

**NVIDIA® QUADRO®  
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**NVIDIA Quadro**

**UHD and 4K Display Solutions**

# UHD and 4K Display Solutions

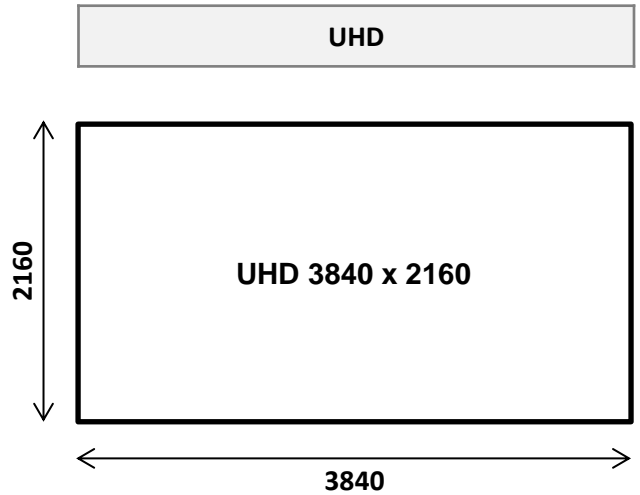
## Topics covered

1	What is UHD?
2	What is 4K?
3	Driving UHD and 4K displays
4	UHD and 4K displays + NVIDIA Mosaic technology
5	UHD and 4K multi-display configurations
6	NVIDIA Quadro K6000 and K5000 Display Outputs

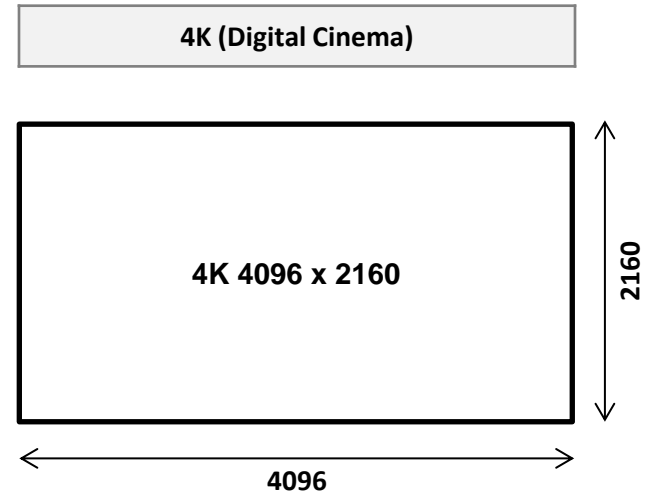


# What are UHD and 4K Displays?

## Overview and specifications



Video Bandwidth ~533MHz at 60Hz



Video Bandwidth ~567MHz at 60Hz

Video Connection Bandwidth	
▪	DVI SL = 165MHz
▪	DVI DL = 330MHz
▪	DisplayPort 1.1 ~330MHz
▪	HDMI 1.4a ~340MHz <sup>1</sup>
▪	DisplayPort 1.2 ~540 MHz (NVIDIA Quadro K5000) <sup>2</sup>
▪	DisplayPort 1.2 ~592 MHz (NVIDIA Quadro K6000) <sup>2</sup>

<sup>1</sup>HDMI 1.4 supports UHD at 24 or 30 Hz with a single cable <sup>2</sup>DisplayPort 1.2 can drive 4K but the specific implementation varies by graphics card

# Driving UHD Displays With HD Content

Resolution is scaled from 1920 x 1080 to 3840 x 2160



## UHD Display Must Scale HD Content

- Single input 1920 x 1080 at 60Hz
- Scaled to 3840 x 2160 at 60Hz
- Each HD pixel scaled to 4 by UHD scaler



# Refresh Rate Scaling

New frames are interpolated as refresh rate increases

HD



UHD



## Refresh Rate Scaling

- HDMI 1.4a supports 3840 x 2160 at 30Hz
- Display will scale to 60Hz or 120Hz refresh rate
- Can occasionally introduce motion artifacts



30Hz



60Hz



120Hz

# UHD and 4K Displays + Mosaic

Works with prosumer and professional displays

## Prosumer



### LG UHD 84" TV

- Driven by 1 HDMI input
- 24Hz or 30Hz refresh rate

## Professional



### Christie 4K Display

- Driven by 4 HDMI inputs
- 60Hz refresh rate

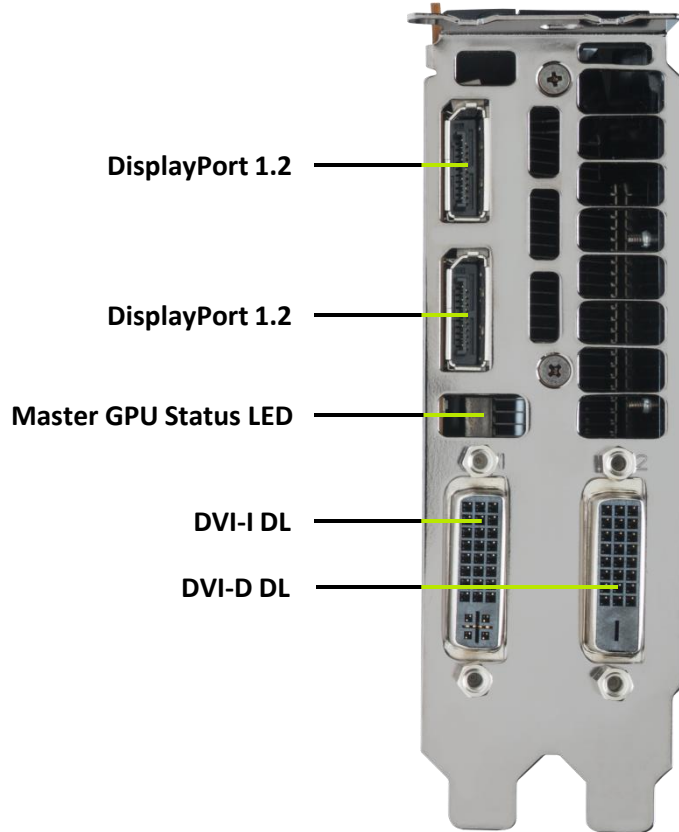


### Sony 4K SXRD VPL GT-100

- Driven by 2 DP inputs
- 60Hz refresh rate

# NVIDIA Quadro K6000 Display Outputs

Four connectors can drive four displays simultaneously



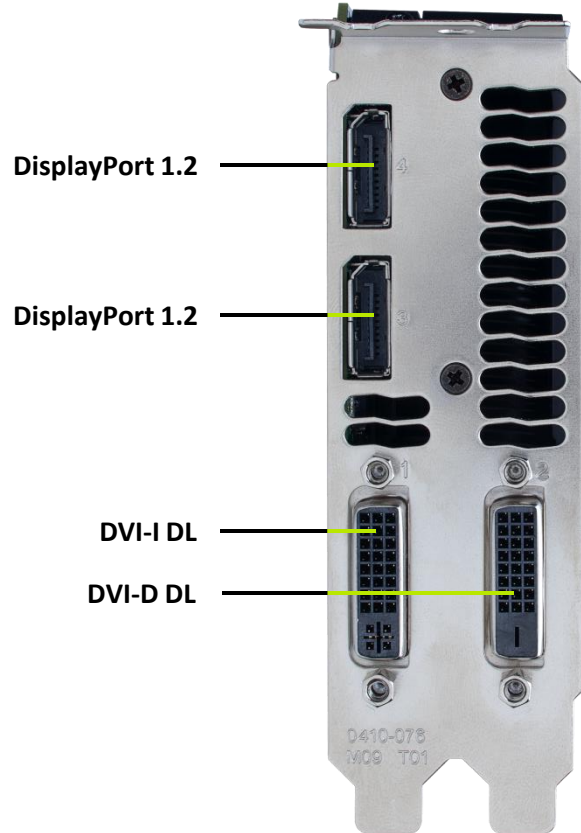
Total of 4 independent display connectors <sup>1</sup>	
▪	Two DisplayPort 1.2 with High Bit Rate 2 (HBR2)
▪	One DVI-I DL, also supports VGA via adapter
▪	One DVI-D DL
▪	Separate stereo connector bracket also provided

NVIDIA Quadro K6000 Display Port 1.2 HBR2 implementation can drive a 4K display (4096 x 2160 at 60Hz) with 30-bit color from a single connector

<sup>1</sup>Windows XP only supports two displays

# NVIDIA Quadro K5000 Display Outputs

Four connectors can drive four displays simultaneously



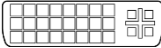
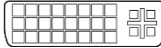






Total of 4 independent display connectors <sup>1</sup>	
▪	Two DisplayPort 1.2 with High Bit Rate 2 (HBR2)
▪	One DVI-I DL, also supports VGA via adapter
▪	One DVI-D DL
▪	Separate stereo connector bracket also provided

NVIDIA Quadro K5000 Display Port 1.2 HBR2 implementation can drive a UHD display (3820 x 2160 at 60Hz) with 30-bit color from a single connector

<sup>1</sup>Windows XP only supports two displays



# Quadro K6000 and K5000 Display Connector Matrix

		K6000   K5000   K5000 For Mac Maximum of 4 Native or DP 1.2 Compliant Displays <sup>1</sup>			
		Connector 1	Connector 2	Connector 3	Connector 4
<b>If You Want to Connect a Display with the Following Cable</b>		 DVI-I	 DVI-D	 DP 1.2	 DP 1.2
 DisplayPort				✓	✓
 DVI		✓	✓	DP → DVI	DP → DVI
 HDMI		DVI → HDMI	DVI → HDMI	DP → HDMI	DP → HDMI
 VGA		DVI → VGA		DP → VGA	DP → VGA



Display Information	
✓	Connects directly no adapter required
▪	DP → DVI up to 1920 x 1200 – use a DP to DVI-SL (Single Link) adapter
▪	DP → DVI above 1920 x 1200 – use a DP to DVI-DL (Dual Link) adapter
▪	DP → HDMI – use a DP to HDMI 1.4a adapter

Maximum Resolution	
▪	DP 1.2 HBR2 K6000 4096 x 2160 at 60Hz, 30bpp
▪	DP 1.2 HBR2 K5000 3840 x 2160 at 60Hz, 30bpp
▪	DVI-DL 2560 x 1600 at 60 Hz
▪	VGA 2048 x 1536 at 85 Hz

<sup>1</sup>DisplayPort multi-streaming requires DisplayPort 1.2 compliant monitors or a DisplayPort 1.2 compliant hub.

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