



Numonyx™ Flash memory programming algorithm optimizations

Application Note 759

March 2008

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Contents

1.0	Introduction	4
2.0	Programming Flow Optimizations	4
3.0	Programming Algorithm Optimizations	4
4.0	Data Transfer Optimizations	5
5.0	Summary	6
A	Additional Information	6

Revision History

Date	Revision	Description
May 2002	01	Original revision
March 2008	02	Applied Numonyx branding.

1.0 Introduction

Hardware and software engineers continually seek manufacturing improvements that reduce product development costs. Numonyx helps these engineers by providing ideas to optimize programming algorithms to significantly reduce programming times. This technical paper suggests methods to help you optimize your programming algorithms for quicker Numonyx Flash Memory programming times.

2.0 Programming flow optimizations

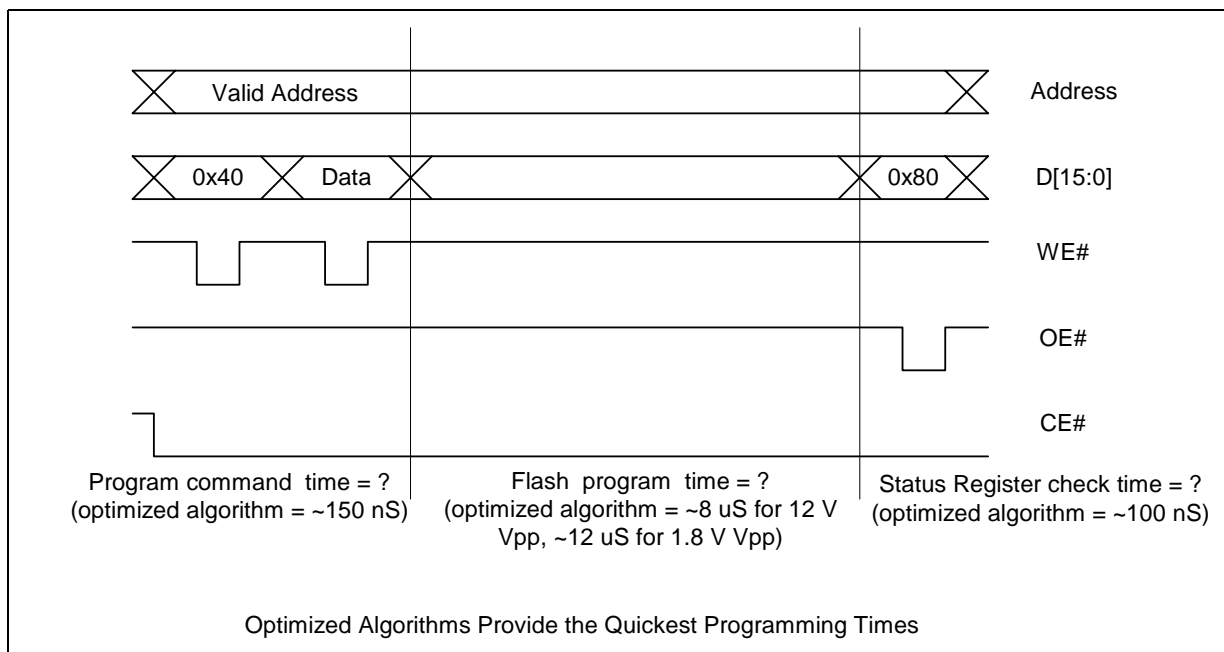
From a high level you can optimize your programming flow to reduce overall programming times. Here are some suggestions for high-level optimizations.

- Don't Perform Erase on Blank Components
- Eliminate Program Verify when using 0x40 Programming Command
 - If you must perform program verify, do it only once at nominal Vcc
 - Program verify is performed with EFP and BEFP methods
- Program using the Maximum Bus Width
- Check Status Register After Typical Program Time
- When Applicable, use 12V Vpp for Faster Program Time
- Hold CE# Low for Entire Program Operation
- Take Advantage of Augmented Features
 - Enhanced Factory Programming
 - Buffered Enhanced Factory Programming
 - Write Buffers

3.0 Programming algorithm optimizations

Figure 1, “Logic Analyzer Plot of Numonyx Flash Memory 0x40 Programming Command Sequence” on page 5 shows a logic analyzer plot of Numonyx Flash Memory Word programming signals when using the 0x40 programming command. To better understand your programming environment, connect a logic analyzer to your programming application, and set up the logic analyzer to capture a plot similar to the plot shown Figure 1.

Figure 1: Logic Analyzer Plot of Numonyx Flash Memory 0x40 Programming Command Sequence

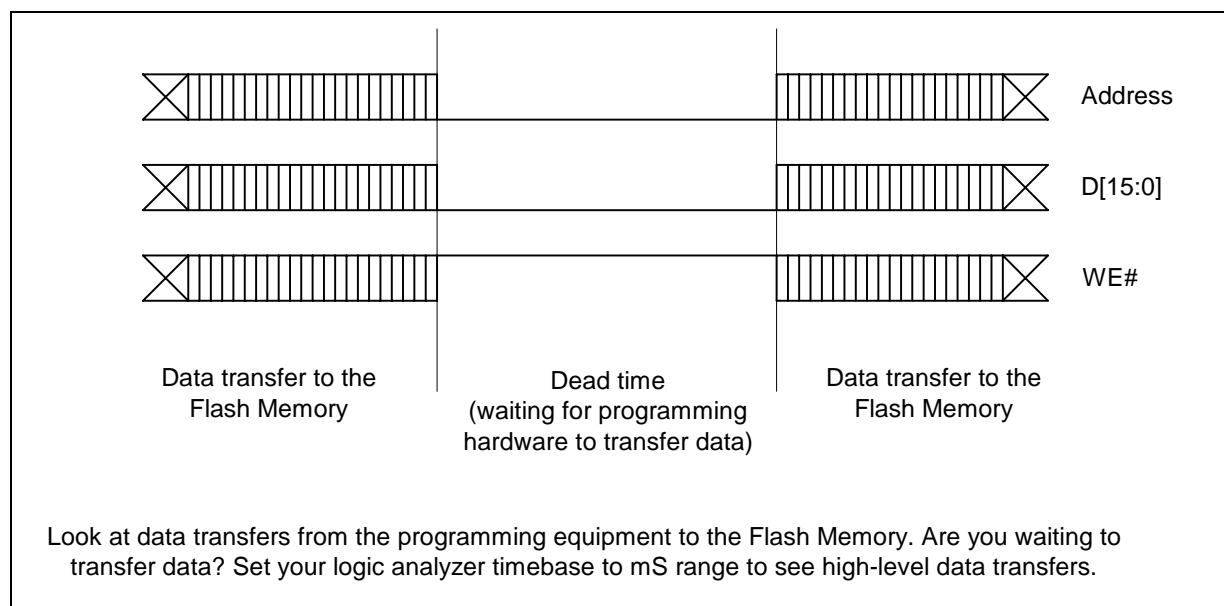


Optimized programming times are suggested in [Figure 1, “Logic Analyzer Plot of Numonyx Flash Memory 0x40 Programming Command Sequence” on page 5](#). You should optimize your programming application hardware and software to obtain timings in the approximate range of optimized programming times. Optimizations may consist of hardware or software modifications that allow your application to meet the suggested signal timings. Your hardware and software engineers can evaluate the programming environment, and determine which optimization ideas are appropriate to implement.

4.0 Data transfer optimizations

Another function that consumes programming time is transferring data from an external source (i.e., programming equipment) to the Flash Memory. [Figure 2, “Logic Analyzer Plot for Data Transfers” on page 6](#) shows this data transfer time.

Figure 2: Logic Analyzer Plot for Data Transfers



Work with your hardware and software engineers to understand why your application is consuming time for data transfers. Look for parallel operations (i.e., other testing) that you can perform during the data transfer operation to take advantage of every bus cycle.

5.0 Summary

The manufacturing programming process consumes both time and money. As Flash Memory densities and application codes increase, so do manufacturing programming times. Both hardware and software engineers are continually seeking methods to reduce manufacturing times and costs. Numonyx recognizes the need to improve manufacturing programming times and provides suggestions to help you optimize your programming algorithms. Every hardware and software engineer responsible for designing manufacturing programming environments should understand the optimization ideas suggested in this document before beginning the product design. This will help ensure that your Numonyx Flash Memory manufacturing programming times are the quickest possible.

Appendix A Additional information

Order Number	Document/Tool
297769	Improving Programming Throughput of Automated Flash Memories: Application Note 678
292286	Reduce Manufacturing Costs with Numonyx Flash Memory Enhanced Factory Programming: Application Note 738

Note: Visit the Numonyx World Wide Web home page at <http://www.numonyx.com> for technical documentation and tools.