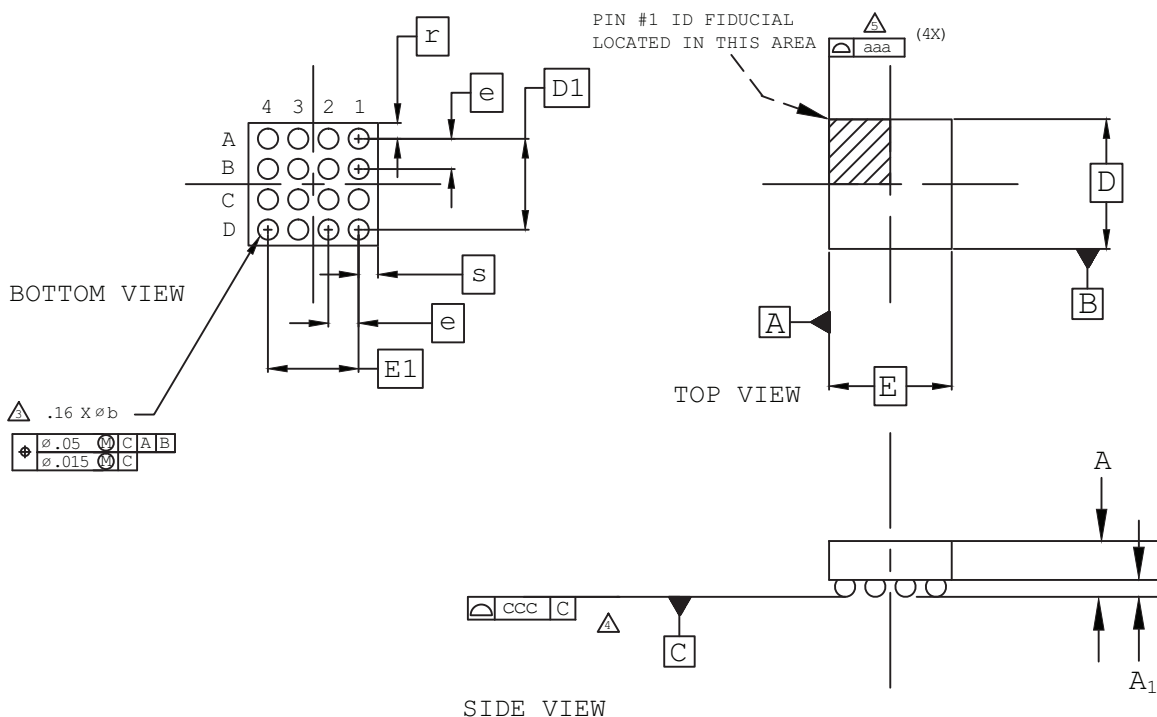


## 16-Ball WLCS Package Option 1: iCE40 LP

Dimensions in Millimeters



### NOTES:

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

△ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.

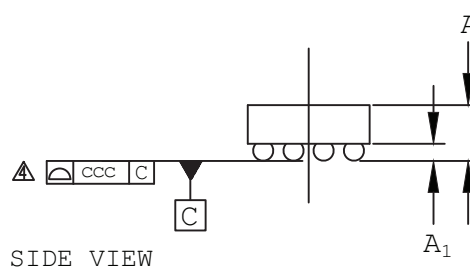
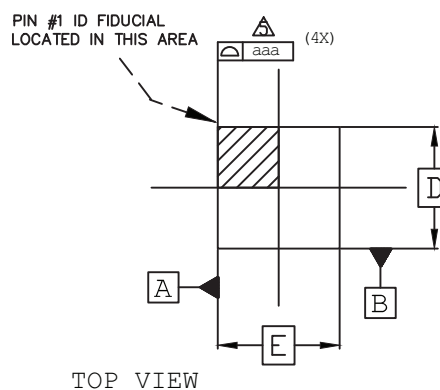
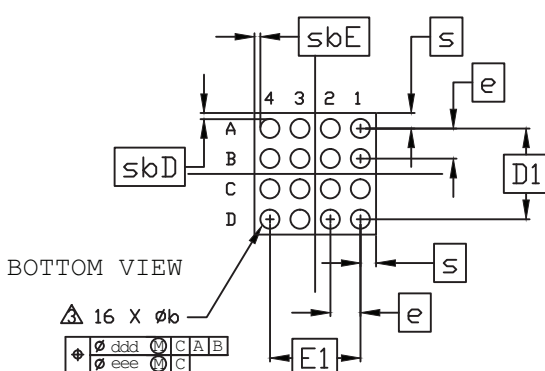
△ PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

△ 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    | 1.40 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 | -     |

## 16-Ball WLCS Package Option 2: iCE40 UltraLite™

### Dimensions in Millimeters



NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

△ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER  
PARALLEL TO PRIMARY DATUM C.

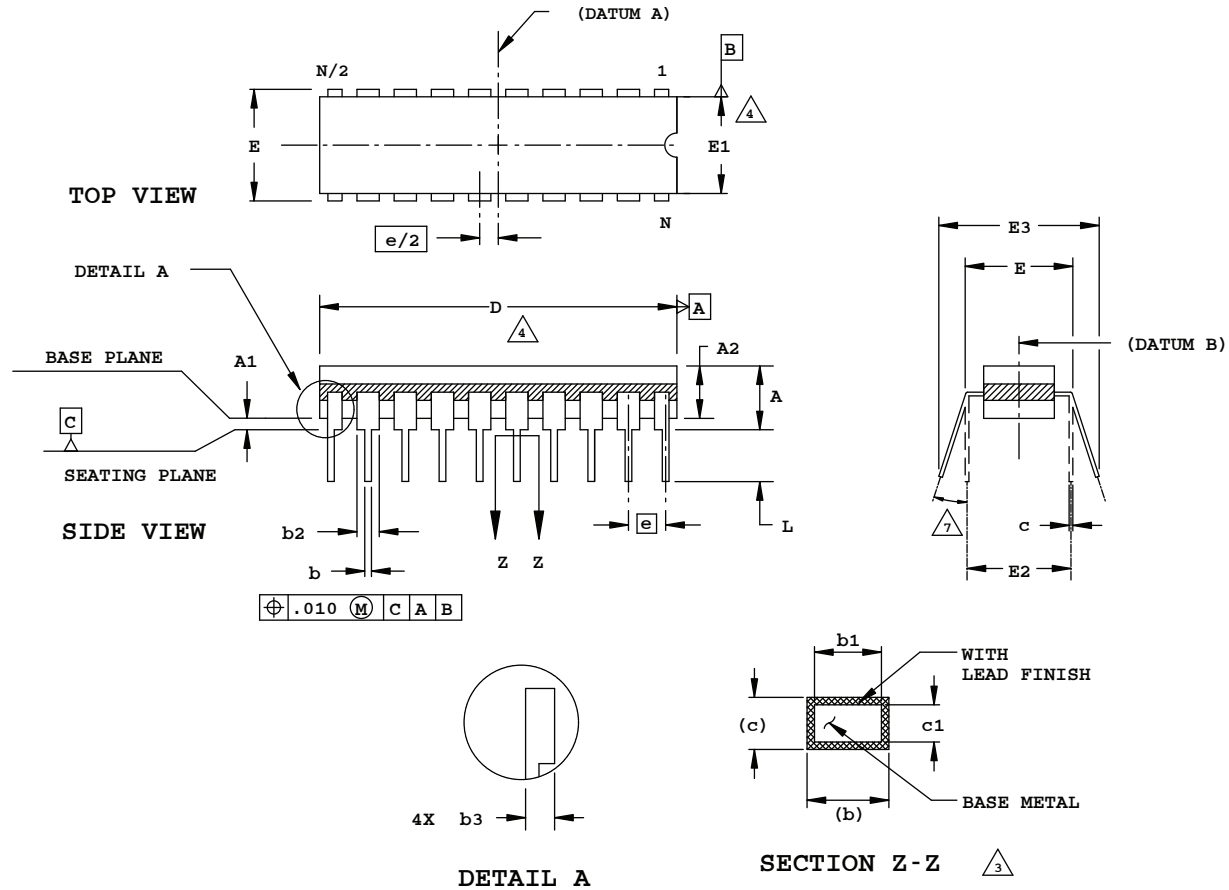
△ PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

△ 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 | –     |
| skD  | 0.067     | 0.071 | 0.072 |
| skE  | 0.067     | 0.071 | 0.072 |
| aaa  | 0.03      |       |       |
| ccc  | 0.03      |       |       |
| ddd  | 0.050     |       |       |
| eee  | 0.015     |       |       |

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

Dimensions in Inches



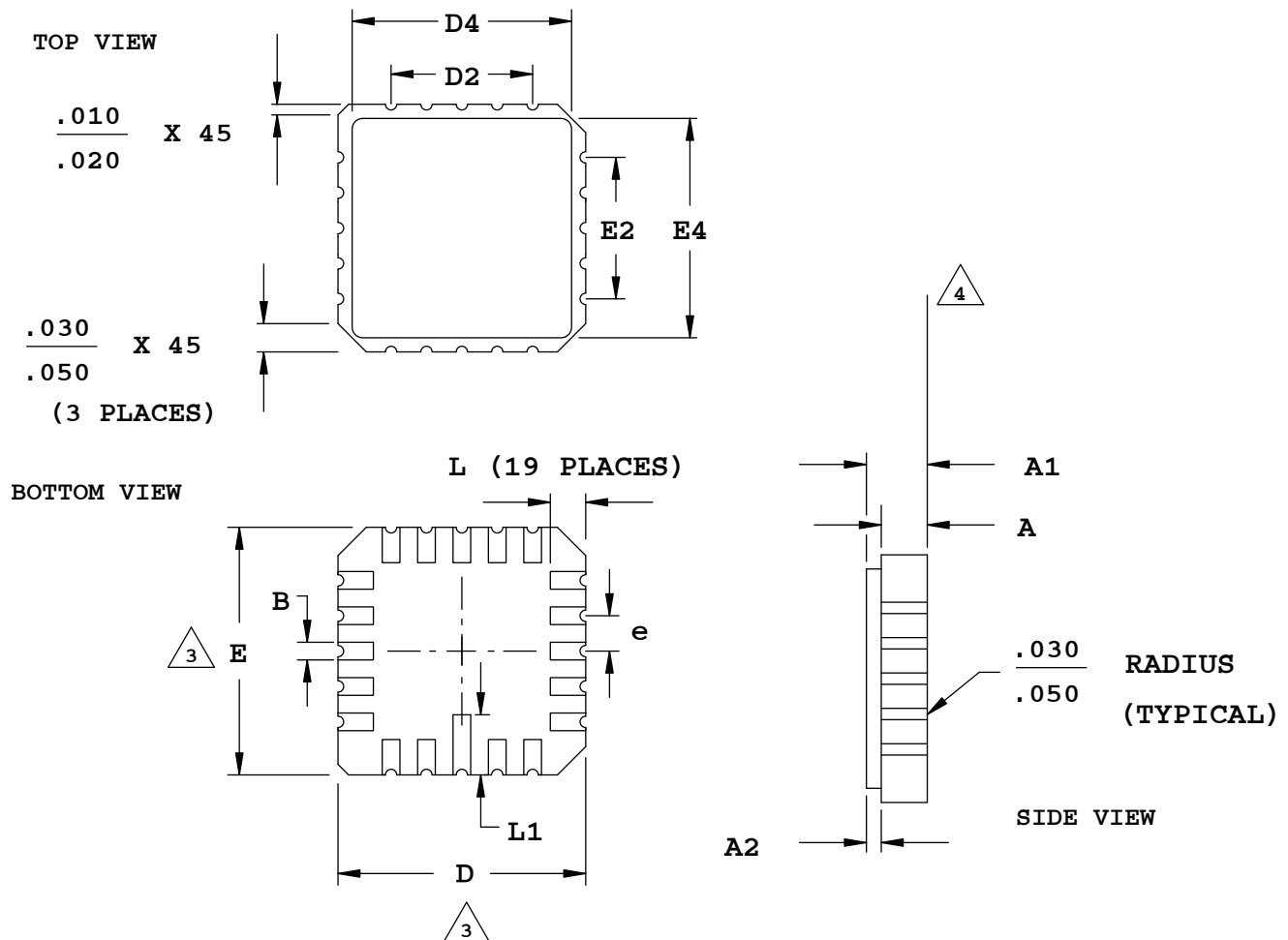
### NOTES:

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.

|    | 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       |      |      |

## 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.

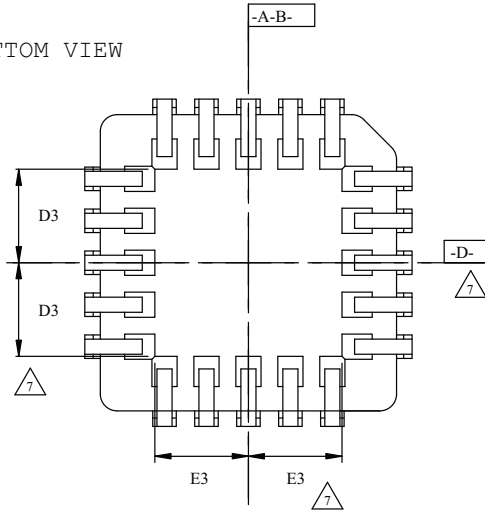
4. FLATNESS TOLERANCE IS .004 INCHES PER INCH.

| SYMBOL | 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 |

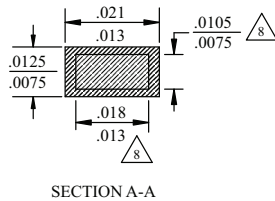
## 20-Pin PLCC Package

Dimensions in Inches

BOTTOM VIEW

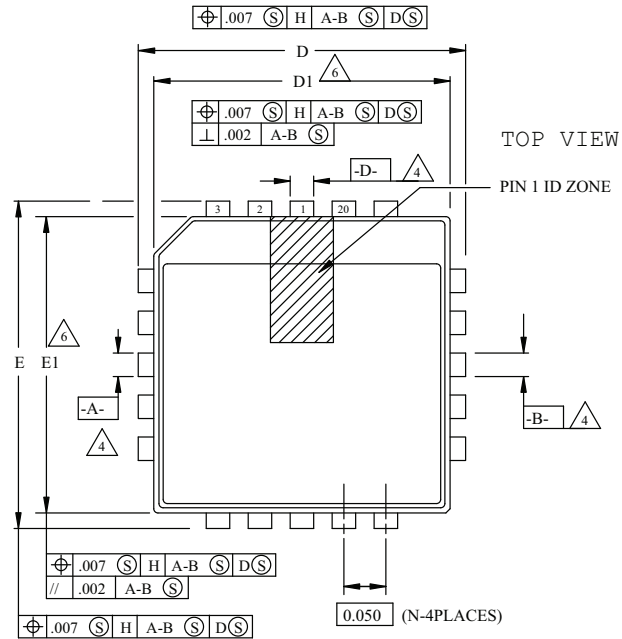


|    | MIN. | NOM. | MAX. |
|----|------|------|------|
| A  | .165 | .172 | .180 |
| A1 | .090 | .105 | .120 |
| A2 | .062 | -    | .083 |
| D  | .385 | .390 | .395 |
| D1 | .350 | .353 | .356 |
| D2 | .141 | .155 | .169 |
| D3 |      | .075 |      |
| E  | .385 | .390 | .395 |
| E1 | .350 | .353 | .356 |
| E2 | .141 | .155 | .169 |
| E3 |      | .075 |      |
| N  |      | 20   |      |

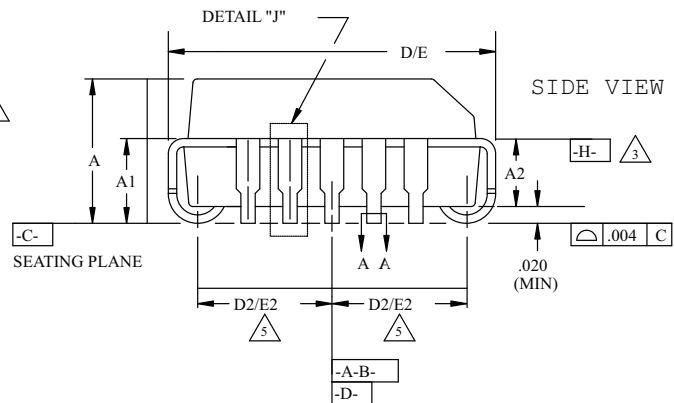


SECTION A-A

TOP VIEW

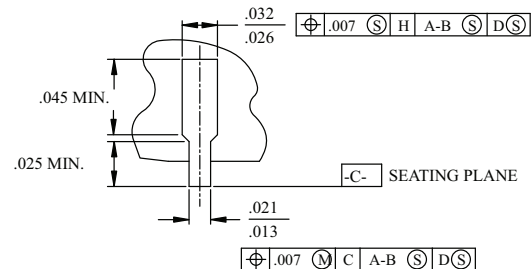


SIDE VIEW



### NOTES:

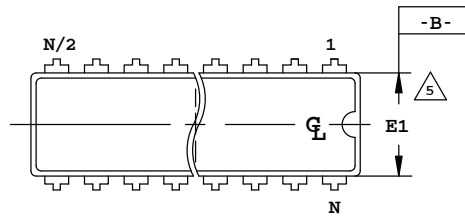
- ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1982
- ALL DIMENSIONS IN INCHES
- DATUM PLANE  $\boxed{-H-}$  LOCATED AT TOP OF MOLD PARTING LINE AND COINCIDENT WITH TOP OF LEAD WHERE LEAD EXITS PLASTIC BODY
- DATUMS  $\boxed{-A-B-}$  AND  $\boxed{-D-}$  TO BE DETERMINED WHERE CENTER LEADS EXIT PLASTIC BODY AT DATUM PLANE  $\boxed{-H-}$
- TO BE MEASURED AT SEATING PLANE  $\boxed{-C-}$  CONTACT POINT
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .010 PER SIDE.
- TOP POINT OF MEASUREMENT IS DATUM  $\boxed{-H-}$ ; BOTTOM POINT OF MEASUREMENT IS AT MAJOR FLAT AREA OF LOWER PLASTIC SURFACE DEFINED BY D3/E3
- DIMENSION APPLIES TO BASE METAL ONLY



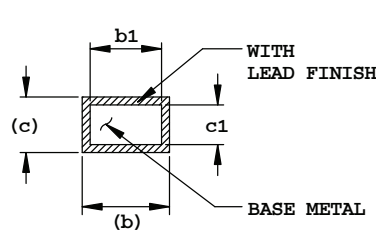
DETAIL "J" (TYP ALL SIDES)

## 20-Pin Plastic DIP Package

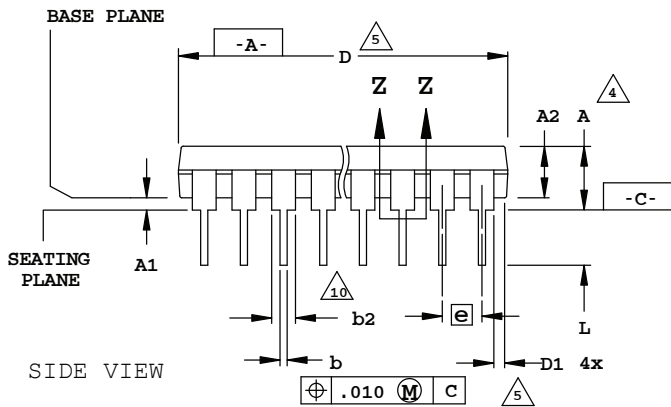
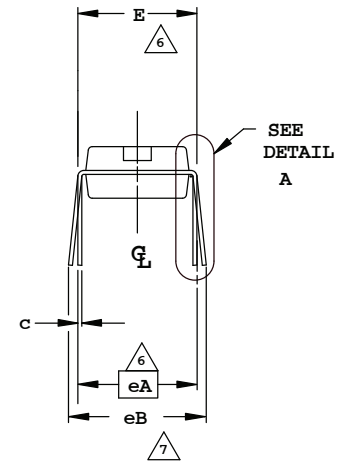
Dimensions in Inches



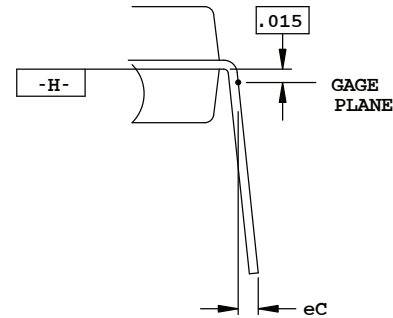
TOP VIEW



SECTION Z-Z



SIDE VIEW



DETAIL A

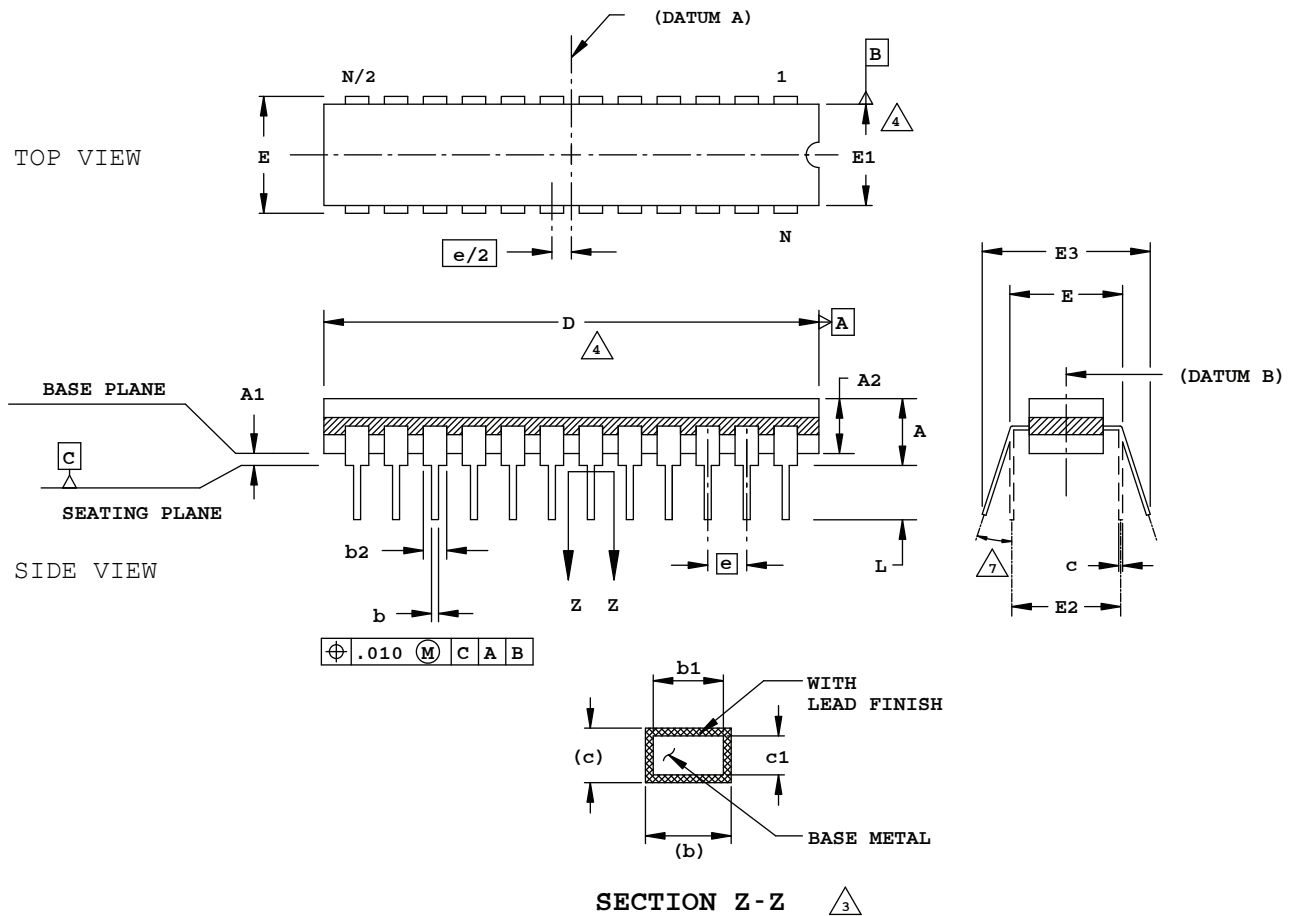
### NOTES:

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

| N = 20 |          |       |       |       |
|--------|----------|-------|-------|-------|
| SYMBOL | INCHES   |       |       | NOTES |
|        | 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      | .980     | 1.030 | 1.060 | 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  | 4     |

## 24-Pin (300-Mil) Cerdip

Dimensions in Inches



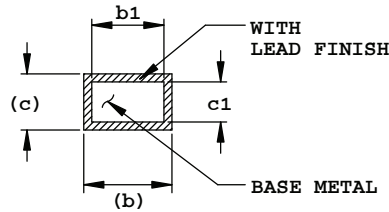
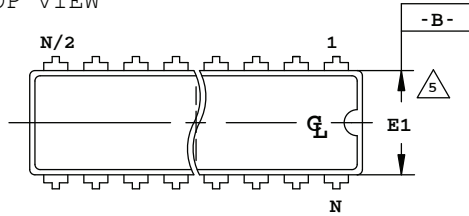
### NOTES:

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.

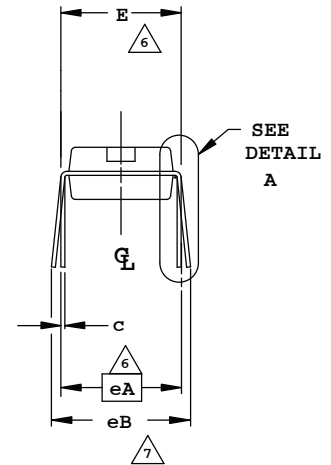
## 24-Pin Plastic DIP

Dimensions in Inches

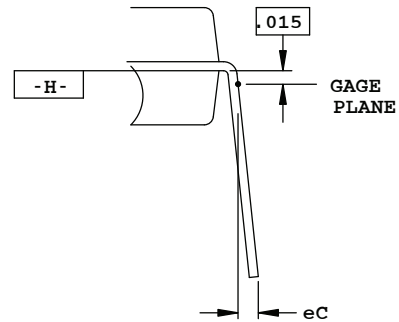
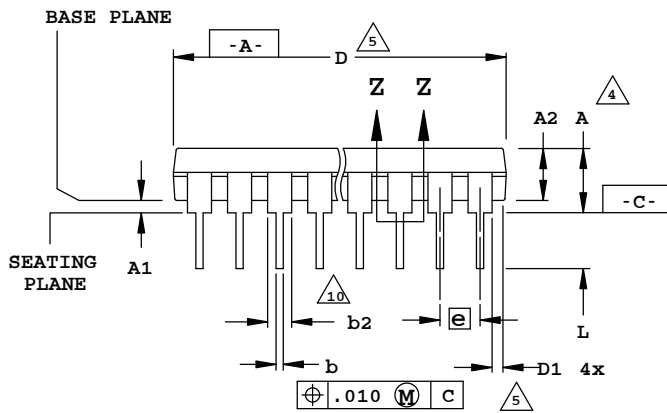
TOP VIEW



SECTION Z-Z



SIDE VIEW



DETAIL A

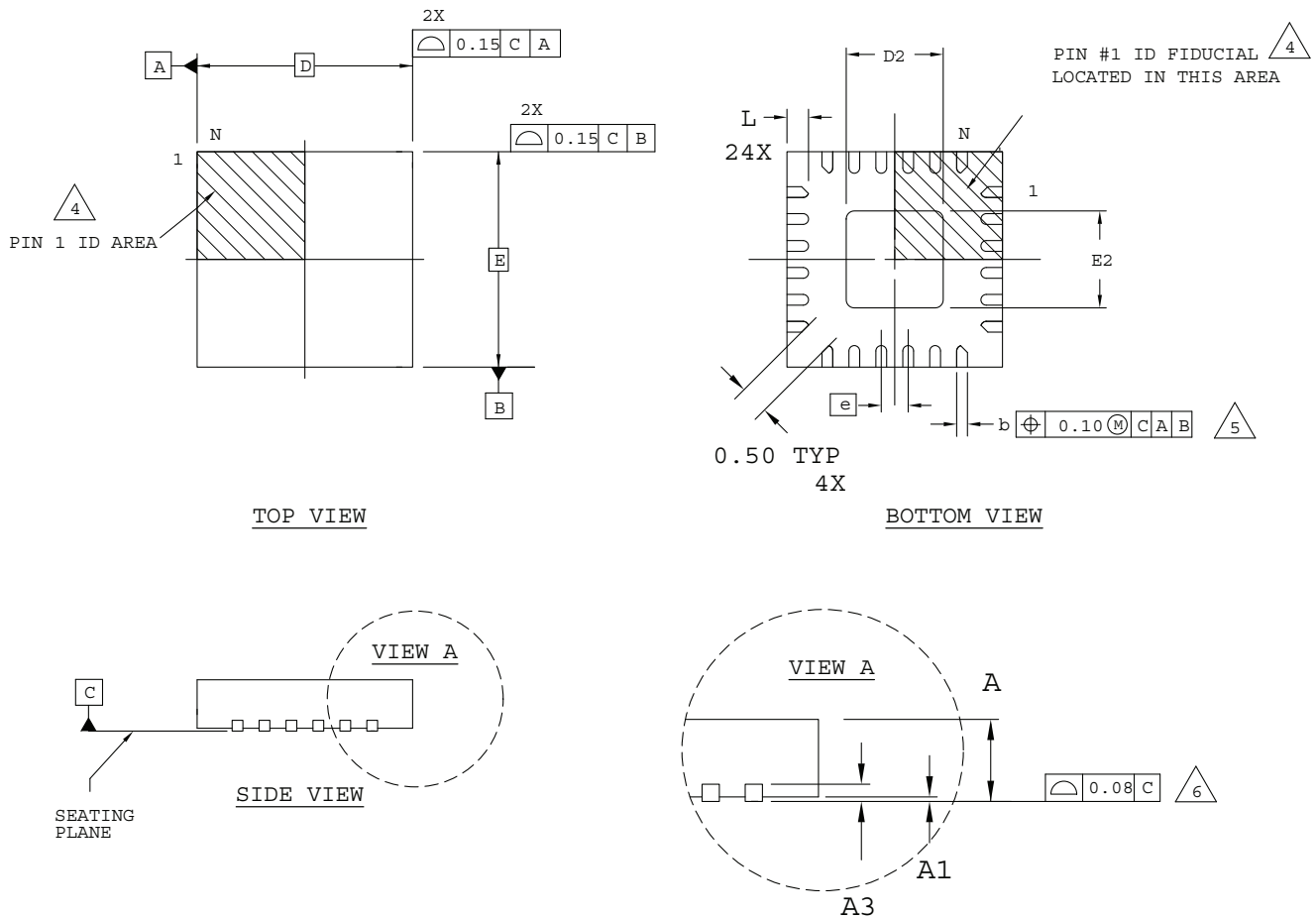
NOTES:

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

| N = 24 |          |       |       |      |
|--------|----------|-------|-------|------|
| SYMBOL | INCHES   |       |       | HOLE |
|        | 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  |      |

## 24-Pin QFNS 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.

 EXACT SHAPE AND SIZE OF THIS  
FEATURE IS OPTIONAL.

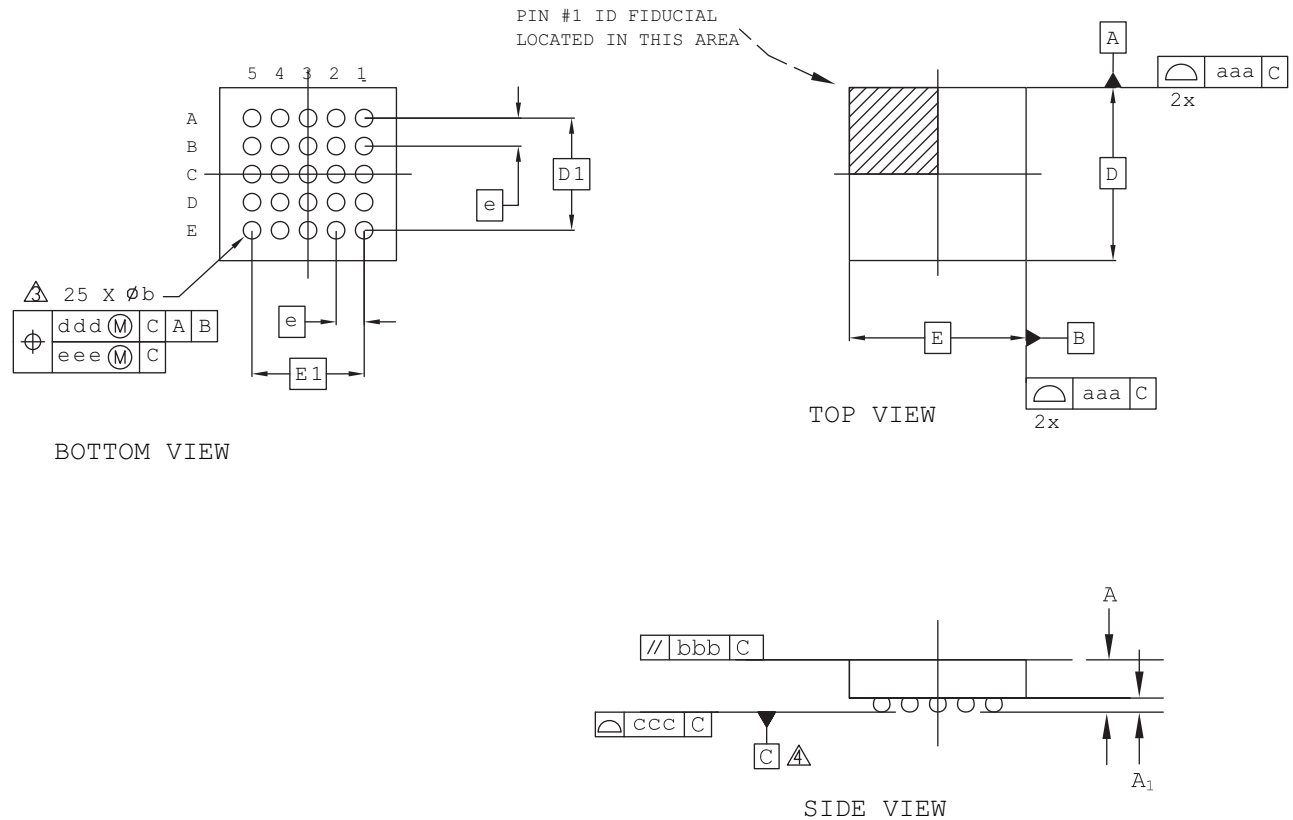
 DIMENSION b APPLIES TO PLATED  
TERMINAL AND IS MEASURED BETWEEN  
0.15 AND 0.30 mm FROM TERMINAL TIP.

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 |

## 25-Ball WLCS Package (0.40 mm Pitch)

Dimensions in Millimeters



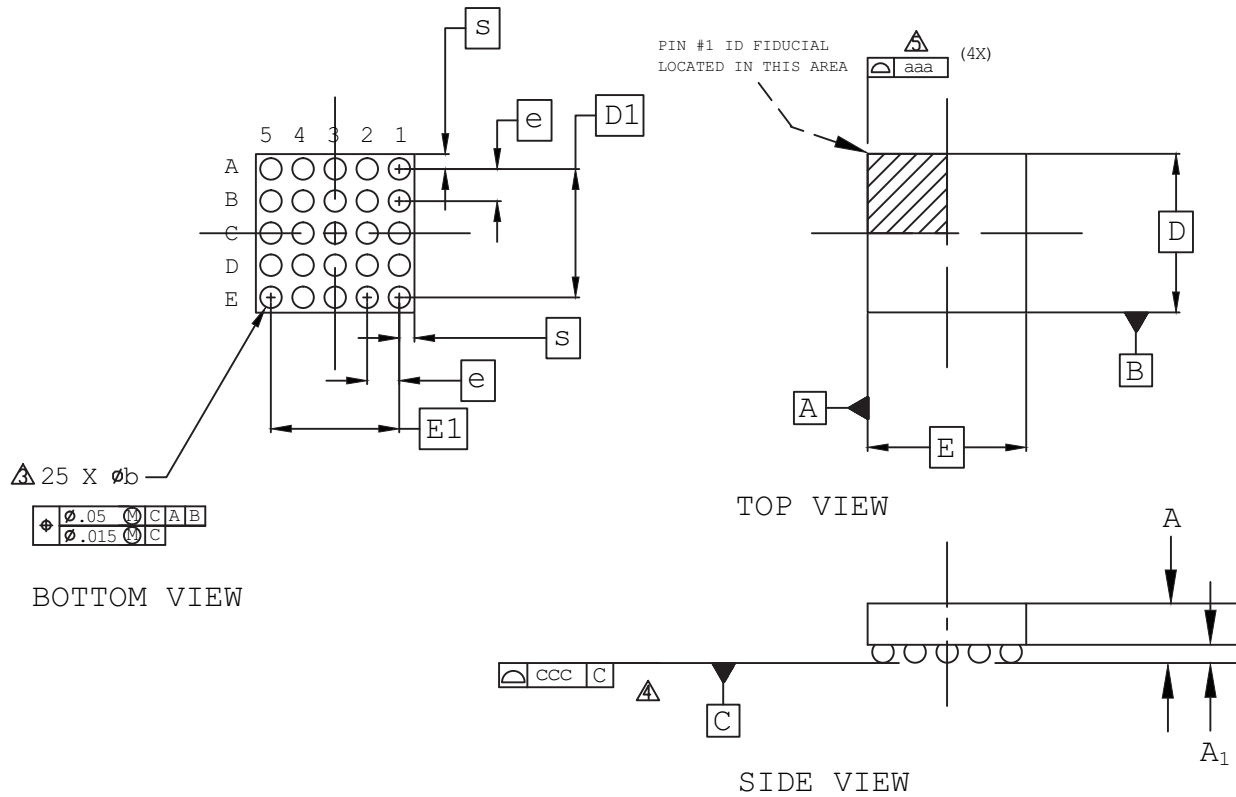
### Notes:

- 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     |       |       |

## 25-Ball WLCS Package (0.35 mm Pitch)

### Dimensions in Millimeters



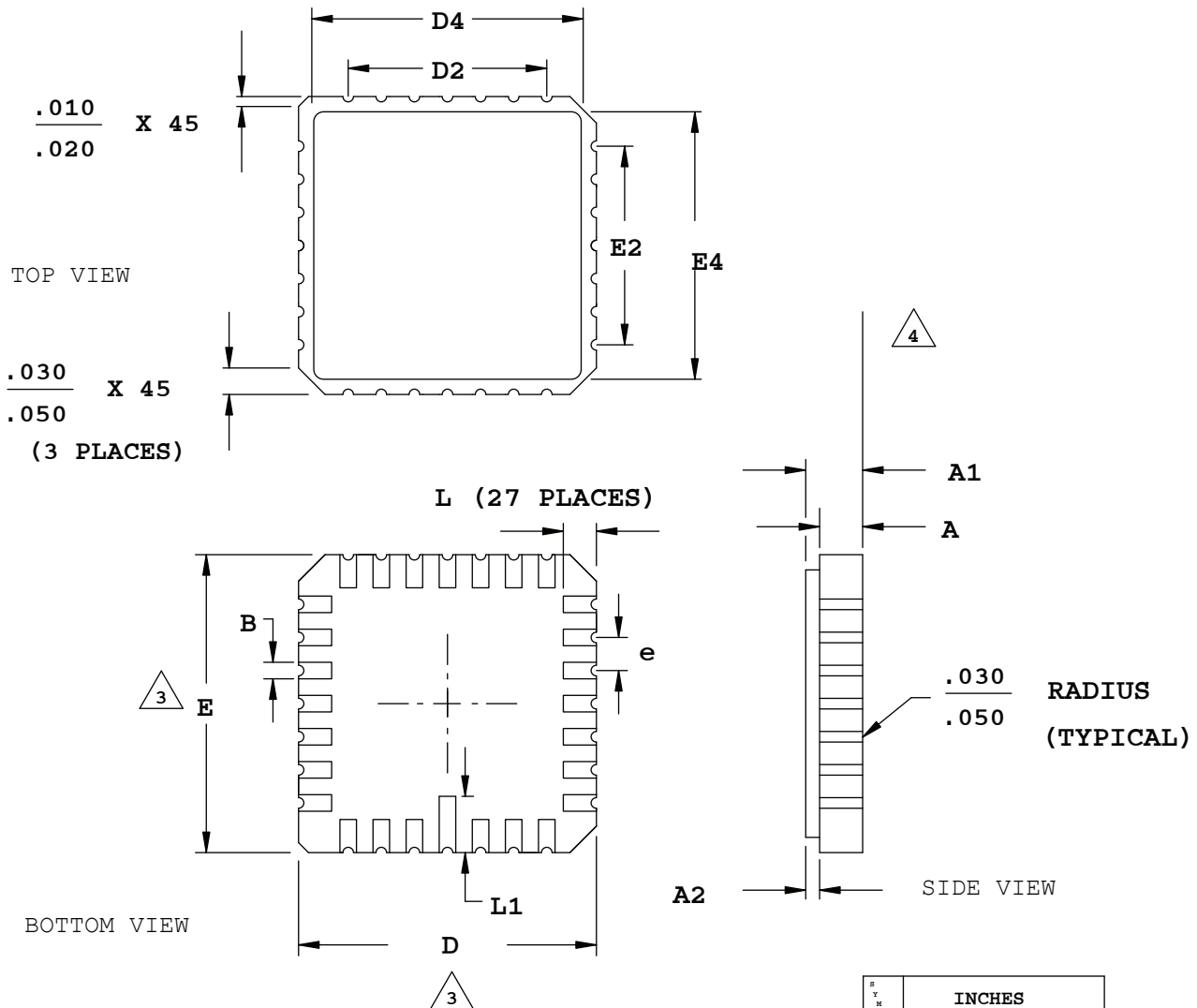
Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.  
2 ALL DIMENSIONS ARE IN MILLIMETERS.  
△ 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    | 1.71 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 | —     |

## 28-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.

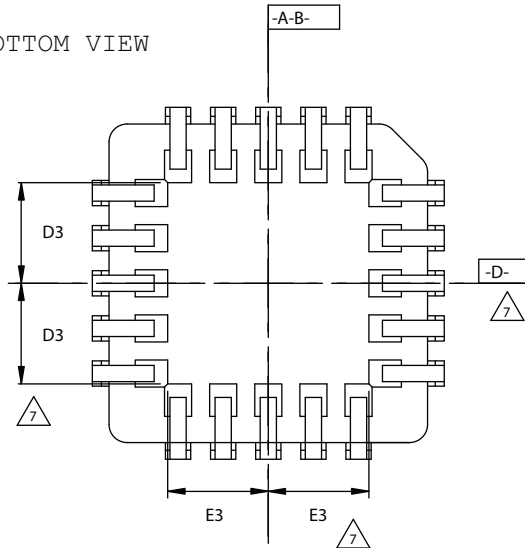
4. FLATNESS TOLERANCE IS .004 INCHES PER INCH.

| SYMBOL | 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 |

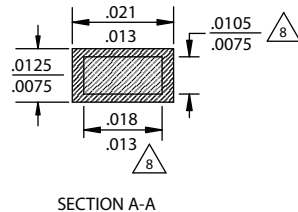
## 28-Pin PLCC Package

Dimensions in Inches

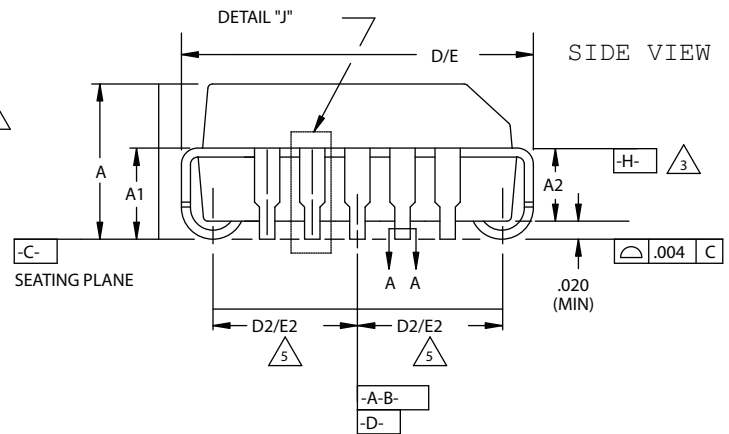
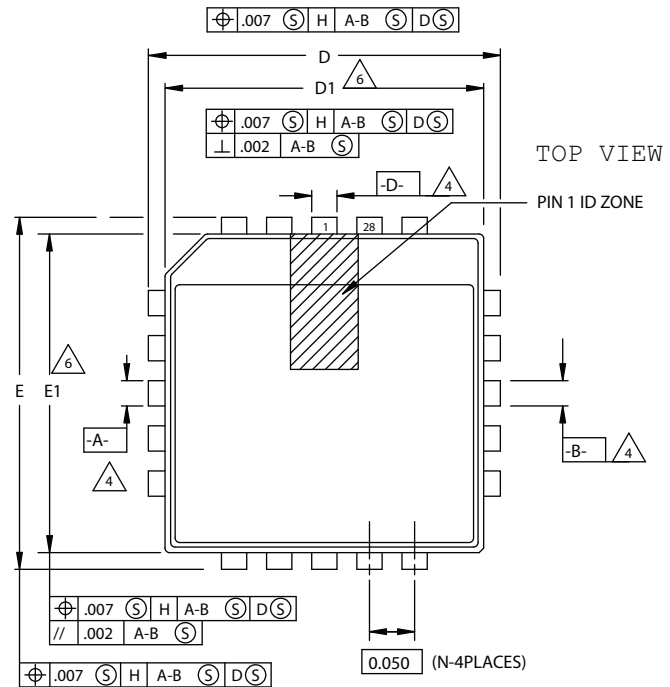
BOTTOM VIEW



| SYMBOL | MIN. NOM. MAX. |      |      |
|--------|----------------|------|------|
|        | MIN.           | NOM. | MAX. |
| A      | .165           | .172 | .180 |
| A1     | .090           | .105 | .120 |
| A2     | .062           | -    | .083 |
| D      | .485           | .490 | .495 |
| D1     | .450           | .453 | .456 |
| D2     | .191           | .205 | .219 |
| D3     |                | .125 |      |
| E      | .485           | .490 | .495 |
| E1     | .450           | .453 | .456 |
| E2     | .191           | .205 | .219 |
| E3     |                | .125 |      |
| N      |                | 28   |      |

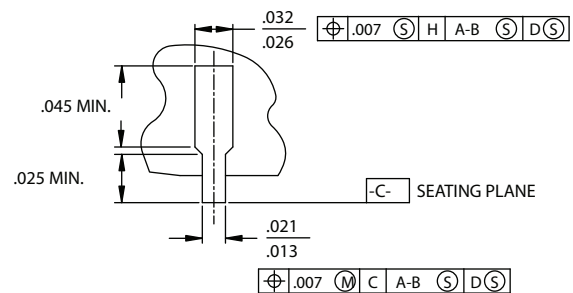


SECTION A-A



### NOTES:

- ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1982
- ALL DIMENSIONS IN INCHES
- DATUM PLANE  $\text{H-}$  LOCATED AT TOP OF MOLD PARTING LINE AND COINCIDENT WITH TOP OF LEAD WHERE LEAD EXITS PLASTIC BODY
- DATUMS  $\text{A-B}$  AND  $\text{D-}$  TO BE DETERMINED WHERE CENTER LEADS EXIT PLASTIC BODY AT DATUM PLANE  $\text{H-}$
- TO BE MEASURED AT SEATING PLANE  $\text{C-}$  CONTACT POINT
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .010 PER SIDE.
- TOP POINT OF MEASUREMENT IS DATUM  $\text{H-}$ ; BOTTOM POINT OF MEASUREMENT IS AT MAJOR FLAT AREA OF LOWER PLASTIC SURFACE DEFINED BY D3/E3
- DIMENSION APPLIES TO BASE METAL ONLY

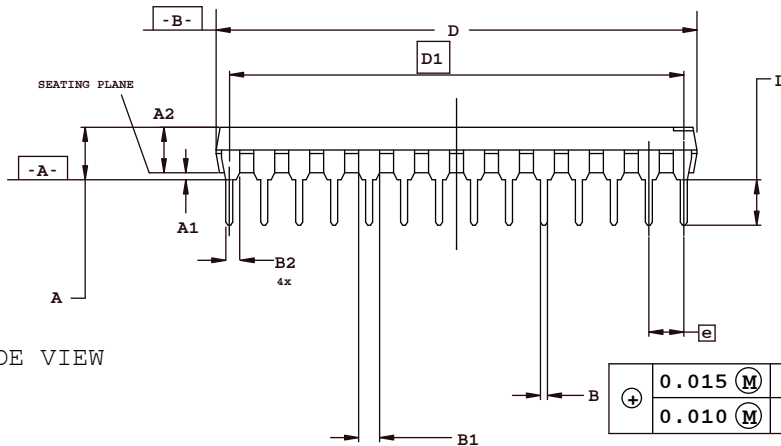
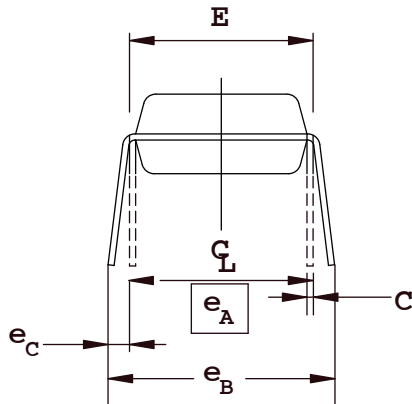
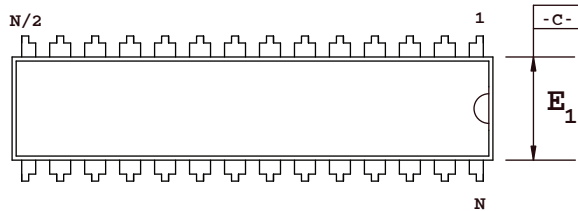


DETAIL "J" (TYP ALL SIDES)

## 28-Pin Plastic DIP Package

### Dimensions in Inches

TOP VIEW



NOTE :

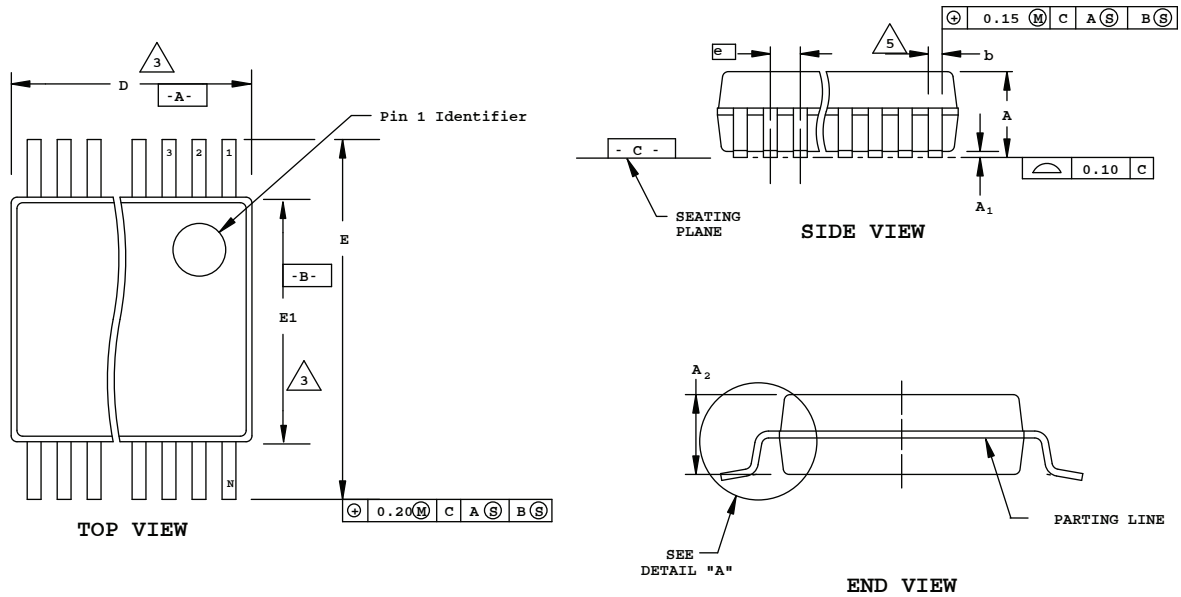
- 1 CONTROLLING DIMENSION: INCHES
- 2 DIMENSIONING AND TOLERANCING  
PER ANSI Y14.5M-1982
- 3 ALL END LEADS IN THIS FAMILY ARE 1/2 LEADS
- 4 DIMENSION A, A1, AND L ARE MEASURED WITH THE  
PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3
- 5 D AND E1 DIMENSIONS DO NOT INCLUDE MOLD  
FLASH OR PROTRUSION. 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

| SYMBOL         | 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 <sup>1</sup> | .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        |       |       |

|   |           |   |   |   |
|---|-----------|---|---|---|
| + | 0.015 (M) | A | B | C |
|   | 0.010 (M) | A |   |   |

## 28-Pin SSOP Package

Dimensions in Millimeters



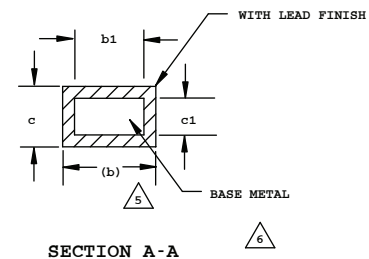
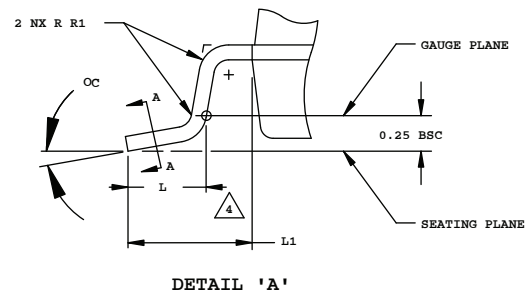
| SYMBOL         | COMMON DIMENSIONS |       |       |
|----------------|-------------------|-------|-------|
|                | MIN.              | NOM.  | MAX.  |
| A              | --                | --    | 2.0   |
| A <sub>1</sub> | 0.05              | --    | --    |
| A <sub>2</sub> | 1.65              | 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 |
| E1             | 5.00              | 5.30  | 5.60  |
| e              | 0.65 BSC          |       |       |
| E              | 7.40              | 7.80  | 8.20  |
| L              | 0.55              | 0.75  | 0.95  |
| L1             | 1.25 REF.         |       |       |
| N              | 28                |       |       |
| OC             | 0                 | 4     | 8     |
| R1             | 0.09              | --    | --    |

### NOTES:

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

3. "D" & "E1" 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.

4. TO BE DETERMINED AT THE SEATING PLANE



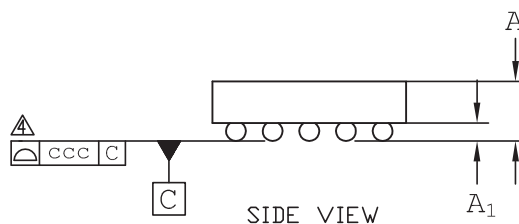
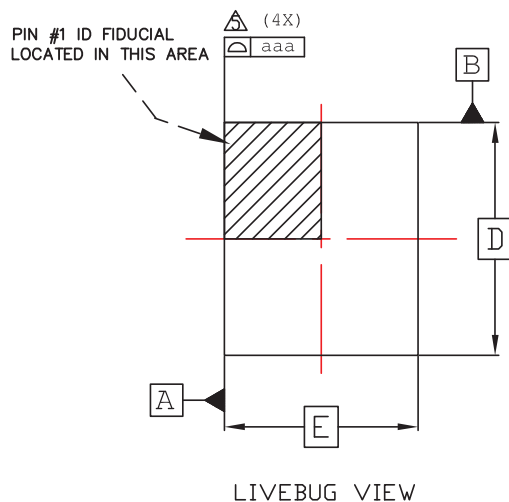
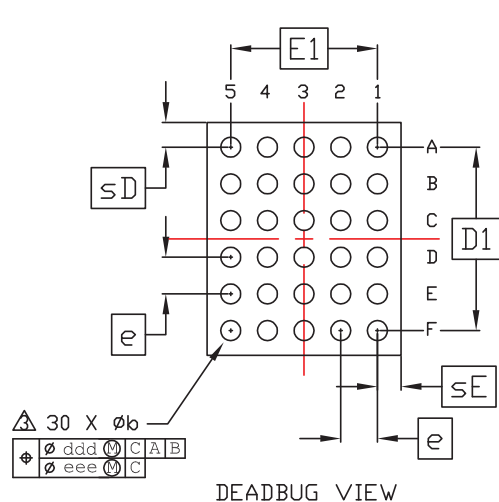
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13mm TOTAL IN EXCESS OF b DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION b BY MORE THAN 0.07mm AT LEAST MATERIAL CONDITION.

6. 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

## 30-Ball WLSC Package

Dimensions in Millimeters



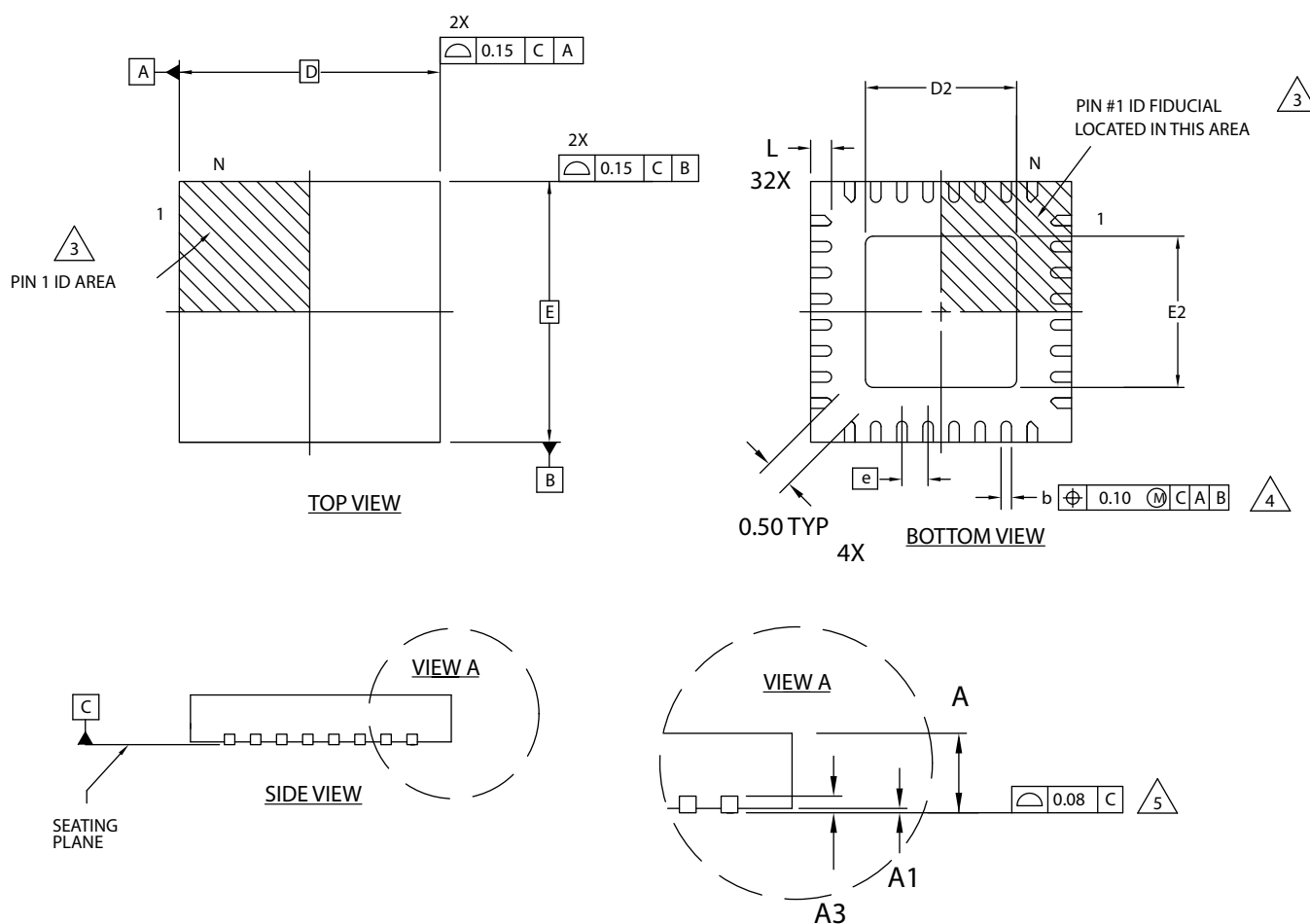
### Notes:

- 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    | -         | -     | 0.600 |
| 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 BSC  |       |       |
| sD   | -         | 0.26  | -     |
| sE   | -         | 0.27  | -     |
| aaa  | 0.030     |       |       |
| ccc  | 0.050     |       |       |
| ddd  | 0.015     |       |       |
| eee  | 0.050     |       |       |

### 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.

 EXACT SHAPE AND SIZE OF THIS  
FEATURE IS OPTIONAL.

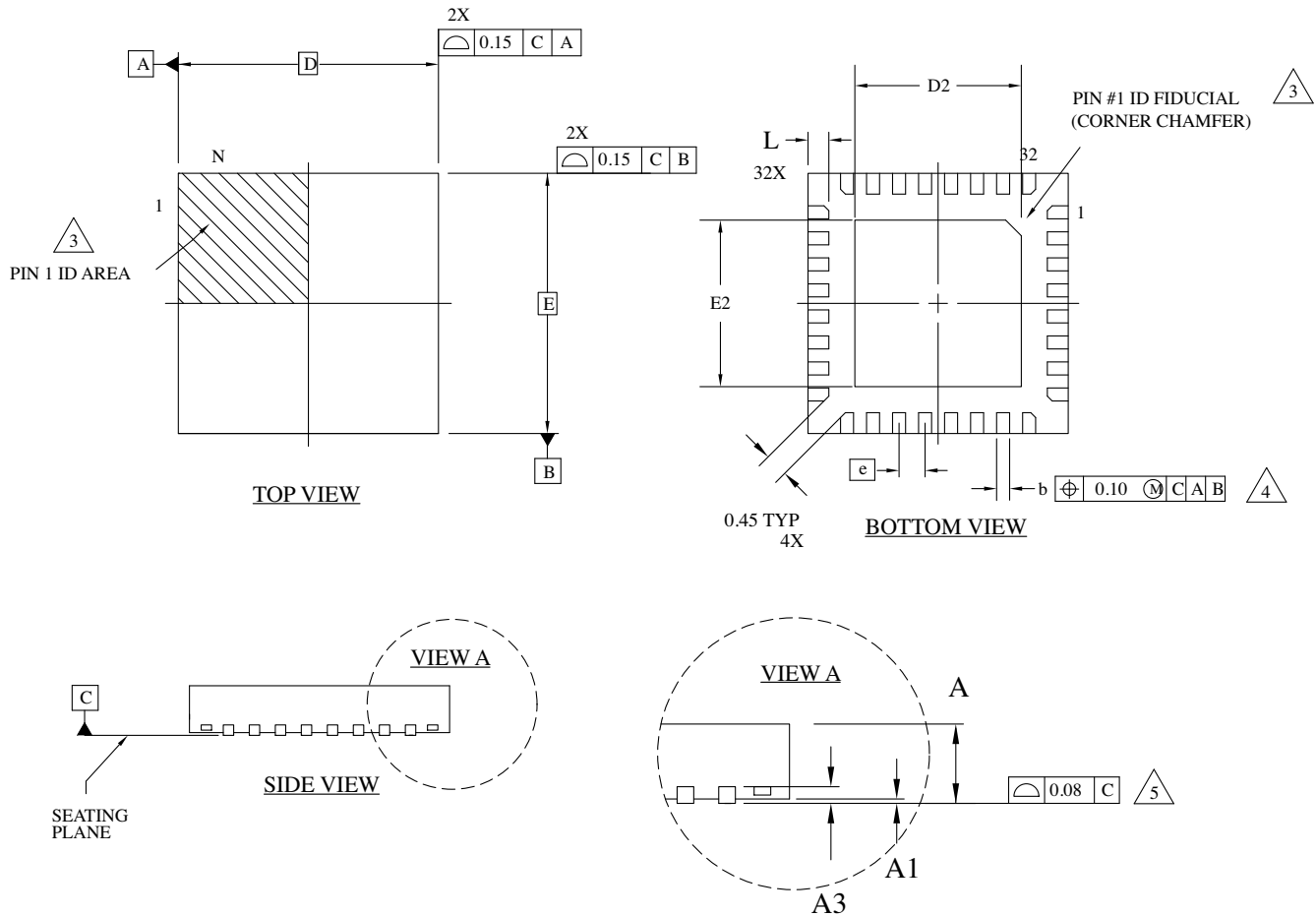
 DIMENSION b APPLIES TO PLATED  
TERMINAL AND IS MEASURED BETWEEN  
0.15 AND 0.30 mm FROM TERMINAL TIP.

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 |

## 32-Pin QFN Package Option 2: MachXO2™

Dimensions in Millimeters



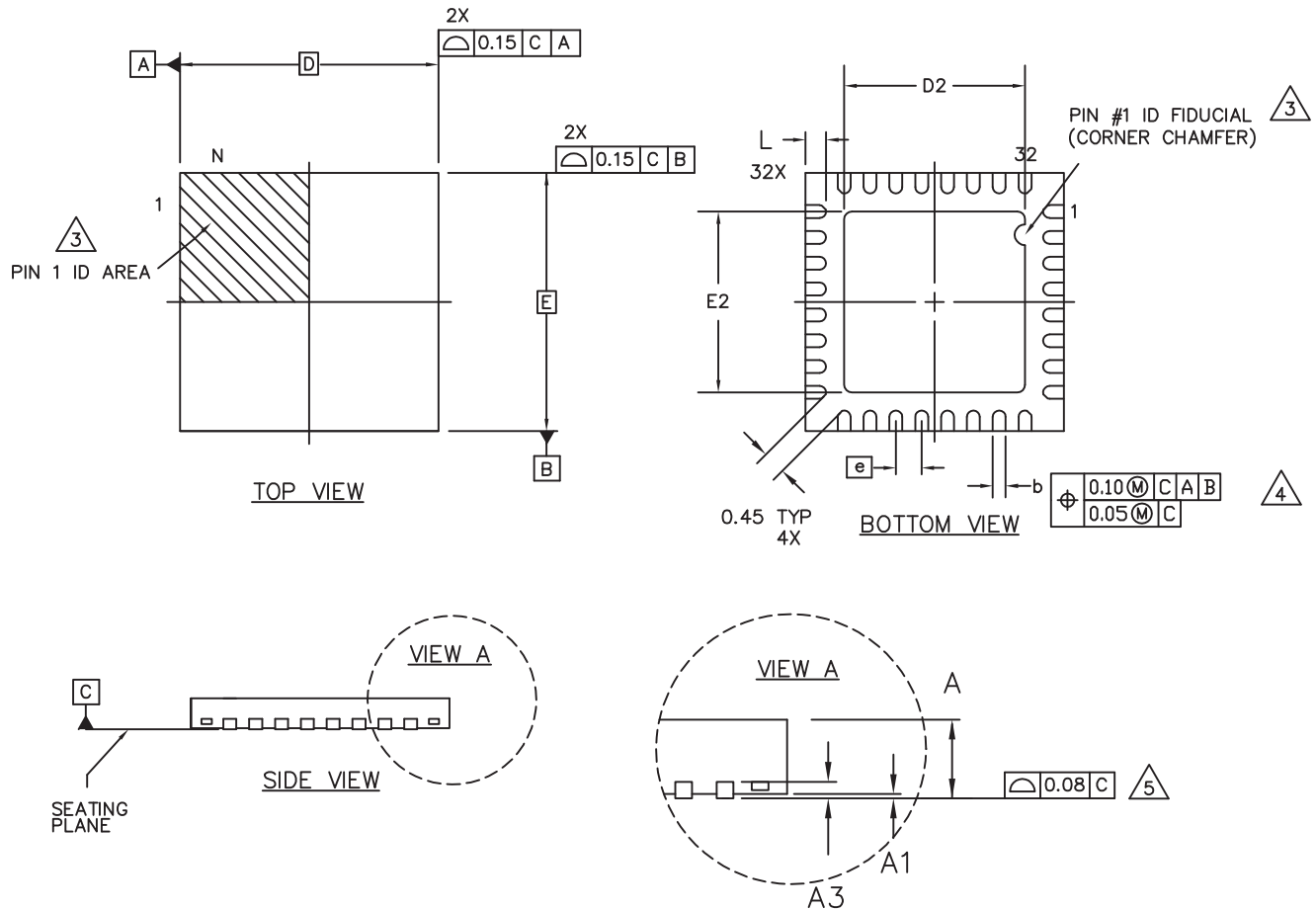
NOTES: UNLESS OTHERWISE SPECIFIED

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      | 0.50     | 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 |

## 32-Pin QFN Package Option 3: MachXO2 SG32C

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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

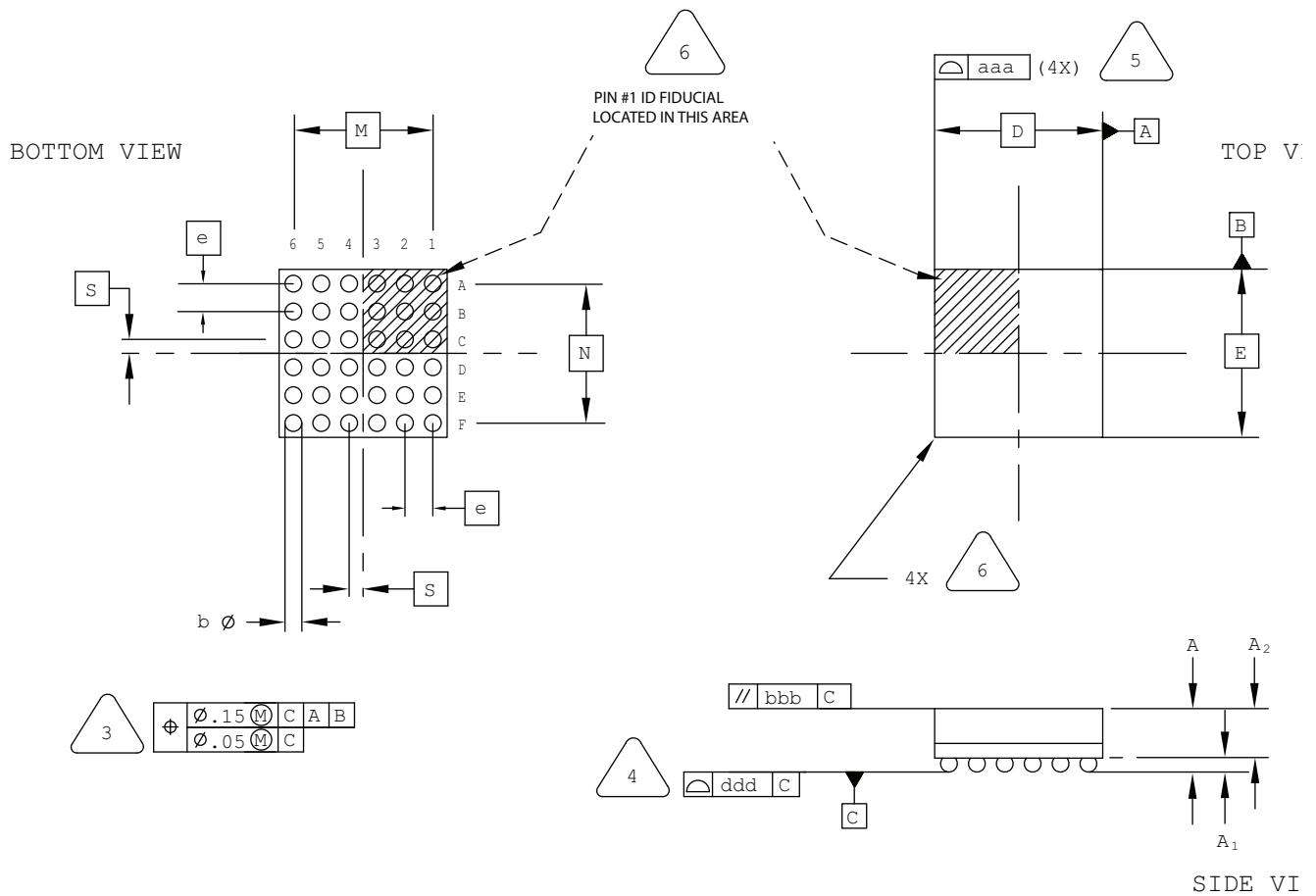
 APPLIES TO EXPOSED PORTION OF TERMINALS.

- 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     | 0.2 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 |

## 36-Ball ucBGA Package Option 1

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.

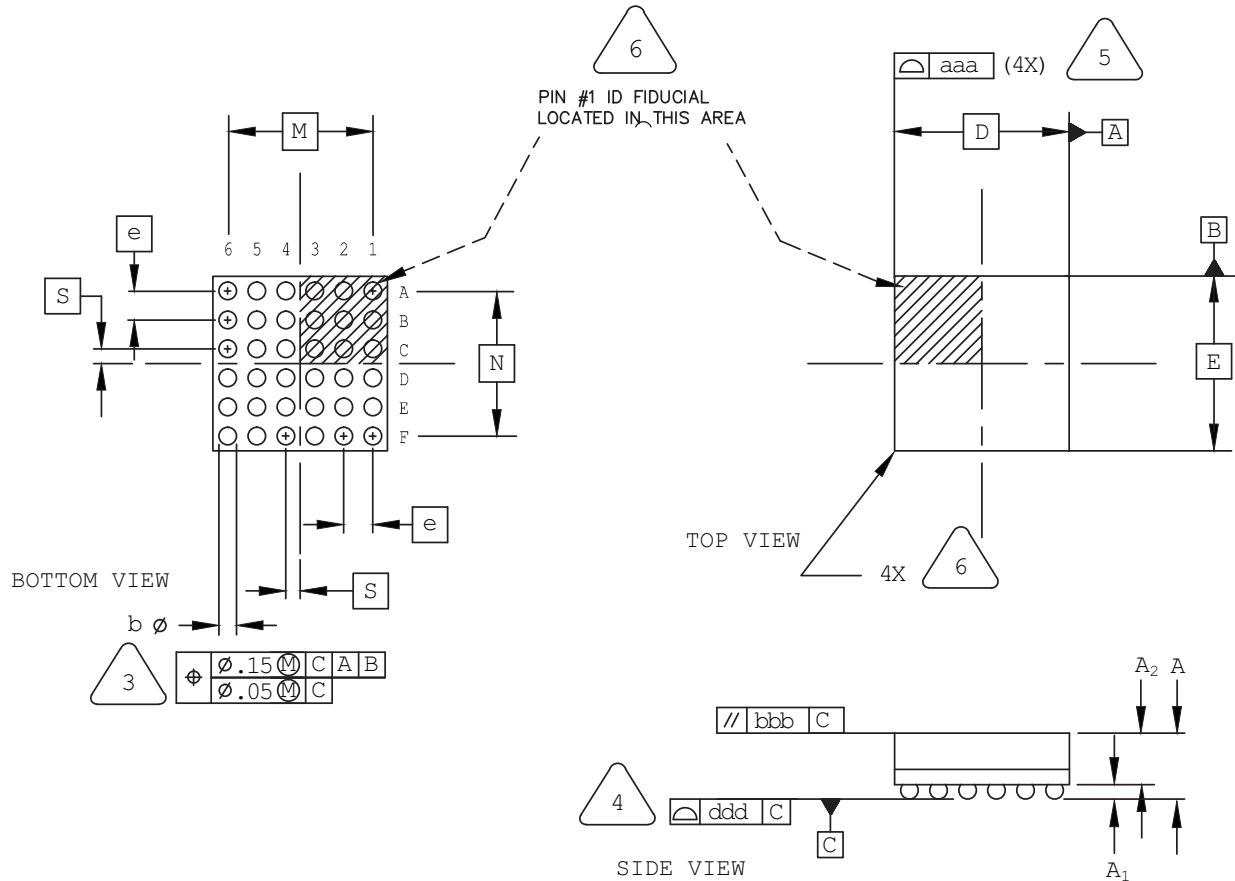


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 36-Ball ucfBGA Package: iCE40 Ultra™

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

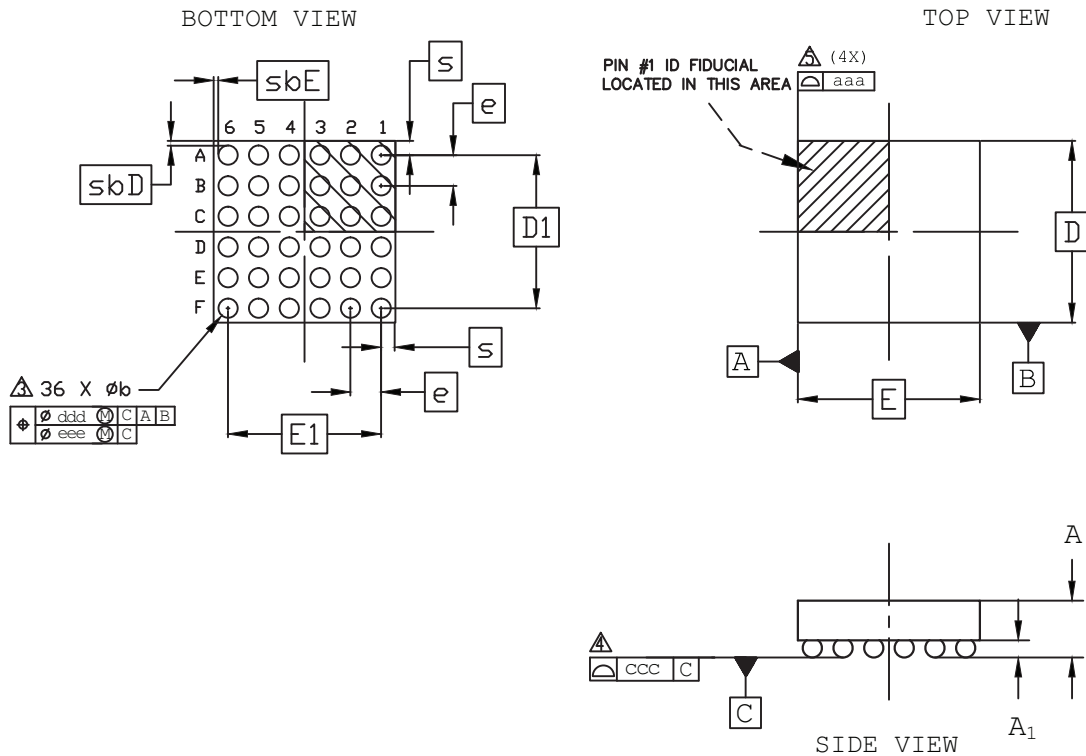
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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 |

## 36-Ball WLCS 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 MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].

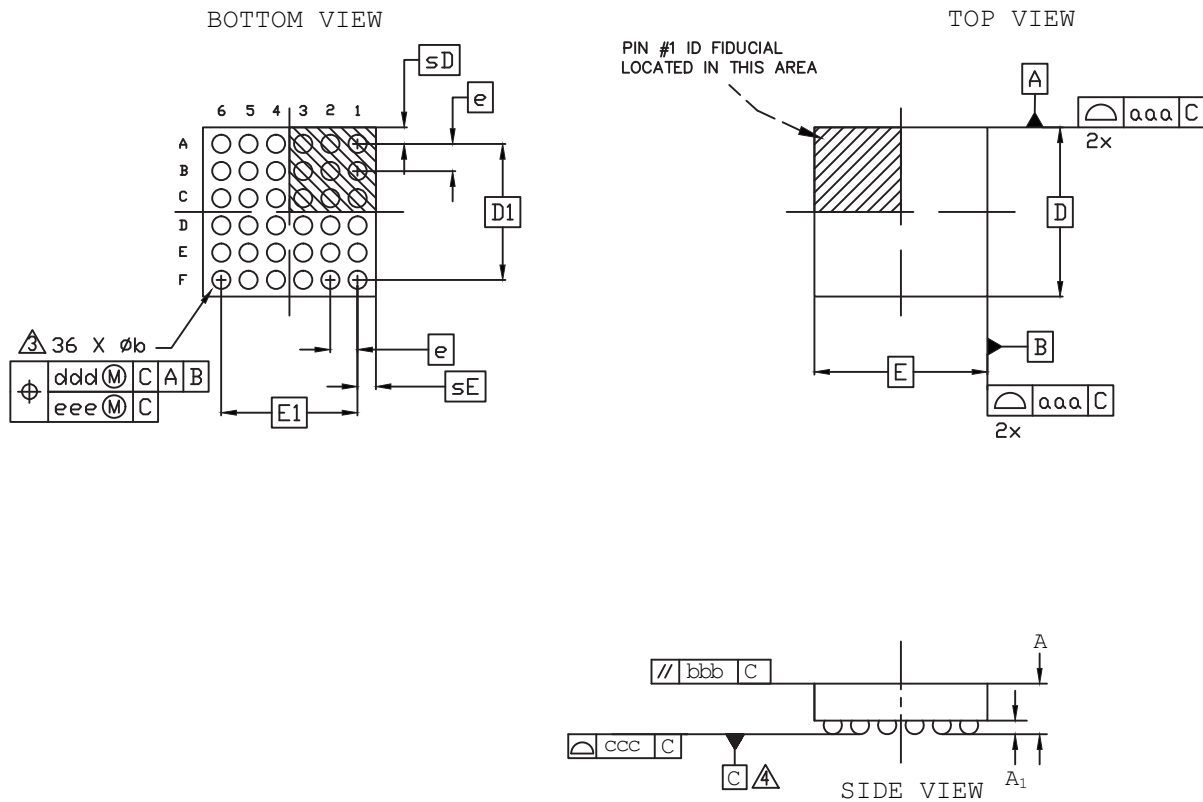
△ PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

△ 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     |       |       |

## 36-Ball WLCS Package Option 2: MachXO3™

Dimensions in Millimeters



### NOTES:

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

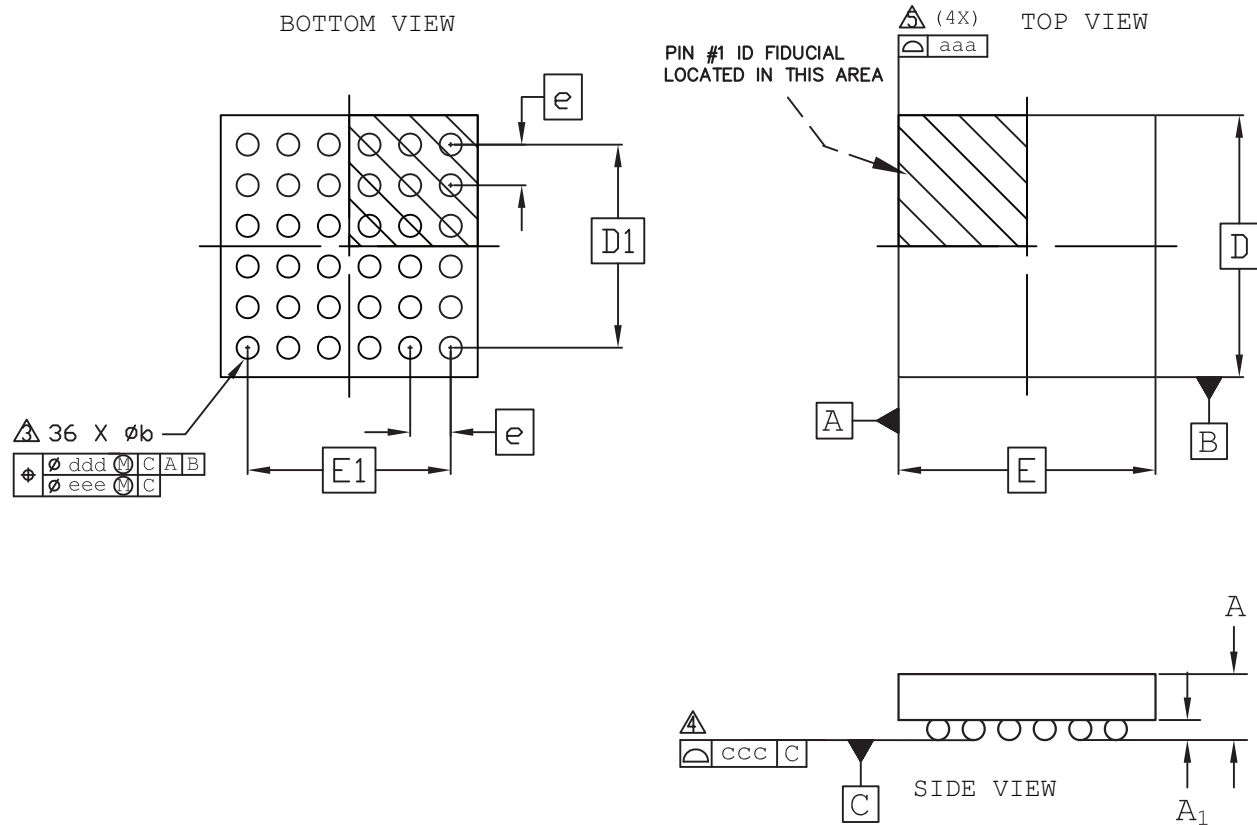
△ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].

△ 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     |       |       |

## 36-Ball WLCS Package Option 3: LIFMD™

Dimensions in Millimeters



### NOTES:

1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.

2. ALL DIMENSIONS ARE IN MILLIMETERS.

△ DIMENSION "b" IS MEASURES 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.

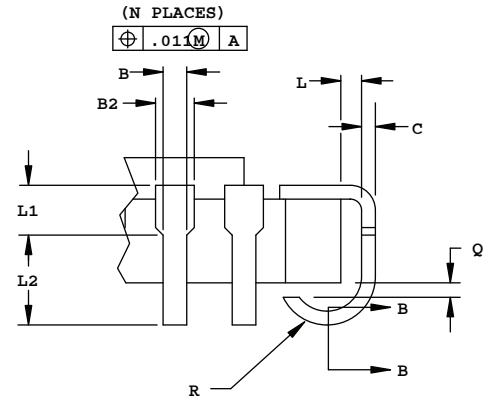
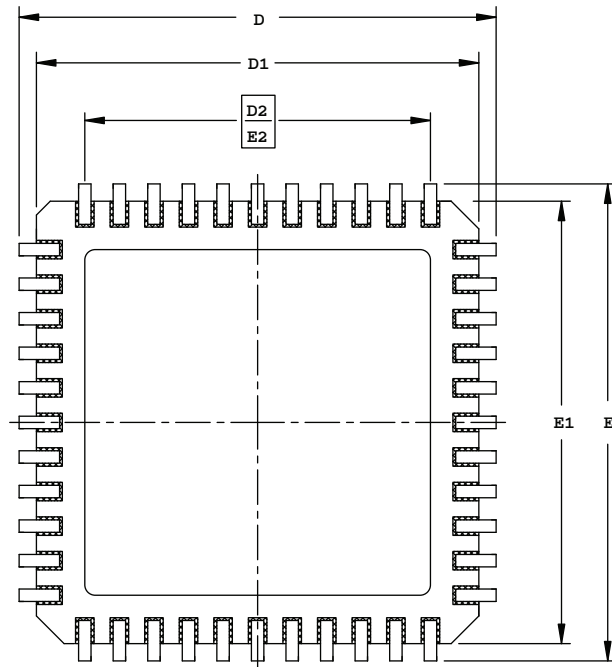
△ BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

| REF. | Min.      | Nom.  | Max.  |
|------|-----------|-------|-------|
| A    | -         | -     | 0.600 |
| A1   | 0.113     | -     | -     |
| 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     |       |       |

## 44-Pin JLCC Package

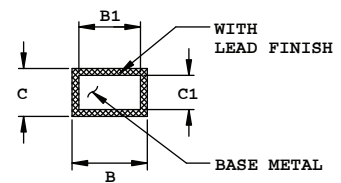
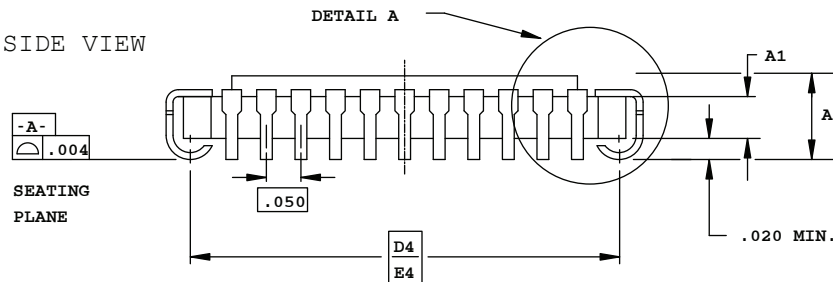
Dimensions in Inches

BOTTOM VIEW



DETAIL A

SIDE VIEW



SECTION B-B

### NOTES :

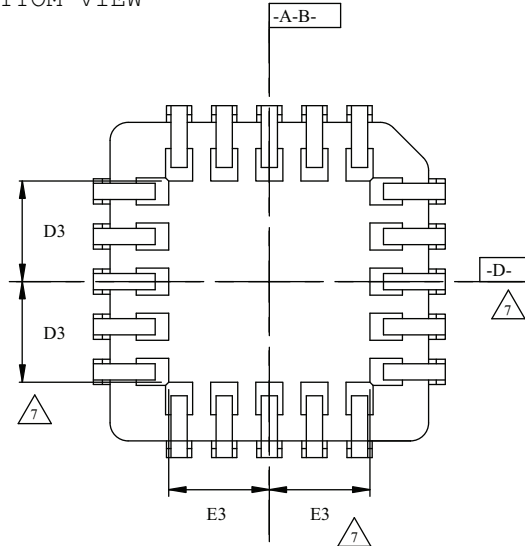
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.
3. CORNER CHAMFERS AND/OR NOTCHES ARE OPTIONAL.

| SYMBOL | 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       |      |      |

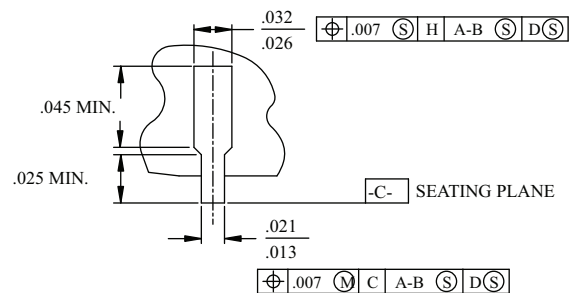
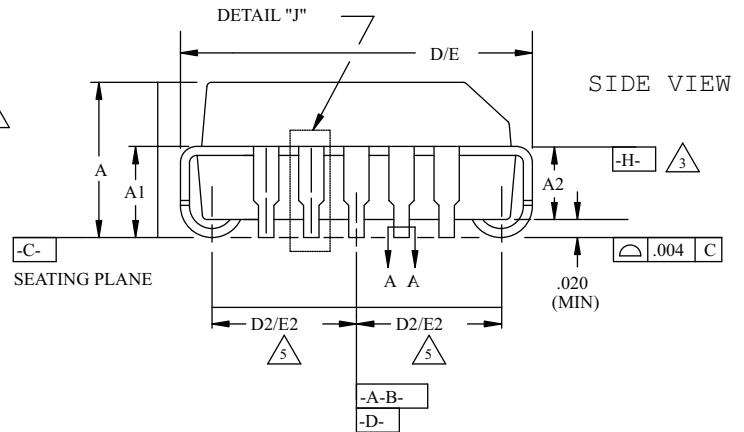
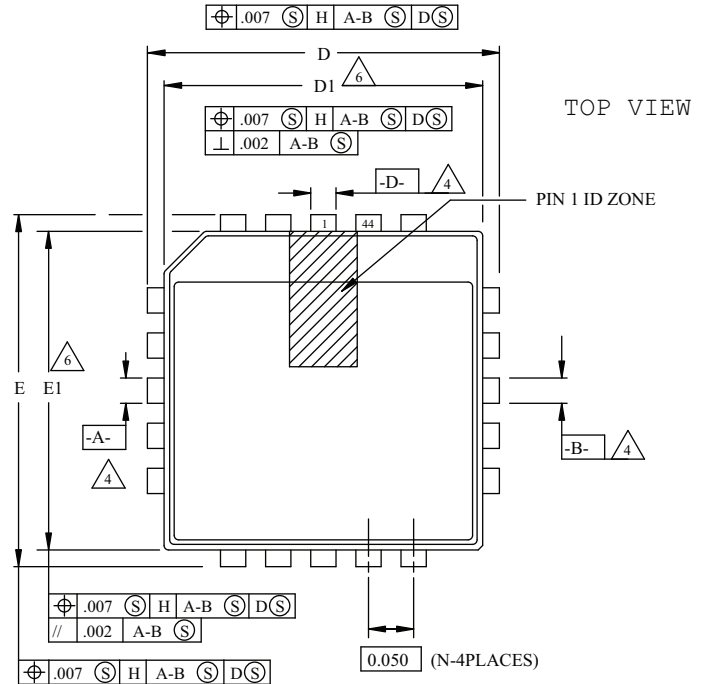
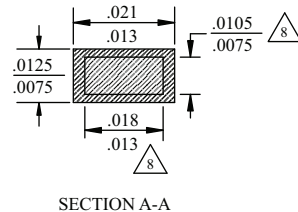
# 44-Pin PLCC Package

Dimensions in Inches

BOTTOM VIEW



|    | MIN. | NOM. | MAX. |
|----|------|------|------|
| A  | .165 | .172 | .180 |
| A1 | .090 | .105 | .120 |
| A2 | .062 | -    | .083 |
| D  | .685 | .690 | .695 |
| D1 | .650 | .653 | .656 |
| D2 | .291 | .305 | .319 |
| D3 |      | .225 |      |
| E  | .685 | .690 | .695 |
| E1 | .650 | .653 | .656 |
| E2 | .291 | .305 | .319 |
| E3 |      | .225 |      |
| N  |      | 44   |      |

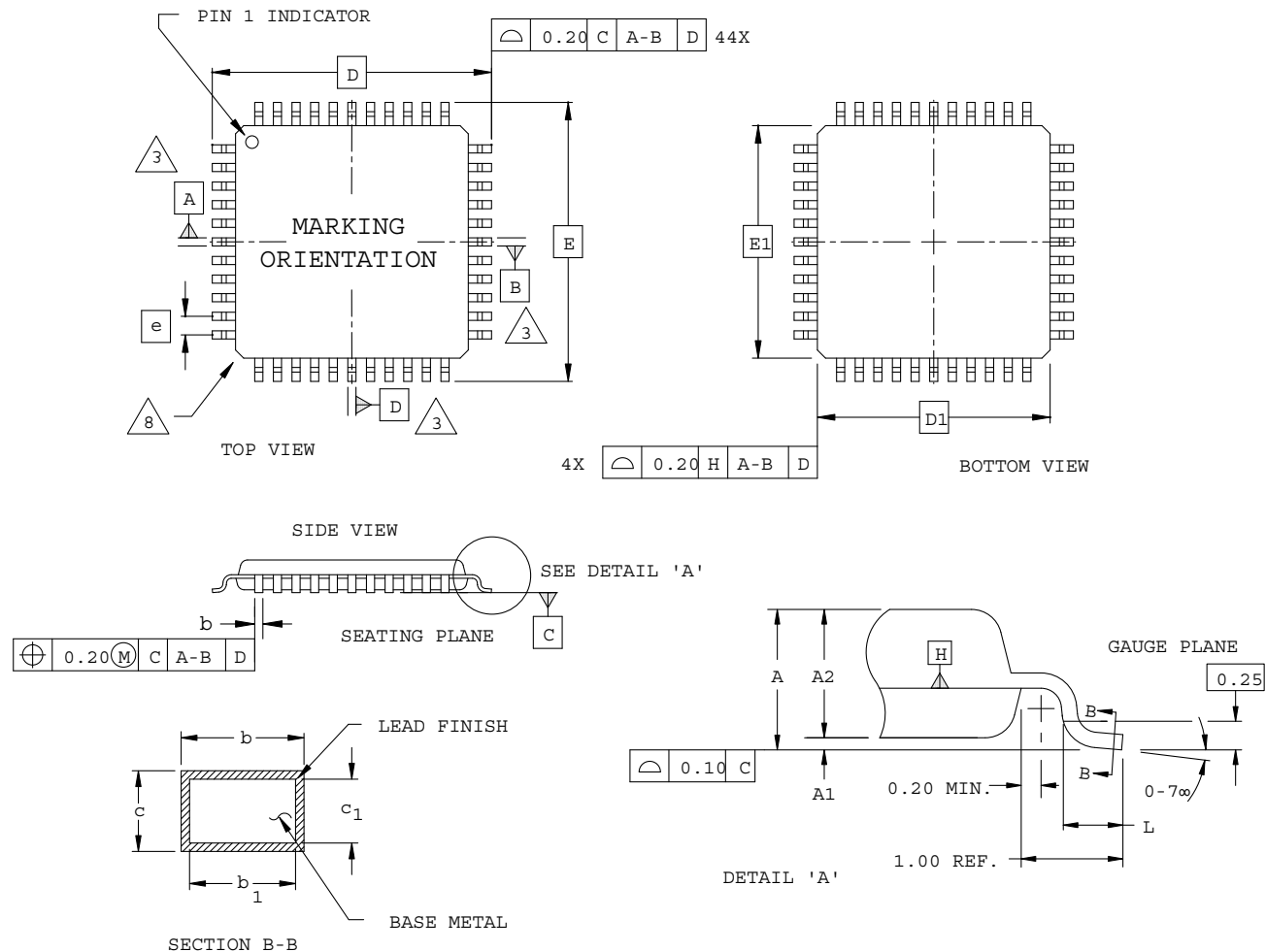


## NOTES:

- ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1982
- ALL DIMENSIONS IN INCHES
- DATUM PLANE  $\square$  H- LOCATED AT TOP OF MOLD PARTING LINE AND COINCIDENT WITH TOP OF LEAD WHERE LEAD EXITS PLASTIC BODY
- DATUMS  $\square$  A-B AND  $\square$  D- TO BE DETERMINED WHERE CENTER LEADS EXIT PLASTIC BODY AT DATUM PLANE  $\square$  H-
- TO BE MEASURED AT SEATING PLANE  $\square$  C- CONTACT POINT
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .010 PER SIDE.
- TOP POINT OF MEASUREMENT IS DATUM  $\square$  H- ; BOTTOM POINT OF MEASUREMENT IS AT MAJOR FLAT AREA OF LOWER PLASTIC SURFACE DEFINED BY D3/E3
- DIMENSION APPLIES TO BASE METAL ONLY

## 44-Pin TQFP Package (1.0 mm thick)

Dimensions in Millimeters



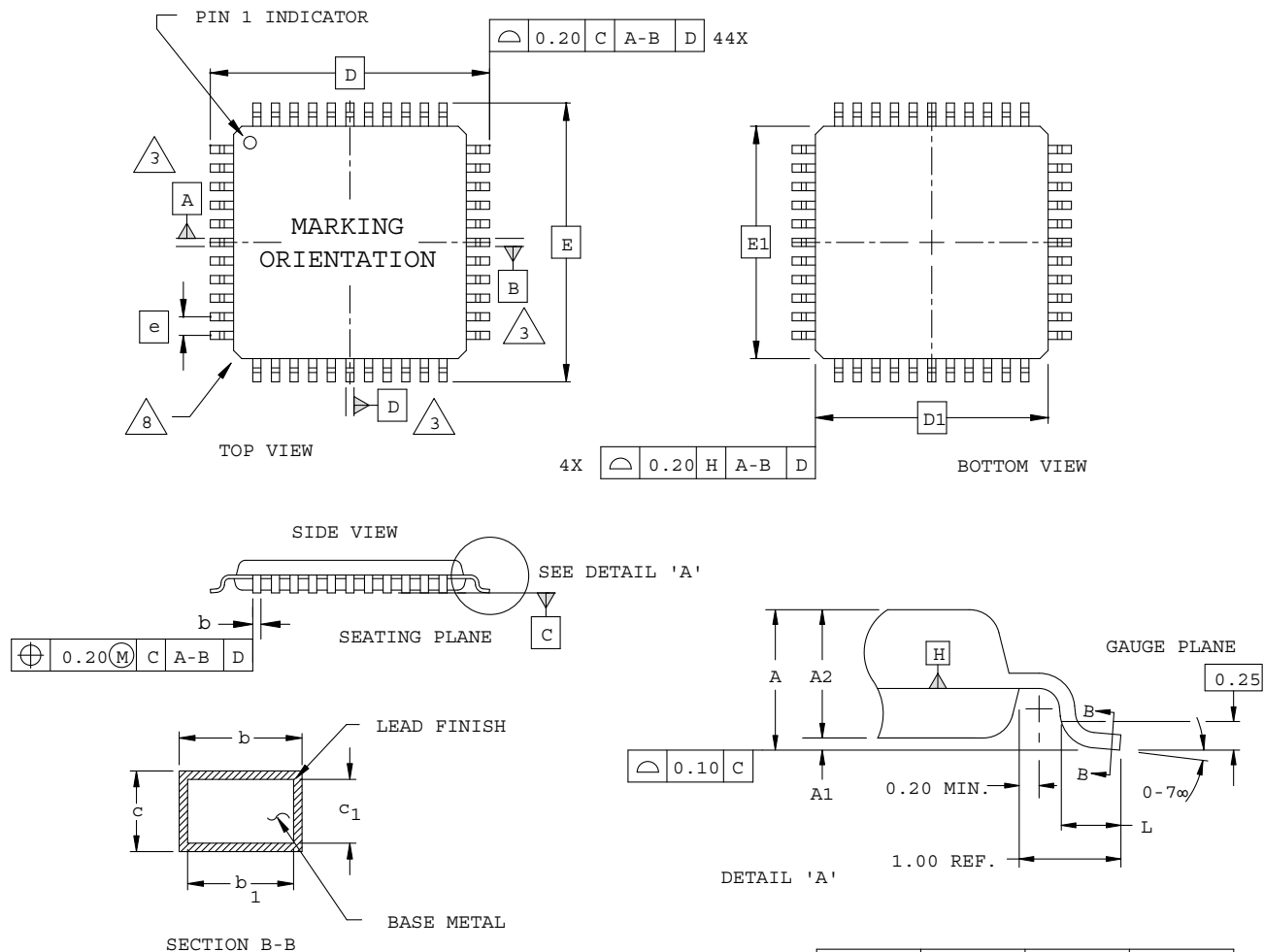
### NOTES:

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 |

## 44-Pin TQFP Package (1.4 mm thick)

Dimensions in Millimeters



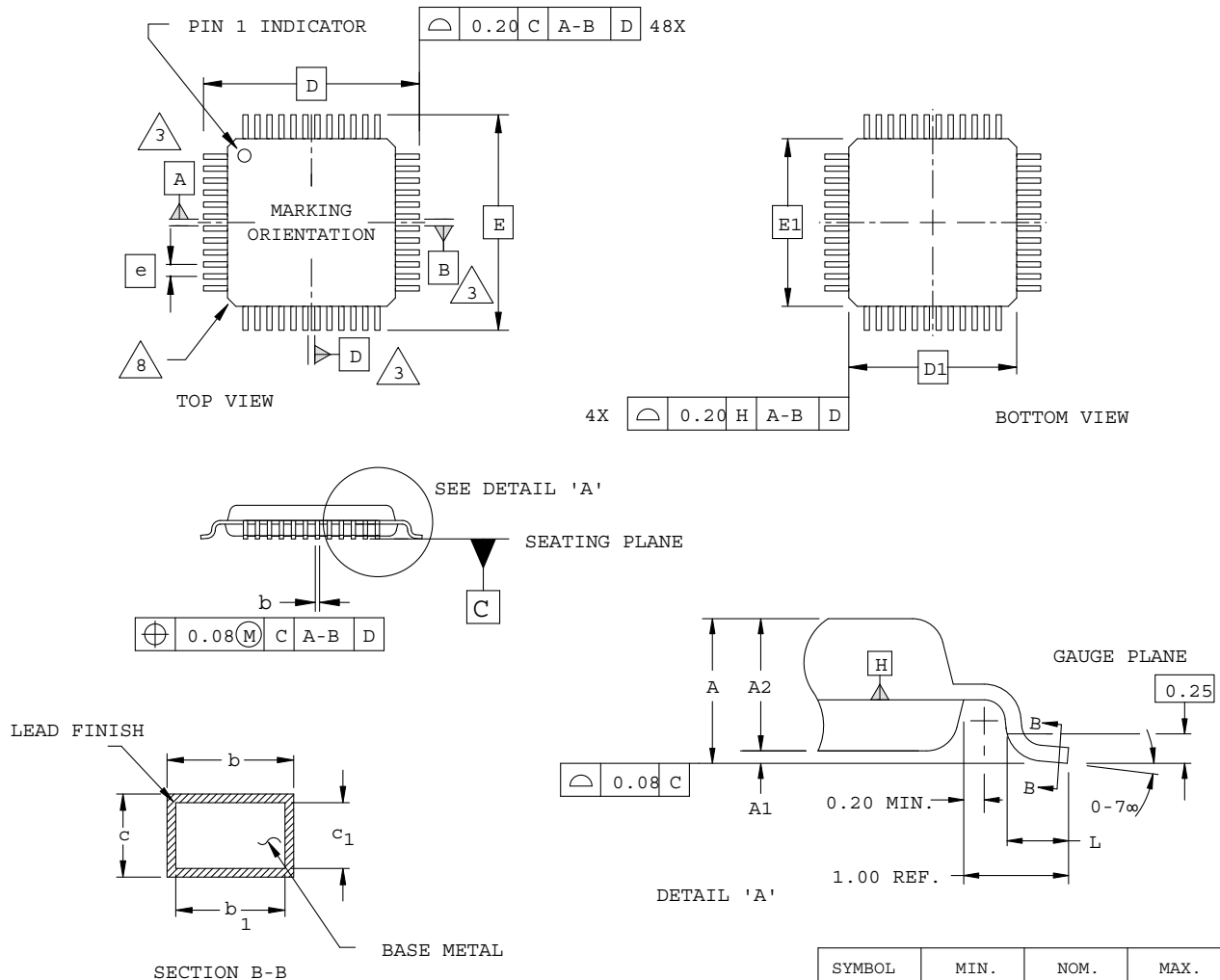
### NOTES:

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 |

## 48-Pin TQFP Package (1.0 mm thick)

Dimensions in Millimeters

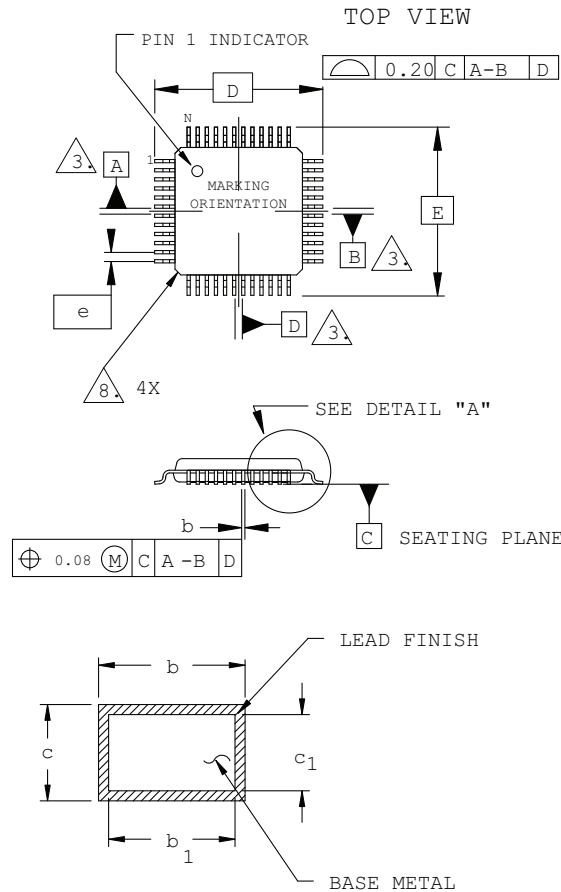


### NOTES:

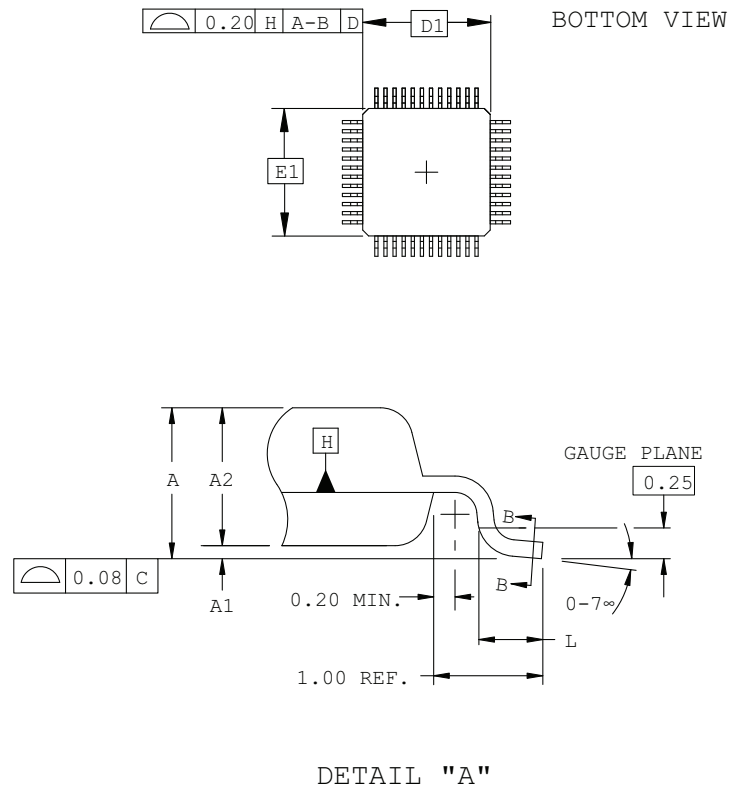
- DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 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.

## 48-Pin TQFP Package (1.4 mm thick)

Dimensions in Millimeters



SECTION B - B



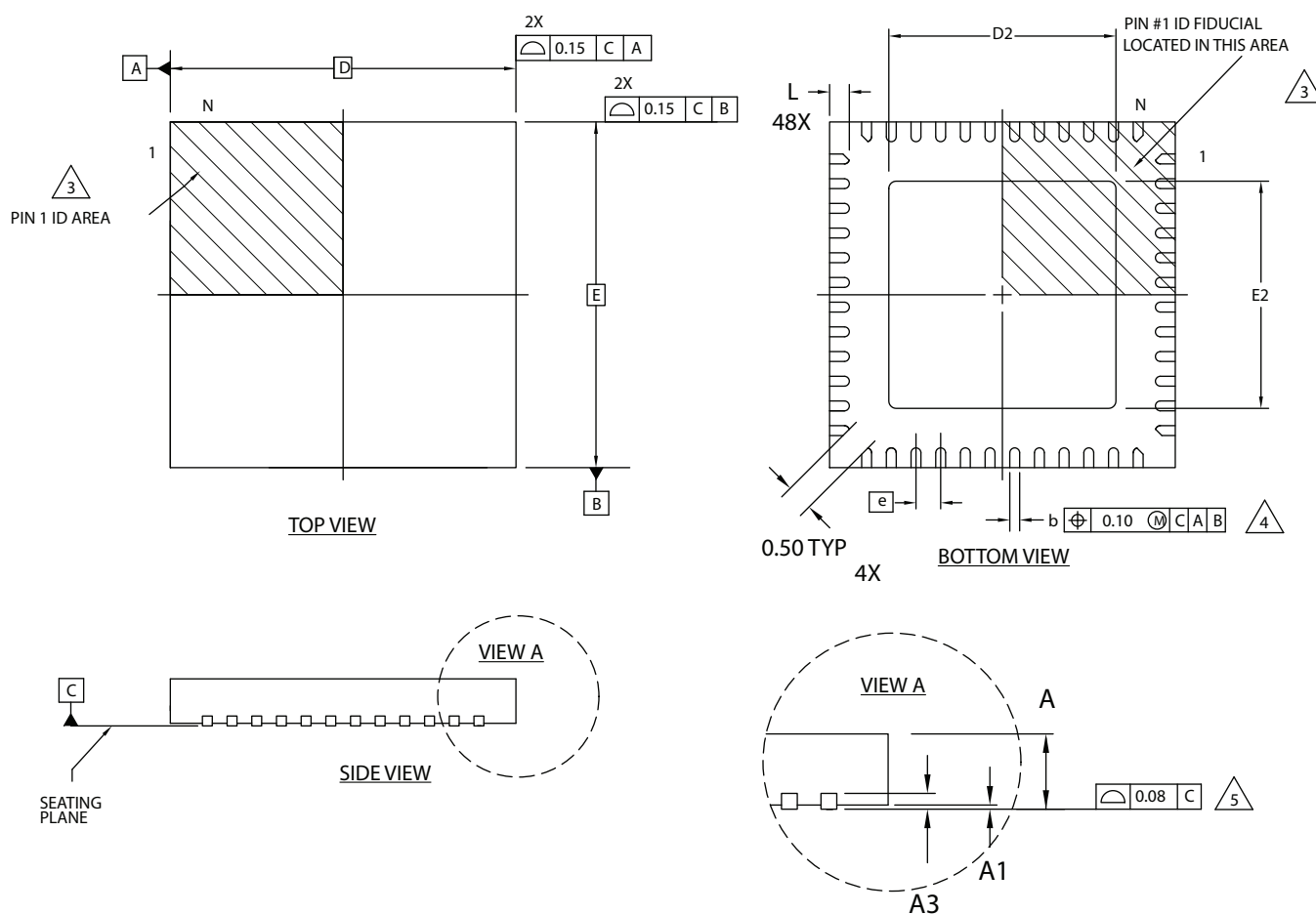
| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.60 |
| A1     | 0.05     | -    | 0.15 |
| A2     | 1.35     | 1.40 | 1.45 |
| D      | 9.00 BSC |      |      |
| D1     | 7.00 BSC |      |      |
| E      | 9.00 BSC |      |      |
| E1     | 7.00 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 |

### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 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.

## 48-Pin QFN Package Option 1

Dimensions in Millimeters



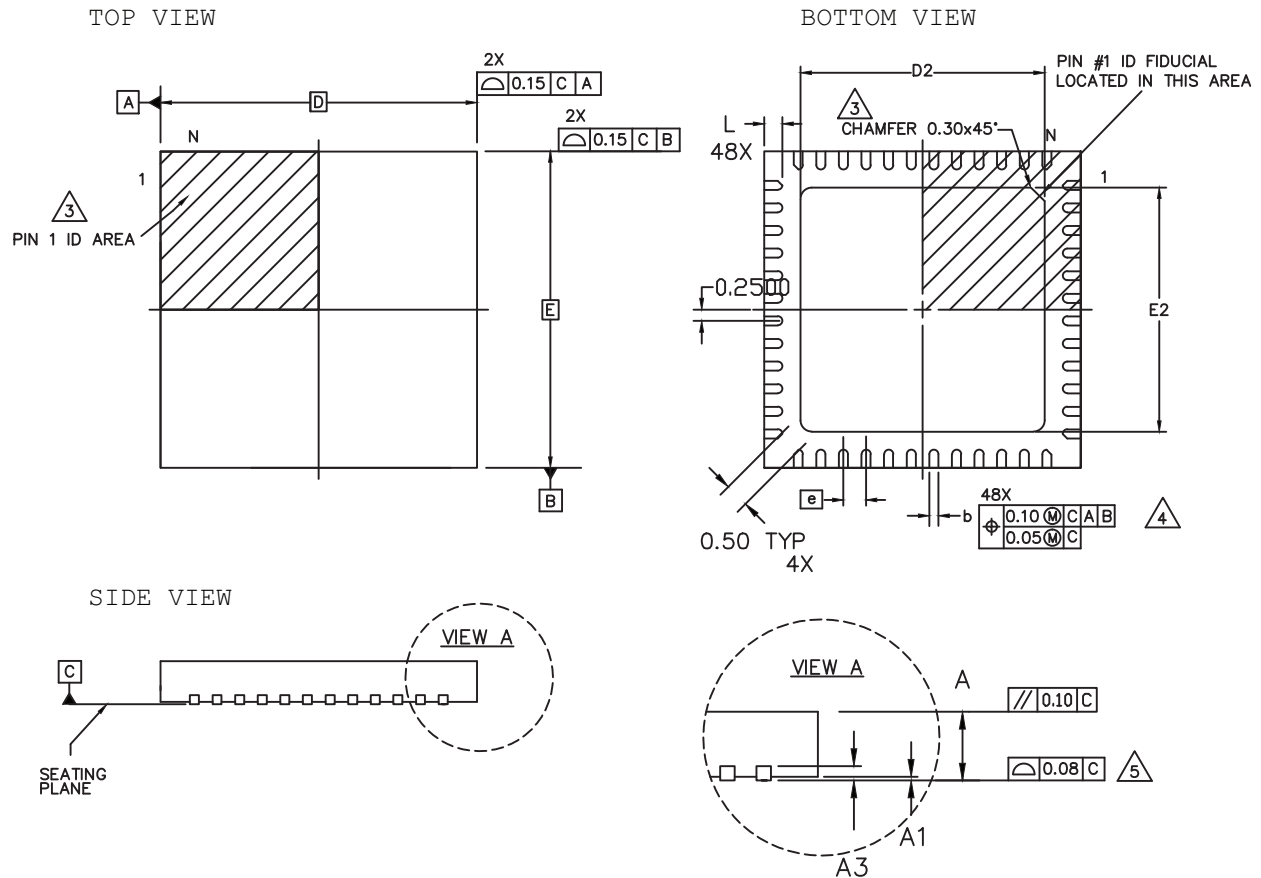
NOTES: UNLESS OTHERWISE SPECIFIED

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      | 7.0 BSC  |      |      |
| D2     | 3.00     | -    | 5.80 |
| E      | 7.0 BSC  |      |      |
| E2     | 3.00     | -    | 5.80 |
| b      | 0.18     | 0.24 | 0.30 |
| e      | 0.50 BSC |      |      |
| L      | 0.30     | 0.40 | 0.50 |

## 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2

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.

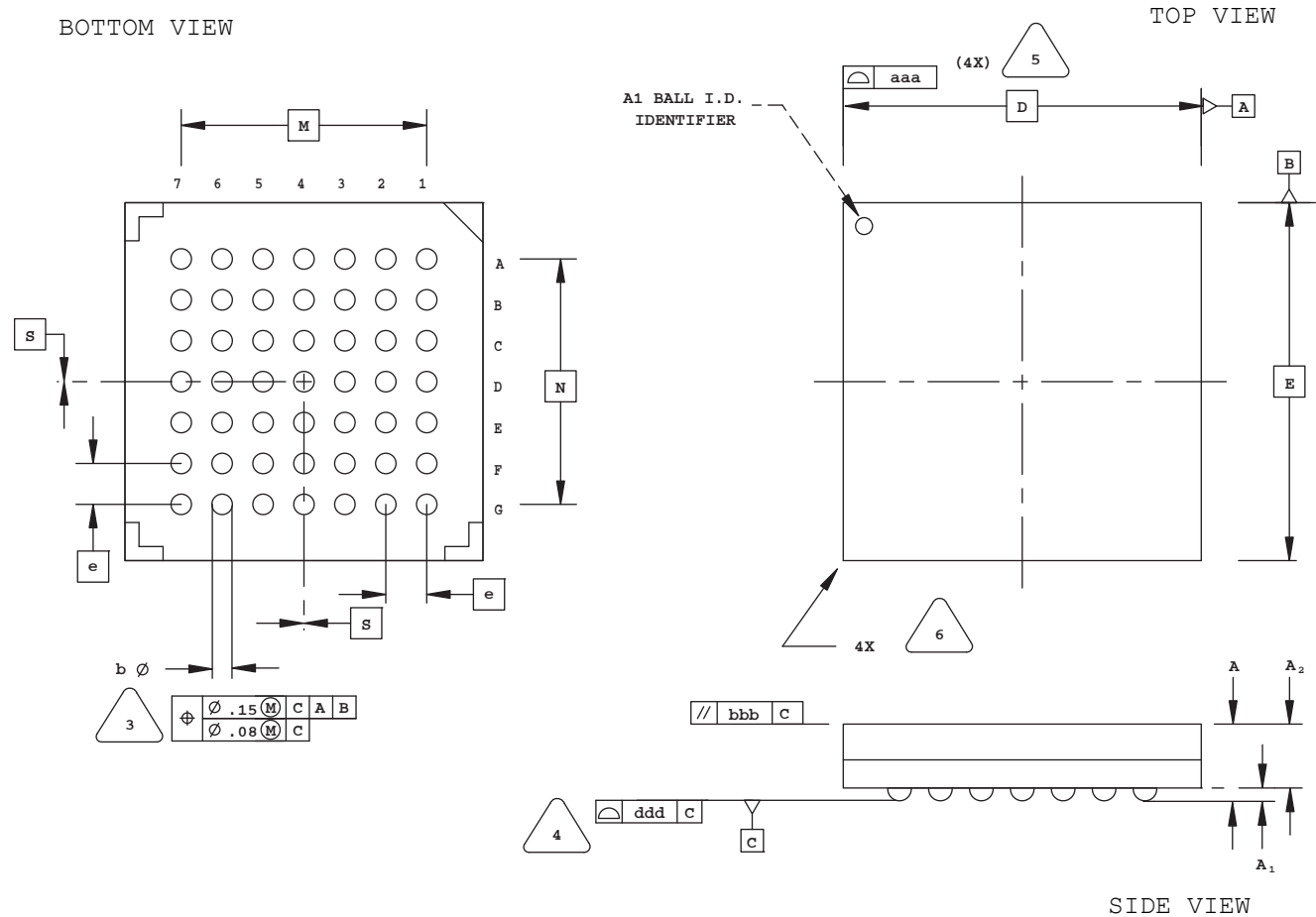
 DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

 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      | 7.0 BSC  |      |      |
| D2     | 5.30     | 5.40 | 5.50 |
| E      | 7.0 BSC  |      |      |
| E2     | 5.30     | 5.40 | 5.50 |
| b      | 0.15     | 0.20 | 0.25 |
| e      | 0.50 BSC |      |      |
| L      | 0.35     | 0.40 | 0.45 |

## 49-Ball caBGA 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.

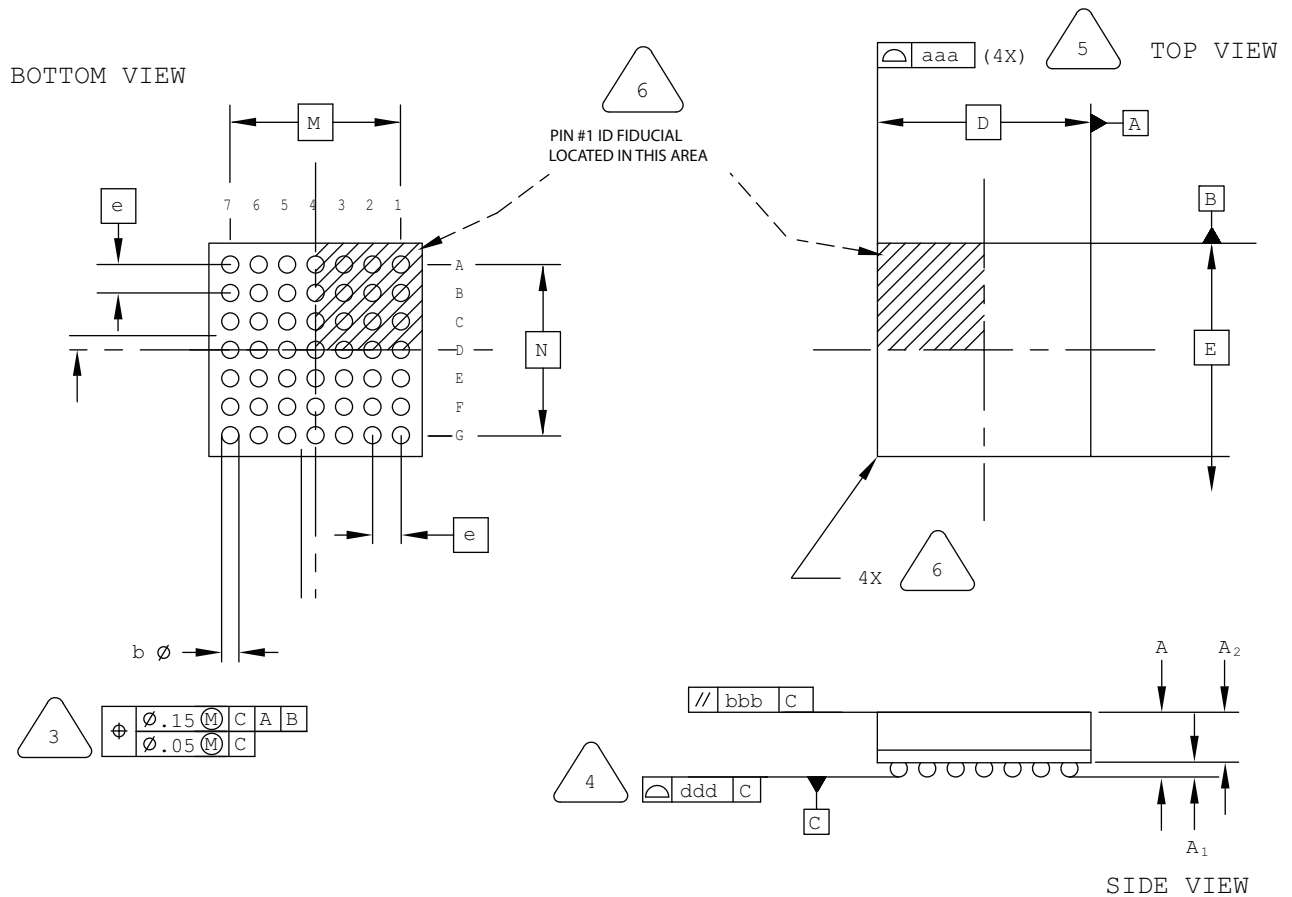


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 49-Ball ucBGA 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.

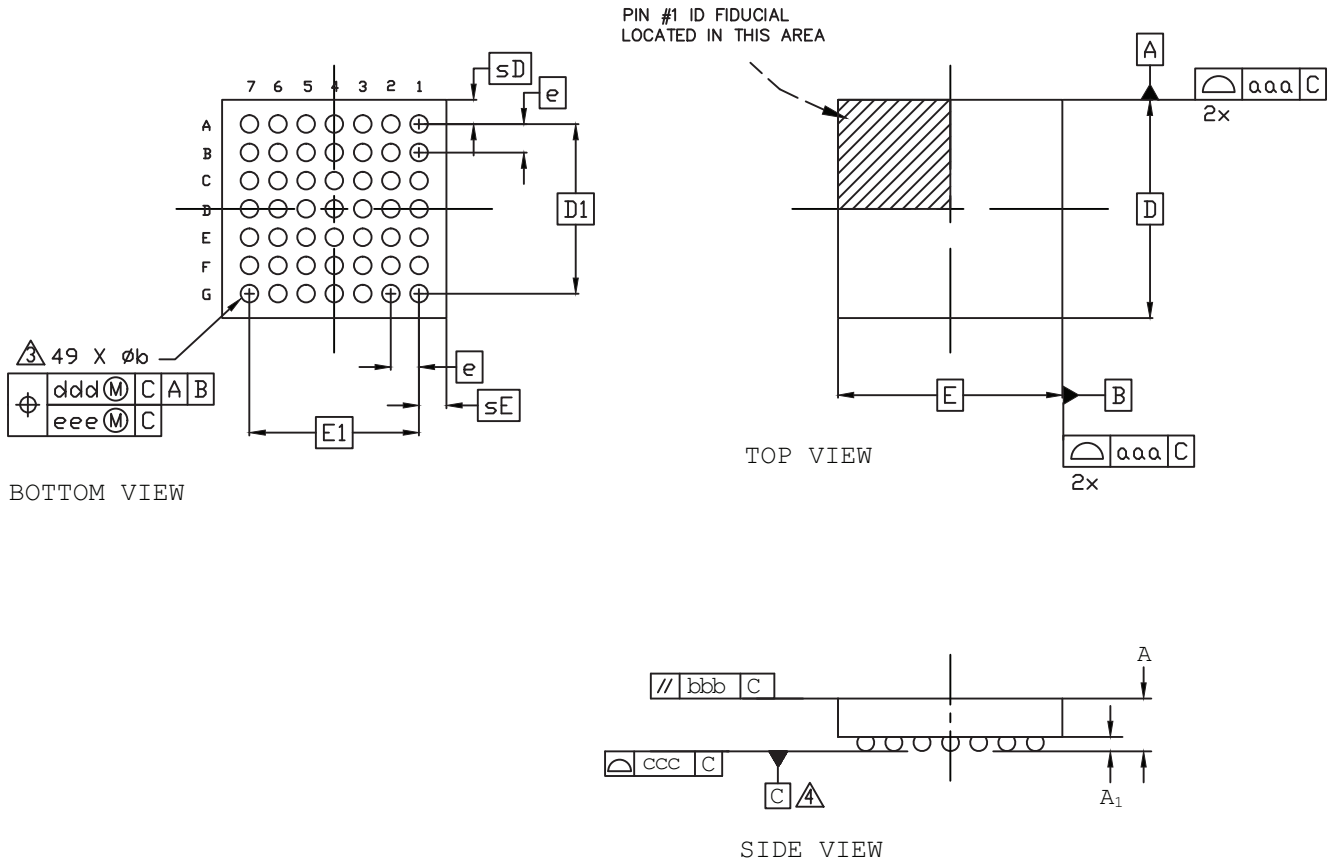


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 49-Ball WLCS Package

Dimensions in Millimeters



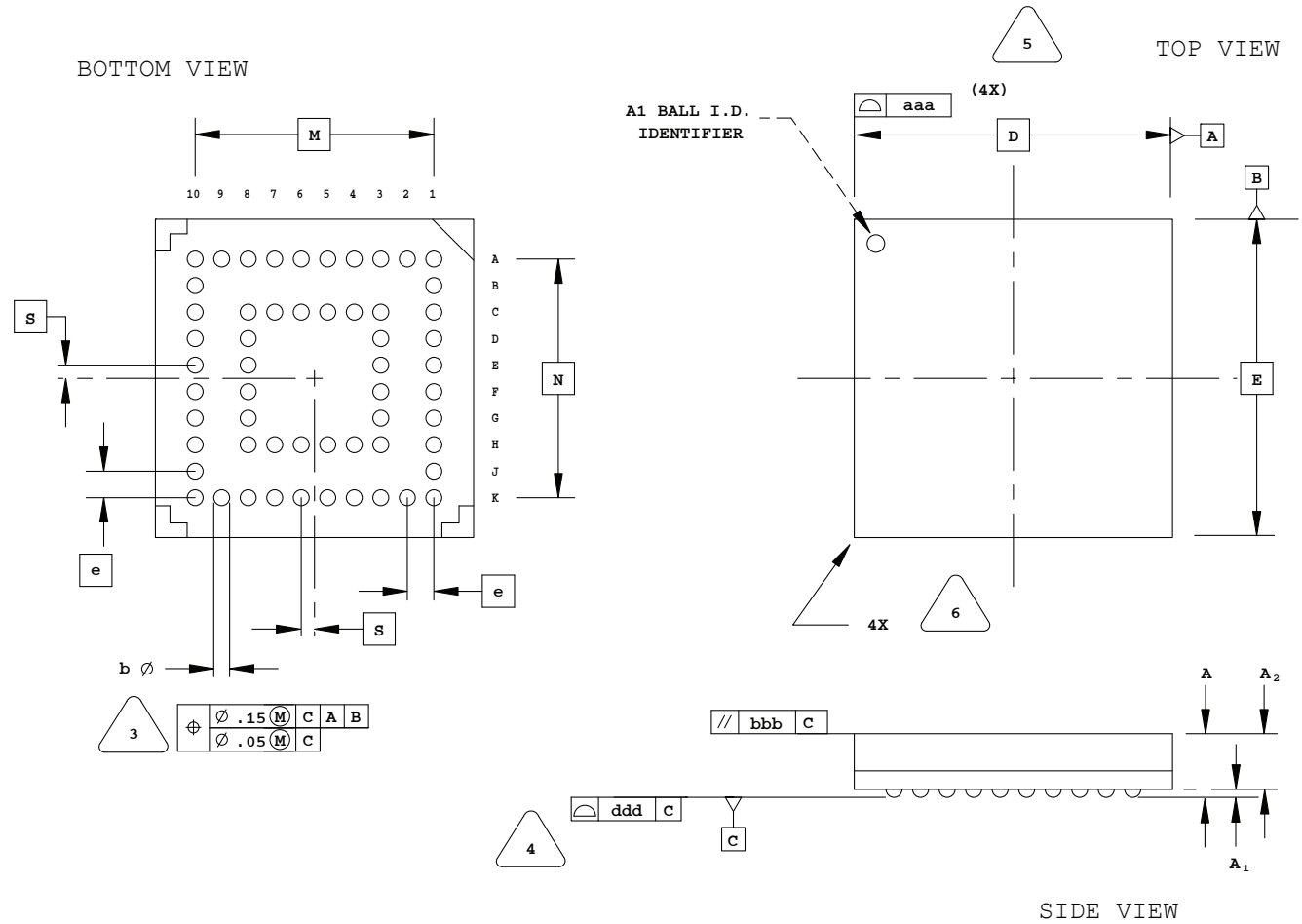
### Notes:

- 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    | -        | -     | 0.600 |
| 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    |       |       |

## 56-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

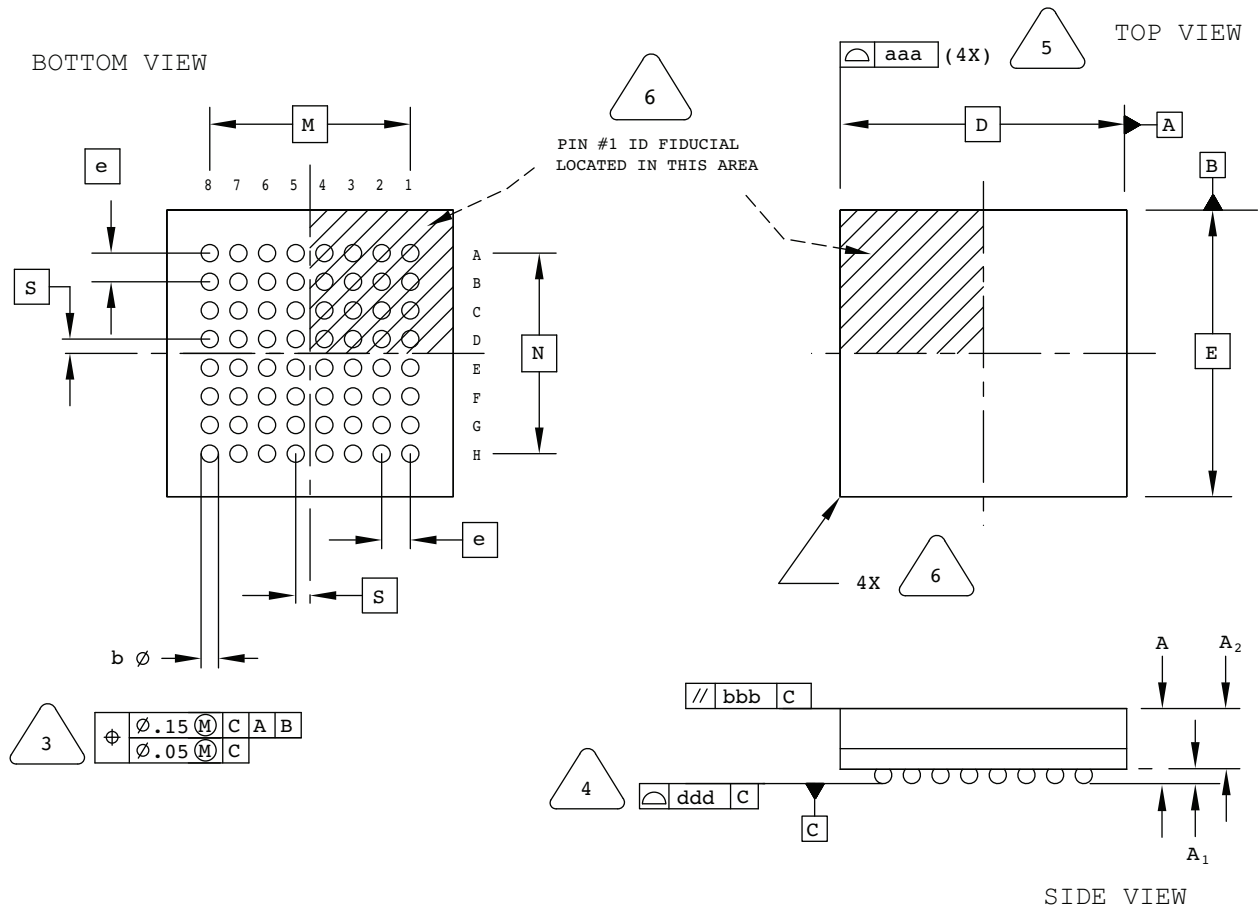
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM  $\square$  C
4. PRIMARY DATUM  $\square$  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 |

## 64-Ball csBGA 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.

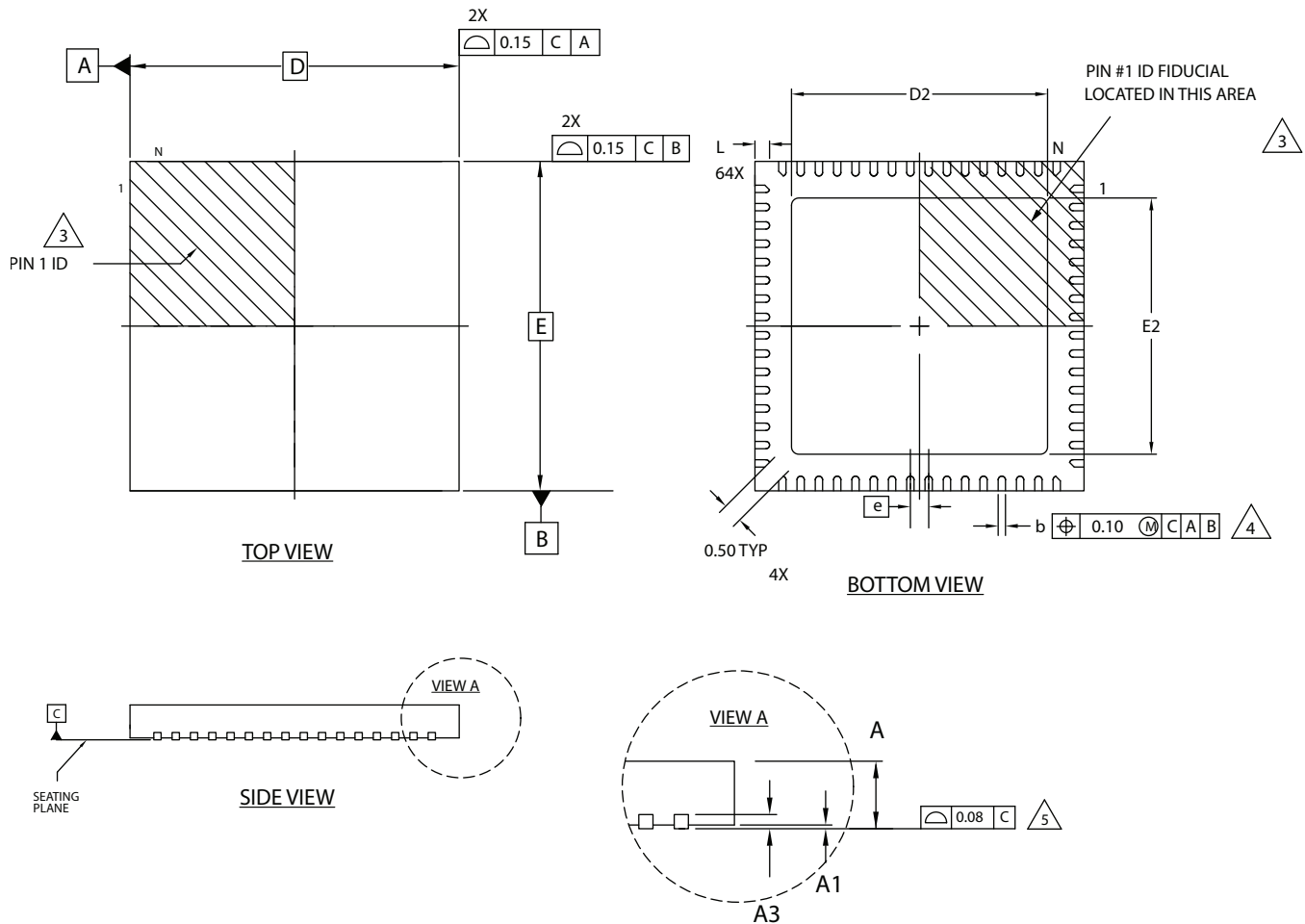


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | 0.90     | 1.00 | 1.10 |
| A1     | 0.15     | -    | -    |
| A2     | -        | -    | 0.85 |
| D/E    | 5.00 BSC |      |      |
| M/N    | 3.50 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 |

## 64-Pin QFNS Package

Dimensions in Millimeters



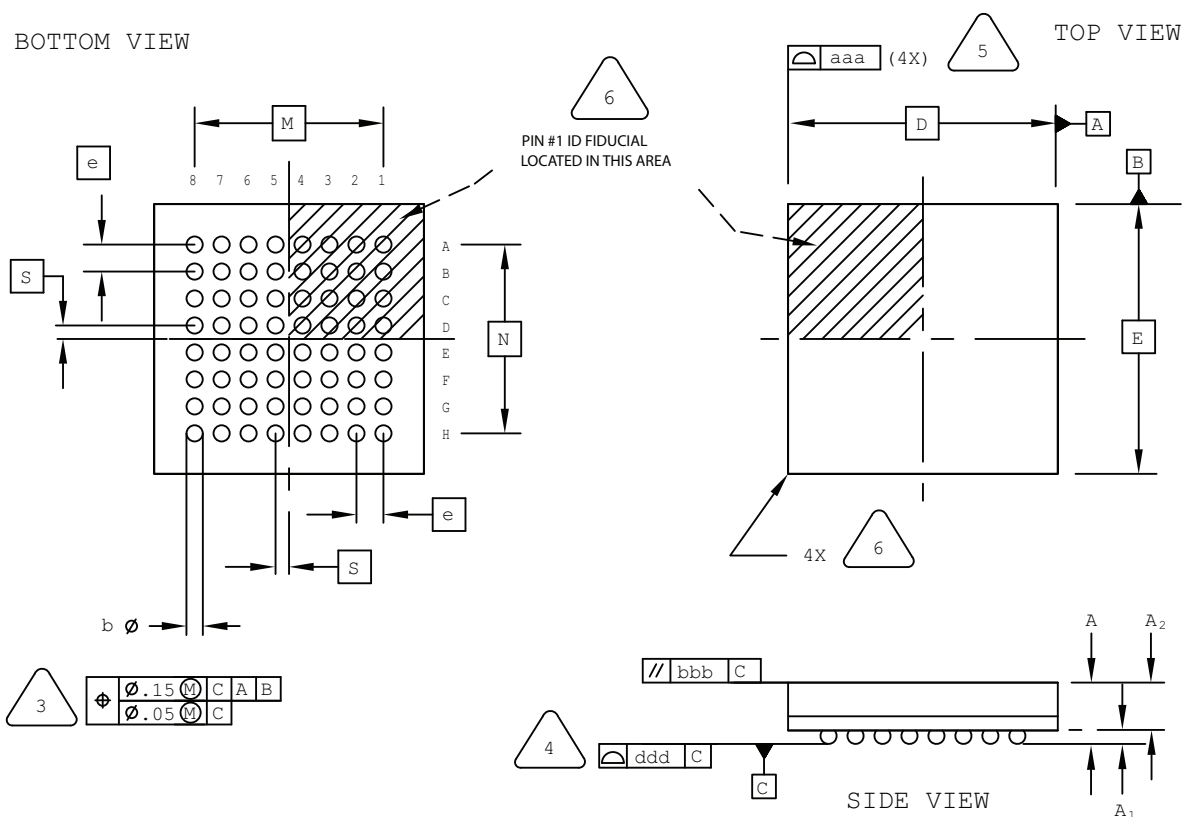
NOTES: UNLESS OTHERWISE SPECIFIED

- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- 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 |

## 64-Ball ucBGA 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.



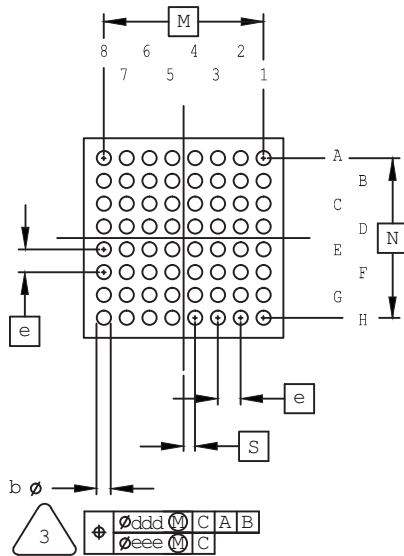
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.00 |
| A1     | 0.10     | -    | -    |
| A2     | -        | -    | 0.90 |
| D/E    | 4.00 BSC |      |      |
| M/N    | 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 |

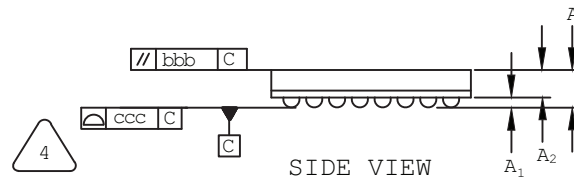
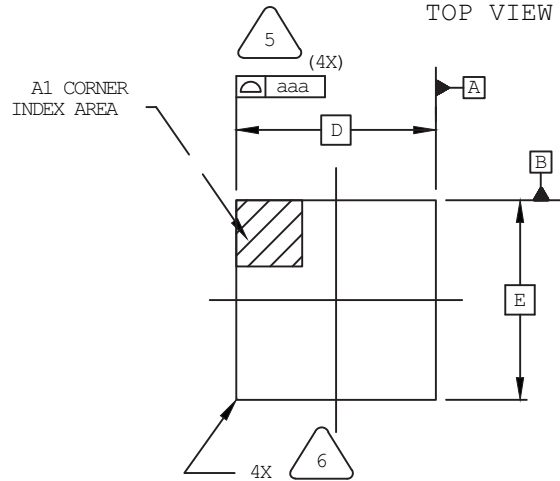
## 64-Ball ucfBGA Package

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.



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.

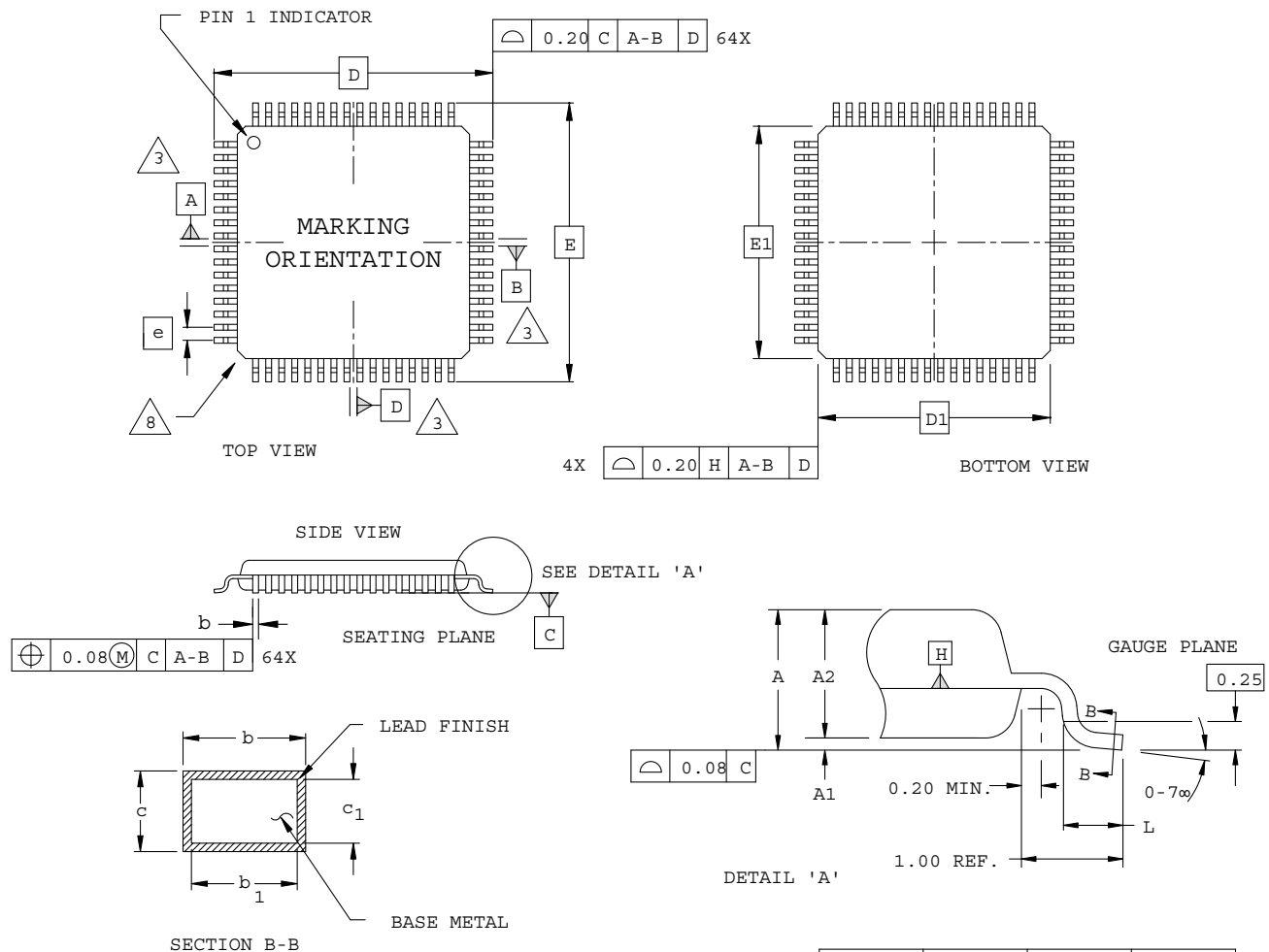


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | –        | –    | 1.00 |
| A1     | 0.11     | –    | –    |
| 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     |      |      |

## 64-Pin TQFP Package

Dimensions in Millimeters



### NOTES:

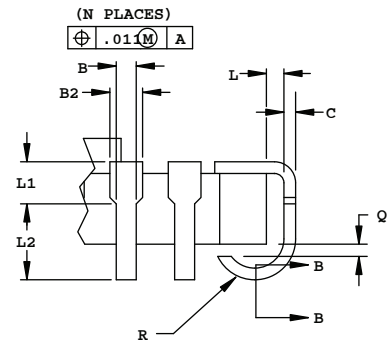
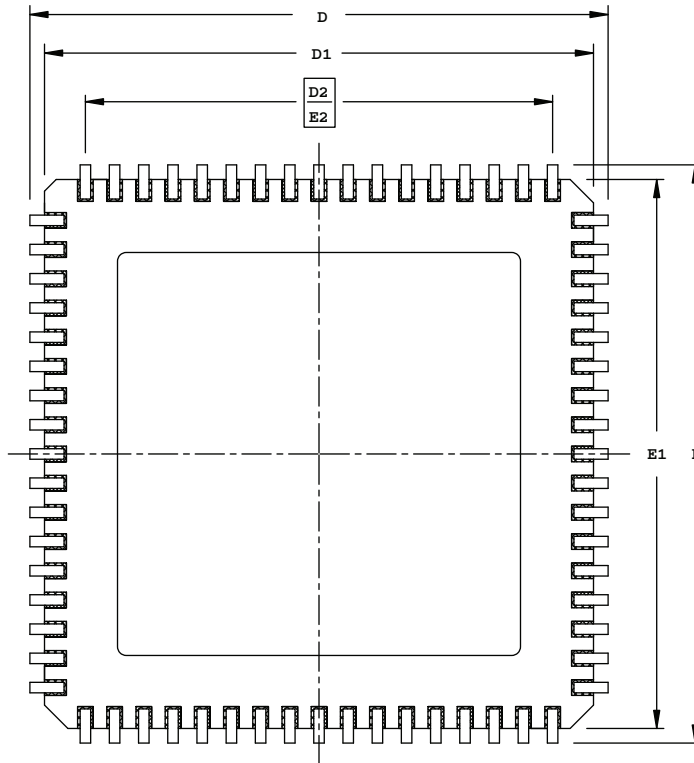
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
2. ALL DIMENSIONS ARE IN MILLIMETERS.
3. DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
4. DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
5. THE TOP OF PACKAGE MAY BE SMALLER 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      | -         | -    | 1.60 |
| 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 |

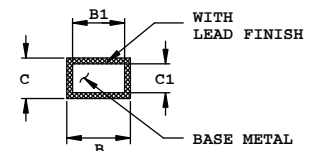
## 68-Pin JLCC Package

Dimensions in Inches

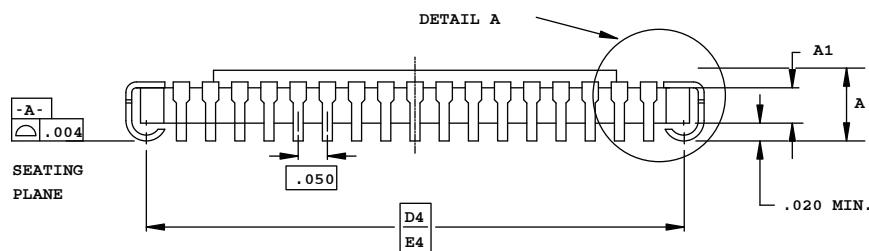
BOTTOM VIEW



DETAIL A



SECTION B-B



SIDE VIEW

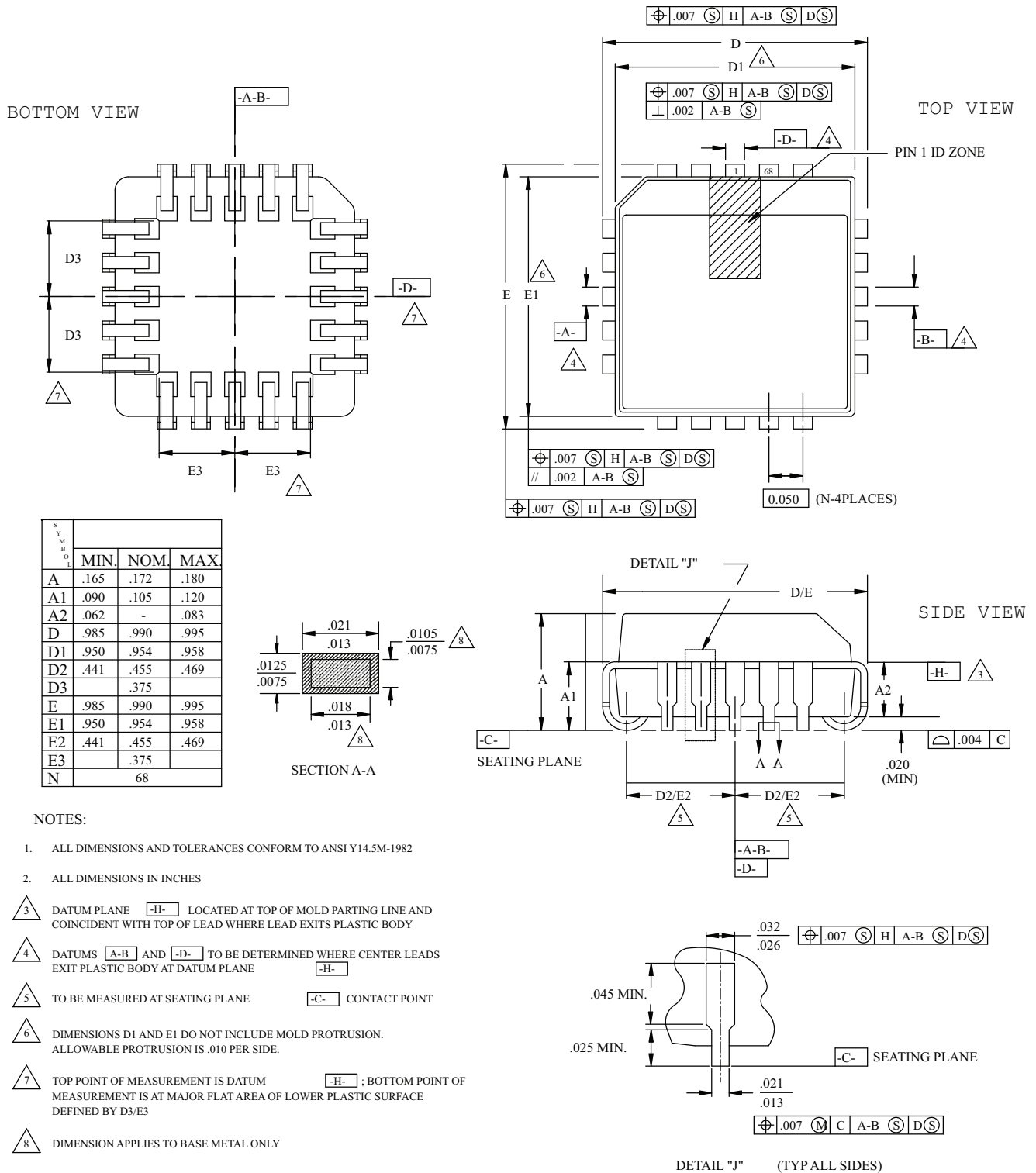
### NOTES:

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

| SYMBOL | 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 | 1.000 |
| 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       |      |       |

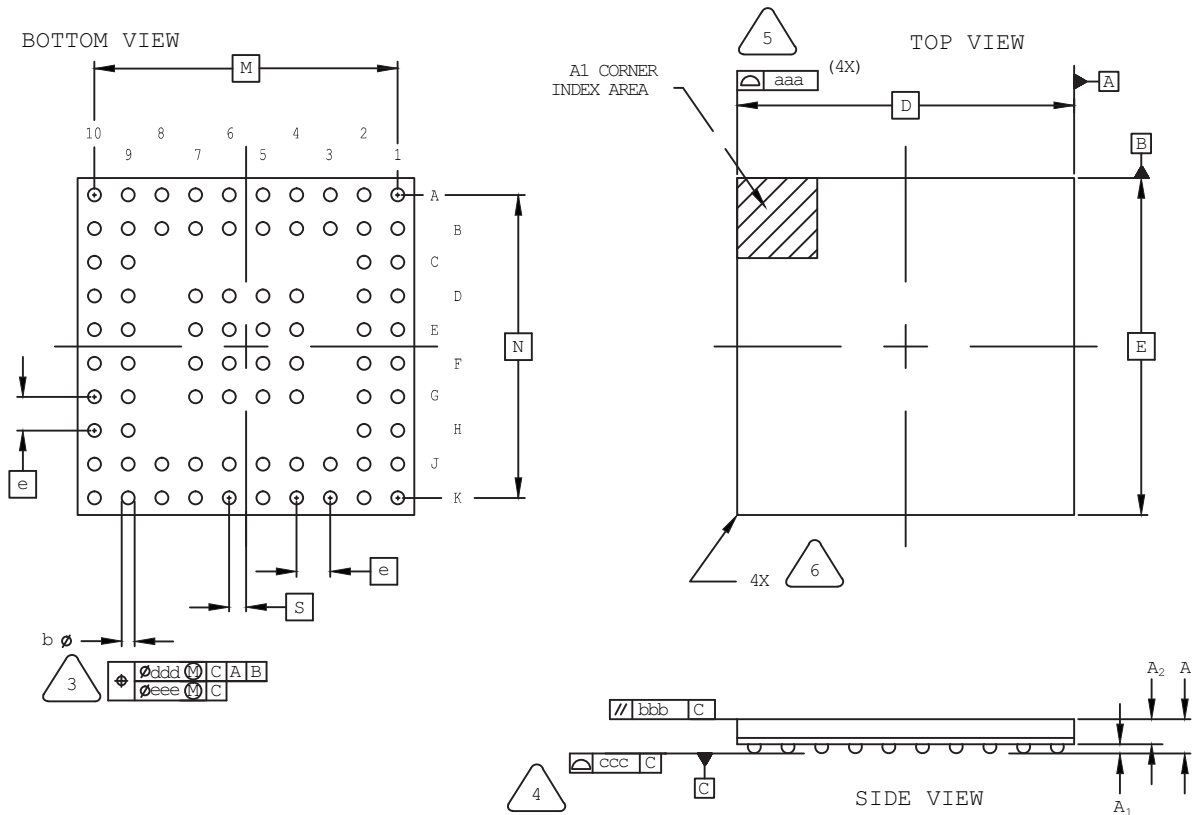
## 68-Pin PLCC Package

Dimensions in Inches



## 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.

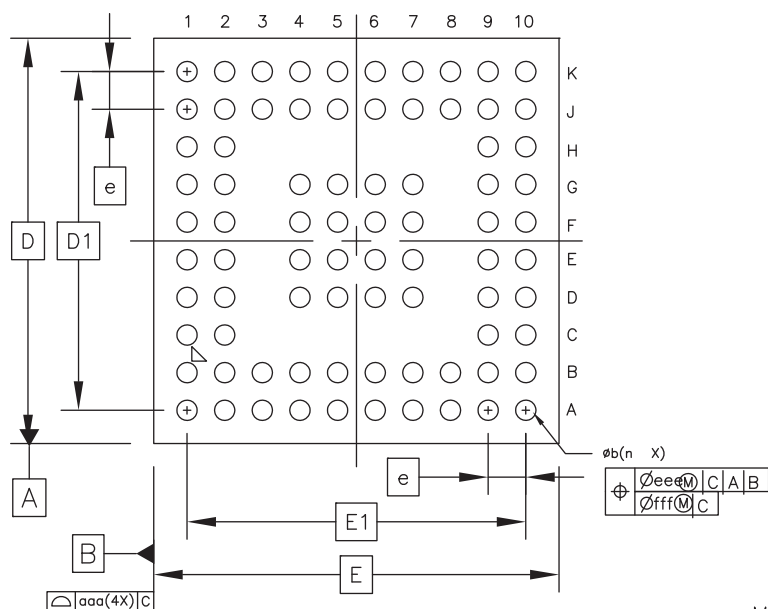
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C].
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE 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      |      |      |

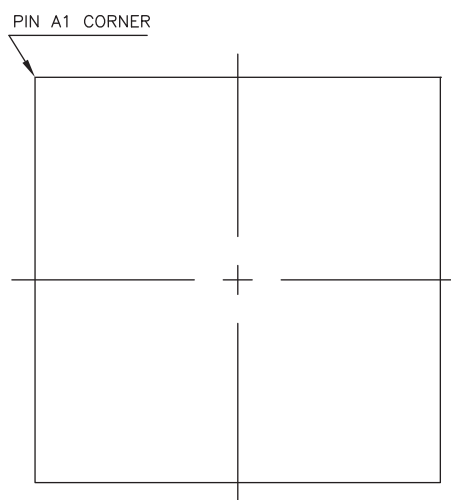
## 80-Ball ckgBGA Package

### Dimensions in Millimeters

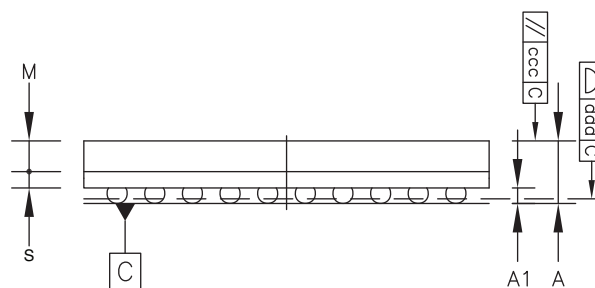
BOTTOM VIEW



TOP VIEW



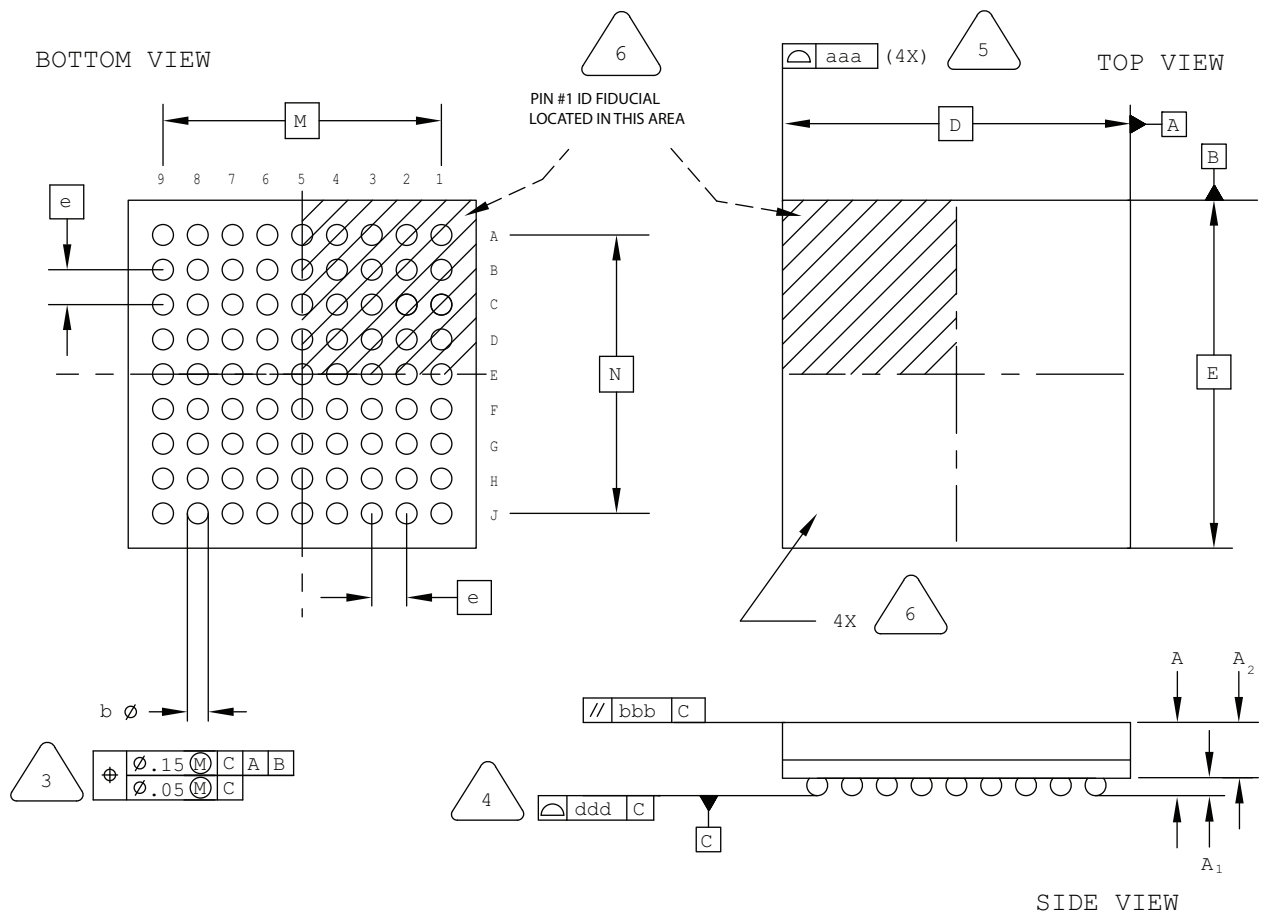
SIDE VIEW



|                              |   | 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             |       |       |

## 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.

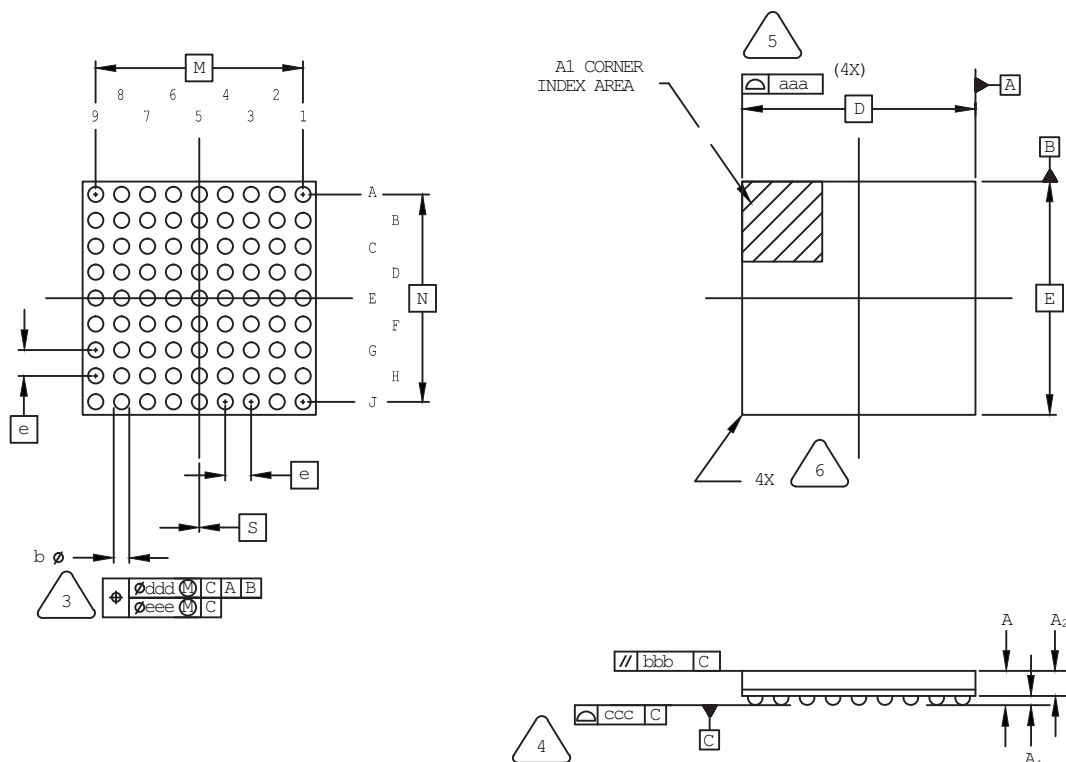
BILATERAL TOLERANCE ZONE IS APPLIED  
TO EACH SIDE OF THE PACKAGE BODY.

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 |

## 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.



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.

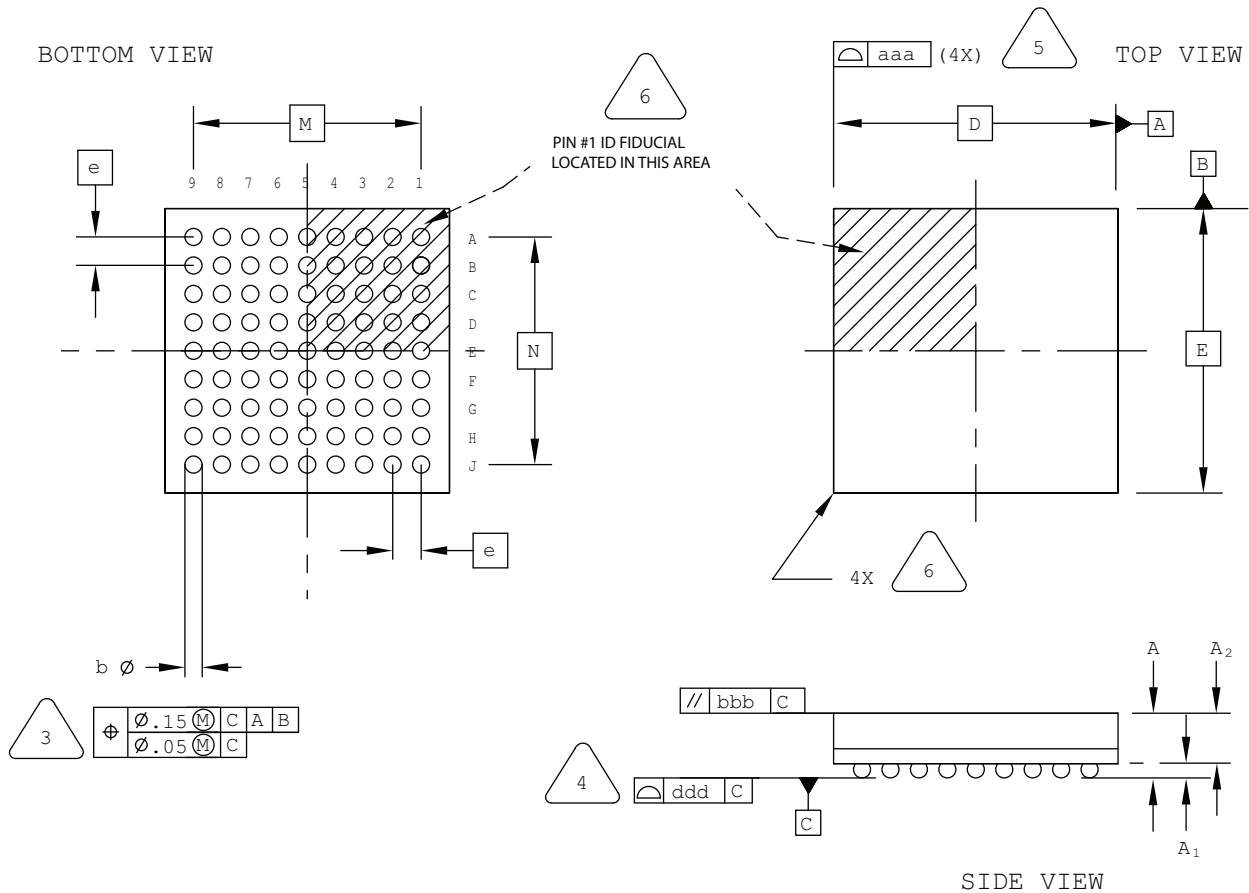


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.00 |
| A1     | 0.11     | -    | -    |
| 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     |      |      |

# 81-Ball ucBGA 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.

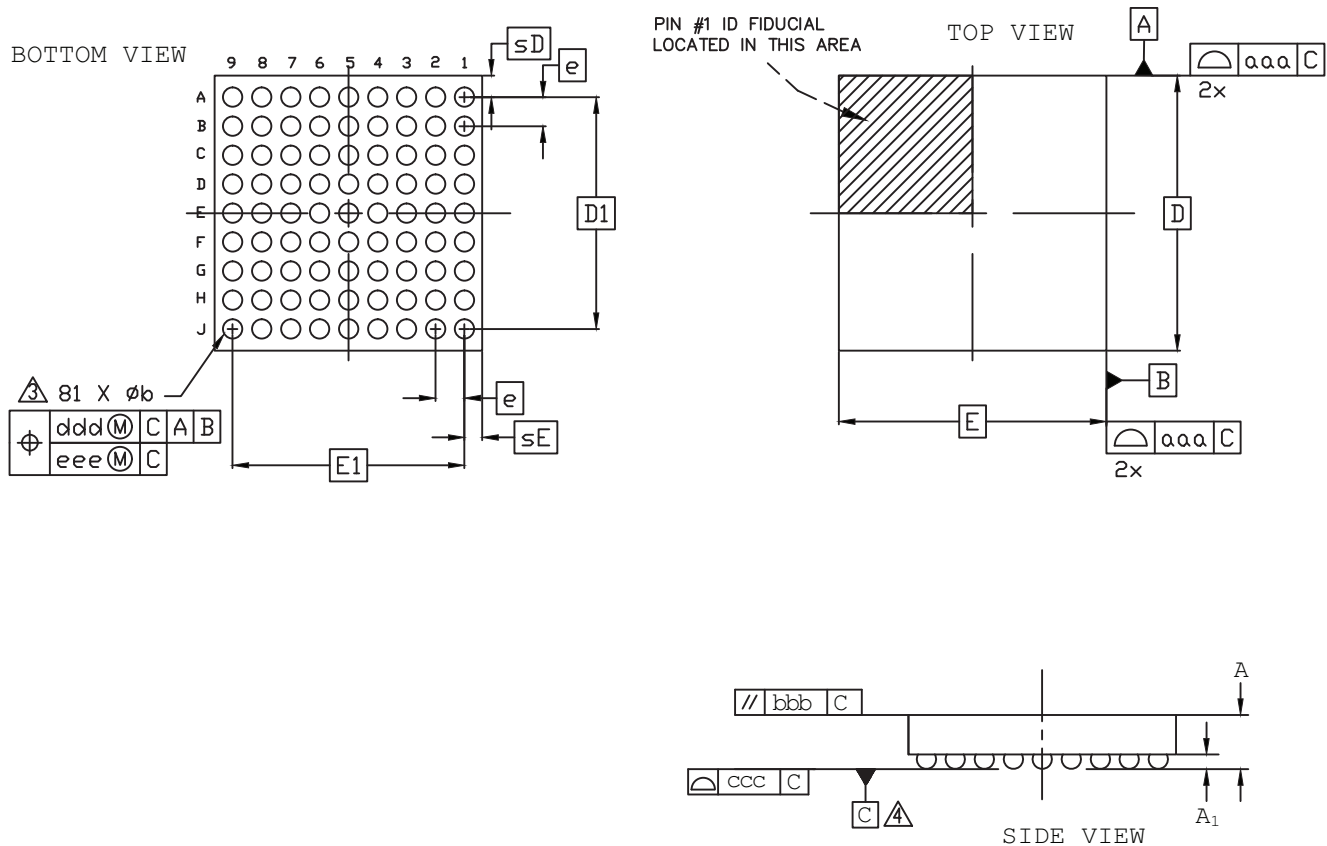


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 81-Ball WLCS Package

Dimensions in Millimeters



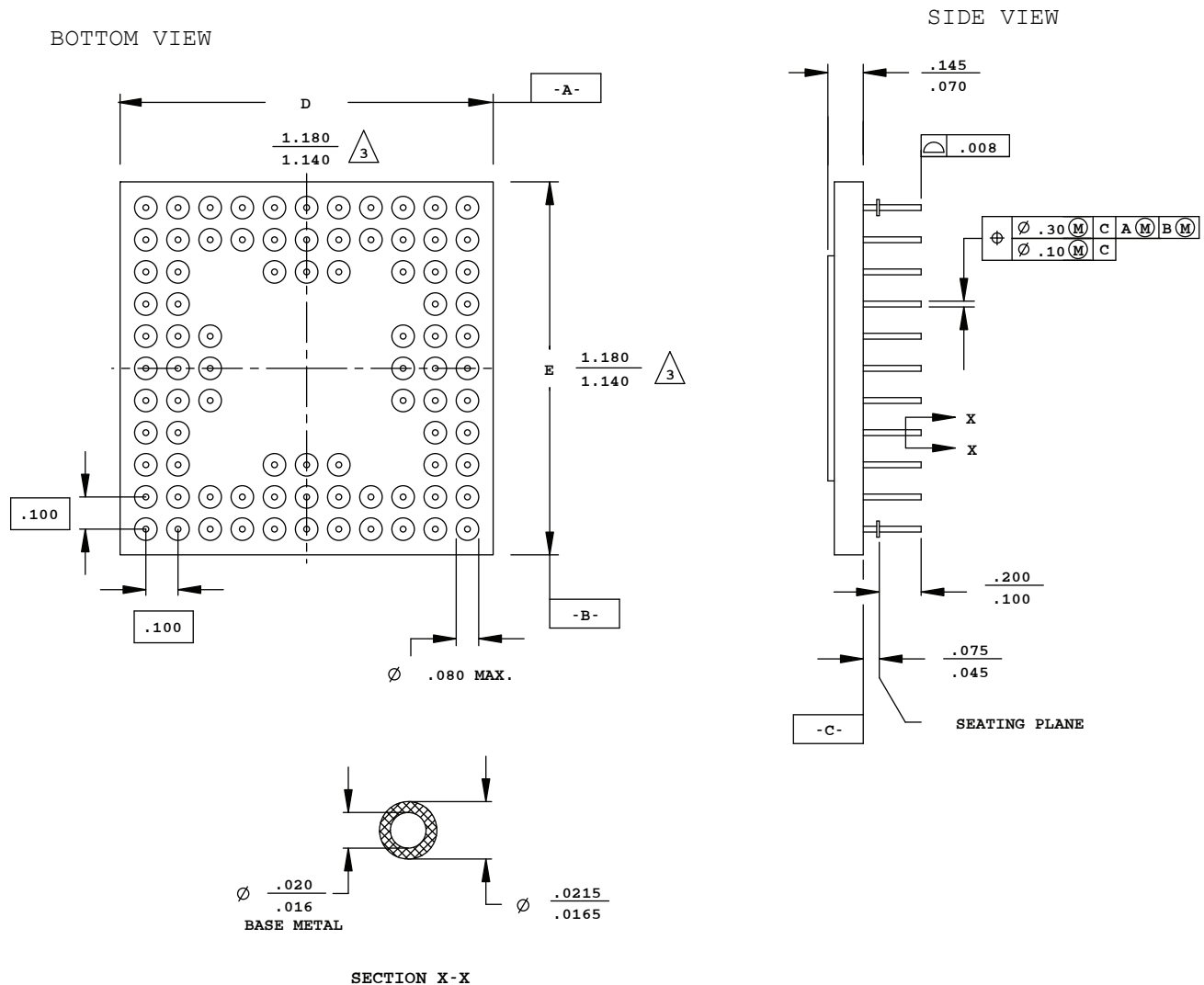
### Notes:

- 1 ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M - 1994.
- 2 ALL DIMENSIONS ARE IN MILLIMETERS.
- $\Delta$  DIMENSION "b" IS MEASURED AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].
- $\Delta$  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     |       |       |

## 84-Pin CPGA Package

Dimensions in Inches



### NOTES :

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.

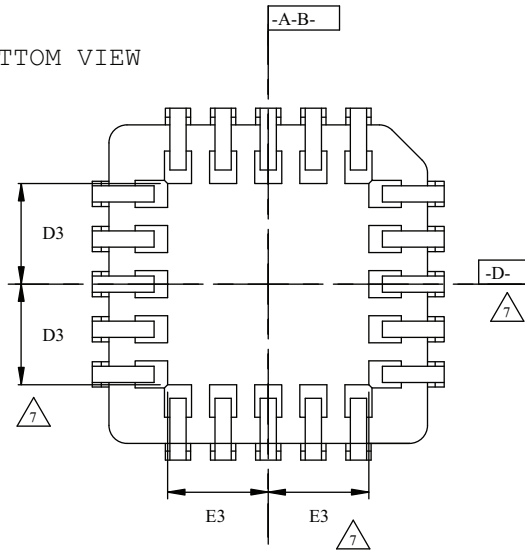


DIMENSIONS D AND E MAY HAVE MATERIAL PROTRUSION OF .006 INCHES MAXIMUM ABOVE THE DIMENSION SHOWN NOT TO EXCEED .003 INCHES MAXIMUM PER SIDE.

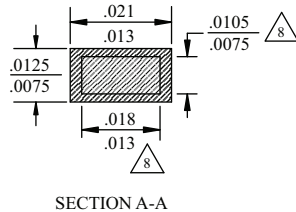
# 84-Pin PLCC Package

Dimensions in Inches

BOTTOM VIEW



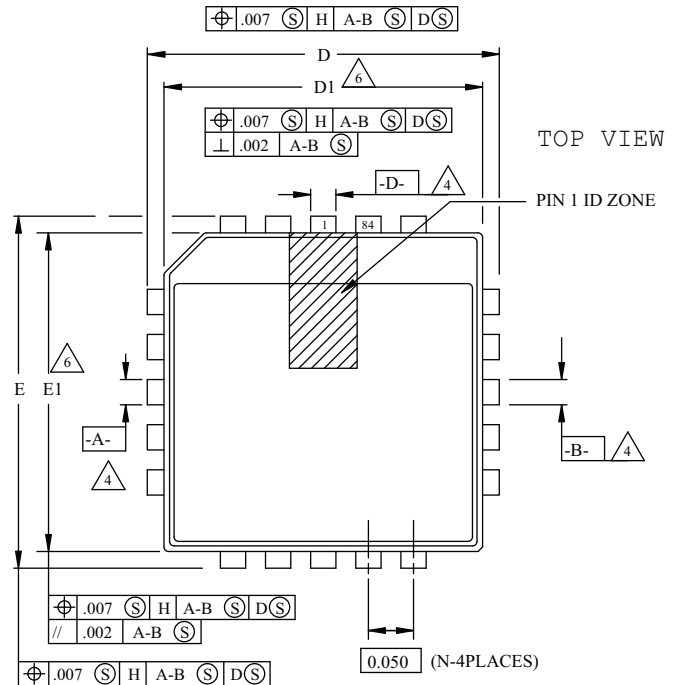
|    | MIN.  | NOM.  | MAX.  |
|----|-------|-------|-------|
| A  | .165  | .172  | .180  |
| A1 | .090  | .105  | .120  |
| A2 | .059  | -     | .080  |
| D  | 1.185 | 1.190 | 1.195 |
| D1 | 1.150 | 1.154 | 1.158 |
| D2 | .541  | .555  | .569  |
| D3 |       | .475  |       |
| E  | 1.185 | 1.190 | 1.195 |
| E1 | 1.150 | 1.154 | 1.158 |
| E2 | .541  | .555  | .569  |
| E3 |       | .475  |       |
| N  | 84    |       |       |



SECTION A-A

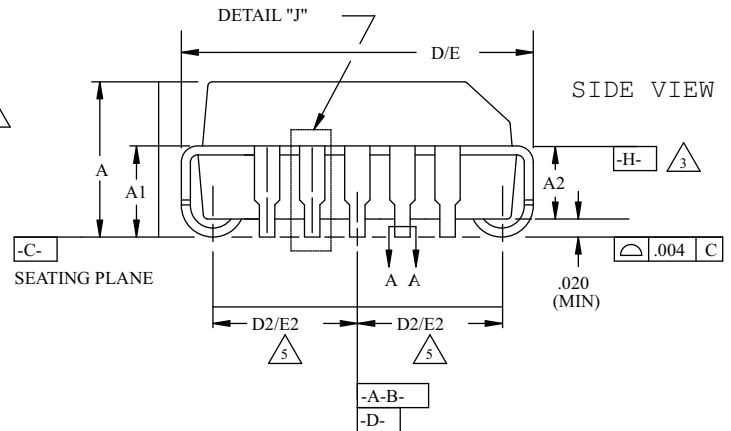
## NOTES:

- ALL DIMENSIONS AND TOLERANCES CONFORM TO ANSI Y14.5M-1982
- ALL DIMENSIONS IN INCHES
- DATUM PLANE **-H-** LOCATED AT TOP OF MOLD PARTING LINE AND COINCIDENT WITH TOP OF LEAD WHERE LEAD EXITS PLASTIC BODY
- DATUMS **-A-B-** AND **-D-** TO BE DETERMINED WHERE CENTER LEADS EXIT PLASTIC BODY AT DATUM PLANE **-H-**
- TO BE MEASURED AT SEATING PLANE **-C-** CONTACT POINT
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE PROTRUSION IS .010 PER SIDE.
- TOP POINT OF MEASUREMENT IS DATUM **-H-**; BOTTOM POINT OF MEASUREMENT IS AT MAJOR FLAT AREA OF LOWER PLASTIC SURFACE DEFINED BY D3/E3
- DIMENSION APPLIES TO BASE METAL ONLY



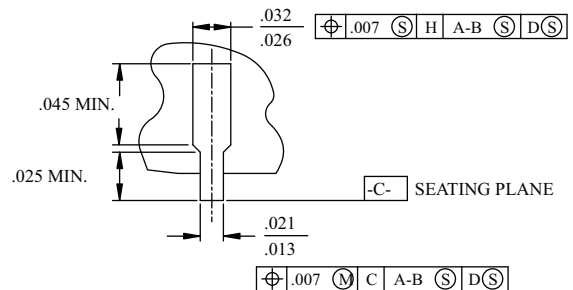
TOP VIEW

PIN 1 ID ZONE



SIDE VIEW

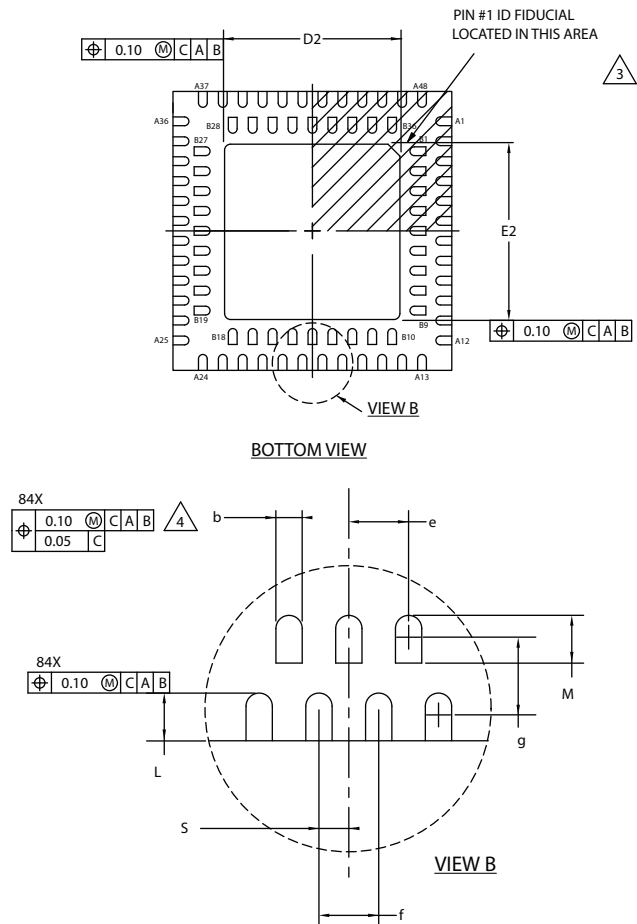
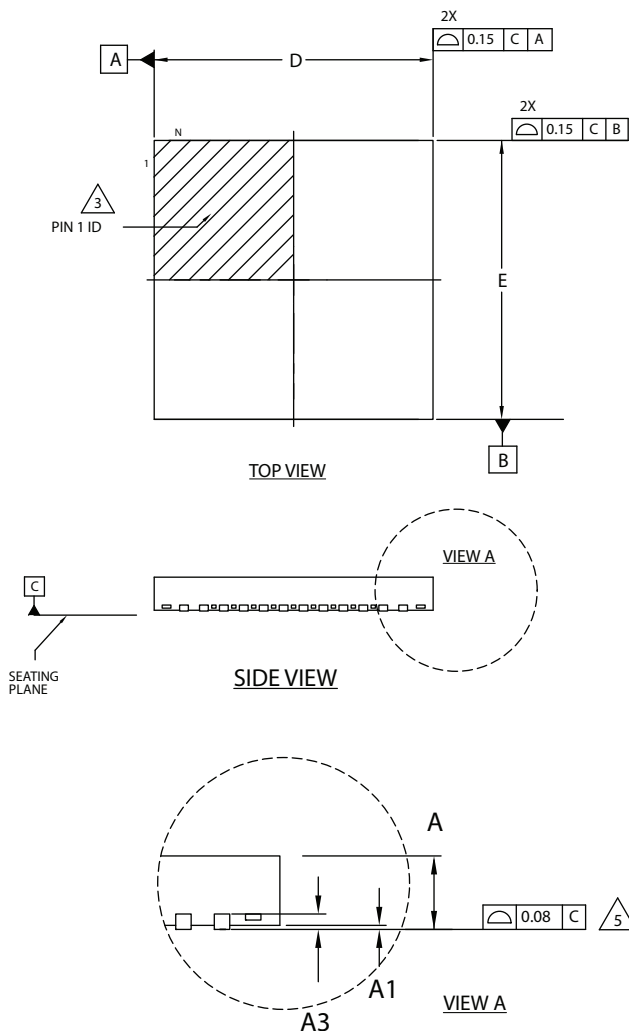
SEATING PLANE



DETAIL "J" (TYP ALL SIDES)

## 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.

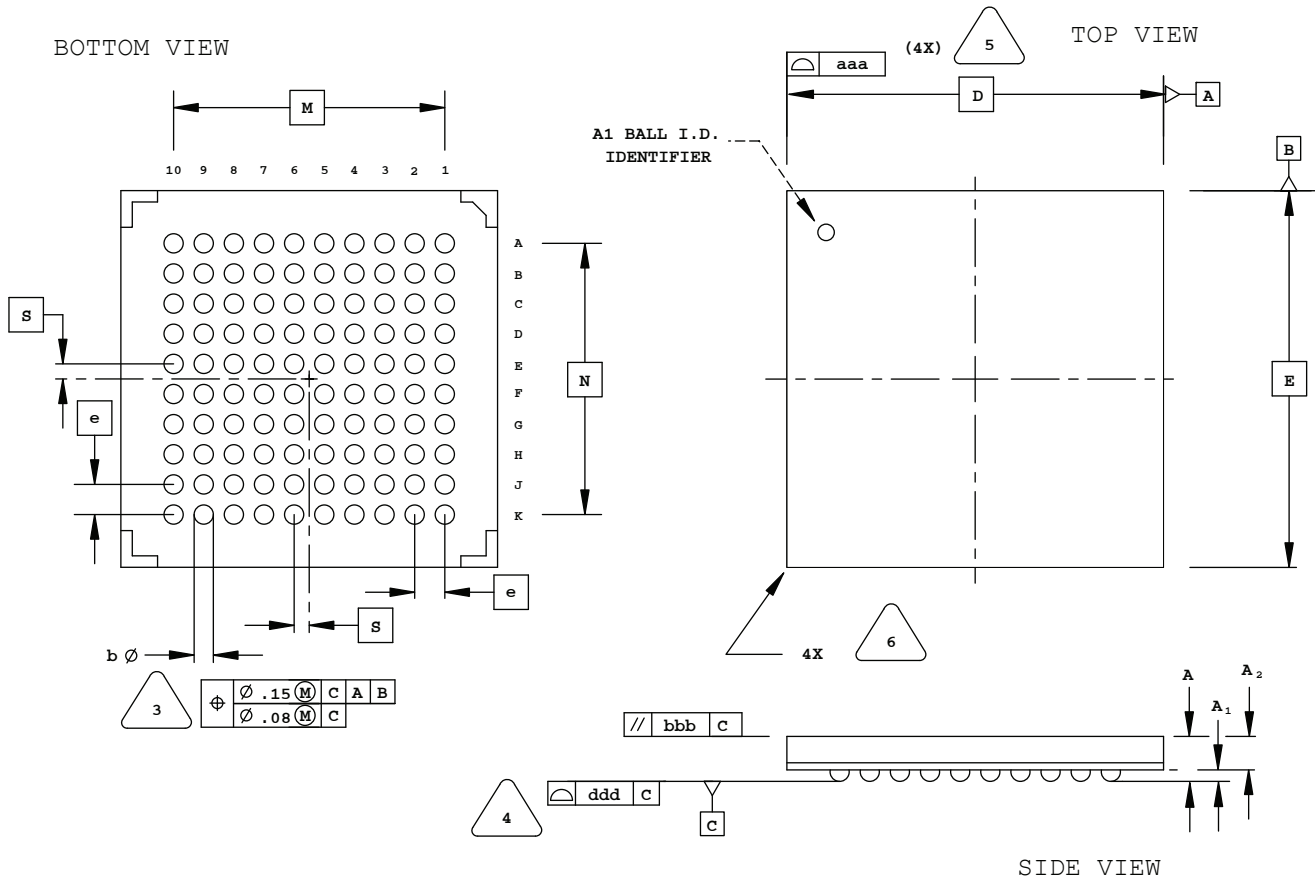
4 DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

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 |

## 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.

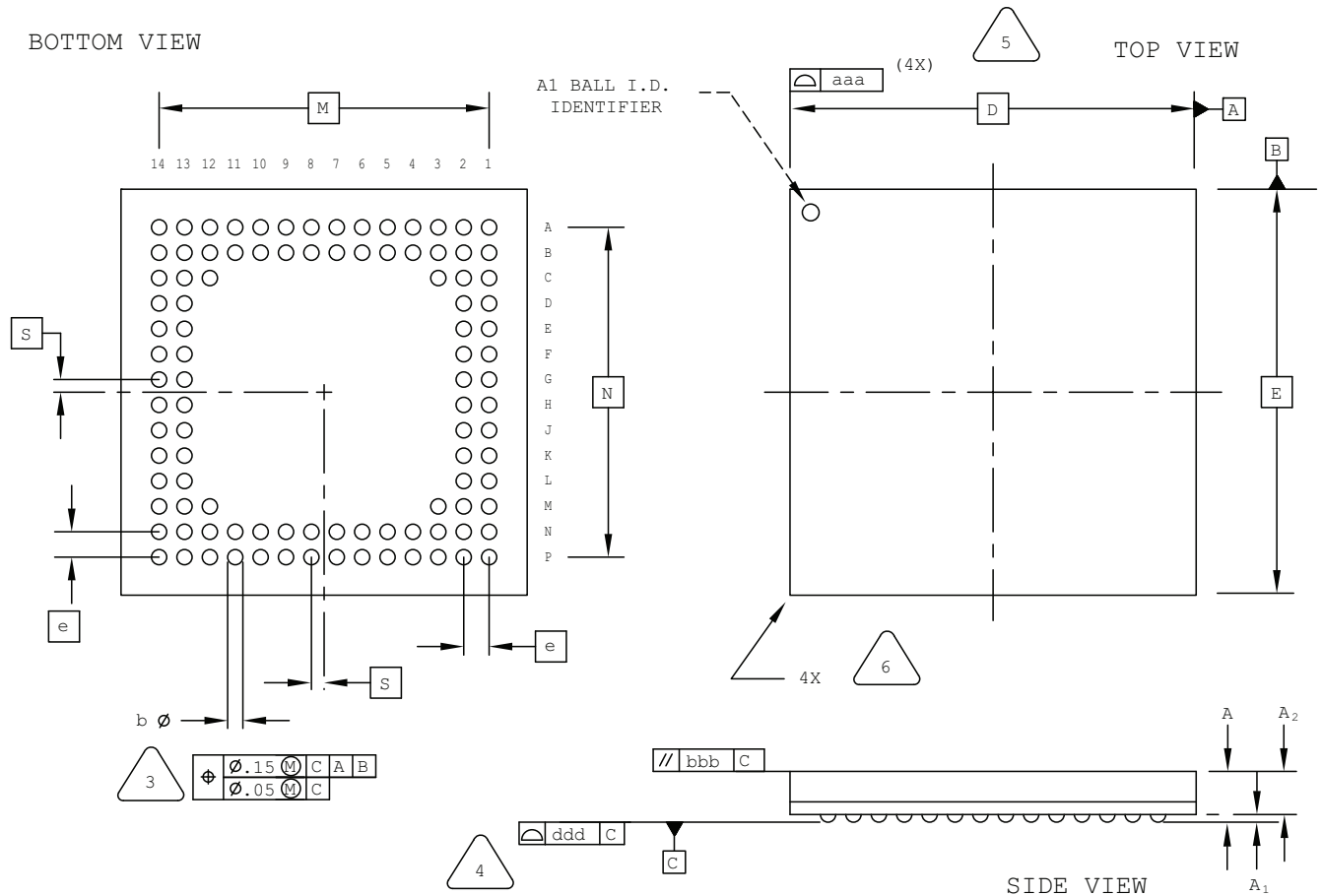


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 100-Ball csBGA Package

## Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

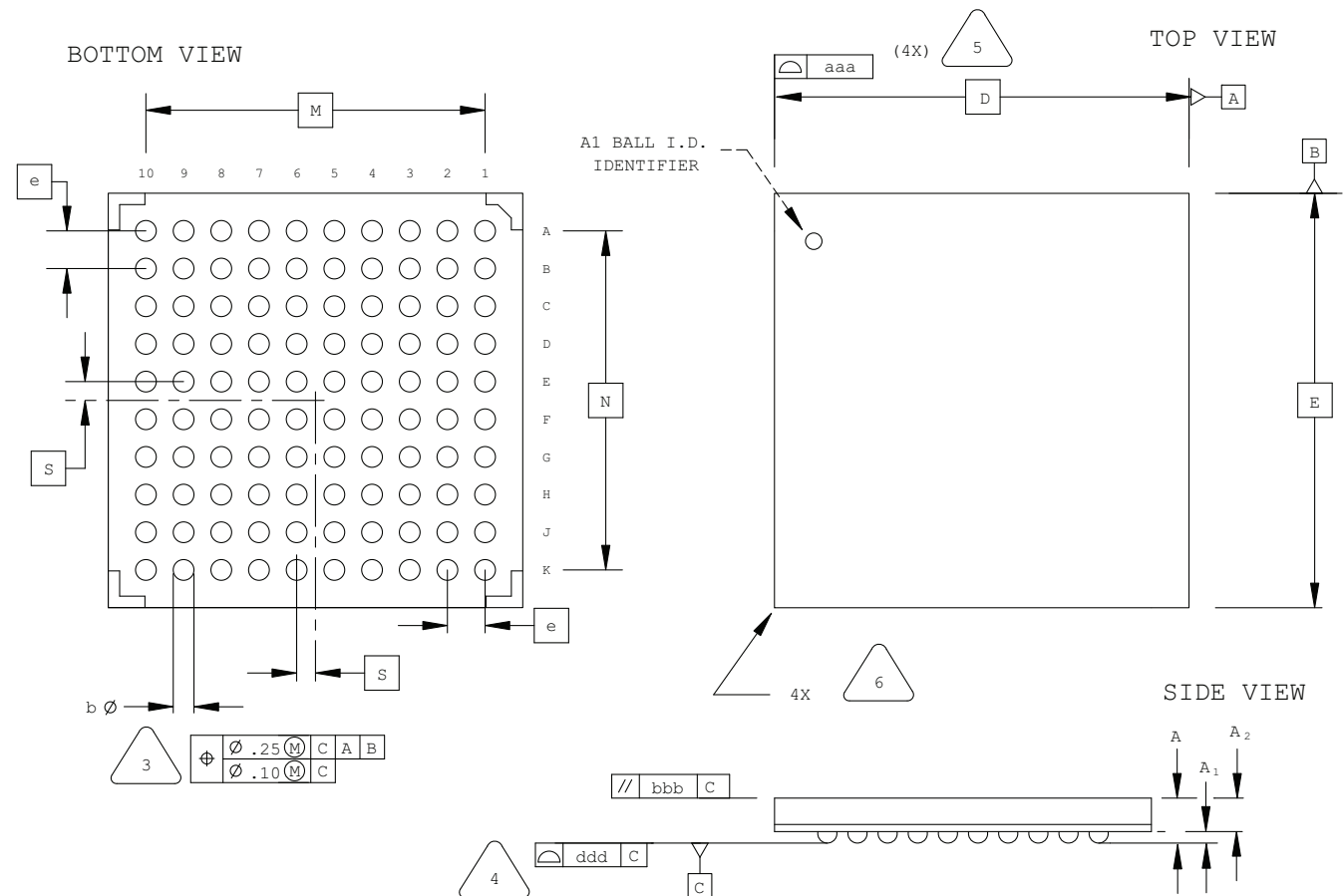
1. DIMENSIONS AND TOLERANCES  
PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

- 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     | 1.23 | 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 |

## 100-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

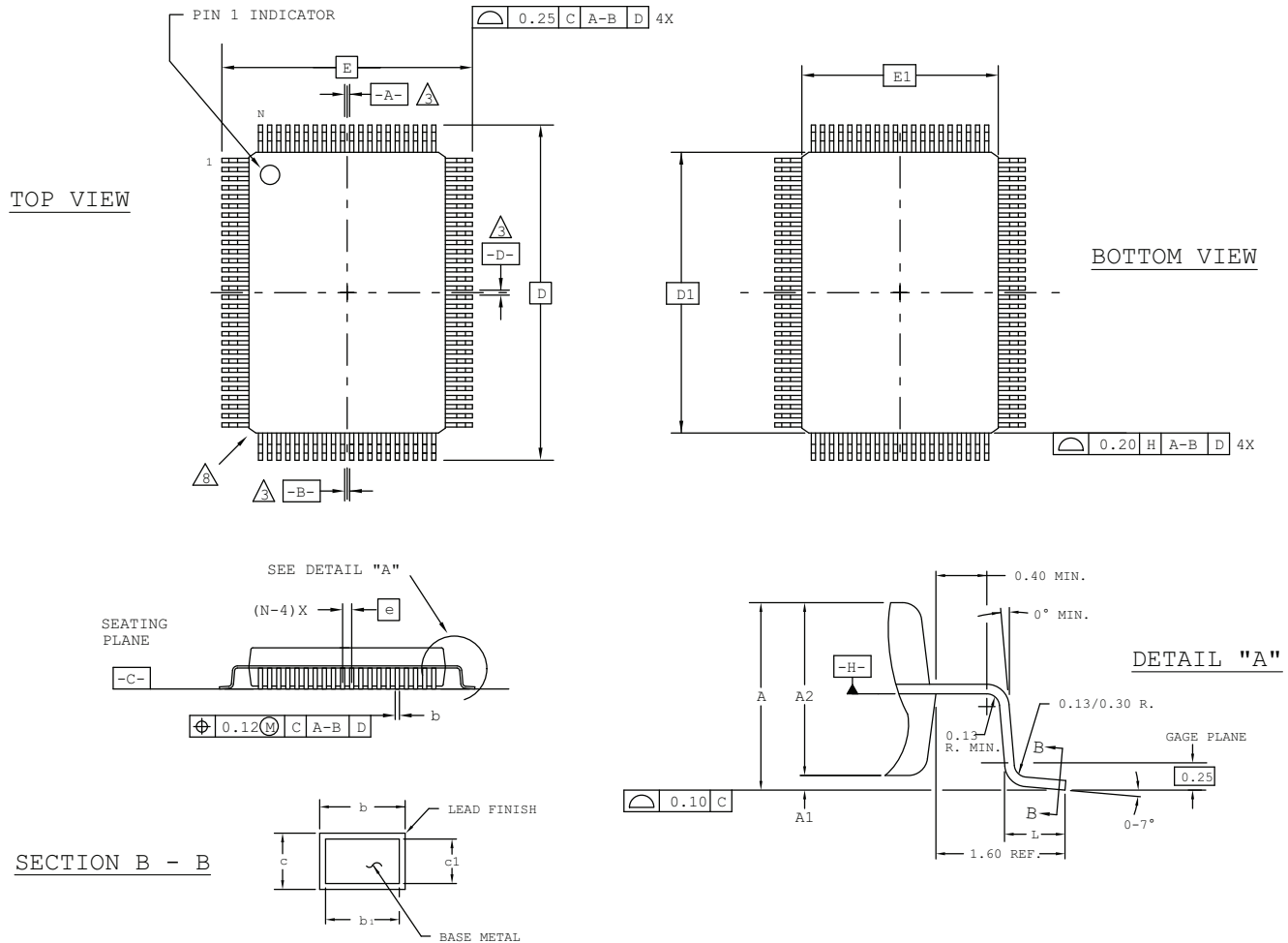
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.

- 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.
- 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 |

## 100-Pin PQFP Package

Dimensions in Millimeters



### NOTES:

1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.

2.0 ALL DIMENSIONS ARE IN MILLIMETERS.

3.0 DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.

4.0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.

5.0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.

6.0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.

7.0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.

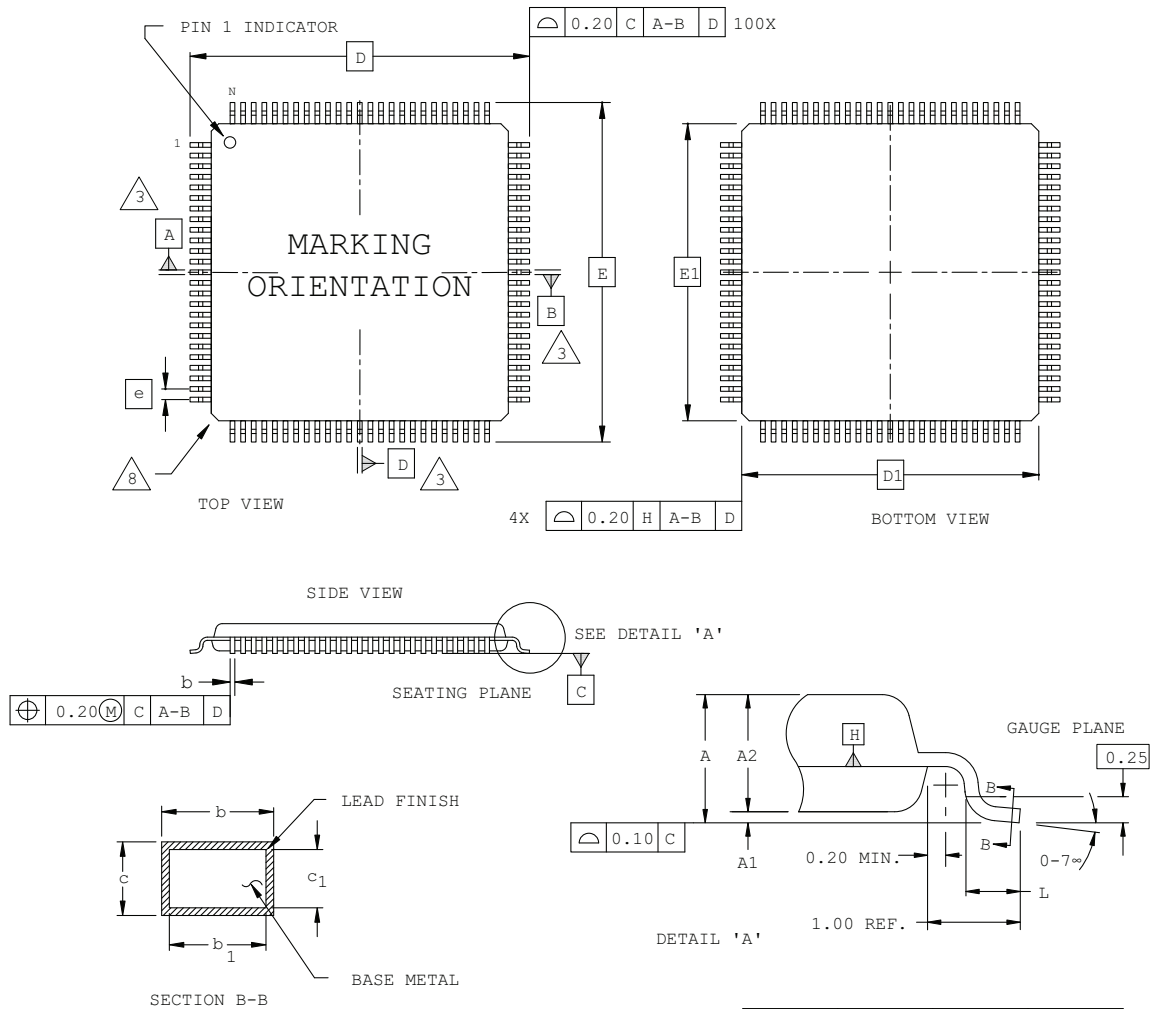
8.0 EXACT SHAPE OF EACH CORNER IS OPTIONAL.

9.0 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 |

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

Dimensions in Millimeters



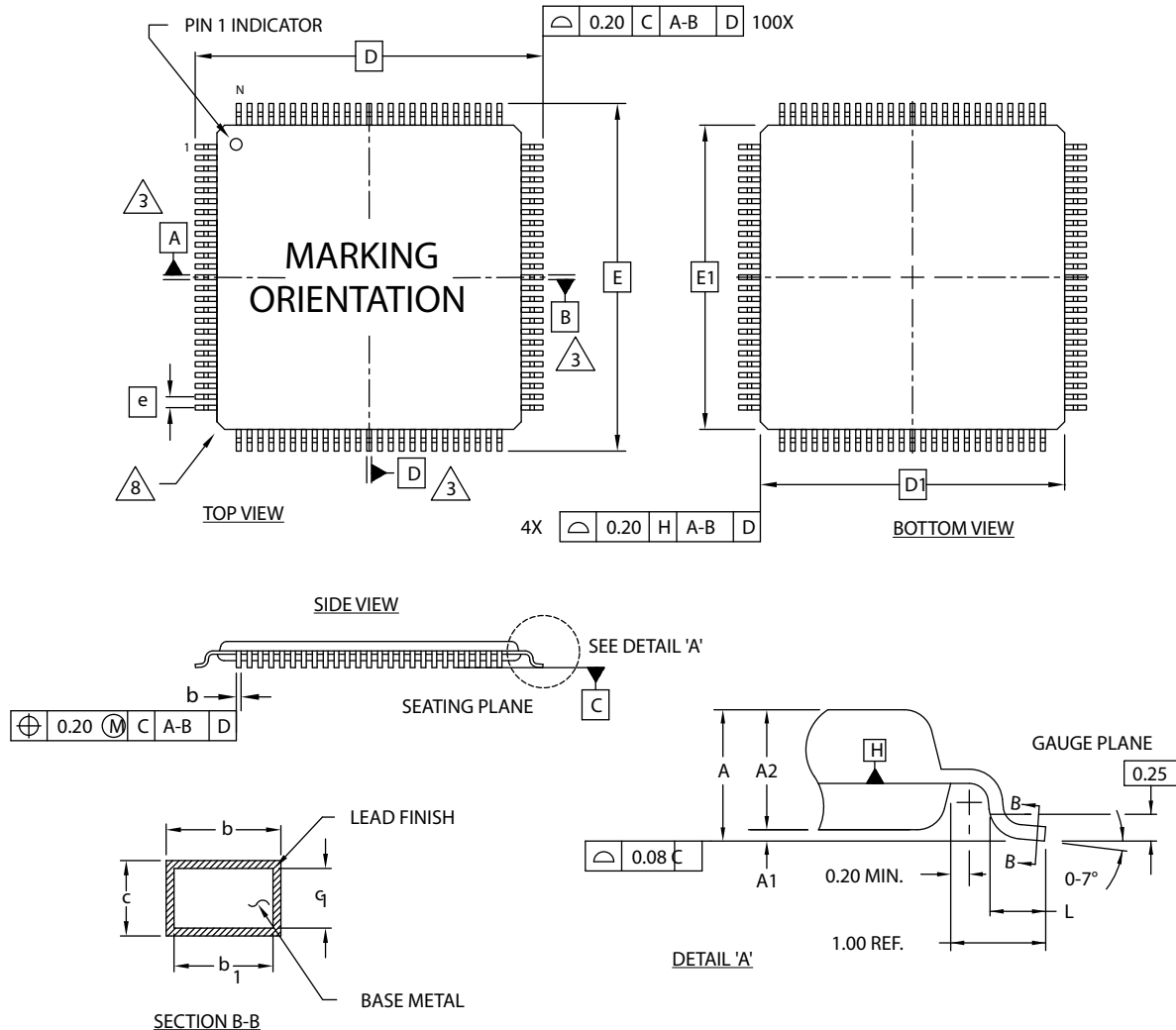
### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 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.

| 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      | 100       |      |      |
| 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 |

# 100-Pin VQFP Package Option 2: iCE40

Dimensions in Millimeters

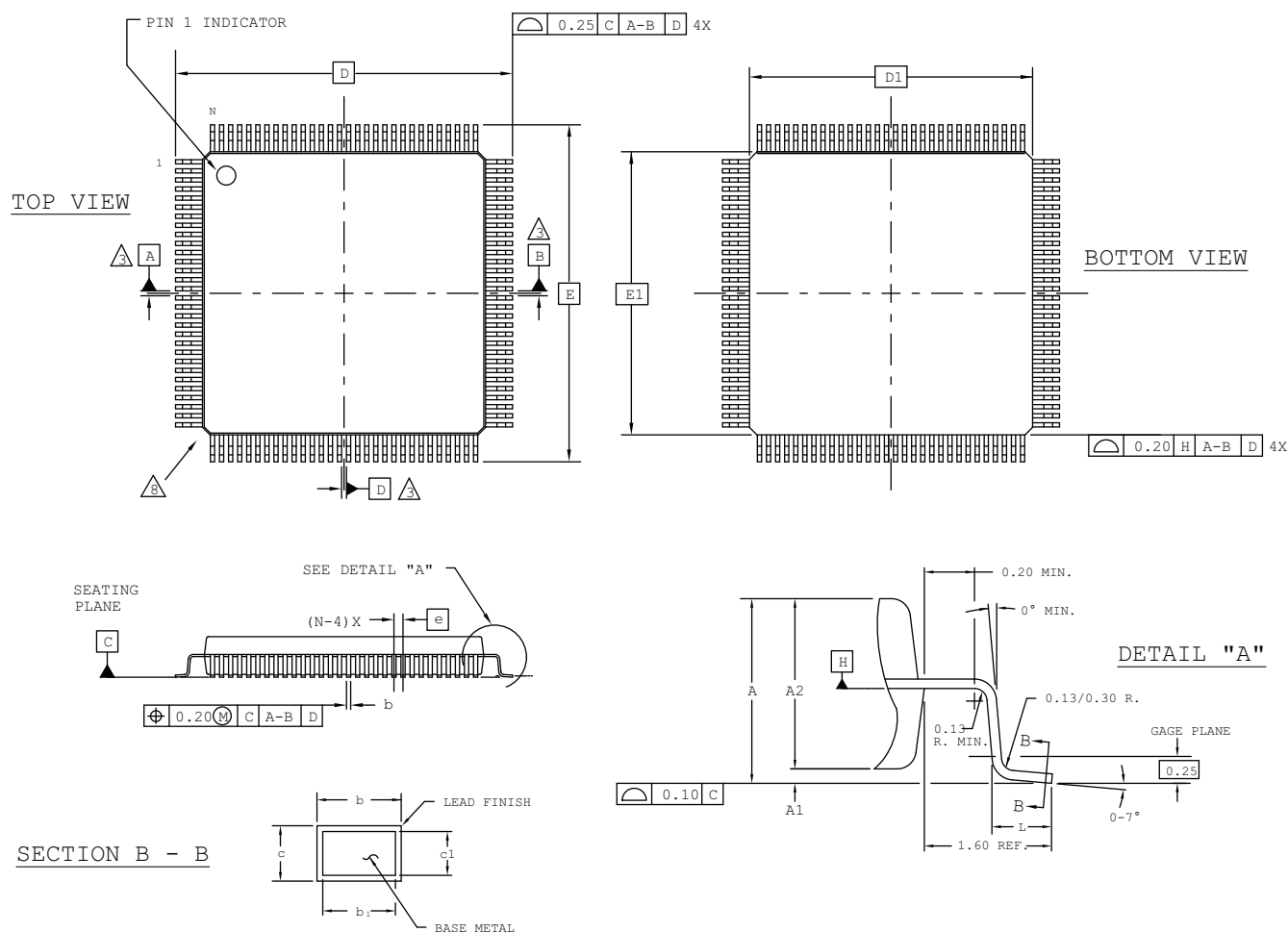


## NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 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.

## 120-Pin PQFP Package

Dimensions in Millimeters



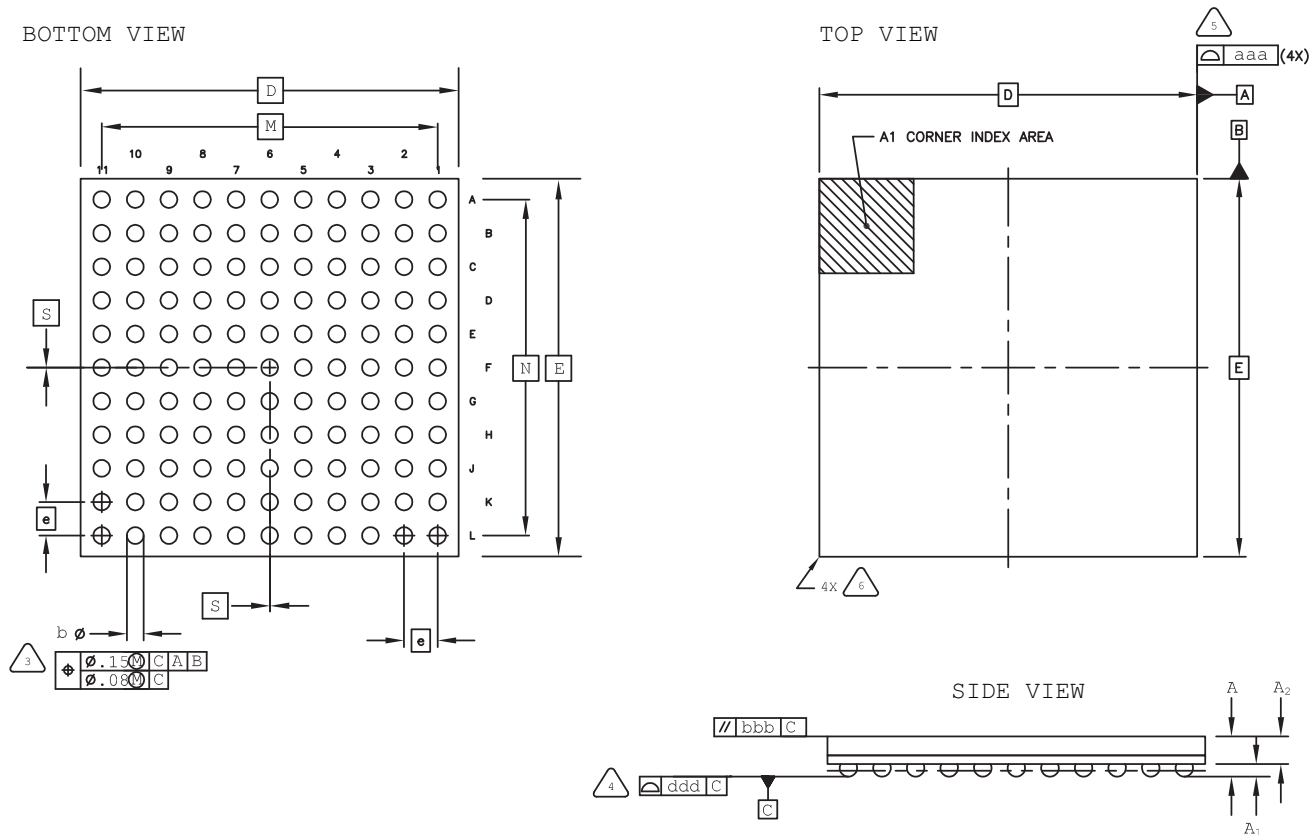
### NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 2.0 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3.0 DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 4.0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 5.0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 6.0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 7.0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- 8.0 EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- 9.0 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 |

## 121-Ball caBGA Package (9x9 mm Body)

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.

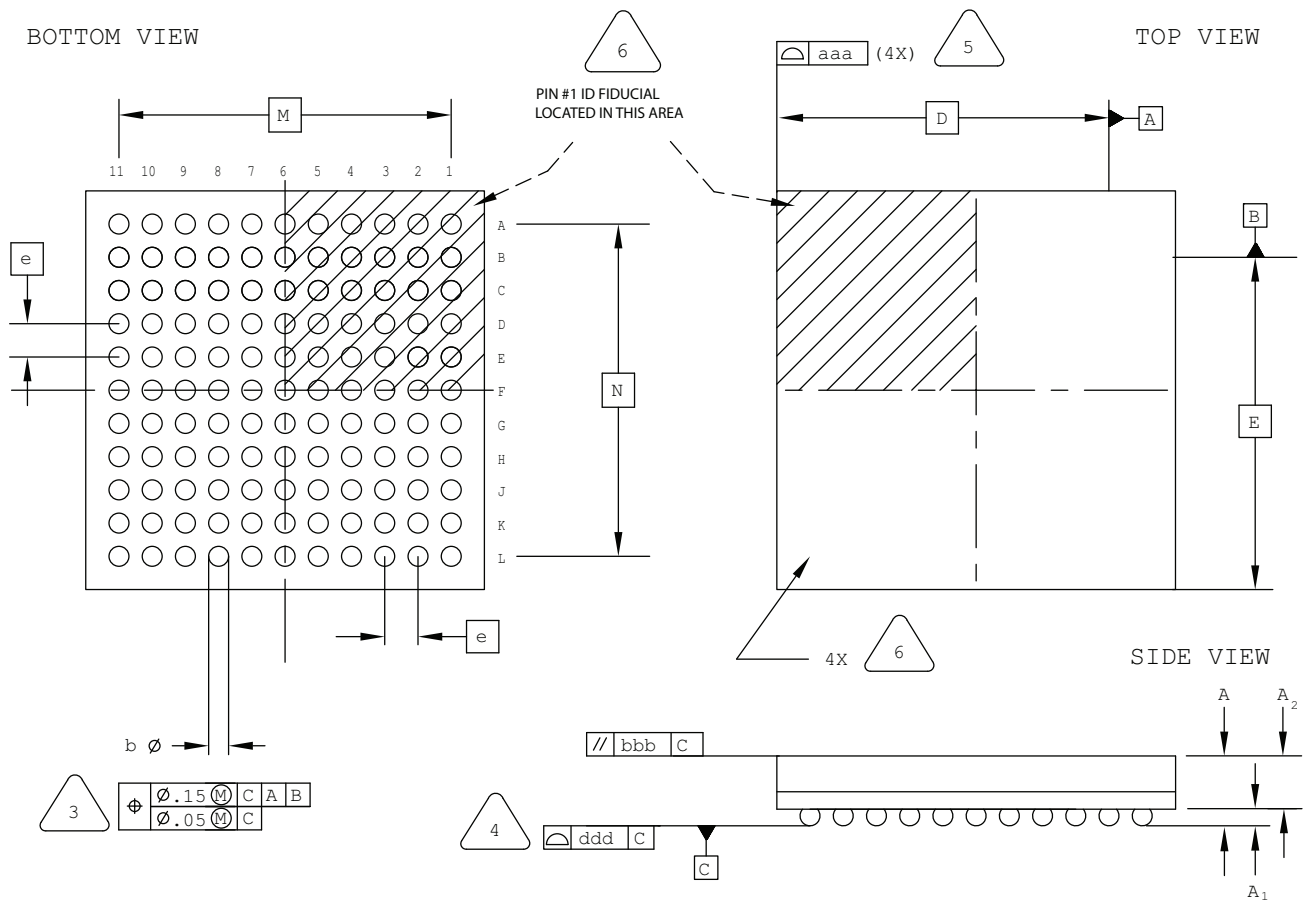


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.10 |
| 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     |      |      |

## 121-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

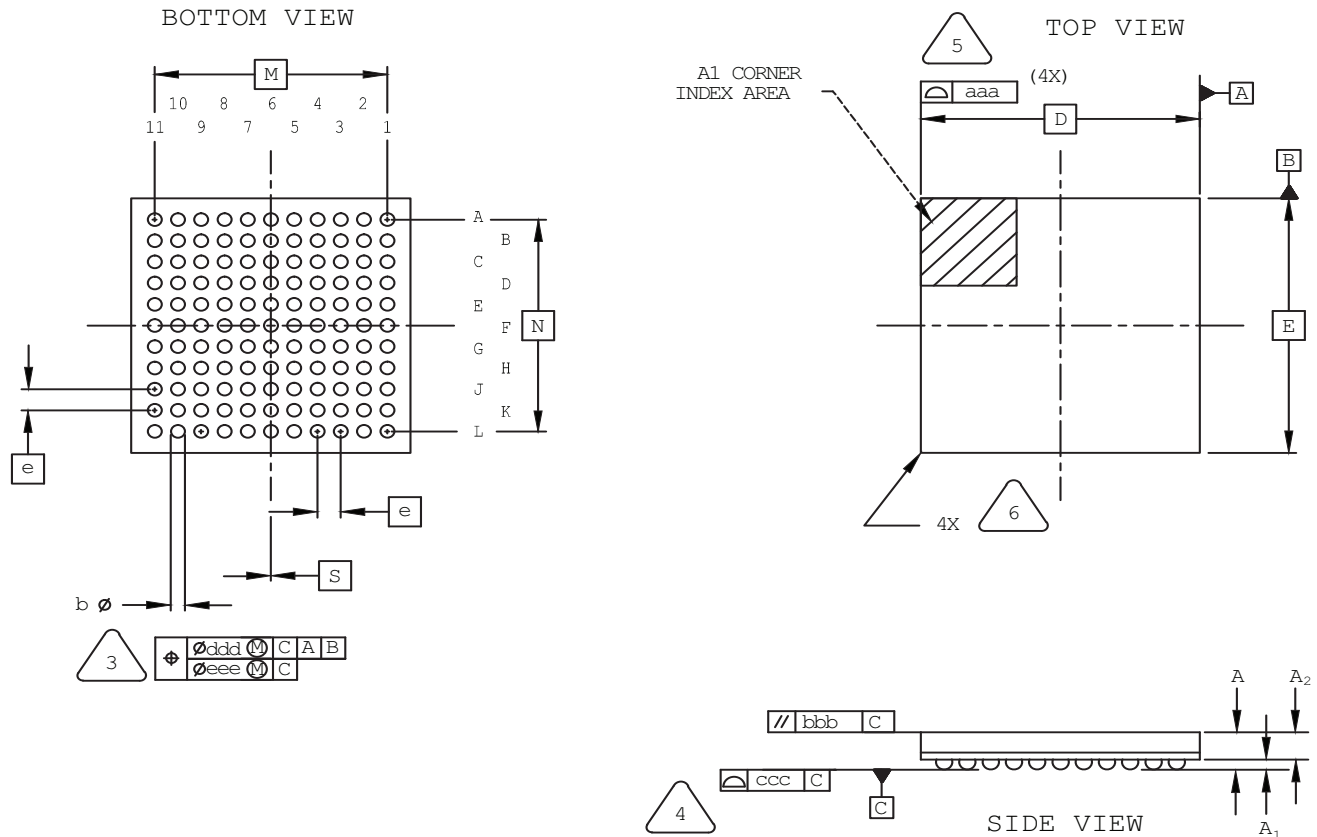
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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    | 5.00 BSC |      |      |
| b      | 0.20     | 0.25 | 0.30 |
| e      | 0.50 BSC |      |      |
| aaa    | -        | -    | 0.10 |
| bbb    | -        | -    | 0.10 |
| ddd    | -        | -    | 0.10 |

## 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.

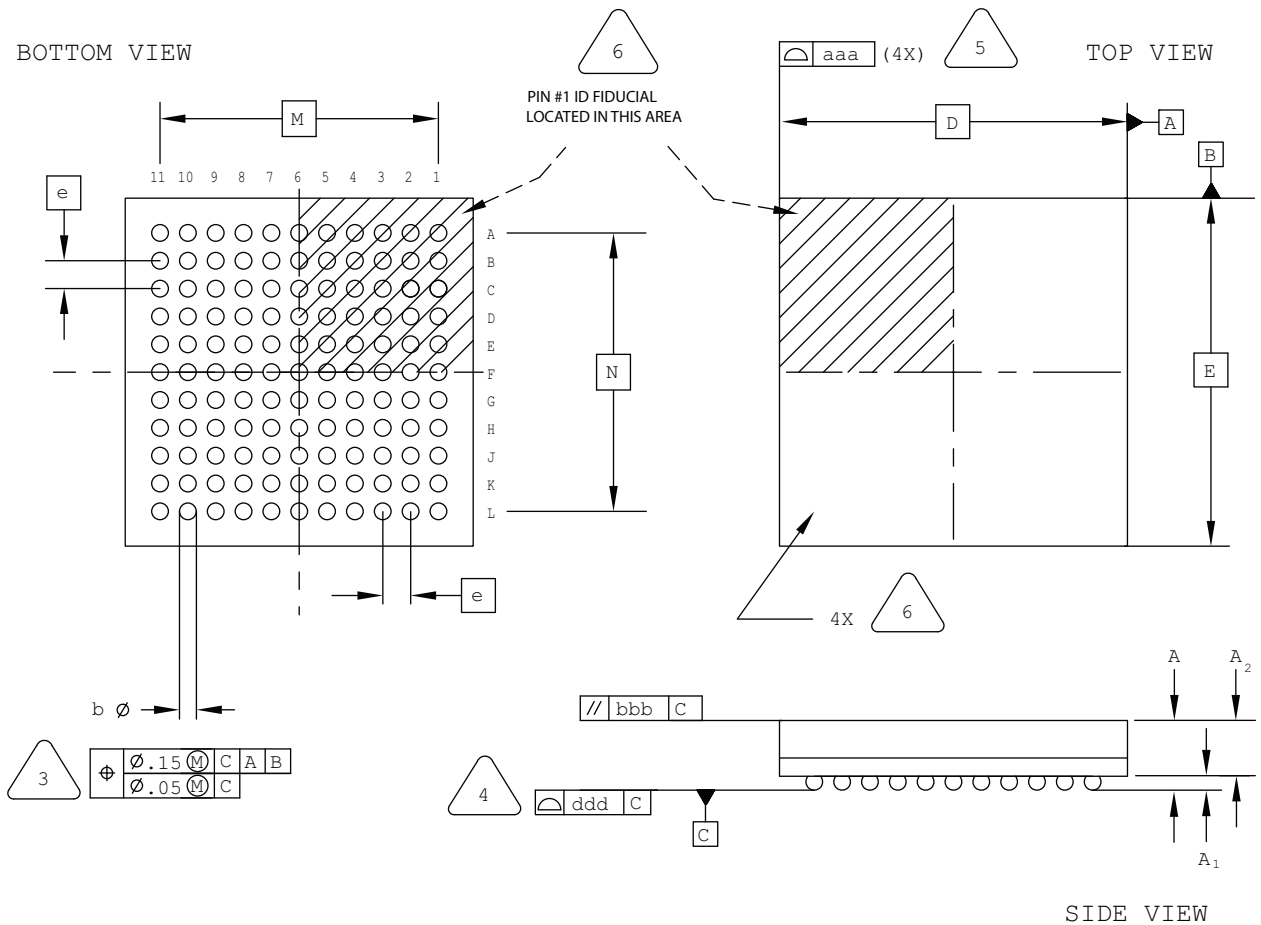
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

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     |      |      |

## 121-Ball ucBGA 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.

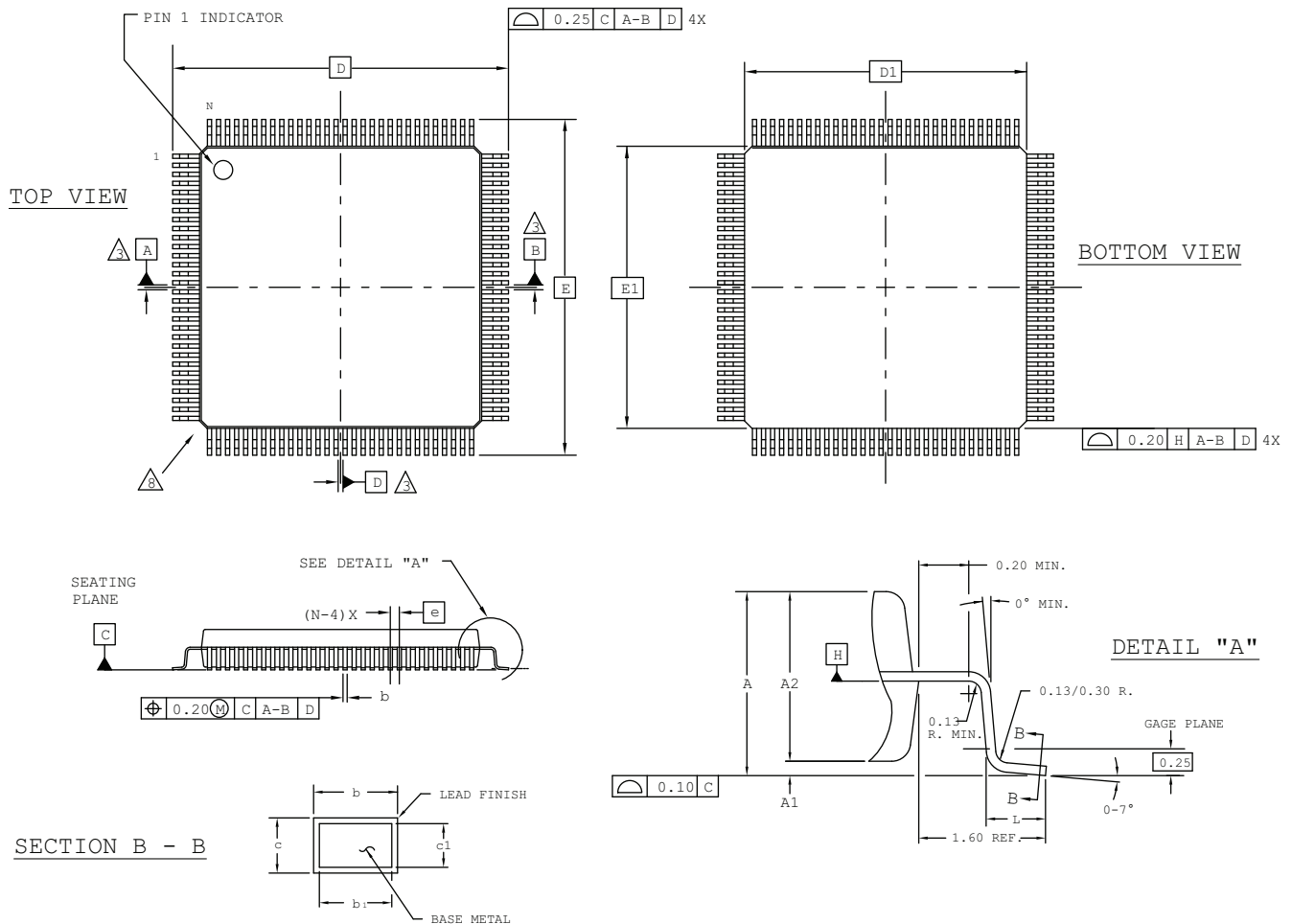


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 128-Pin PQFP Package

Dimensions in Millimeters



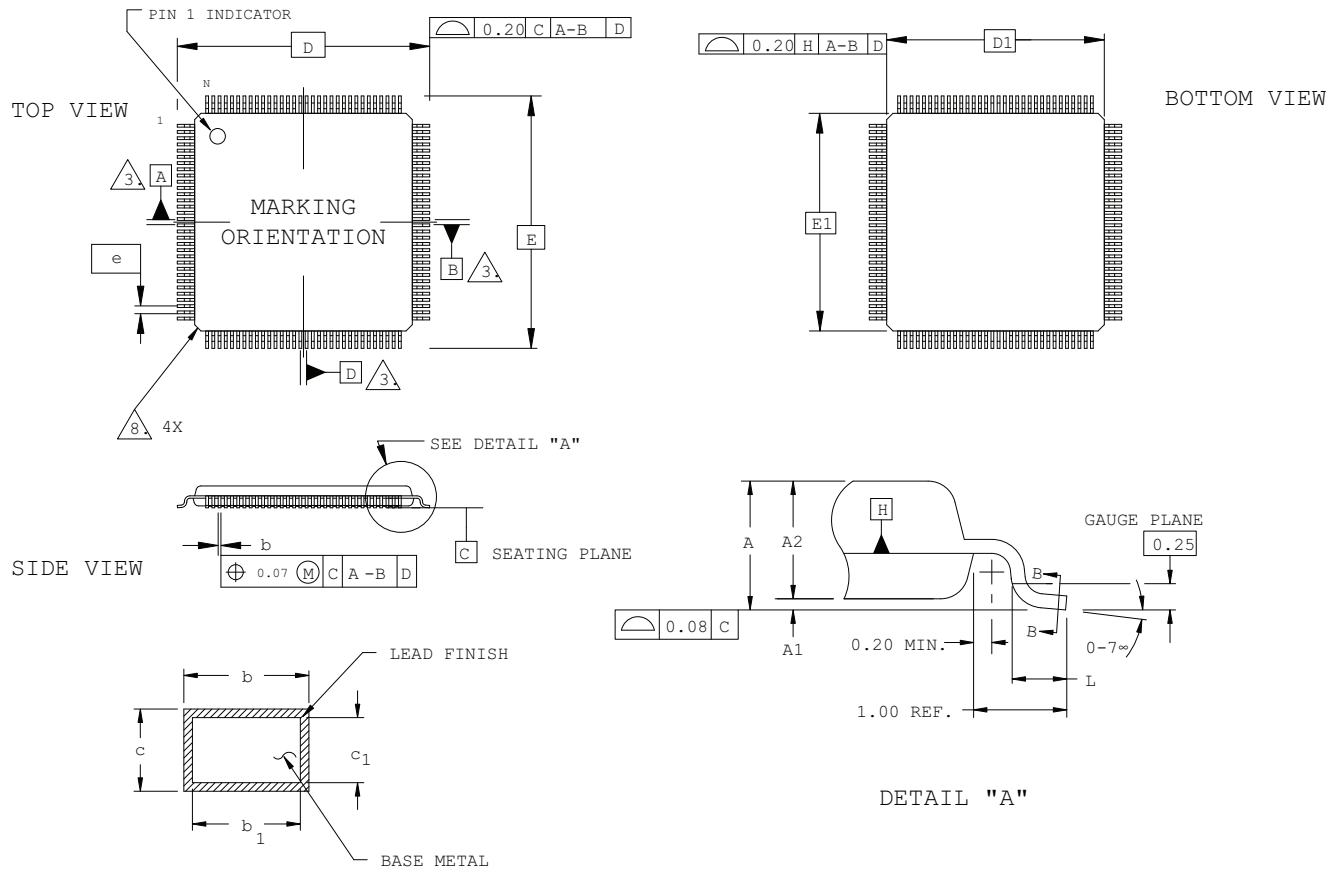
### NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 2.0 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3.0 DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 4.0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 5.0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 6.0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 7.0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- 8.0 EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- 9.0 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 |

## 128-Pin TQFP Package

Dimensions in Millimeters



SECTION B - B

SIDE VIEW

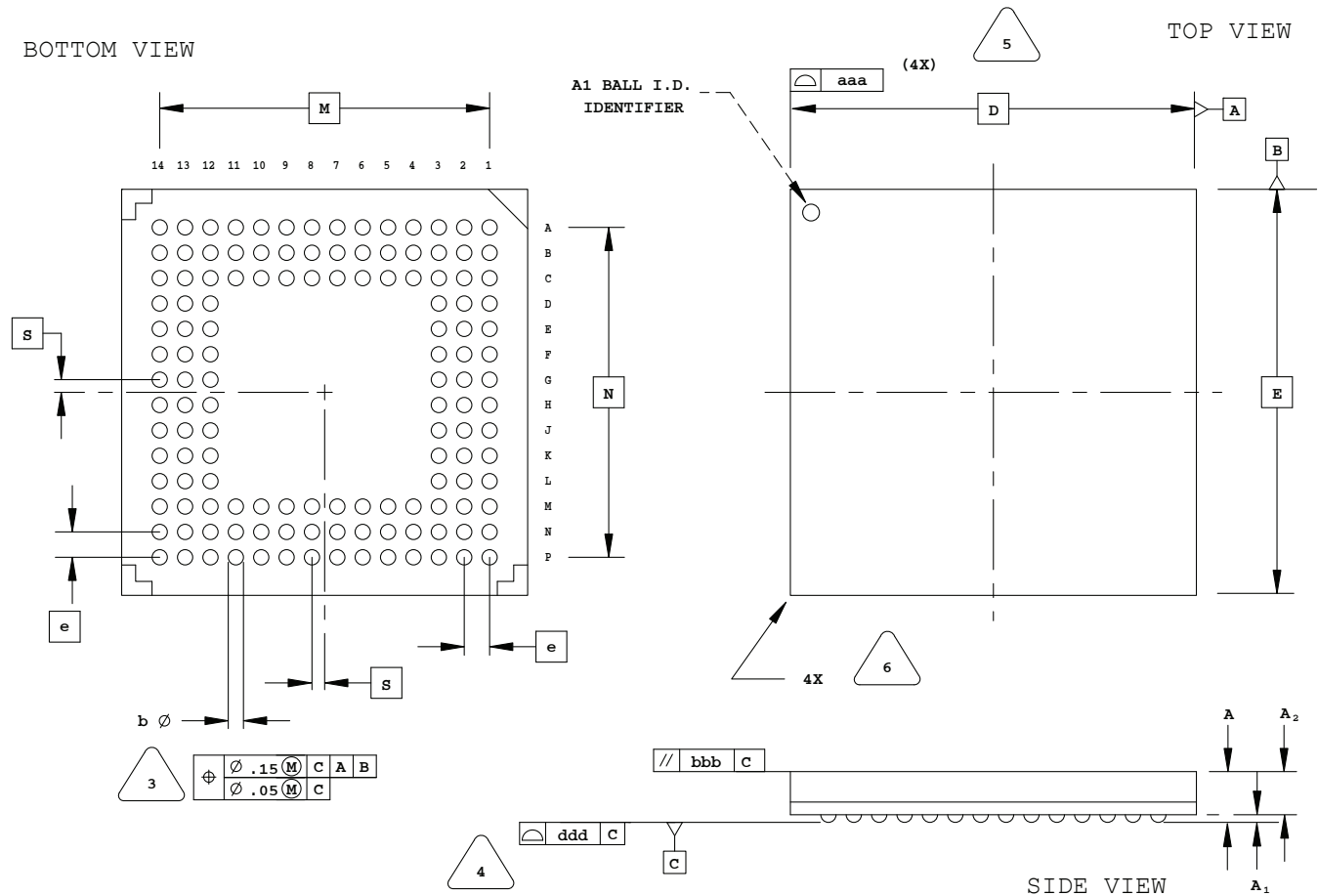
### NOTES:

- DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- ALL DIMENSIONS ARE IN MILLIMETERS.
- DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- SECTION B-B: THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 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.

| 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 |

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

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  $\begin{matrix} \square \\ C \end{matrix}$



PRIMARY DATUM  $\begin{matrix} \square \\ C \end{matrix}$  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.

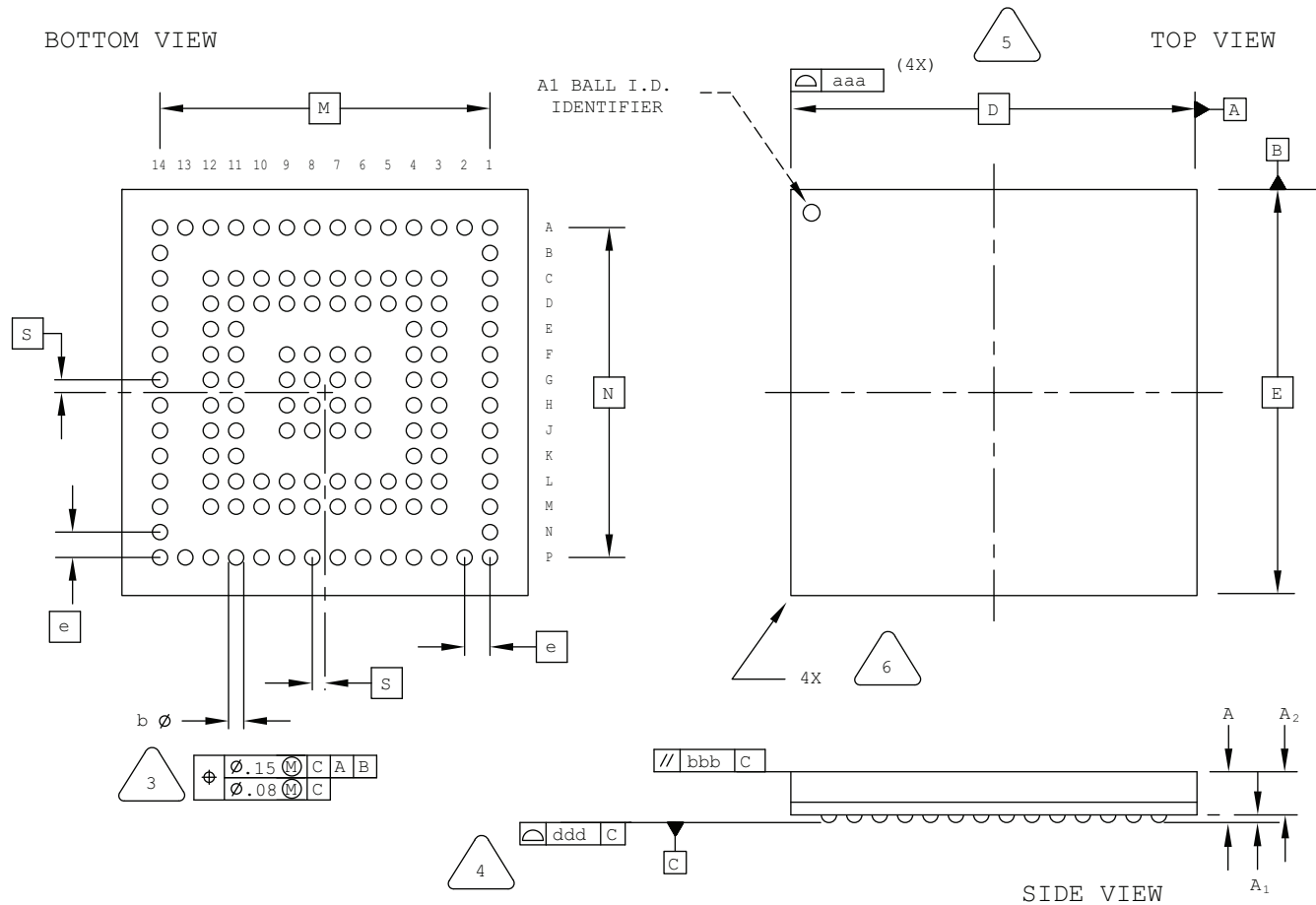


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 132-Ball csBGA Package Option 2: iCE40

### 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  
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.



5

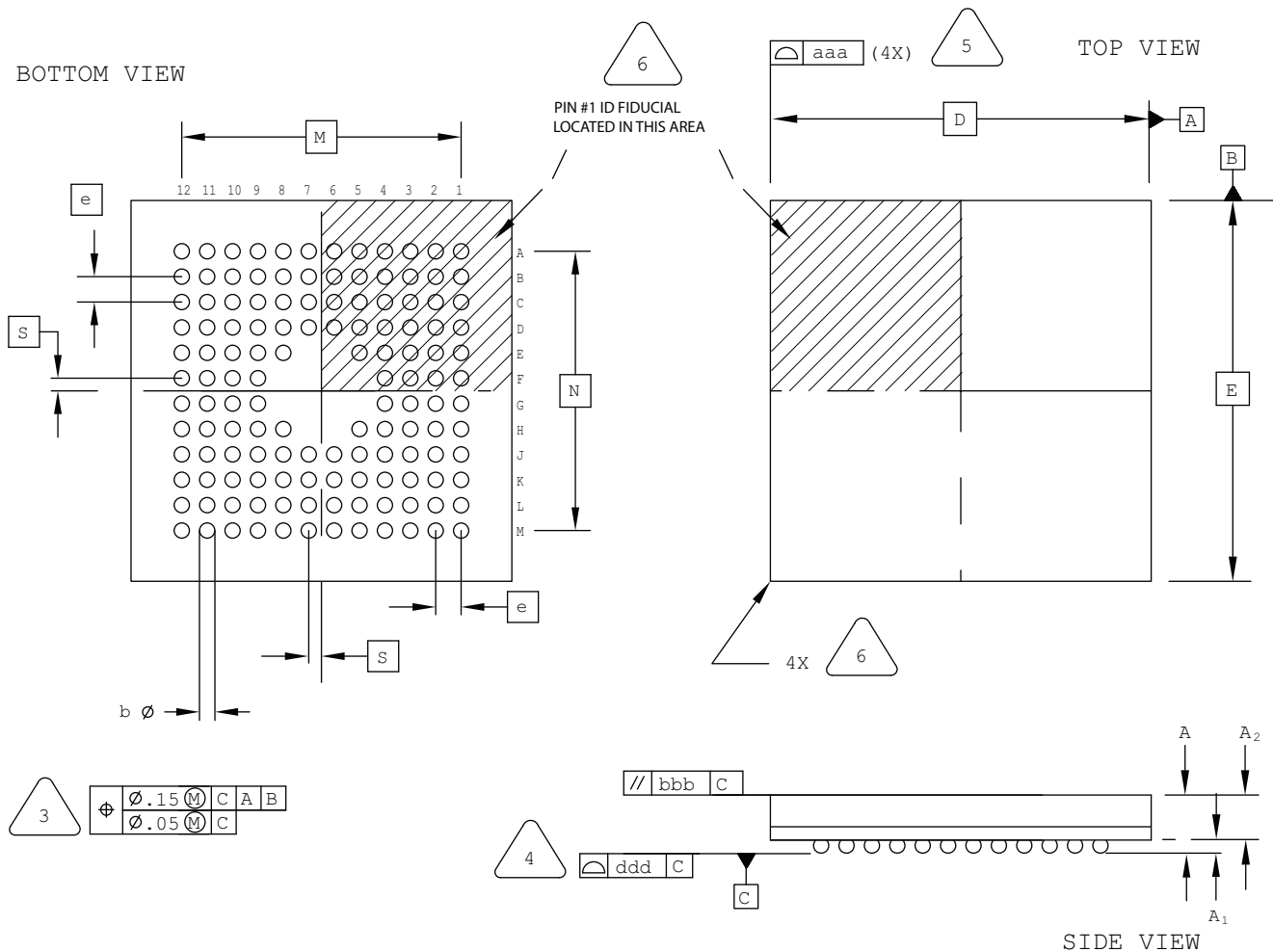
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.


 EXACT SHAPE AND SIZE OF THIS FEATURE  
 IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | –        | –    | 1.00 |
| A1     | 0.15     | –    | –    |
| A2     | –        | –    | 0.85 |
| D/E    | 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 |

## 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.

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.

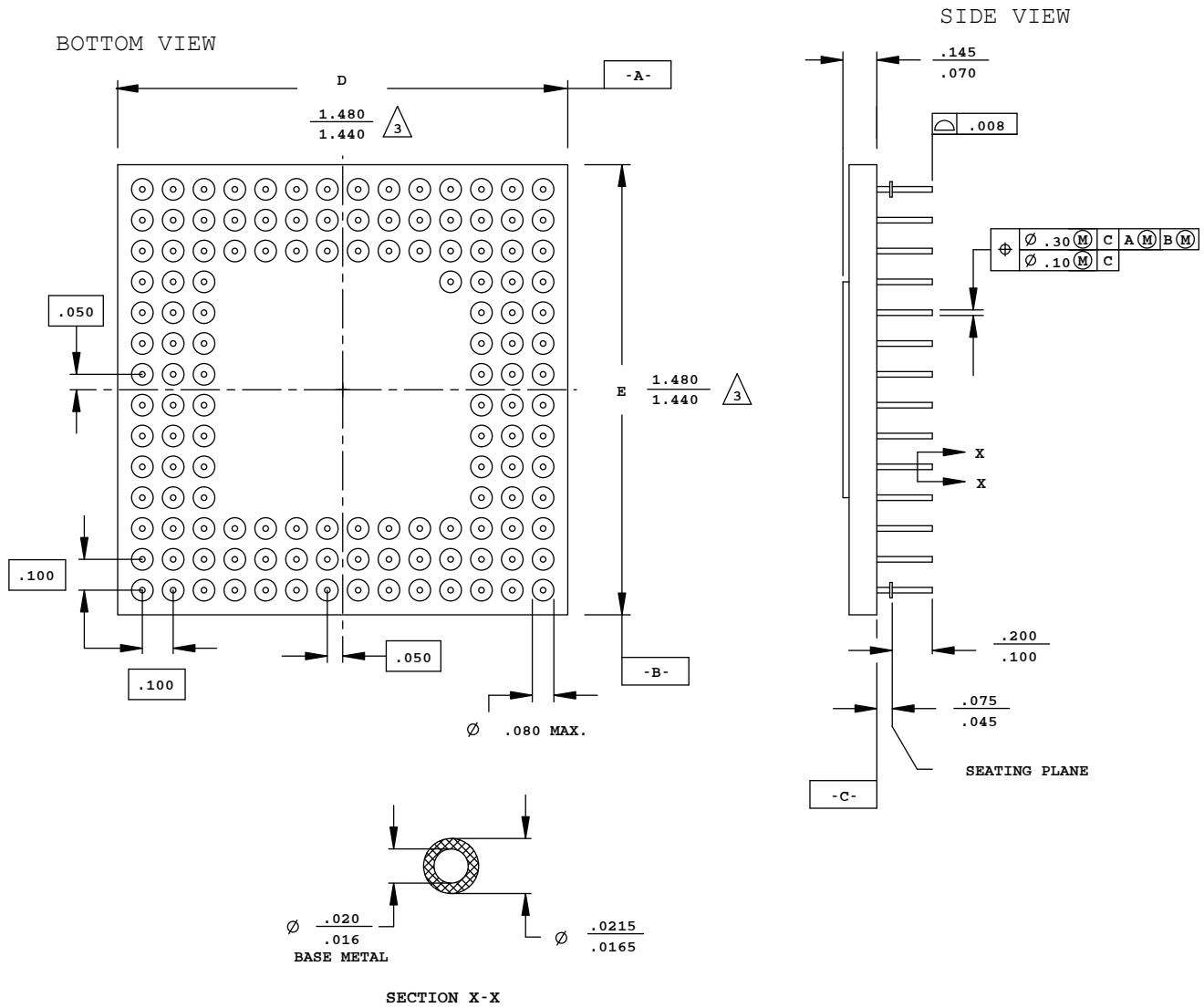
BILATERAL TOLERANCE ZONE IS APPLIED  
TO EACH SIDE OF THE PACKAGE BODY.

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    | 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 |

# 133-Pin CPGA Package

Dimensions in Inches



## NOTES:

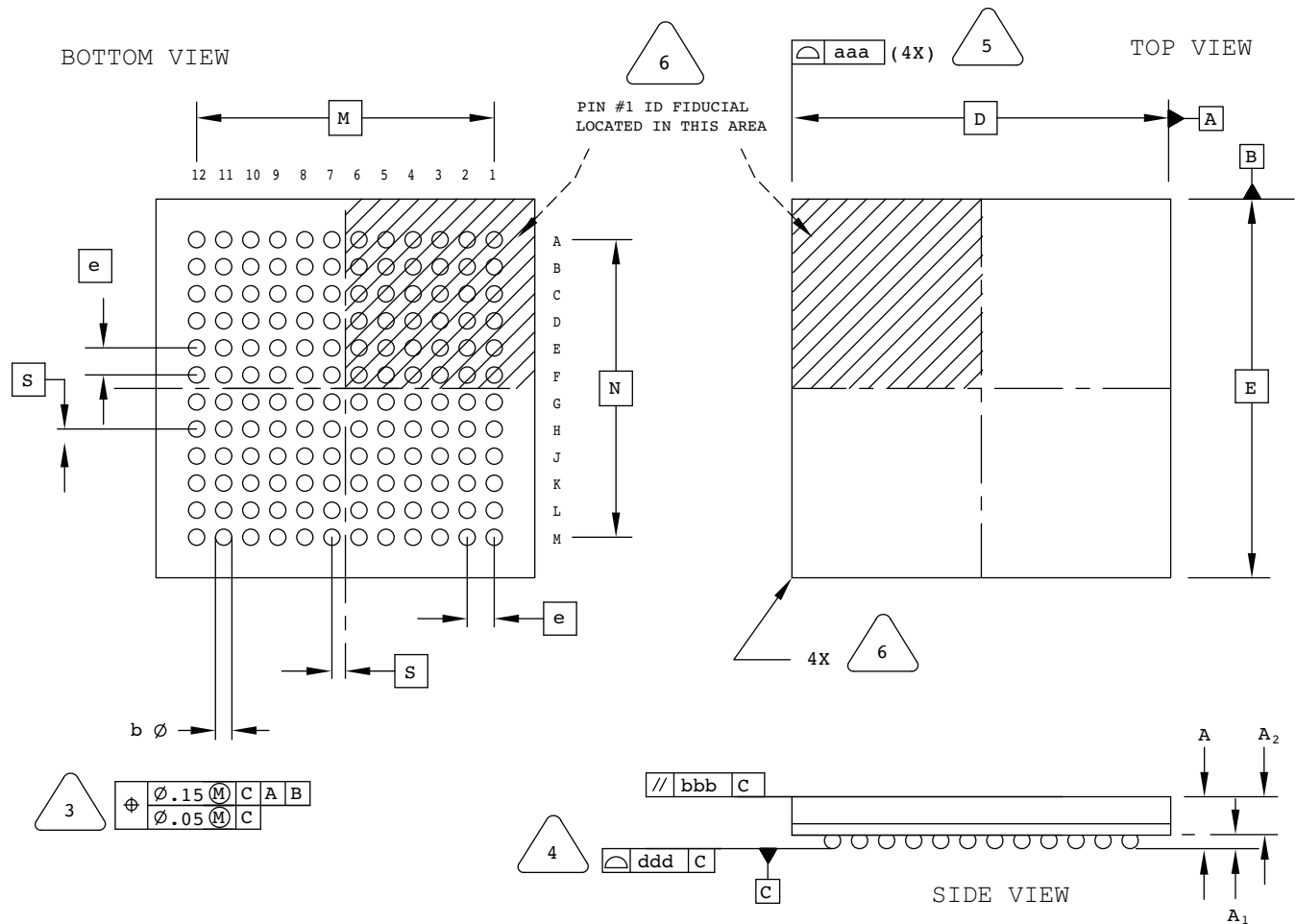
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN INCHES.



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

## 144-Ball csBGA 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.

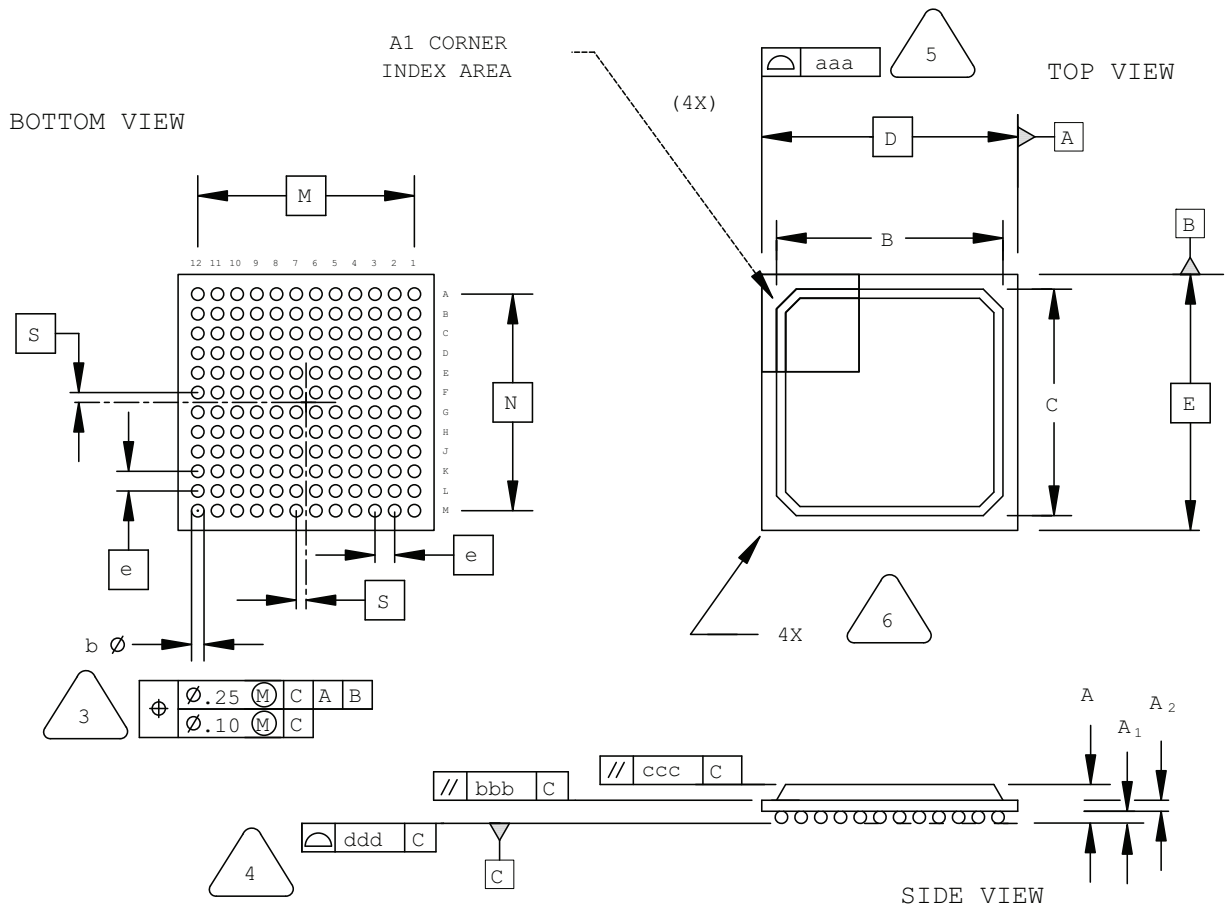


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | 0.90     | 1.00 | 1.10 |
| A1     | 0.15     | -    | -    |
| A2     | -        | -    | 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 |

## 144-Ball fpBGA 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.

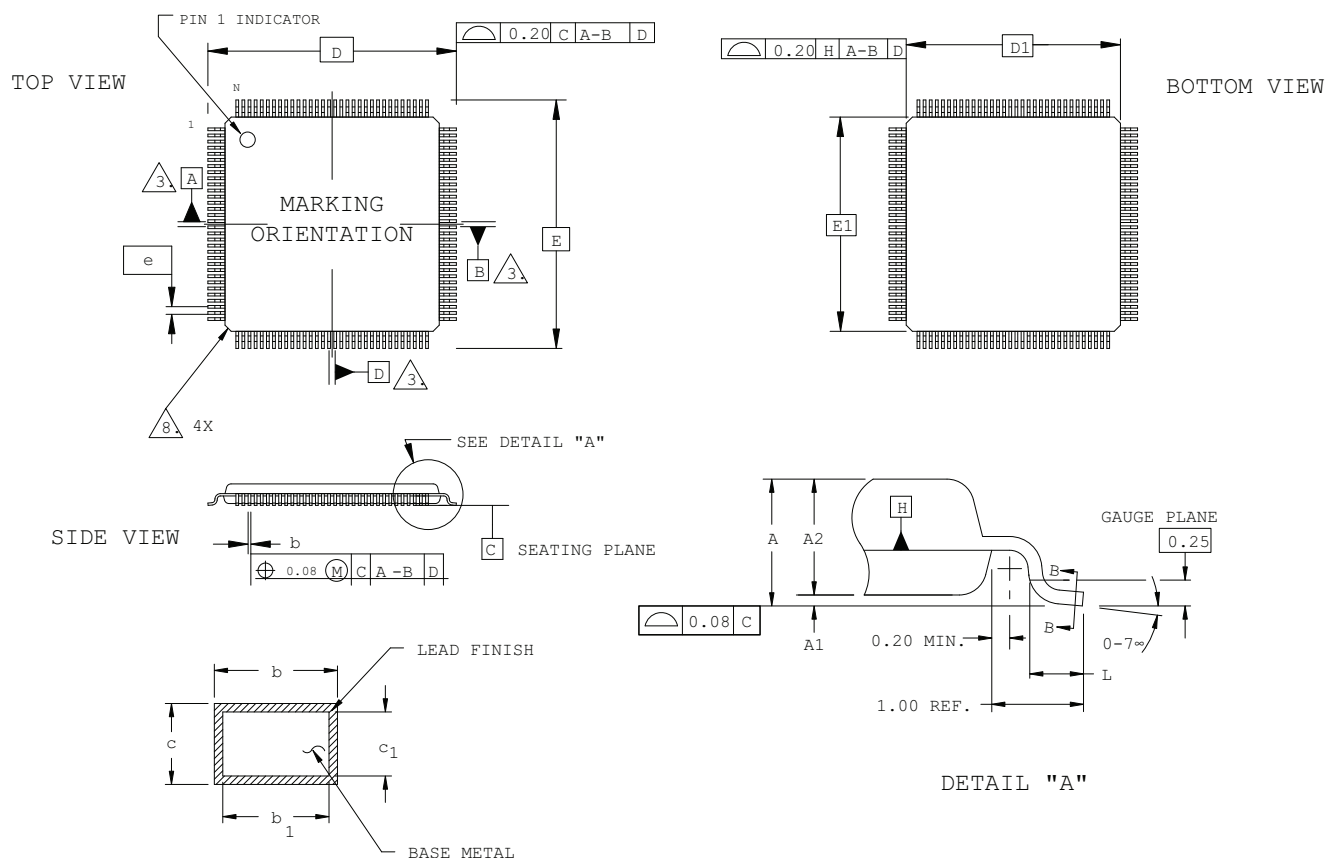


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 144-Pin TQFP Package

Dimensions in Millimeters



SECTION B - B

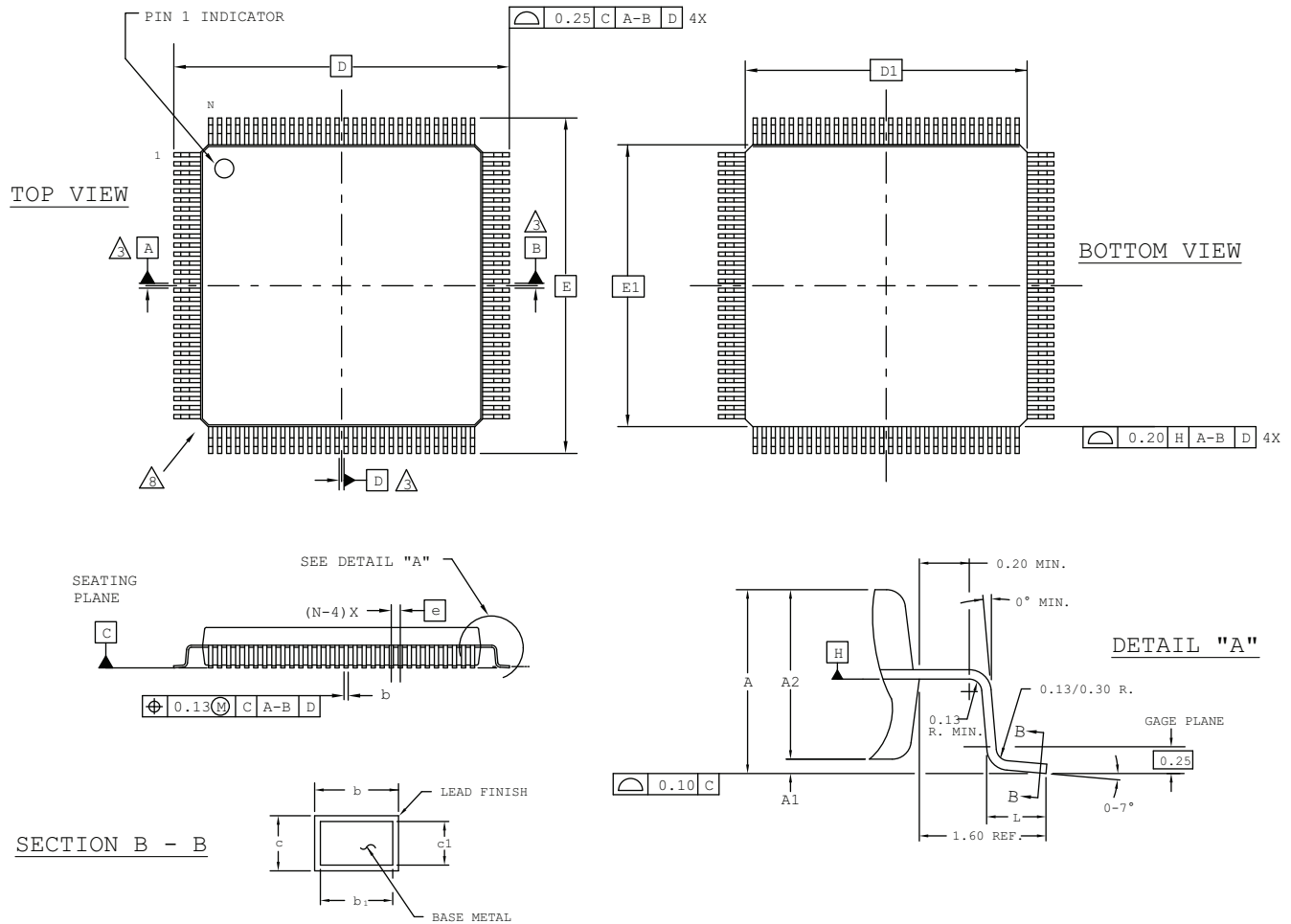
### NOTES:

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      | 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 |

## 160-Pin PQFP Package

Dimensions in Millimeters



### NOTES:

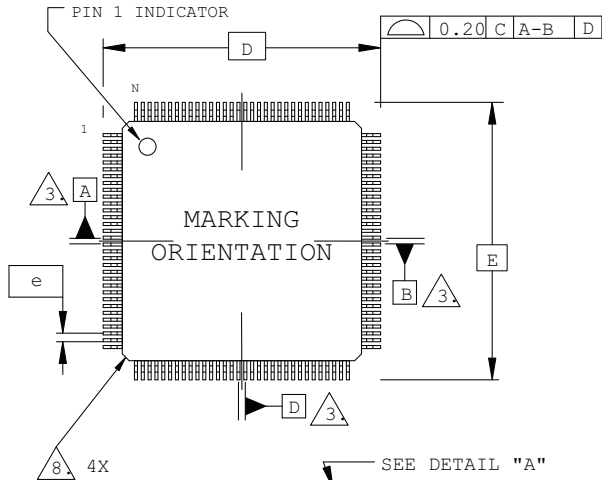
- 1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 2.0 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3.0 DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 4.0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 5.0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 6.0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 7.0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- 8.0 EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- 9.0 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 |

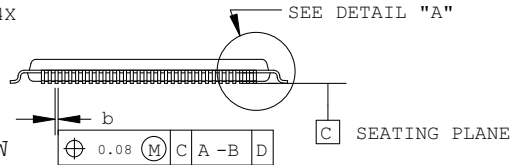
## 176-Pin TQFP Package

Dimensions in Millimeters

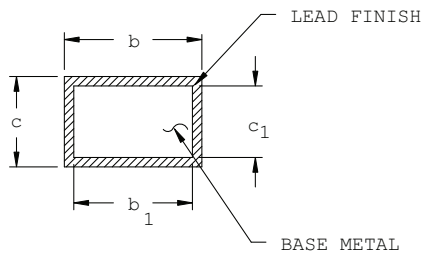
TOP VIEW



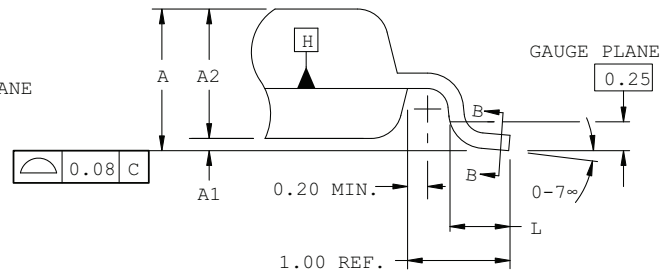
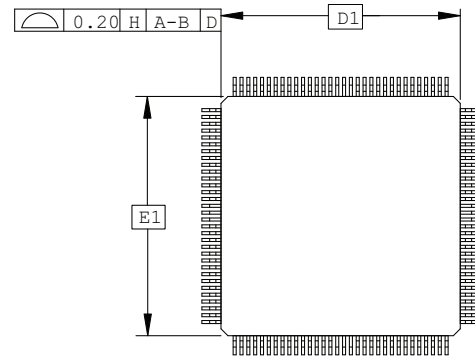
SIDE VIEW



SECTION B - B



BOTTOM VIEW



DETAIL "A"

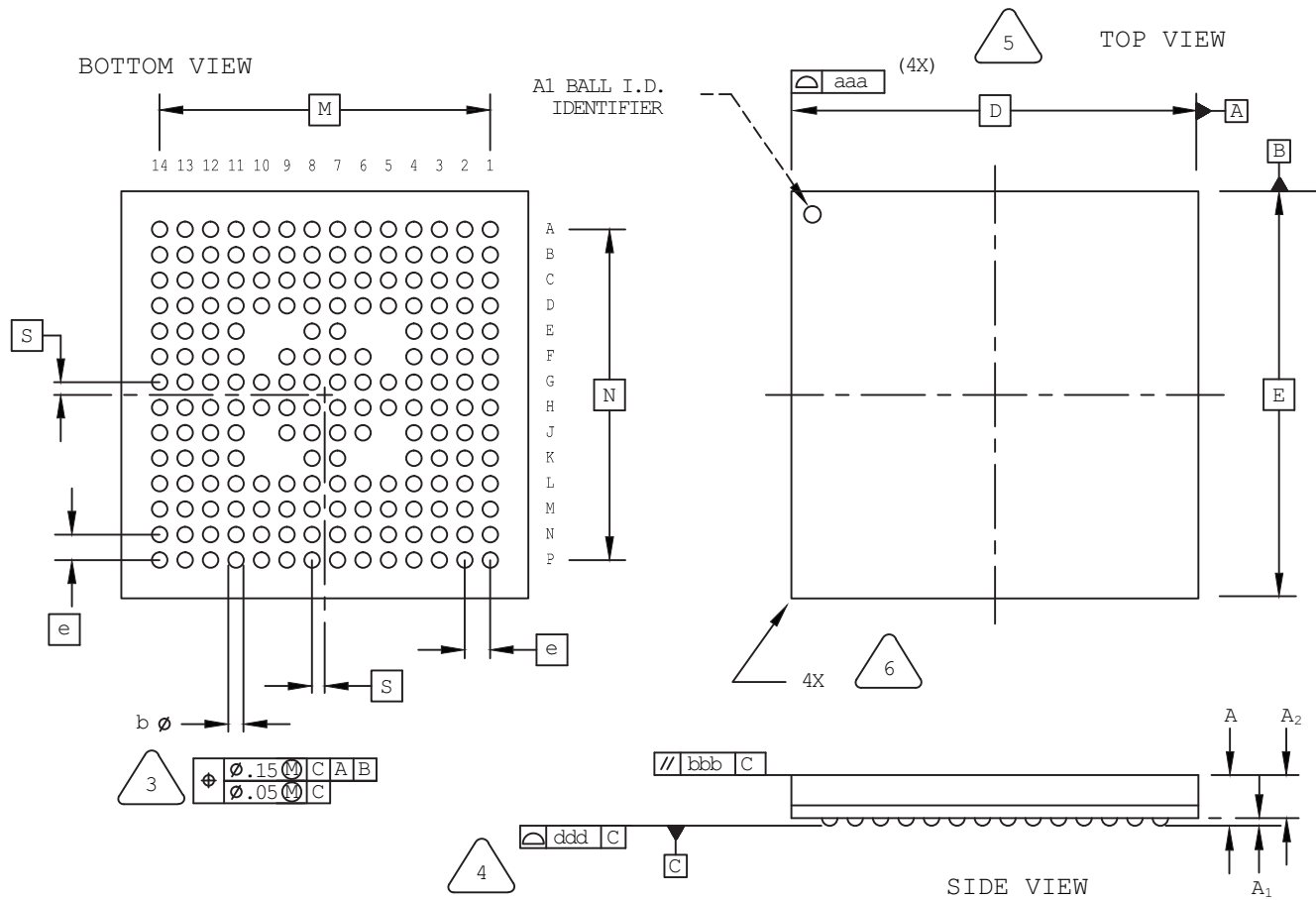
NOTES:

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 |
| b1     | 0.17      | 0.20 | 0.23 |
| c      | 0.09      | 0.15 | 0.20 |
| c1     | 0.09      | 0.13 | 0.16 |

## 184-Ball csBGA 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.

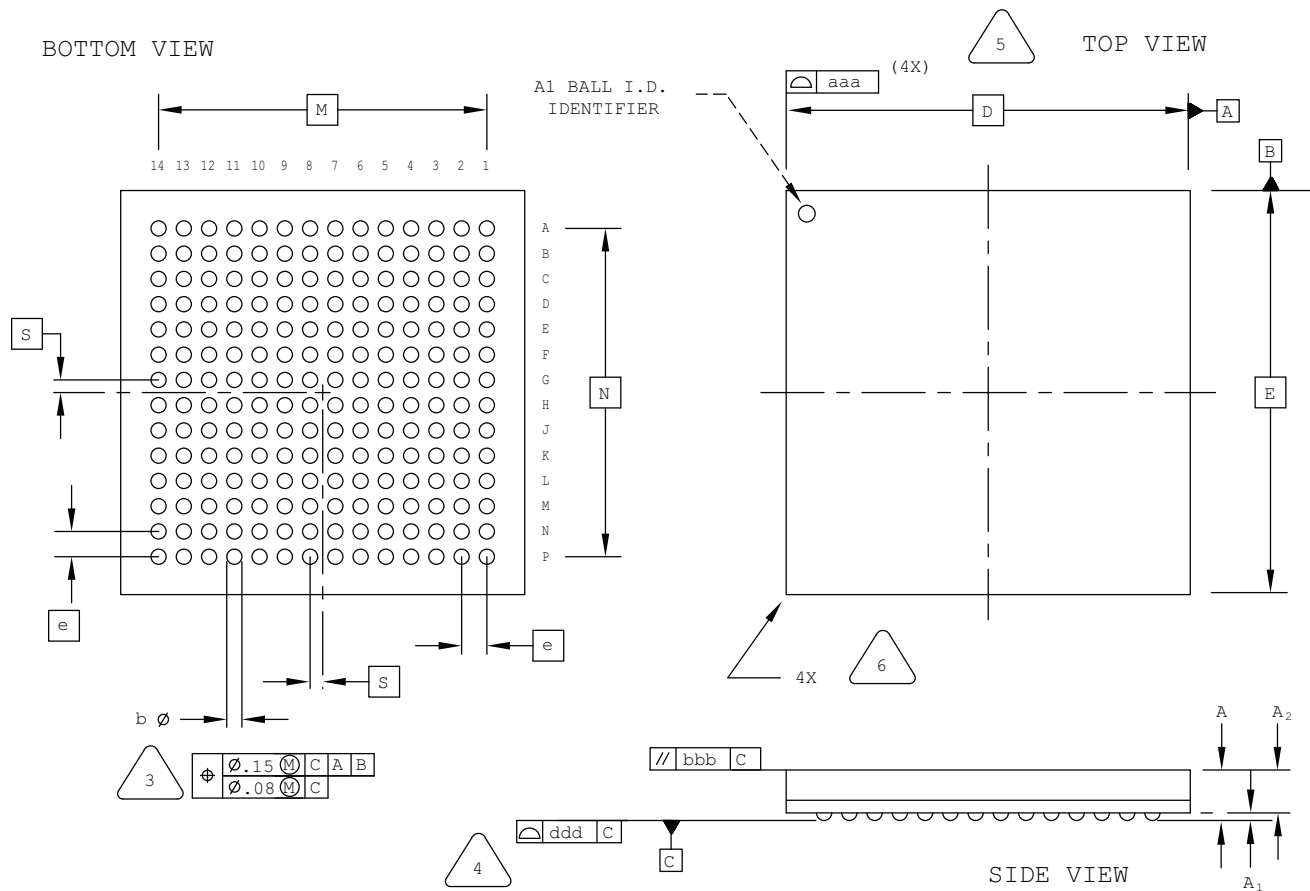


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 196-Ball csBGA 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.



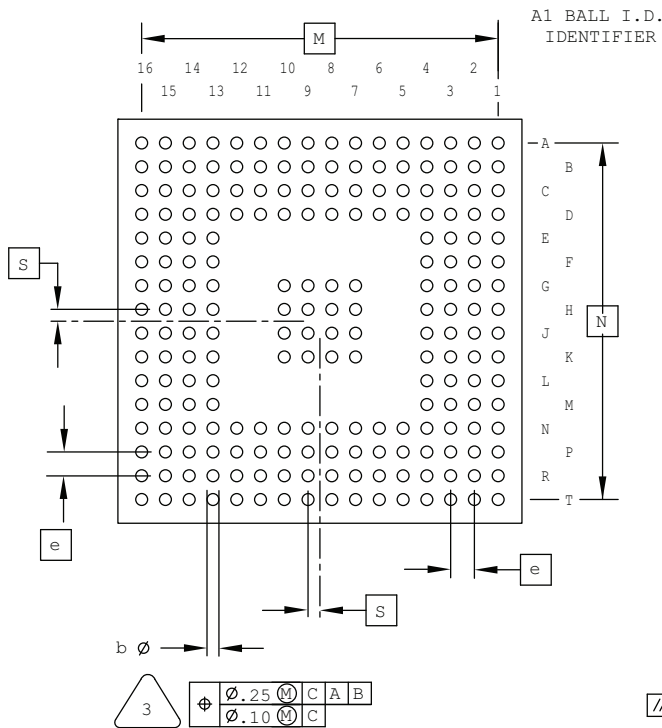
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

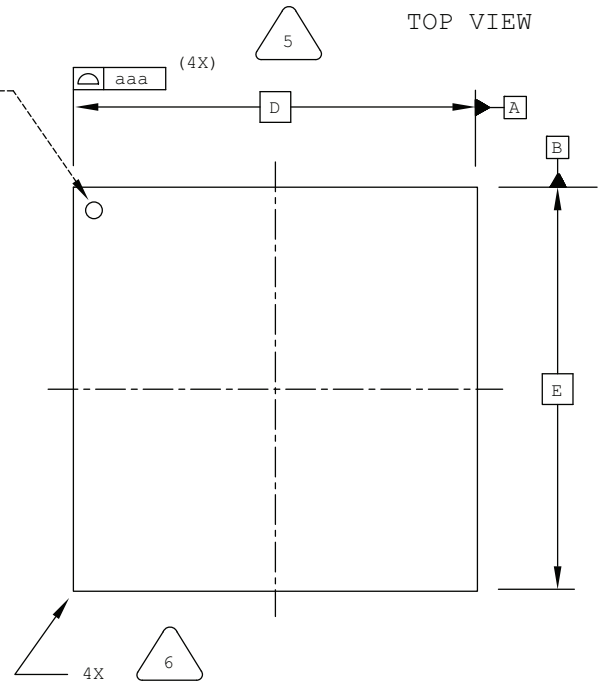
## 208-Ball ftBGA Package

Dimensions in Millimeters

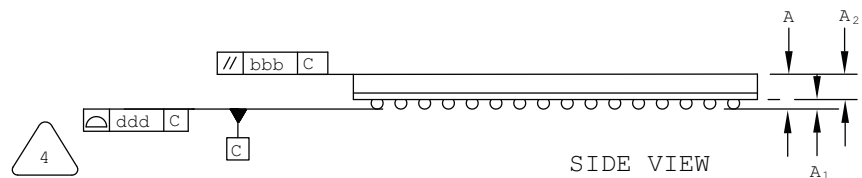
BOTTOM VIEW



TOP VIEW



SIDE VIEW



NOTES: UNLESS OTHERWISE SPECIFIED

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



DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM  $\boxed{C}$



PRIMARY DATUM  $\boxed{C}$  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.

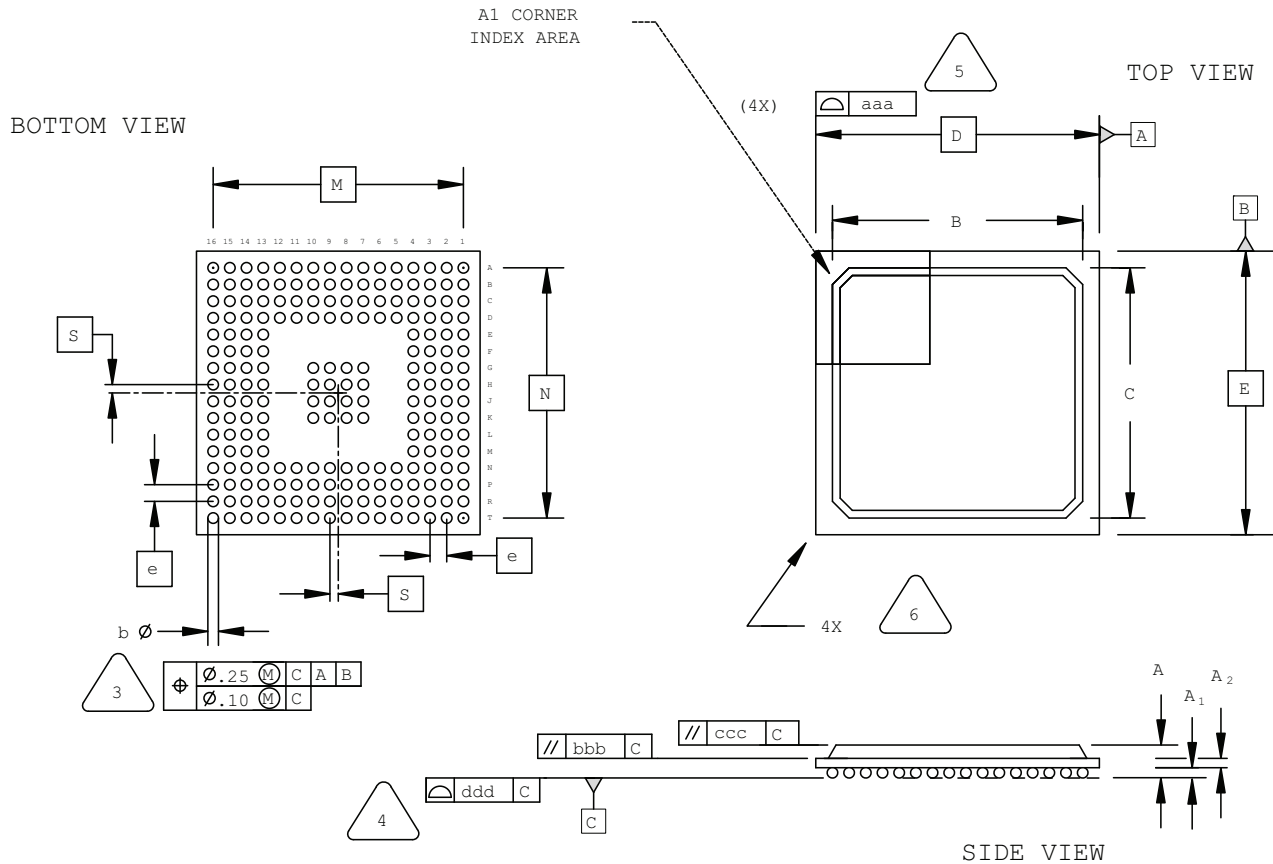


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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      | 1.0 BSC  |      |      |
| aaa    | -        | -    | 0.20 |
| bbb    | -        | -    | 0.25 |
| ddd    | -        | -    | 0.12 |

## 208-Ball fpBGA 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  $\boxed{C}$



PRIMARY DATUM  $\boxed{C}$  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.

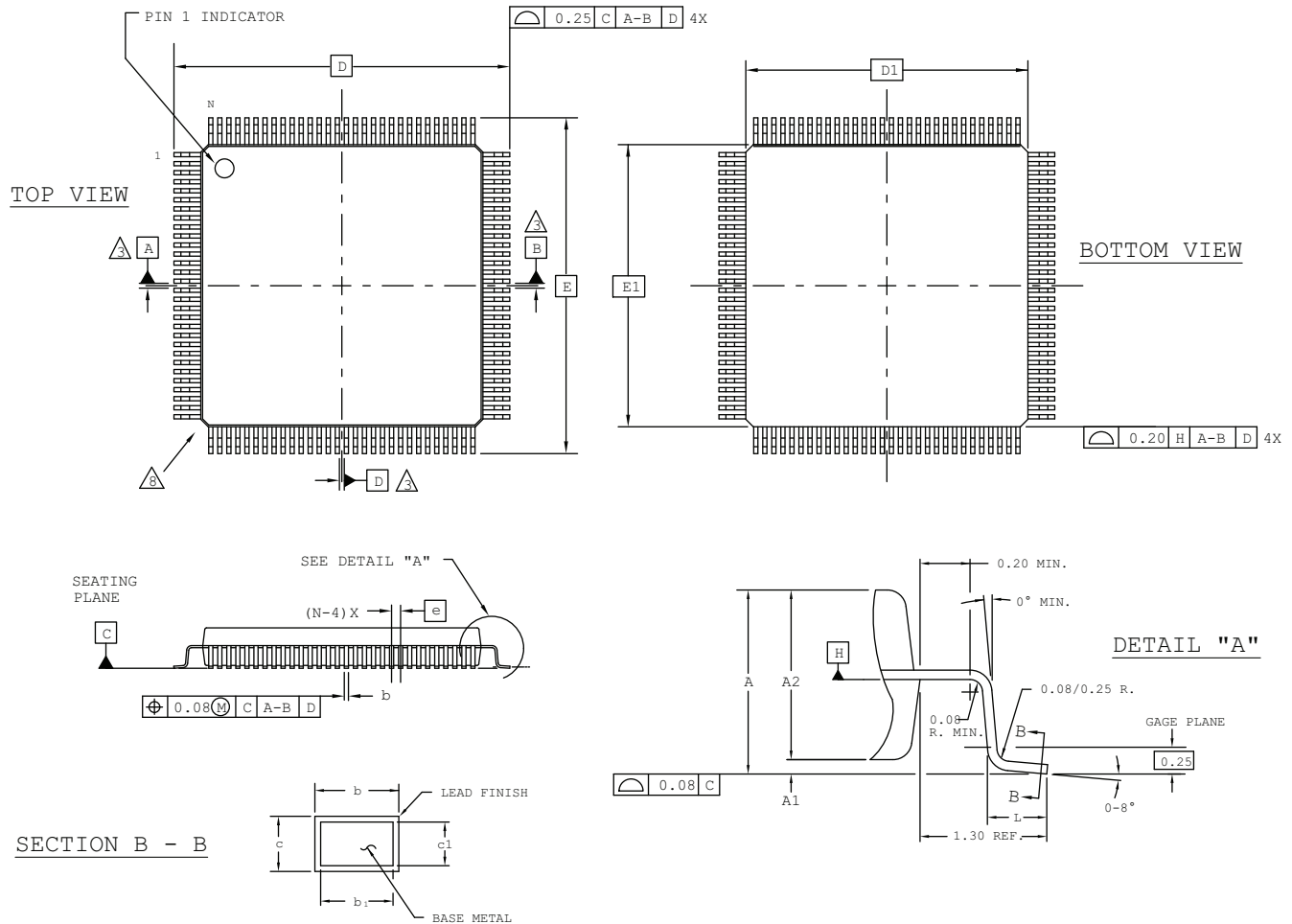


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 208-Pin PQFP Package

Dimensions in Millimeters



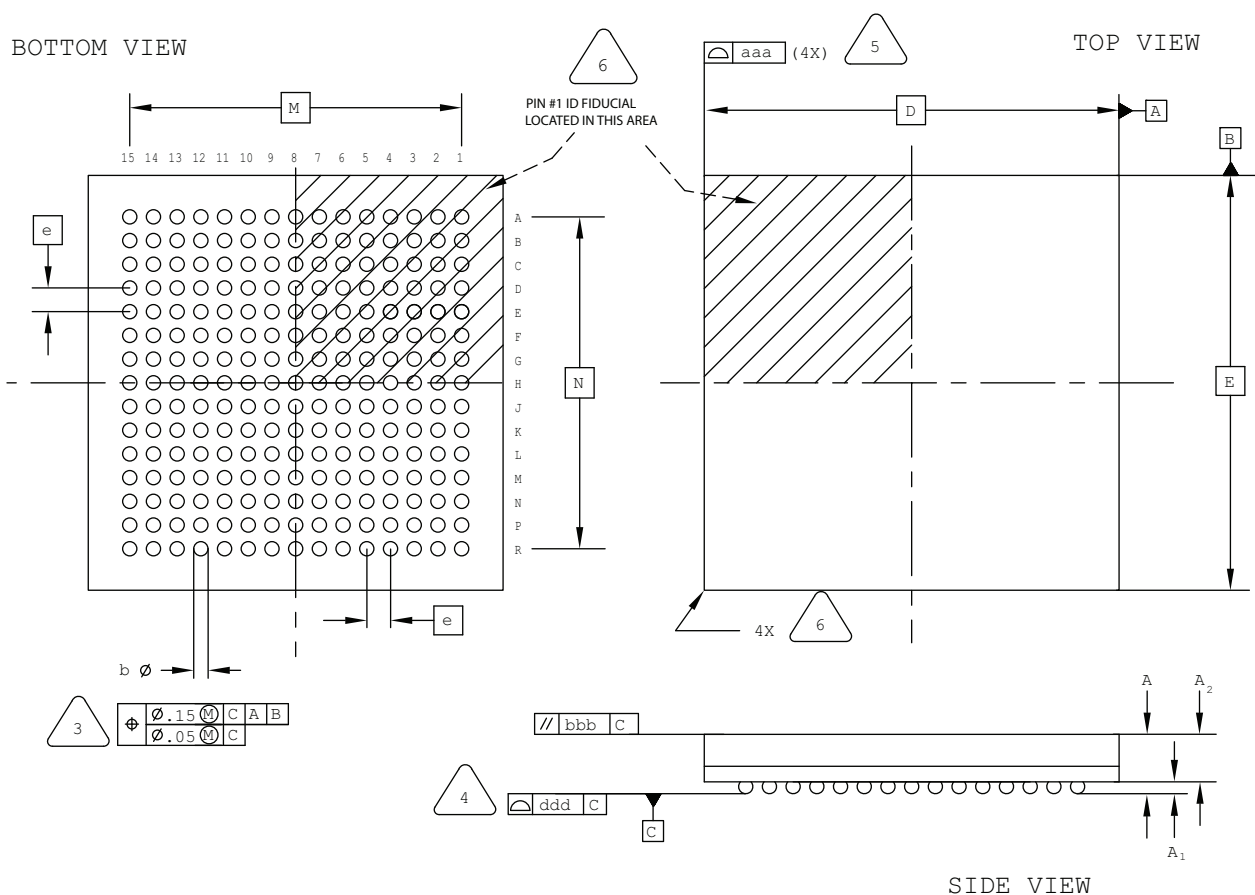
### NOTES:

- 1.0 DIMENSIONING AND TOLERANCING PER ANSI Y14.5 - 1982.
- 2.0 ALL DIMENSIONS ARE IN MILLIMETERS.
- 3.0 DATUMS A, B AND D TO BE DETERMINED AT DATUM PLANE H.
- 4.0 DIMENSIONS D1 AND E1 DO NOT INCLUDE MOLD PROTRUSION. ALLOWABLE MOLD PROTRUSION IS 0.254 MM ON D1 AND E1 DIMENSIONS.
- 5.0 THE TOP OF PACKAGE MAY BE SMALLER THAN THE BOTTOM OF THE PACKAGE BY 0.15 MM.
- 6.0 SECTION B-B:  
THESE DIMENSIONS APPLY TO THE FLAT SECTION OF THE LEAD BETWEEN 0.10 AND 0.25 MM FROM THE LEAD TIP.
- 7.0 A1 IS DEFINED AS THE DISTANCE FROM THE SEATING PLANE TO THE LOWEST POINT ON THE PACKAGE BODY.
- 8.0 EXACT SHAPE OF EACH CORNER IS OPTIONAL.
- 9.0 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 |

## 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.

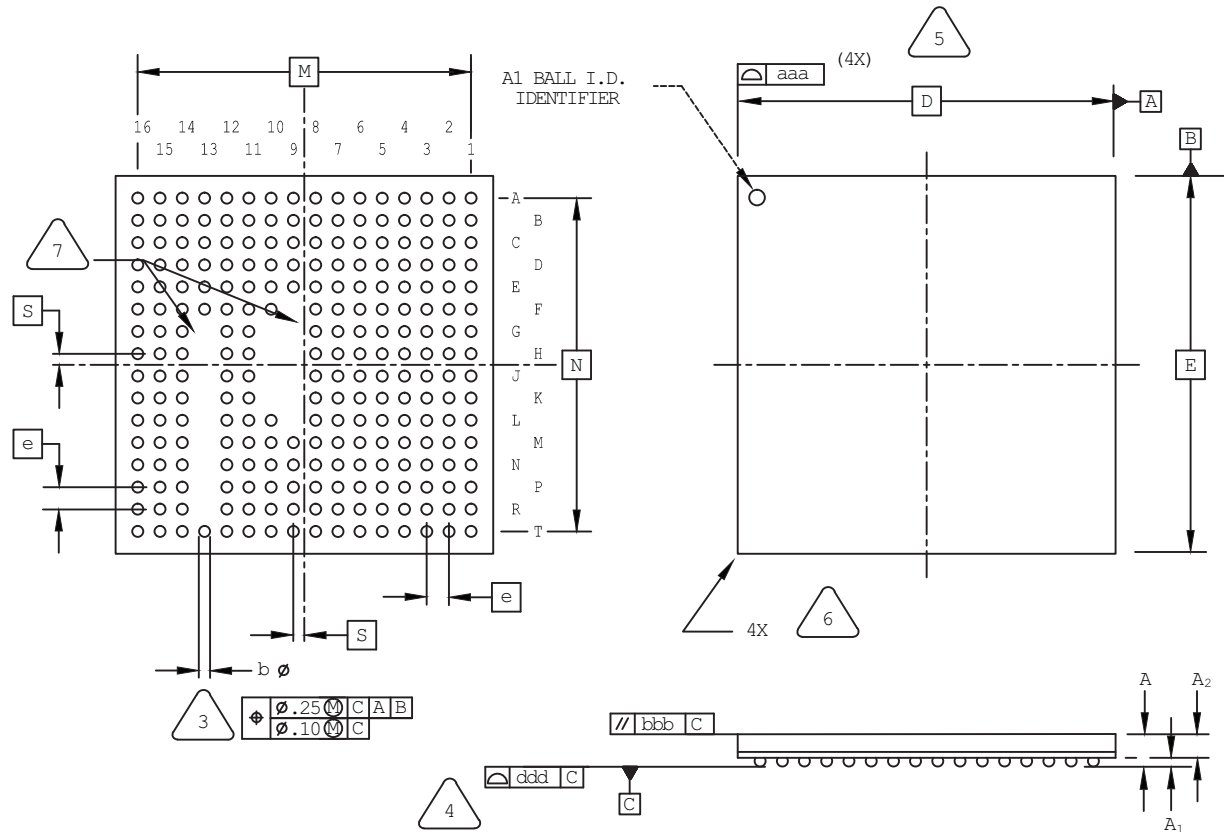
BILATERAL TOLERANCE ZONE IS APPLIED  
TO EACH SIDE OF THE PACKAGE BODY.

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 |

## 237-Ball ftBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

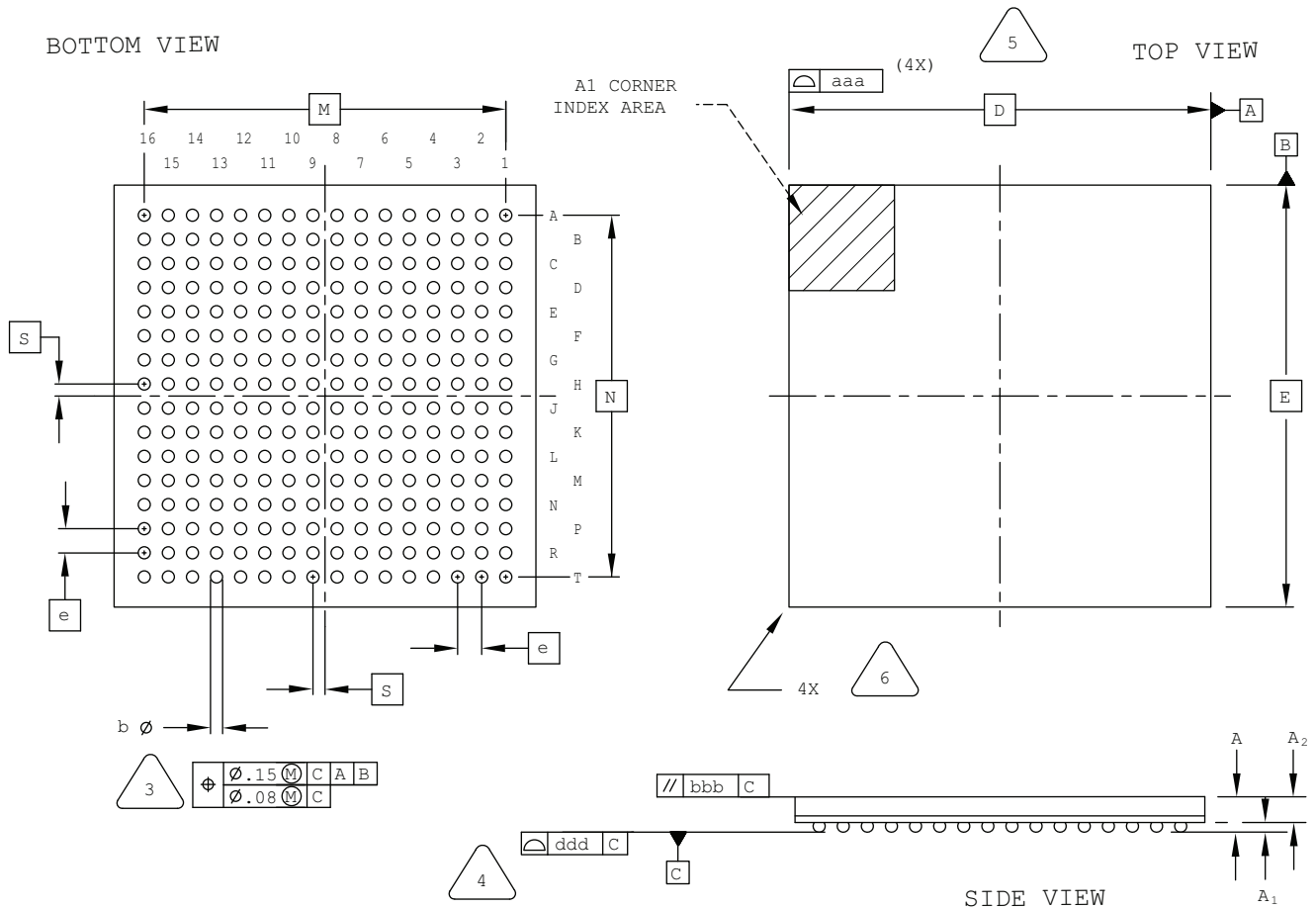
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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 |

## 256-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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

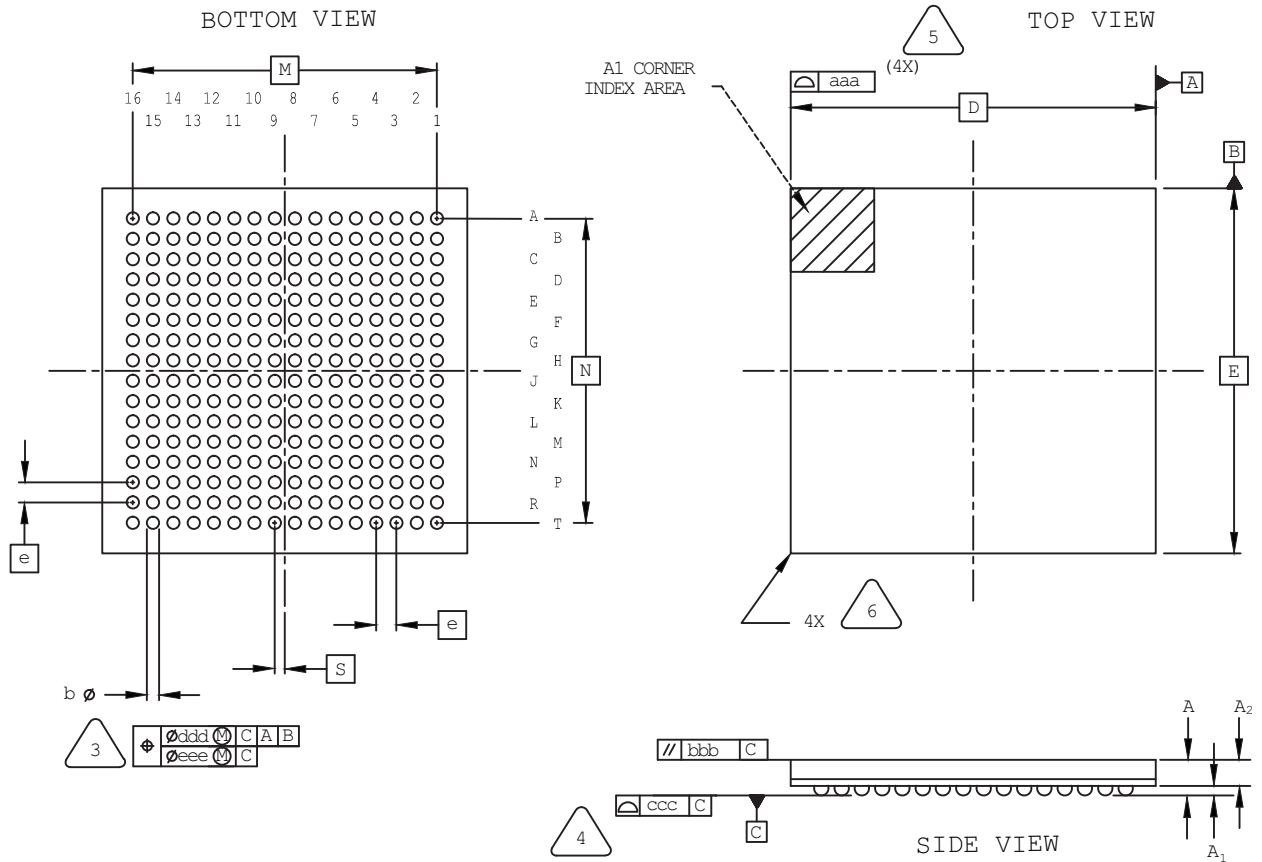
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE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

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 |

## 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.



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.

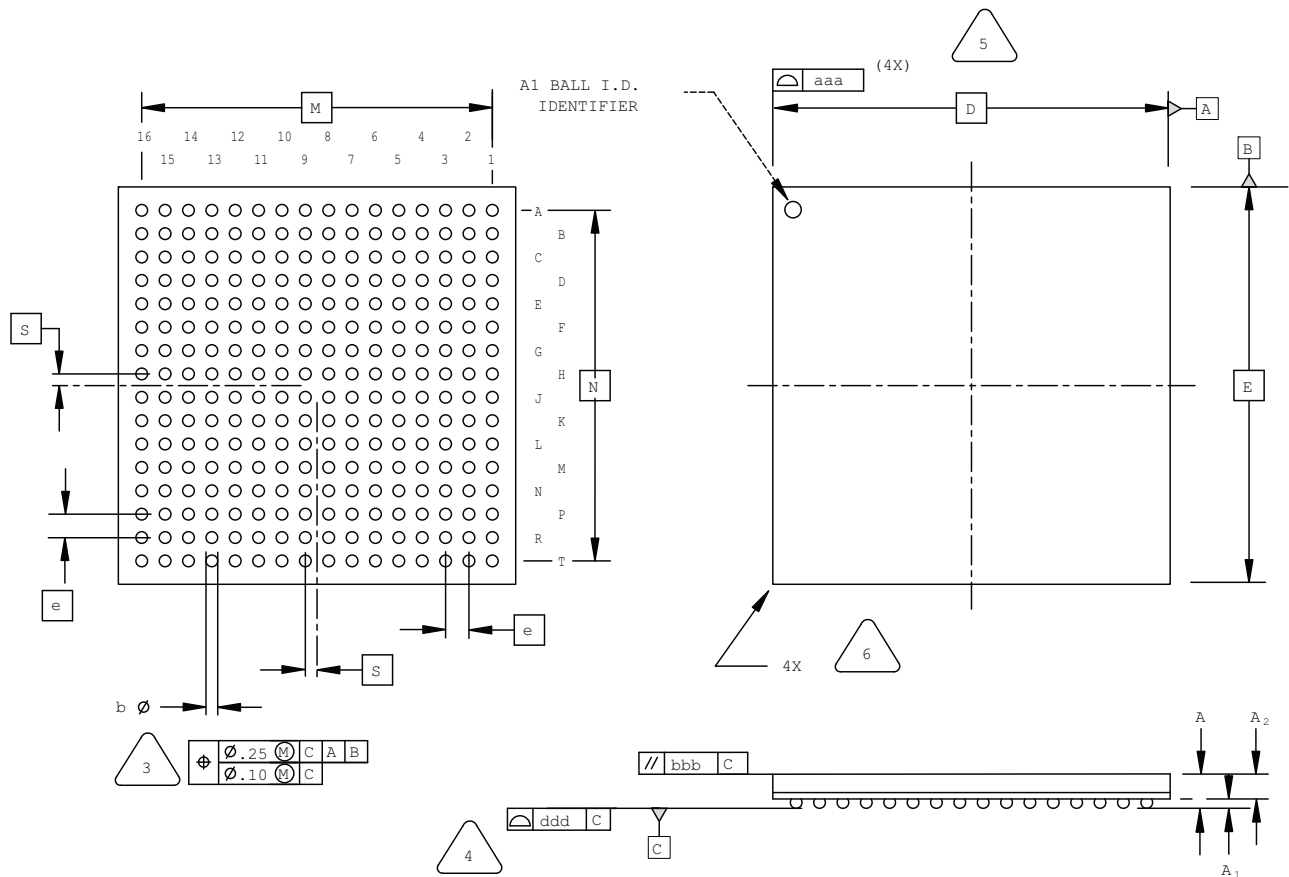


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | —        | —    | 1.00 |
| A1     | 0.15     | 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     |      |      |

## 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.

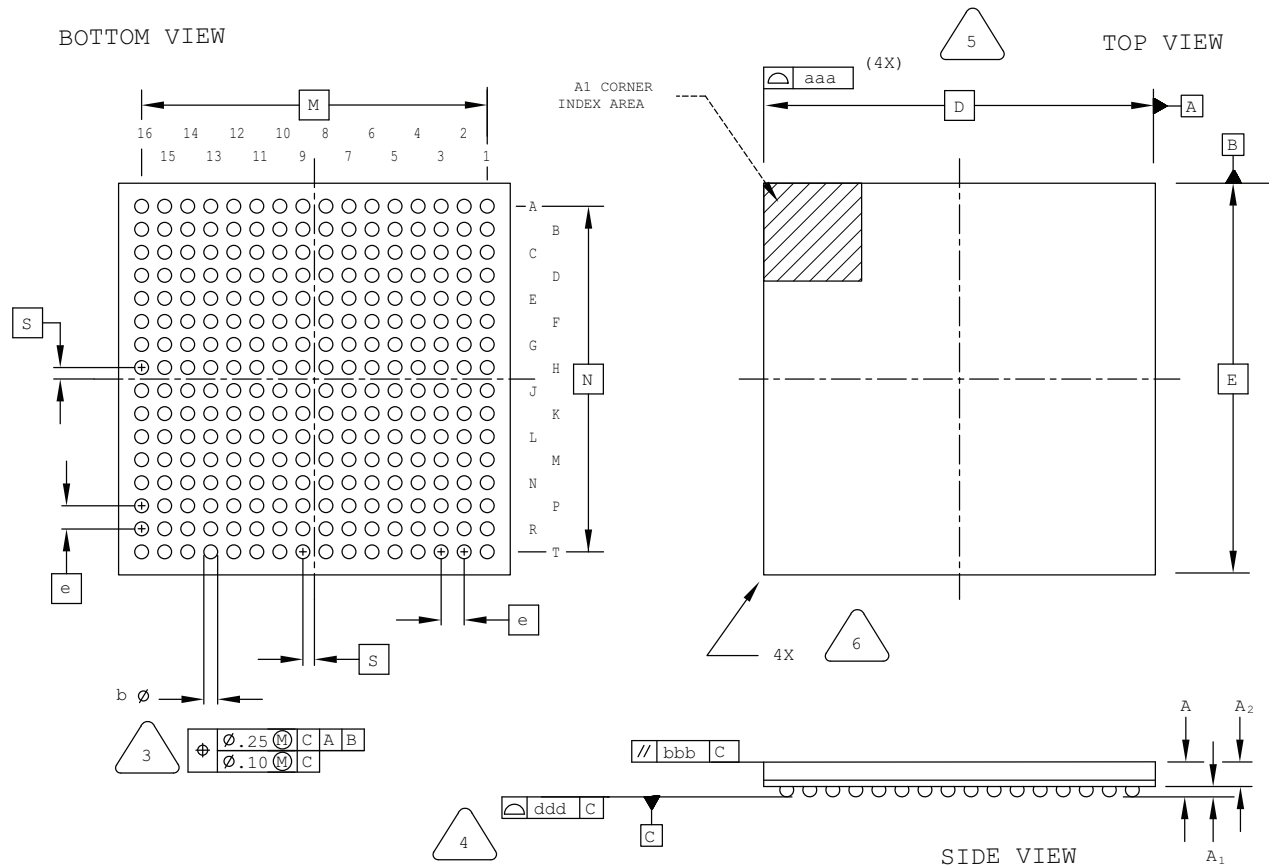


EXACT SHAPE AND SIZE OF THIS FEATURE  
IS OPTIONAL.

| 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 |

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

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.

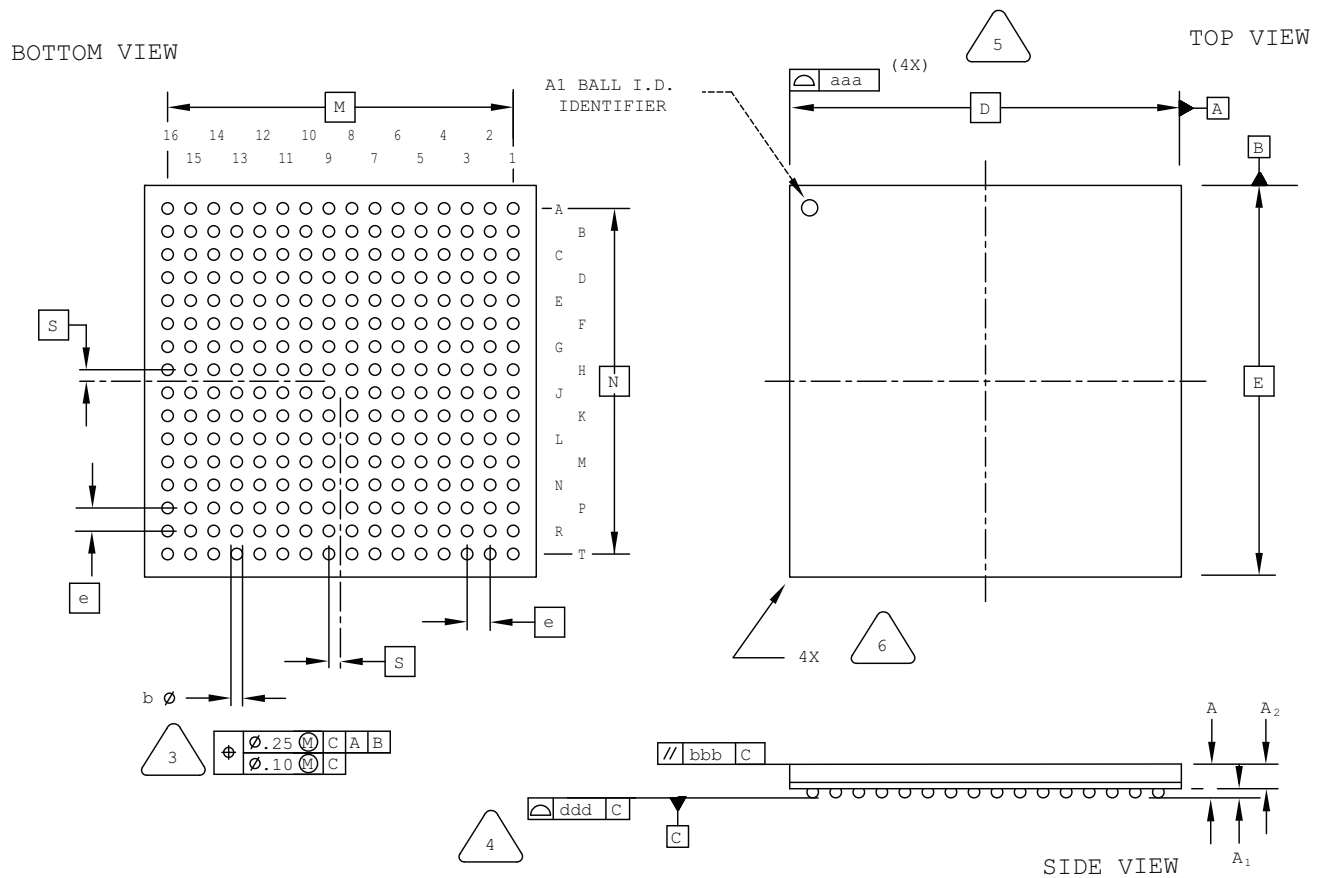


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | 1.30     | 1.70 | 2.10 |
| A1     | 0.30     | 0.50 | 0.70 |
| A2     | 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 |

## 256-Ball ftBGA Package Option 3: MachXO2

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

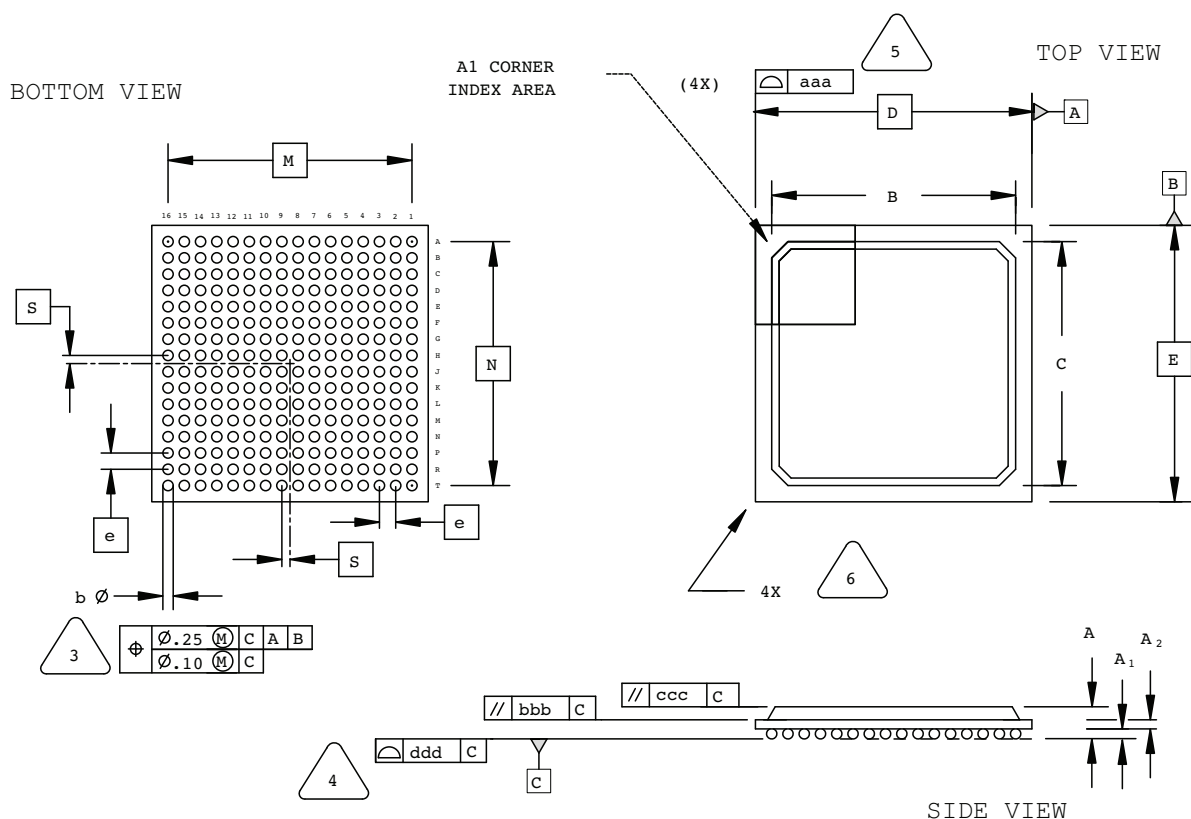
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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      | 1.40     | 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 |

## 256-Ball fpBGA 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.



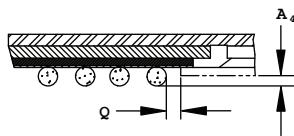
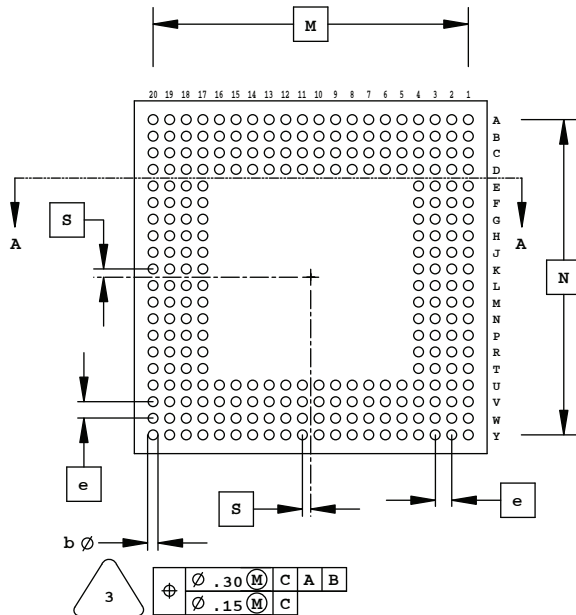
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

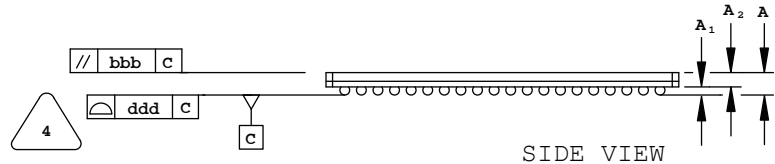
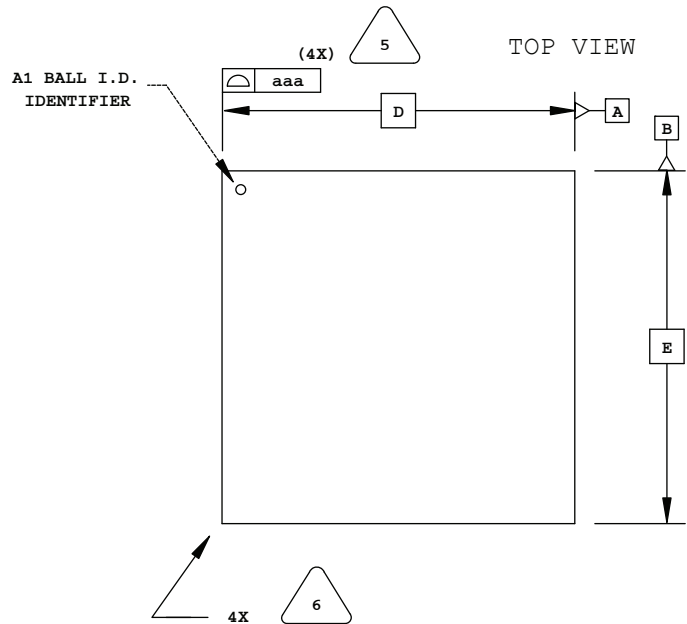
# 256-Ball SBGA Package

Dimensions in Millimeters

BOTTOM VIEW



A-A SECTION VIEW



SIDE VIEW

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.

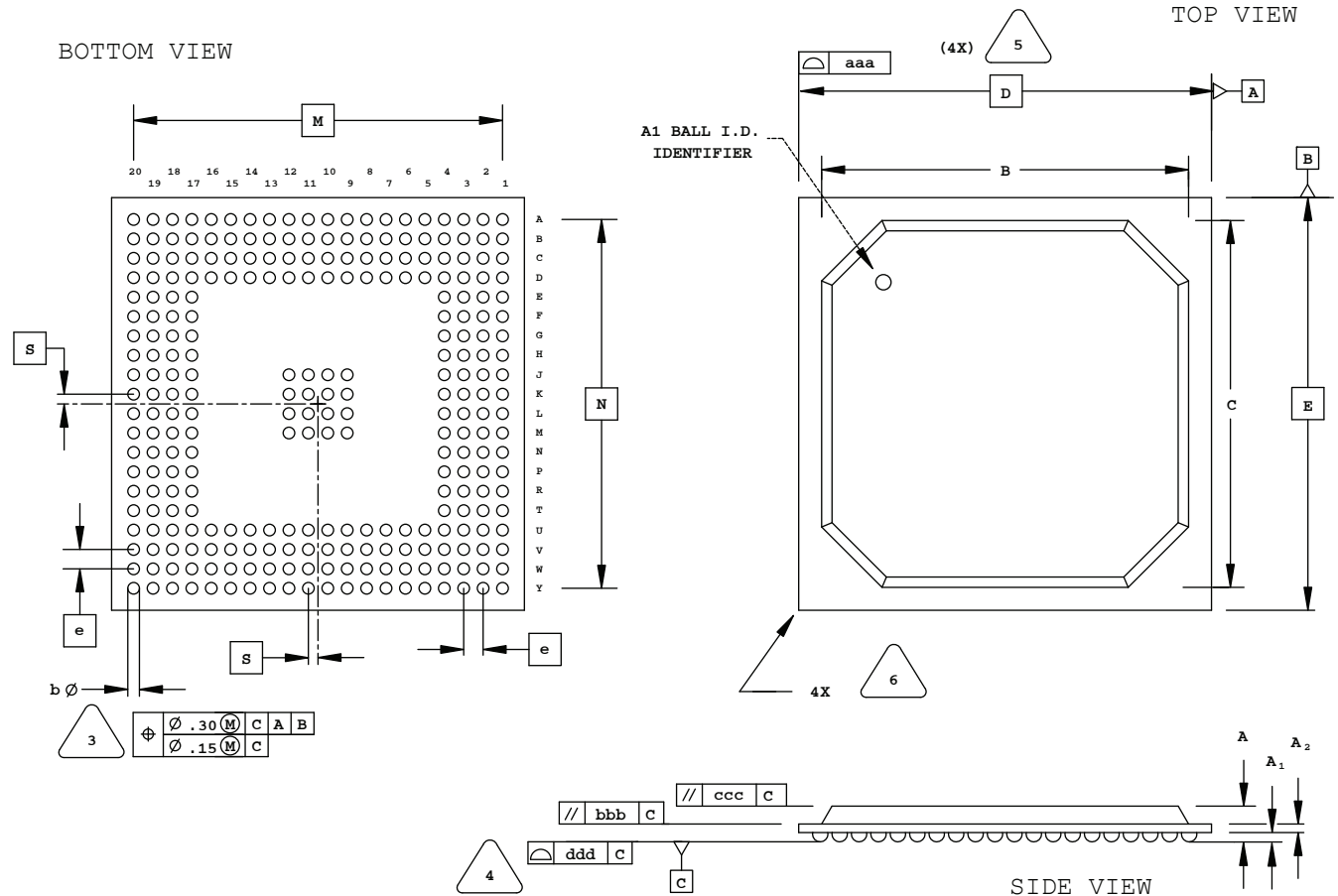


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | -         | -    | 1.70 |
| A1     | 0.50      | 0.65 | 0.80 |
| A2     | 0.80      | 0.90 | 1.00 |
| D/E    | 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 |

## 272-Ball BGA 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  $\boxed{C}$



PRIMARY DATUM  $\boxed{C}$  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.

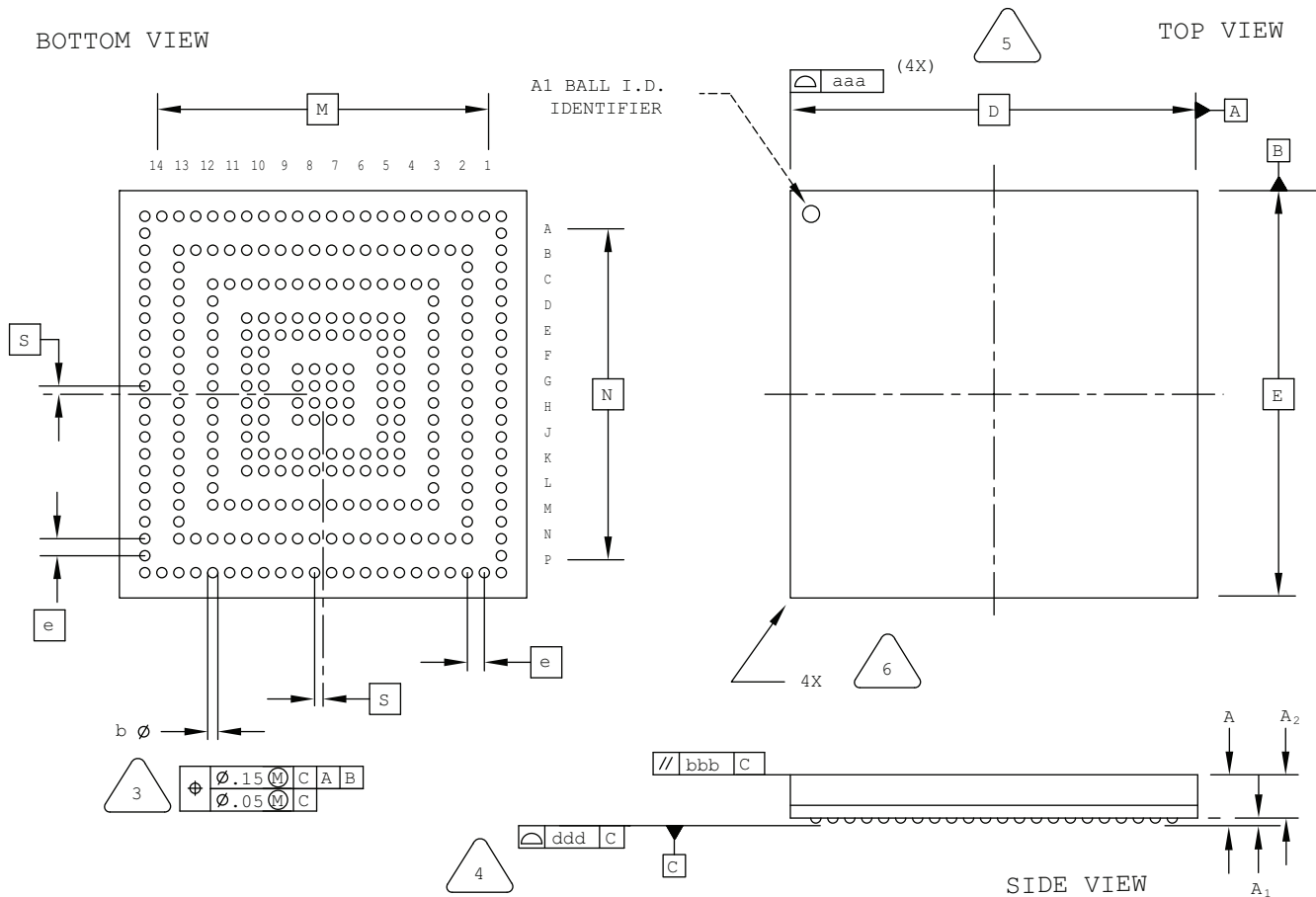


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 1.90      | 2.25  | 2.80  |
| 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  |

## 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.

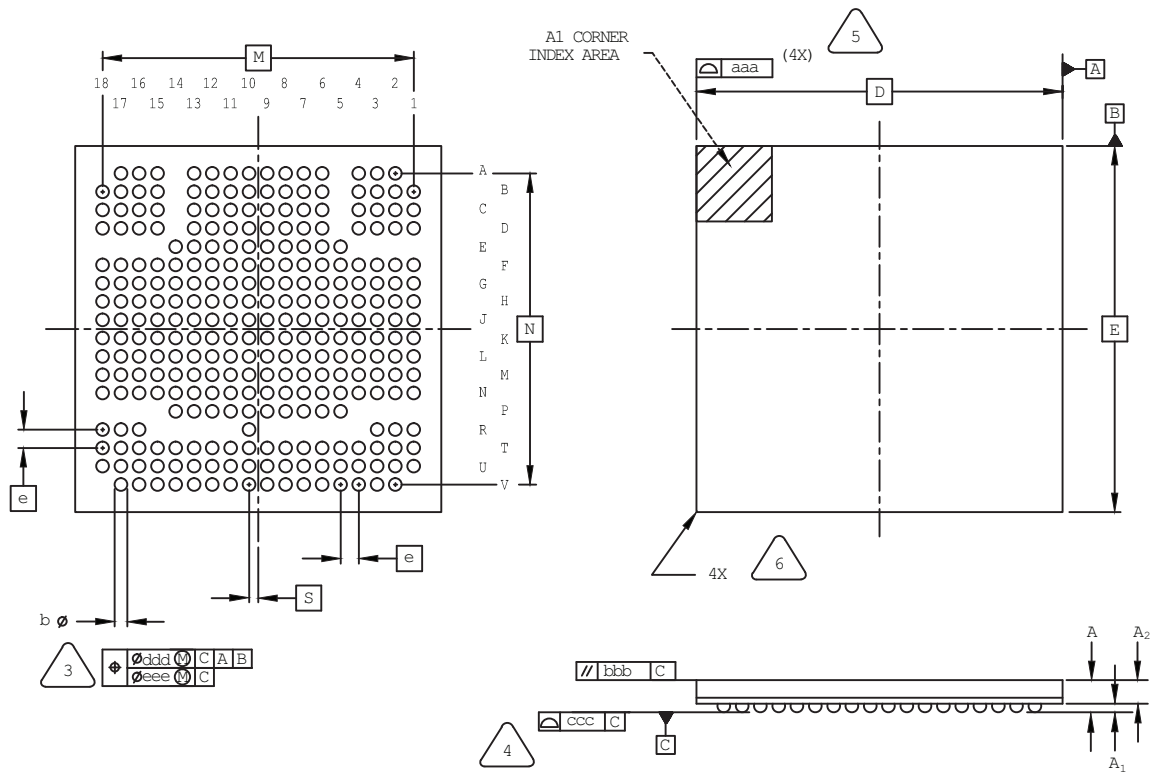


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 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.



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.

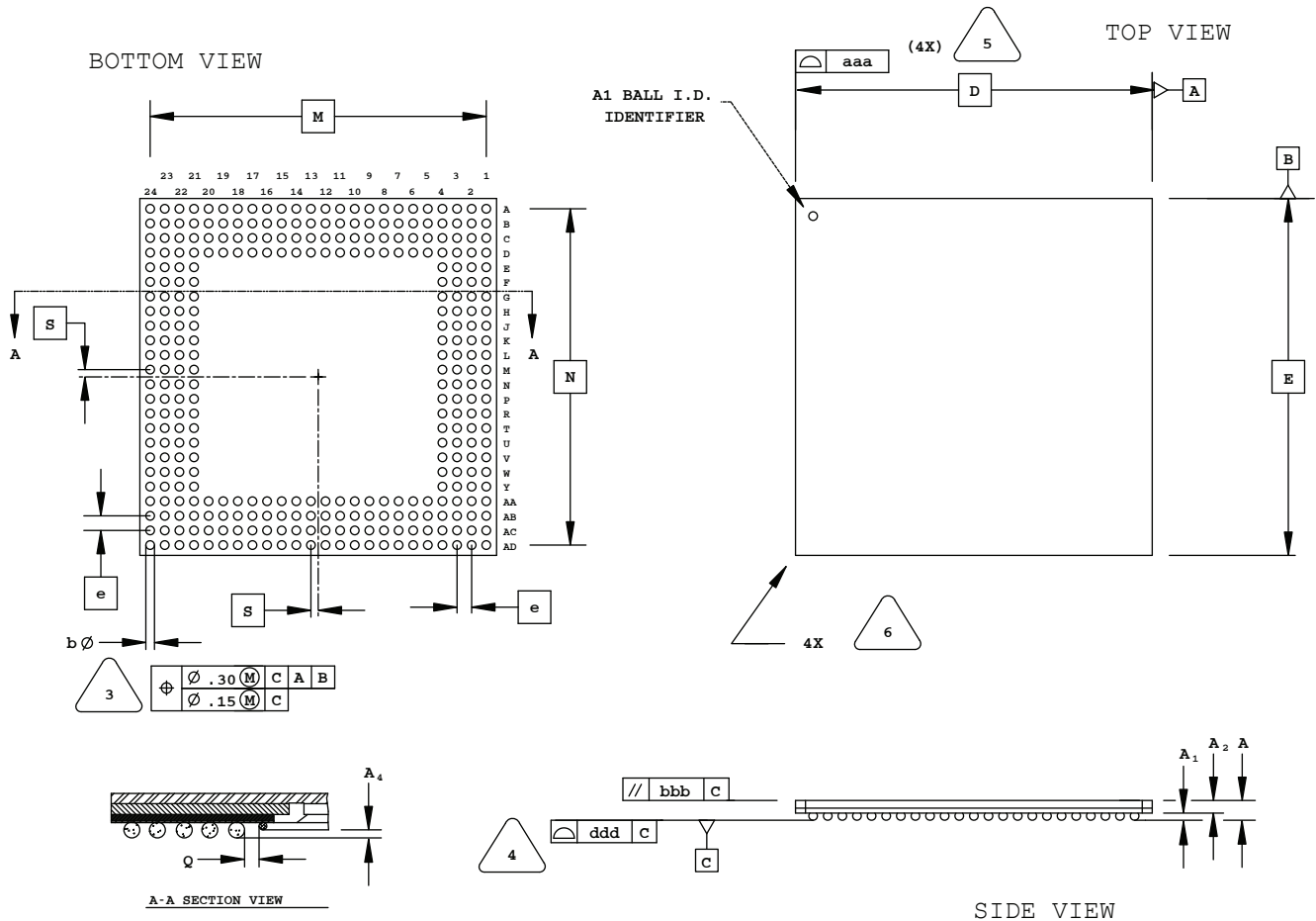


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | -         | -    | 1.30 |
| 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      |      |      |

## 320-Ball SBGA 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.

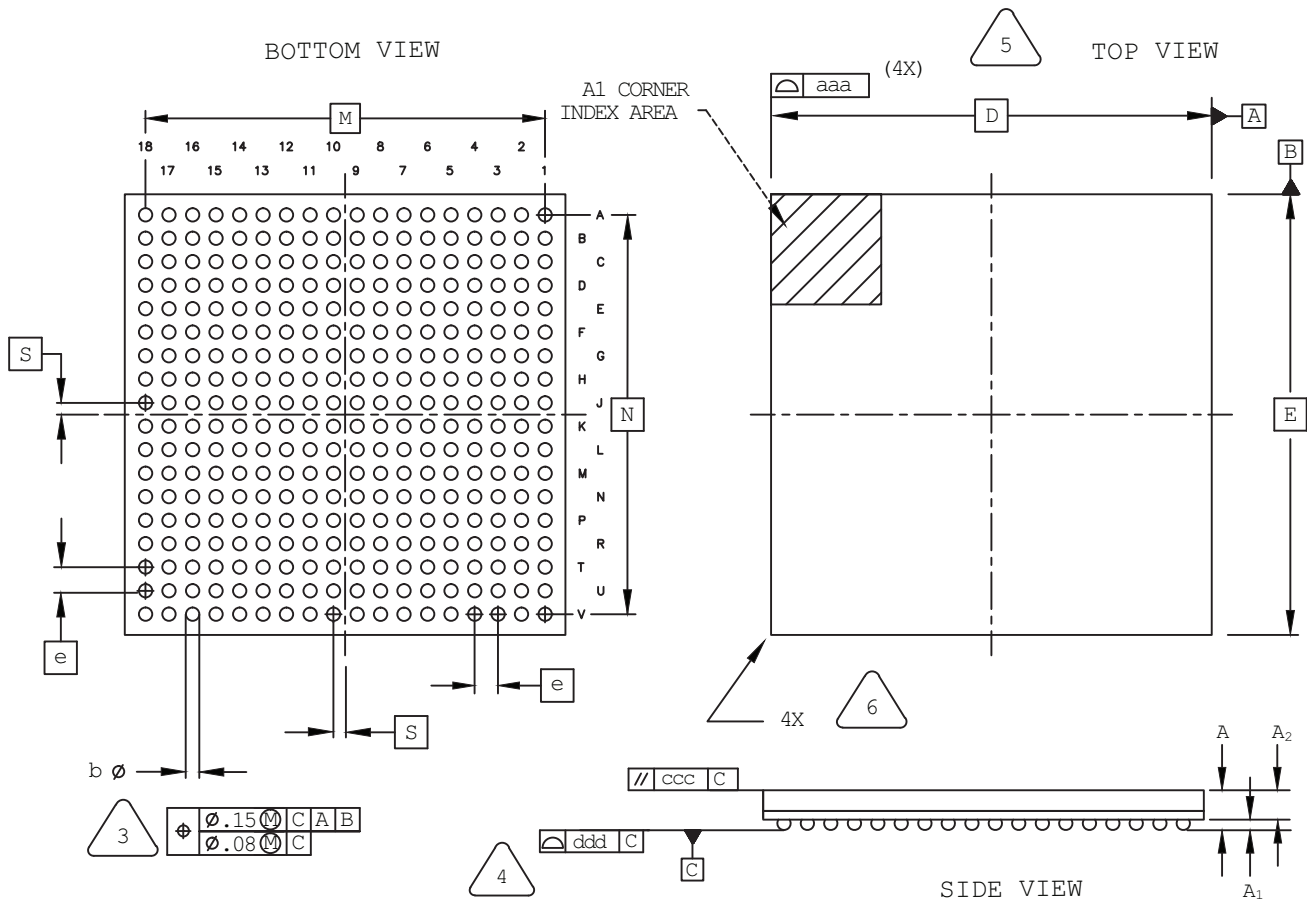


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | -         | -    | 1.70 |
| A1     | 0.50      | 0.65 | 0.80 |
| A2     | 0.80      | 0.90 | 1.00 |
| D/E    | 31.00 BSC |      |      |
| M/N    | 29.21 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 |

## 324-Ball caBGA 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.



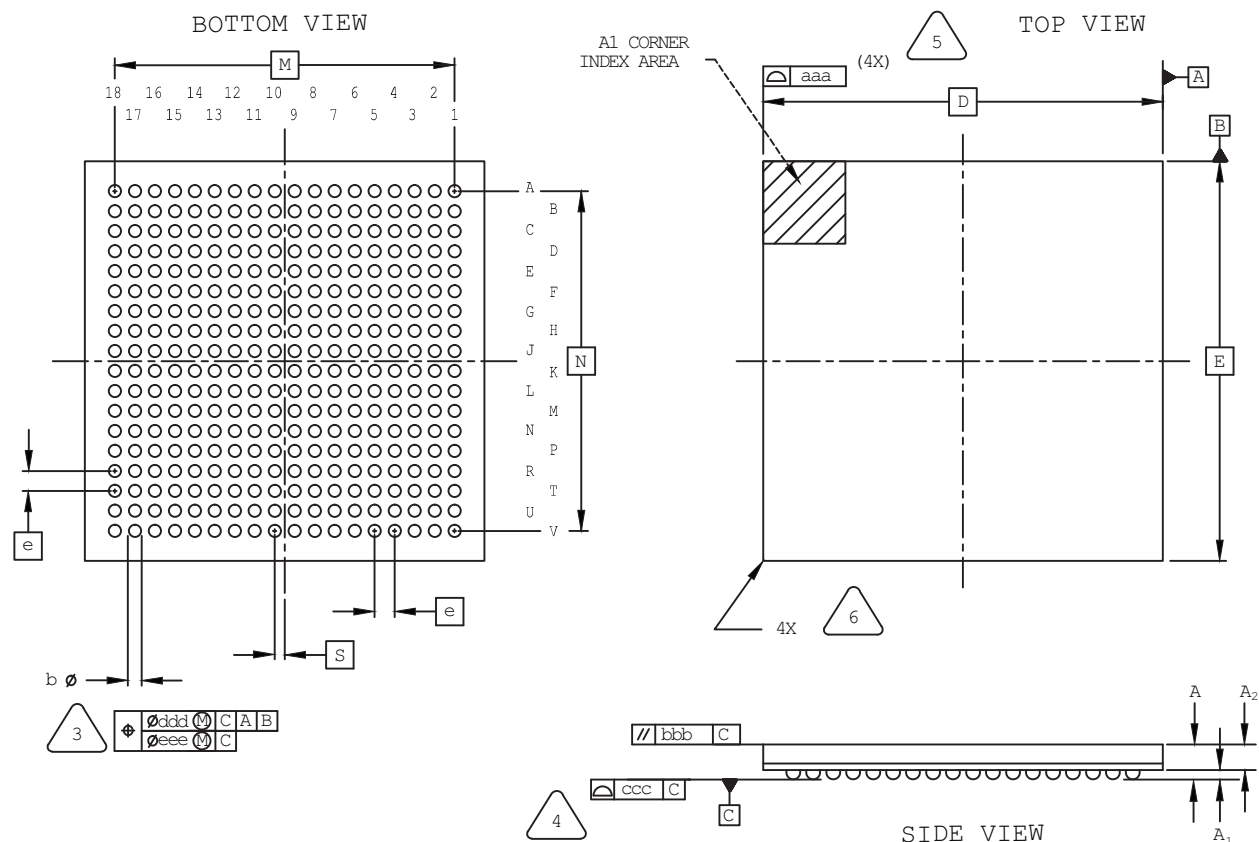
BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.



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 |

### 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.

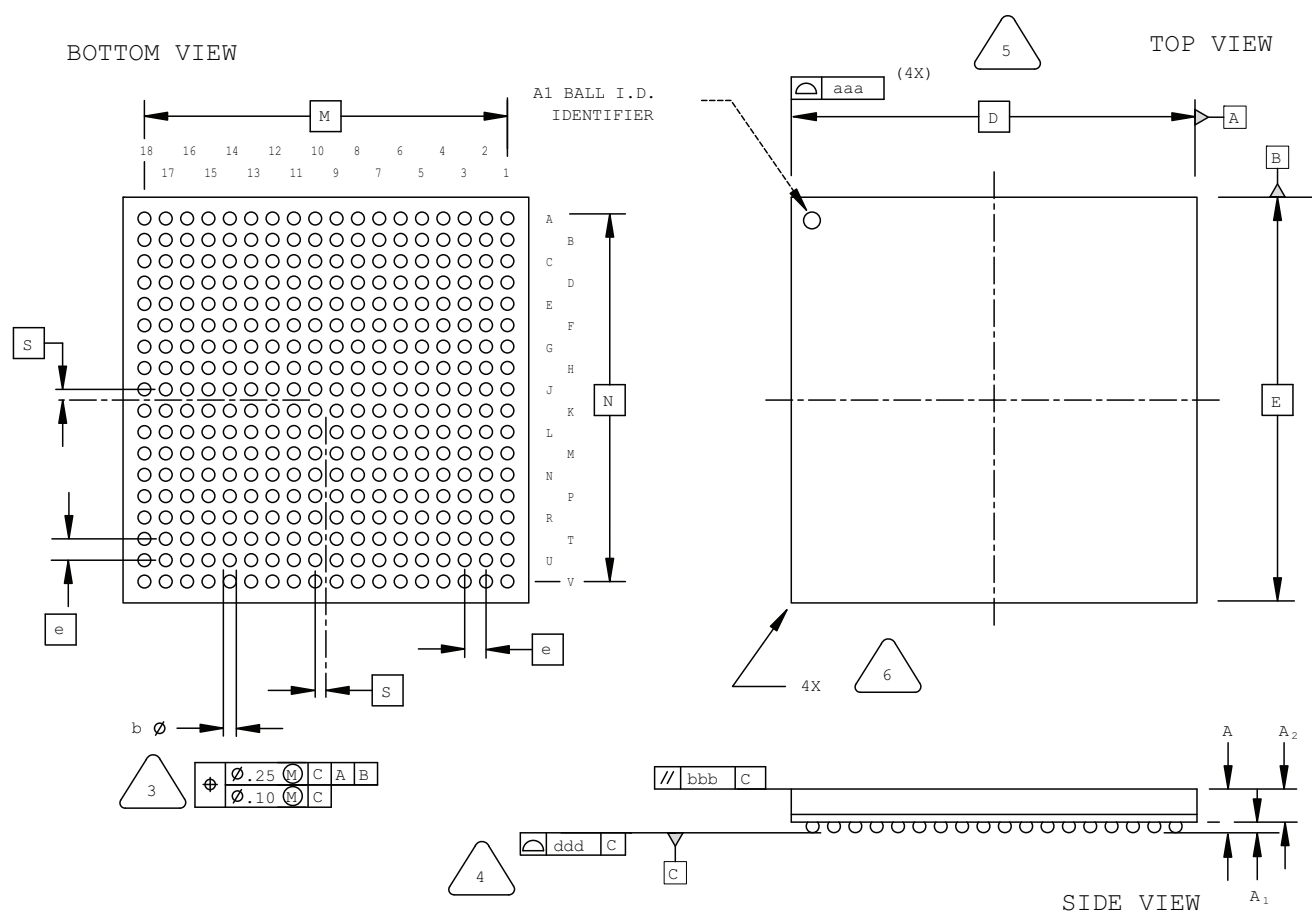
BILATERAL TOLERANCE ZONE IS APPLIED  
TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE  
IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | –         | –    | 1.00 |
| A1     | 0.15      | 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      |      |      |

## 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.



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.

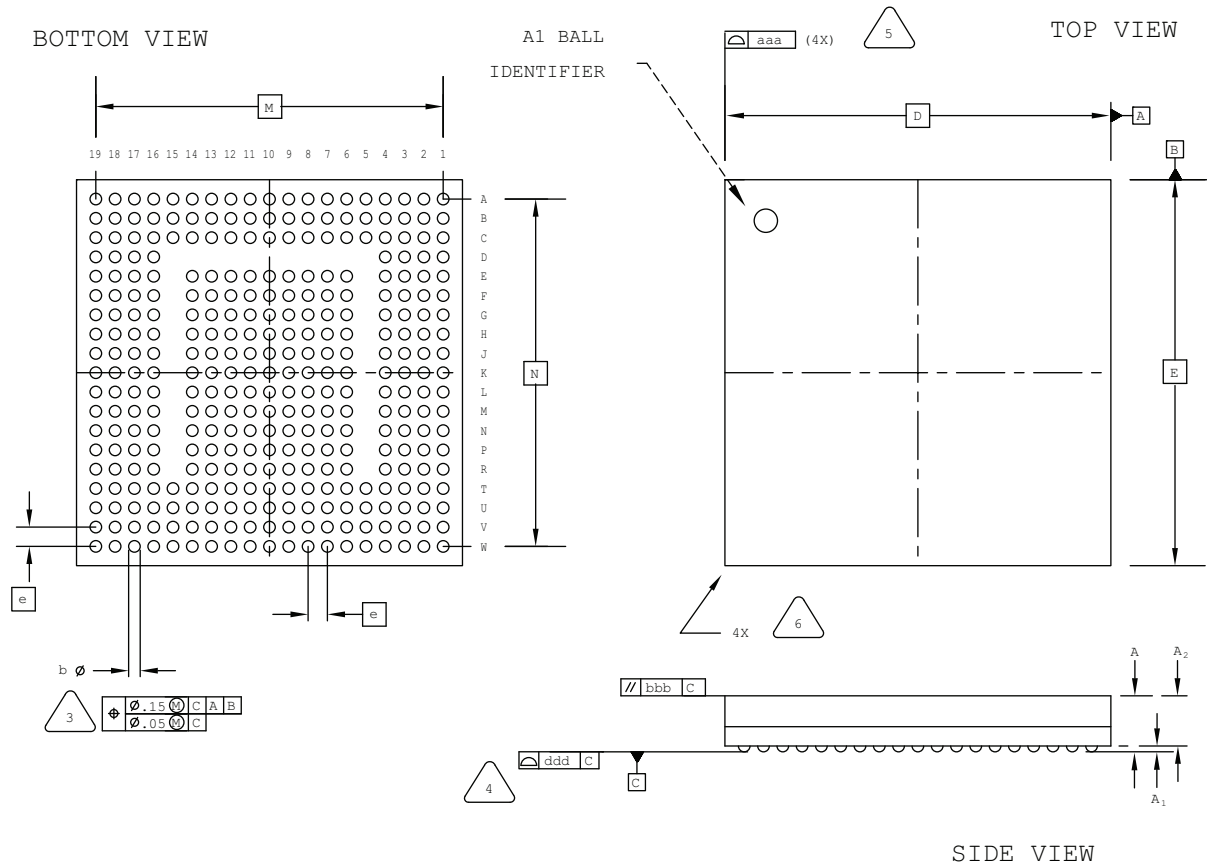


EXACT SHAPE AND SIZE OF THIS FEATURE  
IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | 1.25     | 1.50 | 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 |

## 328-Ball csBGA Package

Dimensions in Millimeters



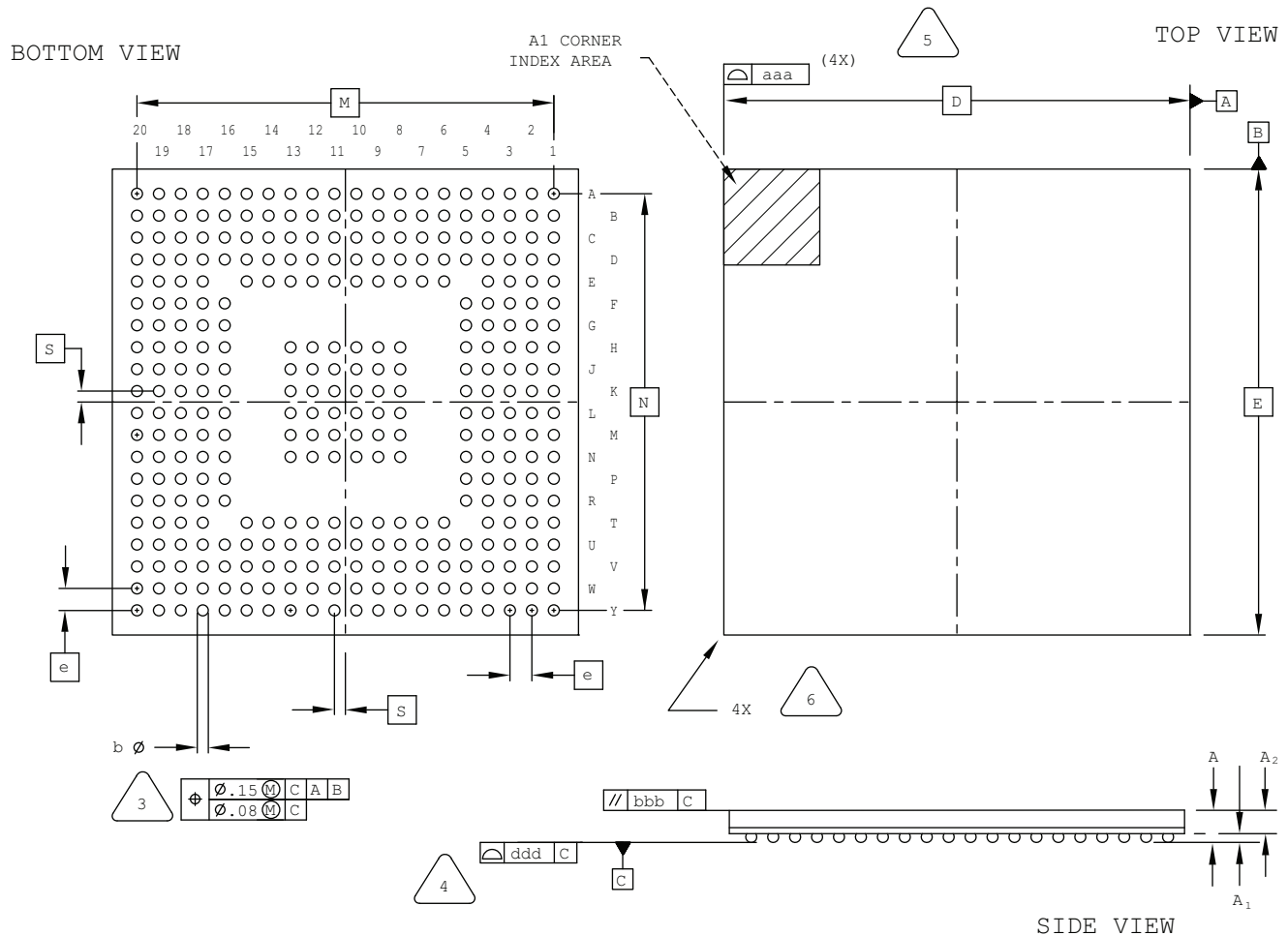
NOTES: UNLESS OTHERWISE SPECIFIED

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

| 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 |

## 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.

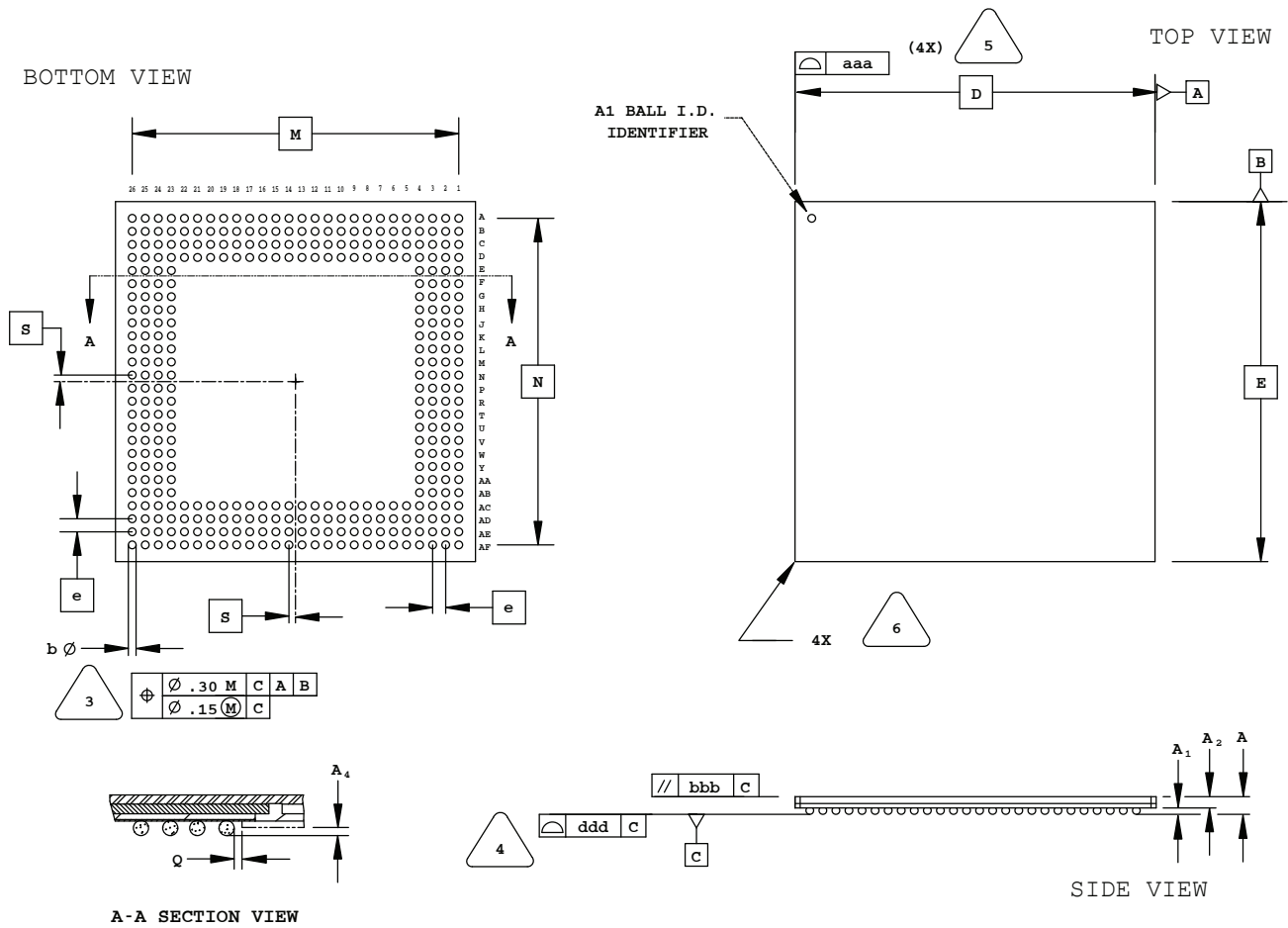


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 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.



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.

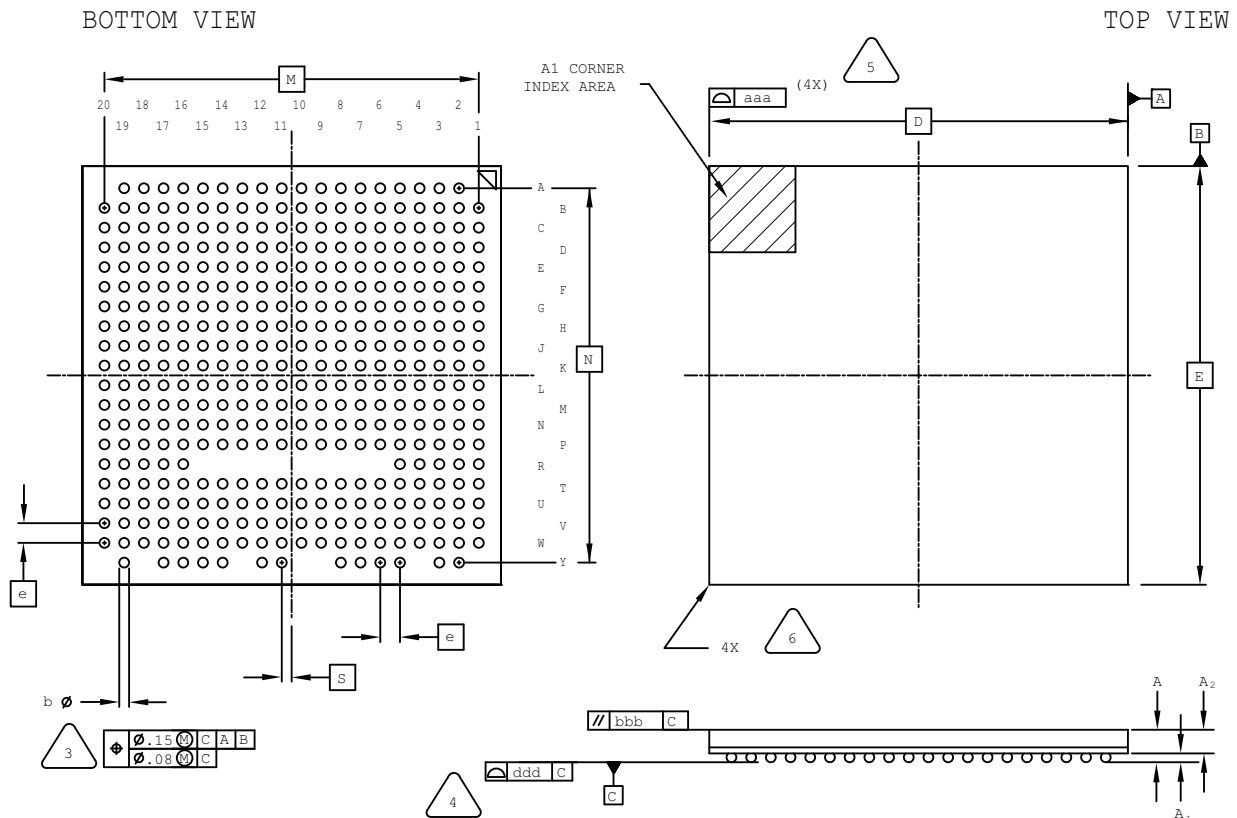


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | -         | -    | 1.70 |
| A1     | 0.50      | 0.65 | 0.80 |
| A2     | 0.80      | 0.90 | 1.00 |
| D/E    | 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 |

## 381-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

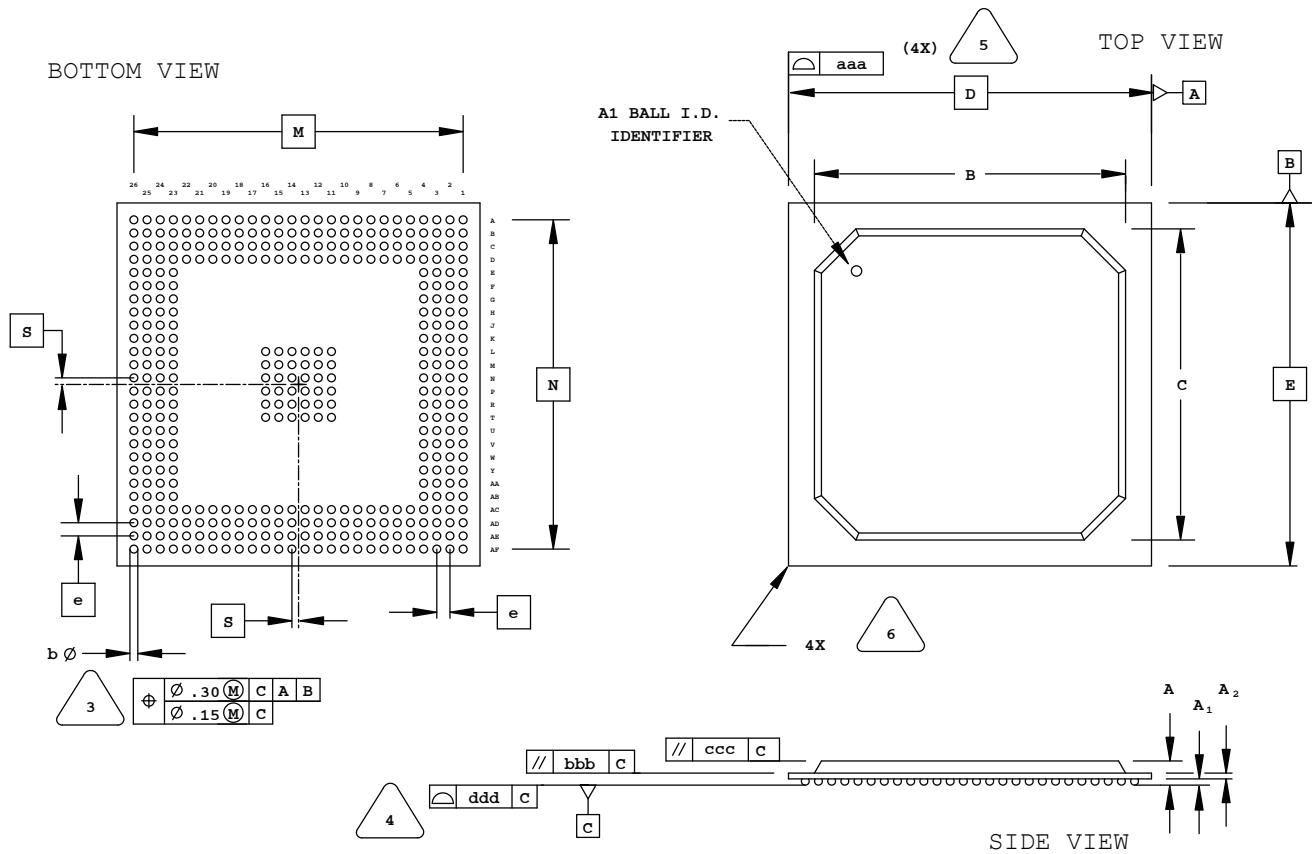
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.

- 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    | 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 |

## 388-Ball BGA 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.

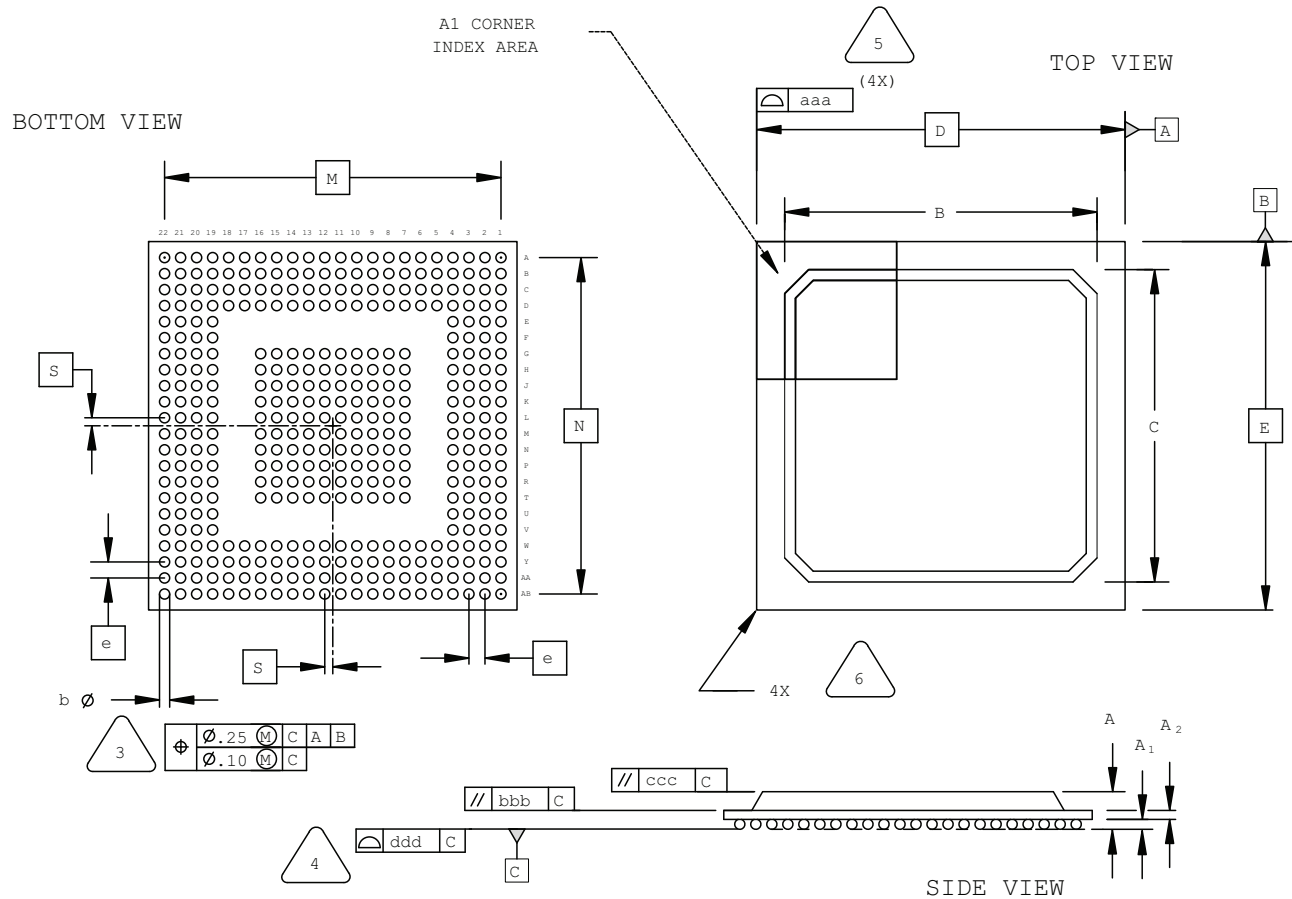
BILATERAL TOLERANCE ZONE IS APPLIED  
TO EACH SIDE OF THE PACKAGE BODY.

EXACT SHAPE AND SIZE OF THIS FEATURE  
IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 1.90      | 2.80  | 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  |

## 388-Ball fpBGA 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.

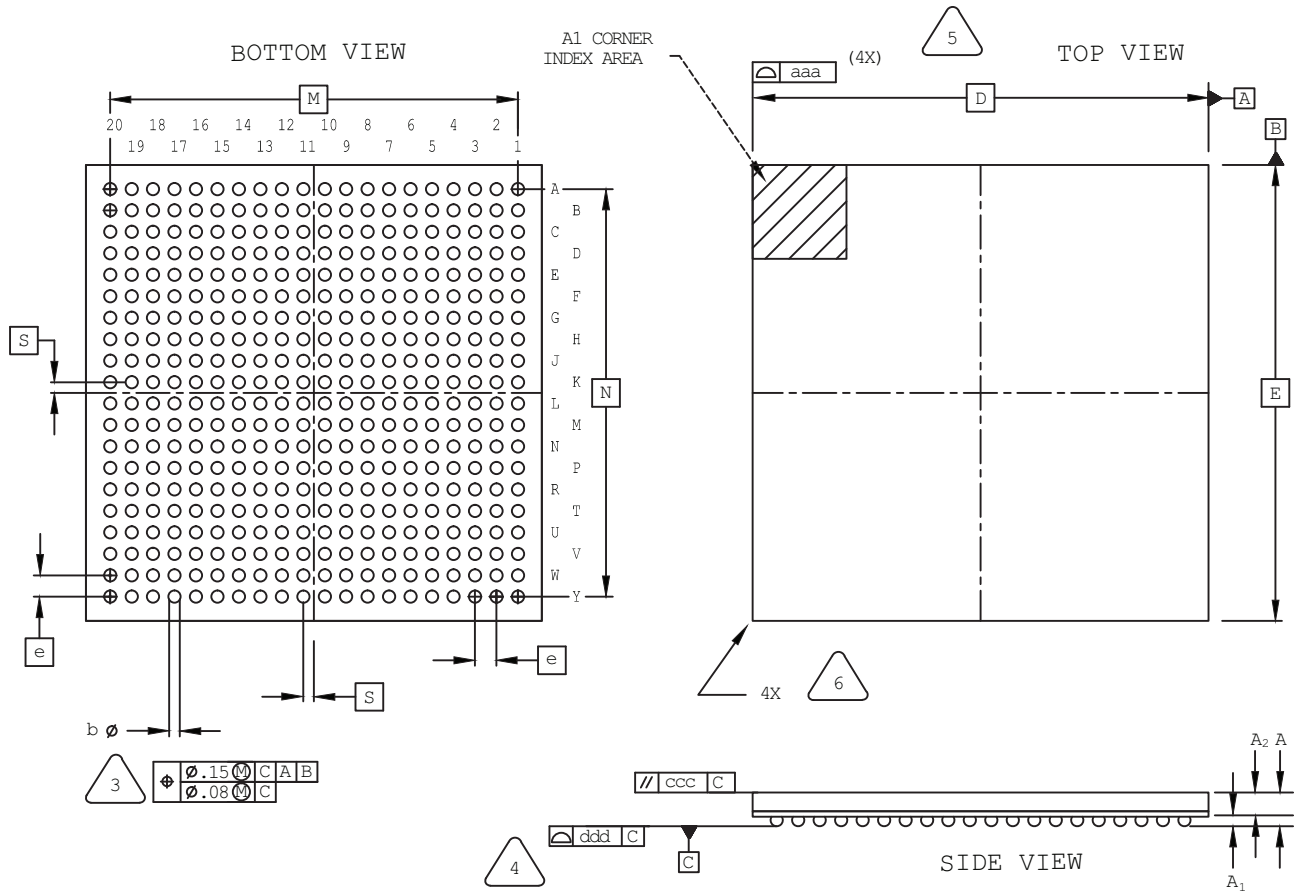


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

# 400-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.

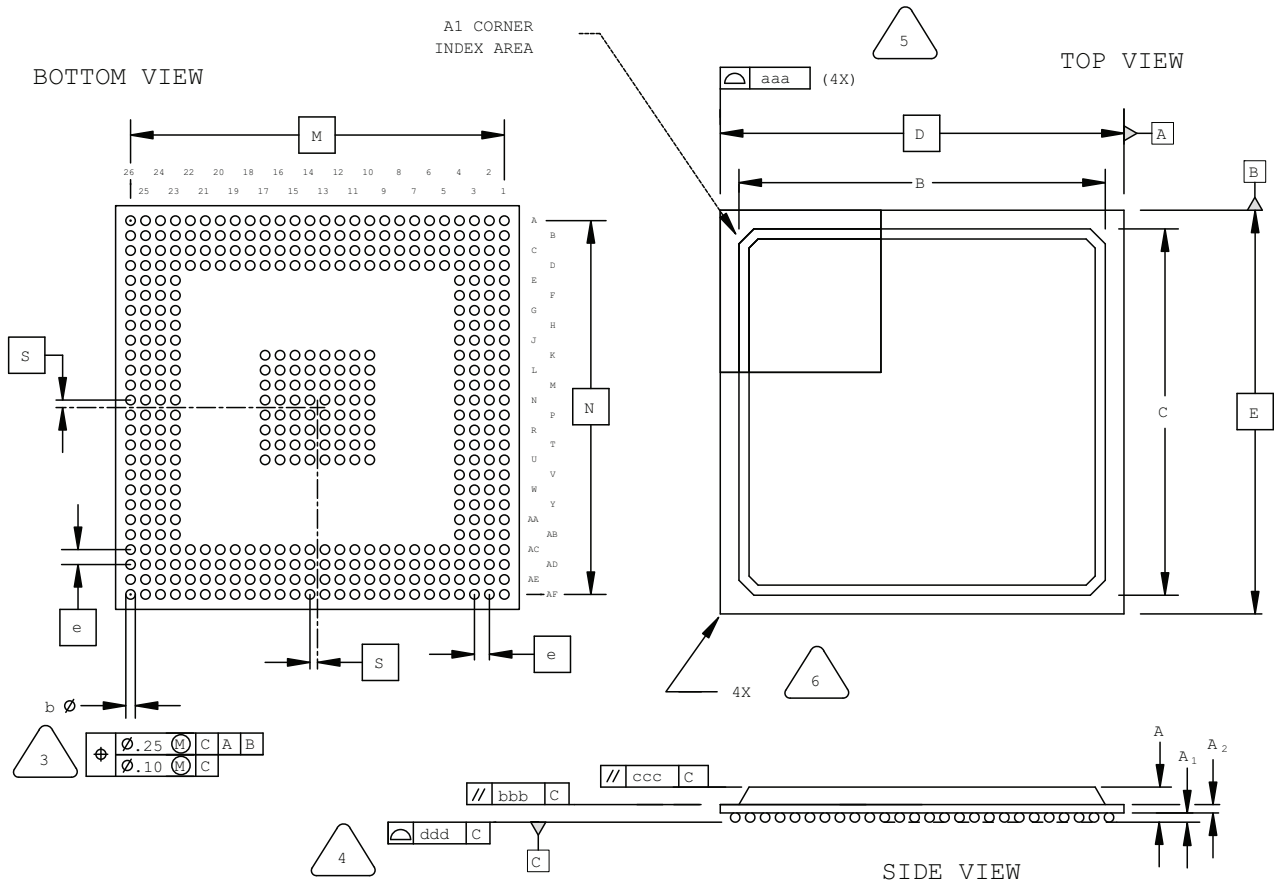


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.70 |
| 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 |

## 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.

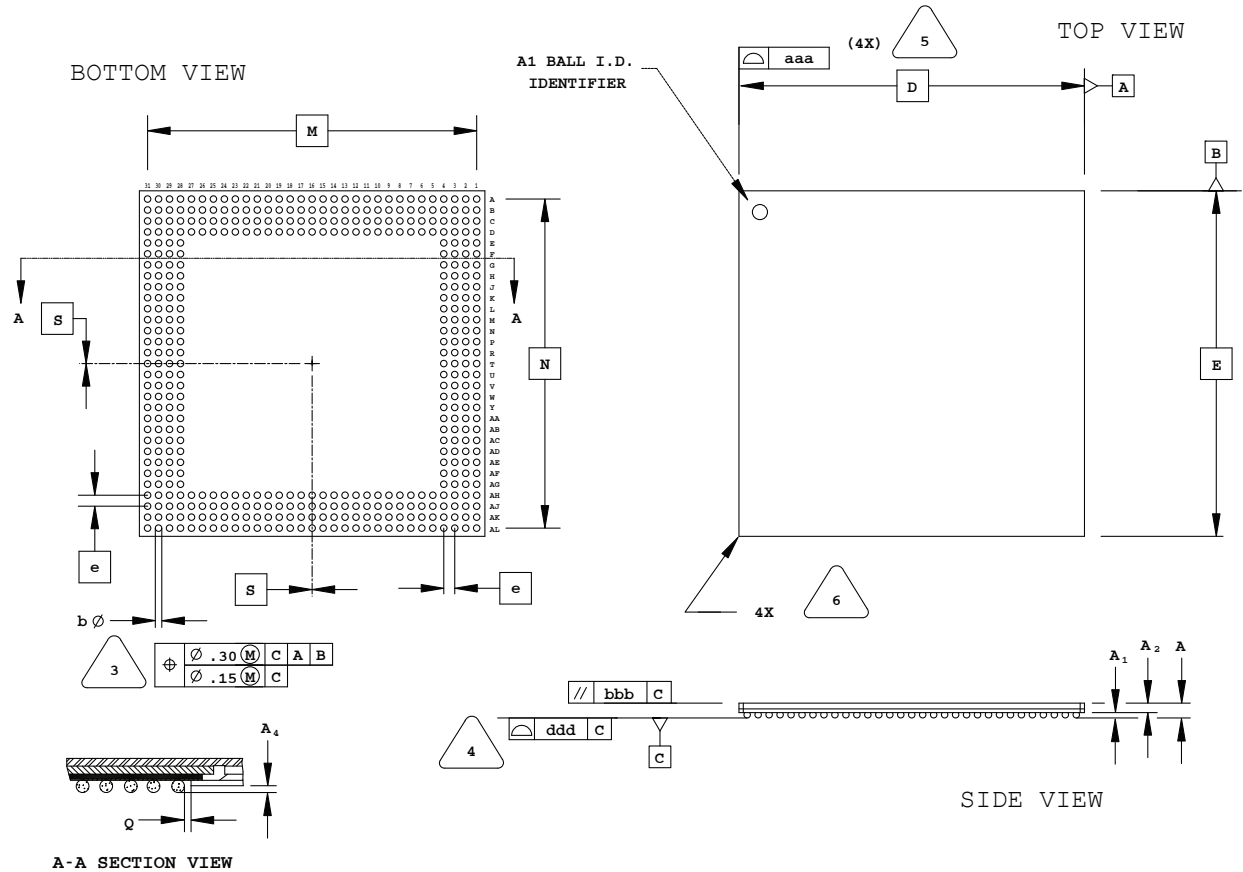
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

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  |

## 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.

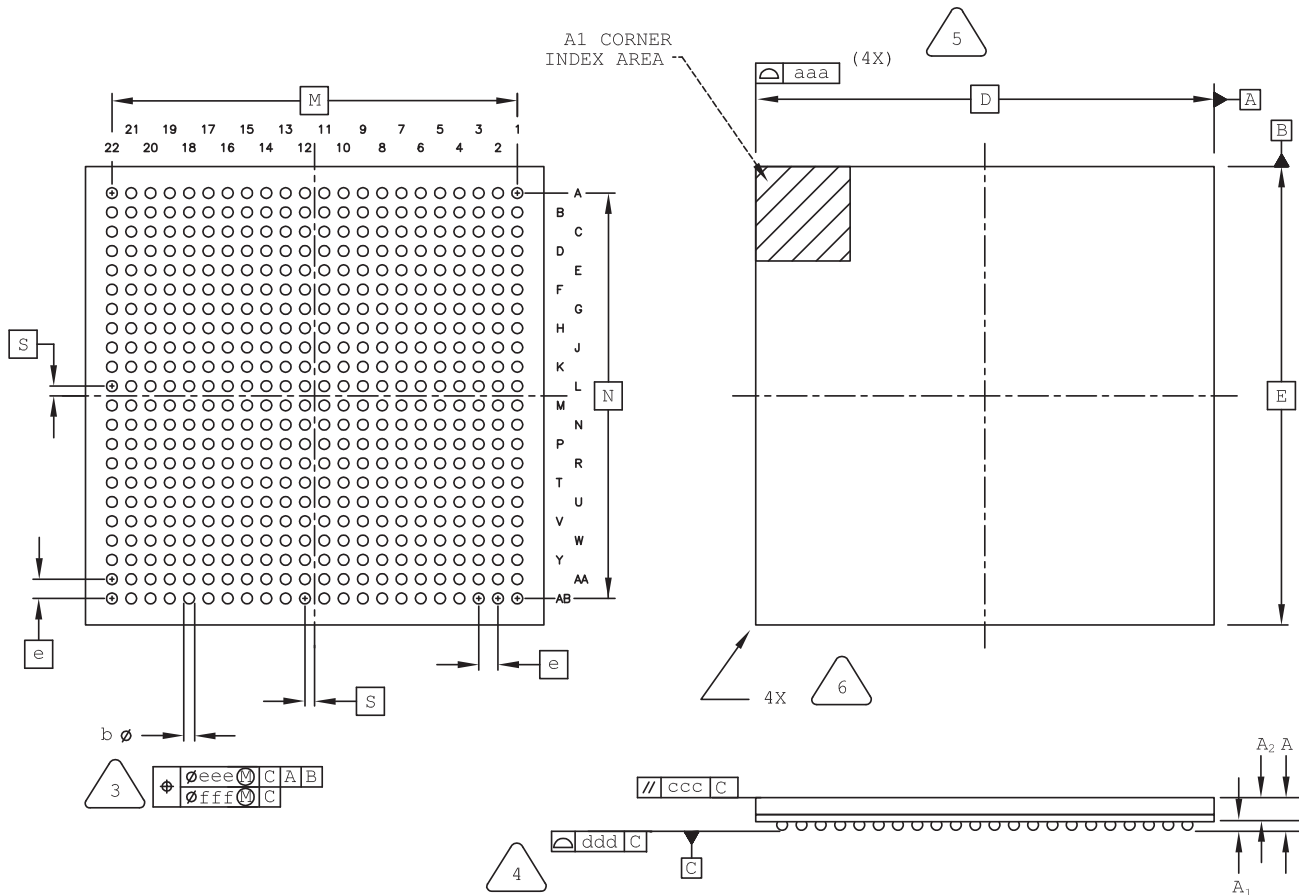


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |

## 484-Ball caBGA Package (19x19 mm Body)

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.



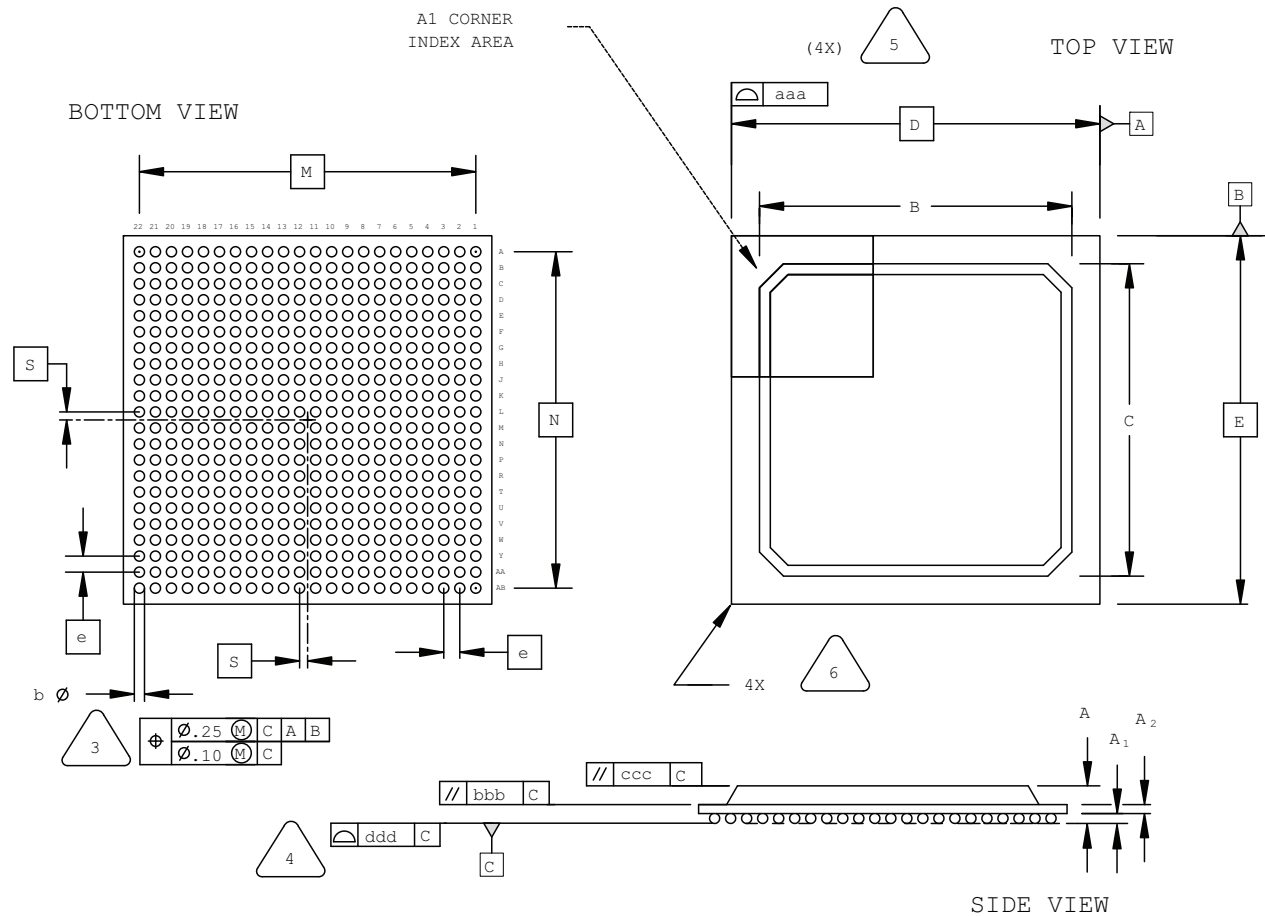
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

- 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 |

## 484-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

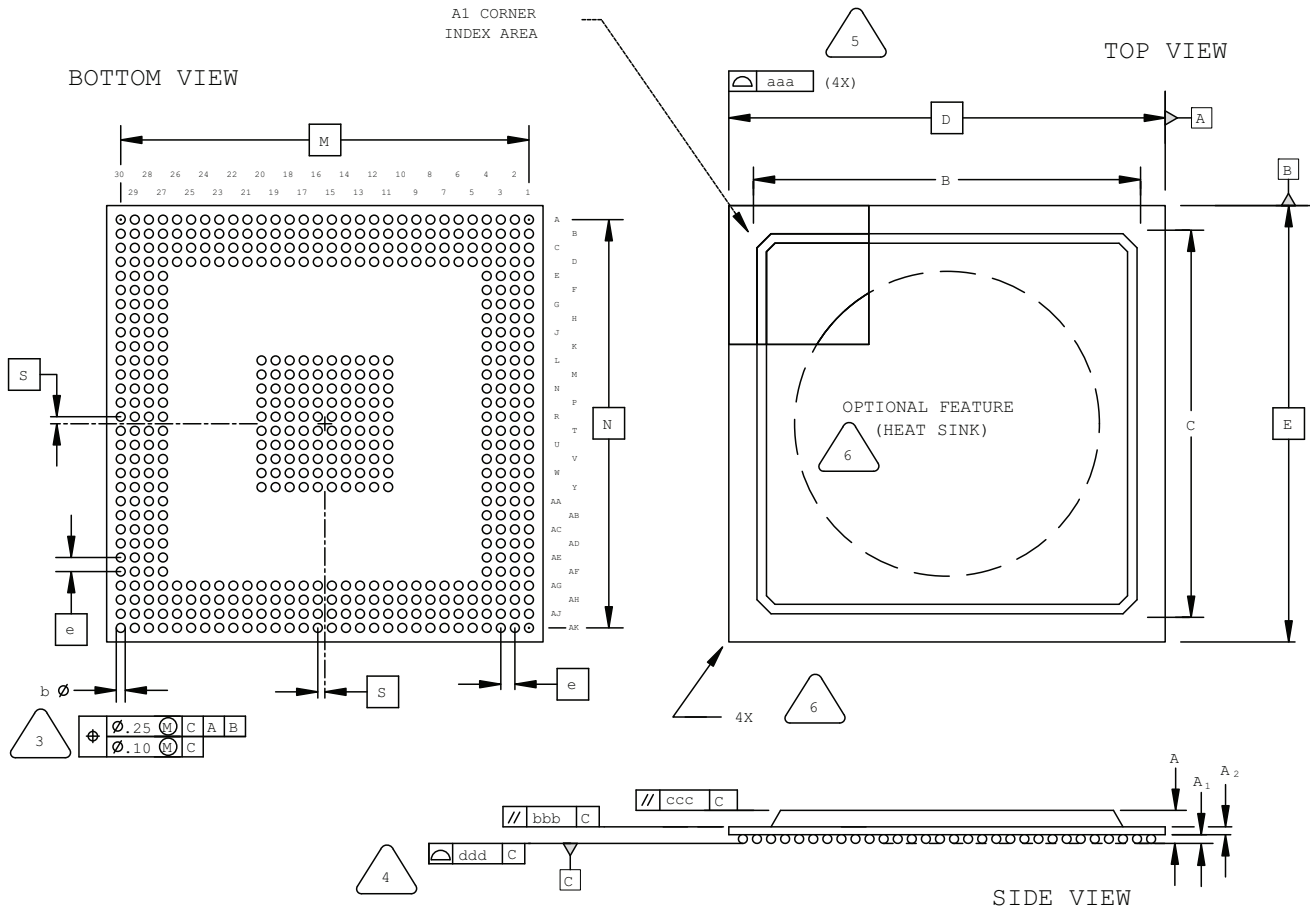
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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  |

## 516-Ball fpBGA 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.

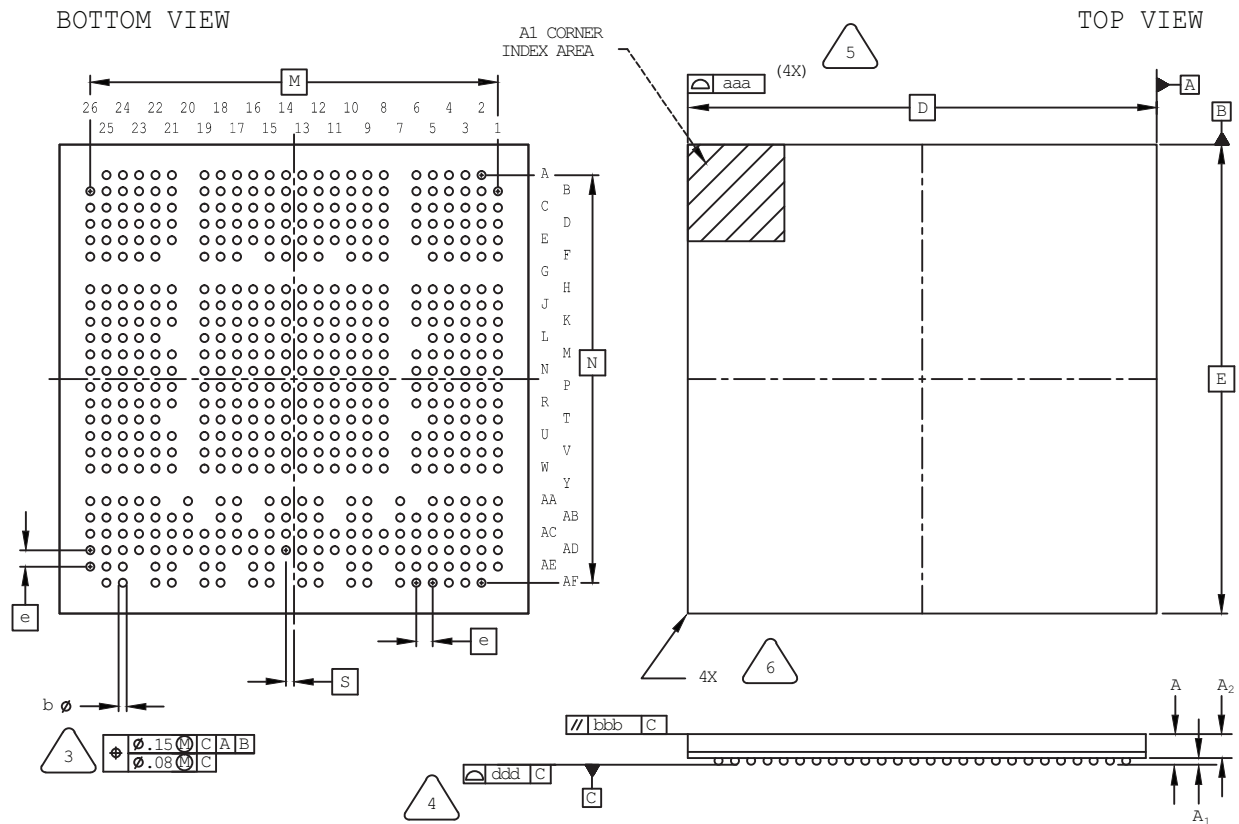


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

# 554-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

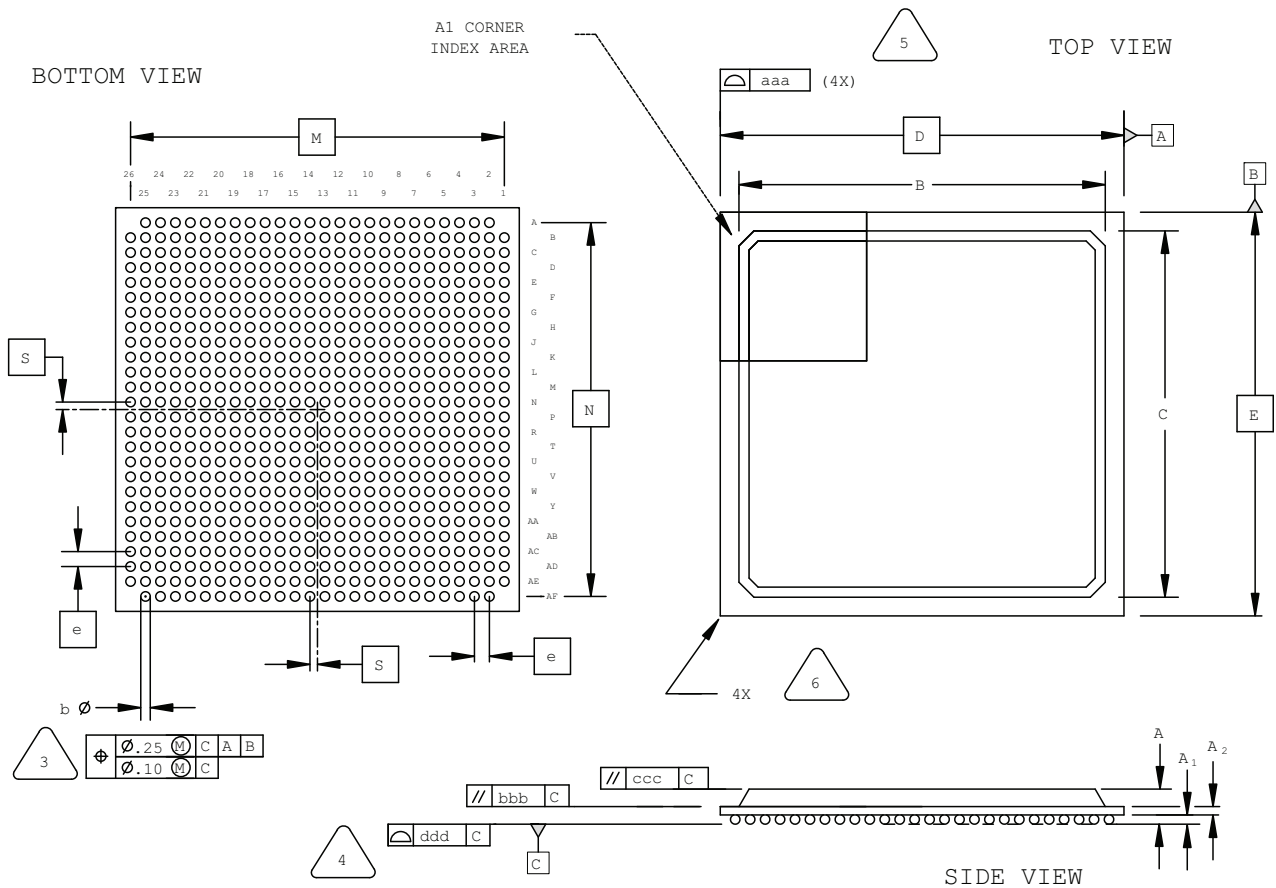
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.

- 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 |

## 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.

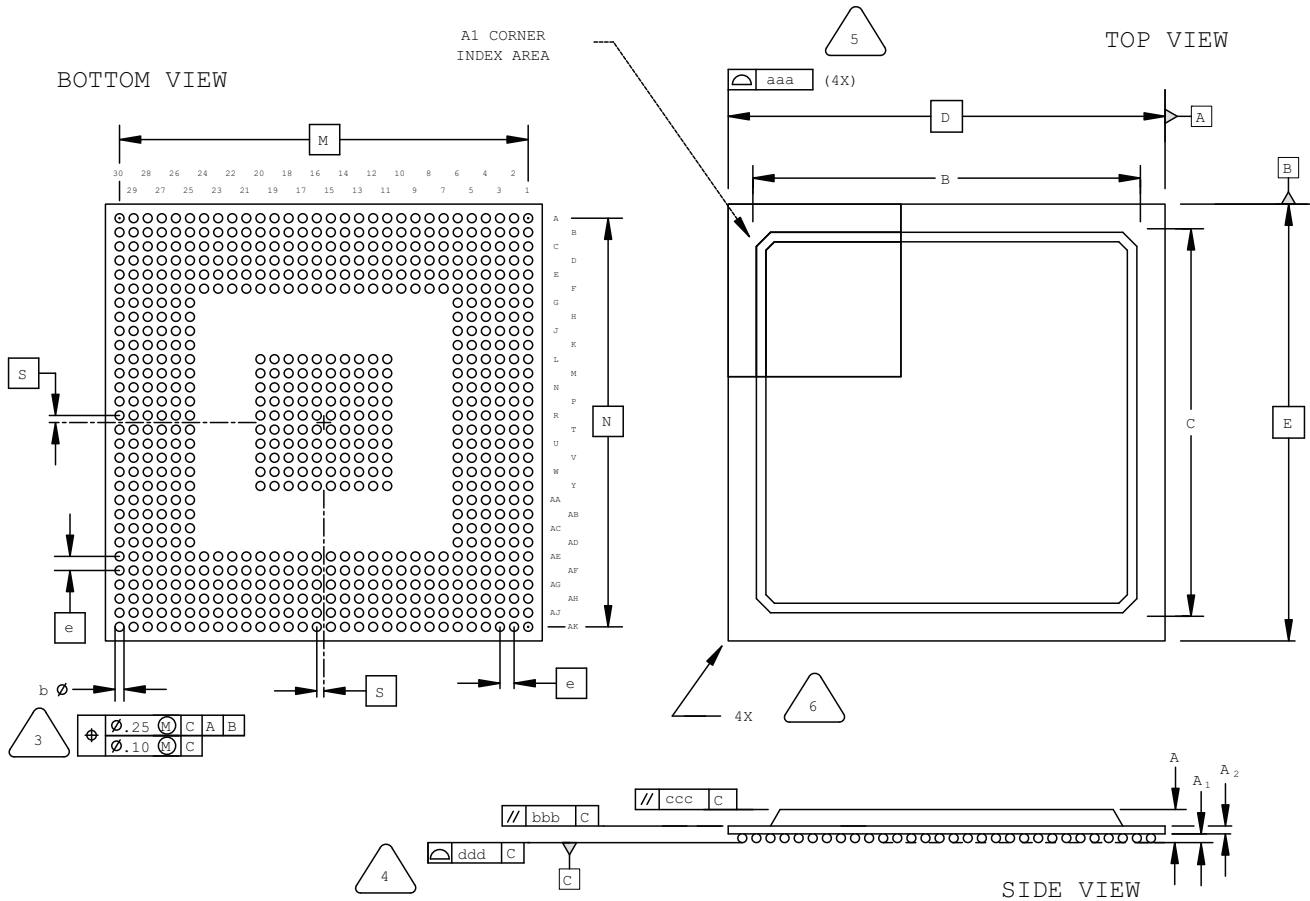
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

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  |

## 676-Ball fpBGA 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.

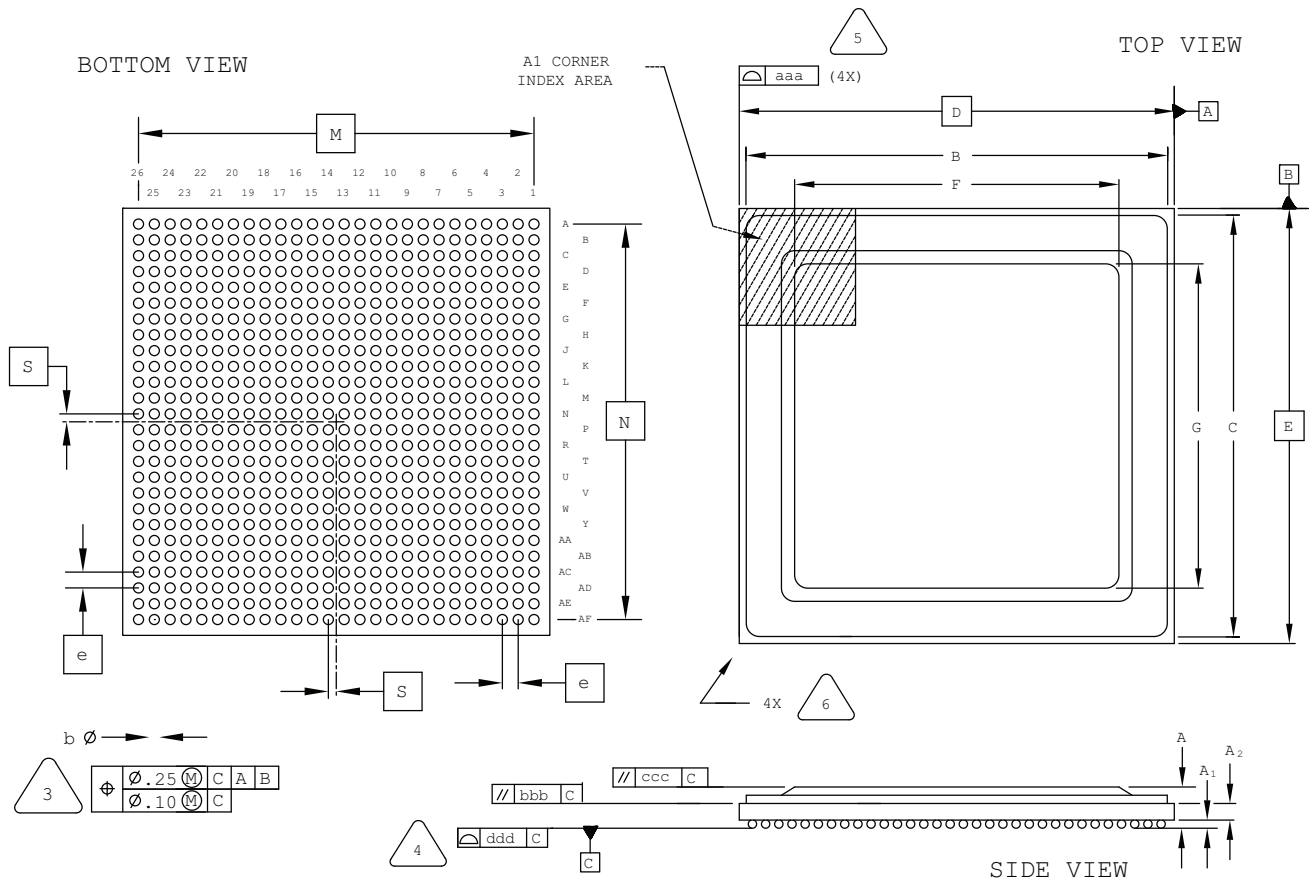


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 676-Ball fcBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

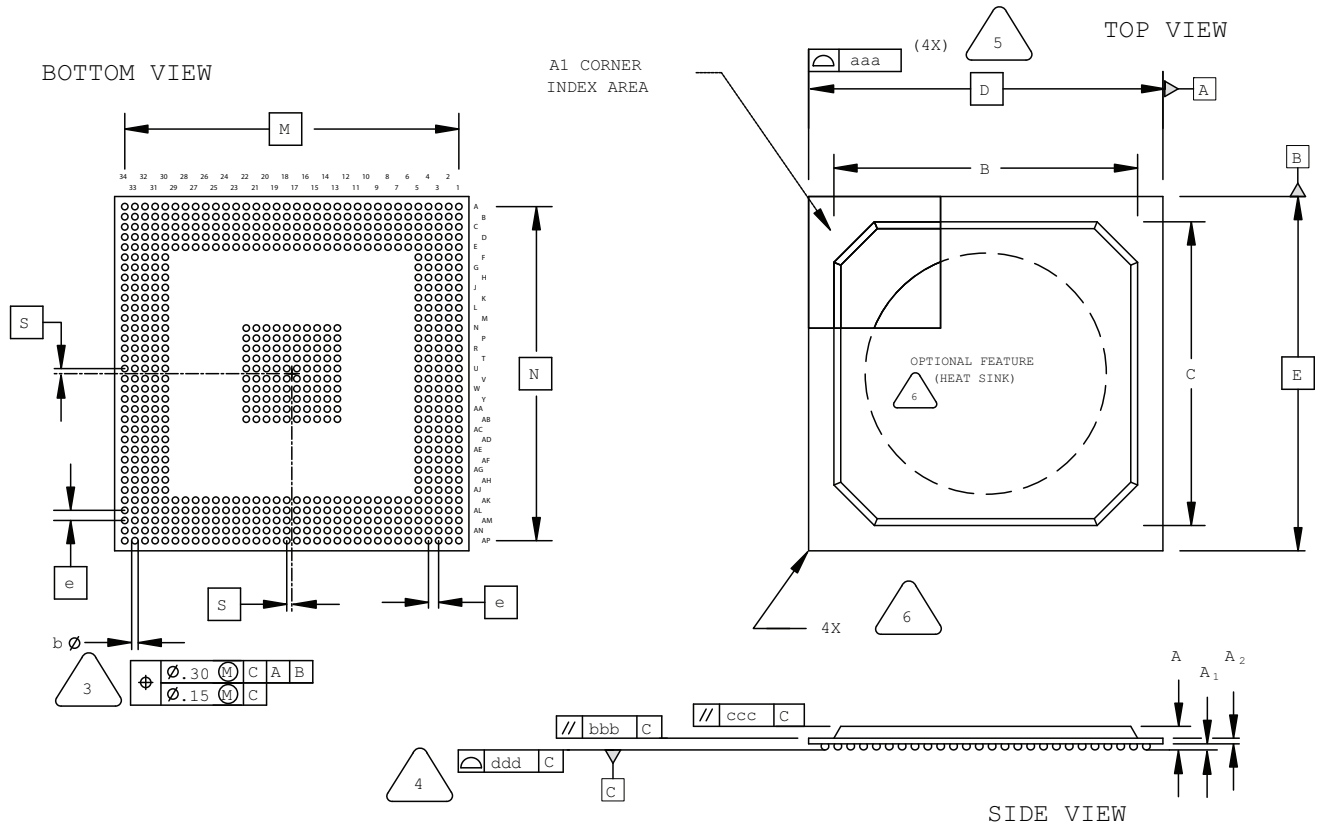
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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  |

# 680-Ball fpBGA Package

(with or without Internal Heat Spreader)  
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.

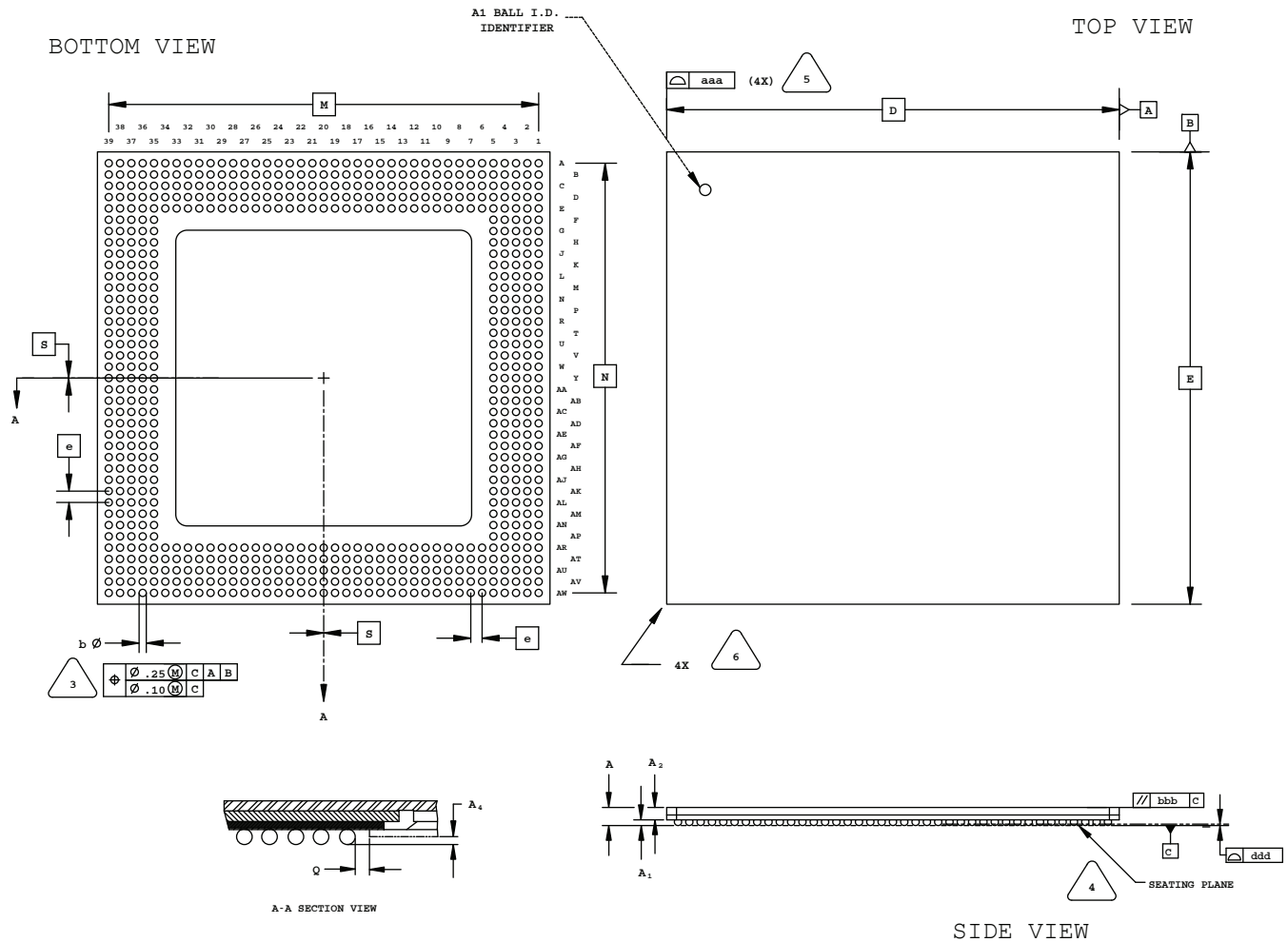


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

# 680-Ball fpSBGA 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.

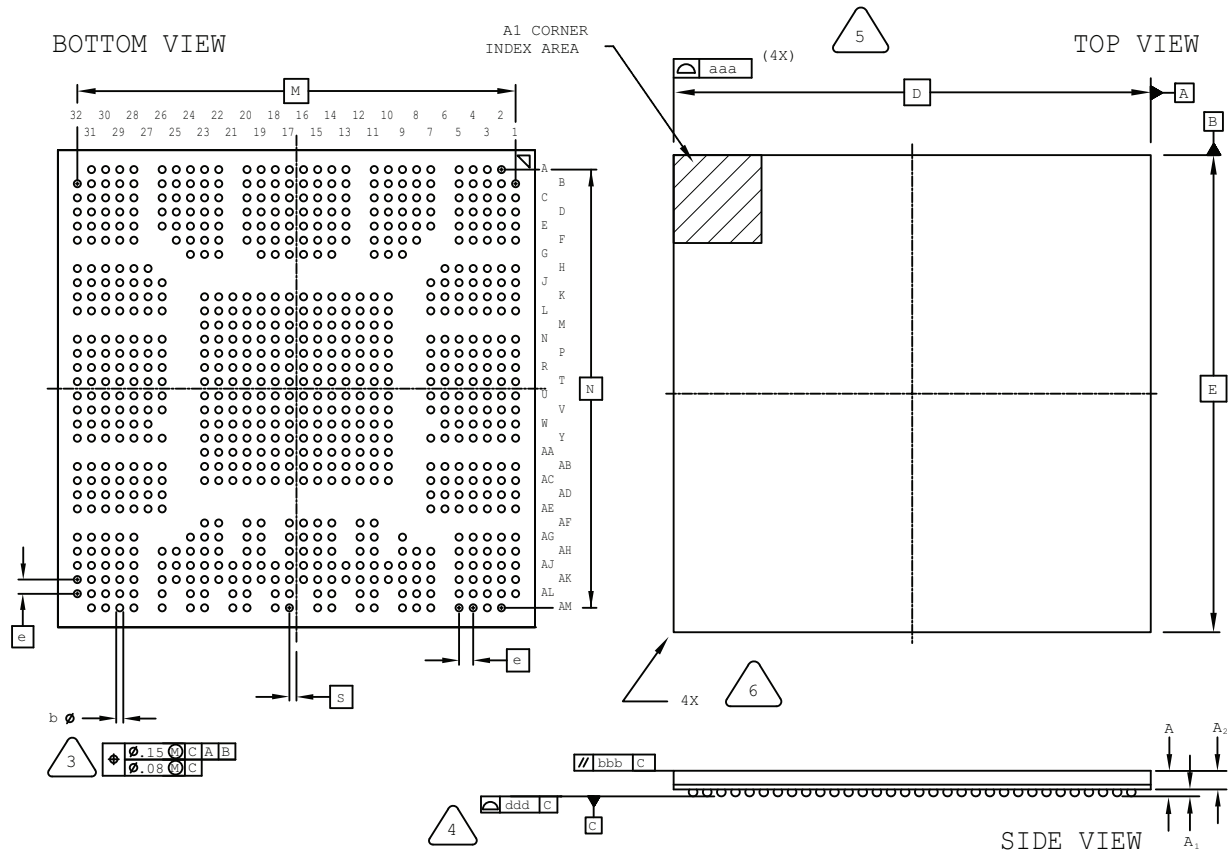


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM. | MAX. |
|--------|-----------|------|------|
| A      | -         | -    | 1.70 |
| A1     | 0.45      | 0.53 | 0.60 |
| A2     | 0.90      | 0.98 | 1.05 |
| D/E    | 40.00 BSC |      |      |
| M/N    | 38.00 BSC |      |      |
| S      | 0.00 BSC  |      |      |
| b      | 0.50      | 0.65 | 0.80 |
| e      | 1.00 BSC  |      |      |
| Q      | 0.25      | -    | -    |
| A4     | 0.10      | -    | -    |
| aaa    | -         | -    | 0.20 |
| bbb    | -         | -    | 0.25 |
| ddd    | -         | -    | 0.20 |

# 756-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

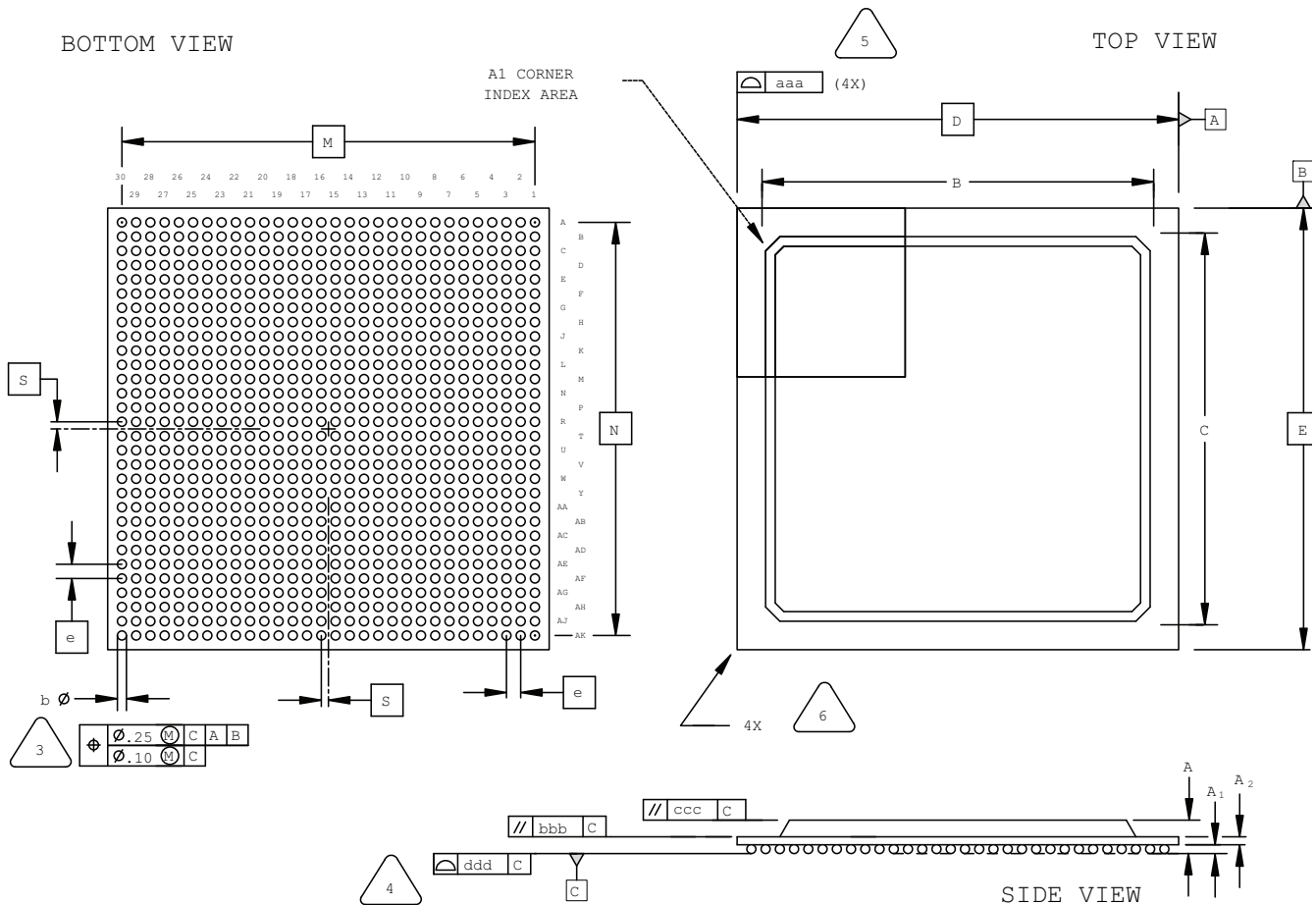
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.

- 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    | 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 |

# 900-Ball fpBGA 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.

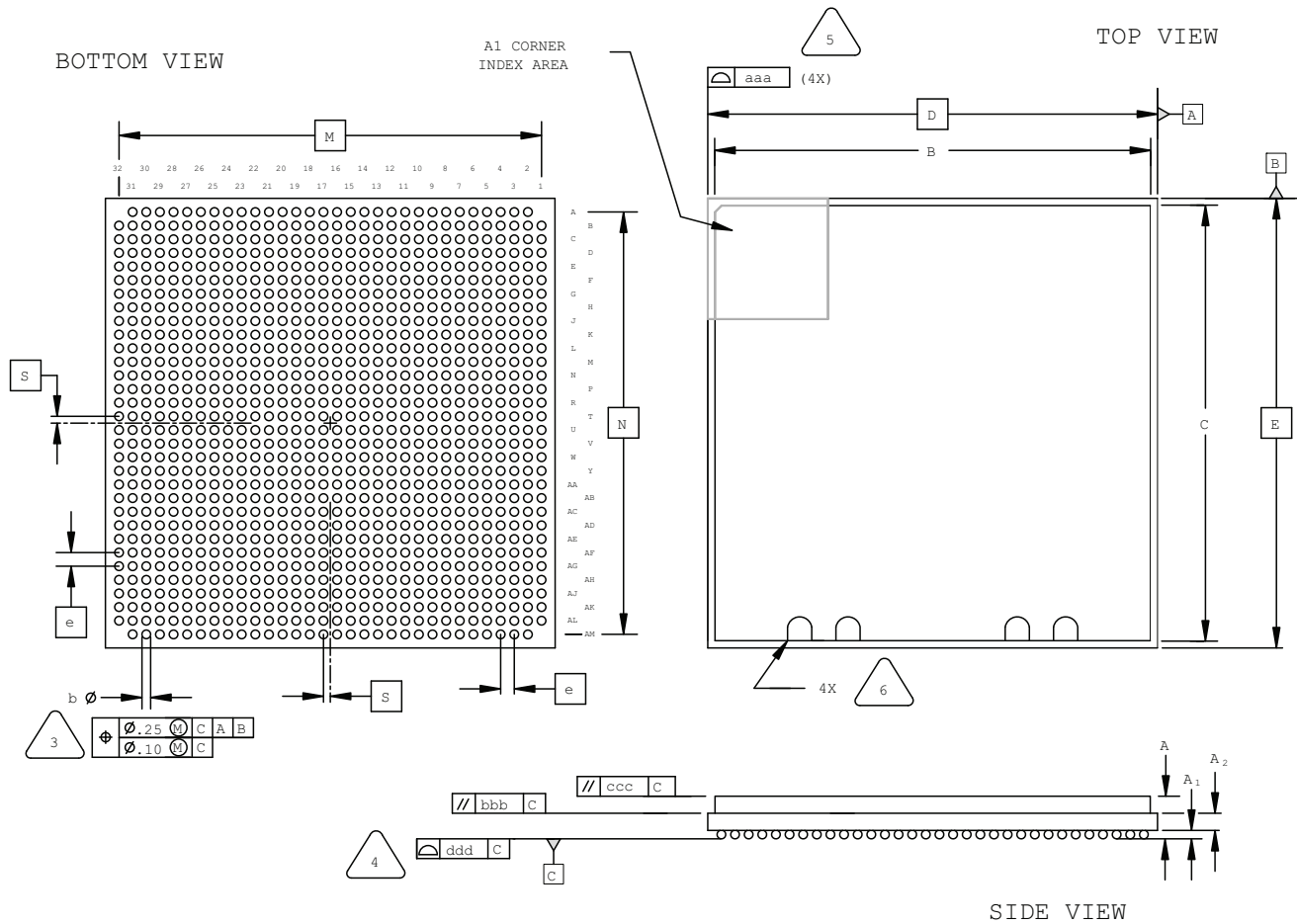


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

# 1020-Ball Organic 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.

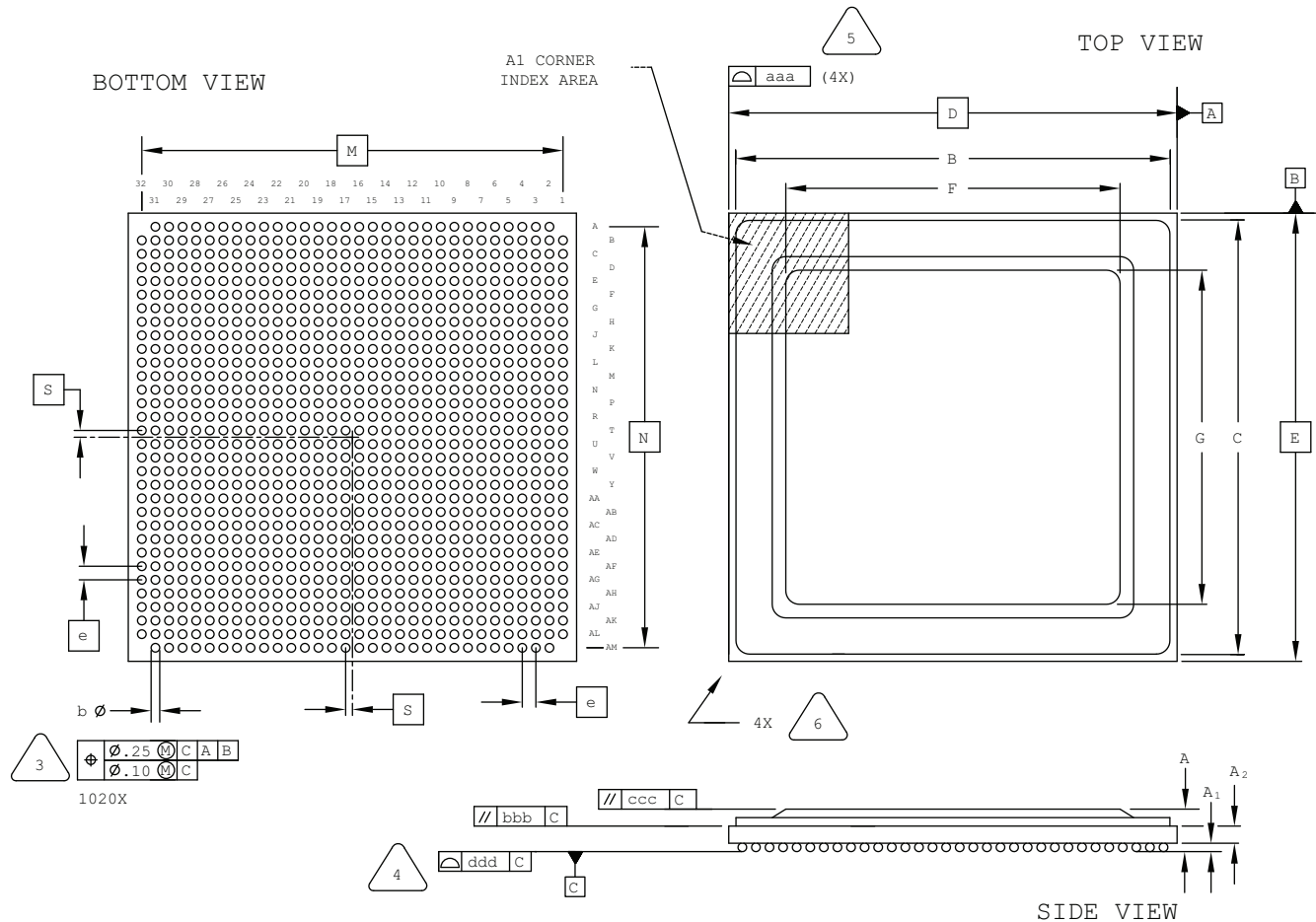


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

# 1020-Ball Organic fcBGA Package Rev. 2

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.

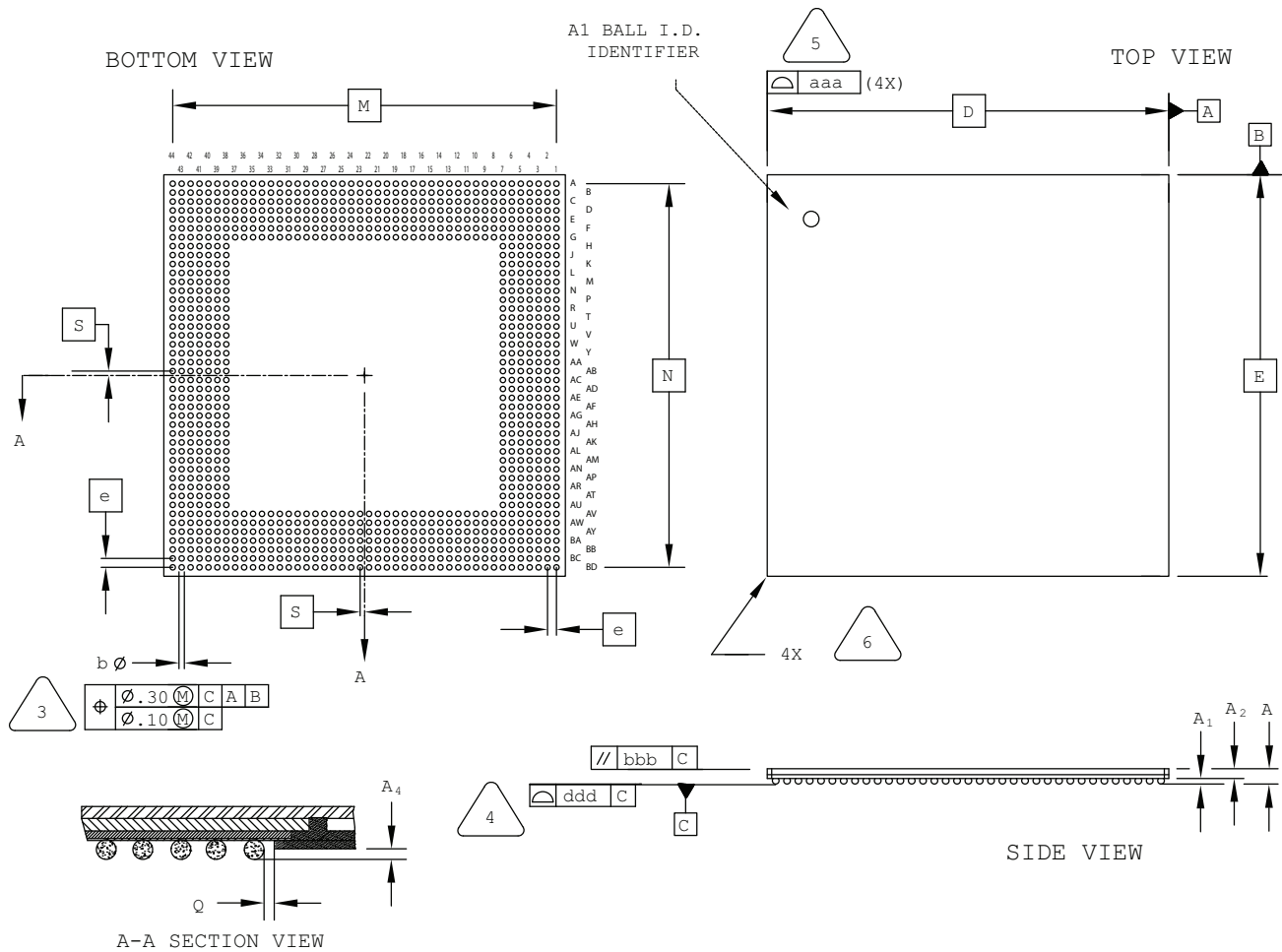


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 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.

 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.



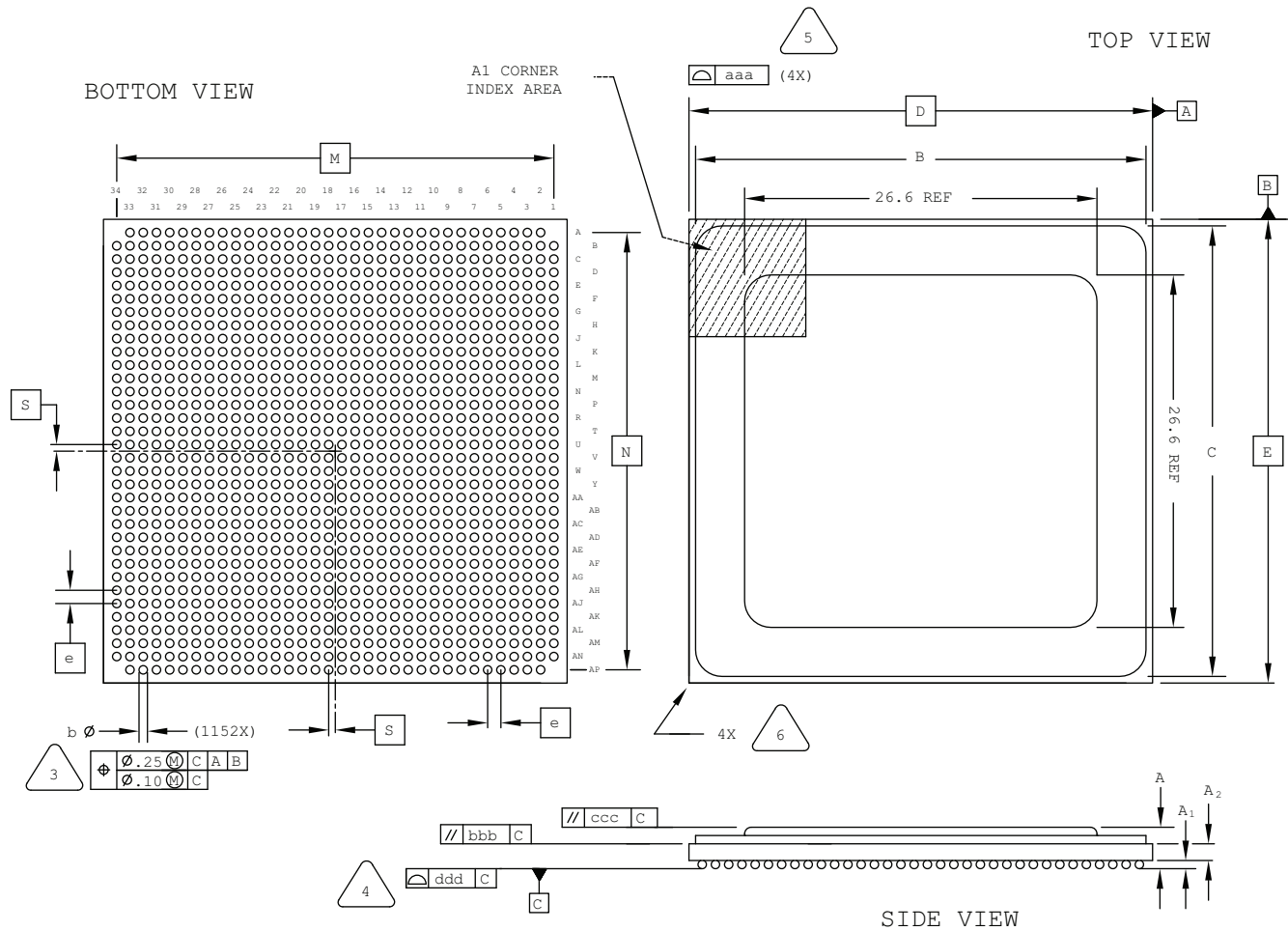
5 BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

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 |

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

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.

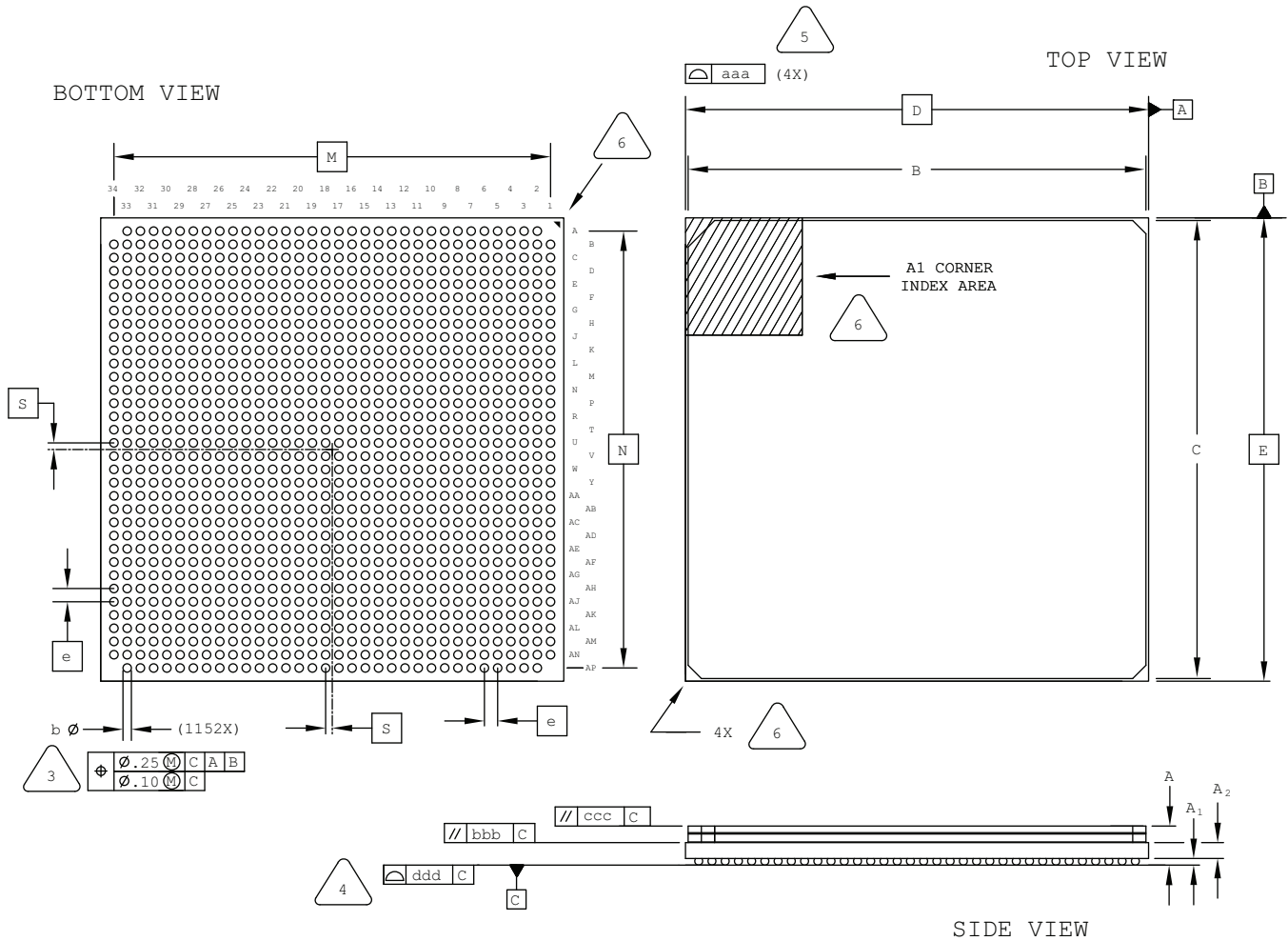


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 2.55      | 2.90  | 3.25  |
| A1     | 0.35      | 0.50  | 0.65  |
| A2     | 1.20 REF  |       |       |
| B/C    | 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  |

## 1152-Ball Organic fcBGA Package Option 2: LatticeSC/SCM80 & SC/SCM115

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.

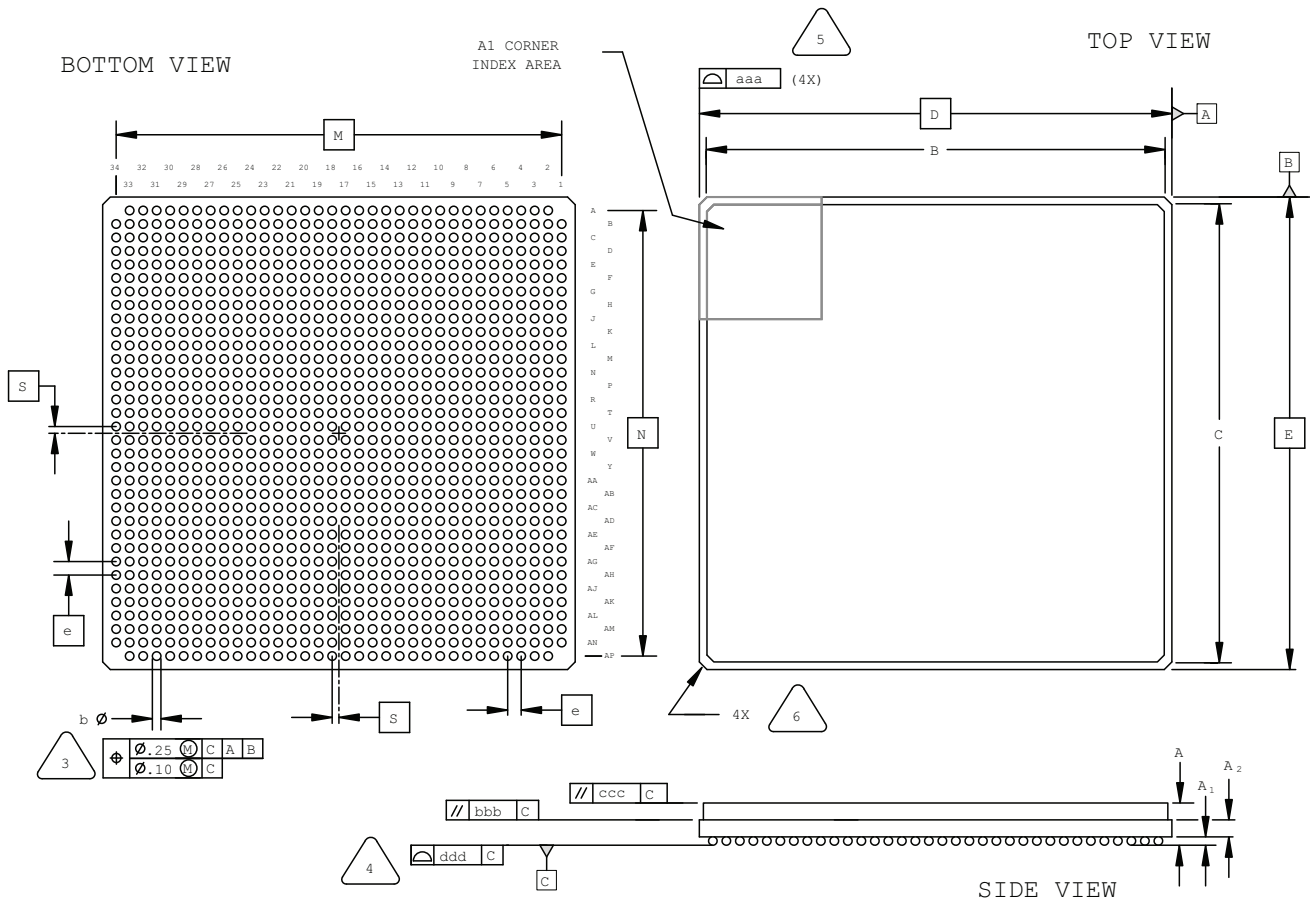


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 2.80      | 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  |

## 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.



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.

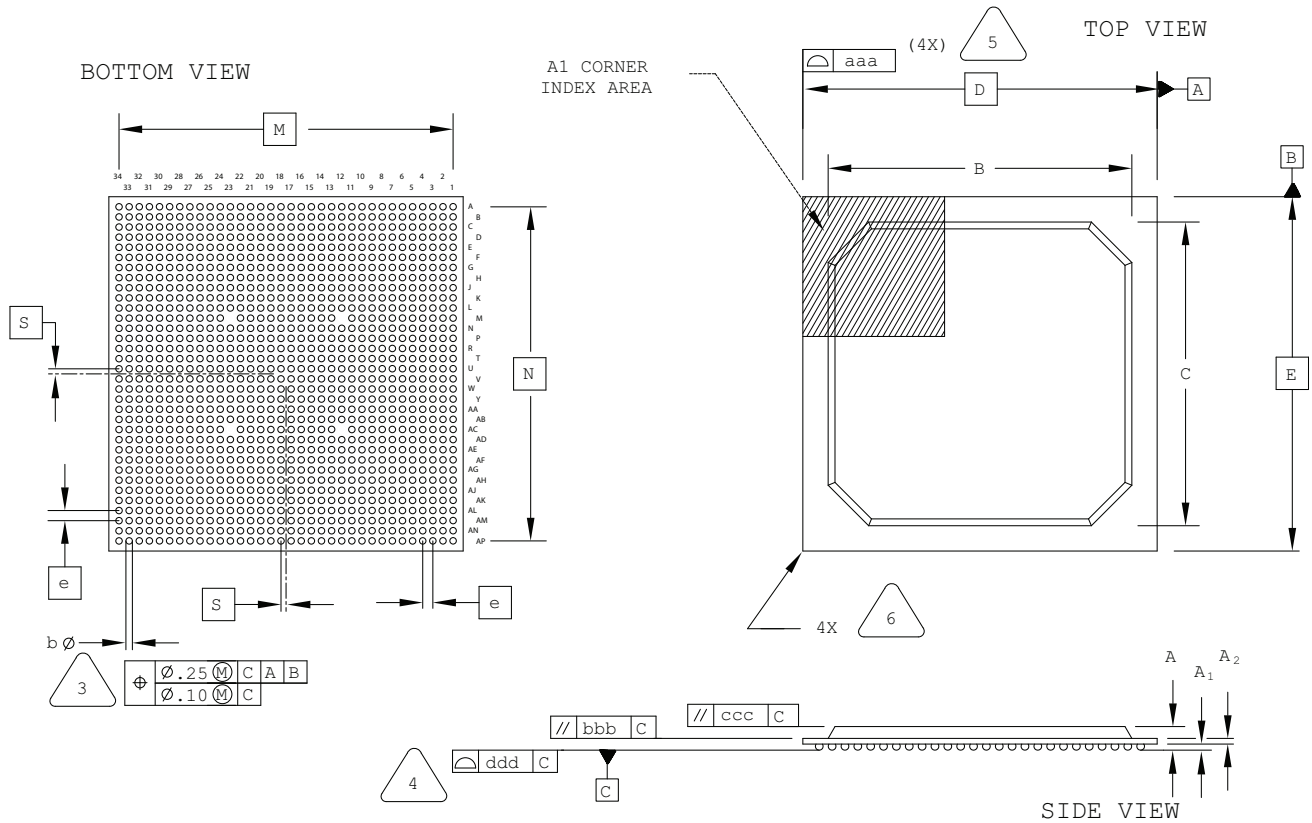


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 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  |

## 1152-Ball fpBGA 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.



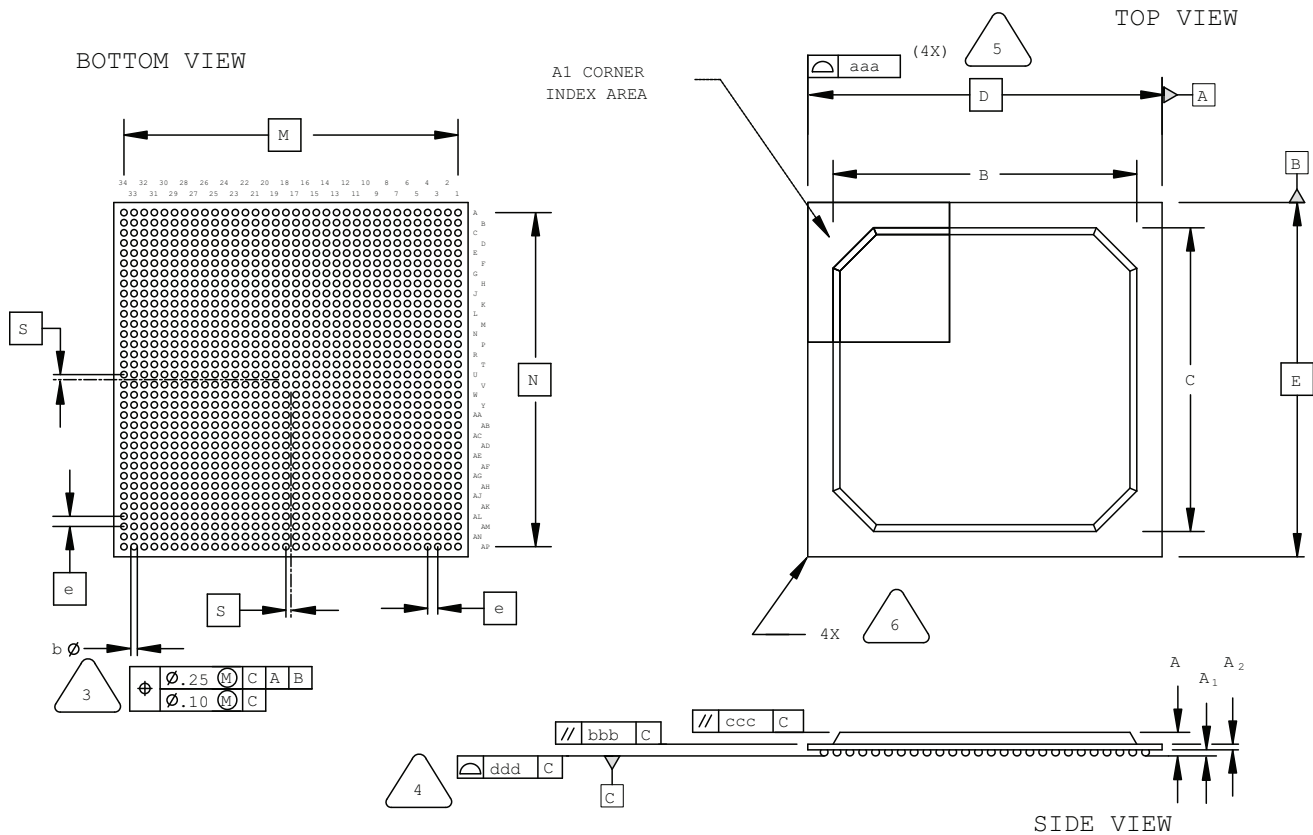
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

**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  |

## 1156-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

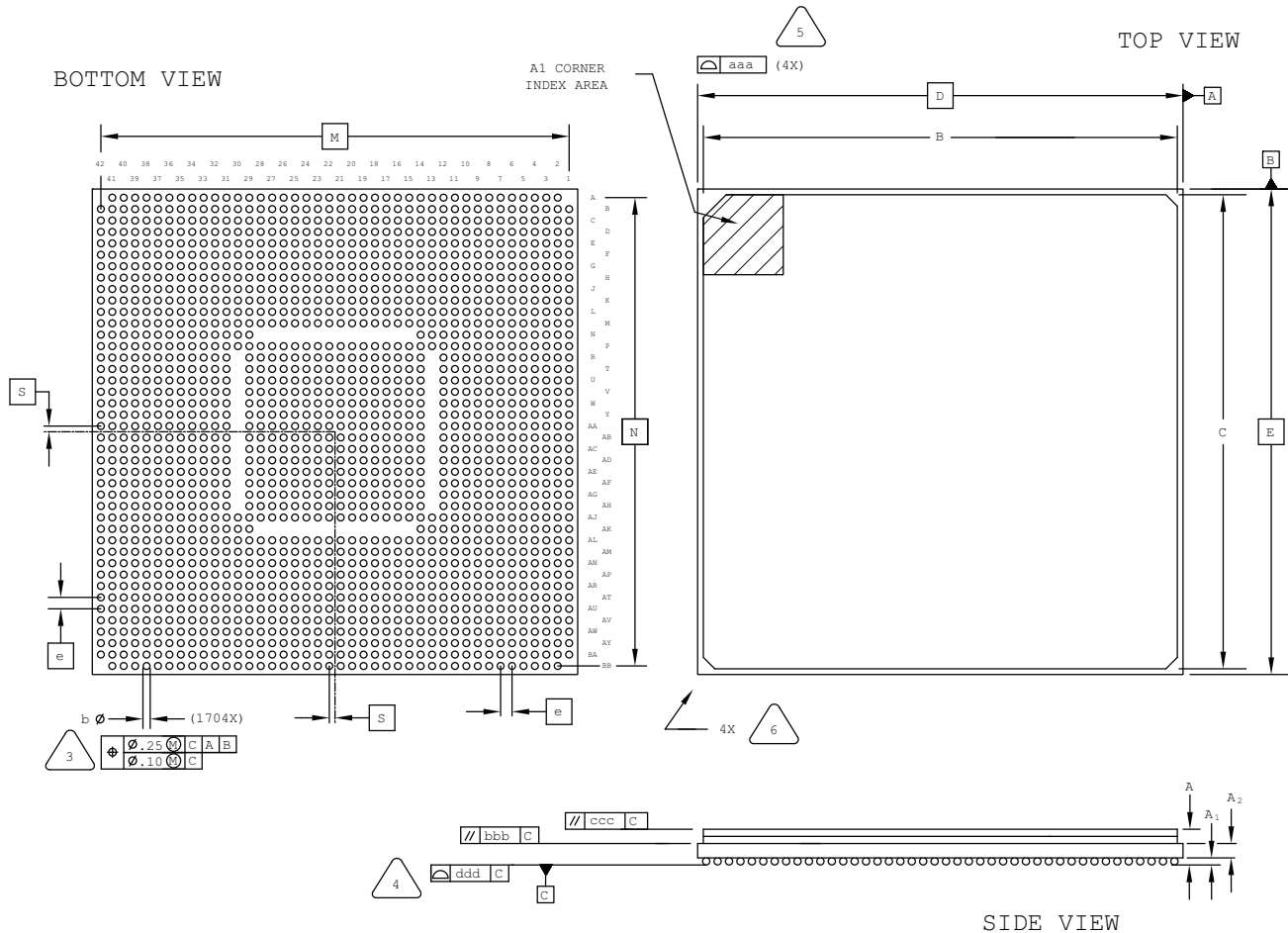
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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      | 1.90      | 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  |

## 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.



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.

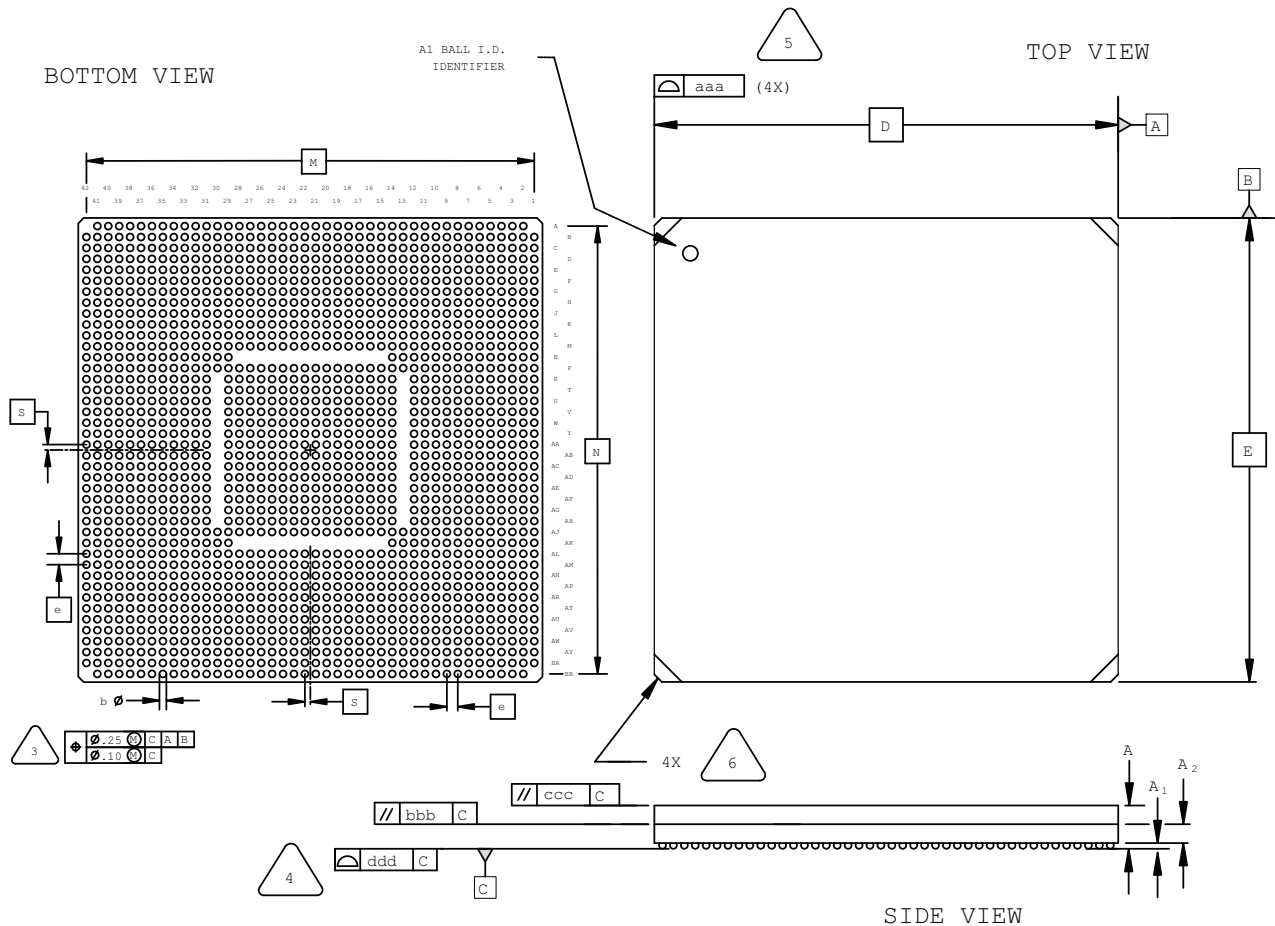


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.      | NOM.  | MAX.  |
|--------|-----------|-------|-------|
| A      | 2.55      | 2.90  | 3.25  |
| A1     | 0.35      | 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  |

# 1704-Ball Ceramic fcBGA Package

Dimensions in Millimeters

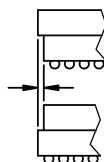


NOTES: UNLESS OTHERWISE SPECIFIED

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. PACKAGE BODY INCLUDES SUBSTRATE AND LID.

MAXIMUM OFFSET: 0.20 mm



6. 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 |

## Revision History

| Date           | Version | Change Summary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|----------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| November 2017  | 5.5     | Added 80-Ball ckbGA Package.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| March 2017     | 5.4     | Added ispMACH 4000 to 100-Pin TQFP Package Option 1: MachXO2, MachXO™, isp-MACH® 4000.<br>Added 121-Ball caBGA Package (9x9 mm Body).                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| December 2016  | 5.3     | Updated “32-Pin QFNS Package” headings to “32-Pin QFN Package”.<br>Added 32-Pin QFN Package Option 3: MachXO2 SG32C.<br>Added 30-Ball WLSC Package.<br>Added iCE40 UltraPlus and MachXO2 to 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2.<br>Added 484-Ball caBGA Package.                                                                                                                                                                                                                                                                     |
| June 2016      | 5.2     | Updated 285-ball csfBGA package outline drawing.<br>Added 36-Ball WLCS Package Option 3: LIFMD™.<br>Fixed typo in 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2.<br>Added 64-Ball ucfBGA Package.<br>Added 80-Ball ctfBGA Package.<br>Added 81-Ball csfBGA Package.                                                                                                                                                                                                                                                                             |
| February 2015  | 5.1     | Added 36-Ball ucfBGA Package: iCE40 Ultra.<br>Updated 36-Ball ucBGA Package heading to 36-Ball ucBGA Package Option 1.<br>Updated 48-Pin QFN Package Option 2: L-ASC10 heading to 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra.                                                                                                                                                                                                                                                                                                                                          |
| January 2015   | 5.0     | Added 16-Ball WLCS Package Option 2: iCE40 UltraLite.<br>Updated 16-Ball WLCS Package heading to 16-Ball WLCS Package Option 1: iCE40 LP.                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| October 2014   | 4.9     | Updated 48-Pin QFN Package heading and moved the section after 48-Pin QFN Package Option 1 (previously Option 2).                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                | 4.8     | Removed 20-Ball WLCS Package.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|                | 4.7     | Updated 121-Ball csfBGA Package. Revised M/N dimension.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| September 2014 | 4.6     | Updated 84-Pin QFN Package. Revised pin numbers from A36 and B27 to A37 and B28.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| August 2014    | 4.5     | Updated 16-Ball WLCS Package. Changed second E to e in REF. column.<br>Updated 36-Ball WLCS Package Option 1: iCE40 Ultra heading.<br>Added 36-Ball WLCS Package Option 2: MachXO3.<br>Added 81-Ball WLCS Package.<br>Added 121-Ball csfBGA Package.<br>Added 256-Ball csfBGA Package.<br>Added 324-Ball caBGA Package.<br>Added 324-Ball csfBGA Package.<br>Added 400-Ball caBGA Package.<br>Updated 84-Pin QFN Package. Revised dimension “b” maximum value.<br>Updated 256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2.<br>Revised dimension “A” values. |

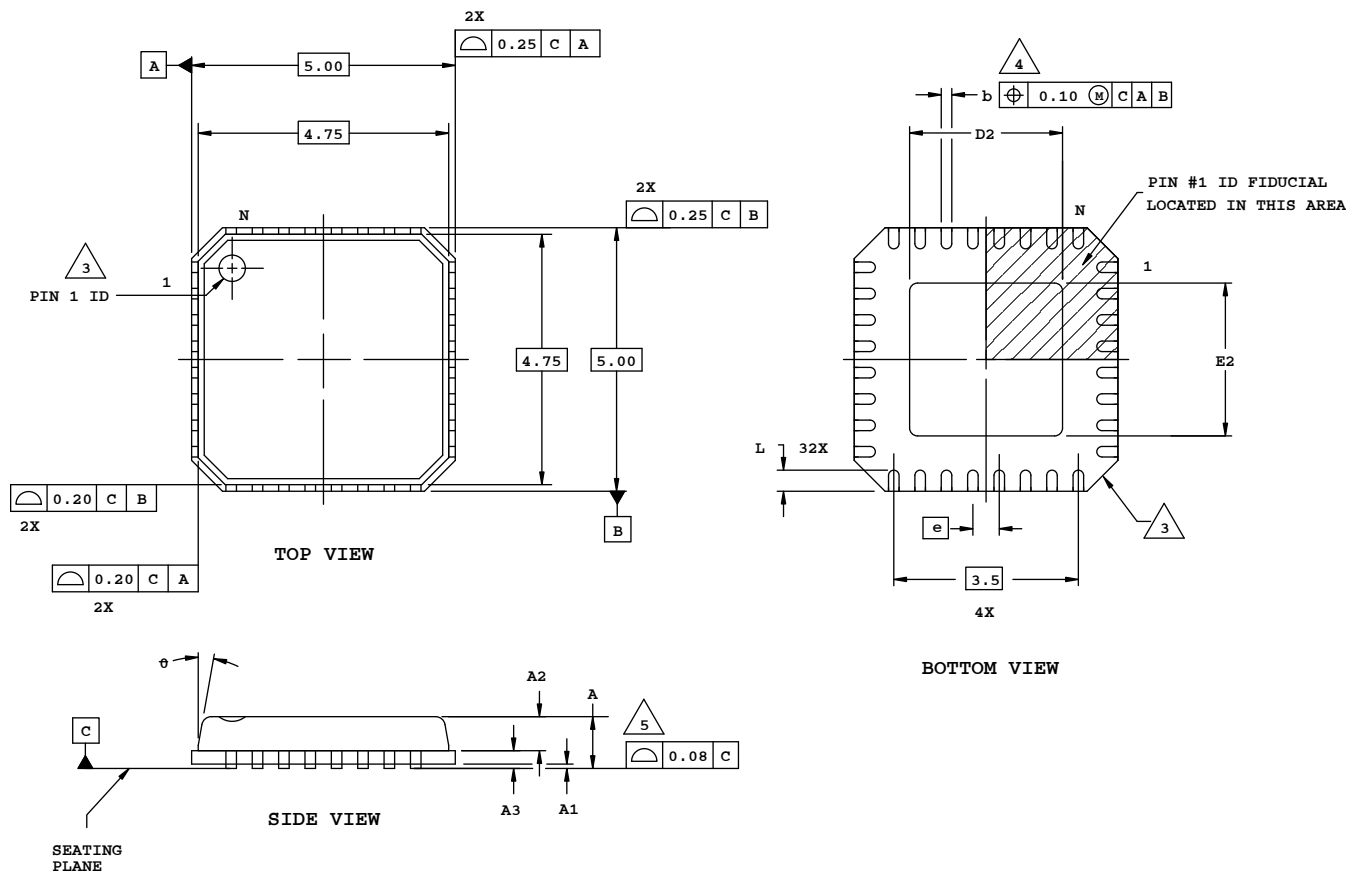
| Date           | Version | Change Summary                                                                                                                                                                                                                      |
|----------------|---------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| June 2014      | 4.4     | Updated 48-Pin QFNS Package to 48-Pin QFN Package.                                                                                                                                                                                  |
|                |         | Added 48-Pin QFN Package Option 2.                                                                                                                                                                                                  |
|                |         | Added 49-Ball WLCS Package.                                                                                                                                                                                                         |
|                |         | Added 237-Ball ftBGA Package.                                                                                                                                                                                                       |
|                |         | Added 285-Ball csfBGA Package.                                                                                                                                                                                                      |
|                |         | Added 20-Ball WLCS Package.                                                                                                                                                                                                         |
|                |         | Added 36-Ball WLCS Package.                                                                                                                                                                                                         |
| March 2014     | 04.3    | Restored references to indicate top, bottom, and side views.                                                                                                                                                                        |
|                |         | Added 381-Ball caBGA Package.                                                                                                                                                                                                       |
|                |         | Added 554-Ball caBGA Package.                                                                                                                                                                                                       |
|                |         | Added 756-Ball caBGA Package.                                                                                                                                                                                                       |
| December 2013  | 04.2    | Added "1" and "N" characters to 100-Pin TQFP Package Option 1: MachXO2, MachXO diagram (Top View).                                                                                                                                  |
| September 2013 | 04.1    | Added 16-ball WLCS package.                                                                                                                                                                                                         |
|                |         | Revised 25-Ball WLCS Package title to 25-Ball WLCS Package (0.40mm Pitch).                                                                                                                                                          |
|                |         | Added 25-Ball WLCS Package (0.35mm Pitch).                                                                                                                                                                                          |
|                |         | Added references to indicate top, bottom, and side views.                                                                                                                                                                           |
| August 2013    | 04.0    | Revised 144-pin TQFP package diagram.                                                                                                                                                                                               |
| February 2013  | 03.9    | Added 184-ball csBGA package.                                                                                                                                                                                                       |
| November 2012  | 03.8    | Added iCE40 to the list of applicable products for the 32-pin QFNS Option 1 package.                                                                                                                                                |
| October 2012   | 03.7    | Revised 324-ball ftBGA package drawing.                                                                                                                                                                                             |
| September 2012 | 03.6    | Nomenclature change – “iCE40 100-Pin TQFP Package Option 2” changed to “iCE40 100-Pin VQFP Package Option 2”.                                                                                                                       |
| August 2012    | 03.5    | 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.              |
| July 2012      | 03.4    | Added 676-ball fcBGA package.                                                                                                                                                                                                       |
| March 2012     | 03.3    | Added new 32-Pin QFNS Package Option 2 for MachXO2. Moved 32-pin QFN (punch singulated) package drawing to new Package Archive Appendix.                                                                                            |
| February 2012  | 03.2    | Updated document with new corporate logo.                                                                                                                                                                                           |
| December 2011  | 03.1    | Updated WLCS package offering.                                                                                                                                                                                                      |
| October 2011   | 03.0    | Added 49-ball WLCS package and updated 25-ball WLCS package.                                                                                                                                                                        |
|                |         | Added 328-ball csBGA package.                                                                                                                                                                                                       |
| July 2011      | 02.8    | 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.                                                                                  |
| May 2011       | 02.7    | Added MachXO2 to the list of applicable products for the 256 ftBGA Option 1 package outline.                                                                                                                                        |
| November 2010  | 02.6    | Added 25-ball WLCS 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. |
| October 2010   | 02.5    | Added 208-ball ftBGA package.                                                                                                                                                                                                       |
| September 2010 | 02.4    | 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.                                                                                              |
| March 2010     | 02.3    | 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.                                                                              |
| February 2010  | 02.2    | Revised 256-ball caBGA nominal solder ball diameter from 0.5 mm to 0.45 mm to better match actual dimension.                                                                                                                        |
| December 2009  | 02.1    | Revised 256-ball caBGA package to specify correct JEDEC reference number.                                                                                                                                                           |

| Date          | Version | Change Summary                                                                                                                                                        |
|---------------|---------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| May 2009      | 02.0    | Added new 256-ball caBGA and 256-ball ftBGA (Option A) packages.                                                                                                      |
| April 2009    | 01.9    | 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). |
| December 2008 | 01.8    | Added 32-pin QFNS, 48-pin QFNS and 64-pin QFNS package diagrams.                                                                                                      |
| November 2008 | 01.7    | Added 64-ball ucBGA and 132-ball ucBGA package diagrams.                                                                                                              |
| April 2008    | 01.6    | Added 64-ball csBGA and 144-ball csBGA package diagrams.                                                                                                              |
| November 2007 | 01.5    | Added 1152-ball fpBGA package diagram.                                                                                                                                |
| October 2007  | 01.4    | Revised 1036 ftSBGA package diagram. Removed 1036 fpSBGA.                                                                                                             |
| June 2007     | 01.3    | Added 1036 ftSBGA package diagram.                                                                                                                                    |
| February 2007 | 01.2    | Revised 1704 fcBGA package drawing: removed lid dimension, clarified package body dimension as the combination of substrate and lid.                                  |
| January 2007  | 01.1    | Added Marking Orientation text for all TQFP packages (1.0 mm and 1.4 mm thick).                                                                                       |
| October 2006  | 01.0    | Added 64-pin TQFP and 1704-ball fcBGA package diagrams.                                                                                                               |
| —             | —       | Previous Lattice releases.                                                                                                                                            |

## Appendix A. Package Archive

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

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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

EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.20 AND 0.25 mm FROM TERMINAL TIP.

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   |