Lower Power Operation with the Fusion Device

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Introduction

Flash-based Fusion devices exhibit power characteristics similar to an ASIC, making them an ideal choice for power-sensitive applications. With Fusion devices, there is no power-on current surge and no high current transition, both of which occur on many field programmable gate arrays (FPGAs). Fusion devices also have low dynamic power consumption and support both low power Standby mode and very low power Sleep mode, offering further power savings.

Multiple Operation Modes

In Microsemi Fusion® devices, the user can implement the different operation modes (Active Normal mode, Active Low Frequency mode, Standby mode, and Sleep mode) by configuring and controlling the following major functional blocks: FPGA fabric, real-time counter (RTC), voltage regulator (VR), and no glitch MUX (NGMUX).

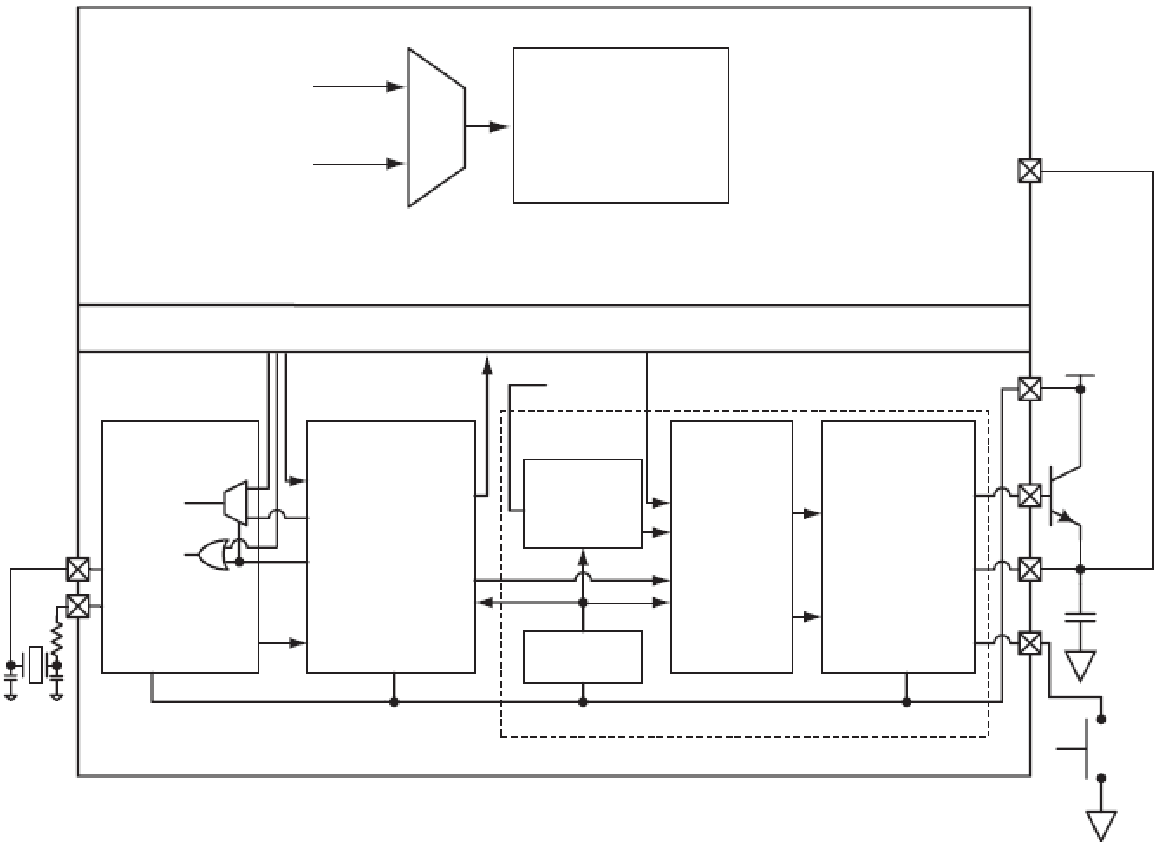

***Figure 1* • Low Power Operation Implementation Diagram**

Table 1 shows the different operation modes controlled by the combinations of the major functional blocks inside the Fusion device.

***Table 1* • Operation Mode Table**

Operation Mode	Fabric	RTC	NGMUX	Wake Up Method
Active Normal	On	On	Hi-Freq	N/A
Active Low Power	On	On	Lo-Freq	User logic
Standby	Off	On	X	PUB pad, RTC match
Sleep	Off	Off	X	PUB pad

Note: *In all these operation modes, the 3.3 V analog supply is always on.*

Fusion Fabric

The Fusion fabric can turn-off the 1.5 V voltage regulator to initiate Standby mode with a logic function and/or soft microcontroller (MCU) core. When the voltage regulator powers down the FPGA core will be turned-off, requiring a signal external to the FPGA core to power-up the voltage regulator. While in Standby mode, the device consume less than 200 µA, or 3.3 × 200 µW.

Real-Time Counter (RTC)

The RTC is running off the 3.3 V analog supply while the Fusion fabric could be powered by the internal 1.5 V voltage regulator, routed external to the chip.

The RTC can be configured to power-up the FPGA fabric at a specific time or periodically. The user logic or a soft microcontroller within the FPGA fabric portion of the Fusion device can be programmed to read and/or modify the registers in the RTC.

If the RTC is running while the Fusion fabric is powered down (Standby mode), RTC generates a turn-on instruction to the 1.5 V voltage regulator when a preset match value (that is., 2 ms) has met in the RTC. Fusion fabric is powered up, once 1.5 V voltage regulator is live and Fusion device is in Active mode.

The 3.3 V supply must be valid and the crystal oscillator (nominally 32.768 kHz) must be enabled for self-time wake-up or restart operation.

Besides the turn-on instruction from RTC, the 1.5 V voltage regulator can also be turned on by an external pad, or PUB pad. After the PUB pad is grounded temporarily, then released, the 1.5 V voltage regulator is turned-on; therefore the fabric is up and running.

The FPGA fabric portion of the Fusion device must be powered-up and active at least once to write to the various registers within the RTC to initialize them for the users application. The user sets up the RTC by configuring the RTC from the Microsemi SmartGen tools, implementing custom logic, or programming a soft microcontroller.

The user can bring the Fusion device into Sleep mode if the user powers down the fabric and also turns-off the RTC by disabling the crystal oscillator. The Sleep mode consumes very low power of less than 10 µA. The user can also wake up the device by grounding the PUB pad temporarily. This powers up the 1.5 V voltage regulator and the Fusion fabric. The Fusion fabric logic can enable the crystal oscillator which turns-on the RTC, therefore the Fusion device is in Active mode.

NGMUX

When the Fusion device runs at Active mode, the user can choose to run the application in a Low Frequency mode for power consumption considerations. The user can instantiate an NGMUX to switch between high frequency clock and low frequency clock based on any preset internal conditions or external events. This way, the Fusion device can work in the Active Normal mode when high frequency performance is needed or work in the Active Low Power mode, when low power consumption is desired at a given time frame.

Summary

Microsemi Fusion devices are designed to operate with minimum power consumption. Supporting a wide range of power modes, Fusion can be configured to reduce power consumption in all operating conditions. These easy to use features enable the user to develop the system in a timely fashion and also to update the designs conveniently.

List of Changes

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

Revision	Changes	Pages
Revision 3 (December 2015)	Non-technical updates.	N/A
Revision 2 (June 2006)	The low power modes of operation were updated and clarified.	N/A
Revision 1 (December 2005)	Figure 1 was updated.	2

Note: *The part number is located on the last page of the document.*

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