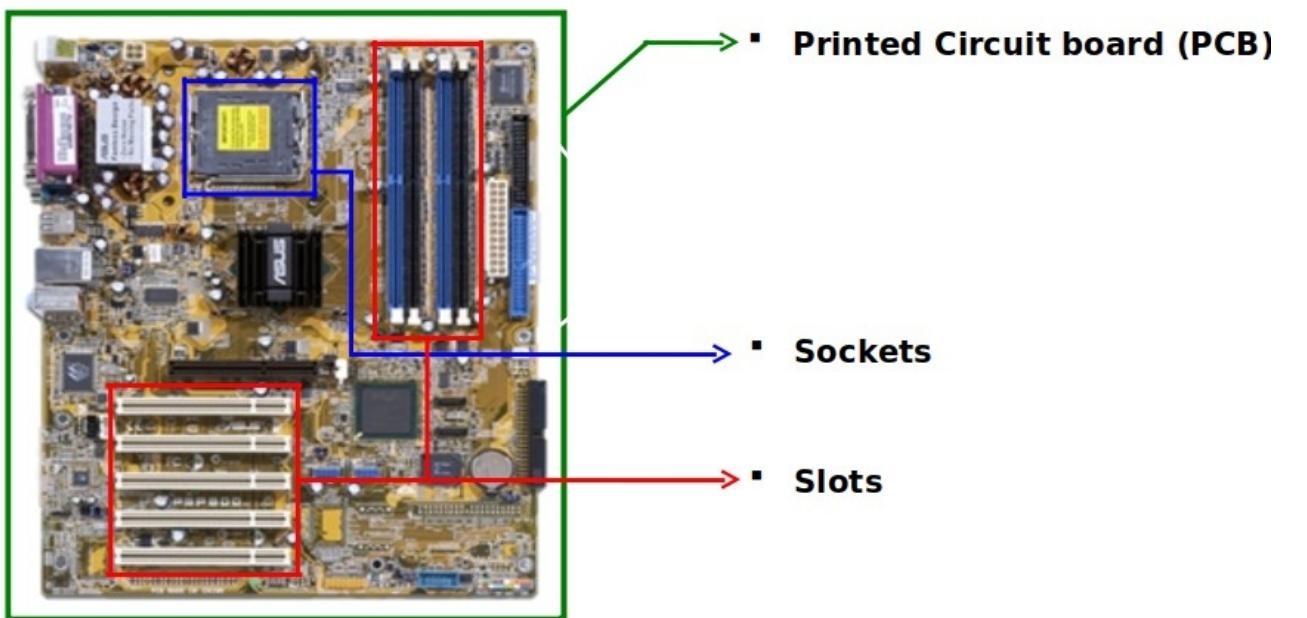


MotherBoard:

A **motherboard** (sometimes alternatively known as the **mainboard**, **main circuit board**, **system board**, **baseboard**, **planar board** or **logic board** or informally, a **mobo**) is the main printed circuit board (PCB) found in general purpose computers and other expandable systems. It holds, and allows, communication between many of the crucial electronic components of a system, such as the central processing unit (CPU) and memory, and provides connectors for other peripherals.

Motherboard, as the name suggests, this board is often referred to as the "mother" of all components attached to it, which often include peripherals, interface cards, and daughtercards: sound cards, video cards, network cards, hard drives, or other forms of persistent storage.

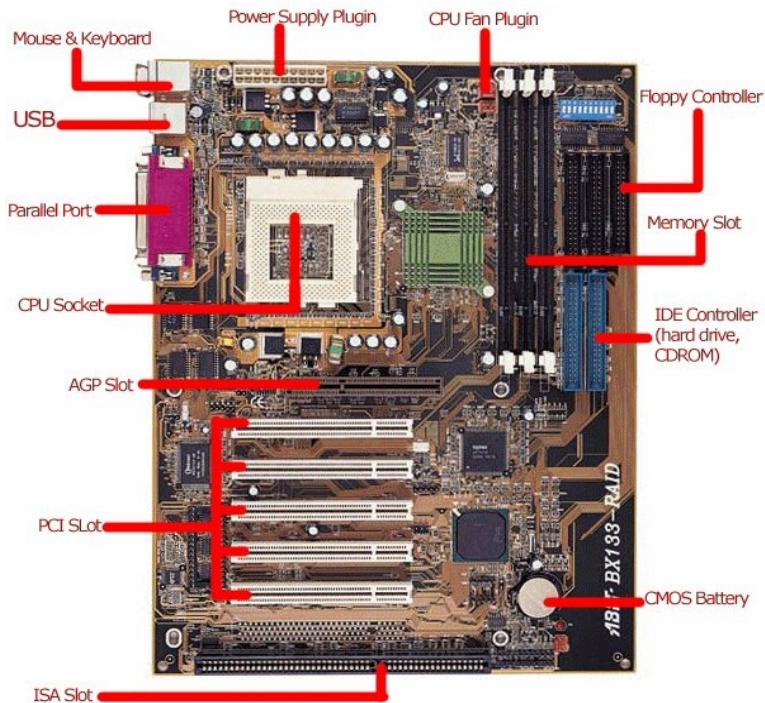


Specifications
Upgrade Capabilities
Size and shape
Speed

Processor / CPU Type:	<input checked="" type="checkbox"/> No Preference <input type="checkbox"/> Intel® Atom™ <input type="checkbox"/> Intel® Celeron® <input type="checkbox"/> Intel® Xeon® <input type="checkbox"/> Intel Core™ Duo <input type="checkbox"/> Intel Core™2 Duo <input type="checkbox"/> Intel Core 2 Duo / Celeron® <input type="checkbox"/> Intel Core™2 Quad <input type="checkbox"/> Intel Core™2 Extreme <input type="checkbox"/> AMD Athlon™ <input type="checkbox"/> AMD Turion™ 64 X2 Dual-Core <input type="checkbox"/> AMD Geode™ GX1 <input type="checkbox"/> Other
Processor Socket:	<input checked="" type="checkbox"/> No Preference <input type="checkbox"/> Socket 370 <input type="checkbox"/> Socket 478 <input type="checkbox"/> LGA Socket <input type="checkbox"/> Other
Chipset Type:	<input checked="" type="checkbox"/> No Preference <input type="checkbox"/> Intel® Chipset <input type="checkbox"/> VIA Chipset <input type="checkbox"/> Other
Max Speed:	At least <input type="text"/> No more than <input type="text"/> GHz ▾
Memory Capacity:	At least <input type="text"/> No more than <input type="text"/> GB ▾
ISA Slots:	At least <input type="text"/>
PCI Slots:	At least <input type="text"/>
Mini PCI:	At least <input type="text"/> No more than <input type="text"/>
PCI Express:	At least <input type="text"/> No more than <input type="text"/>
LAN / Networking:	At least <input type="text"/> No more than <input type="text"/>
SATA:	At least <input type="text"/> No more than <input type="text"/>
USB:	At least <input type="text"/> No more than <input type="text"/>
Other Slot Type?	<input type="button" value="No Preference ▾"/>
On Board Features:	<input checked="" type="checkbox"/> No Preference <input type="checkbox"/> Parallel Interface (PC printer port, Centronics?)* <input type="checkbox"/> Serial Interface (RS232, RS422, RS485)? <input type="checkbox"/> Floppy Drive Support? <input type="checkbox"/> On-board IDE Channels? <input type="checkbox"/> On-board Video Controller? <input type="checkbox"/> On-board Ethernet Controller? <input type="checkbox"/> Other
Certifications:	<input checked="" type="checkbox"/> No Preference <input type="checkbox"/> RoHS <input type="checkbox"/> Other

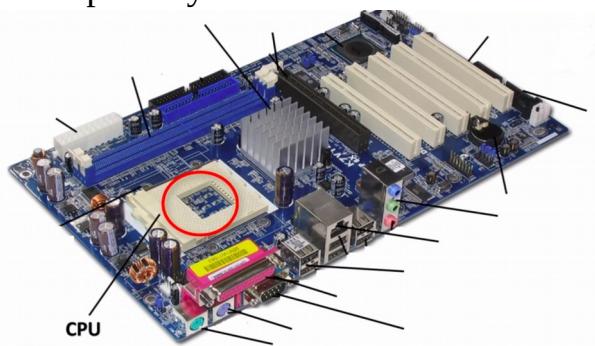
Components of Motherboard

The important components of a Motherboard are given below:



1. CPU Socket :

CPU refers to a processor, the central processing unit, also called the microprocessor performs all the task that take place inside a computer system. It is also known as brain of computer. The processor socket (also called a CPU socket) is the connector on the motherboard that connects a CPU.



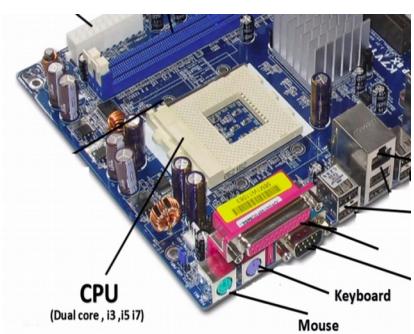
2. Mouse & keyboard :

There are two types of keyboard and mouse connectors. First type is called PS/2 (Personal System) and second one is called USB.

Computer PS/2 Ports



USB cable and port

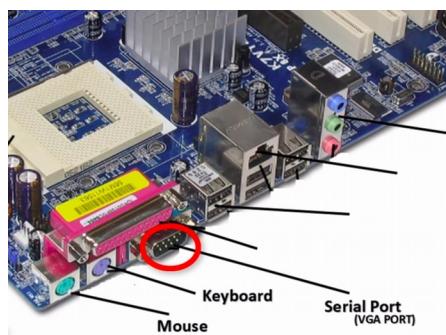


2. USB (Universal serial bus) :

USB is **Universal serial bus**. It is used for connection for PC. There are different devices which is used to connect with USB port such as mouse, keyboards, scanners, cameras, and even printers. USB connector is used to connect computer motherboard and a peripheral device. We can insert or remove peripheral device connect by USB connector without restarting your system.

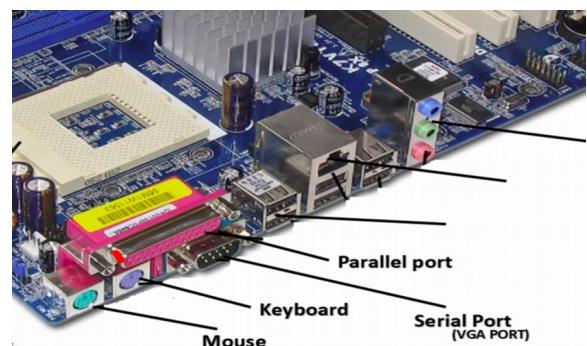
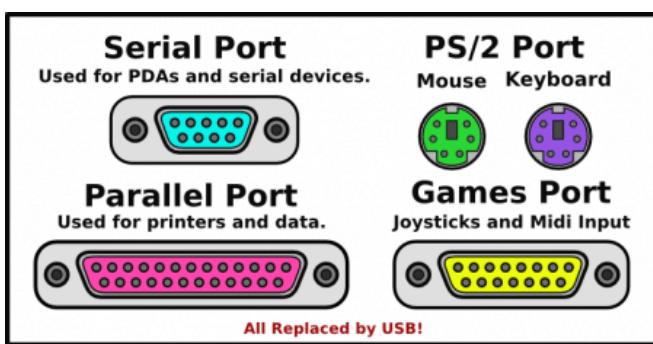
3. Serial port:

In computing, a serial port is a serial communication interface through which information transfers in or out sequentially one bit at a time. The **serial port** is a type of connection on PCs that is used for peripherals such as gaming controllers, modems, and older printers. Common example: VGA port.



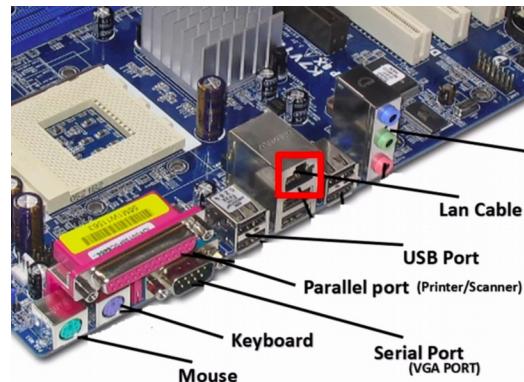
3. Parallel port :

A parallel port is a type of interface found on computers for connecting peripherals. The name refers to the way the data is sent; parallel ports send multiple bits of data at once, as opposed to serial interfaces that send bits one at a time. Parallel port **was widely used for** printers.



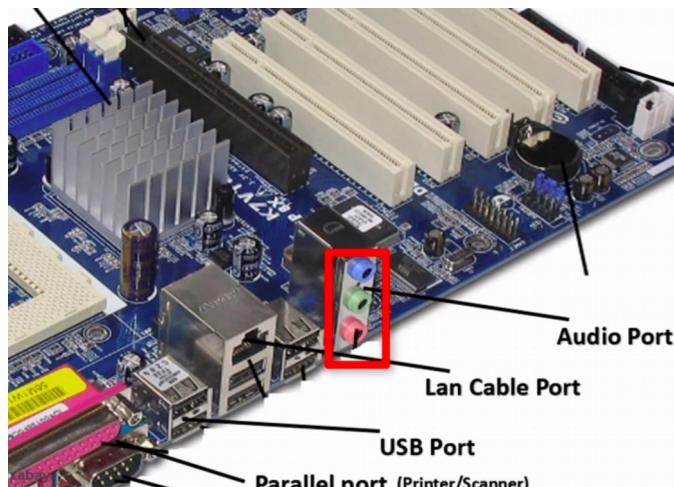
4. LAN Cable slot :

LAN used wired connections to link computers to and from other computers and also to other peripheral devices such as printers. Devices connected to **LAN cable** will be able to access data from any machine that is connected to the network. **LAN** stands for Local Area Network.



5. Audio Port:

To connect devices related to audio: mike, speaker etc.



Line Out : It used to connect speakers or headphone into the Line Out jack.



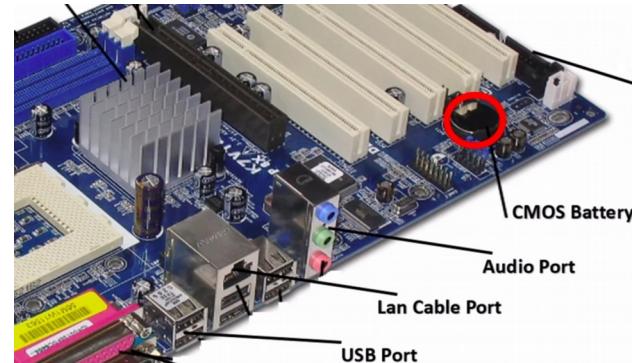
Line In : The Line In jack allows you to listen to your computer using a stereo system.



Microphone : It used to connect a microphone into this jack to record sounds on your computer.

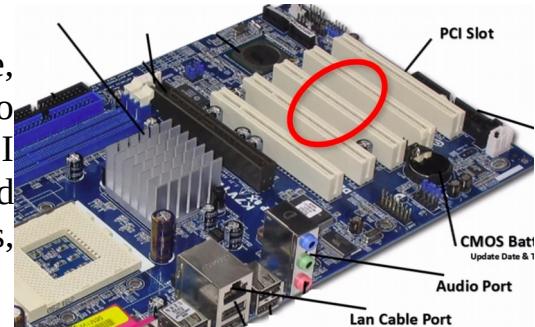
6.CMOS Battery:

CMOS is complementary metal-oxide-semiconductor is used to store BIOS setting in computer motherboard. CMOS battery that maintains the time, date, hard disk and other configuration settings in the CMOS memory. The battery or a cell is a 3.0 Volts lithium type cell. CMOS batteries are small and are attached directly to the motherboard.



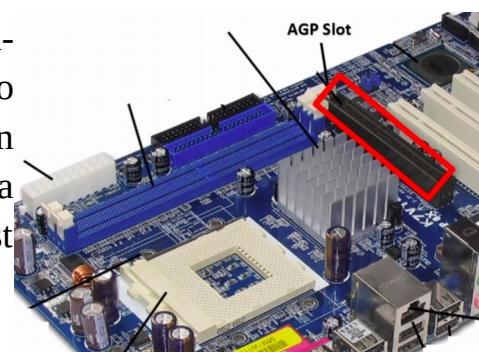
7. PCI Slot:

PCI stands for Peripheral Component Interface, PCI slot allows us to insert expansion cards into our computer. PCI used to connect additional PCI device like network cards, sound cards, modems, video cards. To add extra modems, network hardware or sound and video cards.



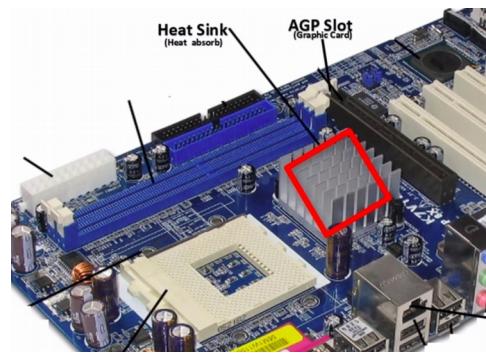
8. AGP Slot :

The Accelerated Graphics Port (**AGP**) is a high-speed point-to-point channel for attaching a video card to a computer system. If you have a modern motherboard, you will almost certainly notice a single connector that looks like a PCI slot. A fast port for a graphics card.



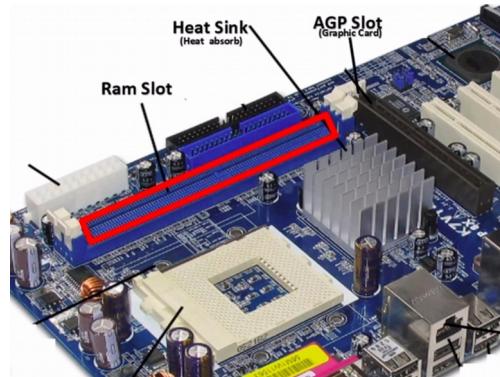
9. Heat Sink:

To control unwanted heat of CPU and motherboard or to absorb and reduced heat.



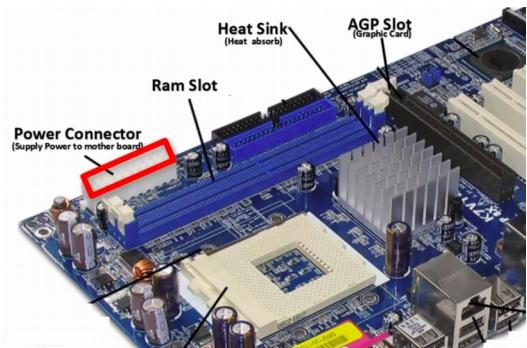
10. RAM slots :

RAM slots is for attaching RAM on it. In general desktop we can see two slot of RAM but in server motherboard we can see 4+ slot of RAM. RAM comes in different size (memory).



11. Power Connector:

To supply power on motherboard.

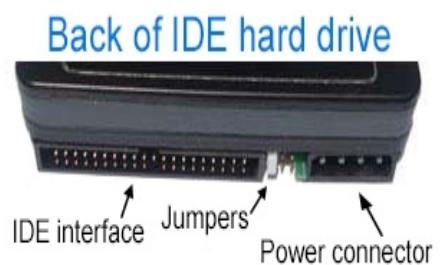


12. Floppy controller :

In old motherboard the floppy drive connects to the computer via a 34-pin ribbon cable, one end of ribbon cable is connect to floppy drive and other is connected to the motherboard.

13. IDE controller :

IDE that is **Integrated Drive Electronics**, a hardware interface for hard drives and CD/DVD drives, also called as **ATA (Advanced Technology Attachment) or PATA (parallel ATA)**. IDE controller is responsible for controlling the hard drive. Today's computers no longer come with a IDE controller.



14. ISA slot :

ISA stands for Industry Standard Architecture, It is the standard architecture of the Expansion bus. Its connect modem and input devices.

15. Chipset

A **chipset** which forms an interface between the CPU's front-side bus, main memory, and peripheral buses.

16. Clock Generator

A **clock generator** which produces the system clock signal to synchronize the various components.

Functions of Motherboard

- It integrates all Hardware components into one system.
- Allows all parts of computer to receive power and communicate with one another.
- The motherboard acts as the central backbone of a computer on which other modular parts are installed such as the CPU, RAM and hard disks.
- The motherboard also acts as the platform on which various expansion slots are available to install other devices / interfaces.
- The motherboard is also responsible to distribute power to the various components of the computer.
- They are also used in the coordination of the various devices in the computer and maintain an interface among them.

Computer motherboard is single platform to connect all of the parts (components) of a computer together. Hence it considered as the backbone of a computer.

Motherboard Form Factor:

Form factor refers to the motherboard's geometry, dimensions, arrangement and electrical requirements. That is, the shape and layout of a motherboard is called the **form factor**. The form factor affects where individual components go and the shape of the computer's case. There are several specific form factors that most PC motherboards use so that they can all fit in standard cases. Advanced Technology Extended (ATX) is the most common design of motherboard for desktop computers. Other form factors of motherboards are: XT(not used now), AT, Baby AT, Mini-ATX, Micro-ATX, Flex ATX, LPX and Mini LPX, NLX, BTX.

1) AT (Advanced Technology):

- Oldest and biggest form factor and popular until Baby AT.
- Capable of using 386 processor.
- 12' inch size and was difficult to install, service and upgrade.

AT connector: It consists of 2 number of 6 pin male connectors and is found on old types of motherboards.

2) Baby AT:

- Standard in computer industries and still being used in Pentium class products.
- CPU socket is placed in such a way that it can interfere with other bus cards.
- Limitation over peripheral card installation.

3) ATX (Advanced Technology Extended):

- Improvement done in easy to use, support for current and future I/O, and also to current and future technology.
- New mounting configuration for power supply.
- Processor relocated away from expansion slots to allow full length add-in cards.
- Provides air-flow across the processor.

ATX connector. The latest in the series of power connectors, they are either 20 or 24 pin female connectors. Found in all the latest types of motherboards.

ATX 24-pin power supply connector



4) Mini ATX:

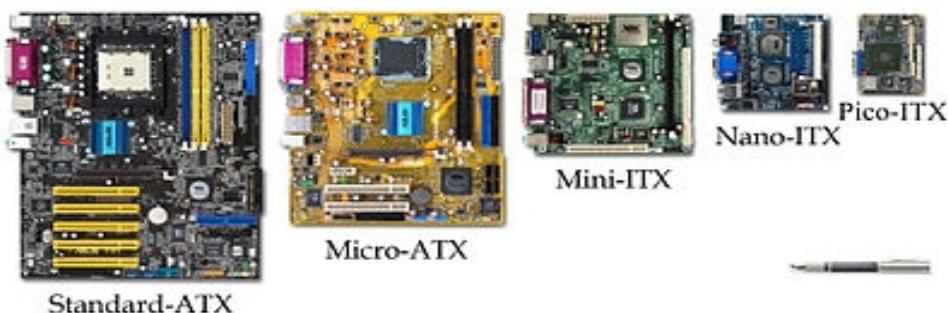
- Commonly same as ATX.
- Just change in size from ATX= 12" x 9.6" to Mini ATX= 11.2" x 8.2".

5) Micro ATX:

- Supports current and new processor technologies.
- AGP (Accelerated graphics port) to have high performance graphics.
- Smaller in size and less power supply.

6) Flex ATX:

- A subset of micro ATX.
- Gives chance to system developers to create new personal computer design.
- Enhanced flexibility to allow custom case and board design to be manufactured.
- Small motherboard size and supports current processor technology.



7) LPX (Low Profile Extension) and Mini LPX:

- Usually found in desktop pc's.
- Case are slim-line, low profile case with riser card arrangement for expansion cards.
- Riser card arrangement means expansion boards are parallel rather than perpendicular.
- This make smaller case but limits number of expansion slots to two or three.
- High quality product at low cost but makes difficult to upgrade and repair.

8) NLX (New Low Profile Extended):

- Supports current and future processor technologies.
- Also supports new AGP technology.
- Installing and upgrading the system is easy.

9) BTX (Balanced Technology eXtended)

BTX (Balanced Technology eXtended) is a form factor for *motherboards*, originally intended to be the replacement for the aging ATX *motherboard* form factor in late 2004 and early 2005. The BTX features a low profile, more efficient layout to facilitate cooling, a scalable board to accommodate different system sizes, and support for high-mass motherboard components.

Types and Size of Form Factors

Form Factor	Motherboard Size	Description
ATX, full size	Up to 12" x 9.6"	Most popular form factor, which has had many revisions
MicroATX	Up to 9.6" x 9.6"	Smaller version of ATX
FlexATX	Up to 9" x 7.5"	Smaller version of MicroATX
BTX	Up to 12.8" wide	Has improvements over ATX and can have up to seven expansion slots
MicroBTX	Up to 10.4" wide	Has up to four expansion slots
PicoBTX	Up to 8" wide	None or one expansion slot
NLX	Up to 9" x 13.6"	Used in low-end systems with a riser card

Classification of Motherboard

1. Non-Integrated Motherboard

- Assemblies such as I/O port connectors, hard drive connectors, CD drive connectors etc installed as expansion boards.
- Takes lot of free space inside the case because of expansion slots.
- If something goes wrong such as bend or broken pin or defective controller can be repaired with minor cost.
- Are cheap and easy to produce.
- Most of the olden motherboards were non-integrated.
- The major assemblies like **Video circuitry, disk controllers, and accessories** are installed on the Computer as expansion cards.
- Can easily identify the Non-integrated motherboards by their expansion slots usually occupied by one of the components.

2. Integrated Motherboard

- Assemblies are integrated or built right onto the board.
- Serial and parallel ports, IDE, CD drive are directly connected to the motherboard.
- This tends to free some space inside case and better accessibility to the components.
- Cheaper to produce but are expensive to repair.
- Fast, powerful, feature rich motherboard at reasonable price.
- Components are in built in the motherboard.
- Designed for simplicity.

Drawbacks

- When one component in the board is broken or stops working you have to replace the whole board.
- Cheaper to produce but more expensive to repair.

Motherboard Manufacturers:

Motherboard Manufacturers	
Manufacturer	Web Address
Motherboards.com	www.motherboards.com
Abit	www.abit.com.tw
American Megatrends, Inc. (AMI)	www.megatrends.com or www.ami.com
ASUS	www.asus.com
Dell	www.dell.com
First International Computer of America, Inc.	www.fica.com
Gateway	www.gateway.com
Gigabyte Technology Co., Ltd.	us.giga-byte.com
IBM	www.ibm.com
Intel Corporation	www.intel.com
Iwill Corporation	www.iwill.net
Supermicro Computer, Inc.	www.supermicro.com
Tyan Computer Corporation	www.tyan.com

BIOS

- The full form of BIOS is **Basic Input Output System**. It is a motherboard component in the form of a Integrated chip.
- Unlike your operating system (which is stored on your hard drive), your computer's BIOS is stored on a chip on your motherboard.
- When you power your computer on, your BIOS takes control, starting the power-on self test (POST) and passing control over to the boot loader, which boots your computer's operating system. The BIOS is low-level system software that should “just work” without getting in your way.
- This chip contains all the information and settings of the motherboard which you can modify by entering the BIOS mode from your computer.
- The **BIOS** is a ROM chip found on motherboards that allows you to access and set up your computer system at the most basic level.
- In the picture below, is an example of what a BIOS chip may look like on your computer motherboard. In this case, this is a picture of an early AMIBIOS, a type of BIOS manufactured by AMI.

Computer BIOS



- The BIOS includes instructions on how to load basic computer hardware and includes a test referred to as a POST(**Power On Self Test**) that helps verify the computer meets requirements to boot up properly. That is, POST verifies that the hardware are working properly and ready to load operating system.
- If the computer does not pass the POST, you will receive a combination of beeps indicating what is malfunctioning within the computer.
- BIOS updates will not make your computer faster, they generally won't add new features you need, and they may even cause additional problems. You should only update your BIOS if the new version contains an improvement you need.

- Manufacturers often release updates to their computers BIOSes. If you built your own computer, a BIOS update would come from your motherboard vendor. These updates can be “flashed” onto the BIOS chip, replacing the BIOS software the computer came with a new version of the BIOS. [Flashing it means to update it with a new program. You shouldn't do it unless you need to do so in order to fix something. If power goes out while flashing, you can be left with an unbootable computer.]
- BIOSes are computer-specific (or motherboard-specific), so you will need the BIOS for your exact model of computer (or motherboard) to update your computer's BIOS.

The four main functions of a PC BIOS

- **POST** - Test the computer hardware and make sure no errors exist before loading the operating system. Additional information on the POST can be found on our POST and beep code page.
- **Bootstrap Loader** - Locate the operating system. If a capable operating system is located, the BIOS will pass control to it.
- **BIOS drivers** - Low-level drivers that give the computer basic operational control over your computer's hardware.
- **BIOS or CMOS Setup** - Configuration program that allows you to configure hardware settings including system settings such as computer passwords, time, and date.

Daughter Board

- A **daughterboard** is a circuit board that plugs into and extends the circuitry of the main board called motherboard. A daughterboard is connected directly to the motherboard gives added functionality.
- Today, these boards are not found or used in desktop computers and have been replaced with ISA cards, PCI cards etc.
- However, some laptops still use these boards.
- Unlike expansion cards, which connect with the motherboard using the bus and other serial interfaces, daughterboards are usually directly embedded. Like a motherboard, a daughterboard has sockets, pins, plugs, and connectors to be attached to other boards. Typically, daughterboards are released as a post-

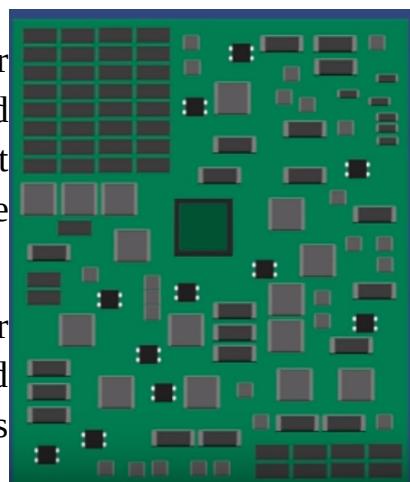
launch update to a motherboard or expansion card. For example, a MIDI(Musical Instrument Digital Interface) daughterboard is used to add on the functionality of the sound card. Modern computers rarely have daughterboards. In the past, this was common.



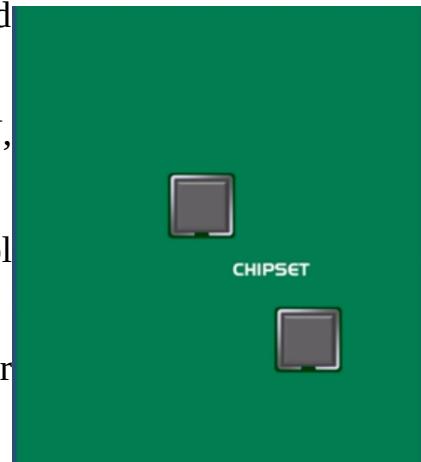
The earliest microcomputers were made up of different circuit boards, each of which performed a different function. All of these circuit boards were attached to a single board which is designed for some power regulation circuitry and a group of connectors. This board was commonly called a “bus board” or “backplane.”

Chipset

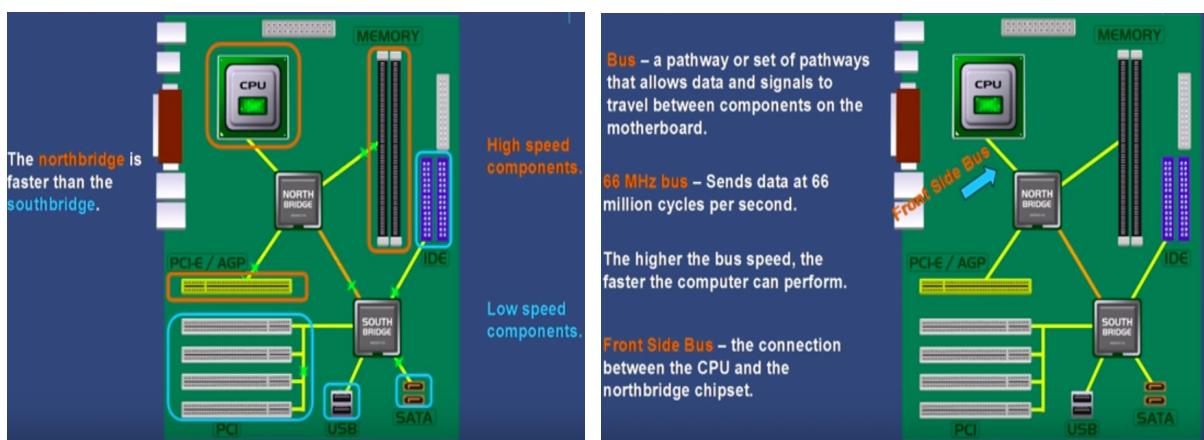
- One of the main and most important component that find on the motherboard is the chipset.
- Older motherboards were designed with a lot of different chips scattered all over the motherboard.
- There were chips for different things, like chips for bus controllers, memory controllers, keyboard controllers and so on. So they had a lot of different chips controlling different functions on the motherboard.
- So as technology progressed, to reduce the number of chips and have them more in a centralized location, chips are integrated together, which is known as chipset.

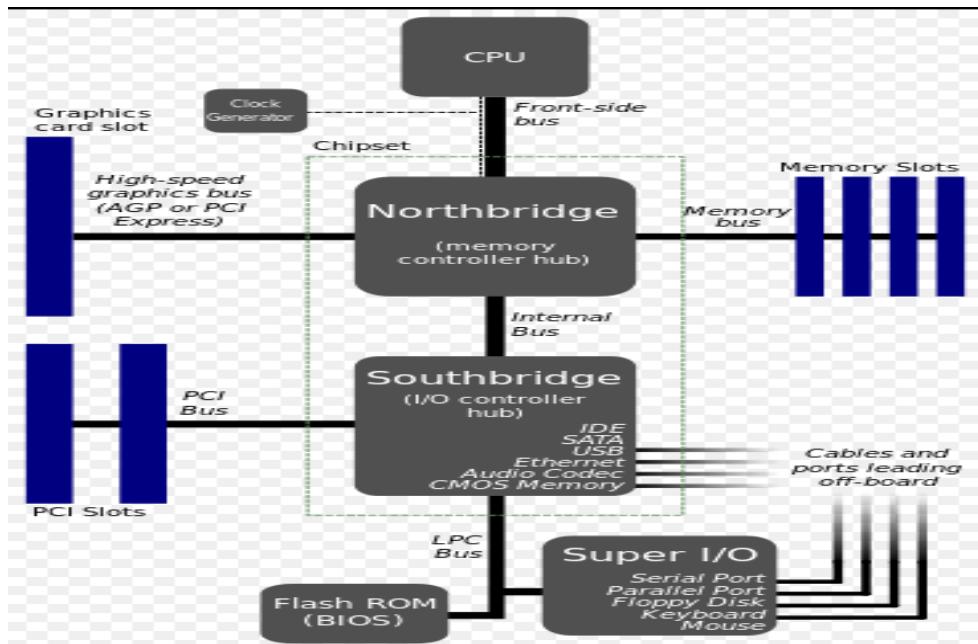


- A chipset is a smaller set of chips that has replaced a larger amount of chips.
- Its job is to control data flow between the CPU, peripherals, bus slots and memory.
- Chipsets can include instructions that help control the CPU, PCI, ISA, or USB hardware.
- An example of a recent Intel chipset is the i820 or the Intel 820 chipset.



- A chipset has two sections – **southbridge** and **northbridge** – with specific sets of functions that communicate between the CPU and external devices.
- The **southbridge**, is an IC on the motherboard responsible for the hard drive controller, I/O controller and integrated hardware. which is not directly connected to the CPU, is also known as the input/output controller hub. Southbridge handles the motherboard's slower connections, including input/output (I/O) devices and computer peripherals like expansion slots and hard disk drives.
- The **northbridge** connects the southbridge to the CPU and is commonly known as the memory controller hub. The northbridge handles a computer's faster interaction requirements and controls communication between the CPU, RAM, ROM, BIOS, the accelerated graphics port (AGP) and the southbridge chip. The northbridge links I/O signals directly to the CPU. The CPU uses the northbridge frequency as a baseline for determining its operating frequency.





Block diagram of a modern motherboard, which supports many on-board peripheral functions as well as several expansion slots

- Generally it's common for the northbridge and southbridge to have a heat sink; in addition, the northbridge is usually slightly larger than the southbridge and is the closest to the CPU and memory.
- The southbridge gets its name for commonly being South of the PCI bus whereas, the northbridge that lies North of the PCI bus,
- Some newer motherboards have replaced the northbridge and the southbridge with **IHA(Intel Hub Architecture)**.
- Short for **Intel Hub Architecture**, **IHA** is the replacement for the Northbridge and Southbridge found on computer motherboards. The IHA is found on all Intel 800 series chipsets, and like its predecessor it has two parts: the GMCH and the ICH.
 - The **GMCH**, or Graphics and AGP Memory Control Hub, is similar to the Northbridge and helps control the AGP and memory.
 - The **ICH**, or I/O Controller Hub for short, is similar to the Southbridge and is responsible for the I/O ports and PCI controller.
- A chipset is specifically designed for a motherboard. The chipset and motherboard must be compatible with the CPU to prevent system failover. Most chipset drivers are manually updated and installed.

- A chipset and device drivers are compatible when an operating system is initially installed. However, device drivers eventually become outdated due to subsequent hardware and software installations. Outdated or incompatible device drivers create compatibility issues, lack of features and degrade device performance.

Steps for Installing motherboard

- First read the manual available with the motherboard.
- Now place the motherboard on proper position and screw it up tightly and also check whether it is touching to any metal anywhere.
- Plug in components like processor, CPU fan, RAM, hard disk, graphic card, power supply etc.
- Check all the connections are properly connected according to the manual and then test the motherboard.

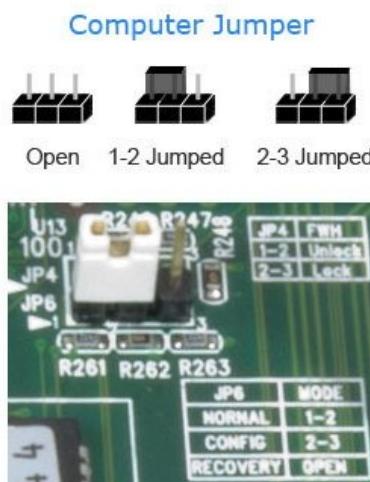
Jumper

- In electronics and particularly computing, a jumper is a short length of conductor used to close, open or bypass part of an electronic circuit. They are typically used to set up or configure printed circuit boards, such as the motherboard of computers. Jumper pins (points to be connected by the jumper) are arranged in groups called jumper blocks, each having at least one pair of contact points.

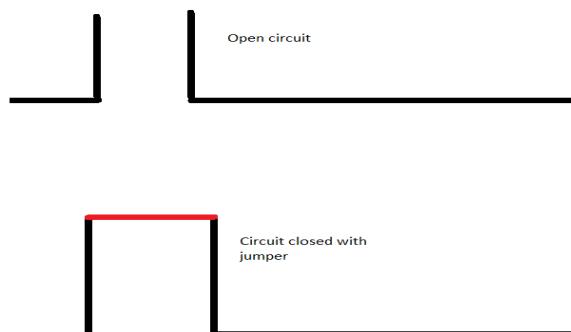


- Some documentation may refer to setting the jumpers to on, off, closed, or open. When a jumper is on or covering at least two pins it is a closed jumper, when a jumper is off, is covering only one pin, or the pins have no jumper it is an open jumper.
- **Jumpers** allow the computer to close an electrical circuit, allowing the electricity to flow certain sections of the circuit board.
- Jumpers consist of a set of small pins that can be covered with a small plastic box (**jumper block**), as shown in the illustration. Below the illustration is a picture of what the jumpers may look like on your motherboard.

- In this example, the jumper is the white block covering two of the three gold pins. Next to the pins is a silkscreen description of each of the pin settings. In the picture jump pins 1-2 for Normal mode, 2-3 for config mode, and when open the computer is in recovery mode.
- Jumpers are used to configure the settings for computer peripherals, such as the motherboard, hard drives, modems, sound cards, and other components. For example, if your motherboard supported intrusion detection (ID is a security measure that notifies an administrator when a system policy is being violated), a jumper can be set to enable or disable this feature.

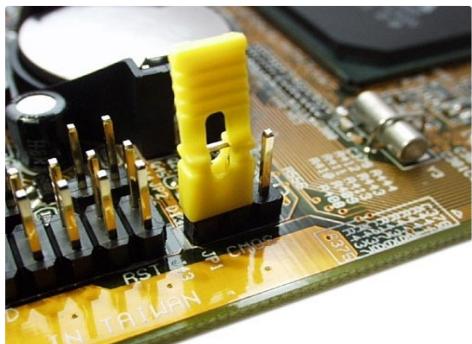


- You could also solder a wire between two things - that would also be a jumper.

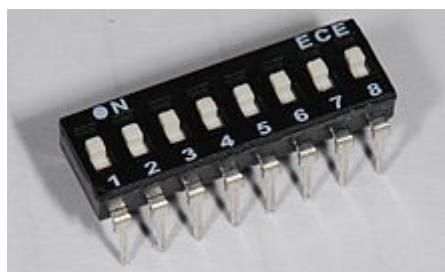


- A long time ago, jumpers needed to be manually set on a motherboard to set the bus speed, the CPU clock speed multiplier, and other settings. DIP Switches were also common.

Here's a picture of a motherboard with a jumper on it.



- In this picture, the plastic piece holds a conductor that connects the pins and allows electricity to flow through the circuit.
- DIP switches are an alternative to jumper blocks. Their main advantages are that they are quicker to change and there are no parts to lose.
- A DIP switch is a manual electric switch that is packaged with others in a group in a standard dual in-line package(DIP). The term may refer to each individual switch, or to the unit as a whole. This type of switch is designed to be used on a printed circuit board along with other electronic components and is commonly used to customize the behaviour of an electronic device for specific situations.
- That is, a dip switch is just like a series of pins set up to use jumpers, only instead of putting the conductor over the wires yourself, you just flip a switch to make the connection.



A slide style DIP switch

Motherboard Tools

Motherboard Handheld Tools



Some Extra:

SATA and PATA

There are two types of hard drive connections that a computer could have: PATA (Parallel ATA), also known as IDE, and SATA (Serial ATA). SATA is most commonly used in nearly all computers today, due to below advantages.

Advantages

➤ **Increased data transfer rate**

The primary reason SATA is used over PATA is because of the increased data transfer speeds with that SATA. PATA is capable of data **transfers speeds** of 66/100/133 MBs/second, whereas SATA is capable of 150/300/600 MBs/second. The speed differences are due to the various flavors of PATA and SATA, with the fastest speeds being the latest version of each currently available. You'll notice that SATA's slowest speed is still faster than PATA's fastest speed. The improved speed of SATA allows for programs to load faster, as well as pictures and larger documents. For video game enthusiasts, faster data transfer speeds can mean better gaming experiences (i.e. smoother game-play).

➤ **Easy cable management and cable length**

Another advantage of SATA over PATA is the length of the cable connecting the hard drive to the computer motherboard. The max length of a PATA cable is 18-inches, whereas a SATA cable can be up to 3.3 feet (1 meter) in length. With this extra length, you have more flexibility of where a hard drive can be mounted in a computer case.

PATA and SATA cables



➤ **Increased airflow**

SATA cables are also smaller in size than a PATA cable, allowing for increased airflow inside the computer case and decreased heat build-up. Better airflow can help improve the overall life of a computer.

➤ **Support for more drives**

There are four to six SATA connections on a computer motherboard, allowing for multiple SATA hard drives to be hooked up. There are usually only two PATA connections on a computer motherboard that supports a total of four PATA hard drives.

Disadvantages

➤ **Drivers and support**

There are only a few small disadvantages of SATA over PATA. One disadvantage is that SATA hard drives sometimes require a special device driver for the computer to recognize and use the drive. However, a SATA hard drive can act as a PATA hard drive, thus eliminating the need for the specific driver to be loaded. However, some SATA functionality will be lost to gain this PATA functionality.

Older operating systems such as Windows 95 and 98 that were released long before SATA was introduced do not support SATA drives.

➤ **One drive per cable**

Another disadvantage with SATA is that the cable allows for only one SATA hard drive to be connected at a time. Whereas a PATA cable allows for hooking up two PATA hard drives per cable.

Expansion Slots

- An expansion slot is a socket on the motherboard that is used to insert an expansion card (or circuit board), which provides additional features to a computer such as video, sound, advanced graphics, Ethernet or memory.
- The expansion card has an edge connector that fits precisely into the expansion slot as well as a row of contacts that is designed to establish an electrical connection between the motherboard and the electronics on the card, which are mostly integrated circuits. Depending on the form factor of the case and motherboard, a computer system generally can have anywhere from one to seven expansion slots. With a backplane system, up to 19 expansion cards can be installed.
- Expansion cards can provide various functions including:
 - Sound
 - Modems
 - Network
 - Interface adapters
 - TV and radio tuning
 - Video processing
 - Solid-state drive
 - Power-on self-test
 - Basic input/output system (BIOS)
 - Expansion read-only memory (ROM)
 - Security devices

Some expansion slots includes:

- **ISA slots:** These were the oldest expansion slots in the history of motherboards. They were found in AT boards and are identified by black color. Conventional display cards or sound cards were installed in these slots. The full form of ISA is **Industry Standard Architecture** and is a 16-bit bus.
- **AGP slot:** Accelerated graphics port(AGP) is specifically used to install a latest graphics card. AGP runs on a 32-bit bus and both PCIe and AGP can be used to

install high-end gaming display cards. Short for **accelerated graphics port**, AGP is an advanced port designed for video cards. AGP introduces a dedicated point-to-point channel that allows the graphics controller direct access to the system memory.

- **PCI Slots:** The full form of PCI is Peripheral Component Interconnect. The PCI slot is one of the important motherboard components today and is vastly used to install add-on cards on the motherboard. The PCI supports 64-bit high-speed bus.
- **PCI Express (Peripheral Component Interconnect Express),** officially abbreviated as **PCIe** or **PCI-e** is a high-speed serial computer expansion bus standard, designed to replace the older PCI, PCI-X and AGP bus standards. It is the common motherboard interface for personal computers graphics cards, hard drives, SSDs, Wi-Fi and Ethernet hardware connections. PCIe has numerous improvements over the older standards, including higher maximum system bus throughput, lower I/O pin count and better performance scaling for bus devices, a more detailed error detection and reporting mechanism (Advanced Error Reporting) and native hot-swap(replacing or adding components without shutting down the system) functionality.
- **AMR:** AMR is short for **audio/modem riser** and allows to make one card with the functionality of either a Modem or audio or both as one card. This specification allows for the motherboard to be manufactured at a lower cost and free up industry standard expansion slots in the system for other additional plug-in peripherals. With modems and sound cards being integrated into the motherboard, more people using broadband, and better technologies like PCIe, AMR never gained mass adoption. Today, AMR is no longer found or used with any modern motherboard. It includes: modem, sound card.
- **EISA-** Short for **Extended Industry Standard Architecture.** It includes: SCSI , network card, video card.
- **CNR** - Short for **Communication and Network Riser**, CNR is a specification that supports Audio, Modem, USB, and LAN interfaces.