

DTI & Altera Displaying the Future in Real-Depth 3D

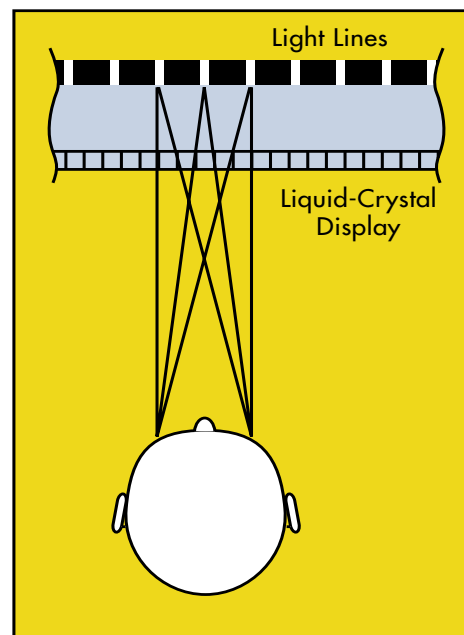
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Flat panel displays that show content in Real-Depth 3D™—without the use of glasses or other cumbersome headgear—were once the exclusive domain of specialized, high-cost, high-end applications such as military and space hardware. The familiar technology curve has recently changed that, driving this advanced technology into much more affordable consumer products such as desktop displays, cell phones, and laptops. This migration, of course, requires that 3D display systems keep pace in technology and cost. As the acknowledged world leader in this rapidly evolving technology, Dimension Technologies' 2D/3D switchable auto stereoscopic monitors use Altera® Cyclone™ devices and soft intellectual property (IP) cores for rapid, low cost, feature rich product development.

When viewing the real world, the human visual system uses different cues to construct an internal 3D model of what it is seeing. There are many such cues, including shadowing, the apparent size of objects, perspective, and others. The cue that provides a vivid sensation of depth that you see when looking at the real world or a DTI Real Depth® display is called binocular disparity. That is the term for the fact that the image that your left eye sees and the one that your right eye sees are slightly different from one another: your eyes see the world from two different locations, about 2.5 inches apart. The brain processes the differences in these two views (called a stereo pair) to provide an accurate representation of the shape and position of objects within the scene.

With the DTI no-glasses 2D/3D switchable flat panel display—as in the real world—your left eye sees the left eye view and your right eye sees the right eye view. This is accomplished with a special illumination pattern of light lines and optics behind the LCD screen that make alternate columns of pixels visible to the left and right eyes when you are sitting in front of the display, or in certain areas off to the side. As illustrated in Figure 1, the DTI system displays the left and right halves of stereo pairs on alternate columns of pixels on the LCD.

Figure 1. Alternate Columns of Pixels



To achieve the proper display image, a unique LCD data pattern is required. To generate this pattern, logic and memory resources are needed to buffer and manipulate the input data stream as well as implement the necessary control functions for the user interface and achieve the required output format. The Altera Cyclone FPGA is the centerpiece of the DTI Real-Depth 3D electronic subsystem. The FPGA handles all of the necessary processing as well as implementation of two SDRAM controllers, user interface sections, and unique control algorithms as shown in Figure 2.

DTI's decision to use Altera's Cyclone family was an easy one because it satisfies all of the design's requirements along with providing a significant cost savings. Our previous board used four FPGAs at a cost of \$100/board, while Cyclone features have reduced that to \$25/board for the base display. The high I/O pin, fine-pitch ball-grid array (BGA) package of the Cyclone FPGA also allowed a 75 percent printed circuit board (PCB) size reduction and increased functionality and flexibility. The increased functionality provides a better user experience with support for features such as additional resolutions and refresh rates, increased color spectrum, and more advanced video support, to name a few. The increased flexibility allows us to keep the same base PCB and system structure across products, reducing fabrication and assembly NREs, as well as reducing the different inventory required to produce our full line of Real-Depth 3D flat panel displays.

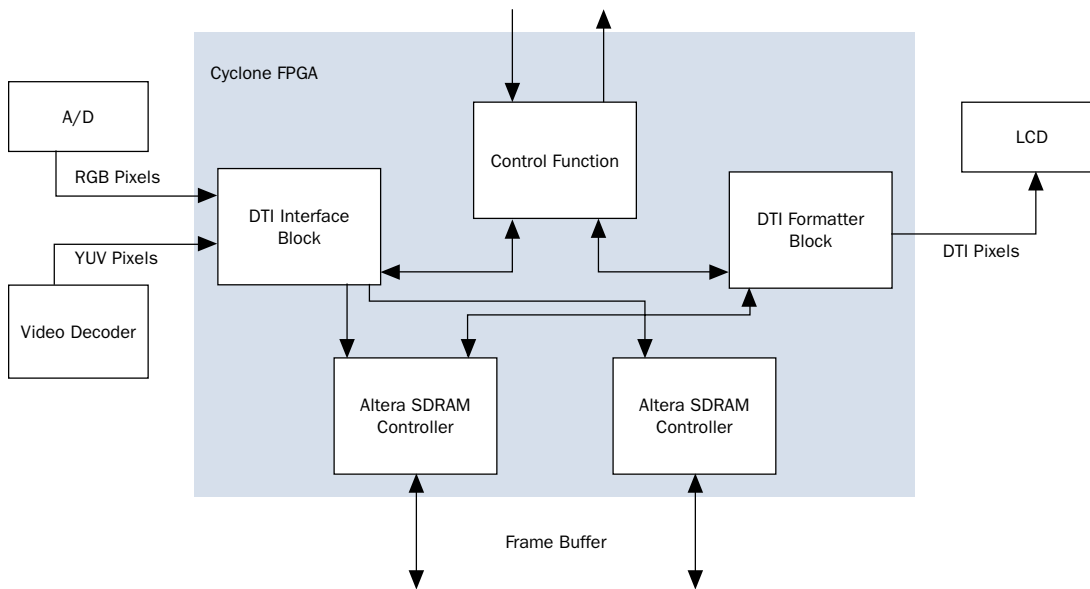
Company:
DTI

Industry:
3D Graphics
Display

End Products:
2D/3D Switchable
Displays, Custom
3D Solutions

Altera Product:
Cyclone FPGA

Figure 2. Cyclone Implementation Block Diagram



In addition to the production benefits, Altera also reduced the development time of our new 2D/3D switchable flat panel displays by providing soft IP cores and increased testing functionality. The soft IP cores provided were an SDRAM controller, first-in first-out (FIFO) buffers, and other Verilog HDL cores, through the MegaWizard® Plug-In Manager available in the Quartus® II and the SOPC builder software tools available with the Nios® processor. The increased test support was in the form of Altera's SignalTap® II logic analyzer available through the Quartus II software. The SignalTap II logic analyzer facilitates access into the inner part of the FPGA design for node watching, conditional triggering, and the other necessary debugging functions of a high-end logic analyzer without the additional equipment cost or I/O and test point penalty. The bottom line is that Altera's Cyclone FPGAs allow us to provide our customers with a better product at a reduced cost.

Conclusion

The familiar technology curve is unrelenting. Capabilities that were once wildly expensive and exotic regularly find their way into less expensive and more mundane consumer products. As display technology and content combine in more and more unique ways, the concept of Real-Depth 3D allows us to see more of our world on flat panels in the same way we see it in real life—with real depth, without the use of clunky glasses or other cumbersome devices. DTI and Altera are working together to provide industry professionals and consumers with a best-in-class product at an affordable price. See the world in Real-Depth 3D today.