Overview

NVIDIA Quadro M6000—Real Interactive Expression

Get real interactive expression with NVIDIA Quadro—the world’s most powerful workstation graphics. The NVIDIA Quadro M6000, accelerated by NVIDIA’s Maxwell™ GPU architecture, lets you conquer your most challenging visualization workloads with ease and enjoy interactive physically based rendering of your work. 12 GB of GDDR5 GPU memory with ultra-fast bandwidth allows you to create and render large, complex models and compute massive datasets. Plus, there’s the all-new display engine that drives up to four 4K resolution displays natively with DisplayPort 1.2 support for ultra-high resolutions like 4096 x 2160 at 60 Hz with 30-bit color. Synchronize multiple displays across systems with the Quadro Sync board (see PNY PN VCQM6000SYNC-PB) and accelerate data transfer with external I/O boards through GPU Direct™ for Video and dual-copy engines.

Designed and built specifically for professional workstations, NVIDIA Quadro GPUs power more than 200 professional applications across a broad range of industries including manufacturing, media and entertainment, sciences, and energy. Professionals trust them to realize their most ambitious visions—whether it’s product design, visualization and simulation, or spectacular visual storytelling—and get results to market faster.

CUDA Cores: 3072
GPU Memory: 12 GB GDDR5
Memory Interface: 384-bit
Memory Bandwidth: 317 GB/s
System Interface: PCI Express 3.0 x16
Display Connectors: DP 1.2 (4) + DVI-I DL (1) + Stereo
DisplayPort 1.2: Yes
Warranty: 3 Years
PNY Part Number: VCQM6000-PB

PNY provides unsurpassed service and commitment to its professional graphics customers offering: 3-Year Warranty, pre and post sales support, dedicated Quadro Field Application Engineers and direct tech support hotlines. In addition, PNY delivers a complete solution including the appropriate adapters, cables, brackets, software installation disc and documentation to ensure a quick and successful install.
**Product Specifications**

<table>
<thead>
<tr>
<th>Specification</th>
<th>Value</th>
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<tbody>
<tr>
<td>CUDA Cores</td>
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<td>System Interface</td>
<td>PCI Express 3.0 x16</td>
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<tr>
<td>Maximum Power Consumption</td>
<td>250 W</td>
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<tr>
<td>Energy Star Enabling</td>
<td>Yes</td>
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<tr>
<td>Thermal Solution</td>
<td>Ultra-quiet active fansink</td>
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<tr>
<td>Form Factor</td>
<td>4.40” H x 10.50” L, Dual Slot</td>
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<tr>
<td>Display Connectors</td>
<td>DP 1.2 (4) + DVI-D DL (1) + Stereo</td>
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<tr>
<td>DisplayPort 1.2</td>
<td>Yes</td>
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<tr>
<td>DisplayPort with Audio</td>
<td>Yes</td>
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<tr>
<td>DVI-D Dual Link Connector</td>
<td>Via optional adapter</td>
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<tr>
<td>DVI-D Single-Link Connector</td>
<td>Via included adapters</td>
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<tr>
<td>VGA Support</td>
<td>Via included adapter</td>
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<tr>
<td>Number of Displays Supported</td>
<td>4</td>
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<tr>
<td>Maximum DP 1.2 Resolution</td>
<td>4096 x 2160 at 60Hz</td>
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<td>Maximum DVI-I DL Resolution</td>
<td>2560 x 1600 at 60Hz</td>
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<td>Maximum DVI-I SL Resolution</td>
<td>1920 x 1200 at 60Hz</td>
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<tr>
<td>Maximum VGA Resolution</td>
<td>2048 x 1536 at 85Hz</td>
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<tr>
<td>HDCP Support</td>
<td>Yes</td>
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<tr>
<td>Professional 3D Support</td>
<td>Yes, via included stereo connector bracket</td>
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<tr>
<td>Quadro Sync Compatible</td>
<td>Yes</td>
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<tr>
<td>NVIDIA GPU Direct Compatible</td>
<td>Yes</td>
</tr>
<tr>
<td>Graphics APIs</td>
<td>Shader Model 5.0, OpenGL 4.5, DirectX 12</td>
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</table>
**Compute APIs**
CUDA, DirectCompute, OpenCL

**NVIEW**
Yes

**NVIDIA Mosaic**
Yes (Windows 8.1, 8, 7, and Linux)

**NVIDIA 3D Vision and 3D Vision Pro**
Yes

**Warranty**
3 Years

**PNY Part Number**
VCQM6000-PB

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**Minimum System Requirements**
- Microsoft Windows® 8.1, 8, 7, Vista, Linux®, or Solaris®
- PCIe x16 Gen 3 (preferred) expansion slot
- 2 GB or more of system memory, 8 GB recommended
- 200MB of available disk space for full driver installation
- Blu-ray or DVD-ROM drive
- Internet connection (if preferred for driver installation)
- DisplayPort, DVI, or VGA compatible display(s)

**Package Contains**
- NVIDIA Quadro M6000 professional graphics board
- Stereo connector bracket
- Three DisplayPort to DVI-D SL adapters
- DVI-I to VGA adapter
- 8-pin to dual 6-pin auxiliary power cable
- Software installation disc for Windows 8.1, 8, 7, and Vista (32- and 64-bit)
- Printed QuickStart Guide

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**Features and Benefits**

**3D Graphics Architecture**
- Scalable geometry architecture
- Hardware tessellation engine
- NVIDIA GigaThread engine with dual copy engines
- Shader Model 5.0 (OpenGL 4.5 and DirectX 12)
- Up to 16K x 16K texture and render processing
- Transparent multisampling and super sampling
- 16x angle independent anisotropic filtering
- 128-bit floating point performance
- 32-bit per component floating point texture filtering and blending
- 64X full scene antialiasing
- FXAA and TXAA full scene antialiasing
- Decode acceleration for MPEG-2, MPEG-4 Part 2 Advanced Simple Profile, H.264, MVC, VC1, DivX (version 3.11 and later), and Flash (10.1 and later)
- Dedicated H.264 encoder
- Blu-ray dual-stream hardware accelerating (supporting HD picture-in-picture playback)
- NVIDIA GPU Boost automatically adjusts the GPU engine throughput to maximize application performance.

Parallel Computing Capabilities
- SMX architecture (streaming multi-processor design that delivers greater processing and efficiency)
- HyperQ (allows multiple CPU cores to simultaneously utilize a single M6000 GPU to execute independent compute kernels)
- Dynamic Parallelism (GPU dynamically spans new threads without going back to the CPU)
- API support including: CUDA C, CUDA C++, DirectCompute 5.0, OpenCL, Java, Python, and Fortran
- NVIDIA Parallel Data Cache hierarchy (per SM L1 and unified L2 caches)
- Error-Correction Code (ECC) memory on graphics memory
- 96KB of RAM (dedicated shard memory per SM)

Advanced Display Features
- 30-bit color (10-bit per each red, green and blue channel)
- Support for any combination of four connected displays
- DisplayPort 1.2 (supporting resolutions such as 4096 x 2160 at 60 Hz)
- DVI-I Dual-Link output (up to 2560 x 1600 at 60Hz and 1920 x 1200 at 120Hz)
- DVI-D Dual-Link output (up to 2560 x 1600 at 60Hz and 1920 x 1200 at 120Hz)
- Internal 400MHz DAC DVI-I output (analog display up to 2048 x 1536 at 85Hz)
- DisplayPort to VGA, DisplayPort to DVI (single-link and dual-link) and DisplayPort to HDMI cables optionally available (resolution support based on dongle specifications)
- 10-bit internal display processing (hardware support for 10-bit scanout for both windowed desktop and full screen, only available on Windows with Aero disabled and Linux
- NVIDIA 3D Vision™ technology, 3D DLP, interleaved, and other 3D stereo format support
- Full OpenGL quad buffered stereo support
- Underscan/overscan compensation and hardware scaling
- Support for NVIDIA Quadro Mosaic, NVIDIA NVIEW multi-display technology, NVIDIA Enterprise Management Tools
- Support for large-scale, ultra-high resolution visualization using the NVIDIA SVS platform which includes NVIDIA Mosaic, NVIDIA Sync and NVIDIA Warp/Blend technologies

DisplayPort and HDMI Digital Audio
- Dolby Digital (AC3), DTS 5.1, multi-channel (7.1) LPCM, Dolby Digital Plus (DD+), and MPEG-2/MPEG-4 AAC
- Data rates of 44.1 KHz, 48 KHz, 88.2 KHz, 96 KHz, 176KHz, and 192 KHz
- Word sizes of 16-bit, 20-bit, and 24-bit
GPU Features

Maxwell Streaming Multiprocessor
The heart of Maxwell’s power efficient performance is its newly designed Streaming Multiprocessor which delivers incredible performance and unmatched power efficiency, through an improved instruction scheduler and new data path organization.

Maxwell Memory Architecture
Improved caching effectiveness and significant enhancements in memory compression techniques in Maxwell reduces traffic and provides higher performance for applications dependent on memory bandwidth. Additionally, Maxwell’s dedicated shared memory per SM (separated from the L1 cache) and larger L2 cache, dramatically improves programmability and efficiency.

Viewport Multicast
Dedicated hardware to automatically broadcast input geometry to render to multiple render targets which drastically speeds up ‘multi projection’ (the ability of rendering the same scene from multiple view) leading to accelerated rendering for cube maps used in multi view projectors and 3D CAVE environments.

Sparse Textures
Virtualizes texture sizes enabling applications to seamlessly work with large and complex data sets regardless of the available frame buffer.

Accelerated Voxelization
Enhancements to voxel handling techniques enables fast voxelization which significantly accelerates workflows like fluid simulation and 3D printing.

Multiple Copy Engines
Enables the highest rates of parallel data processing and concurrent throughput between the GPU and host, accelerating techniques such as ray tracing, color grading and physical simulation.

Bindless Graphics
Optimizes GPU utilization by dramatically reducing CPU-GPU interactions, enabling developers to implement more sophisticated and complex algorithms providing end users greater performance and higher levels of visual fidelity.

H.264 and HEVC Encoder
Dedicated H.264 and HEVC encode engine that is independent of 3D/compute pipeline and delivers faster than real-time performance for transcoding, video editing, and other encoding applications.

NVIDIA CUDA Architecture
Parallel-computing architecture that tightly integrates advanced visualization and compute features to significantly accelerate professional workflows.
NVIDIA Scalable Geometry Engine
Dramatically improves geometry performance across a broad range of CAD, DCC and medical applications, enabling you to work interactively with models and scenes that are an order of magnitude more complex than ever before.

Dynamic Parallelism
Simplifies GPU programming by allowing programmers to easily accelerate all parallel nested loops – resulting in a GPU dynamically spawning new threads on its own without going back to the CPU.

Large Framebuffers with Ultra-Fast Bandwidth
Large GPU memory with fast bandwidth for display of complex models and scenes, as well as computation of large datasets.

PCI Express 3.0 Compliance
Supports data transfer rate up to 8 GT/sec per lane for an aggregate bandwidth of 32 GB/sec bi-directional (16 GB/sec in each direction.)

Error Correcting Code (ECC) on Graphics Memory
Meets strict requirements for mission critical applications with uncompromised computing accuracy and reliability for workstations. Offers enhanced application data integrity protection through single bit memory error correction.

Unified Driver Architecture (UDA)
Guarantees forward and backward compatibility with software drivers, simplifying upgrading to a new Quadro solution whenever you’re ready.

Remote Workstation Application Acceleration
Remotely interact with professional GPU-accelerated applications through software such as Microsoft RDP, Splashtop, and HP Remote Graphics Software.

Ultra-Quiet Design
Silent cooling design enables lower acoustics for an ultra-quiet desktop environment.

NVIDIA GPU Boost
Maximum application performance through automatic adjustment of the GPU clock to take maximum advantage of the power and thermal headroom of the card in real-time.

Image Quality

Full-Scene Antialiasing (FSAA)
Up to 64X FSAA for dramatically reducing visual aliasing artifacts or “jaggies,” resulting in unparalleled image quality and highly realistic scenes.
NVIDIA FXAA and TXAA
Reduces visible aliasing and delivers higher image quality without the performance hit by harnessing the power of the GPU's CUDA cores and new film-style AA techniques.

GPU Tessellation
Quadro Tessellation Engines automatically generate finely detailed geometry for cinematic quality environments and scenes, without sacrificing performance.

16K Texture and Render Processing
Provides the ability to texture from and render to 16K x 16K surfaces. Beneficial for applications that demand the highest resolution and quality image processing.

Display Features

NVIDIA Quadro Mosaic Technology
Enables transparent scaling of the desktop and applications across up to 16 displays from 4 GPUs from a single workstation while delivering full performance and image quality.

Multi-Display Support
All-new display engine drives up to four displays simultaneously and fully supports the next generation Display Port 1.2 standard capable of resolutions such as 3840 x 2160 at 60Hz, making it easy to deploy multiple displays across a desktop, build an expansive digital signage wall, or create a sophisticated stereoscopic 3D CAVE environment.

NVIDIA NVIEW Advanced Desktop Software
This software delivers maximum flexibility for single large display or multi-display options, providing unprecedented end-user control of the desktop experience for increased productivity.

DisplayPort 1.2 Support (with Audio)
Compact and secure DisplayPort 1.2 connectors support multi-stream technology, stream cloning and ultra-high-resolution panels (up to 3840 x 2160 at 60Hz). This enables maximum range, resolution, refresh rate, and color depth designed to support the latest display technologies.

Quadro Sync (see NVIDIA Quadro M6000 Sync)
Synchronizes the display and image output from one system or across a cluster of multiple systems. The Quadro Sync board manages up to 16 displays from 4 GPUs in one system, reducing the number of machines needed to power a video wall or multi-projector visualization environment, and supports image and frame synchronization between up to four GPUs when running Quadro Mosaic or independent GPUs in cluster. Quadro Sync also allows synchronization to an external timing source (also known as genlock or house sync). Quadro Sync enables advanced visualization systems to scale the resolution of the display surface with multiple projectors or displays with standard applications or applications designed for clusters.
NVIDIA 3D Vision

Advanced active shutter glasses that deliver crystal-clear stereoscopic 3D visualization for the most immersive experience. 3D Vision and 3D Vision Pro are sold separately.

OpenGL Quad Buffered Stereo Support

Provides a smooth and immersive 3D Stereo experience for professional applications.

Professional 3D Stereo Synchronization

Enables robust control of stereo effect through a dedicated three-pin mini-din connection to directly synchronize 3D stereo hardware to Quadro graphics card.

Deep Color Processing and Display

Preserve color detail and precision throughout the processing and display pipeline for smooth gradients transitions, even on high dynamic range imagery. Each color component can be processed at up to 32-bit floating point precision and displayed at up to 12-bit precision with supported DisplayPort 1.2 or HDMI 1.4 displays.

SOFTWARE SUPPORT

NVIDIA CUDA Parallel Computing Architecture

Quadro solutions leverage general-purpose GPU computing using standard programming languages like C/C++ and Fortran, and emerging APIs such as OpenCL and Direct Compute. This broad adoption of CUDA accelerates techniques like ray tracing, video and image processing, and computation fluid dynamics.

NVIDIA GPUDirect

NVIDIA GPUDirect capability increases compute performance when data throughput or latency reduction are key considerations by allowing direct access to GPU memory by 3rd-party devices such as SDI video adapters, NICs and SSDs.

NVIDIA GPUDirect for Video

NVIDIA GPUDirect for Video technology allows 3rd party hardware to communicate directly with NVIDIA GPUs. By taking advantage of this new API the historical issues of introducing too much delay or latency are gone. With NVIDIA GPUDirect for Video, devices are fully synchronized and the CPU doesn't waste cycles copying data between device drivers.

MULTI-GPU TECHNOLOGY

NVIDIA Multi-GPU Technology

NVIDIA Multi-GPU powered workstations combine the visualization and interactive design capability of multiple GPUs, by leveraging any combination of Quadro and Tesla GPUs to intelligently scale the performance of your application and dramatically speed up your production workflow.