

CSN08101 TUTORIAL 2 : PC MOTHERBOARDS

(This tutorial has two parts: the first is specifically about motherboards, the second part has more general questions taken from previous tests)

LEARNING OUTCOME

On completion of this tutorial you should understand:

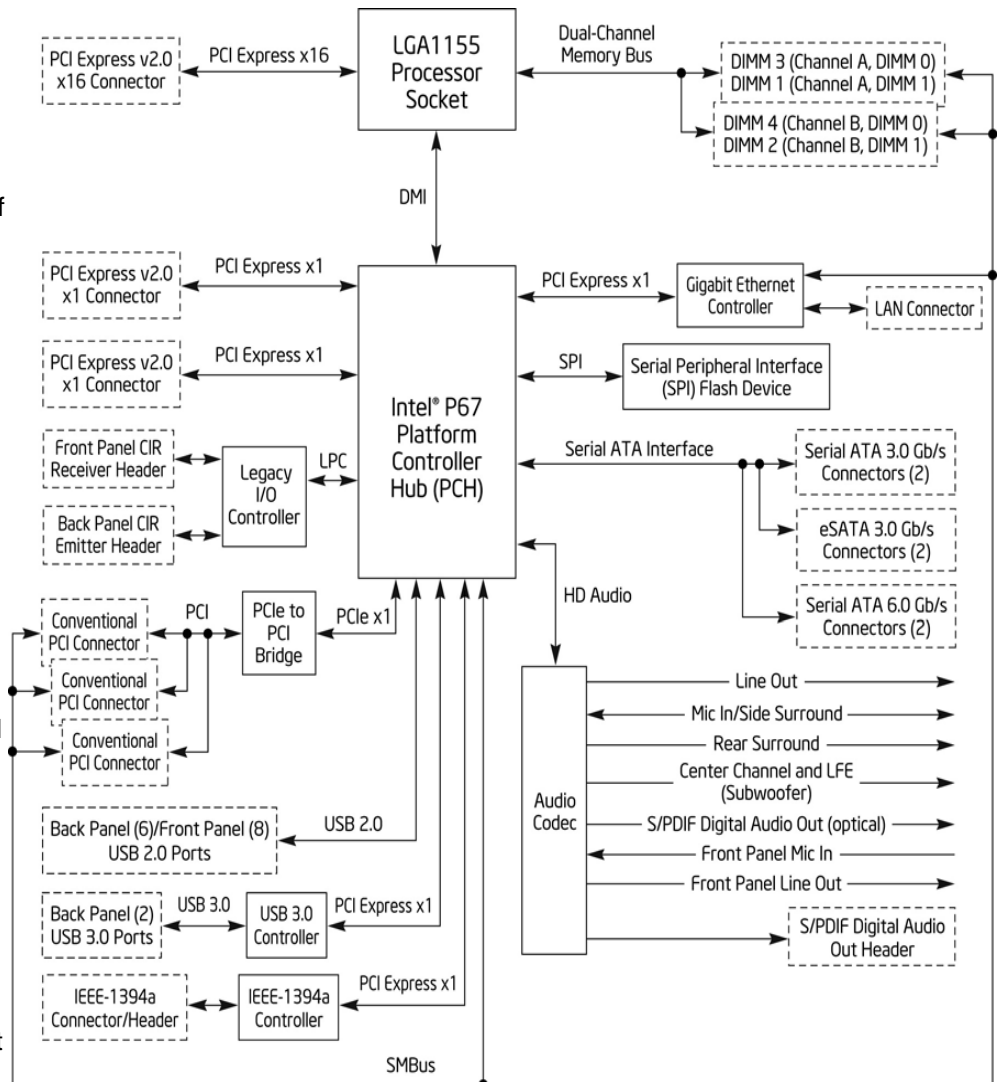
- The main components on a typical PC motherboard
- The way the possible options that allow the motherboard to be tailored to specific needs.

INTRODUCTION

The Intel DP67BA is a recent motherboard for desktop PCs suitable for general purpose PCs. There are options that allow a system to be built up to suit particular specifications. These options include the type of processor, the number and type of disk drives, and the amount of main memory. The purpose of this tutorial is to familiarise you with the sort of facilities that are provided by the board, hopefully giving you a better idea of how the computer system is built up. On the next pages is a data sheet that originally came from Intel's web site. I have assembled the relevant sections into the accompanying handout. You should be able to find answers to the following questions in the data sheet, but ask the demonstrator if you need help.

OPTIONS

1. What processors can be used with this board, and what limits the choice of processors?
2. Where does the graphics get connected?
3. What is the minimum and maximum of cache and RAM that is available?
4. What determines the amount of cache?
5. The specification of memory chips for this board is very restricted. What exactly is specified? (i.e. what would you have to ask for if you were upgrading the RAM?)
6. Any idea what the 'Dual-Channel Configuration' for the DRAM is?
7. How many disk drives (hard disk or optical disks) could be plugged in before you would have to add an expansion card or use an external USB drive?
8. There is support for RAID. What is RAID?
9. Which of the following are built in, and which would need extra plug-in cards? (note, you may need to refer to the Block Diagram as well as the table summarising the features):
 - Local Area Network support
 - Graphics
 - Sound
 - Hard disk drives



OTHER FEATURES

10. SPI Flash memory is used to hold the BIOS*. This is a type of memory that doesn't lose data when the board is powered down, so it retains the BIOS. However, it can be re-programmed. Why would this facility be needed?
11. What can be done if more USB ports are needed than are actually provided?
12. Any idea what an S/PDIF connector is?
13. Legacy controllers for the old serial, parallel and PS-2 ports are no longer provided. What could you do if you had an old device that needed to be connected via one of these interfaces?
14. What is the difference between 'conventional' PCI and PCI Express?

***BIOS: The Basic I/O System that configures the PC on power up and provides the lowest layer of features used by the operating system. Amongst other things, the BIOS is responsible for loading the operating system from disk.**

Table 1. Feature Summary

Form Factor ATX (9.60 inches by 11.60 inches [243.84 millimeters by 294.64 millimeters])

Processor • Intel® Core™ i7, Intel® Core™ i5, and Intel Core™ i3 processors with up to 95W TDP in an LGA1155 socket

- One PCI Express* 2.0 x16 graphics interface
- Integrated memory controller with dual channel DDR3 memory support

Memory Four 240-pin DDR3 SDRAM Dual Inline Memory Module (DIMM) sockets

Support for DDR3 1333 MHz and DDR3 1066 MHz DIMMs

Support for 1 Gb, 2 Gb, and 4 Gb memory technology

Two independent memory channels with interleaved mode support

Unbuffered, single-sided or double-sided DIMMs (Double-sided DIMMs with x16 organization are not supported.) non-ECC memory

Minimum recommended total system memory: 512 MB

Support for 1.35 V low voltage JEDEC memory

Chipset Intel® P67 Express Chipset consisting of the Intel® P67 Express Platform Controller Hub (PCH)

Graphics Discrete graphics support for PCI Express 2.0 x16 add-in graphics card

Audio 10-channel (7.1 + 2) Intel High Definition Audio via the Realtek ALC892 audio codec

Peripheral Interfaces

- Two USB 3.0 ports are implemented with stacked back panel connectors (blue)
- Fourteen USB 2.0 ports:
 - Six ports are implemented with stacked back panel connectors (black)
 - Eight front panel ports implemented through four internal headers
- Two Serial ATA (SATA) 6.0 Gb/s interfaces through the Intel P67 Express Chipset with Intel® Rapid Storage Technology RAID support (blue)
- Four SATA 3.0 Gb/s interfaces through the Intel P67 Express Chipset with Intel Rapid Storage Technology RAID support:
 - Two internal SATA ports (black) — One internal eSATA port (red) — One back panel eSATA port (red)
- Two IEEE 1394a ports:
 - One port via a back panel connector & one port via an internal header for front panel cabling

Expansion Capabilities

- One PCI Express 2.0 x16 add-in card connector
- Two PCI Express 2.0 x1 add-in card connectors
- Three Conventional PCI bus connector

BIOS • Intel® BIOS resident in the SPI Flash device

- Support for Advanced Configuration and Power Interface (ACPI), Plug and Play, and SMBIOS

LAN Support Gigabit (10/100/1000 Mbps/s) LAN subsystem using the Intel® 82579V Gigabit Ethernet Controller

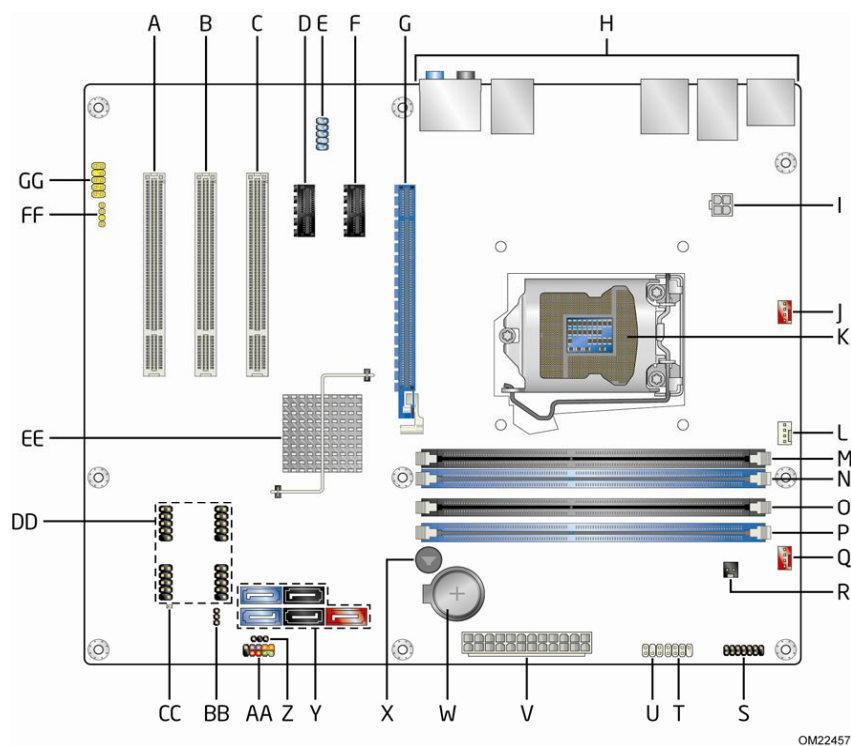
Supported Memory Configurations

DIMM Capacity	Configuration	SDRAM Density	SDRAM Organization	Number of SDRAM Devices
512 MB	SS	1 Gbit	64 M x16/empty	4
1024 MB	SS	1 Gbit	128 M x8/empty	8
1024 MB	SS	2 Gbit	128 M x16/empty	4
2048 MB	DS	1 Gbit	128 M x8/128 M x8	16
2048 MB	SS	2 Gbit	128 M x16/empty	8
4096 MB	DS	2 Gbit	256 M x8/256 M x8	16
4096 MB	SS	4 Gbit	512 M x8/empty	8
8192 MB	DS	4 Gbit	512 M x8/512 M x8	16

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

Processor	Processor Frequency	Intel HD Graphics	Cache
CORE 3			
I3-2120	3.30 GHz	Yes	3 MB
I3-2105	3.10 GHz	Yes	3 MB
I3-2100T	2.50 GHz	Yes	3 MB
CORE 5			
I5-2500K	3.30 GHz	Yes	6 MB
I5-2400	3.10 GHz	Yes	6 MB
I5-2300	2.80 GHz	Yes	6 MB
CORE 7			
I7-2600	3.40 GHz	Yes	8 MB
I7-2600K	3.40 GHz	Yes	8 MB
I7-2600S	2.80 GHz	Yes	8 MB
XEON			
E3-1260L	2.40 GHz	Yes	8 MB
E3-1220L	2.20 GHz	No	3 MB

- A PCI Conventional bus add-in card connector
- B PCI Conventional bus add-in card connector
- C PCI Conventional bus add-in card connector
- D PCI Express x1 bus add-in card connector
- E IEEE 1394a front panel header
- F PCI Express x1 bus add-in card connector
- G PCI Express x16 bus add-in card connector
- H Back panel connectors
- I Processor core power connector (2 x 2)
- J Rear chassis fan header
- K LGA1155 processor socket
- L Processor fan header
- M DIMM 3 (Channel A DIMM 0)
- N DIMM 1 (Channel A DIMM 1)
- O DIMM 4 (Channel B DIMM 0)
- P DIMM 2 (Channel B DIMM 1)
- Q Front chassis fan header
- R Chassis intrusion header
- S Low Pin Count (LPC) Debug header
- T Consumer IR emitter (output) header
- U Consumer IR receiver (input) header
- V Main power connector (2 x 12)
- W Battery
- X Piezoelectric speaker
- Y SATA connectors (5)
- Z Alternate front panel power LED header
- AA Front panel header
- BB BIOS Setup configuration jumper block
- CC Standby power LED
- DD Front panel USB 2.0 headers (4)
- EE Intel P67 Express Chipset
- FF S/PDIF out header
- GG Front panel audio header



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TEST PAPER STYLE QUESTIONS

1. On a PC motherboard, the faster chips are nearest the processor. Either explain or use a diagram to show how the main chips and buses are connected, and what their relative speeds are.
2. In a typical PC, there is no direct connection between the processor and I/O peripherals. Explain, using a diagram if necessary, how this connection is done, and why it is not practical to directly connect, say, a disk drive to the processor.
3. Explain why the Graphics and Memory Controller Hub chip on a PC motherboard has to be physically close to the processor, while the I/O hub can be further away.
4. In modern PCs, many of the buses have changed from parallel to serial data connections. Explain why this has happened.
5. Briefly describe the function of the main hub chip(s) that make up the backbone of a PC motherboard.
6. Describe one way in which the speed of communications between the processor and memory is being improved on current PC motherboards.
7. Describe how the motherboard of a multi-core PC differs from the motherboard of a PC with multiple separate processors (such as Xeon or Opteron chips).
8. Many of the components that make up the motherboard are interchangeable, for instance if you want to upgrade a PC. Which are the main components that are fixed?
9. Describe the advantages and disadvantages of the big.LITTLE style of processor as used in the Galaxy S4 phone.
10. Describe two ways in which a typical processor chip on a mobile platform (phone, tablet etc.) differs from that of a desktop PC.