

## Comparing Spansion® S34ML04G100 with Macronix MX30LF4G28AB

### 1. Introduction

This application note is a guide for migrating to the Macronix MX30LF4G28AB from the Spansion® S34ML04G100 4Gb, 3V, NAND flash memory.

The document does not provide detailed information on the individual devices, but highlights the similarities and differences between them. The comparison covers the general features, performance, command codes and other differences.

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. Features

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

**Table 2-1: Feature Comparison**

Feature	Macronix MX30LF4G28AB	Spansion S34ML04G100
Vcc Voltage Range	2.7V ~ 3.6V	2.7V ~ 3.6V
Bus Width	x8	x8
Operating Temperature	-40°C ~ 85°C	-40°C ~ 85°C
Interface	ONFI 1.0 Standard	ONFI 1.0 Standard
Block Size	128KB+7KB	128KB+4KB
Page Size	2KB+112B	2KB+64B
ECC Requirement	8b/540B	1b/528B
OTP size	30 pages	64 pages
Guaranteed Good blocks at shipping	Block 0	Block 0 & 1
Unique ID	ONFI standard	ONFI standard
ID Code	C2h/DCh/90h/95h/57h	01h/DCh/90h/95h/54h
ONFI signature	4Fh/4Eh/46h/49h	4Fh/4Eh/46h/49h
Data Retention	10 Years	10 Years
Package	48-TSOP (12x20mm) 63-VFBGA (9x11mm)	48-TSOP (12x20mm) 63-VFBGA (9x11mm)

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### 3. Performance

Table 3-1 and Table 3-2 show MX30LF4G28AB and S34ML04G100 Read/Write performance.

**Table 3-1: Read Function Performance (Read Latency time and Sequential Read)**

Read function	Macronix MX30LF4G28AB	Spansion S34ML04G100
Read Latency time (tR)	25us (max.)	25us (max.)
Sequential Read time (tRC)	20ns (min.)	25ns (min.)

**Table 3-2: Write Function Performance (Program and Erase)**

Write Function	Macronix MX30LF4G28AB	Spansion S34ML04G100
Page Program time (tPROG)	300us (typ.)/600us (max.)	300us (typ.)/700us (max.)
Block Erase time (tERASE)	1ms (typ.)/3.5ms (max.)	3.5ms (typ.)/10ms (max.)
NOP	4 (max.)	4 (max.)
Write/Erase Cycles* <sup>1</sup> (Endurance)	100,000	100,000

*Note: 100K Endurance cycle with ECC protection.*

### 4. DC Characteristics

Read/Write power requirements (Table 4-1) and I/O voltage limits (Table 4-2) are similar.

**Table 4-1: Read / Write Current**

DC Characteristic	Macronix MX30LF4G28AB	Spansion S34ML04G100
Sequential Read Current (ICC1)	20mA (typ.)/30mA (max.)	15mA (typ.)/30mA (max.)
Program Current (ICC2)	20mA (typ.)/30mA (max.)	15mA (typ.)/30mA (max.)
Erase Current (ICC3)	15mA (typ.)/30mA (max.)	15mA (typ.)/30mA (max.)
Standby Current – CMOS	10uA (typ.)/50uA (max.)	10uA (typ.)/50uA (max.)

**Table 4-2: Input / Output Voltage**

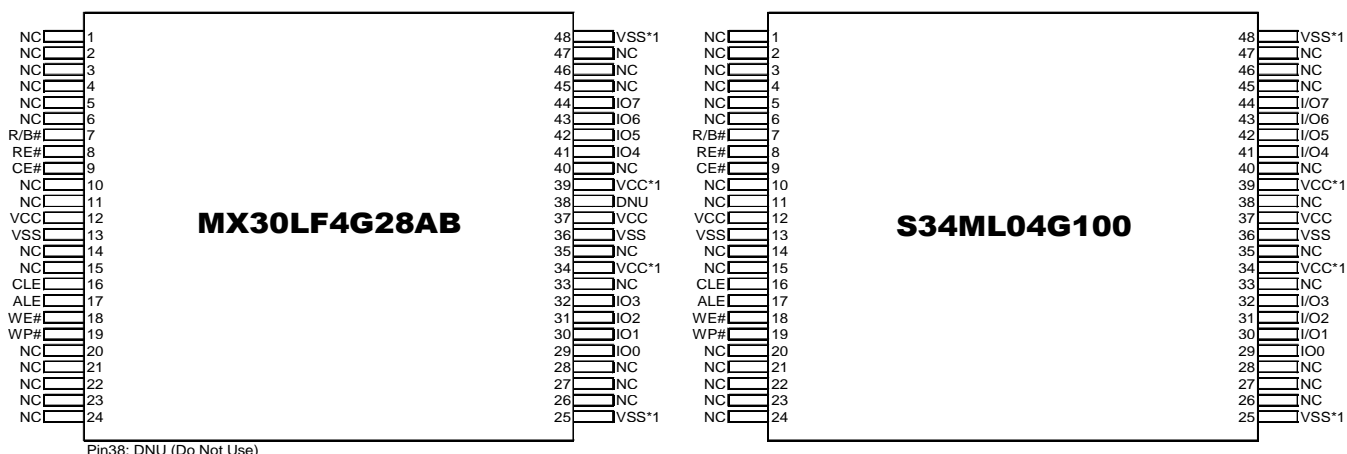
DC Characteristic	Macronix MX30LF4G28AB	Spansion S34ML04G100
Input Low Voltage (VIL)	-0.3V (min.) / 0.2VCC (max.)	-0.3V (min.) / 0.2Vcc (max.)
Input High Voltage (VIH)	0.8VCC (min.) / VCC+0.3V (max.)	0.8Vcc (min.) / Vcc+0.3V (max.)
Output Low Voltage (VOL)	0.2V (max.)	0.4V (max.)
Output High Voltage (VOH)	VCC-0.2V (min.)	2.4V (min.)

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### 5. Package Pins

Package physical dimensions are similar to each other. For detailed information, please refer to the individual datasheets. Tables 5-1 and 5-2 show differences in pin assignments between the Macronix and Spansion devices. S34ML04G100 can be compared by the MX30LF4G28AB without pin conflicts. Only 48-TSOP pin 38 and 63-VFBGA pin G5 may need special attention because the pins are designated “DNU” (Do Not Use) on the MX30LF4G28AB. A DNU pin should not be connected to any signal or power trace on the board.

**Figure 5-1: 48-TSOP (12x20mm) Package and Pin Layout Comparison**



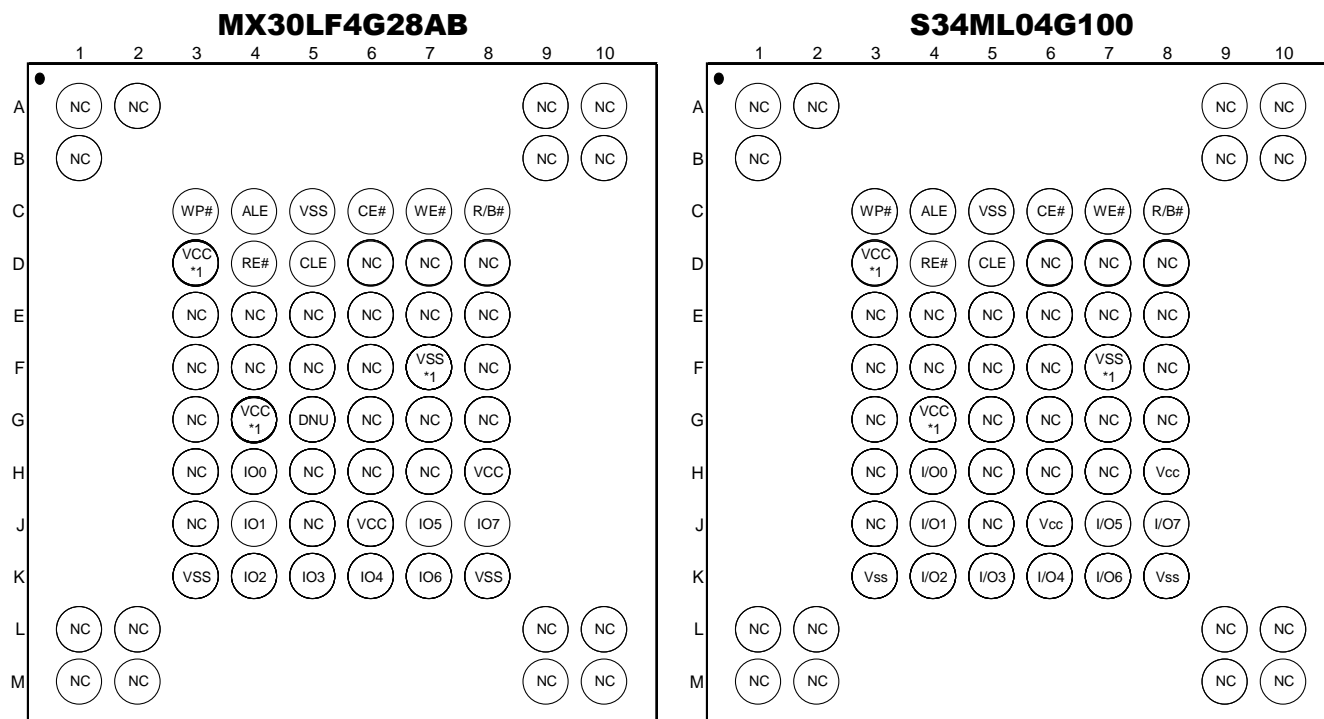
Note:  
1. These pins might not be connected internally. However it is recommended to connect these pins to power(or ground) as designated for ONFI compatibility.

**Table 5-1: 48-TSOP Package Pin Differences**

Brand	Macronix	Spansion
Part Name	MX30LF4G28AB-TI	S34ML04G100TFI00
<i>pin 38</i>	<i>DNU</i>	<i>NC</i>

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Figure 5-2: 63-VFBGA (9x11mm) Package and Pin Layout Comparison



Note:

1. These pins might not be connected internally. However it is recommended to connect these pins to power(or ground) as designated for ONFI compatibility.

Table 5-2: 63-VFBGA Package Pin Differences

Brand	Macronix	Spansion
Part Name	MX30LF4G28AB-XKI	S34ML04G100
<i>pin G5</i>	<i>DNU</i>	<i>NC</i>

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**6. Command Set**

Basic command sets and status checking methods are the same (Table 6-1). Basic Two-Plane commands are also the same (Table 6-2).

**Table 6-1: Command Table**

Command	Macronix MX30LF4G28AB		Spansion S34ML04G100	
	1st Cycle	2nd Cycle	1st Cycle	2nd Cycle
Read	00h	30h	00h	30h
Random Data Input	85h	-	85h	-
Random Data Output	05h	E0h	05h	E0h
Cache Read Random	00h	31h	00h	31h
Cache Read Sequential	31h	-	31h	-
Cache Read End	3Fh	-	3Fh	-
Read ID	90h	-	90h	-
Reset	FFh	-	FFh	-
Page Program	80h	10h	80h	10h
Cache Program	80h	15h	80h	15h
Block Erase	60h	D0h	60h	D0h
Read Status	70h	-	70h	-
Read Status Enhanced	78h		78h	
Read Parameter Page	ECh	-	ECh	-
Read Unique ID	EDh		-	
Set Feature	EFh		-	
Get Feature	EEh		-	

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**Table 6-2: Two-Plane Command Table**

Command	Macronix MX30LF4G28AB				Spansion S34ML04G100			
	1st Cycle	2nd Cycle	3rd Cycle	4th Cycle	1st Cycle	2nd Cycle	3rd Cycle	4th Cycle
2 Plane Program	80h	11h	80h	10h	80h	11h	80h	10h
2 Plane Cache Program	80h	11h	80h	15h	80h	11h	80h	15h
2 Plane Block Erase	60h	D1h	60h	D0h	60h	D1h	60h	D0h

**6-1 Status Register**

When a flash Read/Program/Erase operation is in progress, either the “Ready/Busy# Pin Checking” or “Status Output Checking” method may be used to monitor the operation. Both are standard NAND flash algorithms and can be used for both device families. Table 6-3 shows that Status Output content provided by the Read Status command (70h) is compatible.

**Table 6-3: Status Output**

Status Output	Macronix MX30LF4G28AB	Spansion S34ML04G100
SR[0]	PGM/ERS status: Pass/Fail	PGM/ERS status: Pass/Fail
SR[1]	Cache Program status: Pass/Fail	Cache Program status: Pass/Fail
SR[2]	Not Used	Not Used
SR[3]	Not Used	Not Used
SR[4]	Not Used	Not Used
SR[5]	PGM/ERS/Read internal controller: Ready/Busy	PGM/ERS/Read internal controller: Ready/Busy
SR[6]	PGM/ERS/Read status: Ready/Busy	PGM/ERS/Read status: Ready/Busy
SR[7]	Write Protect	Write Protect

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### 7. Device Identification

The 5-byte device identification codes of the S34ML04G100 and the MX30LF4G28AB are identical with the exception of the first and last byte of the ID which contain the manufacturer ID and the ECC requirement (Table 7-1). Please note that although the Spansion and Macronix devices have the same code of “1” for the Spare Area Size (4th Byte, Bit 2), the S34ML04G100 Spare Area Size is 16 Bytes per 512 Bytes (64 Bytes per page), whereas the MX30LF4G28AB Spare Area Size is 28 bytes per 512 bytes (112 Bytes per page). Firmware that uses a non-ONFI detection method may need to be modified to recognize the larger spare area of the Macronix device.

**Table 7-1: Manufacturer and Device IDs**

ID Code		Macronix MX30LF4G28AB	Spansion S34ML04G100
Value		C2h/DCh/90h/95h/57h	01h/DCh/90h/95h/54h
1 <sup>st</sup> Byte		Manufacturer Code	Manufacturer Code
2 <sup>nd</sup> Byte		Device Identifier	Device Identifier
3 <sup>rd</sup> Byte	bit 1 - 0	Number of Die per Chip Enable	Number of Die per Chip Enable
	bit 3 - 2	Cell Structure	Cell Structure
	bit 5 - 4	Number of Simultaneously Programmed Pages	Number of Simultaneously Programmed Pages
	bit 6	Interleaved Programming Between Multiple Chips	Interleaved Programming Between Multiple Chips
	bit 7	Cache Program	Cache Program
4 <sup>th</sup> Byte	bit 1 - 0	Page Size (excluding Spare Area)	Page Size (excluding Spare Area)
	bit 2	Spare Area Size (per 512 Bytes)	Spare Area Size (per 512 Bytes)
	bit 7, 3	Sequential Read Cycle Time (tRC)	Serial Access Time (tRC)
	bit 5 - 4	Block Size (excluding Spare Area)	Block Size (excluding Spare Area)
	bit 6	Organization	Organization
5 <sup>th</sup> Byte	bit 1 - 0	ECC Level Requirement	Reserved
	bit 3 - 2	Number of Planes per Chip Enable	Number of Planes per Chip Enable
	bit 6 - 4	Plane Size	Plane Size
	bit 7	Reserved	Reserved

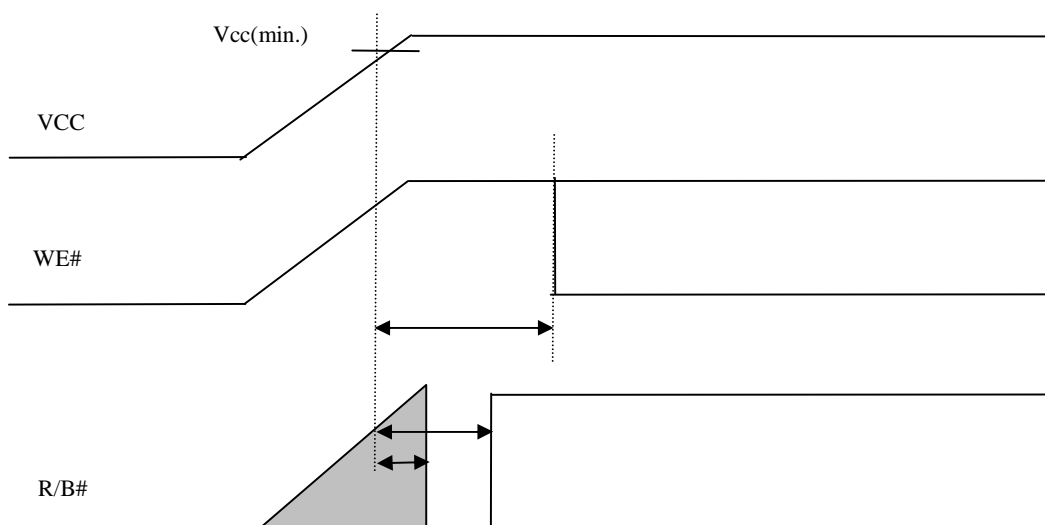
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### 8. Power-Up Timing

Macronix and Spansion® Power-up sequences are similar, but the timing is slightly different. Although both devices use 2.7V (VCC min.) as the start point to activate the internal initialization sequence, timing parameters used to identify the end of the sequence are different. Check the system timing to determine if adjustments are needed.

**Table 8-1: Power-Up Timing**

H/W Timing Characteristic	Macronix MX30LF4G28AB	Spansion S34ML04G100
Vcc (min.) to WE# low	1ms (max.)	N/A
Vcc (min.) to R/B# high	N/A	5ms (max.)
Vcc (min.) to R/B# low	10us (max.)	100us (max.)



**Figure 8-1: Power-Up Timing**



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## 9. Summary

Macronix MX30LF4G28AB and Spansion® S34ML04G100 NAND have similar features and pinouts. Basic Read/Program/Erase commands are the same. Overall, device migration may require minimal or no firmware modifications, except those that may be needed to accommodate differences in spare area size and ECC requirements.

## 10. References

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**

Datasheet	Location	Date Issued	Revision
MX30LF4G28AB	Website	Jun. 3, 2014	Rev. 1.1
S34ML01G1_04G1	-	Aug. 9, 2013	Rev. 16

*Note:* Macronix datasheet is subject to change without notice.

## 11. Part Number Cross-Reference

**Table 11-1: Part Number Cross Reference**

Density	Macronix Part No.	Spansion Part No.	Package	Dimension
4Gb	MX30LF4G28AB-TI	S34ML04G100TFI00	48-TSOP	12x20mm
	MX30LF4G28AB-XKI	S34ML04G100BHI00	63-VFBGA	9x11x1.0mm

## 12. Revision History

**Table 12-1: Revision History**

Revision	Description	Date
1.0	Initial Release	Dec. 26, 2013
2.0	Table 3-1 values revised to match Macronix Rev 1.1 datasheet. Added text in Section 7 to highlight that firmware changes may be needed to properly recognize the Macronix Spare Area Size.	Jun. 10, 2014



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## APPLICATION NOTE

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### Comparing Spansion<sup>®</sup> S34ML04G100 with Macronix MX30LF4G28AB

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