

Macronix MX29GL_G Programming Guide

1. Introduction

This application note is a programming guide for the Macronix MX29GL_G Parallel NOR Flash with its focus on the Buffer Program function. It describes how to best use the larger MX29GL_G page buffer size to increase programming performance and maximize data reliability. The information in this document is based on datasheets listed in Section 6. Newer versions of the datasheets may override the contents of this document.

2. Features

MX29GL_F and MX29GL_G have similar features, but MX29GL_G provides better performance with its larger buffer sizes. Sustained buffer program throughput roughly doubles when migrating from the MX29GL_F to the MX29GL_G flash (from Tables 2-1 and 3-1: MX29GL_F = 32W/70us = 0.9MB/sec., while MX29GL_G = 256W/284us = 1.8MB/sec.)

Table 2-1: Feature Comparison

Feature	Macronix MX29GL_F	Macronix MX29GL_G
Vcc Voltage Range	2.7V ~ 3.6V	2.7V ~ 3.6V
I/O Voltage Range	2.7V ~ 3.6V (H/L type) 1.65V ~ 3.6V (U/D type)	2.7V ~ 3.6V (H/L type) 1.65V ~ 3.6V (U/D type)
Bus Width	x16 / x8	x16 / x8
Sector Size	128KB	128KB
Page Read Buffer	8 Words / 16 Bytes	16 Words / 32 Bytes
Write Buffer ^{*1}	32 Words / 64 Bytes	256 Words / 256 Bytes
WP# Pin Function	Highest/Lowest address sector	Highest/Lowest address sector

Note: 1. A 256 Byte Write Buffer length is available when using Macronix flash with a x8 Data Bus width.

3. Buffer Program Introduction

The MX29GL_G provides a 256-word Write Buffer with flexible usage. Some existing designs may use the prior generation MX29GL_F which has a 32-Word Write Buffer. For backwards compatibility, the MX29GL_G 256-Word Write Buffer can also be used as a 32-Word Write Buffer requiring no changes to existing software. Write performance is improved with the MX29GL_G flash even when performing 32-Word Buffer Programming (Table 3-1). For new designs, it is highly recommended to use the full 256-Word buffer size in the MX29GL_G, in order to achieve the best programming performance. The following section will introduce the buffer program concept used to optimize buffer programming.

Table 3-1: Buffer Program Function Performance (typ.)

Buffer Program Size	Macronix MX29GL_F	Macronix MX29GL_G
16 Words	45us ^{*1}	30us ^{*1}
32 Words	70us	40us ^{*1}
256 Words	N/A	284us

Note: 1. Performance time from small sample for reference. Device performance refers to datasheet spec.

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Most applications contain system code (boot code, file system, O.S., and so on) which take multiple blocks to store, and meta data (parameter settings, system configuration, user data, and so on) which is variable in size (it may vary from a few bytes to hundreds of bytes). We will discuss how to best to program with these types of data in the following sections.

4-1. System Code Programming Guide

Most system code sizes are large and take many blocks to store. When programming large blocks of code, it is recommended to use the full buffer size to program the flash. This will improve overall write performance and throughput. To show the performance benefit of using a larger Write Buffer, we compare the time it takes to program 48MB of system code using the MX29GL512F and MX29GL512G with different buffer sizes (Table 4-1). The MX29GL512G provides best performance when the full 256-Word Program Buffer is used. This will save mass production line cost in code programming.

Table 4-1: System Code Programming Time vs. Buffer Size (typ.)^{*1}

System Code Size	Buffer Program Size	Macronix MX29GL_F	Macronix MX29GL_G
48MB (384Mb)	16 Words	70.7s	47.2s
	32 Words	55.1s	31.5s
	256 Words	N/A	27.9s

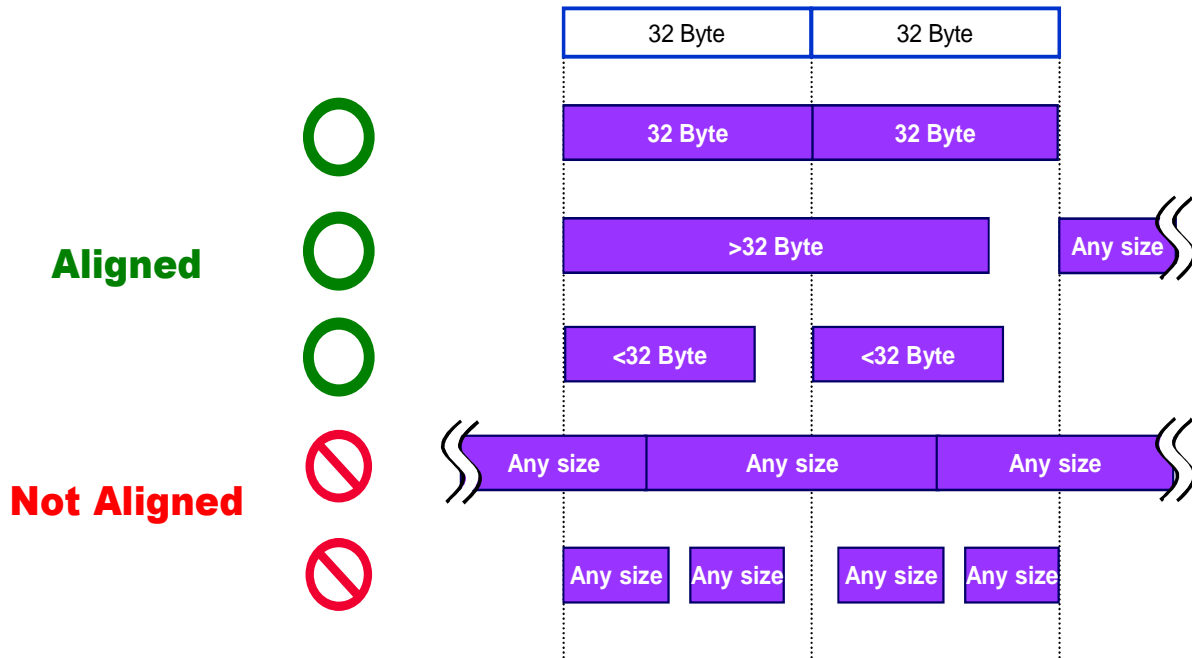
Note: 1. The timing does not include command overhead time.

4-2. Meta Data Programming Guide

Meta data varies in length depending on value and type definition. Meta data storage is sector based (a sector is the smallest erase size) and will not generally require multiple block programming. In order to achieve the best programming throughput and enhanced data reliability, address and data size alignment should be used to program variable length data (such as Meta Data) into the flash. Strictly enforcing a 16-Word or 256-Word buffer boundary for variable length Meta Data is recommended. For data shorter than 16 or 256 words, the software algorithm can pad the remainder of the buffer with null data. This will ensure that full buffers are always used and address alignment and data length will always be on 16-Word or 256-Word boundaries (Figure 4-1).

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Figure 4-1: Apply Boundary Condition to achieve Maximum Data Integrity



The system then programs the Meta Data into the allocated address space. Table 4-2 shows this concept using a 16-Word (32 Byte) alignment as an example.

Table 4-2: Meta Data Programming Guide

Original Structure

Data Order	0	1	2	3
Data Size	5W	256W	22W	28W
Address Offset	0	5	261	283

New Structure

Data Order	0	0	1	2	2	3	3
Data Size	5W	11W	256W	22W	10W	28W	4W
Address Offset	0	5	16	272	294	304	332

Original Data: 5W
Add 11W null data (FFh)
for 16W alignment.

Data: 256W
16 times 16W
alignment.

Original Data: 22W
Add 10W null data
(FFh) for 2 times
16W alignment.

Original Data: 28W
Add 4W null data (FFh) for 2
times 16W alignment.

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5. Summary

The MX29GL-G has a larger Write Buffer than the MX29GL-F and is capable of higher programming throughput. The MX29GL-G supports the same Word Program and Buffer Program commands as the MX29GL-F. However, in order maintain the same data reliability as the MX29GL-F, it is strongly recommended that data be written to the MX29GL-G Write Buffer in multiples of 32-Byte (16-Word) pages. Writing individual bytes or words with the “Program” command or writing partial pages (non-multiples of 32-bytes) with the “Write Buffer Program” command is discouraged.

6. Reference

Table 6-1 shows the datasheet versions used for comparison in this application note. For the most current, detailed Macronix specification, please refer to the Macronix Website at <http://www.macronix.com>

Table 6-1: Datasheet Version

Datasheet	Location	Date Issue	Revision
MX29GL256GMX29GL512GMX68GL1G0G	-	Jan 23, 2014	Rev. 0.01

Note: Macronix data sheet is subject to change without notice.

7. Revision History

Revision	Description	Date
1.0	Initial Release	April 1, 2014



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APPLICATION NOTE

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