Intel® Desktop Board D101GGC

Technical Product Specification

November 2005

Order Number: D36105-002US

The Intel® Desktop Board D101GGC 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 D101GGC Specification Update.

Revision History

Revision	Revision History	Date
-001	First release of the Intel® Desktop Board D101GGC Technical Product Specification.	October 2005
-002	Second release of the Intel® Desktop Board D101GGC Technical Product Specification. Summary of changes: corrected name of Northbridge component to read “ATI Radeon* Xpress 200 Northbridge”.	November 2005

This product specification applies to only standard Intel Desktop Board D101GGC with BIOS identifier GC11010N.86A.

Changes to this specification will be published in the Intel Desktop Board D101GGC 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 Intel® Desktop Board D101GGC. It describes the standard product and available manufacturing options.

Intended Audience

The TPS is intended to provide detailed, technical information about the Desktop Board D101GGC 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 the Desktop Board D101GGC
2	A map of the resources of the Desktop Board

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.

INTEGRATOR'S NOTES

Integrator's notes are used to call attention to information that may be useful to system integrators.

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.
GB	Gigabyte (1,073,741,824 bytes)
GB/sec	Gigabytes per second
KB	Kilobyte (1024 bytes)
Kbit	Kilobit (1024 bits)
kbits/sec	1000 bits per second
MB	Megabyte (1,048,576 bytes)
MB/sec	Megabytes per second
Mbit	Megabit (1,048,576 bits)
Mbit/sec	Megabits per second
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

Figures

Tables

1 Product Description

What This Chapter Contains

1.1 Overview

1.1.1 Feature Summary

Table 1 summarizes the major features of the board.

Table 1. Feature Summary

Form Factor	microATX (9.60 inches by 8.60 inches [243.84 millimeters by 218.44 millimeters])
Processor	Support for the following: • Intel® Pentium® 4 processor in an LGA775 socket with an 800 or 533 MHz system bus • Intel® Celeron® D processor in an LGA775 socket with a 533 MHz system bus
Memory	• Two DDR SDRAM Dual Inline Memory Module (DIMM) sockets • Support for DDR 400 MHz and DDR 333 MHz DIMMs • Support for up to 2 GB of system memory
Chipset	• ATI Radeon* Xpress 200 Northbridge • ATI IXP 450 Southbridge • 4 Mbit Firmware Hub (FWH)
Video	ATI Radeon Xpress 200 Northbridge
Audio	High Definition Audio subsystem using the Realtek ALC861 audio codec
Legacy I/O Control	SMSC SCH5017 Legacy I/O controller for hardware management, diskette drive, serial, parallel, and PS/2* ports
USB	Support for USB 2.0 devices
Peripheral Interfaces	• Eight USB ports • One serial port • One parallel port • Four Serial ATA interfaces • Two Parallel ATA IDE interfaces with UDMA 33, ATA-66/100 support • One diskette drive interface • PS/2 keyboard and mouse ports
LAN Support	10/100 Mbits/sec LAN subsystem using the Realtek 8101L LAN adapter device
BIOS	AwardBIOS* for Intel® resident in the 4 Mbit FWH
Expansion Capabilities	• Two PCI Conventional* bus connectors • One PCI Express* x1 bus add-in card connector • One PCI Express x16 bus add-in card connector
Instantly Available PC Technology	• Support for PCI Local Bus Specification Revision 2.2 • Support for PCI Express Revision 1.0a • Suspend to RAM support • Wake on PCI, RS-232, front panel, PS/2 devices, and USB ports
Hardware Monitor Subsystem (controlled by SMSC SCH5017 I/O controller)	• Voltage sense to detect out of range power supply voltages • Thermal sense to detect out of range thermal values • Three fan connectors • Three fan sense inputs used to monitor fan activity • Fan speed control

For information about	Refer to
Available configurations for the Desktop Board D101GGC	Section 1.2, page 14

1.1.2 Block Diagram

Figure 1 is a block diagram of the major functional areas of the board.

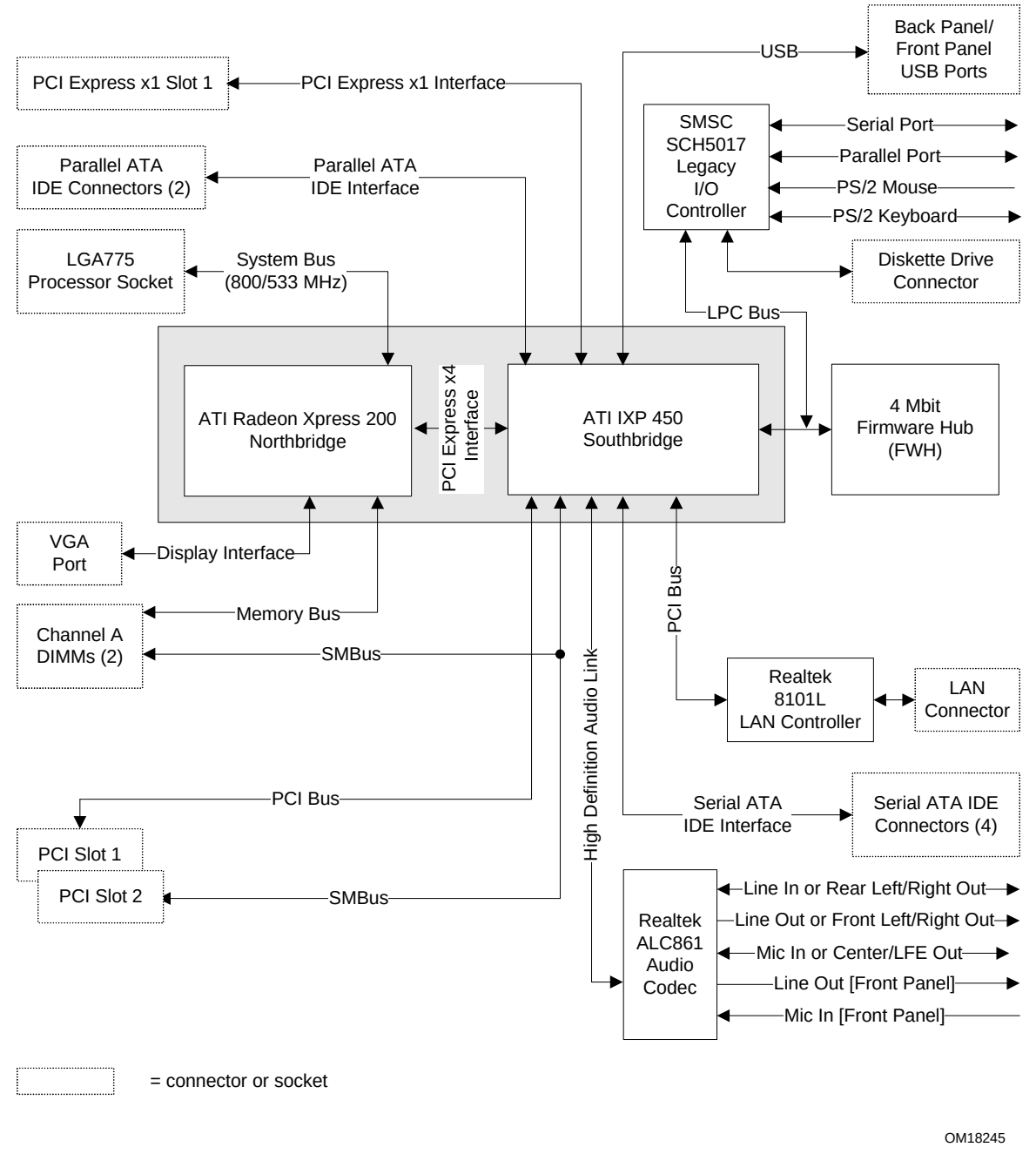


Figure 1. Block Diagram

1.1.3 Board Layout

Figure 2 shows the location of the major components.

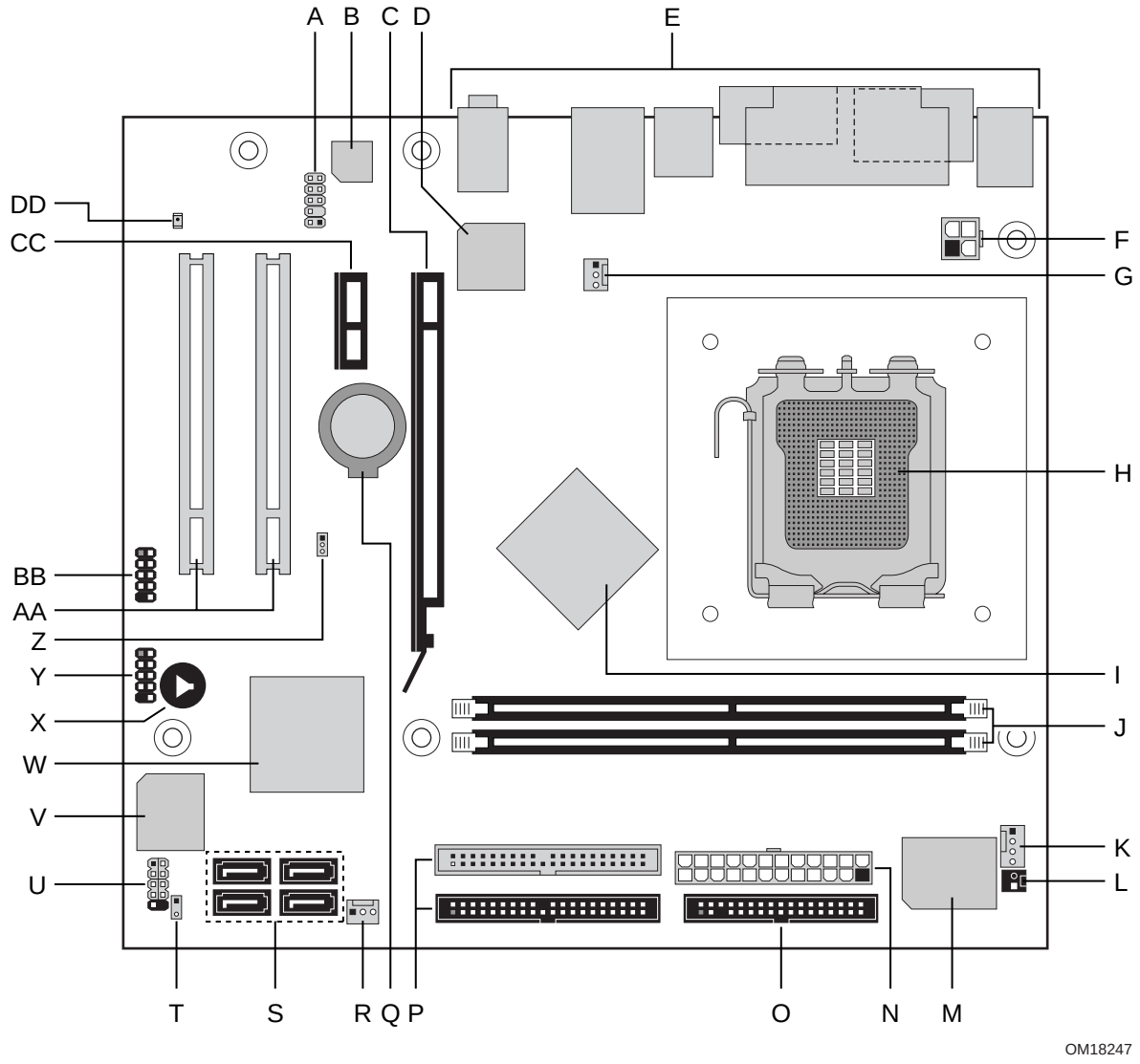


Figure 2. Board Components

Table 2 lists the components identified in Figure 2.

Table 2. Board Components Shown in Figure 2

Item/callout from Figure 2	Description
A	Front panel audio connector
B	Audio codec
C	PCI Express x16 add-in card connector
D	Ethernet device
E	Back panel connectors
F	+12V power connector (ATX12V)
G	Rear chassis fan connector
H	LGA775 processor socket
I	ATI Radeon Xpress 200 Northbridge
J	DIMM Channel A sockets [2]
K	Processor fan connector
L	Chassis intrusion connector
M	Legacy I/O controller
N	Main power connector
O	Diskette drive connector
P	Parallel ATE IDE connectors [2]
Q	Battery
R	Front chassis fan connector
S	Serial ATA connectors [4]
T	Auxiliary front panel power LED connector
U	Front panel connector
V	4 Mbit Firmware Hub (FWH)
W	IXP 450 Southbridge
X	Speaker
Y	Front panel USB connector
Z	BIOS Setup configuration jumper block
AA	PCI Conventional bus add-in card connectors [2]
BB	Front panel USB connector
CC	PCI Express x1 bus add-in card connector
DD	Standby power indicator LED

1.2 Online Support

To find information about…	Visit this World Wide Web site:
Intel Desktop Board D101GGC under "Desktop Board Products" or "Desktop Board Support"	http://www.intel.com/design/motherbd http://support.intel.com/support/motherboards/desktop
Available configurations for the Desktop Board D101GGC	http://developer.intel.com/design/motherbd/gc/gc_available.htm
Processor data sheets	http://www.intel.com/design/litcentr
Audio software and utilities	http://www.intel.com/design/motherbd

1.3 Processor

The board is designed to support the following processors:

- Intel Pentium 4 processor in an LGA775 processor socket with an 800 or 533 MHz system bus
- Intel Celeron D processor in an LGA775 processor socket with a 533 MHz system bus

For information about…	Refer to:
Supported processors for the D101GGC board	http://www.intel.com/design/motherbd/gc/gc_documentation.htm

⚠ CAUTION

Use only the processors listed on web site above. Use of unsupported processors can damage the board, the processor, and the power supply.

@ INTEGRATOR'S NOTE

- *Use only ATX12V-compliant power supplies.*
- *Refer to Table 3 on page 15 for a list of supported system bus frequency and memory speed combinations.*

For information about	Refer to
Power supply connectors	Section 2.7.2.1, page 41

1.4 System Memory

The board has two DIMM sockets and supports the following memory features:

- 2.5 V (only) DDR SDRAM DIMMs
- Unbuffered, single-sided or double-sided DIMMs with the following restriction:

  Double-sided DIMMS with x16 organization are not supported.
- Minimum total system memory: 128 MB
- Non-ECC DIMMs
- Serial Presence Detect
- DDR 400 MHz and DDR 333 MHz SDRAM DIMMs

Table 3 lists the supported system bus frequency and memory speed combinations.

Table 3. Supported System Bus Frequency and Memory Speed Combinations

To use this type of DIMM…	The processor's system bus frequency must be…
DDR 400	800 MHz
DDR 333	800 or 533 MHz

NOTE

To be fully compliant with all applicable DDR SDRAM memory specifications, the board should be populated with DIMMs that support the Serial Presence Detect (SPD) data structure. 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 or the DIMMs may not function under the determined frequency.

Table 4 lists the supported DIMM configurations.

Table 4. Supported Memory Configurations

DIMM Capacity	Configuration	SDRAM Density	SDRAM Organization Front-side/Back-side	Number of SDRAM Devices
128 MB	SS	256 Mbit	16 M x 16/empty	4
256 MB	SS	256 Mbit	32 M x 8/empty	8
256 MB	SS	512 Mbit	32 M x 16/empty	4
512 MB	DS	256 Mbit	32 M x 8/32 M x 8	16
512 MB	SS	512 Mbit	64 M x 8/empty	8
512 MB	SS	1 Gbit	64 M x 16/empty	4
1024 MB	DS	512 Mbit	64 M x 8/64 M x 8	16
1024 MB	SS	1 Gbit	128 M x 8/empty	8

Note: In the second column, “DS” refers to double-sided memory modules (containing two rows of SDRAM) and “SS” refers to single-sided memory modules (containing one row of SDRAM).

1.5 ATI Radeon* Xpress 200 Chipset

The ATI Radeon Xpress 200 chipset consists of the following devices:

- ATI Radeon Xpress 200 Northbridge
- IXP 450 Southbridge

The ATI Radeon Xpress 200 Northbridge is a centralized controller for the system bus, the memory bus, and the PCI Express bus. The ATI Radeon Xpress 200 Northbridge also provides integrated graphics capabilities supporting 3D, 2D and display capabilities. The IXP 450 is a centralized controller for the board's I/O paths. The FWH provides the nonvolatile storage of the BIOS.

For information about	Refer to
The ATI Radeon Xpress 200 Northbridge	http://www.ati.com/
The IXP 450 Southbridge	http://www.ati.com/
Resources used by the chipset	Chapter 2

1.5.1 Graphics Subsystem

The board contains two separate, mutually exclusive graphics options. Either the integrated graphics processor (contained within the ATI Radeon Xpress 200 Northbridge) is used, or a PCI Express x16 add-in card can be used. When a PCI Express x16 add-in card is installed, the ATI Radeon Xpress 200 Northbridge graphics controller is disabled.

1.5.2 Firmware Hub (FWH)

The Firmware Hub provides the nonvolatile storage of the AwardBIOS for Intel.

1.5.3 USB

The board supports up to eight USB 2.0 ports, supports UHCI and EHCI, and uses UHCI- and EHCI-compatible drivers.

The IXP 450 Southbridge provides the USB controller for all ports. The port arrangement is as follows:

- Four ports are implemented with dual stacked back panel connectors adjacent to the audio connectors
- Four ports are routed to two separate front panel USB connectors

NOTE

Computer systems that have an unshielded cable attached to a USB port may not meet FCC Class B requirements, even if no 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 37
The location of the front panel USB connectors	Figure 7, page 38

1.5.4 IDE Support

The board provides six IDE interface connectors:

- Two parallel ATA IDE connector that supports two devices
- Four serial ATA IDE connectors that support one device per connector

1.5.4.1 Parallel ATE IDE Interface

The IXP 450's Parallel ATA IDE controller has two bus-mastering Parallel ATA IDE interfaces. The Parallel ATA IDE interfaces support the following modes:

- Programmed I/O (PIO): processor controls data transfer.
- 8237-style DMA: DMA offloads the processor, supporting transfer rates of up to 16 MB/sec.
- Ultra DMA: DMA protocol on IDE bus supporting host and target throttling and transfer rates of up to 33 MB/sec.
- ATA-66: DMA protocol on IDE bus supporting host and target throttling and transfer rates of up to 66 MB/sec. ATA-66 protocol is similar to Ultra DMA and is device driver compatible.
- ATA-100: DMA protocol on IDE bus allows host and target throttling. The IXP 450's ATA-100 logic can achieve read transfer rates up to 100 MB/sec and write transfer rates up to 88 MB/sec.

NOTE

ATA-66 and ATA-100 are faster timings and require a specialized cable to reduce reflections, noise, and inductive coupling.

The Parallel ATA IDE interfaces also support ATAPI devices (such as CD-ROM drives) and ATA devices using the transfer modes.

For information about	Refer to
The location of the Parallel ATA IDE connectors	Figure 7, page 38

1.5.4.2 Serial ATA Interfaces

The IXP 450's Serial ATA controller offers four independent Serial ATA ports with a theoretical maximum transfer rate of 150 MB/s per port. One device can be installed on each port for a maximum of four Serial ATA devices. A point-to-point interface is used for host to device connections, unlike Parallel ATA IDE which supports a master/slave configuration and two devices per channel.

For compatibility, the underlying Serial ATA functionality is transparent to the operating system. The Serial ATA controller can operate in both legacy and native modes. In legacy mode, standard IDE I/O and IRQ resources are assigned (IRQ 14 and 15). In Native mode, standard PCI Conventional bus resource steering is used. Native mode is the preferred mode for configurations using the Windows* XP and Windows 2000 operating systems.

NOTE

Many Serial ATA drives use new low-voltage power connectors and require adaptors or power supplies equipped with low-voltage power connectors.

For more information, see: http://www.serialata.org/

For information about	Refer to
The location of the Serial ATA IDE connectors	Figure 7, page 38

1.5.5 Real-Time Clock, CMOS SRAM, and Battery

A coin-cell battery (CR2032) 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 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.

NOTE

If the battery and AC power fail, custom defaults, if previously saved, will be loaded into CMOS RAM at power-on.

1.6 PCI Express* Connectors

The board provides the following PCI Express connectors:

- One PCI Express x16 connector supporting simultaneous transfer speeds up to 8 GBytes/sec
- One PCI Express x1 connector. The x1 interface supports simultaneous transfer speeds up to 500 MBytes/sec

The PCI Express interface supports the PCI Conventional bus configuration mechanism so that the underlying PCI Express architecture is compatible with PCI Conventional compliant operating systems. Additional features of the PCI Express interface include the following:

- Support for the PCI Express enhanced configuration mechanism
- Automatic discovery, link training, and initialization
- Support for Active State Power Management (ASPM)
- SMBus 2.0 support
- Wake# signal supporting wake events from ACPI S1, S3, S4, or S5
- Software compatible with the PCI Power Management Event (PME) mechanism defined in the PCI Power Management Specification Rev. 1.1

1.7 Legacy I/O Controller

The SMSC SCH5017 Legacy I/O controller provides the following features:

- One serial port
- One parallel port with Extended Capabilities Port (ECP) and Enhanced Parallel Port (EPP) support
- Serial IRQ interface compatible with serialized IRQ support for PCI Conventional bus systems
- PS/2-style mouse and keyboard interfaces
- Interface for one 1.44 MB or 2.88 MB diskette drive
- Intelligent power management, including a programmable wake-up event interface
- PCI Conventional bus power management support

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

1.7.1 Serial Port

The Serial port A connector is located on the back panel. The serial port supports data transfers at speeds up to 115.2 kbits/sec with BIOS support.

For information about	Refer to
The location of the serial port A connector	Figure 6, page 37

1.7.2 Parallel Port

The 25-pin D-Sub parallel port connector is located on the back panel. Use the BIOS Setup program to set the parallel port mode.

For information about	Refer to
The location of the parallel port connector	Figure 6, page 37

1.7.3 Diskette Drive Controller

The I/O controller supports one diskette drive. Use the BIOS Setup program to configure the diskette drive interface.

For information about	Refer to
The location of the diskette drive connector	Figure 7, page 38

1.7.4 Keyboard and Mouse Interface

PS/2 keyboard and mouse connectors are located on the back panel.

NOTE

The keyboard is supported in the bottom PS/2 connector and the mouse is supported in the top PS/2 connector. Power to the computer should be turned off before a keyboard or mouse is connected or disconnected.

For information about	Refer to
The location of the keyboard and mouse connectors	Figure 6, page 37

1.8 High Definition Audio Subsystem

The board includes a flexible 6-channel audio subsystem based on an Intel® High Definition Audio interface. The audio subsystem features:

- ATI IXP 450 Southbridge
- Realtek ALC861 audio codec
- Impedance sensing capability for jack re-tasking
- S/N (signal-to-noise) ratio of 90 dB
- Microphone input supporting:

  Stereo microphone

  Microphone boost

@ INTEGRATOR'S NOTE

For the front panel jack sensing and automatic retasking feature to function, a front panel daughter card that is designed for Intel High Definition Audio must be used. Otherwise, an AC '97 style audio front panel connector will be assumed and the Line Out and Mic In functions will be permanent.

1.8.1 Audio Subsystem Software

Audio software and drivers are available from Intel's World Wide Web site.

For information about	Refer to
Obtaining audio software and drivers	Section 1.2, page 14

1.8.2 Audio Connectors

The board contains audio connector on both the back panel and the component side of the board. The front panel audio connector is a 2 x 5-pin connector that provides mic in and line out signals for front panel audio connectors.

The audio subsystem connectors are shown in Figure 3.

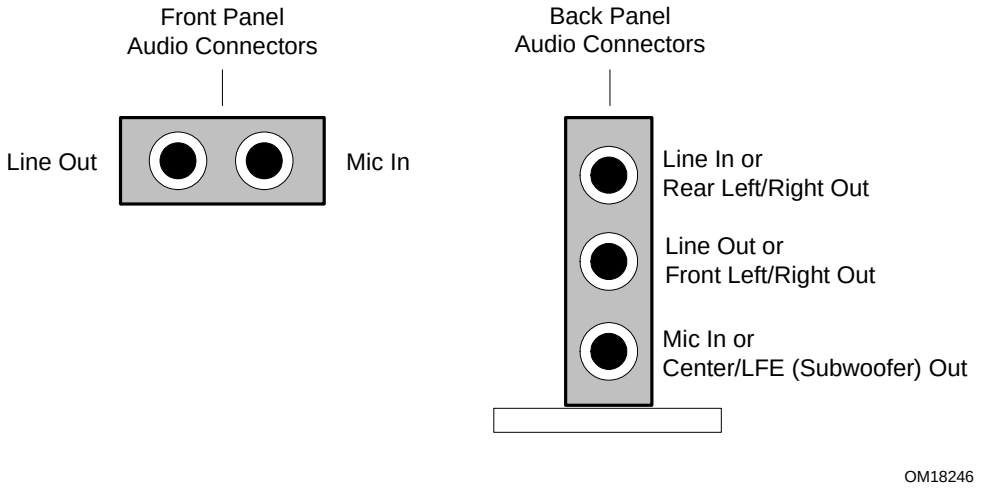


Figure 3. Front/Back Panel Audio Connector Options for High Definition Audio Subsystem

For information about	Refer to
The location of the front panel audio connector	Figure 7, page 38
The signal names of the front panel audio connector	Table 17, page 39
The back panel audio connectors	Figure 6, page 37

1.9 LAN Subsystem

The LAN subsystem consists of the following:

- Realtek 8101L LAN adapter device for 10/100 Mbits/sec Ethernet LAN connectivity
- RJ-45 LAN connector with integrated status LEDs
- Programmable transit threshold
- Configurable EEPROM that contains the MAC address

Two LEDs are built into the RJ-45 LAN connector (shown in Figure 4).

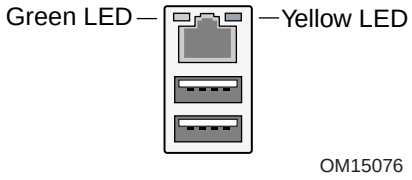


Figure 4. LAN Connector LED Locations

Table 5 describes the LED states when the board is powered up and the 10/100 Mbits/sec LAN subsystem is operating.

Table 5. LAN Connector LED States

LED Color	LED State	Condition
Green	Off	LAN link is not established.
	On	LAN link is established.
	Blinking	LAN activity is occurring.
Yellow	Off	10 Mbits/sec data rate is selected.
	On	100 Mbits/sec data rate is selected.

1.9.1 LAN Subsystem Software

LAN software and drivers are available from Intel's World Wide Web site.

For information about	Refer to
Obtaining LAN software and drivers	Section 1.2, page 14

1.10 Hardware Management Subsystem

The hardware management features enable the board to be compatible with the Wired for Management (WfM) specification. The SMSC SCH5017 I/O controller is used to implement hardware monitoring and fan control. The features of the SMSC SCH5017 I/O controller include:

- Internal ambient temperature sensor
- Two remote thermal diode sensors for direct monitoring of processor temperature and ambient temperature sensing
- Power supply monitoring of five voltages (+5 V, +12 V, +3.3 VSB, +1.5 V, and +VCCP) to detect levels above or below acceptable values
- Thermally monitored closed-loop fan control, for all three fans, that can adjust the fan speed or switch the fans on or off as needed
- SMBus interface

1.10.1 Fan Monitoring

Fan monitoring can be implemented using Intel® Desktop Utilities, LANDesk* software, or third-party software.

For information about	Refer to
The functions of the fan connectors	Section 1.11.2.2, page 27

1.10.2 Chassis Intrusion and Detection

The board supports a chassis security feature that detects if the chassis cover is removed. The security feature uses a mechanical switch on the chassis that attaches to the chassis intrusion connector. When the chassis cover is removed, the mechanical switch is in the closed position.

For information about	Refer to
The location of the chassis intrusion connector	Figure 7, page 38
The signal names of the chassis intrusion connector	Table 18, page 40

1.11 Power Management

Power management is implemented at several levels, including:

- Software support through Advanced Configuration and Power Interface (ACPI)
- Hardware support:
  - Power connector
  - Fan connectors
  - LAN wake capabilities
  - Instantly Available PC technology
  - Resume on Ring
  - Wake from USB
  - Wake from PS/2 devices
  - Power Management Event signal (PME#) wake-up support

1.11.1 ACPI

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 an operating system that provides full ACPI support. ACPI features include:

- Plug and Play (including bus and device enumeration)
- Power management control of individual devices, add-in boards (some add-in boards may require an ACPI-aware driver), video displays, and hard disk drives
- Methods for achieving less than 15-watt system operation in the power-on/standby sleeping state
- A Soft-off feature that enables the operating system to power-off the computer
- Support for multiple wake-up events (see Table 8 on page 25)
- Support for a front panel power and sleep mode switch

Table 6 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 6. 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/G5 – Soft off)	Less than four seconds	Power-on (ACPI G0 – working state)
On (ACPI G0 – working state)	Less than four seconds	Soft-off/Standby (ACPI G1 – sleeping state)
On (ACPI G0 – working state)	More than four seconds	Fail safe power-off (ACPI G2/G5 – Soft off)
Sleep (ACPI G1 – sleeping state)	Less than four seconds	Wake-up (ACPI G0 – working state)
Sleep (ACPI G1 – sleeping state)	More than four seconds	Power-off (ACPI G2/G5 – Soft off)

1.11.1.1 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 7 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 7. Power States and Targeted System Power

Global States	Sleeping States	Processor States	Device States	Targeted System Power (Note 1)
G0 – working state	S0 – working	C0 – working	D0 – working state.	Full power > 30 W
G1 – sleeping state	S1 – Processor stopped	C1 – stop grant	D1, D2, D3 – device specification specific.	5 W < power < 52.5 W
G1 – sleeping state	S3 – Suspend to RAM. Context saved to RAM.	No power	D3 – no power except for wake-up logic.	Power < 5 W (Note 2)
G1 – sleeping state	S4 – Suspend to disk. Context saved to disk.	No power	D3 – no power except for wake-up logic.	Power < 5 W (Note 2)
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 (Note 2)
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. Service can be performed safely.

Notes:

1. Total system power is dependent on the system configuration, including add-in boards and peripherals powered by the system chassis' power supply.
2. Dependent on the standby power consumption of wake-up devices used in the system.

1.11.1.2 Wake-up Devices and Events

Table 8 lists the devices or specific events that can wake the computer from specific states.

Table 8. Wake-up Devices and Events

These devices/events can wake up the computer…	…from this state
LAN	S1, S3, S4, S5 (Note)
Modem (back panel Serial Port A)	S1, S3
PME# signal	S1, S3, S4, S5 (Note)
Power switch	S1, S3, S4, S5
PS/2 devices	S1, S3
RTC alarm	S1, S3, S4, S5
USB	S1, S3
WAKE# signal	S1, S3, S4, S5

Note: For LAN and PME# signal, S5 is disabled by default in the BIOS Setup program. Setting this option to Power On will enable a wake-up event from LAN in the S5 state.

NOTE

The use of these wake-up events from an ACPI state requires an operating system that provides full ACPI support. In addition, software, drivers, and peripherals must fully support ACPI wake events.

1.11.2 Hardware Support

CAUTION

Ensure that the power supply provides adequate +5 V standby current if LAN wake capabilities and Instantly Available PC technology features are used. 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.

The board provides several power management hardware features, including:

- Power connector
- Fan connectors
- LAN wake capabilities
- Instantly Available PC technology
- Resume on Ring
- Wake from USB
- Wake from PS/2 keyboard
- PME# signal wake-up support
- WAKE# signal wake-up support

LAN wake capabilities and Instantly Available PC technology require power from the +5 V standby line.

Resume on Ring enables 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).

NOTE

The use of Resume on Ring and Wake from USB technologies from an ACPI state requires an operating system that provides full ACPI support.

1.11.2.1 Power Connector

ATX12V-compliant power supplies can turn off the system power through system control. When an ACPI-enabled system receives the correct command, the power supply removes all non-standby voltages.

When resuming from an AC power failure, the computer returns to the power state it was in before power was interrupted (on or off). The computer's response can be set using the Last Power State feature in the BIOS Setup program's Boot menu.

For information about	Refer to
The location of the main power connector	Figure 7, page 38
The signal names of the main power connector	Table 22, page 41

1.11.2.2 Fan Connectors

The function/operation of the fan connectors is as follows:

- The fans are on when the board is in the S0 or S1 state.
- The fans are off when the board is off or in the S3, S4, or S5 state.
- Each fan connector is wired to a fan tachometer input of the SMSC SCH5017 I/O controller.
- All fan connectors support closed-loop fan control that can adjust the fan speed or switch the fan on or off as needed.
- All fan connectors have a +12 V DC connection.

For information about	Refer to
The signal names of the processor fan connector	Table 20, page 40
The signal names of the chassis fan connectors	Table 21, page 40

1.11.2.3 LAN Wake Capabilities

⚠ CAUTION

For LAN wake capabilities, the +5 V standby line for the power supply must be capable of providing adequate +5 V standby current. Failure to provide adequate standby current when implementing LAN wake capabilities can damage the power supply.

LAN wake capabilities enable remote wake-up of the computer through a network. The LAN network adapter monitors network traffic at the Media Independent Interface. Upon detecting a Magic Packet* frame, the LAN subsystem asserts a wake-up signal that powers up the computer. Depending on the LAN implementation, the board supports LAN wake capabilities with ACPI in the following ways:

- The PCI Express WAKE# signal
- The PCI Conventional bus PME# signal for PCI 2.2 compliant LAN designs
- The onboard LAN subsystem

1.11.2.4 Instantly Available PC Technology

⚠ CAUTION

For Instantly Available PC technology, the +5 V standby line for the power supply must be capable of providing adequate +5 V standby current. Failure to provide adequate standby current when implementing Instantly Available PC technology can damage the power supply.

Instantly Available PC technology enables the board to enter the ACPI S3 (Suspend-to-RAM) sleep-state. While in the S3 sleep-state, the computer will appear to be off (the power supply is off, and the front panel LED is amber if dual colored, or off if single colored.) When signaled by a wake-up device or event, the system quickly returns to its last known wake state. Table 8 on page 25 lists the devices and events that can wake the computer from the S3 state.

The board supports the *PCI Bus Power Management Interface Specification*. Add-in boards that also support this specification can participate in power management and can be used to wake the computer.

The use of Instantly Available PC technology requires operating system support and PCI 2.2 compliant add-in cards, PCI Express add-in cards, and drivers.

1.11.2.5 Resume on Ring

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

- Resumes operation from ACPI S1 or S3 states
- Detects incoming call similarly for external and internal modems
- Requires modem interrupt be unmasked for correct operation

1.11.2.6 Wake from USB

USB bus activity wakes the computer from ACPI S1 or S3 states.

✏ NOTE

Wake from USB requires the use of a USB peripheral that supports Wake from USB.

1.11.2.7 Wake from PS/2 Devices

PS/2 device activity wakes the computer from an ACPI S1 or S3 state.

1.11.2.8 PME# Signal Wake-up Support

When the PME# signal on the PCI Conventional bus is asserted, the computer wakes from an ACPI S1, S3, S4, or S5 state (with Wake on PME enabled in BIOS).

1.11.2.9 WAKE# Signal Wake-up Support

When the WAKE# signal on the PCI Express bus is asserted, the computer wakes from an ACPI S1, S3, S4, or S5 state.

1.11.2.10 +5 V Standby Power Indicator LED

The +5 V standby power indicator LED shows that power is still present even when the computer appears to be off. Figure 5 shows the location of the standby power indicator LED.

CAUTION

If AC power has been switched off and the standby power indicator is still lit, disconnect the power cord before installing or removing any devices connected to the board. Failure to do so could damage the board and any attached devices.

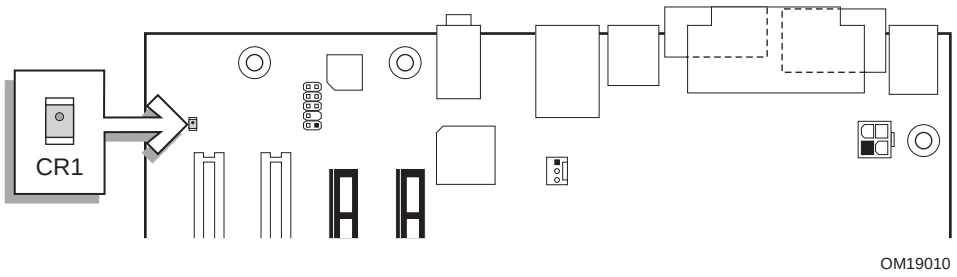


Figure 5. Location of the Standby Power Indicator LED

2 Technical Reference

What This Chapter Contains

2.1 Memory Map

Table 9 lists the system memory map.

Table 9. System Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K - 4194304 K	100000 - FFFFFFFF	4095 MB	Extended memory
960 K - 1024 K	F0000 - FFFFF	64 KB	Runtime BIOS
896 K - 960 K	E8000 - EFFFF	32 KB	Reserved
800 K - 896 K	C8000 – E7FFF	128 KB	Potential available high DOS memory (open to the PCI Conventional bus). Dependent on video adapter used.
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

2.2 DMA Channels

Table 10. DMA Channels

DMA Channel Number	Data Width	System Resource
0	8 or 16 bits	Open
1	8 or 16 bits	Parallel port
2	8 or 16 bits	Diskette drive
3	8 or 16 bits	Parallel port (for ECP or EPP)
4	8 or 16 bits	DMA controller
5	16 bits	Open
6	16 bits	Open
7	16 bits	Open

2.3 Fixed I/O Map

Table 11. I/O Map

Address (hex)	Size	Description
0000 - 00FF	256 bytes	Used by the Desktop Board D101GGC. Refer to the IXP 450 data sheet for dynamic addressing information.
0170 - 0177	8 bytes	Secondary Parallel ATA IDE channel command block
01F0 - 01F7	8 bytes	Primary Parallel ATA IDE channel command block
0228 - 022F (Note 1)	8 bytes	LPT3
0278 - 027F (Note 1)	8 bytes	LPT2
02E8 - 02EF (Note 1)	8 bytes	COM4
02F8 - 02FF (Note 1)	8 bytes	COM2
0374 - 0377	4 bytes	Secondary Parallel ATA IDE channel control block
0377, bits 6:0	7 bits	Secondary IDE channel status port
0378 - 037F	8 bytes	LPT1
03E8 - 03EF	8 bytes	COM3
03F0 - 03F5	6 bytes	Diskette channel
03F6 – 03F7	1 byte	Primary Parallel ATA IDE channel control block
03F8 - 03FF	8 bytes	COM1
04D0 - 04D1	2 bytes	Edge/level triggered PIC
LPTn + 400	8 bytes	ECP port, LPTn base address + 400h
0CF8 - 0CFB (Note 2)	4 bytes	PCI Conventional bus configuration address register
0CF9 (Note 3)	1 byte	Reset control register
0CFC - 0CFF	4 bytes	PCI Conventional bus configuration data register
FB00 – FB07	8 bytes	Primary Parallel ATA IDE bus master registers
FB08 – FB0F	8 bytes	Secondary Parallel ATA IDE bus master registers

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 IXP 450 address aliasing. The IXP 450 data sheet provides more information on address aliasing.

2.4 Interrupts

The interrupts can be routed through either the Programmable Interrupt Controller (PIC) or the Advanced Programmable Interrupt Controller (APIC) portion of the IXP 450 Southbridge component. The PIC is supported in Windows 98 SE and Windows ME and uses the first 16 interrupts. The APIC is supported in Windows 2000 and Windows XP and supports a total of 24 interrupts.

Table 12. 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	COM2 (Note 1)
4	COM1 (Note 1)
5	LPT2 (Plug and Play option)/User available
6	Diskette drive
7	LPT1 (Note 1)
8	Real-time clock
9	User available
10	User available
11	User available
12	Onboard mouse port (if present, else user available)
13	Reserved, math coprocessor
14	Primary IDE/Serial ATA (if present, else user available)
15	Secondary IDE/Serial ATA (if present, else user available)
16 (Note 2)	User available (through PIRQA)
17 (Note 2)	User available (through PIRQB)
18 (Note 2)	User available (through PIRQC)
19 (Note 2)	User available (through PIRQD)
20 (Note 2)	User available (through PIRQE)
21 (Note 2)	User available (through PIRQF)
22 (Note 2)	User available (through PIRQG)
23 (Note 2)	User available (through PIRQH)

Notes:

1. Default, but can be changed to another IRQ.
2. Available in APIC mode only.

2.5 PCI Configuration Space Map

Table 13. PCI Configuration Space Map

Bus Number (hex)	Device Number (hex)	Function Number (hex)	Description
00	00	00	ATI Host Bridge
00	02	00	ATI PCI Express x16 port Bridge (Note 1)
00	06	00	ATI PCI Express x1 port Bridge (Note 2)
00	11	00	ATI IDE controller
00	12	00	ATI IDE controller
00	13	00	ATI USB OHCI controller 1
00	13	01	ATI USB OHCI controller 2
00	13	02	ATI USB OHCI controller 3
00	14	00	ATI SMBus controller
00	14	01	ATI IDE controller
00	14	02	ATI Azalia controller
00	14	03	ATI ISA bridge
00	14	04	ATI Decode PCI/PCI bridge
01	05	00	ATI VGA controller
01 (Notes 1 and 3)			PCI Express x16 connector
02 (Notes 2 and 3)			PCI Express x1 connector
02 (Note 3)	02	00	Ethernet controller
03 (Note 3)	03	00	PCI Conventional bus connector 1
03 (Note 3)	04	00	PCI Conventional bus connector 2

Notes:

1. Present only when a PCI Express x16 graphics card is installed.
2. Present only when a PCI Express x1 add-in card is installed.
3. Bus number is dynamic and can change based on add-in cards used.

2.6 PCI Conventional Interrupt Routing Map

Table 14 lists how the PIRQ signals are routed.

Table 14. PCI Interrupt Routing Map

PCI Interrupt Source	IXP 450 PIRQ Signal Name							
	PIRQA	PIRQB	PIRQC	PIRQD	PIRQE	PIRQF	PIRQG	PIRQH
PCI bus connector 1	INTA	INTB	INTC	INTD				
PCI bus connector 2	INTB	INTC	INTD	INTA				
Realtek LAN	INTF							

2.7 Connectors

CAUTION

Only the following connectors have overcurrent protection: back panel USB, front panel USB, and PS/2.

The other internal connectors are not overcurrent protected and should connect only to devices inside the computer's chassis, such as fans and internal peripherals. Do not use these connectors to power devices external to the computer's chassis. A fault in the load presented by the external devices could cause damage to the computer, the power cable, and the external devices themselves.

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

- Back panel I/O connectors (see page 37)
- Component-side I/O connectors (see page 38)

2.7.1 Back Panel Connectors

Figure 6 shows the location of the back panel connectors. The back panel connectors are color-coded. The figure legend (Table 15) lists the colors used (when applicable).

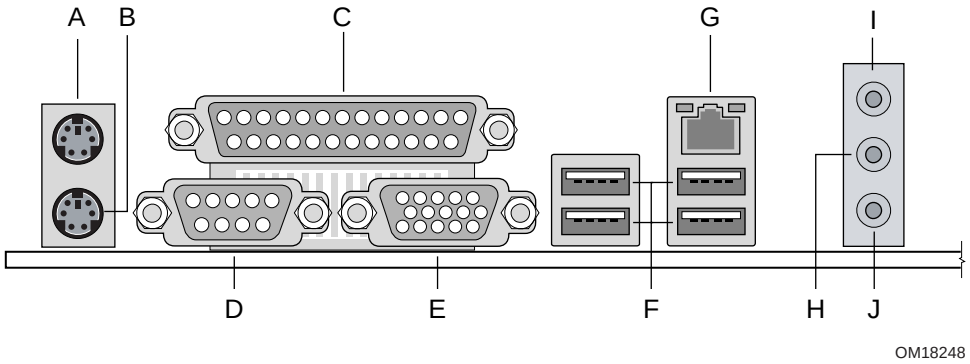


Figure 6. Back Panel Connectors

Table 15. Back Panel Connectors Shown in Figure 6

Item/callout from Figure 6	Description
A	PS/2 mouse port (Green)
B	PS/2 keyboard port (Purple)
C	Parallel port (Burgundy)
D	Serial port A (Teal)
E	VGA port
F	USB ports [4]
G	LAN
H	Line in or Rear Left/Right Out
I	Line out or Front Left/Right Out
J	Mic in or Center/LFE (Subwoofer) Out

NOTE

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

2.7.2 Component-side Connectors

Figure 7 shows the locations of the component-side connectors.

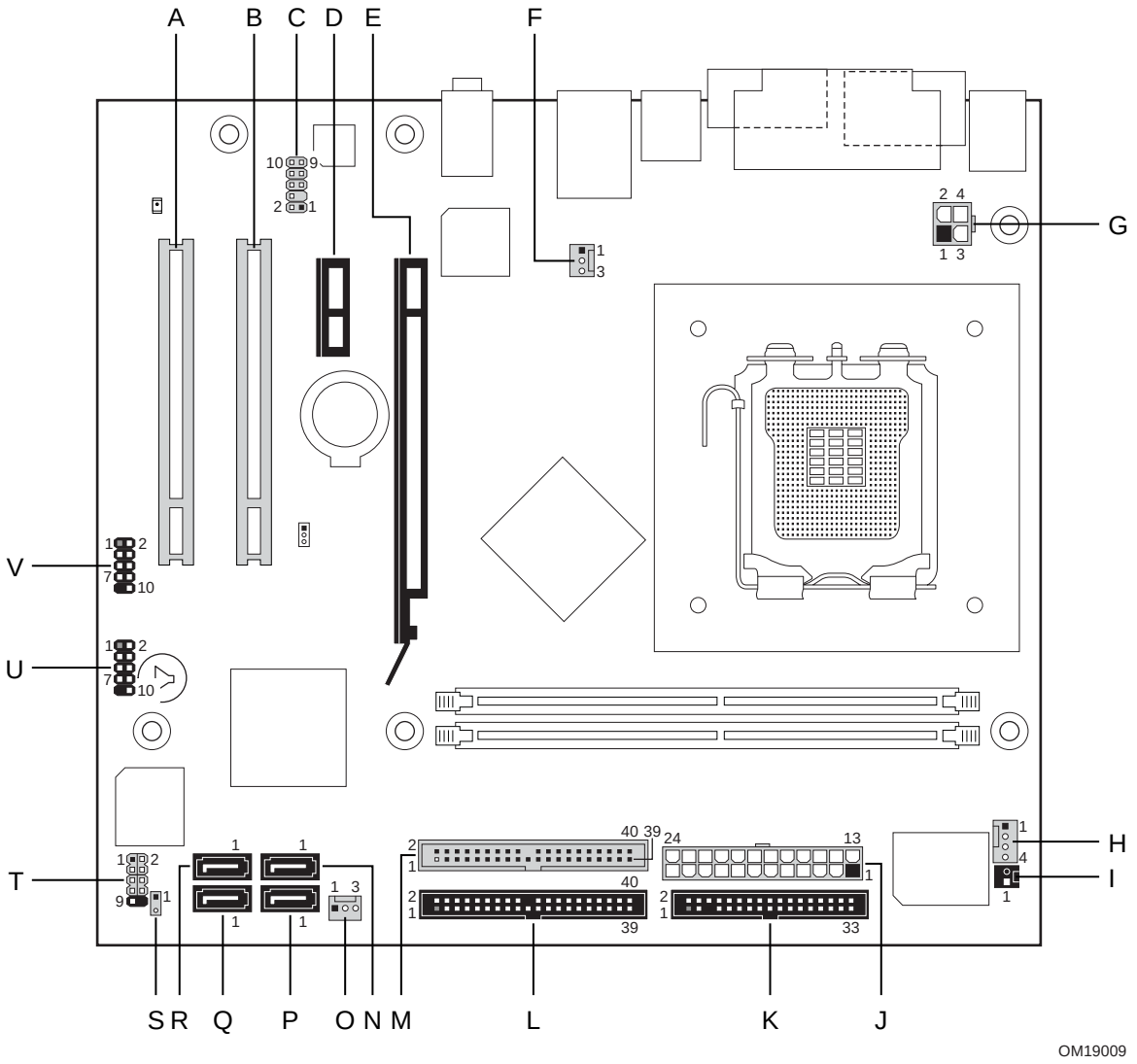


Figure 7. Component-side Connectors

Table 16 lists the component-side connectors identified in Figure 7.

Table 16. Component-side Connectors Shown in Figure 7

Item/callout from Figure 7	Description
A	PCI Conventional bus add-in card connector 2
B	PCI Conventional bus add-in card connector 1
C	Front panel audio connector
D	PCI Express x1 bus add-in card connector
E	PCI Express x16 add-in card connector
F	Rear chassis fan connector
G	+12V power connector (ATX12V)
H	Processor fan connector
I	Chassis intrusion connector
J	Main power connector
K	Diskette drive connector
L	Primary parallel ATA IDE connector
M	Secondary parallel ATA IDE connector
N	Serial ATA connector 1
O	Front chassis fan connector
P	Serial ATA connector 2
Q	Serial ATA connector 4
R	Serial ATA connector 3
S	Auxiliary front panel power LED connector
T	Front panel connector
U	Front panel USB connector
V	Front panel USB connector

Table 17. Front Panel Audio Connector

Pin	Signal Name	Pin	Signal Name
1	Port F Left Channel	2	Ground
3	Port F Right Channel	4	Presence# (dongle present)
5	Port E Right Channel	6	Port F Sense return (jack detection)
7	Port E and Port F Sense send (jack detection)	8	Key
9	Port E Left Channel	10	Port E Sense return (jack detection)

@ INTEGRATOR'S NOTE

The front panel audio connector is colored yellow.

Table 18. Chassis Intrusion Connector

Pin	Signal Name
1	Intruder
2	Ground

Table 19. Serial ATA Connectors

Pin	Signal Name
1	Ground
2	TXP
3	TXN
4	Ground
5	RXN
6	RXP
7	Ground

Table 20. Processor Fan Connector

Pin	Signal Name
1	Ground
2	+12 V
3	FAN_TACH
4	FAN_CONTROL

Table 21. Chassis Fan Connectors

Pin	Signal Name
1	Control
2	+12 V
3	Tach

2.7.2.1 Power Supply Connectors

The board has three power supply connectors:

- **Main power** – a 2 x 12 connector. This connector is compatible with 2 x 10 connectors previously used on Intel Desktop boards. The board supports the use of ATX12V power supplies with either 2 x 10 or 2 x 12 main power cables. When using a power supply with a 2 x 10 main power cable, attach that cable on the rightmost pins of the main power connector, leaving pins 11, 12, 23, and 24 unconnected.
- **ATX12V power** – a 2 x 2 connector. This connector provides power directly to the processor voltage regulator and must always be used. Failure to do so will prevent the board from booting.

Table 22. Main Power Connector

Pin	Signal Name	Pin	Signal Name
1	+3.3 V	13	+3.3 V
2	+3.3 V	14	-12 V
3	Ground	15	Ground
4	+5 V	16	PS-ON# (power supply remote on/off)
5	Ground	17	Ground
6	+5 V	18	Ground
7	Ground	19	Ground
8	PWRGD (Power Good)	20	No connect
9	+5 V (Standby)	21	+5 V
10	+12 V	22	+5 V
11	+12 V (Note)	23	+5 V (Note)
12	2 x 12 connector detect (Note)	24	Ground (Note)

Note: When using a 2 x 10 power supply cable, this pin will be unconnected.

Table 23. ATX12V Power Connector

Pin	Signal Name	Pin	Signal Name
1	Ground	2	Ground
3	+12 V	4	+12 V

2.7.2.2 Add-in Card Connectors

The board has the following add-in card connectors:

- PCI Express x16: one connector supporting simultaneous transfer speeds up to 8 GBytes/sec.
- PCI Express x1: one PCI Express x1 connector. The x1 interface supports simultaneous transfer speeds up to 500 MBytes/sec.
- PCI Conventional (rev 2.3 compliant) bus: two PCI Conventional bus add-in card connectors. The SMBus is routed to PCI Conventional bus connector 2 only (ATX expansion slot 6). PCI Conventional bus add-in cards with SMBus support can access sensor data and other information residing on the board.

Note the following considerations for the PCI Conventional bus connectors:

- All of the PCI Conventional bus connectors are bus master capable.
- SMBus signals are routed to PCI Conventional bus connector 2. This enables PCI Conventional bus add-in boards with SMBus support to access sensor data on the board. The specific SMBus signals are as follows:

  The SMBus clock line is connected to pin A40.

2.7.2.3 Auxiliary Front Panel Power/Sleep LED Connector

Pins 1 and 3 of this connector duplicate the signals on pins 2 and 4 of the front panel connector.

Table 24. Auxiliary Front Panel Power/Sleep LED Connector

Pin	Signal Name	In/Out	Description
1	HDR_BLNK_GRN	Out	Front panel green LED
2	Not connected		
3	HDR_BLNK_YEL	Out	Front panel yellow LED

2.7.2.4 Front Panel Connector

This section describes the functions of the front panel connector. Table 25 lists the signal names of the front panel connector. Figure 8 is a connection diagram for the front panel connector.

Table 25. Front Panel Connector

Pin	Signal	In/Out	Description	Pin	Signal	In/Out	Description
Hard Drive Activity LED [Orange]				**Power LED [Green]**			
1	HD_PWR	Out	Hard disk LED pull-up (750 Ω) to +5 V	2	HDR_BLNK_ GRN	Out	Front panel green LED
3	HAD#	Out	Hard disk active LED	4	HDR_BLNK_ YEL	Out	Front panel yellow LED
Reset Switch [Blue]				**On/Off Switch [Red]**			
5	Ground		Ground	6	FPBUT_IN	In	Power switch
7	FP_RESET#	In	Reset switch	8	Ground		Ground
Power				**Not Connected**			
9	+5 V		Power	10	N/C		Not connected

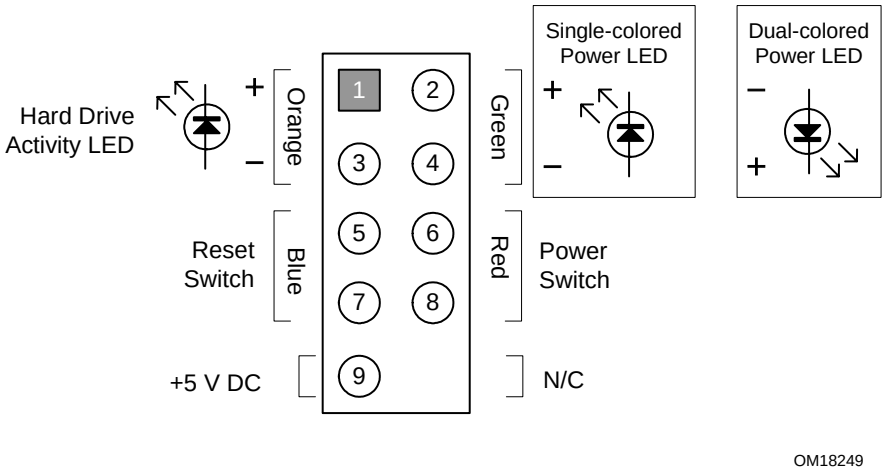


Figure 8. Connection Diagram for Front Panel Connector

2.7.2.4.1 Hard Drive Activity LED Connector [Orange]

Pins 1 and 3 [Orange] can be connected to an LED to provide a visual indicator that data is being read from or written to a hard drive. Proper LED function requires one of the following:

- A Serial ATA hard drive connected to an onboard Serial ATA connector
- An IDE hard drive connected to an onboard IDE connector

2.7.2.4.2 Reset Switch Connector [Blue]

Pins 5 and 7 [Blue] can be connected to a momentary single pole, single throw (SPST) type switch that is normally open. When the switch is closed, the board resets and runs the POST.

2.7.2.4.3 Power/Sleep LED Connector [Green]

Pins 2 and 4 [Green] can be connected to a one- or two-color LED. Table 26 shows the possible states for a one-color LED. Table 27 shows the possible states for a two-color LED.

Table 26. States for a One-Color Power LED

LED State	Description
Off	Power off/sleeping
Steady Green	Running

Table 27. States for a Two-Color Power LED

LED State	Description
Off	Power off
Steady Green	Running
Steady Yellow	Sleeping

NOTE

The colors listed in Table 26 and Table 27 are suggested colors only. Actual LED colors are product- or customer-specific.

2.7.2.4.4 Power Switch Connector [Red]

Pins 6 and 8 [Red] can be connected to a front panel momentary-contact 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.

2.7.3 Front Panel USB Connectors

Figure 9 is a connection diagram for the front panel USB connectors.

INTEGRATOR'S NOTES

- *The +5 V DC power on the USB connector is fused.*
- *Pins 1, 3, 5, and 7 comprise one USB port.*
- *Pins 2, 4, 6, and 8 comprise one USB port.*
- *Use only a front panel USB connector that conforms to the USB 2.0 specification for high-speed USB devices.*

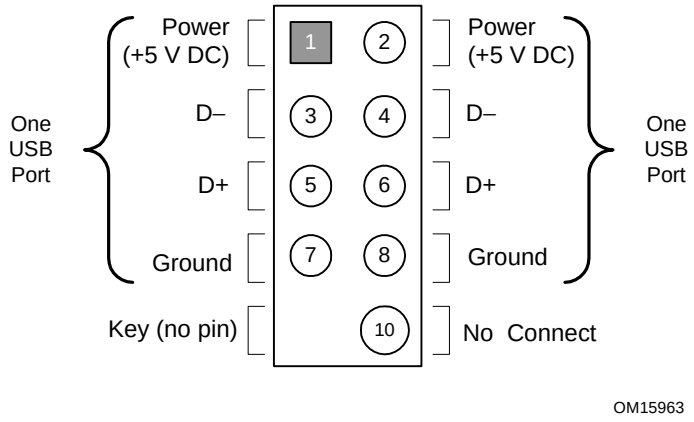


Figure 9. Connection Diagram for Front Panel USB Connectors

2.8 Jumper Block

⚠ CAUTION

Do not move the jumper 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 10 shows the location of the jumper block. The jumper block determines the BIOS Setup program's mode. Table 28 describes the jumper settings for the three modes: normal, configure, and recovery. When the jumper is set to configure mode and the computer is powered-up, the BIOS compares the processor version and the microcode version in the BIOS and reports if the two match.

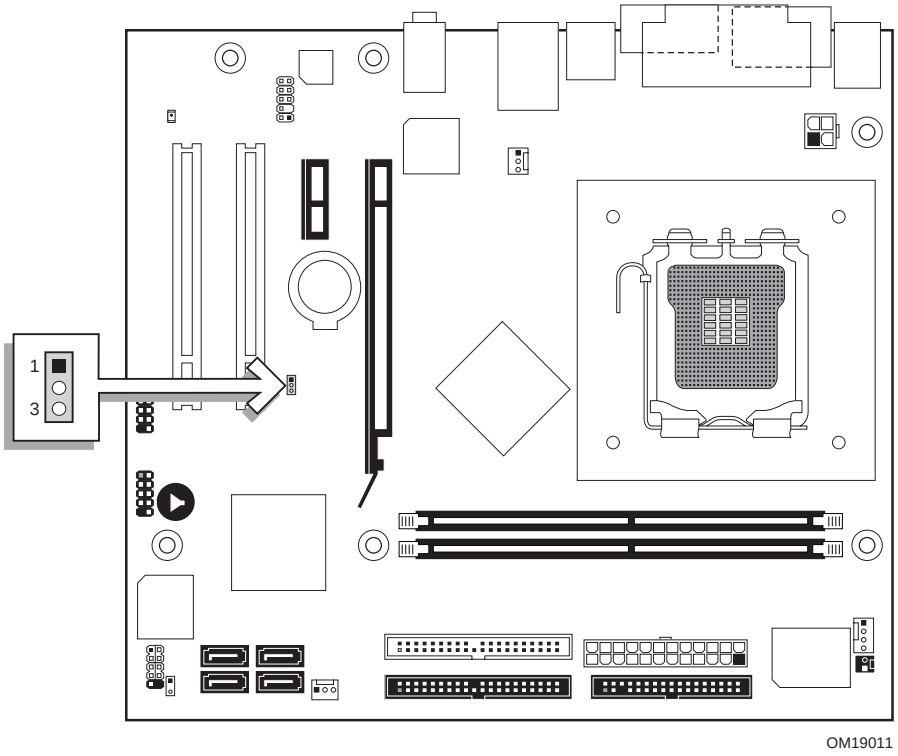


Figure 10. Location of the Jumper Block

Table 28. BIOS Setup Configuration Jumper Settings

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

2.9 Mechanical Considerations

2.9.1 Form Factor

The board is designed to fit into either a microATX or an ATX-form-factor chassis. Figure 11 illustrates the mechanical form factor of the board. Dimensions are given in inches [millimeters]. The outer dimensions are 9.60 inches by 8.60 inches [243.84 millimeters by 218.44 millimeters]. Location of the I/O connectors and mounting holes are in compliance with the ATX specification.

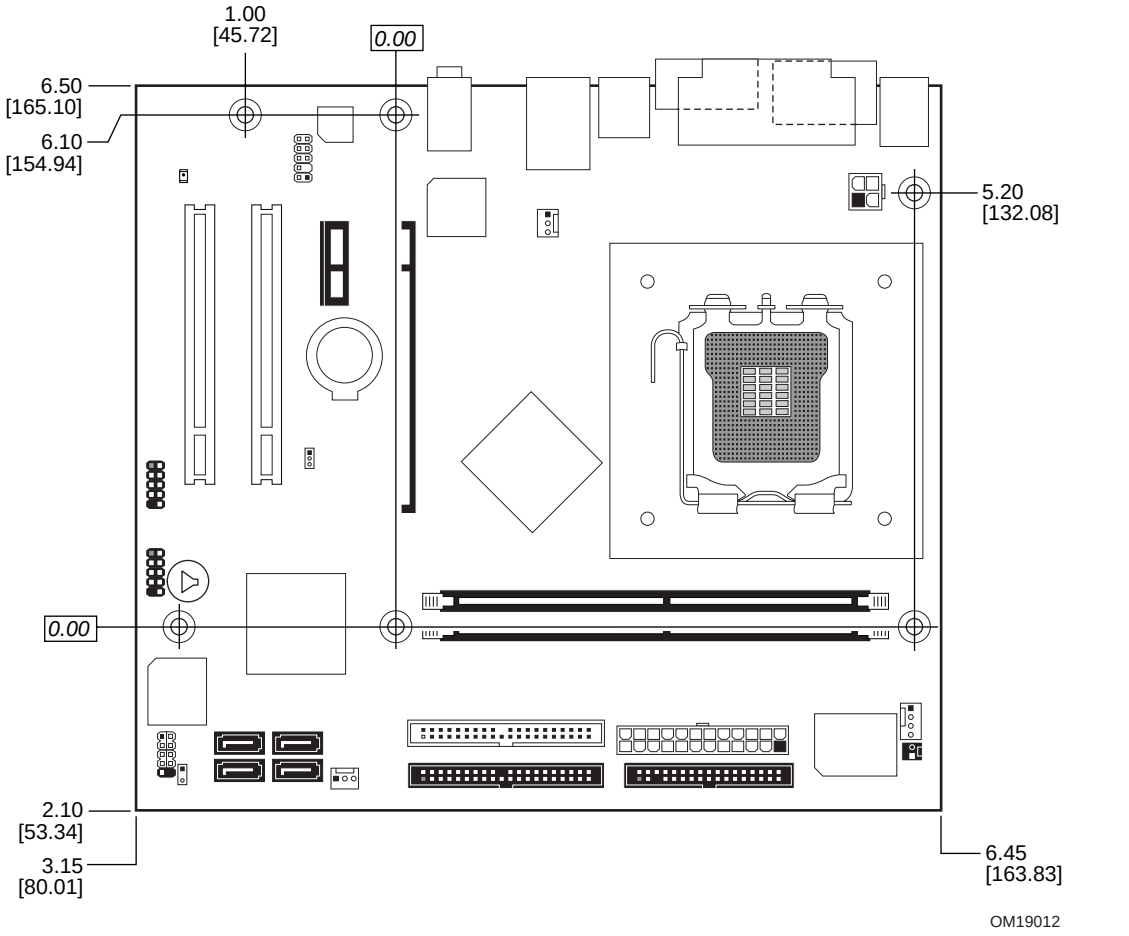


Figure 11. Board Dimensions

2.9.2 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 12 shows the I/O shield. Dimensions are given in millimeters [inches].

The figure also indicates the position of each cutout. Additional design considerations for I/O shields relative to chassis requirements are described in the ATX specification.

NOTE

The I/O shield drawing in this document is for reference only. An I/O shield compliant with the ATX chassis specification 2.03 is available from Intel.

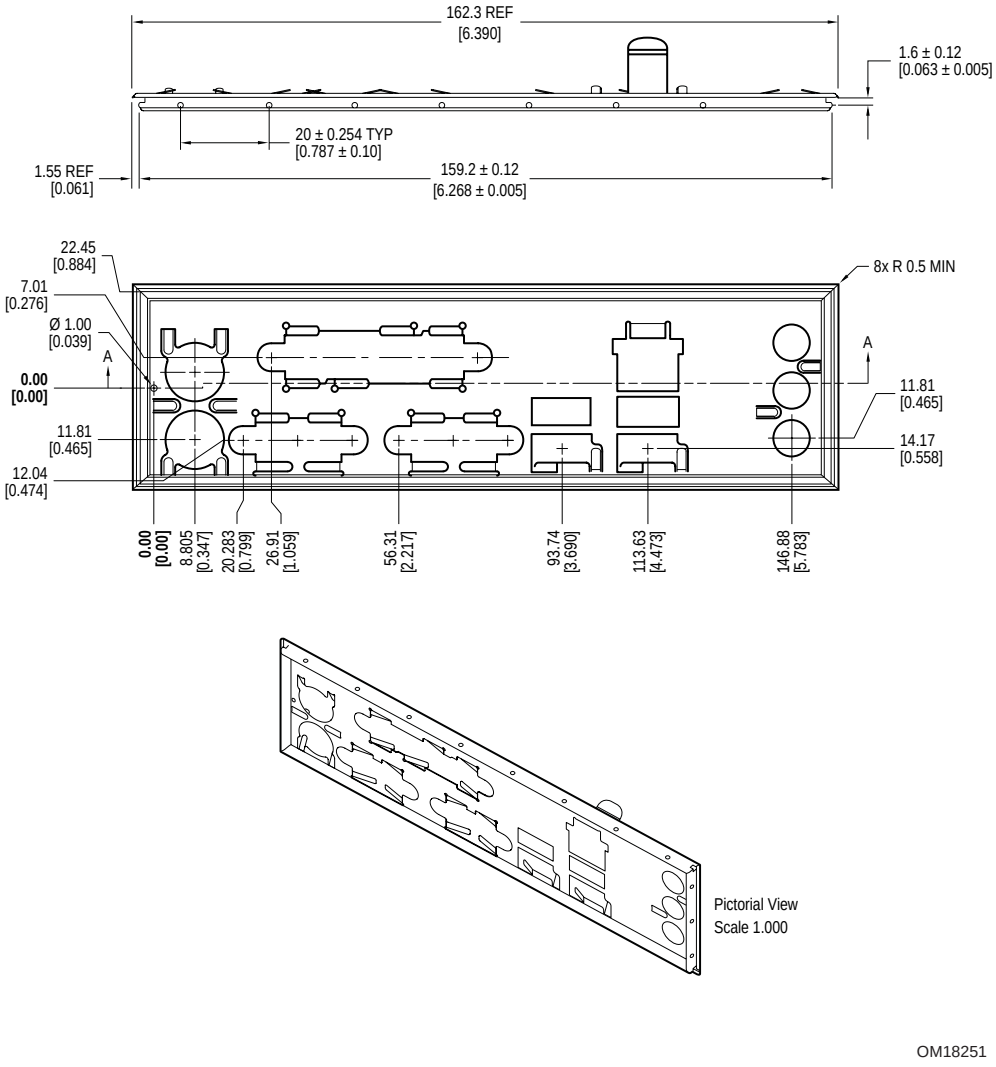


Figure 12. I/O Shield Dimensions

2.10 Electrical Considerations

2.10.1 DC Loading

Table 29 lists the DC loading characteristics of the board. This data is based on a DC analysis of all active components within the board that impact its power delivery subsystems. The analysis does not include PCI add-in cards. Minimum values assume a light load placed on the board that is similar to an environment with no applications running and no USB current draw. Maximum values assume a load placed on the board that is similar to a heavy gaming environment with a 500 mA current draw per USB port. These calculations are not based on specific processor values or memory configurations but are based on the minimum and maximum current draw possible from the board's power delivery subsystems to the processor, memory, and USB ports.

Use the datasheets for add-in cards, such as PCI, to determine the overall system power requirements. The selection of a power supply at the system level is dependent on the system's usage model and not necessarily tied to a particular processor speed.

Table 29. DC Loading Characteristics

		DC Current at:				
Mode	**DC Power**	**+3.3 V**	**+5 V**	**+12 V**	**-12 V**	**+5 VSB**
Minimum loading	247 W	2.1 A	2.9 A	18.1 A	0.05 A	1.8 A
Maximum loading	480 W	20.1 A	19.3 A	25 A	0.1 A	2.3 A

2.10.2 Add-in Board Considerations

The board is designed to provide 2 A (average) of +5 V current for each add-in board. The total +5 V current draw for the board is as follows: a fully loaded D101GGC board (all three expansion slots and the PCI Express x16 add-in card connector filled) must not exceed 8 A.

2.10.3 Fan Connector Current Capability

CAUTION

The processor fan must be connected to the processor fan connector, not to a chassis fan connector. Connecting the processor fan to a chassis fan connector may result in onboard component damage that will halt fan operation.

Table 30 lists the current capability of the fan connectors.

Table 30. Fan Connector Current Capability

Fan Connector	Maximum Available Current
Processor fan	3000 mA
Front chassis fan	1500 mA
Rear chassis fan	1500 mA

2.10.4 Power Supply Considerations

CAUTION

The +5 V standby line for the power supply must be capable of providing 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.

System integrators should refer to the power usage values listed in Table 29 when selecting a power supply for use with the board.

Additional power required will depend on configurations chosen by the integrator.

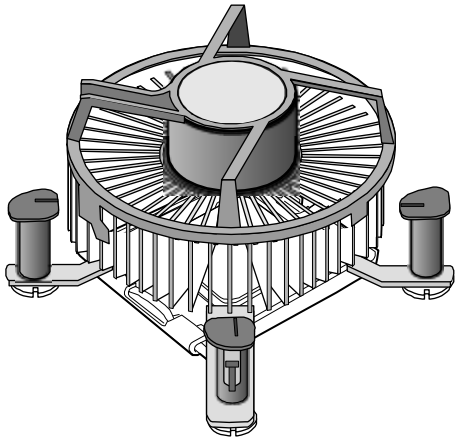
The power supply must comply with the following recommendations found in the indicated sections of the ATX form factor specification.

- The potential relation between 3.3 VDC and +5 VDC power rails
- The current capability of the +5 VSB line
- All timing parameters
- All voltage tolerances

2.11 Thermal Considerations

CAUTION

A chassis with a maximum internal ambient temperature of 38 °C at the processor fan inlet is a requirement. Use a processor heatsink that provides omni-directional airflow (similar to the type shown in Figure 13) to maintain required airflow across the processor voltage regulator area.



OM16996

Figure 13. Processor Heatsink for Omni-directional Airflow

CAUTION

Failure to ensure appropriate airflow may result in reduced performance of both the processor and/or voltage regulator or, in some instances, damage to the board. For a list of chassis that have been tested with Intel desktop boards please refer to the following website:

http://developer.intel.com/design/motherbd/cooling.htm

All responsibility for determining the adequacy of any thermal or system design remains solely with the reader. Intel makes no warranties or representations that merely following the instructions presented in this document will result in a system with adequate thermal performance.

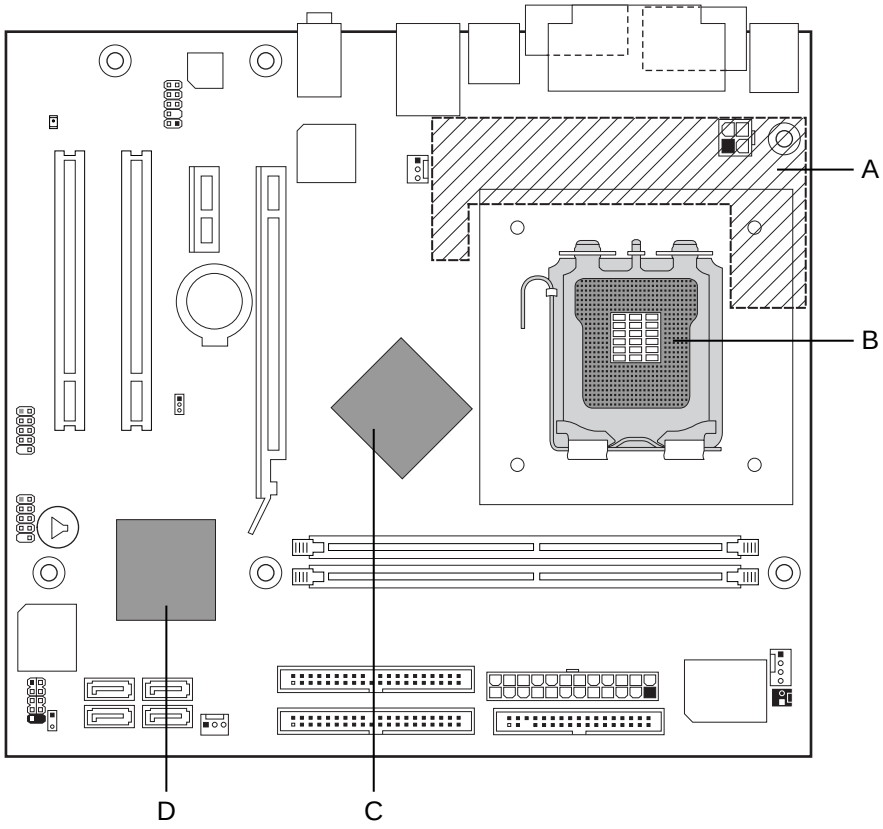
CAUTION

Ensure that the ambient temperature does not exceed the board's maximum operating temperature. Failure to do so could cause components to exceed their maximum case temperature and malfunction. For information about the maximum operating temperature, see the environmental specifications in Section 2.13.

CAUTION

Ensure that proper airflow is maintained in the processor voltage regulator circuit. Failure to do so may result in damage to the voltage regulator circuit. The processor voltage regulator area (item A in Figure 14) can reach a temperature of up to 85 °C in an open chassis.

Figure 14 shows the locations of the localized high temperature zones.



Item	Description
A	Processor voltage regulator area
B	Processor
C	ATI Radeon Xpress 200 Northbridge
D	IXP 450 Southbridge

Figure 14. Localized High Temperature Zones

Table 31 provides maximum case temperatures for the components that are sensitive to thermal changes. The operating temperature, current load, or operating frequency could affect case temperatures. Maximum case temperatures are important when considering proper airflow to cool the board.

Table 31. Thermal Considerations for Components

Component	Maximum Case Temperature
Intel Pentium 4 processor	For processor case temperature, see processor datasheets and processor specification updates
ATI Radeon Xpress 200 Northbridge	95 °C
IXP 450 Southbridge	85 °C

For information about	Refer to
Intel Pentium 4 processor datasheets and specification updates	Section 1.2, page 14

2.12 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.

The MTBF data is calculated from predicted data at 55 ºC. The MTBF for the D101GGC board is 95,006 hours.

2.13 Environmental

Table 32 lists the environmental specifications for the board.

Table 32. Environmental Specifications

Parameter	Specification		
Temperature			
Non-Operating	-40 °C to +70 °C		
Operating	0 °C to +55 °C		
Shock			
Unpackaged	50 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	5 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		

2.14 Regulatory Compliance

This section contains the following regulatory compliance information for Desktop Board D101GGC:

- Safety regulations
- European Union Declaration of Conformity statement
- Product Ecology statements
- Electromagnetic Compatibility (EMC) regulations
- Product certification markings

2.14.1 Safety Regulations

Desktop Board D101GGC complies with the safety regulations stated in Table 33 when correctly installed in a compatible host system.

Table 33. Safety Regulations

Regulation	Title
UL 60950-1:2003/ CSA C22.2 No. 60950-1-03	Information Technology Equipment – Safety - Part 1: General Requirements (USA and Canada)
EN 60950-1:2002	Information Technology Equipment – Safety - Part 1: General Requirements (European Union)
IEC 60950-1:2001, First Edition	Information Technology Equipment – Safety - Part 1: General Requirements (International)

2.14.2 European Union Declaration of Conformity Statement

We, Intel Corporation, declare under our sole responsibility that the product Intel® Desktop Board D101GGC is in conformity with all applicable essential requirements necessary for CE marking, following the provisions of the European Council Directive 89/336/EEC (EMC Directive) and Council Directive 73/23/EEC (Safety/Low Voltage Directive).

The product is properly CE marked demonstrating this conformity and is for distribution within all member states of the EU with no restrictions.

CE

This product follows the provisions of the European Directives 89/336/EEC and 73/23/EEC.

Čeština Tento výrobek odpovídá požadavkům evropských směrnic 89/336/EEC a 73/23/EEC.

Dansk Dette produkt er i overensstemmelse med det europæiske direktiv 89/336/EEC & 73/23/EEC.

Dutch Dit product is in navolging van de bepalingen van Europees Directief 89/336/EEC & 73/23/EEC.

Eesti Antud toode vastab Euroopa direktiivides 89/336/EEC ja 73/23/EEC kehtestatud nõuetele.

Suomi Tämä tuote noudattaa EU-direktiivin 89/336/EEC & 73/23/EEC määräyksiä.

Français Ce produit est conforme aux exigences de la Directive Européenne 89/336/EEC & 73/23/EEC.

Deutsch Dieses Produkt entspricht den Bestimmungen der Europäischen Richtlinie 89/336/EEC & 73/23/EEC.

Ελληνικά Το παρόν προϊόν ακολουθεί τις διατάξεις των Ευρωπαϊκών Οδηγιών 89/336/ΕΟΚ και 73/23/ΕΟΚ.

Magyar E termék megfelel a 89/336/EEC és 73/23/EEC Európai Irányelv előírásainak.

Icelandic Þessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 89/336/ EEC & 73/23/EEC.

Italiano Questo prodotto è conforme alla Direttiva Europea 89/336/EEC & 73/23/EEC.

Latviešu Šis produkts atbilst Eiropas Direktīvu 89/336/EEC un 73/23/EEC noteikumiem.

Lietuvių Šis produktas atitinka Europos direktyvų 89/336/EEC ir 73/23/EEC nuostatas.

Malti Dan il-prodott hu konformi mal-provvedimenti tad-Direttivi Ewropej 89/336/EEC u 73/23/EEC.

Norsk Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 89/336/ EEC & 73/23/EEC.

Polski Niniejszy produkt jest zgodny z postanowieniami Dyrektyw Unii Europejskiej 89/336/EWG i 73/23/EWG.

Portuguese Este produto cumpre com as normas da Diretiva Européia 89/336/EEC & 73/23/EEC.

Español Este producto cumple con las normas del Directivo Europeo 89/336/EEC & 73/23/EEC.

Slovensky Tento produkt je v súlade s ustanoveniami európskych direktív 89/336/EEC a 73/23/EEC.

Slovenščina Izdelek je skladen z določbami evropskih direktiv 89/336/EGS in 73/23/EGS.

Svenska Denna produkt har tillverkats i enlighet med EG-direktiv 89/336/EEC & 73/23/EEC.

Türkçe Bu ürün, Avrupa Birliği'nin 89/336/EEC ve 73/23/EEC yönergelerine uyar.

2.14.3 Product Ecology Statements

The following information is provided to address worldwide product ecology concerns and regulations.

2.14.3.1 Disposal Considerations

This product contains the following materials that may be regulated upon disposal: lead solder on the printed wiring board assembly.

2.14.3.2 Recycling Considerations

As part of its commitment to environmental responsibility, Intel has implemented the Intel Product Recycling Program to allow retail consumers of Intel's branded products to return used products to select locations for proper recycling.

Please consult the http://www.intel.com/intel/other/ehs/product_ecology/Recycling_Program.htm for the details of this program, including the scope of covered products, available locations, shipping instructions, terms and conditions, etc.

Intel Product Recycling Program

http://www.intel.com/intel/other/ehs/product_ecology/Recycling_Program.htm

Deutsch

Als Teil von Intels Engagement für den Umweltschutz hat das Unternehmen das Intel Produkt-Recyclingprogramm implementiert, das Einzelhandelskunden von Intel Markenprodukten ermöglicht, gebrauchte Produkte an ausgewählte Standorte für ordnungsgemäßes Recycling zurückzugeben.

Details zu diesem Programm, einschließlich der darin eingeschlossenen Produkte, verfügbaren Standorte, Versandanweisungen, Bedingungen usw., finden Sie auf der http://www.intel.com/intel/other/ehs/product_ecology/Recycling_Program.htm

Español

Como parte de su compromiso de responsabilidad medioambiental, Intel ha implantado el programa de reciclaje de productos Intel, que permite que los consumidores al detalle de los productos Intel devuelvan los productos usados en los lugares seleccionados para su correspondiente reciclado.

Consulte la http://www.intel.com/intel/other/ehs/product_ecology/Recycling_Program.htm para ver los detalles del programa, que incluye los productos que abarca, los lugares disponibles, instrucciones de envío, términos y condiciones, etc.