Intel® Server Board SE7221BK1-E

Technical Product Specification

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Revision History

Date	Revision Number	Modifications
July 2004	0.5	Preliminary Release; subject to change.
September 2004	0.8	Revised technical details of PCI subsystem, memory support and GMCH.
September 2004	0.9	Revised connectors section
October 2004	1.0	Released revision
November 2004	1.1	Corrected supported CPU matrix
January 2005	1.2	Added Diagnostic LED codes to error handling and reporting section
February 2005	1.3	Modified Diagnostic LED section. Correct supported CPU matrix.
May 2005	1.4	Added Adaptive Slot pinouts
September 2005	1.5	Added supported video

This product specification applies to the Intel® Server Board SE7221BK1-E with BIOS identifier SE7221BK10.86B.

Changes to this specification will be published in the Intel® Server Board SE7221BK1-E Specification Update before being incorporated into a revision of this document.

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1.   Introduction

This *Intel® Server Board SE7221BK1-E Technical Product Specification* (TPS) provides a high-level technical description for the Intel® Server Board SE7221BK1-E. It details the architecture and feature set for all functional sub-systems that make up the server board.

This document is divided into the following main categories:

Chapter 2.   Server Board Overview

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2.   Server Board Overview

2.1   SE7221BK1-E Feature Set

The Intel® Server Board SE7221BK1-E supports the following feature set:

- **Processor and Front Side Bus (FSB) support**
  - Supports single Intel® Pentium® 4 and Celeron® processors in an LGA775 package
  - Capable of 800 MT/s on system bus
  - Supports Hyper-Threading Technology
  - Supports Intel® Extended Memory System 64 Technology (EM64T)
- **Intel® E7221 chipset components**
  - GMCH integrated graphics controller in GMCH component (Intel® GMA 900)
  - ICH6R I/O controller
  - PXH PCI-X Hub
  - 12-deep In-Order Queue
- **Memory System**
  - 4 DIMM sockets supporting 400/533MHz DDR2 DIMMs
  - Data bandwidth per channel of 4.2GB/s or 8.5GB/s in dual channel when using DDR2 533MHz
  - Support for up to two DDR2 channels for a total of 4 DIMMs (2 DIMMs /Channel) providing up to 4GB max memory capacity.
  - Support for 256MB, 512MB, 1GB and 2GB DRAM sizes
  - Supports Performance Acceleration Technology (PAT)
- **I/O Subsystem**
  Four independent PCI Buses:
  - Segment A: One PCI 32-bit/33-MHz, 5 V connector supporting full length PCI add-in cards and one embedded device(Supports *PCI Specification, Rev 2.3*)
  One Intel® 10/100/1000 82541PI gigabit Ethernet Controller
  - Segment B: One PCI 32-bit/66-MHz embedded device (SE7221BK1LX sku only)
  One Intel® 10/100/1000 82541PI gigabit Ethernet Controller
  - Segment C: Two PCI-X 64-bit/66-MHz, 3.3 V slots supporting full length / full height PCI / PCI-X add-in cards **or** one 3.3V PCI-X 64-bit/100-MHz slot with riser card (SE7221BK1LX sku only)
  - Segment D: One x8 PCI Express* slot supporting x1/x2/x4/x8 PCI Express* add-in card **or** one x8 PCI Express* slot with riser card (SE7221BK1LX sku only)
- **Serial ATA host controller**
  - Four independent SATA ports supports data transfer rates up to 1.5 Gb/s (150MB/s) per port
- **IDE controller**
  - One IDE connector, supporting up to two ATA-100 compatible devices

- **USB 2.0**

  Two external Universal Serial Bus (USB) ports with an additional internal header providing two optional USB ports for front panel support.

  -Supports wake-up from sleeping states S1-S4

  -Supports legacy Keyboard/Mouse connections when using PS2-USB dongle

- **LPC (Low Pin Count) bus segment with one embedded devices:**
- Super I/O (Super IO) controller chip, NS PC87427, providing all PC-compatible I/O (floppy, serial, keyboard, mouse, two serial com port) and integrated hardware monitoring

- **SSI-compliant connectors for SSI interface support: front panel and power connectors.**
- **Support for up to four system fans and one processor fan**

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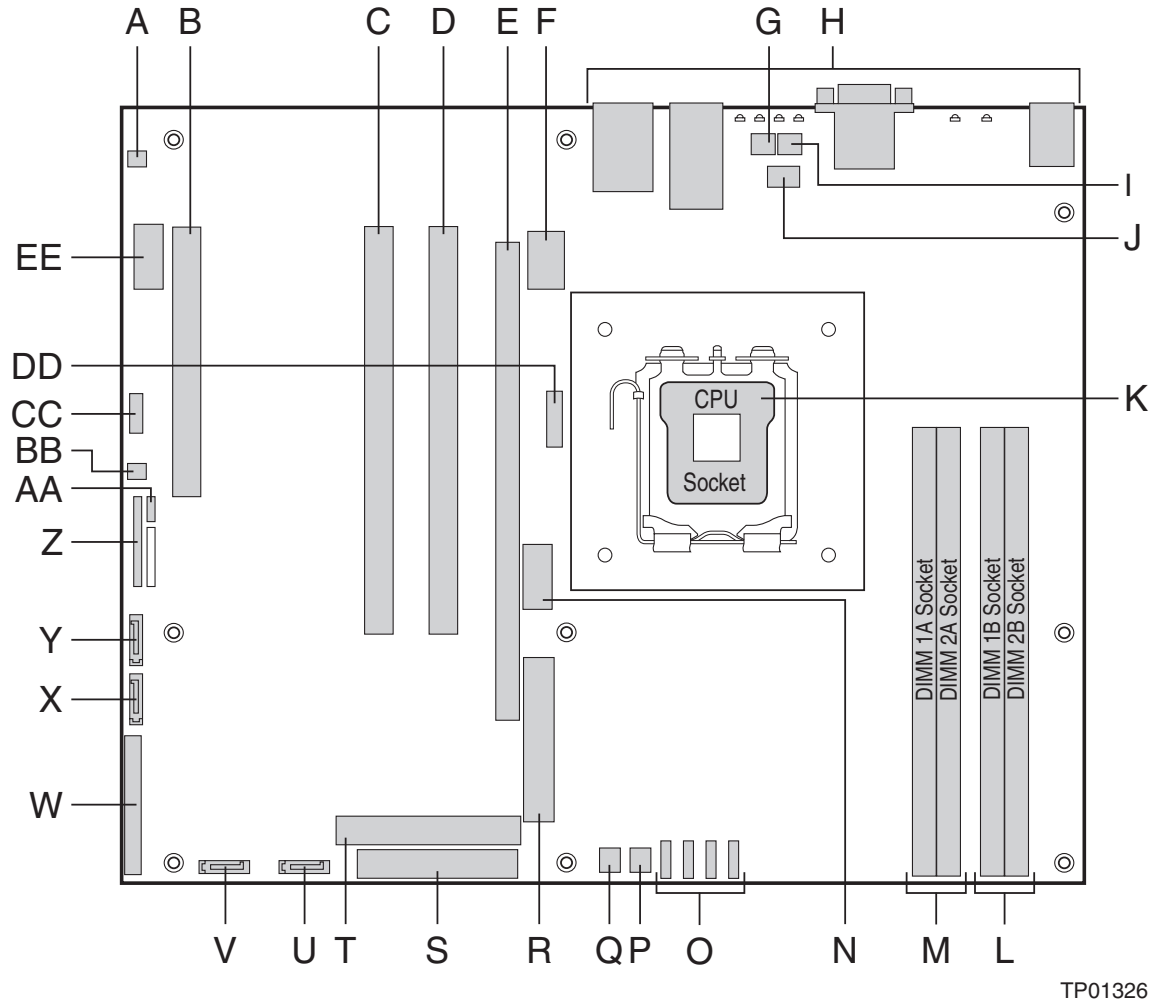
Figure 1. Intel® Server Board SE7221BK1-E Diagram

A Chassis Intrusion Header

B PCI Slot

C PCI-X 100 SLOT

D PCI-X 100 SLOT

E PCI-Express* or Riser Connector Slot

F +12v CPU Power

G System Fan #1 (optional)

H Back Panel I/O Connectors

I System Fan #2 (optional)

J CPU Fan (optional)

K CPU Socket

L DIMM Sockets (two – from left to right: DIMM 1B, DIMM 2B)

M DIMM Sockets (two – from left to right: DIMM 1A, DIMM 2A)

N Front USB Header (optional)

O System Fan Headers (for Intel® Server Board SR1425BK1-E)

P System Fan #4

Q System Fan #3 (optional)

R Main Power Connector

S Floppy Connector

T IDE Connector

U SATA 4 Connector

V SATA 3 Connector

W 34-pin Front Panel Connector

X Serial ATA (SATA) 2 Connector

Y SATA 1 Connector

Z BIOS Control Jumper

AA BIOS Select Jumper

BB HDD LED Header

CC HSBP Header

DD Battery

EE Serial B Header

3. Functional Architecture

This chapter provides a high-level description of the functionality distributed between the architectural blocks of the Intel® Server Board SE7221BK1-E.

3.1 Processor Subsystem

The Intel® Server Board SE7221BK1-E supports Intel® Pentium® 4 and Celeron® D processors in the 775-land package, which is a follow on to Pentium® 4 and Celeron® D processors in the 478-pin package, with enhancements to the Intel® NetBurst® micro-architecture. Intel® Pentium® 4 and Celeron® D processors built on 90nm process technology in the 775-land package utilize Flip-Chip Land Grid Array (FC-LGA4) package technology, and plug into a 775-land LGA socket, referred to as the LGA775 socket. Pentium® 4 and Celeron® D processors in the 775-land package, like their predecessors in the 478-pin package, are based on the same Intel® 32-bit micro-architecture and maintain the tradition of compatibility with IA-32 software. Specific models of the Pentium® 4 Processor in the LGA775 package support Intel® EM64T (Extended Memory 64 Technology) for 64bit native mode operation with 64bit operating systems. The Intel® Celeron® Processor currently does not support EM64T.

3.1.1 Processor VRD

The Intel® Server Board SE7221BK1-E has a VRD (Voltage Regulator Down) to support one processor. It is compliant with the *VRM 10.1 DC-DC Converter Design Guide Line* and provides a maximum of 120A, which is capable of supporting the requirements for Intel® Pentium® 4 and Intel® Celeron® D processors.

The board hardware must monitor the processor VTTEN (Output enable for VTT) pin before turning on the VRD. If the VTTEN pin of the processors is not identical the Power ON Logic will not turn on the VRD.

3.1.2 Reset Configuration Logic

The BIOS determines the processor stepping, cache size, etc through the CPUID instruction. The requirements are as follows:

- Processors run at a fixed speed, but can be programmed by BIOS to operate at a lower or higher speed.

The processor information is read at every system power-on.

Note: The processor speed is the processor power on reset default value. No manual processor speed setting options exist either in the form of a BIOS setup option or jumpers.

3.1.3 Processor Module Presence Detection

SE7221BK1-E does not support this function.

3.1.4 Processor Support

The Intel® Server Board SE7221BK1-E supports one processor in the LGA775 package. The support circuitry on the server board consists of the following:

- LGA775 processor socket supporting 800MHz FSB Intel® Pentium® 4 processor.
- Processor host bus AGTL+ support circuitry.

Table 1. Processor Support Matrix

Processor Family	Package Type	Frequency	Cache Size	Front Side Bus
Pentium® 4	LGA775	3.0 - 3.8 GHz	2MB L2	800MHz
Pentium® 4	LGA775	2.8 - 3.8 GHz	1MB L2	800MHz
Celeron® D	LGA775	2.26 - 2.93 GHz	256K L2	533MHz

Note: The **Pentium® 4 Processor Extreme Edition IS NOT supported** for use with the Intel® Server Board SE7221BK1-E.The board is designed to provide up to 120A of processor current. Processors with higher current requirements are not supported. For a complete list of all supported processors, please visit the Intel® Server Board SE7221BK1-E support site located at the following URL:

http://support.intel.com/support/motherboards/server/sb/CS-012690.htm

In addition to the circuitry described above, the processor subsystem contains the following:

- Reset configuration logic
- Server management registers and sensors

3.1.5 Interrupts and APIC

Interrupt generation and notification to the processor is done by the APICs in the ICH6R using messages on the front side bus.

3.2 Memory Subsystem

The baseboard supports up to four DIMM slots for a maximum memory capacity of 4 GB. The DIMM organization is x72, which includes eight ECC check bits. The memory interface runs at 400/533MT/s. The memory controller supports memory scrubbing, single-bit error correction and multiple-bit error detection and Intel® x4 SDDC support with x4 DIMMs. Memory can be implemented with either single sided (one row) or double-sided (two row) DIMMs.

3.2.1.1 Memory DIMM Support

The board supports un-buffered **(not registered)** DDR2 400/533-compliant ECC or Non-ECC DIMMs operating at 400/533MT/s. Only DIMMs tested and qualified by Intel or a designated memory test vendor are supported on this board. A list of qualified DIMMs is available at http://support.intel.com/support/motherboards/server/SE7221BK1E. Note that all DIMMs are supported by design, but only fully qualified DIMMs will be supported on the board.

The minimum supported DIMM size is 256 MB. Therefore, the minimum main memory configuration is 1 x 256 MB or 256 MB. The largest size DIMM supported is 2 GB however, the maximum main memory configuration is 4 GB implemented by 4 x 1 GB or 2 x 2 GB DIMMs.

- Only un-buffered DDR2 400/533 compliant, ECC x8 and Non-ECC x8 or x16 memory DIMMs are supported
- ECC single-bit errors (SBE) will be corrected and multiple-bit error (MBE) will be detected.
- Intel® Server Board SE7221BK1-E also supports Intel® x4 SDDC with x4 DIMMs.

- The maximum memory capacity is 4 GB

Note* Although the Intel® Server Board SE7221BK1-E supports a maximum memory capacity of 4 GB, system resources consume roughly 750 MB of physical memory in the maximum memory configuration. As a result, when 4 GB of memory is used, the amount of memory made available to the operating system is significantly lower than 4 GB; roughly 3200 MB. **THIS IS ONLY AN ISSUE WHEN 4 GB OF MEMORY IS USED**. A memory configuration of less than 4 GB will not be susceptible to this issue. Please refer to *Intel® Technical Advisory TA 719-01* on the support web site located at http://support.intel.com/support/motherboards/server/SE7221BK1E.

- The minimum memory capacity is 256 MB via 1 x 256 MB DIMM module

3.2.1.2 Memory Configuration

The memory interface between the GMCH and the DIMMs is 64-bit (non-ECC) or 72-bit (ECC) wide interface.

There are two banks of DIMMs, labeled 1 and 2. Bank 1 contains DIMM socket locations DIMM_1A and DIMM_2A. Bank 2 contains DIMM socket locations DIMM_1B and DIMM_2B. The sockets associated with each bank or "channel", are located next to each other and the DIMM socket identifiers are marked on the baseboard silkscreen, near the DIMM socket. Bank 1 is associated with Memory Channel A while Bank 2 is associated with Memory Channel B. When only two DIMM modules are being used, the population order must be DIMM_1A, DIMM_1B to ensure dual channel operating mode.

To reiterate: In order to operate in Dual Channel Dynamic Paging Mode, the following conditions must be met:

- **2 identical DIMMs are installed, one each in DIMM_1A and DIMM_1B**

- **4 identical DIMMs are installed (one in each socket location)**

Installing only 3 DIMMs is not supported. Do not use DIMMs that are not "matched" (same type and speed). Use of identical memory parts is always the preferred method.

See Table 2 and Figure 2 on the following page for reference.

The system design is free to populate or not to populate any rank on either channel, including either degenerate single channel case.

DIMM and memory configurations must adhere to the following:

- DDR2 400/533 , un-buffered, DDR2 DIMM modules
- DIMM organization: x72 ECC or x 64 Non-ECC
- Pin count: 240
- DIMM capacity: 256 MB, 512 MB, 1 GB DIMMs
- Serial PD: JEDEC Rev 2.0
- Voltage options: 1.8 V
- Interface: SSTL2

Table 2. Memory Bank Labels and DIMM Population Order

Location	DIMM Label	Channel	Population Order
J8J1	(DIMM_1A)	A	**1**
J8J2	(DIMM_2A)	A	**3**
J9J2	(DIMM_1B)	B	**2**
J9J1	(DIMM_2B)	B	**4**
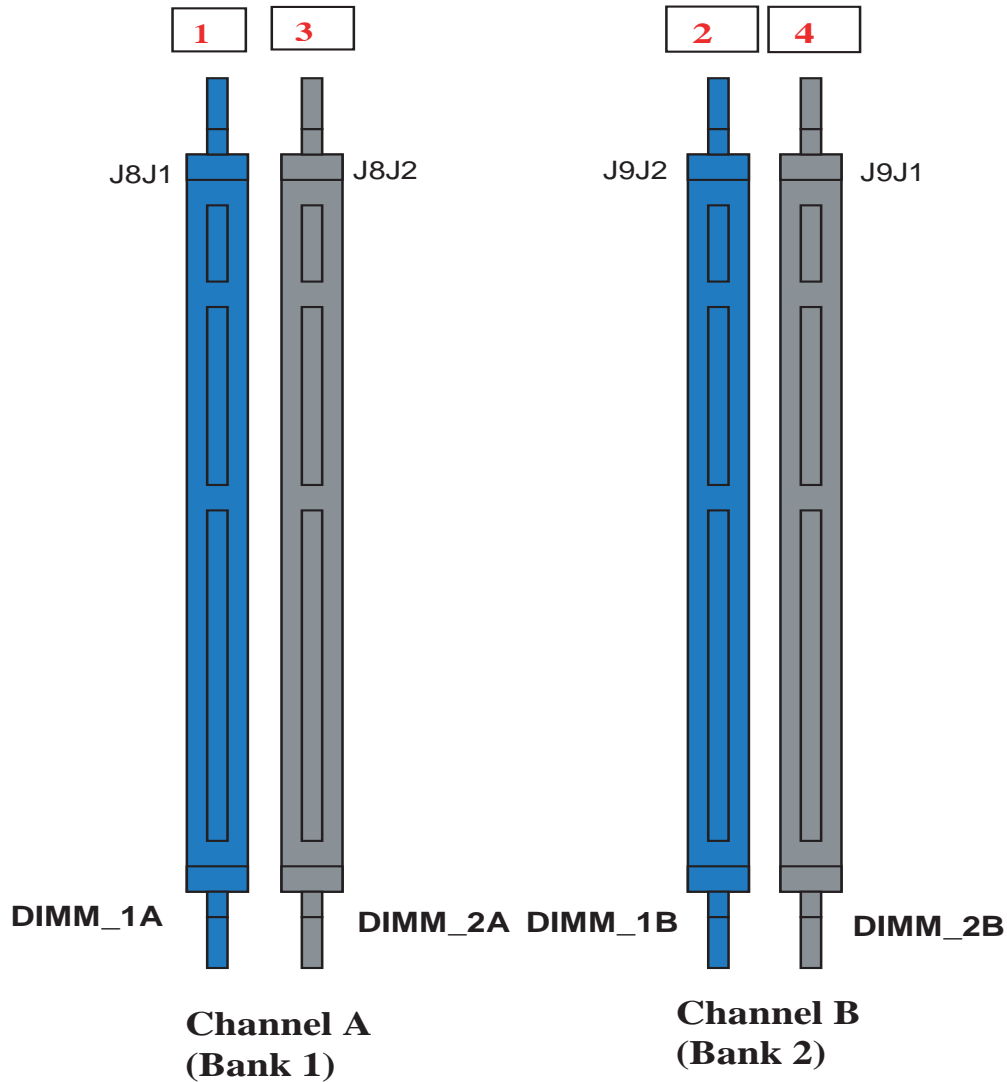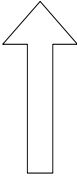
Figure 2. Memory Bank Label Definition

Table 3 summarizes the characteristics of dual and single channel configurations with and without the use of Dynamic Mode.

Table 3. Characteristics of Dual/Single Channel Configuration with/without Dynamic Mode

Throughput Level	Configuration	Characteristics
Highest	Dual Channel with Dynamic Paging Mode	All DIMMs matched
	Dual Channel without Dynamic Paging Mode	DIMMs matched from Channel A to Channel B DIMMs not matched within channels
	Single Channel with Dynamic Paging Mode	Single DIMM or DIMMs matched with a channel
Lowest	Single Channel without Dynamic Paging Mode	DIMMs not matched

4.   The Intel® E7221 Chipset

The Intel® Server Board SE7221BK1-E is designed around the Intel® E7221 chipset. The chipset provides an integrated I/O bridge and memory controller, and a flexible I/O subsystem core (PCI Express*). The chipset consists of three primary components:

- **GMCH: Graphics Memory Control Hub.** The GMCH accepts access requests from the host (processor) bus and directs those accesses to memory or to one of the PCI buses. The GMCH monitors the host bus, examining addresses for each request. Accesses may be directed to a memory request queue for subsequent forwarding to the memory subsystem, or to an outbound request queue for subsequent forwarding to one of the PCI buses. The GMCH also accepts inbound requests from the ICH6R. The GMCH is responsible for generating the appropriate controls to control data transfer to and from memory.

  The Intel® E7221 GMCH comes with an integrated high performance graphics media accelerator (Intel® GMA 900) and supports one x8 port configuration PCI-E interface. Maximum theoretical peak bandwidth on each x8 PCI Express* interface of 2.5 GB/s in each direction simultaneously, for 5 GB/s per port.

- **ICH6R: I/O Controller Hub 6R.** The ICH6R controller has several components. It provides the interface for a 32-bit/33-MHz PCI bus. The ICH6R can be both a master and a target on that PCI bus. The ICH6R also includes a USB 2.0 controller and an IDE controller. The ICH6R is also responsible for much of the power management functions, with ACPI control registers built in. The ICH6R also provides a number of GPIO pins and has the LPC bus to support low speed legacy I/O.

  The GMCH and ICH6R chips provide the pathway between processor and I/O systems. The GMCH is responsible for accepting access requests from the host (processor) bus, and directing all I/O accesses to one of the PCI buses or legacy I/O locations. If the cycle is directed to one of the PCI-E segments, the GMCH communicates with the PCI-E Devices (add-in card, on board devices) through the PCI-E interface.   If the cycle is directed to the ICH6R, the cycle is output on the GMCH's DMI bus. All I/O for the board, including PCI and PC-compatible I/O, is directed through the GMCH and then through the ICH6R provided PCI buses.

- **PXH: PCI-X Hub** The PXH hub is peripheral chips that perform PCI bridging functions between the PCI Express* interface and the PCI bus. The PXH contains two PCI bus

interfaces that can be independently configured to operate in PCI (33 or 66 MHz), PCI-X Mode1 (66,100,133), for either 32 or 64 bits.

4.1.1 GMCH Memory Architecture Overview

The GMCH supports a 72-bit wide memory sub-system that can support a maximum of 4 GB of DDR2 memory using 1 GB DIMMs. This configuration needs external registers for buffering the memory address and control signals. The four chip selects are registered inside the GMCH and need no external registers for chip selects.

The memory interface runs at 400/533MT/s. The memory interface supports a 72-bit wide memory array. It uses seventeen address lines (BA [2:0] and MA [13:0]) and supports 256 Mb, 512 Mb, 1 Gb DRAM densities. The DDR DIMM interface supports memory scrubbing, single-bit error correction, and multiple bit error detection and Intel® x4 SDDC with x4 DIMMs.

4.1.1.1 DDR2 Configurations

The DDR2 interface supports up to 4 GB of main memory and supports single- and double-density DIMMs. The DDR2 can be any industry-standard DDR2. The following table shows the DDR2 DIMM technology supported.

Table 4. Supported DDR2 modules

DDR2-400 and DDR2-533 Un-buffered SDRAM Module Matrix					
DIMM Capacity	DIMM Organization	SDRAM Density	SDRAM Organization	# SDRAM Devices/rows/Banks	# Address bits rows/Banks/column
256MB	32M x 72	256Mbit	32M x 8	9 /1 / 4	13 / 2 / 10
512MB	64M x 72	256Mbit	32M x 8	18 / 2 / 4	13 / 2 / 10
512MB	64M x 72	512Mbit	64M x 8	9 / 1 / 4	14 / 2 / 10
1GB	128M x 72	512Mbit	64M x 8	18 / 2 / 4	14 / 2 / 10
1GB	128M x 72	1Gbit	128M x 8	9 / 1 / 8	14 / 3 / 10

4.1.2 Graphics Memory Controller Hub (GMCH)

The GMCH is a 1210-ball FC-BGA device and uses the proven components of previous generations like the Intel® Pentium® 4 processor bus interface unit, the hub interface unit, and the DDR2 memory interface unit. In addition, the GMCH incorporates an integrated high performance graphics media accelerator and a PCI Express* interface. The PCI Express* interface allows the GMCH to directly interface with the PCI Express* devices (like PXH/PXHD). The GMCH also increases the main memory interface bandwidth and maximum memory configuration with a 72-bit wide memory interface.

The GMCH integrates the following main functions:

- An integrated high performance main memory subsystem.

- A PCI Express* bus which provides an interface to the PCI-Express* devices(Fully compliant to the *PCI Express* Base Specification, Rev 1.0a*)
- A DMI which provides an interface to the ICH6R

Other features provided by the GMCH include the following:

- Full support of ECC on the processor bus
- Full support of Intel® x4 SDDC on the memory interface with x4 DIMMs
- Twelve deep in-order queue, two deep defer queue
- Full support of un-buffered DDR2 ECC DIMMs.
- Support for 1 GB DDR2 memory modules
- Memory scrubbing

4.1.3   ICH6R

The ICH6R is a multi-function device, housed in a 609-pin mBGA device, providing a DMI bus, a PCI 32-bit/33 MHz interface, a IDE interface, an integrated Serial ATA Host controller, a USB controller, a PCI-E x4 interface, and a power management controller. Each function within the ICH6R has its own set of configuration registers. Once configured, each appears to the system as a distinct hardware controller sharing the same PCI bus interface.

The primary role of the ICH6R is to provide the gateway to all PC-compatible I/O devices and features. The board uses the following the ICH6R features:

- PCI 32-bit/33MHz interface
- LPC bus interface
- PCI Express* x4
- DMI (Direct Media Interface)
- IDE interface, with Ultra ATA 100/66/33 capability
- Integrated Serial ATA Host controller
- Universal Serial Bus (USB) 2.0 interface
- PC-compatible timer/counter and DMA controllers
- APIC and 82C59 interrupt controller
- Power management
- System RTC
- Supports *Smbus 2.0 Specification*
- General purpose I/O (GPIO)

The following are the descriptions of how each supported feature is used for ICH6R on the board.

4.1.3.1   PCI Bus P32-A I/O Subsystem

The ICH6R provides a legacy 32-bit PCI subsystem and acts as the central resource on this PCI interface. P32-A supports the following embedded devices and connectors:

- One Intel® ® 82541PI network controller

▪ One slots capable of supporting full length legacy PCI add-in cards operating at 33 MHz

4.1.3.2 PCI Express* X4 Subsystem

The ICH6R supports one x4-lane PCI Express* interface that can also be configured as a single x1 or x4-lane port. The PCI Express* interface allows direct connection with the PXH/PXHD or PCI-E devices. (Fully compliant to the *PCI Express* Base Specification, Rev 1.0a*)

4.1.3.3 PCI Bus Master IDE Interface

The ICH6R acts as a PCI-based Ultra ATA 100/66/33 IDE controller that supports programmed I/O transfers and bus master IDE transfers. The ICH6R supports one IDE channel, supporting two drives each (drives 0 and 1). The baseboard provides a 40-pin (2x20) IDE connector to access the IDE functionality.

The IDE interface supports Ultra ATA 100/66/33 Synchronous DMA Mode transfers on the 40-pin connector.

4.1.3.4 USB Interface

The ICH6R contains one EHCI USB 2.0 controller and four USB ports. The USB controller moves data between main memory and up to four USB connectors. All ports function identically and with the same bandwidth. The Intel® Server Board SE7221BK1-E implements four ports on the board.

The baseboard provides two external USB ports on the back of the server board. The dual-stack USB connector is located within the standard ATX I/O panel area. The *Universal Serial Bus Specification, Revision 1.1,* defines the external connectors.

The third/fourth USB port is optional and can be accessed by cabling from an internal 9-pin connector located on the baseboard to an external USB port located either in front or the rear of a given chassis.

4.1.3.5 SATA interface

The ICH6R contains four SATA ports. The data transfer rates up to 150Mbyte/s.

4.1.3.6 Compatibility Interrupt Controller

The ICH6R provides the functionality of two cascaded 82C59 with 15 interrupts handling. Support processor system bus interrupt.

4.1.3.7 APIC

The ICH6R integrates an I/O APIC capability with 24 interrupts.

4.1.3.8 Power Management

One of the embedded functions of the ICH6R is a power management controller. This is used to implement ACPI-compliant power management features. The baseboard does support sleep states S0, S1, S4, and S5.

4.2   Super I/O

National Semiconductor* PC87427Super IO device contains all of the necessary circuitry to control two serial ports, one parallel port, floppy disk, PS/2-compatible keyboard and mouse and hardware monitor controller. The baseboard implements the following features:

- GPIOs
- Two serial ports
- Floppy
- Keyboard and mouse
- Local hardware monitoring
- Wake up control
- System Health Support

4.2.1   Serial Ports

The board provides two serial ports, an external serial port, and an internal serial header. The following sections provide details on the use of the serial ports.

4.2.1.1   Serial A

Serial A is a standard DB9 interface located at the rear I/O panel of the server board, below the video connector. Serial A is designated by as "Serial A" on the silkscreen. The reference designator is J8A1.

4.2.1.2   Serial B

Serial B is an optional port, accessed through a 9-pin internal header (J1B1). A standard DH-10 to DB9 cable can be used to direct serial B to an external connector on any given chassis. The serial B interface follows the standard RS232 pin-out. The baseboard has a "Serial_B" silkscreen label next to the connector and is located beside the PCI32 5V connector.

4.2.1.3   Floppy Disk Controller

The floppy disk controller (FDC) in the Super IO is functionally compatible with floppy disk controllers in the DP8473 and N844077. All FDC functions are integrated into the Super IO including analog data separator and 16-byte FIFO. The baseboard provides a standard 34-pin interface for the floppy disk controller.

4.2.1.4   Keyboard and Mouse

Two external PS/2 ports, located on the back of the baseboard, are provided to access the keyboard or mouse functions.

4.2.1.5   Fast X-Bus extension for boot flash, memory and I/O.

The fast X-bus Supports I/O and memory read/write operations and 8 bit data bus, 28-bit addressing.

4.2.1.6 Wake-up Control

The Super IO contains functionality that allows various events to control the power-on and power-off the system.

4.2.2 BIOS Flash

The board incorporates an Intel® ® 28F320C3 flash memory component. The 28F320C3 is a high-performance 32-megabit memory component that provides 2096K x 16 of BIOS and non-volatile storage space. The flash device is connected through the X Bus from Super IO.

4.2.3 System Health Support

I2C interface to LM96000 sensors
Fan Monitor and Control (FMC)
— One PWM-based fan controls
— Software or local temperature feedback control
Chassis intrusion detection

5. I/O Subsystem

5.1 PCI Subsystem

The primary I/O buses for the SE7221BK1-E are 3 independent PCI bus segments (4 independent segments with SE7221BK1LX sku) with PCI, PCI-E and two PCI-X buses. The PCI buses comply with the *PCI Local Bus Specification, Rev 2.3*. The P32-A bus segment is directed through the ICH6R. The P32-B and P64-C bus segment are independently configured to PXH that is through ICH6R by PCI Express* x 4 interface. The PCI-E x8 bus is directed through the GMCH. The table below lists the characteristics of the three PCI bus segments.

Table 5. PCI Bus Segment Characteristics

PCI Bus Segment	Voltage	Width	Speed	Type	PCI I/O Card Slots
PCI	5V	32 bits	33MHz	P32-A	Slot 1
PCI-X	3.3V	64 bits	66/100MHz	P64-C	Slot 4; Slot 5, (Slot 6 through riser card)
PCI-E (x8)	3.3V	8 lanes	100MHz		Slot 6

5.1.1 P32-A: 32-bit/33-MHz PCI Subsystem

All 32-bit/33-MHz PCI I/O for the board is directed through the ICH6R. The 32-bit/33-MHz PCI segment created by the ICH6R is known as the P32-A segment. The P32-A segment supports the following embedded devices and connectors:

▪ One 10/100/1000-T Network Interface Controller: Intel® 82541PI Fast Ethernet Controller.

5.1.1.1 Device IDs (IDSEL)

Each device under the PCI hub bridge has its IDSEL signal connected to one bit of AD [31:16], which acts as a chip select on the PCI bus segment in configuration cycles. This determines a

unique PCI device ID value for use in configuration cycles. The following table shows the bit to which each IDSEL signal is attached for P32-A devices and the corresponding device description.

Table 6. P32-A Configuration IDs

IDSEL Value	Device
19	Intel® 82541PI LAN (NIC1)
18	PCI Slot 1 (32b/33MHz)

5.1.1.2   P32-A Arbitration

P32-A supports two PCI devices: the ICH6R and one PCI bus masters (NIC). All PCI masters must arbitrate for PCI access, using resources supplied by the ICH6R. The host bridge PCI interface (ICH6R) arbitration lines REQx* and GNTx* are a special case in that they are internal to the host bridge. The following table defines the arbitration connections.

Table 7. P32-A Arbitration Connections

Baseboard Signals	Device
PCI REQ1_N/GNT_N1	Intel® 82541PI LAN (NIC1)
PCI REQ0_N/GNT_N0	PCI Slot 1 (32bit/33MHz)

5.1.2   P32-B 66-MHz PCI-X Subsystem (SE7221BK1LX sku   only)

One 32-bit PCI bus segment is directed through the PXH interface A. This PCI segment, P32-B, just has an embedded device, Intel® 82541PI LAN (NIC2) clocked at 66MHz. (SE7221BK1LX sku   only)

5.1.2.1   Device IDs (IDSEL)

Each device under the PCI hub bridge has its IDSEL signal connected to one bit of AD [31:16], which acts as a chip select on the PCI bus segment in configuration cycles. This determines a unique PCI device ID value for use in configuration cycles. The following table shows the bit to which each IDSEL signal is attached for P32-B devices and corresponding device description.

Table 8. P32-B Configuration IDs

IDSEL Value	Device
19	Intel® 82541PI LAN (NIC2)

5.1.2.2   P32-B Arbitration

P32-B supports one PCI masters. All PCI masters must arbitrate for PCI access using resources supplied by the PXH. The host bridge PCI interface (PXH) arbitration lines REQx*

and GNTx* are a special case in that they are internal to the host bridge. The following table defines the arbitration connections.

Table 9. P32-B Arbitration Connections

Baseboard Signals	Device
PCIX REQ_N0/GNT_N0	Intel® 82541PI LAN (NIC2)

5.1.3   P64-C 66/100-MHz PCI-X Subsystem

One 64-bit PCI-X bus segment is directed through the PXH. This PCI-X segment, P64-C, provides two 3.3V 64-bit PCI-X slots or one 3.3V 64-bit PCI-X riser slot, (SE7221BK1LX sku only) capable of up to 100 MHz operation **(with 1 adapter, either slot is capable of 100MHz, only speeds of 66MHz are supported with two adapters populated)** and supports full-length PCI and PCI-X adapters.

5.1.3.1   Device IDs (IDSEL)

Each device under the PCI hub bridge has its IDSEL signal connected to one bit of AD [31:16], which acts as a chip select on the PCI bus segment in configuration cycles. This determines a unique PCI device ID value for use in configuration cycles. The following table shows the bit to which each IDSEL signal is attached for P64-C devices and corresponding device description.

Table 10. P64-C Configuration IDs

IDSEL Value	Device
17	PCI Slot 4 (64bit/66-100MHz)/ PCI Slot 6 (64bit/100MHz) (Riser, SE7221BK1LX sku only)
18	PCI Slot 5 (64bit/66-100MHz)

5.1.3.2   P64-C Arbitration

P64-C supports two PCI masters: two PCI-X slots or one riser slot. All PCI masters must arbitrate for PCI access using resources supplied by the ICH6. The host bridge PCI interface (ICH6) arbitration lines REQx* and GNTx* are a special case in that they are internal to the host bridge. The following table defines the arbitration connections.

Table 11. P64-C Arbitration Connections

Baseboard Signals	Device
PCIX REQ_N0/GNT_N0	PCI Slot 4 (64bit/66M) / PCI Slot 6 (64bit/100M) (Riser, SE7221BK1LX sku only)
PCIX REQ_N1/GNT_N1	PCI Slot 5(64bit/66M)

5.1.4 PCI-E x8

In this board, Lanes 0~7 are connected to a x8 PCI-E connector directly. It can support x1, x4, x 8 PCI-E add-in cards.

Table 12. PCI-E x 8 Connections

Lane	Device
Lane 0~7	Slot 6 (PCI Express* x 8)

5.2   Video Controller

The Intel® E7221 GMCH includes an integrated graphics engine that supports standard SVGA drivers with analog display capabilities.

Table 13. Supported On-board Video Modes

Pixel Resolution	Refresh Rates	8 bpp	16 bpp	32 bpp
640x480	60,75,85	Supported	Supported	Supported
800x600	60,75,85	Supported	Supported	Supported
1024x768	60,75,85	Supported	Supported	Supported
1280x1024	60,75,85	Supported	Supported	Supported
1600x1200	60,75,85	Supported	Supported	Supported
1920x1440	60,75,85	Supported	Supported	

8 MB of memory is pre-allocated in the main memory to support the internal graphical device when less than 4 GB of physical memory is installed. However, when the maximum of 4 GB of memory is installed, onboard system resources such as video consume a considerable amount of memory, leaving just above 3 GB of available memory for the operating system. Details of this issue have been communicated via the *Technical Advisory TA_719-01* which can be found at: http://support.intel.com/support/motherboards/server/SE7221BK1-E.

The baseboard provides a standard 15-pin VGA connector at the rear of the system, in the standard ATX I/O opening area. The video controller is disabled by default in BIOS Setup when an off-board video adapter is detected in either the PCI-E or PCI slots.

5.3   Network Interface Controller (NIC)

The Intel® Server Board SE7221BK1-E supports two 10Base-T/100Base/1000Base-T (82541PI controller) network interfaces. One is through ICH6R directly, and another one is through PXH (SE7221BK1LX sku only).

The Intel® 82541PI Gigabit Ethernet is a single, compact component with an integrated Gigabit Ethernet Media Access Control (MAC) and physical layer (PHY) functions. For desktop, workstation and mobile PC Network designs with critical space constraints, the Intel® 82541PI allows for a Gigabit Ethernet implementation in a very small area that is footprint compatible

with current generation 10/100 Mbps Fast Ethernet designs. The Intel® 82541PI integrates fourth generation gigabit MAC design with fully integrated, physical layer circuitry to provide a standard IEEE 802.3 Ethernet interface for 1000BASE-T, 100BASE_TX, and 10BASE-T applications (802.3, 802.3u, and 802.3ab). The controller is capable of transmitting and receiving data at rates of 1000 Mbps, 100 Mbps, or 10 Mbps. In addition to managing MAC and PHY layer functions, the controller provides a 32-bit wide direct Peripheral Component Interconnect (PCI) 2.3 compliant interface capable of operating at 33 or 66MHz.

5.3.1 NIC Connector and Status LEDs

The NICs drive two LEDs located on each network interface connector.

For the NIC 1 connector, the green LED indicates network connection when on, and Transmit/Receive activity when blinking. The yellow LED indicates 1000-Mbps operation when lit, the green LED indicates 100-Mbps operation when lit and 10-Mbps when off.

For the NIC 2 connector (SE7221BK1LX sku only), the yellow LED indicates network connection when on, and Transmit/Receive activity when blinking. The orange LED indicates 1000-Mbps operation when lit, the green LED indicates 100-Mbps operation when lit and 10-Mbps when off.

5.4 Interrupt Routing

The board interrupt architecture accommodates both PC-compatible PIC mode and APIC mode interrupts through use of the integrated I/O APICs in the ICH6.

5.4.1 Legacy Interrupt Routing

For PC-compatible mode, the ICH6 provides two 82C59-compatible interrupt controllers. The two controllers are cascaded with interrupt levels 8-15 entering on level 2 of the primary interrupt controller (standard PC configuration). A single interrupt signal is presented to the processors, to which only one processor will respond for servicing. The ICH6R contains configuration registers that define which interrupt source logically maps to I/O APIC INTx pins.

The ICH6 handles both PCI and IRQ interrupts. The ICH6R translates these to the APIC bus. The numbers in the table below indicate the ICH6R PCI interrupt input pin to which the associated device interrupt (INTA, INTB, INTC, INTD, INTE, INTF, INTG, INTH for PCI bus and PXIRQ0, PXIRQ1, PXIRQ2, PXIRQ3 for PCI-X bus) is connected. The ICH6R I/O APIC exists on the I/O APIC bus with the processors.

Table 14. PCI AND PCI-X Interrupt Routing/Sharing

Interrupt	INT A	INT B	INT C	INT D
Intel® 82541PI	PIRQC			
PCI Slot 1 (PCI 32b/33M)	PIRQF	PIRQG	PIRQE	PIRQH
PCI Slot 4 (64b/66M)/ PCI Slot 6 (64bit/100MHz) (Riser, SE7221BK1LX sku only)	PXIRQ0	PXIRQ1	PXIRQ2	PXIRQ3
PCI Slot 5 (64b/66M	PXIRQ5	PXIRQ6	PXIRQ7	PXIRQ4

5.4.2   APIC Interrupt Routing

For APIC mode, the baseboard interrupt architecture incorporates three Intel® I/O APIC devices to manage and broadcast interrupts to local APICs in each processor. The Intel® I/O APICs monitor each interrupt on each PCI device; including PCI slots in addition to the ISA compatibility interrupts IRQ (0-15).

When an interrupt occurs, a message corresponding to the interrupt is sent across a three-wire serial interface to the local APICs. The APIC bus minimizes interrupt latency time for compatibility interrupt sources. The I/O APICs can also supply greater than 16 interrupt levels to the processor(s). This APIC bus consists of an APIC clock and two bidirectional data lines.

5.4.2.1   Legacy Interrupt Sources

The table below recommends the logical interrupt mapping of interrupt sources on the board. The actual interrupt map is defined using configuration registers in the ICH6.

Table 15. Interrupt Definitions

ISA Interrupt	Description
INTR	Processor interrupt.
NMI	NMI to processor.
IRQ0	System timer
IRQ1	Keyboard interrupt.
IRQ2	Slave PIC
IRQ3	Serial port 1 or 2 interrupt from SUPER IO device, user-configurable.
IRQ4	Serial port 1 or 2 interrupt from SUPER IO device, user-configurable.
IRQ5	
IRQ6	Floppy disk.
IRQ7	Parallel Port / Generic
IRQ8_L	Active low RTC interrupt.
IRQ9	SCI*
IRQ10	Generic
IRQ11	Generic
IRQ12	Mouse interrupt.
IRQ13	Floaty processor.
IRQ14	Compatibility IDE interrupt from primary channel IDE devices 0 and 1.
IRQ15	Secondary IDE Cable
SMI*	System Management Interrupt. General purpose indicator sourced by the ICH6R to the processors.

5.4.3   Serialized IRQ Support

The SE7221BK1-E server board supports a serialized interrupt delivery mechanism. Serialized Interrupt Requests (SERIRQ) consists of a start frame, a minimum of 17 IRQ / data channels, and a stop frame. Any slave device in the quiet mode may initiate the start frame. While in the continuous mode, the start frame is initiated by the host controller.

5.5   PCI Error Handling

The PCI bus defines two error pins, PERR# and SERR#, for reporting PCI parity errors and system errors, respectively. In the case of PERR#, the PCI bus master has the option to retry the offending transaction, or to report it using SERR#. All other PCI-related errors are reported by SERR#. SERR# is routed to NMI if enabled by BIOS.
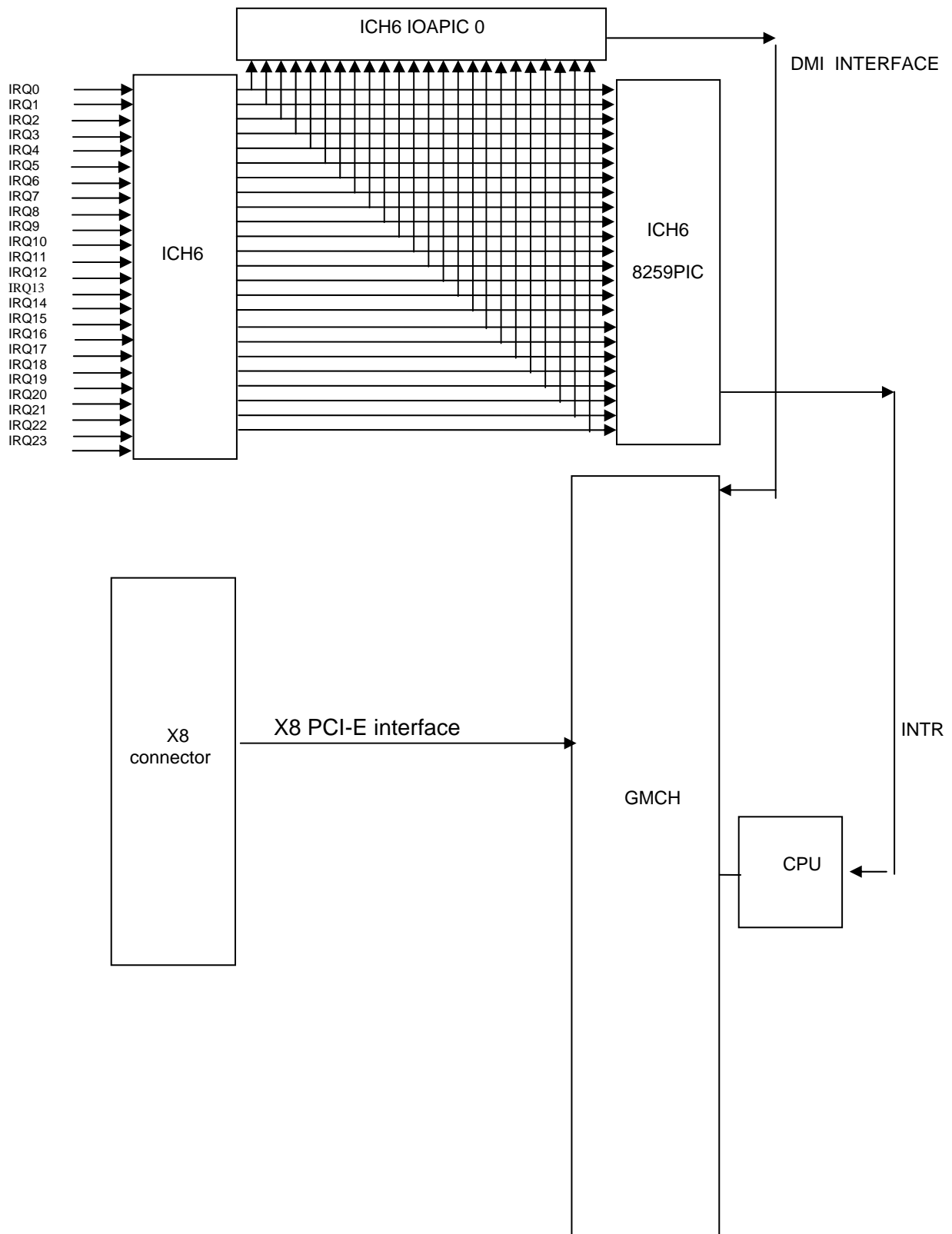
Figure 3. Interrupt Routing Diagram
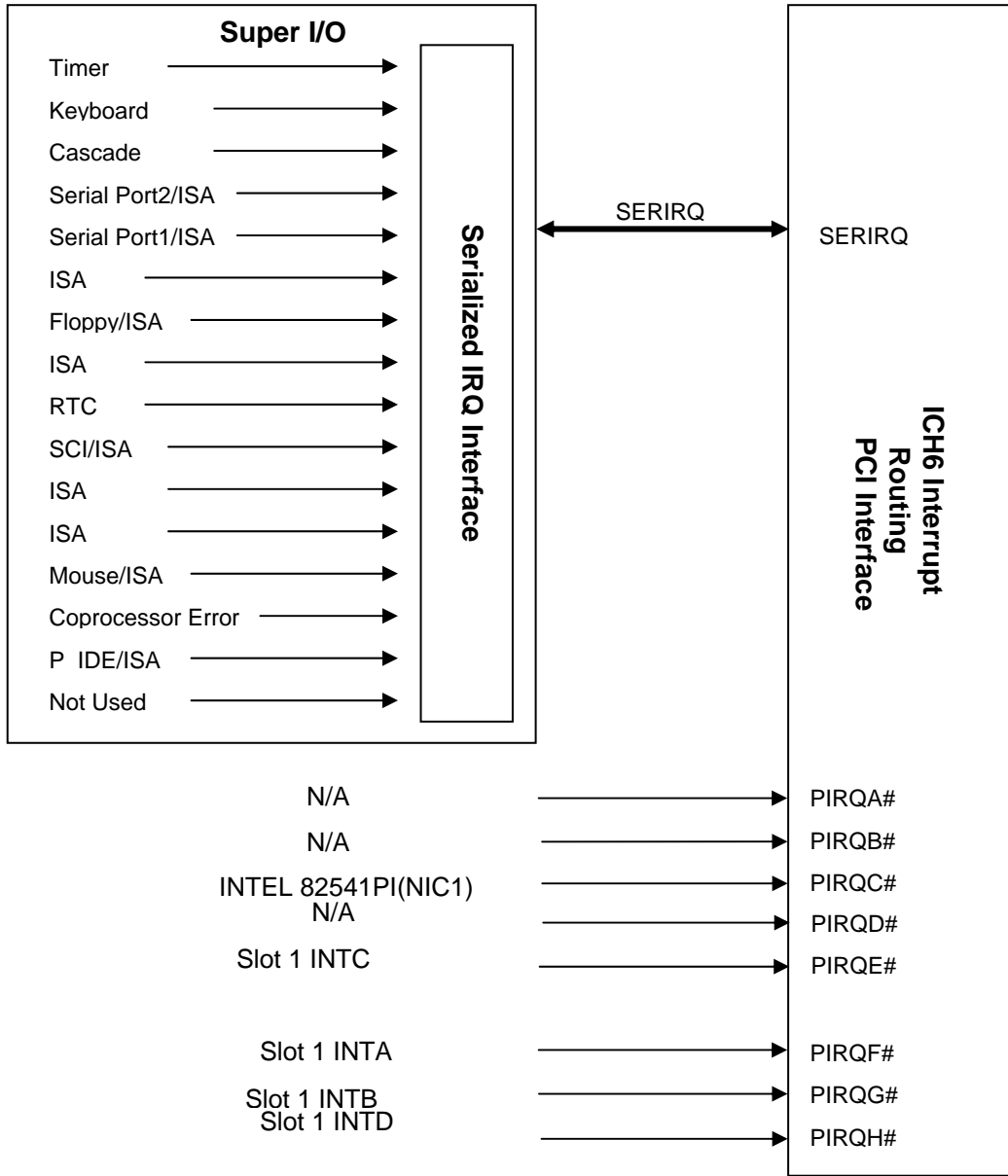
Figure 4. ICH6R Interrupt Routing Diagram
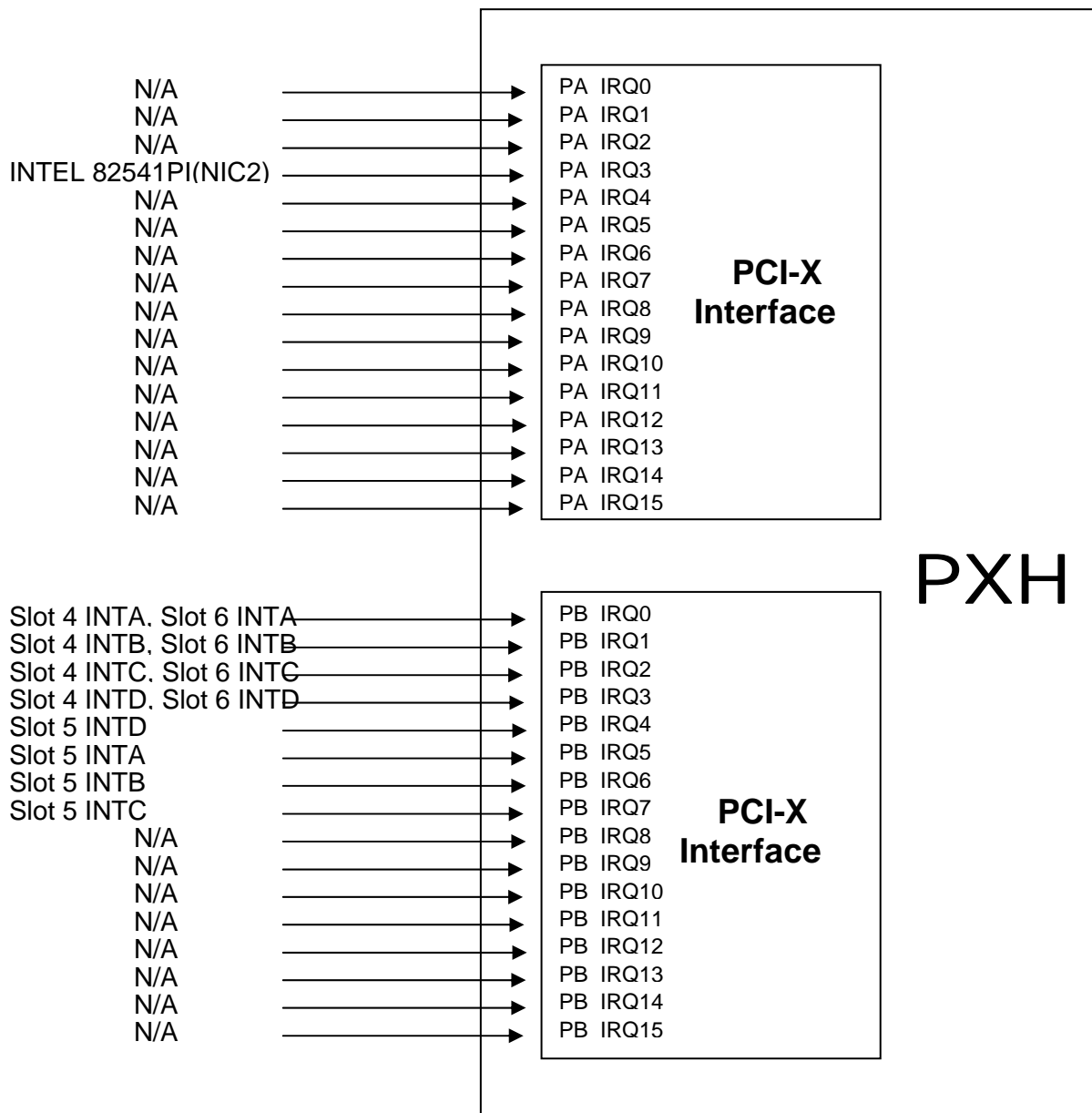
Figure 5. PXH Interrupt Routing Diagram

6. ACPI Implementation

6.1 ACPI

An ACPI-aware operating system generates an SMI to request that the system be switched into ACPI mode. The BIOS responds to enable ACPI mode. The system automatically returns to legacy mode upon hard reset or power-on reset.

The SE7221BK1-E platform supports S0, S1, S4, and S5 states. When the system is operating in ACPI mode, the OS retains control of the system and OS policy determines the entry methods and wake up sources for each sleep state

Note: Sleep entry and wake up event capabilities are provided by the hardware but are enabled by the operating system.

S0 Sleep State   The S0 sleep state is when everything is on. This is the state that no sleep is enabled.

S1 Sleep State   The S1 sleep state is a low wake-up latency sleep state. In this state, no system context is lost (Processor or chipset). The system context is maintained by the hardware.

S4 Sleep State   The S4 Non-Volatile Sleep state (NVS) is a special global system state that allows system context to be saved and restored (relatively slowly) when power is lost to the baseboard. If the system has been commanded to enter the S4 sleep state, the operating system will write the system context to a non-volatile storage file and leave appropriate context markers.

S5 Sleep State   The S5 sleep state is similar to the S4 sleep state except the operating system does not save any context nor enable any devices to wake the system. The system is in the "soft" off state and requires a complete boot when awakened.

6.1.1   Front Panel Switches

The baseboard supports two front panel buttons:

- Power button
- Reset button

Power Button Off to On: The power button input (J1J1 pin 11and 13) provides FP_PWR_BTN_N signal to the mBMC (PC87431M). mBMC will output a MBMC_PWR_BTN_N signal to ICH6. If the PWRBTN# signal of ICH6R is asserted, the assertion causes a wake event. And then, the SLP_S3 signal of ICH6R will be not asserted. The SLP_S3 signal will be passed to the PS_ON# signal of ATX power

supply through an inverter, and then transition to an ON state.

Power Button On to Off (Legacy): The ICH6 is configured to generate an SMI due to a power button event. The BIOS services this SMI and sets the state of the machine in the ICH6 and Super IO to the OFF state.

Power Button On to Off (ACPI): If an ACPI operating system is loaded, the power button switch generates a request (via SCI) to the OS to shutdown the system. The OS retains control of the system and determines what sleep state (if any) the system transitions to.

Reset Button: The reset button will generate a hard reset to the system.

NMI Button: The NMI button will force an NMI to the processors.

6.1.2 Wake up Sources (ACPI and Legacy)

The baseboard is capable of wake up from several sources under a non-ACPI configuration, such as when the operating system does not support ACPI. The wake up sources are defined in the following table.

Table 16. Supported Wake Events

Wake Event	Supported via ACPI (by sleep state)	Supported Via Legacy Wake
Power Button	Always wakes system	Always wakes system
PME from PCI 32/33	S1, S4	S5
PME from primary PCI 64/66	S1, S4	S5
RTC Alarm	S1, S4	No
Mouse	S1	No
Keyboard	S1	No
USB	S1	No

Under ACPI, the operating system programs the ICH6R and Super IO to wake up on the desired event, but in legacy mode, the BIOS enables/disables wake up sources based on an option in BIOS Setup. The operating system or a driver must clear any pending wake up status bits in the associated hardware (such as the Wake on LAN status bit in the LAN application specific integrated circuit (ASIC), or PCI Power Management Event (PME) status bit in a PCI device. The legacy wake up feature is disabled by default.

7.   Connectors

7.1   Main Power Connector

The main power supply connection is obtained using the 24-pin connector. The following table defines the pin-outs of the connector.

Table 17. Power Connector Pin-out (CN4H1)

Pin	Signal	18 AWG Color	Pin	Signal	18 AWG Color
1*	+3.3VDC	Orange	13	+3.3VDC	Orange
	3.3V RS	Orange (24AWG)	14	-12VDC	Blue
2	+3.3VDC	Orange	15	COM	Black
3*	COM	Black	16	PSON#	Green
	COM RS	Black (24AWG)	17	COM	Black
4*	+5VDC	Red	18	COM	Black
	5V RS	Red (24AWG)	19	COM	Black
5	COM	Black	20	Reserved	N.C.
6	+5VDC	Red	21	+5VDC	Red
7	COM	Black	22	+5VDC	Red
8	PWR OK	Gray	23	+5VDC	Red
9	5 VSB	Purple	24	COM	Black
10	+12V3	Yellow			
11	+12V3	Yellow			
12	+3.3VDC	Orange			

Table 18. Auxiliary CPU Power Connector Pin-out (CN4B1)

Pin	Signal	18 AWG color	Pin	Signal	18 AWG Color
1	COM	Black	5*	+12V1	White
2	COM	Black		12V1 RS	Yellow (24AWG)
3	COM	Black	6	+12V1	White
4	COM	Black	7	+12V2	Brown
			8*	+12V2	Brown
				12V2 RS	Yellow (24AWG)

7.2 Intel Adaptive Slot

Table 19. Intel Adaptive Slot pinout

Pin-Side B	PCI Spec Signal	Description	Pin-Side A	PCI Spec Signal	Description
1	12V		1	Presnt1#	
2	12V		2	12V	
3	12V		3	12V	
4	GND		4	GND	
5	SMCLK		5	JTAG-TCK	
6	SMDATA		6	JTAG-TDI	
7	GND		7	JTAG-TDO	
8	3.3V		8	JTAG-TMS	
9	JTAG-TRST#		9	3.3V	
10	3.3VAux		10	3.3V	
11	Wake#		11	PERST#	
KEY	**KEY**		**KEY**	**KEY**	
KEY	**KEY**		**KEY**	**KEY**	
12	RSVD		12	GND	
13	GND		13	REFCLK1+	
14	HSOp(0)		14	REFCLK1+	
15	HSOn(0)		15	GND	
16	GND		16	HSIp(0)	
17	Present2#		17	HSIn(0)	
18	GND	1X end	18	GND	
19	HSOp(1)		19	RSVD	
20	HSOn(1)		20	GND	
21	GND		21	HSIp(1)	
22	GND		22	HSIn(1)	
23	HSOp(2)		23	GND	
24	HSOn(2)		24	GND	
25	GND		25	HSIp(2)	
26	GND		26	HSIn(2)	
27	HSOp(3)		27	GND	
28	HSOn(3)		28	GND	
29	GND		29	HSIp(3)	
30	RSVD		30	HSIn(3)	
31	PRSNT2#		31	GND	
32	GND	4X end	32	REFCLK2+	second x4 clock
33	HSOp(4)		33	REFCLK2+	second x4 clock
34	HSOn(4)		34	GND	
35	GND		35	HSIp(4)	
36	GND		36	HSIn(4)	

37	HSOp(5)		37	GND	
38	HSOn(5)		38	GND	
39	GND		39	HSIp(5)	
40	GND		40	HSIn(5)	
41	HSOp(6)		41	GND	
42	HSOn(6)		42	GND	
43	GND		43	HSIp(6)	
44	GND		44	HSIn(6)	
45	HSOp(7)		45	GND	
46	HSOn(7)		46	GND	
47	GND		47	HSIp(7)	
48	PRSNT2#		48	HSIn(7)	
49	GND	8X end	49	GND	
KEY	**KEY**	Blocks a x16 PCI-Express board	**KEY**	**KEY**	and allows a x8 to be used instead
KEY	**KEY**	Blocks a x16 PCI-Express board	**KEY**	**KEY**	
50	-12V		50	12V	
51	+5V		51	INTB#	
52	INTD#		52	+5V	
53	+5V		53	+5V	
54	+5V		54	+5V	
55	INTA#		55	INTC#	
56	GND		56	GND	
57	CLK3		57	REQ3#	
58	GND		58	GND	
59	CLK2		59	GNT3#	
60	GND		60	GND	
61	REQ2#		61	RST#	
62	GND		62	+5V	
63	GND		63	RSVD	
64	CLK1		64	GND	
65	GND		65	GNT2#	
66	REQ1#		66	+3.3V	
67	+3.3V		67	GNT1#	
68	PME2#		68	GND	
69	AD[31]		69	PME1#	
70	AD[29]		70	PME3#	
71	GND		71	AD[30]	
72	AD[27]		72	+3.3V	
73	AD[25]		73	AD[28]	
74	+3.3V		74	AD[26]	
75	C/BE[3]#		75	GND	
76	AD[23]		76	AD[24]	

77	GND		77	AD[22]	
78	AD[21]		78	+3.3V	
79	AD[19]		79	AD[20]	
80	+3.3V		80	AD[18]	
81	AD[17]		81	GND	
82	C/BE[2]#		82	AD[16]	
83	GND		83	PCI-XCAP	
84	IRDY#		84	+3.3V	
85	+3.3V		85	FRAME#	
86	DEVSEL#		86	GND	
87	GND		87	TRDY#	
88	LOCK#		88	GND	
89	PERR#		89	STOP#	
90	+3.3V		90	+3.3V	
91	3.3V		91	SERR#	
92	C/BE[1]#		92	GND	
93	AD[14]		93	PAR	
94	GND		94	AD[15]	
95	AD[12]		95	+3.3V	
96	AD[10]		96	AD[13]	
97	M66EN		97	AD[11]	
98	GND		98	GND	
99	GND		99	AD[09]	
100	AD[08]		100	C/BE[0]#	
101	AD[07]		101	+3.3V	
102	+3.3V		102	AD[06]	
103	AD[05]		103	AD[04]	
104	AD[03]		104	GND	
105	GND		105	AD[02]	
106	AD[01]		106	AD[00]	
107	+3.3V		107	+3.3V	
108	ACK64#		108	REQ64#	
109	+5V		109	+5V	
110	+5V		110	+5V	
111	GND		111	C/BE[7]#	
112	C/BE[6]#		112	C/BE[5]#	
113	C/BE[4]#		113	GND	
114	GND		114	PAR64	
115	AD[63]		115	AD[62]	
116	AD[61]		116	3.3V	

117	3.3V		117	AD[60]	
118	AD[59]		118	AD[58]	
119	AD[57]		119	GND	
120	GND		120	AD[56]	
121	AD[55]		121	AD[54]	
122	AD[53]		122	3.3V	
123	GND		123	AD[52]	
124	AD[51]		124	AD[50]	
125	AD[49]		125	GND	
126	3.3V		126	AD[48]	
127	AD[47]		127	AD[46]	
128	AD[45]		128	GND	
129	GND		129	AD[44]	
130	AD[43]		130	AD[42]	
131	AD[41]		131	3.3V	
132	GND		132	AD[40]	
133	AD[39]		133	AD[38]	
134	AD[37]		134	GND	
135	3.3V		135	AD[36]	
136	AD[35]		136	AD[34]	
137	AD[33]		137	GND	
138	GND		138	AD[32]	
139	Type1	Type(1:0)	139	GND	
		(1U)00 = PCI-Express,			
		(1U)01 = PCI			
		(1U)10 = N/A			
		(1U)11 = N/A			
140	Type0	(2U)00=2xPCI-Express+PCI	140	Size	0=1U, 1=2U
		(2U)01=3x PCI			
		(2U)10=PXH 3 PCI-X			
		(2U)11=No Riser			
	Special Riser Signals				

7.3   I^{2}C Header

Table 20. HSBP Header Pin-out (J1D1)

Pin	Signal Name	Description
1	HR_SMB_5V_DAT	Data Line

Pin	Signal Name	Description
2	GND	GROUND
3	HR_SMB_5V_CLK	Clock Line
4	GND	GROUND

Table 21. LCD Header Pin-out (J1C1)

Pin	Signal Name	Description
1	HR_SMB_5V_DAT	Data Line
2	GND	GROUND
3	HR_SMB_5V_CLK	Clock Line
4	P5V_STBY	POWER

Table 22. LEGEND SE_LINK Header Pin-out (J2B1)

Pin	Signal Name	Description
1	MBMC_SMC_PHL_DAT	Data Line
2	GND	GROUND
3	MBMC_SMC_PHL_CLK	Clock Line
4	P5V_STBY	POWER
5	POST_STATUS_N	
6	FP_RST_BTN_N	
7	P5V	
8	FP_PWR_BTN_N	

7.4   Front Panel Connector

A standard SSI 34-pin header is provided to support a system front panel. The header contains reset, NMI, power control buttons, and LED indicators. The following table details the pin-out of this header.

Table 23. Front Panel 34-Pin Header Pin-out (J1J1)

Signal Name	Pin	Pin	Signal Name
P5V_STB	1	2	P5V_STB
KEY	3	4	P5V_STB
FP_PWR_LED_N	5	6	NC
P5V	7	8	P5V_STB
HDD_LED#	9	10	FP_STATUS_LED2_N
FP_PWR_BTN_N	11	12	LAN1_ACT_N
GND	13	14	LAN1_LINK_UP_N
FP_RST_BTN_N	15	16	MBMC_SMC_PHL5V_DAT
RESET switch (GND)	17	18	MBMC_SMC_PHL5V_CLK
NC	19	20	NC

Signal Name	Pin	Pin	Signal Name
GND	21	22	LAN2_ACT_N
NMI switch#	23	24	LAN2_LINK_UP_N
Key	25	26	Key
P5V_STB	27	28	P5V_STB
FP_ID_LED_N	29	30	FP_STATUS_LED1_N
FP_ID_BTN_N	31	32	P5V
GND	33	34	NC

Note: NC (No Connect) in this project

7.5 VGA Connector

The following table details the pin-out of the VGA connector. This connector is combined with COM1 connector.

Table 24. VGA Connector Pin-out (J8A1)

Signal Name	Pin	Pin	Signal Name
RED	B1	B9	Fused VCC (+5V)
GREEN	B2	B10	GND
BLUE	B3	B11	NC
NC	B4	B12	DDCDAT
GND	B5	B13	HSY
GND	B6	B14	VSY
GND	B7	B15	DDCCLK
GND	B8		

Note: NC (No Connect) in this project

7.6 NIC Connector

The Intel® Server Board SE7221BK1-E supports two NIC RJ45 connectors. The following tables detail the pin-out of the connector.

Table 25. NIC1-82541PI(10/100/1000) Connector Pin-out (J5A1)

Signal Name	Pin	Pin	Signal Name
LGND_LAN1	1	10	LAN1_TRDN3
LAN1_TRDP0	2	11	LAN1_LINK_UP_N
LAN1_TRDN0	3	12	LAN1_ACT_N
LAN1_TRDP1	4	LAN1_TRDP3	9
LAN1_TRDN1	5	13	LAN1_LINK100_N
P1V8_STB_LAN1	6	14	P3V3_STB
LAN1_TRDP2	7	15	LAN1_LINK1000_N
LAN1_TRDN2	8	16	LINK100_L

Table 26. NIC2-82541PI (10/100/1000) Connector Pin-out (J6A1)

Signal Name	Pin	Pin	Signal Name
P1V8_STB_LAN2	1	10	LAN2_TRDN0
LAN2_TRDN2	2	11	LAN2_TRDP0
LAN2_TRDP2	3	12	P1V8_STB_LAN2
LAN2_TRDP1	4	13	LAN2_LINK100_N
LAN2_TRDN1	5	14	LAN2_LINK1000_N
P1V8_STB_LAN2	6	15	LAN2_LINK_UP_N
P1V8_STB_LAN2	7	16	LAN2_ACT_N
LAN2_TRDP3	8	17	GND_CHASSIS

Signal Name	Pin	Pin	Signal Name
LAN2_TRDN3	9	18	GND_CHASSIS

7.7 IDE Connector

The board provides one 40-pin ATA-100 IDE connector.

Table 27. ATA 40-pin Connector Pin-out (J3J1)

Pin	Signal Name	Pin	Signal Name
1	RESET#	2	GND
3	IDE_DD7	4	IDE_DD8
5	IDE_DD6	6	IDE_DD9
7	IDE_DD5	8	IDE_DD10
9	IDE_DD4	10	IDE_DD11
11	IDE_DD3	12	IDE_DD12
13	IDE_DD2	14	IDE_DD13
15	IDE_DD1	16	IDE_DD14
17	IDE_DD0	18	IDE_DD15
19	GND	20	KEY
21	IDE_DMAREQ	22	GND
23	IDE_IOW#	24	GND
25	IDE_IOR#	26	GND
27	IDE_IORDY	28	GND
29	IDE_DMAACK#	30	GND
31	IRQ_IDE	32	Test Point
33	IDE_A1	34	DIAG
35	IDE_A0	36	IDE_A2
37	IDE_DCS0#	38	IDE_DCS1#
39	IDE_HD_ACT#	40	GND

7.8 SATA Connector

ICH6R integrated a SATA controller with four SATA ports output. The pin-out for these four connectors is listed below.

Table 28. SATA Connector Pin-out (J1G1, J1G2, J1J2, J2J1)

Pin	Signal Name
1	GND
2	SATA0_TX_P
3	SATA0_TX_N
4	GND
5	SATA0_RX_N
6	SATA0_RX_P
7	GND

7.9   USB Connector

The following table provides the pin-out for the dual external USB connectors. This connector is combined with a RJ45 (connected to COM2 signals).

Table 29. USB Connectors Pin-out (J5A1)

Pin	Signal Name
U1	GND
U2	USB_B5_P
U3	USB_B5_N
U4	VCC_USB5
U5	GND
U6	USB_B4_P
U7	USB_B4_N
U8	VCC_USB4

A header on the server board provides an option to support one additional USB connector. The pin-out of the header is detailed in the following table.

Table 30. Optional USB Connection Header Pin-out (J4F1)

Signal Name	Pin	Pin	Signal Name
Fused VCC (+5V /w over current monitor of both port 1)	1	2	Fused VCC (+5V /w over current monitor of both port 0)
USB_B2_N	3	4	USB_B1_N
USB_B2_P	5	6	USB_B1_P
GND	7	8	GND
Key	9	10	NC

7.10 Floppy Connector

The board provides a standard 34-pin interface to the floppy drive controller. The following tables detail the pin-out of the 34-pin floppy connector.

Table 31. Legacy 34-pin Floppy Connector Pin-out (JP3J1)

Signal Name	Pin	Pin	Signal Name
GND	1	2	FDDENSEL
GND	3	4	Unused
KEY	5	6	FDDRATE0
GND	7	8	FDINDEX#
GND	9	10	FDMTR0#
GND	11	12	FDR1#
GND	13	14	FDR0#

Signal Name	Pin	Pin	Signal Name
GND	15	16	FDMTR1#
Unused	17	18	FDDIR
GND	19	20	FDSTEP#
GND	21	22	FDWDATA#
GND	23	24	FDWGATE#
GND	25	26	FDTRK0#
Unused	27	28	FLWP#
GND	29	30	FRDATA#
GND	31	32	FHDSEL#
GND	33	34	FDSKCHG#

7.11 Serial Port Connector

Two serial ports are provided on the Intel® Server Board SE7221BK1-E.

- A standard, external DB9 serial connector is located on the back edge of the baseboard to supply a Serial A interface. This connector is combined with VGA connector (J8A1)
- A Serial B port is provided through a 9-pin header (J1B1) on the server board.

The following tables detail the pin-outs of these two ports.

Table 32. External DB9 Serial A Port Pin-out (J8A1)

Signal Name	Pin	Pin	Signal Name
DCD-P	T1	T6	DSR-P
RXD-P	T2	T7	RTS-P
TXD-P	T3	T8	CTS-P
DTR-P	T4	T9	RI-P
GND	T5		

Table 33. 9-pin Header Serial B Port Pin-out (J1B1)

Signal Name	Pin	Pin	Signal Name
DCDB	1	2	DSRB
RXDB	3	4	RTSB
TXDB	5	6	CTSB
DTRB	7	8	RIB
GND	9	10	Key

7.12 Keyboard and Mouse Connector

Two PS/2 ports are provided for use by a keyboard and a mouse. The following table details the pin-out of the PS/2 connectors.

Table 34. Keyboard and Mouse PS/2 Connectors Pin-out (KM9A1)

PS/2 Connectors	Pin	Signal Name
Keyboard	K1	RKBDATA
	K2	NC
	K3	GND
	K4	P5V_KB_MS
	K5	RKBCLK
	K6	NC
Mouse	M1	MSEDATA
	M2	NC
	M3	GND
	M4	P5V_KB_MS
	M5	RMSCLK
	M6	NC

7.13 Miscellaneous Headers

7.13.1 Fan Header

There are four 3-pin fan headers. (JP5J1, JP5J2, JP7A1, and JP6A1) These fan headers have the same pin-out and are detailed below.

Table 35. Three-pin Fan Headers Pin-out (JP5J1, JP5J2, JP7A1, JP6A1)

Pin	Signal Name	Type	Description
1	Ground	Power	GROUND is the power supply ground
2	Fan Power	Power	Fan Power with FAN_SPEED_CNTL1 (Fan speed control)
3	Fan Tach	Out	FAN_TACH signal is connected to the LM96000 to monitor the FAN speed.

There are also four 8-pin fan headers. (J6J1, J6J2, J6J3, J6J4) These fan headers have the same pin-out and are detailed below.

Table 36. Eight-pin Fan Header Pin-out (J6J1, J6J2, J6J3, and J6J4)

Pin	Signal Name	Type	Description
1	Fan Power	Power	Fan Power with FAN_SPEED_CNTL1 (Fan speed control)
2	Fan Tach	Out	FAN_TACH signal is connected to the Super IO/LM96000 to monitor the FAN speed.

3	Ground	Power	GROUND is the power supply ground
4	NC		
5	Ground	Power	GROUND is the power supply ground
6	Ground	Power	GROUND is the power supply ground
7	Fan Tach	Out	FAN_TACH signal is connected to the Super IO/LM96000 to monitor the FAN speed.
8	Fan Power	Power	Fan Power with FAN_SPEED_CNTL1 (Fan speed control)

7.13.2 Intrusion Cable Connector

Table 37. Intrusion Cable Connector (J1A1)Pin-Out

Pin	Signal Name
1	INTRUDER_N
2	GND

7.13.3 HDD LED Header

There is a 1x2 pin Header for HDD LED Connection. This jumper reserves for PCI add-in card which supports the SCSI or SATA interface with external HDD LED activity cable.

Table 38. HDD LED Header (J1E1) Pin-Out

Pin	Signal Name
1	HDD_LED_ACT_N
2	NC

7.13.4 Rolling BIOS selection header

There is a 1x3 pin Header that is used to configure the function of rolling BIOS. The figure below shows the jumper pins and their functions. The factory defaults are set to a primary BIOS mode for each function.

Table 39. HDD LED Header (J1E1) Pin-Out

Function	Pin – Pin	Function	Description
Rolling BIOS selection	1-2	*Primary BIOS (Default)*	Although some details of this feature are described within this manual, please refer to section 9.6.3 for complete details.
	2-3	Secondary BIOS	

8. Configuration Jumpers

This section describes configuration jumper options on the Intel® Server Board SE7221BK1-E.

8.1 System Recovery and Update Jumpers

An 11-pin (Key in pin 4, 8) Header (J1F2), located just beside the PCI Slot 1 connectors, provides a total of three 3-pin jumper blocks that are used to configure several system recovery and update options. The figure below shows the jumper pins and their functions. The factory defaults are set to a protected mode for each function.

Three jumpers are stored on six pins during normal operation. Please refer to below figure for the detail function.
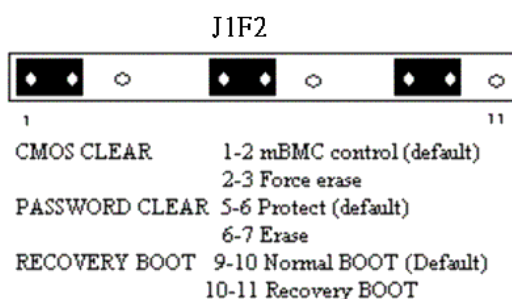
Figure 6. System Recovery and Update Jumpers (J1F2)

The following table describes each jumper option.

Table 40. System Recovery and Update Jumper Options

Function	Pin – Pin	Function	Description
CMOS CLEAR	1-2	***MBMC control***	These three pins are connected to GPIs of SUPER IO. The system BIOS reads these GPIs status and decides whether or not to execute related task. The clear CMOS status is reflected to ICH6. Defaults are in bold.
	2-3	Force erase	
PASSWORD CLEAR	5-6	***Protect***	
	6-7	Erase	
RECOVERY BOOT	9-10	***Normal BOOT***	
	10-11	Recovery BOOT	

9.   BIOS Setup Utility

The BIOS Setup utility is provided to perform system configuration changes and to display current settings and environment information.

The BIOS Setup utility stores configuration settings in system non-volatile storage. Changes affected by BIOS Setup will not take effect until the system is rebooted. The BIOS Setup Utility can be accessed when prompted during POST by using the F2 key.

9.1   Localization

The BIOS Setup utility uses the Unicode standard and is capable of displaying setup forms in English, French, Italian, German, and Spanish. BIOS supports these languages for console strings as well.

9.2   Console Redirection

BIOS Setup is functional via console redirection over various terminal standards emulation. This may limit some functionality for compatibility, e.g., usage of colors or some keys or key sequences or support of pointing devices.

9.3   Configuration Reset

There are different mechanisms for resetting the system configuration to default values. When a reset system configuration request is detected, the BIOS will load the default system configuration values during the next POST.

A reset system configuration request can be generated by moving the Clear CMOS jumper.

9.4   Keyboard Commands

The Keyboard Command Bar supports the following keys:

Table 41. BIOS Setup Keyboard Command Bar Options

Key	Option	Description
Enter	Execute Command	The Enter key is used to activate sub-menus when the selected feature is a sub-menu, or to display a pick list if a selected option has a value field, or to select a sub-field for multi-valued features like time and date. If a pick list is displayed, the Enter key will undo the pick list, and allow another selection in the parent menu.

Key	Option	Description
ESC	Exit	The ESC key provides a mechanism for backing out of any field. This key will undo the pressing of the Enter key. When the ESC key is pressed while editing any field or selecting features of a menu, the parent menu is re-entered.
		When the ESC key is pressed in any sub-menu, the parent menu is re-entered. When the ESC key is pressed in any major menu, the exit confirmation window is displayed and the user is asked whether changes can be discarded. If "No" is selected and the Enter key is pressed, or if the ESC key is pressed, the user is returned to where they were before ESC was pressed without affecting any existing any settings. If "Yes" is selected and the Enter key is pressed, setup is exited and the BIOS continues with POST.
↑	Select Item	The up arrow is used to select the previous value in a pick list, or the previous options in a menu item's option list. The selected item must then be activated by pressing the Enter key.
↓	Select Item	The down arrow is used to select the next value in a menu item's option list, or a value field's pick list. The selected item must then be activated by pressing the Enter key.
↔	Select Menu	The left and right arrow keys are used to move between the major menu pages. The keys have no affect if a sub-menu or pick list is displayed.
Tab	Select Field	The Tab key is used to move between fields. For example, Tab can be used to move from hours to minutes in the time item in the main menu.
-	Change Value	The minus key on the keypad is used to change the value of the current item to the previous value. This key scrolls through the values in the associated pick list without displaying the full list.
+	Change Value	The plus key on the keypad is used to change the value of the current menu item to the next value. This key scrolls through the values in the associated pick list without displaying the full list. On 106-key Japanese keyboards, the plus key has a different scan code than the plus key on the other keyboard, but will have the same effect.
F9	Setup Defaults	Pressing F9 causes the following to appear: **Load Setup Defaults?** **[<u>OK</u>]**　　**[Cancel]** If "OK" is selected and the Enter key is pressed, all setup fields are set to their default values. If "Cancel" is selected and the Enter key is pressed, or if the ESC key is pressed, the user is returned to where they were before F9 was pressed without affecting any existing field values.
F7	Discard Changes	Pressing F7 causes the following message to appear: **Discard Changes?** **[<u>OK</u>]**　　**[Cancel]** If "OK" is selected and the Enter key is pressed, all changes are not saved and setup is exited. If "Cancel" is selected and the Enter key is pressed, or the ESC key is pressed, the user is returned to where they were before F7 was pressed without affecting any existing values.

Key	Option	Description
F10	Save Changes and Exit	Pressing F10 causes the following message to appear: **Save configuration changes and exit setup?** **[OK] [Cancel]** If "OK" is selected and the Enter key is pressed, all changes are saved and setup is exited. If "Cancel" is selected and the Enter key is pressed, or the ESC key is pressed, the user is returned to where they were before F10 was pressed without affecting any existing values.

9.5 Entering BIOS Setup

The BIOS Setup utility is accessed by pressing the <F2> hotkey during POST.

9.5.1   Main Menu

The first screen displayed when entering the BIOS Setup Utility is the Main Menu selection screen. This screen displays the major menu selections available: The following tables describe the available options on the top level and lower level menus. Default values are shown in **bold** text.

Table 42. BIOS Setup, Main Menu Options

Feature	Options	Help Text	Description
System Overview	N/A	N/A	
AMIBIOS	N/A	N/A	
Version	N/A	N/A	BIOS ID string (excluding the build time and date)
Build Date	MM/DD/YY	N/A	BIOS build date
Processor	N/A	N/A	
Type	N/A	N/A	Processor brand ID string
Speed	N/A	N/A	Calculated processor speed
Count	N/A	N/A	Detected number of physical processors
System Memory	N/A	N/A	
Size	N/A	N/A	Amount of physical memory detected
System Time	HH:MM:SS	Use [ENTER], [TAB] or [SHIFT-TAB] to select a field. Use [+] or [-] to configure system time.	Configures the system time on a 24 hour clock. Default is 00:00:00
System Date	DAY MM/DD/YYYY	Use [ENTER], [TAB] or [SHIFT-TAB] to select a field. Use [+] or [-] to configure System date.	Configures the system date. Default is [Tue 01/01/2002]. Day of the week is automatically calculated.

Feature	Options	Help Text	Description
Language	**English** French German Italian Spanish	Use [ENTER], [Up Arrow], [Down Arrow] to select language.	Select the current default language used by BIOS.

9.5.2 Advanced menu

Table 43. BIOS Setup, Advanced Menu Options

Feature	Options	Help Text	Description
Processor Configuration	N/A	Configure processors.	Selects submenu.
IDE Configuration	N/A	Configure the IDE device(s).	Selects submenu.
Floppy Configuration	N/A	Configure the Floppy drive(s).	Selects submenu.
Super IO Configuration	N/A	Configure the Super I/O Chipset.	Selects submenu.
USB Configuration	N/A	Configure the USB support.	Selects submenu.
PCI Configuration	N/A	Configure PCI devices.	Selects submenu.
Memory Configuration	N/A	Configure memory devices.	Selects submenu.

9.5.2.1 Processor configuration sub-menu

Table 44. BIOS Setup, Processor configuration sub-menu options

Feature	Options	Help Text	Description
Manufacturer	Intel	N/A	Displays processor manufacturer string
Brand String	N/A	N/A	Displays processor brand ID string
Frequency	N/A	N/A	Displays the calculated processor speed
FSB Speed	N/A	N/A	Displays the processor front-side bus speed.
Cache L1	N/A	N/A	Displays cache L1 size.
Cache L2	N/A	N/A	Displays cache L2 size.
Cache L3	N/A	N/A	Displays cache L3 size. Visible only if the processor contains an L3 cache.
Processor Retest	Enabled **Disabled**	If enabled, all processors will be activated and retested on the next boot. This option will be automatically reset to disabled on the next boot.	Rearms the processor sensors. Only displayed if the Intel® Management Module is present.
Max CPUID Value Limit	Enabled **Disabled**	This should be enabled in order to boot legacy OSes that cannot support processors with extended CPUID functions.	

Feature	Options	Help Text	Description
Hyper-Threading Technology	**Enabled** Disabled	"ENABLE: Enable CPU Hyperthreading for HT enabled processor(s). DISABLE: Disable CPU Hyperthreading for HT enabled processor(s)." Controls Hyperthreading state. Primarily used to support older Operating Systems that do not support Hyperthreading.	Controls Hyper-Threading state. Primarily used to support older Operating Systems that do not support Hyper Threading.

9.5.2.2   IDE configuration sub-menu

Table 45. BIOS Setup IDE Configuration Menu Options

Feature	Options	Help Text	Description
ATA/IDE configuration	Disabled **Compatible** Enhanced	Disable:SATA and PATA controller will be disabled	Controls state of integrated S-ATA and P-ATAcontroller.
Legacy IDE Channel	SATA Only PATA Pri,SATA,Sec **SATA Pri,PATA,Sec** PATA Only	SATA Only:SATA controller enabled only. PATA Pri,SATA Sec:PATA controller is primary ,SATA is secondary SATA Pri,PATA Sec: SATA controller is primary ,PATA is secondary PATA Only:PATA controller enabled only.	This option will be hided when ATA/IDE configuration Disabled In compatible mode this item will be used.
Configure S-ATA as	**IDE** RAID AHCI		In Enhance mode this item will be showed
Stagger Spinup support	**Disabled** Enabled		This item showed when Configure S-ATA as RAID/AHCI
Primary IDE Master	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.
Primary IDE Slave	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.
Secondary IDE Master	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.

Feature	Options	Help Text	Description
Secondary IDE Slave	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.
Third IDE Master	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.
Third IDE Slave	N/A	While entering setup, BIOS auto detects the presence of IDE devices. This displays the status of auto detection of IDE devices.	Selects submenu with additional device details.
Hard Disk Write Protect	**Disabled** Enabled	Disable/Enable device write protection. This will be effective only if device is accessed through BIOS.	Primarily used to prevent unauthorized writes to hard drives.
IDE Detect Time Out (Sec)	0 5 10 15 20 25 30 **35**	Select the time out value for detecting ATA/ATAPI device(s).	Primarily used with older IDE devices with longer spin up times.
ATA(PI) 80Pin Cable Detection	**Host & Device** Host Device	Select the mechanism for detecting 80Pin ATA(PI) Cable.	

Table 46. BIOS Setup, IDE Device Configuration Sub-menu Selections

Feature	Options	Help Text	Description
Device	N/A	N/A	Display detected device info
Vendor	N/A	N/A.	Display IDE device vendor.
Size	N/A	N/A	Display IDE DISK size.
LBA Mode	N/A	N/A	Display LBA Mode
Block Mode	N/A	N/A	Display Block Mode
PIO Mode	N/A	N/A	Display PIO Mode
Async DMA	N/A	N/A	Display Async DMA mode
Ultra DMA	N/A	N/A	Display Ultra DMA mode.
S.M.A.R.T.	N/A	N/A	Display S.M.A.R.T. support.
Type	Not Installed **Auto** CDROM ARMD	Select the type of device connected to the system.	The Auto setting should work in most cases.
LBA/Large Mode	Disabled **Auto**	Disabled: Disables LBA Mode. Auto: Enabled LBA Mode if the device supports it and the device is not already formatted with LBA Mode disabled.	The Auto setting should work in most cases.

Feature	Options	Help Text	Description
Block (Multi-Sector Transfer)	Disabled **Auto**	Disabled: The Data transfer from and to the device occurs one sector at a time. Auto: The data transfer from and to the device occurs multiple sectors at a time if the device supports it.	The Auto setting should work in most cases.
PIO Mode	**Auto** 0 1 2 3 4	Select PIO Mode.	The Auto setting should work in most cases.
DMA Mode	**Auto** SWDMA0-2 MWDMA0-2 UWDMA0-5	Selcet DMA Mode. Auto :Auto detected SWDMA :SinglewordDMAn MWDMA :MultiwordDMAn UWDMA :UltraDMAn	The Auto setting should work in most cases.
S.M.A.R.T.	**Auto** Disabled Enabled	S.M.A.R.T. stands for Self-Monitoring, Analysis and Reporting Technology.	The Auto setting should work in most cases.
32Bit Data Transfer	**Disabled** Enabled	Enable/Disable 32-bit Data Transfer	

9.5.2.3 Floppy configuration sub-menu

Table 47. BIOS Setup, Floppy Configuration Sub-menu Selections

Feature	Options	Help Text	Description
Floppy A	Disabled **1.44 MB 3 1/2"**	Select the type of floppy drive connected to the system.	Note: Intel no longer validates 720 Kb & 2.88 Mb drives.
Onboard Floppy Controller	Disabled **Enabled**	Allows BIOS to Enable or Disable Floppy Controller.	

9.5.2.4 Super I/O configuration sub-menu

Table 48. BIOS Setup, Super I/O Configuration Sub-menu

Feature	Options	Help Text	Description
Serial Port1 Address	Disabled **3F8/IRQ4** 2F8/IRQ3 3E8/IRQ4 2E8/IRQ3	Allows BIOS to Select Serial Port1 Base Addresses.	Option that is used by other serial port is hidden to prevent conflicting settings.

| Serial Port 2 Address | Disabled
3F8/IRQ4
2F8/IRQ3
3E8/IRQ4
2E8/IRQ3 | Allows BIOS to Select Serial Port2 Base Addresses. | Option that is used by other serial port is hidden to prevent conflicting settings. |

9.5.2.5 USB configuration sub-menu

Table 49. BIOS Setup, USB Configuration Sub-menu Selections

Feature	Options	Help Text	Description
USB Devices Enabled	N/A	N/A	List of USB devices detected by BIOS.
USB Function	Disabled 2 USB ports **All Ports**	Enables USB HOST controllers.	When the item is disabled, Legacy USB Support, USB 2.0 Controller, and USB 2.0 Controller mode will all disappear.
Legacy USB Support	Disabled **Enabled** Auto	Enables support for legacy USB. AUTO option disables legacy support if no USB devices are connected.	
Port 64/60 Emulation	**Disabled** Enabled	Enables I/O port 60/64h emulation support. This should be enabled for the complete USB keyboard legacy support for non-USB aware OS.	
USB 2.0 Controller	**Enabled** Disabled	N/A	
USB 2.0 Controller mode	FullSpeed **HiSpeed**	Configures the USB 2.0 controller in HiSpeed (480 Mbps) or FullSpeed (12 Mbps).	When USB 2.0 Controller is disabled, it will disappear.
USB Mass Storage Device Configuration	N/A	Configures the USB Mass Storage Device Class.	Selects submenu with USB Device enable.

9.5.2.5.1 *USB mass storage device configuration sub-menu*

Table 50. BIOS Setup, USB Mass Storage Device Configuration Sub-menu Selections

Feature	Options	Help Text	Description
USB Mass Storage Reset Delay	10 Sec **20 Sec** 30 Sec 40 Sec	Number of seconds POST waits for the USB mass storage device after start unit command.	
Device #1	N/A	N/A	Only displayed, if a device is detected, includes a DeviceID string returned by the USB device.

Emulation Type	**Auto** Floppy Forced FDD Hard Disk CDROM	If Auto, USB devices less than 530 MB will be emulated as Floppy and remaining as hard drive. Forced FDD option can be user to force a HDD formatted drive to boot as FDD (Ex. ZIP drive).	
Device #n	N/A	N/A	Only displayed, if a device is detected. Includes a DeviceID string returned by the USB device.
Emulation Type	**Auto** Floppy Forced FDD Hard Disk CDROM	If Auto, USB devices less than 530 MB will be emulated as Floppy and remaining as hard drive. Forced FDD option can be user to force a HDD formatted drive to boot as FDD (Ex. ZIP drive).	

9.5.2.6   PCI configuration sub-menu

This sub-menu provides control over PCI devices and their option ROM's. If the BIOS is reporting POST error 146, use this menu to disable option ROM's that are not required to boot the system.

Table 51. BIOS Setup, PCI Configuration Sub-menu Selections

Feature	Options	Help Text	Description
Onboard Video	Disabled **Enabled**	Enable/Disable on board VGA Controller	
Onboard NIC 1	Disabled **Enabled**		
Onboard NIC 1 ROM	Disabled **Enabled**		
Onboard NIC 2	Disabled **Enabled**		
Onboard NIC 2 ROM	Disabled **Enabled**		
Slot 1 Option ROM	**Enabled** Disabled		PCI 32/33
Slot 4 Option ROM	**Enabled** Disabled		PCI-X 100Mhz
Slot 5 Option ROM	**Enabled** Disabled		PCI-X 100Mhz
Slot 6 Option ROM	**Enabled** Disabled		Super Slot

9.5.2.7   Memory configuration sub-menu

This sub-menu provides information about the DIMM's detected by BIOS. The DIMM number is
printed on the baseboard next to each device.

Table 52. BIOS Setup, Memory Configuration Sub-menu Selections

Feature	Options	Help Text	Description
DIMM_1A	Installed Not Installed		Informational display.
DIMM_1B	Installed Not Installed		Informational display.
DIMM_2A	Installed Not Installed		Informational display.
DIMM_2B	Installed Not Installed		Informational display.
Extended Memory Test	1 MB 1 KB Every Location **Disabled**	Settings for extended memory test	
Memory Retest	Enabled **Disabled**	If "Enabled", BIOS will activate and retest all DIMM's on the next system boot. This option will automactically reset to "Disabled" on the next system boot.	

9.5.3   Boot menu

Table 53. BIOS Setup, Boot Menu Selections

Feature	Options	Help Text	Description
Boot Settings Configuration	N/A	Configure settings during system boot.	Selects submenu.
Boot Device Priority	N/A	Specifies the boot device priority sequence.	Selects submenu.
Hard Disk Drives	N/A	Specifies the boot device priority sequence from available hard drives.	Selects submenu.
Removable Drives	N/A	Specifies the boot device priority sequence from available removable drives.	Selects submenu.
ATAPI CDROM Drives	N/A	Specifies the boot device priority sequence from available ATAPI CD-ROM drives.	Selects submenu.

9.5.3.1 Boot settings configuration sub-menu selections

Table 54. BIOS Setup, Boot Settings Configuration Sub-menu Selections

Feature	Options	Help Text	Description
Quick Boot	Disabled **Enabled**	Allows BIOS to skip certain tests while booting. This will decrease the time needed to boot the system.	
Quiet Boot	**Disabled** Enabled	Disabled: Displays normal POST messages. Enabled: Displays OEM Logo instead of POST messages.	
Bootup Num-Lock	**Off** On	Select power-on state for numlock.	
PS/2 Mouse Support	Disabled Enabled **Auto**	Select support for PS/2 mouse.	
POST Error Pause	Disabled **Enabled**	If enabled, the system will wait for user intervention on critical POST errors. If disabled, the system will boot with no intervention, if possible.	
Hit <F2> Message Display	Disabled **Enabled**	Displays "Press <F2> to run Setup" in POST.	
Scan User Flash Area	**Disabled** Enabled	Allows BIOS to scan the Flash ROM for user binaries.	

9.5.3.2 Boot device priority sub-menu selections

Table 55. BIOS Setup, Boot Device Priority Sub-menu Selections

Feature	Options	Help Text	Description
1st Boot Device	Varies	Specifies the boot sequence from the available devices. A device enclosed in parenthesis has been disabled in the corresponding type menu.	Number of entries will vary based on system configuration.
nth Boot Device	Varies	Specifies the boot sequence from the available devices. A device enclosed in parenthesis has been disabled in the corresponding type menu.	

9.5.3.2.1 Hard disk drive sub-menu selections

Table 56. BIOS Setup, Hard Disk Drive Sub-Menu Selections

Feature	Options	Help Text	Description
1st Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.
nth Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.

9.5.3.2.2   Removable drive sub-menu selections

Table 57. BIOS Setup, Removable Drives Sub-menu Selections

Feature	Options	Help Text	Description
1st Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.
nth Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.

9.5.3.2.3   ATAPI CDROM drives sub-menu selections

Table 58. BIOS Setup, ATAPI CDROM Drives Sub-menu Selections

Feature	Options	Help Text	Description
1st Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.
nth Drive	Varies	Specifies the boot sequence from the available devices.	Varies based on system configuration.

9.5.4   Chipset Menu

Table 59. BIOS Setup, ATAPI CDROM Drives Sub-menu Selections

Feature	Options	Help Text	Description
North Bridge Configuration	N/A	Configure North Bridge features	Opens sub screen to configure NB
South Bridge Configuration	N/A	Configure South bridge features	Opens sub screen to configure SB
Intel PCI Express* – PCI-X configuration	N/A	Configure PXH device	Opens sub screen to configure PXH

System management sub-menu selections

9.5.4.1   North Bridge Chipset Configuration

Table 60. BIOS Setup, ATAPI CDROM Drives Sub-menu Selections

Feature	Options	Help Text	Description
DRAM Frequency	**AUTO** 333Mhz 400Mhz 533Mhz	DRAM frequency to be programmed	DRAM frequency selection
Configure DRAM Timing by SPD	Disabled **Enabled**	N/A	Whether to read the DRAM Timing paramaters from SPD or from User setup

Feature	Options	Help Text	Description
DRAM CAS# Latency	3, 2.5, **2**	Select CAS latency to be used	Greyed when DRAM timing programming are done using SPD. Selects the CAS latency value to be programmed when manual configuration of DRAM parameters are used.
DRAM RAS# to CAS# Delay	2 DRAM Clocks 3 DRAM Clocks 4 DRAM Clocks **5 DRAM Clocks**	Select RAS# to CAS# delay	Greyed when DRAM timing programming are done using SPD. RAS to CAS delay setting will be programmed into DRAM timing register when manual setting is selected
DRAM RAS# Precharge	2 DRAM Clocks 3 DRAM Clocks 4 DRAM Clocks **5 DRAM Clocks**	Select RAS# precharge	Greyed when DRAM timing programming are done using SPD. RAS# precharge setting will be programmed into DRAM timing register when manual setting is selected
DRAM RAS# Activate to Precharge	4 DRAM Clocks 5 DRAM Clocks 6 DRAM Clocks 7 DRAM Clocks 8 DRAM Clocks 9 DRAM Clocks 10 DRAM Clocks 11 DRAM Clocks 12 DRAM Clocks 13 DRAM Clocks 14 DRAM Clocks **15 DRAM Clocks**	Select RAS# Activate to precharge	Greyed when DRAM timing programming are done using SPD. RAS# activate to precharge setting will be programmed into DRAM timing register when manual setting is selected
Boots Grapchics Adapter priority	IGD **PCI/IGD**	Select which graphics controller to be used as primary boot device	IGD – Integrated Video has more priority PCI/IGD – Offboard video has more priority
Internal Graphics Mode Select	Disabled Enabled, 1MB **Enabled, 8MB**	Select the amount of memory used by Internal Graphics device	Enabled / Disable internal graphics and Select the sieze of memory to be used

9.5.4.2   South Bridge Chipset Configuration

Table 61. BIOS Setup, ATAPI CDROM Drives Sub-menu Selections

Feature	Options	Help Text	Description
SLP_S4# Min Assertion	4-5 Seconds 3-4 Seconds 2-3 Seconds **1-2 Seconds**	Select Timing for SLP_S4# pin	SLP_S4# pin timing selection

PCI-EX Port Configuration	N/A	N/A	Title
VC1 for Root Port	**Disabled** Enabled	Enable / Disable VC1 feature	VC1 feature setting on PCI Express* Root port

9.5.4.3 PXH Bridge Configuration

Table 62. BIOS Setup, ATAPI CDROM Drives Sub-menu Selections

Feature	Options	Help Text	Description
PCI Bus frequency	**Auto** 33Mhz PCI 66Mhz PCI 66Mhz PCI-X M1 100Mhz PCI-X M1 133 Mhx PCI-X M1 66Mhz PCI-X M2 100Mhz PCI-X M2 133 Mhx PCI-X M2	Allows selection of the maximum PCI Bus speed to be programmed, default will always be set to Auto where Bus speed will be decided based on the capabilities of the device on the Bus.	Select Bus speed and operating frequency of bus coming out PXH
IO Port Decode	**4K Decode** 1K Decode	Select the decode range for IO	IO decode range
RAS Sticky error handling	**Clear Errors** Leave Errors	Select the method of handling for sticky RAS errors	RAS errors handing method selection
VGA 16 Bit decode	Disabled **Enabled**	Enabled/Disable decoding of VGA for devices behind PXH	

9.5.5 Security menu

Table 63. BIOS Setup, Security Menu Options

Feature	Options	Help Text	Description
Administrator Password is	N/A	Install / Not installed	Informational display.
User Password is	N/A	Install / Not installed	Informational display.
Set Admin Password	N/A	Set or clear Admin password	Set password to null to clear.
Set User Password	N/A	Set or clear User password	This node is grayed out until Admin password is installed. Set password to null to clear.
User Access Level	No Access View Only Limited **Full Access**	LIMITED: Allows only limited fields to be changed such as Date and Time. NO ACCESS: Prevents User access to the Setup Utility. VIEW ONLY: Allows access to the Setup Utility but the fields can not be changed.	This node is grayed out and becomes active only when Admin password is set.

Feature	Options	Help Text	Description
Clear User Password	N/A	Immediately clears the user password.	Admin uses this option to clear User password (Admin password is used to enter setup is required). This node is hidden if Administrator password is not installed.
Fixed disk boot sector protection	**Disabled** Enabled	Enable/Disable Boot Sector Virus Protection.	
Password On Boot	**Disabled** Enabled	If enabled, requires password entry before boot.	This node is grayed out if a password is not installed.
Secure Mode Timer	**1 minute** 2 minutes 5 minutes 10 minutes 20 minutes 60 minutes 120 minutes	Period of key/PS/2 mouse inactivity specified for Secure Mode to activate. A password is required for Secure Mode to function. Has no effect unless at least one password is enabled.	This node is grayed out if a password is not installed.
Secure Mode Hot Key (Ctrl-Alt-)	[Z] **[L]**	Key assigned to invoke the secure mode feature. Cannot be enabled unless at least one password is enabled. Can be disabled by entering a new key followed by a backspace or by entering delete.	This node is grayed out if a password is not installed.
Secure Mode Boot	**Disabled** Enabled	When enabled, allows the host system to complete the boot process without a password. The keyboard will remain locked until a password is entered. A password is required to boot from diskette.	This node is grayed out if a password is not installed.
Front Panel Switch Inhibit	**Disabled** Enabled	Disables the Power Switch and the Reset Switch when Secure mode is activated. A password is required to unlock the system. This cannot be enabled unless at least one password is enabled. This option is only present if the system includes an embedded video controller.	This node is grayed out if a password is not installed.
NMI Control	**Disabled** Enabled	Enable / disable NMI control through mBMC for the front panel NMI button.	Password is not required for this option.

9.5.6   Server menu

Table 64. BIOS Setup, Server Menu Selections

Feature	Options	Help Text	Description
System management	N/A	N/A	Selects submenu.
Serial Console Features	N/A	N/A	Selects submenu.
Event Log configuration	N/A	Configures event logging.	Selects submenu.

Feature	Options	Help Text	Description
Assert NMI on PERR	Disabled **Enabled**	If enabled, NMI is generated. SERR option needs to be enabled to activate this option.	
Assert NMI on SERR	Disabled **Enabled**	If enabled, NMI is generated on SERR and logged.	
Resume on AC Power Loss	**Stays Off** Power On	Determines the mode of operation if a power loss occurs. Stays off, the system will remain off once power is restored. Power On, boots the system after power is restored.	
Late POST Timeout	**Disabled** 5 minutes 10 minutes 15 minutes 20 minutes	This controls the time limit for add-in card detection. The system is reset on timeout.	
Hard Disk OS Boot Timeout	**Disabled** 5 minutes 10 minutes 15 minutes 20 minutes	This controls the time limit allowed fo booting an operating system from a Hard disk drive. The action taken on timeout is determined by the OS Watchdog Timer policy setting.	
PXE OS Boot Timeout	**Disabled** 5 minutes 10 minutes 15 minutes 20 minutes	This controls the time limit allowed for booting an operating system using PXE boot. The action taken on timeout is determined by OS Watchdog Timer policy setting.	
OS Watchdog Timer Policy	**Stay On** Reset Power Off	Controls the policy upon timeout. Stay on action will take no overt action. Reset will force the system to reset. Power off will force the system to power off.	
Platform Event Filtering	**Enabled** Disabled	Disable trigger for system sensor events inside BMC.	Applicable for all BMCs.

9.5.6.1 System management sub-menu selections

Table 65. BIOS Setup, System Management Sub-menu Selections

Feature	Options	Help Text	Description
Board Part Number:	N/A	N/A	Field contents varies
Board Serial Number	N/A	N/A	Field contents varies
System Part Number	N/A	N/A	Field contents varies
System Serial Number	N/A	N/A	Field contents varies
Chassis Part Number	N/A	N/A	Field contents varies
Chassis Serial Number	N/A	N/A	Field contents varies
BIOS Version	N/A	N/A	BIOS ID string (excluding the build time and date).
BMC Device ID	N/A	N/A	Field contents varies
BMC Firmware Revision	N/A	N/A	Field contents varies
BMC Device Revision	N/A	N/A	Field contents varies

PIA Revision	N/A	N/A	Field contents varies
SDR Revision	N/A	N/A	Field contents varies

9.5.6.2 Serial Console features sub-menu selections

Table 66. BIOS Setup Serial Console Features Sub-menu Selections

Feature	Options	Help Text	Description
BIOS Redirection Port	**Disabled** Serial 1 Serial 2	If enabled, BIOS uses the specified serial port to redirect the console to a remote ANSI terminal. Enabling this option disables Quiet Boot.	
Baud Rate	9600 **19.2K** 38.4K 57.6K 115.2K	N/A	
Flow Control	No Flow Control **CTS/RTS** XON/XOFF CTS/RTS + CD	If enabled, it will use the Flow control selected. CTS/RTS = Hardware XON/XOFF = Software CTS/RTS + CD = Hardware + Carrier Detect for modem use.	
Terminal Type	PC-ANSI **VT100+** VT-UTF8	VT100+ selection only works for English as the selected language. VT-UTF8 uses Unicode. PC-ANSI is the standard PC-type terminal.	

9.5.6.3 Event Log configuration sub-menu selections

Table 67. BIOS Setup, Event Log Configuration Sub-menu Selections

Feature	Options	Help Text	Description
Clear All Event Logs	**Disabled** Enabled	Setting this to Enabled will clear the DMI event log after system booting.	
Event Logging	Disabled **Enabled**	Select enabled to allow logging of events.	Allow records to be sent to SEL.
Critical Event Logging	Disabled **Enabled**	If enabled, BIOS will detect and log events for system critical errors. Critical errors are fatal to system operation. These errors include PERR, SERR, ECC.	Enable SMM handlers to detect and log events to SEL.

Feature	Options	Help Text	Description
ECC Event Logging	**Disabled** Enabled	Enables or Disables ECC Event Logging.	Grayed out if "Critical Event Logging" option is disabled.
PCI Error Logging	**Disabled** Enabled	Enables or Disables PCI Error Logging.	Grayed out if "Critical Event Logging" option is disabled.

9.5.7 Exit menu

Table 68. BIOS Setup, Exit Menu Selections

Feature	Options	Help Text
Save Changes and Exit	N/A	Exit system setup after saving the changes. F10 key can be used for this operation.
Discard Changes and Exit	N/A	Exit system setup without saving any changes. ESC key can be used for this operation.
Discard Changes	N/A	Discards changes done so far to any of the setup questions. F7 key can be used for this operation.
Load Setup Defaults	N/A	Load Setup Default values for all the setup questions. F9 key can be used for this operation.
Load Custom Defaults	N/A	Load custom defaults.
Save Custom Defaults	N/A	Save custom defaults

9.6 Upgrading the BIOS

9.6.1 Preparing for the Upgrade

Before you upgrade the BIOS, prepare for the upgrade by recording the current BIOS settings, obtaining the upgrade utility, reviewing the release notes, and making a copy of the current BIOS.

9.6.1.1 Recording the Current BIOS Settings

1. Boot the computer and press <F2> when you see the message:

```
Press <F2> Key if you want to run SETUP
```

2. Write down the current settings in the BIOS Setup program or go to the Exit menu and choose to "Save Custom Defaults".

Note: **Do not skip step 2. You will need these settings to configure your computer at the end of the procedure.**

If you chose to "Save Custom Defaults," after the new BIOS is flashed, you can restore your settings from the "Load Custom Default" option.

9.6.1.2 Obtaining the Upgrade Utility

You can upgrade to a new version of the BIOS using the new BIOS files and the BIOS upgrade utility. You can obtain the BIOS upgrade file and the utility from the Intel Customer Support Web site: http://support.intel.com/support/motherboards/server/SE7221BK1-E.

9.6.1.3 Creating a Bootable Diskette

1. Use a DOS system to create the diskette.

2. Insert a diskette in diskette drive A.

3. At the C:\ prompt, for an unformatted diskette, type:

   ```
   format a:/s
   ```

   or, for a diskette that has already been formatted, type:

   ```
   sys a:
   ```

4. Press <Enter>.

9.6.1.4 Flash Update Utility

The BIOS flash utility suite is compatible with DOS, WIN NT 4.0 / 2000 / XP, and LINUX operating environments.
The afuXXX AMI Firmware Update Utilities are required for BIOS updates.

[1] In DOS
1.The flash bootable disk must have ROM image and afudos.
2.Enter in DOS.
3. Run AFUDOS /i<ROM filename> [/n] [/p[b][n][c]].
 [2] In WIN NT 4.0 / 2000 / XP
        1. The flash disk must have ROM image, AMIFLDRV.SYS and AFUWIN.EXE.
        2. Enter in WIN NT 4.0 / 2000 / XP.
        3. Run command AFUWIN /i<ROM filename> [/n] [/p[b][n][c]].
[3] In LINUX
        1.The flash disk must have ROM image and AFULNX.
        2.Enter in linux and include floppy device.
        3.Run command ./afulnx /i<ROM filename> [/n] [/p[b][n][c]].

[4] In EFI Shell
    1. The flash disk must have ROM image and AFUEFI.
    2. Boot to EFI Shell with the flash disk.
    3. Do a map -r to obtain the file system on the disk.
    4. Change drive to the flash disk. E.g., if the flash disk is fs0:, type fs0: at the prompt.

Run command afuefi [/n] [/p[b][n][c]] <ROM filename> to perform the update.

The afuXXX utilities format and usage:
afuXXX /i<ROM filename> [/n] [/p[b][n][c]] [/r<registry_path>] [/s] [/k] [/q] [/h]

> /n   - don't check ROM ID
> /pbnc -
> > b - Program Boot Block
> > n - Program NVRAM
> > c - Destroy System CMOS
> /r   - registry path to store result of operation (only for Windows version)
> /k   - Program non-critical block only
> /s   - leave signature in BIOS
> /q   - silent execution
> /h   - print help

9.6.2   Flash Architecture and Flash Update Utility

The flash ROM contains system initialization routines, the BIOS Setup Utility, and runtime support routines. The exact layout is subject to change, as determined by Intel. A 64 KB user block is available for user ROM code or custom logos. The flash ROM also contains initialization code in compressed form for on-board peripherals, like SCSI, NIC and video controllers. The flash ROM also contains support for the Rolling single boot BIOS update feature.

The complete ROM is visible, starting at physical address 4 GB minus the size of the flash ROM device. The Flash Memory Update utility loads the BIOS image minus the recovery block to the secondary flash partition, and notifies the BIOS that this image should be used on the next system re-boot. Because of shadowing, none of the flash blocks are visible at the aliased addresses below 1 MB.

9.6.3   Rolling BIOS and On-line updates

The Online Update nomenclature refers to the ability to update the BIOS while the server is online, in operation, as opposed to having to put the server out of operation while doing a BIOS update. The Rolling BIOS nomenclature refers to the capability for having two copies of BIOS, viz. the one in use, and the other to which an updated BIOS version can be written. When ready, the system can roll forward to the new BIOS. In case of a failure with the new version, the system can roll back to the previous version.

While the exact nature of hardware changes for the support of on-line update / rolling BIOS are out of scope of this document, BIOS relies on specialized hardware and additional flash space for this. Flash is divided into two partitions, viz. primary and secondary. The active partition from which the system boots shall be referred to as the primary partition. The AMI FLASH update suite and Intel On-line updates preserve the existing BIOS image on the primary partition. BIOS updates are diverted to the secondary partition. After the update, a notification flag will be set. During the subsequent boot following BIOS update, system will continue to attempt to boot from primary BIOS partition. On determining that a BIOS update occurred in the previous boot, system will attempt to boot the new BIOS. If a failure happens, specialized hardware will switch back to the BIOS on the other partition, thus affecting a "Roll Back".

9.6.3.1 Recovery Mode

Three conditions can cause the system to enter recovery mode. Pressing a hot-key, setting the recovery jumper, and damage to both partitions of the ROM image will cause the system to enter recovery and update System ROM without the boot-block.

- **BIOS Recovery**
  The recovery disk must include the BIOS image file AMIBOOT.ROM. The 2 MB AMIBOOT.ROM file may be used on a 2.88MB floppy media (to go with a 2.88 MB legacy or USB floppy device), a USB mass storage device (i.e. a USB disk on key, must be USB 1.1 or 2.0 compliant), a USB CDROM (USB 1.1 or 2.0 compliant), an ATAPI mass storage device, or an ATAPI CDROM or DVD.
  The recovery mode procedure is as follows:
    1) Insert the Recovery media with AMIBOOT.ROM into the system as appropriate based on whatever device is used.
    2) Power on system, and when progress code E9 is displayed on port 80h,the system will detect the disk.(if there is no image file present, the system will cycle through progress code F1 to EF.)
    3) When F3 is displayed on port 80h, the system will read the BIOS image file.
    4) The screen will display flash progress and show if NVRAM and CMOS have been destroyed.
    5) When recovery mode is complete, the system will halt and the system can be powered off.

  NOTE: There are three different hot-keys that can be invoked:
      <Ctrl+Home> - Recovery with CMOS destroyed and NVRAM preserved.
      <Ctrl+PageDown> - Recovery with both CMOS and NVRAM preserved.
      <Ctrl+PageUp> - Recovery with both CMOS and NVRAM destroyed.

- **Multi-Disk Recovery**
  With this new feature the System Recovery can be made from Multiple Floppy Disks to support ROM image greater than 1MB.

  Usage:
      1) Use the SPLIT.EXE utility to split the ROM image.
      Execute the following command at the command prompt:

  split <File Name To Be Split> <New File Name> <File Size in KB>

  For Example:
  C:\split AMIBOOT.ROM AMIBOOT 1024

      2) The above command will create the files of sizes 1MB each (1024 KB) with names AMIBOOT.000, AMIBOOT.001... and so on, depending upon the AMIBOOT.ROM file size.

      3) Load the first disk AMIBOOT.000

4) After reading the file it increments the file extension and then searches for AMIBOOT.001 in the same floppy.

5) If doesn't find the file in the floppy it will beep for once (1sec) and search again.

6) If it finds the first file and if it needs more files it will increment the file extension and searches again for AMIBOOT.002 this time it beeps 2 times (each beep 1sec long and with 0.5sec gap)

7) This continues until the total file size read is equal to the ROM image size.

Summary of Beep codes

Beep Code List:
This uses the standard beep codes used by AMI Core8 for Recovery with some additional codes. They are… (each beep is 1sec long with 0.5sec gap)
1) 1 long beep   Insert for AMIBOOT.001 File
2) 2 long beeps   Insert for AMIBOOT.002 File
3) 3 long beeps   Insert for AMIBOOT.003 File

Limitations:
1) Maximum Files supported 1000 files (AMIBOOT.000 to AMIBOOT.999)

- **Manually Recovering the BIOS**
  A BIOS recovery can also be manually initiated. This option would be used only when the BIOS is corrupt, but the ROM checksum error does not occur during POST. To manually initiate a BIOS recovery, use the following steps:

  1) Power down and unplug the system from the AC power source.

  2) Move the recovery jumper at J1F2 from the storage position at pins 9 and 10 to cover pins 10 and 11. See the figure below.

  3) Insert the Crisis Recovery Diskette into the A: diskette drive.

  4) Plug the system into the AC power source and power it on.

  5) A blue screen will be displayed and the recovery process will automatically run. The system will continue to beep throughout the recovery process. The recovery process is complete when the beeping stops.

  6) Remove the diskette.

  7) Power down and unplug the system from the AC power source.

  8) Move the BIOS recovery jumper at J1F2 back to the original position, covering storage pins 9 and 10.

9) Plug the system into the AC power source and power it up to confirm that the recovery was successful.
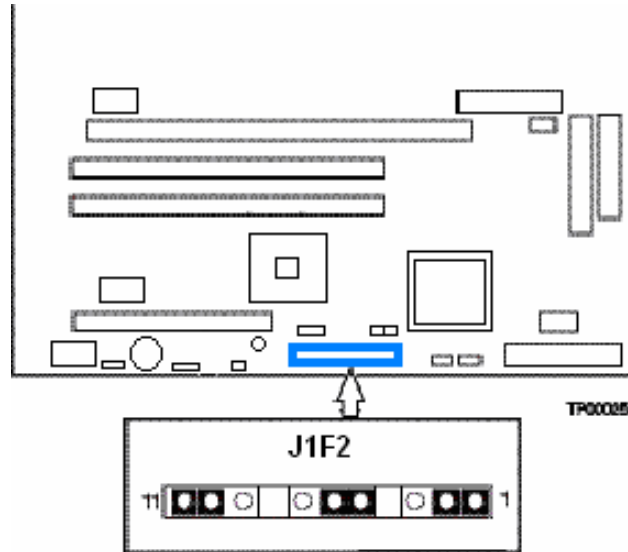
Figure 7. BIOS Recovery Jumper

9.7   Error Handling and Reporting

9.7.1   POST Error Beep Codes

Table 69. POST Error Beep Codes

Beeps	Error Message	POST Progress Code	Description
1	Fatal error		System halted because of an unspecified fatal error that was detected.
2	Processor error		System halted because a fatal error related to a processor was detected.
3	Memory error		System halted because a fatal error related to the memory was detected.
4	Motherboard error		System halted because a fatal error related to the system motherboard hardware was detected.

Table 70. BIOS Recovery Beep Codes

Beeps	Error Message	POST Progress Code	Description
1	Recovery Started	E9h	Start of recovery process
2	Recovery Boot Error	Flashing series of POST codes: EFh, FAh, FBh, F4h, FCh, FDh, FFh	Unable to boot to floppy, ATAPI, or ATAPI CD-ROM. Recovery process will retry.
Series of long low-pitched single beeps	Recovery Failed	FDh	Unable to process valid BIOS recovery images. BIOS already passed control to operating system and flash utility.
2 long high-pitched beeps	Recovery Complete	FFh	BIOS recovery succeeded, ready for power-down, reboot.

9.7.2   BIOS Event Log

The BIOS will output the current boot progress codes on the video screen. Progress codes are 32 bit quantities plus optional data. The 32 bit numbers include Class, subclass and Operation information. Class and subclass point to the type of the hardware that is being initialized, where as the Operation field represents the specific initialization activity. Based upon the data bit availability to display Progress Code, a progress code can be customized to fit the data width. The higher the data bit, higher the granularity of information, which could send on the progress port. The progress codes may be reported by system BIOS or option ROMs.

The Response section in following table is divided in 3 different types:
*   **Warning** – The message is displayed on screen and error is logged in SEL. System will continue booting with degraded state. User may want to replace erroneous unit
*   **Pause** – The message is displayed on screen and user input is required to continue. User can take immediate corrective action or can choose to continue booting.
*   **Halt** – System cannot boot unless error is resolved. User needs to replace faulty part and restart the system.

Table 71. POST Error Messages and Handling

Error Code	Error Message	Response
100	Timer Error	Warning
103	CMOS Battery Low	Warning
104	CMOS Settings Wrong	Warning
105	CMOS Checksum Bad	Warning
10B	CMOS memory size different	Warning
112	CMOS time not set	Warning
140	Refresh timer test failed	Halt
141	Display memory test failed	Warning
142	CMOS Display Type Wrong	Pause
147	Unknown BIOS error. Error code = 147 (this is really a PMM_MEM_ALLOC_ERR)	Halt
148	Password check failed	Halt
149	Unknown BIOS error. Error code = 149 (this is really SEGMENT_REG_ERR)	Halt
14A	Unknown BIOS error. Error code = 14A (this is really ADM_MODULE_ERR)	Warning
14B	Unknown BIOS error. Error code = 14B (this is really	Warning

Error Code	Error Message	Response
	LANGUAGE_MODULE_ERR)	
14D	Primary Master Hard Disk Error	Pause
14E	Primary Slave Hard Disk Error	Pause
14F	Secondary Master Hard Disk Error	Pause
150	Secondary Slave Hard Disk Error	Pause
151	Primary Master Drive - ATAPI Incompatible	Pause
152	Primary Slave Drive - ATAPI Incompatible	Pause
153	Secondary Master Drive - ATAPI Incompatible	Pause
154	Secondary Slave Drive - ATAPI Incompatible	Pause
8100	Processor failed BIST	Warning
8110	Processor Internal error (IERR)	Warning
8120	Processor Thermal Trip error	Warning
8160	Processor unable to apply BIOS update	Pause
8170	Processor L2 cache Failed	Pause
8180	BIOS does not support current stepping for Processor	Pause
8190	Watchdog Timer failed on last boot	Warning
8191	12:1 Core to bus ratio: Processor Cache disabled	Pause
8192	L2 Cache size mismatch	Pause
8193	CPUID, Processor Stepping are different	Pause
8194	CPUID, Processor Family are different	Pause
8195	Front Side Bus Speed mismatch. System Halted	Pause
8197	CPU Speed mismatch	Pause
8300	Baseboard Management Controller failed to function	Pause
8301	Front Panel Controller failed to Function	Pause
84F2	Server Management Interface Failed	Pause
84F3	BMC in Update Mode	Pause
84F4	Sensor Data Record Empty	Pause
84FF	System Event Log Full	Warning

9.7.3   POST Progress Codes and Messages

9.7.3.1 POST Code Checkpoints

Table 72. POST Code Checkpoints

Checkpoint	Description
03	Disable NMI, Parity, video for EGA, and DMA controllers. Initialize BIOS, POST, Runtime data area. Also initialize BIOS modules on POST entry and GPNV area. Initialized CMOS as mentioned in the Kernel Variable "wCMOSFlags."
04	Check CMOS diagnostic byte to determine if battery power is OK and CMOS checksum is OK. Verify CMOS checksum manually by reading storage area. If the CMOS checksum is bad, update CMOS with power-on default values and clear passwords. Initialize status register A. Initializes data variables that are based on CMOS setup questions. Initializes both the 8259 compatible PICs in the system

Checkpoint	Description
05	Initializes the interrupt controlling hardware (generally PIC) and interrupt vector table.
06	Do R/W test to CH-2 count reg. Initialize CH-0 as system timer. Install the POSTINT1Ch handler. Enable IRQ-0 in PIC for system timer interrupt.
	Traps INT1Ch vector to "POSTINT1ChHandlerBlock."
08	Initializes the CPU. The BAT test is being done on KBC. Program the keyboard controller command byte is being done after Auto detection of KB/MS using AMI KB-5.
C0	Early CPU Init Start -- Disable Cache - Init Local APIC
C1	Set up boot strap processor Information
C2	Set up boot strap processor for POST
C5	Enumerate and set up application processors
C6	Re-enable cache for boot strap processor
C7	Early CPU Init Exit
0A	Initializes the 8042 compatible Key Board Controller.
0B	Detects the presence of PS/2 mouse.
0C	Detects the presence of Keyboard in KBC port.
0E	Testing and initialization of different Input Devices. Also, update the Kernel Variables.
	Traps the INT09h vector, so that the POST INT09h handler gets control for IRQ1. Uncompress all available language, BIOS logo, and Silent logo modules.
13	Early POST initialization of chipset registers.
24	Uncompress and initialize any platform specific BIOS modules.
30	Initialize System Management Interrupt.
2A	Initializes different devices through DIM.
	See DIM Code Checkpoints section of document for more information.
2C	Initializes different devices. Detects and initializes the video adapter installed in the system that have optional ROMs.
2E	Initializes all the output devices.
31	Allocate memory for ADM module and uncompress it. Give control to ADM module for initialization. Initialize language and font modules for ADM. Activate ADM module.
33	Initializes the silent boot module. Set the window for displaying text information.
37	Displaying sign-on message, CPU information, setup key message, and any OEM specific information.
38	Initializes different devices through DIM. See DIM Code Checkpoints section of document for more information.
39	Initializes DMAC-1 & DMAC-2.
3A	Initialize RTC date/time.
3B	Test for total memory installed in the system. Also, Check for DEL or ESC keys to limit memory test. Display total memory in the system.
3C	Mid POST initialization of chipset registers.
40	Detect different devices (Parallel ports, serial ports, and coprocessor in CPU, … etc.) successfully installed in the system and update the BDA, EBDA…etc.
50	Programming the memory hole or any kind of implementation that needs an adjustment in system RAM size if needed.
52	Updates CMOS memory size from memory found in memory test. Allocates memory for Extended BIOS Data Area from base memory.
60	Initializes NUM-LOCK status and programs the KBD typematic rate.
75	Initialize Int-13 and prepare for IPL detection.
78	Initializes IPL devices controlled by BIOS and option ROMs.

Checkpoint	Description
7A	Initializes remaining option ROMs.
7C	Generate and write contents of ESCD in NVRam.
84	Log errors encountered during POST.
85	Display errors to the user and gets the user response for error.
87	Execute BIOS setup if needed / requested.
8C	Late POST initialization of chipset registers.
8D	Build ACPI tables (if ACPI is supported)
8E	Program the peripheral parameters. Enable/Disable NMI as selected
90	Late POST initialization of system management interrupt.
A0	Check boot password if installed.
A1	Clean-up work needed before booting to OS.
A2	Takes care of runtime image preparation for different BIOS modules. Fill the free area in F000h segment with 0FFh. Initializes the Microsoft IRQ Routing Table. Prepares the runtime language module. Disables the system configuration display if needed.
A4	Initialize runtime language module.
A7	Displays the system configuration screen if enabled. Initialize the CPU's before boot, which includes the programming of the MTRR's.
A8	Prepare CPU for OS boot including final MTRR values.
A9	Wait for user input at config display if needed.
AA	Uninstall POST INT1Ch vector and INT09h vector. De-initializes the ADM module.
AB	Prepare BBS for Int 19 boot.
AC	End of POST initialization of chipset registers.
B1	Save system context for ACPI.
00	Passes control to OS Loader (typically INT19h).

9.7.3.2 Boot Block Initialization Code Checkpoints

The Boot Block initialization code sets up the chipset, memory and other components before system memory is available. The following table describes the type of checkpoints that may occur during the boot block initialization.

Table 73. Bootblock Initialization Code Checkpoints

Checkpoint	Description
Before D1	Early chipset initialization is done. Early super I/O initialization is done including RTC and keyboard controller. NMI is disabled.
D1	Perform keyboard controller BAT test. Check if waking up from power management suspend state. Save power-on CPUID value in scratch CMOS.
D0	Go to flat mode with 4GB limit and GA20 enabled. Verify the bootblock checksum.
D2	Disable CACHE before memory detection. Execute full memory sizing module. Verify that flat mode is enabled.

D3	If memory sizing module not executed, start memory refresh and do memory sizing in Bootblock code. Do additional chipset initialization. Re-enable CACHE. Verify that flat mode is enabled.
D4	Test base 512KB memory. Adjust policies and cache first 8MB. Set stack.
D5	Bootblock code is copied from ROM to lower system memory and control is given to it. BIOS now executes out of RAM.
D6	Both key sequence and OEM specific method is checked to determine if BIOS recovery is forced. Main BIOS checksum is tested. If BIOS recovery is necessary, control flows to checkpoint E0. See Bootblock Recovery Code Checkpoints section of document for more information.
D7	Restore CPUID value back into register. The Bootblock-Runtime interface module is moved to system memory and control is given to it. Determine whether to execute serial flash.
D8	The Runtime module is uncompressed into memory. CPUID information is stored in memory.
D9	Store the Uncompressed pointer for future use in PMM. Copying Main BIOS into memory. Leaves all RAM below 1MB Read-Write including E000 and F000 shadow areas but closing SMRAM.
DA	Restore CPUID value back into register. Give control to BIOS POST (ExecutePOSTKernel). See POST Code Checkpoints section of document for more information.

9.7.3.3   Boot Block Recovery Code Checkpoints

The Boot block recovery code gets control when the BIOS determines that a BIOS recovery needs to occur because the user has forced the update or the BIOS checksum is corrupt. The following table describes the type of checkpoints that may occur during the Bootblock recovery portion of the BIOS:

Table 74. Bootblock Recovery Code Checkpoints

Checkpoint	Description
E0	Initialize the floppy controller in the super I/O. Some interrupt vectors are initialized. DMA controller is initialized. 8259 interrupt controller is initialized. L1 cache is enabled.
E9	Set up floppy controller and data. Attempt to read from floppy.
EA	Enable ATAPI hardware. Attempt to read from ARMD and ATAPI CDROM.
EB	Disable ATAPI hardware. Jump back to checkpoint E9.
EF	Read error occurred on media. Jump back to checkpoint EB.
E9 or EA	Determine information about root directory of recovery media.
F0	Search for pre-defined recovery file name in root directory.
F1	Recovery file not found.

F2	Start reading FAT table and analyze FAT to find the clusters occupied by the recovery file.
F3	Start reading the recovery file cluster by cluster.
F5	Disable L1 cache.
FA	Check the validity of the recovery file configuration to the current configuration of the flash part.
FB	Make flash write enabled through chipset and OEM specific method. Detect proper flash part. Verify that the found flash part size equals the recovery file size.
F4	The recovery file size does not equal the found flash part size.
FC	Erase the flash part.
FD	Program the flash part.
FF	The flash has been updated successfully. Make flash write disabled. Disable ATAPI hardware. Restore CPUID value back into register. Give control to F000 ROM at F000:FFF0h.

9.7.3.4 DIM Code Checkpoints

The Device Initialization Manager Module gets control at various times during BIOS POST to initialize different BUSes. The following table describes the main checkpoints where the DIM module is accessed.

Table 75. DIM Code Checkpoints

Checkpoint	Description
2A	Initialize different buses and perform the following functions: Reset, Detect, and Disable (function 0); Static Device Initialization (function 1); Boot Output Device Initialization (function 2). Function 0 disables all device nodes, PCI devices, and PnP ISA cards. It also assigns PCI bus numbers. Function 1 initializes all static devices that include manual configured onboard peripherals, memory and I/O decode windows in PCI-PCI bridges, and noncompliant PCI devices. Static resources are also reserved. Function 2 searches for and initializes any PnP, PCI, or AGP video devices.
38	Initialize different buses and perform the following functions: Boot Input Device Initialization (function 3); IPL Device Initialization (function 4); General Device Initialization (function 5). Function 3 searches for and configures PCI input devices and detects if system has standard keyboard controller. Function 4 searches for and configures all PnP and PCI boot devices. Function 5 configures all onboard peripherals that are set to an automatic configuration and configures all remaining PnP and PCI devices.

9.7.3.5 ACPI Runtime Checkpoints

ACPI checkpoints are displayed when an ACPI capable operating system either enters or leaves a sleep state. The following table describes the type of checkpoints that may occur during ACPI sleep or wake events.

Table 76. ACPI Runtime Checkpoints

Checkpoint	Description

AC	First ASL check point. Indicates the system is running in ACPI mode.
AA	System is running in APIC mode.
01, 02, 03, 04, 05	Entering sleep state S1, S2, S3, S4, or S5.
10, 20, 30, 40, 50	Waking from sleep state S1, S2, S3, S4, or S5.

9.8 Diagnostic LEDs

All port 80 codes are displayed using the Diagnostic LEDs found on the back edge of the baseboard. The diagnostic LED feature consists of a hardware decoder and four dual color LEDs. During POST, the LEDs will display all normal POST codes representing the progress of the BIOS POST. Each code will be represented by a combination of colors from the four LEDs.

The LEDs are capable of displaying three colors: Green, Red, and Amber. The POST codes are divided into two nibbles, an upper nibble and a lower nibble. Each bit in the upper nibble is represented by a Red LED and each bit in the lower nibble is represented by a green LED. If both bits are set in the upper and lower nibbles then both Red and Green LEDs are lit, resulting in an Amber color. If both bits are clear, then the LED is off.

In the below example, BIOS sends a value of ACh to the Diagnostic LED decoder. The LEDs are decoded as follows:

- Red bits = 1010b = Ah
- Green bits = 1100b = Ch

Since the red bits correspond to the upper nibble and the green bits correspond to the lower nibble, the two are concatenated to be ACh.

Table 77. POST Progress Code LED Example

LEDs	Red	Green	Red	Green	Red	Green	Red	Green
Ach	1	1	0	1	1	0	0	0
Result	Amber		Green		Red		Off	
	MSB						LSB	

9.8.1 Diagnostic LED POST Progress Codes

Table 78. Boot Block POST Progress Codes

	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			Low	
10h	Off	Off	Off	R	The NMI is disabled. Start Power-on delay. Initialization code checksum verified.
11h	Off	Off	Off	A	Initialize the DMA controller, perform the keyboard controller BAT test, start memory refresh, and enter 4 GB flat mode.

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	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			**Low**	
12h	Off	Off	G	R	Get start of initialization code and check BIOS header.
13h	Off	Off	G	A	Memory sizing.
14h	Off	G	Off	R	Test base 512K of memory. Return to real mode. Execute any OEM patches and set up the stack.
15h	Off	G	Off	A	Pass control to the uncompressed code in shadow RAM. The initialization code is copied to segment 0 and control will be transferred to segment 0.
16h	Off	G	G	R	Control is in segment 0. Verify the system BIOS checksum. If the system BIOS checksum is bad, go to checkpoint code E0h. Otherwise, going to checkpoint code D7h.
17h	Off	G	G	A	Pass control to the interface module.
18h	G	Off	Off	R	Decompress of the main system BIOS failed.
19h	G	Off	Off	A	Build the BIOS stack. Disable USB controller. Disable cache.
1Ah	G	Off	G	R	Uncompress the POST code module. Pass control to the POST code module.
1Bh	A	R	Off	R	Decompress the main system BIOS runtime code.
1Ch	A	R	Off	A	Pass control to the main system BIOS in shadow RAM.
E0h	R	R	R	Off	Start of recovery BIOS. Initialize interrupt vectors, system timer, DMA controller, and interrupt controller.
E8h	A	R	R	Off	Initialize extra module if present.
E9h	A	R	R	G	Initialize floppy controller.
Eah	A	R	A	Off	Try to boot floppy diskette.
Ebh	A	R	A	G	If floppy boot fails, intialize ATAPI hardware.
Ech	A	A	R	Off	Try booting from ATAPI CD-ROM drive.
Eeh	A	A	A	Off	Jump to boot sector.
Efh	A	A	A	G	Disable ATAPI hardware.

Table 79. POST Progress Codes

	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			**Low**	
20h	Off	Off	R	Off	Uncompress various BIOS Modules
22h	Off	Off	A	Off	Verify password Checksum
24h	Off	G	R	Off	Verify CMOS Checksum.
26h	Off	G	A	Off	Read Microcode updates from BIOS ROM.
28h	G	Off	R	Off	Initializing the processors. Set up processor registers. Select least featured processor as the BSP.
2Ah	G	Off	A	Off	Go to Big Real Mode
2Ch	G	G	R	Off	Decompress INT13 module

	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			Low	
2Eh	G	G	A	Off	Keyboard Controller Test: The keyboard controller input buffer is free. Next, issuing the BAT command to the keyboard controller
30h	Off	Off	R	R	Keyboard/Mouse port swap, if needed
32h	Off	Off	A	R	Write Command Byte 8042: The initialization after the keyboard controller BAT command test is done. The keyboard command byte will be written next.
34h	Off	G	R	R	Keyboard Init: The keyboard controller command byte is written. Next, issuing the pin 23 and 24 blocking and unblocking commands
36h	Off	G	A	R	Disable and initialize 8259
38h	G	Off	R	R	Detect Configuration Mode, such as CMOS clear.
3Ah	G	Off	A	R	Chipset Initialization before CMOS initialization
3Ch	G	G	R	R	Init System Timer: The 8254 timer test is over. Starting the legacy memory refresh test next.
3Eh	G	G	A	R	Check Refresh Toggle: The memory refresh line is toggling. Checking the 15 second on/off time next
40h	Off	R	Off	Off	Calculate CPU speed
42h	Off	R	G	Off	Init interrupt Vectors: Interrupt vector initialization is done.
44h	Off	A	Off	Off	Enable USB controller in chipset
46h	Off	A	G	Off	Initialize SMM handler. Initialize USB emulation.
48h	G	R	Off	Off	Validate NVRAM areas. Restore from backup if corrupted.
4Ah	G	R	G	Off	Load defaults in CMOS RAM if bad checksum or CMOS clear jumper is detected.
4Ch	G	A	Off	Off	Validate date and time in RTC.
4Eh	G	A	G	Off	Determine number of micro code patches present
50h	Off	R	Off	R	Load Micro Code To All CPUs
52h	Off	R	G	R	Scan SMBIOS GPNV areas
54h	Off	A	Off	R	Early extended memory tests
56h	Off	A	G	R	Disable DMA
58h	G	R	Off	R	Disable video controller
5Ah	G	R	G	R	8254 Timer Test on Channel 2
5Ch	G	A	Off	R	Enable 8042. Enable timer and keyboard IRQs. Set Video Mode: Initialization before setting the video mode is complete. Configuring the monochrome mode and color mode settings next.
5Eh	G	A	G	R	Init PCI devices and motherboard devices. Pass control to video BIOS. Start serial console redirection.
60h	Off	R	R	Off	Initialize memory test parameters
62h	Off	R	A	Off	Initialize AMI display manager Module. Initialize support code for headless system if no video controller is detected.
64h	Off	A	R	Off	Start USB controllers in chipset
66h	Off	A	A	Off	Set up video parameters in BIOS data area.
68h	G	R	R	Off	Activate ADM: The display mode is set. Displaying the power-on message next.
6Ah	G	R	A	Off	Initialize language module. Display splash logo.
6Ch	G	A	R	Off	Display Sign on message, BIOS ID and processor information.
6Eh	G	A	A	Off	Detect USB devices

	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			Low	
70h	Off	R	R	R	Reset IDE Controllers
72h	Off	R	A	R	Displaying bus initialization error messages.
74h	Off	A	R	R	Display Setup Message: The new cursor position has been read and saved. Displaying the Hit Setup message next.
76h	Off	A	A	R	Ensure Timer Keyboard Interrupts are on.
78h	G	R	R	R	Extended background memory test start
7Ah	G	R	A	R	Disable parity and NMI reporting.
7Ch	G	A	R	R	Test 8237 DMA Controller: The DMA page register test passed. Performing the DMA Controller 1 base register test next
7Eh	G	A	A	R	Init 8237 DMA Controller: The DMA controller 2 base register test passed. Programming DMA controllers 1 and 2 next.
80h	R	Off	Off	Off	Enable Mouse and Keyboard: The keyboard test has started. Clearing the output buffer and checking for stuck keys. Issuing the keyboard reset command next
82h	R	Off	G	Off	Keyboard Interface Test: A keyboard reset error or stuck key was found. Issuing the keyboard controller interface test command next.
84h	R	G	Off	Off	Check Stuck Key Enable Keyboard: The keyboard controller interface test completed. Writing the command byte and initializing the circular buffer next.
86h	R	G	G	Off	Disable parity NMI: The command byte was written and global data initialization has completed. Checking for a locked key next
88h	A	Off	Off	Off	Display USB devices
8Ah	A	Off	G	Off	Verify RAM Size: Checking for a memory size mismatch with CMOS RAM data next
8Ch	A	G	Off	Off	Lock out PS/2 keyboard/mouse if unattended start is enabled.
8Eh	A	G	G	Off	Init Boot Devices: The adapter ROM had control and has now returned control to BIOS POST. Performing any required processing after the option ROM returned control.
90h	R	Off	Off	R	Display IDE mass storage devices.
92h	R	Off	G	R	Display USB mass storage devices.
94h	R	G	Off	R	Report the first set of POST Errors To Error Manager.
96h	R	G	G	R	Boot Password Check: The password was checked. Performing any required programming before Setup next.
98h	A	Off	Off	R	Float Processor Initialize: Performing any required initialization before the coprocessor test next.
9Ah	A	Off	G	R	Enable Interrupts 0,1,2: Checking the extended keyboard, keyboard ID, and NUM Lock key next. Issuing the keyboard ID command next
9Ch	A	G	Off	R	Init FDD Devices. Report second set of POST errors To Error messager
9Eh	A	G	G	R	Extended background memory test end
A0h	R	Off	R	Off	Prepare And Run Setup: Error manager displays and logs POST errors. Waits for user input for certain errors. Execute setup.
A2h	R	Off	A	Off	Set Base Expansion Memory Size
A4h	R	G	R	Off	Program chipset setup options, build ACPI Tables, build INT15h E820h table
A6h	R	G	A	Off	Set Display Mode
A8h	A	Off	R	Off	Build SMBIOS table and MP tables.
Aah	A	Off	A	Off	Clear video screen.

	Diagnostic LED Decoder G=Green, R=Red, A=Amber				Description
	Hi			**Low**	
Ach	A	G	R	Off	Prepare USB controllers for operating system
Aeh	A	G	A	Off	One Beep to indicate end of POST. No beep if silent boot is enabled.
000h	Off	Off	Off	Off	POST completed. Passing control to INT 19h boot loader next.

10. Power Information

10.1 Intel® Server Board SE7221BK1-E Power Budget

The following table shows the power consumed on each supply line for the SE7221BK1-E baseboard that is configured with one processor (128W max). This configuration includes four 1 GB DDR2 DIMMs stacked burst at 70% max. The numbers provided in the table should be used for reference purposes only. Different hardware configurations will produce different numbers. The numbers in the table reflect a common usage model operating at a higher than average stress levels.

Table 80. The Board Power Budget

			Power Supply Rail Voltages						Units
		Watts	AMPS						
FUNCTIONAL UNIT	Utilization	Power	3.3V	5.V	12.V	12V VRM	-12v	5VSB	
BASEBOARD INPUT TOTALS		290.73W	6.26W	8.47W	6.38W	9.28W	0.05W	1.67	
BASEBOARD DISCRETE TOTALS	50%	32.02W	1.51	1.17	0.00	0.00	0.00	0.00	
BASEBOARD CONVERTERS	Efficiency	41.90W	3.24	7.29	0.00	9.28	0.00	1.67	
BASEBOARD CONFIG TOTATLS		246.80W	1.52	0.00	6.38	0.00	0.05	0.00	
SYSTEM COMPONENTS		45.12W	0.00	2.40	2.76	0.00	0.00	0.00	
SYSTEM TOTALS		335.85W	6.26	10.87	9.14	9.28	0.05	1.67	Amps
3.3v/5v combined power									
Power Supply Requirements – 1U		300W	14A	18A	Max 12V+ 12V VRM		0.5A	2A	

		350W peak							
3.3V/5V combined power		100W	1Amin	1Amin	2Amin	2Amin	0Amin	1Amin	
					12V + 12WRM max of 20A				

10.2 Power Supply Specifications

This section provides power supply design guidelines for the baseboard, including voltage and current specifications, and power supply on/off sequencing characteristics.

Table 81. The Board Power Supply Voltage Specification

PARAMETER	TOLERANCE	MIN	NOM	MAX	UNITS
+ 3.3V	- 5% / +5%	+3.14	+3.30	+3.46	Vrms
+ 5V	- 5% / +5%	+4.75	+5.00	+5.25	Vrms
+ 12V	- 5% / +5%	+11.40	+12.00	+12.60	Vrms
- 12V	- 10% / +10%	-11.40	-12.00	-13.08	Vrms
+ 5VSB	- 5% / +5%	+4.75	+5.00	+5.25	Vrms

10.2.1   Power Timing Requirements

These are the timing requirements for the power supply operation. The output voltages must rise from 10% to within regulation limits (Tvout_rise) within 5 to 70ms, except for 5VSB - it is allowed to rise from 1.0 to 70ms. The +3.3V, +5V and +12V output voltages should start to rise approximately at the same time**. All outputs must rise monotonically**. The +5V output needs to be greater than the +3.3V output during any point of the voltage rise. The +5V output must never be greater than the +3.3V output by more than 2.25V. Each output voltage shall reach regulation within 50ms (Tvout_on) of each other during turn on of the power supply. Each output voltage shall fall out of regulation within 400msec (Tvout_off) of each other during turn off. Refer to the table below for the timing requirements for the power supply being turned on and off via the AC input, with PSON held low and the PSON signal, with the AC input applied.

Table 82. Output Voltage Timing

Item	Description	MIN	MAX	UNITS
Tvout_rise	Output voltage rise time from each main output.	5.0 *	70 *	msec
Tvout_on	All main outputs must be within regulation of each other within this time.		50	msec
T vout_off	All main outputs must leave regulation within this time.		400	msec

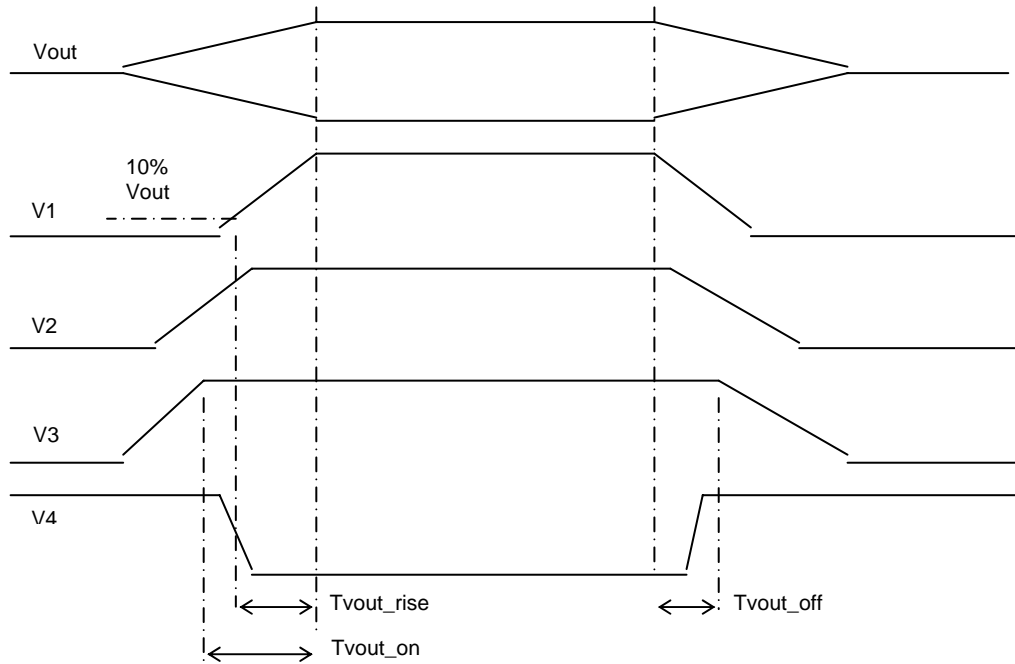- **The 5VSB output voltage rise time shall be from 1.0ms to 25.0ms**

Figure 8. Output Voltage Timing

Table 83. Turn On/Off Timing

Item	Description	MIN	MAX	UNITS
Tsb_on_delay	Delay from AC being applied to 5VSB being within regulation.		1500	msec
T ac_on_delay	Delay from AC being applied to all output voltages being within regulation.		2500	msec
Tvout_holdup	Time all output voltages stay within regulation after loss of AC.	21		msec
Tpwok_holdup	Delay from loss of AC to de-assertion of PWOK	20		msec
Tpson_on_delay	Delay from PSON# active to output voltages within regulation limits.	5	400	msec
T pson_pwok	Delay from PSON# deactive to PWOK being de-asserted.		50	msec
Tpwok_on	Delay from output voltages within regulation limits to PWOK asserted at turn on.	100	1000	msec

| T pwok_off	Delay from PWOK de-asserted to output voltages (3.3V, 5V, 12V, -12V) dropping out of regulation limits.	1	200	msec
Tpwok_low	Duration of PWOK being in the de-asserted state during an off/on cycle using AC or the PSON signal.	100		msec
Tsb_vout	Delay from 5VSB being in regulation to O/Ps being in regulation at AC turn on.	50	1000	msec
T5VSB_holdup	Time the 5VSB output voltage stays within regulation after loss of AC.	70		msec
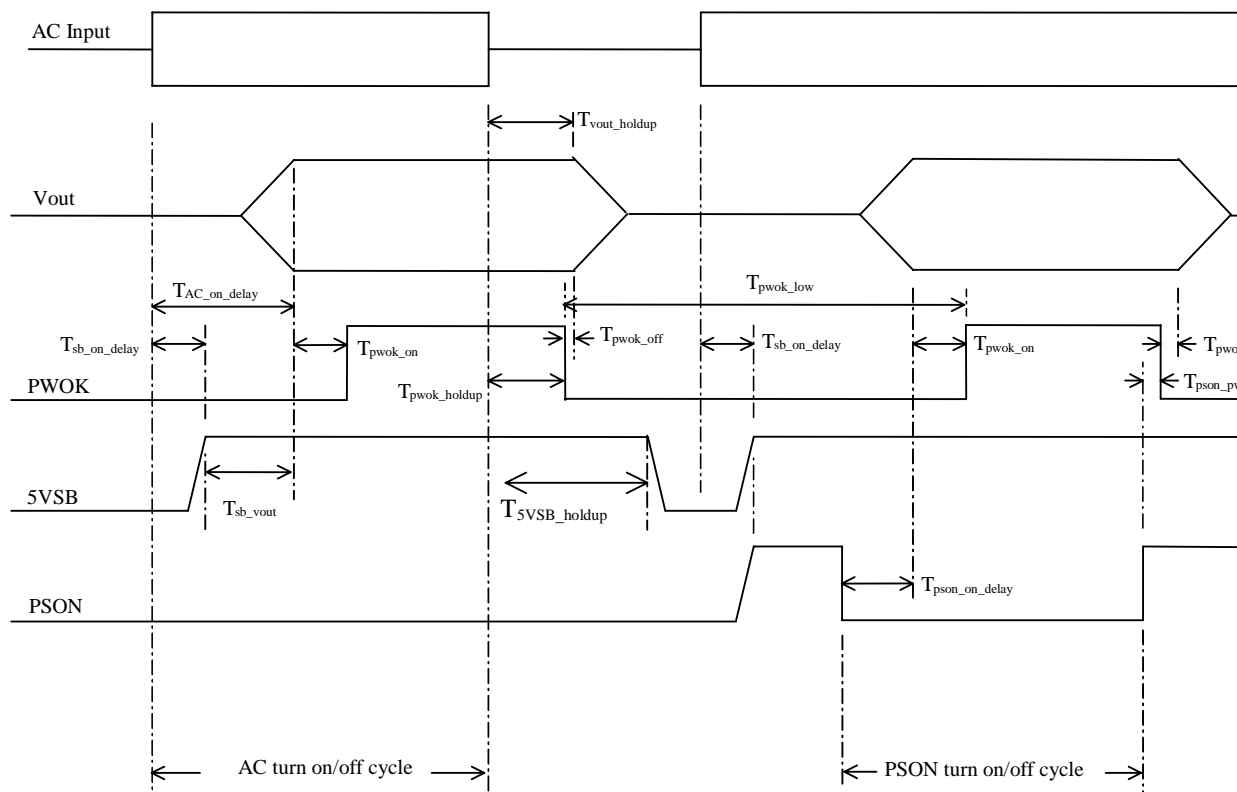
Figure 9. Turn On/Off Timing (Power Supply Signals)

10.2.2   Dynamic Loading

The output voltages shall remain within limits specified for the step loading and capacitive loading specified in the table below. The load transient repetition rate shall be tested between 50Hz and 5kHz at duty cycles ranging from 10%-90%. The load transient repetition rate is only a test specification. The Δ step load may occur anywhere within the MIN load to the MAX load conditions.

Table 84. Transient Load Requirements

Output	Δ Step Load Size (See note 2)	Load Slew Rate	Test capacitive Load

+3.3V	5.0A	0.25 A/μsec	250 μF
+5V	6.0A	0.25 A/μsec	400 μF
12V	9.0A	0.25 A/μsec	500 μF
+5VSB	0.5A	0.25 A/μsec	20 μF

Notes

1) Step loads on each 12V output may happen **simultaneously**.
2) For Load Range 2 (light system loading), the tested step load size should be 60% of those listed.

10.2.3   AC Line Transient Specification

AC line transient conditions shall be defined as "sag" and "surge" conditions. "Sag" conditions are also commonly referred to as "brownout", these conditions will be defined as the AC line voltage dropping below nominal voltage conditions. "Surge" will be defined to refer to conditions when the AC line voltage rises above nominal voltage.

The power supply shall meet the requirements under the following AC line sag and surge conditions.

Table 85. AC Line Sag Transient Performance

AC Line Sag				
Duration	Sag	Operating AC Voltage	Line Frequency	Performance Criteria
Continuous	10%	Nominal AC Voltage ranges	50/60Hz	No loss of function or performance
0 to 1 AC cycle	100%	Nominal AC Voltage ranges	50/60Hz	No loss of function or performance
> 1 AC cycle	>10%	Nominal AC Voltage ranges	50/60Hz	Loss of function acceptable, self recoverable

Table 86. AC Line Surge Transient Performance

AC Line Surge				
Duration	Surge	Operating AC Voltage	Line Frequency	Performance Criteria
Continuous	10%	Nominal AC Voltages	50/60Hz	No loss of function or performance
0 to ½ AC cycle	30%	Mid-point of nominal AC Voltages	50/60Hz	No loss of function or performance

10.2.4   AC Line Fast Transient (EFT) Specification

The power supply shall meet the *EN61000-4-5* directive and any additional requirements in *IEC1000-4-5:1995* and the Level 3 requirements for surge-withstand capability, with the following conditions and exceptions:

• These input transients must not cause any out-of-regulation conditions, such as overshoot and undershoot, nor must it cause any nuisance trips of any of the power supply protection circuits.

• The surge-withstand test must not produce damage to the power supply.

• The supply must meet surge-withstand test conditions under maximum and minimum DC-output load conditions.

11. Absolute Maximum Ratings

Operating the board at conditions beyond those shown in the following table may cause permanent damage to the system. The table is provided for stress testing purposes only. Exposure to absolute maximum rating conditions for extended periods may affect system reliability.

Table 87. Absolute Maximum Ratings

Operating Temperature	5 °C to 50 °C [1]
Storage Temperature	-55 °C to +150 °C
Voltage on any signal with respect to ground	-0.3 V to Vdd + 0.3V [2]
3.3 V Supply Voltage with Respect to ground	-0.3 V to 3.63 V
5 V Supply Voltage with Respect to ground	-0.3 V to 5.5 V

Notes:

1. Chassis design must provide proper airflow to avoid exceeding the processor maximum case temperature.
2. VDD means supply voltage for the device

11.1 Mean Time Between Failures (MTBF) Test Results

This section provides results of MTBF testing done by a 3rd party testing facility. MTBF is a standard measure for the reliability and performance of the board under extreme working conditions. For the SE7221BK1-E server board, MTBF was measured at **190,727** hours at **40** degrees Centigrade.

12. Hardware Monitoring

12.1 Monitored Components

The Intel® Server Board SE7221BK1-E has an integrated LM96000 chip that is responsible for hardware monitoring. The LM96000 chip provides basic server hardware monitoring which alerts a system administrator if a hardware problem occurs on the board. The NS super IO PC87427 has implemented some FAN speed control/monitor pins. Below is a table of monitored headers and sensors on the board.

Table 88. Monitored Components

| Item		Description	
Voltage	P_VCC (PIN #24)	Monitors processor voltage	LM96000
	P12V (PIN #21)	Monitors +12Vin for system +12V supply	LM96000
	P1V8 (PIN #22)	Monitors 1.8V DDRII power	LM96000
	P5V (PIN #20)	Monitors +5V	LM96000
Fan Speed	PWM1 (PIN #24)	Controls system front fans (JP5J1,JP5J2,JP7A1,JP6A1,J6J3,J6J1,J6J4,J6J2)	LM96000
	PWM2 (PIN #10)	Controls CPU fans (J7A1)	LM96000
	PWM3 (PIN #13)	N/A	LM96000
	TACH1 (PIN #11)	Monitors CPU fan (J7A1)	LM96000
	TACH2 (PIN #12)	Monitors SYS FAN_3 (JP5J1)	LM96000
	TACH3 (PIN #9)	Monitors SYS FAN_4 (JP5J2)	LM96000
	FANIN0 (PIN #66)	Monitors SYS FAN_2 (JP7A1) / SYS FAN_5A (J6J1)	Super IO
	FANIN1 (PIN #81)	Monitors SYS FAN_1 (JP6A1) / SYS FAN_5B (J6J1)	Super IO
	FANIN2 (PIN #77)	Monitors SYS FAN_6A (J6J2)	Super IO
	FANIN3 (PIN #76)	Monitors SYS FAN_6B (J6J2)	Super IO
	FANIN4 (PIN #75)	Monitors SYS FAN_8A (J6J4)	Super IO
	FANIN5 (PIN #83)	Monitors SYS FAN_8B (J6J4)	Super IO
	FANIN6 (PIN #36)	Monitors SYS FAN_7A (J6J3)	Super IO
	FANIN7 (PIN #9)	Monitors SYS FAN_7B (J6J3)	Super IO
Temperature	H_THEMP_DA/C	Monitors processor temperature	LM96000

12.2 Fan Speed Control
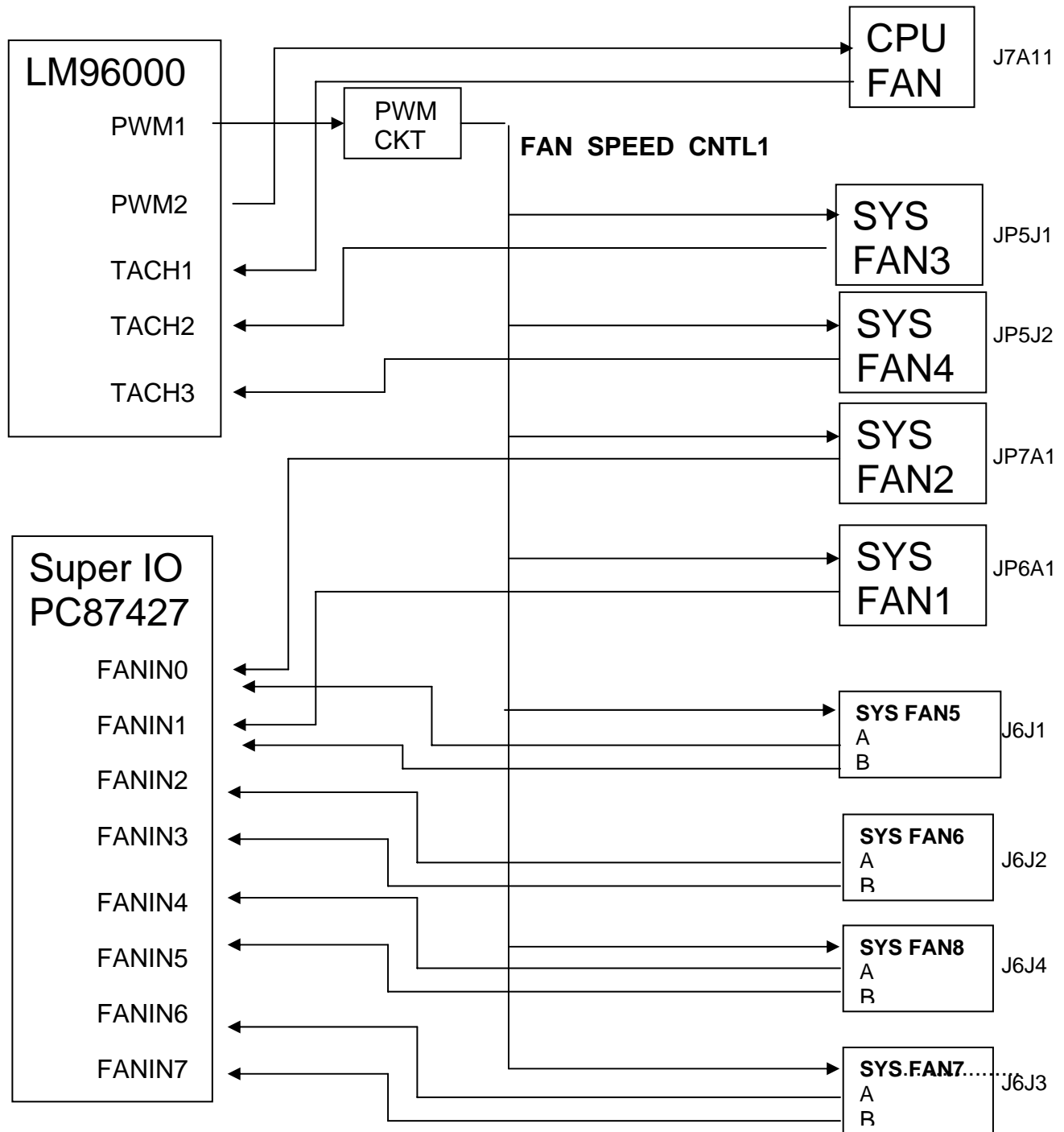
Figure 10. Fan Speed Control Block Diagram

12.3 Chassis Intrusion

The Intel® Server Board SE7221BK1-E supports a chassis security feature that detects if the chassis cover is removed. For the chassis intrusion circuit to function, the chassis' power supply must be connected to AC power. The security feature uses a mechanical switch on the chassis that attaches to the chassis intrusion connector. When the chassis cover is removed the mechanical switch is in the closed position.

13. Product Regulatory Compliance

13.1.1 Product Safety Compliance

The SE7221BK1-E complies with the following safety requirements:

- UL 1950 - CSA 950 (US/Canada)
- EN 60 950 (European Union)
- IEC60 950 (International)
- CE – Low Voltage Directive (73/23/EEC) (European Union)
- EMKO-TSE (74-SEC) 207/94 (Nordics)
- GOST R 50377-92 (Russia)

13.1.2 Product EMC Compliance

The SE7221BK1-E has been has been tested and verified to comply with the following electromagnetic compatibility (EMC) regulations when installed in a compatible Intel host system. For information on compatible host system(s), contact your local Intel representative.

- FCC (Class A Verification) – Radiated & Conducted Emissions (USA)
- ICES-003 (Class A) – Radiated & Conducted Emissions (Canada)
- CISPR 22, 3rd Edition (Class A) – Radiated & Conducted Emissions (International)
- EN55022 (Class A) – Radiated & Conducted Emissions (European Union)
- EN55024 (Immunity) (European Union)
- CE – EMC Directive (89/336/EEC) (European Union)
- VCCI (Class A) – Radiated & Conducted Emissions (Japan)
- AS/NZS 3548 (Class A) – Radiated & Conducted Emissions (Australia / New Zealand)
- RRL (Class A) Radiated & Conducted Emissions (Korea)
- BSMI CNS13438 (Class A) Radiated & Conducted Emissions (Taiwan)
- GOST R 29216-91 (Class A) Radiated & Conducted Emissions (Russia)
- GOST R 50628-95 (Immunity) (Russia)

13.1.3 Product Regulatory Compliance Markings

This product is provided with the following product certification markings:

Table 89. Product Certification Markings

UL Recognition Mark	
CE Mark	
Russian GOST Mark	 **ME06**
Australian C-Tick Mark	 **N232**
BSMI DOC Marking	 D33025
BSMI EMC Warning	警告使用者： 這是甲類的資訊產品，在居住的環境中使用時， 可能會造成射頻干擾，在這種情況下，使用者會 被要求採取某些適當的對策
RRL MIC Mark	

13.2 Electromagnetic Compatibility Notices

13.2.1   FCC (USA)

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 A 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 not expressly approved by the grantee of this device could void the user's authority to operate the equipment.   The customer is responsible for ensuring compliance of the modified product.

Only peripherals (computer input/output devices, terminals, printers, etc.) that comply with FCC Class A or B limits may be attached to this server product. Operation with noncompliant peripherals is likely to result in interference to radio and TV reception.
All cables used to connect to peripherals must be shielded and grounded. Operation with cables, connected to peripherals, that are not shielded and grounded may result in interference to radio and TV reception.

13.2.2   INDUSTRY CANADA (ICES-003)

This digital apparatus does not exceed the Class A limits for radio noise emissions from digital apparatus set out in the interference-causing equipment standard entitled: "Digital Apparatus," ICES-003 of the Canadian Department of Communications.
Cet appareil numérique respecte les limites bruits radioélectriques applicables aux appareils numériques de Classe A prescrites dans la norme sur le matériel brouilleur: "Apparelis Numériques", NMB-003 édictee par le Ministre Canadian des Communications.

13.2.3   Europe (CE Declaration of Conformity)

This product has been tested in accordance to, and complies with the Low Voltage Directive (73/23/EEC) and EMC Directive (89/336/EEC). The product has been marked with the CE Mark to illustrate its compliance.

13.2.4   Taiwan Declaration of Conformity

This product has been tested and complies with CNS13438. The product has been marked with the BSMI DOC mark to illustrate compliance.

13.2.5   Korean RRL Compliance

This product has been tested and complies with MIC Notices No. 1997-41 and 1997-42. The product has been marked with the MIC logo to illustrate compliance.

The English translation for the above is as follows:
1. Type of Equipment (Model Name): SE7221BK1-E
2. Certification No.: Contact Intel Representative
3. Name of Certification Recipient: Intel
4. Date of Manufacturer: Marked on Product
5. Manufacturer / Nation : Intel

13.2.6   Australia / New Zealand

This product has been tested and complies with AS/NZS 3548. The product has been marked with the C-Tick mark to illustrate compliance.

13.3 Replacing the Back-Up Battery

The lithium battery on the server board powers the RTC for up to 10 years in the absence of power. When the battery starts to weaken, it loses voltage, and the server settings stored in CMOS RAM in the RTC (for example, the date and time) may be wrong. Contact your customer service representative or dealer for a list of approved devices.

⚠   WARNING

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

⚠   ADVARSEL**!**
Lithiumbatteri - Eksplosionsfare ved fejlagtig håndtering. Udskiftning må kun ske med batteri af samme fabrikat og type. Levér det brugte batteri tilbage til leverandøren.

⚠   ADVARSEL
Lithiumbatteri - Eksplosjonsfare. Ved utskifting benyttes kun batteri som anbefalt av apparatfabrikanten. Brukt batteri returneres apparatleverandøren.

⚠   VARNING
Explosionsfara vid felaktigt batteribyte. Använd samma batterityp eller en ekvivalent typ som rekommenderas av apparattillverkaren. Kassera använt batteri enligt fabrikantens instruktion.

⚠   VAROITUS
Paristo voi räjähtää, jos se on virheellisesti asennettu. Vaihda paristo ainoastaan laitevalmistajan suosittelemaan tyyppiin. Hävitä käytetty paristo valmistajan ohjeiden mukaisesti.

13.4 Calculated Mean Time Between Failures (MTBF)

The MTBF (Mean Time Between Failures) for the Intel® Server Board SE7221BK1-E as configured from the factory is shown in the table below.

Table 90. MTBF Data

Product Code	Calculated MTBF	Operating Temperature
SE7221BK1	TBD hours	35 degrees C
SE7221BK1LX	TBD hours	35 degrees C

13.5 Mechanical Specifications

The following figure shows the Intel® Server Board SE7221BK1-E mechanical drawing. This drawing will be updated in a future revision of this document.
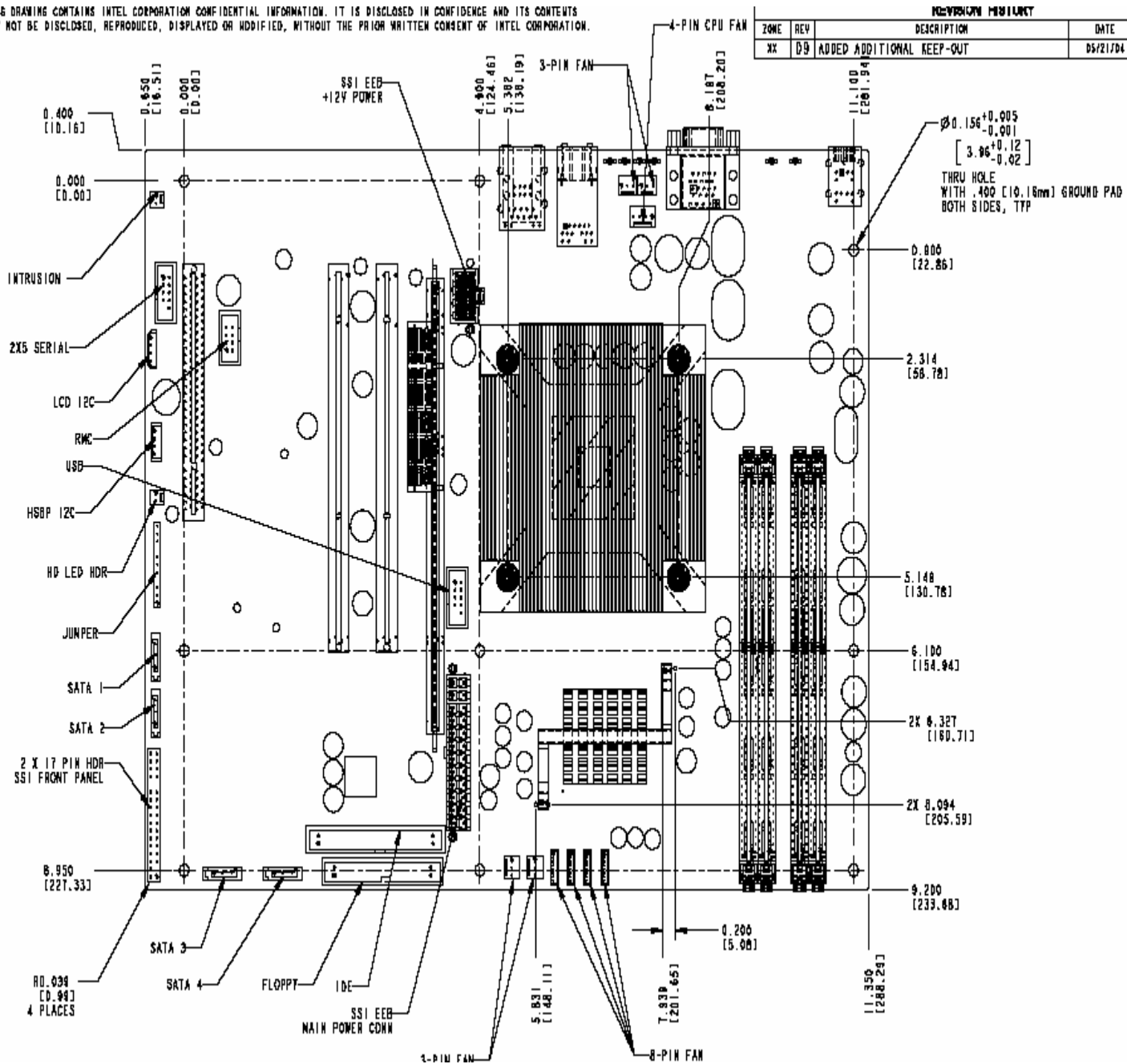
Figure 11. SE7221BK1-E Server Board Mechanical Drawing

The following figures show the I/O shield mechanical drawings for use in pedestal mount applications such as the Intel® Server Chassis SC5200 for both sku 's (SE7221BK1-E and SE7221BK1-E (LX).

Figure 12.   sku 1 Pedestal mount I/O shield mechanical drawing
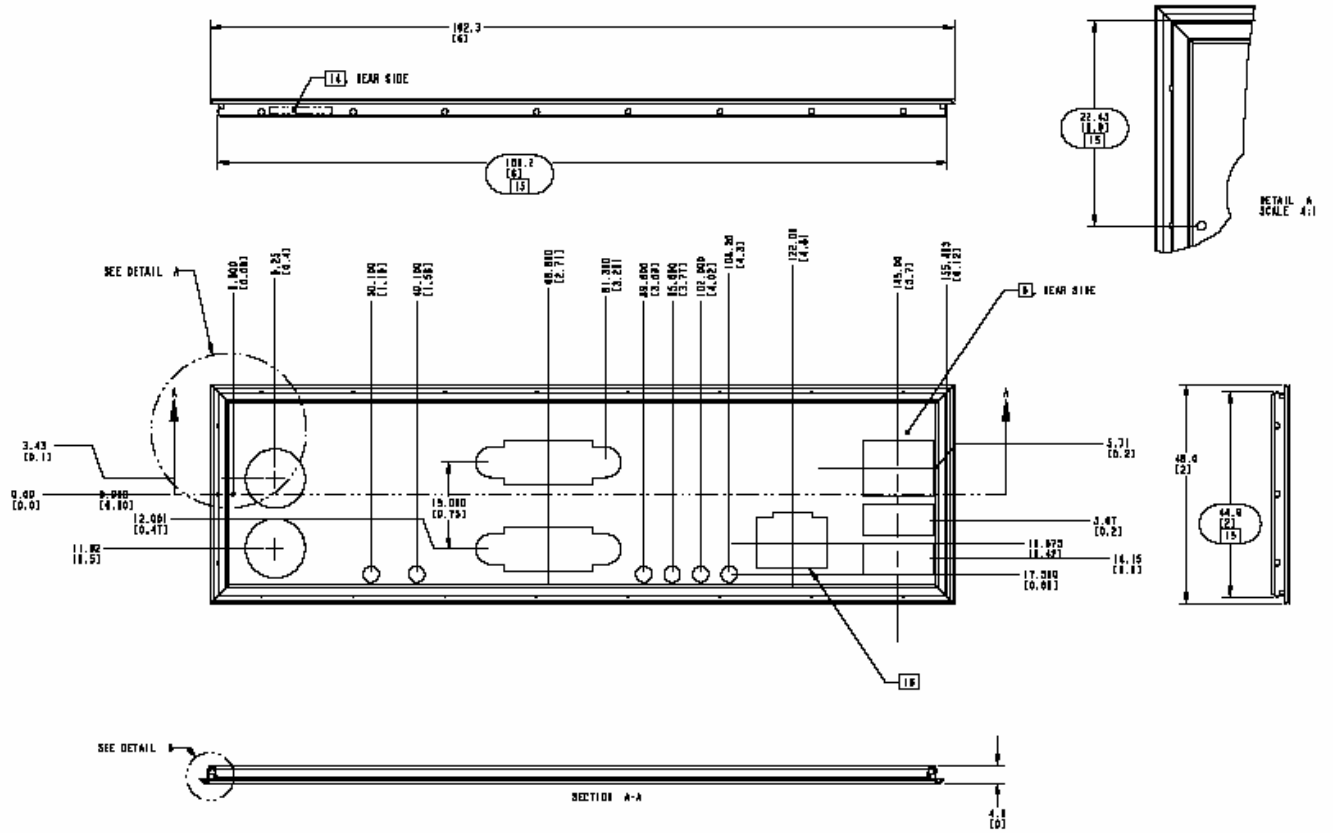
Figure 13.   sku 2 Pedestal mount I/O shield mechanical drawing

Glossary

This appendix contains important terms used in the preceding chapters. For ease of use, numeric entries are listed first (e.g., "82460GX") with alpha entries following (e.g., "AGP 4x"). Acronyms are then entered in their respective place, with non-acronyms following.

Term	Definition
ACPI	Advanced Configuration and Power Interface
ANSI	American National Standards Institute
AP	Application Processor
ASIC	Application Specific Integrated Circuit
ASR	Asynchronous Reset
BGA	Ball-grid Array
BIOS	Basic input/output system
Byte	8-bit quantity.
CMOS	In terms of this specification, this describes the PC-AT compatible region of battery-backed 128 bytes of memory, which normally resides on the server board.
DCD	Data Carrier Detect
DMA	Direct Memory Access
DMTF	Distributed Management Task Force
ECC	Error Correcting Code
EMC	Electromagnetic Compatibility
EPS	External Product Specification
ESCD	Extended System Configuration Data
FDC	Floppy Disk Controller
FIFO	First-In, First-Out
FRU	Field replaceable unit
GB	1024 MB.
GPIO	General purpose I/O
GUID	Globally Unique ID
Hz	Hertz (1 cycle/second)
HDG	Hardware Design Guide
I^2C	Inter-integrated circuit bus
IA	Intel® architecture
ICMB	Intelligent Chassis Management Bus
IERR	Internal error
IMB	Inter Module Bus
IP	Internet Protocol
IRQ	Interrupt Request
ITP	In-target probe
KB	1024 bytes
KCS	Keyboard Controller Style
LAN	Local area network
LBA	Logical Block Address
LCD	Liquid crystal display

Term	Definition
LPC	Low pin count
LSB	Least Significant Bit
MB	1024 KB
MBE	Multi-Bit Error
Ms	milliseconds
MSB	Most Significant Bit
MTBF	Mean Time Between Failures
Mux	multiplexor
NIC	Network Interface Card
NMI	Non-maskable Interrupt
OEM	Original equipment manufacturer
Ohm	Unit of electrical resistance
PBGA	Pin Ball Grid Array
PERR	Parity Error
PIO	Programmable I/O
PMB	Private Management Bus
PMC	Platform Management Controller
PME	Power Management Event
PnP	Plug and Play
POST	Power-on Self Test
PWM	Pulse-Width Modulator
RAIDIOS	RAID I/O Steering
RAM	Random Access Memory
RI	Ring Indicate
RISC	Reduced instruction set computing
RMCP	Remote Management Control Protocol
ROM	Read Only Memory
RTC	Real Time Clock
SBE	Single-Bit Error
SCI	System Configuration Interrupt
SDR	Sensor Data Record
SDRAM	Synchronous Dynamic RAM
SEL	System event log
SERIRQ	Serialized Interrupt Requests
SERR	System Error
SM	Server Management
SMI	Server management interrupt. SMI is the highest priority nonmaskable interrupt
SMM	System Management Mode
SMS	System Management Software
SNMP	Simple Network Management Protocol
SPD	Serial Presence Detect
SSI	Server Standards Infrastructure
TPS	Technical Product Specification
UART	Universal asynchronous receiver and transmitter

Term	Definition
USB	Universal Serial Bus
VGA	Video Graphic Adapter
VID	Voltage Identification
VRM	Voltage Regulator Module
Word	16-bit quantity
ZCR	Zero Channel RAID