The Comparison of MX25U25643G and MX25U25645G

1. Introduction

The application note compares Macronix MX25U25643G and MX25U25645G Serial NOR Flash products.

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	
		MX25U25643G	MX25U25645G
Process Technology		55 nm	55 nm
VCC		1.65V – 2V	1.65V – 2V
I/O		x1/x2/x4	x1/x2/x4
Sector Size	4KB	Yes	Yes
	32KB	Yes	Yes
	64KB	Yes	Yes
Program Buffer Size		256 Byte	256 Byte
Security OTP		8K Bit	8K Bit
Read Interface	Normal Read	50 MHz	66 MHz
	Fast Read 1x I/O	133 MHz	133 MHz
	Fast Read 2x I/O	84 MHz (4 dummy cycles) 120 MHz (8 dummy cycles)	84 MHz (4 dummy cycles) 166 MHz (10 dummy cycles)
	Fast Read 4x I/O	84 MHz (6 dummy cycles) 120 MHz (10 dummy cycles)	84 MHz (6 dummy cycles) 133 MHz (10 dummy cycles)
DTR (4x I/O)		84 MHz (10 dummy cycles)	102 MHz (10 dummy cycles)
Features			
QPI Interface		Yes	Yes
Read Enhance Mode		Yes	Yes
Wrap Around Read Mode		Yes	Yes
Configurable Dummy Cycle		Yes	Yes
Adjustable Output Driver		Yes	Yes
Suspend & Resume		Yes	Yes
Fast Boot Mode		NA	Yes
BP Protection		Yes	Yes
Password Protection		NA	Yes
Volatile Write Protection		Yes	Yes
Non-volatile Write Protection		Yes	Yes
SFDP		JESD216B	JESD216B

2. Package

MX25U25643G provides 16-SOP (300mil), 8-WSON (8x6mm) and 24-BGA (5x5mm) packages options, which have pin out and physical dimensions identical to the MX25U25645G.

For more package information, please refer to the datasheets or contact our regional sales.

Table 2-1: Package Pins Comparison

16-SOP

16-PIN SOP (300mil)				
MX25U25645G	**MX25U25643G**		**MX25U25643G**	**MX25U25645G**
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	DNU	5 12	DNU	DNU
DNU	DNU	6 11	DNU	DNU
CS#	CS#	7 10	GND	GND
SO/SIO1	SO/SIO1	8 9	WP#/SIO2	WP#/SIO2

8-WSON

8-WSON (8x6mm)				
MX25U25645G	**MX25U25643G**		**MX25U25643G**	**MX25U25645G**
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

24 BGA (5x5mm)

MX25U25643G

	1	2	3	4	5
A		NC	NC	RESET#	DNU
B	NC	SCLK	GND	VCC	NC
C	NC	CS#	NC	WP#/SIO2	NC
D	NC	SO/SIO1	SI/SIO0	NC/SIO3	NC
E	NC	NC	NC	NC	NC

MX25U25645G

	1	2	3	4	5
A		NC	NC	RESET#	DNU
B	NC	SCLK	GND	VCC	NC
C	NC	CS#	NC	WP#/SIO2	NC
D	NC	SO/SIO1	SI/SIO0	NC/SIO3	NC
E	NC	NC	NC	NC	NC

3. Command Set

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	MX25U25643G	MX25U25645G
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, start from bottom 128Mb)	EBh	EBh
	4DTRD	Quad I/O DT Read	EDh	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
SFDP	RDSFDP	Read SFDP Table	5Ah	5Ah
ID Read	RDID	Read ID	9Fh	9Fh
	RES	Read Electronic ID	ABh	ABh
	REMS	Read Electronic & Manufacturer ID	90h	90h
	QPIID	QPI ID Read	AFh	AFh

Table 3-2: Command Set Comparison (Register/Mode/Reset)

Command	Symbol	Description	MX25U25643G	MX25U25645G
Register	RDSR	Read Status Register	05h	05h
	RDCR	Read Configuration register	15h	15h
	WRSR	Write Status Register	01h	01h
	RDSCUR	Read Security Register	2Bh	2Bh
	WRSCUR	Write Security Register	2Fh	2Fh
	RDFBR	Read Fast Boot Register	NA	16h
	WRFBR	Write Fast Boot Register	NA	17h
	ESFBR	Erase Fast Boot Register	NA	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
	WPSEL	Write Protect Selection	68h	68h
	DP	Deep Power Down	B9h	B9h
	RDP	Release from Deep Power Down	ABh	ABh
	ENSO	Enter Secured OTP	B1h	B1h
	EXSO	Exit Secured OTP	C1h	C1h
	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

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

Command	Symbol	Description	MX25U25643G	MX25U25645G
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 Higher Speed 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
	4DTRD4B	Quad I/O DT Read	EEh	EEh

4. Data Protection

4-1. BP bit Block Protection

Both Macronix MX25U25643G and MX25U25645G can use BP bits in the Status Register to select groups of memory areas for write protection. All the regions protected by MX25U25645G can be protected by MX25U25643G with the identical BP setting. Please refer to the following comparison table.

Table 4-1: Block Protection (BP) Comparison of MX25U25643G and MX25U25645G

Protected Area Sizes (T/B bit = 0)

Status bit				Protect Level	
BP3	BP2	BP1	BP0	MX25U25643G	MX25U25645G
0	0	0	0	0 (none)	0 (none)
0	0	0	1	1 (1 block, protected block 511th)	1 (1 block, protected block 511th)
0	0	1	0	2 (2 blocks, protected block 510th-511th)	2 (2 blocks, protected block 510th-511th)
0	0	1	1	3 (4 blocks, protected block 508th-511th)	3 (4 blocks, protected block 508th-511th)
0	1	0	0	4 (8 blocks, protected block 504th-511th)	4 (8 blocks, protected block 504th-511th)
0	1	0	1	5 (16 blocks, protected block 496th-511th)	5 (16 blocks, protected block 496th-511th)
0	1	1	0	6 (32 blocks, protected block 480th-511th)	6 (32 blocks, protected block 480th-511th)
0	1	1	1	7 (64 blocks, protected block 448th-511th)	7 (64 blocks, protected block 448th-511th)
1	0	0	0	8 (128 blocks, protected block 384th-511th)	8 (128 blocks, protected block 384th-511th)
1	0	0	1	9 (256 blocks, protected block 256th-511th)	9 (256 blocks, protected block 256th-511th)
1	0	1	0	10 (512 blocks, protected all)	10 (512 blocks, protected all)
1	0	1	1	11 (512 blocks, protected all)	11 (512 blocks, protected all)
1	1	0	0	12 (512 blocks, protected all)	12 (512 blocks, protected all)
1	1	0	1	13 (512 blocks, protected all)	13 (512 blocks, protected all)
1	1	1	0	14 (512 blocks, protected all)	14 (512 blocks, protected all)
1	1	1	1	15 (512 blocks, protected all)	15 (512 blocks, protected all)

5. Register Comparison

The MX25U25643G Status Register bits are identical to the MX25U25645G.

Table 5-1: Status Register Comparison

	MX25U25643G	MX25U25645G
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)

The MX25U25643G Configuration Register bits are identical to the MX25U25645G.

Table 5-2: Configuration Register Comparison

	MX25U25643G	MX25U25645G
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	PBE (preamble bit enable)	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 MX25U25643G Security Register bits are identical to the MX25U25645G.

Table 5-3: Security Register Comparison

	MX25U25643G	MX25U25645G
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

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		MX25U25643G	MX25U25645G
Active Current	Read (4 I/O) (max.)	25mA @120MHz 20mA @104MHz	22mA @133MHz 18mA @104MHz
	Erase (max.)	20mA	40mA
	Program (max.)	25mA	40mA
VCC Standby Current (typ.)		18uA	20uA
Deep Power Down Current (typ.)		1.5uA	3uA

Table 6-2: AC Characteristics

AC Performance			MX25U25643G	MX25U25645G
Erase Time	4KB	typ.	35ms	25ms
		max.	400ms	400ms
	32KB	typ.	170ms	150ms
		max.	1000ms	1000ms
	64KB	typ.	380ms	220ms
		max.	2000ms	1300ms
	Chip Erase	typ.	130s	75s
		max.	260s	150s
Program Time	Byte	typ.	18us	25us
		max.	40us	60us
	Page (256-Byte)	typ.	0.36ms	0.15ms
		max.	3ms	0.75ms
	Write Status Register	typ.	-	-
		max.	40ms	40ms
Erase/Program Cycles		typ.	100,000	100,000
tCLQV (4I/O)	15pf	max.	6ns	4.5ns
	30pf	max.	8ns	5ns

7. Memory Organization

The memory and sector architecture of the MX25U25643G flash memory are identical to the MX25U25645G flash memory.

8. Device Identification

The Manufacturer ID and Device ID values of MX25U25643G flash memory are identical to the MX25U25645G flash memory.

Table 8-1: Manufacturer ID & Device ID

ID item		MX25U25643G	MX25U25645G
RDID	Manufacturer ID	C2h	C2h
	Type	25h	25h
	Density	39h	39h
RES	Electronic ID	39h	39h
REMS	Manufacturer ID	C2h	C2h
	Device ID	39h	39h
QPIID	Manufacturer ID	C2h	C2h
	Type	25h	25h
	Density	39h	39h

9. Summary

Generally, the MX25U25643G is compatible with the MX25U25645G 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 Fast Boot and Password Protection.

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
MX25U25645G	Macronix Website	January 18, 2019	Rev 1.3
MX25U25643G	Macronix Website	April 23, 2020	Rev. 0.02

11. Revision History

Table 11-1: Revision History

Revision No.	Description	Page	Date
Rev. 1	Initial Release	All	July 9, 2020

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