Comparison of Macronix Serial NOR Flash MX25V16066, MX25L1606E, MX25V1635F and MX25V1606F

1. Introduction

This application note compares Macronix Serial NOR Flash products MX25V16066, MX25L1606E, MX25V1635F and MX25V1606F. The document provides detailed information on individual devices. The comparison covers the general features, performance, command set and device ID.

The information provided is based on the data available at the time. MX25V16066, MX25L1606E, MX25V1635F and MX25V1606F datasheets may override this application note if there is a different description for the same specifications in the datasheets.

Please refer to the contents and comparison tables below for more details.

2. General Features

2-1. Feature Comparison

For the features comparison between these products, please check the comparison tables below for details. For additional product differences, please refer to Table 2-1: Feature Comparison as below.

Table 2-1: Feature Comparison

Part no.		MX25V16066	MX25L1606E	MX25V1635F	MX25V1606F
Technology		68nm	110nm	75nm	75nm
Density		16Mb	16Mb	16Mb	16Mb
VCC		2.3V – 3.6V	2.7V – 3.6V	2.3V – 3.6V	2.3V – 3.6V
Structure					
Operation Frequency	READ (1-1-1)	33MHz (@2.3V-2.7V) 50MHz (@2.7V-3.6V)	33MHz	33MHz	33MHz (@2.3V-2.7V) 50MHz (@2.7V-3.6V)
	FAST READ (1-1-1)	50MHz (@2.3V-2.7V) 80MHz (@2.7V-3.6V)	86MHz	80MHz	50MHz (@2.3V-2.7V) 104MHz (@2.7V-3.6V)
	DREAD (1-1-2)	50MHz (@2.3V-2.7V) 80MHz (@2.7V-3.6V)	80MHz	80MHz	50MHz(@2.3V-2.7V) 104MHz (@2.7V-3.6V)
	2READ (1-2-2)	-	-	80MHz	-
	QREAD (1-1-4)	-	-	80MHz	-
	4READ (1-4-4)	-	-	80MHz	-
Sector Size		4KB	4KB	4KB	4KB
Block Size		32KB/64KB	64KB	32KB/64KB	32KB/64KB
Program Buffer Size		256 bytes	256 bytes	256 bytes	256 bytes
SFDP		Yes	Yes	Yes	Yes
Endurance		100K cycles (typ.)	100K cycles (typ.)	100K cycles (min.)	100K cycles (typ.)
Data Retention (typ.)		20 years	20 years	20 years	20 years
tVSL	VCC (min) to CS# low (VCC Rise Time)	800us (min.)	200us (min)	800us (min.)	800us (min.)
tRES1	CS# High to Standby Mode without Electronic Signature Read	8.8 (max.)	8.8 (max.)	-	8.8 (max.)
tRES2	CS# High to Standby Mode with Electronic Signature Read	8.8 (max.)	8.8 (max.)	-	8.8 (max.)
tRDP	Release from deep power mode	-	-	45us (min.)	8.8us (min.)
tDP	CS# High to Deep Power- down Mode	10us (max.)	10us (max.)	10us (max.)	10us (max.)
Hardware Pin#		WP#	WP#/Hold#	WP#/Hold#	WP#
Software Features					
Suspend/Resume		-	-	Yes	-
Deep Power Down Mode		Yes	Yes	Yes	Yes
Secured OTP Size		-	512bit x 1	4Kb x 2	-

2-2. Performance Comparison

Tables below are the comparison of the two products.

Table 2-2: DC Performance Comparison

DC Performance	Condition	Unit	MX25V16066	MX25L1606E	MX25V1635F	MX25V1606F
Standby Current (ISB1)	Typ	uA	2	15	9	2
	Max	uA	20	25	50	50
Deep Power Down Current (ISB2)	Typ	uA	2	2	0.1	2
	Max	uA	20	20	0.5	20
Read Current (ICC1) (2I/O)	Typ	mA	4	-	4.2	4
	Max	mA	6	25	6.5	6
Program Current (ICC2)	Typ	mA	5	15	5.8	5
	Max	mA	15	20	10	15
Icc Write Status Reg. Current (ICC3)	Typ	mA	5	3	3.5	5
	Max	mA	15	20	10	15
Sector Erase Current (ICC4)	Typ	mA	5	9	3.5	5
	Max	mA	15	20	10	15
Chip Erase Current (ICC5)	Typ	mA	4.5	15	4	4.5
	Max	mA	15	20	10	15

Table 2-3: AC Performance Comparison

AC Performance		Condition	Unit	MX25V16066	MX25L1606E	MX25V1635F	MX25V1606F
Page Program Time	256 Bytes	Typ	ms	0.82 (@2.3V-2.7V) 0.73 (@2.7V-3.6V)	0.6	0.8	0.82 (@2.3V-2.7V) 0.73 (@2.7V-3.6V)
		Max	ms	5 (@2.3V-2.7V) 4 (@2.7V-3.6V)	3	4	5 (@2.3V-2.7V) 4 (@2.7V-3.6V)
Byte Program Time		Typ	us	43 (@2.3V-2.7V) 30 (@2.7V-3.6V)	9	30	43 (@2.3V-2.7V) 30 (@2.7V-3.6V)
		Max	us	200 (@2.3V-2.7V) 180 (@2.7V-3.6V)	50	100	110 (@2.3V-2.7V) 75 (@2.7V-3.6V)
Erase Time	4KB	Typ	ms	75	40	38	72 (@2.3V-2.7V) 68 (@2.7V-3.6V)
		Max	ms	750	200	240	750
	32KB	Typ	s	0.35	-	0.225	0.26 (@2.3V-2.7V) 0.23 (@2.7V-3.6V)
		Max	s	4.95	-	1.5	4.95
	64KB	Typ	s	0.65	0.4	0.45	0.53 (@2.3V-2.7V) 0.5 (@2.7V-3.6V)
		Max	s	5.3	2	3	5.3 (@2.3V-2.7V) 4 (@2.7V-3.6V)
	Chip Erase	Typ	s	3.5*(Note)*	6.5	12	12.2 (@2.3V-2.7V) 11 (@2.7V-3.6V)
		Max	s	56 (@2.3V-2.7V) 45 (@2.7V-3.6V)	20	38	55 (@2.3V-2.7V) 45 (@2.7V-3.6V)
Write Status Register Cycle Time		Typ	ms	5	5	9.5	5
		Max	ms	40	40	20	40
tCLQV (Clock Low to Output Valid)	30pF (max)	Max	ns	8	8	8	8
	15pF (max)	Max	ns	6	6	6	6

Note: *Blank to Blank pattern*

3. Command Code Comparison

User has to check the differences in detail by comparison table below. For the details of command sets function, please refer to the datasheet of each product

Table 3-1: Command Code Comparison

Command	Symbol	Description	MX25V16066	MX25L1606E	MX25V1635F	MX25V1606F
ID Read	RDID	Read Identification	9Fh	9Fh	9Fh	9Fh
	RES	Read Electronic ID	ABh	ABh	ABh	ABh
	REMS	Read Electronic Manufacturer & Device ID	90h	90h	90h	90h
	RDSFDP	Read SFDP	5Ah	5Ah	5Ah	5Ah
Read	READ	Read Data	03h	03h	03h	03h
	FAST READ	Fast Read	0Bh	0Bh	0Bh	0Bh
	2READ	2 x I/O Fast Read	-	-	BBh	-
	DREAD	1I 2O Fast Read	3Bh	3Bh	3Bh	3Bh
	4READ	4 x I/O Fast Read	-	-	EBh	-
	QREAD	1I 4O Fast Read	-	-	6Bh	-
Erase	SE	Sector Erase	20h	20h	20h	20h
	BE (64K)	Block Erase 64KB	D8h	52h or D8h	D8h	D8h
	BE (32K)	Block Erase 32KB	52h	-	52h	52h
	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 Page Program	-	-	38h	-
Device operation	WREN	Write Enable	06h	06h	06h	06h
	WRDI	Write Disable	04h	04h	04h	04h
	DP	Deep Power Down	B9h	B9h	B9h	B9h
	RDP	Release from Deep Power Down	ABh	ABh	CS# toggle	ABh
	SBL	Set Burst Length	-	-	C0h	-
	PGM/ERS Suspend	Suspend Program/Erase	-	-	75h or B0h	-
	PGM/ERS Resume	Resume Program/Erase	-	-	7Ah or 30h	-
	NOP	No Operation	-	-	00h	-
	FMEN	Factory Mode Enable	41h	-	-	41h
	RSTEN	Reset Enable	66h	-	66h	-
	RST	Reset Memory	99h	-	99h	-
Register	WRSR	Write Status Register	01h	01h	01h	01h
	RDSR	Read Status Register	05h	05h	05h	05h
	RDSCUR	Read Security Register	-	2Bh	2Bh	-
	WRSCUR	Write Security Register	-	2Fh	2Fh	-
	RDCR	Read Configuration Register	-	-	15h	-
	ENSO	Enter Secured OTP	-	B1h	B1h	-
	EXSO	Exit Secured OTP	-	C1h	C1h	-

4. Device ID Code Comparison

The following tables show that the Manufacturer and Device IDs have not changed, as shown in Table 4-1: ID Code Comparison.

Table 4-1: ID Code Comparison

Electronic Identification			MX25V16066	MX25L1606E	MX25V1635F	MX25V1606F
RDID	9Fh	Manufacturer ID	C2h		C2h	C2h
		Type	20h		23h	20h
		Density	15h		15h	15h
RES	ABh	Electronic ID	14h		15h	14h
REMS	90h	Manufacturer ID	C2h		C2h	C2h
		Device ID	14h		15h	14h

5. References

Table 5-1 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 5-1: Datasheet Version

Datasheet	Location	Date Issued	Versions
MX25V16066	Macronix Website	June 15, 2022	1.4
MX25L1606E	Macronix Website	November 13, 2017	1.9
MX25V1635F	Macronix Website	September 13, 2016	1.4
MX25V1606F	Macronix Website	January 15, 2020	1.0

6. Revision History

Table 6-1: Revision History

Revision No.	Description	Page	Date
Rev. 1	Initial Release	ALL	April 15, 2021
Rev. 2	1. Content correction 2. Added tRES1/tRES2 information 3. Updated Table 2-2: DC Performance Comparison 4. Updated Table 2-3: AC Performance Comparison 5. Added FMEN(factory mode enable) in Table 3-1: Command Code Comparison 6. Updated Table 5-1: Datasheet Version	P2-5	August 03, 2022

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