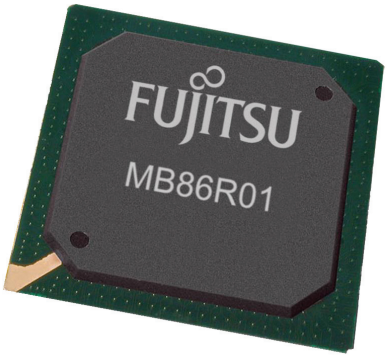
JTAG Flash Programming Option with the Fujitsu MB86R01 "Jade" During Mass Production

Application Note

Introduction

The Fujitsu MB86R01 "Jade" is an SOC with an ARM926 processor, coupled with an MB8629x "Coral"-class 2D/3D graphics processor and accompanied by a rich peripheral set. The peripherals include a 16/32-bit external bus interface that can connect to a NOR flash for permanently storing system software. The Flash interface is asynchronous and is internally driven by the MB86R01 "Jade" using an 83MHz AHB bus.



This application note briefly discusses the options available when programming NOR Flash.

JTAG Flash Programming

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JTAG Flash Programming

Overview

The Fujitsu MB86R01 “Jade” is an SOC with an ARM926 processor, coupled with an MB8629x “Coral”-class 2D/3D graphics processor and accompanied by a rich peripheral set. The peripherals include a 16/32-bit external bus interface that can connect to a NOR flash for permanently storing system software. (NOR is a class of non-volatile memory where one end of each cell is connected directly to ground and the other end to a bit line.) The Flash interface is asynchronous and is internally driven by the MB86R01 “Jade” using an 83MHz AHB bus.

Typically the Flash maker or vendor pre-programs the NOR Flash during mass production of an electronic system using MB86R01 “Jade” (or any other SOC or MCU). Thus the code is already integrated when the Flash is delivered to the board manufacturer. The approach, however, is relatively inflexible when the code changes unexpectedly before the programmed devices are mounted on the PCB. The NOR Flash must then be reprogrammed. If the parts cannot be discarded, the only remaining option is to send the pre-programmed Flash back to the vendor for reprogramming—increasing both cost and time to market.

An alternative approach is to have a dedicated Flash programming unit in-house. This approach eliminates the extra time and cost associated with using outside resources. However, the approach has similar drawbacks as relying on an outside vendor to reprogram un-mounted Flash devices because the device still needs to be re-programmed. Also, economic pressures do not allow every company to invest in an in-house programming unit and to dedicate personnel to operate and maintain it.

An interesting approach that can address this issue is to program the NOR flash after it has been mounted on the PCB. The only way to do that is by using the JTAG interface and an ICE unit. (JTAG is an industry-standard interface that allows a debug connection to be established with a processor inside a chip that is mounted on a PCB. ICE stands for In Circuit Emulator. This piece of hardware lets a desktop computer or a laptop connect to the processor inside the chip through the JTAG interface.)

While the programming will be comparatively slower with the JTAG approach, the cost savings are significant. There is no need to ship the devices back to a vendor or to have a dedicated Flash programming unit reprogram them in case there is a sudden code change. It is still possible to reprogram the Flash devices in-house like they were done initially, using the JTAG and ICE combination. The only extra cost associated with this approach is the ICE unit and the extra JTAG connector on the target PCB. If a JTAG/ICE solution achieves a decent programming time, the cost savings will definitely be worthwhile.

As discussed previously, the cost savings include the costs of:

- Shipping back to Flash vendor or third party
- Reprogramming the devices
- Disposing of the Flash devices with out-of-date code
- Purchasing new pre-programmed devices with new code
- An expensive programming unit in the case of a conventional in-house arrangement.

JTAG Flash Programming

Fujitsu Microelectronics America conducted an informal survey by contacting JTAG solution vendors and checking whether they offered acceptable NOR Flash programming speeds with JTAG. The target specified in the survey was a minimum programming time of around two minutes for a 16MB device. The results in Table 1 show that at least one company, Segger, exceeded the requirement and that another one, Ronetix, was borderline. Two other companies included in the list do not meet the requirement by a wide margin. There are indications of a growing availability of JTAG vendors and increasing program speeds. In the meantime, Segger and Ronetix have viable solutions.

It should be noted that these programming speeds were not actually tested in hardware with the MB86R01 "Jade," but are based on estimates provided by the JTAG solution vendors.

Table 1: Survey of JTAG Solution for Programming of Blank NOR Flash Used with Jade.

JTAG Tool Vendor	Claimed NOR Flash Programming Speed (KB/s)	Time to Program 16MB Flash (minutes)
Segger	140	1.9
Ronetix	105	2.53
XJTAG	40	6.7
Arium	33	8

In conclusion, while the survey was not exhaustive, it shows that at least a few options are available for programming blank NOR Flash using JTAG at a decent speed. This fact adds some weight to the option of using a JTAG solution completely for Flash programming during mass production of an electronic system.

Application Note

Revision History

Date	Revision	Updates
October 5, 2009	V1.0	First Release

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