NVIDIA Quadro Technical Specifications

NVIDIA Quadro Workstation GPU
- Full 128-bit floating point precision pipeline
- 12-bit subpixel precision
- Hardware-accelerated antialiased points and lines
- Hardware OpenGL overlay planes
- Hardware-accelerated two-sided lighting
- Hardware-accelerated clipping planes
- Third-generation occlusion culling
- 16 textures per pixel
- OpenGL quad-buffered stereo (3-pin sync connector)
- Hardware-accelerated pixel read-back

Next-generation Shading Architecture
- Fully programmable GPU (OpenGL 2.0/ DirectX 9.0c support)
- Unlimited long fragment and vertex programs
- Looping and subroutines (up to 256 loops per vertex program)
- Dynamic flow control
- Conditional execution

Architecture
- x16 PCI Express
- 128-bit IEEE floating point precision graphics pipeline
- 32-bit floating point per component
- 12-bit subpixel precision
- Up to 1GB memory
- Up to 42.2GB/sec. memory bandwidth
- Up to 2.4GB/sec. read back performance
- Unlimited programmability
- 3D volumetric texture support
- Single-system powerwall

High-level Shader Languages
- Optimized compilers for Cg, OpenGLSL, and Microsoft HLSL
- OpenGL 2.0 and DirectX 9.0c support
- Open source compiler

High-resolution Antialiasing
- Up to 32x full-scene antialiasing (FSAA), at resolutions up to 1920 x 1200
- 12-bit subpixel sampling precision enhances AA quality
- Rotated-grid FSAA significantly increases color accuracy and visual quality for edges, while maintaining performance

Memory
- High-speed memory (up to 1GB)
- Advanced lossless compression algorithms (color and Z data)

Unified Driver Architecture
- Single driver supports all products

Operating Systems
- Microsoft Windows® XP, 2000, NT®
- Linux—Full OpenGL impleamentation, complete with NVIDIA and ARB extensions (complete XFree 86 drivers)
- AMD64, Intel EM64T

NVIDIA® nView™ Architecture
- Advanced multi-display desktop and application management seamlessly integrated into Microsoft Windows
- Dual DVI output—drives two independent digital displays at 1600 x 1200, or one at up to 3840 x 2400[5]
- Dual-link TMDS—drives up to two digital displays at 3840 x 2400 @ 24Hz simultaneously[3,6]
- 400MHz DACs—two analog displays up to 2048 x 1536 @ 85Hz each
- OpenGL stereo support for resolutions up to 3840 x 2400[7]

Professional Certifications
CAD
- Ansys
- Autodesk Architectural Desktop, AutoCAD, AutoStudio, DesignStudio, Inventor, Lightscape, Mechanical Desktop, Showcase, VIZ
- AVEVA: PDMS
- Bentley Microstation
- Co|Create OneSpace
- Dassault CATIA, SolidWorks
- ESRI ArcGIS
- ICEM Surf
- MSC.Nastran, MSC.Patran
- PTC Pro/ENGINEER Wildfire, 3Dpaint, CDRS
- UGS NX Series, I-deas, SolidEdge, Unigraphics, SDRC
- and many more…

Digital Content Creation (DCC)
- Autodesk Media and Entertainment 3ds Max, Maya, MotionBuilder, VIZ, Smoke, Lustre
- NewTek Lightwave 3D
- Side Effects Houdini
- Softimage|XSI
- and many more…

Video/Broadcast Applications
- Adobe Premiere, After Effects, Macromedia Suite
- Apple Shake
- Avid Media Composer Adrenaline HD, NewsCutter, Xpress Family, DS Nitris, Liquid Family, Studio
- Pinnacle Studio, and Liquid Edition
- Autodesk Media and Entertainment Fire, Smoke, Inferno, Flame, Flint, Toxik, Combustion
- NewTek, TriCaster

Energy
- Schlumberger
- Paradigm GEO
- Landmark

1 Available on NVIDIA Quadro FX 5500, 4500 X2, 4500, 3500, and 3450
2 Bidirectional reflectance distribution function
3 Dual dual-link digital displays available on NVIDIA Quadro FX 5500, 4500 X2, 4500, 3500, and 1500
4 Available on NVIDIA Quadro FX 5500
5 NVIDIA Quadro FX 540 and 350 include one DVI and one analog output; NVIDIA Quadro FX 2500M, 1500M, and 350M support a combination of VGA, DVI, LVDS, and TV-out
6 Single dual-link digital display available on NVIDIA Quadro FX 5500 SDI, 4500 SDI, FX 3450, and FX 560
7 Available on NVIDIA Quadro FX 5500, 5500 SDI, 4500 X2, 4500, 4500 SDI, 3500, and 1400

The Standard for Professional Graphics

The **NVIDIA Quadro®** family of professional solutions for workstations delivers the fastest application performance and the highest quality graphics.

Raw performance and quality are only the beginning. The NVIDIA Quadro family takes the leading computer-aided design (CAD), digital content creation (DCC), and visualization applications to a new level of interactivity by enabling unprecedented capabilities in programmability and precision. The industry's leading workstation applications leverage this architecture to enable hardware-accelerated features not found in any other professional graphics solution.

In addition to a full line up of 2D and 3D workstation graphics solutions, the NVIDIA Quadro professional products include a set of specialty solutions that have been architected to meet the needs of a wide range of industry professionals. These specialty solutions provide distinct features to enable advanced imaging visualization and broadcast applications—from multi-system scalability and synchronization to uncompressed 12-bit HD-SDI video output.

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Image courtesy Realtime Technology AG (RTT) | NVIDIA Quadro Product Overview | MAR06

The Definition of Performance. The Standard for Quality.

NVIDIA Quadro Architecture Achieves Unprecedented Performance

The NVIDIA Quadro architecture takes application performance to new levels by featuring an array of parallel vertex engines, a radically new line engine, and fully programmable pixel pipelines coupled to a high-speed graphics DRAM bus. Pipeline efficiency is further multiplied by NVIDIA's next-generation crossbar memory architecture, enabling occlusion culling, lossless depth Z-buffer, and color compression.

These elements combine to achieve unprecedented 3D performance: blazing geometry performance, lightening-fast line performance, and massive fill rates powered by superscalar pixel pipelines. However, the true measure of power is application performance. The NVIDIA Quadro architecture more than doubles the performance of the previous generation. With a pixel read-back performance of up to 2.4GB/sec., massive host throughput gains can be achieved for professional applications. In addition, NVIDIA Quadro graphics solutions feature NVIDIA® SLI™ technology[1], a revolutionary platform innovation that enables professional users to dynamically scale graphics performance, enhance image quality, and expand display real estate by combining multiple NVIDIA Quadro graphics solutions in a single system. Using dedicated scalability logic, NVIDIA SLI technology delivers new levels of performance, quality, and resolution.

Advanced Programmability Empowers a New Class of Applications

For the first time, styling and production rendering become integral functions of the design workflow, shortening the production process and enabling faster time to market.

Leading this change in functionality are the major CAD and DCC application vendors. End users can take full advantage of the programmable NVIDIA Quadro architecture by enabling sophisticated shaders to simulate a virtually unlimited range of physical characteristics, such as lighting effects (dispersion, reflection, refraction, BRDF[2] models) and even physical surface properties (casting effects, porosity, molded surfaces). Real-time shaders allow these effects to be combined and modified interactively, something that is impossible with simple 2D static texture maps.

Full 128-bit Floating Point Precision Delivers the Industry's Highest Workstation Quality

Sophisticated real-time effects typically involve multiple mathematical operations that demand high precision to maintain image quality. The NVIDIA Quadro architecture features true 128-bit IEEE floating point precision (32-bit fp per component), resulting in the highest level of accuracy and the ultimate in visual quality.

High subpixel precision is another major contributor to image quality, addressing visual anomalies that cause models to "speckle" or "crack." The NVIDIA Quadro architecture virtually eliminates this problem by providing 12-bit subpixel precision, three times higher precision than the nearest competitive product.

The NVIDIA Quadro family delivers true 16-bit and 32-bit floating point formats for accurately matching visual images. The 32-bit floating point precision format, an industry first and exclusive, meets the needs of cutting-edge applications. All images have a smoother, more appealing variation in color density, which increases visual realism and generates photorealistic rendered images.

Certified for the Highest Quality Experience with the Most Demanding Workstation Applications

The performance and power of the NVIDIA Quadro architecture are built on a solid foundation of quality engineering. This engineering excellence is exemplified by the NVIDIA Unified Driver Architecture (UDA), which is certified for quality by the entire spectrum of CAD and DCC applications.

The true power of UDA lies in the breadth of supported products and its long-term delivery of quality and performance. All NVIDIA Quadro products, including previous generations, are continually tested and certified. This rigorous testing process results in the industry's highest quality hardware and drivers, even with applications released long after an NVIDIA Quadro product has shipped.

Uncompromised Professional Graphics to Go

The NVIDIA Quadro FX professional solutions for mobile workstations deliver the fastest application performance and the highest quality graphics. The NVIDIA Quadro FX mobile solutions take the leading CAD, DCC, and visualization applications to a new level of interactivity on a notebook by enabling unprecedented capabilities in programmability and precision.

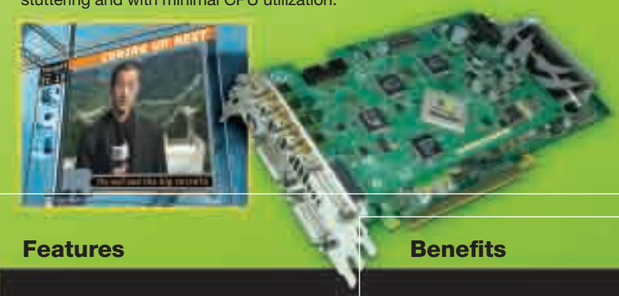
SPECIALTY PRODUCTS

Revolutionizing Advanced Vizualiation

The **NVIDIA Quadro G-Sync** is an option-card that delivers frame lock and genlock functionality to unprecedented levels of industrial realism, visualization, and collaborative capabilities. The NVIDIA Quadro G-Sync can be combined with the NVIDIA Quadro FX 5500 or 4500 to provide advanced multi-system visualization and external signal synchronization.

Integrated Graphics to Video Solution for Broadcast, Video, and Film Professionals

The **NVIDIA Quadro SDI** solutions featuring NVIDIA PureVideo technology are ideal for on-air broadcast professionals across many applications, including virtual-set, sports, and weather news systems. The NVIDIA Quadro SDI solution is the industry's only fully integrated graphics to video out product, and will composite live video footage onto virtual backgrounds and send the result to live video for TV broadcast. The solution also allows film production and post-production professionals to preview the results of 3D compositing, editing, and color grading in real time on HD broadcast monitors. Furthermore, PureVideo delivers ultra-smooth, crisp, and vibrant HD video playback without annoying artifacts and stuttering and with minimal CPU utilization.



Available NVIDIA Quadro Graphics Boards

	PCI Express
Ultra-High-End	NVIDIA Quadro FX 5500 NVIDIA Quadro FX 4500 X2 NVIDIA Quadro FX 4500
High-End	NVIDIA Quadro FX 3500 NVIDIA Quadro FX 3450
Mid-Range	NVIDIA Quadro FX 1500 NVIDIA Quadro FX 1400
Entry-Level	NVIDIA Quadro FX 560 NVIDIA Quadro FX 550 NVIDIA Quadro FX 540 NVIDIA Quadro FX 350
Specialty	NVIDIA Quadro FX 5500 SDI NVIDIA Quadro FX 4500 SDI NVIDIA Quadro G-Sync
Mobile	NVIDIA Quadro FX 2500M NVIDIA Quadro FX 1500M NVIDIA Quadro FX 350M

Features	Benefits
Dual Dual-Link Digital Display Connectors	Dual dual-link TMDS transmitters support ultra-high-resolution panels (up to 3840 x 2400 @ 24Hz on each panel) —which result in amazing image quality producing detailed photorealistic images[3].
1GB (1024MB) Frame Buffer Support	Delivers high throughput for interactive visualization of large models and high performance for real-time processing of large textures and frames, and enables the highest quality and resolution full-scene antialiasing[4].
NVIDIA SLI Technology	Enables NVIDIA Quadro products to be linked together via an intelligent communication protocol,resulting in true graphics scaling to unprecedented levels of performance and quality[1].
Advanced Vertex and Pixel Programmability	Enables real-time shaders to simulate a wide range of physical effects and surface properties.
Full 128-Bit Precision Graphics Pipeline	Enables mathematical computations to maintain high accuracy, resulting in unmatched visual quality.
12-Bit Subpixel Precision	3x that of the nearest competitive workstation graphics, 12-bit subpixel precision delivers high geometric accuracy, eliminating spreckles, cracks, and other rasterization anomalies.
High-Quality Full-Scene Antialiasing (FSAA)	Up to 16x FSAA dramatically reduces visual aliasing artifacts or "jaggies" at resolutions up to 1920 x 1200, resulting in highly realistic scenes. New rotated-grid FSAA algorithm (RG FSAA) delivers unprecedented quality and performance.
High Precision, Dynamic Range Imaging Technology	Sets new standards for image clarity and quality through floating point capabilities in shading, filtering, texturing, and blending. Enables unprecedented quality of rendered images for visual effects processing.
Hardware-Accelerated Pixel Read-Back	Up to 2.4GB/sec. pixel read-back performance delivers massive host throughput, more than 10x the performance of previous generations of graphics systems.
NVIDIA PureVideo Technology	NVIDIA® PureVideo™ technology is the combination of high-definition video processors and software that delivers unprecedented picture clarity, smooth video, accurate color, and precise image scaling for SD and HD video content. Features include, high-quality scaling, spatial temporal de-interlacing, inverse telecine, and high quality HD video playback from DVD.