



Release 375 Quadro, NVS, Tesla, & Notebook Drivers - Version 377.83

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Windows 10

Release Notes



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01 INTRODUCTION TO RELEASE NOTES

This edition of *Release Notes* describes the Release 375 family of NVIDIA Quadro, NVS, Tesla, GRID, and Quadro Notebook Drivers for Microsoft® Windows® 10¹. NVIDIA provides these notes to describe performance improvements and bug fixes in each documented version of the driver.

Structure of the Document

This document is organized in the following sections:

- ▶ “Release 375 Driver Changes” on page 2 gives a summary of changes, and fixed and open issues in this version.
- ▶ “The Release 375 Driver” on page 25 describes the NVIDIA products and languages supported by this driver, the system requirements, and how to install the driver.
- ▶ “Mode Support for Windows” on page 36 lists the default resolutions supported by the driver.
- ▶ “NVIDIA Tesla Compute Cluster Mode” on page 43 describes the Tesla Compute Cluster mode.

Changes in this Edition

This edition of the *Release Notes* for Windows 10 includes information about NVIDIA graphics driver version 377.83, and lists changes made to the driver since version 372.95. These changes are discussed beginning with the chapter “Release 375 Driver Changes” on page 2.

1. Includes support for Windows 10 Anniversary Update.

02 RELEASE 375 DRIVER CHANGES

This chapter describes open issues for version 377.83, and resolved issues and driver enhancements for versions of the Release 375 driver up to version 377.83. The chapter contains these sections:

- ▶ “Version 377.83 Highlights” on page 3
- ▶ “Advanced Instructions for this Release” on page 6
- ▶ “Changes in Version 377.83” on page 12
- ▶ “Changes in Version 377.61” on page 13
- ▶ “Changes in Version 377.55” on page 13
- ▶ “Changes in Version 377.48” on page 14
- ▶ “Changes in Version 377.35” on page 15
- ▶ “Changes in Version 376.33” on page 16
- ▶ “Changes in Version 375.86” on page 17
- ▶ “Changes in Version 375.63” on page 18
- ▶ “Open Issues in Version 377.83” on page 19
- ▶ “Known Product Limitations” on page 20

Version 377.83 Highlights

This section provides highlights of version 377.83 of the NVIDIA Release 375 Driver for Windows 10 and later.

- ▶ Existing Support
- ▶ What's New in Version 377.83
- ▶ What's New in Release 375
- ▶ Limitations Under Windows 10
- ▶ Discontinued and Unsupported Features in this Release

Existing Support

- ▶ This release supports the following APIs:
 - Open Computing Language (OpenCL™ software) 1.2 for NVIDIA® Kepler™, Maxwell™, and Pascal™ GPUs
 - OpenGL® 4.5
 - Vulkan® 1.0
 - DirectX 12 (Kepler, Maxwell, and Pascal GPUs)
 - DirectX 11 (Fermi GPUs)
 - CUDA 8.0
- ▶ This driver installs **nView Desktop Manager** version 148.47.

What's New in Version 377.83

- ▶ This driver adds security updates for driver components. See [“Security Updates in this Release”](#) on page 12 for details.

What's New in Release 375

Quadro ODE Driver

Release 375 is an 'Optimal Drivers for Enterprise'(ODE) branch release. ODE branches are dedicated to relatively long term stability for ISV certification, OEMs, and Enterprise customers.

New Product Support

Added support for the following products:

- ▶ NVIDIA Quadro GP100
- ▶ NVIDIA Quadro P6000, P5000, P4000, P2000, P1000, P600, and P400
- ▶ NVIDIA Quadro M5000 SE
- ▶ NVIDIA Quadro M3000 SE

New Features Supported

- ▶ Added support for Quadro Sync II.

Quadro Sync II provides Quadro Sync functionality for the Pascal family of Quadro products.

Advanced features for Quadro Sync II will be available in a later ODE branch release.

- ▶ Video SDK Support

Hardware video encoding and decoding via Video SDK APIs are officially supported by FFMPEG and libAV as of Video SDK 7.0.

Limitations Under Windows 10

Cross-adapter Clone Mode

Under Windows 10, clone mode across graphics processors is handled by the Windows OS, and not by the NVIDIA driver. Consequently, there are no controls for cross-adapter clone mode in the NVIDIA Control Panel under Windows 10.

Optimus Systems

Because cross-adapter clone mode is handled by the Windows 10 OS, there are no display controls in the NVIDIA Control Panel if no display is connected to the NVIDIA GPU.

Discontinued and Unsupported Features in this Release

Discontinued Features

- ▶ Support for Quadro SDI products is discontinued for Windows 8 and later operating systems.
- ▶ Discontinued support for NVIDIA GRID products.

Beginning with Release 375, the NVIDIA drivers no longer support the NVIDIA GRID K2, K1, K520, and K340 products.

Advanced Instructions for this Release

This section clarifies instructions for successfully accomplishing the following tasks:

- ▶ Turning Off V-Sync to Boost Performance
- ▶ NVIDIA Application Configuration Engine (ACE)
- ▶ Using the WDDM Driver Model with Tesla GPU GOMs
- ▶ SLI Multi-OS – GPU Assignment in System Virtualization

Turning Off V-Sync to Boost Performance

To get the best benchmark and application performance measurements, turn V-Sync off as follows:

- 1 Open the NVIDIA Control Panel and make sure that *Advanced Settings* is selected from the control panel tool bar.
- 2 From the *Select a Task* pane, under 3D Settings, click **Manage 3D Settings**, then click the Global Settings tab.
- 3 From the Global presets pull-down menu, select **Base profile**.
- 4 From the Settings list box, select **Vertical sync** and change its value to **Force off**, then click **Apply**.
- 5 From the Global presets pull-down menu, select **3D App - Default Global Settings** (the driver's default profile) or use the application profile that matches the application you are testing, then click **Apply**.

Be sure to close the NVIDIA Control Panel completely —leaving it open will affect benchmark and application performance.

NVIDIA Application Configuration Engine (ACE)

This driver includes the NVIDIA Application Configuration Engine (ACE), which automatically detects the workstation application and configures the appropriate profile settings in the NVIDIA Control Panel.

See the *NVIDIA Quadro Professional Drivers: NVIDIA Control Panel Quick Start Guide* for more information about this feature.

Using the WDDM Driver Model with Tesla GPU GOMs

Tesla GPU Operation Modes

Tesla K20X and K20 GPU Accelerators offer the ability to specify the GPU operation mode using NV-SMI/NVML. (refer to: <https://developer.nvidia.com/nvidia-management-library-nvml>).

By setting the GPU operation mode, developers can selectively turn off certain features in the GPU to get the best performance per watt for certain workloads.

The following are the supported GOMs:

- ▶ **Compute-Only:** For running compute tasks only.
By default the Tesla K20X and K20 accelerator boards ship in this mode.
- ▶ **Low-Double Precision:** For graphics applications that don't require high bandwidth double precision.
This is recommended for workloads that are not sensitive to double precision but at the same time need graphics capabilities.
- ▶ **All On:** This is recommended only when the workload needs full double precision as well as graphics capabilities.

WDDM and TCC Driver Models

Along with the GPU operation mode, the developer needs to select the compatible driver model for the Tesla K20X and K20.

- ▶ **Tesla Compute Cluster (TCC):** Optimized for running compute workloads.
- ▶ **Windows Device Driver Model (WDDM):** Designed for graphics application and not recommended for compute workloads.

Compatibility Between GOM and Driver Models

Table 1 shows which GPU operation modes are compatible with which driver models.

Table 1 GOM and Driver Model Compatibility

GOM	TCC Driver Model	WDDM Driver Model	Use Case Support
All On	YES	YES	All use cases are supported.
Compute-Only	YES	NO	The following are unsupported : X11 and those that require X11 (GLInterop, OCL conformance and VIPER) 32-bit Windows OS
Low Double Precision	YES	YES	All use cases supported.

The compute-only GOM is supported only on the TCC driver model, while the WDDM driver model supports only GOM modes that enable graphics.

The compute-only GOM and WDDM are incompatible and should not be used simultaneously.

The Tesla K20 Active Accelerators for workstations ship in “compute-only” mode and cannot be modified. Therefore, use only the TCC driver model with these products.

Using the WDDM Driver Model

To use the WDDM driver model with Tesla K20x and K20 GPU Accelerators for servers, first switch the GOM mode from compute-only to All On, then switch from TCC to WDDM.

Do not attempt to specify the driver model by editing the registry. Doing so can result in compute-only GOM and WDDM being configured simultaneously, which might require a clean installation of the driver to fix.

Always use NVIDIA-provided tools to specify a processing mode or to switch between driver models. Such tools include nvidia-smi or the NVIDIA Control Panel->Manage Maximus Settings page. These tools provide warnings in the case of a conflict.

SLI Multi-OS - GPU Assignment in System Virtualization

On systems with two or more graphics cards installed, this driver supports a hypervisor's ability to directly assign GPUs to guest virtual machines (VMs). This direct assignment allows each guest VM to run on their own operating system with their own GPU and driver. The assignment allows full GPU performance and functionality in the guest VM.

Hardware Platform Requirements

To make use of GPU passthrough with virtual machines running Windows and Linux, the hardware platform must support the following features:

- ▶ A CPU with hardware-assisted instruction set virtualization: Intel VT-x or AMD-V.
- ▶ Platform support for I/O DMA remapping.

On Intel platforms the DMA remapper technology is called Intel VT-d.

On AMD platforms it is called AMD IOMMU.

Support for these feature varies by processor family, product, and system, and should be verified at the manufacturer's website.

Supported Hypervisors

The following hypervisors are supported:

Hypervisor	Notes
Citrix XenServer	Version 6.0 and later.
VMware vSphere (ESX / ESXi)	Version 5.1 and later.
Parallels Workstation Extreme	Version 4 and later

Supported Graphics Cards

The following GPUs are supported for device passthrough:

GPU Family	Boards supported
Pascal	<u>Quadro</u> : P2000, P4000, P5000, P6000, GP100
Maxwell	<u>Quadro</u> : K2200, M2000, M4000, M5000, M6000, M6000 24GB <u>Tesla</u> : M60, M6
Kepler	<u>Quadro</u> : K2000, K4000, K4200, K5000, K5200, K6000 <u>Tesla</u> : K10, K20, K20x, K20Xm, K20c, K20s, K40m, K40c, K40s, K40st, K40t, K80

GPU Family	Boards supported
Fermi	<u>Quadro</u> : 2000, 4000, 5000, 6000 <u>Quadro-MXM</u> : 1000M, 3000M <u>Tesla</u> : C2050, C2075, M2050, M2070, M2070Q

Notes and Known Issues

VMware

- PCI I/O hole may need to be changed for Windows 64-bit VMs.
Windows 64-bit VMs may require that you edit the VM configuration file to configure a larger PCI I/O hole for the GPU.
- Access Control Services is required on some switches.
Starting with ESX 5.0 Update 1, Access Control Services (ACS) is required on any switches in the PCIe hierarchy above a PCIe device that is to be used for passthrough. If ACS is not present, ESX will not allow the device to be assigned directly to a VM.
To allow assignment of devices below switches that do not support ACS, you can disable the ACS check as follows:
esxcfg-advcfg -k true disableACSCheck
- Configuring passthrough to a Windows Server 2008R2 VM.
The VMware WDDM driver must be manually installed on Windows Server 2008 R2.
Follow the steps provided at <http://communities.vmware.com/message/1423263#1425288> .
- MSI translation must be disabled for ESXi 5.1 and 5.5.
Blue-screen crashes may occur on VMs with assigned GPUs if MSI is initially enabled for passthrough devices.
To avoid this issue, disable MSI translation by setting *pciPassthru0.msiEnabled = "FALSE"* in the VM's VMX file.
Disabling MSI translation is not needed for ESXi 6.0 and later.

Citrix Xenserver

- XenServer 6.1 workaround for 64-bit MMIO failures on PCI passthrough.
Dom0 kernel may relocate GPU BARs to an invalid location immediately beyond the end of physical RAM. There are two workaround options to address this condition:
Workaround option #1: Add 'pci=use_crs' to the kernel parameters by running the following command in Dom0:
/opt/xensource/libexec/xen-cmdline --set-dom0 pci=use_crs

Workaround option #2: Install the hotfix provided by Citrix at <http://support.citrix.com/article/CTX137645>):

Changes in Version 377.83

The following sections list the important changes and the most common issues resolved since driver version 377.61.

Security Updates in this Release

For more information about NVIDIA's vulnerability management, visit the [NVIDIA Product Security](#) page.

Table 2.1 Security Updates for NVIDIA Software Vulnerabilities

CVE ID	NVIDIA Issue Number	More Information
CVE-2017-5753	2034846	Security Bulletin: NVIDIA Driver Security Updates for CPU Speculative Side Channel Vulnerabilities

Changes in Version 377.61

The following sections list the important changes and the most common issues resolved since driver version 377.55.

Changes and Fixed Issues

- ▶ This driver added security updates for driver components.

Changes in Version 377.55

The following sections list the important changes and the most common issues resolved since driver version 377.48.

Changes and Fixed Issues

- ▶ This driver added security updates for driver components.

Changes in Version 377.48

The following sections list the important changes and the most common issues resolved since driver version 377.35.

Changes and Fixed Issues

- ▶ Users may experience issues loading the Windows display driver on systems with greater than 1.75TB of system memory.
- ▶ [OpenGL][Cinema 4D]: Random driver crashes occur when running the OpenGL application.
- ▶ [3dsMax]: The benchmark viewport may hang under DirectX graphics modes.
- ▶ [Quadro P4000/P2000][AliasStudio 2017]: Errors occur when using antialiasing.

Changes in Version 377.35

The following sections list the important changes and the most common issues resolved since driver version 376.33.

Changes and Fixed Issues

- ▶ This driver adds security updates for driver components.
- ▶ [Quadro M4000 + GP100 (2 or more)][DaVinci Resolve]: The application crashes when importing media.
- ▶ Fixed a bug that can cause the GPU InfoROM to be corrupted.

Changes in Version 376.33

The following sections list the important changes and the most common issues resolved since driver version 375.86.

Changes and Fixed Issues

- ▶ This driver adds security updates for driver components.

Changes in Version 375.86

The following sections list the important changes and the most common issues resolved since driver version 375.63.

Changes and Fixed Issues

- ▶ ITU conformance stream is not being decoded correctly.

Changes in Version 375.63

The following sections list the important changes and the most common issues resolved since driver version 372.95.

Changes and Fixed Issues

- ▶ Added security updates for driver components.
- ▶ [NVIDIA Control Panel][CATIA V5/V6]: Updated application profile settings.
- ▶ [Quadro M6000][Quantum 3D Mantis]: Fixed intermittent GPU stalling when running the application.
- ▶ [Quadro M5000][Quantum 3D Mantis][Quadro Sync]: Fixed swapgroup and swapbarrier failures when running the application with Quadro Sync enabled.

Open Issues in Version 377.83

As with every released driver, version 377.83 of the Release 375 driver has open issues and enhancement requests associated with it. This section includes lists of issues that are either not fixed or not implemented in this version. Some problems listed may not have been thoroughly investigated and, in fact, may not be NVIDIA issues. Others may have workaround solutions.

Windows 10 Issues

- ▶ [Quadro P5000][Quadro Sync][Mantis]: Frame overruns occur in the application when using the QuadroSync swap group.
- ▶ [Quadro M6000][Quadro Sync]: Unexpected flashing may appear on the display connected to the second GPU.

Please consult your NVIDIA support team for details on resolving this behavior.

- ▶ [Multi-GPU Mosaic][Quadro Sync]: Application corruption and possible blue-screen crash occurs when enabling WARP while Mosaic and Quadro Sync are enabled.
- ▶ [Quadro 4000/K5000]: Rendering fails with `GL_INVALID_OPERATION` error in the draw call.

Known Product Limitations

This section describes problems that will not be fixed. Usually, the source of the problem is beyond the control of NVIDIA. Following is the list of problems and where they are discussed in this document:

- ▶ “Driver Update from 362.13 Fails if NVIDIA Control Panel Opened” on page 20
- ▶ “System Should not Enter Sleep/Hibernate Mode With SDI Capture in Progress” on page 21
- ▶ “Once Installed, the SDI Capture Driver Release Must Always Match the Graphics Driver” on page 21
- ▶ “Some APIs do not Report Total Available Graphics Memory Correctly” on page 21
- ▶ “Using HDMI/DisplayPort Audio with Displays that have a High Native Resolution” on page 23
- ▶ “Using HDMI/DisplayPort Audio in Dualview or Clone Mode Configurations” on page 23
- ▶ “GPU Runs at a High Performance Level (full clock speeds) in Multi-display Modes” on page 23
- ▶ “SLI Connector Requirement on NVIDIA Quadro SLI Cards” on page 24
- ▶ “Applying Workstation Application Profiles” on page 24

Driver Update from 362.13 Fails if NVIDIA Control Panel Opened

Issue

When updating the 362.13 driver to a newer version, the installation fails if the NVIDIA Control Panel is opened.

Resolution

To successfully update the driver, close the NVIDIA Control Panel before attempting to install the newer driver.

This issue occurs only when updating from 362.13.

System Should not Enter Sleep/Hibernate Mode With SDI Capture in Progress

SDI capture programs will become non-responsive upon resume from sleep or hibernate modes.

This is not a typical use case, so power management tests should not be performed when testing SDI.

Once Installed, the SDI Capture Driver Release Must Always Match the Graphics Driver

To use the Quadro SDI Capture card, you need to install the NVIDIA WDM driver for the Quadro SDI Capture card after installing the Quadro professional driver. The WDM driver version must be from the same branch as the installed NVIDIA graphics driver.

If at a later time you install a different Quadro professional driver version—for example, when upgrading from a Release 260 driver to a Release 265 driver—you must reinstall the WDM driver from the same driver branch as well—in this example, Release 265.

You must install the updated WDM driver even if remove the SDI Capture card and uninstall the WDM driver. Portions of the old WDM driver remain on the system, and the resulting mismatch with the updated graphics driver results in a faulty driver installation. Installing a matching WDM driver corrects this issue.

Some APIs do not Report Total Available Graphics Memory Correctly

Background-TAG Memory

In the Windows Display Driver Model (WDDM), Total Available Graphics (TAG) memory is reported as the sum of

- Dedicated Video Memory (video memory dedicated for graphics use)
- Dedicated System Memory (system memory dedicated for graphics use), and
- Shared System Memory (system memory shared between the graphics subsystem and the CPU).

The values for each of these components are computed according to WDDM guidelines when the NVIDIA Display Driver is loaded.

Issue

NVIDIA has found that some TAG-reporting APIs represent video memory using 32-bits instead of 64-bits, and consequently do not properly report available graphics memory when the TAG would otherwise exceed 4 gigabytes (GB). This results in under reporting of available memory and potentially undesirable behavior of applications that rely on these APIs to report available memory.

The reported memory can be severely reduced. For example, 6 GB might be reported as 454 MB, and 8 GB might be reported as 1259 MB.

NVIDIA Action for Some GeForce-based Systems

For GeForce GPUs with 2.75 GB or less of video memory, the NVIDIA display driver constrains TAG memory to just below 4 GB¹. In this scenario, the Shared System Memory component of TAG is limited first, before limiting Dedicated Video Memory.

This is a policy decision within the driver, and results in reliable reporting of sub-4 GB TAG memory.

When TAG Reporting Would Not Be Limited

For GeForce-based GPUs with more than 2.75 GB of video memory, as well as all Quadro and Tesla GPUs, the NVIDIA display driver does not constrain TAG memory reporting.

The disadvantage of constraining TAG on systems with larger amounts of video and system memory is that memory which otherwise would be available for graphics use is no longer available. Since shared system memory is limited first, driver components and algorithms utilizing shared system memory may suffer performance degradation when TAG is constrained.

Since these and similar scenarios are prevalent in many Workstation applications, the NVIDIA driver avoids constraining TAG on all Quadro and Tesla-based systems. Likewise, the driver does not constrain TAG for GeForce-based systems with more than 2.75 GB of video memory.

1. The WDDM guidelines dictate minimum and maximum values for the components, but the display driver may further constrain the values that are reported (within the allowed minimum and maximum).

Using HDMI/DisplayPort Audio with Displays that have a High Native Resolution

To use HDMI/DisplayPort audio with some displays that have a native resolution higher than 1920x1080, you must set the display to a lower HD resolution.

Some HDMI TV's have a native resolution that exceeds the maximum supported HD mode. For example, TVs with a native resolution of 1920x1200 exceed the maximum supported HD mode of 1920x1080.

Applying this native mode results in display overscan which cannot be resized using the NVIDIA Control Panel since the mode is not an HD mode.

To avoid this situation and provide a better user experience, the driver treats certain TVs—such as the Viewsonic VX2835wm and the Westinghouse LVM- 37w3—as a DVI monitor when applying the native mode. Because the driver does not treat the TV as an HDMI in this case, the HDMI audio is not used.

Using HDMI/DisplayPort Audio in Dualview or Clone Mode Configurations

Two Audio-enabled Ports

In a multi-display configuration where both HDMI/DisplayPort audio ports are enabled, only the primary display will provide the audio.

One Audio-enabled Port

In a multi-display configuration where only one audio port is enabled, such as when one display is a DVI display, then the HDMI/DisplayPort display can provide the audio whether is it the primary or secondary display.

GPU Runs at a High Performance Level (full clock speeds) in Multi-display Modes

This is a hardware limitation and not a software bug. Even when no 3D programs are running, the driver will operate the GPU at a high performance level in order to efficiently drive multiple displays. In the case of SLI or multi-GPU PCs, the second GPU will always operate with full clock speeds; again, in order to efficiently drive multiple displays. Today, all hardware from all GPU vendors have this limitation.

SLI Connector Requirement on NVIDIA Quadro SLI Cards

The SLI connector that links two SLI cards is needed for proper SLI operation. However, the connector can be removed if you do not intend to enable SLI mode. If you remove the connector, then you must make sure that SLI mode is disabled from the NVIDIA control panel. Enabling SLI mode without the SLI connector installed will result in video corruption.

Applying Workstation Application Profiles

► Background

The workstation application profiles are software settings used by the NVIDIA Display Drivers to provide optimum performance when using a selected application. The profile also works around known application issues and bugs.

If there is an available setting for an application, it should be used, otherwise incorrect behavior or reduced performance is likely to occur.

► Issues

Configuration changes require that you restart the application.

Once an application is running, it does not receive notification of configuration changes. Therefore, if you change the configuration while the application is running, you must exit and restart the application for the configuration changes to take effect.

03 THE RELEASE 375 DRIVER

This chapter covers the following main topics:

- ▶ “Hardware and Software Support” on page 25
- ▶ “Driver Installation” on page 34

Hardware and Software Support

Supported Operating Systems

The Release 375 driver, version 377.83, has been tested with

- ▶ Microsoft Windows® 10 32-bit
- ▶ Microsoft Windows® 10 64-bit
- ▶ Microsoft Windows® 10 Anniversary Update 32-bit
- ▶ Microsoft Windows® 10 Anniversary Update 64-bit

Supported NVIDIA Products

The following tables list the NVIDIA products supported by the Release 375 driver, version 377.83.

- ▶ Table 3.1, “Supported NVIDIA Quadro & NVS Products” on page 26
- ▶ Table 3.2, “Supported NVIDIA Quadro Sync II Products” on page 28
- ▶ Table 3.3, “Supported NVIDIA Quadro Sync Products” on page 28
- ▶ Table 3.4, “Supported NVIDIA Quadro G-Sync II Products” on page 28
- ▶ Table 3.5, “Supported NVIDIA Quadro Plex Products” on page 29
- ▶ Table 3.6, “Supported NVIDIA Quadro Blade/Embedded Graphics Board Series” on page 29
- ▶ Table 3.7, “Supported NVIDIA Tesla Products” on page 30

NVIDIA Quadro & NVS Product

Table 3.1 Supported NVIDIA Quadro & NVS Products

Product	GPU Architecture
NVIDIA Quadro GP100	Pascal
NVIDIA Quadro P6000	Pascal
NVIDIA Quadro P5000	Pascal
NVIDIA Quadro P4000	Pascal
NVIDIA Quadro P2000	Pascal
NVIDIA Quadro P1000	Pascal
NVIDIA Quadro P600	Pascal
NVIDIA Quadro P400	Pascal
NVIDIA Quadro M6000 24GB	Maxwell
NVIDIA Quadro M6000	Maxwell
NVIDIA Quadro M5000	Maxwell
NVIDIA Quadro M4000	Maxwell
NVIDIA Quadro M2000	Maxwell
NVIDIA Quadro K6000	Kepler
NVIDIA Quadro K5200	Kepler
NVIDIA Quadro K5000	Kepler
NVIDIA Quadro K4200	Kepler
NVIDIA Quadro K4000	Kepler
NVIDIA Quadro K2200	Maxwell
NVIDIA Quadro K2000	Kepler
NVIDIA Quadro K1200	Maxwell

Table 3.1 Supported NVIDIA Quadro & NVS Products (continued)

Product	GPU Architecture
NVIDIA Quadro K620	Maxwell
NVIDIA Quadro K600	Kepler
NVIDIA Quadro K420	Kepler
NVIDIA Quadro 6000	Fermi
NVIDIA Quadro 5000	Fermi
NVIDIA Quadro 4000	Fermi
NVIDIA Quadro 2000D	Fermi
NVIDIA Quadro 2000	Fermi
NVIDIA Quadro 600	Fermi
NVIDIA Quadro 410	Fermi
NVIDIA NVS 810	Maxwell
NVIDIA NVS 510	Kepler
NVIDIA NVS 315	Fermi
NVIDIA NVS 310	Fermi

NVIDIA Quadro Sync II Products

Table 3.2 Supported NVIDIA Quadro Sync II Products

Product	GPU Architecture
NVIDIA Quadro GP100	Pascal
NVIDIA Quadro P6000	Pascal
NVIDIA Quadro P5000	Pascal
NVIDIA Quadro P4000	Pascal

NVIDIA Quadro Sync Products

Table 3.3 Supported NVIDIA Quadro Sync Products

Product	GPU Architecture
NVIDIA Quadro M6000 24GB	Maxwell
NVIDIA Quadro M6000	Maxwell
NVIDIA Quadro M5000	Maxwell
NVIDIA Quadro M4000	Maxwell
NVIDIA Quadro K6000	Kepler
NVIDIA Quadro K5200	Kepler
NVIDIA Quadro K5000	Kepler
NVIDIA Quadro K4200	Kepler

NVIDIA Quadro G-Sync II Products

Table 3.4 Supported NVIDIA Quadro G-Sync II Products

Product	GPU Architecture
NVIDIA Quadro 6000	Fermi
NVIDIA Quadro 5000	Fermi

NVIDIA Quadro Plex Products

Table 3.5 Supported NVIDIA Quadro Plex Products

Product	GPU Architecture
NVIDIA Quadro Plex 7000	Fermi

NVIDIA Quadro Blade/Embedded Graphics Board

Table 3.6 Supported NVIDIA Quadro Blade/Embedded Graphics Board Series

Product	GPU Architecture
NVIDIA Quadro M5000 SE	Maxwell
NVIDIA Quadro M3000 SE	Maxwell
NVIDIA Quadro K3100M	Kepler
NVIDIA Quadro 4000M	Fermi
NVIDIA Quadro 3000M	Fermi
NVIDIA Quadro 1000M	Fermi
NVIDIA Quadro 500M	Fermi

NVIDIA Tesla Products

The Tesla driver package is designed for systems that have one or more Tesla products installed.

- ▶ Only one GHIC can be connected to the server in a Tesla system.
- ▶ This release of the Tesla driver supports CUDA C/C++ applications and libraries that rely on the CUDA C Runtime and/or CUDA Driver API.

Table 3.7 Supported NVIDIA Tesla Products

Product	GPU Architecture	Notes
Tesla P-Series Products		
NVIDIA Tesla P100	Pascal	
NVIDIA Tesla P40	Pascal	
NVIDIA Tesla P4	Pascal	
Tesla M-Series Products		
NVIDIA Tesla M60	Maxwell	
NVIDIA Tesla M40	Maxwell	
NVIDIA Tesla M6	Maxwell	
NVIDIA Tesla M4	Maxwell	
Tesla K-Series Products		
NVIDIA Tesla K80	Kepler	64-bit OS only
NVIDIA Tesla K40(m/c/s/st/t)	Kepler	64-bit OS only
NVIDIA Tesla K20(x/c/m/Xm/s)	Kepler	64-bit OS only
NVIDIA Tesla K10	Kepler	
Tesla S-Class Products		
NVIDIA Tesla S2050	Fermi	
Tesla M-Class Products		
NVIDIA Tesla M2090	Fermi	
NVIDIA Tesla M2075	Fermi	
NVIDIA Tesla M2070	Fermi	
NVIDIA Tesla M2070Q	Fermi	
NVIDIA Tesla M2050	Fermi	
Tesla C-Class Products		
NVIDIA Tesla C2075	Fermi	
NVIDIA Tesla C2070	Fermi	
NVIDIA Tesla C2050	Fermi	

Supported NVIDIA Notebook Products

The notebook driver is part of the NVIDIA Verde Notebook Driver Program, and can be installed on supported NVIDIA notebook GPUs. However, please note that your notebook original equipment manufacturer (OEM) provides certified drivers for your specific notebook on their website. NVIDIA recommends that you check with your notebook OEM about recommended software updates for your notebook. OEMs may not provide technical support for issues that arise from the use of this driver.

The following tables list the NVIDIA notebook products supported by the Release 375 driver, version 377.83:

Table 3.8 Supported NVIDIA NVS and Quadro NVS Notebook GPUs

Quadro Notebook Products	GPU Architecture
NVS 5400M	Fermi
NVS 5200M	Fermi
NVS 4200M	Fermi

Table 3.9 Supported NVIDIA Quadro M Notebook GPUs

Consumer Products	GPU Architecture
Quadro M5500	Maxwell
Quadro M5000M	Maxwell
Quadro M4000M	Maxwell
Quadro M3000M	Maxwell
Quadro M2000M	Maxwell
Quadro M1000M	Maxwell
Quadro M600M	Maxwell
Quadro M500M	Maxwell

Table 3.9 Supported NVIDIA Quadro M Notebook GPUs

Consumer Products	GPU Architecture
Quadro K5000M	Kepler
Quadro K5100M	Kepler
Quadro K4000M	Kepler
Quadro K4100M	Kepler
Quadro K3000M	Kepler
Quadro K3100M	Kepler
Quadro K2000M	Kepler
Quadro K2200M	Maxwell
Quadro K2100M	Kepler
Quadro K1000M	Kepler
Quadro K1100M	Kepler
Quadro K620M	Maxwell
Quadro K610M	Kepler
Quadro K510M	Kepler
Quadro K500M	Kepler
Quadro 5010M	Fermi
Quadro 5000M	Fermi
Quadro 4000M	Fermi
Quadro 3000M	Fermi
Quadro 2000M	Fermi
Quadro 1000M	Fermi

Supported Languages

The Release 375 Graphics Drivers supports the following languages in the main driver Control Panel:

English (USA)	German	Portuguese (Euro/ Iberian)
English (UK)	Greek	Russian
Arabic	Hebrew	Slovak
Chinese (Simplified)	Hungarian	Slovenian
Chinese (Traditional)	Italian	Spanish
Czech	Japanese	Spanish (Latin America)
Danish	Korean	Swedish
Dutch	Norwegian	Thai
Finnish	Polish	Turkish
French	Portuguese (Brazil)	

Driver Installation

Minimum Hard Disk Space

The hard disk space requirement for international is minimum 1158 MB.

The hard disk space requirement for English-only is minimum 570 MB.

Before You Begin

nTune

If you have previously installed NVIDIA nTune, NVIDIA recommends that you uninstall nTune before installing this driver. After the driver install is complete, you can reinstall NVIDIA nTune.

Notebooks

- ▶ Check to make sure that your notebook has a supported GPU (see [“Supported NVIDIA Notebook Products”](#) on page 31).
- ▶ It is recommended that you back up your current system configuration.
- ▶ If you own a Dell Inspiron 1420, Dell XPS M1330, or Dell XPS M1530, or Dell LatitudeD630 or D630c, it is highly recommended that you first install this [Dell software update](#).

SLI Mosaic Mode

You must make sure SLI Mosaic mode is disabled before installing a new driver over a previously installed driver. If SLI Mosaic mode is active on your displays when you install the new driver, the driver will not install properly.

Installation Instructions

- 1 Follow the instructions on the NVIDIA .com Web site driver download page to locate the appropriate driver to download, based on your hardware and operating system.
- 2 Click the driver download link.
The license agreement dialog box appears.
- 3 Click **Accept** if you accept the terms of the agreement, then either open the file or save the file to your PC and open it later.
- 4 Open the NVIDIA driver installation .EXE file to launch the NVIDIA InstallShield Wizard.

- 5 Follow the instructions in the NVIDIA InstallShield Wizard to complete the installation.



Note: If you are overinstalling the driver (installing over a previous driver without first removing the previous driver), then you must reboot your computer in order to complete the installation.

APPENDIX A MODE SUPPORT FOR WINDOWS

This chapter details the Windows modes supported by the Release 375 driver for NVIDIA products. It contains these sections:

- ▶ “General Mode Support Information” on page 37
- ▶ “Default Modes Supported by GPU” on page 38

General Mode Support Information

The NVIDIA graphics driver includes a standard list of display modes that are supported by default. These modes are listed in the section “Default Modes Supported by GPU” on page 38.

The actual modes available depend on the capabilities of the display. In addition, the NVIDIA graphics driver has a “dynamic EDID detection” capability and will make available *additional* modes that are listed in the display EDID, provided the graphics hardware can support it.

The NVIDIA graphics driver also supports the high resolutions available with the displays listed in [Table A.1](#) as well as the non-standard modes listed in [Table A.2](#).

Table A.1 Modes Supported for High Resolution Displays

Display	Maximum Resolution
Apple 30" Cinema HD Display (Dual link DVI)	2560x1600 @ 60 Hz
Dell WFP 3007 (Dual Link DVI)	2560x1600 @ 60 Hz
HP LP3065 dual-link DVI flat panel	2560x1600 @ 60Hz.

Table A.2 Non-standard Modes Supported

Resolution		
1680 x 1050		
1366 x 768		

Default Modes Supported by GPU

This section lists the modes that are included by default in the driver INF for the following product families:

- ▶ “Tesla, Quadro, & NVS GPUs” on page 39
- ▶ “Quadro Notebook GPUs” on page 41

Understanding the Mode Format

Figure A.1 gives an example of how to read the mode information presented in this section.

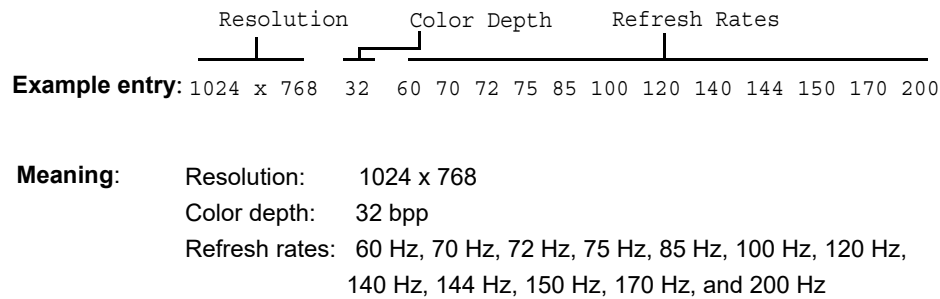


Figure A.1 Mode Format

Note:

- Horizontal spanning modes of 3840x1080 and above, and vertical spanning modes of 1920x2160 and above generally require at least 32 MB of video memory at 32 bpp.
- An “i” next to the refresh rate indicates an interlaced refresh rate.

Tesla, Quadro, & NVS GPUs

This sections lists the supported display resolutions, color depths, and refresh rates for the products listed in [“Supported NVIDIA Products”](#) on page 26.

Standard Modes

640 x 480	8	60 70 72 75 85 100 120 140 144 150 170 200 240
720 x 480	8	60
720 x 576	8	50
800 x 600	8	60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x 768	8	60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x 864	8	60 70 72 75 85 100 120 140 144 150 170 200
1280 x 720	8	60
1280 x 768	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 800	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 960	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 1024	8	60 70 72 75 85 100 120 140 144 150 170
1360 x 768	8	60 70 72 75 85 100 120 140 144 150 170
1600 x 900	8	60 70 72 75 85 100 120 140 144 150
1600 x 1024	8	60 70 72 75 85 100 120
1600 x 1200	8	60 70 72 75 85 100 120
1680 x 1050	8	60
1920 x 1080	8	60
1920 x 1200	8	60 70 72 75 85 100
1920 x 1440	8	60 70 72 75 85
2048 x 1536	8	60

640 x 480	16	60 70 72 75 85 100 120 140 144 150 170 200 240
720 x 480	16	60
720 x 576	16	50
800 x 600	16	60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x 768	16	60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x 864	16	60 70 72 75 85 100 120 140 144 150 170 200
1280 x 720	16	60
1280 x 768	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 800	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 960	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 1024	16	60 70 72 75 85 100 120 140 144 150 170
1360 x 768	16	60 70 72 75 85 100 120 140 144 150 170
1600 x 900	16	60 70 72 75 85 100 120 140 144 150
1600 x 1024	16	60 70 72 75 85 100 120
1600 x 1200	16	60 70 72 75 85 100 120
1680 x 1050	16	60
1920 x 1080	16	60
1920 x 1200	16	60 70 72 75 85 100

1920 x 1440	16	60 70 72 75 85
2048 x 1536	16	60

640 x 480	32	60 70 72 75 85 100 120 140 144 150 170 200 240
720 x 480	32	60
720 x 576	32	50
800 x 600	32	60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x 768	32	60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x 864	32	60 70 72 75 85 100 120 140 144 150 170 200
1280 x 720	32	60
1280 x 768	32	60 70 72 75 85 100 120 140 144 150 170
1280 x 800	32	60 70 72 75 85 100 120 140 144 150 170
1280 x 960	32	60 70 72 75 85 100 120 140 144 150 170
1280 x 1024	32	60 70 72 75 85 100 120 140 144 150 170
1360 x 768	32	60 70 72 75 85 100 120 140 144 150 170
1600 x 900	32	60 70 72 75 85 100 120 140 144 150
1600 x 1024	32	60 70 72 75 85 100 120
1600 x 1200	32	60 70 72 75 85 100 120
1680 x 1050	32	60
1920 x 1080	32	60
1920 x 1200	32	60 70 72 75 85 100
1920 x 1440	32	60 70 72 75 85
2048 x 1536	32	60

Quadro Notebook GPUs

This sections lists the supported display resolutions, color depths, and refresh rates for the products listed in [“Supported NVIDIA Notebook Products”](#) on page 31.

Standard Modes

640 x 480	8	60 70 72 75 85 100 120 140 144 150 170 200 240
720 x 480	8	60
720 x 576	8	50
800 x 600	8	60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x 768	8	60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x 864	8	60 70 72 75 85 100 120 140 144 150 170 200
1280 x 720	8	60
1280 x 768	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 800	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 960	8	60 70 72 75 85 100 120 140 144 150 170
1280 x 1024	8	60 70 72 75 85 100 120 140 144 150 170
1360 x 768	8	60 70 72 75 85 100 120 140 144 150 170
1600 x 900	8	60 70 72 75 85 100 120 140 144 150
1600 x 1024	8	60 70 72 75 85 100 120
1600 x 1200	8	60 70 72 75 85 100 120
1680 x 1050	8	60
1920 x 1080	8	60
1920 x 1200	8	60 70 72 75 85 100
1920 x 1440	8	60 70 72 75 85
2048 x 1536	8	60

640 x 480	16	60 70 72 75 85 100 120 140 144 150 170 200 240
720 x 480	16	60
720 x 576	16	50
800 x 600	16	60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x 768	16	60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x 864	16	60 70 72 75 85 100 120 140 144 150 170 200
1280 x 720	16	60
1280 x 768	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 800	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 960	16	60 70 72 75 85 100 120 140 144 150 170
1280 x 1024	16	60 70 72 75 85 100 120 140 144 150 170
1360 x 768	16	60 70 72 75 85 100 120 140 144 150 170
1600 x 900	16	60 70 72 75 85 100 120 140 144 150
1600 x 1024	16	60 70 72 75 85 100 120
1600 x 1200	16	60 70 72 75 85 100 120
1680 x 1050	16	60
1920 x 1080	16	60
1920 x 1200	16	60 70 72 75 85 100

```

1920 x 1440 16      60 70 72 75 85
2048 x 1536 16      60
-----
 640 x  480 32      60 70 72 75 85 100 120 140 144 150 170 200 240
 720 x  480 32      60
 720 x  576 32      50
 800 x  600 32      60 70 72 75 85 100 120 140 144 150 170 200 240
1024 x  768 32      60 70 72 75 85 100 120 140 144 150 170 200 240
1152 x  864 32      60 70 72 75 85 100 120 140 144 150 170 200
1280 x  720 32      60
1280 x  768 32      60 70 72 75 85 100 120 140 144 150 170
1280 x  800 32      60 70 72 75 85 100 120 140 144 150 170
1280 x  960 32      60 70 72 75 85 100 120 140 144 150 170
1280 x 1024 32      60 70 72 75 85 100 120 140 144 150 170
1360 x  768 32      60 70 72 75 85 100 120 140 144 150 170
1600 x  900 32      60 70 72 75 85 100 120 140 144 150
1600 x 1024 32      60 70 72 75 85 100 120
1600 x 1200 32      60 70 72 75 85 100 120
1680 x 1050 32      60
1920 x 1080 32      60
1920 x 1200 32      60 70 72 75 85 100
1920 x 1440 32      60 70 72 75 85
2048 x 1536 32      60
-----

```

APPENDIX B NVIDIA TESLA COMPUTE CLUSTER MODE

This chapter describes the Tesla Compute Cluster (TCC) mode.

- ▶ “About Tesla Compute Cluster Mode” on page 43
- ▶ “Operating on Systems with non-TCC NVIDIA GPUs” on page 45
- ▶ “Setting TCC Mode” on page 45

About Tesla Compute Cluster Mode

TCC Overview

Tesla Compute Cluster (TCC) mode is designed for compute cluster nodes that have one or more Tesla or Quadro products installed.

Benefits

- ▶ TCC drivers make it possible to use NVIDIA GPUs in nodes with non-NVIDIA integrated graphics.
- ▶ NVIDIA GPUs on systems running the TCC drivers will be available via Remote Desktop, both directly and via cluster management systems that rely on Remote Desktop.
- ▶ NVIDIA GPUs will be available to applications running as a Windows service (i.e. in Session 0) on systems running the Tesla/Quadro driver in TCC mode.

TCC Does not Support Graphics Acceleration

- ▶ TCC mode does not provide CUDA–DirectX/OpenGL interoperability. It is a “non-display” driver, and NVIDIA GPUs using this driver will not support DirectX or OpenGL hardware acceleration.

Running CUDA Applications

- ▶ This release of the Tesla driver supports CUDA C/C++ applications and libraries that rely on the CUDA C Runtime and/or CUDA Driver API.
- ▶ NVIDIA GPUs running the Tesla driver in TCC mode will be available for CUDA applications running via services or Remote Desktop.
- ▶ In this release, all GPUs will be in compute exclusive mode. As a result, only one CUDA context may exist on a particular device at a time.
- ▶ SDK applications that use graphics will not run properly under TCC mode. The following are examples of CUDA SDK applications that are not supported:

bicubicTexture	boxFilter	cudaDecodeD3D9	smokeParticles
cudaDecodeGL	fluidsD3D9	fluidsGL	SobelFilter
imageDenoising	Mandelbrot	marchingCubes	volumeRender
nbody	oceanFFT	particles	
postProcessGL	recursiveGaussian	simpleD3D10	
simpleD3D10Texture	simpleD3D11Texture	simpleD3D9	
simpleD3D9Texture	simpleGL	simpleTexture3D	

Operating on Systems with non-TCC NVIDIA GPUs

- ▶ NVIDIA GPUs running under TCC mode may coexist with other display devices.
- ▶ The Tesla driver is overinstalled over any NVIDIA display driver in the system—the NVIDIA Tesla/Quadro driver then becomes the only driver for all NVIDIA GPUs in the system.
If the Tesla/Quadro driver is uninstalled at a later time, the previous driver is not restored.
- ▶ NVIDIA GPUs that do not support TCC mode will appear as “VGA adapters” in the Windows Device Manager and can be used to drive displays.
Non-supported NVIDIA GPUs can still function as CUDA devices, but the GPU’s graphics functionality is not available to applications.

Setting TCC Mode

To change the TCC mode, use the NVIDIA **smi** utility as follows:

```
nvidia-smi -g (GPU ID) -dm (0 for WDDM, 1 for TCC)
```

The following table shows the default TCC/non-TCC mode for supported products.

Table B.1 Default TCC Mode

Product	Default Mode
K20Xm/c	TCC
K20m	TCC Off
C2075	TCC
C2050	TCC Off
C2070	TCC Off
S2050	TCC
M2050	TCC
M2070	TCC
M2075	TCC
M2070-Q	TCC Off
M2090	TCC
Quadro (Kepler/Maxwell)	TCC Off

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