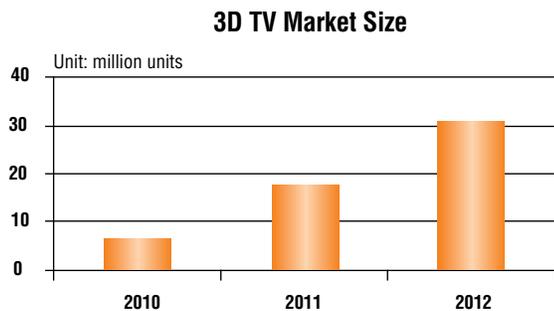


Enabling 3D Active Shutter Glasses

Universal 3D Shutter Glasses using the iCE40 Ultra-Low Density FPGA

3D Market Dynamics

Consumer electronics heavyweights are betting big on 3D technology to help drive sales of new televisions and other hardware. Figure 1 shows the estimated volume of 3D TV shipments. Aside from the considerable cost of the hardware, one of the most significant impediments to broader 3D adoption at home is the glasses.



Source: Insight Media

Figure 1: 3D TV Market Size

While there are two types of 3D glasses available in the market today (Figure 2), it is clear that the shutter type is the dominant choice as it provides better brightness, yields a lower cost for 3D panels and provides 2D/3D panel co-use (240Hz).



Figure 2: 3D Passive Glasses (left) and Shutter Glasses (right)

How it Works

The lenses in the glasses darken and lighten in time with the refresh rate of the TV screen. Liquid crystal and a polarizing filter contained in the lenses cause this change to happen (see Figure 3). An IR emitter sends a signal that causes the glasses to darken over one eye and then switches to the other, depending on what the TV screen is doing.

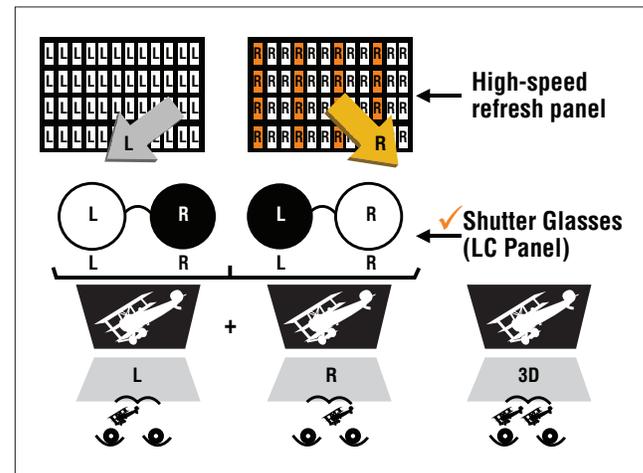


Figure 3: Shutter Glasses Operation Model

Although active shutter glasses are the dominant technology for consumer-oriented 3D-enabled televisions, they come with a number of serious drawbacks. This technology is relatively expensive and uses batteries that have to be replaced or recharged. There are also a number of interoperability issues that prevent some active shutter glasses from being fully compatible with products from different vendors.

Interoperability Issues

The biggest interoperability challenge is compatibility on the infrared (IR) signal operation timing.

Most TV makers define their own standards when it comes to IR transmissions between 3D TVs and shutter glasses. Sometimes different IR transmission operation timings exist even within the same company. For example, Sony's 50Hz and 60Hz versions have different IR operation timings. This creates the problem of preventing low-cost universal 3D active shutter glasses for massive deployment.

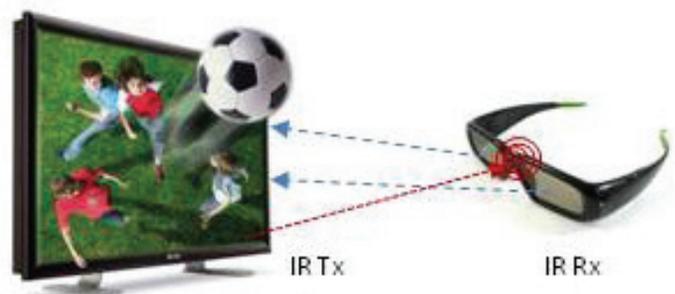


Figure 4: Shutter Glasses with 3D Display and IR

Implementing Universal 3D Active Shutter Glasses Using iCE40 FPGAs

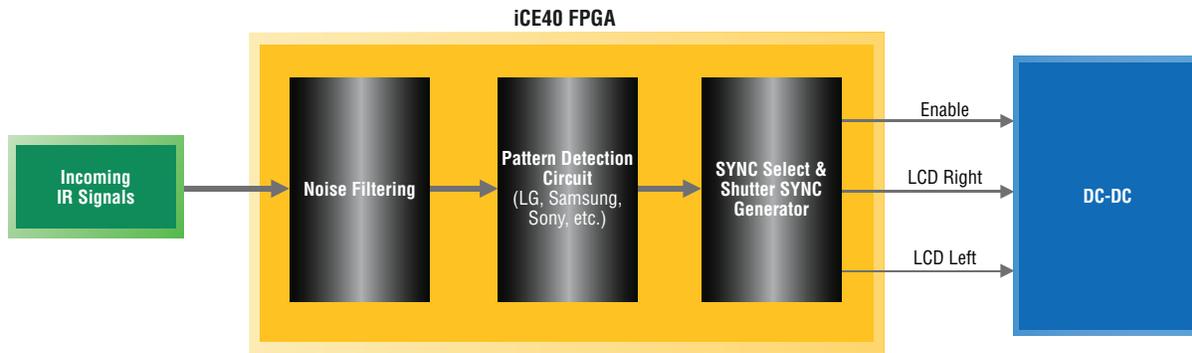


Figure 5: Block Diagram of 3D active shutter glasses using an iCE40 FPGA

The low power, low cost iCE40™ FPGA family is offered in small form factor packages ideal for portable and handheld type space constrained applications. For 3D active shutter glasses, it can be used to implement IR noise filtering and pattern detection circuits. With built-in IR noise filtering and pattern detection circuit, the 3D active shutter glasses can work with multiple 3D shutter enabled TVs as long as the IR timing sequence is pre-implemented in the silicon. In fact, the iCE40 family is based on SRAM technology, therefore a new IR timing sequence can be added later even after a product has been released in the market.

Figure 6 shows the flow of a universal 3D shutter glasses design implemented in an iCE40 FPGA:

- Power on the universal 3D active shutter glasses
- Check incoming IR signals through the “pattern detection circuit” to determine which TV maker and shutter pattern to use
- Enable the DC-DC block for the LCD display
- Generate the LCD waveform and send it to the DC-DC module

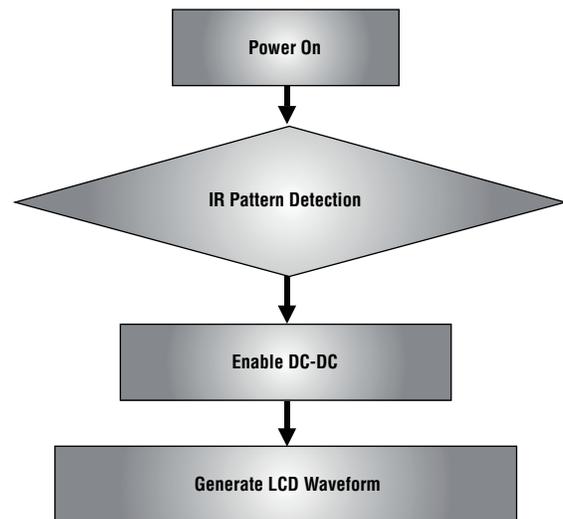


Figure 6: Universal 3D Shutter Glasses Design Implemented in an iCE40 FPGA

The iCE40 FPGA family is the ideal platform for emerging applications where standards are still evolving. It allows designers to develop a product quickly and easily while allowing for future updates.

Applications Support

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