The Comparison of MX66L51235F and MX25L51245G

1. Introduction

This document compares the features and parameters of Macronix Serial NOR Flash MX66L51235F (75nm Revision “F”) and MX25L51245G (55nm Revision “G”).

In Macronix Part Name rule, MX25 is our Serial NOR Flash product family, while MX66 means Serial NOR Flash with stacked die. Generally, the MX25L51245G is backward compatible with the MX66L51235F as it is pin and command compatible with the basic Read/Program/Erase commands. There may be some differences if special features are used such as DTR mode.

The document does not provide detailed information on the individual devices, but highlights the major similarities and differences between them. The comparison covers the general features, performance, command codes and other differences.

The information provided in this document is based on datasheets listed in Section *"10. Reference Documents"*. Newer versions of the datasheets may override the contents of this document. A comparison of key features is provided in *"Table 1-1: Key Feature Comparison"*.

Table 1-1: Key Feature Comparison

Feature		Part Number	
		MX66L51235F	**MX25L51245G**
Process Technology		75nm	55nm
VCC		2.7V – 3.6V	2.7V – 3.6V
I/O		x1/x2/x4	x1/x2/x4
Sector Size	4KB	Yes	Yes
	32KB	Yes	Yes
	64KB	Yes	Yes
Program Buffer Size		256Byte	256Byte
Security OTP		4KBit	4KBit
Read	Normal Read	50MHz	66MHz
	Fast Read 1x I/O	104MHz	133MHz
	Fast Read 2x I/O (4 dummy cycles)	84MHz	84MHz
	Fast Read 4x I/O (6 dummy cycles)	84MHz	84MHz
Enhanced Frequency (x1/x2/x4: Maximum dummy cycles)		133MHz	166MHz
DTR (Maximum dummy cycle)		**NA**	**100MHz**
QPI Interface		Yes	Yes
Suspend & Resume		Yes	Yes
Read Enhance Mode		Yes	Yes
Wrap around read mode		Yes	Yes
Configurable dummy cycle		Yes	Yes
Adjustable output driver		Yes	Yes
Fast boot (XIP) mode		Yes	Yes
BP Protection		Yes	Yes
Password protection		Yes	Yes
volatile write protection		Yes	Yes
non-volatile write protection		Yes	Yes
Factory Mode		**NA**	**Support on -08G**

2. Package

MX25L51245G series provide 8-SOP (200mil), 16-SOP (300mil) and 8-WSON (8x6mm) package options, which have pin out and physical dimensions identical to the MX66L51235F. For more package information, please refer to datasheets or local sales contact our regional sales.

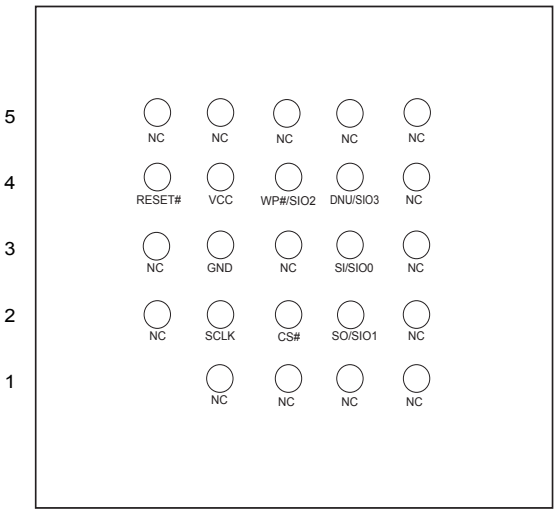
Table 2-1: Package Pins Comparison

16-PIN SOP (300mil)				
MX25L51245G	MX66L51235F		MX66L51235F	MX25L51245G
NC/SIO3	NC/SIO3	1 16	SCLK	SCLK
VCC	VCC	2 15	SI/SIO0	SI/SIO0
RESET#	RESET#	3 14	NC	NC
NC	NC	4 13	NC	NC
DNU	NC	5 12	NC	DNU
DNU	NC	6 11	NC	DNU
CS#	CS#	7 10	GND	GND
SO/SIO1	SO/SIO1	8 9	WP#/SIO2	WP#/SIO2

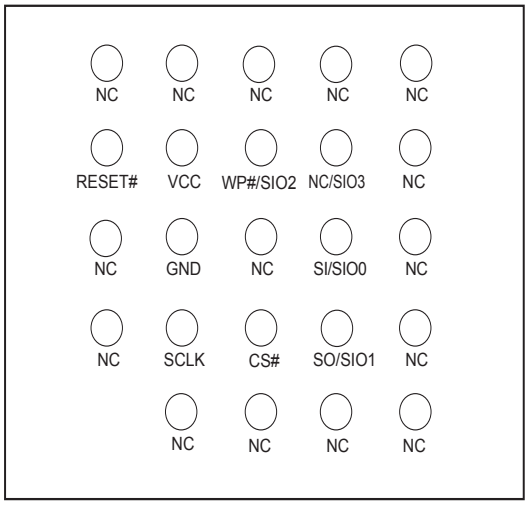
8-WSON (8x6mm)				
MX25L51245G	MX66L51235F		MX66L51235F	MX25L51245G
CS#	CS#	1 8	VCC	VCC
SO/SIO1	SO/SIO1	2 7	RESET#/SIO3	RESET#/SIO3
WP#/SIO2	WP#/SIO2	3 6	SCLK	SCLK
GND	GND	4 5	SI/SIO0	SI/SIO0

24 BGA (5x5)

MX66L51235F



MX25L51245G



3. Command Set

The core commands for read, erase, and program are unchanged between the F and G 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 (Read/Erase/Program/ID Read)

Command	Symbol	Description	MX66L51235F	MX25L51245G
Read	READ	Normal Read (1-1-1)	03h	03h
	FASTREAD	Fast Read (1-1-1)	0Bh	0Bh
	DREAD	Dual Output (1-1-2)	3Bh	3Bh
	2READ	2 I/O (1-2-2)	BBh	BBh
	QREAD	Quad Output (1-1-4)	6Bh	6Bh
	4READ	4 I/O (1-4-4)	EBh	EBh
	FASTDTRD	fast DT read		0Dh
	2DTRD	Dual I/O DT Read		BDh
	4DTRD	Quad I/O DT Read		EDh
Erase	SE	Sector Erase (4KB)	20h	20h
	BE32KB	Block Erase (32KB)	52h	52h
	BE	Block Erase (64KB)	D8h	D8h
	CE	Chip Erase	60h or C7h	60h or C7h
Program	PP	Page Program	02h	02h
	4PP	Quad Input Page Program	38h	38h
ID Read	RDID	Read ID	9Fh	9Fh
	RES	Read Electronic ID	ABh	ABh
	REMS	Read Electronic & Mfr ID	90h	90h
	QPIID	QPI ID Read	AFh	AFh

Table 3-1: Command Set Comparison - (Register/Mode/Reset)

Command	Symbol	Description	MX66L51235F	MX25L51245G
Register	RDSR	Read Status Register	05h	05h
	WRSR	Write Status Register	01h	01h
	RDSCUR	Read Security Register	2Bh	2Bh
	WRSCUR	Write Security Register	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
	WRDI	Write Disable	04h	04h
	EQIO	Enable QPI	35h	35h
	RSTQIO	Disable QPI	F5h	F5h
	SBL	Set Burst Length	C0h	C0h
	PGM/ERS Suspend	Suspends Program/Erase	B0h	B0h
	PGM/ERS Resume	Resumes Program/Erase	30h	30h
	FMEN	factory mode enable (only G-version with -08G)		41h
Reset	NOP	No Operation	00h	00h
	RSTEN	Reset Enable	66h	66h
	RST	Reset Memory	99h	99h

Table 3-1: Command Set Comparison - (Security)

Command	Symbol	Description	MX66L51235F	MX25L51245G
Security	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
	GBLK	Gang block lock	7Eh	7Eh
	GBULK	Gang block unlock	98h	98h

Table 3-1: Command Set Comparison - (4-Byte Mode/EAR/4-Byte Command Set)

Command	Symbol	Description	MX66L51235F	MX25L51245G
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	C5h
	RDEAR	Read Extended Address Register	C8h	C8h
4-Byte Command Set	READ4B	Read Data Bytes Using 4 Bytes Address	13h	13h
	FASTREAD4B	Read Data Bytes at HigherSpeed using 4 Bytes Address	0Ch	0Ch
	DREAD4B	Dual Output Fast Read Using 4 Byte Address	3Ch	3Ch
	2READ4B	Dual Input/Output Fast Read Using 4 Byte Address	BCh	BCh
	QREAD4B	Quad Output Fast Read Using 4 Byte Address	6Ch	6Ch
	4READ4B	Quad Input/Output Fast Read Using 4 Byte Address	ECh	ECh
	SE4B	Sector Erase Using 4 Byte Address	21h	21h
	BE32K4B	Block Erase 32KB Using 4 Byte Address	5Ch	5Ch
	BE4B	Block Erase 64KB Using 4 Byte Address	DCh	DCh
	PP4B	Page Program Using 4 Byte Address	12h	12h
	4PP4B	Quad Page Program Using 4 Byte Address	3Eh	3Eh
	FRDTRD4B	fast DT read		0Eh
	2DTRD4B	Dual I/O DT Read		BEh
	4DTRD4B	Quad I/O DT Read		EEh

4. Data Protection

Both F and G version products provide three write protection modes to easily protect sectors from inadvertent changes and will be discussed in more detail below.

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 refer to the datasheets for more details.

5. Register Comparison

The MX25L51245G Status Register bits are backward compatible with the registers of the MX66L51235F.

Table 5-1: Status Register Comparison

	MX66L51235F	MX25L51245G
bit 0	WIP (write in progress bit)	WIP (write in progress bit)
bit 1	WEL (write enable latch)	WEL (write enable latch)
bit 2	BP0 (level of protected block)	BP0 (level of protected block)
bit 3	BP1 (level of protected block)	BP1 (level of protected block)
bit 4	BP2 (level of protected block)	BP2 (level of protected block)
bit 5	BP3 (level of protected block)	BP3 (level of protected block)
bit 6	QE (Quad Enable)	QE (Quad Enable)
bit 7	SRWD (status register write protect)	SRWD (status register write protect)

Basically, Configuration Register bits on G version are backward compatible with the registers of F version. G version adds bit4 for Preamble bit Enable to improve data capture reliability while the flash memory is running in high frequency.

Table 5-2: Configuration Register Comparison

	MX66L51235F	MX25L51245G
bit 0	ODS 0 (Output driver strength)	ODS 0 (Output driver strength)
bit 1	ODS 1 (Output driver strength)	ODS 1 (Output driver strength)
bit 2	ODS 2 (output driver strength)	ODS 2 (output driver strength)
bit 3	TB (Top/bottom selected)	TB (Top/bottom selected)
bit 4	Reserved	PBE (Preamble bit Enable)
bit 5	4 BYTE	4 BYTE
bit 6	DC0 (Dummy cycle 0)	DC0 (Dummy cycle 0)
bit 7	DC1 (Dummy cycle 1)	DC1 (Dummy cycle 1)

The MX25L51245G Security Register bits are backward compatible with the registers of the MX66L51235F.

Table 5-3: Security Register Comparison

	MX66L51235F	MX25L51245G
bit 0	Secured OTP Indicator bit	Secured OTP Indicator bit
bit 1	LDSO (Indicate if lock-down)	LDSO (Indicate if lock-down)
bit 2	PSB (Program Suspend bit)	PSB (Program Suspend bit)
bit 3	ESB (Erase Suspend bit)	ESB (Erase Suspend bit)
bit 4	Reserved	Reserved
bit 5	P_FAIL	P_FAIL
bit 6	E_FAIL	E_FAIL
bit 7	WPSEL	WPSEL

The MX25L51245G Lock Register bits are backward compatible with the registers of the MX66L51235F.

Table 5-4: Lock register Comparison

	MX66L51235F	MX25L51245G
bit 0	Reserved	Reserved
bit 1	Solid Protection Mode Lock Bit	Solid Protection Mode Lock Bit
bit 2	Password Protection Mode Lock Bit	Password Protection Mode Lock Bit
bit 3 - 15	Reserved	Reserved

6. Electrical Characteristics

The comparison of DC and AC characteristics are shown in Tables 6-1 and 6-2:

Table 6-1: DC Characteristics

DC Performance		MX66L51235F	MX25L51245G
Active Current	Read (4I/O)	40mA @104MHz	20mA @104MHz
	Erase	40mA (SE/BE/BE32) 50mA(CE)	25mA
	Program	40mA	25mA
VCC Standby Current		100uA	100uA
Deep Power Down Current		40uA	20uA

Note: *All of the data shown in* ***Table 6-1*** *are maximum values.*

Table 6-2: AC Characteristics

AC Performance			MX66L51235F	MX25L51245G
Erase Time	4KB	typ	30ms	30ms
		max	120ms	400ms
	32KB	typ	150ms	150ms
		max	650ms	1000ms
	64KB	typ	280ms	280ms
		max	650ms	2000ms
	Chip Erase	typ	110s	140s
		max	300s	200s
Program Time	Byte	typ	16us	25us
		max	30us	60us
	Page (256-Byte)	typ	0.5ms	0.25ms
		max	1.5ms	0.75ms
	Write Status Register	max	40ms	40ms
Erase/Program Cycles		typ	100,000	100,000
tCLQV (4I/O)	15pf	max	7ns	6ns
	30pf	max	9ns	8ns

7. Memory Organization

The memory and sector architecture of the MX25L51245G flash memory is identical to the MX66L51235F flash memory.

8. Device Identification

The Manufacturer ID and Device ID values of the MX25L51245G are identical to MX66L51235F flash memory.

Table 8-1: Manufacturer ID & Device ID

ID Item		MX66L51235F	MX25L51245G
RDID	Manufacturer ID	C2h	C2h
	Type	20h	20h
	Density	1Ah	1Ah
RES	Electronic ID	19h	19h
REMS	Manufacturer ID	C2h	C2h
	Device ID	19h	19h
QPIID	Manufacturer ID	C2h	C2h
	Type	20h	20h
	Density	1Ah	1Ah

9. Summary

Generally, the MX25L51245G is backward compatible with the MX66L51235F as it is pin and command compatible with the basic Read/Program/Erase commands. There may be some differences if special features are used such as using DTR mode.

10. Reference Documents

Table 10-1 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 10-1: Datasheet Version

Datasheet	Location	Date Issued	Versions
MX66L51235F	Macronix Website	August 02, 2016	Rev. 1.1
MX25L51245G	Macronix Website	July 27, 2017	Rev 1.6

11. Revision History

Table 11-1: Revision History

Revision No.	Description	Page	Date
Rev. 1	Initial Release	ALL	June 21, 2016
Rev. 2	1. Modified Document Title and descriptions of the Introduction Section. 2. Revised Configuration Register descriptions and Table 5-1. 3. Updated Table 6-1 and 6-2 for parameters of DC/AC Characteristics. 4. Updated Datasheet Version. 5. Added "Macronix Proprietary" footnote.	P1, 9, 11, 13	March 03, 2020

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