design FAQs

Flash FPGAs And Mixed-Signal Design

FREQUENTLY ASKED QUESTIONS

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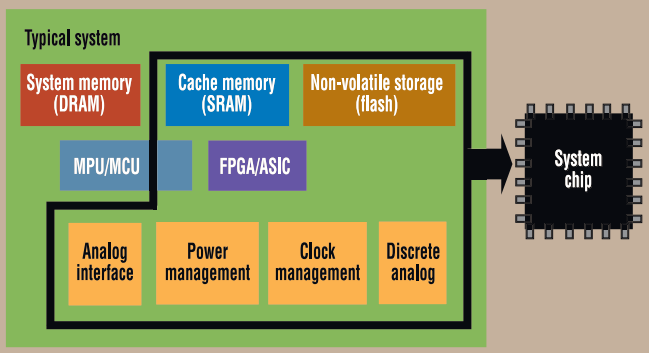
Where do I need analog and flash memory in a digital system?

Many systems accomplish most of their tasks using digital logic. But the logic chips themselves—FPGAs, ASICs, ASSPs, etc.—all require some analog support. That support takes the form of power-sequencing control, voltage sensing to detect brownout conditions, power management, and temperature sensing to provide dynamic control of fan speed, clock speed, and even operating voltage *(see the figure)*.

For example, power sequencing requires a combination of logic and analog sensing. The logic controls the order in which the various power-supply voltages are applied to the chips, and the analog senses the voltage levels. To implement the sequencing function, many RAM-based FPGA users and ASIC/ASSP users have added a small flash-based programmable logic device and a comparator to do the job.

If a flash-based FPGA or anti-fuse-based FPGA is used in the system today, the "instant-on" aspect of those FPGAs allows the sequencing function to be incorporated into the FPGA. RAM-based FPGAs and other circuits that load data into RAM upon power-up would still require external sequencing logic to ensure they start up in the proper state.

Some of these functions, such as temperature sensing and operating voltage control, will require analog circuits that can deliver precision results to within a few percent of the value to ensure that the digital circuits operate properly. Critical items like calibration values or various setpoints determined during system setup, along with other system data, must be saved. Flash memory, either standalone or integrated on the logic chips, provides a good match to hold that information.



A typical digital system isn't purely digital. It often contains multiple analog functions to sense temperature, manage power, and control the operating voltage, clock speed, and fan speed. To simplify system design, these functions can be incorporated into a mixed-signal ASIC or one of the latest mixed-signal FPGAs.

What implementation tradeoffs are possible?

There are many ways to implement the necessary functions to support the FPGAs, ASICs, and other digital circuits. Analog functions such as comparators, op amps, analog-to-digital and digital-to-analog converters, discrete transistors, and passive components such as resistors and capacitors can be used to implement the desired functions in many cases. Alternately, some of the analog functions can be integrated into a mixed-signal support ASIC or microcontroller to reduce the circuit-board clutter.

Today's FPGAs are basically digital. But as more FPGAs incorporate analog phase-locked loops and high-speed serial interfaces (which are somewhat analog in their design), their ability to handle additional analog support functions also will improve.

Recently, mixed-signal FPGAs have entered the market. These FPGAs incorporate analog capabilities, flash memory, and a configurable logic fabric on a single chip, eliminating the clutter of support components that might otherwise be required.

How can I leverage user-programmable flash in FPGAs?

The amount of user-available flash memory on FPGAs is increasing—next-generation FPGAs will offer multiple megabits worth of storage. This storage will be needed to support one or more soft processors that designers can overlay on the programmable logic fabrics. Each CPU will require its own program and data space.

By integrating large on-chip flash memories, the FPGA suppliers will allow the FPGAs to hold the program and critical data on chip, away from the prying eyes of competitors. This becomes increasingly important since more and more intellectual property is software-based, whether it be an algorithm or a logic configuration.

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