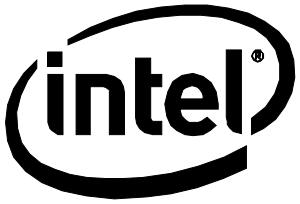


Intel® Desktop Board DH61AG

Technical Product Specification

July 2013

Order Number: G28731-009

The Intel Desktop Board DH61AG 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 DH61AG Specification Update.

Revision History

Revision	Revision History	Date
-001	First release of the Intel® Desktop Board DH61AG Technical Product Specification	May 2011
-002	Updated to include specification clarifications	July 2011
-003	Updated the Board Identification Information Section	July 2011
-004	Updated to include specification clarifications	October 2011
-005	Specification Clarification	January 2012
-006	Specification Clarification	October 2012
-007	Specification Clarification	January 2013
-008	Specification Clarification	May 2013
-009	Specification Clarification	July 2013

This product specification applies to only the standard Intel® Desktop Board with BIOS identifier AGH6110H.86A.

Board Identification Information

Basic Desktop Board DH61AG Identification Information

AA Revision	BIOS Revision	Notes
G23736-400	AGH6110H.86A.0023	1,2
G23736-500	AGH6110H.86A.0023	1,2
G23736-502	AGH6110H.86A.0023	1,2
G23736-503	AGH6110H.86A.0040	1,2
G23736-504	AGH6110H.86A.0040	1,2

Notes:

1. The AA number is found on a small label on the component side of the board.
2. The H61 chipset used on this AA revision consists of the following component:

Device	Stepping	S-Spec Numbers
BD82H61	B3	SLJ4B

Specification Changes or Clarifications

The table below indicates the Specification Changes or Specification Clarifications that apply to the Intel® Desktop Board DH61AG.

Specification Changes or Clarifications

Date	Type of Change	Description of Changes or Clarifications
July 2011	Spec Clarification	• The BIOS was updated to AGH6110H.86A.0023 just prior to product launch. • Section 2.2.3.3 Power Supply Connectors – additional information has been added to the External Power Supply section. • Sections 1.10 Audio Subsystem and Section 2.2.3.1 Signal Tables for the Connectors and Headers have been updated to show that AA revision G23736-400 supports 5.1 analog surround audio and AA revision G23736-500 supports both 5.1 and 7.1 analog surround audio.
July 2011	Spec Clarification	AGH6110H.86A.0027 will not be implemented with AA Revision G23736-500 as planned. The BIOS will remain at AGH6110H.86A.0023.
October 2011	Spec Clarification	• Updates were made to Tables 3, 4, and 14. • References to 2.6A USB current specifics were removed from the TPS
January	Spec Clarification	• Updated Table 26 on page 55 to change the pinout of the 3-wire fan. • Added a Note to Table 31 on page 57 concerning LVDS single-channel output. • Added Section 3.8 Hard Disk Drive Password Security Feature on page 83.
October 2012	Spec Clarification	Updated Table 44. Environmental Specifications to address operating temperature requirements for the board.
January 2013	Spec Clarification	Updated Table 11. Wake-up Devices and Events to add Consumer IR.
May 2013	Spec Clarification	Added ENERGY STAR Note to Section 5.1.5.
July 2013	Spec Clarification	Deleted references to ENERGY STAR.

Errata

Current characterized errata, if any, are documented in a separate Specification Update. See http://www.intel.com/content/www/us/en/motherboards/desktop-motherboards/motherboards.html?wapkw=desktop+boards for the latest documentation.

Preface

This Technical Product Specification (TPS) specifies the board layout, components, connectors, power and environmental requirements, and the BIOS for Intel® Desktop Board DH61AG.

Intended Audience

The TPS is intended to provide detailed, technical information about Intel Desktop Board DH61AG 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 Intel Desktop Board DH61AG
2	A map of the resources of the Intel Desktop Board
3	The features supported by the BIOS Setup program
4	A description of the BIOS error messages, beep codes, and POST codes
5	Regulatory compliance and battery disposal information

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.

Other Common Notation

#	Used after a signal name to identify an active-low signal (such as USBP0#)
GB	Gigabyte (1,073,741,824 bytes)
GB/s	Gigabytes per second
Gb/s	Gigabits per second
KB	Kilobyte (1024 bytes)
Kbit	Kilobit (1024 bits)
kbits/s	1000 bits per second
MB	Megabyte (1,048,576 bytes)
MB/s	Megabytes per second
Mbit	Megabit (1,048,576 bits)
Mbits/s	Megabits per second
TDP	Thermal Design Power
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

4 Error Messages and Beep Codes

5 Regulatory Compliance and Battery Disposal Information

Figures

Tables

1 Product Description

1.1 Overview

1.1.1 Feature Summary

Table 1 summarizes the major features of the board.

Table 1. Feature Summary

Form Factor	Mini-ITX (6.7 inches by 6.7 inches [170.18 millimeters by 170.18 millimeters])
Processor	• Intel® Core i7, Intel® Core™ i5, Intel® Core™ i3, Intel® Pentium®, Intel® Celeron®, and Intel® Xeon® processors in an LGA1155 socket with up to 65 W TDP: — Integrated graphics processing (processors with Intel® Graphics Technology) — Integrated PCI Express* v2.0 interface controller — Integrated memory controller
Memory	• Two 204-pin DDR3 SDRAM Small Outline Dual Inline Memory Module (SO-DIMM) sockets • Support for DDR3 1333 MHz and DDR3 1066 MHz SO-DIMMs • Support for 1 Gb, 2 Gb, and 4 Gb memory technology • Support for up to 16 GB of system memory with two SO-DIMMs using 4 Gb memory technology • Support for non-ECC memory • Support for 1.35 V low voltage JEDEC memory
Chipset	Intel® H61 Express Chipset consisting of the Intel® H61 Express Platform Controller Hub (PCH)
Graphics	• Integrated graphics support for processors with Intel Graphics Technology: — High Definition Multimedia Interface* (HDMI*) — DVI-I — Internal flat panel displays: ▪ LVDS ▪ eDP (Embedded DisplayPort*)
Audio	• 10-channel (8+2) Intel® High Definition (Intel® HD) audio via the Realtek* ALC892 audio codec — Digital/analog stereo line-out (2-in-1 digital/analog back panel jack) — In-chassis stereo speakers support (3 W/4 Ω via internal header) — AV-compliant 7.1 (see note on page 32) surround support (analog line-level via internal header) — Secondary S/PDIF digital audio output (internal header) — DMIC digital microphone input (internal header) — Analog line-in (back panel jack) — Front panel HD Audio/AC'97 headphones/mic support (internal header) • 8-channel (7.1) Intel High Definition Audio via the HDMI interface

continued

Table 1. Feature Summary (continued)

Peripheral Interfaces	• Two USB 3.0 ports, via an NEC D720200 controller, implemented through two back panel connectors (blue) • Ten USB 2.0 ports: — Four ports implemented through two dual-port internal headers (black) — One single-port internal header (black) — Two high-current/fast-charging ports implemented through stacked back panel connectors (yellow) — One port implemented in the PCI Express Half–Mini Card slot — Two ports implemented in the PCI Express Full-Mini Card slot • Four SATA ports: — Two internal SATA connectors (black) — One back panel eSATA connector (red) — One internal mSATA port (PCI Express Full-Mini Card slot)
Expansion Capabilities	• One PCI Express 2.0 x4 add-in card connector • One PCI Express Half-Mini Card slot • One PCI Express Full-/Half-Mini Card slot
BIOS	• Intel® BIOS resident in the Serial Peripheral Interface (SPI) Flash device • Support for Advanced Configuration and Power Interface (ACPI), Plug and Play, and System Management BIOS (SMBIOS)
LAN Support	Gigabit (10/100/1000 Mbits/s) LAN subsystem using the Intel® 82579V Gigabit Ethernet Controller
Legacy I/O Control	Nuvoton W83677HG-i I/O controller for CIR and hardware management support
Hardware Monitor Subsystem	• Hardware monitoring through the Nuvoton I/O controller • Voltage sense to detect out of range power supply voltages • Thermal sense to detect out of range thermal values • Two fan headers • Two fan sense inputs used to monitor fan activity • Fan speed control

1.1.2 Board Layout (Top)

Figure 1 shows the location of the major components on the top-side of the Intel Desktop Board DH61AG.

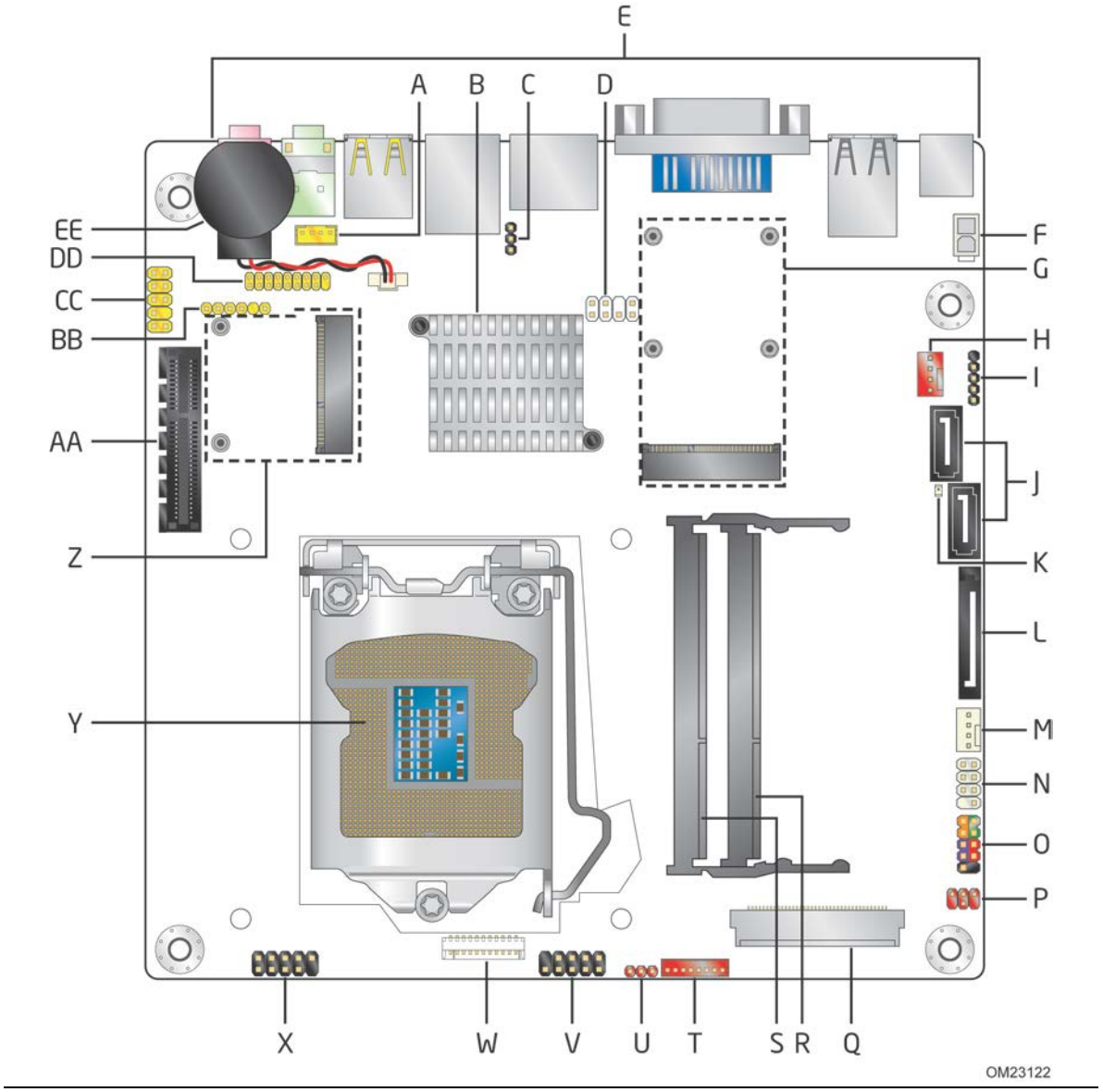


Figure 1. Major Board Components (Top)

Table 2 lists the components identified in Figure 1.

Table 2. Components Shown in Figure 1

Item from Figure 1	Description
A	Internal stereo speakers connector
B	Intel H61 Express Chipset
C	BIOS Setup configuration jumper block
D	Home Theater PC (HTPC) header
E	Back panel connectors
F	Internal power connector
G	PCI Express Full-/Half-Mini Card slot
H	System fan header
I	Single-port USB 2.0 header
J	SATA data connectors
K	Standby power LED
L	SATA power connector
M	Processor fan header
N	Consumer IR receiver header
O	Front panel header
P	Flat panel voltage selection header
Q	LVDS connector
R	DDR3 SO-DIMM 2 socket
S	DDR3 SO-DIMM 1 socket
T	FPD brightness connector
U	Backlight inverter voltage selection header
V	Front panel dual-port USB 2.0 header
W	Debug connector
X	Front panel dual-port USB 2.0 header
Y	LGA1155 processor socket
Z	PCI Express Half-Mini Card slot
AA	PCI Express 2.0 x4 connector
BB	Internal S/PDIF / DMIC header
CC	Front panel audio header
DD	Analog surround audio header
EE	Battery

1.1.3 Board Layout (Bottom)

Figure 2 shows the location of the major components on the bottom-side of the Intel Desktop Board DH61AG.

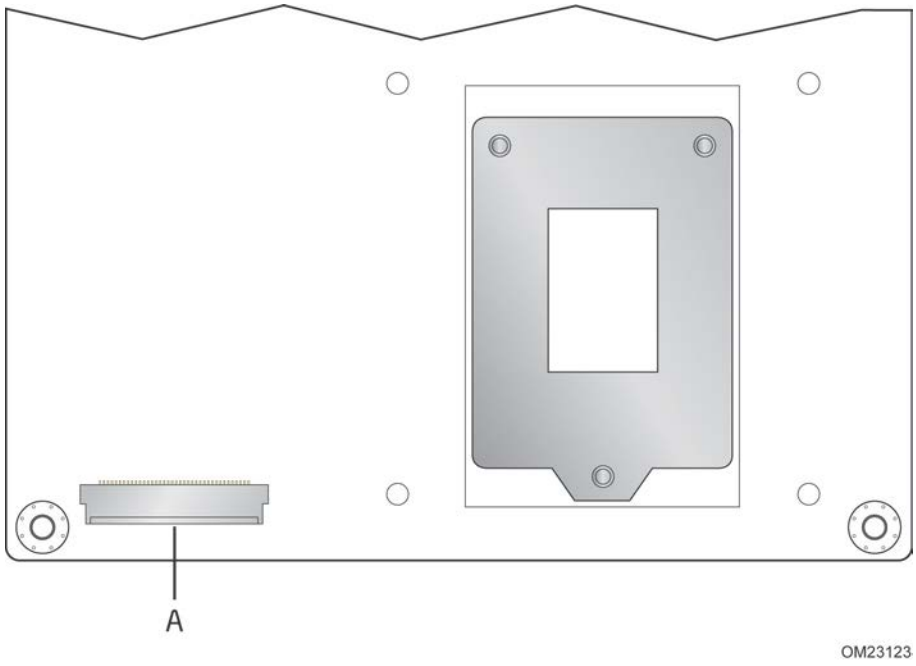


Figure 2. Major Board Components (Bottom)

Table 3. Components Shown in Figure 2

Item/callout from Figure 2	Description
A	Embedded DisplayPort (eDP) connector

1.1.4 Block Diagram

Figure 3 is a block diagram of the major functional areas of the board.

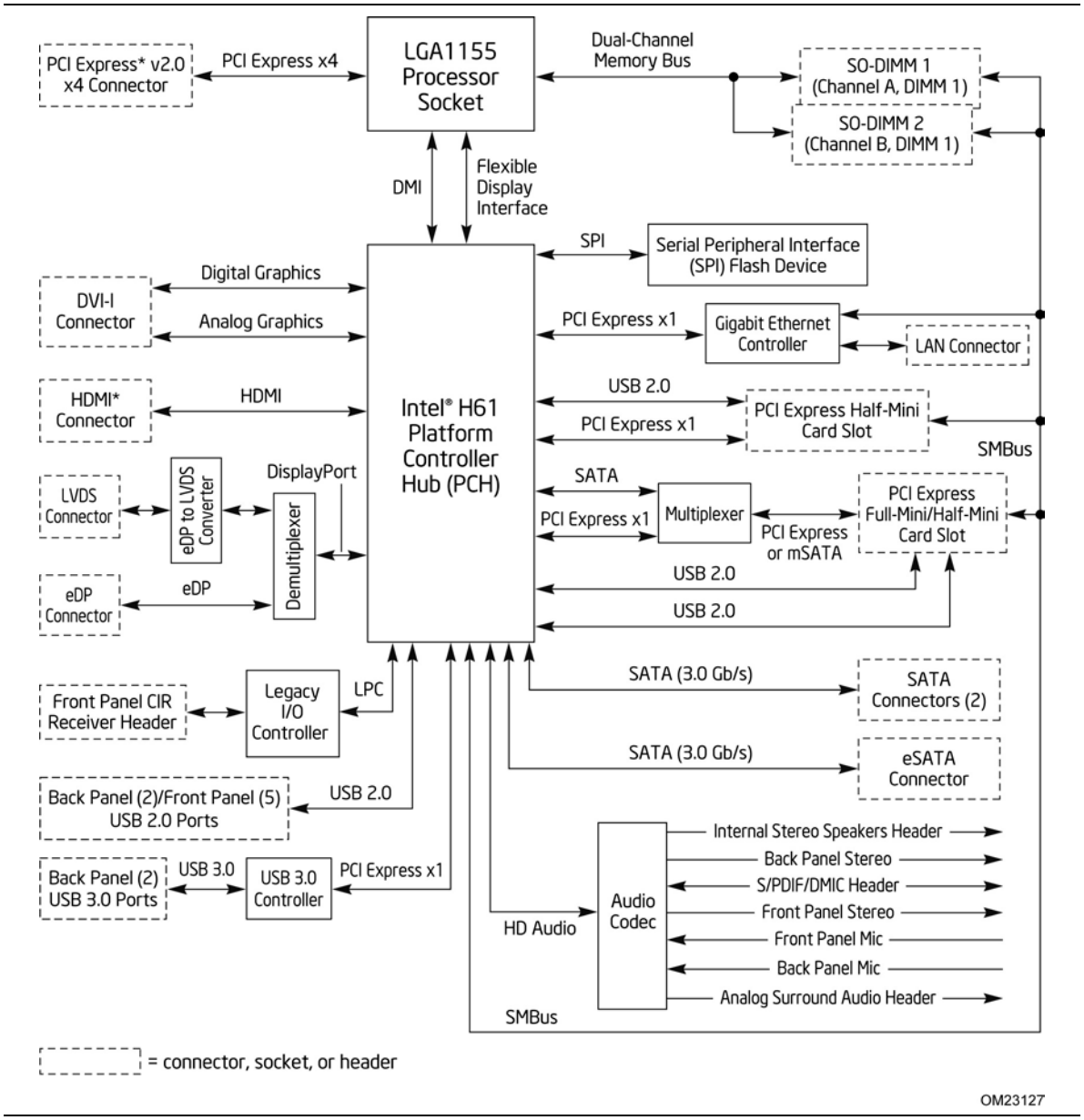


Figure 3. Block Diagram

1.2 Online Support

To find information about...	Visit this World Wide Web site:
Intel Desktop Board DH61AG	http://www.intel.com/products/motherboard/index.htm
Desktop Board Support	http://www.intel.com/p/en_US/support?iid=hdr+support
Available configurations for Intel Desktop Board DH61AG	http://ark.intel.com
Supported processors	http://processormatch.intel.com
Chipset information	http://www.intel.com/products/desktop/chipsets/index.htm
BIOS and driver updates	http://downloadcenter.intel.com
Tested memory	http://www.intel.com/support/motherboards/desktop/sb/CS-025414.htm
Integration information	http://www.intel.com/support/go/buildit

1.3 Processor

The board is designed to support the Intel Core i7, Intel Core i5, Intel Core i3, Intel Pentium, Intel Celeron, and Intel Xeon processors in an LGA1155 socket.

Other processors may be supported in the future. This board is designed to support processors with a maximum Thermal Design Power (TDP) of 65 W. The processors listed above are only supported when falling within the power requirements of Intel Desktop Board DH61AG. See the Intel web site listed below for the most up-to-date list of supported processors.

For information about...	Refer to:
Supported processors	http://processormatch.intel.com

CAUTION

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

NOTE

This board has specific requirements for providing power to the processor. Refer to Section 2.6.1 on page 71 for information on power supply requirements for this board.

1.4 System Memory

The board has two 204-pin SO-DIMM sockets and supports the following memory features:

- 1.5 V DDR3 SDRAM SO-DIMMs with gold plated contacts.
- Support for 1.35 V Low Voltage DDR3 (new JEDEC specification)
- Two independent memory channels with interleaved mode support
- Unbuffered, single-sided or double-sided SO-DIMMs
- 16 GB maximum total system memory (with 4 Gb memory technology). Refer to Section 2.1.1 on page 45 for information on the total amount of addressable memory.
- Minimum recommended total system memory: 1024 MB
- Non-ECC SO-DIMMs
- Serial Presence Detect
- XMP profile support for voltage detection
- DDR3 1333 MHz and DDR3 1066 MHz SDRAM SO-DIMMs

NOTE

To be fully compliant with all applicable DDR SDRAM memory specifications, the board should be populated with SO-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 SO-DIMMs may not function under the determined frequency.

Table 4 lists the supported SO-DIMM configurations.

Table 4. Supported Memory Configurations

Raw Card Version	SO-DIMM Capacity	DRAM Device Technology	DRAM Organization	# of DRAM Devices
A	1 GB	1 Gb	64 M x 16	8
	2 GB	2 Gb	128 M x 16	8
B	1 GB	1 Gb	128 M x 8	8
	2 GB	2 Gb	256 M x 8	8
C	512 MB	1 Gb	64 M x 16	4
	1 GB	2 Gb	128 M x 16	4
F	2 GB	1 Gb	128 M x 8	16
	4 GB	2 Gb	256 M x 8	16
	8 GB	4 Gb	512 M x 8	16

Note: System memory configurations are based on availability and are subject to change.

For information about...	Refer to:
Tested Memory	http://support.intel.com/support/motherboards/desktop/sb/CS-025414.htm

1.4.1 Memory Configurations

Processors in the LGA1155 socket support the following types of memory organization:

- **Dual channel (Interleaved) mode**. This mode offers the highest throughput for real world applications. Dual channel mode is enabled when the installed memory capacities of both SO-DIMM channels are equal. Technology and device width can vary from one channel to the other but the installed memory capacity for each channel must be equal. If different speed SO-DIMMs are used between channels, the slowest memory timing will be used.
- **Single channel (Asymmetric) mode**. This mode is equivalent to single channel bandwidth operation for real world applications. This mode is used when only a single SO-DIMM is installed or the memory capacities are unequal. Technology and device width can vary from one channel to the other. If different speed SO-DIMMs are used between channels, the slowest memory timing will be used.

For information about...	Refer to:
Memory Configuration Examples	http://www.intel.com/support/motherboards/desktop/sb/cs-011965.htm

Figure 4 illustrates the memory channel and SO-DIMM configuration.

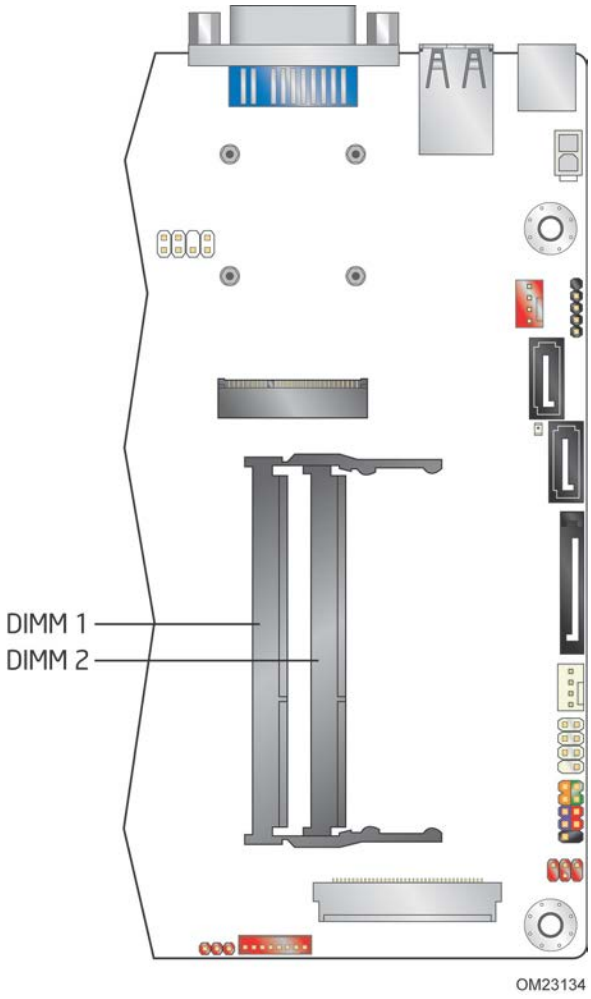


Figure 4. Memory Channel and SO-DIMM Configuration

1.5 Intel® H61 Express Chipset

Intel H61 Express Chipset with Direct Media Interface (DMI) interconnect provides interfaces to the processor and the USB, SATA, LPC, LAN, and PCI Express interfaces. The Intel H61 Express Chipset is a centralized controller for the board's I/O paths.

For information about	Refer to
The Intel H61 chipset	http://www.intel.com/products/desktop/chipsets/index.htm
Resources used by the chipset	Chapter 2

1.6 Graphics Subsystem

The board supports graphics through Intel Graphics Technology.

1.6.1 Integrated Graphics

The board supports integrated graphics through the Intel® Flexible Display Interface (Intel® FDI) for processors with Intel Graphics Technology.

NOTE

If using a processor with integrated graphics, the board can simultaneously support up to two of the three integrated graphics interfaces: HDMI, DVI-I, and Flat Panel Display.

Flat Panel Display is supported by eDP and LVDS interfaces, however only one can be used at a time.

1.6.1.1 Intel® High Definition (Intel® HD) Graphics

The Intel HD graphics controller features the following:

- 3D Features
  - DirectX* 10.1 and OpenGL* 3.0 compliant
  - DirectX 11.0 CS4.0 only
  - Shader Model 4.0
- Video
  - Hi-Definition content at up to 1080p resolution
  - Hardware accelerated MPEG-2, VC-1/WMV and H.264/AVC Hi-Definition video formats
  - Intel® HD Technology with Advanced Hardware Video Transcoding
  - Blu-ray* S3D via HDMI 1.4
  - Dynamic Video Memory Technology (DVMT) 5.0 support
  - Support of up to 1.7 GB Video Memory with 4 GB and above system memory configuration

1.6.1.2 Video Memory Allocation

Intel® Dynamic Video Memory Technology (DVMT) is a method for dynamically allocating system memory for use as graphics memory to balance 2D/3D graphics and system performance. If your computer is configured to use DVMT, graphics memory is allocated based on system requirements and application demands (up to the configured maximum amount). When memory is no longer needed by an application, the dynamically allocated portion of memory is returned to the operating system for other uses.

1.6.1.3 High Definition Multimedia Interface* (HDMI*)

The HDMI port supports standard, enhanced, or high definition video, plus multi-channel digital audio on a single cable. It is compatible with all ATSC and DVB HDTV standards and supports eight full range channels at 24-bit/96 kHz audio of lossless audio formats such as Dolby* TrueHD or DTS* HD Master Audio. The maximum supported resolution is 1920 x 1200 (WUXGA). The HDMI port is compliant with the HDMI 1.4 specification.

Depending on the type of add-in card installed in the PCI Express x4 connector, the HDMI port will behave as described in Table 5.

Table 5. HDMI Port Status Conditions

PCI Express x4 Connector Status	HDMI Port Status
No add-in card installed	Enabled
Non-video PCI Express x1/x4 add-in card installed	Enabled
Video PCI Express x1/x4 add-in card installed	Disabled (Note)

Note: Default behavior per BIOS setup option.

1.6.1.4 Digital Visual Interface (DVI-I)

The DVI-I port supports both digital and analog DVI displays. The maximum supported resolution is 1920 x 1200 (WUXGA). The DVI port is compliant with the DVI 1.0 specification. DVI analog output can also be converted to VGA using a DVI-VGA converter.

Depending on the type of add-in card installed in the PCI Express x4 connector, the DVI port will behave as described in Table 6.

Table 6. DVI Port Status Conditions

PCI Express x4 Connector Status	DVI Digital (DVI-D) Port Status	DVI Analog (DVI-A) Port Status(Note 1)
No add-in card installed	Enabled	Enabled
Non-video PCI Express x1/x4 add-in card installed	Enabled	Enabled
Video PCI Express x1/x4 add-in card installed	Disabled (Note 2)	Disabled (Note 2)

Notes:

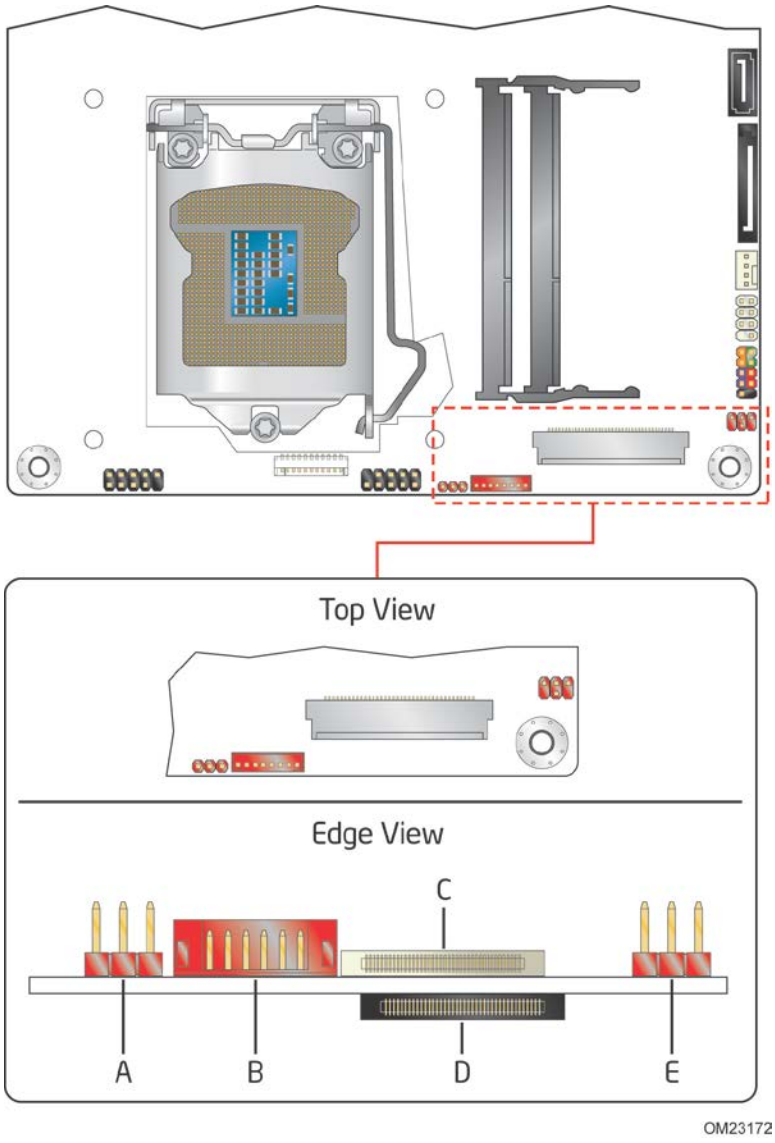
1. DVI analog output can also be converted to VGA with a DVI-VGA converter.
2. Default behavior per BIOS setup option.

1.6.1.5 Analog Display (VGA)

The VGA port supports analog displays. The maximum supported resolution is 2048 x 1536 (QXGA).

1.6.2 Flat Panel Display Interfaces

The board supports flat panel display via the LVDS and Embedded DisplayPort interfaces. Figure 5 shows the flat panel connectors.



Item	Description
A	Backlight inverter voltage selection header
B	FPD brightness connector
C	LVDS connector
D	Embedded DisplayPort connector
E	Flat panel voltage selection header

Figure 5. Flat Panel Connectors

1.6.2.1 LVDS Interface

The LVDS flat panel display interface supports the following:

- 1920 x 1200 @ 60 Hz resolution
- Single-channel and dual-channel interface, up to 135 MHz clock rate 18 bpp and 24 bpp (VESA* and JEIDA mappings) color depth support
- Multiple EDID data source capability (panel, predefined, and custom payloads)
- 3.3 V, 5 V, and 12 V flat panel display voltage flexibility, with up to 3 A current
- 12 V and 19 V backlight inverter voltage flexibility, with up to 3 A current
- Backlight inverter signal redundancy on dedicated header as well as an LVDS connector (for discrete inverter or panel-integrated inverter support using a single cable)
- Flat panel brightness control via front panel button input as well as Windows* 7 “Screen brightness” adjustment slider
- Spread-spectrum control

1.6.2.2 Embedded DisplayPort (eDP) Interface

The eDP (Embedded DisplayPort) flat panel display interface supports the following:

- 1920 x 1200 @ 60 Hz resolution
- 1-lane, 2-lane, and 4-lane bandwidth at 1.62 Gb/s or 2.7 Gb/s
- Multiple EDID data source capability (panel, predefined, and custom payloads)
- 3.3 V, 5 V, and 12 V flat panel display voltage flexibility, with up to 3 A current
- 12 V and 19 V backlight inverter voltage flexibility, with up to 3 A current
- Backlight inverter signal redundancy on a dedicated header as well as an eDP connector (for discrete inverter or panel-integrated inverter support using a single cable)
- Flat panel brightness control via front panel button input as well as Windows 7 “Screen brightness” adjustment slider

1.6.2.3 Configuration Modes

For monitors attached to the HDMI and DVI ports, video modes supported by this board are based on the Extended Display Identification Data (EDID) protocol.

Video mode configuration for eDP/LVDS displays is supported as follows:

- Automatic panel identification via Extended Display Identification Data (EDID) for panels with onboard EDID support
- Panel selection from common predefined panel types (without onboard EDID)
- Custom EDID payload installation for ultimate parameter flexibility, allowing custom definition of EDID data on panels without onboard EDID

In addition, BIOS setup provides the following configuration parameters for internal flat panel displays:

- Screen Brightness: allows the end user to set the screen brightness for the display effective through the Power-On Self Test stage (such as while showing the splash screen image and BIOS setup). Windows 7 will ignore this setting in favor of the native “screen brightness” control provided by the operating system.

- Brightness Steps: allows the system integrator to configure the brightness steps for the operating system's "screen brightness" control (such as the "Screen brightness" adjustment slider under the Windows 7 "Power Options" control panel).
- Flat Panel Configuration Changes Lock: allows the system integrator to "lock" critical settings of the LVDS configuration to avoid end users potentially rendering the display unusable.
- LVDS Interface Type: allows the system integrator to select whether the LVDS panel is a single-channel or dual-channel display.
- Color Depth: allows the system integrator to select whether the panel is 24 bpp with VESA color mapping (eDP and LVDS), 24 bpp with JEIDA color mapping (LVDS only), or 18 bpp (eDP and LVDS).
- eDP Interface Type: allows the system integrator to select whether the eDP panel is a 1-lane, 2-lane, or 4-lane display.
- eDP Data Rate: allows the system integrator to select whether the eDP panel runs at 1.62 Gb/s or 2.7 Gb/s.
- Inverter Frequency and Polarity: allows the system integrator to set the operating frequency and polarity of the panel inverter board.
- Maximum and Minimum Inverter Current Limit (%): allows the system integrator to set maximum PWM%, as appropriate, according to the power requirements of the internal flat panel display and the selected inverter board.
- Panel Power Sequencing: allows the system integrator to adjust panel sequencing parameters, if necessary.
- LVDS Spread Spectrum Control: allows the system integrator to adjust spread spectrum for the LVDS interface.

NOTE

Support for flat panel display configuration complies with the following:

1. *Internal flat panel display connectivity is disabled (and all parameters hidden) by default.*
2. *Internal flat panel display settings are not exposed through Intel® Integrator Toolkit or Intel® Integrator Assistant GUIs.*
3. *Internal flat panel display settings will not be overwritten by loading BIOS setup defaults.*
4. *Internal flat panel display settings will be preserved across BIOS updates.*

1.6.3 USB

The board supports up to ten USB2.0 ports and two USB 3.0 ports.

The Intel H61 Express Chipset provides the USB controller for the USB 2.0 ports. The two USB 3.0 ports are provided by the NEC D720200 controller. The port arrangement is as follows:

- Two USB 3.0 ports are implemented through two back panel connectors (blue).
- Two USB 2.0 high-current/fast charging ports are implemented through two back panel connectors (yellow).
- Four USB 2.0 ports are implemented through two dual-port internal headers (black).
- One USB 2.0 port is implemented through a single-port internal header (black).
- One USB 2.0 port is implemented in the PCI Express Half-Mini Card slot.
- Two USB 2.0 ports are implemented in the PCI Express Full-Mini Card slot.

All ten USB 2.0 ports are high-speed, full-speed, and low-speed capable.

USB 3.0 ports are SuperSpeed capable as well as backwards compatible with USB 2.0 high-speed, full-speed, and low-speed modes. USB 2.0 functionality will be enabled on these ports for basic BIOS setup/update operation, however the USB 3.0 driver must be installed for the operating system to use them.

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 a 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 12, page 48
The location of the front panel USB headers	Figure 13, page 49

To download...	Visit this World Wide Web site:
The USB 3.0 driver	http://downloadcenter.intel.com

1.7 SATA Interfaces

The board provides four SATA connectors through the PCH, which support one device per connector:

- Two internal SATA 3.0 Gb/s connectors (black)
- One internal mSATA 3.0 Gb/s port (PCI Express Full-/Half-Mini Card slot)
- One eSATA 3.0 Gb/s connector on the back panel for external connectivity (red)

The PCH provides independent SATA ports with a theoretical maximum transfer rate of 3 Gb/s. A point-to-point interface is used for host to device connections.

The underlying SATA functionality is transparent to the operating system. The SATA 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 Windows operating systems.

The board has an internal SATA power connector and ships with a power cable for powering internal SATA storage devices. The power cable includes:

- Right-angled 15-pin SATA female connector (for motherboard connectivity)
- 1 x 4 Molex female connector (for slim optical drive adapter connectivity)
- 15-pin SATA female connector (for storage connectivity)
- Vertical 15-pin SATA female connector (for storage connectivity)

NOTE

Board power supplied through SATA power connector is rated at a maximum of:

- *1.0 A from 12 V rail*
- *2.5 A from 5 V rail*
- *0.5 A from 3.3 V rail*

For information about	Refer to
The location of the SATA connectors	Figure 13, page 49

1.7.1 AHCI Mode

The board supports AHCI storage mode via the Intel H61 Express Chipset.

NOTE

In order to use AHCI mode, AHCI must be enabled in the BIOS. Also, during Microsoft Windows XP installation, F6 must be pressed to install the AHCI drivers. See your Microsoft Windows XP documentation for more information about installing drivers during installation. Microsoft Windows 7 includes the necessary AHCI drivers without the need to install separate AHCI drivers during the operating system installation process, however, it is always good practice to update the AHCI drivers to the latest available by Intel.

1.8 Real-Time Clock Subsystem

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 via the power supply 5 V STBY rail.

NOTE

If the battery and AC power fail, date and time values will be reset and the user will be notified during the POST.

When the voltage drops below a certain level, the BIOS Setup program settings stored in CMOS RAM (for example, the date and time) might not be accurate. Replace the battery with an equivalent one. Figure 1 on page 15 shows the location of the battery.

1.9 Legacy I/O Controller

The I/O controller provides the following features:

- Consumer Infrared (CIR) header
- Serial IRQ interface compatible with serialized IRQ support for PCI systems
- Intelligent power management, including a programmable wake-up event interface

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

1.9.1 Consumer Infrared (CIR)

The Consumer Infrared (CIR) feature is designed to comply with Microsoft Consumer Infrared usage models. Microsoft Windows 7 is the supported operating system for these usage models.

The CIR receiving header consists of a filtered translated infrared input compliant with Microsoft CIR specifications, and also a “learning” infrared input. This learning input is simply a high pass input which the computer can use to “learn” to speak the infrared communication language of other user remotes.

Customers are required to buy or create their own interface modules to connect to Intel Desktop Boards for this feature to work.

For information about	Refer to
Basic CIR Architecture	http://msdn.microsoft.com/en-us/library/ff539443.aspx

1.10 Audio Subsystem

The board supports Intel HD Audio via the Realtek ALC892 audio codec. The audio subsystem supports the following features:

- Digital/analog stereo line-out (2-in-1 optical/analog back panel jack)
- In-chassis stereo speakers support (3 W/4 Ω via internal header)
- AV-compliant 7.1 surround (see note below) support (analog line-level via internal header)
- Analog line-in (back panel jack)
- Signal-to-noise ratios (SNR) of 97 dB for the DACs and 90 dB for the ADCs
- Support for 44.1 kHz/48 kHz/96 kHz/192 kHz sample rates on all analog inputs and outputs
- Secondary S/PDIF digital audio output (internal header)
- Support for 32 kHz/44.1 kHz/48 kHz/88.2 kHz/96 kHz/192 kHz sample rates at 16-bit/20-bit/24-bit resolution on SPDIF outputs
- DMIC interface (internal header), with support for mono and stereo digital microphones
- Front panel HD Audio/AC'97 headphones/microphone support (internal header)
- Advanced jack sense for the back panel line-out jack that enables the audio codec to recognize the connected device
- Microphone input jack that supports a single dynamic, condenser, or electret microphone
- Windows 7 Ultimate certification

NOTE

- *AA revision G23736-400 supports up to 5.1 analog surround audio.*
- *AA revision G23736-500 supports both 5.1 and 7.1 analog surround audio.*

Table 7 lists the supported functions of the front panel and back panel audio jacks.

Table 7. Audio Jack Support

Audio Jack	Microphone	Headphones	Line Out	Line In
FP Green Jack	Default			
FP Pink Jack		Default		
Rear Green Jack			Jack detect	
Rear Pink Jack				Default
Internal Stereo Speaker			Default	
Analog Surround			Default	

1.10.1 Audio Subsystem Software

The latest audio software and drivers are available from Intel's World Wide Web site.

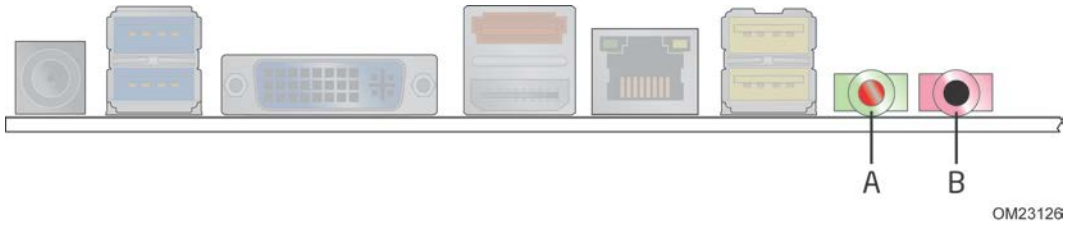
For information about	Refer to
Obtaining audio software and drivers	Section 1.2, page 19

1.10.2 Audio Subsystem Components

The audio subsystem includes the following components:

- Intel H61 Express Chipset
- Realtek ALC892 audio codec
- Two ports for analog input and analog/digital line-out on the back panel
- 7.1 Analog surround audio header (see note on page 32)
- Front panel audio header that supports Intel HD audio and AC'97 audio (a 2 x 5-pin header that provides microphone in and headphones signals for front panel audio connectors)
- Internal S/PDIF or DMIC header (1 x 6-pin header)
- Internal stereo speakers connector (1 x 4-pin, shrouded)

The back panel audio connectors are configurable through the audio device drivers. The available configurable back panel audio connectors are shown in Figure 6.



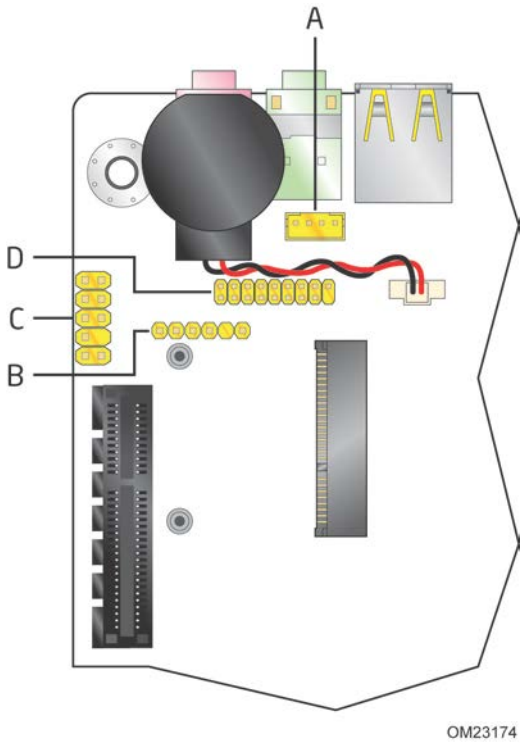
Item	Description
A	2-in-1 analog and optical line out
B	Microphone in

Figure 6. Back Panel Audio Connectors

NOTE

The analog circuit of 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.

Figure 5 shows the location of the internal audio headers.



Item	Description
A	Internal stereo speakers connector
B	Internal S/PDIF / DMIC header
C	Front panel audio header
D	Analog surround audio header

Figure 7. Internal Audio Headers

For information about	Refer to
The signal names of the front panel audio header and S/PDIF / DMIC audio header	Section 2.2.3.1, page 52

1.11 LAN Subsystem

The LAN subsystem consists of the following:

- Intel 82579V Gigabit Ethernet Controller (10/100/1000 Mbits/s)
- Intel H61 Express Chipset
- RJ-45 LAN connector with integrated status LEDs

Additional features of the LAN subsystem include:

- CSMA/CD protocol engine
- Jumbo frame support
- LAN connect interface between the PCH and the LAN controller
- Power management capabilities
  - ACPI technology support
  - LAN wake capabilities
- LAN subsystem software

For information about	Refer to
LAN software and drivers	http://downloadcenter.intel.com

1.11.1 Intel® 82579V Gigabit Ethernet Controller

The Intel 82579V Gigabit Ethernet Controller supports the following features:

- 10/100/1000 BASE-T IEEE 802.3 compliant
- Energy Efficient Ethernet (EEE) IEEE802.3az support (Low Power Idle (LPI) mode)
- Dual interconnect between the Integrated LAN Controller and the Physical Layer (PHY):
  - PCI Express-based interface for active state operation (S0) state
  - SMBUS for host and management traffic (Sx low power state)
- Compliant to IEEE 802.3x flow control support
- 802.1p and 802.1q
- TCP, IP, and UDP checksum offload (for IPv4 and IPv6)
- Full device driver compatibility

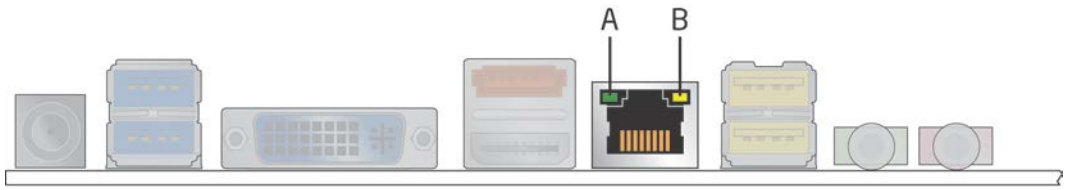
1.11.2 LAN Subsystem Software

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

For information about	Refer to
Obtaining LAN software and drivers	http://downloadcenter.intel.com

1.11.3 RJ-45 LAN Connector with Integrated LEDs

Two LEDs are built into the RJ-45 LAN connector (shown in Figure 8).



Item	Description
A	Link LED (Green)
B	Data Rate LED (Green/Yellow)

Figure 8. LAN Connector LED Locations

Table 8 describes the LED states when the board is powered up and the LAN subsystem is operating.

Table 8. LAN Connector LED States

LED	LED Color	LED State	Condition
Link	Green	Off	LAN link is not established.
		On	LAN link is established.
		Blinking	LAN activity is occurring.
Data Rate	Green/Yellow	Off	10 Mbits/s data rate is selected.
		Green	100 Mbits/s data rate is selected.
		Yellow	1000 Mbits/s data rate is selected.

1.12 Hardware Management Subsystem

The hardware management features enable the board to be compatible with the Wired for Management (WfM) specification. The board has several hardware management features, including thermal and voltage monitoring.

For information about	Refer to
Wired for Management (WfM) Specification	www.intel.com/design/archives/wfm/

1.12.1 Hardware Monitoring

The hardware monitoring and fan control subsystem is based on an embedded controller, which supports the following:

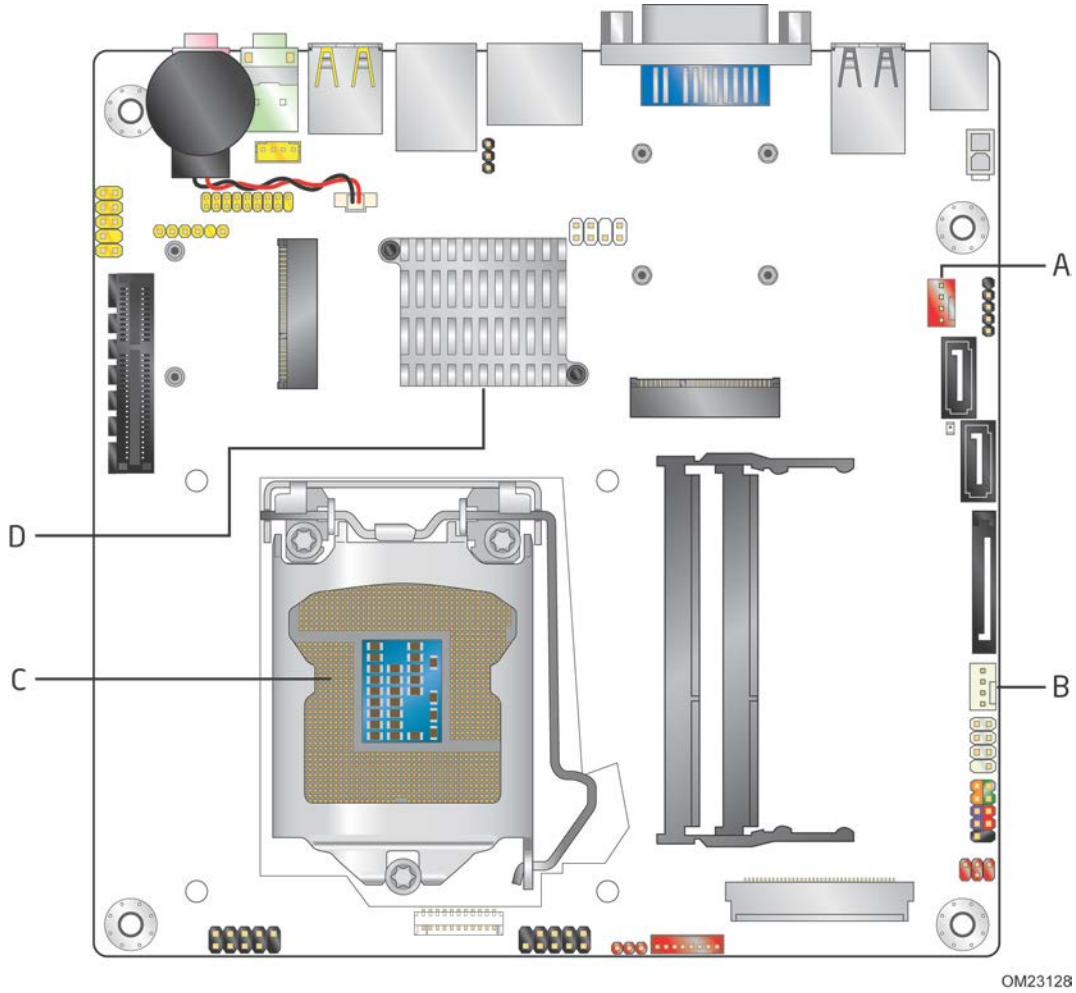
- Processor and system ambient temperature monitoring
- Chassis fan speed monitoring
- Voltage monitoring of +12 V, +5 V, +3.3 V, Memory Vcc (V_SM), PCH_Vcc, and Processor Vcc (+VCCP)
- SMBus interface

1.12.2 Fan Monitoring

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

1.12.3 Thermal Monitoring

Figure 9 shows the locations of the thermal sensors and fan headers.



Item	Description
A	System fan header
B	Processor fan header
C	Thermal diode, located on the processor die
D	Thermal diode, located on the Intel H61 PCH

Figure 9. Thermal Sensors and Fan Headers

1.13 Power Management

Power management is implemented at several levels, including:

- Software support through Advanced Configuration and Power Interface (ACPI)
- Hardware support:
  - Power Input
  - Instantly Available PC technology
  - LAN wake capabilities
  - Wake from USB
  - WAKE# signal wake-up support
  - +5 V Standby Power Indicator LED

1.13.1 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 11 on page 41)
- Support for a front panel power and sleep mode switch

Table 9 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 9. 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) Note
On (ACPI G0 – working state)	More than six 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 six seconds	Power-off (ACPI G2/G5 – Soft off)

Note: Depending on power management settings in the operating system.

1.13.1.1 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 10 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 10. 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	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.

1.13.1.2 Wake-up Devices and Events

Table 11 lists the devices or specific events that can wake the computer from specific states.

Table 11. Wake-up Devices and Events

Devices/events that wake up the system...	...from this sleep state	...from this global state
Power switch	S3, S4, S5 (Note 1)	G1, G2, G3
RTC alarm	S3, S4, S5 (Note 1)	G1, G2 (Note 3)
LAN	S3, S4, S5 (Note 1)	G1, G2 (Note 3)
USB	S3	G1
WAKE#	S3, S4, S5 (Note 1)	G1, G2 (Note 3)
Consumer IR	S3, S4, S5 (Note 1)	G1, G2 (Note 3)

Notes:

1. S4 implies operating system support only.
2. Wake from S4 and S5 is recommended by Microsoft.
3. Wake from device/event not supported immediately upon return from AC loss.

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.

1.13.2 Hardware Support

The board provides several power management hardware features, including:

- Power Input
- Instantly Available PC technology
- LAN wake capabilities
- Wake from USB
- WAKE# signal wake-up support
- +5 V Standby Power Indicator LED

NOTE

The use of Wake from USB from an ACPI state requires an operating system that provides full ACPI support.

1.13.2.1 Power Input

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 internal power connector	Figure 13, page 49
The signal names of the internal power connector	Table 34, page 60

1.13.2.2 Instantly Available PC Technology

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 11 on page 41 lists the devices and events that can wake the computer from the S3 state.

The use of Instantly Available PC technology requires operating system support and drivers for any installed PCI Express add-in card.

1.13.2.3 LAN Wake Capabilities

LAN wake capabilities enable remote wake-up of the computer through a network. The LAN subsystem 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.

1.13.2.4 Wake from USB

USB bus activity wakes the computer from an ACPI S3 state.

NOTE

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

1.13.2.5 WAKE# Signal Wake-up Support

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

1.13.2.6 +5 V Standby Power Indicator LED

The standby power indicator LED shows that power is still present even when the computer appears to be off. Figure 10 shows the location of the standby power 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.

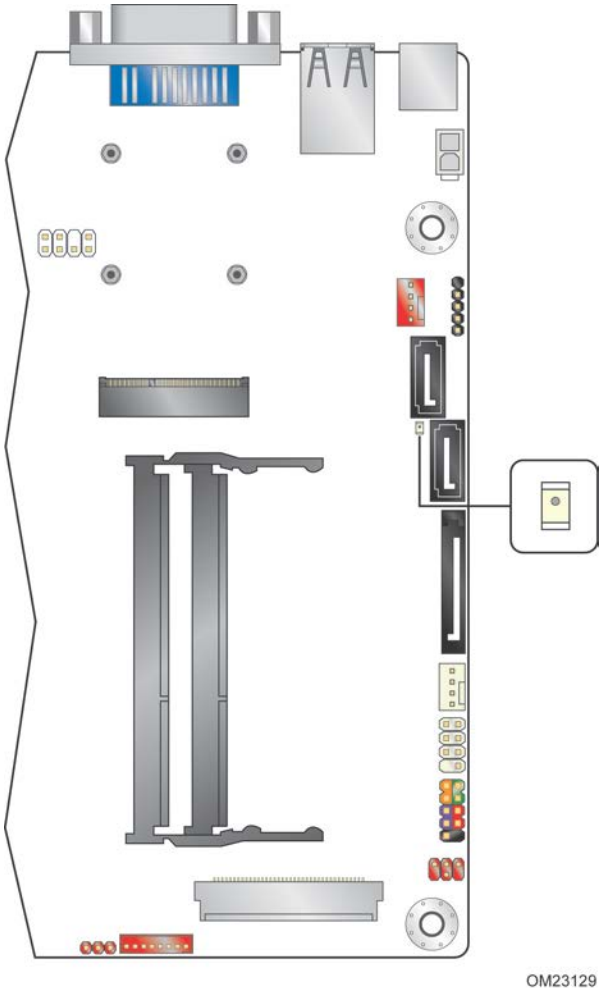


Figure 10. Location of the Standby Power LED

2 Technical Reference

2.1 Memory Resources

2.1.1 Addressable Memory

The board utilizes 16 GB of addressable system memory. Typically the address space that is allocated for PCI Conventional bus add-in cards, PCI Express configuration space, BIOS (SPI Flash device), and chipset overhead resides above the top of DRAM (total system memory). On a system that has 16 GB of system memory installed, it is not possible to use all of the installed memory due to system address space being allocated for other system critical functions. These functions include the following:

- BIOS/SPI Flash device (16 Mbit)
- Local APIC (19 MB)
- Direct Media Interface (40 MB)
- PCI Express configuration space (256 MB)
- PCH base address registers PCI Express ports (up to 256 MB)
- Memory-mapped I/O that is dynamically allocated for PCI Express add-in cards (256 MB)

The board provides the capability to reclaim the physical memory overlapped by the memory mapped I/O logical address space. The board remaps physical memory from the top of usable DRAM boundary to the 4 GB boundary to an equivalent sized logical address range located just above the 4 GB boundary. Figure 11 shows a schematic of the system memory map. All installed system memory can be used when there is no overlap of system addresses.

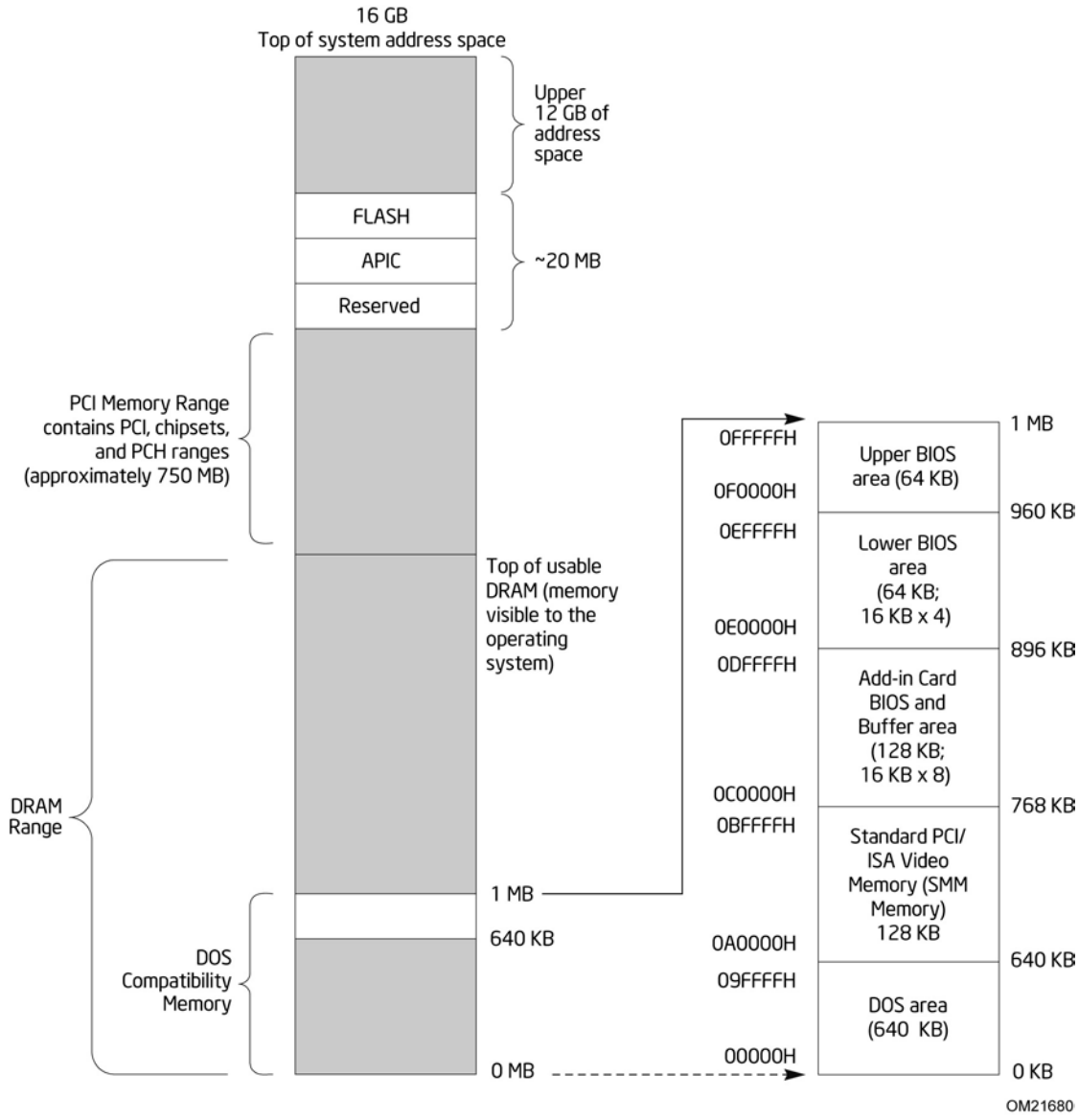


Figure 11. Detailed System Memory Address Map

2.1.2 Memory Map

Table 12 lists the system memory map.

Table 12. System Memory Map

Address Range (decimal)	Address Range (hex)	Size	Description
1024 K - 16777216 K	100000 – 400000000	16382 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	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 Connectors and Headers

CAUTION

Only the following connectors and headers have overcurrent protection: back panel and front panel USB.

The other internal connectors and headers 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 or headers 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.

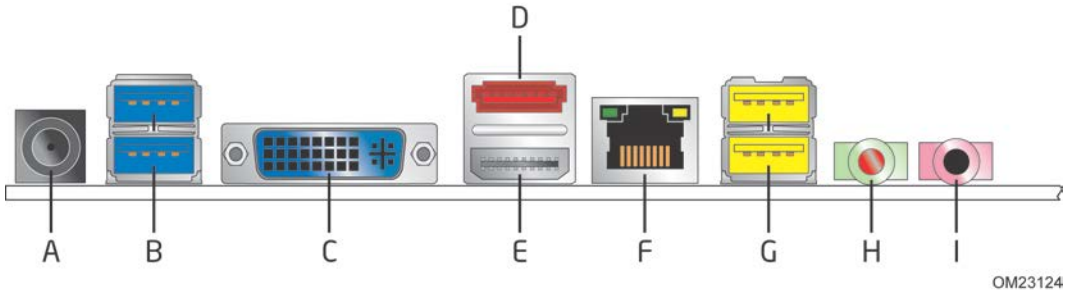
Furthermore, improper connection of USB header single wire connectors may eventually overload the overcurrent protection and cause damage to the board.

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

- Back panel I/O connectors
- On-board I/O connectors and headers (see page 49 and page 51)

2.2.1 Back Panel Connectors

Figure 12 shows the location of the back panel connectors for the board.



Item	Description
A	19 V DC input jack
B	USB 3.0 ports
C	DVI-I connector
D	eSATA connector
E	HDMI connector
F	LAN connector
G	High-current/fast charging USB 2.0 ports
H	Digital/Analog Line out
I	Microphone in

Figure 12. Back Panel Connectors

2.2.2 Connectors and Headers (Top)

Figure 13 shows the locations of the connectors and headers on the top-side of the board.

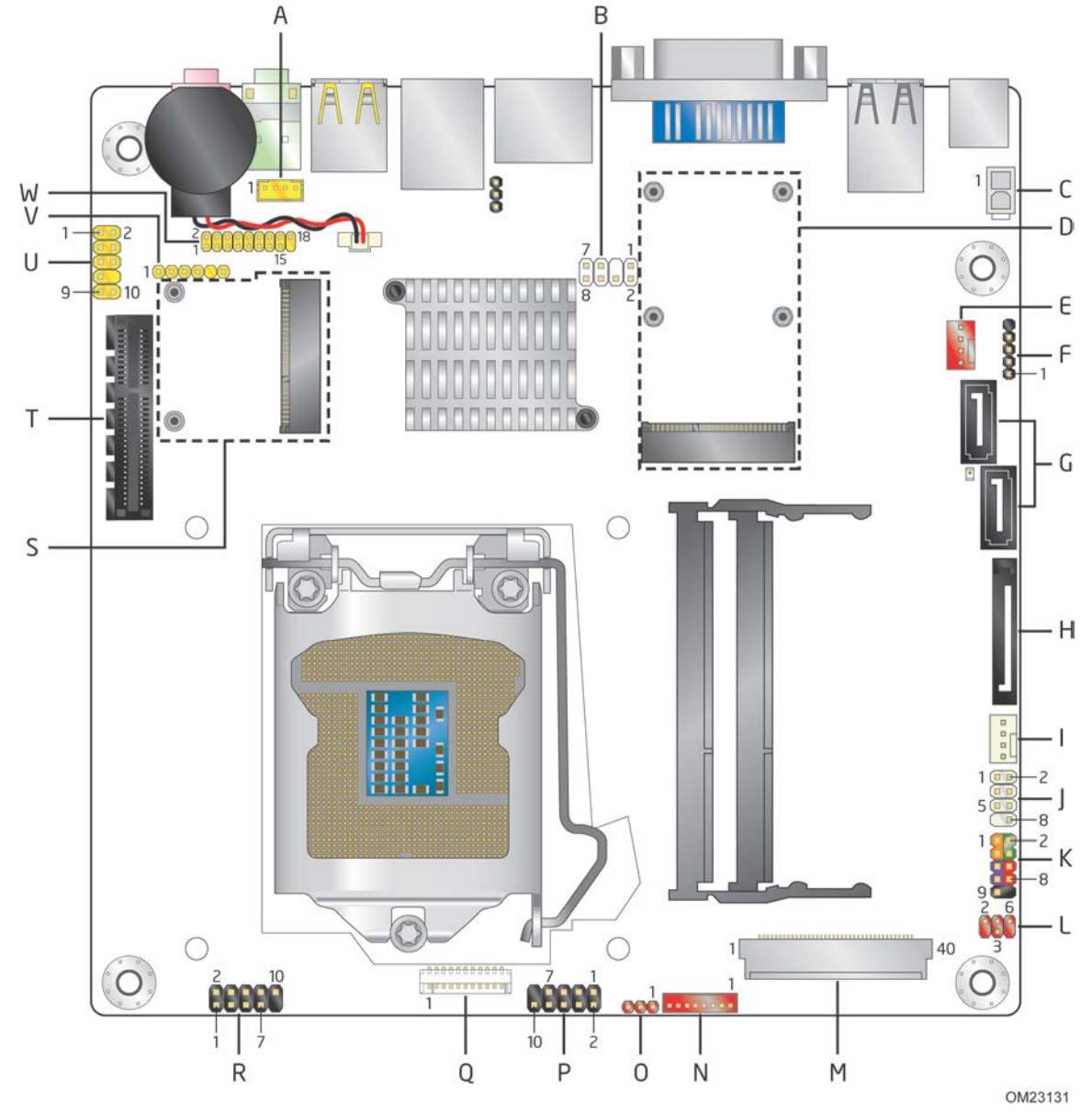


Figure 13. Connectors and Headers (Top)

Table 13 lists the connectors and headers identified in Figure 13.

Table 13. Connectors and Headers Shown in Figure 13

Item from Figure 13	Description	Connector Information	
		Board Connector	**Mating Plug**
A	Internal stereo speakers header	JS*-1125-04	JWT*-A2001H02-4P
B	HTPC header	2x4, 2.00mm-pitch	
C	Internal power connector	Molex* 5566-2	Molex 5557-02R
D	PCI Express Full-/Half-Mini Card slot		
E	System fan header	4-wire/3-wire fan	
F	Single port USB 2.0 header	1x5, 2.54mm-pitch	
G	SATA data connectors	7-pin SATA (male)	7-pin SATA (female)
H	SATA power connector	15-pin SATA (male)	15-pin SATA (female)
I	Processor fan header	4-wire fan	
J	Consumer IR receiver header	2x4, 2.54mm-pitch	
K	Front panel header	2x5, 2.54mm-pitch	
L	Flat panel voltage selection header	2x3, 2.54mm-pitch	Jumper
M	LVDS connector	ACES* 88341-40	ACES 88441-40 Starcom* 107F40
N	FPD brightness connector	Foxconn* HF5508	JWT A2001H02-8P
O	Backlight inverter voltage selection header	1x3 2.54mm-pitch	Jumper
P	Front panel dual-port USB 2.0 header	2x5, 2.54mm-pitch	
Q	Debug connector	1x11, 1.25mm-pitch	
R	Front panel dual-port USB 2.0 header	2x5, 2.54mm-pitch	
S	PCI Express Half-Mini Card slot		
T	PCI Express 2.0 x4 connector		
U	Front panel audio header	2x5, 2.54mm-pitch	
V	Internal S/PDIF / DMIC header	1x6, 2.54mm-pitch	
W	Analog surround audio header	2x9, 2.00mm-pitch	

2.2.3 Connectors and Headers (Bottom)

Figure 14 shows the locations of the connectors and headers on the bottom-side of the board.

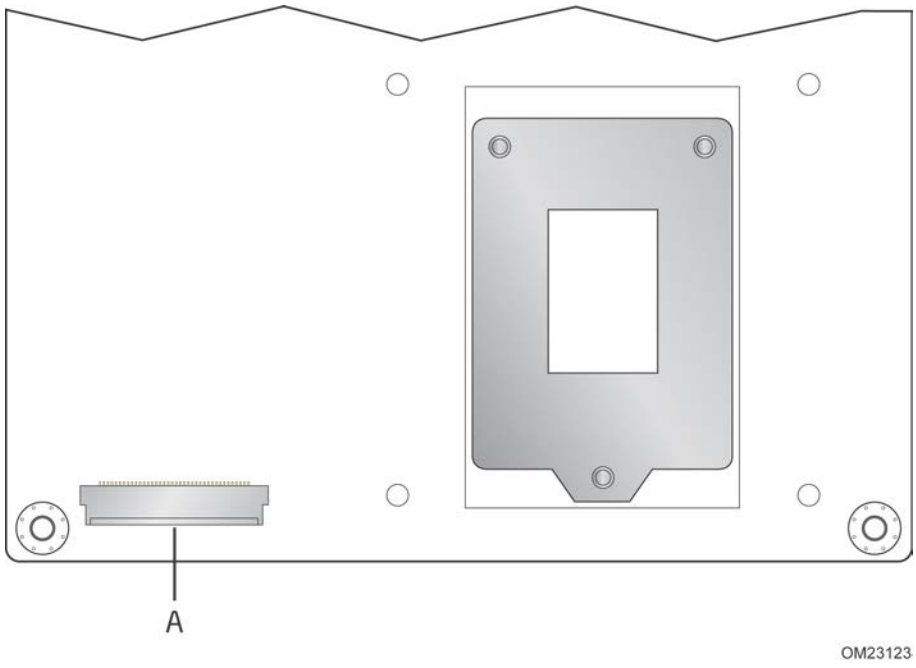


Figure 14. Connectors and Headers (Bottom)

Table 14 lists the connectors and headers identified in Figure 14.

Table 14. Connectors and Headers Shown in Figure 14

Item from Figure 14	Description	Connector Information	
		Board Connector	Mating Plug
A	eDP connector	ACES 50203-040	ACES 88441-40 Starconn 107F40

2.2.3.1 Signal Tables for the Connectors and Headers

Table 15. Front Panel Audio Header for Intel HD Audio

Pin	Signal Name	Description
1	PORT_1L	Analog Port 1 – Left channel (Microphone)
2	GND	Ground
3	PORT_1R	Analog Port 1 – Right channel (Microphone)
4	PRESENCE#	Active low signal that signals BIOS that an Intel HD Audio dongle is connected to the analog header. PRESENCE# = 0 when an Intel HD Audio dongle is connected
5	PORT_2R	Analog Port 2 – Right channel (Headphone)
6	SENSE1_RETURN	Jack detection return for front panel (JACK1)
7	SENSE_SEND	Jack detection sense line from the Intel HD Audio CODEC jack detection resistor network
8	KEY	No pin
9	PORT_2L	Analog Port 2 – Left channel (Headphone)
10	SENSE2_RETURN	Jack detection return for front panel (JACK2)

Table 16. Front Panel Audio Header for AC'97 Audio

Pin	Signal Name	Description
1	MIC	Front panel microphone input signal (biased when supporting stereo microphone)
2	AUD_GND	Ground used by analog audio circuits
3	MIC_BIAS	Microphone power / additional MIC input for stereo microphone support
4	PRESENCE#	Active low signal that signals BIOS that an Intel HD Audio dongle is connected to the analog header. PRESENCE# = 0 when an Intel HD Audio dongle is connected
5	FP_OUT_R	Right channel audio signal to front panel (headphone drive capable)
6	AUD_GND	Ground used by analog audio circuits
7	RESERVED	Reserved
8	KEY	No pin
9	FP_OUT_L	Left channel audio signal to front panel (headphone drive capable)
10	AUD_GND	Ground used by analog audio circuits

Table 17. Analog Surround Audio Header for AA Revision G23736-400

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Front_L	Front left	2	A_GND	Analog ground
3	A_GND	Analog ground	4	Front_R	Front right
5	NC	RESERVED	6	A_GND	Analog ground
7	A_GND	Analog ground	8	NC	RESERVED
9	Surr_Rear_L	5.1 surround rear left	10	A_GND	Analog ground
11	A_GND	Analog ground	12	Surr_Rear_R	5.1 surround rear right
13	Center	Center channel	14	A_GND	Analog ground
15	A_GND	Analog ground	16	LFE	Subwoofer/LFE
17	KEY	No pin	18	SENSE	Dongle detection signal

Table 18. Analog Surround Audio Header for AA Revision G23736-500

Pin	Signal Name	Description	Pin	Signal Name	Description
1	Front_L	Front left	2	A_GND	Analog ground
3	A_GND	Analog ground	4	Front_R	Front right
5	Surr_Side_L	7.1 surround side left	6	A_GND	Analog ground
7	A_GND	Analog ground	8	Surr_Side_R	7.1 surround side right
9	Surr_Rear_L	5.1/7.1 surround rear left	10	A_GND	Analog ground
11	A_GND	Analog ground	12	Surr_Rear_R	5.1/7.1 surround rear right
13	Center	Center channel	14	A_GND	Analog ground
15	A_GND	Analog ground	16	LFE	Subwoofer/LFE
17	KEY	No pin	18	SENSE	Dongle detection signal

Table 19. Internal Stereo Speakers Header

Pin	Signal Name	Description
1	Front_L–	Analog front left (differential negative)
2	Front_L+	Analog front left (differential positive)
3	Front_R+	Analog front right (differential positive)
4	Front_R–	Analog front right (differential negative)

Table 20. Internal S/PDIF or DMIC Header

Pin	Signal Name	Description
1	+3.3 V	3.3 V power (for DMIC module)
2	DMIC_DATA	DMIC data signal
3	GND	Ground
4	SPDIF_OUT/DMIC_CLK	Multiplexed DMIC clock or S/PDIF signal
5	Key (no pin)	Key (no pin)
6	+5 V	5 V power (for optical/TOSLINK module)

Table 21. Dual-Port Front Panel USB 2.0 Headers

Pin	Signal Name	Pin	Signal Name
1	+5 V DC	2	+5 V DC
3	D–	4	D–
5	D+	6	D+
7	Ground	8	Ground
9	KEY (no pin)	10	No Connect

Table 22. Single-Port USB 2.0 Header

Pin	Signal Name
1	+5 V DC
2	D–
3	D+
4	Ground
5	Key (no pin)

Table 23. SATA Connectors

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

Table 24. SATA Power Connector

Pin	Signal Name
1	3.3 V DC
2	3.3 V DC
3	3.3 V DC
4	Ground
5	Ground
6	Ground
7	5 V DC
8	5 V DC
9	5 V DC
10	Ground
11	Ground
12	Ground
13	12 V DC
14	12 V DC
15	12 V DC

Table 25. Fan Headers

Pin	4-Wire Support	Pin	3-Wire Support
1	Ground	1	Ground
2	+12 V	2	FAN_POWER
3	FAN_TACH	3	FAN_TACH
4	FAN_CONTROL	N/A	N/A

Note: Fan speed control on this header uses Pulse Width Modulation for 4-wire fans and linear-voltage for 3-wire fans.

Table 26. Front Panel CIR Receiver (Input) Header

Pin	Signal Name
1	Ground
2	LED
3	NC
4	Learn-in
5	5 V standby
6	VCC
7	Key (no pin)
8	CIR input

Table 27. HTPC Header

Pin	Signal Name
1	Recording LED
2	Ground
3	Key (no pin)
4	SMB_CLK
5	3.3 V standby
6	SMB_DATA
7	#Power_Button
8	HDMI CEC

Table 28. Panel Voltage Selection Header

Pin	Signal Name	Description
1	Key	No pin
2	3.3 V	3.3 V option (default)
3	12 V	12 V option
4	LCD_VCC	Send voltage to connector
5	Key	No pin
6	5 V	5 V option

Table 29. Backlight Inverter Voltage Selection Header

Pin	Signal Name	Description
1	12 V	12 V option
2	BKLT_PWR	Send voltage to connector
3	19 V	19 V option

Table 30. 40-Pin LVDS Connector

Pin	Signal Name	Pin	Signal Name
1	ODD_Lane3_P	21	N/C
2	ODD_Lane3_N	22	EDID_3.3 V
3	ODD_Lane2_P	23	LCD_GND
4	ODD_Lane2_N	24	LCD_GND
5	ODD_Lane1_P	25	LCD_GND
6	ODD_Lane1_N	26	ODD_CLK_P
7	ODD_Lane0_P	27	ODD_CLK_N
8	ODD_Lane0_N	28	BKLT_GND
9	EVEN_Lane3_P	29	BKLT_GND
10	EVEN_Lane3_N	30	BKLT_GND
11	EVEN_Lane2_P	31	EDID_CLK
12	EVEN_Lane2_N	32	BKLT_ENABLE
13	EVEN_Lane1_P	33	BKLT_PWM_DIM
14	EVEN_Lane1_N	34	EVEN_CLK_P
15	EVEN_Lane0_P	35	EVEN_CLK_N
16	EVEN_Lane0_N	36	BKLT_PWR (12 V/19 V)
17	EDID_GND	37	BKLT_PWR (12 V/19 V)
18	LCD_VCC (3.3 V/5 V/12 V)	38	BKLT_PWR (12 V/19 V)
19	LCD_VCC (3.3 V/5 V/12 V)	39	N/C
20	LCD_VCC (3.3 V/5 V/12 V)	40	EDID_DATA

NOTE

LVDS single-channel output is driven from the ODD signals.

Table 31. 40-Pin eDP Connector

Pin	Signal Name	Pin	Signal Name
1	NC_Reserved	21	LCD_VCC (3.3 V/5 V/12 V)
2	High-speed_GND	22	LCD_Self_Test-or-NC
3	Lane3_N (DDPD_[3]N)	23	LCD_GND
4	Lane3_P (DDPD_[3]P)	24	LCD_GND
5	High-speed_GND	25	LCD_GND
6	Lane2_N (DDPD_[2]N)	26	LCD_GND
7	Lane2_P (DDPD_[2]P)	27	HPD (DDPD_HPD)
8	High-speed_GND	28	BKLT_GND
9	Lane1_N (DDPD_[1]N)	29	BKLT_GND
10	Lane1_P (DDPD_[1]P)	30	BKLT_GND
11	High-speed_GND	31	BKLT_GND
12	Lane0_N (DDPD_[0]N)	32	BKLT_ENABLE
13	Lane0_P (DDPD_[0]P)	33	BKLT_PWM_DIM
14	High-speed_GND	34	NC_Reserved
15	AUX_CH_P (DDPD_AUXP)	35	NC_Reserved
16	AUX_CH_N (DDPD_AUXN)	36	BKLT_PWR (12 V/19 V)
17	High-speed_GND	37	BKLT_PWR (12 V/19 V)
18	LCD_VCC (3.3 V/5 V/12 V)	38	BKLT_PWR (12 V/19 V)
19	LCD_VCC (3.3 V/5 V/12 V)	39	BKLT_PWR (12 V/19 V)
20	LCD_VCC (3.3 V/5 V/12 V)	40	NC_Reserved

Table 32. 8-Pin FPD Brightness Connector

Pin	Signal Name	Description
1	BKLT_EN	Backlight enable
2	BKLT_PWM	Backlight control
3	BKLT_PWR (12 V/19 V)	Backlight inverter power
4	BKLT_PWR (12 V/19 V)	Backlight inverter power
5	BKLT_GND/Brightness_GND	Ground (shared)
6	BKLT_GND/Brightness_GND	Ground (shared)
7	Brightness_Up	Panel brightness increase
8	Brightness_Down	Panel brightness decrease

Table 33. PCI Express Full-/Half-Mini Card Connector

Pin	Signal Name	Additional Signal Name
1	WAKE#	
2	3.3 V	
3	Reserved	(Extra USB) +5 V_MINI
4	GND	
5	Reserved	(Extra USB) CARDIN
6	1.5 V	
7	CLKREQ#	
8	Reserved	
9	GND	
10	Reserved	
11	REFCLK-	
12	Reserved	
13	REFCLK+	
14	Reserved	
15	GND	
16	Reserved	
17	Reserved	(Extra USB) LP5-
18	GND	
19	Reserved	(Extra USB) LP5+
20	Reserved	
21	GND	
22	PERST#	
23	PERn0	
24	+3.3 V aux	
25	PERp0	
26	GND	
27	GND	
28	+1.5 V	
29	GND	
30	SMB_CLK	
31	PETn0	
32	SMB_DATA	
33	PETp0	
34	GND	
35	GND	
36	USB_D-	
37	GND	
38	USB_D+	

continued

Table 33. PCI Express Full-/Half-Mini Card Connector (continued)

Pin	Signal Name	Additional Signal Name
39	+3.3 Vaux	
40	GND	
41	+3.3 Vaux	
42	LED_WWAN#	
43	Reserved	
44	LED_WLAN#	
45	Reserved	(mSATA) Vendor
46	LED_WPAN#	
47	Reserved	(mSATA) Vendor
48	+1.5V	
49	Reserved	(mSATA) DA/DSS
50	GND	
51	Reserved	(mSATA) Presence Detection
52	+3.3V	

2.2.3.2 Add-in Card Connectors

The board has the following add-in card connectors:

- One PCI Express 2.0 x4 connector. The x4 interface supports simultaneous transfer speeds up to 500 MB/s of peak bandwidth per lane, per direction, for up to 4 GB/s concurrent and bi-directional bandwidth.
- One PCI Express Half-Mini Card slot
- One PCI Express Full-/Half-Mini Card slot (removable stand-offs in full-length keep out zone allows repurposing of Full-Mini Card slot into Half-Mini Card slot)

2.2.3.3 Power Supply Connectors

The board has the following power supply connectors:

- **External Power Supply** – the board can be powered through a 19 V DC connector on the backpanel. The backpanel DC connector is compatible with a 7.4 mm/OD (outer diameter) and 5.1 mm/ID (inner diameter) plug, where the inner contact is +19 (±10%) V DC and the shell is GND. The maximum current rating is 12 A.
- **Internal Power Supply** – the board can alternatively be powered via the internal 19 V DC 1 x 2 power connector, where pin 1 is GND and pin 2 is +19 (±10%) VDC.

Table 34. 19 V Internal Power Supply Connector

Pin	Signal Name
1	Ground
2	+19 V (±10%)

For information about	Refer to
Power supply considerations	Section 2.6.1, page 71

2.2.3.4 Front Panel Header

This section describes the functions of the front panel header. Table 35 lists the signal names of the front panel header. Figure 15 is a connection diagram for the front panel header.

Table 35. Front Panel Header

Pin	Signal Name	Description	Pin	Signal Name	Description
1	HDD_POWER_LED	Pull-up resistor (750 Ω) to +5V	2	POWER_LED_MAIN	[Out] Front panel LED (main color)
3	HDD_LED#	[Out] Hard disk activity LED	4	POWER_LED_ALT	[Out] Front panel LED (alt color)
5	GROUND	Ground	6	POWER_SWITCH#	[In] Power switch
7	RESET_SWITCH#	[In] Reset switch	8	GROUND	Ground
9	+5V_DC	Power	10	Key	No pin

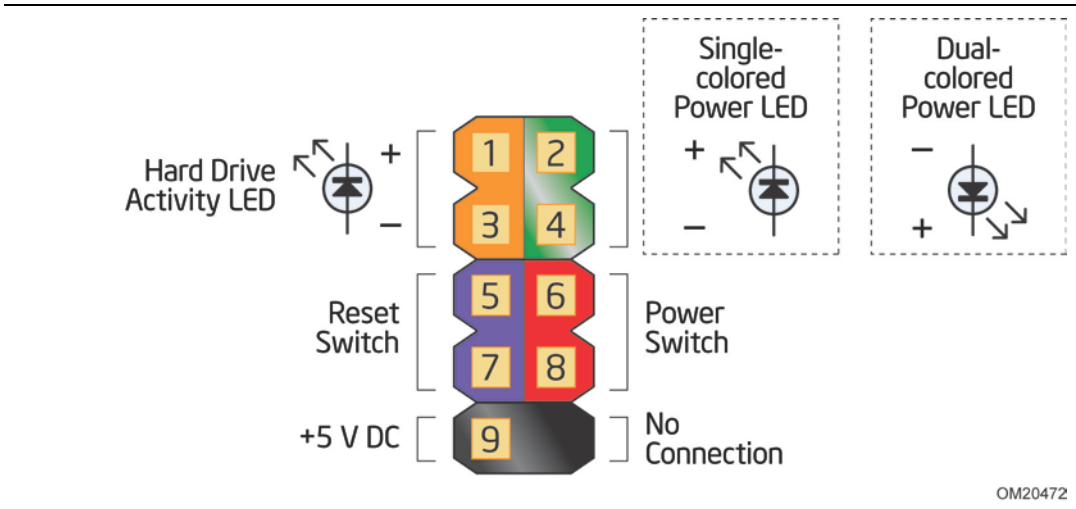


Figure 15. Connection Diagram for Front Panel Header

2.2.3.4.1 Hard Drive Activity LED Header

Pins 1 and 3 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 a SATA hard drive or optical drive connected to an onboard SATA connector.

2.2.3.4.2 Reset Switch Header

Pins 5 and 7 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.

2.2.3.4.3 Power/Sleep LED Header

Pins 2 and 4 can be connected to a one- or two-color LED. Table 36 shows the possible LED states.

Table 36. States for a One-Color Power LED

LED State	Description
Off	Power off
Blinking	Standby
Steady	Normal operation

NOTE

The LED behavior shown in Table 36 is default – other patterns may be set via BIOS setup.

2.2.3.4.4 Power Switch Header

Pins 6 and 8 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.

2.2.3.5 Front Panel USB 2.0 Headers

Figure 16 and Figure 17 are connection diagrams for the front panel USB 2.0 headers.

NOTE

- *The +5 V DC power on the USB headers is fused.*
- *Use only a front panel USB connector that conforms to the USB 2.0 specification for high-speed USB devices.*

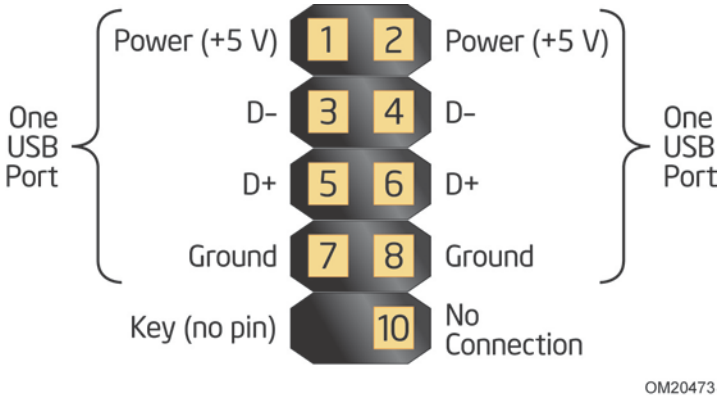


Figure 16. Connection Diagram for Front Panel USB 2.0 Dual-Port Headers

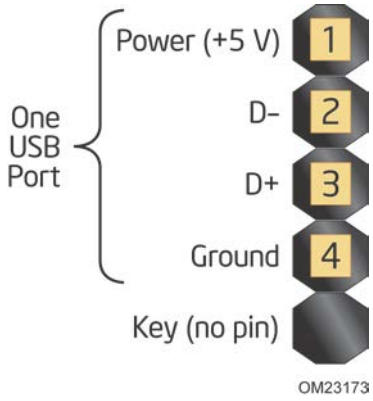


Figure 17. Connection Diagram for the Front Panel USB 2.0 Single-Port Header

2.2.3.6 Debug Header

During the POST, the BIOS generates diagnostic progress codes (POST codes) to I/O port 80h. If the POST fails, execution stops and the last POST code generated is left at port 80h. This code is useful for determining the point where an error occurred.

Displaying the POST codes requires a POST card that can interface with the Debug header. The POST card can decode the port and display the contents on a medium such as a seven-segment display.

Table 37. Debug Header

Pin	Signal Name
1	VCC3
2	VCC3
3	PLTRST#
4	LPC_CLK
5	LAD0/FWH0
6	LAD1/FWH1
7	LAD2/FWH2
8	LAD3/FWH3
9	LFRAME/FWH4#
10	GND
11	GND

2.3 I/O Shields

Two I/O shields are provided with the board:

- Half-height I/O shield
- Standard-height I/O shield

The half-height I/O shield allows access to all back panel connectors while being specifically designed for thin mini-ITX chassis, compliant with version 2.0 of the *Mini-ITX Addendum to the microATX Motherboard Interface Specification*. As an added benefit for system configurations with an internal TV tuner in the PCI Express Mini Card form factor, the I/O shield also provides a pre-cut hole for user installation of an F-type external antenna connector.

The standard-height I/O shield provides access to all the same connectors as the half-height I/O shield while being compatible with standard mini-ITX and microATX chassis. In addition to the F-type pre-cut hole, the standard-height I/O shield also provides pre-cut holes for user installation of two external wireless antennas for system configurations with wireless PCI Express Mini Card solutions.

Figure 18 and Figure 19 are I/O shield reference diagrams.

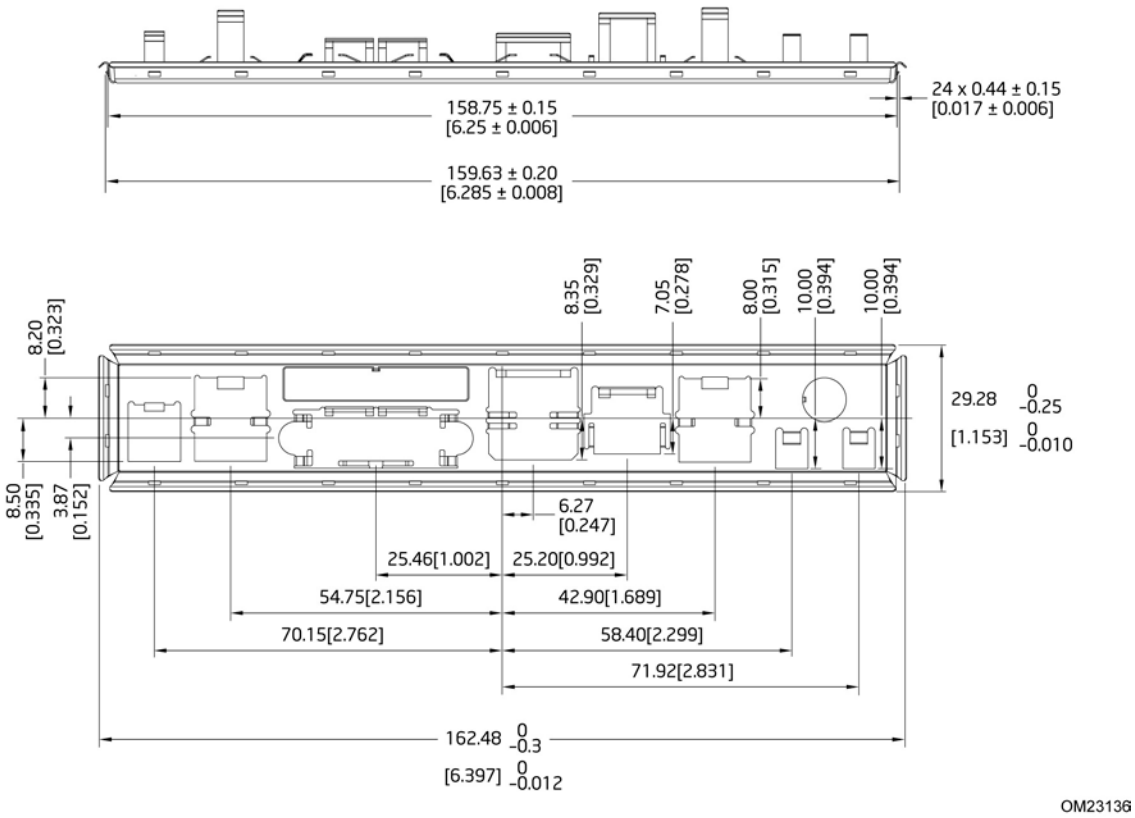


Figure 18. Half-Height Back Panel I/O Shield

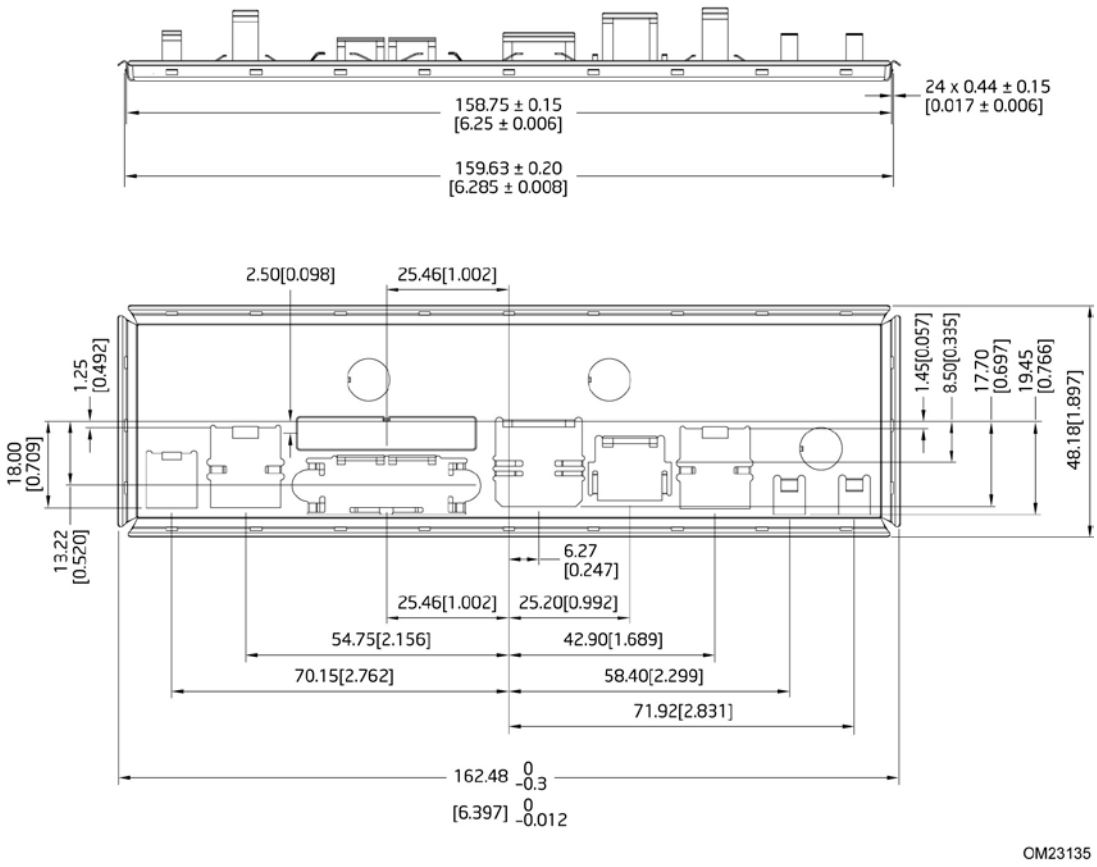


Figure 19. Standard-Height Back Panel I/O Shield

For more information about	Refer to
Thin mini-ITX form factor	http://www.formfactors.org/developer%5Cspecs%5CMini_ITX_Spec_V2_0.pdf

2.4 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 20 shows the location of the jumper block. The 3-pin jumper block determines the BIOS Setup program's mode. Table 38 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.

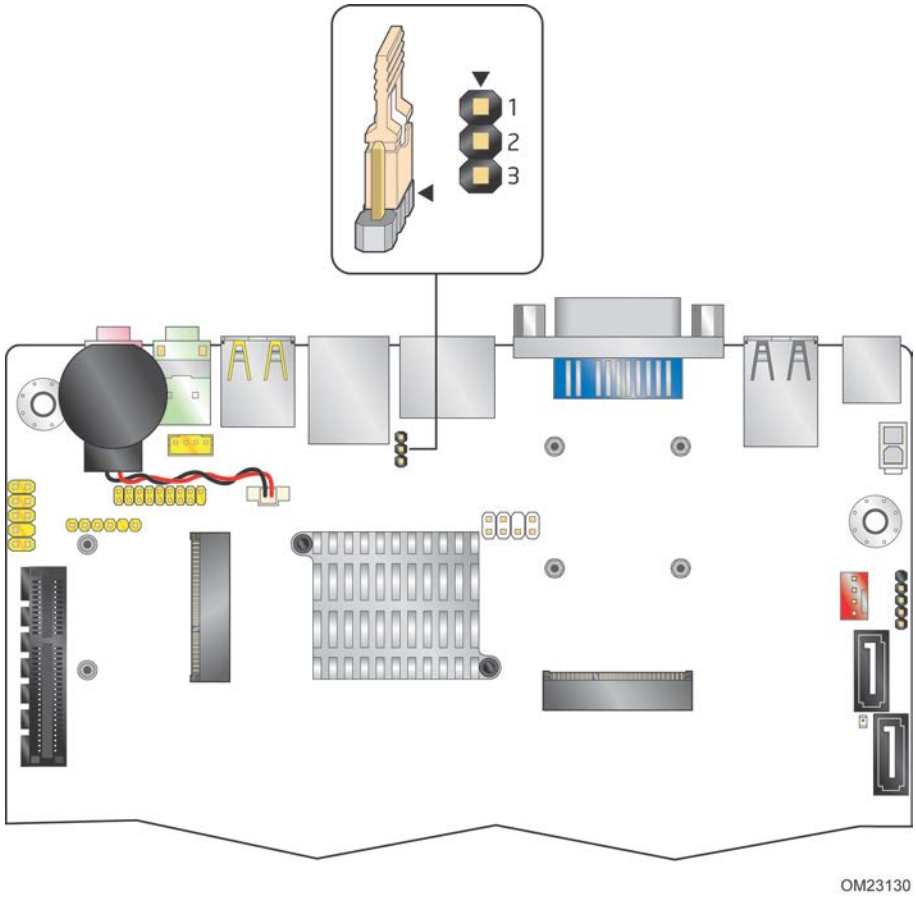


Figure 20. Location of the Jumper Block

Table 38. BIOS Setup Configuration Jumper Settings

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. Note that this Configure mode is the only way to clear the BIOS/CMOS settings. Press F9 (restore defaults) while in Configure mode to restore the BIOS/CMOS settings to their default values.
Recovery	None	The BIOS attempts to recover the BIOS configuration. A recovery CD or flash drive is required.

2.5 Mechanical Considerations

2.5.1 Form Factor

The board is designed to fit into a Mini-ITX form-factor chassis. Figure 21 illustrates the mechanical form factor for the board. Dimensions are given in inches [millimeters]. The outer dimensions are 6.7 inches by 6.7 inches [170.18 millimeters by 170.18 millimeters]. Location of the I/O connectors and mounting holes are in compliance with the ATX specification.

NOTE

The board is designed to have a total height of less than 20 mm from the underside of the board to the top of its tallest components, including all back panel I/O ports, internal connectors, installed system memory, and factory-installed thermal solutions, in compliance with thin mini-ITX requirements per version 2 of the Mini-ITX Addendum to the microATX Motherboard Interface Specification.

For more information about	Refer to
Thin mini-ITX form factor	http://www.formfactors.org/developer%5Cspecs%5CMini_ITX_Spec_V2_0.pdf

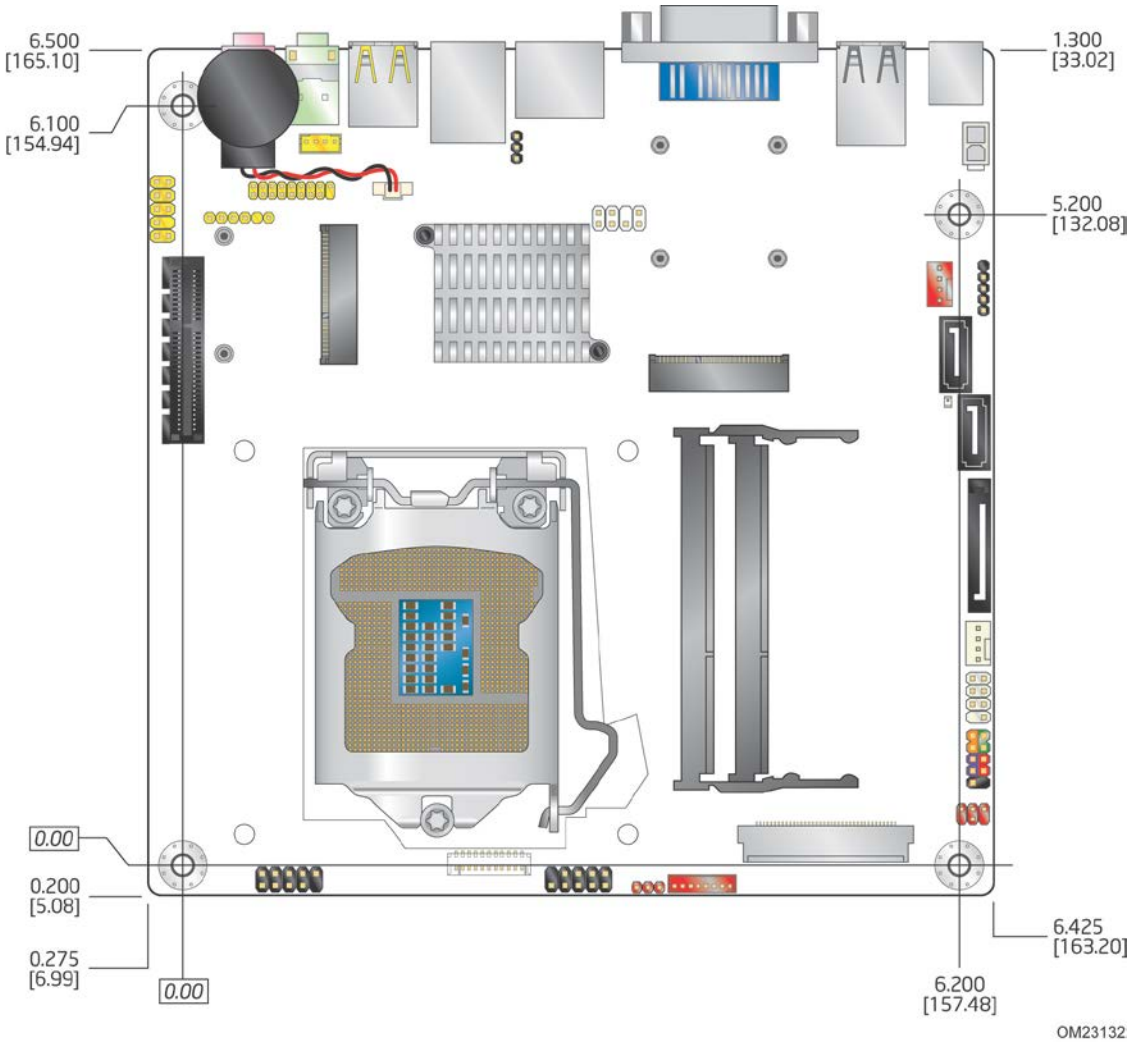


Figure 21. Board Dimensions

2.5.2 Board 3D View

The Intel Desktop Board DH61AG has a 3D view as shown in Figure 22.

Figure 22. 3D View of Intel Desktop Board DH61AG

NOTE

Adobe Acrobat* Pro or Adobe Reader, version 8.1 or later, is required for interactive 3D view. Use mouse controls in the 3D view to manipulate the drawing, as follows:*

- *mouse wheel for zoom in/out*
- *click-and-drag for rotation*
- *right-click and "Full Screen Multimedia" for full-screen mode*
- *right-click for other tools…*

2.6 Electrical Considerations

2.6.1 Power Supply Considerations

CAUTION

The external 19 V DC jack is the primary power input connector of Intel Desktop Board DH61AG. However, the desktop board also provides an internal 1 x 2 power connector that can be used in custom-developed systems that have an internal power supply.

There is no isolation circuitry between the external 19 V DC jack and the internal 1 x 2 power connector. It is the system integrator's responsibility to ensure no more than one power supply unit is or can be attached to the board at any time and to ensure the external 19 V DC jack is covered if the internal 1 x 2 power connector is to be used. A plastic lid for the external 19 V DC jack is provided in the accessories box shall it be useful to the system integrator for this purpose.

Simultaneous connection of both external and internal power supply units could result in potential damage to the desktop board, power supplies, or other hardware.

System power requirements will depend on actual system configurations chosen by the integrator, as well as end user expansion preferences. It is the system integrator's responsibility to ensure an appropriate power budget for the system configuration is properly assessed based on the system-level components chosen. Table 39 lists example power consumption from both the board and typical system-level components.

Table 39. Typical System-Level Power Consumption Figures

	Max Power Rating (W)	Power Req[1] (W)	35 W Slim Desktop		65 W AiO	
			Util	Budget (W)	Util	Budget (W)
35 W processor	35	43.8	95%	41.6		
65 W processor	65	81.3			95%	77.2
PCH	5	6.3	75%	4.7	75%	4.7
LCD w/LED backlight	25	31.3			95%	29.7
2 x 2 GB RAM	4	5	95%	4.8		
2 x 4 GB RAM	8	10			95%	9.5
2 x USB3 (incl. cntlr)	10	12.5	56%[2]	6.9	56%[2]	6.9
2 x USB2 (high current)	13	16.3	58%[3]	9.4	58%[3]	9.4
5 x USB2 (std current)	12.5	15.6	36%[4]	5.6	36%[4]	5.6
PCIe* HMC	5	6.25	20%[5]	1.25	20%[5]	1.25
PCIe FMC	5	6.25	40%[6]	2.5	40%[6]	2.5
PCIe x4	25	31.25				
SATA power	26.15	32.69	29%[7]	9.48	29%[7]	9.48
LAN, audio, other ICs	5	6.25	95%	5.94	95%	5.94
Speakers	6	7.5			100%	7.5
CPU fan	2.4	3	100%	3	100%	3
System fan	3.6	4.5	100%	4.5	100%	4.5
Total System Power				**99.7**		**177.17**

Notes:

1. Power requirement estimated for 80% VR efficiency.
2. 56% utilization for USB3 refers to current draw of 100 mA on port 1 and 900 mA on port 2; an additional 1 A for controller power is then added to this ratio.
3. 58% utilization for back panel USB2 refers to current draw of 500 mA on port 3 and 1.0 A on port.
4. 36% utilization for internal USB2 headers refers to current draw of 100 mA on ports 5-8 and 500 mA on port 9.
5. 20% utilization for Half-Mini Card refers to ~1 W Wi-Fi card power consumption.
6. 40% utilization for Full-Mini Card refers to ~2 W misc card power consumption.
7. 29% utilization for SATA refers to ~5 W slim ODD and ~2.5 W HDD (2.5") power consumption.

2.6.2 Fan Header Current Capability

CAUTION

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

Table 40 lists the current capability of the fan headers.

Table 40. Fan Header Current Capability

Fan Header	Maximum Available Current
Processor fan	2.0 A
System fan	1.5 A

2.6.3 PCI Express* Add-in Card Considerations

The motherboard is designed to provide up to 25 W to the PCI Express x4 slot. The total power consumption from add-in boards on this slot must not exceed this rating.

2.7 Thermal Considerations

CAUTION

A chassis with a maximum internal ambient temperature of 38 °C at the processor fan inlet is a requirement. Whenever possible, use of a processor heat sink that provides omni-directional airflow to maintain required airflow across the processor voltage regulator area is recommended.

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://www3.intel.com/cd/channel/reseller/asmo-na/eng/tech_reference/53211.htm

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

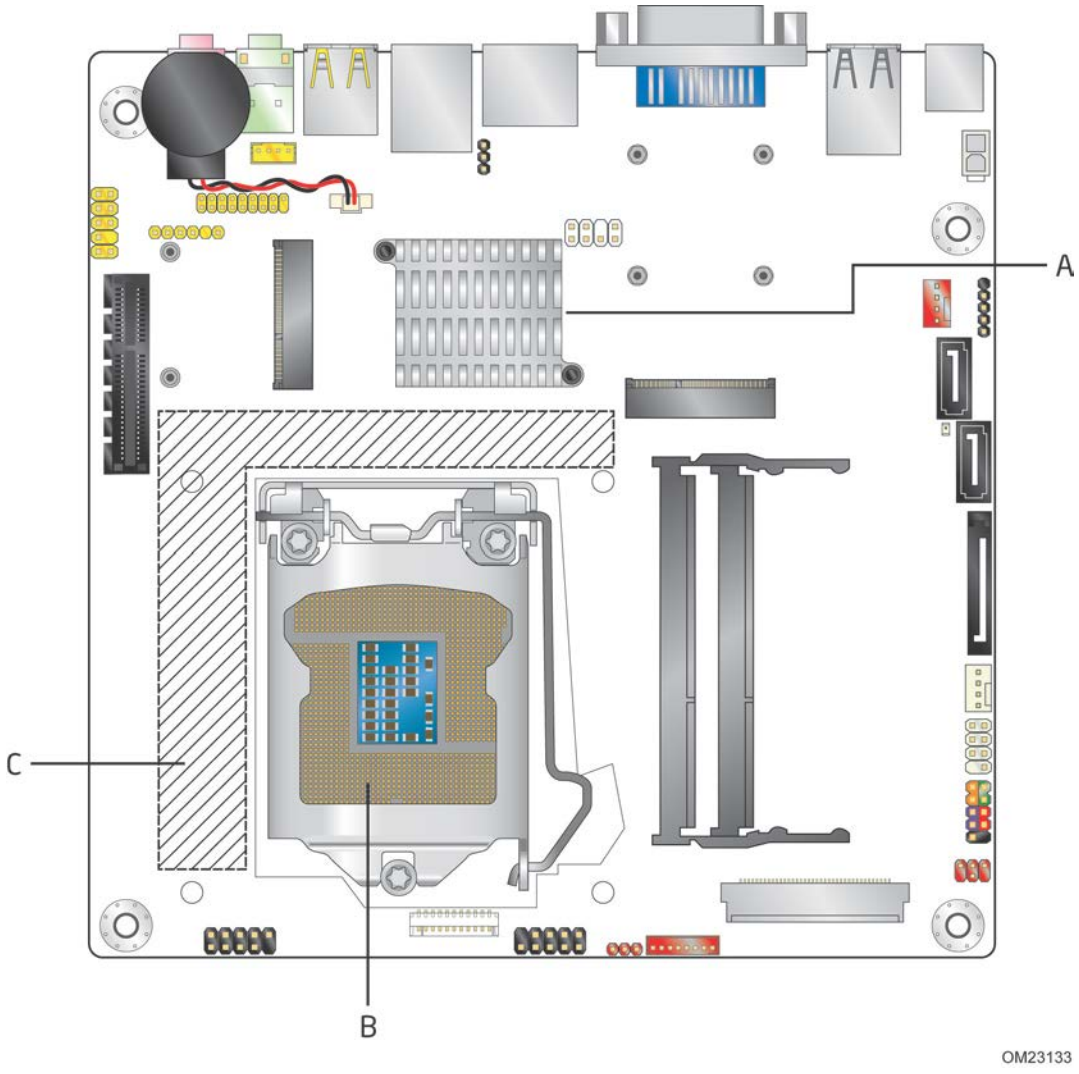
CAUTION

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 2.9.

CAUTION

The processor voltage regulator area (shown in Figure 23) can reach a temperature of up to 120 °C in an open chassis. Ensure that proper airflow is maintained in the processor voltage regulator circuit. Failure to do so may result in shorter than expected product lifetime.

Figure 23 shows the locations of the localized high temperature zones.



Item	Description
A	Intel H61 Express Chipset
B	Processor socket
C	Processor voltage regulator area

Figure 23. Localized High Temperature Zones

Table 41 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 41. Thermal Considerations for Components

Component	Maximum Case Temperature
Processor	For processor case temperature, see processor datasheets and processor specification updates
Intel H61 Express Chipset	104 °C

To ensure functionality and reliability, the component is specified for proper operation when Case Temperature is maintained at or below the maximum temperature listed in Table 42. This is a requirement for sustained power dissipation equal to Thermal Design Power (TDP is specified as the maximum sustainable power to be dissipated by the components). When the component is dissipating less than TDP, the case temperature should be below the Maximum Case Temperature. The surface temperature at the geometric center of the component corresponds to Case Temperature.

It is important to note that the temperature measurement in the system BIOS is a value reported by embedded thermal sensors in the components and does not directly correspond to the Maximum Case Temperature. The upper operating limit when monitoring this thermal sensor is Tcontrol.

Table 42. Tcontrol Values for Components

Component	Tcontrol
Processor	For processor case temperature, see processor datasheets and processor specification updates
Intel H61 Express Chipset	104 °C

For information about	Refer to
Processor datasheets and specification updates	Section 1.2, page 19
Intel® 6 Series Chipset Thermal Mechanical Specifications and Design Guidelines	http://www.intel.com/Products/Desktop/Chipsets/ec-h61/h61-technicaldocuments.htm

2.8 Reliability

The Mean Time Between Failures (MTBF) prediction is calculated using component and subassembly random failure rates. The calculation is based on the Telcordia SR-332 Issue 2, Method I, Case 3, 55 ºC ambient. The MTBF prediction is used to estimate repair rates and spare parts requirements. The MTBF for the board is 298,107 hours.

2.9 Environmental

Table 43 lists the environmental specifications for the board.

Table 43. Environmental Specifications

Parameter	Specification		
Temperature			
Non-Operating	-20 °C to +70 °C (Note)		
Operating	0 °C to +55 °C The operating temperature of the board may be determined by measuring the air temperature from within 1 inch of the edge of the chipset/PCH heatsink and 1 inch above the board, in a closed chassis, while the system is in operation.		
Shock			
Unpackaged	50 g trapezoidal waveform		
	Velocity change of 170 inches/s²		
Packaged	Half sine 2 millisecond		
	Product Weight (pounds)	Free Fall (inches)	Velocity Change (inches/s²)
	<20	36	167
	21-40	30	152
	41-80	24	136
	81-100	18	118
Vibration			
Unpackaged	5 Hz to 20 Hz: 0.01 g² Hz sloping up to 0.02 g² Hz		
	20 Hz to 500 Hz: 0.02 g² Hz (flat)		
Packaged	5 Hz to 40 Hz: 0.015 g² Hz (flat)		
	40 Hz to 500 Hz: 0.015 g² Hz sloping down to 0.00015 g² Hz		

Note: Before attempting to operate this board, the overall temperature of the board must be above the minimum operating temperature specified. It is recommended that the board temperature be at least room temperature before attempting to power on the board.

3 Overview of BIOS Features

3.1 Introduction

The board uses an Intel BIOS that is stored in the Serial Peripheral Interface Flash Memory (SPI Flash) and can be updated using a disk-based program. The SPI Flash contains the BIOS Setup program, POST, the PCI auto-configuration utility, LAN EEPROM information, and Plug and Play support.

The BIOS displays a message during POST identifying the type of BIOS and a revision code. The initial production BIOSs are identified as AGH6110H.86A.

When the BIOS Setup configuration jumper is set to configure mode and the computer is powered-up, the BIOS compares the CPU version and the microcode version in the BIOS and reports if the two match.

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	Configuration	Performance	Security	Power	Boot	Exit

NOTE

The maintenance menu is displayed only when the board is in configure mode. Section 2.4 on page 67 shows how to put the board in configure mode.

Table 44 lists the BIOS Setup program menu features.

Table 44. BIOS Setup Program Menu Bar

Maintenance	Main	Configura-tion	Performance	Security	Power	Boot	Exit
Clears passwords and displays processor information	Displays processor and memory configuration	Configures advanced features available through the chipset	Configures Memory, Bus and Processor overrides	Sets passwords and security features	Configures power management features and power supply controls	Selects boot options	Saves or discards changes to Setup program options

Table 45 lists the function keys available for menu screens.

Table 45. BIOS Setup Program Function Keys

BIOS Setup Program Function Key	Description
<←> or <→>	Selects a different menu screen (Moves the cursor left or right)
<↑> or <↓>	Selects an item (Moves the cursor up or down)
<Tab>	Selects a field (Not implemented)
<Enter>	Executes command or selects the 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

3.2 BIOS Flash Memory Organization

The Serial Peripheral Interface Flash Memory (SPI Flash) includes a 32 Mbit (4096 KB) flash memory device.

3.3 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 third-party management software 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 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. Additional board information can be found in the BIOS under the Additional Information header under the Main BIOS page.

3.4 Legacy USB Support

Legacy USB support enables USB devices to be used even when the operating system's USB drivers are not yet available. Legacy USB support is used to access the BIOS Setup program, and to install an operating system that supports USB. By default, Legacy USB support is set to Enabled.

Legacy USB support operates as follows:

1. When you apply power to the computer, legacy support is disabled.
2. POST begins.
3. Legacy USB support is enabled by the BIOS allowing you to use a USB keyboard to enter and configure the BIOS Setup program and the maintenance menu.
4. POST completes.
5. The operating system loads. While the operating system is loading, USB keyboards and mice are recognized and may be used to configure the operating system. (Keyboards and mice are not recognized during this period if Legacy USB support was set to Disabled in the BIOS Setup program.)
6. After the operating system loads the USB drivers, all legacy and non-legacy USB devices are recognized by the operating system, and Legacy USB support from the BIOS is no longer used.
7. Additional USB legacy feature options can be access by using Intel® Integrator Toolkit.

To install an operating system that supports USB, verify that Legacy USB support in the BIOS Setup program is set to Enabled and follow the operating system's installation instructions.

3.5 BIOS Updates

The BIOS can be updated using either of the following utilities, which are available on the Intel World Wide Web site:

- Intel® Express BIOS Update utility, which enables automated updating while in the Windows environment. Using this utility, the BIOS can be updated from a file on a hard disk, a USB drive (a flash drive or a USB hard drive), or a CD-ROM, or from the file location on the Web.
- Intel® Flash Memory Update Utility, which requires booting from DOS. Using this utility, the BIOS can be updated from a file on a hard disk, a USB drive (a flash drive or a USB hard drive), or a CD-ROM.
- Intel® F7 switch during POST allows a user to select where the BIOS .bio file is located and perform the update from that location/device. Similar to performing a BIOS Recovery without removing the BIOS configuration jumper.

Both utilities verify that the updated BIOS matches the target system to prevent accidentally installing an incompatible BIOS.

NOTE

Review the instructions distributed with the upgrade utility before attempting a BIOS update.

For information about	Refer to
BIOS update utilities	http://support.intel.com/support/motherboards/desktop/sb/CS-022312.htm.

3.5.1 Language Support

The BIOS Setup program and help messages are supported in US English. Check the Intel web site for support.

3.5.2 Custom Splash Screen

During POST, an Intel® splash screen is displayed by default. This splash screen can be augmented with a custom splash screen. The Intel Integrator's Toolkit that is available from Intel can be used to create a custom splash screen.

NOTE

If you add a custom splash screen, it will share space with the Intel branded logo.

For information about	Refer to
Intel Integrator Toolkit	http://developer.intel.com/design/motherbd/software/itk/
Additional Intel® software tools	http://developer.intel.com/design/motherbd/software.htm

3.6 BIOS Recovery

It is unlikely that anything will interrupt a BIOS update; however, if an interruption occurs, the BIOS could be damaged. Table 46 lists the drives and media types that can and cannot be used for BIOS recovery. The BIOS recovery media does not need to be made bootable.

Table 46. Acceptable Drives/Media Types for BIOS Recovery

Media Type (Note)	Can be used for BIOS recovery?
Hard disk drive (connected to SATA or USB)	Yes
CD/DVD drive (connected to SATA or USB)	Yes
USB flash drive	Yes
USB diskette drive (with a 1.4 MB diskette)	No (BIOS update file is bigger than 1.4 MB size limit)

NOTE

Supported file systems for BIOS recovery:

- *NTFS (sparse, compressed, or encrypted files are not supported)*
- *FAT32*
- *FAT16*
- *FAT12*
- *ISO 9660*

For information about	Refer to
BIOS recovery	http://www.intel.com/support/motherboards/desktop/sb/cs-023360.htm

3.7 Boot Options

In the BIOS Setup program, the user can choose to boot from a hard drive, optical drive, removable drive, or the network. The default setting is for the optical drive to be the first boot device, the hard drive second, removable drive third, and the network fourth.

3.7.1 Optical Drive Boot

Booting from the optical drive is supported in compliance to the El Torito bootable CD-ROM format specification. Under the Boot menu in the BIOS Setup program, the optical drive is listed as a boot device. Boot devices are defined in priority order. Accordingly, if there is not a bootable CD in the optical drive, the system will attempt to boot from the next defined drive.

3.7.2 Network Boot

The network can be selected as a boot device. This selection allows booting from the onboard LAN or a network add-in card with a remote boot ROM installed.

Pressing the <F12> key during POST automatically forces booting from the LAN. To use this key during POST, the User Access Level in the BIOS Setup program's Security menu must be set to Full.

3.7.3 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 following devices are not present:

- Video adapter
- Keyboard
- Mouse

3.7.4 Changing the Default Boot Device During POST

Pressing the <F10> key during POST causes a boot device menu to be displayed. This menu displays the list of available boot devices. Table 47 lists the boot device menu options.

Table 47. Boot Device Menu Options

Boot Device Menu Function Keys	Description
<↑> or <↓>	Selects a default boot device
<Enter>	Exits the menu, and boots from the selected device
<Esc>	Exits the menu and boots according to the boot priority defined through BIOS setup

3.8 Hard Disk Drive Password Security Feature

The Hard Disk Drive Password Security feature blocks read and write accesses to the hard disk drive until the correct password is given. Hard Disk Drive Passwords are set in BIOS SETUP and are prompted for during BIOS POST. For convenient support of S3 resume, the system BIOS will automatically unlock drives on resume from S3.

The User hard disk drive password, when installed, will be required upon each power-cycle until the Master Key or User hard disk drive password is submitted.

The Master Key hard disk drive password, when installed, will not lock the drive. The Master Key hard disk drive password exists as an unlock override in the event that the User hard disk drive password is forgotten. Only the installation of the User hard disk drive password will cause a hard disk to be locked upon a system power-cycle.

Table 48 shows the effects of setting the Hard Disk Drive Passwords.

Table 48. Master Key and User Hard Drive Password Functions

Password Set	Password During Boot
Neither	None
Master only	None
User only	User only
Master and User Set	Master or User

During every POST, if a User hard disk drive password is set, POST execution will pause with the following prompt to force the user to enter the Master Key or User hard disk drive password:

```
Enter Hard Disk Drive Password:
```

Upon successful entry of the Master Key or User hard disk drive password, the system will continue with normal POST.

If the hard disk drive password is not correctly entered, the system will go back to the above prompt. The user will have three attempts to correctly enter the hard disk drive password. After the third unsuccessful hard disk drive password attempt, the system will halt with the message:

```
Hard Disk Drive Password Entry Error
```

A manual power cycle will be required to resume system operation.

NOTE

As implemented on DH61AG, Hard Disk Drive Password Security is only supported on SATA port 0. The passwords are stored on the hard disk drive so if the drive is relocated to another SATA port or computer that does not support Hard Disk Drive Password Security feature, the drive will not be accessible.

3.9 Adjusting Boot Speed

These factors affect system boot speed:

- Selecting and configuring peripherals properly
- Optimized BIOS boot parameters
- Enabling the new Fast Boot feature

3.9.1 Peripheral Selection and Configuration

The following techniques help improve system boot speed:

- Choose a hard drive with parameters such as “power-up to data ready” in less than eight seconds that minimizes hard drive startup delays.
- Select a CD-ROM drive with a fast initialization rate. This rate can influence POST execution time.
- Eliminate unnecessary add-in adapter features, such as logo displays, screen repaints, or mode changes in POST. These features may add time to the boot process.
- Try different monitors. Some monitors initialize and communicate with the BIOS more quickly, which enables the system to boot more quickly.

3.9.2 BIOS Boot Optimizations

Use of the following BIOS Setup program settings reduces the POST execution time.

- In the Boot Menu, set the hard disk drive as the first boot device. As a result, the POST does not first seek a diskette drive, which saves about one second from the POST execution time.
- In the Peripheral Configuration submenu, disable the LAN device if it will not be used. This can reduce up to four seconds of option ROM boot time.

NOTE

It is possible to optimize the boot process to the point where the system boots so quickly that the Intel logo screen (or a custom logo splash screen) will not be seen. Monitors and hard disk drives with minimum initialization times can also contribute to a boot time that might be so fast that necessary logo screens and POST messages cannot be seen.

This boot time may be so fast that some drives might be not be initialized at all. If this condition should occur, it is possible to introduce a programmable delay ranging from zero to 30 seconds by 5 second increments (using the Hard Disk Pre-Delay feature of the Advanced Menu in the Drive Configuration Submenu of the BIOS Setup program).

3.10 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 the supervisor mode.
- The user password gives restricted access to view and change Setup options in the BIOS Setup program. This is the 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.
- For enhanced security, use different passwords for the supervisor and user passwords.
- Valid password characters are A-Z, a-z, and 0-9. Passwords may be up to 16 characters in length.

Table 49 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 49. 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 (Note)	Can change all options (Note)	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

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

4 Error Messages and Beep Codes

4.1 Speaker

Audible error code (beep code) information during POST is routed to the audio codec and can be heard through attached speakers.

4.2 BIOS Beep Codes

Whenever a recoverable error occurs during POST, the BIOS causes the board's speaker to beep an error message describing the problem (see Table 50).

Table 50. BIOS Beep Codes

Type	Pattern	Frequency
BIOS update in progress	None	
Video error (Note)	On-off (1.0 second each) two times, then 2.5-second pause (off), entire pattern repeats (beeps and pause) once and the BIOS will continue to boot.	932 Hz When no VGA option ROM is found.
Memory error	On-off (1.0 second each) three times, then 2.5-second pause (off), entire pattern repeats (beeps and pause) until the system is powered off.	932 Hz
Thermal trip warning	Alternate high and low beeps (1.0 second each) for eight beeps, followed by system shut down.	High beep 2000 Hz Low beep 1500 Hz

Note: Disabled per default BIOS setup option.

4.3 Front-panel Power LED Blink Codes

Whenever a recoverable error occurs during POST, the BIOS causes the board's front panel power LED to blink an error message describing the problem (see Table 51).

Table 51. Front-panel Power LED Blink Codes

Type	Pattern	Note
BIOS update in progress	Off when the update begins, then on for 0.5 seconds, then off for 0.5 seconds. The pattern repeats until the BIOS update is complete.	
Video error (Note)	On-off (1.0 second each) two times, then 2.5-second pause (off), entire pattern repeats (blink and pause) until the system is powered off.	When no VGA option ROM is found.
Memory error	On-off (1.0 second each) three times, then 2.5-second pause (off), entire pattern repeats (blinks and pause) until the system is powered off.	
Thermal trip warning	Each beep will be accompanied by the following blink pattern: .25 seconds on, .25 seconds off, .25 seconds on, .25 seconds off. This will result in a total of 16 blinks.	

Note: Disabled per default BIOS setup option.

4.4 BIOS Error Messages

Table 52 lists the error messages and provides a brief description of each.

Table 52. BIOS Error Messages

Error Message	Explanation
CMOS Battery Low	The battery may be losing power. Replace the battery soon.
CMOS Checksum Bad	The CMOS checksum is incorrect. CMOS memory may have been corrupted. Run Setup to reset values.
Memory Size Decreased	Memory size has decreased since the last boot. If no memory was removed, then memory may be bad.
No Boot Device Available	System did not find a device to boot.

4.5 Port 80h POST Codes

During the POST, the BIOS generates diagnostic progress codes (POST codes) to I/O port 80h. If the POST fails, execution stops and the last POST code generated is left at port 80h. This code is useful for determining the point where an error occurred.

Displaying the POST codes requires a POST card that can interface with the Debug header. The POST card can decode the port and display the contents on a medium such as a seven-segment display. Refer to the location of the Debug header in Figure 1.

The following tables provide information about the POST codes generated by the BIOS:

- Table 53 lists the Port 80h POST code ranges
- Table 54 lists the Port 80h POST codes themselves
- Table 55 lists the Port 80h POST sequence

NOTE

In the tables listed above, all POST codes and range values are listed in hexadecimal.

Table 53. Port 80h POST Code Ranges

Range	Subsystem
0x00 – 0x05	Entering SX states S0 to S5.
0x10, 0x20, 0x30, 0x40, 0x50	Resuming from SX states (0x10 –0x20 – S2, 0x30 – S3, etc.)
0x01 – 0x0F	Security (SEC) phase
0x11 – 0x1F	PEI phase pre MRC execution
0x21 – 0x29	MRC memory detection
0x2A – 0x2F	PEI phase post MRC execution
0x31 – 0x35	Recovery
0x36 – 0x3F	Platform DXE driver
0x41 – 0x4F	CPU Initialization (PEI, DXE, SMM)
0x50 – 0x5F	I/O Buses: PCI, USB, ATA etc. 0x5F is an unrecoverable error. Start with PCI.
0x60 – 0x6F	BDS
0x70 – 0x7F	Output devices: All output consoles.
0x80 – 0x8F	For future use
0x90 – 0x9F	Input devices: Keyboard/Mouse.
0xA0 – 0xAF	For future use
0xB0 – 0xBF	Boot Devices: Includes fixed media and removable media. Not that critical since consoles should be up at this point.
0xC0 – 0xCF	For future use
0xD0 – 0xDF	For future use

Table 54. Port 80h POST Codes

Port 80 Code	Progress Code Enumeration
	ACPI S States
0x00,0x01,0x02,0x03,0x04,0x05	Entering S0, S2, S3, S4, or S5 state
0x10,0x20,0x30,0x40,0x50	Resuming from S2, S3, S4, or S5 state
	Security Phase (SEC)
0x08	Starting BIOS execution after CPU BIST
0x09	SPI prefetching and caching
0x0A	Load BSP microcode
0x0B	Load APs microcode
0x0C	Platform program baseaddresses
0x0D	Wake Up All APs
0x0E	Initialize NEM
0x0F	Pass entry point of the PEI core
	PEI before MRC
	PEI Platform driver
0x11	Set bootmode, GPIO init
0x12	Early chipset register programming including graphics init
0x13	Basic PCH init, discrete device init (IEEE 1394, SATA)
0x14	LAN init
0x15	Exit early platform init driver
	PEI SMBUS
0x16	SMBUSriver init
0x17	Entry to SMBUS execute read/write
0x18	Exit SMBUS execute read/write
	Memory
0x21	MRC entry point
0x22	Reading SPD from memory DIMMs
0x23	Detecting presence of memory DIMMs
0x25	Configuring memory
0x28	Testing memory
0x29	Exit MRC driver
	PEI after MRC
0x2A	Start to Program MTRR Settings
0x2B	Done Programming MTRR Settings

continued

Table 54. Port 80h POST Codes (continued)

Port 80 Code	Progress Code Enumeration
	PEIMs/Recovery
0x31	Crisis Recovery has initiated
0x34	Loading recovery capsule
0x35	Start recovery capsule / valid capsule is found
	CPU Initialization
	CPU PEI Phase
0x41	Begin CPU PEI Init
0x42	XMM instruction enabling
0x43	End CPU PEI Init
	CPU PEI SMM Phase
0x44	Begin CPU SMM Init smm relocate bases
0x45	Smm relocate bases for APs
0x46	End CPU SMM Init
	CPU DXE Phase
0x47	CPU DXE Phase begin
0x48	Refresh memory space attributes according to MTRRs
0x49	Load the microcode if needed
0x4A	Initialize strings to HII database
0x4B	Initialize MP support
0x4C	CPU DXE Phase End
	CPU DXE SMM Phase
0x4D	CPU DXE SMM Phase begin
0x4E	Relocate SM bases for all APs
0x4F	CPU DXE SMM Phase end
	I/O BUSES
0x50	Enumerating PCI buses
0x51	Allocating resources to PCI bus
0x52	Hot Plug PCI controller initialization
	USB
0x58	Resetting USB bus
0x59	Reserved for USB
	ATA/ATAPI/SATA
0x5A	Resetting PATA/SATA bus and all devices
0x5B	Reserved for ATA

continued

Table 54. Port 80h POST Codes (continued)

Port 80 Code	Progress Code Enumeration
	BDS
0x60	BDS driver entry point initialize
0x61	BDS service routine entry point (can be called multiple times)
0x62	BDS Step2
0x63	BDS Step3
0x64	BDS Step4
0x65	BDS Step5
0x66	BDS Step6
0x67	BDS Step7
0x68	BDS Step8
0x69	BDS Step9
0x6A	BDS Step10
0x6B	BDS Step11
0x6C	BDS Step12
0x6D	BDS Step13
0x6E	BDS Step14
0x6F	BDS return to DXE core (should not get here)
	Keyboard (PS/2 or USB)
0x90	Resetting keyboard
0x91	Disabling the keyboard
0x92	Detecting the presence of the keyboard
0x93	Enabling the keyboard
0x94	Clearing keyboard input buffer
0x95	Instructing keyboard controller to run Self Test (PS/2 only)
	Mouse (PS/2 or USB)
0x98	Resetting mouse
0x99	Detecting mouse
	Detecting presence of mouse
0x9B	Enabling mouse
	Fixed Media
0xB0	Resetting fixed media
0xB1	Disabling fixed media
0xB2	Detecting presence of a fixed media (IDE hard drive detection etc.)
0xB3	Enabling/configuring a fixed media

continued

Table 54. Port 80h POST Codes (continued)

Port 80 Code	Progress Code Enumeration
	Removable Media
0xB8	Resetting removable media
0xB9	Disabling removable media
0xBA	Detecting presence of a removable media (IDE, CDROM detection etc.)
0xBC	Enabling/configuring a removable media
	DXE Core
0xE4	Entered DXE phase
	BDS
0xE7	Waiting for user input
0xE8	Checking password
0xE9	Entering BIOS setup
0xEB	Calling Legacy Option ROMs
	Runtime Phase/EFI OS Boot
0xF8	EFI boot service ExitBootServices ( ) has been called
0xF9	EFI runtime service SetVirtualAddressMap ( ) has been called

Table 55. Typical Port 80h POST Sequence

POST Code	Description
21	Initializing a chipset component
22	Reading SPD from memory DIMMs
23	Detecting presence of memory DIMMs
25	Configuring memory
28	Testing memory
34	Loading recovery capsule
E4	Entered DXE phase
12	Starting application processor initialization
13	SMM initialization
50	Enumerating PCI buses
51	Allocating resourced to PCI bus
92	Detecting the presence of the keyboard
90	Resetting keyboard
94	Clearing keyboard input buffer
95	Keyboard Self Test
EB	Calling Video BIOS
58	Resetting USB bus
5A	Resetting PATA/SATA bus and all devices
92	Detecting the presence of the keyboard
90	Resetting keyboard
94	Clearing keyboard input buffer
5A	Resetting PATA/SATA bus and all devices
28	Testing memory
90	Resetting keyboard
94	Clearing keyboard input buffer
E7	Waiting for user input
01	INT 19
00	Ready to boot

5 Regulatory Compliance and Battery Disposal Information

5.1 Regulatory Compliance

This section contains the following regulatory compliance information for Intel Desktop Board DH61AG:

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

5.1.1 Safety Standards

Intel Desktop Board DH61AG complies with the safety standards stated in Table 56 when correctly installed in a compatible host system.

Table 56. Safety Standards

Standard	Title
CSA/UL 60950-1	Information Technology Equipment – Safety - Part 1: General Requirements (USA and Canada)
EN 60950-1	Information Technology Equipment – Safety - Part 1: General Requirements (European Union)
IEC 60950-1	Information Technology Equipment – Safety - Part 1: General Requirements (International)

5.1.2 European Union Declaration of Conformity Statement

We, Intel Corporation, declare under our sole responsibility that the products Intel® Desktop Board DH61AG is in conformity with all applicable essential requirements necessary for CE marking, following the provisions of the European Council Directive 2004/108/EC (EMC Directive), 2006/95/EC (Low Voltage Directive), and 2002/95/EC (ROHS Directive).

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

This product follows the provisions of the European Directives 2004/108/EC, 2006/95/EC, and 2002/95/EC.

Čeština Tento výrobek odpovídá požadavkům evropských směrnic 2004/108/EC, 2006/95/EC a 2002/95/EC.

Dansk Dette produkt er i overensstemmelse med det europæiske direktiv 2004/108/EC, 2006/95/EC & 2002/95/EC.

Dutch Dit product is in navolging van de bepalingen van Europees Directief 2004/108/EC, 2006/95/EC & 2002/95/EC.

Eesti Antud toode vastab Euroopa direktiivides 2004/108/EC, ja 2006/95/EC ja 2002/95/EC kehtestatud nõuetele.

Suomi Tämä tuote noudattaa EU-direktiivin 2004/108/EC, 2006/95/EC & 2002/95/EC määräyksiä.

Français Ce produit est conforme aux exigences de la Directive Européenne 2004/108/EC, 2006/95/EC & 2002/95/EC.

Deutsch Dieses Produkt entspricht den Bestimmungen der Europäischen Richtlinie 2004/108/EC, 2006/95/EC & 2002/95/EC.

Ελληνικά Το παρόν προϊόν ακολουθεί τις διατάξεις των Ευρωπαϊκών Οδηγιών 2004/108/EC, 2006/95/EC και 2002/95/EC.

Magyar E termék megfelel a 2004/108/EC, 2006/95/EC és 2002/95/EC Európai Irányelv előírásainak.

Icelandic Þessi vara stenst reglugerð Evrópska Efnahags Bandalagsins númer 2004/108/EC, 2006/95/EC, & 2002/95/EC.

Italiano Questo prodotto è conforme alla Direttiva Europea 2004/108/EC, 2006/95/EC & 2002/95/EC.

Latviešu Šis produkts atbilst Eiropas Direktīvu 2004/108/EC, 2006/95/EC un 2002/95/EC noteikumiem.

Lietuvių Šis produktas atitinka Europos direktyvų 2004/108/EC, 2006/95/EC, ir 2002/95/EC nuostatas.

Malti Dan il-prodott hu konformi mal-provvedimenti tad-Direttivi Ewropej 2004/108/EC, 2006/95/EC u 2002/95/EC.

Norsk Dette produktet er i henhold til bestemmelsene i det europeiske direktivet 2004/108/EC, 2006/95/EC & 2002/95/EC.

Polski Niniejszy produkt jest zgodny z postanowieniami Dyrektyw Unii Europejskiej 2004/108/EC, 206/95/EC i 2002/95/EC.

Portuguese Este produto cumpre com as normas da Diretiva Européia 2004/108/EC, 2006/95/EC & 2002/95/EC.

Español Este producto cumple con las normas del Directivo Europeo 2004/108/EC, 2006/95/EC & 2002/95/EC.

Slovensky Tento produkt je v súlade s ustanoveniami európskych direktív 2004/108/EC, 2006/95/EC a 2002/95/EC.

Slovenščina Izdelek je skladen z določbami evropskih direktiv 2004/108/EC, 2006/95/EC in 2002/95/EC.

Svenska Denna produkt har tillverkats i enlighet med EG-direktiv 2004/108/EC, 2006/95/EC & 2002/95/EC.

Türkçe Bu ürün, Avrupa Birliği'nin 2004/108/EC, 2006/95/EC ve 2002/95/EC yönergelerine uyar.

5.1.3 Product Ecology Statements

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

5.1.3.1 Disposal Considerations

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

5.1.3.2 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 selected locations for proper recycling.

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

中文

作为其对环境责任之承诺的部分，英特尔已实施 Intel Product Recycling Program（英特尔产品回收计划），以允许英特尔品牌产品的零售消费者将使用过的产品退还至指定地点作恰当的重复使用处理。

请参考http://www.intel.com/intel/other/ehs/product_ecology
了解此计划的详情，包括涉及产品之范围、回收地点、运送指导、条款和条件等。

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

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 para ver los detalles del programa, que incluye los productos que abarca, los lugares disponibles, instrucciones de envío, términos y condiciones, etc.

Français

Dans le cadre de son engagement pour la protection de l'environnement, Intel a mis en œuvre le programme Intel Product Recycling Program (Programme de recyclage des produits Intel) pour permettre aux consommateurs de produits Intel de recycler les produits usés en les retournant à des adresses spécifiées.

Visitez la page Web http://www.intel.com/intel/other/ehs/product_ecology pour en savoir plus sur ce programme, à savoir les produits concernés, les adresses disponibles, les instructions d'expédition, les conditions générales, etc.

日本語

インテルでは、環境保護活動の一環として、使い終えたインテル
ブランド製品を指定の場所へ返送していただき、リサイクルを適切に行えるよう、インテル製品リサイクル
プログラムを発足させました。

対象製品、返送先、返送方法、ご利用規約など、このプログラムの詳細情報は、http://www.intel.com/intel/other/ehs/product_ecology（英語）をご覧ください。

Malay

Sebagai sebahagian daripada komitmennya terhadap tanggungjawab persekitaran, Intel telah melaksanakan Program Kitar Semula Produk untuk membenarkan pengguna-pengguna runcit produk jenama Intel memulangkan produk terguna ke lokasi-lokasi terpilih untuk dikitarkan semula dengan betul.

Sila rujuk http://www.intel.com/intel/other/ehs/product_ecology untuk mendapatkan butir-butir program ini, termasuklah skop produk yang dirangkumi, lokasi-lokasi tersedia, arahan penghantaran, terma & syarat, dsb.

Portuguese

Como parte deste compromisso com o respeito ao ambiente, a Intel implementou o Programa de Reciclagem de Produtos para que os consumidores finais possam enviar produtos Intel usados para locais selecionados, onde esses produtos são reciclados de maneira adequada.

Consulte o site http://www.intel.com/intel/other/ehs/product_ecology (em Inglês) para obter os detalhes sobre este programa, inclusive o escopo dos produtos cobertos, os locais disponíveis, as instruções de envio, os termos e condições, etc.

Russian

В качестве части своих обязательств к окружающей среде, в Intel создана программа утилизации продукции Intel (Product Recycling Program) для предоставления конечным пользователям марок продукции Intel возможности возврата используемой продукции в специализированные пункты для должной утилизации.

Пожалуйста, обратитесь на веб-сайт http://www.intel.com/intel/other/ehs/product_ecology за информацией об этой программе, принимаемых продуктах, местах приема, инструкциях об отправке, положениях и условиях и т.д.

Türkçe

Intel, çevre sorumluluğuna bağımlılığının bir parçası olarak, perakende tüketicilerin Intel markalı kullanılmış ürünlerini belirlenmiş merkezlere iade edip uygun şekilde geri dönüştürmesini amaçlayan Intel Ürünleri Geri Dönüşüm Programı'nı uygulamaya koymuştur.

Bu programın ürün kapsamı, ürün iade merkezleri, nakliye talimatları, kayıtlar ve şartlar v.s dahil bütün ayrıntılarını ögrenmek için lütfen http://www.intel.com/intel/other/ehs/product_ecology

Web sayfasına gidin.

5.1.4 EMC Regulations

Intel Desktop Board DH61AG complies with the EMC regulations stated in Table 57 when correctly installed in a compatible host system.

Table 57. EMC Regulations

Regulation	Title
FCC 47 CFR Part 15, Subpart B	Title 47 of the Code of Federal Regulations, Part 15, Subpart B, Radio Frequency Devices. (USA)
ICES-003	Interference-Causing Equipment Standard, Digital Apparatus. (Canada)
EN55022	Limits and methods of measurement of Radio Interference Characteristics of Information Technology Equipment. (European Union)
EN55024	Information Technology Equipment – Immunity Characteristics Limits and methods of measurement. (European Union)
EN55022	Australian Communications Authority, Standard for Electromagnetic Compatibility. (Australia and New Zealand)
CISPR 22	Limits and methods of measurement of Radio Disturbance Characteristics of Information Technology Equipment. (International)
CISPR 24	Information Technology Equipment – Immunity Characteristics – Limits and Methods of Measurement. (International)
VCCI V-3, V-4	Voluntary Control for Interference by Information Technology Equipment. (Japan)
KN-22, KN-24	Korean Communications Commission – Framework Act on Telecommunications and Radio Waves Act (South Korea)
CNS 13438	Bureau of Standards, Metrology, and Inspection (Taiwan)

FCC Declaration of Conformity

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) this device may not cause harmful interference, and (2) this device must accept any interference received, including interference that may cause undesired operation.

For questions related to the EMC performance of this product, contact:

Intel Corporation, 5200 N.E. Elam Young Parkway, Hillsboro, OR 97124
1-800-628-8686

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to Part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and the receiver.
- Connect the equipment to an outlet on a circuit other than the one to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

Any changes or modifications to the equipment not expressly approved by Intel Corporation could void the user's authority to operate the equipment.

Tested to comply with FCC standards for home or office use.

Canadian Department of Communications Compliance Statement

This digital apparatus does not exceed the Class B limits for radio noise emissions from digital apparatus set out in the Radio Interference Regulations of the Canadian Department of Communications.

Le présent appareil numerique német pas de bruits radioélectriques dépassant les limites applicables aux appareils numériques de la classe B prescrites dans le Réglement sur le broullage radioélectrique édicté par le ministére des Communications du Canada.

Japan VCCI Statement

Japan VCCI Statement translation: This is a Class B product based on the standard of the Voluntary Control Council for Interference from Information Technology Equipment (VCCI). If this is used near a radio or television receiver in a domestic environment, it may cause radio interference. Install and use the equipment according to the instruction manual.

この装置は、情報処理装置等電波障害自主規制協議会（ＶＣＣＩ）の基準に基づくクラスＢ情報技術装置です。この装置は、家庭環境で使用することを目的としていますが、この装置がラジオやテレビジョン受信機に近接して使用されると、受信障害を引き起こすことがあります。
取扱説明書に従って正しい取り扱いをして下さい。

Korea Class B Statement

Korea Class B Statement translation: This equipment is for home use, and has acquired electromagnetic conformity registration, so it can be used not only in residential areas, but also other areas.

이 기기는 가정용(B급) 전자파적합기기로서 주 로 가정에서 사용하는 것을 목적으로 하며, 모 든 지역에서 사용할 수 있습니다.

5.1.5 e-Standby and ErP Compliance

Intel Desktop Board DH61AG meets the following program requirements in an adequate system configuration, including appropriate selection of an efficient power supply:

- EPEAT*
- Korea e-Standby
- European Union Energy-related Products Directive 2013 (ErP) Lot 6

For information about	Refer to
Electronic Product Environmental Assessment Tool (EPEAT)	http://www.epeat.net/
Korea e-Standby Program	http://www.kemco.or.kr/new_eng/pg02/pg02100300.asp
European Union Energy-related Products Directive 2009 (ErP)	http://ec.europa.eu/enterprise/policies/sustainable-business/sustainable-product-policy/ecodesign/index_en.htm

5.1.6 Regulatory Compliance Marks (Board Level)

Intel Desktop Board DH61AG has the regulatory compliance marks shown in Table 58.

Table 58. Regulatory Compliance Marks

Description	Mark
UL joint US/Canada Recognized Component mark. Includes adjacent UL file number for Intel Desktop Boards: E210882.	
FCC Declaration of Conformity logo mark for Class B equipment.	
CE mark. Declaring compliance to the European Union (EU) EMC directive, Low Voltage directive, and RoHS directive.	
Australian Communications Authority (ACA) and New Zealand Radio Spectrum Management (NZ RSM) C-tick mark. Includes adjacent Intel supplier code number, N-232.	
Japan VCCI (Voluntary Control Council for Interference) mark.	
Korea Certification mark. Includes an adjacent KCC (Korean Communications Commission) certification number: KCC-REM-CPU-DH61AG.	
Taiwan BSMI (Bureau of Standards, Metrology and Inspections) mark. Includes adjacent Intel company number, D33025.	
Printed wiring board manufacturer's recognition mark. Consists of a unique UL recognized manufacturer's logo, along with a flammability rating (solder side).	V-0
China RoHS/Environmentally Friendly Use Period Logo: This is an example of the symbol used on Intel Desktop Boards and associated collateral. The color of the mark may vary depending upon the application. The Environmental Friendly Usage Period (EFUP) for Intel Desktop Boards has been determined to be 10 years.	

5.2 Battery Disposal Information

CAUTION

Risk of explosion if the battery is replaced with an incorrect type. Batteries should be recycled where possible. Disposal of used batteries must be in accordance with local environmental regulations.

PRÉCAUTION

Risque d'explosion si la pile usagée est remplacée par une pile de type incorrect. Les piles usagées doivent être recyclées dans la mesure du possible. La mise au rebut des piles usagées doit respecter les réglementations locales en vigueur en matière de protection de l'environnement.

FORHOLDSREGEL

Eksplosionsfare, hvis batteriet erstattes med et batteri af en forkert type. Batterier bør om muligt genbruges. Bortskaffelse af brugte batterier bør foregå i overensstemmelse med gældende miljølovgivning.

OBS!

Det kan oppstå eksplosjonsfare hvis batteriet skiftes ut med feil type. Brukte batterier bør kastes i henhold til gjeldende miljølovgivning.

VIKTIGT!

Risk för explosion om batteriet ersätts med felaktig batterityp. Batterier ska kasseras enligt de lokala miljövårdsbestämmelserna.

VARO

Räjähdysvaara, jos pariston tyyppi on väärä. Paristot on kierrätettävä, jos se on mahdollista. Käytetyt paristot on hävitettävä paikallisten ympäristömääräysten mukaisesti.

VORSICHT

Bei falschem Einsetzen einer neuen Batterie besteht Explosionsgefahr. Die Batterie darf nur durch denselben oder einen entsprechenden, vom Hersteller empfohlenen Batterietyp ersetzt werden. Entsorgen Sie verbrauchte Batterien den Anweisungen des Herstellers entsprechend.

AVVERTIMENTO

Esiste il pericolo di un esplosione se la pila non viene sostituita in modo corretto. Utilizzare solo pile uguali o di tipo equivalente a quelle consigliate dal produttore. Per disfarsi delle pile usate, seguire le istruzioni del produttore.

PRECAUCIÓN

Existe peligro de explosión si la pila no se cambia de forma adecuada. Utilice solamente pilas iguales o del mismo tipo que las recomendadas por el fabricante del equipo. Para deshacerse de las pilas usadas, siga igualmente las instrucciones del fabricante.

WAARSCHUWING

Er bestaat ontploffingsgevaar als de batterij wordt vervangen door een onjuist type batterij. Batterijen moeten zoveel mogelijk worden gerecycled. Houd u bij het weggooien van gebruikte batterijen aan de plaatselijke milieuwetgeving.

ATENÇÃO

Haverá risco de explosão se a bateria for substituída por um tipo de bateria incorreto. As baterias devem ser recicladas nos locais apropriados. A eliminação de baterias usadas deve ser feita de acordo com as regulamentações ambientais da região.

AŚCIAROŽZNAŚĆ

Існуе рызыка выбуху, калі заменены акумулятар неправільнага тыпу. Акумулятары павінны, па магчымасці, перапрацоўвацца. Пазбаўляцца ад старых акумулятараў патрэбна згодна з мясцовым заканадаўствам па экалогіі.

UPOZORNÌNÍ

V případě výměny baterie za nesprávný druh může dojít k výbuchu. Je-li to možné, baterie by měly být recyklovány. Baterie je třeba zlikvidovat v souladu s místními předpisy o životním prostředí.

Προσοχή

Υπάρχει κίνδυνος για έκρηξη σε περίπτωση που η μπαταρία αντικατασταθεί από μία λανθασμένου τύπου. Οι μπαταρίες θα πρέπει να ανακυκλώνονται όταν κάτι τέτοιο είναι δυνατό. Η απόρριψη των χρησιμοποιημένων μπαταριών πρέπει να γίνεται σύμφωνα με τους κατά τόπο περιβαλλοντικούς κανονισμούς.

VIGYÁZAT

Ha a telepet nem a megfelelő típusú telepre cseréli, az felrobbanhat. A telepeket lehetőség szerint újra kell hasznosítani. A használt telepeket a helyi környezetvédelmi előírásoknak megfelelően kell kiselejtezni.

注意

異なる種類の電池を使用すると、爆発の危険があります。リサイクル
が可能な地域であれば、電池をリサイクルしてください。使用後の電
池を廃棄する際には、地域の環境規制に従ってください。

AWAS

Risiko letupan wujud jika bateri digantikan dengan jenis yang tidak betul. Bateri sepatutnya dikitar semula jika boleh. Pelupusan bateri terpakai mestilah mematuhi peraturan alam sekitar tempatan.

OSTRZEŻENIE

Istnieje niebezpieczeństwo wybuchu w przypadku zastosowania niewłaściwego typu baterii. Zużyte baterie należy w miarę możliwości utylizować zgodnie z odpowiednimi przepisami ochrony środowiska.

PRECAUȚIE

Risc de explozie, dacă bateria este înlocuită cu un tip de baterie necorespunzător. Bateriile trebuie reciclate, dacă este posibil. Depozitarea bateriilor uzate trebuie să respecte reglementările locale privind protecţia mediului.

ВНИМАНИЕ

При использовании батареи несоответствующего типа существует риск ее взрыва. Батареи должны быть утилизированы по возможности. Утилизация батарей должна проводится по правилам, соответствующим местным требованиям.

UPOZORNENIE

Ak batériu vymeníte za nesprávny typ, hrozí nebezpečenstvo jej výbuchu.
Batérie by sa mali podľa možnosti vždy recyklovať. Likvidácia použitých batérií sa musí vykonávať v súlade s miestnymi predpismi na ochranu životného prostredia.

POZOR

Zamenjava baterije z baterijo drugačnega tipa lahko povzroči eksplozijo.
Če je mogoče, baterije reciklirajte. Rabljene baterije zavrzite v skladu z lokalnimi okoljevarstvenimi predpisi.

คำเตือน

ระวังการระเบิดที่เกิดจากเปลี่ยนแบตเตอรี่ผิดประเภท หากเป็นไปได้ ควรนำแบตเตอรี่ไปรีไซเคิล การทิ้งแบตเตอรี่ใช้แล้วต้องเป็นไปตามกฎข้อบังคับด้านสิ่งแวดล้อมของท้องถิ่น.

UYARI

Yanlış türde pil takıldığında patlama riski vardır. Piller mümkün olduğunda geri dönüştürülmelidir. Kullanılmış piller, yerel çevre yasalarına uygun olarak atılmalıdır.

ОСТОРОГА

Використовуйте батареї правильного типу, інакше існуватиме ризик вибуху. Якщо можливо, використані батареї слід утилізувати. Утилізація використаних батарей має бути виконана згідно місцевих норм, що регулюють охорону довкілля.

UPOZORNĚNÍ

V případě výměny baterie za nesprávný druh může dojít k výbuchu. Je-li to možné, baterie by měly být recyklovány. Baterie je třeba zlikvidovat v souladu s místními předpisy o životním prostředí.

ETTEVAATUST

Kui patarei asendatakse uue ebasobivat tüüpi patareiga, võib tekkida plahvatusoht. Tühjad patareid tuleb võimaluse korral viia vastavasse kogumispunkti. Tühjade patareide äraviskamisel tuleb järgida kohalikke keskkonnakaitse alaseid reegleid.

FIGYELMEZTETÉS

Ha az elemet nem a megfelelő típusúra cseréli, felrobbanhat. Az elemeket lehetőség szerint újra kell hasznosítani. A használt elemeket a helyi környezetvédelmi előírásoknak megfelelően kell kiselejtezni.

UZMANĪBU

Pastāv eksplozijas risks, ja baterijas tiek nomainītas ar nepareiza veida baterijām. Ja iespējams, baterijas vajadzētu nodot attiecīgos pieņemšanas punktos. Bateriju izmešanai atkritumos jānotiek saskaņā ar vietējiem vides aizsardzības noteikumiem.

DĖMESIO

Naudojant netinkamo tipo baterijas įrenginys gali sprogti. Kai tik įmanoma, baterijas reikia naudoti pakartotinai. Panaudotas baterijas išmesti būtina pagal vietinius aplinkos apsaugos nuostatus.

ATTENZJONI

Riskju ta' splużjoni jekk il-batterija tinbidel b'tip ta' batterija mhux korrett. Il-batteriji għandhom jiġu riċiklati fejn hu possibbli. Ir-rimi ta' batteriji użati għandu jsir skond ir-regolamenti ambjentali lokali.

OSTRZEŻENIE

Ryzyko wybuchu w przypadku wymiany na baterie niewłaściwego typu. W miarę możliwości baterie należy poddać recyklingowi. Zużytych baterii należy pozbywać się zgodnie z lokalnie obowiązującymi przepisami w zakresie ochrony środowiska.