

# Enabling Dual Displays in Digital Still Cameras

## Add a second display using the iCE40 Ultra-Low Density FPGA

### Self Portrait with a Digital Still Camera

Self portraits can be a lot of fun and are extremely popular with young consumers. There are two ways to take a self portrait:

- Using the built-in timer
- Extending the user's arm to operate the shutter by hand (see Figure 1)



Figure 1: People taking a self portrait using a digital still camera

### The Self Portrait Challenge

Self portraits are challenging for a number of reasons:

- You can't see the image until after the photo has been taken
- Setup can be time consuming due to the running back and forth to set timers
- Focus is difficult because you can't see where the focus point is resting
- When using the built-in timer there is a chance you aren't in the frame

Each of the two self portrait methods takes tremendous effort to master and it is easy to make mistakes even after mastering them.

### Self Portrait Solution

There are a few ways to solve this problem. One easy solution is to add a mirror on the front side of the digital camera. While this does not exactly represent the image on the display, it provides some insight into the resulting picture. However, adding a mirror only works for a short and fixed distance.

The ideal solution is a front display showing the exact image of the picture. When taking a self portrait, it is much easier to adjust your position based on the image on the front display.

### Adding a Front Display

Since most camera DSPs support only a single display output, they cannot add a front display because:

- The camera DSP has no second display output
- The same size display can't be added because the camera is physically too small

Even if there is room to add a second display of the same size, it is generally not cost-effective. The designer's default choice is to add a smaller display with less resolution supported. To overcome this, the designer has two choices:

- Re-spin the camera DSP to add an additional display output
- Use a cost-effective, low-power iCE40™ FPGA

Re-spinning the camera DSP can be risky and time consuming for a product with such a short product life cycle.



Figure 2: A camera with a front display.

## USB Keyboard Docking Solution

The iCE40 FPGA cannot support a USB interface directly and needs to interface first to a USB PHY. However, a USB 1.1 physical interface can be emulated by using a pair of 3.3V, single-ended I/Os. In addition, USB 2.0 is required to be backward compatible with USB 1.1 devices. Thus, the iCE40 FPGA is able to emulate a USB 1.1 device and is compatible with a USB 2.0 host.

In addition to implementing the required USB slave functions such as endpoints, the majority of the work for Lattice involves creating the proper HiD report, which is stored in the iCE40 FPGA as a ROM. The report structures tell the USB host software the capability of the USB devices and how to interface to them. In addition, optional SHA-2 type challenge/response encryption can be implemented to authenticate genuine equipment.

## Keyboard and Touchpad Docking Solution Using the iCE40 FPGA

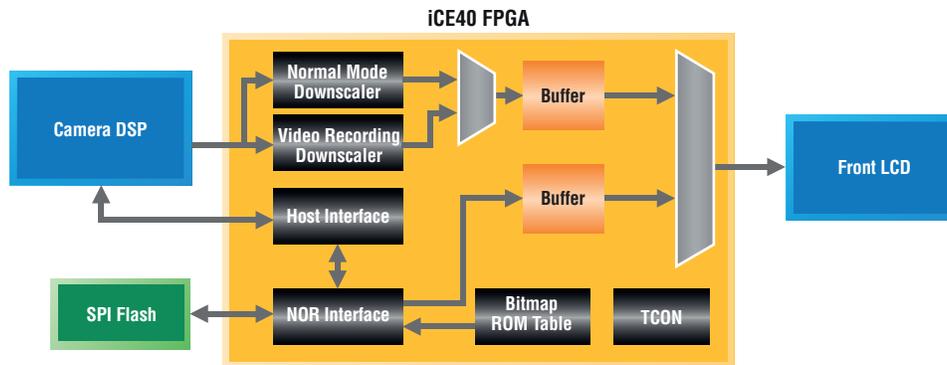


Figure 3: Using an iCE40 FPGA to implement front LCD integration and bitmap display.

## Media Docking Solution

The purpose of a media docking station is to provide enhanced audio and video quality. The Lattice media docking solution provides an easy way to connect all the audio and video sources from media devices (e.g., radios, smartphones and tablets) to the external world. The video scaling portion of the design takes video input source from the media device and either downscals or upscales it and sends it to the external HDMI connector. Audio mixing takes in I<sup>2</sup>S audio source from the media devices and radio and plays one of them based on user input. In addition, optional SHA-2 type challenge/response encryption can be implemented to authenticate genuine equipment.



Figure 4: Modes that can be supported by adding a front display.

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