

DDR MEMORY

DOUBLE - DATA RATE
SYNCHRONOUS DRAM



COMMITTED
TO MEMORY

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What is DDR?

DDR SDRAM, or simply DDR, is the acronym for Double-Data Rate Synchronous DRAM (SDRAM). DDR is a memory technology that is considered evolutionary as it is based upon the stable and mature PC133 or PC100 SDRAM technology.

A 100MHz SDRAM chip handles a single memory operation per clock cycle; its data rate is effectively 100MHz x 1 or 100MHz. Similarly, a PC133 SDRAM chip has a data rate of 133MHz. PC100 and PC133 are in effect Single-Data Rate SDRAM.

DDR memory chips can do 2 operations during a single clock cycle. A 100MHz DDR memory chip's data rate is thus 100MHz x 2 or 200MHz. A 133MHz DDR memory chip has a data rate of 133MHz x 2 or 266MHz.

Technically, DDR memory supports a memory-bus clock rate of 100MHz for PC1600, 133MHz for PC2100, and 166MHz for PC2700. However, DDR memory modules and memory chips run at an effective (data) rate of 200MHz, 266MHz and 333MHz. The computer industry has adopted a practical convention of just referring to the data rate as the DDR DIMM speed. So, PC1600 DIMMs are said to run at 200MHz, PC2100 at 266MHz and PC2700 at 333MHz.

DDR memory enables a new generation of higher performance, lower-cost computer systems, including desktops, workstations, servers, notebooks, compact and sub-compact computers, as well as new communications and networking products such as routers and switches.

KINGSTON DDR MEMORY

Kingston has a comprehensive line of DDR modules for desktop PCs, servers, notebooks, compact and sub-compact computers and networking/communications applications:

- ECC or non-ECC modules
- Unbuffered DDR DIMMs
- Registered DDR DIMMs for servers and high-end workstations
- High-capacity stacked Registered DDR DIMMs for servers and workstations
- Unbuffered DDR SODIMMs for portable PCs or communications/networking applications
- Unbuffered MicroDIMMs for portable, compact and subcompact PCs and communications/networking applications
- Custom DDR modules for special applications



JEDEC specifications and naming convention

The specifications for DDR memory modules are developed and approved by JEDEC. JEDEC is the semiconductor standardization body of the Electronic Industries Alliance (EIA). About 300 member companies, representing every segment of the industry, actively participate to develop standards to meet industry needs. Kingston is a long-time member of JEDEC and is active on the JEDEC Board of Directors as well as a number of memory technology committees.

JEDEC has completed specifications for PC1600, PC2100 and PC2700, which are now widely available. Development on faster DDR memory products is ongoing.

The PC1600, PC2100 and PC2700 memory technologies are considered to be DDR-I technologies. JEDEC is working on a next-generation DDR technology, called DDR-II, with speeds starting at 400MHz. DDR-II will not be backward-compatible with DDR-I and will represent a new memory technology and architecture.

DDR NAMING CONVENTION RECOMMENDED BY JEDEC

Memory chips are referred to by their native speed. For example, 200MHz DDR SDRAM memory chips are called DDR200 chips, 266MHz DDR SDRAM memory chips are called DDR266 chips and 333MHz DDR SDRAM memory chips are called DDR333 chips.

DDR modules are named after their peak bandwidth, which is the maximum amount of data that can be delivered per second. A 200MHz DDR DIMM is called a PC1600 DIMM, a 266MHz DDR DIMM is called a PC2100 DIMM, and a 333MHz DDR DIMM is called a PC2700 DIMM.

JEDEC 200/266/333MHZ DDR SPECIFICATIONS SUMMARY

- 184 pin DIMM, ECC or non-ECC
- Unbuffered or Registered DIMMs
- 200 pin SODIMM, ECC or non-ECC
- 172 pin MicroDIMM, non-ECC
- 2.5 Volts
- SSTL-2 I/O Interface
- CAS Latencies: 2, 2.5 for PC1600/2100
2.5 for PC2700
- Serial Presence Detect (SPD) Support
- Support for Memory Chip Stacking

DDR memory bandwidth

The calculations below illustrate how the peak bandwidth for DDR memory modules is calculated.

Peak Bandwidth = (Memory Bus Width) x (Data Rate) where
Data Rate = (Memory Bus Speed x Operations per Clock Cycle)

- Each DIMM module is 64 bits wide or 8 Bytes wide
(Each Byte = 8 bits)
- Peak bandwidth for PC2100 DIMMs:
(8 Bytes) x (266MHz Data Rate) = 2,128MB/second which is rounded to 2,100MB/second or 2.1GB/second
- Peak bandwidth for PC1600 DIMMs:
(8 Bytes) x (200MHz Data Rate) = 1,600MB/second or 1.6GB/second
- Peak bandwidth for PC2700 DIMMs:
(8 Bytes) x (333MHz Data Rate) = 2,664MB/second or 2.7GB/second

DDR BANDWIDTH SUMMARY

PC100 SDRAM	PC133 SDRAM	PC1600 DDR	PC2100 DDR	PC2700 DDR
800MB/s	1.1GB/s	1.6GB/s	2.1GB/s	2.7GB/s

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