ET960

Intel® QM87

COM-Express Module

USER'S MANUAL

Version 1.0

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Introduction

Product Description

The ET960 COM-Express Module is based on the latest Intel® QM87 chipset and comes with Type 6 pin-outs, fully complying with the PICMG (PCI Industrial Computer Manufactures Group) COM.0 R2.0 specification. The platform supports 5th generation Intel® Core processor family with BGA packing and features an integrated dual-channel DDR3 memory controller as well as a graphics core.

QM87 utilizes the 22-nanometer technology that supports Intel's first processor architecture to unite the CPU and the graphics core on the transistor level. The ET960 COM-Express Module uses the dramatic increase in performance provided this Intel's latest cutting-edge technology. Measuring 125mm x 95mm, the ET960 offers fast 6Gbps SATA, USB3.0 and DisplayPort interfaces. ET960 also features Intel Active Management Technology 8.0.

ET960F FEATURES:

- Supports Intel® 5th Generation Core i7 QC/DC mobile processors
- Two DDR3 SO-DIMM, 1333/1600MHz, Max. 16GB memory
- Intel® PCI-Express Gigabit LAN
- Integrated graphics for VGA/DisplayPort/LVDS displays
- 2x SATA 2.0, 2x SATA 3.0, 8x USB 2.0, USB 3.0 (4 ports)
- 1x PEG (x16), 7x PCI-E(x1)

Checklist

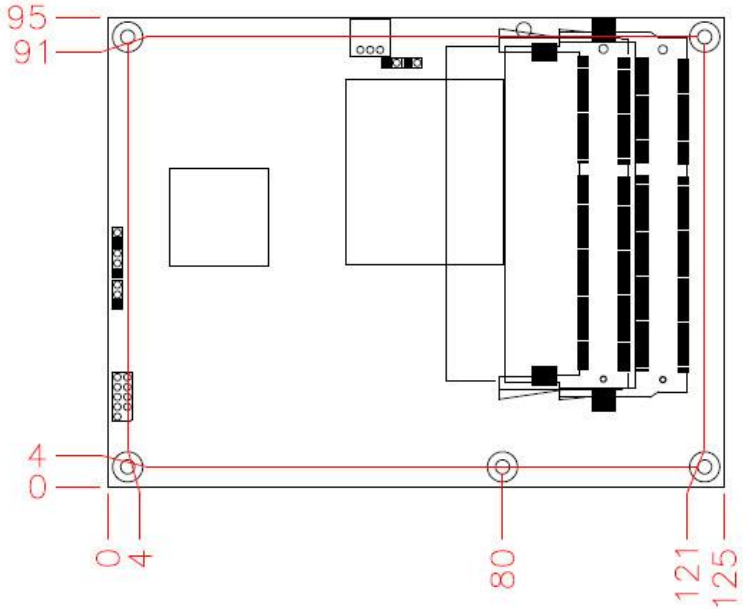
Your ET960 package should include the items listed below.

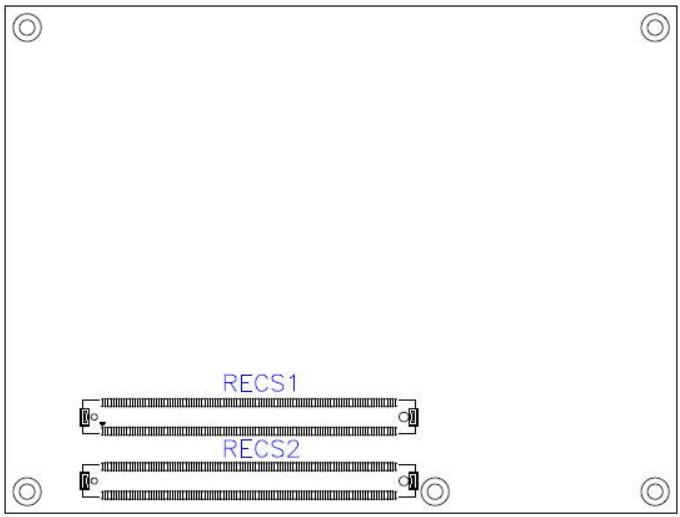
- The ET960 COM-Express Module
- This User's Manual
- 1 CD containing chipset drivers and flash memory utility
- 1 heat sink (Optional)

Specifications

Product Name	ET960-Q26 (i7- 5700EQ CPU on board) ET960-Q27e (i7- 5850QE CPU on board) "ET960-Q27e" will be the model name printed on PCB surface
Form Factor	COM Express Type 6
CPU Type	Intel® 5th generation Core™ H CPU BGA1364 , 22nm, 37.5mm x 32mm x 1.6mm
Chipset	Intel® BD82QM87 PCH (C013QM87000024200P) - 20mm x 20mm, TDP = 2.7W
BIOS	AMI BIOS
Memory	DDR3L-1333/1600 SO-DIMM x 2, Max. 16GB (Non-ECC), Dual-channel, horizotal type
VGA	Intel® 5th generation Core™ H CPU integrated HD graphic, Supports triple independent displays Thru interface on carrier board for 3 x DDI, VGA, PEG
LVDS	Thru NXP PTN3460 (C01Z3460BSFX12000P) for eDP to LVDS
LAN	Intel® I21**8**LM PHY GbE x 1(C013218LM00029000P) Thru interface on carrier board
USB	Intel® BD82QM87 PCH built-in USB host controller, supports USB 3.0 x 4 ports & USB 2.0 x 8 ports
Serial ATA Ports	Intel® BD82QM87 PCH built-in controller, Supports 4 ports for SATA 3.0 (6Gb/sec.)
Audio	Intel® BD82QM87 PCH built-in HD audio controller with external HD codec on carrier board
RTC	Intel® BD82QM87 PCH built-in RTC, battery on carrier board
LPC I/O	Nuvoton NCT5523D **ver. C** (C0135523D00012100P) (64-pin LQFP [7 mmx7 mm]) ** Supports OVT**
Watchdog Timer	Yes (256 segments, 0, 1, 2…255. sec/min)
Connector to Carrier Board	Two 220-pin connectors (A-B & C-D) [COM Express 2.1 standard]
Power	+12V, +5VSB
TPM 2.0	Infineon **SLB9665** (C01Z9665TT2007000P)
Others	Heat spreader 2 x 2-pin headers for PEG selectable to 2 x (8x) or 1x(8x) + 2x(4x) Validate with iBASE IP409 carrier board
Certification	CE (EN55032: 2012) FCC Class B LVD
OS support	Windows 7 Pro (32b/64b) Windows 8.1(64b) / Embedded Industrial (64b) Linux Fedora (64b) / Ubuntu (64b)
Board Size	95mm x 125mm
RoHS	Yes

Board Dimensions





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Installations

This section provides information on how to use the jumpers and connectors on the ET960 in order to set up a workable system. The topics covered are:

Installing the Memory.....6
Setting the Jumpers 7

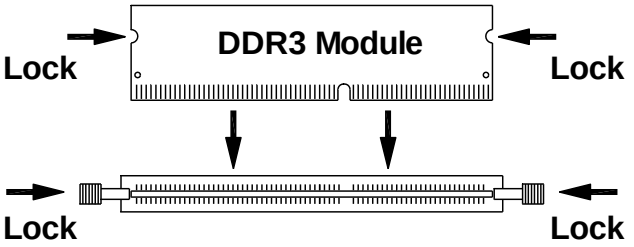
Installing the Memory

The ET960 board supports two DDR3 memory socket for a maximum total memory of 16GB in DDR3 SO-DIMM memory type.

Installing and Removing Memory Modules

To install the DDR3 modules, locate the memory slot on the board and perform the following steps:

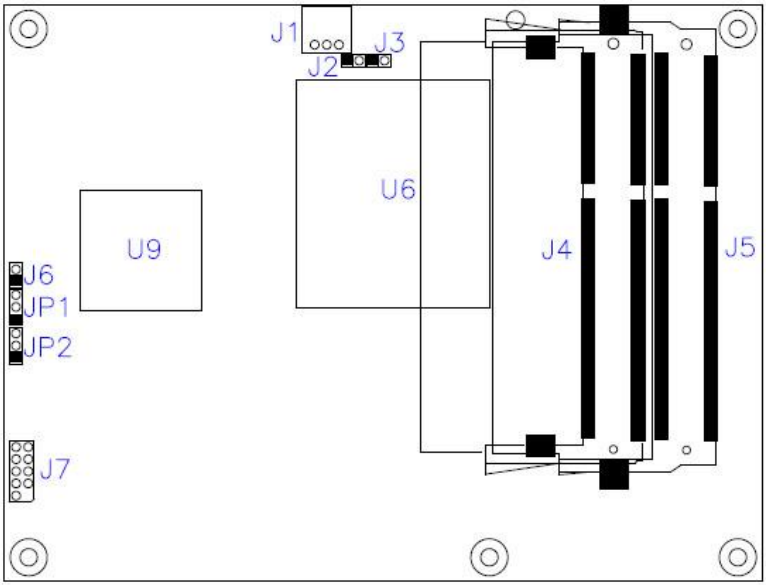
1. Hold the DDR3 module so that the key of the DDR3 module aligned with that on the memory slot.
2. Gently push the DDR3 module in an upright position until the clips of the slot close to hold the DDR3 module in place when the DDR3 module touches the bottom of the slot.
3. To remove the DDR3 module, press the clips with both hands.



Setting the Jumpers

Jumpers are used on ET960 to select various settings and features according to your needs and applications. Contact your supplier if you have doubts about the best configuration for your needs. The following lists the connectors on ET960 and their respective functions.

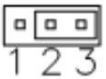
JP1: ME RST 8
JP2: RTC RST 8
J2, J3: PCI Express Bifurcation 8
J7: SPI Flash connector (Factory use only) 8
J6: Flash Descriptor Security Override (Factory use only) 8



JP1: ME RST

JP1	Setting	Function
	Pin 1-2 Short/Closed	Normal (default)
	Pin 2-3 Short/Closed	Clear ME

JP2: RTC RST

JP2	Setting	Function
	Pin 1-2 Short/Closed	Normal
	Pin 2-3 Short/Closed	Clear CMOS

J2, J3: PCI Express Bifurcation

	J2	J3
X16 (Default)	Open	Open
X8, X8	Open	Close
X8, X4, X4	Close	Close

J6: Flash Descriptor Security Override (Factory use only)

J6	Flash Descriptor Security Override
Open	Disabled (Default)
Close	Enabled

J7: SPI Flash connector (Factory use only)

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 10
BIOS Setup 10
Advanced Settings 12
Chipset Settings..... 24
Boot Settings 32
Security Settings..... 34
Save & Exit Settings 35

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:

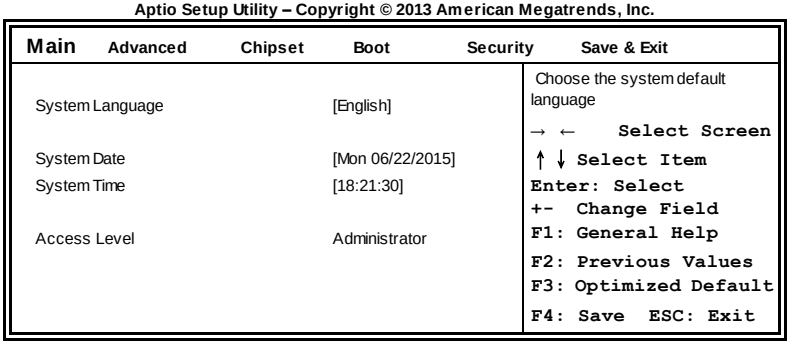
```
Press  <DEL>  to  Enter  Setup
```

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



System Language

Choose the system default language.

System Date

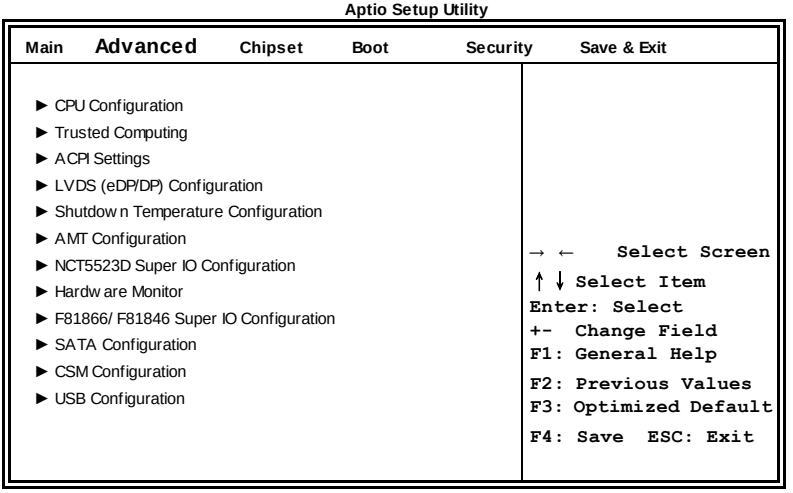
Set the Date. Use Tab to switch between Data elements.

System Time

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

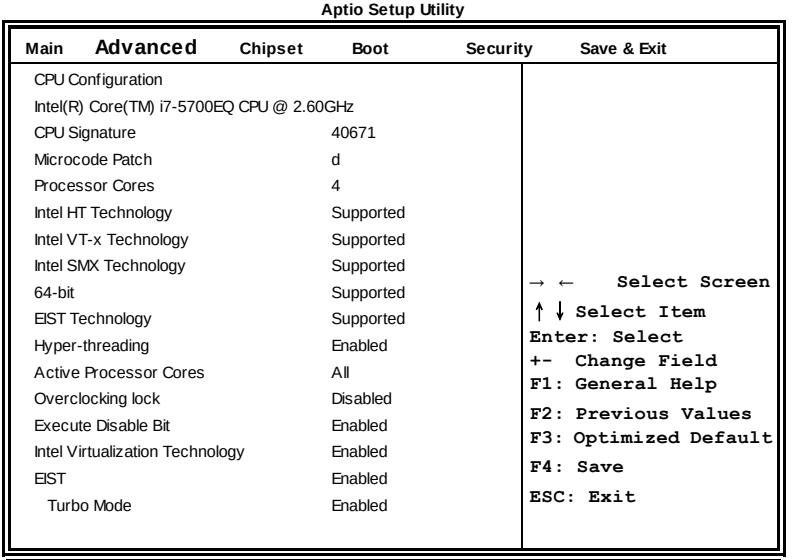
Advanced Settings

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



CPU Configuration

This section shows the CPU configuration parameters.



Hyper-threading
Enabled for Windows XP and Linux (OS optimized for Hyper-Threading Technology) and Disabled for other OS (OS not optimized for Hyper-Threading Technology). When Disabled only one thread per enabled core is enabled.

Active Processor Cores
Number of cores to enable in each processor package.

Overclocking lock
FLEX_RATIO(194) MSR

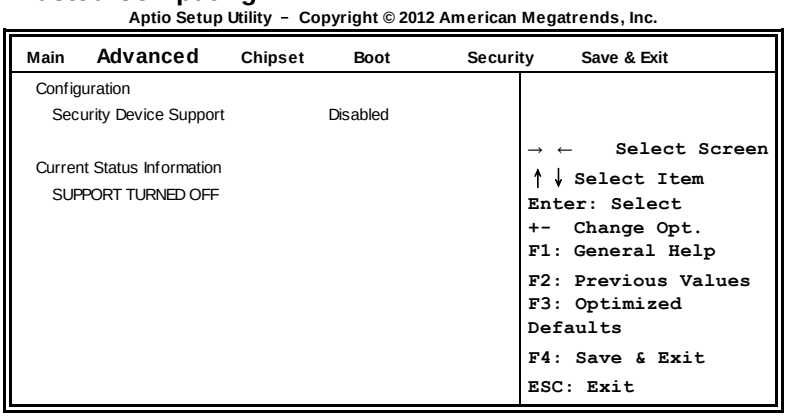
Execute Disable Bit
XD can prevent certain classes of malicious buffer overflow attacks when combined with a supporting OS (Windows Server 2003 SP1, Windows XP SP2, SuSE Linux 9.2, RedHat Enterprise 3 Update 3.)

Intel Virtualization Technology
When enabled, a VMM can utilize the additional hardware capabilities provided by Vanderpool Technology.

EIST
Enabled/Disabled Intel Speedstep.

Turbo Mode
Turbo Mode.

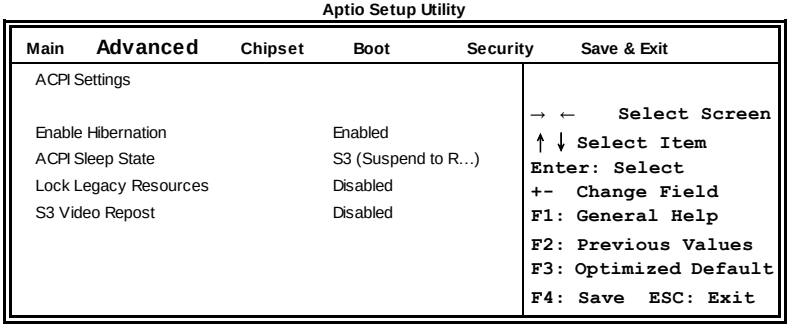
Trusted Computing



Security Device Support

Enables or disables BIOS support for security device. O.S. will not show Security Device. TCG EFI protocol and INT1A interface will not be available.

ACPI Settings



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.

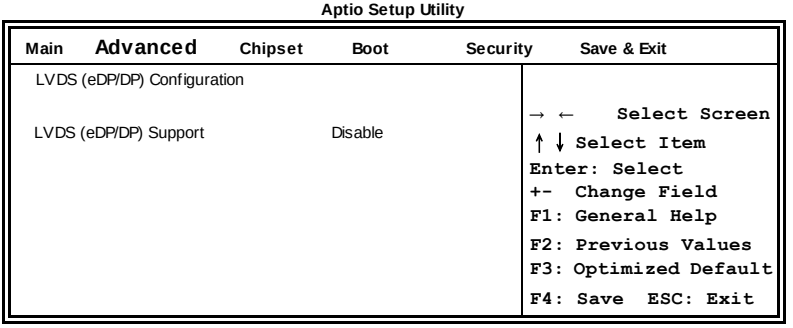
Lock Legacy Resources

Enabled or Disabled Lock of Legacy Resources.

S3 Video Repost

Enable or disable S3 Video Repost.

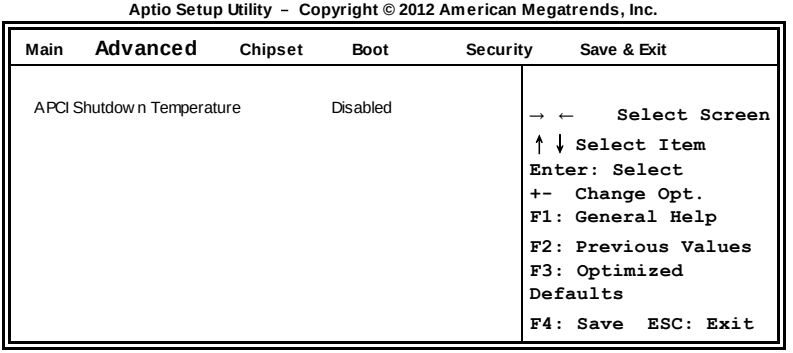
LVDS (eDP/DP) Configuration



LVDS (eDP/DP) Support

LVDS (eDP/DP) ON/OFF

Shutdown Temperature Configuration



ACPI Shutdown Temperature

The default setting is Disabled.

AMT Configuration

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	Save & Exit

Intel AMT	Enabled
BIOS Hotkey Pressed	Disabled
MEBx Selection Screen	Disabled
Hide Un-Configure ME Confirmation	Disabled
Amt Wait Timer	0
Activate Remote Assistance Process	Disabled
USB Configure	Enabled
PET Progress	Enabled
AMT CIRA Timeout	0
Watchdog	Disabled
OS Timer	0
BIOS Timer	0

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

Intel AMT

Enable/Disable Intel (R) Active Management Technology BIOS Extension.
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

BIOS Hotkey Pressed

OEMFLag Bit 1:
Enable/Disable BIOS hotkey press.

MEBx Selection Screen

OEMFLag Bit 2:
Enable/Disable MEBx selection screen.

Hide Un-Configure ME Configuration

OEMFlag Bit 6:
Hide Un-Configure ME without password Confirmation Prompt

Amt Wait Timer

Set timer to wait before sending ASF_GET_BOOT_OPTIONS.

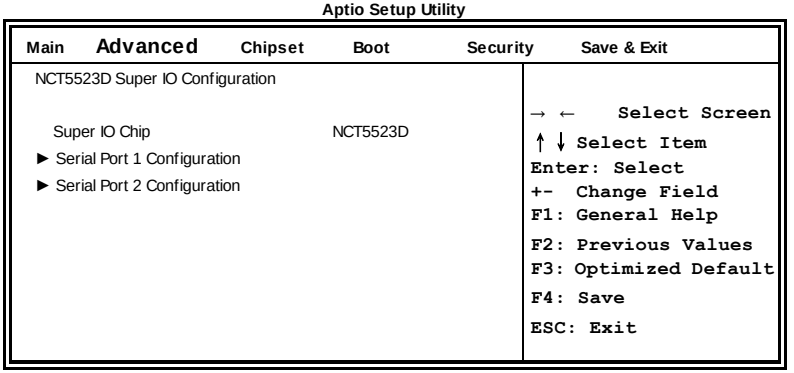
Activate Remote Assistance Process
Trigger CIRA boot.

USB Configure
Enable/Disable USB Configure function.

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

Watchdog Timer
Enable/Disable Watchdog Timer.

NCT5523D Super IO Configuration



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.

Hardware Monitor

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	Save & Exit
PC Health Status					
#### Smart Fan Function ####					
CPU Smart Fan Control		Disabled			
System temperature		+34.5 C			
CPU temperature		+43.0 C			
CPU Fan Speed		4366 RPM			
Vcore		+1.794 V			
Memory		+1.344 V			

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

CPU Smart Fan Control

The default setting is Disabled.

Temperatures/Voltages

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

F81866 Super IO Configuration

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	Save & Exit
F81866/ F81846 Super IO Configuration					
Super IO Chip		F81866/ F81846			
► Serial Port 1 Configuration					
► Serial Port 2 Configuration					
► Parallel Port Configuration					

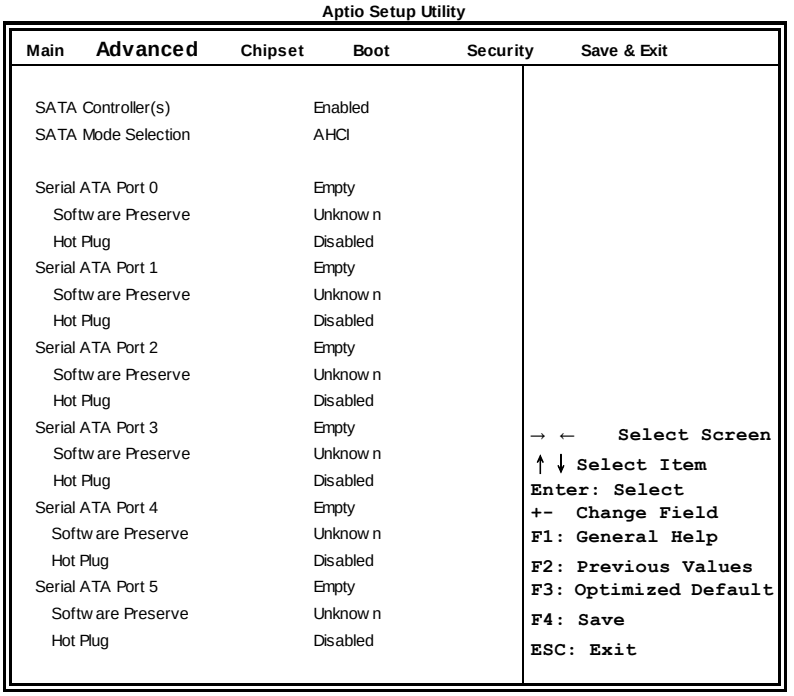
→ ← Select Screen
↑ ↓ Select Item
Enter: Select
+- Change Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save
ESC: Exit

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.

SATA Configuration

SATA Devices Configuration.



SATA Controller(s)

Enable / Disable Serial ATA Controller.

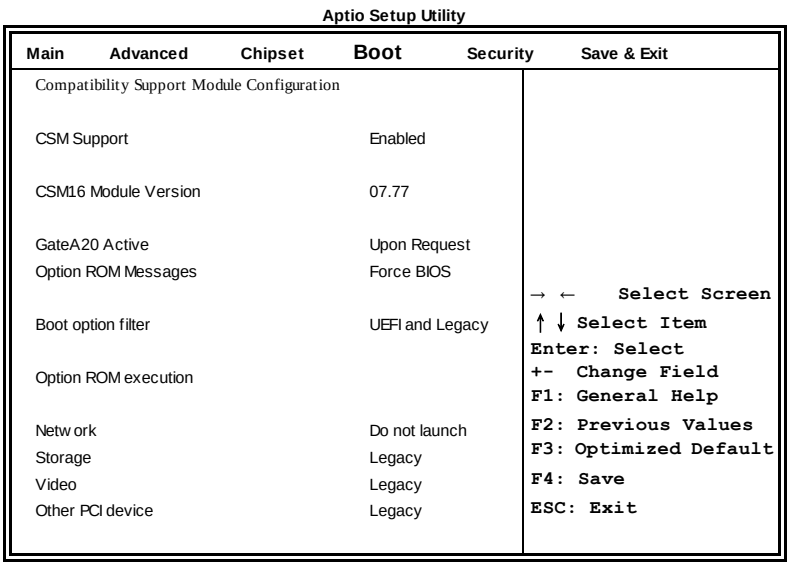
SATA Mode Selection

(1) AHCI Mode.
(2) RAID Mode.

Hot Plug

Designates this port as Hot Pluggable.

CSM Configuration



CSM Support
Enable/Disable CSM Support.

Boot option filter
This option controls Legacy/UEFI ROMs priority.

Network
Controls the execution of UEFI and Legacy PXE OpROM.

Storage
Controls the execution of UEFI and Legacy Storage OpROM.

Video
Controls the execution of UEFI and Legacy Video OpROM.

Other PCI device
Determines OpROM execution policy for devices other than Network, Storage, or Video.

USB Configuration

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	Save & Exit
USB Configuration					
USB Module Version			11		
USB Controllers:					
2 EHCIs, 1 XHCI					
USB Devices:					
1 Drive, 1 Keyboard, 1 Mouse , 2 Hubs					
Legacy USB Support			Enabled		
XHCI Hand-off			Enabled		
EHCI Hand-off			Enabled		
USB Mass Storage Driver Support			Enabled		
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 Field
F1: General Help
F2: Previous Values
F3: Optimized Default
F4: Save
ESC: Exit

Legacy USB Support

Enables Legacy USB support.
AUTO option disables legacy support if no USB devices are connected.
DISABLE option keeps 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.

EHCI Hand-off

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

USB Mass Storage Driver Support

Enable/Disable USB Mass Storage Driver Support.

USB Transfer time-out

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

Device reset time-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	Boot	Security	Save & Exit
► System Agent (SA) Configuration					
► PCH-IO Configuration					

System Agent (SA) Configuration

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	Save & Exit
System Agent Bridge Name			Broadwell		
System Agent RC Version			2.7.1.0		
VT-d Capability			Supported		
VT-d			Enabled		
►Graphics Configuration					
► Memory Configuration					

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

VT-d

Check to enable VT-d function on MCH.

Graphics Configuration

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

Main	Advanced	Chipset	Boot	Security	Save & Exit
Graphics Configuration					
IGFX VBIOS Version			1038		
IGfx Frequency			600 MHz		
Primary Display			Auto		
Primary PEG			Auto		
Primary PCIE			Auto		
Internal Graphics			Auto		
GTT Size			8MB		
Aperture Size			256MB		
CD Clk Frequency			Auto		
DVMT Pre-Allocated			32M		
DVMT Total Gfx Mem			256MB		

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

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

Primary PEG
Select PEG0/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.

GTT Size
Select the GTT Size.

Aperture Size
Select the Aperture Size.

CD Clk Frequency
Select CD Clk Frequency.

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

Aptio Setup Utility

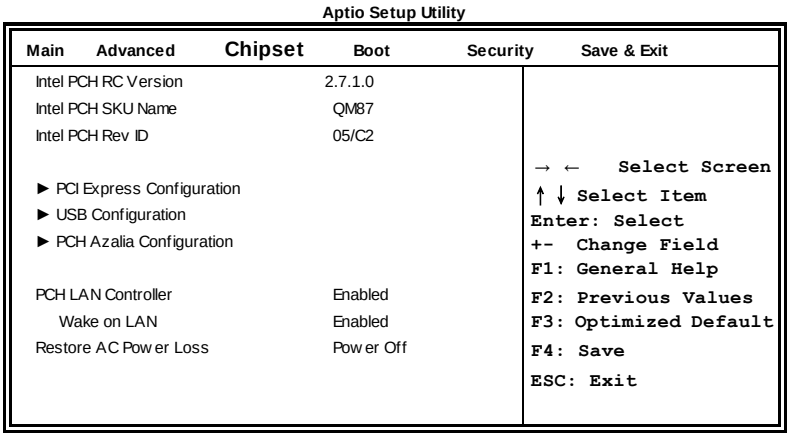
Main	Advanced	Chipset	Boot	Security	Save & Exit

Memory Information	
Memory Frequency	1600 MHz
Total Memory	4096 MB (DDR3)
Memory Voltage	1.35v
DIMM#0	2048 MB (DDR3)
DIMM#2	2048 MB (DDR3)
CAS Latency (tCL)	11
Minimum delay time	
CAS to RAS (tRCDmin)	11
Row Precharge (tRPmin)	11
Active to Precharge (tRASmin)	28

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

PCH-IO Configuration

This section allows you to configure the North Bridge Chipset.



PCH LAN Controller

Enable or disable onboard NIC.

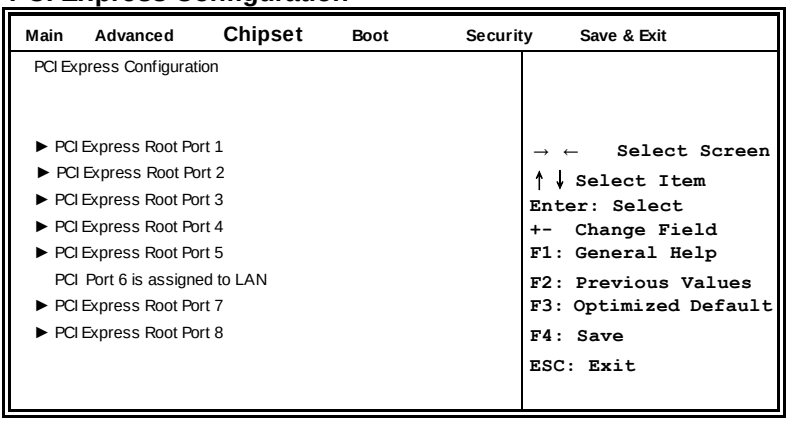
Wake on LAN

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

Restore AC Power Loss

Options are:
Power Off (default)
Power On
Last State

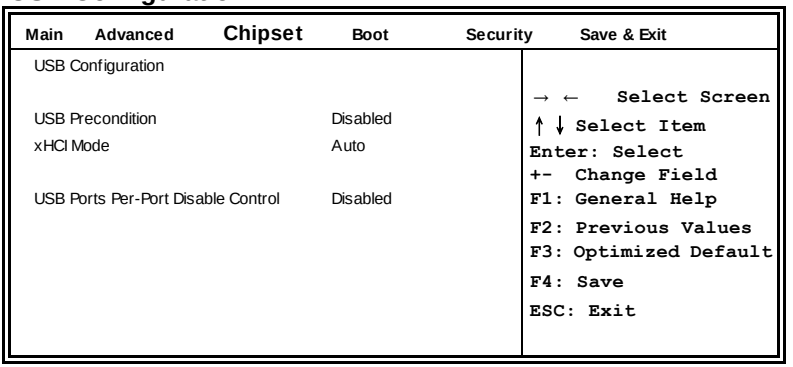
PCI Express Configuration



PCI Express Configuration

PCI Express Root Port Settings.

USB Configuration



USB Precondition

Precondition work on USB host controller and root ports for faster enumeration.

xHCI Mode

Mode of operation of xHCI controller.

USB Ports Per-Port Disable Control

Control each of the USB ports (0~13) disabling.

PCH Azalia Configuration

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

Azalia

Control Detection of the Azalia device.
Disabled = Azalia will be unconditionally be disabled.
Enabled = Azalia will be unconditionally be enabled.
Auto = Azalia will be enabled if present, disabled otherwise.

Security Settings

Aptio Setup Utility

Main	Advanced	Chipset	Boot	Security	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					→ ← Select Screen ↑ ↓ Select Item Enter: Select +- Change Field F1: General Help F2: Previous Values F3: Optimized Default F4: Save ESC: Exit
The password length must be in the following range:					
Minimum length			3		
Maximum length			20		
Administrator Password					
User Password					

Administrator Password

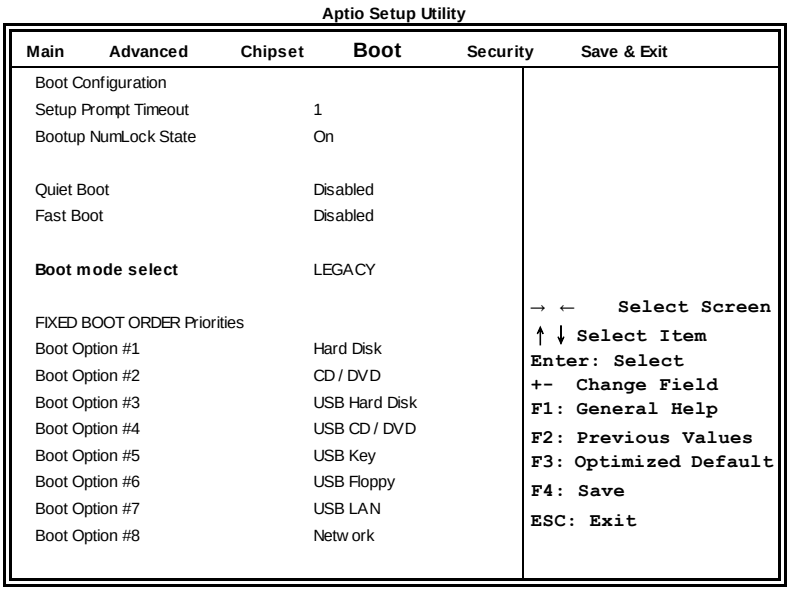
Set Setup Administrator Password.

User Password

Set User Password.

Boot Settings

This section allows you to configure the boot settings.



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.

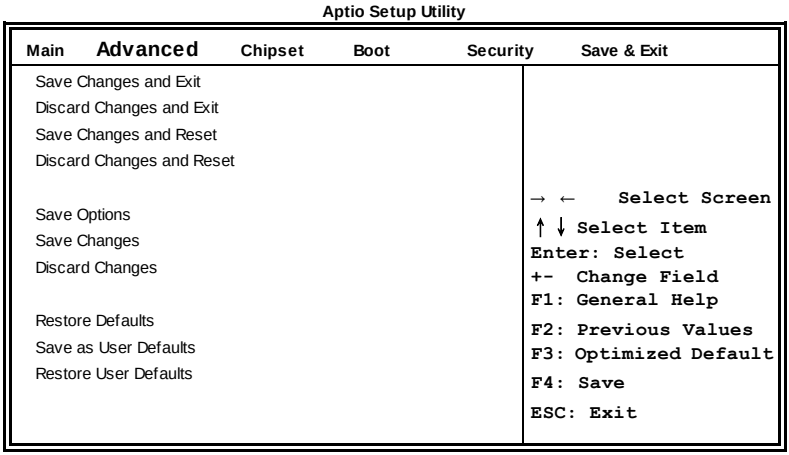
Boot mode select

Select boot mode LEGACY/UEFI

FIXED BOOT ORDER Priorities

Sets the system boot order.

Save & Exit Settings



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:

Intel Chipset Software Installation Utility 33
VGA Drivers Installation 36
Realtek HD Audio Driver Installation 39
LAN Drivers Installation 41
Intel® USB 3.0 Drivers 48

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.

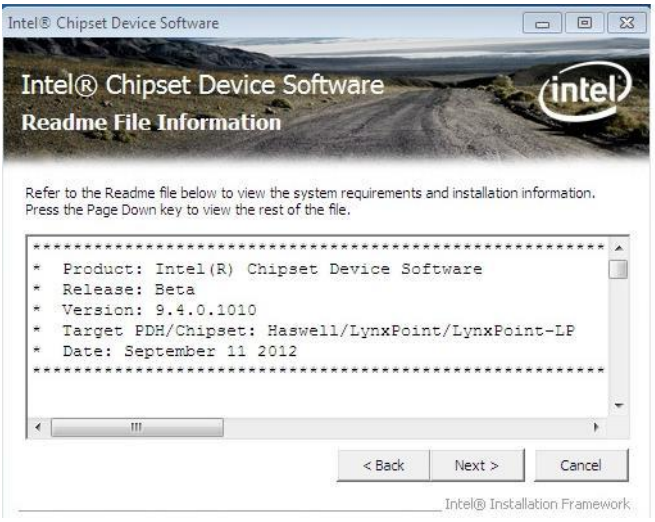
1. Insert the DVD that comes with the board. Click ***Intel*** and then ***Intel(R) Broadwell Chipset Drivers***.

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 ***Next*** to continue the installation.



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

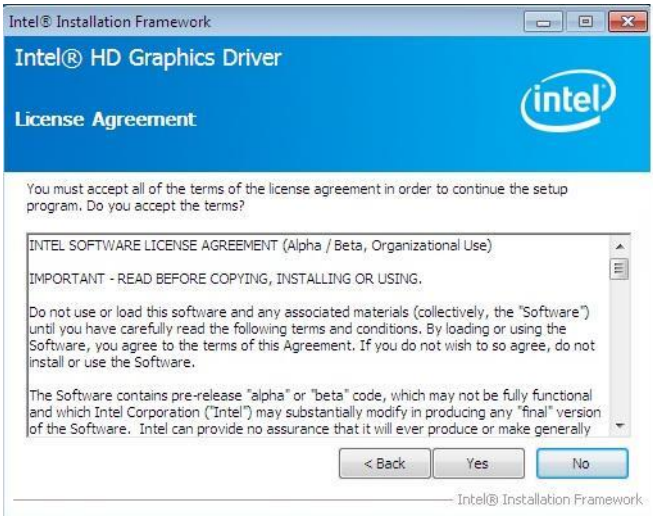
VGA Drivers Installation

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

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

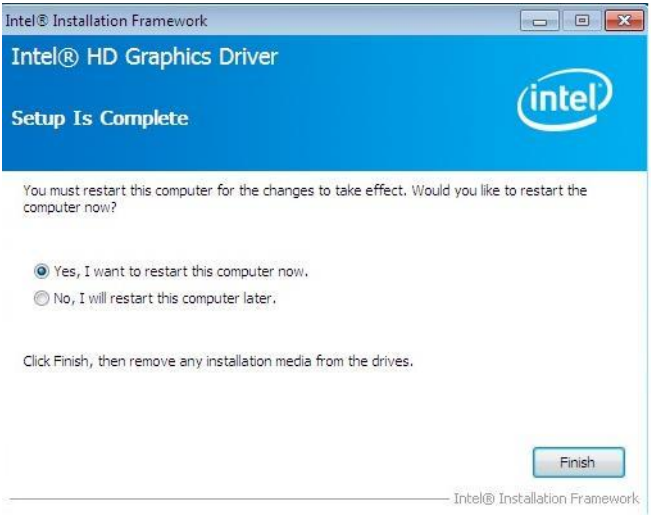
3. When the Welcome screen appears, click ***Next*** to continue.

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.

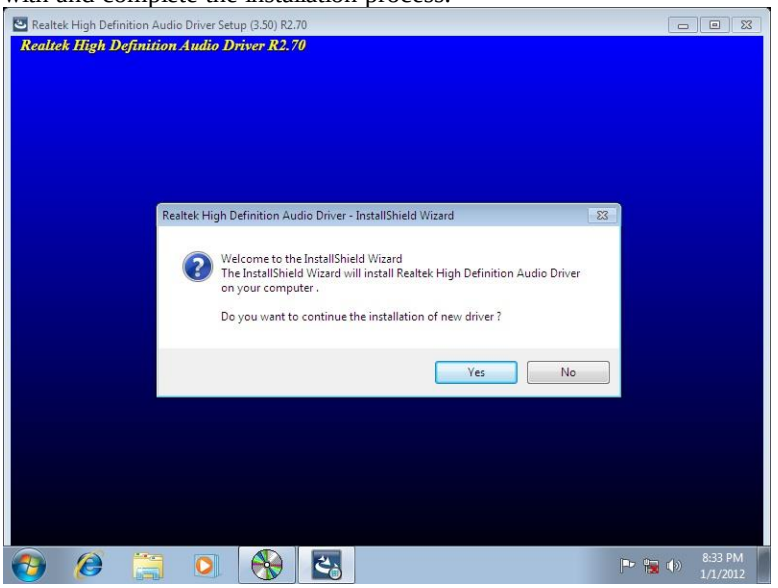


Realtek HD Audio Driver Installation

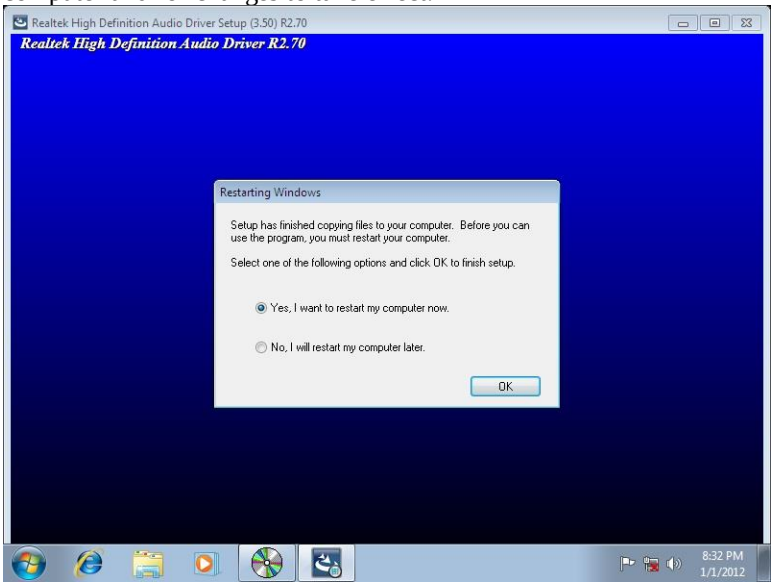
1. Insert the DVD that comes with the board. Click ***Intel*** and then ***Intel(R) Broadwell Chipset Drivers***.

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

3. On the Welcome to the InstallShield Wizard screen, click ***Yes*** 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.

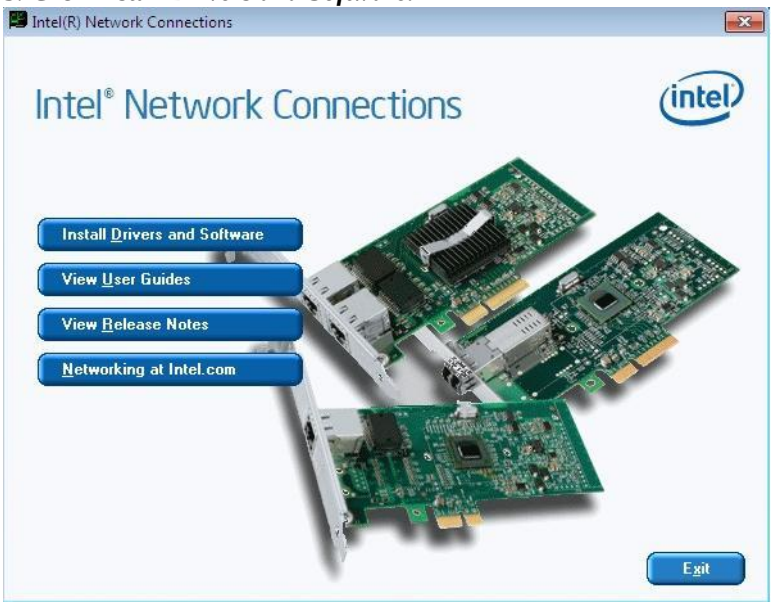


LAN Drivers Installation

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

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

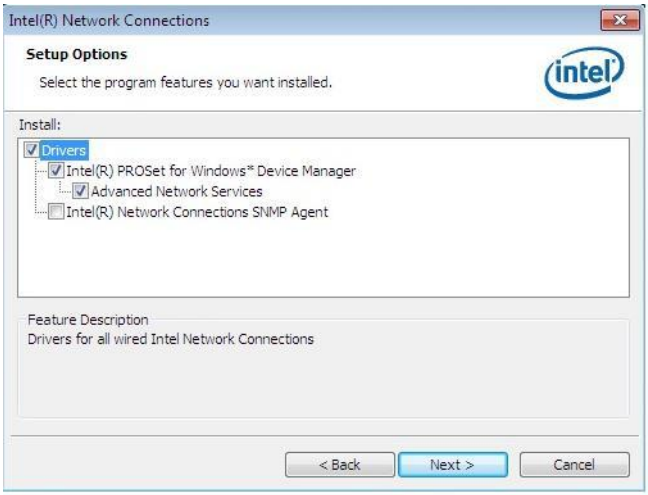
3. Click ***Install Drivers and Software.***



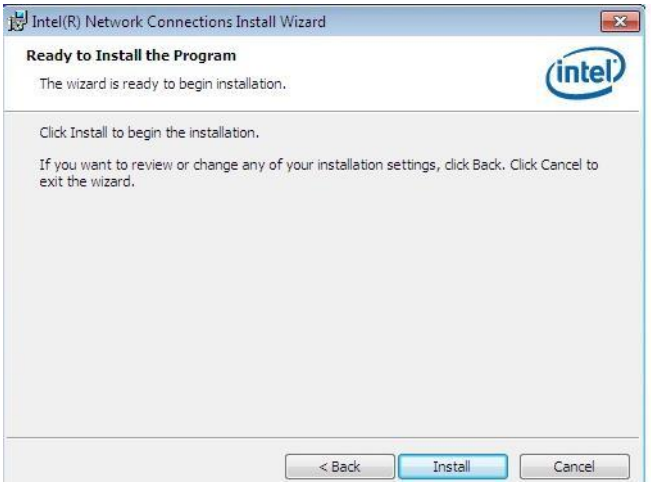
4. When the Welcome screen appears, click ***Next***.

5. Click ***Next*** to to agree with the license agreement.

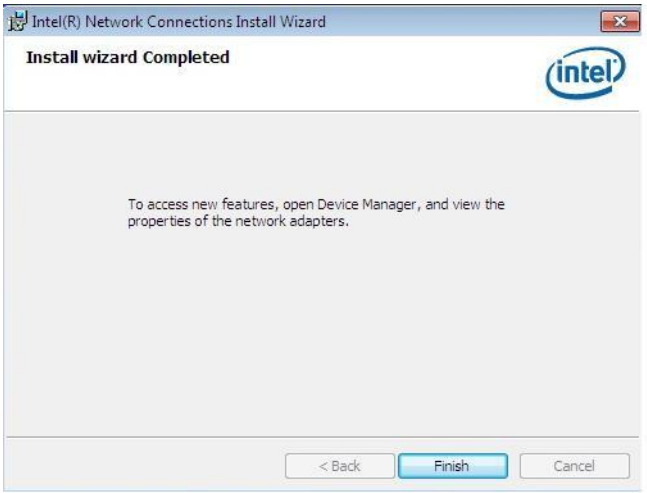
6. Click the checkbox for **Drivers** in the Setup Options screen to select it and click **Next** to continue.



7. The wizard is ready to begin installation. Click ***Install*** to begin the installation.



8. When InstallShield Wizard is complete, click ***Finish***.



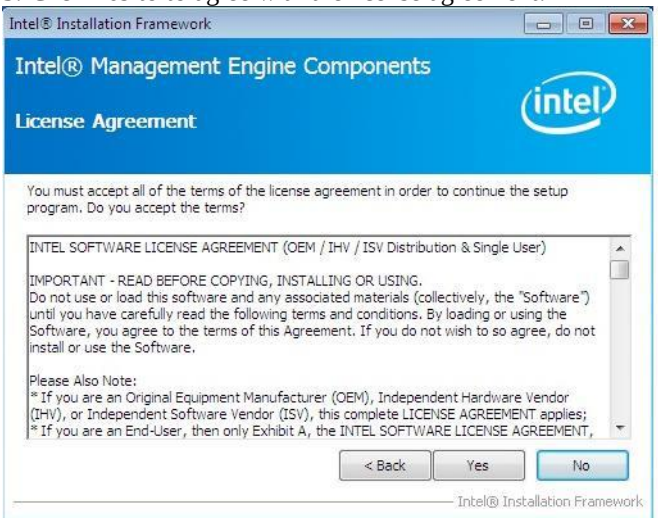
Intel® Management Engine Interface

Follow the steps below to install the Intel Management Engine.

1. Insert the DVD that comes with the board. Click ***Intel*** and then ***Intel(R) Broadwell Chipset Drivers*** and then ***Intel(R) AMT 9.x 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 ***Yes*** to to agree with the license agreement.



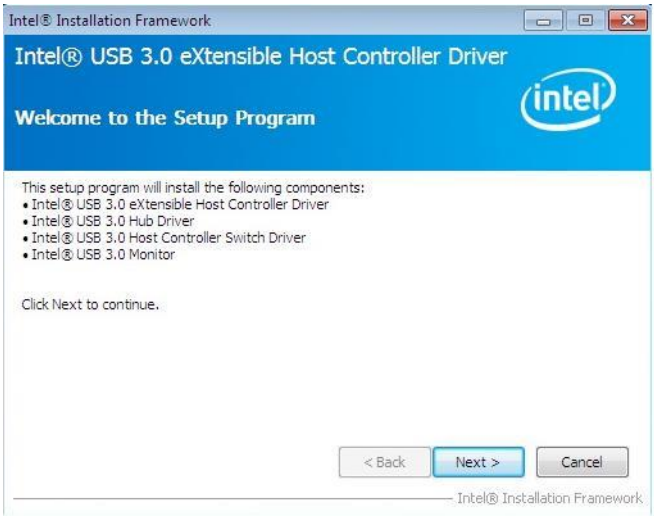
4. When the Setup Progress screen appears, click ***Next***. Then, click ***Finish*** when the setup progress has been successfully installed.

Intel® USB 3.0 Drivers

1. Insert the DVD that comes with the board. Click ***Intel*** and then ***Intel(R) Broadwell 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 ***Yes*** 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-001Fh	Direct memory access controller
0000h-001Fh	PCI bus
0040h-0043h	System timer
0050h-0053h	System timer
0060h-0060h	PS/2 Keyboard
0064h-0064h	PS/2 Keyboard
0070h-0077h	System CMOS/real time clock
0081h-0091h	Direct memory access controller
0093h-009Fh	Direct memory access controller
00C0h-00DFh	Direct memory access controller
00F0h-00F0h	Numeric data processor
0240h-0247h	Communications Port (COM3)
0250h-0257h	Communications Port (COM4)
02E8h-02EFh	Communications Port (COM1)
02F8h-02FFh	Communications Port (COM2)
0378h-037Fh	Printer Port (LPT1)
03B0h-03BBh	Intel(R) HD Graphics 5600
03C0h-03DFh	Intel(R) HD Graphics 5600
0D00h-FFFFh	PCI bus
3000h-303Fh	Intel(R) HD Graphics 5600
3040h-305Fh	Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
3060h-307Fh	Intel(R) 8 Series/C220 Series SATA AHCI Controller - 8C03
30A0h-30A3h	Intel(R) 8 Series/C220 Series SATA AHCI Controller - 8C03
30B0h-30B7h	Intel(R) 8 Series/C220 Series SATA AHCI Controller - 8C03
30C0h-30C3h	Intel(R) 8 Series/C220 Series SATA AHCI Controller - 8C03
30D0h-30D7h	Intel(R) 8 Series/C220 Series SATA AHCI Controller - 8C03
30E0h-30E7h	Intel(R) Active Management Technology - SOL (COM5)

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 Output
IRQ1	PS/2 Keyboard
IRQ3	Serial Port #2
IRQ4	Serial Port #1
IRQ6	Serial Port #4
IRQ7	Serial Port #3
IRQ8	Real Time Clock
IRQ11	Intel(R) 8 Series/C220 Series SMBus Controller - 8C22
IRQ12	PS/2 Mouse
IRQ13	Numeric data processor
IRQ 16	PCI standard PCI-to-PCI bridge
IRQ 16	Intel(R) 8 Series/C220 Series USB EHCI #2 - 8C2D
IRQ 16	Intel(R) Management Engine Interface
IRQ 17	Intel(R) Active Management Technology - SOL (COM5)
IRQ 19	Intel(R) 8 Series SATA AHCI Controller - 8C03
IRQ 22	High Definition Audio Controller
IRQ 23	Intel(R) 8 Series/C220 Series USB EHCI #1 - 8C26

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:

File of the NCT5523D.H

```
//-----------------------------------------------------------------------------
//
// THIS CODE AND INFORMATION IS PROVIDED "AS IS" WITHOUT WARRANTY OF ANY
// KIND, EITHER EXPRESSED OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE
// IMPLIED WARRANTIES OF MERCHANTABILITY AND/OR FITNESS FOR A PARTICULAR
// PURPOSE.
//
//-----------------------------------------------------------------------------
#ifndef __NCT5523D_H
#define __NCT5523D_H                    1
//-----------------------------------------------------------------------------
#define     NCT5523D_INDEX_PORT         (NCT5523D_BASE)
#define     NCT5523D_DATA_PORT          (NCT5523D_BASE+1)
//-----------------------------------------------------------------------------
#define     NCT5523D_REG_LD             0x07
//-----------------------------------------------------------------------------
#define NCT5523D_UNLOCK                 0x87
#define     NCT5523D_LOCK               0xAA
//-----------------------------------------------------------------------------
unsigned int Init_NCT5523D(void);
void Set_NCT5523D_LD( unsigned char);
void Set_NCT5523D_Reg( unsigned char, unsigned char);
unsigned char Get_NCT5523D_Reg( unsigned char);
//-----------------------------------------------------------------------------
#endif      //__NCT5523D_H
```

File of the MAIN.CPP.

```
//---------------------------------------------------------------------------
//
// 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 "NCT5523D.H"
//---------------------------------------------------------------------------
int main (void);

void WDTInitial(void);
void WDTEnable(unsigned char);
void WDTDisable(void);

//---------------------------------------------------------------------------
int main (void)
{
	char SIO;

	SIO = Init_NCT5523D();
	if (SIO == 0)
	{
		printf("Can not detect Nuvoton NCT5523D, program abort.\n");
		return(1);
	}

	WDTInitial();

	WDTEnable(10);

	WDTDisable();

	return 0;
}
//---------------------------------------------------------------------------
void WDTInitial(void)
{
	unsigned char bBuf;
	Set_NCT5523D_LD(0x08);                          //switch to logic device 8
	bBuf = Get_NCT5523D_Reg(0x30);
	bBuf &= (~0x01);
	Set_NCT5523D_Reg(0x30, bBuf);                   //Enable WDTO
}
//---------------------------------------------------------------------------
```

```
void WDTEnable(unsigned char NewInterval)
{
	unsigned char bBuf;

	Set_NCT5523D_LD(0x08);				//switch to logic device 8
	Set_NCT5523D_Reg(0x30, 0x01);			//enable timer

	bBuf = Get_NCT5523D_Reg(0xF0);
	bBuf &= (~0x08);
	Set_NCT5523D_Reg(0xF0, bBuf);			//count mode is second

	Set_NCT5523D_Reg(0xF1, NewInterval);		//set timer
}
//-----------------------------------------------------------------------------
void WDTDisable(void)
{
	Set_NCT5523D_LD(0x08);				//switch to logic device 8
	Set_NCT5523D_Reg(0xF1, 0x00);			//clear watchdog timer
	Set_NCT5523D_Reg(0x30, 0x00);			//watchdog disabled
}
//-----------------------------------------------------------------------------
```

File of the NCT5523D.CPP

```
//---------------------------------------------------------------------------
//
// 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 "NCT5523D.H"
#include <dos.h>
//---------------------------------------------------------------------------
unsigned int NCT5523D_BASE;
void Unlock_NCT5523D (void);
void Lock_NCT5523D (void);
//---------------------------------------------------------------------------
unsigned int Init_NCT5523D(void)
{
        unsigned int result;
        unsigned char ucDid;

        NCT5523D_BASE = 0x4E;
        result = NCT5523D_BASE;

        ucDid = Get_NCT5523D_Reg(0x20);
        if (ucDid == 0xC4)                                      //NCT5523D??
        {       goto Init_Finish;  }

        NCT5523D_BASE = 0x2E;
        result = NCT5523D_BASE;

        ucDid = Get_NCT5523D_Reg(0x20);
        if (ucDid == 0xC4)                                      //NCT5523D??
        {       goto Init_Finish;  }

        NCT5523D_BASE = 0x00;
        result = NCT5523D_BASE;

Init_Finish:
        return (result);
}
//---------------------------------------------------------------------------
void Unlock_NCT5523D (void)
{
        outportb(NCT5523D_INDEX_PORT, NCT5523D_UNLOCK);
        outportb(NCT5523D_INDEX_PORT, NCT5523D_UNLOCK);
}
//---------------------------------------------------------------------------
void Lock_NCT5523D (void)
{
        outportb(NCT5523D_INDEX_PORT, NCT5523D_LOCK);
}
//---------------------------------------------------------------------------
```

```
void Set_NCT5523D_LD( unsigned char LD)
{
	Unlock_NCT5523D();
	outportb(NCT5523D_INDEX_PORT, NCT5523D_REG_LD);
	outportb(NCT5523D_DATA_PORT, LD);
	Lock_NCT5523D();
}
//----------------------------------------------------------------------------
void Set_NCT5523D_Reg( unsigned char REG, unsigned char DATA)
{
	Unlock_NCT5523D();
	outportb(NCT5523D_INDEX_PORT, REG);
	outportb(NCT5523D_DATA_PORT, DATA);
	Lock_NCT5523D();
}
//----------------------------------------------------------------------------
unsigned char Get_NCT5523D_Reg(unsigned char REG)
{
	unsigned char Result;
	Unlock_NCT5523D();
	outportb(NCT5523D_INDEX_PORT, REG);
	Result = inportb(NCT5523D_DATA_PORT);
	Lock_NCT5523D();
	return Result;
}
```