Technical Brief

Introducing Hybrid SLI Technology

March 11, 2008 | TB-03875-001_v01

Document Change History

Version	Date	Responsible	Description of Change
01	March 11, 2008	SR, DV	Initial release

Table of Contents

Introducing Hybrid SLI Technology i

Introducing Hybrid SLI Technology 1

Introduction 1

Hybrid SLI 1

Hybrid SLI Requirements 2

Hybrid SLI Modes 2

Multi Adapter Mode 2

Hybrid SLI Platform Support 4

GeForce Boost: Supported dGPUs 4

HybridPower: Supported dGPUs 4

Multi-GPU SLI Support in Hybrid SLI Systems 4

Hybrid SLI User Interface 5

Hybrid SLI Mode Change: Blocking Events 9

Hybrid SLI Use Cases 10

Case 1. All Displays Connected to mGPU 10

Case 2. All Displays Connected to dGPU 11

Case 3. Displays Connected to Both mGPU and dGPU 12

Hybrid SLI FAQ 13

List of Figures

Figure 1. Hybrid SLI Block Diagram 3
Figure 2. Hybrid SLI Mode Select UI 5
Figure 3. Hybrid SLI State In Sync with Vista Power Profile 6
Figure 4. Hybrid SLI State Out of Sync with Vista Power Profile 6
Figure 5. Tool Tip when Sys Out of Sync with VPP 6
Figure 6. Laptop GPU Settings 7
Figure 7. Desktop GPU Settings 8
Figure 8. Open 3D Applications Block Hybrid SLI Transition 9
Figure 9. All Displays Connected to mGPU 10
Figure 10. All Displays Connected to mGPU 11
Figure 11. Displays Connected to both the mGPU and dGPU 12

List of Tables

Table 1. HSLI Mode Benefits for Case 1 10
Table 2. HSLI Mode Benefits for Case 2 11
Table 3. HSLI Mode Benefits for Case 3 12

Introducing Hybrid SLI Technology

Introduction

Built upon NVIDIA SLI® technology, Hybrid SLI® enables NVIDIA® discrete GPUs* and NVIDIA® motherboard GPUs to work together to deliver multi-GPU benfits. It provides significant performance scaling through GeForce® Boost and compelling power and noise reduction benefits through HybridPower™.

This technical brief describes the GeForce Boost and HybridPower features. It also describes the setup requirements and instructions to enable and verify GeForce Boost and HybridPower functionality.

Hybrid SLI

SLI technology enables two discrete GPUs to work together and provide increased graphics performance. Hybrid SLI technology is similar to SLI technology in that it enables a motherboard GPU (mGPU) to work with a discrete GPU (dGPU) to provide two key benefits to the user.

The GeForce Boost feature enables the motherboard GPU to work collaboratively with the discrete GPU to increase the performance of the discrete GPU. When GeForce Boost is enabled, the mGPU and dGPU share the rendering load by rendering different frames of an image. Thus the graphics processing power of the mGPU is harnessed to enhance the processing power of the dGPU.

The HybridPower feature enables the user to switch off the dGPU when the maximum performance of the dGPU is not required and use the mGPU for non-intensive graphics applications, such as high definition DVD playback, Web surfing and office productivity applications. Switching off the dGPU not only lowers the total system power consumption but also lowers total system noise and heat.

Hybrid SLI Requirements

- Hybrid SLI is only supported on the Windows Vista® operating system.
- GeForce Boost mode allows up to two displays to be connected to either the mGPU or dGPU. When displays are connected to both adapters, Hybrid SLI mode is disabled and multi adapter extended desktop mode is enabled. In the multi-adapter extended desktop mode, up to four displays may be connected (up to two displays driven by the mGPU and up to two displays by the dGPU)
- HybridPower mode requires displays to be connected to the mGPU. HybridPower mode cannot be enabled when displays are driven through the dGPU.
- HybridPower and GeForce Boost features are supported by specific discrete GPUs. Please refer to www.nvidia.com/hybridsli for a list of Hybrid SLI-enabled GPUs

Hybrid SLI Modes

The two preferred operating modes of a Hybrid SLI-enabled PC include:

- **Boost Performance Mode**
  The Hybrid SLI mode where the discrete GPU and motherboard GPU are simultaneously active and working collaboratively to provide higher performance (GeForce Boost).
- **Save Power Mode**
  The Hybrid SLI mode where the dGPU completely shuts off and the mGPU renders and drives the display (HybridPower).

Multi Adapter Mode

When Hybrid SLI is disabled, the dGPU and mGPU operate independently supporting Multi-Adapter mode.

The current Hybrid SLI state of the system is determined by a variety of inputs such as the user switch, Vista Power Plan state, and hardware configuration.

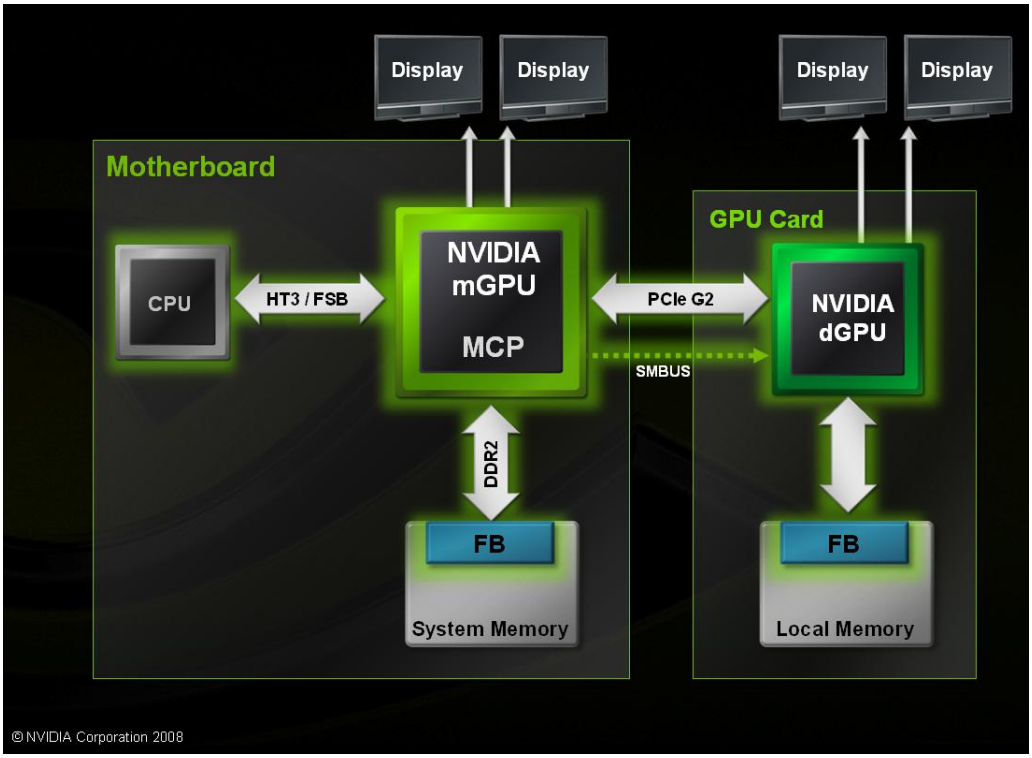

Figure 1. Hybrid SLI Block Diagram

Note: Hybrid SLI supports up to two displays simultaneously (both connected to either mGPU or dGPU). The user controls which displays are used with the standard display property pages in Vista.

Hybrid SLI Platform Support

GeForce Boost: Supported dGPUs

The GeForce Boost feature of Hybrid SLI works only with specific dGPUs whose performance is comparable with the mGPU. The list of dGPUs supported by the GeForce feature can be found at the following website.

www.nvidia.com/hybridsli

A Hybrid SLI-enabled dGPU must be used with a Hybrid SLI capable motherboard in order to achieve additive performance boost.

HybridPower: Supported dGPUs

The HybridPower feature is supported by specific dGPUs that are able to power down or enter into a low power state when the system enters 'Save Power' mode. The list of the dGPUs supported by HybridPower on NVIDIA-based systems can be found at the following website

www.nvidia.com/hybridsli

Multi-GPU SLI Support in Hybrid SLI Systems

When two dGPUs are connected in SLI mode through an SLI connector on a Hybrid SLI-enabled system, the SLI setup for the dGPU works as it does for existing non-Hybrid SLI systems. Only one dGPU adapter will be seen and only one display can be attached to the dGPU. The single attached display can be connected to the mGPU or dGPU. Connecting the display to the mGPU will enable HybridPower mode and will allow user to enter 'Save Power" mode. 'Save Power" mode is only supported in multi dGPU configurations when SLI is enabled on the dGPUs. When more than one dGPU is plugged into a Hybrid SLI system, the GeForce Boost feature will not be available.

Hybrid SLI User Interface

The NVIDIA Graphics Driver includes a Hybrid SLI control panel which provides information on the current hybrid mode and allows the user to change mode. The following options are provided :

- Save Power
- Boost Performance
- Additional Displays (Hybrid SLI Disabled)

The control panel indicates when a hybrid mode change cannot be made due to open applications. The control panel also indicates when the user selected Hybrid State is not in sync with the Vista Power Profile of the system.

When HybridPower is supported on the system, the driver automatically changes the system mode to HybridPower after four minutes of WinIdle detection and it saves the current Hybrid SLI mode. When WinIdle state is exited, the system automatically reverts back to the saved Hybrid SLI mode.

The following figures illustrate the Hybrid SLI User Interfaces.

Figure 2. Hybrid SLI Mode Select UI

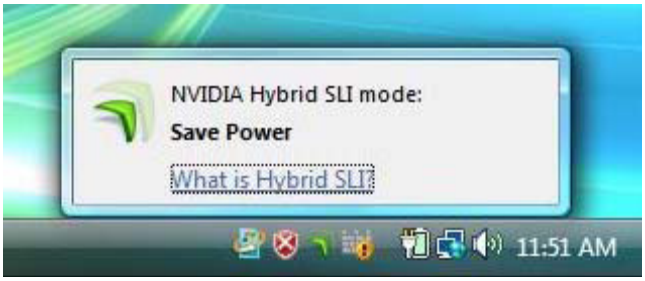

Figure 3. Hybrid SLI State In Sync with Vista Power Profile

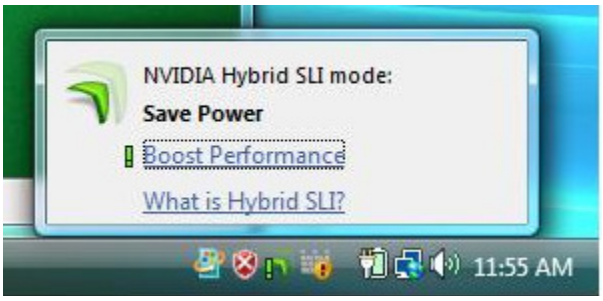

Figure 4. Hybrid SLI State Out of Sync with Vista Power Profile

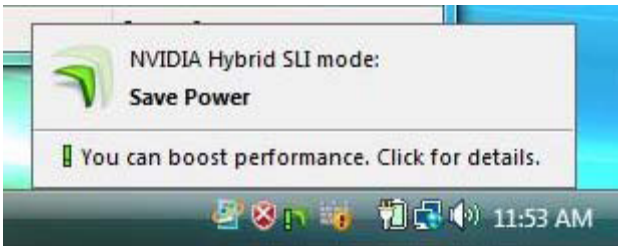

Figure 5. Tool Tip when Sys Out of Sync with VPP

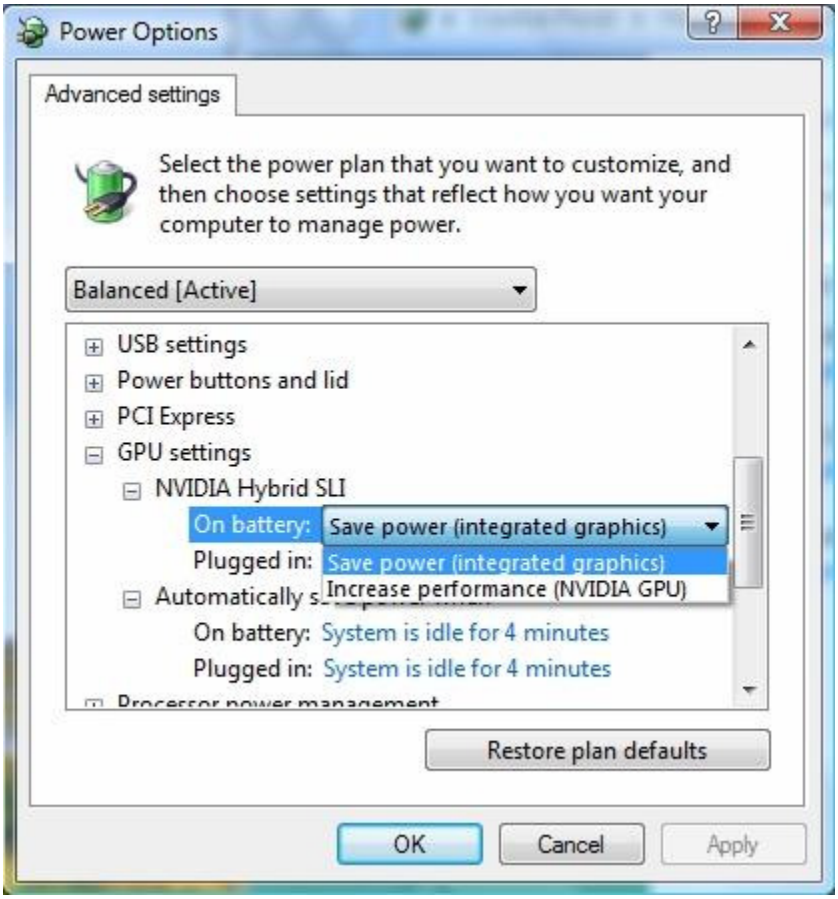

Figure 6. Laptop GPU Settings

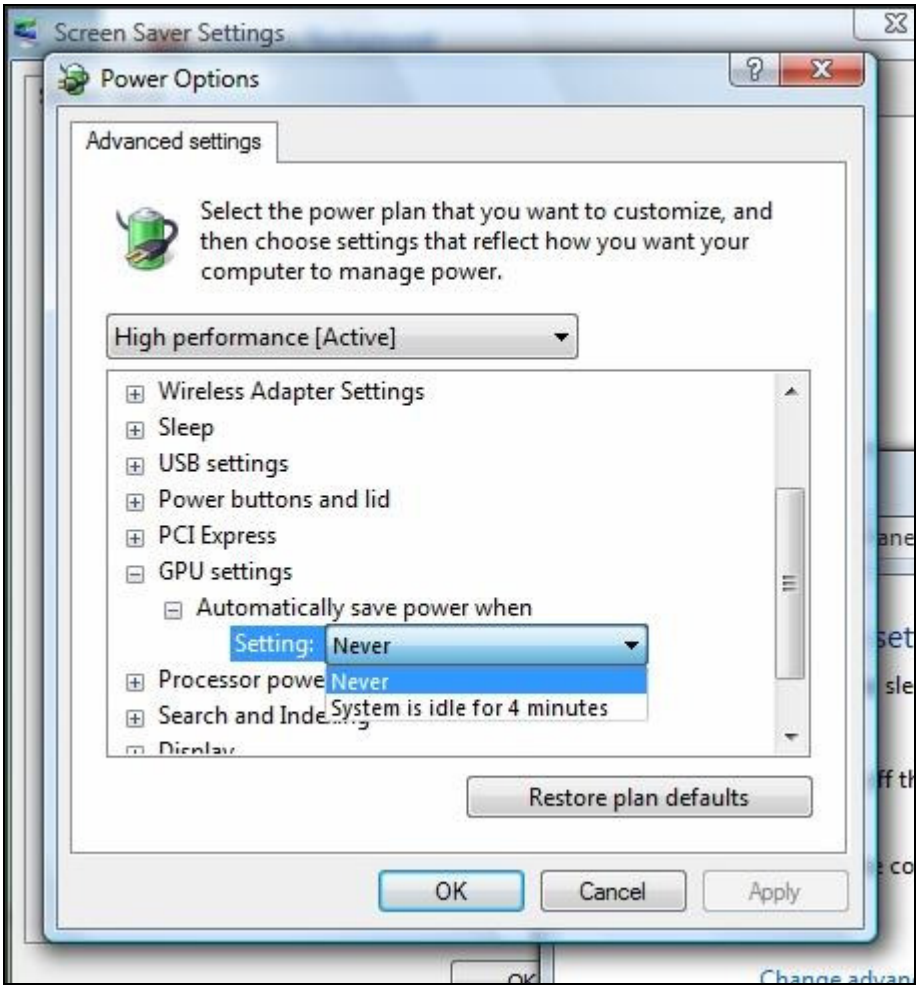

Figure 7. Desktop GPU Settings

Hybrid SLI Mode Change: Blocking Events

- Transitioning from *Boost Performance* mode to *Save Power* mode and vice versa is allowed only when there are no open 3D applications. The control panel prevents the transition when there are open 3D applications.
- The control panel provides a list of applications that are blocking the Hybrid SLI transition and asks the user to close those applications to complete the transition (Figure 8).

Figure 8. Open 3D Applications Block Hybrid SLI Transition

Hybrid SLI Use Cases

The following figures illustrate the various use cases of Hybrid SLI technology.

Case 1. All Displays Connected to mGPU

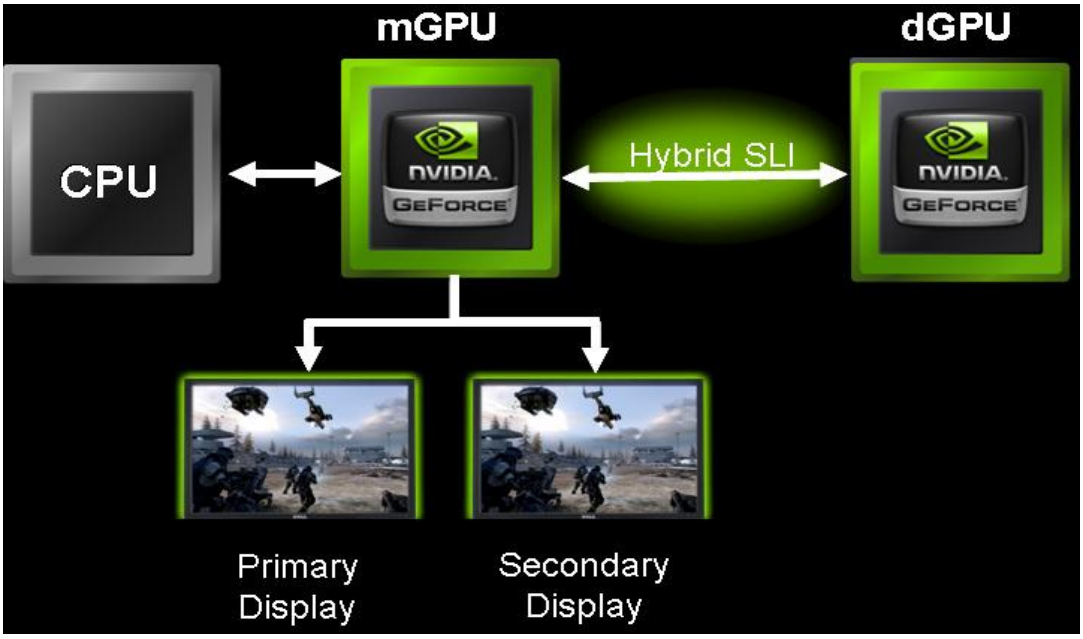

Figure 9. All Displays Connected to mGPU

Table 1. HSLI Mode Benefits for Case 1

HSLI Mode	Enabled	Benefit
GeForce Boost	Yes	Additive GPU performance (Only on supported dGPUs. Refer to www.nvidia.com/hybridsli)
HybridPower	Yes	Power Savings and lower noise due to dGPU shutdown (only on supported dGPUs. Refer to www.nvidia.com/hybridsli)

Case 2. All Displays Connected to dGPU

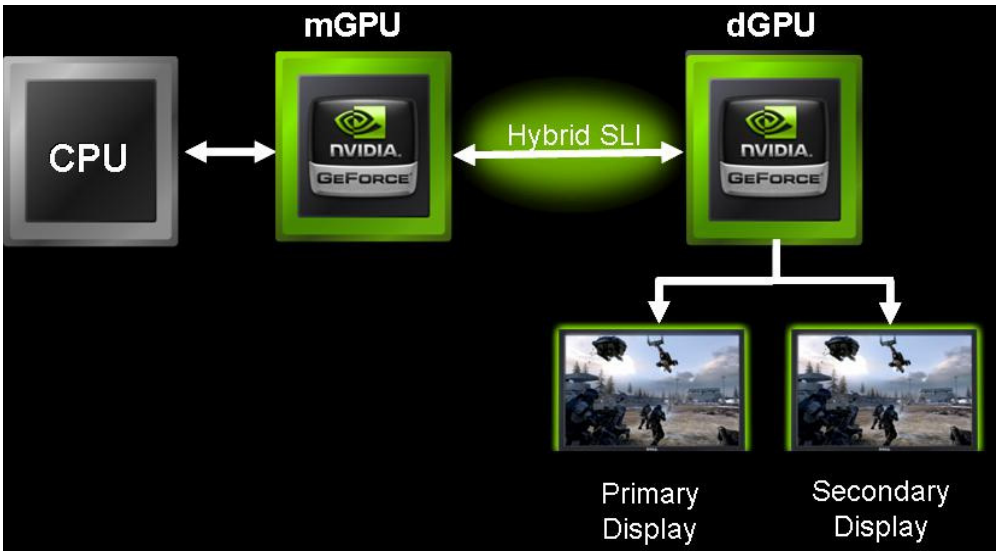

Figure 10. All Displays Connected to mGPU

Table 2. HSLI Mode Benefits for Case 2

HSLI Mode	Enabled	Benefit
GeForce Boost	Yes	Additive GPU performance (Only on supported dGPUs. Refer to www.nvidia.com/hybridsli)
HybridPower	No	Not supported because dGPU must be turned on to drive display.

Case 3. Displays Connected to Both mGPU and dGPU

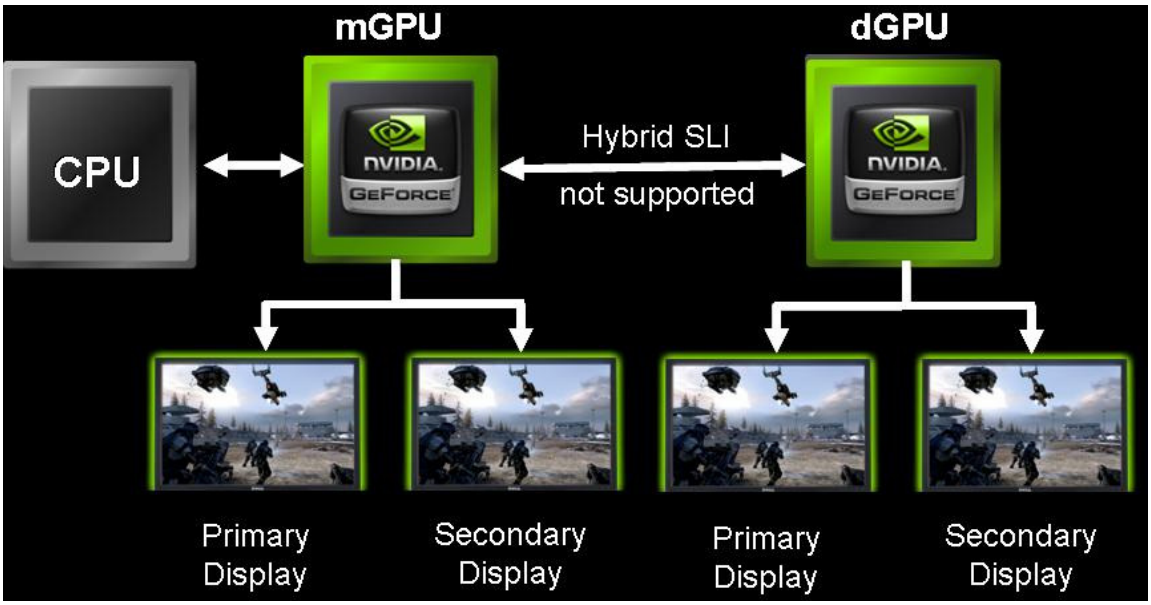

Figure 11. Displays Connected to both the mGPU and dGPU

Table 3. HSLI Mode Benefits for Case 3

HSLI Mode	Enabled	Benefit
GeForce Boost	**No**	Not supported. Each GPU functions as independent adapter
HybridPower	**No**	Not supported. Each GPU functions as independent adapter and dGPU must be turned on for it to drive its displays

Hybrid SLI FAQ

Q: Which OS supports Hybrid SLI?

A: Hybrid SLI is supported only by Windows Vista. It is currently not supported with any other operating system.

Q: What happens when a user tries to enable Hybrid SLI when the motherboard GPU is disabled?

A: The API will prevent user from enabling hybrid SLI when the motherboard GPU is disabled. The API will indicate 'performance mode' and will not allow user to transition to 'Energy Saver' mode.

Q: Will performance of GeForce Boost increase if the frame buffer size of mGPU is increased? Is there a minimum frame buffer size required for GeForce Boost?

A: The minimum frame buffer size of the mGPU required for GeForce Boost support is 256MB. The performance of GeForce Boost depends on the processing powers of the dGPU and the mGPU and other system factors. For best scaling, a dGPU that is recommended for GeForce be used along with the a Hybrid SLI enabled motherboard GPU

Q: When one monitor is connected to the mGPU and one monitor is connected to the dGPU, can the dGPU still run at x16 mode?

A: Yes. The dGPU will be able to run at x16 mode.

Q: What is the maximum number of monitors that can be connected in a system that has onboard GPU and dGPU?

A: Two displays can be connected to the mGPU and two displays to the dGPU. When both display adapters are enabled, the system will be in multi adapter mode. Neither GeForce Boost nor HybridPower is supported when the system is in multi adapter mode.

Q: Will GeForce Boost performance increase if the dGPU or mGPU refreshes the display?

A: There are several variables that control the amount of scaling provided by GeForce Boost. GeForce Boost performance is comparable if either dGPU refreshes the display or mGPU refreshes display.

Q: Which hybrid mode should the user enter to best support HD DVD/Blu-ray playback?

A: Both Hybrid-Performance and Hybrid-Power modes deliver excellent playback of HD DVD and Blu-ray DVD titles at full 1080p resolution. Hybrid-Power mode is recommended as it will offer the best acoustic and low power experience when watching high definition content.

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 or otherwise under any patent or patent rights of NVIDIA Corporation. Specifications mentioned in this publication are subject to change without notice. This publication supersedes and replaces all information previously supplied. NVIDIA Corporation products are not authorized for use as critical components in life support devices or systems without express written approval of NVIDIA Corporation.

Trademarks

NVIDIA, the NVIDIA logo, GeForce, and HybridPower are trademarks or registered trademarks of NVIDIA Corporation in the United States and other countries. Other company and product names may be trademarks of the respective companies with which they are associated.

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 4,631,603, 4,577,216 and 4,819,098 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.

Copyright

© 2008 NVIDIA Corporation. All rights reserved.