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Indirect Programming of BPI PROMs with Virtex-5 FPGAs

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Summary

Virtex®-5 FPGAs and ISE® software support configuration from and programming of industry-standard, parallel NOR flash memory (BPI PROMs). Industry standard BPI PROMs are an alternate solution for Virtex-5 FPGA designs whose requirements are not met by the Platform Flash XL configuration and storage device (see [Ref 1] for more information on Platform Flash XL). The iMPACT software, included in the ISE® development software tools, provides indirect programming for select BPI PROMs during prototyping. This application note demonstrates how to program a Numonyx StrataFlash P30 BPI PROM indirectly using iMPACT 11.4 and a Xilinx cable. In this solution, the Virtex-5 FPGA serves as a bridge between the IEEE Std 1149.1 (JTAG) bus interface and the BPI bus interface. The required hardware setup, BPI-UP PROM file generation flow, and BPI indirect programming flow are shown. The Virtex-5 FPGA BPI-UP configuration sequence is also described.

Note: Parallel NOR flash memory is referred to by the term BPI PROM throughout this document.

Introduction

Xilinx FPGAs are CMOS configurable latch (CCL) based and must be configured at power-up from a non-volatile source. FPGA configuration is traditionally accomplished with a JTAG interface, a microprocessor, or the Xilinx PROMs (Platform Flash PROMs). In systems where the easiest solution is preferred, Master Serial mode with a Xilinx Platform Flash PROM is still the most popular configuration mode because it has:

- A direct JTAG interface for programming
- The smallest interface pin requirement for configuration
- Flexible I/O voltage support

Moreover, this solution is available for any Virtex-5 FPGA device (refer to [Ref 2] for more information).

In addition to the traditional methods, a direct configuration interface to third-party BPI PROMs is included on Virtex-5 FPGAs to address changing system requirements. Systems with a BPI PROM already onboard for random-access, non-volatile application data storage can benefit from consolidating the configuration storage into the same memory device.

Similar to the traditional configuration memories, BPI PROMs must be loaded with the configuration data. BPI PROMs have a single interface for programming, and three primary methods to deliver the data to this interface:

- Third-party programmers (off-board programming)
- In-system programming (ISP) with an embedded processor
- Indirect ISP (using JTAG or custom solution)

Production programming is often accomplished off-board with a third-party programmer or in-system with a JTAG tool vendor. During the prototyping phase, indirect ISP is preferred to easily accommodate design iterations.

Because BPI PROMs do not have a JTAG interface, extra logic is required to serve as a bridge between the iMPACT programmer (using a cable to drive the JTAG bus interface), and the BPI

PROM (connected to the FPGA's BPI bus interface). This extra logic must be downloaded into the FPGA by iMPACT before indirect programming is possible.

This application note is divided into three main sections. The first section discusses the hardware connections required for the indirect in-system programming of BPI PROMs for prototype designs. The second section shows the Xilinx software tool flows for generating a PROM file formatted for 16-bit BPI-UP mode and then for programming the select BPI PROMs. The third section provides a basic configuration flow overview for the FPGA after the BPI PROM is programmed and describes expectations when using this indirect setup.

iMPACT Indirect In-System Programming with a Virtex-5 FPGA

The basic hardware setup required for the iMPACT indirect BPI PROM programming method is shown in Figure 1.

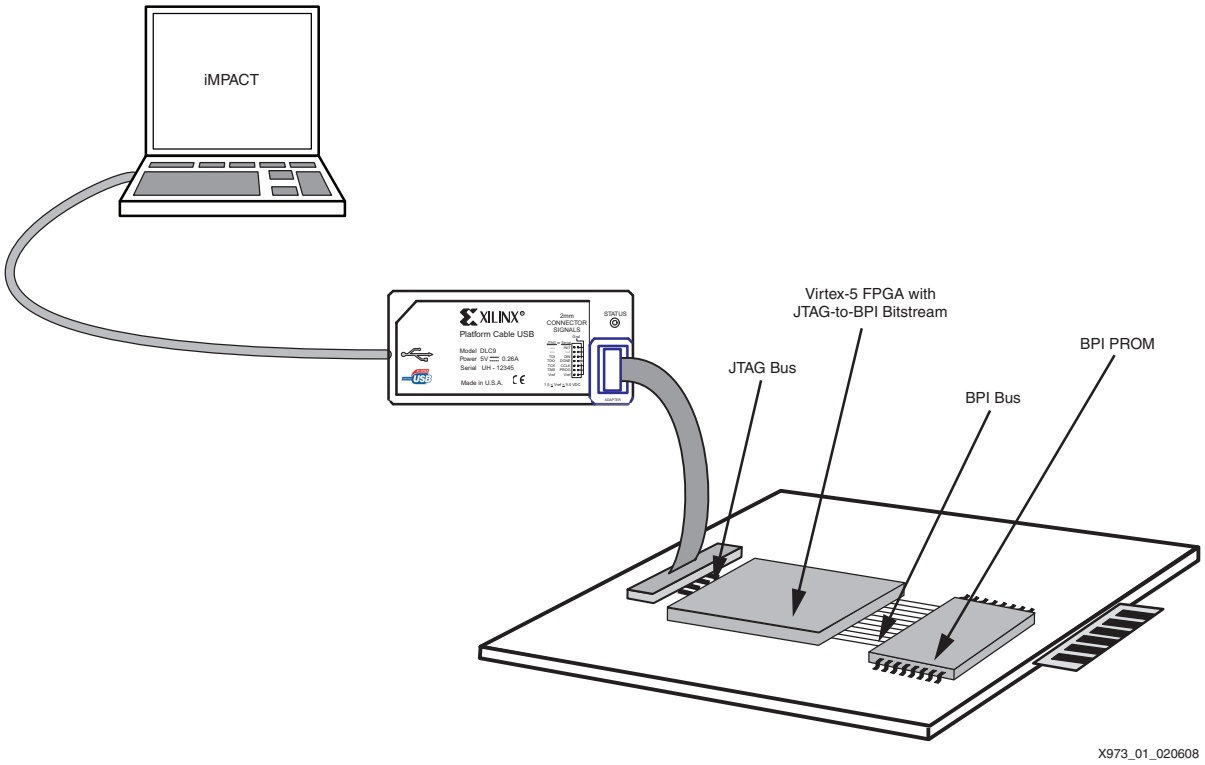

Figure 1: **iMPACT Indirect BPI PROM Programming with a Virtex-5 FPGA**

Minimum Requirements

- Virtex-5 FPGA
- BPI PROM (refer to Table 1)
- Xilinx Cable and Connector (refer to Table 4, page 7)
- ISE iMPACT Software 11.4

  Note: Indirect BPI PROM programming was introduced with limited device support in iMPACT 9.2i. This application note demonstrates the software flow and lists the device support in iMPACT 11.4.