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SOLID STATE  
PRODUCT OUTLINE

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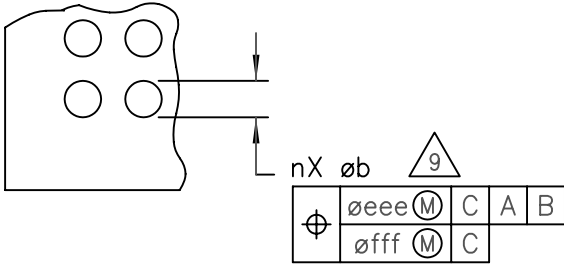
TITLE: VERY THIN, FINE-PITCH,  
STACKABLE BALL GRID  
0.50 mm BALL PITCH ARRAY FAMILY

PACKAGE DESIGNATOR:  
VF-XBGA

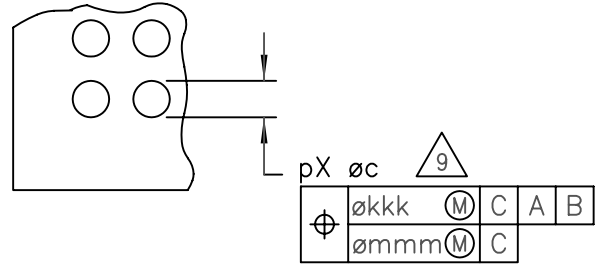
ISSUE: C  
DATE: JAN 2009

MO-266

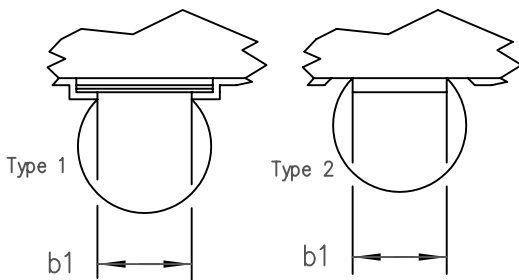
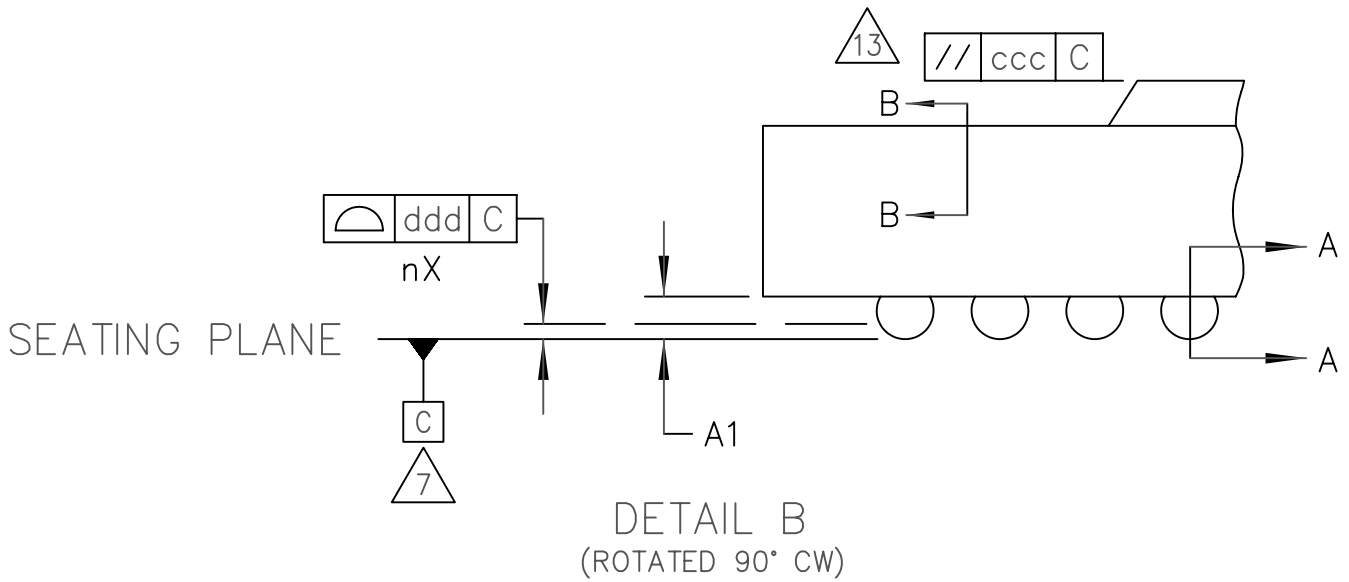
PAGE: 1 OF 21



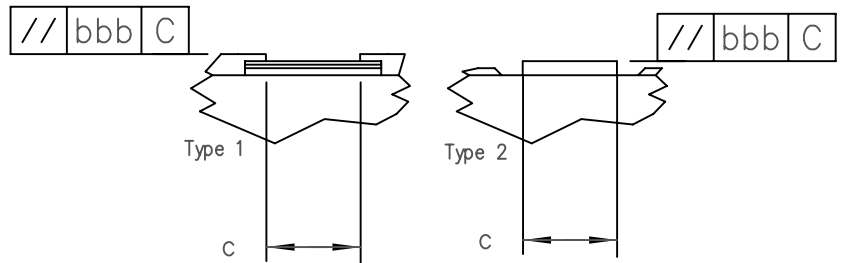
DETAIL A  
(BOTTOM SIDE)



DETAIL C  
(TOP SIDE)



$\triangle 16$  SECTION A-A



$\triangle 16$  SECTION B-B

TABLE 1

GENERAL TOLERANCES OF FORM AND POSITION	
BALL PITCH	
SYMBOLS	0.50
aaa	0.10
bbb	0.10
ccc	0.20
ddd	0.08 for D,E≤10.00 0.10 for D,E>10.00 and D,E≤14.00 0.12 for D,E>14.00
eee	0.15
fff	0.05
ggg	0.15
kkk	0.15
mmm	0.08 for f=0.80 0.08 for f=0.65 0.05 for f=0.50
NOTES	
REF	11-807
ISSUE	C

TABLE 2 – 0.80 mm TOP LAND PITCH



VARIATION TABLE					
VARIATION SYMBOLS		CA			NOTE
A	MIN	----			8
	NOM	----			
	MAX	1.00			
A1	MIN	0.15			8
	NOM	----			
	MAX	----			
A2	MIN	----			8
	NOM	----			
	MAX	0.75			
A5	MIN	0.30			8
	NOM	0.35			
	MAX	0.40			
b	MIN	0.25			
	NOM	0.30			
	MAX	0.35			
b1	Type 1	MIN	0.20		
		NOM	----		
		MAX	----		
	Type 2	MIN	0.20		
		NOM	----		
		MAX	----		
c	MIN	0.32			
	NOM	0.35			
	MAX	0.38			
D BSC		14.00			
F MAX		10.20			
E BSC		14.00			
G MAX		10.20			
e BSC		0.50			
f BSC		0.80			
H	MIN	0.25			
	NOM	----			
	MAX	----			
J	MIN	0.25			
	NOM	----			
	MAX	----			
MD		26			4
ME		26			4
MD2		17			4
ME2		17			4
p		120			5
n		372			5
SD		0.25			11
SE		0.25			11
TD		0			11
TE		0			11
FOOTPRINT FIGURE		7			14
Θ	MIN	15			
	NOM	30			
	MAX	45			
NOTE		19			
ITEM		11.11-769			
ISSUE		B			

TABLE 3 – 0.65 mm TOP LAND PITCH  

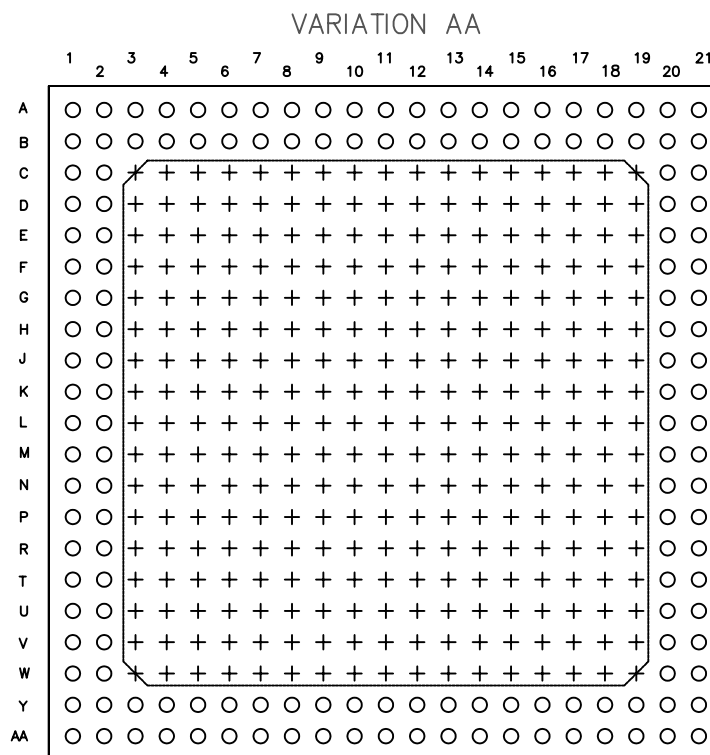
VARIATION TABLE								
VARIATION SYMBOLS		AA	AB	AC	AD	AE	AF	NOTE
A	MIN	----	----	----	----	----	----	8
	NOM	----	----	----	----	----	----	
	MAX	0.90	0.90	0.90	0.90	0.90	0.90	
A1	MIN	0.15	0.15	0.15	0.15	0.15	0.15	8
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
A2	MIN	----	----	----	----	----	----	8
	NOM	----	----	----	----	----	----	
	MAX	0.65	0.65	0.65	0.65	0.65	0.65	
A5	MIN	0.20	0.20	0.20	0.20	0.20	0.20	8
	NOM	0.25	0.25	0.25	0.25	0.25	0.25	
	MAX	0.33	0.33	0.33	0.33	0.33	0.33	
b	MIN	0.25	0.25	0.25	0.25	0.25	0.25	
	NOM	0.30	0.30	0.30	0.30	0.30	0.30	
	MAX	0.35	0.35	0.35	0.35	0.35	0.35	
b1	Type 1	MIN	0.20	0.20	0.20	0.20	0.20	
		NOM	----	----	----	----	----	
		MAX	----	----	----	----	----	
	Type 2	MIN	0.20	0.20	0.20	0.20	0.20	
		NOM	----	----	----	----	----	
		MAX	----	----	----	----	----	
c	MIN	0.27	0.27	0.27	0.27	0.27	0.27	
	NOM	0.30	0.30	0.30	0.30	0.30	0.30	
	MAX	0.33	0.33	0.33	0.33	0.33	0.33	
D BSC		14.00	13.00	12.00	10.00	11.00	15.00	
F MAX		10.80	9.50	8.85	6.25	7.55	11.15	
E BSC		14.00	13.00	12.00	10.00	11.00	15.00	
G MAX		10.80	9.50	8.85	6.25	7.55	11.15	
e BSC		0.50	0.50	0.50	0.50	0.50	0.50	
f BSC		0.65	0.65	0.65	0.65	0.65	0.65	
H	MIN	0.30	0.30	0.30	0.30	0.30	0.30	
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
J	MIN	0.30	0.30	0.30	0.30	0.30	0.30	
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
MD		26	25	23	19	21	29	4
ME		26	25	23	19	21	29	4
MD2		21	19	18	14	16	22	4
ME2		21	19	18	14	16	22	4
p		152	136	128	96	112	160	5
n		353	337	305	361	441	841	5
SD		0.25	0	0	0	0	0	11
SE		0.25	0	0	0	0	0	11
TD		0	0	0.325	0.325	0.325	0.325	11
TE		0	0	0.325	0.325	0.325	0.325	11
FOOTPRINT FIGURE		1	2	3	8	9	10	14
Θ	MIN	15	15	15	15	15	15	
	NOM	30	30	30	30	30	30	
	MAX	45	45	45	45	45	45	
NOTE		19	19	19	19	19	19	
ITEM		11.11–725	11.11–725	11.11–725	11.11–769	11.11–769	11.11–769	
ISSUE		A	A	A	B	B	B	

TABLE 4 – 0.50 mm TOP LAND PITCH

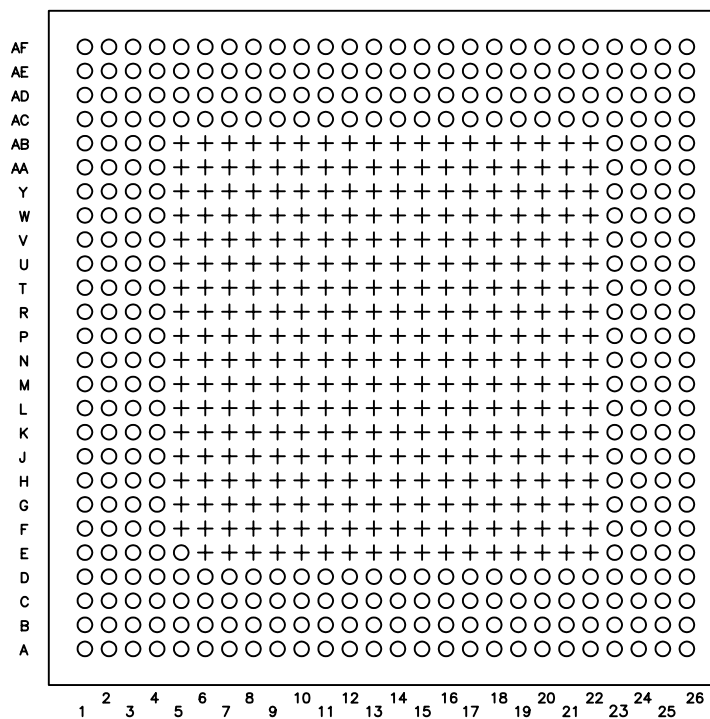


VARIATION TABLE								
VARIATION		BA	BB	BC	BD	BE	BF	NOTE
SYMBOLS								
A	MIN	----	----	----	----	----	----	8
	NOM	----	----	----	----	----	----	
	MAX	0.85	0.85	0.85	0.85	0.85	0.85	
A1	MIN	0.15	0.15	0.15	0.15	0.15	0.15	8
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
A2	MIN	----	----	----	----	----	----	8
	NOM	----	----	----	----	----	----	
	MAX	0.60	0.60	0.60	0.60	0.60	0.60	
A5	MIN	0.18	0.18	0.18	0.18	0.18	0.18	8
	NOM	0.20	0.20	0.20	0.20	0.20	0.20	
	MAX	0.22	0.22	0.22	0.22	0.22	0.22	
b	MIN	0.25	0.25	0.25	0.25	0.25	0.25	
	NOM	0.30	0.30	0.30	0.30	0.30	0.30	
	MAX	0.35	0.35	0.35	0.35	0.35	0.35	
b1	Type 1	MIN	0.20	0.20	0.20	0.20	0.20	
		NOM	----	----	----	----	----	
		MAX	----	----	----	----	----	
	Type 2	MIN	0.20	0.20	0.20	0.20	0.20	
		NOM	----	----	----	----	----	
		MAX	----	----	----	----	----	
c	MIN	0.22	0.22	0.22	0.22	0.22	0.22	
	NOM	0.25	0.25	0.25	0.25	0.25	0.25	
	MAX	0.28	0.28	0.28	0.28	0.28	0.28	
D BSC		14.00	13.00	12.00	10.00	11.00	15.00	
F MAX		11.20	10.20	9.20	7.20	8.20	12.20	
E BSC		14.00	13.00	12.00	10.00	11.00	15.00	
G MAX		11.20	10.20	9.20	7.20	8.20	12.20	
e BSC		0.50	0.50	0.50	0.50	0.50	0.50	
f BSC		0.50	0.50	0.50	0.50	0.50	0.50	
H	MIN	0.225	0.225	0.225	0.225	0.225	0.225	
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
J	MIN	0.225	0.225	0.225	0.225	0.225	0.225	
	NOM	----	----	----	----	----	----	
	MAX	----	----	----	----	----	----	
MD		27	25	23	19	21	29	4
ME		27	25	23	19	21	29	4
MD2		27	25	23	19	21	29	4
ME2		27	25	23	19	21	29	4
p		200	184	168	136	152	216	5
n		368	336	304	361	441	841	5
SD		0	0	0	0	0	0	11
SE		0	0	0	0	0	0	11
TD		0	0	0	0	0	0	11
TE		0	0	0	0	0	0	11
FOOTPRINT FIGURE		4	5	6	11	12	13	14
Θ	MIN	15	15	15	15	15	15	
	NOM	30	30	30	30	30	30	
	MAX	45	45	45	45	45	45	
NOTE		19	19	19	19	19	19	
ITEM		11.11–725	11.11–725	11.11–725	11.11–769	11.11–769	11.11–769	
ISSUE		A	A	A	B	B	B	

# FIGURE 1: BALL AND LAND PATTERNS FOOTPRINTS



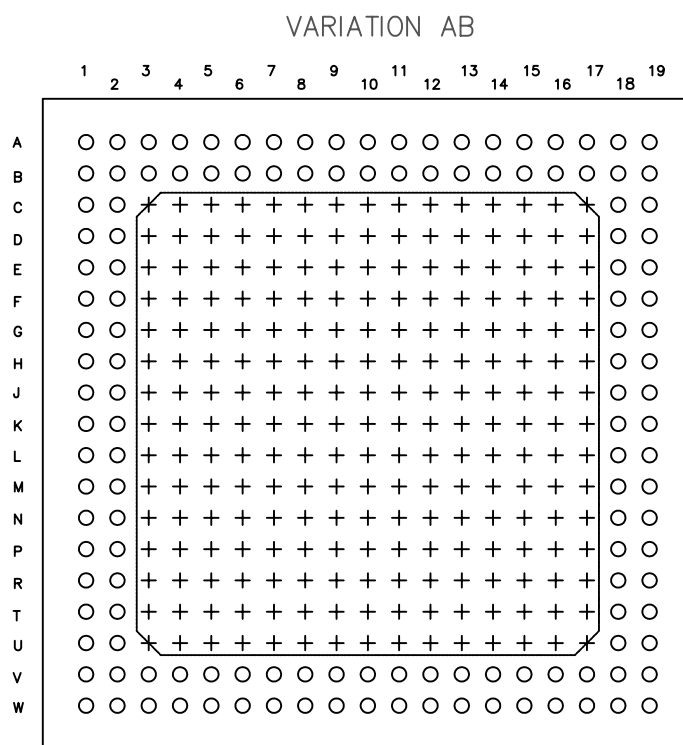
TOP VIEW



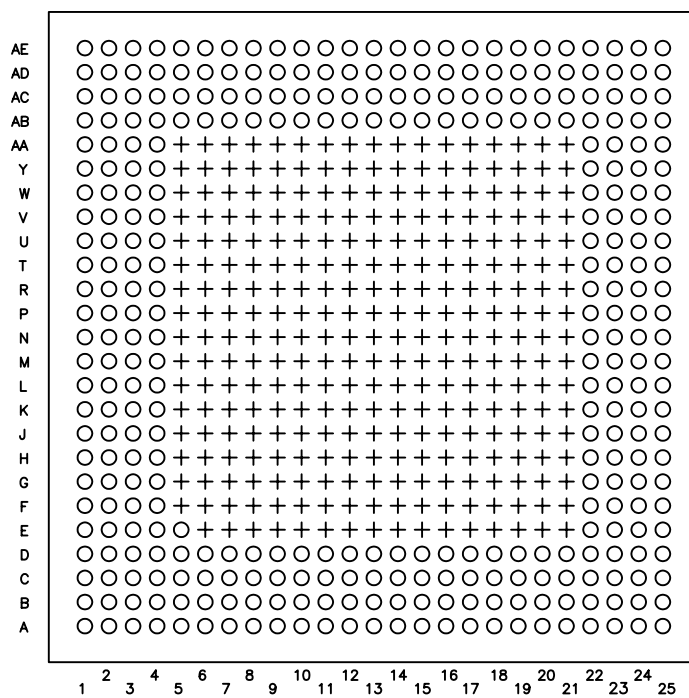
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

# FIGURE 2: BALL AND LAND PATTERNS FOOTPRINTS



TOP VIEW



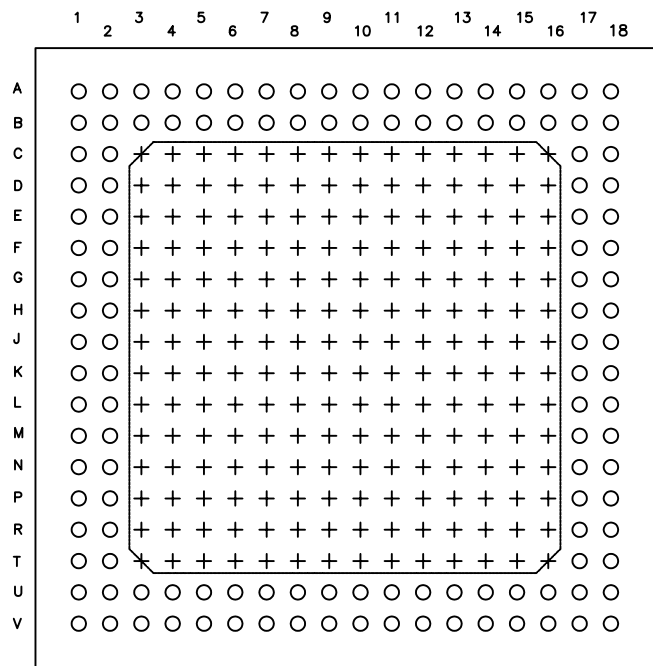
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

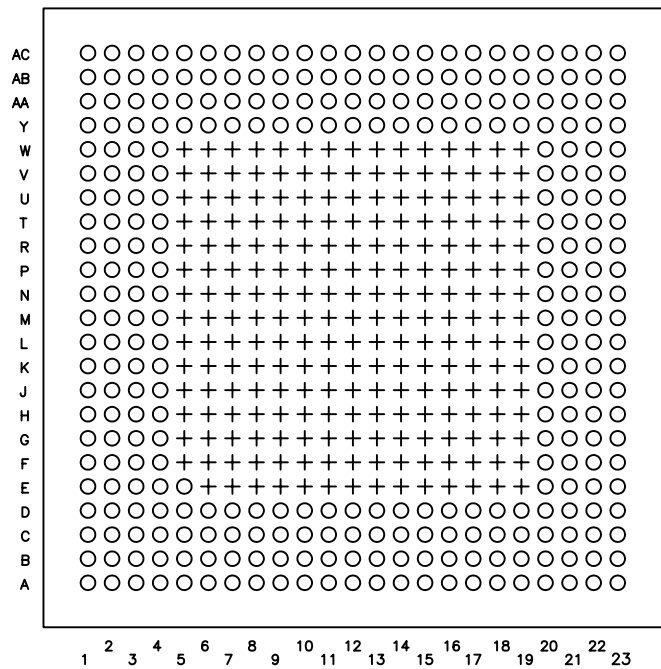
FIGURE 3: BALL AND LAND PATTERNS  
FOOTPRINTS



VARIATION AC



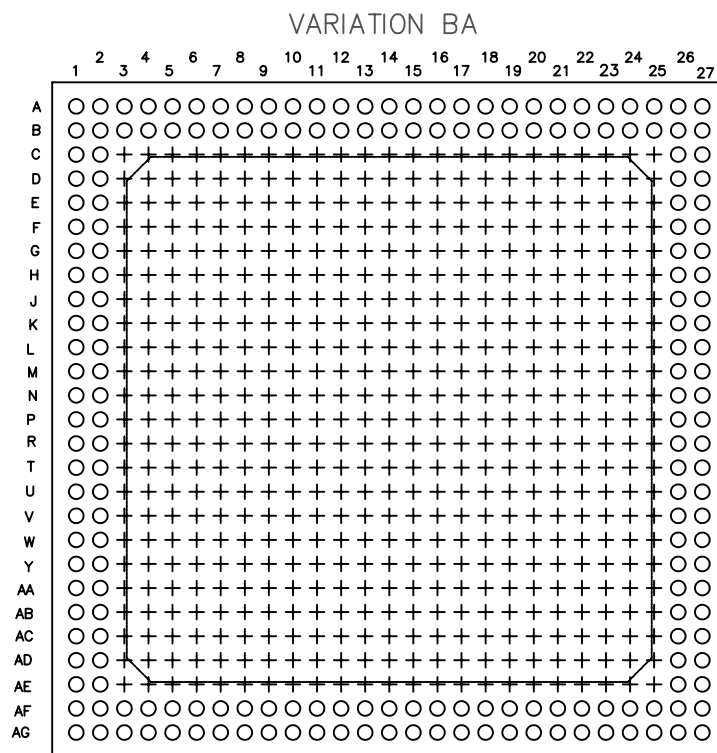
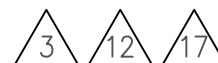
TOP VIEW



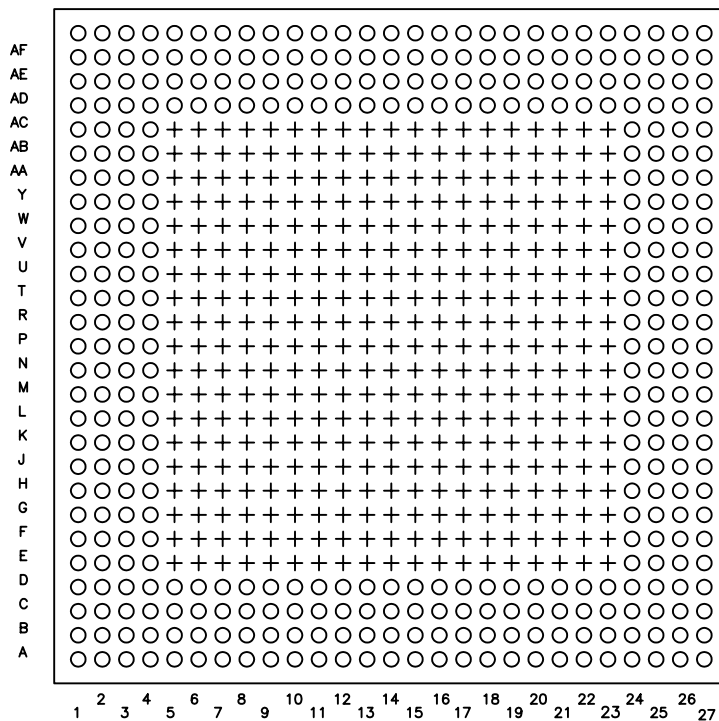
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

# FIGURE 4: BALL AND LAND PATTERNS FOOTPRINTS



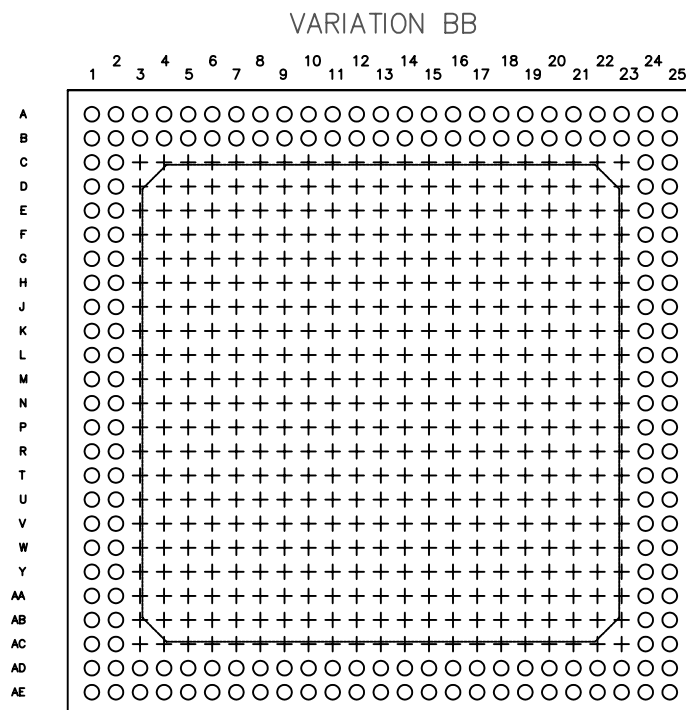
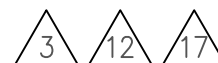
TOP VIEW



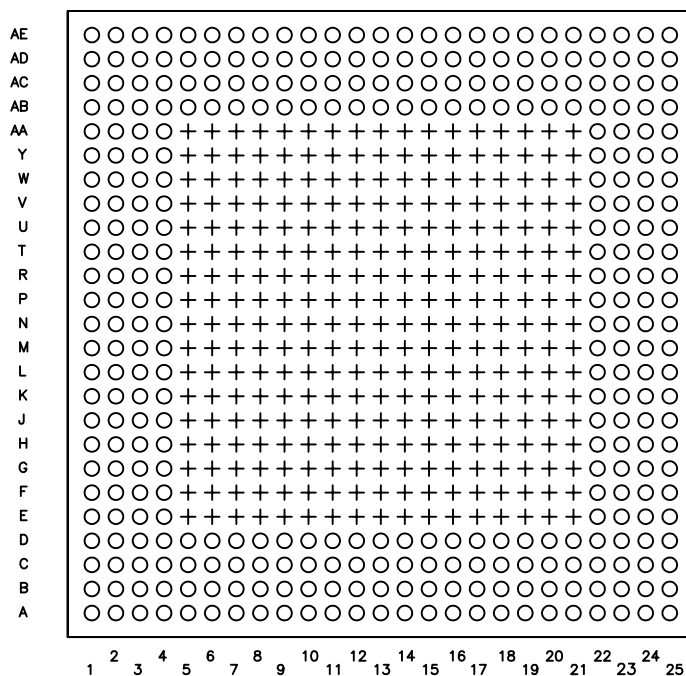
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

# FIGURE 5: BALL AND LAND PATTERNS FOOTPRINTS



TOP VIEW



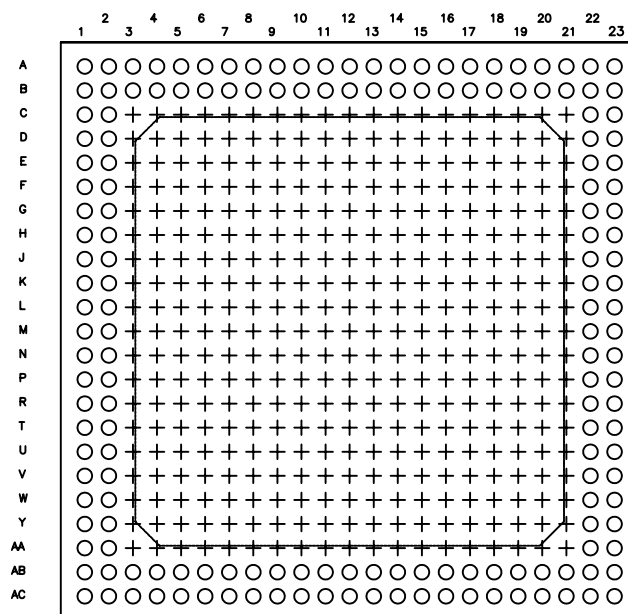
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

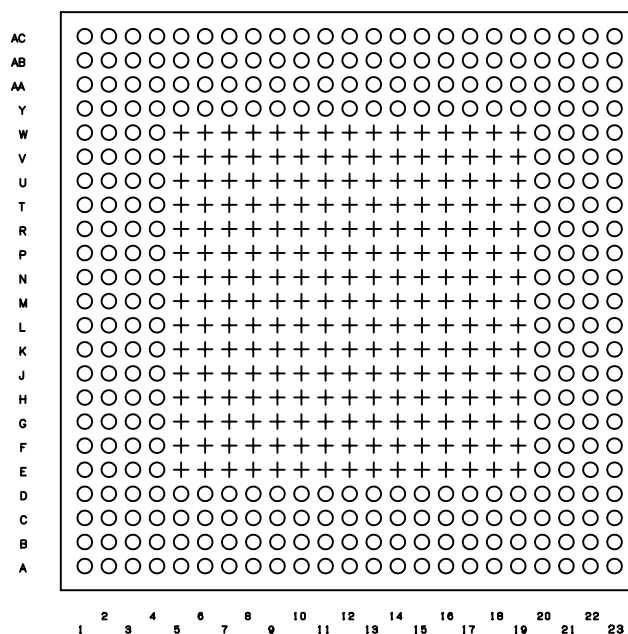
# FIGURE 6: BALL AND LAND PATTERNS FOOTPRINTS



## VARIATION BC



## TOP VIEW



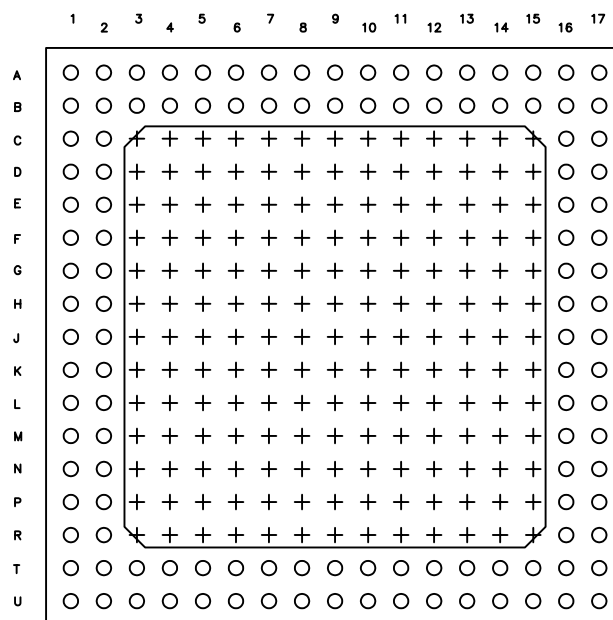
## BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

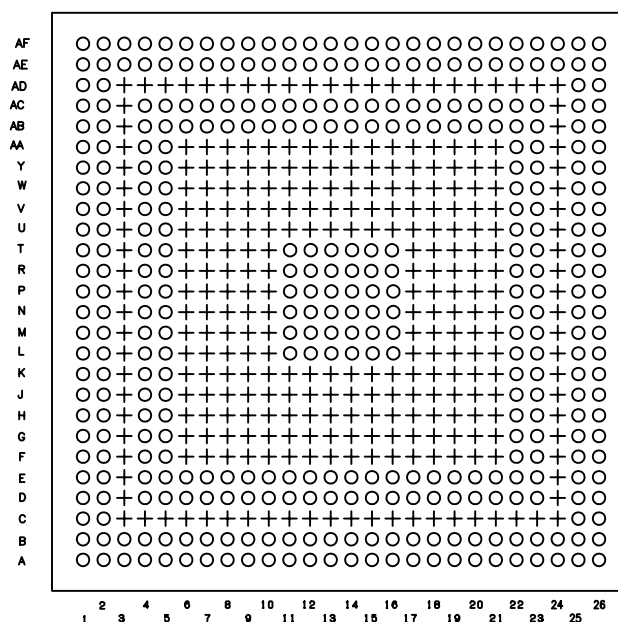
# FIGURE 7: BALL AND LAND PATTERNS FOOTPRINTS



## VARIATION CA



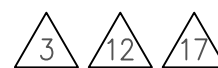
## TOP VIEW



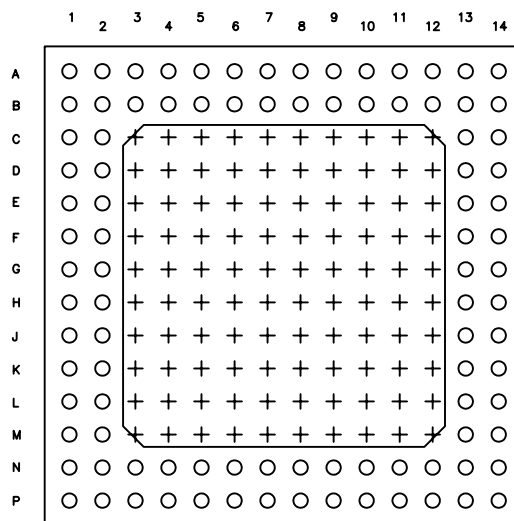
## BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

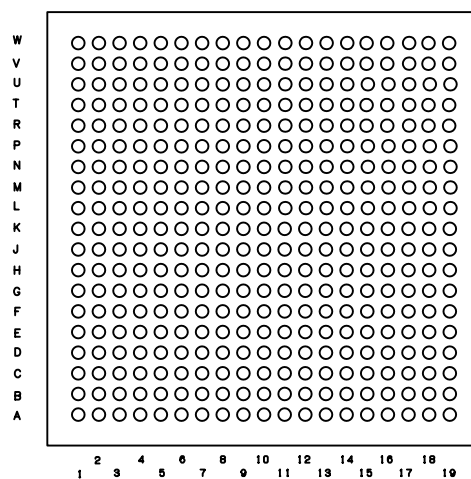
# FIGURE 8: BALL AND LAND PATTERNS FOOTPRINTS



VARIATION AD



TOP VIEW



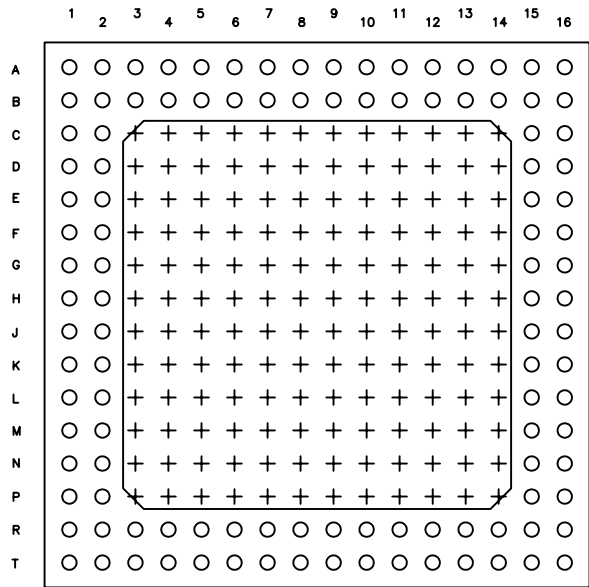
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

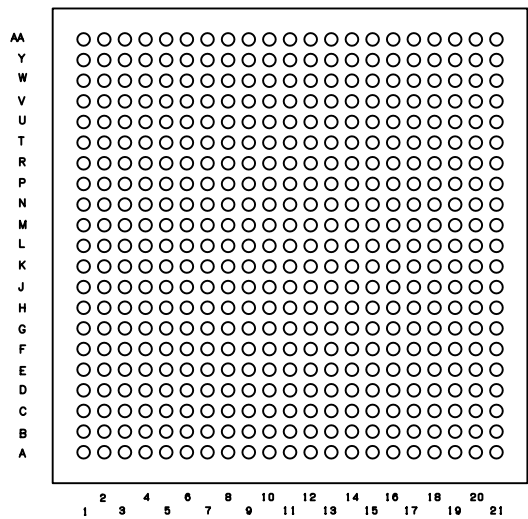
FIGURE 9: BALL AND LAND PATTERNS  
FOOTPRINTS



VARIATION AE



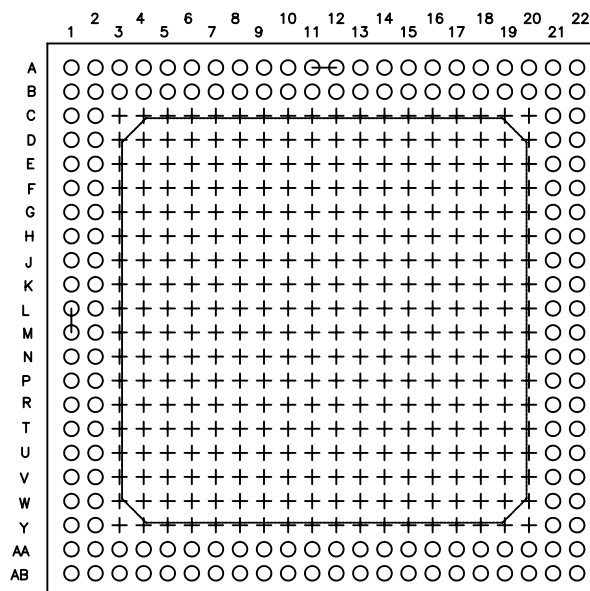
TOP VIEW



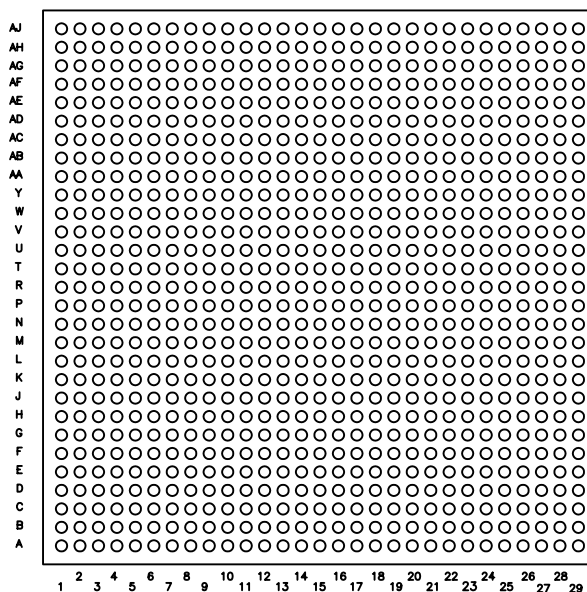
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

FIGURE 10: BALL AND LAND PATTERNS  
FOOTPRINTS  
VARIATION AF



TOP VIEW



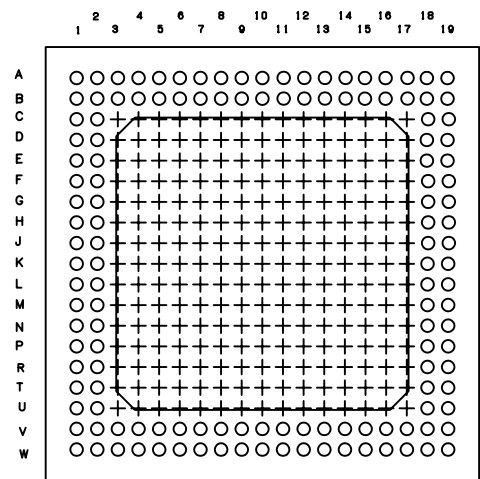
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

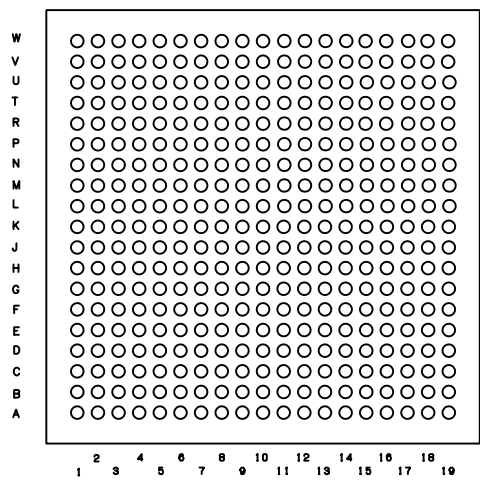
FIGURE 11: BALL AND LAND PATTERNS  
FOOTPRINTS



VARIATION BD



TOP VIEW



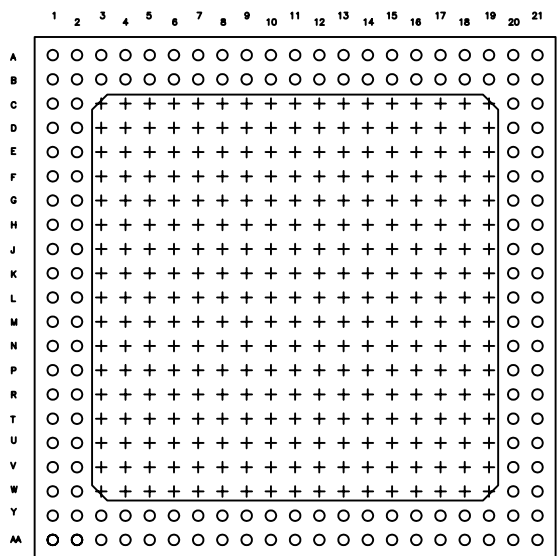
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

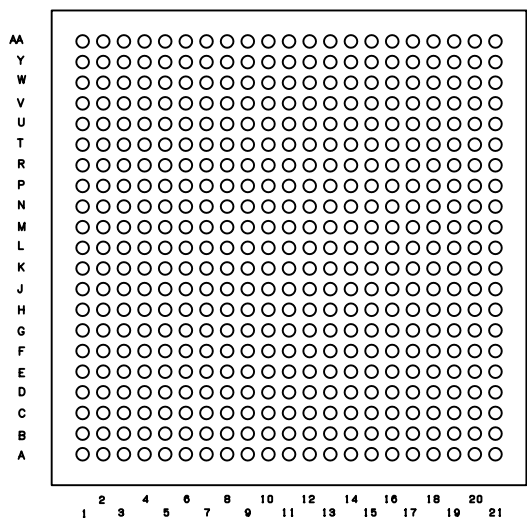
FIGURE 12: BALL AND LAND PATTERNS  
FOOTPRINTS



VARIATION BE



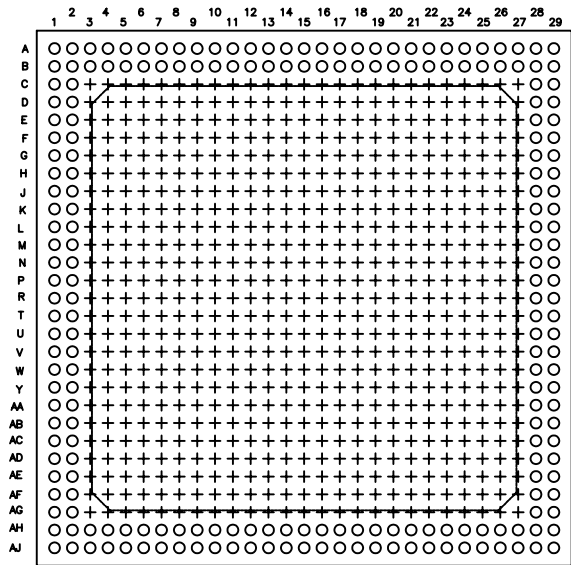
TOP VIEW



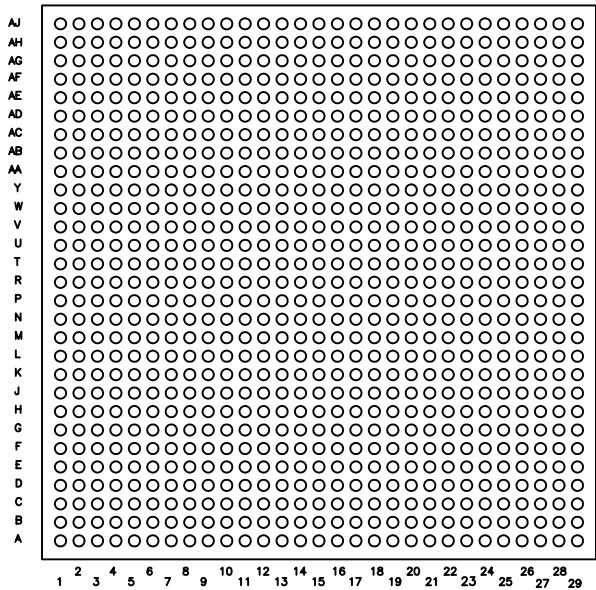
BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

# FIGURE 13: BALL AND LAND PATTERNS FOOTPRINTS VARIATION BF



TOP VIEW



BOTTOM VIEW

+ = UNPOPULATED BALL POSITION

NOTES:

- 1 DIMENSIONING AND TOLERANCING ARE PER ASME Y14.5M-1994. This registration is in compliance with JEP 95 Sec. 4.22, Fine Pitch, Square Ball Grid Array Package (FBGA) Package on Package (PoP)
- 2 DIMENSIONS ARE IN MILLIMETERS. ANGLES ARE IN DEGREES.
- 3 BALL AND LAND DESIGNATIONS ARE PER JEP95, SECTION 3, SPP-010.
- 4 MD AND ME (BOTTOM SIDE) AS WELL AS MD2 AND ME2 (TOP SIDE) REPRESENT THE MATRIX SIZE CORRESPONDING TO THE D AND E DIRECTIONS RESPECTIVELY.
- 5 n REPRESENTS THE NUMBER OF BALLS POPULATED ON THE BOTTOM SIDE AND p REPRESENTS THE NUMBER OF LANDS POPULATED ON THE TOP SIDE OF THE PACKAGE FOR EACH VARIATION.
- 6 THE 20 X 20 TWO ROW LAND (TOP SIDE) MATRIX AND THE 26X 26 FOUR ROW BALL (BOTTOM SIDE) MATRIX IS SHOWN FOR ILLUSTRATION ONLY.
- 7 DATUM C (SEATING PLANE) IS DEFINED BY THE CROWNS OF THE BALLS.
- 8 PACKAGE PROFILE HEIGHT (A) INCLUDES STAND-OFF HEIGHT (A1) AND BODY THICKNESS (A2).
- 9 DIMENSION c IS MEASURED AT THE MAXIMUM LAND DIAMETER AND DIMENSION b IS MEASURED AT THE MAXIMUM BALL DIAMETER IN A PLANE PARALLEL TO DATUM C.
- 10 THE CORNER A1 MUST BE IDENTIFIED ON BOTH THE BOTTOM AND TOP SIDE OF THE PACKAGE. THE IDENTIFICATION FEATURE CAN BE MADE USING INK OR METALIZED MARKINGS, INDENTATIONS, OR OTHER FEATURES. THE EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- 11 DIMENSIONS SD AND SE AS WELL AS TD AND TE ARE MEASURED WITH RESPECT TO DATUMS A AND B AND DEFINE THE POSITION OF THE CENTER MOST LANDS AND BALLS IN THE OUTER ROWS FOR A FULLY POPULATED MD X ME OR MD2 X ME2 MATRIX. WHEN THERE IS AN ODD NUMBER OF BALLS OR LANDS IN THE OUTER ROW, SD, TD, SE, AND / OR TE = 0; WHEN THERE IS AN EVEN NUMBER OF BALLS OR LANDS IN THE OUTER ROW, SD/SE = e/2 AND TD/TE = f/2.
- 12 THE LAND AND / OR BALL ARRAY MAY BE DEPOPULATED IN ANY PATTERN. DEPOPULATION IS THE OMISSION OF BALLS FROM A FULL MD X ME OR MD2 X ME2 MATRIX.
- 13 PARALLELISM (ccc) APPLIES ONLY TO THE SURFACE DIRECTLY ABOVE THE DIE AREA FOR GLOB TOP, OVER MOLDED AND / OR FLIP CHIP CONFIGURATIONS. THE PARALLELISM SPECIFICATION WILL NOT APPLY TO ANY FILLET OR SLOPED REGION OF THE ENCAPSULANT.
- 14 SEE FIGURES 1 THROUGH 13 FOR ALL BALL AND LAND PATTERNS
- 15 VARIOUS COMPANIES HAVE ISSUED PATENTS AND RELATED PATENT APPLICATIONS THAT MAY APPLY TO THIS REGISTRATION. IF THE CURRENT ISSUED PATENTS OR LATER PATENTS RESULTING FROM RELATED APPLICATIONS DO APPLY, THESE COMPANIES INTEND TO COMPLY WITH THE JEDEC PATENT POLICY AND LICENSE UNDER REASONABLE TERMS AND CONDITIONS THAT ARE DEMONSTRABLY FREE OF ANY UNFAIR DISCRIMINATION. REFERENCED PATENTS ARE AS FOLLOWS:

COMPANY	U.S. PATENT #S
MICRON TECHNOLOGY	6,048,753
TESSERA	5,950,304; 6,133,627

- 16 THE SOLDERABLE SURFACE MAY BE DEFINED BY AN OPENING IN THE SOLDER RESIST LAYER (TYPE 1) OR BY THE SIZE OF THE METALLIZED PAD (TYPE 2). IT MAY BE ELLIPTICAL, PROVIDED THE RATIO OF MAJOR TO MINOR AXIS IS NO GREATER THAN 2/1, AND THE SURFACE AREA IS NO LESS THAN THE MINIMUM FOR A CIRCULAR PAD. FOR TYPE 2 DESIGNS, COPPER TRACES ARE PERMITTED OUTSIDE THE b1 AND / OR c PAD AREA.
- 17 FOR A COMPLETE SET OF DIMENSIONS FOR EACH VARIATION, SEE THE INDIVIDUAL VARIATION TABLE 2 THROUGH 4, BALL AND LAND PATTERNS FIGURE 1 THROUGH 13 AND THE GENERAL TOLERANCES OF FORM AND POSITION TABLE 1.
- 18 WHEN MORE THAN ONE VARIATION (OPTION) EXISTS FOR THE SAME PROFILE HEIGHT, BODY SIZE (D X E), BALL DIAMETER, BALL PITCH, AND / OR LAND PITCH, THEN THOSE VARIATIONS WILL BE DENOTED BY AN ADDITIONAL DASH NUMBER (i.e.: -1, -2, etc.) DESIGNATOR TO IDENTIFY THEM. THE NEW VARIATIONS WOULD BE CREATED FROM ALL OR ANY OF THE FOLLOWING REASONS: BALL COUNTS, LAND COUNTS AND / OR BALL DIAMETERS.

APPLICATION NOTES:

- 19 DUE TO THE THICKNESS OF THE LID, ENCAPSULATION OR MOLD CAP OF THE BOTTOM PACKAGE, THE 'A5' VALUES DEFINED IN THIS OUTLINE SHOULD BE COMPATIBLE WITH THE 'B' VALUES OF THE MATCHING UPPER PACKAGE DEFINED IN MO-273. REFER TO DESIGN GUIDE 4.22 FOR THE SUGGESTED VALUES. IF 'A1 MIN' OF THE UPPER PACKAGE IS SMALLER THAN 'A5 MAX' OF THE LOWER PACKAGE, ADDITION OF SOLDER PASTE MAY BE REQUIRED DURING THE JOINING OF THE TWO PACKAGES.

# Change Record

If the change involves any words added or deleted (excluding deletion of accidentally repeated words), the change is included. Punctuation changes may not be included.

Initial Issue:	Date:	Item:
A	November 2005	11.11-725

## Change Record History

Issue: B	Date Published: Aug. 2007	Item #: 11.11-769
Location	Changed from:	Changed to:
Page 3	Does not exist	Add Table 2, 0.80mm Top Land Pitch for CA
Page 13	Does not exist	Add Figure 7 Ball and Land Patterns Footprint for CA
Page 4	Does not exist	Add new variations AD, AE, and AF to Table 3 for 0.65 mm Top Land Pitches
Page 14,15 and 16	Does not exist	Add new Figures 8, 9 and 10 Ball and Land Patterns Footprints for Variations AD, AE, and AF
Page 5	Does not exist	Add new variations BD, BE, and BF to Table 4 for 0.50 mm Top Land Pitches
Page 17,18 and 19	Does not exist	Add new Figures 11, 12 and 13 Ball and Land Patterns Footprints for Variations BD, BE, and BF
Page 6	Notes 19 and 20	Update Notes 19 and 20 to reflect the proposed 0.65 and 0.50 mm Variations.
Page 6	Does not exist	Add new Application Note 21 to reflect the proposed 0.80 mm Variation
Page 20	Does not exist	Add Change Record

# Change Record Continued

If the change involves any words added or deleted (excluding deletion of accidentally repeated words), the change is included. Punctuation changes may not be included.

## Change Record History

Issue: C	Date Published: Jan 2009	Item #: 11.11-807																																																																														
Location	Changed from:	Changed to:																																																																														
Page 3	<table><tr><td colspan="2">TABLE 1</td></tr><tr><td colspan="2">GENERAL TOLERANCES OF FORM AND POSITION</td></tr><tr><td><table><tr><td>BALL PITCH</td><td></td></tr><tr><td>SYMBOLS</td><td>0.50</td></tr></table></td><td></td></tr><tr><td>aaa</td><td>0.10</td></tr><tr><td>bbb</td><td>0.10</td></tr><tr><td>ccc</td><td>0.20</td></tr><tr><td>ddd</td><td>0.10</td></tr><tr><td>eee</td><td>0.15</td></tr><tr><td>fff</td><td>0.05</td></tr><tr><td>ggg</td><td>0.15</td></tr><tr><td>kkk</td><td>0.15</td></tr><tr><td>mmm</td><td><table><tr><td>0.08 for f=0.80</td></tr><tr><td>0.08 for f=0.65</td></tr><tr><td>0.05 for f=0.50</td></tr></table></td></tr><tr><td>NOTES</td><td></td></tr><tr><td>REF</td><td>11-725</td></tr><tr><td>ISSUE</td><td>A</td></tr></table>	TABLE 1		GENERAL TOLERANCES OF FORM AND POSITION		<table><tr><td>BALL PITCH</td><td></td></tr><tr><td>SYMBOLS</td><td>0.50</td></tr></table>	BALL PITCH		SYMBOLS	0.50		aaa	0.10	bbb	0.10	ccc	0.20	ddd	0.10	eee	0.15	fff	0.05	ggg	0.15	kkk	0.15	mmm	<table><tr><td>0.08 for f=0.80</td></tr><tr><td>0.08 for f=0.65</td></tr><tr><td>0.05 for f=0.50</td></tr></table>	0.08 for f=0.80	0.08 for f=0.65	0.05 for f=0.50	NOTES		REF	11-725	ISSUE	A	<table><tr><td colspan="2">TABLE 1</td></tr><tr><td colspan="2">GENERAL TOLERANCES OF FORM AND POSITION</td></tr><tr><td><table><tr><td>BALL PITCH</td><td></td></tr><tr><td>SYMBOLS</td><td>0.50</td></tr></table></td><td></td></tr><tr><td>aaa</td><td>0.10</td></tr><tr><td>bbb</td><td>0.10</td></tr><tr><td>ccc</td><td>0.20</td></tr><tr><td>ddd</td><td><table><tr><td>0.08 for D,E≤10.00</td></tr><tr><td>0.10 for D,E&gt;10.00</td></tr><tr><td>and D,E&lt;14.00</td></tr><tr><td>0.12 for D,E≥14.00</td></tr></table></td></tr><tr><td>eee</td><td>0.15</td></tr><tr><td>fff</td><td>0.05</td></tr><tr><td>ggg</td><td>0.15</td></tr><tr><td>kkk</td><td>0.15</td></tr><tr><td>mmm</td><td><table><tr><td>0.08 for f=0.80</td></tr><tr><td>0.08 for f=0.65</td></tr><tr><td>0.05 for f=0.50</td></tr></table></td></tr><tr><td>NOTES</td><td></td></tr><tr><td>REF</td><td></td></tr><tr><td>ISSUE</td><td></td></tr></table>	TABLE 1		GENERAL TOLERANCES OF FORM AND POSITION		<table><tr><td>BALL PITCH</td><td></td></tr><tr><td>SYMBOLS</td><td>0.50</td></tr></table>	BALL PITCH		SYMBOLS	0.50		aaa	0.10	bbb	0.10	ccc	0.20	ddd	<table><tr><td>0.08 for D,E≤10.00</td></tr><tr><td>0.10 for D,E&gt;10.00</td></tr><tr><td>and D,E&lt;14.00</td></tr><tr><td>0.12 for D,E≥14.00</td></tr></table>	0.08 for D,E≤10.00	0.10 for D,E>10.00	and D,E<14.00	0.12 for D,E≥14.00	eee	0.15	fff	0.05	ggg	0.15	kkk	0.15	mmm	<table><tr><td>0.08 for f=0.80</td></tr><tr><td>0.08 for f=0.65</td></tr><tr><td>0.05 for f=0.50</td></tr></table>	0.08 for f=0.80	0.08 for f=0.65	0.05 for f=0.50	NOTES		REF		ISSUE	
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