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**Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q  
24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays**

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**1. Introduction**

Macronix offers MX25L\_E/F high performance serial flash in densities ranging from 32Mb to 512Mb. Macronix MX25L\_E/F, Spansion S25FL\_S and Micron N25Q devices have similar 24-BGA packages, but they have different ball arrays. This application note explains how to use a dual layout for 24-BGA packages that have different ball arrays.

The information in this document is based on datasheets listed in Section 5. For functional descriptions, please refer to each vendor's latest datasheet. Newer versions of the datasheets may override the contents of this document.

## Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays

### 2. Hardware Consideration

The Macronix 24-BGA has a similar ball footprint with the Spansion and Micron devices. However, some hardware differences may require a minor PCB adjustment to create a “dual layout” which will accommodate both devices.

#### 2-1. 24-BGA Pin definition (4x6 ball array / 5x5 ball array)

Hardware pins are similar, but some balls have minor function differences.

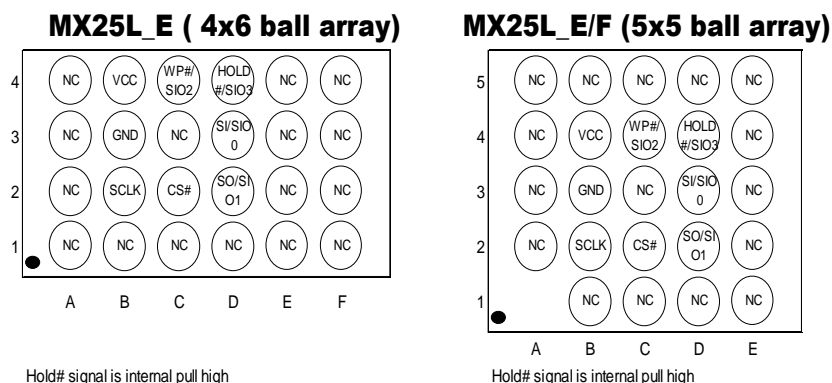
**Table 2-1: 24-BGA (6x4 Ball Array) Ball Assignment Differences**

4x6 ball array Ball No.	Macronix MX25L_E/F	Spansion S25FL_S	Note
A4	NC	RESET#/RFU	-
D4	HOLD#/SIO3	HOLD#/IO3	NC/SIO3: MX25L6435E/6455E/12855E
E4	NC	VIO/RFU	RESET#: MX25L25655E

**Table 2-2: 24-BGA (5x5 Ball Array) Ball Assignment Differences**

5x5 ball array Ball No.	Macronix MX25L_E/F	Spansion S25FL_S	Micron N25Q	Note
A4	NC	RESET#/RFU	NC	RESET#: MX66L51235F, N25Q256/512A
D4	HOLD#/SIO3	HOLD#/IO3	HOLD#/DQ3	NC/SIO3: MX66L51235F <sup>*1</sup> HOLD#/RESET#/DQ3: N25Q256/512A
E4	NC	VIO/RFU	NC	-

Note:1: MX66L51235F is a 2 die solution and is a member of the MX25L\_35F family. MX25L\_35F refers to all family members.

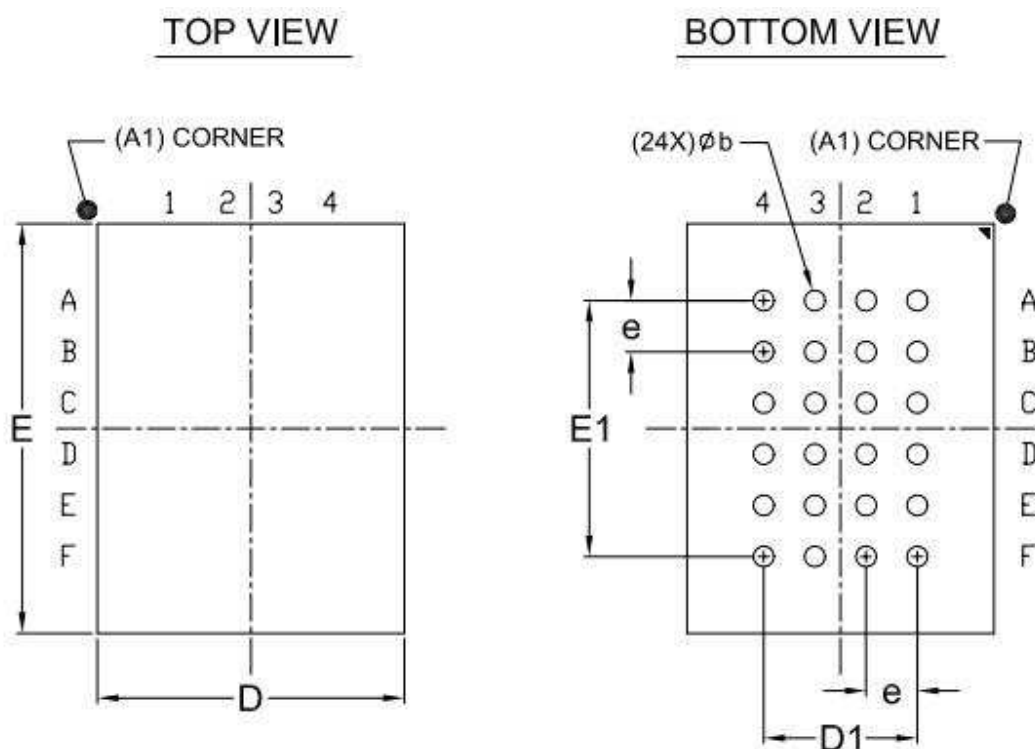


**Figure 2-1: 24-BGA Pin Definition**

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**2-2. 24-BGA Package dimension (4x6 ball array)**

Generally, package dimensions (symbol D & E) are the same. Ball dimension and ball pitch are also the same (symbol b, e, D1, E1). Table 2-3 shows all package dimensions.



**Table 2-3: 24-BGA (4x6 ball array) Package Dimensions**

Dimension Symbol	Macronix MX25L_E/F			Spansion S25FL_S		
	Min.	Nom.	Max.	Min.	Nom.	Max.
D	5.90	6.00	6.10	-	6.00	-
D1	-	3.00	-	-	3.00	-
E	7.90	8.00	8.10	-	8.00	-
E1	-	5.00	-	-	5.00	-
b	0.35	0.40	0.45	0.35	0.40	0.45
e	-	1.00	-	-	1.00	-

Unit: mm

## Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays

### 2-3. 24-BGA Package dimension (5x5 ball array)

Package dimensions (symbol D & E), ball dimension and ball pitch are the same (symbol b, e, D1, E1).

Table 2-4 shows all package dimensions.

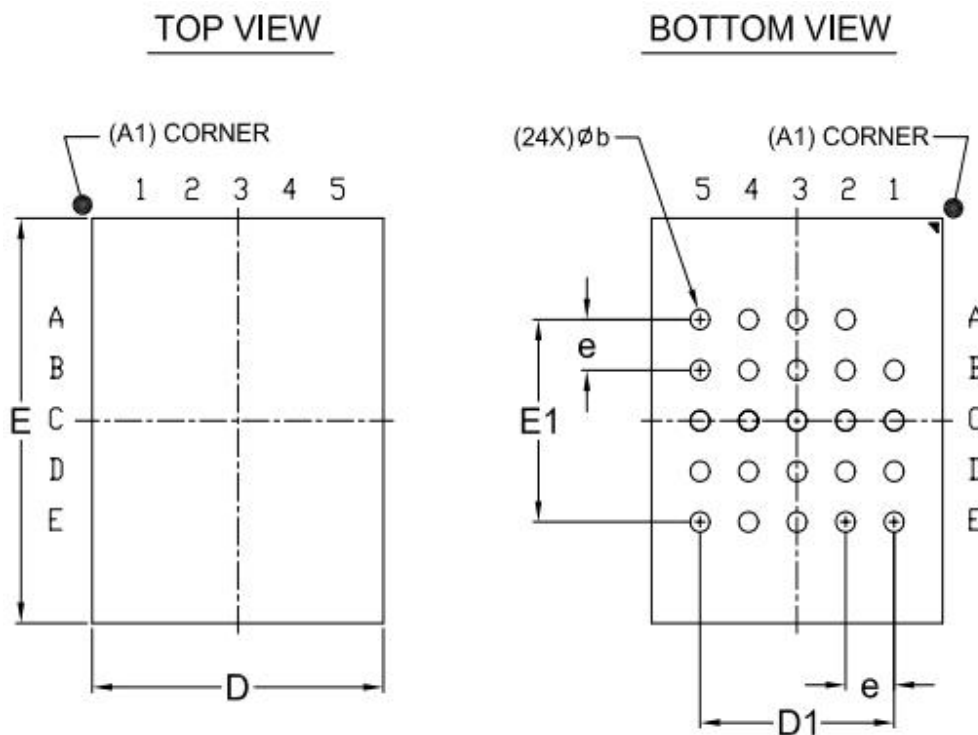


Table 2-4: 24-BGA (5x5 ball array) Package Dimensions

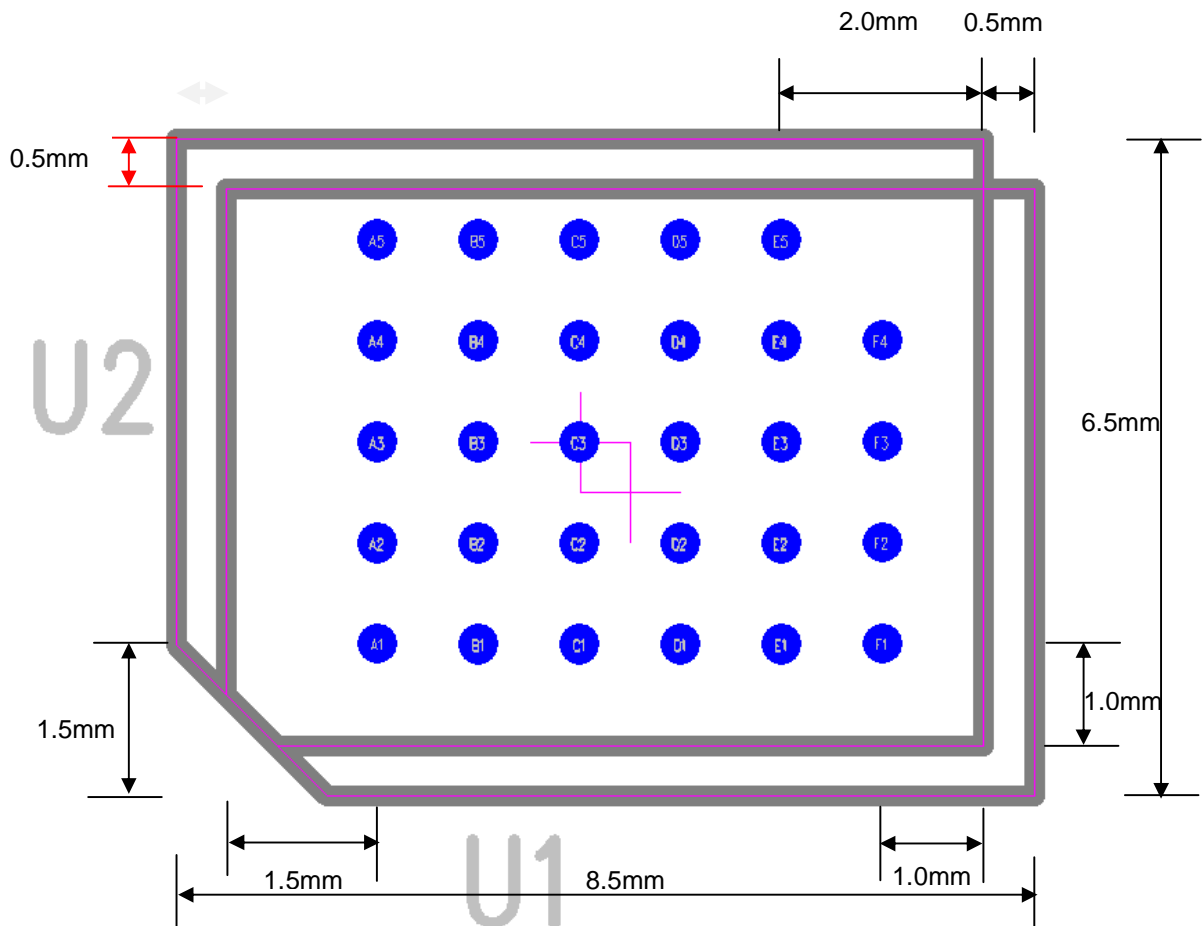
Dimension Symbol	Macronix MX25L_E/F			Spansion S25FL_S			Micron N25Q		
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.
D	5.90	6.00	6.10	-	6.00	-	5.90	6.00	6.10
D1	-	4.00	-	-	4.00	-	-	4.00	-
E	7.90	8.00	8.10	-	8.00	-	7.90	8.00	8.10
E1	-	4.00	-	-	4.00	-	-	4.00	-
b	0.35	0.40	0.45	0.35	0.40	0.45	0.35	0.40	0.45
e	-	1.00	-	-	1.00	-	-	1.00	-

Unit: mm

**Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q  
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**3. 4x6 Ball Array and 5x5 Ball Array 24-BGA Layout Recommendation**

In general, a PCB “dual layout” can accommodate both packages in the same footprint when clearance is provided around the overlapped package outlines. In order to align the balls of both 24-BGA packages, one package must be offset from the other by 0.5mm. When comparing the 4x6 ball array 24-BGA (rectangle offset to the lower right corner in Figure 3-1) with 5x5 ball array 24-BGA (rectangle offset to the upper left corner in Figure 3-1), it can be seen in Figure 3-1, that by extending the package space on the PCB board to 8.5mm in length and 6.5mm in width (red dot rectangle), the PCB can now accommodate both BGA footprints.



**Figure 3-1: 4x6 Ball Array and 5x5 Ball Array 24-BGA Dual Layout**

## Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays

### 4. Part Number Cross-Reference

Table 4-1 shows basic part number and package information cross references for the Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q.

**Table 4-1: Part Number Cross-Reference**

Density	Macronix Part	Spansion Part	Micron Part	Ball array
32Mb	MX25L3255EXCI-10G	-	-	4x6 ball array
	MX25L3255EXDI-10G	-	N25Q032A13E1240	5x5 ball array
64Mb	MX25L6435EXCI-10G	-	-	4x6 ball array
	MX25L6455EXCI-10G	-	-	4x6 ball array
	MX25L6456EXCI-10G	-	-	4x6 ball array
	MX25L6456EXDI-10G	-	N25Q064A13E1240	5x5 ball array
128Mb	MX25L12855EXCI-10G	S25FL128SAGBHI3/B/D_	-	4x6 ball array
	-	S25FL128SAGBHI2/A/C_	N25Q128A13E1240	5x5 ball array
256Mb	MX25L25655EXCI-12G	S25FL256SAGBHI3/B/D_	-	4x6 ball array
	-	S25FL256SAGBHI2/A/C_	N25Q256A1/3/83E1240	5x5 ball array
512Mb	MX66L51235FXDI-10G	S25FL256SAGBHI2/A/C1	N25Q512A1/83E1240	5x5 ball array
	-	S25FL256SAGBHI3/B/D1	-	4x6 ball array

### 5. References

Table 5-1 shows the datasheet versions used for comparison in this application note. For the most current, detailed specification, please refer to the each flash vender's website.

**Table 5-1: Datasheet Version**

Datasheet	Location	Data Issued	Version
MX25L3255E	Macronix Website	Jul. 23, 2012	Rev 0.01
MX25L6435E	Macronix Website	Apr. 19, 2012	Rev 0.05
MX25L6455E/12855E	Macronix Website	Jun. 18, 2012	Rev 1.5
MX25L6456E	Macronix Website	Jul. 23, 2012	Rev 0.00
MX25L25655E	Macronix Website	Sep 01, 2010	Rev. 1.0
MX66L51235F	Macronix Website	Aug. 08, 2012	Rev. 0.00
S25FL128S/256S	Spansion Website	Jul. 12, 2012	Rev. 05
S25FL512S	Spansion Website	Mar. 2, 2012	Rev. 02
N25Q032A	Micron Website	Jun. 2012	Rev. E
N25Q064A	Micron Website	Jun. 2012	Rev. G
N25Q128A	Micron Website	Jun. 2012	Rev. L
N25Q256A	Micron Website	Aug. 2012	Rev. L
N25Q512A	Micron Website	Aug. 2012	Rev. J



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## APPLICATION NOTE

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### Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays

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#### 6. Summary

The Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA packages have the same ball size and pitch dimensions with similar pin functions, but they use different ball arrays.

A PCB “dual layout” can be created to accommodate both packages in the same footprint if a small amount of extra clearance is provided around the overlapped package outlines.

In general, the designer may use this application note as a reference while designing a PCB with a dual layout to accommodate the 5x5 and 6x4 ball arrays within the same footprint.

#### 7. Revision History

Revision No.	Description	Date
1.0	Initial Release	Sep. 12, 2012



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## APPLICATION NOTE

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### Macronix MX25L\_E/F, Spansion S25FL\_S, and Micron N25Q 24-BGA PCB Dual Layout for 4x6 and 5x5 Ball Arrays

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