Intel® Desktop Board DZ87KLT-75K

Technical Product Specification

Revision History

Revision	Revision History	Date
001	First release of the Intel® Desktop Board DZ87KLT-75K Technical Product Specification	May 2013

This product specification applies to only the standard Intel® Desktop Board DZ87KLT-75K with BIOS identifier KLZ8711D.86A.

Board Identification Information

Basic Desktop Board DZ87KLT-75K Identification Information

AA Revision	BIOS Revision	Notes
G74721-003	KLZ8711D.86A	1,2

Notes:

1. The AA number is found on a small label on the component side of the board.

2. The Z87 chipset used on this AA revision consists of the following component:

Device	Stepping	S-Spec Numbers
Intel Z87 Express Chipset	C1	SR13A

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 the Intel® Desktop Board DZ87KLT-75K.

Intended Audience

The TPS is intended to provide detailed, technical information about the Intel Desktop Board DZ87KLT-75K and its components to the vendors, system integrators, and other engineers and technicians who need this level of information. It is specifically *not* intended for general audiences.

What This Document Contains

Chapter	Description
1	A description of the hardware used on the Intel Desktop Board DZ87KLT-75K
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)
Kb	Kilobit (1024 bits)
kb/s	1000 bits per second
MB	Megabyte (1,048,576 bytes)
MB/s	Megabytes per second
Mb	Megabit (1,048,576 bits)
Mb/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.

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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	ATX (12.00 inches by 9.60 inches [304.80 millimeters by 243.84 millimeters])

Processor	• 4th generation Intel® Core™ processor with up to 95 W TDP in an LGA1150 socket
	  — PCI Express* 3.0 x16 graphics interfaces
	  — Integrated memory controller with dual channel DDR3 memory support
	  — Integrated graphics processing (processors with Intel® HD Graphics)
	  — External graphics interface controller

Memory	• Four 240-pin DDR3 SDRAM Dual Inline Memory Module (DIMM) sockets • Support for DDR3 1066 MHz up to 2400+ MHz DIMMs (see Section 1.5 for complete details) • Support for 1 Gb, 2 Gb, and 4 Gb memory technology • Support for up to 32 GB of system memory with four DIMMs using 4 Gb memory technology • Support for non-ECC memory • Support for 1.5 V (standard voltage) and 1.35 V (low voltage) JEDEC memory • Support for XMP memory
Chipset	Intel® Z87 Express Chipset consisting of the Intel® Z87 Platform Controller Hub (PCH)

Audio	• 10-channel (7.1 + 2) Intel® High Definition (Intel® HD) Audio via the Realtek* ALC898 audio codec including:
	  — Front panel audio connector with support for Intel HD Audio and AC '97 Audio
	  — Five analog audio jacks on the back panel
	  — Onboard S/PDIF out header and back panel optical S/PDIF out connector
	• 8-channel (7.1) Intel HD Audio via the High Definition Multimedia Interface* (HDMI*)

Graphics	• Integrated graphics support via an HDMI v1.4a interface • Support for PCI Express 3.0 x16 add-in graphics card
Legacy I/O Control	Nuvoton* legacy I/O controller for Consumer Infrared (CIR) and hardware management support

<div align="right">continued</div>

Table 1. Feature Summary (continued)

Peripheral Interfaces	• USB 3.0 ports:
	  — Six ports implemented with stacked back panel connectors (blue)
	  — Two ports implemented through one dual-port internal connector (blue)
	• USB 2.0 ports:
	  — Two ports implemented with stacked back panel connectors (orange high current charging ports)
	  — Six front panel ports are implemented through three dual-port internal connectors (two black and one orange high current charging port)
	• Serial ATA (SATA) ports:
	  — Six SATA 6.0 Gb/s interfaces through the Intel Z87 Express Chipset with Intel® Rapid Storage Technology RAID support (blue)
	  — Two SATA 6.0 Gb/s interfaces through a Marvel 88SE9172 controller (gray)
	• Two IEEE 1394a ports:
	  — One port via a back panel connector
	  — One port via a front-panel connector (blue)

Wireless Module	• Separate module that provides both Bluetooth* and WiFi included with the desktop board Note: Only Bluethooth v2.1 is supported
Intel® Visual BIOS	• Intel® BIOS resident in SPI Flash device • Support for Advanced Configuration and Power Interface (ACPI), Plug and Play, and SMBIOS
Instantly Available PC Technology	• Support for PCI* Local Bus Specification Revision 2.2 • Support for PCI Express* Revision 2.0 • Suspend to RAM support • Wake on PCI, PCI Express, LAN, front panel, CIR, and USB ports
Connectivity	• Two Gigabit (10/100/1000 Mb/s) LAN subsystems using the Intel® i217V Gigabit Ethernet Controller and Intel® i210 Gigabit Ethernet Controller • Thunderbolt™ Technology Interface

Expansion Capabilities	• Three PCI Express 3.0 x16 bus add-in card connectors from the processor
	  — 1st PCI Express x16 slot is electricallyx8 or x16
	  — 2nd PCI Express x16 slot is electrically x8 or disabled
	  — 3rd PCI Express x16 slot is electrically x4
	• Three PCI Express 2.0 x1 bus add-in card connectors from the PCH
	• One Conventional PCI bus add-in card connector from the PCH via a PCI bridge
	• One PCI Express Full-/Half-Mini Card slot with support for mSATA
	  Note: No USB is routed to the PCI Express Full-/Half-Mini Card slot

Hardware Monitor Subsystem	• Hardware monitoring and fan control 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 • Six fan headers using PWM control • Fan sense inputs used to monitor fan activity • Fan speed control using voltage control (4-pin fan headers front, rear, and auxiliary) with selectable support in BIOS for 3-wire fans • Support for Platform Environmental Control Interface (PECI)

1.1.2 Board Layout

Figure 1 shows the location of the major components on Intel Desktop Board DZ87KLT-75K.

Figure 1. Major Board Components

Table 2 lists the components identified in Figure 1.

Table 2. Components Shown in Figure 1

Label	Description
A	PCI Express x16 add-in card connector (x4 electrical; x16 compatible)
B	Conventional PCI add-in card connector
C	PCI Express x16 add-in card connector (x8 electrical; x16 compatible)
D	PCI Express x1 add-in card connector
E	PCI Express x1 add-in card connector
F	PCI Express x16 add-in card connector
G	Battery
H	Rear chassis fan header 2
I	PCI Express x1 add-in card connector
J	Rear chassis fan header 1
K	Back panel connectors
L	12 V processor core voltage connector (2 x 4 pin)
M	LGA 1150 processor socket
N	Voltage regulator status LEDs
O	Processor fan header
P	DIMM 3 (Channel A DIMM 0)
Q	DIMM 1 (Channel A DIMM 1)
R	DIMM 4 (Channel B DIMM 0)
S	DIMM 2 (Channel B DIMM 1)
T	Front chassis fan header 1
U	Front chassis fan header 2
V	Onboard power button
W	Onboard reset button
X	Piezoelectric speaker
Y	Main power connector (2 x 12)
Z	Standby power LED
AA	Front panel USB 3.0 connector
BB	BIOS security jumper
CC	Chassis intrusion header
DD	SATA 6.0 Gb/s connectors through the PCH (blue)
EE	SATA 6.0 Gb/s connectors through a Marvel 88SE9172 controller (gray)
FF	PCI Express Full-/Half-Mini Card slot
GG	Consumer IR receiver (input) header
HH	Alternate front panel power/sleep LED header
II	Front panel connector
JJ	Power On Self Test (POST) LED display
KK	POST LED display
LL	Front panel USB 2.0 connector (black)

continued

Table 2. Components Shown in Figure 1 (continued)

Label	Description
MM	Power Supervisor LED
NN	Front panel USB 2.0 connector (black)
OO	Front panel USB 2.0 connector (orange high current charging)
PP	Board status LEDs
QQ	S/PDIF header
RR	Auxiliary fan header
SS	IEEE 1394a front panel connector
TT	Front panel audio connector

1.1.3 Block Diagram

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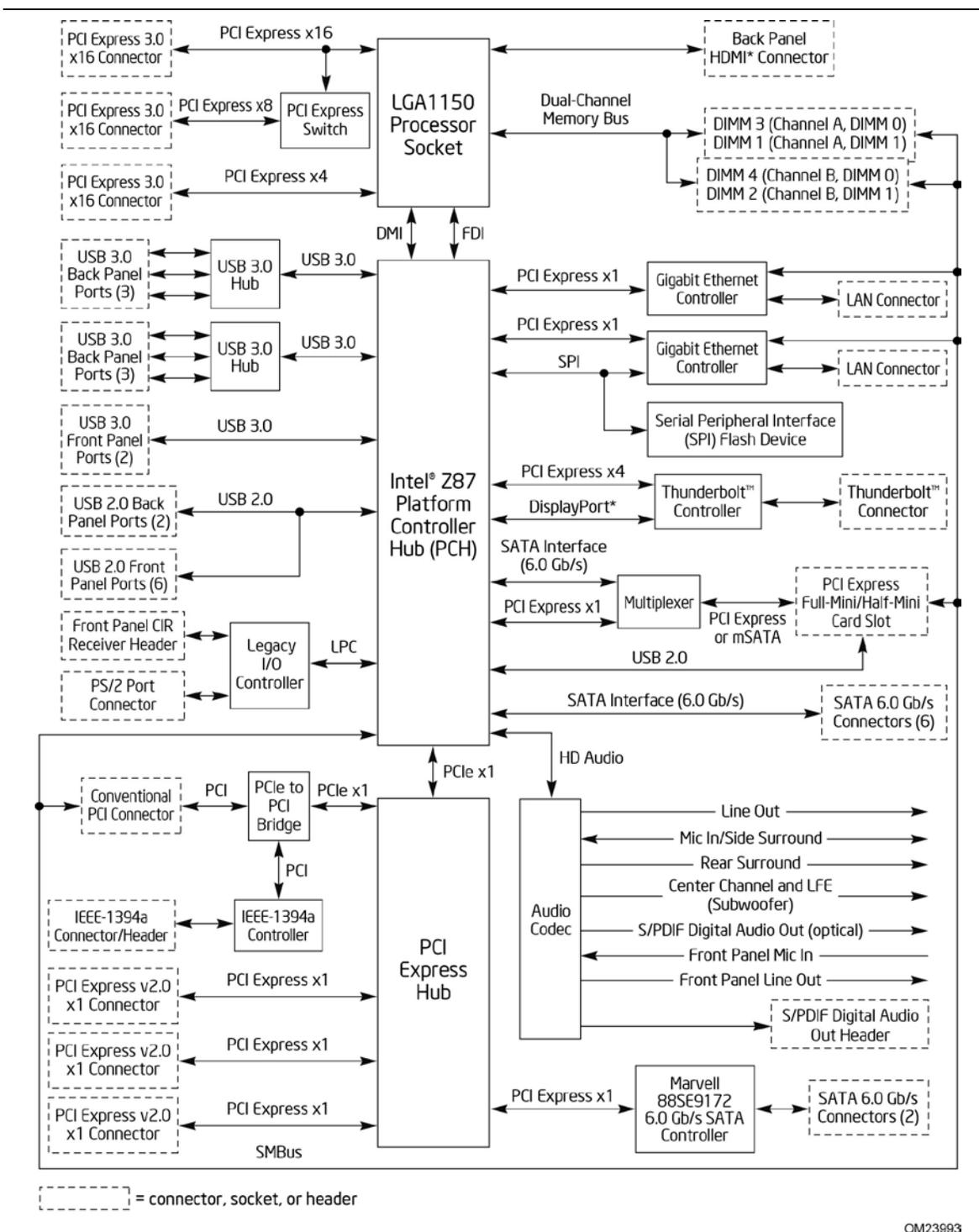
Figure 2. Block Diagram

1.2 Online Support

To find information about...	Visit this World Wide Web site:
Intel Desktop Board DZ87KLT-75K	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 the Intel Desktop Board DZ87KLT-75K	http://ark.intel.com
Supported processors	http://processormatch.intel.com
Chipset information	https://www-ssl.intel.com/content/www/us/en/chipsets/performance-chipsets/chipsets.html
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 supports 4th generation Intel Core processors. Other processors may be supported in the future. This board supports processors with a maximum wattage of 95 W Thermal Design Power (TDP). The processors listed above are only supported when falling within the wattage requirements of Intel Desktop Board DZ87KLT-75K. 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 2.5.1 on page 66 for information on power supply requirements for this board.

1.3.1　　　Processor Graphics Subsystem

The board supports graphics through either the processor Intel HD Graphics or a PCI Express x16 add-in graphics card.

The board supports integrated graphics for processors with Intel HD Graphics.

1.3.1.1　　Intel® High Definition (Intel® HD) Graphics

The Intel HD graphics controller features the following:

- 3D Features
  — DirectX* 11.1 support
  — OpenGL* 4.0 support
- Video
  — Next Generation Intel® Clear Video Technology HD support is a collection of video playback and enhancement features that improve the end user's viewing experience
    ▪ Encode/transcode HD content
    ▪ Playback of high definition content including Blu-ray* disc
    ▪ Superior image quality with sharper, more colorful images
    ▪ Playback of Blu-ray disc S3D content using HDMI (1.4a spec compliant with 3D)
  — DirectX* Video Acceleration (DXVA) support for accelerating video processing
    ▪ Full AVC/VC1/MPEG2 HW Decode
  — Intel® HD Graphics with Advanced Hardware Video Transcoding (Intel® Quick Sync Video)

    Note: Intel Quick Sync Video is enabled by an appropriate software application.

1.3.1.2　　High Definition Multimedia Interface* (HDMI*)

The High-Definition Multimedia Interface (HDMI) is provided for transmitting uncompressed digital audio and video signals to television sets, projectors and other video displays. It can carry high quality multi-channel audio data and all standard and high-definition consumer electronics video formats. The HDMI display interface connecting the processor and display devices utilizes transition minimized differential signaling (TMDS) to carry audiovisual information through the same HDMI cable. The processor HDMI interface is designed according to the High-Definition Multimedia Interface Specification with 3D, 4K, Deep Color, and x.v.Color.

The maximum supported resolution is 4096 x 2304 @ 24Hz or 2560 x 1600 @ 60Hz. The HDMI interface supports the HDMI 1.4a specification.

Depending on the type of add-in card installed in the PCI Express x16 connector, the HDMI port will behave as described in Table 3.

Table 3. HDMI Port Status Conditions

PCI Express x16 Connector Status	HDMI Port Status
No add-in card installed	Enabled
PCI Express x16 add-in card installed	Enabled (Note)

Note: May require BIOS setup menu changes.

1.3.1.3   High-bandwidth Digital Content Protection (HDCP)

HDCP is the technology for protecting high definition content against unauthorized copy or interception between a source (computer, digital set top boxes, etc.) and the sink (panels, monitor, and TVs). The PCH supports HDCP 1.4 for content protection over wired displays (HDMI).

1.3.1.4   Integrated Audio Provided by the HDMI Interface

The HDMI interface from the PCH supports audio. The processor supports two High Definition audio streams on two digital ports simultaneously.

Table 4 shows the specific audio technologies supported by the PCH.

Table 4. Audio Formats Supported by the HDMI Interface

Audio Formats	HDMI
AC-3 - Dolby* Digital	Yes
Dolby Digital Plus	Yes
DTS-HD*	Yes
LPCM, 192 kHz/24 bit, 8 Channel	Yes
Dolby TrueHD, DTS-HD Master Audio* (Lossless Blu-ray Disc Audio Format)	Yes

1.3.1.5   Multiple Display Configurations

The following multiple display configuration modes are supported (with appropriate driver software):

- Single Display is a mode with one display port activated to display the output to one display device.
- Intel® Display Clone is a mode with up to three display ports activated to drive the display content of same color depth setting but potentially different refresh rate and resolution settings to all the active display devices connected.
- Extended Desktop is a mode with up to three display ports activated to drive the content with potentially different color depth, refresh rate, and resolution settings on each of the active display devices connected.

1.3.1.6 PCI Express Graphics

4th generation Intel Core processors support PCI Express 3.0, 2.x, and 1.x:

- PCI Express 3.0 with a raw bit rate of 8.0 GT/s results in an effective bandwidth of 1 GB/s each direction per lane. The maximum theoretical bandwidth of the x16 interface is 16 GB/s in each direction, simultaneously, for a total bandwidth of 32 GB/s.
- PCI Express 2.x with a raw bit rate of 5.0 GT/s results in an effective bandwidth of 500 MB/s each direction per lane. The maximum theoretical bandwidth of the x16 interface is 8 GB/s in each direction, simultaneously, for a total bandwidth of 16 GB/s.
- PCI Express 1.x with a raw bit rate of 2.5 GT/s results in an effective bandwidth of 250 MB/s each direction per lane. The maximum theoretical bandwidth of the x16 interface is 4 GB/s in each direction, simultaneously, for a total bandwidth of 8 GB/s.

For information about	Refer to
PCI Express technology	http://www.pcisig.com

1.4 Intel® Z87 Express Chipset

Intel Z87 Express Chipset with Direct Media Interface (DMI) interconnect provides interfaces to the processor and USB, SATA, LPC, LAN, and PCI Express. The Intel Z87 Express Chipset is a centralized controller for the board's I/O paths.

For information about	Refer to
The Intel Z87 chipset	http://www.intel.com/products/desktop/chipsets/index.htm
Resources used by the chipset	Chapter 2

1.4.1 Direct Media Interface (DMI)

Direct Media Interface (DMI) is the chip-to-chip connection between the processor and the PCH. This high-speed interface integrates advanced priority-based servicing allowing for concurrent traffic and true isochronous transfer capabilities.

1.5 System Memory

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

- 1.5 V DDR3 SDRAM DIMMs with gold plated contacts, with the option to raise the voltage to support higher performance DDR3 SDRAM DIMMs.
- 1.35 V Low Voltage DDR3 DIMMs (JEDEC specification)
- Unbuffered, single-sided or double-sided DIMMs with the following restriction: Double-sided DIMMs with x16 organization are not supported.
- 32 GB maximum total system memory (using 4 Gb memory technology). Refer to Section 2.1.1 on page 49 for information on the total amount of addressable memory.
- Minimum total system memory: 1 GB using 512 MB x16 module
- Non-ECC DIMMs
- Serial Presence Detect
- Support for DDR3 1066 MHz up to 2400+ MHz DIMMs
    — DDR3 2133 dual channel mode is supported via the Overclocking Assistant
    — DDR3 2400 dual channel mode is supported via XMP profiles and manual mode
    — DDR3 2667 single channel mode is supported via XMP profiles and manual mode
- XMP version 1.3 performance profile support for memory speeds above 1600 MHz

NOTE

To be fully compliant with all applicable DDR SDRAM memory specifications, the board should be populated with DIMMs that support the Serial Presence Detect (SPD) data structure. This allows the BIOS to read the SPD data and program the chipset to accurately configure memory settings for optimum performance. If non-SPD memory is installed, the BIOS will attempt to correctly configure the memory settings, but performance and reliability may be impacted or the DIMMs may not function under the determined frequency.

⚠ CAUTION

1.5 V is the recommended and default setting for DDR3 memory voltage. The other memory voltage settings in the BIOS Setup program are provided for performance tuning purposes only. Altering the memory voltage may (i) reduce system stability and the useful life of the system, memory, and processor; (ii) cause the processor and other system components to fail; (iii) cause reductions in system performance; (iv) cause additional heat or other damage; and (v) affect system data integrity.

Intel has not tested and does not warranty the operation of the processor beyond its specifications. For information on the processor warranty, refer to http://www.intel.com/support/processors/sb/CS-020033.htm?wapkw=(processor+warranty).

Intel assumes no responsibility that the memory installed on the desktop board, if used with altered clock frequencies and/or voltages, will be fit for any particular purpose. Check with the memory manufacturer for warranty terms and additional details.

Table 5 lists the supported DIMM configurations.

Table 5. Supported Memory Configurations

DIMM Capacity	Configuration (Note)	SDRAM Density	SDRAM Organization Front-side/Back-side	Number of SDRAM Devices
1024 MB	SS	1 Gbit	128 M x8/empty	8
1024 MB	SS	2 Gbit	128 M x16/empty	4
2048 MB	DS	1 Gbit	128 M x8/128 M x8	16
2048 MB	SS	2 Gbit	128 M x16/empty	8
4096 MB	DS	2 Gbit	256 M x8/256 M x8	16
4096 MB	SS	4 Gbit	512 M x8/empty	8
8192 MB	DS	4 Gbit	512 M x8/512 M x8	16

Note: "DS" refers to double-sided memory modules (containing two rows of SDRAM) and "SS" refers to single-sided memory modules (containing one row of SDRAM).

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

1.5.1 Memory Configurations

4th generation Intel Core processors 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 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 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 DIMM is installed or the memory capacities are unequal. Technology and device width can vary from one channel to the other. If different speed 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 3 illustrates the DIMM configuration.

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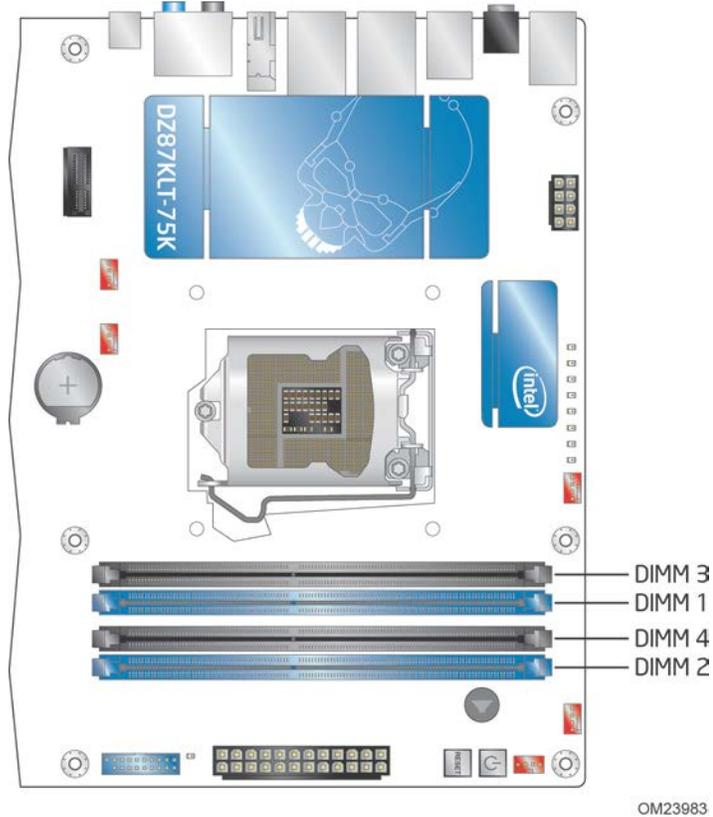
Figure 3. DIMM Configuration

🗒 **NOTE**

For best memory performance always install memory in the blue DIMM sockets if installing only two DIMMs on your board.

1.5.2   USB

The PCH contains up to two Enhanced Host Controller Interface (EHCI) host controllers that support USB high-speed signaling. High-speed USB 2.0 allows data transfers up to 480 Mb/s. All ports are high-speed, full-speed, and low-speed capable.

The PCH also contains an integrated eXtensible Host Controller Interface (xHCI) host controller which supports USB 3.0 ports. This controller allows data transfers up to 5 Gb/s. The controller supports SuperSpeed (SS), high-speed (HS), full-speed (FS), and low-speed (LS) traffic on the bus.

The Intel Z87 Express Chipset provides the USB controller for the USB 2.0/3.0 ports. The port arrangement is as follows:

- USB 3.0 ports:
  — Six ports implemented with stacked back panel connectors (blue)
  — Two ports implemented through one dual-port internal connectors (blue)
- USB 2.0 ports:
  — Two ports implemented with stacked back panel connectors (orange high current charging ports)
  — Six front panel ports are implemented through three dual-port internal connectors (two black and one orange high current charging port)

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 51
The location of the front panel USB headers	Figure 13, page 52

1.5.3   SATA Interfaces

The board provides eight SATA connectors, through the PCH, which support one device each:

- Six SATA 6.0 Gb/s interfaces through the Intel Z87 Express Chipset with Intel® Rapid Storage Technology RAID support (blue)
- Two SATA 6.0 Gb/s interfaces through a Marvel 88SE9172 controller (gray)

The PCH provides independent SATA ports with a theoretical maximum transfer rate of 6.0 Gb/s. A point-to-point interface is used for host to device connections.

The PCH supports the Serial ATA Specification, Revision 3.0. The PCH also supports several optional sections of the Serial ATA II: Extensions to Serial ATA 1.0 Specification, Revision 1.0 (AHCI support is required for some elements).

📝 NOTE

Many SATA drives use new low-voltage power connectors and require adapters or power supplies equipped with low-voltage power connectors.

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

For information about	Refer to
The location of the SATA connectors	Figure 13, page 52

1.5.3.1   Intel® Rapid Storage Technology/SATA RAID

The PCH supports Intel® Rapid Storage Technology, providing both AHCI and integrated RAID functionality. The RAID capability provides high-performance RAID 0, 1, 5, and 10 functionality on all SATA ports. Other RAID features include hot spare support, SMART alerting, and RAID 0 auto replace. Software components include an Option ROM for pre-boot configuration and boot functionality, a Microsoft* Windows* compatible driver, and a user interface for configuration and management of the RAID capability of the PCH.

1.5.3.2   Intel® Smart Response Technology

Intel® Smart Response Technology is a disk caching solution that can provide improved computer system performance with improved power savings. It allows configuration of a computer system with the advantage of having HDDs for maximum storage capacity with system performance at or near SSD performance levels.

For more information on Intel Smart Response Technology, go to http://www.intel.com/support/chipsets/sb/CS-032826.htm

📝 NOTE

In order to use supported RAID and Intel Smart Response Technology features, you must first enable RAID in the BIOS.

1.6 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 °C with 3.3 VSB applied via the power supply 5V STBY rail.

NOTE

If the battery and AC power fail date and time values will be reset and the user will be notified during 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 13 shows the location of the battery.

1.7 Super I/O Controller

The I/O controller provides the following features:

- Consumer Infrared (CIR) header
- PS/2-style keyboard/mouse interface on the back panel
- Serial IRQ interface compatible with serialized IRQ support for PCI systems
- Intelligent power management, including a programmable wake-up event interface
- PCI power management support

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

1.8 Audio Subsystem

The board supports Intel HD Audio through the Realtek ALC898 audio codec as well as the HDMI interface. The audio subsystem supports the following features:

- Advanced jack sense for the back panel audio jacks that enables the audio codec to recognize the device that is connected to an audio port.
- Digital-to-Analog Converters (DAC) with 110 dB SNR (A-weighting) and Analog-to-Digital Converters (ADC) with 104 dB SNR (A-weighting).
- Ten DAC channels support 16/20/24-bit PCM format for 7.1 channel sound playback, plus two channels of concurrent independent stereo sound output (multiple streaming) through the front panel output.
- Three stereo ADCs support 16/20-bit PCM format, multiple stereo recording
- Microphone Acoustic Echo Cancellation (AEC), Noise Suppression (NS), and Beam Forming (BF) technology for voice applications.
- Windows 7 Ultimate certification.

Table 6 lists the supported functions of the front panel and back panel audio jacks.

Table 6. Audio Jack Support

Audio Jack	Micro- phone	Head- phones	Line-Out (Front Speaker)	Line-In	Rear Surround	Center/ Sub	Mic-In (Side Surround)
FP Green		Default					
FP Pink	Default						
Rear Blue		Ctrl panel	Ctrl panel	Default	Ctrl panel	Ctrl panel	Ctrl panel
Rear Green		Ctrl panel	Default	Ctrl panel	Ctrl panel	Ctrl panel	Ctrl panel
Rear Pink	Ctrl panel	Ctrl panel	Ctrl panel	Ctrl panel	Ctrl panel	Ctrl panel	Default
Rear Black		Ctrl panel	Ctrl panel	Ctrl panel	Default	Ctrl panel	Ctrl panel
Rear Orange		Ctrl panel	Ctrl panel	Ctrl panel	Ctrl panel	Default	Ctrl panel

1.8.1 Audio Subsystem Software

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

For information about	Refer to
Obtaining audio software and drivers	Section 1.2, page 17

1.8.2   Audio Subsystem Components

The audio subsystem includes the following components:

- Intel Z87 Express Chipset
- Realtek ALC898 audio codec
- Front panel audio header that supports Intel HD audio and AC '97 audio (a 2 x 5-pin header that provides mic in and line out signals for front panel audio connectors) (yellow)
- S/PDIF digital audio out header (1 x 4-pin header) (yellow)
- S/PDIF digital audio out connector on the back panel
- 5-port analog audio input/output stack on the back panel

The back panel audio connectors are configurable through the audio device drivers. The available configurable back panel audio connectors are shown in Figure 4.

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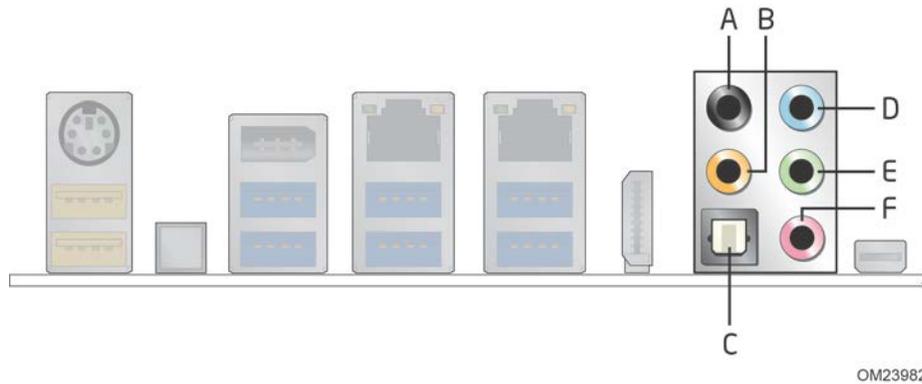
Item	Description
A	Rear surround
B	Center channel and LFE (Subwoofer)
C	S/PDIF out (optical)
D	Line-in
E	Line-out (front speaker)
F	Mic-in (side surround)

Figure 4. Back Panel Audio Connectors

NOTE

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

For information about	Refer to
The locations of the front panel audio header and S/PDIF audio header	Figure 13, page 52
The signal names of the front panel audio header and S/PDIF audio header	Section 2.2.2.1, page 54
The back panel audio connectors	Section 2.2.1, page 51

1.9   Connectivity

1.9.1   LAN Subsystem

The two LAN subsystems consist of the following:

- Intel i217V Gigabit Ethernet Controller and Intel i210 Gigabit Ethernet Controller (10/100/1000 Mb/s)
- Intel Z87 Express Chipset
- RJ-45 LAN connector with integrated status LEDs

Additional features of the LAN subsystem include:
- CSMA/CD protocol engine
- LAN connect interface between the PCH and the LAN controller
- Conventional PCI bus power management
  — ACPI technology support
  — LAN wake capabilities
- LAN subsystem software

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

1.9.1.1   Intel® i217V Gigabit Ethernet Controller and Intel® i210 Gigabit Ethernet Controller

The Ethernet Controllers support the following features:

Network Features:

- Compliant with the 1 Gb/s Ethernet 802.3, 802.3u, 802.3z, 802.3ab specifications
- Multi-speed operation: 10/100/1000 Mb/s
- Full-duplex operation at 10/100/1000 Mb/s; Half-duplex operation at 10/100 Mb/s
- Flow control support compliant with the 802.3X specification as well as the specific operation of asymmetrical flow control defined by 802.3z
- VLAN support compliant with the 802.3q specification
- MAC address filters: perfect match unicast filters, multicast hash filtering, broadcast filter, and promiscuous mode

Performance Features:

- Configurable receive and transmit data FIFO, programmable in 1 KB increments
- TCP segmentation capability compatible with Windows NT 5.x off-loading features
- Fragmented UDP checksum offload for packet reassembly
- IPv4 and IPv6 checksum offload support (receive, transmit, and TCP segmentation offload)
- Split header support to eliminate payload copy from user space to host space
- Receive Side Scaling (RSS) with two hardware receive queues
- Supports 9018 bytes of jumbo packets
- Packet buffer size

- LinkSec offload compliant with 802.3ae specification
- TimeSync offload compliant with 802.1as specification

Power Management Features:
- Magic Packet* wake-up enable with unique MAC address
- ACPI register set and power down functionality supporting D0 and D3 states
- Full wake up support (APM, ACPI)
- MAC power down at Sx, DMoff with and without WoL
- Auto connect battery saver at S0 no link and Sx no link
- Energy Efficient Ethernet (EEE) support
- Latency Tolerance Reporting (LTR)
- Optimized Buffer Flash/Fill (OBFF) support
- ARP and ND proxy support through LAN Connected Device proxy
- Wake on LAN (WoL) from Deep Sx
- Provides lower power usage to meet ENERGY STAR 5.2 and ErP specifications

1.9.1.2   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

1.9.1.3   RJ-45 LAN Connectors with Integrated LEDs

Two LEDs are built into the RJ-45 LAN connectors (shown in Figure 5).
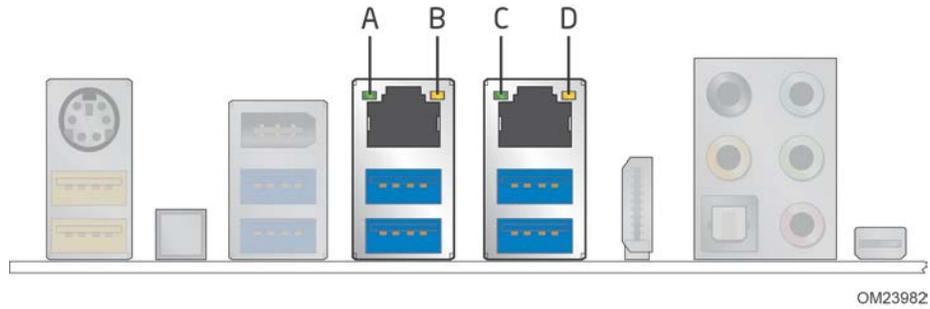
Item	Description
A	Link LED (green)
B	Data Rate LED (green/yellow)
C	Link LED (green)
D	Data Rate LED (green/yellow)

Figure 5. LAN Connectors LED Locations

Table 7 describes the LED states when the board is powered up and the LAN subsystems are operating.

Table 7. 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 Mb/s data rate is selected.
		Green	100 Mb/s data rate is selected.
		Yellow	1000 Mb/s data rate is selected.

1.9.2 Thunderbolt™ Technology Interface

The board's Thunderbolt Technology Interface is supported by an Intel® L3310L CIO 10 Gb Controller.

The Thunderbolt controller connects a PC and other devices, transmitting and receiving information for PCI Express and DisplayPort protocols. The Thunderbolt controller switches between the two protocols to support communications over a single cable.

Thunderbolt technology is implemented on Intel Desktop Board DZ87KLT-75K as a plug and play interface. No software drivers are required.

1.10 Bluetooth*/WiFi Module

The Bluetooth*/WiFi module is supplemental hardware that is included with certain Desktop Boards (see Figure 6).
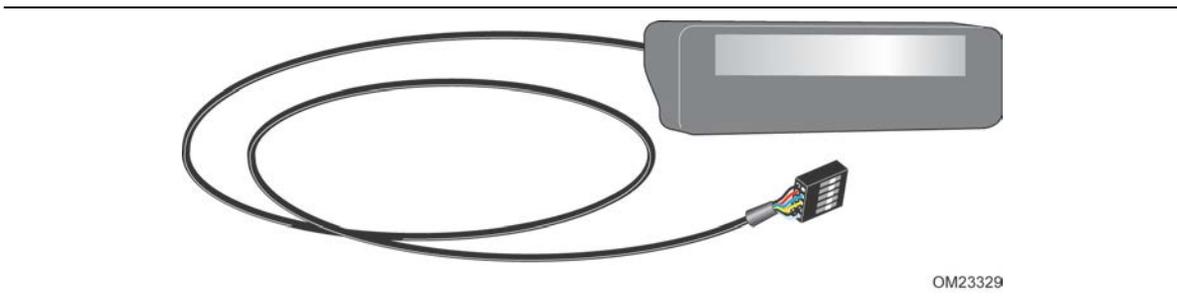
Figure 6. Bluetooth/WiFi Module

1.10.1 Bluetooth Technology (Module)

The Bluetooth Module enables the user to connect with a variety of Bluetooth enabled devices. Driver support is provided by Microsoft operating systems like Microsoft Vista and Microsoft Windows 7. The Bluetooth driver stack is supplied by Microsoft but some Bluetooth enable devices might provide additional Bluetooth features and for proper functioning of those features, will need their own supplied drivers installed.

- CSR Bluetooth module (BC0401PC08)
- Maximum data rate 3.0 Mb/s
- Forward and backward compatibility with Bluetooth v1.1, v1.2, v2.0, and v2.1
- Integrated antenna
- Operating system support (Windows XP, Windows Vista, and Windows 7 both 32 bit and 64 bit)

For information about	Refer to
Obtaining Bluetooth information and drivers	http://msdn.microsoft.com/en-us/library/aa362932(VS.85).aspx

1.10.2   WiFi 802.11 Wireless (Module)

The WiFi Module enables the user to connect with a variety of WiFi enabled networks, access points and allows peer to peer connections. Driver support is provided by Microsoft operating systems like Microsoft Vista and Microsoft Windows 7 with additional support provided by the supplied WiFi driver included on the Driver DVD and online.

- Ralink WiFi 802.11 (RT8070)
- Range up to 300 meters
- Supports the following:
  — IEEE 802.11B supports up to 11 Mb/s data rate
  — IEEE 802.11G supports up to 54 Mb/s data rate
  — IEEE 802.11N supports up to 150 Mb/s data rate
- Integrated antenna
- Operating system support (Windows XP, Windows Vista, and Windows 7 both 32 bit and 64 bit)

For information about	Refer to
Obtaining WiFi information and drivers	http://msdn.microsoft.com/en-us/library/aa362932(VS.85).aspx

1.11   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 the following:

- Fan monitoring and control
- Thermal and voltage monitoring
- Chassis intrusion detection

1.11.1   Hardware Monitoring and Fan Control

The hardware monitoring and fan control subsystem is based on the Nuvoton device, which supports the following:

- Processor and system ambient temperature monitoring
- Chassis fan speed monitoring
- Power monitoring of +12 V, +5 V, +3.3 V, V_{SM}, +V_{CCP}, and PCH V_{CC}
- SMBus interface

1.11.2   Fan Monitoring

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

For information about	Refer to
The functions of the fan headers	Section 1.12.2.2, page 41

1.11.3   Chassis Intrusion and Detection

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

For information about	Refer to
The location of the chassis intrusion header	Figure 13, page 52

1.11.4   Thermal Monitoring

Figure 7 shows the locations of the thermal sensors and fan headers.
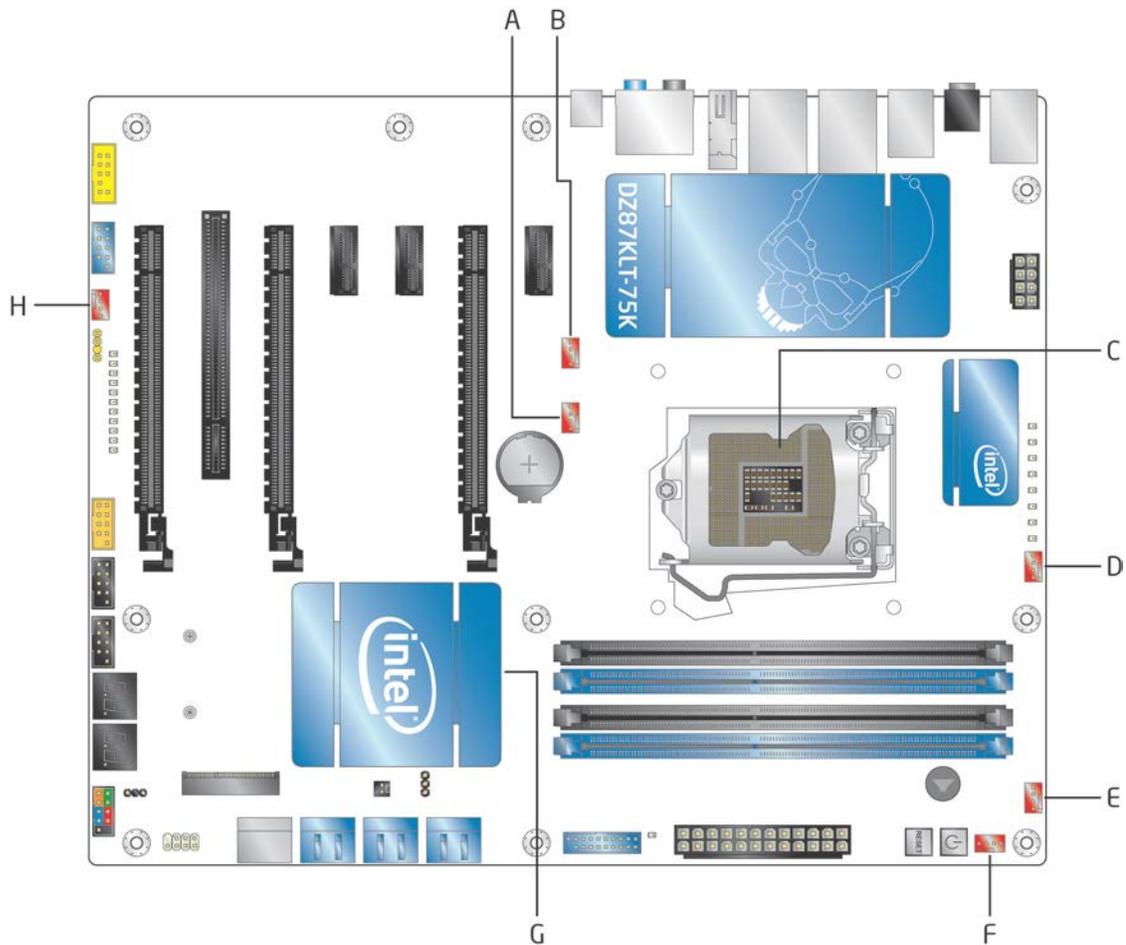
Item	Description
A	Rear chassis fan header 1
B	Rear chassis fan header 2
C	Thermal diode, located on processor die
D	Processor fan header
E	Front fan header 1
F	Front fan header 2
G	Thermal diode, located on the Intel Z87 Express Chipset
H	Auxiliary fan header

Figure 7. Thermal Sensors and Fan Headers

1.12 Power Management

Power management is implemented at several levels, including:

- Software support through Advanced Configuration and Power Interface (ACPI)
- Hardware support

1.12.1 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 10 on page 39)
- Support for a front panel power and sleep mode switch

Table 8 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 8. Effects of Pressing the Power Switch

If the system is in this state...	...and the power switch is pressed for	...the system enters this state
Off (ACPI G2/G5 – Soft off)	Less than four seconds	Power-on (ACPI G0 – working state)
On (ACPI G0 – working state)	Less than four seconds	Soft-off/Standby (ACPI G1 – sleeping state)
On (ACPI G0 – working state)	More than 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)

1.12.1.1 System States and Power States

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

Table 9 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 9. 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.

1.12.1.2 Wake-up Devices and Events

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

Table 10. Wake-up Devices and Events

These devices/events can wake up the computer…	…from this state
Power switch	S3, S4, S5 (Note 1)
RTC alarm	S3, S4, S5 (Note 1)
LAN	S3, S4, S5 (Notes 1 and 3)
USB	S3
PME# signal	S3, S4, S5 (Note 1)
WAKE#	S3, S4, S5 (Note 1)
Consumer IR	S3, S4, S5 (Notes 2 and 4)

Notes:
1. S4 implies operating system support only.
2. Wake from S4 and S5 is recommended by Microsoft.
3. Wake on LAN is only supported from sleep (S3) or hibernate (S4) in Windows 8.
4. When Deep S4/S5 is enabled only Wake from RTC and Front Panel is supported.

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.

1.12.2 Hardware Support

⚠ CAUTION

Ensure that the power supply provides adequate +5 V standby current if LAN wake capabilities and Instantly Available PC technology features are used. Failure to do so can damage the power supply. The total amount of standby current required depends on the wake devices supported and manufacturing options.

The board provides several power management hardware features, including:

- Power connector
- Fan headers
- LAN wake capabilities
- Instantly Available PC technology
- Wake from USB
- Power Management Event signal (PME#) wake-up support
- PCI Express WAKE# signal support
- Wake from Consumer IR
- Wake from S5
- Power Supervisor
- +5 V Standby Power Indicator LED

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

📝 NOTE

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

1.12.2.1 Power Connector

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

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

For information about	Refer to
The location of the main power connector	Figure 13, page 52
The signal names of the main power connector	Table 26, page 59

1.12.2.2   Fan Headers

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

- The fans are on when the board is in the S0 state
- The fans are off when the board is off or in the S3, S4, or S5 state
- Each fan header is wired to a fan tachometer input of the hardware monitoring and fan control ASIC
- All fan headers support closed-loop fan control that can adjust the fan speed or switch the fan on or off as needed
- All fan headers have a +12 V DC connection
- 4-pin fan headers are controlled by Pulse Width Modulation

For information about	Refer to
The location of the fan headers	Figure 13, page 52
The location of the fan headers and sensors for thermal monitoring	Figure 7, page 36

1.12.2.3   LAN Wake Capabilities

⚠ **CAUTION**

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

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

- The PCI Express WAKE# signal
- The PCI bus PME# signal for PCI 2.3 compliant LAN designs
    — By Ping
    — Magic Packet
- The onboard LAN subsystem

1.12.2.4   Instantly Available PC Technology

⚠ **CAUTION**

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

Instantly Available PC technology enables the board to enter the ACPI S3 (Suspend-to-RAM) sleep-state. While in the S3 sleep-state, the computer will appear to be off (the power supply is off, and the front panel LED is amber if dual colored, or off if single colored.) When signaled by a wake-up device or event, the system quickly returns to its last known wake state. Table 10 on page 39 lists the devices and events that can wake the computer from the S3 state.

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

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

1.12.2.5   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 and is supported by the operating system.

1.12.2.6   PME# Signal Wake-up Support

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

1.12.2.7   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.

1.12.2.8   Wake from Consumer IR

CIR activity wakes the computer from an ACPI S3, S4, or S5 state.

1.12.2.9   Wake from S5

When the RTC Date and Time is set in the BIOS, the computer will automatically wake from an ACPI S5 state.

1.12.2.10 Power Supervisor

The Power Supervisor actively monitors the input voltages from the power supply and protects the board and any attached peripherals from electrical overstress and possible physical damage. The Power Supervisor will activate if it detects the power supply voltage rails have deviated outside the current ATX power supply specification and safe operating levels.

If the Power Supervisor detects an out of spec voltage, the following will happen:

1. The board will be powered down immediately to protect circuits from electrical overstress and possible physical damage.
2. A red warning LED (see Figure 1) on the board will activate as a visual cue.
3. During the next power on, a message will be displayed on the screen to notify the user that the power supply voltage rails have deviated outside the current ATX power supply specification and safe operating levels.
4. A message will be added to the BIOS Event Log for each event that takes place until the BIOS Event Log is cleared.

1.12.2.11 +5 V Standby Power Indicator LED

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

OM23986
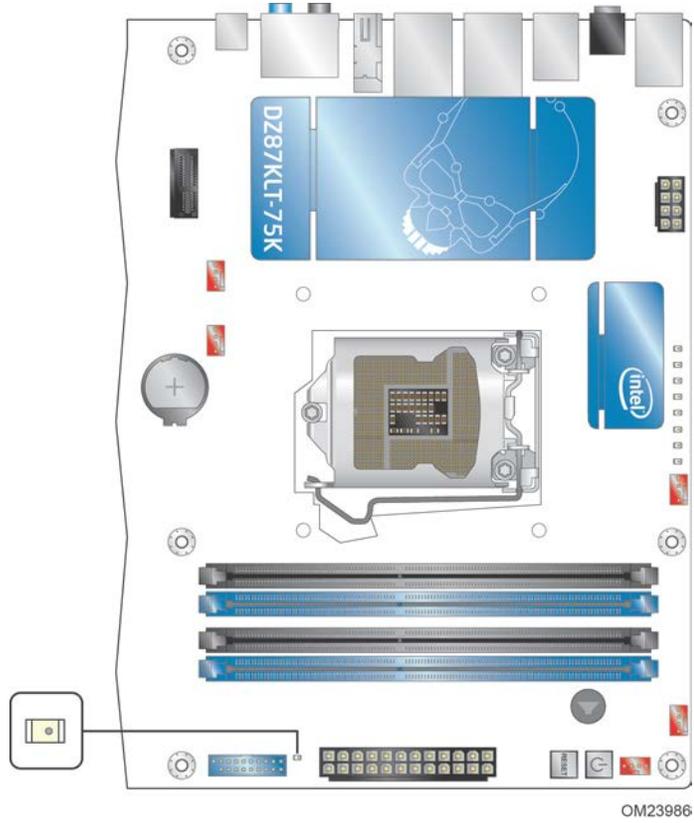
Figure 8. Location of the Standby Power LED

1.12.2.12 Voltage Regulator (VR) Status LEDs

The VR status LEDs provide a real-time indication of how many processor VR phases are active. During normal system operation the power requirements of the processor can vary due to its power saving features. When the processor is in a low-power or idle state it requires less power to be provided by the VR. The VR responds to the lower power demand by shutting down unneeded phases thereby increasing overall power efficiency. Each VR phase has an LED connected to it that indicates when that phase is active. Figure 9 shows the location of the VR status LEDs.
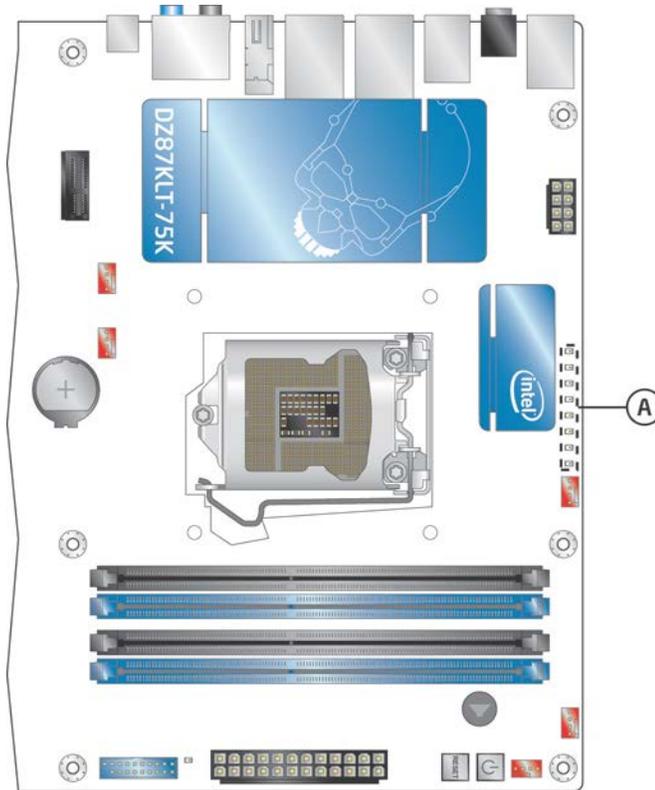
Item	Description
A	VR Status LEDs

Figure 9. Location of the VR Status LEDs

1.13 Board Status LEDs

The Desktop Board provides 11 LEDs that allow you to monitor the board's progress through the BIOS Power-on Self-Test. At initial power on, all the LEDs are off. When the BIOS starts an activity such as memory initialization, the corresponding LED starts flashing. Once the activity has completed, the LED will remain on. Figure 10 shows the location of the board status LEDs.
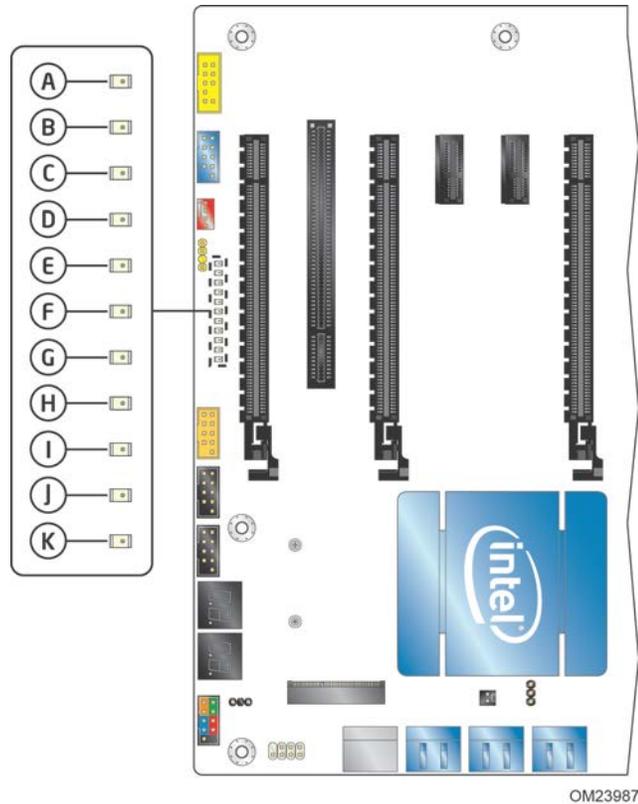
Figure 10. Location of Board Status LEDs

Table 11 gives a description of the LEDs shown in Figure 10.

Table 11. Board Status LEDs

Item/Callout in Figure 10	LED Name	LED Color	Supported Modes	Control Source
A	Hard Drive Activity	Blue	On/Off	Hard drive controller(s)
B	CPU Hot	Red	On/Off	Discrete circuit
C	VR Hot	Red	On/Off	Discrete circuit
D	Watch Dog Fire / Back to BIOS	Red	On/Off/Flash	BIOS
E	CPU Initialization	Green	On/Off/Flash	BIOS
F	Memory Initialization	Green	On/Off/Flash	BIOS
G	Video Initialization	Green	On/Off/Flash	BIOS
H	USB Initialization	Green	On/Off/Flash	BIOS
I	Hard Drive Initialization	Green	On/Off/Flash	BIOS
J	Option ROM Initialization	Green	On/Off/Flash	BIOS
K	Operating System Start	Green	On/Off/Flash	BIOS

1.14 Onboard Power and Reset Buttons

The lighted onboard power button has the same functionality as the front panel power button connected via the front panel header. The onboard power button does not remove standby power. This button is intended for use at integration facilities for testing purposes. The power button on the front panel is recommended for all other instances of turning the computer on or off. To turn the computer off using the onboard power button, keep the button pressed down for three seconds.

The lighted onboard reset button can be used to reset the board. This button duplicates the function of the front panel reset button. Figure 11 shows the location of the onboard power and reset buttons.
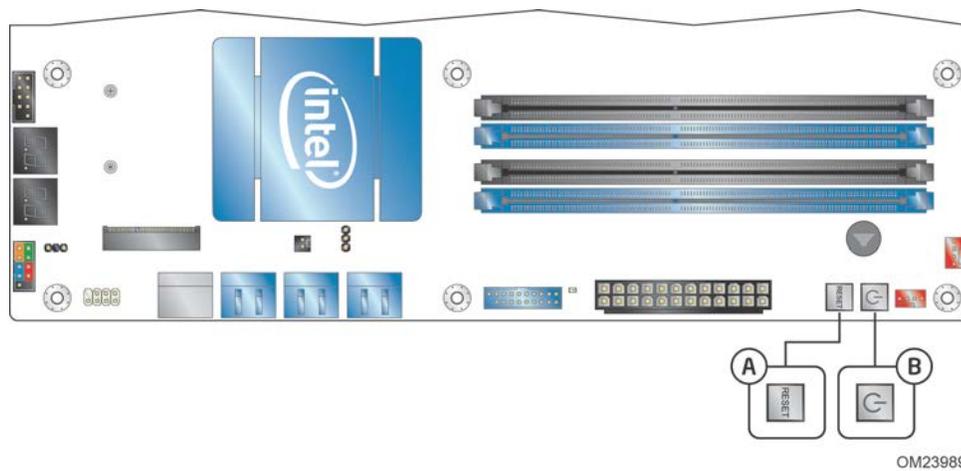
Item	Description
A	Onboard reset
B	Onboard power

Figure 11. Location of the Onboard Power and Reset Buttons

⚠ CAUTION

Electrostatic discharge (ESD) can damage components. The onboard power button should be used only at an ESD workstation using an antistatic wrist strap and a conductive foam pad. If such a station is not available, some ESD protection can be provided by wearing an antistatic wrist strap and attaching it to a metal part of the computer chassis.

2   Technical Reference

2.1   Memory Resources

2.1.1   Addressable Memory

The board utilizes 32 GB of addressable system memory. Typically the address space that is allocated for Conventional PCI 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 32 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 (8 MB)
- 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 Conventional PCI and 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. All installed system memory can be used when there is no overlap of system addresses.

2.2   Connectors and Headers

⚠ CAUTION

Only the following connectors and headers have overcurrent protection: back panel and front panel USB, as well as IEEE 1394a.

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 or 1394 header single wire connectors may eventually overload the overcurrent protection and cause damage to the board.

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

- Back panel I/O connectors
- Component-side connectors and headers (see page 52)

2.2.1   Back Panel Connectors

Figure 12 shows the location of the back panel connectors for the board.
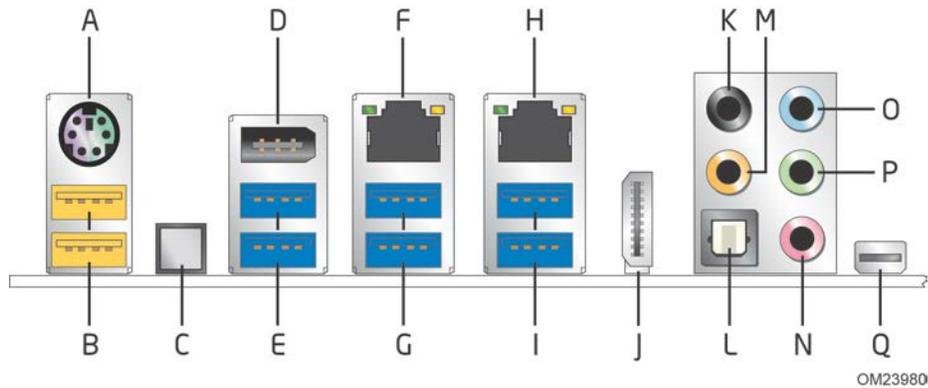
Item	Description
A	PS/2 port
B	USB 2.0 high-current charging ports
C	Back to BIOS button
D	IEEE 1394a connector
E	USB 3.0 ports
F	LAN port
G	USB 3.0 ports
H	LAN port
I	USB 3.0 ports
J	HDMI connector
K	Rear surround
L	Center channel and LFE (Subwoofer)
M	S/PDIF out (optical)
N	Line-in
O	Line-out (front speaker)
P	Mic-in (side surround)
Q	Thunderbolt connector

Figure 12. Back Panel Connectors

NOTE

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

2.2.2 Component-side Connectors and Headers

Figure 13 shows the locations of the component-side connectors and headers.
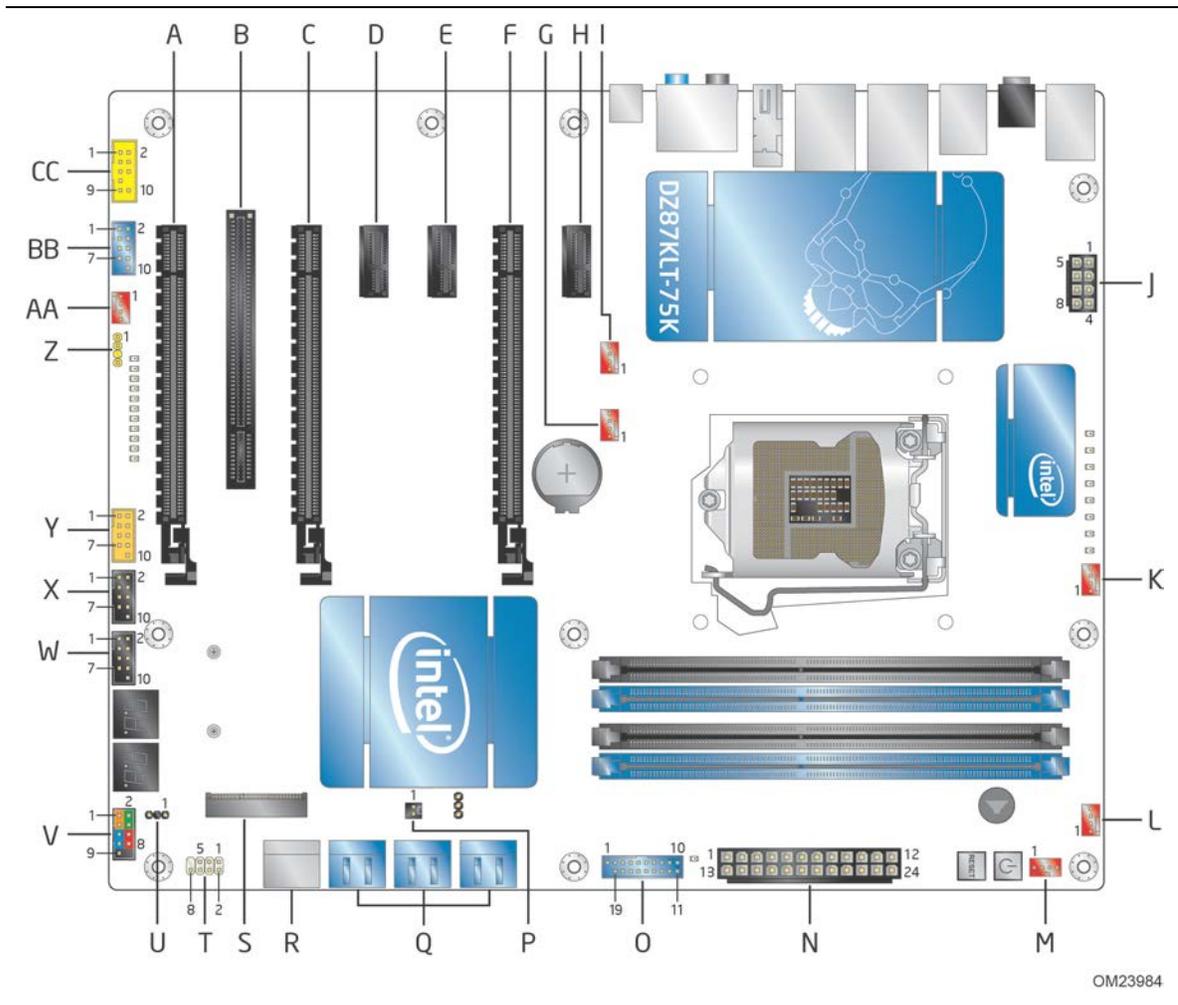
Figure 13. Component-side Connectors and Headers

Table 12 lists the component-side connectors and headers identified in Figure 13.

Table 12. Component-side Connectors and Headers Shown in Figure 13

Item/callout from Figure 13	Description
A	PCI Express x16 add-in card connector (x4 electrical; x16 compatible)
B	Conventional PCI add-in card connector
C	PCI Express x16 add-in card connector (x8 electrical; x16 compatible)
D	PCI Express x1 add-in card connector
E	PCI Express x1 add-in card connector
F	PCI Express x16 bus add-in card connector
G	Rear chassis fan header 2
H	PCI Express x1 add-in card connector
I	Rear chassis fan header 1
J	12 V processor core voltage connector (2 x 4 pin)
K	Processor fan header
L	Front chassis fan header 1
M	Front chassis fan header 2
N	Main power connector (2 x 12)
O	Front panel USB 3.0 connector
P	Chassis intrusion header
Q	SATA 6.0 Gb/s connectors through the PCH (blue)
R	SATA 6.0 Gb/s connectors through a Marvel 88SE9172 controller (gray)
S	PCI Express Full-/Half-Mini Card slot
T	Consumer IR receiver (input) header
U	Alternate front panel power/sleep LED header
V	Front panel connector
W	Front panel USB 2.0 connector (black)
X	Front panel USB 2.0 connector (black)
Y	Front panel USB 2.0 connector (orange high current charging)
Z	S/PDIF header
AA	Auxiliary fan header
BB	IEEE 1394a front panel connector
CC	Front panel audio connector

2.2.2.1　　Signal Tables for the Connectors and Headers

Table 13. IEEE 1394a Header

Pin	Signal Name	Pin	Signal Name
1	Data A (positive)	2	Data A (negative)
3	Ground	4	Ground
5	Data B (positive)	6	Data B (negative)
7	+12 V DC	8	+12 V DC
9	Key (no pin)	10	Ground

Table 14. Front Panel Audio Header for Intel HD Audio

Pin	Signal Name	Pin	Signal Name
1	[Port 1] Left channel	2	Ground
3	[Port 1] Right channel	4	PRESENCE# (Dongle present)
5	[Port 2] Right channel	6	[Port 1] SENSE_RETURN
7	SENSE_SEND (Jack detection)	8	Key (no pin)
9	[Port 2] Left channel	10	[Port 2] SENSE_RETURN

Table 15. Front Panel Audio Header for AC '97 Audio

Pin	Signal Name	Pin	Signal Name
1	MIC	2	AUD_GND
3	MIC_BIAS	4	PRESENCE#
5	FP_OUT_R	6	AUD_GND
7	No_Connect	8	KEY (no pin)
9	FP_OUT_L	10	AUD_GND

Table 16. S/PDIF Header

Pin	Signal Name
1	Ground
2	S/PDIF out
3	Key (no pin)
4	+5 V DC

Table 17. SATA Connectors

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

Table 18. 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 19. Front Panel USB 3.0 Connector

Pin	Signal Name	Description
1	Vbus	Power
2	IntA_P1_SSRX−	USB3 ICC Port1 SuperSpeed Rx−
3	IntA_P1_SSRX+	USB3 ICC Port1 SuperSpeed Rx+
4	GND	Ground
5	IntA_P1_SSTX−	USB3 ICC Port1 SuperSpeed Tx−
6	IntA_P1_SSTX+	USB3 ICC Port1 SuperSpeed Tx+
7	GND	Ground
8	IntA_P1_D−	USB3 ICC Port1 D− (USB2 Signal D−)
9	IntA_P1_D+	USB3 ICC Port1 D+ (USB2 Signal D+)
10	ID	Over Current Protection
11	IntA_P2_D+	USB3 ICC Port2 D+ (USB2 Signal D+)
12	IntA_P2_D−	USB3 ICC Port2 D− (USB2 Signal D−)
13	GND	Ground
14	IntA_P2_SSTX+	USB3 ICC Port2 SuperSpeed Tx+
15	IntA_P2_SSTX−	USB3 ICC Port2 SuperSpeed Tx−
16	GND	Ground
17	IntA_P2_SSRX+	USB3 ICC Port2 SuperSpeed Rx+
18	IntA_P2_SSRX−	USB3 ICC Port2 SuperSpeed Rx+
19	Vbus	Power
20	Key	No pin

Table 20. Chassis Intrusion Header

Pin	Signal Name
1	Ground
2	Intruder#

Table 21. Processor, Front and Rear Chassis, and Auxiliary (4-Pin) Fan Headers

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

Note: These fan headers use Pulse Width Modulation control for fan speed.

Table 22. 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 23. Alternate Power LED Header

Pin	Signal Name
1	MAIN_COLOR_LED
2	KEY (no pin
3	ALT_COLOR_LED

Table 24. PCI Express Full-/Half-Mini Card Connector

Pin	Signal Name	Additional Signal Name	Pin	Signal Name
1	WAKE#		2	3.3 V
3	Reserved		4	GND
5	Reserved		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		18	GND
19	Reserved		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	(mSATA) GND	38	USB_D+
39	+3.3 V aux	(mSATA) 3.3 V	40	GND
41	+3.3 V aux	(mSATA) 3.3 V	42	LED_WWAN#
43	Reserved	(mSATA indicator)	44	LED_WLAN#
45	Reserved	(mSATA) Vendor	46	LED_WPAN#
47	Reserved	(mSATA) Vendor	48	+1.5 V
49	Reserved	(mSATA) DA/DSS	50	GND
51	Reserved	(mSATA) Presence Detection	52	_3.3 V

2.2.2.2   Add-in Card Connectors

The board has the following add-in card connectors:

- Three PCI Express 3.0 x16 bus add-in card connectors from the processor
    — 1st PCI Express x16 slot is electrically x8 or x16
    — 2nd PCI Express x16 slot is electrically x8 or disabled
    — 3rd PCI Express x16 slot is electrically x4
- Three PCI Express 2.0 x1 bus add-in card connectors from the PCH
- One Conventional PCI bus add-in card connector from the PCH via a PCI bridge
- One PCI Express Full-/Half-Mini Card slot with support for mSATA
    Note: No USB is routed to the PCI Express Full-/Half-Mini Card slot

Note the following considerations for the Conventional PCI bus connector:

- The Conventional PCI bus connectors are bus master capable.
- SMBus signals are routed to the Conventional PCI bus connectors. This enables Conventional PCI bus add-in boards with SMBus support to access sensor data on the desktop board. The specific SMBus signals are as follows:
    — The SMBus clock line is connected to pin A40.
    — The SMBus data line is connected to pin A41.

NOTE

If the system is overclocked and a video card is installed in the PCI Express x16 (x4 electrical) slot, the system will not complete POST. No POST issue is caused by the overclocked PCI Express base clock differential compared to the alternate generated clock use for the PCI Express x16 (x4 electrical) slot.

2.2.2.3   Power Supply Connectors

The board has the following power supply connectors:

- **Main power** – a 2 x 12 connector. This connector is compatible with 2 x 10 connectors previously used on Intel Desktop boards. The board supports the use of ATX12V power supplies with either 2 x 10 or 2 x 12 main power cables. When using a power supply with a 2 x 10 main power cable, attach that cable to the main power connector, leaving pins 11, 12, 23, and 24 unconnected.
- **Processor core power** – a 2 x 4 connector. This connector provides power directly to the processor voltage regulator and must always be used. Failure to do so will prevent the board from booting.

Table 25. Processor Core Power Connector

Pin	Signal Name	Pin	Signal Name
1	Ground	2	+12 V
3	Ground	4	+12 V
5	Ground	6	+12 V
7	Ground	8	+12 V

Table 26. Main Power Connector

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

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

For information about	Refer to
Power supply considerations	Section 2.5.1 on page 66

2.2.2.4   Front Panel Header

This section describes the functions of the front panel header. Table 27 lists the signal names of the front panel header. Figure 14 is a connection diagram for the front panel header.

Table 27. Front Panel Header

Pin	Signal	In/Out	Description	Pin	Signal	In/Out	Description
Hard Drive Activity LED				Power LED			
1	HD_PWR	Out	Hard disk LED pull-up to +5 V	2	HDR_BLNK_GRN	Out	Front panel green LED
3	HDA#	Out	Hard disk active LED	4	HDR_BLNK_YEL	Out	Front panel yellow LED
Reset Switch				On/Off Switch			
5	Ground		Ground	6	FPBUT_IN	In	Power switch
7	FP_RESET#	In	Reset switch	8	Ground		Ground
Power				Not Connected			
9	+5 V		Power	10	N/C		Not connected
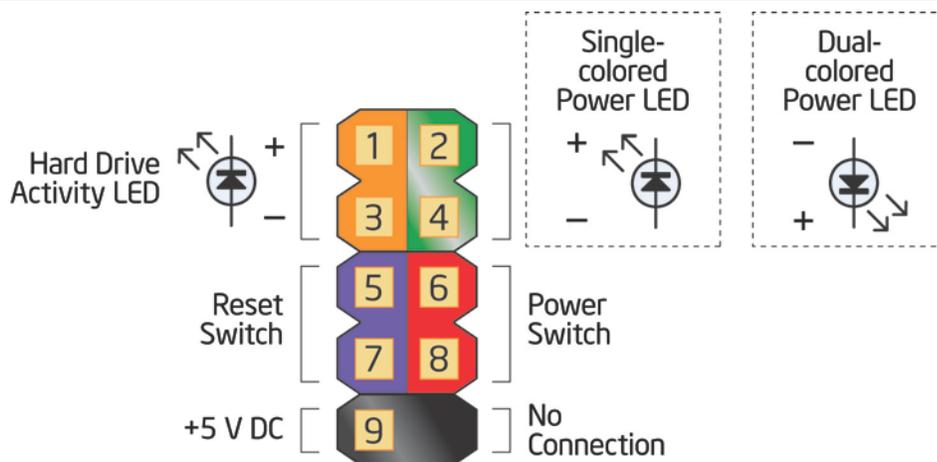
Figure 14. Connection Diagram for Front Panel Header

2.2.2.4.1   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.

2.2.2.4.2   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.

2.2.2.4.3   Power/Sleep LED Header

Pins 2 and 4 can be connected to a one- or two-color LED. Table 28 shows the possible states for a one-color LED. Table 29 shows the possible states for a two-color LED.

Table 28. States for a One-Color Power LED

LED State	Description
Off	Power off/sleeping
Steady Green	Running

Table 29. States for a Two-Color Power LED

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

NOTE

The colors listed in Table 28 and Table 29 are suggested colors only. Actual LED colors are chassis-specific.

2.2.2.4.4   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.

2.2.2.5 Front Panel USB Connectors

Figure 15 and Figure 16 are connection diagrams for the front panel USB connectors.

📝 **NOTE**

- *The +5 V DC power on the USB connectors is fused.*
- *Use only a front panel USB connector that conforms to the USB 2.0 specification for high-speed USB devices.*
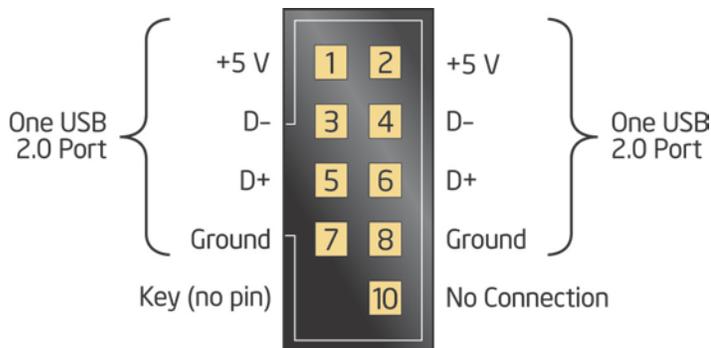
Figure 15. Connection Diagram for the Front Panel Dual-Port USB 2.0 Connectors
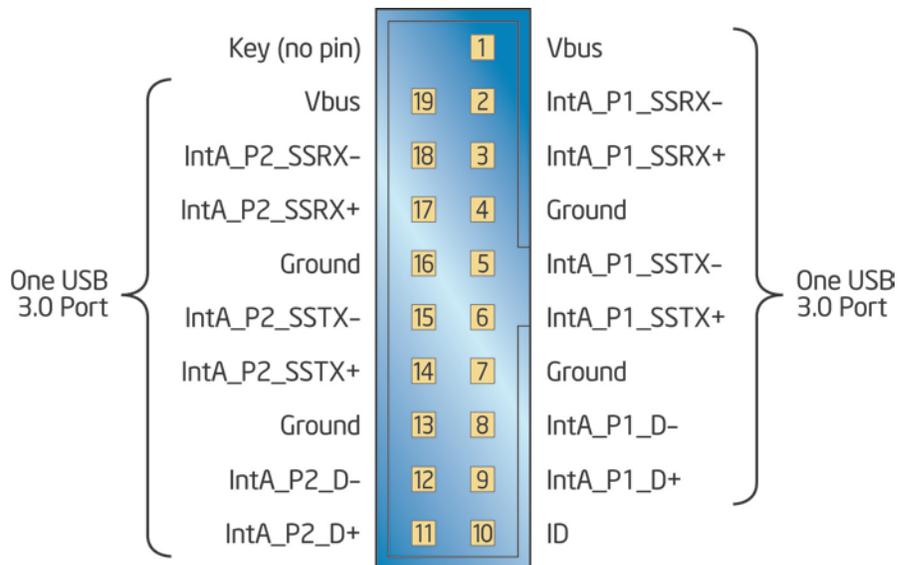
Figure 16. Connection Diagram for the Front Panel USB 3.0 Connector

2.3 BIOS Security Jumper

⚠️ **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 17 shows the location of the jumper. The 3-pin jumper determines the BIOS Security program's mode. Table 30 describes the jumper settings for the three modes: normal, lockdown, and configuration.

OM23985
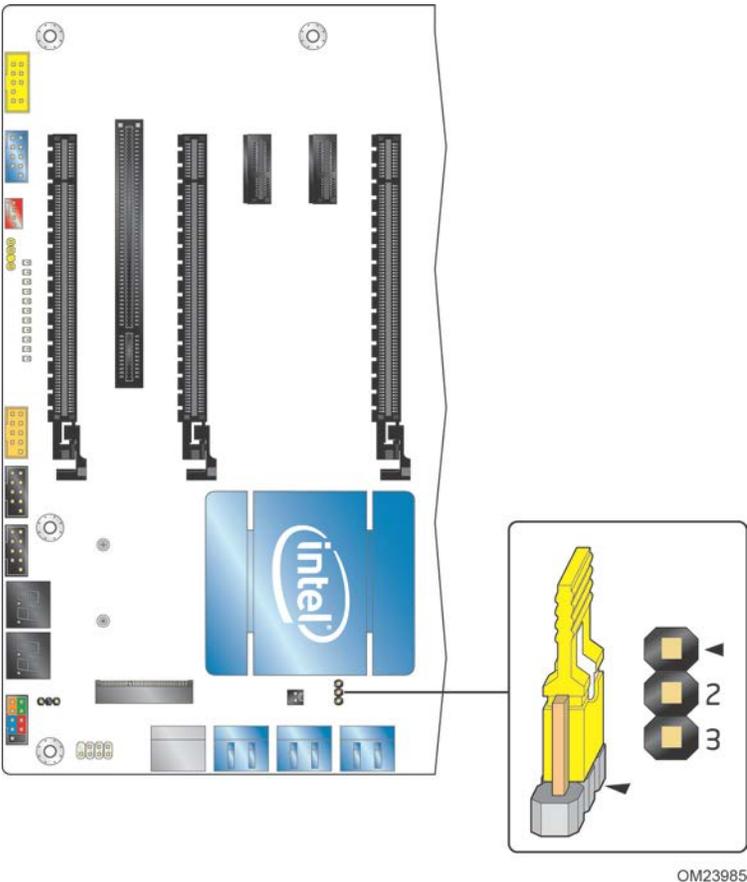
Figure 17. Location of the Jumper

Table 30. BIOS Setup Security Jumper Settings

Function/Mode	Jumper Setting	Configuration
Normal	1-2	The BIOS uses current configuration information and passwords for booting.
Lockdown	2-3	The BIOS uses current configuration information and passwords for booting, except: • All POST Hotkeys are suppressed (prompts are not displayed and keys are not accepted. For example, F2 for Setup, F10 for the Boot Menu). • Power Button Menu is not available (see Section 3.9.3 Power Button Menu). BIOS updates are not available except for automatic Recovery due to flash corruption.
Configuration Mode	None	BIOS Recovery Update process if a matching *.bio file is found. Recovery Update can be cancelled by pressing the Esc key. If the Recovery Update was cancelled or a matching *.bio file was not found, a Config Menu will be displayed. The Config Menu consists of the following (followed by the Power Button Menu selections): [1] Suppress this menu until the BIOS Security Jumper is replaced. [2] Clear BIOS User and Supervisor Passwords. [3] Reset Intel AMT to default factory settings. [4] Clear Trusted Platform Module. See Section 3.9.3 Power Button Menu.

2.4   Mechanical Considerations

2.4.1   Form Factor

The board is designed to fit into an ATX-form-factor chassis. Figure 18 illustrates the mechanical form factor for the board. Dimensions are given in inches [millimeters]. The outer dimensions are 12.00 inches by 9.60 inches [304.80 millimeters by 243.84 millimeters]. Location of the I/O connectors and mounting holes are in compliance with the ATX specification.
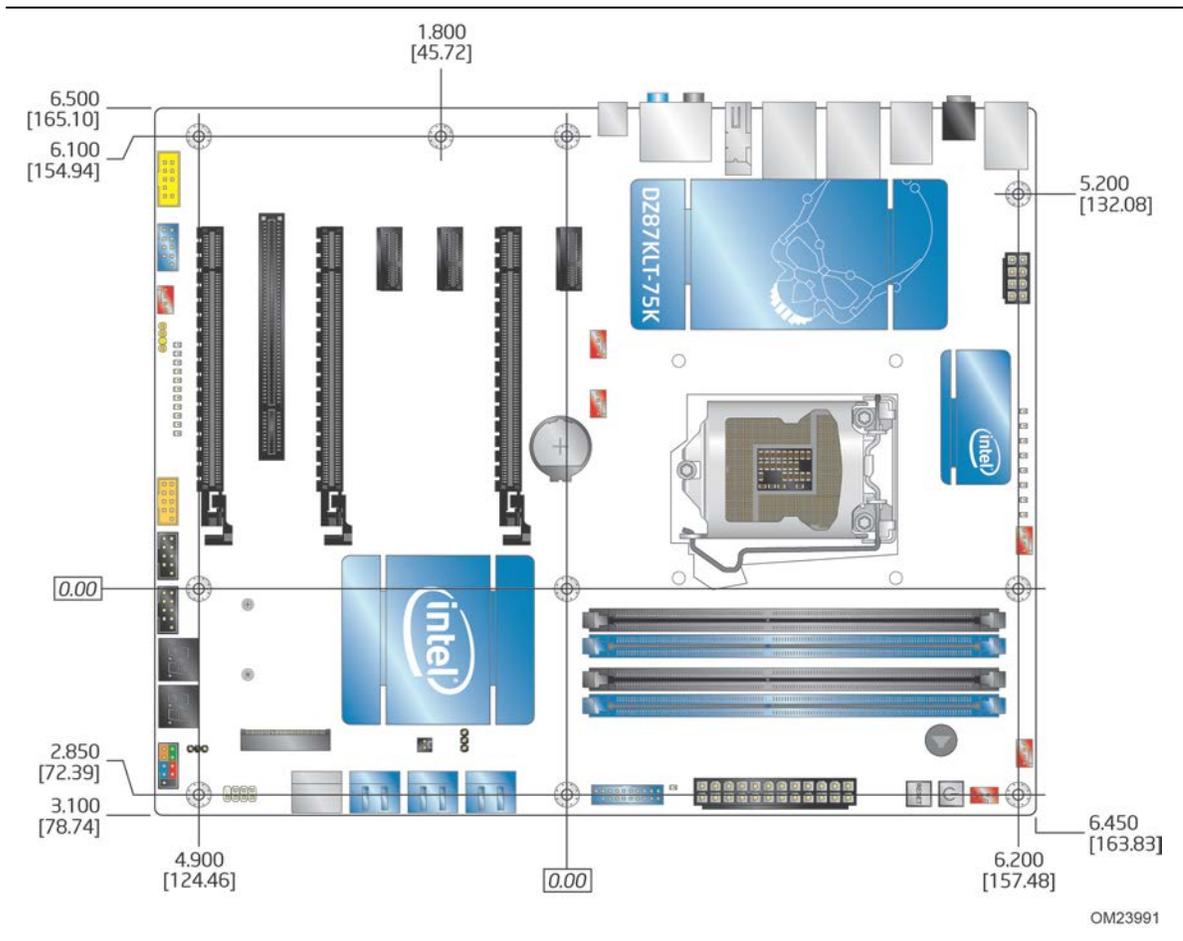
Figure 18. Board Dimensions

2.5   Electrical Considerations

2.5.1   Power Supply Considerations

⚠ **CAUTION**

The +5 V standby line from the power supply must be capable of providing adequate +5 V standby current. Failure to do so can damage the power supply. The total amount of standby current required depends on the wake devices supported and manufacturing options.

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

Due to improvements in 4th generation Intel Core processor power efficiency, the requirements for the processor's power supply have changed. More specifically, the latest Power Supply Design Guide rev 1.3 has indicated a minimum current of 0.05A on +12 V2DC and recommends 0A. This is to prevent Power Supply Unit (PSU) protection from triggering during minimum loading.

Intel recommends that system integrators and builders check the latest list of tested PSUs to find out which are capable of supporting the 4th generation Intel Core processor. This list may be found at: http://www.intel.com/go/powersupplies/. From the filters at the top right of the page, set **12V2 Min Load 0A** to "Yes" to see which PSUs are capable of supporting the processor's new power requirements.

The power supply must comply with the indicated parameters of the ATX form factor specification.

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

For example, for a system consisting of a supported 95 W processor (see Section 1.3 on page 17 for a list of supported processors), 4 GB DDR3 RAM, one high end video card, one hard disk drive, one optical drive, and all board peripherals enabled, the minimum recommended power supply is 460 W. Table 31 lists the recommended power supply current values.

Table 31. Recommended Power Supply Current Values

Output Voltage	3.3 V	5 V	12 V1	12 V2	-12 V	5 VSB
Current	22 A	20 A	16 A	16 A	0.3 A	1.5 A

For information about	Refer to
Selecting an appropriate power supply	http://support.intel.com/support/motherboards/desktop/sb/CS-026472.htm
Selecting a power supply capable of supporting the 4th generation Intel Core processor	http://www.intel.com/go/powersupplies/

2.5.2   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 32 lists the current capability of the fan headers.

Table 32. Fan Header Current Capability

Fan Header	Maximum Available Current
Processor fan	2.0 A
Front chassis fans	1.5 A
Rear chassis fans	1.5 A
Auxiliary chassis fan	1.5 A

2.5.3   Add-in Board Considerations

The board is designed to provide 2 A (average) of current for each add-in board from the +5 V rail. The total +5 V current draw for add-in boards for a fully loaded board (all six expansion slots filled) must not exceed the system's power supply +5 V maximum current or 14 A in total.

2.6 Thermal Considerations

⚠ **CAUTION**

A chassis with a maximum internal ambient temperature of 38 °C at the processor fan inlet is a requirement. Use a processor heat sink that provides omni-directional airflow to maintain required airflow across the processor voltage regulator area. If a non omni-directional thermal solution is used customer might need to provide supplemental cooling to the processor voltage regulator area.

⚠ **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 reader. Intel makes no warranties or representations that merely following the instructions presented in this document will result in a system with adequate thermal performance.

⚠ **CAUTION**

Ensure that the ambient temperature does not exceed the board's maximum operating temperature. Failure to do so could cause components to exceed their maximum case temperature and malfunction. For information about the maximum operating temperature, see the environmental specifications in Section 2.8.

⚠ **CAUTION**

Ensure that proper airflow is maintained in the processor voltage regulator circuit. Failure to do so may result in damage to the voltage regulator circuit. The processor voltage regulator area (shown in Figure 19) can reach a temperature of up to 85 °C in an open chassis.

Figure 19 shows the locations of the localized high temperature zones.
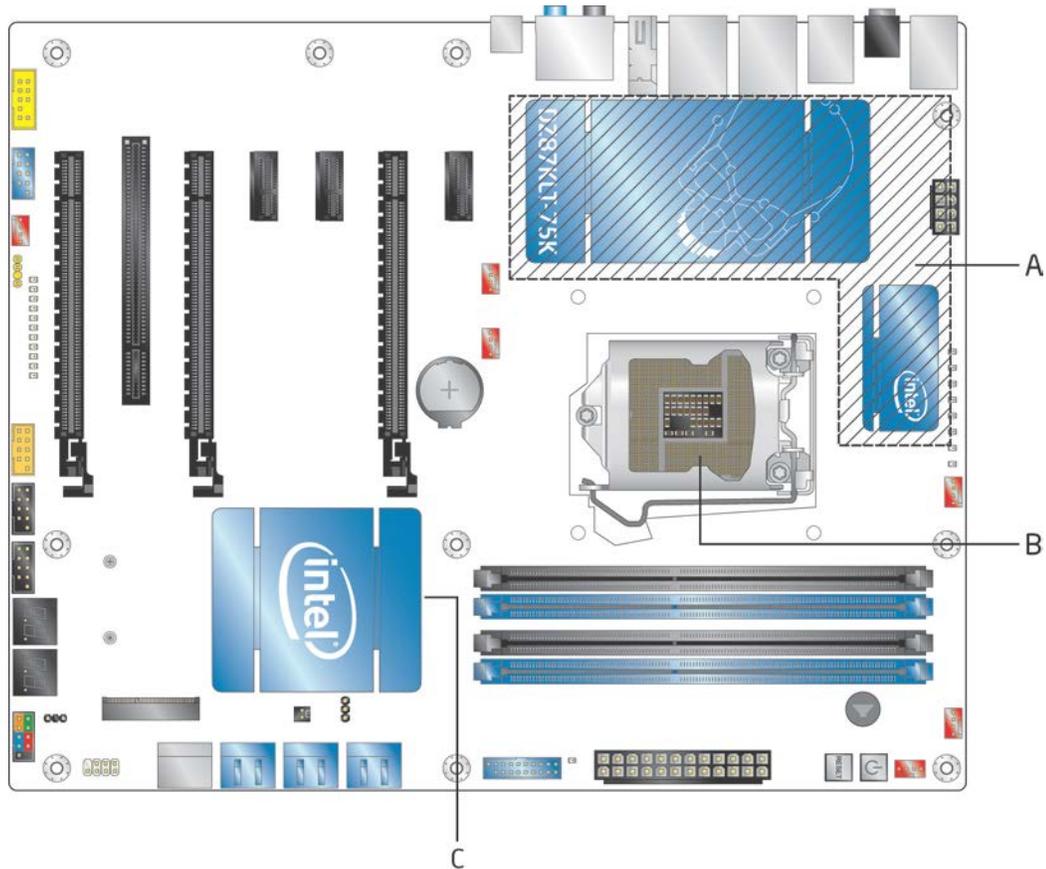
OM23992

Item	Description
A	Processor voltage regulator area
B	Processor
C	Intel Z87 Express Chipset

Figure 19. Localized High Temperature Zones

Table 33 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 33. Thermal Considerations for Components

Component	Maximum Case Temperature
Processor	For processor case temperature, see processor datasheets and processor specification updates
Intel Z87 Express Chipset	104 $^{\circ}$C (under bias)

For information about	Refer to
Processor datasheets and specification updates	Section 1.2, page 17

2.7 Reliability

The Mean Time Between Failures (MTBF) prediction is calculated using a parts count method. The calculation is based on the Telcordia SR-332, Issue 2, Method I Case 1 50% electrical stress, 55 °C ambient. The MTBF prediction is used to estimate repair rates and spare parts requirements. The MTBF data is calculated from predicted data at 55 °C. The MTBF for the board is 148,826 hours.

2.8 Environmental

Table 34 lists the environmental specifications for the board.

Table 34. 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/second²		
Packaged	Half sine 2 millisecond		
	Product Weight (pounds)	Free Fall (inches)	Velocity Change (inches/sec²)
	<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 Visual 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 Visual 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 KLZ8711D.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 POST memory test begins and before the operating system boot begins.

Figure 20. Intel Visual BIOS Screen

Table 35 lists the BIOS Setup program menu features.

Table 35. Intel Visual BIOS Setup Display Areas

Home 1	Home 2	Home 3	Main	Devices & Peripherals	Cooling
Displays processor, graphics, memory, and configuration with quick launch to tuning, UEFI apps, BIOS update, and system profiles	Environmental monitoring display and attached SATA devices	System, desktop board, chassis, and processor information	Displays processor, memory, configuration, event log, date, and time	Configures advanced features available through the chipset and other discrete controllers	Real-time system monitoring, adjust fan speeds, set temperature set points, and define system voltage settings

continued

Table 35. Intel Visual BIOS Setup Display Areas (continued)

Performance	Security	Power	Boot	Exit
Displays and Configures Memory, Graphics, Bus, and Processor overrides	Sets passwords and security features	Configures power management features and power supply controls	Selects boot options and boot display options	Saves or discards changes to Setup program options

Table 36 lists the function keys available for menu screens.

Table 36. 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)
Mouse	Allows control of all options and slider controls in Intel Visual BIOS
<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 96 Mb (12288 KB) flash memory device.

3.3   Resource Configuration

3.3.1   PCI Express Autoconfiguration

The BIOS can automatically configure PCI Express devices. PCI Express devices may be onboard or add-in cards. Autoconfiguration lets a user insert or remove PCI Express cards without having to configure the system. When a user turns on the system after adding a PCI Express card, the BIOS automatically configures interrupts, the I/O space, and other system resources. Any interrupts set to Available in Setup are considered to be available for use by the add-in card.

3.4   System Management BIOS (SMBIOS)

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

The main component of SMBIOS is the Management Information Format (MIF) database, which contains information about the computing system and its components. Using SMBIOS, a system administrator can obtain the system types,

capabilities, operational status, and installation dates for system components. The MIF database defines the data and provides the method for accessing this information. The BIOS enables applications such as 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.

3.5　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 version 5.

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.

3.6 BIOS Updates

The BIOS can be updated using either of the following utilities, which are available on the Intel World Wide Web site (see Section 1.2 on page 17):

- 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 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.
- Intel Visual BIOS Update Utility allows the user to select the BIOS .bio file from the internet, USB device, hard disk drive, or other media.

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.

3.6.1 Language Support

The BIOS Setup program and help messages are supported in US English.

3.6.2   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 version 5 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://www.intel.com/go/itk

3.7   BIOS Recovery

It is unlikely that anything will interrupt a BIOS update; however, if an interruption occurs, the BIOS could be damaged. Table 37 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 37. Acceptable Drives/Media Types for BIOS Recovery

Media Type	Can be used for BIOS recovery?
CD-ROM drive connected to the SATA interface	Yes
USB removable drive (a USB Flash Drive, for example)	Yes
USB diskette drive (with a 1.44 MB diskette)	No
USB hard disk drive	No

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

3.8   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.

3.8.1   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.

3.8.2   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.

3.8.3   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

3.8.4   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 38 lists the boot device menu options.

Table 38. 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

3.9   Adjusting Boot Speed

These factors affect system boot speed:

- Selecting and configuring peripherals properly
- Optimizing BIOS boot parameters
- Enabling the 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, enable the settings for Fast Boot. This option will allow the BIOS to skip through various stages of POST and boot quickly to the last detected boot device.
- 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 option ROM boot time by up to four seconds.

📝 **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).

3.9.3   Power Button Menu

The Power Button Menu can be accessed during power on if the user presses the power button and holds it down until three short beep sounds are emitted by the board piezoelectric speaker. The BIOS will display the following prompt and wait for a keystroke:

[ESC]   Normal Boot
[F2]   Intel® Visual BIOS
[F3]   Disable Fast Boot
[F4]   BIOS Recovery
[F7]   Update BIOS
[F10]   Enter Boot Menu
[F12]   Network Boot

NOTE

[F3] Disable Fast Boot is only displayed if at least one Fast Boot optimization is enabled.

If an unrecognized key is pressed, the BIOS will beep and wait for another keystroke. If one of the listed hotkeys is pressed, the BIOS will follow the indicated boot path. Password requirements must still be honored.

If Disable Fast Boot is selected, the BIOS will disable all Fast Boot optimizations and reset the system.

3.10 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 39 shows the effects of setting the Hard Disk Drive Passwords.

Table 39. 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 DZ87KLT-75K, 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.

NOTE

Hard Disk Drive Password Security is not supported in PCH RAID mode. Secured hard disk drives attached to the system when the system is in PCH RAID mode will not be accessible due to the disabling of BIOS Hard Disk Drive Password support.

3.11 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 19 characters in length.

Table 40 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 40. 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.

NOTE

The BIOS complies with NIST Special Publication 800-147 BIOS Protection Guidelines / Recommendations of the National Institute of Standards and Technology. Refer to http://csrc.nist.gov/publications/nistpubs/800-147/NIST-SP800-147-April2011.pdf for more information.

3.12 BIOS Performance Features

The BIOS includes the following options to provide custom performance enhancements when using 4th generation Intel Core processors in an LGA1150 socket.

- Processor maximum non-turbo ratio (processor multiplier can only be adjusted down)
- Processor turbo ratio adjustment
- Host clock frequency
- Various other processor adjustments
- Memory multiplier adjustment
- Memory voltage adjustment
- Memory latency adjustments
- Graphics multiplier adjustment
- Graphics voltage adjustment

3.13 Back to BIOS Button

The back panel Back to BIOS button duplicates the functionality of the BIOS configuration jumper with the following exceptions:

- It can only be used to force the board to power on to the BIOS Maintenance Menu using default values but it will retain all previously saved changes.
- It cannot be used to override passwords set in the BIOS.
- It cannot be used to invoke BIOS recovery mode.

The button glows red when it is activated.

NOTE

Using the Back to BIOS button does not set the board to the factory BIOS defaults. To restore settings to the factory defaults, use the <F9> key once BIOS setup mode is active.

4   Error Messages and Beep Codes

4.1   Speaker

The board-mounted speaker provides audible error code (beep code) information during POST.

For information about	Refer to
The location of the onboard speaker	Figure 1, page 13

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 41).

Table 41. BIOS Beep Codes

Type	Pattern	Frequency
F2 Setup/F10 Boot Menu Prompt	One 0.5 second beep when BIOS is ready to accept keyboard input	932 Hz
BIOS update in progress	None	
Video error	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 8 beeps, followed by system shut down.	High beep 2000 Hz Low beep 1500 Hz

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 42).

Table 42. Front-panel Power LED Blink Codes

Type	Pattern	Note
F2 Setup/F10 Boot Menu Prompt	None	
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	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.	

4.4   BIOS Error Messages

Table 43 lists the error messages and provides a brief description of each.

Table 43. 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 Power On Self Test (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 and displayed on the Desktop Board's seven-segment LED displays shown in Figure 1 (JJ, KK). This code is useful for determining the point where an error occurred during the POST.

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

- Table 44 lists the Port 80h POST code ranges
- Table 45 lists the Port 80h POST codes themselves
- Table 46 lists the Port 80h POST sequence

NOTE

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

Table 44. 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.
0x08 – 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
0xF0 – 0xFF	

Table 45. 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, S5
	Security Phase (SEC)
0x08	Starting BIOS execution after CPU BIST
0x09	SPI prefetching and caching
0x0A	Load BSP microcode
0x0B	Load APs microcodes
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 (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
	PEI CK505 Clock Programming
0x19	Entry to CK505 programming
0x1A	Exit CK505 programming
	PEI Over-Clock Programming
0x1B	Entry to entry to PEI over-clock programming
0x1C	Exit PEI over-clock programming
	Memory
0x21	MRC entry point
0x23	Reading SPD from memory DIMMs
0x24	Detecting presence of memory DIMMs
0x27	Configuring memory
0x28	Testing memory
0x29	Exit MRC driver
	PEI after MRC
0x2A	Start to Program MTRR Settings
0x2B	Done Programming MTRR Settings

Table 45. Port 80h POST Codes (continued)

Port 80 Code	Progress Code Enumeration
	PEIMs/Recovery
0x31	Crisis Recovery has initiated
0x33	Loading recovery capsule
0x34	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

Table 45. 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
0Z87	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
0x9A	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 45. 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.)
0xBB	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 46. 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 DZ87KLT-75K:

- 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 DZ87KLT-75K complies with the safety standards stated in Table 47 when correctly installed in a compatible host system.

Table 47. 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 product Intel Desktop Board DZ87KLT-75K 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.

$C\epsilon$

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: printed wiring board assembly and lithium battery.

5.1.4   EMC Regulations

Intel Desktop Board DZ87KLT-75K complies with the EMC regulations stated in Table 48 when correctly installed in a compatible host system.

Table 48. 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 ENERGY STAR* 5.2, e-Standby, and ErP Compliance

The US Department of Energy and the US Environmental Protection Agency have continually revised the ENERGY STAR requirements. Intel has worked directly with these two governmental agencies in the definition of new requirements.

Intel Desktop Board DZ87KLT-75K allows for a compliant system built to meet the following program requirements, including appropriate selection of an efficient power supply:

- ENERGY STAR v5.2, category A
- EPEAT*
- Korea e-Standby
- European Union Energy-related Products Directive 2009 (ErP) Lot 6, Tier 2
- ENERGY STAR v6.0 draft 3

NOTE

ENERGY STAR denotes a system level energy specification, defined by the US Environmental Protection Agency, that relies upon all of the system's components, including processor, chipset, power supply, HDD, graphics controller, memory, etc. to meet the specification. For more information on ENERGY STAR Computers Program requirements version 5.2, go to:

http://www.energystar.gov/

For information about	Refer to
ENERGY STAR requirements and recommended configurations	http://www.intel.com/go/energystar
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 DZ87KLT-75K has the regulatory compliance marks shown in Table 49.

Table 49. 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-DZ87KLT-75K.	
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, перепрацоўвацца. 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。使用後の電池を破棄する際には、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.

⚠️ **PRECAUŢIE**

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.

⚠️ 小心

如果更換的電池類型不正確，可能會有爆炸的危險。請盡可能將電池送至回收處。請依照當地的環保
規範來處理使用過的電池。

⚠️ 주의

배터리를 잘못된 종류로 교체할 경우 폭발 위험이 있습니다. 가능한 경우 배터리는 재활용해야
하며, 수명이 다한 배터리를 폐기할 때는 각 지역의 환경법을 따라야 합니다.

⚠️ **THẬN TRỌNG**

*Có nguy cơ xảy ra nổ nếu thay pin không đúng loại. Pin cần được tái chế nếu có thể
thực hiện được. Việc thải bỏ pin đã sử dụng phải tuân theo các quy định của địa
phương về môi trường.*

⚠️ 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.