



MACRONIX
INTERNATIONAL Co., LTD.

APPLICATION NOTE

Migrating to MX25L6406E from MX25L6405D and MX25L6445E



Migrating to MX25L6406E from MX25L6405D and MX25L6445E

1. Introduction

This application note introduces the related notices for migrating to MX25L6406E from MX25L6405D and MX25L6445E. The document does not provide detailed information on individual devices, but highlights the similarities and differences between them. The comparison covers the general features, performance, command set and device ID.

MX25L6406E supports new feature, the Dual Output mode (1I/2O: Single Input / Dual Output), but MX25L6406E does not support x2 I/O (Dual Input / Dual Output), x4 I/O (Quad Input / Quad Output), Continuous Program (CP) mode and ACC function.

The information provided is based on the data available at the time the document is released. The MX25L6406E datasheet may override this application note if there are content differences in the latest datasheet.

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



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2. General Features**2-1: Feature Comparison**

The Dual Output mode (1I/2O) is one of the new features of the MX25L6406E, and the most advanced technique is that this new product accepts wide range of clock rate from DC (Direct Current)~ 86MHz for frequency control from host system.

MX25L6406E does not support Continuous Program (CP) mode after the migration. In comparison with MX25L6405D, MX25L6406E no longer supports Program/Erase Acceleration (ACC) function (for fast Program/Erase by 9.5~10.5V high voltage input on WP#/ACC pin). The removal of the ACC mode means that the high voltage can no longer be applied to the WP# pin. Doing this will damage the MX25L6406E. Make sure that the programmer does not use the ACC mode.

For MX25L6405D, the MX25L6406E is identical in forms and functions with the MX25L6405D in x1 I/O mode.

For MX25L6445E, the MX25L6406E supports x1 I/O mode (Single Input / Single Output) and Dual Output mode (1I/2O: Single Input / Dual Output), and the migration is for application of Fast Read speed under 86MHz.

For the difference between these products, please check the comparison tables below for the details.

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Table 1: Major Feature Comparison

Feature		MX25L6405D	MX25L6445E	MX25L6406E
Voltage		2.7~3.6 V	2.7~3.6 V	2.7~3.6 V
Interface		x1, x2	x1, x2, x4	x1, 1I/2O*
Package		16-SOP(300mil) 8-WSON(6x5mm)	16-SOP(300mil) 8-SOP(209mil) 8-WSON(8x6mm)	16-SOP(300mil) 8-SOP(209mil) 8-WSON(8x6mm)
Operation Temperature		-40~85 °C	-40~85°C	-40~85°C
Sector / Block		4KB / 64KB	4KB / 32KB or 64KB	4KB / 64KB
Clock Rate**	Fast Read	10KHz~86MHz	DC~104MHz	DC~86MHz
	Read	10KHz~33MHz	50MHz	DC~33MHz
	DREAD (Dual Output)	--	--	DC~80MHz
	2 READ(x2 I/O)	10KHz~50MHz	70MHz	--
	4 READ(x4 I/O)	--	70MHz	--
	TDDRRD	--	50MHz	--
	2DDRRD	--	50MHz	--
	4DDRRD	--	50MHz	--
4PP		--	20MHz	--
DTR mode		--	Yes	--
Block Erase 32KB		--	Yes	--
Byte Program		Yes	Yes	Yes
CP Mode		Yes	Yes	No
ACC Mode		Yes	No	No
Data Protection	Security OTP	512bits	4Kbits	512bits
	Block Protection	BP3~BP0**	BP3~BP0***	BP3~BP0**
	Individual Protection	--	Sector/Block Individual Protect	--
HOLD#		Yes	No	Yes
WP#		Yes	Yes	Yes

***Note:**

* MX25L6406E 1I/2O is Dual Output mode, means Single input - Dual output

** MX25L6405D & MX25L6406E protect area : 1/64, 1/32, 1/16, 1/8, 1/4, 1/2(Top) & 1/2, 3/4, 7/8, 15/16, 31/32, 63/64(Bottom) & All Arrays

*** MX25L6445E protect area : 1/64, 1/32, 1/16, 1/8, 1/4, 1/2(Top) & All Arrays or Individual Block (or Sector) Protection

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2-2: Performance Comparison

Table below is the comparison of new product and the former products.

Table 2: Performance Comparison

Performance		MX25L6405D	MX25L6445E	MX25L6406E
Clock High/Low Time	tCH	86MHz: 5.5ns 33MHz: 13ns	104MHz: 4.5ns 50MHz: 9ns	86MHz: 5.5ns 33MHz: 13ns
	tCL	86MHz: 5.5ns 33MHz: 13ns	104MHz: 4.5ns 50MHz: 9ns	86MHz: 5.5ns 33MHz: 13ns
Program Time	Byte	9us(typ.) ; 300us(max.)	9us(typ.) ; 300us(max.)	9us(typ.) ; 300us(max.)
	Page	1.4ms(typ.) ; 5ms(max.)	1.4ms(typ.) ; 5ms(max.)	1.4ms(typ.) ; 5ms(max.)
Erase Time	Sector	60ms(typ.)	60ms(typ.)	60ms(typ.)
	Block	64KB:0.7s(typ.); 2s(max.)	32KB:0.5s(typ.); 2s(max.) 64KB:0.7s(typ.); 2s(max.)	64KB:0.7s(typ.); 2s(max.)
	Chip	50s (typ.)	50s (typ.)	50s (typ.)
Active Setup Time	tSLCH	5ns(min.)	8ns(min.)	7ns(min.)
Not Active Setup Time	tSHCH	5ns(min.)	8ns(min.)	7ns(min.)
Active Hold Time	tCHSH	5ns(min.)	5ns(min.)	7ns(min.)
Not Active Hold Time	tCHSL	5ns(min.)	5ns(min.)	7ns(min.)
CS# Deselect Time	tSHSL	Read=40ns(min.) ; Write=40ns(min.)	Read=15ns(min.) ; Write=50ns(min.)	Read=15ns(min.) ; Write=40ns(min.)
CS# High to standby	tRES1	8.8 us(max.)	100 us(max.)	8.8 us(max.)
	tRES2	8.8 us(max.)	100 us(max.)	8.8 us(max.)
VCC Standby	ISB1	20uA(max.)	50uA(max.)	50uA(max.)
Deep Power Down	ISB2	20uA(max.)	20uA(max.)	20uA(max.)
Active Current	ICC1	25mA(max.) @86MHz 20mA(max.) @66MHz 10mA(max.) @33MHz	19mA(max.) @104MHz 15mA(max.) @66MHz 10mA(max.) @33MHz	25mA(max.) @86MHz 20mA(max.) @66MHz 10mA(max.) @33MHz
	ICC2	20mA	25mA	20mA
	ICC3	20mA	20mA	20mA
	ICC4	20mA	25mA	20mA
	ICC5	20mA	20mA	25mA

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3. Command Set Comparison

MX25L6406E is capable of new features and their command sets for Dual Output mode (1I/2O, Single Input / Dual Output).

MX25L6406E does not support x2 I/O (Dual Input / Dual Output), x4 I/O (Quad Input / Quad Output), DTRD (Double Transfer Rate Read) and CP (Continuous Program).

All commands of MX25L6405D for x2 I/O are not available, such as 2READ, and all commands of MX25L6445E for x2 I/O, x4 I/O and DTRD are not available, such as 2RDAD, 4READ, FASTDTRD, 2DTRD, 4DTRD, and 4PP.

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

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Table 3. Command Set Comparison

Command		MX25L6405D	MX25L6445E	MX25L6406E
Write	WREN	06h	06h	06h
	WRDI	04h	04h	04h
	WRSR	01h	01h	01h
Read	RDID	9Fh	9Fh	9Fh
	RDSR	05h	05h	05h
	READ	03h	03h	03h
	Fast Read	0Bh	0Bh	0Bh
	2READ	BB	BBh	--
	4READ	--	EBh	--
	FASTDTRD	--	0Dh	--
	2DTRD	--	BD	--
	4DTRD	--	EDh	--
	DREAD	--	--	3Bh
	RES	ABh	Abh	ABh
	REMS	90h	90h	90h
	REMS2	EFh	EFh	--
	REMS4	--	DFh	--
REMS4D	--	CFh	--	
Erase	SE	20h	20h	20h
	BE	D8h	D8h	52h or D8h
	BE32K	--	52h	--
	CE	60h or C7h	60h or C7h	60h or C7h
Program	4PP	--	38h	--
	PP	02h	02h	02h
	CP	ADh	ADh	--
Security	RDSCUR	2Bh	2Bh	2Bh
	WRSCUR	2Fh	2Fh	2Fh
	ENSO	B1h	B1h	B1h
	EXSO	C1h	C1h	C1h
SO output	ESRY	70h	70h	--
	DSRY	80h	80h	--
Deep Power Down	DP	B9h	B9h	B9h
	DRP	ABh	ABh	ABh
Parallel Mode	ENPLM	--	55h	--
	EXPLM	--	45h	--
Block Lock	SBLK	--	36h	--
	SBULK	--	39h	--
	GBLK	--	7Eh	--
	GBULK	--	98h	--
Clear SR	CLSR	--	30h	--
High Performance	HPM	--	A3h	--
Block Protect	RDBLOCK	--	3Ch	--

Migrating to MX25L6406E from MX25L6405D and MX25L6445E**4. Device ID Code Comparison of 64Mb Devices**

This table shows that Manufacturer and Device IDs have not been changed. The density (17) is defined by MXIC and also has not been changed.

Table 4: ID Code Comparison

Command Type	MX25L6405D			MX25L6445E			MX25L6406E		
RDID Command	M ID	Type	Density	M ID	Type	Density	M ID	Type	Density
	C2	20	17	C2	20	17	C2	20	17
RES Command	E ID			E ID			E ID		
	16			16			16		
REMS	M ID	Device ID		M ID	Device ID		M ID	Device ID	
	C2	16		C2	16		C2	16	

5. References

The following datasheets were used for preparing this comparison note:

Datasheet	Location	Date Issued	Versions
MX25L6405D	Macronix Website	Apr., 2009	1.5
MX25L6445E	Macronix Website	Jul., 2010	1.4
MX25L6406E	Macronix Website	Jul., 2010	1.0

For more functional and parametric specifications, please refer to the datasheet on the Macronix Website at <http://www.macronix.com/> and go to: Products/Flash Memory/Serial Flash.



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APPLICATION NOTE

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