



## Package Diagrams

## Data Sheet

FPGA-DS-02053-7.4

June 2023

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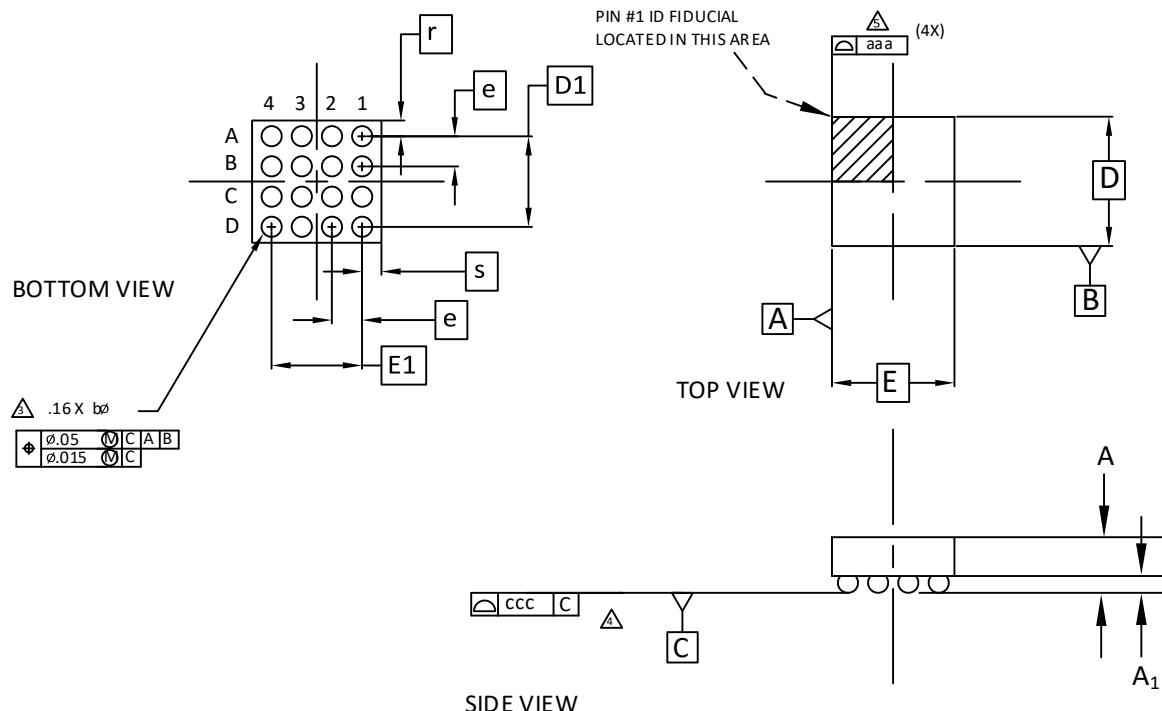
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# 1. 16-Ball WLCSP Package Option 1: iCE40™ LP

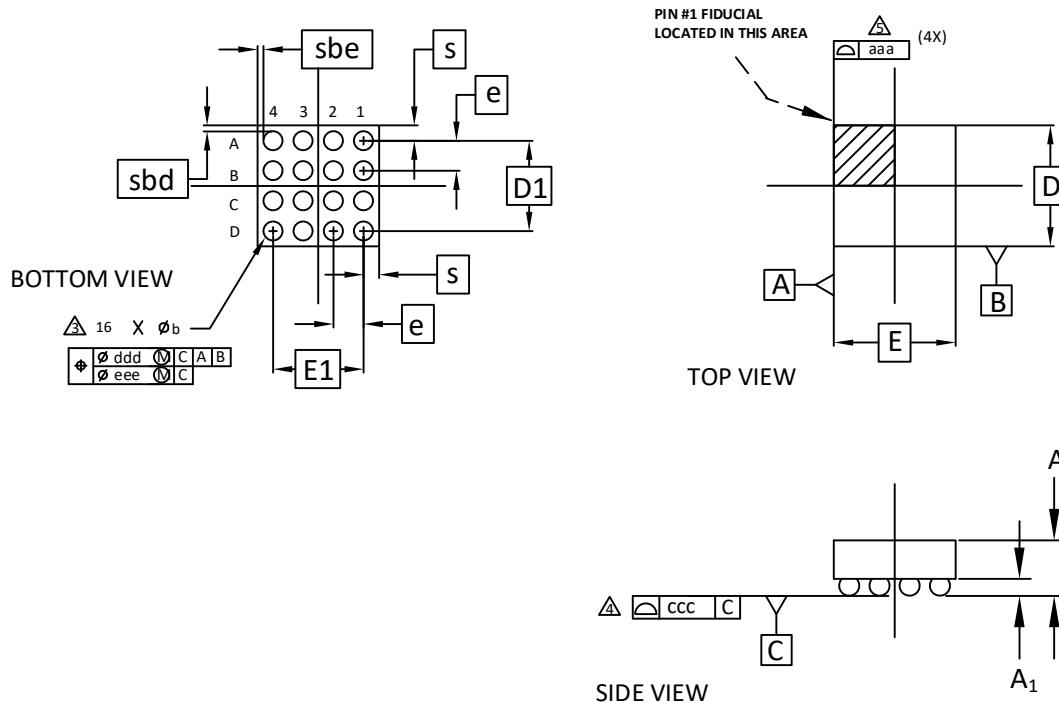
Dimensions in Millimeters



REF.	Min.	Nom.	Max.
A	0.413	0.452	0.491
A1	0.122	0.152	0.182
b	0.188	0.218	0.248
D		1.40 BSC	
E		1.48 BSC	
D1		1.05 BSC	
E1		1.05 BSC	
e		0.35 BSC	
aaa		0.03	
ccc		0.03	
r	—	0.175	—
s	—	0.215	—

## 2. 16-Ball WLCSP Package Option 2: iCE40 UltraLite™

Dimensions in Millimeters



NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y14.5M - 1994.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

**⚠** DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.

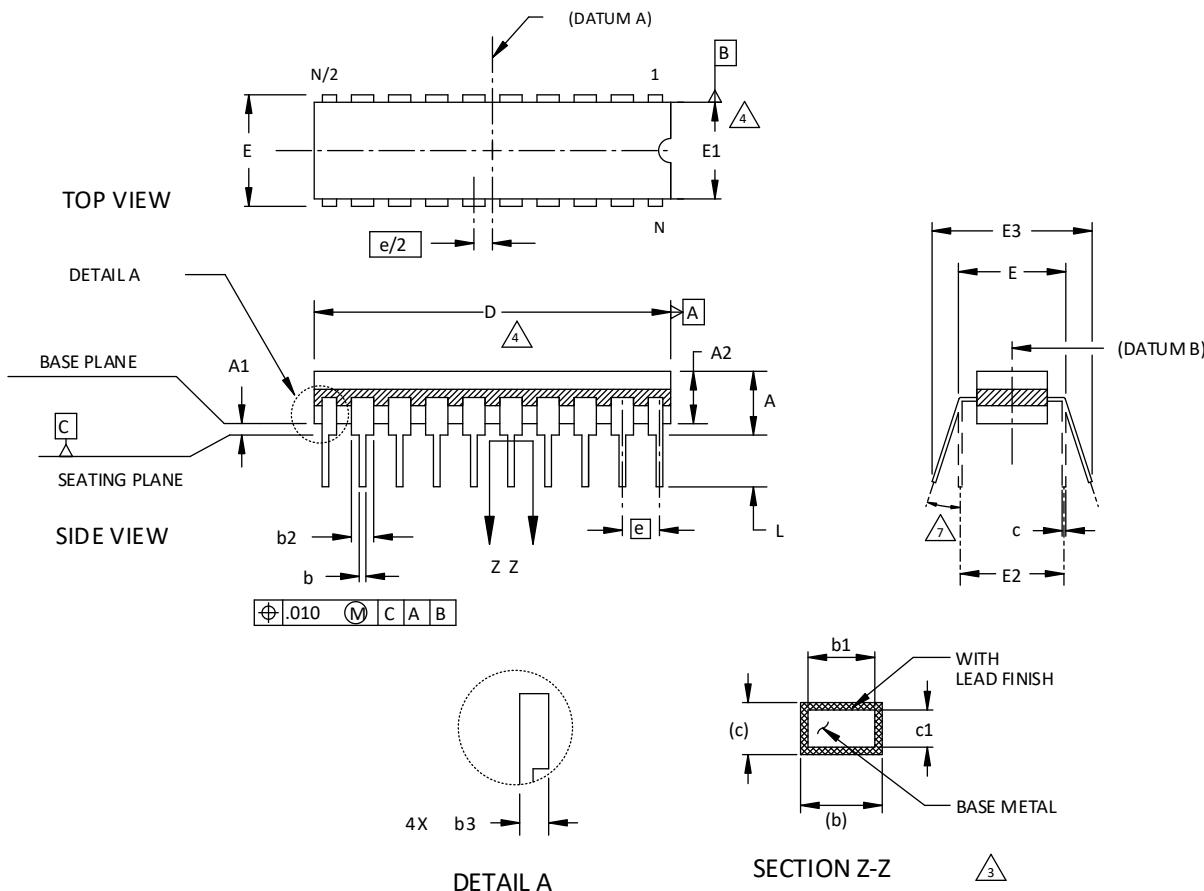
**⚠** PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

**⚠** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

REF.	Min.	Nom.	Max.
A	0.413	0.452	0.491
A1	0.122	0.152	0.182
b	0.188	0.218	0.248
D	1.409	BSC	
E	1.409	BSC	
D1	1.05	BSC	
E1	1.05	BSC	
e	0.35	BSC	
s	—	0.180	—
sbD	0.067	0.071	0.072
sbE	0.067	0.071	0.072
aaa		0.03	
ccc		0.03	
ddd		0.050	
eee		0.015	

### 3. 20-Pin (300-Mil) CERDIP Package

Dimensions in Inches



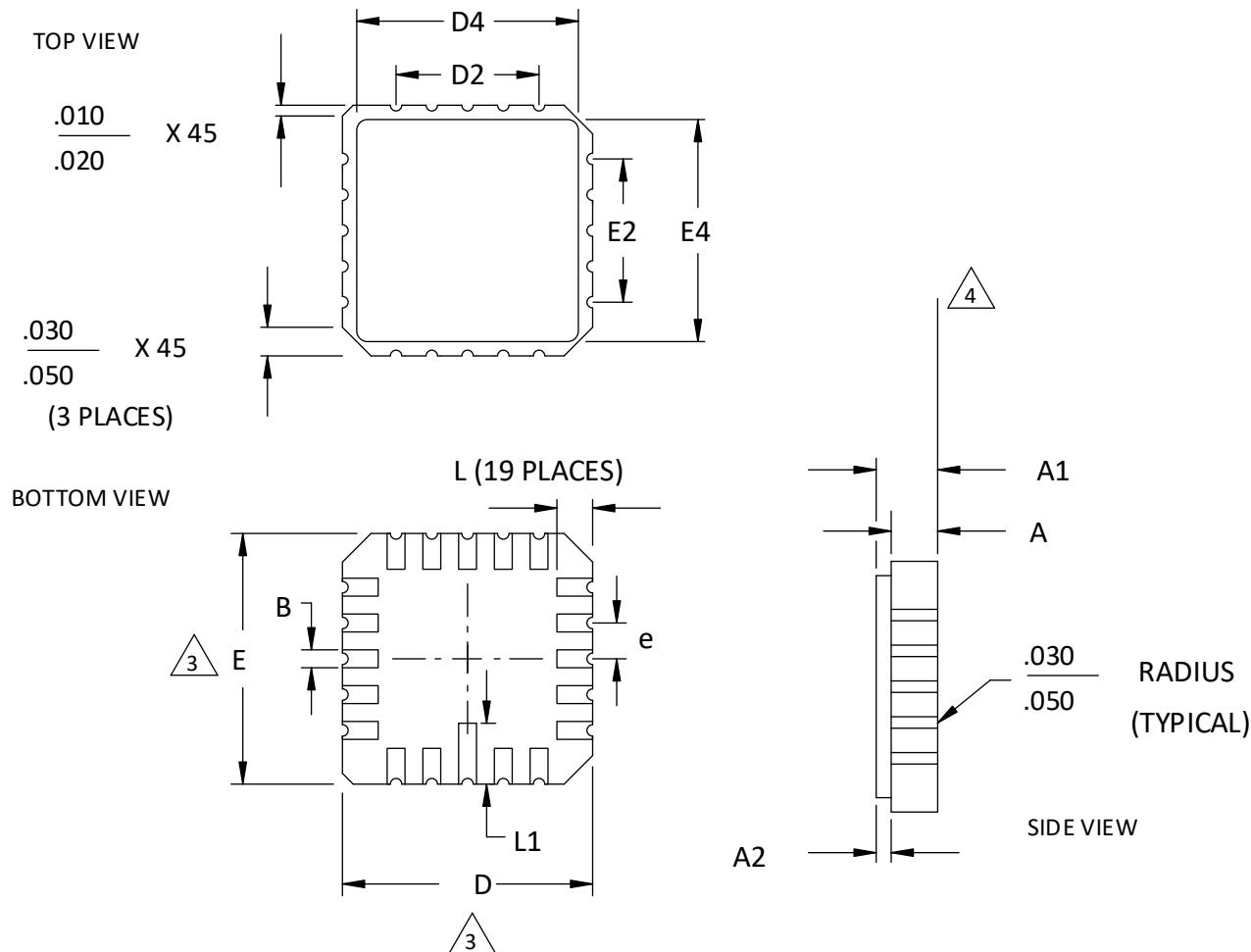
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.
3. MEASUREMENTS TO BE TAKEN AT A MINIMUM OF .060 INCHES FROM THE LEAD TIP.
4. DIMENSIONS D AND E1 INCLUDE ALLOWANCE FOR GLASS OVERRUN AND MENISCUS, AND LID TO BASE MISMATCH.
5. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-003.
6. E3 IS TO BE MEASURED AT THE LEAD TIPS.
7. ALLOWED LEAD TIP POSITION RANGE.

SYMBOL	INCHES		
	MIN.	NOM.	MAX.
A	-	-	.200
A1	.015	-	-
A2	.140	-	.175
b	.015	-	.023
b1	.015	.018	.021
b2	.045	-	.065
b3	.023	-	.045
c	.008	-	.014
c1	.008	.010	.012
D	.942	.950	.970
E	.308	-	.325
E1	.280	.288	.296
E2	.300 REF		
E3	.325	-	.410
e	.100 BSC		
L	.125	-	.200
N	20		

## 4. 20-Pin LCC Package

Dimensions in Inches



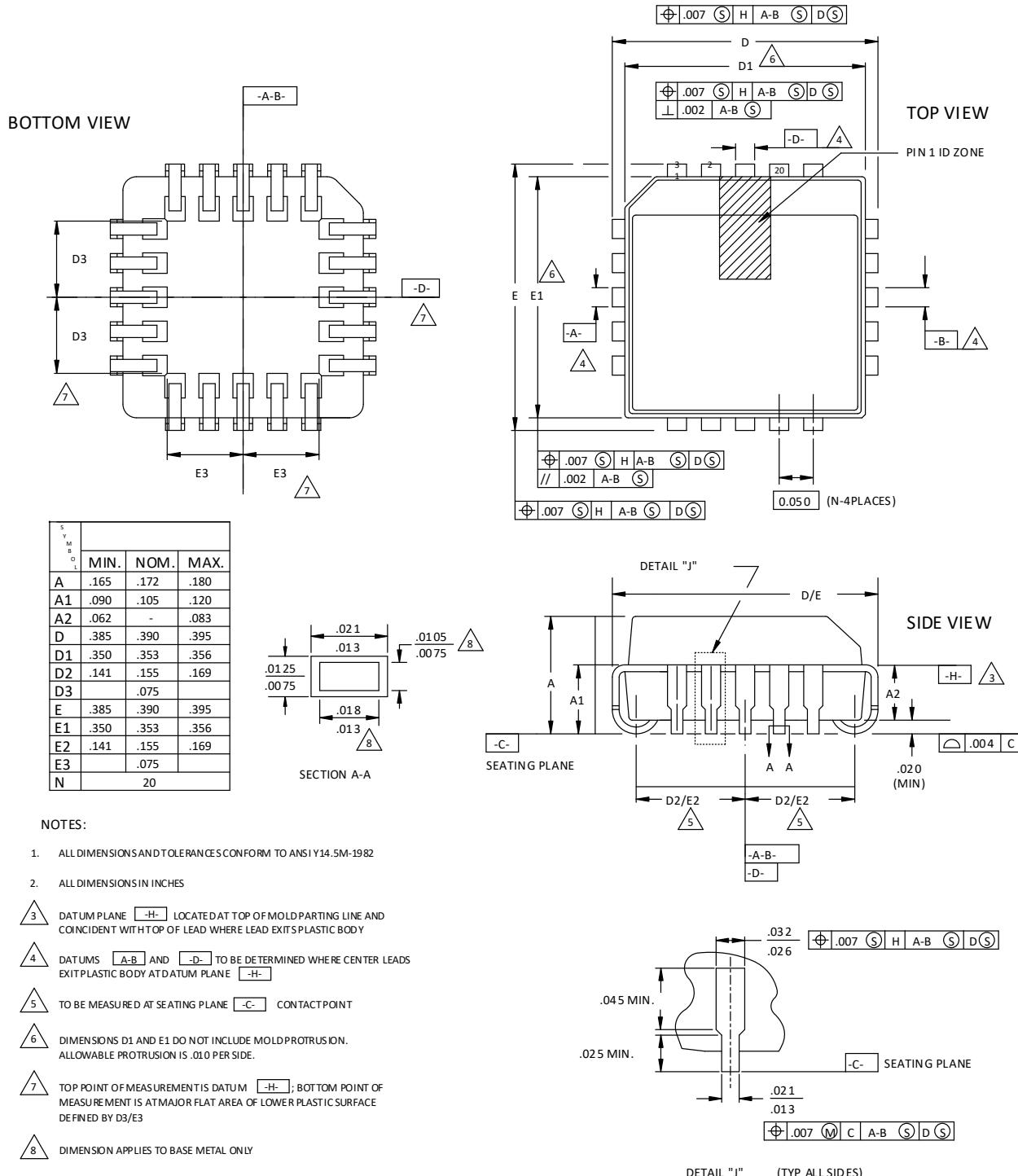
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5.
2. ALL DIMENSIONS ARE IN INCHES.
3. DIMENSIONS D AND E MAY HAVE MATERIAL PROTRUSION OF .010 INCHES MAXIMUM ABOVE THE DIMENSION SHOWN NOT TO EXCEED .005 INCHES MAXIMUM PER SIDE.
4. FLATNESS TOLERANCE IS .004 INCHES PER INCH.

S Y M B O L	INCHES		
	MIN.		MAX.
A	.054		.074
A1	.064		.089
A2	.007		.015
B	.022		.028
D	.342		.358
D2		.200	
D4	.270		.315
E	.342		.358
E2		.200	
E4	.270		.315
e		.050 BSC	
L	.042		.058
L1	.075		.095

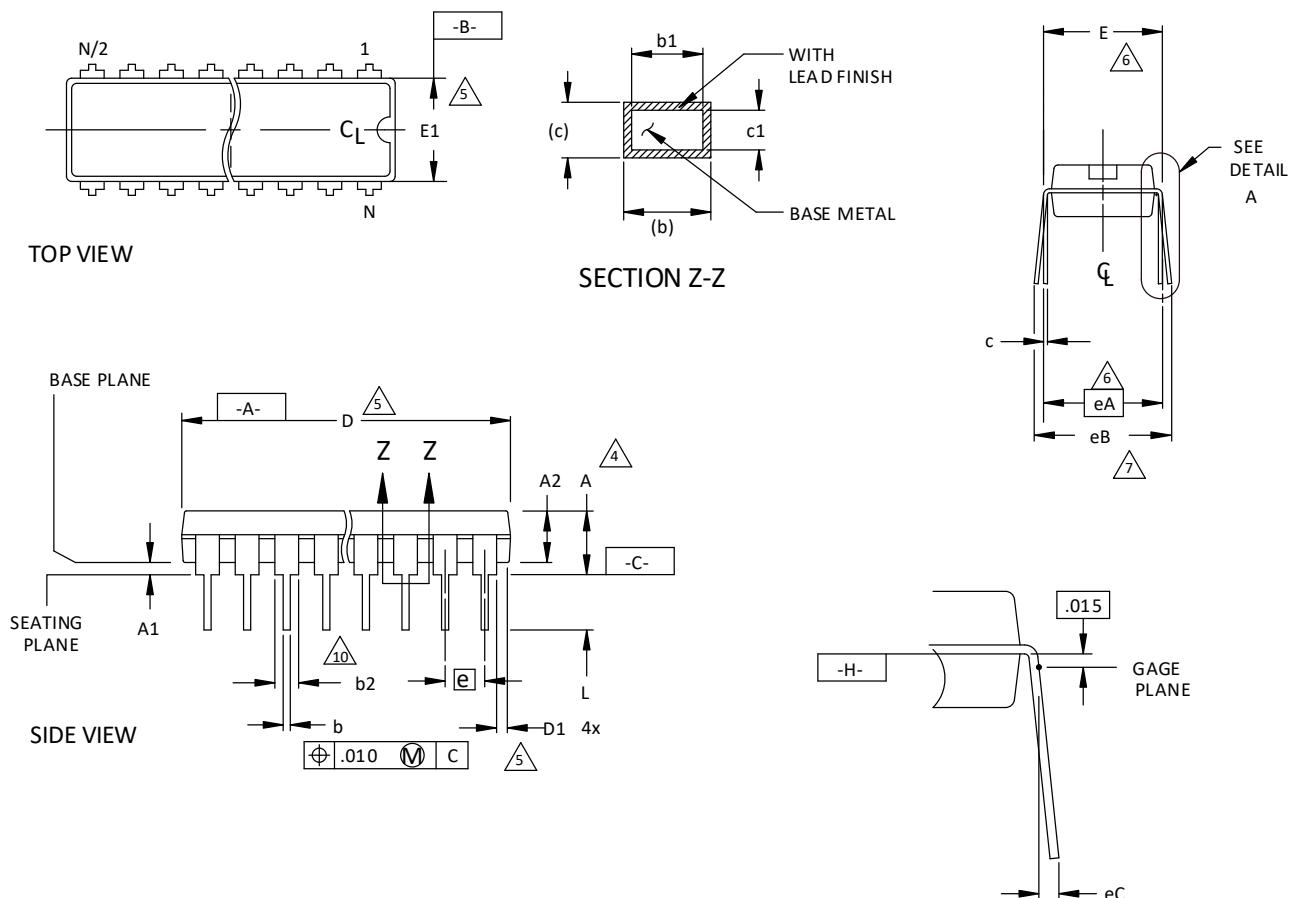
## 5. 20-Pin PLCC Package

Dimensions in Inches



## 6. 20-Pin Plastic DIP Package

Dimensions in Inches



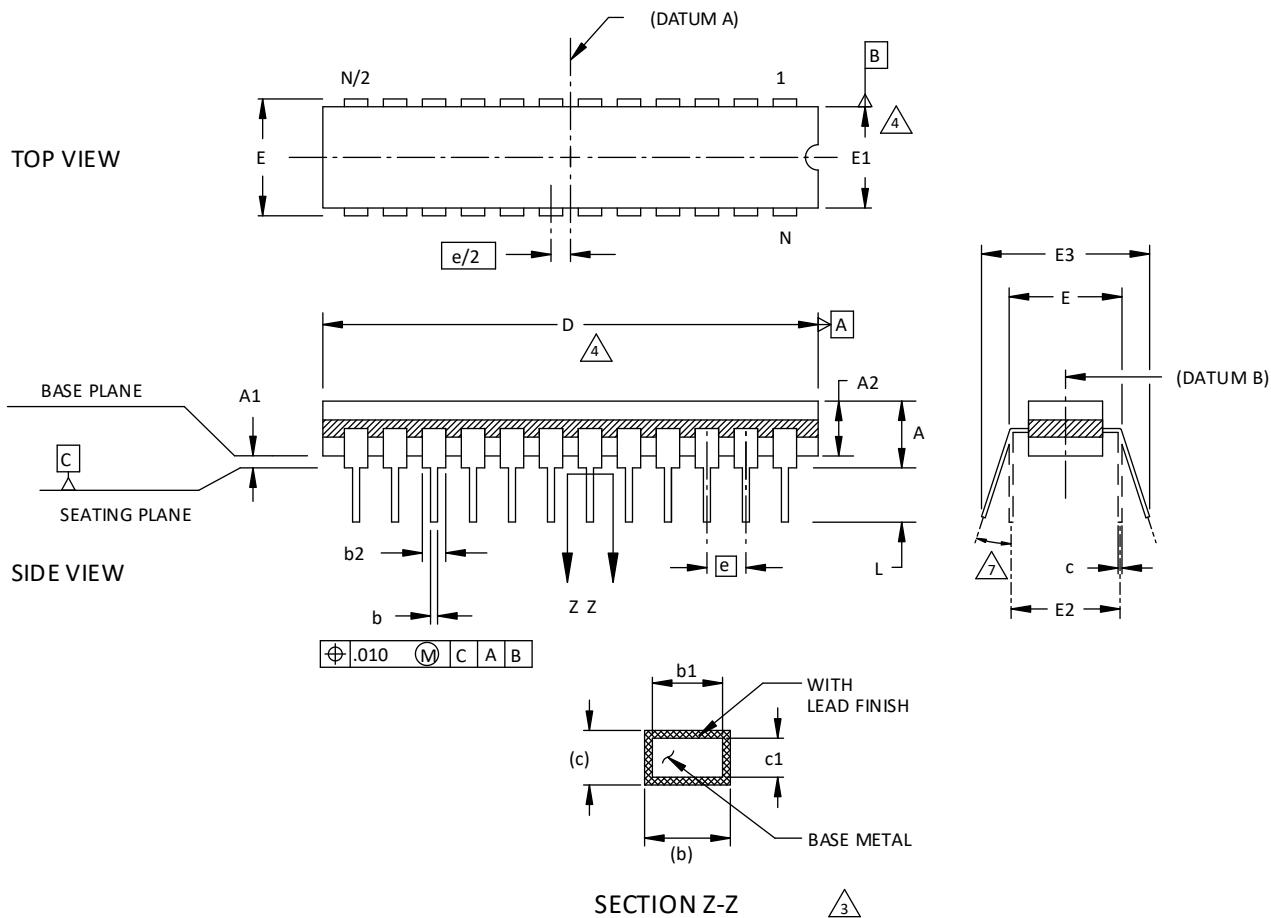
NOTES:

- CONTROLLING DIMENSION: INCH.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M
- DISTANCE BETWEEN LEADS INCLUDING DAMBAR PROTRUSIONS TO BE .005 MINIMUM.
- DIMENSIONS A, A1 & L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3.
- DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010
- E AND eA MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM  $\text{--C--}$
- eB AND eC ARE MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
- N IS THE MAXIMUM NUMBER OF LEAD POSITIONS.
- POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION
- b2 MAXIMUM DIMENSION DOES NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSIONS SHALL NOT EXCEED .010
- DATUM PLANE -H- COINCIDENT WITH THE BOTTOM OF LEAD, WHERE LEAD EXITS BODY

S Y M B O	N = 20		
	INCHES		
	MIN.	NOM.	MAX.
A	-	-	.210
A1	.015	-	-
A2	.115	.130	.195
b	.014	.018	.022
b1	.014	.018	.020
b2	.045	.060	.070
c	.008	.010	.014
c1	.008	.010	.011
D	.980	1.030	1.060
D1	.005	-	-
E	.300	.310	.325
E1	.240	.250	.280
e	.100 BSC		
eA	.300 BSC		6
eB	-	-	.430
eC	.000		.060
L	.115	.130	.150

## 7. 24-Pin (300-Mil) CERDIP

Dimensions in Inches



### NOTES:

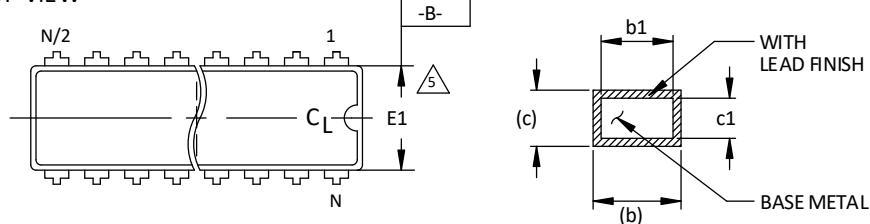
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.
3. MEASUREMENTS TO BE TAKEN AT A MINIMUM OF .060 INCHES FROM THE LEAD TIP.
4. DIMENSIONS D AND E1 INCLUDE ALLOWANCE FOR GLASS OVERRUN AND MENISCUS, AND LID TO BASE MISMATCH.
5. DIMENSIONS A, A1 AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-003.
6. E3 IS TO BE MEASURED AT THE LEAD TIPS.
7. ALLOWED LEAD TIP POSITION RANGE.

S Y M B O L	INCHES		
	MIN.	NOM.	MAX.
A	-	-	.200
A1	.015	-	-
A2	.140	-	.175
b	.015	-	.023
b1	.015	.018	.021
b2	.045	-	.065
c	.008	-	.014
c1	.008	.010	.012
D	1.242	1.250	1.270
E	.308	-	.325
E1	.280	.288	.296
E2		.300 REF	
E3	.325	-	.410
e		.100 BSC	
L	.125	-	.200
N		24	

## 8. 24-Pin Plastic DIP

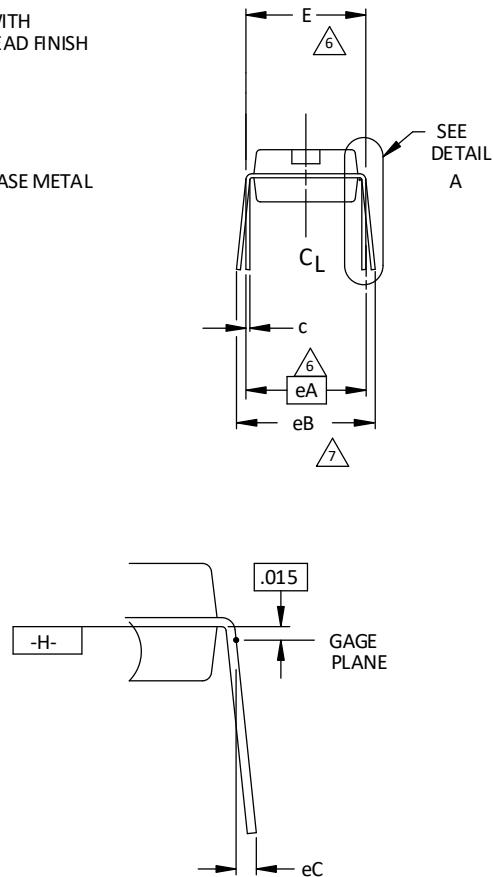
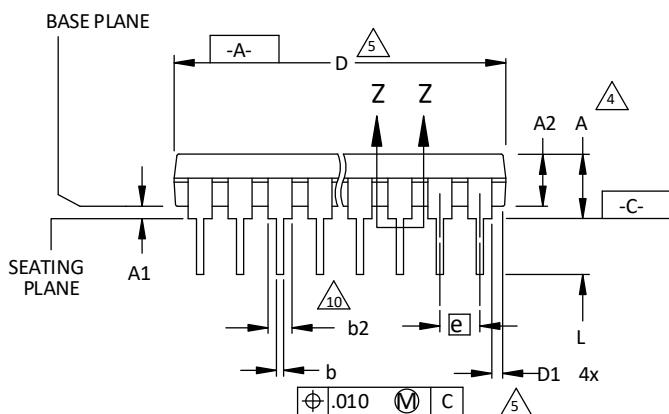
Dimensions in Inches

TOP VIEW



SECTION Z-Z

SIDE VIEW



DETAIL A

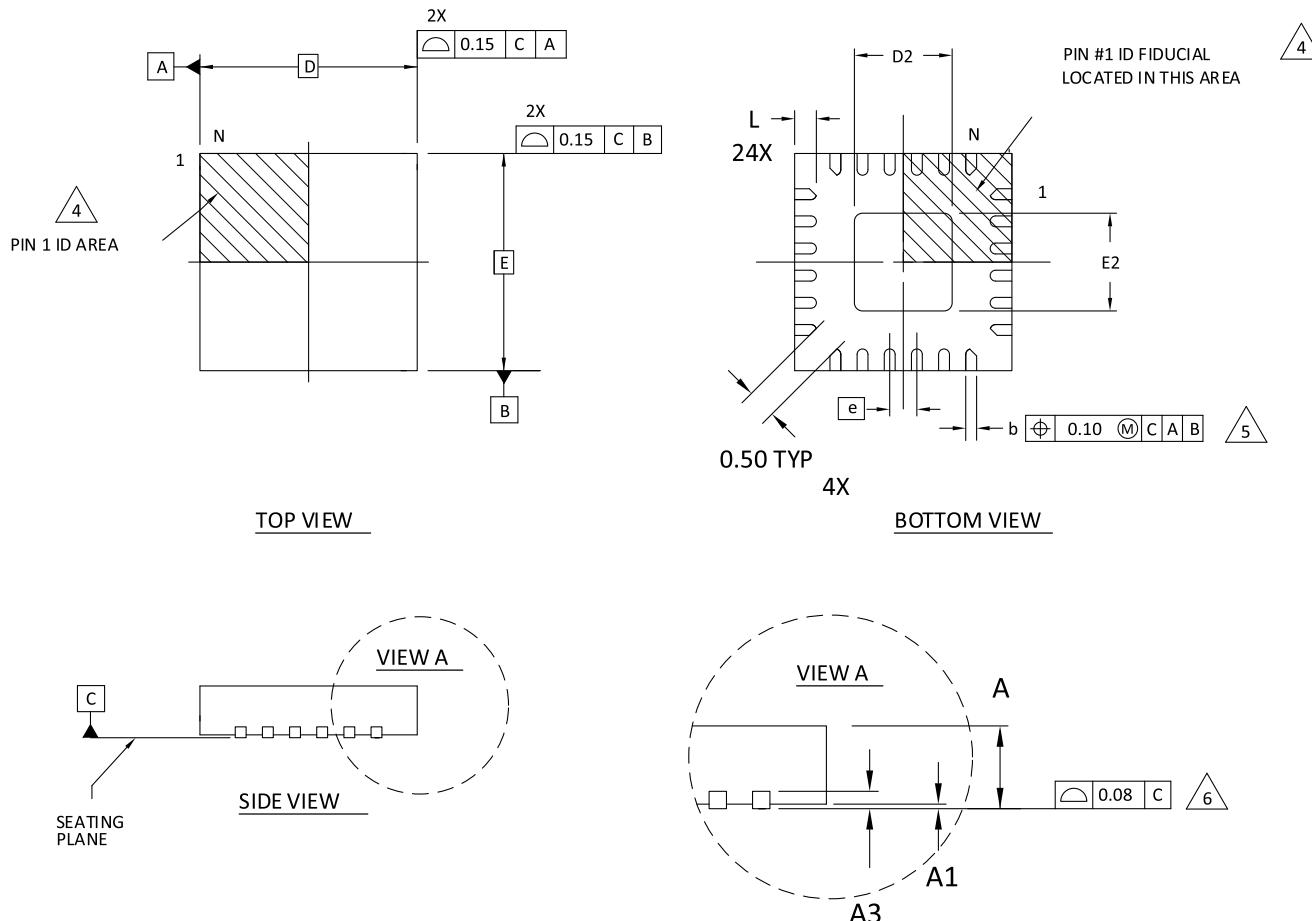
NOTES:

- CONTROLLING DIMENSION: INCH.
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
- DISTANCE BETWEEN LEADS INCLUDING DAMBAR PROTRUSIONS TO BE .005 MINIMUM.
- DIMENSIONS A, A1 & L ARE MEASURED WITH THE PACKAGE SEADED IN JEDEC SEATING PLANE GAUGE GS-3.
- DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED .010.
- E AND eA MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO DATUM -C-
- eB AND eC ARE MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED.
- N IS THE MAXIMUM NUMBER OF LEAD POSITIONS.
- POINTED OR ROUNDED LEAD TIPS ARE PREFERRED TO EASE INSERTION.
- b2 MAXIMUM DIMENSIONS DOES NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSIONS SHALL NOT EXCEED .010.
- DATUM PLANE -H- COINCIDENT WITH THE BOTTOM OF LEAD , WHERE LEAD EXITS BODY

S Y M B O L	N = 24			N O T
	INCHES			
	MIN.	NOM.	MAX.	
A	-	-	.210	4
A1	.015	-	-	4
A2	.115	.130	.195	
b	.014	.018	.022	
b1	.014	.018	.020	
b2	.045	.060	.070	10
c	.008	.010	.014	
c1	.008	.010	.011	
D	1.230	1.250	1.280	5
D1	.005	-	-	5
E	.300	.310	.325	6
E1	.240	.250	.280	5
e	.100 BSC			
eA	.300 BSC			6
eB	-	-	.430	7
eC	.000	-	.060	7
L	.115	.130	.150	

## 9. 24-Pin QFN Package

Dimensions in Millimeters



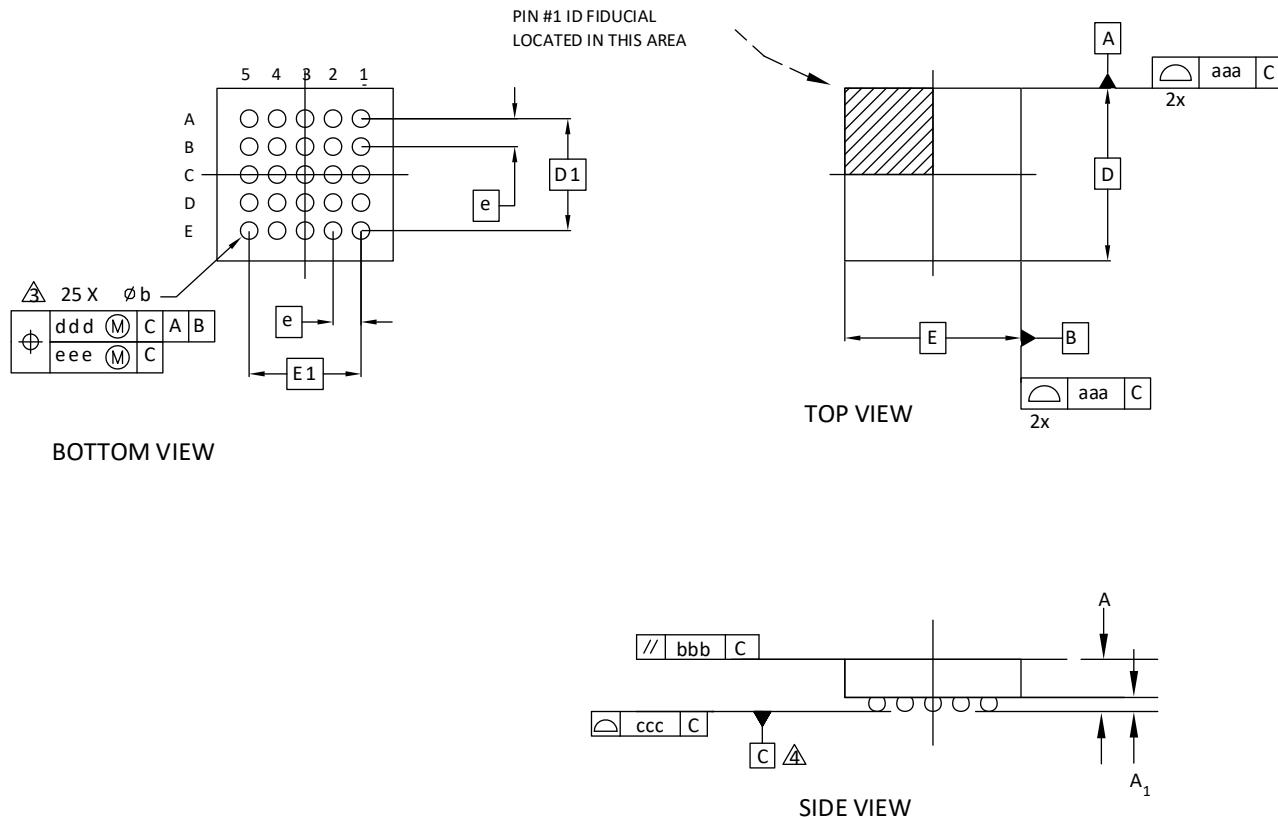
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
  3. DRAWING CONFORMS TO JEDEC MO-220, VARIATION VGGD-9.
- 4** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- 5** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
- 6** APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A3			0.2 REF
D	4.0 BSC		
D2	1.05	-	2.45
E	4.0 BSC		
E2	1.05	-	2.45
b	0.18	0.25	0.30
e	0.50 BSC		
L	0.45	0.50	0.55

## 10. 25-Ball WLCSP Package (0.40 mm Pitch)

Dimensions in Millimeters



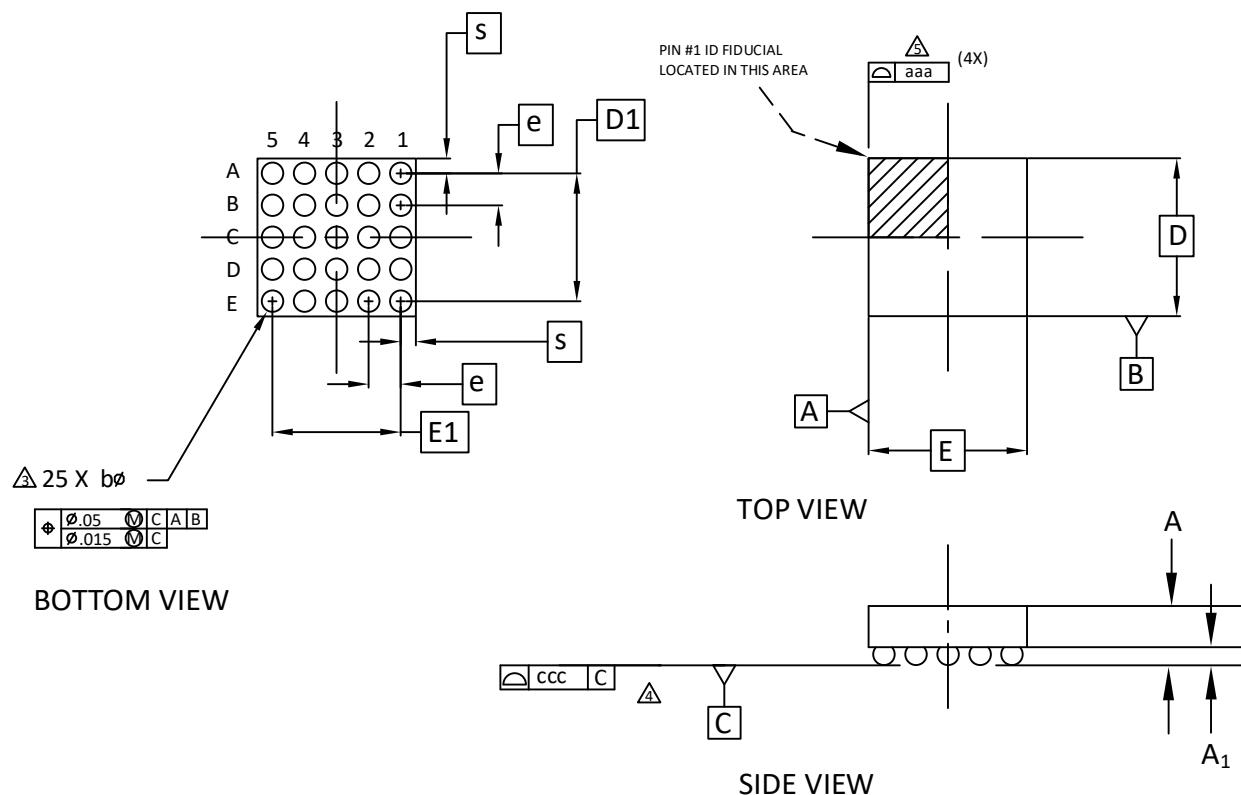
Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
- 2 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3 DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- 4 PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

REF.	Min.	Nom.	Max.
A	0.535	0.575	0.615
A1	0.170	0.200	0.230
b	0.220	0.250	0.280
D	2.492	BSC	
E	2.546	BSC	
D1	1.60	BSC	
E1	1.60	BSC	
e	0.40	BSC	
aaa	0.025		
bbb	0.060		
ccc	0.015		
ddd	0.150		
eee	0.050		

## 11. 25-Ball WLCSP Package (0.35 mm Pitch)

Dimensions in Millimeters



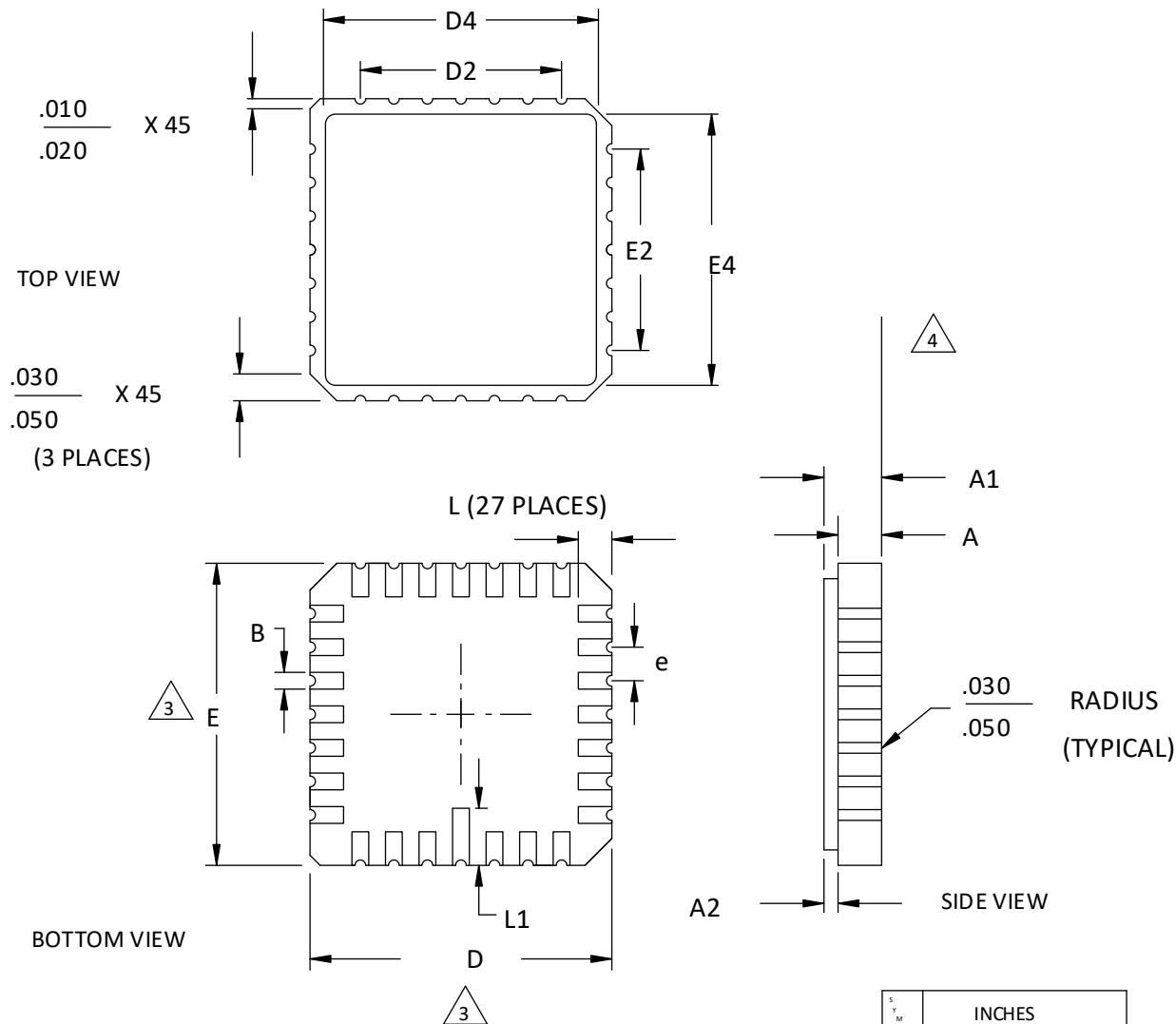
Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
- 2 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3 DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- 4 PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.
- 5 BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

REF.	Min.	Nom.	Max.
A	0.413	0.452	0.491
A1	0.122	0.152	0.182
b	0.188	0.218	0.248
D		1.71 BSC	
E		1.71 BSC	
D1		1.40 BSC	
E1		1.40 BSC	
e		0.35 BSC	
aaa		0.03	
ccc		0.03	
S	—	0.015	—

## 12. 28-Pin LCC Package

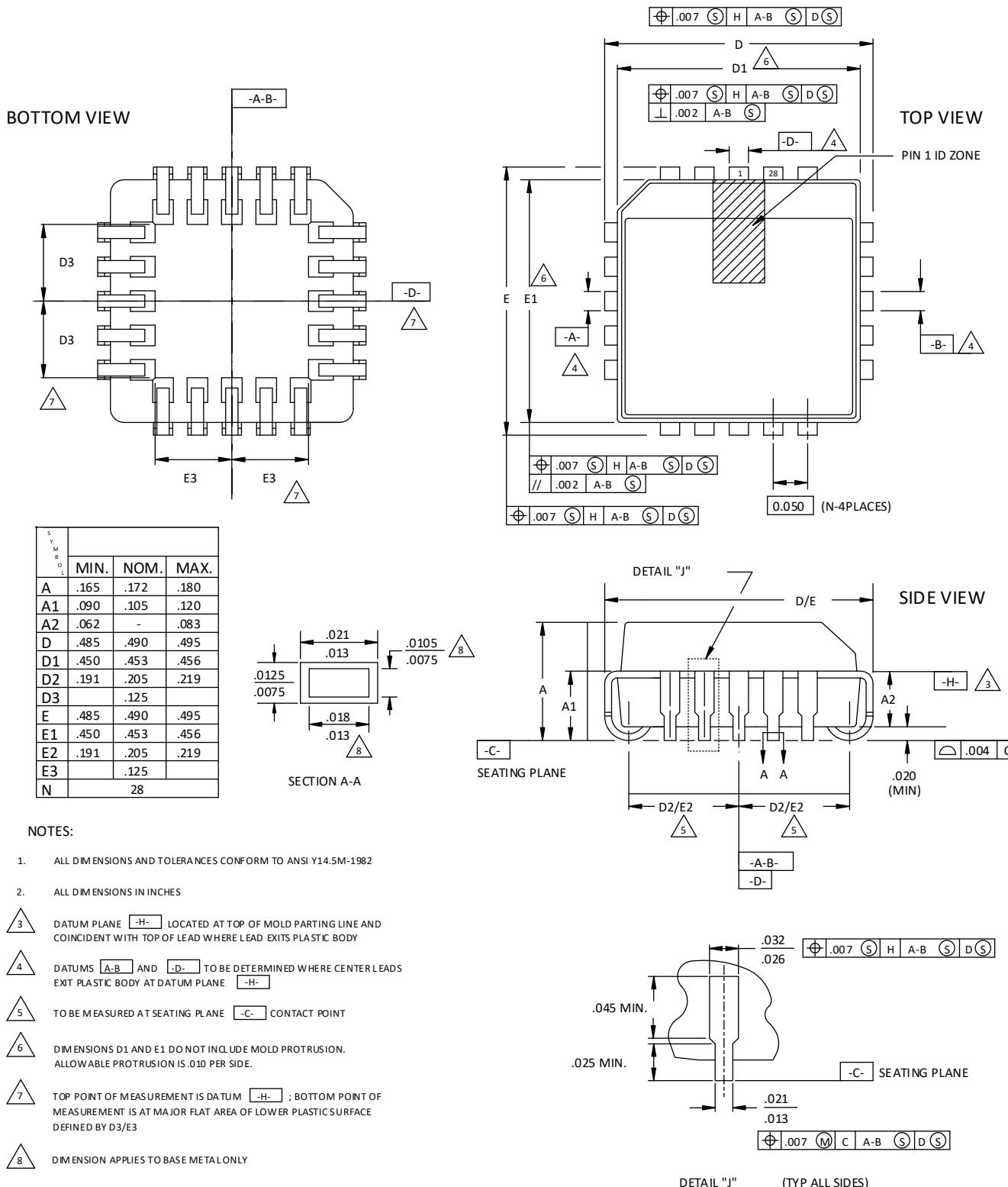
Dimensions in Inches



S Y M B O L	INCHES	
	MIN.	MAX.
A	.054	.074
A1	.064	.089
A2	.007	.015
B	.022	.028
D	.440	.460
D2	.300	
D4	.370	.403
E	.440	.460
E2	.300	
E4	.370	.403
e	.050 BSC	
L	.042	.058
L1	.075	.095

## 13. 28-Pin PLCC Package

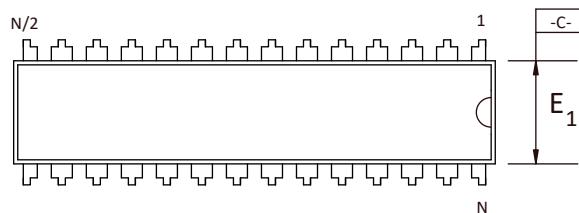
Dimensions in Inches



## 14. 28-Pin Plastic DIP Package

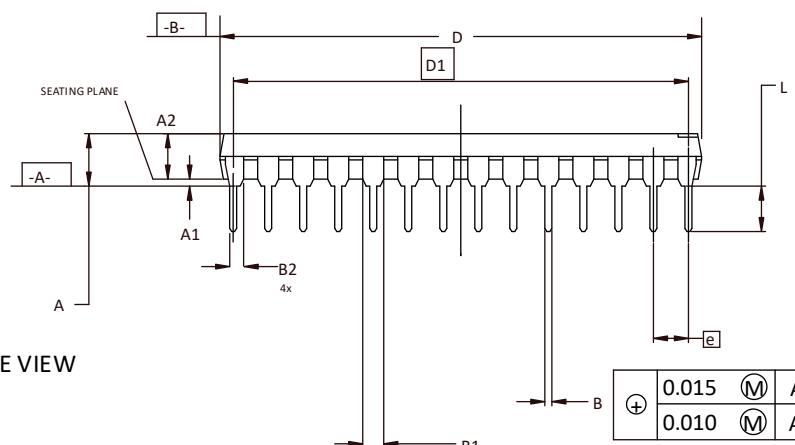
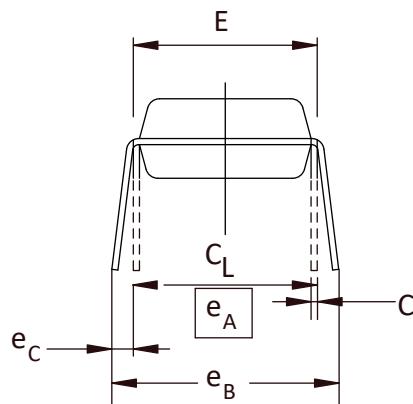
Dimensions in Inches

TOP VIEW



NOTE:

- 1 CONTROLLING DIMENSION: INCHES
- 2 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M-1982
- 3 ALL END LEADS IN THIS FAMILY ARE 1/2 LEADS
- 4 DIMENSION A, A1, AND L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3
- 5 D AND E1 DIMENSIONS DO NOT INCLUDE MOLD FLASH OR PROTRUSION. MOLD FLASH AND PROTRUSION SHALL NOT EXCEED 0.010
- 6 E AND eA MEASURED WITH THE LEADS CONSTRAINED TO BE PERPENDICULAR TO PLANE A
- 7 eB AND eC ARE MEASURED AT THE LEAD TIPS WITH THE LEADS UNCONSTRAINED. eC MUST BE ZERO OR GREATER
- 8 N IS THE NUMBER OF TERMINAL POSITIONS
- 9 B1 AND B2 MAXIMUM DIMENSIONS DO NOT INCLUDE DAMBAR PROTRUSIONS. DAMBAR PROTRUSIONS SHALL NOT EXCEED 0.010

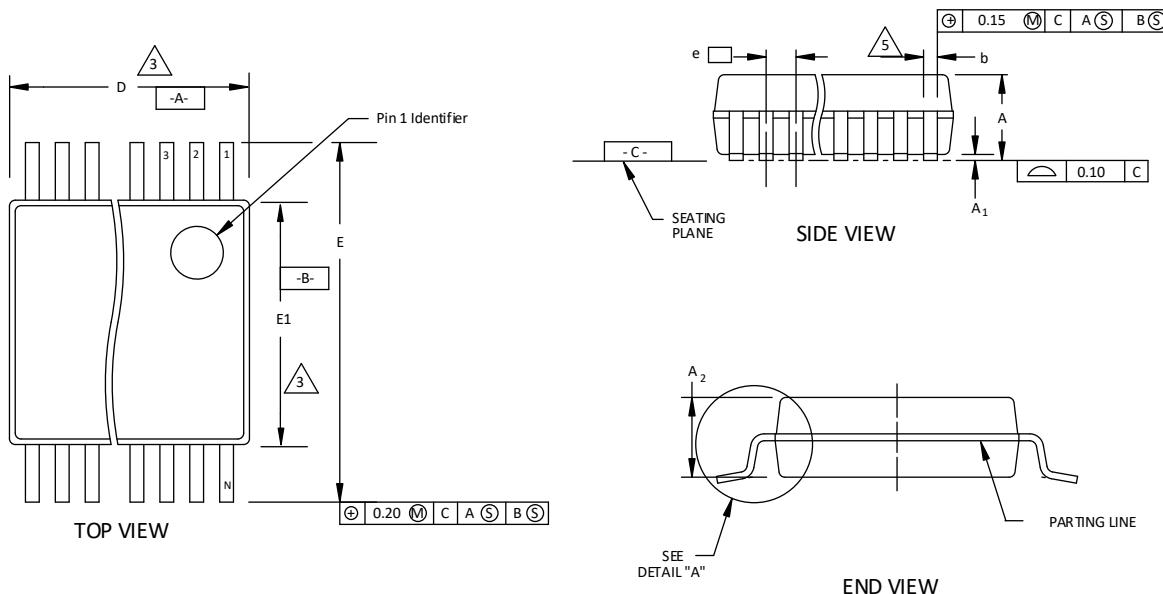


S Y M B O L	INCHES		
	MIN.	NOM.	MAX.
A	-	-	.180
A <sub>1</sub>	.015	-	-
A <sub>2</sub>	.120	.135	.150
B	.014	.018	.022
B <sub>1</sub>	.045	.050	.060
B <sub>2</sub>	.030	.040	.045
C	.008	.010	.015
D	1.345	1.365	1.385
D1	1.300 BSC		
E	.300	.310	.325
E <sub>1</sub>	.275	.285	.295
e	.100 BSC		
e <sub>A</sub>	.300 BSC		
e <sub>B</sub>	-	-	.430
e <sub>C</sub>	.000	-	.060
L	.110	.130	.150
N	28		

SIDE VIEW

## 15. 28-Pin SSOP Package

Dimensions in Millimeters



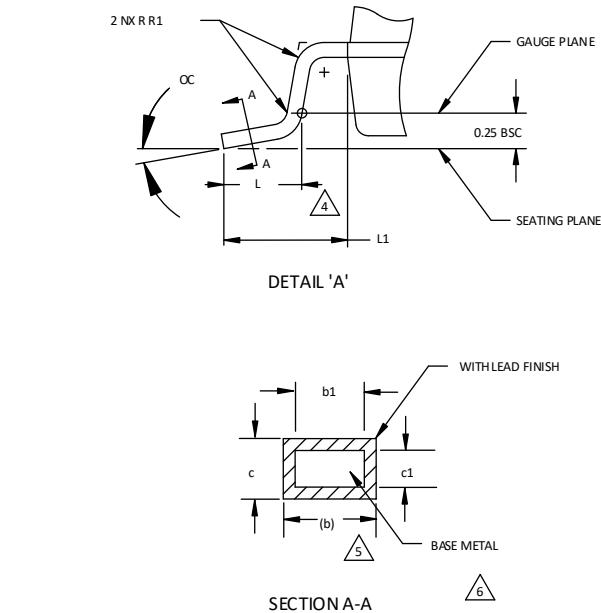
S Y M B O L	COMMON DIMENSIONS		
	MIN.	NOM.	MAX.
A	--	--	2.0
A <sub>1</sub>	0.05	--	--
A <sub>2</sub>	1.65	1.75	1.85
b	0.22	-	0.38
b <sub>1</sub>	0.22	0.30	0.33
c	0.09	--	0.25
c <sub>1</sub>	0.09	0.15	0.21
D	9.90	10.20	10.50
E <sub>1</sub>	5.00	5.30	5.60
e	0.65 BSC		
E	7.40	7.80	8.20
L	0.55	0.75	0.95
L <sub>1</sub>	1.25 REF.		
N	28		
O <sub>C</sub>	0	4	8
R <sub>1</sub>	0.09	--	--

NOTES:

- CONTROLLING DIMENSION: MILLIMETERS.
- DIMENSIONING & TOLERANCES PER ANSI.Y14.5M-1982.

**△** "D" & "E<sub>1</sub>" DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS, BUT DO INCLUDE MOLD MISMATCH AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.20mm PER SIDE.

**△** TO BE DETERMINED AT THE SEATING PLANE



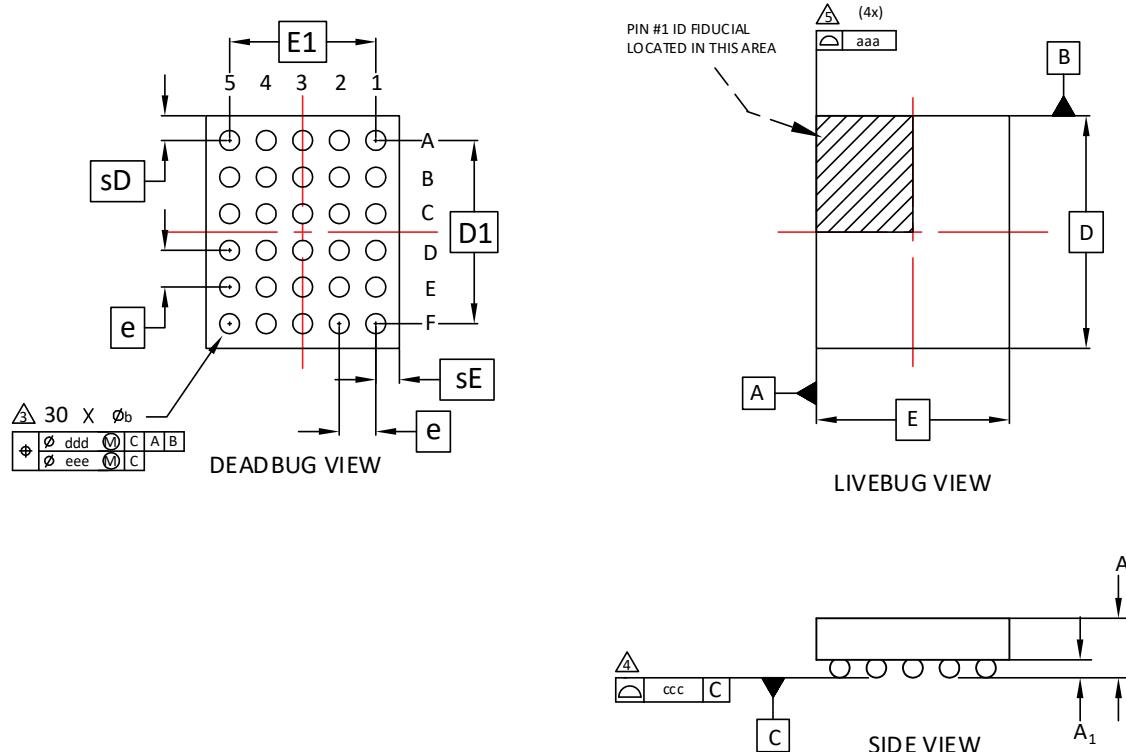
**△** DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13mm TOTAL IN EXCESS OF b DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION b BY MORE THAN 0.07mm AT LEAST MATERIAL CONDITION.

**△** THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 & 0.25mm FROM THE LEAD TIP

7. "N" IS THE NUMBER OF TERMINAL POSITIONS

## 16. 30-Ball WLCSP Package

Dimensions in Millimeters



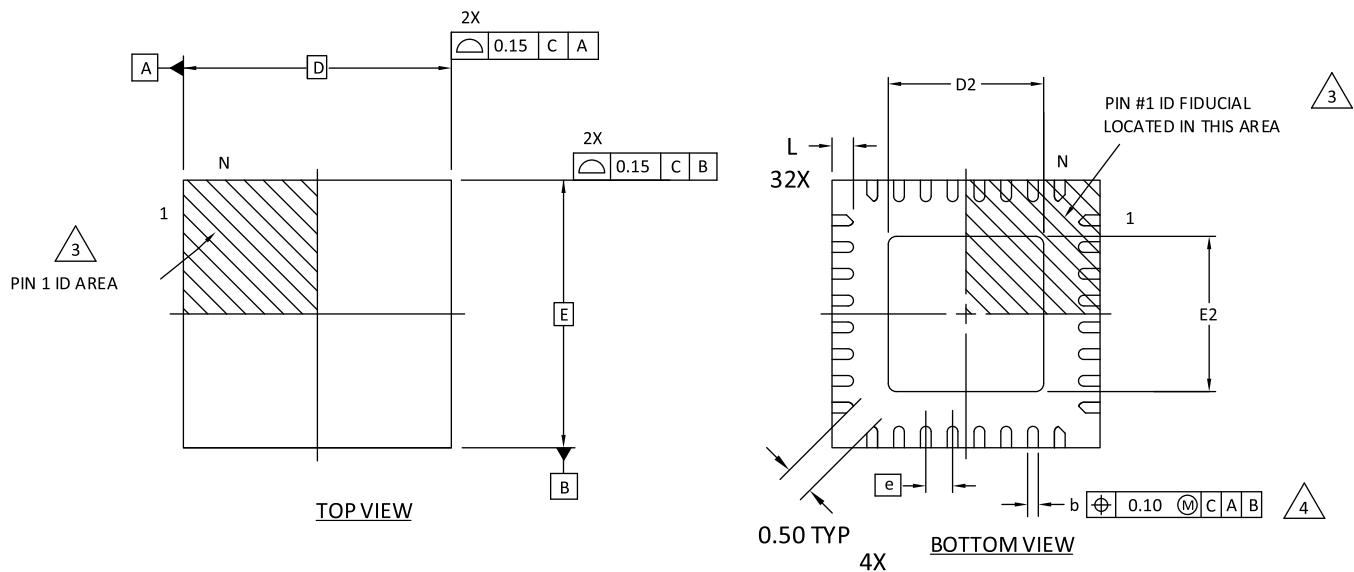
### Notes:

- ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M – 1994.
- ALL DIMENSIONS ARE IN MILLIMETERS
- DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.**
- PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.**
- BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.**

REF.	Min.	Nom.	Max.
A	-	-	0.600
A1	0.140	-	-
b	0.230	0.260	0.290
D	2.537	BSC	
E	2.114	BSC	
D1	2.00	BSC	
E1	1.60	BSC	
e		0.40	
sD	-	0.27	-
sE	-	0.26	-
aaa		0.030	
ccc		0.050	
ddd		0.015	
eee		0.050	

## 17. 32-Pin QFN Package Option 1: Power Manager II, iCE40

Dimensions in Millimeters



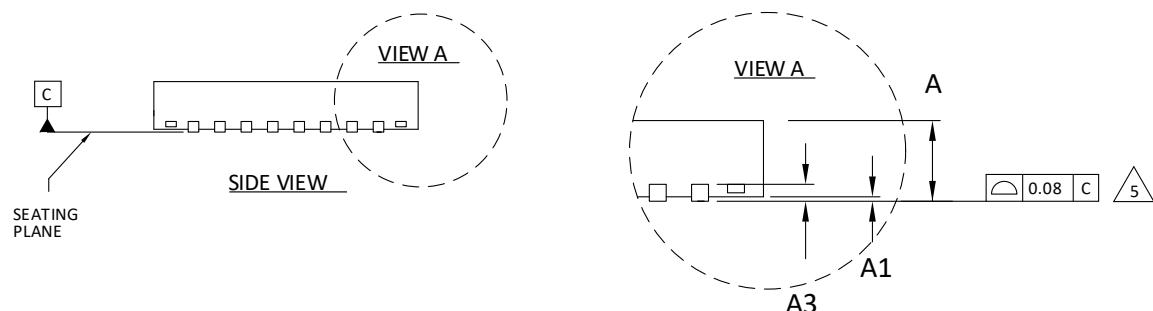
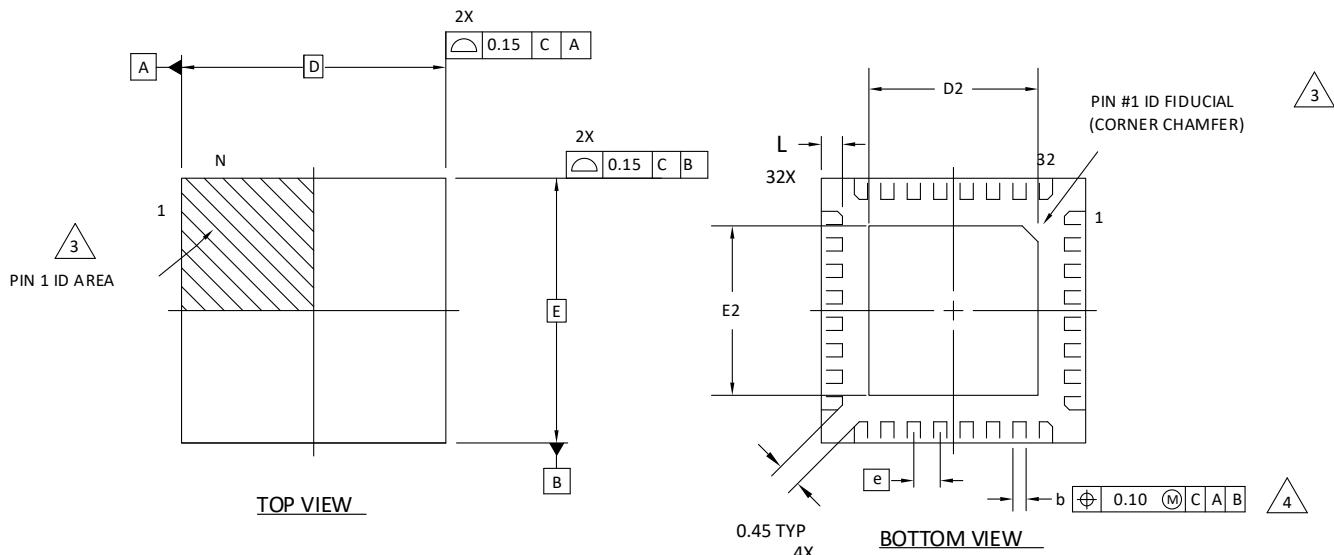
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- 4** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
- 5** APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A3	0.2 REF		
D	5.0 BSC		
D2	1.25	2.70	3.75
E	5.0 BSC		
E2	1.25	2.70	3.75
b	0.18	0.24	0.30
e	0.50 BSC		
L	0.30	0.40	0.50

## 18. 32-Pin QFN Package Option 2: MachXO2™ 256HC/ZE

Dimensions in Millimeters



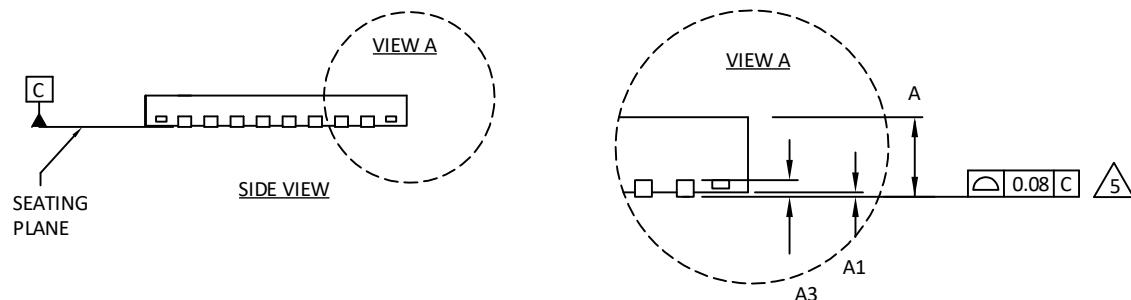
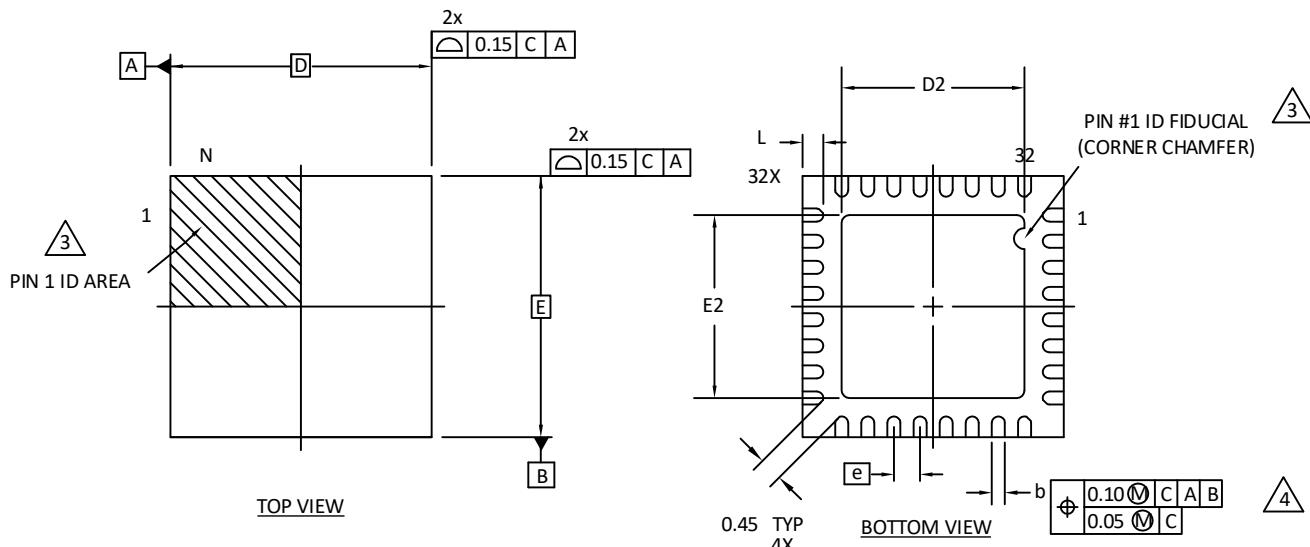
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- 4** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
- 5** APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	0.50	0.55	0.60
A1	0.00	0.02	0.05
A3                    0.2 REF			
D	5.0 BSC		
D2	3.10	3.20	3.30
E	5.0 BSC		
E2	3.10	3.20	3.30
b	0.20	0.25	0.30
e	0.50 BSC		
L	0.35	0.40	0.45

## 19. 32-Pin QFN Package Option 3: MachXO2 1200HC/ZE

Dimensions in Millimeters



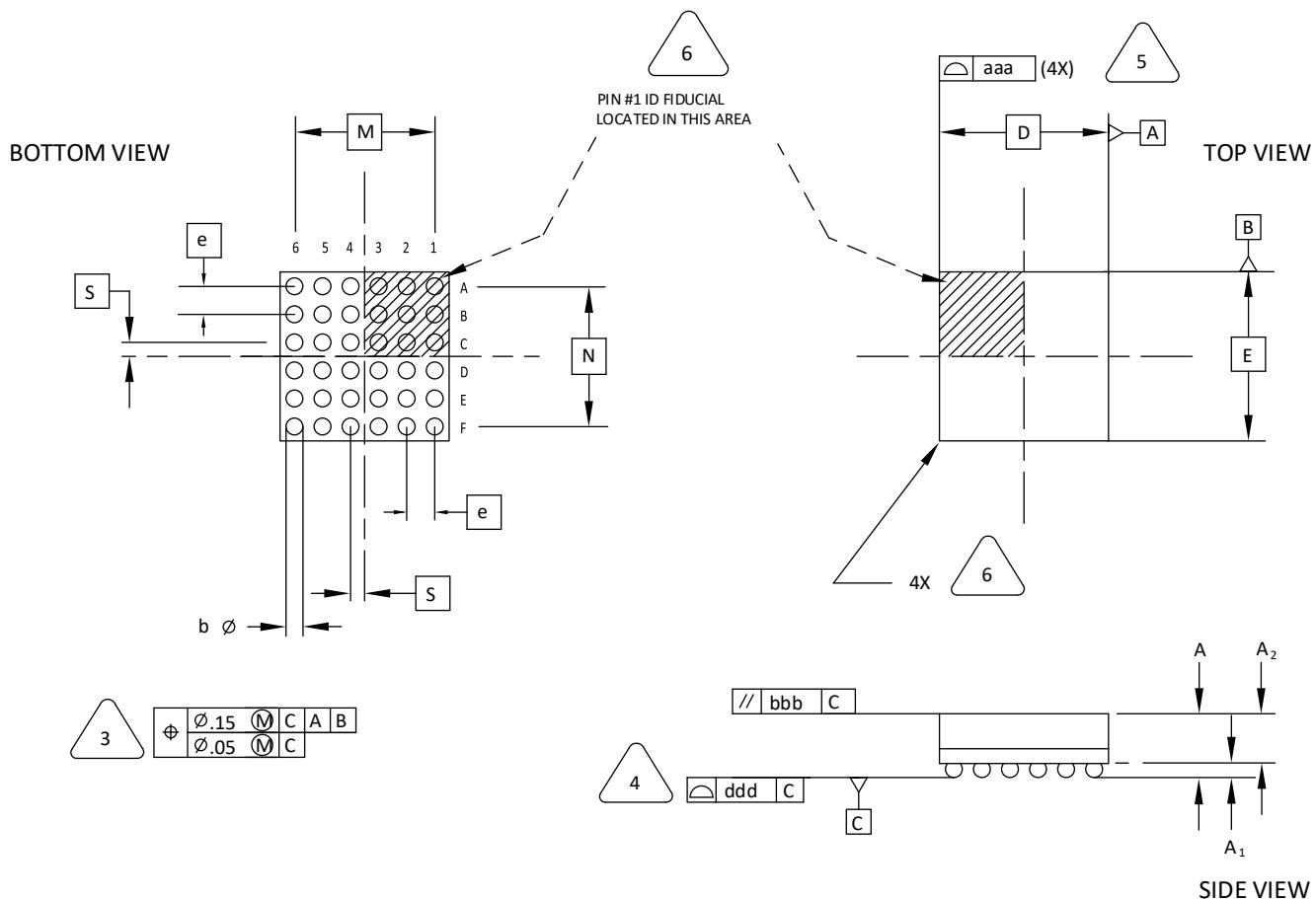
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
5. APPLIES TO EXPOSED PORTION OF TERMINALS.
6. JEDEC REFERENCE MO-248 AND DR-4.2.

SYMBOL	MIN.	NOM.	MAX.
A	0.50	0.55	0.65
A1	0.00	0.02	0.05
A3			0.02 REF
D			5.0 BSC
D2	3.40	3.50	3.60
E	5.0 BSC		
E2	3.40	3.50	3.60
b	0.18	0.25	0.30
e	0.50 BSC		
L	0.35	0.40	0.45

## 20. 36-Ball ucBGA Package

Dimensions in Millimeters



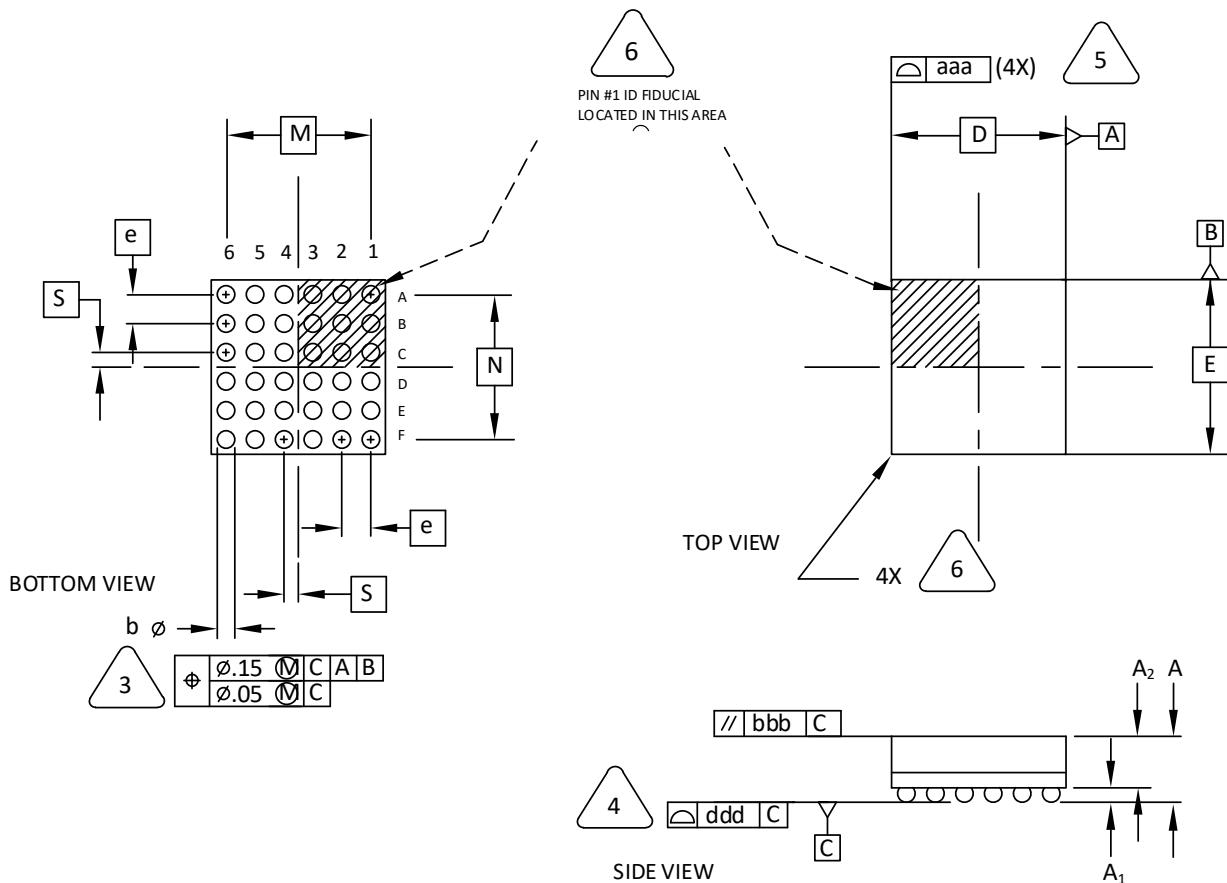
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- Callout 3:** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C
- Callout 4:** PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- Callout 5:** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- Callout 6:** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	2.50	BSC	
M/N	2.00	BSC	
S	0.20	BSC	
b	0.20	0.25	0.30
e	0.40	BSC	
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 21. 36-Ball ucfBGA Package: iCE40 Ultra™

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

**3**  
DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.

**4**  
PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

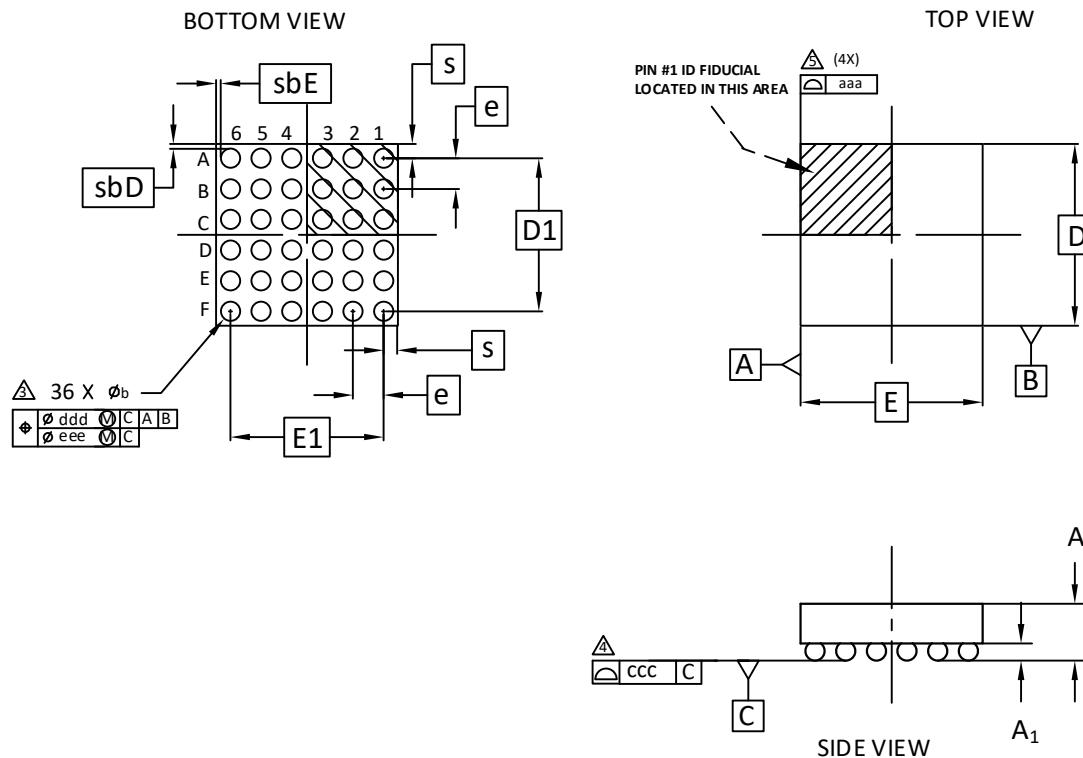
**5**  
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

**6**  
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	0.81	0.91
A1	0.12	-	-
A2	-	-	0.70
D/E	2.50 BSC		
M/N	2.00 BSC		
S	0.20 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 22. 36-Ball WLCSP Package Option 1: iCE40 Ultra

Dimensions in Millimeters



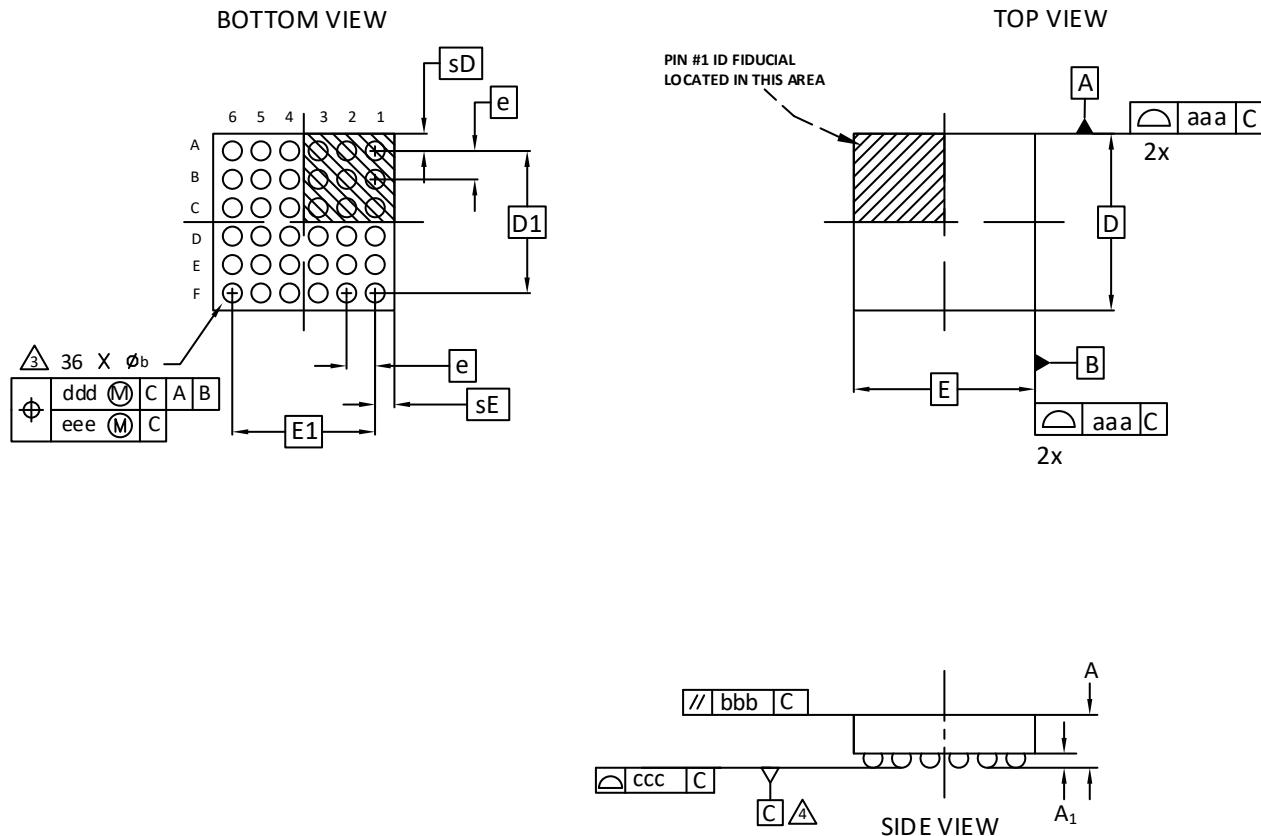
NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- △ DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].
- △ PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.
- △ BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

REF.	Min.	Nom.	Max.
A	0.413	0.452	0.491
A1	0.122	0.152	0.182
b	0.188	0.218	0.248
D	2.078 BSC		
E	2.078 BSC		
D1	1.75 BSC		
E1	1.75 BSC		
e	0.35 BSC		
s	0.157	0.164	0.172
sbD	0.051	0.055	0.056
sbE	0.051	0.055	0.056
aaa		0.030	
ccc		0.030	
ddd		0.015	
eee		0.050	

## 23. 36-Ball WLCSP Package Option 2: MachXO2, MachXO3™

Dimensions in Millimeters



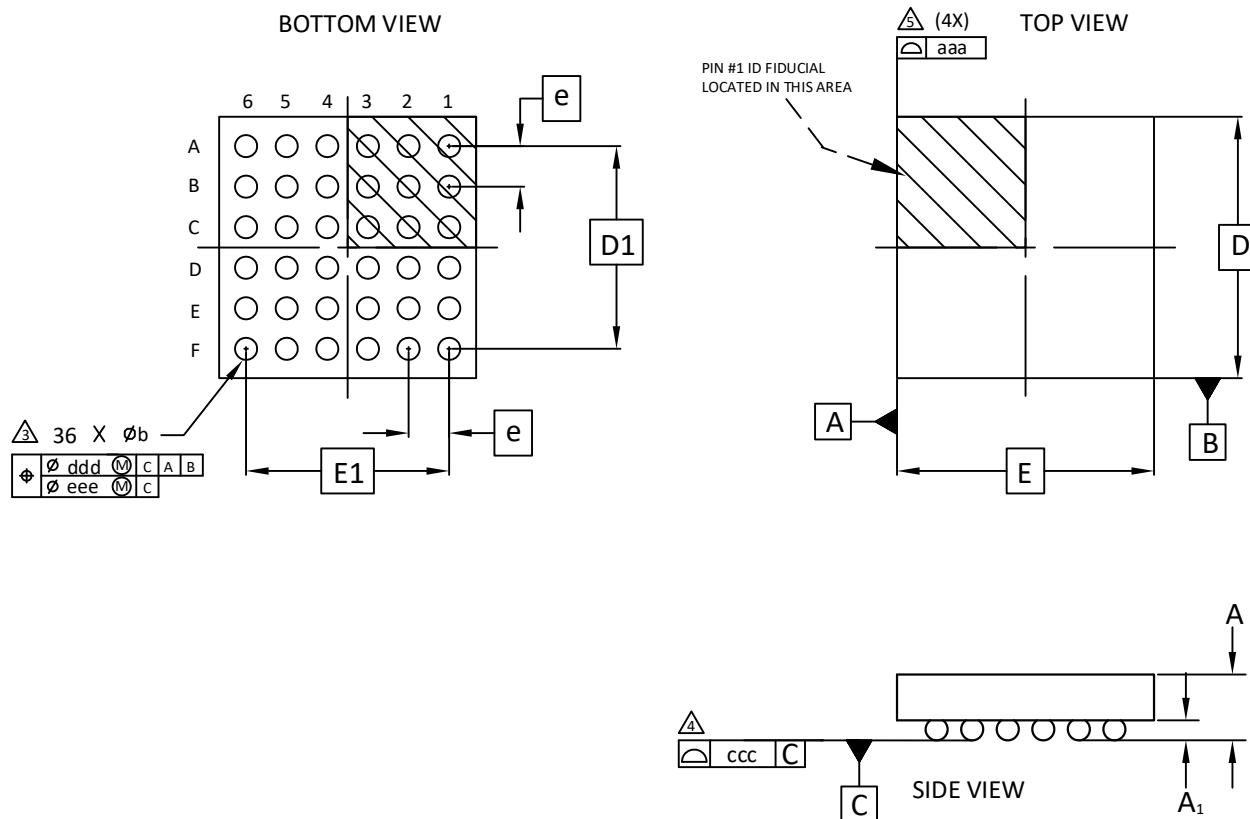
NOTES:

- ALL DIMENSIONS AND TOLERANCE PER ASME Y14.5M - 1994.
  - ALL DIMENSIONS ARE IN MILLIMETERS.
- ⚠ DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].
- ⚠ PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

REF.	Min.	Nom.	Max.
A	0.510	0.543	0.576
A1	0.167	0.196	0.225
b	0.239	0.266	0.319
D		2.487 BSC	
E		2.541 BSC	
D1		2.00 BSC	
E1		2.00 BSC	
e		0.40 BSC	
sD	-	0.244	-
sE	-	0.271	-
aaa		0.025	
bbb		0.060	
ccc		0.030	
ddd		0.0150	
eee		0.050	

## 24. 36-Ball WLCSP Package Option 3: CrossLink™

Dimensions in Millimeters

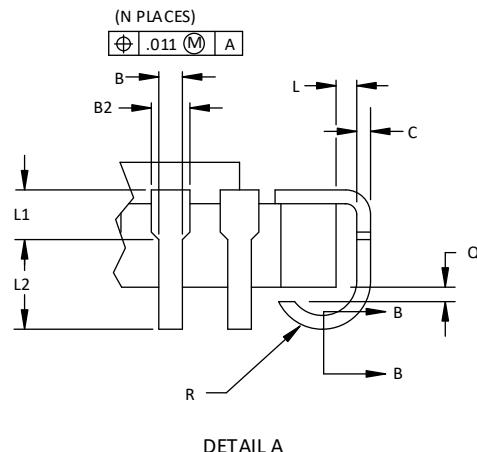
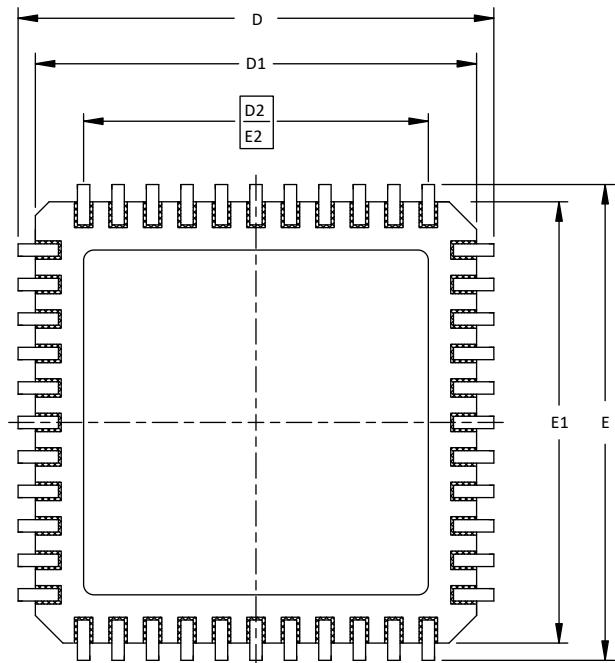


REF.	Min.	Nom.	Max.
A	-	-	0.600
A1	0.113	-	-
b	0.188	0.218	0.248
D	2.535	BSC	
E	2.583	BSC	
D1	2.00	BSC	
E1	2.00	BSC	
e	0.40	BSC	
aaa	0.030		
ccc	0.050		
ddd	0.050		
eee	0.015		

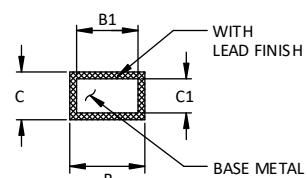
## 25. 44-Pin JLCC Package

Dimensions in Inches

BOTTOM VIEW

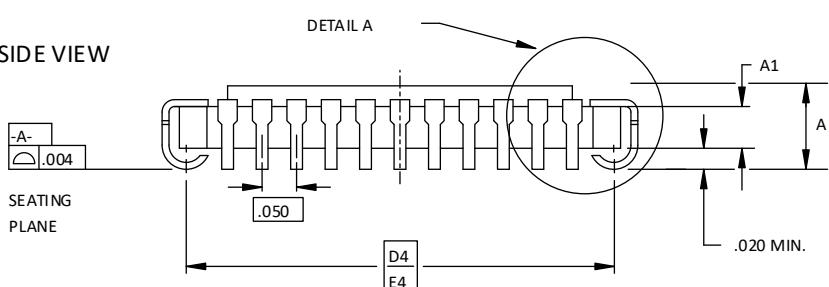


DETAIL A



SECTION B-B

SIDE VIEW



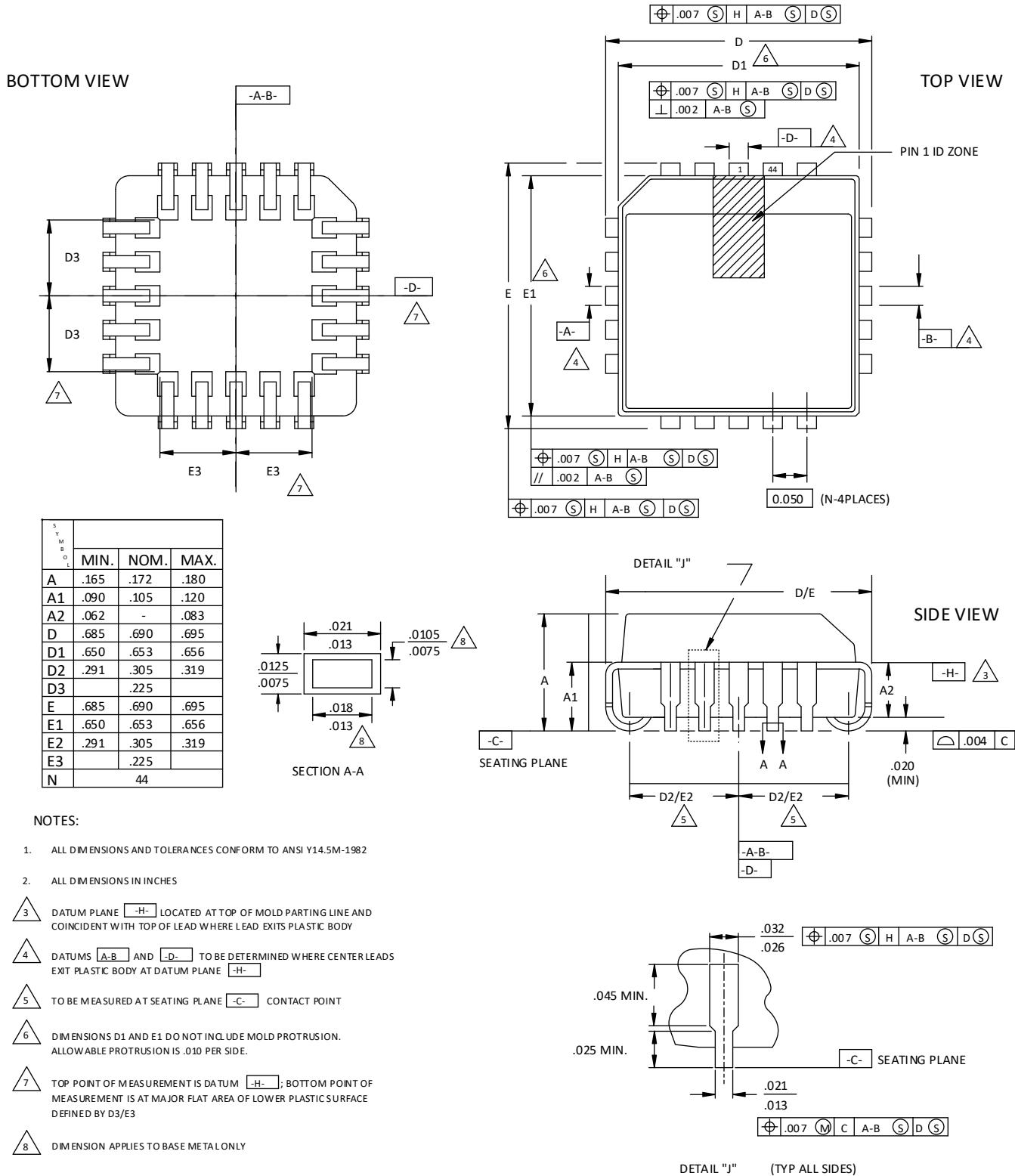
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.
3. CORNER CHAMFERS AND/OR NOTCHES ARE OPTIONAL.

S Y M B O L	INCHES		
	MIN.		MAX.
A	.115	-	.190
A1	.065	REF	
B	.013	-	.023
B1	.013	-	.020
B2	.022	-	.035
C	.007	-	.013
C1	.007	-	.010
D/E	.675	.690	.700
D1/E1	.620	-	.660
D2/E2	.500 BSC		
D4/E4	.630 BSC		
L	.005	-	-
L1	.020	-	-
L2	.025	-	-
Q	.003	-	-
R	.020	-	.040
N	44		

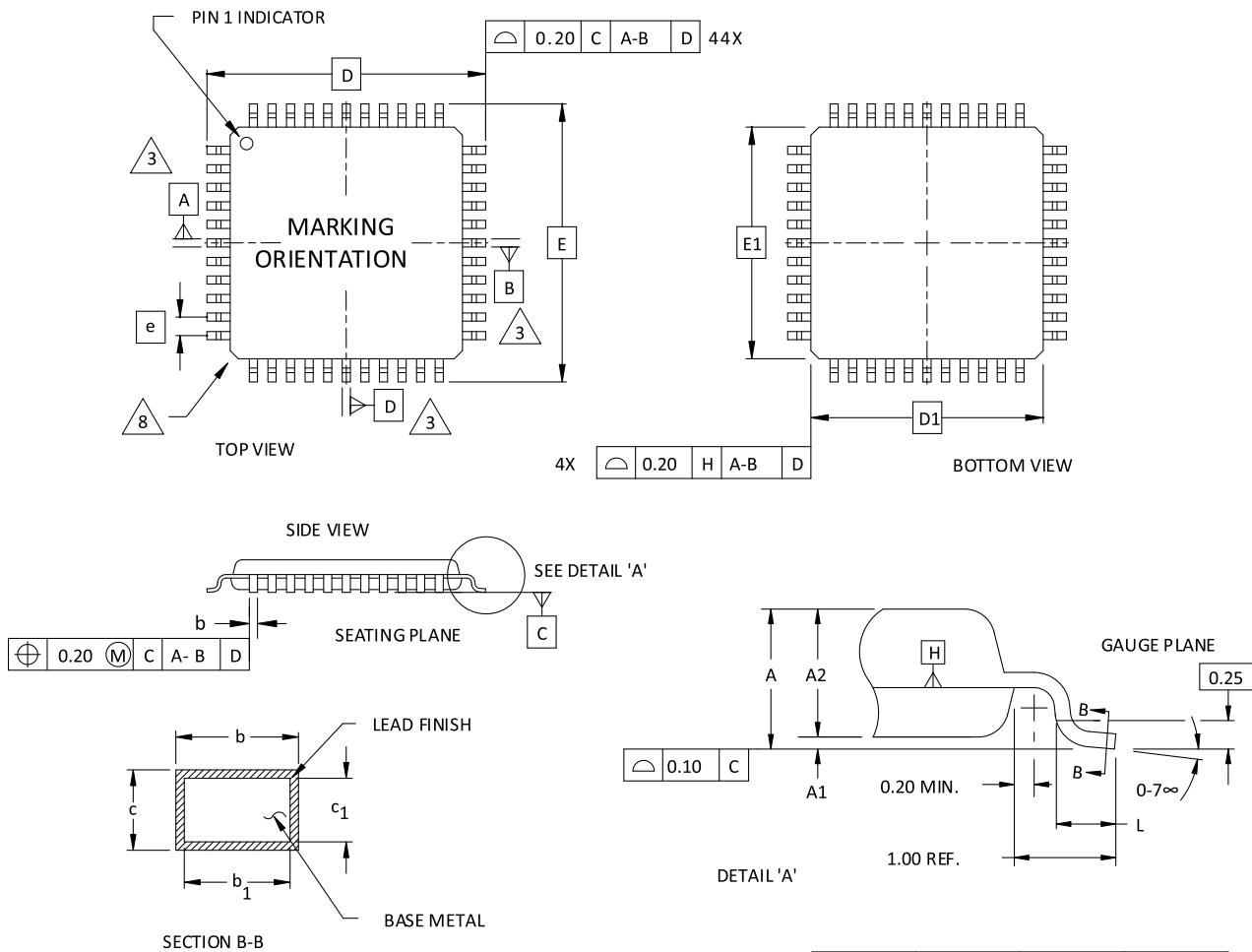
## 26. 44-Pin PLCC Package

Dimensions in Inches



## 27. 44-Pin TQFP Package

Dimensions in Millimeters



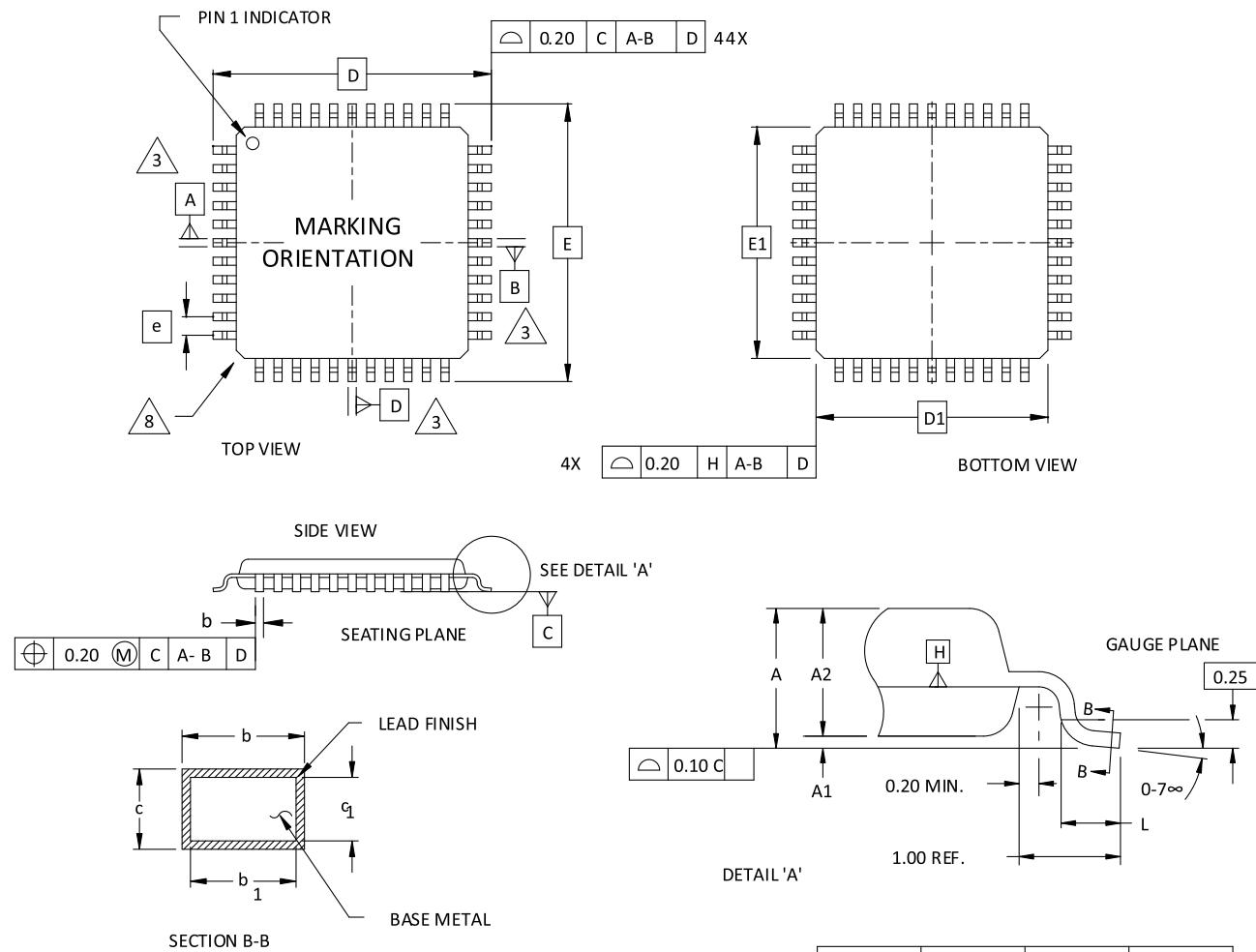
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.05	-	0.15
A2	.95	1.00	1.05
D	12.00 BSC		
D1	10.00 BSC		
E	12.00 BSC		
E1	10.00 BSC		
L	0.45	0.60	0.75
N	44		
e	0.80 BSC		
b	0.30	0.37	0.45
b1	0.30	0.35	0.40
c	0.09	0.15	0.20
C1	0.09	0.13	0.16

## 28. 44-Pin LQFP Package

Dimensions in Millimeters



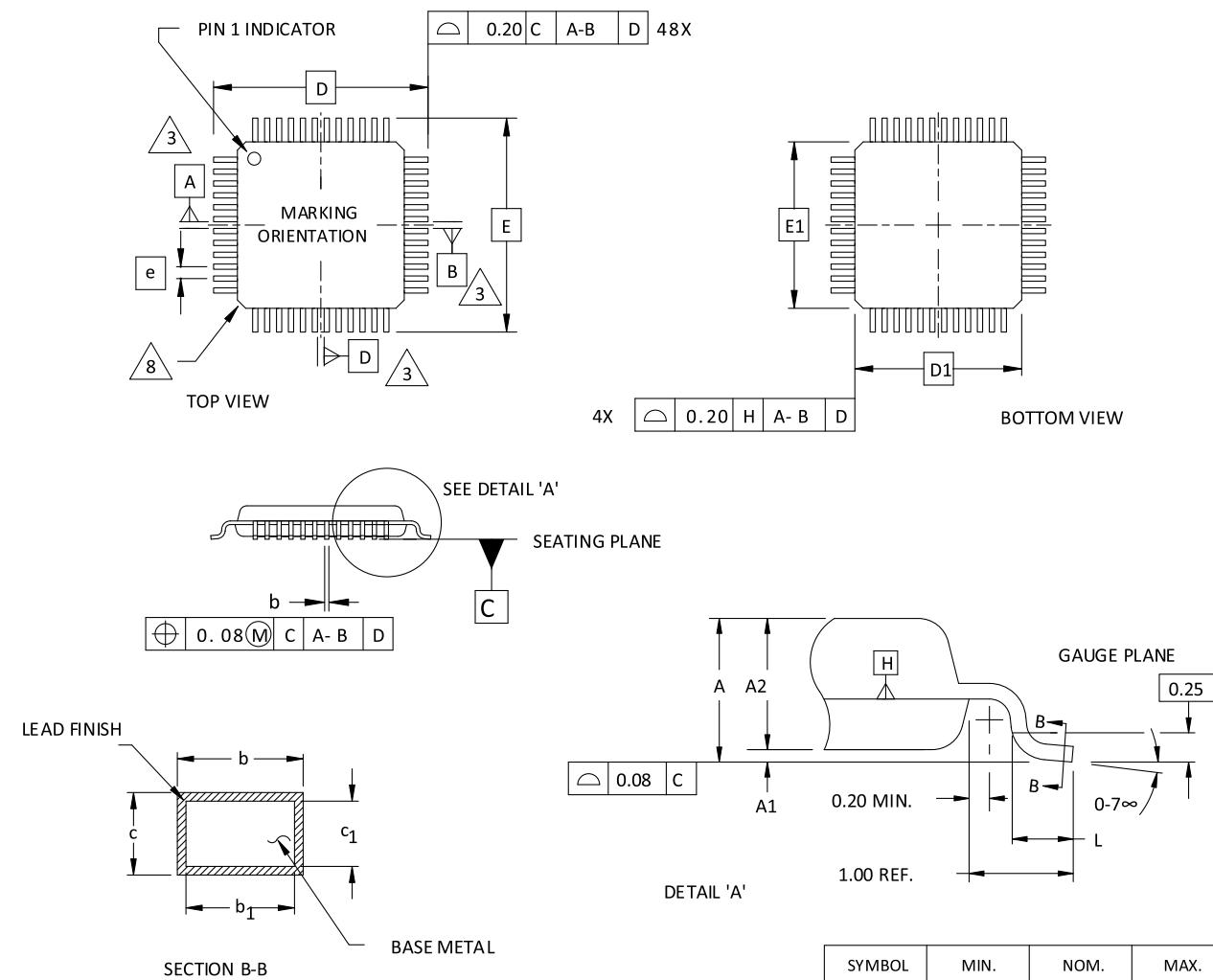
### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D	12.00	BSC	
D1	10.00	BSC	
E	12.00	BSC	
E1	10.00	BSC	
L	0.45	0.60	0.75
N		44	
e		0.80	BSC
b	0.30	0.37	0.45
b1	0.30	0.35	0.40
c	0.09	0.15	0.20
C1	0.09	0.13	0.16

## 29. 48-Pin TQFP Package

Dimensions in Millimeters



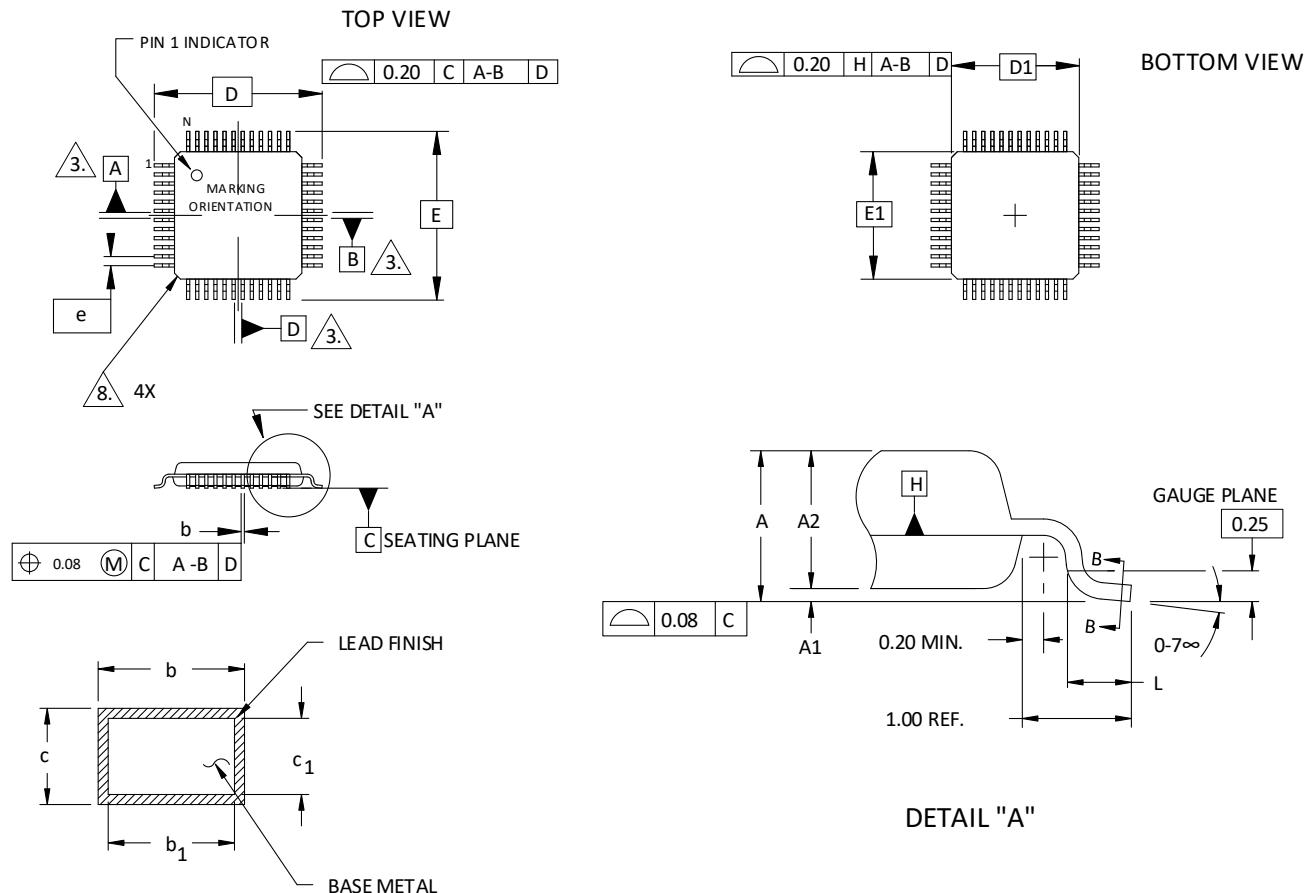
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.05	-	0.15
A2	.95	1.00	1.05
D		9.00 BSC	
D1		7.00 BSC	
E		9.00 BSC	
E1		7.00 BSC	
L	0.45	0.60	0.75
N		48	
e		0.50 BSC	
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
c	0.09	0.15	0.20
c1	0.09	0.13	0.16

## 30. 48-Pin LQFP Package

Dimensions in Millimeters



### SECTION B - B

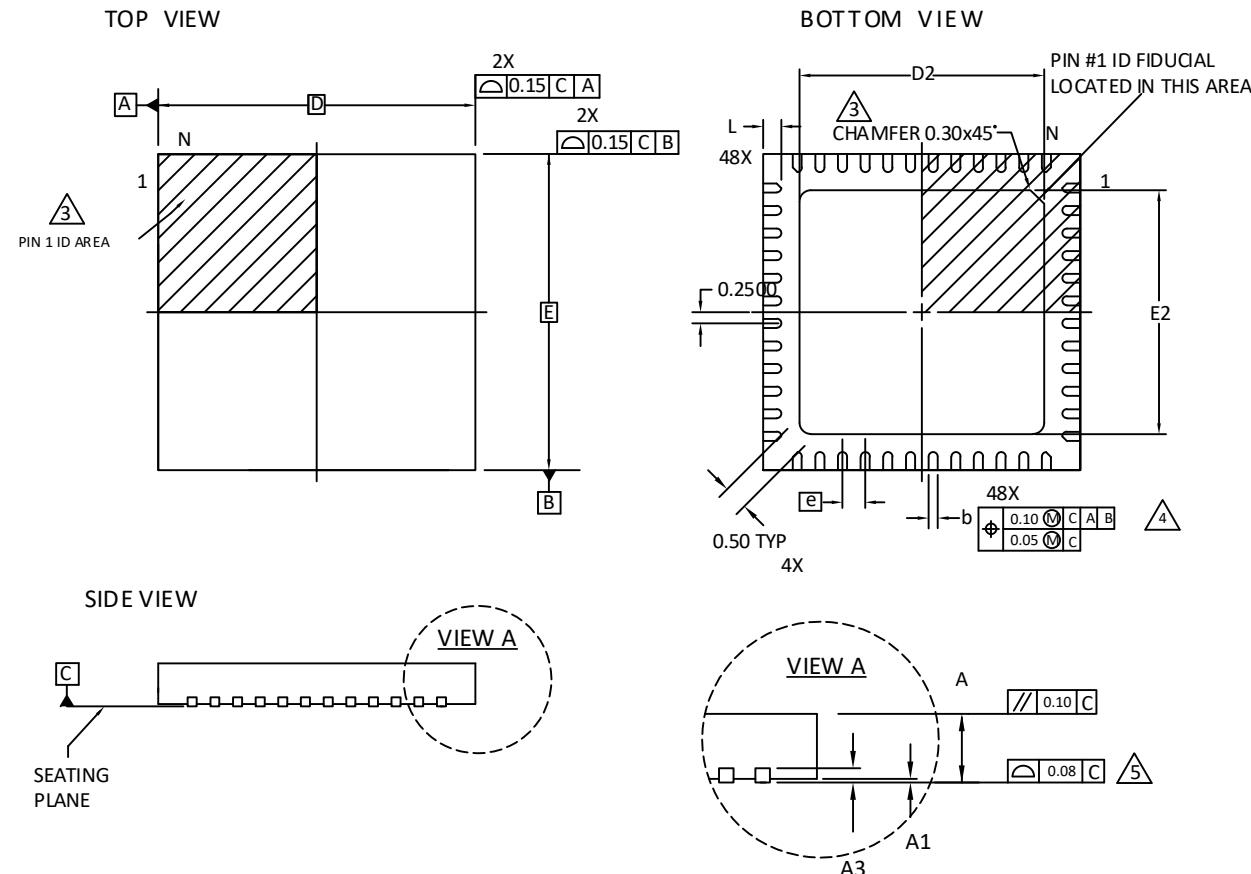
#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D	9.00 BSC		
D1	7.00 BSC		
E	9.00 BSC		
E1	7.00 BSC		
L	0.45	0.60	0.75
N	48		
e	0.50 BSC		
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
c	0.09	0.15	0.20
c1	0.09	0.13	0.16

## 31. 48-Pin QFN Package: L-ASC10, iCE40 Ultra, iCE40 UltraPlus™, MachXO2

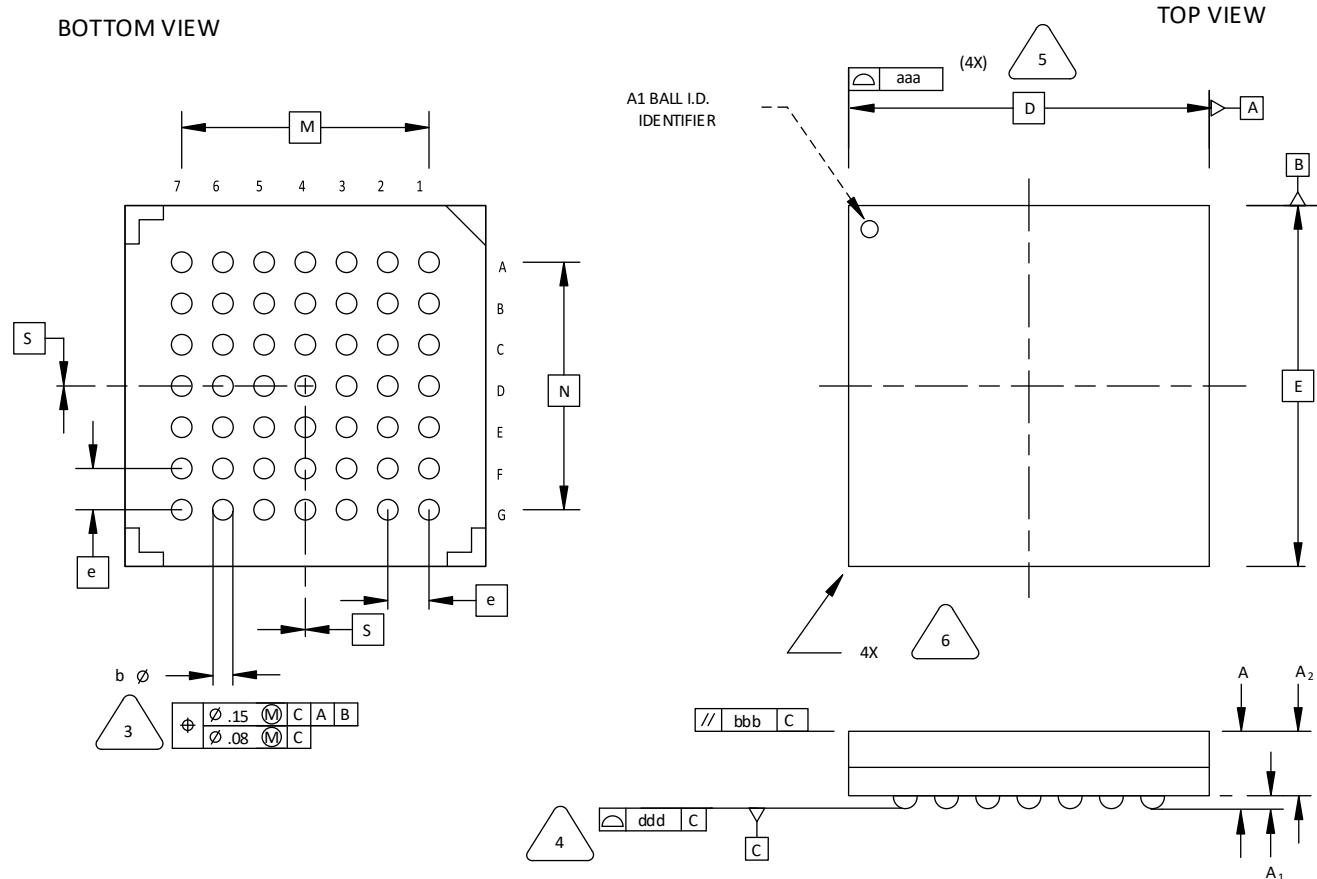
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A3	0.2 REF		
D	7.0 BSC		
D2	5.20	5.35	5.50
E	7.0 BSC		
E2	5.20	5.35	5.50
b	0.15	0.225	0.30
e	0.50 BSC		
L	0.35	0.40	0.45

## 32. 49-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

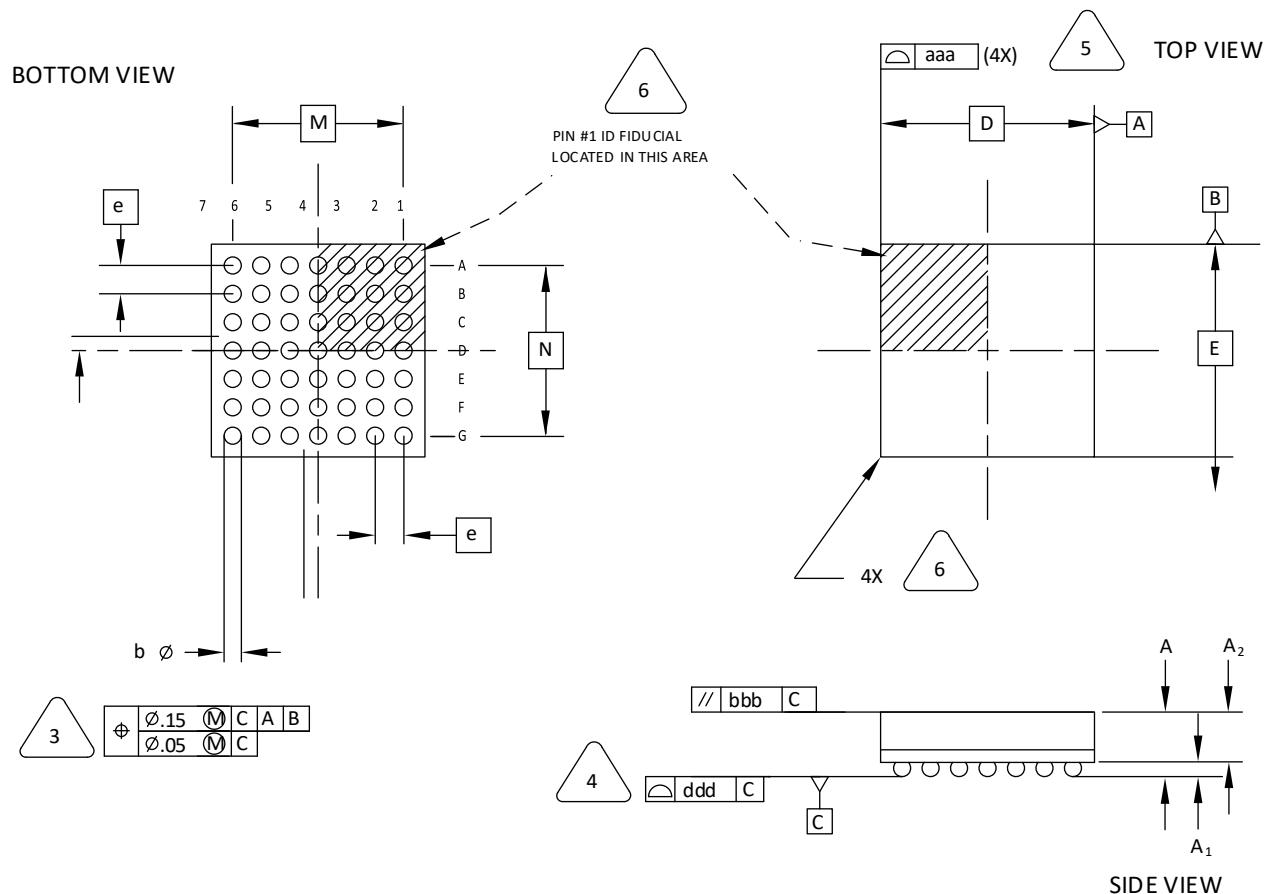


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.40	1.50
A1	0.31	0.36	0.41
A2	0.99	1.04	1.09
D/E	7.00 BSC		
M/N	4.80 BSC		
S	0 BSC		
b	0.40	0.46	0.52
e	0.80 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.12

## 33. 49-Ball ucBGA Package

Dimensions in Millimeters



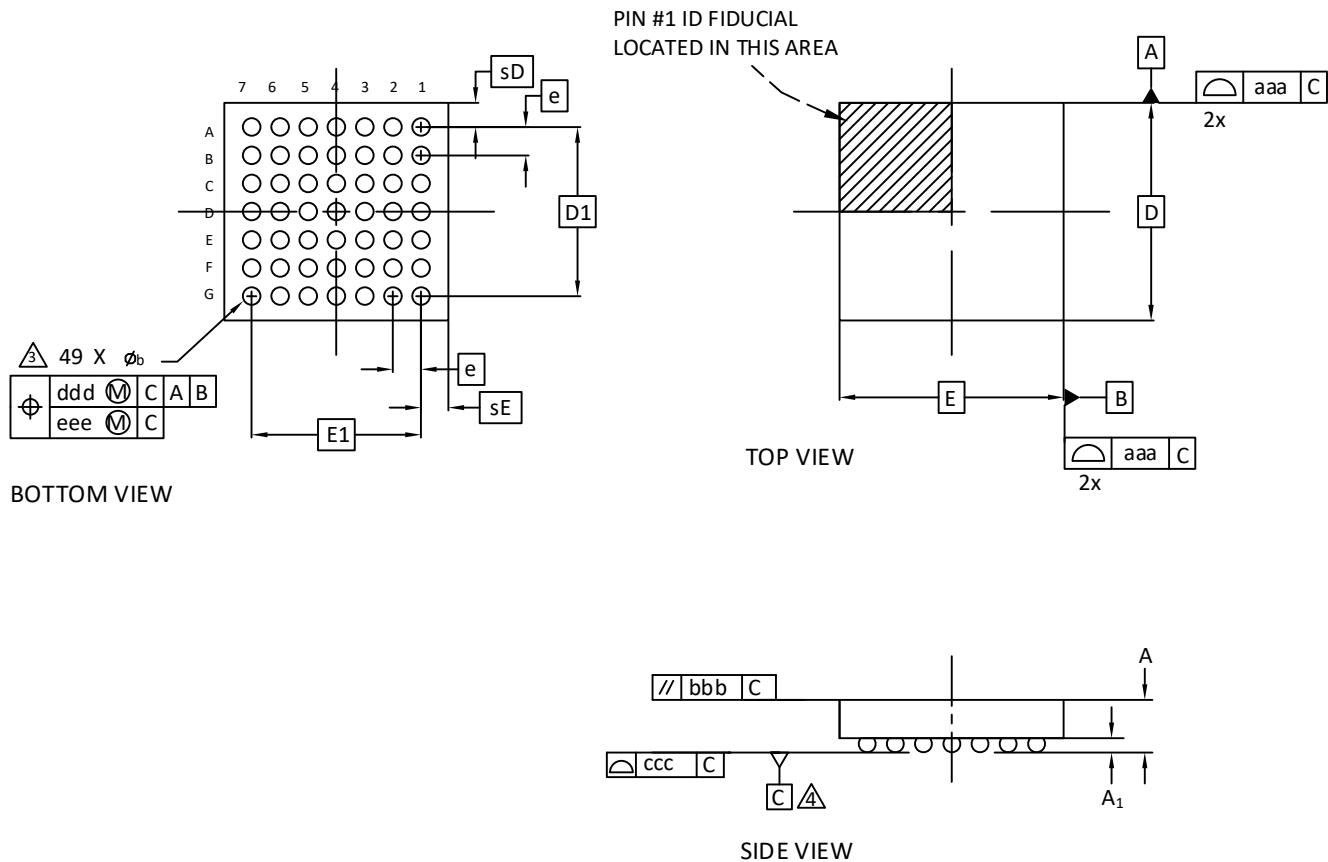
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	3.00 BSC		
M/N	2.40 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 34. 49-Ball WLCSP Package

Dimensions in Millimeters



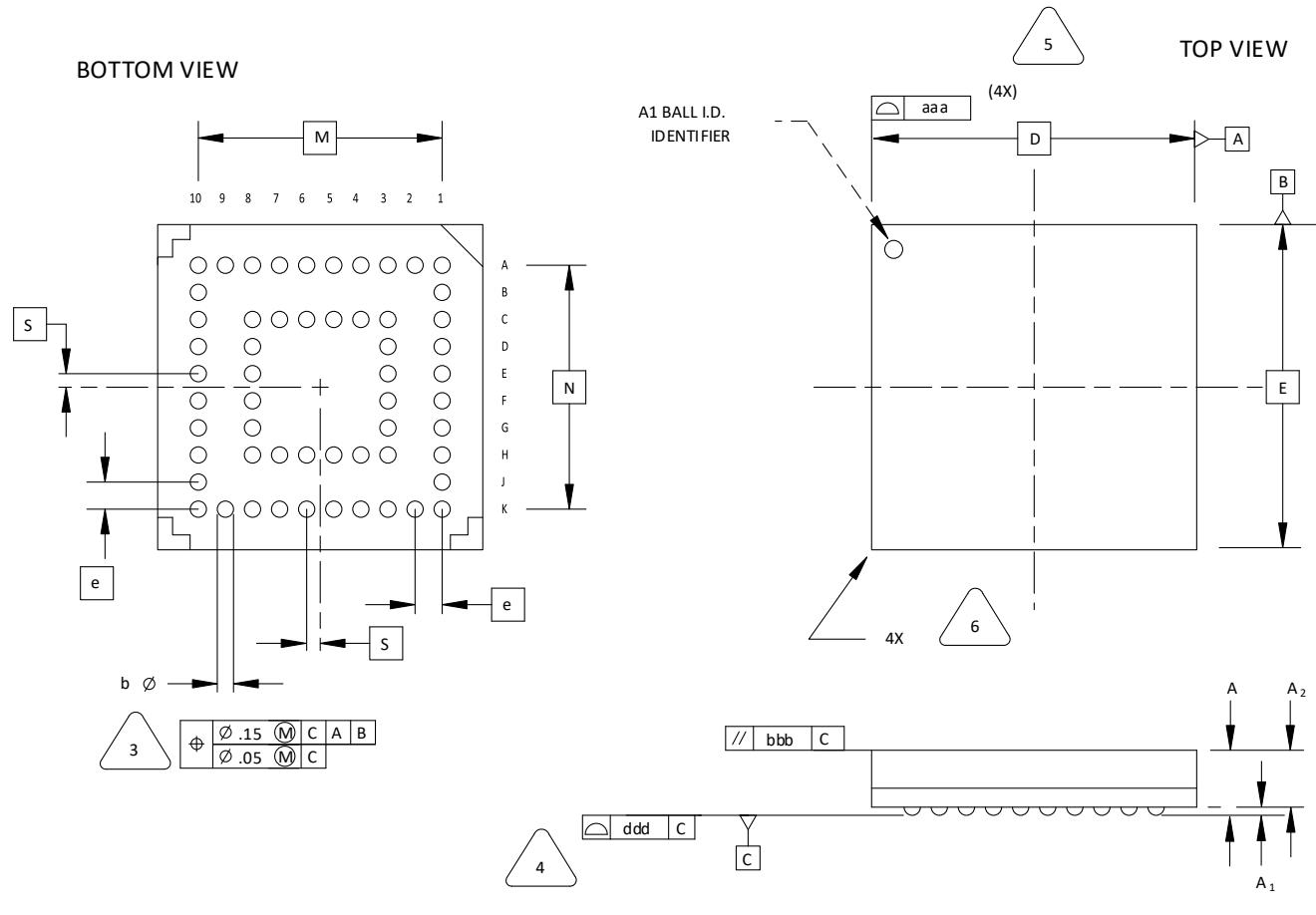
Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
- 2 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3 DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- 4 PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

REF.	Min.	Nom.	Max.
A	-	-	0.600
A1	0.167	0.199	0.232
b	0.239	0.266	0.319
D	3.055	3.106	3.155
E	3.125	3.185	3.225
D1	2.40 BSC		
E1	2.40 BSC		
e	0.40 BSC		
sD	0.353	-	0.383
sE	0.388	-	0.418
aaa	0.030		
bbb	0.060		
ccc	0.050		
ddd	0.015		
eee	0.050		

## 35. 56-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.

4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

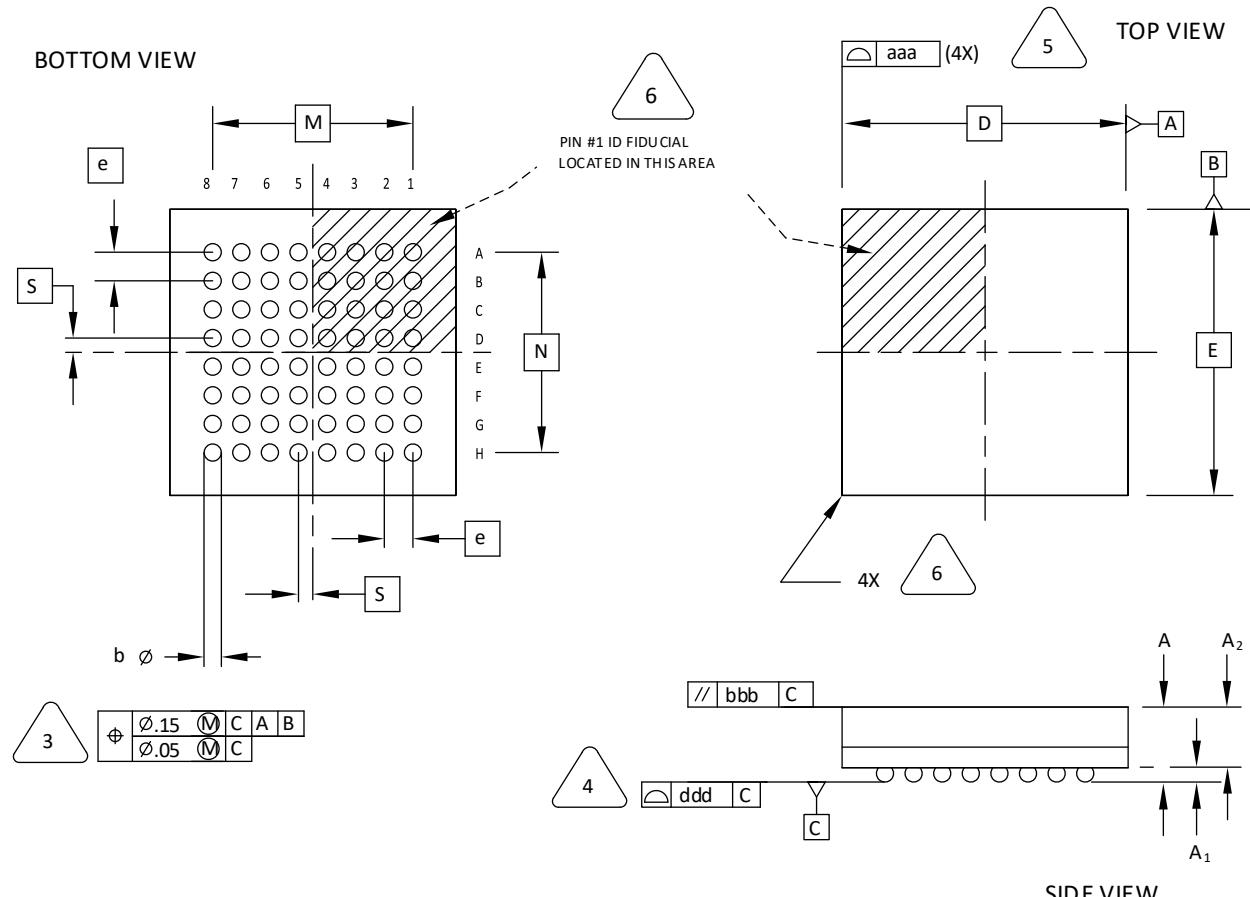
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.10	1.23	1.35
A1	0.15	-	-
A2	-	-	1.10
D/E	6.00 BSC		
M/N	4.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

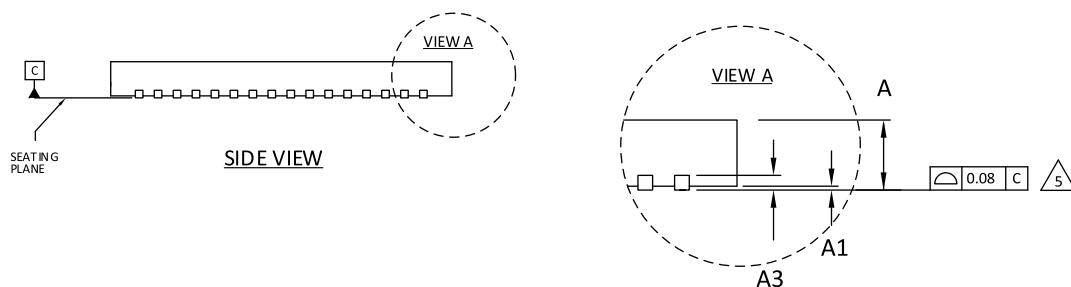
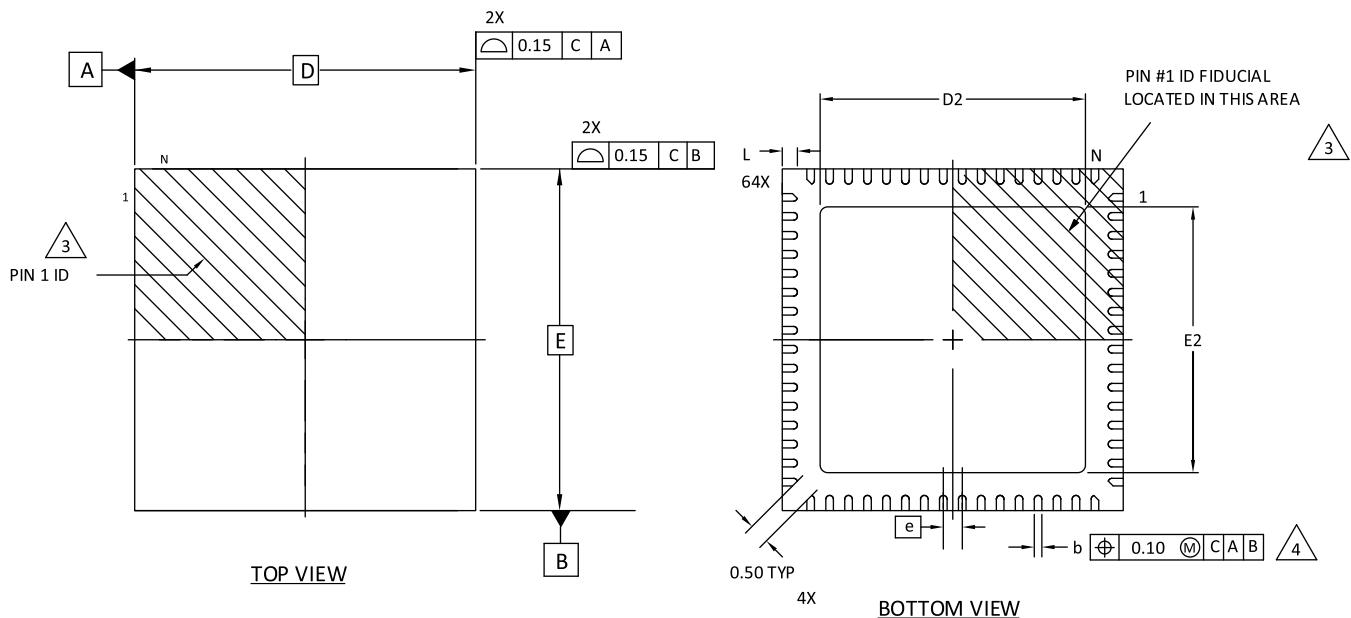
## 36. 64-Ball csBGA Package

Dimensions in Millimeters



## 37. 64-Pin QFNS Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

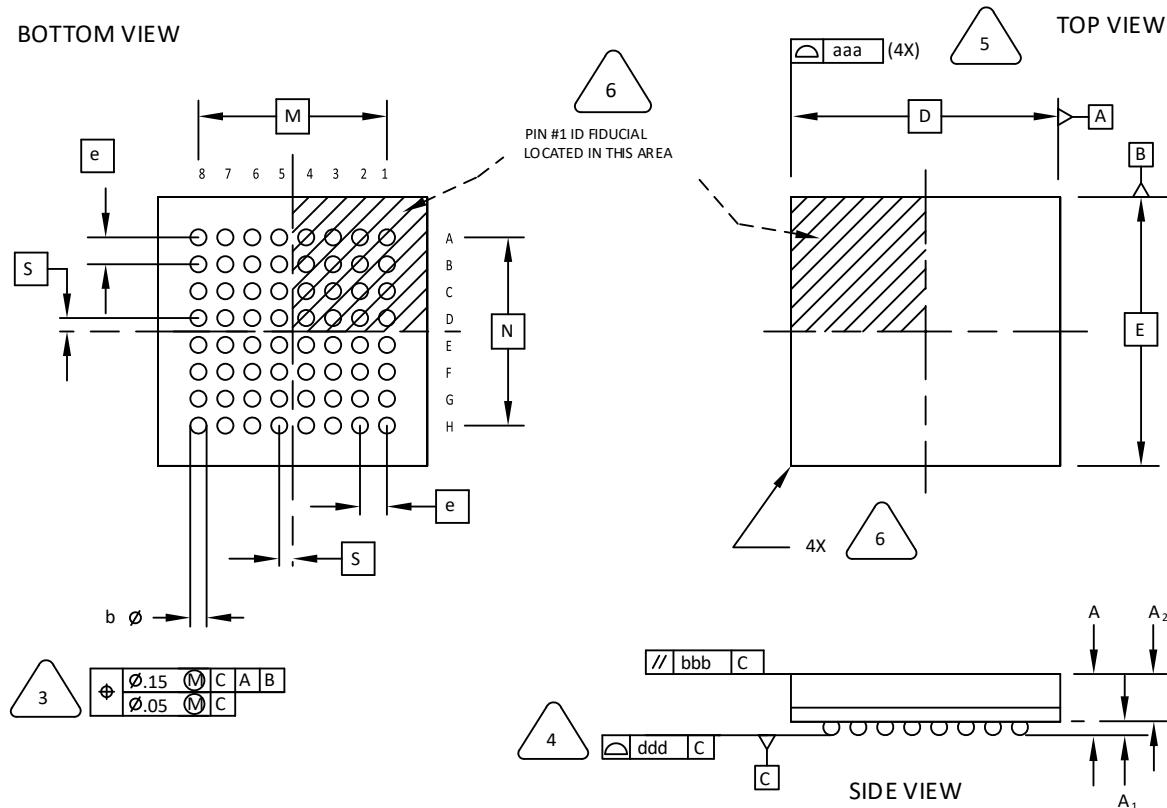
DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	0.80	0.90	1.00
A1	0.00	0.02	0.05
A3	0.2 REF		
D	9.0 BSC		
D2	5.00	-	7.50
E	9.0 BSC		
E2	5.00	-	7.50
b	0.18	0.24	0.30
e	0.50 BSC		
L	0.30	0.40	0.50

## 38. 64-Ball ucBGA Package

Dimensions in Millimeters

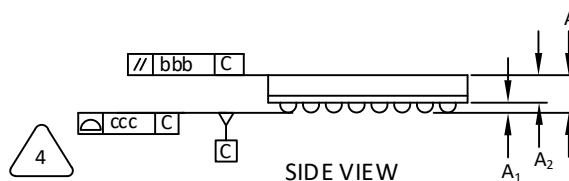
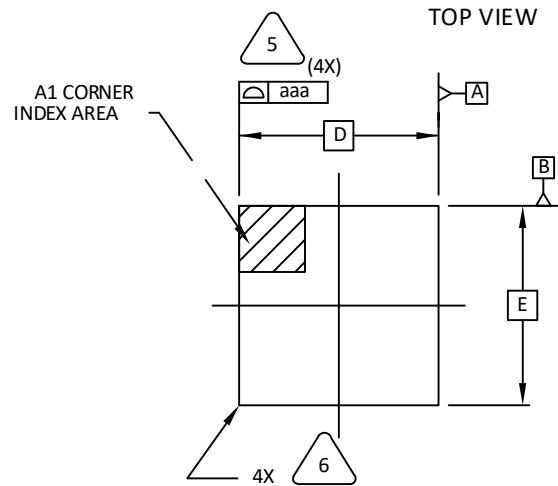
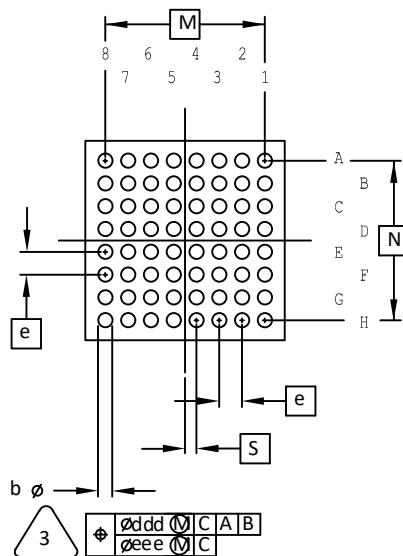


SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	4.00 BSC		
M/N	2.80 BSC		
S	0.20 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 39. 64-Ball ucfBGA Package

Dimensions in Millimeters

BOTTOM VIEW



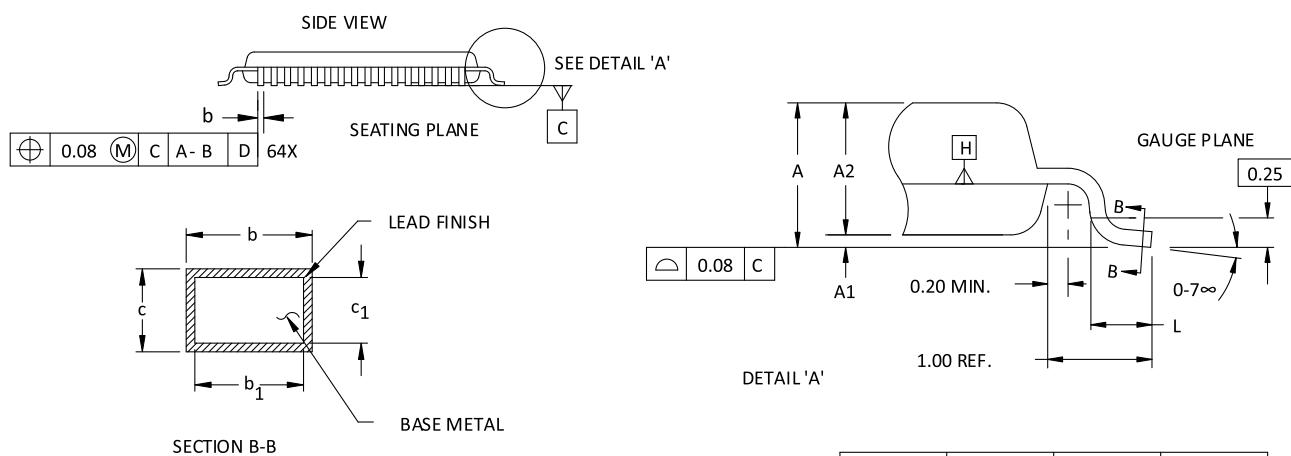
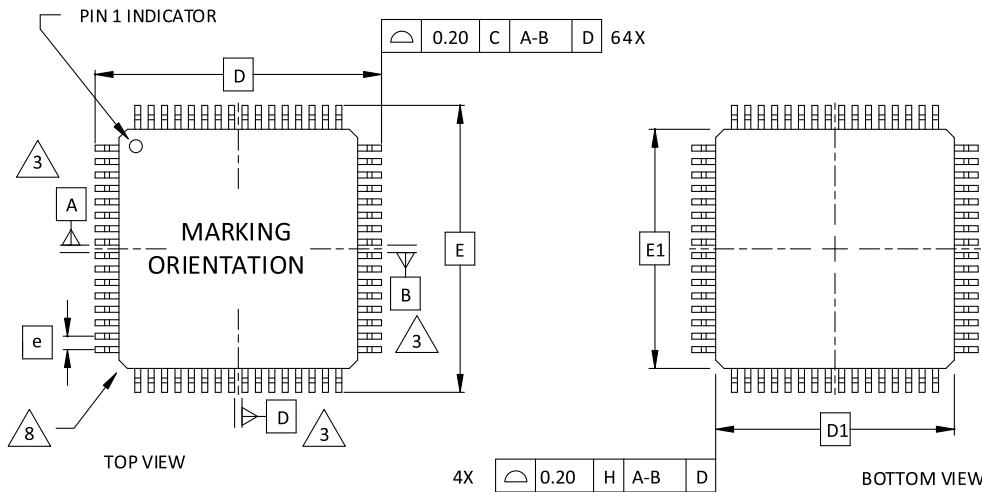
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
- 4** PRIMARY DATUM C AND SEATING PLANE E ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.11	-	-
A2	0.62	-	-
D/E	3.50 BSC		
M/N	2.80 BSC		
S	0.20 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.08		

## 40. 64-Pin LQFP Package

Dimensions in Millimeters



DETAIL 'A'

NOTES:

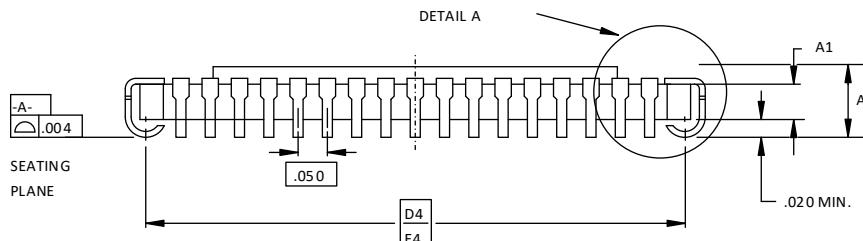
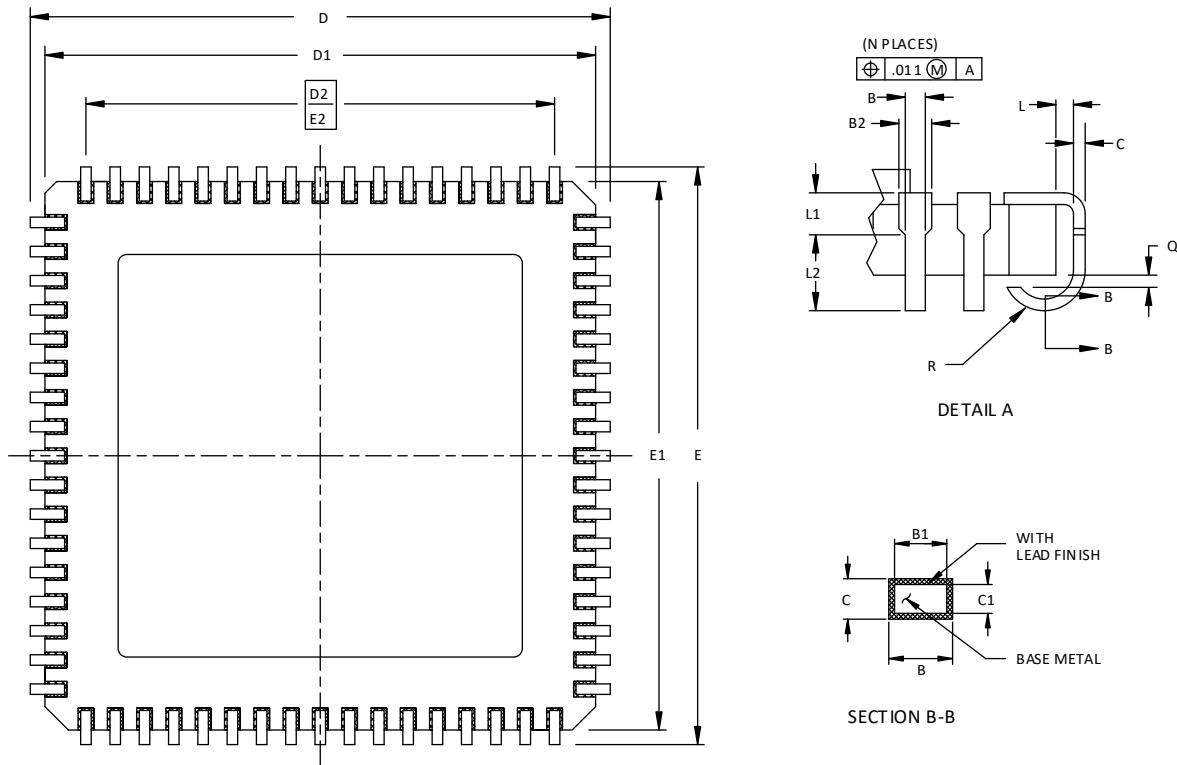
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D	12.00	BSC	
D1	10.00	BSC	
E	12.00	BSC	
E1	10.00	BSC	
L	0.45	0.60	0.75
N		64	
e		0.50	BSC
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
c	0.09	-	0.20
c1	0.09	-	0.16

## 41. 68-Pin JLCC Package

Dimensions in Inches

BOTTOM VIEW



SIDE VIEW

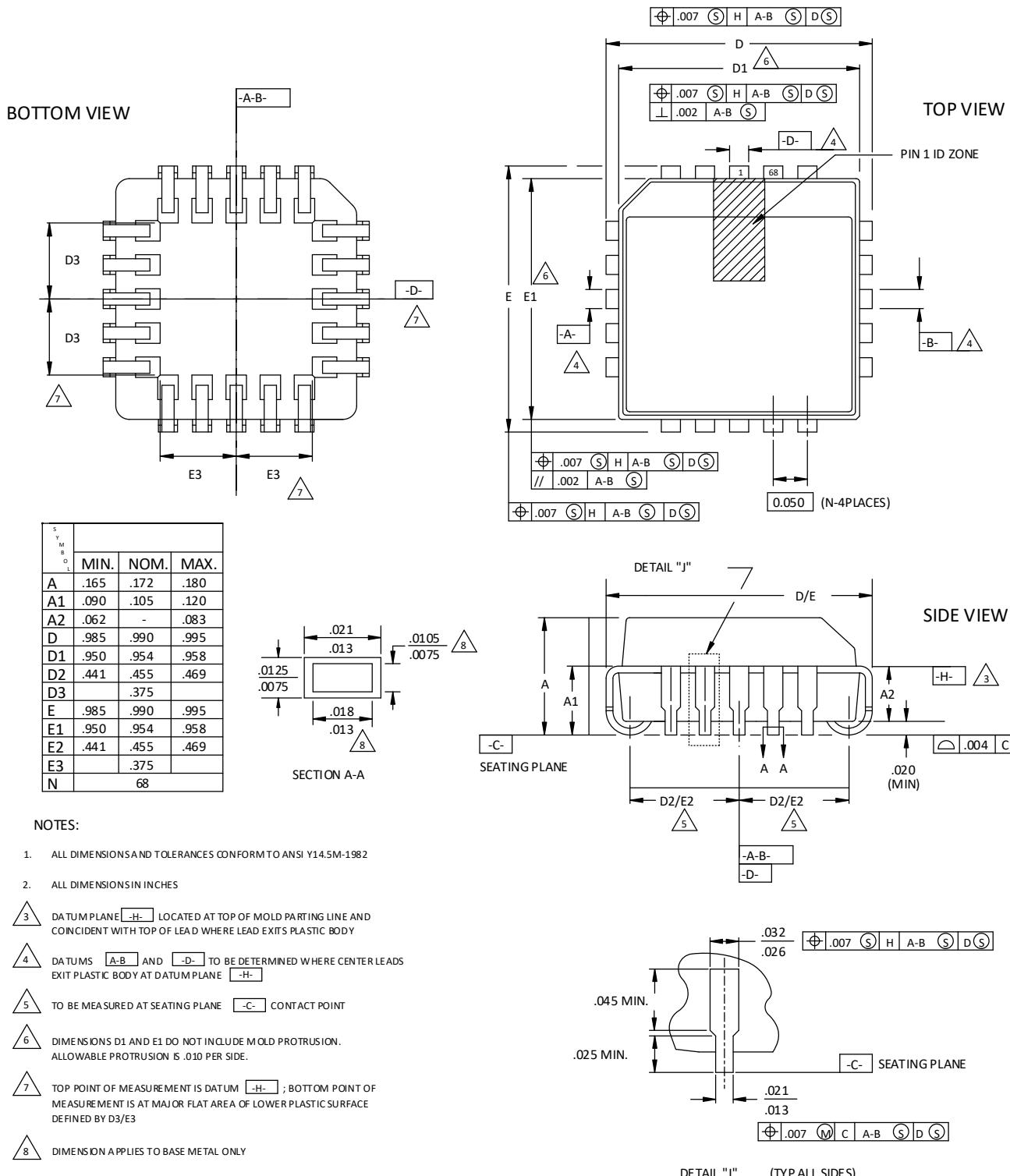
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.
3. CORNER CHAMFERS AND/OR NOTCHES ARE OPTIONAL.

S <sub>Y</sub> M <sub>B</sub> O <sub>L</sub>	INCHES	
	MIN.	MAX.
A	.115	.190
A1	.080	REF
B	.013	.023
B1	.013	.020
B2	.022	.035
C	.007	.013
C1	.007	.010
D/E	.975	.990
D1/E1	.920	.960
D2/E2	.800	BSC
D4/E4	.930	BSC
L	.005	-
L1	.020	-
L2	.025	-
Q	.003	-
R	.020	.040
N	68	

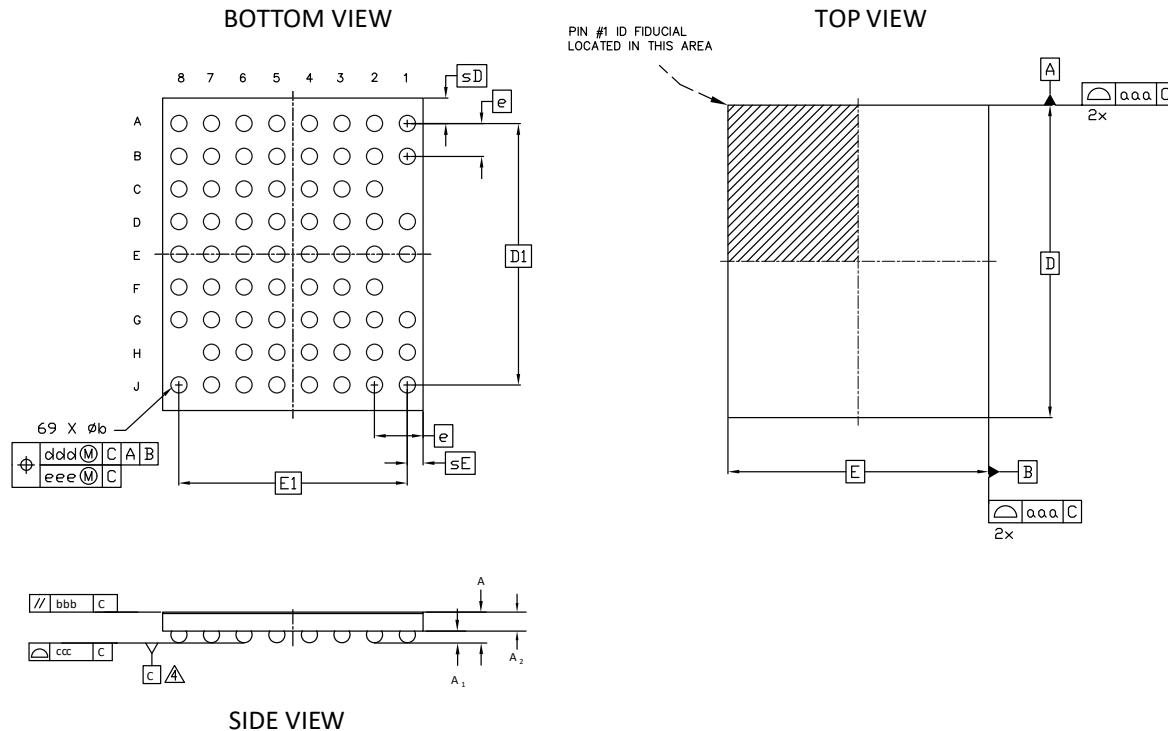
## 42. 68-Pin PLCC Package

Dimensions in Inches



## 43. 69-Ball WLCSP Package

Dimensions in Inches



NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994
2. ALL DIMENSIONS ARE IN MILLIMETERS.

**3** DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER, PARALLEL TO PRIMARY DATUM **C**

**4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

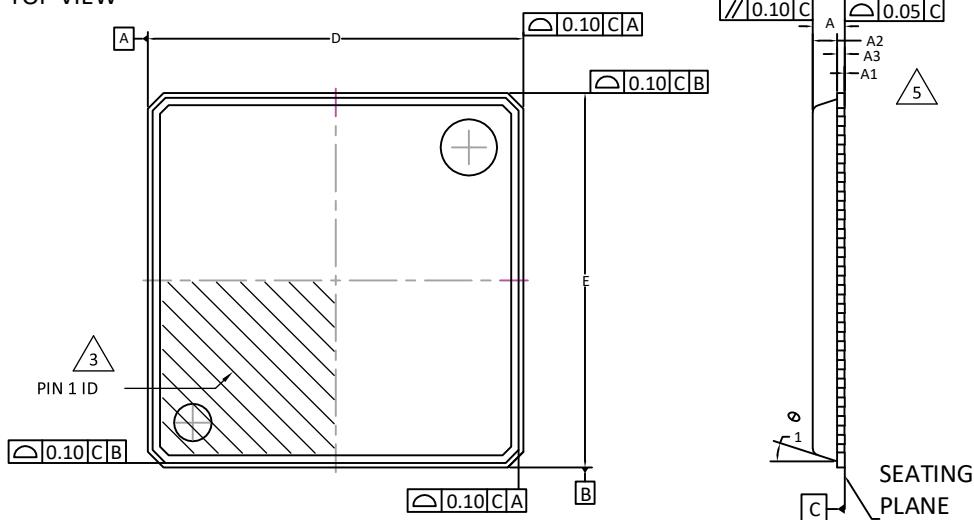
5 JEDEC REFERENCE: JEP95 DR4.18

REF	MIN.	NOM.	MAX.
A	0.598	0.611	0.676
A1	0.206	0.236	0.266
A2	$0.350 \pm 0.025$		
b	0.300		
D	6.218 BSC		
E	5.192 BSC		
D1	5.200 BSC		
E1	4.550 BSC		
e	0.650 BSC		
sD	0.509 REF		
sE	0.310 REF		
aaa	0.03		
bbb	0.060		
ccc	0.05		
ddd	0.015		
eee	0.050		

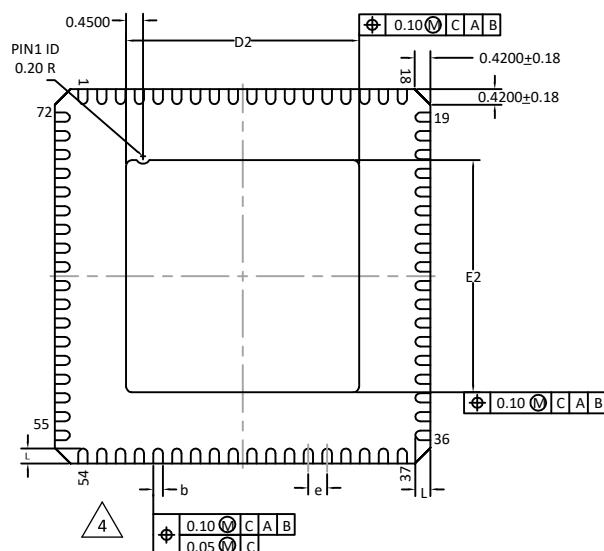
## 44. 72-Pin QFN Package Option 1: CrossLink™-NX

### Dimensions in Millimeters

TOP VIEW



BOTTOM VIEW



## SIDE VIEW

SYMBOL	MIN.	NOM.	MAX.
A			0.90
A1	0.00	0.01	0.05
A3		0.2	REF
D		10.0	
D2	6.05	6.20	6.35
E		10.0	
E2	6.05	6.20	6.35
b	0.20	0.25	0.30
e		0.50	BSC
L	0.30	0.40	0.50

**NOTES: UNLESS OTHERWISE SPECIFIED**

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.

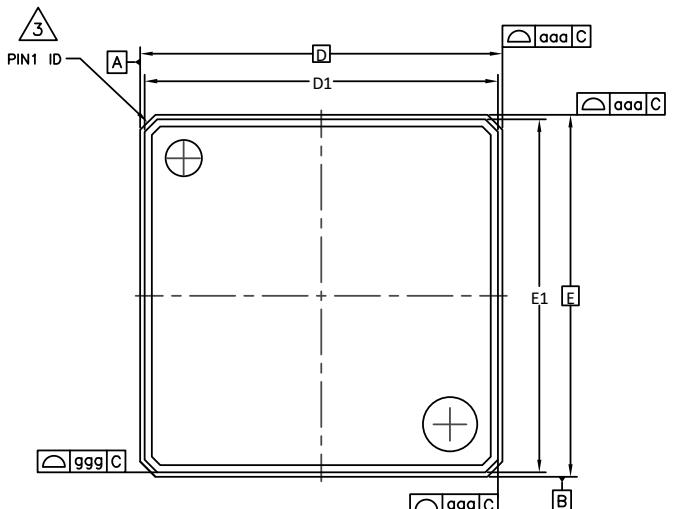
 **3.** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

 **4.** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

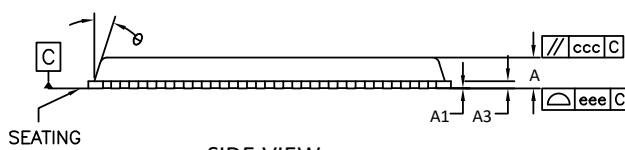
 **5.** APPLIES TO EXPOSED PORTION OF TERMINALS.

## 45. 72-Pin QFN Package Option 2: MachXO3D™

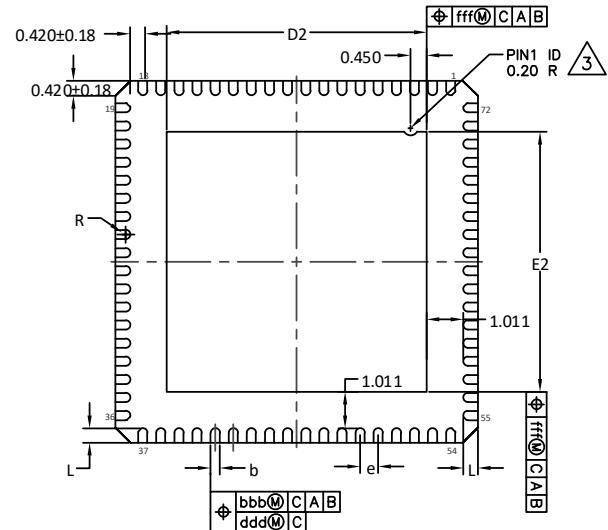
Dimensions in Millimeters



TOP VIEW



SIDE VIEW



BOTTOM VIEW

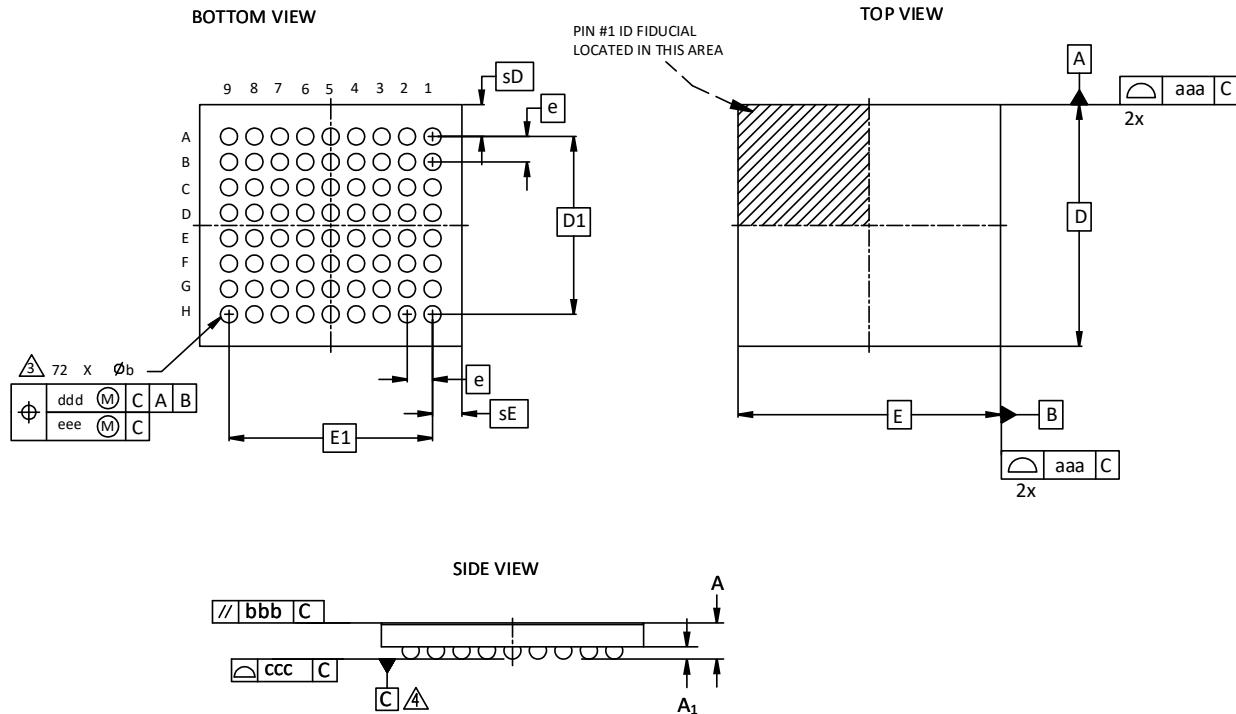
SYMBOL	MIN.	NOM.	MAX.
A	—	—	0.90
A1	0.00	0.01	0.05
A3	0.2 REF		
D/E	10.0 BSC		
D1/E1	9.75 BSC		
D2/E2	7.078	7.178	7.278
b	0.20	0.25	0.30
e	0.50 BSC		
L	0.30	0.40	0.50
aaa	0.100		
bbb	0.100		
ccc	0.100		
ddd	0.050		
eee	0.050		
fff	0.100		
ggg	0.200		

NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
4. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
5. APPLIES TO EXPOSED PORTION OF TERMINALS.
6. JEDEC STANDARD REFERENCE: MO -220 K.01

## 46. 72-Pin WLCSP Package: CrossLink-NX

Dimensions in Millimeters



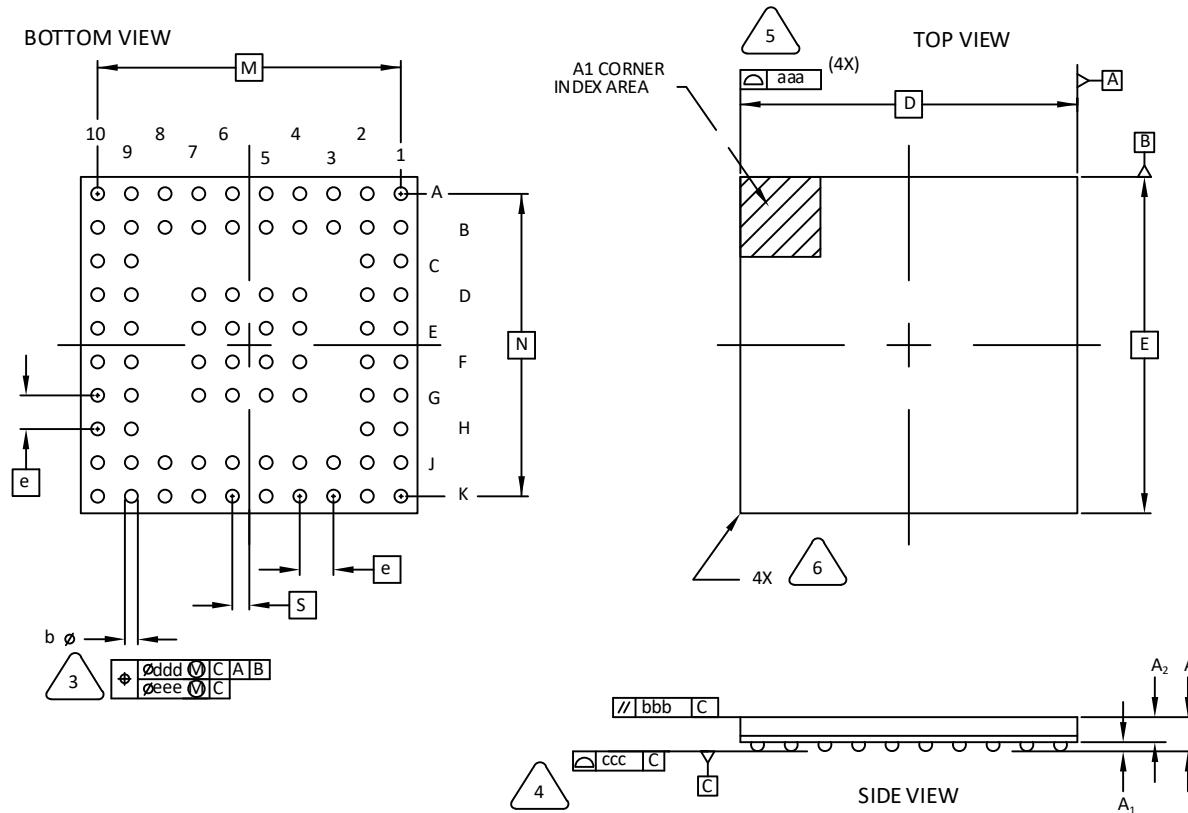
NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M – 1994.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- ⚠ DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- ⚠ PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

REF.	Min.	Nom.	Max.
A	–	–	0.608
A1	0.164	0.194	0.224
b	0.239	0.269	0.299
D	3.8074	BSC	
E	4.1251	BSC	
D1	2.800	BSC	
E1	3.200	BSC	
e	0.40	BSC	
sD	0.485	–	0.515
sE	0.445	–	0.475
aaa		0.03	
bbb		0.060	
ccc		0.03	
ddd		0.015	
eee		0.050	

## 47. 80-Ball ctfBGA Package

Dimensions in Millimeters



### NOTES: UNLESS OTHERWISE SPECIFIED

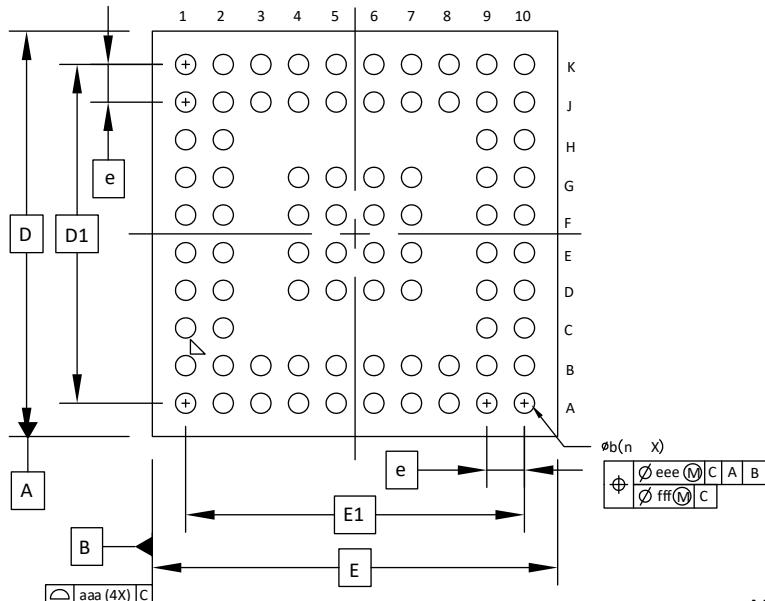
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.11	-	-
A2	0.61	-	-
D/E	6.50 BSC		
M/N	5.85 BSC		
S	0.325 BSC		
b	0.20	0.25	0.30
e	0.65 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.05		

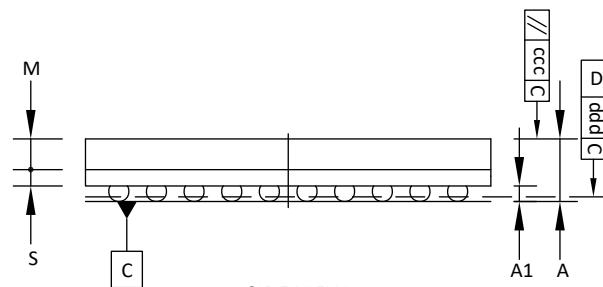
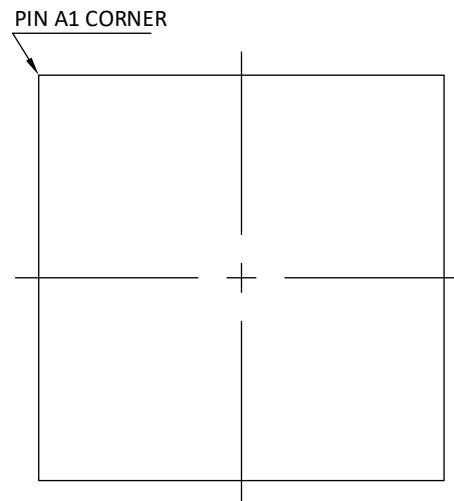
## 48. 80-Ball ckfBGA Package

Dimensions in Millimeters

BOTTOM VIEW



TOP VIEW

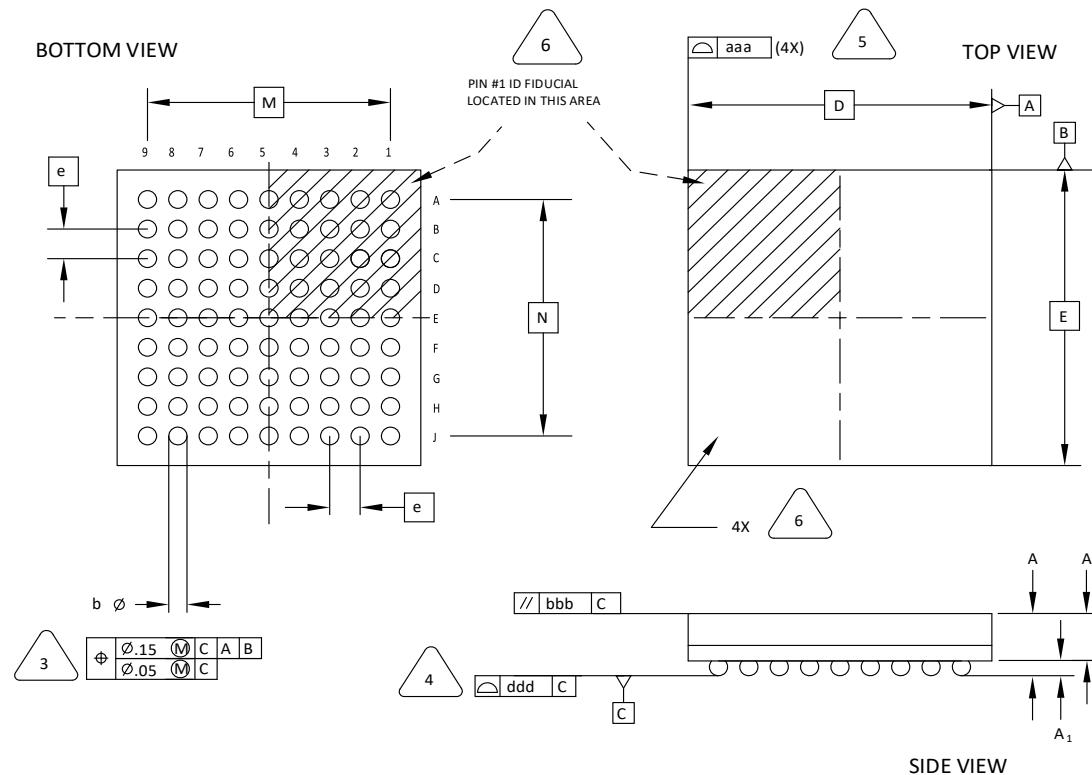


SIDE VIEW

	Symbol	Common Dimensions		
		MIN.	NOM.	MAX.
Package:			MFC TFBGA	
Body Size:	X	E	7.000	
	Y	D	7.000	
Ball Pitch:	e		0.650	
Total Thickness:	A	0.962	1.082	1.200
Mold Thickness:	M	0.490	0.530	0.570
Substrate Thickness:	S	0.252	0.282	0.312
Ball Diameter:		0.350		
Stand Off:	A1	0.220	0.270	0.320
Ball Width:	b	0.320	0.370	0.420
Package Edge Tolerance:	aaa	0.100		
Mold Parallelism:	ccc	0.100		
Coplanarity:	ddd	0.080		
Ball Offset (Package):	eee	0.150		
Ball Offset (Ball):	fff	0.050		
Ball Count:	n	80		
Edge Ball Center to Center:	X	E1	5.850	
	Y	D1	5.850	

## 49. 81-Ball csBGA Package

Dimensions in Millimeters



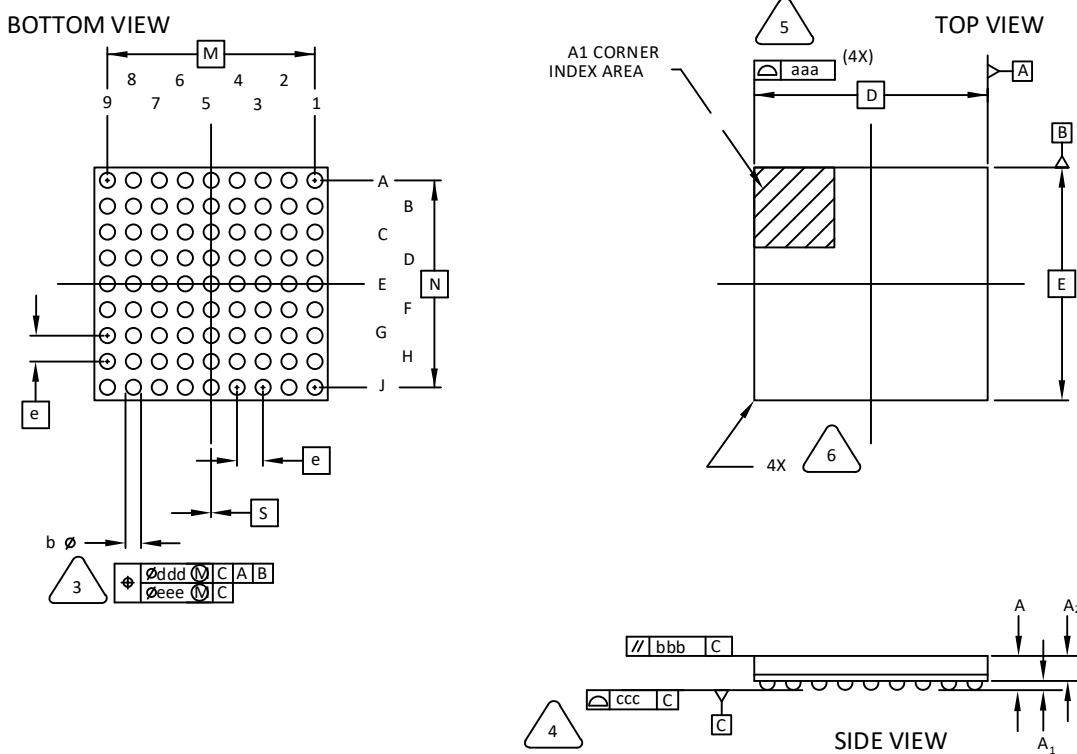
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**
- PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	
A2	-	-	0.90
D/E	5.00 BSC		
M/N	4.00 BSC		
b	0.20	0.25	0.30
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 50. 81-Ball csfBGA Package

Dimensions in Millimeters



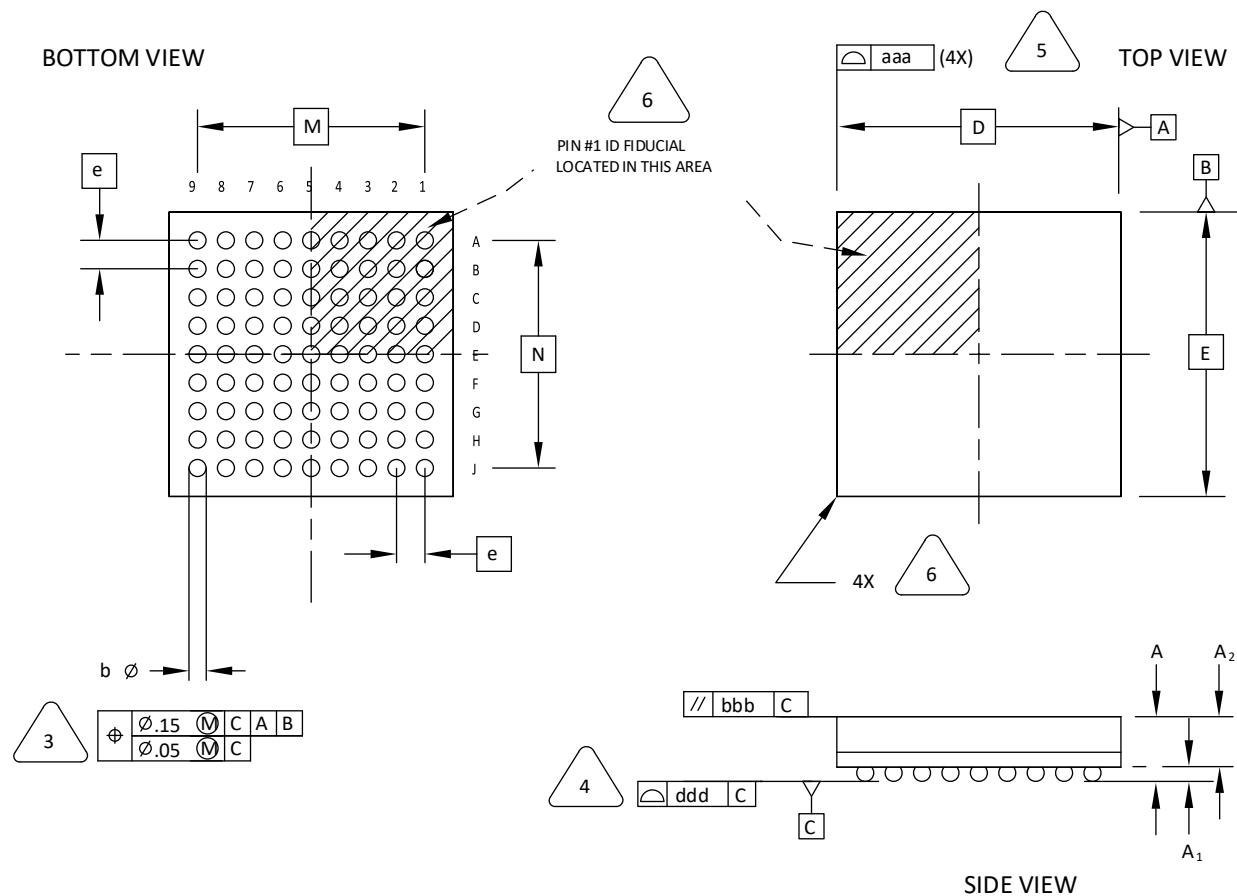
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- (3) DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- (4) PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- (5) BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- (6) EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.11	-	-
A2	0.64	-	-
D/E	4.50 BSC		
M/N	4.00 BSC		
S	0.00 BSC		
b	0.20	0.25	0.30
e	0.50 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.08		

## 51. 81-Ball ucBGA Package

Dimensions in Millimeters



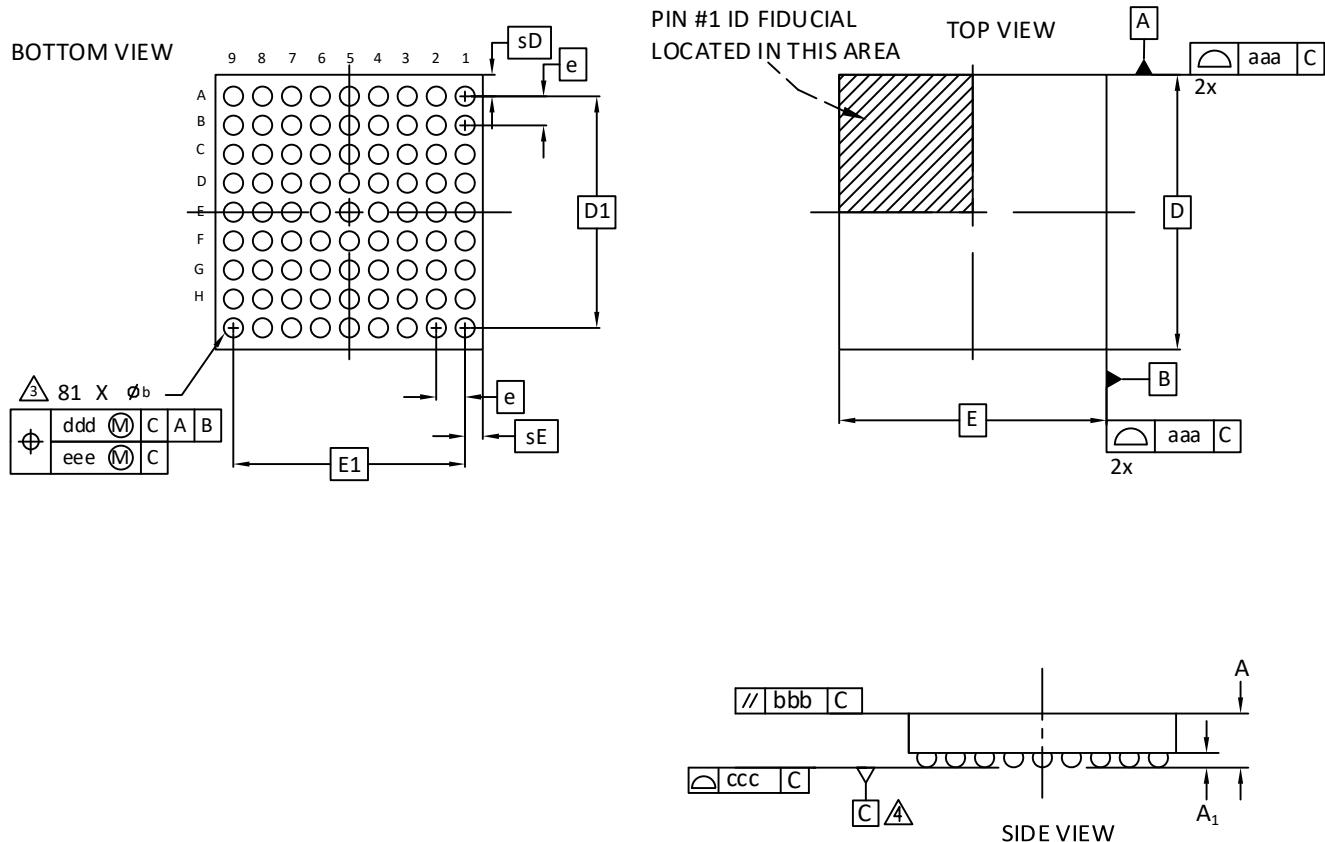
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	4.00 BSC		
M/N	3.20 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 52. 81-Ball WLCSP Package

Dimensions in Millimeters



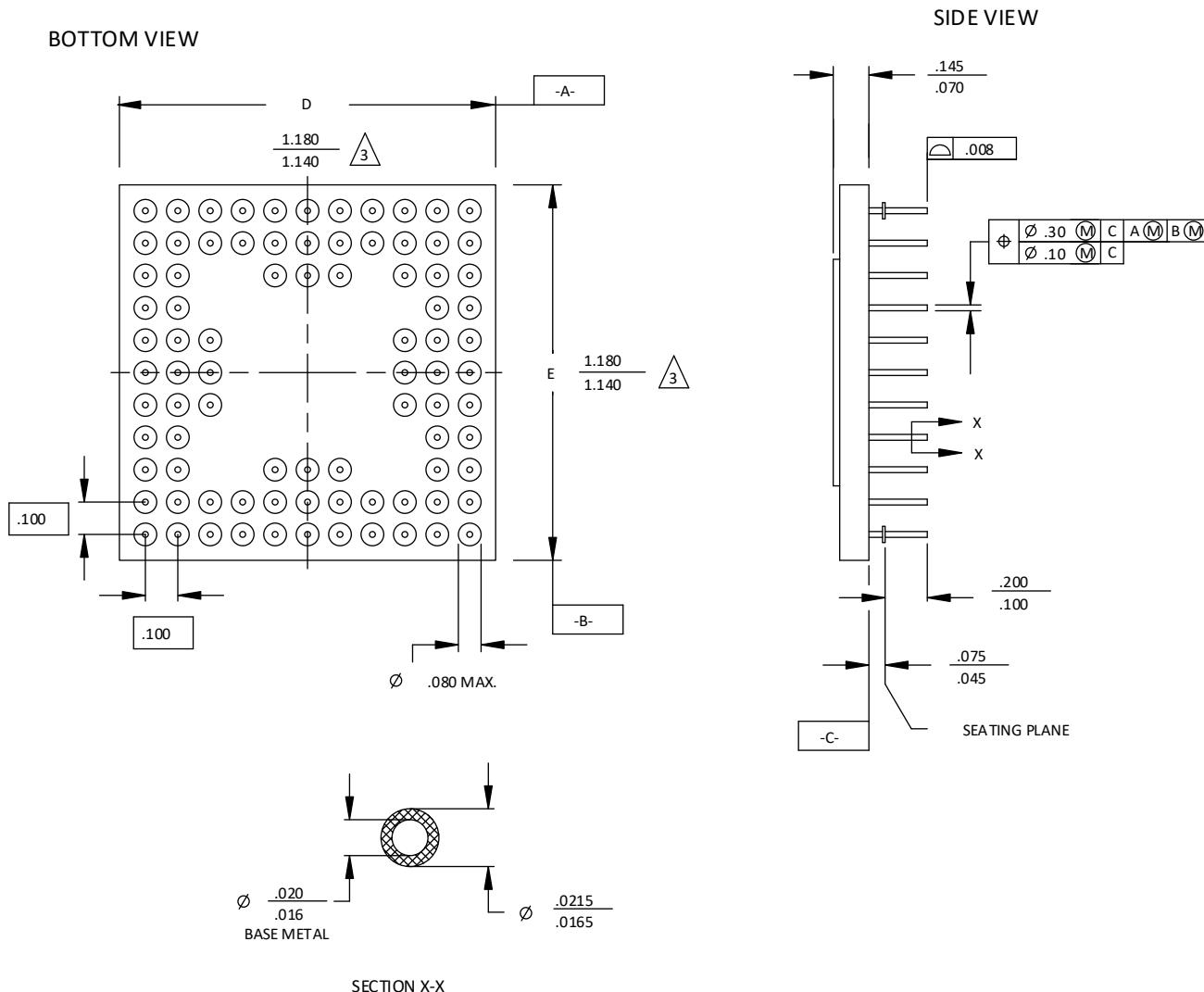
Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
- 2 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3 DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- 4 PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

REF.	Min.	Nom.	Max.
A	0.510	0.543	0.567
A1	0.167	0.196	0.225
b	0.239	0.266	0.319
D	3.797 BSC		
E	3.693 BSC		
D1	3.20 BSC		
E1	3.20 BSC		
e	0.40 BSC		
sD	-	0.299	-
sE	-	0.247	-
aaa	0.025		
bbb	0.060		
ccc	0.030		
ddd	0.015		
eee	0.050		

## 53. 84-Pin CPGA Package

Dimensions in Inches



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.

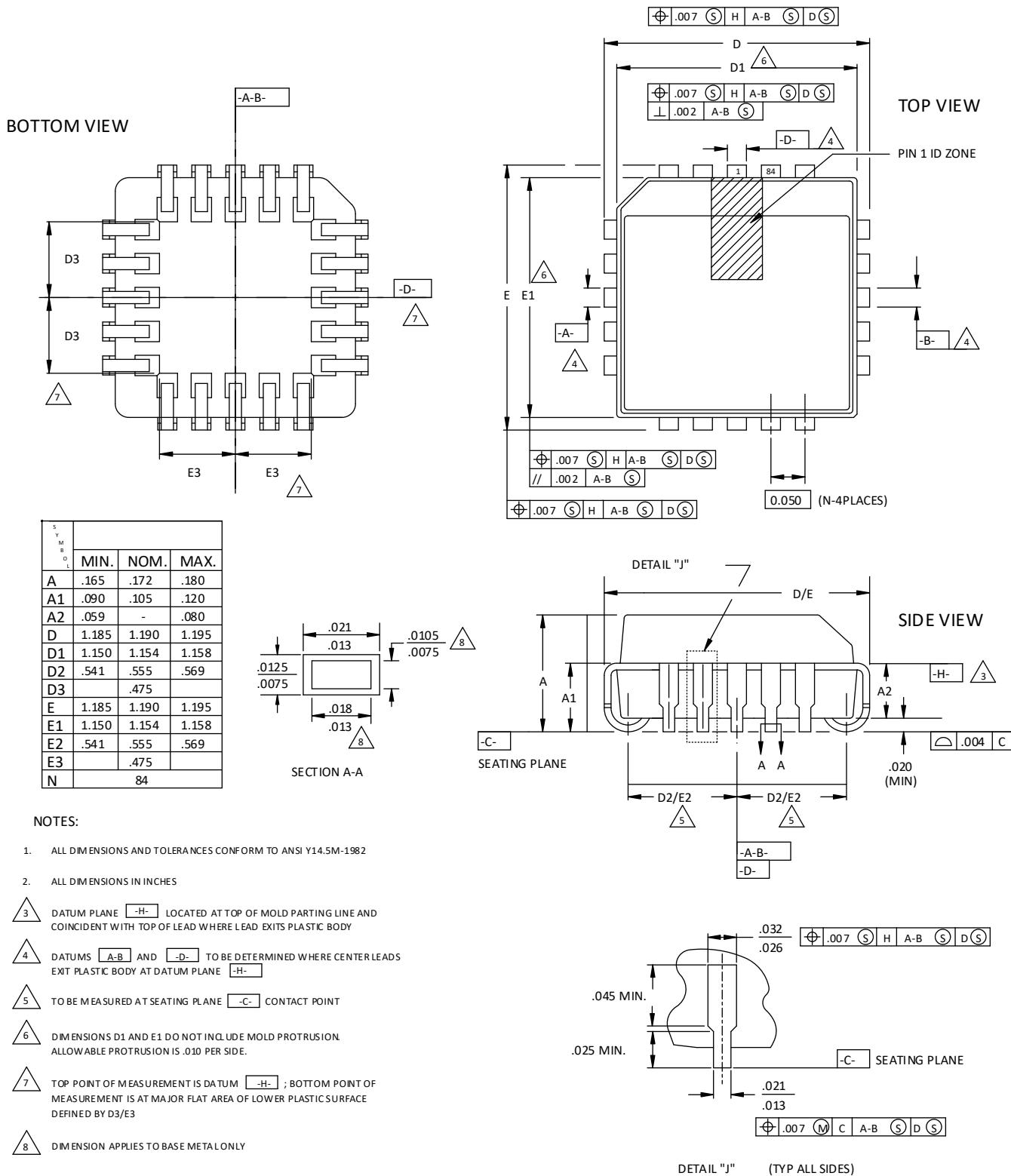
2. ALL DIMENSIONS ARE IN INCHES.



DIMENSIONS D AND E MAY HAVE MATERIAL PROTRUSION OF .006 INCHES MAXIMUM ABOVE THE DIMENSION SHOWN  
NOT TO EXCEED .003 INCHES MAXIMUM PER SIDE.

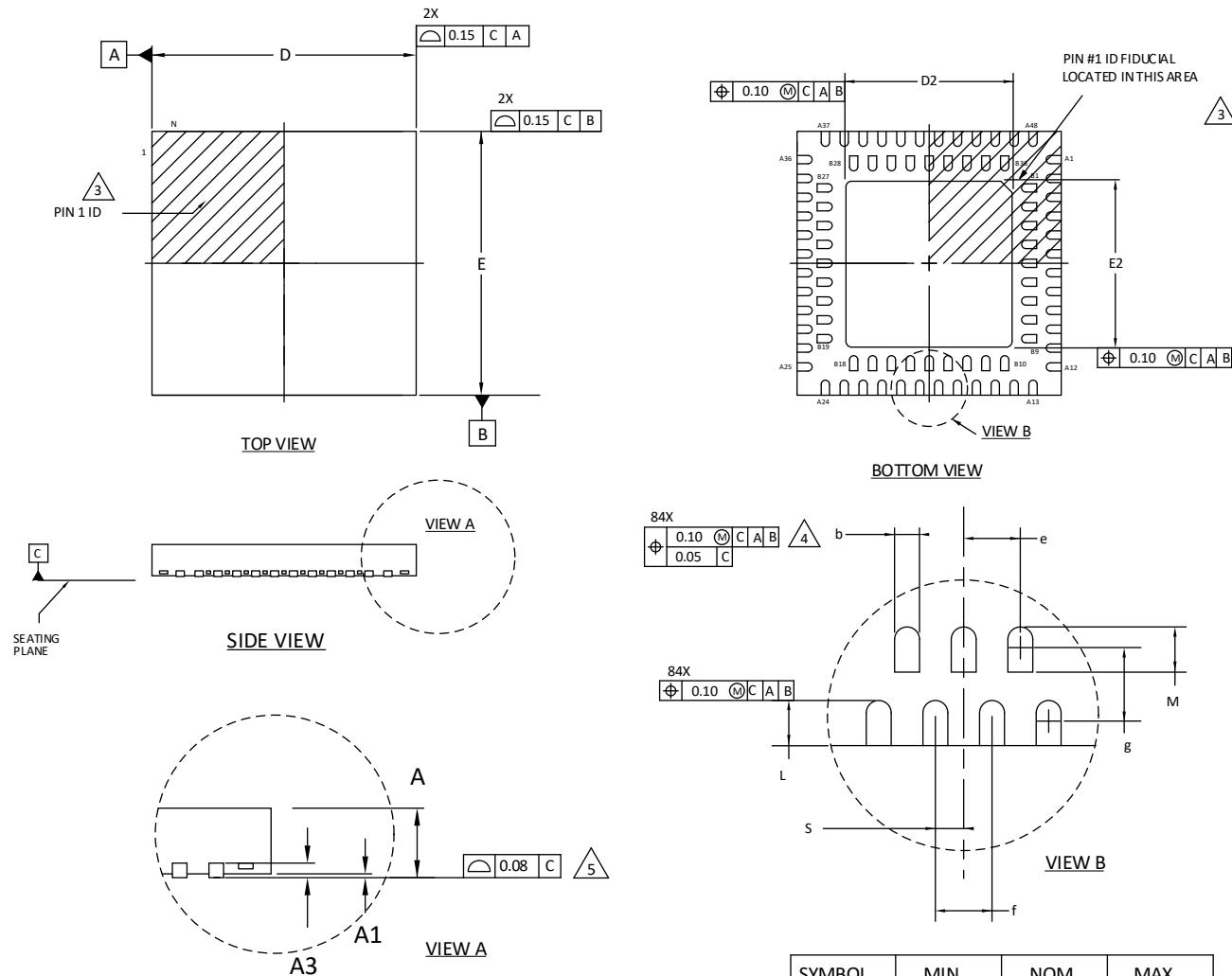
## 54. 84-Pin PLCC Package

Dimensions in Inches



## 55. 84-Pin QFN Package

Dimensions in Millimeters



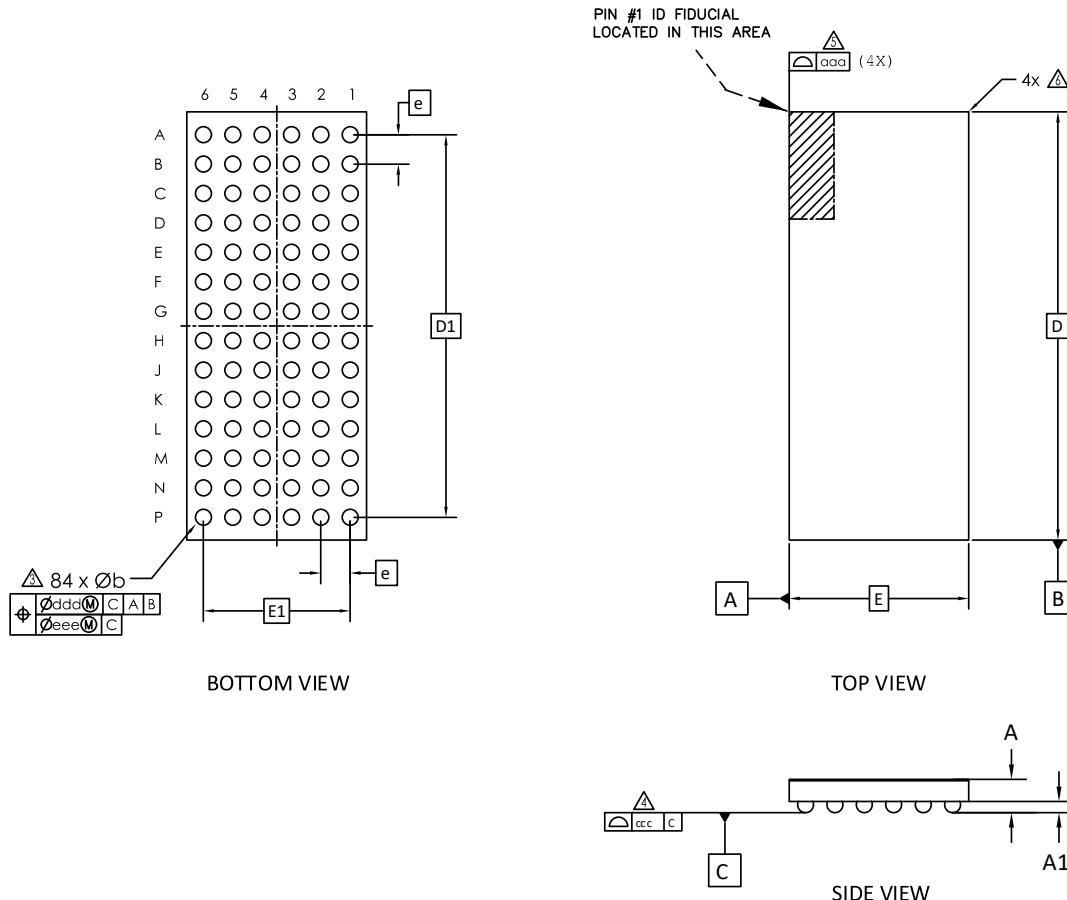
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- 4** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.
- 5** APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	0.75	0.85	0.95
A1	0.00	0.02	0.05
A3	0.15 REF		
D	7.0 BSC		
D2	4.30	-	4.50
E	7.0 BSC		
E2	4.30	-	4.50
b	0.17	0.22	0.27
e	0.50 BSC		
f	0.50 BSC		
g	0.65 BSC		
S	0.25 BSC		
L	0.30	0.40	0.50
M	0.30	0.40	0.50

## 56. 84-Ball WLCSP Package (7.275 mm × 3.054 mm Body)

Dimensions in Millimeters



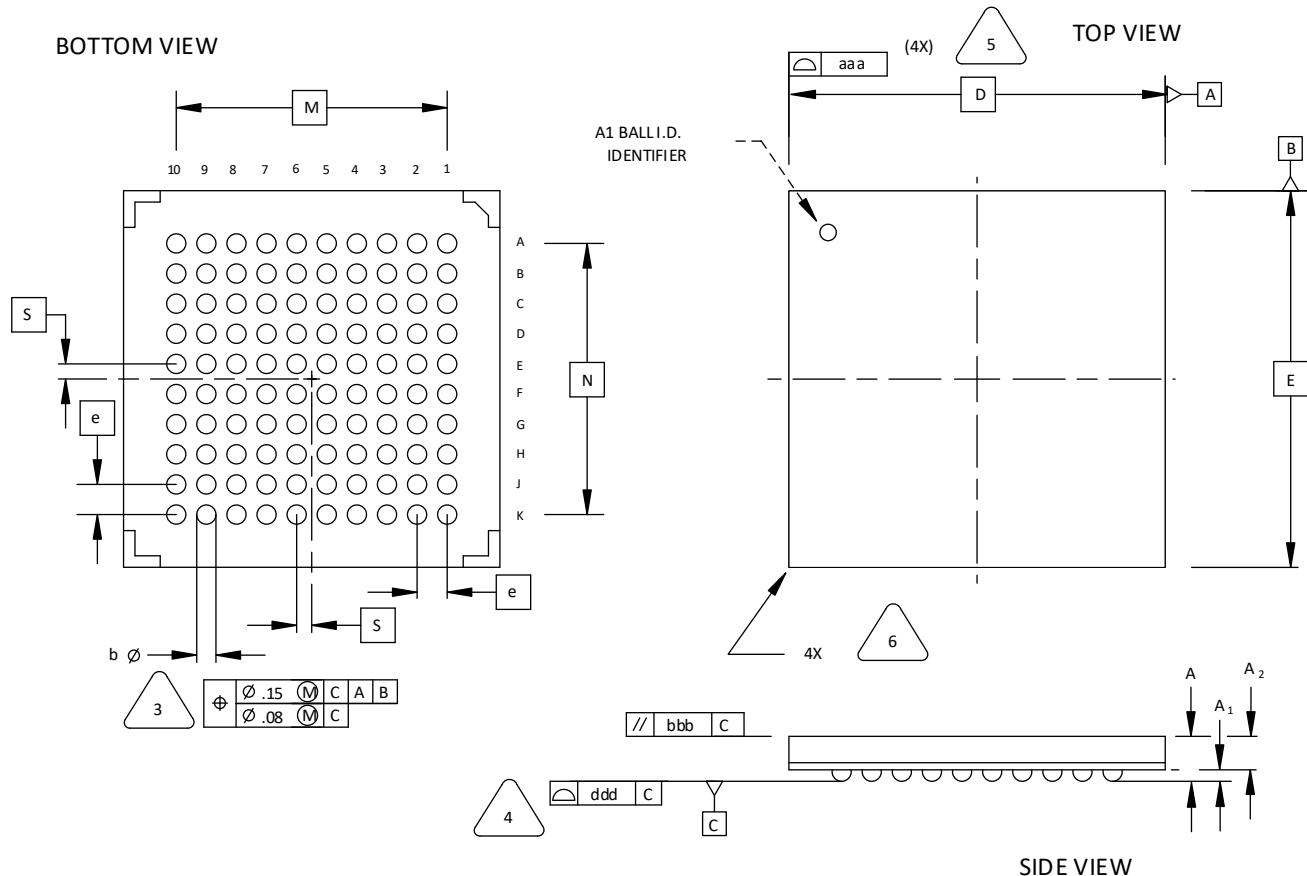
### NOTES:

1. DIMENSIONS AND TOLERANCES PER ASME Y 14.5M - 1994.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE JEP95 DG 4.18

SYMBOL	Min.	Nom.	Max.
A	-	-	0.608
A1	0.164	-	-
b	0.200	0.250	0.300
D	7.275	BSC	
E	3.054	BSC	
D1	6.50	BSC	
E1	2.50	BSC	
e	0.50	BSC	
aaa	0.030		
ccc	0.050		
ddd	0.050		
eee	0.015		

## 57. 100-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

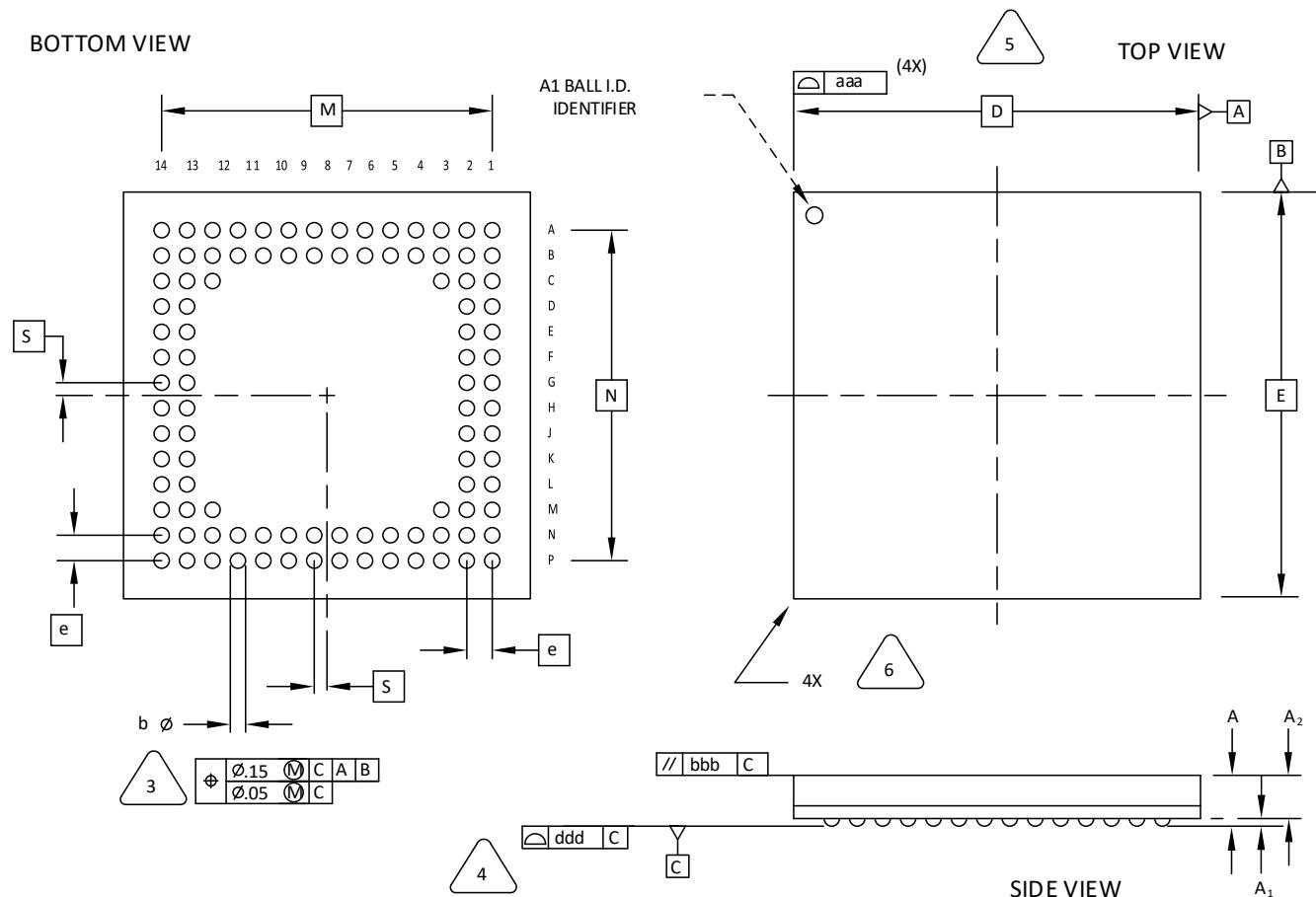


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.40	1.50
A1	0.31	0.36	0.41
A2	0.99	1.04	1.09
D/E	10.00 BSC		
M/N	7.20 BSC		
S	0.40 BSC		
b	0.40	0.46	0.52
e	0.80 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.12

## 58. 100-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

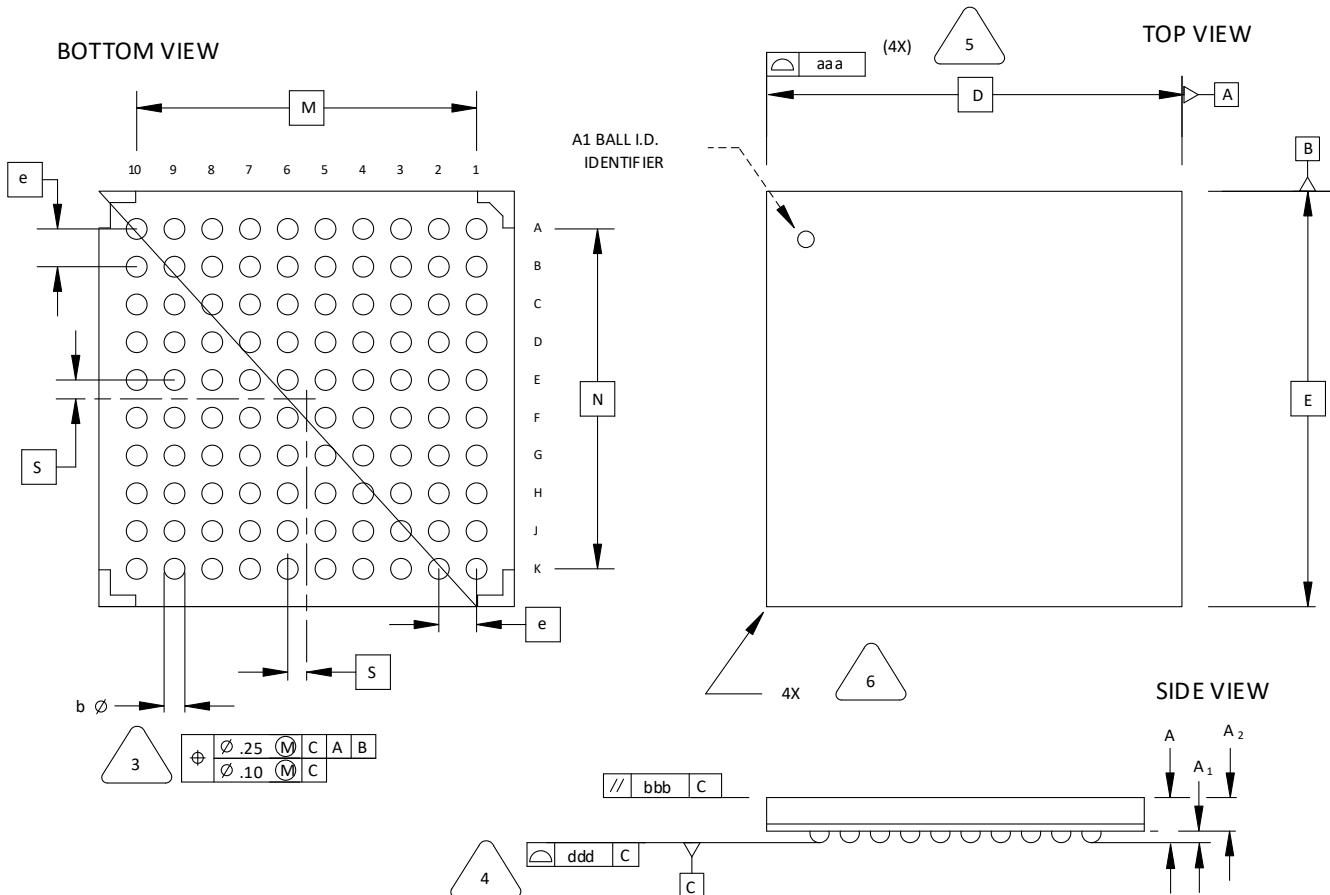
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	0.90	1.23	1.35
A1	0.15	-	-
A2	-	-	1.10
D/E	8.00 BSC		
M/N	6.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 59. 100-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

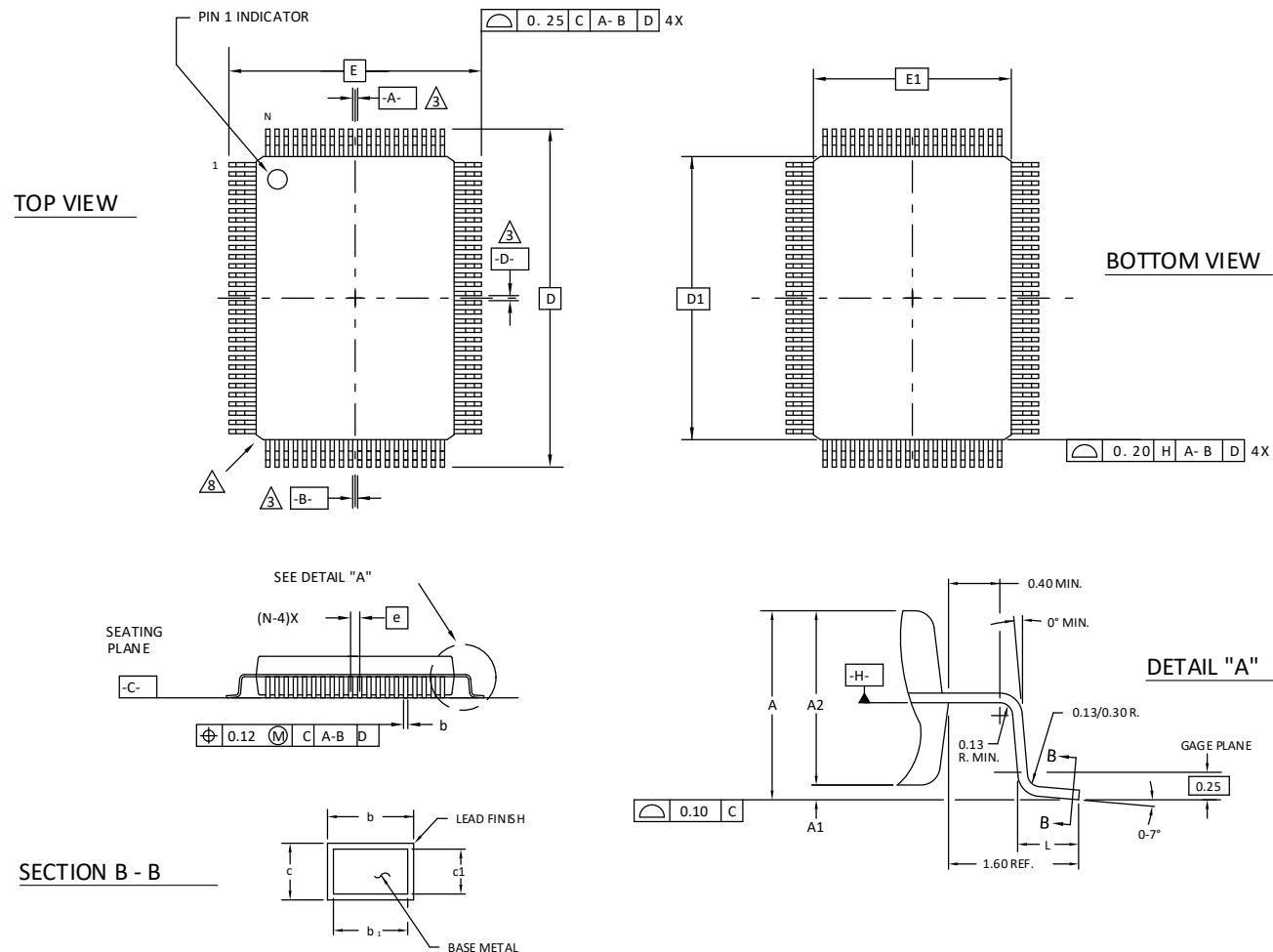
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.50	1.70
A1	0.30	0.50	0.70
A2 1.10 REF			
D/E 11.00 BSC			
M/N 9.00 BSC			
S 0.50 BSC			
b	0.40	0.55	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 60. 100-Pin PQFP Package

Dimensions in Millimeters



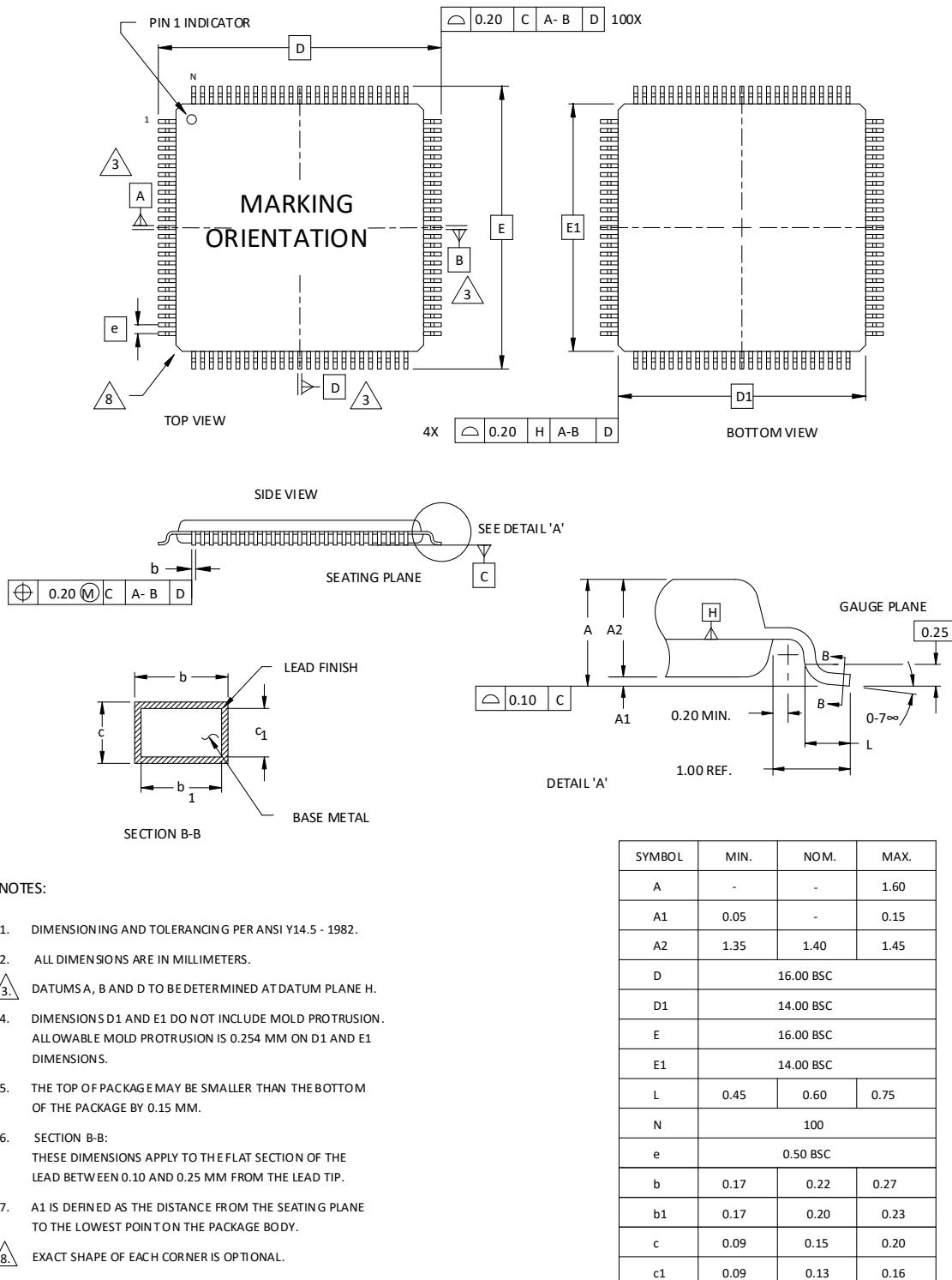
### NOTES:

- 0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 0 ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.**
- 0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.  
ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1  
DIMENSIONS.
- 0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM  
OF THE PACKAGE BY 0.15 MM.
- 0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE  
LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE  
TO THE LOWEST POINT ON THE PACKAGE BODY.
- EXACT SHAPE OF EACH CORNER IS OPTIONAL.**
- EXACT SHAPE OF EXPOSED HEATSINK IS OPTIONAL.**

SYMBOL	MIN.	NOM.	MAX.
A	-	-	3.40
A1	0.25	-	0.50
A2	2.50	2.70	2.90
D	23.20 BSC		
D1	20.00 BSC		
E	17.20 BSC		
E1	14.00 BSC		
L	0.73	0.88	1.03
N		100	
e		0.65 BSC	
b	0.22	-	0.40
b1	0.22	0.30	0.36
c	0.11	-	0.23
c1	0.11	0.15	0.19

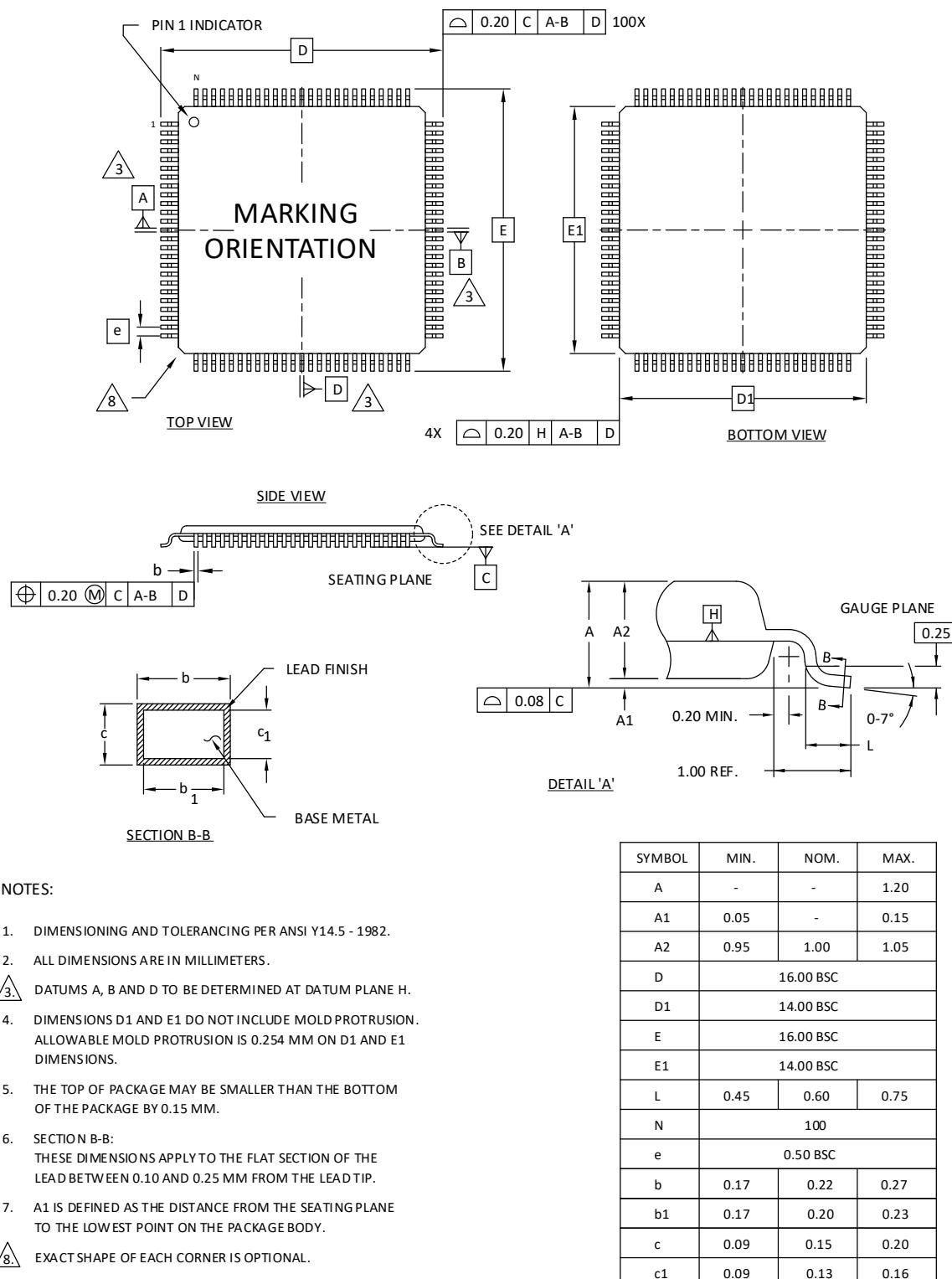
## 61. 100-Pin LQFP/TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000

Dimensions in Millimeters



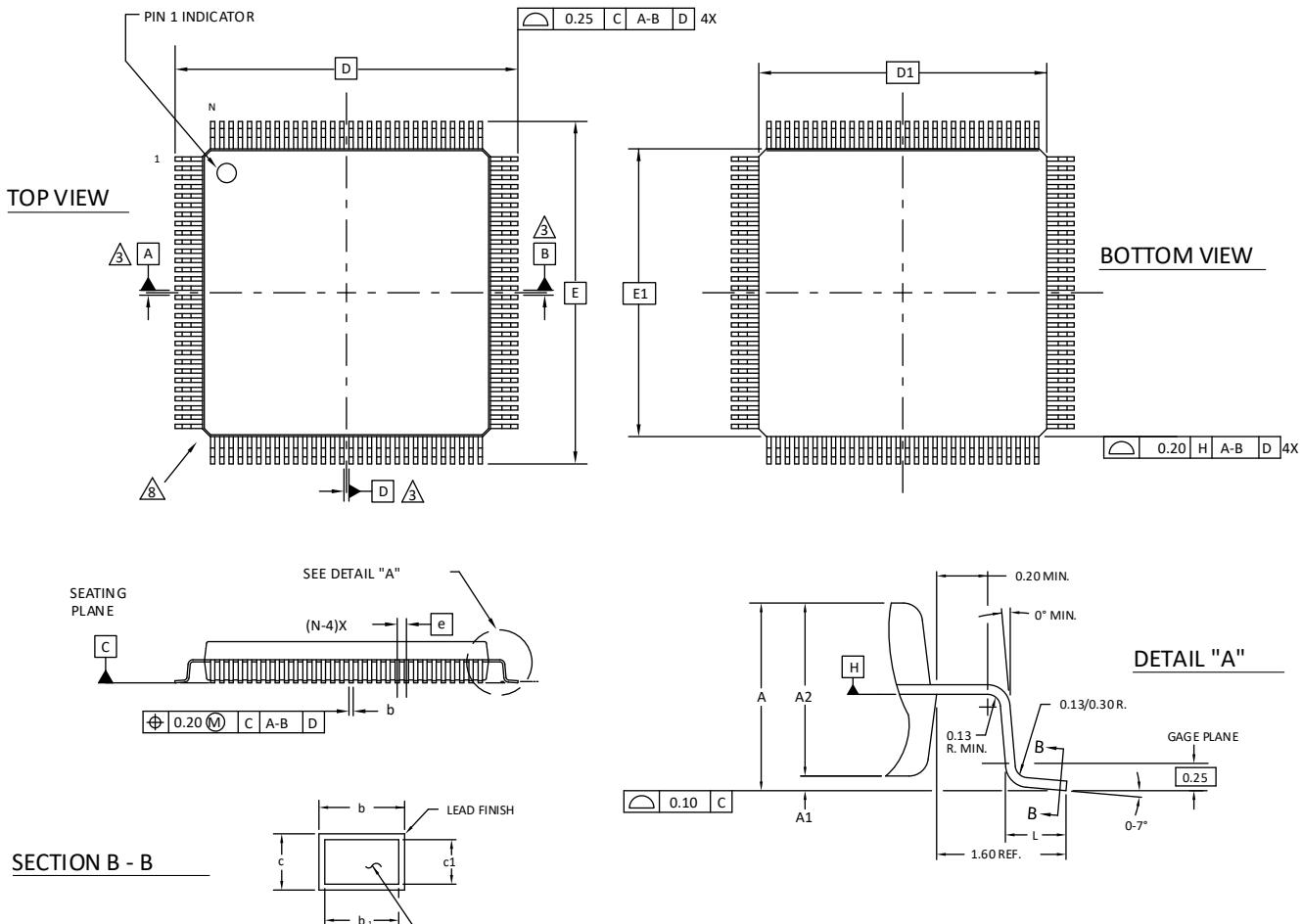
## 62. 100-Pin VQFP Package Option 2: iCE40

Dimensions in Millimeters



## 63. 120-Pin PQFP Package

Dimensions in Millimeters



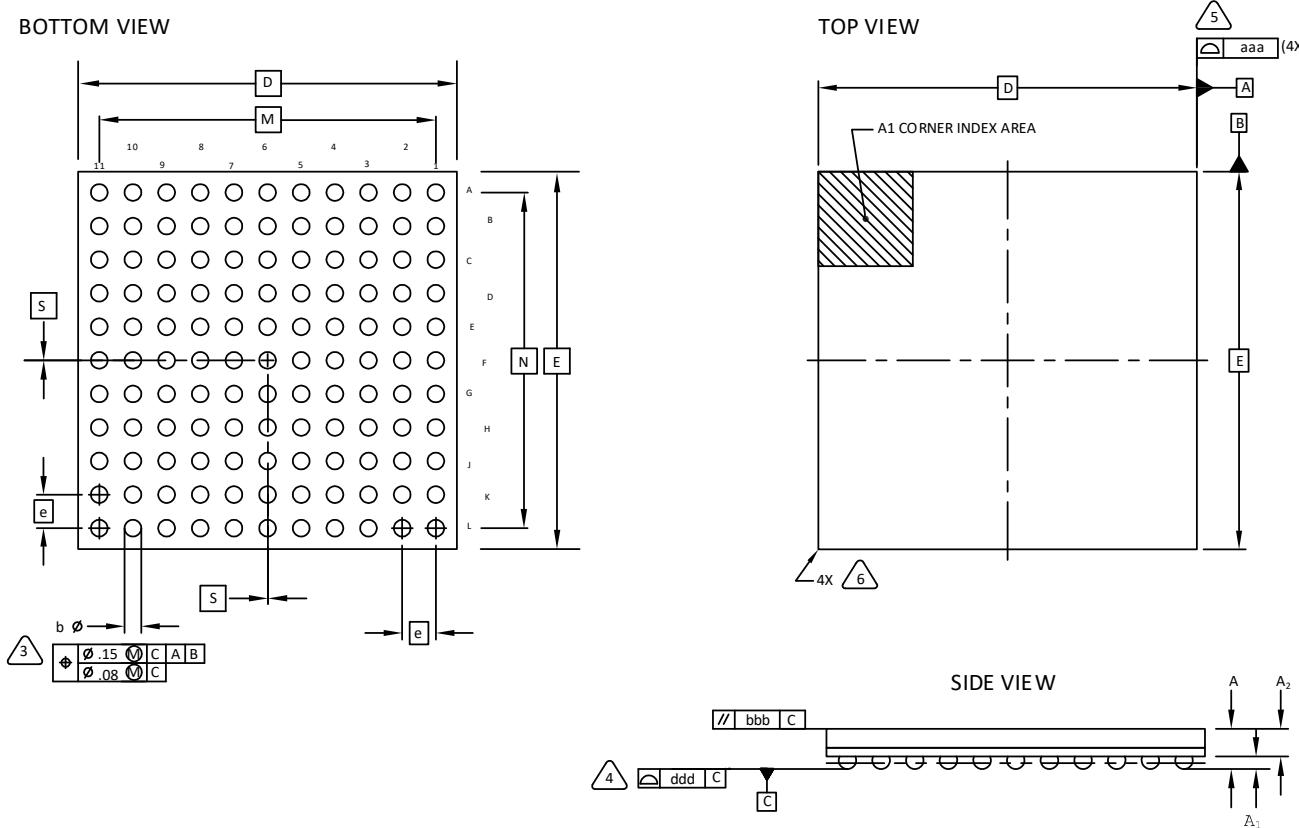
NOTES:

- 0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 0 ALL DIMENSIONS ARE IN MILLIMETERS.
- (3)** DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION.  
ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- (8)** EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- (9)** EXACT SHAPE OF EXPOSED HEATSINK IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	4.10
A1	0.25	-	0.50
A2	3.20	3.40	3.60
D	31.20	BSC	
D1	28.00	BSC	
E	31.20	BSC	
E1	28.00	BSC	
L	0.73	0.88	1.03
N		120	
e		0.80	BSC
b	0.29	-	0.45
b1	0.29	0.35	0.41
c	0.11	-	0.23
c1	0.11	0.15	0.19

## 64. 121-Ball caBGA Package (9 mm x 9 mm Body)

Dimensions in Millimeters



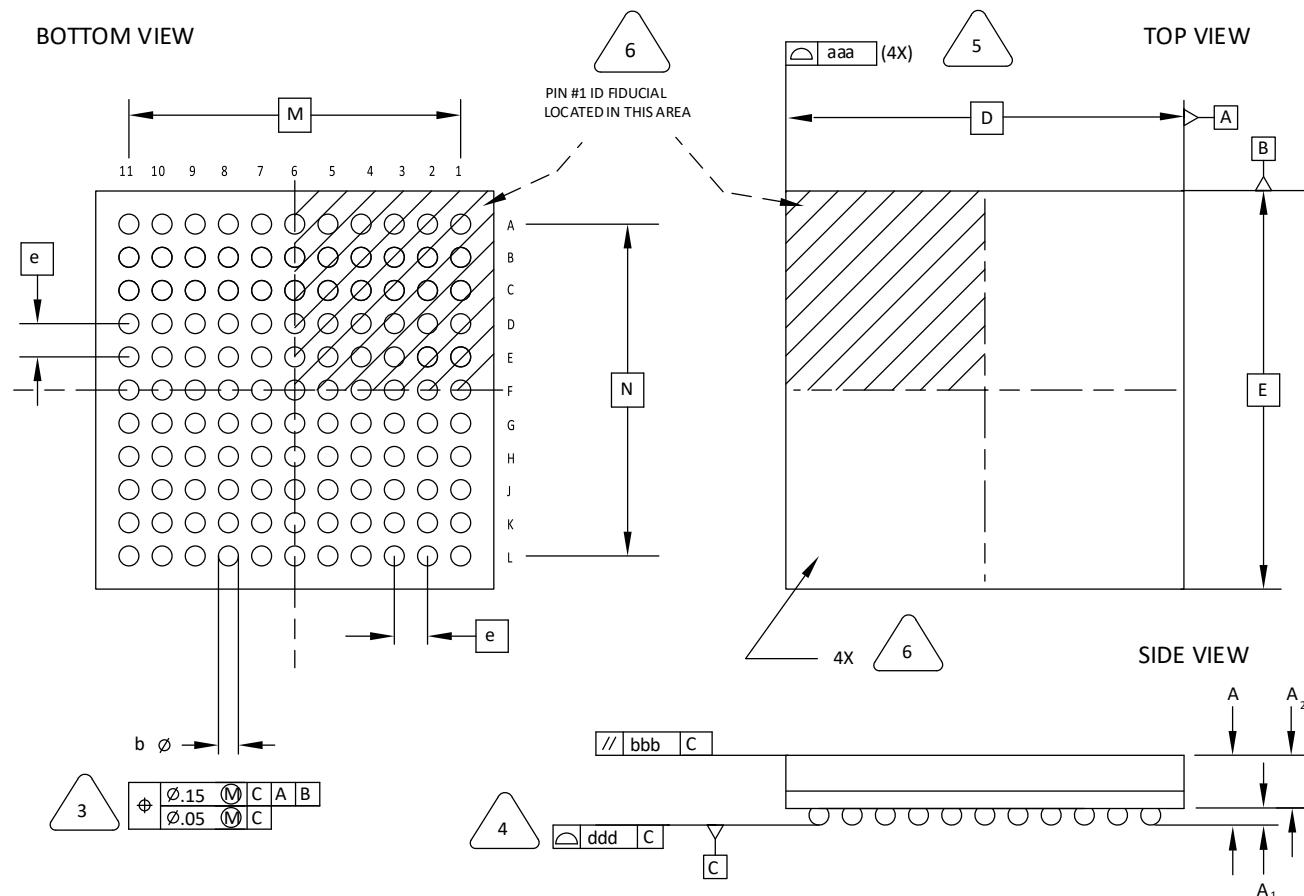
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	—	—	1.10
A1	0.15	—	—
A2	0.55	—	—
D/E	9.00 BSC		
M/N	8.00 BSC		
S	0.00 BSC		
b	0.30	0.40	0.50
e	0.80 BSC		
aaa	0.15		
bbb	0.20		
ddd	0.10		

## 65. 121-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]



PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

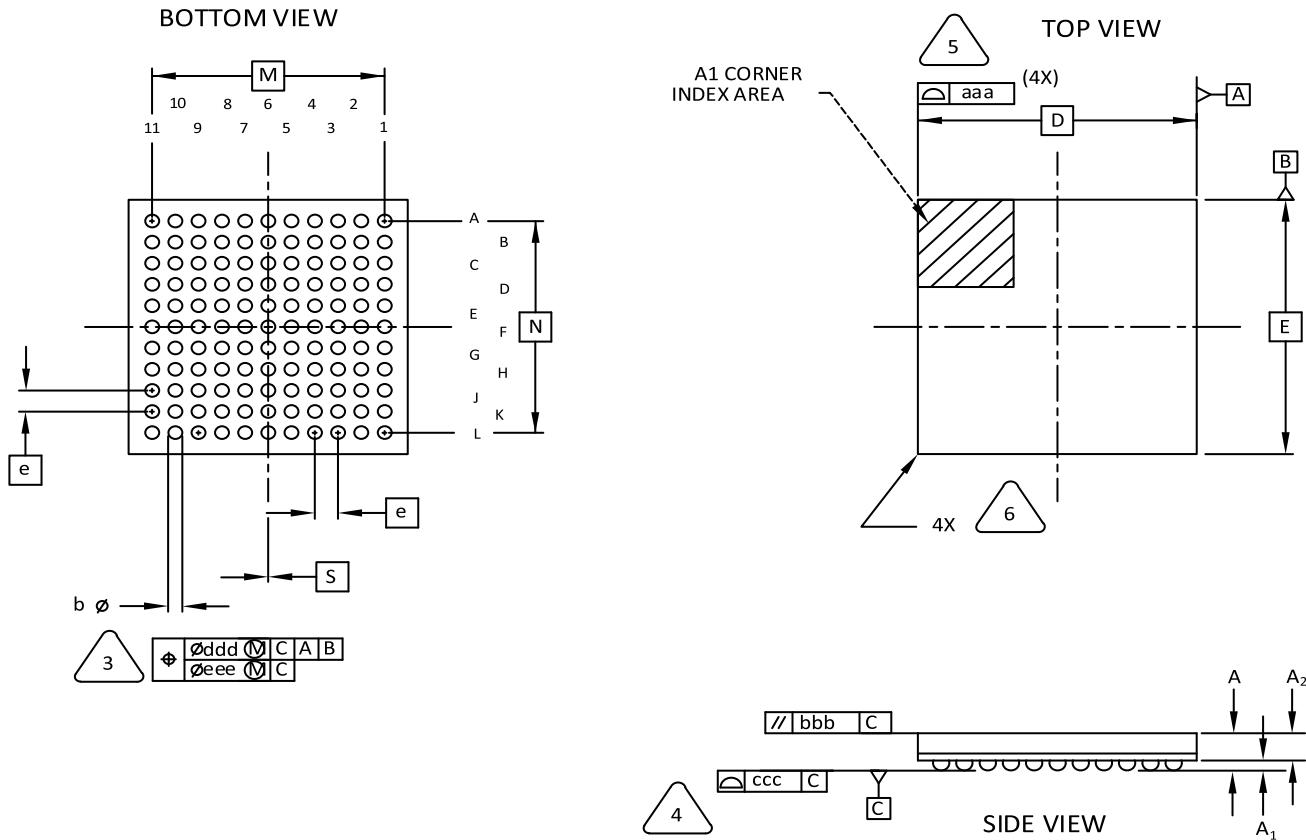


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	6.00 BSC		
M/N	5.00 BSC		
b	0.20	0.25	0.30
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 66. 121-Ball csfBGA Package

Dimensions in Millimeters



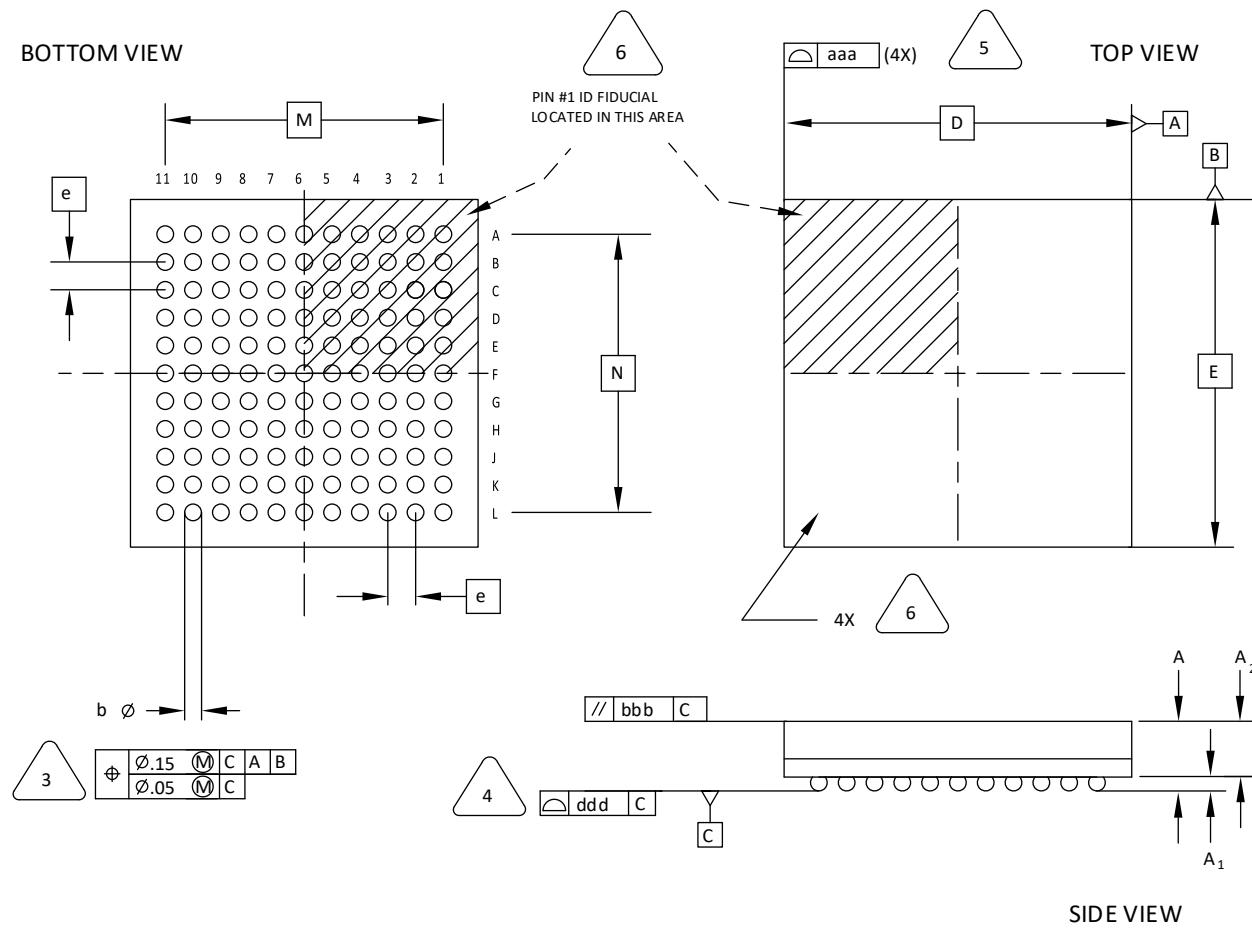
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
- 4** PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	0.24	-
A2	-	0.66	-
D/E	6.00 BSC		
M/N	5.00 BSC		
S	0.00 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.05		

## 67. 121-Ball ucBGA Package

Dimensions in Millimeters



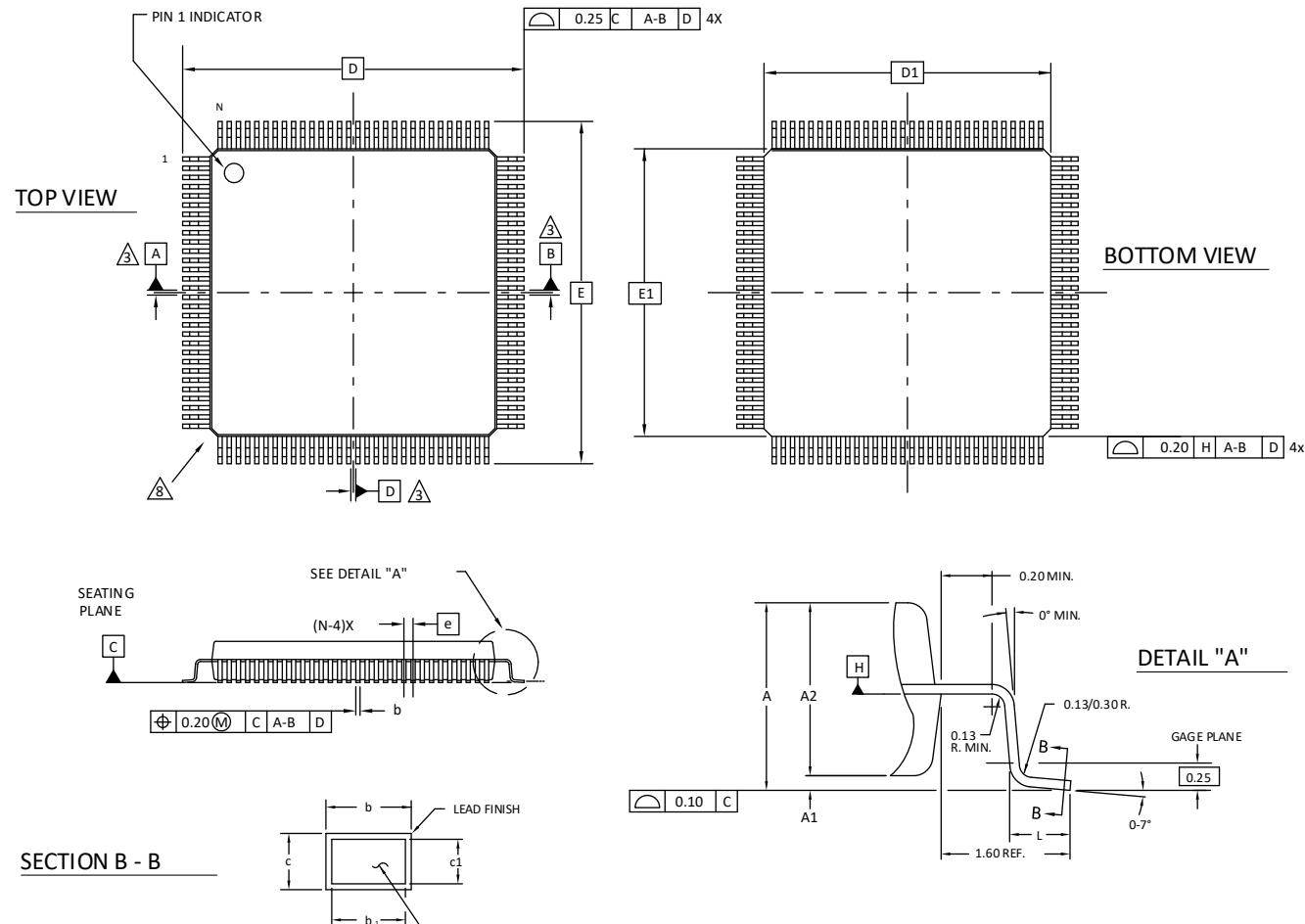
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	5.00 BSC		
M/N	4.00 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 68. 128-Pin PQFP Package

Dimensions in Millimeters



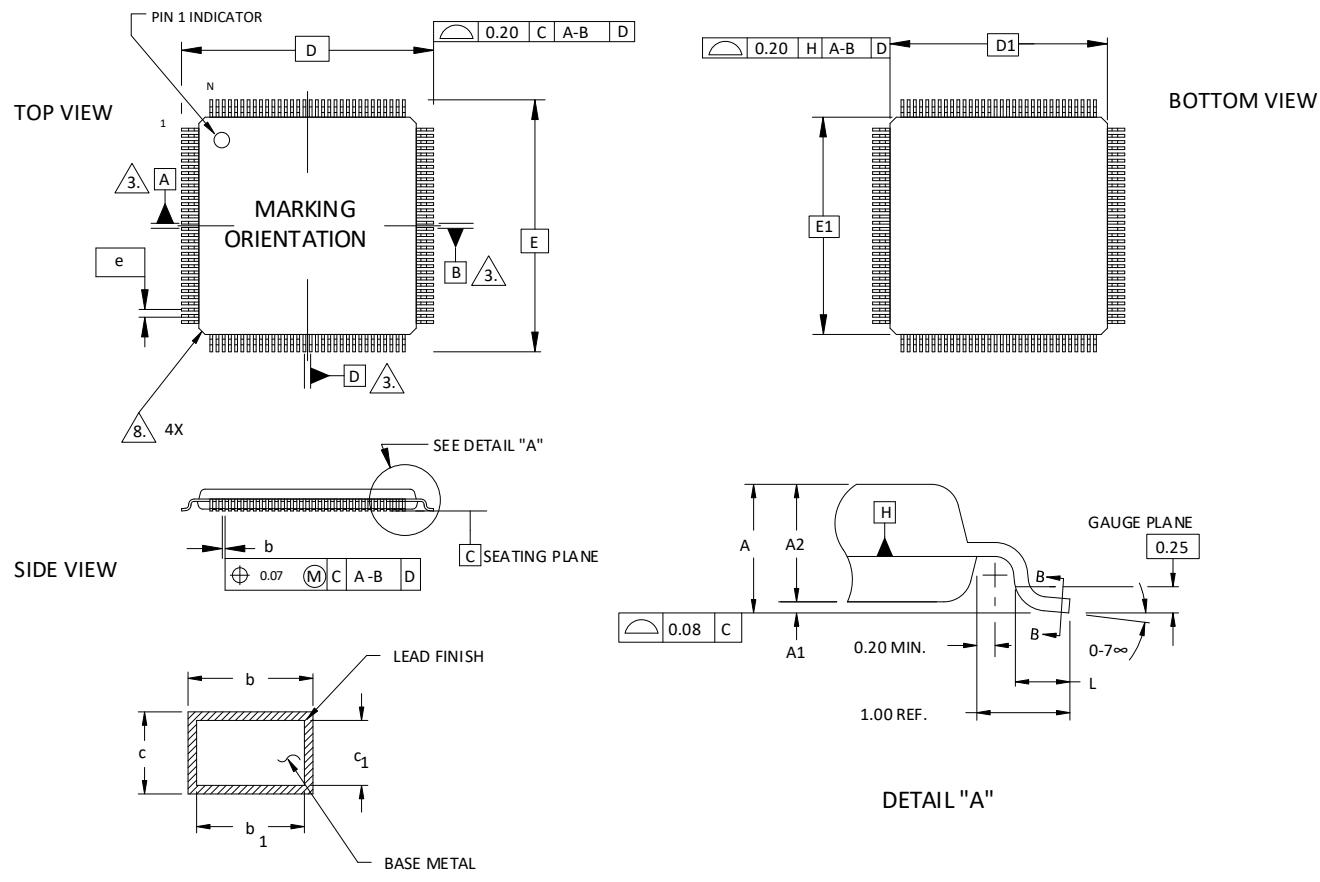
### NOTES:

- 0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 0 ALL DIMENSIONS ARE IN MILLIMETERS.
- △** DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- △** EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- △** EXACT SHAPE OF EXPOSED HEATSINK IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	4.10
A1	0.25	-	0.50
A2	3.20	3.40	3.60
D	31.20	BSC	
D1	28.00	BSC	
E	31.20	BSC	
E1	28.00	BSC	
L	0.73	0.88	1.03
N		128	
e		0.80	BSC
b	0.29	-	0.45
b1	0.29	0.35	0.41
c	0.11	-	0.23
c1	0.11	0.15	0.19

## 69. 128-Pin LQFP Package

Dimensions in Millimeters



SECTION B - B

NOTES:

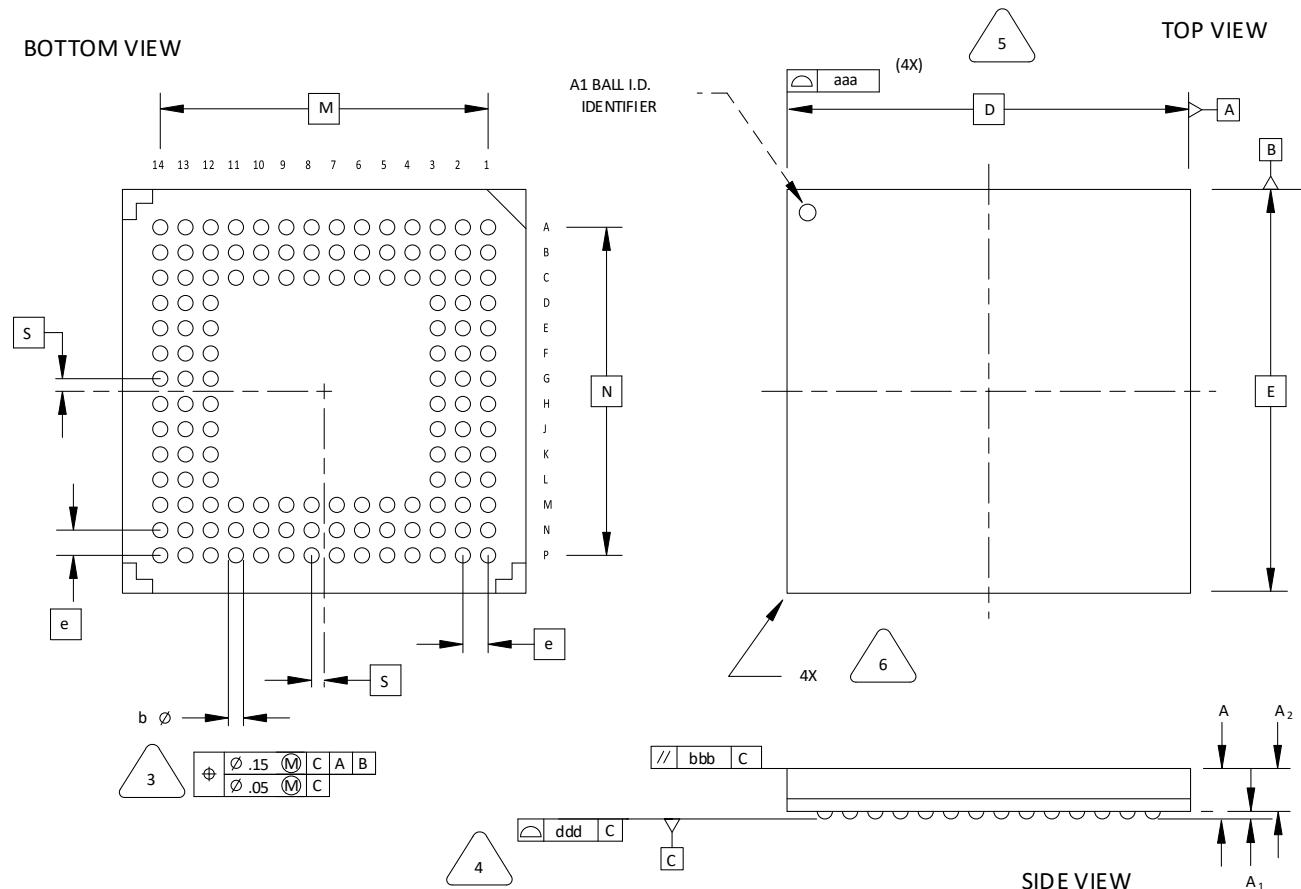
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B: THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SIDE VIEW

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D	16.00	BSC	
D1	14.00	BSC	
E	16.00	BSC	
E1	14.00	BSC	
L	0.45	0.60	0.75
N		128	
e	0.40	BSC	
b	0.13	0.18	0.23
b1	0.13	0.16	0.19
c	0.09	0.15	0.20
c1	0.09	0.13	0.16

## 70. 132-Ball csBGA Package Option 1: MachXO2, MachXO, LatticeXP2™

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C

PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

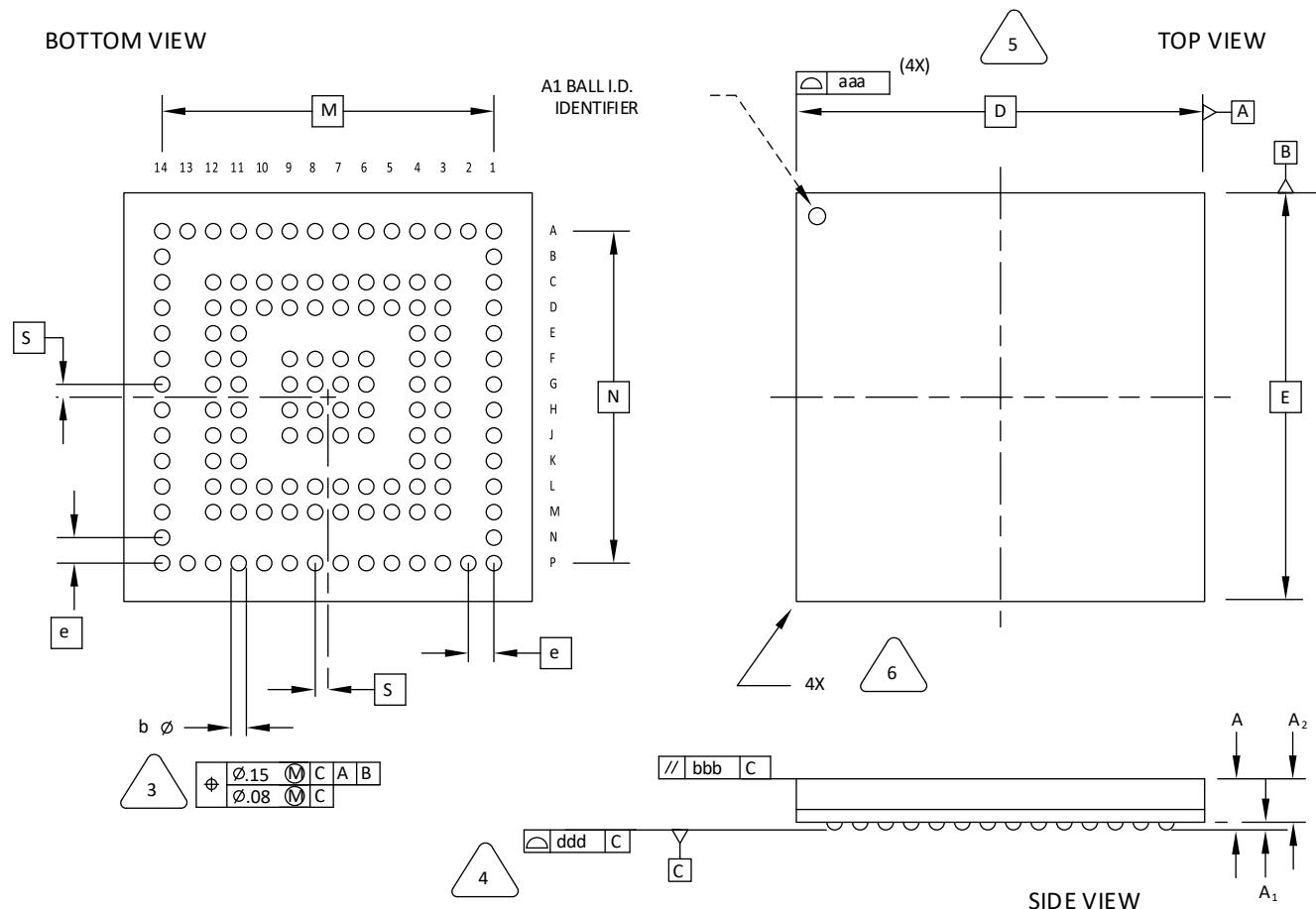
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	0.90	1.23	1.35
A1	0.15	-	-
A2	-	-	1.10
D/E	8.00 BSC		
M/N	6.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 71. 132-Ball csBGA Package Option 2: iCE40

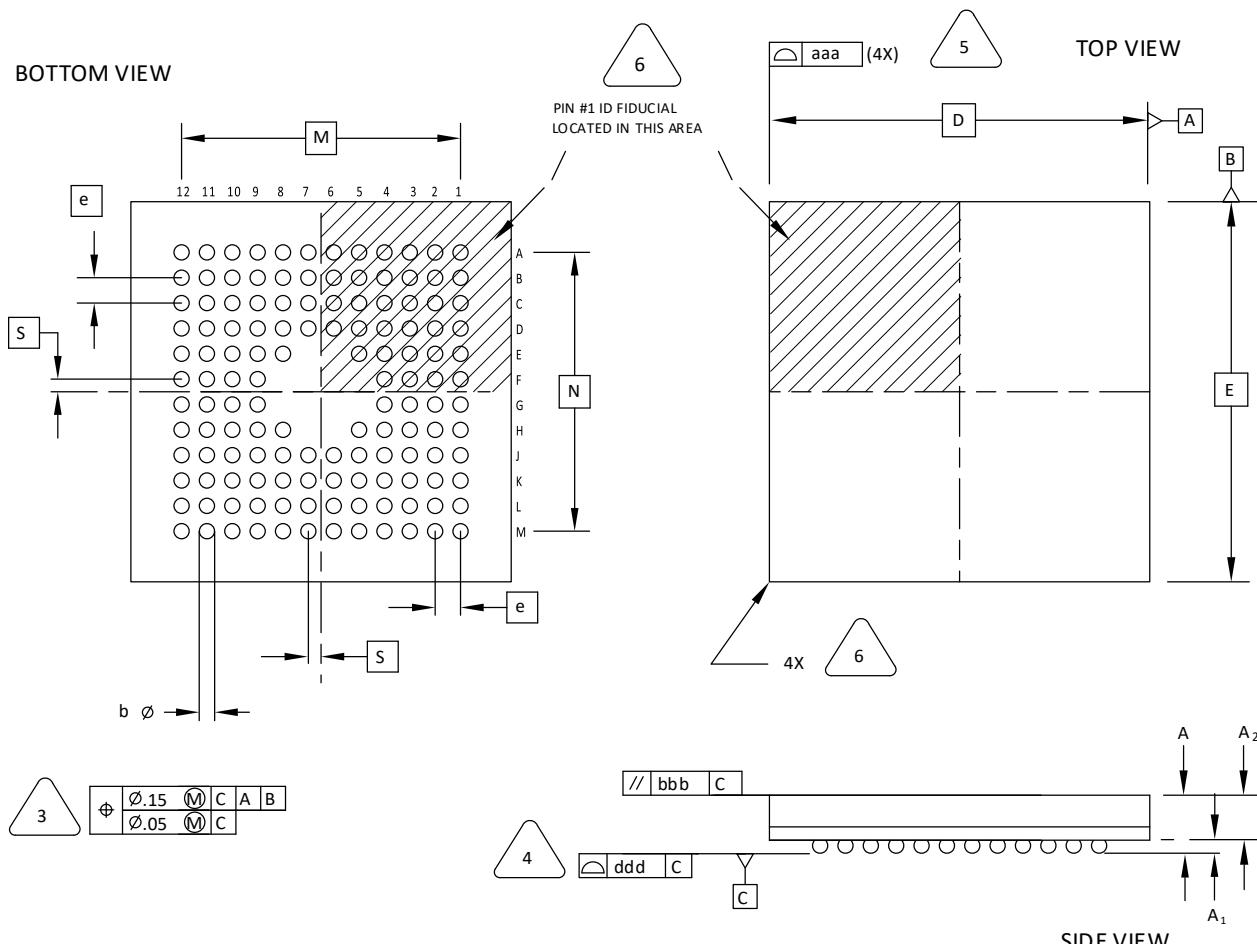
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	-	-
A2	-	-	0.85
D/E	8.00 BSC		
M/N	6.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 72. 132-Ball ucBGA Package

Dimensions in Millimeters



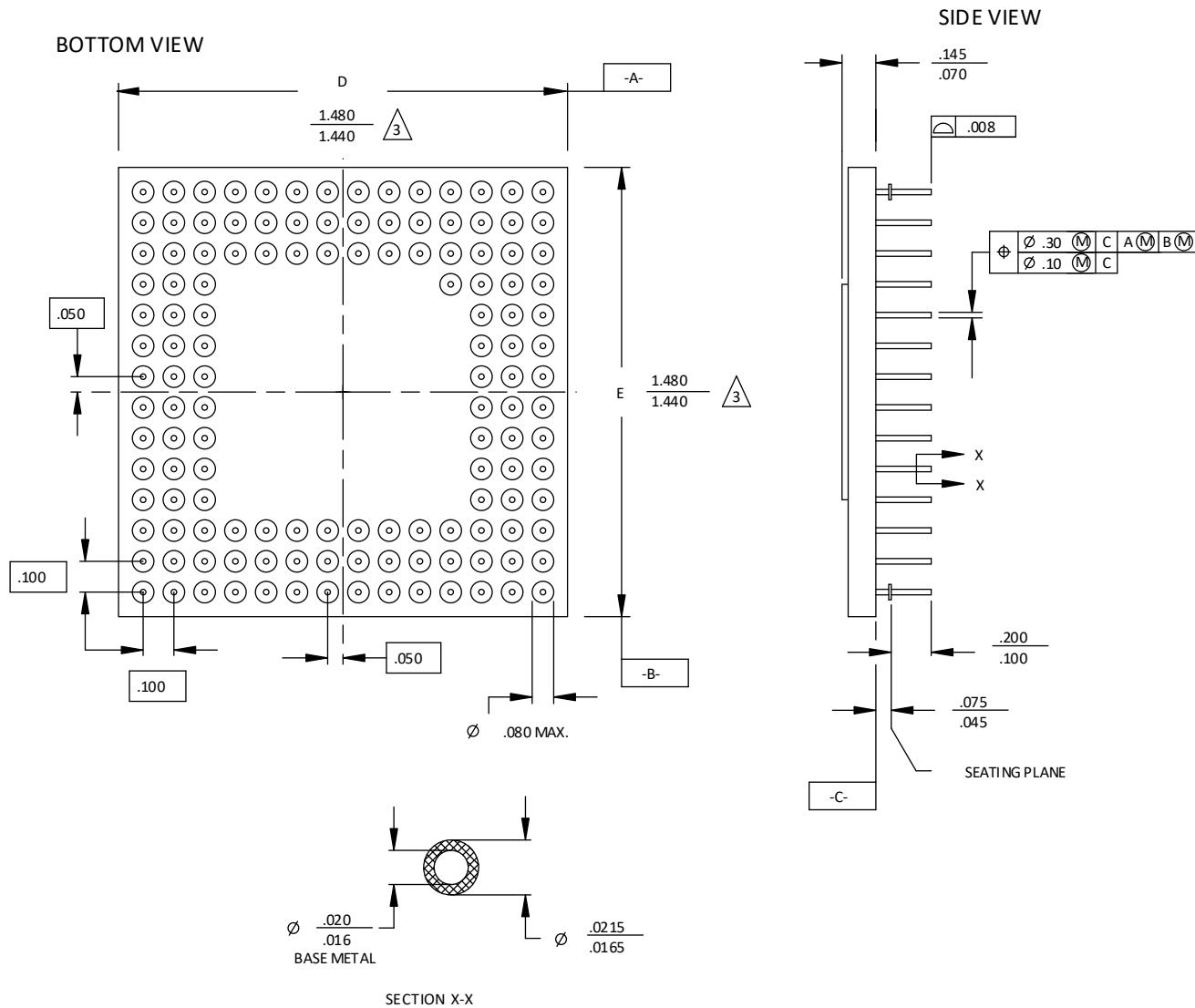
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	6.00 BSC		
M/N	4.40 BSC		
S	0.20 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 73. 133-Pin CPGA Package

Dimensions in Inches



### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.

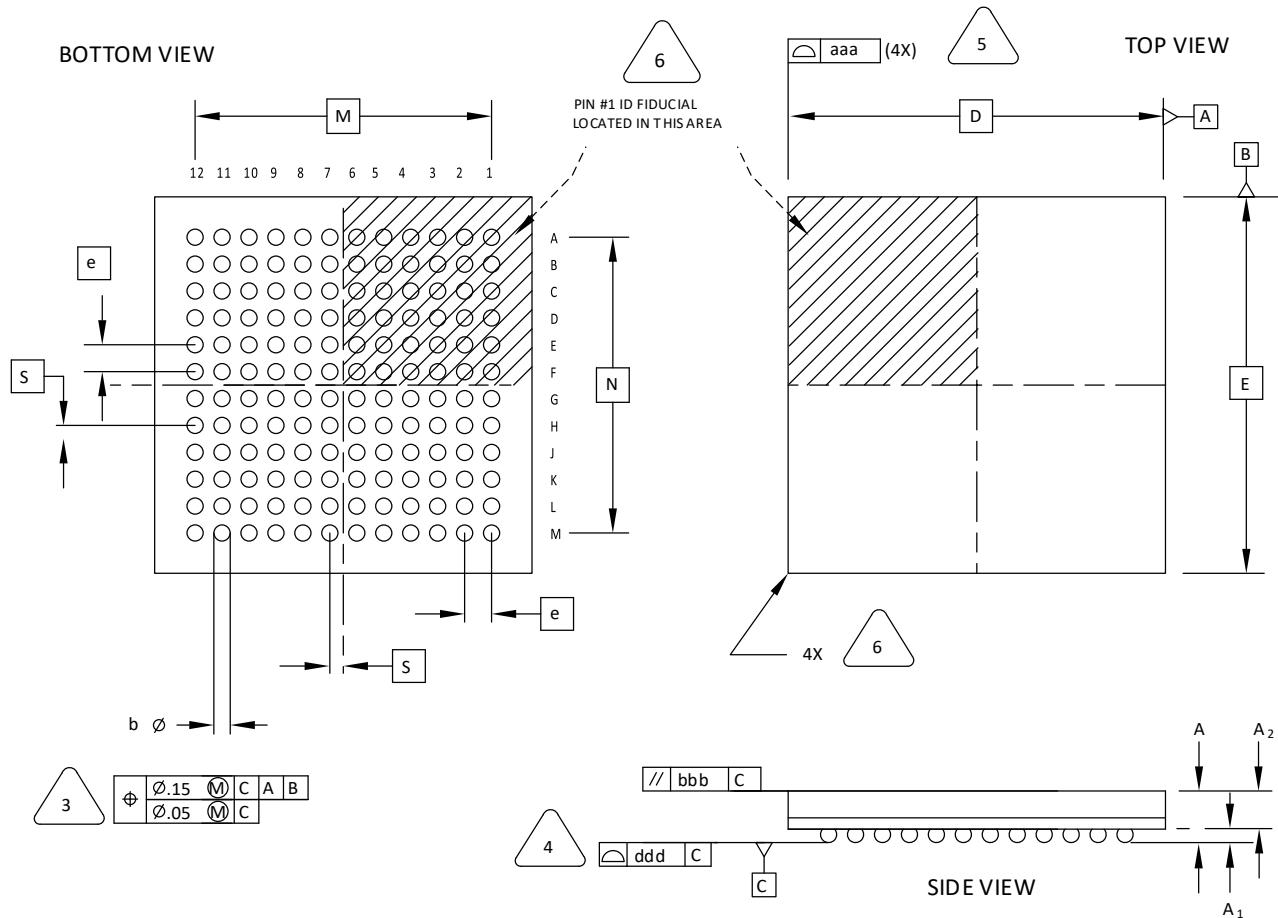
2. ALL DIMENSIONS ARE IN INCHES.



3. DIMENSIONS D AND E MAY HAVE MATERIAL PROTRUSION OF .006 INCHES MAXIMUM ABOVE THE DIMENSION SHOWN NOT TO EXCEED .003 INCHES MAXIMUM PER SIDE.

## 74. 144-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.

4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

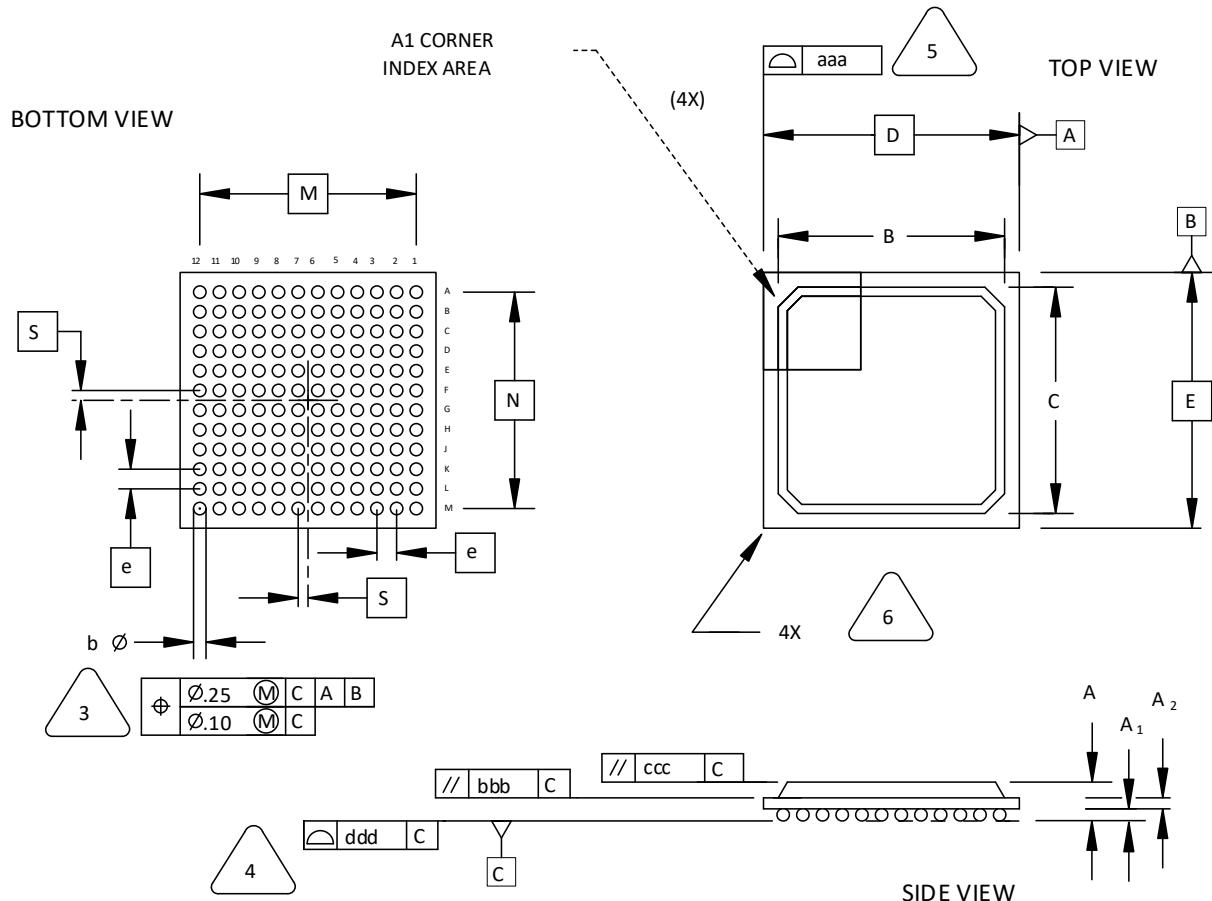
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	0.90	1.00	1.10
A <sub>1</sub>	0.15	-	-
A <sub>2</sub>	-	-	0.85
D/E	7.00 BSC		
M/N	5.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 75. 144-Ball fpBGA Package

Dimensions in Millimeters



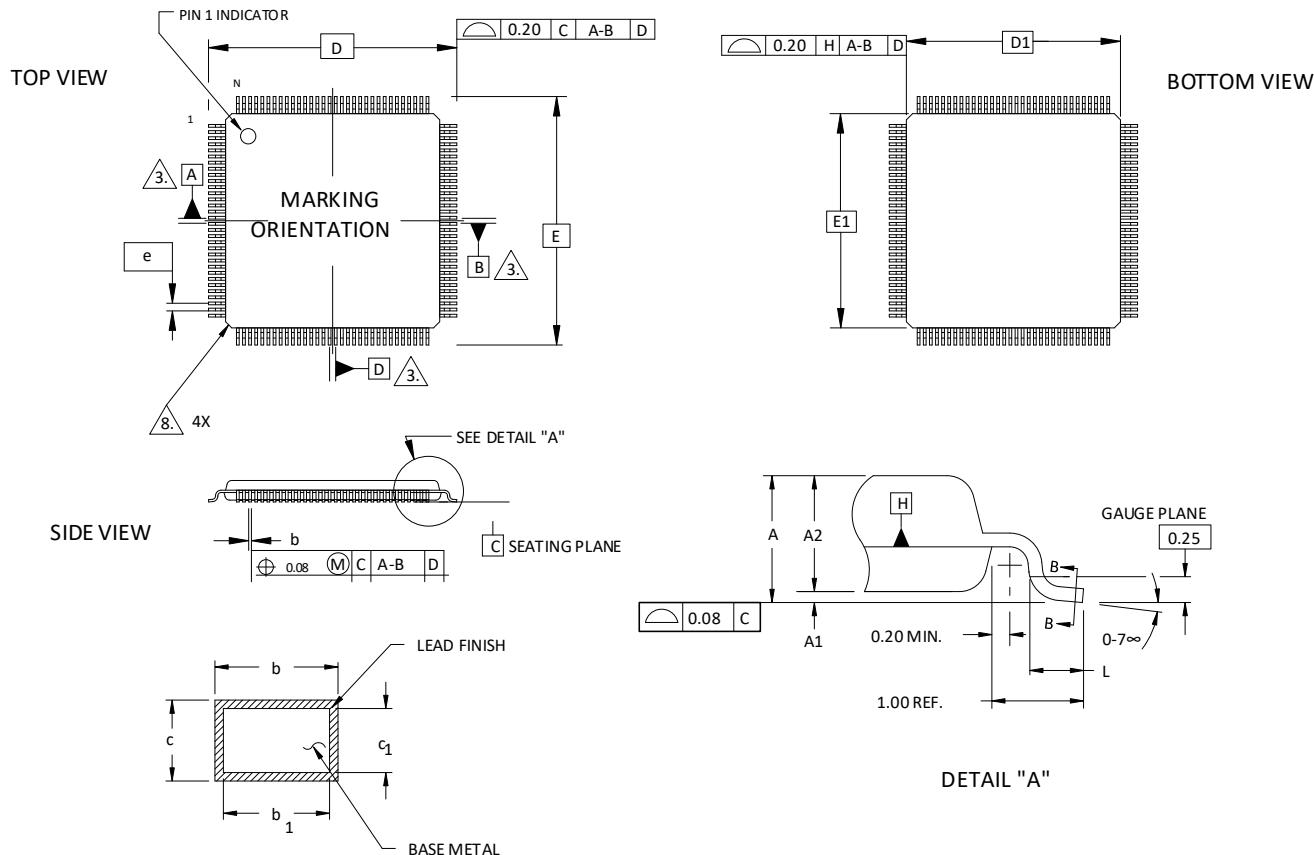
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. Dimension "b" is measured at the maximum solder ball diameter, parallel to primary datum [C].
4. Primary datum [C] and seating plane are defined by the spherical crowns of the solder balls.
5. Bilateral tolerance zone is applied to each side of the package body.
6. Exact shape and size of this feature is optional.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.70	2.10
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	11.00	11.60	12.20
D/E	13.00 BSC		
M/N	11.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 76. 144-Pin LQFP/TQFP Package

Dimensions in Millimeters



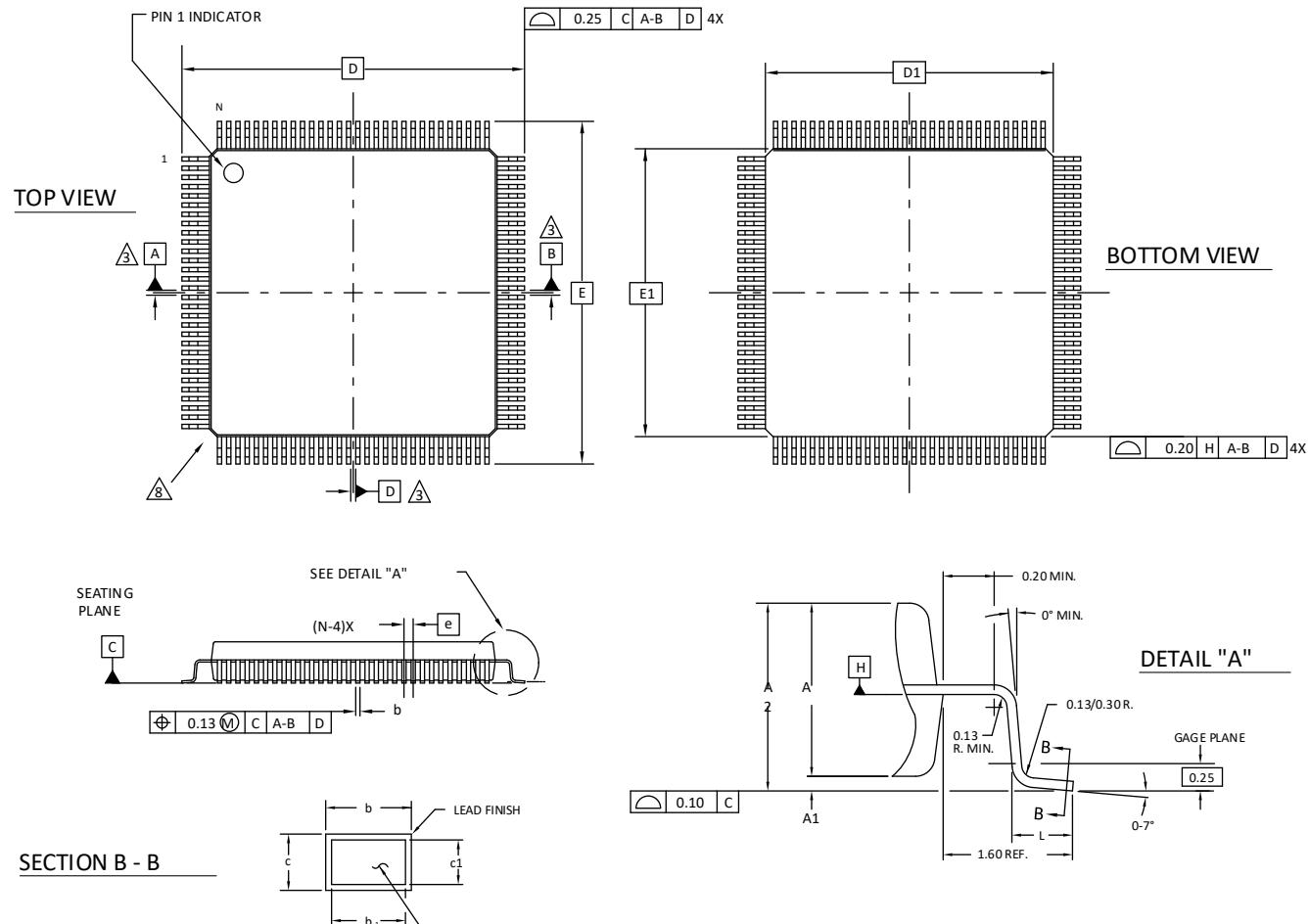
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D	22.00	BSC	
D1	20.00	BSC	
E	22.00	BSC	
E1	20.00	BSC	
L	0.45	0.60	0.75
N		144	
e		0.50	BSC
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
c	0.09	0.15	0.20
c1	0.09	0.13	0.16

## 77. 160-Pin PQFP Package

Dimensions in Millimeters



### NOTES:

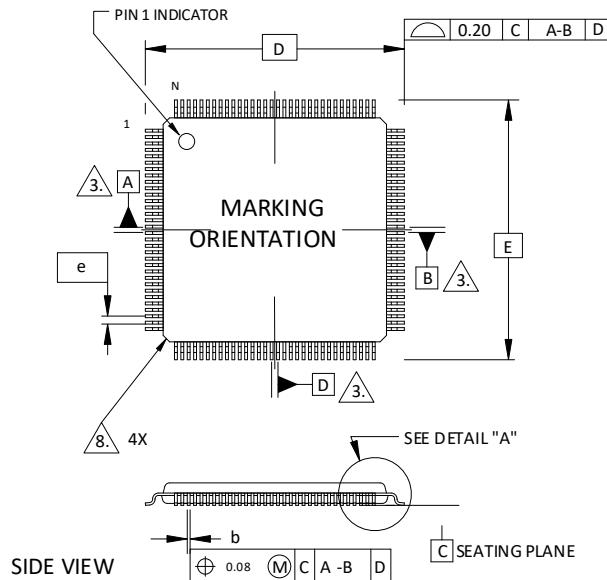
- O DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- O ALL DIMENSIONS ARE IN MILLIMETERS.
- △** DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- O DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- O THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- O SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- O A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE E TO THE LOWEST POINT ON THE PACKAGE BODY.
- △** EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- △** EXACT SHAPE OF EXPOSED HEATSINK IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	4.10
A1	0.25	-	0.50
A2	3.20	3.40	3.60
D	31.20 BSC		
D1	28.00 BSC		
E	31.20 BSC		
E1	28.00 BSC		
L	0.73	0.88	1.03
N		160	
e		0.65 BSC	
b	0.22	-	0.40
b1	0.22	0.30	0.36
c	0.11	-	0.23
c1	0.11	0.15	0.19

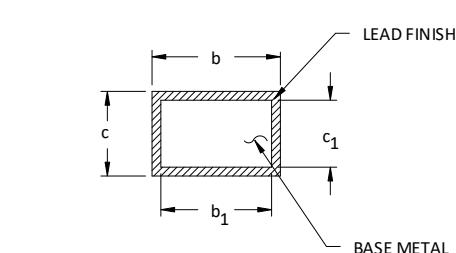
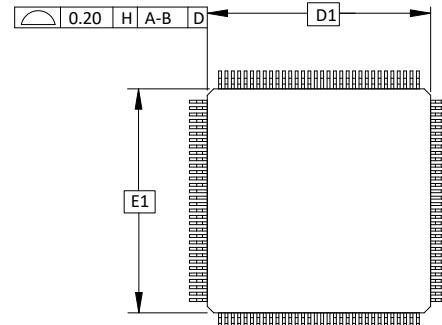
## 78. 176-Pin LQFP/TQFP Package

Dimensions in Millimeters

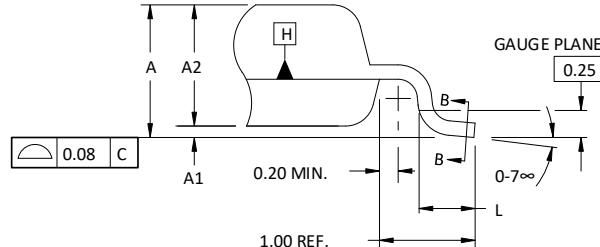
TOP VIEW



BOTTOM VIEW



SECTION B - B



DETAIL "A"

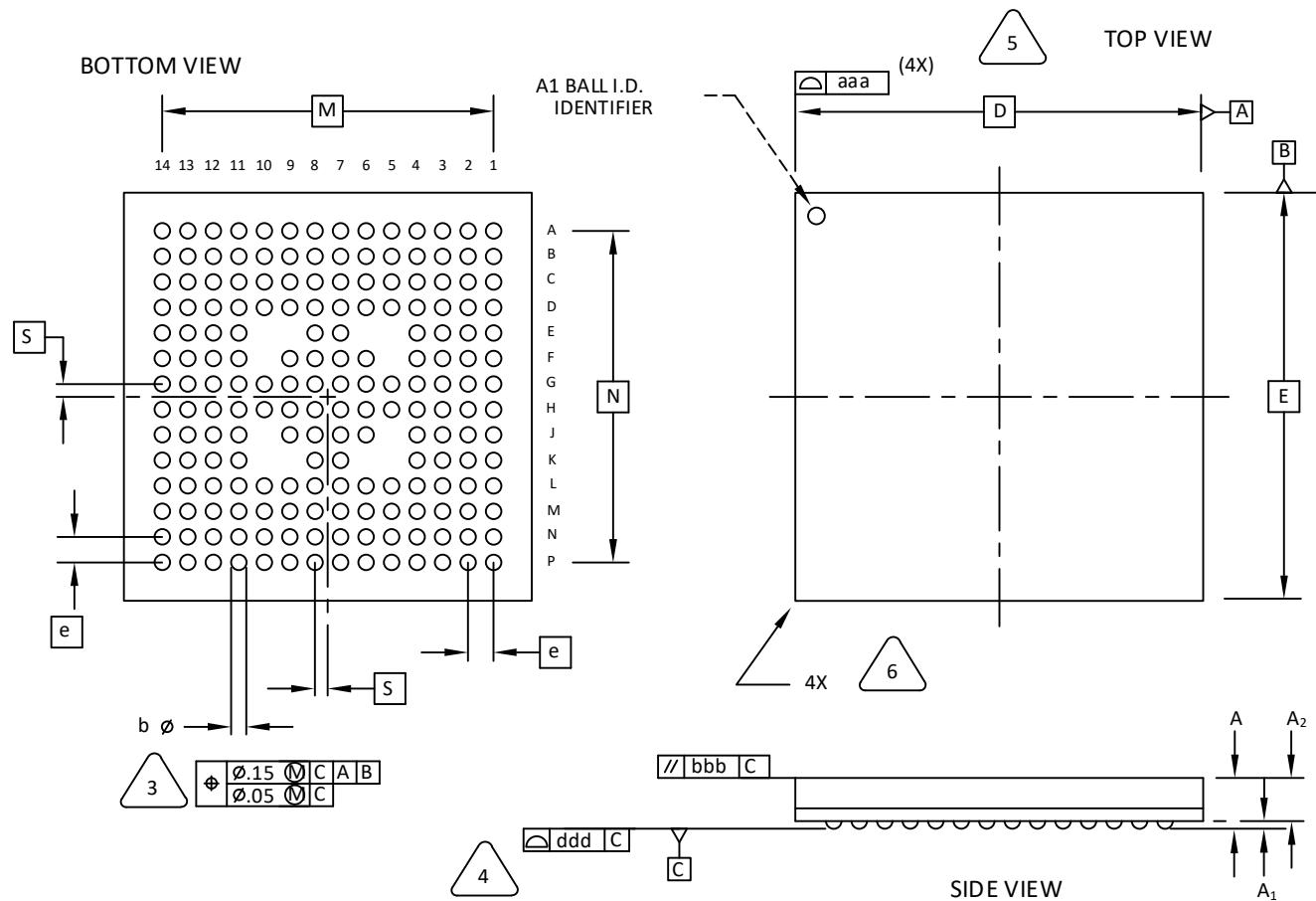
NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
6. SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
7. A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
8. EXACT SHAPE OF EACH CORNER IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
D 26.00 BSC			
D1	24.00 BSC		
E	26.00 BSC		
E1	24.00 BSC		
L	0.45	0.60	0.75
N 176			
e	0.50 BSC		
b	0.17	0.22	0.27
b <sub>1</sub>	0.17	0.20	0.23
c	0.09	0.15	0.20
c <sub>1</sub>	0.09	0.13	0.16

## 79. 184-Ball csBGA Package

Dimensions in Millimeters

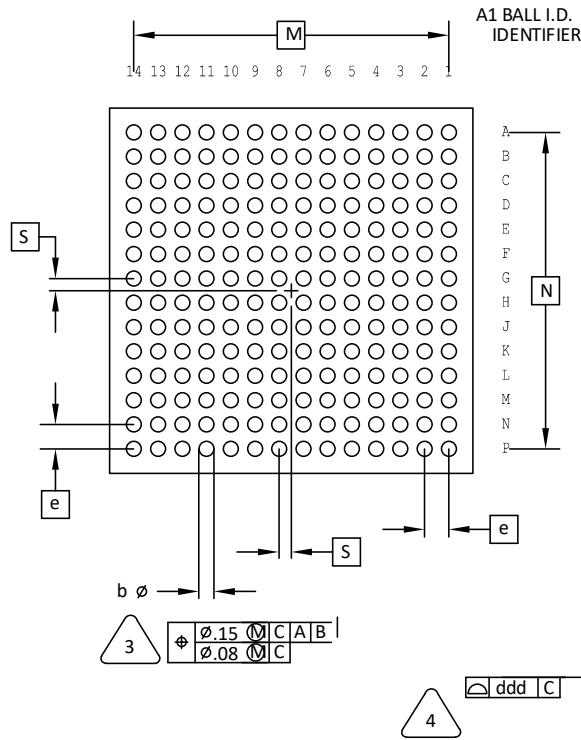


SYMBOL	MIN.	NOM.	MAX.
A	1.20	1.35	1.50
A1	0.16	-	-
A2	-	-	1.34
D/E	8.00 BSC		
M/N	6.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

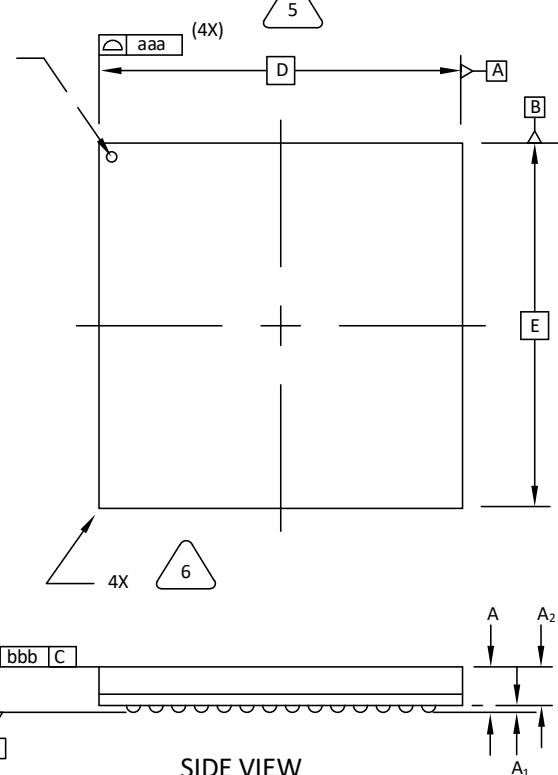
## 80. 196-Ball caBGA Package

Dimensions in Millimeters

BOTTOM VIEW



TOP VIEW



SIDE VIEW

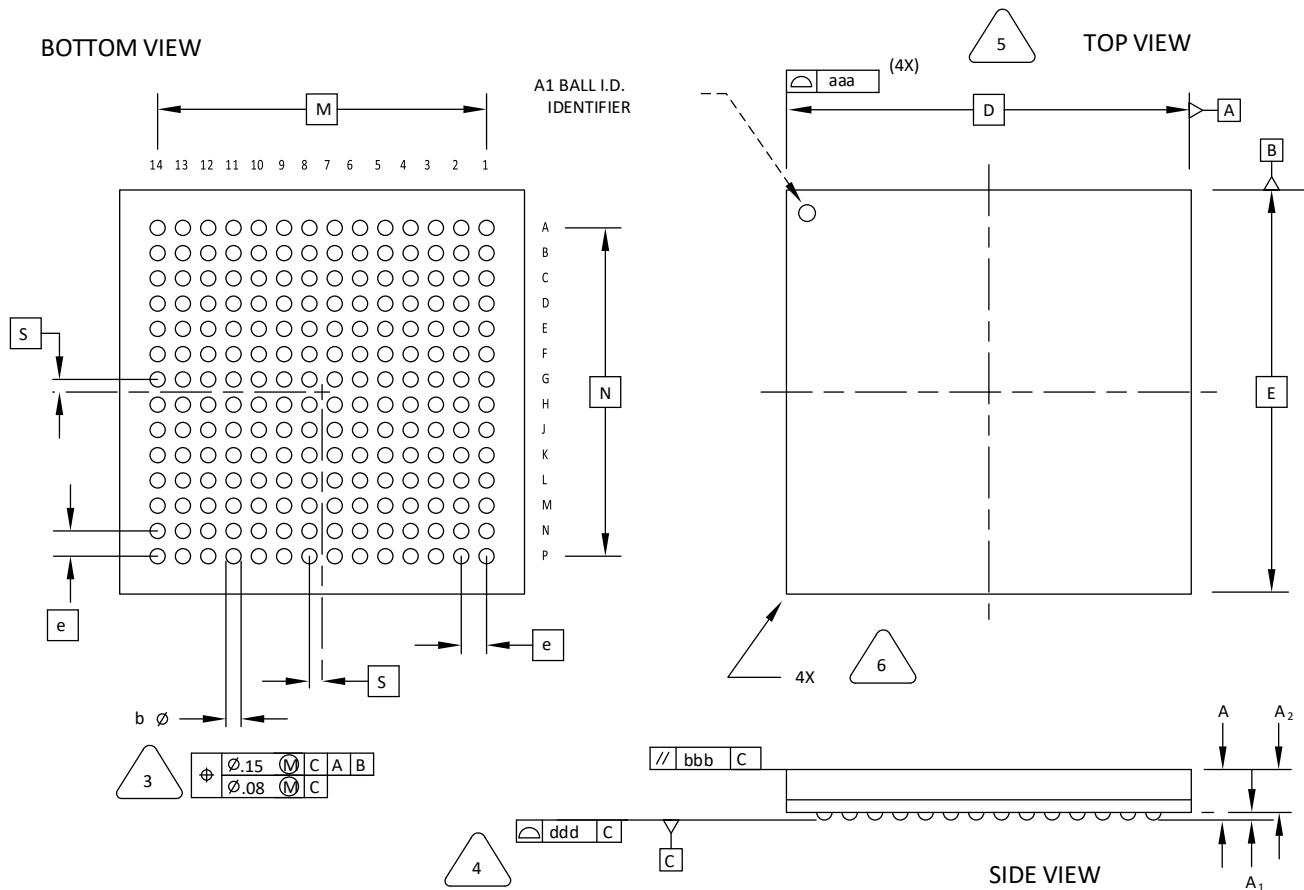
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: JEP95DR4.5

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.27		
A2	-	-	1.10
D/E	12.00 BSC		
M/N	10.40 BSC		
S	0.40 BSC		
b	0.45	0.50	0.55
e	0.80 BSC		
aaa	-	-	0.15
bbb	-		0.20
ddd	-	-	0.20

## 81. 196-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

3 DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.

4 PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

5 BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

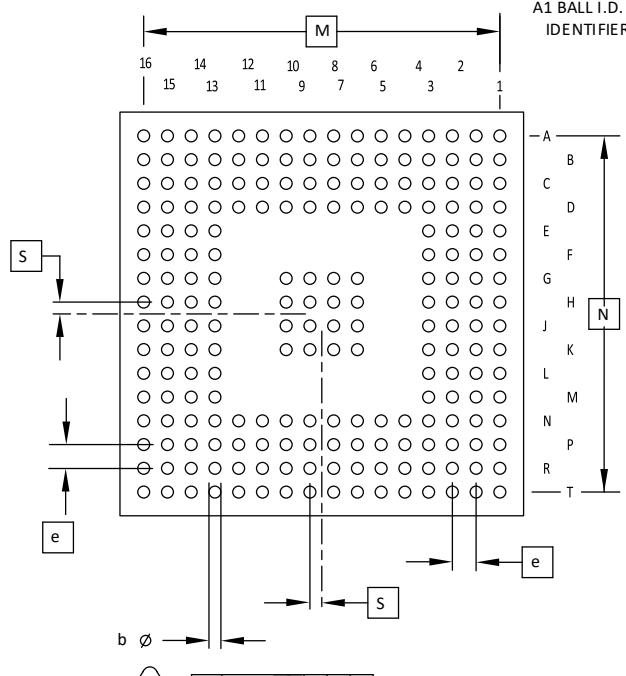
6 EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	-	-
A2	-	-	0.85
D/E	8.00 BSC		
M/N	6.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

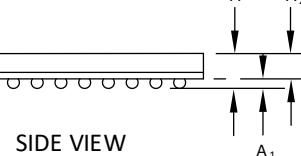
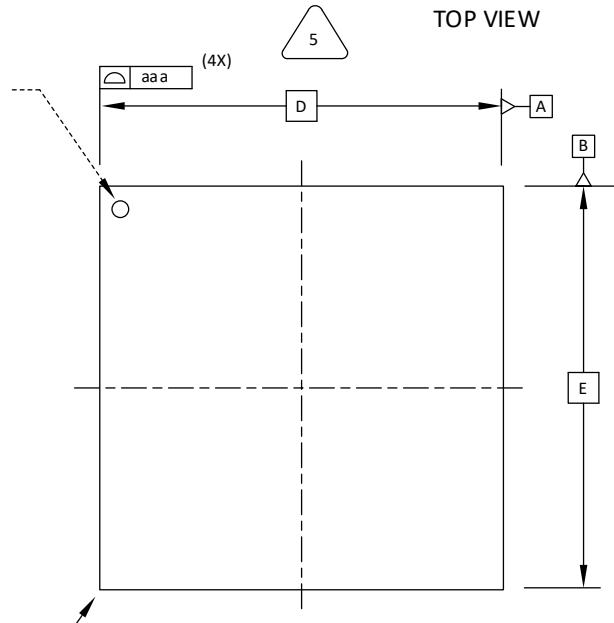
## 82. 208-Ball ftBGA Package

Dimensions in Millimeters

BOTTOM VIEW



TOP VIEW



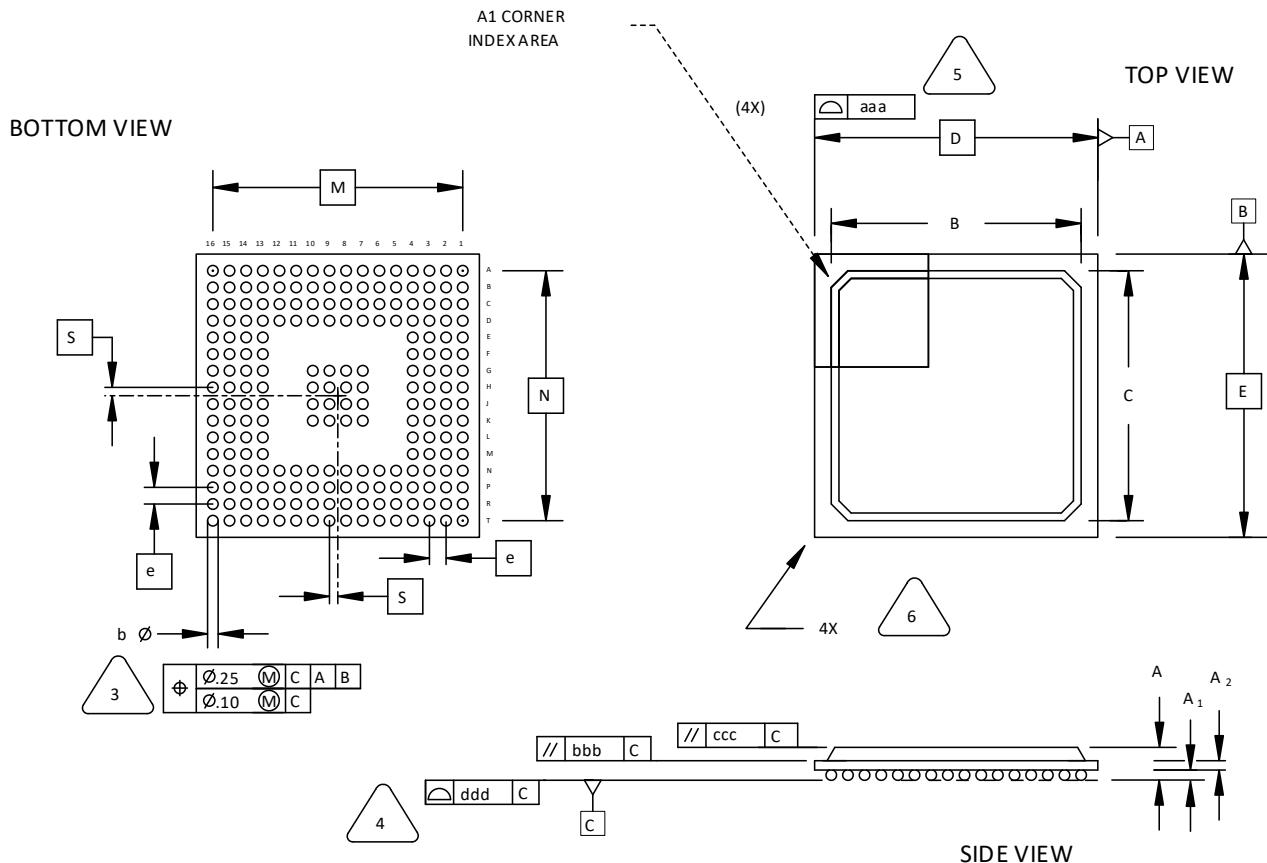
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.25	1.40	1.55
A1	0.30	-	-
A2	-	-	1.25
D/E	17.0 BSC		
M/N	15.0 BSC		
S	0.50 BSC		
b	0.40	0.50	0.60
e	1.0 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.12

## 83. 208-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

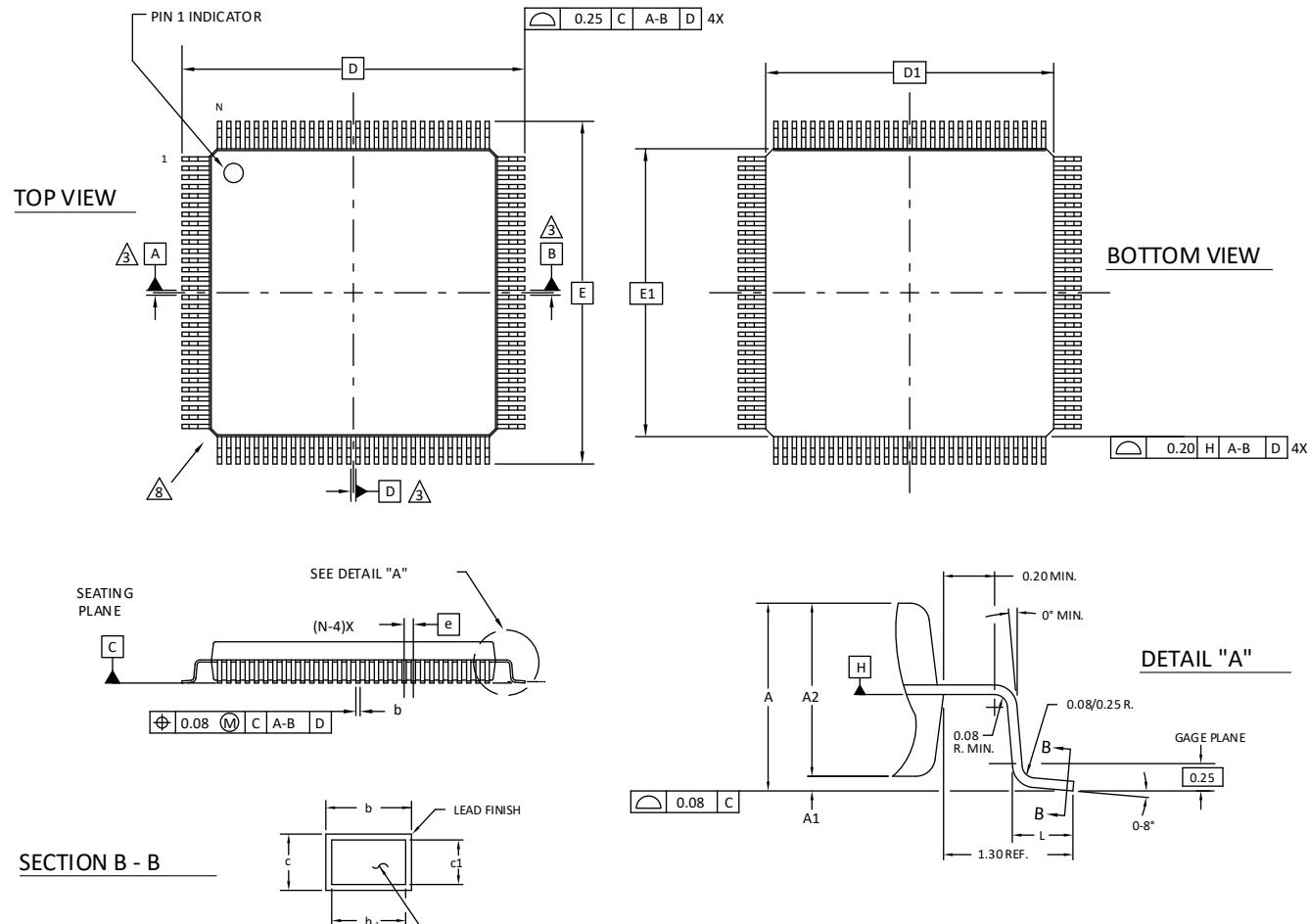
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.70	2.10
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	14.80	15.30	15.80
D/E		17.00	BSC
M/N		15.00	BSC
S		0.50	BSC
b	0.50	0.60	0.70
e		1.00	BSC
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 84. 208-Pin PQFP Package

Dimensions in Millimeters



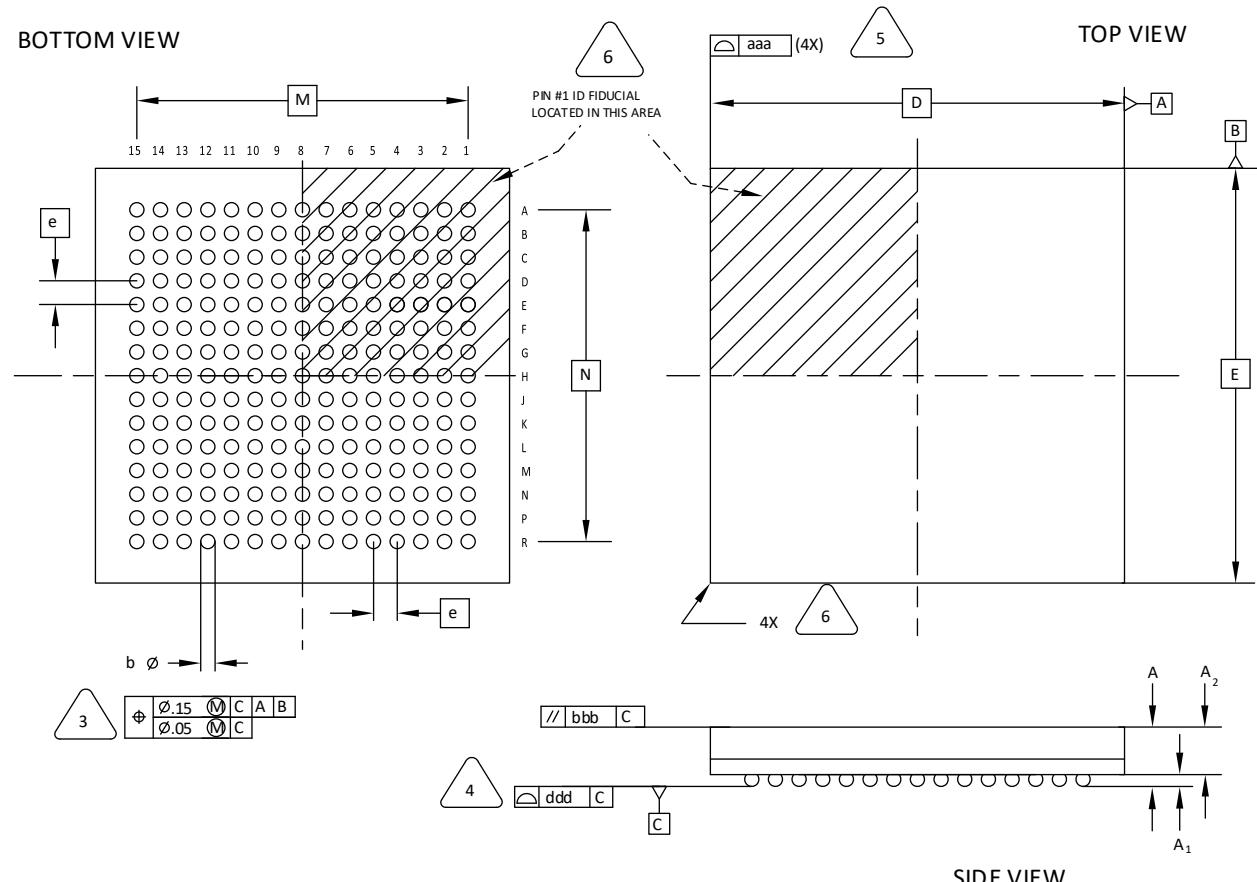
### NOTES:

- O DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- O ALL DIMENSIONS ARE IN MILLIMETERS.
- △** DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- O DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- O THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- O SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- O A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- △** EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- △** EXACT SHAPE OF EXPOSED HEATSINK IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	4.10
A1	0.25	-	0.50
A2	3.20	3.40	3.60
D	30.60 BSC		
D1	28.00 BSC		
E	30.60 BSC		
E1	28.00 BSC		
L	0.45	0.60	0.75
N	208		
e	0.50 BSC		
b	0.17	-	0.27
b1	0.17	0.20	0.23
c	0.09	-	0.20
c1	0.09	0.12	0.16

## 85. 225-Ball ucBGA Package

Dimensions in Millimeters



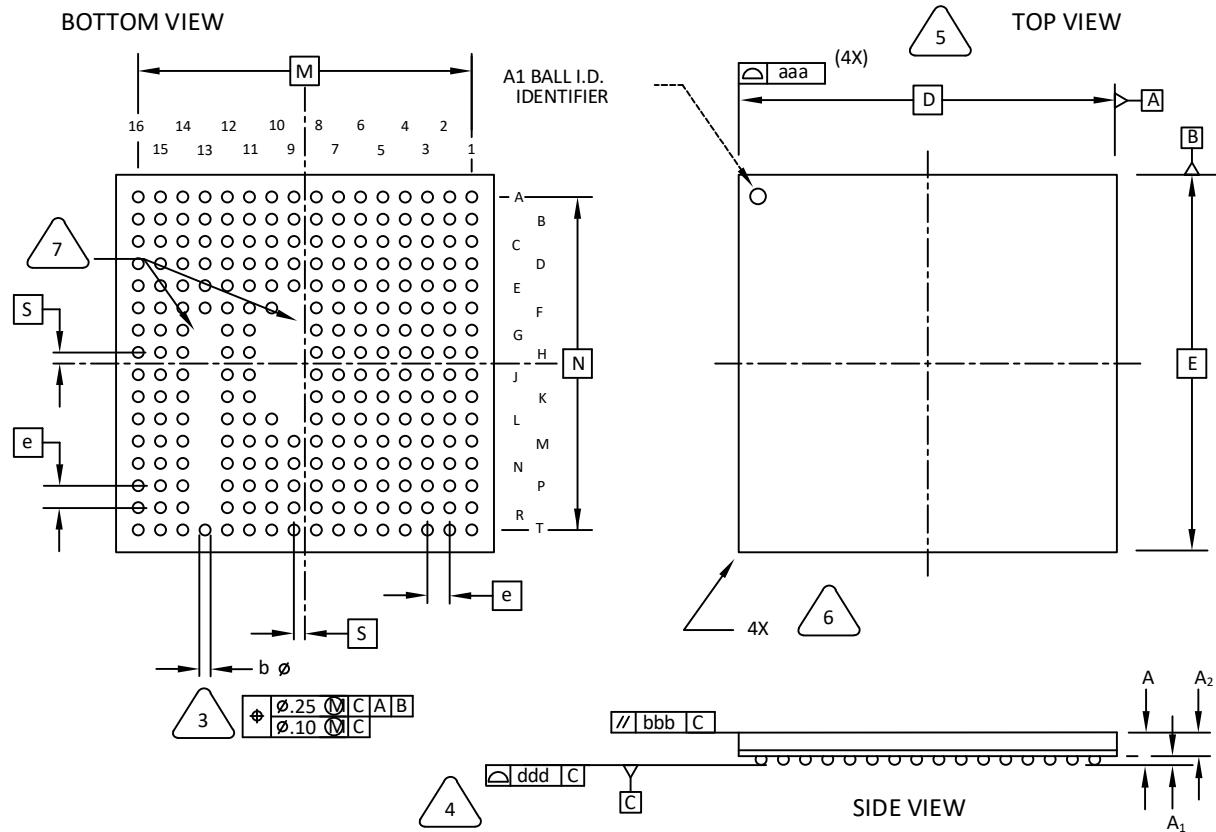
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**
- PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.10	-	-
A2	-	-	0.90
D/E	7.00 BSC		
M/N	5.60 BSC		
b	0.20	0.25	0.30
e	0.40 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.10

## 86. 237-Ball ftBGA Package

Dimensions in Millimeters



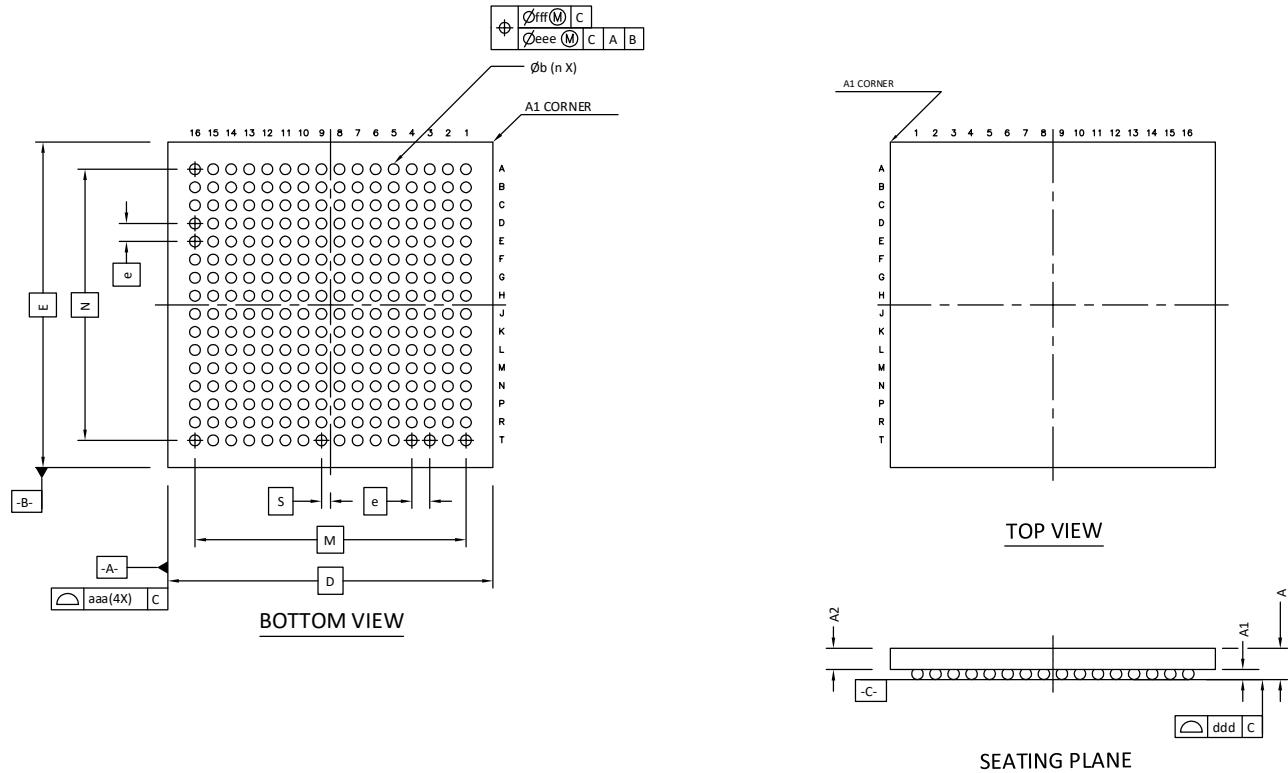
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. DEPOPULATED 13G TO 13R, 10G TO 10K, AND 9F TO 9L.

SYMBOL	MIN.	NOM.	MAX.
A	1.40	1.55	1.70
A1	0.30	-	-
A2	-	-	1.24
D/E	17.0 BSC		
M/N	15.0 BSC		
S	0.50 BSC		
b	0.40	0.50	0.60
e	1.0 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.15

## 87. 256-Ball ASG256/FOWLP Package

Dimensions in Millimeters



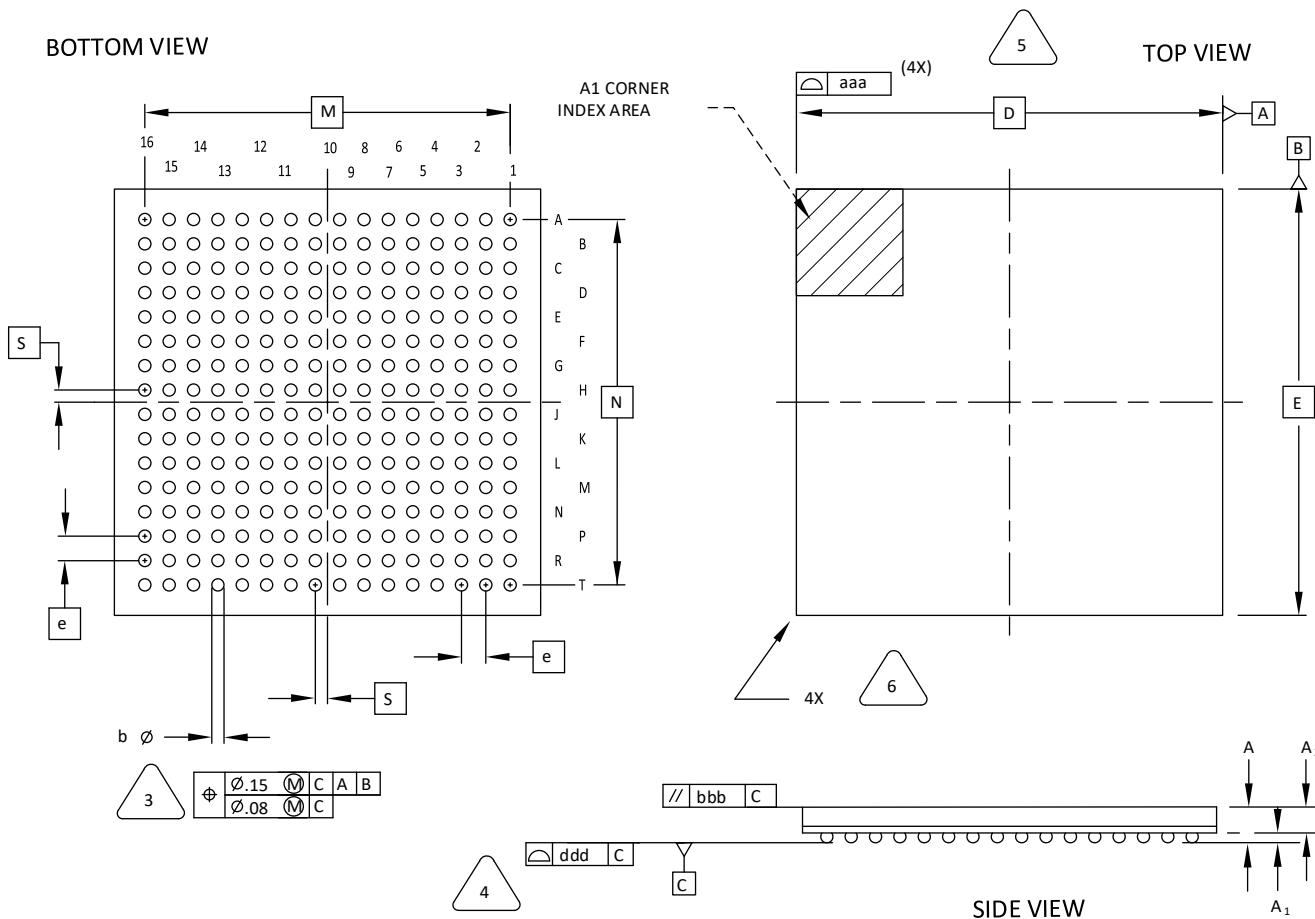
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM  $C$ .
4. PRIMARY DATUM  $C$  AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: JEP95 DG4.18
- \* THESE VALUES ARE BASED ON SUBCON CAPABILITY

SYMBOL	MIN.	NOM.	MAX.
A	-	-	0.931
A1	0.206	-	-
A2	0.63	0.655	0.68
D/E		9.00 BSC	
M/N		7.50 BSC	
S		0.25 BSC	
b	0.25	0.30	0.35
e		0.50 BSC	
aaa	-	-	0.03
*ddd	-	-	0.05

## 88. 256-Ball caBGA Package Option 1: MachXO3

Dimensions in Millimeters



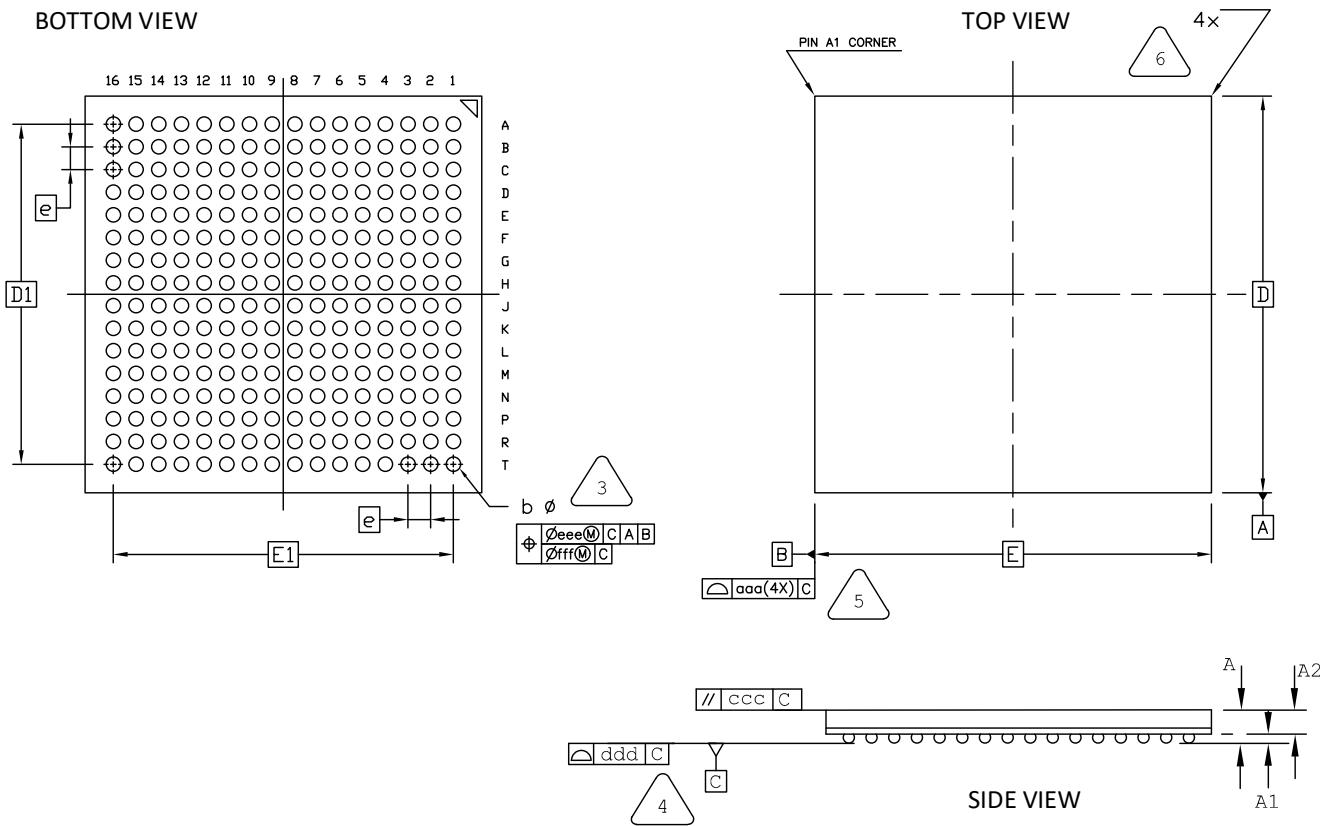
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. REFERENCE JEDEC MO-275, VARIATION JJAB-2.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	-	-
A2	0.65	-	-
D/E	14.0 BSC		
M/N	12.0 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.20

## 89. 256-Ball BBG256/caBGA Package Option 2: MachXO5™-NX

Dimensions in Millimeters



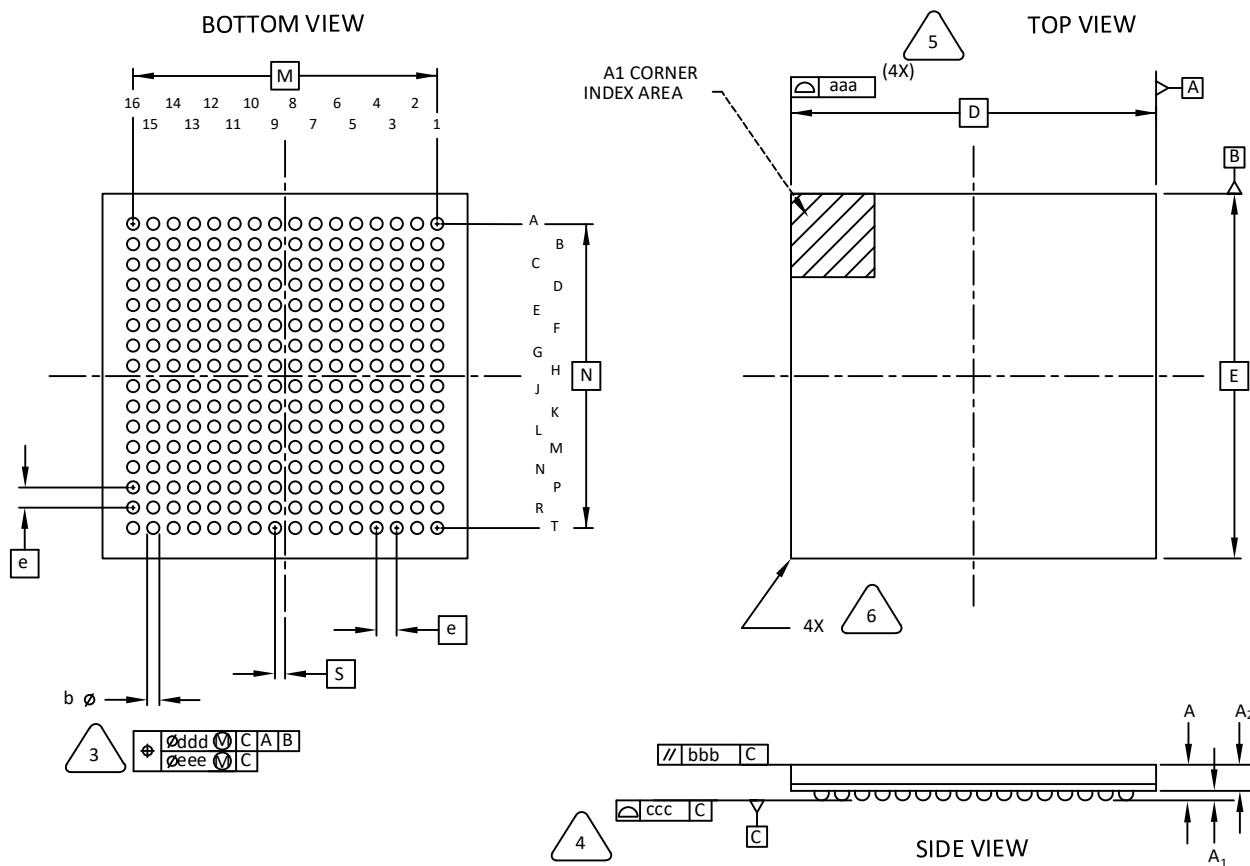
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: MO-275A\_01.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	-	-
A2	-	-	1.45
D/E	14.0 BSC		
D1/E1	12.0 BSC		
n	256		
b	0.45	0.50	0.55
e	0.80		
aaa	0.15		
ccc	0.20		
ddd	0.20		
eee	0.15		
fff	0.08		

## 90. 256-Ball csfBGA Package

Dimensions in Millimeters



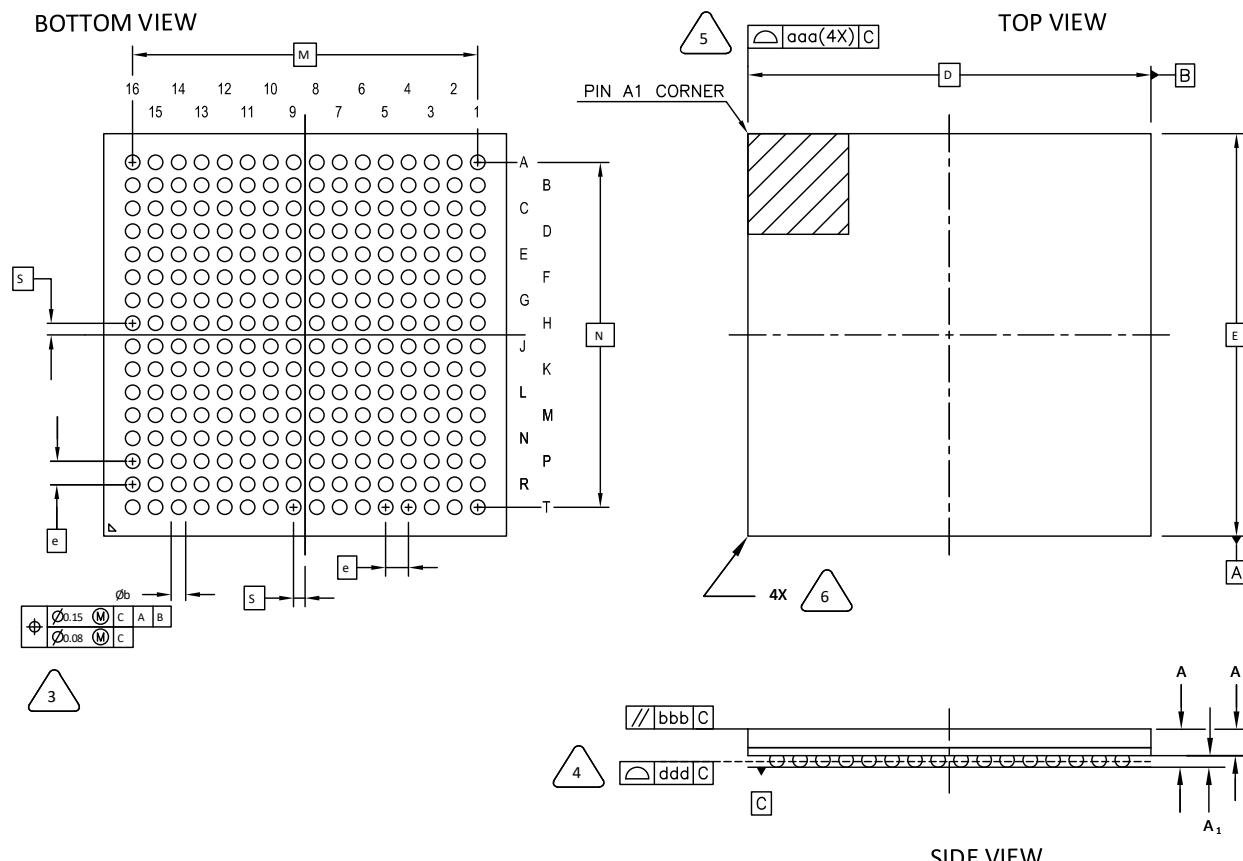
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	0.24	-
A2	-	0.66	-
D/E	9.00 BSC		
M/N	7.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.05		

## 91. 256-Ball CBG256/csfBGA Package Option 1: Mach™-NX

Dimensions in Millimeters



### NOTES: UNLESS OTHERWISE SPECIFIED

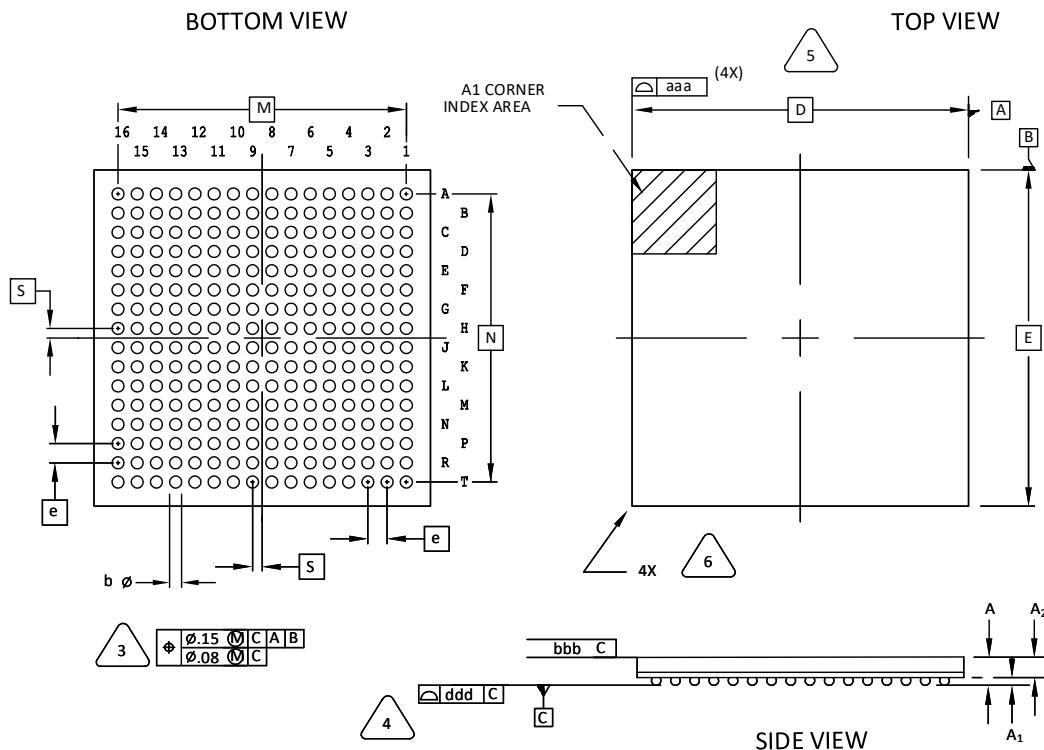
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

REFERENCE: JEDEC JEP 95 DR 4.5

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.327
A1	0.27	-	-
A2	0.812	-	-
D/E	14.0 BSC		
M/N	12.0 BSC		
S	0.40 BSC		
b	0.45	0.50	0.55
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.20

## 92. 256-Ball CBG256/csfBGA Package Option 2: CertusPro-NX

Dimensions in Millimeters



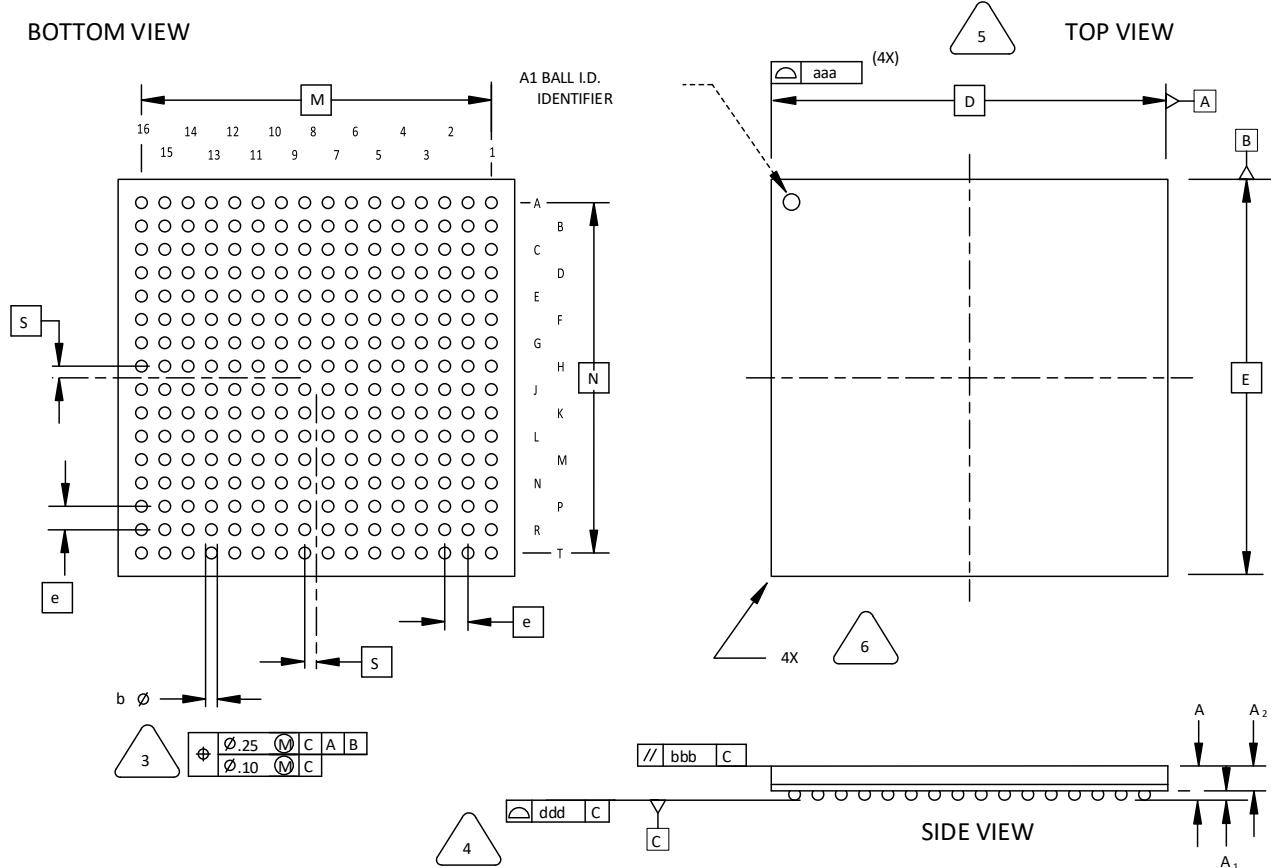
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. REFERENCE JEDEC: JEP95 DR 4.5

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.27	-	-
A2	0.60	-	-
D/E	14.0 BSC		
M/N	12.0 BSC		
S	0.40 BSC		
b	0.45	0.50	0.55
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.20

## 93. 256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C



PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

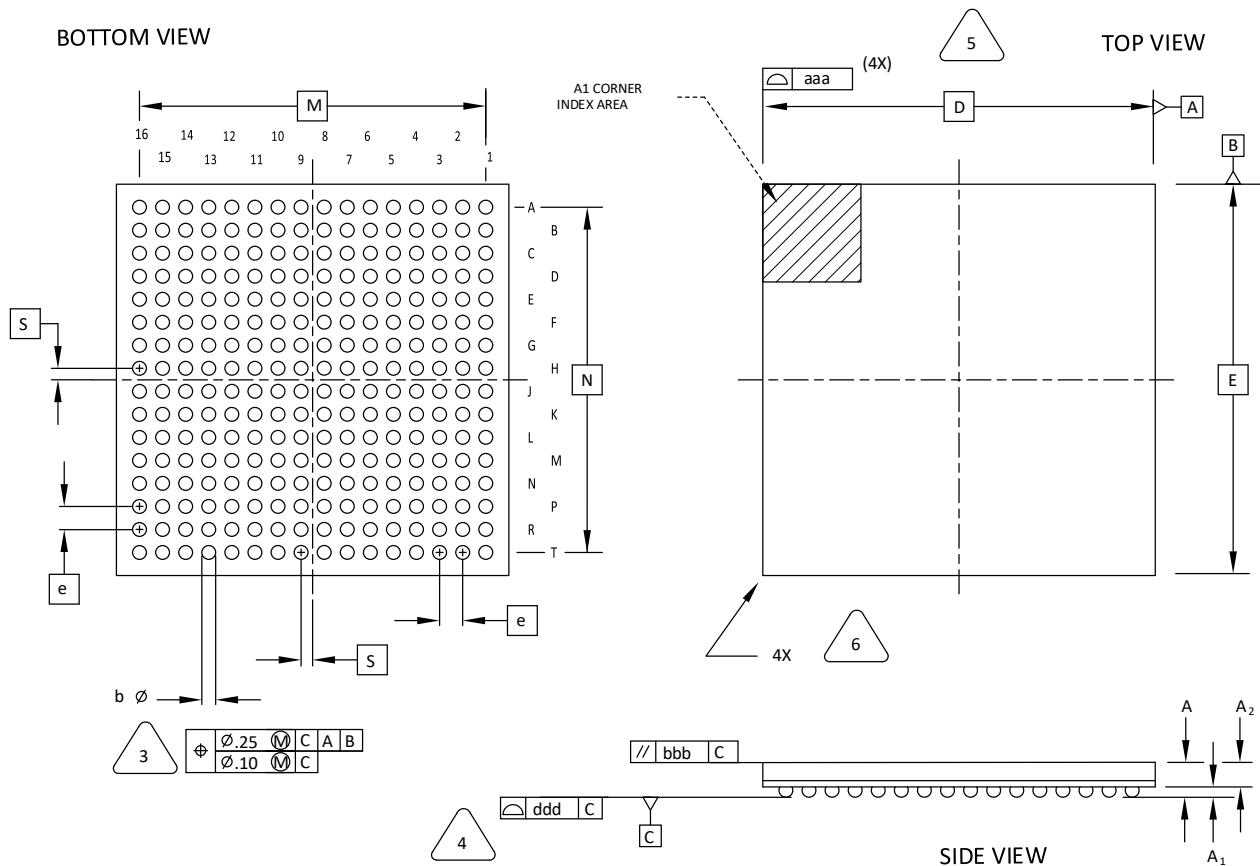


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.25	1.40	1.55
A1	0.30	-	-
A2	-	-	1.25
D/E	17.0 BSC		
M/N	15.0 BSC		
S	0.50 BSC		
b	0.40	0.50	0.60
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.12

## 94. 256-Ball ftBGA Package Option 2: LatticeECP3™

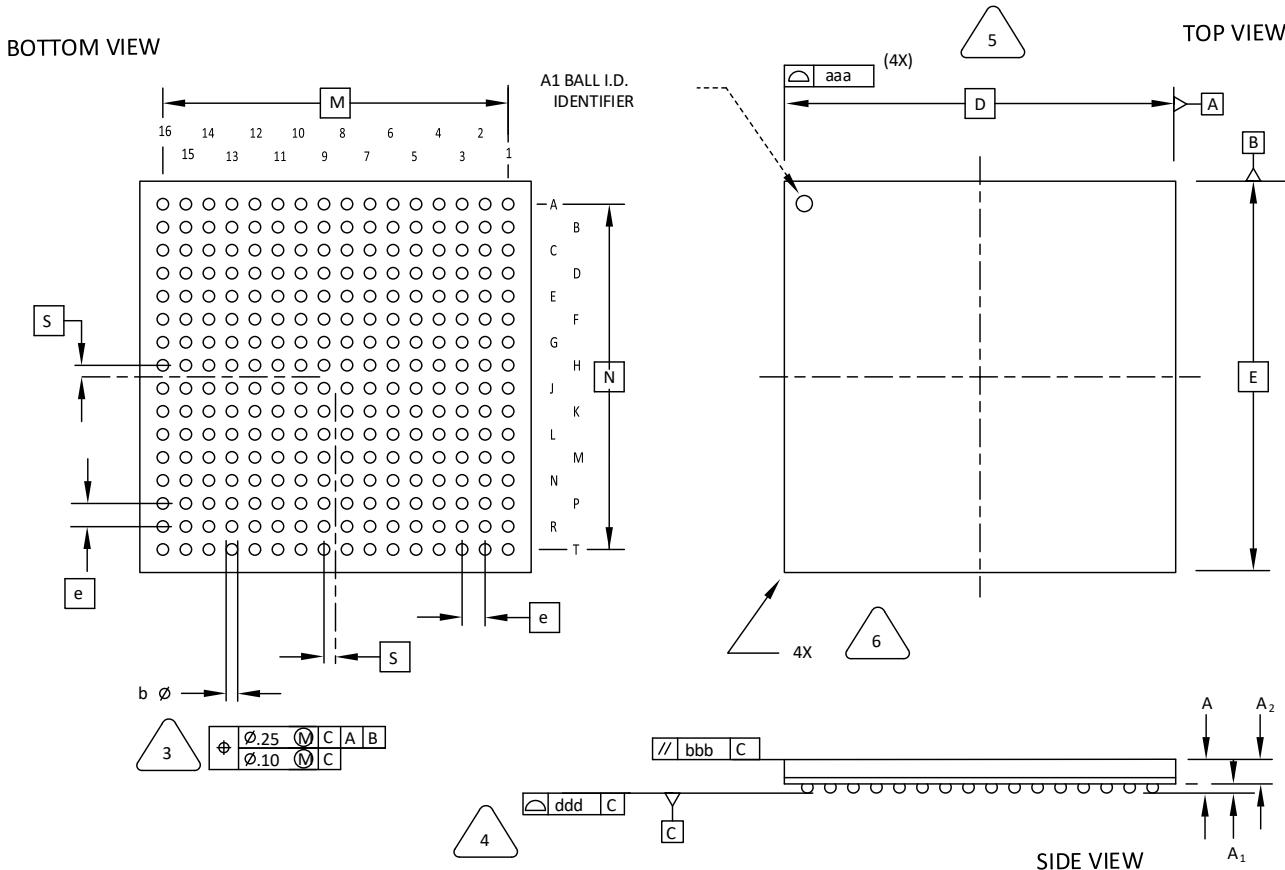
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.70	2.10
A1	0.30	0.50	0.70
A2			1.40 REF
D/E			17.0 BSC
M/N			15.0 BSC
S			0.50 BSC
b	0.50	0.60	0.70
e	1.0 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 95. 256-Ball ftBGA Package Option 3: MachXO2

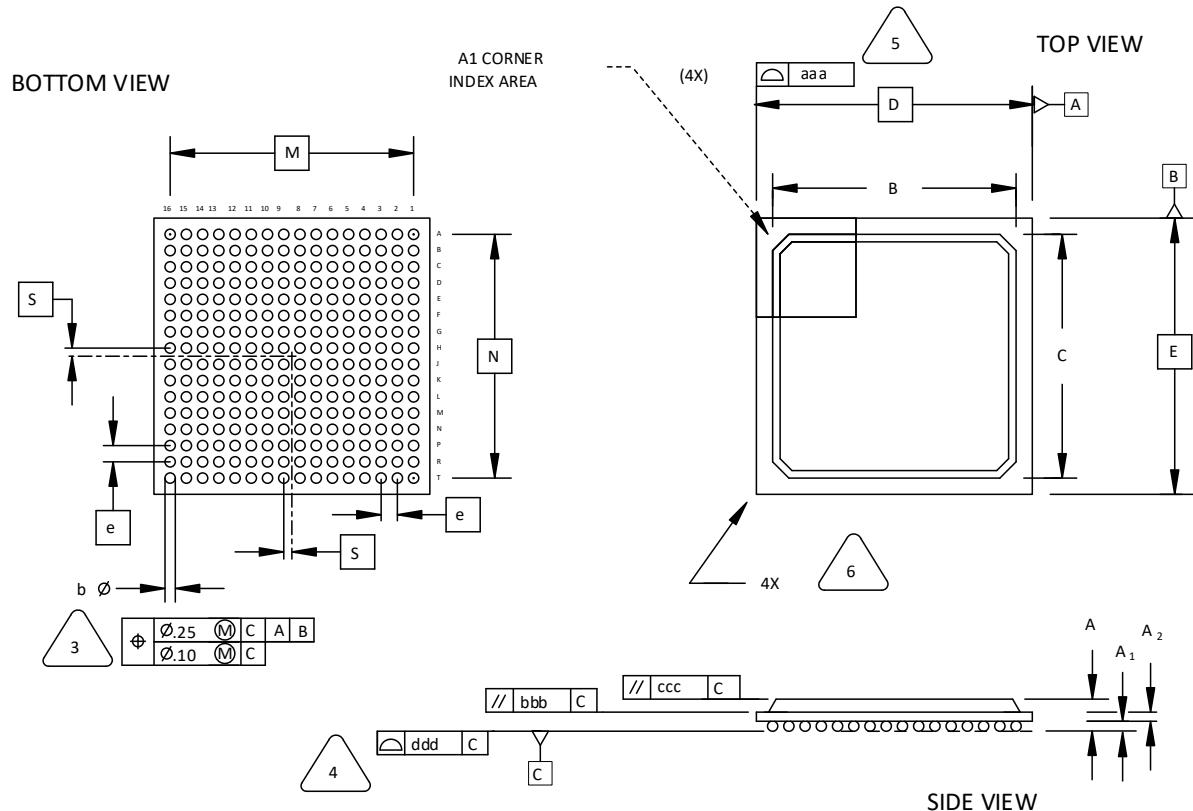
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.40	1.55	1.70
A1	0.30	-	-
A2	1.00	-	-
D/E	17.0 BSC		
M/N	15.0 BSC		
S	0.50 BSC		
b	0.40	0.50	0.60
e	1.0 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.12

## 96. 256-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]



PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

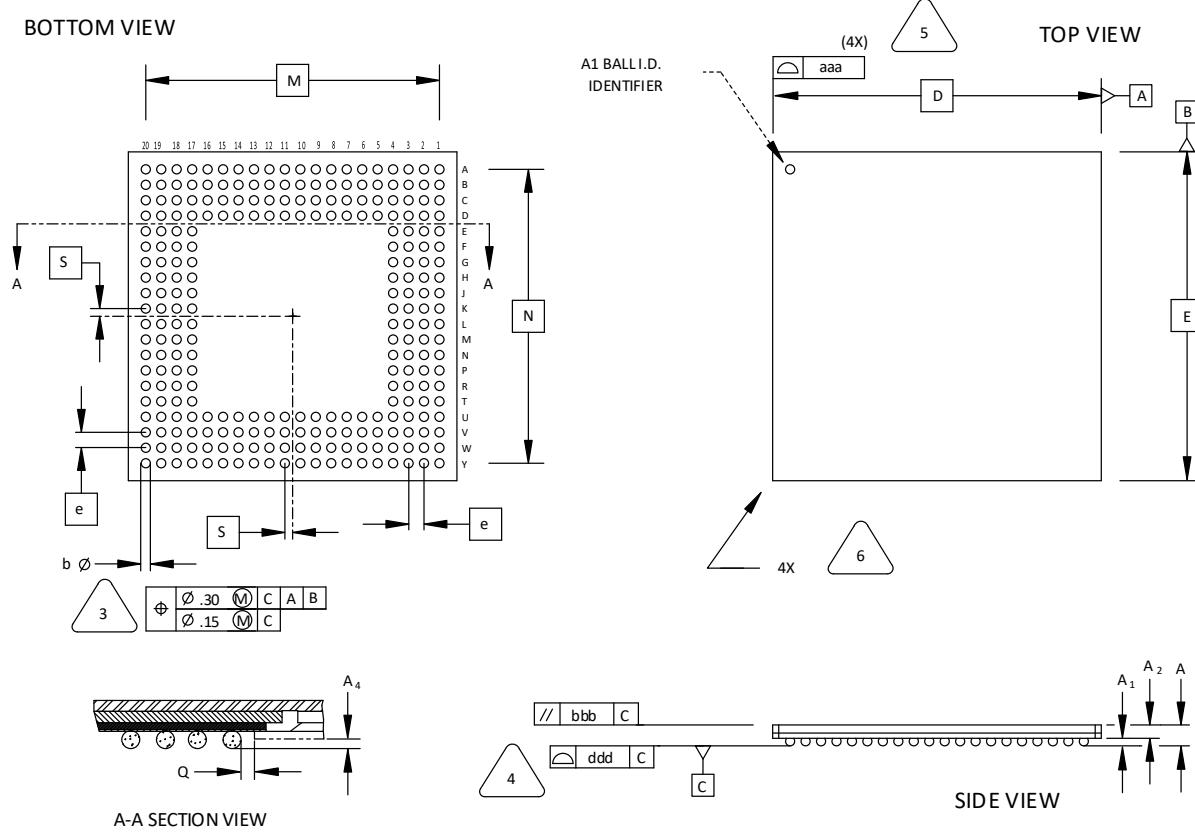


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.30	1.70	2.10
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	14.80	15.30	15.80
D/E	17.00 BSC		
M/N	15.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 97. 256-Ball SBGA Package

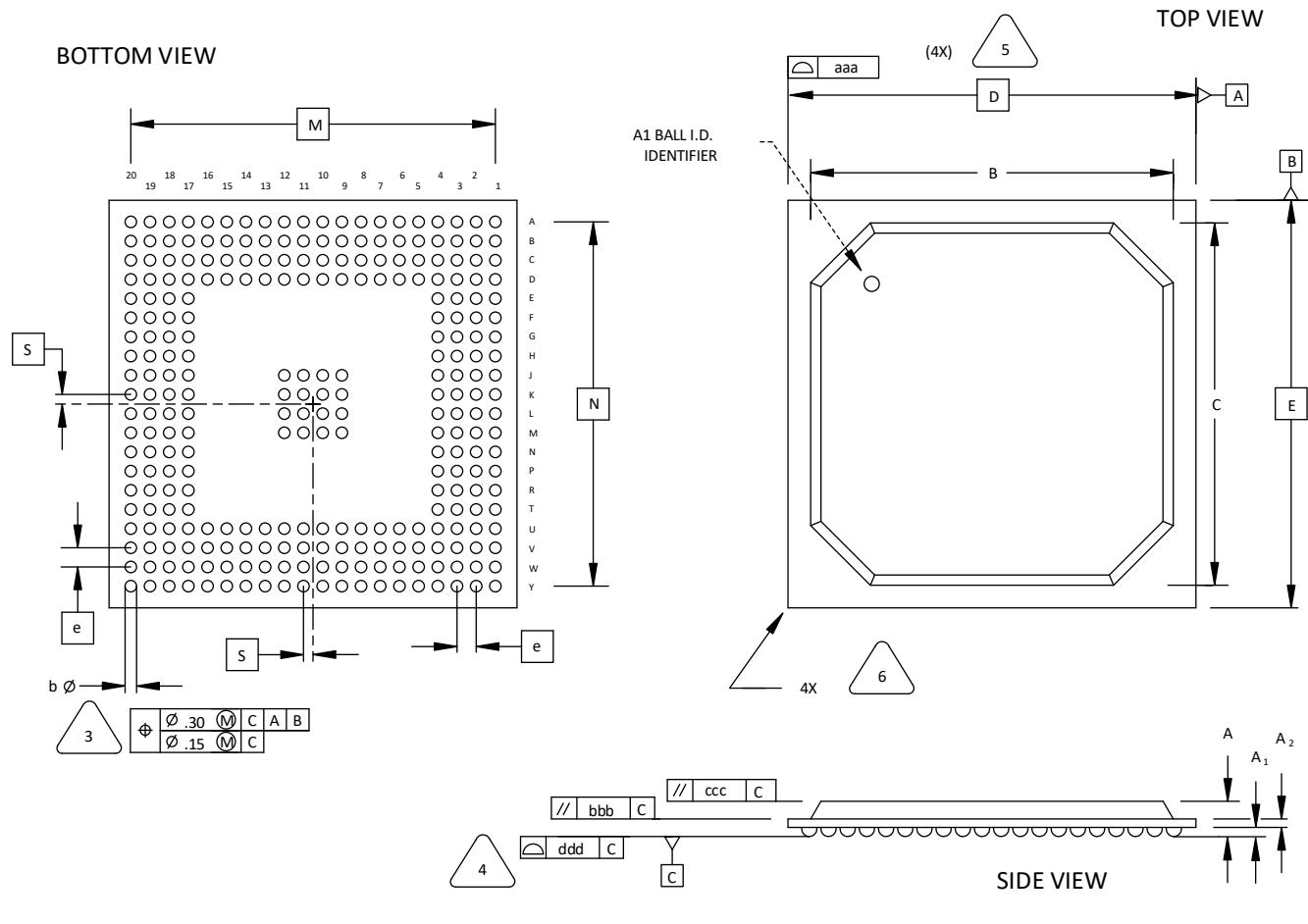
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.50	0.65	0.80
A2	0.80	0.90	1.00
D/E	27.00 BSC		
M/N	24.13 BSC		
S	0.635 BSC		
b	0.60	0.75	0.90
e	1.27 BSC		
Q	0.25	-	-
A4	0.10	-	-
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 98. 272-Ball BGA Package

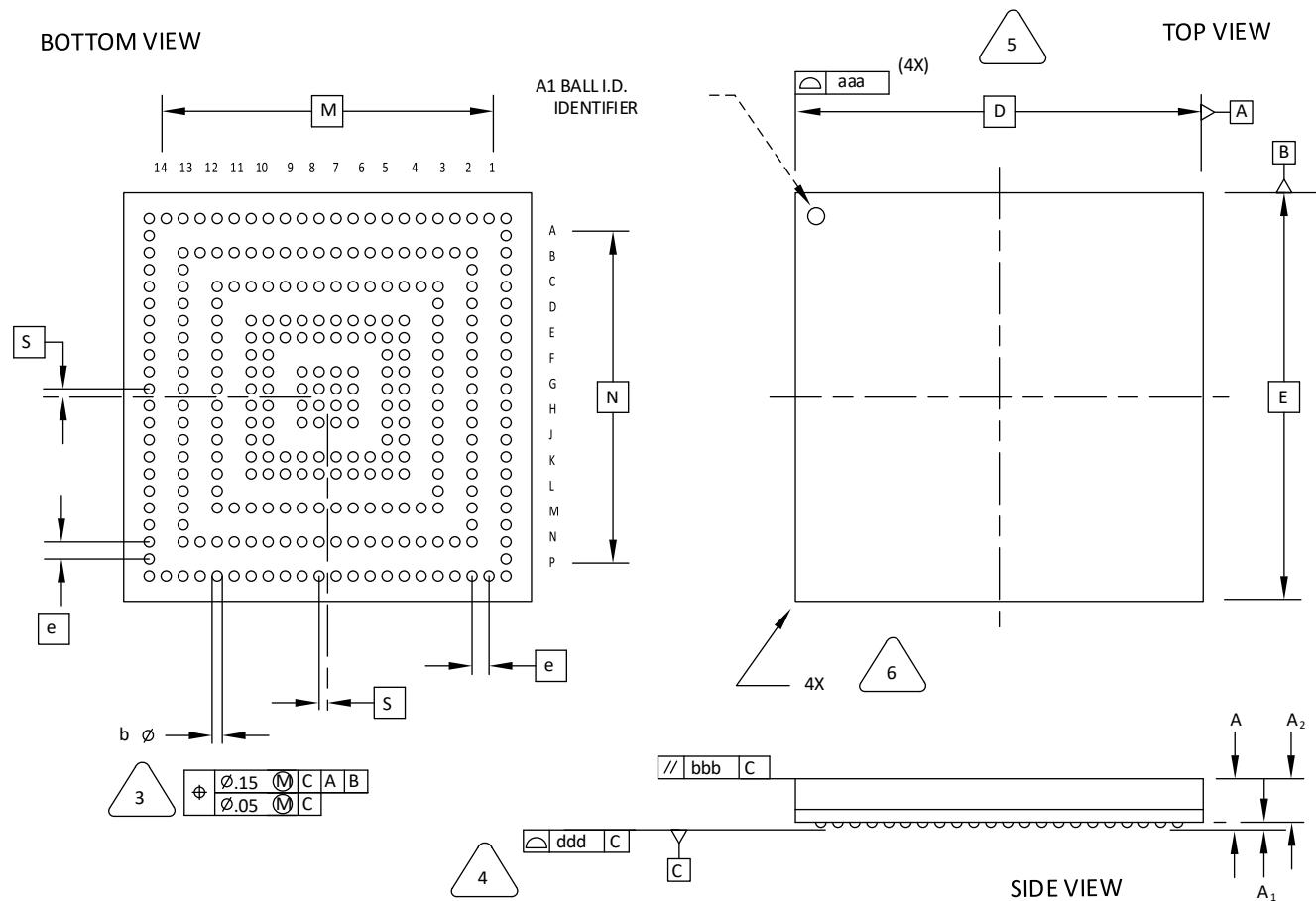
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.25	2.80
A1	0.50	0.65	0.80
A2	0.28	0.54	0.80
B/C	23.80	24.30	24.80
D/E	27.00 BSC		
M/N	24.13 BSC		
S	0.635 BSC		
b	0.60	0.75	0.90
e	1.27 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## **99. 284-Ball csBGA Package**

Dimensions in Millimeters



**NOTES: UNLESS OTHERWISE SPECIFIED**

1. DIMENSIONS AND TOLERANCES  
PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE  
MAXIMUM SOLDER BALL DIAMETER,  
PARALLEL TO PRIMARY DATUM C

PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

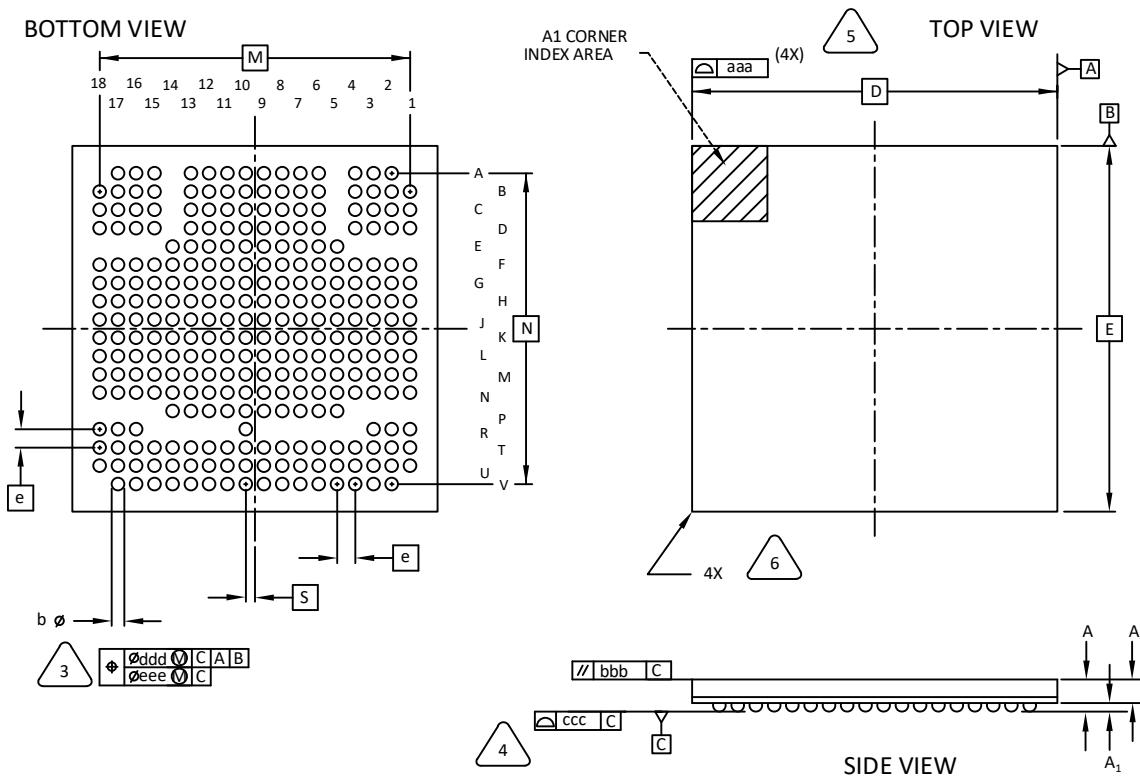
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE  
IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	-	-
A2	-	-	0.85
D/E	12.00 BSC		
M/N	10.50 BSC		
S	0.25 BSC		
b	0.25	0.31	0.37
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

# 100.285-Ball csfBGA Package

Dimensions in Millimeters



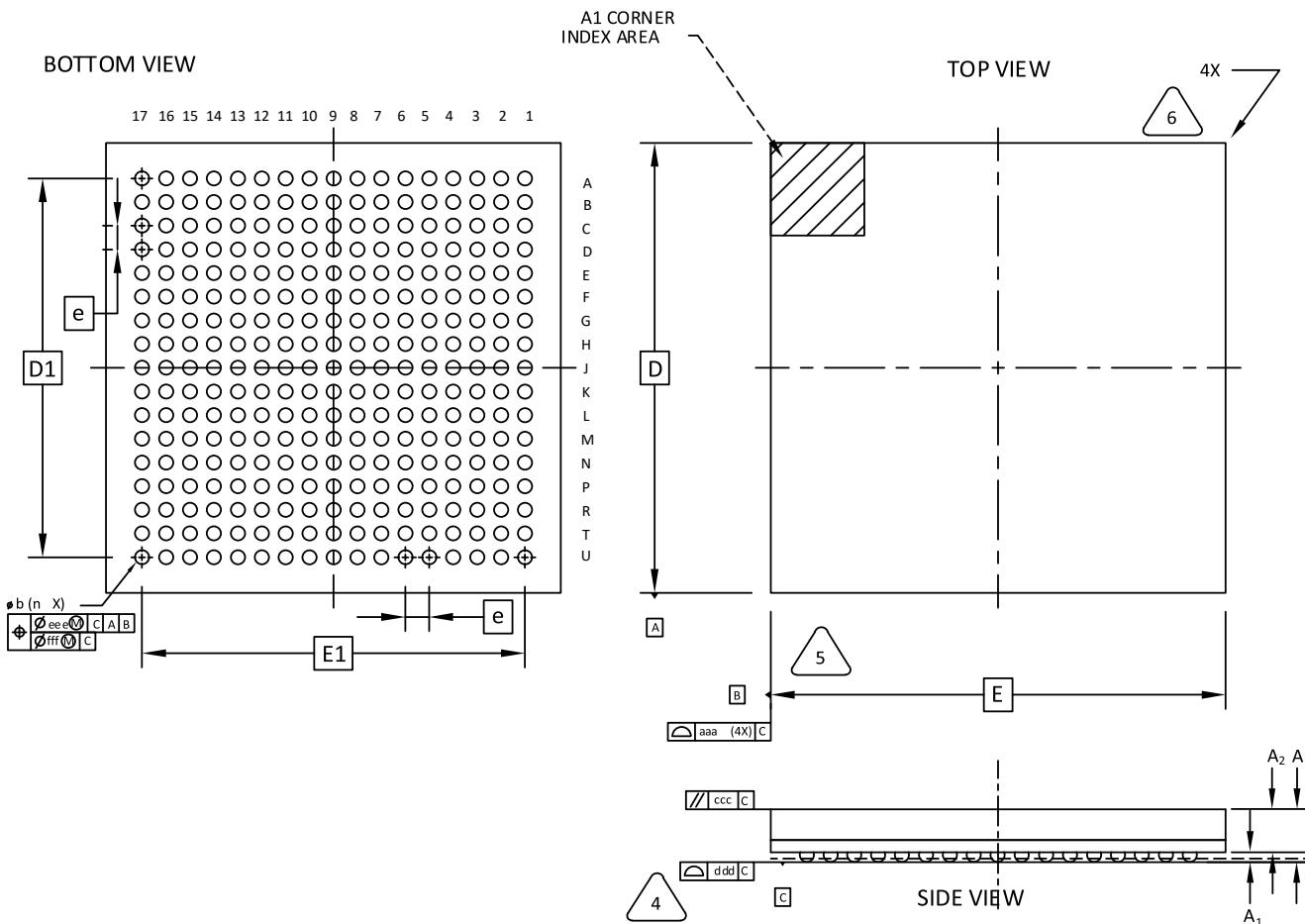
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
- 4** PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.30
A1	0.15	-	-
A2	-	-	1.00
D/E	10.00 BSC		
M/N	8.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.05		

## 101. 289-Ball csBGA Package (9.5 mm × 9.5 mm Body)

Dimensions in Millimeters



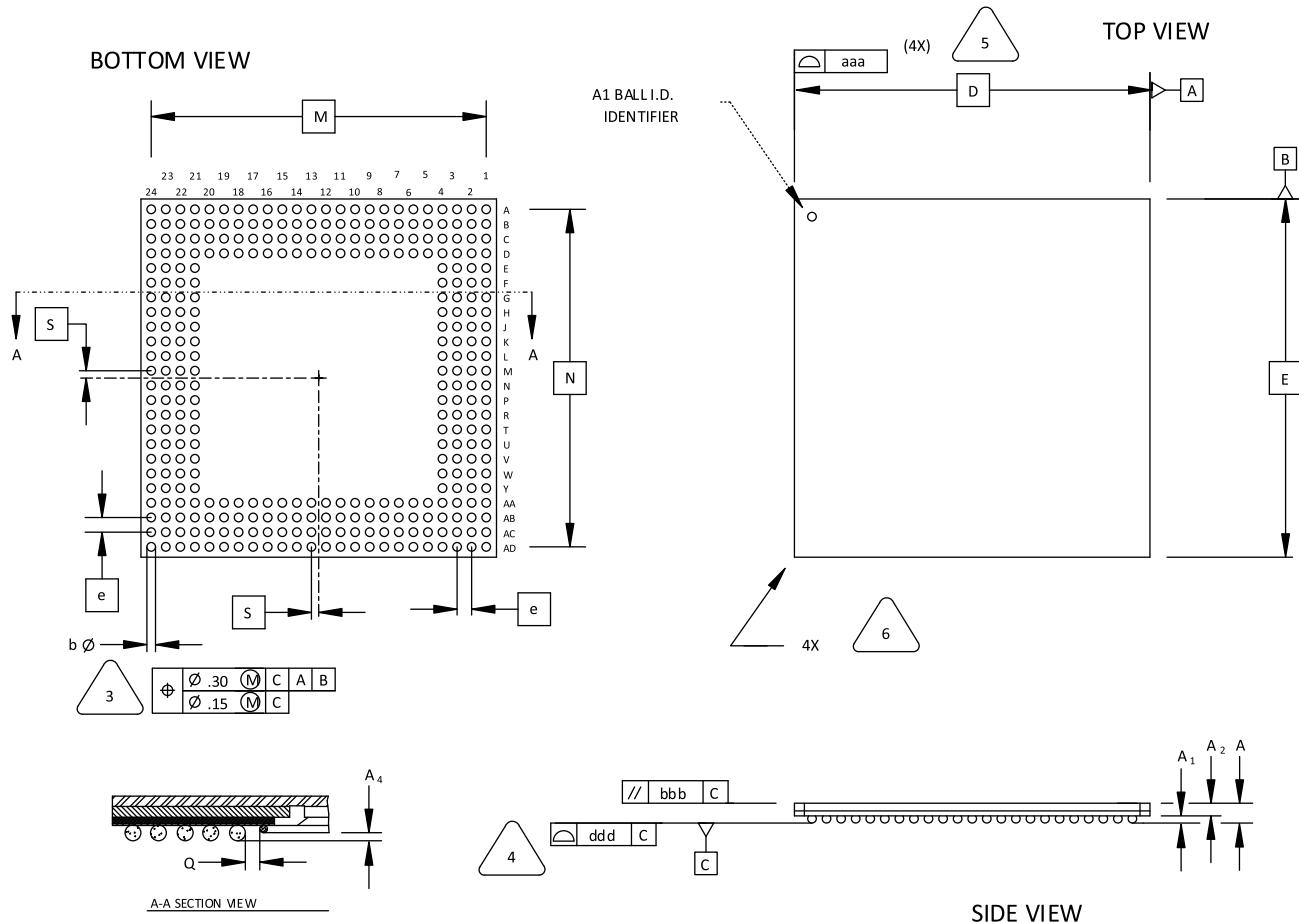
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: MO-276N

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.15	-	-
D/E                                    9.5 BSC			
D1/E1                                8.0 BSC			
b	0.25	0.30	0.35
e                                      0.50 BSC			
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.08
eee	-	-	0.15
fff	-	-	0.05

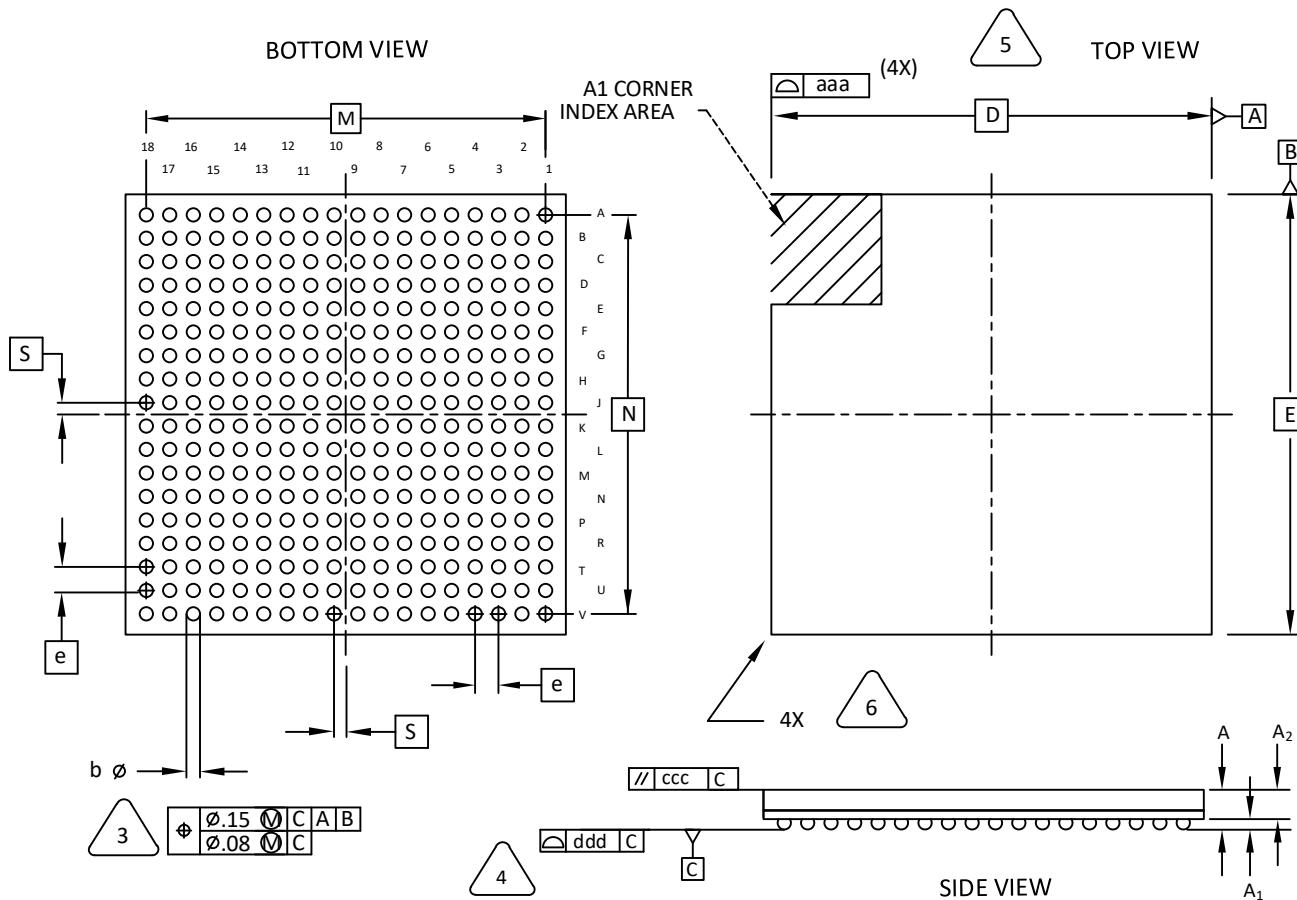
## 102. 320-Ball SBGA Package

Dimensions in Millimeters



## 103. 324-Ball caBGA Package

Dimensions in Millimeters



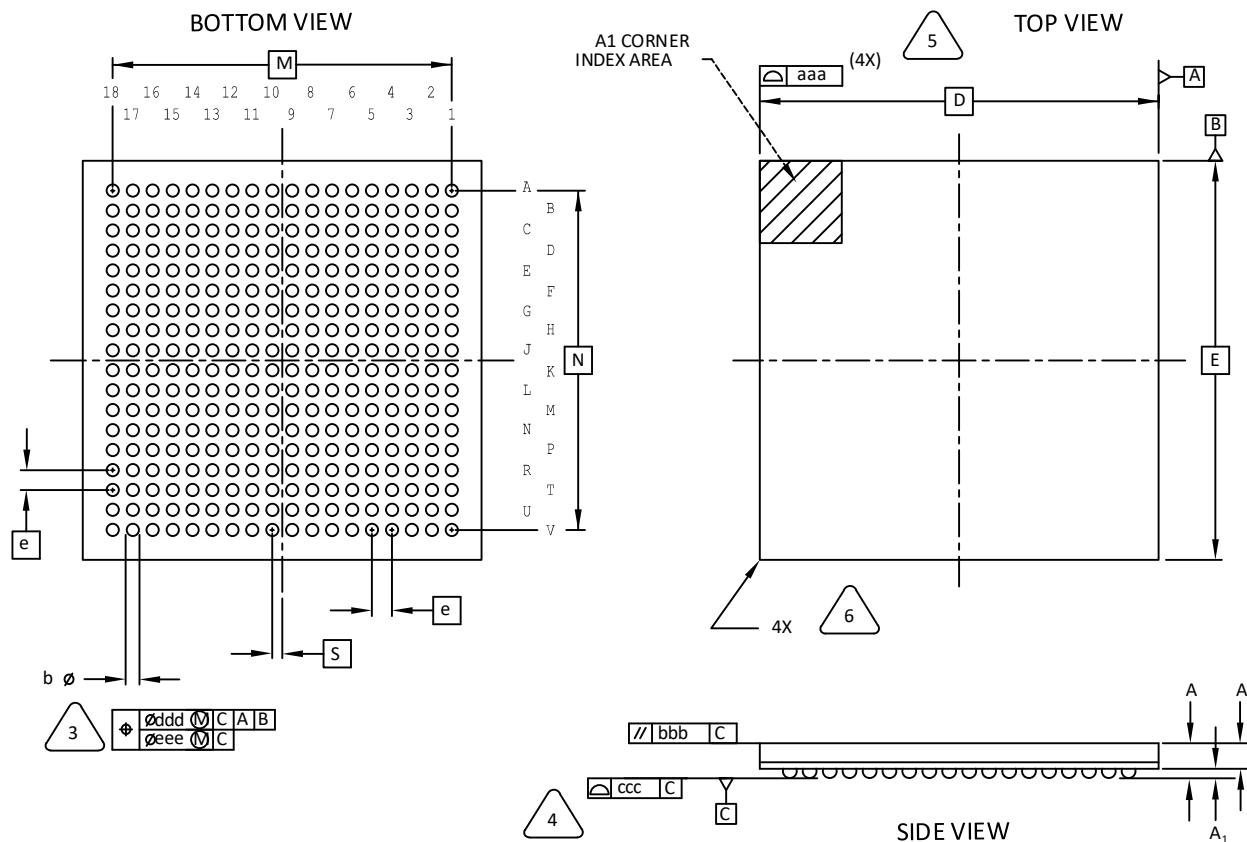
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	0.35	-
A2	0.80	1.00	-
D/E	15.0 BSC		
M/N	13.6 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
e	0.80 BSC		
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.20

## 104. 324-Ball csfBGA Package

Dimensions in Millimeters



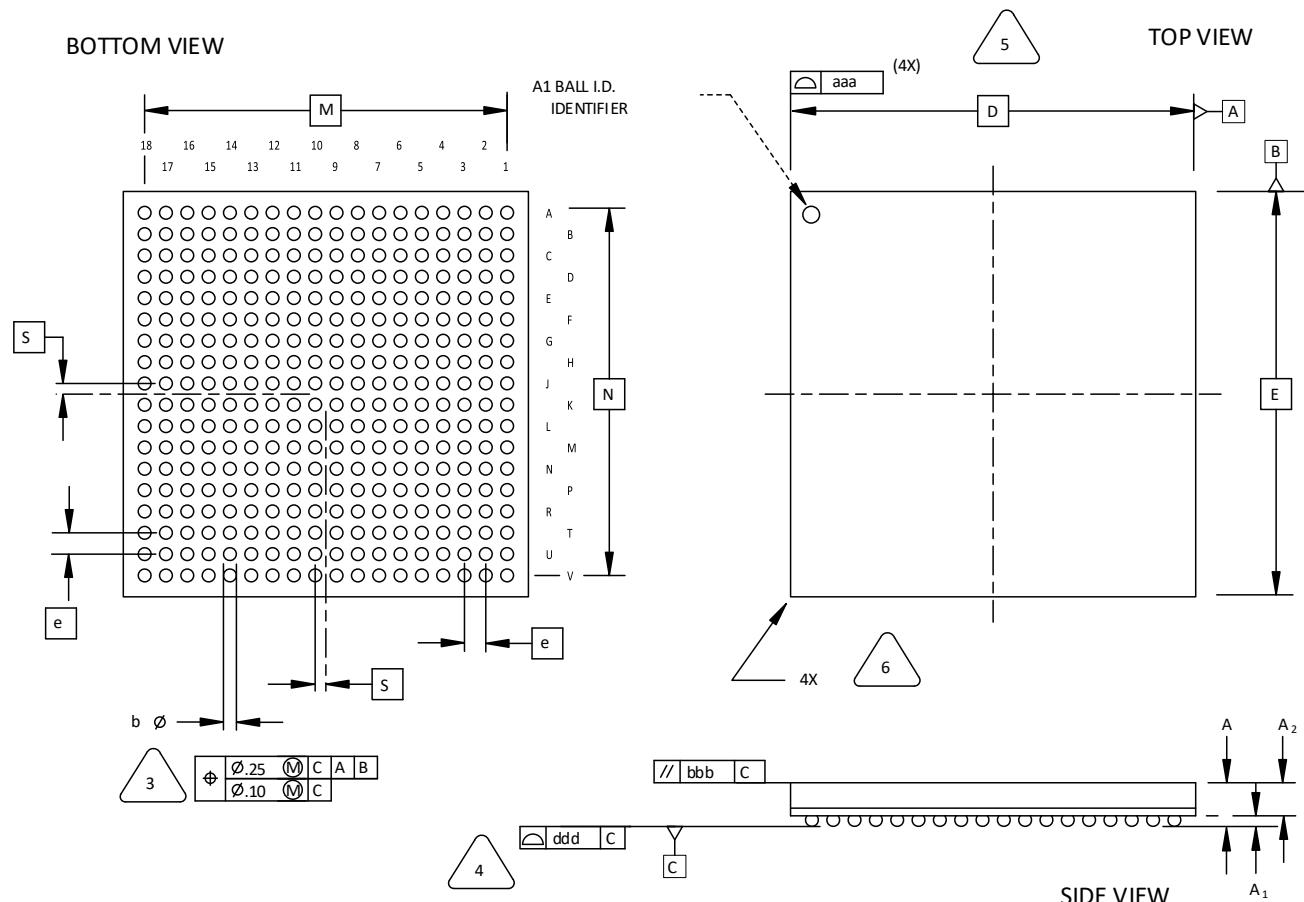
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.00
A1	0.15	0.24	-
A2	-	0.66	-
D/E	10.00 BSC		
M/N	8.50 BSC		
S	0.25 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	0.10		
bbb	0.10		
ccc	0.08		
ddd	0.15		
eee	0.05		

## 105. 324-Ball ftBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.

4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

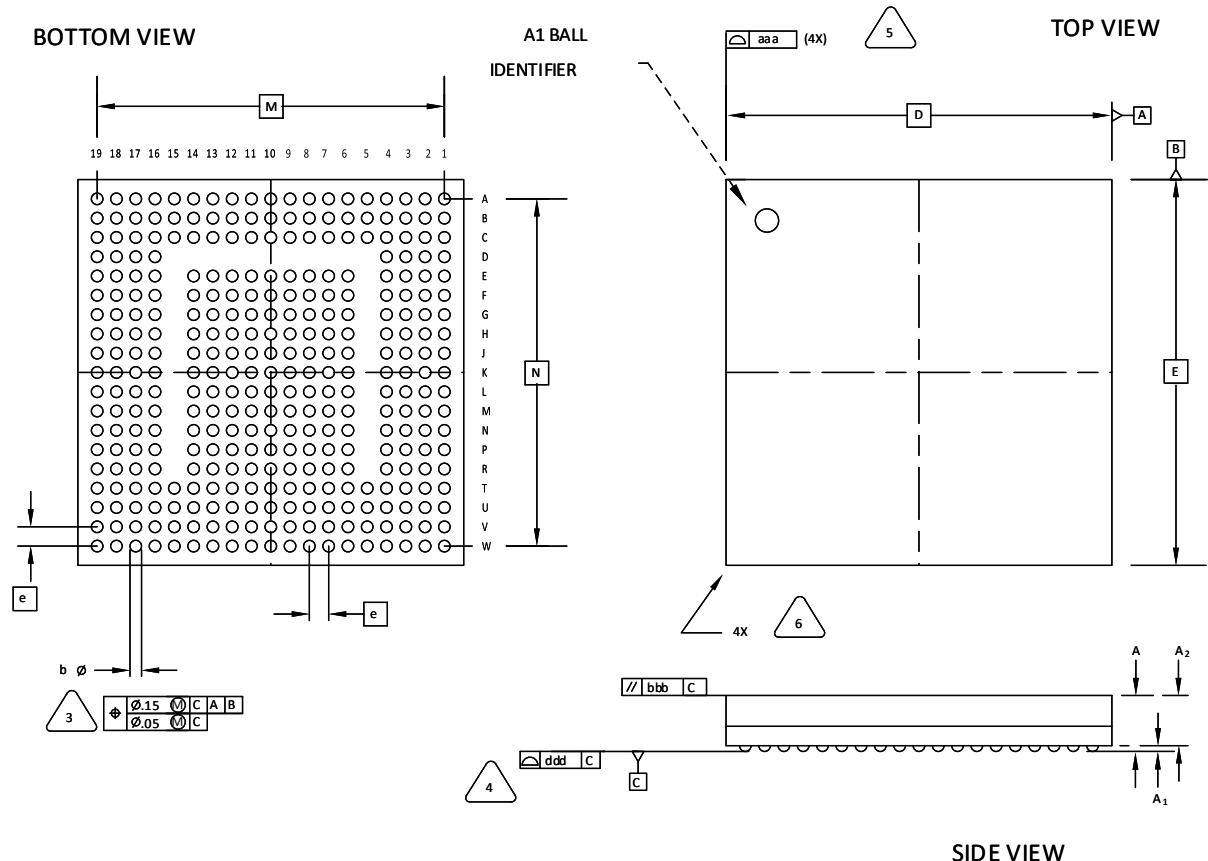
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.25	1.50	1.70
A1	0.30	-	-
A2	-	-	1.40
D/E	19.0 BSC		
M/N	17.0 BSC		
S	0.50 BSC		
b	0.40	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 106. 328-Ball csBGA Package

Dimensions in Millimeters



### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

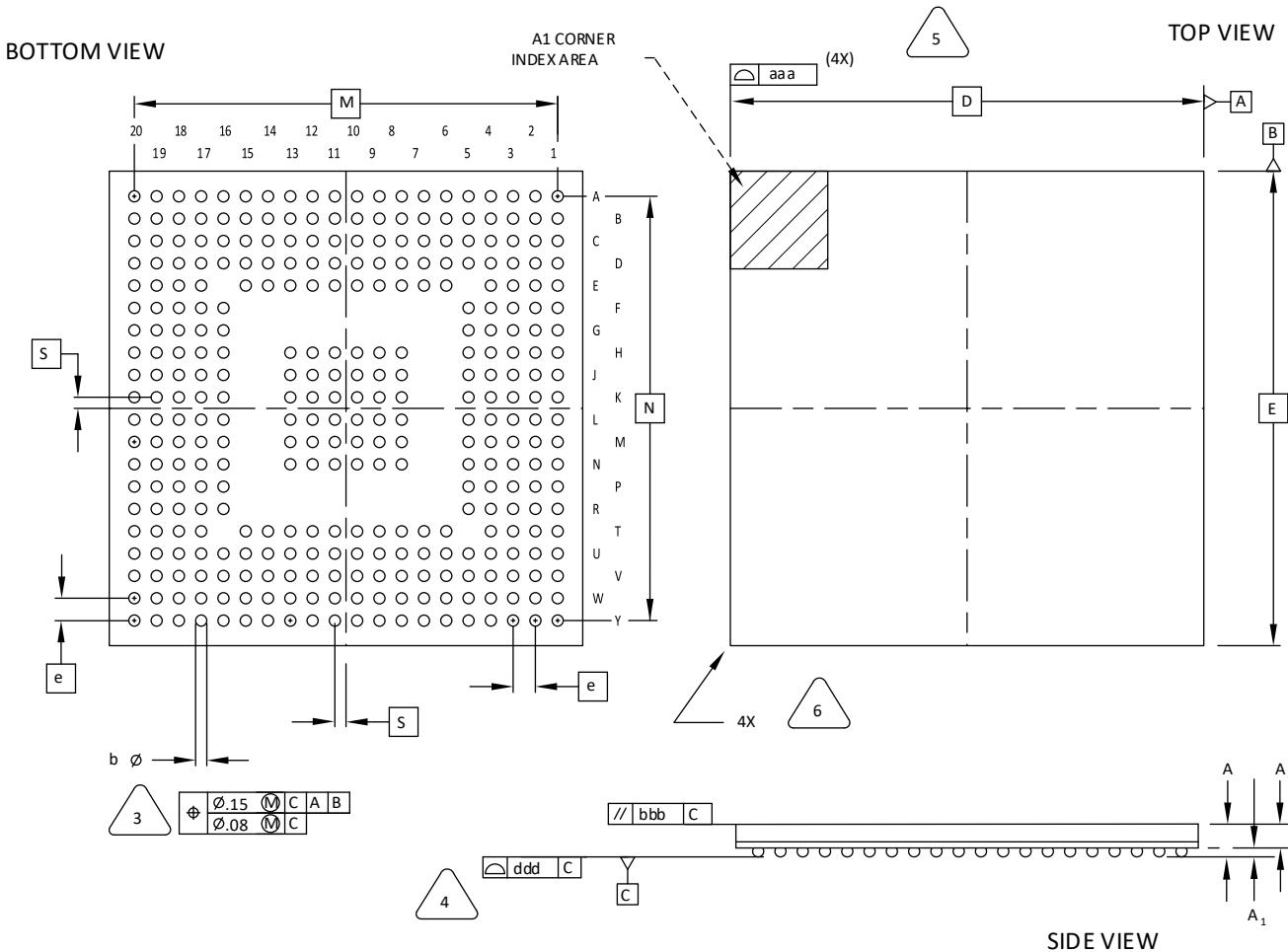
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.05	1.35	1.50
A1	0.15	-	-
A2	-	-	1.20
D/E	10.0 BSC		
M/N	9.00 BSC		
b	0.25	0.30	0.35
e	0.50 BSC		
aaa	-	-	0.10
bbb	-	-	0.10
ddd	-	-	0.08

## 107. 332-Ball caBGA Package

Dimensions in Millimeters



### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

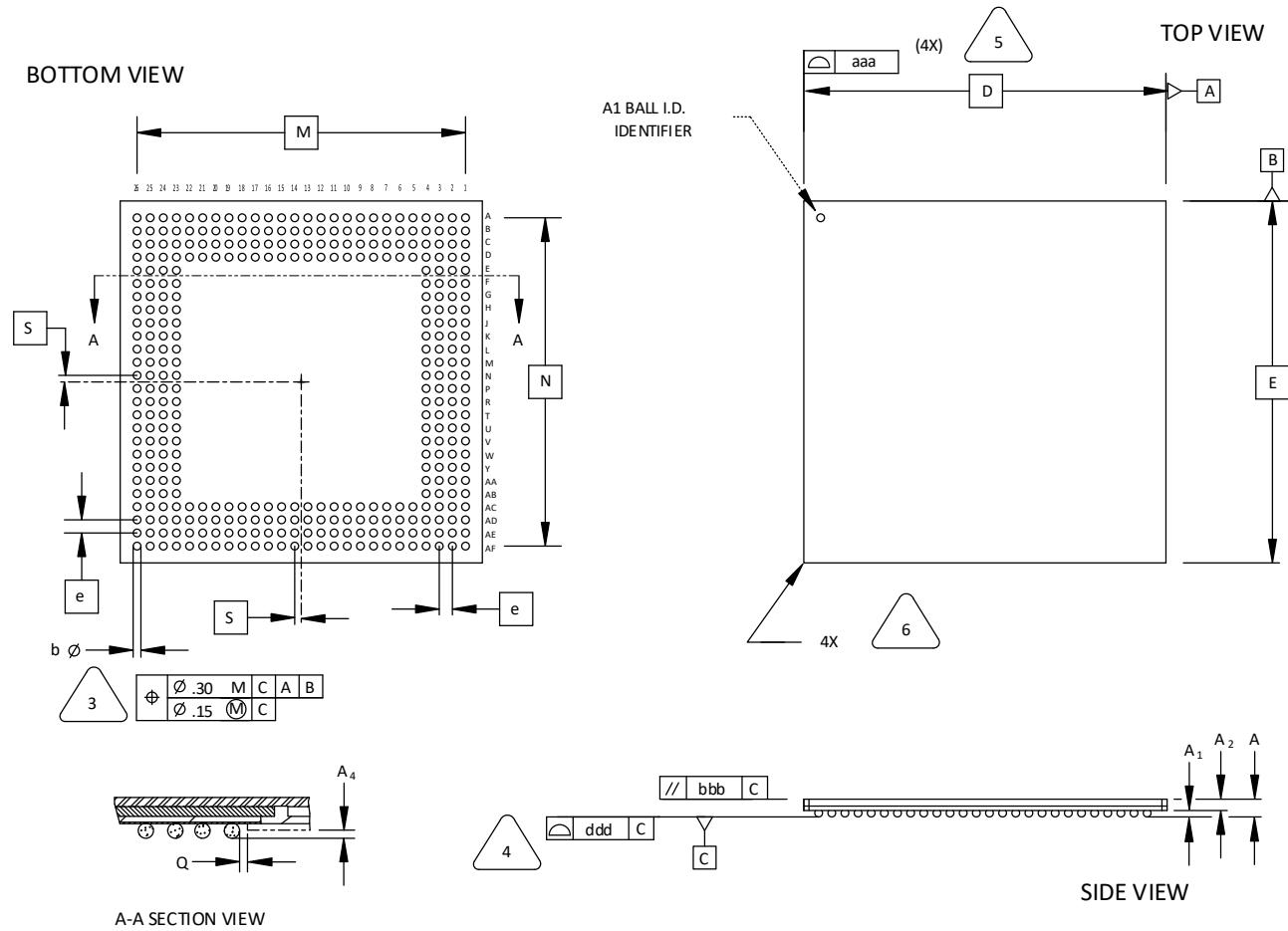


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	2.00
A1	0.25	-	-
A2	0.65	-	-
D/E	17.0 BSC		
M/N	15.2 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.20

## 108. 352-Ball SBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

**3**  
DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.

**4**  
PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

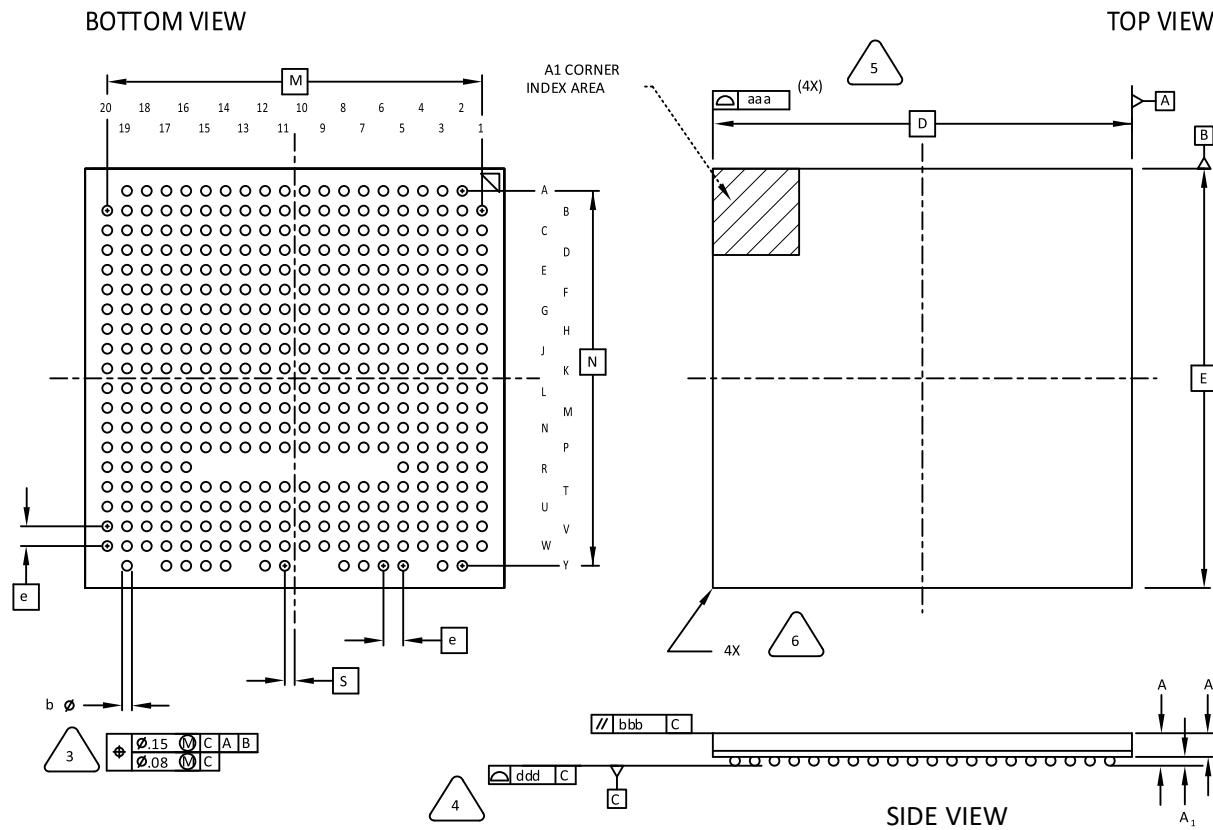
**5**  
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

**6**  
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.50	0.65	0.80
A2	0.80	0.90	1.00
D/E	35.00 BSC		
M/N	31.75 BSC		
S	0.635 BSC		
b	0.60	0.75	0.90
e	1.27 BSC		
Q	0.25	-	-
A4	0.10	-	-
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 109. 381-Ball caBGA Package Option 1: All Except LAE5UM-45F

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

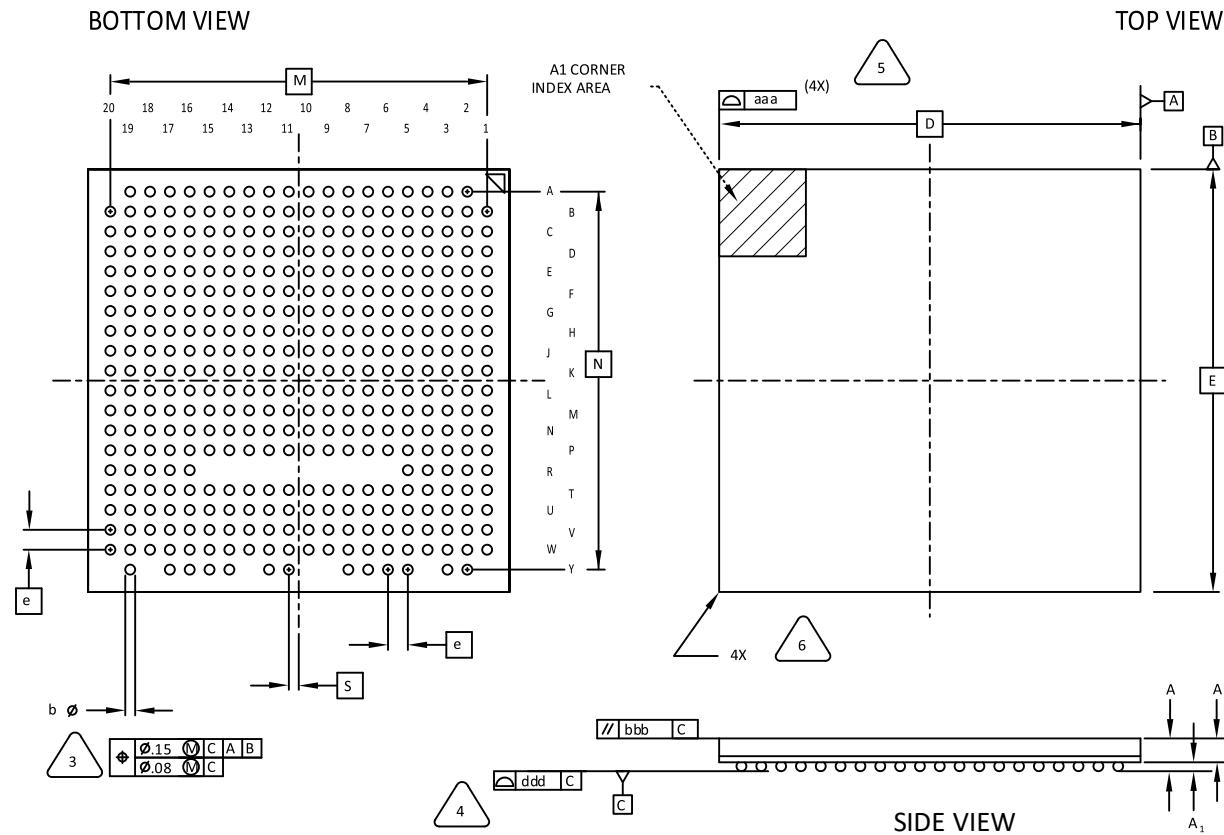


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.76
A1	0.25	0.30	0.35
A2	0.80	-	-
D/E	17.00 BSC		
M/N	15.20 BSC		
S	0.40 BSC		
b	0.35	0.40	0.45
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.12

## 110. 381-Ball caBGA Package Option 2: LAE5UM-45F

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.



PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

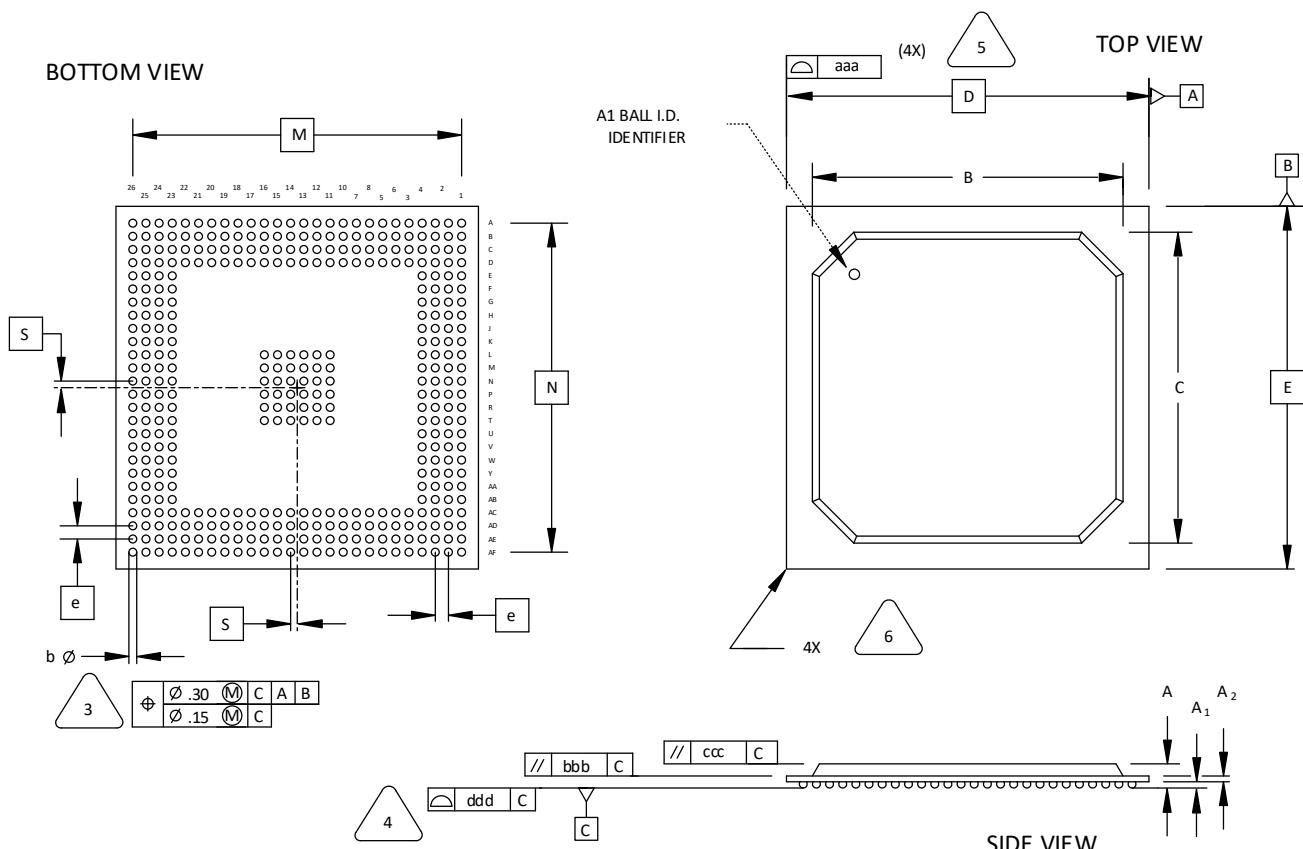


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.76
A1	0.25	0.30	0.35
A2	0.80	-	-
D/E			
17.00 BSC			
M/N			
15.20 BSC			
S			
0.40 BSC			
b	0.35	0.40	0.45
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.10

## 111. 388-Ball BGA Package

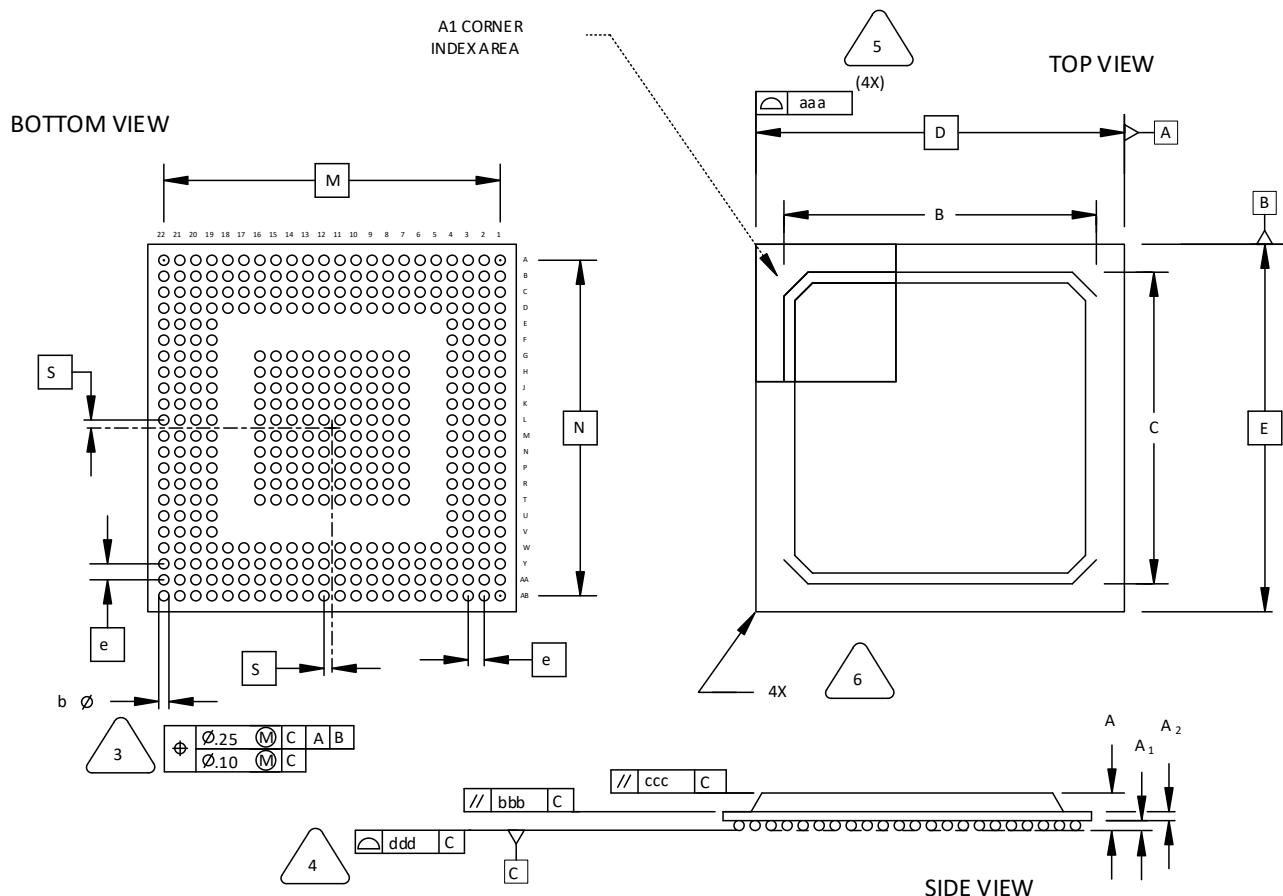
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.80	3.25
A1	0.50	0.65	0.80
A2	0.28	0.54	0.80
B/C	29.80	31.80	33.80
D/E	35.00 BSC		
M/N	31.75 BSC		
S	0.635 BSC		
b	0.60	0.75	0.90
e	1.27 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 112. 388-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

**3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

**4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

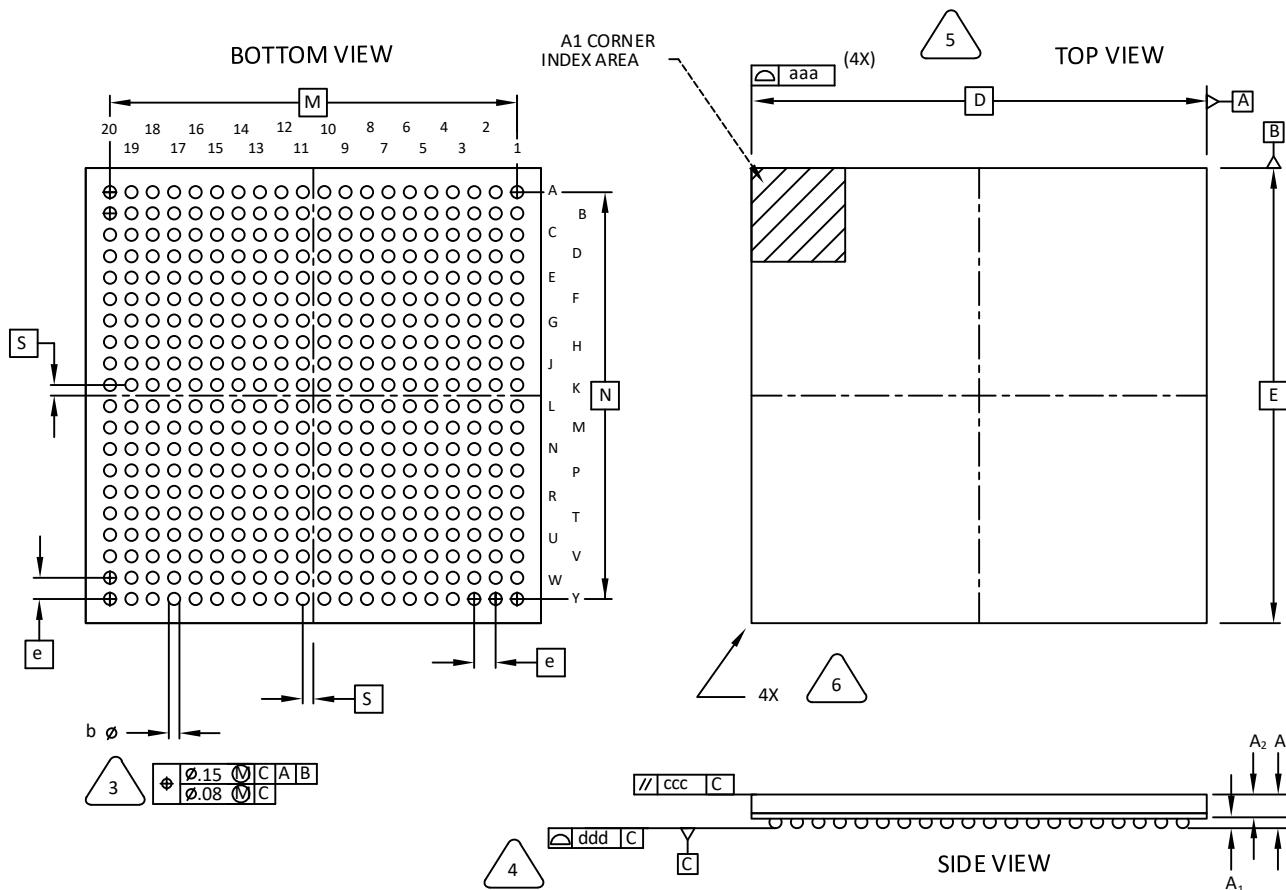
**5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

**6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	19.30	19.80	20.30
D/E	23.00 BSC		
M/N	21.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 113. 400-Ball caBGA Package Option 1: MachXO3

Dimensions in Millimeters



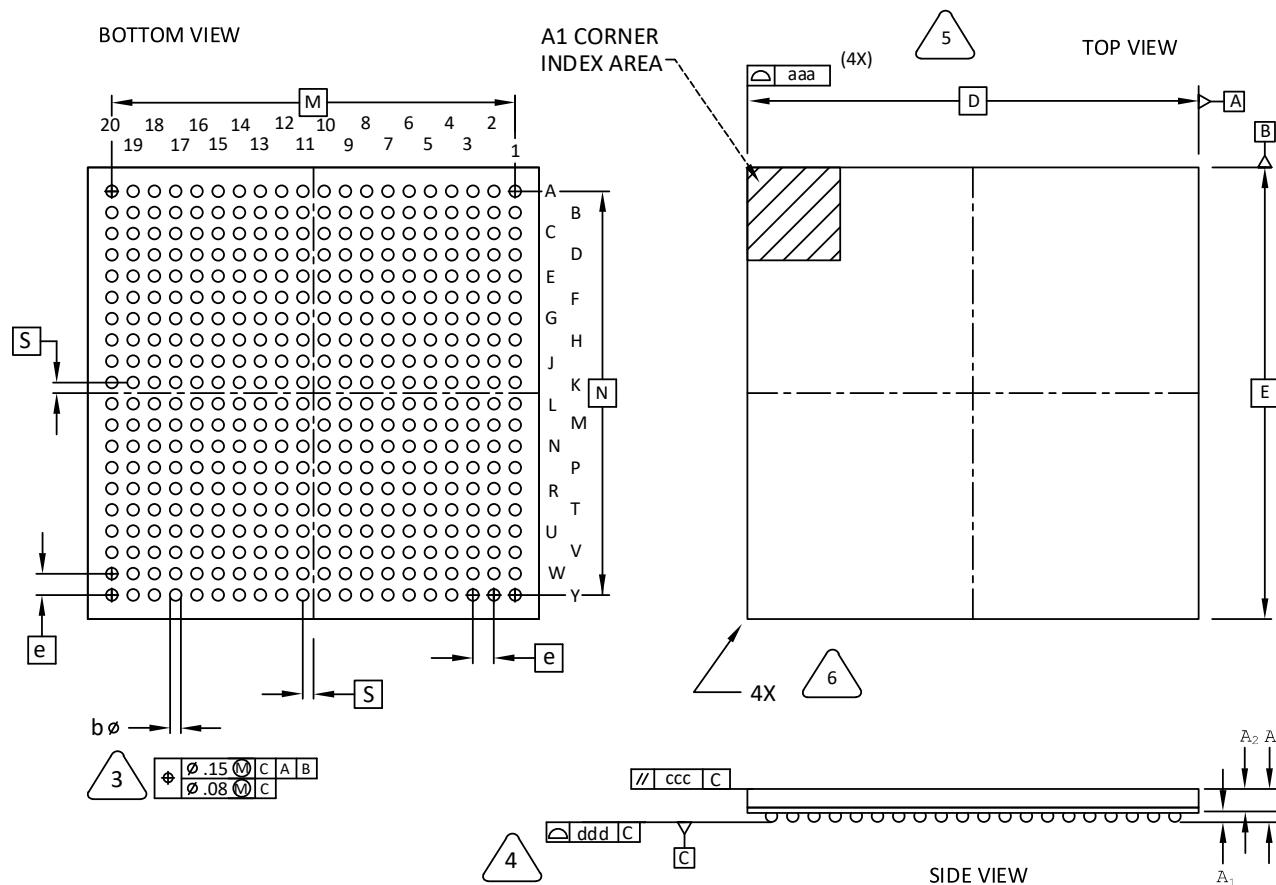
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	0.35	-
A2	0.80	1.00	-
D/E	17.0 BSC		
M/N	15.2 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
e	0.80 BSC		
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.20

## 114. 400-Ball caBGA Package Option 2: CrossLink-NX, MachXO5-NX

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

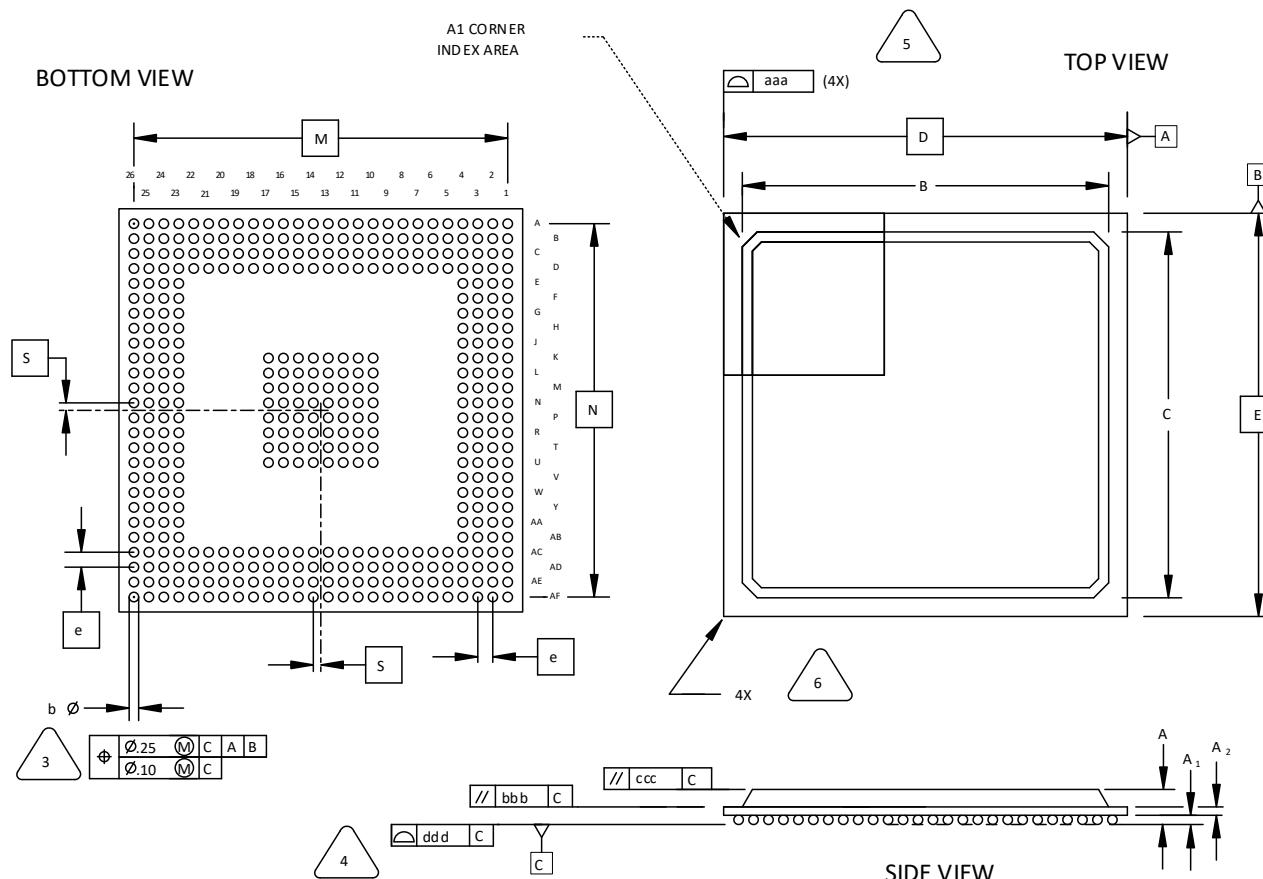
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL

7 JEDEC REFERENCE JEP95 DR4.5 AND MO-210

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.27	-	-
A2	-	-	1.45
D/E	17.0 BSC		
M/N	15.2 BSC		
S	0.40 BSC		
b	0.45	0.50	0.55
e	0.80 BSC		
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.20

## 115. 416-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

**3**: DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.

**4**: PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

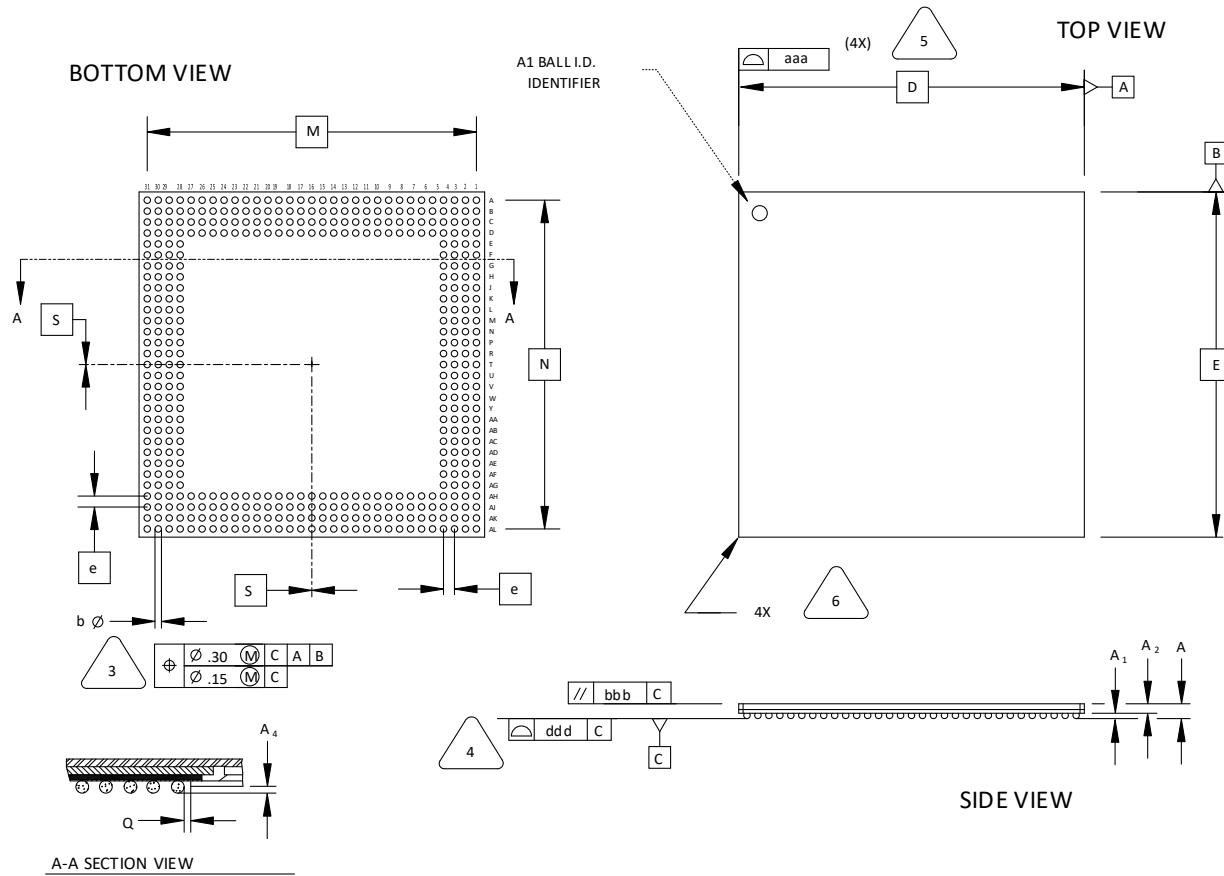
**5**: BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

**6**: EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	23.80	24.80	25.80
D/E	27.00 BSC		
M/N	25.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 116. 432-Ball SBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

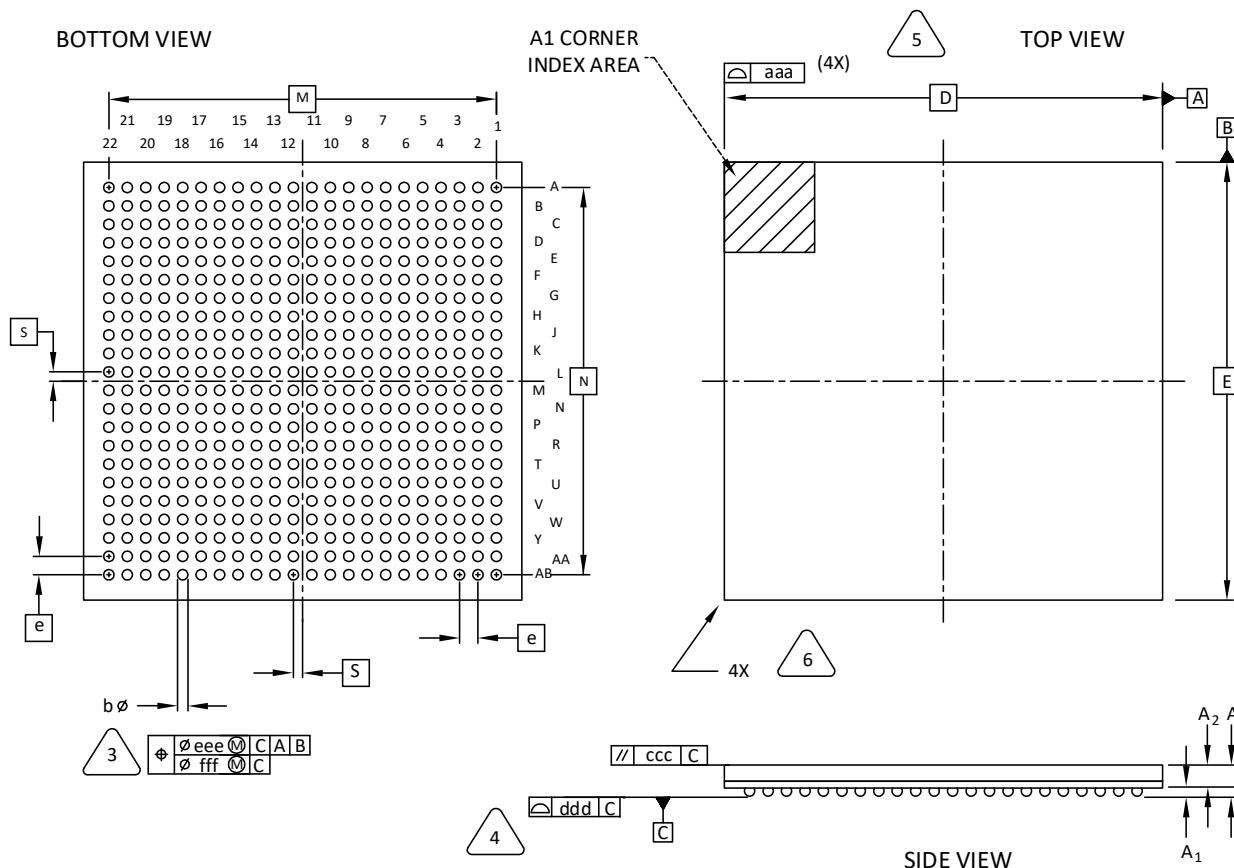


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.50	0.65	0.80
A2	0.80	0.90	1.00
D/E	40.00 BSC		
M/N	38.10 BSC		
S	0.00 BSC		
b	0.60	0.75	0.90
e	1.27 BSC		
Q	0.25	-	-
A4	0.10	-	-
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20

## 117. 484-Ball caBGA Package (19 mm x 19 mm Body) Option 1: MachXO3/MachXO3D

Dimensions in Millimeters



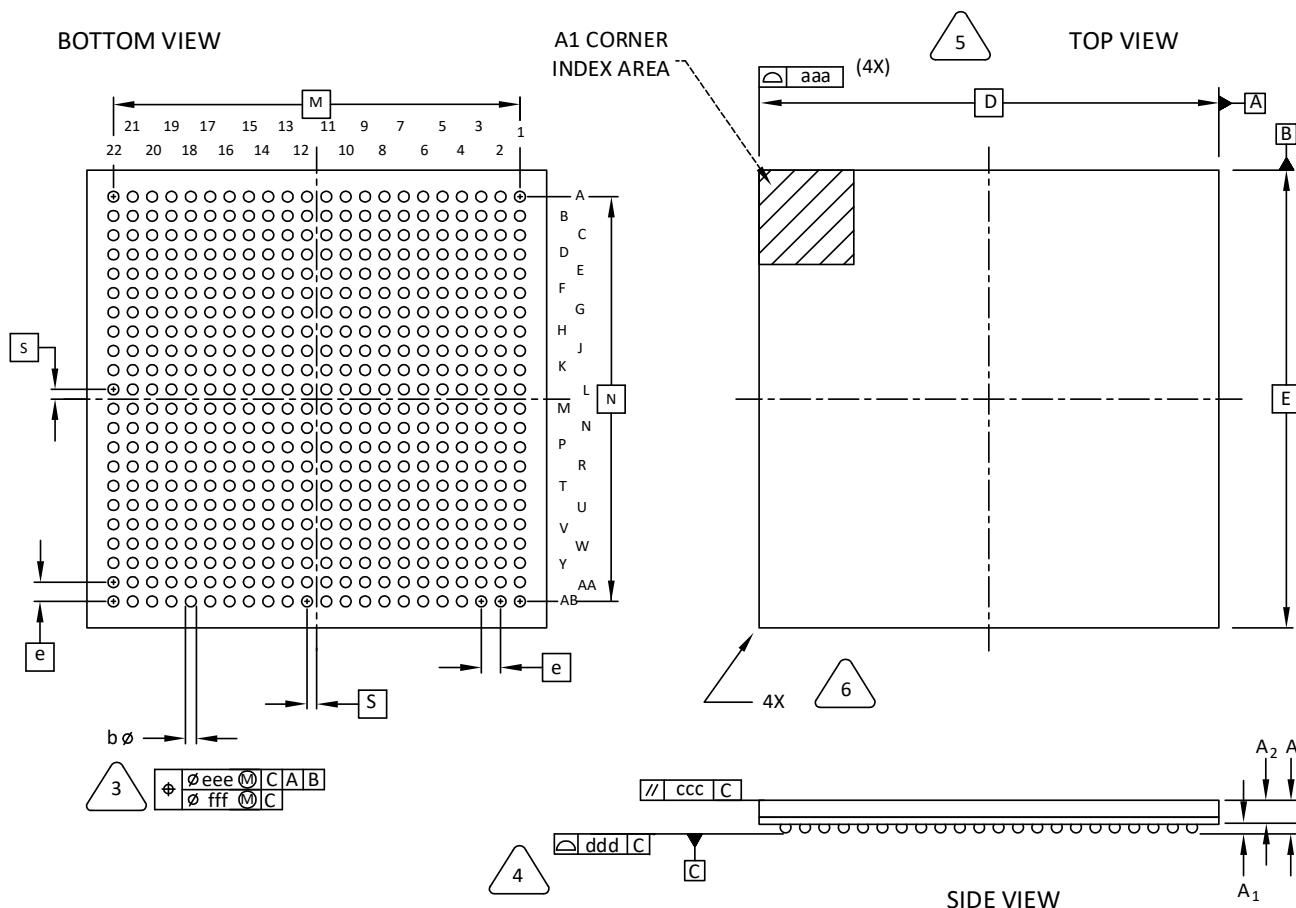
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: MO-275A

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	-	-
A2	0.65	-	-
D/E	19.0 BSC		
M/N	16.8 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
e	0.80 BSC		
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.20
eee	-	-	0.15
fff	-	-	0.08

## 118. 484-Ball BBG484/caBGA Package Option 2: CertusPro™-NX

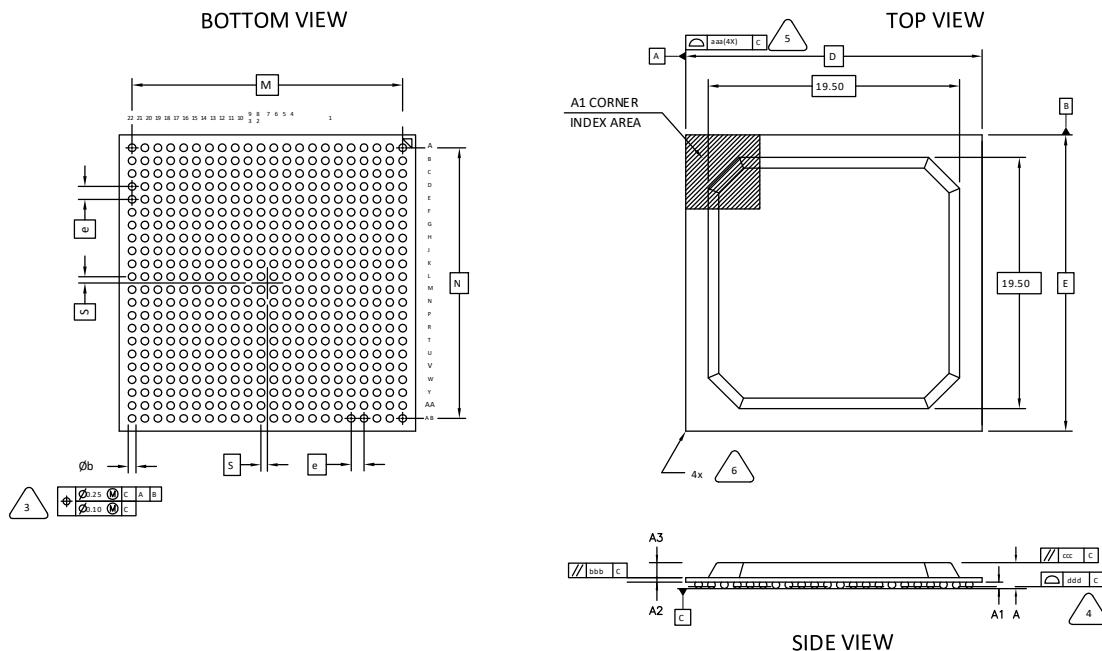
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.25	-	-
A2	0.65	-	-
D/E	19.0	BSC	
M/N	16.8	BSC	
S	0.40	BSC	
b	0.45	0.50	0.55
e	0.80	BSC	
aaa	-	-	0.15
ccc	-	-	0.20
ddd	-	-	0.20
eee	-	-	0.15
fff	-	-	0.08

## 119. 484-Ball BFG484/PBGA Package

Dimensions in Millimeters



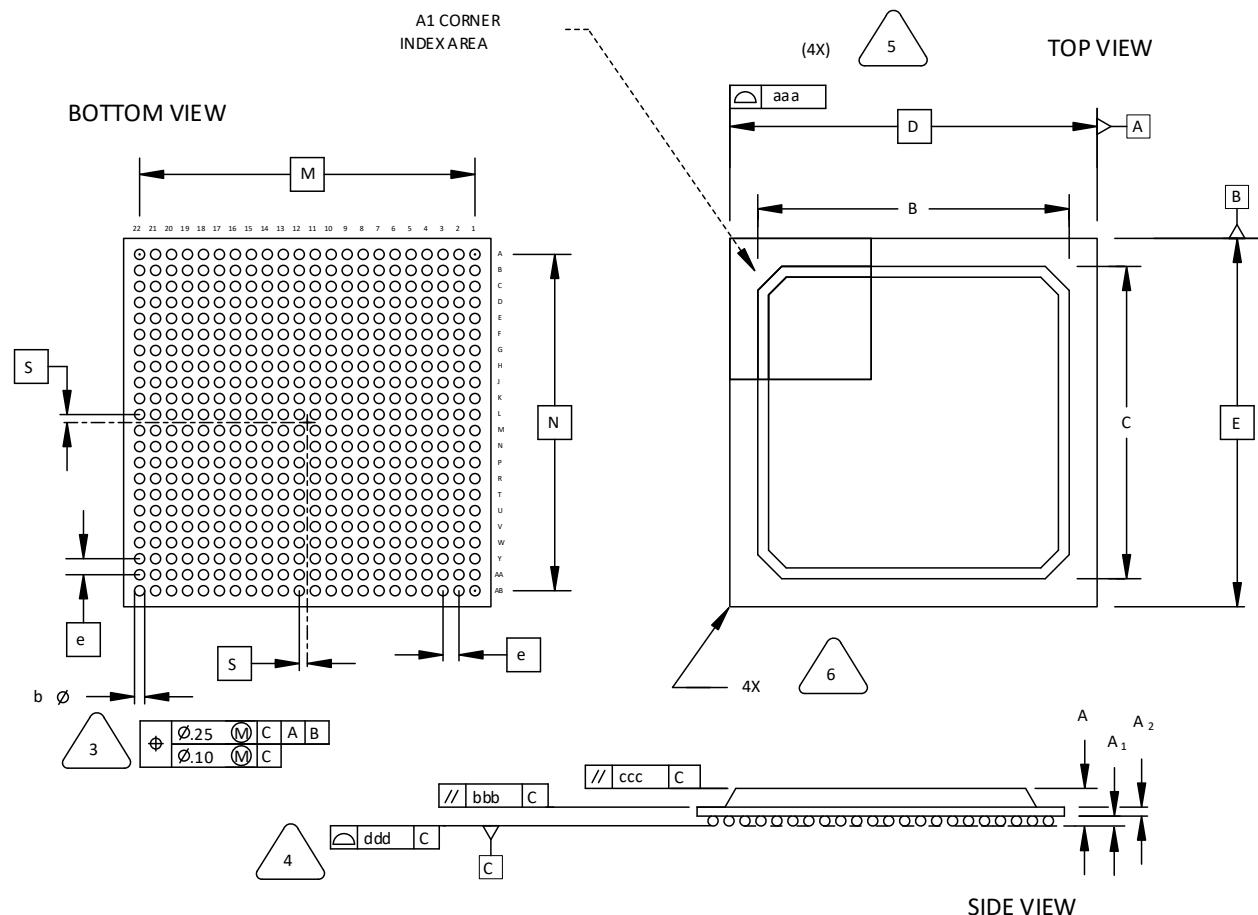
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: MO-318B

SYMBOL	MIN.	NOM.	MAX.
A	-	-	2.20
A1	0.30	-	-
A2	-	-	1.90
A3	1.170 Ref		
D/E	23.0 BSC		
M/N	21.0 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	0.20		
bbb	0.25		
ccc	0.35		
ddd	0.20		

## 120. 484-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**

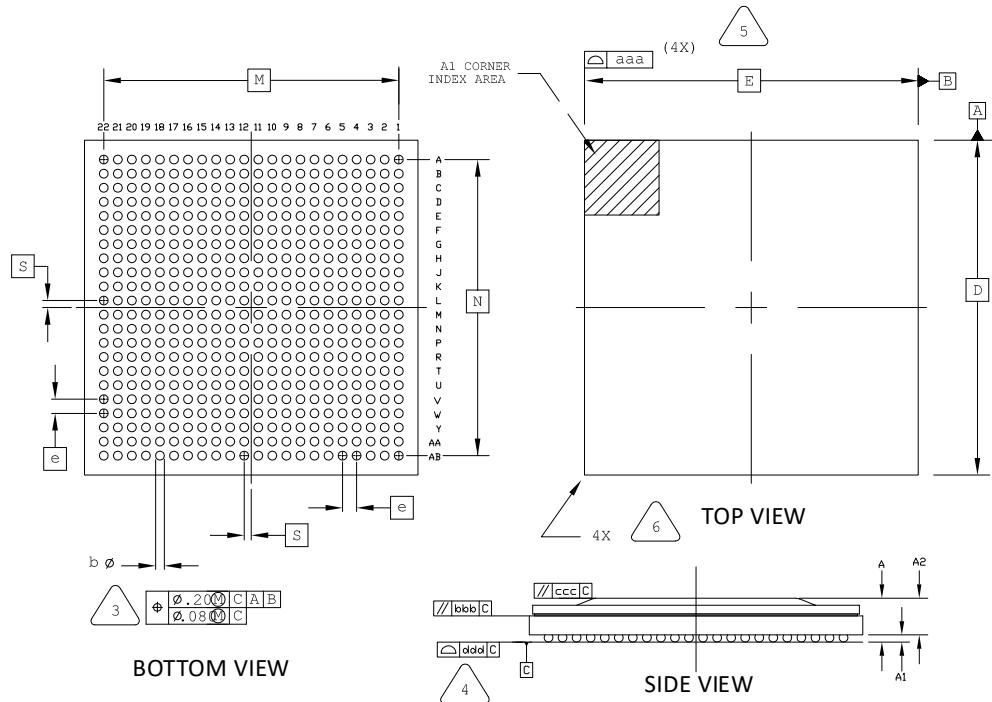
PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	19.30	19.80	20.30
D/E	23.00 BSC		
M/N	21.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 121. 484-Ball fcBGA Package: Mach™-NX



NOTES: UNLESS OTHERWISE SPECIFIED

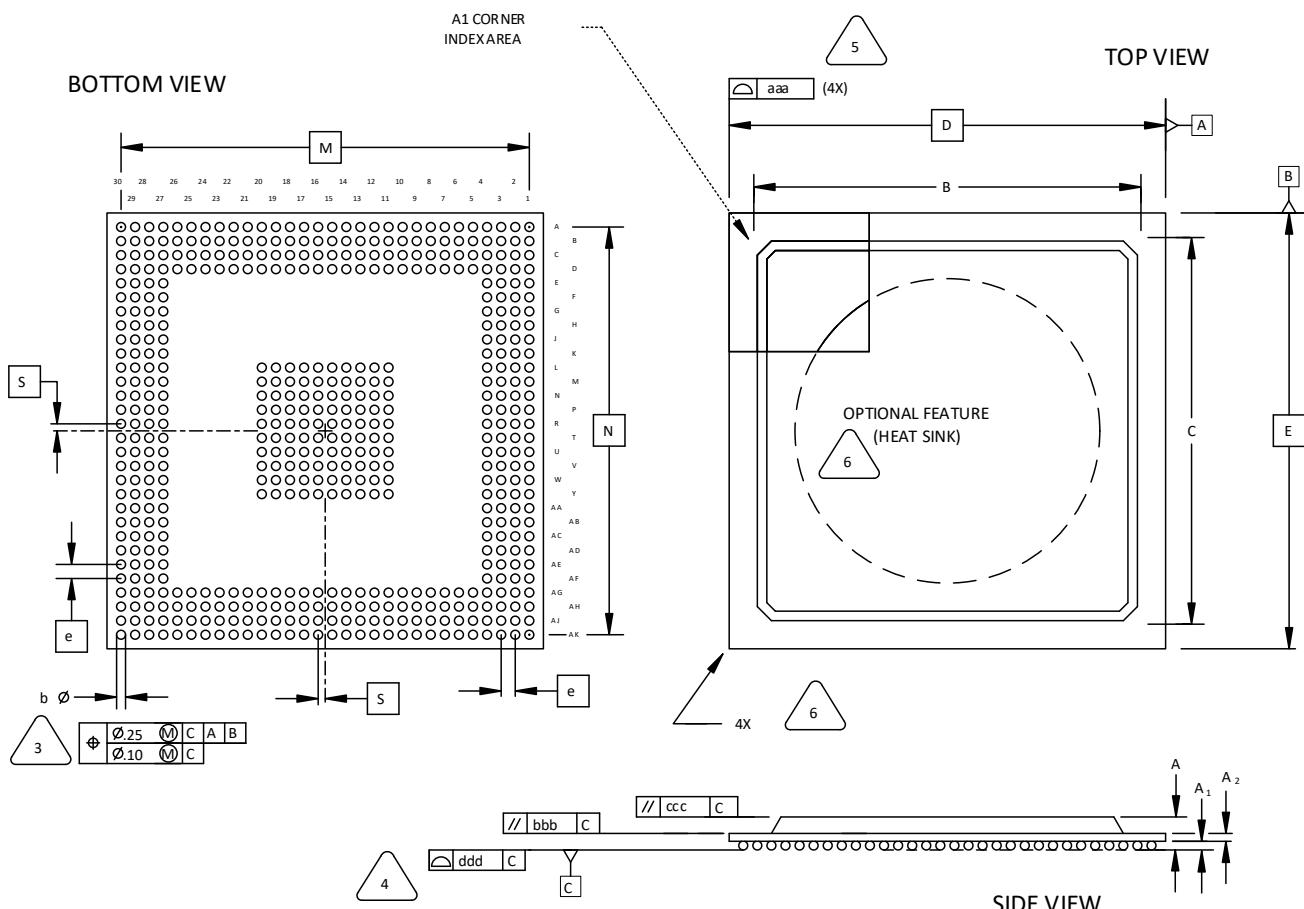
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
4. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
5. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
6. JEDEC REFERENCE: JEP95 DR4.5

\* THESE VALUES ARE BASED ON SUBCON CAPABILITY

SYMBOL	MIN.	NOM.	MAX.
A	-	-	2.736
A1	0.27	-	-
A2	2.086	REF	
D/E	19.00	BSC	
M/N	16.80	BSC	
S	0.40	BSC	
b	0.45	0.50	0.55
e	0.40	0.80	BSC
aaa*	-	-	0.20
bbb*	-	-	0.25
ccc	-	-	0.35
ddd			0.20

## 122. 516-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]

PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

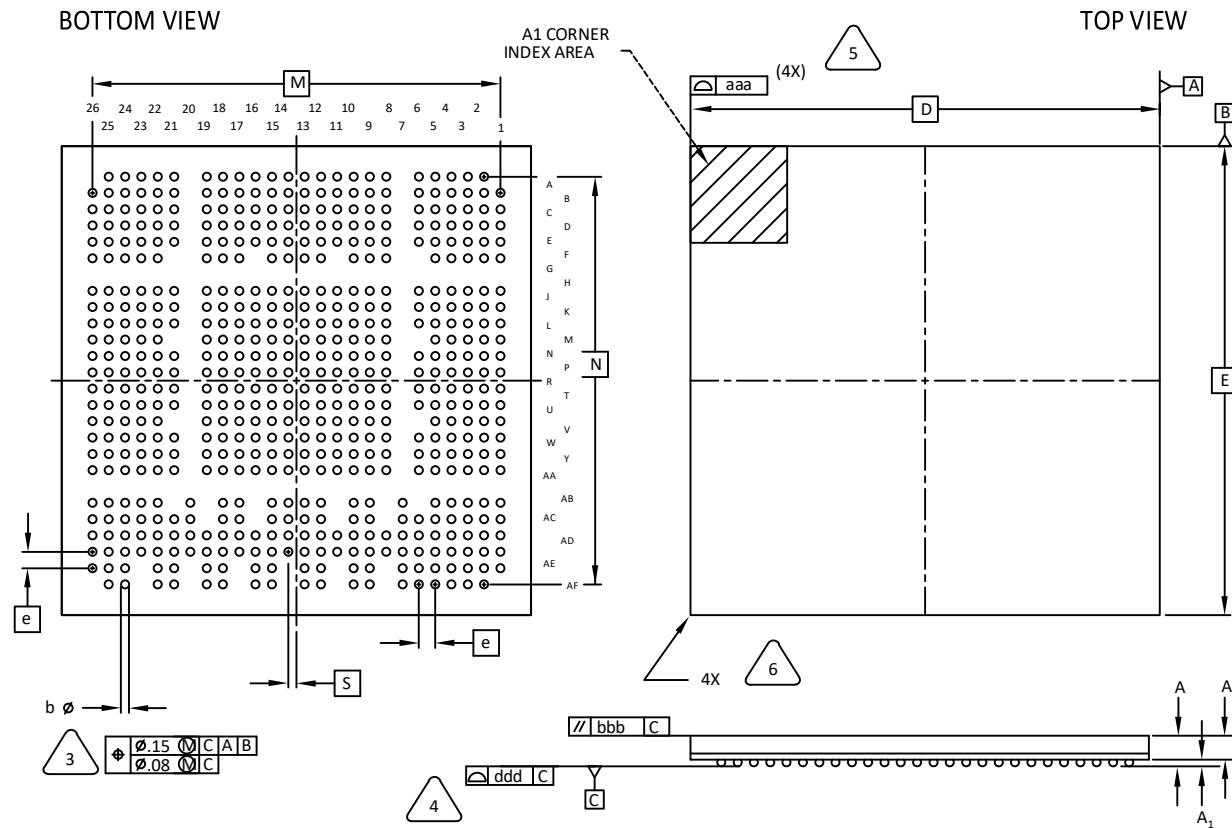
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	25.80	27.55	29.30
D/E	31.00 BSC		
M/N	29.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 123. 554-Ball caBGA Package

Dimensions in Millimeters



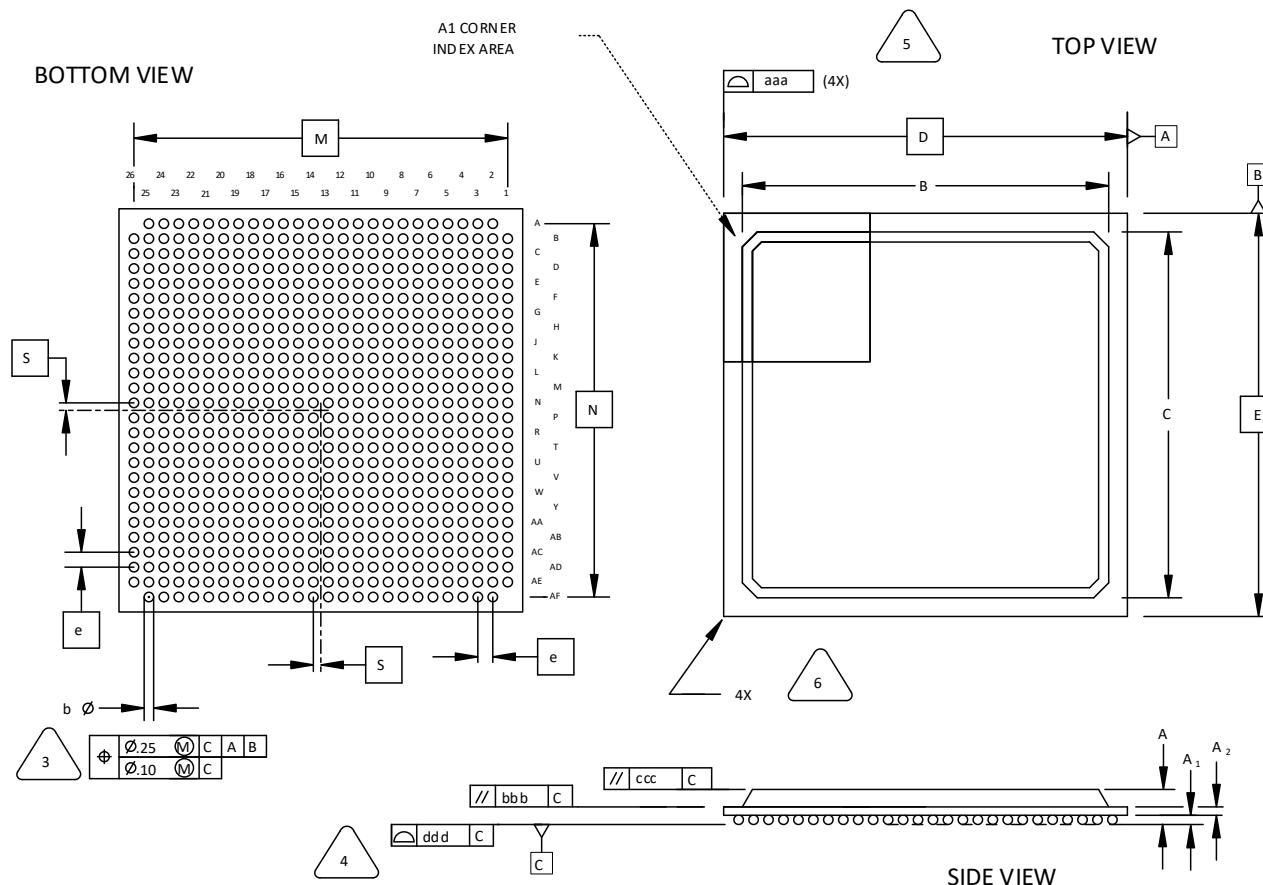
### NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.76
A1	0.25	0.30	0.35
A2	0.80	-	-
D/E	23.0 BSC		
M/N	20.0 BSC		
S	0.40 BSC		
b	0.35	0.40	0.45
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.12

## 124. 672-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]

4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

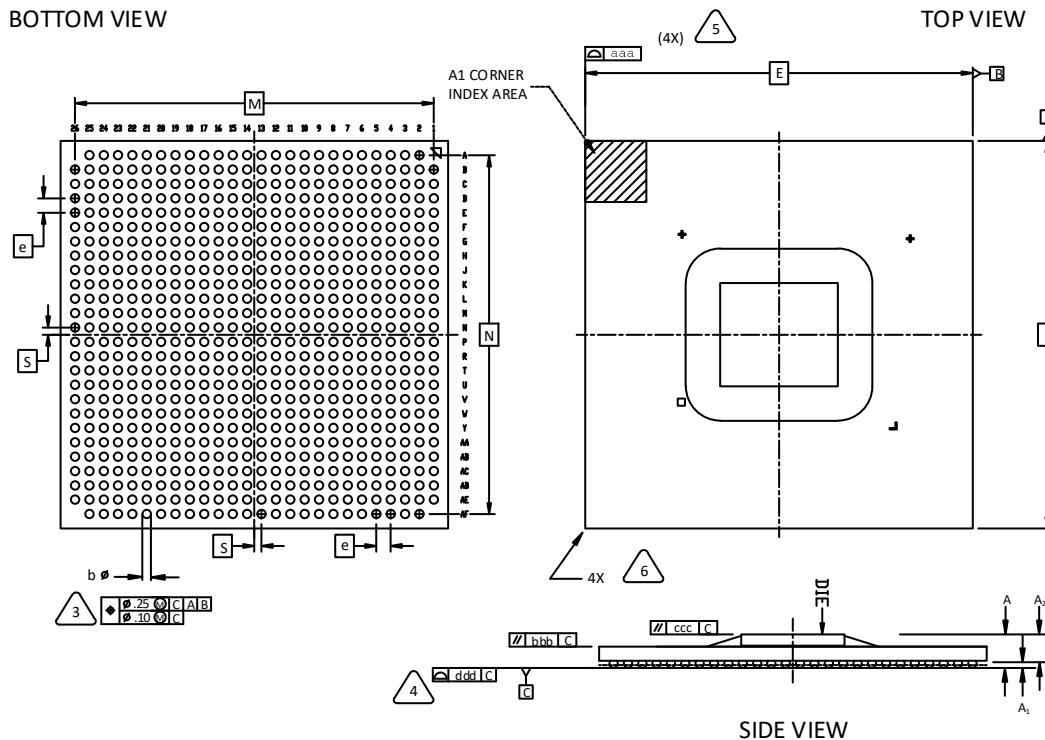
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	23.80	24.80	25.80
D/E	27.00 BSC		
M/N	25.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 125. 672-Ball LFG672/fcBGA Package

Dimensions in Millimeters



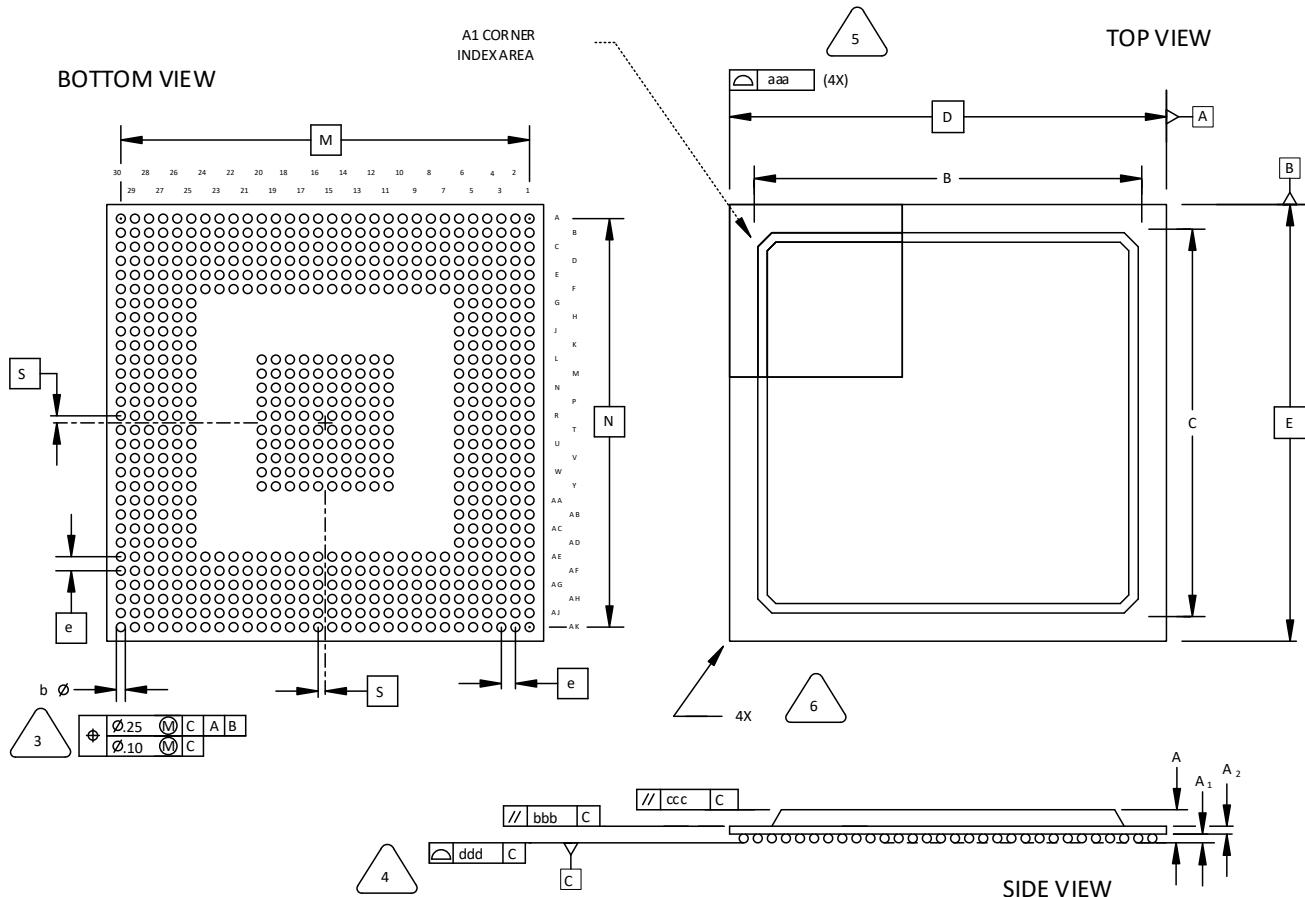
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: JEP 95 DR4.4

SYMBOL	MIN.	NOM.	MAX.
A	—	—	2.586
A1	0.300	—	—
A2	1.836 REF		
D/E	27.00 BSC		
M/N	25.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	—	—	0.20
bbb	—	—	0.25
ccc	—	—	0.20
ddd	—	—	0.20

## 126. 676-Ball fpBGA Package

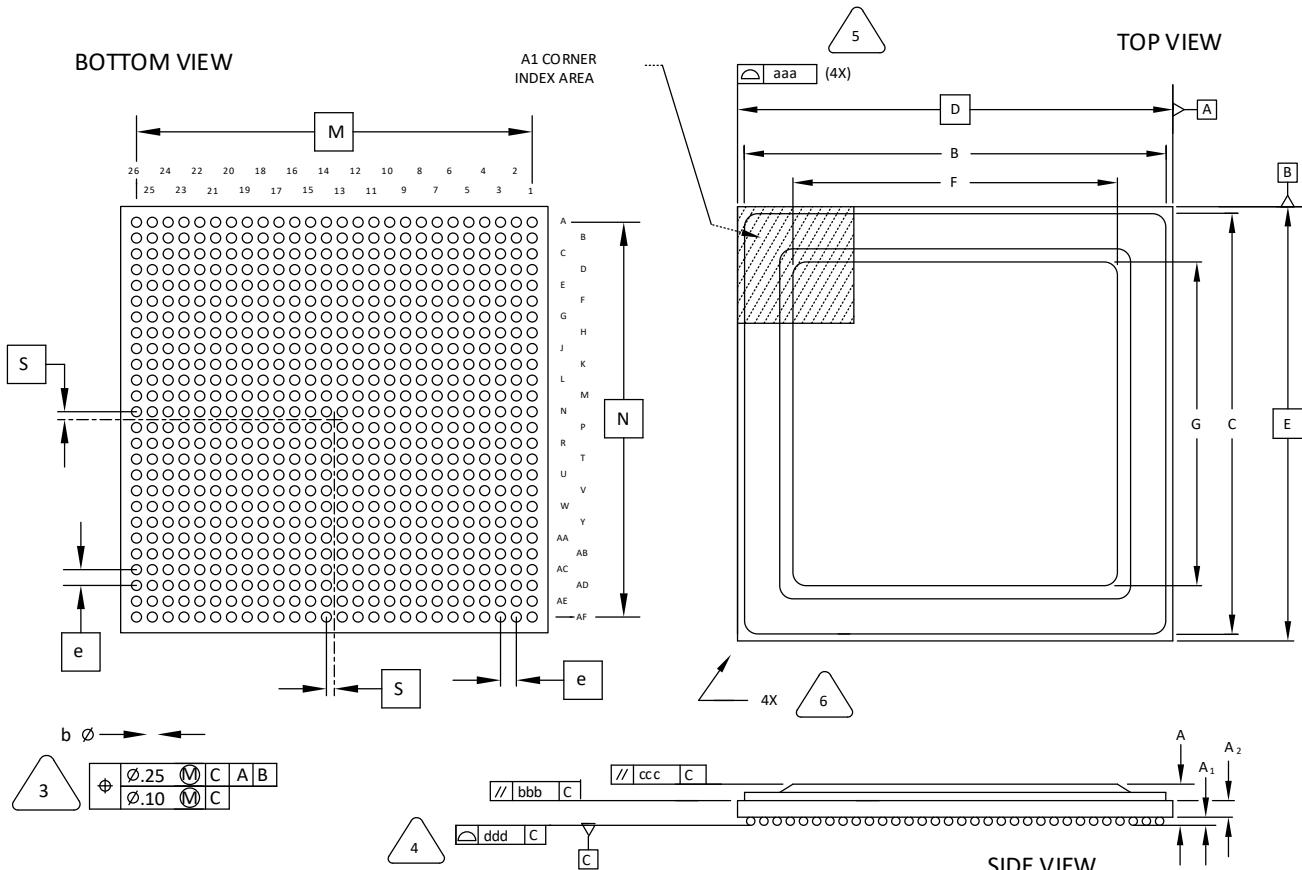
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	25.80	27.55	29.30
D/E	31.00 BSC		
M/N	29.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 127. 676-Ball fcBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.

4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

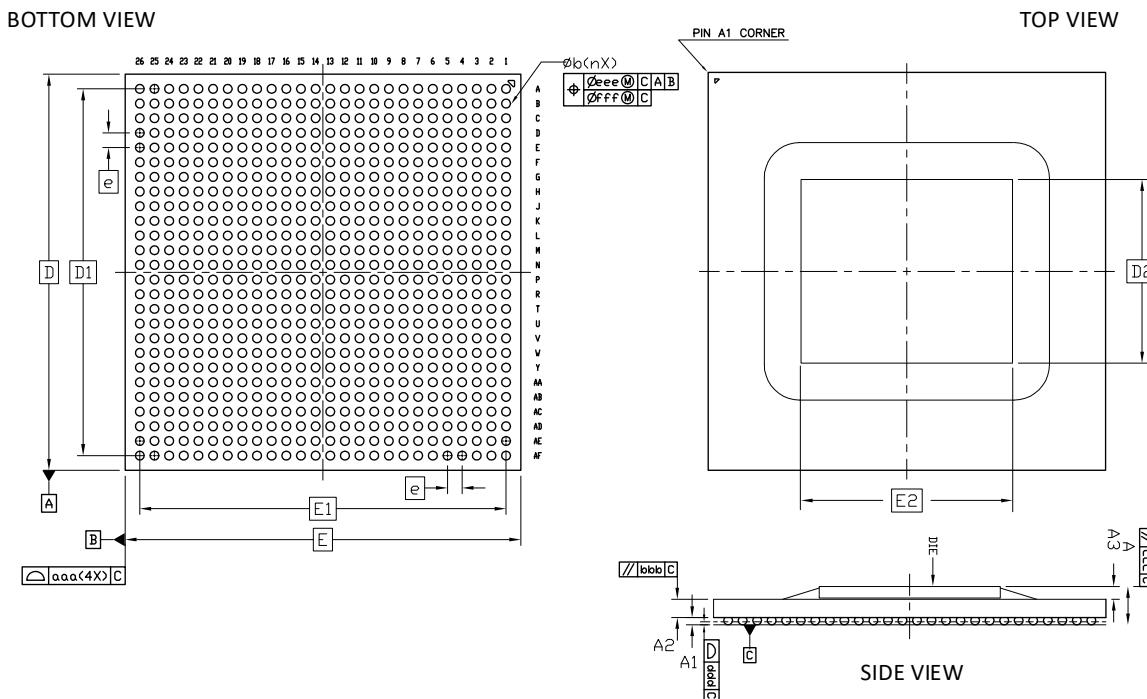
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	2.55	2.90	3.25
A1	0.40	0.50	0.60
A2	1.20 REF		
B/C	26.55	26.60	26.65
D/E	27.00 BSC		
F/G	18.55	18.60	18.65
M/N	25.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 128. 676-Ball LFG676/fcBGA Package

Dimensions in Millimeters



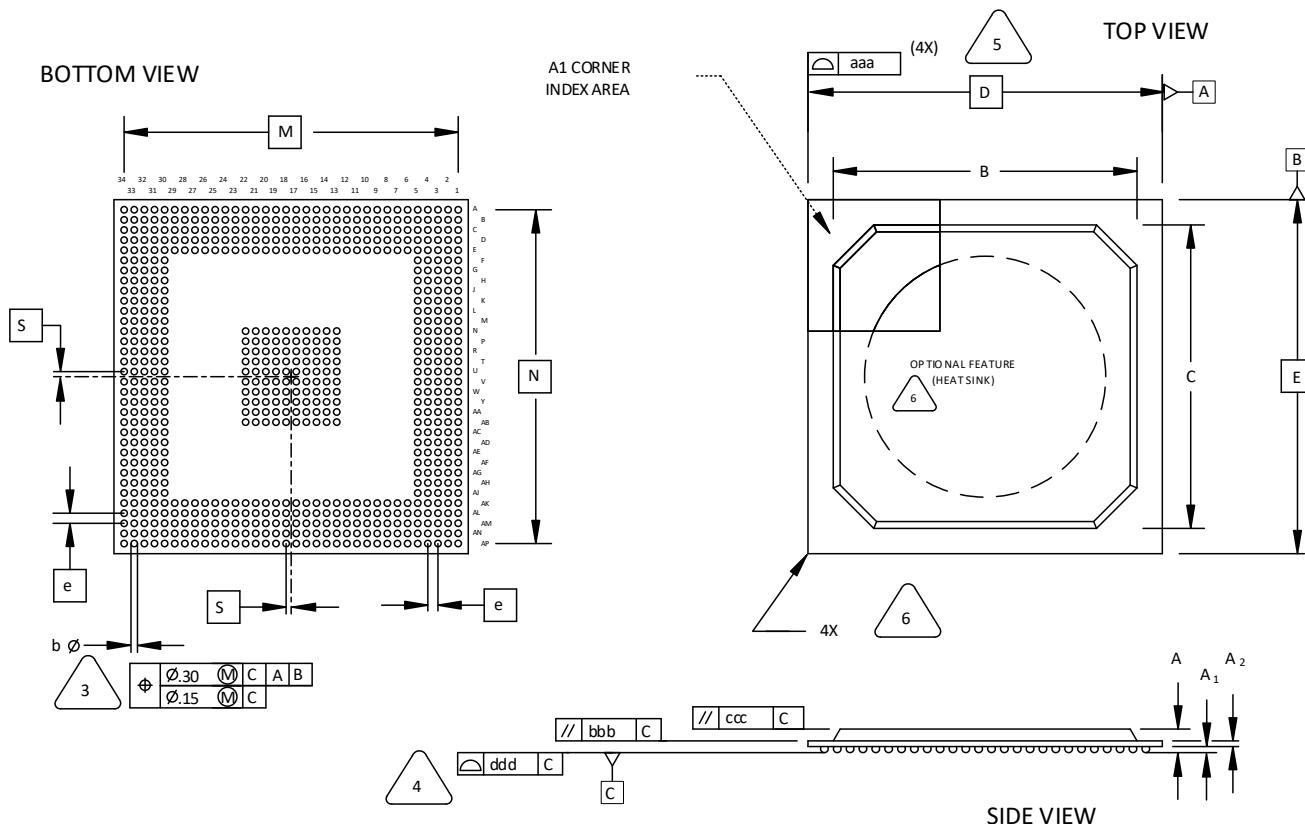
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
4. PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: JEP 95 DR4.4

SYMBOL	MIN.	NOM.	MAX.
A	2.385	2.635	2.885
A1	0.400	—	0.600
A2		1.258	REF
A3		0.877	REF
E		27.00	BSC
D		27.00	BSC
		0.600	
b	0.500	—	0.700
		1.000	BSC
e		676	
E1		25.000	BSC
D1		25.000	BSC
E2		14.376	BSC
D2		12.475	BSC
aaa		0.200	
bbb		0.250	
ccc		0.350	
ddd		0.200	
eee		0.250	
fff		0.100	

## 129. 680-Ball fpBGA Package

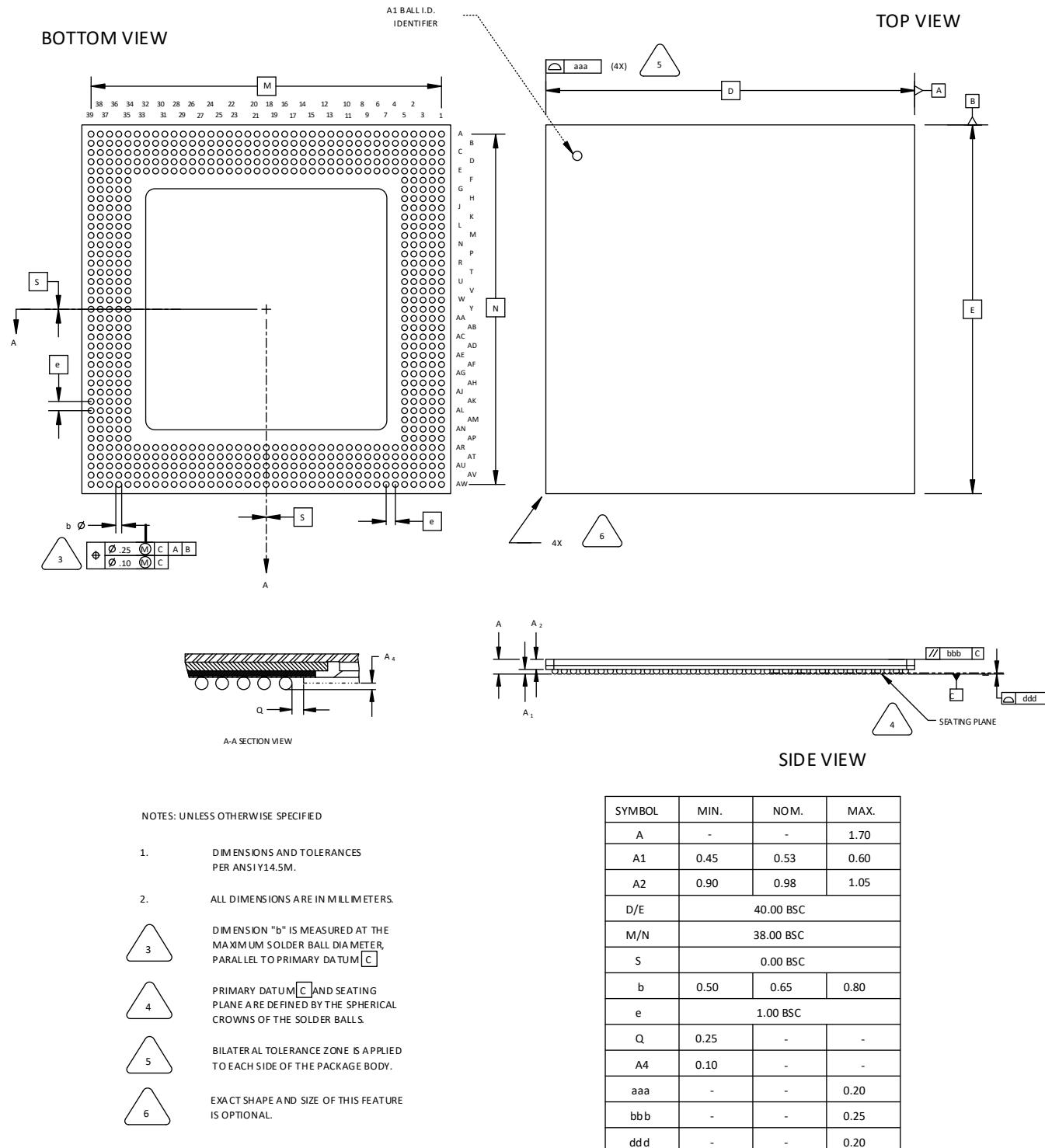
(With or without Internal Heat Spreader) Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.25	2.60
A1	0.30	0.50	0.70
A2	0.40	0.60	0.80
B/C	29.80	30.30	30.80
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

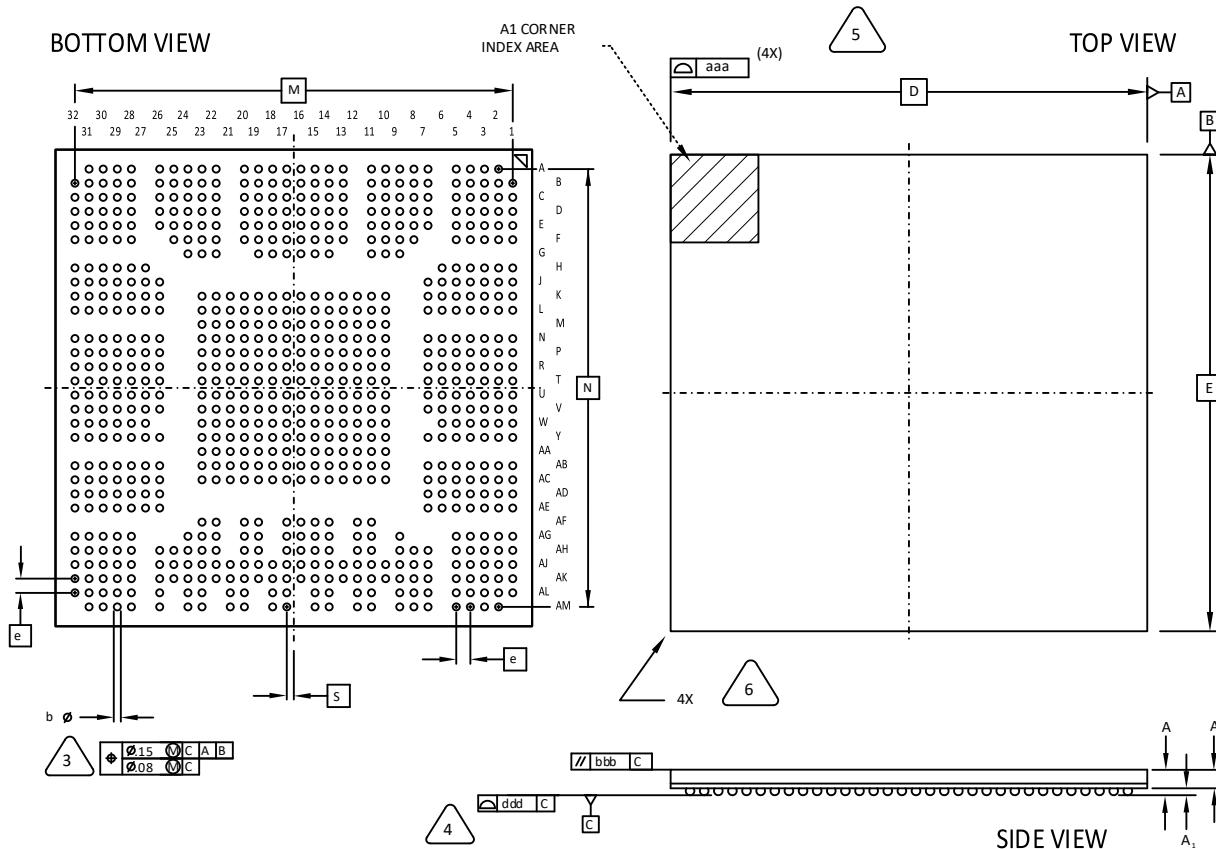
## 130. 680-Ball fpSBGA Package

Dimensions in Millimeters



## 131. 756-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]



PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

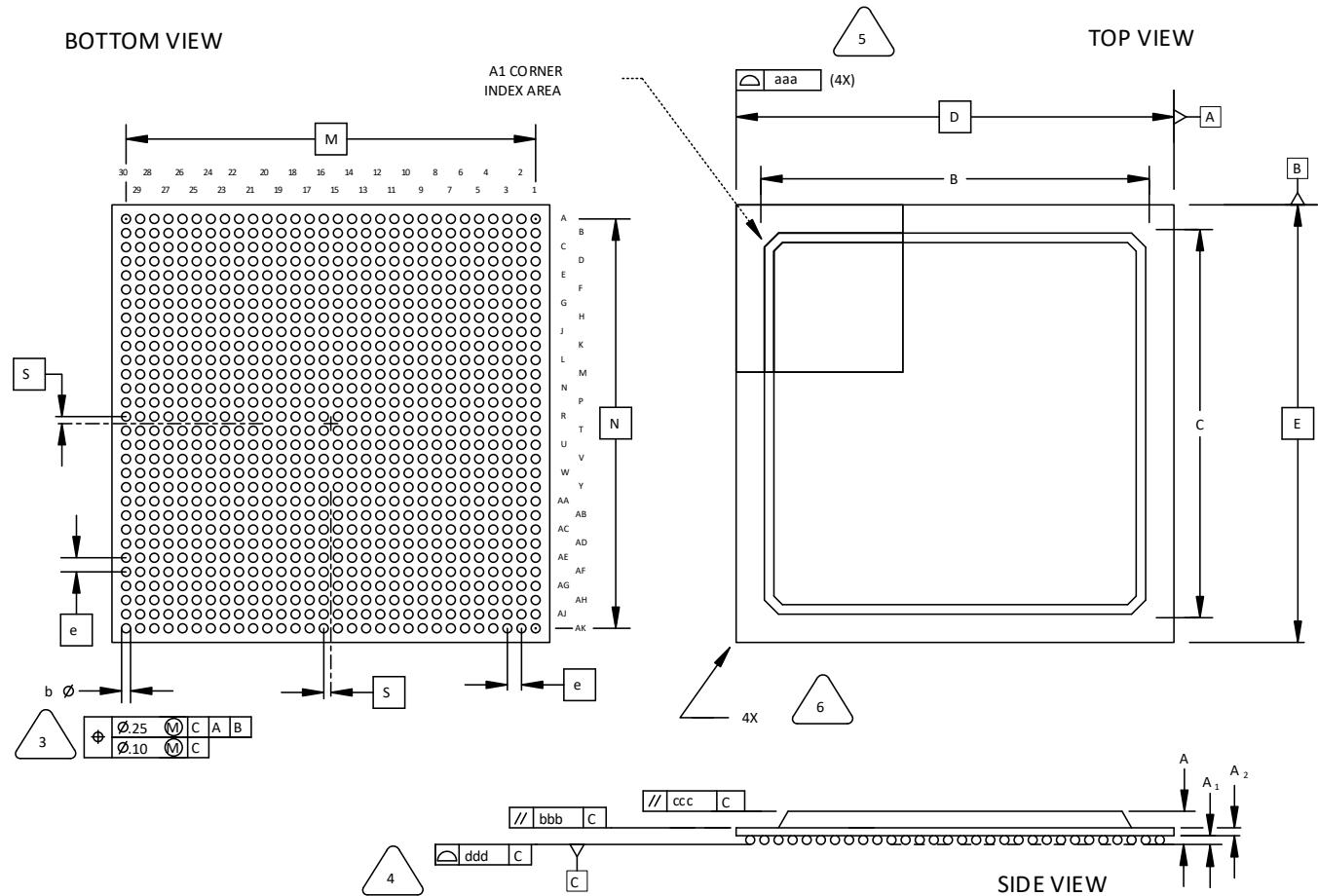


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.76
A1	0.25	0.30	0.35
A2	0.80	-	-
D/E	27.00 BSC		
M/N	24.80 BSC		
S	0.40 BSC		
b	0.35	0.40	0.45
e	0.80 BSC		
aaa	-	-	0.15
bbb	-	-	0.20
ddd	-	-	0.12

## 132. 900-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]

PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.

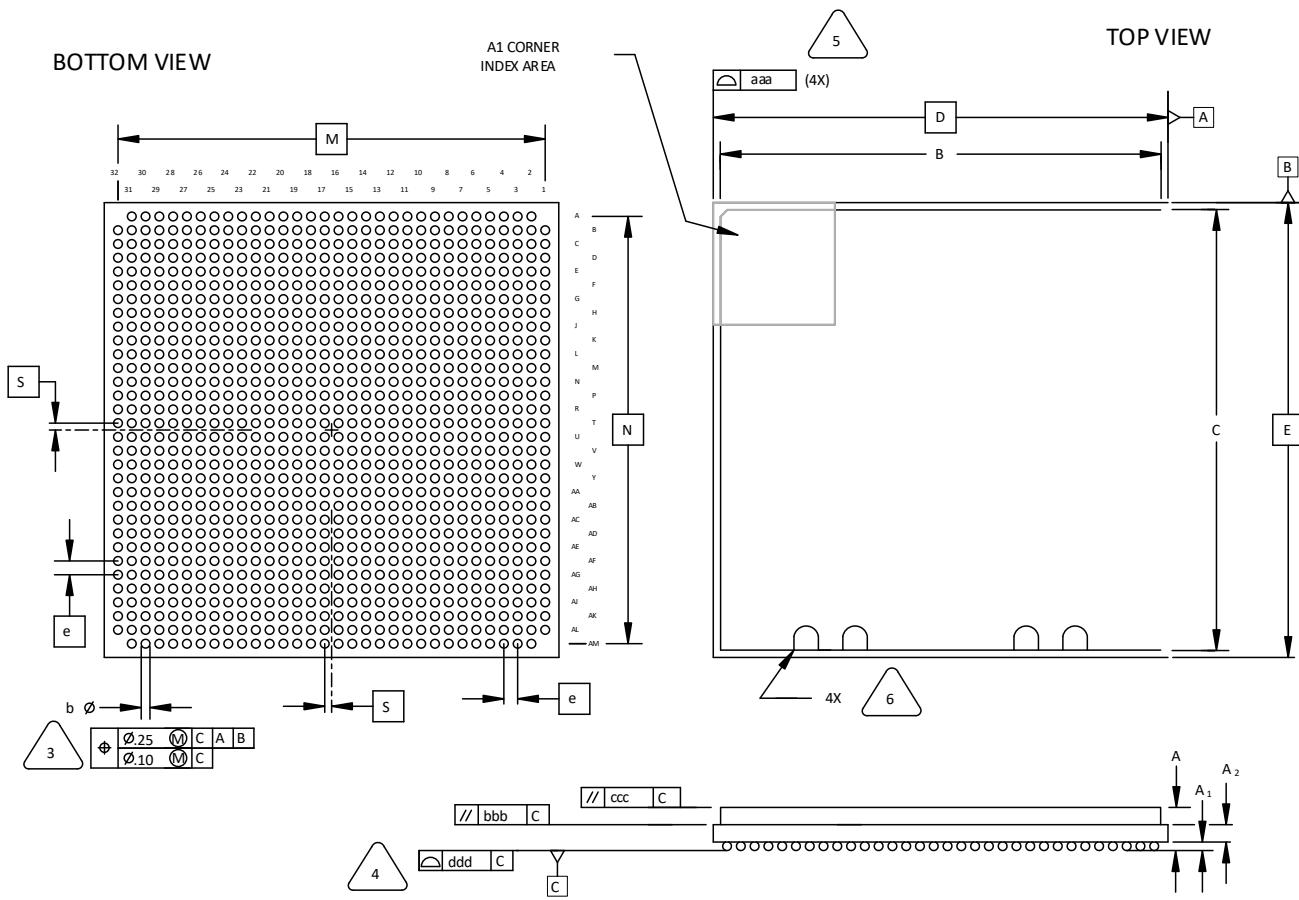
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	25.80	27.55	29.30
D/E	31.00 BSC		
M/N	29.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 133. 1020-Ball Organic fcBGA Package

Dimensions in Millimeters



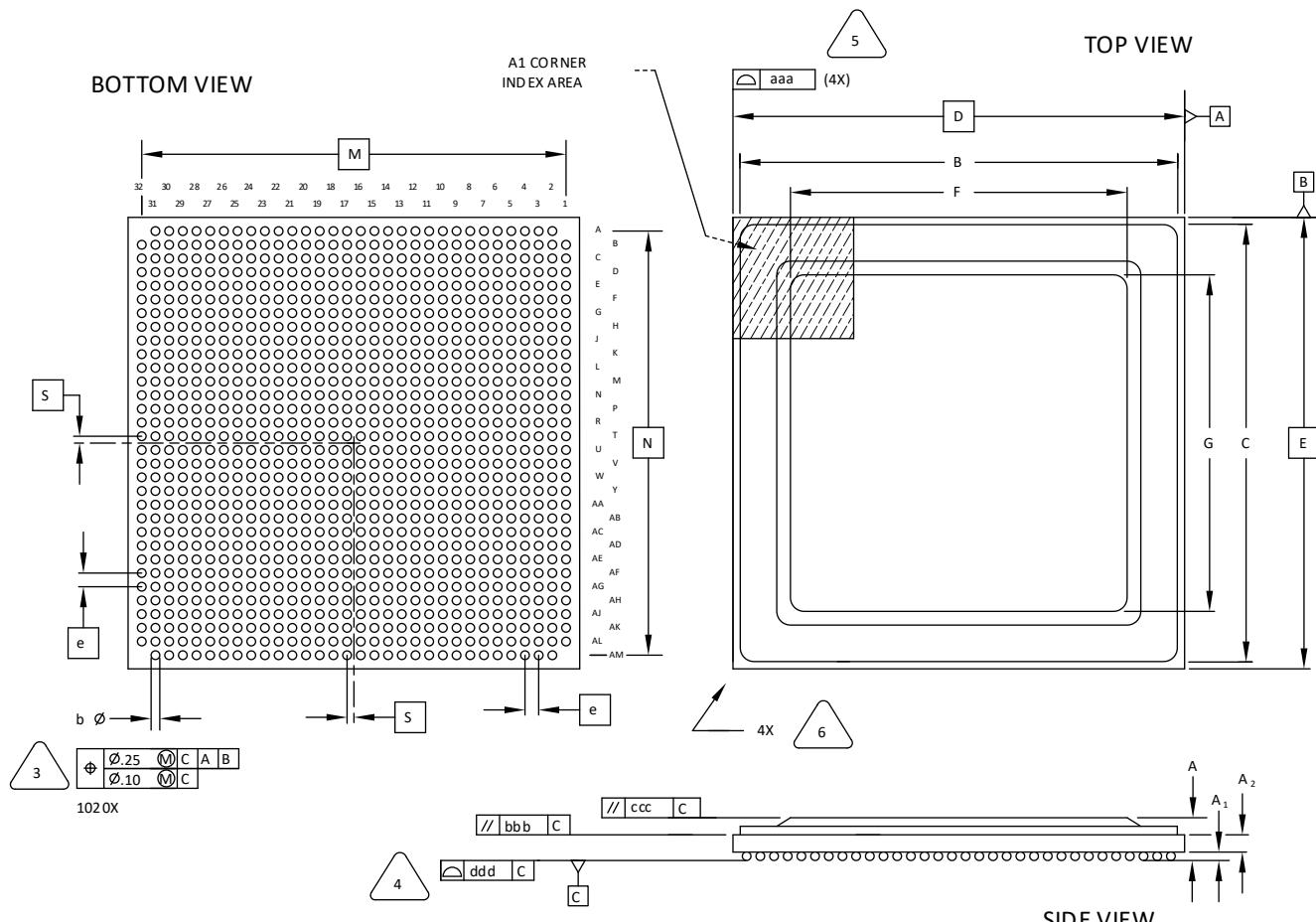
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- 4** PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	2.52	3.12	3.82
A1	0.30	0.50	0.70
A2		1.24 REF	
B/C	31.10	32.00	32.90
D/E		33.00 BSC	
M/N		31.00 BSC	
S		0.50 BSC	
b	0.50	0.60	0.70
e		1.00 BSC	
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 134. 1020-Ball Organic fcBGA Package Rev. 2

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]



PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

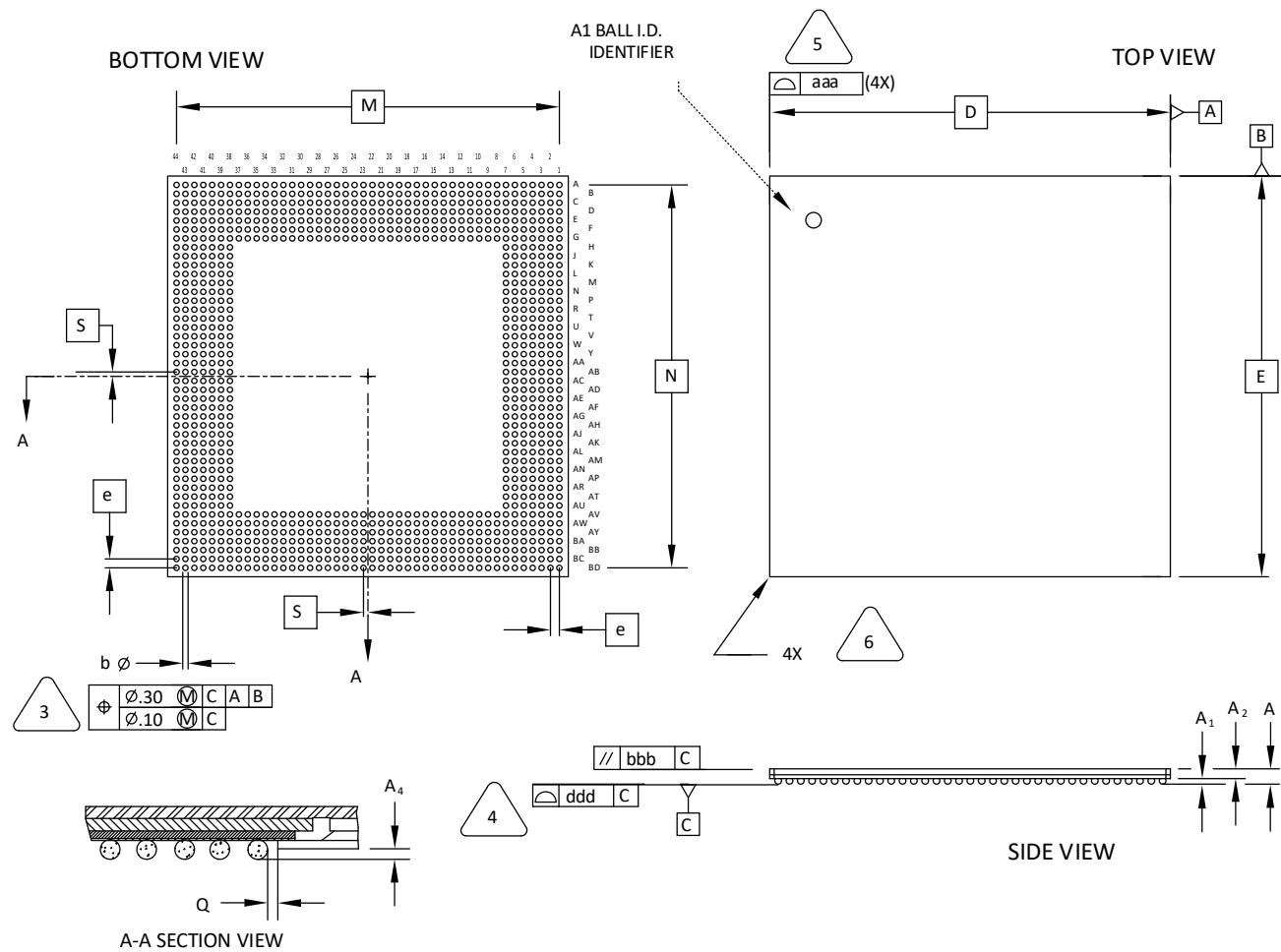


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	2.55	2.90	3.25
A1	0.40	0.50	0.60
A2	1.20 REF		
B/C	32.40	32.60	32.80
D/E	33.00 BSC		
F/G	24.50	24.60	24.70
M/N	31.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 135. 1036-Ball ftSBGA Package

Dimensions in Millimeters



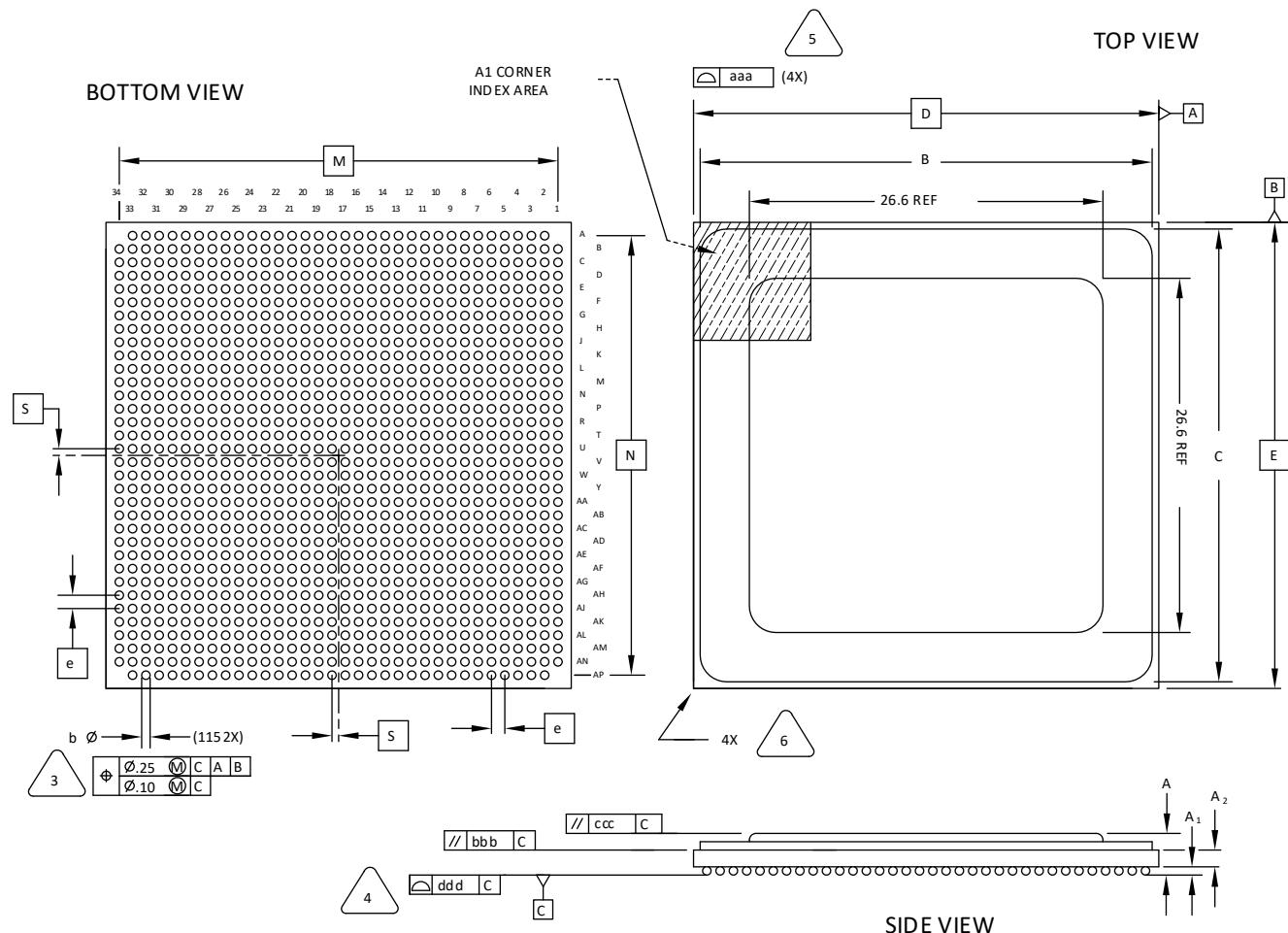
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- (3) DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
- (4) PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- (5) BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- (6) EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.80
A1	0.40	0.55	0.70
A2	0.90	0.98	1.10
D/E	45.00 BSC		
M/N	43.00 BSC		
S	0.50 BSC		
b	0.50	0.65	0.80
e	1.00 BSC		
Q	0.25	-	-
A4	0.10	-	-
aaa	-	-	0.20
bbb	-	-	0.35
ddd	-	-	0.20

## 136. 1152-Ball Organic fcBGA Package Option 1: LatticeSC/SCM40

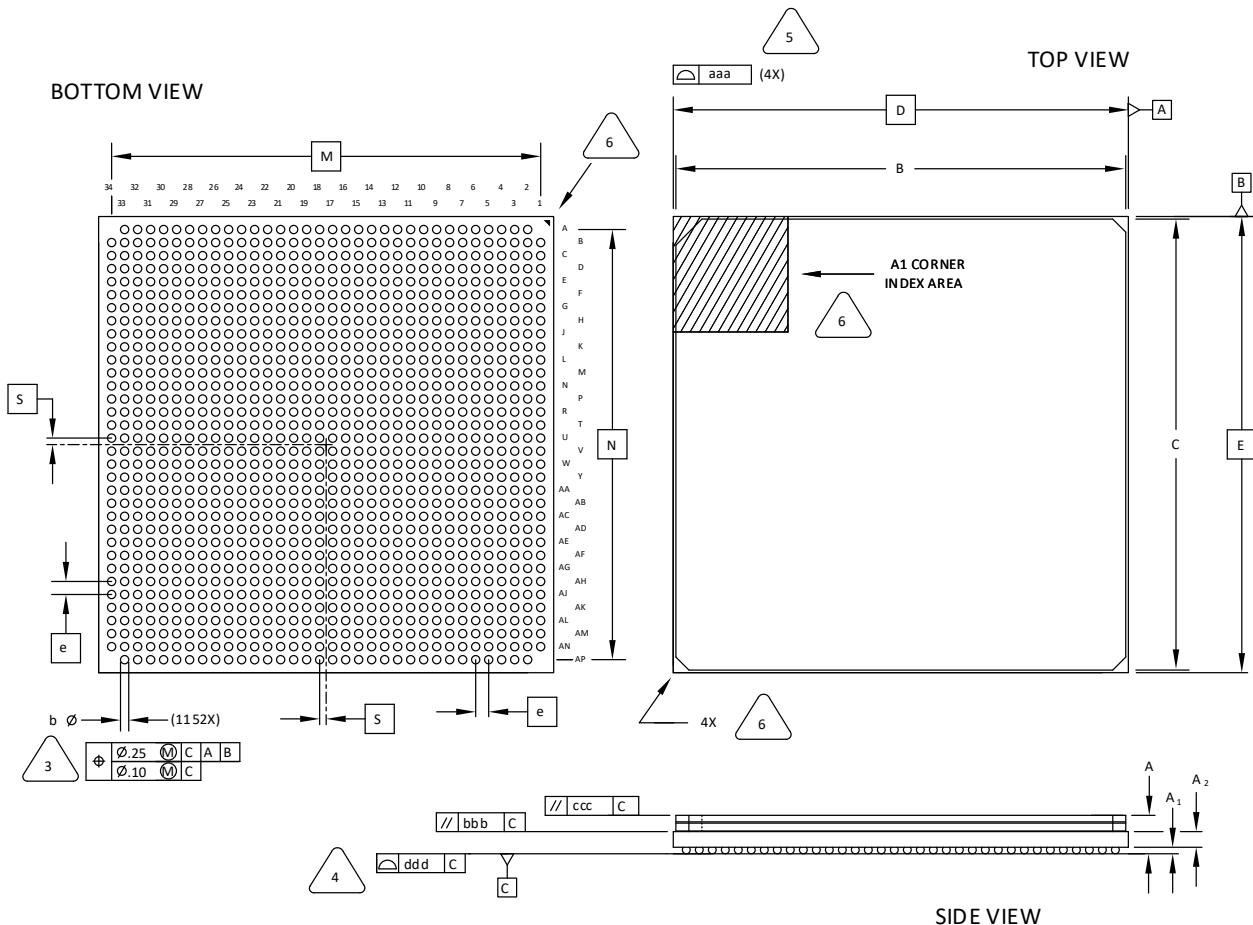
Dimensions in Millimeters



SYMBOL	MIN.	NOM.	MAX.
A	2.55	2.90	3.25
A1	0.35	0.50	0.65
A2	1.20 REF		
B/C	34.25	34.50	34.75
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 137. 1152-Ball Organic fcBGA Package Option 2: LatticeSC/SCM80 and SC/SCM115

Dimensions in Millimeters



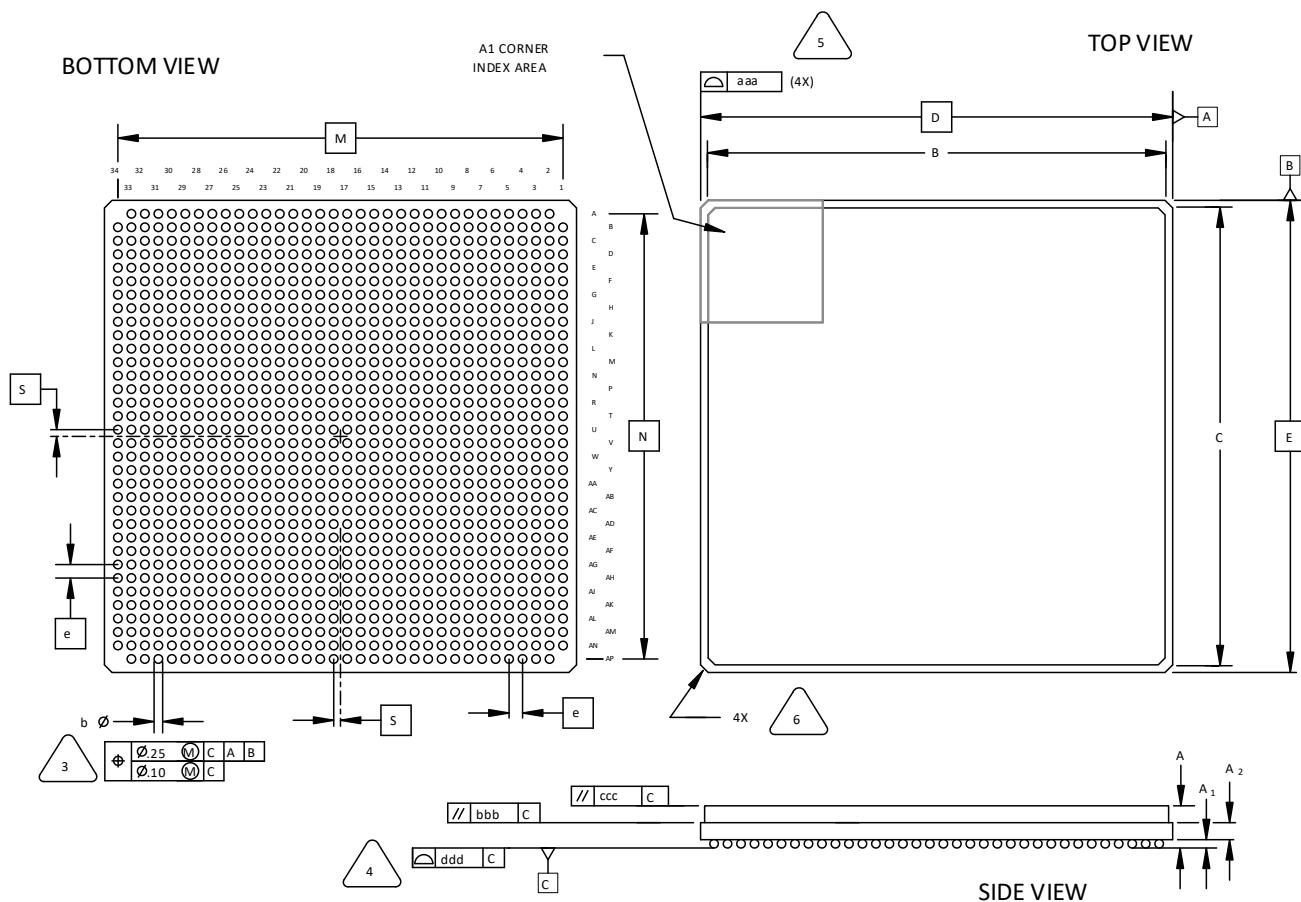
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	2.80	3.15	3.50
A1	0.35	0.50	0.65
A2	1.20 REF		
B/C	34.30	34.60	34.90
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.23

## 138. 1152-Ball Ceramic fcBGA Package

Dimensions in Millimeters



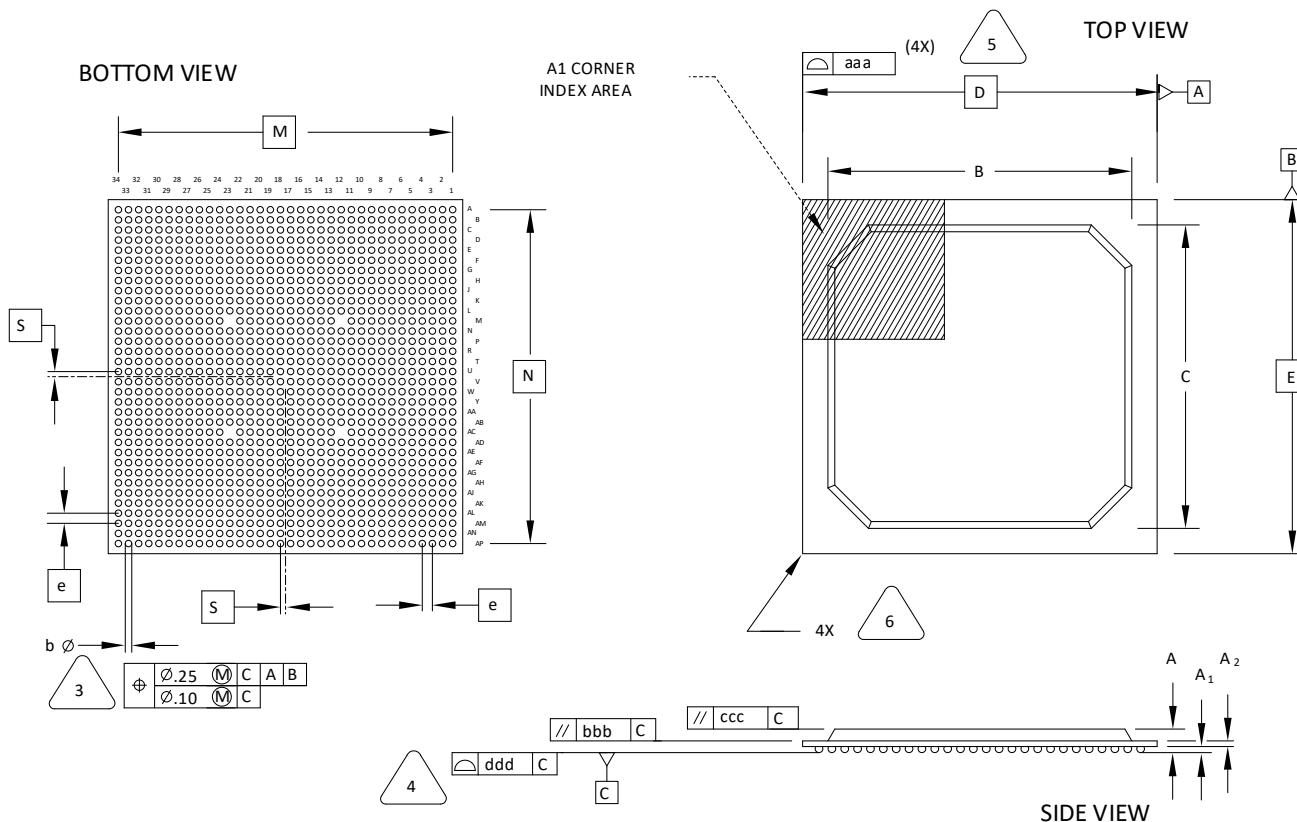
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	4.00	4.60	5.20
A1	0.30	0.50	0.70
A2 1.40 REF			
B/C	33.10	34.00	34.90
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 139. 1152-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**



PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.



EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

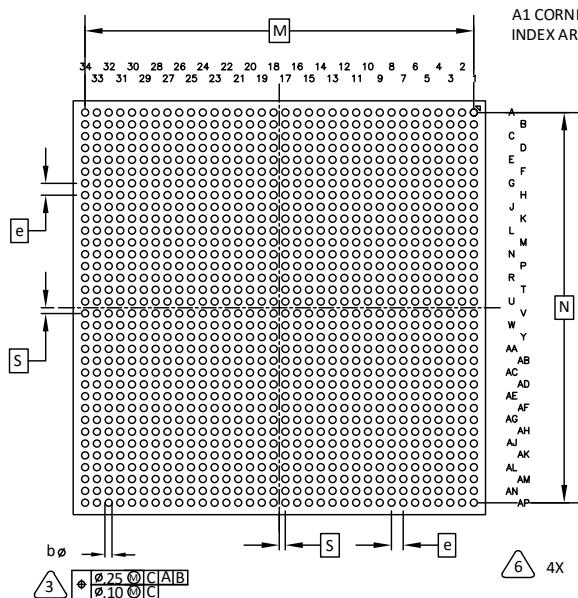
Note: Depopulated ball locations are M12, M23, AC12, and AC23.

SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.25	2.60
A1	0.30	0.50	0.70
A2	0.40	0.60	0.80
B/C	29.80	30.30	30.80
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

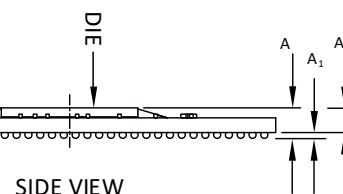
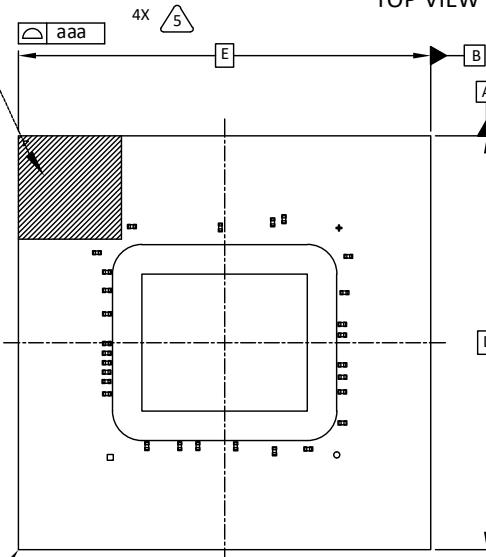
## 140. 1156-Ball LFG1156/fcBGA Package

Dimensions in Millimeters

BOTTOM VIEW



TOP VIEW



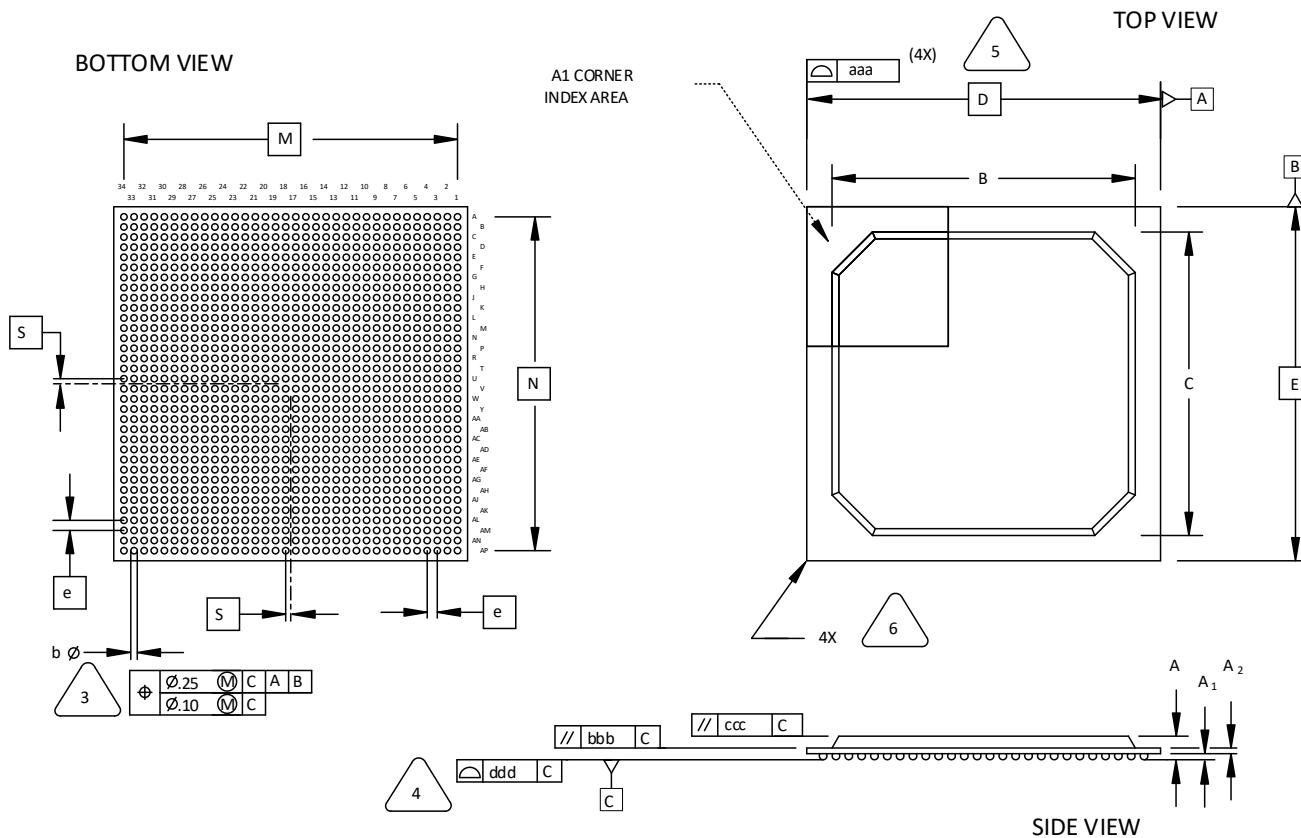
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
7. JEDEC REFERENCE: JEP95 DR.14

SYMBOL	MIN.	NOM.	MAX.
A	-	-	2.787
A1	0.400	-	-
A2	2.105		
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.20
ddd	-	-	0.20

## 141. 1156-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]



PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

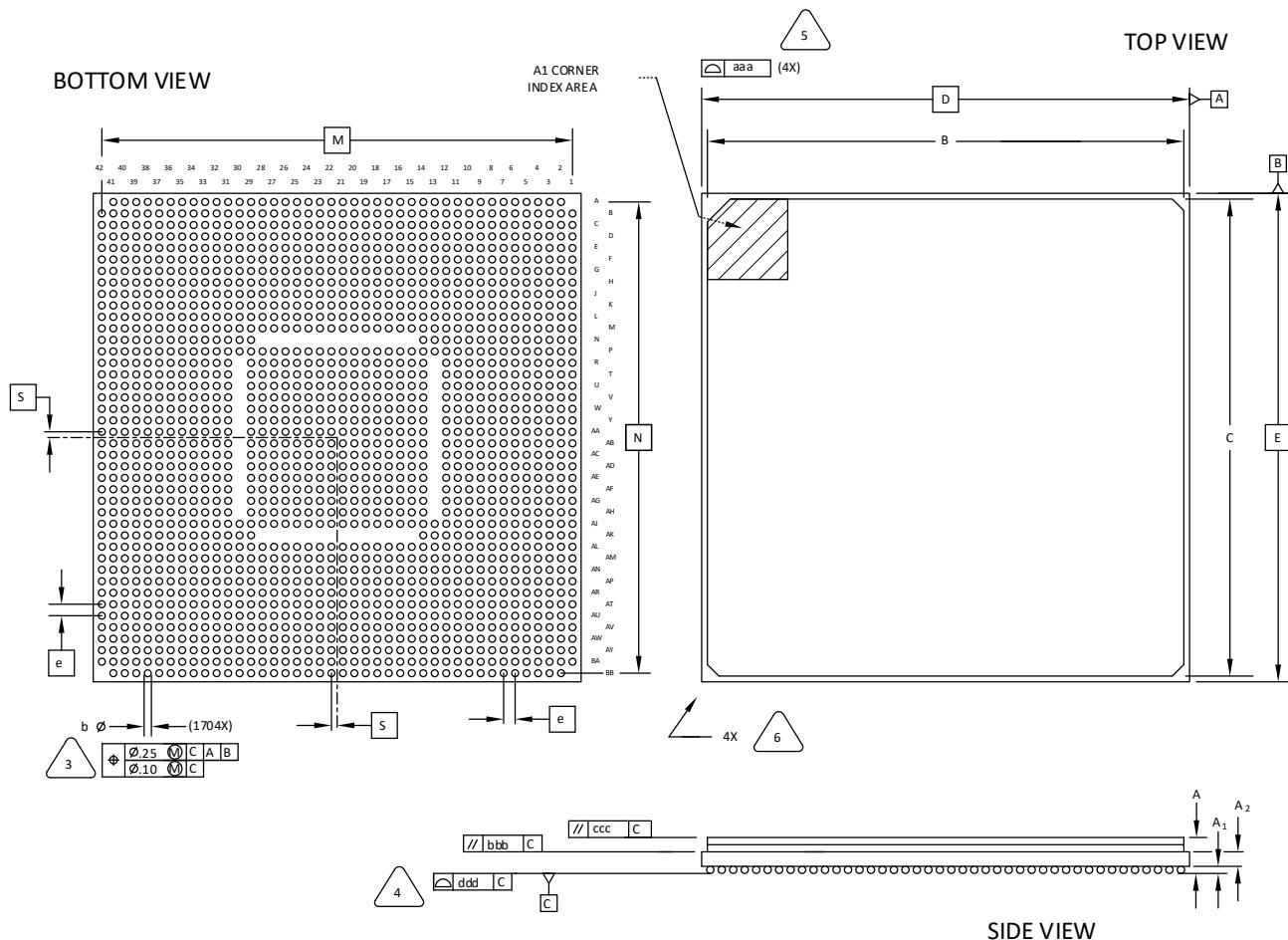


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.25	2.60
A1	0.30	0.50	0.70
A2	0.40	0.60	0.80
B/C	29.80	30.30	30.80
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## 142. 1704-Ball Organic fcBGA Package

Dimensions in Millimeters



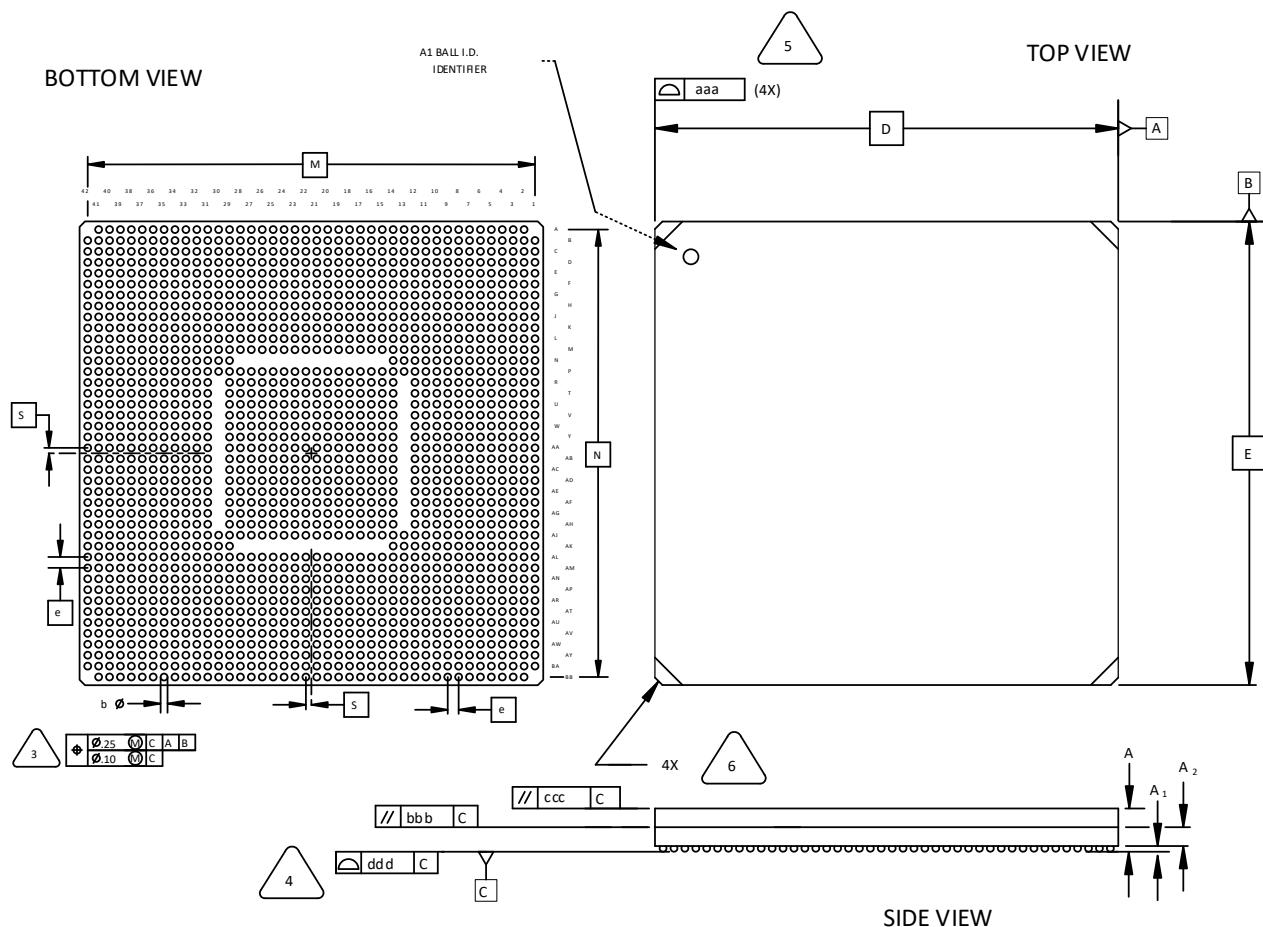
NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C.
4. PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	2.55	2.90	3.25
A1	0.35	0.50	0.65
A2	1.20 REF		
B/C	41.70	42.00	42.30
D/E	42.50 BSC		
M/N	42.50 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.23

## 143. 1704-Ball Ceramic fcBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM **C**.
- PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY. PACKAGE BODY INCLUDES SUBSTRATE AND LID.

MAXIMUM OFFSET: 0.20 mm

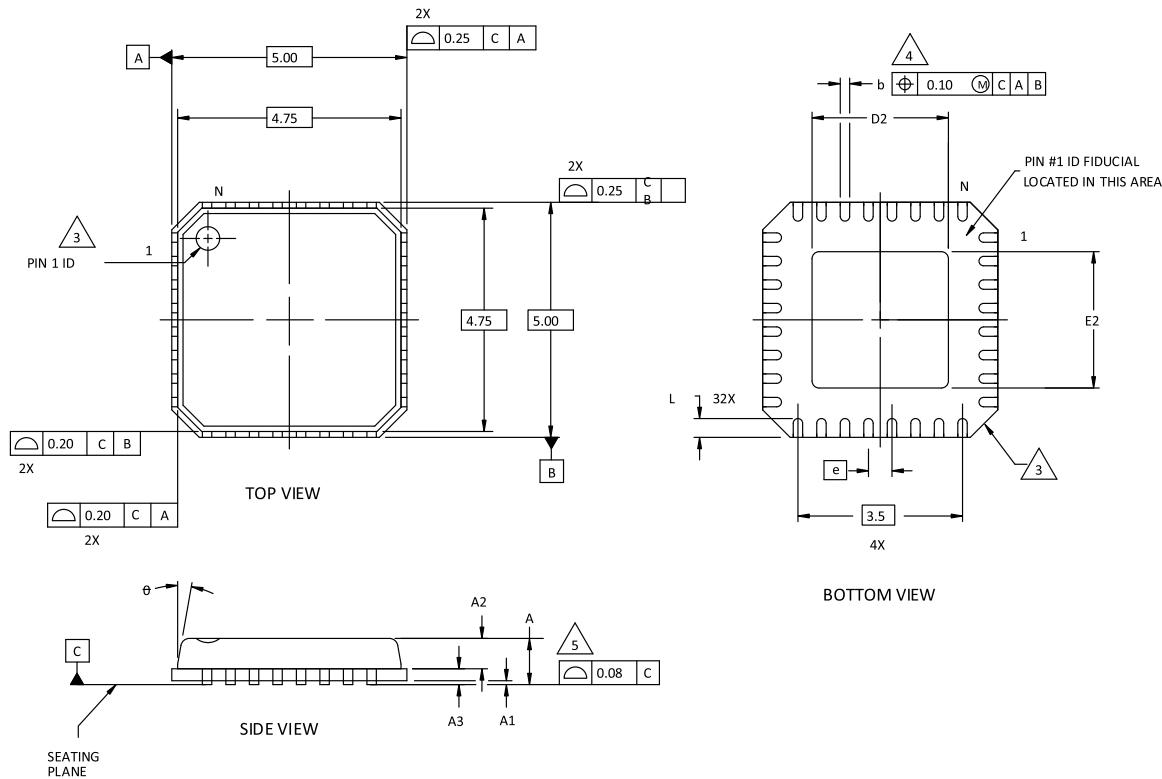
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.
A	4.30	4.80	5.30
A1	0.30	0.50	0.70
A2	1.30	1.60	1.90
D/E	42.50 BSC		
M/N	41.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
e	1.00 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20

## Appendix A – Package Archive

### 32-Pin QFN (Punch Singulated) Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
  2. ALL DIMENSIONS ARE IN MILLIMETERS.
- 3** EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.
- 4** DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25 mm FROM TERMINAL TIP.
- 5** APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	-	0.85	1.00
A1	0.00	0.01	0.05
A2	0.00	0.65	1.00
A3 0.20 REF			
D2	1.25	2.70	3.25
E2	1.25	2.70	3.25
e	0.50 BSC		
b	0.18	0.24	0.30
L	0.30	0.40	0.50
θ	-	-	12

## Technical Support Assistance

Submit a technical support case through [www.latticesemi.com/techsupport](http://www.latticesemi.com/techsupport).

For frequently asked questions, refer to the Lattice Answer Database at [www.latticesemi.com/Support/AnswerDatabase](http://www.latticesemi.com/Support/AnswerDatabase).

## Revision History

### Revision 7.4, June 2023

Section	Change Summary
72-Pin QFN Package Option 2: MachXO3D™	Added 9.75 mm value for D1 and E1.

### Revision 7.3, April 2023

Section	Change Summary
256-Ball CBG256/csfBGA Package Option 1: Mach™-NX	Added the 256-Ball CBG256/csfBGA Package Option 1: Mach™-NX section.
256-Ball CBG256/csfBGA Package Option 2: CertusPro-NX	Changed the heading from 256-Ball CBG256/csfBGA Package to 256-Ball CBG256/csfBGA Package Option 2: CertusPro-NX.
672-Ball LFG672/fcBGA Package	For the 672-Ball LFG672/fcBGA Package, corrected the M/N dimension value from 27.00 BSC to 25.00 BSC.

### Revision 7.2, December 2022

Section	Change Summary
256-Ball caBGA Package Option 1:	Updated heading to 256-Ball caBGA Package Option 1: MachXO3.
256-Ball BBG256/caBGA Package Option 2: MachXO5™-NX	Added 256-Ball BBG256/caBGA Package Option 2: MachXO5-NX.
400-Ball caBGA Package Option 2: CrossLink-NX, MachXO5-NX	Added ball count and ball matrix information.
Technical Support Assistance	Added reference to the Lattice Answer Database on the Lattice website.

### Revision 7.1, November 2022

Section	Change Summary
672-Ball LFG672/fcBGA Package	Updated 672-Ball LFG672/fcBGA Package.
1156-Ball LFG1156/fcBGA Package	Updated 1156-Ball LFG1156/fcBGA Package.

### Revision 7.0.1, June 2022

Section	Change Summary
1156-Ball LFG1156/fcBGA Package	Added 1156-Ball LFG1156/fcBGA Package.

### Revision 7.0, June 2022

Section	Change Summary
84-Ball WLCSP Package (7.275 mm × 3.054 mm Body)	Added 84-Ball WLCSP Package (7.257 mm × 3.054 mm Body) for CrossLink™-NX-33.

### Revision 6.9, May 2022

Section	Change Summary
400-Ball caBGA Package Option 2: CrossLink-NX, MachXO5-NX	Updated heading to include MachXO5-NX.

#### Revision 6.8, December 2021

Section	Change Summary
32-Pin QFN Package Option 2: MachXO2™ 256HC/ZE	Updated heading to include 256HC/ZE.
32-Pin QFN Package Option 3: MachXO2 1200HC/ZE	Updated heading to change SG32C to 1200HC/ZE
484-Ball caBGA Package (19 mm x 19 mm Body) Option 1: MachXO3/MachXO3D	Added 484-Ball caBGA Package (19 mm x 19 mm Body) option for MachXO3 and MachXO3D.
484-Ball BBG484/caBGA Package Option 2: CertusPro™-NX	Indicated <i>Option 2: CertusPro-NX</i> to heading.

#### Revision 6.7, November 2021

Section	Change Summary
100-Pin LQFP/TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000	Added TQFP to heading.
144-Pin LQFP/TQFP Package	Added TQFP to heading.
176-Pin LQFP/TQFP Package	Added TQFP to heading.
381-Ball caBGA Package Option 1: All Except LAE5UM-45F	Updated heading to 381-Ball caBGA Package Option 1: All Except LAE5UM-45F.
381-Ball caBGA Package Option 2: LAE5UM-45F	Added 381-Ball caBGA Package Option 2: LAE5UM-45F.

#### Revision 6.6, September 2021

Section	Change Summary
69-Ball WLCSP Package	Added 69-Ball WLCSP Package to support MachXO3D.
256-Ball CBG256/csfBGA Package	Added 256-Ball CBG256/csfBGA Package to support CertusPro™-NX
400-Ball caBGA Package Option 1: MachXO3	Updated heading to 400-Ball caBGA Package Option 1: MachXO3.
400-Ball caBGA Package	Added 400-Ball caBGA Package Option 2: CrossLink-NX.
484-Ball BFG484/PBGA Package	Added 484-Ball BFG484/PBGA Package to support CertusPro-NX.

#### Revision 6.5, July 2021

Section	Change Summary
256-Ball ASG256/FOWLP Package	Added 256-Ball ASG256/FOWLP Package.

#### Revision 6.4, June 2021

Section	Change Summary
484-Ball BBG484/caBGA Package	Updated 484-Ball BBG484/caBGA Package to support CertusPro-NX.
672-Ball LFG672/fcBGA Package	Added 672-Ball LFG672/fcBGA Package.

### Revision 6.3, April 2021

Section	Change Summary
44-Pin TQFP Package	Removed ( <i>1.0 mm thick</i> )
44-Pin LQFP Package	Changed TQFP to LQFP. Removed ( <i>1.4 mm thick</i> )
48-Pin TQFP Package	Removed ( <i>1.0 mm thick</i> )
48-Pin LQFP Package	Removed ( <i>1.4 mm thick</i> )
64-Pin LQFP Package	Changed TQFP to LQFP.
100-Pin LQFP/TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000	Changed TQFP to LQFP.
144-Pin LQFP/TQFP Package	Changed TQFP to LQFP.
128-Pin LQFP Package	Changed TQFP to LQFP.
176-Pin LQFP/TQFP Package	Changed TQFP to LQFP.

### Revision 6.2, March 2021

Section	Change Summary
—	Removed 48-Pin QFN Package Option 1.
48-Pin QFN Package: L-ASC10, iCE40 Ultra, iCE40 UltraPlus™, MachXO2	Removed <i>Option 2</i> from heading.

### Revision 6.1, January 2021

Section	Change Summary
36-Ball WLCSP Package Option 2: MachXO2, MachXO3™	Added MachXO2.
36-Ball WLCSP Package Option 3: CrossLink™	Added ball labels and changed LIFMD to CrossLink.
72-Pin QFN Package Option 1: CrossLink™-NX	Indicated Pin 1.
72-Pin QFN Package Option 2: CrossLink™-NX	Indicated Pin 1.
Multiple	Restored labels that indicate top, bottom, and side views in the following packages: <ul style="list-style-type: none"> <li>• 36-Ball uCBGA Package</li> <li>• 81-Ball csFBGA Package</li> <li>• 237-Ball ftBGA Package</li> <li>• 256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2</li> <li>• 285-Ball csFBGA Package</li> <li>• 484-Ball caBGA Package (19 mm x 19 mm Body)</li> </ul>
Multiple	Corrected alignment of pin order labeling.

### Revision 6.0, December 2020

Section	Change Summary
All	Updated document template.
196-Ball caBGA Package	Added 196-Ball caBGA Package.
484-Ball fcBGA Package for Mach-NX	Added 484-Ball fcBGA Package: Mach-NX.

### Revision 5.9, August 2020

Section	Change Summary
All	<ul style="list-style-type: none"> <li>Added table of contents</li> <li>Changed WLCS Package to WLCSP Package in all heading.</li> <li>Moved Disclaimers to second page.</li> </ul>
30-Ball WLCSP Package	Corrected the 30-Ball WLCSP Package sD and sE values. Fixed heading typo.
72-Pin WLCSP Package: CrossLink-NX	Added 72-Pin WLCSP Package: CrossLink-NX.
121-Ball csBGA Package	Updated D and E dimension lines in 121-Ball csBGA Package.

### Revision 5.8, August 2020

Section	Change Summary
36-Ball ucBGA Package	Removed Option 1 from 36-Ball ucBGA Package heading.
48-Pin LQFP Package (1.4 mm thick)	Changed 48-Pin TQFP Package (1.4 mm thick) heading to 48-Pin LQFP Package (1.4 mm thick).
Multiple	Specified device(s) in the following packages: <ul style="list-style-type: none"> <li>48-Pin QFN Package Option 1: L-ASC10, iCE40 LP, iCE40 UltraPlus, MachXO2</li> <li>72-Pin QFN Package Option 1: CrossLink™-NX</li> <li>72-Pin QFN Package Option 2: MachXO3D</li> </ul>
289-Ball csBGA Package (9.5 mm x 9.5 mm Body).	Added 289-Ball csBGA Package (9.5 mm x 9.5 mm Body).

### Revision 5.7, November 2019

Section	Change Summary
48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2	Updated 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2. Revised values for Lead Width (b) and Bottom Pad (E2, D2).
72-Pin QFN Package Option 2: MachXO3D	Added 72-Pin QFN Package Option 2: MachXO3D.
Disclaimers	Added this section.

### Revision 5.6, April 2019

Section	Change Summary
All	Changed document ID from pkg to FPGA-DS-02053. When downloaded from the Lattice website, the PDF file name is now FPGA-DS-02053-<X-X>-Package-Diagrams.pdf (previously PackageDiagrams.pdf).
72-Pin QFN Package	Added 72-Pin QFN Package.

### Revision 5.5, November 2017

Section	Change Summary
80-Ball ckfBGA Package	Added 80-Ball ckfBGA Package.

#### Revision 5.4, March 2017

Section	Change Summary
100-Pin TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000	Added ispMACH 4000 to 100-Pin TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000.
121-Ball caBGA Package (9 mm x 9 mm Body)	Added 121-Ball caBGA Package (9 mm x 9 mm Body).

#### Revision 5.3, December 2016

Section	Change Summary
32-Pin QFN Package	Updated “32-Pin QFNS Package” headings to “32-Pin QFN Package”.
32-Pin QFN Package Option 3: MachXO2 SG32C	Added 32-Pin QFN Package Option 3: MachXO2 SG32C.
30-Ball WLCSP Package	Added 30-Ball WLCSP Package.
48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2	Added iCE40 UltraPlus and MachXO2 to 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2.
484-Ball caBGA Package	Added 484-Ball caBGA Package.

#### Revision 5.2, June 2016

Section	Change Summary
285-ball csfBGA Package	Updated 285-ball csfBGA package outline drawing.
36-Ball WLCSP Package Option 3: LIFMD	Added 36-Ball WLCSP Package Option 3: LIFMD.
48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2	Fixed typo in 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2.
64-Ball ucfBGA Package	Added 64-Ball ucfBGA Package.
72-Pin QFN Package Option 2: MachXO3D	Added 72-Pin QFN Package Option 2: MachXO3D.
81-Ball csfBGA Package	Added 81-Ball csfBGA Package.

#### Revision 5.1, February 2015

Section	Change Summary
36-Ball ucfBGA Package: iCE40 Ultra	Added 36-Ball ucfBGA Package: iCE40 Ultra.
36-Ball ucBGA Package Option 1	Updated 36-Ball ucBGA Package heading to 36-Ball ucBGA Package Option 1.
48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra	Updated 48-Pin QFN Package Option 2: L-ASC10 heading to 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra.

#### Revision 5.0, January 2015

Section	Change Summary
16-Ball WLCSP Package Option 2: iCE40 UltraLite	Added 16-Ball WLCSP Package Option 2: iCE40 UltraLite.
16-Ball WLCSP Package Option 1: iCE40 LP	Updated 16-Ball WLCSP Package heading to 16-Ball WLCSP Package Option 1: iCE40 LP.

#### Revision 4.9, October 2014

Section	Change Summary
48-Pin QFN Package	Updated 48-Pin QFN Package heading and moved the section after 48-Pin QFN Package Option 1 (previously Option 2).

#### Revision 4.8, October 2014

Section	Change Summary
—	Removed 20-Ball WLCSP Package.

#### Revision 4.7, October 2014

Section	Change Summary
121-Ball csfBGA Package	Updated 121-Ball csfBGA Package. Revised M/N dimension.

#### Revision 4.6, September 2014

Section	Change Summary
84-Pin QFN Package	Updated 84-Pin QFN Package. Revised pin numbers from A36 and B27 to A37 and B28.

#### Revision 4.5, August 2014

Section	Change Summary
16-Ball WLCSP Package	Updated 16-Ball WLCSP Package. Changed second E to e in REF. column.
36-Ball WLCSP Package Option 1: iCE40 Ultra	Updated 36-Ball WLCSP Package Option 1: iCE40 Ultra heading.
36-Ball WLCSP Package Option 2: MachXO3	Added 36-Ball WLCSP Package Option 2: MachXO3.
81-Ball WLCSP Package	Added 81-Ball WLCSP Package.
121-Ball csfBGA Package	Added 121-Ball csfBGA Package.
256-Ball csfBGA Package	Added 256-Ball csfBGA Package.
324-Ball caBGA Package	Added 324-Ball caBGA Package.
324-Ball csfBGA Package	Added 324-Ball csfBGA Package.
400-Ball caBGA Package	Added 400-Ball caBGA Package.
84-Pin QFN Package	Updated 84-Pin QFN Package. Revised dimension "b" maximum value.
256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2	Updated 256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2. Revised dimension "A" values.

#### Revision 4.4, June 2014

Section	Change Summary
48-Pin QFN Package	Updated 48-Pin QFNS Package to 48-Pin QFN Package.
48-Pin QFN Package Option 2	Added 48-Pin QFN Package Option 2.
49-Ball WLCSP Package	Added 49-Ball WLCSP Package.
237-Ball ftBGA Package	Added 237-Ball ftBGA Package.
285-Ball csfBGA Package	Added 285-Ball csfBGA Package.
20-Ball WLCSP Package	Added 20-Ball WLCSP Package.
36-Ball WLCSP Package	Added 36-Ball WLCSP Package.

#### Revision 4.3, March 2014

Section	Change Summary
All	Restored references to indicate top, bottom, and side views.
381-Ball caBGA Package	Added 381-Ball caBGA Package.
554-Ball caBGA Package	Added 554-Ball caBGA Package.
756-Ball caBGA Package	Added 756-Ball caBGA Package.

#### Revision 4.2, December 2013

Section	Change Summary
100-Pin TQFP Package Option 1: MachXO2, MachXO	Added "1" and "N" characters to 100-Pin TQFP Package Option 1: MachXO2, MachXO diagram (Top View).

#### Revision 4.1, September 2013

Section	Change Summary
16-ball WLCSP Package	Added 16-ball WLCSP package.
25-Ball WLCSP Package (0.40 mm Pitch)	Revised 25-Ball WLCSP Package title to 25-Ball WLCSP Package (0.40mm Pitch).
25-Ball WLCSP Package (0.35 mm Pitch)	Added 25-Ball WLCSP Package (0.35mm Pitch).
All	Added references to indicate top, bottom, and side views.

#### Revision 4.0, August 2013

Section	Change Summary
144-pin TQFP Package	Revised 144-pin TQFP package diagram.

#### Revision 3.9, February 2013

Section	Change Summary
184-ball csBGA Package.	Added 184-ball csBGA package.

#### Revision 3.8, November 2012

Section	Change Summary
32-pin QFNS Option 1	Added iCE40 to the list of applicable products for the 32-pin QFNS Option 1 package.

#### Revision 3.7, October 2012

Section	Change Summary
324-ball ftBGA Package	Revised 324-ball ftBGA package drawing.

#### Revision 3.6, September 2012

Section	Change Summary
iCE40 100-Pin VQFP Package Option 2	Nomenclature change – “iCE40 100-Pin TQFP Package Option 2” changed to “iCE40 100-Pin VQFP Package Option 2”.

#### Revision 3.5, August 2012

Section	Change Summary
Multiple	Added 36-ball ucBGA, 49-ball ucBGA, 81-ball ucBGA, 81-ball csBGA, 84-pin QFN, 100-pin TQFP Option 2, 121-ball csBGA, 121-ball ucBGA, 132-ball csBGA Option 2, 196-ball csBGA, 225-ball ucBGA, 284-ball csBGA packages.

#### Revision 3.4, July 2012

Section	Change Summary
676-ball fcBGA Package	Added 676-ball fcBGA package.

#### Revision 3.3, March 2012

Section	Change Summary
Appendix A	Added new 32-Pin QFNS Package Option 2 for MachXO2. Moved 32-pin QFN (punch singulated) package drawing to new Package Archive Appendix.

#### Revision 3.2, February 2012

Section	Change Summary
All	Updated document with new corporate logo.

#### Revision 3.1, December 2011

Section	Change Summary
Multiple	Updated WLCSP package offering.

#### Revision 3.0, October 2011

Section	Change Summary
Multiple	Added 49-ball WLCSP package and updated 25-ball WLCSP package.

#### Revision 2.9, October 2011

Section	Change Summary
328-ball csBGA Package	Added 328-ball csBGA package.

#### Revision 2.8, July 2011

Section	Change Summary
Multiple	Included revised diagrams for the following packages: 56-ball csBGA, 100-ball csBGA and 132-ball csBGA. Added new 256-ball ftBGA Option 3 package.

#### Revision 2.7, May 2011

Section	Change Summary
256 ftBGA Option 1 Package	Added MachXO2 to the list of applicable products for the 256 ftBGA Option 1 package outline.

#### Revision 2.6, November 2010

Section	Change Summary
Multiple	Added 25-ball WLCSP and 332-ball caBGA package drawings. Revised 100-pin PQFP, 120-pin PQFP, 128-pin PQFP, 160-pin PQFP and 208-pin PQFP package drawings. Removed obsolete packages including 144-, 240- and 304-pin PQFP packages.

#### Revision 2.5, October 2010

Section	Change Summary
208-ball ftBGA Package	Added 208-ball ftBGA package.

#### Revision 2.4, September 2010

Section	Change Summary
Multiple	Revised maximum coplanarity values on Organic 1152 Flip Chip BGA – Option 2 and on Organic 1704 Flip Chip BGA from 0.20 mm to 0.23 mm.

#### Revision 2.3, March 2010

Section	Change Summary
Multiple	Added new 1020-ball Organic fcBGA rev.2, 1152-ball Organic fcBGA, and 1704-ball Organic fcBGA package drawings. Removed obsolete 492-Ball BGA package.

#### Revision 2.2, February 2010

Section	Change Summary
256-Ball caBGA Package	Revised 256-ball caBGA nominal solder ball diameter from 0.5 mm to 0.45 mm to better match actual dimension.

#### Revision 2.1, December 2009

Section	Change Summary
256-ball caBGA Package	Revised 256-ball caBGA package to specify correct JEDEC reference number.

#### Revision 2.0, May 2009

Section	Change Summary
Multiple	Added new 256-ball caBGA and 256-ball ftBGA (Option A) packages.

#### Revision 1.9, April 2009

Section	Change Summary
Multiple	Added 24-pin QFNS package diagram. Removed discontinued and obsolete packages (16 SOIC, 20 SOIC, 24 SOIC, 28 SOIC, 16 PDIP, 240 MQFP, 269 fcBGA, 304 MQFP, 600 SBGA).

#### Revision 1.8, December 2008

Section	Change Summary
Multiple	Added 32-pin QFNS, 48-pin QFNS and 64-pin QFNS package diagrams.

**Revision 1.7, November 2008**

Section	Change Summary
Multiple	Added 64-ball ucBGA and 132-ball ucBGA package diagrams.

**Revision 1.6, April 2008**

Section	Change Summary
Multiple	Added 64-ball csBGA and 144-ball csBGA package diagrams.

**Revision 1.5, November 2007**

Section	Change Summary
1152-ball fpBGA Package	Added 1152-ball fpBGA package diagram.

**Revision 1.4, October 2007**

Section	Change Summary
1036 ftSBGA Package	Revised 1036 ftSBGA package diagram. Removed 1036 fpSBGA.

**Revision 1.3, June 2007**

Section	Change Summary
1036 ftSBGA Package	Added 1036 ftSBGA package diagram.

**Revision 1.2, February 2007**

Section	Change Summary
1704 fcBGA Package	Revised 1704 fcBGA package drawing: removed lid dimension, clarified package body dimension as the combination of substrate and lid.

**Revision 1.1, January 2007**

Section	Change Summary
Multiple	Added Marking Orientation text for all TQFP packages (1.0 mm and 1.4 mm thick).

**Revision 1.0, January 2007**

Section	Change Summary
Multiple	Added 64-pin TQFP and 1704-ball fcBGA package diagrams.



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