Sharpen Module Datasheet

Digital Design Corporation

The Sharpen module is used to perform spatial filtering on the 10-bit grayscale video image.

Frame Size and Edge Effects

The Sharpen module outputs a frame that is identical in size to that of the input frame. Because mathematically sharpen operates by computing with spacially adjacent pixels, the output frame will contain edge artifacts. See Figure 1 : Edge Artifacts. For computation of the edge pixels, data outside the input frame is treated as zero. Note that this architecture implies a one line latency.

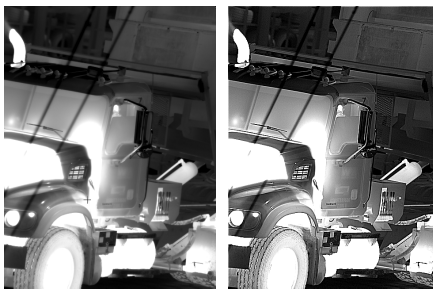

Figure 1

Internal Operations

A 3x3 filter mask with programmable 10-bit signed coefficients is used to implement this function. For every pixel, the surrounding pixels are multiplied by the coefficients of the horizontally inverted mask and the results added and scaled.

The Sharpen module accepts frames of 640x480 10-bit video data in the Common Video Bus format (CVF). Valid data will be extracted from the Common Video Bus and loaded into a series of 640-pixel line buffers. These buffers store the two previous lines of video data required for performing the filter operation. The buffers are implemented with block RAM and the addressing will be generated so that the RAMs behave like shift registers.

Data output from the line buffers feeds a register-based shift matrix that supplies the video data to the nine multipliers, implicitly performing the horizontal inversion of the filter mask (so that symmetric as well as asymmetric filters will behave correctly). These multipliers generate the products of the 10-bit unsigned pixel data and the 10-bit signed two's complement programmable mask coefficients. The products are accumulated and rounded to produce a 10-bit unsigned sharpen output.

If the result of the multiply-accumulate (MAC) process is negative, the sharpen output will be zero. If the result of the MAC exceeds the 10-bit unsigned representable range, the sharpen will be saturated (0x3FF). In both cases, status bits are set; these bits are reset at the start of every frame.

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