NK16X
USER MANUAL

Arima Computer Corp.
Building Your Competitive Advantage

TABLE OF CONTENTS:

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Technical Support

If a problem arises with your system during installation or operation and is unable to be resolved from the user manual, consult the following list of resources for help:

➢ Contact the place of purchase for help. This is the recommended solution as they can provide the quickest assistance.
➢ Visit Arima Computer Corp. website for up to the minute FAQ, guides and updates. The website can be found at: http://www.arima.com.tw/server
➢ Or contact our support staff at: server@arima.com.tw

About this User Guide

This manual contains some special icons that accompany special sections that are meant to help you along in the installation process. The special sections contain useful and/or critical information that you should know. Watch for these icons as you read through the manual.

Type of icons:	Description:
NOTE	This icon indicates useful and timely information that will aid you in the setup.
WARNING	This icon indicates information on dangerous and/or costly behavior to avoid.

Safety Instruction

> Keep this manual for future reference.
> Keep the equipments in a safe, cool, dry place.
> Perform the installation on a dry, flat surface.
> Ground yourself by touching a plugged-in power supply, which displaces static electricity.
> Adjust the power source to the proper voltage before connecting the equipment to the power outlet.
> Place the power cord in such a manner as to ensure that no one can step on it or trip over it.
> Always unplug the power cord when performing installation.
> Do not have liquid nearby as electrical shock can occur if liquid spills onto the equipment.
> Pay attention to the warnings in the installation instructions when appropriate.
> In the following cases, do not try to fix the problem yourself, contact a party in Technical Support
>   • The power cord or plug is damaged.
>   • Liquid has been spilled onto the equipment.
>   • Obvious sign of damage can be detected on the equipment.
> Operating temperature

Operating Temperature	10°C to 35°C	50°F to 95°F

Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer.

4

Chapter 1. Getting Started

1.1 Congratulations

You have in possession one of the most powerful and versatile AMD processor solution, the NK16X.
The One-way server, NN16X, support the AMD Opteron™ 1000 series Socket AM2 Processor with PCI-E
high performance expansion slot. Moreover, NK16X also provides an optional choice of PCI-X to fit all
kinds of requirements. Thank you for purchasing Arima Computer Corp. family of products.

1.2 Unpacking

Arima Computer Corp. provides a number of accessories for your convenience. Check for the following
items that come with your motherboard:

1 x IDE cable
1 x FDD cable
1 x I/O shield
2 x SATA cables
1 x SATA power cord
1 x Retention module
1 x Spare jumper

NK16X Board Quick Installation Guide
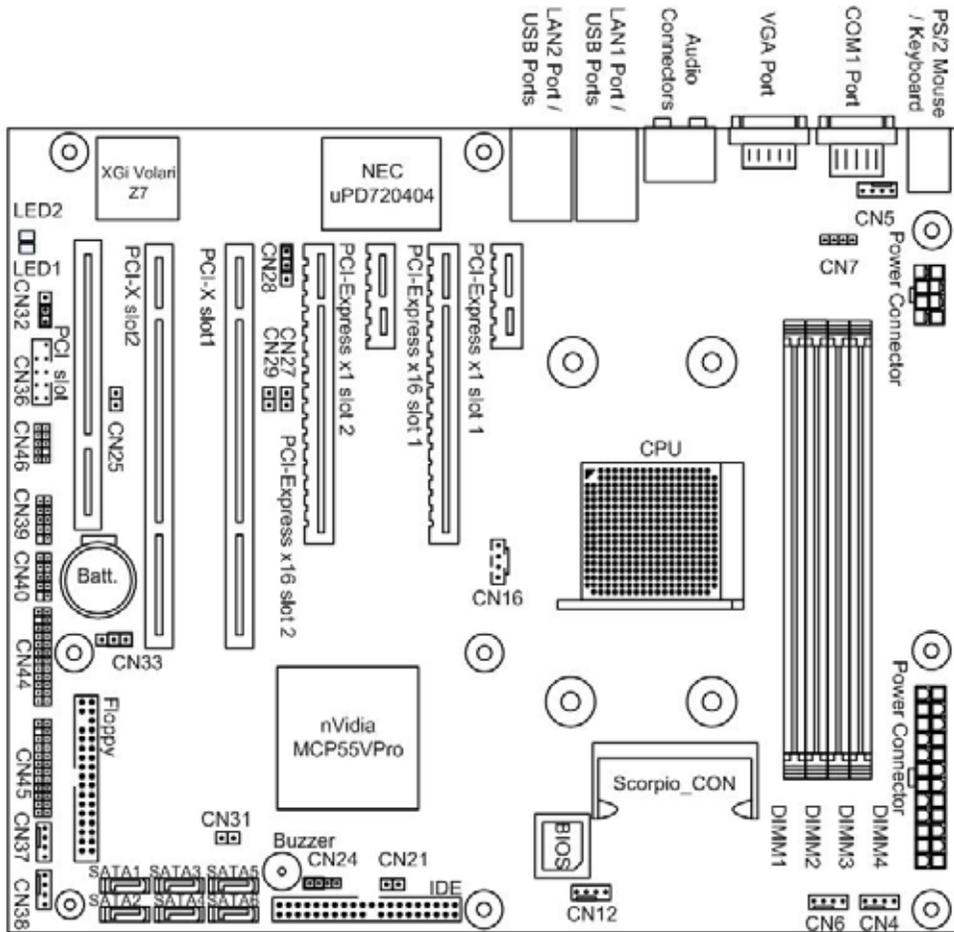
The diagram above depicts the major components on the NK16X serverboard. However, the actual number of PCI slot may vary for each product SKU. For more detail, please refer to the Product SKU feature Matrix.

CN33   Clear CMOS Select Jumper

1-2	2-3
Clear CMOS	Normal (default)

CN32   On-Board VGA Select Jumper

1-2	2-3
VGA Enabled (default)	VGA Disabled

CN28   PCI-X Slot Frequency Select Pin Header

1-2	2-3
100 MHz Enabled	133 MHz Enabled (default)

CN25, 27, 29   PCI-X Frequency Selection

Short	Description
CN27	PCI-X 66 MHz Enabled
CN29	PCI 66 MHz Enabled
CN29, CN25	PCI 33 MHz Enabled

CN24   Speaker Header

Pin	Description
1	Speaker
2	Buzzer
3	N/A
4	Speaker Power

CN36   COM2 Header

Pin	Description	Pin	Description
1	SP_DCD2	2	SP_DSR2
3	SP_RXD2	4	SP_RTS2
5	SP_TXD2	6	SP_CTS2
7	SP_DTR2	8	SP_RI2
9	GND	10	N/A

CN39 / CN40   USB Header

Pin	Description	Pin	Description
1	USB0/2_PWR	2	USB1/3_PWR
3	USB0N/2N	4	USB1N/3N
5	USB0P/2P	6	USB1P/3P
7	USB0/2_GND	8	USB1/3_GND
9		10	N/A

CN45   Front Panel

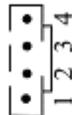|		
Power LED Anode	1	2	5VSB
Key	3	4	Cooling Fault LED Anode
Power LED Cathode	5	6	Cooling Fault LED Cathode
HDD Activity LED Anode	7	8	System Fault LED Anode
HDD Activity LED Cathode	9	10	System Fault LED Cathode
Power Switch	11	12	NIC#1 Activity LED Anode
Power Switch (GND)	13	14	NIC#1 Activity LED Cathode
Reset Switch	15	16	SMBus SDA
Reset Switch (GND)	17	18	SMBus SCL
ACPI Sleep Switch	19	20	Chassis Intrusion
ACPI Sleep Switch (GND)	21	22	NIC#2 Activity LED Anode
NMI to CPU Switch	23	24	NIC#2 Activity LED Cathode

LAN Connector Indicator Light

State of Link	Speed LED (Green/Orange)	Link/Activity LED (Orange)
No link	OFF	OFF
Link @ 10Mbps	OFF	On/Blink
Link @ 100Mbps	ON (Green)	On/Blink
Link @ 1000Mbps	ON (Orange)	On/Blink
Activity	ON	BLINK

CN44   LED Backplane PIN Header

Pin	Description	Pin	Description
1	KEY	2	FP_ALERT
3	N/A	4	GROUND
5	N/A	6	SW_CLR
7	NIC1_LED_1000	8	NIC1_LED_100
9	FP_ID_LED	10	N/A
11	GROUND	12	GROUND
13	NIC2_LED_1000	14	NIC2_LED_100
15	N/A	16	GROUND
17	GROUND	18	HDD_LED
19	GROUND	20	N/A

Product SKU Feature Matrix

SKU/Feature	SLI	Audio	PCI-E x16 slot with x8 signal (Slot 4)	PCI-X
NK166	N/A	N/A	N/A	Yes
NK162	N/A	N/A	Yes	N/A
NK164	Yes	Yes	Yes	N/A

Recommended Memory Configurations

1 DIMM	Slot 3
2 DIMMs	Slot 3, 4 or Slot 1, 2
4 DIMMs	Slot 1, 2, 3, 4

The Latest BIOS, Manual, Memory Recommended List, Drivers and Utility can be downloaded from http://www.arima.com.tw/server

CN46 Front Audio Pin Header

Pin	Description	Pin	Description
1	MIC-L	2	Ground
3	MIC-R	4	+3.3V
5	LINE-R	6	MIC Detect Pin
7	Front IO Sense	8	
9	LINE-L	10	NE Detect Pin

CN16   CD-In Connector

Pin	Description
1	CD_L
2	Ground
3	Ground
4	CD_R

CN31 Intrusion Function Pin Header

1-2
Short

Rev. 0.91

S1775370G00001

1.3 Features Highlight

CPU:
- Single socket AM2 (940)
- Support one AMD Opteron 1000 series processor with 110/125 Wattage
- Support dual core Opteron processor
- Support 2000MT/s HyperTransport

CHIPSET:
- NVIDIA MCP55-Vpro
- XGi Volari Z7
- NEC uPD720404 PCI-E to PCI-X bridge (Optional)
- Winbond Super I/O W83627EHG chip

Main Memory:
- 4 x 240-pin DDRII DIMM sockets
- Two-way interleaved memory banks (pair of DIMMs required)
- Supports DDRII-800/667/533/400 memory
- Supports Unbuffered ECC and Non ECC memory modules
- Supports up to 16GB
- Supports Chipkill, Parity, On-line spare function

SYSTEM MANAGEMENT:
- Hardware Monitor ADM1026
- IPMI connector supports Arima Scorpio (IPMI 2.0) management daughter card (optional)
- Arima SmartWatch server management software

1.4 Motherboard Specification

Processors
- ❖ Supports AMD Opteron Socket AM2 1000 Series Processors
- ❖ Single 940 pin socket AM2
- ❖ Digital VRM

Chipsets
- ❖ NVIDIA nForce® Professional 3400 MCP (MCP55-VPro)
- ❖ NEC uPD720404 PCI-E to PCI-X bridge (optional)
- ❖ Super I/O Winbond W83627EHG

HyperTransport
- ❖ 2000 MT/s

Memory
- ❖ 4 x 240-pin DDRII DIMM sockets
- ❖ Two-way interleaved memory banks (pair of DIMMs required)
- ❖ Supports DDRII-800/667/533/400 memory
- ❖ Supports Unbuffered ECC and Non ECC memory modules
- ❖ Supports up to 16GB
- ❖ Supports Chipkill, Parity, On-line spare function

IDE Bus
- ❖ Single channel master mode
- ❖ Supports up to two Enhanced IDE devices
- ❖ Ultra DMA 100/66/33 MB/s

PCI Slots
- ❖ 2 x PCI-E x16 slot for NK162 and NK164 (NK166 only have one onboard PCI-E x16 slot)
- ❖ 2 x PCI-X (64bit/133/100MHz) slots for NK166 (NK162 and NK164 does not have onboard PCI-X slot)
- ❖ 1 x PCI32 bit slot

VGA
- ❖ Integrated XGi Volari Z7 video controller with 32MB memory
- ❖ NK164 provide support for SLI technology

LAN
- ❖ Dual IEEE 802.3 nVidia MACs for 1000/100/10 GbE with TCP Offload Engine(TOE)
- ❖ 2 x Marvell 88E1116 gigabit PHY
- ❖ PXE option ROM solution

Serial ATA 2
- ❖ Integrated Serial ATA II 6 Ports on Die (MCP55-Pro)
- ❖ Supports nVidia MediaShield RAID for 0,1,5,10 and JBOD

Onboard Multi I/O
- ❖ One (9-pin) serial ports with UART 16550 (Rear)
- ❖ One DB15 VGA port
- ❖ Two RJ-45 LAN ports
- ❖ Eight USB2.0 connectors (4 rear, 4 front)
- ❖ PS/2 mouse and keyboard connectors with Wake-up function
- ❖ 2x3 Audio connector (only available with NK164)

System Management

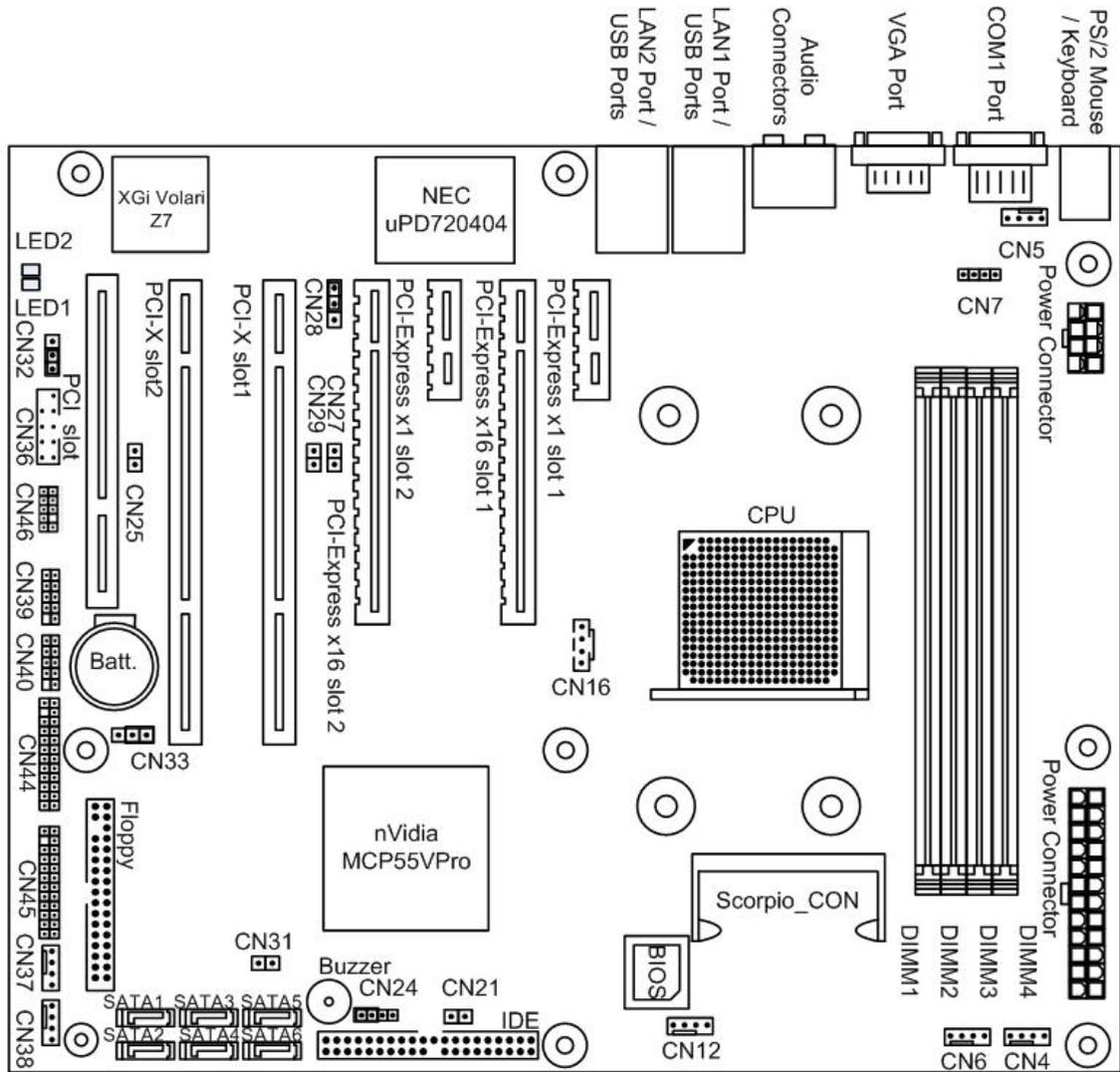- ❖ Hardware Monitor ADM1026
- ❖ IPMI connector supports Arima Scorpio (IPMI 2.0) management daughter card (optional)
- ❖ Arima SmartWatch server management software

M/B Size

- ❖ ATX form factor with size: 12" X 9.6" 6 layers
- ❖ EPS 12V power connectors (24pin + 8pin)

1.5 Motherboard Layout [major components]

The following diagram indicates all the major components of the motherboard.

Chapter 2. Hardware Installation

2.1 Installing the motherboard

! INSTALLATION WARNING!

Use Caution When Installing the ServerBoard into the System Chassis

The components underneath the PS/2 Mouse/Keyboard connectors around the mounting hole are very FRAGILE and can be knocked off of their soldered positions, resulting in IRREPARABLE DAMAGE during installation when sliding the board into a system chassis. Gently install the ServerBoard into the chassis, and use a Mylar Sheet to cover and protect the underside of the ServerBoard during installation. Take care NOT to scrape the bottom of the ServerBoard on the chassis stand-offs and mounting holes.

These components are necessary for many different operations, including the Mouse and the Keyboard. If you damage any of these chips, one of the symptoms is that the ServerBoard will NOT respond to keystrokes through the PS/2 port and the ServerBoard will have to be replaced. Other symptoms include the loss of response or functionality in any of the rear I/O ports. Contact your authorized dealer for more information.

The Damage noted here in this WARNING may require the ServerBoard to be replaced. Due to the Nature of the Damage, this may be considered Out-of-Warranty Damage. Make certain that ALL documented procedures are followed correctly.

2.2 Installing the processor

Procedure:
First read the instructions that comes with the CPU

1. Locate the processor socket on the motherboard.
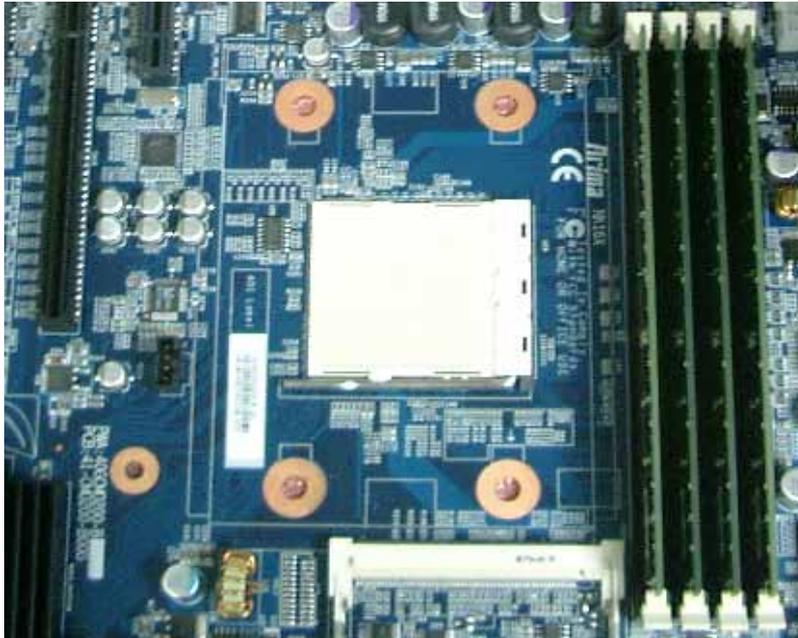
2. Pull the lever out of its locked position.
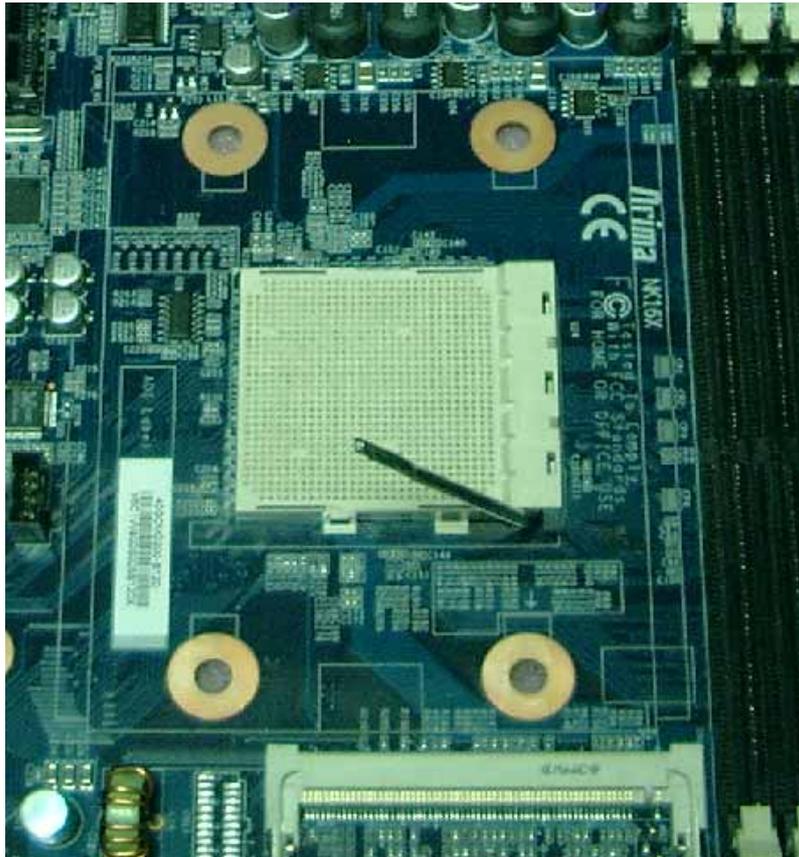
12

3. Place the CPU into the socket with the arrows pointing to the upper left of the socket as shown.
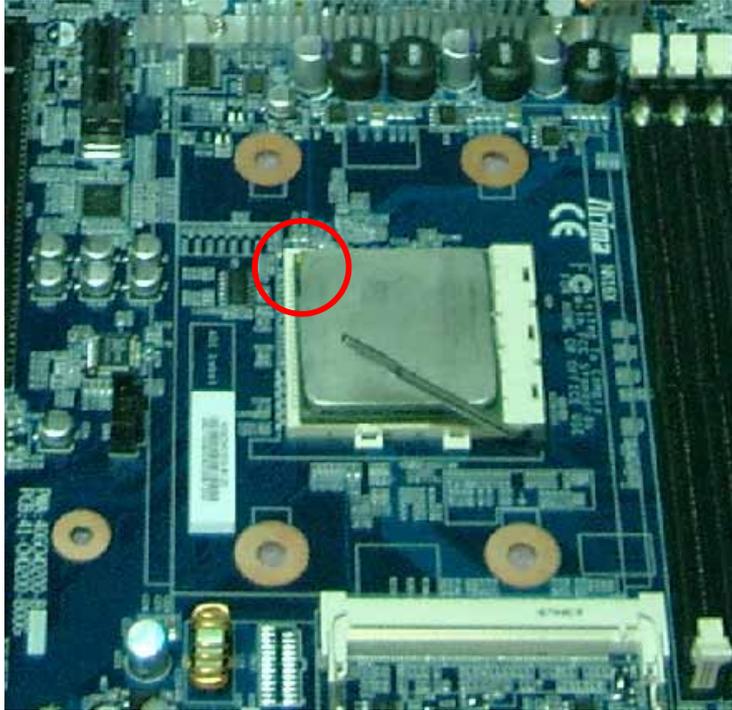
4. Return the lever into its original locked position.

5. First align the four pegs with the four mounting holes on the motherboard. After you have made sure that the pegs are in their proper positions, push down on the four plastic pegs until you hear clicking sounds, notifying you that the pegs have been securely locked into the mounting holes.
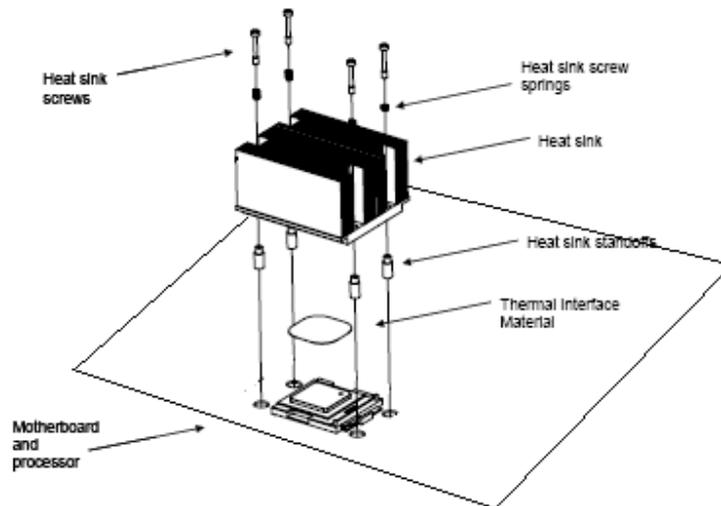
6. Connect the 3-wire fan cable to the fan connector on the motherboard.

7. Now, rest the motherboard into the chassis, align the holes of the backplate to the chassis

To remove the heatsink, gently turn the pegs until they loosen themselves from the mounting holes. Gently pull up the heatsink, to prevent any damage to the CPU.

Heatsink is not included in the package.

2.3 Installing the memory

2.3.1 DIMM combination

The following diagram indicates the locations of memory sockets.
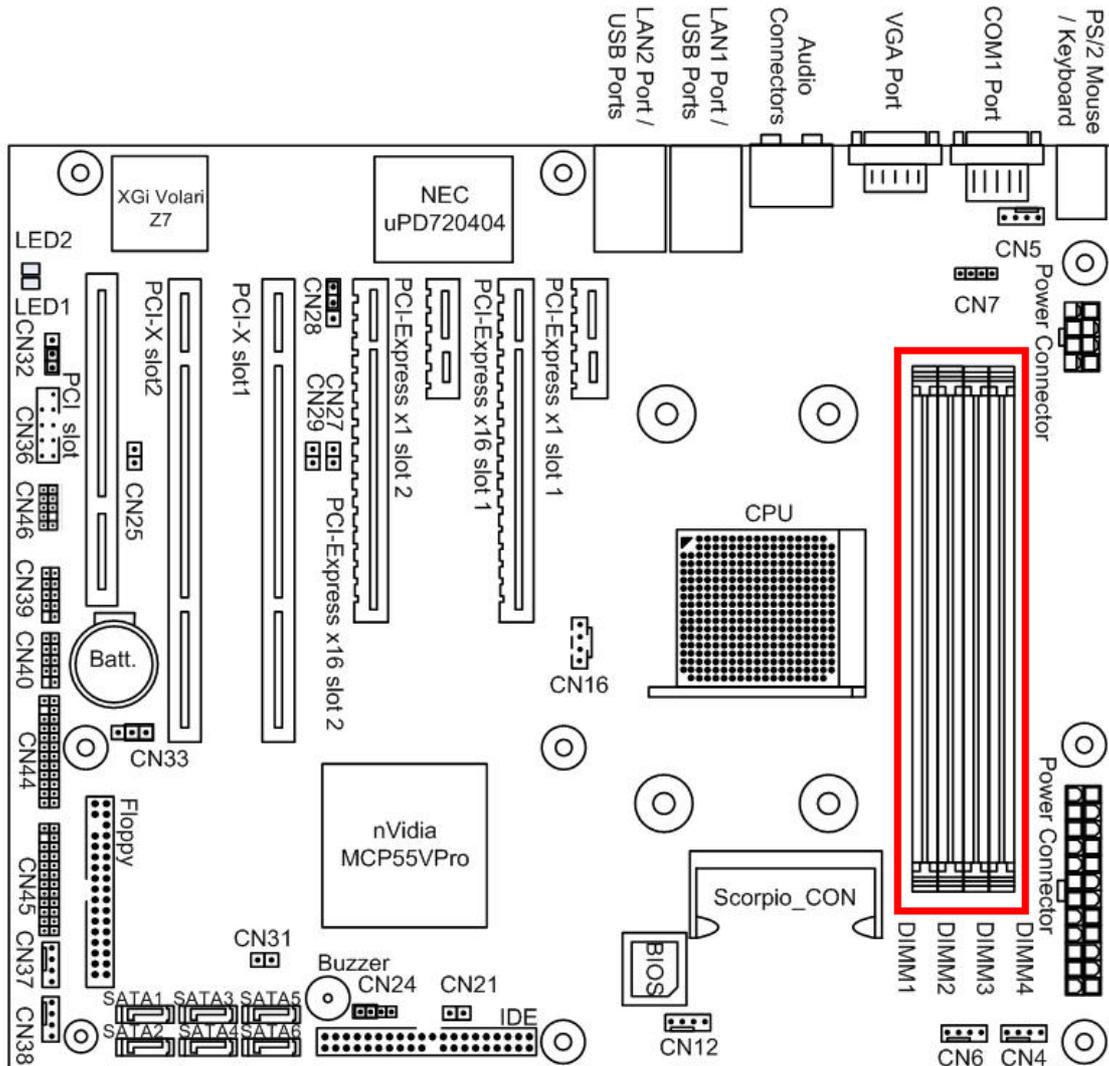
Types of memory supported:
There are 4 slots 240-pin DDR2 DIMM sockets. Before you started to install the memory module. Please ensure that the memory module are compatible with the NK16X. The NK16X will only support Unbuffered ECC type (DDRII 800/667/533/400) memory modules. The maximum recommended memory is 16GB.

Recommended Memory Configurations

1 DIMM	Slot 3
2 DIMMs	Slot 3, 4 or Slot 1, 2
4 DIMMs	Slot 1, 2, 3, 4

2.3.2 Installing DIMM modules

1. Open up the brackets.

2. Line up the memory with socket. Make sure the gap fits into the socket.
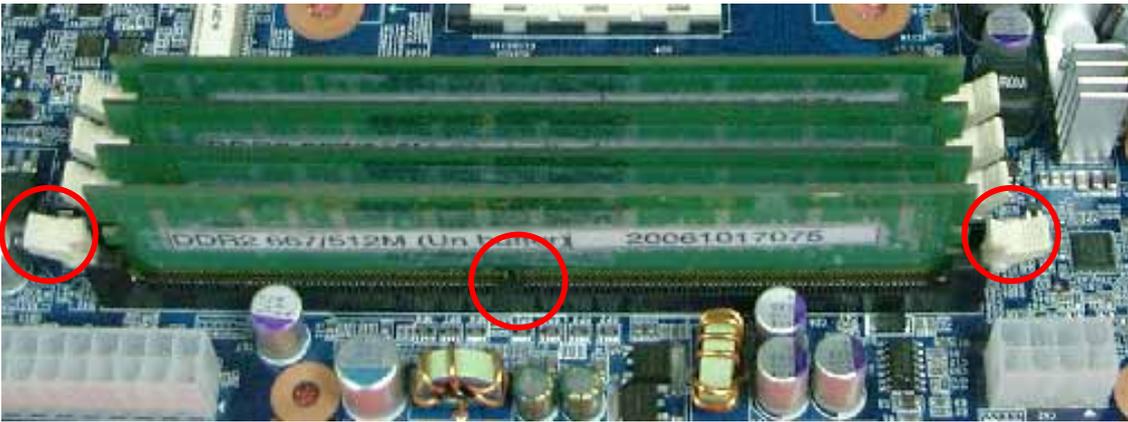
3. Push in the memory stick until bracket can be closed securely onto the stick. Make sure the brackets hold onto the memory module.

2.4 Jumpers Configuration

2.4.1 Clear CMOS Select Jumper

Header CN33 controls CMOS setting. Position your motherboard as it appears in the following diagram. Pin 1 is closer to the mounting hole, whereas pin 3 is closer to the PCI-X slot. To clear CMOS:

1. Turn off the system.
2. Short pin 1 and pin 2 using a jumper for a few seconds.
3. Take out the jumper.
4. Turn on the system and reconfigure the BIOS.
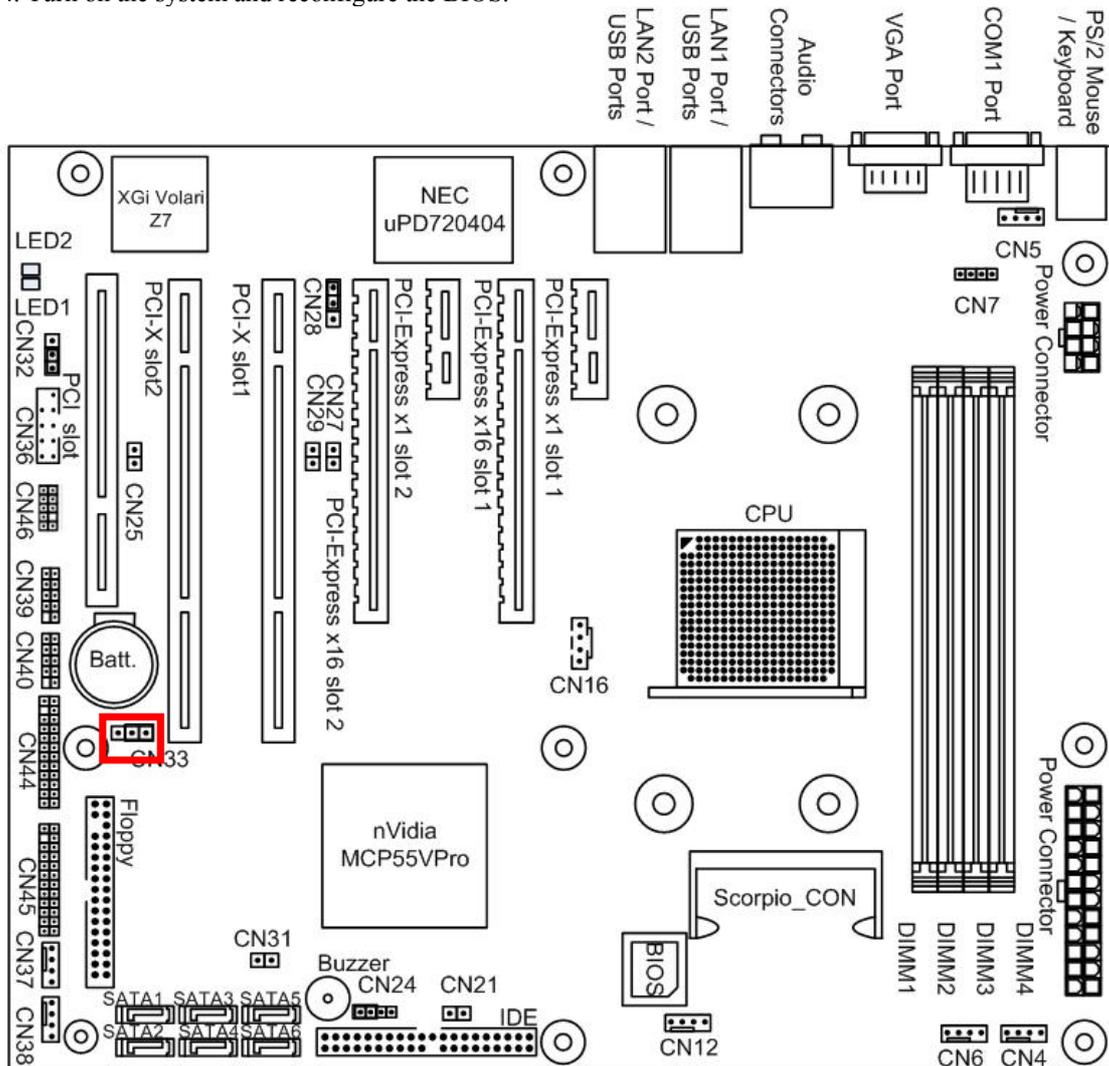
2.4.2 PCI-X Slot Frequency Select Jumper

Header CN28 controls the PCI-X slot frequency selection setting. When CN28 is 1-2 short, the PCI-X slot frequency is adjusted to 100Mhz. When CN28 is 2-3 short, the PCI-X slot frequency is adjusted to 133Mhz. Refer to the following diagram for the location of CN28.
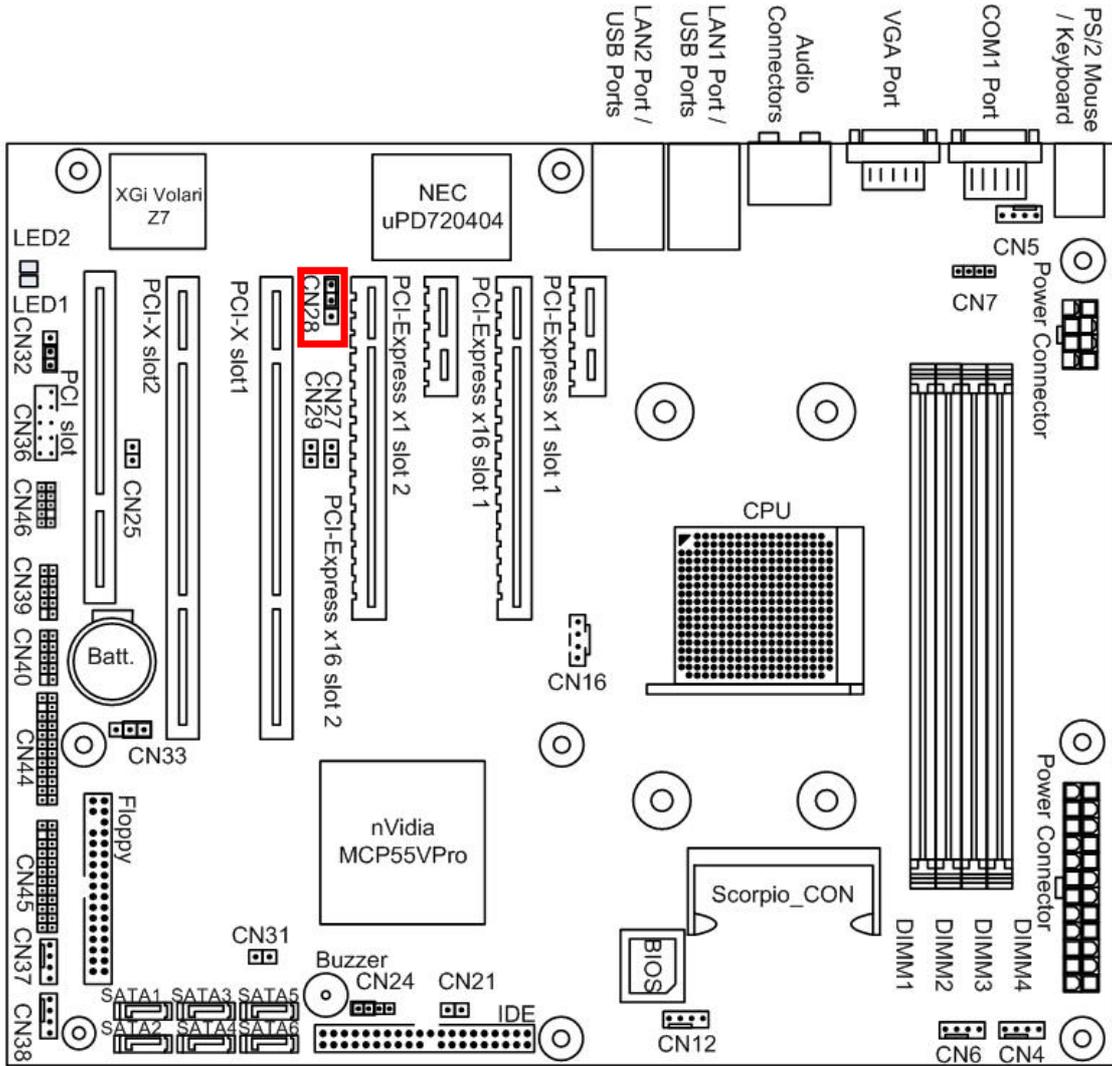
2.4.3 On-Board VGA Select Jumper

Header CN32 controls On-Board VGA setting. When CN32 is 1-2 short, On-Board VGA is enabled. When CN32 is 2-3 short, on-Board VGA is disabled. Refer to the following diagram for the location of CN32.
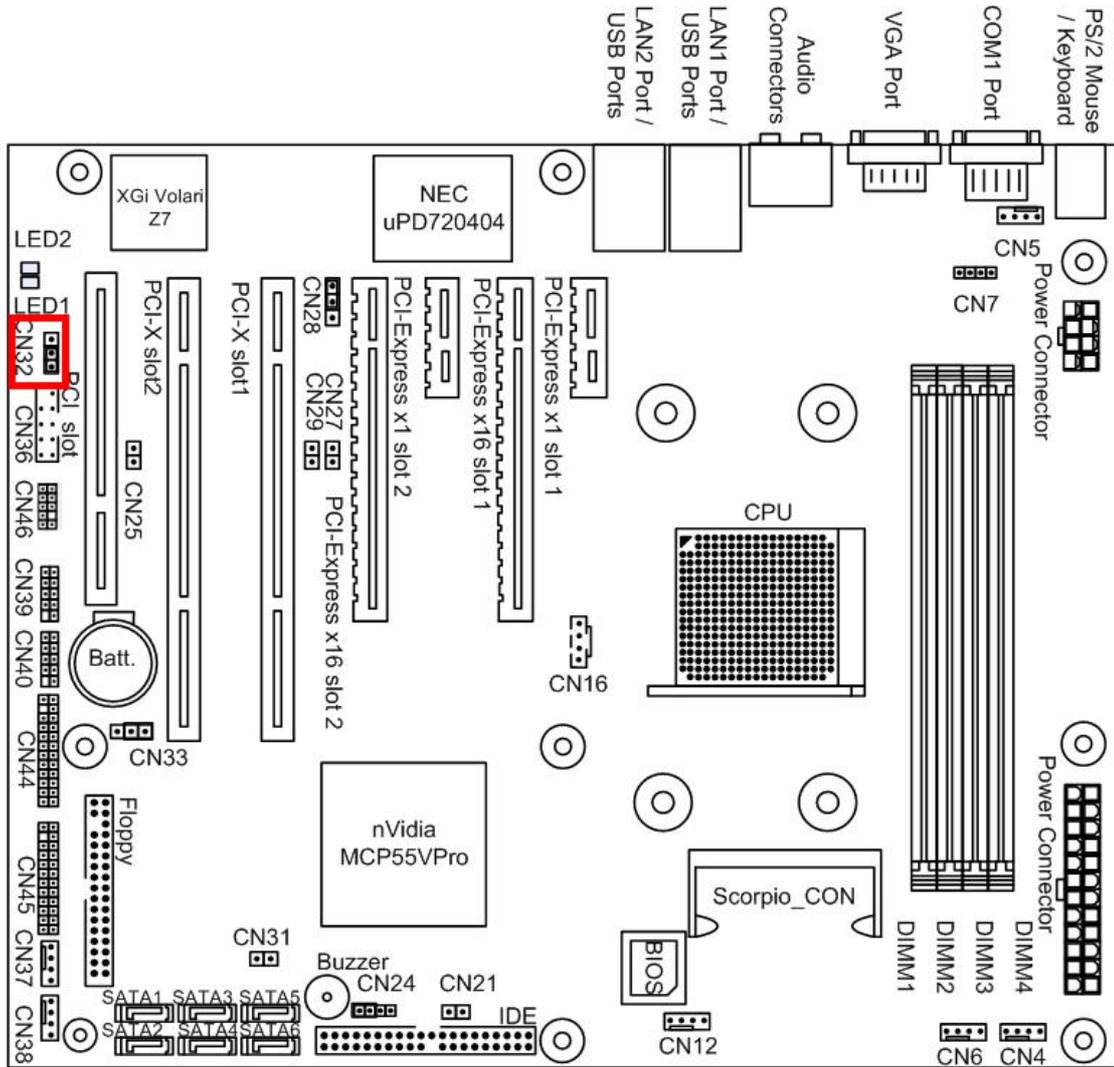
2.4.4 PCI-X Frequency Selection

Header CN25, CN27 and CN29 control the PCI-X Frequency Selection. When CN27 is short, PCI-X 66 MHz is enabled. When CN29 is short, PCI 66 MHz is enabled. When both CN25 and CN29 are short, PCI 33 MHz is enabled Refer to the following diagram for the location of these headers.
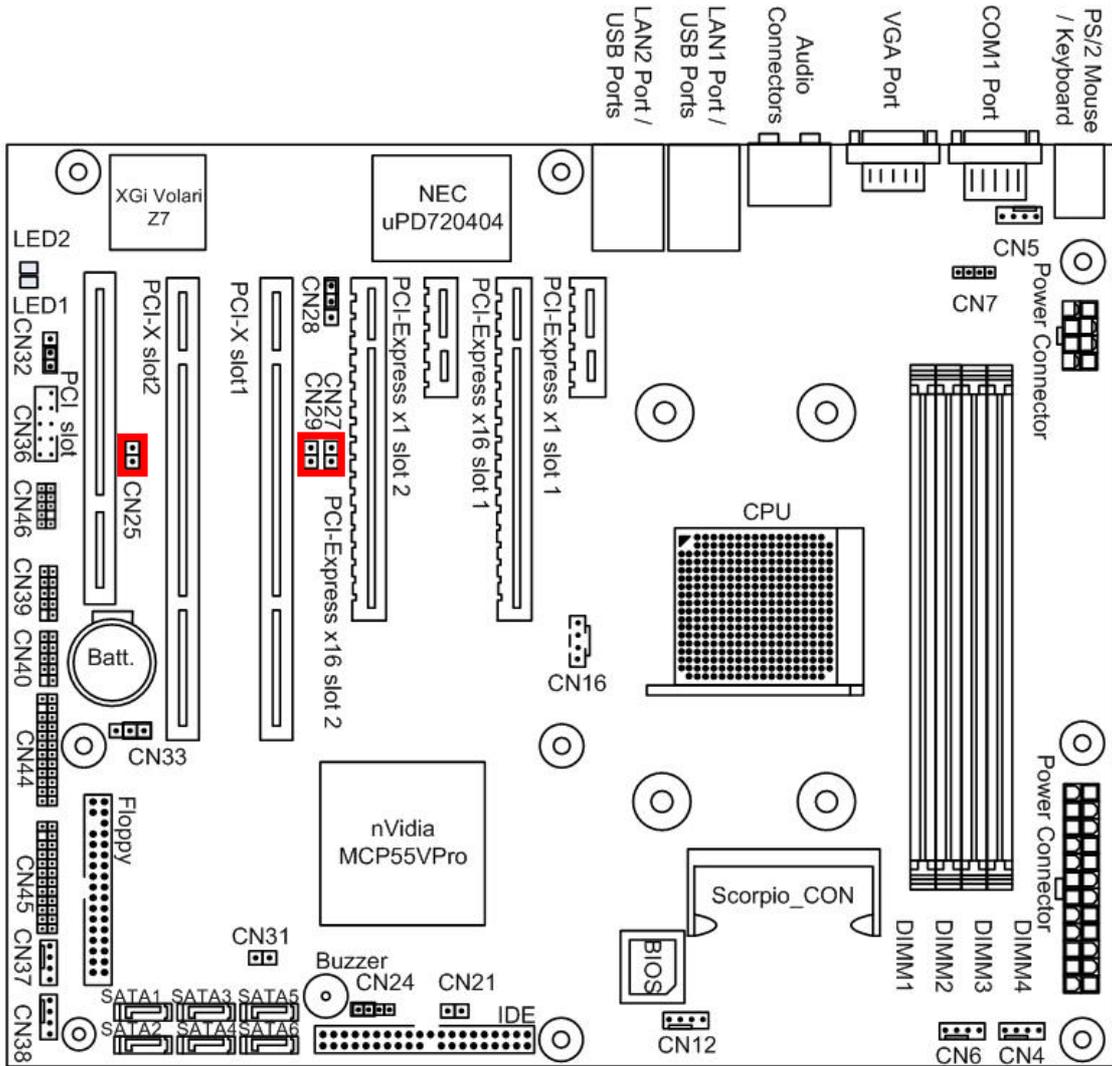
2.4.5 Intrusion Function Pin Header

Header CN31 controls the Intrusion Function. When CN31 is short, the Intrusion Function is disabled. Refer to the following diagram for the location of this header.
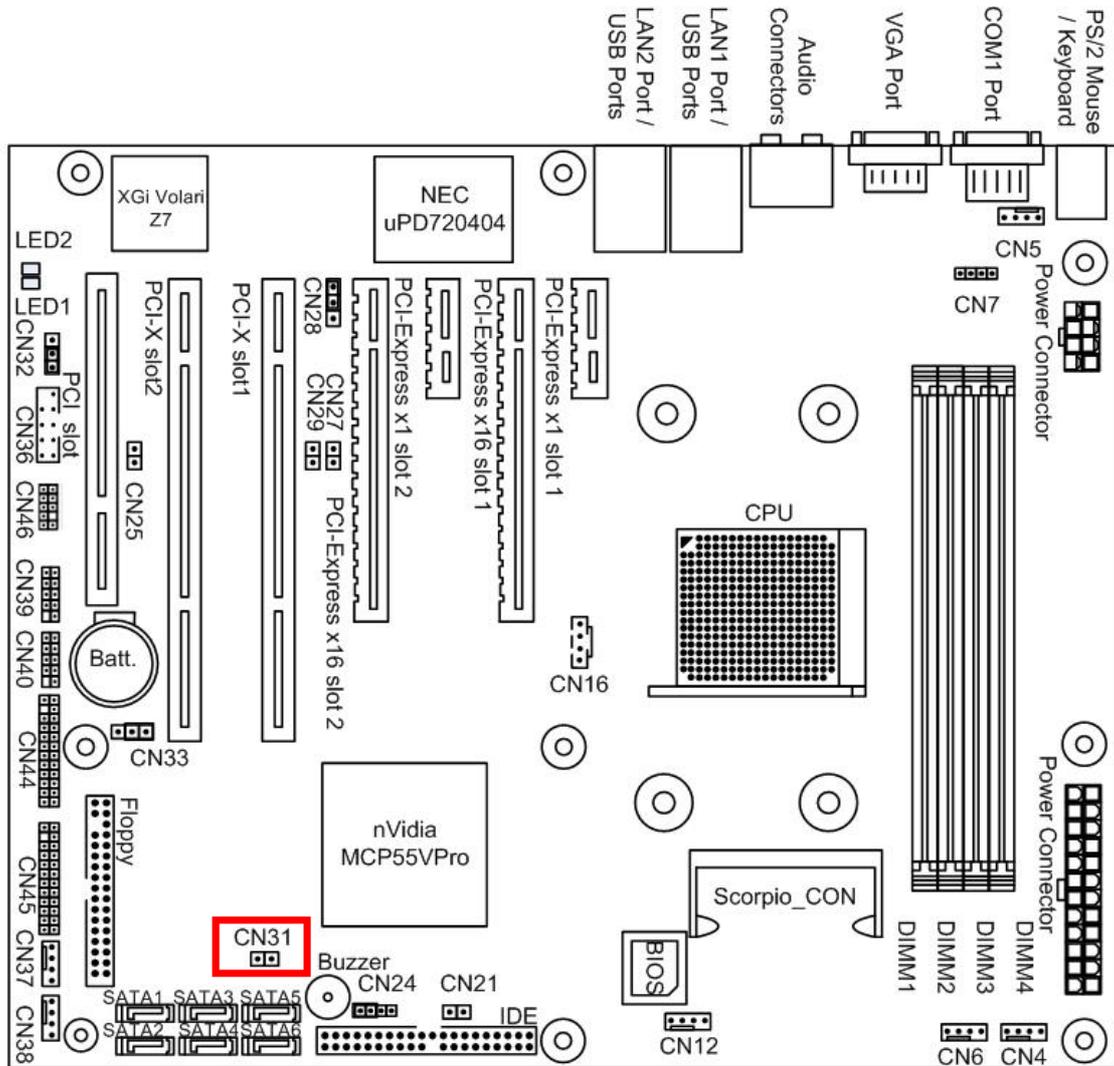
2.5 Power Supply

2.5.1 ATX 24-PIN POWER CONNECTOR

The 24-pin connector provides power to the motherboard and the 8-pin connector provides power to the CPU. So both must be connected for the system to run properly. Be sure to plug the power supply connector in the right direction. Failure to do so could cause damage to the motherboard. Make sure your power supply can support at least 2 amps standby power for the Advanced Configuration and Power Interface (ACPI) functions. Refer to the following diagram for the connector locations and orientations.
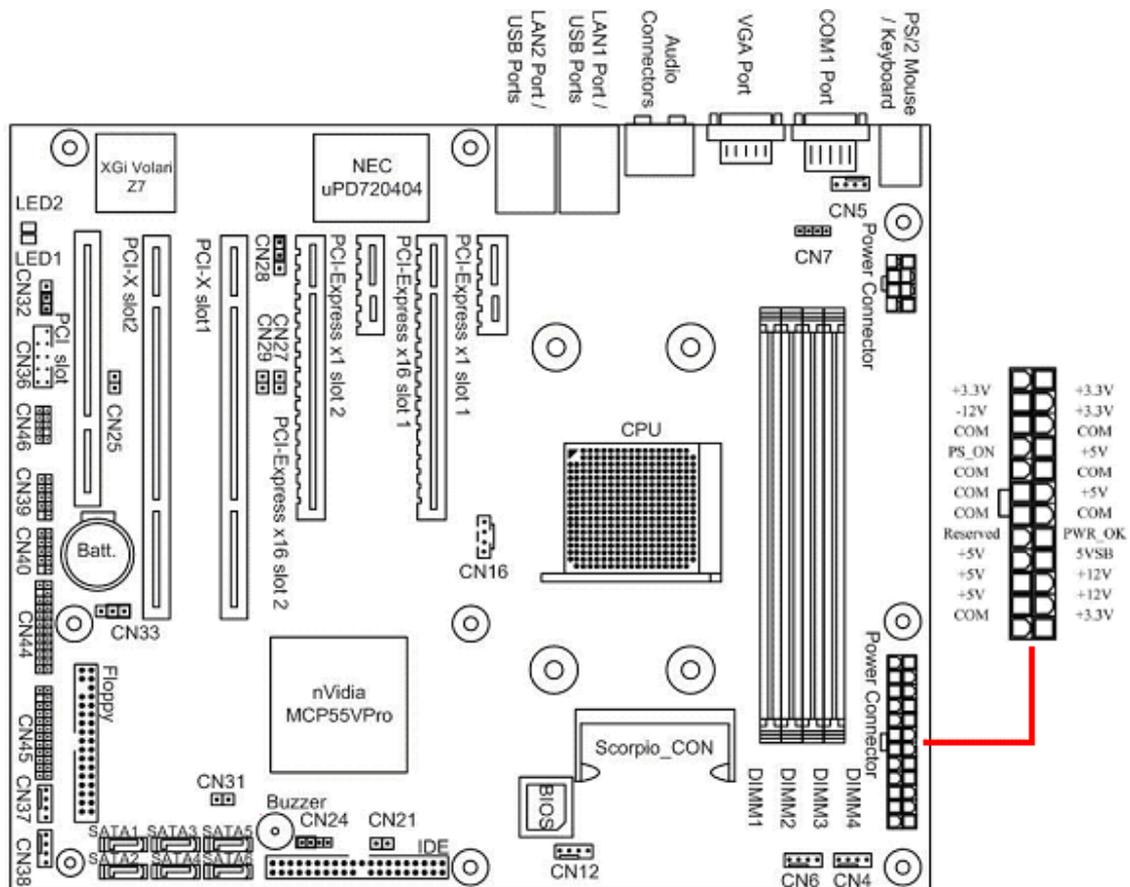
Make sure the AC adapter is not plugged into the wall outlet during installation. The electric current could damage the motherboard.

2.5.2 ATX 8-PIN POWER CONNECTOR

The 8-pin connector provides dedicated power to the CPU. Refer to the following diagram for its location and configuration.
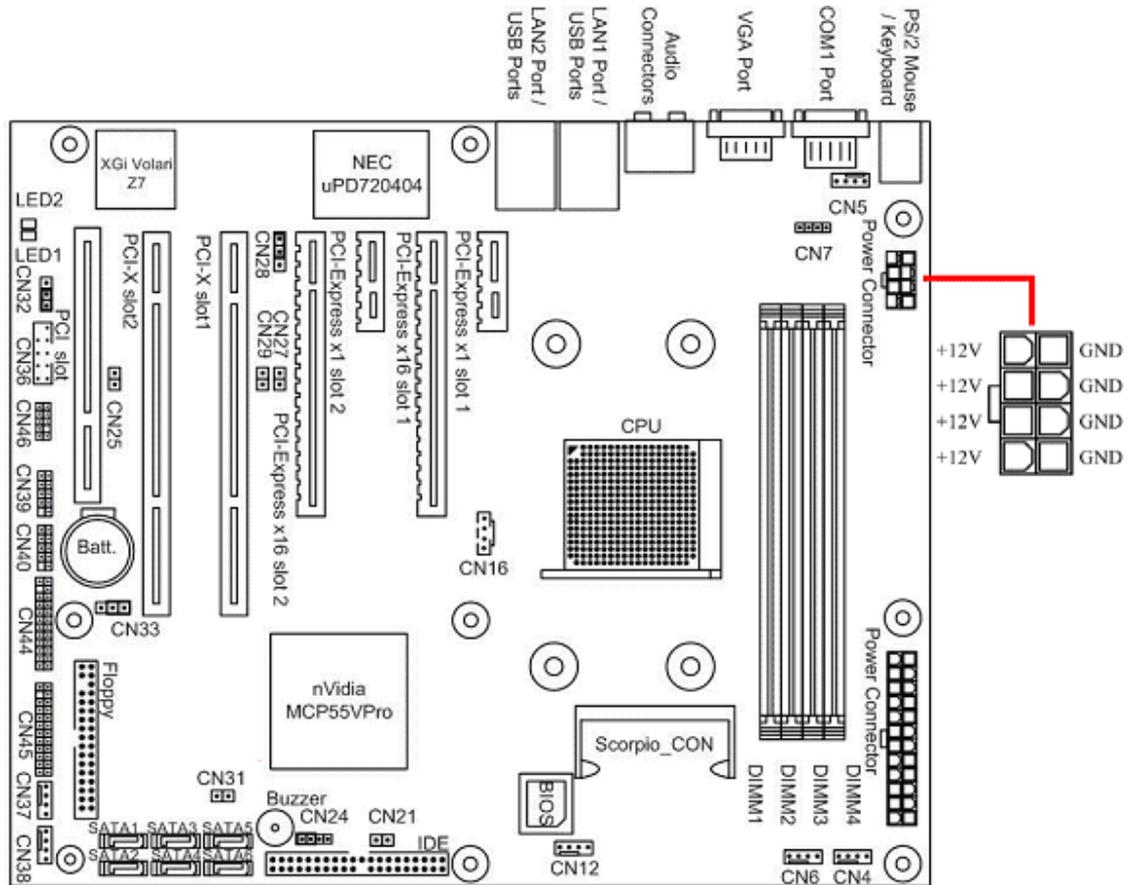
2.6 CABLES AND CONNECTORS

2.6.1 IDE AND SATA CONNECTORS

The following diagram indicates the location of the IDE and SATA connectors:
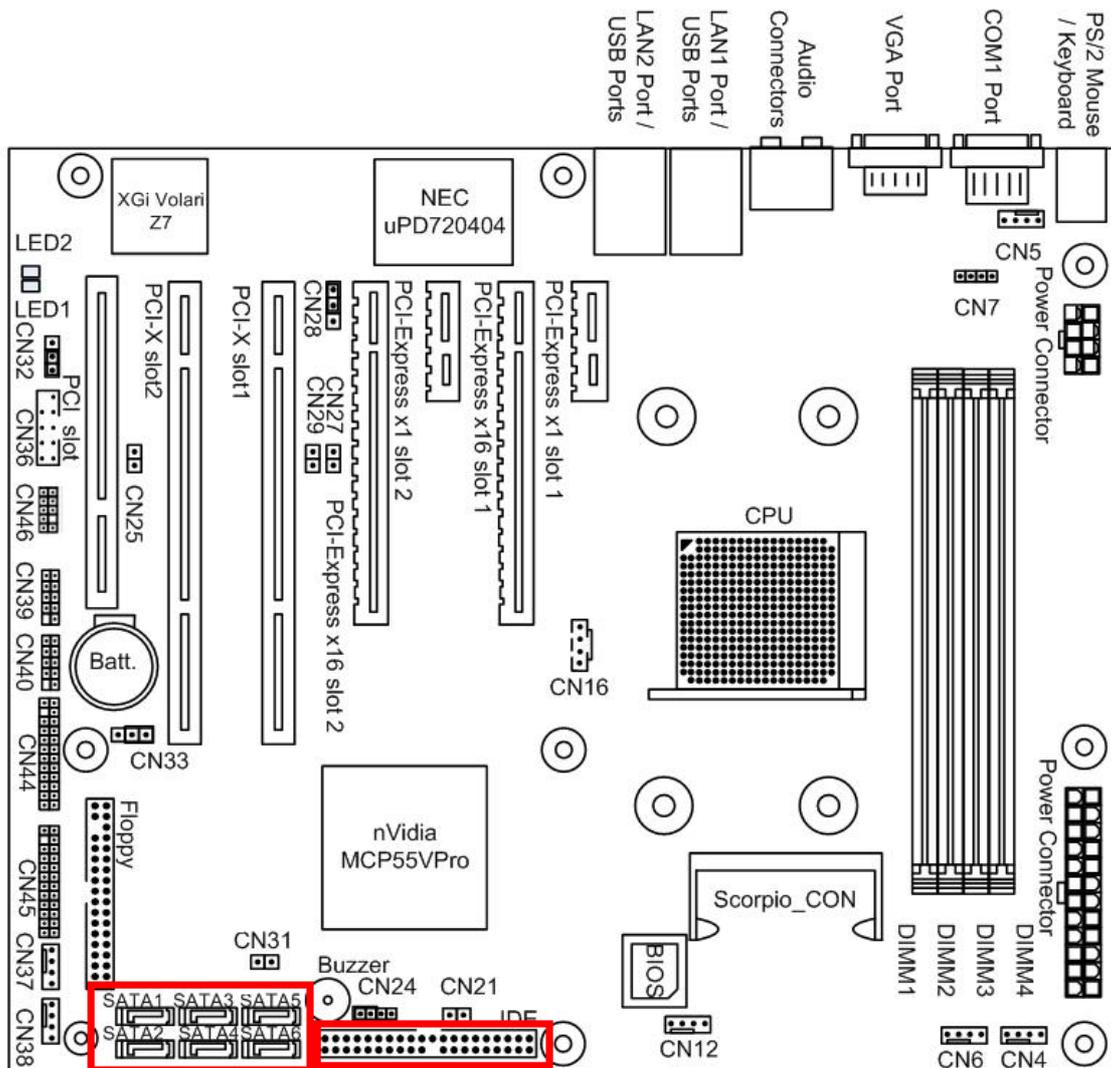
2.6.2 FRONT PANEL CONNECTORS

You can find the pin number on the corner of the pin block. Pin 1 is located closer to the outer edge of the motherboard. The + indicates the anode, or the +5V. The opposite pin, then, indicates the cathode or the ground.
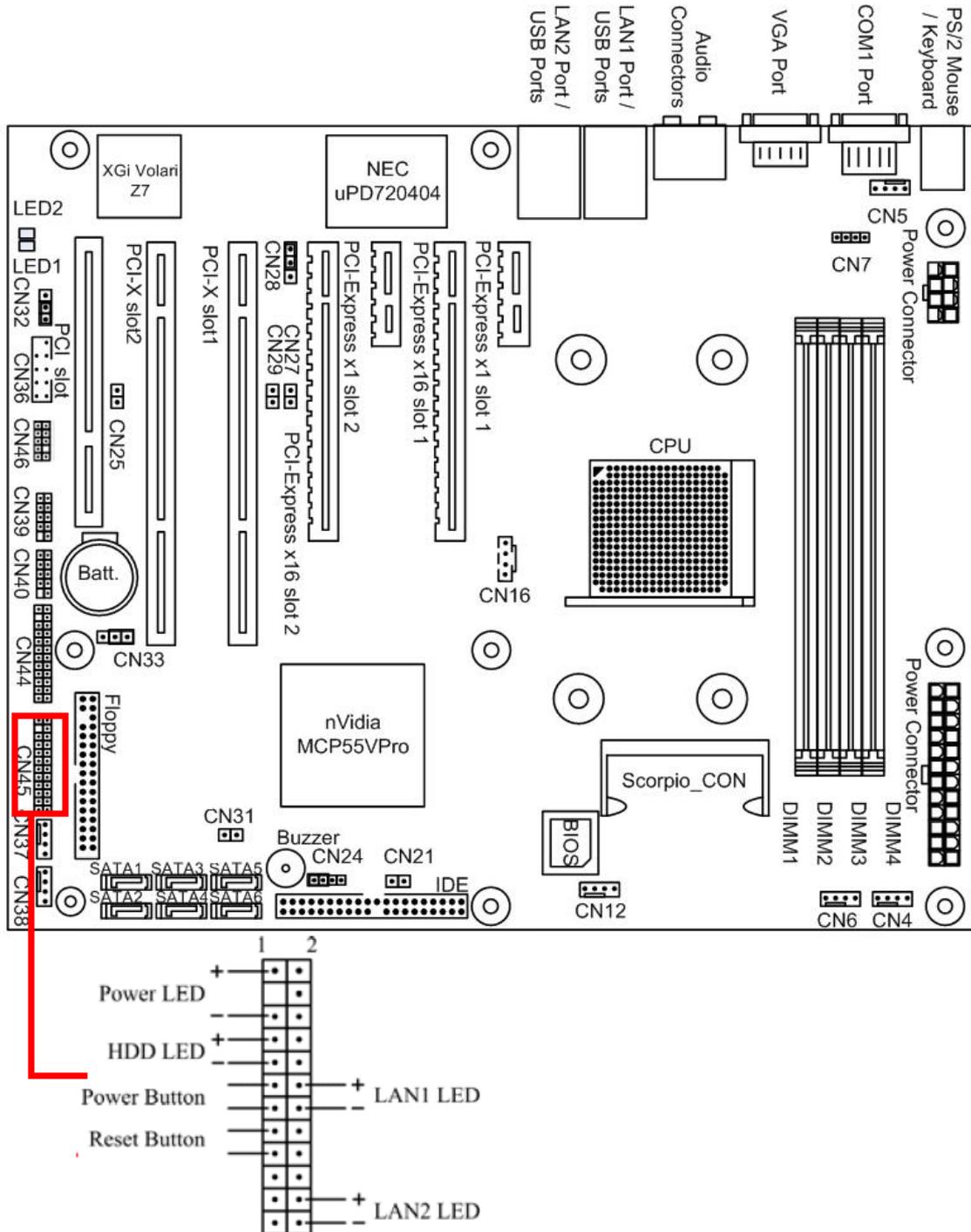
2.6.3 Rear Panel I/O ports

The following illustration displays the motherboard I/O port array.

State of Link	Speed LED (Green/Orange)	Link/Activity LED (Orange)
No link	OFF	OFF
Link @ 10Mbps	OFF	On/Blink
Link @ 100Mbps	ON (Green)	On/Blink
Link @ 1000Mbps	ON (Orange)	On/Blink
Activity	ON	BLINK
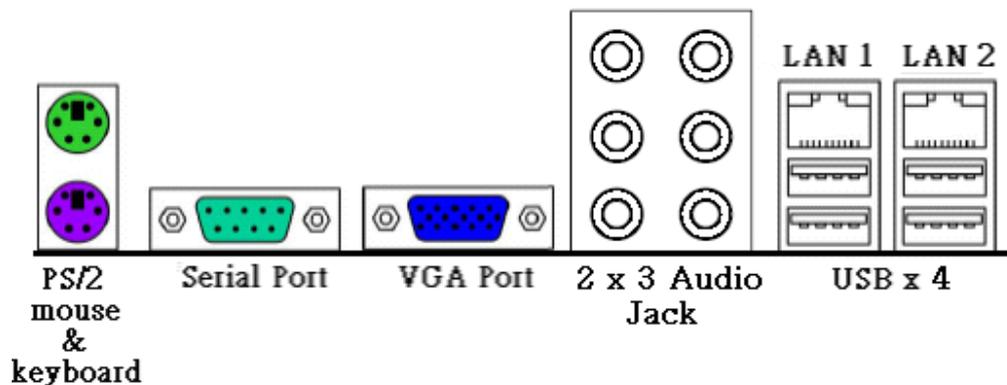
Type of Port	Function
PS/2 Mouse connector	This connection is for a standard mouse using a PS/2 plug (mini DIN).
PS/2 Keyboard connector	This connection is for a standard keyboard using a PS/2 plug (mini DIN). This connector will not allow standard AT size (large DIN) keyboard plugs. You may use a DIN to mini DIN adapter on standard AT keyboards.
USB Port 1,2,3 and 4	Four external USB 2.0 ports that allow simultaneous connections of 4 USB devices.
Serial Port connector (9-pin male)	This serial port can be used for pointing devices or other serial devices. See BIOS setup.
Gigabit Ethernet Port 1 & 2	These ports are RJ-45. The motherboard uses Intel 82563 Dual-port Gigabit Ethernet Controller.
VGA connector (15-pin female)	The VGA port connects display devices such as a monitor. See the BIOS setup.

2.6.4 Floppy disk drive connector

The following diagram indicates the location of the floppy drive connector:
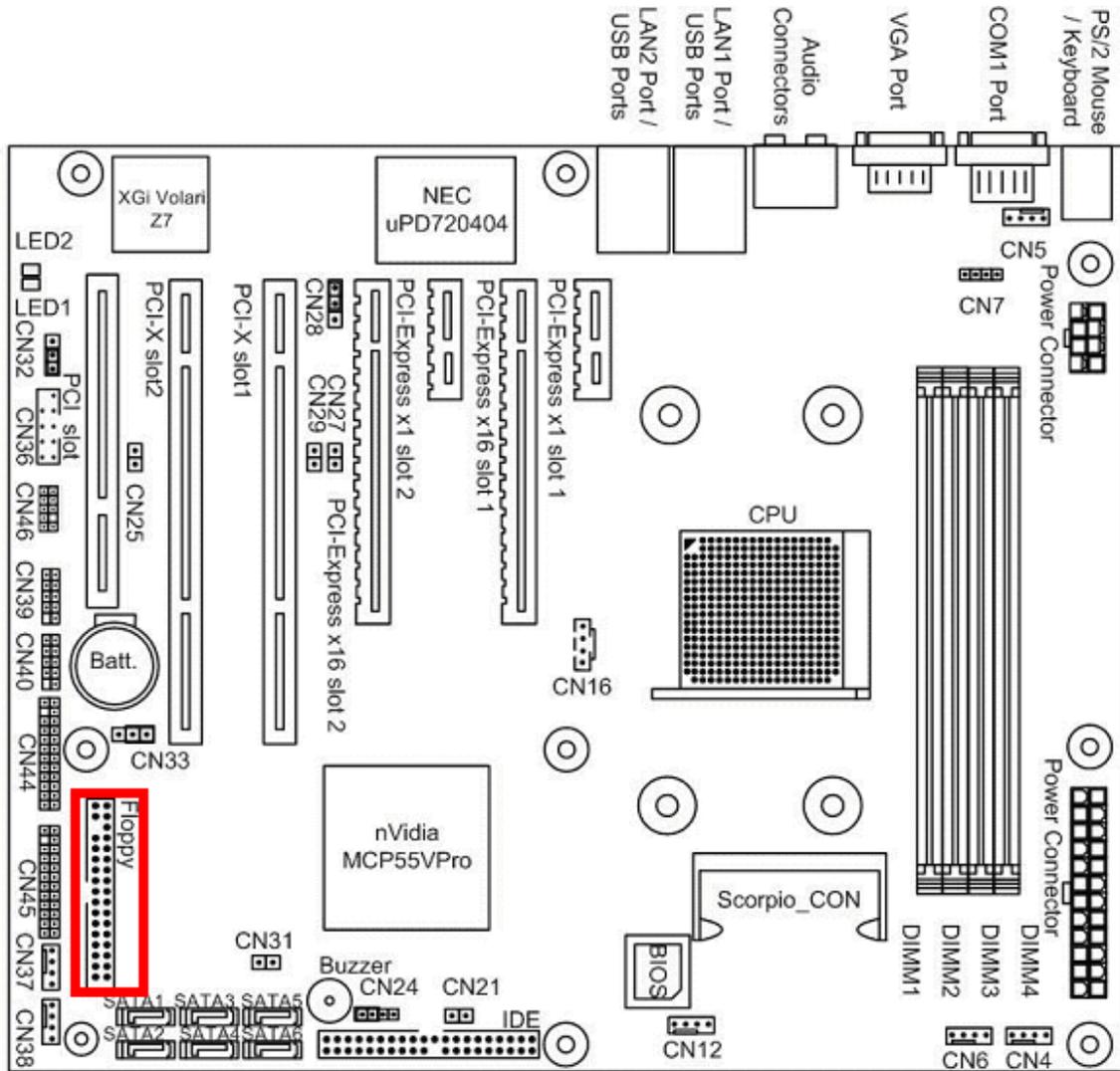
2.6.5 SLI Feature

NK164 serverboard has two PCI-E x16 slots. SLI feature are available from this serverboard. The SLI (Scalable Link Interface) technology links two graphics cards together to provide scalability and increased performance. Depending on the application, this feature can deliver as much as two times the performance of a single GPU configuration.
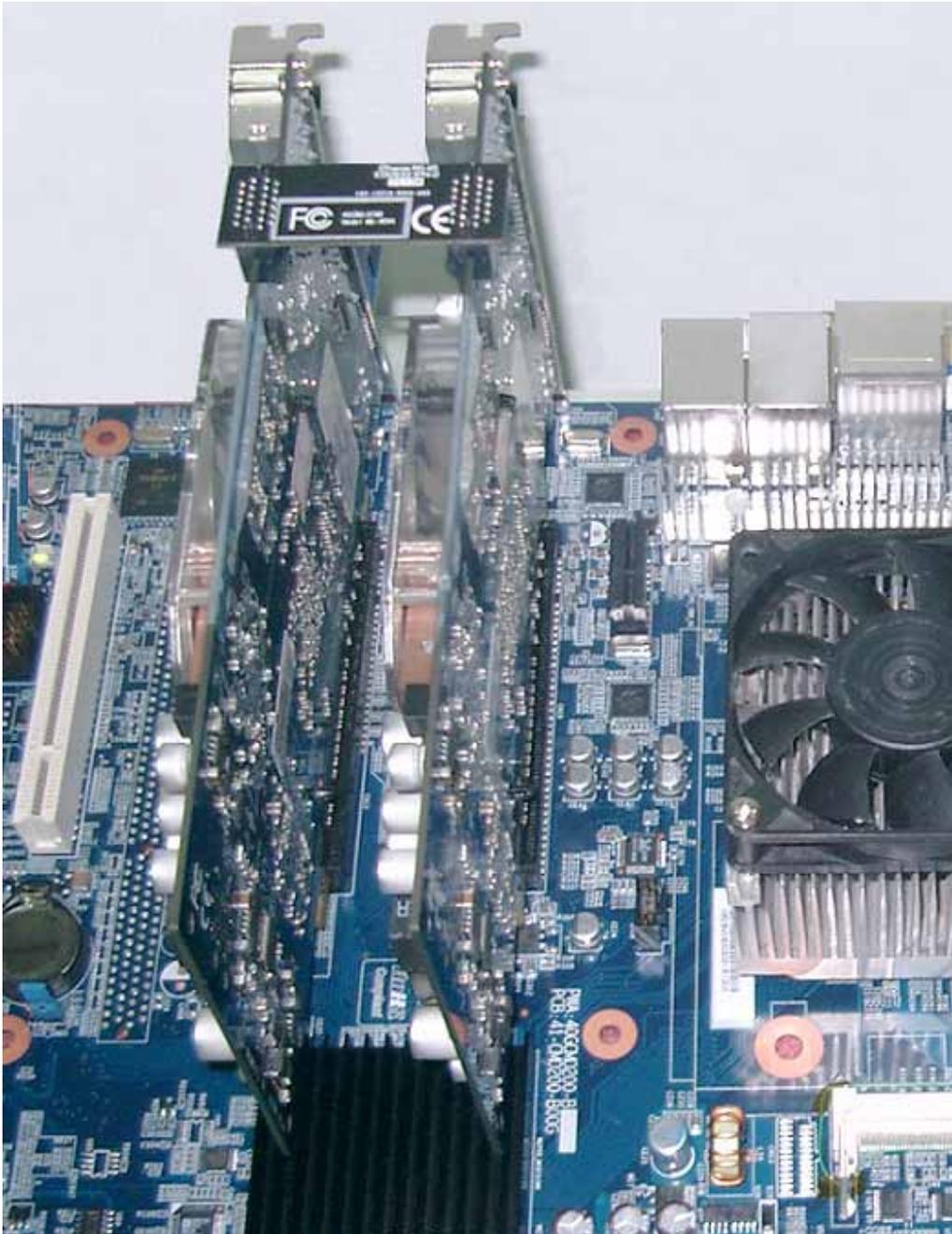
2.6.6 Speaker Header

The following diagram indicates the location of Speaker Header:
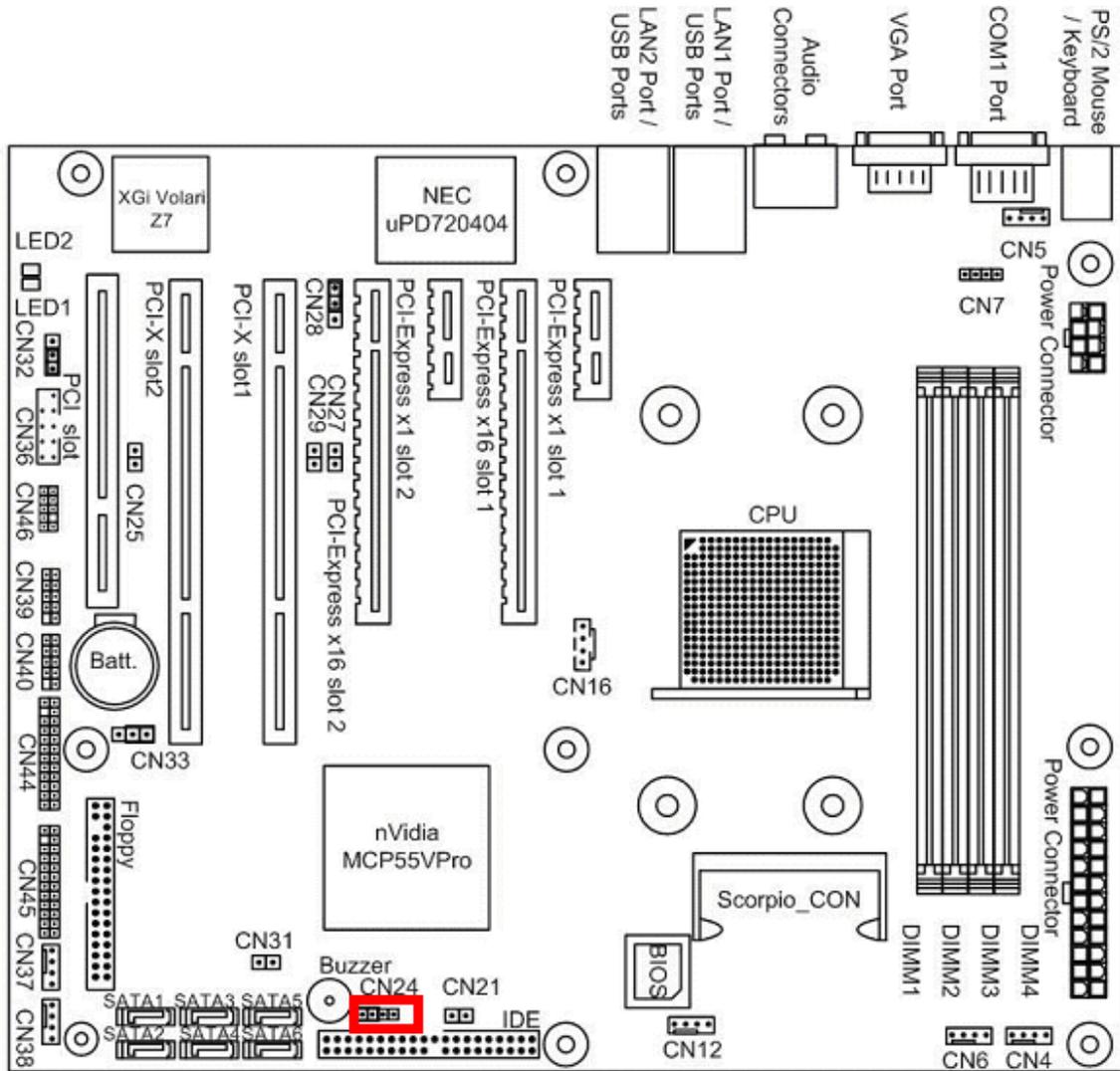
2.6.7 COM2 Header

The following diagram indicates the location of COM2 Header:
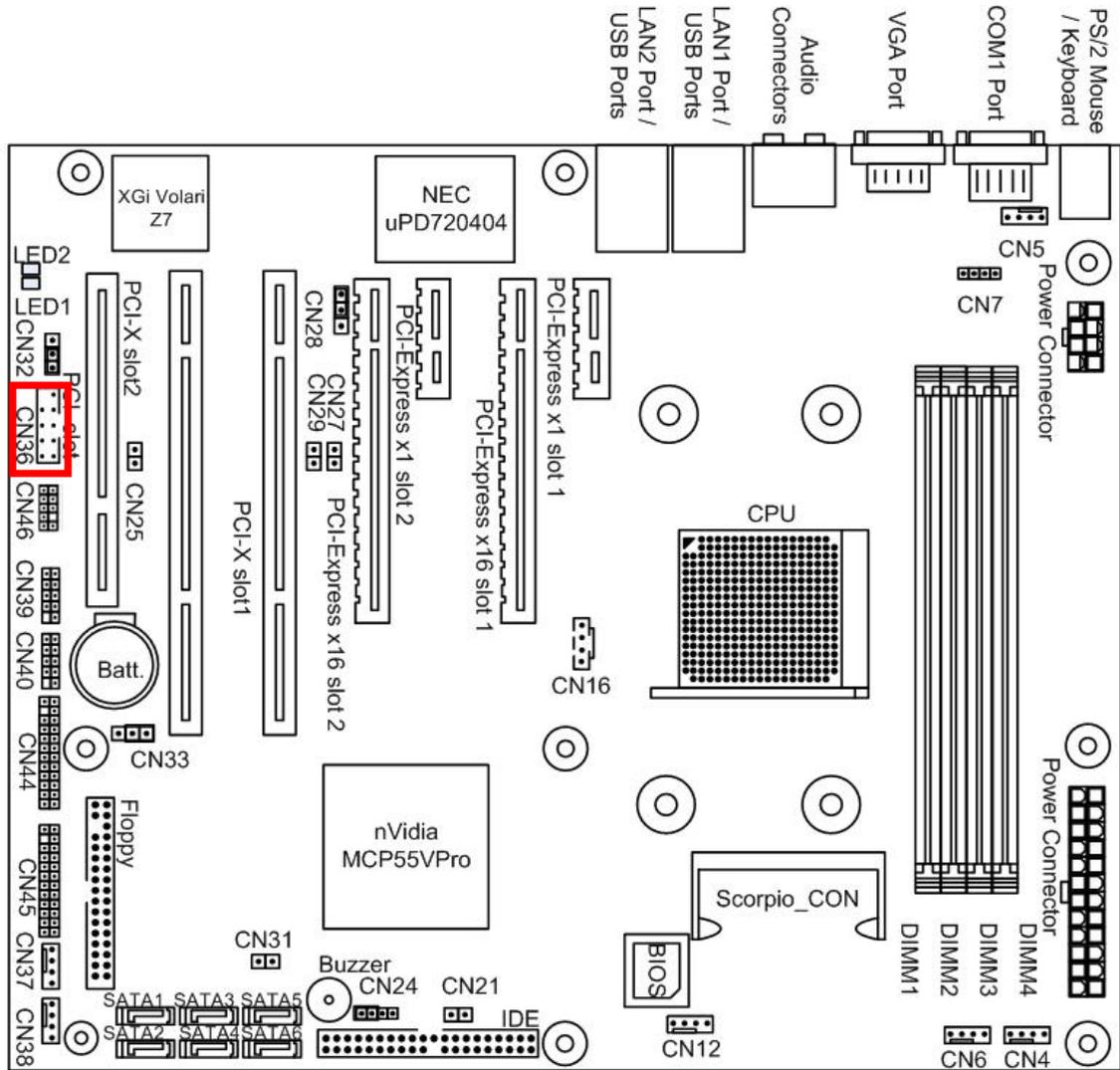
2.6.8 USB Header

The following diagram indicates the location of USB Header:
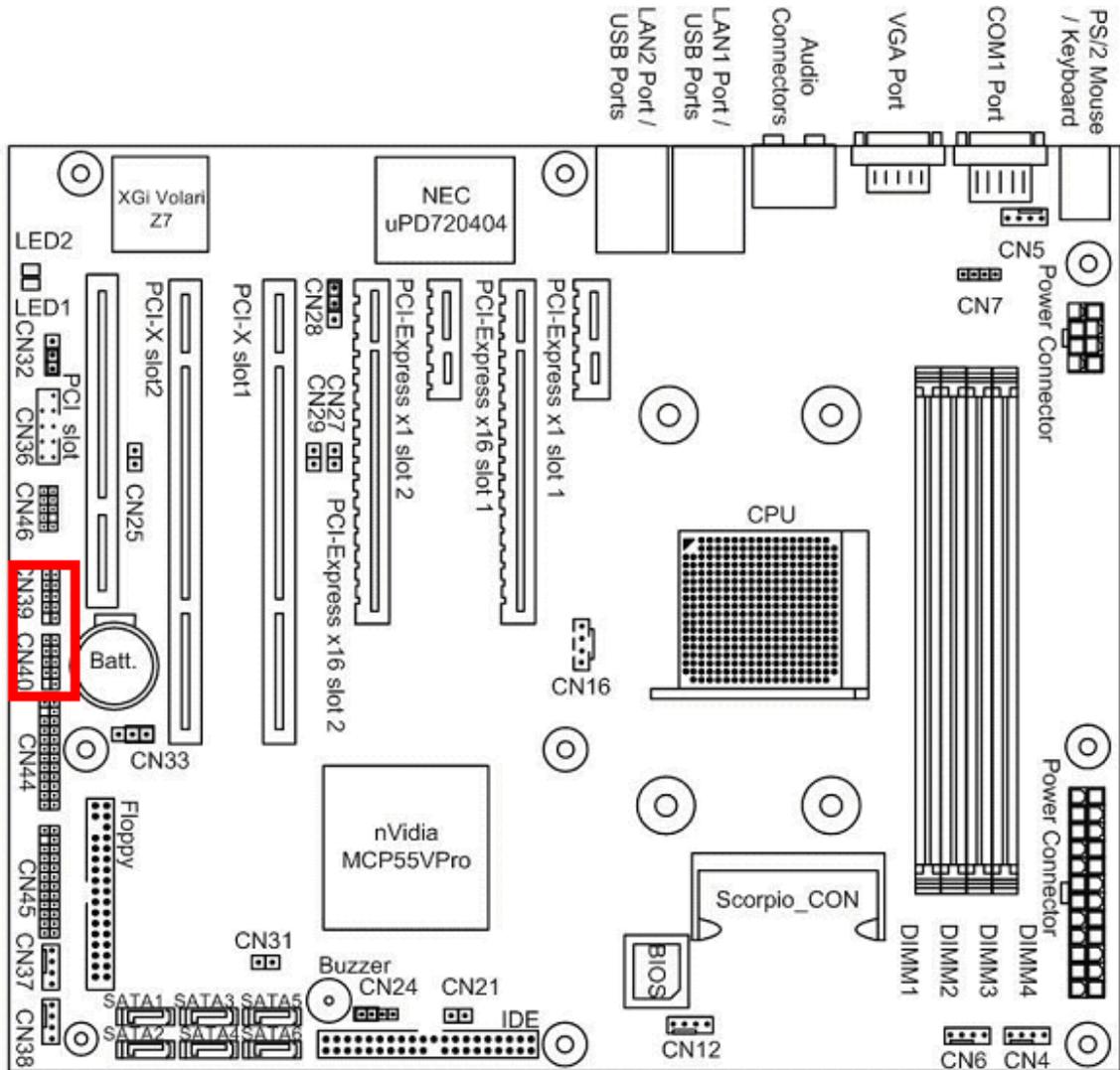
2.6.9 CD-In Connector

The following diagram indicates the location of CD-In Connector:
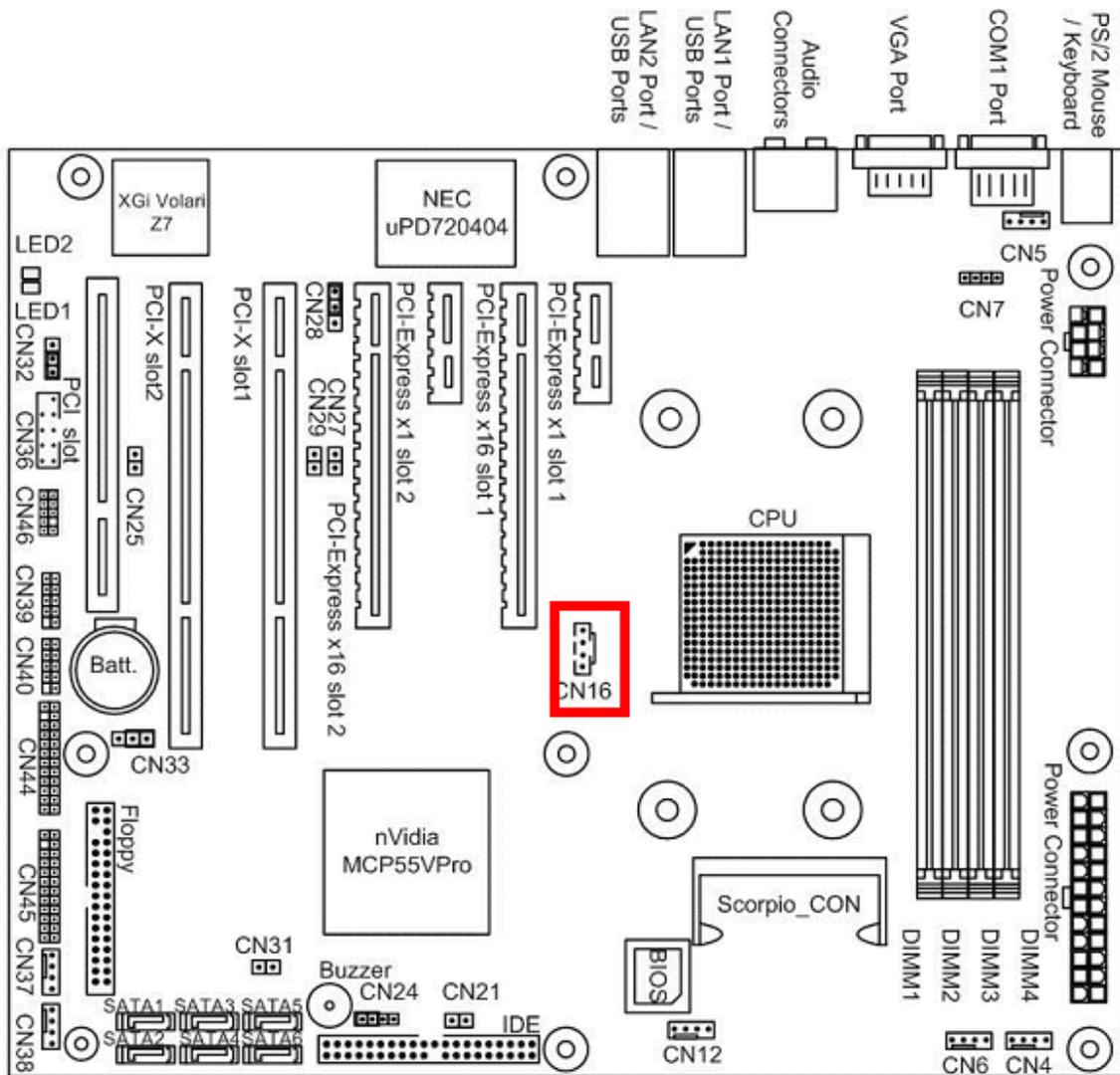
CHAPTER 3. BIOS SETUP

This chapter discusses the PhoenixBIOS setup program built into the ROM BIOS. BIOS is the basic input/output system, the firmware on the motherboard that enables the hardware to interface with the software. The setup program allows the users to modify the basic system configurations according to their needs. The configuration is then stored in battery-backed NVRAM so that it retains the configuration when the power is turned off. The PhoenixBIOS installed in the motherboard's ROM is a custom version of an industry standard BIOS. The rest of the chapter will list all the menus and sub-menus in the BIOS. Along with them, you can also find the list of possible values for any configurable item in the BIOS.

3.1 ENTERING BIOS SETUP

The PhoenixBIOS is activated when the system powers on. The BIOS reads the system information contained in the CMOS and begins the process of checking out the system and configuring it. After finishing configuring the whole system, BIOS will seek an OS on disk and turn over control of the system to the OS found. While BIOS is in control, the Setup menu can be accessed by pressing the <F2> key when the following message appears briefly at the bottom of the screen during Power On Self Test: "Press <F2> to enter SETUP."

3.2 Using Setup

The following table provides details about how to navigate the Setup program using keyboard.

KEY	FUNCTION
Up Arrow	Move to the previous item.
Down Arrow	Move to the next item.
Left Arrow	Move to the previous menu.
Right Arrow	Move to the next menu.
Esc	In the submenu: Exit the submenu. In the main menu: Exit without saving.
Enter	Select the item. A pop-up window will appear to allow setting of the item's value. If the item has a 4 in front of it, it means that the item leads to a submenu. Pressing <Enter> will take you to the sub-menu.
PgUp	Increase the numeric value or goes to the previous setting value.
PgDn	Decrease the numeric value or goes to the next setting value.
+	Increase the numeric value or goes to the previous setting value.
-	Decrease the numeric value or goes to the next setting value.
F1	General help on setup navigation keys. Press <F1> key to pop up a small help window that describe the appropriate keys to use and the possible selections for the highlighted item. To exit the Help Window, press <ESC> key or <F1> key again.
F9	Setup Defaults.
F10	Save and Exit.

3.3 Troubleshooting

In case the system cannot be booted after some changes in BIOS, use the clear CMOS jumper setting to reset the BIOS to default. To avoid such problem, configure only the items that you thoroughly understand and refrain from modifying the default chipset settings.

3.4 Main Menu:

Phoenix BIOS Setup Utility								
Main	Advanced	Security	Power	Boot	Server	Exit		
								Item Specific Help
								<Tab>, <Shift-Tab>, or <Enter> selects field.
System Time:		[12:31:16]						
System Date:		[12/10/2006]						
BIOS Date		12/19/06						
BIOS Version:		NK16X V050						
Floppy Configuration								
System Memory :		633 KB						
Extended Memory :		4095 MB						
F1 Help	↑↓ Select Item	-/+ Change Values		F9 Setup Defaults				
ESC Exit	←→Select Menu	Enter Select▶Sub-Menu		F10 Save and Exit				

The following table shows the items that you can customize on the Main menu page:

Item	Options	Description
System Time	HH:MM:SS	Sets the system time.
System Date	MM/DD/YYYY	Sets the system date.
BIOS Version	N/A	Displays the BIOS version.
Floppy Configuration	360 Kb 1.2 MB 720 Kb 1.44/1.25 MB 2.88 MB Disabled	Selects the type of floppy-disk drive installed in your system.
System Memory	N/A	Displays the amount of conventional memory detected during boot up.
Extended Memory	N/A	Displays the amount of extended memory detected during boot up.

3.5 Advanced Menu:

		Phoenix BIOS Setup Utility					
Main	**Advanced**	Security	Power	Boot	Server	Exit	

	Item Specific Help
Reset Configuration Data: [No] QuickBoot Mode: [Disabled] Summary screen: [Disabled] LPC port 80: [Enable] SLI Broadcast Aperture [Disabled] ► Hammer Configuration ► Integrated Devices ► IDE Configuration ► I/O Device Configuration ► Console Redirection IOMMU: [Disabled] DRAM Bank Interleave [Auto]	Select 'Yes' if you want to clear the extended system configuration data (ESCD) area.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→ Select Menu Enter Select ► Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Advanced menu page:

Item	Options	Description
Reset Configuration Data	No Yes	"Yes" erases all configuration data in a section of memory reserved for ESCD (Extended System Configuration Data) which stores the configuration settings for non-PnP plug-in devices. Select Yes when required to restore the manufacturer's defaults.
QuickBoot Mode	Disabled Enabled	Allows the system to skip certain tests while booting. This will decrease the time needed to boot the system.
Summary Screen	Disabled Enabled	Display the system configuration on boot.
LPC port 80	Disabled Enabled	Enable/Disable LPC port 80.
SLI Broadcast Aperture	Disabled SLI on Master SLI on Slave	Allocate 256MB aperture for SLI traffic. If set disabled, SLI traffic will use CPU bus and resources, which results in a performance loss. Set to Master or slave depends on which CK804 the video cards are installed. Incorrect selection will cause poor performance.

Item	Options	Description
IOMMU	Disabled Enabled	Enable/Disable IOMMU.
DRAM Bank Interleave	Disabled Auto	Interleave memory blocks across the DRAM chip selects. Auto will set this enabled when possible

The Hammer Configuration Sub Menu looks like the following:

Phoenix BIOS Setup Utility	
Advanced	
Hammer Configuration	Item Specific Help
	Set frequency of HT links for coherent and non-coherent.
HT-LDT Frequency [1000Mhz] Memory Frequency Downgrade [AUTO] CAS# Latency tcl [AUTO] CAS# R/W Delay trcd [AUTO] RAS# Active Time tras [AUTO] Row Precharge Time trp [AUTO]	
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Chipset Feature sub-menu page:

Item	Options	Description
Machine Checking	200Mhz 400Mhz 600Mhz 800Mhz 1000Mhz	Set frequency of HT links for coherent and non-coherent.
Memory Frequency Downgrade	AUTO DDR400 DDR533 DDR667	Memory Frequency Downgrade Auto: Follow AMD spec. to downgrade MAX. memory frequency. DDR400: Downgrade MAX. frequency to 400Mhz. DDR533: Downgrade MAX. frequency to 533Mhz. DDR667: Downgrade MAX. frequency to 667Mhz.
CAS# Latency tcl	AUTO 2 Clocks 3 Clocks 2.5 Clocks	Function 2 Reg 88[2:0] This field specifies the CAS# latency. The number of clocks after the read, that the DRAM returns the read data.

Item	Options	Description
CAS# R/W Delay trcd	AUTO 2 Clocks 3 Clocks 4 Clocks 5 clocks 6 clocks	Function 2 Reg 88[14:12] This field specifies the RAS# to CAS# delay to Rd/Wr command to the same bank.
RAS# Active Time tras	AUTO 5 Clocks 6 Clocks 7 Clocks 8 clocks 9 clocks 10 Clocks 11 Clocks 12 Clocks 13 clocks 14 clocks 15 clocks	Function 2 Reg 88[23:20] This field specifies the minimum RAS# active time.
Row Precharge Time trp	AUTO 2 Clocks 3 Clocks 4 Clocks 5 clocks 6 clocks	Function 2 Reg 88[26:24] This field specifies the Row precharge time (Precharge to Active or Auto-Refresh of the same bank).

3.5.1 Integrated Devices Sub Menu

The Integrated Devices Sub Menu looks like the following:

Phoenix BIOS Setup Utility	
Advanced	
Integrated Devices	Item Specific Help
USB Control [USB1.1+USB2] USB BIOS Legacy Support: [Enabled] MAC 1 LAN: [Enabled] MAC 1 LAN Bridge: [Enabled] MAC 2 LAN: [Enabled] MAC 2 LAN Bridge: [Enabled] SATA1 Controller: [Enabled] SATA2 Controller: [Enabled] SATA3 Controller: [Enabled] ► NV RAID Configuration	Enable/Disable USB controller. Under DOS only support USB1.1
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Integrated Device sub-menu page:

Item	Options	Description
USB Control	Disabled USB1.1 USB1.1+USB2	Enable/Disable USB controller. Under DOS only support USB1.1.
USB BIOS Legacy Support	Enable Disable	Enable or Disable USB keyboard and mouse.
MAC 1 LAN	Enable Disable	Enable/Disable MAC 1 LAN Device.
MAC 1 LAN Bridge	Enable Disable	Enable/Disable MAC 1 LAN Bridge.
MAC 2 LAN	Enable Disable	Enable/Disable MAC 2 LAN Device.
MAC 2 LAN Bridge	Enable Disable	Enable/Disable MAC 2 LAN Bridge.
SATA1 Controller	Enable Disable	Enable/Disable First Serial ATA device.
SATA2 Controller	Enable Disable	Enable/Disable Second Serial ATA device.
SATA3 Controller	Enable Disable	Enable/Disable Third Serial ATA device.
NV RAID Configuration	Enable Disable	NV RAID Configuration sub menu.

3.5.2 IDE Configuration Sub Menu

The IDE Configuration Sub Menu looks like the following:

Phoenix BIOS Setup Utility	
Advanced	
IDE Configuration	Item Specific Help
► Primary Master [100GB] ► Primary Slave [CD-ROM]	
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The Primary Master Sub Menu looks like the following:

Phoenix BIOS Setup Utility	
Advanced	
Primary Master [100GB]	Item Specific Help
Type: [Auto] LBA format Maximum Sectors: 195813072 Total Capacity: 100GB Multi-Sector Transfer: [16 sectors] LBA Mode Control:………………… [Enabled] 32 Bit I/O: [Disabled] Transfer Mode: [FPIO 4 / DMA 2] Ultra DMA Mode: [Mode 6]	User = you enter Parameters of hard-disk drive installed at this connection. Auto = autotypes Hard-disk installed here. CD-ROM = a CD-ROM drive is installed here. ATAPI Removable = removable disk drive is installed here.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Primary Master sub-menu page:

Item	Description
Type	User = you enter parameters of hard-disk drive installed at this connection. Auto = autotypes hard-disk drive installed here. CD-ROM = a CD-ROM drive is installed here. ATAPI Removable = removable disk drive is installed here.
Multi-Sector Transfers	This setting enables or disables multi-sector transfers.
LBA Mode Control	This setting enables or disables LBA mode control.
32 Bit I/O	This setting enables or disables 32 Bit IDE data transfer.
Transfer Mode	This setting adjusts the IDE transfer mode.
Ultra DMA Mode	This setting adjusts the Ultra DMA mode.

The Primary Slave Sub Menu looks like the following:

Phoenix BIOS Setup Utility **Advanced**	
Primary Slave [None]	Item Specific Help
Type: [Auto] Multi-Sector Transfer: [Disabled] LBA Mode Control: [Disabled] 32 Bit I/O: [Disabled] Transfer Mode: [FPIO 4 / DMA 2] Ultra DMA Mode: [Mode 2]	User = you enter Parameters of hard-disk drive installed at this connection. Auto = autotypes Hard-disk installed here. CD-ROM = a CD-ROM drive is installed here. ATAPI Removable = removable disk drive is installed here.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Primary Slave sub-menu page:

Item	Description
Type	User = you enter parameters of hard-disk drive installed at this connection. Auto = autotypes hard-disk drive installed here. CD-ROM = a CD-ROM drive is installed here. ATAPI Removable = removable disk drive is installed here.
Multi-Sector Transfers	This setting enables or disables multi-sector transfers.
LBA Mode Control	This setting enables or disables LBA mode control.
32 Bit I/O	This setting enables or disables 32 Bit IDE data transfer.
Transfer Mode	This setting adjusts the IDE transfer mode.
Ultra DMA Mode	This setting adjusts the Ultra DMA mode.

3.5.3 I/O Device Configuration Sub Menu

The I/O Configuration Sub Menu looks like the following:

Phoenix BIOS Setup Utility		
Advanced		
I/O Device Configuration		Item Specific Help
		Configure serial port A using options:
Serial Port A:	[Enabled]	
Base I/O address:	[3F8]	[Disabled]
Interrupt:	[IRQ4]	No configuration.
Serial Port B:	[Enabled]	
Base I/O address:	[2F8]	[Enabled]
Interrupt:	[IRQ3]	User configuration.
Floppy Disk Controller:	[Enabled]	
Base I/O Address	[Primary]	[Auto] Bios or OS chooses Configuration.
		(OS controlled) Displayed when controled by OS.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit		

The following table shows the items that you can customize on the I/O Device Configuration sub-menu:

Item	Options	Description
Serial Port A	Disabled Enabled Auto	Enable or Disable serial port A.
Base I/O address	3F8 2F8 3E8 2E8	Set the base I/O address for serial port A.
Interrupt	IRQ 3 IRQ 4	Set the interrupt for serial port A.
Serial Port B	Disabled Enabled Auto	Enable or Disable serial port B.
Floppy Disk Controller	Disabled Enabled Auto	Enable or Disable Floppy disk controller.
Base I/O Address	Primary Secondary	Set the base I/O address for the floppy disk controller.

3.5.4 Console Redirection Sub Menu

Phoenix BIOS Setup Utility	
Advanced	
Console Redirection	Item Specific Help
Com Port Address: [Disabled] Baud Rate: [19.2K] Console Type: [PC ANSI] Flow Control: [CTS/RTS] Console Connection: [Direct] Continue C.R. after POST: [Off]	If enabled, it will use a port on the motherboard.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit	

The following table shows the items that you can customize on the Console Redirection sub-menu:

Item	Options	Description
Com Port Address	Disabled On-board COM port A On-board COM port B	If enabled, it will use a port on the motherboard.
Baud Rate	300 1200 2400 9600 19.2K 38.4K 57.6K 115.2K	Enables the specified baud rate.
Console Type	VT100 VT100, 8bits PC ANSI, 7bits PC ANSI VT100+ VT-UTF8 ASCII	Enables the specified console type.
Flow Control:	None XON/XOFF CTS/RTS	Enables the flow control.
Console Connection	Direct Via Modem	Indicate whether console is connected directly to the system or a modem is used.
Continue C.R. after Post	Off On	Enables console redirection after OS has loaded.

3.6 Security Menu

Phoenix BIOS Setup Utility							
Main	Advanced	**Security**	Power	Boot	Server	Exit	
							Item Specific Help
Supervisor Password Is:		Clear					Supervisor Password controls access to the setup utility.
User Password Is:		Clear					
Boot-time Diagnostic Screen:		[Enabled]					
Set Supervisor Password:		[Enter]					
Set User Password:		[Enter]					
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

The following table shows the items that you can customize on the Security menu page:

Item	Options	Description
Supervisor Password Is	Clear Set	Displays the password if there is one.
User Password Is	Clear Set	Displays the password if there is one.
Boot-time Diagnostic Screen	Enabled Disabled	Display diagnostic screen during boot.
Set Supervisor Password	Enter	Supervisor Password controls access to the setup utility.
Set User Password	Enter	*Note: to use this feature, you must first set supervisor password.

3.7 Power Menu:

Use this menu to specify your settings for Power Management. Remember that the options available depend upon the hardware installed in your system. Those shown here are from a typical system. The Power menu selection in the menu bar on top of the screen displays the following:

Phoenix BIOS Setup Utility							
Main	Advanced	Security	**Power**	Boot	Server	Exit	
							Item Specific Help
Spread Spectrum		[Disabled]					Enabled wakes the system up at a specific time.
Enabled Multimedia Timer:		[Yes]					
WakeUp On LAN/PME:		[Enabled]					
AC Recovery:		[Enabled]					
Resume On Time:		[Off]					
Resume Time:		[00:00:00]					
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults							
ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

The following table shows the items that you can customize on the Power menu page:

Item	Options	Description
Spread Spectrum	Enabled Disabled	Disabled (default) or enabled spread spectrum
Enabled Multimedia Timer	Yes No	Enable/disable Multimedia Timer Support
WakeUp On LAN/PME	Enabled Disabled	Enables WakeUp On LAN/PME support
AC Recovery	Enabled Disabled	Disable = when power applied, the system will remain in the standby mode Enabled = when power applied, the system will boot to G2:S5 state.
Resume On Time	Off On	Enabled wakes the system up at a specific time.
Resume Time	No Options	Specify the time when the system is to wake up. <Tab>, <Shift-Tab>, or <Enter> selects field.

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3.8 Boot Menu:

After you turn on your computer, it will attempt to load an operating system from the first device set in the Boot Menu. If it cannot find an operating system on that device, it will attempt to load it from one or more other devices in the order specified in the Boot Menu. Boot devices can include: hard drives, floppy drives, CD-ROMs, removable devices (e.g., Iomega Zip drives), and network cards.

NOTE
Specifying any device as a boot on the Boot Menu requires the availability of an operating system on that device. Most systems come with an operating system already installed on drive C.

The Boot menu sets boot up options:

Phoenix BIOS Setup Utility							
Main	Advanced	Security	Power	**Boot**	Server	Exit	
							Item Specific Help
Boot priority order:							Keys used to view or configuration devices up and down arrows. Select a device <+> and <-> moves the device up or down. <f>and <r> specifies the device fixed or removable. <x> exclude or include the device to boot. <shift+1> enables or disable a device. <1-4> loads default boot sequence.
1: IDE CD: DVD-ROM DDU1622-(PS)							
2: PCI SCSI: HDT722525DLA380							
3: PCI BEV: MBA v8.25 slot 0320							
excluded from boot order:							
: PCI BEV: MBA v8.25 slot 0920							
: Bootable Add-in Cards							
: Legacy Floppy Drives							
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults							
ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

Boot Priority Sub Menu
Use this menu to arrange to specify the priority of the devices from which the BIOS will attempt to boot the Operating System.
Removable Devices, Hard Drive, and Network Boot are the generic types of devices on your system from which you can boot an operating system. You may have more than one device of each type. If so, the generic type is marked with a plus sign. Use the <Enter> key to expand or collapse the devices marked with a <+> or <->. Press <Ctrl+Enter> to expand all such deviceTo change a device's priority on the list, first select it with the up-or-down arrows, and move it up or down using the <+> and <-> keys. Pressing <n> moves a device between the Removable Devices and Hard Drive. Pressing <Shift+1> enables or disables a device

Item	Description
Legacy Floppy Drive	Boot from the floppy disk drive.
Hard Drive	Boot from Hard Drive
Bootable Add-in Cards	Boot from Bootable cards
IDE CD-ROM	Boot from the CD-ROM drive.
Legacy Network Card	Boot from the network PCI card.
PCI BEV: IBA GE slot 0500 v1240 PCI BEV: IBA GE slot 0501 v1240	Boot from the network through the On-Board LAN connection.

3.9 Server Menu

		Phoenix BIOS Setup Utility					
Main	Advanced	Security	Power	Boot	**Server**	Exit	
							Item Specific Help
Display without KB Err Msg [No] ►Hardware Monitor							Control post error message display or not when without KB.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

The following table shows the items that you can customize on the Server menu page:

Item	Options	Description
Display without KB Err Msg	No Yes	Control post error message display or not when without KB

3.9.1 Hardware Monitor Sub Menu

The Hardware Monitor Sub Menu looks like the following:

Phoenix BIOS Setup Utility							
Main	Advanced	Security	Power	Boot	**Server**	Exit	
Hardware Monitor							Item Specific Help
CPU1 Fan Speed= 82RPM CPU2 Fan Speed= 82RPM System Fan1 Speed= 5750RPM System Fan2 Speed= 8837RPM System Fan3 Speed= 5538RPM Front Fan1 Speed= 4595RPM Front Fan2 Speed= No Function CPU1 Temperature= 77°C Vbat: 2.860V Vcc (5V): 4.956V -12V: -12.235V +12V: +12.1250V CPU1 Vcore (1.35V): 1.3969V CPU Vtt (0.9V): 0.8832V Vsio (3.0V): 3.3320V							All items on this menu cannot be modified in user mode. If any items require changes, please consult your system Supervisor.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

3.10 Exit Menu

The Exit menu allows you to save or discard changes and exit BIOS.

Phoenix BIOS Setup Utility							
Main	Advanced	Security	Power	Boot	Server	**Exit**	
							Item Specific Help
Exit Saving Changes Exit Discarding Changes Load Setup Defaults Discard Changes Save Changes							Exit System Setup and save your changes to CMOS.
F1 Help ↑↓ Select Item -/+ Change Values F9 Setup Defaults ESC Exit ←→Select Menu Enter Select►Sub-Menu F10 Save and Exit							

The Exit menu has the following options. Note that <Esc> does not exit this menu. You must select one of the items from the menu or menu bar to exit.

Item	Description
Exit Saving Changes	Saves changes to CMOS and exits BIOS.
Exit Discarding Changes	Discard any changes made and exits BIOS.
Load Setup Defaults	Restores all settings to the default values.
Discard changes	Discards and changes made since the last time settings were saved.
Save changes	Saves changes to CMOS.

3.11 BIOS FLASH UPGRADE UTILITY

Phoenix Phlash gives you the ability to update your BIOS from a floppy disk without having to install a new ROM BIOS chip.

Phoenix Phlash is a utility for "flashing" (copying) a BIOS to the Flash ROM installed on your computer from a floppy disk. A Flash ROM is a Read-Only Memory chip that you can write to using a special method called "flashing."
Phoenix Phlash automatically updates or replaces the current BIOS with the one which your OEM or dealer supplies you (it's a .ROM file).

Command Example:
      A:\> phlash16 nk16xv001.ROM /MODE=3 /BBL /C
Syntax:
      phlash16 Phlash command name
      nk16xv001.ROM Filename of new BIOS ROM supplied by dealer
      /BBL Flash the Boot Block
      /C Clear CMOS
      /MODE=3 Update both BIOS and DMI imfornation

APPENDIX I: Glossary

ACPI (Advanced Configuration and Power Interface): a power management specification that allows the operating system to control the amount of power distributed to the computer's devices. Devices not in use can be turned off, reducing unnecessary power expenditure.

AGP (Accelerated Graphics Port): a PCI-based interface which was designed specifically for demands of 3D graphics applications. The 32-bit AGP channel directly links the graphics controller to the main memory. While the channel runs only at 66 MHz, it supports data transmission during both the rising and falling ends of the clock cycle, yielding an effective speed of 133 MHz.

ATAPI (AT Attachment Packet Interface): also known as IDE or ATA; a drive implementation that includes the disk controller on the device itself. It allows CD-ROMs and tape drives to be configured as master or slave devices, just like HDDs.

ATX: the form factor designed to replace the AT form factor. It improves on the AT design by rotating the board 90 degrees, so that the IDE connectors are closer to the drive bays, and the CPU is closer to the power supply and cooling fan. The keyboard, mouse, USB, serial, and parallel ports are built-in.

Bandwidth: refers to carrying capacity. The greater the bandwidth, the more data the bus, phone line, or other electrical path can carry. Greater bandwidth results in greater speed.

BIOS (Basic Input/Output System): the program that resides in the ROM chip, which provides the basic instructions for controlling your computer's hardware. Both the operating system and application software use BIOS routines to ensure compatibility.

Buffer: a portion of RAM which is used to temporarily store data; usually from an application though it is also used when printing and in most keyboard drivers. The CPU can manipulate data in a buffer before copying it to a disk drive. While this improves system performance (reading to or writing from a disk drive a single time is much faster than doing so repeatedly) there is the possibility of losing your data should the system crash. Information in a buffer is temporarily stored, not permanently saved.

Bus: a data pathway. The term is used especially to refer to the connection between the processor and system memory, and between the processor and PCI or ISA local buses.

Bus mastering: allows peripheral devices and IDEs to access the system memory without going through the CPU (similar to DMA channels).

Cache: a temporary storage area for data that will be needed often by an application. Using a cache lowers data access times since the information is stored in SRAM instead of slower DRAM. Note that the cache is also much smaller than your regular memory: a typical cache size is 512KB, while you may have as much as 4GB of regular memory.

Closed and open jumpers: jumpers and jumper pins are active when they are "on" or "closed", and inactive when they are "off" or "open".

CMOS (Complementary Metal-Oxide Semiconductors): chips that hold the basic startup information for the BIOS.

COM port: another name for the serial port, which is called as such because it transmits the eight bits of a byte of data along one wire, and receives data on another single wire (that is, the data is transmitted in serial form, one bit after another). Parallel ports transmit the bits of a byte on eight different wires at the same time (that is, in parallel form, eight bits at the same time).

DDR (Double Data Rate): a technology designed to double the clock speed of the memory. It activates output on both the rising and falling edge of the system clock rather than on just the rising edge, potentially doubling output.

DIMM (Dual In-line Memory Module): faster and more capacious form of RAM than SIMMs, and do not need to be installed in pairs.

DIMM bank: sometimes called DIMM socket because the physical slot and the logical unit are the same. That is, one DIMM module fits into one DIMM socket, which is capable of acting as a memory bank.

DMA (Direct Memory Access): channels that are similar to IRQs. DMA channels allow hardware devices (like soundcards or keyboards) to access the main memory without involving the CPU. This frees up CPU resources for other tasks. As with IRQs, it is vital that you do not double up devices on a single line. Plug-n-Play devices will take care of this for you.

DMI: A specification that establishes a standard framework for managing networked computers. DMI covers hardware and software, desktop systems and servers, and defines a model for filtering events and describing interfaces.

DRAM (Dynamic RAM): widely available, very affordable form of RAM which looses data if it is not recharged regularly (every few milliseconds). This refresh requirement makes DRAM three to ten times slower than non-recharged RAM such as SRAM.

ECC (Error Correction Code or Error Checking and Correcting): allows data to be checked for errors during run-time. Errors can subsequently be corrected at the same time that they're found.

EEPROM (Electrically Erasable Programmable ROM): also called Flash BIOS, it is a ROM chip which can, unlike normal ROM, be updated. This allows you to keep up with changes in the BIOS programs without having to buy a new chip.

ESCD (Extended System Configuration Data): a format for storing information about Plug-n-Play devices in the system BIOS. This information helps properly configure the system each time it boots.

Firmware: low-level software that controls the system hardware.

Form factor: an industry term for the size, shape, power supply type, and external connector type of the Personal Computer Board (PCB) or motherboard. The standard form factors are the AT and ATX.

IDE (Integrated Device/Drive Electronics): a simple, self-contained HDD interface. It can handle drives up to 8.4 GB in size. Almost all IDEs sold now are in fact Enhanced IDEs (EIDEs), with maximum capacity determined by the hardware controller.

IDE INT (IDE Interrupt): a hardware interrupt signal that goes to the IDE.

I/O (Input/Output): the connection between your computer and another piece of hardware (mouse, keyboard, etc.)

IRQ (Interrupt Request): an electronic request that runs from a hardware device to the CPU. The interrupt controller assigns priorities to incoming requests and delivers them to the CPU. It is important that there is only one device hooked up to each IRQ line; doubling up devices on IRQ lines can lock up your system. Plug-n-Play operating systems can take care of these details for you.

Latency: the amount of time that one part of a system spends waiting for another part to catch up. This occurs most commonly when the system sends data out to a peripheral device and has to wait for the peripheral to spread (peripherals tend to be slower than onboard system components).

NVRAM: ROM and EEPROM are both examples of Non-Volatile RAM, memory that holds its data without power. DRAM, in contrast, is volatile.

OPROM: Firmware on adapter cards that control bootable peripherals. The system BIOS interrogates the option ROMs to determine which devices can be booted.

Parallel port: transmits the bits of a byte on eight different wires at the same time.

PCI (Peripheral Component Interconnect): a 32 or 64-bit local bus (data pathway) which is faster than the ISA bus. Local buses are those which operate within a single system (as opposed to a network bus, which connects multiple systems).

PCI PIO (PCI Programmable Input/Output) modes: the data transfer modes used by IDE drives. These modes use the CPU for data transfer (in contrast, DMA channels do not). PCI refers to the type of bus used by these modes to communicate with the CPU.

PCI-to-PCI bridge: allows you to connect multiple PCI devices onto one PCI slot.

PnP (Plug-n-Play): a design standard that has become ascendant in the industry. Plug-n-Play devices require little set-up to use. Devices and operating systems that are not Plug-n-Play require you to reconfigure your system each time you add or change any part of your hardware.

RAID (Redundant Array of Independent Disks): a way for the same data to be stored in different places on many hard drives. By using this method, the data is stored redundantly and multiple hard drives will appear as a single drive to the operating system. RAID level 0 is known as striping, where data is striped (or overlapped) across multiple hard drives, but offers no fault-tolerance. RAID level 1 is known as mirroring, which stores the data within at least two hard drives, but does not stripe. RAID level 1 also allows for faster access time and fault-tolerance, since either hard drive can be read at the same time. RAID level 0+1 is both striping and mirroring, providing fault-tolerance, striping, and faster access all at the same time.

SDRAM (Synchronous Dynamic RAM): called as such because it can keep two sets of memory addresses open simultaneously. By transferring data alternately from one set of addresses and then the other, SDRAM cuts down on the delays associated with non-synchronous RAM, which must close one address bank before opening the next.

Serial port: called as such because it transmits the eight bits of a byte of data along one wire, and receives data on another single wire (that is, the data is transmitted in serial form, one bit after another).

Sleep/Suspend mode: in this mode, all devices except the CPU shut down.

SRAM (Static RAM): unlike DRAM, this type of RAM does not need to be refreshed in order to prevent data loss. Thus, it is faster and more expensive.

SMBIOS: The system management specification addresses how motherboard and system vendors present management information about their products in a standard format by extending the BIOS interface on Intel architecture systems.

Standby mode: in this mode, the video and hard drives shut down; all other devices continue to operate normally.

USB (Universal Serial Bus): a versatile port. This one port type can function as a serial, parallel, mouse, keyboard or joystick port. It is fast enough to support video transfer, and is capable of supporting up to 127 daisy-chained peripheral devices.

ZCR (Zero Channel RAID): ZCR card provides RAID-5 solution by working with the onboard SATA/SATA-II chip through special PCI-X slot with Intel RAIDIOS logic, thus lowering cost of RAID-5 solution.