Technical Note

Migrating from 512Mb Spansion S29GL Devices to Micron M29AW NOR Flash Devices

Introduction

This technical note describes the process for converting a system design using Spansion® S29GL (all series) devices to Micron® M29AW multilevel cell (MLC) NOR Flash devices.

This document was written based on device information available at publication time. The 512Mb MLC M29AW data sheet may override this technical note if there is a different description for the same items in the data sheet.

Comparative Overview

The M29AW is manufactured on leading 65nm process lithography and is compatible with the S29GL NOR Flash device.

Table 1: Features Comparison

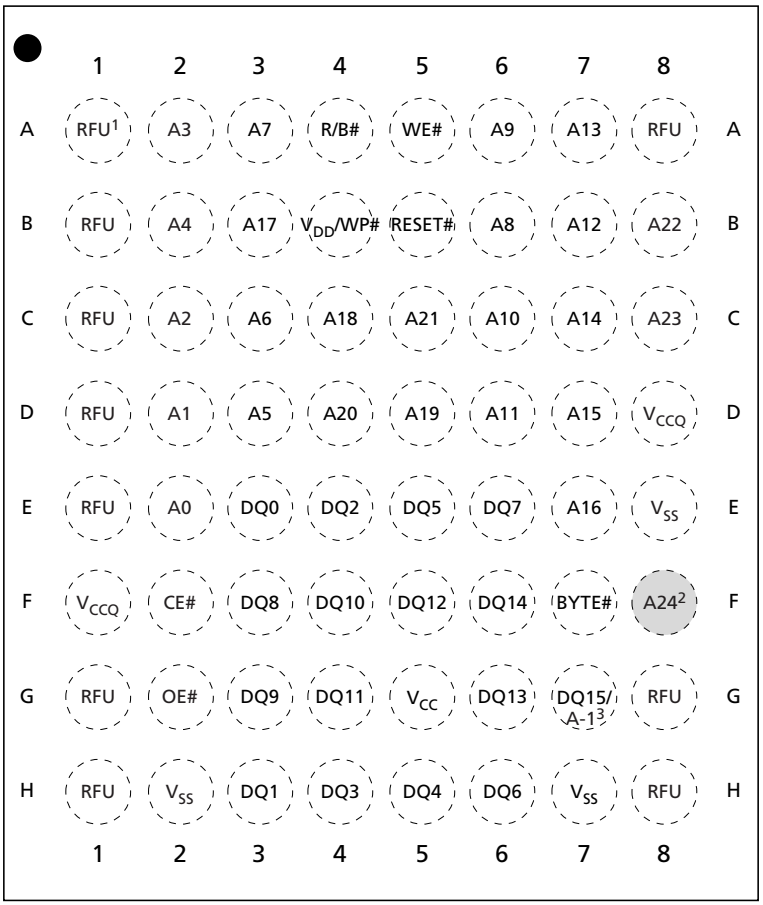
Feature	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
Process technology	65nm FG	65nm MirrorBit	65nm MirrorBit	90nm MirrorBit	110nm MirrorBit
Package	64-ball fortified BGA, 56-pin TSOP	64-ball fortified BGA, 56-pin TSOP	64-ball fortified BGA, 56-pin TSOP	64-ball fortified BGA, 56-pin TSOP	64-ball fortified BGA, 56-pin TSOP
Block architecture	Uniform 128KB	Uniform 128KB	Uniform 128KB	Uniform 128KB	Uniform 128KB
Page read size	16-word	16-word	8-word	8-word	8-word
Program buffer size	512-word	256-word	32-word	32-word	16-word
Program speed with full buffer (TYP)	1.86µs per word	1.64µs per word	15µs per word	15µs per word	15µs per word
Access time	100ns random/ 25ns page	100ns random/ 15ns page/ 15ns on versatile I/O	100ns random/ 25ns page	100ns random/ 25ns page	100ns random/ 25ns page
OTP block	128 words	512 words	256 words	128 words	128 words
Read protection	Yes	Yes	Yes	No	No
Unlock bypass	Yes	No	No	Yes	Yes
Sleep mode	Yes	No	No	No	Yes
Single word programming	Yes	Yes	Yes	Yes	Yes
eBlank check	Yes	Yes	No	No	No
Multisector erase	Yes	No	No	Yes	Yes
Program acceleration	Yes	No	No	Yes	Yes

Notes:
1. Sleep mode functions similarly to power-down. It reduces high-voltage stress and extends the lifetime of the application.
2. The M29AW device is qualified in accordance with JEDEC standard JESD47E.
3. Entering and exiting sleep mode requires E# assertion; Micron device uses commands for this capability.

Hardware Considerations

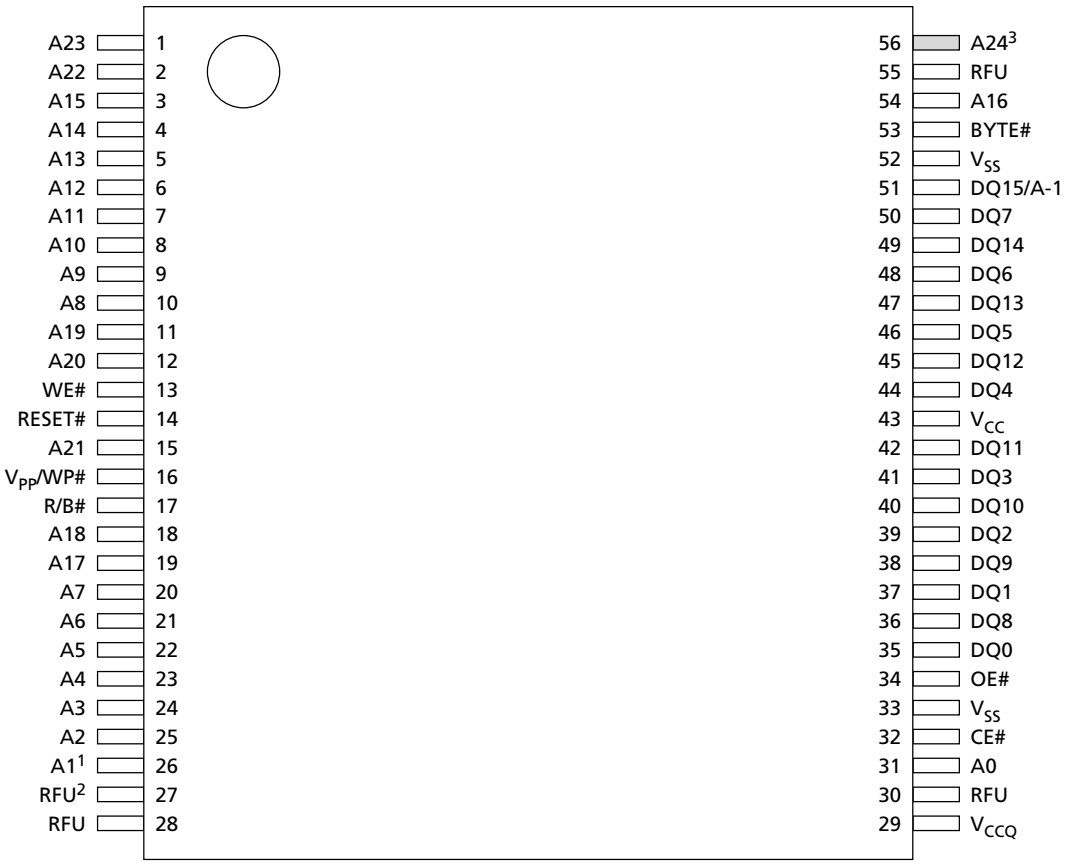
The M29AW is available in two packages: a 64-ball fortified BGA and a 56-pin TSOP. For compatibility, the pin and ball assignments and the physical dimensions are equivalent to the S29GL.

Figure 1: M29AW 64-Ball Fortified BGA – Top View, Ball Down



Notes:
1. Reserved for future use. These balls should be treated as no connects (NC).
2. Valid for 512Mb densities and above; otherwise, it is RFU.
3. A-1 is the least significant address bit in x8 mode.

Figure 2: M29AW 56-Pin TSOP – Top View (14mm x 20mm)



Notes:
1. Least significant address bit in x8 mode.
2. Reserved for future use. These pins can be treated as no connects (NC).
3. A24 is valid for 512Mb densities and above; otherwise, it is RFU.

Signal Differences

On both the M29AW and S29GL, V_{PP} supports the use of external high voltage to improve programming time. The WRITE PROTECT (WP#) function provides a hardware method for protecting the highest or lowest blocks.

The highest or lowest blocks of M29AW and S29GL are protected when V_{PP}/WP# is LOW. When V_{PP}/WP# is HIGH, the device reverts to its previous status of the highest or lowest block protected.

Both the M29AW and S29GL automatically enter unlock bypass mode when V_{PP}/WP# is raised to V_{PPH}, while the R-Series and the S-Series do not support unlocking the bypass mode.

Table 2: Signal Comparison

Symbol		Type	Description
M29AW	S29GL		
A[MAX:0]	A[MAX:0]	Input	Address inputs
BYTE#	BYTE#	Input	Byte/Word organization select
CE#	CE#	Input	Chip enable
OE#	OE#	Input	Output enable
RST#	RESET#	Input	Reset
WE#	WE#	Input	Write enable
V_{PP}/WP#	WP#/A_{CC}	Input	Acceleration input/write protect input
DQ15/A-1	DQ15/A-1	I/O or Input	Data input/output or address input
DQ[14:8]	DQ[14:8]	I/O	Data inputs/outputs
DQ[7:0]	DQ[7:0]	I/O	Data inputs/outputs
R/B#	R/B#	Output	Ready/Busy
V_{CC}	V_{CC}	Supply	Supply voltage
V_{CCQ}	V_{IO}	Supply	Input/Output buffer supply voltage
V_{SS}	V_{SS}	–	Ground
NC	NC	–	No connect

Mechanical Comparison

The M29AW and S29GL 56-pin TSOP packages have the same mechanical dimensions. The M29AW and S29GL 64-ball fortified BGA packages have the same mechanical dimensions.

Auto Select Entry Comparison

M29AW does not support V_{HH} on address A9. Instead, use the command sequence AAh-55h-90h to enter auto select mode. Applying 12V on A9 could damage the M29AW. The S29GL supports both methods for entering auto select mode.

Table 3: AUTO SELECT ENTRY Command Comparison

AUTO SELECT ENTRY Method	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
12V on A9 input	No	No	No	Yes	Yes
AUTO SELECT ENTRY command (90h)	Yes	No	No	Yes	Yes

Sleep Mode Comparison

After receiving the SLEEP MODE ENTRY command, the M29AW device will be in sleep mode after ^{t}SLEEP. S29GL devices do not support sleep mode.

Table 4: SLEEP MODE ENTRY Command Comparison

Sleep Mode	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
SLEEP MODE ENTRY command	Yes	Yes	Yes	No	No

After receiving the SLEEP MODE ENTRY command, the M29AW device will be in sleep mode after ^{t}SLEEP. S29GL devices do not support sleep mode. The SLEEP MODE ENTRY command enables the device to shut down the internal high-voltage circuit, ensuring a reduction of internal voltage stress. The S29GL-R and S29GL-S include a similar feature, automatic sleep mode, that enables the device's internal logic to enter standby mode to conserve power. The automatic sleep mode is driven by maintaining stable data on the bus for an extended period, without CE# going HIGH.

I_{CC} Differences

The I_{CC} values for the M29AW and S29GL are provided in the table below. The higher I_{CCS} of M29AW is offset by its lower I_{CCR}, I_{CCW},and I_{CCE} specs.

Table 5: I_{CC} Comparison (512Mb Devices)

Symbol	Test Condition	M29AW		S29GL-S		S29GL-R		S29GL-P		S29GL-N		Unit
		Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	
I_{CCS}	CE# = V_{CCQ} ± 0.2V RST# = V_{CCQ} ± 0.2V	65	210	70	100	70	100	1	5	1	5	µA
I_{CCR}	Random read, f = 5 MHz	26	31	55	60	65	90	30	55	30	50	mA
I_{CCW}	V_{PP}/WP# = V_{IL} or V_{IH}	35	50	55	90	55	90	50	90	50	90	
I_{CCE}	V_{PP}/WP# = V_{PPH}	35	50	55	90	55	90	50	90	50	90	
I_{CC},sleep	CE# = V_{CCQ} ± 0.2V RST# = V_{CCQ} ± 0.2V	1.0	1.5	3.0	6.0	0.07	0.1	–	–	–	–	

Device Capacitance Differences

Table 6: I/O Capacitance Comparison

Parameter	Symbol	Test Conditions			M29AW		S29GL-S		S29GL-R		S29GL-P		S29GL-N		Unit
					Typ	Max	Typ	Max	Typ	Max	Typ	Max	Typ	Max	
Input capacitance	C_{IN}	V_{IN} = 0V	512Mb	TSOP	3	8	12	14	8	10	6	10	6	7.5	pF
				BGA	3	5	11	13	8	10	6	10	4.2	5	
Output capacitance	C_{OUT}	V_{OUT} = 0V	512Mb	TSOP	2	5	5	4	8	10	10	12	8.5	12	
				BGA	2	5	8	10	8	10	10	12	5.4	6.5	

Performance Differences

Write Performance

The M29AW device provides better program performance than S29GL because it has a larger program buffer than the S29GL-P and S29GL-N. Modifying system software can also greatly improve system performance.

Note that during PROGRAM/ERASE operations, the READ/RESET (F0h) command must be issued with a 15µs delay after the DQ5 error bit is set.

Table 7: Write Performance Comparison

Description		M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
Program buffer size		512-word	256-word	32-word	32-word	16-word
Typical program speed with full buffer		1.075 MB/s	0.420 MB/s	0.215 MB/s	0.148 MB/s	0.148 MB/s
Nonvolatile protection bit clear time		0.8s	–	–	–	–
Erase suspend latency	Typ	40µs	40µs	40µs	5µs	5µs
	Max	70µs	–	–	20µs	20µs
Program suspend latency	Typ	40µs	40µs	40µs	5µs	5µs
	Max	70	–	–	15µs	20µs
Erase to suspend	Typ	500µs	–	–	–	–

Power-on and Reset Timings

Because many of the more common processors support the M29AW timings, there should be no adverse effect from timing differences.

Table 8: Power-on and Reset Timing Comparison

Parameter	Symbol	Alternative	Min/Max	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
V_{CC} power valid to RST# HIGH	^{t}VCHPH	^{t}VCS	Min	300µs	300µs	300µs	35µs	50µs
RST# LOW to read mode during program or erase	^{t}PLRH	^{t}READY	Max	25µs	35µs	35µs	35µs	20µs
RST# pulse width	^{t}PLPH	^{t}RP	Min	100ns	200ns	35µs	35µs	500ns
RST# HIGH to CE# LOW, OE# LOW	^{t}PHEL, ^{t}PHGL	^{t}RH	Min	50ns	200ns	150ns	200ns	50ns
R/B# HIGH to CE# LOW, OE# LOW	^{t}RHEL, ^{t}RHGL	^{t}RB	Min	0ns	0ns	0ns	0ns	0ns
SLEEP MODE ENTRY command to sleep mode achieved	^{t}SLEEP	–	Max	150µs	–	–	–	–
RST# HIGH to normal device operation	^{t}WAKE	–	Max	150ms	–	–	–	–

Figure 3: Power-On Timing

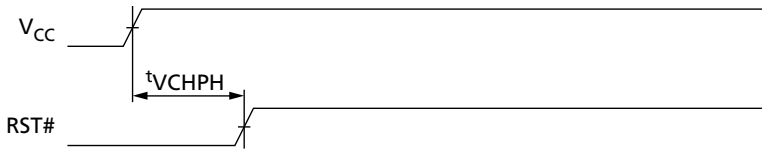


Figure 4: RST# Timing During Non-PROGRAM/ERASE Operations

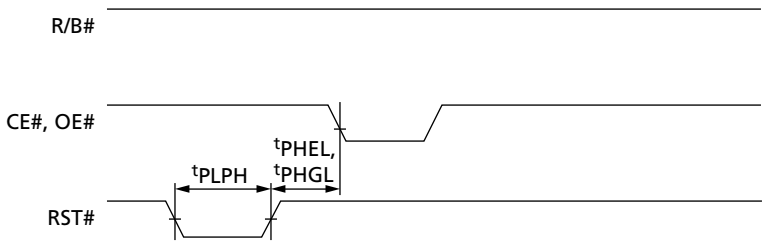


Figure 5: RST# Timing During PROGRAM/ERASE Operations

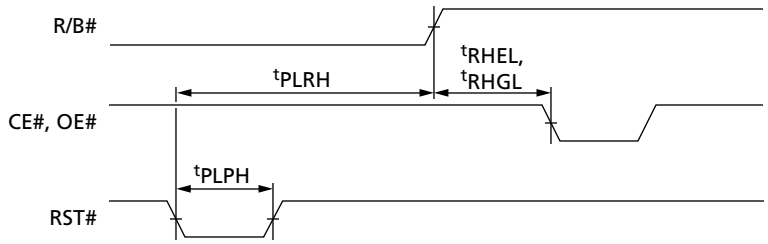
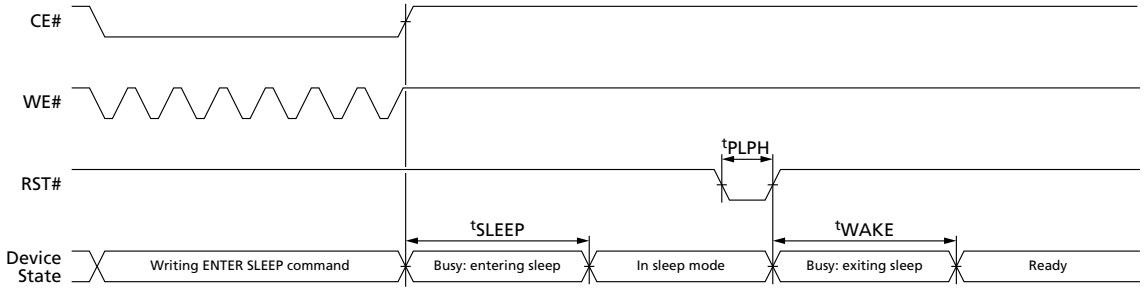


Figure 6: Sleep Mode Timing



Software Considerations

Command Set

The M29AW command set is fully compatible with that of S29GL-P and S29GL-N; therefore, no command change in the software is required.

Manufacturer ID and Other Auto Select Information

Micron and Spansion have different manufacturer IDs and different protection register indicators; therefore, a slight modification in the software is required during migration.

Table 9: Auto Select Information Comparison (16-Bit Mode)

Description		Address	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
Manufacturer ID		(Base) + 00h	0089h	0001h	0001h	0001h	0001h
Device ID (cycle 1)		(Base) + 01h	227Eh	227Eh	227Eh	227Eh	227Eh
Device ID (cycle 2)	512Mb	(Base) + 0Eh	22A3h	2223h	2223h	2223h	2223h
Device ID (cycle 3)		(Base) + 0Fh	2201h	2201h	2201h	2201h	2201h

Table 9: Auto Select Information Comparison (16-Bit Mode) (Continued)

Description		Address	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
Protection register indicator – V_{PP}/WP# locks highest block	Factory locked	(Base) + 03h	0099h	009h	N/A	009h	0098h
	Factory unlocked		0019h	0009h	N/A	0009h	0018h
Protection register indicator – V_{PP}/WP# locks lowest block	Factory locked		0089h	0089h	N/A	0089h	0088h
	Factory unlocked		0009h	0009h	N/A	0009h	0008h
Block protection	Unprotected	(Base) + 02h	0000	0000h	N/A	0000h	0000h
	Protected		0001h	0001h	N/A	0001h	0001h

Unlock Bypass Mode

In unlock bypass mode on the M29AW, the use of auto select mode is not recommended. If existing software is using the AUTO SELECT ENTRY (90h) command to read information in unlock bypass mode, an additional F0h command must be issued after AUTO SELECT READ to return to unlock bypass mode. S29GL does not require this additional command.

CFI Differences

CFI differences exist between M29AW and S29GL-P/S29GL-N due to device features and performance characteristics.

Table 10: CFI Comparison (16-Bit)

Address	Description	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
1D	V_{PPH} (programming) supply minimum PROGRAM/ERASE voltage Bits[7:4] hex value in volts Bits[3:0] BCD value in 100mV	B5h	00h	N/A	00h	00h
1E	V_{PPH} (programming) supply maximum PROGRAM/ERASE voltage Bits[7:4] hex value in volts Bits[3:0] BCD value in 100mV	C5h	00h	N/A	00h	00h
1F	Typical timeout for single byte/word PROGRAM = 2^nµs	09h	08h	N/A	06h	07h
20	Typical timeout for maximum size BUFFER PROGRAM = 2^nµs	0Ah	09	N/A	06h	07h
21	Typical timeout for individual BLOCK ERASE = 2^nms	0Ah	08h	N/A	09h	0Ah
22	Typical timeout for full-chip ERASE = 2^nms	13h	11h	N/A	13h	00h
23	Maximum timeout for byte/word PROGRAM = 2^n times typical timeout	01h	01h	N/A	03h	03h

Table 10: CFI Comparison (16-Bit) (Continued)

Address	Description	M29AW	S29GL-S	S29GL-R	S29GL-P	S29GL-N
24	Maximum timeout for BUFFER PROGRAM = 2^n times typical timeout	02h	02h	N/A	05h	05h
25	Maximum timeout per individual BLOCK ERASE = 2^n times typical timeout	02h	03h	N/A	03h	04h
26	Maximum timeout for chip ERASE = 2^n times typical timeout	02h	03h	N/A	02h	00h
2A, 2B	Maximum number of bytes in multiple-byte write = 2^n	0Ah, 00h	09h/001h	N/A	06h, 00h	05h, 00h
45	Address-sensitive unlock (bits[1:0]) 0 = required 1 = not required Silicon revision number (bits[7:2])	18h	00h	N/A	14	10h

Password Access

Password access is a security enhancement offered on the M29AW. This feature protects information stored in the main array blocks by preventing content alteration or READs until a valid 64-bit password is received. Password access can be combined with nonvolatile and/or volatile protection to create multi-tiered security. S29GL-P and S29GL-N do not support this feature.

For more details regarding the password access feature, contact your Micron sales representative.

Power-Loss Recovery

Robust power-loss recovery in the software system is recommended, especially during WRITE operations.

Related Information

Table 11: Document List

Request Item Number	Document/Tool
209045	Micron M29AW 512Mb (x8/x16, Uniform Block) 3V-Supply NOR Flash Memory Data Sheet
S29GL-P_00	SPANSION® MirrorBit® S29GL-P 1-Gbit, 512-Mbit, 256-Mbit, 128-Mbit 3.0 Volt-only Page Mode Flash Memory Datasheet
S29GL-N_00	SPANSION® MirrorBit® S29GL-N 512-Mbit, 256-Mbit, 128-Mbit 3.0 Volt- only Page Mode Flash Memory Datasheet

Notes:
1. Contact your local Micron or distribution sales office to request additional documentation.
2. Visit http://www.micron.com/numonyx for technical documentation.

Revision History

Rev. C – 6/11

- Added in new devices

Rev. B – 2/11

- Updated formats

Rev. A – 11/10

- Initial release

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