

LV-674

Mini-ITX motherboard

User's Manual

Edition: 1.00

2005/09/30



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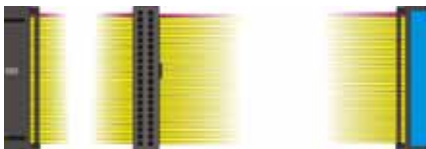
Packing List

Please check package component before you use our products.

Hardware:

LV-674 Mini-ITX motherboard x 1

Cable Kit:



40-pin ATA100 IDE flat cable x 1



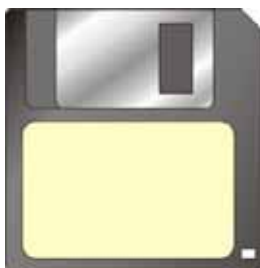
26-pin slim type floppy cable x 1



Serial ATA ribbon cable x 2



I/O Shield x 1



RAID drivers Disc for Windows 2000,
Windows XP and Windows Server 2003

Other Accessories:

Divers CD (including User's Manual) x 1

User's Manual x 1

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Chapter1 <Introduction>

1.1 <Product Overview>

LV-674 is the motherboard with last Intel desktop technology with Mini-ITX form factor. Based on Intel® 945G and ICH7R, the board integrates a new Pentium 4 processor 775-pin socket, DDR2 memory socket, Intel® Graphic Media Accelerator 950 technology, PCI express interface and Serial ATA II with RAID function for a powerful desktop system.

Intel® LGA775 processor

The Intel® Pentium 4 processor now comes with a new form factor with 775-pin PLGA package, for 533/800/1066MHz front-side-bus, 1MB L2 cache, and for 90nm manufacturing technology, the PLGA processor without pin header on solder side can make user installing the processor on the socket easier.

Intel® 945G and ICH7R chipset

The Intel 945G integrates DDR2 400/533/667MHz for memory, and Graphic Media Accelerator (GMA) 950 technology for new graphic engine. It can provide up to 224MB of frame buffer when you install over 256MB of system memory. The ICH7R integrates with up to 4 USB2.0 interfaces (4 ports for **LV-674**), and serial ATA II interface with RAID function.

Four Marvell E8053

Four Gigabit LAN with Marvell E8053, **LV-674** comes with a powerful network function for the system that requires large transfer data of NAS system or Server platform.

PCI-Express interface

LV-674 integrates a x16 PCI-Express interface, it can provide up to 8GB/s of bandwidth, which AGP 8x can only provide up to 2GB/s.

Multimedia interfaces

LV-674 also integrates 7.1 channel AC97 audio, mini-PCI interface and IEEE1394 port, for these flexible function, system integrator can built more powerful systems for many applications.

1.2 <Product Specification>

General Specification

| | |
|-----------------|---|
| Form Factor | Mini-ITX motherboard |
| CPU | Intel® Pentium 4 / Pentium D/ Celeron D processor with LGA775 socket Package type: 775 pin PLGA Front side bus: 533/800/1066MT/s (133/200/266MHz x 4) Intel® Hyper-Threading Technology and Dual code supported |
| Memory | 2 x 240-pin DDR2 400/533/667MHz SDRAM up to 2GB Up to 8GB/s of bandwidth with dual-channel interleaved mode Dual-Channel technology supported Unbuffered, none-ECC memory supported only |
| Chipset | Intel® 945G (Northbridge) and ICH7R (Southbridge) |
| BIOS | Phoenix-Award v6.00PG 4Mb PnP flash BIOS |
| Green Function | Power saving mode includes doze, standby and suspend modes. ACPI version 1.0 and APM version 1.2 compliant |
| Watchdog Timer | System reset programmable watchdog timer with 1 ~ 255 sec./min. of timeout value |
| Real Time Clock | Intel® ICH7R built-in RTC with lithium battery |
| Enhanced IDE | Enhanced IDE interface supports dual channels and up to 2 ATAPI devices at Ultra DMA100 One 40-pin IDE port onboard |
| Serial ATAII | Intel® ICH7R integrates 4 Serial ATA II interface RAID 0, 1,5,10 Intel Matrix Storage Technology supported |

Multi-I/O Port

| | |
|---------------|--|
| Chipset | Intel® 82801GR ICH7R with Winbond® W83627THF controller |
| Serial Port | Two external RS-232 serial ports |
| USB Port | Four Hi-Speed USB 2.0 ports with 480Mbps of transfer rate |
| Parallel Port | None |
| Floppy Port | One slim type Floppy port |
| IrDA Port | One IrDA compliant Infrared interface supports SIR |
| K/B & Mouse | External PS/2 keyboard and mouse ports on rear I/O panel |
| GPIO | One 12-pin Digital I/O connector with 8-bit programmable I/O interface |
| Smart Fan | One CPU fan connectors for fan speed controllable |

VGA Display Interface

| | |
|----------------|--|
| Chipset | Intel® 945G GMCH (Graphic Memory Controller Hub) |
| Core Frequency | 400MHz |
| Memory | Intel® DVMT 3.0 with up to 224MB shared with system memory |
| Display Type | CRT, LCD monitor with analog display |
| Connector | External DB15 female connector on rear I/O panel |

Ethernet Interface

| | |
|-----------|--|
| Chipset | 100/1000MT LAN interface with Marvell E8053 |
| Type | 10Base-T / 100Base-TX/1000Base-T, auto-switching Fast Ethernet Full duplex, IEEE802.3U compliant |
| Connector | Four External RJ45 connectors with LED on rear I/O panel |

Audio Interface

| | |
|-----------|---|
| Chipset | Intel® ICH7R with Realtek® ALC880 codec Intel High Definition Audio compliance |
| Interface | 7.1 channels sound output |
| Connector | External Audio phone jack for Line-out, Line-in, MIC-in, Surround, Center and Backsurround Onboard audio connector with pin header (built-in amplifier for speaker out) Onboard CD-IN connector |

Expansive Interface

| | |
|-------------|---|
| PCI-Express | One x16 PCI-Express slot (compatible with x1 slot) Up to 8GB/s of transfer bandwidth Power supply: +3.3V, +12V |
| PCI | One Mini-PCI socket TYPE III (32-bit, 33MHz) Power supply: +3.3V, +5V |
| IEEE1394 | AGERE FW323-06 controller integrated IEEE1394A supported Up to 400Mb/s of transferring rate |

Power and Environment

| | |
|-------------------|---|
| Power Requirement | Standard ATX 24-pin (20-pin is compatible) power supply Additional +12V 8-pin power connector |
| Dimension | 170 (L) x 170 (H) mm |
| Temperature | Operating within 0 ~ 60°C (32 ~ 140°F) Storage within -20 ~ 85°C (-4 ~ 185°F) |

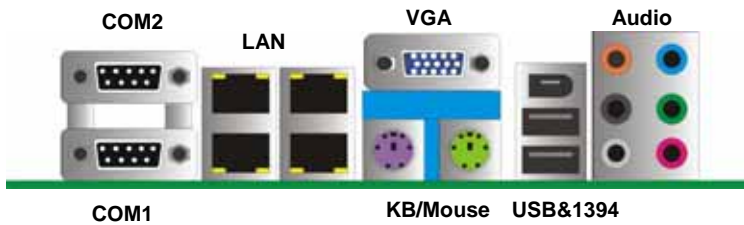
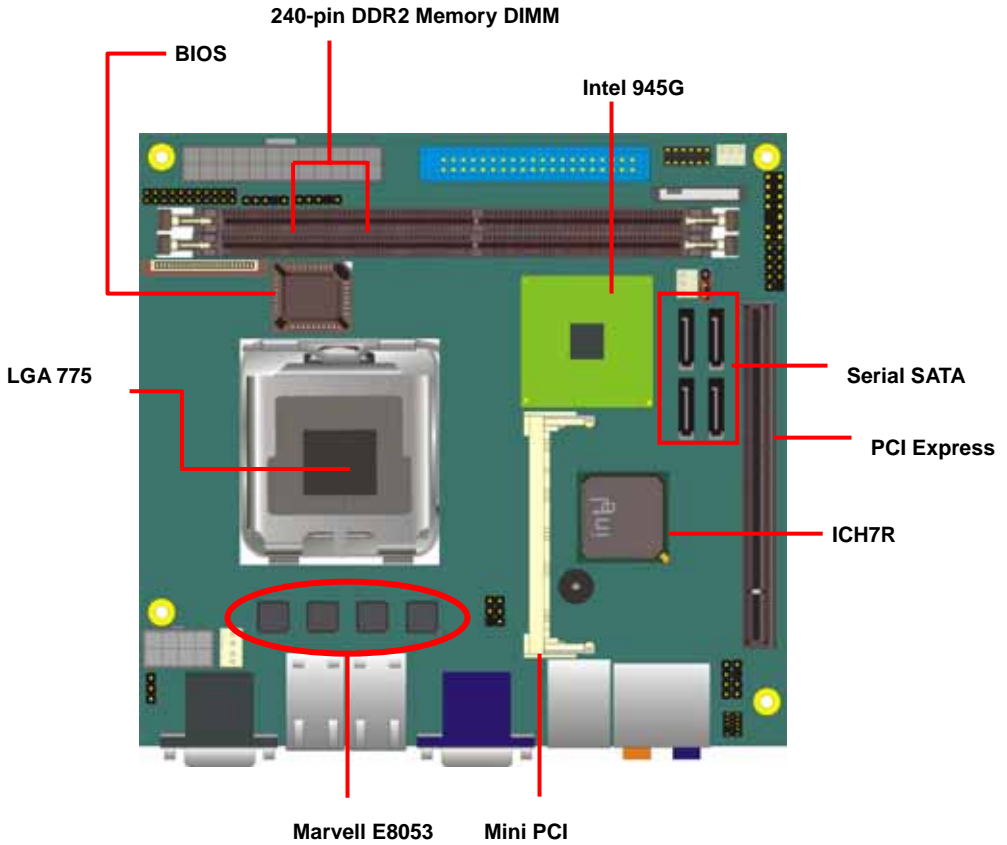
Ordering Code

| | |
|-------------------|---|
| LV-674 | Intel® Pentium 4 platform with Mini-ITX form factor LGA775 socket, DDR2, onboard GMA950 VGA, 7.1CH Audio, SATAII, USB2.0, PCI-Express 16x slot, Mini-PCI, IEEE1394 four Gigabit LAN. |
| PCIE-SDVOD | PCI-Express add-on card for single DVI interface |
| PCIE-SDVOX | PCI-Express add-on card for 18-bit/24-bits Dual channel LVDS module. |

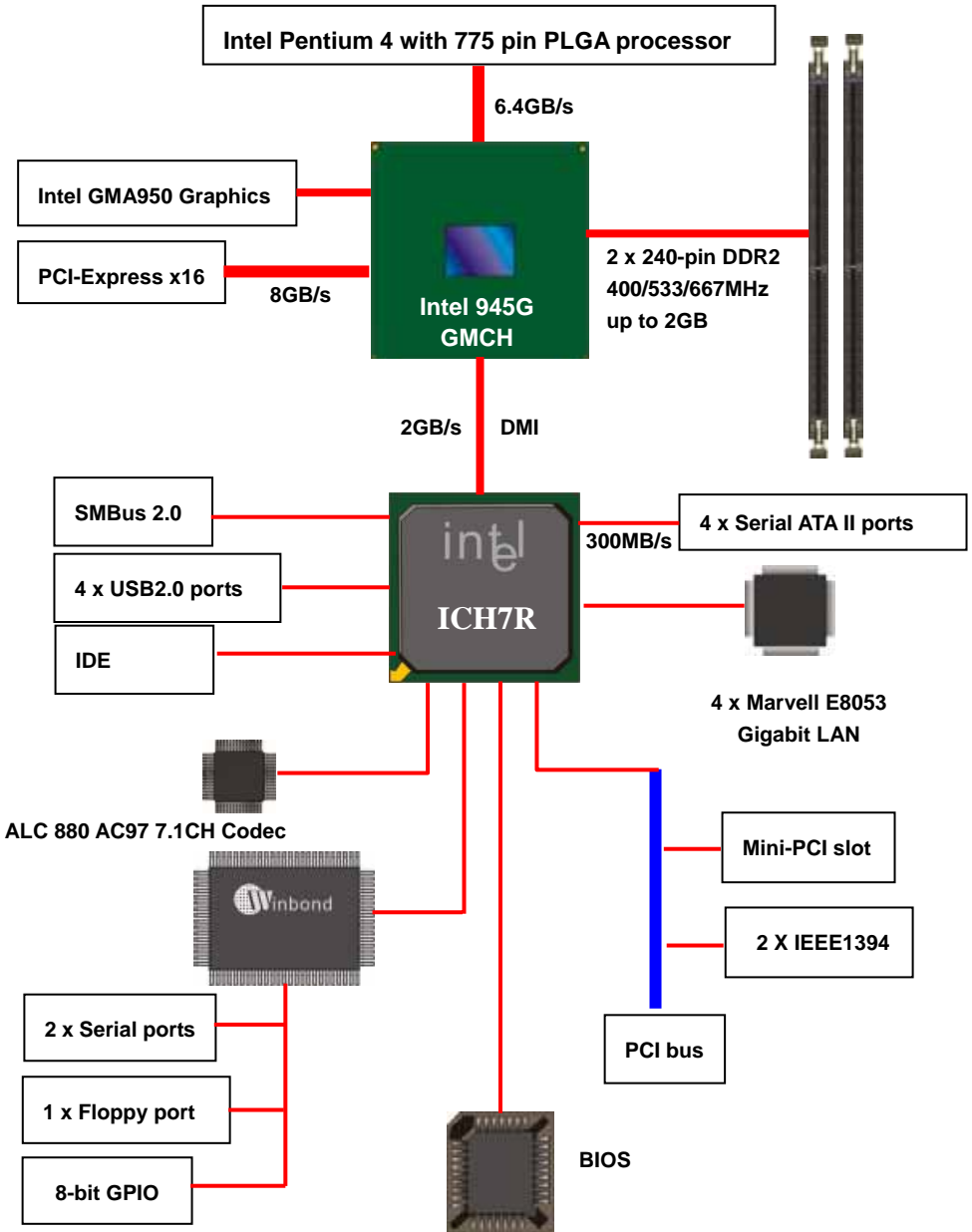
The specifications may be different as the actual production.

For further product information please visit the website at <http://www.anso.com>

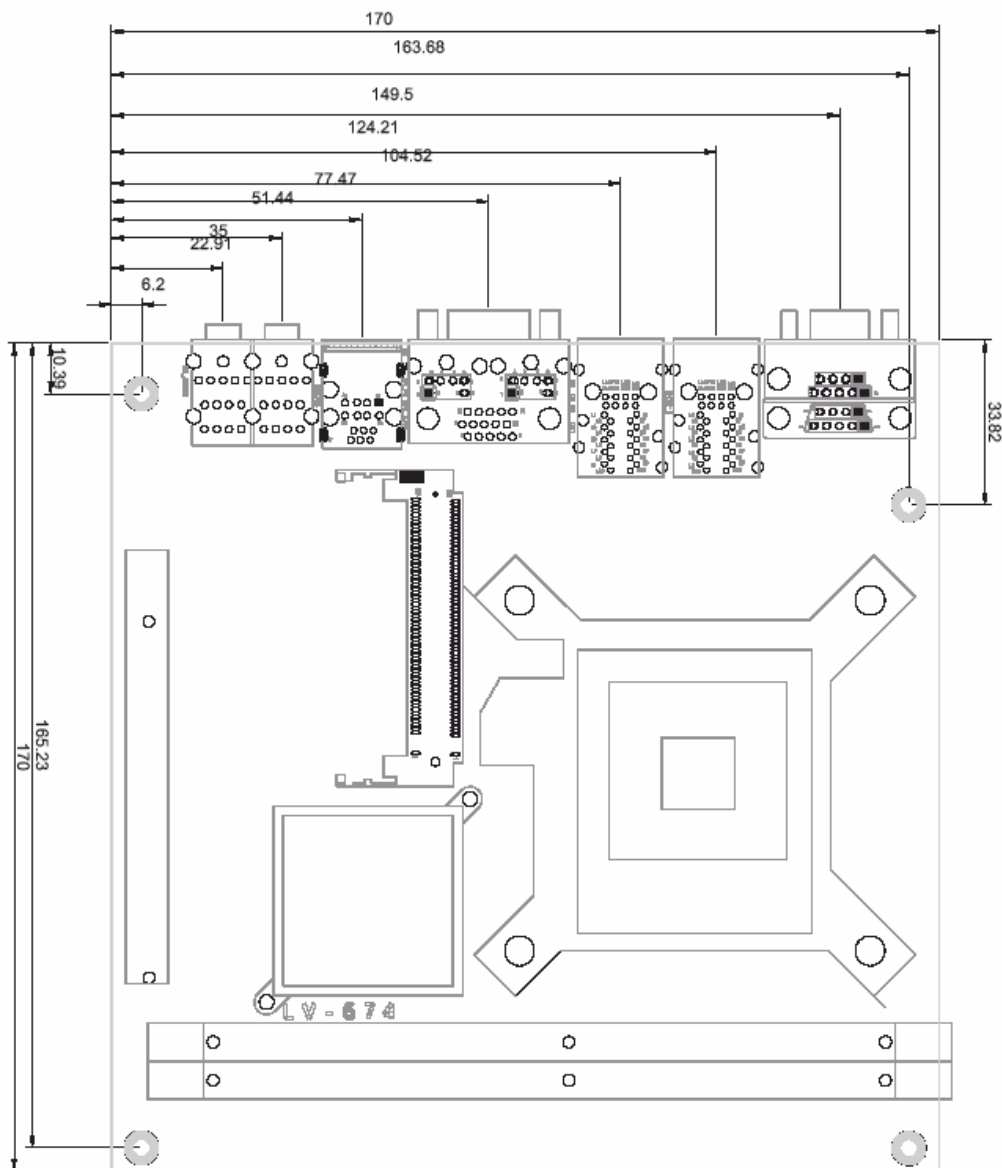
1.3 <Component Placement>



1.4 <Block Diagram>

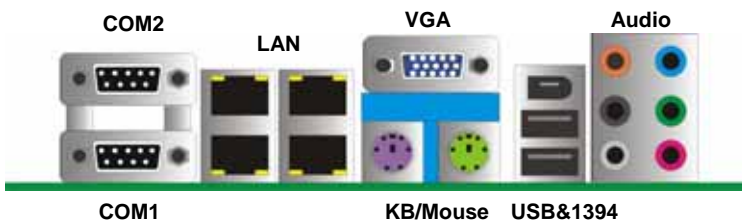
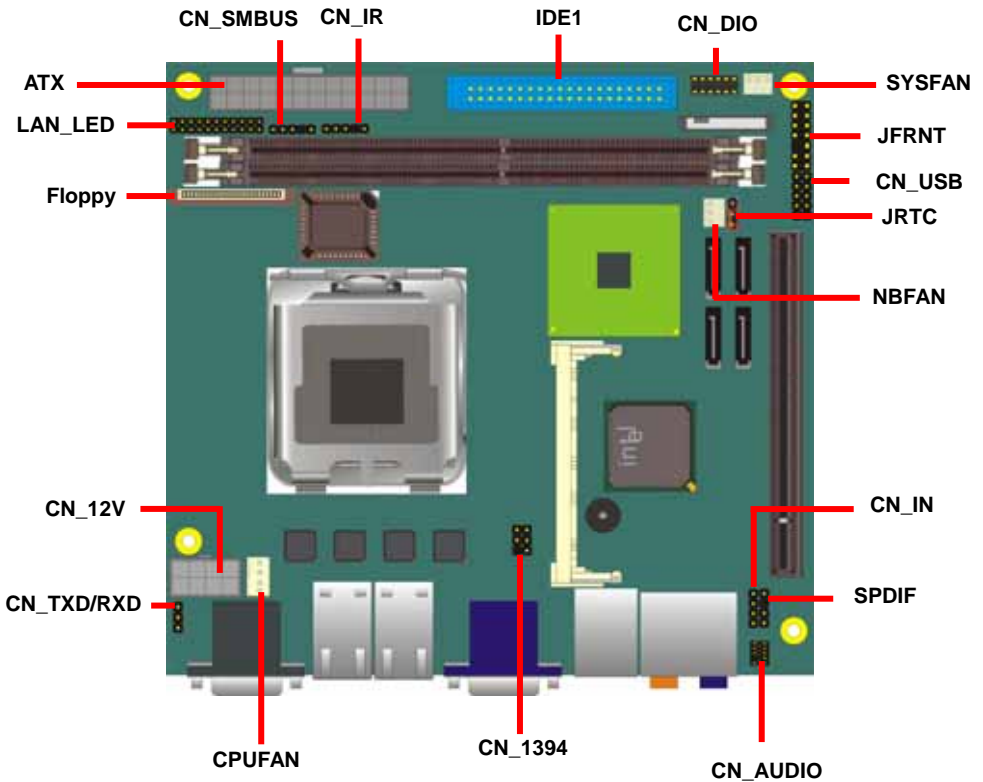


1.5 <Mechanical Drawing >



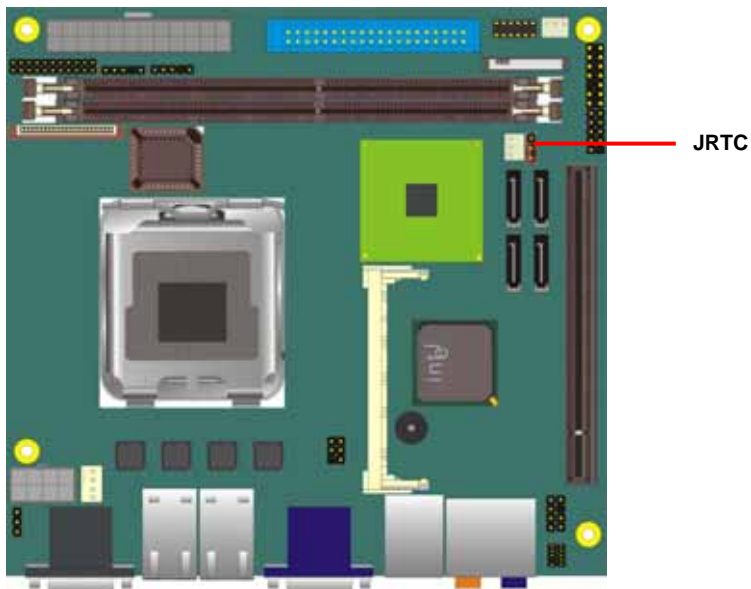
Chapter 2 <Hardware Setup>

2.1 <Connector Location>



2.2 <Jumper Reference>

| Jumper | Function |
|--------|------------------------------|
| JRTC | CMOS Operating/Clear Setting |



2.3 <Connector Reference>

2.3.1 <Internal Connectors>

| Connector | Function | Remark |
|---------------|---|----------|
| CPU | LGA775 CPU socket | Standard |
| DDR11/2 | 240 -pin DDR2 SDRAM DIMM socket | Standard |
| IDE1 | 40-pin primary IDE connector | Standard |
| FDD | 26-pin slim type floppy connector | Slim |
| S_ATA11/2/3/4 | 7-pin Serial ATA II connector | Standard |
| ATX | 24-pin power supply connector | Standard |
| CN_12V | 8-pin +12V additional power supply connector | Standard |
| CN_AUDIO | 5 x 2-pin audio connector | Standard |
| CDIN | 4-pin CD-ROM audio input connector | Standard |
| CN_DIO | 6 x 2-pin digital I/O connector | Standard |
| CN_USB | 10-pin USB connector | Standard |
| CPUFAN | 4-pin CPU cooler fan connector | Standard |
| SYSFAN | 3-pin system cooler fan connector | Standard |
| NBFAN | 3-pin Northbridge cooler fan connector | Standard |
| CN_IR | 5-pin IrDA connector | Standard |
| CN_SMBUS | 4-pin I ² C connector | Standard |
| CN_TXD/RXD | 3-pin TXD/RXD COM port signal connector | Standard |
| JFRNT | 14-pin front panel switch/indicator connector | Standard |
| SPDIF | Digital audio optical interface | Standard |
| 1394 | 8-pin IEEE 1394 connector | Standard |

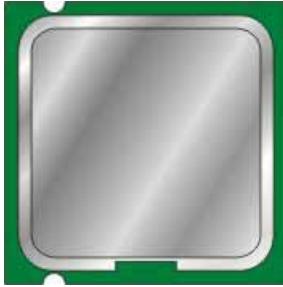
2.3.2 <External Connectors>

| Connector | Function | Remark |
|-----------|-------------------------------|----------|
| VGA | DB15 VGA connector | Standard |
| USB | Dual USB Port | Standard |
| COM1/2 | Serial port connector | Standard |
| PS2 | PS/2 Keyboard/Mouse connector | Standard |
| AUDIO | Audio connectors | Standard |
| 1394 | IEEE1394 port | Standard |
| LAN Port | Four RJ45 LAN Port | Standard |

2.4 <CPU and Memory Setup>

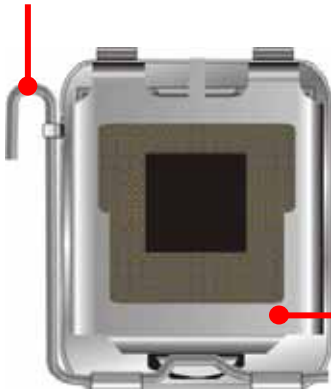
2.4.1 <CPU installation>

LV-674 has a LGA755 CPU socket onboard; please check following steps to install the processor properly.



Intel® Pentium 4 processor
Package type: 775 pin PLGA
L2 Cache: 1MB
FSB: 533/800/1066MHz (266MHz x 4)
Manufacturing: 90nm
Intel Hyper Threading Technology
and Dual code supported

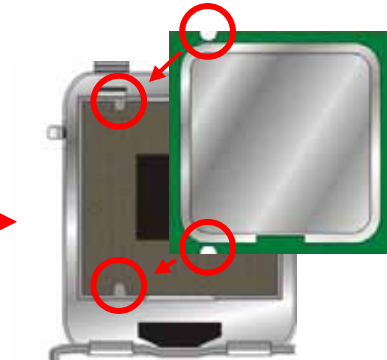
1. Lift this bar



2. Uncover this plate



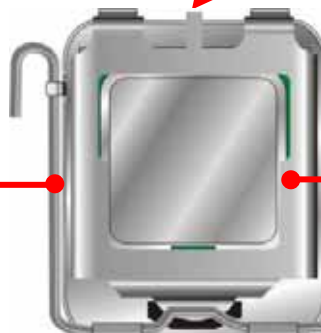
Check point



3. Place the CPU on the top of
the pins



4. Lock this bar

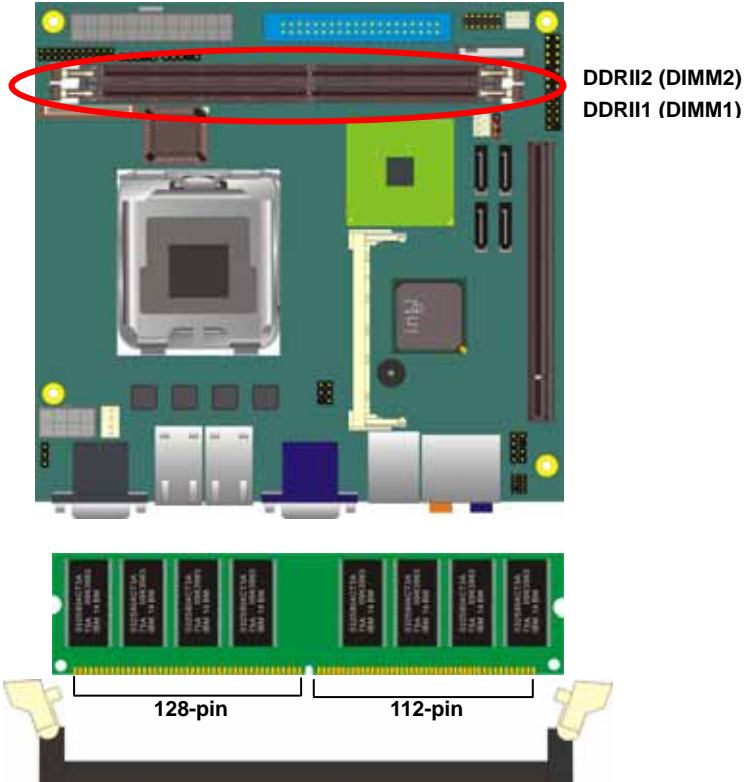


3. Cover this plate

Notice: Please place the CPU on the pins tenderly to avoid bending the pins

2.4.2 <Memory installation>

LV-674 has two 240-pin DDR2 DIMM support up to 2GB of memory capacity. The memory frequency supports 400/533/667MHz .Only Non-ECC memory is supported. **Dual-Channel technology** is supported while applying two same modules.



Please check the pin number to match the socket side well before installing memory module.

2.5 <CMOS Setup>

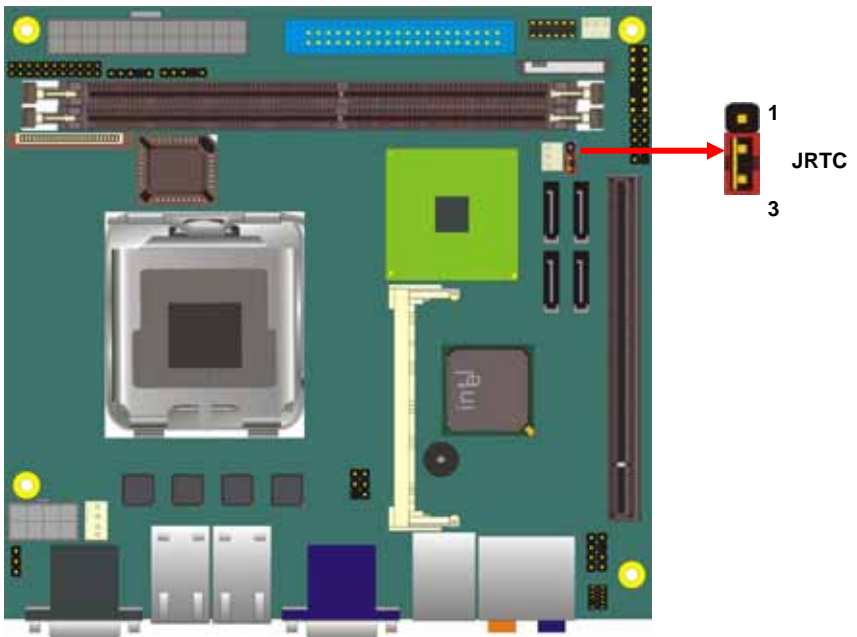
The board's data of CMOS can be setting in BIOS. If the board refuses to boot due to inappropriate CMOS settings, here is how to proceed to clear (reset) the CMOS to its default values.

Jumper: JRTC

Type: Onboard 3-pin jumper

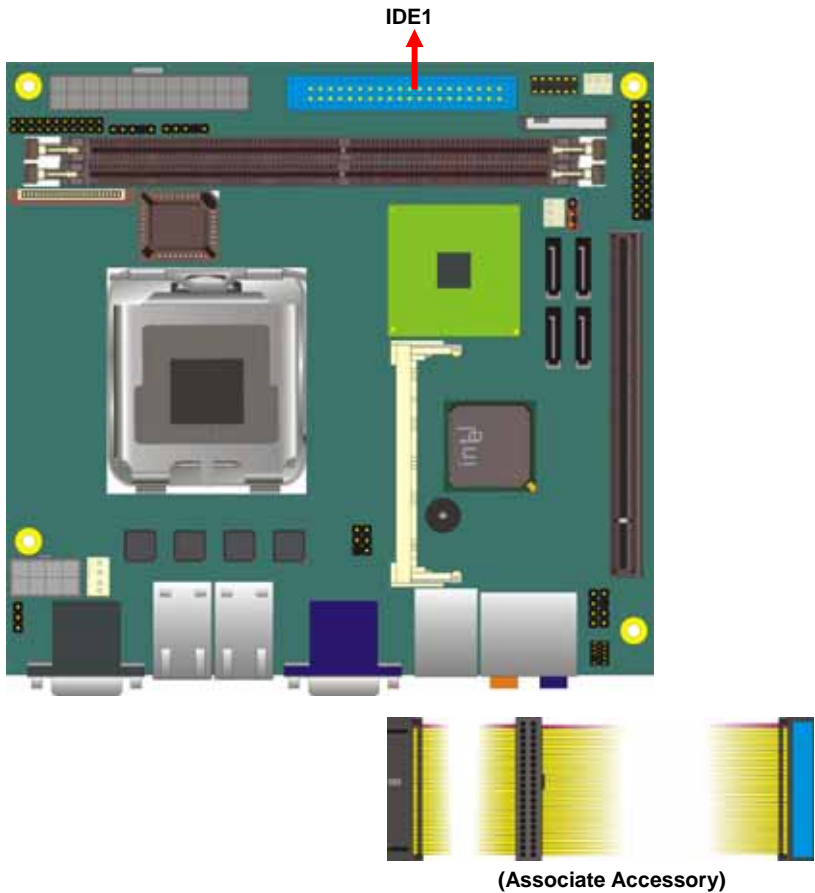
| JRTC | Mode |
|------|------------------|
| 1-2 | Clear CMOS |
| 2-3 | Normal Operation |

Default setting



2.6 <Enhanced IDE interface>

The Intel® ICH7R (south bridge chip) supports one enhanced IDE interface, dual channel for two ATAPI devices with ATA100. Based on this function, **LV-674** has one 40-pin IDE connector with jumper selectable for pin-20 +5V supported.



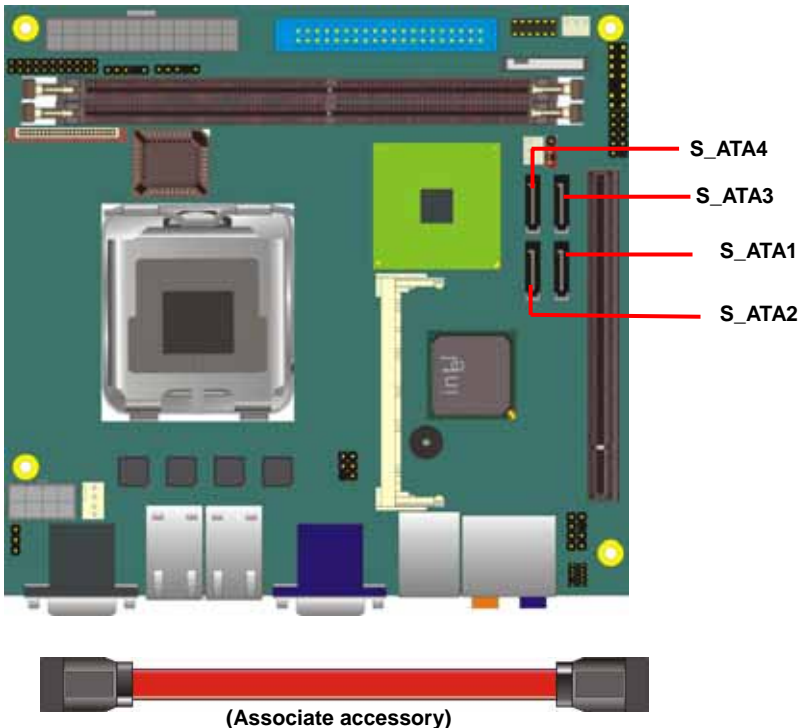
2.7 <Serial ATA installation>

LV-674 has four Serial ATA II interfaces with RAID function, the transfer rate of the Serial ATA II can be up to 300MB/s. Please go to <http://www.serialata.org/> for more about Serial ATA technology information. Based on Intel® ICH7R, it supports **Intel® Matrix Storage Technology** with combination of RAID 0,1,5 and 10. The main features of RAID on ICH7R are listed below:

1. Supports for up to RAID volumes on a single, two-hard drive RAID array.
2. Supports for two, two-hard drive RAID arrays on any of four Serial ATA ports.
3. Supports for Serial ATA ATAPI devices.
4. Supports for RAID spares and automatic rebuild.
5. Supports on RAID arrays, including NCQ and native hot plug.

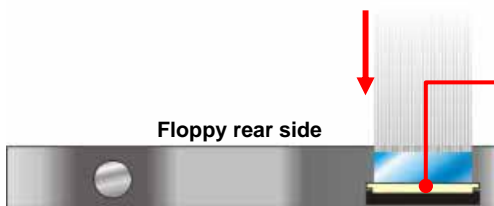
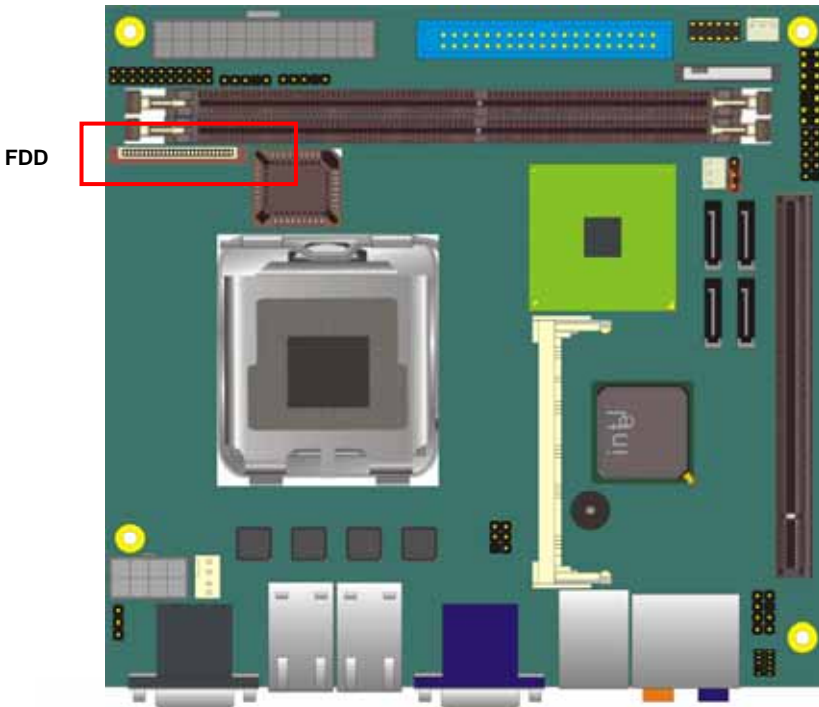
For more information please visit Intel's official website.

For more about the system setup for Serial ATA, please check the chapter of SATA configuration.

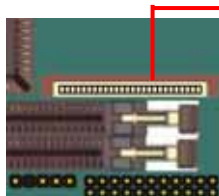


2.8 <Floppy Installation>

LV-674 has one slim type 26-pin floppy interface, it supports notebook use floppy and powering from onboard, please follow up the steps below to install the device.



1. Lift up this plastic bar
2. Slot the cable in (Blue paste for outside)
3. Press back the plastic bar

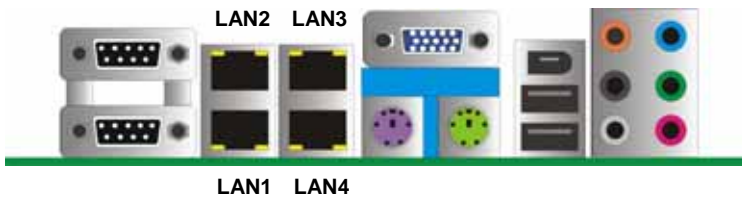


4. Lift up the brown plastic bar
5. Slot the cable in (Blue paste for brown bar side)
6. Press back the plastic bar

2.9 <LAN installation>

LV-674 integrates four Gigabit LAN interfaces with Marvell E8053; they provide a standard IEEE 802.3 Ethernet interface for 1000BASE-T, 100BASE-TX and 10BASE-T applications.

LV-674 provides four RJ45 connectors on the rear I/O panel.



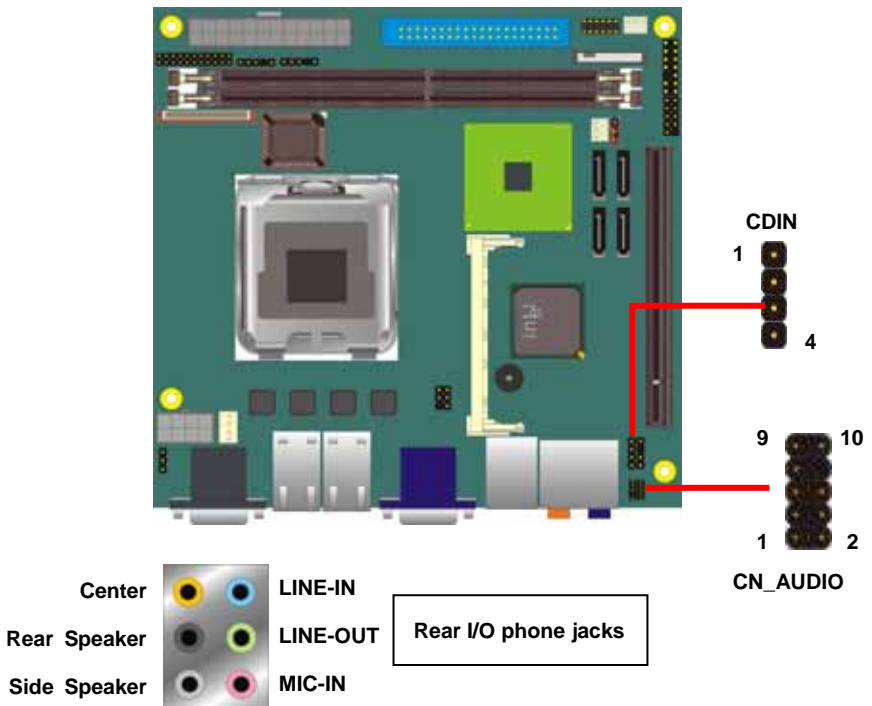
2.10 <Audio Installation>

The board integrates onboard audio interface with REALTEK ALC880 codec, with Intel next generation of audio standard as High Definition Audio, it offers more vivid sound and other advantages than former AC97 audio compliance.

The main specifications of ALC880 are:

- **High-performance DACs with 100dB S/N ratio**
- **8 DAC channels support 16/20/24-bit PCM format for 7.1 audio solution**
- **16/20/24-bit S/PDIF-OUT supports 44.1K/48K/96kHz sample rate**
- **Compatible with AC'97**
- **Meets Microsoft WHQL/WLP 2.0 audio requirements**

The board provides 7.1 channels audio phone jacks on rear I/O port, and amplified speaker out and Line-in/MIC-in ports for front I/O panel through optional cable.



Connector: CN_AUDIO

Type: 10-pin (2 x 5) header (pitch = 2.00mm)

| Pin | Description | Pin | Description |
|-----|------------------|-----|-----------------|
| 1 | Line – Left | 2 | Ground |
| 3 | Line – Right | 4 | MIC1 |
| 5 | MIC2 | 6 | Ground |
| 7 | N/C | 8 | Line Out – Left |
| 9 | Line Out – Right | 10 | Ground |

Connector: CDIN

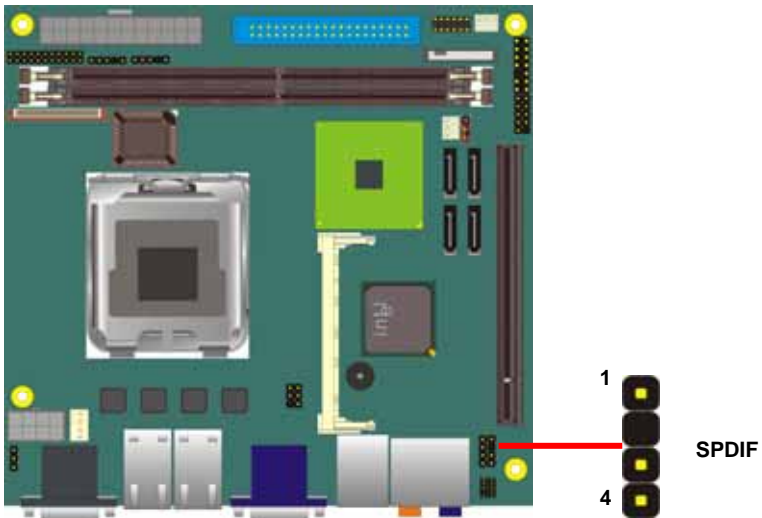
Type: 4-pin header (pitch = 2.54mm)

| Pin | Description |
|-----|-------------|
| 1 | CD – Left |
| 2 | Ground |
| 3 | Ground |
| 4 | CD – Right |

Connector: SPDIF

Type: 4-pin header (pitch = 2.54mm)

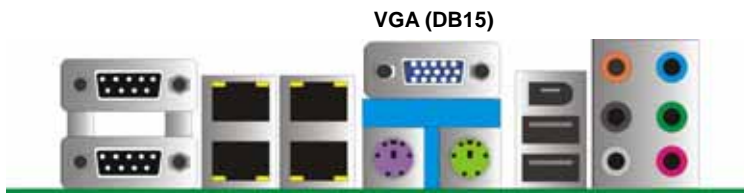
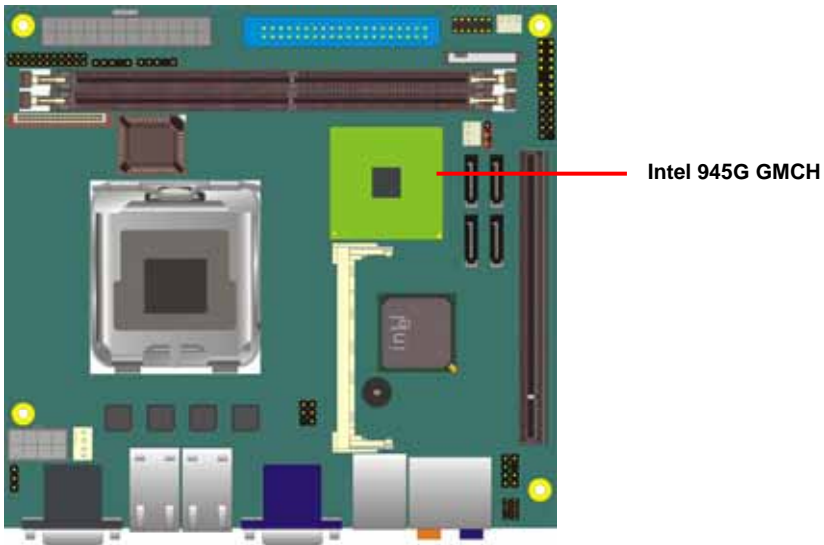
| Pin | Description |
|-----|-------------|
| 1 | +5V |
| 2 | N/C |
| 3 | SPDIFO |
| 4 | Ground |



2.11 <Display Installation>

LV-674 integrates with Intel® 945G GMCH for Intel Graphic Media Accelerator (GMA) 950 technology. It supports Intel® DVM (Dynamic Video Memory Technology) 3.0 for up to 224MB frame buffer size shared with system memory. With a 400MHz core and DirectX 9 and OpenGL acceleration, **LV-674** provides the powerful onboard graphics interface without additional graphic card. *(More information please visit Intel's website)*

For more information of configuring the frame buffer size, please check the chapter of video memory configuration.



2.12 <IEEE1394 and USB Installation>

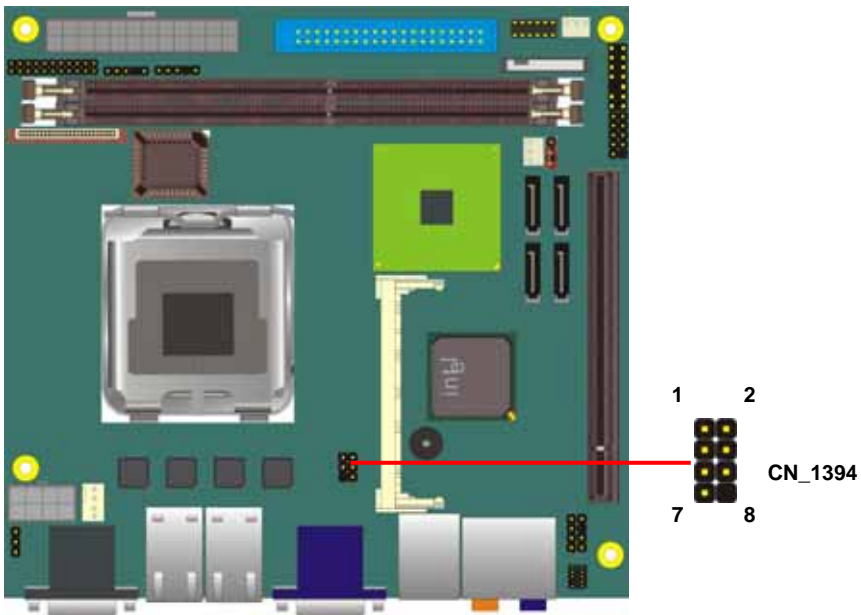
LV-674 integrates two IEEE1394 (FireWire) ports and four USB2.0 ports. The specifications of IEEE1394 and USB2.0 are listed below:

| Interface | IEEE1394 | USB2.0 |
|----------------|-----------------|---------------|
| Controller | AGERE FW323-06 | Intel ICH7R |
| Transfer Rate | 100/200/400Mb/s | Up to 480Mb/s |
| Output Voltage | 12V | 500mA |

The Intel® ICH7R contains an Enhanced Host Controller Interface (EHCI) and four Universal Host Controller Interfaces (UHCI), it can determine whether your connected device is for USB1.1 or USB2.0, and change the transfer rate automatically.



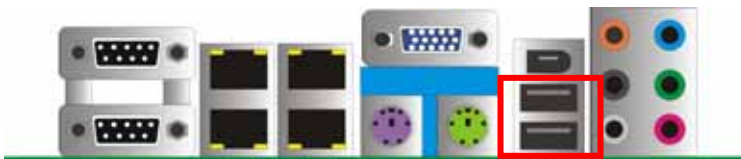
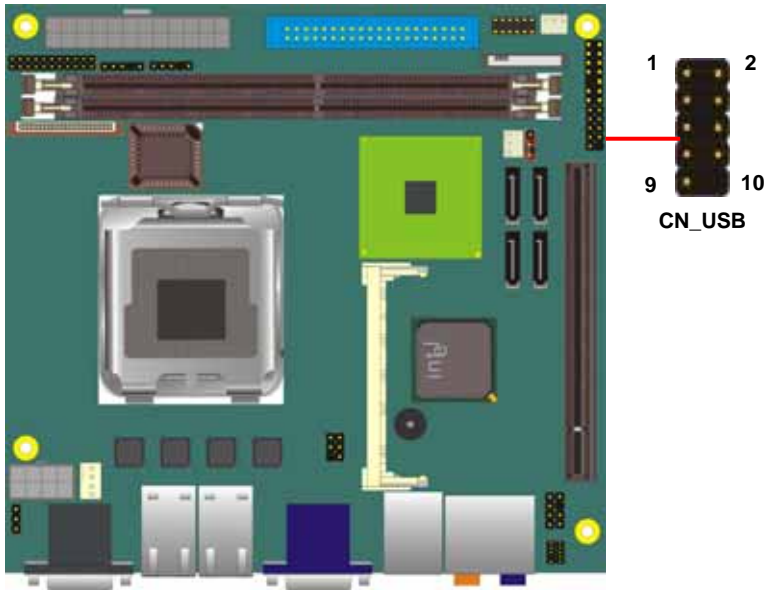
1394



Connector: **CN_USB**

Type: 10-pin (5 x 2) header for USB5/6 Ports

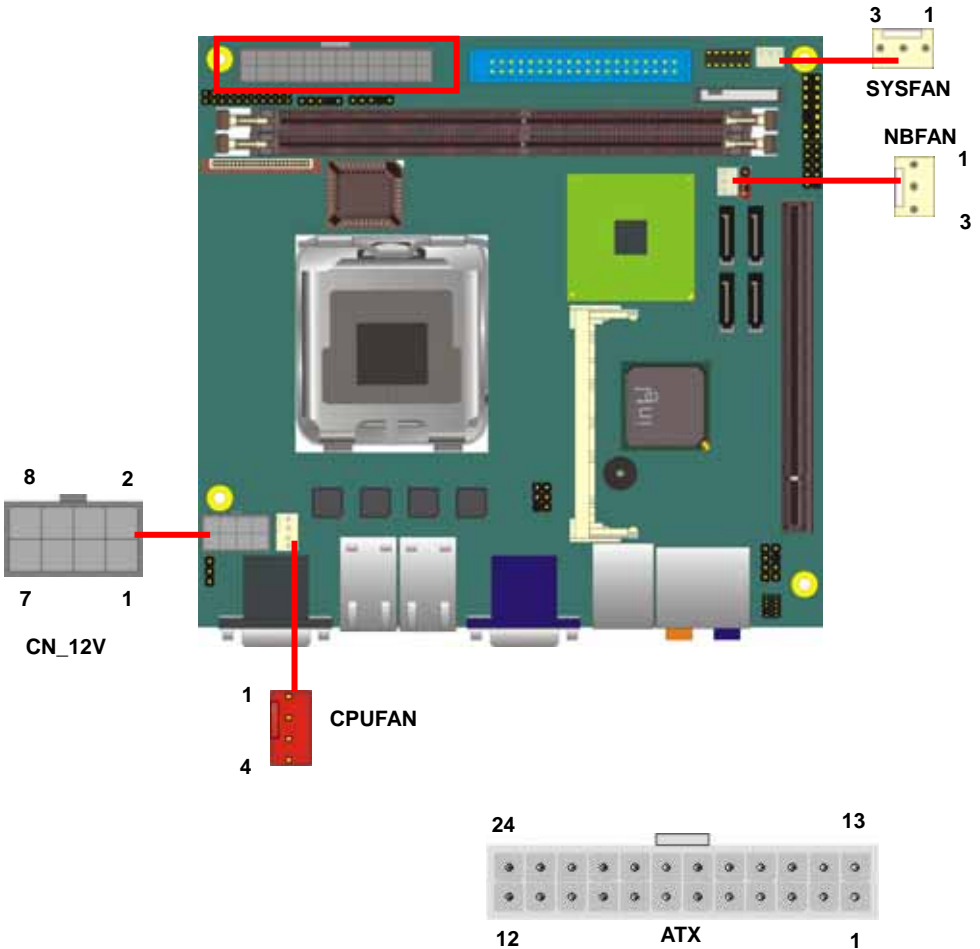
| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | VCC | 2 | VCC |
| 3 | Data0- | 4 | Data1- |
| 5 | Data0+ | 6 | Data1+ |
| 7 | Ground | 8 | Ground |
| 9 | Ground | 10 | N/C |



USB1/2

2.13 <Power and Fan Installation>

The LV-674 provides a standard ATX power supply with **24-pin** ATX connector and additional 12V connector, and the board provides one **8-pin** fan connectors supporting smart fan for CPU cooler and two 3-pin cooler fan connectors for system and Northbridge chip. The 8-pin additional power connector is necessary for CPU powering; please connect this well before you finishing the system setup.



Connector: **ATX**

Type: 24-pin ATX power connector

| PIN assignment | | | |
|----------------|-------|----|-------|
| 1 | 3.3V | 13 | 3.3V |
| 2 | 3.3V | 14 | -12V |
| 3 | GND | 15 | GND |
| 4 | 5V | 16 | PS_ON |
| 5 | GND | 17 | GND |
| 6 | 5V | 18 | GND |
| 7 | GND | 19 | GND |
| 8 | PW_OK | 20 | -5V |
| 9 | 5V_SB | 21 | 5V |
| 10 | 12V | 22 | 5V |
| 11 | 12V | 23 | 5V |
| 12 | 3.3V | 24 | GND |

Connector: **CN_12V**

Type: 4-pin standard Pentium 4 additional +12V power connector

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | Ground | 2 | +12V |
| 3 | Ground | 4 | +12V |
| 5 | Ground | 6 | +12V |
| 7 | Ground | 8 | +12V |

Connector: **CPUFAN**

Type: 4-pin fan wafer connector

| Pin | Description | Pin | Description |
|-----|---------------------|-----|-------------|
| 1 | Ground | 2 | +12V |
| 3 | Fan Speed Detection | 4 | Sense |

Connector: **NBFAN, SYSFAN**

Type: 3-pin fan wafer connector

| Pin | Description | Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|-----|-------------|
| 1 | Ground | 2 | +12V | 3 | Sense |

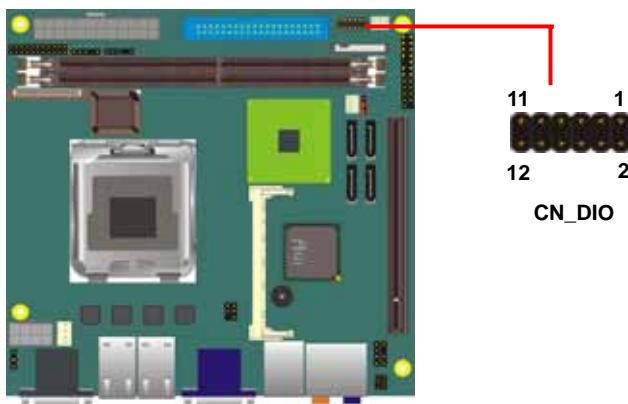
2.14 <GPIO interface>

The board provides a programmable 8-bit digital I/O interface, and a SMBus (System management bus) interface for control panel application.

Connector: **CN_DIO**

Type: onboard 2 x 6-pin header, pitch=2.0mm

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | Ground | 2 | Ground |
| 3 | GP10 | 4 | GP14 |
| 5 | GP11 | 6 | GP15 |
| 7 | GP12 | 8 | GP16 |
| 9 | GP13 | 10 | GP17 |
| 11 | VCC | 12 | +12V |



| W83627THF | Assignment | CN_DIO |
|-----------|----------------|--------|
| PIN 121 | GPSA2/GP17 | PIN 10 |
| PIN 122 | GPSB2/GP16 | PIN 8 |
| PIN 123 | GPY1/GP15 | PIN 6 |
| PIN 124 | GPY2/P16/GP14 | PIN 4 |
| PIN 125 | GPX2/P15/GP13 | PIN 9 |
| PIN 126 | GPX1/P14/GP12 | PIN 7 |
| PIN 127 | GPSB1/P13/GP11 | PIN 5 |
| PIN 128 | GPSA1/P12/GP10 | PIN 3 |

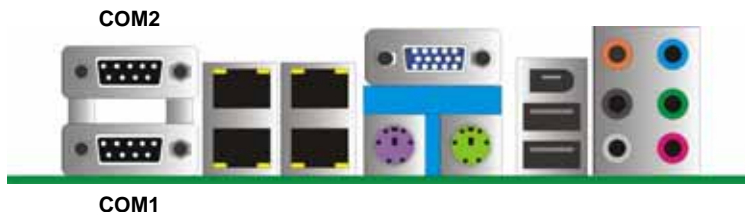
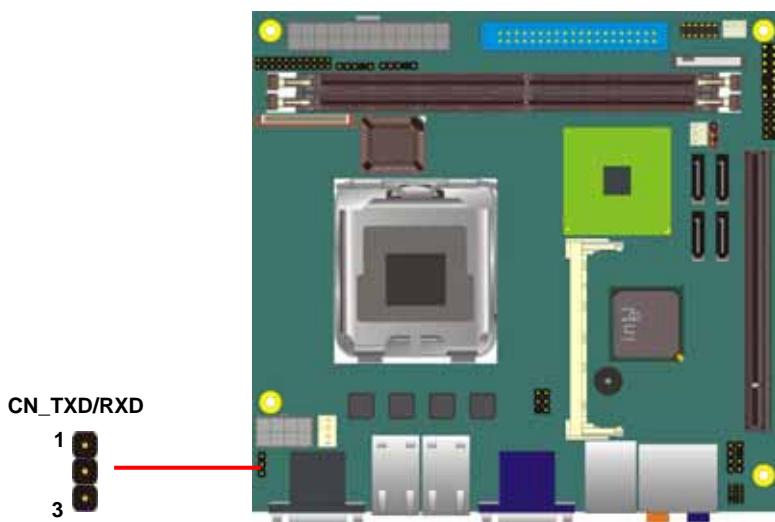
2.15 <Serial Port>

The board has two RS232 serial ports on real I/O panel, and onboard one 3-pin additional TXD/RXD connector for POS application.

Connector: **CN_TXD/RXD**

Connector type: onboard 3-pin header (pitch = 2.00mm)

| Pin Number | Pin Assignment |
|------------|----------------|
| 1 | TXD |
| 2 | RXD |
| 3 | Ground |



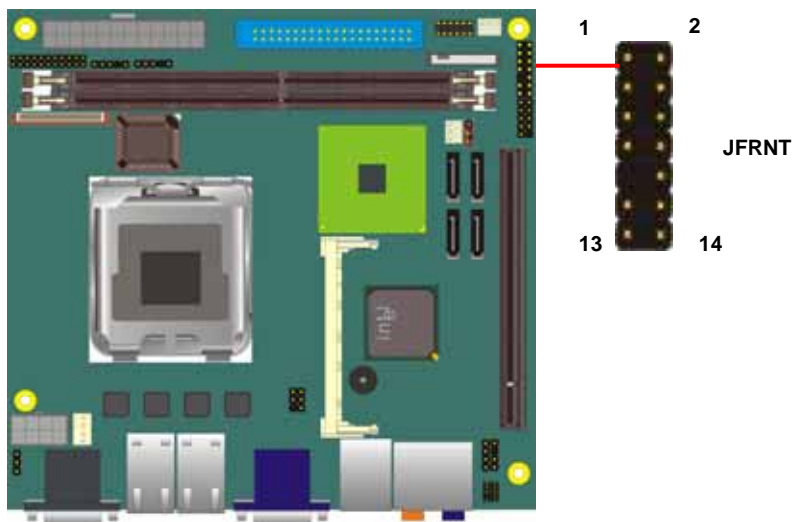
2.16 <Switch and Indicator>

The **JFRNT** provides front control panel of the board, such as power button, reset and beeper, etc. Please check well before you connecting the cables on the chassis.

Connector: **JFRNT**

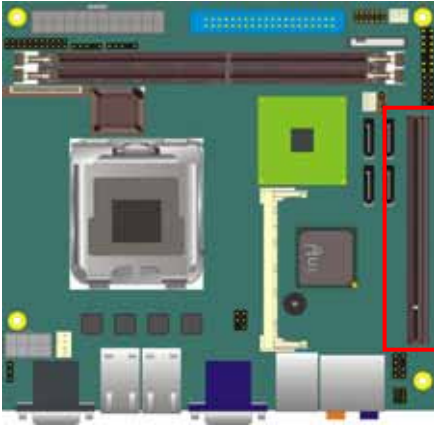
Type: onboard 14-pin (2 x 7) 2.54-pitch header

| Function | Signal | PIN | | Signal | Function |
|--------------|--------|-----|----|---------|-----------|
| IDE LED | HDLED+ | 1 | 2 | PWDLED+ | Power LED |
| | HDLED- | 3 | 4 | N/C | |
| Reset | Reset+ | 5 | 6 | PWDLED- | Speaker |
| | Reset- | 7 | 8 | SPKIN+ | |
| N/C | | 9 | 10 | N/C | |
| Power Button | PWRBT+ | 11 | 12 | N/C | |
| | PWRBT- | 13 | 14 | SPKIN- | |

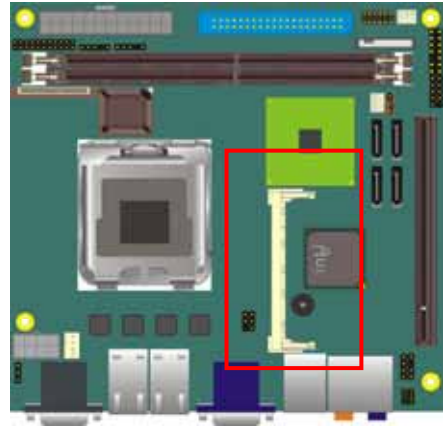


2.17 <Expansion Interface>

LV-674 has one PCI-Express 16x slot and one Mini-PCI socket onboard. PCI-Express is the last expansion interface technology, for its serial data transfer scheme, each lane will be up to 500MB/s (duplex), and the 16x (16 lanes) can be up to 8GB/s more than 2GB/s as AGP 8x bus transfer rate. The 16x slot can be also for 1x compatible use.



PCIE (PCI-Express 16x slot)



MINIPCI

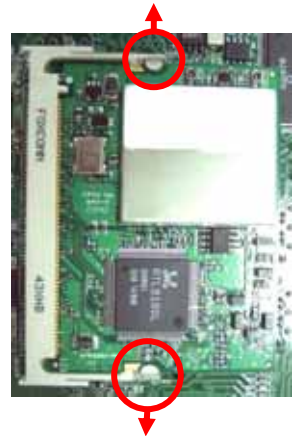
Mini-PCI Card installation:



1. Slot in the card at 45 degree



2. Press the card onto the socket to hear a click sound



3. to remove the card, please pull out the locker on the socket.

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Chapter 3 <System Configuration>

3.1 <SATA configuration>

Based on Intel® ICH7R Southbridge chip, the board supports 4 Serial ATA II ports; please follow the touring guide to setup your Serial ATA devices.

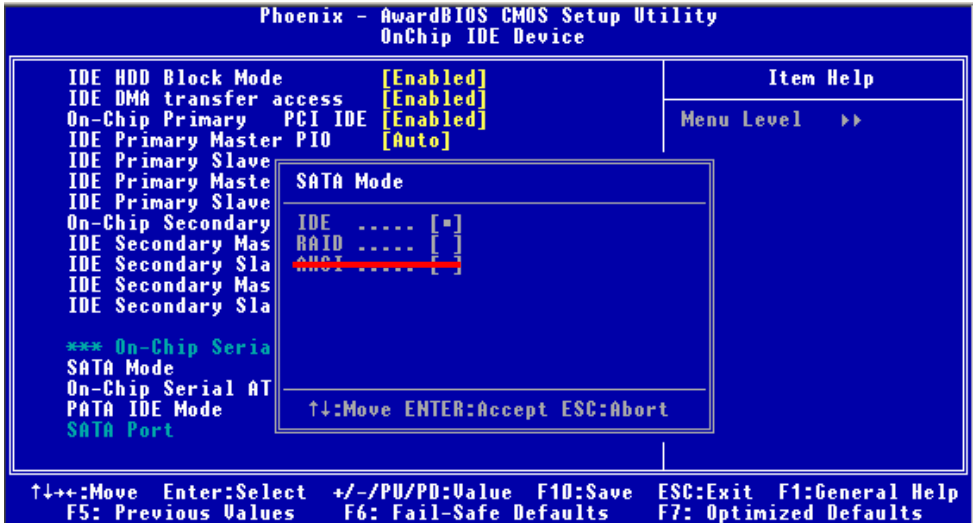
For Windows 98/SE/ME, Windows NT4.0 and DOS system, they only support up to 4 IDE devices including SATA devices, and Windows 2000/XP/Server2003 have no such limitation.

| Operating System (Support Mode) | Parallel ATA | Serial ATA | | | |
|------------------------------------|------------------------|----------------------------|------------------------------|---------------------------|-----------------------------|
| | Primary (2 Devices) | SATA1 | SATA2 | SATA3 | SATA4 |
| Windows 2000/XP (Enhance Mode) | ○ | ○ | ○ | ○ | ○ |
| Windows 98/ME/NT4.0 | | | | | |
| Type 1 (Combine Mode) | ○ (Primary) | X | ○ (Secondary) | X | ○ (Secondary) |
| Type 2 (Combine Mode) | ○ (Secondary) | ○ (Primary) | X | ○ (Primary) | X |
| Type 3 (SATA only) | X | ○ (Primary) (Master) | ○ (Secondary) (Master) | ○ (Primary) (Slave) | ○ (Secondary) (Slave) |

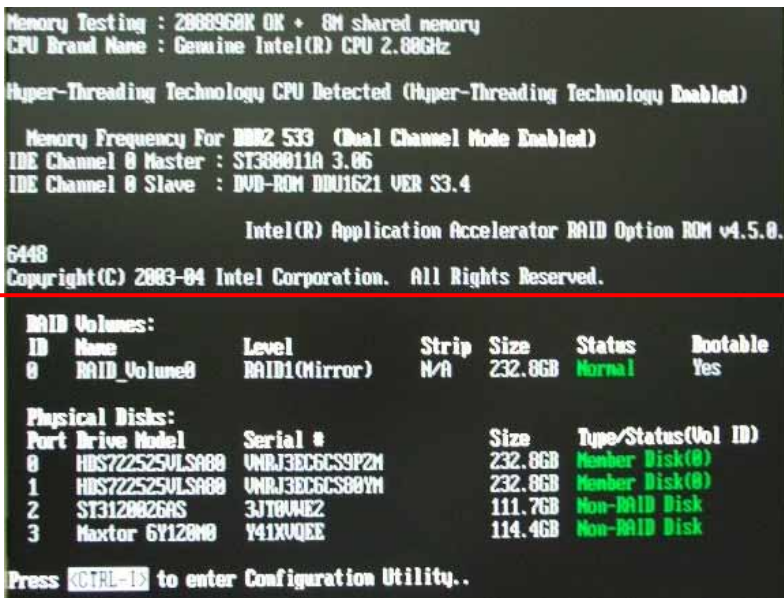
(Table 3.1.1)

The following BIOS setup screen shows how to setup your ATAPI devices with each mode.

SATA Mode:



This option can let you select whether the Serial ATA hard drives would work under normal IDE mode or RAID mode. The RAID mode need more than one HDD is applied.



Once you enable the RAID mode, the boot-up screen would pop up the RAID configuration option for setup.

On-Chip Serial ATA mode:



This option can let you select operation modes of Serial ATA drives.

Disabled: To disable the onboard Serial ATA controller.

Auto: To allow the system select the optimized mode automatically.

Combined mode: PATA and SATA work as two channels for supporting two drives on each channel.

Enhanced mode: Max supported of the PATA and SATA for up to 6 drives.

SATA Only: To disable the PATA and only apply the SATA drives.

Notice: The Combined mode and Enhanced mode are supported depends on your operating system, please check **page35** for relative information.

3.2 <SATA RAID Configuration>

The board integrates Intel® ICH7R with RAID function for Serial ATA II drives, and supports the configurations below:

RAID 0 (Striping): Two hard drives operating as one drive for optimized data R/W performance. It needs two unused drives to build this operation.

RAID 1 (Mirroring): Copies the data from first drive to second drive for data security, and if one drive fails, the system would access the applications to the workable drive. It needs two unused drives or one used and one unused drive to build this operation. The second drive must be the same or larger size than first one.

RAID 5 (striping with parity)

A RAID 5 array contains three or more hard drives where the data is divided into manageable blocks called strips. Parity is a mathematical method for recreating data that was lost from a single drive, which increases fault-tolerance. The data and parity are striped across all the hard drives in the array. The parity is striped in a rotating sequence to reduce bottlenecks associated with the parity calculations.

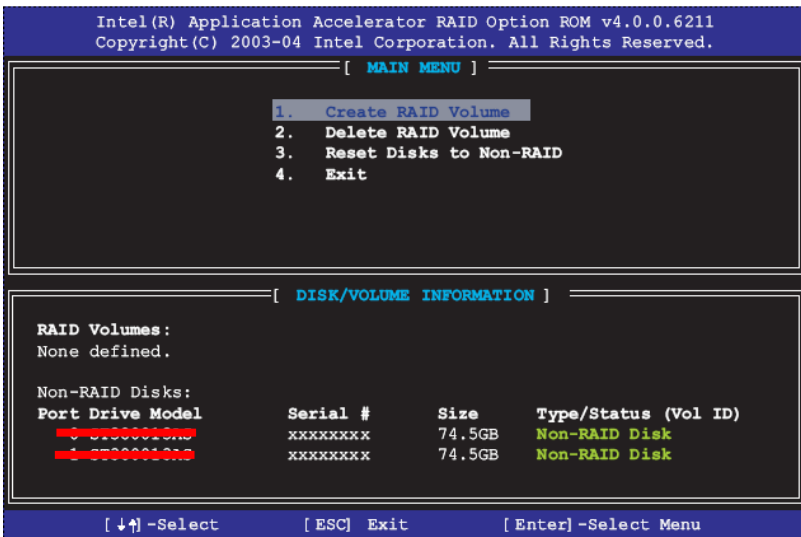
RAID 10 (RAID 0+1)

A RAID 10 array uses four hard drives to create a combination of RAID levels 0 and 1. The data is striped across a two-drive array forming the RAID 0 component. Each of the drives in the RAID 0 array is then mirrored by a RAID 1 component.

Intel Matrix Storage Technology: This technology would allow you to use **RAID 0+1** mode on only two drives (4 drives needed on traditional RAID 0+1). It will create two partitions on each hard drive to simulate **RAID 0** and **RAID 1**. It also can let you modify the partition size without re-formatted.

For more information of Intel Matrix Storage Technology, please visit Intel's website.

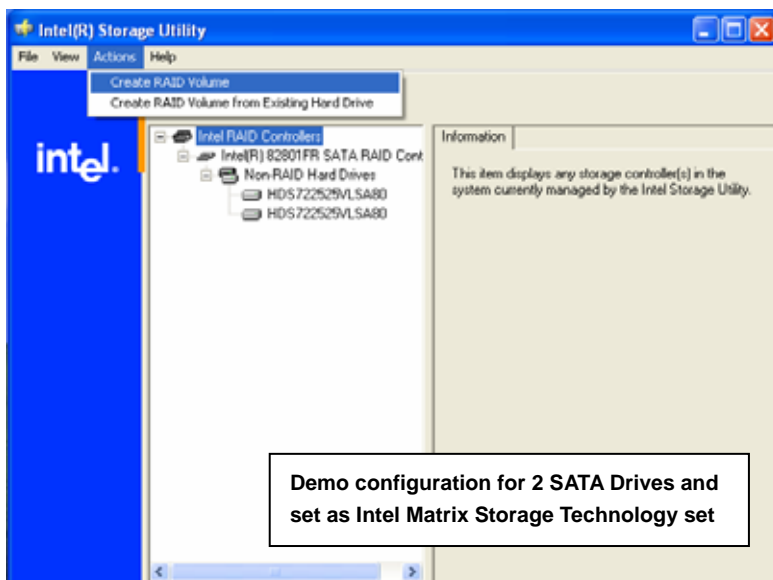
If you need to install an operation system on the RAID set, please use the driver disk attached in the package when it informs you to obtain the RAID drivers.



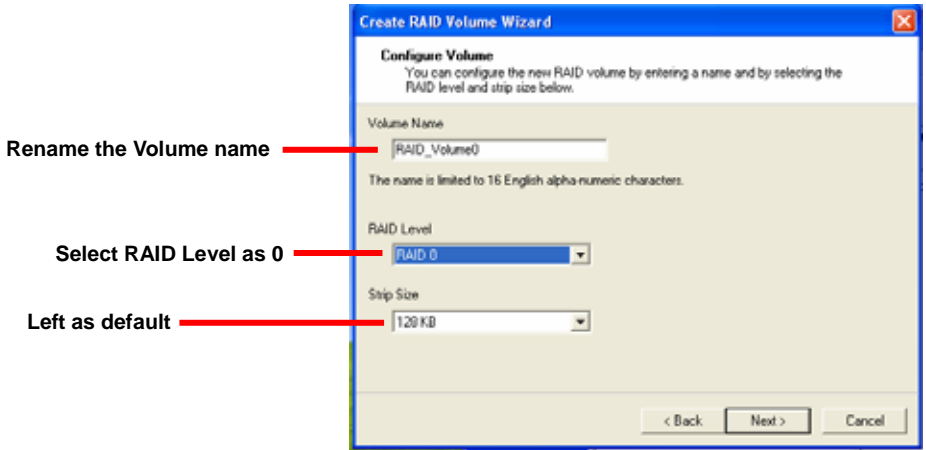
Please press <CTRL+I> to enter the RAID configuration menu.

You can setup the RAID under operation system for Microsoft® Windows XP SP1 or Windows 2000 SP4 version, please install the Intel® Application Accelerator Ver.4.5 later to support RAID configuration with Intel® Matrix Storage Technology.

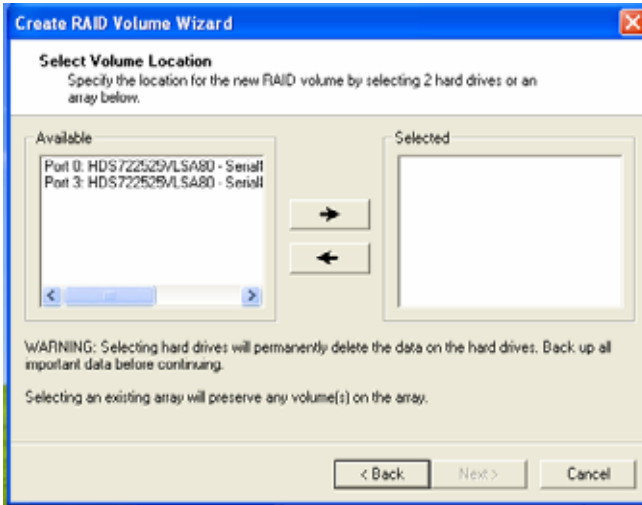
1. After installing Intel Application Accelerator, please execute Intel® Storage Utility.



2. Select Actions to Create RAID Volume

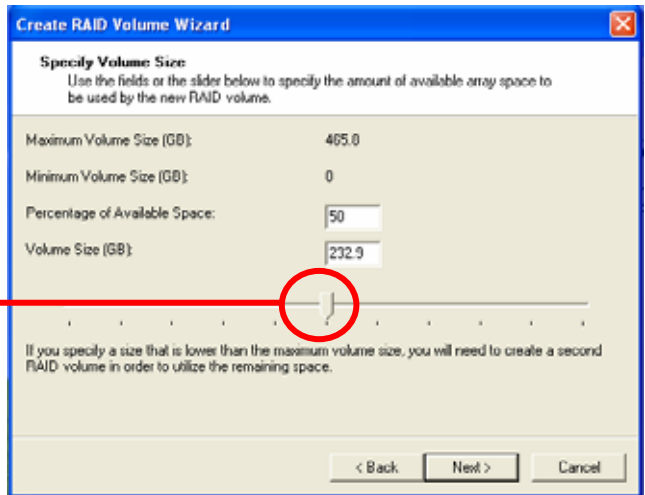


3. Please select two hard drives to prepare to set the RAID volume

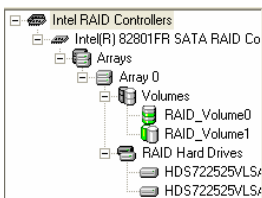


4. Specify the Volume size

Tune this bar to specify the volume size, if you specify the volume size lower than maximum, you can create a second volume for another RAID set. (Make RAID 0+1 on only two hard drives)



5. Repeat the step 1 to create second volume as RAID Level 1.



For other configuration set please click Help on tool bar.

3.3 <Audio Configuration>

The board integrates Intel® ICH7R with REALTEK® ALC880 codec. It can support 2-channel or 7.1 channel sound under system configuration. Please follow the steps below to setup your sound system.

1. Install REALTEK AC97 Audio driver.



2. Launch the control panel and Sound Effect Manager.
3. Select Speaker Configuration



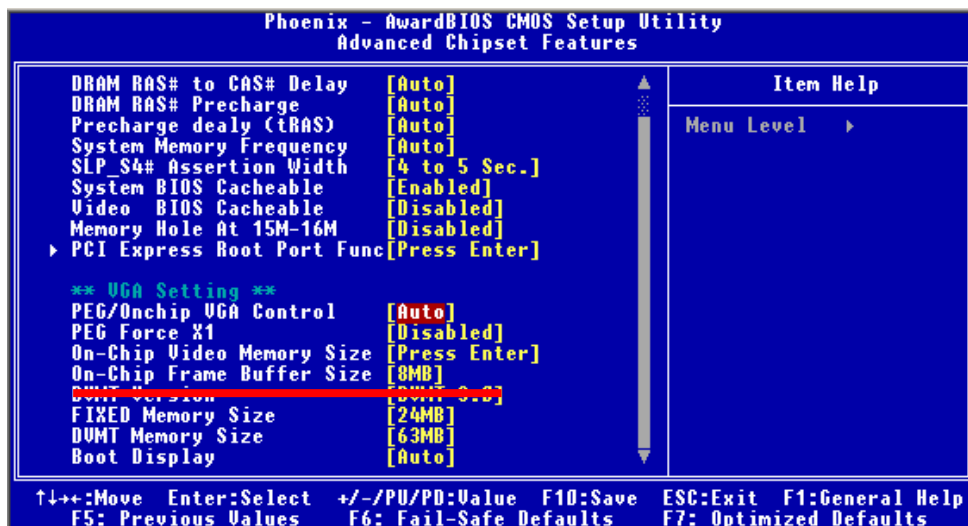
4. Select the sound mode to meet your speaker system.

3.4 <Video Memory Setup>

Based on Intel® 945G chipset with GMA (Graphic Media Accelerator) 950, the board supports Intel® DVMT (Dynamic Video Memory Technology) 3.0, which would allow the video memory be triggered up to 224MB.

To support DVMT, you need to install the Intel GMA 950 Driver with supported OS.

BIOS Setup:



On-Chip Video Memory Size: This option combines three items below for setup.

On-Chip Frame Buffer Size:

This item can let you select video memory which been allocated for legacy VGA and SVGA graphics support and compatibility. The available option is **1MB** and **128MB**.

Fixed Memory Size:

This item can let you select a static amount of page-locked graphics memory which will be allocated during driver initialization. Once you select the memory amount, it will be no longer available for system memory.

DVMT Memory Size:

This item can let you select a maximum size of dynamic amount usage of video memory, the system would configure the video memory depends on your application, this item is strongly recommend to be selected as **MAX DVMT**.

Fixed + DVMT Memory Size:

You can select the fixed amount and the DVMT amount at the same time for a guaranteed video memory and additional dynamic video memory, please check the table below for available setting.

| System Memory | On-Chip Frame Buffer Size | Fixed Memory Size | DVMT Memory Size | Total Graphic Memory |
|----------------------|----------------------------------|--------------------------|-------------------------|-----------------------------|
| 128MB~255MB | 1MB | 32MB | 0MB | 32MB |
| | 1MB | 0MB | 32MB | 32MB |
| | 8MB | 32MB | 0MB | 32MB |
| | 8MB | 0 | 32MB | 32MB |
| 256MB~511MB | 1MB | 64MB | 0MB | 64MB |
| | 1MB | 0 | 64MB | 64MB |
| | 1MB | 128MB | 0MB | 128MB |
| | 1MB | 0 | 128MB | 128MB |
| | 1MB | 64MB | 64MB | 128MB |
| | 8MB | 64MB | 0MB | 64MB |
| | 8MB | 0 | 64MB | 64MB |
| | 8MB | 128MB | 0MB | 128MB |
| | 8MB | 0 | 128MB | 128MB |
| | 8MB | 64MB | 64MB | 128MB |
| 512MB upper | 1MB | 64MB | 0 | 64MB |
| | 1MB | 0 | 64MB | 64MB |
| | 1MB | 128MB | 0 | 128MB |
| | 1MB | 0 | 128MB | 128MB |
| | 1MB | 64MB | 64MB | 128MB |
| | 1MB | 0 | 224MB | 224MB |
| | 8MB | 64MB | 0 | 64MB |
| | 8MB | 0 | 64MB | 64MB |
| | 8MB | 128MB | 0 | 128MB |
| | 8MB | 0 | 128MB | 128MB |
| | 8MB | 64MB | 64MB | 128MB |
| | 8MB | 0 | 224MB | 224MB |

Notice:

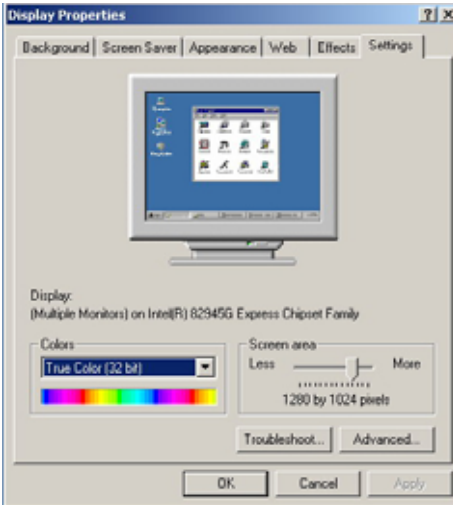
1. The On-Chip Frame Buffer Size would be included in the Fixed Memory.
2. Please select the memory size according to this table.

3.5 <Display Properties Setting>

Based on Intel 945G GMCH with GMA 950 (Graphic Media Accelerator), the board supports two DACs for display device as different resolution and color bit.

Please install the Intel Graphic Driver before you starting setup display devices.

1. Click right button on the desktop to lunch **display properties**



2. Click **Advanced** button for more specificity setup.



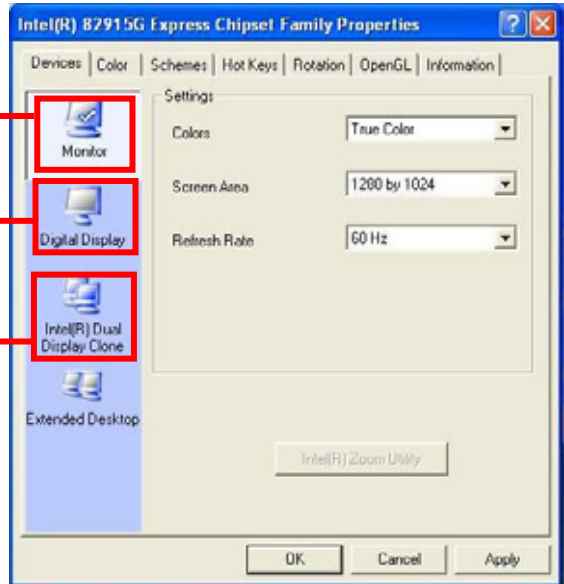
Click Graphics Properties... for advanced setup

3. This setup options can let you define each device settings.

Click **Monitor** to setup the CRT monitor for Colors, Resolution and Refresh Rate

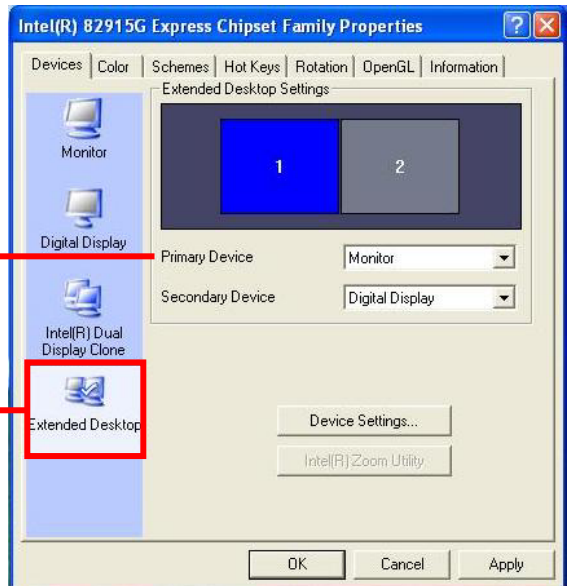
Click **Digital Display** to setup the DVI monitor for Colors, and Resolution

Click **Intel® Dual Display Clone** to setup the dual display mode as same screen



Set the main display device here

Click **Extended Desktop** to setup the dual display mode as different screen display

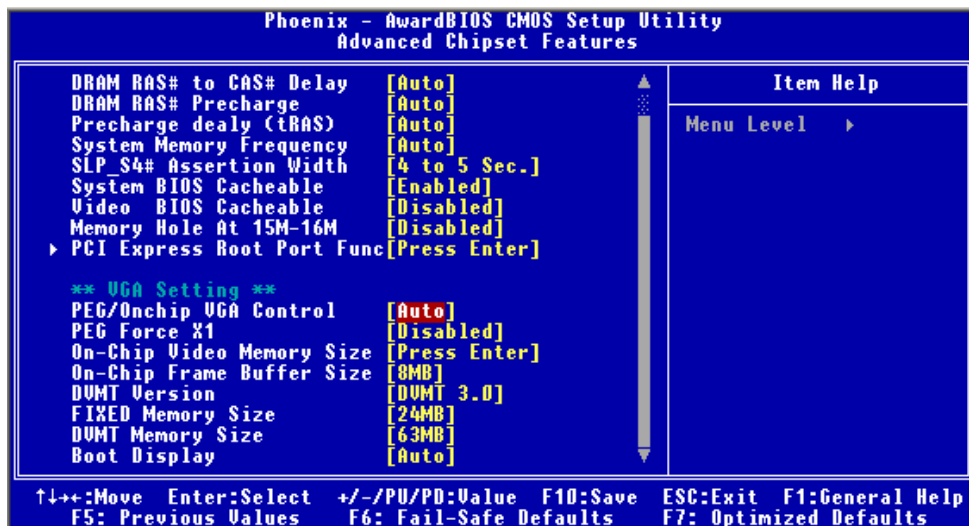


Notice: The dual display needs PCIE-SDVO module to support more than one display devices.

3.6 <PCI-Express interface setting>

The board provides one 16 lanes PCI-Express slot, it can be used for x16 graphic cards, or 1x LAN cards. (4x SCSI cards can be also compatible with x1 transfer way). Please check BIOS setting before you using PCI-Express card.

PEG Force X1:



If you use a x16 graphic card, please disable this function; if you use other x1 or x4 devices, please enable this function to force the interface working under x1 transfer mode.

Chapter 4 <BIOS Setup>

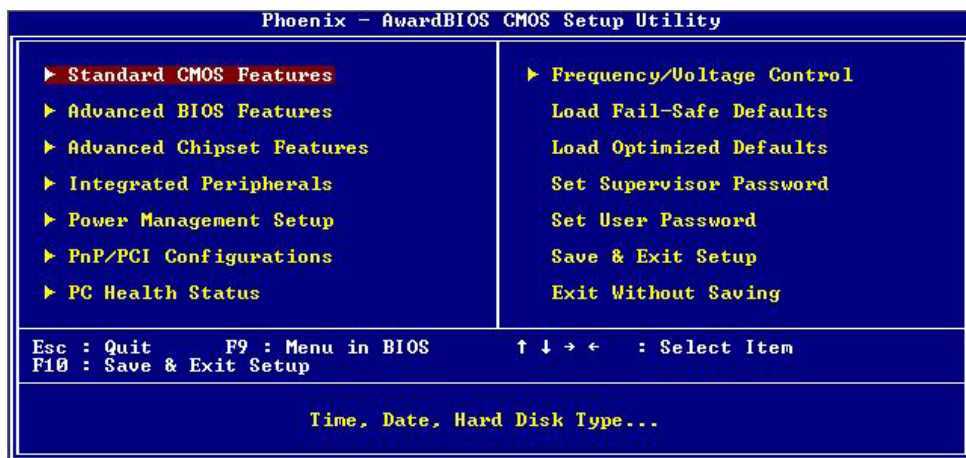
The motherboard uses the Award BIOS for the system configuration. The Award BIOS in the single board computer is a customized version of the industrial standard BIOS for IBM PC AT-compatible computers. It supports Intel x86 and compatible CPU architecture based processors and computers. The BIOS provides critical low-level support for the system central processing, memory and I/O sub-systems.

The BIOS setup program of the single board computer let the customers modify the basic configuration setting. The settings are stored in a dedicated battery-backed memory, NVRAM, retains the information when the power is turned off. If the battery runs out of the power, then the settings of BIOS will come back to the default setting.

The BIOS section of the manual is subject to change without notice and is provided here for reference purpose only. The settings and configurations of the BIOS are current at the time of print, and therefore they may not be exactly the same as that displayed on your screen.

To activate CMOS Setup program, press key immediately after you turn on the system. The following message "Press DEL to enter SETUP" should appear in the lower left hand corner of your screen. When you enter the CMOS Setup Utility, the Main Menu will be displayed as **Figure 4-1**. You can use arrow keys to select your function, press <Enter> key to accept the selection and enter the sub-menu.

Figure 4-1 CMOS Setup Utility Main Screen



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Appendix A <I/O Port Pin Assignment>

A.1 IDE Port

Connector: IDE1

Type: 40-pin (20 x 2) box header

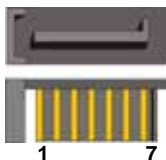


| Pin | Description | Pin | Description |
|-----|-----------------|-----|----------------|
| 1 | Reset | 2 | Ground |
| 3 | D7 | 4 | D8 |
| 5 | D6 | 6 | D9 |
| 7 | D5 | 8 | D10 |
| 9 | D4 | 10 | D11 |
| 11 | D3 | 12 | D12 |
| 13 | D2 | 14 | D13 |
| 15 | D1 | 16 | D14 |
| 17 | D0 | 18 | D15 |
| 19 | Ground | 20 | VCC |
| 21 | REQ | 22 | Ground |
| 23 | IOW-/STOP | 24 | Ground |
| 25 | IOR-/HDMARDY | 26 | Ground |
| 27 | IRDY/DDMARDY | 28 | IDE66#/IDE33 |
| 29 | DACK- | 30 | Ground |
| 31 | IRQ | 32 | N/C |
| 33 | A1 | 34 | CBLID |
| 35 | A0 | 36 | A2 |
| 37 | CS0 (MASTER CS) | 38 | CS1 (SLAVE CS) |
| 39 | LED ACT- | 40 | Ground |

A.2 <Serial ATA Port>

Connector: S_ATA1/2/3/4

Type: 7-pin wafer connector



| 1 | 2 | 3 | 4 | 5 | 6 | 7 |
|-----|------------|------------|-----|------------|------------|-----|
| GND | RSATA_TXP1 | RSATA_TXN1 | GND | RSATA_RXN1 | RSATA_RXP1 | GND |

A.3 <Floppy Port>

Connector: **FDD**

Type: 26-pin connector



| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | VCC | 2 | INDEX |
| 3 | VCC | 4 | DRV0 |
| 5 | VCC | 6 | DSKCHG |
| 7 | DRV1 | 8 | N/C |
| 9 | MTR1 | 10 | MTR0 |
| 11 | RPM | 12 | DIR |
| 13 | N/C | 14 | STEP |
| 15 | Ground | 16 | WRITE DATA |
| 17 | Ground | 18 | WRITE GATE |
| 19 | N/C | 20 | TRACK 0 |
| 21 | N/C | 22 | WRPTR |
| 23 | Ground | 24 | RDATA- |
| 25 | Ground | 26 | SEL |

A.4 <IrDA Port>

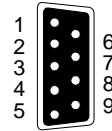
Connector: **CN_IR**

Type: 5-pin header for SIR Ports



| Pin | Description |
|-----|-------------|
| 1 | VCC |
| 2 | N/C |
| 3 | IRRX |
| 4 | Ground |
| 5 | IRTX |

A.5 <Serial Port>

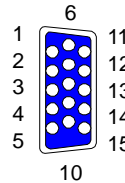


Connector: **COM1/COM2**

Type: 9-pin D-sub male connector on bracket

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | DCD | 6 | DSR |
| 2 | SIN | 7 | RTS |
| 3 | SO | 8 | CTS |
| 4 | DTR | 9 | RI |
| 5 | Ground | | |

A.6 <VGA Port>



Connector: **VGA**

Type: 15-pin D-sub female connector on bracket

| Pin | Description | Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|-----|-------------|
| 1 | RED | 6 | Ground | 11 | N/C |
| 2 | GREEN | 7 | Ground | 12 | 5VCCA |
| 3 | BLUE | 8 | Ground | 13 | HSYNC |
| 4 | N/C | 9 | LVGA5V | 14 | VSYNC |
| 5 | Ground | 10 | Ground | 15 | 5VCLK |

A.7 <LAN Port>

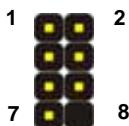


Connector: **RJ451/2/3/4**

Type: RJ45 connector with LED on bracket

| Pin | 1 | 2 | 3 | 4 | 5 |
|-------------|-------|-------|-------|-------|-------|
| Description | TRD0+ | TRD0- | TRD1+ | TRD1- | NC |
| Pin | 6 | 7 | 8 | 9 | 10 |
| Description | NC | TRD2+ | TRD2- | TRD3+ | TRD3- |

A.8 <IEEE 1394 Port>



Connector : **CN_1394**

Type : 8-pin header for IEEE 1394 port

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | BPWR | 2 | BPWR |
| 3 | TPB1- | 4 | TPB+ |
| 5 | TPA1- | 6 | TPB+ |
| 7 | Ground | 8 | N/C |

A.9 <LAN LED>



Connector : **LAN_LED**

Type : 24-pin header for LAN LED

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | Active1- | 2 | Active1+ |
| 3 | Link100M1- | 4 | Link100M1+ |
| 5 | Link1000M1- | 6 | Link1000M1+ |
| 7 | Active2- | 8 | Active2+ |
| 9 | Link100M2- | 10 | Link100M2+ |
| 11 | Link1000M2- | 12 | Link1000M2+ |
| 13 | Active3- | 14 | Active3+ |
| 15 | Link100M3- | 16 | Link100M3+ |
| 17 | Link1000M3- | 18 | Link1000M3+ |
| 19 | Active4- | 20 | Active4+ |
| 21 | Link100M4- | 22 | Link100M4+ |
| 23 | Link1000M4- | 24 | Link1000M4+ |

A.10 <SMBus>



Connector: **CN_SMBUS**

Type: 4-pin SMBus connector

| Pin | Description | Pin | Description |
|-----|-------------|-----|-------------|
| 1 | VCC | 2 | N/C |
| 3 | SMBDATA | 4 | SMBCLK |
| 5 | Ground | | |

Appendix B <System Resources>

B1.<I/O Port Address Map>

| | |
|-----------------------|---|
| [00000000 - 0000000F] | Direct memory access controller |
| [00000000 - 00000CF7] | PCI bus |
| [00000010 - 0000001F] | Motherboard resources |
| [00000020 - 00000021] | Programmable interrupt controller |
| [00000022 - 0000003F] | Motherboard resources |
| [00000040 - 00000043] | System timer |
| [00000044 - 0000005F] | Motherboard resources |
| [00000060 - 00000060] | Standard 101/102-Key or Microsoft Natural PS/2 Keyboard |
| [00000061 - 00000061] | System speaker |
| [00000062 - 00000063] | Motherboard resources |
| [00000064 - 00000064] | Standard 101/102-Key or Microsoft Natural PS/2 Keyboard |
| [00000065 - 0000006F] | Motherboard resources |
| [00000070 - 00000073] | System CMOS/real time clock |
| [00000074 - 0000007F] | Motherboard resources |
| [00000080 - 00000090] | Direct memory access controller |
| [00000091 - 00000093] | Motherboard resources |
| [00000094 - 0000009F] | Direct memory access controller |
| [000000A0 - 000000A1] | Programmable interrupt controller |
| [000000A2 - 000000BF] | Motherboard resources |
| [000000C0 - 000000DF] | Direct memory access controller |
| [000000E0 - 000000EF] | Motherboard resources |
| [000000F0 - 000000FF] | Numeric data processor |
| [00000170 - 00000177] | Secondary IDE Channel |
| [000001F0 - 000001F7] | Primary IDE Channel |
| [00000274 - 00000277] | ISAPNP Read Data Port |
| [00000279 - 00000279] | ISAPNP Read Data Port |
| [000002F8 - 000002FF] | Communications Port (COM2) |
| [00000376 - 00000376] | Secondary IDE Channel |
| [000003B0 - 000003BB] | Intel(R) 82945G Express Chipset Family |
| [000003C0 - 000003DF] | Intel(R) 82945G Express Chipset Family |
| [000003F0 - 000003F5] | Standard floppy disk controller |
| [000003F6 - 000003F6] | Primary IDE Channel |
| [000003F7 - 000003F7] | Standard floppy disk controller |
| [000003F8 - 000003FF] | Communications Port (COM1) |

| | |
|-----------------------|--|
| [00000400 - 000004BF] | Motherboard resources |
| [000004D0 - 000004D1] | Motherboard resources |
| [00000500 - 0000051F] | Intel(R) 82801GB SMBus Controller - 27DA |
| [00000800 - 0000087F] | Motherboard resources |
| [00000A79 - 00000A79] | ISAPNP Read Data Port |
| [00000D00 - 0000FFFF] | PCI bus |
| [00009000 - 00009FFF] | Intel(R) 82801GB PCI Express Root Port - 27E0 |
| [00009E00 - 00009EFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #4 |
| [0000B000 - 0000BFFF] | Intel(R) 82801GB PCI Express Root Port - 27D6 |
| [0000BE00 - 0000BEFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #3 |
| [0000C000 - 0000CFFF] | Intel(R) 82801GB PCI Express Root Port - 27D4 |
| [0000CE00 - 0000CEFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller |
| [0000D000 - 0000DFFF] | Intel(R) 82801GB PCI Express Root Port - 27D2 |
| [0000DE00 - 0000DEFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #2 |
| [0000E000 - 0000EFFF] | Intel(R) 82801GB PCI Express Root Port - 27D0 |
| [0000F500 - 0000F51F] | Intel(R) 82801GR/GH SATA RAID Controller |
| [0000F600 - 0000F603] | Intel(R) 82801GR/GH SATA RAID Controller |
| [0000F700 - 0000F707] | Intel(R) 82801GR/GH SATA RAID Controller |
| [0000F800 - 0000F803] | Intel(R) 82801GR/GH SATA RAID Controller |
| [0000F900 - 0000F907] | Intel(R) 82801GR/GH SATA RAID Controller |
| [0000FA00 - 0000FA0F] | Intel(R) 82801GB Ultra ATA Storage Controllers - 27DF |
| [0000FB00 - 0000FB1F] | Intel(R) 82801GB USB Universal Host Controller - 27CB |
| [0000FC00 - 0000FC1F] | Intel(R) 82801GB USB Universal Host Controller - 27CA |
| [0000FD00 - 0000FD1F] | Intel(R) 82801GB USB Universal Host Controller - 27C9 |
| [0000FE00 - 0000FE1F] | Intel(R) 82801GB USB Universal Host Controller - 27C8 |
| [0000FF00 - 0000FF07] | Intel(R) 82945G Express Chipset Family |

B2.<Memory Address Map>

| | |
|-----------------------|--|
| [00000000 - 0009FFFF] | System board |
| [000A0000 - 000BFFFF] | Intel(R) 82945G Express Chipset Family |
| [000A0000 - 000BFFFF] | PCI bus |
| [000C0000 - 000DFFFF] | PCI bus |
| [000D1000 - 000D3FFF] | System board |
| [000E0000 - 000EFFFF] | System board |
| [000F0000 - 000F7FFF] | System board |
| [000F8000 - 000FBFFF] | System board |
| [000FC000 - 000FFFFF] | System board |
| [00100000 - 3F6DFFFF] | System board |
| [3F6E0000 - 3F6FFFFF] | System board |
| [3F700000 - FEBFFFFF] | PCI bus |
| [C0000000 - CFFFFFFF] | Intel(R) 82945G Express Chipset Family |
| [E0000000 - EFFFFFFF] | Motherboard resources |
| [FD200000 - FD2FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D0 |
| [FD4FF000 - FD4FFFFF] | OHCI Compliant IEEE 1394 Host Controller |
| [FD500000 - FD5FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D0 |
| [FD600000 - FD6FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27E0 |
| [FD700000 - FD7FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27E0 |
| [FD7FC000 - FD7FFFFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #4 |
| [FD800000 - FD8FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D6 |
| [FD900000 - FD9FFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D6 |
| [FD9FC000 - FD9FFFFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #3 |
| [FDA00000 - FDAFFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D4 |
| [FDB00000 - FDBFFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D4 |
| [FDBFC000 - FDBFFFFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller |
| [FDC00000 - FDCFFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D2 |
| [FDD00000 - FDDFFFFF] | Intel(R) 82801GB PCI Express Root Port - 27D2 |
| [FDDFC000 - FDDFFFFF] | Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #2 |
| [FDE80000 - FDEFFFFF] | Intel(R) 82945G Express Chipset Family |
| [FDF00000 - FDF3FFFF] | Intel(R) 82945G Express Chipset Family |
| [FDF80000 - FDFBFFFF] | Microsoft UAA Bus Driver for High Definition Audio |
| [FDFFE000 - FDFFE3FF] | Intel(R) 82801GR/GH SATA RAID Controller |
| [FDFFF000 - FDFFF3FF] | Universal Serial Bus (USB) Controller |
| [FEC00000 - FEC00FFF] | System board |
| [FED13000 - FED1DFFF] | System board |
| [FED20000 - FED8FFFF] | System board |
| [FEE00000 - FEE00FFF] | System board |
| [FFB00000 - FFB7FFFF] | System board |
| [FFB80000 - FFBFFFFF] | Intel(r) 82802 Firmware Hub Device |
| [FFF00000 - FFFFFFFF] | System board |

B3.<System IRQ & DMA Resources>**DMA :**

- 2 Standard floppy disk controller
- 4 Direct memory access controller

IRQ :

- 0 System timer
- 1 Standard 101/102-Key or Microsoft Natural PS/2 Keyboard
- 3 Communications Port (COM2)
- 4 Communications Port (COM1)
- 6 Standard floppy disk controller
- 8 System CMOS/real time clock
- 9 Microsoft ACPI-Compliant System
- 12 PS/2 Compatible Mouse
- 13 Numeric data processor
- 14 Primary IDE Channel
- 15 Secondary IDE Channel
- 7 Universal Serial Bus (USB) Controller
- 15 Intel(R) 82801GB SMBus Controller - 27DA
- 16 Intel(R) 82801GB PCI Express Root Port - 27D0
- 16 Intel(R) 82801GB USB Universal Host Controller - 27CB
- 16 Intel(R) 82945G Express Chipset Family
- 16 Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #4
- 16 Microsoft UAA Bus Driver for High Definition Audio
- 17 Intel(R) 82801GB PCI Express Root Port - 27D2
- 17 Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #2
- 17 OHCI Compliant IEEE 1394 Host Controller
- 18 Intel(R) 82801GB PCI Express Root Port - 27D4
- 18 Intel(R) 82801GB PCI Express Root Port - 27E0
- 18 Intel(R) 82801GB USB Universal Host Controller - 27CA
- 18 Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller
- 19 Intel(R) 82801GB PCI Express Root Port - 27D6
- 19 Intel(R) 82801GB USB Universal Host Controller - 27C9
- 19 Intel(R) 82801GR/GH SATA RAID Controller
- 19 Marvell Yukon 88E8053 PCI-E Gigabit Ethernet Controller #3
- 23 Intel(R) 82801GB USB Universal Host Controller - 27C8

Appedix C <Flash BIOS>

C.1 BIOS Auto Flash Tool

The board is based on Award BIOS and can be updated easily by the BIOS auto flash tool. You can download the tool online at the address below:

<http://www.award.com>

File name of the tool is "awdf flash.exe", it's the utility that can write the data into the BIOS flash ship and update the BIOS.

C.2 Flash Method

1. Please make a bootable floppy disk.
2. Get the last .bin files you want to update and copy it into the disk.
3. Copy awardflash.exe to the disk.
4. Power on the system and flash the BIOS. (Example: C:/ awardflash XXX.bin)
5. Re-star the system.

Appendix D <Programming GPIO's>

The GPIO can be programmed with the MSDOS debug program using simple IN/OUT commands. The following lines show an example how to do this.

```

GPIO0.....GPIO7  bit0.....bit7
-o 2E 87                ;enter configuration
-o 2E 87
-o 2E 29
-o 2E 40                ;enale GPIO function
-o 2E 07
-o 2E 07                ;enable GPIO configuration
-o 2E F0
-o 2F xx                ;set GPIO as input/output; set '1' for input,'0' for
output
-o 2E F1
-o 2F xx                ;if set GPIO's as output,in this register its value can
                        be set

Optional :
-o 2E F2
-o 2F xx                ; Data inversion register ; '1' inverts the current valus
                        of the bits ,'0' leaves them as they are
-o 2E 30
-o 2F 01                ; active GPIO's

```

For further information ,please refer to Winbond W83627THF datasheet.

Contact Information

Any advice or comment about our products and service, or anything we can help you please don't hesitate to contact with us. We will do our best to support you for your products, projects and business.

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