Intel® Desktop Board BA810
Technical Product Specification

March 2000

Order Number A15858-001

The Intel® Desktop Board BA810 may contain design defects or errors known as errata that may cause the product to deviate from published specifications. Current characterized errata are documented in the Intel Desktop Board BA810 Specification Update.

Revision History

Revision	Revision History	Date
-001	First Release of the Intel® Desktop Board BA810 Technical Product Specification	March 2000

This product specification applies to only standard BA810 boards with BIOS identifier BA81010A.86A.

Changes to this specification will be published in the Intel Desktop Board BA810 Specification Update before being incorporated into a revision of this document.

Preface

This Technical Product Specification (TPS) specifies the board layout, components, connectors, power and environmental requirements, and the BIOS for the BA810 board. It describes the standard BA810 board product and available manufacturing options.

Intended Audience

The TPS is intended to provide detailed, technical information about the board and its components to the vendors, system integrators, and other engineers and technicians who need this level of information. It is specifically *not* intended for general audiences.

What This Document Contains

Chapter	Description
1	A description of the hardware used on this board
2	A map of the resources of the board
3	The features supported by the BIOS Setup program
4	The contents of the BIOS Setup program's menus and submenus
5	A description of the BIOS error messages, beep codes, and POST codes

Typographical Conventions

This section contains information about the conventions used in this specification. Not all of these symbols and abbreviations appear in all specifications of this type.

Notes, Cautions, and Warnings

NOTE

Notes call attention to important information.

CAUTION

Cautions are included to help you avoid damaging hardware or losing data.

WARNING

Warnings indicate conditions which, if not observed, can cause personal injury.

Other Common Notation

#	Used after a signal name to identify an active-low signal (such as USBP0#).
(NxnX)	When used in the description of a component, N indicates component type, xn are the relative coordinates of its location on the board, and X is the instance of the particular part at that general location. For example, J5J1 is a connector, located at 5J. It is the first connector in the 5J area.
KB	Kilobyte (1024 bytes)
Kbit	Kilobit (1024 bits)
MB	Megabyte (1,048,576 bytes)
Mbit	Megabit (1,048,576 bits)
GB	Gigabyte (1,073,741,824 bytes)
xxh	An address or data value ending with a lowercase h indicates a hexadecimal value.
x.x V	Volts. Voltages are DC unless otherwise specified.
†	This symbol is used to indicate third-party brands and names that are the property of their respective owners.

Contents

5 Error Messages and Beep Codes

Figures

Tables

1 Board Description

What This Chapter Contains

1.1 Overview

1.1.1 Feature Summary

Table 1 summarizes the BA810 board's major features.

Table 1. Feature Summary

Form Factor	FlexATX (9.0 inches by 7.2 inches)
Processor	Support for either an: • Intel® Pentium® III processor with 256 KB L2 cache (in an FCPGA package) • Intel® Celeron™ processor with 128 KB L2 cache (in a PPGA package)
Memory	• One 22° 168-pin dual inline memory module (DIMM) socket • Supports up to 256 MB of 100 MHz non-ECC synchronous DRAM (SDRAM) • Support for a serial presence detect (SPD) or a non-SPD DIMM
Chipset	Intel® 810 Chipset, consisting of: • Intel® 82810 Graphics/Memory Controller Hub (GMCH) • Intel® 82801AA I/O Controller Hub (ICH) • Intel® 82802AB 4 Mbit Firmware Hub (FWH)
Instantly Available PC	• Support for *PCI Local Bus Specification, Revision 2.2* • Suspend-to-RAM support • Wake from USB
Accelerated Graphics Port (AGP) Video	• Intel 82810 GMCH graphics support • 4 MB display cache
Audio	Audio Codec '97 (AC'97) compatible audio subsystem, consisting of the following: • Intel 82801AA ICH (AC link output) • Analog Devices AD1881 analog codec
I/O Controller	IT8761E Low Pin Count (LPC) I/O controller
Onboard modem	• Motorola SM56 AC-L (AC link) software modem • Silicon Laboratories Si3038 family MC '97 modem codec
USB Hub	TUSB2046
Peripheral Interfaces	• Four universal serial bus (USB) ports • One IDE interface with Ultra DMA support • One diskette drive interface • One 9-pin serial port connector
BIOS	• Intel/AMI BIOS stored in an Intel 82802AB 4 Mbit Firmware Hub (FWH) • Support for Advanced Configuration and Power Interface (ACPI), Advanced Power Management (APM), Plug and Play, and SMBIOS

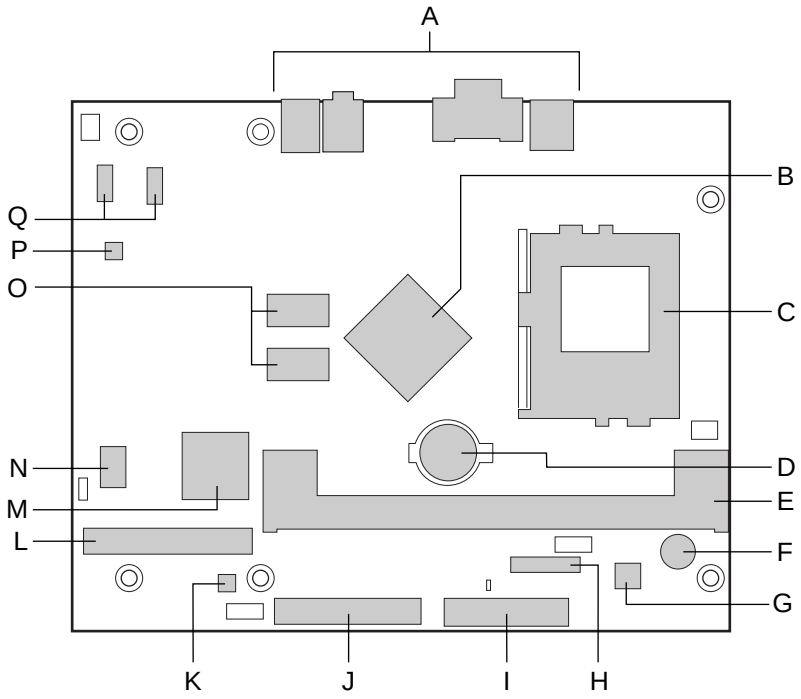
⟹ NOTE

The BA810 board is designed to support only USB-aware operating systems.

For information about	Refer to
The board's compliance level with ACPI, APM, Plug and Play, and SMBIOS	Table 2, page 13

1.1.2 Board Layout

Figure 1 shows the location of the major components on the board.



A	Back panel connectors	J	Diskette drive connector
B	Intel 82810 Graphics Memory Controller Hub (GMCH)	K	IT8761E I/O controller
C	Processor socket	L	IDE connector
D	Battery	M	Intel 82801AA I/O Controller Hub (ICH)
E	22º DIMM socket	N	Intel 82802AB Firmware Hub (FWH)
F	Speaker	O	4 MB display cache
G	USB hub	P	AD1881 analog codec
H	Front panel connector	Q	Modem codec devices
I	Power connector		

Figure 1. Board Components

1.1.3 Block Diagram

Figure 2 is a block diagram of the major functional areas of the board.

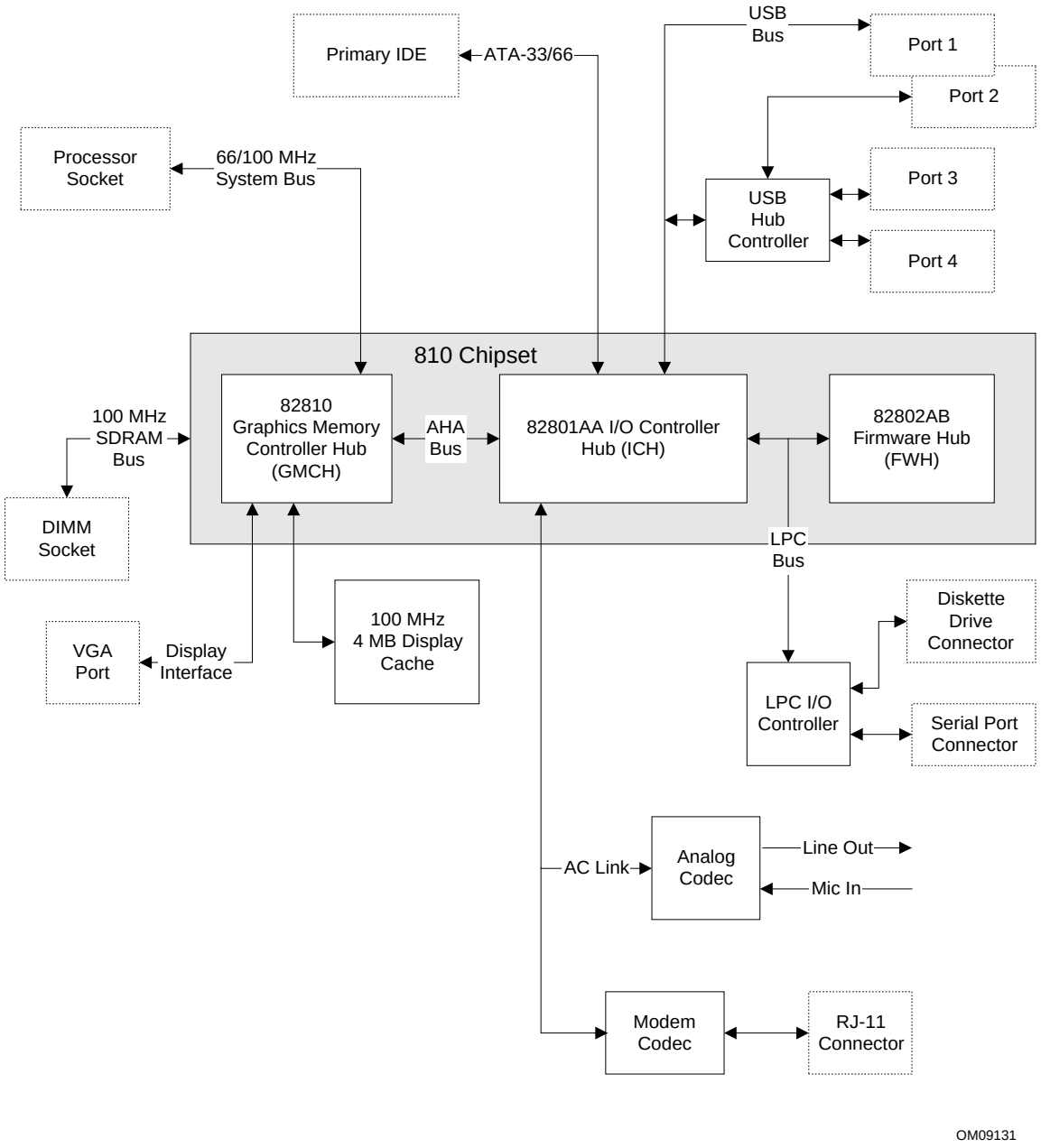


Figure 2. Block Diagram

1.2 Online Support

Find information about Intel® desktop boards under "Product Info" or "Customer Support" at these World Wide Web sites:

http://www.intel.com/design/motherbd

1.3 Design Specifications

Table 2 lists the specifications applicable to the BA810 board.

Table 2. Specifications

Description	Specification Title	Version, Revision Date, and Ownership	The specification is available from…
AC '97	*Audio Codec '97*	Version 2.1, May 22, 1998, Intel Corporation.	http://developer.intel.com/ial/scalableplatforms/audio/index.htm
ACPI	*Advanced Configuration and Power Interface Specification*	Version 1.0b, February 2, 1999, Intel Corporation, Microsoft Corporation, and Toshiba Corporation.	http://www.teleport.com/~acpi/
AGP	*Accelerated Graphics Port Interface Specification*	Version 2.0, May 4, 1998, Intel Corporation.	http://www.intel.com/technology/agp/agp_index.htm
AMI BIOS	*American Megatrends BIOS Specification*	AMIBIOS 99, June 1999, American Megatrends, Inc.	http://www.ami.com/amibios/bios.platforms.desktop.html
APM	*Advanced Power Management Specification*	Version 1.2, February, 1996, Intel Corporation and Microsoft Corporation.	http://www.microsoft.com/hwdev/busbios/amp_12.htm
ATAPI	*Information Technology AT Attachment with Packet Interface Extensions T13/1153D*	Version 18, August 19, 1998, Contact: T13 Chair, Seagate Technology.	T13 Anonymous FTP Site: ftp://fission.dt.wdc.com/x3t13/project/d1153r18.pdf
ATX	*ATX Specification*	Revision 2.01, February 1997, Intel Corporation.	http://developer.intel.com/design/motherbd/atx.htm
El Torito	*Bootable CD-ROM Format Specification*	Version 1.0, January 25, 1995, Phoenix Technologies Ltd. and IBM Corporation.	the Phoenix Technologies Web site at: http://www.ptltd.com/techs/specs.html

continued

Table 2. Specifications (continued)

Description	Specification Title	Version, Revision Date, and Ownership	The specification is available from…
FlexATX	*FlexATX addendum*	Addendum version 1.0 to the microATX Specification version 1.0, March 12, 1999, Intel Corporation.	http://www.teleport.com/~ffsupprt/spec/FlexATXaddn1_0.pdf
Intel Celeron Processor	*Intel Celeron Processor*	January 2000, Intel Corporation.	http://developer.intel.com/design/intarch/celeron/nodoc.htm
	Intel Celeron Processor Specification Update	Version 22, February 2000, Intel Corporation.	http://developer.intel.com/design/intarch/celeron/nodoc.htm
Intel Pentium III Processor	*Pentium III Processor for the PGA370 Socket*	January 2000, Intel Corporation.	http://developer.intel.com/design/intarch/pentiumiii/nodoc.htm
	Pentium III Processor Specification Update	Version 13, February 2000, Intel Corporation.	http://developer.intel.com/design/intarch/pentiumiii/nodoc.htm
LPC	*Low Pin Count Interface Specification*	Version 1.0, September 29, 1997, Intel Corporation.	http://www.intel.com/design/chipsets/industry/lpc.htm
MicroATX	*microATX Motherboard Interface Specification*	Version 1.0, December 1997, Intel Corporation.	http://www.teleport.com/~ffsupprt/spec/microatxspecs.htm
	SFX Power Supply Design Guide	Version 1.1, February 1998, Intel Corporation.	http://www.teleport.com/~ffsupprt/spec/microatxspecs.htm
PCI	*PCI Bus Power Management Interface Specification*	Version 1.1, December 18, 1998, PCI Special Interest Group.	http://www.pcisig.com/tech/availspecs.html#5
	PCI Local Bus Specification	Version 2.2, December 18, 1998, PCI Special Interest Group.	http://www.pcisig.com/tech/availspecs.html#5
Plug and Play	*Plug and Play BIOS Specification*	Version 1.0a, May 5, 1994, Compaq Computer Corp., Phoenix Technologies Ltd., and Intel Corporation.	http://www.microsoft.com/hwdev/respec/pnpspecs.htm
SDRAM DIMM (64-and 72-bit)	*PC SDRAM Unbuffered DIMM Specification*	Revision 1.0, February 1998, Intel Corporation.	http://www.intel.com/design/chipsets/memory/pcsdram/spec/index.htm
	PC SDRAM Serial Presence Detect (SPD) Specification	Revision 1.2B, November 1999, Intel Corporation.	http://www.intel.com/design/chipsets/memory/pcsdram/spec/index.htm

continued

Table 2. Specifications (continued)

Description	Specification Title	Version, Revision Date, and Ownership	The specification is available from…
SMBIOS	*System Management BIOS*	Version 2.3.1 March 16, 1999, American Megatrends Inc., Award Software International Inc., Compaq Computer Corporation, Dell Computer Corporation, Hewlett-Packard Company, Intel Corporation, International Business Machines Corporation, Phoenix Technologies Limited, and SystemSoft Corporation.	ftp://download.intel.com/ial/wfm/smbios.pdf
UHCI	*Universal Host Controller Interface Design Guide*	Version 1.1, March 1996, Intel Corporation.	http://developer.intel.com/design/USB/UHCI11D.htm
USB	*Universal Serial Bus Specification*	Version 1.1, September 23, 1998, Compaq Computer Corporation, Intel Corporation, Microsoft Corporation, and NEC.	http://www.usb.org/developers/docs.html
WfM	*Wired for Management Baseline*	Version 2.0, December 18, 1998, Intel Corporation.	http://developer.intel.com/ial/WfM/wfmspecs.htm

1.4 Processor

CAUTION

The board supports processors that draw a maximum of 19.4 A. Using a processor that draws more than 19.4 A can damage the processor, the board, and the power supply. See the processor's data sheet for current usage requirements.

The board supports a single Celeron processor or a single Pentium III processor as shown in Table 3. The system bus frequency is automatically selected.

Table 3. Supported Processors

Type	Designation	System Bus Frequency	L2 Cache Size
Pentium III processor in a FCPGA package	500E, 550E, 600E, 650, 700, 750, and 800	100 MHz	256 KB
Celeron processor in a PPGA package	333, 366, 400, 433, 466, 500, 533, 566, and 600	66 MHz	128 KB

All supported onboard memory can be cached, up to the cachability limit of the processor.

For information about	Refer to
Intel Celeron processor datasheets and specification updates	Table 2, page 13
Intel Pentium III processor datasheets and specification updates	Table 2, page 13
Processor support for the BA810 board	http://support.intel.com/support/motherboards/desktop

1.5 System Memory

CAUTION

To be fully compliant with all applicable Intel® SDRAM memory specifications, the board should be populated with a DIMM that supports the Serial Presence Detect (SPD) data structure. If your memory module does not support SPD, you will see a notification to this effect on the screen at power up. The BIOS will attempt to configure the memory controller for normal operation; however, the DIMM may not function at the determined frequency.

CAUTION

Because the main system memory is also used as video memory, the board requires a 100 MHz SDRAM DIMM even though the system bus frequency may be 66 MHz. It is highly recommended that an SPD DIMM be used, since this allows the BIOS to read the SPD data and program the chipset to accurately configure memory settings for optimum performance. If non-SPD memory is installed, the BIOS will attempt to correctly configure the memory settings, but performance and reliability may be impacted.

The board has one 22º DIMM socket. The minimum memory size is 32 MB and the maximum memory size is 256 MB. The BIOS automatically detects memory type, size, and frequency.

The board supports the following memory features:

- 3.3 V, 168-pin DIMM with gold-plated contacts
- 100 MHz SDRAM
- Serial Presence Detect (SPD) or non-SPD memory (BIOS recovery requires SPD DIMM)
- Non-ECC (64-bit) memory
- Unbuffered single- or double-sided DIMM

The board is designed to support a DIMM in the configurations listed in Table 4 below.

Table 4. System Memory Configuration

DIMM Size	Non-ECC Configuration
32 MB	4 Mbit x 64
64 MB	8 Mbit x 64
128 MB	16 Mbit x 64
256 MB	32 Mbit x 64

For information about	Refer to
The *PC Serial Presence Detect Specification*	Table 2, page 13
Obtaining copies of PC SDRAM specifications	Table 2, page 13

1.6 Intel® 810 Chipset

The Intel 810 chipset consists of the following devices:

- 82810 Graphics Memory Controller Hub (GMCH) with accelerated hub architecture (AHA) bus.
- 82801AA I/O Controller Hub (ICH) with AHA bus supports ATA-33 and ATA-66 devices, Suspend-to-RAM, and Wake from USB.
- 82802AB Firmware Hub (FWH).

The chipset provides the system, memory, display, and I/O interfaces shown in Figure 3.

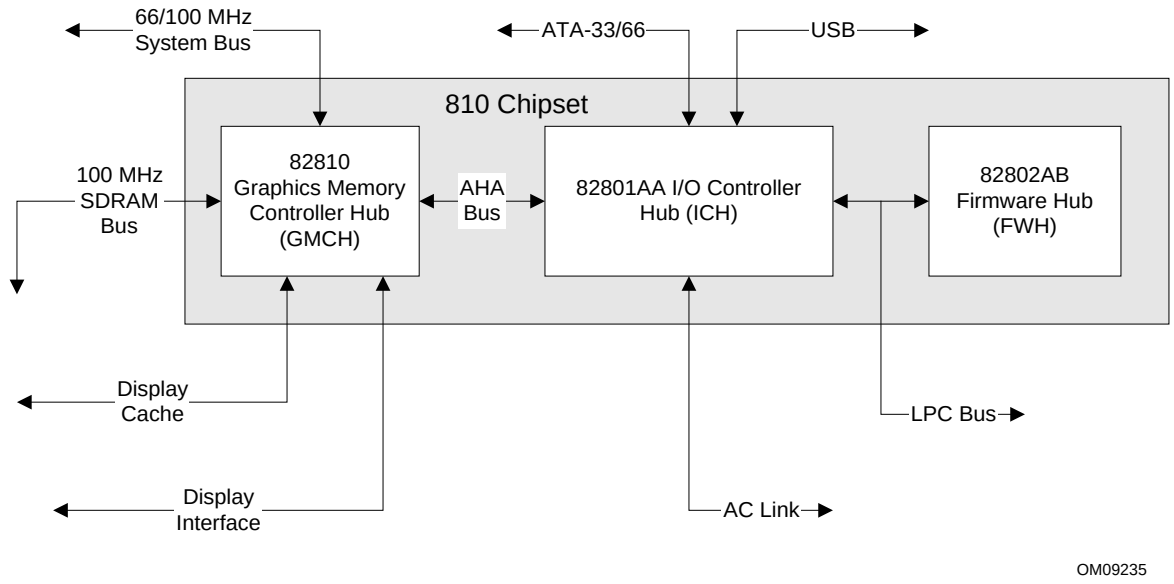


Figure 3. Intel 810 Chipset Block Diagram

For information about	Refer to
The Intel 810 chipset	http://developer.intel.com
The resources used by the chipset	Chapter 2
The chipset's compliance with ACPI and AC '97	Table 2, page 13

1.6.1 Direct AGP

Direct (integrated) AGP is a high-performance bus (independent of the PCI bus) for graphics-intensive applications, such as 3D applications. AGP overcomes certain limitations of the PCI bus related to handling large amount of graphics data with the following features:

- Pipelined memory read and write operations that hide memory access latency
- Demultiplexing of address and data on the bus for nearly 100 percent bus efficiency

For information about	Refer to
The location of the VGA port connector	Figure 6, page 41
Obtaining the *Accelerated Graphics Port Interface Specification*	Table 2, page 13

1.6.2 USB

The board has an onboard USB hub and four USB ports; one USB peripheral can be connected to each port. For more than four USB devices, an external hub can be connected to any of the ports. Two of the USB ports are implemented with stacked back panel connectors. The other two ports are routed to the front panel connector; accessing these ports requires a cable from the panel connector to the front of the chassis. The board fully supports UHCI and uses UHCI-compatible software drivers. USB features include:

- Self-identifying peripherals that can be plugged in while the computer is running
- Automatic mapping of function to driver and configuration
- Support for isochronous and asynchronous transfer types over the same set of wires
- Support for up to 127 physical devices
- Guaranteed bandwidth and low latencies appropriate for telephony, audio, and other applications
- Error-handling and fault-recovery mechanisms built into the protocol

NOTE

Computer systems that have an unshielded cable attached to a USB port may not meet FCC Class B requirements, even if no device or a low-speed USB device is attached to the cable. Use shielded cable that meets the requirements for full-speed devices.

For information about	Refer to
The location of the USB connectors on the back panel	Figure 6, page 41
The signal names of the USB connectors	Table 18, page 42
The location of the front panel USB connector	Figure 8, page 48
The signal names of the front panel USB connector	Table 28, page 49
The USB and UHCI specifications	Table 2, page 13

1.6.3 USB Hub

The TUSB2046 USB hub provides the following features:

- Universal Serial Bus version 1.1 compliant
- One upstream port and three downstream ports
- All downstream ports support full-speed and low-speed operations
- Suspend and resume operations support

For information about	Refer to
The TUSB2046 USB Hub	http://www.ti.com

1.6.4 IDE Support

The board has one bus-mastering IDE interface. This interface supports:

- ATAPI devices (such as CD-ROM drives)
- ATA devices using the transfer modes listed in Table 50 on page 82

The BIOS supports logical block addressing (LBA) and extended cylinder head sector (ECHS) translation modes. The drive reports the transfer rate and translation mode to the BIOS.

The board supports laser servo (LS-120) diskette technology through its IDE interface. The LS-120 drive can be configured as a boot device by setting the BIOS Setup program's Boot menu to one of the following:

- ARMD-FDD (ATAPI removable media device – floppy disk drive)
- ARMD-HDD (ATAPI removable media device – hard disk drive)

For information about	Refer to
The location of the IDE connector	Figure 7, page 44
The signal names of the IDE connector	Table 26, page 47
BIOS Setup program's Boot menu	Table 55, page 87

1.6.5 Real-Time Clock, CMOS SRAM, and Battery

The real-time clock is compatible with DS1287 and MC146818 components. The clock provides a time-of-day clock and a multicentury calendar with alarm features and century rollover. The real-time clock supports 256 bytes of battery-backed CMOS SRAM in two banks that are reserved for BIOS use.

A coin-cell battery powers the real-time clock and CMOS memory. When the computer is not plugged into a wall socket, the battery has an estimated life of three years. When the computer is plugged in, the 3.3 V standby current from the power supply extends the life of the battery. The clock is accurate to ± 13 minutes/year at 25 ºC with 3.3 VSB applied.

The time, date, and CMOS values can be specified in the BIOS Setup program. The CMOS values can be returned to their defaults by using the BIOS Setup program.

NOTE

If the battery and AC power fail, standard defaults, not custom defaults, will be loaded into CMOS RAM at power on.

NOTE

The recommended method of accessing the date in systems with Intel desktop boards is indirectly from the Real-Time Clock (RTC) via the BIOS. The BIOS on Intel desktop boards contains a century checking and maintenance feature. This feature checks the two least significant digits of the year stored in the RTC during each BIOS request (INT 1Ah) to read the date and, if less than 80 (i.e., 1980 is the first year supported by the PC), updates the century byte to 20. This feature enables operating systems and applications using the BIOS date/time services to reliably manipulate the year as a four-digit value.

For information about	Refer to
Proper date access in systems with Intel desktop boards	http://support.intel.com/support/year2000/

1.7 I/O Controller

The IT8761E I/O controller provides the following features:

- Low pin count (LPC) interface
- One serial port
- Plug and Play compatible register set
- Support for SERIRQ protocol
- Supports System Management Interrupt (SMI)
- Interface for one 1.2 MB, 1.44 MB, or 2.88 MB diskette drive
- Fan monitoring

The BIOS Setup program provides configuration options for the I/O controller.

For information about	Refer to
The IT8761E I/O controller	http://www.iteusa.com

1.8 Serial Port

The board has one 9-pin serial port connector. This is not accessible through the back panel. The serial port's NS16C550-compatible UART supports data transfers at rates of up to 115.2 kbits/sec with BIOS support. The serial port can be assigned as COM1 (3F8h), COM2 (2F8h), COM3 (3E8h), or COM4 (2E8h).

For information about	Refer to
The location of the serial port connector	Figure 8, page 48
The signal names of the serial port connector	Table 30, page 49

1.9 Graphics Subsystem

The graphics subsystem provides the following features:

- Intel 82810 GMCH graphics support, including:
  - — Integrated 2D and 3D graphics engines
  - — Integrated hardware motion compression engine
  - — Integrated 230 MHz DAC
- 4 MB of SDRAM display cache, 100 MHz display cache for 66/100 MHz system bus processor

Table 5 lists the refresh rates supported by the graphics subsystem. Supported graphics refresh rates may vary depending on BIOS and video driver version used.

Table 5. Supported Graphics Refresh Rates

Resolution	Available Refresh Rates (Hz)
640 x 200 x 16 colors	70
640 x 350 x 16 colors	70
640 x 400 x 256 colors	60, 70, 75, 85
640 x 400 x 64 K colors	60, 70, 75, 85
640 x 400 x 16 M colors	70
640 x 480 x 16 colors	60, 72, 75, 85
640 x 480 x 256 colors	60, 70, 72, 75, 85
640 x 480 x 32 K colors	60, 75, 85
640 x 480 x 64 K colors	60, 70, 72, 75, 85
640 x 480 x 16 M colors	60, 70, 72, 75, 85
800 x 600 x 256 colors	60, 75, 85
800 x 600 x 32 K colors	60, 70, 72, 75, 85
800 x 600 x 64 K colors	60, 70, 72, 75, 85
800 x 600 x 16 M colors	60, 70, 72, 75, 85
1024 x 768 x 256 colors	60, 70, 75, 85
1024 x 768 x 32 K colors	60, 75, 85
1024 x 768 x 64 K colors	60, 70, 72, 75, 85
1024 x 768 x 16 M colors	60, 70, 72, 75, 85
1056 x 800 x 16 colors	70
1280 x 1024 x 256 colors	60, 70, 72, 75, 85
1280 x 1024 x 32 K colors	60, 75, 85
1280 x 1024 x 64 K colors	60, 70, 72, 75
1280 x 1024 x 16 M colors	60, 70, 72, 75, 85

For information about	Refer to
Obtaining graphics software and utilities	http://support.intel.com/support/motherboards/desktop

1.10 Audio Subsystem

The board includes an Audio Codec ‘97 (AC ‘97) compatible SoundMAX† audio subsystem consisting of the these devices:

- Intel 82801AA ICH (AC link output)
- Analog Devices AD1881 analog codec

Figure 4 is a block diagram of the audio subsystem.

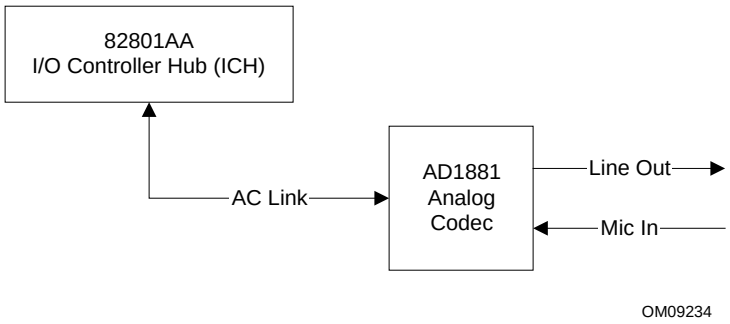


Figure 4. Block Diagram of Audio Subsystem with AD1881 Analog Codec

Features of the audio subsystem include:

- Independent channels for PCM in, PCM out, and Mic in
- 16-bit stereo I/O up to 48 kHz
- Multiple sample rates

For information about	Refer to
Obtaining audio software and utilities	http://support.intel.com/support/motherboards/desktop

1.10.1 AD1881 Analog Codec

The AD1881 is a fully AC ‘97 compliant codec. The codec's features include:

- 16-bit stereo full-duplex codec
- CD-quality audio
- Stereo line level output
- Power management support
- Full duplex variable sampling rate (7 kHz to 48 kHz) with 1 Hz resolution
- Phat† Stereo 3D stereo enhancement

For information about	Refer to
The audio subsystem’s compliance with AC ‘97	Table 2, page 13

1.10.2 Audio Connectors

The audio connectors, located on the back panel, include the following:

- Line out
- Mic in

NOTE

CD-ROM digital audio signals are routed through the IDE interface.

For information about	Refer to
The location of the back panel audio connectors	Figure 6, page 41
The signal names of the back panel audio connectors	Section 2.8.1, page 41

1.11 Modem Subsystem

The modem subsystem consists of the following:

- Motorola SM56 AC-L (AC link) software modem
- Silicon Laboratories Si3038 family MC ‘97 modem codec
- RJ-11 connector

1.11.1 Software Modem

The Motorola SM56 AC-L Software Modem is a Host Signal Processing (HSP) based modem with both controller and datapump functions executed by the processor. The software driver works with the Intel 82801AA ICH’s integrated AC-Link and the companion Si3038 family MC ‘97 modem codec.

1.11.2 Modem Codec

The Silicon Laboratories Si3038 family consists of the following components:

- Si3014 Direct Access Arrangement (DAA) device (with a phone line interface)
- Si3024 (AC ‘97 interface)

Together, these devices provide a programmable line interface to meet international telephone line requirements. The Si3038 family complies with international regulatory requirements and the *AC‘97/MC‘97 Interface Specification, Revision 2.1*.

1.11.3 Modem AT Commands and S-Register Settings

Information on AT commands and S-register settings can be found in the Online SM56 User’s Guide. The User’s Guide can be accessed by clicking on the Motorola SM56 Modem icon on the desktop tray next to the time icon. Command information is available for the following:

- AT and AT& commands
- AT commands - basics
- AT#UD Unimodem diagnostic command
- AT% and AT\ commands
- AT* commands
- AT+ commands
- ATS (S-register) commands

1.11.4 Modem Specifications

Table 6 summarizes the modem's features and capabilities.

Table 6. Modem Specifications

Data Modem	V.90 and K56flex (up to 56 Kbps receive) V.34 (33,600 bps - 2,400 bps) V.32bis (14,400 bps - 4,800 bps) V.32 (9,600 bps - 4,800 bps) V.22bis (2,400 bps - 1,200 bps) V.22 (1,200 bps) V.23 (75/1,200 - 600 bps) V.21 (300 bps) Bell 212A (1,200 bps) Bell 103 (300 bps)
Error Correction	V.42, LAP-M and MNP 2-4
Data Compression	V.42bis and MNP 5
Fax Modem	Group III, Class 1 Class 1 fax error correction mode V.17 (14,400/12,000 bps) V.29 (9,600/7,200 bps) V.27ter (4,800/2,400 bps) V.21 (300 bps)
Answering Machine	8 kHz PCM and IMA ADPCM Concurrent DTMF detection Voice/Silence detection
Video Phone Ready Modem	V.80 sync access mode interface Transparent and framed sub-modes Voice call first supports Intel Video Phone with Intel® ProShare® technology
Adaptive Connection Support	V.8 automode negotiation V.8 PRIME and V.8bis Adaptive rate renegotiation Automatically adjusts speeds up and down to accommodate changing line conditions
Extensive Diagnostics Support	AT&V, AT#UD- Call setup and phone line quality statistics Real-time modem status with connect rate and retrain indication Last disconnect reason Local Analog Loopback (LAL)-Hardware board check
Other Telephony Features	Tone detections: Dial tone, second dial tone Ring back, busy Data/Fax answering tones DTMF
Enhanced Caller ID (U.S. and Canada)	Supports name and number
Distinctive Ring	Distinguish among data, fax, and voice
Windows† 98 SE Control Panel Applet	Familiar Windows tabular interface Easy to use on-line user's guide Real-time modem status Flexible international country configuration Essential product support information

1.12 Power Management Features

Power management is implemented at several levels, including:

- Advanced Configuration and Power Interface (ACPI)
- Advanced Power Management (APM)
- Hardware support:
  - Power connector
  - Fan connectors
  - Instantly Available technology
  - Wake on Ring
  - Resume on Ring
  - Wake from USB

1.12.1 ACPI

If the board is used with an ACPI-aware operating system, the BIOS can provide ACPI support. ACPI gives the operating system direct control over the power management and Plug and Play functions of a computer. The use of ACPI with this board requires the support of an operating system that provides full ACPI functionality. ACPI features include:

- Plug and Play (including bus and device enumeration) functionality normally contained in the BIOS
- Power management control of individual devices, video displays, and hard disk drives
- Methods for achieving less than 30-watt system operation in the Power On Suspend sleeping state, and less than 5-watt system operation in the Suspend to Disk sleeping state
- A Soft-off feature that enables the operating system to power off the computer
- Support for multiple wake up events (see Table 9 on page 29)
- Support for a front panel power and sleep mode switch. Table 7 lists the system states based on how long the power switch is pressed, depending on how ACPI is configured with an ACPI-aware operating system.

Table 7. Effects of Pressing the Power Switch

If the system is in this state…	…and the power switch is pressed for	…the system enters this state
Off (ACPI G2/S5 state)	Less than four seconds	Power on
On (ACPI G0 state)	Less than four seconds	Soft off/Suspend
On (ACPI G0 state)	More than four seconds	Fail safe power off
Sleep (ACPI G1 state)	Less than four seconds	Wake up
Sleep (ACPI G1 state)	More than four seconds	Power off

For information about	Refer to
The board's compliance level with ACPI	Table 2, page 13

1.12.1.1 System States and Power States

Under ACPI, the operating system directs all system and device power state transitions. The operating system puts devices in and out of low-power states based on user preferences and knowledge of how devices are being used by applications. Devices that are not being used can be turned off. The operating system uses information from applications and user settings to put the system as a whole into a low-power state.

Table 8 lists the power states supported by the board along with the associated system power targets. See the ACPI specification for a complete description of the various system and power states.

Table 8. Power States and Targeted System Power

Global States	Sleeping States	CPU States	Device States	Targeted System Power*
G0 – working state.	S0 – working.	C0 – working.	D0 – working state.	Full power > 30 W.
G1 – sleeping state.	S1 – CPU stopped.	C1 – stop grant.	D1, D2, D3 – device specification specific.	5 W < power < 30 W.
G1 – sleeping state.	S3 – Suspend-to-RAM. Context saved to RAM.	No power.	D3 – no power except for wake up logic.	Power < 5W. **
G2/S5	S5 – Soft off. Context not saved. Cold boot is required.	No power.	D3 – no power except for wake up logic.	Power < 5 W. **
G3 – mechanical off. AC power is disconnected from the computer.	No power to the system.	No power.	D3 – no power for wake up logic, except when provided by battery or external source.	No power to the system so that service can be performed.

* Total system power is dependent on the system configuration, including add-in boards and peripherals powered by the system chassis' power supply.

** Dependent on the standby power consumption of wake-up devices used in the system.

1.12.1.2 Wake Up Devices and Events

Table 9 lists the devices or specific events that can wake the computer from specific states.

Table 9. ACPI Wake Up Devices and Events

These devices/events can wake up the computer…	…from this state
Power switch	S3, S5
RTC alarm*	S1, S3
Modem	S1, S3
USB	S1, S3

* Unattended Wake Mode – display will be video BIOS ID string only

1.12.1.3 Plug and Play

In addition to power management, ACPI provides controls and information so that the operating system can facilitate Plug and Play device enumeration and configuration. ACPI is used only to enumerate and configure onboard devices that do not have other hardware standards for enumeration and configuration. PCI devices on the board, for example, are not enumerated by ACPI.

1.12.2 APM

APM makes it possible for the computer to enter an energy saving standby mode. The standby mode can be initiated in the following ways:

- Time-out period specified in the BIOS Setup program
- Suspend/Resume switch connected to the front panel sleep connector
- From the operating system, such as the Suspend menu item in Windows 98 SE

In standby mode, the board can reduce power consumption by spinning down hard drives, and reducing power to or turning off VESA† DPMS-compliant monitors. Power-management mode can be enabled or disabled in the BIOS Setup program.

While in standby mode, the system retains the ability to respond to external interrupts and service requests, such as incoming faxes or network messages. Any keyboard or mouse activity brings the system out of standby mode and immediately restores power to the monitor.

The BIOS enables APM by default, but the operating system must support an APM driver for the power-management features to work. For example, Windows 98 SE supports the power-management features upon detecting that APM is enabled in the BIOS.

Table 10 lists the devices or specific events that can wake the computer from specific states.

Table 10. APM Wake Up Devices and Events

These devices/events can wake up the computer…	…from this state
Power switch	Soft-off
RTC alarm*	Soft-off, suspend
Modem	Soft-off, suspend
USB	Suspend

* Unattended Wake Mode – display will be video BIOS string only

For information about	Refer to
Enabling or disabling power management in the BIOS Setup program	Section 4.6, page 86
The board's compliance level with APM	Table 2, page 13

1.12.3 Hardware Support

CAUTION

If Instantly Available technology feature is used, ensure that the power supply provides adequate +5 V standby current. Failure to do so can damage the power supply. The total amount of standby current required depends on the wake devices supported and manufacturing options. Refer to Section 2.11.2 on page 55 for additional information.

The board provides several hardware features that support power management, including:

- Power connector
- Fan connectors
- Instantly Available technology
- Wake on Ring
- Resume on Ring
- Wake from USB

Instantly Available technology requires power from the +5 V standby line. The sections discussing these features describe the incremental standby power requirements.

Wake on Ring and Resume on Ring enable telephony devices to access the computer when it is in a power-managed state. The method used depends on the type of telephony device (external or internal) and the ACPI or APM state being used.

NOTE

The use of Wake on Ring, Resume on Ring, and Wake from USB technologies from an ACPI state require the support of an operating system and a peripheral device that provides full ACPI functionality.

1.12.3.1 Power Connector

When used with an ATX-compliant power supply that supports remote power on/off, the board can turn off the system power through software control.

With soft-off enabled, if power to the computer is interrupted by a power outage or a disconnected power cord, when power resumes, the computer returns to the power state it was in before power was interrupted (on or off).

For information about	Refer to
The location of the power connector	Figure 7, page 44
The signal names of the power connector	Table 24, page 45
The ATX specification	Table 2, page 13

1.12.3.2 Fan Connectors

The board has two fan connectors. The functions of these connectors are described in Table 11.

Table 11. Fan Connector Descriptions

Connector	Function
Processor fan	Provides +12 V DC for a processor fan or active fan heatsink.
Chassis fan	Provides +12 V DC for a system or chassis fan.

For information about	Refer to
The location of the fan connectors	Figure 7, page 44
The signal names of the processor fan connector	Table 23, page 45
The signal names of the chassis fan connector	Table 27, page 47

1.12.3.3 Instantly Available Technology

CAUTION

For Instantly Available technology, the 5-V standby line for the power supply must be capable of delivering adequate standby current. Failure to provide adequate standby current when using this feature can damage the power supply. Refer to Section 2.11.2 on page 55 for additional information.

Instantly Available technology enables the board to enter the ACPI S3 (Suspend-to-RAM) state. While in the S3 sleep-state, the computer will appear to be off (the power supply is off, the fans are off, and the power LED is amber). When signaled by a wake-up device or event, the system quickly returns to its last known wake state. Table 9 on page 29 lists the devices and events that can wake the computer from the S3 state. The use of Instantly Available technology requires:

- Operating system support
- PCI 2.2 compliant devices and drivers

The optional standby power indicator LED (located between the power connector and the DIMM socket) provides an indication that standby power is still present, even when the computer appears to be off. Figure 5 shows the location of the standby power indicator LED.

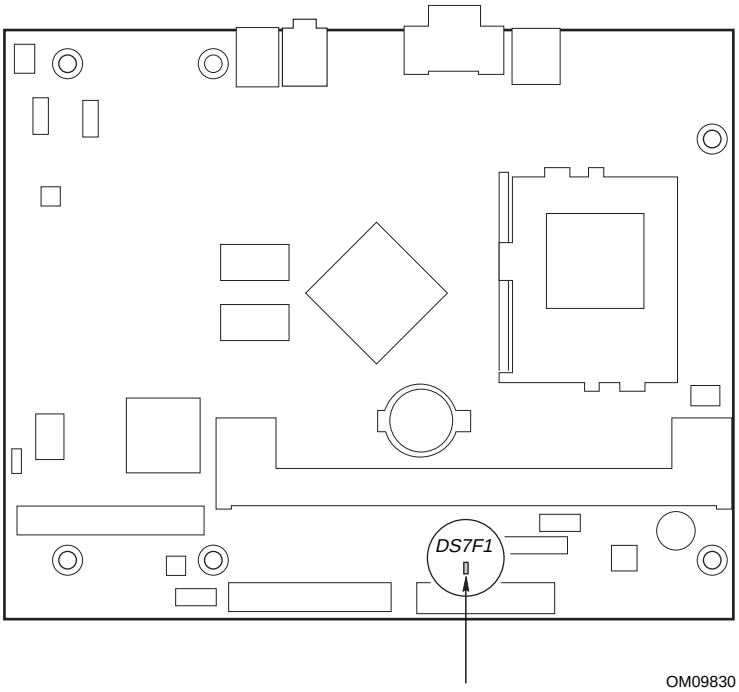


Figure 5. Location of Standby Power Indicator LED

1.12.3.4 Wake on Ring

The operation of Wake on Ring can be summarized as follows:

- Wakes the computer from an ACPI S3 state or from APM soft-off mode
- Requires two calls to access the computer:
  - First call restores the computer from an ACPI S3 state or powers up the computer from APM soft-off mode
  - Second call enables access (when the appropriate software is loaded)
- The onboard modem detects the incoming call through the AC ‘97 Wake Up feature

1.12.3.5 Resume on Ring

The operation of Resume on Ring can be summarized as follows:

- Resumes operation from the ACPI S1 state or APM suspend mode
- Requires only one call to access the computer
- The onboard modem detects the incoming call through the AC ‘97 Wake Up feature

1.12.3.6 Wake from USB

USB bus activity wakes the computer from an ACPI S1 or S3 state or APM suspend mode.

NOTE

Wake from USB requires the use of a USB peripheral that supports the Wake from USB feature. Wake from USB is not supported in APM soft-off mode.

2 Technical Reference

What This Chapter Contains

2.1 Introduction

Sections 2.2 – 2.6 contain several standalone tables. Table 12 describes the system memory map, Table 13 shows the I/O map, Table 14 lists the DMA channels, Table 15 defines the PCI configuration space map, and Table 16 describes the interrupts. The remaining sections in this chapter are introduced by text found with their respective section headings.

2.2 Memory Map

Table 12. System Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K – 262144 K	100000 – FFFFFFF	255 MB	Extended memory
960 K – 1024 K	F0000 – FFFFF	64 KB	Runtime BIOS
896 K – 960 K	E0000 – EFFFF	64 KB	Reserved
800 K – 896 K	C8000 – DFFFF	96 KB	Available high DOS memory (open to PCI bus)
640 K – 800 K	A0000 – C7FFF	160 KB	Video memory and BIOS
639 K – 640 K	9FC00 – 9FFFF	1 KB	Extended BIOS data (movable by memory manager software)
512 K – 639 K	80000 – 9FBFF	127 KB	Extended conventional memory
0 K – 512 K	00000 – 7FFFF	512 KB	Conventional memory

2.3 I/O Map

Table 13. I/O Map

Address (hex)	Size	Description
0000 – 000F	16 bytes	DMA controller
0020 – 0021	2 bytes	Programmable Interrupt Controller (PIC)
0040 – 0043	4 bytes	System timer
0060	1 byte	Keyboard controller byte – reset IRQ
0061	1 byte	System speaker
0064	1 byte	Keyboard controller, CMD/STAT byte
0070 – 0071	2 bytes	System CMOS / Real-Time Clock
0072 – 0073	2 bytes	System CMOS
0080 – 008F	16 bytes	DMA controller
0092	1 byte	Fast A20 and PIC
00A0 – 00A1	2 bytes	PIC
00C0 – 00DF	32 bytes	DMA
00F0	1 byte	Numeric data processor
01F0 – 01F7	8 bytes	Primary IDE channel
02E8 – 02EF[1]	8 bytes	COM4/video (8514A)
02F8 – 02FF[1]	8 bytes	COM2
03B0 – 03BB	12 bytes	Intel 82810 – Graphics/Memory Controller Hub (GMCH)
03C0 – 03DF	32 byte	Intel 82810 – Graphics/Memory Controller Hub (GMCH)
03E8 – 03EF	8 bytes	COM3
03F0 – 03F5	6 bytes	Diskette channel 1
03F6	1 byte	Primary IDE channel command port
03F8 – 03FF	8 bytes	COM1
04D0 – 04D1	2 bytes	Edge/level triggered PIC
0CF8 – 0CFB[2]	4 bytes	PCI configuration address register
0CF9[3]	1 byte	Turbo and reset control register
0CFC – 0CFF	4 bytes	PCI configuration data register
FFA0 – FFA7	8 bytes	Primary bus master IDE registers
96 contiguous bytes starting on a 128-byte divisible boundary		ICH (ACPI + TCO)
64 contiguous bytes starting on a 64-byte divisible boundary		Onboard resources
256 contiguous bytes starting on a 256-byte divisible boundary		ICH audio mixer
64 contiguous bytes starting on a 64-byte divisible boundary		ICH audio bus master
256 contiguous bytes starting on a 256-byte divisible boundary		ICH modem mixer

continued

Table 13. I/O Map (continued)

Address (hex)	Size	Description
16 contiguous bytes starting on a 16-byte divisible boundary		ICH (SMBus)
32 contiguous bytes starting on a 32-byte divisible boundary		ICH (USB)
4096 contiguous bytes starting on a 4096-byte divisible boundary		Intel 82810 PCI Bridge

Notes:

1. Default, but can be changed to another address range
2. Dword access only
3. Byte access only

NOTE

Some additional I/O addresses are not available due to ICH addresses aliasing. For information about ICH addressing, refer to the Web site at:

http://developer.intel.com/design/chipsets/datashts/

2.4 DMA Channels

Table 14. DMA Channels

DMA Channel Number	Data Width	System Resource
0	8 or 16 bits	Open
1	8 or 16 bits	Open
2	8 or 16 bits	Diskette drive
3	8 or 16 bits	Open
4		Reserved - cascade channel
5	16 bits	Open
6	16 bits	Open
7	16 bits	Open

2.5 PCI Configuration Space Map

Table 15. PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Description
00	00	00	Memory controller of Intel 82810 component
00	01	00	Graphics controller of Intel 82810 component
00	1E	00	Link to PCI bridge
00	1F	00	PCI-to-LPC bridge
00	1F	01	IDE controller
00	1F	02	USB controller
00	1F	03	SMBus controller
00	1F	04	Reserved
00	1F	05	AC ’97 audio controller
00	1F	06	AC ’97 modem controller

2.6 Interrupts

Table 16. Interrupts

IRQ	System Resource
NMI	I/O channel check
0	Reserved, interval timer
1	Reserved, keyboard buffer full
2	Reserved, cascade interrupt from slave PIC
3	User available
4	COM1*
5	User available
6	Diskette drive
7	User available
8	Real-Time Clock
9	Reserved for ICH system management bus
10	Audio / Modem
11	Video
12	User available
13	Reserved, math coprocessor
14	Primary IDE (if present, else user available)
15	Network / User available

* Default, but can be changed to another IRQ

2.7 PCI Interrupt Routing Map

This section describes interrupt sharing and how the interrupt signals are connected between the onboard PCI devices. The PCI specification specifies how interrupts can be shared between devices attached to the PCI bus. In most cases, the small amount of latency added by interrupt sharing does not affect the operation or throughput of the devices. In some special cases where maximum performance is needed from a device, a PCI device should not share an interrupt with other PCI devices.

PCI devices are categorized as follows to specify their interrupt grouping:

- INTA: By default, all add-in devices that require only one interrupt are in this category. For almost all devices that require more than one interrupt, the first interrupt on the device is also classified as INTA.
- INTB: Generally, the second interrupt on add-in devices that require two or more interrupts is classified as INTB. (This is not an absolute requirement.)
- INTC and INTD: Generally, a third interrupt on add-in devices is classified as INTC and a fourth interrupt is classified as INTD.

The ICH PCI-to-LPC bridge has four programmable interrupt request (PIRQ) input signals. Any PCI interrupt source connects to one of these PIRQ signals. Because there are only four signals, some PCI interrupt sources are mechanically tied together on the board and therefore share the same interrupt. Table 17 lists the PIRQ signals and shows how the signals are connected to the onboard PCI interrupt sources.

Table 17. PCI Interrupt Routing Map

PCI Interrupt Source	ICH PIRQ Signal			
	PIRQA	**PIRQB**	**PIRQC**	**PIRQD**
AGP Controller	INTA			
ICH Audio Controller		INTB		
ICH Modem Controller		INTB		
ICH USB Controller				INTD
SM Bus		INTB		

NOTE

The ICH can connect each PIRQ line internally to one of the IRQ signals (3, 4, 5, 7, 9, 10, 11, 14, and 15). Typically, a device that does not share a PIRQ line will have a unique interrupt. However, in certain interrupt-constrained situations, it is possible for two or more of the PIRQ lines to be connected to the same IRQ signal.

2.8 Connectors

CAUTION

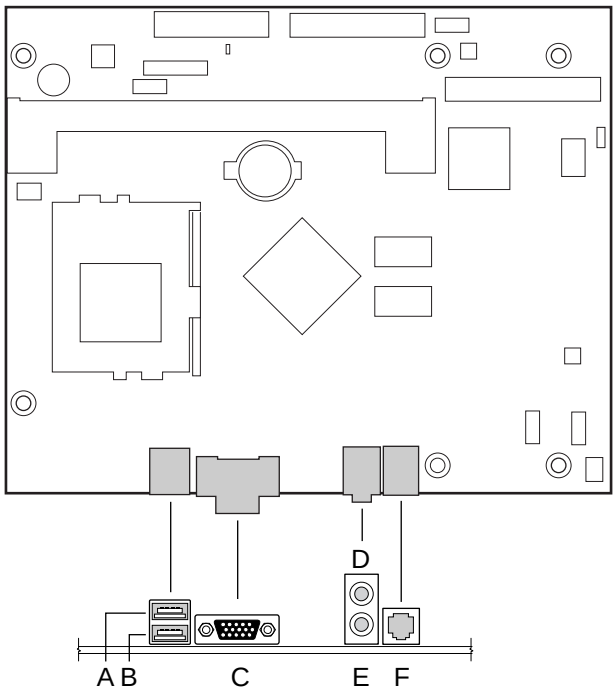
Only the back panel I/O connectors of this board have overcurrent protection. The internal board connectors are not overcurrent protected, and should connect only to devices inside the computer chassis, such as fans and internal peripherals. Do not use these connectors for powering devices external to the computer chassis. A fault in the load presented by the external devices could cause damage to the computer, the interconnecting cable, and the external devices themselves.

This section describes the board's connectors. The connectors can be divided into the following groups:

- Back panel I/O connectors (see page 41)
  - USB (2)
  - VGA
  - Audio line out
  - Mic in
  - RJ-11 telephone jack
- Internal I/O connectors (see page 44)
  - Fans (2)
  - Power
  - Diskette drive
  - IDE
- External I/O connectors (see page 48)
  - USB ports
  - Front panel (Power/Sleep/Message waiting LED, power switch, hard drive activity LED, reset switch, and infrared port)
  - Serial port

2.8.1 Back Panel I/O Connectors

Figure 6 shows the location of the back panel connectors.



Item	Description	For more information, see…
A	USB port 0 (ICH)	Table 18, page 42
B	USB port 1 (USB hub)	Table 18, page 42
C	VGA port	Table 19, page 42
D	Audio line out	Table 20, page 43
E	Mic in	Table 21, page 43
F	RJ-11 telephone jack	Table 22, page 43

Figure 6. Back Panel I/O Connectors

NOTE

The back panel audio line out connector is designed to power headphones or amplified speakers only. Poor audio quality may occur if passive (non-amplified) speakers are connected to this output.

Table 18. USB Connectors

Pin	Signal Name
1	+5 V (fused)
2	USBP0# / USBP1#
3	USBP0 / USBP1
4	Ground

Table 19. VGA Port Connector

Pin	Signal Name
1	Red
2	Green
3	Blue
4	No connect
5	Ground
6	Ground
7	Ground
8	Ground
9	Fused VCC
10	Ground
11	No connect
12	MONID1
13	HSYNC
14	VSYNC
15	MONID2

Table 20. Audio Line Out Connector

Pin	Signal Name
Tip	Audio left out
Ring	Audio right out
Sleeve	Ground

Table 21. Mic In Connector

Pin	Signal Name
Tip	Microphone in
Ring	Mic bias voltage
Sleeve	Ground

Table 22. RJ-11 Telephone Jack

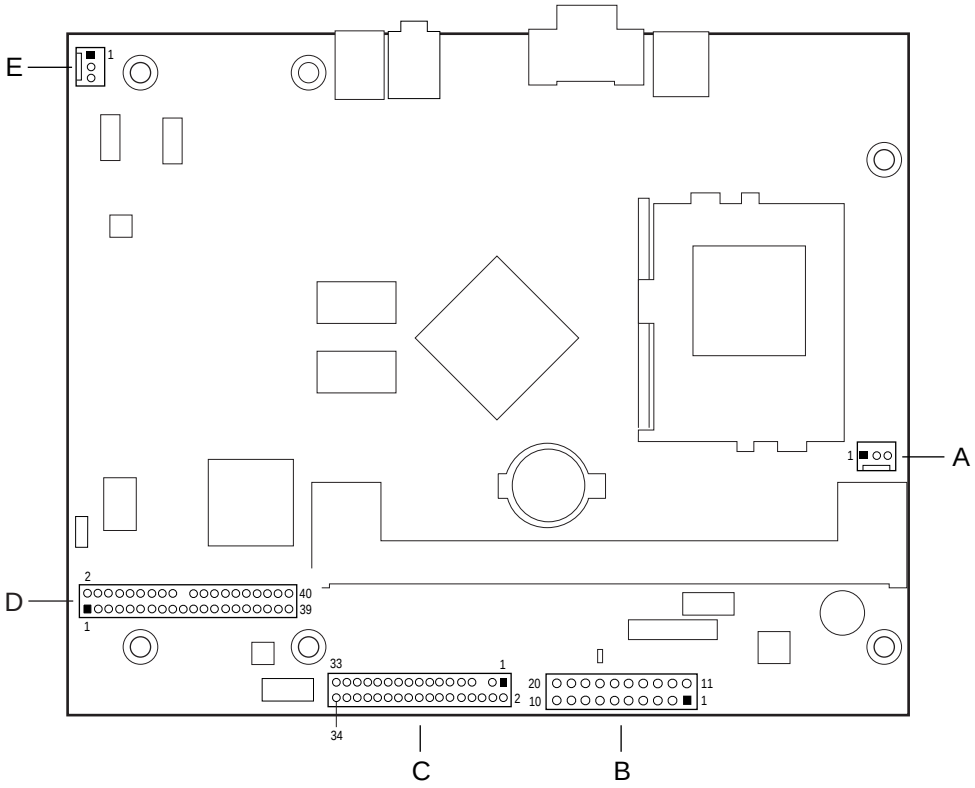
Pin	Signal Name
1	No connect
2	Tip
3	Ring
4	No connect

NOTE

To comply with regulatory information a 26 AWG or larger telecommunication line cord must be used.

2.8.2 Internal I/O Connectors

Figure 7 shows the location of the internal connectors.



Item	Description	Reference Designator	For more information, see…
A	Processor fan	J5J1	Table 23, page 45
B	Power	J7G3	Table 24, page 45
C	Diskette drive	J7D1	Table 25, page 46
D	IDE	J7B1	Table 26, page 47
E	Chassis fan	J1A1	Table 27, page 47

Figure 7. Internal I/O Connectors

For information about	Refer to
The power connector	Section 1.12.3.1, page 31
The functions of the fan connectors	Section 1.12.3.2, page 31

Table 23. Processor Fan Connector (J5J1)

Pin	Signal Name
1	Ground
2	+12 V
3	FAN_TACH1

Table 24. Power Connector (J7G3)

Pin	Signal Name	Pin	Signal Name
1	+3.3 V	11	+3.3 V
2	+3.3 V	12	-12 V
3	Ground	13	Ground
4	+5 V	14	PS-ON# (power supply remote on/off)
5	Ground	15	Ground
6	+5 V	16	Ground
7	Ground	17	Ground
8	PWRGD (Power Good)	18	-5 V
9	+5 VSB	19	+5 V
10	+12 V	20	+5 V

Table 25. Diskette Drive Connector (J7D1)

Pin	Signal	Pin	Signal
1	Ground	2	DENSEL
3	Ground	4	No connect
5	Key	6	FDEDIN
7	Ground	8	FDINDX# (Index)
9	Ground	10	FDM00# (Motor Enable A)
11	Ground	12	No connect
13	Ground	14	FDDS0# (Drive Select A)
15	Ground	16	No connect
17	No connect	18	FDDIR# (Stepper Motor Direction)
19	Ground	20	FDSTEP# (Step Pulse)
21	Ground	22	FDWD# (Write Data)
23	Ground	24	FDWE# (Write Enable)
25	Ground	26	FDTRK0# (Track 0)
27	No connect	28	FDWPD# (Write Protect)
29	Ground	30	FDRDATA# (Read Data)
31	Ground	32	FDHEAD# (Side 1 Select)
33	Ground	34	DSKCHG# (Diskette Change)

Table 26. IDE Connector (J7B1)

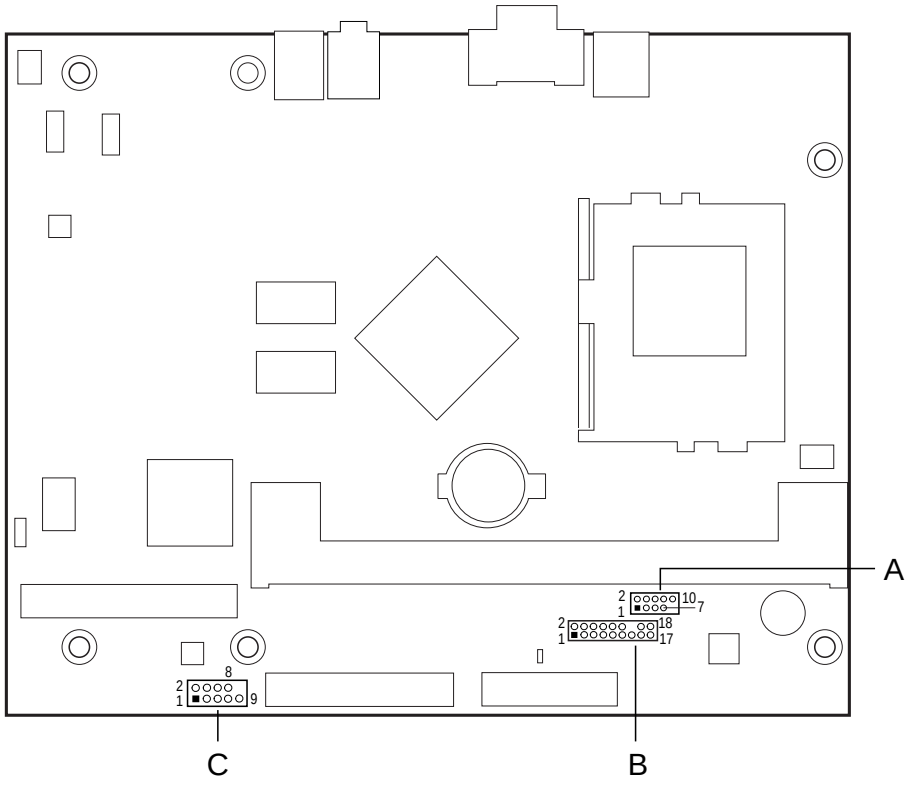
Pin	Signal Name	Pin	Signal Name
1	Reset IDE	2	Ground
3	Data 7	4	Data 8
5	Data 6	6	Data 9
7	Data 5	8	Data 10
9	Data 4	10	Data 11
11	Data 3	12	Data 12
13	Data 2	14	Data 13
15	Data 1	16	Data 14
17	Data 0	18	Data 15
19	Ground	20	Key
21	DDRQ0	22	Ground
23	I/O Write#	24	Ground
25	I/O Read#	26	Ground
27	IOCHRDY	28	Ground
29	DDACK0#	30	Ground
31	IRQ 14	32	Reserved
33	DAG1 (Address 1)	34	DMA66_DETECT
35	DAG0 (Address 0)	36	DAG2 (Address 2)
37	Chip Select 1P#	38	Chip Select 3P#
39	Activity#	40	Ground

Table 27. Chassis Fan Connector (J1A1)

Pin	Signal Name
1	Ground
2	+12 V
3	Ground

2.8.3 External I/O Connectors

Figure 8 shows the location of the external connectors.



Item	Description	Reference Designator	For more information, see…
A	USB port	J7G1	Table 28, page 49
B	Front panel	J7G2	Table 29, page 49
C	Serial port	J7C1	Table 30, page 49

Figure 8. External I/O Connectors

Table 28. USB Port Connector (J7G1)

Pin	Signal Name	Pin	Signal Name
1	VREG_USB2_PWR	2	VREG_USB2_PW
3	USB_DM3	4	USB_DM4
5	USB_DP3	6	USB_DP4
7	Ground	8	Ground
9	Key (no pin)	10	No connect

Table 29. Front Panel Connector (J7G2)

Pin	Signal	In/Out	Description	Pin	Signal	In/Out	Description
Hard Drive Activity LED				Power LED			
1	HD_PWR	Out	Hard disk LED pull-up (330 Ω) to +5 V	2	HDR_BLNK_GRN	Out	Front panel green LED
3	HDA#	Out	Hard disk active LED	4	HDR_BLNK_YEL	Out	Front panel yellow LED
Reset Switch				On / Off Switch			
5	GND		Ground	6	SW_ON#	In	Front panel power switch
7	FP_RESET#	In	Front panel Reset button	8	GND		Ground
Miscellaneous				Miscellaneous			
9	+5 V	Out	Power	10	N/C	In	Not connected
11	N/C		Not connected	12	GND		Ground
13	GND		Ground	14	(Pin removed)		Not connected
15	N/C		Not connected	16	+5 V	Out	Power
17	+5 V		Power	18	N/C		Not connected

Table 30. Serial Port Connector (J7C1)

Pin	Signal Name	Pin	Signal Name
1	DCD (Data Carrier Detect)	2	DSR (Data Set Ready)
3	SIN # (Serial Data In)	4	RTS (Request to Send)
5	SOUT # (Serial Data Out)	6	CTS (Clear to Send)
7	DTR (Data Terminal Ready)	8	RI (Ring Indicator)
9	Ground	10	Key (no pin)

2.8.3.1 Power / Sleep / Message Waiting LED Connector

Pins 2 and 4 of the front panel connector can be connected to a single- or dual-colored LED. Table 31 shows the possible states for a single-colored LED. Table 32 shows the possible states for a dual-colored LED.

Table 31. States for a Single-colored Power LED

LED State	Description
Off	Power off
Steady Green	Running
Blinking Green	Running/message waiting

Table 32. States for a Dual-colored Power LED

LED State	Description
Off	Power off
Steady Green	Running
Blinking Green	Running/Message waiting
Steady Yellow	Sleeping
Blinking Yellow	Sleeping/Message waiting

NOTE

To use the message waiting function, ACPI must be enabled in the operating system and a message-capturing application must be invoked.

2.8.3.2 Power Switch Connector

Pins 6 and 8 of the front panel connector can be connected to a front panel power switch. The switch must pull the SW_ON# pin to ground for at least 50 ms to signal the power supply to switch on or off. (The time requirement is due to internal debounce circuitry on the board.) At least two seconds must pass before the power supply will recognize another on/off signal.

2.8.3.3 Hard Drive Activity LED Connector

Pins 1 and 3 of the front panel connector can be connected to an LED to provide a visual indicator that data is being read from or written to a hard drive. For the LED to function properly, an IDE drive must be connected to the onboard IDE interface.

2.8.3.4 Reset Switch Connector

Pins 5 and 7 of the front panel connector can be connected to a momentary SPST type switch that is normally open. When the switch is closed, the board resets and runs the POST.

2.9 Jumper Block

CAUTION

Do not move any jumpers with the power on. Always turn off the power and unplug the power cord from the computer before changing a jumper setting. Otherwise, the board could be damaged.

Figure 9 shows the location of the BIOS Setup jumper block. This 3-pin jumper block determines the BIOS Setup program's mode. Table 33 on page 52 describes the jumper settings for the three modes: normal, configure, and recovery.

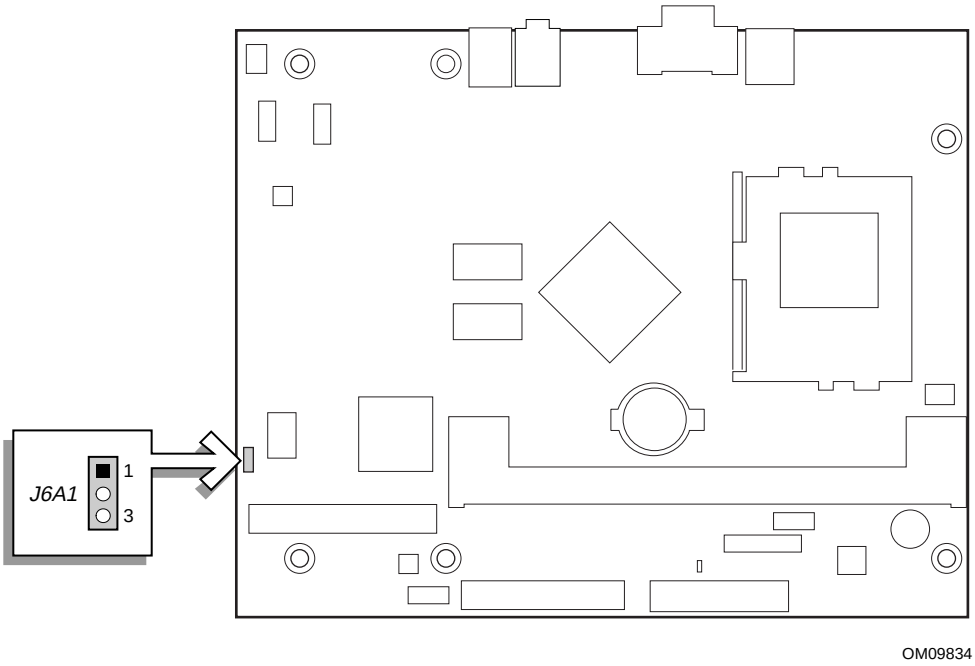
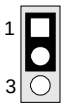
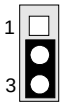
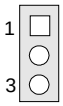


Figure 9. Location of the Jumper Block

Table 33. BIOS Setup Configuration Jumper Settings (J6A1)

Function/Mode	Jumper Setting	Configuration
Normal	1-2 	The BIOS uses current configuration information and passwords for booting.
Configure	2-3 	After the POST runs, Setup runs automatically. The maintenance menu is displayed.
Recovery	None 	The BIOS attempts to recover the BIOS configuration. A recovery diskette is required.

For information about	Refer to
How to access the BIOS Setup program	Section 4.1, page 75
The maintenance menu of the BIOS Setup program	Section 4.2, page 76
BIOS recovery	Section 3.6, page 70

2.10 Mechanical Considerations

2.10.1 FlexATX Form Factor

The board is designed to fit into an ATX- or microATX-form-factor chassis. Figure 10 illustrates the mechanical form factor for the board. Dimensions are given in inches [millimeters]. The outer dimensions are 9.0 inches by 7.2 inches (228.60 millimeters by 182.88 millimeters). Location of the I/O connectors and mounting holes is in compliance with the FlexATX addendum of the microATX specification (see Table 2, page 13).

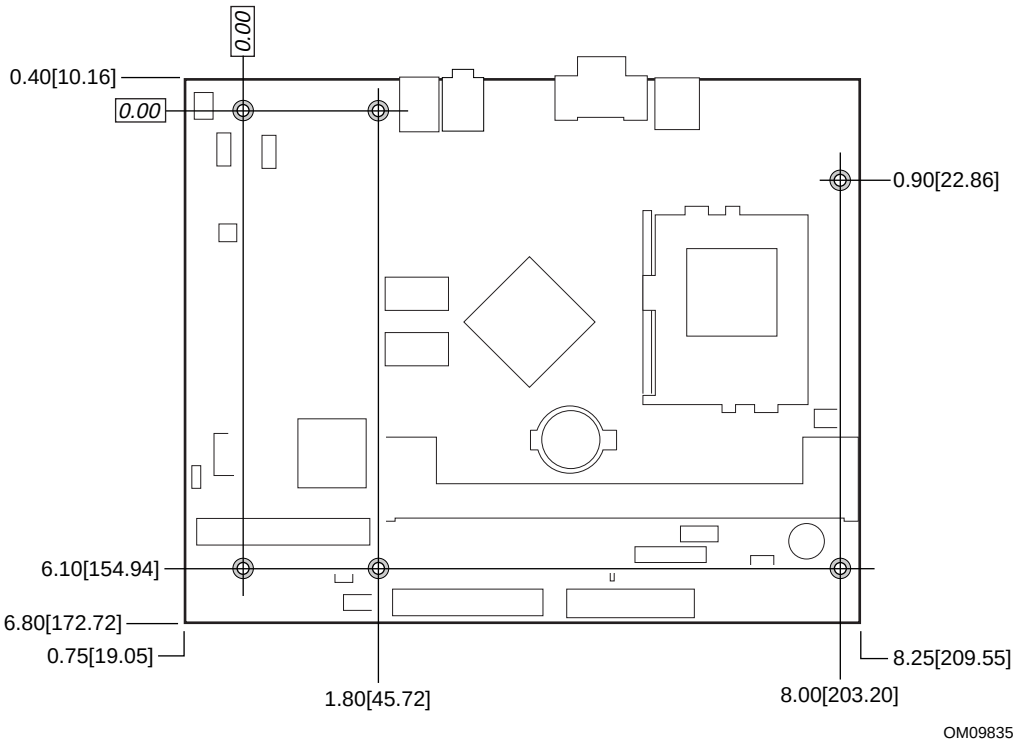


Figure 10. Board Dimensions

2.10.2 I/O Shield

The back panel I/O shield for the board must meet specific dimension and material requirements. Systems based on this board need the back panel I/O shield to pass certification testing. Figure 11 shows the critical dimensions of the I/O shield. Dimensions are given in inches [millimeters]. For dimensions given to two decimal places, the tolerance is ±0.02 inches; for dimensions given to three decimal places, the tolerance is ±0.010 inches [0.254 millimeters]. The figure indicates the position of each cutout. Additional design considerations for I/O shields relative to chassis requirements are described in the ATX specification. See Table 2, page 13 for information about the ATX specification.

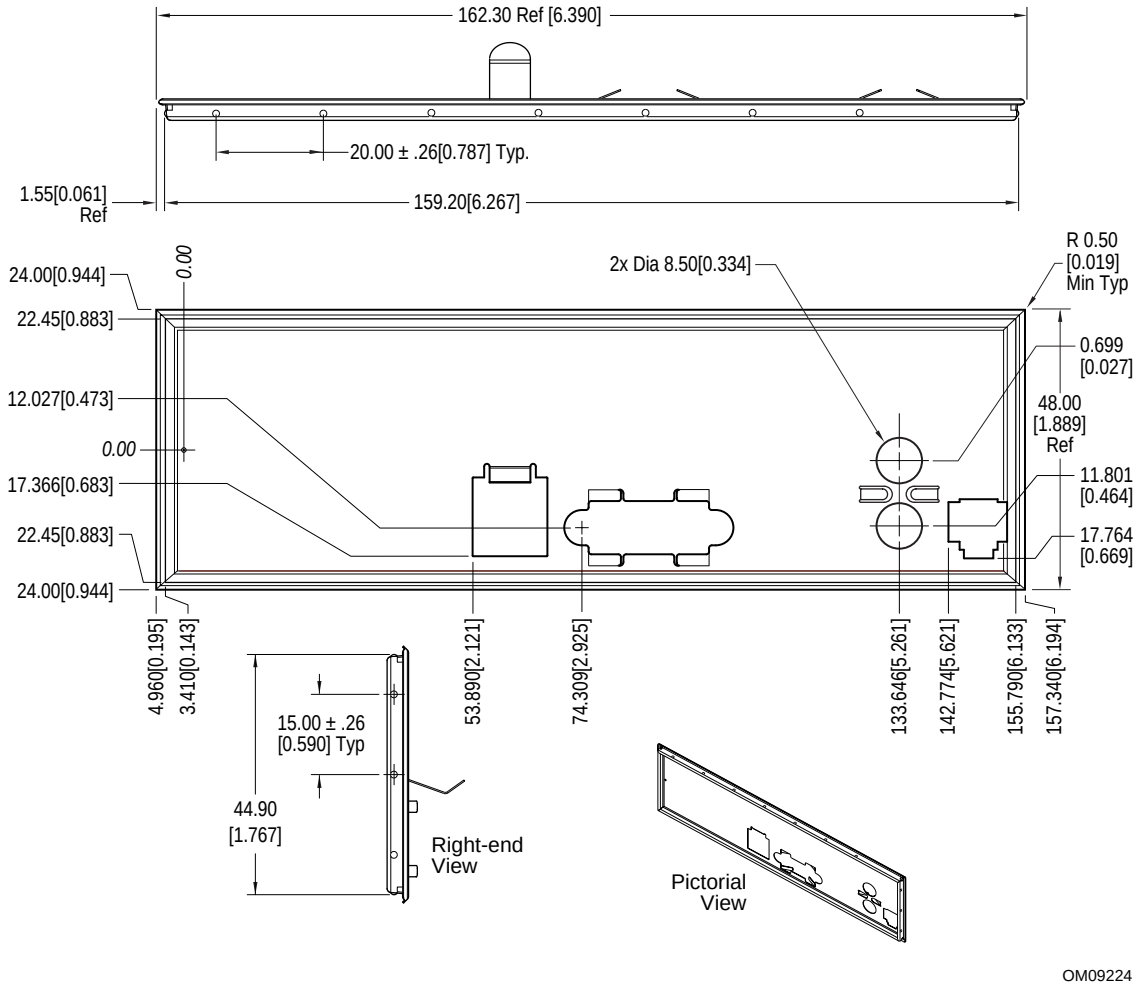


Figure 11. I/O Shield Dimensions

2.11 Electrical Considerations

2.11.1 Power Consumption

Table 34 lists voltage and current specifications for a computer that contains the board and the following:

- 700 MHz Intel Pentium III processor with a 256 KB cache
- 128 MB SDRAM
- 3.5-inch diskette drive
- 6.0 GB IDE hard disk drive
- 34X IDE CD-ROM drive

This information is provided only as a guide for calculating approximate power usage with additional resources added.

Values for the Windows 98 SE desktop mode are measured at 640 x 480 x 256 colors and 60 Hz refresh rate. AC watts are measured with a typical 145 W power supply, nominal input voltage and frequency, with true RMS wattmeter at the line input.

Table 34. Power Usage

Mode	AC Power	DC Current at:				
		+3.3 V	+5 V	+12 V	-12 V	+5 VSB
Windows 98 SE ACPI S0	31 W	1.54 A	0.48 A	0.167 A	-0.0162 A	0.196 A
Windows 98 SE ACPI S1	26 W	1.50 A	0.38 A	0.167 A	-0.0161 A	0.185 A
Windows 98 SE ACPI S3	3 W	0.0003 A	-0.0003 A	0.0002 A	0.0001 A	0.180 A
Windows 98 SE APM On	46 W	1.49 A	2.77 A	0.173 A	-0.016 A	0.228 A
Windows 98 SE APM 1*	33 W	1.43 A	2.75 A	0.173 A	-0.016 A	0.228 A
Windows 98 SE APM 2**	25 W	1.40 A	0.36 A	0.172 A	-0.016 A	0.196 A

* Video and hard drive timeout

** Start menu/Standby

2.11.2 Power Supply Considerations

System integrators should refer to the power usage values listed in Table 34 when selecting a power supply for use with this board. The power supply must comply with the following recommendations found in the ATX Specification (see Table 2, page 13):

- The potential relation between 3.3 VDC and +5 VDC power rails (Section 4.2)
- The current capability of the +5 VSB line (Section 4.2.1.2)
- All timing parameters (Section 4.2.1.3)
- All voltage tolerances (Section 4.2.2)

2.11.3 Fan Power Requirements

Table 35 lists the maximum DC voltage and current requirements for the chassis fan when the board is in normal operating mode, sleep mode, or Suspend-to-RAM state. Power consumption is independent of the operating system used and other variables.

Table 35. Chassis Fan (J1A1) DC Power Requirements

Mode	Voltage	Maximum Current
Normal (S0)	+12 VDC	0.132 A (current limited)
Sleep (S1)	+12 VDC	0.132 A (current limited)
Suspend-to-RAM (S3)	0.0 VDC	0.0 A

For information about	Refer to
The location of the chassis fan connector	Figure 7, page 44
The signal names of the chassis fan connector	Table 27, page 47

2.12 Thermal Considerations

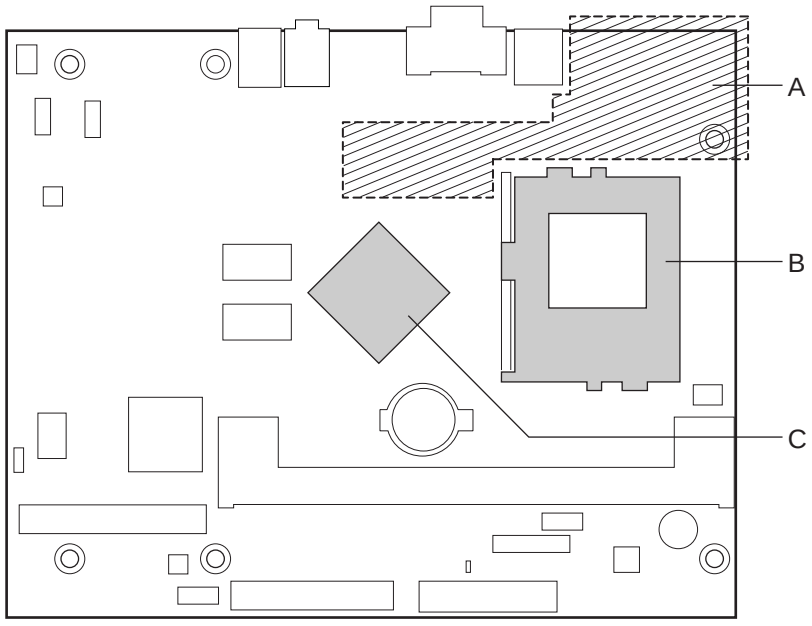
CAUTION

An ambient temperature that exceeds the board's maximum operating temperature by 5 °C to 10 °C could cause components to exceed their maximum case temperature and malfunction. For information about the maximum operating temperature, see the environmental specifications in Section 2.14.

CAUTION

The voltage regulator area can reach a temperature of up to 85 °C in an open chassis. System integrators should ensure that proper airflow is maintained in the voltage regulator area (item A in Figure 12). Failure to do so may result in damage to the voltage regulator circuit.

Figure 12 shows the localized high temperature zones.



A Processor voltage regulator area
B Processor
C Intel 82810 GMCH

Figure 12. High Temperature Zones

Table 36 provides maximum component case temperatures for board components that could be sensitive to thermal changes. Case temperatures could be affected by the operating temperature, current load, or operating frequency. Maximum case temperatures are important when considering proper airflow to cool the board.

Table 36. Thermal Considerations for Components

Component	Maximum Case Temperature
Intel Pentium III processor, 100 MHz host bus frequency	For processor case temperature, see processor datasheets and processor specification updates.
Intel Celeron processor	
Intel 82810 GMCH	70 °C
Intel 82801AA ICH	70 °C

For information about	Refer to
Intel Celeron processor datasheets and specification updates	Table 2, page 13
Intel Pentium III processor datasheets and specification updates	Table 2, page 13

2.13 Reliability

The mean time between failures (MTBF) prediction is calculated using component and subassembly random failure rates. The calculation is based on the Bellcore Reliability Prediction Procedure, TR-NWT-000332, Issue 4, September 1991. The MTBF prediction is used to estimate repair rates and spare parts requirements. MTBF data is calculated from predicted data at 55 ºC.

Board MTBF: 153,873 hours

2.14 Environmental

Table 37 lists the environmental specifications for the board.

Table 37. Board Environmental Specifications

Parameter	Specification		
Temperature			
Non-Operating	-40 °C to +70 °C		
Operating	0 °C to +55 °C		
Shock			
Unpackaged	30 g trapezoidal waveform		
	Velocity change of 170 inches/second		
Packaged	Half sine 2 millisecond		
	Product Weight (pounds)	Free Fall (inches)	Velocity Change (inches/sec)
	<20	36	167
	21-40	30	152
	41-80	24	136
	81-100	18	118
Vibration			
Unpackaged	5 Hz to 20 Hz: 0.01 g^2 Hz sloping up to 0.02 g^2 Hz		
	20 Hz to 500 Hz: 0.02 g^2 Hz (flat)		
Packaged	10 Hz to 40 Hz: 0.015 g^2 Hz (flat)		
	40 Hz to 500 Hz: 0.015 g^2 Hz sloping down to 0.00015 g^2 Hz		

2.15 Regulatory Compliance

This section describes the board's compliance with safety and EMC regulations.

2.15.1 Safety Regulations

Table 38 lists the safety regulations the board complies with when it is correctly installed in a compatible host system.

Table 38. Safety Regulations

Regulation	Title
UL 1950/CSA950, 2nd edition, Dated 26 February 1993	Bi-National Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (USA and Canada)
EN 60950, 2nd Edition, 1992 (with Amendments 1, 2, 3, and 4)	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (European Community)
IEC 950, 2nd edition, 1991 (with Amendments 1, 2, 3, and 4)	The Standard for Safety of Information Technology Equipment including Electrical Business Equipment. (International)
EMKO-TSE (74-SEC) 207/94	Summary of Nordic deviations to EN 60950. (Norway, Sweden, Denmark, and Finland)

2.15.2 EMC Regulations

Table 39 lists the EMC regulations the board complies with when it is correctly installed in a compatible host system.

Table 39. EMC Regulations

Regulation	Title
FCC Class B	Title 47 of the Code of Federal Regulations, Parts 2 and 15, Subpart B, pertaining to unintentional radiators. (USA)
CISPR 22, 2nd Edition, 1993 (Class B)	Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (International)
VCCI Class B (ITE)	Implementation Regulations for Voluntary Control of Radio Interference by Data Processing Equipment and Electronic Office Machines. (Japan)
EN55022 (1994) (Class B)	Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (Europe)
EN50082-1 (1992)	Generic Immunity Standard; Currently compliance is determined via testing to IEC 801-2, -3, and -4. (Europe)
ICES-003 (1997)	Interference-Causing Equipment Standard, Digital Apparatus, Class B (Including CRC c.1374). (Canada)
AS/NZ 3548	Australian Communications Authority (ACA), Standard for Electromagnetic Compatibility.

2.15.3 Telecommunications Regulations

Table 40 lists the telecommunications regulations the board complies with when it is correctly installed in a compatible host system.

Table 40. Telecommunications Regulations

Regulation	Title
FCC Part 68	Title 47 of the Code of Federal Regulations, Part 68, Connection of Terminal Equipment to the Telephone Network
CS 03 Issue 8 (1996)	Harmonized Requirements for Terminal Equipment, Terminal Systems, and Certified Protection Circuitry
CTR21	Council Decision 98/482/EC On a Common Technical Regulation for the Attachment Requirements for Connection to the Analogue Public Switched Telephone Networks (PSTNs) of Terminal Equipment (Excluding Terminal Equipment Supporting the Voice Telephony Justified Case Service) in Which Network Addressing, if Provided, is by Means of Dual Tone Multi-Frequency (DTMF) Signalling
ETSI Guide 201 121	Advisory Notes for CTR21
TS001	Safety Requirements for Customer Equipment
TS002	Analogue Interworking and Non-Interference
PTC200	Requirements for Analogue Telecommunications Equipment
TS PSTN1	Infocomm Development Authority (iDA) of Singapore Type Approval Specification for Connection of Terminal Equipment to Public Switched Telephone Network
PW-TFI	SIRIM
JATE Blue Book	For Analog Telephone Terminals

2.15.4 Telecommunications Regulatory Information

2.15.4.1 Safety

WARNING

To reduce the risk of fire, use only No. 26 AWG or larger telecommunication line cord.

Middle Path is the main construction option, developed to address the needs of the computer segment of the ITE/Telecom Industry. It allows basic construction features, which have a proven record of safety for the protection against over-voltage.

WARNING

Danger of explosion if the lithium battery is incorrectly replaced. Replace only with the same or equivalent type recommended by the manufacturer. Dispose of used batteries according to the manufacturer's instructions.

2.15.4.2 FCC Regulatory Information

The BA810 desktop board complies with Part 68 of the Federal Communications Commission Rules. The board has a label that contains, among other information, the FCC registration number, Facility Interface Code (FIC), ringer equivalence number (REN), and Service Order Code (SOC). This information must be provided to the telephone company.

FCC Registration No:	TBD
FIC:	TBD
REN:	TBD
SOC:	TBD
USOC Jack:	RJ-11 C Jack

An FCC-compliant telephone cord and modular plug must be provided with the board. The board is designed to be connected to the telephone network or premises wiring using a compatible modular jack which is Part 68 compliant. See installation instructions for details.

If the board causes harm to the telephone network, the telephone company will notify you in advance that temporary discontinuance of service may be required. But, if advance notice is not practical, the telephone company will notify the customer as soon as possible. Also, you will be advised of your right to file a complaint with the FCC if you believe it is necessary.

The telephone company may make changes in its facilities, equipment, operations, or procedures that could affect the operation of the board. If this happens, the telephone company will provide advance notice in order for you to make necessary modifications in order to maintain uninterrupted service.

If trouble is experienced with the board please contact Customer Support at 800-628-8086. If the board is causing harm to the network, the telephone company may request you to remove the board from the network until the problem is resolved.

No repairs are to be made by you. Repairs are to be made only by Intel Corporation or its licensees. Unauthorized repairs void registration and warranty.

The board cannot be used on public coin service provided by the telephone company. Connection to Party Line Service is subject to state tariffs. (Contact the state public utility commission, public service commission or corporation commission for information.)

We suggest the customer install an AC surge arrestor in the AC outlet to which the board is connected. Telephone companies report that electrical surges, typically lightning transients, are very destructive to customer terminal equipment connected to AC power sources and that this is a major nationwide problem.

2.15.4.3 Canadian Equipment Attachment Limitations

NOTE

The Industry Canada label identifies certified equipment. This certification means that the equipment meets telecommunications network protective, operational and safety requirements as prescribed in the appropriate Terminal Equipment Technical Requirements document(s). The department does not guarantee the equipment will operate to the user's satisfaction.

Before installing the BA810 desktop board, users should ensure that it is permissible to be connected to the facilities of the local telecommunications company. The board must also be installed using an acceptable method of connection. The customer should be aware that compliance with the above conditions may not prevent degradation of service in some situations.

Repairs to certified equipment should be coordinated by a representative designated by the supplier. Any repairs or alterations made by the user to this equipment, or equipment malfunctions, may give the telecommunications company cause to request the user to disconnect the equipment.

Users should ensure for their own protection that the electrical ground connections of the power utility, telephone lines and internal metallic water pipe system, if present, are connected together. This precaution may be particularly important in rural areas.

WARNING

Users should not attempt to make such connections themselves, but should contact the appropriate electric inspection authority, or electrician, as appropriate.

NOTE

The ringer equivalence number (REN) assigned to each terminal device provides an indication of the maximum number of terminals allowed to be connected to a telephone interface. The termination on an interface may consist of any combination of devices subject only to the requirement that the sum of the ringer equivalence numbers of all the devices does not exceed 5.

2.15.4.4 New Zealand Requirements

2.15.4.4.1 General Warning

The grant of a Telepermit for any item of terminal equipment indicates only that Telecom has accepted that the item complies with minimum conditions for connection to its network. It indicates no endorsement of the product by Telecom, nor does it provide any sort of warranty. Above all, it provides no assurance that any item will work correctly in all respects with another item of Telepermitted equipment of a different make or model, nor does it imply that any product is compatible with all of Telecom's network services.

The BA810 desktop board shall not be set up to make automatic calls to the Telecom '111' Emergency Service.

NOTE

Under power failure conditions, this telephone device may not operate. Please ensure that a separate telephone device, not dependent on local power, is available for emergency use.

Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. The associated equipment shall be set to operate within the following limits for compliance with Telecom's specifications:

(a) There shall be no more than 10 calls to the same number within any 30 minute period for any single manual call initiation, and

(b) The equipment shall go on-hook for a period of not less than 30 seconds between the end of one attempt and the beginning of the next attempt.

Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. In order to operate within the limits for compliance with Telecom's specifications, the associated equipment shall be set to ensure that automatic calls to different numbers are spaced such that there is no less than 5 seconds between the end of one call attempt and the beginning of another.

Some parameters required for compliance with Telecom's Telepermit requirements are dependent on the equipment (PC) associated with this device. In order to operate within the limits for compliance with Telecom's specifications, the associated equipment shall be set to ensure that calls are answered between 3 and 30 seconds of receipt of ringing.

2.15.4.4.2 Compliance Testing (6) and (7) (Functional Tests)

This equipment is not capable, under all operating conditions, of correct operation at the higher speeds for which it is designed. Telecom will accept no responsibility should difficulties arise in such circumstances.

2.15.5 Certification Markings

This printed circuit assembly has the following product certification markings:

- UL Joint Recognition Mark: Consists of small c followed by a stylized backward UR and followed by a small US (Component side).
- Manufacturer's recognition mark: Consists of a unique UL recognized manufacturer's logo, along with a flammability rating (94V-0) (Solder side).
- UL File Number for desktop boards: E139761 (Component side).
- PB Part Number: Intel bare circuit board part number (Solder side) A02613-003.
- Battery "+ Side Up" marking: located on the component side of the board in close proximity to the battery holder.
- FCC Part 15 Class B Logo/Declaration: (Solder side).
- FCC Part 68 Declaration: Includes the part 68 certificate number of the format EJMxxx-xxxxx-xx-x, followed by the REN number in the format x.xB. In addition for Canadian compliance add the Canadian REN number in the format x.xA.
- ACA (A-Tick) mark: Consists of a unique triangle, with a tick mark; followed by N-232. Located on the component side of the board and on the shipping container.
- CE Mark with CTR21 additions: (Component side) This mark consists of the CE mark followed by the number of the Notified Body that approved the product followed by the CTR21 symbol of "crossed hockey sticks". The CE mark should also be on the shipping container. The additions for CTR21 (Notified Body number and "crossed hockey sticks") are not required on the shipping container.

There are requirements for some countries in addition to the silk-screened items above. Some of these requirements are additional labels that cannot be silk-screened onto the board, including the following:

- The Canadian Telecommunication Label must be affixed to the board. These are purchased separately from Canada.
- The Telepermit label must be on the board. It can be incorporated into a label that contains other approval marks. It has color requirements. See Telepermit for size and color requirements. There is an approval number in the format PTCxxx/xx/xxx.
- The TAS label or mark must be on the board. It can be incorporated into a label that contains other approval marks. There is an approval number in the format xxxxx-xxxx-xx-xxxx-xx.
- The Japan Telecom label must be on the board. It can be incorporated into a label that contains other approval marks. There is an approval number in the format xxx-xxxx-x.

3 Overview of BIOS Features

What This Chapter Contains

3.1 Introduction

The board uses an Intel/AMI BIOS, which is stored in flash memory and can be updated using a disk-based program. In addition to the BIOS, the flash memory contains the BIOS Setup program, POST, the PCI auto-configuration utility, and Plug and Play support.

This board supports system BIOS shadowing, allowing the BIOS to execute from 64-bit onboard write-protected DRAM.

The BIOS displays a message during POST identifying the type of BIOS and a revision code. The initial production BIOS is identified as BA81010A.86A.

For information about	Refer to
The board's compliance level with Plug and Play	Table 2, page 13

3.2 BIOS Flash Memory Organization

The Intel 82802AB Firmware Hub (FWH) includes a 4 Mbit (512 KB) symmetrical flash memory device. Internally, the device is grouped into eight 64 KB blocks that are individually erasable, lockable, and unlockable. Figure 13 shows the organization of the flash memory.

The last two 8 KB blocks of the fault tolerance area are the parameter blocks. These blocks contain data such as BIOS updates, vital product data (VPD), logo, System Management BIOS (SMBIOS) interface, and extended system configuration data (ESCD) information. The backup block contains a copy of the fault tolerance block.

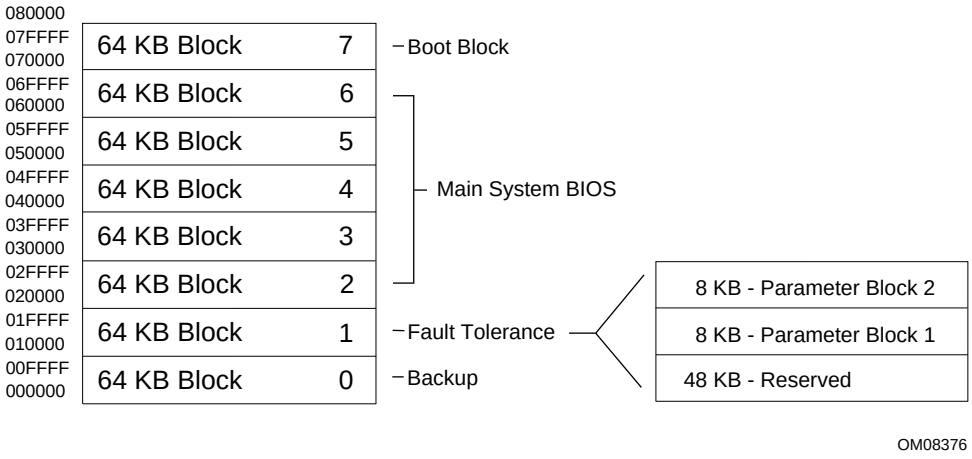


Figure 13. Memory Map of the Flash Memory Device

3.3 Resource Configuration

3.3.1 PCI Autoconfiguration

The BIOS can automatically configure PCI devices. When a user turns on the system, the BIOS automatically configures interrupts, the I/O space, and other system resources. Onboard PCI devices can share an interrupt. Autoconfiguration information is stored in ESCD format.

For information about	Refer to
The BIOS's compliance level with Plug and Play	Table 2, page 13

3.3.2 PCI IDE Support

If you select Auto in the BIOS Setup program, the BIOS automatically sets up the PCI IDE connector with independent I/O channel support. The IDE interface supports hard drives up to ATA-66 and recognizes any ATAPI devices, including CD-ROM drives, tape drives, and Ultra DMA drives. The BIOS determines the capabilities of each drive and configures them to optimize capacity and performance. To take advantage of the high capacities typically available today, hard drives are automatically configured for Logical Block Addressing (LBA) and to PIO Mode 3 or 4, depending on the capability of the drive. You can override the auto-configuration options by specifying manual configuration in the BIOS Setup program.

To use ATA-66 features the following items are required:

- An ATA-66 peripheral device
- An ATA-66 compatible cable
- ATA-66 operating system device drivers

NOTE

ATA-66 compatible cables are backward compatible with drivers using slower IDE transfer protocols. If an Ultra ATA-66 disk drive and a disk drive using any other IDE transfer protocol are attached to the same cable, the maximum transfer rate for either drive is 33 MB/sec.

NOTE

Do not connect an ATA device as a slave on the same IDE cable as an ATAPI master device. For example, do not connect an ATA hard drive as a slave to an ATAPI CD-ROM drive.

3.4 System Management BIOS (SMBIOS)

SMBIOS is a Desktop Management Interface (DMI) compliant method for managing computers in a managed network.

The main component of SMBIOS is the Management Information Format (MIF) database, which contains information about the computing system and its components. Using SMBIOS, a system administrator can obtain the system types, capabilities, operational status, and installation dates for system components. The MIF database defines the data and provides the method for accessing this information. The BIOS enables applications such as Intel® LANDesk® Client Manager to use SMBIOS. The BIOS stores and reports the following SMBIOS information:

- BIOS data, such as the BIOS revision level
- Fixed-system data, such as peripherals, serial numbers, and asset tags
- Resource data, such as memory size, cache size, and processor speed
- Dynamic data, such as event detection and error logging

Non-Plug and Play operating systems, such as Windows NT†, require an additional interface for obtaining the SMBIOS information. The BIOS supports an SMBIOS table interface for such operating systems. Using this support, an SMBIOS service-level application running on a non-Plug and Play operating system can obtain the SMBIOS information.

For information about	Refer to
The board's compliance level with SMBIOS	Table 2, page 13

3.5 BIOS Updates

A new version of the BIOS can be updated from a diskette using the Intel® Flash Memory Update Utility that is available from Intel. This utility supports the following BIOS maintenance functions:

- Update the flash BIOS from a file on a diskette
- Change the language section of the BIOS
- Verify that the updated BIOS matches the target system to prevent accidentally installing an incompatible BIOS
- Update BIOS boot block
- Update Video BIOS
- Insert a user logo

BIOS updates and the Intel Flash Memory Update Utility are available from Intel through the Intel World Wide Web site.

NOTE

Please review the instructions distributed with the update utility before attempting a BIOS update.

For information about	Refer to
The Intel World Wide Web site	Section 1.2, page 13

3.5.1 Language Support

The BIOS Setup program and help messages are supported in five languages: US English, German, Italian, French, and Spanish. The default language is US English, which is present unless another language is selected in the BIOS Setup program.

3.5.2 Custom Splash Screen

During POST, an Intel splash screen is displayed by default. This splash screen can be replaced with a custom splash screen. A utility is available from Intel to assist with creating a custom splash screen. The custom splash screen can be programmed into the flash memory using the BIOS update utility. Information about this capability is available on the Intel Support World Wide Web site.

For information about	Refer to
The Intel World Wide Web site	Section 1.2, page 13

3.6 Recovering BIOS Data

Some types of failure can destroy the BIOS. For example, the data can be lost if a power outage occurs while the BIOS is being updated in flash memory. The BIOS can be recovered from a diskette using the BIOS recovery mode. When recovering the BIOS, be aware of the following:

- Because of the small amount of code available in the nonerasable boot block area, there is no video support. You can only monitor this procedure by listening to the speaker or looking at the diskette drive LED.
- The recovery process may take several minutes; larger BIOS flash memory devices require more time.
- A single beep indicates the beginning of the BIOS recovery process.
- Two beeps and the end of activity in the diskette drive indicate successful BIOS recovery.
- A series of continuous beeps indicates a failed BIOS recovery.

To create a BIOS recovery diskette, a bootable diskette must be created and the BIOS update files copied to it. BIOS updates and the Intel Flash Memory Update Utility are available from Intel Customer Support through the Intel World Wide Web site.

NOTE

BIOS Recovery cannot be accomplished using a non-SPD DIMM. SPD data structure is required for the recovery process.

NOTE

If the computer is configured to boot from an LS-120 diskette (in the Removable Devices submenu), the BIOS recovery diskette must be a standard 1.44 MB diskette not a 120 MB diskette.

For information about	Refer to
The BIOS recovery mode	Section 2.9, page 51
The Boot menu in the BIOS Setup program	Section 4.7, page 87
Contacting Intel customer support	Section 1.2, page 13

3.7 Boot Options

In the BIOS Setup program, the user can choose to boot from a diskette drive, hard drives, or a CD-ROM drive. The default setting is for the diskette drive to be the primary boot device and the hard drive to be the secondary boot device. By default, the fourth device is disabled.

3.7.1 Booting from CD-ROM

Booting from CD-ROM is supported in compliance to the El Torito bootable CD-ROM format specification.

For information about	Refer to
The El Torito specification	Table 2, page 13

3.7.2 Booting Without Attached Devices

For use in embedded applications, the BIOS has been designed so that after passing the POST, the operating system loader is invoked even if the keyboard and mouse are not present.

3.8 USB Legacy Support

USB legacy support enables USB keyboards, mice, and hubs to be used even when no operating system USB drivers are in place. USB legacy support is used in accessing the BIOS Setup program and installing an operating system that supports USB. USB legacy support is automatically enabled whenever a USB device is connected to a USB port. This sequence describes how USB legacy support operates:

1. When you power up the computer, USB legacy support is enabled if a USB device is connected to a USB port.
2. POST begins.
3. USB legacy support is still enabled by the BIOS. This allows you to use a USB keyboard to enter the BIOS Setup program or the maintenance mode.
4. POST completes.
5. The operating system loads. While the operating system is loading, USB keyboards and mice are recognized. After the operating system loads the USB drivers, the USB devices are recognized by the operating system.

To install an operating system that supports USB, follow the operating system's installation instructions. Once the operating system is installed and the USB drivers have been configured, USB legacy support is no longer used.

Notes on using USB legacy support:

- Do not use USB devices with an operating system that does not support USB. USB legacy is not intended to support the use of USB devices in a non-USB aware operating system.
- USB legacy support is for keyboards, mice, and hubs only. Other USB devices are not supported.

3.9 BIOS Security Features

The BIOS includes security features that restrict access to the BIOS Setup program and who can boot the computer. A supervisor password and a user password can be set for the BIOS Setup program and for booting the computer, with the following restrictions:

- The supervisor password gives unrestricted access to view and change all the Setup options in the BIOS Setup program. This is supervisor mode.
- The user password gives restricted access to view and change Setup options in the BIOS Setup program. This is user mode.
- If only the supervisor password is set, pressing the <Enter> key at the password prompt of the BIOS Setup program allows the user restricted access to Setup.
- If both the supervisor and user passwords are set, users can enter either the supervisor password or the user password to access Setup. Users have access to Setup respective to which password is entered.
- Setting the user password restricts who can boot the computer. The password prompt will be displayed before the computer is booted. If only the supervisor password is set, the computer boots without asking for a password. If both passwords are set, the user can enter either password to boot the computer.

Table 41 shows the effects of setting the supervisor password and user password. This table is for reference only and is not displayed on the screen.

Table 41. Supervisor and User Password Functions

Password Set	Supervisor Mode	User Mode	Setup Options	Password to Enter Setup	Password During Boot
Neither	Can change all options*	Can change all options*	None	None	None
Supervisor only	Can change all options	Can change a limited number of options	Supervisor Password	Supervisor	None
User only	N/A	Can change all options	Enter Password Clear User Password	User	User
Supervisor and user set	Can change all options	Can change a limited number of options	Supervisor Password Enter Password	Supervisor or user	Supervisor or user

* If no password is set, any user can change all Setup options.

For information about	Refer to
Setting user and supervisor passwords	Table 53, page 85

4 BIOS Setup Program

What This Chapter Contains

4.1 Introduction

The BIOS Setup program can be used to view and change the BIOS settings for the computer. The BIOS Setup program is accessed by pressing the <F2> key after the Power-On Self-Test (POST) memory test begins and before the operating system boot begins. The menu bar is shown below.

Maintenance	Main	Advanced	Security	Power	Boot	Exit

Table 42 lists the BIOS Setup program menu functions.

Table 42. BIOS Setup Program Menu Bar

Maintenance	Main	Advanced	Security	Power	Boot	Exit
Clears passwords and enables extended configuration mode	Allocates resources for hardware components	Configures advanced features available through the chipset	Sets passwords and security features	Configures power management features	Selects boot options and power supply controls	Saves or discards changes to Setup program options

NOTE

In this chapter, all examples of the BIOS Setup Program menu bar include the maintenance menu; however, the maintenance menu is displayed only when the board is in configuration mode. Section 2.9 on page 51 tells how to put the board in configuration mode.

Table 43 lists the function keys available for menu screens.

Table 43. BIOS Setup Program Function Keys

BIOS Setup Program Function Key	Description
<←> or <→>	Selects a different menu screen
<↑> or <↓>	Selects an item
<Tab>	Selects a field
<Enter>	Executes command or selects a submenu
<F9>	Load the default configuration values for the current menu
<F10>	Save the current values and exits the BIOS Setup program
<Esc>	Exits the menu

4.2 Maintenance Menu

To access this menu, select Maintenance on the menu bar at the top of the screen.

The menu shown in Table 44 is for clearing Setup passwords. Setup only displays this menu in configuration mode. See Section 2.9 on page 51 for configuration mode setting information.

Table 44. Maintenance Menu

Feature	Options	Description
Clear All Passwords	No options	Clears the user and supervisor passwords

4.3 Main Menu

To access this menu, select Main on the menu bar at the top of the screen.

Maintenance	**Main**	Advanced	Security	Power	Boot	Exit

Table 45 describes the Main Menu. This menu reports processor and memory information and is for configuring the system date and system time.

Table 45. Main Menu

Feature	Options	Description
BIOS Version	No options	Displays the version of the BIOS.
Processor Type	No options	Displays processor type.
Processor Speed	No options	Displays processor speed.
System Bus Frequency	No options	Displays system bus frequency.
Cache RAM	No options	Displays the size of second-level cache.
Total Memory	No options	Displays the total amount of RAM on the board.
Memory Bank 0	No options	Displays type of DIMM installed in each memory bank.
Processor Serial Number*	• **Disabled (default)** • Enabled	Enables or disables the Intel Pentium III processor serial number feature.
System Time	Hour, minute, and second	Specifies the current time.
System Date	Month, day, and year	Specifies the current date.

* This feature appears only if a Pentium III processor is installed.

4.4 Advanced Menu

To access this menu, select Advanced on the menu bar at the top of the screen.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration
Diskette Configuration
Event Log Configuration

Table 46 describes the Advanced Menu. This menu is used for setting advanced features that are available through the chipset.

Table 46. Advanced Menu

Feature	Options	Description
Boot Configuration	No options	Configures Plug and Play and the Numlock key, and resets configuration data. When selected, displays the Boot Settings Configuration submenu.
Peripheral Configuration	No options	Configures peripheral ports and devices. When selected, displays the Peripheral Configuration submenu.
IDE Configuration	No options	Specifies type of connected IDE device.
Diskette Configuration	No options	When selected, displays the Floppy Options submenu.
Event Log Configuration	No options	Configures Event Logging. When selected, displays the Event Log Configuration submenu.

4.4.1 Boot Configuration Submenu

To access this submenu, select Advanced on the menu bar, then Boot Configuration.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration
Diskette Configuration
Event Log Configuration

The submenu represented by Table 47 is for setting Plug and Play options, resetting configuration data, and the power-on state of the Numlock key.

Table 47. Boot Configuration Submenu

Feature	Options	Description
Plug & Play O/S	• **No (default)** • Yes	Specifies if a Plug and Play operating system is being used. *No* lets the BIOS configure all devices. *Yes* lets the operating system configure Plug and Play devices. Not required with a Plug and Play operating system.
Reset Config Data	• **No (default)** • Yes	Clears the BIOS configuration data on the next boot.
Numlock	• Off • **On (default)**	Specifies the power on state of the Numlock feature on the numeric keypad of the keyboard.

4.4.2 Peripheral Configuration Submenu

To access this submenu, select Advanced on the menu bar, then Peripheral Configuration.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration
Diskette Configuration
Event Log Configuration

The submenu represented in Table 48 is used for configuring computer peripherals.

Table 48. Peripheral Configuration Submenu

Feature	Options	Description
Serial port A	• **Auto (default)** • Disabled • 3F8/COM1 • 2F8/COM2 • 3E8/COM3 • 2E8/COM4	Configures serial port A. *Auto* assigns the first free COM port, normally COM1 at I/O address 3F8h.
Audio Device	• Disabled • **Enabled (default)**	Enables or disables the onboard audio subsystem.
Modem Device	• Disabled • **Enabled (default)**	Enables or disables the onboard modem device.

4.4.3 IDE Configuration

To access this submenu, select Advanced on the menu bar, then IDE Configuration.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration Primary IDE Master Primary IDE Slave
Diskette Configuration
Event Log Configuration

The menu represented in Table 49 is used to configure IDE device options.

Table 49. IDE Device Configuration

Feature	Options	Description
IDE Controller	• Disabled • **Enabled (default)**	Enables or disables the integrated IDE controller.
Hard Disk Pre-Delay	• **Disabled (default)** • 3 Seconds • 6 Seconds • 9 Seconds • 12 Seconds • 15 Seconds • 21 Seconds • 30 Seconds	Specifies the hard disk drive pre-delay.
▸ Primary IDE Master	No options	Reports type of connected IDE device. When selected, displays the Primary IDE Master submenu.
▸ Primary IDE Slave	No options	Reports type of connected IDE device. When selected, displays the Primary IDE Slave submenu.

4.4.3.1 Primary IDE Master/Slave Submenus

To access these submenus, select Advanced on the menu bar, then IDE Configuration and then the master or slave to be configured.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration **Primary IDE Master** **Primary IDE Slave**
Diskette Configuration
Event Log Configuration

There are two IDE submenus: primary master and primary slave. Table 50 shows the format of the IDE submenus. For brevity, only one example is shown.

Table 50. Primary IDE Master/Slave Submenus

Feature	Options	Description
Type	• None • User • **Auto (default)** • CD-ROM • ATAPI Removable • Other ATAPI • IDE Removable	Specifies the IDE configuration mode for IDE devices. *User* allows the cylinders, heads, and sectors fields to be changed. *Auto* automatically fills in the values for the cylinders, heads, and sectors fields.
LBA Mode Control	• Disabled • **Enabled (default)**	Enables or disables the LBA mode control.
Multi-Sector Transfers	• Disabled • 2 Sectors • 4 Sectors • 8 Sectors • **16 Sectors (default)**	Specifies number of sectors per block for transfers from the hard disk drive to memory. Check the hard disk drive's specifications for optimum setting.
PIO Mode	• **Auto (default)** • 0 • 1 • 2 • 3 • 4	Specifies the method for moving data to/from the drive.
Ultra DMA	• **Disabled (default)** • Mode 0 • Mode 1 • Mode 2 • Mode 3 • Mode 4	Specifies the Ultra DMA mode for the drive.

4.4.4 Diskette Configurations Submenu

To access this submenu, select Advanced on the menu bar, then Diskette Configuration.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration
Diskette Configuration
Event Log Configuration

The submenu represented by Table 51 is used for configuring the diskette drive.

Table 51. Diskette Configurations Submenu

Feature	Options	Description
Diskette Controller	• Disabled • **Enabled (default)**	Enables or disables the integrated diskette controller.
Diskette A	• Not Installed • 360 KB 5¼ " • 1.2 MB 5¼ " • 720 KB 3½ " • **1.44/1.25 MB 3½ " (default)** • 2.88 MB 3½ "	Specifies the capacity and physical size of diskette drive A.
Diskette Write Protect	• **Disabled (default)** • Enabled	Enables or disables write protect for the diskette drive.

4.4.5 Event Log Configuration

To access this submenu, select Advanced on the menu bar, then Event Log Configuration.

Maintenance	Main	**Advanced**	Security	Power	Boot	Exit

Boot Configuration
Peripheral Configuration
IDE Configuration
Diskette Configuration
Event Log Configuration

The submenu represented by Table 52 is used to configure the event logging features.

Table 52. Event Log Configuration Submenu

Feature	Options	Description
Event log	No options	Indicates if there is space available in the event log.
Event log validity	No options	Indicates if the contents of the event log are valid.
View event log	[Enter]	Displays the event log.
Clear all event logs	• **No (default)** • Yes	Clears the event log after rebooting.
Event Logging	• Disabled • **Enabled (default)**	Enables logging of events.
Mark events as read	[Enter]	Marks all events as read.

4.5 Security Menu

To access this menu, select Security from the menu bar at the top of the screen.

Maintenance	Main	Advanced	**Security**	Power	Boot	Exit

The menu represented by Table 53 is for setting passwords and security features.

Table 53. Security Menu

Feature	Options	Description
Supervisor Password Is	No options	Reports if there is a supervisor password set.
User Password Is	No options	Reports if there is a user password set.
Set Supervisor Password	Password can be up to seven alphanumeric characters.	Specifies the supervisor password.
Set User Password	Password can be up to seven alphanumeric characters.	Specifies the user password.
Clear User Password*	[Enter]	Clears the user password.
User Access Level**	• Limited • No Access • View Only • **Full (default)**	Sets BIOS Setup Utility access rights for user level.
Unattended Start*	• **Disabled (default)** • Enabled	The keyboard remains locked until a password is entered.

* This feature appears only if a user password has been set.

** This feature appears only if both a user password and a supervisor password have been set.

4.6 Power Menu

To access this menu, select Power from the menu bar at the top of the screen.

Maintenance	Main	Advanced	Security	**Power**	Boot	Exit

The menu represented in Table 54 is for setting the power management features.

Table 54. Power Menu

Feature	Options	Description
Power Management*	• Disabled • **Enabled (default)**	Enables or disables the BIOS power management feature.
Inactivity Timer*	• Off • 1 minute • 5 minutes • 10 minutes • **20 minutes (default)** • 30 minutes • 60 minutes • 120 minutes	Specifies the amount of time before the computer enters standby mode, when APM power management is active.
Hard Drive*	• Disabled • **Enabled (default)**	Enables or disables power management for hard disks during standby and suspend modes, when APM power management is active.
Video Power Down*	• Disabled • StandBy • **Suspend (default)** • Sleep	Specifies power management for video during standby and suspend modes, when APM power management is active.
ACPI Suspend State	• **S1 State (default)** • S3 State	Specifies the ACPI suspend state.

* Power Management, Inactivity Timer, Hard Drive, and Video Power Down features apply only for APM operating systems.

4.7 Boot Menu

To access this menu, select Boot from the menu bar at the top of the screen.

Maintenance	Main	Advanced	Security	Power	**Boot**	Exit

The menu represented in Table 55 is used to set the boot features and the boot sequence.

Table 55. Boot Menu

Feature	Options	Description
Quiet Boot	• Disabled • **Enabled (default)**	*Disabled* displays normal POST messages. *Enabled* displays OEM logo instead of POST messages.
Quick Boot	• Disabled • **Enabled (default)**	Enables the computer to boot without running certain POST tests.
Scan User Flash Area	• **Disabled (default)** • Enabled	Enables the BIOS to scan the flash memory for user binary files that are executed at boot time.
After Power Failure	• Stays Off • **Last State (default)** • Power On	Specifies the mode of operation if an AC/Power loss occurs. *Stay Off* keeps the power off until the power button is pressed. *Last State* restores the previous power state before power loss occurred. *Power On* restores power to the computer.
On Modem Ring	• **Stay Off (default)** • Power On	Specifies how the computer responds to an incoming call on an installed modem when the power is off.
First Boot Device Second Boot Device Third Boot Device Fourth Boot Device	• Floppy • ARMD-FDD* • ARMD-HDD** • IDE-HDD*** • ATAPI CDROM • Disabled	Specifies the boot sequence from the available devices. To specify boot sequence: 1. Select the boot device with <↑> or <↓>. 2. Press <Enter> to set the selection as the intended boot device. The operating system assigns a drive letter to each boot device in the order listed. Changing the order of the devices changes the drive lettering. Not all of the devices in this list are available as second, third, and fourth boot devices. The default settings for the first through fourth boot devices are, respectively: • Floppy • IDE-HDD • ATAPI CDROM • Disabled
IDE Drive Configuration	• Primary Master IDE **1st IDE (default)** • Primary Slave IDE 2nd IDE	Selects the IDE boot device. If selected, allows the slave IDE device to be the boot device.

* ARMD-FDD = ATAPI removable device - floppy disk drive

** ARMD-HDD = ATAPI removable device - hard disk drive

*** HDD = Hard Disk Drive

4.8 Exit Menu

To access this menu, select Exit from the menu bar at the top of the screen.

Maintenance	Main	Advanced	Security	Power	Boot	**Exit**

The menu represented in Table 56 is for exiting the BIOS Setup program, saving changes, and loading and saving defaults.

Table 56. Exit Menu

Feature	Description
Exit Saving Changes	Exits and saves the changes in CMOS SRAM.
Exit Discarding Changes	Exits without saving any changes made in the BIOS Setup program.
Load Setup Defaults	Loads the factory default values for all the Setup options.
Load Custom Defaults	Loads the custom defaults for Setup options.
Save Custom Defaults	Saves the current values as custom defaults. Normally, the BIOS reads the Setup values from flash memory. If this memory is corrupted, the BIOS reads the custom defaults. If no custom defaults are set, the BIOS reads the factory defaults.
Discard Changes	Discards changes without exiting Setup. The option values present when the computer was turned on are used.

5 Error Messages and Beep Codes

What This Chapter Contains

5.1 BIOS Error Messages

Table 57 lists the error messages and provides a brief description of each.

Table 57. BIOS Error Messages

Error Message	Explanation
GA20 Error	An error occurred with Gate-A20 when switching to protected mode during the memory test.
Pri Master HDD Error Pri Slave HDD Error	Could not read sector from corresponding drive.
Pri Master Drive - ATAPI Incompatible Pri Slave Drive - ATAPI Incompatible	Corresponding drive in not an ATAPI device. Run Setup to make sure device is selected correctly.
A: Drive Error	No response from diskette drive.
Cache Memory Bad	An error occurred when testing L2 cache. Cache memory may be bad.
CMOS Battery Low	The battery may be losing power. Replace the battery soon.
CMOS Display Type Wrong	The display type is different than what has been stored in CMOS. Check Setup to make sure type is correct.
CMOS Checksum Bad	The CMOS checksum is incorrect. CMOS memory may have been corrupted. Run Setup to reset values.
CMOS Settings Wrong	CMOS values are not the same as the last boot. These values have either been corrupted or the battery has failed.
CMOS Date/Time Not Set	The time and/or date values stored in CMOS are invalid. Run Setup to set correct values.
DMA Error	Error during read/write test of DMA controller.
FDC Failure	Error occurred trying to access diskette drive controller.
HDC Failure	Error occurred trying to access hard disk controller.

continued

Table 57. BIOS Error Messages (continued)

Error Message	Explanation
Checking NVRAM.....	NVRAM is being checked to see if it is valid.
Update OK!	NVRAM was invalid and has been updated.
Updated Failed	NVRAM was invalid but was unable to be updated.
Keyboard Is Locked	The system keyboard lock is engaged. The system must be unlocked to continue to boot.
Keyboard Error	Error in the keyboard connection. Make sure keyboard is connected properly.
KB/Interface Error	Keyboard interface test failed.
Memory Size Decreased	Memory size has decreased since the last boot. If no memory was removed then memory may be bad.
Memory Size Increased	Memory size has increased since the last boot. If no memory was added there may be a problem with the system.
Memory Size Changed	Memory size has changed since the last boot. If no memory was added or removed then memory may be bad.
No Boot Device Available	System did not find a device to boot.
Off Board Parity Error	A parity error occurred on an offboard card. This error is followed by an address.
On Board Parity Error	A parity error occurred in onboard memory. This error is followed by an address.
Parity Error	A parity error occurred in onboard memory at an unknown address.
<CTRL_N> Pressed	CMOS is ignored and NVRAM is cleared. User must enter Setup.

5.2 Bus Initialization Checkpoints

The system BIOS gives control to the different buses at several checkpoints to do various tasks. Table 58 describes the bus initialization checkpoints.

Table 58. Bus Initialization Checkpoints

Checkpoint	Description
2A	Different buses init (system, static, and output devices) to start if present.
38	Different buses init (input, IPL, and general devices) to start if present.
39	Display different buses initialization error messages.
95	Init of different buses optional ROMs from C800 to start.

While control is inside the different bus routines, additional checkpoints are output to port 80h as WORD to identify the routines under execution. In these WORD checkpoints, the low byte of the checkpoint is the system BIOS checkpoint from which the control is passed to the different bus routines. The high byte of the checkpoint is the indication of which routine is being executed in the different buses. Table 59 describes the upper nibble of the high byte and indicates the function that is being executed.

Table 59. Upper Nibble High Byte Functions

Value	Description
0	func#0, disable all devices on the bus concerned
1	func#1, static devices init on the bus concerned
2	func#2, output device init on the bus concerned
3	func#3, input device init on the bus concerned
4	func#4, IPL device init on the bus concerned
5	func#5, general device init on the bus concerned
6	func#6, error reporting for the bus concerned
7	func#7, add-on ROM init for all buses

Table 60 describes the lower nibble of the high byte and indicates the bus on which the routines are being executed.

Table 60. Lower Nibble High Byte Functions

Value	Description
0	Generic DIM (Device Initialization Manager)
1	Onboard system devices
2	ISA devices
3	EISA devices
4	ISA PnP devices
5	PCI devices

5.3 Speaker

A 47 Ω inductive speaker is mounted on the board. The speaker provides audible error code (beep code) information during the power-on self-test (POST).

For information about	Refer to
The location of the onboard speaker	Figure 1, page 11

5.4 BIOS Beep Codes

Whenever a recoverable error occurs during power-on self-test (POST), the BIOS displays an error message describing the problem (see Table 61). The BIOS also issues a beep code (one long tone followed by two short tones) during POST if the video configuration fails (a faulty video card or no card installed) or if an external ROM module does not properly checksum to zero.

There are several POST routines that issue a POST terminal error and shut down the system if they fail. Before shutting down the system, the terminal-error handler issues a beep code signifying the test point error, writes the error to I/O port 80h, attempts to initialize the video and writes the error in the upper left corner of the screen (using both monochrome and color adapters).

If POST completes normally, the BIOS issues one short beep before passing control to the operating system.

Table 61. Beep Codes

Beep	Description
1	Refresh failure
2	Parity cannot be reset
3	First 64 KB memory failure
4	Timer not operational
5	Not used
6	8042 GateA20 cannot be toggled
7	Exception interrupt error
8	Display memory R/W error
9	Not used
10	CMOS Shutdown register test error
11	Invalid BIOS (e.g. POST module not found, etc.)