

Comparative Study on Different Types of Motherboards

Introduction

In any computer system, the motherboard is the most fundamental component; it is the central hub that connects all other components of the computer. Its design, commonly referred to as its form factor, is essentially the overall size of the motherboard, dictating its number of expansion slots. When it comes to design aspects, it is crucial to select the appropriate form factor of a motherboard for your computer. This study provides a surface-level comparison of common motherboard form factors, differentiating their dimensions, CPU and memory slot capacities, expansion capabilities, storage interfaces, and unique built-in features to further understand their applications and limitations.

Discussion

The changing evolution of form factors of motherboards shows the changing needs of the computing industry, balancing performance, size, and efficiency.

The ATX (Advanced Technology eXtended) form factor is the standard for desktop computers, offering a balance between size and expansion capabilities. Its 12 by 9.6-inch dimensions provide enough space for a single CPU (Central Processing Unit), four memory slots, and a great number of PCI slots (Peripheral Component Interconnect). The provision of 6-12 SATA (Serial AT Attachment) ports supports multiple storage drives, making ATX motherboards versatile for almost any application, including gaming, content creation, etc.

BTX (Balanced Technology eXtended), though less common today, emphasizes thermal management optimization, having airflow directed over the CPU. Its slightly larger 12.8 by 10.5 inches allowed for a similar number of expansion storage options as ATX, but with a focus on cooling efficiency.

For high-performance servers, the Extended-ATX (E-ATX) form factor offers a larger 12 by 13 inches size, for more power delivery, offering 8 or more memory slots and 6-16 SATA ports. This form factor is ideal for demanding applications that require extensive memory and multiple graphics cards.

Moving towards more compact sizes, the Micro-ATX, with a size of 9.6 by 9.6 inches, provides a smaller size while retaining much of its functionality. It supports four memory slots and 4-8 SATA ports, but often reduces the number of expansion slots to four. This makes Micro-ATX an excellent choice for mainstream desktop PCs where space is an issue.

The most compact mainstream option for consumer PCs is Mini-ITX (6.7 by 6.7 inches). Designed with two memory slots, 2-6 SATA ports. Their primary limitation is often due to a single PCI expansion slot, restricting the system to one graphics card or other expansion card. Despite this, they are still capable of housing powerful components, making them popular for discreet office setups where space is really limited.

Finally, Standard-ATX is essentially another term for the default ATX discussed earlier, which also has the same characteristics as it but does not mean it is a fully ATX board offering 7 PCI expansion slots, still with the same versatility, and is a widely adopted standard.

Table

Form Factor	Build	CPU Slots	Memory Slots	PCI Slots	SATA	Builtin Features
ATX Motherboard	12 X 9.6 in	1	4	7 (x16, x4, x1)	6-12	Integrated I/O panel, optimized airflow, easy access to components, often multiple fan headers, USB/audio headers, M.2 slots (modern).
BTX Motherboard	12.8 X 10.5 in	1	4	7 (x16, x4, x1)	2+	Inverted internal layout for improved thermal management (CPU near front fan), straight-through airflow, fewer cable obstructions.
Extended-ATX Motherboard	12 x 13 in	1	8+	8 (x16, x4, x1)	6-16	More robust power delivery, support for dual CPUs or HEDT, extra features for overclocking, multiple M.2 slots, advanced cooling options, often ECC RAM support.
Micro-ATX Motherboard	9.6 X 9.6 in	1	4	1-2 (x16) 1 (x4) 1-2(x1)	4-8	Compact size for smaller cases, cost-effective, typically includes integrated graphics output, fan headers, USB/audio headers, M.2 slots (modern).
Mini ITX Motherboard	6.7 X 6.7 in	1	2	1 (x16) 1 (Mini)	2-6	Ultra-compact for SFF builds/HTPCs, low power consumption, usually integrates Wi-Fi/Bluetooth, limited expansion but powerful for its size, fan headers, USB/audio headers, M.2 slot (modern).
Standard-ATX Motherboard	12 X 9.6 in	1	4	2-3 (x16, x1)	6+	Industry standard, wide compatibility with cases/components, good balance of features, performance, and expansion. (Note: The "2-3 (x16, x1)" in the original image for standard ATX is an underestimate, typically it is 7 for full ATX.)

References

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