Intel® Pentium® 4 Processor

The most Powerful Combination from Intel for Your New PC

RDRAM Memory

Doubling Memory Channels
Tripling Data Throughput
For more Productivity

Datarate of different Memory Technologies

- 2 Channel PC800 RDRAM — 3200
- DDR266 SDRAM — 2100
- DDR200 SDRAM — 1600
- PC133 SDRAM — 1066
- PC100 SDRAM — 800

BANDWIDTH (MB/sec)
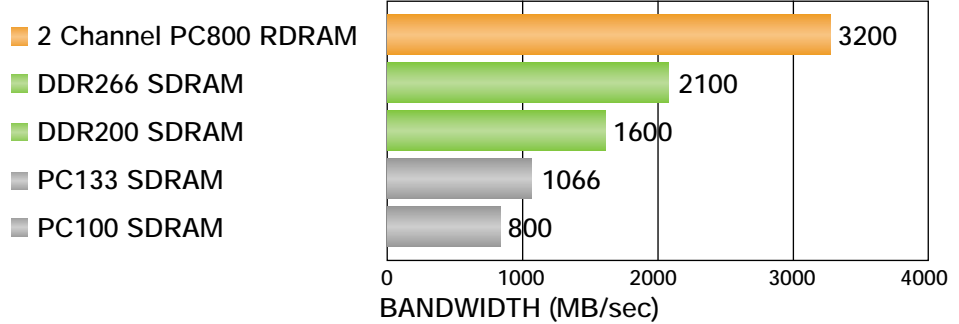
Memory Pricing
(Historic and *Projected)

RDRAM — SDRAM

Q2 '00 Q3 '00 Q4 '00 Q1 '01 Q2 '01 Q3 '01* Q4 '01*
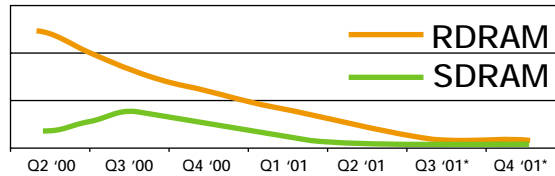
RDRAM prices are falling rapidly. From Q2`00 to Q2`01, the price for a 128MB module (non-ECC) has come down over 65%.

### "We think RDRAM will be very price-competitive with DDR memory."

Geoff Hughes, Samsung* senior vice president of sales and marketing as quoted in EETimes, 3/29/01

Intel®
Pentium® 4
Processor

Balanced Performance

3.2 GB/s
@400 MHz

AGP4X Graphics >1GB/s

1.6 GB/s
1.6 GB/s

Dual Channel RDRAM

Intel® 850

As processor technology has crossed the 1 GHz boundary, the bottleneck within PC systems has shifted to how fast data can be transferred between processor and memory. Direct Rambus DRAM (RDRAM) technology offers high memory throughput to address the needs for bandwidth.

Dual-channel RDRAM provides 3.2GB/second of memory bandwidth to the system. Combined with the Intel® Pentium® 4 processor's 300% increase in system bus bandwidth (as compared to the Intel® Pentium® III processor), today's RDRAM platforms provide noticeable performance benefits.

The Intel® Pentium® 4 processor in combination with the Intel® 850 chipset™ offers you the best balanced performance approach for PC systems you have ever seen from Intel.

On applications that are not bandwidth constrained, such as word processing, RDRAM and DDR may not differ in performance compared to other memory technologies. However on intense applications that tax system bandwidth, such as XML-based Internet tools, media encoding/decoding, streaming technologies and 3D graphics, the Intel® Pentium® 4 processor with RDRAM provides a superior user experience.
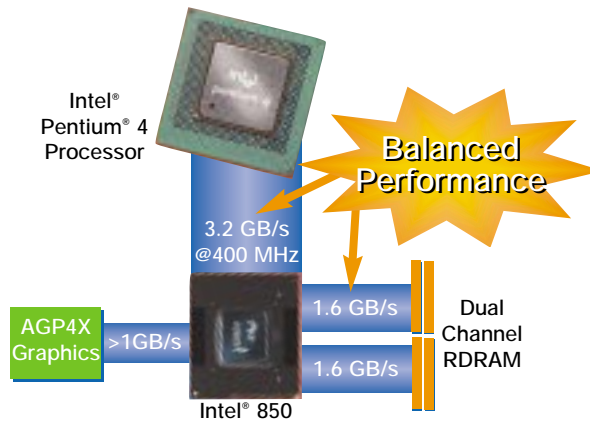
Memory Technology	Features				
	Memory Channels	Memory Clock Rate	Clock Rate for		Maximal Data Rate
			Address Transfers	Data Transfers	
PC800 RDRAM for Intel® Pentium® 4 Proc.	2	400 MHz	800 MHz	800 MHz	3200 MB/s
DDR 266 SDRAM	1	133 MHz	133 MHz	266 MHz	2100 MB/s
DDR 200 SDRAM	1	100 MHz	100 MHz	200 MHz	1600 MB/s
PC133 SDRAM	1	133 MHz	133 MHz	133 MHz	1066 MB/s
PC100 SDRAM	1	100 MHz	100 MHz	100 MHz	800 MB/s

Intel plans to drive new RDRAM platforms in the future, which is creating demand for more RDRAM output from memory manufactures going forward.

RDRAM Technology, Myths and Realities

The explosive demands from the Internet and high-performance consumer products are driving the need for more bandwidth. As processor technology has crossed the 1 GHz boundary, the bottleneck in system design has frequently shifted to how fast data can be transferred between chips. Direct Rambus DRAM (RDRAM) technology offers higher memory bus throughput speeds to address the needs for bandwidth. Here are some things you may or may not know about Intel and Rambus* technology.

Myth: **RDRAM is expensive and will always be more expensive than SDRAM or DDR**
Reality: RDRAM prices are rapidly falling. From Q2'00 to Q2'01, the price for a 128 MB RIMM (non-ECC) has come down over 65%. As volumes ramp, 4i technology is introduced, and memory densities continue to increase, RDRAM costs will continue to decline. In 2002, market projections are that RDRAM costs to memory manufactures will be within 5% of PC133 and cost parity with DDR. (4i stands for 4 independent memory banks on one RDRAM component; compared to 16d – 16 dependant banks – as of today, this represents a potential 30% cost saving.)

Myth: **RDRAM has limited performance benefits in many applications.**
Reality: Dual-channel RDRAM provides 3.2 GB/second of memory bandwidth to the system. Combined with the Pentium® 4 processor's 300% increase in system bus bandwidth compared to the Pentium® III processor, today's RDRAM platforms provide noticeable performance benefits. Furthermore, as processor speeds increase, the advantage of RDRAM over alternative high volume technologies continues to widen.

Myth: **Memory vendors are not building RDRAM**
Reality: Memory vendors are not only building RDRAM, but they are ramping production at a tremendous rate. Samsung Semiconductor Inc., San Jose, Calif., said it has exceed $1 billion in revenue to date from its Direct Rambus DRAM shipments. "Japanese chip and PC maker Toshiba* Corp said on Friday it will more than triple its output of Rambus DRAM chips by September while cutting commodity DRAM production, and NEC Corp said it is eyeing a similar move." Yahoo Finance, 2/9/2001

See also: http://developer.intel.com/technology/memory/Spring_IDF2001.htm

Myth: **RDRAM systems are inherently more expensive to build than DDR systems**
Reality: Initial RDRAM systems were indeed more expensive to build than established SDRAM platforms. However, as RDRAM volumes continue to increase, supporting component and motherboard costs decrease. In fact, Intel believes that in 2002, the cost of a dual memory channel RDRAM motherboard BOM will be at about at parity with a single channel DDR design.

Myth: **RDRAM will not be available for upgrades in 2-3 years**
Reality: Intel plans to continue to drive RDRAM platforms in the future, which will continue to create demand-pull for more RDRAM output. RDRAM is a major part of Intel's current long-term roadmap. Additional future RDRAM platforms are committed, staffed and funded.

Myth: **Intel collects royalties on RDRAM**
Reality: Intel does not collect royalties on RDRAM memory technology.

Myth: **As soon as Intel or others launch platforms supporting SDRAM or DDR, Intel will drop RDRAM**
Reality: Intel uses and promotes RDRAM because we believe it provides the best performance for our customers, as well as architectural advantages for the PC industry. However, Intel will offer customers a choice of memory technologies for the Intel® Pentium® 4 processor, which allow different price and system configurations. Intel is planning to continue on the development of RDRAM based platform, as we consider RDRAM as a leading price/performance technology.

Intel is taking compatibility seriously

Intel and RDRAM manufactures are taking compatibility and interoperability seriously. This is to your advantage if you upgrade your system. These continued testing and validation efforts ensure seamless operation.

Check out all validated RIMMs at: http://developer.intel.com/technology/memory/rdram/

Technology Outlook

Rambus* Inc. has outlined a technology road map to boost the bandwidth of the company's memory products to 9.6 GB/s and to increase the width of Rambus-in-line memory modules (RIMMs) fourfold by 2005.
Samsung Electronics Co. Ltd., Toshiba Semiconductor Co. and Elpida* Memory Inc. are expecting volume shipments of PC1066 (1.066 MHz) Rambus DRAM in 2002 and of PC1200 (1.200 MHz) RDRAMs in 2005. The PC1200 version will be 50 percent faster than the PC800 parts used with today's Intel® Pentium® 4 microprocessor, delivering 2.400MB/s per channel or 4.8GB/s on a dual channel platform.