Voodoo5™ 5500 for Mac
Reviewer's Guide

DRAFT - DATED MATERIAL

THE CONTENTS OF THIS REVIEWER'S GUIDE IS INTENDED SOLELY
FOR REFERENCE WHEN REVIEWING Rev A VERSIONS OF VOODOO5 5500 REFERENCE BOARDS.
THIS INFORMATION MAY BE UPDATED, AND REVIEWERS SHOULD CONTACT
THE PERSONS LISTED IN THIS GUIDE FOR UPDATES DURING EVALUATION.

3dfx Interactive, Inc.
4435 Fortran Dr.
San Jose, Ca 95134
408-935-4400

Bryan Speece
(408) 934-5062
bryan.speece@3dfx.com

Lisa Grubb
(408) 934-5068
lisag@3dfx.com

Bubba Wolford
281-578-7782
bubba@3dfx.com

www.3dfx.com
www.3dfxgamers.com

Visit the 3dfx Virtual Press Room at http://www.3dfx.com/comp/pressweb/index.html.

Table of Contents

Table of Contents (cont.)

- **The information provided in this document is not for publication.**

Benchmarking the Voodoo4/5 series of cards:

The introduction of real time Full Scene Anti-Aliasing (FSAA) in hardware, made possible by the T-Buffer technology incorporated in the 3dfx Voodoo5 product family, brings a new set of challenges for reviewers. For years, frame rates were imperative to games, as manufacturers of 3D accelerators strove to get a frame rate high enough to maintain smooth game play. But as 3D accelerators have continued to dramatically improve fillrates with each subsequent generation, it begs the question, “Why do we need all this fillrate?”

Voodoo5 5500 marks a watershed in Macintosh graphics where the technology emphasis expands from simply achieving incredibly high frame rates to delivering mind-blowing image quality at playable frame rates. Voodoo5 5500 features like FSAA coupled with 32-bit rendering and 2Kx2K textures deliver a new level of realism that greatly enhances game play. Combining extreme improvements in image quality in addition to the pursuit of raw speed is our new charter.

Reviewing a feature which dramatically improves image quality such as the Voodoo5’s FSAA is undoubtedly complicated. Which is better: an image with jagged edges, crawling textures and popping pixels running at some obscene framerate; or a beautifully rendered, anti-aliased image that appears almost like pre-rendered quality running at a slightly lower frame rate? If the anti–aliased image is of a higher quality at 800x600 than an aliased image at 1024x768, which frame rate is more important: the 800x600 or 1024x768 score? Of course, the answer depends on the game itself. Some “twitch” games (e.g. Quake3) require absolute immediate response and the highest possible frame rates. Other games, such as flight sims, sports games, racing sims, role playing games, strategy games and the like often times become much more immersive and realistic when the visual quality is significantly improved with FSAA. Since there is no “right” answer to which games should be played with FSAA enabled, we provide the user the ability to enable or disable FSAA in the control panel. For fast-paced action games like Quake3 where performance is paramount, turn off FSAA and enable the world’s highest fillrates with Voodoo5. And for other games when you want to enjoy the beautiful rendering accomplished with FSAA, turn it on and experience the world’s best rendering quality with Voodoo5’s FSAA capability.

We believe strongly that FSAA is something that no graphics card should be without. We hope in your review of our product that you will also come to believe this. Those of you that have already seen our FSAA demonstrated, understand the superior image quality that 3dfx’s hardware FSAA delivers for games, both old and new. Please understand, this is not a feature that games must specifically be written to take advantage. We believe that our FSAA is truly the industry’s most powerful “out of box” experience ever delivered. Consider this— when the first 3D hardware accelerators became available we “wowed” consumers with great demos, but the reality was that no games were available to take advantage of the new hardware acceleration. Moving forward we as a 3D industry made incremental improvements to the 3D capabilities: adding higher resolution textures, higher pixel depths, higher triangle rates, hardware T&L, etc. But every time a consumer purchased one of these new boards it was an act of faith – faith that some day in the future that user could actually buy a game that took advantage of some new hardware feature. Well, quite frankly, we believe we have changed the equation with the Voodoo5 family of products. Now, immediately when the user puts his new Voodoo5 into his system he UPGRADES HIS ENTIRE GAME LIBRARY. No more waiting for future games to take advantage of a hardware feature. The same day a user purchases a Voodoo5 is the same

day that user can experience the breakthrough FSAA capability in his titles. This is why we say that Voodoo5 is the most powerful “out of box” experience ever delivered. We believe you will agree.

So, the difficult question becomes how to incorporate visual quality (i.e. FSAA) when benchmarking and reviewing 3D boards? We offer the following basic guideline:

> Make sure that when you compare the frame rates achieved by two graphics cards that you have set the cards to achieve similar levels of image quality. A corollary to this rule is if one card delivers image quality that’s far beyond anything that other cards can achieve then it must be considered in a class by itself. Never directly compare benchmarks from two boards when one board’s image quality is substantially better than the other’s.

Here are more specific benchmark procedures to consider when testing our boards:

1) Make sure that your competitive benchmarks are truly “apples to apples” comparisons. Voodoo5 5500 offers two levels of FSAA: 2-sample and 4-sample (“2X” and “4X”). Our 2X “jittered” FSAA is equivalent to competitors’ “4-sample” algorithms - although no competitive FSAA implementation is available on the Mac (see our FSAA white paper for a detailed explanation). Our 4X-jittered FSAA has quality beyond anything offered on the market today. No competing product offers image quality to compare with Voodoo5 5500’s 4X FSAA therefore it should be considered in a class by itself (Read the section describing the use of our “3dfx MacTools” control panel later in this guide to insure that you are always setting the correct level of FSAA for your tests.).

2) Because FSAA has previously been unavailable on the Macintosh, many titles from top developers have used techniques such as dim lighting, low variation of spatial color and shape, and outright avoidance of finely detailed objects to minimize aliasing artifacts. The result is that some titles, Quake3 for example, are not dramatically visually improved when FSAA is enabled due to the inherent low contrast artwork. It is therefore imperative to review many titles of different genres and compare their appearance with and without FSAA enabled. Pull out some of your favorite old titles and see how much better they look and how much more fun they are to play with FSAA enabled!

3) Start at 800x600x32bpp. Benchmark our board against our competitors’ with FSAA “OFF”. Generate the FPS scores while also taking great pains to notice image quality of all the boards.

4) Now benchmark our board with 2-sample FSAA ”ON”. Generate the FPS scores while again, taking great pains to notice the huge image quality improvements.

5) Finally, benchmark our board with 4-sample FSAA on (there is no “apples to apples” comparison with the image quality that you will see from our competitors’ products). Notice the incredible rendering quality of our 4-sample FSAA. Remember that since none of our competitors’ achieve visual quality levels equal to our 4x FSAA, there is really no way to perform an “apples to apples’ performance comparison of our 4x FSAA to anything our competitors have to offer.

6) Increase the resolution to 1024x768 at 32-bit color and repeat steps two through four.

7) Finally, turn all the cards to 1600x1200x32 and turn FSAA “OFF” on our card. Benchmark them. How was the score? Did the higher resolution take away *all* the “jaggies” and the crawling textures caused by aliased images? Which resolution plays and looks better? 1600x1200x32 with FSAA “OFF” or 800x600x32 with FSAA “ON”? Which would you play?

It is imperative that you note the differences in visual quality to be sure you are giving a fair comparison. With FSAA, all images are no longer created equal. Run our 4x FSAA because you’ll see the world’s finest 3D rendering quality, but don’t compare it to any of our competitors’ solutions for performance because it is truly in a class by itself in terms of visual quality.

Cures to Common Benchmarking and Image Quality mistakes

When using MacBench 5.0 always make sure to compare different boards using identical Macintosh OS configurations: the same resolution, refresh rate, color bit depth, enabling of font aliasing, etc.

To take screenshots in Glide or RAVE use the following keys: command+shift+3. This takes a picture of the screen and saves it as a pict file in the startup disk. If you just want to take a picture of the window that is open or just a small part of the screen, use command+shift+4. You will then have a little draggable area that you can adjust to select what you want to take a picture of.

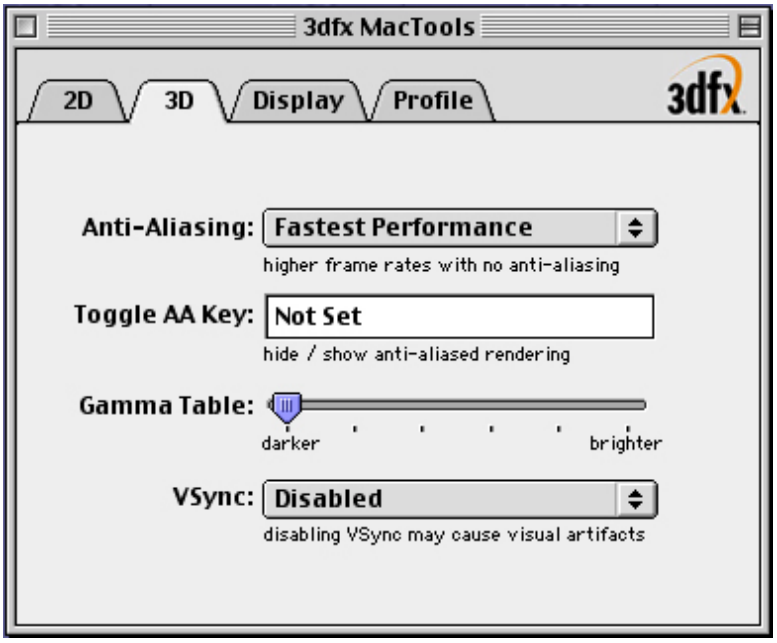
In most modern games there's actually a screenshot button. Usually this can be found in the preferences settings. This technique should work fine for Glide and Rave games, but it doesn't work currently in OpenGL games.

When using images to compare image quality, you may want to use the highest quality compression to preserve image integrity. We recommend TGA files.

Benchmarking Tips

- **Disabling VSynch**

Make sure to disable VSynch. To disable VSynch, open the 3dfx MacTools control panel. Select the *3D* tab. There you will find a popup menu that will allow you to disable Vsynch.



- **FSAA Hide/Show Hotkey**

It's easiest to see the impact of FSAA with a hot key that enables you to switch between aliased and anti-aliased rendering. For this reason we've given the user the opportunity to define a hot key that will achieve this.**

**Note: the technique that we use to enable and disable FSAA with this hot key causes the full FSAA performance hit to be incurred even with FSAA disabled. Do not assume that merely hiding FSAA through this hot key will allow you to achieve the highest performance for benchmarking purposes. This utility is simply a convenience to allow easy viewing of the tremendous image quality benefits that FSAA can provide. To fully deactivate FSAA select the *Fastest Performance* item from the *Anti-Aliasing* popup menu under the *3D* tab in the MacTools control panel.

To define a hot key which toggles between hiding and showing the effects of FSAA do the following:

1) Open the MacTools control panel
2) Select the 3D tab
3) Type the desired key combination into the *toggle AA key* field

INTRODUCTION:

3dfx™ is the industry-leader in 3D entertainment for consumer PC's, and the new VSA-100 accelerator chip, featured on the Voodoo5 5500 products, is the pinnacle of 3D acceleration. The VSA-100 offers blazing 3D/2D/video performance, 1x/2x/4x AGP support, unmatched image quality, and the largest number of compatible gaming titles for the Glide®, QuickDraw 3D RAVE®, and Apple OpenGL® API's. VSA-100 also provides a unique combination of Voodoo chip-level compatibility, standard-setting image quality features and scalable performance.

The Voodoo5 5500 is an excellent example of the VSA-100's scalability. The Voodoo5 5500 exploits the power of the two VSA-100 chips by coupling them in Scanline Interleave (SLI™) mode and drawing 3D acceleration from both chips simultaneously. The unique scalability of two-chip and four-chip scan-line-interleave (SLI™) configurations delivers industry-leading 3D fill rates that are simply unavailable from other 3D technologies. Multi-chip SLI™ configurations supporting up to 256MB of frame buffer allow the advanced technology of the VSA-100 to manage huge volumes of texture data from even the most demanding 3D applications for stunning visual realism and awesome performance.

Voodoo5 5500 products feature 3dfx's advanced T-Buffer™ technology to provide stunning image quality features like full-scene anti-aliasing, motion blur, and depth-of-field blur. The Voodoo5 5500's VSA-100 chips also support important new image quality features, such as full 32-bit rendering, 32-bit textures, 24-bit floating point depth buffer and 8-bit stencil buffer, and support for texture sizes up to 2Kx2K.

Content developers demand the flexibility and freedom provided by large amounts of texture memory. VSA-100 delivers with multiple forms of 4-bit-per-texel compression. VSA-100 also supports texture compression through 8-bit palletized textures. VSA-100 supports the greatest range of 3D API's available including Glide 2.x and 3.x, QuickDraw 3D RAVE 1.6, and Apple OpenGL 1.1.3. Hundreds of Mac 3D titles optimized for acceleration on Voodoo Banshee, Voodoo2, and Voodoo3 run on VSA-100. No other gaming platform runs more Mac titles.

The VSA-100 chip featured on the Voodoo5 5500 is a full 128-bit single-cycle GUI accelerator with 128-bit VGA core. Apple's QuickDraw API is accelerated providing optimum benefits to 2D applications and the Macintosh desktop. A 350Mhz RAMDAC and support for digital flat panels through a standard DVI output assures the ultimate clarity to professionals in design and publishing disciplines. And Apple's Quicktime API is also accelerated yielding performance benefits to a variety of multimedia applications.

SECTION 1: Voodoo5 5500 Board Overview

Feature Summary for VSA-100

General features

- Fully-integrated 128-bit 3D/2D/Video Accelerator
- Ultimate 3D experience with 366 Million pixels/sec. and 11 Million triangles/sec.
- T-Buffer™ technology:
  - Spatial: full-scene 2 or 4 sample anti-aliasing
  - Focus: depth-of-field blur
  - Motion: motion blur
- 2-way SLI scalability
- 1x/2x/4x AGP with full sideband support
- 32-bit rendering
- Up to 24-bit floating point depth buffer (Z and W)
- 8-bit stencil buffer
- 32-bit textures
- 2Kx2K maximum texture size
- Industry-standard and proprietary texture compression
- [-4k,4k] rendering coordinate range
- Fully software-compatible with 3dfx Voodoo3

3D Feature Set

- Dual pixel pipeline: 2-pixels/clock (single texture) or 2 textures/clock (single pixel)
- Full-scene anti-aliasing in hardware:
  - Single-chip: 2-sample
  - 2-way SLI: 4-sample
- Full hardware setup of triangle parameters
- Supports multi-triangle strips and fans
- Transparency/chroma-key with dedicated color mask
- Alpha blending of source and destination pixels
- Sub-pixel and sub-texel correction to 0.4x0.4 resolution
- Per-pixel atmospheric fog with programmable fog zones
- Dynamic environment mapping
- Perspective-correct true divide-per-pixel 3D texture mapping and Gouraud shading
- Single-cycle bump mapping
- Single-cycle trilinear mip-mapping
- True per-pixel Level of Detail (LOD) MIP-mapping with biasing and clamping
- RGB modulation combines textures and shaded pixels
- Texture compositing for multi-texture special effects
- Support for 14 different texture map formats
- 8-bit palletized textures with full bilinear filtering
- 4-bit-per-texel texture compression algorithms

2D Feature Set

- 128-bit VGA core
- 128-bit GUI accelerator
- Acceleration for Bresenham line draw, polygon fill, scissors and rectangle clipping
- SDRAM function support, including color expansion and block-write

Voodoo5 Video Subsystem

- Planar-to-packed-pixel digital video format conversion
- Full VMI 1.4 video port support with CCIR-656 extension
- 350MHz RAMDAC for refresh rates up to 160Hz; up to 2048x1536 at 85Hz display support
- VGA and DVI outputs

SLI

Scan Line Interleave is a big benefit of the VSA-100's scalable architecture. It allows 3dfx to use multiple graphics chips simultaneously, dramatically increasing fill rates and performance. The VSA-100 supports up to 32 chips being used in SLI. 3dfx has announced plans to offer 2 chip configurations to the Macintosh market.

3dfx first introduced SLI with the Voodoo2, used to link two whole video cards together, with one video card rendering the odd lines of a video output, while the other card renders the even lines. With the 3Dfx Voodoo2, the slave 3D card sent its rendered output via a ribbon cable into the master video card. The combined output was then rendered on screen by the master card.

Multiple VSA-100 chips can be mounted on a single card, eliminating the need to use multiple slots for an SLI configuration. The VSA-100 also adds AGP support to SLI, and support for SLI resolutions beyond 1600x1200. The VSA-100 adds the dimension of programmability to SLI, meaning game developers can break the scene up into anywhere from 1 to 128 lines and assign certain lines to a particular graphics chip to optimize the performance of the game with 3dfx hardware.

DVI

The Digital Video Interface supplied on the Voodoo for Macintosh products is based on Transition Minimized Differential Signaling (TMDS) and terminates via a standard 24-pin connector on the backplane bracket.

This form of digital output is currently used by all Apple Digital flat panel displays including the 22" Apple Cinema Display and the 15" Apple Studio Display. In addition Silicon Graphics has recently introduced an external box, called the MultiLink adapter, which allows their 17.3" SGI 1600SW digital flat panel to be driven from a standard DVI output. Voodoo for Macintosh products will drive some of these panels to their maximum native resolution of 1600x1024. This provides the cleanest, all-digital display quality often preferred by Design and Publishing professionals.

Voodoo for Macintosh also provides a standard VGA output for driving analog cathode ray tubes (CRT's). The DVI output and VGA output are meant to be used separately – they are not intended to simultaneously drive a CRT + DFP combination.

Texture compression

The VSA-100 supports FXT1™ and Narrow Channel texture compression in hardware.

3dfx's open source FXT1™ texture compression technology alleviates the performance bottlenecks associated with the use of many high-resolution textures. The texture compression algorithm reduces the amount of memory required to store each texture, which allows developers to use many more textures at higher resolutions with increased performance. As a result, games and applications utilizing FXT1™ texture compression will run at faster frame rates with significantly enhanced visual quality. Additionally, with the proliferation of 3D content on the Internet, FXT1™ texture compression will help reduce download times for 3D content featuring high-resolution textures.

The FXT1™ texture compression algorithm works by breaking each texture down into multiple 4 x 4 or 4 x 8 texel (texture element) blocks. In contrast to other texture compression schemes, the FXT1™ technology uses 4 different compression algorithms at the block level. For each block, all 4 compression algorithms are applied and the one, which produces the highest quality result, is then used for that block. Since each block can use a different compression algorithm, the overall visual quality of the compressed image is substantially better than other texture compression schemes. The result of the FXT1™ texture compression algorithm is a compressed image, which only requires ½ a byte of memory storage per texel. For example, an uncompressed 32-bit texture image of 256x256 resolution requires 256 Kbytes of memory storage, whereas that same texture compressed with the FXT1™ texture compression requires only 32 Kbytes of memory storage, an effective compression ratio of 8:1.

FXT1™ is currently available to developers registered with the 3dfx Developer Program and can be accessed at www-dev.3dfx.com/fxt1.

Narrow Channel texture compression is a proprietary 3dfx texture compression used in legacy products and by the GLIDE API.

Fillrate Vs T&L

There are several fundamental problems to address with today's 3D accelerators. One issue that will never change is the need for increased fillrate. While there has been a great deal of hype surrounding Transform and Lighting (T&L), this feature has not yet become a mainstream component of today's games and 3D code. Adding more polygons and triangles causes an increased use of fillrate and while more detail is added to the scene, adding more detail while greatly reducing available fillrate means that each scene is rendered at a slower speed and with an increased amount of aliasing.

In addition T&L solutions can often require higher bus bandwidths to achieve the same performance as non-T&L systems. The Macintosh bus does not currently implement bursting methodologies common on PC systems and, as a consequence, may not be well suited to T&L solutions.

FSAA: The 3dfx approach to Full Scene Anti-Aliasing

The anti-aliasing implemented on Voodoo4 and Voodoo5 is a “jittered” or “Rotated Grid SuperSample” (RGSS) subsample approach. Jittered subsamples gives a much higher quality than a regular grid pattern for the subsamples. In general, 2 jitterered subsamples is roughly equivalent to 4 unjittered subsamples, as each will produce 2 levels of coverage for nearly horizontal or vertical edges. Four jittered subsamples is roughly equivalent to 16 unjittered subsamples, as each will produce 4 levels of coverage for nearly horizontal or vertical edges. This means, for instance, that the 4 jittered sample anti-aliasing on Voodoo5 is significantly better in quality than a 4x supersampled (2x in each direction) implementation.

This is a screenshot from the game “Rune” with FSAA off.

This is an identical screenshot from “Rune”. This time our FSAA is turned on.

Can you see the difference? Look at the sword, axe and helmet. The “jaggies” are gone.

Introduction to the 3dfx T-buffer

The 3dfx T-Buffer™ technology marks the first time sophisticated, high-end cinematic effects are available in real-time for consumer-level PCs. Up until now, creating the effects accelerated by the T-Buffer™ technology was reserved for the special effects elite: primarily professionals who could afford the excessive costs associated with developing Hollywood-like digital effects on professional workstations.

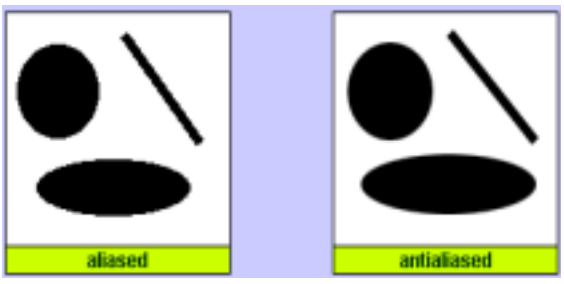
Designed to dramatically raise the level of quality of 3D graphics rendering, the T-Buffer™ technology enables cinematic effects never before available on the Mac at real-time frame rates essential to attaining and experiencing true-to-life imagery. Chief among these are real-time Full-Scene Anti-Aliasing (FSAA), which removes the appearance of jagged edges in a rendered scene, and real-time Motion Blur, which dramatically improves the rendered realism for fast-moving objects. The T-Buffer™ technology also allows for the first time acceleration of Depth of Field effects commonly used in professional photography and cinematography.

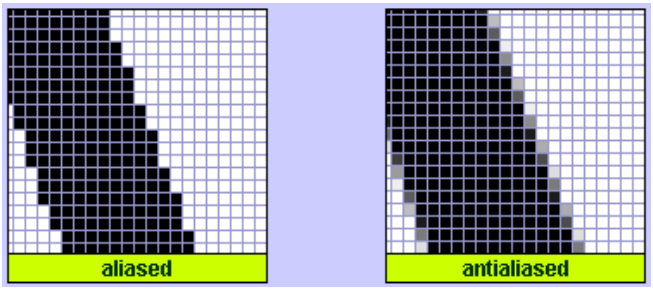
Spatial Anti-Aliasing, Motion Blur, Depth of Field, and related techniques are key to producing real-life imagery, and can mean the difference between viewer belief and disbelief of an image's realism. To the viewer's eye, the sharp, jagged edges, the absence of blurred images during movement, and the lack of depth reference commonly found in images rendered by today's 3D accelerators are actually indicators of *unrealism* since these artifacts do not occur naturally in real-life, photography, or film. As a result, the human eye registers these poorly rendered scenes as artificial, and the attempt to convey realism is lost. For the first time on the Mac all of these realistic effects can be accelerated in real-time by this breakthrough.

For a detailed explanation on how the T-Buffer works, visit the Virtual Press Room at http://www.3dfx.com/comp/pressweb/index.html.

Full Scene Anti-Aliasing (FSAA)

Long considered the "Holy Grail" of 3D image quality, Full Scene Anti Aliasing has long been the goal of 3D graphics companies, however, until the VSA-100, full scene AA required such a performance hit that it was unplayable in real world applications. As a result, many manufactures would put full scene AA support in their chips and write it in big bold letters on the front of their boxes, but recommend you turn it off to test their cards. Full Scene AA is quite simply the smoothing of rough spatial edges or "jaggies" that always exist in real-time digitally-generated artwork that are created by the intersection of the triangles used to create 3d models (think wire frame). Full Scene AA smoothes those edges and removes triangle edge "jaggies" and eliminates pixel "popping" associated with aliasing. 3dfx is 100% compatible with standard API's and works with existing games. It allows you to automatically upgrade existing and future games to a new level of image quality.





Alternative APIs

3dfx is a strong supporter of emerging alternative API's. As such we have open sourced our proprietary API Glide, our 2D and 3D registry specs, as well as all of our driver efforts on the Linux platform. 3dfx is committed to the open source community because it taps into a multitude of hardcore developers who wish to get full access to all parts of their video card. More information about Linux, open source code, and 3dfx can be found here: http://www.linux.3dfx.com.

Pricing and Availability

Voodoo5™ 5500 PCI for Macintosh with 64MB of SDRAM will be available on store shelves in early August for the suggested retail price of $329.

3dfx products can be purchased at leading retailers and online resellers including Amazon.com, Buy.com, Egghead, Electronics Boutique, Outpost.com or through leading distributors. Customers may also purchase their products directly through www.shop.3dfx.com.

Warranty

Retail versions of the Voodoo5™ 5000 series are covered by a lifetime warranty in the US and a 10 year warranty internationally.

Technical Support

For technical support, questions, or additional information during the review process, contact:

Bryan Speece, Director Macintosh Business Development
(408) 934-5062
bryan.speece@3dfx.com

Rich Aronson, Macintosh Software Quality Assurance
(408) 719-5946
raronson@3dfx.com

Lisa Grubb, Public Relations Specialist
(408) 934-5068
lisag@3dfx.com

Bubba Wolford, Senior Public Relations Specialist
(281) 578-7782
bubba@3dfx.com

Consumers can access toll free technical support from 3dfx by calling 1-800-234-4334. For 24-hour BBS support dial (214) 437-9615. 3dfx's Technical Support Fax number is: 214-669-1326. Or contact 3dfx at www.3dfx.com

Photos, Screen shots, White papers and more.

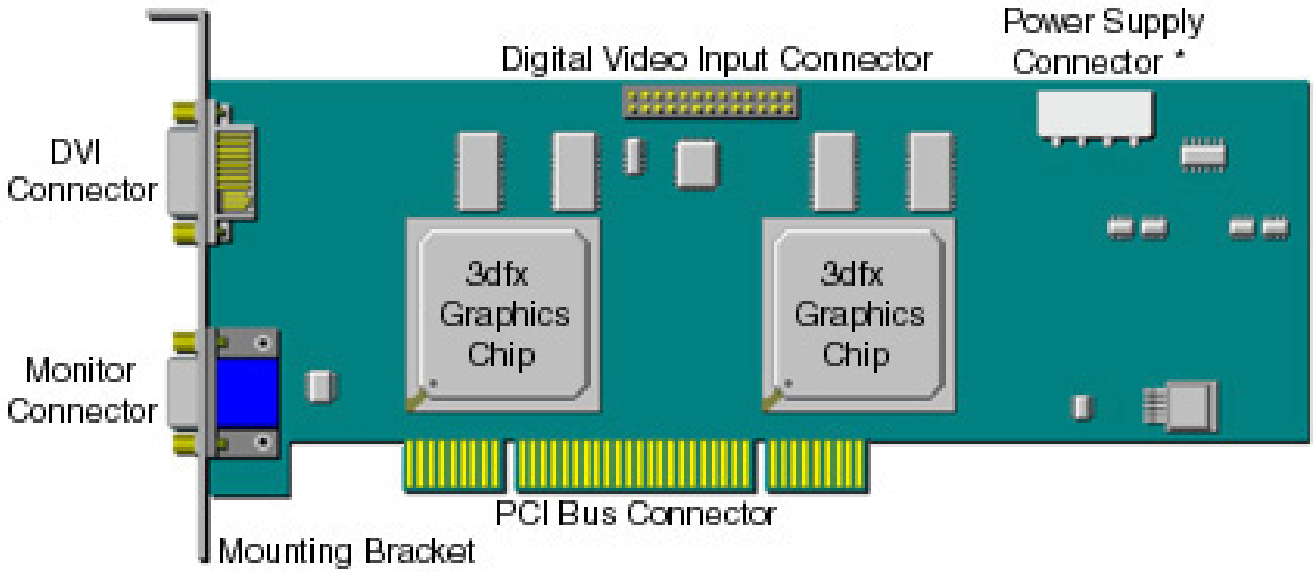
Visit the 3dfx Virtual Press Room at http://www.3dfx.com/comp/pressweb/index.html. We provide this as a service for our media partners. In the press room you will provide a number of documents that will help you build background on your stories like news releases, executive backgrounders, white papers, and past Powerpoint presentations on a number of different topics. To add pop to your story, we provide executive headshots, product images, company logos and screen shots that show the different features of our products.

The site is password protected, so remember to apply for your password before your deadline approaches.

To recommend other resources you would like to see added to the press website, please email webmaster@3dfx.com.

SECTION 2: About the Voodoo5 5500 PCI Board

Board Layout



Hardware Components

Graphics Subsystem

- Graphics Controller –166MHz VSA-100 (2x)
- Frame Buffer –64MB of 1Mx16 SDRAM (5500)
- RAMDAC – 350MHz

Bus Interface

- Graphics bus interface – PCI 2.2

I/O Connectors

- Standard Monitor VGA
- 24-pin TMDS DVI output for DFP's
- CCIR-601 / CCIR 656 Video Input

System Requirements

- Mac OS 8.5-9.x
- Apple Macintosh with a G3 or G4 processor and a free PCI slot.
- 64MB of system RAM

Display Mode Table:

Apple Cinema Display (22” DFP)

640x480
800x512
800x600
1024x640
1024x748 1280x800
1280x1024
1600x1024

Note: No clarity gain is accomplished through driving of DFP's above 60Hz

SGI's 1600SW (17.3” DFP)

640x480
800x512
800x600
1024x640 1024x748
1280x800
1280x1024
1600x1024

Note: No clarity gain is accomplished through driving of DFP's above 60Hz

Apple Studio Display (15" DFP)

640x480
800x600
1024x768

Note: No clarity gain is accomplished through driving of DFP's above 60Hz

Applicable Analog CRT's

320x200@70 320x200@85 320x240@60 320x240@72 320x240@75 320x240@85
320x400@70 360x200@70 360x400@70 400x300@60 400x300@72 400x300@75
400x300@85 512x384@60 512x384@70 512x384@75 512x384@85 640x200@70
640x350@70 640x350@85 640x400@70 640x400@85 640x480@60 640x480@67
640x480@72 640x480@75 640x480@85 640x480@100 640x480@120 640x480@140
640x480@160 720x400@70 720x400@85 720x480@60 720x480@72 720x480@85
720x576@72 720x576@100 800x600@56 800x600@60 800x600@72 800x600@75
800x600@85 800x600@100 800x600@120 800x600@140 800x600@160
832x624@75 864x480@60 960x720@60 960x720@75 960x720@85 1024x768@60
1024x768@70 1024x768@74 1024x768@75 1024x768@85 1024x768@100
1024x768@120 1072x600@60 1152x864@60 1152x864@70 1152x864@75
1152x864@85 1152x864@100 1152x864@120 1152x870@75 1280x960@60
1280x960@75 1280x960@85 1280x1024@60 1280x1024@75 1280x1024@85
1280x1024@100 1376x768@60 1600x1024@60 1600x1024@76 1600x1024@85
1600x1200@60 1600x1200@65 1600x1200@70 1600x1200@75 1600x1200@80
1600x1200@85 1600x1200@100 1792x1344@60 1792x1344@75 1856x1392@60

1856x1392@75 1920x1080@60 1920x1080@72 1920x1080@75 1920x1080@85
1920x1200@60 1920x1200@76 1920x1200@85 1920x1440@60 1920x1440@75
2048x1536@60 2048x1536@75 2048x1536@85

SECTION 3: About the VSA-100 Chip

Overview

At the heart of the new Voodoo5 boards is the highly scalable VSA-100 chip. Debuted at COMDEX in November, VSA-100 is the most advanced graphics processor technology available for Macs today. The T-Buffer technology dramatically improves the rendering capabilities for consumer PCs, bridging the “realism” gap that currently exists between motion picture/photographic imagery and computer-generated images. The T-Buffer makes it possible to do real time Full Scene Anti-Aliasing (FSAA), and cinematic effects like motion blur effects, depth of field and soft shadows and reflections.

With 14 million transistors and manufactured in an advanced .25 micron CMOS process, VSA-100 is designed for optimal performance through massive fill-rates on both G3 and G4 processors.

In addition, the VSA-100 chip featured on the Voodoo5™ 5500 series is a full 128-bit single-cycle GUI accelerator with 128-bit VGA core.

VSA-100 provides breakthrough features and performance including:

- A Scalable Architecture
- Real-Time Full Scene HW Anti-Aliasing
- T-Buffer™ Digital Cinematic Effects
  - Motion blur
  - Depth of field
  - Soft Shadows
  - Soft Reflections
- Leadership Fill Rates
- FXT1™ Texture Compression

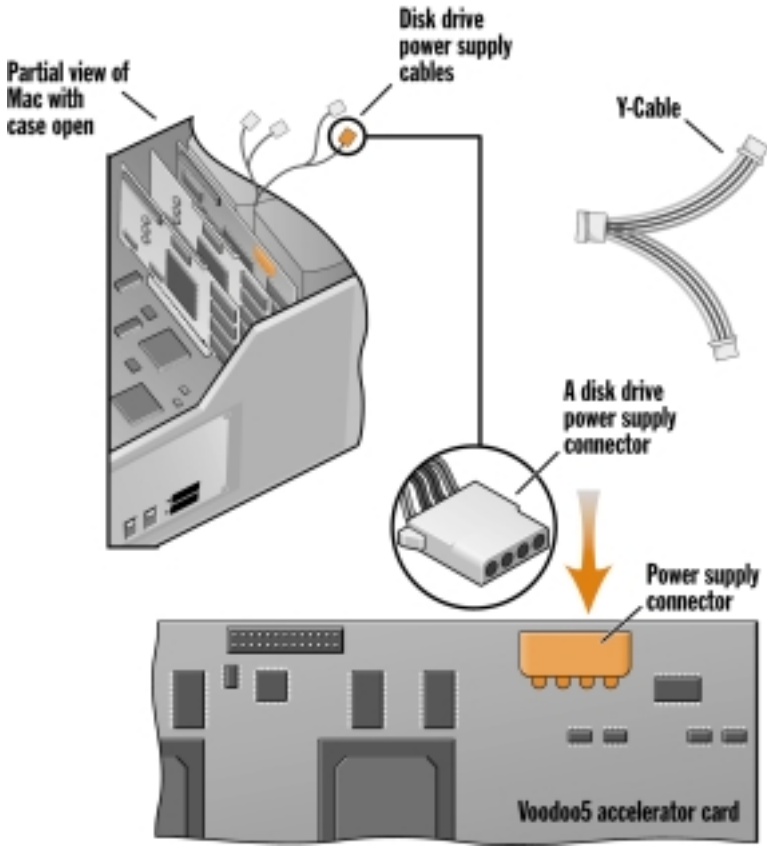
SECTION 4: Installation and Start-Up
Installing the Board

Installation Instructions
Follow the simple steps described in the Quick Install Guide and in just a few minutes you can easily replace your computer's old display card with the powerful new Voodoo5 accelerator card. The Quick Install software on the 3dfx Installation CD will lead you through the installation process in a few simple steps.

IMPORTANT NOTES:

- There is also an Online User's Guide on the 3dfx Installation CD which is in HTML format. Your system must have internet/web browser software installed (either Microsoft Internet Explorer or Netscape Navigator) to view the Online User's Guide.

- The "Hardware Installation" section of the Online User's Guide has important information that you will need while your computer is shut down and the Online User's Guide is unavailable to you. It is very important that you print this section so that you can refer to it during the installation.



Power Supply Connection Diagram

- Your new Voodoo5™ card requires additional power from your Mac's power supply. Be sure to connect one of your Mac's disk drive power cables to the Power Supply Connector on your new Voodoo5™ card, using the included Power Supply Y-cable, if necessary.

SECTION 5: FAQ

Have you been speaking with Apple about getting 3dfx boards in every Mac?
During the normal course of day-to-day operations we communicate with Apple pretty consistently. Unfortunately we can't comment on the nature or content of our discussions. But, we believe, as with other platforms, that Mac end-user's have a big part to play in the definition of the standard Mac.

Will Apple make Voodoo4 or 5 BTO (build-to-order) options through their company store?
Currently Voodoo4 and 5 are not BTO options.

What versions of the Voodoo4 and Voodoo5 line will be created for the Mac?
Currently we've announced a V4 4500 PCI and V5 5500 PCI product.

Why are you offering the Voodoo4 and Voodoo5 in PCI configurations rather than AGP?
We realize a large part of the Macintosh market is PCI-based and that these users have an equal desire to see the VSA-100 technology made available to their machines. Further, we believe this strategy has the ability to impact the broadest base of Macintosh owners as legacy PCI-based Macs and newer AGP-based Macs can both take advantage of this card type.

Will 3dfx be offering AGP versions of Voodoo4 or Voodoo5 for the Mac?
We constantly evaluate the market potential for AGP-based Mac offerings. All technical hurdles for releasing these products have been overcome. Unfortunately PowerMacs are not currently available from Apple with an empty AGP slot with which to accommodate such a product. Consequently, the purchaser would be put in a position of additional expense - and this plays a large part in our view of an AGP card's market potential.

When can I buy a Voodoo4 or Voodoo5 for the Mac?
We expect products to reach retail shelves in early August.

What are the anticipated prices of the Mac products?
The Voodoo4 4500 PCI will be under $200. The Voodoo5 5500 PCI will be priced at $329.99.

Why do the Macintosh Voodoo4 and Voodoo5 products cost more than the "equivalent" WinPC products?
This is a common misperception. We aren't marketing any one-for-one equivalents to our Windows products. Both the hardware and software is unique - Digital Flat Panels are supported in hardware and different desktop, multimedia and 3D API's are supported. In the end the Macintosh products carry a slight price increase over our similar WinPC products. But this similarity is wholely predicated on the number of VSA-100 engines present on the boards and not by the overall product composition.

So what's a VSA-100?
The VSA-100 chip is the latest silicon chip from 3dfx. It's the engine that drives the Voodoo4 and Voodoo5 product families. Its scalable architecture allows it to be used alone or in

multiple configurations. The Voodoo 4 4500 uses one VSA-100 whereas the Voodoo5 5500 uses two working in tandem.

What is the fill rate on the single chip solution? Dual-chip?
A single VSA-100 processor is capable of delivering 333 Megapixels of fill rate each second. Specifically the V4 4500 PCI for Macintosh is expected to deliver 333 Megapixels per second, whereas the dual-chip Voodoo5 5500 is expected to deliver 667.

Was the VSA-100 chip designed with the Mac in mind?
Yes. The VSA-100 was built as a truly cross-platform chip. It includes native support for Mac addressing modes such as the ability to address byte information in big endian format. In addition it includes native support for the Macintosh pixel format. This 1-5-5-5 pixel format is different from that used on PC platforms.

How are Voodoo4 and 5 different from the Voodoo3?
The Voodoo4 and 5 are based on the scalable nature of the VSA-100. They incorporate a whole new set of features, enhancements, optimizations and technology. These include full-scene anti-aliasing, T-Buffer, FXT1, 32-bit color, and 2K X 2K textures, etc.

Will Voodoo4 and Voodoo5 have T&L? No. It is our belief the benefits of T&L are reduced by the current Mac architecture and, in any event, the supported title availability will be very minimal until the end of the year. Instead we have emphasized FSAA - which is of benefit to all Mac users immediately.

What is FSAA?
Full-Scene Anti-Aliasing. FSAA provides remarkable visual quality enhancements to full screen 3D titles including the smoothing of jagged edges and the elimination of artifacts such as shimmering, swimming, bumblebees and interference patterns. It's backwards compatible with your old titles and forward compatible with those you'll enjoy in the future. And full-scene anti-aliasing is done on-the-fly in hardware by the VSA-100.

What is the T-Buffer?
The T-Buffer allows several key digital effects for improving photorealism in real-time 3D graphics rendering. The primary purpose of 3dfx's T-Buffer technology is to improve image quality. The challenge is exactly how to narrow this gap between computer-generated 3D graphics and what users typically see in real life, photography, and motion pictures. The T-Buffer attempts to narrow the gap considerably by offering real-time hardware acceleration of spatial anti-aliasing, motion blur, depth of field, and some other closely-related effects.

Do you have any Mac developers who are adding T-buffer effects to their games?
Every game that runs in full-scene uses the T-Buffer to some extent - that's the beauty of it. But there are a few game developers that are really excited about what they can do with it beyond that. Unfortunately we can't disclose who they are until their games are done (or in late beta), due to confidentiality agreements. Watch for new games with T-Buffer enabled effects in the Fall 2000 timeframe.

Would motion blur in a game like Quake 3 increase your target area?
No.

Can a single VSA-100 (Voodoo4) board do T-buffer effects?
No.

Can a single VSA-100 (Voodoo4) board do FSAA?
Yes -- it can do full-scene anti-aliasing based on 2-samples. In most titles this will provide an immediate visual quality improvement.

Is the FSAA provided by the dual-chip boards better?
Yes. The dual-chip V5 5500 can do full-scene anti-aliasing based on 4 samples as opposed to the single chip's 2 samples. This yields even better visual quality improvements.

Can a single chip VSA-100 board (Voodoo4) do cinematic effects and full scene AA at the same time?
No, because the Voodoo4 doesn't support T-Buffer but it can do 2-sample FSAA.

Can the Voodoo5 do cinematic effects and full-scene AA at the same time?
Yes. Voodoo5 products are capable of doing combinations of FSAA and T-Buffer.

Is there a performance penalty?
Because multiple rendering passes are required to do T-Buffer effects and full-scene AA simultaneously, there is a performance hit that increases as more simultaneous effects are enabled.

Does your FSAA and T-Buffer technology cause performance hits?
The real question concerning gamers is whether they can run their favorite titles at real-time frame rates with these features turned on. While the actual performance will vary depending on processor speeds and the application being run our goal is to provide realistic frame rates at 32bpp with FSAA turned on and then run even faster with FSAA turned off.

What displays can be driven with the boards?
The Voodoo4 and Voodoo5 for Mac support a wide range of resolutions and timings making them very compatible with a wide array of CRT's from Apple and others. In addition they provide DVI output to drive select Apple and SGI digital flat panels.

Do Voodoo4 and Voodoo5 support 32-bit color?
Yes.

Why did you decide to go with the type of SDRAM instead of a higher performing memory type on the board?
SDR SDRAM is cost-effective, highly available, and presents no technology risks. SLI and SDR SDRAM give us higher memory bandwidth than any competing product, making it an easy choice.

Did you look at using embedded memory in this chip?
We evaluated embedded memory, but found it is still not economical for a chip with this performance level.

What will the clock speeds of the configurations be?
The clock speed for both the V4 4500 and V5 5500 is 166Mhz.

Are the memory and processor clocks synchronous?
Yes. There's a single clock memory and core clock.

Will any of the boards ship with a fan?
Yes. The Voodoo4 and Voodoo5 ship with fans mounted to their VSA-100 chips.

Can you overclock Voodoo4? Voodoo5?
Any component that has a clock, can be overclocked. However, we don't warrant or support overclocked products. We guarantee stability at the shipped clock rate.

Will you do a Mac version of a VSA-100 based multimedia card like the 3500 TV?
There are no plans to release a Mac multimedia product at this time.

What will the Macintosh software package consist of?
A quick installer, drivers, control panel and online user's guide.

Will there be an additional third-party software bundle included?
Yes.

What Macintosh API's will be supported/accelerated?
For desktop and 2D acceleration QuickDraw will be accelerated. For multimedia Quicktime will be accelerated. Every major Macintosh 3D API is accelerated. This includes, Glide, RAVE and Apple OpenGL.

What are the minimum system requirements for Voodoo4 and Voodoo5
An Apple Macintosh using a G3 or G4 CPU running Mac OS version 8.5 to 9.x with a free PCI slot. We'd also recommend at least 64MB's of RAM as a minimum to enjoy 3D titles.

Is 3dfx planning to support OS X in the future?
Yes.

Will the boards function on pre-G3 Macs?
It's possible that older Apple CPU's may also be able to take advantage of the Voodoo4 and Voodoo5. However, the boards are full length - which may preclude some older legacy machines. And they will be warranted and supported only on G3 or G4 based PowerMacs.

Can I buy a Windows VSA-100 board and use it in a Mac like I did the Voodoo3?
No. Our Windows products are different than our Mac products from a hardware and software standpoint. You will not be able to use a Windows board in conjunction with the Macintosh software kit or vice versa.

Will the beta Voodoo3 drivers ever be officially supported?
We have many happy customers using our Voodoo3 products in Macintoshes, but we don't intend to officially support this implementation. However we may, from time to time, release driver upgrades for the Voodoo 3 specifically targeted at improving its performance solely as a Mac gaming solution. Official support will be focused on the Voodoo4 and Voodooo5. These are our first branded Macintosh products and the first intended to provide broadbased acceleration benefits to the platform.

Does Voodoo4/5 regain the technology leadership position for 3dfx?
VSA-100 is a very compelling product line that addresses a multitude of customer needs. There are several technological breakthroughs including breaking the gigapixel barrier, FSAA, T-Buffer™ effects and FXT1™. None of our competitors can match our leadership position.

Why have you decided to bring back SLI?
Performance scalability is a critical component in providing a solution to multiple market segments. SLI effectively addresses the variety of end-user and OEM needs from very high-end game enthusiasts to the cost-sensitive mainstream consumer.

How about SLI support for the Mac?
SLI is applicable to any platform including PCs, Mac and Linux.

With the introduction of Voodoo4, will there be any revisions made to Glide?
No revisions were necessary. Voodoo4 will be compatible with all existing Glide titles.

Isn't the Voodoo4/5 board just a stopgap until Rampage, your new architecture and T&L board?
No. VSA-100 is its own product with its own unique feature set. Rampage is a codename for a future, unannounced product.

What is Rampage?
Rampage is a codename for a future product.

Will you do a version of Voodoo4/5 that has a tuner like the Voodoo3 3500TV?
We are not able to disclose at this time future multimedia products which incorporate the VSA-100 graphics design.

Will there be a T&L daughter card for Voodoo4/5?
No. The benefits of T&L do not match the cost and title availability until later down the road.

What is the fill rate on the single chip solution? SLI?
The single chip is 333 Megapixels – the 2-way SLI is 667 Megapixels.

Do you expect any supply limitations with Voodoo4/5 like you had with Voodoo3, and especially the 3500TV?
No.

What's a VSA-100 chip?
The VSA-100 chip is the latest silicon chip that is contained in the Voodoo4 and Voodoo5 product families.

Can the 2-way SLI product do cinematic effects and full-scene AA at the same time?
Yes. The Voodoo 5 products are capable of doing any combination of FSAA and T-Buffer.

Is there a performance penalty associated?
Because multiple rendering passes are required to do T-Buffer effects and FSAA simultaneously, there is a performance hit that increases as more simultaneous effects are enabled.

Will you be speed grading the Voodoo4/5 chips like you did with Voodoo3?
We expect good yields at high speeds for VSA-100 therefore we don't have plans to speed-bin the parts.

Do you have full 4X AGP support in Voodoo4/5? If not, why not?
We support AGP 4X but we do not support execute mode (i.e. texturing from system memory).

FSAA doesn't matter at high resolutions – does it?
You can see from our demos, which are all run at 1024x768 resolution, that FSAA makes a huge difference. The difference is noticeable even at 1600x1200.

Does your FSAA and T-Buffer technology cause performance hits?
The real question concerning gamers is whether they can run their favorite titles at real-time frame rates with features turned on. Our goal is to make applications run at real-time frame rates at 32bpp with FSAA turned on and then run them even faster with FSAA turned off.

Can you overclock Voodoo4? Voodoo5?
Any component that has a clock, can be overclocked. Overclocking is dangerous to your video board and although we know some computer savy people are going to overclock their video cards, we do no recommend it or warranty cards damaged products due to overclocking. We only guarantee stability at the shipped clock rate.

How do higher and lower speed processors affect the Voodoo4/5 cards performance (is it highly scalable across different processor speeds)?
It is scalable across different processor speeds. Obviously faster processors will allow users to more fully experience the Voodoo4/5 capabilities.

Will consumers with lower-end systems see a benefit when upgrading to a Voodoo4/5?
Absolutely. Full-scene anti-aliasing and high fill rates are completely independent of CPU performance, so users who have lower-end systems can still experience an amazing upgraded graphics capability with Voodoo4/5.

How will you overcome the memory bandwidth problems on the 2-way and 4-way SLI boards?
There are no memory bandwidth problems with the 2 and 4 way boards. Each chip has its own allocated set of RAM.

Does the VSA-100 contain any technology carried over from The Voodoo 1-3 series of cards, or was every portion of it built a new from the ground up?
VSA-100 builds on the Voodoo architecture but represents significant enhancements and refinements. Voodoo 1-3 introduced many innovations to the consumer 3D market that are still valuable today such as per-pixel mipmapping, exponential fog, single-clock single-cycle

multitexturing, and a floating-point Z and W buffer. We have retained these functions but of course have upgraded the datapath to 32-bits from 16. The rasterizer was completely re-written from Voodoo3 and is about 20% more efficient. VSA-100 retains the same 2D and video overlay engines as Voodoo3, and the RAMDAC design is basically unchanged. Of course the new functions were built from the ground-up: scan-line interleave, FXT1 and DXTC texture compression, and T-Buffer. For comparison, Voodoo3 used 8.3M transistors while VSA-100 employs roughly 14M.

VSA-100 is at .25 micron –your competitors are at .22 or less –how can you be cost competitive?

There are several factors involved in cost competitiveness. Process is only part of that equation. A key differentiator for 3dfx is that we optimize our yields and reliability by using ESD layers and implementation of full scan. Our analysis clearly shows that using 6 layers of metal in a .25um process produces a more cost-effective chip than one with the same number of gates and 5 layers of metal in 0.22um or 0.18um.

SECTION 6: Glossary of 3D Terms

Accelerated Graphics Port (AGP)
An expansion bus developed by Intel specifically for the video card subsystem. It operates independent of the PCI bus and normally runs at 66MHz (i.e., 1x). Whenever you see multipliers attached to AGP, such as 2x or 4x, they are referring to how much faster the bus will run--2x means 66MHz x 2, or 133MHz.

Alpha Blending
The process of blending multiple image layers together during 3D rasterization. Used primarily to create visual effects like transparency (water or glass), translucency (artifacts that partially obscure objects, such as smoke, clouds or explosions), “lens flare” and reflections.

Anti-Aliasing
Techniques for eliminating the stair-step “jaggies” and pixel popping on lines and polygon edges. Anti-aliasing algorithms makes edges smooth and realistic by blending the edges together.

Application Programming Interface (API)
The software-to-hardware interface that games and applications use to communicate with the underlying hardware.

Bilinear Filtering
A type of texture filtering that blends 4 neighboring texture map elements (“texels”) for a smoother appearance. Bilinear filtering removes the traditional “blocky” look-and-feel of software renderers and older 3D accelerators such as the original Sony PlayStation.

Bump Mapping
The process of bump mapping gives an object a rough, textured appearance. As light passes over a bump-mapped surface, different shadows and reflections appear across the surface, which shift according to the light’s movements and placement. For example, viewing a rug from a distance, the rug looks smooth. But were you to look closely, you would notice ridges and bumps, crevasses and shadows.

CCIR (-601)
A video format standard used to transmit and receive digital video date. Graphics accelerators typically receive CCIR-601 video through their video input ports.

Chipset
A generic term for the silicon component(s) of a 3D accelerator. 3dfx chipsets include Voodoo Graphics, Voodoo Rush, Voodoo2, Voodoo Banshee, Voodoo3, and VSA-100.

Depth Of Field
A technique popularized by Hollywood cinematographers used to direct the viewer’s attention towards a specific part of an overall scene by focusing on only a part of the scene while the rest of the scene appears out of focus or “blurred.”

Digital Video Interface (DVI)
An increasingly common standard of output for driving digital flat panel displays including those from Apple and SGI. The DVI connector on Voodoo for Macintosh products is implemented

using Transmission Minimized Differential Signaling (TMDS) and terminates in a 24-pin connector located on the backplane bracket.

Double Buffering

This is a method of using two frame buffers for smooth graphics animation. While the image of the first buffer is being displayed on the monitor, the graphics card can use the second buffer to render the next image. When the next image has been completed, then the monitor switches to use the new image. The result of this technique is smooth 3D animation without "tearing" or other visual artifacts.

Environment Mapping

The process of applying a reflection of the surrounding environment to a 3D model. Examples include reflecting clouds off a car's window or reflecting a street scene off a store's display window.

Frames Per Second (FPS)

The number of unique images that are created and displayed in one second. Generally speaking, the higher the frames per second metric, the smoother the 3D animation and the more immersive 3D experience.

Frame Buffer

The memory used to hold "pixels," which are the individual components which in total compose the overall image. The larger the frame buffer size, the higher the resolution which can be displayed to the monitor.

Fill Rate

Fill rate is the number of pixels per second which can be rendered by a 3D accelerator. Generally speaking, cards with higher fill rate performance will generate faster frame rates and a better overall 3D experience.

FSAA

FSSA is an acronym for "Full-Scene Anti-Aliasing." See the Full-Scene Anti-Aliasing description below.

Full-Scene Anti-Aliasing

Full-scene anti-aliasing is simply applying anti-aliasing techniques to an entire image, as opposed to only performing anti-aliasing on parts of the image. See the description of anti-aliasing above.

FXT1™

FXT1 is 3dfx's open source texture compression technology which can reduce texture map sizes through compression by up to $1/8^{th}$ their uncompressed size. The use of compressed textures allows more textures to fit in a given size of memory and allows software developers to use more textures in their 3D applications.

Glide

Glide is a 3D API which was originally developed by 3dfx to enable software developers to access specific features found only in 3dfx hardware. Subsequently, Glide has been released to the Open Source community to enable future evolution of the API.

Gouraud Shading
Gouraud shading is a method where each pixel's color within a triangle is obtained by linearly interpolating the vertex colors that are located on each corner of the triangle. This allows objects to appear much more realistic due to the appearance of smooth lighting effects.

MIP map
A pyramidal organization of gradually smaller, filtered texture maps which are all typically derived from the same high resolution texture map. For example, a typical texture map may be 128x128 texels in size, and its mipmaps would consist of that original texture map image filtered down into 64x64, 32x32, 16x16, 8x8, 4x4, 2x2, and 1x1 mip map images. The smaller versions of the original texture map image are required during rendering to generate the best possible image quality without introducing unnecessary visual artifacts. What size texture is used by the 3D renderer is often known as the texture "Level of Detail," or "LOD" for short, and describes which size of the original texture is being used during rendering.

Motion Blur
A 3D rendering technique which attempts to mimic the characteristics of physical camera film by rendering multiple images of a moving object to create "ghosting" or "smearing" effects which appear to the viewer as if the object is moving.

Multi-Texture
Multi-texturing is a general 3D method for combining multiple texture maps together on a single polygon to generate various imaging effects. For example, stones on a roadway or grass on a field can be rendered efficiently using two different texture maps combined together to form the final desired image.

OpenGL
OpenGL is a 3D graphics API originally developed by Silicon Graphics. OpenGL is now the preferred cross-platform API, with support on a variety of workstations, PCs running Windows or Windows NT, Linux systems, Apple systems, etc. Apple OpenGL is the version of the OpenGL API that is optimized for the Mac platform and included with the Macintosh OS.

PCI
Peripheral Component Interconnect (PCI) is a bus standard developed by the PCI Special Interest Group. The Mac's PCI bus is implemented as 32 or 64-bits wide typically running at a clock rate of 33 or 66MHz.

QuickDraw
The 2D applications programming interface used by Macintosh systems running pre-OS X operating systems. QuickDraw is responsible for accomplishing all 2D rendering including elements of the Macintosh desktop and Finder.

QuickDraw 3D RAVE
A legacy 3D applications programming interface used by Macintosh systems running pre-OS X operating systems. This API is proprietary to Apple and many 3D titles still render exclusively through the RAVE interface despite the fact that Apple has announced a discontinuation of support.

Quicktime
A rich, diverse set of multimedia functions proprietary to Apple and implemented through a common API. Quicktime is used by a variety of applications on the Macintosh to play movies, sounds and edit video footage.

SDRAM
Synchronous Dynamic Access Memory (SDRAM) is a type of memory that incorporates a synchronous clocked, pipelined architecture. SDRAM is now the preferred memory for use as both system memory and graphics memory.

Scan Line Interleaving
Scan Line Interleaving, or “SLI” for short, is a method of using multiple graphics chips running simultaneously. The method dramatically increases fill rates and overall performance.

Soft Shadows
A 3D rendering technique which gradually fades the intensity of an object’s shadow as the shadow is further from the object to create a more realistic shadowing effect.

Soft Reflections
A 3D rendering technique which gradually “diffuses” an object’s reflection off a shiny surface as the reflection is further from the object to create a more realistic reflection effect.

T-Buffer™
The T-Buffer allows several key digital effects for improving photo-realism in real-time 3D graphics rendering. Chief among these are full-scene spatial anti-aliasing, motion blur, depth of field, soft shadows and soft reflections.

Texture Mapping
Texture mapping is the process of applying a image bitmap, known as a “texture,” to a polygon rendered by a 3D accelerator. The use of texture mapping dramatically improves the photo-realism of a rendered scene.

Trilinear Filtering
Trilinear filtering is a type of texture filtering which is higher quality than bilinear filtering. Trilinear filtered selects 2 texture mipmaps, performs bilinear filtering on each mipmap, then blends between the 2 bilinear filtered mipmaps to form a final result.

Z-Buffering
A rendering technique used by 3D accelerators to allow calculation of which pixels are visible for a particular scene. For example, in a scene with a horse and a barn, if the software developer specifies that the horse should be in front of the barn, then Z-Buffering in the 3D accelerator ensures that the horse is indeed in front of the barn and not visa-versa.

SECTION 7: Contacts

Bryan Speece
(408) 934-5062
bryan.speece@3dfx.com

Lisa Grubb
(408) 934-5068
lisag@3dfx.com

Bubba Wolford
(281) 578-7782
bubba@3dfx.com

Visit the 3dfx Virtual Press Room at http://www.3dfx.com/comp/pressweb/index.html.

APPENDIX 1: Current Benchmarks

These suggestions and sample results are provided as a courtesy. There are a number of variables that can effect your results. If a large discrepancy occurs between your testing and the sample results shown below, please contact Rich Aronson at (408) 719-5946 or raronson@3dfx.com. This will help us isolate the reason for the discrepancy and ensure both your benchmarks and our benchmarks are accurate.

3dfx MacTools settings for visually sampling FSAA in Star Wars Racer:

Launch the 3dfx MacTools control panel and select the 3D tab, then adjust the settings as follows:

- Anti-Aliasing: 4 Sample Anti-Aliasing
- Toggle AA Key: Select a key, example *num-lock/Clear*
- VSync: Disabled

Now, install and launch the Star Wars game.

- Navigate to the first racetrack and start the race.
- Without moving the Pod, tap the hot key for AA and notice the overall quality difference, and keep in mind that the game is in 640x480.
- Now…run the same test with a competitor's card.

3dfx MacTools settings for running Macbench:

The following are the default settings in the 2D Tab. To re-set to this state click the 'Profile' tab and select the 'Restore Factory Defaults' option.

- QuickDraw Acceleration: Advanced
- Font Caching: Enabled
- Picture Caching: Enabled
- QuickTime Acceleration: Enabled

Macbench Test Environment Settings:

Everything is left at default except the video playback option:

- After launch the Macbench application, press the 'command + T' to open the 'Current System Test Settings' menu, or click the 'Tests' menu item and select 'Test Settings…*T
- Click the 'Video' tab and select 'Hard Disk' from the 'Play Movie From Selected:' options.
- Note: This needs to be selected before every run of the video tests in order to achieve the results listed below.

Quake III Arena Test Environment Settings:

In the 'System Setup' menu, from the main 'Setup' menu, the following setting should be set for all tests. Specific settings are listed below next to the expected results;

- GL Driver: Default
- GL Extensions: On
- Video Mode: *See specific test below*
- Color Depth: *See specific test below*
- Fullscreen: On
- Lighting: Lightmap
- Geometric Detail: *See specific test below*
- Texture Detail: set highest, move slider all the way to the right
- Texture Quality: *See specific test below*
- Texture Filter: *See specific test below*

Results:	**V5 5500 FSAA=0**
Date of test	Sat Jul, 15 2000
Product	Voodoo5 5500 FSAA Off
Chip	V5 5500 PCI
Graphics Memory	64MB
Memory Type	SDRAM
Grx clock speed	166
Mem clock speed	166
BIOS Version	1.3b5 Copyright (C)

G4 500 256MB Macintosh Benchmarks

Ziff Davis Benchmarks MacBench

MacBench 5.0 Video Frames Played, 1152x870x16, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x16, 75 Hz	60.08
MacBench 5.0 Video Frames Played, 1152x870x32, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x32, 75 Hz	60.21
2D Graphics MacBench, 1152x870x16, 75 Hz	4918
2D Publishing Graphics MacBench, 1152x870x16, 75 Hz	3233
2D Graphics MacBench, 1152x870x32, 75 Hz	3972
2D Publishing Graphics MacBench, 1152x870x32, 75 Hz	2934

G4 400 256MB Macintosh Benchmarks

Ziff Davis Benchmarks MacBench

MacBench 5.0 Video Frames Played, 1152x870x16, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x16, 75 Hz	48.67
MacBench 5.0 Video Frames Played, 1152x870x32, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x32, 75 Hz	46.63
2D Graphics MacBench, 1152x870x16, 75 Hz	4168
2D Publishing Graphics MacBench, 1152x870x16, 75 Hz	2787
2D Graphics MacBench, 1152x870x32, 75 Hz	3734
2D Publishing Graphics MacBench, 1152x870x32, 75 Hz	2904

G3 400 256MB Macintosh Benchmarks

Ziff Davis Benchmarks MacBench

MacBench 5.0 Video Frames Played, 1152x870x16, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x16, 75 Hz	25.88
MacBench 5.0 Video Frames Played, 1152x870x32, 75 Hz	100.00
MacBench 5.0 Video Max Frame Rate, 1152x870x32, 75 Hz	25.95
2D Graphics MacBench, 1152x870x16, 75 Hz	4436
2D Publishing Graphics MacBench, 1152x870x16, 75 Hz	2805
2D Graphics MacBench, 1152x870x32, 75 Hz	3944
2D Publishing Graphics MacBench, 1152x870x32, 75 Hz	3422

Quake Benchmarks (Mac)
Quake 3 1.11 Demo001 (V-Sync Off)

G4 500 256MB

color depth:16 texture depth:16 geometry detail:medium texture detail:3 filtering:bilinear	V5 5500 FSAA=Off	V5 5500 FSAA= 2	V5 5500 FSAA =4
640x480	52.4	50.8	27.2
800x600	51.8	36.6	16.0
1024x768	50.2	23.2	9
color depth:32 texture depth:32 geometry detail: high texture detail:4 filtering:trilinear			
640x480	47.7	44.9	22.3
800x600	47.1	30.2	13.3
1024x768	44.6	19.4	7.5

G4 400 256MB

color depth:16 texture depth:16 geometry detail:medium texture detail:3 filtering:bilinear	V5 5500 FSAA=Off	V5 5500 FSAA= 2	V5 5500 FSAA =4
640x480	36.5	36.4	36.4
800x600	36.2	36.4	30.7
1024x768	35.8	34.2	16.7
color depth:32 texture depth:32 geometry detail:high texture detail:4 filtering:trilinear			
640x480	34.8	32.5	19.2
800x600	34.2	25.4	11.5
1024x768	33.6	17.0	6.0

G3 400 256MB

color depth:16 texture depth:16 geometry detail:medium texture detail:3 filtering:bilinear	V5 5500 FSAA=Off	V5 5500 FSAA= 2	V5 5500 FSAA =4
640x480	34.6	34.5	34.4
800x600	34.2	34.3	30.3
1024x768	33.9	32.9	16.8
color depth:32 texture depth:32 geometry detail:high texture detail:4 filtering:trilinear			
640x480	32.0	31.5	19.5
800x600	31.6	25.9	11.6
1024x768	31.1	17.2	6.2

APPENDIX 2: Errata (PENDING)

Voodoo5 Known Problems

Please visit our website at www.3dfx.com/mac for updates and enhancements to the Macintosh Voodoo5 5500.

APPENDIX 3: 3dfx MacTools User Guide

3dfx MacTools

The 3dfx MacTools software is a powerful and flexible utility for controlling the 2D and 3D acceleration features and other display characteristics of your 3dfx Voodoo card. Explore the options listed below for more specific details.

NOTE: Some of the features and options described here may not be supported by your specific model of the Voodoo card.

The 3dfx MacTools Control Panel

To open the 3dfx MacTools control panel, simply open the Apple menu, select Control Panels, and then select 3dfx MacTools.

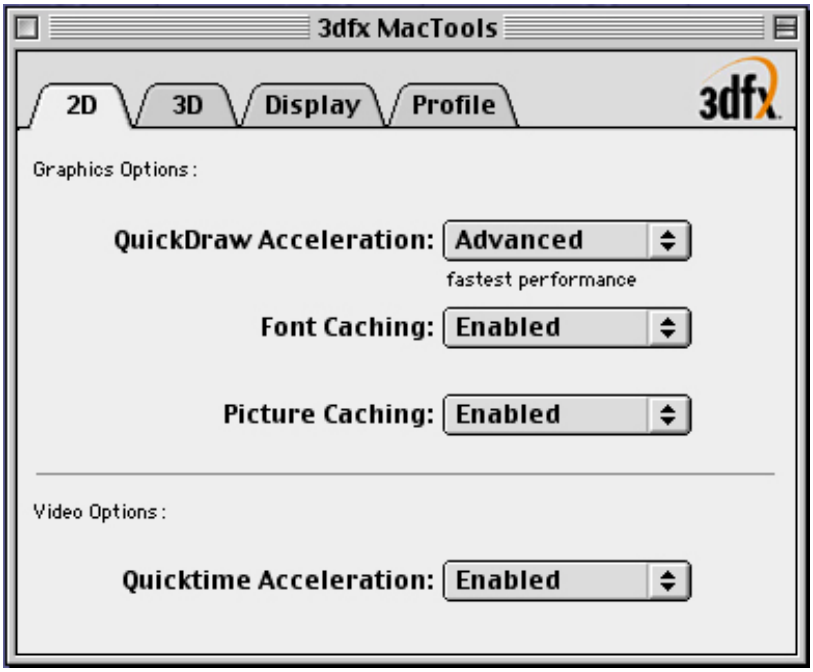
The 3dfx MacTools control panel contains separate pages for the controls for easy and direct access to the 3dfx MacTools features and options. The pages in the 3dfx MacTools control panel are:

2D - Select the specific 2D acceleration features you prefer.
3D - Select the best combination of processing power and image quality for your specific 3D requirements, or adjust the Gamma level of your display.
Display - Select the resolution, refresh rate, and color depth for your display.

The 3dfx MacTools Icon

3dfx MacTools "2D" Page

Select the "2D" tab to open the "3dfx MacTools 2D" page, shown here…



The "2D" page of the 3dfx MacTools control panel

QuickDraw Acceleration - Use this control to select the amount of QuickDraw acceleration you prefer.

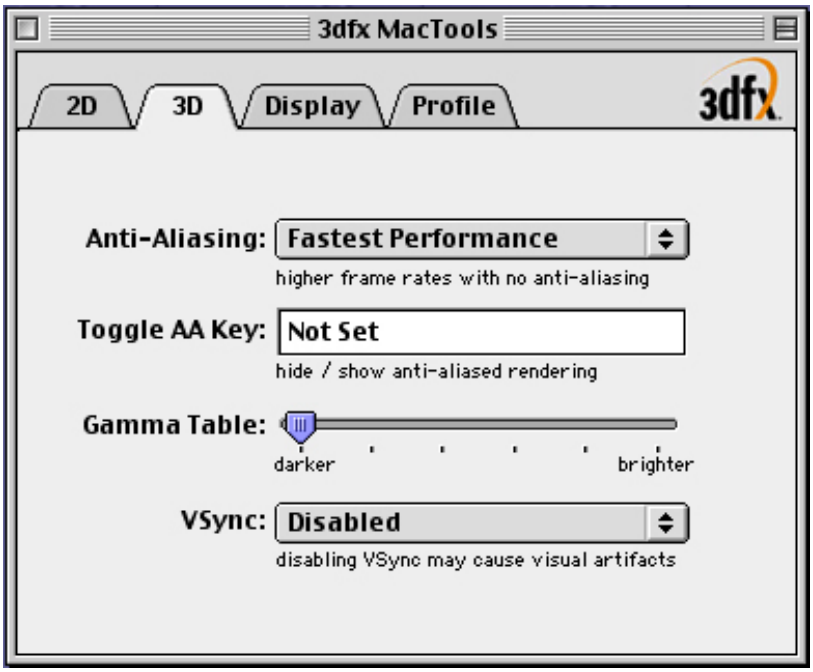
Font Caching - Use this control to enable or disable font caching.

Picture Caching - Use this control to enable or disable picture caching.

Quicktime Acceleration - Use this control to enable or disable your Voodoo card's Quicktime acceleration.

3dfx MacTools "3D" Page

Select the "3D" tab to open the "3dfx MacTools 3D" page, shown here…



The "3D" page of the 3dfx MacTools control panel

NOTE: Anti-Aliasing (AA) options are dependant upon the specific model of the Voodoo card installed in your system, so all of the options shown here may not be available for your card.

Anti-Aliasing - Two or four sub-samples are used per pixel to fill-in the jagged edges of lines and smooth the appearance of curves for a more pleasing and realistic visual image by taking multiple samples of a scene and blending them together. Enable AA, or increase from 2-sample AA to 4-sample AA, to improve image quality. Disable AA, or reduce from 4-sample AA to 2-sample AA, to improve 3D performance.

- **Single chip only** - Compatibility mode (for troubleshooting, if necessary).
- **Fastest Performance** - Maximum hardware performance with no Anti-Aliasing.
- **2-sample AA** - High performance hardware mode with 2-sample Anti-Aliasing for improved image quality.
- **4-sample AA** - Normal hardware performance with 4-sample Anti-Aliasing for the best image quality.

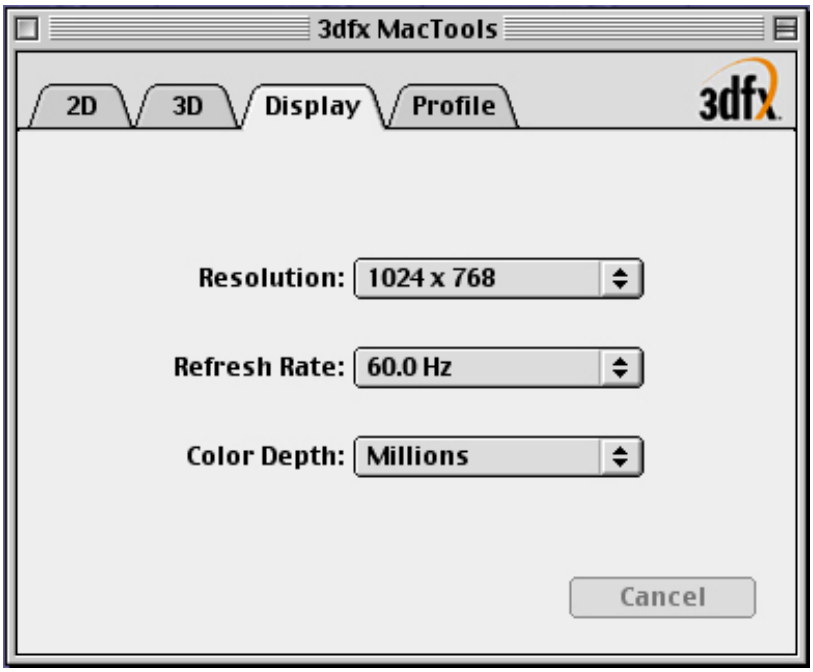
Toggle AA Key - This control allows you to select a "Hot Key" to hide the effects of anti-aliasing and requires that AA be enabled according to the setting in the Anti-Aliasing menu as noted above. This is useful for visual comparison of aliased vs. anti-aliased displays, but does not affect 3D performance.

Gamma Table - This control allows you to increase or decrease the color brightness levels of your display. If your display seems too dark or too bright, move the Gamma slider controls to the left to decrease the Gamma levels or to the right to increase the Gamma levels.

VSync - This control allows you to enable or disable your Voodoo card's VSync option.

3dfx MacTools "Display" Page

Select the "Display" tab to open the "3dfx MacTools Display" page, shown here…



The "Display" page of the 3dfx MacTools control panel

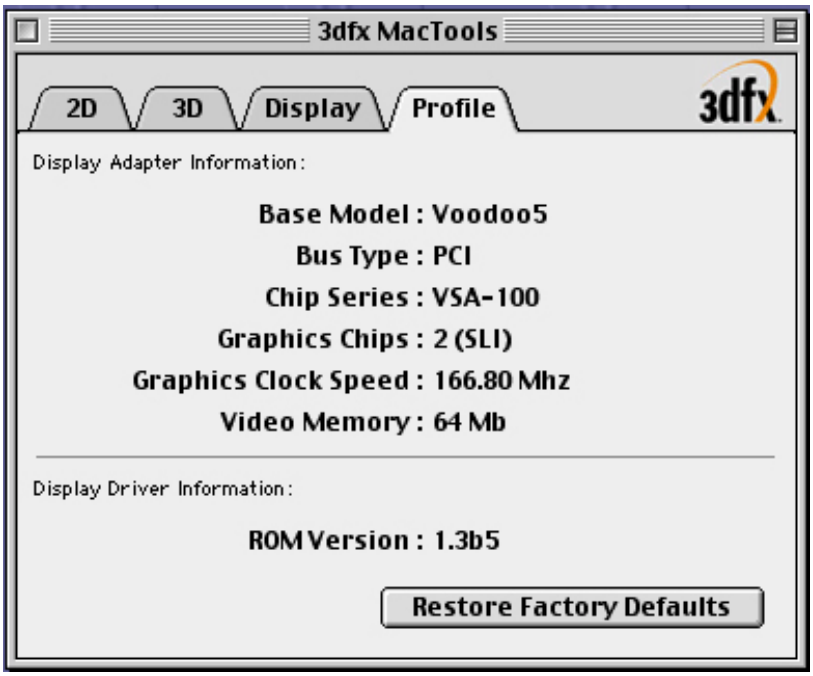
Resolution - Use this control to select the resolution you would like to use from the available list.

Refresh Rate - Use this control to select the vertical refresh rate you would like to use from the available list.

Color Depth - Use this control to select the number of on-screen colors you would like to use from the available list.

3dfx MacTools "Profile" Page

Select the "Profile" tab to open the "3dfx MacTools Profile" page, shown here…



The "Profile" page of the 3dfx MacTools control panel

NOTE: The version numbers and features shown in the above example would be replaced on your screen with the actual version numbers and features supported by your Voodoo hardware and software.

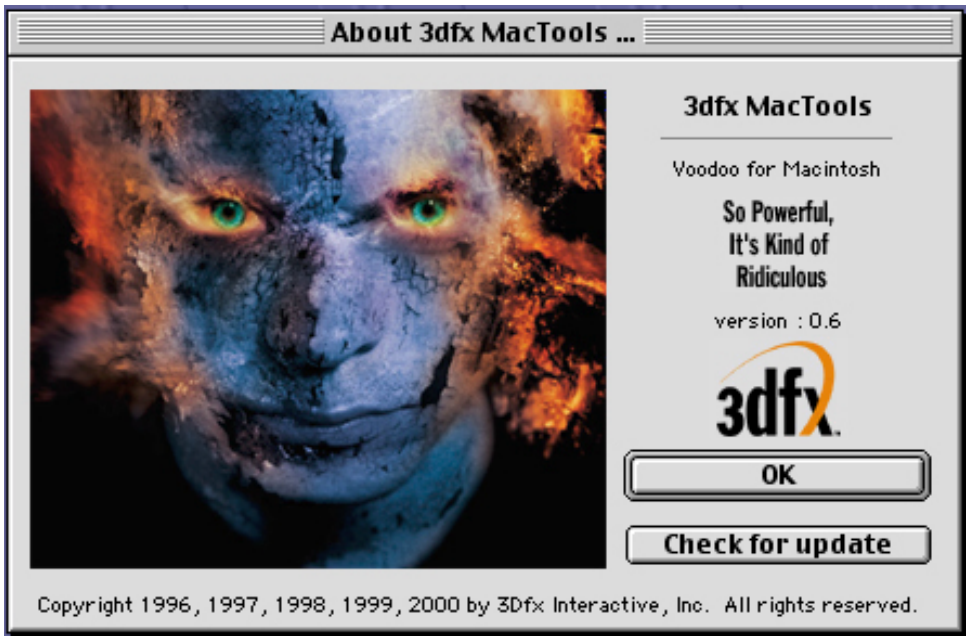
Some of the information available for your Voodoo card includes:

Base Model (Name)
Bus Type (AGP or PCI)
Chip Series
Graphics Chips (the number of graphics chips on your 3dfx card)
Graphics Clock Speed
Video Memory

Information about the ROM version of the 3dfx card is also shown.

3dfx MacTools "About" Page

Select the "About" tab to open the "About 3dfx MacTools…" page, shown here…



The "About" page of the 3dfx MacTools control panel

The version of your 3dfx MacTools software is shown on this page.

Press the “Check for update” button to use your system’s Internet connection to check for any updates to your 3dfx software.

Appendix 4:

Other Bundled Software

A game demo CD will be bundled with the Voodoo5 5500 Macintosh product. The following demos and utilities are included on that CD:

Games:

Terminus - Vicarious Visions
Korea F/A-18 Gold - Graphic Simulations
Unreal Tournament - MacSoft
Quake 3 Arena - Activision
Bugdom - PangeaSoft
Tomb Raider 4: The Last Revelation - Aspyr Media

Utilities:

Player GameRanger - GameRanger