VIDEO BRIDGING SOLUTION PROMISES NEW LEVEL OF DESIGN FLEXIBILITY AND INNOVATION

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Ask embedded video system designers to describe some of the more intractable challenges they face and many will cite the rapidly evolving I/O landscape. Dramatic advances in mobile application processors, the rapid proliferation of low cost image sensors and displays, and the widespread adoption of MIPI standard interfaces have revolutionized embedded system design over the past few years. Today these mobile platforms lie at the heart of new innovations not only in smartphones and tablets, but also DSLR cameras, drones, virtual reality (VR) systems, medical tools and industrial displays. Ideally each device in a system would interface directly to the applications processor, but in today's emerging video markets that is not always the case. Often the interface type or number of interfaces on the applications processor does not match those on the system's image sensors or displays.

Designers of VR and 3D video are constantly in search for higher performance. For example, how can they quickly and cost effectively take the signal from a single input and spread it across two displays? Or how do drone designers take the input from multiple cameras and integrate it into a single, larger frame in a tightly synchronized manner? Unfortunately, there are very limited options and the ones that do exist are limited in performance, are high in power, and have a relatively large footprint.

What today's embedded video, designers need are high performance, low power and compact interface bridges that can resolve these connectivity problems in a manner that maximizes design flexibility and spurs design innovation. Ideally they need a bridging solution that can convert incompatible interfaces between cameras, displays and processors, combine multiple video stream inputs into a single interface output, or split video streams into multiple interfaces. They need a bridging solution that supports a broad range of both new and legacy interfaces. Finally, they need a bridging solution that delivers a high level of performance without violating strict system power and footprint budgets.

Introducing the New CrossLink™ Solution - Bridging the Connectivity Gap

To address this growing problem, Lattice Semiconductor has developed CrossLink™, the world's most versatile video interface bridge that supports leading protocols for mobile image sensors and displays. The CrossLink device takes the flexibility and fast

time to market advantages of an FPGA, along with being optimized for power and efficiency. CrossLink delivers the most flexible, highest bandwidth, lowest power and smallest footprint solutions for several high-growth market segments. This makes it the optimal solution for applications that can range from virtual reality (VR) headsets, drones and DSLR cameras to smartphones, tablets and wearable devices.

The key to the CrossLink device's potential is its comprehensive feature set. This new device sets the bar in performance as the industry's fastest MIPI D-PHY bridging solution supporting speeds up to 12 Gbps. To maximize designer flexibility this revolutionary new device supports a wide range of interfaces and protocols including MIPI D-PHY, MIPI CSI-2, MIPI DSI as well as a long list of legacy video interfaces and protocols such as CMOS , RGB, MIPI DPI, MIPI DBI, SubLVDS, SLVS, LVDS and OpenLDI.

At the same time, the CrossLink solution is highly optimized for consumer applications. It offers low operating power of <100 mW for many use cases and it's the first programmable bridging solution with a built-in sleep mode. This compact new device squeezes all its capabilities into a footprint as small as 6mm^2. The CrossLink device delivers the best of both worlds by taking advantage of the flexibility of an FPGA and the performance of an ASSP for video technologies.

To deliver fully customizable interfacing solutions, the CrossLink solution includes a mobile FPGA fabric with multiple physical interfaces. Each CrossLink IC features up to two embedded MIPI D-PHY blocks with each block containing up to four data lanes and a clock to support transmit and receive functions. The adjacent FPGA fabric features 5,936 LUTs, 180 Kbits of block RAM, and 47 Kbits of distributed RAM. Those FPGA resources are sufficient to support a wide range of video functions including multiplexing, merging, de-multiplexing, arbitrating, splitting, data conversion and custom protocol design. Data rates range up to 1.5 Gbps/lane using two hard D-PHYs and up to 1.2 Gbps/lane using programmable differential I/O blocks. Finally, the CrossLink device adds 15-programmable differential IOs, extensive GPIO resources, 10 KHz and 48 MHz oscillators and PLLs, two user I^{2}C embedded blocks for system functions as well as I^{2}C/SPI device configuration.

Development Support

To help speed development and shorten time-to-market, Lattice is offering extensive development resources for the CrossLink device. As part of its product support, Lattice is giving developers its Lattice Diamond FPGA design and verification software, and its Power Estimator tool along with the product data sheet. The company also offers IP free-of-charge from Clarity Designs to support implementation of a wide variety of display and camera interfaces including:

Display IP	Camera IP
MIPI DSI to MIPI DSI	Dual MIPI CSI-2 to MIPI CSI-2
MIPI DSI to Dual MIPI DSI	MIPI CSI-2 to Parallel CMOS
MIPI DSI to OpenLDI/LVDS	Parallel CMOS to MIPI CSI-2
MIPI DSI to Dual OpenLDI/LVDS	SubLVDS to MIPI CSI-2
Dual MIPI DSI to Dual LVDS	
MIPI DSI to MIPI DPI	
Single OpenLDI/LVDS to MIPI DSI	
Dual Link OpenLDI/LVDS to MIPI DSI	
Dual Link OpenLDI/LVDS to Dual MIPI DSI	
MIPI DPI to MIPI DSI	

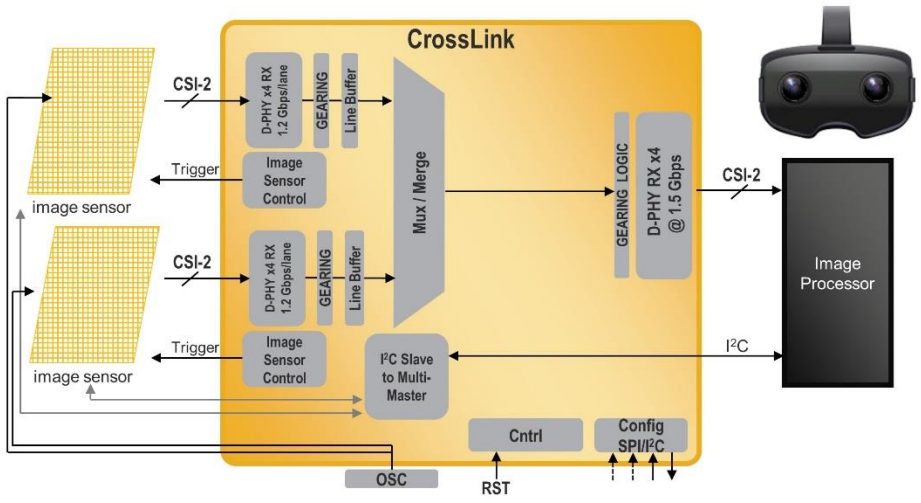
The basic CrossLink Development Kit includes a SMA daughter board and .1 inch header daughter board for easy connectivity to a variety of image sensors, displays, and application processors. Additional daughter boards are available as well. Raspberry Pi daughter boards allow connectivity of two cameras to the Raspberry Pi Board.

Typical CrossLink Applications:

MIPI CSI-2 Image Sensor Expansion

There are a growing number of new and exciting applications for this market and many of them require a camera aggregator that serves as a hub to manage multiple MIPI CSI-2 image sensors. In these applications designers may need to merge multiple image sensor inputs into a single larger frame, multiplex between image sensors or arbitrate between image sensors based on virtual channels. To create a depth perception or an augmented reality system, for instance, a bridge must merge multiple MIPI CSI-2 camera inputs into a larger single frame output. The CrossLink solution allows designers to interface to multiple MIPI CSI-2 image sensors simultaneously.

However, building a bridge that links multiple CSI-2 camera inputs into a single large format output presents some unique challenges. The bridge must capture each image sensor at the exact same moment in time with minimal latency. It must then combine those inputs into a single larger frame with images from each sensor and send it out at a faster video stream. The sensors must not only be synchronized with minimal latency, which requires general purpose pin control, they also need to share a common clock domain. In many cases each image sensor also requires its own unique power up sequence. Each of these functions demands additional I/O that must be customized for the particular application.

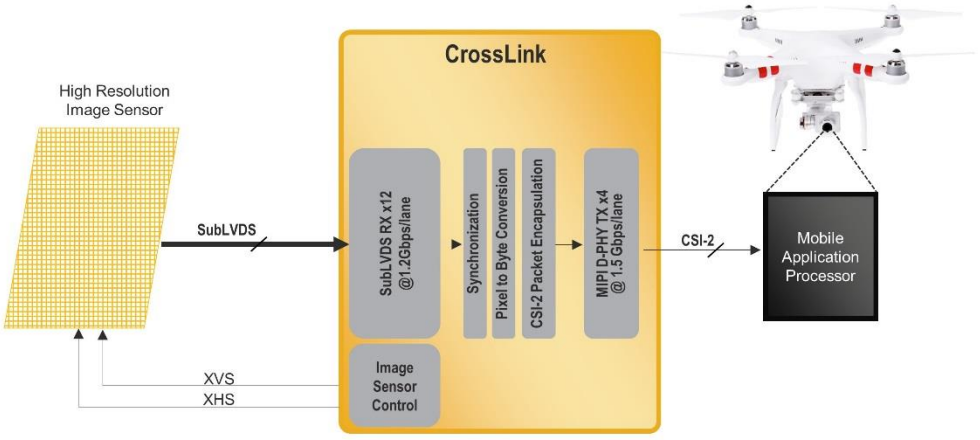


Industrial Sensor to Mobile Processor

In applications such as DSLR cameras, surveillance applications and drones, designers need to bridge between industrial image sensors and mobile application processors. Many of the industrial image sensors in these applications offer excellent performance, but use a legacy proprietary interface originally developed by the sensor manufacturer.

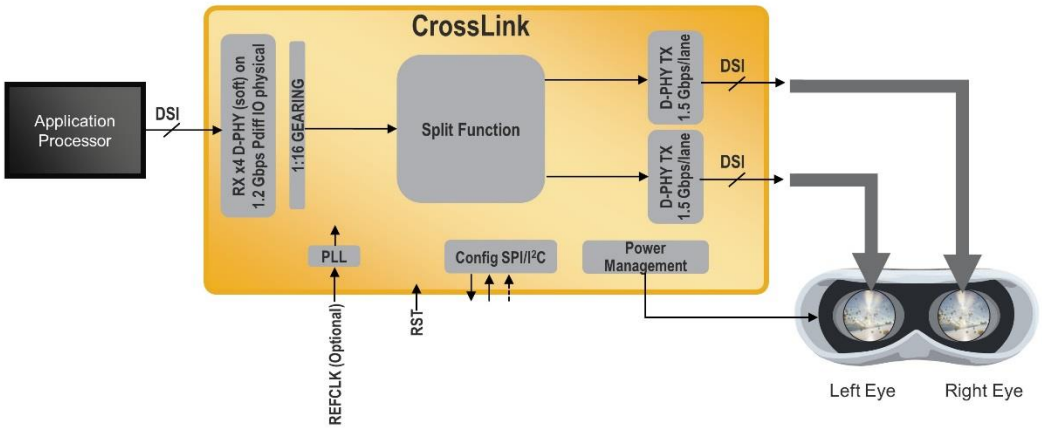
Designers building embedded applications in these markets typically want to leverage the tremendous innovations available on popular mobile application processors. In order to do this they need to convert the signal from those proprietary image sensor interfaces

to a mobile MIPI CSI-2 image sensor interface found on most of today's mobile application processors. Using its programmable fabric, the CrossLink device offers developers the ability to build compact, high performance, low power interface bridges that can convert a signal from those proprietary interfaces to MIPI CSI-2.



MIPI DSI Interface Expansion

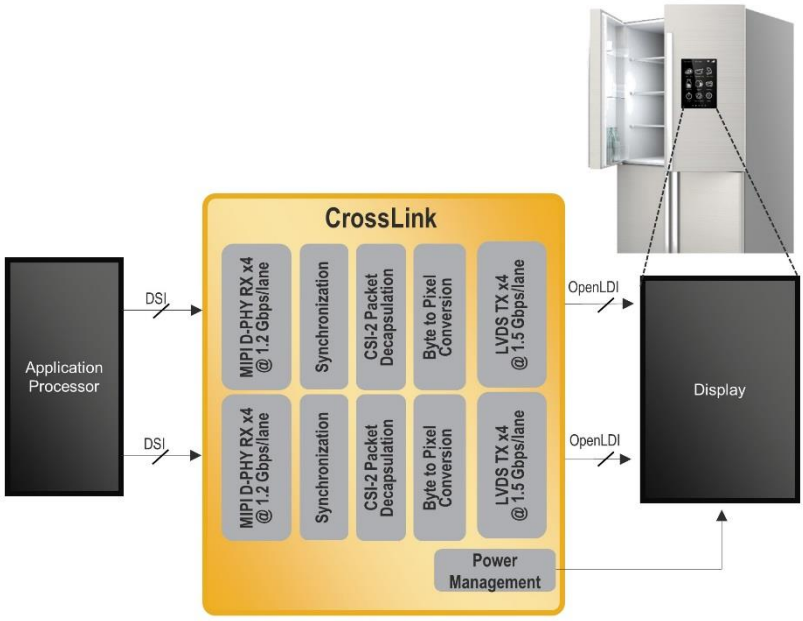
A third key application for the CrossLink device is MIPI DSI interface expansion. In today's VR headsets and mobile set top boxes designers often need to convert incoming video from a single MIPI DSI interface and split it out over two MIPI DSI interfaces at half the bandwidth. How does the designer support these types of applications if the application processor only has a single DSI interface or one of its available DSI interfaces is being used for another function?



One way to solve this problem is to use a CrossLink device as a single MIPI DSI to Dual MIPI DSI bridge. As the diagram above illustrates, this device can support two HD displays or a single QHD display at I/O rates up to 1.5 Gbps/lane. Operating power for this device is generally 25 to 50 percent lower than comparable ASSPs or ASICs.

Integrate Industrial Panels with OpenLDI, LVDS or Proprietary Interfaces with Mobile Apps Processors

Many users of industrial displays want to preserve their investment, but find it difficult when they try to bridge displays from OpenLDI, LVDS or proprietary interfaces to mobile applications processors. Typical applications can include Human-Machine Interface (HMI), smart displays and smart home systems. How can they leverage the advantages of the latest generation of mobile applications processors and retain use of their legacy displays?



In this case developers of HMI solutions, smart displays or smart home applications can use the CrossLink solution to convert interfaces from OpenLDI, LVDS or proprietary interfaces to MIPI CSI-2 at data rates up to 6 Gbps per PHY.

Conclusion

The future looks promising for the embedded video systems market. Exciting new applications are coming to market ranging from VR and 3D video to new surveillance systems, smart homes, improved medical tools and industrial systems. One key to their success will be designers' ability to continually improve performance and utility. By delivering a new level of high performance, low power, compact bridging solutions, Lattice's CrossLink solution offers designers a unique opportunity to maximize design flexibility and, in the process, enable design innovations.

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