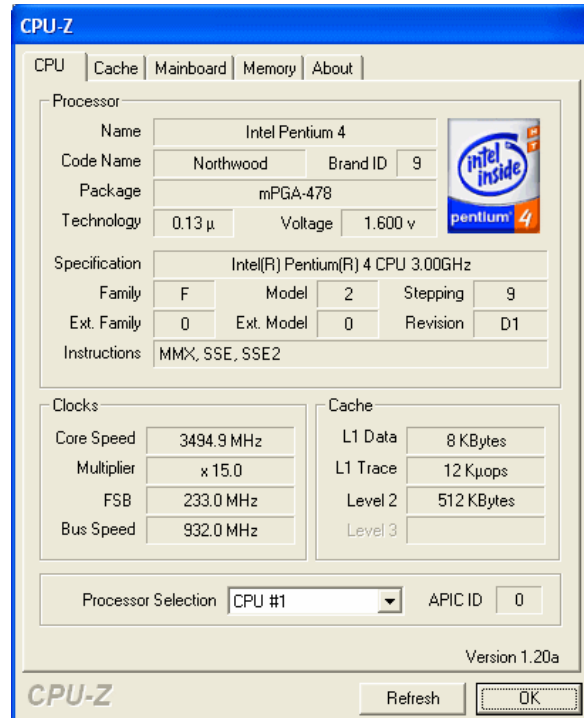


chillblast

How to Overclock

What is overclocking? Overclocking simply means running something at a higher speed than it is rated for. So for example, take a Pentium 4 2.4GHz (2400MHz). It is designed to run at 2400MHz, no less, no more, but if you're lucky you can run it at a higher speed, say 2600MHz, which would obviously make it perform like a proper Pentium 4 2.6GHz.

The question is, how do we manage to do this, and can it be done to every processor? First we'll take a quick look at how clock speed (the 2400MHz part of our Pentium 4) is derived.



All current processors are much the same, they have a multiplier, and a front side bus (FSB). In the case of the Pentium 4, the FSB or bus speed is 100, 133 or 200MHz depending on what model of Pentium 4 you have. Our Pentium 4 2.4c processor uses the fastest 200MHz FSB, which Intel quote as 800MHz due to their marketing of the 'Quad Pumped' bus, but we can ignore that.

So, to achieve 2400MHz from a 200MHz bus, we multiply 200 by 12, which gives the final clock speed. So,

$$\text{Multiplier} \times \text{FSB} = \text{Clock Speed}$$

For a Pentium 4 2.53GHz (which uses the older 133MHz bus) this would be

$$19 * 133\text{MHz} = 2527\text{MHz}$$

And it works the same way for Athlons too, for instance, an Athlon XP 2500+ which is in reality running at 1.83GHz, uses a 166MHz FSB, has a multiplier of 11.

$$11 * 166 = 1826\text{MHz}$$

So in theory, if we had other components that could support it, and the processor itself was capable of running at the increased speed, we could change the FSB from 166MHz to 200MHz.

$$11 * 200 = 2200\text{MHz}$$

This is the same speed as an Athlon XP 3200+!

How do we go about changing the FSB or bus speed? Most motherboards today have a section in the BIOS which allows you to make changes to the bus speed, processor voltage, memory voltage, memory speed etc. The BIOS is usually accessible by pressing 'Delete' shortly after power on, but you can refer to your motherboard manual for exact instructions on how to do this.

CPU Operating Speed	User Defined
- Ext. Clock (CPU/AGP/PCI)	412/ 66/ 33MHz
- Estimated New CPU Clock	4944MHz
- N/B Strap CPU As	By CPU
- DRAM Ratio (CPU:DRAM)	1:1
- AGP Ratio (CPU:AGP:PCI)	Fixed
- Fixed AGP/PCI Frequency	66/33MHz

Once in the BIOS, have a look for 'Frequency / Voltage Control', 'Softmenu', 'Advanced' or similar menus, as these will be the areas that contain all the overclocking controls. What your BIOS has will depend upon what motherboard you own, if you have an Abit motherboard, you'll see 'Softmenu' listed, if it's an Asus, you'll need to look out for 'Advanced' at the top of the screen, other motherboard manufacturers may use the more generic term of 'Frequency / Voltage Control'. Again, your motherboard manual should provide information on what is available in the BIOS.



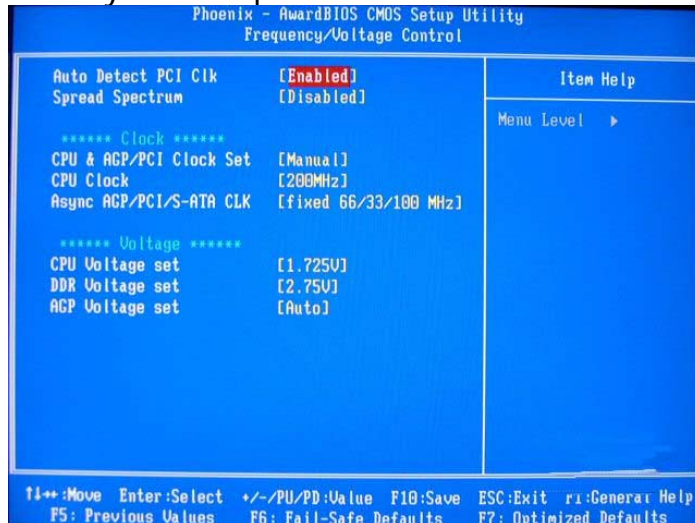
Standard Award Bios, similar to that found on Abit, Gigabyte, and Shuttle motherboards



Medallion Award Bios found on Asus motherboards

Once in the overclocking section of your BIOS, you can start experimenting; try increasing the FSB/Bus speed a few MHz at a time, saving and exiting the BIOS and booting into your operating system to check if the overclocking has worked. Common overlocks are increasing a Pentium 4 2.4c to 3GHz, that's going from 200MHz FSB to 250MHz. Similar overlocks can often be achieved with other Pentium 4s, you just have to experiment, and always expect the worst!

No motherboard BIOS is identical, so make sure you know what to look for. FSB might be listed as bus speed or external clock. Also, it may list CPU/AGP/PCI clocks, in which case CPU refers to the FSB, AGP refers to the AGP clock speed (default is 66MHz) and PCI refers to the PCI clock speed (default 33MHz). If you can avoid it, don't make the AGP and PCI clocks go up, 70MHz and 35MHz for AGP/PCI are safe values. Some boards allow you to 'lock' these clock speeds, so regardless of what FSB you run, everything else is always within specification.



There is also the question of voltages. A typical Pentium 4 runs at 1.525v, but by increasing the voltage to say, 1.6v, you may achieve a higher clock speed. It is best to try overclocking at default voltage until you find a limit, and then try increasing the voltage a little bit at a time to see if that helps. It is not advisable to increase

voltage more than 10% over the default value. Increasing voltage will also increase the temperature of your processor, which in turn may limit its overclockability. Overclocking itself will increase the processor temperature, as the processor has to do more work. Make sure you have a decent heatsink/fan, or you could try more exotic cooling solutions such as water or phase change. Due to the nature of electronics, processors are usually able to run faster at lower temperatures, so if your processor is already running at 60°C you'll probably find that you can't overclock very much, If at all.

Finishing off, you need to remember a few basic things. For instance, memory speed is usually directly related to FSB, so if you increase the FSB on your Pentium 4 to 220MHz, you also increase the memory frequency to 220MHz. Many motherboards allow you to use a 'memory divider', which can let the memory run slower than the FSB. So, if the memory runs at the same speed as the FSB, the divider is 1:1. Common dividers are 5:4 and 3:2. To work out the memory frequency from the divider, you divide the FSB by the first number, and then multiply by the second number. For example if we run a 200MHz FSB and use the 5:4 divider we get

$$(200 / 5) \times 4 = 160\text{MHz}$$

or DDR320. These dividers can be useful at higher speeds to bring the memory speed down to specification.

And just because your system can boot at its new higher speed, don't assume that it's 100% stable. You must test the system before continuing any

important work. Try something like [Prime95](#) which you can use to really torture test your PC, sometimes even non-overclocked systems fail this test!!

If you need a utility to check what speed and settings you're running your system at, look no further than [CPU-Z](#) (screenshot at the top of this article) which provides CPU speed, FSB, memory timings and frequency, CPU voltage and many other things.

A widely used benchmark utility is [SiSoftware Sandra](#) which includes benchmarks for the CPU, Memory, Hard Disk, CDROM, Network etc. This is useful to check that your tweaking has actually made some difference!

This guide was brought to you by [Chillblast](#) – Specialists in overclocking and the finest PC components!

Disclaimer: Overclocking can be very dangerous, and may result in hardware failure if you go too far. So don't expect huge increases, and try going up a little bit at a time, otherwise you may be very disappointed; you have been warned!