Voodoo3™ 2000/3000 Reviewer's Guide

For reviewers of:

Voodoo3 2000
Voodoo3 3000

DRAFT - DATED MATERIAL

THE CONTENTS OF THIS REVIEWER'S GUIDE IS INTENDED SOLELY
FOR REFERENCE WHEN REVIEWING SHIPPING VERSIONS OF VOODOO3 REFERENCE BOARDS.
THIS INFORMATION WILL BE REGULARLY UPDATED, AND REVIEWERS
SHOULD CONTACT THE PERSONS LISTED IN THIS GUIDE FOR UPDATES BEFORE EVALUATING
ANY VOODOO3 BOARD.

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INTRODUCTION:

The Voodoo3 2000/3000 Reviewer's Guide is a concise guide to the Voodoo3 143MHz, and 166MHz graphics accelerator boards. Included are a board overview and feature set, a display mode table, installation procedures, and Voodoo3 evaluation guidelines. It is assumed that the reviewers are well-versed in the various aspects of graphics hardware and software. Accordingly, the installation description is concise. If issues or questions do arise during the review please contact the 3dfx Interactive contacts listed later in this document.

The information provided in this document is not for publication.

SECTION 1: Voodoo3 Board Overview

The Voodoo3 boards deliver the ultimate in 3D and 2D performance, while supporting the new generation of ultra-high resolution displays.   The Voodoo3 2000 is designed for the mainstream computer user looking to upgrade his graphics subsystem. The Voodoo3 3000 boards are designed for consumers and game enthusiasts seeking the most compelling entertainment experience available on a PC. With optimized software drivers for 3dfx Glide®, Direct 3D™, and OpenGL®, PCs equipped with Voodoo3 can run more than 500 enhanced games developed for the Voodoo Graphics® family.

Both the retail and PC/OEM versions of Vooodoo3 2000 PCI and AGP feature an internal core and external SDRAM clock rates of 143MHz. Both the retail and PC/OEM versions of Vooodoo3 3000 AGP and PCI will feature an internal core and external clock rates of 166MHz. The Voodoo3 product line is rounded out by the Voodoo3 3500 TV, 3dfx's highest-end graphics accelerator, which also includes complete TV, VCR and FM stereo capabilities. The Voodoo3 3500 TV details will be provided in a separate reviewer's guide.

Feature Summary

3D Feature Set
- 7 million triangles per second *(Voodoo3 3000 at 166 MHz)*
- 6 million triangles per second *(Voodoo3 2000 at 143 MHz)*
- 333 megatexels per second fill rate *(Voodoo3 3000 at 166 MHz)*
- 286 megatexels per second fill rate *(Voodoo3 2000 at 143 MHz)*
- 128-bit 3D acceleration
- Dual, 32-bit texture rendering architecture
- True multi-texturing. 2 textures per-pixel per-clock
- Full hardware setup of triangle parameters
- Support for multi-triangle strips and fans
- Single Pass, Single-cycle Bump mapping
- Single Pass, Single-cycle trilinear MIP-mapping
- Sub-pixel and sub-texel correction with 0.4x0.4 resolution
- Per-pixel atmospheric fog with programmable fog zones
- Floating point Z buffer (W buffer)
- True per-pixel, LOD MIP mapping with biasing and clamping
- Texture compositing for multi-texture and special effects
- Support for 14 texture map formats
- 8-bit palletized textures with full bilinear filtering
- Texture compression through narrow channel YAB format

2D Feature Set
- Fully integrated 128-bit VGA and 2D engine
- High-speed 128-bit Windows GUI acceleration
- Hardware acceleration for Bresenham line draw, 2-edge polygon fill, scissor/rectangle clippers and full 256 ROPs
- Internal 256-bit datapath
- Source and destination chroma-keying for DirectDraw
- Color expansion and single-cycle block writes
- Accelerated 8, 16, 24 (packed), and 32-bit modes

Video Subsystem
- Support for ultra-high resolution displays on PC monitors
- Resolutions of up to 2046 x 1536 at a full 75Hz screen refresh rate
- YUV 4:2:2 and YUV 4:2:0 planar support
- 30 frames per second DVD playback with no dropped frames
- Supports the latest MPEG2 software CODECs via DirectShow™
- De-interlacing using Bob and Weave
- Separate gamma correction for video and graphics
- Auto page flipping using VBI for smooth motion video
- 350MHz Integrated RAMDAC
- Supports up to 24 bits per pixel or 16.7 million colors
- Sub-pixel image scaling technology

Pricing and Availability

Both the Voodoo3 2000 and 3000 boards are available now on retail shelves worldwide, and through some of the world's leading PC makers.

The suggested U.S. retail price for the Voodoo3 2000 is $129.99. The suggested U.S. retail price for the Voodoo3 3000 is $179.99.

Warranty

Retail versions of the Voodoo3 2000, and 3000 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:

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Consumers can access toll free technical support 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 on the Web at www.3dfx.com

SECTION 2: About the Voodoo3 Board
Board Layout
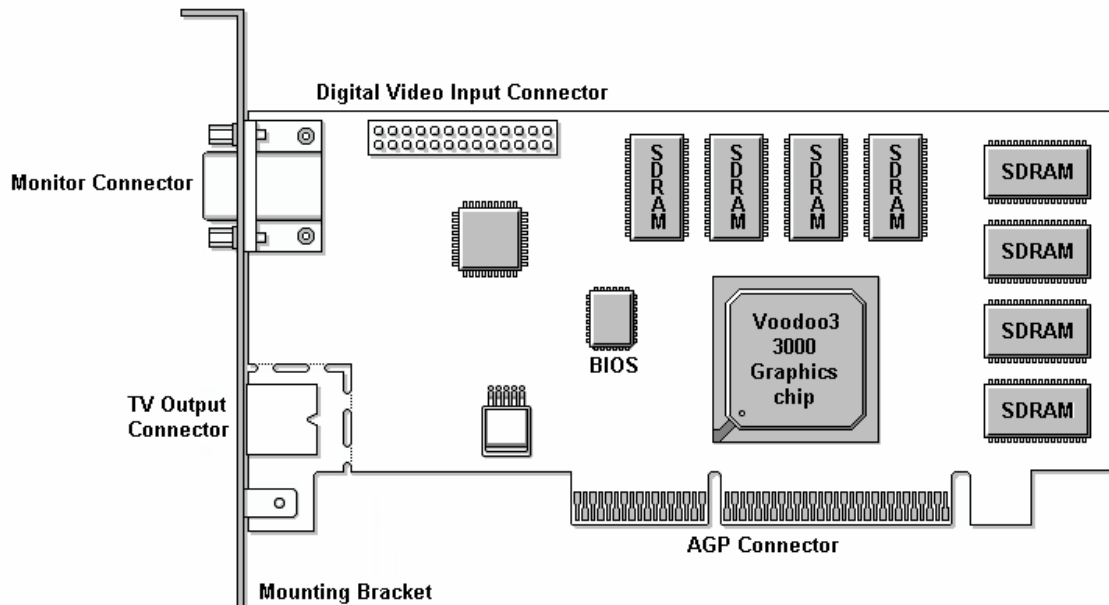
The Voodoo3 3000 AGP card

Hardware Components
Graphics Subsystem

- Graphics Controller – 143MHz Voodoo3 2000 or 166MHz Voodoo3 3000
- Frame Buffer – 16MB of 512Kx32 SDR SDRAM for the 166MHz
- RAMDAC – up to 350MHz
- Video Input – 8-bit VMI 1.2 video input port to support video peripherals such as:
  - TV tuners
  - MPEG2 decoders
- 24-bit (12-bit dual-edge) digital RGB data output to support video output devices such as:
  - NTSC or PAL TV encoders (Brooktree Bt868 included on board)

Bus Interface

- Graphics bus interface – AGP 2X with sidebands

I/O Connectors

- HD15 – VGA output and monitor detection I/O
- Video – Composite Video-Out (S-Video)
- CCR-601

System Requirements
- Windows 95 or Windows 98 (Windows NT4.0 for 2D benchmark test)
- PC with a Pentium, Celeron ™, Pentium II, or Pentium Pro Processor (Pentium 233 and up recommended), AMD K6-2, K6-3 with 3DNow! and a free AGP or PCI slot.
- 32MB of system RAM (64MB recommended)

Display Mode Table: Driver Modes for Win95, Win98, WinNT, and Win2000

Resolution	Vertical Frequency (Hz)	Color Depth	Comments
320x200	70,85	8,16	Ddraw, SW D3D only, No Desktop Support: WHQL Requirement
320x240	60,70,75,85	8,16	Ddraw, SW D3D only, No Desktop Support: WHQL Requirement
400x300	60,70,75,85	8,16	Ddraw, SW D3D only, No Desktop Support: WHQL Recommended
512x384	60,70,75,85	8,16	Ddraw, SW D3D, D3D, Glide, OGL HW Accel, No Desktop Support: WHQL Recommended
640x400	70,85	8,16	Ddraw, SW D3D, D3D, Glide, OGL HW Accel, No Desktop Support: WHQL Requirement
640x480	60,72,75,85,100, 120,140,160	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color), TV Out support: NTSC and PAL
720x400	60,72,85	8,16,24,32	VIDEO ONLY Ddraw only: Video, No Desktop support
720x480	60,72,85	8,16,24,32	VIDEO ONLY Ddraw only: Video, No Desktop support, WHQL Requirement
720x576	72,100	8,16,24,32	VIDEO ONLY: Ddraw only: Video, No Desktop support, WHQL Requirement (PAL)
800x600	60,72,75,85,100, 120,140,160	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color), TV OUT support: NTSC and PAL
920x768	60,75,85	8,16	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1024x768	60,70,75,85,100, 120	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1152x864	60,70,75,85,100, 120	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1280x960	60,75,85	8,16	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1280x1024	60,75,85,100	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1600x1024	60,76,85	8,16,24,32	16x10 Aspect Ratio
1600x1200	60,65,70,75,80, 85,100	8,16,24,32	Desktop, Ddraw, D3D, Glide, OGL HW Accel(less 24,32 bit color)
1792x1344	60,75	8,16,24,32	Desktop, Ddraw
1856x1392	60,75	8,16,24,32	Desktop, Ddraw
1920x1080	60,72,75,85	8,16,24,32	16x9 Aspect Ratio
1920x1200	60,76,85	8,16,24,32	16x10 Aspect Ratio
1920x1440	60,75	8,16,24,32	Desktop, Ddraw
2046x1536	60,75	8,16,24,32	Desktop, Ddraw, 75Hz and 85Hz (Voodoo3 3000 only with 350MHz RAMDAC)

- Note: All refresh rates supported by Voodoo3 3000 unless otherwise noted.
- Note: All refresh rates greater than 85Hz will use pre-calculated GTF timings.

Extended VGA Modes in BIOS

Resolution	Vertical Frequency (Hz)	Color Depth	Frame Buffer Alignment
320x200	70	8,16,24	Banked (Windowed) + Linear
320x240	70	8,16,24	Banked + Linear
400x300	70	8,16,24	Banked + Linear
512x384	70	8,16,24	Banked + Linear
640x400	70	8,16,24	Banked + Linear
640x480	70	8,16,24	Banked + Linear
800x600	70	4,8,16,24	Banked + Linear (4bpp banked only)
1024x768	70	8,16,24	Banked + Linear
1280x1024	70	8,16,24	Banked + Linear

Software Drivers

Drivers included with this kit:

- Voodoo3 Driver Kit
- Voodoo3 DirectX Driver
- Voodoo3 Win9x 2D/3D Display Drivers
- Voodoo3 Glide 2.X Driver
- Voodoo3 Glide 3.X Driver
- Voodoo3 Control Panel
- 3dfx MiniGL 1.49
- OpenGL ICD

3dfx Tools Summary

3dfx Tools make it easy to adjust and control various aspects of the system's display and performance. For a complete overview and guide to the 3dfx Tools available with Voodoo3 boards, please refer to Appendix 3.

SECTION 3: About the Voodoo3 Chip

Overview

At the heart of the new Voodoo3 boards is the Voodoo3 chip. Debuted at COMDEX in November, the much-anticipated Voodoo3 is the most advanced graphics processor technology available in PCs today.

With 8.2 million transistors and manufactured in an advanced .25 micron CMOS process, Voodoo3 is designed for optimal performance on both Pentium II, Pentium III, and future CPUs from Intel, as well as the AMD K7, AMD-K6®-II and K6-III processors featuring 3DNow!™ technology.

The latest in 3dfx Interactive's long line of highly acclaimed 3D and 2D accelerators, Voodoo3 provides complete compatibility with the largest library of enhanced 3D entertainment titles available: more than 300 titles are currently available, with over 500 expected by the end of 1999. Voodoo3 is optimized for Microsoft's Direct X application programming interface (API), as well as other standard API's including Glide® from 3dfx and OpenGL from Silicon Graphics.

SECTION 4: Installation and Start-Up

Installing the Board

<u>For Windows 95, 98, or NT 4.0 Systems</u>

Follow these simple steps and in just a few minutes you can easily replace your computer's old display card with the powerful new Voodoo3 accelerator card. The Quick Install software on the Voodoo3 CD will analyze your computer and then open the Quick Install Guide which will lead you through the installation process in a few simple steps and can even show you examples.

IMPORTANT NOTES:

• The On-line User's Guide on the Voodoo3 CD is in HTML format. Your system must have internet/web browser software installed (either Microsoft Internet Explorer or Netscape Navigator) to view the On-line User's Guide.

• The "Hardware Installation" section of the On-line User's Guide has important information that you will need while your computer is shut down and the On-line 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. Also, please watch one of the Quick Install videos to familiarize yourself with the installation procedure before you begin.

• A simplified version of the hardware installation instructions is also included in this Quick Install Guide along with some basic troubleshooting information in case you have any difficulty getting your computer restarted after the installation of your new Voodoo3 card.

Quick Install Instructions:
1. Before you do anything else, start your computer normally and insert the Voodoo3 CD into your computer's CD-ROM drive.

    If the Quick Install software does not open automatically, simply open Windows Explorer, select your CD-ROM drive, and then double-click on the SETUP.EXE file on the Voodoo3 CD.

2. The Quick Install software will perform a simple check of your computer's configuration and then it will open the On-line Quick Install Guide to Page 1.

    If you see any error messages instead of the On-line Quick Install Guide, check the Troubleshooting section in the back of this Quick Install Guide for important information about your computer.

3. When you have read the instructions on Page 1 of the On-line Quick Install Guide, printed the instructions on the next page that you will need during the hardware installation, and watched the Quick Install video, then shutdown your system and proceed with the Hardware Installation.

When your system is shutdown, open the computer and replace the old display card with your new one. NOTE: Be sure to leave the Voodoo3 CD in your CD-ROM drive when you shutdown the computer.

4. Use these Hardware Installation Instructions to install your new Voodoo3 accelerator card:

Hardware Installation Instructions

a. Turn off the power and open the computer's case. Refer to the documentation for your computer for detailed instructions on opening your computer's case.

b. Locate the cable connecting your monitor to the current display card and disconnect it from the card.

c. Remove the screw securing the mounting bracket of the old card and remove the old card from your computer.

d. Locate the AGP slot for your new Voodoo3 card and install the Voodoo3 card into the AGP slot.

e. Connect your monitor's cable to the Monitor Connector of your Voodoo3 card.

f. Replace the computer's cover and restart the system.
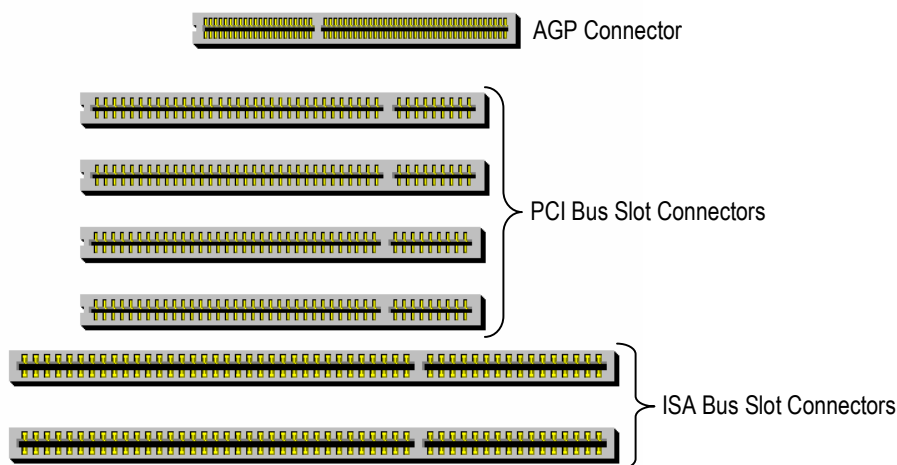
Overhead view of the expansion slots inside a computer

NOTE: Be sure to connect your monitor's cable to the Monitor Connector of your new Voodoo3 3000 card.

5. When you replace the old display card with your new card and restart your computer, the Quick Install software will open the On-line Quick Install Guide to the next page, but your system will be using the standard VGA display driver at a resolution of 640x480 with only 16 colors. Select your software installation options and press one of the buttons to finish installing the Voodoo3 card's display drivers and other software that may be needed to complete the upgrade. You will then be prompted to restart your computer for the changes to

take effect. Restart your computer and the installation of your new Voodoo3 accelerator card is complete!

You will probably want to open the "Settings" page of the "Display Properties" dialog box and select new display settings for your new accelerator card. If you chose to install the 3dfx Tools software, then you will also want to open the "Advanced Properties" dialog box and the "3dfx Tools" dialog box (located in the Windows Control Panel) to select your 3dfx Tools options.

3dfx Tools make it easy to adjust and control various aspects of the system's display and performance. For a complete overview and guide to the 3dfx Tools available with Voodoo3 2000 and 3000, please refer to Appendix 3.

SECTION 5: Testing Recommendations

Testing the Voodoo3 Board

When testing Voodoo3 2000 or 3000, we recommend you work in the highest resolution possible. The key strengths of Voodoo3 are phenomenal graphics memory bandwidth and high pixel fill rates. In other words, you can still achieve high frame rates at high resolutions. As an example, when working with a Voodoo3 3000 card running on a 400MHz CPU or better, try testing Quake II at 1024 x 768 resolution: You should expect to see well over 30 frames per second!   Leading triangle setup and pixel fill rates mean Voodoo3 will rarely be the "bottleneck" to gaming performance in a PC system: Indeed, the faster your PC's CPU, the more you will be able to witness the extent of Voodoo3's graphics power.

Voodoo3 incorporates many features to optimize the image quality of 3D content. For example, to see the impact of Voodoo3's per-pixel trilinear mapmaking and accurate LOD calculations - simply look at a polygon in perspective, e.g. a floor or wall in Quake or Wiz and move slowly forward/backward. You won't see any mipmap bands (caused by bilinear or poor trilinear filtering). Neither will you find aliening or sparkling (caused by inaccurate LOD), or mipmap "popping," which is an abrupt change in sharpness or blur (per-polygon mapmaking will cause this).

Cures to common benchmarking and image quality issues

- Be sure to use the New MiniGL drivers that are on the CD.

- When testing Quake II, go to the video options and turn off 8-bit textures. This removes banding when viewing the sky by allowing the game to use the higher quality 16-bit textures.

- Prior to testing frame rates, ensure that vsync is disabled. Before you do any frame rate testing make sure that vsync is disabled. You can do this by downloading PowerStrip from http://www.entechtaiwan.com/ps.htm or by adding the following to your autoexec for opengl/glide: **SET FX_GLIDE_SWAPINTERVAL=0**

- For D3D, you will need to edit the registry and enter a new string value under **[HKEY_LOCAL_MACHINE\System\CurrentControlSet\Services\Class\Display\xxxx\D3D]** (xxxx will be 0000, 0001 or higher) **SSTH3_SWAPINTERVAL 0**

- When grabbing screenshots, keep in mind 3dfx has a unique way of converting data in the frame buffer before we send it to the screen to be displayed. As a result, we store "unfiltered" data in the frame buffer - and the filtering is performed at scan-out on the way to display. This improves the quality of the picture displayed on the monitor, but doesn't actually change the data in the frame buffer. Typically when you are doing a frame grab, you are just grabbing data directly from the frame buffer, which is "unfiltered" so the quality of raw images grabbed from the frame buffer is actually lower than what is actually displayed. HyperSnap, a frame grabbing utility, actually implements our filtering technique on their frame grabs, producing a more accurate

representation of what the user would see on their display by actually running our filter on the data and writing out the filtered, instead of the "raw" data. Get HyperSnap at http://www.hyperionics.com/

- For a higher quality image, make sure you have "Use High Quality but lower Perfromace Video" checked in the D3D/Direct Draw section of the "3dfx tweaks" page in "3dfx tools" (see page 5 of Appendix 3 for details). It's basically a 2x2 box filter, which means we filter images to produce a more pleasing image by sampling and filtering 2x2 blocks on scan-out. The reason this runs slightly slower than standard filtering is that it consumes some additional frame buffer bandwidth to perform this, which in frame buffer bandwidth limited applications can have a slight (a few %) performance impact.

For a list of recommended benchmarks and expected results, see Appendix 1.

SECTION 6: FAQ

Q. Are the Voodoo3 2000, -3000 and –3500 TV based on the same chip? What are the differences?
A. All three boards are based on the same chip design and are pin compatible; however, each is a different configuration.   The Voodoo3 2000 operates at 143 MHz and produces 286 million texels (megatexels) per second. The Voodoo3 3000 operates at 166 MHz and produces 333 megatexels per second, and the Voodoo3 3500 TV operates at 183MHz and produces 366 megatexels per second. Additionally, the Voodoo3 3500 TV includes multimedia, TV tuner and FM stereo capabilities.

Q. At Comdex, you introduced Voodoo3 as a 125MHz chip and a 183MHz chip. Why the change?
A. When we put Voodoo3 into production, three things happened which we think are very exciting for consumers and hard-core gamers.

First, we discovered that we could beat our projected internal clock rate of our entry-level chip, so we decided to power the Voodoo3 2000 with a faster 143MHz chip. This still is offered under the price point we had pegged for the 125MHz chip, so it's a real bonus for consumers.

Second, we were able to yield excellent performance from a 166MHz version of the chip, so it made sense to make that the heart of the Voodoo3 3000, the high-end mainstream product. The Voodoo3 3000 offers industry-leading performance for the vast majority of game enthusiasts, and promises to be an enormously popular product for us. We think consumers will agree that it's a tremendous value and very powerful graphics accelerator.

Third, we discovered that the 183MHz chip again yields performance that exceeds even our expectations. Based on the relative performance of this chip versus the other Voodoo3 chips (not to mention the technology available from our competitors), it was clear that this processor was an ideal engine to drive the Voodoo3 3500 TV product. The 3500 TV is an ideal product for hard-core gamers and multimedia enthusiasts.

Q. When will 3dfx offer AGP 4X?
A. We've announced that a 4X member of the Voodoo3 family will be available to our OEM partners in time to intercept the debut of AGP 4X in the market. The AGP 4X member of the Voodoo3 family is timed to ship with the high-volume ramp of the first 4X AGP chipsets.

Q. Why doesn't 3dfx offer 32-bit rendering?
A. The answer is frame rate. Our internal rendering calculations are done at 32-bits but, as our press release has explained, we focus on achieving the highest frame rate possible to provide the best possible content experience. This means that we've chosen to limit our frame buffer format, which is the external data storage format, to 16 bits per pixel. The visual difference in an individual frame is imperceptible, but the frame rate, the number of frames that we can render per second, is dramatically increased. We believe frame rate is the single most important feature for end users and should not be compromised for imperceptible increases in the graphics display. (For additional information on this topic, please refer to the Frame Rates white paper we are publishing in February 1999.)

Q. Does Voodoo3 support texture compression?
A. Yes, Voodoo3 supports 3dfx's "narrow channel compression" or NCC, a texture compression format that we've used since the original Voodoo Graphics. Developers favor NCC because visually, it is virtually lossless, meaning that you can't really see the difference between a compressed texture and a non-compressed texture.

Q. Does Voodoo3 support anisotropic filtering?
A. When we launched at Comdex '98, this was primarily a software feature that we decided not to productize after having reviewed the resulting image quality.

Q. Does Voodoo3 support full scene anti-aliasing?
A. This is primarily a software feature that is currently under review.

Q. Can you use Voodoo3 in SLI mode?
A. No.

Q. With the introduction of Voodoo3, will there be any revisions made to Glide?
A. We use Glide to tie together all of our hardware offerings with a common API. Glide 3.0 has recently been released and Voodoo3 is fully compatible with Glide 3.0. Voodoo3 is also backward compatible with the older Glide 2.X API.

Q. Will Glide be updated prior to the release of Voodoo3?
There will be unique Glide drivers for Voodoo3; however, the core Glide functionality and programming interface will be unchanged for Voodoo3.

Q. Is Voodoo3 faster than Voodoo2 SLI? If so, how much faster?
A. Yes, the Voodoo3 3000 is faster than two Voodoo2 boards used together in the SLI configuration. In terms of raw texture rate, the Voodoo3 3500 TV provides 366 million texels per second versus 360 million for the Voodoo2 SLI, but that's just the beginning of the story. Efficiencies stemming from Voodoo3's single graphics and texture frame buffer, as opposed to the separate graphics and texture memories used by the Voodoo2, will produce further 3D-performance improvements.

Q. Does Voodoo3 have any special support for AMD's K6-II, K6-III and 3DNow! instructions?
A. We have worked diligently with AMD to ensure that our drivers for Voodoo3, as well as drivers for Voodoo Banshee and Voodoo2, will get the maximum benefit from the 3DNow! instruction set.

Q. Are you providing optimizations for Pentium III? How about optimizations for Pentium II?

A. Collaborating with Intel, we have optimized current and future Voodoo products for the Pentium III processor, enabling consumers to enjoy greater levels of realism in their games and entertainment content. All of the application programming interfaces (APIs) supported by Voodoo3 – including Microsoft's Direct X6, Glide from 3dfx and OpenGL from Silicon Graphics – have been optimized for the Pentium III processor. As a result, content developers can incorporate more intricate models and scenes, and apply significantly greater realism to the movements of characters and objects.

As for Pentium II, we introduced a patent with Voodoo Banshee to directly handle out-of-order commands from the Pentium II so that there are no CPU stalls. This hardware optimization results in as much as a 20 percent performance improvement.

SECTION 7: 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 most common and one of the most important methods of blending 3D accelerated games. Used primarily to create visual effects like transparency (water or glass), translucency (artifacts that partially obscure objects, such as smoke, clouds or explosions), lensflare and reflections.

Anti-Aliasing
Techniques for eliminating the stair-step jaggies on lines and edges. Makes edges smooth and realistic.

Application Programming Interface (API)
The software-to-hardware interface that makes your game run 3D.

Bi-Linear Filtering
Blends the colors together for a smoother appearance. As you walk toward a wall in a game, bi-linear filtering smoothes it out. In the software version, the textures would become chunky.

Bump Mapping
Bump mapping gives an object a rough, textured appearance. As light passes over this texture, 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.

Chipset
Refers to the key components of silicon that drive the graphics of your game. Another way of referring to the Voodoo Graphics, Voodoo Rush, Voodoo2, Voodoo Banshee or Voodoo3 cards.

Environment Mapping
The process of applying a reflection of the surrounding environment to a model. For example, in Ultimate R@ce Pro, environment mapping is used to reflect the cloud in the car's rear window.

Frames Per Second
The number of times the monitor draws a screen. Often mistakenly referred to the speed of the game. It actually refers to the smoothness with which a game runs.

Frame Buffer
The memory used to hold pixels. Voodoo2 cards can have either 2MB of frame buffer or 4MB. The more memory in the frame buffer, the larger the size of the resolution you are able to display on the screen.

Fill Rate
How fast a system can place pixels on the screen. A Voodoo2 card is capable of displaying up to 90 million pixels per second.

Level of Detail (LOD)
The difference in textures when objects are at different distances or scales. LOD varies the detail of a texture according to the distance.

MIP Map
A pyramidal organization of gradually smaller, filtered subtextures or an individual texture map within the set. For example, to simulate a plane approaching, an artist would draw one small plane for the distant view, a series of the same object, and end in a large, highly detailed plane. MIP mapping swaps in the different-sized objects to simulate the movement towards you.

Multi-Texture
Method of combining two different textures to create special effects (projected textures, detail textures). It is unique in that it can combine textures with no performance penalties due to the Voodoo architecture's second texture memory unit.

Texture Mapping
The process of applying a texture to a triangle.

Tri-Linear Filtering
A higher quality texture filtering technique than bi-linear. Voodoo2 can perform this at full speed.

W-Buffering
A much more precise way than Z-buffering of storing depth values to reduce the amount of pixels drawn on a screen. Voodoo2 is one of the very few architectures that can process W-buffering, allowing it to run at full speed while others are forced to slow down for similar levels of accuracy.

Z-Buffering
Removing polygons from a scene that aren't visible to improve performance. By using Z-Buffering, the computer checks each object's value, then doesn't have to draw it if it's hidden from the camera viewpoint.

SECTION 8: Contacts

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APPENDIX 1: Current Benchmarks and Expected Performance

Note: With regular driver updates and enhancements, we continually run and verify industry-standard benchmarks on the Voodoo3 product line. The information provided is the most recent available at publication time, however more up-to-date results may be available at http://www.3dfx.com.

3D Performance

- **3D Winbench:** The industry accepted standard for measuring 3D accelerator performance. This benchmark consists of a number of 3D rendering tests including: Z-Buffer accuracy, Anti-Aliasing, Texture Blending, Fog, MIP-Mapping, and Perspective Correction capabilities. For more information, visit http://www.zdnet.com/zdbop/

  The standard configuration for running 3D Winbench99 is 1024x768 resolution, 16 bits per pixel color depth, 85Hz refresh rate with triple-buffering enabled and with VSYNC locked.

  The standard configuration for running 3D Winbench99 is 1024x768 resolution, 16 bits per pixel color depth, 85Hz refresh rate with triple-buffering enabled and with VSYNC locked.

- **FutureMark's 3DMark:** This benchmark mimics "real world" application performance by measuring a variety of polygon sizes, texture sizes, and single and multiple textures per pixel. The recommended resolution for running 3DMark is 1280x1024. For more information, visit http://www.3dmark.com

2D Performance

- **Winbench99**: Winbench99 measures business and high-end graphics. This benchmark can also be run under Windows NT 4.0 to simulate a business desktop environment. For more information, visit http://www.zdnet.com/zdbop/

- **Speedy**: Speedy is a Windows graphics performance benchmark that can be used in a variety of ways to compare the relative performance of different graphics hardware and display driver combinations. Speedy tests a wide range of Windows Graphics Device Interface (GDI) calls and delivers a single SPEEDMARK number for comparison with other systems/devices running Speedy. For more information, visit http://www.winsite.com/info/pc/win3/util/speedy.zip/

Real-World Game Performance (See Notes on Page 14.)

- **Game Gauge 2**: Game Gauge is designed to allow the game software itself report the real-world performance based on the actual game data. Game Gauge focuses on frame rate as the ultimate arbiter of a game's performance, returning an average FPS score for each game. This allows a specific 3D card to be evaluated across a spectrum of 3D titles, providing an accurate overall score. For more information, visit http://www.gamespot.com/downloads/utilities.html#CGW

- **Quake 3:** Test IHV1 (60hz V-Sync Off) at 16bpp

Expected Results to Popular Benchmarks with Voodoo3 3000 and 2000

These results are provided as a courtesy. There are a number of variables that can effect your results. Please use them to check your results. If a large discrepancy occurs in a similar configuration listed here, please contact PT Barnum at 972-234-8750,ext 2226 or pbarnum@3dfx.com so we can isolate the reason for the discrepancy and insure both your benchmarks and our benchmarks are accurate.

Product	Voodoo3 3000			Voodoo3 2000		
System	Intel PIII-500	Intel Celeron-400a	AMD K6-3 400	Intel PIII-500	Intel Celeron-400a	AMD K6-3 400
System Memory, OS	128MB SDRAM, Win98			128MB SDRAM, Win98		
Date of test	7/01/99	7/01/99	7/01/99	7/01/99	7/01/99	7/01/99
BIOS version	1.00.01-SD	1.00.01-SD	1.00.01-SD	1.00.01-SD	1.00.01-SD	1.00.01-SD
Device Driver version	4.11.01.1147	4.11.01.1147	4.11.01.1147	4.11.01.1147	4.11.01.1147	4.11.01.1147
Quake 3 TestIHV1 (60hz V-Sync Off) 16bpp	MiniGL 1.49	MiniGL 1.49	MiniGL 1.49	MiniGL 1.49	MiniGL 1.49	MiniGL 1.49
640x480	68.6	45.8	50.8	63.9	45.7	49.6
1024x768	44.4	38.1	39.3	38.7	34.8	35.6
1600x1200	21.9	20.9	21.2	18.6	18.1	18.2
Crusher (dm2)	MiniGL 1.49 OGL 1.0.0.0442 ICD	MiniGL And OGL	MiniGL And OGL	MiniGL And OGL	MiniGL And OGL	MiniGL And OGL
1024x768x16bpp	50.9	35.9	39.7	48.0	39.9	39.4
3DMark99Max 1024x768 triple buffered	4636	3063	3435	4197	3104	3358
Ziff Davis WinBench99 v1.2 1024x768x16bpp @ 85 Hz						
3D Winmark 99 triple buffered	948	801	857	846	736	785
2D Business Graphics Winmark 16 bpp	192	148	187	190	148	187
2D High-End Graphics Winmark 16 bpp	532	423	511	522	424	513
1024x768x32bpp @ 85 Hz						
2D Business Graphics Winmark 32 bpp	186	144	183	185	144	181
2D High-End Graphics Winmark 32 bpp	523	419	508	519	419	506
OTHER GAMES						
Unreal						
1024x768x16bpp-Glide	26.7	21.3	18.5	25.3	20.1	18.6
1024x768x16bpp-D3D	25.1	20.9	19.4	23.8	21.9	19.1
Battlezone II						
1024x768x16bpp-D3D	28.0	24.0	18.0	24.0	23.0	18.0
Half Life						
1024x768x16bpp-miniGL	37.9	28.9	22.7	37.8	28.9	22.8
1024x768x16bpp-OGL ICD	25.7	20.0	18.0	25.8	20.2	18.1
Powerslide						
1024x768x16bpp-Glide	114.4	98.7	85.0	97.3	92.8	84.9
1024x768x16bpp-D3D	108.7	90.1	76.8	93.0	87.0	74.8
Madden 99						
1024x768x16bpp-D3D	38.7	27.1	22.2	39.9	28.5	22.2
Descent 3						
1024x768x16bpp-Glide	51.6	45.5	39.7	44.1	41.9	37.4
1024x768x16bpp-D3D	42.6	34.6	31.4	39.0	33.0	30.6
Expendable II						
1024x768x16bpp-D3D	51.4	35.6	28.0	50.2	35.4	28.0
Jane's WW II						
1024x768x16bpp-D3D	33.0	24.4	17.7	33.1	25.8	18.5
1024x768x16bpp-Glide	33.7	25.7	17.5	32.2	25.3	17.0

APPENDIX 2: Errata

Voodoo3 Known Problems

Note: This is a list of problems that have been experienced with the v1.00 Voodoo3 product.

- Intermittent vertical black bar on right side of screen when displaying Video
- Noise appears when adjusting Gamma in very high resolution modes
- Descent3: Level 2 will have texture corruption on doors
- Running Quake 3 in a resolution that is higher than desktop and not supported in DDraw causes a page fault
- Kingpin performance with OGL ICD is considerably less than with MiniGL 1.49
- With OGL ICD, Hexen2 will have major performance degradation when if you alt/tab out of and then back into the game
- Monster Truck Madness 2 has video corruption at beginning of game
- Pro Pilot99 has flashing 2D corruption
- Windowed OGL ICD performance is lower than full screen performance
- Quake 3 has intermittent texture flashing when jumping on jump pads
- Forsaken 2 Ship Demo (benchmark version) crashes when loading a new level
- 3dfx Tools won't install V3 drivers with V3/Banshee multimon setup. User must force install using Display CP
- Attempting to launch Quake or Hexen II at resolutions higher than 800x600 generates a wgl failure
- When setting up FIFA 99 for night play corrupts the lights on the outside of stadiums
- Descent 3 Demo 2 Problem with OpenGL ICD where textures are missing in certain areas of game
- Descent 3 Demo 2 Exiting Game to Black Desktop running game in OpenGL
- A system lock up will occur while running the screen saver Organic Art (Plus '98.)
- Zoran DVD player will lock up when switching bit depths while playing a movie
- Mortyr beta title has lightmap corruption with Voodoo3 and Banshee
- Tribes menu/load screen corruption in OpenGL at all modes except 640x480 on Voodoo3
- Severe desktop icon corruption after playing ICD apps on Voodoo3
- TrueSpace 4 locks system when switching from D3D to OpenGL
- Flashing decals in Half-Life
- Incorrect Mip Mapping in Turok2
- Fifa 99 not running on Voodoo3
- AVI Playback, via Windows Media Player is in SW only (Workaround: update to latest version of MS Media Player)
- Flashing textures in Unreal
- EA titles (Tiger Woods '99, NFS III) do not recognize Voodoo3 and thus cannot run glide (workaround: install latest game patch)
- Half-life causes an application error when switching game resolutions (workaround: install latest game patch)
- Corrupted text in Rogue Squadron

APPENDIX 3: 3dfx Tools User Guide

Product Overview

Introduction to 3dfx Tools

3dfx Tools is a set of utility tools designed by STB Systems, Inc. to give Voodoo3 products the cutting edge difference that distinguishes them from the competition. Over time, 3dfx Tools will be segmented into several parts ranging from Professional Edge pages to Gamers Edge pages. All of these sections have been realized as strategic parts missing from most video card tool kits. While some companies have incorporated some elements of these features into tool sets, only 3dfx Tools will contain all of the power and flexibility of these industry leading components.

Differentiation

Some of the most important differentiating factors of 3dfx Tools are the powerful features brought to the user in an easy-to-use interface specifically targeting an example of the 'Professional Edge' Page: With only a single mouse click, any user can instantly customize his/her video card for optimal performance with leading industry software like Microsoft's SoftImage. Included in this page are control optimizations for most of the leading 3D Design and CAD applications used today, with the addition ability to add other programs with only a few mouse & keystrokes. Another differentiating factor is the ability of 3dfx Tools to automatically download (connection to the Internet required), compare and install new drivers, effectively keeping our clients up-to-date with out making them have to hunt for the latest drivers then painfully try to install them. With this feature set and level of integration, STB will possess the industry's best control tool set.

Key Features and Benefits

3dfx Tools will be broken down into phases of development. The first incorporates all the basic tools normally associated with driver utilities, such as gamma control and TV-out utility. Additional phases will add several new state-of-the-art concept utilities. The following 3dfx Tools User's Guide describes the use of the first set of 3dfx Tools, which is included with your Voodoo3 review unit.

Enhanced Installation Process

In the design process for 3dfx Tools, the development group has realized the need for an easy-to-use and smart installation process.   It is our intent that the installation process for this software be as simple and user-friendly as possible. The installation process will have 'Complete' un-install capabilities. When the user asks to remove the software, it will remove it completely. The un-install process will also ask the user if he/she would like to un-install the video drivers. If this is so, the un-installer will remove the current video driver and replace it with the standard VGA driver.

Control Page Applet

        This is the page that controls all the other pages that are requested by the OEM or retail group. Each of the other pages will be 'equipped' from this page. If the retail group decides that all the pages are just too much for the general user, the DEFAULT loaded pages will be 'un-equipped' and not shown; however, if the user wants to go back an re-enable the page, all he/she has to do is click on the page name and it's back.

        Note: The Control page should be populated with data from the actual card in the system. (i.e. If a Banshee is installed, the LCD and TV out pages will not show up)

        As more and more features are added to 3dfx Tools, more items will be added to the list of items that can be enabled or disabled. The entire purpose of this page is to organize and keep the visible tab/pages under control. This way, if the user decides that he/she never wants to see the TV Out page because he doesn't use it, he/she un-checks the item and it's gone until which time that he/she wants it back.

New graphics from v1.2.0.16 – 3/31/1999
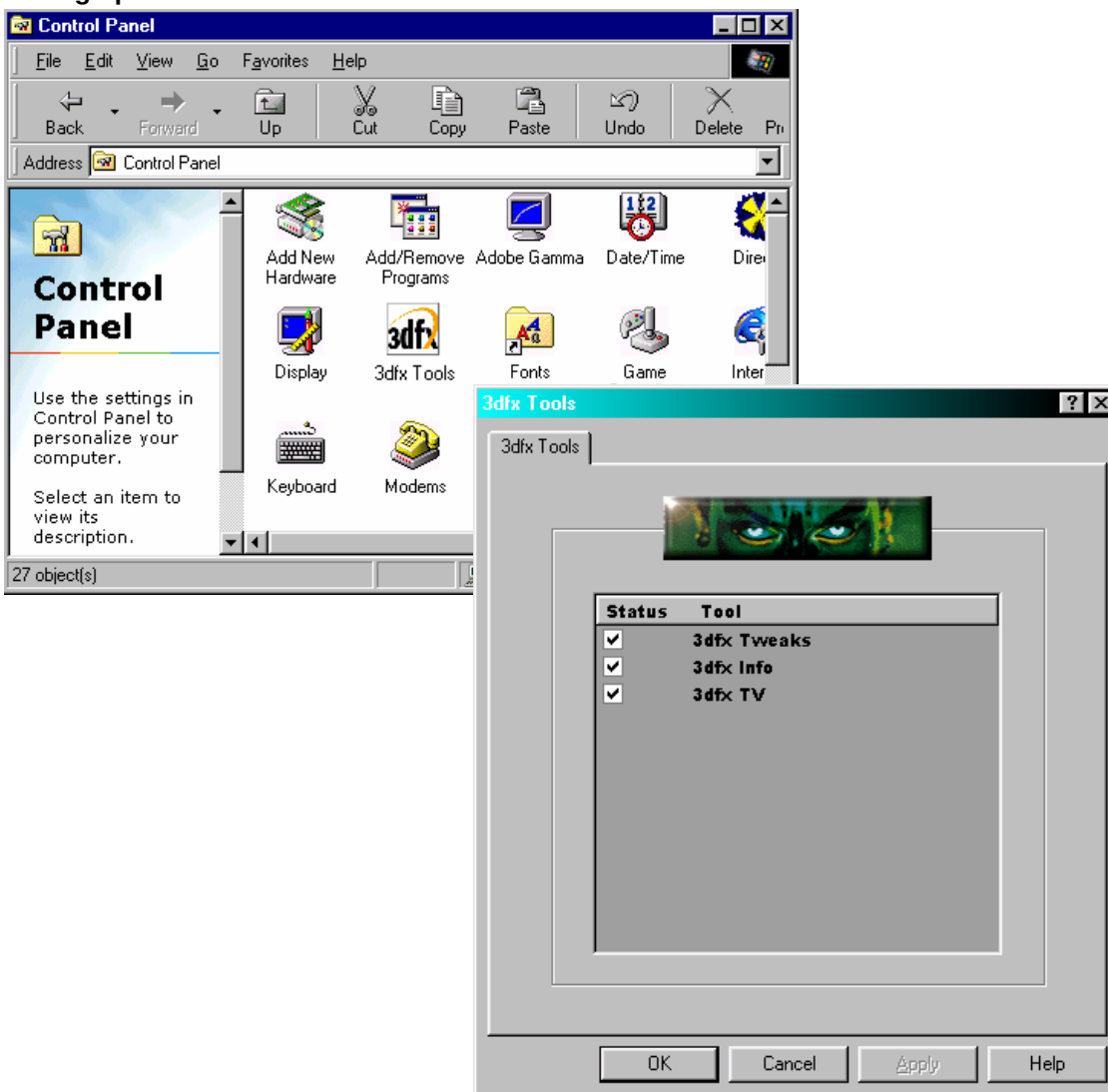
Tweaks Page

The new 3dfx Tweaks page is shown below. This page allows the user to customize the setting of the video card. The following features can be used from this page:

Selection box - This box allows the user to toggle which part of the interface he will be changing. If the user has Direct3D toggled, then the D3D/DirectDraw box will become highlighted allowing him to modify the selections in addition to changing the Gamma setting for that mode. Is button is used as a standard toggle radio button. Only one selection is used at a time.

Gamma Settings box - This box contains the actual sliders that adjust the red, green and blue values of gamma. These sliders can be linked/locked to allow simple modification to the gamma value. When the specific mode is selected in the SELECTION box, the value of this slider will adjust appropriately. (i.e. When Glide/OpenGL is selected in the SELECTION box, the center value for gamma is changed to 1.30 vs. the default center of 1.00 for DeskTop.)

Glide / OpenGL box - This box contains all the available features currently incorporated into 3dfxTools that allow modification to the Glide / OpenGL settings of the board. Any and all of these settings can be used at once.

Reset to Previous Button - This button resets all data on this page to the Previous data that was 'APPLIED' with the APPLY button. All setting on this page will not be saved until the APPLY button is pushed.

Factory Defaults Button - This button resets all the settings on this page back to the factory default settings.

Image Quality Settings – These new driver enhancements allow users to choose Image Quality settings that deliver the optimal image based on user preferences. A new **Alpha-Blending** quality control panel allows you to select Automatic, Sharper, and Smoother settings. By choosing the appropriate settings for their favorite titles, you can experience the most realistic graphics possible, particularly for games that utilize alpha-blending rendering techniques for visual effects such as transparency (water or glass), translucency (artifacts that partially obscure objects, such as smoke, clouds or explosions), lensflare and reflections. The three settings offer maximum flexibility for you to find the Alpha-Blending Quality combination that best meets your preferences**:**

- **Automatic**: Setting this mode allows the driver to determine when to use 3dfx's new Alpha-Blending Quality technique as needed. This is the Default mode.
- **Sharper**: This option turns off the Alpha-Blending Quality technique, which results in a sharper image and removes some of the "screen door" effects on the image.
- **Smoother**: This option activates the Alpha-Blending Quality technique, which results in a smoother image without the "screen-door" effects that can appear in some games.

The new drivers also feature a **Video Display** quality menu which allows users to choose Automatic, High and Normal settings. These options give users the ability to employ special image processing technology that optimize output based on the graphics demands of a particular title, and on the performance or image quality preferences of the user:

- **Automatic**: This allows the driver to determine the specific image processing algorithm which provides the best combination of performance and image quality.   This is the Default mode.
- **High**: This "high quality" option produces an image without the color "banding" that can appear in some games. Choosing this option results in a slight performance trade-off with some titles.
- **Normal**: This "high-performance" option removes some of the color "banding" on the image, but does not impact rendering performance.

For further information on the driver enhancements, visit 3dfx Interactive's Web site at http://www.3dfx.com.

Information Page

This page will contain general information on the video card installed in the system. This information is to be generated dynamically. The following information will be provided:

|	
▪ Card Name	• RAMDAC Speed
▪ Card Bios Version	• CLK Speed
▪ Driver Version	• MemCLK Speed
▪ Tools Version	• Amount of RAM on Video Card
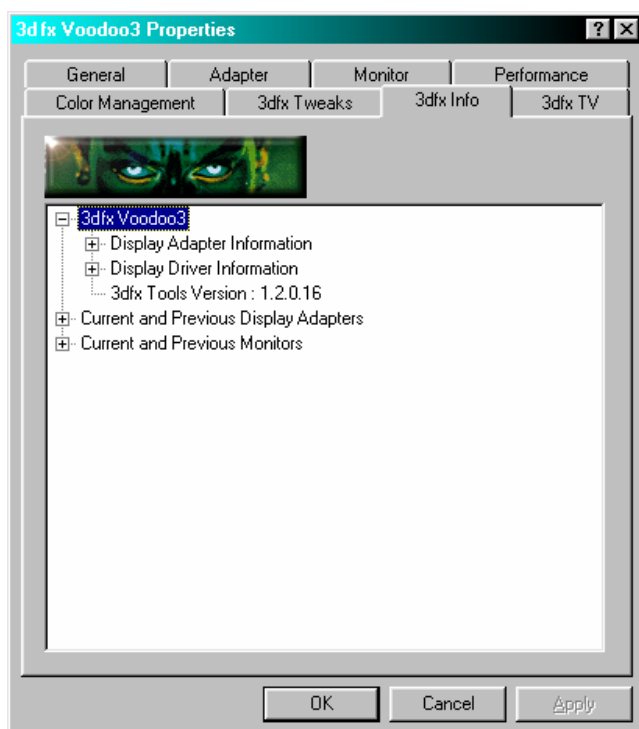
New graphics from v1.2.0.16 - 3/31/1999

This page operates much in the same way as Microsoft Explorer does with expanding / collapsing branches and scroll bars. The data is pretty straightforward.

TV-Out Page (if supported)

This page is used to control the TV-out function of the video card. The checkboxes are fairly straight forward. The following information describes each section of this page:
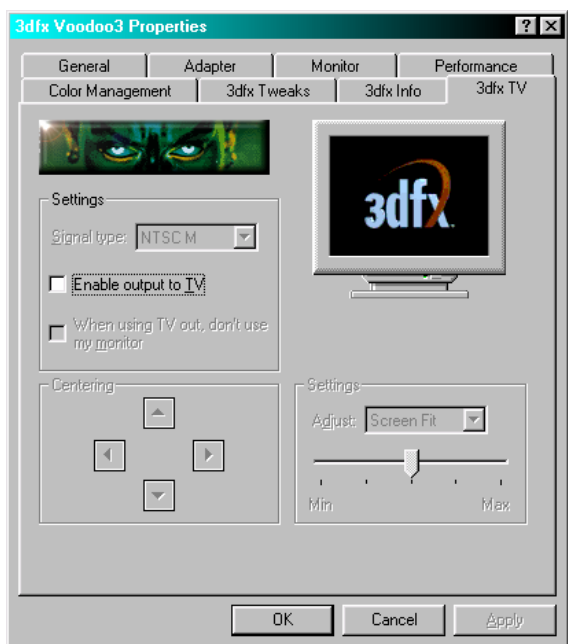
General Settings group – The 'Signal Type' selection box allows the user to select the desired TV output format such as NTSC or PAL. The first checkbox allows the user to switch between TV and VGA Monitor output. As soon as the user selects a mode, the picture to the right should change to indicate that he's/she's about to go into TV or Monitor mode as soon as he/she presses the APPLY button located at the bottom of the page. The two images shown here show the different pictures that will be displayed. The other checkbox allows the user to turn off the output to the VGA monitor while using the TV output option.

Centering group – The controls in this group allow the user to adjust the position of the image on the TV. This mode is disabled until the TV is activated. The arrow keys move the image in the indicated direction.

Settings box - This box allows the users to modify the following TV output options: Screen Fit, Flicker Filter, Color, and Brightness.