



NVIDIA VIDEO CODEC SDK APPLICATION NOTE - DECODER

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DOCUMENT CHANGE HISTORY

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Version	Date	Authors	Description of Change	Highlight
01	June 10, 2016	SM	Updated for Video Codec SDK 7.0	VP8&VP9 decoding
02	Nov 15, 2016	SM	Updated for Video Codec SDK 7.1	
03	Feb 15, 2017	SM	Updated for Video Codec SDK 8.0	10&12-bit decoding

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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 scenarios, in addition to video playback.

The hardware capabilities available in NVDEC are exposed through APIs herein referred to as NVDECODE APIs in the document. This document provides information about the capabilities of the NVDEC engine and the features exposed through NVDECODE APIs. The current document highlights *only* 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).

NVDECODE API *guarantees* backward compatibility (and will make explicit reference whenever backward compatibility is broken). This means that the applications compiled with earlier header(s) can be expected to work with the driver supporting SDK 8.0 and beyond.

2. WHAT'S NEW IN SDK 8.0

Table 1. What is new in SDK 8.0?

Features	Description
HEVC 10 bit decoding	Decoding support for 10 bit HEVC bit streams.
HEVC 12 bit decoding	Decoding support for 12 bit HEVC bit streams.
VP9 10 bit decoding	Decoding support for 10 bit VP9 bit streams.
VP9 12 bit decoding	Decoding support for 12 bit VP9 bit streams.
Decoding capability API	NVDECODE API to query hardware capabilities.
Decode latency reduction	Enables user to kick off decoding if the user is ready with one frame data.
Memory optimization for I/IDR-frame only decoding	Enables user to achieve memory optimization if the use-case involves decoding of I/IDR frames only. This support is currently available for H.264, support for other codecs will be added in future drivers. It can be enabled through a flag exposed the NVDECODE API.

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 2 provides an indicative data of the decoding performance of NVDEC across Kepler, Maxwell and Pascal GPU architectures for HEVC, VP9 and H.264 encoded bitstream (approximately at 20 Mbps), at resolution of 1920×1080 and decoded frames in YUV 4:2:0 8 and 10-bit format. Note that performance numbers in Table 2 are measured on GeForce hardware with certain clocks and thermal characteristics. The performance varies across GPU classes (e.g. Quadro, Tesla), and scales (almost) linearly with the clock speeds for each hardware.

Table 2. NVDEC decoding performance (indicative)

GPU Architecture	Codec	Performance in frames/second
Kepler	H.264	161
First generation Maxwell	H.264	417
Second generation Maxwell	H.264	426
	VP9	396
	HEVC	464
	HEVC Main10	444
Pascal	H.264	633
	VP9	627
	VP9 10 bit	622
	HEVC	708
	HEVC Main10	701

4. PROGRAMMING NVDEC

Video Codec SDK 8.0 is supported on R378 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 (NVDEC API). 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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