What is a Computer Motherboard?

A motherboard is a circuit board which is fixed inside the Central Processing Unit (CPU) of a computer. It can be considered as a computing system which integrates most of the essential components of a computer.

A motherboard serves as a single platform to connect all of the parts of a computer. It connects the CPU, memory, hard drives, optical drives, video cards, sound cards, and other ports and expansion cards directly or via cables. It can be considered as the backbone of a computer. Generally, it is made up of fibreglass and copper.

The motherboard is mounted inside the case and is securely attached via small screws through pre-drilled holes. The motherboard contains ports to connect all of the internal components. It provides a single socket for the CPU, whereas for memory, normally one or more slots are available. Motherboards provide ports to attach the floppy drive, hard drive, and optical drives via ribbon cables. The motherboard carries fans and a special port designed for power supply.

There is a peripheral card slot in front of the motherboard using which video cards, sound cards, and other expansion cards can be connected to the motherboard.

On the left side, motherboards carry several ports to connect the monitor, printer, mouse, keyboard, speaker, and network cables. Motherboards also provide USB ports, which allow compatible devices to be connected in a plug-in/plug-out fashion—for example, pen drives, digital cameras, etc.

Components of a Motherboard

A motherboard is made up of different components; some of the primary elements are as follows −

CPU Socket − It's a major component which determines the processor connected to the system.

Memory Slots − These slots allow connecting memory devices into it.

Storage Connectors − These slots include Serial ATA ports to connect hard drives like hard drives and SSDs.

ROM Slots − These slots allow ROM BIOS to connect.

Chipset − It connects CPU, memory, storage and peripheral devices.

Cooling fans − Cooling fans that maintain a suitable internal operating temperature.

Peripheral connector − these include USB ports to connect peripheral devices.

Audio Connectors − These allow audio input and output devices to work with analogue and digital audio signals.

Network Connectors − These ports are used for wired network connections, or Wi-Fi to access the internet.

Power connector − power connectors are used to connect external power sources. There are two basic types: the 24-pin ATX power connector and the 4 or 8-pin CPU power connector.

BIOS/UEFI − The Basic Input / Output System (BIOS), also known as the Unified Extensible Firmware Interface (UEFI), is a type of firmware that initializes and tests hardware during the boot process; it also provides runtime services to operating systems and programs.

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Features of Computer Motherboard

A motherboard comes with the following features −

- Motherboard varies greatly in supporting various types of components.
- The motherboard supports a single type of CPU and a few types of memory.
- Video cards, hard disks, and sound cards have to be compatible with the motherboard to function properly.
- Motherboards, cases, and power supplies must be compatible to work properly together.

Types of Motherboards

Different types of Motherboards are as follows −

Advanced Technology (AT) motherboard

This motherboard was designed by IBM in 1984 with the IBM PC/AT. It was most widely used in industry and influenced the design of many subsequent motherboards. This motherboard has larger physical dimensions but is not suitable for smaller desktop computers.

The original AT motherboards were available in 12 inches × 13.8 inches (305 mm x 351 mm) in size, making them relatively large by modern standards. The configuration of AT motherboards was not standardized, resulting in major differences between manufacturers. This frequently resulted in inadequate airflow and complex cable management.

The Advanced Technology (AT) motherboard was a key form factor in the history of personal computing, establishing standards that impacted subsequent designs. However, due to its large size, convoluted layout, and restricted integration, it was eventually replaced by the more efficient and user-friendly ATX specification.

Standard ATX motherboard

ATX stands for advanced technology extended; it is an extended version of the AT motherboard that was created by Intel in the 1990s. It has become one of the most prevalent motherboard sizes used in desktop computers because of its compatibility and interchanged component features. A standard ATX motherboard is a popular desktop computer form factor that offers a good combination of size, capabilities, and expansion. Standard ATX motherboards are typically 305 mm x 244 mm (12 in x 9.6 in) in size. This size provides enough space for components and expansion slots.

ATX motherboard uses a common layout to enhance ventilation and component placement. The CPU socket is normally located toward the top or middle of the board, with expansion slots aligned for effective cooling and simplicity of installation.

Micro ATX motherboard

Micro ATX motherboards are smaller in size and have limited ports and slots than the Standard ATX board. This motherboard is better suited to users who don't desire too many connections and subsequent updates.

Micro ATX (mATX) motherboards are smaller versions of the conventional ATX motherboard form factor. It has been specifically designed concerning size and features which make it ideal for compact desktop builds while not compromising too much expandability or speed.

Micro ATX motherboards typically have dimensions of 244 mm x 244 mm (9.6 in x 9.6 in), which are smaller than conventional ATX but larger than Mini-ITX.

Micro ATX motherboards provide the right blend of size, capabilities, and expandability, making them a popular choice for a variety of desktop PC configurations. They provide ample PCIe slots and connectivity choices for most users while fitting in smaller cases than typical ATX boards. This makes them suited for a wide range of applications, including gaming, entertainment, and home office sets.

Extended ATX motherboard

An Extended ATX (eATX) motherboard is a larger variant of the normal ATX motherboard that is intended to provide additional features, improved performance, and expanded functionality like up to eight RAM slots, additionally, a higher number of PCIe (where e is for Express) and PCI slots.

An extended ATX (E-ATX) motherboard has a larger form factor than a conventional ATX motherboard, allowing for more components and more capabilities. E-ATX motherboards often have dimensions of 305 mm x 330 mm (12 in × 13 in) or greater. They are broader than regular ATX boards, making sufficient space for more components and expansion slots.

E-ATX motherboards have a larger form factor than regular ATX, allowing for more components, expansion slots, and functionality. They are ideal for high-performance desktop builds and enthusiast systems that require flexibility, performance, and a wide range of networking options.

E-ATX motherboards typically have several PCIe slots, including several PCIe x16 slots for high-performance graphics cards and several PCIe x1 slots for further expansion cards.

Flex ATX motherboard

The FlexATX standard sets a balance between size and capability, making it a popular choice for projects that need a tiny footprint without sacrificing features. FlexATX motherboards are often smaller than normal ATX and microATX boards, with dimensions of 229 mm x 191 mm (9 in × 7.5 in).

Despite their compact size, FlexATX motherboards can provide a wide range of functionality such as multiple USB ports, integrated audio, and network connectivity. However, they may contain limited ports and connectors than larger form factors.

Low-Profile EXtended (LPX) motherboard

These are comparatively older motherboard form factors that were popular in the late 1980s and early 1990s. It was designed for low-profile desktop cases. The dimensions of LPX motherboards include around 330 mm x 229 mm (13 in x 9 in), although these can vary.

One of the distinguishing characteristics of LPX motherboards is the use of a riser card. The riser card enables expansion cards to be placed parallel to the motherboard, lowering the overall height of the system. This design was ideal for low-profile desktop cases. The LPX motherboard had a significant impact on the evolution of computer form factors, particularly in permitting the creation of smaller desktop systems. However, it has subsequently been replaced by more modern and adaptable standards.

BTX motherboard

BTX stands for balanced technology extended. It was designed by Intel in 2003 to overcome the limitations and thermal issues associated with the ATX standard. BTX motherboards are available in different sizes, including conventional, mini, and pico. Standard BTX boards typically measure 325 mm x 267 mm (12.8 in x 10.5 in). These have a different layout than ATX motherboards. They were created to optimize airflow and thermal management by arranging the key heat-generating components, such as the CPU and GPU, in a manner that allows for more efficient cooling. BTX motherboards include similar functionality and connectivity options to ATX boards, such as multiple USB ports, SATA connectors, integrated audio, and network interfaces.

Pico BTX motherboard

The Pico BTX (Balanced Technology eXtended) motherboard is a small version of the BTX form factor intended for ultra-compact devices. Pico BTX motherboards are available with 203 mm x 267 mm (8 in x 10.5 in) size. This compact size is designed for small form factor (SFF) cases.

Pico BTX boards, like all other BTX form factors, are designed to optimize airflow and thermal management. The CPU and other important heat-generating components are

positioned to align with the system's airflow path, which typically runs from the front intake to the back exhaust.

Mini ITX motherboard

A Mini-ITX (Information Technology Extended) motherboard is a small form factor introduced by VIA Technologies in 2001. It was created for small form factor (SFF) computing, achieving a balance of size, performance, and usefulness. Mini-ITX motherboards are 170 mm by 170 mm (6.7 in x 6.7 in) in size.

Despite its compact size, a Mini-ITX motherboard is designed to handle a wide range of components, making it appropriate for a wide range of computing requirements, including basic desktop use, gaming, and home theatre PCs.

Mini STX motherboard

In 2015, Intel developed the Mini-STX (Mini Socket Technology Extended) motherboard. It provides an ideal combination of size, performance, and upgradeability for small form factor (SFF) PCs. Mini-STX motherboards are 147 mm by 140 mm (5.8 in x 5.5 in) in size; the Mini-STX form factor is designed to fit in ultra-compact enclosures while yet delivering adequate performance for different applications.

Mini-STX motherboards offer a unique alternative for ultra-compact, upgradeable PCs. Their small size and socketed CPU make them excellent for SFF builds, home theatre PCs, and other applications where space is constrained but performance and upgradeability are still required.

Popular Motherboard Manufacturers

Following are the popular manufacturers of the motherboard.

Intel

ASUS

AOpen

ABIT

Biostar

Gigabyte

MSI