

Migrating from MX25L25635E/25735E to MX25L25635F/25735F

1. Introduction

This document highlights parameters which may require attention when migrating from the MX25L25635E/25735E (110nm Revision “E”) to the MX25L25635F/25735F (75nm Revision “F”). The information provided in this document is based on datasheets listed in Section 10. Newer versions of the datasheets may override the contents of this document. A comparison of key features is provided in Table 1-1.

Table 1-1: Key Feature Comparison

Feature		Part Number			
		MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Process Technology		110nm	75nm	110nm	75nm
VCC		2.7V – 3.6V	2.7V – 3.6V	2.7V – 3.6V	2.7V – 3.6V
I/O		x1/x2/x4	x1/x2/x4	x1/x2/x4	x1/x2/x4
Read	Normal Read	50MHz	50MHz	50MHz	50MHz
	Fast Read 1x I/O	80MHz	104MHz	80MHz	104MHz
	Fast Read 2x I/O	70MHz	84MHz	70MHz	84MHz
	Fast Read 4x I/O	70MHz	84MHz	70MHz	84MHz
Enhanced Frequency (x1/x2/x4: 10 dummy cycles)		-	133MHz	-	133MHz
QPI Interface		-	Yes	-	Yes
4-Byte Address Command Set		-	Yes	-	-
Read Enhance Mode		Yes	Yes	Yes	Yes
Read Burst Mode		-	Yes	-	Yes
Software Reset Command		-	Yes	-	Yes
Erase Suspend & Resume		-	Yes	-	Yes
Program Suspend & Resume		-	Yes	-	Yes
Flexible Dummy Cycles		-	Yes	-	Yes
Adjustable Output Driver		-	Yes	-	Yes
Fast Boot Mode		-	Yes	-	Yes
Protection	Security OTP	4KBit	4KBit	4KBit	4KBit
	BP Protect	Top	Top/Bottom	Top	Top/Bottom
	Volatile Write Protection	Yes	Yes	Yes	Yes
	Non-volatile Write Protection	-	Yes	-	Yes
	Password Protection	-	Yes	-	Yes

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2. Package

MX25L25635F/25735F series provide 16-SOP (300mil) and 8-WSON (8x6mm) package options, which have pin out and physical dimensions identical to the MX25L25635E/25735E (with the exception of pin #1 of the MX25635F 16SOP where the HOLD# feature has been removed).

Table 2-1: Package Pins Comparison

16-PIN SOP (300mil)								
MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F		MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
HOLD#/SIO3	DNU/SIO3	HOLD#/SIO3	HOLD#/SIO3	1	SCLK	SCLK	SCLK	SCLK
VCC	VCC	VCC	VCC	2	SI/SIO0	SI/SIO0	SI/SIO0	SI/SIO0
RESET#	RESET#	NC	NC	3	NC	NC	NC	NC
NC	NC	NC	NC	4	NC	NC	NC	NC
NC	NC	NC	NC	5	NC	NC	NC	NC
NC	NC	NC	NC	6	NC	NC	NC	NC
CS#	CS#	CS#	CS#	7	GND	GND	GND	GND
SO/SIO1	SO/SIO1	SO/SIO1	SO/SIO1	8	WP#/SIO2	WP#/SIO2	WP#/SIO2	WP#/SIO2

8-WSON (8x6mm)								
MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F		MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
CS#	CS#	CS#	CS#	1	VCC	VCC	VCC	VCC
SO/SIO1	SO/SIO1	SO/SIO1	SO/SIO1	2	RESET#/SIO3	RESET#/SIO3	HOLD#/SIO3	HOLD#/SIO3
WP#/SIO2	WP#/SIO2	WP#/SIO2	WP#/SIO2	3	SCLK	SCLK	SCLK	SCLK
GND	GND	GND	GND	4	SI/SIO0	SI/SIO0	SI/SIO0	SI/SIO0

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3. Command Set

The core commands for read, erase, and program are unchanged between the E and F versions. For a full list of commands and a description of their functions, please refer to each product's datasheet

Table 3-1: Command Set Comparison

Command	Symbol	Description	MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Read	READ	Normal Read (1-1-1)	03h	03h	03h	03h
	FASTREAD	Fast Read (1-1-1)	0Bh	0Bh	0Bh	0Bh
	DREAD	Dual Output (1-1-2)	3Bh	3Bh	3Bh	3Bh
	2READ	2 I/O (1-2-2)	BBh	BBh	BBh	BBh
	QREAD	Quad Output (1-1-4)	6Bh	6Bh	6Bh	6Bh
	4READ	4 I/O (1-4-4)	EBh	EBh	EBh	EBh
Erase	SE	Sector Erase (4KB)	20h	20h	20h	20h
	BE32KB	Block Erase (32KB)	52h	52h	52h	52h
	BE	Block Erase (64KB)	D8h	D8h	D8h	D8h
	CE	Chip Erase	60h or C7h	60h or C7h	60h or C7h	60h or C7h
Program	PP	Page Program	02h	02h	02h	02h
	4PP	Quad Input Page Program	38h	38h	38h	38h
ID Read	RDID	Read ID	9Fh	9Fh	9Fh	9Fh
	RES	Read Electronic ID	ABh	ABh	ABh	ABh
	REMS	Read Electronic & Mfr ID	90h	90h	90h	90h
	REMS2	Read ID for 2x I/O Mode	EFh	-	EFh	-
	REMS4	Read ID for 4x I/O Mode	DFh	-	DFh	-
	QPIID	QPI ID Read	-	AFh	-	AFh

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Table 3-1: Command Set Comparison - Continued

Command	Symbol	Description	MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Register	RDSR	Read Status Register	05h	05h	05h	05h
	WRSR	Write Status Register	01h	01h	01h	01h
	RDSCUR	Read Security Register	2Bh	2Bh	2Bh	2Bh
	WRSCUR	Write Security Register	2Fh	2Fh	2Fh	2Fh
	RDFBR	Read Fast Boot Register	-	16h	-	16h
	WRFBR	Write Fast Boot Register	-	17h	-	17h
	ESFBR	Erase Fast Boot Register	-	18h	-	18h
Mode	WREN	Write Enable	06h	06h	06h	06h
	WRDI	Write Disable	04h	04h	04h	04h
	EQIO	Enable QPI	-	35h	-	35h
	RSTQIO	Disable QPI	-	F5h	-	F5h
	SBL	Set Burst Length	-	C0h	-	C0h
	ESRY	Enable SO to output RY/ BY#	70h	-	70h	-
	DSRY	Disable SO to output RY/ BY#	80h	-	80h	-
	HPM	High Performance Enable Mode	A3h	-	A3h	-
	PGM/ERS Suspend	Suspends Program/Erase	-	B0h	-	B0h
	PGM/ERS Resume	Resumes Program/Erase	-	30h	-	30h
Reset	NOP	No Operation	-	00h	-	00h
	RSTEN	Reset Enable	-	66h	-	66h
	RST	Reset Memory	-	99h	-	99h
	CLSR	Clear SR Fail Flags	30h	-	30h	-

The E versions use the CLSR (30h) command to clear the P_FAIL and E_FAIL flags. However, the F versions clear these flags automatically upon successful completion of a program or erase operation.

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Table 3-1: Command Set Comparison - Continued

Command	Symbol	Description	MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Protection	SBLK	Single Block Lock	36h	-	36h	-
	SBULK	Single Block Unlock	39h	-	39h	-
	RDBLOCK	Block Protect Read	3Ch	-	3Ch	-
	WRLR	Write Lock Register	-	2Ch	-	2Ch
	RDLR	Read Lock Register	-	2Dh	-	2Dh
	WRPASS	Write Password Register	-	28h	-	28h
	RDPASS	Read Password Register	-	27h	-	27h
	PASSULK	Password Unlock	-	29h	-	29h
	WRSPB	SPB Bit Program	-	E3h	-	E3h
	ESSPB	All SPB Bit Erase	-	E4h	-	E4h
	RDSPB	Read SPB Status	-	E2h	-	E2h
	SPBLK	SPB Lock Set	-	A6h	-	A6h
	RDSPBLK	Read SPB Lock Register	-	A7h	-	A7h
	WRDPB	Write DPB Register	-	E1h	-	E1h
	RDDPB	Read DPB Register	-	E0h	-	E0h

The command set and implementation of Individual Sector Protection Mode is has changed between the E and F versions. Please refer to each product's datasheet for more details.

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Table 3-1: Command Set Comparison - Continued

Command	Symbol	Description	MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
4-Byte Mode	EN4B	Enter 4-byte Address Mode	B7h	B7h	-	-
	EX4B	Exit 4-byte Address Mode	E9h	E9h	-	-
EAR	WREAR	Write Extended Address Register	-	C5h	-	-
	RDEAR	Read Extended Address Register	-	C8h	-	-
4-Byte Command Set	READ4B	Read Data Bytes Using 4 Bytes Address	-	13h	-	-
	FASTREAD4B	Read Data Bytes at Higher Speed using 4 Bytes Address	-	0Ch	-	-
	DREAD4B	Dual Output Fast Read Using 4 Byte Address	-	3Ch	-	-
	2READ4B	Dual Input/Output Fast Read Using 4 Byte Address	-	BCh	-	-
	QREAD4B	Quad Output Fast Read Using 4 Byte Address	-	6Ch	-	-
	4READ4B	Quad Input/Output Fast Read Using 4 Byte Address	-	ECh	-	-
	SE4B	Sector Erase Using 4 Byte Address	-	21h	-	-
	BE32K4B	Block Erase 32KB Using 4 Byte Address	-	5Ch	-	-
	BE4B	Block Erase 64KB Using 4 Byte Address	-	DCh	-	-
	PP4B	Page Program Using 4 Byte Address	-	12h	-	-
4PP4B	Quad Page Program Using 4 Byte Address	-	3Eh	-	-	

The MX25L25635F adds a new 4-Byte Command Set to supplement the legacy 3-Byte Command Set. The 4-Byte Command Set operates similar to the legacy 3-Byte Command set except 4-Bytes of address are required during the address phase. The 4-Byte Command Set is capable of addressing the full address space of the serial flash without needing to enter 4-Byte addressing mode.

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4. Write Protection

The E and F version products provide two write protection modes to easily protect sectors from inadvertent changes. The default is Block Protection Mode, utilizing the nonvolatile Block Protection (BP) bits in the Status Register. The BP bits specify which block groups will be protected. The second mode uses an individual block protection method. This method utilizes a volatile SRAM lock bit assigned to each block (or sector) and controls its protection status. The Gang Block Lock (GBLK) and Gang Block Unlock (GBULK) commands, which set or clear all SRAM lock bits simultaneously, are identical for both E and F versions. However, the E and F versions use different commands to control individual SRAM lock bits. In addition, the F versions can also be protected with nonvolatile SPB (Solid Protection Bits).

4-1. Block Protection (BP) Mode

The F version has a finer granularity of block protection. Furthermore, the F version has the ability to specify whether block protection begins at the top or bottom of memory. This is controlled by the Top/Bottom (TB) bit in the F version's new Configuration Register. The TB default setting is '0' and specifies the top of memory.

4-2. Individual Sector Protection

Both E and F version products provide volatile individual block write protection, to easily protect sectors or blocks against inadvertent changes, as an alternative to the grouped block protection provided by the Block Protection (BP) bits in the Status Register. The F version has additional protection features in the Advanced Sector Protection mode that provide higher levels of protection. These higher levels of protection include:

1. Nonvolatile individual sector/block protection.
2. A software locking mechanism to prevent modifications to the nonvolatile protection until after the next Reset or power-up cycle.
3. A password protection option.

These additional protection features can be used to prevent accidental or deliberate data corruption in protected memory areas. Please see the MX25L25635F or MX25L25735F datasheets for more details.

5. Electrical Characteristics

The comparison of DC and AC characteristics are shown in Tables 5-1 and 5-2:

Table 5-1: DC Characteristics

DC Performance		MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Active Current	Read (4I/O)	45mA	20mA	45mA	20mA
	Erase	25mA	25mA	25mA	25mA
	Program	25mA	25mA	25mA	25mA
VCC Standby Current		200uA	60uA	200uA	60uA
Deep Power Down Current		80uA	20uA	80uA	20uA

(Note: All of the data shown in Table 5-1 are maximum values).

Table 5-2: AC Characteristics

AC Performance			MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
Erase Time	4KB	typ	60ms	43ms	60ms	43ms
		max	300ms	200ms	300ms	200ms
	32KB	typ	0.5s	0.19s	0.5s	0.19s
		max	2s	1s	2s	1s
	64KB	typ	0.7s	0.34s	0.7s	0.34s
		max	2s	2s	2s	2s
	Chip Erase	typ	160s	120s	160s	120s
		max	400s	300s	400s	300s
Program Time	Byte	typ	9us	12us	9us	12us
		max	300u	30us	300us	30us
	Page (256-Byte)	typ	1.4ms	0.6ms	1.4ms	0.6ms
		max	5ms	3ms	5ms	3ms
	Write Status Register	typ	40ms	-	40ms	-
		max	100ms	40ms	100ms	40ms
Erase/Program Cycles		typ	100,000	100,000	100,000	100,000
tCLQV (4I/O)	15pf	max	12ns	6ns	12ns	6ns
	30pf	max	15ns	8ns	15ns	8ns

6. Memory Organization

The memory and sector architecture of the MX25L25635F/MX25L25735F flash are identical to the MX25L25635E/MX25L25735E flash.

7. Device Identification

The Manufacturer ID and Device ID values of the MX25L25635F/MX25L25735F are identical to MX25L25635E/MX25L25735E flash.

Table 7-1: Manufacturer ID & Device ID

ID item		MX25L25635E	MX25L25635F	MX25L25735E	MX25L25735F
RDID	Manufacturer ID	C2h	C2h	C2h	C2h
	Type	20h	20h	20h	20h
	Density	19h	19h	19h	19h
RES	Electronic ID	18h	18h	18h	18h
REMS	Manufacturer ID	C2h	C2h	C2h	C2h
	Device ID	18h	18h	18h	18h
QPIID	Manufacturer ID	-	C2h	-	C2h
	Type	-	20h	-	20h
	Density	-	19h	-	19h

8. Part Number Cross-Reference

The part number and package information cross reference between the MX25L25635E/25735E and MX25L25635F/25735F series is shown in Table 8-1.

Table 8-1: Part Number Cross-Reference

Density	Package	E Revision	F Revision
256Mb	16SOP (300mil)	MX25L25635EMI-12G	MX25L25635FMI-10G
		MX25L25735EMI-12G	MX25L25735FMI-10G
	8WSON (8x6mm)	MX25L25635EZNI-12G	MX25L25635FZ2I-10G
		MX25L25735EZNI-12G	MX25L25735FZ2I-10G

9. Summary

The MX25L25635F/735F is backwards compatible with most of the common commands and features of the earlier E versions. Additionally, the supported package types have identical footprints and nearly identical pinout definitions. The following is a summary of the differences to consider when migrating from the MX25L25635E/25735E to the MX25L25635F/25735F:

- Block Protection Mode has finer granularity in the F version.
- Individual Sector Protection has a different implementation and command set in the F version.
- The method of clearing the E_FAIL and P_FAIL flags is different in the F version.
- The Security Register bit assignments have changed.

A more detailed analysis should be done if “special” functions such as write protection are used. If common features are utilized in standard and basic modes, then the migration may only need minimal software modification, if any at all, to accommodate differences between the E and F versions.

10. Reference Documents

Table 9-1 shows the datasheet versions used for comparison in this application note. For the most current Macronix specification, please refer to the Macronix Website at <http://www.macronix.com>

Table 9-1: Datasheet Version

Datasheet	Location	Date Issued	Versions
MX25L25635E	Macronix Website	Feb.10,2012	Rev. 1.3
MX25L25635F	Macronix Website	Oct.30,2012	Rev 1.0
Mx25L25735E	Macronix Website	Feb.10,2012	Rev. 1.2
MX25L25735F	Macronix Website	Oct.30,2012	Rev 1.0

11. Revision History

Table 10-1: Revision History

Revision No.	Description	Page	Date
REV. 1	Initial Release	ALL	DEC. 13, 2012



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