

Analog Switches Provide Multiplexing Function for Cameras and Displays in Mobile Applications

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The latest smartphones integrate multiple displays and cameras as a matter of both convenience and to serve specific applications. Moreover, the smartphones have begun to look much like a PC, from an architectural point of view, integrating an applications processor and video/imaging coprocessors alongside the baseband processor that handles the wireless link. Design teams face a tough challenge in connecting the processors and coprocessors with cameras and displays although analog switches can greatly simplify the challenge.

The emerging use of multiple displays and cameras is a matter of both application requirements and customer satisfaction. For example, a front-mounted camera that faces the user is required for video teleconferencing. Meanwhile a rear-mounted camera provides a superior experience when users capture still images or video. Camera sensors have dropped in price to enable such designs, and a typical implementation might use a lower-resolution 5-Mpixel camera on the front and a higher-resolution 12-Mpixel camera on the rear.

Multiple displays are more of a convenience factor. A smaller, lower resolution display can persistently provide information such as the time of day, or indications of newly arrived email or text messages. A larger, higher-resolution display, perhaps inside a flip or slider design, provides a better user experience for web surfing or video teleconferencing.

There are two primary approaches to connecting peripherals such as displays and cameras with application processors

or coprocessors. Older designs use wide parallel interfaces, while serial-oriented interfaces promulgated by the MIPI® (Mobile Industry Processor Interface) Alliance are quickly pervading designs.

Whether the design is based on a parallel legacy interconnect or a MIPI standard, multiple displays and cameras create a problem with signal-integrity. To make matters worse, the cameras and displays are sometimes connected by flex cable, mounted away from the main PCB where the processors are mounted.

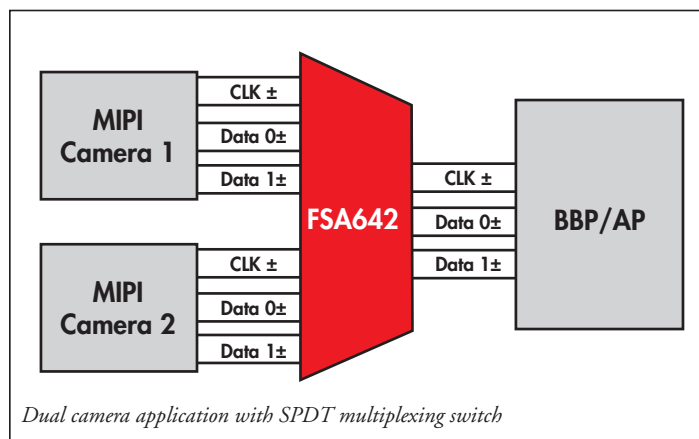
In the case of a parallel interface, the simplest approach is to simply connect the two peripherals to the same set of signals. In the case of a camera, the data flows to the processor, and in the case of a display, it flows from the processor. The one way flow can allow the bussed-signal connection to function even without a bus-contention management scheme.

But two peripherals connected on the same set of conductors causes problems in either the camera or display case. There is inherently a different distance between the processor and each of the peripherals creating significant potential for signal reflections.

Consider the case of dual displays. Even if the external display is disabled when the phone is flipped open, signals still travel along the conductors to the external display and create noise that hampers the performance of the primary display.

One way to improve the parallel interconnect design case is via the use of a parallel analog switch such as the Fairchild FSA1211. A typical design switches the signals that travel the farthest distance. For example, the switches would only close when the external display is in use, and would open when the primary display in use. The shorter signal stubs that remain connected to the primary display at all times cause less of a problem with reflections than would the longer stubs that connect to the secondary display.

Newer designs that utilize MIPI interfaces have a similar problem. The MIPI specifications for cameras and displays were conceived as point-to-point links, and most processors and coprocessors include only a single MIPI port for each peripheral type.



The MIPI interconnects do afford an even better opportunity to support multiple cameras and displays because the serial-based schemes have fewer conductors that must be switched at any given time. For example, the MIPI camera interface has only four data signals and two clock signals. With only six conductors to switch, a single-

pole double-throw switch such as the FSA642 can fully multiplex access to a peripheral ensuring that only one link is active at any given time.

Whether a given design is based on a legacy parallel interconnect or a MIPI interface, the task is more complex than simply adding a switch to the design. In both cases, there are significant signal-integrity issues that must be mitigated. An activated switch still creates a discontinuity and an incident wave response.

Design teams need to follow best practices in PCB layout to successfully support multiple peripherals. The list of those practices is long. Short trace lengths are key. Signals should be routed on a PCB layer adjacent to a ground plane. And location of the switches is important.

The good news is that proper design techniques combined with analog switches present the best approach to supporting complex peripheral requirements in smartphones and similar devices such as tablets. If you would like more information, Fairchild has an expanded technical paper that examines this topic and provides further guidance on both the problem and solution.