

NETWORKING AND SYSTEM ADMINISTRATION LAB ASSIGNMENT

Topic: Components of a Motherboard

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COMPONENTS OF MOTHERBOARD

What is a Motherboard?

The motherboard is a thin **printed circuit board** (PCB) which links all different components inside your computer. So, we can say the motherboard acts as a hub in a network. People call motherboard with a different name like mainboard, logic board, baseboard, system board, mobo, etc.

Location of Motherboard:

In Desktop PC: In a desktop PC, you will find a big rectangular computer case. Once you open the case to expose inside the machine, you will find green/blue/brown/red large square printed circuit plate. This plate is the motherboard of the PC.

In laptop: If you open the bottom cover of your laptop, you will get exposed to the large PCB board which is the motherboard.

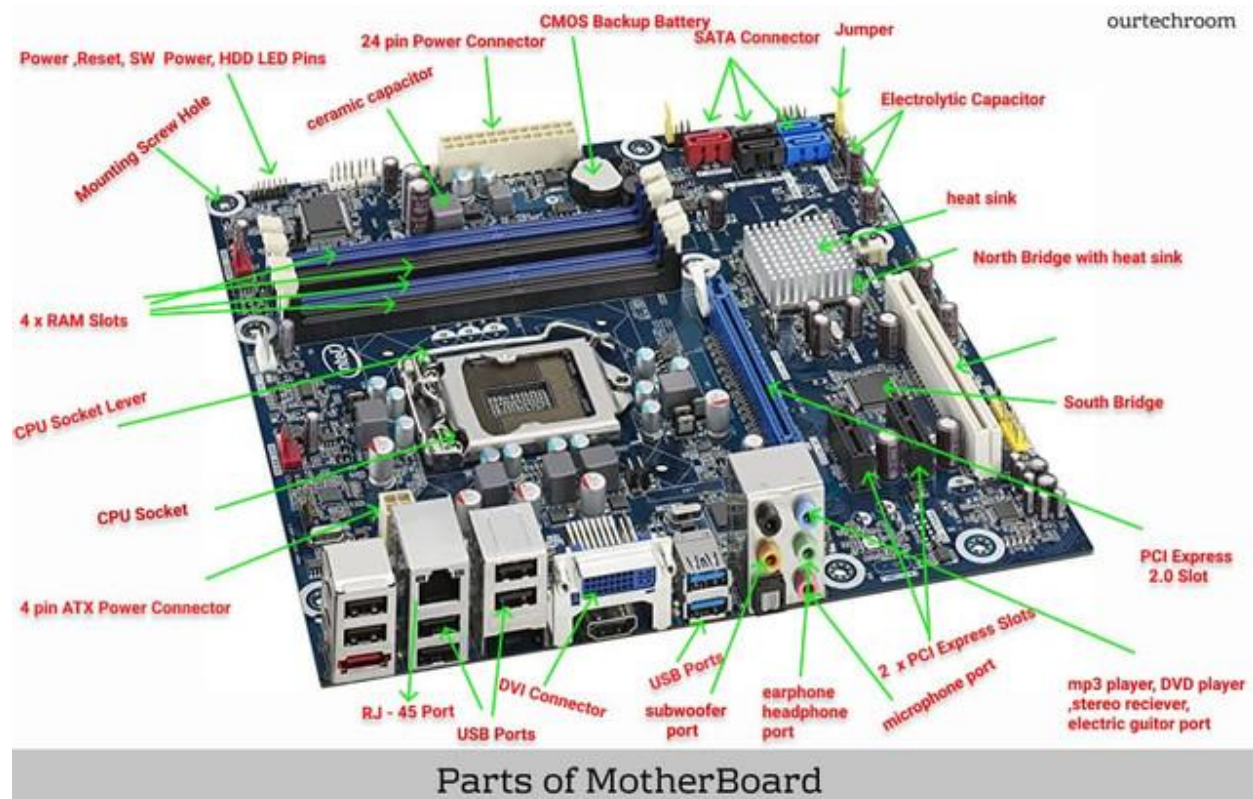
In smartphone: When you open the back cover of the smartphone, and screws up some pins then you will find your motherboard.

Types of Motherboard

In all the programmable electronics devices motherboard is a large PCBs board. The component attached to the board may vary from system to system. The desktop has different kinds of sockets and hardware which may vary from a smartphone. General components like CPU, memory, storage, capacitor, transistor, slots, connectors are common in all electronic devices.

If you know all of these components on the desktop, then you can easily get an idea about components in other electronic devices. So in this article, we focus on desktop components.

Parts of Motherboard



Parts of the Motherboard are as follow.

- RAM Chip and RAM Slot
- CPU Chip and Socket
- PCI Slots
- Accelerated Graphics Port
- North Bridge
- SouthBridge
- CMOS Battery
- Power Supply Plug
- Parallel Port
- Serial Port
- SATA and PATA Connector
- USB Port
- DVI Port

- RJ-45 Port
- HDMI Port
- FDD Connector
- Optical Drive Audio Connector
- 1394 Headers
- F Audio Connectors
- Heat Sink
- Switches and Jumper
- Microphone port, headphone port, subwoofer port, guitar port, DVD player port, stereo receiver port
- Capacitor
- Transistor
- Mounting Screw Hole
- Power, Reset, SW, LED Pins

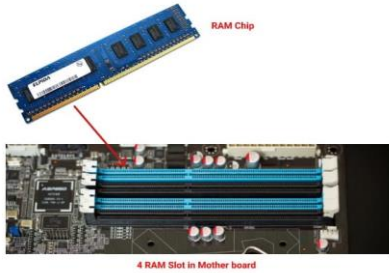
1) RAM chip and RAM Slot

RAM stands for Random Access Memory. It is also called the **main memory**. RAM is a **temporary data storage** device in computers and other devices. Data stored in RAM will get erased as soon as power is turned off.

RAM has **bidirectional data transfer** capacity from CPU to memory during a write operation and from RAM to CPU during the reading operation. It acts as a mediator for data transfer from CPU to other devices like HDD, cdrom, PEN drives.

It is called **Random-access memory** because any memory address of RAM can be accessed directly from any location. If row number and column number are known then data in any memory location can be accessed.

Various types of RAM are available in the market some of them are DRAM, SDRAM, DDR, SRAM, CMOS RAM, VRAM etc. Generally available RAM in the PC market is from 2 GB to 16 GB.

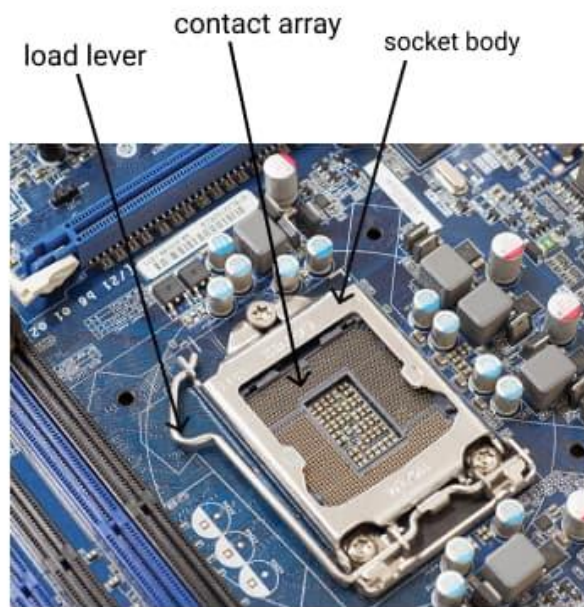


2) CPU Chip and Socket

CPU stands for Central Processing Unit. Considered as the **brain of the computer** and other electronic devices because all the decision making tasks of the computer is performed by the CPU. It is a large printed circuit board where all the components and peripherals are directly or indirectly connected. The main function of the CPU is to execute basics arithmetical, logical, and input/output operations.



CPU Chip



CPU Socket

CPU consists of 3 main typical components. ALU, CU

ALU: Arithmetical Logical Unit (ALU) is a digital circuit(gates) of CPU which is used for performing all arithmetical and logical operations. Some normal arithmetical operations performed by ALU are addition, subtraction,

multiplication, and division. Some logical operations performed by ALU is comparisons between numbers and letters. A single CPU may also contain more than one ALU.

CU: Control Unit (CU) is a digital circuit of CPU which controls all the operations within the CPU. It allows and teaches various logical units, I/O devices, the memory of computer how to respond to a program's instructions of the various components as well as the user.

Memory or Storage Unit:

3) PCI Slots and PCI Chip



PCI Chip

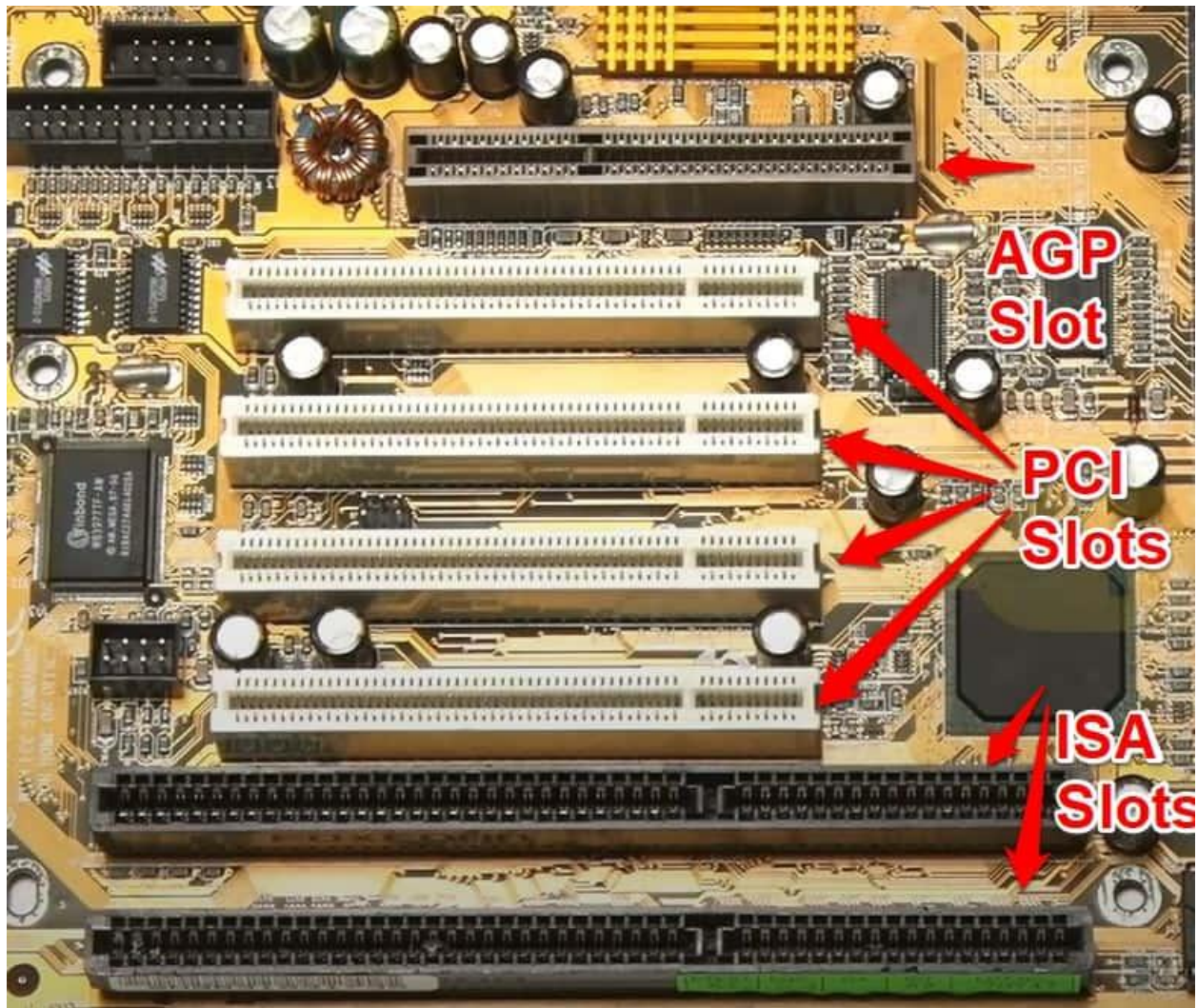


PCI Slots

Peripheral Component Interconnected (PCI) is an attached hardware component of motherboard for connecting various hardware components like modems, disk controller, NIC cards, Sound Card, graphics cards, SSD add-on cards, RAID cards, extra USB and serial port required so PCI slots help increasing motherboard capabilities without adding or replacing the motherboard.

If you have limited ports and slots on the motherboard to connect various types of hardware devices like saying graphics card port (AGP port) then you can use PCI

slots to connect Graphics cards and enjoy the same features. Same way if you have limited USB port in your computer system and want more than you can use a USB expansion card and get more USB port in your system.



4) AGP Slot and Chip

Accelerated Graphics Port Slot(AGP Slot) is a kind of expansion slot like a PCI slot but mainly designed for graphics cards. It was first introduced by Intel in 1996. We can easily locate this expansion slot because it is usually presented in **brown color**.

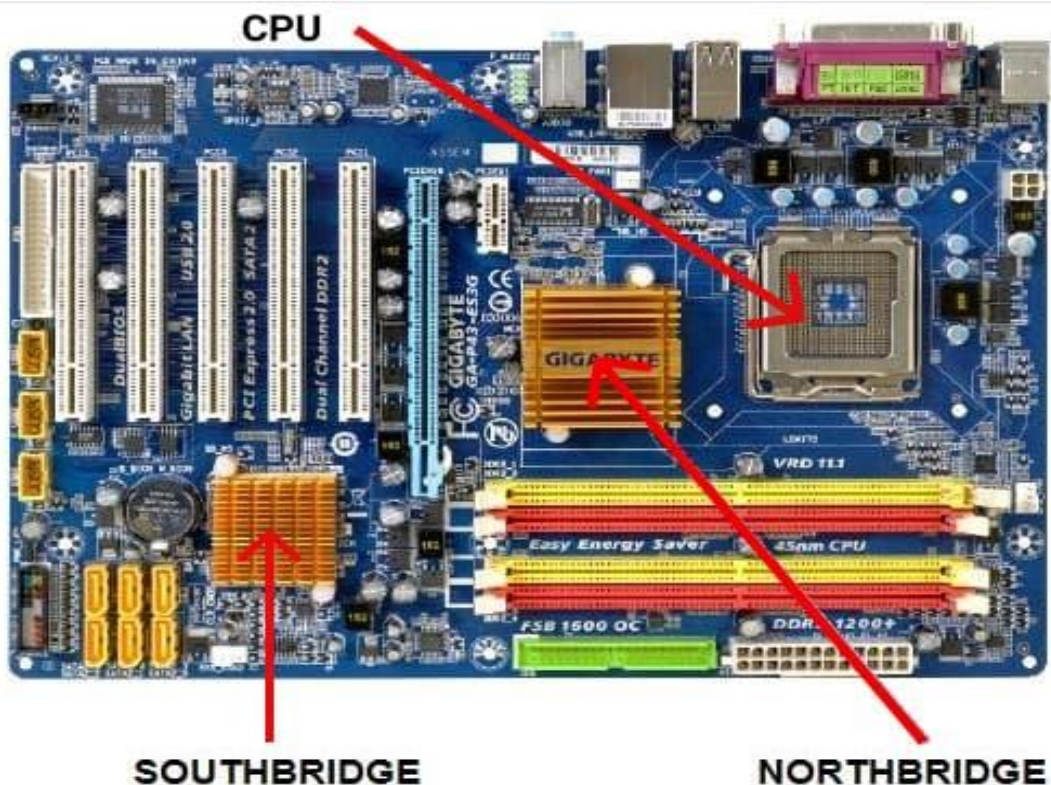
5) North Bridge

North Bridge is also called Host bridge or Memory Controller Hub. It acts as the primary controller in the motherboard which directs traffics to and from the CPU. So, the performance of the computer also depends on the northbridge chip. It does lots of processing so it generally comes with a heatsink.

Characteristics of North Bridge:

- It connects southbridge to the CPU.
- It handles and communicates faster components on the motherboard like Main Memory, AGP, PCIe, ROM, and CPU.
- It acts as a controller in bus speed on the motherboard.
- Generally, it does lots of work with the CPU, so it is located near to the CPU generally with the heatsink.
- It is a core component and is directly connected to the CPU.

In some processors of Intel, all the functioning of northbridge is performed by CPU.



6) South Bridge

Southbridge is an IC chip that generally handles and controls IO functioning in the motherboard. Unlike Northbridge, it does not have direct with CPU. It generally handles low-speed devices because its communication speed is lower. Instruction from CPU reaches northbridge then from northbridge to southbridge. It is connected to the PCI bus, ISA buses, IDE buses, audio, serial devices like mouse, keyboard, USB ports, etc, and SATA hard disk connector.

7) CMOS Backup Battery

CMOS stands for "**Complementary Metal Oxide Semiconductor**" and found in both laptop and desktop PC as a small circular coin shape. CMOS stores a wide range of system information like current system clock, date, time, pulses, mostly used hardware settings, BIOS configuration settings, BOOT sequences, BIOS master/admin password, GPU and virtualization settings, power management, etc. They can save those set for a longer time around 2 to 10 years. CMOS works continuously even if you shut down your system because it is continually holding all those setting mention above.

8) Power Supply Plug

The main work of the Power Supply port in the Motherboard is to provide power to Motherboard and its attached components and peripherals.

i) **24(20+4) ATX power supply**

In modern PCs, ATX power supply is provided which is 24 Pin(20 + 4) Main Power Supply Connector (Older Pcs only have 20 Pin)

ii) **4 Pin or 8 Pin Connector**

This port in the motherboard is to provide dedicated power to the CPU. Older PCs may not have this Plugin motherboard but modern computers can do lots of works like overclocking so, a dedicated cable is provided to the CPU.

8Pin connector can be split into two and each split part can be used as 4 pin connector.

iii) **PCI-Express 6-Pin or 8-Pin Connector**

This is required to power the PCI-E port. PCI-E slot required 75W power to operates.

THE older PC does not have this.

iv)Molex

Molex pin is 4 power pin which is required to supply power to older CDROM and hard drives. Molex is nowadays used for Case Fan. (some have some do not have)

Molex connector comes with Mini Molex connectors, which is used for floppy disk drives in much older PCs.

v)SATApowersupply

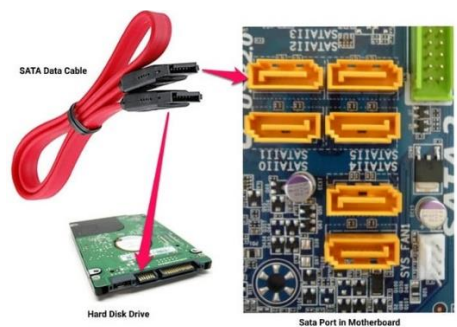
Modern hard drives and CDROM uses SATA cable for power. In motherboard, it is L-shape port and so its cable is connected to SATA port in one way only. In motherboard, it has 15 pins. It provides features of hot-swappable hard drives ie. plug and play hard drive features.

9) SATA and PATA Port and Connector

PATA stands for Parallel Advanced Technology Attachment. It is 40 pins long and wide ribbon cable used for connecting mass storage devices like hard disks(HDD or SSD), optical drives to the computer. It was launched in 1986 by Western Digital and Compaq. Every cable of PATA has two or three connectors, of which one is attached to the adapter interfacing and the remaining are plugged into secondary storage devices.

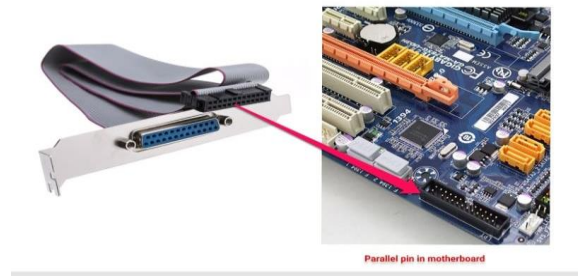
In modern computers, it is not used. It is outdated technology and is replaced by SATA Technology

SATA stands for Serial Advanced Technology Attachment. It is 7 pin cable which is shorter and powerful than the PATA connector and its function is the same as the PATA connector. The first version of SATA was launched in 2000.



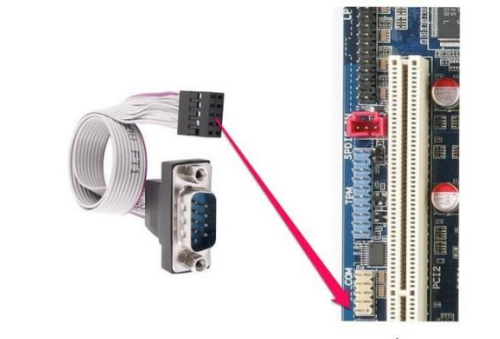
10) Parallel Port

A parallel port is used to transfer in a parallel manner through multiple communication channels. Used for printers, scanner, Zip Drive, external HDD, tape backup devices, external CD ROM, etc.



10) Serial Port

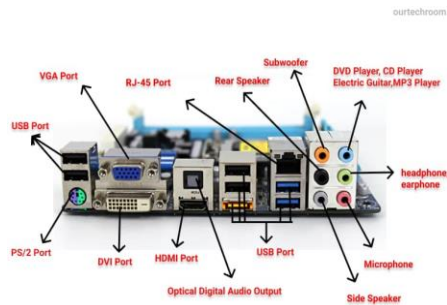
With a serial port, only one bit of data gets transfer at a time. It is found in an older PC to connect older keyboards, PDAs, external modems.



11) PS/2 Port

PS/2 port was popular in older desktop PCs. But now it is obsolete.

- PS/2 (green color) is for the mouse.
- PS/2 (purple) is for the keyboard.



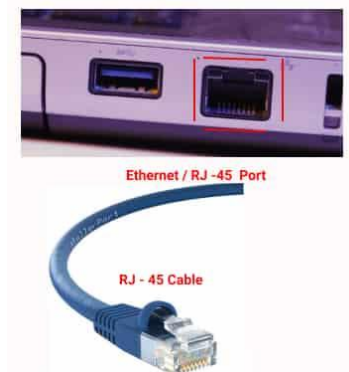
11) USB Port

USB stands for Universal Serial Bus. Its transfer rate is faster than PS/2 connector so in modern PC we do not find PS/2 port. There are various types of USB port some of them are :

- Type A
- Type B
- Type C
- Type A Mini
- Type B Mini
- Type A Micro
- Type B Micro
- Type B Micro USB3

12) RJ-45 Port

RJ stands for **Register Jack**. It looks like a telephone jack but slightly bigger. RJ45 is also called Ethernet Port because it is used to provide the internet to the computer. RJ 45 port is used to connect to Local Area Network using twisted pair ethernet cable. Ethernet Cable has a connector this connector is connected to RJ45 port.



13) HDMI port

HDMI stands for **High Definition Multimedia Interface**. It was developed in 2002 AD. It looks like a USB port but it is quite larger in size. HDMI is a digital interface for transmission of audio and video data in a single cable to digital devices like digital TV, projector, gaming console, computer, mobile devices, digital camera, cable box, blu ray, etc.

14) Audio Port

Most of the desktop computer nowadays comes with 3 to 6 port.

- Green Color Port is a Line Out which is for headphones and stereo speakers.
- Pink /Light Pink Port for Microphones input.
- Light Blue Port is line In which is for mp3 players, DVD player, CD player, stereo receiver, turntable, electric guitar, VCR audio outputs.
- Dolby Audio Black Port for rear speaker.
- Orange/yellow port is Center/Bass Channel which is for subwoofer



15) Heatsink

Heatsinks use a thermal conductor to reduce heat generated and prevent overheating from hardware components like CPU, GPU, northbridge, southbridge, RAM modules, etc. In general, that component that generates heats required a heatsink.

CPU has to perform a large number of tasks every second. While performing large

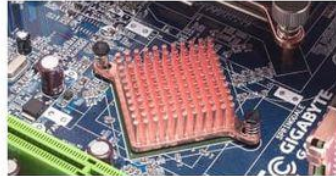
tasks, it begins to generate heat and if heat is not maintained then the processor will destroy itself. Also at the top of the heatsink will have a FAN and this FAN helps to cool down the heat sink. This is Air coolant Heatsink

But in the market, we will have liquid coolant heatsink as well generally used in a high-end gaming environment, servers, and datacenter.

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CPU Fan and Heatsink



NorthBridge with Heatsink



CPU with Heatsink above it

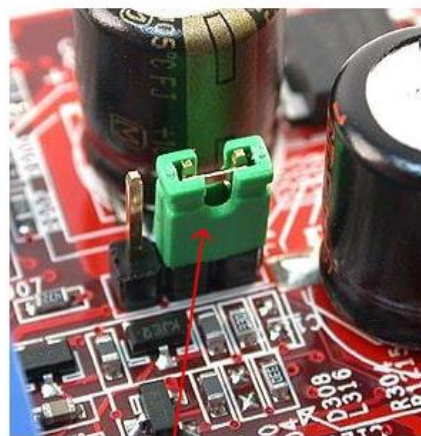
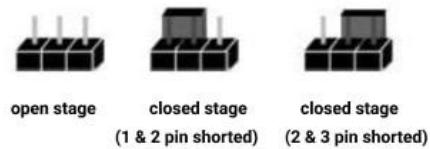
16) Switches and Jumper

Switches and jumpers are used to reconfigure the circuit onto an existing circuit board in a reversible way.

Jumper also called Jumper Shunt is a small circuit board used to close, open or bypass part of an electronic circuit.

Closed Stage Jumper: If the plug is pushed down over two pins, the jumper is referred to as jumpered.

Opened Stage Jumper: If there is no plug into the pin then it is an open stage.



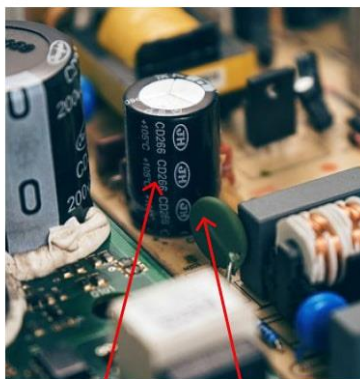
Jumper

17) Capacitor

A capacitor is an electronic device used for filtering, decoupling, and timing the circuit in the motherboard. There are more capacitors in the motherboard which mostly does decoupling functionality, so those capacitors are called a decoupling capacitor. A decoupling capacitor is used for stabilizing power in each IC used in the system.

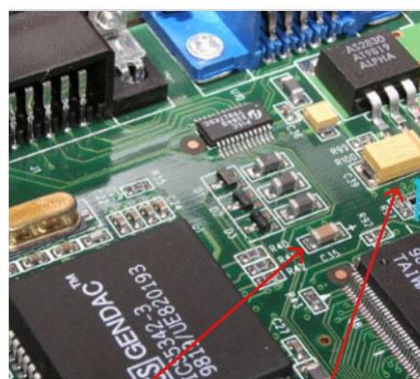
It comes with various voltage levels like 3.3 V, 5 V, 12 V.

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Electrolytic Capacitor

Ceramic Capacitor



Ceramic SMD capacitor

Tantalum SMD Capacitor



Suppose a circuit needs 5 V input than before that circuit there will be capacitors in parallel which allow up to 5 V to pass to that circuit.

18) Transistor and MOSFET

Transistor is used in most of the component of motherboard for various purpose like

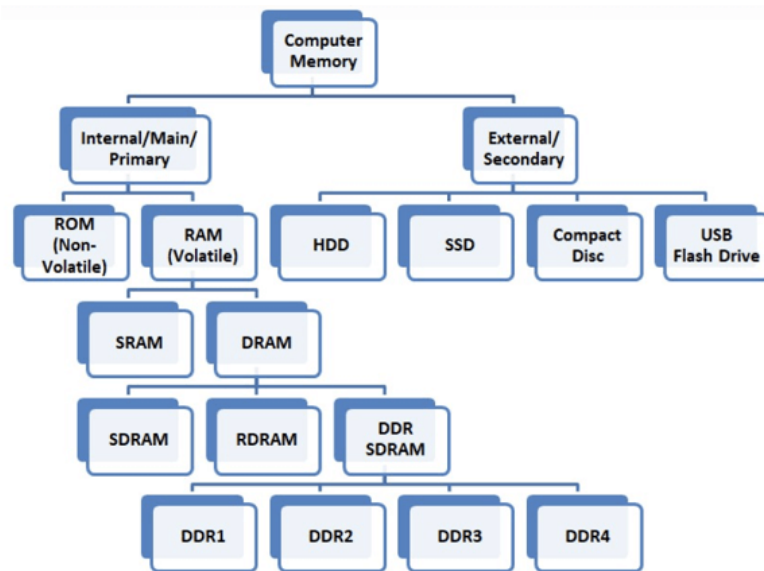
- controlling the amount of current or voltage in the component
- amplification/modulation electronic signal
- switching of an electronic signal and electrical power.

RAM MODULES

What is RAM?

The full form of RAM is Random Access Memory. The information stored in this type of memory is lost when the power supply to the PC or laptop is switched off. The information stored in RAM can be checked with the help of BIOS. It is generally known as the main memory or temporary memory or cache memory or volatile memory of the computer system.

Types of RAM



Types of RAM

Two main types of RAM are:

- Static RAM
- Dynamic RAM

Static RAM

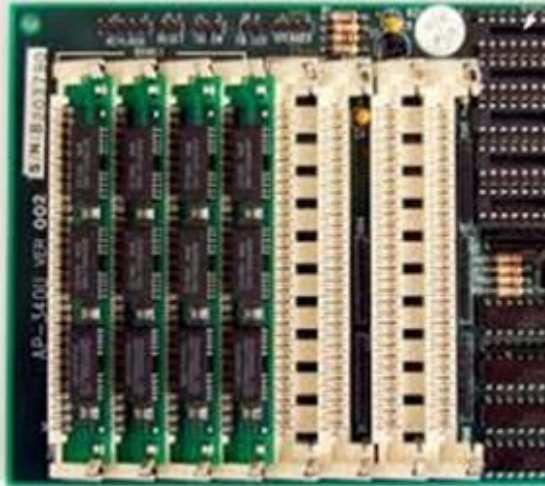
Static RAM is the full form of SRAM. In this type of RAM, data is stored using the state of a six transistor memory cell. Static RAM is mostly used as a cache memory for the processor (CPU).

Dynamic RAM

DRAM stands for Dynamic Random Access Memory. It is a type of RAM which allows you to store each bit of data in a separate capacitor within a specific integrated circuit. Dynamic RAM is a standard computer memory of the many modern desktop computers.

This type of RAM is a volatile memory that needs to be refreshed with voltage regularly. Else it loses the information stored on it.

Other Important Types of RAM



FPM DRAM

Fast Page Mode Dynamic Random Access Memory is a type of RAM that waits through the entire process of locating a bit of data by column and row and then reading the bit before it begins on the next bit. Max transfer rate is around 176 Mbps.

SDR RAM



SDR RAM

SDR RAM is a full form of synchronous dynamic access memory. It has access times between 25 and 10 ns(nanosecond), and they are in DIMM (dual in-line memory module) modules of 168 contacts.

They store data using capacitors using IC's (Integrated Circuits). On one of its sides, they have terminations, which can be inserted inside of the individual slots for the Motherboard's memory. RD RAM



RD RAM

Rambus Dynamic Random Access Memory is a full form of RDRAM. This type of RAM chips works in parallel, which allows you to achieve a data rate of 800 MHz or 1,600 Mbps. It generates much more heat as they operate at such high speeds.

VRAM (Video):



VRAM

RAM optimized for video adapters is called VRAM. These chips have two ports so that video data can be written to chips at the same time the video adapter regularly reads the memory to refresh the monitor's current display.EDO RAM



EDO RAM

EDO DRAM is an abbreviation of Extended Data Output Random Access Memory. It doesn't wait for the completion of the processing of the first bit before continuing to the next one. As soon as the address of the first bit is located, EDO DRAM begins looking for the next bit.

Flash Memory :



Flash Memory

Flash memory is an electrically erasable and programmable permanent type of memory. It uses a one-transistor memory to store a bit. It offers low power consumption and helps to reduce the cost. It is mainly used in digital cameras, MP3 players, etc.

DDR SDRAM



DDR RAM

The full form of DDR SDRAM is Double Data Rate Synchronous Dynamic Random-Access Memory. It is just like SDRAM. The only difference between the two is that it has a higher bandwidth, which offers greater speed. It's maximum transfer rate to L2 cache which is approximately 1,064 Mbps.

Uses of RAM

Here, are important uses of RAM:

- RAM is utilized in the computer as a scratchpad, buffer, and main memory.
- It offers a fast operating speed.
- It is also popular for its compatibility
- It offers low power dissipation

A daughterboard (or *daughter board* , *daughter card* , or *daughtercard*) is a circuit board that plugs into and extends the circuitry of another circuit board. The other circuit board may be the computer's main board (its motherboard) or it may be another board or card that is already in the computer, often a sound card. The term is commonly used by manufacturers of wavetable daughterboards that attach to existing sound cards.

Alternatively known as a **bus slot** or **expansion port**, an **expansion slot** is a connection or port inside a computer on the motherboard or riser card. It provides an installation point for a hardware expansion card to be connected. For example, if you wanted to install a new video card in the computer, you'd purchase a video expansion card and install that card into the compatible expansion slot.

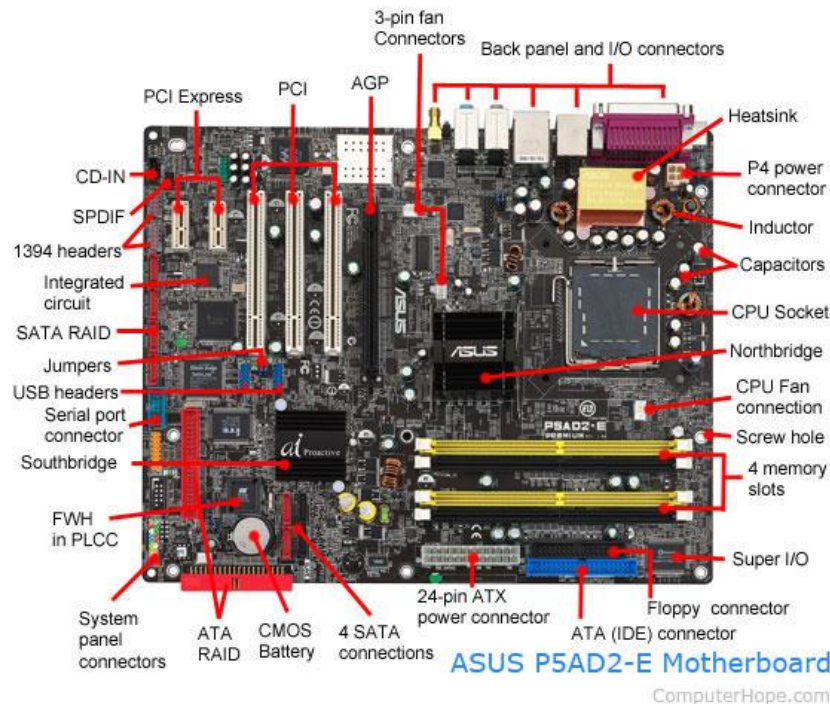
Computer expansion slots

Below is a listing of expansion slots commonly found in a computer and the devices associated with those slots. Clicking any of the links below provide you with additional details.

- **AGP** - Video card.
- **AMR** - Modem, sound card.
- **CNR** - Modem, network card, sound card.
- **EISA** - SCSI, network card, video card.
- **ISA** - Network card, sound card, video card.
- **PCI** - Network card, SCSI, sound card, video card.

- **PCI Express** - Video card, modem, sound card, network card.
- **VESA** - Video card.

Many of the expansion card slots above are obsolete. You're most likely only going to encounter AGP, PCI, and PCI Express when working with computers today. The picture below is an example of what expansion slots may look like on a motherboard. In this picture, there are three different types of expansion slots: PCI Express, PCI, and AGP.



How many expansion slots does my computer have?

Every computer motherboard is different, to determine how many expansion slots are on your computer motherboard identify the manufacturer and model of the motherboard. Once you've identified the model of motherboard, you can find complete information about the motherboard in its manual.

Adding additional expansion slots for older motherboards could be accomplished using a riser board, which would add several ISA or PCI slots. Today, riser boards

are rarely used with motherboards, as there is limited need for additional expansion slots with modern motherboards.

What type of expansion slots are on my motherboard?

As mentioned above, every motherboard model is unique, so to determine the type of expansion slots on the motherboard, consult the board's specifications and owner's manual. You can also open the computer case and visually examine the motherboard.

Why do computers have expansion slots?

Computers have expansion slots to give the user the ability to add new devices to their computer. For example, a computer gamer may upgrade their video card to get better performance in their games. An expansion slot allows them to remove the old video card and add a new video card without replacing the motherboard.

What is the most common expansion slot today?

Today, the most commonly used expansion slot used and found on computer motherboards is the PCI Express expansion slot.

Does a laptop have an expansion slot?

Laptops do not have expansion slots like a desktop computer. However, some laptops do have PC Cards that can be inserted into the side of the laptop. They may also have a Cardbus slot for an ExpressCard to be added.

SMPS

SMPS is the Switched Mode Power Supply circuit which is designed for obtaining the regulated DC output voltage from an unregulated DC or AC voltage. There are four main types of **SMPS** such as. DC to DC Converter. AC to DC Converter.

The SMPS is mostly used where switching of voltages is not at all a problem and where efficiency of the system really matters. There are few points which are to be noted regarding SMPS. They are

- SMPS circuit is operated by switching and hence the voltages vary continuously.
- The switching device is operated in saturation or cut off mode.
- The output voltage is controlled by the switching time of the feedback circuitry.
- Switching time is adjusted by adjusting the duty cycle.
- The efficiency of SMPS is high because, instead of dissipating excess power as heat, it continuously switches its input to control the output.

Disadvantages

There are few disadvantages in SMPS, such as

- The noise is present due to high frequency switching.
- The circuit is complex.
- It produces electromagnetic interference.

Advantages

The advantages of SMPS include,

- The efficiency is as high as 80 to 90%
- Less heat generation; less power wastage.
- Reduced harmonic feedback into the supply mains.
- The device is compact and small in size.
- The manufacturing cost is reduced.
- Provision for providing the required number of voltages.

Applications

There are many applications of SMPS. They are used in the motherboard of computers, mobile phone chargers, HVDC measurements, battery chargers, central power distribution, motor vehicles, consumer electronics, laptops, security systems, space stations, etc.

Types of SMPS

SMPS is the Switched Mode Power Supply circuit which is designed for obtaining the regulated DC output voltage from an unregulated DC or AC voltage. There are four main types of SMPS such as

- DC to DC Converter
- AC to DC Converter
- Fly back Converter
- Forward Converter

Internal Storage Devices

Internal storage can mean several different things, but most often refers to a computer's **internal** hard drive. This is the primary **storage device** used to store a user's files and applications. If a computer has multiple **internal** hard **drives**, they are all considered part of the computer's **internal storage**

Optical Storage

Optical Storage is a device for storage method in which data is written and readable with a laser and purpose is to store backup. Data written methods such as CDs and DVDs. From some of the years Optical storage is replacement for drives in personal computers and tape backup in mass storage. This is durable and protected to environmental conditions. Now the optical speeds approaching hard drives as said by OSTA(Optical Storage Technology Association). There are some of the new formats introduced Blu-ray and UDO i.e. ultra density optical and also use blue laser to increase capacity.

Magnetic Storage

Magnetic Storage is the most common and enduring form of removable storage device which is used in mostly systems. It is used as a drive which is mechanical device connects to computer in that you can insert the media that actually used as a storage device. The media used in removable storage device is made up of iron oxide and that oxide is ferromagnetic material, here the meaning of the term ferromagnetic is if you expose it into magnetic field it is permanently magnetised that is known as a disk or cartridge. The drive use motor to rotate the device at a

very high speed and access information stored by the heads. There are many types of magnetic storage devices hard drives, Tapes, Floppy disk, Iomega.

Semiconductor Storage

This storage device is used to store digital information that is fabricated by using integrated circuit technology also known as semiconductor technology which is an essential parts of today world. As there is rapid improvement in the requirement of such kind of technologies there are some of the related technologies emerged are ROM, RAM, EPROM, EEPROM, Flash Memory, DRAM and so on. Now we are going to discuss Flash memory its function and features. In this data can written and erased on the individual cell basis. To re-programme different areas of chip at different levels electronic equipment are used. It is non-volatile which make it useful to use. Used in many different fields like mobile phone, memory cards for digital cameras and many other applications.

Ports and Interfaces

The Motherboard of a computer has many I/O sockets that are connected to the ports and interfaces found on the rear side of a computer (Figure 3.13). The external devices can be connected to the ports and interfaces. The various types of ports are given below:

Serial Port: To connect the external devices, found in old computers.

Parallel Port: To connect the printers, found in old computers.

USB Ports: To connect external devices like cameras, scanners, mobile phones, external hard disks and printers to the computer.

USB 3.0 is the third major version of the Universal Serial Bus (USB) standard to connect computers with other electronic gadgets as shown in Figure 3.13. USB 3.0 can transfer data up to 5 Giga byte/second. USB3.1 and USB 3.2 are also released.



Figure 3.13 USB 3.0 Ports

VGA Connector: To connect a monitor or any display device like LCD projector.

Audio Plugs: To connect sound speakers, microphone and headphones.

PS/2 Port: To connect mouse and keyboard to PC.

SCSI Port: To connect the hard disk drives and network connectors.

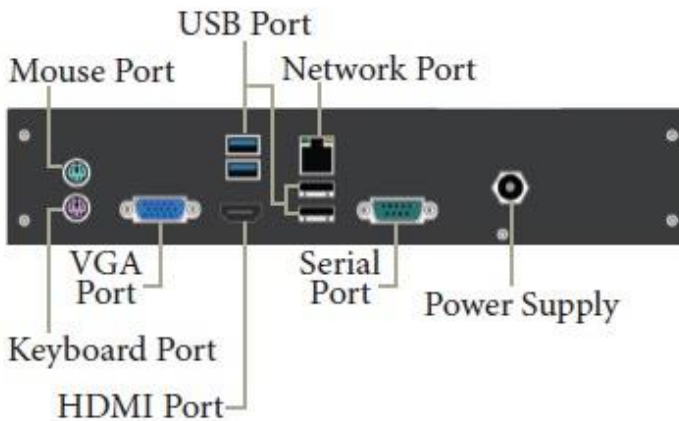


Fig 3.14 Ports and Interfaces

High Definition Multimedia Interface (HDMI)

High-Definition Multimedia Interface is an audio/video interface which transfers the uncompressed video and audio data from a video controller, to a compatible computer monitor, LCD projector, digital television etc.

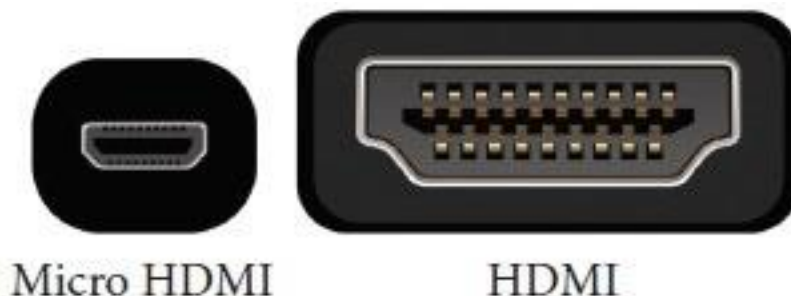


Figure 3.15 HDMI Ports