Video Scaling and Expansion in Media Tablets

Flexible Video Solutions using the iCE40 Ultra-Low Density FPGA

Explosive Growth in the Media Tablet Market

Sales of tablets are experiencing explosive growth. International Data Corporation (IDC) estimates that about 17 million (media-focused) tablets shipped in 2010, and that 44.6 million will ship in 2011, with 70.8 million shipping in 2012. Much of this predicted growth will result from Android (and other OS) tablets arriving on the scene. IDC defines media tablets as ranging from 5 to 14 inches in size and running a lightweight OS, like iOS or Android.

In addition to growing sales of tablets, the market for e-readers is experiencing significant growth with estimates of over 16 million e-readers shipping in 2012. In the e-reader category, the Amazon Kindle leads the pack with about 41.5% market share globally.

The Need for Video in Media Tablets

Application processors (APs) used in media tablets are primarily driven from two places, the netbook arena and the smartphone arena (Figure 1). Since these APs are not originally designed for tablets, mismatches are created. For example, most smartphone APs support only a single display output. A problem arises when these products attempt to drive an external display at a different resolution from its own display. To resolve this problem, a video splitter device capable of driving two different resolutions is needed. This video splitter device should ideally contain an upscaler/downscaler and a video traffic controller that can be used to control different video data going out to displays.

> " In 2010, media tablet sales grew 45% in Q3 comparing to Q2 with total estimated shipment of 17 million units in 2010. IDC predicts that 44.6 million media tablets will ship in 2011 and 70.8 million shipping in 2012. "
>
> IDC

Lattice Solutions

Lattice offers wide range of video-related IP cores in the areas of scaling, expansion, Color Space Conversion (CSC) and video traffic control for media tablets. Below are some of the available IP cores from Lattice :

- I^{2}C Base Dual Display (Video Traffic Controller)
- XGA to WVGA LANCZOS2 (Downscaler)
- XGA to WVGA NN (Downscaler)
- YcbCr 10bit to RGB565 (Color Space Conversion)
- YcbCr 8bit to RGB565 (Color Space Conversion)

Since the Lattice solution is based on a flexible FPGA architecture, other solutions such as frame buffer, image rotation, downscaling using different algorithms, upscaling, and other color space converters can also be implemented.

Figure 1: Processors used in media tablet applications are mainly driven by notebooks and smartphones.

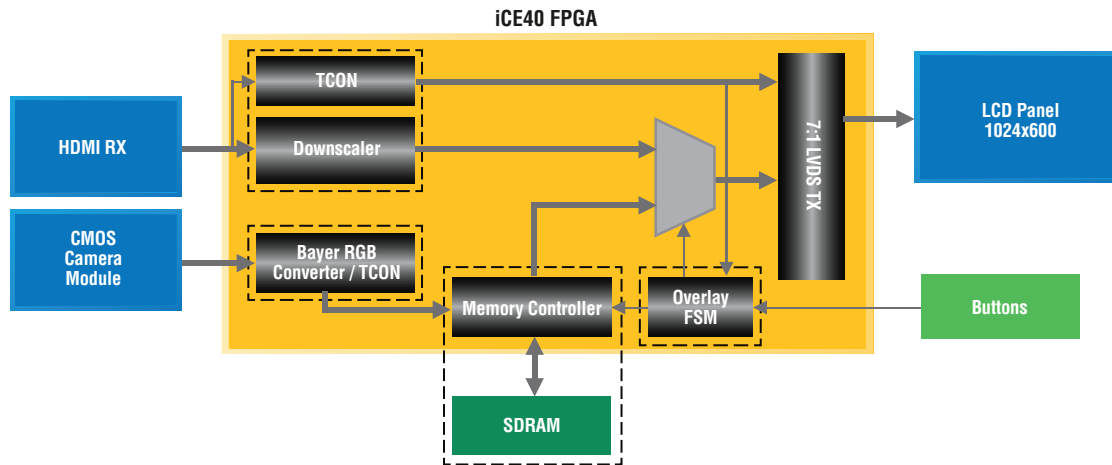# Video Example Using the iCE40™ FPGA

iCE40 FPGA

Figure 2: Block Diagram of Video downscaling with frame buffer design on the Video Demo Board.

- The parallel RGB and sync video signals from the 720p video source are downscaled for the LCD display. The RGB and sync video outputs are serialized for 7:1 LVDS transmission.
- The CMOS camera module video signals are demosaic to parallel RGB format. The Timing Controller (TCON) from the converter will inform the overlay Finite State Machine (FSM) when a new frame is available.

- Overlay FSM is used to control a "Video in Video" application. By using information from the TCON unit, the FSM can change video source from the downscaled 720p or frame buffer. A set of external buttons allow the overlay window to change its position.
- Optionally a memory controller can be implemented inside the iCE40 FPGA for frame buffering.

Video Demo Board

- CMOS camera module input
- Support for HDMI input
- Bayer RGB (raw format) demoasic to RGB565
- SDRAM memory as video frame buffer as demonstrated by freeze frame feature
- 720p video downscaling
- 7:1 LVDS TX to 1024x600 LCD panel
- Optional second display connector
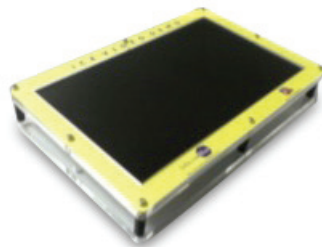
The Video Demo Board is available for demo only through Lattice sales representatives. Please contact your local Lattice sales office to schedule a demo.

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