The OSVP (Omnitek Scaleable Video Processor) is a highly configurable set of IP blocks with optional features that together provide a powerful range of tools for multi-video format conversion and image enhancement for video formats up to 60Hz Ultra HD, with 120Hz Ultra HD output as a further option. For ease of implementation and to make best use of system resources, the principal IP blocks are packaged as a single OSVP Core offering up to 8 video channels that you can individually configure to carry out the precise range of actions needed to deliver the transformations you require.

**Summary**

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**Connectivity**

Intel® Design Services provides a large range of complementary IP cores for video processing and connection. These IP cores can be used individually or in combination to provide FPGA solutions for applications in broadcast, AV, aerospace/defence, medical and automotive industries. Intel Design Services can provide a bespoke solution which can be designed for you and tailored to your specific needs.
Key Features

Video Support:
- Interlaced, progressive or segmented frame (PsF) video input formats up to 4096 x 2160 at 60Hz
- Interlaced or progressive output video output formats up to 4096 x 2160 at 120Hz
- YUV and RGB color in 4:2:0, 4:2:2 or 4:4:4 format
- 8, 10 or 12-bit color depths
- Up to 8 video processing paths, each individually configured for video standard and processing

Full 12-bit YUV or RGB 4:4:4 processing:
- Up/Down/Cross conversion between any supported standards
- Asynchronous input and output timing with frame synchronization (when changing frame rate)
- Chroma re-sampling
- Full 6-axis YUV/RGB color correction, brightness and saturation level control, and hue rotation with color primary mapping
- Motion- and/or Edge-adaptive de-interlacing with best-in-class low-angle handling
- 3:2 and 2:2 film cadence detection and processing, including handling of mixed cadence such as interlaced video over 3:2 film
- Noise reduction
- Crop and resize with Super-Resolution image enhancement
- Alpha blending of multiple video sources

Input De-Interlacer

Interlaced and PsF format inputs need to be de-interlaced prior to signal processing. However, special care is needed in order to avoid generating artefacts, particularly where the video includes motion or low-angle edges. Failure to detect film cadences correctly will also give rise to artefacts in the de-interlaced video stream.

Chroma Re-sampler

Chroma re-sampling may be needed both to up-sample the incoming video stream to the 4:4:4 format, used for signal processing throughout the OSVP core, and to deliver the required output video format.

The OSVP Subsystem includes 4:2:2 to 4:4:4 and 4:4:4 to 4:2:2 re-samplers as standard. 4:2:2 to 4:2:0 and 4:2:0 to 4:2:2 Chroma re-samplers are available as an add-on to the OSVP Subsystem. All four re-samplers may be used alongside the OSVP core or instantiated independently as required.
Noise Reduction

Before an image is up-sized, it is advisable to remove any noise or stuck pixels. The OSVP Subsystem Advanced option adds Noise Reduction to the range of facilities offered by the OSVP Core. Noise is reduced by applying a variable statistical filter to the signal. This approach achieves good results with both specular noise and stuck pixels.

Color Space Conversion and Color Primaries

A necessary part of transforming video is the mapping of pixel data between color spaces in order to preserve the coloring of the content. This mapping is required because the different formats define different sets of primary colors. For example, SD uses the Rec 601 set of color primaries, while HD follows Rec 709 and UHD follows Rec 2020. Each display device also uses a particular set of primary colors.

The marked difference between the color spaces used by these standards is illustrated in Figure 10. The two triangles formed by joining the Color Primaries for HD (Rec 709) and UHD (Rec 2020) enclose the color spaces defined for these two formats.

The OSVP Color Space Conversion block enables pixel data to be transformed between any input color space and any output color space. All that is needed is the three primary colors and the white point associated with each color space. The color spaces need to be accurately defined; any errors in their definition will result in a poor coloration.

The OSVP Color Conversion block supports standard color spaces such as those defined for SD, HD and UHD. With the Advanced option, it also supports user-defined color spaces, allowing detailing of the color space used by a particular display device. It also offers gamma correction, allowing the correction of any gamma that may have been applied.
6-Axis Color Corrector

A further level of color change is brought about by applying Gain and/or Lift to the individual color components. This is added to the OSVP by the Advanced option and provides individual Gain and Lift controls for each of the six color RGB and YUV components. Controls are also offered for Overall Brightness, Saturation Level and Hue Rotation. Out-of-range values are automatically clipped.

Image Re-sizer

Moving between different resolutions and compositing several source images into a single image typically requires images to be resized. The OSVP Re-sizer allows images to be compressed or expanded across the full range of image resolutions. Moreover the technique used makes highly efficient use of the underlying FPGA/SoCs DSP resources.

The process of resizing an image is however prone to introducing a range of unwanted effects. For instance, the result of up-scaling an image often appears softened. Another common effect is ringing near edges.

Adding the Advanced option to the OSVP adds a range of Super-Resolution Enhancement algorithms that both counteract these effects and offer different levels of smoothness or sharpening in the end result.
Image Combiner

As well as providing the facility to process more than one video stream at a time, the OSVP also includes a Combiner block that can be instantiated to pull the output from OSVP video channels together into a single final image. The Combiner allows up to 16 channels to be combined into a single video frame, with the user specifying the X,Y position and the transparency of that image and which layer it occupies.

Frame Synchronizer

Differences between the input and output frame rate are handled by Frame Sync logic within the OSVP Core that repeats frames or drop frames as required.

Output Interlacer

To allow video to be output in interlaced formats, the OSVP Subsystem also includes an Interlacer block that can be instantiated alongside the OSVP Core where interlaced output is required.