



Release 375 Quadro, NVS, Tesla, & Notebook Drivers - Version 377.61

RN-07954-377.61_v01 | September 25, 2017
Windows 7, Windows 8, & Windows 8.1

Release Notes



TABLE OF CONTENTS

1	Introduction to Release Notes	1
	Structure of the Document	1
	Changes in this Edition	1
2	Release 375 Driver Changes	2
	Version 377.61 Highlights	3
	Existing Support	3
	What's New in Version 377.61	3
	What's New in Release 375	3
	Discontinued and Unsupported Features in this Release	4
	Advanced Instructions for this Release	5
	Turning Off V-Sync to Boost Performance	5
	NVIDIA Application Configuration Engine (ACE)	5
	Using the WDDM Driver Model with Tesla GPU GOMs	6
	SLI Multi-OS - GPU Assignment in System Virtualization	8
	Changes in Version 377.55	11
	Windows 7/Windows 8 Changes and Fixed Issues	11
	Changes in Version 377.48	12
	Windows 7/Windows 8 Changes and Fixed Issues	12
	Changes in Version 377.35	13
	Windows 7/Windows 8 Changes and Fixed Issues	13
	Changes in Version 376.33	14
	Windows 7/Windows 8 Changes and Fixed Issues	14
	Changes in Version 375.86	15
	Windows 7/Windows 8 Changes and Fixed Issues	15
	Changes in Version 375.63	16
	Windows 7/Windows 8 Changes and Fixed Issues	16
	Open Issues in Version 377.61	17
	Windows 7 Issues	17
	Windows 8 Issues	17
	Issues Not Caused by NVIDIA Drivers	18
	Windows 7 Considerations	18
	Issues	18

TABLE OF CONTENTS

Known Product Limitations	19
System Should not Enter Sleep/Hibernate Mode With SDI Capture in Progress	19
Once Installed, the SDI Capture Driver Release Must Always Match the Graphics Driver	20
Some APIs do not Report Total Available Graphics Memory Correctly ..	20
Using HDMI/DisplayPort Audio with Displays that have a High Native Resolution	21
Using HDMI/DisplayPort Audio in Dualview or Clone Mode Configurations	22
GPU Runs at a High Performance Level (full clock speeds) in Multi-display Modes	22
Aero Must be Enabled for Windowed SLI AFR Mode Under Vista	22
SLI Connector Requirement on NVIDIA Quadro SLI Cards	22
Applying Workstation Application Profiles	23
3 The Release 375 Driver	24
Hardware and Software Support	24
Supported Operating Systems	24
Supported NVIDIA Products	25
Supported NVIDIA Notebook Products	30
Supported Languages	32
Driver Installation	33
Minimum Hard Disk Space	33
Before You Begin	33
Installation Instructions	33
Appendix A: Mode Support for Windows	35
General Mode Support Information	36
Default Modes Supported by GPU	37
Understanding the Mode Format	37
Quadro, & NVS GPUs	38
Quadro Notebook GPUs	40
Appendix B: NVIDIA Tesla Compute Cluster Mode	42
About Tesla Compute Cluster Mode	42
TCC Overview	42

Running CUDA Applications.....	43
Operating on Systems with non-TCC NVIDIA GPUs	44
Setting TCC Mode	44

LIST OF TABLES

Table 1	GOM and Driver Model Compatibility	7
Table 3.1	Supported NVIDIA Quadro & NVS Products	25
Table 3.2	Supported NVIDIA Quadro Sync II Products	26
Table 3.3	Supported NVIDIA Quadro Sync Products	27
Table 3.4	Supported NVIDIA Quadro G-Sync II Products	27
Table 3.5	Supported NVIDIA Quadro SDI Products	28
Table 3.6	Supported NVIDIA Quadro Plex Products.....	28
Table 3.7	Supported NVIDIA Quadro Blade/Embedded Graphics Board Series.....	28
Table 3.8	Supported NVIDIA Tesla Products	29
Table 3.9	NVIDIA NVS and Quadro NVS Notebook GPU Support	30
Table 3.10	Supported NVIDIA Quadro M and Quadro FX M GPUs	30
Table A.1	Modes Supported for High Resolution Displays	36
Table A.2	Non-standard Modes Supported.....	36
Table B.1	Default TCC Mode	44

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® 7 and later¹. 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 24 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 35 lists the default resolutions supported by the driver.
- ▶ “[NVIDIA Tesla Compute Cluster Mode](#)” on page 42 describes the Tesla Compute Cluster mode.

Changes in this Edition

This edition of the *Release Notes* for Windows 7 and later includes information about NVIDIA graphics driver version 377.61, and lists changes made to the driver since version 373.06. These changes are discussed beginning with the chapter “[Release 375 Driver Changes](#)” on page 2.

1. Includes Windows 7, Windows 8, and Windows 8.1.

02 RELEASE 375 DRIVER CHANGES

This chapter describes open issues for version 377.61, and resolved issues and driver enhancements for versions of the Release 375 driver up to version 377.61. The chapter contains these sections:

- ▶ “Version 377.61 Highlights” on page 3
- ▶ “Advanced Instructions for this Release” on page 5
- ▶ “Changes in Version 377.55” on page 11
- ▶ “Changes in Version 377.48” on page 12
- ▶ “Changes in Version 377.35” on page 13
- ▶ “Changes in Version 376.33” on page 14
- ▶ “Changes in Version 375.86” on page 15
- ▶ “Changes in Version 375.63” on page 16
- ▶ “Open Issues in Version 377.61” on page 17
- ▶ “Issues Not Caused by NVIDIA Drivers” on page 18
- ▶ “Known Product Limitations” on page 19

Version 377.61 Highlights

This section provides highlights of version 377.61 of the NVIDIA Release 375 Driver for Windows 7 and later.

- ▶ Existing Support
- ▶ What's New in Version 377.61
- ▶ What's New in Release 375
- ▶ Discontinued and Unsupported Features in this Release
- ▶ Limitations 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 11
 - CUDA 8.0
- ▶ This driver installs **nView Desktop Manager** version 148.47.

What's New in Version 377.61

- ▶ This driver adds security updates for driver components.
- ▶ See also “What's New in Release 375” on page 3.

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.

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.

Limitations in This Release

The following features are not currently supported or have limited support in this driver release:

- ▶ **Video Memory Support**
For Windows 7 64-bit, this driver recognizes up to the total available video memory on Quadro cards for Direct3D and OpenGL applications.
For Windows 7 32-bit, this driver recognizes only up to 4 GB of video memory on Quadro cards for DirectX, OpenGL, and CUDA applications.

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

GPU Family	Boards supported
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
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 377.55

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

Windows 7/Windows 8 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.

Windows 7/Windows 8 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.

Changes in Version 377.35

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

Windows 7/Windows 8 Changes and Fixed Issues

- ▶ This driver adds security updates for driver components.
- ▶ [Quadro P2000 (3 or more)]: The system takes a long time to boot up.
- ▶ 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.

Windows 7/Windows 8 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.

Windows 7/Windows 8 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 373.06.

Windows 7/Windows 8 Changes and Fixed Issues

- ▶ [NVIDIA Control Panel][CATIA V5/V6]: Updated application profile settings.
- ▶ [Quandro M6000][Quantum 3D Mantis]: Fixed intermittent GPU stalling when running the application.
- ▶ [Quandro M5000][Quantum 3D Mantis][Quadro Sync]: Fixed swapgroup and swapbarrier failures when running the application with Quadro Sync enabled.
- ▶ [IC.IDO][VR]: Fixed “Error code 8” crash that occurred when running the application on VR hardware.

Open Issues in Version 377.61

As with every released driver, version 377.61 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 7 Issues

- ▶ [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.
- ▶ [Quadro Sync][Quadro K5000]: Performance drop occurs when using Quadro Sync.
- ▶ [Quadro Sync]: Frame overruns occur on low resolution channels when using Quadro Sync swap synchronization.
- ▶ [Quadro 4000/K5000]: Rendering fails with `GL_INVALID_OPERATION` error in the draw call.
- ▶ [Quadro][Eyeon Fusion]: With Aero/desktop compositing and Quad-buffer stereo enabled, the application child windows flicker.

Windows 8 Issues

- ▶ [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.
- ▶ [Quadro Sync][Quadro K5000]: Performance drop occurs when using Quadro Sync.
- ▶ [Quadro 4000/K5000]: Rendering fails with `GL_INVALID_OPERATION` error in the draw call.

Issues Not Caused by NVIDIA Drivers

This section lists issues that are not due to the NVIDIA driver as well as features that are not meant to be supported by the NVIDIA driver for Windows 7.

- ▶ “Windows 7 Considerations” on page 18
- ▶ “Issues” on page 18

Windows 7 Considerations

Windows DWM Disabled for SLI Mosaic Mode

Due to compatibility issues, when using SLI Mosaic mode the driver turns off the Windows 7 Desktop Window Manager (DWM). As a result, DWM-managed desktop features such as Windows Aero or Windows Flip 3D will not be available.

Limitation

- ▶ When switching the refresh rate from 59 Hz to 60Hz, the refresh rate remains at 59 Hz.
See the Microsoft KB article KB2006076 at <http://support.microsoft.com/kb/2006076>.

Issues

- ▶ [Quadro K2200][Bunkspeed Shot 2014]: Render Argument exception occurs in Accurate Mode, and Internal Rendering Error occurs with Fast Mode.
Quadro K2200/K60 are not supported by Bunkspeed software.
- ▶ Quadro 6000: OpenCL/OpenGL interoperability performance suffers with `clEnqueueReleaseGLObjects`.
To avoid this issue, use CUDA.
- ▶ The Windows Vista display mode switches from Aeroglass to Basic when a quad-buffer for stereo is created.
Quad-buffered windowed stereo is only supported with Aeroglass turned off.

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:

- ▶ “System Should not Enter Sleep/Hibernate Mode With SDI Capture in Progress” on page 19
- ▶ “Once Installed, the SDI Capture Driver Release Must Always Match the Graphics Driver” on page 20
- ▶ “Some APIs do not Report Total Available Graphics Memory Correctly” on page 20
- ▶ “Using HDMI/DisplayPort Audio with Displays that have a High Native Resolution” on page 21
- ▶ “Using HDMI/DisplayPort Audio in Dualview or Clone Mode Configurations” on page 22
- ▶ “GPU Runs at a High Performance Level (full clock speeds) in Multi-display Modes” on page 22
- ▶ “Aero Must be Enabled for Windowed SLI AFR Mode Under Vista” on page 22
- ▶ “SLI Connector Requirement on NVIDIA Quadro SLI Cards” on page 22
- ▶ “Applying Workstation Application Profiles” on page 23

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 you 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.

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.

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 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.

Aero Must be Enabled for Windowed SLI AFR Mode Under Vista

Windows 7 Aero must be enabled in order to achieve SLI acceleration using windowed AFR mode.

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 24
- ▶ “Driver Installation” on page 33

Hardware and Software Support

Supported Operating Systems

The Release 375 driver, version 377.61, has been tested with

- ▶ Microsoft Windows® 8.1, and supports both 32-bit and 64-bit versions.
- ▶ Microsoft Windows® 8, and supports both 32-bit and 64-bit versions.
- ▶ Microsoft Windows® 7, and supports both 32-bit and 64-bit versions.

Supported NVIDIA Products

The following tables list the NVIDIA products supported by the Release 375 driver, version 377.61.

- ▶ Table 3.1, “Supported NVIDIA Quadro & NVS Products” on page 25
- ▶ Table 3.2, “Supported NVIDIA Quadro Sync II Products” on page 26
- ▶ Table 3.3, “Supported NVIDIA Quadro Sync Products” on page 27
- ▶ Table 3.4, “Supported NVIDIA Quadro G-Sync II Products” on page 27
- ▶ Table 3.5, “Supported NVIDIA Quadro SDI Products” on page 28
- ▶ Table 3.6, “Supported NVIDIA Quadro Plex Products” on page 28
- ▶ Table 3.7, “Supported NVIDIA Quadro Blade/Embedded Graphics Board Series” on page 28
- ▶ Table 3.8, “Supported NVIDIA Tesla Products” on page 29

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

Table 3.1 Supported NVIDIA Quadro & NVS Products (continued)

Product	GPU Architecture
NVIDIA Quadro K1200	Maxwell
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 SDI Products

Table 3.5 Supported NVIDIA Quadro SDI Products

Product	GPU Architecture
NVIDIA Quadro K6000	Kepler
NVIDIA Quadro K5200	Kepler
NVIDIA Quadro K5000	Kepler
NVIDIA Quadro K4200	Kepler
NVIDIA Quadro K4000	Kepler
NVIDIA Quadro 6000	Fermi
NVIDIA Quadro 5000	Fermi
NVIDIA Quadro 4000	Fermi



Note: Quadro SDI products are not supported under Windows 8.

NVIDIA Quadro Plex Products

Table 3.6 Supported NVIDIA Quadro Plex Products

Product	GPU Architecture
NVIDIA Quadro Plex 7000	Fermi

NVIDIA Quadro Blade/Embedded Graphics Board

Table 3.7 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 3.8 Supported NVIDIA Tesla Products

Product	GPU Architecture	Notes
Tesla P-Series Products		
NVIDIA Tesla P100	Pascal	
NVIDIA Tesla P40	Pascal	
NVIDIA Tesla P46	Pascal	
Tesla M-Series Products		
NVIDIA Tesla M60	Maxwell	
NVIDIA Tesla M6	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 377.61:

Table 3.9 NVIDIA NVS and Quadro NVS Notebook GPU Support

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

Table 3.10 Supported NVIDIA Quadro M and Quadro FX M 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 3.10 Supported NVIDIA Quadro M and Quadro FX M 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 30).
- ▶ 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 36
- ▶ “Default Modes Supported by GPU” on page 37

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 37.

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:

- ▶ “Quadro, & NVS GPUs” on page 38
- ▶ “Quadro Notebook GPUs” on page 40

Understanding the Mode Format

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

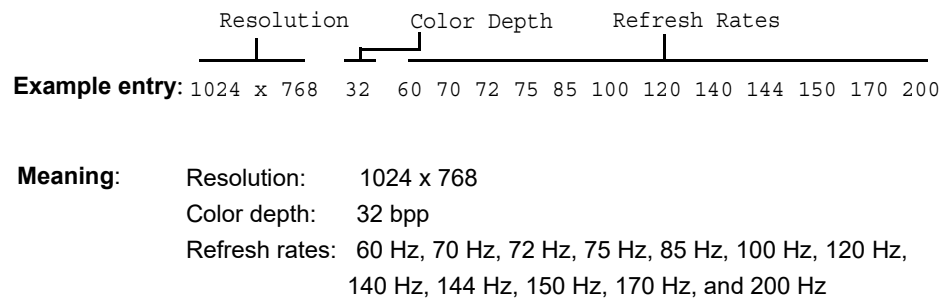


Figure A.1 Mode Format

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.

Quadro, & NVS GPUs

This section lists the supported display resolutions, color depths, and refresh rates for the products listed in [“Supported NVIDIA Products”](#) on page 25.

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 30.

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 42
- ▶ “Operating on Systems with non-TCC NVIDIA GPUs” on page 44
- ▶ “Setting TCC Mode” on page 44

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 supported 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 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/Quadro 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/Quadro 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/Quadro driver is overinstalled over any NVIDIA display driver in the system—the NVIDIA Tesla 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

Notice

ALL NVIDIA DESIGN SPECIFICATIONS, REFERENCE BOARDS, FILES, DRAWINGS, DIAGNOSTICS, LISTS, AND OTHER DOCUMENTS (TOGETHER AND SEPARATELY, "MATERIALS") ARE BEING PROVIDED "AS IS." NVIDIA MAKES NO WARRANTIES, EXPRESSED, IMPLIED, STATUTORY, OR OTHERWISE WITH RESPECT TO THE MATERIALS, AND EXPRESSLY DISCLAIMS ALL IMPLIED WARRANTIES OF NONINFRINGEMENT, MERCHANTABILITY, AND FITNESS FOR A PARTICULAR PURPOSE.

Information furnished is believed to be accurate and reliable. However, NVIDIA Corporation assumes no responsibility for the consequences of use of such information or for any infringement of patents or other rights of third parties that may result from its use. No license is granted by implication of otherwise under any patent rights of NVIDIA Corporation. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all other information previously supplied. NVIDIA Corporation products are not authorized as critical components in life support devices or systems without express written approval of NVIDIA Corporation.

HDMI

HDMI, the HDMI logo, and High-Definition Multimedia Interface are trademarks or registered trademarks of HDMI Licensing LLC.

Macrovision Compliance Statement

NVIDIA Products that are Macrovision enabled can only be sold or distributed to buyers with a valid and existing authorization from Macrovision to purchase and incorporate the device into buyer's products.

Macrovision copy protection technology is protected by U.S. patent numbers 5,583,936; 6,516,132; 6,836,549; and 7,050,698 and other intellectual property rights. The use of Macrovision's copy protection technology in the device must be authorized by Macrovision and is intended for home and other limited pay-per-view uses only, unless otherwise authorized in writing by Macrovision. Reverse engineering or disassembly is prohibited.

Third Party Notice

Portions of the NVIDIA system software contain components licensed from third parties under the following terms:

Clang & LLVM:

Copyright (c) 2003-2015 University of Illinois at Urbana-Champaign.

All rights reserved.

Portions of LLVM's System library:

Copyright (C) 2004 eXtensible Systems, Inc.

Developed by:

LLVM Team

University of Illinois at Urbana-Champaign

<http://llvm.org>

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal with the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

* Redistributions of source code must retain the above copyright notice, this list of conditions and the following disclaimers.

* Redistributions in binary form must reproduce the above copyright notice, this list of conditions and the following disclaimers in the documentation and/or other materials provided with the distribution.

* Neither the names of the LLVM Team, University of Illinois at Urbana-Champaign, nor the names of its contributors may be used to endorse or promote products derived from this Software without specific prior written permission.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE CONTRIBUTORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS WITH THE SOFTWARE.

Vulkan Notice

Copyright (c) 2015-2016 The Khronos Group Inc.

Copyright (c) 2015-2016 LunarG, Inc.

Copyright (c) 2015-2016 Valve Corporation

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and/or associated documentation files (the "Materials"), to deal in the Materials without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Materials, and to permit persons to whom the Materials are furnished to do so, subject to the following conditions:

The above copyright notice(s) and this permission notice shall be included in all copies or substantial portions of the Materials.

THE MATERIALS ARE PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT.

IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE MATERIALS OR THE USE OR OTHER DEALINGS IN THE MATERIALS.

Unless otherwise noted in the LICENSE.txt file in the install folder, all components of the Vulkan Runtime are licensed under the above license. Licenses for any components not so licensed are listed in the LICENSE.txt file.

Trademarks

NVIDIA, the NVIDIA logo, NVIDIA nForce, GeForce, NVIDIA Quadro, NVDDVD, NVIDIA Personal Cinema, NVIDIA Soundstorm, Vanta, TNT2, TNT, RIVA, RIVA TNT, VODOO, VODOO GRAPHICS, WAVEBAY, Accuview Antialiasing, Detonator, Digital Vibrance Control, ForceWare, NVRotate, NVSensor, NVSync, PowerMizer, Quincunx Antialiasing, Sceneshare, See What You've Been Missing, StreamThru, SuperStability, T-BUFFER, The Way It's Meant to be Played Logo, TwinBank, TwinView and the Video & Nth Superscript Design Logo are registered trademarks or trademarks of NVIDIA Corporation in the United States and/or other countries.

OpenCL and the OpenCL logo are trademarks of Apple Inc. used by permission by Khronos.

Vulkan and the Vulkan logo are trademarks of the Khronos Group Inc.

Other company and product names may be trademarks or registered trademarks of the respective owners with which they are associated.

Copyright

© 2015 - 2017 NVIDIA Corporation. All rights reserved.