**CPU Buying Guide**

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**What is a CPU/Processor?**

The CPU (Central Processing Unit) is essentially the brain of the computer. It interprets and executes instructions and data contained in software programs. The more generic term "processor" is often used to refer to a CPU as well, and the more specific term "microprocessor", meaning CPUs that are manufactured on integrated circuits, is also widely used nowadays. These three words mean exactly the same thing in this article, and elsewhere in most cases.

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**What are the basics I need to know when selecting my CPU?**

There are many different ways of classifying processors, and the most common ones are:

* By CPU brand name (Intel, AMD) and series - e.g. Core i, Phenom II, etc.
* By processor core: Ivy Bridge, Deneb and Windsor, etc.
* CPU socket geometry, e.g. Socket AM3+, LGA 2011, etc.

**Major Manufacturers and Product Series**

Intel and AMD are the two most prolific CPU manufacturers in the current PC market; they provide almost all the processors used in PCs.

Intel's six high-performance yet economical desktop processor product lines consist of the well-known **Atom,** **Pentium**, and **Celeron** for budget and entry-level users, **CoreTM i3** and **CoreTM i5** for mainstream applications, as well as **CoreTM i7**, which is aimed at high-end gamers/enthusiasts. Intel's latest and greatest offerings come in the form of its celebrated dual-core and quad-core **Next Generation** CoreTM**i3,** **i5**, and **i7** processors.

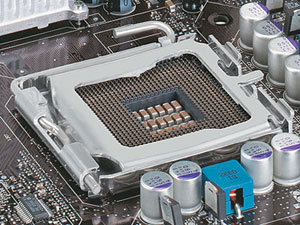
AMD offers several desktop processor product series. One of the top-performing series is the Phenom II. AMD Phenom™ II processors deliver the performance you need for high definition entertainment and advanced multitasking. Our dependable, backwards-compatible, multi-core processors are priced for the savvy consumer who seeks outstanding performance for the money.  
  
AMD Phenom™ II Black Edition processors enable skilled users to unlock even more performance from the AMD Phenom II processor with amazing overclocking potential.  Black Edition processors let you go beyond the limits of maximum speed with easy-to-use AMD OverDrive™ and AMD Catalyst Control Center™ software suites.

**What is the Processor Core?**

We often use the term "core" (this is not the same as Intel's "Core" brand of processors or "Core microarchitecture") to represent the microarchitecture (cache size, number of pipeline stages etc.) of the processor. Their internal microarchitectures are different, and their performance levels are different at equal clock speeds.

**Socket Type and Platform**

The CPU socket is the interface between the processor and the motherboard. When building a computer system, you must make sure the CPU socket matches the motherboard's CPU socket (i.e. Socket AM3 processors for Socket AM3 motherboards, LGA1155 processors for LGA 1155 motherboards), and that the motherboard supports the particular CPU model. The example below is of a LGA775 (or Socket T) motherboard socket.



Socket match aside, your chosen motherboard (mainly the chipset on the motherboard) must be able to support the processor. Otherwise, the system will not work or will not be able to function properly. An example of a non-matching combination is an Intel motherboard with a H57 chipset paired with a third generation Core i7 processor. The H57 chipset supports Core i7 processors, but not the third generation. For safety, always double check with the manufacturer's website when pairing processors to motherboards.

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**Demystifying the Specifications**

The specification of a processor may seem boring for most people, and you do not have to know all these technical terms to choose the right processor for you. But if you are willing to know a bit more things about processor, this section should be able to help you.

**Clock Speed/Operating Frequency**

A processor can execute instructions more quickly using a faster clock speed, resulting in increased performance of the processor and system. Clock speed is still an important feature contributing to performance, especially when comparing processors based on the same core.

**FSB**

The front side bus carries all data that travels between the CPU and other devices of the system such as system memory and graphics. A faster front side bus can increase performance and responsiveness by transferring data faster.

**L2 Cache**

A larger capacity (e.g. 2MB vs. 1MB) allows more data to be accessible from the fast L2 Cache storage area, and benefits most applications by increasing performance and responsiveness.

**Process Type/Manufacturing Process**

The manufacturing process is the typical width of basic wiring that connects parts of the semiconductor to the assembly circuit. The smaller this value is, the higher the number of transistors that can be integrated into the same-sized piece of silicon, and the higher the clock speed the processor can reach. Advanced (smaller) manufacturing processes reduce processor power consumption and production cost as well.

**Multi-Core**

With multi-core processors now available, the core count became a new way of establishing processor performance. Where multi-core or dual-core processors have the advantage are in multi-threading applications where multiple programs are running simultaneously, and/or applications specifically optimized for multi-threading.

As Intel and AMD are both pursuing a multi-core future, we can expect there to be an increasing number of applications/programs optimized for multi-threading. Choosing a dual-core processor now can safeguard your investment for a considerable amount of time.

In practice, multi-core processors excel when running two or more computing-intensive program simultaneously. For example, you can perform video encoding in the background while playing 3D games. There are also applications that can take advantage of dual-core processors now, with video processing/encoding/decoding being some of the most attractive. Dual-core processors can boost performance by up to 50% or even more in these applications when compared with single-core processors of the same core design and same clock speed.

**Hyper-Threading and Hyper-Transport**

Hyper-Threading enables multi-threaded software applications to execute two software threads in parallel on a single processor execution core, thereby improving system responsiveness. Hyper-Threading is an Intel technology and is helpful when running multi-threaded applications or multiple tasks simultaneously (e.g. running virus scanning software while using your everyday software).

HyperTransport Technology is a high-speed, low latency, point-to-point link designed to increase the communication speed between integrated circuits in computers. Specific AMD processors utilize this technology for communications between the processor and the chipset.

**64-bit Support**

Processors that offer 64-bit support can enable simultaneous 32- and 64-bit computing, and improve performance by allowing the system to address more than 4 GB of memory.

**Power Consumption**

Performance is definitely not the only requirement to consider as power consumption and heat dissipation are both currently very serious problems and deserve extra attention. A lower power bill is usually pretty nice to have as well. New technologies such as EIST (Enhanced Intel SpeedStep Technology) from Intel and Cool'n'Quiet from AMD have been developed to reduce processor power consumption.

**Retail vs. OEM**

There are two types of the packaging often seen in the retail market: boxed (retail) and tray (OEM or Original Equipment Manufacturer). The boxed version is for the retail market with a processor and a CPU cooler included. The OEM package, which is often cheaper and contains only a processor, was originally provided only to the PC manufacturers. Boxed/retail processors usually have better/longer warranties.

**CPU Cooler for the BTX Form Factor**

Some Intel boxed processors come with a BTX CPU cooler now, instead of a "traditional" ATX cooler. This BTX cooler must be used on a BTX motherboard and installed in a BTX case. The BTX cooler is not compatible with ATX cases. The processor itself is the same, however, and you can install it in both ATX and BTX systems. If you don't have a BTX-compatible motherboard and case, do not buy boxed processors with BTX coolers unless you have or are willing to buy another suitable CPU cooler.

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**Choosing the Right Processor**

As the brain of a computer, the processor (or CPU) plays a defining role in the total PC system. The performance of a PC system is roughly determined by the processor, so choosing the right processor is key when building your own computer. The other components, such as RAM and hard disk drive, also play important roles, while the video card is crucial when it comes to 3D graphics performance.  
  
**Zero-in on Your Applications**

It is very important to figure out the applications you will run most often and your real performance requirements when choosing your processor. Processors of different cores (or microarchitectures) perform differently according to the application.

**Price/Budget Concern**

Price is always an important factor to consider regardless of what you are buying. Finding the price/performance sweet spot is usually the best way to choose a processor for most users.  
  
As a matter of course, processors with higher clock speeds typically cost more (vs. products of the same series/core) but provide higher levels of performance. After choosing the processor series based on your own applications/requirements, you should consider your budget when deciding what clock speed to get.

**Our Recommendations**

**For Mainstream Users**

A midrange processor may provide sufficient performance for many users (for web browsing, word processing, multimedia application, gaming etc.), but if you perform video processing/encoding very often or want to play the latest 3D games under very demanding graphics settings, you may want to look at processors with higher clock frequencies.

**For Power Gamers/Hi-End Users**

If you are a power gamer or require extremely high computing power, consider spending extra money on a high-end processor or even an extreme edition processor. They are the most powerful desktop processors available at the moment.

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**Related Products**

**Cooling Devices & Thermal Pastes**

Heat dissipation is a critical problem for today's processors, as thermal power for the most powerful processors can go beyond 100+ watts, bringing along with it undesirably high temperatures, instability and reduced CPU service life.   
  
Generally speaking, the stock CPU cooler included with the boxed processor is capable of dissipating the heat generated by the processor. However, this may be insufficient in a variety of scenarios, for example, when ambient temperatures are very high and heat dissipation becomes more challenging. The problem is even more serious for those one who overclock their processors. In these cases, a powerful CPU cooling device is recommended. The same applies to the thermal paste - decent aftermarket thermal paste can help reduce temperatures as well.   
  
Performance is not the only reason to replace the stock CPU cooler. Some users may find the stock coolers too noisy, and others simply prefer the aesthetics of aftermarket products. The various aftermarket CPU cooling devices are able to fulfill a variety of different requirements.