SH845GV Product Manual

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Preface

Notational Conventions

This manual uses the following conventions:

- `Screen text and syntax strings appear in this font.`
- All numbers are decimal unless otherwise stated.

Notes indicate important information about the product.

Tips indicate alternate techniques or procedures that you can use to save time or better understand the product.

The globe indicates a World Wide Web address.

The book indicates a book or file.

ESD cautions indicate situations that *may* cause damage to hardware via electro-static discharge (ESD).

Cautions indicate potentially hazardous situations which, if not avoided, may result in minor or moderate injury, or damage to data or hardware. It may also alert you about unsafe practices.

Warnings indicate potentially hazardous situations, which, if not avoided, can result in death or serious injury.

Danger indicates imminently hazardous situations, which, if not avoided, will result in death or serious injury.

Installation Notes

When installing this motherboard into a suitable chassis, refer to the following notes:

- Read and save all instructions.
- Always disconnect Cord/Plug before installation or upgrade. Parts of the motherboard can remain powered even when the power supply is switched off unless the cord is disconnected.
- Pay attention to the safety warnings included in this document.
- When installing expansion cards, pay attention to the maximum loads detailed in this document. Use only UL approved peripheral cards.
- Route wiring away from sharp edges, heat sources and cooling fans.
- Pay attention to the thermal issues described in this document. The motherboard requires suitable airflow to maintain an ambient temperature within its operating range.

Safety and Approval Notices

Table 1. Safety and approval notices

Item	Description
Battery	This product contains a lithium cell. • When removing or replacing the lithium cell, do not use a conductive instrument as a short-circuit may cause the cell to explode. Always replace the cell with one of the same type. This product uses a CR2032 cell. Dispose of a spent cell promptly – do not recharge, disassemble or incinerate. Keep cells away from children. • **CAUTION!** Danger of explosion if battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of batteries according to the manufacturer's instructions.
LAN (Local Area Network) Connector	This product may include an RJ45 LAN connector (see product options). Do not connect to anything other than an Ethernet LAN.
Thermal Interface Material	This product may contain thermal interface material between devices and heatsinks. This can cause irritation and can stain clothing. Avoid prolonged or repeated contact with the skin and wash thoroughly with soap and water after handling. Avoid contact with eyes and inhalation of fumes. Do not ingest.
Anti-static Precautions	This product contains static-sensitive components and should be handled with care. It is recommended that the product be handled in a Special Handling Area (SHA) as defined in EN100015-1:1992. Such an area has working surfaces, floor coverings and chairs connected to a common earth reference point. An earthed wrist strap should be worn whilst handling. Other examples of static-sensitive devices are the memory modules and the processor. Failure to employ adequate anti-static measures can cause irreparable damage to components on the motherboard.
Electromagnetic Compatibility	This product is designed to meet the following EMC standards when installed in a suitable chassis. • FCC Class B (Title 47 of Code of Federal Regulations, parts 2 & 15, subpart B) • EN55022:1998 Class B • EN55024:1998
Safety	This product complies with the American Safety Standard UL60950 when installed in a suitable chassis.
Legal Directives	This product complies with the relevant clauses of the following European Directives. Low Voltage Directive 73/23/EEC EMC Directive 89/336/EEC

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1. Overview

The SH845GVis an ATX form factor motherboard based around an Intel Celeron or Pentium 4 processor and an Intel 845GV chipset. It integrates video, audio, system monitoring, Ethernet controller and a CompactFlash socket on a 12.0 x 9.6-inch board.

Table 2. Features

Item	Description
Form Factor	ATX, 12.0 x 9.6 inches.
Processor	478-pin PGA socket for Intel Celeron and Pentium 4 processors with a 400 or 533MHz processor bus speed in an FC-PGA2 package.
Chipset	Intel 845GV GMCH with Intel ICH4 I/O hub.
Memory	Two 184-pin DIMM sockets for PC2100 and PC2700 DDR modules without ECC or parity. Maximum 2GB, minimum 32MB memory.
Video	Intel® Extreme Graphics 3D controller integrated within chipset with support for digital display or TV-Out via ADD card.
Audio	Digital audio controller integrated within chipset with AC97 CODEC. MIC, Line output and Line input (optional) jacks on I/O panel. CD input, AUX input and Line output ATAPI internal connectors. On-board PC speaker.
Expansion	Six 5V PCI 2.2 slots and one ADD slot for 1.5V ADD cards.
Power Management	ACPI, PCI PME.
System Management	System voltage and temperature monitoring. Monitoring for 3 fans including processor fan. Fan speed control with automatic option based on thermal monitors. Lithium cell voltage monitoring. Programmable watchdog timer. Status LED stack on I/O panel (4 LEDs). SMBus header.
BIOS	Phoenix ServerBIOS™ 3.0-based including video BIOS and network boot (dependent on network controllers). 4 or 8Mbit device with optional socket. Customizable including system configuration and startup logo.
I/O	Six USB 2.0 ports - four on rear panel, two on locking headers. Two RS232 serial ports – one on rear panel, one on header. Bi-directional/EPP/ECP parallel port on rear panel. PS/2 keyboard and mouse on rear panel (and via internal headers). General Purpose I/O lines (13) with LCD character display support.
Network	Intel-based 10/100Mbps Ethernet port.
Disks	Two Ultra ATA/100 interfaces supporting ATAPI CD, LS120 and ZIP drives and CompactFlash socket sharing secondary interface. 3-mode floppy interface with on-board connector.

1.1 Motherboard Layout

The next figure shows the layout of the SH845GV motherboard with the major components identified.

Figure 1. Motherboard layout

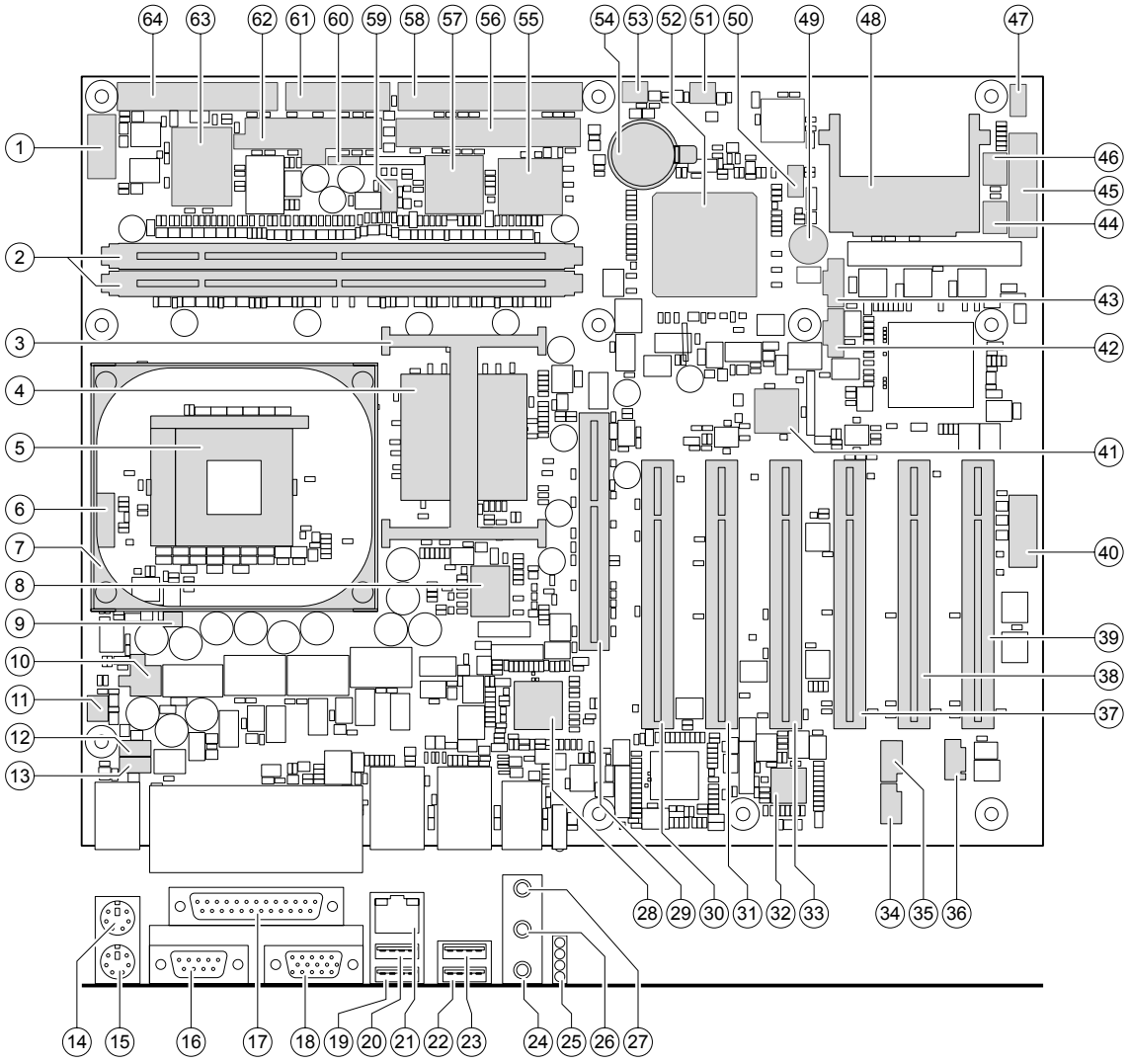


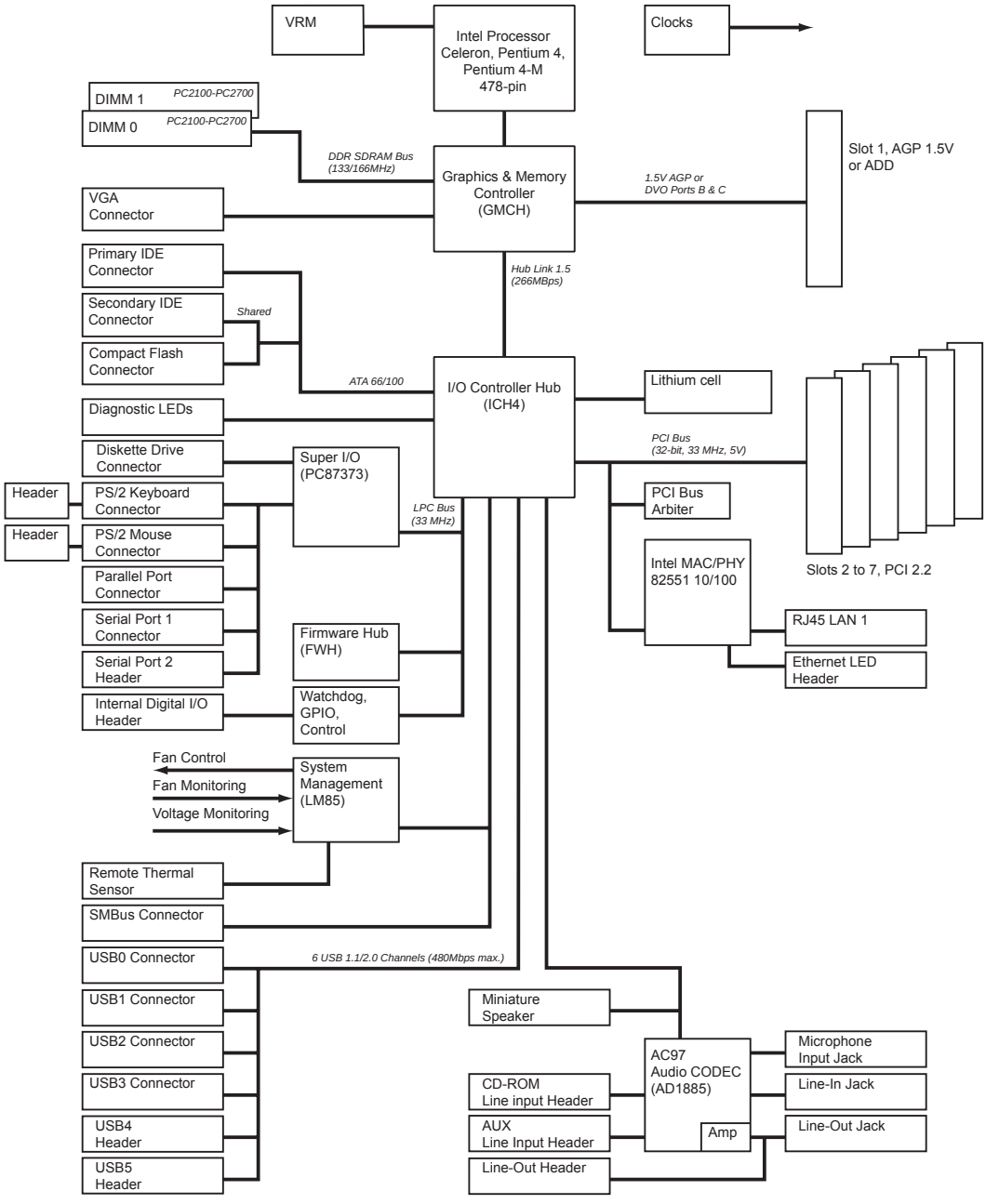
Table 3. Component Identification

	Description		Description		Description
1	Serial port 2 header	23	USB 2.0 channel 3	45	Front panel connector
2	Memory sockets	24	Audio Microphone input jack	46	CompactFlash master/slave select
3	Chipset GMCH heatsink clip	25	Diagnostic LED stack	47	Alternate Power LED header
4	Chipset GMCH heatsink	26	Audio Line output jack	48	CompactFlash socket
5	478-pin socket for processor	27	Audio Line input jack	49	Miniature speaker
6	ITP debug port (not fitted)	28	Ethernet controller	50	SMBus header
7	Processor retention mechanism	29	Slot 1 - 1.5V ADD	51	System fan 2 power connector
8	Clock generator	30	Slot 2 - PCI 2.2	52	I/O controller hub (ICH4)
9	Remote thermal sensor	31	Slot 3 - PCI 2.2	53	System fan 1 power connector
10	12V power connector from PSU	32	AC97 audio CODEC	54	3V Lithium cell – use CR2032
11	Processor fan power connector	33	Slot 4 - PCI 2.2	55	BIOS ROM (FWH)
12	Mouse header	34	Audio AUX Line input header	56	Secondary IDE connector
13	Keyboard header	35	Audio Line output header	57	Control logic
14	PS/2 mouse (green)	36	Audio CD-ROM Line input header	58	Primary IDE connector
15	PS/2 keyboard (purple)	37	Slot 5 - PCI 2.2	59	IDE/CompactFlash select jumper
16	Serial port 1	38	Slot 6 - PCI 2.2	60	BIOS ROM write-protect jumper
17	Parallel port	39	Slot 7 - PCI 2.2	61	GPIO header
18	VGA monitor	40	Ethernet ports LED header	62	Primary power supply connector
19	USB 2.0 channel 0	41	PCI bus arbiter	63	Super I/O controller
20	USB 2.0 channel 1	42	USB 2.0 channel 5 header	64	Diskette header
21	Ethernet port (RJ45)	43	USB 2.0 channel 4 header		
22	USB 2.0 channel 2	44	Operating mode jumper		

1.2 Block Diagram

The next figure shows a block diagram of the SH845GVmotherboard.

Figure 2. Block diagram



1.3 Product Options

The next table lists the product options available.

Table 4. Product options

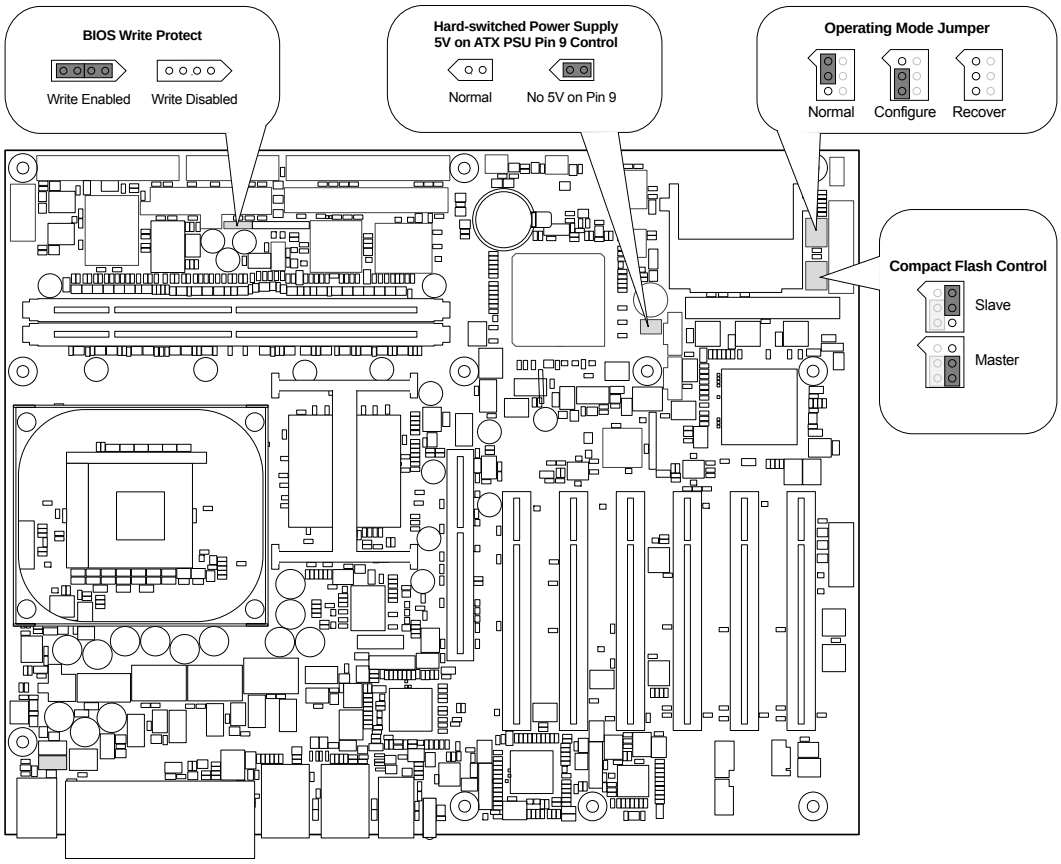
Functions	SH845GV-L
Chipset	Intel 845GV
LAN	10/100 (82551ER)
LAN Remote boot	No
LAN wake-up	No
Audio	Yes, 3 jacks
CompactFlash socket	Yes
ADD	Yes
Watchdog	Yes
Headless	No
Socketed BIOS ROM	No

Products are available with a choice of CPU and memory. Consult the latest price list for the available options. Other product options are available to special order for high volume customers.

1.4 Configuration

The majority of the configuration of the motherboard is done through the Setup utility built into the BIOS – discussed later in this document. There are, however, a number of jumpers that control the operation of the motherboard as described below. Some jumpers are not fitted to certain products.

Figure 3. Jumpers



1.4.1 Operation Mode Selection

This jumper selects one of these operating modes for the motherboard:

Normal Mode (Factory default) this is the position the jumper should be in for normal operation of the motherboard.

Recovery Mode If the jumper is in the recovery mode position then recovery mode is entered. The motherboard does not boot and waits until a valid recovery diskette is detected and then copies a new BIOS into the ROM. The motherboard must be powered down and then re-powered with the jumper in the normal position before normal operation can resume.

Configure Mode With the jumper in this position the motherboard automatically runs the BIOS Setup utility regardless of the state of the Setup disable flag that can be set in the BIOS defaults. In this mode, the CMOS RAM contents are ignored and the manufacturer (F9) defaults are used to configure the motherboard.

1.4.2 BIOS Write Protection

Some motherboard configurations include a BIOS write protection jumper facility. In this case, the BIOS ROM contents cannot be updated or changed in any way (including CMOS Save/Restore and ESCD) unless the jumpers are fitted. Motherboards without this option have the write protection controlled by software alone.

1.4.3 CompactFlash Control

The CompactFlash socket can be configured to operate as the master or slave device but master operation is recommended. When configured as a slave, there must be a drive configured as a master attached to the secondary IDE port. When configured as a master, ensure that any drive connected to the secondary IDE interface is configured as a slave. The other jumper in this block should always be fitted in the location shown.

CAUTION

The CompactFlash socket shares the secondary IDE interface and when the socket is in use, the secondary IDE port supports only one disk drive. Ensure that only one device is configured as master or slave. Use a 40-pin IDE cable if connecting a drive with a CompactFlash fitted.

1.4.4 Front Panel Connections

The primary controls and indicators for the motherboard are connected via the front panel connector using either a single ribbon cable to a 'front panel' assembly, or using a number of small PC-standard connectors. The functions are described below. See appendix B for the connector pin-out information.

Power LED

Connects either a single-color LED (usually green) or a two-terminal bi-color LED (usually green/yellow) to indicate the powered status of the motherboard. In both cases, the 'green' anode should be attached to pin 2 of the front panel connector. See the Indicators section later in this document for further information.

Power Switch

If the motherboard is used with a soft-switch power supply, a momentary switch should be connected between pins 6 and 8 of the power connector. If the switch is closed for greater than approximately 4 seconds, the motherboard powers off immediately, regardless of the state of the operating system, losing any system context information. Do not connect to this input when using a hard-switched power supply.

Reset Switch

If used, a momentary switch connected between pins 5 and 7 will cause the motherboard to restart when closed.

Hard Disk LED

To indicate hard disk activity on either of the two ATA channels, a single color LED should be connected between pins 1 (anode) and 3.

Speaker

Connect an external speaker between pins 10 and 11 or 10 and 16. This is used only for the PC 'beep' functions. The speaker should typically be 8Ω.

Tamper Switch

To make use of the tamper detection logic of the motherboard, connect a momentary switch between pins 18 and 20. The switch should be open when the chassis is closed.

1.4.5 Alternate Power LED

The power LED function on the front panel connector is duplicated on the Alternate Power LED connector for use with LEDs cabled to a 3-pin connector. Do not use both the primary (front panel) and alternate connectors simultaneously.

2. Motherboard Description

2.1 Processor

The SH845GVmotherboard supports Intel Celeron and Pentium 4 processors in a 478-pin PGA FC-PGA2 package and built with a 0.13 micron process. The next table lists the supported processors. An on-board voltage regulator generates the voltage for the CPU. Both the processor voltage and the operating frequency are automatically adjusted by the motherboard to suit the installed processor.

Table 5. Supported processors

Processor Type	Processor Speed	CPU bus speed	Cache size	Package
Intel Celeron	2.00 GHz	400 MHz	128kB	FC-PGA2
Intel Pentium 4	2.00 GHz	400 MHz	512kB	FC-PGA2
Intel Pentium 4	2.40 GHz	533 MHz	512kB	FC-PGA2
Intel Pentium 4	2.60 GHz	400 MHz	512kB	FC-PGA2
Intel Pentium 4	2.80 GHz	533 MHz	512kB	FC-PGA2

2.2 System Memory

The SH845GVmotherboard has two DIMM sockets to accept 64-bit DDR memory modules. The sockets may be populated in any order and each can accept either single or double-sided modules. The minimum total memory size is 32MB and the maximum is 2GB. The BIOS automatically configures the motherboard for the correct size, speed and type. See the Manuals, Drivers & BIOS section on the RadiSys web site at www.radisys.com for a list of memory modules that were tested with this product.

Note

When using the on-board video controller, the frame buffer is held within system memory and thus less memory is available to the operating system.

- Compliance with the JEDEC DDR specification for 2.5V 184-pin unbuffered DDR SDRAM
- Speed of either PC2100 (DDR266) or PC2700 (DDR333)
- Inclusion of a valid serial presence detect (SPD) ROM
- Based on 64Mb, 128Mb, 256Mb or 512Mb devices
- Capacity of between 32MB and 1GB
- 64 bits wide. ECC or parity is not supported

2.3 Chipset

The motherboard is based around an Intel 845GV chipset comprising these parts:

- Graphics and memory controller hub (GMCH). This includes the processor interface, a high-performance 3D graphics controller and the system memory controller.
- I/O controller hub (ICH4). This provides all the PCAT-compatible devices and the PCI bus interface. In addition, it integrates an Ethernet controller (not used on this product), a USB

controller, an SMBus controller, a dual UltraATA/100 disk controller and power management functions.

In addition a firmware hub flash ROM contains the system BIOS, Setup utility and video BIOS and optional remote boot code.

2.4 Video

The board video controller is integrated within the 845GV chipset GMCH and cannot be disabled. Multiple independent displays are supported via PCI video cards. The integrated video controller provides these features:

- 2D graphics with full 2D acceleration
- 3D graphics with setup and extensive rendering capabilities
- Hardware motion compensation for software MPEG2 decode
- System memory is used as frame buffer storage
- 15-way D-type for analog RGB output with VESA DDC2B capability
- Support for 1.5V ADD cards

Note

The integrated video controller cannot be disabled.

2.4.1 System Memory Allocation

The video controller does not have dedicated frame buffer memory but instead makes use of system memory for all its needs. This must be taken into account when the amount of system memory is chosen. When the on-board video controller is not used, it should be disabled completely via BIOS Setup to prevent system memory being allocated to the controller.

The motherboard BIOS allocates 1MB of system memory to the video controller to support legacy VGA graphics. The amount of system memory reported by the BIOS will reflect this reduction when the on-board video controller is enabled. Once the operating system loads, the video driver dynamically allocates further system memory dependent on availability and the application requirement. Systems should have at least 128MB of system memory when using these graphics drivers. The amount of memory allocated is capped to 32MB for systems with 128MB and to 64MB otherwise.

2.4.2 Video Modes

The Intel 845GV chipsets and drivers support a wide variety of video modes as indicated by the next table.

Note

Meeting EMC emissions limits may restrict the supportable video resolutions depending on chassis design, peripherals and required classification.

Table 6. Supported video modes

Resolution	Color Depth (bpp) *	Refresh Rates (Hz)
640 x 480	8, 16, 32	60, 72, 75, 85, 100, 120
800 x 600	8, 16, 32	60, 72, 75, 85, 100, 120
1024 x 768	8, 16, 32	60, 70, 75, 85, 100, 120
1152 x 864	8, 16, 32	60, 75, 85, 100
1280 x 720	8, 16, 32	60, 75, 85, 100
1280 x 960	8, 16, 32	60, 75, 85
1400 x 1050	8, 16, 32	60, 70, 75, 85, 100, 120
1600 x 900	8, 16, 32	60, 75, 85, 100
1600 x 1200	8, 16	60, 75, 85

* Bits per pixel. 8bpp=256 colors, 16bpp=64k colors, 32bpp=16M colors.

2.5 IDE Drives

Two independent bus-mastering IDE interfaces are provided, each supporting ATA modes up to UltraATA/100. The secondary interface is shared with the CompactFlash socket. The following drive types are supported.

- ATA hard disks up to UltraATA/100 speeds
- ATAPI devices such as CD-ROMs
- LS120 drives

The BIOS supports logical block addressing (LBA) and extended CHS translation modes for hard disks. When booting from LS120 drives, the correct mode (floppy or hard disk) must be chosen via the IDE drive type setting in Setup. The BIOS also supports automatic determination of ATA cable type (80- or 40-pin) for UltraATA/66 or ATA/100 drives, and 48-bit addressing for very large capacity hard disk drives (exceeding 137GB).

2.6 CompactFlash Support

A single CompactFlash socket is provided, supporting true IDE mode only and sharing the secondary IDE port. The following configurations using the CompactFlash socket are supported.

1. CompactFlash socket configured as master and no drives connected to the secondary IDE port. This is the recommended configuration.

2. CompactFlash socket configured as master and a single drive connected to the secondary IDE port via a 40-pin cable (do not use 80-pin cable) and configured as slave.

3. CompactFlash socket configured as slave and a single drive connected to the secondary IDE port via a 40-pin cable and configured as master. This configuration is supported only with Microsoft Windows 2000, XP or embedded XP operating systems.

2.7 Diskette Drives

The diskette drive interface supports a single 2- or 3-mode 3.5-inch drive and 720kB, 1.2MB or 1.44MB formats. The controller is located at I/O addresses 3F0-3F7h and uses IRQ6.

2.8 Audio

The motherboard audio system comprises the chipset ICH4 digital audio controller and an Analog Devices AD1885 audio CODEC. Three ATAPI headers provide CD-ROM and auxiliary stereo audio Line input, and stereo audio Line output connections. Two or three 3.5mm audio jacks on the I/O panel provide connections for stereo Line output, a monaural microphone input with phantom power suitable for electret microphones and, dependent on build, a stereo Line input. The ATAPI header Line output is a duplicate of the 3.5mm jack output and care must be taken if both connectors are being used simultaneously to ensure that the combined load does not have an adverse effect on the output levels. From either connector, the Line output includes an amplifier capable of driving headphones.

An on-board miniature speaker provides standard PC speaker functionality - error 'beep', for example.

2.9 Network

The SH845GV provides an Ethernet port based around an Intel controller with an RJ45 connector located on the I/O panel including two integrated LED indicators to provide link status information. The list below describes the features provided by each port.

- 10/100 IEEE 802.3 10Base-T and 100Base-TX compatible
- 32-bit bus-mastering PCI device
- RJ45 with two integral LEDs showing line activity, link integrity and line speed

The operation of the two indicators is described in the next table. The motherboard also supports cabling to alternate Ethernet status indicators (to a front panel assembly, for example). For a description of this header, see Indicators on page 24.

Table 7. RJ45 LEDs

LED color	LED state	Indicates
Green	Off	10Mbps link speed
	Green	100Mbps link speed
Yellow	Off	No link established
	Steady on	Link established; communication activity not detected
	Blinking	Link established; communication activity detected

2.10 Standard PC I/O

The standard PC I/O functions serial ports, parallel ports, keyboard and mouse ports and diskette drive controller are provided via a National Semiconductor PC87373 Super I/O (SIO) device attached to the low pin count (LPC) bus from the chipset. In addition, this device provides system control functions and general-purpose I/O lines.

2.10.1 Serial Ports

The motherboard supports two 16C550-compatible serial ports that can operate at speeds of up to 115.2kbps. Serial port 1 is located on the I/O panel whilst serial port 2 is via a header. Each port can be assigned as COM1 through COM4 via the BIOS Setup utility:

- I/O addresses 3F8-3FFh, 2F8-2FFh, 3E8-3EFh or 2E8-2EFh
- Interrupts IRQ3 or IRQ4

2.10.2 Parallel Port

The motherboard has a 25-way female D-sub parallel port connector located on the rear panel. It supports the following operating modes, configured via the BIOS Setup utility:

- Standard PC-compatible parallel port
- Bi-directional parallel port
- EPP mode
- ECP mode

The I/O locations can be assigned as follows.

- I/O address 378-37Fh & 778-77Fh, IRQ5 or IRQ7
- I/O address 278-27Fh & 678-67Fh, IRQ5 or IRQ7

2.10.3 Keyboard and Mouse Ports

Two PS/2 style keyboard and mouse ports are provided on the rear panel. The two ports are interchangeable with the motherboard automatically detecting which peripheral is attached to which port. Both ports provide a resettable fuse protected +5V supply to the peripheral. In addition, both the keyboard and mouse ports are accessible internally via 4-way headers.

The keyboard controller is functionally equivalent to the 8042 standard and is located at I/O addresses 60-64h and uses IRQ1. The mouse shares the same controller and uses IRQ12. The keyboard controller code is from AMI.

2.11 USB Ports

The motherboard provides six independent USB 2.0 compliant ports; four on the I/O panel and two via internal headers, all with a resettable fuse protected +5V supply to the peripheral. The chipset includes three 2-channel USB 1.1 controllers, which allow each port to operate in USB1.1 mode, and a single 6-channel USB2.0 controller, which provides USB2.0 support to each port when a high-speed peripheral is detected.

The BIOS supports the use of a USB keyboard and/or mouse in lieu of a PS/2 device via the BIOS customization tools (the feature is disabled by default). This USB legacy support provides emulation of standard keyboards and/or mice and since it causes performance degradation should be enabled only when the operating system being used also supports USB (the emulation is automatically disabled once the operating system is running). The BIOS supports booting from USB devices at USB1.1 speeds.

2.12 General Purpose I/O Lines

To support products that require a small number of internal input or output lines (such as switches or LED indicators), the motherboard provides access to 13 general-purpose lines via a 20-pin header. Ten lines can be programmed as inputs or outputs (in two groups), two are input only and one is output only. It is the responsibility of the customer to provide suitable software to control these lines.

2.13 CMOS RAM & RTC

The chipset integrates a Motorola MC146818A compatible real-time clock (RTC) and 256 bytes of CMOS RAM that is used by the BIOS to store configuration information. A replaceable primary lithium coin cell backs up both the RTC and the CMOS RAM and provides for

approximately 5 years of unpowered backup. The RTC includes a century byte and is supported by the BIOS to provide year 2000 compliance.

The lithium coin cell is a CR2032 device.

When the +5V standby power is applied to the motherboard, the RTC and the CMOS RAM are powered from that rather than the lithium cell.

2.14 Expansion Cards

The motherboard provides six bus-master 5V PCI 2.2 compliant slots and one ADD slot. The motherboard generates the 3.3Vaux supply to these slots using the 5V standby input from the power supply. Always ensure that the 5V standby rail can support the required current when using a PCI card that makes use of the 3.3Vaux supply. The SH845GVis designed to support a maximum total power consumption of 100W for all seven slots (15W each PCI and 10W for ADD on average).

Slot 1 is the ADD slot that supports digital display adapters - ADD cards that enable the chipset digital video ports to be used to drive flat panel monitors or to provide TV-out capabilities, dependent on the specification of the card.

2.15 System management

The motherboard includes hardware system management functions via the National Semiconductor LM85 device. They monitor system voltages, motherboard, processor and external temperatures, fan speed and control system fans. The following sections describe this in more detail.

2.15.1 Voltage Monitoring

The next table details the motherboard voltage rails monitored and their usage.

Table 8. Voltage rails

Voltage Rail	Usage on Motherboard
+12V	Serial ports, voltage regulators (including processor), fans, expansion slots.
+5.0V	Internal logic, keyboard, mouse, USB and video ports, expansion slots.
+3.3V	Chipset ICH4, firmware hub, SIO, clock generator, system monitor, audio, internal logic, expansion slots.
VCPU	Processor core voltage.
VBAT	This internal rail is used to power the RTC and the CMOS RAM.

The processor voltage regulator generates the operating voltage automatically based on the processor type jumper and the voltage requirement indicated by the processor (VID). The next table indicates the supported voltages.

Table 9. Supported voltages

Processor VID Code (VID4...0)	Processor Voltage Regulator Output
01111	1.475V
01110	1.500V
01101	1.525V

Table 9. Supported voltages

Processor VID Code (VID4...0)	Processor Voltage Regulator Output
01100	1.550V
00100	1.750V

2.15.2 Temperature Monitoring

There are three thermal monitors, two of which connect to temperature sensors on the motherboard. The first measures the motherboard temperature using a sensor contained within the LM85. This is a localized reading dominated by the motherboard surface temperature around the component. The second temperature sensor is located on the processor die and thus accurately measures the local die temperature. Since the local die temperature fluctuates rapidly with activity, the controller within the LM85 filters the signal to produce an average temperature. Note that there is temperature deviation across the processor die that cannot be observed by this sensor. Intel provides information on this in the processor datasheet. A third sensor can be connected to the motherboard using the external sensor connector. The sensor should be a silicon diode or transistor connected as a diode, such as a Fairchild MMBT3904.

2.15.3 Fan Monitoring

The motherboard supports three fan monitors that check the fan tachometer signals to determine the rotational speed. Fan speeds can be monitored by software to provide early warning of a failing fan, indicated by a slower than normal rotational speed. Note that when a fan is temperature controlled, the speed is determined by the control mechanism and the fan will sometimes be intentionally slowed or stopped – monitoring software must accommodate this.

The three fan tachometer monitors are assigned to fans as follows. Fan monitor 2 is not supported.

Table 10. Fan monitors

	Usage by motherboard
Fan monitor 1	Processor fansink (see motherboard layout section)
Fan monitor 3	System fan 1(see motherboard layout section)
Fan monitor 4	System fan 2 (see motherboard layout section)

2.15.4 Fan Control

The motherboard supports individual variable speed controls for the processor fansink and the two system fans by pulse-width modulation of the fan drive output voltage. In addition to direct software control, the LM85 supports automatic fan control based on the temperature indicated by the three thermal sensors. Each sensor defines a thermal zone and the fans can then be independently assigned to these zones. Parameters defining PWM frequency, temperature range, spin-up delays etc. are programmed into the LM85 to enable automatic control. The default parameter set programmed by the BIOS can be customized.

2.15.5 Tamper Detection

The motherboard supports tamper detection security that operates via a chassis tamper switch connected to the front panel connector. When the motherboard detects this signal low the BIOS can be configured to display a warning message or to require a password at the next boot. Since the lithium cell powers the logic, the tamper detection continues to operate even if the board is unpowered.

2.16 Power management

The SH845GVmotherboard implements a number of power management features via ACPI. An ACPI-compliant operating system is required in order to take advantage of the power management features.

2.16.1 ACPI Power States

An ACPI-aware operating system directs the power management of the motherboard – causing various devices within the system to change power state as appropriate. The next table describes the ACPI power states available using the motherboard with a soft-switched power supply.

Table 11. ACPI power states

Global State	Sleep State	Device State	Description
G0	S0	C0, D0	Fully operational, all devices powered.
G1 Sleeping	S1 CPU stopped	C1, D1, D2	Sleep state. CPU is stopped but all devices are powered.
G1 Sleeping	S4 Suspend to disk	D3	All devices are unpowered except wake-up logic. Memory and system context saved to disk.
G2/S5	S5 Soft Off	D3	All devices are unpowered. Memory contents and context are lost. Wake-up from PCI PME (including on-board LAN) possible if enabled via BIOS Setup (and drivers).
G3 Mechanical Off	No power	No power	System is unpowered with no standby rails. No wake-up is possible

2.16.2 ACPI Wake-up Support

The next table indicates which events can cause an ACPI wake-up and from which sleep states.

Table 12. ACPI wake-up support

Event	Sleep State	Comment
Power switch	S1, S4, S5	
RTC alarm	S1, S4	
PS/2 keyboard or mouse	S1	Ports are unpowered in S4, S5
USB device (any port)	S1	Ports are unpowered in S4, S5
On-board LAN	S1, S4, S5	S5 if enabled via BIOS Setup
PCI PME signal	S1, S4, S5	S5 if enabled via BIOS Setup

2.17 Indicators

2.17.1 Power State Indicators

The motherboard supports a single dual-color LED indicator that shows both power and message waiting status. It is possible to use a single-color LED although some functionality is lost. The next table describes how the indicator is driven when operating with both single and dual-color devices and assumes 5V standby power is available.

Table 13. Power state indicators

LED	LED state	Indicates
Single color	Off	The motherboard is powered down or in one of the ACPI sleep states (including S1).
	On	The motherboard is fully powered up (S0).
	Blinking	The motherboard is fully powered up (S0) with a message waiting (as determined by ACPI TAPI).
Dual color (green/yellow)	Off	The motherboard is powered down or in ACPI sleep states S4 or S5 (no +5V supply available).
	Green	The motherboard is fully powered up (S0).
	Yellow	The motherboard is in sleep state S1.
	Blinking green	The motherboard is fully powered up (S0) with a message waiting (as determined by ACPI TAPI).
	Blinking yellow	The motherboard is in sleep state S1 with a message waiting (as determined by ACPI TAPI).

2.17.2 Network Status Indicators

To support off-board network status indicators, a header is provided that duplicates the functions of the LEDs integrated into the RJ45 connectors. The next table shows how this connector is used.

Table 14. Network status indicators

Color	State	Indicates	Channel 1 Pins	Channel 2 Pins
Green	Off	10Mbps link speed	11: Green Anode	5: Green Anode
	Green	100Mbps link speed	12: Green Cathode	6: Green Cathode
Yellow	Off	No link is established	8: Anode (+)	2: Anode (+)
	Steady on	Link is established but there is no communication activity	10: Cathode	4: Cathode
	Blinking	Link is established and activity is detected		

2.17.3 I/O Panel Indicators

Four software configurable indicators are available on the rear I/O panel and controlled via GPIO signals form the chipset ICH4, as shown in the next table.

Table 15. I/O panel indicators

LED	GPIO	Default state after boot	Color
1 (bottom)	ICH4 GPIO18	Off	Green
2	ICH4 GPIO19	Off	Green
3	ICH4 GPIO22	On	Green
4 (top)	ICH4 GPIO23	On	Green

2.18 BIOS

The system BIOS is held within a flash ROM device called the firmware hub (FWH). The device is a 4Mbit or 8Mbit part that contains the following code.

- System BIOS, POST and configuration (Setup) utility
- Video BIOS
- Product configuration information including boot logo and CMOS defaults
- Processor microcode updates
- Customizations
- Network remote boot code, dependent on product

The code is built from a number of software and data modules that can be customized and assembled with a software tool that can be provided by RadiSys. Software to support BIOS updates and crisis recovery is also available -– see the Manuals, Drivers & BIOS section on www.radisys.com for BIOS updates and support software.

The configuration of the motherboard is generally automatic with intervention possible via the built-in BIOS Setup utility. The operation and feature set are described in the BIOS chapter of this document.

2.19 Operating Systems Support

The following operating systems are validated by RadiSys with the SH845GVmotherboard. Contact RadiSys for information on the support of other operating systems. For device drivers, see the Manuals, Drivers & BIOS section on www.radisys.com.

- Microsoft Embedded Windows NT, Embedded Windows XP
- Microsoft Windows NT4.0, Windows 2000, Windows XP
- Linux

3. Specifications

The following sections specify the conditions required for correct operation of the motherboard, usage information and regulatory and industry compliance statements. Failure to operate the product within its specification can result in system failures or reduce product lifetime.

3.1 Environmental

The next table details the environmental operating limits and the calculated product reliability data.

Table 16. Environmental specifications

Parameter	State	Specification
Temperature [1] (ambient)	Operating	0°C to 55°C
	Storage	–40 to 85 °C
Humidity		5% to 95% non-condensing
Vibration	Operating	Random 5Hz to 2kHz, 7.7grms, 10 min. in each of 3 axes: • 5Hz to 20Hz: 0.004g^2/Hz ramping up to 0.04g^2/Hz; • 20Hz to 1000Hz: 0.04g^2/Hz; • 1000Hz to 2000Hz: 0.04g^2/Hz ramping down to 0.01g^2/Hz
	Non-operating	Sine 5Hz to 500Hz, 0.15 octave/min up and back, 10 min. dwell at 3 resonances in each of 3 axes: 5 to 50Hz swept – 0.1g; 50 to 500Hz swept – 0.25g
	Packaged	Random 5Hz to 2kHz, 9.7grms, 10 min. in each of 3 axes: • 5Hz to 20Hz: 0.006g^2/Hz ramping up to 0.06g^2/Hz; • 20Hz to 1000Hz: 0.06g^2/Hz; • 1000Hz to 2000Hz: 0.06g^2/Hz ramping down to 0.02g^2/Hz
Shock	Non-operating	30g 11ms, half-sine pulse
	Packaged	Drop test, 30 inches free fall, 10-up bulk packaging
Altitude	Operating	To 15000 ft. (4500m)
	Storage	To 40000 ft. (12000m)
ESD	Operating	4kV direct contact, 8kV air

[1] See Thermal specification section. This specification must be met at all points across the motherboard.

3.2 Thermal

The ambient operating temperature range for the motherboard is 0 to 55°C but the selection of processor and heatsink (or fansink) can reduce the system operating range. Intel Pentium 4 and Celeron processors have a minimum operating temperature of 5°C. The processor and fansink combinations normally supplied as standard with the motherboards are tested by RadiSys to the full operating range using software designed to cause maximum power dissipation in the processor. This testing is done in an environmental test chamber with forced-air circulation. The maximum operating temperature of the supplied processor and fansink combination is specified in

the Endura Processor Support document, which can be found in the motherboard section of the RadiSys web site.

CAUTION

- Always test the final system configuration to determine if the operating temperature range limits for the motherboard and processor are being met. Failure to do so can lead to unstable operation, motherboard or processor damage and/or shortened life.
- Intel Pentium 4 and Celeron processors have a minimum operating temperature of 5°C. Refer to the relevant Intel processor datasheet for the maximum operating temperature.

3.3 Regulatory EMC Compliance

When correctly installed in a suitable chassis, the SH845GVmotherboard is designed to meet these EMC regulations:

- FCC Class B (Title 47 of Code of Federal Regulations, parts 2 & 15, subpart B)
- EN55022:1998 Class B
- EN55024:1998

3.4 Regulatory Safety Compliance

When correctly installed in a suitable chassis, the SH845GVmotherboard is designed to meet these safety regulations:

- UL60950/07.95
- CAN/CSA-C22.2 No. 950-95
- IEC60950, 1991 2nd edition with amendments 1, 2, 3, and 4

3.5 Industry Compliance

The SH845GVmotherboard implements the industry specifications shown in the next table

Table 17. Industry specifications

Specification	Description	Revision
ACPI	Advanced Configuration and Power Interface Specification	1.0b
ATAPI	ATA Packet Interface for CD-ROMs	2.5
ATX	ATX Motherboard Form Factor Specification	2.1
CompactFlash	CompactFlash Specification	2.1
PCI	Peripheral Component Interconnect Local Bus Specification	2.2
	PCI Power Management Interface Specification	1.1
USB	Universal Serial Bus Specification	2.0

3.6 Mechanical

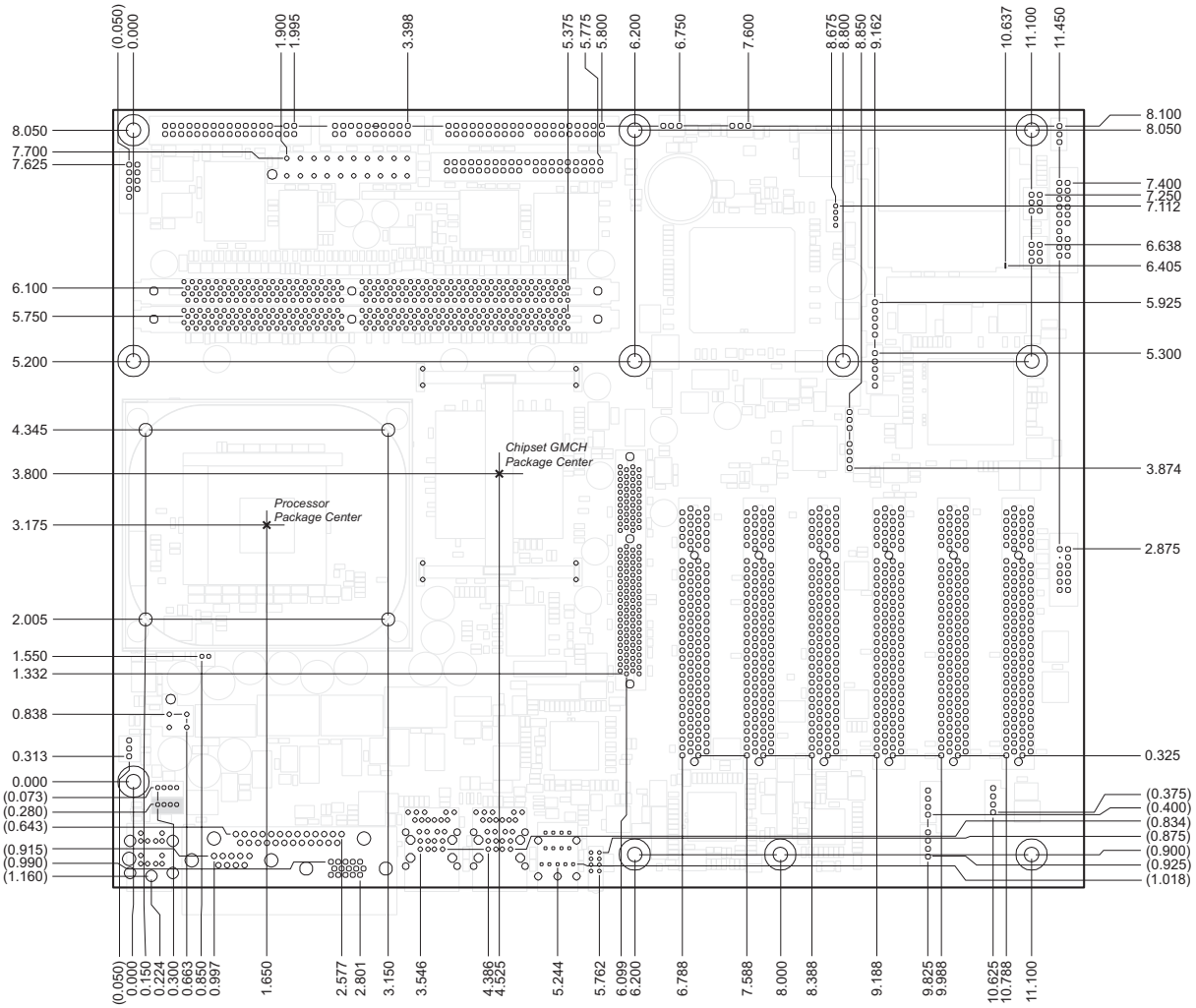
3.6.1 Motherboard

The SH845GVmotherboard meets the ATX Specification version 2.1. It measures 12.0 x 9.6 inches and is manufactured using a 4-layer PCB with components on the topside only. The screen-printing includes:

- Product Name, RadiSys part number, and RadiSys branding.
- Location for serial number and product labels.
- Selected component reference designators.

The next figure shows the dimensions of the motherboard and the location of the rear panel connectors (referenced via pin 1) and the location of the processor, memory sockets and expansion slots.

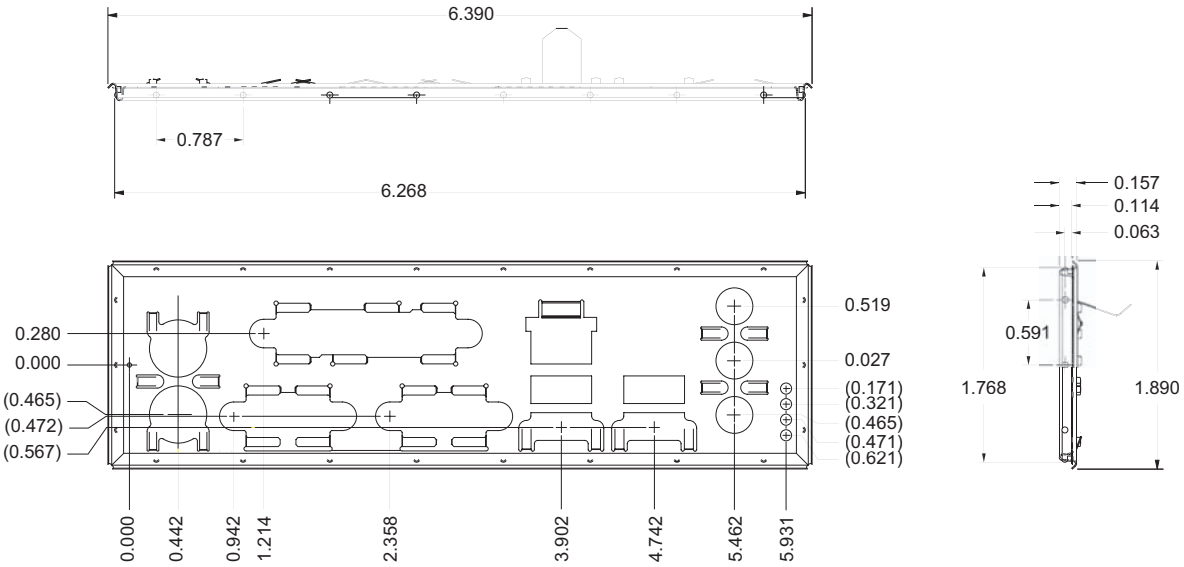
Figure 4. Dimensions and rear-panel connectors



3.6.2 I/O Shield

An I/O shield is available for the SH845GVwhen used in a standard ATX chassis and is illustrated below. The shield press-fits into the chassis shield aperture. The drawing below includes all port apertures and is not intended to show a particular shield variant.

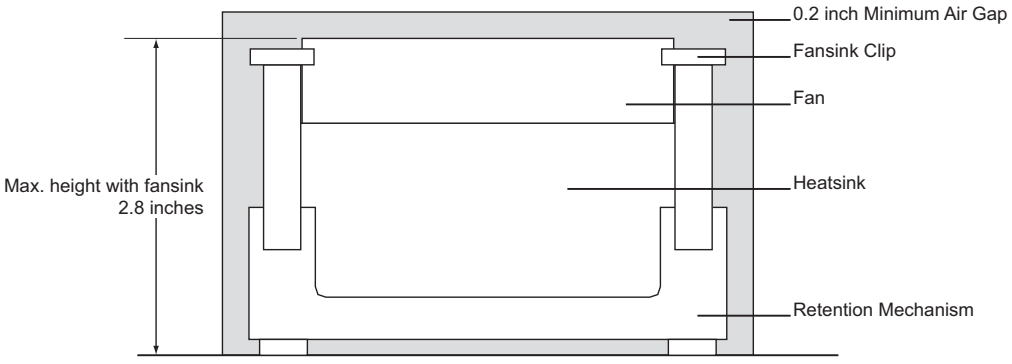
Figure 5. I/O shield



3.6.3 Fansink

The motherboard can be optionally shipped with a processor fansink, which must have a minimum air space of 0.2 inches around it to function correctly. The standard height fansink is shown in the next figure. For lower profile solutions contact RadiSys.

Figure 6. Fansink



3.7 Electrical

3.7.1 Motherboard Power Consumption

The motherboard power consumption is highly dependent on the processor, memory and devices attached and also on the software that is running and the power state that the board is in. The figures given in Table 22 are a guide to the power requirements to expect under selected conditions. They should not be interpreted as maximum requirements.

The figures are based on measurements of a real system configured as shown in the next table.

Table 18. Configuration for power requirements

Fansink	AVC C7015B12M
Memory	2 off 512MB DDR PC2700 DIMM modules MT16VDDT6464AG-335G4
Drives	Powered independently
Video	On-board
Network	On-board (dual LAN, not operating)

Table 19. Intel Pentium 4 at 2.8GHz with 533MHz processor bus

Mode	Motherboard Current					Power
	+3.3V	+5V	+12V (combined)	–12V	+5Vsby	Total
MS-DOS Prompt without power management	3.8A	0.1A	3.8A	30mA	4mA	60W
Windows 2000 desktop idle	3.8A	0.1A	1.5A	30mA	4mA	32W
Windows 2000 standby	3.6A	0.1A	1.3A	30mA	4mA	29W
Windows 2000 shutdown	0A	0A	0A	0A	220mA	1.2W
Windows 2000 hibernate	0A	0A	0A	0A	120mA	0.6W
Windows 2000 stress test (3Dmark 2001 SE)	5.3A	0.1A	6.1A	30mA	4mA	92W

3.7.2 Power Delivery to Expansion Slots

The next table indicates the maximum current that should be drawn from each expansion slot – do not exceed these ratings. PCI slots are limited to 25W in total on the main +5.0V and +3.3V supplies, all of which can be drawn from either voltage rail. The maximum combined power consumption of all slots in the system must not exceed 100W.

Table 20. Maximum Expansion Slot Current

	+1.5V	+3.3V	+5V	+12V	–12V	+3.3Vaux[2]
ADD	8.0A (3W)[3]	6.0A (20W)	2.0A (10W)	1.0A (12W)	N/A	N/A
PCI	N/A	7.6A (25W)[4]	5.0A (25W)[4]	0.5A (6W)	100mA (1.2W)	375mA/20mA (1.3W/0.1W)

[2] One wake-enabled PCI card at 375mA and the remainder at 20mA.

[3] The 8.0A is a maximum AC (transient) switching current. Average current is 2.0A maximum.

[4] The combined PCI slot power consumption via the +3.3V and +5.0V supplies is a maximum of 25W.

DANGER

Do not exceed the limits for each slot or voltage rail shown in the previous table or the limit of 100W for the combined power consumption of all expansion slots in the system.

3.7.3 Power Supply Selection

The motherboard is designed to operate with an ATX compatible power supply, as defined in section 4 of the ATX 2.1 specification. The provision of a 5V standby power rail is optional but, if not provided, the soft-switched power supply control features of the motherboard cannot be used. Where the standby rail is provided, ensure it can provide sufficient current for the motherboard, particularly for the motherboard LAN controllers and when an adapter card that draws current from the auxiliary 3.3V supply is used. The ATX -5.0V rail is not used by the motherboard.

Table 21. Power supply selection

Voltage Rail	Tolerance	Voltage Rail	Tolerance
+5.0V DC	± 5%[5]	+3.3V DC	± 4%
+12.0V DC	± 5%	+5.0V DC standby	± 5%
–12.0V DC	± 10%		

[5] To meet the USB output supply voltage specification, the minimum +5V should be 4.90V.

Note

When operating with a hard-switched power supply, the BIOS should be customized with the PSU flag in the enclosure data set to ‘Hard-Switched’ using the tools described in the BIOS Customization section of this document.

CAUTION

Ensure the power supply can support the required load current on all rails – failure to meet this can cause damage to the power supply or the motherboard. Pay particular attention to the 5V Standby power requirement — the LAN controllers are powered from this rail.

DANGER

The power supply must be properly approved by a third party agency for use in IEC/EN/UL/CSA 60950 applications.

3.7.4 Power Budget

The next table gives an example power budget for the motherboard with processor, memory and expansions cards fitted. The figures are based on the maximum figures from the motherboard power consumption section of this document (measured under stress testing except for the standby rail) and they should not be interpreted as typical values. Before choosing a power supply, always create a power budget for your system. These figures yield a total power requirement of 289W.

Table 22. Power budget

	Motherboard Current					Power
	+3.3V	+5V	+12V	–12V	+5Vsby	
Motherboard	5.3A	0.1A	6.1A	0.03A	0.22A	92.7W
Keyboard		0.3A				1.5W
Mouse		0.1A				0.5W
Six USB ports		3.0A				15.0W
Slots (total)	30.2A[6]	20.0A[6]	4.0A	0.6A	0.48A	158W
Fans			1.7A			20.4W
Front panel		0.1A				0.5W
Video DDC channel		0.05A				0.3W
Total	35.5A	23.7A	11.8A	0.7A	0.7A	289W

[6] These cannot be drawn simultaneously — total combined for all slots and both rails power is 100W.

3.7.5 General Purpose I/O Lines

Table 23. General purpose I/O lines

Symbol	Parameter	Conditions	Min	Max	Unit
V_{IH}	Input High Voltage		2.0	5.5	V
V_{IL}	Input Low Voltage		–0.3	0.8	V
I_{IL}	Input Leakage Current	V_{IN} = 3.6V, V_{CC} = max		5	µA
		V_{IN} = 0V, V_{CC} = max		–5	µA
V_{OH}	Output High Voltage	I_{OH} = -3.2mA	2.4		V
V_{OL}	Output Low Voltage	I_{OL} = 24mA [7]		0.5	V

[7] Total I_{OL} of outputs within each port must not exceed 64mA, for ports 1 and 2.

3.8 Miscellaneous

Table 24. Miscellaneous specifications

Parameter	Conditions	Specification
RTC Clock accuracy	25°C, 3.3V	+/- 25 ppm max.
Processor fan drive capability	12.0V	800mA max.
System fan drive capability	12.0V	450mA max.

4. Motherboard BIOS

4.1 Configuration

The motherboard BIOS includes a Setup utility that can be used to both view and modify the board's configuration. The settings are stored in CMOS RAM with the default settings held in the flash ROM. To start the utility, press the F2 key when prompted. If 'silent-boot' is on (logo displays) then press the ESC key to show the start-up messages.

The display is divided into these areas:

- Top bar shows the five main menus.
- Large left area: shows the options.
- Large right area: displays help text specific to the highlighted option or menu.
- Bottom bar: shows the action of the active keys.

The primary menus are briefly described in the next table. The help text describes each option more fully. Many options have sub-menus.

Table 25. BIOS menus

Menu	Options
Main	Product description including processor and memory fitted. Date and time.
Information	Product information. Status of system monitors.
Configuration	Chipset configuration. Processor cache control. PCI space configuration. I/O devices configuration. Hard disk drive options. Action after AC-reconnect. Power savings modes and timers. Passwords and permissions.
Boot	Selects device boot order. Operating system type (ACPI etc.). Start-up display mode (silent-boot etc.).
Exit	Save with or without changes. Load/save default settings (from flash ROM).

4.2 Update and Recovery

This section describes how to update the code and data held in the BIOS ROM. The process should be undertaken with care and must not be interrupted. A recovery mechanism is also described that enables a corrupted BIOS ROM (as a result of an interrupted update, for example) to be repaired.

Updates are available online from the RadiSys site in the form of a compressed image (ZIP) of a number of files. Using the software contained in the ZIP file, you must first create a flash diskette that is then used for the update or recovery process. Included in the ZIP file is a Readme.txt file that contains information on the update and instructions on how to use it. Always read this document before proceeding as it may contain updates to the descriptions below.

The update process assumes you have a PC that can be used to create an update diskette and that the system to update or recover has a diskette drive attached.

CAUTION

Updating the BIOS is a process that should be undertaken with caution. Always complete the process before powering-down or restarting the motherboard – failure to do this may result in a corrupted BIOS that will require recovery.

4.2.1 Creating a BIOS Update Diskette

Follow the steps below. You need a PC with Microsoft MS-DOS, Windows 95 or Windows 98 and a blank diskette.

1. Obtain the update ZIP file from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents to an empty directory on your hard drive.
3. Insert a blank diskette into the floppy drive.
4. Run CRISDISK from the directory created in step 2 to create the update diskette.
5. Follow the steps as directed. A copy of MS-DOS Format.com' must be available for CRISDISK to complete successfully.

4.2.2 Updating the System BIOS

The system BIOS can be updated from MS-DOS without changing jumpers as described below. It is recommended that you create a recovery diskette (described later) before updating the BIOS. This operation does not affect the customization area in the BIOS. If you use the BIOS Setup utility CMOS Save and Restore functions to save a set of defaults, you will need to recreate and re-save these once the update is complete.

1. Create an update diskette as described above.
2. Boot the system to be updated into MS-DOS without memory managers or boot from the update diskette.
3. If you did not boot from the update diskette, do the following.
   A. Insert the update diskette into the floppy drive.
   B. Change the MS-DOS directory to match the floppy drive's directory.
   C. Type UPDATE and press Enter.

D. Follow the instructions to initiate the update. When it is finished, the following message appears:

```
Flash memory has been successfully programmed
PRESS ANY KEY TO RESTART THE SYSTEM
If the system does not restart
TURN THE POWER OFF, THEN ON
```

E. Turn off the system power and re-boot. The motherboard boots using RadiSys defaults.

If the update operation fails for any reason (if it was interrupted, for example), and the motherboard no longer operates, then the BIOS must be recovered.

4.2.3 Creating a BIOS Recovery Diskette

Follow the steps below. You need a PC with Microsoft MS-DOS, Windows 95, Windows 98 or Windows NT and a blank diskette.

1. Obtain the update ZIP file from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents to an empty directory on your hard drive.
3. Insert a blank diskette into the floppy drive.
4. Run CRISDISK /R from the directory created in step 2 and follow the steps as directed to create the recovery diskette. A copy of MS-DOS Format.com must be available for CRISDISK to complete successfully.

4.2.4 Recovering the System BIOS

The recovery diskette should be used to recover a system BIOS when the motherboard no longer operates after a failed BIOS update operation. The process is described below.

1. Remove the operating mode selection jumper to place the board into the recover mode (see Configuration section of this document).
   A. Turn off the power.
   B. Remove any covers to gain access to the jumper.
   C. Remove the jumper from the operating mode selection block
2. Insert the recovery diskette into the floppy drive.
3. Power up the motherboard. You will hear the following audio signals from the on-board speaker. If you cannot hear the speaker, wait for approximately 1 minute after all activity has stopped to ensure the operation has completed.

Table 26. Beep codes

Beep code	Definition
One short beep	BIOS update begins.
One long beep	BIOS update is finished.
Three beeps	This indicates an error.

4. Power down the motherboard.
5. Refit the jumper into the normal operating position and replace the system cover(s).

6. Power up the motherboard. The recovery process is now complete and the product should boot normally.

4.2.5 Updating the Flash Bootblock

There is an area of the BIOS ROM, the bootblock, which is normally not updated. It contains code to perform the recovery process and data that identifies the motherboard. Occasionally, a BIOS release may require this bootblock area to be updated and the update disk will do this automatically. However, exercise caution when attempting such an update as a damaged bootblock area means that the motherboard may need to be returned to RadiSys for repair.

CAUTION

Exercise caution when updating BIOS that includes a bootblock update. If this process is interrupted, the motherboard cannot be recovered and must be returned to RadiSys for repair.

4.3 Customization

There are a number of features of the BIOS that can be customized and the software to accomplish this is contained within the BIOS OEM kit ZIP file that can be obtained from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com. The 'Readme.txt' file also contained in this ZIP provides updated customization information and should be read before proceeding.

The process involves creating a new update disk that contains the customized BIOS. The steps below guide you through the process.

1. Obtain both the update and OEMKIT ZIP files from the Manuals, Drivers & BIOS section on the RadiSys web site, www.radisys.com.
2. Unzip the contents of the update ZIP to an empty directory on your hard drive.
3. Unzip the contents of the OEMKIT ZIP to the same directory as step 2. This may replace some files.
4. Replace the 'Logo.bmp' file with a customized logo if required (see description below).
5. Replace the 'P6upd.bin' file with a customized version if required (see description below).
6. Run MAKEBIOS to create the customized binary.
7. Create the update diskette by running CRISDISK /O with a blank diskette in the floppy drive and following the instructions.
8. Using a reference or 'gold' board, update its BIOS with the diskette created in step 6 above using the standard update procedure.
9. Re-boot the board and run the BIOS Setup utility.
10. Configure the board as required.
11. From the Exit menu, save the new settings to flash and re-boot the board with the update disk still in the floppy drive.
12. There should be no reported difference between disk and ROM BIOS versions at this point and you will be prompted to read-back the BIOS. Select this to extract the motherboard ROM image and save it to the update disk, replacing the BIOS binary in the file BIOS.ROM.
13. The diskette is now a fully customized update disk. Save the BIOS.ROM file back to the directory on your hard disk used in step 2, replacing the previous version.
14. Create a new version of the update disk by running CRISDISK (with no switches) with a blank diskette in the floppy drive and following the instructions.

The customized ‘Logo.bmp’ file must be a 16-colour standard BMP format file. The palette can be chosen at will but note that three colors are used by the BIOS for the start-up progress indicator, text and background — palette entries 8, 7, and 0 respectively. The total size of the BMP file must not exceed 40960 bytes, which represents approximately 80k pixels. The BIOS centers the image on the screen.

Intel microprocessors allow for their microcode to be updated by the BIOS to workaround some outstanding errata. Each processor type and revision has a unique update image and the BIOS supports a maximum of four contained in the ‘P6upd.bin’ file. To customize the processor microcode update selections, create a new version of this file by concatenating four microcode updates in binary form — these can be obtained from Intel.

4.4 BIOS Error Indications

Once the motherboard powers-up the BIOS code runs Power-On-Self-Test software to check that the motherboard is operating correctly. During this process, the code writes an 8-bit value to an error port at various code checkpoints. If a fatal error is determined, then the error code indicates the last successful checkpoint reached. The BIOS will attempt to write this code to the display. The error port (I/O location 80h) can be read via “off-the-shelf” Debug cards. The next table lists the checkpoint codes.

There are a number of checkpoints that also generate an audible ‘beep’ code on failure using the standard PC speaker (also routed though the motherboard audio system). The beep codes are made up of up to four groups of short beeps and are also listed in the next table.

Once the video is enabled, further errors generated during and after POST are sent to the video display as text messages. These messages always display unless the motherboard is configured for silent boot or headless (no keyboard, mouse or display) operation.

Table 27. BIOS POST check point codes

Addr	Description	Addr	Description
02h	Verify Real Mode	6Ch	Display shadow message
03h	Disable NMI	6Eh	Display non-disposable segments
04h	Get CPU type	70h	Display error messages
06h	Initialize system hardware	72h	Check for configuration errors
08h	Initialize chipset registers with initial POST values	74h	Test real-time clock
09h	Set in POST flag	76h	Check for keyboard errors
0Ah	Initialize CPU registers	7Ah	Test for key lock on
0Bh	Enable CPU cache	7Ch	Set up hardware interrupts vectors
0Ch	Initialize cache to initial POST values	7Eh	Test coprocessor if present
0Eh	Initialize I/O	80h	Disable onboard I/O ports
0Fh	Initialize local bus IDE	81h	Late device initialization
10h	Initialize Power Management	82h	Detect and install external RS232 ports
11h	Load alternate registers with initial POST values	83h	Configure IDE controller
12h	Restore CR0	84h	Detect and install external parallel ports
13h	Reset PCI BM	85h	Initialize PCI PCC devices

Table 27. BIOS POST check point codes

Addr	Description	Addr	Description
14h	Initialize keyboard controller	86h	Re-initialize onboard I/O ports
16h	BIOS ROM checksum	87h	Configure MCD devices
17h	Pre-size DRAM	88h	Initialize BIOS Data Area
18h	8254 timer initialization	89h	Enable NMI
1Ah	8237 DMA controller initialization	8Ah	Initialize Extended BIOS Data Area
1Ch	Reset Programmable Interrupt Controller	8Bh	Initialize mouse
20h	Test DRAM refresh	8Ch	Initialize floppy controller
22h	Test 8742 Keyboard Controller	8Eh	Execute auto-typing
24h	Set ES segment to register to 4GB	8Fh	Hard disk controller fast pre-initialization
26h	Enable A20	90h	Initialize hard disk controller
28h	Autosize DRAM	91h	Initialize local bus hard disk controller
29h	Initialize PMM	92h	Disable unused PCI clocks
2Ah	Clear 512KB base RAM	93h	Build MPTABLE for multiprocessor boards
2Ch	Test 512KB base address lines	95h	Install CDROM for boot
2Eh	Test low byte of 512KB base memory	96h	Clear huge ES segment register
2Fh	Pre-System Shadow	97h	Fix up MP table
30h	Test high byte of 512KB base memory	98h	Search for option ROMs (beep for bad checksum)
32h	Test CPU bus-clock frequency	99h	Check for SMART HDD
33h	Initialize PDM	9Ah	Shadow option ROMs
34h	Test CMOS RAM	9Ch	Set up Power Management
35h	Initialize alternate chipset registers	9Dh	Initialize security
36h	Warm start shutdown entry point	9Eh	Enable hardware interrupts
37h	Reinitialize the chipset	9Fh	(Second) HDD fast initialization
38h	Shadow system BIOS ROM	A0h	Set time of day
39h	Reinitialize the cache	A2h	Check keylock
3Ah	Auto-size cache	A4h	Initialize typematic rate
3Ch	Configure advanced chipset registers	A8h	Erase F2 prompt
3Dh	Load alternate registers with CMOS values	AAh	Scan for F2 keystroke
3Eh	Read HW	ACh	Enter SETUP
40h	Set Initial CPU speed	AEh	Clear in-POST flag
42h	Initialize interrupt vectors	B0h	Check for errors
44h	Initialize BIOS interrupts	B2h	POST done--prepare to boot operating system
45h	Core Device Init	B4h	One beep before boot

Table 27. BIOS POST check point codes

Addr	Description	Addr	Description
46h	Check ROM copyright notice	B5h	Quiet boot end/Display MultiBoot menu
48h	Check video configuration against CMOS	B6h	Check password (optional)
49h	Initialize PCI bus and devices	B8h	Clear global descriptor table
4Ah	Initialize all video adapters in system	B9h	Prepare to boot
4Bh	Display QuietBoot™ screen	BAh	DMI
4Ch	Shadow video BIOS ROM	BBh	Initialize BCVS
4Eh	Display copyright notice	BCh	Clear parity checkers
50h	Display CPU type and speed	BDh	Boot Menu
51h	Initialize EISA board	BEh	Clear screen (optional)
52h	Test keyboard	BFh	Check virus and backup reminders
54h	Set key click if enabled	C0h	Try to boot with INT19
56h	Enable keyboard	C1h	Initialize PEM
58h	Test for unexpected interrupts	C2h	PEM log
59h	Initialize PDS	C3h	PEM Display
5Ah	Display prompt “Press F2 to enter SETUP”	C4h	PEM sys error initialization
5Bh	CPU cache off	C5h	Dual CMOS
5Ch	Test RAM between 512KB and 640KB	C6h	Docking initialization
5Eh	Base Address	C7h	Late docking initialization
60h	Test extended memory	D0h	Interrupt handler error
62h	Test extended memory address lines	D2h	Unknown interrupt error
64h	Jump to UserPatch1	D4h	Pending interrupt error
66h	Configure advanced cache registers	D6h	Initialize option ROM error
68h	Enable external and CPU caches	D8h	Shutdown error
69h	PM set up SMM	DAh	Extended Block Move
6Ah	Display external cache size	DCh	Shutdown 10 error
6Bh	Load custom defaults	DFh	A20 Error

Table 28. BIOS POST checkpoint codes with beep

Check point Code		point Code
16h	BIOS ROM checksum	1-2-2-3
20h	Test DRAM refresh	1-3-1-1
22h	Test 8742 Keyboard Controller	1-3-1-3
28h	Autosize DRAM	1-3-3-1

Table 28. BIOS POST checkpoint codes with beep

Check point Code		point Code
29h	Initialize PMM	1-3-3-2
2Ch	Test 512KB base address lines	1-3-4-1
2Eh	Test low byte of 512KB base memory	1-3-4-3
34h	Test CMOS RAM	1-4-3-1
3Ah	Auto-size cache	1-4-3-3
46h	Check ROM copyright notice	2-1-2-3
58h	Test for unexpected interrupts	2-2-3-1
90h	Initialize hard disk controller	3-2-1-1
98h	Search for option ROMs (beep for bad checksum)	1-2
B4h	One beep before boot	1
DFh	A20 Error	4-2-4-4

5. Customer Support

RadiSys Online Support can be found at www.radisys.com and includes device drivers, BIOS updates, support software and documentation. See the Manuals, Drivers & BIOS section.

RadiSys hotline numbers for the US and Canada are:

Support: (800) 438-4769
Service: (800) 256-5917

The next table displays online specifications and reference material:

Table 29. References

Specification	Description	Location
ACPI	Advanced Configuration and Power Interface specification	www.acpi.info
Intel 845GV Chipset	Intel 845GV chipset datasheet	http://developer.intel.com/design/chipsets/845gv/index.htm
Intel Celeron processor	Intel Celeron processor datasheet	http://developer.intel.com/design/celeron
Intel Pentium 4 processor	Intel Pentium 4 processor datasheet	http://developer.intel.com/design/pentium4
ATX	Form factor specifications	www.formfactors.org
CompactFlash	CompactFlash Association	http://www.compactflash.org/
PCI	PCI local bus specification	www.pcisig.com
DDR SDRAM DIMMs	Memory module specifications	http://developer.intel.com/technology/memory/ http://www.jedec.org/
SMBus	System management bus	www.smbus.org
USB	Universal Serial Bus specification	www.usb.org/developers
VESA	Video Electronics Standards Association	www.vesa.org

A Technical Reference

A.1 I/O Map

Table 30. I/O map

Address (hex)*	Description
0000 – 000F	DMA controller 1
0020 – 0021	Interrupt controller 1
002E – 002F	SIO control registers
0040 – 0043	Timer counter
0060 – 0064	Keyboard and mouse controller
0062, 0066	Motherboard control registers
0070 – 0071	RTC and CMOS RAM
0080 – 008F	DMA controller page registers (for channels 1 and 2)
0092	PC compatible Port 92 (fast A20 and PIC)
00A0 – 00A1	Interrupt controller 2
00C0 – 00DF	DMA controller 2
00F0	Floating point error control
0170 – 0177	Secondary IDE controller
01F0 – 01F7	Primary IDE controller
0278 –027F	Parallel port, LPT2
02E8 – 02EF	COM4 serial port
02F8 – 02FF	COM2 serial port
0374 – 0376	Secondary IDE controller
0378 –037F	Parallel port, LPT1
x3B0 – x3BB	VGA controller
x3C0 – x3CF	EGA controller registers
x3D4 – x3DA	CGA controller registers
03F0 – 03F5	Flexible diskette controller
03F6 – 03F7	Primary IDE controller
03E8 – 03EF	COM3 serial port
03F8 – 03FF	COM1 serial port
04D0 – 04D1	Interrupt controller
0678 – 067A	ECP registers for parallel port LPT2
0778 – 077A	ECP registers for parallel port LPT1
0CF8 – 0CFF	PCI configuration address and data registers
1000 – 105F	ACPI registers
1060 – 107F	TCO controller
1200 – 12FF	AC97 audio mixer
1300 – 133F	AC97 audio master

Table 30. I/O map

Address (hex)*	Description
1800 – 182F	SIO GPIO and control logic
FFA0 – FFA7	Primary IDE bus master registers
FFA8 – FFAF	Secondary IDE bus master registers
Dynamically assigned	USB controller (four) (32 locations on 32-byte boundary)
Dynamically assigned	SMBus controller (16 locations on 16-byte boundary)
Dynamically assigned	LAN controllers (two) (4096 locations on a 4096-byte boundary)

* An 'x' prefix for the address indicates that only the low-order 10 address bits are decoded.

A.2 PCI Interrupt Allocation

In order to share PCI interrupts efficiently, the routing of the PCI interrupts INTA - INTD to the motherboard PCI interrupts PIRQE – PIRQH are rotated for each slot. Thus the PCI card INTA signals for the PCI slots are spread across these four motherboard inputs.

Table 31. PCI interrupt allocation

Device	PIRQA	PIRQB	PIRQC	PIRQD	PIRQE	PIRQF	PIRQG	PIRQH
Slot 1 (ADD)	INTA	INTB	-	-	-	-	-	-
Slot 2 (PCI 2.2)	-	-	-	-	INTA	INTB	INTC	INTD
Slot 3 (PCI 2.2)	-	-	-	-	INTD	INTA	INTB	INTC
Slot 4 (PCI 2.2)	-	-	-	-	INTC	INTD	INTA	INTB
Slot 5 (PCI 2.2)	-	-	-	-	INTB	INTC	INTD	INTA
Slot 6 (PCI 2.2)	-	-	-	-	INTA	INTB	INTC	INTD
Slot 7 (PCI 2.2)	-	-	-	-	INTD	INTA	INTB	INTC
VGA controller	INTA	-	-	-	-	-	-	-
Ethernet controller	INTA	-	-	-	-	-	-	-
USB UHCI controller 1	INTA	-	-	-	-	-	-	-
USB UHCI controller 2	-	-	-	INTB	-	-	-	-
USB UHCI controller 3	-	-	INTC	-	-	-	-	-
USB EHCI controller	-	-	-	-	-	-	-	INTD
SMBus controller	-	INTB	-	-	-	-	-	-
AC97 controller	-	INTB	-	-	-	-	-	-

Example: From the previous table, the INTA interrupt from a card plugged into slot 2 would be routed to the motherboard PIRQE.

A.3 PCI Device Assignments

Table 32. PCI device assignments

Device	IDSEL	Bus Number	Device Number	Function Number
Chipset host bridge and memory controller	–	0	0	0
Graphics controller	–	0	2	0
PCI bridge	–	0	30	0
LPC bridge (Includes DMA, timers, PIC, APIC, RTC, power & system management, GPIO)	–	0	31	0
IDE controller (and CompactFlash)	–	0	31	1
SMBus controller	–	0	31	3
AC97 audio controller	–	0	31	5
USB UHCI controller 1	–	0	29	0
USB UHCI controller 2	–	0	29	1
USB UHCI controller 3	–	0	29	2
USB EHCI controller	–	0	29	7
Slot 1 (ADD)	AD16	2	0	–
Slot 2 (PCI 2.2)	AD17	2	1	–
Slot 3 (PCI 2.2)	AD18	2	2	–
Slot 4 (PCI 2.2)	AD19	2	3	–
Slot 5 (PCI 2.2)	AD20	2	4	–
Slot 6 (PCI 2.2)	AD21	2	5	–
Slot 7 (PCI 2.2)	AD22	2	6	–
Ethernet controller	AD23	2	7	0

The PCI slots and the Ethernet controller are behind a virtual bridge to PCI bus 2 implemented by the chipset ICH4.

A.4 SMBus Resource Allocation

Table 33. SMBus resource allocation

Address	Description
0101 110X	System management controller (LM85)
1010 000X	Memory module 1
1010 001X	Memory module 2
1101 001X	Clock synthesizer

A.5 ISA Interrupt Allocation

Whilst the motherboard does not include an ISA bus, it includes an ISA-compatible interrupt controller (PIC) in order to be compatible with AT standard architecture. The interrupts are allocated as described in the next table.

Table 34. ISA interrupt allocation

Interrupt	Description
IRQ0	System Timer
IRQ1	Keyboard Controller
IRQ2	Cascade interrupt
IRQ3	COM2, COM1 or unassigned
IRQ4	COM1, COM2 or unassigned
IRQ5	Parallel port or unassigned
IRQ6	Floppy
IRQ7	Printer port or unassigned
IRQ8	Real time clock/CMOS RAM
IRQ9	ACPI SCI (when configured for ACPI operating system)
IRQ10	Unassigned
IRQ11	Unassigned
IRQ12	PS/2 mouse or unassigned
IRQ13	Floating point unit
IRQ14	Primary IDE or unassigned
IRQ15	Secondary IDE or unassigned
NMI	PCI PERR and SERR signals

A.6 ISA DMA Channel Allocation

Whilst the motherboard does not support an ISA bus, it includes an ISA-compatible DMA controller in order to be compatible with AT standard architecture. The DMA channels are allocated as described in the next table.

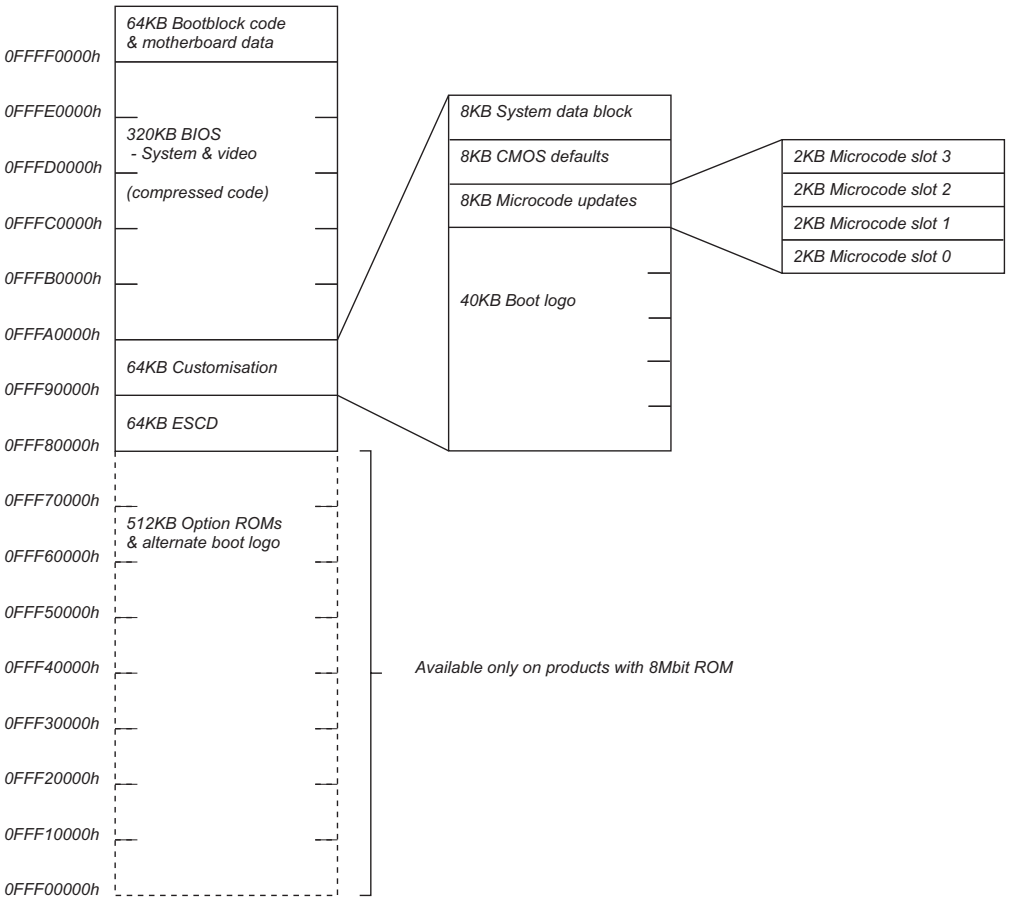
Table 35. ISA DMA channel allocation

DMA Channel	Description
Channel 0	Unassigned 8-bit channel
Channel 1	Unassigned 8-bit channel
Channel 2	Floppy controller or unassigned 8-bit channel
Channel 3	ECP parallel port or unassigned 8-bit channel
Channel 4	Cascade channel
Channel 5	Unassigned 16-bit channel
Channel 6	Unassigned 16-bit channel
Channel 7	Unassigned 16-bit channel

A.7 BIOS Organization

The BIOS ROM is a 4or 8Mbit device containing eight or sixteen symmetrical 64KB blocks. The next figure shows how the ROM stores code and control information. The addresses shown refer to the ROM image at the top of the 4GB-address space. Note that the system BIOS segment is compressed in this image. When the BIOS runs, the code is uncompressed in real-time and the resulting code and data image is found at physical address 0E0000h through 0FFFFFh.

Figure 7. BIOS ROM addresses



B Control Registers

Notes

- The following abbreviations are used in register descriptions:
  R=Read RO=Read only R/W=Read/Write W=Write only
- The MSB (Most Significant Bit) is listed first.

B.1 Index Register

7	6	5	4	3	2	1	0
Version				Index			
RO	RO	RO	RO	R/W	R/W	R/W	R/W

I/O location: 062h
Default: *vvvv*1010b

Version — A read-only field containing the software version number for the logic.

0001	Version 1

Index — Value description.

0000	Watchdog Control
0000	Watchdog Kick
0000	Watchdog Status
0001	Watchdog Timeout Period
0010	General Purpose I/O Port 1
0011	General Purpose I/O Port 2 and Control
1000	PWM Control
1001	Part Number, low digits
1010	Processor Identification
1011	Part Number, high digits

B.2 Watchdog Control

7	6	5	4	3	2	1	0
Prescale				RES	SMI	WEN	0
W	W	W	W	W	W	W	W

I/O location: 066h
Index: 0
Default: 00000000b

Prescale	4-bit value to set the watchdog counter period	
	0.15	16.1s period (a value of 1010b gives a period of 6 seconds)
	1	Description
RES	Reset after second timeout:	
	0	No reset
	1	Force system reset after second watchdog timeout
SMI	Generate SMI after first timeout:[8]	
	0	No SMI
	1	Generate SMI after first watchdog timeout
WEN	Watchdog enable:	
	0	Disable watchdog timer
	1	Enable and start watchdog timer

[8] Use of this feature normally requires a custom BIOS – contact RadiSys for more information. The standard BIOS does not route the SMI and thus ignores the event – causing a system reset after the second timeout unless the timer is restarted.

B.3 Watchdog Kick

7	6	5	4	3	2	1	0
Don't care							1
W	W	W	W	W	W	W	W

I/O location: 066h
Index 0
Default: 00000000b

B.4 Watchdog Status

7	6	5	4	3	2	1	0
Prescale				TO2	TO1	WEN	0
RO	RO	RO	RO	RO	RO	RO	RO

I/O location: 066h
Index: 0
Default: N/A

Prescale	4-bit value to set counter period (copy of data written)	
TOC1	First timeout:	
	0	First timeout has not occurred
	1	Timer has expired at least once
TOC2	Second timeout:	
	0	Second timeout has not occurred
	1	Timer has expired at least once

WEN Timer enable:

0	Timer is disabled
1	Timer is enabled and counting

B.5 Watchdog Timeout Period

7	6	5	4	3	2	1	0
Watchdog timeout period							
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W

I/O location: 066h
Index 1
Default: 11111111b

Timeout period

0	Do not use (causes immediate timeout)
1–255	Timeout period in units of 1 x prescale value seconds

B.6 General Purpose I/O Port 1

7	6	5	4	3	2	1	0
PI7	PI6	PI5	PI4	PI3	PI2	PI1	PI0
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W

I/O location: 066h
Index: 2
Default: 00000000b

P17–P10, GPIO Port 1 data:

When programmed as an output, the GPIO port 1 bit follows the value written into this register and reads reflect the value written.

When programmed as inputs, writes are ignored and a read follows the state of the GPIO port 1 signal. Direction control is via the GPIO port 2 and control register.

B.7 General Purpose I/O Port 2 and Control

7	6	5	4	3	2	1	0
D201	D157	D104	P24	P23	P22	P21	P20
R/W	R/W	R/W	R/W	R/W	R/W	R/W	R/W

I/O location: 066h
Index: 3
Default: 00000000b

P21 – P20, GPIO Port 2 data:

When programmed as an output, the GPIO port 2 bit follows the value written into this register and reads reflect the value written. When programmed as

inputs, writes are ignored and a read follows the state of the GPIO port 2 signal. Direction control is via the D201 control.

P22, GPIO Port 2 data:
This bit is output only. GPIO port 2 bit 2 follows the value written into this register and reads reflect the value written.

P24 - P23, GPIO Port 2 data:
These bits are input only. Writes to these bits have no effect; reads reflect the state of the GPIO port 2 bits 4 and 3 respectively.

D104, GPIO Port 1 bits 0 – 4 direction control:

GPIO bits 10 – 14 are inputs

GPIO bits 10 – 14 are outputs

D157, GPIO Port 1 bits 5 – 7 direction control:

GPIO bits 15 – 17 are inputs

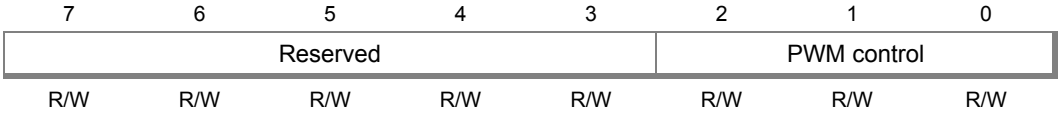
GPIO bits 15 – 17 are outputs

D201, GPIO Port 2 bits 0 – 1 direction control:

GPIO bits 20 – 21 are inputs

GPIO bits 20 – 21 are outputs

B.8 PWM Control



I/O location: 066h
Index: 8
Default: 00000000b

PWM Control Determines the pulse width of the PWM output.

B.9 Processor Identification

I/O location: 066h
Index: 10
Default: N/A

VID Processor voltage ID (selected by processor):

Returns the voltage identification value presented by the processor.

B.10 Controller Part Number

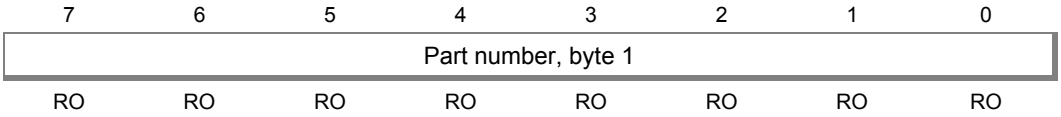
The controller part number format is 97-xxyy-0v where v is version number (top 4 bits of index register), xx is the byte 2 value and yy is the byte 1 value. BCD encoding is used for all digits.

Byte 1 is 85h

Byte 2 is 42h.

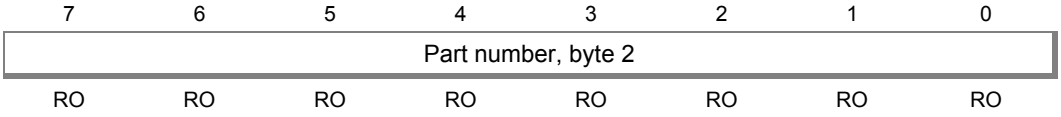
The programmed part number is 97-4285-0v for production motherboards.

Controller Part Number, low digits



I/O location: 066h
Index: 9
Default: N/A

Controller Part Number, high digits



I/O location: 066h
Index: 11
Default: N/A

C Connector Descriptions

Note: Connector views in the following sections are shown from the motherboard side.

C.1 Connector Part Numbers

The various motherboard connectors are listed in the next table along with the part number of one of the approved vendors. The list is intended to assist in the selection of mating connectors.

Table 36. Connector part numbers

Connector	Part Number	Type
I/O panel dual USB	Foxconn UB1112C-81	Dual vertically stacked USB
I/O panel 10/100 RJ45 over dual USB	Bel 0812-1X1T-03	RJ45 with LEDs and transformer over dual USB, 10/100
I/O panel PS/2 keyboard and mouse	Foxconn MH11067-PD2	Stacked 6-way mini-DIN
I/O panel VGA monitor	Foxconn DZ11A37-P9	15-way high-density female D-sub
I/O panel parallel port	Foxconn DM11352-PR3	25-way female D-sub
I/O panel serial port	Foxconn DT10122-P5T	9-way male D-sub
Serial port 2 header	Foxconn HL20051-P5	2 by 5-way shrouded header
Fan drive headers	Foxconn HF06030	3-way with locking ramp
Primary and secondary IDE	Foxconn HL20201-D2	40-pin shrouded header
Diskette drive	Foxconn HL20171-P4	34-pin shrouded header
GPIO header	Foxconn HL20101-L7	2 by 10-way shrouded header
Processor socket	Foxconn PZ47807-2748-01	478-pin ZIF PGA
DIMM sockets	Foxconn AT09217-D1	184-pin, 2.5V DDR SDRAM
Keyboard and mouse headers	Foxconn HF55040	4-pin 2mm headers
ADD connector, slot 1	Foxconn EE06217-BUB	1.5V with retention mechanism
PCI connector, slots 2 to 7	Foxconn EH06007-GU-V	5V signaling
Ethernet LED header	Foxconn HL07061-P7	2 by 6-way shrouded header
Front panel header	Foxconn HC19107-L6	2 by 10-way header
ATAPI CD-ROM header	Foxconn HF14040-P1	4-way header with latch, black
ATAPI Line input header	Foxconn HF14040-NP1	4-way header with latch, white
ATAPI Line output header	Foxconn HF1404E-YP1	4-way header with latch, yellow
Triple stack audio jacks	Foxconn JA3333L-G01	Triple vertically stacked 3.5mm
Double stack audio jacks	Foxconn JA23331-G16	Double vertically stacked 3.5mm
Internal USB headers	Foxconn HF01051	5-pin locking ATAPI-style, black
CompactFlash socket	Foxconn 1DA61600-WY	50-way horizontal CompactFlash socket
Remote thermal sensor	Foxconn HF55020	2-pin 2mm header

Table 36. Connector part numbers

Connector	Part Number	Type
SMBus header	Foxconn HF55040	4-pin 2mm header
Lithium cell holder	Kun Chang KR01-005	Top loading, CR2032
Power Supply, main	Foxconn HM20100-HP1	2 by 10-way ATX power header
Power Supply, 12V	Foxconn HM20020-P1	2 by 2-way ATX power header
Alternate power LED header	Foxconn HB11037	3-pin header

C.2 ADD Expansion Slot

Table 37. ADD expansion slot

Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	+12V	B1	*Not Used*	A34	VDDQ1.5	B34	VDDQ1.5
A2	*Not Used*	B2	+5V	A35	DVCD3	B35	DVCD2
A3	*Not Used*	B3	+5V	A36	DVCD1	B36	DVCD0
A4	*Not Used*	B4	*Not Used*	A37	GND	B37	GND
A5	GND	B5	GND	A38	DVCBLANK#	B38	DVCHSYNC
A6	*Not Used*	B6	*Not Used*	A39	DVCVSYNC	B39	*Not Used*
A7	*Not Used*	B7	*Not Used*	A40	VDDQ1.5	B40	VDDQ1.5
A8	*Not Used*	B8	*Not Used*	A41	MDVIDATA	B41	MI2CCLK
A9	+3.3V	B9	+3.3V	A42	KEY	B42	KEY
A10	*Not Used*	B10	*Not Used*	A43	KEY	B43	KEY
A11	*Not Used*	B11	*Not Used*	A44	KEY	B44	KEY
A12	*Not Used*	B12	*Not Used*	A45	KEY	B45	KEY
A13	GND	B13	GND	A46	MDVICLK	B46	MI2CDATA
A14	*Not Used*	B14	*Not Used*	A47	MDDCDATA	B47	VDDQ1.5
A15	ADDID1	B15	ADDID0	A48	*Not Used*	B48	*Not Used*
A16	+3.3V	B16	+3.3V	A49	GND	B49	GND
A17	ADDID3	B17	ADDID2	A50	ADDDETCT#	B50	*Not Used*
A18	*Not Used*	B18	*Not Used*	A51	MDDCCLK	B51	DVBBLANK#
A19	GND	B19	GND	A52	VDDQ1.5	B52	VDDQ1.5
A20	ADDID5	B20	ADDID4	A53	DVBCLKINT#	B53	DVBFLDSTL
A21	ADDID7	B21	ADDID6	A54	DVBD11	B54	DVBD10
A22	*Not Used*	B22	*Not Used*	A55	GND	B55	GND
A23	GND	B23	GND	A56	DVBD9	B56	DVBD8
A24	*Not Used*	B24	+3.3VAUX	A57	DVBD7	B57	DVBD6
A25	+3.3V	B25	+3.3V	A58	VDDQ1.5	B58	VDDQ1.5
A26	DVBCINTR#	B26	DVCFLDSTL	A59	DVBCLK#	B59	DVBCLK
A27	DVCD11	B27	DVCD10	A60	DVBD5	B60	DVBD4
A28	+3.3V	B28	+3.3V	A61	GND	B61	GND
A29	DVCD9	B29	DVCD8	A62	DVBD3	B62	DVBD2
A30	DVCD7	B30	DVCD6	A63	DVBD1	B63	DVBD0
A31	GND	B31	GND	A64	VDDQ1.5	B64	VDDQ1.5
A32	DVCCLK#	B32	DVCCLK	A65	DVBHSYNC	B65	DVBVSYNC
A33	DVCD5	B33	DVCD4	A66	VREFGC	B66	VREFGC

C.3 PCI Expansion Slot

Table 38. PCI expansion slot

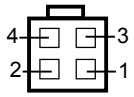
Pin	Signal	Pin	Signal	Pin	Signal	Pin	Signal
A1	TRST#[9]	B1	-12V	A32	AD16	B23	AD17
A2	+12V	B2	TCK[9]	A33	+3.3V	B33	C/BE2#
A3	TMS[10]	B3	GND	A34	FRAME#	B34	GND
A4	TDI[10]	B4	TDO[11]	A35	GND	B35	IRDY#
A5	+5V	B5	+5V	A36	TRDY#	B36	+3.3V
A6	INTA#	B6	+5V	A37	GND	B37	DEVSEL#
A7	INTC#	B7	INTB#	A38	STOP#	B38	GND
A8	+5V	B8	INTD#	A39	+3.3V	B39	LOCK#
A9	CLKRUN#[11]	B9	PRSNT1#	A40	*Not Used*	B40	PERR#
A10	+5V	B10	*Reserved*	A41	*Not Used*	B41	+3.3V
A11	*Reserved*	B11	PRSNT2#	A42	GND	B42	SERR#
A12	GND	B12	GND	A43	PAR	B43	+3.3V
A13	GND	B13	GND	A44	AD15	B44	C/BE1#
A14	+3.3V AUX	B14	*Reserved*	A45	+3.3V	B45	AD14
A15	RST#	B15	GND	A46	AD13	B46	GND
A16	+5V	B16	CLK	A47	AD11	B47	AD12
A17	GNT#	B17	GND	A48	GND	B48	AD10
A18	GND	B18	REQ#	A49	AD9	B49	GND
A19	PME#	B19	+5V	A50	KEY	B50	KEY
A20	AD30	B20	AD31	A51	KEY	B51	KEY
A21	+3.3V	B21	AD29	A52	C/BE0#	B52	AD8
A22	AD28	B22	GND	A53	+3.3V	B53	AD7
A23	AD26	B23	AD27	A54	AD6	B54	+3.3V
A24	GND	B24	AD25	A55	AD4	B55	AD5
A25	AD24	B25	+3.3V	A56	GND	B56	AD3
A26	IDSEL	B26	C/BE3#	A57	AD2	B57	GND
A27	+3.3V	B27	AD23	A58	AD0	B58	AD1
A28	AD22	B28	GND	A59	+5V	B59	+5V
A29	AD20	B29	AD21	A60	REQ64#	B60	ACK64#
A30	GND	B30	AD19	A61	+5V	B61	+5V
A31	AD18	B31	+3.3V	A62	+5V	B62	+5V

[9] Not used but pulled low

[10] Not used but pulled high to +5V

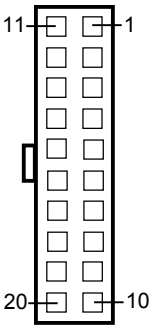
[11] Not connected

Table 39. ATX 12V Power Supply



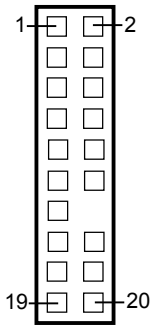
Pin	Description	Pin	Description
1	GND	3	+12.0V
2	GND	4	+12.0V

Table 40. ATX Power Supply



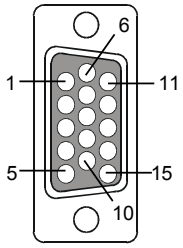
Pin	Description	Pin	Description
11	+3.3V	1	+3.3V
12	–12.0V	2	+3.3V
13	GND	3	GND
14	PS_ON#	4	+5.0V
15	GND	5	GND
16	GND	6	+5.0V
17	GND	7	GND
18	*Not Used*	8	PWR_OK
19	+5.0V	9	+5.0VSBY
20	+5.0V	10	+12.0V

Table 41. Front Panel Header



Pin	Description	Pin	Description
1	HDLED+	2	GREENLED+
3	HDLED-	4	GREENLED-
5	RESETSW-	6	PWRSW+
7	RESETSW+	8	PWRSW-
9	+5V fused	10	SPKR+
11	*Not Used*	12	SPKR-
13	GND	14	KEY
15	*Not Used*	16	SPKR-
17	*Not Used*	18	TMPSW+
19	*Not Used*	20	TMPSW-

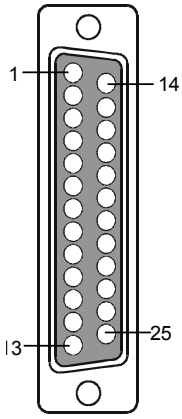
Table 42. VGA Monitor



Pin	Description	Pin	Description
1	RED	9	+5V
2	GREEN	10	GND
3	BLUE	11	*Reserved* [12]
4	*Reserved* [12]	12	SDA
5	GND	13	HSYNC
6	RED RTN	14	VSYNC
7	GREEN RTN	15	SCL
8	BLUE RTN		

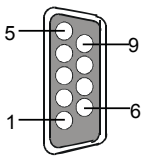
[12] Pulled high to +5V

Table 43. Parallel Port



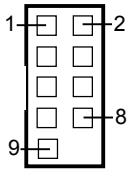
Pin	Description	Pin	Description
1	STB#	14	AFD#
2	DB0	15	ERR#
3	DB1	16	INIT#
4	DB2	17	SLIN#
5	DB3	18	GND
6	DB4	19	GND
7	DB5	20	GND
8	DB6	21	GND
9	DB7	22	GND
10	ACK#	23	GND
11	BUSY	24	GND
12	PE	25	GND
13	SLCT		

Table 44. Serial Port 1



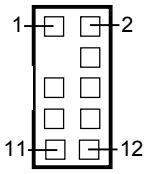
Pin	Description	Pin	Description
1	DCD	6	DSR
2	RxD	7	RTS
3	TxD	8	CTS
4	DTR	9	RING
5	GND		

Table 45. Serial Port 2



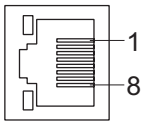
Pin	Description	Pin	Description
1	DCD	2	DSR
3	RxD	4	RTS
5	TxD	6	CTS
7	DTR	8	RING
9	GND	10	KEY

Table 46. Ethernet LED Header



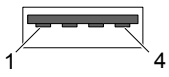
Pin	Description	Pin	Description
1	330R Pullup	2	ACTIVITY2#
3	KEY	4	LINK2#
5	1000MB2#	6	100MB2#
7	330R Pullup	8	ACTIVITY1#
9	330R Pullup	10	LINK1#
11	1000MB1#	12	100MB1#

Table 47. RJ45 Ethernet (10/100)



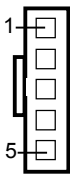
Pin	Description	Pin	Description
1	TxD+	5	75Ω AC termination
2	TxD-	6	RxD-
3	RxD+	7	75Ω AC termination
4	75Ω AC termination	8	75Ω AC termination

Table 48. USB I/O Panel Ports



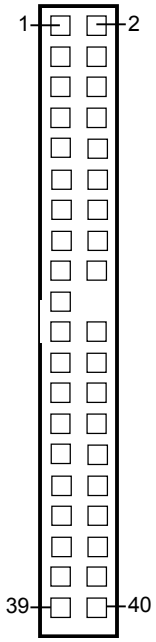
Pin	Description	Pin	Description
1	+5V	3	DATA+
2	DATA-	4	GND

Table 49. USB Internal Ports



Pin	Description	Pin	Description
1	+5V	4	GND
2	DATA-	5	GND
3	DATA+		

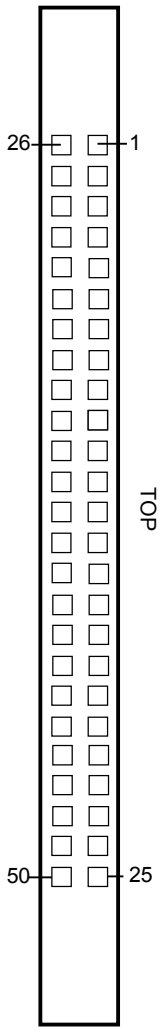
Table 50. IDE Drive Headers



Pin	Description	Pin	Description
1	RST#	2	GND
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	GND	20	KEY
21	DRQ	22	GND
23	IOW#	24	GND
25	IOR#	26	GND
27	IORDY	28	CSEL
29	DAK#	30	GND
31	IRQ[13]	32	*Not Used*
33	DA1	34	CBLID#
35	DA0	36	DA2
37	CS1#	38	CS3#
39	HDACT#	40	GND

[13] IRQ14 for Primary, IRQ15 for Secondary

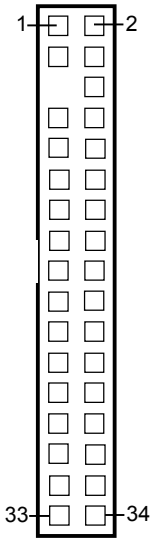
Table 51. CompactFlash Header



Pin	Description	Pin	Description
1	GND	26	*Not Used*
2	D3	27	D11
3	D4	28	D12
4	D5	29	D13
5	D6	30	D14
6	D7	31	D15
7	CS0#	32	CS1#
8	GND	33	*Not Used*
9	GND	34	IOR#
10	GND	35	IOW#
11	GND	36	WE#[14]
12	GND	37	IRQ15
13	+3.3V	38	+3.3V
14	GND	39	CSEL#
15	GND	40	*Not Used*
16	GND	41	RST#
17	GND	42	IORDY
18	DA2	43	*Not Used*
19	DA1	44	REG#[14]
20	DA0	45	DASP#
21	D0	46	PDIAG#
22	D1	47	D8
23	D2	48	D9
24	*Not Used*	49	D10
25	*Not Used*	50	GND

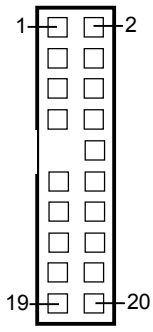
[14] Pulled up to +3.3V

Table 52. Diskette Drive Header



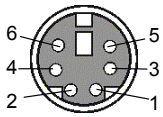
Pin	Description	Pin	Description
1	GND	2	DENSEL
3	GND	4	*Not Used*
5	KEY	6	DRATE0
7	GND	8	INDEX#
9	GND	10	MTR0#
11	GND	12	*Not Used*
13	GND	14	DS0#
15	GND	16	*Not Used*
17	GND	18	DIR#
19	GND	20	STEP#
21	GND	22	WDATA#
23	GND	24	WGATE#
25	GND	26	TRK0#
27	GND	28	WP#
29	GND	30	RDATA#
31	GND	32	HDSEL#
33	GND	34	DSKCHG#

Table 53. GPIO Header



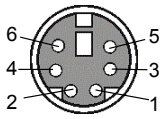
Pin	Description	Pin	Description
1	GND	2	+5V fused
3	PWM	4	GPIO20
5	GPIO21	6	GPO22
7	GPIO10	8	GPIO11
9	GPIO12	10	GPIO13
11	GPIO14	12	GPIO15
13	GPIO16	14	GPIO17
15	*Reserved*	16	KEY
17	GND	18	GPI23
19	GND	20	GPI24

Table 54. PS/2 Keyboard



Pin	Description	Pin	Description
1	KDATA	4	+5V
2	MDATA	5	KCLOCK
3	GND	6	MCLOCK

Table 55. PS/2 Mouse



Pin	Description	Pin	Description
1	DATA	4	+5V
2	*Not Used*	5	CLOCK
3	GND	6	*Not Used*

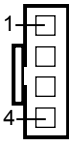
Table 56. Keyboard Header

Pin	Description	Pin	Description
1	+5V	3	GND
2	DATA	4	CLOCK

Table 57. Mouse Header

Pin	Description	Pin	Description
1	+5V	3	GND
2	DATA	4	CLOCK

Table 58. Internal Audio Headers



Pin	Description	Pin	Description
1	LEFT	3	GND
2	GND	4	RIGHT

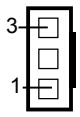
Table 59. Line In and Out Jacks

Pin	Description	Pin	Description
TIP	LEFT	SLEEVE	GND
RING	RIGHT		

Table 60. MIC Jack

Pin	Description	Pin	Description
TIP	MIC MONO INPUT	SLEEVE	GND
RING	BIAS VOLTAGE		

Table 61. Processor and System Fan 1 & 2



Pin	Description	Pin	Description
1	GND	3	TACH#
2	POWER		

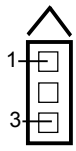
Table 62. Remote Thermal Sensor

Pin	Description	Pin	Description
	DIODE+		DIODE-

Table 63. SMBus Header

Pin	Description	Pin	Description
1	+3.3V	3	CLOCK
2	DATA	4	GND

Table 64. Alternate Power LED



Pin	Description	Pin	Description
1	GREENLED+	3	GREENLED-
2	KEY		