Context Save and Reload with Real-Timestamp

Table of Contents

Introduction

To reduce power, many systems 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. Microsemi Fusion® field programmable gate arrays (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 are 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 designers need for low power (standby or sleep modes) while maintaining critical system data. Figure 1 shows 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.
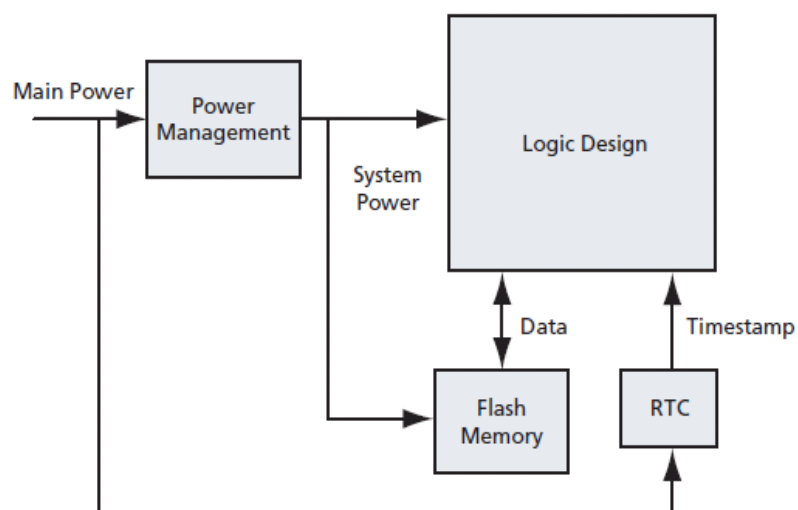

Figure 1 • **A Basic Implementation of Context Save and Reload Application**

Integration Using Fusion Technology

The required blocks for context saving and reload, shown in Figure 1 on page 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 standby or sleep low power modes and for reloading them whenever the system wakes. The embedded Flash is also 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.

RTC

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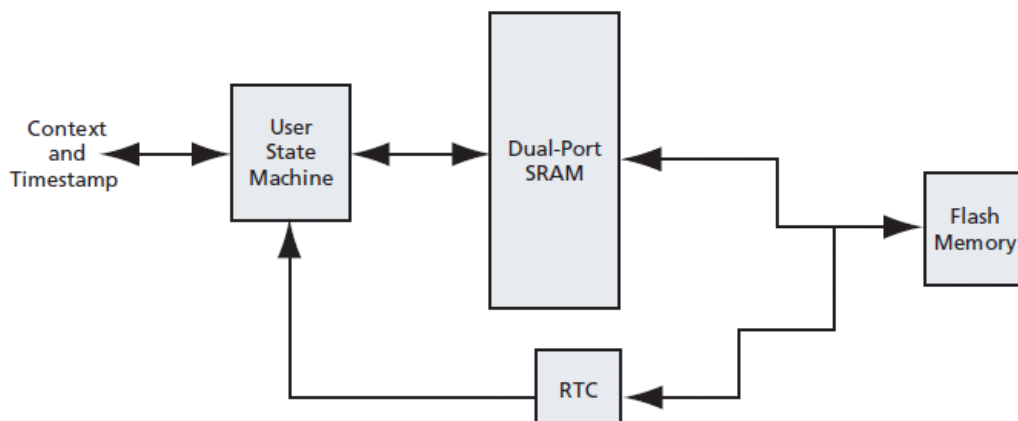
Figure 2 • **Simple Representation of Context Save and Reload in Fusion Devices**

Conclusion

In addition to many other innovative features, Microsemi Fusion FPGAs provide standby and sleep modes, embedded Flash memory, and a RTC. These capabilities make Microsemi Fusion technology an ideal candidate for implementing context saving/reloading and timestamping applications.

List of Changes

The following shows important changes made in this document for each revision.

Revision	Changes	Page
Revision 2 (July 2016)	Non-technical updates.	N/A
Revision 1 (June 2006)	The low power modes of operation were updated and clarified.	N/A
Revision 0 (December 2005)	Initial release.	N/A

Microsemi makes no warranty, representation, or guarantee regarding the information contained herein or the suitability of its products and services for any particular purpose, nor does Microsemi assume any liability whatsoever arising out of the application or use of any product or circuit. The products sold hereunder and any other products sold by Microsemi have been subject to limited testing and should not be used in conjunction with mission-critical equipment or applications. Any performance specifications are believed to be reliable but are not verified, and Buyer must conduct and complete all performance and other testing of the products, alone and together with, or installed in, any end-products. Buyer shall not rely on any data and performance specifications or parameters provided by Microsemi. It is the Buyer's responsibility to independently determine suitability of any products and to test and verify the same. The information provided by Microsemi hereunder is provided "as is, where is" and with all faults, and the entire risk associated with such information is entirely with the Buyer. Microsemi does not grant, explicitly or implicitly, to any party any patent rights, licenses, or any other IP rights, whether with regard to such information itself or anything described by such information. Information provided in this document is proprietary to Microsemi, and Microsemi reserves the right to make any changes to the information in this document or to any products and services at any time without notice.

About Microsemi

Microsemi Corporation (Nasdaq: MSCC) offers a comprehensive portfolio of semiconductor and system solutions for aerospace & defense, communications, data center and industrial markets. Products include high-performance and radiation-hardened analog mixed-signal integrated circuits, FPGAs, SoCs and ASICs; power management products; timing and synchronization devices and precise time solutions, setting the world's standard for time; voice processing devices; RF solutions; discrete components; enterprise storage and communication solutions, security technologies and scalable anti-tamper products; Ethernet solutions; Power-over-Ethernet ICs and midspans; as well as custom design capabilities and services. Microsemi is headquartered in Aliso Viejo, Calif., and has approximately 4,800 employees globally. Learn more at www.microsemi.com.