



AL-H264E-4KI422-HW

Ultra HD (4K) H.264 Encoder IP

PRELIMINARY DATASHEET

Version 1.00

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Atria Logic Inc.



Revision History

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1 General Description

The AL-H264E-4KI422-HW is a hardware-based, feature rich, low latency, high video quality H.264/AVC UHD Hi422 Intra encoder IP core. The AL-H264E-4KI422-HW encoder pairs up with the Atria Logic AL-H264D-4KI422-HW low latency decoder for low latency end-to-end links.

Atria Logic's H.264 4k video encoder IP core is available for Xilinx FPGAs and can be packaged for any ASIC/SoC implementations as well. H.264/AVC 4k video encoder implementation involves software friendly approach.

The encoder supports the H.264 Hi422 (High-422) profile at Level 5.1 (3840x2160p30) for Intra-only coding. Support for 10-bit video content means that there is no degradation of grayscale or color gradients in terms of banding. Support for YUV 4:2:2 video content means that there is better color separation, especially noticeable for red colors, which provides much sharper image details. These video quality aspects are especially important in case of medical imaging applications.

Support for Intra-only encoding allows the encoder to encode uncompressed video at frame latencies. A macroblock-line level pipelined architecture brings the latency further down to sub-frame level, at about 0.3msec.

Encoder IP core can be integrated with any software or hardware based audio encoders seamlessly. Atria Logic provides other peripheral IPs like Ethernet MAC, DDR3 controller which can be integrated with encoder IP core to equip the complete solution.

Atria Logic provides complete glass-to-glass solution around 4k encoder and decoder IPs implemented on Xilinx FPGA kit. It comes along with user application driver running on Linux OS. The required documentations like Users Manual, Test setup are provided with evaluation package. Please refer section Application Setup for more details.

The encoder is targeted for medical imaging, broadcast, enterprise/CE and industrial applications. Medical imaging applications include endoscopy, micro surgery and remote assisted surgery and diagnostics. Broadcast applications include video recorders for news and event coverage, film sets and production studios, as well as real-time monitoring of video shoots. Enterprise/CE applications include HDBaseT video transmission over CAT5/6 Ethernet cabling to computer monitors and UHD TV displays. Industrial applications include monitoring of manufacturing plants, and remote manipulation of mobile or fixed light or heavy machinery.

2 Technical Specifications

- Standard: H.264/AVC (ISO/IEC14496-10), Intra-only Hi422 Level 5.1
- Profiles:
 - Main Profile
 - Baseline Profile
- Color format
 - RGB
 - YUV 4:2:2/4:2:0
- Precision:
 - 8 bits
 - 10 bits
- Frame Rate:
 - 10fps
 - 24fps

- 25fps
- 29.97fps
- 30fps
- 60fps
- Latency:
Latency number of Atria Logic 4k encoder IP core is around 0.15ms due to efficient implementation of pipelined design
- Input interface
The IP core input interface is compliant with ARM AXI4 specifications which are widely used in most of SoC designs. Other customized interfaces like Avalon or FIFO based interface support can be provided if required
- Quality Metrics
 - PSNR is around 45dB
 - SSIM(Structural Similarity)- Vary between 0.97 to 0.99 (Less than 2% degradation with respect to uncompressed picture quality)
 - Blockiness - The degradation for Blockiness is between 1% to 1.2%, when compared to uncompressed video

3 Atria Logic Video Encoder IP core block diagram

Figure 1 shows the architecture of Atria Logic UHD encoder IP core. All the modules are implemented in hardware with pipelining at each level. Atria Logic proprietary macroblock-line level pipelined architecture brings the latency numbers significantly down to sub-frame level.

There are two clocks in the design – Video clock which clocks the video modules; AXI clock – interface clock (at Input/Output) for users logic interface; The video input data interface will use its own clock (for 4k HDMI input clock of 148.5MHz is used).

Since the IP supports Intra-only mode, external memory requirement for IP core is limited only to access the input raw video data thus enhancing the performance and low logic utilization.

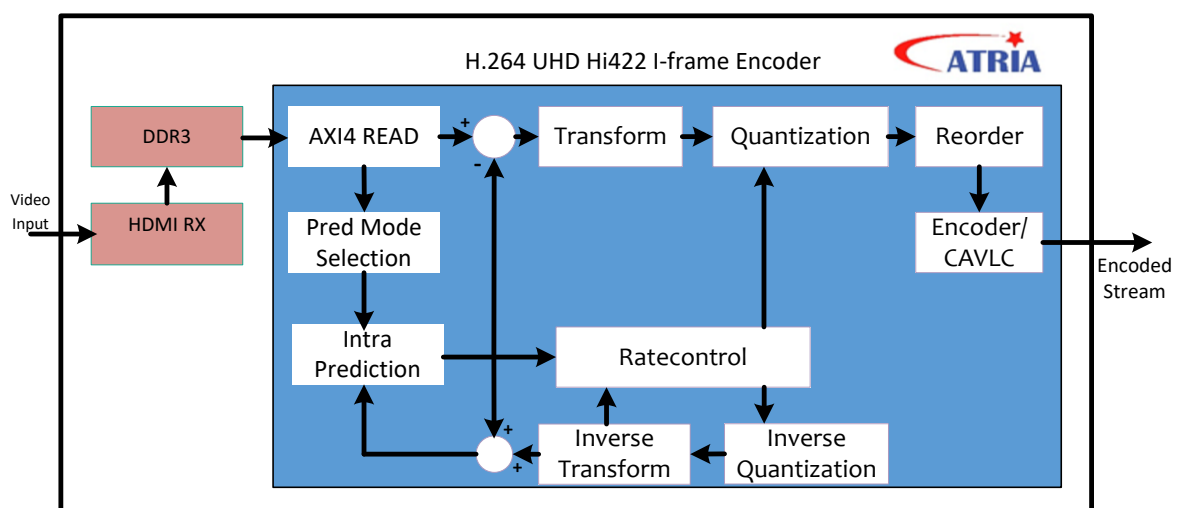


Figure 1: Functional Block Diagram of Atria Logic 4k H.264 Encoder IP Core

4 Application Integration

Atria Logic provides end-to-end evaluation package to validate encoder and decoder IP cores on Xilinx ZC706 evaluation kit. The solution is provided in netlist format along with necessary software drivers and documentation. For further details visit <http://atrialogic.com/4kencoder.php>

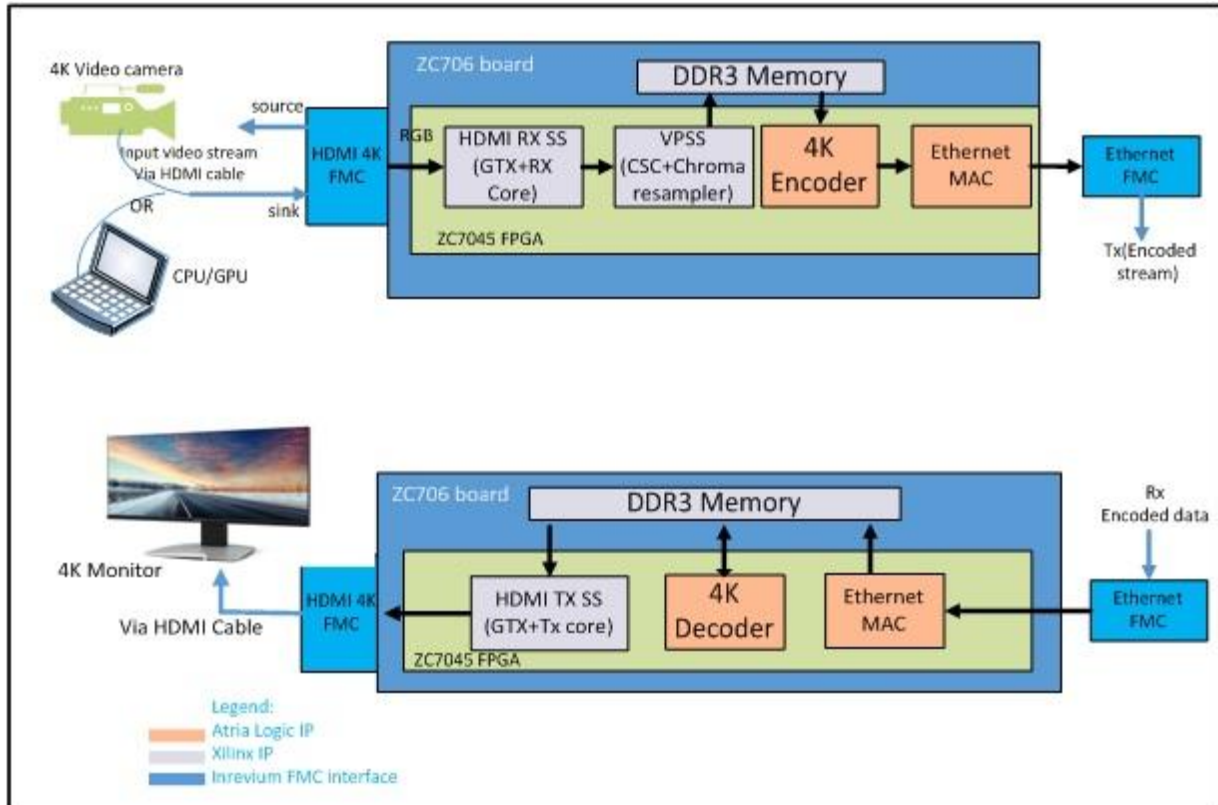


Figure 2: Atria Logic 4k codec evaluation setup

The solution involves Xilinx LogiCore HDMI System IPs (RX, TX, GTX) for HDMI video In/Out support. Also, Atria Logic Gigabit- Ethernet MAC IP is integrated for encoded stream transfer between encoder and decoder boards.

In this solution, the frame rate achieved is 60fps with latency of 0.25ms. The efficient implementation only takes up 78% of the programmable logic and DSP resources and 55% of the available RAM, leaving ample room for implementation of any other required circuitry. Integration of a Gb Ethernet MAC provides streaming over IP support.

5 Technical Support

Atria Logic provides technical support for all its IP offerings through dedicated customer support team. It also includes documentation, support through e-mail or phone depending on the customer requirements. Additional support services, such as on-site training services, can be subscribed from as a service contract.

6 Ordering Information

Atria Logic UGD H.264 video encoder IP core is available for licensing, or one-time fee purchase, or a combination of one-time fee plus reduced royalty payments. Please contact Atria Logic sales by telephone +1-408-730-4100 or e-mail: sales@atrialogic.com

7 Legal Disclaimer Notice

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