MI990

Intel® 6th generation Mobile platform
Mini ITX Motherboard

User's Manual

Version 1.1

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Introduction

The MI990 Mini ITX motherboard features Intel Skylake support and comes with a range of features such support for 6th Generation Intel® Xeon® / Core™ i7/i5/i3 / Celeron® QC/DC processors, with speeds up to 3.7GHz and two DDR4 SO-DIMM for a maximum system memory of 32GB.

The MI990 supports graphics interface including DVI-D, HDMI (2.0), DisplayPort and 24-bit dual channel LVDS. It has two Intel® Gigabit LAN, 4x USB 2.0, 6x USB 3.0, 6x COM, 4x SATAIII, 1x PCI-E(x16), 2x Mini PCI-E and 1x M.2 expansion interface. Standard features also include Watchdog, Digital I/O, iAMT (11.0), TPM (2.0), vPro and iSMART 3.0 for auto scheduling and power saving features.

MI990 Features
➢ Mini-ITX form factor
➢ Onboard 6th Generation Intel® Xeon® / Core™ i7/i5/i3 / Celeron® QC/DC processors, up to 3.7GHz
➢ 2x DDR4 SO-DIMM, Max. 32GB
➢ Intel® Processor integrated graphic device, supports DVI-D, HDMI (2.0), DisplayPort and 24-bit dual channel LVDS
➢ 2x Intel® Gigabit LAN
➢ 4x USB 2.0, 6x USB 3.0, 6x COM, 4x SATAIII
➢ 1x PCI-E(x16), 2x Mini PCI-E, 1x M.2
➢ Watchdog, Digital I/O, iAMT (11.0), TPM (2.0), vPro, iSMART 3.0

Checklist

Your MI990 package should include the items listed below.

- The MI990 motherboard
- This User's Manual
- 1 CD containing chipset drivers and flash memory utility
- Serial ATA cable
- COM port cable
- I/O shield

MI990 Specifications

Product Name	MI990VF-X28 [Support iAMT 11.0 & vPro & ECC] MI990VF-6820 [Support iAMT 11.0 & vPro] MI990VF-6440 [Support iAMT 11.0 & vPro] MI990EF-6100 [Support EuP/ErP only]
Form Factor	Mini-ITX
CPU Type	- Intel® Skylake-H mobile processors (14 nm monolithic) - FCBGA1440 , Package= 42mmx28mmx1.49mm **-** TDP =45W/35W/25W (QC) ; 35W/ 25W (DC)
CPU Speed	Xeon E3-1505M v5 @ 2.8GHz, up to 3.7GHz Core i7-6820EQ @2.8GHz, up to 3.5GHz Core i5-6440EQ @2.7GHz, up to 3.4GHz Core i3-6100E @2.7GHz
Cache	Up to 8MB
Chipset	Intel® Skylake PCH-H CM236 for MI990VF (Support vPro, iAMT); HM170 for MI990EF Package =23 mm x 23 mm x 0.5mm
BIOS	AMI BIOS [16MB SPI ROM]
Memory	Intel® Skylake-H mobile processors integrated memory controller DDR**4** -2133 MHz @1.2V SO-DIMM, Max. 32GB
VGA	Intel® Skylake-H mobile processor integrated HD Gfx, supports 3 independent displays, ● HDMI (Thru port B, support HDMI 2.0 Via DP to HDMI converter, Explore EP963C **Resolution up to 4096x2304 @ 60 Hz** ● DVI-D x 1 (Thru port C, with level shifter NXP PTN3360D) **Resolution up to 4096x2304 @ 30 Hz** ● DisplayPort x 1 (Thru port D) **Resolution up to 4096x2304 @ 60 Hz** ● LVDS (Thru eDP, via NXP PTN3460 **Supports up to1920x1200 @ 60 Hz**
LAN	1.Intel® Jacksonville PHY ** Package = 6mm x 6mm, QFN48** I219LM GbE PHY for MI990VF; I219V GbE PHY for MI990EF 2.Intel® Pearsonville I211AT as 2ⁿᵈ GbE
USB	USB 3.0 host controller [Skylake-H PCH integrated], supports **6** ports - 6 ports in the rear panel USB 2.0 host controller [Skylake-H PCH integrated] supports **6** ports - 2 ports via MiniPCIe sockets - 4 ports via onboard box header

Serial ATA	- Intel® **CM236** PCH built-in SATA controller for **MI990VF** Support **7** x SATA 3.0(6Gbps) 4 x SATA III connector (PCIe#15~#18) 2 x mSATA (PCIe#14 , #19) 1x M.2 (PCIe#9) - Intel® **HM170** PCH built-in SATA controller for **MI990EF** Support **4** x SATA 3.0(6Gbps) 2 x SATA III connector (PCIe#15~#16) 1 x mSATA (PCIe#14) 1x M.2 (PCIe#9)
Audio	Intel® [Skylake-H PCH integrated] built-in High Definition Audio controller + Realtek ALC892 w/ 7.1 channels
LPC I/O	Fintek F81866AD-I (128-pin LQFP [14mm x 14 mm]) ▪ COM #1 (RS232/422/485) 1. With Fintek F81439N transceiver x 1 for jumper-less 2. Support ring-in with power @500 mA (selectable for 5V or 12V) ▪ COM #2~COM #6 (RS232 only) Hardware Monitor (2 thermal inputs,4 voltage monitor inputs & 2 Fan headers) - CPU Fan x 1 (PWM Fan type, 4-pin connector) - SYS Fan x 1 (PWM/ DC Fan type, 4-pin connector)
Digital IO	4 in & 4 out
TPM 2.0	Infineon SLB9665 (MI990VF series) ****Meet FIPS 140-2 certification****
iAMT	Intel® Active Management Technology ver. 11.0 (MI990VF series)

Expansion Slots	- PCI-Express (16x) x1 [Gen 3.0 PEG] - Mini PCIe x 2 ports [Full-sized] , both w/USB 2.0 signal, **Single mSATA → MI990EF @ component side J18** **Dual mSATA → MI990VF series@ J18 & J26** - M.2 Type 2280 + Mechnical key M x1 [PCIe(x4)+SATA3.0]
Edge Connectors	Dual DB9 stack connector for COM #1 / #2 DVI-D + HDMI stack connector x 1 Dual USB (3.0) +DisplayPort stack connector x 1 RJ-45 + dual USB (3.0) stack connector x 2 Triple type Jack 3 x 1 for HD Audio
Onboard Header/Connector	4 ports x SATA **III** [Blue color] for MI990VF series 2 ports x SATA **III** [Blue color] for MI990EF DF-11 8-pin box-header x 2 for 4 ports USB 2.0 DF-20 20-pin connector x 2 for dual –channel LVDS 4 pins box header x 1 for LCD backlight control 2x5 pins pin-header x 1 for front panel audio [Support 7.1 Channel] DF-11 10-pin pin-header x 4 for COM3 ~ COM6 2x5 pins pin-header x 1 for Digital IO M.2 socket x1+ Mini PCIe x 1 @ component side Mini PCIe x 1 @ solder side [MI990VF series only]
Watchdog Timer	Yes (256 segments, 0, 1, 2…255 sec/min)
System Voltage	ATX standard 20-pin type 4 pin type (+12V only)
Others	- LAN Wakeup - iSMART 3.2 - RAID - vPro [MI990VF series only]
OS support	- Windows 8.1(64-bit) - Windows 10 (64-bit) - Windows 7(32-bit / 64-bit) - Fedora (Installation) - Ubuntu (Installation)
Certification	CE (EN55032:2012) FCC Class B LVD
RoHS	YES
Board Size	170mm x 170mm

Board Dimensions

Installations

This section provides information on how to use the jumpers and connectors on the MI990 in order to set up a workable system. The topics covered are:
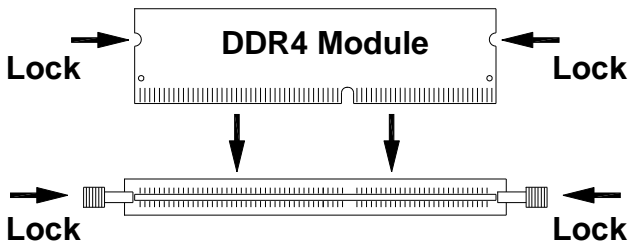
Installing the Memory

The MI990 board supports two DDR4 memory socket for a maximum total memory of 16GB in DDR4 SODIMM memory type.

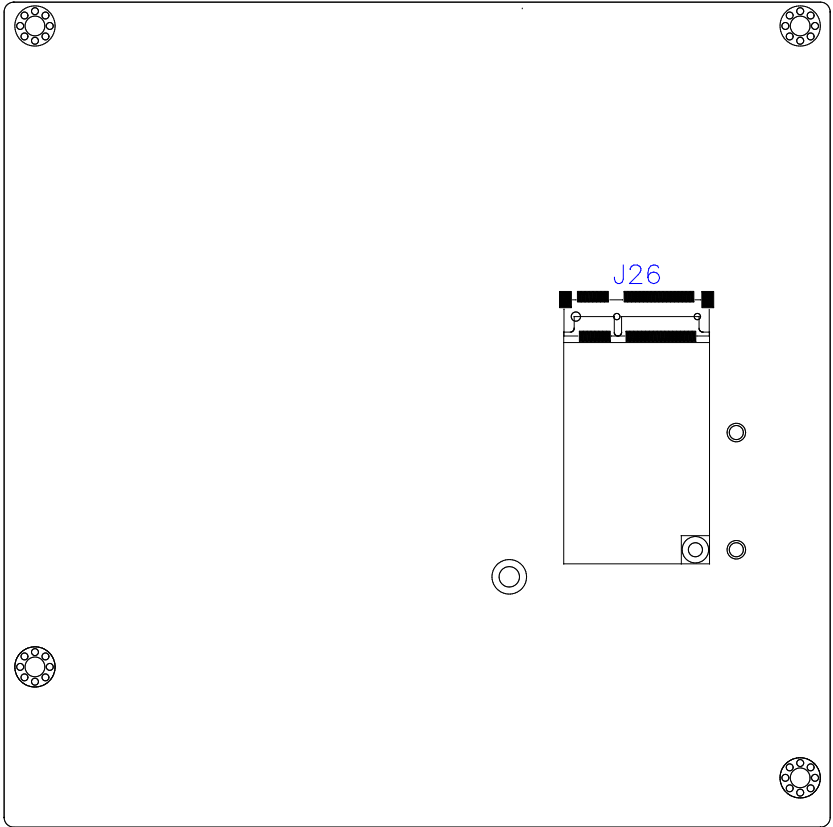**Installing and Removing Memory Modules**

To install the DDR4 modules, locate the memory slot on the board and perform the following steps:
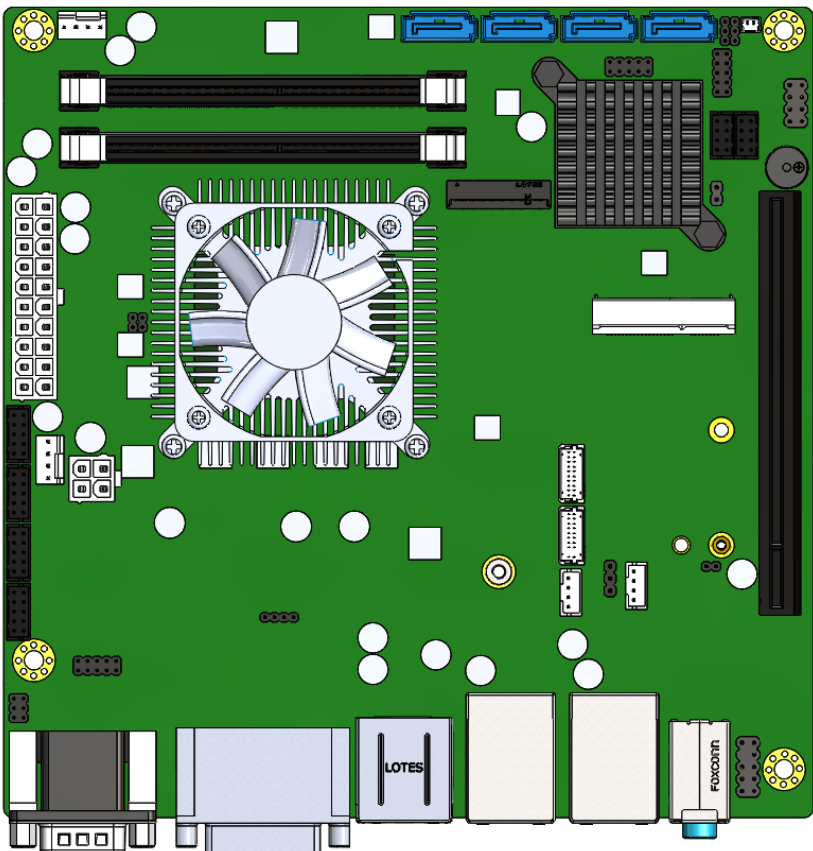
1. Hold the DDR4 module so that the key of the DDR4 module aligned with that on the memory slot.

2. Gently push the DDR4 module in an upright position until the clips of the slot close to hold the DDR4 module in place when the DDR4 module touches the bottom of the slot.

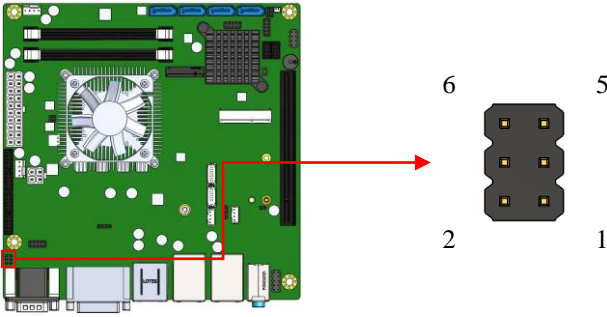3. To remove the DDR4 module, press the clips with both hands.

Jumpers and Connectors

Jumper and Connector Locations on MI990

J26

JP1: COM1 RS232 RI/+5V/+12V Power Setting

6   5

2   1

JP1	Setting	Function
1 ▫ ▫ 2 ▫ ▫ 5 ▫ ▫ 6	Pin 1-3	+12V
	Pin 3-4 (Default)	RI
	Pin 3-5	+5V

J16: LVDS Power Select

3

1
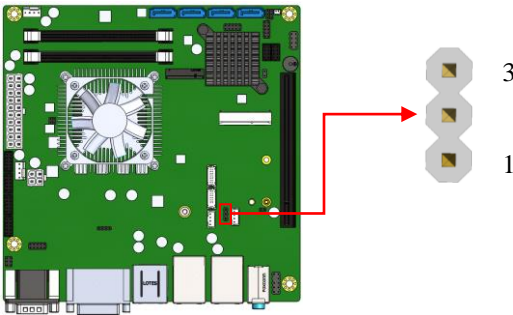
J16	LCD Panel Power
▫ ▫ ▫ 1 2 3	3.3V(Default)
▫ ▫ ▫ 1 2 3	5V

J20: Flash Descriptor Security Override (Factory use only)
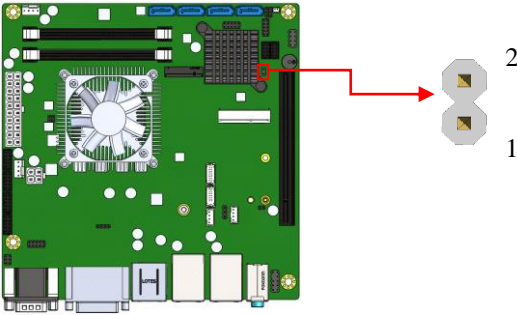
J20	Flash Descriptor Security Override
Open	Disabled (Default)
Close	Enabled

J21: Clear ME Contents
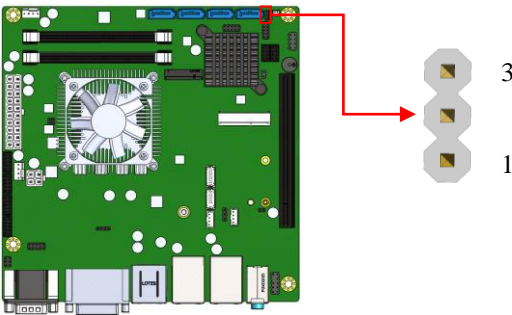
J21	Setting	Function
	Pin 1-2 Short/Closed	Normal
	Pin 2-3 Short/Closed	Clear ME

J22: Clear CMOS Contents
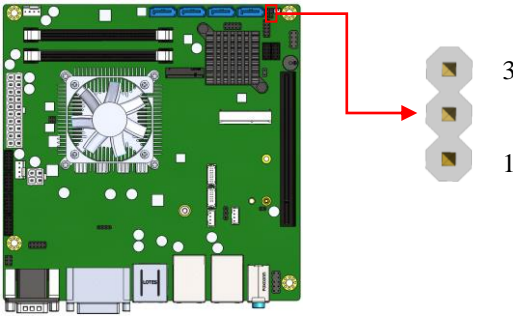
J22	Setting	Function
▢ ▢ ▢ 1 2 3	Pin 1-2 Short/Closed	Normal
▢ ▢ ▢ 1 2 3	Pin 2-3 Short/Closed	Clear CMOS

CN1: COM1 and COM2 Serial Ports
COM1 (top) and COM2 (bottom)
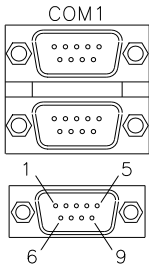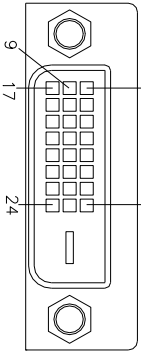
Pin #	Signal Name		
	RS-232	**R2-422**	**RS-485**
1	DCD	TX-	DATA-
2	RX	TX+	DATA+
3	TX	RX+	NC
4	DTR	RX-	NC
5	Ground	Ground	Ground
6	DSR	NC	NC
7	RTS	NC	NC
8	CTS	NC	NC
9	RI	NC	NC
10	NC	NC	NC

CN2: HDMI Connector

Signal Name	Pin #	Pin #	Signal Name
TMDS Data2+	1	10	TMDS Clock+
TMDS Data2 Shield	2	11	TMDS Clock Shield
TMDS Data2-	3	12	TMDS Clock-
TMDS Data1+	4	13	CEC
TMDS Data1 Shield	5	14	Reserved
TMDS Data1-	6	15	SCL
TMDS Data0+	7	16	SDA
TMDS Data0 Shield	8	17	GND
TMDA Data0-	9	18	+5V
		19	Hot Plug

CN3: DVI-D Connector

Signal Name	Pin #	Pin #	Signal Name
DATA 2-	1	16	HOT POWER
DATA 2+	2	17	DATA 0-
Shield 2/4	3	18	DATA 0+
DATA 4-	4	19	SHIELD 0/5
DATA 4+	5	20	DATA 5-
DDC CLOCK	6	21	DATA 5+
DDC DATA	7	22	SHIELD CLK
N.C	8	23	CLOCK -
DATA 1-	9	24	CLOCK +
DATA 1+	10	C1	N.C.
SHIELD 1/3	11	C2	N.C.
DATA 3-	12	C3	N.C.
DATA 3+	13	C4	N.C.
DDC POWER	14	C5	N.C.
A GROUND 1	15	C6	N.C.

CN4: USB3.0

CN5: Display Port

CN6, CN8, CN9, CN11: SATA Connectors
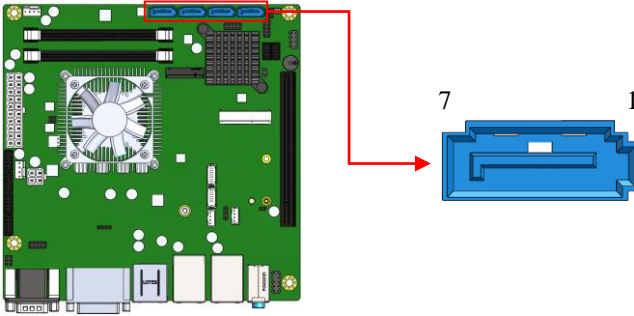
Pin #	Signal Name
1	Ground
2	TX+
3	TX-
4	Ground
5	RX-
6	RX+
7	Ground

CN7: Gigabit LAN (I219LM/V) + USB3 3/4

CN8: SATA Port 5

CN9: SATA Port 2

CN10: Gigabit LAN (I211AT) + USB3 5/6

CN11: SATA #3

CN12: HD Audio Connector

J1, J2, J3, J4: COM6, COM5, COM4, COM3 RS232 Serial Ports

9   10

1   2
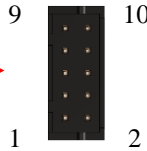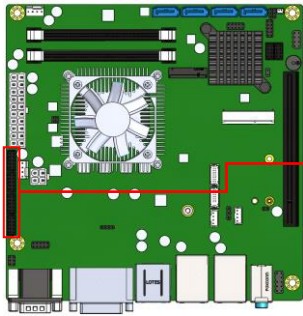
Signal Name	Pin #	Pin #	Signal Name
DCD#	1	6	DSR#
SIN#	2	7	RTS#
SOUT	3	8	CTS#
DTR#	4	9	RI#
GND	5	X	KEY

J5: ATX Power Supply Connector

10   20

1   11
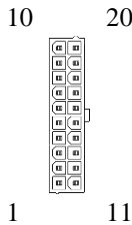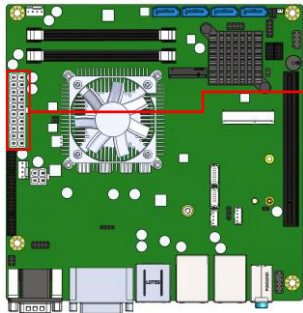
Signal Name	Pin #	Pin #	Signal Name
3.3V	11	1	3.3V
-12V	12	2	3.3V
Ground	13	3	Ground
PS-ON	14	4	+5V
Ground	15	5	Ground
Ground	16	6	+5V
Ground	17	7	Ground
-5V	18	8	Power good
+5V	19	9	5VSB
+5V	20	10	+12V

J6: Digital I/O Connector (4 in, 4 out)

2   10

1   9
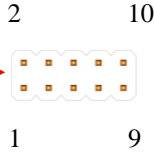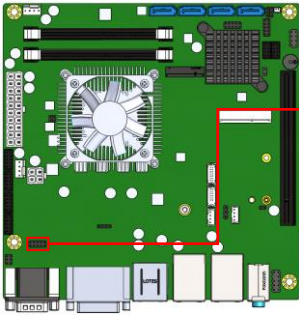
Signal Name	Pin #	Pin #	Signal Name
Ground	1	2	+5V
Out3	3	4	Out1
Out2	5	6	Out0
IN3	7	8	IN1
IN2	9	10	IN0

J7: ATX 12V Power Connector

This connector supplies the CPU operating voltage.

2   4

1   3
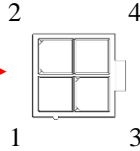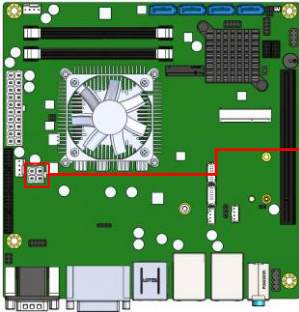
Pin #	Signal Name
1	Ground
2	Ground
3	+12V
4	+12V

J10, J11: PCI Express (16x) Bifurcation
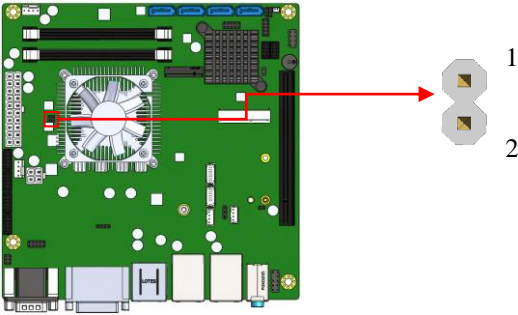
	J10	**J11**
X16 (Default)	Open	Open
X8,X8	Open	Close
X8, X4, X4	Close	Close

J12: DDR4 SO-DIMM CHA
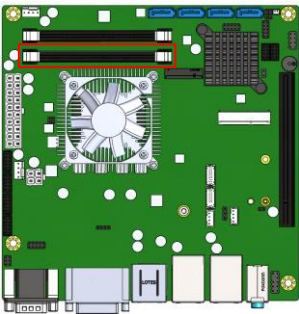
J13: DDR4 SO-DIMM CHB
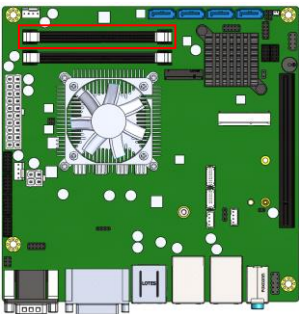
J15: M.2 Socket M-Key (PCIe x4/SATA #0)
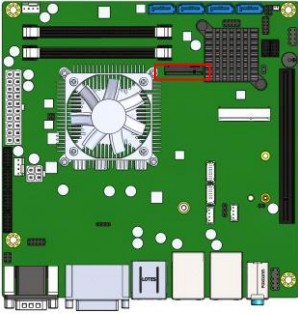
J18: mPCIe/mSATA (SATA #1)
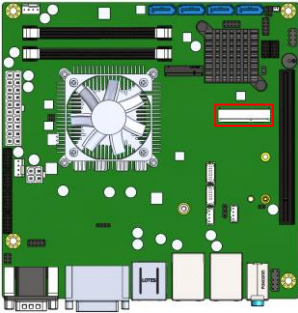
J23: Audio Pin Header for Chassis Front Panel
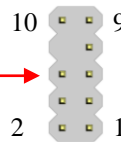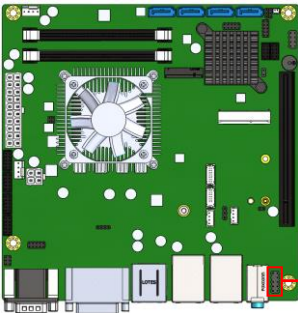
Signal Name	Pin	Pin	Signal Name
MIC IN_L	1	2	Ground
MIC IN_R	3	4	DET
LINE_R	5	6	Ground
Sense	7	8	KEY
LINE_L	9	10	Ground

J25: Front Panel Connector
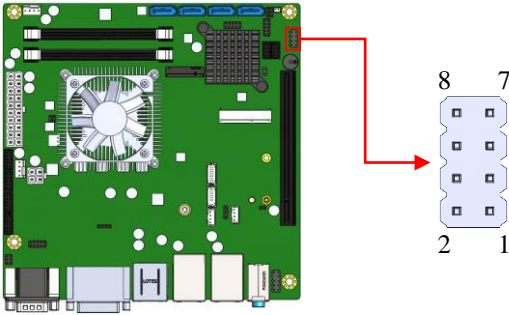
Signal Name	Pin #	Pin #	Signal Name
Power BTN	1	2	Power BTN
HDD LED+	3	4	HDD LED-
Reset BTN	5	6	Reset BTN
Power LED+	7	8	Power LED-

J26: mPCIe/mSATA (SATA #6) (MI990VF series only)
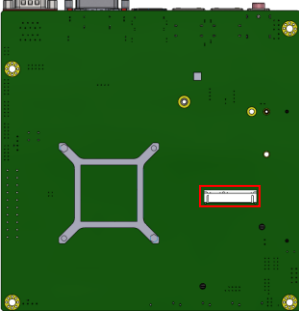
JP2: LCD Backlight Connector

4

1
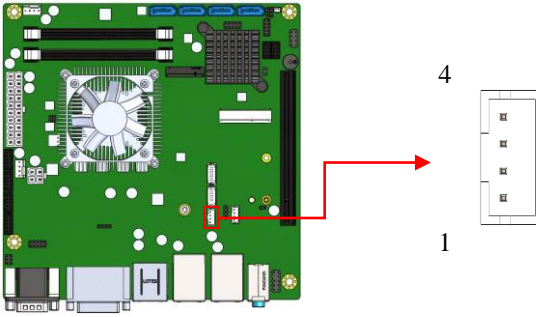
Pin #	Signal Name
1	+12V
2	Backlight Enable
3	Brightness Control
4	Ground

JP4, JP3: LVDS Connectors
JP3: LVDS CHB
JP4: LVDS CHA
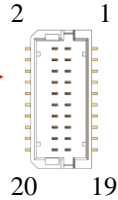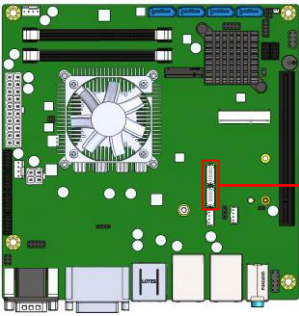
Signal Name	Pin #	Pin #	Signal Name
TX0N	2	1	TX0P
Ground	4	3	Ground
TX1N	6	5	TX1P
Ground	8	7	Ground
TX2N	10	9	TX2P
Ground	12	11	Ground
CLKN	14	13	CLKP
Ground	16	15	Ground
TX3N	18	17	TX3P
Power	20	19	Power

JP5: SPI Flash Connector (Factory use only)
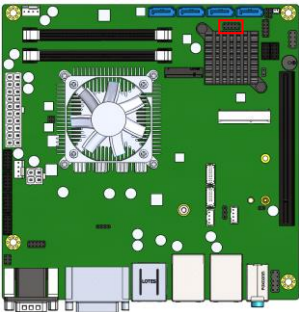
JP6: USB7/USB8 Connector
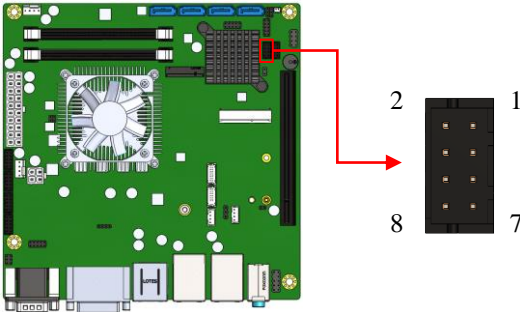
Signal Name	Pin #	Pin #	Signal Name
VCC	1	2	Ground
D0-	3	4	D1+
D0+	5	6	D1-
Ground	7	8	VCC

JP7: LPC Debug Connector (Factory use only)
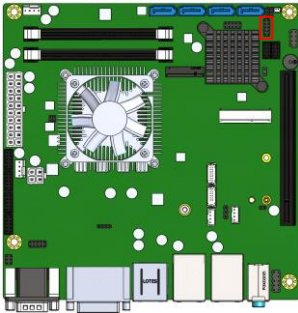
JP8: USB2 11/12 Connector
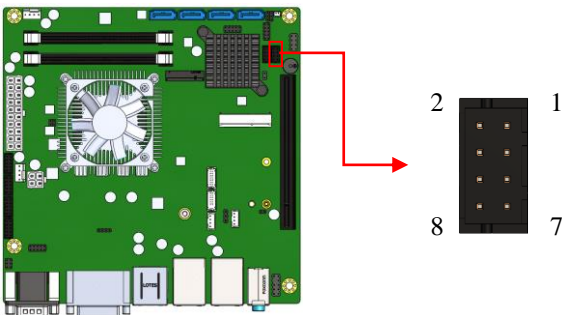
CPU_FAN1: CPU Fan Power Connector (PWM Only)

4

1
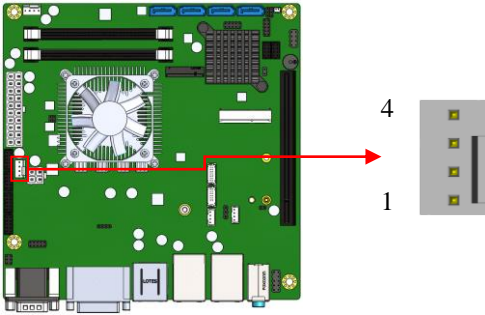
Pin #	Signal Name
1	Ground
2	+12V
3	Rotation detection
4	Control

SYS_FAN1: System Fan Power Connector (PWM/DC Mode)

4   1
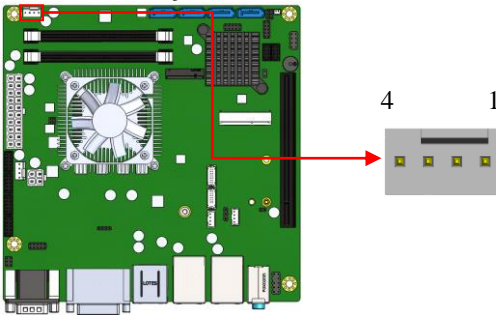
Pin #	Signal Name
1	Ground
2	+12V
3	Rotation detection
4	Control

BIOS Setup

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

BIOS Introduction

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

BIOS Setup

The BIOS provides a Setup utility program for specifying the system configurations and settings. The BIOS ROM of the system stores the Setup utility. When you turn on the computer, the BIOS is immediately activated. Pressing the <Del> key immediately allows you to enter the Setup utility. If you are a little bit late pressing the <Del> key, POST (Power On Self Test) will continue with its test routines, thus preventing you from invoking the Setup. If you still wish to enter Setup, restart the system by pressing the "Reset" button or simultaneously pressing the <Ctrl>, <Alt> and <Delete> keys. You can also restart by turning the system Off and back On again. The following message will appear on the screen:

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

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

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

Warning: *It is strongly recommended that you avoid making any changes to the chipset defaults. These defaults have been carefully chosen by both AMI and your system manufacturer to provide the absolute maximum performance and reliability. Changing the defaults could cause the system to become unstable and crash in some cases.*

Main Settings

Aptio Setup Utility – Copyright © 2011 American Megatrends, Inc.

Main	Advanced	Chipset	Security	Boot	Save & Exit
					Choose the system default language
					→ ←**Select Screen**
System Date			[Mon 01/11/2016]		↑ ↓ **Select Item**
System Time			[21:52:06]		**Enter: Select**
					+- Change Field
					F1: General Help
					F2: Previous Values
					F3: Optimized Default
					F4: Save ESC: Exit

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

System Time
Set the Time. Use Tab to switch between Data elements.

Advanced Settings

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

Aptio Setup Utility

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

►Trusted Computing
► ACPI Settings
► iSmart Controller
► AMT Configuration
► F81866 Super IO Configuration
► H/W Monitor
► CPU Configuration
► SATA Configuration
► CSM Configuration
► Trusted Computing
► USB Configuration

```
→ ←Select Screen
↑↓ Select Item
Enter: Select
+-  Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save  ESC: Exit
```

Trusted Computing

Aptio Setup Utility

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

TPM Configuration
 TPM SUPPORT   Disabled

Current TPM Status Information
 TPM SUPPORT OFF

```
→ ←Select Screen
↑↓ Select Item
Enter: Select
+-  Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save  ESC: Exit
```

TPM Support

This configuration is supported only with MI990VF. Enables or Disables TPM support. O.S. will not show TPM. Reset of platform is required.

ACPI Settings

Aptio Setup Utility

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

ACPI Settings

Enable Hibernation   Enabled
ACPI Sleep State   S3 (Suspend to R…)
Lock Legacy Resources   Disabled
S3 Video Repost   Disabled

```
→ ←Select Screen
↑ ↓ Select Item
Enter: Select
+-   Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save  ESC: Exit
```

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

ACPI Sleep State
Select ACPI sleep state the system will enter, when the SUSPEND button is pressed.

Lock Legacy Resources
Enabled or Disabled Lock of Legacy Resources.

S3 Video Repost
Enable or disable S3 Video Repost.

iSmart Controller

Aptio Setup Utility

Main	Advanced	Chipset	Security	Boot	Save & Exit

iSmart Controller

Power-On after Power failure   Disable
Temperature Guardian   Disable
Schedule Slot 1   None
Schedule Slot 2   None

→ ←Select Screen
↑ ↓ Select Item
Enter: Select
+- Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save ESC: Exit

Power-On after Power failure

This field sets the system power status whether *Disable or Enable* when power returns to the system from a power failure situation.

Temperature Guardian

Generate the reset signal when system hangs up on POST

Schedule Slot 1 / 2

Setup the hour/minute for system power on.

AMT Configuration

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

Intel AMT	Enabled	
BIOS Hotkey Pressed	Disabled	
MEBx Selection Screen	Disabled	
Hide Un-Configure ME Confirmation Prompt	Disabled	
Un-Configure ME	Disabled	
Amt Wait Timer	0	
Activate Remote Assistance Process	Disabled	→ ←Select Screen
USB Configure	Enabled	↑↓ Select Item
PET Progress	Enabled	Enter: Select
AMT CIRA Timeout	0	+- Change Field
Watchdog	Disabled	F1: General Help
OS Timer	0	F2: Previous Values
BIOS Timer	0	F3: Optimized Default
		F4: Save ESC: Exit

AMT Configuration
This configuration is supported only with MI990VF (with iAMT function). Options are Enabled and Disabled.
Note: iAMT H/W is always enabled. This option just controls the BIOS extension execution. If enabled, this requires additional firmware in the SPI device.

Unconfigure ME
This configuration is supported only with MI990VF (with iAMT function). Perform AMT/ME unconfigure without password operation.

Amt Wait Timer
Set timer to wait before sending ASF_GET_BOOT_OPTIONS.

Activate Remote Assistance Process
Trigger CIRA boot.

PET Progress
User can Enable/Disable PET Events progress to receive PET events or not.

Watchdog Timer
This configuration is supported only with MI990VF (with iAMT function). Enable/Disable Watchdog Timer.

F81866 Super IO Configuration

Aptio Setup Utility

Main	Advanced	Chipset	Security	Boot	Save & Exit
F81866 Super IO Configuration					
Super IO Chip		F81866			
Standby Power on S5		All Enable			
					→ ←Select Screen
► Serial Port 1 Configuration					↑↓ Select Item
► Serial Port 2 Configuration					Enter: Select
► Serial Port 3 Configuration					+- Change Field
► Serial Port 4 Configuration					F1: General Help
► Serial Port 5 Configuration					F2: Previous Values
► Serial Port 6 Configuration					F3: Optimized Default
					F4: Save ESC: Exit

Standby Power on S5

This configuration is supported only with MI990EF.

Serial Port Configuration

Set Parameters of Serial Ports. User can Enable/Disable the serial port and Select an optimal settings for the Super IO Device.

H/W Monitor

Aptio Setup Utility

Main	**Advanced**	Chipset	Security	Boot	Save & Exit
PC Health Status					
CPU Fan smart fan control			Disabled		
SYS Fan smart fan control			Disabled		
CPU temperature			+33 C		
SYS temperature			+34 C		
CPU FAN Speed			6849 RPM		
SYS FAN Speed			0 RPM		→ ←**Select Screen**
VCORE			+0.992 V		↑↓ **Select Item**
+5V			+5.087 V		**Enter: Select**
+12V			+12.408 V		**+- Change Field**
Memory Voltage			+1.208 V		**F1: General Help**
VCC3V			+3.376V		**F2: Previous Values**
					F3: Optimized Default
CPU Shutdown Temperature			Disabled		**F4: Save ESC: Exit**

CPU/SYS smart fan control
This field enables or disables the smart fan feature.
Disabled (default)
50 ℃
60 ℃
70 ℃
80 ℃
90 ℃

Temperatures/Voltages
These fields are the parameters of the hardware monitoring function feature of the motherboard. The values are read-only values as monitored by the system and show the PC health status.

CPU Shutdown Temperature
The default setting is Disabled.

CPU Configuration

This section shows the CPU configuration parameters.

Aptio Setup Utility – Copyright © 2012 American Megatrends, Inc.

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

```
CPU Configuration
Intel(R) CPU Core(TM)i5-6440EQ CPU @ 2.70GHz
CPU Signature              506E3
Microcode Patch            39
Processor Cores            4
Hyper Threading  Technology    Not Supported     → ←Select Screen
Intel VT-x Technology          Supported         ↑↓ Select Item
Intel SMX Technology           Supported         Enter: Select
64-bit                         Supported         +-  Change Field
EIST Technology                Supported         F1: General Help
                                                 F2: Previous Values
Intel(R) SpeedStep(tm)         Enabled           F3: Optimized Default
   Turbo Mode                  Enabled           F4: Save  ESC: Exit
```

Intel(R) SpeedStep(tm)

Allows more than two frequency ranges to be supported.

SATA Configuration
SATA Devices Configuration.

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Main	**Advanced**	Chipset	Security	Boot	Save & Exit
SATA Controller(s)			Enabled		
SATA Mode Selection			AHCI		
SATA Port0			Empty		
Software Preserve			Unknown		
Hot Plug			Disabled		
SATA Port1			Empty		
Software Preserve			Unknown		
Hot Plug			Disabled		
SATA Port2			Empty		
Software Preserve			Unknown		
Hot Plug			Disabled		→ ←Select Screen
SATA Port3			Empty		↑↓ Select Item
Software Preserve			Unknown		Enter: Select
Hot Plug			Disabled		+- Change Opt.
SATA Port4			Empty		F1: General Help
Software Preserve			Unknown		F2: Previous Values
Hot Plug			Disabled		F3: Optimized Defaults
SATA Port5			Empty		F4: Save & Exit
Software Preserve			Unknown		ESC: Exit
Hot Plug			Disabled		

SATA Controller(s)
Enable or disable SATA Device.

SATA Mode Selection
Determines how SATA controller(s) operate.
(1) AHCI Mode.
(2) RAID Mode. (MI990VF seriesonly)

Hot Plug
Designates this port as Hot Pluggable.

CSM Configuration

Main	**Advanced**	Chipset	Security	Boot	Save & Exit

Option ROM execution

Network   Do not launch

→ ←Select Screen
↑↓ Select Item
Enter: Select
+- Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save
ESC: Exit

Network
Controls the execution of UEFI and Legacy PXE OpROM

USB Configuration

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Main	**Advanced**	Chipset	Boot	Security	Save & Exit

USB Configuration

USB Module Version   12

USB Controllers:
      1 XHCI
USB Devices:
      2 Keyboards, 1 Mouse, 2 Hubs

Legacy USB Support   Enabled
XHCI Hand-off   Enabled
USB Mass Storage Driver Support   Enabled
Port 60/64 Emulation   Disabled

USB hardware delays and time-outs:
USB Transfer time-out   20 sec
Device reset tine-out   20 sec
Device power-up delay   Auto

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

Legacy USB Support
Enables Legacy USB support.
AUTO option disables legacy support if no USB devices are connected.
DISABLE option will keep USB devices available only for EFI
applications.

XHCI Hand-off
This is a workaround for OSes without XHCI hand-off support. The XHCI ownership change should be claimed by XHCI driver.

USB Mass Storage Driver Support
Enable/Disable USB Mass Storage Driver Support.

Port 60/64 Emulation
Enables I/O port 60h/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OSes.

USB Transfer time-out
The time-out value for Control, Bulk, and Interrupt transfers.

Device reset tine-out
USB mass Storage device start Unit command time-out.

Device power-up delay
Maximum time the device will take before it properly reports itself to the Host Controller. 'Auto' uses default value: for a Root port it is 100ms, for a Hub port the delay is taken from Hub descriptor.

Chipset Settings

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

Aptio Setup Utility

Main	Advanced	**Chipset**	Security	Boot	Save & Exit
					→ ←Select Screen
► System Agent (SA) Configuration					↑ ↓ Select Item
► LCD Control					Enter: Select
► PCH-IO Configuration					+- Change Field
					F1: General Help
					F2: Previous Values
					F3: Optimized Default
					F4: Save ESC: Exit

System Agent (SA) Configuration

Aptio Setup Utility

Main	Advanced	**Chipset**	Security	Boot	Save & Exit
System Agent Bridge Name		Skylake			
SA PCIe Code Version		1.5.0.0			→ ←Select Screen
VT-d		Supported			↑ ↓ Select Item
					Enter: Select
VT-d		Enabled			+- Change Field
					F1: General Help
► Graphics Configuration					F2: Previous Values
► Memory Configuration					F3: Optimized Default
					F4: Save ESC: Exit

VT-d

Check to enable VT-d function on MCH.

Graphics Configuration

Main	Advanced	**Chipset**	Security	Boot	Save & Exit

Graphics Configuration		
IGFX VBIOS Version	1032	
Graphics Turbo IMON Current	31	
Skip Scanning of External Gfx Card	Disabled	
Primary Display	Auto	→ ←**Select Screen**
Primary PEG	Auto	↑↓ **Select Item**
Primary PCIE	Auto	**Enter: Select**
Internal Graphics	Auto	**+- Change Field**
GTT Size	8MB	**F1: General Help**
Aperture Size	256MB	**F2: Previous Values**
DVMT Pre-Allocated	32M	**F3: Optimized Default**
DVMT Total Gfx Mem	256MB	**F4: Save ESC: Exit**

Graphics Turbo IMON Current
Graphics turbo IMON current values supported (14-31)

Skip Scanning of External Gfx Card
If Enable, it will not scan for External Gfx Card on PEG and PCH PCIE ports.

Primary Display
Select which of IGFX/PEG/PCI graphics device should be primary display or select SG for switchable Gfx.

Primary PEG
Select PEGO/PEG1/PEG2/PEG3 Graphics device should be Primary PEG.

Primary PCIE
Select PCIE0/PCIE1/PCIE2/PCIE3/PCIE4/PCIE5/PCIE6PCIE7 Graphics device should be primary PCIE.

Internal Graphics
Keep IGD enabled based on the setup options.

DVMT Pre-Allocated
Select DVMT 5.0 Pre-Allocated (Fixed) graphics memory size used by the internal graphics device.

DVMT Total Gfx Mem
Select DVMT 5.0 total graphics memory size used by the internal graphics device.

Memory Configuration

Main	Advanced	Chipset	Security	Boot	Save & Exit
Memory Information					→ ←Select Screen
					↑ ↓ Select Item
Memory RC Version		1.5.0.0			Enter: Select
Memory Frequency		2133 MHz			+- Change Field
Total Memory		16384 MB			F1: General Help
					F2: Previous Values
					F3: Optimized Default
					F4: Save ESC: Exit

LCD Control

Aptio Setup Utility

Main	Advanced	Chipset	Security	Boot	Save & Exit
LCD Control					→ ←Select Screen
					↑ ↓ Select Item
LCD Control		Disabled			Enter: Select
					+- Change Field
					F1: General Help
					F2: Previous Values
					F3: Optimized Default
					F4: Save ESC: Exit

LCD Control
Configuring LFP usage

PCH-IO Configuration

This section allows you to configure the North Bridge Chipset.

Aptio Setup Utility

Main	Advanced	Chipset	Security	Boot	Save & Exit

Intel PCH RC Version	1.5.0.0
Intel PCH SKU Name	Server SKU Intel CM236 Chipset
Intel PCH Rev ID	31/D1
PCH LAN Controller	Enabled
Wake on LAN	Disabled

→ ←   **Select Screen**
↑ ↓ **Select Item**
Enter: Select
+-   Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save   ESC: Exit

PCH LAN Controller

Enable or disable onboard NIC.

Wake on LAN

Enable or disable integrated LAN to wake the system. (The Wake On LAN cannot be disabled if ME is on at Sx state.)

Security Settings

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

Aptio Setup Utility

Main	Advanced	Chipset	Security	Boot	Save & Exit

Password Description

If ONLY the Administrator's password is set, then this only limit access to Setup and is only asked for when entering Setup.
If ONLY the User's password is set, then this is a power on password and must be entered to boot or enter Setup. In Setup the User will have Administrator rights
The password length must be
in the following range:

Minimum length   3
Maximum length   20

Administrator Password
User Password

→ ←Select Screen
↑ ↓ Select Item
Enter: Select
+-   Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save ESC: Exit

Administrator Password
Set Setup Administrator Password.

User Password
Set User Password.

Boot Settings

This section allows you to configure the boot settings.

<table>
<tr><td colspan="6" align="center">**Aptio Setup Utility**</td></tr>
<tr><td>Main</td><td>Advanced</td><td>Chipset</td><td>Security</td><td>**Boot**</td><td>Save & Exit</td></tr>
<tr><td colspan="3">Boot Configuration</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Setup Prompt Timeout</td><td>1</td><td></td><td></td></tr>
<tr><td colspan="3">Bootup NumLock State</td><td>Off</td><td></td><td></td></tr>
<tr><td colspan="3">Quiet Boot</td><td>Disabled</td><td></td><td></td></tr>
<tr><td colspan="3">Fast Boot</td><td>Disabled</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">New Boot Option Policy</td><td>Default</td><td></td><td></td></tr>
<tr><td colspan="3">Boot mode Select</td><td>LEGACY</td><td></td><td></td></tr>
<tr><td colspan="3"></td><td></td><td></td><td></td></tr>
<tr><td colspan="3">FIXED BOOT ORDER Priorities</td><td></td><td></td><td></td></tr>
<tr><td colspan="3">Boot Option #1</td><td>Hard Disk</td><td></td><td></td></tr>
<tr><td colspan="3">Boot Option #2</td><td>CD/DVD</td><td></td><td>→ ←Select Screen</td></tr>
<tr><td colspan="3">Boot Option #3</td><td>USB Hard Disk</td><td></td><td>↑↓ Select Item</td></tr>
<tr><td colspan="3">Boot Option #4</td><td>USB CD/DVD</td><td></td><td>Enter: Select</td></tr>
<tr><td colspan="3">Boot Option #5</td><td>USB Key</td><td></td><td>+- Change Field</td></tr>
<tr><td colspan="3">Boot Option #6</td><td>USB Floppy</td><td></td><td>F1: General Help</td></tr>
<tr><td colspan="3">Boot Option #7</td><td>USB Lan</td><td></td><td>F2: Previous Values</td></tr>
<tr><td colspan="3">Boot Option #8</td><td>Network</td><td></td><td>F3: Optimized Default</td></tr>
<tr><td colspan="3"></td><td></td><td></td><td>F4: Save ESC: Exit</td></tr>
</table>

Setup Prompt Timeout
Number of seconds to wait for setup activation key.
65535(0xFFFF) means indefinite waiting.

Bootup NumLock State
Select the keyboard NumLock state.

Quiet Boot
Enables/Disables Quiet Boot option.

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

New Boot Option Policy
Controls the placement of newly detected UEFI boot option.

FIXED BOOT ORDER Priorities
Sets the system boot order.

Save & Exit Settings

Main	Advanced	Chipset	Security	Boot	**Save & Exit**
Save Changes and Exit					
Discard Changes and Exit					
Save Changes and Reset					
Discard Changes and Reset					
					→ ←Select Screen
Save Options					↑↓ Select Item
Save Changes					Enter: Select
Discard Changes					+- Change Field
					F1: General Help
Restore Defaults					F2: Previous Values
Save as User Defaults					F3: Optimized Default
Restore User Defaults					F4: Save ESC: Exit

Save Changes and Exit
Exit system setup after saving the changes.

Discard Changes and Exit
Exit system setup without saving any changes.

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

Discard Changes and Reset
Reset system setup without saving any changes.

Save Changes
Save Changes done so far to any of the setup options.

Discard Changes
Discard Changes done so far to any of the setup options.

Restore Defaults
Restore/Load Defaults values for all the setup options.

Save as User Defaults
Save the changes done so far as User Defaults.

Restore User Defaults
Restore the User Defaults to all the setup options.

Drivers Installation

This section describes the installation procedures for software and drivers. The software and drivers are included with the motherboard. If you find the items missing, please contact the vendor where you made the purchase. The contents of this section include the following:

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

Intel Chipset Software Installation Utility

The Intel Chipset Drivers should be installed first before the software drivers to enable Plug & Play INF support for Intel chipset components. Follow the instructions below to complete the installation.
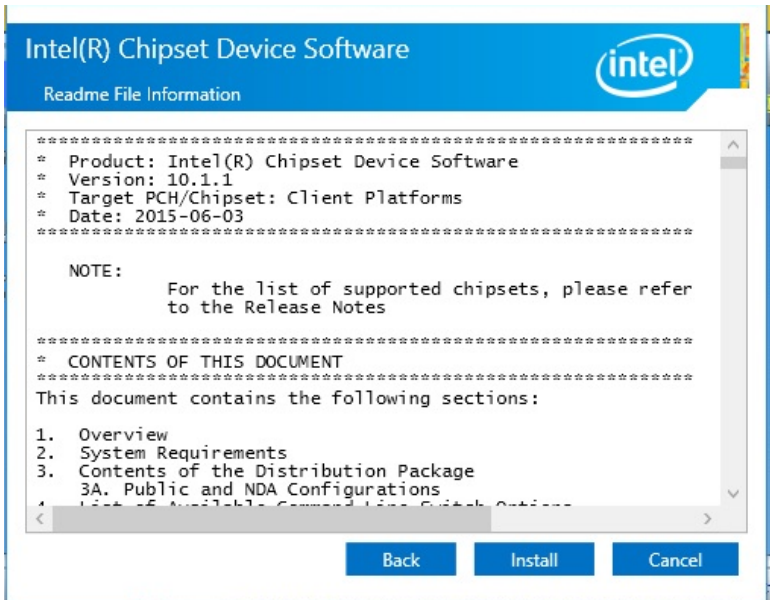
1. Insert the DVD that comes with the board. Click *Intel* and then *Intel(R) Skylake Chipset Drivers*.

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

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

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

5. On the Readme File Information screen, click **Install** to continue the installation.

6. The Setup process is now complete. Click **Finish** to restart the computer and for changes to take effect.

VGA Drivers Installation

1. Insert the DVD that comes with the board. Click *Intel* and then *Intel(R) Skylake Chipset Drivers*.

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

3. When the Welcome screen appears, click *Next* to continue.

4. Click *Yes* to to agree with the license agreement and continue the installation.

5. On the screen shown below, click *Install* to continue.

6. Setup complete. Click *Finish* to restart the computer and for changes to take effect.
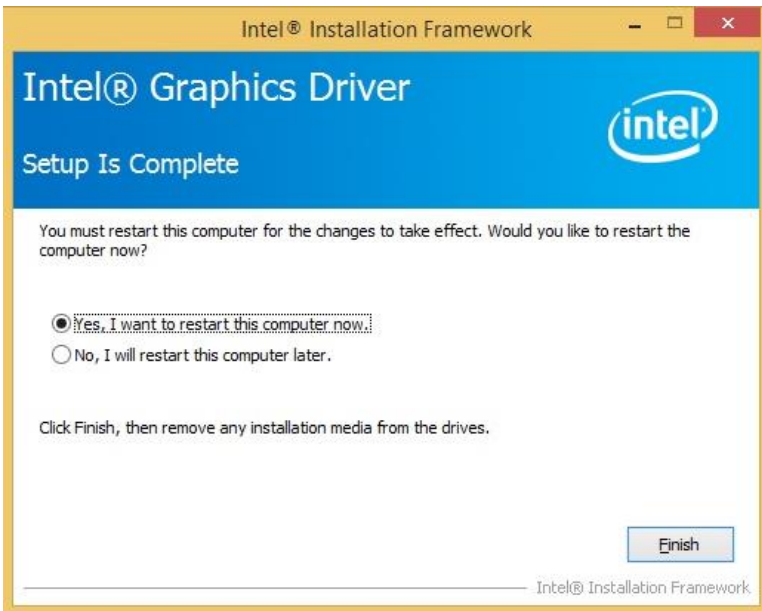
Realtek HD Audio Driver Installation

1. Insert the DVD that comes with the board. Click *Intel* and then *Intel(R) Skylake Chipset Drivers*.

2. Click *Realtek High Definition Audio Driver.*

3. On the Welcome to the InstallShield Wizard screen, click *Next* to proceed with and complete the installation process.
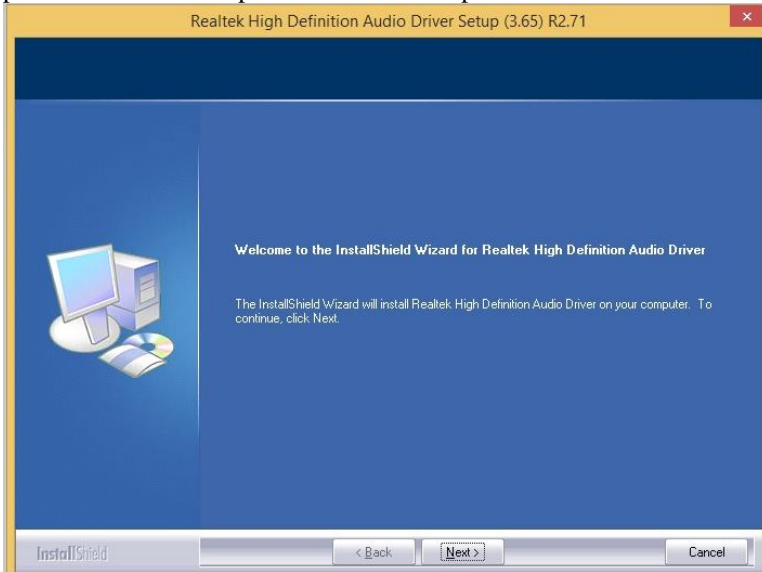
4. The InstallShield Wizard Complete. Click *Finish* to restart the computer and for changes to take effect.

LAN Drivers Installation

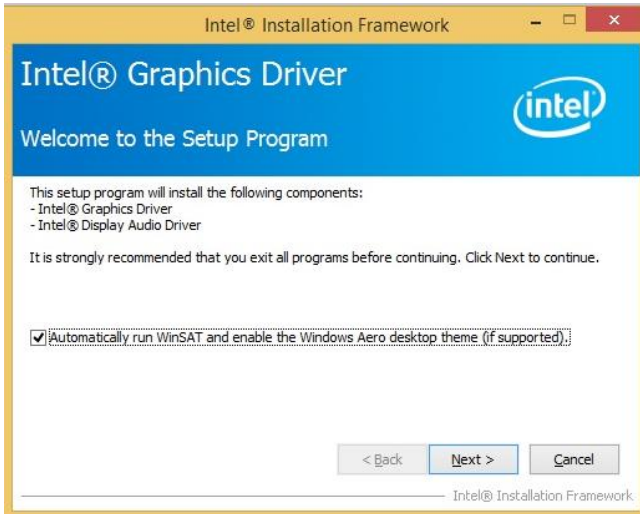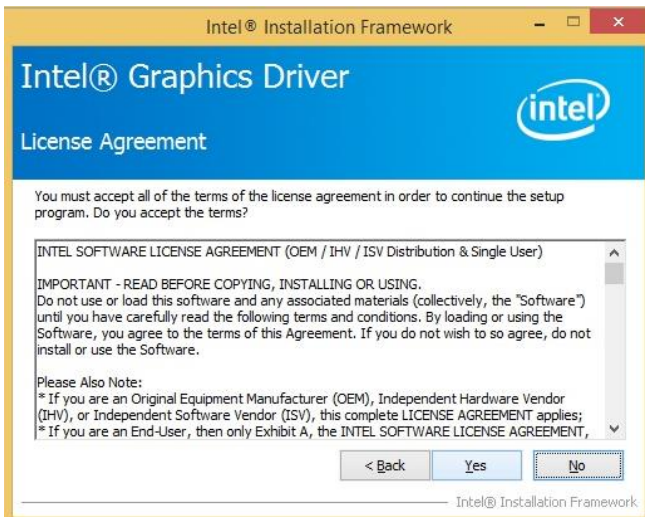1. Insert the DVD that comes with the board. Click *Intel* and then *Intel(R) Skylake Chipset Drivers*.

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

3. Click *Install Drivers and Software.*

4. When the Welcome screen appears, click *Next*.
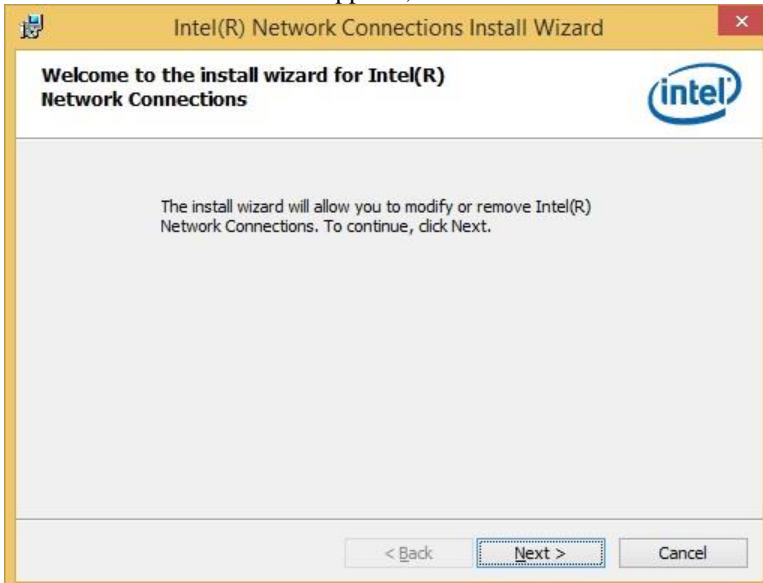
5. Click *Next* to to agree with the license agreement.

6. Click the checkbox for **Drivers** in the Setup Options screen to select it and click **Next** to continue.
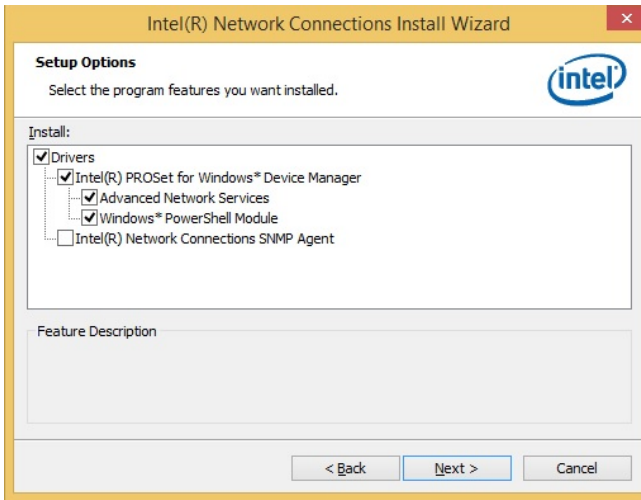
7. The wizard is ready to begin installation. Click *Install* to begin the installation.
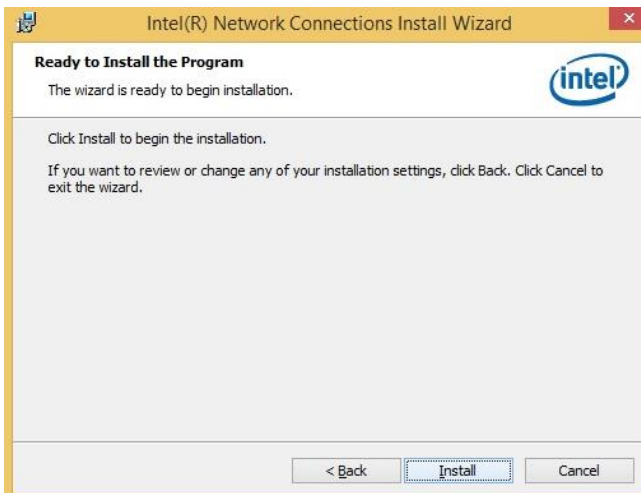
8. When InstallShield Wizard is complete, click *Finish*.

Intel® Management Engine Interface

1. Insert the DVD that comes with the board. Click *Intel* and then
Intel(R) Skylake Chipset Drivers.

2. When the Welcome screen to the InstallShield Wizard for Intel® Management Engine Components, click the checkbox for **Install Intel® Control Center** & click *Next*.
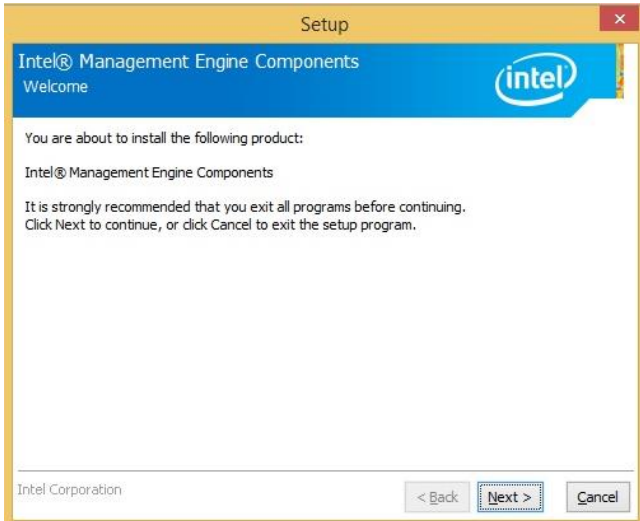
3. Click *Next* to to agree with the license agreement.
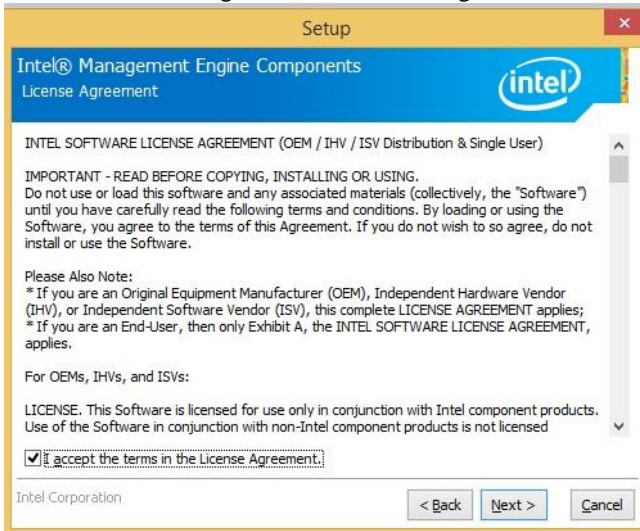
4. When the Setup Progress screen appears, click *Next*. Then, click *Finish* when the setup progress has been successfully installed.

Intel® USB 3.0 Drivers

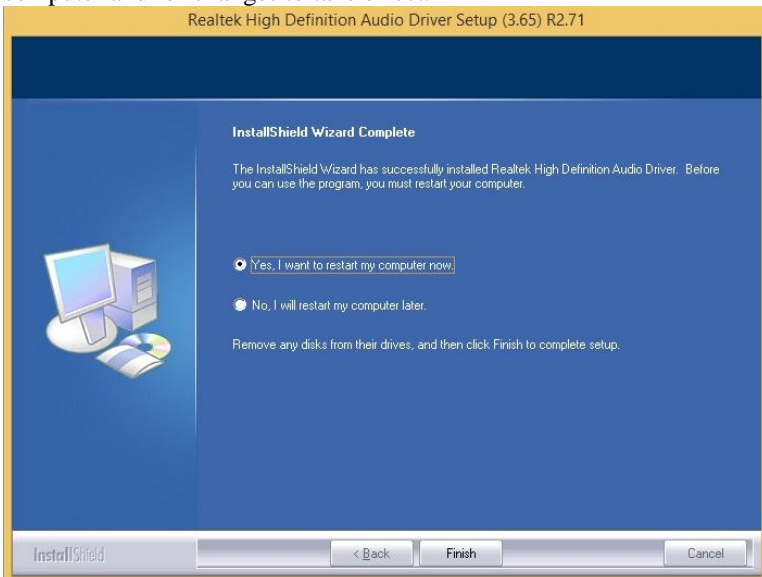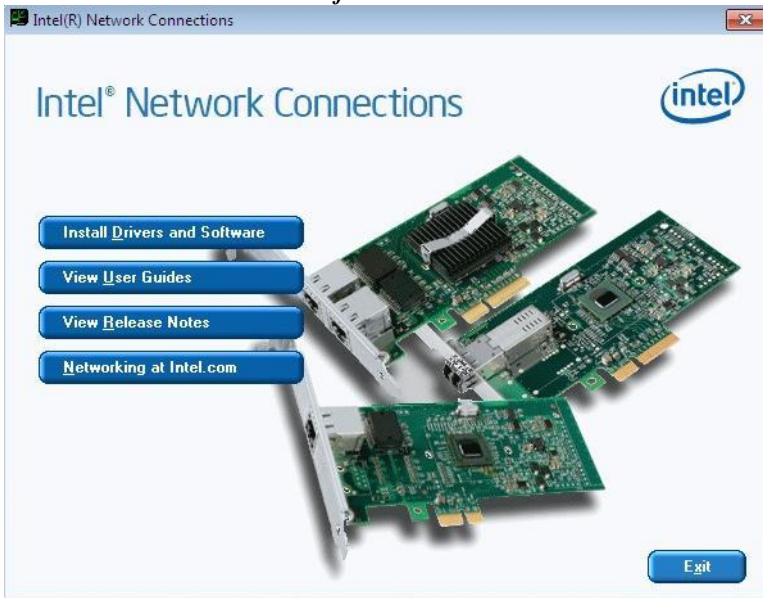1. Insert the DVD that comes with the board. Click *Intel* and then *Intel(R) Skylake Chipset Drivers*.

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

3. When the Welcome screen to the InstallShield Wizard for Intel® USB 3.0 eXtensible Host Controller Driver, click *Next*.
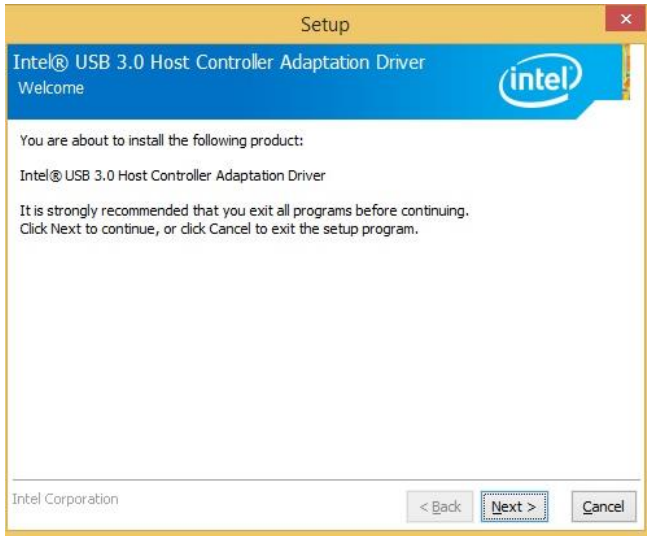
4. Click *Next* to to agree with the license agreement and continue the installation.
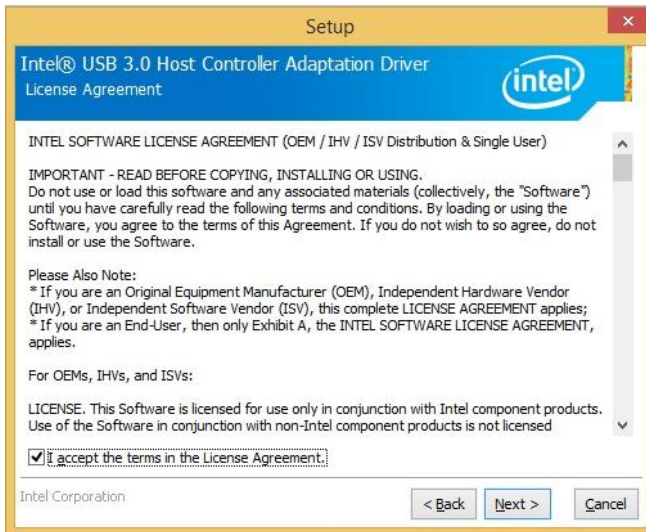
5. On the Readme File Information screen, click **Next** to continue the installation of the Intel® USB 3.0 eXtensible Host Controller Driver.

6. Setup complete. Click **Finish** to restart the computer and for changes to take effect.

Appendix

A. I/O Port Address Map

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

Address	Device Description
0000h-0CF7h	PCI Express Root Complex
0040h-0043h	System timer
0050h-0053h	System timer
0070h-0070h	System CMOS/real time clock
00F0h-00F0h	Numeric data processor
02E0h-02E7h	Communications Port (COM6)
02E8h-02EFh	Communications Port (COM4)
02F0h-02F7h	Communications Port (COM5)
02F8h-02FFh	Communications Port (COM2)
03B0h-03BBh	Intel(R) HD Graphics 530
03C0h-03DFh	Intel(R) HD Graphics 530
03E8h-03EFh	Communications Port (COM3)
03F8h-03FFh	Communications Port (COM1)
0D00h-FFFFh	PCI Express Root Complex
E000h-EFFFh	Intel(R) 100 Series/C230 Series Chipset Family PCI Express Root Port #6 - A115
F000h-F03Fh	Intel(R) HD Graphics 530
F040h-F05Fh	Intel(R) 100 Series/C230 Series Chipset SMBus - A123
F060h-F07Fh	Standard SATA AHCI Controller
F080h-F083h	Standard SATA AHCI Controller
F090h-F097h	Standard SATA AHCI Controller
F0A0h-F0A7h	Intel(R) Active Management Technology - SOL (COM7)

B. Interrupt Request Lines (IRQ)

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

Level	Function
IRQ0	System Timer
IRQ3	Serial Port #2
IRQ4	Serial Port #1
IRQ5	Serial Port #3
IRQ7	Serial Port #4
IRQ8	Real Time Clock
IRQ 10	Serial Port #5
IRQ 11	Serial Port #6
IRQ 11	High Definition Audio Controller
IRQ 11	Intel(R) 100 Series/C230 Series Chipset Family Integrated Sensor Hub
IRQ 13	Numeric data processor
IRQ 19	Intel(R) Active Management Technology - SOL (COM7)

C. Watchdog Timer Configuration

The WDT is used to generate a variety of output signals after a user programmable count. The WDT is suitable for use in the prevention of system lock-up, such as when software becomes trapped in a deadlock. Under these sorts of circumstances, the timer will count to zero and the selected outputs will be driven. Under normal circumstance, the user will restart the WDT at regular intervals before the timer counts to zero.

SAMPLE CODE:

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

        char SIO;

        printf("Fintek 81866 watch dog program\n");

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

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

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

        if (bTime)
        {       EnableWDT(bTime); }
        else
        {       DisableWDT();     }

        return 0;
```

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

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

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

        bBuf = Get_F81866_Reg(0xF5);
        bBuf &= (~0x0F);
        bBuf |= 0x52;
        Set_F81866_Reg(0xF5, bBuf);                     //count mode is second

        Set_F81866_Reg(0xF6, interval);         //set timer

        bBuf = Get_F81866_Reg(0xFA);
        bBuf |= 0x01;
        Set_F81866_Reg(0xFA, bBuf);                     //enable WDTO output

        bBuf = Get_F81866_Reg(0xF5);
        bBuf |= 0x20;
        Set_F81866_Reg(0xF5, bBuf);                     //start counting
}
//------------------------------------------------------------------------
void DisableWDT(void)
{
        unsigned char bBuf;

        Set_F81866_LD(0x07);                            //switch to logic device 7

        bBuf = Get_F81866_Reg(0xFA);
        bBuf &= ~0x01;
        Set_F81866_Reg(0xFA, bBuf);                     //disable WDTO output

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

```
//-----------------------------------------------------------------------
//
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// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-----------------------------------------------------------------------
#include "F81866.H"
#include <dos.h>
//-----------------------------------------------------------------------
unsigned int F81866_BASE;
void Unlock_F81866 (void);
void Lock_F81866 (void);
//-----------------------------------------------------------------------
unsigned int Init_F81866(void)
{
        unsigned int result;
        unsigned char ucDid;

        F81866_BASE = 0x4E;
        result = F81866_BASE;

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

        F81866_BASE = 0x2E;
        result = F81866_BASE;

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

        F81866_BASE = 0x00;
        result = F81866_BASE;

Init_Finish:
        return (result);
}
//-----------------------------------------------------------------------
void Unlock_F81866 (void)
{
        outportb(F81866_INDEX_PORT, F81866_UNLOCK);
        outportb(F81866_INDEX_PORT, F81866_UNLOCK);
}
//-----------------------------------------------------------------------
void Lock_F81866 (void)
{
        outportb(F81866_INDEX_PORT, F81866_LOCK);
}
//-----------------------------------------------------------------------
void Set_F81866_LD( unsigned char LD)
{
        Unlock_F81866();
        outportb(F81866_INDEX_PORT, F81866_REG_LD);
        outportb(F81866_DATA_PORT, LD);
        Lock_F81866();
}
//-----------------------------------------------------------------------
void Set_F81866_Reg( unsigned char REG, unsigned char DATA)
{
        Unlock_F81866();
        outportb(F81866_INDEX_PORT, REG);
        outportb(F81866_DATA_PORT, DATA);
        Lock_F81866();
}
//-----------------------------------------------------------------------
```

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

```
//-------------------------------------------------------------------------
//
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// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-------------------------------------------------------------------------
#ifndef __F81866_H
#define __F81866_H                      1
//-------------------------------------------------------------------------
#define      F81866_INDEX_PORT          (F81866_BASE)
#define      F81866_DATA_PORT           (F81866_BASE+1)
//-------------------------------------------------------------------------
#define      F81866_REG_LD              0x07
//-------------------------------------------------------------------------
#define F81866_UNLOCK             0x87
#define      F81866_LOCK                0xAA
//-------------------------------------------------------------------------
unsigned int Init_F81866(void);
void Set_F81866_LD( unsigned char);
void Set_F81866_Reg( unsigned char, unsigned char);
unsigned char Get_F81866_Reg( unsigned char);
//-------------------------------------------------------------------------
#endif //__F81866_H
```