AN98579

Migration from Macronix™ GL-E (128-512 Mb) to Cypress S29GL-S

AN98579 details how to migrate designs from Macronix 128 Mbit MX29GL128E, 256 Mbit MX29GL256E, and 512 Mbit MX29GL512E flash memory devices to Cypress 128 Mbit 29GL128S, 256 Mbit S29GL256S, and 512 Mbit S29GL512S MirrorBit® flash memory devices, respectively.

1 Introduction

This application note details how to migrate designs from Macronix 128 Mbit MX29GL128E, 256 Mbit MX29GL256E, and 512 Mbit MX29GL512E flash memory devices to Cypress 128 Mbit 29GL128S, 256 Mbit S29GL256S, and 512 Mbit S29GL512S MirrorBit flash memory devices, respectively. The S29GL128S / S29GL256S / S29GL512S devices are 3.0 volt-only Page Mode flash memory manufactured with 65 nm MirrorBit Eclipse™ technology.

Cypress GL-S flash family devices are compatible with the Macronix 128 Mbit MX29GL128E, 256 Mbit MX29GL256E, and 512 Mbit MX29GL512E devices with respect to:

- Sector (or block) architecture,
- JEDEC standard compliant software command set.

2 Feature Comparison

Table 1 shows a feature comparison summary of the Macronix 512 Mbit MX29GL512E flash memory to the Cypress 512 Mbit S29GL512S MirrorBit flash family device.

Table 1. Feature Comparison — Macronix 512 Mbit MX29GL512E to Cypress 512 Mbit S29GL512S (Sheet 1 of 2)

		Cypress	Macronix
		S29GL512S	**MX29GL512E**
V_{CC}	V_{CC}	2.7~3.6V	2.7~3.6V
	V_{IO}	1.65~3.6V	N/A
Access time	Random	100 ns (2.7 to 3.6V) 110 ns (2.7 to 3.6V) 110 ns (Low V_{IO}) 120 ns (Low V_{IO})	100 ns (3.0 to 3.6V) 110 ns (2.7 to 3.6V)
	Page	15 ns (2.7 to 3.6V) 20 ns (2.7 to 3.6V) 25 ns (Low V_{IO}) 30 ns (Low V_{IO})	25 ns
Test Condition (Output Load Capacitance)		30 pF	30 pF
Read Performance		Up to 98.5 MB/s	Up to 58.2 MB/s
Bus width		only x16	x8/x16
Sector		Uniform 128 kB	Uniform 128 kB
Page Size	Program	256 word (512 Byte)	32 word (64 Byte)
	Read	16 word (32 Byte)	8 word (16 Byte)
Data#Polling or Status Register		Data#Polling and Status Register	Data#Polling
Unlock Bypass		No (Note 1)	Yes
Multi-sector Erase		No (Note 1)	Yes
Blank Check		Yes	No
OTP		512 Byte (256 Word) x 2	256 Byte (128 Word)

Table 1. Feature Comparison — Macronix 512 Mbit MX29GL512E to Cypress 512 Mbit S29GL512S (Sheet 2 of 2)

		Cypress	Macronix
		S29GL512S	MX29GL512E
Protection	Software	Password (64 bit) Persistent Protection (Note 2)	Password (64 bit) Persistent Protection (Note 2)
	Hardware	WP# (Lowest or Highest address sector)	WP# (Lowest or Highest address sector)
Package		56-Pin TSOP 64-Ball BGA	56-Pin TSOP 64-Ball BGA 70-Pin SSOP

Notes:

1. *Removed per legacy features.*
2. *Persistent Protection and Solid Write Protection are same function.*

Table 2 shows a feature comparison summary of the Macronix 256 Mbit MX29GL256E and 128 Mbit MX29GL128E flash memory to the Cypress 256 Mbit S29GL256S and 128 Mbit S29GL128S MirrorBit flash family devices.

Table 2. Feature Comparison — Macronix 256 Mbit MX29GL256E and 128Mbit MX29GL128E to Cypress 256 Mbit S29GL256S, and 128 Mbit S29GL128S

		Cypress	Macronix
		S29GL256S/128S	MX29GL256E/128E
V_{CC}	V_{CC}	2.7~3.6V	2.7~3.6V
	V_{IO}	1.65~3.6V	1.65~3.6V
Access time	Random	90 ns (2.7 to 3.6V) 100 ns (2.7 to 3.6V) 100 ns (Low V_{IO}) 110 ns (Low V_{IO})	90 ns (3.0 to 3.6V) 100 ns (2.7 to 3.6V) 110 ns (Low V_{IO})
	Page	15 ns (2.7 to 3.6V) 20 ns (2.7 to 3.6V) 25 ns (Low V_{IO}) 30 ns (Low V_{IO})	25 ns (2.7~3.6V) 30 ns (Low V_{IO})
Test Condition (Output Load Capacitance)		30 pF	30 pF
Read Performance		Up to 101.6 MB/s	Up to 60.4 MB/s
Bus width		only x16	x8/x16
Sector		Uniform 128 kB	Uniform 128 kB
Page Size	Program	256 word (512 Byte)	32 word (64 Byte)
	Read	16 word (32 Byte)	8 word (16 Byte)
Data#Polling or Status Register		Data#Polling and Status Register	Data#Polling
Unlock Bypass		No (Note 1)	Yes
Multi-sector Erase		No (Note 1)	Yes
Blank Check		Yes	No
OTP		512 Byte (256 Word) x2	256 Byte (128 Word) x2
Protection	Software	Password (64 bit) Persistent Protection (Note 2)	Password (64 bit) Persistent Protection (Note 2)
	Hardware	WP# (Lowest or Highest address sector)	WP# (Lowest or Highest address sector)
Package		56-Pin TSOP 64-Ball BGA	56-Pin TSOP 64-Ball BGA 70-Pin SSOP

Notes:

1. *Removed per legacy features.*
2. *Persistent Protection and Solid Write Protection are same function.*

Table 3 shows a comparison between Macronix and Cypress flash memory Erase and Program Performance.

Table 3Erase and Program Performance

		Cypress		Macronix	
		S29GL-S		MX29GL-E	
		Typ	Max	Typ	Max
Program	Word w/o ACC	125 µs	400 µs	11 µs	360 µs
	Word w/ACC	N/A		11 µs	
	Write Buffer 2 Byte w/o ACC	125 µs			
	Write Buffer 32 Byte w/o ACC	160 µs			
	Write Buffer 64 Byte w/o ACC	175 µs		200 µs	
	Write Buffer 128 Byte w/o ACC	198 µs			
	Write Buffer 256 Byte w/o ACC	239 µs			
	Write Buffer 512 Byte w/o ACC	340 µs	750 µs		
	Write Buffer 64 Byte w/ACC			100 µs	
	Program performance w/o ACC	1.5 MB/s (Typ)		320 kB/s (Typ)	
Erase	Sector Erase	0.2s	1.1s	0.6s	5s
	Erase performance (Typ)	655 kB/s (Note 1)		213 kB/s (Note 2)	
	Erase performance (Worst Case)	119 kB/s (Note 1)		25.6 kB/s (Note 2)	

Notes:

1. *Erase performance of S29GL-S is included pre-program time.*
2. *Erase performance of MX29GL-E is not included pre-program time.*

3 DC Specification

The S29GL-S and MX29GL-E have primarily compatible specifications. Differences in DC Characteristics between the devices are highlighted in Table 4. The potential impact of any parameter specification differences should be evaluated and validated. Refer to the respective Macronix MX29GL-E and Cypress S29GL-S data sheets to verify the most up to date specifications.

Table 4. DC Specification

	Cypress			Macronix					
	S29GL-S			MX29GL128/256E			MX29GL512E		
	Min	Typ	Max	Min	Typ	Max	Min	Typ	Max
Input Load Current		+0.02 µA	±1.0 µA			± 2.0 µA			± 4.0 µA
Output Leakage Current		+0.02 µA	±1.0 µA			± 1.0 µA			± 1.0 µA
V_{CC} Active Read Current (5 MHz)		55 mA	60 mA		30 mA	50 mA		30 mA	50 mA
V_{CC} Intra-Page Read Current		9 mA	25 mA		6 mA	20 mA		6 mA	20 mA
V_{CC} Active Erase/Program Current		45 mA	100 mA		26 mA	30 mA		26 mA	30 mA
V_{CC} Standby Current		70 µA	100 µA		30 µA	100 µA		60 µA	200 µA
V_{CC} Reset Current		10 mA	20 mA		30 µA	100 µA		60 µA	200 µA
Automatic Sleep Mode		3 mA	6 mA		30 µA	100 µA		60 µA	200 µA
V_{CC} Current during power up		53 mA	80 mA						
Input Low Voltage	-0.5V		0.2 x V_{IO}	-0.1V		0.3 x V_{IO}	-0.1V		0.3 x V_{IO}
Input High Voltage	0.7 x V_{IO}		V_{IO} + 0.4V	0.7 x V_{IO}		V_{IO} + 0.3V	0.7 x V_{IO}		V_{IO} + 0.3V
Output Low Voltage			0.15 x V_{IO}			0.45V			0.45V
Output High Voltage	0.85 x V_{IO}			0.85 x V_{IO}			0.85 x V_{IO}		

4 Device ID

This section provides a comparison between Macronix and Cypress flash memory Device ID.

The GL-S flash only supports Autoselect Register access via software command sets. Macronix GL-E supports Autoselect Register access via software command sets and high voltage method which requires V_{ID} (nominally 12V) applied to Address input A9.

Table 5. Device ID

			Cypress	Macronix
		Address	**S29GL512S**	**MX29GL512E**
Manufacturer ID		(Base)+00h	0001h	00C2h
Device ID	Word1	(Base)+01h	227Eh	227Eh
	Word2	(Base)+0Eh	2223h	2223h
	Word3	(Base)+0Fh	2201h	2201h
			Cypress	**Macronix**
		Address	**S29GL256S**	**MX29GL256E**
Manufacturer ID		(Base)+00h	0001h	00C2h
Device ID	Cycle1	(Base)+01h	227Eh	227Eh
	Cycle2	(Base)+0Eh	2222h	2222h
	Cycle3	(Base)+0Fh	2201h	2201h
			Cypress	**Macronix**
		Address	**S29GL128S**	**MX29GL128E**
Manufacturer ID		(Base)+00h	0001h	00C2h
Device ID	Cycle1	(Base)+01h	227Eh	227Eh
	Cycle2	(Base)+0Eh	2221h	2221h
	Cycle3	(Base)+0Fh	2201h	2201h

5 Program Suspend / Resume

There are specification differences at program Suspend Resume Command and Specification between Macronix and Cypress flash memory.

Table 6. Program Suspend / Resume Specification

		Cypress		Macronix	
		S29GL-S		**MX29GL-E**	
		Typ	**Max**	**Typ**	**Max**
Erase	Erase Suspend Latency		40 µs		20 µs
Erase Suspend	Erase Resume to next Erase Suspend	100 µs			400 µs
Program	Program Suspend Latency		40 µs	Not defined	
Program Suspend	Program Resume to next Program Suspend	100 µs			5 µs

GL-S has two commands for Program resume: the legacy combined Erase / Program Suspend and resume command (B0h/30h command code), and the separate Program Suspend and Resume command (51h/50h command code).

Table 7. Program Suspend / Resume Command

	Cypress	Macronix
	S29GL-S	MX29GL-E
Program/Erase Suspend	B0h	B0h
Program/Erase Resume	30h	30h
Program Suspend Enhanced Method	51h	N/A
Program suspend Enhanced Method	50h	N/A

6 Power-Up Timing

This section provides a comparison between Macronix and Cypress flash memory power up timing.

Table 8. Power-up Timing

	Cypress	Macronix
	S29GL-S	MX29GL-E
	Min	Min
V_{CC} Setup Time to first access	300 µs	500 µs
V_{IO} Setup Time to first access	300 µs	
RESET# Low to CE# Low during embedded operation	35 µs	20 µs
RESET# Pulse Width during embedded operation	200 ns	10 µs
Time between RESET# (High) and CE# (Low)	50 ns	200 ns

7 Packaging

Several of the pin definitions have changed between Macronix and Cypress flash memory, see Table 9.

- WP#/ACC: GL-S does not support High Voltage Accelerated Programming, ACC is removed. No difference on WP# function.
- BYTE#: GL-S supports only x16 data bus width, BYTE# is not required. This pin is not connected internally and can float or be connected to V_{CC} or GND.
- DQ15/A-1: GL-S supports only x16 data bus width, A-1 input is not required.

Table 9. Pin-out Difference

Pin or Ball	Cypress	Macronix
	S29GL-S	MX29GL-E
TSOP Package		
16	WP# (Note 1)	WP#/ACC
28	DNU (Note 2)	NC (Note 3)
51	DQ15	Q15/A-1
53	RFU (Note 4)	BYTE#
BGA Package		
B4	WP# (Note 1)	WP#/ACC
E1	DNU (Note 2)	NC (Note 3)
F7	RFU (Note 4)	BYTE#
G7	DQ15	Q15/A-1

Notes:

1. *Voltage cannot exceed V_{IO} + 0.4V on WP# input for GL-S.*
2. *DNU = Do Not Use, must remain floating.*
3. *NC = Not Connected, should remain floating, okay to be pulled low or high.*
4. *RFU = Reserved for Future use, not connected internally on GL-S, okay to pull high.*

8 References

- Cypress GL-S MirrorBit Eclipse Flash Non-Volatile Memory Family Datasheet
- Macronix MX29GL512E H/L Datasheet, P/N PM1524
- Macronix MX29GL256E Datasheet, P/N PM1499
- Macronix MX29GL128E Datasheet, P/N PM1500

Document History Page

Document Title: AN98579 - Migration from Macronix™ GL-E (128-512 Mb) to Cypress S29GL-S Document Number: 001-98579				
Rev.	**ECN No.**	**Orig. of Change**	**Submission Date**	**Description of Change**
**	–	–	10/06/2011	Initial version
*A	4959012	MSWI	10/12/2015	Updated in Cypress template
*B	5872335	AESATMP8	09/05/2017	Updated logo and Copyright.

Worldwide Sales and Design Support

Cypress maintains a worldwide network of offices, solution centers, manufacturer's representatives, and distributors. To find the office closest to you, visit us at Cypress Locations.

Products

ARM® Cortex® Microcontrollers	cypress.com/arm
Automotive	cypress.com/automotive
Clocks & Buffers	cypress.com/clocks
Interface	cypress.com/interface
Internet of Things	cypress.com/iot
Memory	cypress.com/memory
Microcontrollers	cypress.com/mcu
PSoC	cypress.com/psoc
Power Management ICs	cypress.com/pmic
Touch Sensing	cypress.com/touch
USB Controllers	cypress.com/usb
Wireless Connectivity	cypress.com/wireless

PSoC® Solutions

PSoC 1 | PSoC 3 | PSoC 4 | PSoC 5LP | PSoC 6

Cypress Developer Community

Forums | WICED IOT Forums | Projects | Video | Blogs | Training | Components

Technical Support

cypress.com/support

Cypress Semiconductor
198 Champion Court
San Jose, CA 95134-1709