Intel® 810 Chipset
Great Performance for Value PCs

Revision 2.1

May 30, 2000

Information in this document is provided in connection with Intel products. No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document. Except as provided in Intel's Terms and Conditions of Sale for such products, Intel assumes no liability whatsoever, and Intel disclaims any express or implied warranty, relating to sale and/or use of Intel products including liability or warranties relating to fitness for a particular purpose, merchantability, or infringement of any patent, copyright or other intellectual property right. Intel products are not intended for use in medical, life saving, or life sustaining applications.
Intel may make changes to specifications and product descriptions at any time, without notice.
The Intel chipsets and processors product may contain design defects or errors known as errata which may cause the product to deviate from published specifications. Current characterized errata are available on request.
*Third-party brands and names are the property of their respective owners.
Contact your local Intel sales office or your distributor to obtain the latest specifications and before placing your product order.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. Buyers should consult other sources of information to evaluate the performance of systems or components they are considering purchasing. For more information on performance tests and on the performance of Intel products, referencewww.intel.com/procs/perf/limits.htm or call (U.S.) 1-800-628-8686 or 1-916-356-3104.

Copies of documents which have an ordering number and are referenced in this document, or other Intel literature, may be obtained from:
Intel Corporation
P.O. Box 7641
Mt. Prospect IL 60056-764

Copyright © Intel Corporation 2000

Table of Contents

1. Prelude

The introduction of the Intel® 810 chipset marks a milestone for PC buyers interested in computing value on a limited budget. The chipset was designed from the ground-up to enable significant platform cost reduction while bringing next generation technologies to the Value PC segment.

1.1 The Value PC Platform

To compliment the Intel® processors, the Intel® 810 chipset delivers a balanced platform solution for value computing. The Intel 810 chipset is a highly-integrated two-chip solution consisting of a Graphics & Memory Controller (Intel 82810) and an I/O Controller (Intel 82801). The chipset extends the Intel® Scalable Graphics Technology into the value segment by incorporating powerful 2D and 3D graphics capability within the core logic. The Intel 810 chipset is optimized for system bus frequencies of 66 or 100MHz with an asynchronous or synchronous main memory interface to PC100 SDRAM. Its revolutionary new logic partitioning, called Intel® Hub Architecture, does not rely on the PCI bus for communicating between chipset devices, enabling direct, dedicated control of major I/O subsystems (including IDE, Audio, Modem, and USB). By eliminating arbitration overhead and bandwidth bottlenecks associated with the 33MHz PCI bus, the Intel 810 chipset architecture reduces access latency to these key subsystems, increasing system performance especially for multimedia and internet applications. Intel's approach to smart integration is a bottoms-up design, optimized to support the feature set appropriate to a targeted market segment. Intel 810 chipset smart integration (including graphics, motion compensation hardware, AC'97 link, DVD decode, TV out, optimized glue sweep, and ISA legacy elimination) not only lowers costs by reducing system component count. The Intel 810 chipset also enables the efficient, cost-effective delivery of Intel® processor systems by reducing integration time, inventory skus, compatibility testing, and support calls. For a detailed description of the individual chipset components, refer to the respective data sheets by visiting http://developer.intel.com/design/chipsets/datashts/.

1.2 Context of Performance Benchmarks

Benchmark and performance tests measure different aspects of processor and/or system performance. While no single numerical measurement can completely describe the performance of a complex device like a microprocessor or a personal computer, benchmarks can be useful tools for comparing different components and systems. Benchmark results published by this report are measured on specific systems or components using specific hardware and software configurations. Note that any differences between these configurations (including software) and your configuration may make the results in this report inapplicable to your component or system. Thus, while reading this document, always refer to the associated appendix for a detailed description of the system software and hardware configuration.

2D Winbench 99

Ziff-Davis 2D Winbench 99 is a subsystem level benchmark that measures the performance of the graphics, disk, CPU (including the floating point unit) and video (including DirectDraw) under Microsoft* Windows 98. The benchmark returns an overall Winmark score. Larger numbers denote better performance.

3D Winbench 99

3D Winbench 99 measures a PC's 3D subsystem performance under Microsoft* Windows 98 using Direct3D* interface. The 3D WinMark test under 3D Winbench includes a series of ten 3D scene tests that very in both complexity and 3D visual quality. Each test goes through a scene using a predefined path and measures the rendering speed in frames per second. The suite returns an overall, unit-less 3D WinMark result summarizing the computer's 3D performance. Larger numbers denote better performance.

3Dmark

Futuremark corp’s 3Dmark 99 is a suite of tests that measure the performance of various 3D functions that are of interest to gamers. Results are given in “3Dmarks”. Larger numbers denote better performance.

Business Winstone 99

Business Winstone 99 is a system level application-based benchmark that measures the PC’s overall performance while running different types of Microsoft* Windows applications under Microsoft* Windows 98. The benchmark uses a scripting interface to emulate a user operating the programs in the test. The execution times of the various operations are recorded and combined into a final score. Larger numbers denote better performance.

Final Reality

Remedy Entertainment’s Final Reality is a game based benchmark that tests the system’s performance in a simulated 3D game environment. The execution times of the various tests are combined into a ‘Reality Mark’ that is compared to a baseline score of 1.00. Larger numbers denote better performance.

3D games

The Quake II, Forsaken and Unreal 3D game benchmarks report frames displayed per second while running a timed demonstration of the game. Larger numbers denote better performance.

2. The Intel® 810 Chipset

The Intel 810 chipset was designed to enable a high degree of scalability so motherboard and system vendors can create the best cost/performance equation for their target price point. Regardless of the configuration, the chipset's graphics capabilities, features and optimized architecture ensure excellent value.

2.1 An Architectural Milestone

When evaluating the task of creating a chipset architecture capable of scaling with tomorrow's microprocessors and multimedia/internet applications, Intel's designers saw the PCI bus as a key limiting factor. The Intel® 810 chipset is the first in a series of Intel chipset products to be based on Intel® Hub Architecture which removes the PCI bus as the main device interconnect. This new architecture provides each critical multimedia subsystem with a direct link to the chipset. For example, data can now move directly from an IDE storage device to memory through a 266MB/s I/O channel without PCI bus contention or bandwidth limitation. The dedicated links to IDE, audio, modem, and USB subsystems ensure deterministic access to/from memory providing improved performance, optimal concurrency, and previously unattainable audio/video isochrony.

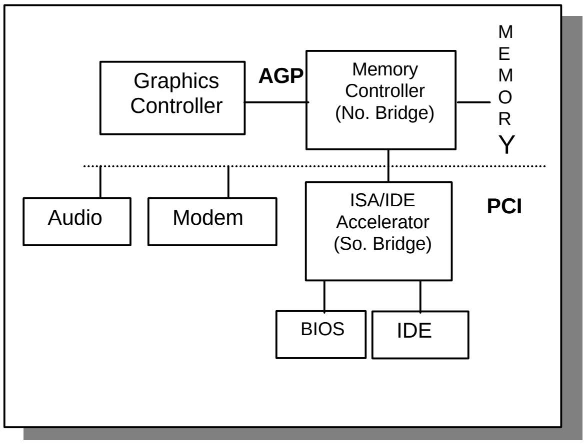

Figure 1 - Earlier generation chipset partitioning

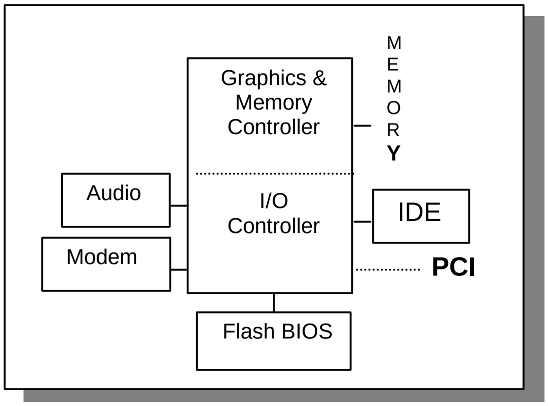

Figure 2 – Intel® Hub Architecture

It is this new chipset architecture that now enables platforms to deliver on the promise of legacy ISA elimination. By creating direct interfaces for traditional ISA & X-bus functionality, the overhead of legacy 5V ISA support can be effectively removed.

The I/O control portion of the Intel 810 chipset is implemented as a separate device in order to isolate platform elements that are common across market segments (and future Intel® Hub Architecture based segment-specific chipset products).

System or motherboard designers can utilize the built-in flexibility of the Intel® 810 chipset to design products that meet the needs of their target market. The Intel 810 chipset provides an interface for an optional 4MB of 100MHz SDRAM display cache providing 3D performance that scales relative to the additional memory cost. Board designers may choose to further reduce cost by producing small form factor boards with reduced I/O expansion or providing only ATA/33 drive capability.

System Integrator – lowest cost	Channel/DIY – lowest cost	Scalable graphics performance
• uATX form factor • No display cache • ATA33 drive support	• mini ATX form factor • no display cache • ATA33 or ATA66 support	• ATX form factor • 4MB display cache • ATA33 or ATA66 support

Table 1 - Typical Intel 810 chipset based motherboard configurations

2.2 Platform Feature Enhancement

It is relatively simple for chipset designers to assign new pins and gates to enable a new feature or protocol. The challenge presents itself in providing an architecture which provides the full capability of the new feature and assures maximum performance in a heavily loaded environment. Intel® Hub Architecture meets this challenge and enables new features to move quickly into the Value PC segment. The Intel 810 chipset delivers several advanced features not found in Intel's earlier generation of Value PC chipset.

- Integrated AC'97 link for scalable soft audio and modem implementation.
- Dedicated IDE path with support for ATA66 – ensures available bandwidth during peak transfers.
- Flexible 66 or 100MHz host processor interface to support a range of existing and upcoming Intel Celeron processors.
- Support for uATX (4 PCI devices) or ATX (6 PCI devices) configurations – additional PCI req/grant pair.
- 3D graphics capability with hardware motion compensation, DVD decode, digital flat panel interface and TV out.
- ISA legacy elimination for PC'99 compliance.
- Asynchronous or synchronous memory interface for PC100 SDRAM performance gains regardless of processor host frequency (66 or 100MHz)
- Instantly Available PC for fast system restart and lower power consumption.

3. Intel® Graphics Technology for the Value PC Segment

The Intel® 810 chipset extends Intel's graphics capabilities into the Value PC segment by incorporating 2D and 3D capabilities with the memory controller.

Intel pioneered the concept of shared memory – utilizing main memory for display and 3D graphics functions – with the introduction of the Intel® 430VX PCIset in 1996. The 430VX provided an option for the elimination of a frame buffer, assigning a fixed portion of main memory for screen refresh and 3D requirements. This shared memory implementation was characterized by req/grant based static assignment of main memory at boot time. Until today, improvement of this implementation has been limited to the simple integration of graphics cores into the tradition chipset north bridge. The Intel® 810 chipset takes two major leaps forward from today's shared memory solutions – complex integration of memory controller and graphics capability (Direct AGP) and advanced dynamic memory utilization (Dynamic Video Memory Technology – D.V.M.T.).

3.1 Graphics Evolution for Value PC

3.1.1 Discrete AGP Architecture with Existing Chipsets

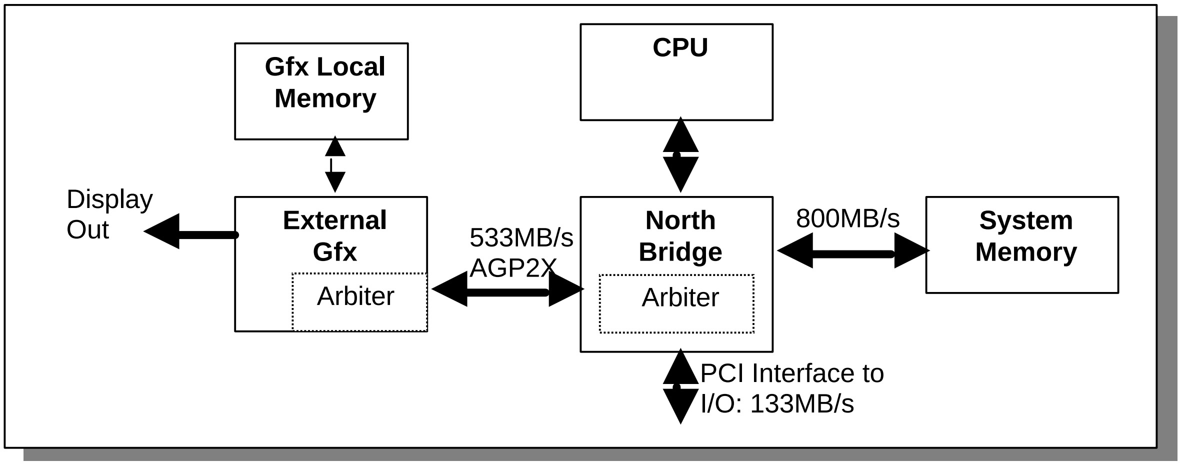

Figure 3 - Discrete AGP Architecture

The discrete AGP architecture offered by existing chipsets is not ideal for the Value PC market due to the additional system design cost which is passed on to the consumers. This source of this cost is the additional components required including the discrete graphics chip and local memory. Another cost adder is the additional design complexity created by the increased number of connections and board size or component density requirements.

The "Arbiter" block within the external graphics component of Figure 3 schedules requests to send and receive data over the AGP bus. The "Arbiter" block within the north bridge component of Figure 3 schedules requests to send and receive data to and from external graphics, the PCI interface, CPU, and System Memory. Graphics performance is enhanced in this architecture by having local graphics memory. This provides the external graphics fast access to critical graphics data stored there, free from scheduling delays imposed by each of the arbiters.

3.1.2 Integrated Graphics

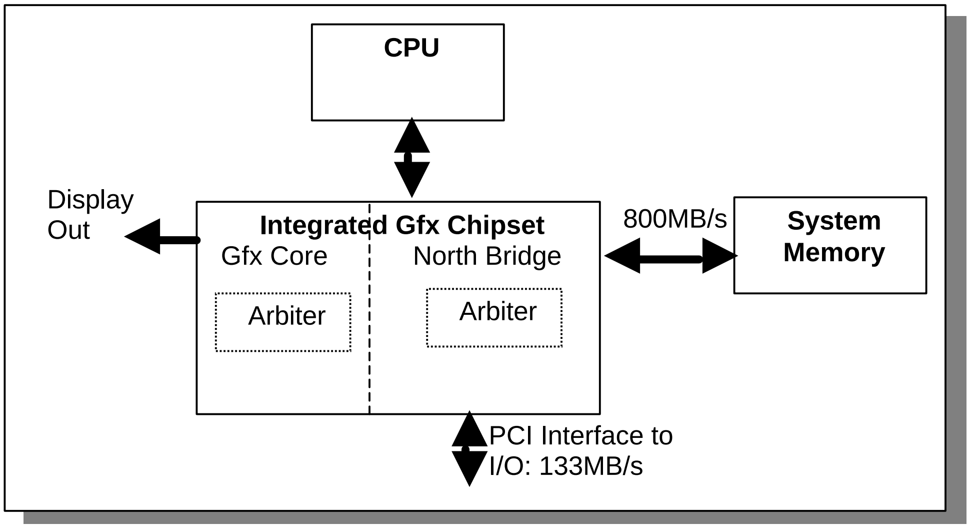

Figure 4 – Typical Approach to Graphics Integration

To lower overall system cost, one approach is to simply integrate a graphics core in the same package as an existing north bridge and remove the local graphics memory. This reduces the number of components and design complexity of the system to reduce cost, however, it does so at the expense of performance. In this implementation, the graphics core accesses system memory for all graphics data which shares memory space with applications data. Without re-engineering the interface between the graphics core and north bridge, the graphics core may be subject to both arbiters' scheduling delays. In contrast to the discrete AGP architecture with graphics local memory, the graphics core will no longer be guaranteed fast access to critical graphics data. While this approach provides value for mid-range graphics, it will not match discrete implementations designed for higher performance/higher priced systems.

3.1.3 The Intel® 810 Chipset Approach: Smart Integration

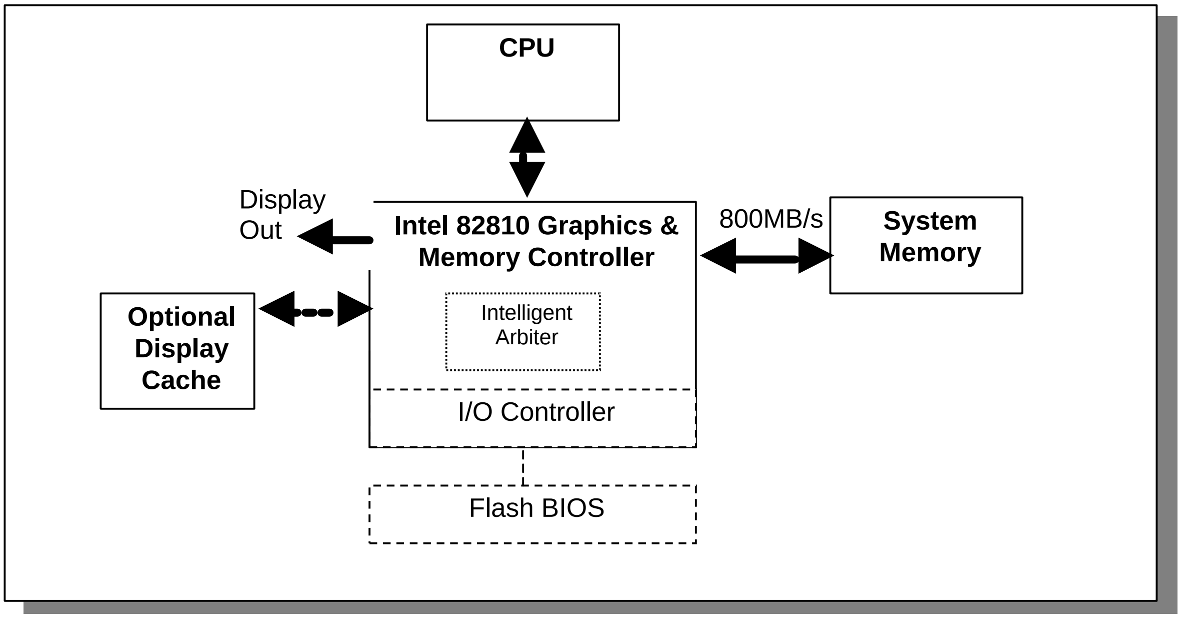

Figure 5 - The Intel 810 Chipset Smart Integration

The system block diagram in Figure 5 shows Intel's innovative new approach to graphics and chipset integration. The Intel 810 chipset is the result of significant ground-up engineering to optimize the shared memory architecture while maintaining the cost benefits of integration through Direct AGP and Dynamic Video Memory Technology.

3.2 Direct AGP

Direct AGP delivers AGP class graphics performance to Value PCs. Rather than simply combining two cell libraries for component reduction, Intel architects undertook the complex process of meshing 2D and 3D video capabilities with the memory control unit. This functional overlap within the Graphics and Memory Controller (Intel 82810) enables Direct AGP. Direct AGP provides the integrated graphics function the capability to make direct memory set-up calls (similar to those associated with standard AGP protocol) to system memory resulting in life-like video quality. Direct AGP calls can dynamically allocate and de-allocate system memory for complex 3D textures, preserving the benefits of standard AGP add-in solutions.

3.3 Dynamic Video Memory Technology

Dynamic Video Memory Technology (D.V.M.T.) enables breakthrough graphics and memory performance for the Value PC segment through Direct AGP and highly efficient memory utilization. D.V.M.T. ensures the most efficient use of all available memory – regardless of frame buffer presence or main memory sizing – for maximum 3D graphics performance. D.V.M.T. dynamically responds to application requirements allocating the proper amount of display and texturing memory. For example, a 3D application might require more texture memory to enhance the richness of 3D objects. The O/S views the Intel 810 chipset driver as an application which uses Direct AGP to request re-allocation of additional memory for 3D applications and returns memory when not required.

D.V.M.T. is highly scalable - as additional memory is added to the system, more memory will be available to allocate to the richest 3D applications. D.V.M.T. works to dynamically modulate the bandwidth available to the CPU, graphics and I/O interface, through the intelligent arbitration built into the Intel 82810. This hard coded intelligence evaluates the operating environment and prioritizes traffic to ensure a rich multimedia experience. This function enables system memory to be used for all graphics data structures while maintaining system performance through dynamic load balancing.

3.4 Memory Usage

D.V.M.T. employs direct AGP and intelligent arbitration to dynamically allocate and de-allocate memory for textures for applications requiring additional texture memory.

The operating system requires allocation of up to 1MB of system memory to support legacy VGA. System properties will display up to 1MB less than physical system memory available to the operating system.

The graphics driver for the Intel 810 configuration will request up to 4MB of memory from the OS to implement a maximum 1024x768 screen resolution, 2MB for a command buffer and 4MB used for Z-buffering. For high end 3D applications, the drivers request allocation of system memory from the O/S for AGP graphics textures. When the 3D application is closed, the O/S will re-allocate system memory back for generic use.

For the Intel 810 DC100 configuration, the graphics driver provides the address of an external 4Mbytes of 100MHz SDRAM display cache to store Z-buffering. Storing the Z-buffering in the external 4MB display cache provides increased 3D performance. Only up to 6MB of system memory is allocated for frame buffer and the remaining graphics data structures.

32MB main memory	32MB with display cache	64MB main memory	64MB with display cache
• Lowest cost solution • 2D support for all resolutions • 3D capability best at 640x480 video resolution	• 2D support for all resolutions • 3D capability best at 800x600 video resolution	• Enhanced performance • 2D support for all resolutions • Optimized 3D resolution of 1024x768	• Optimal performance • 2D support for all resolutions • Optimized 3D resolution of 1024x768

Table 2 - Typical main memory configurations (i.e. 32MB, 64MB, 128MB)

4. Intel® 810 Chipset Performance Benchmarks

Benchmark results are provided in the table below. See section 1.3 for descriptions of the tests and a description of the benchmark numbers. Four different memory configurations were tested. "32MB Standard" and "32 MB DC-100" configuration contained 32MB of system memory and alternately had display cache disabled or enabled. The other configuration doubled the system's memory. See appendix 1 for system configuration parameters and appendix 2 for results of individual tests.

Benchmark	32MB Standard	32MB DC100	64MB Standard	64 MB DC100
99 WinBench 2D	139	140	138	140
99 WinBench 3D	--[2]	--[2]	300	384
Winstone	14.4	15.5	20.6	21
3DMark	--[2]	--[2]	1165	1356
Final Reality	4.08	4.107	4.131	4.14
Forsaken 1024 x 768[1]	33.5	37.65	32.9	37.72
Forsaken 800 x 600[1]	42.85	57.3	43.06	57.4
Quake II 1024 x 768[1]	N/A[3]	14.1	15.7	19.7
Quake II 800 x 600[1]	9.4	23.6	24.3	28.5
Quake II 640 x 480[1]	19.6	30.9	31.3	36.7
Unreal 1024 x 768[1]	8.75	19.8	17	19.8
Unreal 800 x 600[1]	12.51	14.6	27.84	31.56

1 Number pairs denote screen resolution during test.
2 Test requires 64MB of System Memory to run.
3 Quake II recommends 24MB of System Memory for this resolution.

Note that in most cases, turning on the display cache netted some performance benefit, while doubling memory not only increased overall performance of the platform, but was instrumental in enabling the benchmark to run. For 3D games, note that performance drops as resolution increases. This reflects the additional work required to deliver more detail to the screen.

Performance tests and ratings are measured using specific computer systems and/or components and reflect the approximate performance of Intel products as measured by those tests. Any difference in system hardware or software design or configuration may affect actual performance. ***For more information on performance tests and on the performance of Intel products, reference*** www.intel.com/procs/perf/limits.htm.

Appendix 1: Hardware and Software configuration

Intel® 810 Chipset with A2 GMCH and B0 ICH
Intel® Celeron™ 466 MHz processor
66 MHz FSB
PC100 Memory, 2-2-2 Latency
Western Digital 18GB, 7200RPM ATA66 Hard Drive (model 418000)
Intel® 810 Chipset Customer Reference Board Bios revision 2DWCI010
Intel Graphics drivers Beta2.5 (Separate drivers for Standard and DC100)
Screen Resolution 1024x768 unless otherwise noted
Screen Refresh rate 85 Hz and 16 bit high color
Current “INF” files loaded
Ziff Davis suite version 1.1
Final Reality suite version 1.1
3D Mark version 3D Mark Pro 99

Appendix 2: Detailed results for individual tests

For some of the benchmark tests, detailed information was available. This information is presented in the tables below.

3Dmark Individual tests	64 MB Standard	64 MB DC100
3D Mark Results	1167 3D Marks	1356 3D Marks
CPU Geometry Speed	5624 CPUMarks	5688 CPUMarks
Rasterizer Score	729 3D RasterizerMarks	804 3D RasterizerMarks
Game 1 – Race	19.2 FPS	22.0 FPS
Game 2 - First Person	19.7 FPS	23.2 FPS
Fill Rate	56.8 M Texels/s	77.7 M Texels/s
Fill Rate with Multi-Texturing	97.4 M Texels/s	98.8 M Texels/s
2MB Texture Rendering Speed	56.4 FPS	58.5 FPS
4MB Texture Rendering Speed	47.6 FPS	48.1 FPS
8MB Texture Rendering Speed	37.4 FPS	36.9 FPS
16MB Texture Rendering Speed	0.2 FPS	3.7 FPS
32MB Texture Rendering Speed	Failed	Failed
Point Sample Texture Filtering Speed	107.50%	105.80%
Bilinear Texture Filtering Speed	100.00%	100.00%
Trilinear Texture Filtering Speed	See Note 1	See Note 1
Anisotropic Texture Filtering Speed	See Note 1	See Note 1
6 Pixel/Individual	619.5 K Polygons/s	633.5K Polygons/s
6 Pixel/Strips	1591.3 K Polygons/s	1606.8 K Polygons/s
25 Pixel/Individual	558.5 K Polygons/s	561.8 K Polygons/s
25 Pixel/Strips	1322.2 K Polygons/s	1564.6 K Polygons/s
50 Pixel/Individual	359.1 K Polygons/s	505.7 K Polygons/s
50 Pixel/Strips	566.8 K Polygons/s	769.9 K Polygons/s
250 Pixel/Individual	134.3 K Polygons/s	209.2 K Polygons/s
250 Pixel/Strips	151.1 K Polygons/s	222.6 K Polygons/s
1000 Pixel/Individual	43.9 K Polygons/s	62.1 K Polygons/s
1000 Pixel/Strips	46.0 K Polygons/s	64.6 K Polygons/s

[1] Not yet supported by current driver revision.

99 WinBench 3D All Tests	64 MB Standard	64 MB DC100
3D WinBench 99/3D WinMark	300	384
3D WinBench 99/3D WinMark/ 1/IslandsB2G1T1,NML,SA,F (Frames/Sec)	21.7	26.6
3D WinBench 99/3D WinMark/ 2/RaceTrackB1G1T1,NML,SA (Frames/Sec)	28.8	36.4
3D WinBench 99/3D WinMark/ 3/RaceTrackB2G1T1,NML,SA (Frames/Sec)	23.3	30.6
3D WinBench 99/3D WinMark/ 4/ChapelB1G1T1,NML,SA (Frames/Sec)	17.3	20.8
3D WinBench 99/3D WinMark/ 5/StationsB2G2T1,NML,SA (Frames/Sec)	24.6	29.8
3D WinBench 99/3D WinMark/ 6/StationsB2G2T3,NML,SA (Frames/Sec)	22.7	28.1
3D WinBench 99/3D WinMark/ 7/IslandsB2G1T1,NML,SA (Frames/Sec)	20.9	26.8
3D WinBench 99/3D WinMark/ 8/StationsB3G3T1,NML,SA,A,S (Frames/Sec)	22.9	27.9
3D WinBench 99/3D WinMark/ 9/IslandsB4G1T1,NML,SA,A (Frames/Sec)	17.7	20.4
3D WinBench 99/3D WinMark/10/ChamberB3G1T1,NML,SA,M (Frames/Sec)	16	22
3D WinBench 99/3D WinMark/11/ChamberB3G2T2,NML,SA,M (Frames/Sec)	17	22.7
3D WinBench 99/3D WinMark/12/RaceTrackB3G1T1,NML,SA,A,M (Frames/Sec)	23.2	30.5
3D WinBench 99/3D WinMark/13/CanyonB1G1T1,SA,A,M2 (Frames/Sec)	13.8	16.1
3D WinBench 99/3D WinMark/14/RustValleyB3G1T1,SA,A,M,M2 (Frames/Sec)	18.4	23.4
3D WinBench 99/3D WinMark/15/RustValleyB3G1T3,SA,A,M,M2 (Frames/Sec)	11.7	21.5
3D WinBench 99/3D Lighting and Transformation	32	32.1
3D WinBench 99/3D Transformation	69.7	68.7
3D WinBench 99/Buffer/ 1/Double, Flip (Frames/Sec)	20.8	26.9
3D WinBench 99/Buffer/ 2/Triple, Flip (Frames/Sec)	22.4	28.9
3D WinBench 99/Buffer/ 3/Double, Front (Frames/Sec)	22.2	28.6
3D WinBench 99/Buffer/ 4/Double, Back (Frames/Sec)	22.4	28.7
3D WinBench 99/Feature/ 1/Specular Highlights (Frames/Sec)	22.8	28.4
3D WinBench 99/Feature/ 2/Fog (Frames/Sec)	23	28.5
3D WinBench 99/Feature/ 3/Anti-aliasing (Frames/Sec)	NoResult	NoResult
3D WinBench 99/Filter/ 1/Nearest (Frames/Sec)	23.5	28.9
3D WinBench 99/Filter/ 2/Linear (Frames/Sec)	20.9	25.8
3D WinBench 99/Filter/ 3/Nearest Mipmap Nearest (Frames/Sec)	28.2	36.2
3D WinBench 99/Filter/ 4/Nearest Mipmap Linear (Frames/Sec)	26.7	35.8
3D WinBench 99/Resolution/11/640x480,Window (Frames/Sec)	35.4	39.5
3D WinBench 99/Texture Size/ 1/Small (Frames/Sec)	31.9	38.4
3D WinBench 99/Texture Size/ 2/Medium (Frames/Sec)	26.4	30.7
3D WinBench 99/Texture Size/ 3/Large (Frames/Sec)	26.1	30.3
3D WinBench 99/Texture Size/ 4/Small Mipmaps (Frames/Sec)	35.6	43.3
3D WinBench 99/Texture Size/ 5/Medium Mipmaps (Frames/Sec)	33.4	42.6
3D WinBench 99/Texture Size/ 6/Large Mipmaps (Frames/Sec)	33.3	41.7
3D WinBench 99/Texture Size/ 7/Large Compressed Mipmaps (Frames/Sec)	33.8	41.5

2D Winbench 99	32 MB Standard	32 MB DC100	64MB Standard	64 MB DC100
Business Graphics WinMark 99	139	140	138	140
Business Disk WinMark 99 (Thousand Bytes/Sec)	1500	1590	2000	2080
High-End Graphics WinMark 99	398	395	398	397
High-End Disk WinMark 99 (Thousand Bytes/Sec)	4670	4980	5790	5830
CPUmark 99	33.8	34	34.6	34.6
FPU WinMark	2470	2480	2490	2490
Disk Playback/Bus:Overall (Thousand Bytes/Sec)	1500	1590	2000	2080
Disk Playback/HE:AVS/Express 3.4 (Thousand Bytes/Sec)	3430	3570	3670	3620
Disk Playback/HE:FrontPage 98 (Thousand Bytes/Sec)	27200	32700	35000	35000
Disk Playback/HE:MicroStation SE (Thousand Bytes/Sec)	4640	5740	10900	10200
Disk Playback/HE:Overall (Thousand Bytes/Sec)	4670	4980	5790	5830
Disk Playback/HE:Photoshop 4.0 (Thousand Bytes/Sec)	3910	3770	3950	4060
Disk Playback/HE:Premiere 4.2 (Thousand Bytes/Sec)	3620	3790	3940	4000
Disk Playback/HE:Sound Forge 4.0 (Thousand Bytes/Sec)	4360	4430	6020	6240
Disk Playback/HE:Visual C++ 5.0 (Thousand Bytes/Sec)	5170	6030	6950	7070
GDI Playback/HE/AVS/Express 3.4	44.4	44	45.2	44.2
GDI Playback/HE/FrontPage 98	104	106	108	109
GDI Playback/HE/MicroStation SE	10.2	10.1	10.1	10.1
GDI Playback/HE/Photoshop 4.0	62.6	64.3	63.7	64
GDI Playback/HE/Premiere 4.2	55.8	54.6	55.7	55.6
GDI Playback/HE/Sound Forge 4.0	132	130	133	133
GDI Playback/HE/Visual C++ 5.0	233	227	237	235

Final Reality	32MB Standard	32MB DC100	64MB Standard	64MB DC100
Radial Blur (Rips)	42.16	41.94	42.21	42.27
Radial Blur (Rmark)	5.831	5.081	5.838	5.847
Chaos Zoomer (Rips)	67.06	67.06	66.96	66.93
Chaos Zoomer (Rmark)	3.258	3.257	3.253	3.252
25 Pixel (Kppss)	192.43	180.96	215.29	203.04
25 Pixel (Rmark)	6.15	5.783	6.88	6.489
Robots (Rips)	47.09	50.12	48.53	51.11
Robots (Rmark)	12.199	12.984	12.572	13.241
Fillrate (MPps)	25.41	25.42	25.4	25.4
Fillrate (Rmark)	5.501	5.502	5.498	5.498
City Scene (Rips)	65368	66.36	68	67.99
City Scene (Rmark)	16.299	16.467	16.874	16.872
Video Card Bus Transfer (MBps)	93.46	97.23	97.13	97.02
Video Card Bus Transfer (Rmark)	2.975	3.095	3.092	3.089
Direct3D Bus Transfer (MBps)	81.42	81.99	81.61	81.7
Direct3D Bus Transfer (Rmark)	6.959	7.008	6.976	6.983
Visual Appearance	96.30%	96.30%	96.30%	96.30%
Overall 3D	3.796	3.833	3.871	3.891
Overall 2D	4.545	4.529	4.546	4.549
Overall bus rate	4.17	4.269	4.257	4.257

Overall Score	4.077	4.107	4.131	4.144