SDRAM (Synchronous Dynamic Random Access Memory)

SDRAM (Synchronous Dynamic Random Access Memory):
"Synchronous" tells about the behaviour of the DRAM type. In late 1996, SDRAM began to appear in systems. Unlike previous technologies, SDRAM is designed to synchronize itself with the timing of the CPU. This enables the memory controller to know the exact clock cycle when the requested data will be ready, so the CPU no longer has to wait between memory accesses. For example, PC66 SDRAM runs at 66 MT/s, PC100 SDRAM runs at 100 MT/s, PC133 SDRAM runs at 133 MT/s, and so on.
SDRAM can stand for SDR SDRAM (Single Data Rate SDRAM), where the I/O, internal clock and bus clock are the same. For example, the I/O, internal clock and bus clock of PC133 are all 133 Mhz. Single Data Rate means that SDR SDRAM can only read/write one time in a clock cycle. SDRAM have to wait for the completion of the previous command to be able to do another read/write operation.

SDRAM 3.3 Volts		
Module Name	Data Rate	I/O Bus Clock
PC-66	66MT/s	66Mhz
PC-100	100MT/s	100Mhz
PC-133	133MT/s	133Mhz

DDR SDRAM (Double Data Rate SDRAM):
The next generation of SDRAM is DDR, which achieves greater bandwidth than the preceding single data rate SDRAM by transferring data on the rising and falling edges of the clock signal (double pumped). Effectively, it doubles the transfer rate without increasing the frequency of the clock. The transfer rate of DDR SDRAM is the double of SDR SDRAM without changing the internal clock. DDR SDRAM, as the first generation of DDR memory, the prefetch buffer is 2bit, which is the double of SDR SDRAM. The transfer rate of DDR is between 266~400 MT/s. DDR266 and DDR400 are of this type.

DDR SDRAM 2.5 Volts			
Standard Name	Module Name	Data Rate	I/O Bus Clock
DDR-200	PC-1600	200MT/s	100Mhz
DDR-266	PC-2100	266MT/s	133Mhz
DDR-333	PC-2700	333MT/s	166Mhz
DDR-400	PC-3200	400MT/s	200Mhz
DDR-433	PC-3500	433MT/s	216Mhz
DDR-466	PC-3700	466MT/s	233Mhz
DDR-500	PC-4000	500MT/s	250Mhz
DDR-533	PC-4200	533MT/s	266Mhz
DDR-550	PC-4400	550MT/s	275Mhz
DDR-566	PC-4500	566MT/s	283Mhz
DDR-600	PC-4800	600MT/s	300Mhz
DDR-625	PC-5000	625MT/s	313Mhz

DDR2 SDRAM(Double Data Rate Two SDRAM):

Its primary benefit is the ability to operate the external data bus twice as fast as DDR SDRAM. This is achieved by improved bus signal. The prefetch buffer of DDR2 is 4 bit (double of DDR SDRAM). DDR2 memory is at the same internal clock speed (133~200MHz) as DDR, but the transfer rate of DDR2 can reach 533~800 MT/s with the improved I/O bus signal. DDR2 533 and DDR2 800 memory types are on the market.

DDR2 SDRAM 1.8 Volts			
Standard Name	Module Name	Data Rate	I/O Bus Clock
DDR2-533	PC2-4200	533MT/s	266Mhz
DDR2-667	PC2-5400	667MT/s	333Mhz
DDR2-750	PC2-6000	750MT/s	375Mhz
DDR2-800	PC2-6400	800MT/s	400Mhz
DDR2-1000	PC2-8000	1000MT/s	500Mhz
DDR2-1066	PC2-8500	1066MT/s	533Mhz
DDR2-1100	PC2-8800	1100MT/s	550Mhz
DDR2-1120	PC2-9000	1120MT/s	560Mhz

DDR3 SDRAM(Double Data Rate Three SDRAM):

DDR3 memory reduces 40% power consumption compared to current DDR2 modules, allowing for lower operating currents and voltages (1.5 V, compared to DDR2's 1.8 V or DDR's 2.5 V). The transfer rate of DDR3 is 800~1600 MT/s. DDR3's prefetch buffer width is 8 bit, whereas DDR2's is 4 bit, and DDR's is 2 bit. DDR3 also adds two functions, such as ASR (Automatic Self-Refresh) and SRT (Self-Refresh Temperature). They can make the memory control the refresh rate according to the temperature variation.

DDR3 SDRAM 1.5 Volts			
Standard Name	Module Name	Data Rate	I/O Bus Clock
DDR3-800	PC3-6400	800MT/s	400Mhz
DDR3-1066	PC3-8500	1066MT/s	533Mhz
DDR3-1333	PC3-10600	1333MT/s	667Mhz
DDR3-1600	PC3-12800	1600MT/s	800Mhz
DDR3-1800	PC3-14400	1800MT/s	900Mhz
DDR3-1866	PC3-14900	1866MT/s	933Mhz
DDR3-2000	PC3-16000	2000MT/s	1000Mhz
DDR3-2133	PC3-17000	2133MT/s	1066Mhz

DDR4 SDRAM (Double Data Rate Fourth SDRAM):

DDR4 SDRAM provides the lower operating voltage (1.2V) and higher transfer rate. The transfer rate of DDR4 is 2133~3200 MT/s. DDR4 adds four new Bank Groups technology. Each bank group has the feature of singlehanded operation. DDR4 can process 4 data within a clock cycle, so DDR4's efficiency is better than DDR3 obviously. DDR4 also adds some functions, such as DBI (Data Bus Inversion), CRC (Cyclic Redundancy Check) and CA parity. They can enhance DDR4 memory's signal integrity, and improve the stability of data transmission/access.

DDR4 SDRAM 1.2 Volts			
Standard Name	Module Name	Data Rate	I/O Bus Clock
DDR4-2133	PC4-17000	2133MT/s	1066Mhz
DDR4-2400	PC4-19200	2400MT/s	1200Mhz
DDR4-2666	PC4-21300	2666MT/s	1333Mhz
DDR4-2800	PC4-22400	2800MT/s	1400Mhz
DDR4-3000	PC4-24000	3000MT/s	1500Mhz
DDR4-3200	PC4-25600	3200MT/s	1600Mhz
DDR4-3333	PC4-26600	3333MT/s	1666Mhz
DDR4-3400	PC4-27200	3400MT/s	1700Mhz
DDR4-3600	PC4-28800	3600MT/s	1800Mhz
DDR4-3466	PC4-27700	3466MT/s	1733Mhz
DDR4-3733	PC4-29800	3733MT/s	1866Mhz
DDR4-3866	PC4-30000	3866MT/s	1933Mhz
DDR4-4000	PC4-32000	4000MT/s	2000Mhz
DDR4-4133	PC4-33000	4133MT/s	2066Mhz
DDR4-4200	PC4-33600	4200MT/s	2100Mhz
DDR4-4266	PC4-34100	4266MT/s	2133Mhz