



DDR Basics

The Ram Guy gets many questions about DDR. As he is just learning about it himself, he'll do the best he can, and will provide more info as he learns more!

First of all, what does DDR stand for?

"DDR" stands for "Double Data Rate".

So what exactly is being doubled?

Don't worry, I won't be a wise guy and say "the data rate"! With DDR, under optimal conditions twice as much data can be obtained from the memory subsystem during the same amount of time.

How does it do this?

In most modern PCs, memory data is provided to the processor in "synchronous" fashion. This means that data arrives rhythmically, to the beat of a drum (a tick of a clock, in fact...). The memory clock is actually an electrical signal that bounces between two voltage levels, and shown in the picture to the right.

With standard SDRAM, data is transferred from the memory to the processor when the clock signal bounces from LOW to HIGH. With DDR, data is transferred not only when the clock signal goes from LOW to HIGH, but also when the clock signal goes from HIGH to LOW. Voila! Twice as much data on each tick of the clock!

I'm having a hard time visualizing this...

The Ram Guy has been scratching his head for a week trying to think of a real world analogy to make "double data rate" easy to understand. A sharp stone and the resulting flat tire brought this one to light...

The Ram Guy likes road biking and mountain biking, and gets lots of flat tires because he weighs too much. Fortunately, he has a DDR tire pump that makes repairs easier! Where the old technology tire pumps put air in the tire only when you push the pump's plunger DOWN, the Ram Guy's new DDR pump puts air in the tire BOTH when you push the plunger DOWN, and also when you pull the plunger back UP. Twice as much air in each pumping cycle, meeting the inflation demands of today's high tech tires! Now do you get it?

I've heard of PC1600 and PC2100. What does this mean, and what is the difference?

Well, it's kind of like PC100 and PC133. Since it is double data rate, you might expect that DDR would be PC200 and PC266. In fact, the RAM chips themselves are sold as PC200 and PC266. HOWEVER, our module guys did not want you to think that Rambus (at 800 MHz) is four times as fast as PC200 DDR. So, we went with a number that reflects the MODULE bandwidth. Since DDR DIMMs are eight bytes wide, the designation becomes $PC200 * 8 = PC1600$ and $PC266 * 8 = PC2100$. So, to repeat, PC1600 uses both edges of a 100MHz clock, and PC2100 uses both edges of a 133MHz clock. And now, you're only a little less confused than me!

And what about CAS Latency?

CAS Latency is pretty much the same as for SDRAM (see my CAS Latency Bulletin for the scoop) but there is one subtle difference. Where common CAS latency for SDRAM is either 2 clock cycles or 3 clock cycles, the common CAS latencies for DDR SDRAM are 2 clock cycles and 2.5 clock cycles. Most DDR RAMs available now are CAS 2.5.

Everything else the same as SDRAM, i.e. registered vs. unbuffered, ECC vs. non-ECC, etc.?

Yup...

What else do I need to know?

Well, I think this is about it. At least, it's about all I know! But, as new stuff comes up, I will be updating this bulletin. So, bookmark this page and check back often! Also, check www.corsairmemory.com/technotes for the latest on DDR!

Email ramguy@corsairmemory.com with topic suggestions for other Ram Guy Tech Notes.