



# NVIDIA VIDEO CODEC SDK APPLICATION NOTE - DECODER

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## Application Note

## DOCUMENT CHANGE HISTORY

NVDEC\_DA-06209-001\_v08

Version	Date	Authors	Description of Change	Highlight
01	June 10, 2016	SM	Updated for Video Codec SDK 7.0	Support for VP8&VP9 Decoding
02	Nov 15, 2016	SM	Updated for Video Codec SDK 7.1	

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# NVIDIA HARDWARE VIDEO DECODER

## 1. INTRODUCTION

NVIDIA GPUs contain a hardware-based decoder (referred to as NVDEC in this document) which provides fully-accelerated hardware-based video decoding for several popular codecs. With complete decoding offloaded to NVDEC the graphics engine and the CPU are free for other operations.

NVDEC supports much faster than real-time decoding which makes it suitable to be used for transcoding applications, in addition to video playback applications.

The hardware capabilities available in NVDEC are exposed through APIs herein referred to as NVDECODE APIs (referred to as NVCUVID APIs in earlier SDKs) in the document. This document provides information about the capabilities of the NVDEC engine and the features exposed through NVDECODE APIs.

The current document *only* highlights the changes in the current Video Codec SDK package with respect to the previous SDK packages. In order to know about the features exposed in earlier SDKs please refer to the earlier SDK package(s). Any driver supporting SDK 7.0/SDK 7.1 is completely backward compatible with earlier SDKs, which means that applications compiled with earlier header(s) can be expected to work with the driver supporting SDK 7.0/SDK 7.1 and beyond.

## 2. NVDEC CAPABILITIES

At a high level, capabilities of the NVDEC engine exposed through NVDECODE APIs are summarized in Table 1 and the features exposed in the Software stack through NVDECODE APIs in the current SDK are summarized in Table 2.

Table 1. NVDEC Hardware Capabilities

Hardware Features	Fermi GPUs	Kepler GPUs	First Generation Maxwell GPUs	Second Generation Maxwell GPUs	Pascal GPUs
VC1 Simple, Main & Advanced profiles	✓	✓	✓	✓	✓
MPEG4 Simple and Advanced Simple Profiles	✓	✓	✓	✓	✓
MPEG2 Simple & Main profiles	✓	✓	✓	✓	✓
H.264 Baseline, Main, High Profiles	✓	✓	✓	✓	✓
VP8*	✗	✗	✗	✓	✓
HEVC Main Profile**	✗	✗	✗	✓	✓
VP9 Profile 0**	✗	✗	✗	✓	✓
8192x8192 Decoding support (HEVC&VP9 only) ***	✗	✗	✗	✗	✓

\* : Present in Select Pascal GPUs and all Second Generation Maxwell GPUs

\*\* : Present in Select Maxwell Second Generation GPUs and all Pascal GPUs

\*\*\*: Present in Select Pascal GPUs

Table 2. New additions in the current SDK

New software features	Description
Support for Pascal GPUs	Support for Pascal GPUs
VP9 decoding	Software support for VP9 decoding Profile 0.
VP8 decoding	Software support for VP8 decoding.
HEVC & VP9 8K decoding	Software support for decoding HEVC & VP9 content with resolution as high as 8192 × 8192.
Additional sample applications	New sample application to demonstrate interoperability between D3D11 and CUDA.

### 3. NVDEC PERFORMANCE

NVDEC natively supports multiple hardware decoding contexts with negligible context-switching penalty. As a result, subject to the hardware performance limit and available memory, an application can decode multiple videos simultaneously.

The hardware and software maintain the context for each decoding session, allowing a large number of simultaneous decoding sessions to run in parallel. Table 3 provides an indicative data about the decoding performance of NVDEC across Kepler, Maxwell and Pascal GPU architectures for HEVC and H.264 encoded bitstream (approximately at 20 Mbps), at resolution of 1920 × 1080 and decoded frames in YUV 4:2:0 8-bit format.

Table 3. NVDEC decoding performance (indicative)

GPU Architecture	Codec	Performance in frames/second
Kepler	H.264	161
	VP9	NA*
	HEVC	NA*
First Generation Maxwell	H.264	376
	VP9	NA*
	HEVC	NA*
Second Generation Maxwell	H.264	392
	VP9**	340
	HEVC**	408
Pascal	H.264	658
	VP9	540
	HEVC	720

\*Codec is not supported on the hardware

\*\*Supported on select second generation Maxwell GPUs

## 4. PROGRAMMING NVDEC

Video Codec SDK 7.0 and Video Codec SDK 7.1 are supported on R367 and R375 drivers and above. Please refer to the SDK Release notes for information regarding the minimum driver version which adds the support for the SDK.

Various capabilities of NVDEC are exposed to the application software via the NVIDIA proprietary application programming interface (NVDECODE APIs). Please refer to the Video Decoder Programming guide and the Reference Manual for details on using these APIs.

For a complete list of GPUs supporting hardware accelerated decoding please refer to <https://developer.nvidia.com/nvidia-video-codec-sdk>.

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