

Comparing Atmel AT25DF_A with Macronix MX25L_06E

1. Introduction

This application note compares the Macronix MX25L_06E and Atmel AT25DF_A families of serial flash devices. The document does not provide detailed information on the individual devices, but highlights the similarities and differences between them. The comparison covers general features, performance, packaging, and commands.

The information in this document is based on datasheets listed in Section 8. Newer versions of the datasheets may override the contents of this document.

2. Feature Comparison

Both flash device families have similar features and functions as shown in Table 2-1.

Table 2-1: Features

Feature		Macronix MX25L_06E	Atmel AT25DF_A
Vcc Voltage Range		2.7V ~ 3.6V	2.7V ~ 3.6V
I/O Mode ^{*1*2}		1-1-1 1-1-2	1-1-1 1-1-2
Sector Erase Size		4KB / 64KB	4KB / 32KB / 64KB
Program Buffer Size		256 Byte	256 Byte
Security OTP		64 Byte ^{*3}	128 Byte ^{*3}
Hold# Pin		Yes	Yes
Block Protection		BP bit Group Protection	Individual 64KB Sector
Manufacturer ID		C2h	1Fh
Device ID	4Mb	20h/13h	44h/01h
	8Mb	20h/14h	45h/01h
	32Mb	20h/16h	47h/01h
	64Mb	20h/17h	48h/00h

Note:

1. x-y-z in I/O mode indicates the number of active pins used for opcode(x), address(y) and data(z).
2. AT25DF041A doesn't support multi I/O mode
3. MX25L4006E and AT25DF041A don't support Security OTP

Comparing Atmel AT25DF_A with Macronix MX25L_06E

3. Performance Comparison

Tables 3-1 and 3-2 compare the read and write performance of the MX25L_06E and AT25DF_A.

Table 3-1: Read Performance

Parameter		Macronix MX25L_06E	Atmel AT25DF_A
Normal Read (max.)	4Mb	33MHz	33MHz
	8Mb	33MHz	50MHz
	32Mb	33MHz	50MHz
	64Mb	33MHz	40MHz
Fast Read 1-1-1 Mode (max.)	4Mb	86MHz	70MHz
	8Mb	86MHz	85MHz
	32Mb	86MHz	85MHz
	64Mb	86MHz	85MHz
Fast Read 1-1-2 Mode (max.)	4Mb	80MHz	N/A
	8Mb	80MHz	85MHz
	32Mb	80MHz	85MHz
	64Mb	80MHz	65MHz
tCLQV / tv (max.) 15pF load	4Mb	6ns	6ns
	8Mb	6ns	5ns
	32Mb	6ns	5ns
	64Mb	8ns	5ns

Table 3-2: Write Performance

Parameter		Density	Macronix MX25L_06E	Atmel AT25DF_A
Erase (typ.)	4KB	4Mb – 32Mb	60ms	50ms
		64Mb	60ms	75ms
	32KB	4Mb – 32Mb	-	0.25s
		64Mb	-	0.3s
	64KB	4Mb – 32Mb	0.7s	0.4s
		64Mb	0.7s	0.6s
Chip Erase (typ.)		4Mb	3.5s	3s
		8Mb	7s	16s
		32Mb	25s	25s
		64Mb	50s	70s
Program (typ.)	Byte	4Mb – 32Mb	9us	7us
		64Mb	9us	30us
	Page	4Mb	1.4ms	1.2ms
		8Mb, 32Mb	1.4ms	1ms
		64Mb	1.4ms	2.5ms
		Write/Erase Cycles (Endurance)		100,000

Comparing Atmel AT25DF_A with Macronix MX25L_06E

4. DC Characteristics Comparison

Tables 4-1 and 4-2 show that both flash families have similar DC characteristics.

Table 4-1: Read / Write Current

Parameter	Density	Macronix MX25L_06E	Atmel AT25DF_A
Read Current @ 1xI/O (max.)	4Mb	12mA @ 86MHz	16mA @ 70MHz
	8Mb	12mA @ 86MHz	19mA @ 85MHz
	32Mb	25mA @ 86MHz	19mA @ 85MHz
	64Mb	25mA @ 86MHz	38mA @ 85MHz
Standby Current (max.)	4Mb	25uA	35uA
	8Mb	25uA	50uA
	32Mb	40uA	50uA
	64Mb	50uA	50uA
Write Current - Program/Erase (max.)	4Mb	20mA/15mA	18mA/20mA
	8Mb	20mA/15mA	15mA/18mA
	32Mb	20mA/20mA	16mA/18mA
	64Mb	20mA/20mA	18mA/18mA

Table 4-2: Input / Output Voltage

Parameter	Macronix MX25L_06E	Atmel AT25DF_A
Input Low Voltage	0.3VCC (max.)	0.3Vcc (max.)
Input High Voltage	0.7VCC (min.)	0.7Vcc (min.)
Output Low Voltage	0.4V (max.)	0.4V (max.)
Output High Voltage	VCC-0.2 (min.)	Vcc-0.2 (min.)

Comparing Atmel AT25DF_A with Macronix MX25L_06E

5. Hardware Considerations

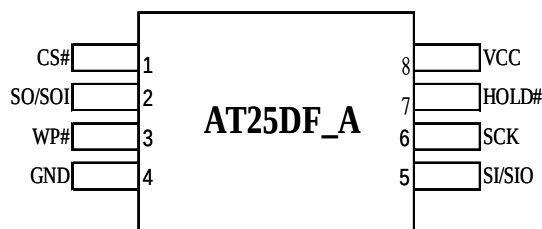
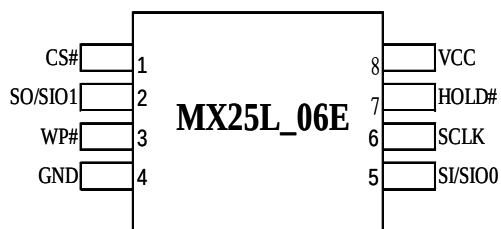
Both devices are available in 8-SOP and 8-WSO packages with identical footprints. The figures below show the common packages and the pinout assignments for the Macronix and Atmel devices.

Table 5-1: Packages

Package	Macronix MX25L_06E				Atmel AT25DF_A			
	4Mb	8Mb	32Mb	64Mb	4Mb	8Mb	32Mb	64Mb
8-SOP (150 mil)	Yes	Yes	-	-	Yes	Yes	-	-
8-SOP (209 mil)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
8-WSO (6mm x 5mm)	Yes	Yes	Yes	-	Yes	Yes	Yes	Yes

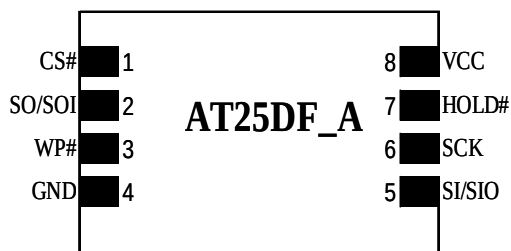
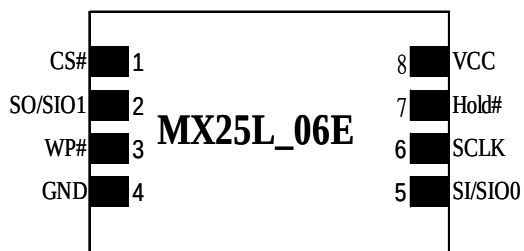
Note: Not all Macronix package options shown. Refer to Macronix datasheet for additional package options.

8-SOP (150mil & 209mil): Macronix and Atmel devices



AT25DF041A doesn't support 1I/2O mode

8-WSO (6x5mm) Macronix and Atmel devices



AT25DF041A doesn't support 1I/2O mode

Comparing Atmel AT25DF_A with Macronix MX25L_06E

6. Software Considerations

Basic command sets of both flash families are similar. Status Register and Security Register definitions may be slightly different, but the concepts are the same. Minor modifications to the algorithm may be necessary depending on application. See the Macronix datasheet for a complete list of commands, as additional features may be available but are not shown.

Table 6-1: Command Comparison

Instruction Type	Instruction	Description	Macronix MX25L_06E	Atmel AT25DF_A
Read ID	RDID	Read Identification	9Fh	9Fh
Read	READ	Read Data Bytes	03h	03h
	FAST_READ	Read Data Bytes at Higher Speed	0Bh	0Bh
	DREAD	1I/2O Read	3Bh	3Bh ^{*2}
Write	WREN	Write Enable	06h	06h
	WRDI	Write Disable	04h	04h
	PP	Page Program	02h	02h
	SE 4K	Sector Erase	20h	20h
	BE 32K	Block Erase 32KB	--	52h
	BE 64K	Block Erase 64KB	52h or D8h	D8h
	CE	Chip Erase	60h or C7h	60h or C7h
Register	RDSR	Read Status Register	05h	05h
	RDSR-2	Read Status Register 2	-	31h ^{*2}
	WRSR	Write Status Register	01h	01h
	RDSCUR	Read Security Register	2Bh ^{*1}	-
	WRSCUR	Write Security Register	2Fh ^{*1}	-
Other Command	DP	Deep Power Down	B9h	B9h
	RES	Release from Deep Power Down	ABh	ABh
	OTPP	Program OTP Memory	--	9Bh ^{*2}
	OTPR	Read OTP Memory	--	77h ^{*2}
	ENSO	Enter Secure OTP	B1h ^{*1}	--
	EXSO	Exit Secure OTP	C1h ^{*1}	--
	RST	Reset Memory	--	F0h ^{*2}

Note:

1. MX25L4006E doesn't support command.
2. AT25DF041A doesn't support command.

Comparing Atmel AT25DF_A with Macronix MX25L_06E

6-2. Status Register and Security Register

Both devices use registers for providing status and setting device configuration, but there are some differences that designers need to be aware of as modifications to software may be needed. Register comparisons are shown in Table 6-2 and Table 6-3. If a detailed functional description of register bits is required, please refer to the datasheets listed in section 8.

Table 6-2: Status Register

Register Bit	Macronix MX25L_06E	Atmel AT25DF_A
Bit0	WIP, 1=write operation	RDY/BSY, 1=write operation
Bit1	WEL, 1=write enable	WEL, 1=write enable
Bit2	BP0, BP protection	Software Protection Status
Bit3	BP1, BP protection	Software Protection Status
Bit4	BP2, BP protection	WPP, 0=WP# asserted
Bit5	BP3, BP protection ^{*1}	EPE, 1=Erase or program error
Bit6	Reserved	SPM, 0=Byte/Page Program mode ^{*2}
Bit7	SRWD, 1=SR write disable	SPRL, 1=SR Protection Locked

Note:

1. MX25L4006E/8006E Bit5 is Reserved for future use and = 0.
2. AT25DF081A/321A/641A Bit6 is Reserved for future use and = 0.

Table 6-3: Macronix Security Register / Atmel Status Register Byte 2

Register Bit	Macronix MX25L_06E	Atmel AT25DF_A
Bit0	Secured OTP; 1=Factory Lock	RDY/BSY, 1=Write operation
Bit1	LDSO; 1=OTP Lock Down	ES, 1=Sector Erase suspended ^{*1}
Bit2	Reserved	PS, 1=Sector Program suspended ^{*1}
Bit3	Reserved	SLE, 1=Sector Lockdown & Lockdown State commands enabled
Bit4	Reserved	RSTE, 1=Reset command enabled
Bit5	Reserved	Reserved
Bit6	Reserved	Reserved
Bit7	Reserved	Reserved

Note:

1. AT25DF081A bits 1 and 2 are Reserved for future use and = 0.

Comparing Atmel AT25DF_A with Macronix MX25L_06E

6-3. Manufacturer ID and Device ID

Manufacturer IDs are different. This permits software to identify the device manufacturer. The Device IDs are different between both families. The same command is used to read the different IDs.

Table 6-4: Manufacturer and Device ID

Command Type		Macronix MX25L_35E	Atmel AT25DF_A
RDID 9Fh	4Mb	C2h/20h/13h	1Fh/44h/01h
	8Mb	C2h/20h/14h	1Fh/45h/01h
	32Mb	C2h/20h/16h	1Fh/47h/01h
	64Mb	C2h/20h/17h	1Fh/48h/00h

7. Summary

The Macronix MX25L_06E and Atmel AT25DF_A have similar commands, functions, and features. Additionally, the supported package types have identical footprints and nearly identical pinout definitions. A more detailed analysis should be done if any of the “special” functions not supported by the Macronix flash are used, such as the Atmel 32KB erase size, or the Individual Block Protection. Commands to access and program the OTP area are different as well. If common features are used in standard traditional modes, the comparing may need only minimal software modification.

8. References

Table 8-1 shows the datasheet versions used for comparison in this application note. For the most current, detailed specification, please refer to the Macronix Website at <http://www.macronix.com>

Table 8-1: Datasheet Version

Datasheet	Location	Data Issued	Version
MX25L4006E	Website	FEB. 10, 2012	Rev. 1.3
MX25L8006E	Website	FEB. 10, 2012	Rev. 1.2
MX25L3206E	Website	FEB. 23, 2012	Rev. 1.4
MX25L6406E	Website	JUN. 13, 2012	Rev. 1.5
AT25DF041A	Website	09/2008	Rev. 3668D
AT25DF081A	Website	08/2010	Rev. 8715B
AT25DF321A	Website	12/2009	Rev. 3686D
AT25DF641A	Website	05/2012	Rev. 8693B

Comparing Atmel AT25DF_A with Macronix MX25L_06E

9. Appendix

Table 9-1 shows the basic part number and package information cross reference between Macronix MX25L_06E and Atmel AT25DF_A parts.

Table 9-1: Part Number Cross Reference

Density	Macronix Part No.	Atmel Part No.	Package	Dimension
4Mb	MX25L4006EM1I-12G	AT25DF041A-SSH-B/T	8-SOP	150 mil
	MX25L4006EM2I-12G	AT25DF041A-SH-B/T	8-SOP	209 mil
	MX25L4006EZNI-12G	AT25DF041A-MH-Y/T	8-WSON	6x5mm
8Mb	MX25L8006EM1I-12G	AT25DF081A-SSH-B/T	8-SOP	150 mil
	MX25L8006EM2I-12G	AT25DF081A-SH-B/T	8-SOP	209 mil
	MX25L8006EZNI-12G	AT25DF081A-MH-Y/T	8-WSON	6x5mm
32Mb	MX25L3206EM2I-12G	AT25DF321A-SH-B/T	8-SOP	209 mil
	MX25L3206EZNI-12G	AT25DF321A-MH-Y/T	8-WSON	6x5mm
64Mb	MX25L6406EM2I-12G	AT25DF641A-SH-B/T	8-SOP	209 mil

10. Revision History

Revision	Description	Date
1.0	Initial Release	MAR. 19, 2013



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APPLICATION NOTE

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