Comparing Spansion® S29AL016J with Macronix MX29LV160D

1. Introduction

Macronix MX29LV160D and Spansion® S29AL016J 16Mb 3.0V parallel flash have similar features, performance, and command codes. This application note explains how to simply and easily compare the Spansion® device with the equivalent Macronix MX29LV160D flash.

The information in this document is based on datasheets listed in Section 10.
Newer versions of the datasheets may override the contents of this document.

2. General Features

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

Table 2-1: Features

Type / Function	MX29LV160D	S29AL016J
VCC Voltage Range	2.7V ~ 3.6V	2.7V ~ 3.6V
Access Time	70ns	55ns[*1]/70ns
Bus Width	X8 / x16	X8 / x16
Boot Block	Top/Bottom	Top/Bottom
Sector Architecture	16KB+ 2*8KB+32KB + 31*64KB sectors.	16KB+ 2*8KB+32KB + 31*64KB sectors.
OTP Security Region	-	256Byte
CFI Compliant	Yes	Yes
Sector Protect/Unprotect	Yes	Yes
Temp Sector Protect/Unprotect	Yes	Yes
Erase Suspend/Resume	Yes	Yes
Hardware Reset# Pin	Yes	Yes
WP# Pin	Yes	Yes
Manufacture ID	C2h	01h
Device ID Top/Bottom	22C4h/2249h	22C4h/2249h

Note: Restricted Vcc Voltage Range, Vcc = 3.0V ~ 3.6V.

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3. Package and Pinout

Current package offerings are shown in Table 3-1.

Table 3-1: Package Options

Package	MX29LV160D	S29AL016J
48-TSOP (12x20mm) Normal	Yes	Yes
48-CSP TFBGA(6x8x1.2mm) 0.3mm ball	Yes	-
48-TFBGA (6x8x1.2mm) 0.4mm ball	Yes[1]	Yes[1]
48-LFBGA (6x8x1.3mm) 0.4mm ball	Yes[1]	Yes[1]
48-XFLGA (4 x 6 x 0.5mm) 0.3mm ball	Yes	-
48-WFBGA (4 x 6 x 0.75mm) 0.3mm ball	Yes	-
64-LFBGA (9x9mm) 0.6mm ball	-	Yes

Notes: 1. Spansion Package body thickness = 0.75mm while Macronix TFBGA= 1.2mm and LFBGA=1.3mm.

The Macronix and Spansion® families have virtually identical footprints and pinouts. The 48-TSOP and 48-LFBGA packages are shown below for comparison. Macronix offers an accelerated programming option on pin 14 of the 48TSOP (pin B3 of the LFBGA) shared with the WP# pin. No modifications are necessary to accommodate this extra feature.

Figure 3-1: 48-TSOP (12x20mm) Package Pin-out Comparison
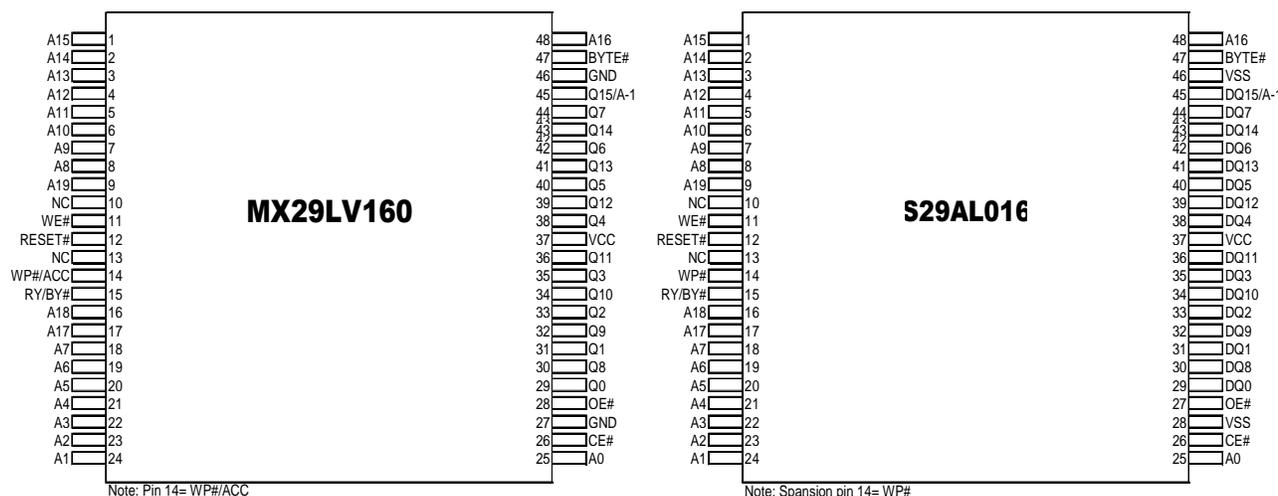
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Figure 3-2: 48-LFBGA (6x8mm) Package Pin-out Comparison

MX29LV160

Note: Pin B3= WP#/ACC

S29AL016

Note: Spansion pin B3= WP#
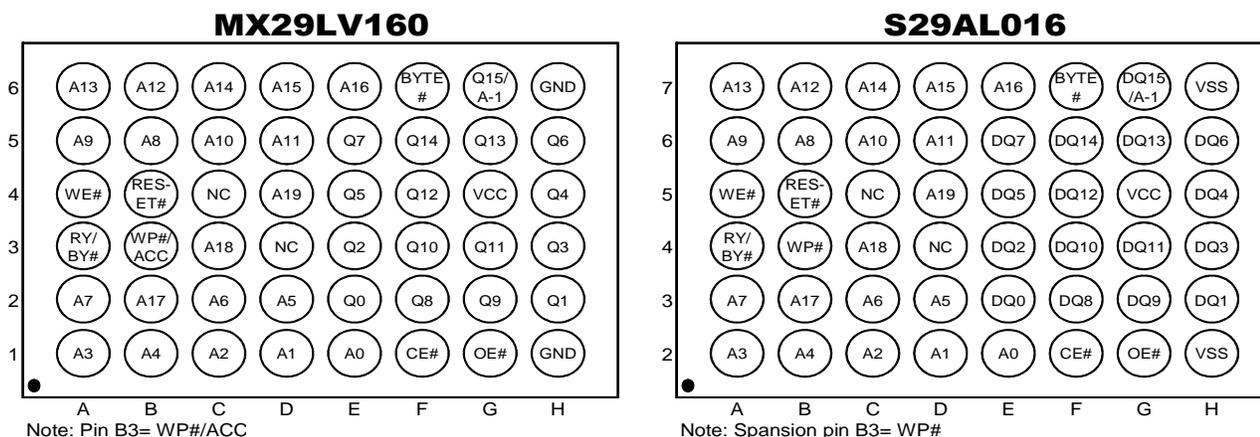
4. Command Set and Firmware

Basic commands and write status checking methods are the same. The Read operation and Write command could be used directly without any modification. Table 4-1 shows the command set in Word mode.

Table 4-1: Basic Commands (Word Mode)

Command		Read	Reset	Program	Chip Erase	Sector Erase	Program/Erase Suspend	Program/Erase Resume
1st Bus	Addr	Addr	XXX	555h	555h	555h	XXX	XXX
Cycle	Data	Data	F0h	AAh	AAh	AAh	B0h	30h
2nd Bus	Addr			2AAh	2AAh	2AAh		
Cycle	Data			55h	55h	55h		
3rd Bus	Addr			555h	555h	555h		
Cycle	Data			A0h	80h	80h		
4th Bus	Addr			Addr	555h	555h		
Cycle	Data			Data	AAh	AAh		
5th Bus	Addr				2AAh	2AAh		
Cycle	Data				55h	55h		
6th Bus	Addr				555h	SA		
Cycle	Data				10h	30h		

Note: SA: Sector Address

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5. Electrical Characteristics

Both device families have similar power requirements during Program and Erase.

Table 5-1: Read / Write Current

DC Characteristic	Condition	MX29LV160D	S29AL016J
Read Current	typ @ 5MHz	5mA	7mA
	max @ 5MHz	12mA	12mA
Standby Current	typ	5uA	0.2uA
	max	15uA	5uA
Write Current	typ	15mA	20mA
	max	30mA	30mA

Table 5-2 shows that both devices have similar input sink and output drive characteristics. Macronix supports a high voltage Accelerated Programming option (typically done off-line).

Table 5-2: Input / Output Voltage

DC Characteristic	Condition	MX29LV160D	S29AL016J
Input Low Voltage	min	-0.5V	-0.1V
	max	0.8V	0.8V
Input High Voltage	min	0.7VCC	0.7VCC
	max	VCC+0.3V	VCC+0.3V
Output Low Voltage	max	0.45V	0.45V
Output High Voltage	min	0.85VCC	0.85VCC
ACC Program Acceleration Voltage		9.5V ~ 10.5V	-

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6. Erase and Programming Performance

Table 6-1 and 6-2 show MX29LV160D and S29AL016J series have similar Read/Write performance.

Table 6-1: AC Characteristics

Symbol	Description		MX29LV160D	S29AL016J
Taa	Random Read Access Time	VCC =3.0-3.6V	-	55ns
		VCC= 2.7-3.6V	70ns	70ns
Tce	Valid data output after CE# low	VCC =3.0-3.6V	-	55ns
		VCC= 2.7-3.6V	70ns	70ns
Tcp	Chip Enable Pulse Width	VCC =2.7-3.6V	35ns	35ns

Note: Values provided in Table 6-1 are "maximum" values.

Table 6-2: Write Function Performance (Program and Erase)

Write Function	MX29LV160D	S29AL016J
Byte Program Time	9us	6us
Word Program Time	11us	6us
Accelerated Byte/Word Programming Time	7us	-
Chip Program Time Byte Mode	18s	21.6s
Chip Program Time Word Mode	12s	6.3s
Sector Erase time	0.7s	0.5s
Chip Erase time	15s	16s

Note: Values provided in Table 6-2 are "typical" values.

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7. Memory Organization

The memory and sector architecture of the MX29LV160D is identical to the S29AL016J, as seen in Features Table 2-1.

8. Manufacturer ID & Device ID Command

Manufacturer IDs are different and permits software to identify the device manufacturer, but Device IDs are the same. The same command set is used read the different Manufacturer IDs.

Table 8-1: Manufacturer and Device ID Command Definitions (Word Mode)

Flash Vender		Manufacturer ID		Device ID	
		MX29LV160D	S29AL016J	MX29LV160D	S29AL016J
1st Bus Cycle (command)	Address	555h	555h	555h	555h
	Data	AAh	AAh	AAh	AAh
2nd Bus Cycle (command)	Address	2AAh	2AAh	2AAh	2AAh
	Data	55h	55h	55h	55h
3rd Bus Cycle (command)	Address	555h	555h	555h	555h
	Data	90h	90h	90h	90h
4th Bus Cycle (ID output)	Address	X00h	X00h	X01h	X01h
	Data	C2h	01h	22C4h/2249h	22C4h/2249h

Note.
(1) Device ID can be read out after Manufacturer ID with proper address and does not need another command sequence.
(2) Use Reset command (F0h) to return to normal read mode.

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9. Part Number Cross-Reference

Cross Reference Table 9-1 shows basic part number and package information for the Macronix MX29LV160D and Spansion products.

Table 9-1: Part Number Cross Reference

Density	Macronix Part[1]	Spansion® Part	Package	Dimension
16Mb	MX29LV160DTXGI-70G[1]	S29AL016J70BFI01	48-LFBGA[1]	6x8x1.2mm 0.4mm ball
	MX29LV160DBXGI-70G[1]	S29AL016J70BFI02		
	MX29LV160DTXGI-70G[1]	S29AL016J70BFI03		
	MX29LV160DBXGI-70G[1]	S29AL016J70BFI04		
	MX29LV160DTXGI-55Q[1]	S29AL016J55BFIR1		
	MX29LV160DBXGI-55Q[1]	S29AL016J55BFIR2		
	MX29LV160DTXEI-70G[1]	S29AL016J70BFI01	48-LFBGA[1]	6x8x1.3mm 0.4mm ball
	MX29LV160DBXEI-70G[1]	S29AL016J70BFI02		
	MX29LV160DTXEI-70G[1]	S29AL016J70BFI03		
	MX29LV160DBXEI-70G[1]	S29AL016J70BFI04		
	MX29LV160DTXEI-55Q[1]	S29AL016J55BFIR1		
	MX29LV160DBXEI-55Q[1]	S29AL016J55BFIR2		
	MX29LV160DTTI-70G	S29AL016J70TFI01	48-TSOP	12x20mm
	MX29LV160DBTI-70G	S29AL016J70TFI02		
	MX29LV160DTTI-70G	S29AL016J70TFI03		
	MX29LV160DBTI-70G	S29AL016J70TFI04		
	MX29LV160DTTI-55Q	S29AL016J55TFIR1		
	MX29LV160DBTI-55Q	S29AL016J55TFIR2		

Notes: 1. Spansion Package body thickness = 0.75mm while Macronix TFBGA= 1.2mm and LFBGA=1.3mm.

10. Reference Documents

Table 10-1 shows the datasheet versions used for comparison in this application note. For the most current, detailed Macronix specification, please refer to the Macronix Website at http://www.macronix.com

Table 10-1: Datasheet Version

Data sheet	Location	Date Issue	Revision
MX29LV160D	Website	Dec. 22, 2011	Rev. 1.2
S29AL016J_00	Website	Apr. 12, 2012	Rev. 12

11. Summary

Macronix MX29LV160D and Spansion S29AL016J 16Mb 3.0V parallel Flash occupy the same PCB footprint and have similar commands, functions, and features. Macronix does not support a Secured Silicon Sector.

12. Revision History

Table 12-1: Revision History

Revision No.	Description	Page	Date
REV. 1	Initial Release	ALL	Jan. 15, 2013

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For the contact and order information, please visit Macronix's Web site at: http://www.macronix.com