

Context Save and Reload with Real-Timestamp

Introduction

To reduce power, many systems will store needed data, suspend operation, or turn off components and return power when needed. For this context saving and switching, designers must have nonvolatile memory, timestamping, and power management. Actel Fusion™ FPGAs offer a one-chip solution that supports integrated Flash memory for data storage, a real-time counter (RTC) for timestamping, and a voltage regulator that enables low power modes of operation. Previously, separate components were needed to save RAM and register contents into Flash with a timestamp prior to shutdown. The integrated features of Fusion also support general data logging with or without timestamp. If the system has an out of control event, the state of the system can be logged for review when serviced.

When used in conjunction with its robust power management capabilities, the Fusion FPGA supports the designer's need for low power (sleep mode) while maintaining critical system data. Figure 1 illustrates the block diagram of a system in which the context is saved in embedded Flash along with a timestamp. Data is then reloaded when required.

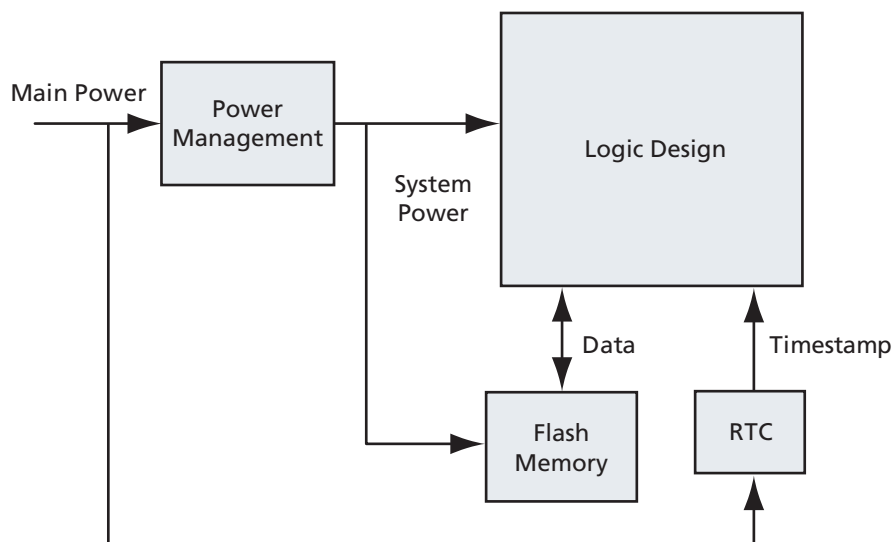


Figure 1 • A Basic Implementation of Context Save and Reload Application

Integration Using Fusion Technology

The required blocks for context saving and reload, depicted in Figure 1, can be implemented in a single Fusion device. The application logic design and the logic of power management can be implemented in the FPGA fabric of the Fusion chip. Fusion devices also include embedded Flash, an RTC, and a 1.5 V regulator that can interface to the FPGA fabric.

Embedded Flash Memory

One unique feature of a Fusion device is the embedded Flash memory. Each Flash memory block contains 256 kbytes of nonvolatile memory space and the associated circuitry required to easily read, modify, and optionally rewrite the memory contents from the FPGA fabric.

For context saving and reloading applications, the embedded Flash is used to store multiple contexts along with their timestamp before entering sleep or power-down modes and for reloading them whenever the system wakes. The embedded Flash may also be used to implement ROM-coded state machines or to store microcode instructions for an embedded processor or any other storage functionality required by the system application.

Real-Time Counter

The real-time counter (RTC) is another embedded hardware block in Fusion devices. It is a 40-bit counter with a 40-bit match register and a match flag. The RTC runs off the 3.3 V input to the Fusion device and can control the 1.5 V supply to the FPGA fabric, creating a standby mode. The clock input of the RTC is provided by an external crystal oscillator. The RTC block can be configured as a real-time clock to create timestamps and wake up the FPGA fabric at a specified time. The contents of the 40-bit counter and match registers (for timestamp comparison) are accessible from the FPGA fabric.

Implementation

In the context saving application shown in [Figure 2](#), the RAM and register values to be saved along with an accompanying real-timestamp, or a version stamp with a count instead of a clock, are temporarily stored in on-chip SRAM. Data is then written to the Flash memory. Once the data is stored in Flash, the 1.5 V voltage regulator can be disabled, turning off power to the FPGA fabric, Flash memory, RAMs, and registers, leaving the 3.3 V supply (and RTC) operational. Later, the voltage regulator can turn on at a predetermined time via the RTC or by an external wake signal. The process is reversed at wake-up, taking data from Flash memory and loading it back into the FPGA fabric, RAMs, and registers.

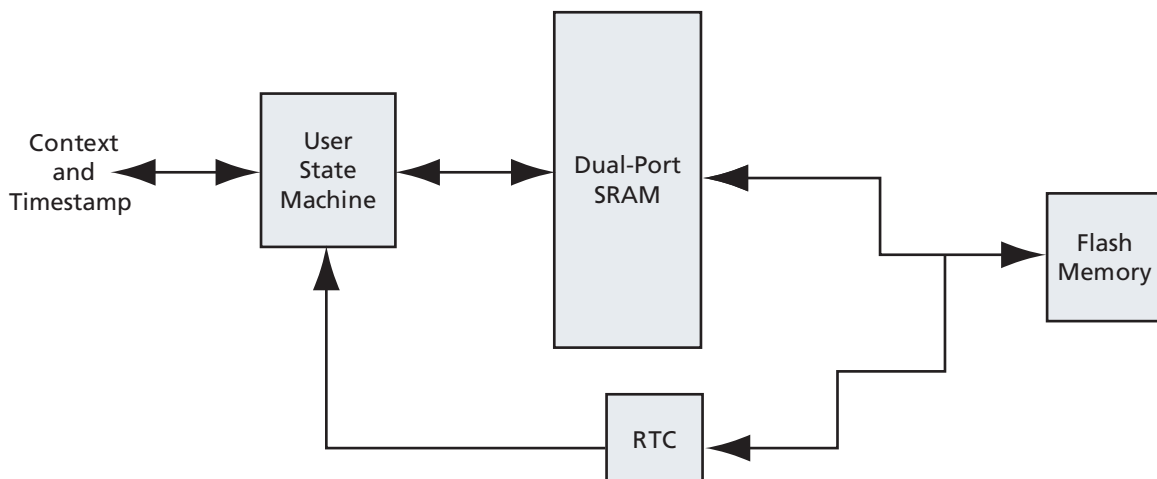


Figure 2 • Simple Representation of Context Save and Reload in Fusion Devices

Conclusion

In addition to many other innovative features, Actel Fusion FPGAs provide a standby mode, embedded Flash memory, and a real-time counter. These capabilities make Actel Fusion technology an ideal candidate for implementing context saving/reloading and timestamping applications.

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