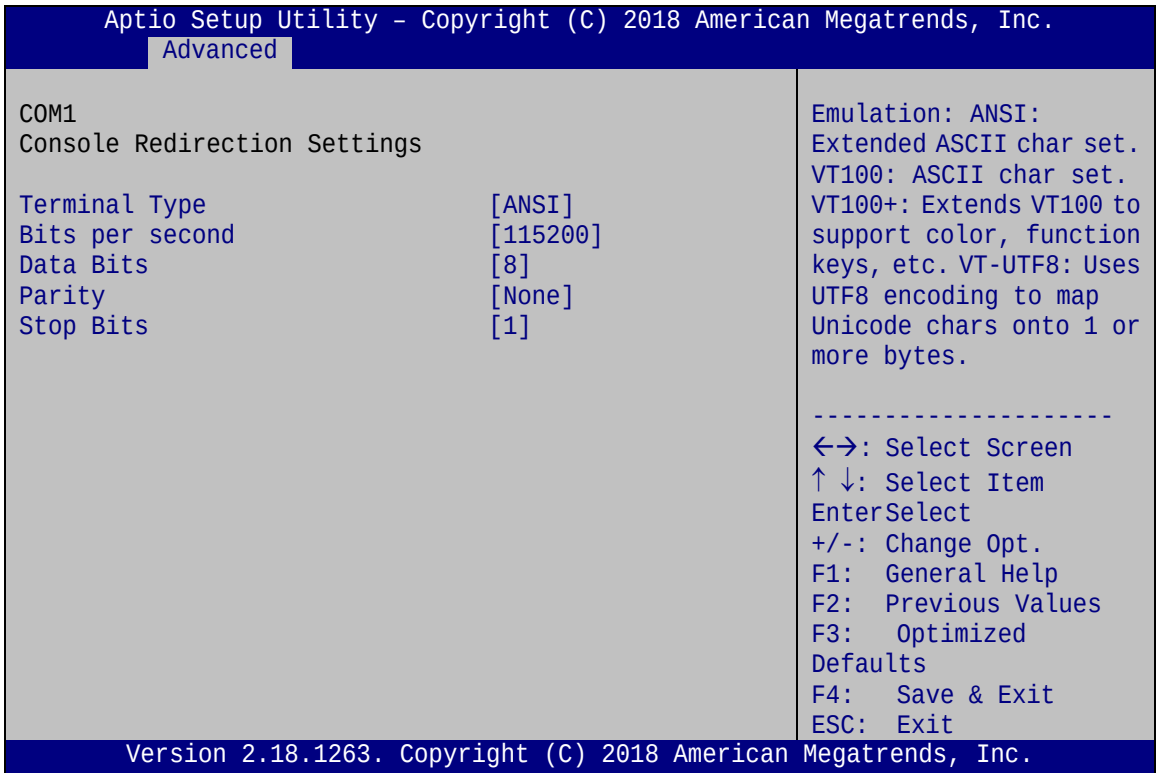
Use **Console Redirection** option to enable or disable the console redirection function.

➔ **Disabled** **DEFAULT** Disabled the console redirection function

➔ **Enabled** Enabled the console redirection function

### 5.3.8.1 Console Redirection Settings

The **Console Redirection Settings** menu (**BIOS Menu 12**) allows the console redirection options to be configured. The option is active when Console Redirection option is enabled.




**BIOS Menu 12: Console Redirection Settings**

➔ **Terminal Type [ANSI]**

Use the **Terminal Type** option to specify the remote terminal type..

➔ **VT100** The target terminal type is VT100

➔ **VT100+** The target terminal type is VT100+

➔ **VT-UTF8** The target terminal type is VT-UTF8

➔ **ANSI** **DEFAULT** The target terminal type is ANSI

➔ **Bits per second [115200]**

Use the **Bits per second** option to specify the transmission speed of the serial port.

| | | |
|---|---|---|
| ➔ **9600** | | The transmission speed is 9600 |
| ➔ **19200** | | The transmission speed is 19200 |
| ➔ **38400** | | The transmission speed is 38400 |
| ➔ **57600** | | The transmission speed is 57600 |
| ➔ **115200** | **DEFAULT** | The transmission speed is 115200 |

➔ **Data Bits [8]**

Use the **Data Bits** option to specify the number of data bits.

| | | |
|---|---|---|
| ➔ **7** | | Sets the data bits at 7. |
| ➔ **8** | **DEFAULT** | Sets the data bits at 8. |

➔ **Parity [None]**

Use the **Parity** option to specify the parity bit that can be sent with the data bits for detecting the transmission errors.

| | | |
|---|---|---|
| ➔ **None** | **DEFAULT** | No parity bit is sent with the data bits. |
| ➔ **Even** | | The parity bit is 0 if the number of ones in the data bits is even. |
| ➔ **Odd** | | The parity bit is 0 if the number of ones in the data bits is odd. |
| ➔ **Mark** | | The parity bit is always 1. This option does not provide error detection. |
| ➔ **Space** | | The parity bit is always 0. This option does not provide error detection. |

➔ **Stop Bits [1]**

Use the **Stop Bits** option to specify the number of stop bits used to indicate the end of a serial data packet. Communication with slow devices may require more than 1 stop bit.

| | | |
|---|---|---|
| ➔ **1** | **DEFAULT** | Sets the number of stop bits at 1. |
| ➔ **2** | | Sets the number of stop bits at 2. |

### 5.3.1 Intel TXT(LT) Configuration

Use the **Intel TXT(LT) Configuration** menu to configure Intel® Trusted Execution Technology support.

```
Aptio Setup Utility – Copyright (C) 2018 American Megatrends, Inc.
Advanced

Intel TXT Information                                  Enables utilization of
                                                       additional hardware
Chipset                          Production Fused      capabilities provided by
BlosAcm                          Production Fused      Intel(R) Trusted
Chipset Txt                      Supported             Execution Technology.
Cpu Txt                          Supported             Changes require a full
Error Code                       None                  power cycle to take
  Class Code                     None                  effect.
  Major Code                     None
  Minor Code                     None
                                                       ---------------------
Intel TXT(LT) Support            [Disabled]            ←→: Select Screen
                                                       ↑↓: Select Item
                                                       Enter Select
                                                       + -   Change Opt.
                                                       F1    General Help
                                                       F2    Previous Values
                                                       F3    Optimized Defaults
                                                       F4    Save & Exit
                                                       ESC   Exit
Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

**BIOS Menu 13: Intel TXT(LT) Configuration**

➔ **Intel TXT(LT) Support [Disabled]**

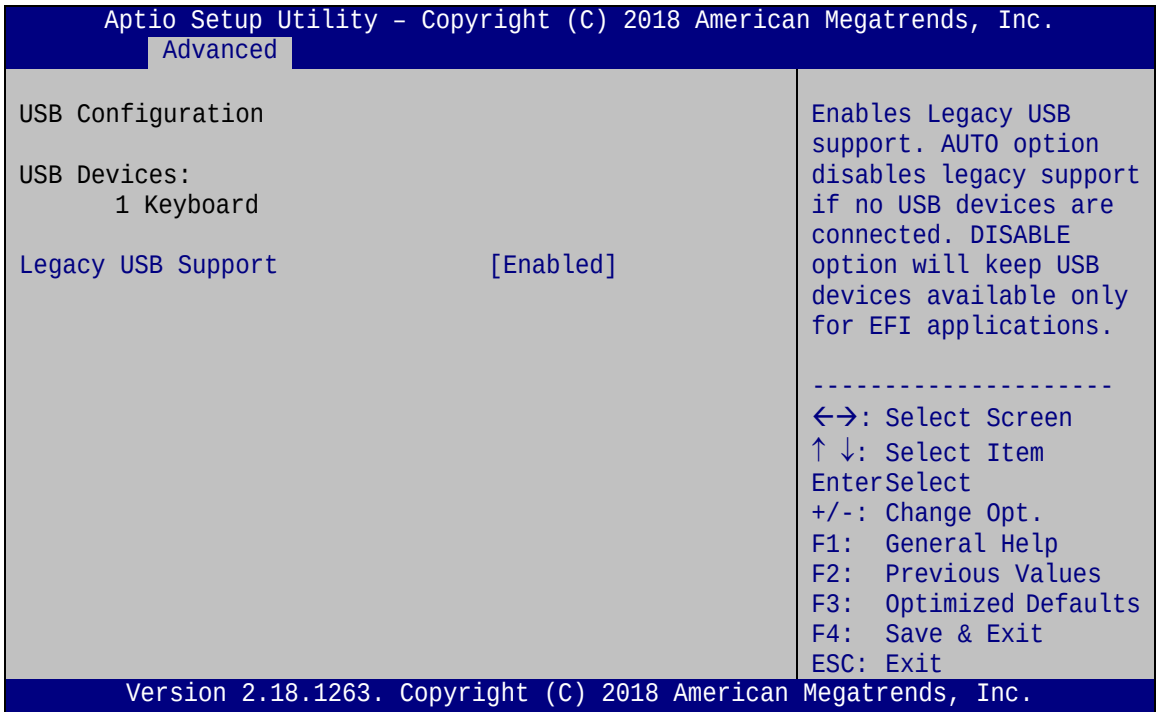
Use the **Intel TXT(LT) Support** BIOS option to enable or disable the Intel Trusted Execution Technology.

| | | |
|---|---|---|
| ➔ **Disabled** | **DEFAULT** | Disables the Intel Trusted Execution Technology. |

➔ **Enabled** Enables the Intel Trusted Execution Technology.

### 5.3.2 USB Configuration

Use the **USB Configuration** menu (**BIOS Menu 14**) to read USB configuration information and configure the USB settings.




**BIOS Menu 14: USB Configuration**

➔ **USB Devices**

The **USB Devices** field lists the USB devices that are enabled on the system

➔ **Legacy USB Support [Enabled]**

Use the **Legacy USB Support** BIOS option to enable USB mouse and USB keyboard support. Normally if this option is not enabled, any attached USB mouse or USB keyboard does not become available until a USB compatible operating system is fully booted with all USB drivers loaded. When this option is enabled, any attached USB mouse or USB keyboard can control the system even when there is no USB driver loaded onto the system.

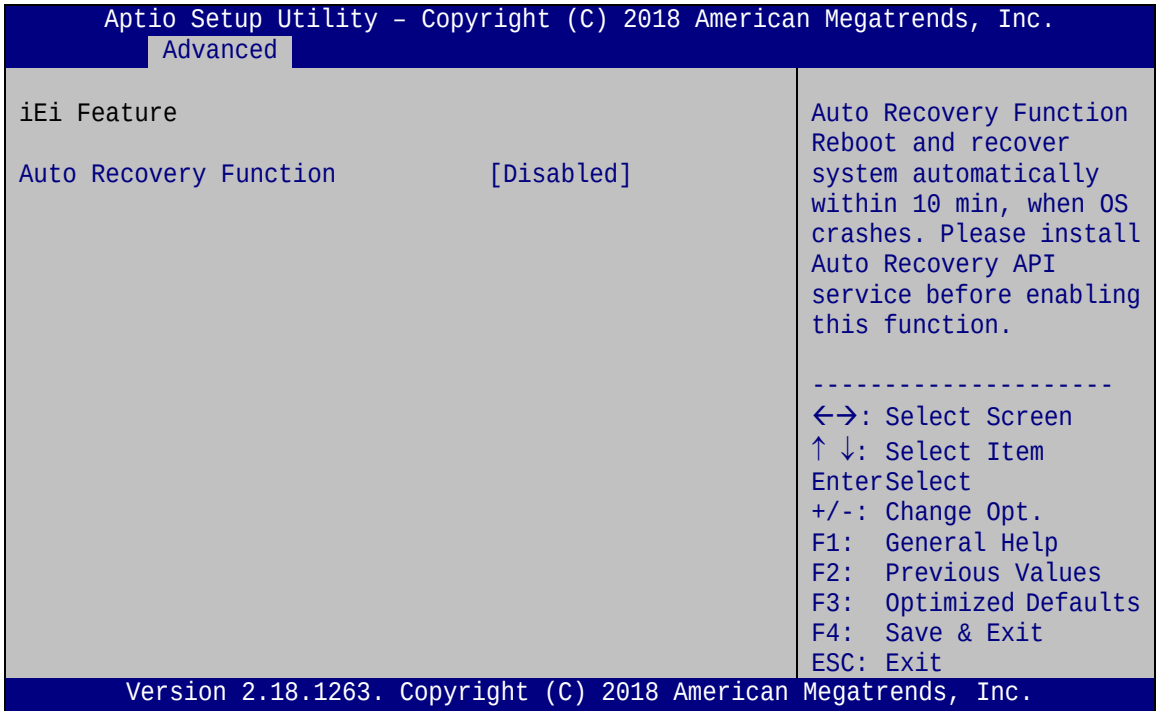
➔ **Enabled** **DEFAULT** Legacy USB support enabled

➔ **Disabled** Legacy USB support disabled

➔ **Auto** Legacy USB support disabled if no USB devices are connected

### 5.3.3 iEi Feature

Use the **iEi Feature** menu (**BIOS Menu 15**) to configure the iEi features.




**BIOS Menu 15: iEi Feature**

➔ **Auto Recovery Function [Disabled]**

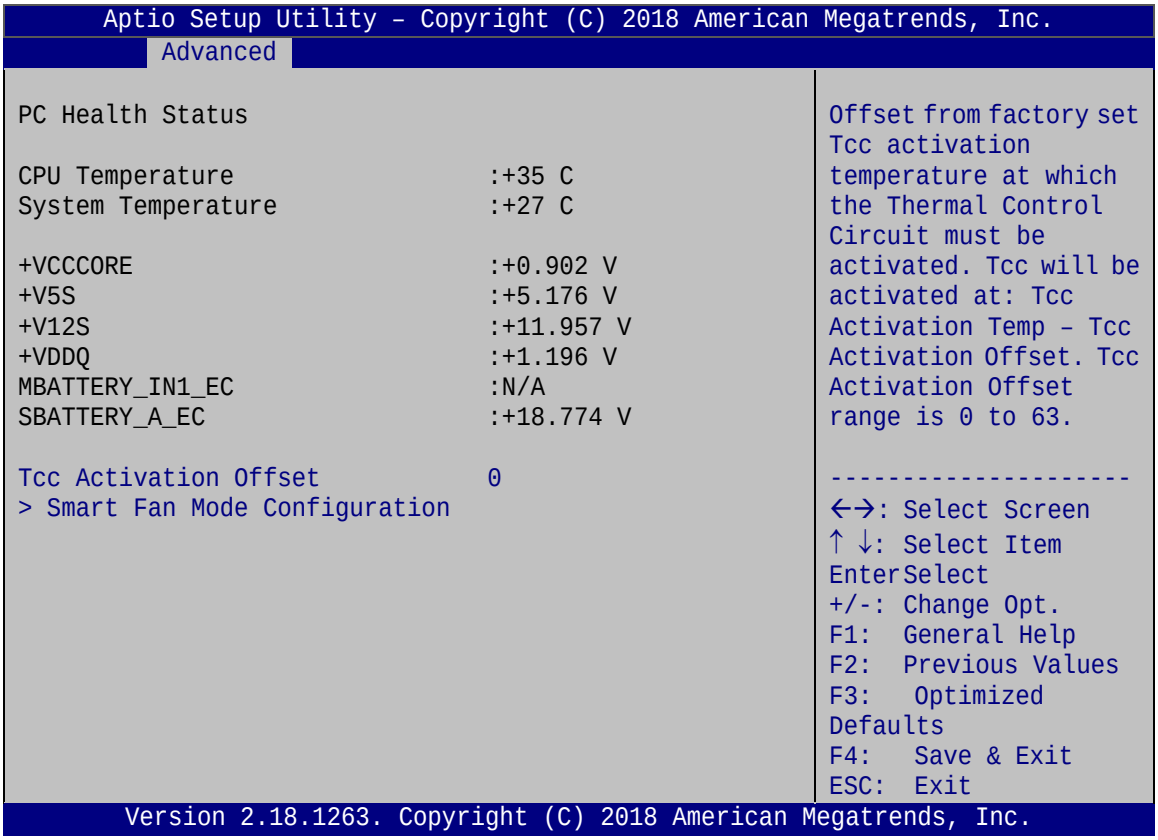
Use **Auto Recovery Function** option to enable or disable the auto recovery function.

➔ **Disabled** **DEFAULT** Disabled the auto recovery function

➔ **Enabled** Enabled the auto recovery function

### 5.3.4 iWDD H/W Monitor

The **iWDD H/W Monitor** menu (**BIOS Menu 16**) shows the operating temperature, fan speeds and system voltages.




**BIOS Menu 16: F81866 H/W Monitor**

➔ **PC Health Status**

The following system parameters and values are shown. The system parameters that are monitored are:

- System Temperatures:
  - CPU Temperature
  - System Temperature
- Voltages:
  - +VCCCORE
  - +V5S
  - +V12S

- +VDDQ
- MBATTERY_IN1_EC
- SBATTERY_A_EC

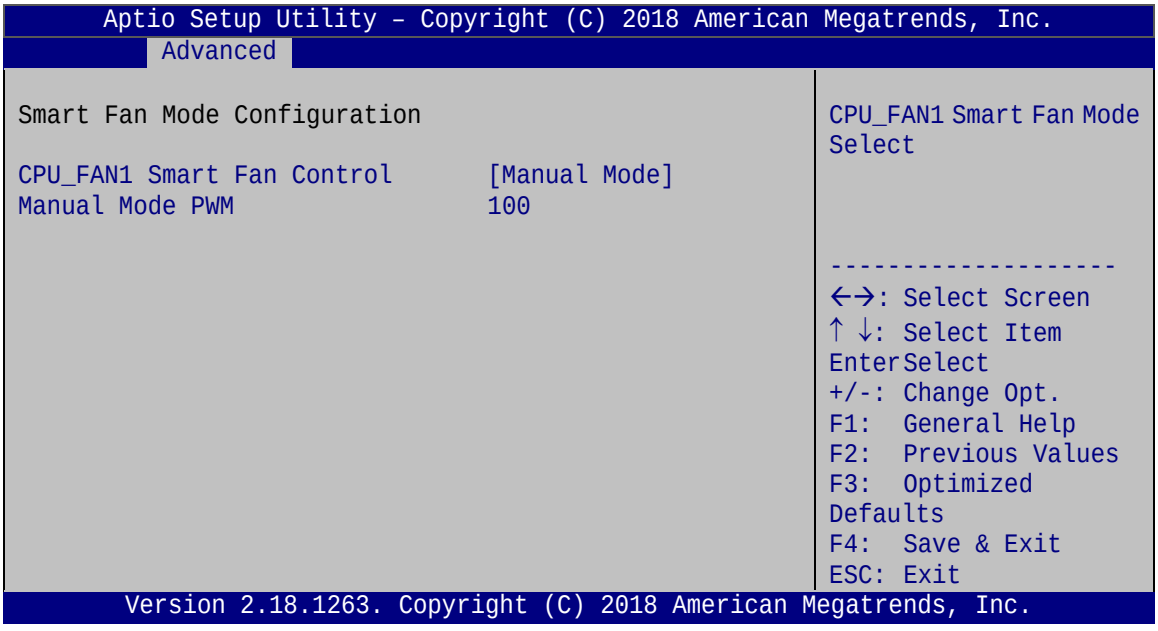
➔ **Tcc Activation Offset**

Use the **Tcc Activation Offset** option to change the **Tcc Activation Offset** value. If CPU Temperature reaches Tcc Activation Offset then reduces CPU Frequency.

- Minimum Value: 0°C
- Maximum Value: 63°C

### 5.3.4.1 Smart Fan Mode Configuration

Use the **Smart Fan Mode Configuration** submenu (**BIOS Menu 17**) to configure the smart fan temperature and speed settings.




**BIOS Menu 17: Smart Fan Mode Configuration**

➔ **Smart Fan control [Auto Mode]**

Use the **Smart Fan control** BIOS option to configure the CPU Smart Fan.

➔ **Auto Mode** **DEFAULT** The fan adjusts its speed using these settings:

CPU_FAN1 Start Temperature

CPU_FAN1 Off Temperature

CPU_FAN1 Start PWM

➔ **Manual Mode** The fan spins at the speed set in the manual setting

➔ **Manual Mode PWM**

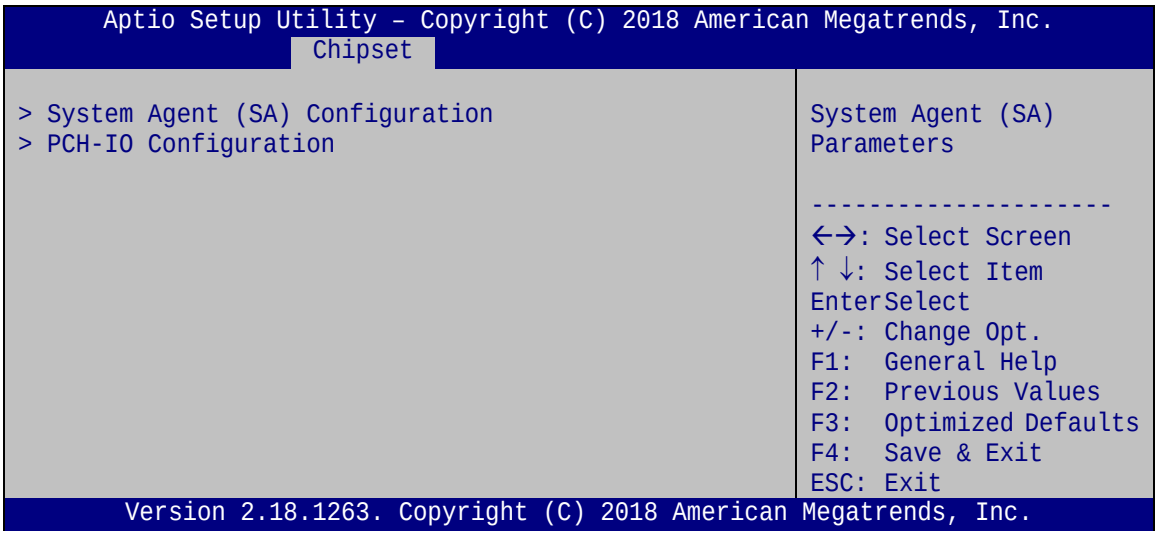
Use the + or – key to change the **Manual Mode PWM** value. Enter a decimal number between 1 and 100.

## 5.4 Chipset

Use the **Chipset** menu (**BIOS Menu 18**) to access the PCH-IO and System Agent (SA) configuration menus.

**WARNING!**

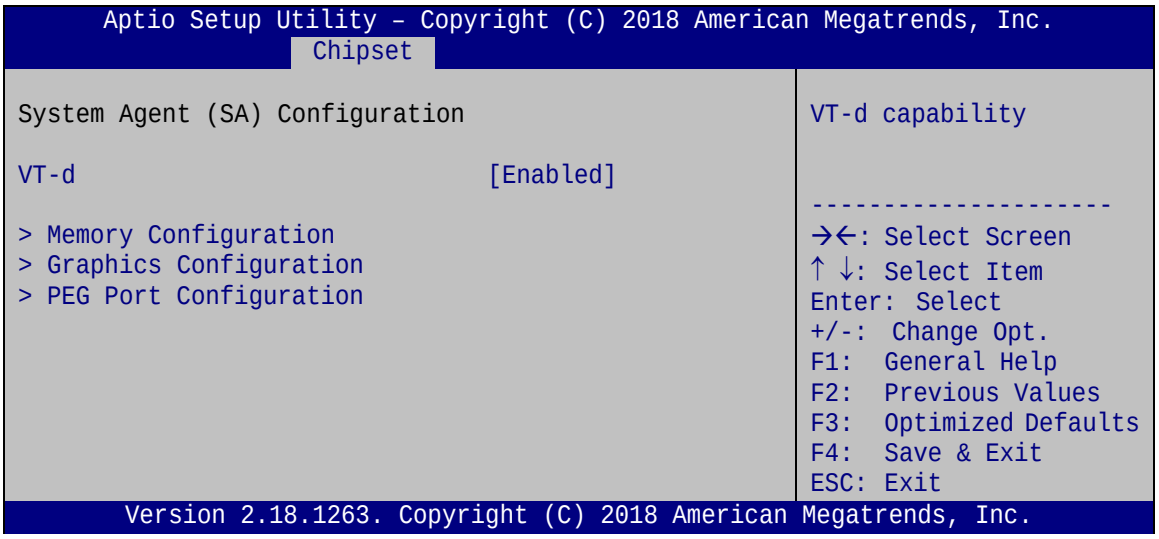
Setting the wrong values for the Chipset BIOS selections in the Chipset BIOS menu may cause the system to malfunction.




**BIOS Menu 18: Chipset**

### 5.4.1 System Agent (SA) Configuration

Use the **System Agent (SA) Configuration** menu (**BIOS Menu 19**) to configure the System Agent (SA) parameters.




**BIOS Menu 19: System Agent (SA) Configuration**

➔ **VT-d [Disabled]**

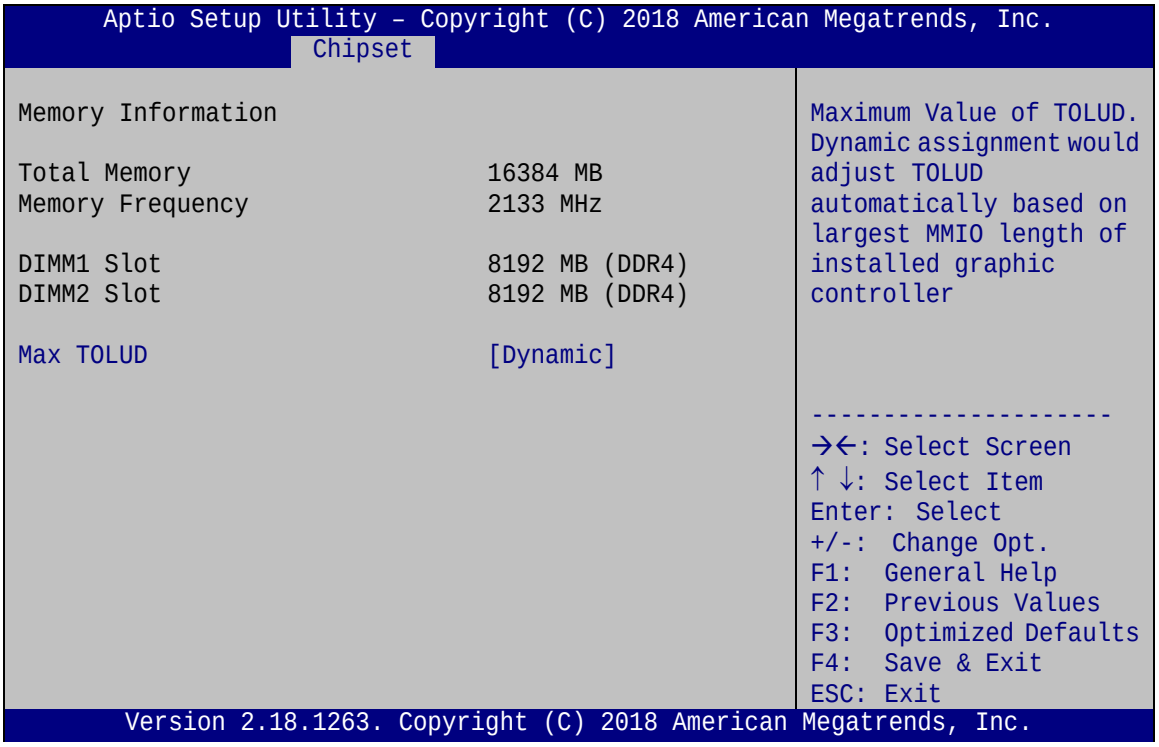
Use the **VT-d** option to enable or disable VT-d support.

➔ **Disabled** **DEFAULT** Disable VT-d support.

➔ **Enabled** Enable VT-d support.

### 5.4.1.1 Memory Configuration

Use the **Memory Configuration** submenu (**BIOS Menu 20**) to view memory information.




**BIOS Menu 20: Memory Configuration**

➔ **Max TOLUD [2.75 GB]**

Use the **Max TOULD** option to select the maximum value of TOLUD.. The following options are available:

- Dynamic **Default**
- 1 GB
- 1.25 GB
- 1.5 GB
- 1.75 GB
- 2 GB
- 2.25 GB
- 2.5 GB

- 2.75 GB
- 3 GB
- 3.25 GB
- 3.5 GB

### 5.4.1.2 Graphics Configuration

Use the **Graphics Configuration** (**BIOS Menu 21**) menu to configure the video device connected to the system.

```
Aptio Setup Utility – Copyright (C) 2018 American Megatrends, Inc.
                    Chipset

Graphics Configuration                          Select which of
Primary Display                  [Auto]         IGFX/PEG/PCI Graphics
Internal Graphics                [Enabled]      device should be Primary
DVMT Pre-Allocated               [256M]         Display Or select SG for
DVMT Total Gfx Mem               [MAX]          Switchable Gfx.

Primary IGFX Boot Display        [DP_HDMI]      ----------------------
                                                →←: Select Screen
                                                ↑ ↓: Select Item
                                                Enter:  Select
                                                +/-:  Change Opt.
                                                F1:   General Help
                                                F2:   Previous Values
                                                F3:   Optimized Defaults
                                                F4:   Save & Exit
                                                ESC:  Exit
Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

**BIOS Menu 21: Graphics Configuration**

➔ **Primary Display [Auto]**

Use the **Primary Display** option to select the primary graphics controller the system uses. The following options are available:

- Auto **Default**
- IGFX
- PEG
- PCI
- SG

➔ **Internal Graphics [Enabled]**

Use the **Internal Graphics** option to keep IGFX enabled or disabled based on the setup options.

- Auto
- Disabled
- Enabled **Default**

➔ **DVMT Pre-Allocated [256M]**

Use the **DVMT Pre-Allocated** option to set the amount of system memory allocated to the integrated graphics processor when the system boots. The system memory allocated can then only be used as graphics memory, and is no longer available to applications or the operating system. Configuration options are listed below:

- 32M
- 64M
- 128M
- 256M **Default**
- 512M

➔ **DVMT Total Gfx Mem [MAX]**

Use the **DVMT Total Gfx Mem** option to select DVMT5.0 total graphic memory size used by the internal graphic device. The following options are available:

- 256M
- 128M
- MAX **Default**

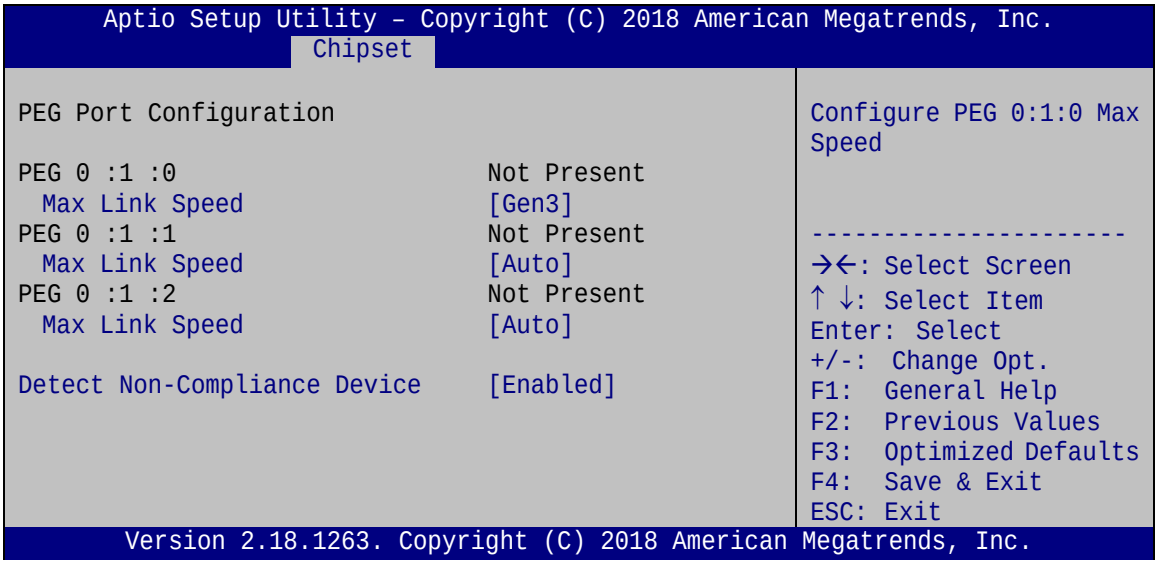
➔ **Primary IGFX Boot Display [DP_HDMI]**

Use the **Primary IGFX Boot Display** option to select the display device used by the system when it boots. Configuration options are listed below.

- VBIOS Default
- VGA
- DP_HDMI **DEFAULT**

- DP (Pin Header)

### 5.4.1.3 PEG Port Configuration




**BIOS Menu 22: NB PCIe Configuration**

➔ **PEG 0 :1 :0 Max Link Speed [Gen3]**

Use the **PEG 0 :1 :0 Max Link Speed** option to configure the PEG port max speed. The following options are available:

- Auto
- Gen1
- Gen2
- Gen3 **Default**

➔ **PEG 0 :1 :1 Max Link Speed [Auto]**

Use the **PEG 0 :1 :1 Max Link Speed** option to configure the PEG port max speed. The following options are available:

- Auto **Default**
- Gen1
- Gen2
- Gen3

➔ **PEG 0 :1 :2 Max Link Speed [Auto]**

Use the **PEG 0 :1 :2 Max Link Speed** option to configure the PEG port max speed. The following options are available:

- Auto **Default**
- Gen1
- Gen2
- Gen3

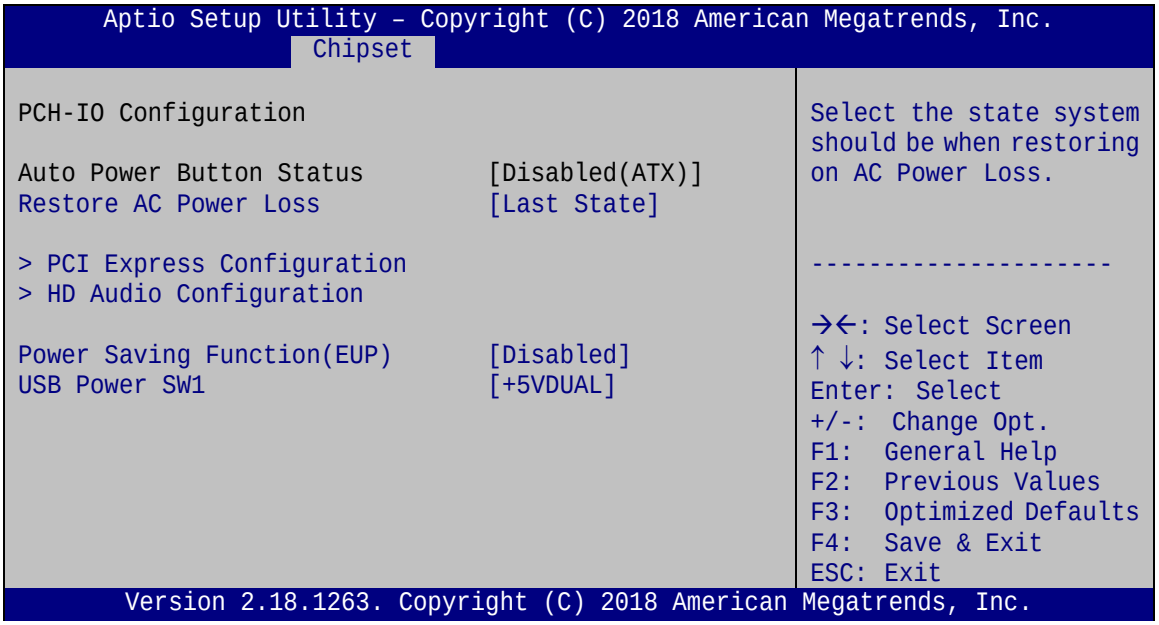
➔ **Detect Non-Compliance Device [Disabled]**

Use the **Detect Non-Compliance Device** option to enable or disable detecting a non-compliance PCI Express device in the PEG. The following options are available:

- Disabled **Default**
- Enabled

### 5.4.2 PCH-IO Configuration

Use the **PCH-IO Configuration** menu (**BIOS Menu 23**) to configure the PCH parameters.




**BIOS Menu 23: PCH-IO Configuration**

➔ **Restore AC Power Loss [Last State]**

Use the **Restore on AC Power Loss** option to specify what state the system returns to if there is a sudden loss of power to the system.

➔ **Power Off** The system remains turned off

➔ **Power On** The system turns on

➔ **Last State** **DEFAULT** The system returns to its previous state. If it was on, it turns itself on. If it was off, it remains off.

➔ **Power Saving Function (ERP) [Disabled]**

Use the **Power Saving Function (ERP)** BIOS option to enable or disable the power saving function.

➔ **Disabled** **DEFAULT** Power saving function is disabled.

➔ **Enabled** Power saving function is enabled. It will reduce power consumption when the system is off.

➔ **USB Power SW1 [+5V DUAL]**

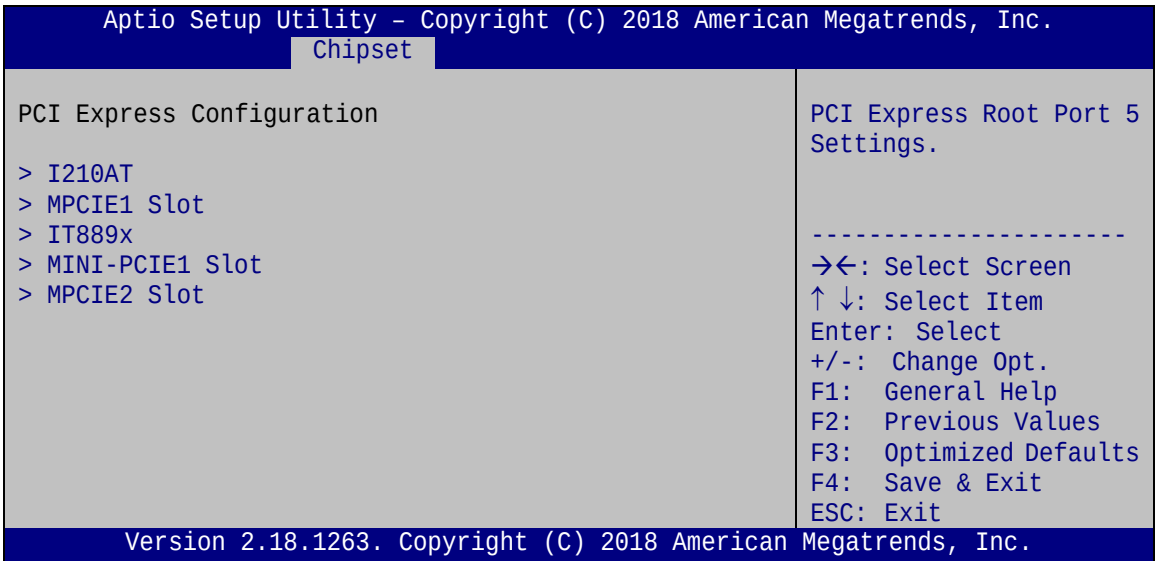
Use the **USB Power SW1** BIOS option to configure the USB power source for the corresponding USB connectors.

➔ **+5V** Sets the USB power source to +5V

➔ **+5VDUAL** **DEFAULT** Sets the USB power source to +5V dual

### 5.4.2.1 PCI Express Configuration

Use the **PCI Express Configuration** menu (**BIOS Menu 24**) to select the support type of the PCIe Mini slot.




**BIOS Menu 24: PCI Express Configuration**

The **I210AT**, **MPCIE1 Slot**, **IT889x**, **MINI-PCIE1 Slot** and **MPCIE2 Slot** submenus all contain the following options:

➔ **PCI Express Root Port n [Enabled]**

Use the **PCI Express Root Port n** option to enable or disable the PCI Express (PEG) controller. The following options are available:

- Disabled
- Enabled **Default**

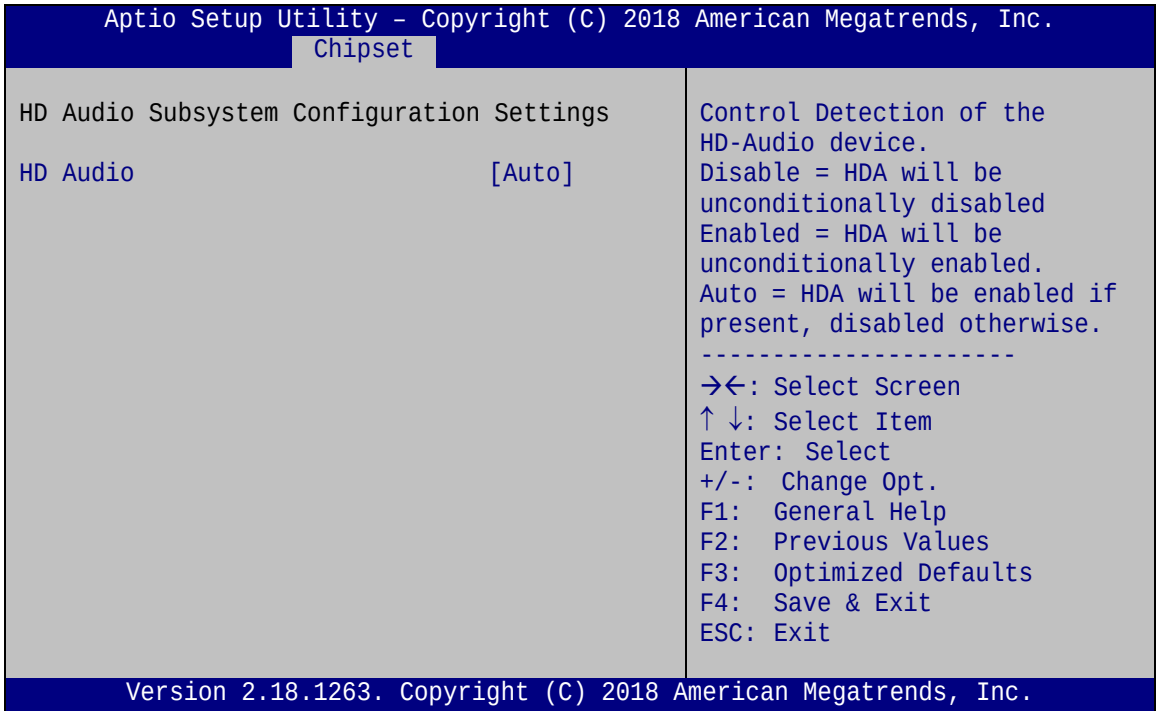
➔ **PCIe Speed**

Use PCIe Speed option to select the speed type of the PCIe Mini slot. The following options are available:

- Auto **Default**
- Gen1
- Gen2
- Gen3

### 5.4.2.2 HD Audio Configuration

Use the **HD Audio Configuration** menu (**BIOS Menu 27**) to configure the HD Audio settings.




**BIOS Menu 25: PCH Azalia Configuration**

➔ **HD Audio [Auto]**

Use the **HD Audio** option to enable or disable the High Definition Audio controller.

- ➔ **Disabled** The onboard High Definition Audio controller is disabled
- ➔ **Enabled** The onboard High Definition Audio controller is enabled
- ➔ **Auto** **DEFAULT** The onboard High Definition Audio controller automatically detected and enabled

## 5.5 Security

Use the **Security** menu (**BIOS Menu 25**) to set system and user passwords.

```
Aptio Setup Utility – Copyright (C) 2018 American Megatrends, Inc.
                                  Security

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         ←→: Select Screen
is a power on password and must be entered to         ↑ ↓: Select Item
boot or enter Setup. In Setup the User will           EnterSelect
have Administrator rights.                            +/-: Change Opt.
The password length must be:                          F1:  General Help
Minimum length                  3                     F2:  Previous Values
Maximum length                  20                    F3:  Optimized Defaults
                                                      F4:  Save & Exit
Administrator Password                                ESC: Exit
User Password

Version 2.18.1263. Copyright (C) 2018 American Megatrends, Inc.
```

**BIOS Menu 26: Security**

➔ **Administrator Password**

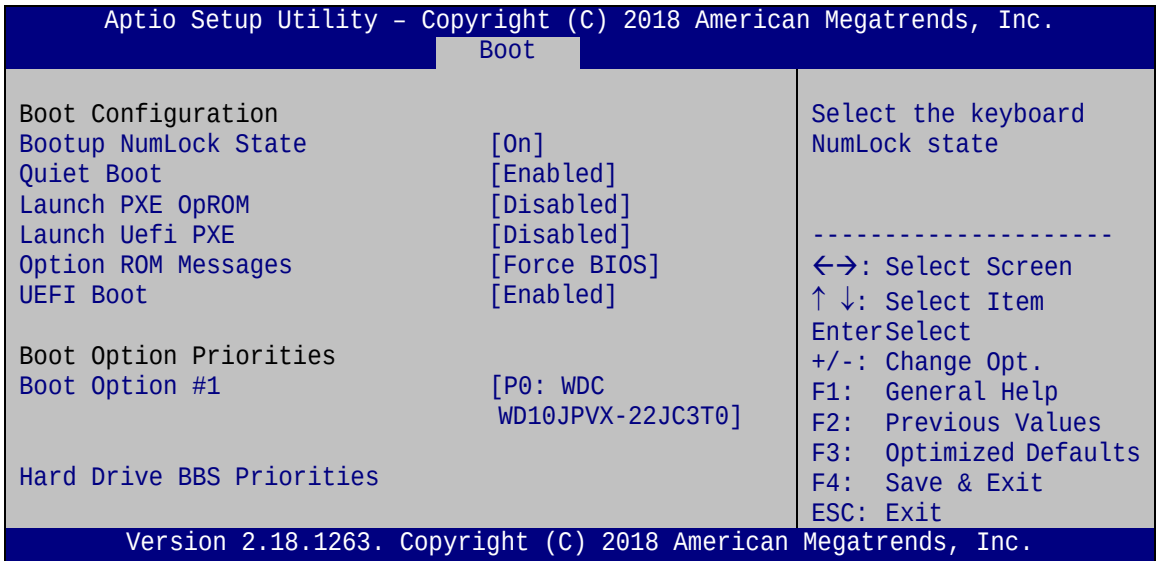
Use the **Administrator Password** to set or change an administrator password.

➔ **User Password**

Use the **User Password** to set or change a user password.

## 5.6 Boot

Use the **Boot** menu (**BIOS Menu 26**) to configure system boot options.




**BIOS Menu 27: Boot**

➔ **Bootup NumLock State [On]**

Use the **Bootup NumLock State** BIOS option to specify if the number lock setting must be modified during boot up.

➔ **On** **DEFAULT** Allows the Number Lock on the keyboard to be enabled automatically when the computer system boots up. This allows the immediate use of the 10-key numeric keypad located on the right side of the keyboard. To confirm this, the Number Lock LED light on the keyboard is lit.

➔ **Off** Does not enable the keyboard Number Lock automatically. To use the 10-keys on the keyboard, press the Number Lock key located on the upper left-hand corner of the 10-key pad. The Number Lock LED on the keyboard lights up when the Number Lock is engaged.

➔ **Quiet Boot [Enabled]**

Use the **Quiet Boot** BIOS option to select the screen display when the system boots.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | | Normal POST messages displayed |
| ➔ | **Enabled** | **DEFAULT** | OEM Logo displayed instead of POST messages |

➔ **Launch PXE OpROM [Disabled]**

Use the **Launch PXE OpROM** option to enable or disable boot option for legacy network devices.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | **DEFAULT** | Ignore all PXE Option ROMs |
| ➔ | **Enabled** | | Load PXE Option ROMs. |

➔ **Launch Uefi PXE [Disabled]**

Use the **Launch Uefi PXE** option to enable or disable UEFI network stack.

| | | | |
|---|---|---|---|
| ➔ | **Disabled** | **DEFAULT** | Disable UEFI network stack. |
| ➔ | **Enabled** | | Enable UEFI network stack. |

➔ **Option ROM Messages [Force BIOS]**

Use the **Option ROM Messages** option to set the Option ROM display mode.

| | | | |
|---|---|---|---|
| ➔ | **Force BIOS** | **DEFAULT** | Sets display mode to force BIOS. |
| ➔ | **Keep Current** | | Sets display mode to current. |

➔ **UEFI Boot [Enabled]**

Use the **UEFI Boot** option to enable or disable to boot from the UEFI devices.

| | | | |
|---|---|---|---|
| ➔ | **Enabled** | **DEFAULT** | Boot from UEFI devices is enabled. |

➔ **Disabled** Boot from UEFI devices is disabled.

➔ **Boot Option Priority**

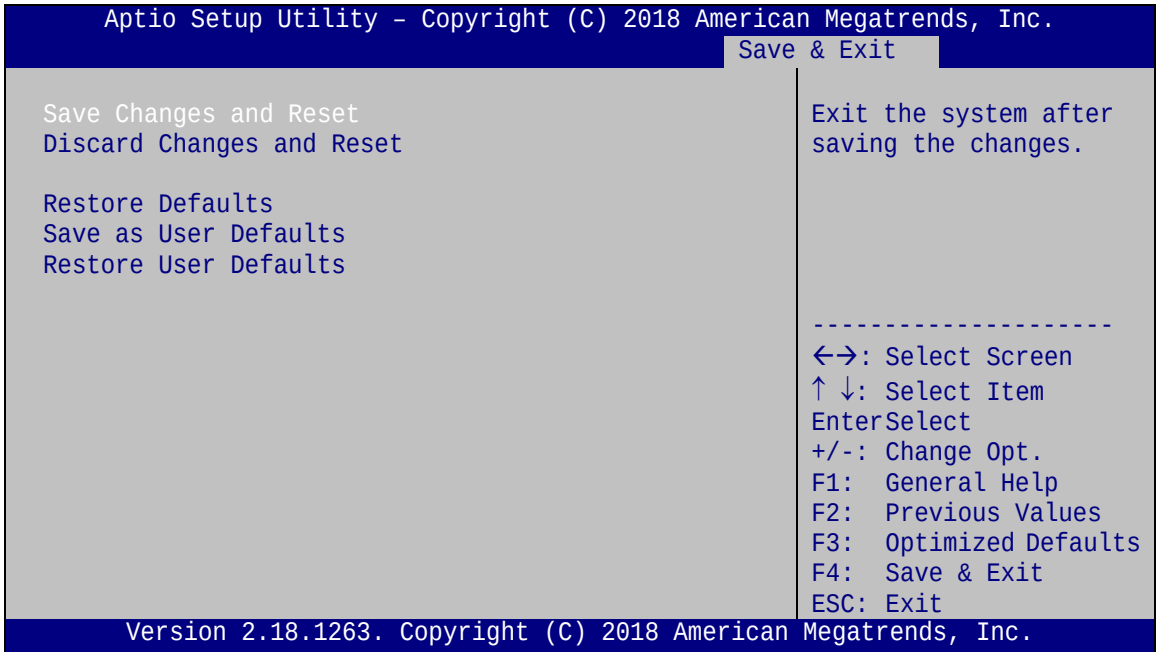
Use the **Boot Option Priority** function to set the system boot sequence from the available devices. The drive sequence also depends on the boot sequence in the individual device section.

➔ **Hard Drive BBS Priorities**

Use the **Hard Drive BBS Priorities** option to set the order of the legacy devices in this group.

## 5.7 Save & Exit

Use the **Save & Exit** menu (**BIOS Menu 27**) to load default BIOS values, optimal failsafe values and to save configuration changes.




**BIOS Menu 28:Exit**

➔ **Save Changes and Reset**

Use the **Save Changes and Reset** option to save the changes made to the BIOS options and reset the system.

➔ **Discard Changes and Reset**

Use the **Discard Changes and Reset** option to exit the system without saving the changes made to the BIOS configuration setup program.

➔ **Restore Defaults**

Use the **Restore Defaults** option to load the optimal default values for each of the parameters on the Setup menus. **F3 key can be used for this operation.**

➔ **Save as User Defaults**

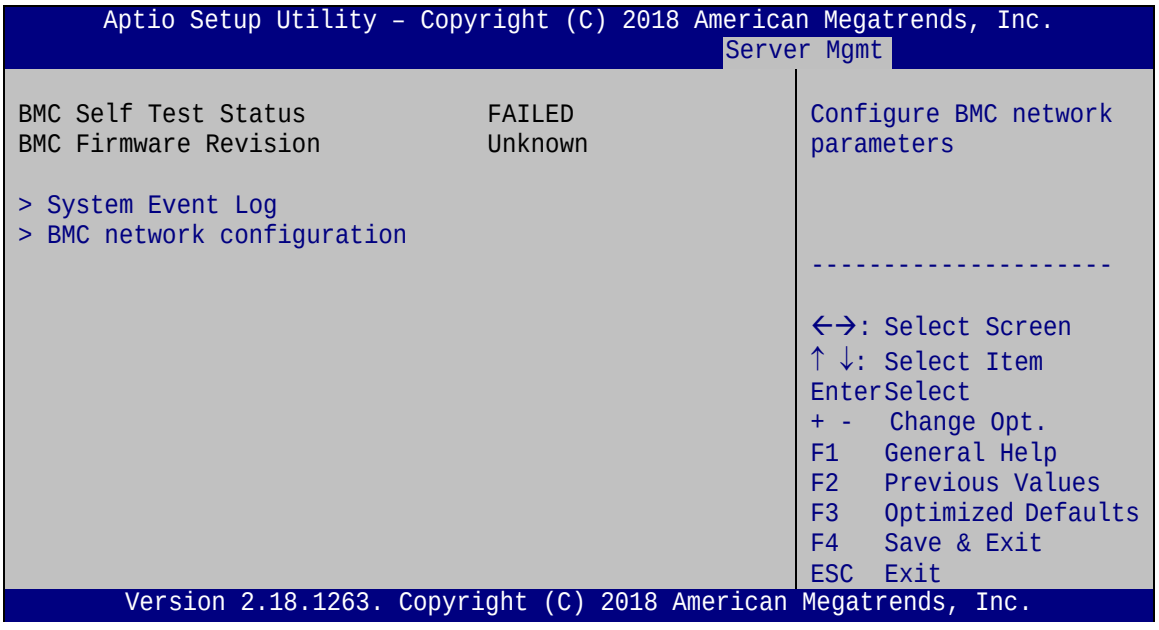
Use the **Save as User Defaults** option to save the changes done so far as user defaults.

➔ **Restore User Defaults**

Use the **Restore User Defaults** option to restore the user defaults to all the setup options.

## 5.8 Server Mgmt

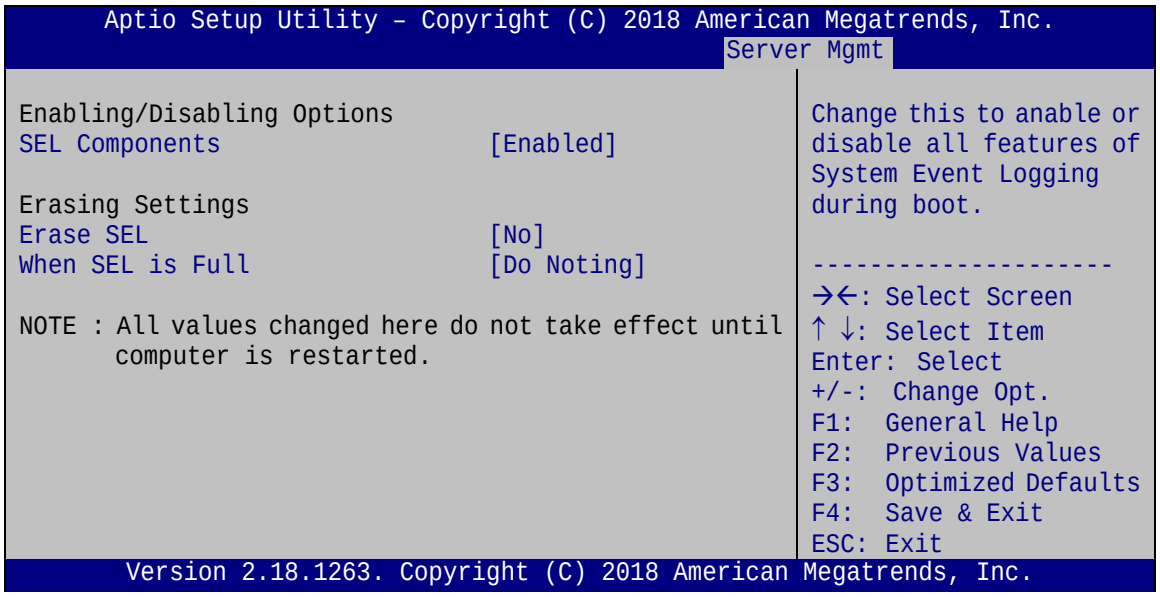
Use the **Server Mgmt** menu (BIOS Menu 28) to access the server management menus.




**BIOS Menu 29: Server Mgmt**

### 5.8.1 System Event Log

Use the **System Event Log** menu (BIOS Menu 29) to configure the event log.




**BIOS Menu 30: System Event Log**

➔ **SEL Components [Enabled]**

Use the **SEL Components** option to enable or disable all features of system event logging during boot.

➔ **Disabled** Disables all features of system event logging during boot.

➔ **Enabled** **DEFAULT** Enables all features of system event logging during boot.

➔ **Erase SEL [No]**

Use **Erase SEL** option to select options for erasing SEL. The following options are available:

- No **Default**
- Yes, On next reset
- Yes, On every reset

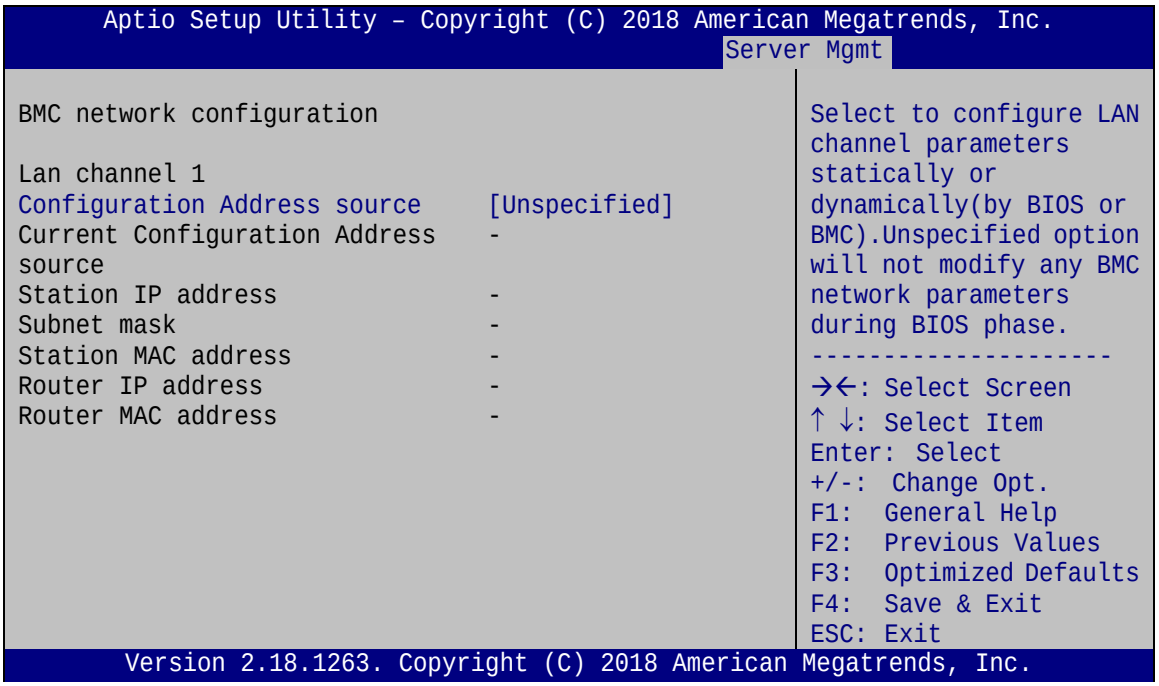
➔ **When SEL is Full [Do Nothing]**

Use **When SEL is FULL** option to select options for reactions to a full SEL. The following options are available:

- Do Nothing **Default**
- Erase Immediately

### 5.8.2 BMC network configuration

Use the **BMC network configuration** menu (BIOS Menu 30) to configure BMC network parameters.




**BIOS Menu 31: PCH Azalia Configuration Menu**

➔ **Configuration Address source [Unspecified]**

Use **Configuration Address source** option to configure LAN channel parameters. The following options are available:

- Unspecified **Default**
- Static
- DynamicBmcDhcp
- DynamicBmcNonDhcp

Chapter

6

# Mustang-F100-A10 AI Acceleration Card

## 6.1 Mustang-F100-A10 Introduction

The Mustang-F100-A10 is a deep learning convolutional neural network acceleration card for speeding up AI inference, in a flexible and scalable way. Equipped with Intel® Arria® 10 FPGA, 8 GB DDR4 on board RAM, the Mustang-F100-A10 PCIe card can be used to enable high-performance computing without costing a fortune.

"Open Visual Inference & Neural Network Optimization (OpenVINO™) toolkit" is based on convolutional neural networks (CNN), the toolkit extends workloads across Intel® hardware and maximizes performance. It can optimize pre-trained deep learning model such as Caffe, MXNET, Tensorflow into IR binary file then execute the inference engine across Intel®-hardware heterogeneously such as CPU, GPU, Intel® Movidius™ Neural Compute Stick, and FPGA.

### 6.1.1 Mustang-F100 Block Diagram

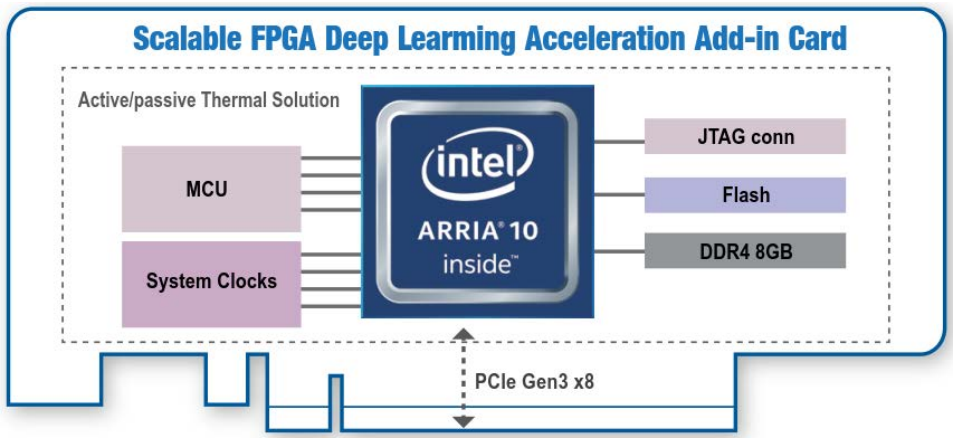



**Figure 6-1: Mustang-F100-A10 Block Diagram**

### 6.1.2 Mustang-F100 I/O and Dimensions

The I/O interfaces and dimensions of the Mustang-F100-A10 are listed below:

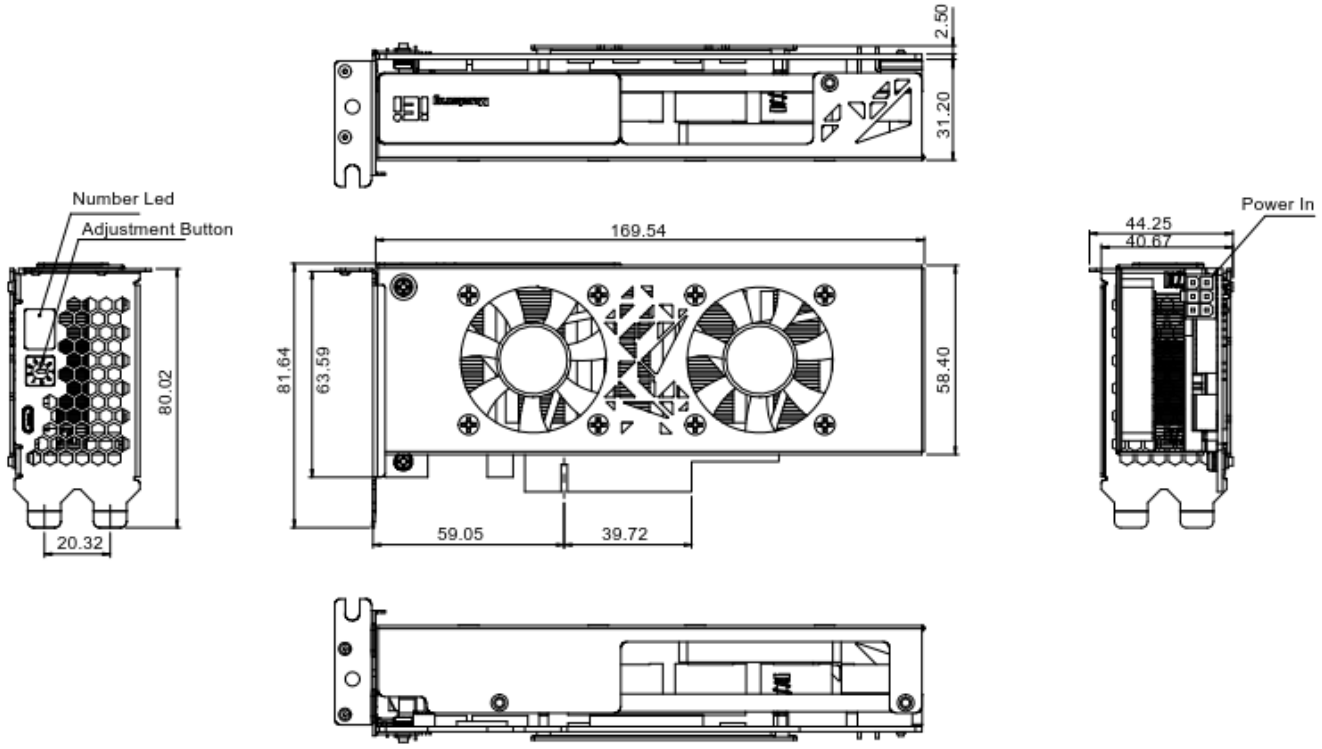



**Figure 6-2: Mustang-F100-A10 Dimensions (mm)**

### 6.1.3 Mustang-F100 Technical Specifications

Mustang-F100-A10 technical specifications are listed below.

| Specification | Mustang-F100-A10 |
|---|---|
| **Operating Systems** | Ubuntu 16.04.3 LTS 64-bit, CentOS 7.4 64-bit (support Windows® 10 in the end of 2018 & more OS are coming soon) |
| **Memory** | 8G on board DDR4 |
| **Mini USB Ports** | USB 2.0 mini port for debugging |
| **Physical PCIe Interface** | PCI Express x8<br>Compliant with PCI Express Specification V3.0 |
| **External Power Connector** | *Preserved PCIe 6-pin 12V external power |
| **Indicator** | 7-segment LED display for card ID |
| **Fan** | Dual fan |
| **Power Consumption** | <60 W, 12 V @ 5 A |
| **Operating Temperature** | 5°C ~ 60°C |
| **Operating Humidity** | 5% ~ 90% |
| **Dimensions (WxHxD)** | 169.5 mm x 68.7 mm x 33.7 mm |

*Standard PCIe slot provides 75W power; this feature is preserved for user in case of different system configuration

## 6.2 Mustang-F100 Hardware Installation

To install the Mustang-F100-A10, please follow the steps below.

**Step 1:** **Prepare the computer.** Turn off the computer, and remove the power cord from the rear of the power supply.

**WARNING:**

Disconnect the computer from the power supply and from any networks to which you will install the Mustang-F100-A10, or you risk damaging the system or experiencing electrical shock.

**Step 2:** **Remove the cover from the chassis.**

**Step 3:** **Locate available PCIe slots and remove the blank brackets.** The Mustang-F100-A10 is compatible with PCIe x8 and x16 slots, and needs two side-by-side PCIe slots for installation. Remove two blank bracket panels on the back of the computer that align with the PCIe slot (right side in **Figure 3-1**) for installing the Mustang-F100-A10. Save the bracket screws.

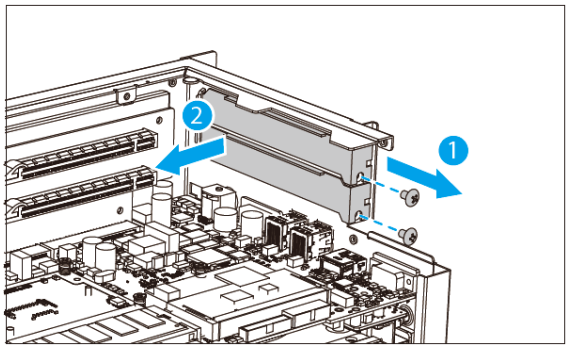



**Figure 3-3: Remove Two Blank Brackets**

**Step 4:** **[Only needed for full-height installation] Change the bracket on the Mustang-F100-A10** from low-profile bracket to full-height bracket.

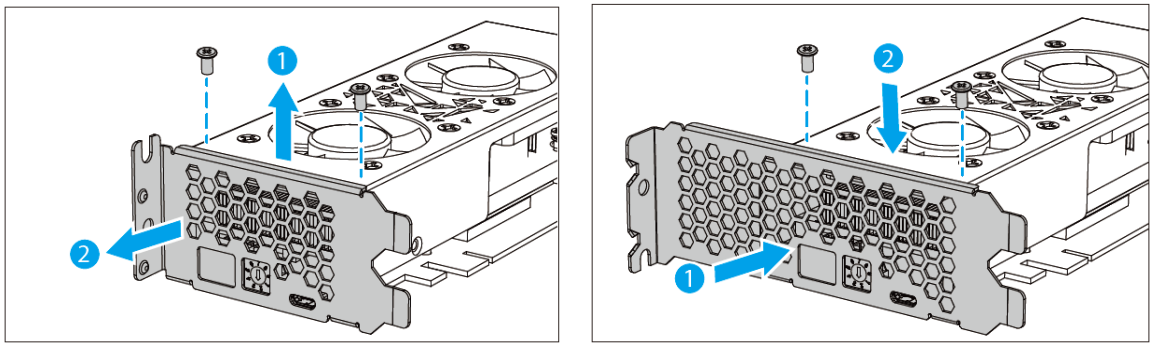



**Figure 3-4: Change to Full-height Bracket**

**Step 5:** **Install and secure the Mustang-F100-A10 to the system.** Align the Mustang-F100-A10 to the PCIe slot. Press down gently, but firmly, to seat the Mustang-F100-A10 correctly in the slot. Install two bracket screws to secure the Mustang-F100-A10 to the system's chassis.

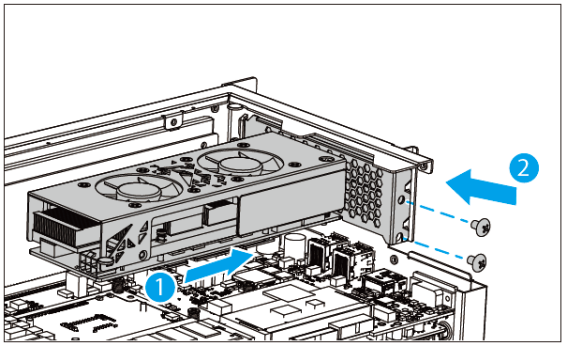



**Figure 3-5: Change to Full-height Bracket**

**Step 6:** **Connect a power cable to the Mustang-F100-A10.** The Mustang-F100-A10 requires 12V 5A DC power. Use a power cable with 6-pin connector from the system, if applicable, or add the 4-pin to 6-pin PCIe power adapter to connect to the power connector of the Mustang-F100-A10.

**NOTE:** For TANK-870AI, you don't need to connect the power cable.

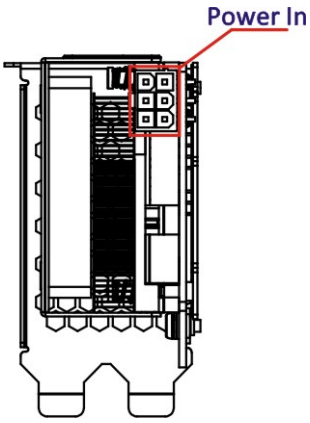



**Figure 3-6: Power Connector Location**

**Step 7:** **Assign a card ID to the Mustang-F100-A10** by adjusting the rotary switch. The card ID number assigned here will be shown on the LED display of the card after power-up.

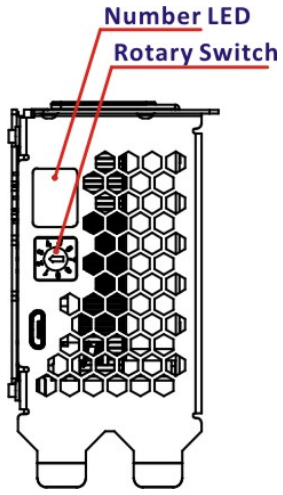



**Figure 3-7: Assign a Card ID**

**Step 8:** **Repeat Step 3 ~ Step 7 to install multiple Mustang-F100-A10 into the system** if available.

**Step 9:** **Replace the cover of the chassis**.

**Step 10:** **Reconnect any power cords and any network cables to the system.** Power up the system.

# 6.3 OpenVINO™ Toolkit Software Installation

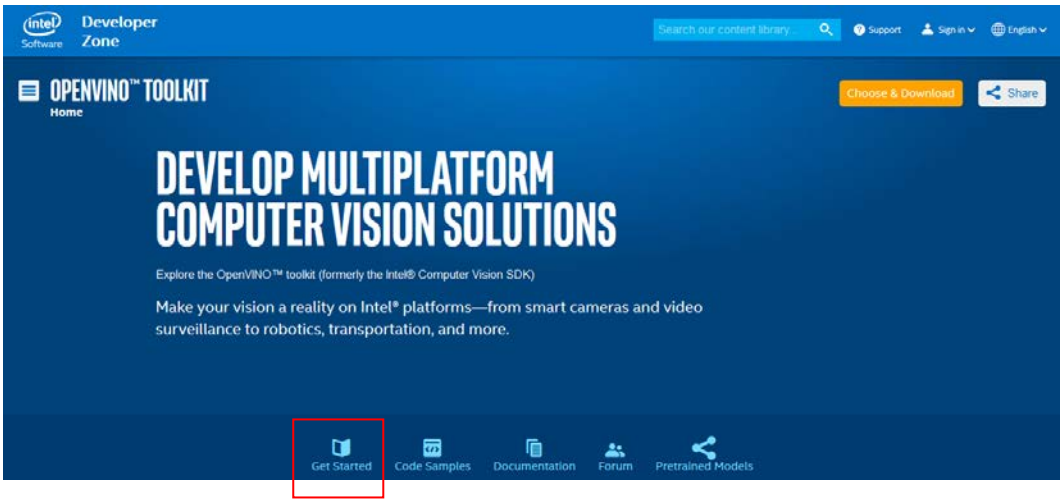
## 6.3.1 System Requirements

- Linux Ubuntu 16.04.3 LTS 64bit
- CentOS 7.4 64bit
- Windows 10 64bit (coming soon)
- OpenVINO™ Toolkit was pre-installed in TANK-870AI.

## 6.3.2 Installation

### 6.3.2.1 Installation via Website.

Go to https://software.intel.com/en-us/openvino-toolkit. Click “Get Started” then choose your configuration from “Development Environment Installation Guides & Videos”. Follow the instruction to complete the installation procedure.



#### 6.3.2.2 Installation - Step by Step

If you have not done so already, download the OpenVINO toolkit R3 release. Be sure to download the Linux version that includes FPGA support.

**NOTE:** Before beginning the installation, make sure you have the correct Linux kernel version:

```
cat /proc/version
```

If you have the correct kernel version, your output looks like this:

```
Linux version 4.13.0-45-generic (buildd@lgw01-amd64-011)(gcc
version 5.4.0 2016 0609 (Ubuntu 5.4.0-6ubuntu1~16.04.9))
#50~16.04.1-Ubuntu SMP Wed May 30 11:18:27 UTC 2018
```

To revert from kernel version 4.15 to 4.13:

1. Run two commands:

```
sudo apt-get install linux-image-4.13.0-45-generic

sudo apt-get install linux-headers-4.13.0-45-generic
```

2. Edit a line in /etc/default/grub

```
GRUB_DEFAULT=”Advanced options for Ubuntu>Ubuntu, with Linux
4.13.0-45-generic”
```

3. Execute the command:

```
update-grub
```

#### 6.3.2.2.1 Install the External Software Dependencies

1. Go to the directory to which you downloaded the OpenVINO toolkit.

   The default directory is `~/Downloads`

   The default filename is `l_openvino_toolkit_fpga_p_<version>.tgz.`

   If you used a different directory or renamed the file, change the following instructions according to your naming conventions.

   ```
   cd ~/Downloads
   ```

2. Unpack the `.tgz` file:

   ```
   tar -xf l_openvino_toolkit_fpga_p_<version>.tgz
   ```

   A directory named l_openvino_toolkit_fpga_p_<version> is created.

3. Go to the l_openvino_toolkit_fpga_p_<version> directory:

   ```
   cd l_openvino_toolkit_fpga_p_<version>
   ```

4. Run a script named install_cv_sdk_dependencies.sh

   ```
   ./install_cv_sdk_dependencies.sh
   ```

   This script downloads and installs the external software dependencies.

   Continue with the next section to install the OpenVINO™ core components.

#### 6.3.2.2.2 Install the OpenVINO™ Core Components

OpenVINO™ installs in one of two locations, depending on how you install it:

- If you install as the root user, the software will install to `/opt/intel/computer_vision_sdk_fpga_<VERSION>/`
- If you install as the the software will install to: `/home/<USERNAME>/intel/computer_vision_sdk_fpga_<VERSION>/`

1. Choose between installing with or without a GUI. Only the visual aspects are different between these options. Choose ONE option:
   - If you want to use a GUI installation wizard to prompt you for input:

     ```
     ./install_GUI.sh
     ```

   - If you want to use command-line instructions to prompt you for input:

     ```
     ./install.sh
     ```

2. Follow the instructions on your screen.
   The base installation is complete. Continue to the next section to set the environment variables.

#### 6.3.2.2.3 Set the Environment Variables

Run a script to set the environment variables that are required to run the OpenVINO™ toolkit for this session:

```
source /opt/intel/computer_vision_sdk_2018.3.<version>/bin/setupvars.sh
```

**NOTE:** The OpenVINO™ environment variables are removed when you close the shell. As an option, use your preferred method to permanently set the variables.

Continue to the next section to initialize the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA.

#### 6.3.2.2.4 Initialize the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA

You must initialize the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA for the Intel® FPGA RTE for OpenCL™. This is required before you can use the Intel® FPGA plugin for the Inference Engine. Improper board initialization might damage the accelerator board.

1. Download and install the Intel® Quartus® Prime Pro Edition *Programmer,* version 17.1.1. Do not install the Intel Quartus Prime Pro Edition version 17.1.1. The correct file is enclosed in a red box in the following figure.

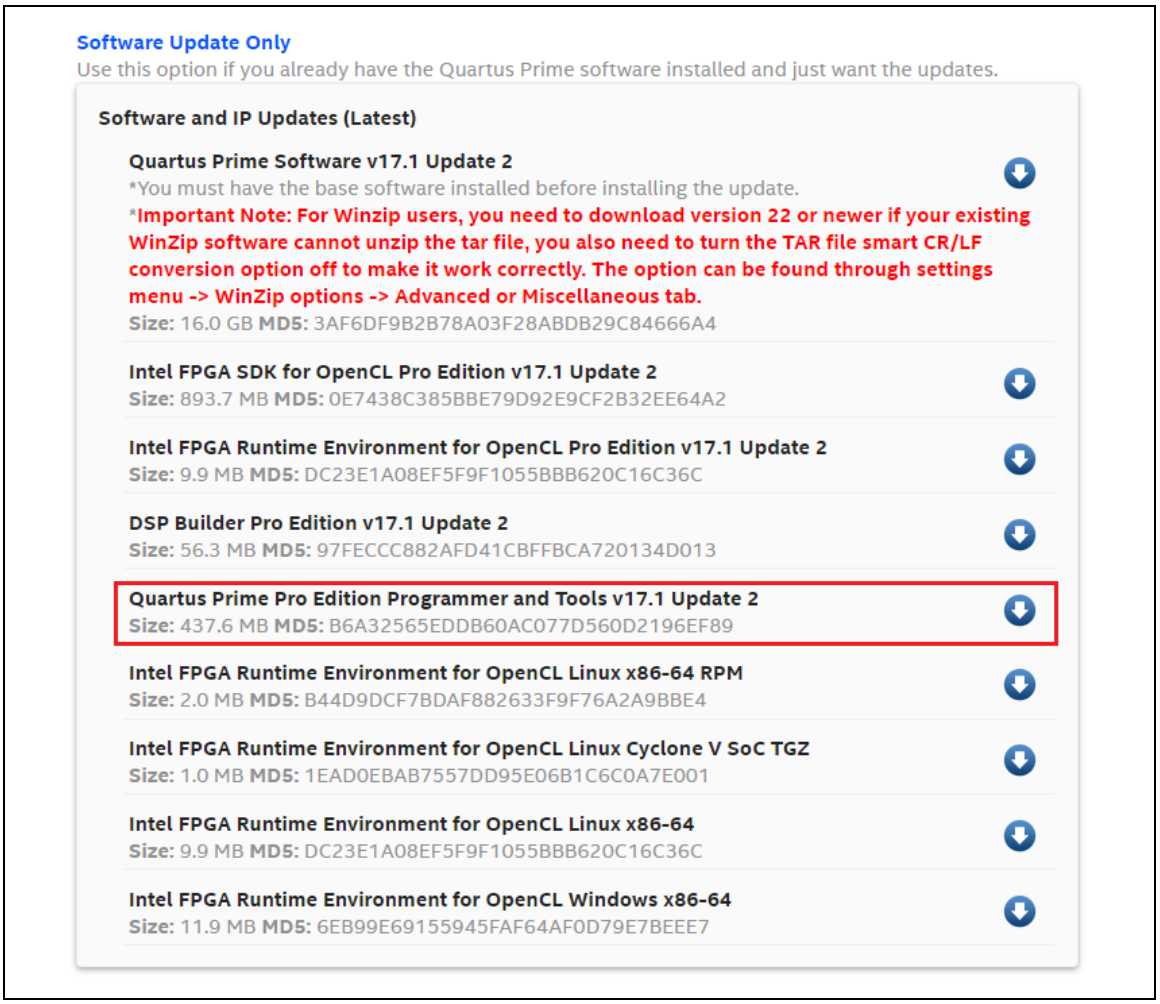



**Figure 6-8: Intel Software Downloads**

2. Add Intel® Quartus® Prime Pro Programmer to your environment variables:
   `export PATH=/opt/intelFPGA_pro/17.1/qprogrammer/bin:$PATH`

### 6.3.2.2.5 Install the Intel OpenCL Runtime Environment

The version of the OpenVINO® toolkit that you installed includes the Intel FPGA RTE for OpenCL Pro Edition software version.

1. Extract the bsp package:
   `tar -xvf hddlf_1150_sg1.tgz`

2. Convert the BSP files from DOS to UNIX:
   `find hddlf_1150_sg1 -type f -print0 | xargs -0 dos2unix`

3. Set the AOCL_BOARD_PACKAGE_ROOT environment variable with the command:
   `export AOCL_BOARD_PACKAGE_ROOT=$HOME/hddlf_1150_sg1`

4. Run a script to temporarily set the Intel OpenCL runtime environment variables:
   `source /opt/altera/aocl-pro-rte/aclrte-linux64/init_opencl.sh`

5. Install the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA drivers:
   `aocl install`

#### 6.3.2.2.6 Verify Your Configuration

1. After configuring the board, run the AOCL diagnose command from a command line prompt on the machine that is connected to Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA.
   `aocl diagnose`

2. If the configuration is successful, the command returns a output similar to:

```
Device Name:
acl0

BSP Install Location:
$HOME/hddlf_1150_sg1

Vendor: Intel(R) Corporation

Phys Dev Name Status Information

aclhddlf_1150_sg10Passed  Arria 10 Pyramid Lake Platform
(aclhddlf_1150_sg10)
PCIe dev_id = 2494, bus:slot.func = 01:00.00, Gen3 x8
FPGA temperature = 46.4297 degrees C.

DIAGNOSTIC_PASSED
---------------------------------------------------------

Call "aocl diagnose <device-names>" to run diagnose for specified
devices
Call "aocl diagnose all" to run diagnose for all devices
```

   `boardtest_1ddr_top.aocx` is programmed in the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA flash.

3. View the PCIe device on your system:
   `lspci | grep -i Altera`
4. Success is indicated by a response similar to:

```
01:00.0 Processing accelerators: Altera Corporation Device 2494
(rev 01)
```

#### 6.3.2.2.7 Intel® DLIA Bitstreams

You must set up the Intel Vision Acceleration Design with Intel Arria 10 FPGA before you program the bitstreams. Make sure that the board and environment are properly configured and set up before you program the bitstream.

Pre-compiled bitstream samples for Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA are available with the OpenVINO™ toolkit that you installed.

The table below lists all bitstreams available, with the associated supported topologies.

| Bitstream | Topology |
|---|---|
| **FP11** | |
| 2-0-1_PL1_FP11_Generic.aocx | AlexNet |
| | GoogleNet |
| | SqueezeNet |
| | VGG16 |
| | ResNet-18 |
| | ResNet-50 |
| | ResNet-101 |
| 2-0-1_PL1_FP11_Alexnet.aocx | Optimized for AlexNet |
| 2-0-1_PL1_FP11_GoogleNet.aocx | Optimized for GoogleNet |
| 2-0-1_PL1_FP11_GoogleNet_LB.aocx | Optimized for GoogleNet |
| 2-0-1_PL1_FP11_GoogleNet_HB.aocx | Optimized for GoogleNet |
| 2-0-1_PL1_FP11_SqueezeNet.aocx | Optimized for SqueezeNet |
| 2-0-1_PL1_FP11_VGG.aocx | Optimized for VGG16 |
| 2-0-1_PL1_FP11_ResNet.aocx | Optimized for ResNet |
| 2-0-1_PL1_FP11_ResNet_LReLU.aocx | Optimized for ResNet |
| 2-0-1_PL1_FP11_SSD300.aocx | Optimized for SSD300 |
| **FP16** | |
| 2-0-1_PL1_FP16_Generic.aocx | AlexNet |
| | GoogleNet |
| | SqueezeNet |
| | VGG16 |
| | ResNet-18 |

| Bitstream | Topology |
|---|---|
| | ResNet-50 |
| | ResNet-101 |
| 2-0-1_PL1_FP16_Alexnet.aocx | Optimized for AlexNet |
| 2-0-1_PL1_FP16_GoogleNet.aocx | Optimized for GoogleNet |
| 2-0-1_PL1_FP16_SqueezeNet.aocx | Optimized for SqueezeNet |
| 2-0-1_PL1_FP16_VGG.aocx | Optimized for VGG16 |
| 2-0-1_PL1_FP16_ResNet.aocx | Optimized for ResNet |
| 2-0-1_PL1_FP16_SSD300.aocx | Optimized for SSD300 |

**Table 6-1:: Bitstream with Topology**

#### 6.3.2.2.8 Program the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA

This step uses the Intel FPGA RTE for OpenCL. To program the AOCX file with FP11 or FP16 bitstreams:

```
aocl program acl0 $<BITSTREAM_DATA_TYPE>.aocx
```

## 6.4 Configure and Use the Model Optimizer

### 6.4.1 Configure the Model Optimizer

You must configure the Model Optimizer for the framework that was used to train your model. Follow the steps in this section to use scripts to configure the Model Optimizer for the Caffe framework.

**NOTE:** As an option, you can manually configure the Model Optimizer instead of following these steps. If this is your choice, see the Custom Layers section of the Model Optimizer Developer Guide.

1. Go to the Model Optimizer prerequisites directory:
   ```
   cd /deployment_tools/model_optimizer/install_prerequisites
   ```

2. Run the script for the Caffe model framework:
   ```
   sudo ./install_prerequisites_caffe.sh
   ```

3. Download the pre-trained models and prototxt files:

   -- Alexnet:
   ```
   cd
   /opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
   /model_downloader/

   ./downloader.py –-name alexnet
   ```

   -- GoogleNet:
   ```
   cd
   /opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
   /model_downloader/

   ./downloader.py –-name googlenet-v1
   ```

   -- SqueezeNet:
   ```
   cd
   /opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
   /model_downloader/

   ./downloader.py –-name squeezenet1.1
   ```

   -- VGG16:
   ```
   cd
   /opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
   /model_downloader/
   ```

```
./downloader.py –-name vgg16
```

-- ResNet-18:

- Model file:

https://onedrive.live.com/?authkey=%21ANF8hWlK9D8LGrk&cid=7C725726AF404CFD&id=7C725726AF404CFD%21110&parId=root&o=OneUp

- Prototxt file:

https://github.com/HolmesShuan/ResNet-18-Caffemodel-on-ImageNet

-- ResNet-50 and ResNet-101:

- Model file:

https://onedrive.live.com/?authkey=%21AAFW2-FVoxeVRck&id=4006CBB8476FF777%2117887&cid=4006CBB8476FF777

- Prototxt file:

https://onedrive.live.com/?authkey=%21AAFW2-FVoxeVRck&id=4006CBB8476FF777%2117887&cid=4006CBB8476FF777

-- SSD300:

```
cd
/opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
/model_downloader/

./downloader.py --name ssd300
```

When complete, you can able to see the classification and object_detection folder in the same directory. The prototxt and caffemodel files for various topologies based on Caffe network can be obtained in the directory.

### 6.4.2 Use the Model Optimizer

Before you use the Inference Engine APIs, you must use the Model Optimizer to create the Intermediate Representation (IR) files from your pre-trained Caffe model. For this conversion, the Model Optimizer Python script converts the prototxt and caffemodel files to generate .xml and .bin topology files that describe the network.

The result is two files:

- Topology file – a .xml file that describes the network topology
- Trained data file – a .bin file that contains the weights and biases binary data

**NOTE:** For information about the Model Optimizer command line arguments and options:

```
python3 mo_caffe.py --help.
```

1. Temporarily set the environment variables
   ```
   source /opt/intel/computer_vision_sdk_<VERSION>/bin/setupvars.sh
   ```

**NOTE:** The OpenVINO™ environment variables are removed when you close the shell. As an option, use your preferred method to permanently set the variables.

2. Get the mean file for the Alexnet or ResNet topology. This file provides optimized performance.
   - Alexnet mean file location: http://dl.caffe.berkeleyvision.org/caffe_ilsvrc12.tar.gz
   - ResNet mean file location: https://github.com/ry/tensorflow-resnet/tree/master/data

3. Go to the Model Optimizer directory:
   ```
   cd
   /opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
   /model_optimizer
   ```

4. Run `mo_caffe.py` on the caffemodel and prototxt files that have the data type that you need. FP11 bitstreams use data type FP16 when generating the IR files:

   -- For Alexnet or ResNet:

   ```
   python3 mo_caffe.py --input_model $<CAFFEMODEL> --input_proto
   $<PROTOTXT_FILE> -n $<NAME_OUT> --data_type $<DATA_TYPE> --scale
   1 --mean_file $<MEAN_FILE> --output_dir $<XML_PATH>
   ```

   -- For GoogleNet, SqueezeNet, VGG16, or SSD300 topology, provide the mean value for optimized performance:

   ```
   python3 mo_caffe.py --input_model $<CAFFEMODEL> --input_proto
   $<PROTOTXT_FILE> -n $<NAME_OUT> --data_type $<DATA_TYPE> --scale
   1 --mean_value [104,117,123] --output_dir $<XML_PATH>
   ```

## 6.5 Build the Sample Applications

This section uses cmake to build the sample applications.

1. Temporarily set the environment variables:

```
source
/opt/intel/computer_vision_sdk_<VERSION>/bin/setupvars.sh
```

**NOTE:** The OpenVINO™ environment variables are removed when you close the shell. As an option, use your preferred method to permanently set the variables.

2. Go to the Inference Engine samples directory:

```
cd
/opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
/inference_engine/samples/
```

3. Create a build directory:

```
mkdir build
```

4. Go to the Inference Engine samples build directory:

```
cd
/opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
/inference_engine/samples/build/
```

5. Run cmake to generate the Makefiles without debugging information:

```
sudo cmake -DCMAKE_BUILD_TYPE=Release
/opt/intel/computer_vision_sdk_fpga_2018.3.version>/deployment
_tools/inference_engine/samples/
```

6. Build the sample applications:

```
make

make install
```

7. Confirm the build exists. If this directory exists, your build was successful:

```
cd
/opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
/inference_engine/samples/build/intel64/Release/
```

The existence of this directory confirms you successfully completed the steps in this section.

## 6.6 Use the Sample Applications

**IMPORTANT:**

You must have completed the previous sections in this document before you will be successful using the sample applications.

For command-line arguments and options used with the sample applications:

```
python3 mo_caffe.py –help
```

### 6.6.1 classification_async_Sample with Maximum Optimization

- AlexNet topology example

```
cd
/opt/intel/computer_vision_sdk_fpga_<OPENVINO_VERSION>/deploym
ent_tools/inference_engine/samples/build/intel64/Release/

export CL_CONTEXT_COMPILER_MODE_INTELFPGA=3

sudo cp
/opt/intel/computer_vision_sdk_fpga_<OPENVINO_VERSION>/deploym
ent_tools/demo/squeezenet1.1.labels $<XML_PATH>

mv squeezenet1.1.labels alexnet_fp16.labels

./classification_sample_async -m $<XML_PATH>/alexnet_fp16.xml -i
$<IMAGE_PATH> -d HETERO:FPGA,CPU -ni $<ITERATION_NUMBER> -nireq
2
```

- AlexNet topology example with a batch size of 96

```
cd
/opt/intel/computer_vision_sdk_fpga_<OPENVINO_VERSION>/deploym
ent_tools/inference_engine/samples/build/intel64/Release/

export CL_CONTEXT_COMPILER_MODE_INTELFPGA=3

sudo cp
/opt/intel/computer_vision_sdk_fpga_<OPENVINO_VERSION>/deploym
ent_tools/demo/squeezenet1.1.labels $<XML_PATH>

mv squeezenet1.1.labels alexnet_fp16.labels
```

```
./classification_sample_async -m $<XML_PATH>/alexnet_fp16.xml
`for i in {1..96}; do echo -n "<IMAGE_PATH>";done` -d
HETERO:FPGA,CPU -ni $<ITERATION_NUMBER> -nireq 2
```

The output example shows the classification_async with data type FP16, 1000 iterations and nireq set to 2 for the AlexNet topology.

```
[ INFO ] InferenceEngine:
        API version ............ 1.2
        Build .................. 13911
[ INFO ] Parsing input parameters
[ INFO ] Parsing input parameters
[ INFO ] Loading plugin

        API version ............ 1.2
        Build .................. heteroPlugin
        Description ....... heteroPlugin
[ INFO ] Loading network files
[ INFO ] Preparing input blobs
[ WARNING ] Image is resized from (787, 259) to (227, 227)
[ INFO ] Batch size is 1
[ INFO ] Preparing output blobs
[ INFO ] Loading model to the plugin
[ INFO ] Start inference (1000 iterations)
[ INFO ] Processing output blobs

Top 10 results:

Image /opt/intel/computer_vision_sdk_fpga_2018.3.343/deployment_tools/demo/car.png

479 0.7081370 label car wheel
511 0.1004352 label convertible
817 0.0958359 label sports car, sport car
436 0.0669043 label beach wagon, station wagon, wagon, estate car, beach waggon, station waggon, waggon
656 0.0101010 label minivan
581 0.0065217 label grille, radiator grille
661 0.0038943 label Model T
717 0.0037160 label pickup, pickup truck
468 0.0017281 label cab, hack, taxi, taxicab
627 0.0015014 label limousine, limo


Top 10 results:

Image /opt/intel/computer_vision_sdk_fpga_2018.3.343/deployment_tools/demo/car.png

479 0.7081370 label car wheel
511 0.1004352 label convertible
817 0.0958359 label sports car, sport car
436 0.0669043 label beach wagon, station wagon, wagon, estate car, beach waggon, station waggon, waggon
656 0.0101010 label minivan
581 0.0065217 label grille, radiator grille
661 0.0038943 label Model T
717 0.0037160 label pickup, pickup truck
468 0.0017281 label cab, hack, taxi, taxicab
627 0.0015014 label limousine, limo


total inference time: 10479.1240692

Throughput: 95.4278233 FPS

[ INFO ] Execution successful
```

**Figure 6-9: classification_async Output**

### 6.6.2 object_detection_ssd

SSD300 topology:

```
cd
/opt/intel/computer_vision_sdk_fpga_<VERSION>/deployment_tools
/inference_engine/samples/build/intel64/Release/

export CL_CONTEXT_COMPILER_MODE_INTELFPGA=3

./object_detection_sample_ssd -m $<XML_PATH> -i $<IMAGE_PATH> -d
HETERO:FPGA,CPU -i
$<OPENVINO_INSTALLATION>/deployment_tools/inference_engine/sam
ples/build/intel64/Release/lib/libcpu_extension.so
```

### 6.6.3 Other Demos

Other sample application are available to run on the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA. For information on how to run the demos in OpenVINO™ toolkit, see the Inference Engine Sample documentation.

| Sample Application | Model Used |
|---|---|
| classification_sample | Model downloader - AlexNet |
| classification_sample_async | Model downloader - AlexNet |
| hello_autoresize_classification | Model downloader - AlexNet |
| hello_request_classification | Model downloader - AlexNet |
| interactive_face_detection_sample | face-detection-retail-0004<br>age-gender-recognition-retail-0013<br>head-pose-estimation-adas-0001 |
| security_barrier_camera_sample | vehicle-license-plate-detection-barrier-0007<br>vehicle-attributes-recognition-barrier-0010<br>license-plate-recognition-barrier-0001 |
| object_detection_sample | faster_rcnn_vgg16 |
| object_detection_sample_ssd | person-detection-retail-0013 |
| object_detection_demo_ssd_async | person-detection-retail-0014 |
| validation_app | Model downloader - AlexNet |
| segmentation_sample | fcn8_FP16 |
| multi-channel-sample | face-detection-retail-0004 |

**Table 6-2: Other Sample Applications You can run with the Intel® Vision Accelerator Design with Intel® Arria® 10 FPGA**

Chapter

7

# Mustang-V100-MX8 AI Acceleration Card

## 7.1 Mustang-V100-MX8 Introduction

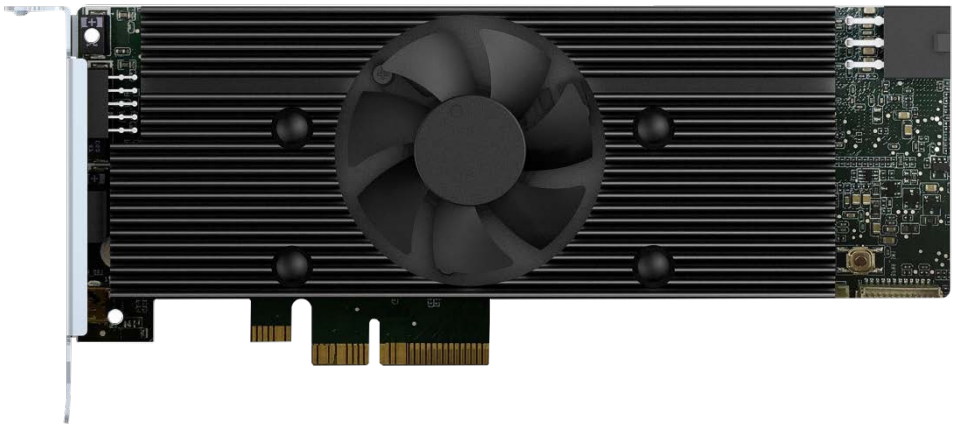


**Figure 7-1: Mustang-V100-MX8**

The Mustang-V100-MX8 is a deep learning convolutional neural network acceleration card for speeding up AI inference, in a flexible and scalable way. Equipped with Intel® Movidius™ Myriad™ X Vision Processing Unit (VPU), the Mustang-V100-MX8 PCIe card can be used with the existing system, enabling high-performance computing without costing a fortune. VPUs can run AI faster, and is well suited for low power consumption applications such as surveillance, retail and transportation. With the advantage of power efficiency and high performance to dedicate DNN topologies, it is perfect to be implemented in AI edge computing device to reduce total power usage, providing longer duty time for the rechargeable edge computing equipment.

"Open Visual Inference & Neural Network Optimization (OpenVINO™) toolkit" is based on convolutional neural networks (CNN), the toolkit extends workloads across Intel® hardware and maximizes performance. It can optimize pre-trained deep learning model such as Caffe, MXNET, Tensorflow into IR binary file then execute the inference engine across Intel®-hardware heterogeneously such as CPU, GPU, Intel® Movidius™ Neural Compute Stick, and FPGA.

### 7.1.1 Mustang-V100-MX8 Block Diagram

**Figure 6-1** shows the block diagram of the Mustang-V100-MX8.

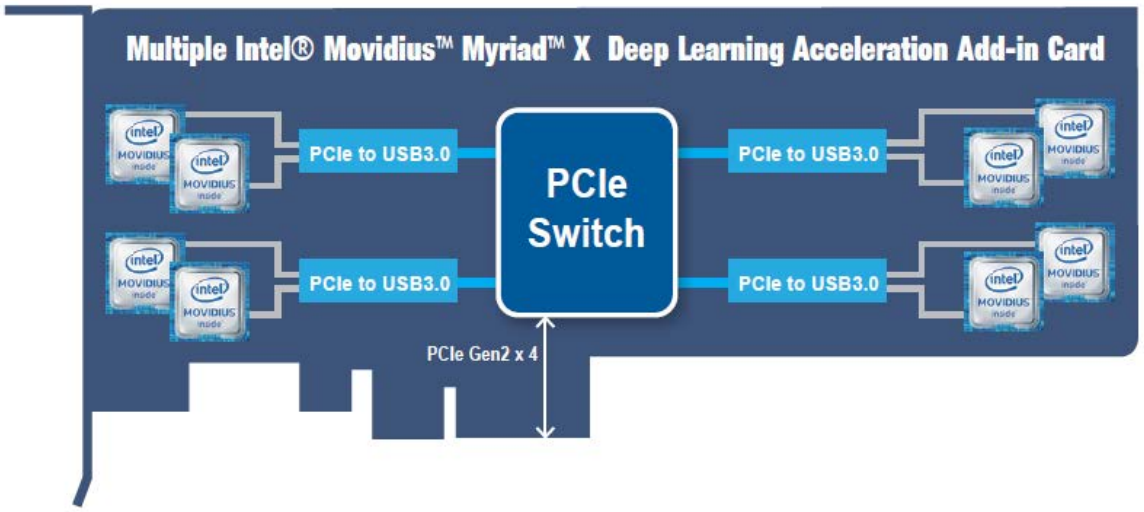



**Figure 7-2: Mustang-V100-MX8 Block Diagram**

### 7.1.2 Mustang-V100-MX8 I/O and Dimensions

The I/O interfaces and dimensions of the board are listed below:

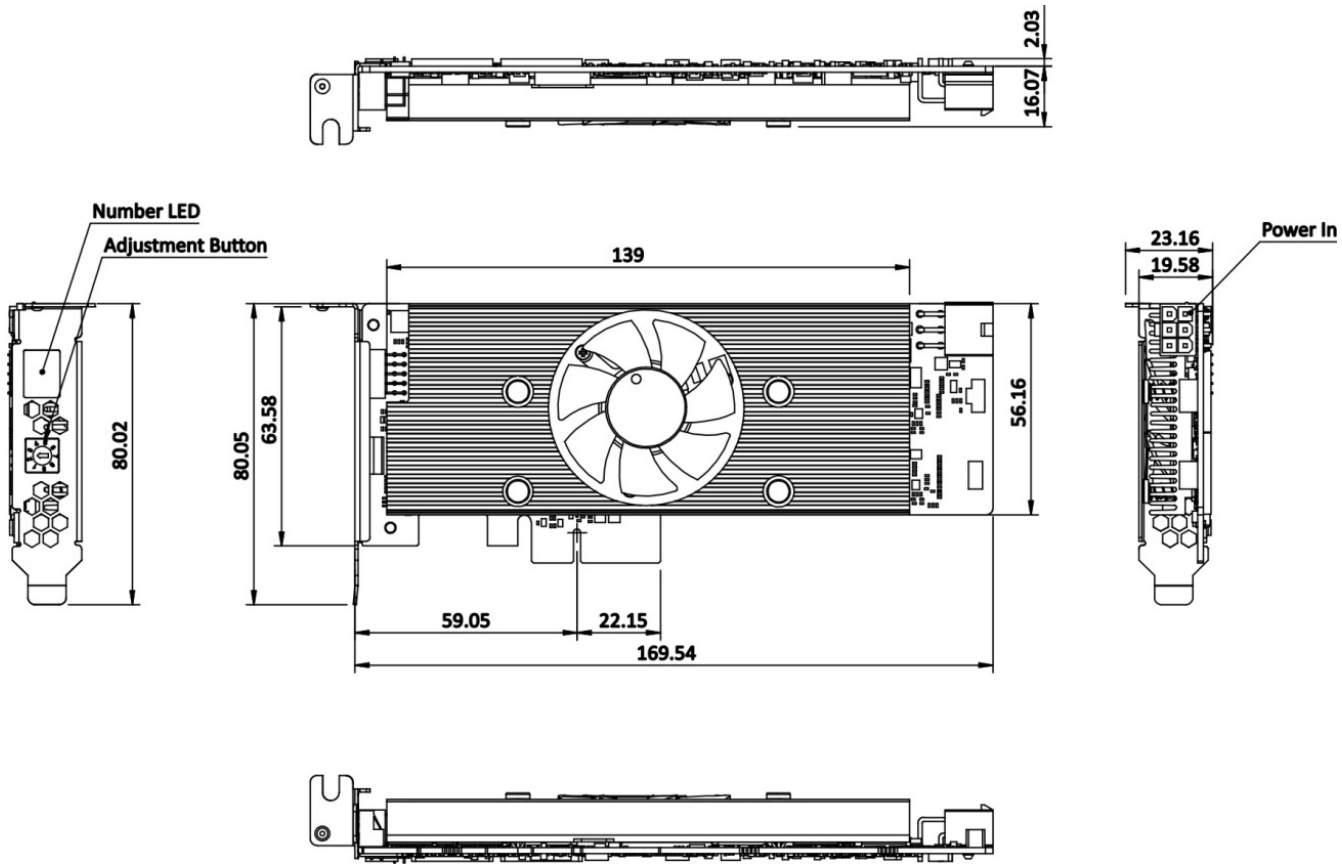



**Figure 7-3: Mustang-V100-MX8 Dimensions (mm)**

### 7.1.3 Mustang-V100-MX8 Technical Specifications

Mustang-V100-MX8 technical specifications are listed below.

| Specification | Mustang-V100-MX8 |
|---|---|
| **Main Chip** | Intel® Movidius™ Myriad™ X |
| **Operating Systems** | Ubuntu* 16.04.3 (LTS), 64-bit<br>CentOS 65-bit |
| **Physical PCIe Interface** | PCI Express x4<br>Compliant with PCI Express Specification v2.0 |
| **Indicator** | 7-segment LED display for card ID |
| **Fan** | Active fan |
| **External Power Connector** | 12 V external power |
| **Power Consumption** | <25 W |
| **Operating Temperature** | 5°C ~ 60°C / 41°F ~ 140°F (ambient temperature) |
| **Operating Humidity** | 5% ~ 90% |
| **Dimensions (WxHxD)** | 169.54 mm x 80.05 mm x 23.16 mm<br>Standard half-height, half-length, single-width |

**Table 7-1: Technical Specifications**

## 7.2 Mustang-V100-MX8 Hardware Installation

To install the Mustang-V100-MX8, please follow the steps below.

**Step 1:** **Prepare the computer.** Turn off the computer, and remove the power cord from the rear of the power supply.

**WARNING:**

Disconnect the computer from the power supply and from any networks to which you will install the Mustang-V100-MX8, or you risk damaging the system or experiencing electrical shock.

**Step 2:** **Remove the cover from the chassis.**

**Step 3:** **Locate available PCIe slots and remove the blank brackets.** The Mustang-V100-MX8 is compatible with PCIe x4 slots, and only needs one PCIe slot for installation. Remove a blank bracket panel on the back of the computer that aligns with the PCIe slot for installing the Mustang-V100-MX8. Save the bracket screw.

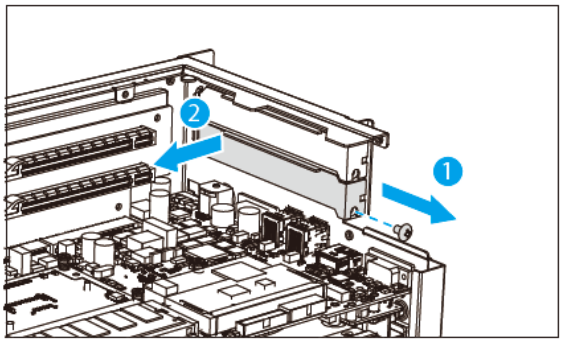



**Figure 7-4: Remove One Blank Bracket**

**Step 4:** **[Only needed for full-height installation] Change the bracket on the Mustang-V100-MX8** from low-profile bracket to full-height bracket.

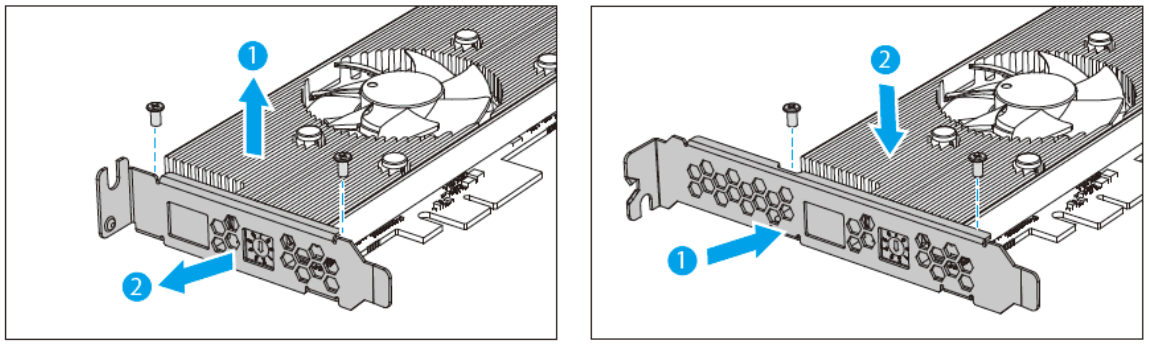


Figure 7-5: Change to Full-height Bracket

**Step 5:** **Install and secure the Mustang-V100-MX8 to the system.** Align the Mustang-V100-MX8 to the PCIe slot. Press down gently, but firmly, to seat the Mustang-V100-MX8 correctly in the slot. Install the bracket screw to secure the Mustang-V100-MX8 to the system's chassis.

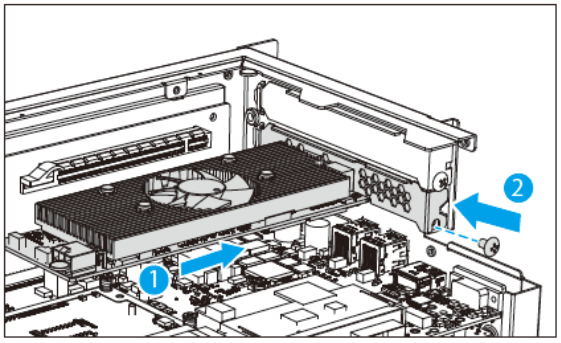


Figure 7-6: Change to Full-height Bracket

**Step 6:** **Connect a power cable to the Mustang-V100-MX8.** The Mustang-V100-MX8 requires 12V DC power. Use a power cable with 6-pin connector from the

system, if applicable, or add the 4-pin to 6-pin PCIe power adapter to connect to the power connector of the Mustang-V100-MX8.

**NOTE:** For TANK-870AI, you don't need to connect the power cable.

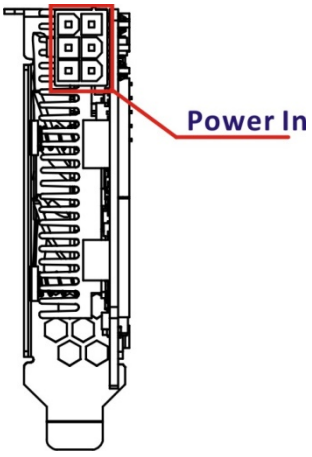



**Figure 7-7: Power Connector Location**

**Step 7:** **Assign a card ID to the Mustang-V100-MX8** by adjusting the rotary switch. The card ID number assigned here will be shown on the LED display of the card after power-up.

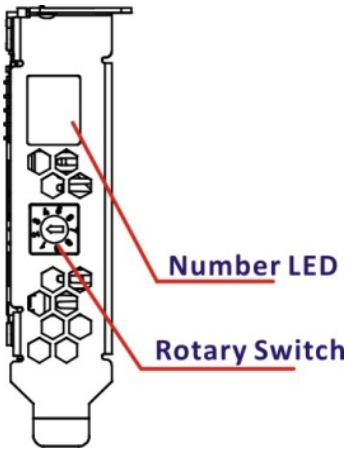



**Figure 7-8: Assign a Card ID**

**Step 8:** **Repeat Step 3 ~ Step 7 to install multiple Mustang-V100-MX8 into the system** if available.

**Step 9:** **Re-install the cover of the chassis**.

**Step 10:** **Reconnect any power cords and any network cables to the system.** Power up the system.

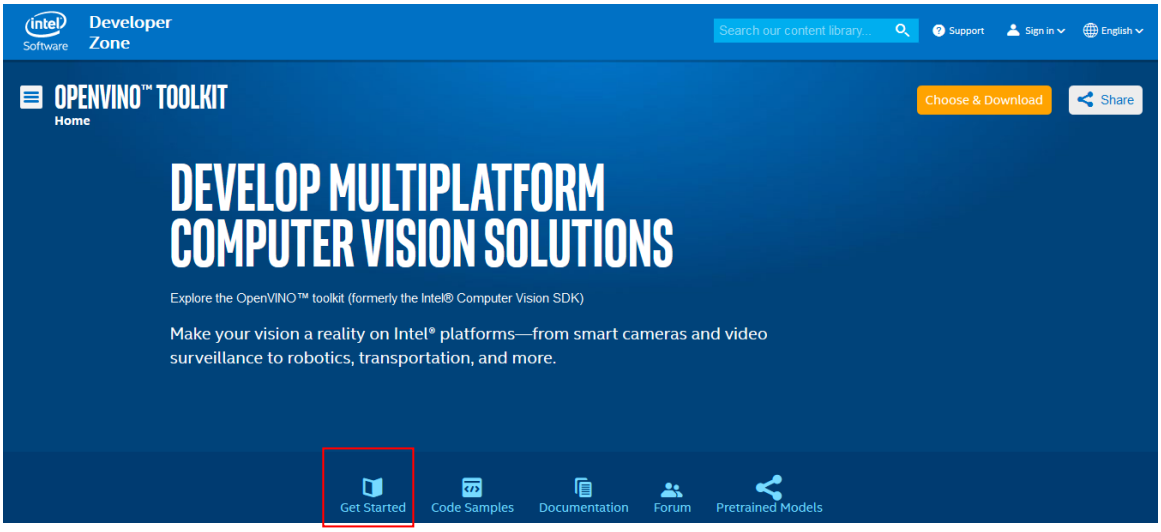
# 7.3 OpenVINO™ Toolkit Software Installation

## 7.3.1 System Requirements

- Linux Ubuntu 16.04.3 LTS 64bit
- CentOS 65-bit
- OpenVINO™ Toolkit was pre-installed in TANK-870AI.

## 7.3.2 Installation

Go to https://software.intel.com/en-us/openvino-toolkit. Click “Get Started” then choose your configuration from “Development Environment Installation Guides & Videos”. Follow the instruction to complete the installation procedure.



Appendix

A

# Regulatory Compliance

## DECLARATION OF CONFORMITY

CE

This equipment is in conformity with the following EU directives:

- EMC Directive (2014/30/EU)
- Low-Voltage Directive (2014/35/EU)
- RoHS II Directive (2011/65/EU, 2015/863/EU)

If the user modifies and/or install other devices in the equipment, the CE conformity declaration may no longer apply.

If this equipment has telecommunications functionality, it also complies with the requirements of the Radio Equipment Directive 2014/53/EU.

| |
|---|
| English |
| IEI Integration Corp declares that this equipment is in compliance with the essential requirements and other relevant provisions of Directive 2014/53/EU. |
| Български [Bulgarian] |
| IEI Integration Corp. декларира, че този оборудване е в съответствие със съществените изисквания и другите приложими правила на Директива 2014/53/EU. |
| Česky [Czech] |
| IEI Integration Corp tímto prohlašuje, že tento zařízení je ve shodě se základními požadavky a dalšími příslušnými ustanoveními směrnice 2014/53/EU. |
| Dansk [Danish] |
| IEI Integration Corp erklærer herved, at følgende udstyr overholder de væsentlige krav c øvrige relevante krav i direktiv 2014/53/EU. |
| Deutsch [German] |
| IEI Integration Corp, erklärt dieses Gerät entspricht den grundlegenden Anforderungen und den weiteren entsprechenden Vorgaben der Richtlinie 2014/53/EU. |

Eesti [Estonian]

IEI Integration Corp deklareerib seadme seadme vastavust direktiivi 2014/53/EÜ põhinõuetele ja nimetatud direktiivist tulenevatele teistele asjakohastele sätetele.

Español [Spanish]

IEI Integration Corp declara que el equipo cumple con los requisitos esenciales y cualesquiera otras disposiciones aplicables o exigibles de la Directiva 2014/53/EU.

Ελληνική [Greek]

IEI Integration Corp ΔΗΛΩΝΕΙ ΟΤΙ ΕΞΟΠΛΙΣΜΟΣ ΣΥΜΜΟΡΦΩΝΕΤΑΙ ΠΡΟΣ ΤΙΣ ΟΥΣΙΩΔΕΙΣ ΑΠΑΙΤΗΣΕΙΣ ΚΑΙ ΤΙΣ ΛΟΙΠΕΣ ΣΧΕΤΙΚΕΣ ΔΙΑΤΑΞΕΙΣ ΤΗΣ ΟΔΗΓΙΑΣ 2014/53/EU.

Français [French]

IEI Integration Corp déclare que l'appareil est conforme aux exigences essentielles et aux autres dispositions pertinentes de la directive 2014/53/EU.

Italiano [Italian]

IEI Integration Corp dichiara che questo apparecchio è conforme ai requisiti essenziali ed alle altre disposizioni pertinenti stabilite dalla direttiva 2014/53/EU.

Latviski [Latvian]

IEI Integration Corp deklarē, ka iekārta atbilst būtiskajām prasībām un citiem ar to saistītajiem noteikumiem Direktīvas 2014/53/EU.

Lietuvių [Lithuanian]

IEI Integration Corp deklaruoja, kad šis įranga atitinka esminius reikalavimus ir kitas 2014/53/EU Direktyvos nuostatas.

Nederlands [Dutch]

IEI Integration Corp dat het toestel toestel in overeenstemming is met de essentiële eisen en de andere relevante bepalingen van richtlijn 2014/53/EU.

Malti [Maltese]

IEI Integration Corp jiddikjara li dan prodott jikkonforma mal-ħtiġijiet essenzjali u ma provvedimenti oħrajn relevanti li hemm fid-Dirrettiva 2014/53/EU.

Magyar [Hungarian]

IEI Integration Corp nyilatkozom, hogy a berendezés megfelel a vonatkozó alapvetõ követelményeknek és az 2014/53/EU irányelv egyéb elõírásainak.

Polski [Polish]

IEI Integration Corp oświadcza, że wyrobu jest zgodny z zasadniczymi wymogami oraz pozostałymi stosownymi postanowieniami Dyrektywy 2014/53/EU.

Português [Portuguese]

IEI Integration Corp declara que este equipamento está conforme com os requisitos essenciais e outras disposições da Directiva 2014/53/EU.

Româna [Romanian]

IEI Integration Corp declară că acest echipament este in conformitate cu cerinţele esenţiale şi cu celelalte prevederi relevante ale Directivei 2014/53/EU.

Slovensko [Slovenian]

IEI Integration Corp izjavlja, da je ta opreme v skladu z bistvenimi zahtevami in ostalimi relevantnimi določili direktive 2014/53/EU.

Slovensky [Slovak]

IEI Integration Corp týmto vyhlasuje, že zariadenia spĺňa základné požiadavky a všetky príslušné ustanovenia Smernice 2014/53/EU.

Suomi [Finnish]

IEI Integration Corp vakuuttaa täten että laitteet on direktiivin 2014/53/EU oleellisten vaatimusten ja sitä koskevien direktiivin muiden ehtojen mukainen.

Svenska [Swedish]

IEI Integration Corp förklarar att denna utrustningstyp står I överensstämmelse med de väsentliga egenskapskrav och övriga relevanta bestämmelser som framgår av direktiv 2014/53/EU.

## FCC WARNING

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

- This device may not cause harmful interference, and
- This device must accept any interference received, including interference that may cause undesired operation.

This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the user will be required to correct the interference at his own expense.

**Federal Communication Commission Interference Statement**

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

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

Appendix

B

# BIOS Options

Below is a list of BIOS configuration options in the BIOS chapter.


- System Date [xx/xx/xx] ..... 61
- System Time [xx:xx:xx] ..... 61
- Intel (VMX) Virtualization Technology [Enabled] ..... 64
- Active Processor Cores [All] ..... 64
- Hyper-threading [Enabled] ..... 64
- EIST [Enabled] ..... 64
- C State [Disabled] ..... 65
- Security Device Support [Disable] ..... 65
- ACPI Sleep State [S3 (Suspend to RAM)] ..... 66
- SATA Controller(s) [Enabled] ..... 67
- SATA Mode Selection [AHCI] ..... 67
- Hot Plug [Disabled] ..... 67
- AMT BIOS Features [Enabled] ..... 68
- Unconfigure ME [Disabled] ..... 68
- Serial Port [Enabled] ..... 70
- Change Settings [Auto] ..... 70
- Serial Port [Enabled] ..... 71
- Change Settings [Auto] ..... 71
- Serial Port [Enabled] ..... 72
- Change Settings [Auto] ..... 72
- Serial Port [Enabled] ..... 73
- Change Settings [Auto] ..... 73
- Serial Port [Enabled] ..... 73
- Change Settings [Auto] ..... 74
- Device Mode [RS232] ..... 74
- Serial Port [Enabled] ..... 74
- Change Settings [Auto] ..... 75
- Device Mode [RS232] ..... 75
- Wake System with Fixed Time [Disabled] ..... 76
- Console Redirection [Disabled] ..... 77
- Terminal Type [ANSI] ..... 78
- Bits per second [115200] ..... 79
- Data Bits [8] ..... 79

- Parity [None] ..... 79
- Stop Bits [1] ..... 80
- Intel TXT(LT) Support [Disabled] ..... 80
- USB Devices ..... 81
- Legacy USB Support [Enabled] ..... 81
- Auto Recovery Function [Disabled] ..... 82
- PC Health Status ..... 83
- Tcc Activation Offset ..... 84
- Smart Fan control [Auto Mode] ..... 84
- Manual Mode PWM ..... 85
- VT-d [Disabled] ..... 86
- Max TOLUD [2.75 GB] ..... 87
- Primary Display [Auto] ..... 88
- Internal Graphics [Enabled] ..... 89
- DVMT Pre-Allocated [256M] ..... 89
- DVMT Total Gfx Mem [MAX] ..... 89
- Primary IGFX Boot Display [DP_HDMI] ..... 89
- PEG 0 :1 :0 Max Link Speed [Gen3] ..... 90
- PEG 0 :1 :1 Max Link Speed [Auto] ..... 90
- Detect Non-Compliance Device [Disabled] ..... 91
- Restore AC Power Loss [Last State] ..... 92
- Power Saving Function (ERP) [Disabled] ..... 92
- USB Power SW1 [+5V DUAL] ..... 93
- PCI Express Root Port n [Enabled] ..... 93
- PCIe Speed ..... 94
- Administrator Password ..... 95
- User Password ..... 95
- Bootup NumLock State [On] ..... 96
- Quiet Boot [Enabled] ..... 97
- Launch PXE OpROM [Disabled] ..... 97
- Launch Uefi PXE [Disabled] ..... 97
- Option ROM Messages [Force BIOS] ..... 97
- UEFI Boot [Enabled] ..... 97
- Boot Option Priority ..... 98
- Hard Drive BBS Priorities ..... 98

- Save Changes and Reset ..... 98
- Discard Changes and Reset ..... 99
- Restore Defaults ..... 99
- Save as User Defaults ..... 99
- Restore User Defaults ..... 99
- SEL Components [Enabled] ..... 100
- Erase SEL [No] ..... 100
- When SEL is Full [Do Nothing] ..... 101
- Configuration Address source [Unspecified] ..... 101

Appendix

C

# Terminology

| | |
|---|---|
| **AC '97** | Audio Codec 97 (AC'97) refers to a codec standard developed by Intel® in 1997. |
| **ACPI** | Advanced Configuration and Power Interface (ACPI) is an OS-directed configuration, power management, and thermal management interface. |
| **AHCI** | Advanced Host Controller Interface (AHCI) is a SATA Host controller register-level interface. |
| **ATA** | The Advanced Technology Attachment (ATA) interface connects storage devices including hard disks and CD-ROM drives to a computer. |
| **ARMD** | An ATAPI Removable Media Device (ARMD) is any ATAPI device that supports removable media, besides CD and DVD drives. |
| **ASKIR** | Amplitude Shift Keyed Infrared (ASKIR) is a form of modulation that represents a digital signal by varying the amplitude ("volume") of the signal. A low amplitude signal represents a binary 0, while a high amplitude signal represents a binary 1. |
| **BIOS** | The Basic Input/Output System (BIOS) is firmware that is first run when the computer is turned on and can be configured by the end user |
| **CODEC** | The Compressor-Decompressor (CODEC) encodes and decodes digital audio data on the system. |
| **CompactFlash®** | CompactFlash® is a solid-state storage device. CompactFlash® devices use flash memory in a standard size enclosure. Type II is thicker than Type I, but a Type II slot can support both types. |
| **CMOS** | Complimentary metal-oxide-conductor is an integrated circuit used in chips like static RAM and microprocessors. |
| **COM** | COM refers to serial ports. Serial ports offer serial communication to expansion devices. The serial port on a personal computer is usually a male D-sub 9 connector. |
| **DAC** | The Digital-to-Analog Converter (DAC) converts digital signals to analog signals. |
| **DDR** | Double Data Rate refers to a data bus transferring data on both the rising and falling edges of the clock signal. |

| | |
|---|---|
| **DMA** | Direct Memory Access (DMA) enables some peripheral devices to bypass the system processor and communicate directly with the system memory. |
| **DIMM** | Dual Inline Memory Modules are a type of RAM that offer a 64-bit data bus and have separate electrical contacts on each side of the module. |
| **DIO** | The digital inputs and digital outputs are general control signals that control the on/off circuit of external devices or TTL devices. Data can be read or written to the selected address to enable the DIO functions. |
| **EHCI** | The Enhanced Host Controller Interface (EHCI) specification is a register-level interface description for USB 2.0 Host Controllers. |
| **EIDE** | Enhanced IDE (EIDE) is a newer IDE interface standard that has data transfer rates between 4.0 MBps and 16.6 MBps. |
| **EIST** | Enhanced Intel® SpeedStep Technology (EIST) allows users to modify the power consumption levels and processor performance through application software. The application software changes the bus-to-core frequency ratio and the processor core voltage. |
| **FSB** | The Front Side Bus (FSB) is the bi-directional communication channel between the processor and the Northbridge chipset. |
| **GbE** | Gigabit Ethernet (GbE) is an Ethernet version that transfers data at 1.0 Gbps and complies with the IEEE 802.3-2005 standard. |
| **GPIO** | General purpose input |
| **HDD** | Hard disk drive (HDD) is a type of magnetic, non-volatile computer storage device that stores digitally encoded data. |
| **ICH** | The Input/Ouput Controll Hub (ICH) is an Intel® Southbridge chipset. |
| **IrDA** | Infrared Data Association (IrDA) specify infrared data transmission protocols used to enable electronic devices to wirelessly communicate with each other. |
| **L1 Cache** | The Level 1 Cache (L1 Cache) is a small memory cache built into the system processor. |
| **L2 Cache** | The Level 2 Cache (L2 Cache) is an external processor memory cache. |

| | |
|---|---|
| **LCD** | Liquid crystal display (LCD) is a flat, low-power display device that consists of two polarizing plates with a liquid crystal panel in between. |
| **LVDS** | Low-voltage differential signaling (LVDS) is a dual-wire, high-speed differential electrical signaling system commonly used to connect LCD displays to a computer. |
| **POST** | The Power-on Self Test (POST) is the pre-boot actions the system performs when the system is turned-on. |
| **RAM** | Random Access Memory (RAM) is volatile memory that loses data when power is lost. RAM has very fast data transfer rates compared to other storage like hard drives. |
| **SATA** | Serial ATA (SATA) is a serial communications bus designed for data transfers between storage devices and the computer chipsets. The SATA bus has transfer speeds up to 1.5 Gbps and the SATA II bus has data transfer speeds of up to 3.0 Gbps. |
| **S.M.A.R.T** | Self Monitoring Analysis and Reporting Technology (S.M.A.R.T) refers to automatic status checking technology implemented on hard disk drives. |
| **UART** | Universal Asynchronous Receiver-transmitter (UART) is responsible for asynchronous communications on the system and manages the system's serial communication (COM) ports. |
| **UHCI** | The Universal Host Controller Interface (UHCI) specification is a register-level interface description for USB 1.1 Host Controllers. |
| **USB** | The Universal Serial Bus (USB) is an external bus standard for interfacing devices. USB 1.1 supports 12Mbps data transfer rates and USB 2.0 supports 480Mbps data transfer rates. |
| **VGA** | The Video Graphics Array (VGA) is a graphics display system developed by IBM. |

Appendix

D

# Safety Precautions

## D.1 Safety Precautions

**WARNING:**

The precautions outlined in this appendix should be strictly followed. Failure to follow these precautions may result in permanent damage to the TANK-870AI series.

Please follow the safety precautions outlined in the sections that follow:

### D.1.1 General Safety Precautions

Please ensure the following safety precautions are adhered to at all times.

- ***Make sure the power is turned off and the power cord is disconnected*** when moving, installing or modifying the system.
- ***Do not apply voltage levels that exceed the specified voltage range***. Doing so may cause fire and/or an electrical shock.
- ***Electric shocks can occur*** if opened while still powered on.
- ***Do not drop or insert any objects*** into the ventilation openings.
- ***If considerable amounts of dust, water, or fluids enter the system***, turn off the power supply immediately, unplug the power cord, and contact the system vendor.
- **DO NOT**:
  - Drop the system against a hard surface.
  - In a site where the ambient temperature exceeds the rated temperature

### D.1.2 Anti-static Precautions

**WARNING:**

Failure to take ESD precautions during the installation of the TANK-870AI series may result in permanent damage to the TANK-870AI series and severe injury to the user.

Electrostatic discharge (ESD) can cause serious damage to electronic components, including the TANK-870AI series. Dry climates are especially susceptible to ESD. It is therefore critical that whenever the TANK-870AI series is opened and any of the electrical components are handled, the following anti-static precautions are strictly adhered to.

- ***Wear an anti-static wristband***: Wearing a simple anti-static wristband can help to prevent ESD from damaging any electrical component.
- ***Self-grounding***: Before handling any electrical component, touch any grounded conducting material. During the time the electrical component is handled, frequently touch any conducting materials that are connected to the ground.
- ***Use an anti-static pad***: When configuring or working with an electrical component, place it on an antic-static pad. This reduces the possibility of ESD damage.
- ***Only handle the edges of the electrical component***: When handling the electrical component, hold the electrical component by its edges.

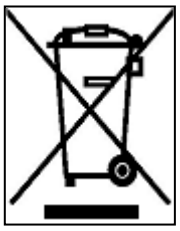
### D.1.3 Product Disposal

**CAUTION:**

Risk of explosion if battery is replaced by and incorrect type. Only certified engineers should replace the on-board battery.

Dispose of used batteries according to instructions and local regulations.

- Outside the European Union – If you wish to dispose of used electrical and electronic products outside the European Union, please contact your local authority so as to comply with the correct disposal method.
- Within the European Union – The device that produces less waste and is easier to recycle is classified as electronic device in terms of the European Directive 2012/19/EU (WEEE), and must not be disposed of as domestic garbage.



EU-wide legislation, as implemented in each Member State, requires that waste electrical and electronic products carrying the mark (left) must be disposed of separately from normal household waste. This includes monitors and electrical accessories, such as signal cables or power cords. When you need to dispose of your display products, please follow the guidance of your local authority, or ask the shop where you purchased the product. The mark on electrical and electronic products only applies to the current European Union Member States.

Please follow the national guidelines for electrical and electronic product disposal.

## D.2 Maintenance and Cleaning Precautions

When maintaining or cleaning the TANK-870AI series, please follow the guidelines below.

### D.2.1 Maintenance and Cleaning

Prior to cleaning any part or component of the TANK-870AI series, please read the details below.

- The interior of the TANK-870AI series does not require cleaning. Keep fluids away from the TANK-870AI series interior.
- Be cautious of all small removable components when vacuuming the TANK-870AI series.
- Turn the TANK-870AI series off before cleaning the TANK-870AI series.
- Never drop any objects or liquids through the openings of the TANK-870AI series.
- Be cautious of any possible allergic reactions to solvents or chemicals used when cleaning the TANK-870AI series.
- Avoid eating, drinking and smoking within vicinity of the TANK-870AI series.

### D.2.2 Cleaning Tools

Some components in the TANK-870AI series may only be cleaned using a product specifically designed for the purpose. In such case, the product will be explicitly mentioned in the cleaning tips. Below is a list of items to use when cleaning the TANK-870AI series.

- □***Cloth*** – Although paper towels or tissues can be used, a soft, clean piece of cloth is recommended when cleaning the TANK-870AI series.
- ***Water or rubbing alcohol*** – A cloth moistened with water or rubbing alcohol can be used to clean the TANK-870AI series.
- ***Using solvents*** – The use of solvents is not recommended when cleaning the TANK-870AI series as they may damage the plastic parts.
- ***Vacuum cleaner*** – Using a vacuum specifically designed for computers is one of the best methods of cleaning the TANK-870AI series. Dust and dirt can restrict the airflow in the TANK-870AI series and cause its circuitry to corrode.
- ***Cotton swabs*** - Cotton swaps moistened with rubbing alcohol or water are excellent tools for wiping hard to reach areas.
- ***Foam swabs*** - Whenever possible, it is best to use lint free swabs such as foam swabs for cleaning.

Appendix

E

# Digital I/O Interface

## E.1 Introduction

The DIO connector on the TANK-870AI series is interfaced to GPIO ports on the Super I/O chipset. The DIO has both 4-bit digital inputs and 4-bit digital outputs. The digital inputs and digital outputs are generally control signals that control the on/off circuit of external devices or TTL devices. Data can be read or written to the selected address to enable the DIO functions.

**NOTE:**

For further information, please refer to the datasheet for the Super I/O chipset.

The BIOS interrupt call **INT 15H** controls the digital I/O.

**INT 15H:**

| AH – 6FH |
|---|
| Sub-function:<br>AL – 8 :Set the digital port as INPUT<br>AL :Digital I/O input value |

## E.2 Assembly Language Sample 1

```
MOV     AX, 6F08H       ;setting the digital port as input
INT     15H             ;
```

**AL low byte = value**

| AH – 6FH |
|---|
| Sub-function:<br>AL – 9 :Set the digital port as OUTPUT<br>BL :Digital I/O input value |

## E.3 Assembly Language Sample 2

```
MOV     AX, 6F09H       ;setting the digital port as output
MOV     BL, 09H         ;digital value is 09H
INT     15H             ;
```

**Digital Output is 1001b**

Appendix

F

# Hazardous Materials Disclosure

The details provided in this appendix are to ensure that the product is compliant with the Peoples Republic of China (China) RoHS standards. The table below acknowledges the presences of small quantities of certain materials in the product, and is applicable to China RoHS only.

A label will be placed on each product to indicate the estimated "Environmentally Friendly Use Period" (EFUP). This is an estimate of the number of years that these substances would "not leak out or undergo abrupt change." This product may contain replaceable sub-assemblies/components which have a shorter EFUP such as batteries and lamps. These components will be separately marked.

Please refer to the following table.

| Part Name | Toxic or Hazardous Substances and Elements | | | | | |
|---|---|---|---|---|---|---|
| | Lead (Pb) | Mercury (Hg) | Cadmium (Cd) | Hexavalent Chromium (CR(VI)) | Polybrominated Biphenyls (PBB) | Polybrominated Diphenyl Ethers (PBDE) |
| Housing | O | O | O | O | O | O |
| Display | O | O | O | O | O | O |
| Printed Circuit Board | O | O | O | O | O | O |
| Metal Fasteners | O | O | O | O | O | O |
| Cable Assembly | O | O | O | O | O | O |
| Fan Assembly | O | O | O | O | O | O |
| Power Supply Assemblies | O | O | O | O | O | O |
| Battery | O | O | O | O | O | O |

O: This toxic or hazardous substance is contained in all of the homogeneous materials for the part is below the limit requirement in SJ/T11363-2006 (now replaced by GB/T 26572-2011).

X: This toxic or hazardous substance is contained in at least one of the homogeneous materials for this part is above the limit requirement in SJ/T11363-2006 (now replaced by GB/T 26572-2011).

此附件旨在确保本产品符合中国 RoHS 标准。以下表格标示此产品中某有毒物质的含量符合中国 RoHS 标准规定的限量要求。

本产品上会附有"环境友好使用期限"的标签，此期限是估算这些物质"不会有泄漏或突变"的年限。本产品可能包含有较短的环境友好使用期限的可替换元件，像是电池或灯管，这些元件将会单独标示出来。

| 部件名称 | 有毒有害物质或元素 | | | | | |
|---|---|---|---|---|---|---|
| | 铅 (Pb) | 汞 (Hg) | 镉 (Cd) | 六价铬 (CR(VI)) | 多溴联苯 (PBB) | 多溴二苯醚 (PBDE) |
| 壳体 | O | O | O | O | O | O |
| 显示 | O | O | O | O | O | O |
| 印刷电路板 | O | O | O | O | O | O |
| 金属螺帽 | O | O | O | O | O | O |
| 电缆组装 | O | O | O | O | O | O |
| 风扇组装 | O | O | O | O | O | O |
| 电力供应组装 | O | O | O | O | O | O |
| 电池 | O | O | O | O | O | O |

O: 表示该有毒有害物质在该部件所有物质材料中的含量均在 SJ/T 11363-2006 (现由 GB/T 26572-2011 取代) 标准规定的限量要求以下。

X: 表示该有毒有害物质至少在该部件的某一均质材料中的含量超出 SJ/T 11363-2006 (现由 GB/T 26572-2011 取代) 标准规定的限量要求。