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## Understanding [Embedded - CPLDs \(Complex Programmable Logic Devices\)](#)

Embedded - CPLDs, or Complex Programmable Logic Devices, are highly versatile digital logic devices used in electronic systems. These programmable components are designed to perform complex logical operations and can be customized for specific applications. Unlike fixed-function ICs, CPLDs offer the flexibility to reprogram their configuration, making them an ideal choice for various embedded systems. They consist of a set of logic gates and programmable interconnects, allowing designers to implement complex logic circuits without needing custom hardware.

## Applications of Embedded - CPLDs

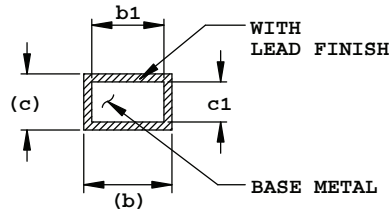
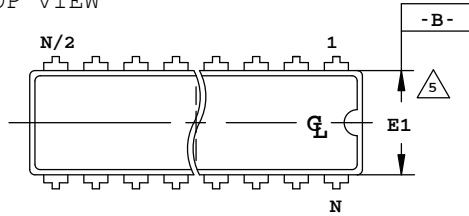
### Details

|                                 |   |
|---------------------------------|---|
| Product Status                  | Obsolete  |
| Programmable Type               | In System Programmable  |
| Delay Time tpd(1) Max           | 7.5 ns  |
| Voltage Supply - Internal       | 3V ~ 3.6V   |
| Number of Logic Elements/Blocks | 24  |
| Number of Macrocells            | 96  |
| Number of Gates                 | 4000  |
| Number of I/O                   | 96  |
| Operating Temperature           | -40°C ~ 85°C (TA)   |
| Mounting Type                   | Surface Mount   |
| Package / Case                  | 128-LQFP  |
| Supplier Device Package         | 128-TQFP (14x14)  |
| Purchase URL                    | <a href="https://www.e-xfl.com/product-detail/lattice-semiconductor/isplsi-2096ve-135lt128i">https://www.e-xfl.com/product-detail/lattice-semiconductor/isplsi-2096ve-135lt128i</a> |

## 24-Pin Plastic DIP

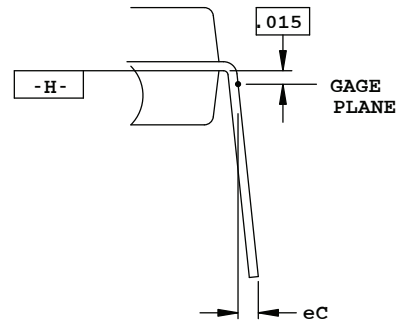
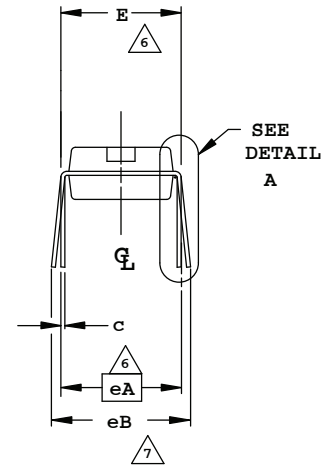
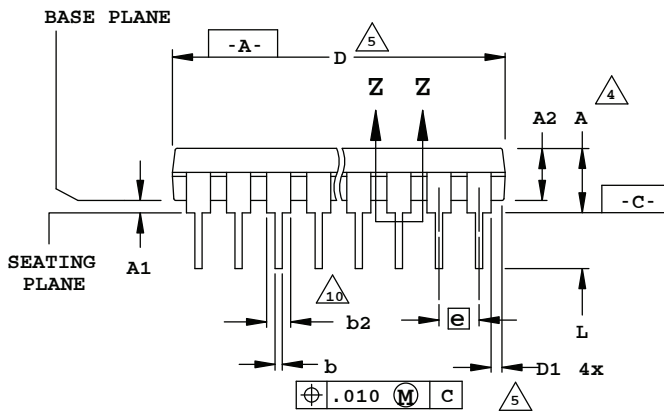
Dimensions in Inches

TOP VIEW



SECTION Z-Z

SIDE VIEW



DETAIL A

NOTES:

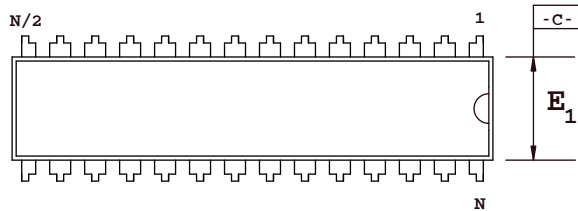
1. CONTROLLING DIMENSION: INCH.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M
3. DISTANCE BETWEEN LEADS INCLUDING DAMBAR PROTRUSIONS TO BE .005 MINIMUM.
4. DIMENSIONS A, A1 & L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3.
5. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH 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  |      |

## 28-Pin Plastic DIP Package

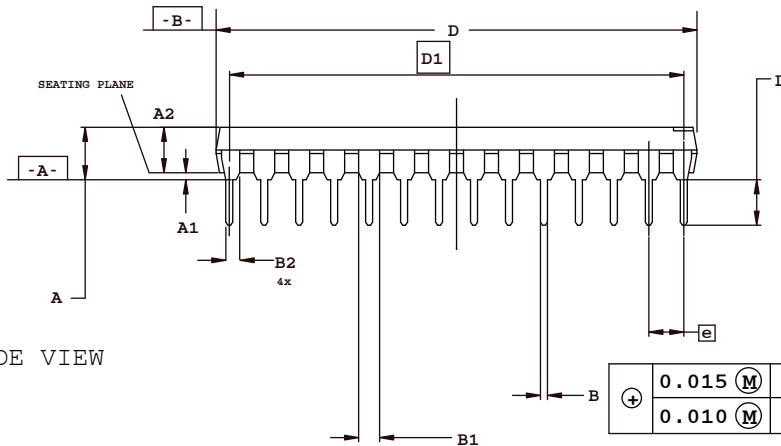
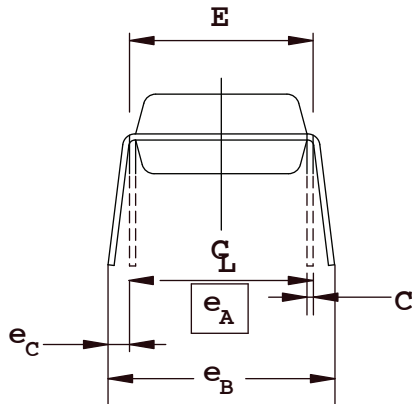
Dimensions in Inches

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



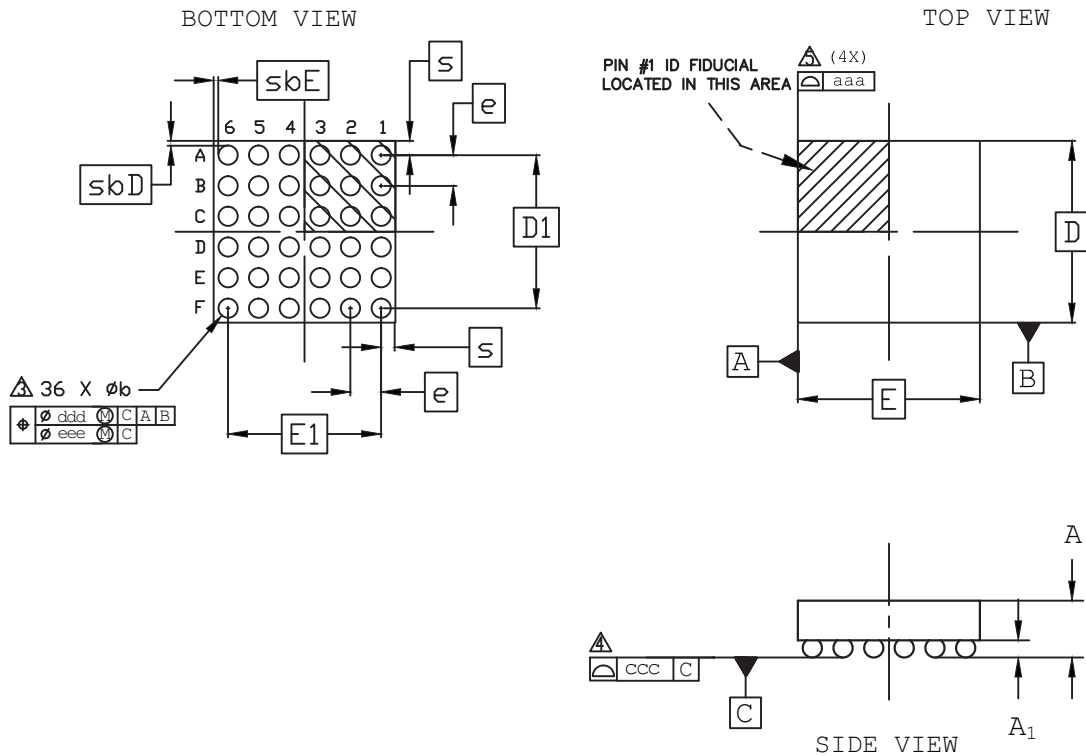
SIDE VIEW

| SYMBOL | INCHES    |       |       |
|--------|-----------|-------|-------|
|        | MIN.      | NOM.  | MAX.  |
| A      | -         | -     | .180  |
| A1     | .015      | -     | -     |
| A2     | .120      | .135  | .150  |
| B      | .014      | .018  | .022  |
| B1     | .045      | .050  | .060  |
| B2     | .030      | .040  | .045  |
| C      | .008      | .010  | .015  |
| D      | 1.345     | 1.365 | 1.385 |
| D1     | 1.300 BSC |       |       |
| E      | .300      | .310  | .325  |
| E1     | .275      | .285  | .295  |
| e      | .100 BSC  |       |       |
| eA     | .300 BSC  |       |       |
| eB     | -         | -     | .430  |
| eC     | .000      | -     | .060  |
| L      | .110      | .130  | .150  |
| N      | 28        |       |       |

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

## 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].

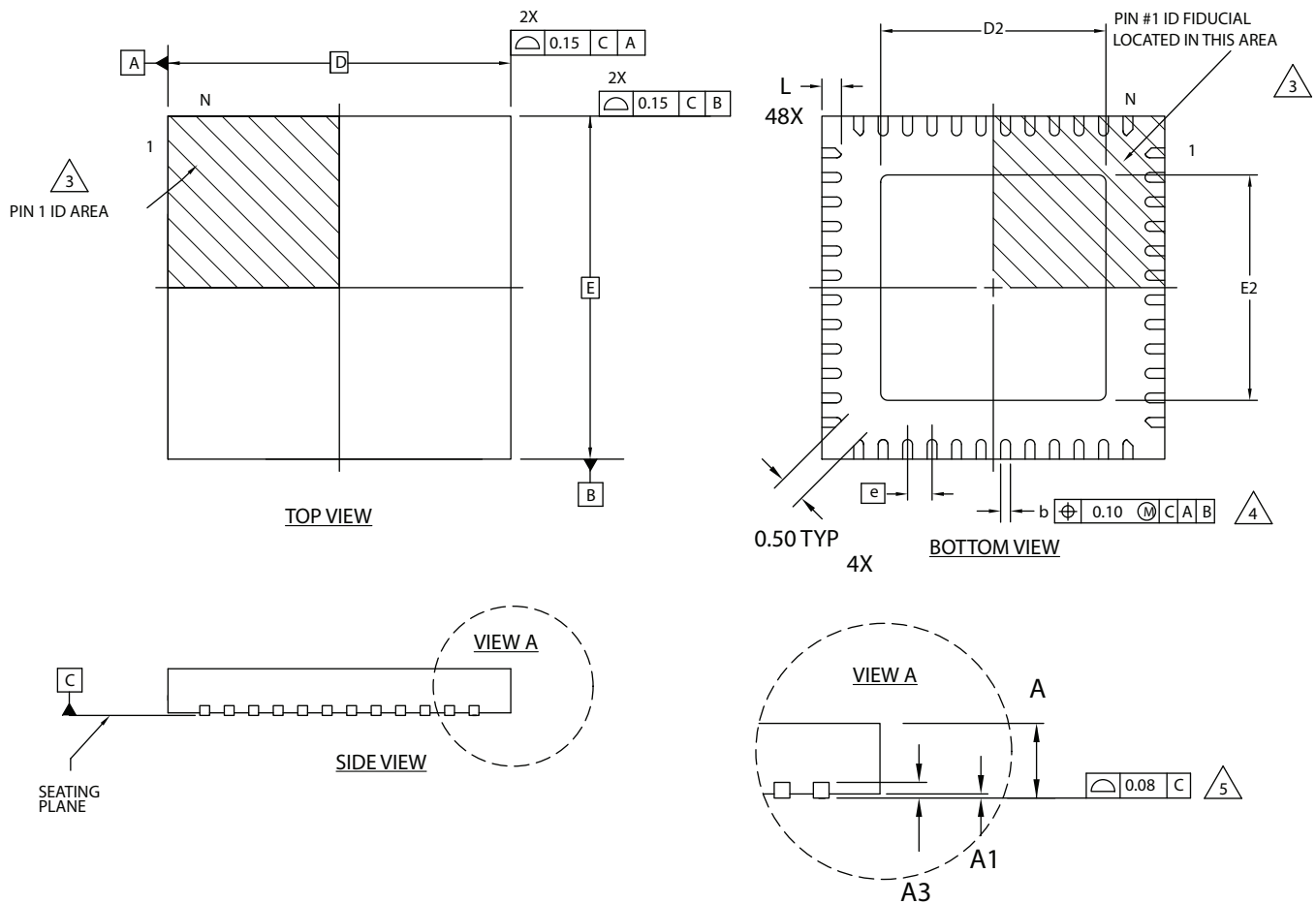
△ PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

△ 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     |       |       |

## 48-Pin QFN Package Option 1

Dimensions in Millimeters



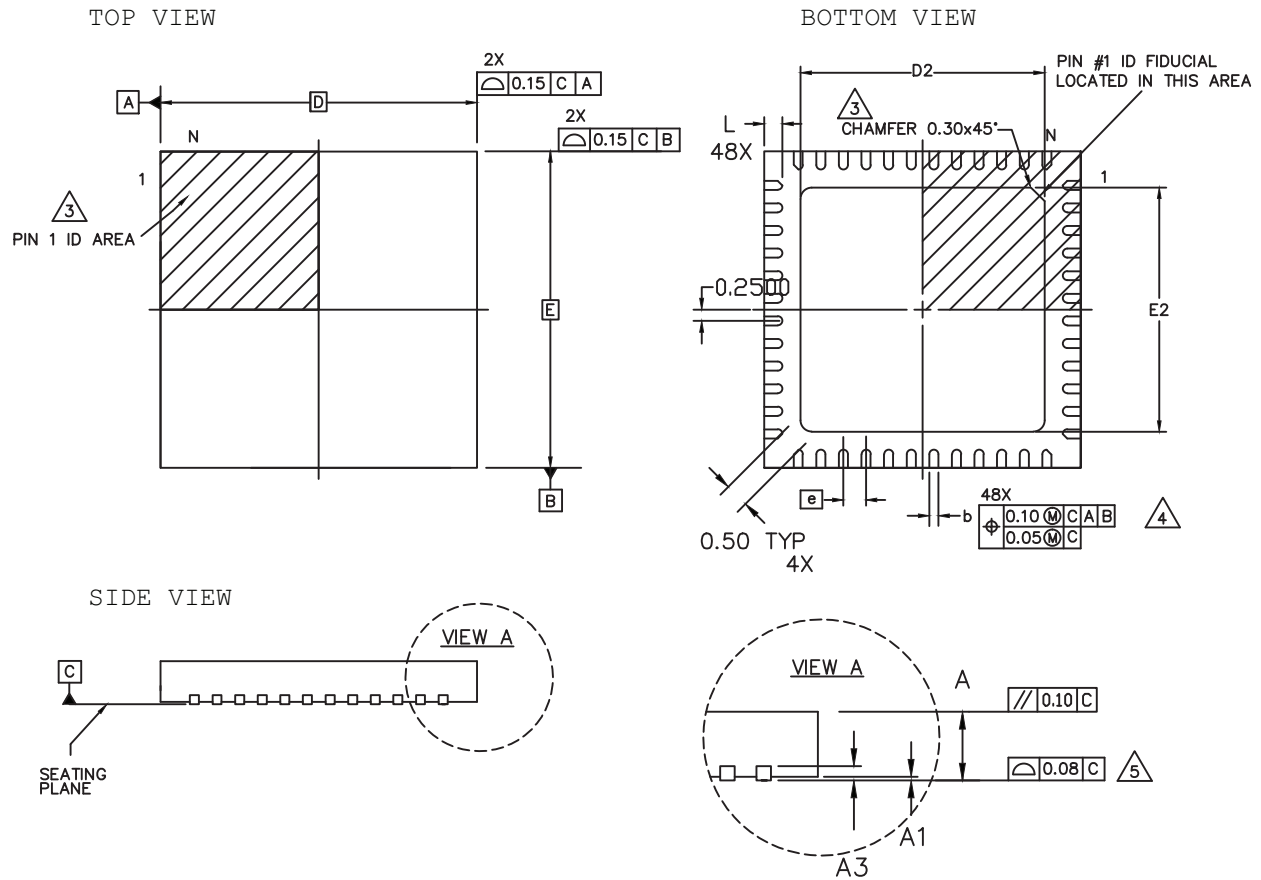
NOTES: UNLESS OTHERWISE SPECIFIED

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.

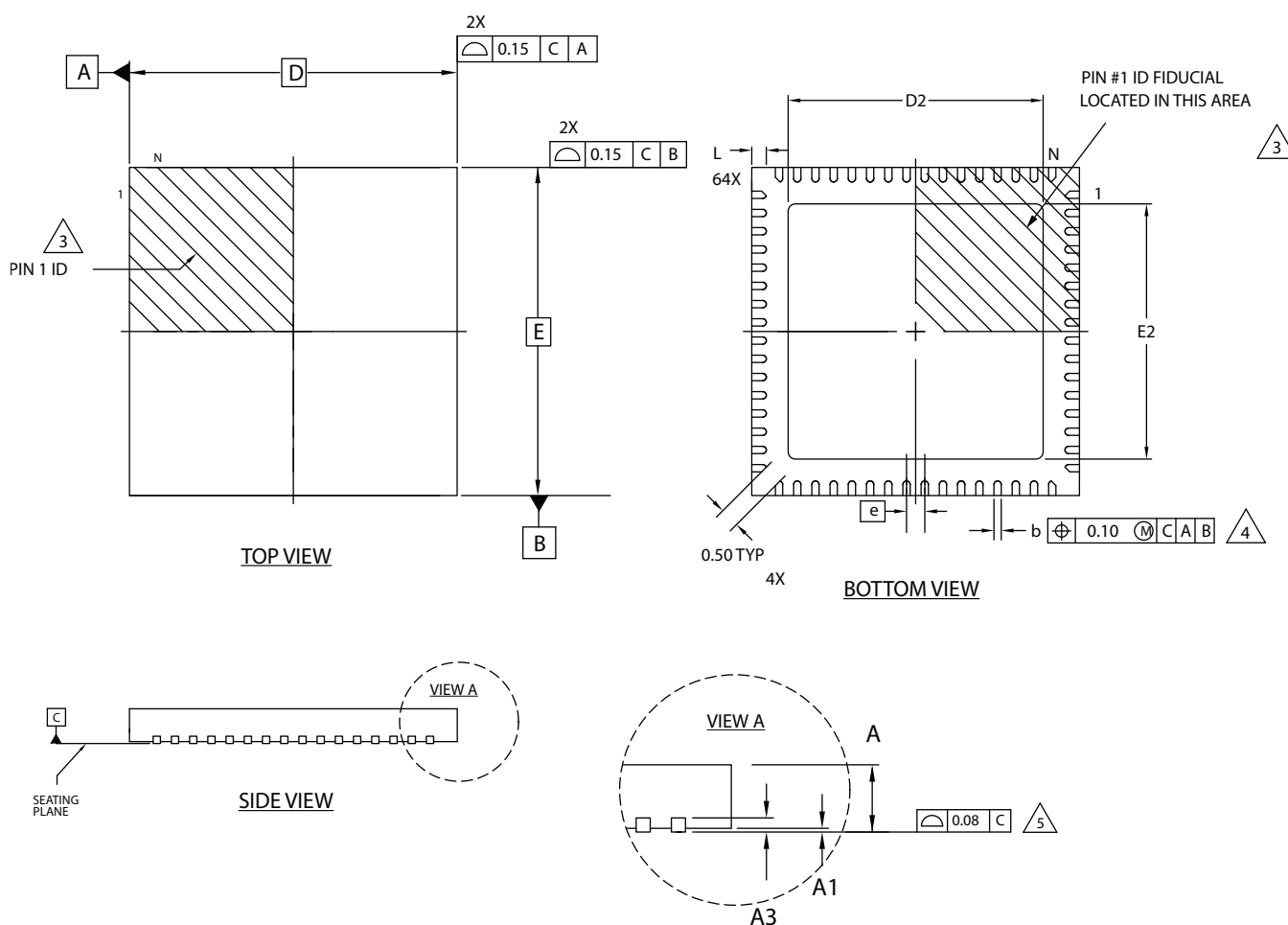
 DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

 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 |

## 64-Pin QFNS Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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

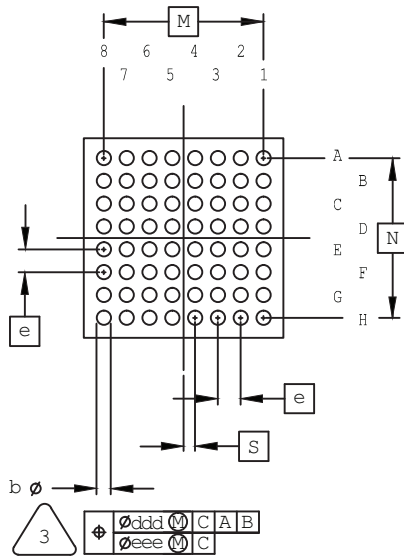
5 APPLIES TO EXPOSED PORTION OF TERMINALS.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | 0.80     | 0.90 | 1.00 |
| A1     | 0.00     | 0.02 | 0.05 |
| A3     | 0.2 REF  |      |      |
| D      | 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 |

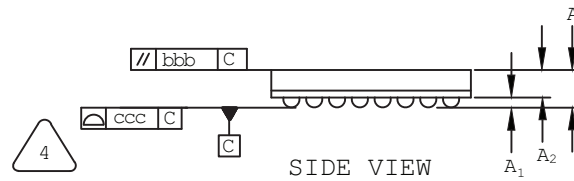
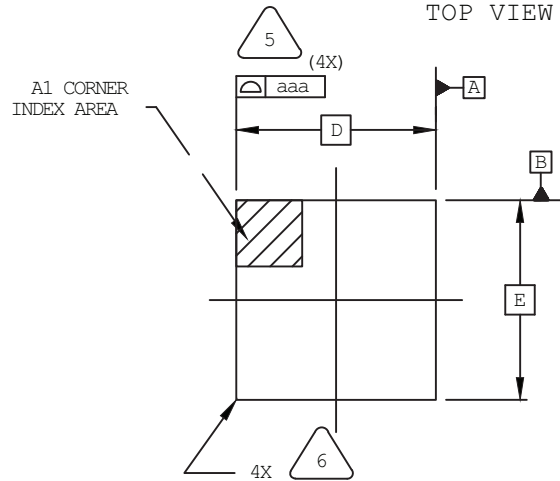
## 64-Ball ucfBGA Package

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.



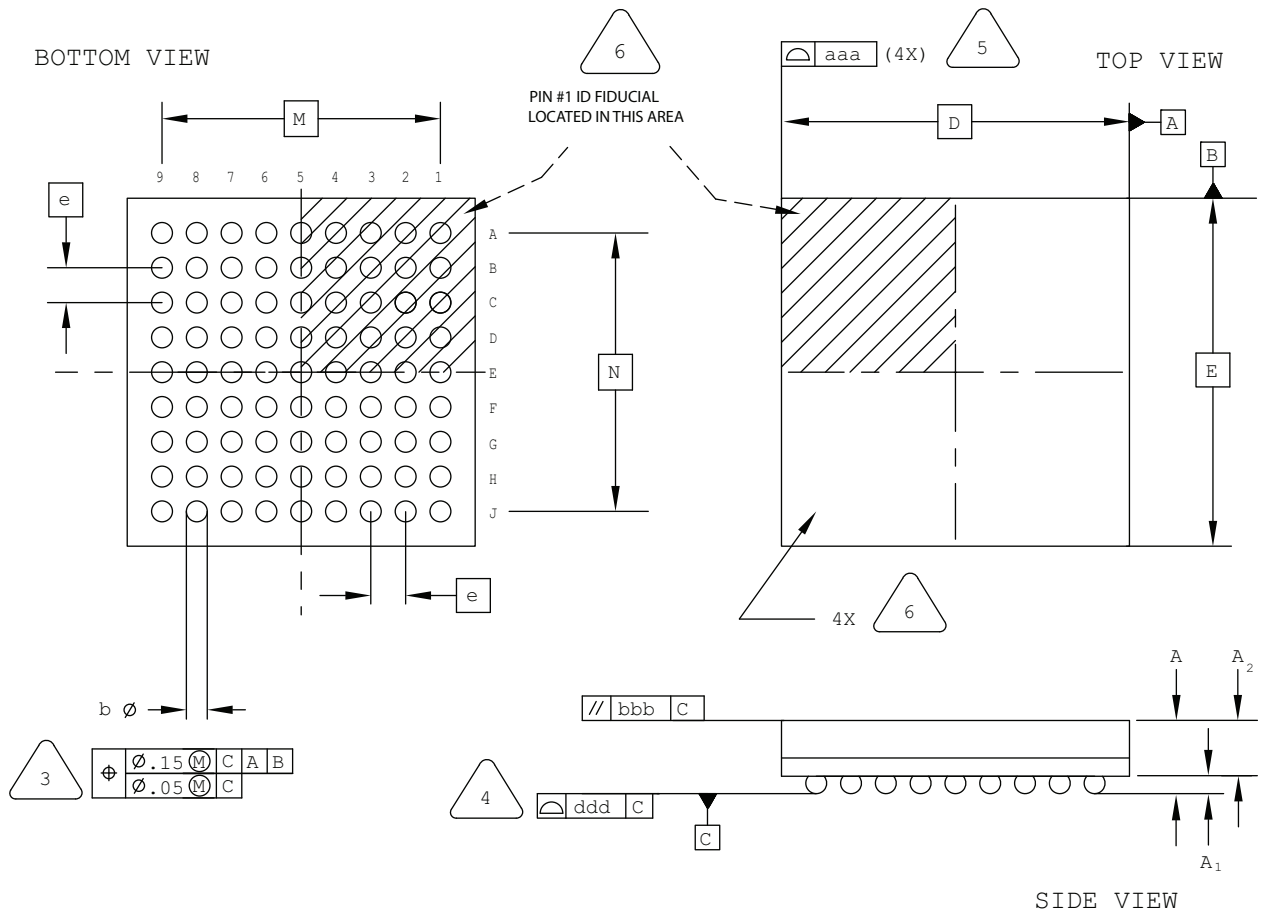
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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     |      |      |



## 81-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.

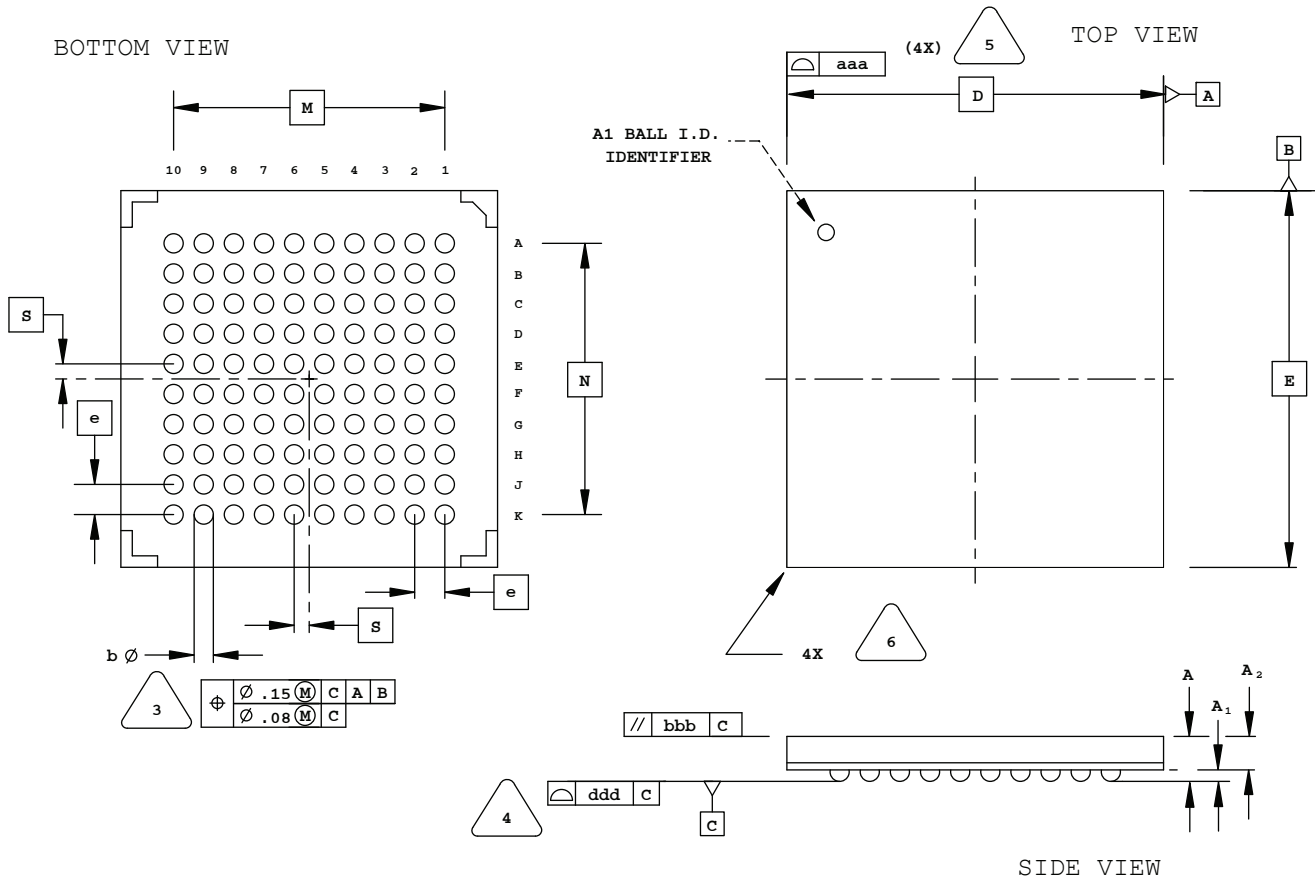


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| SYMBOL | MIN.     | NOM. | MAX. |
|--------|----------|------|------|
| A      | -        | -    | 1.00 |
| A1     | 0.10     | -    | -    |
| 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 |

## 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.

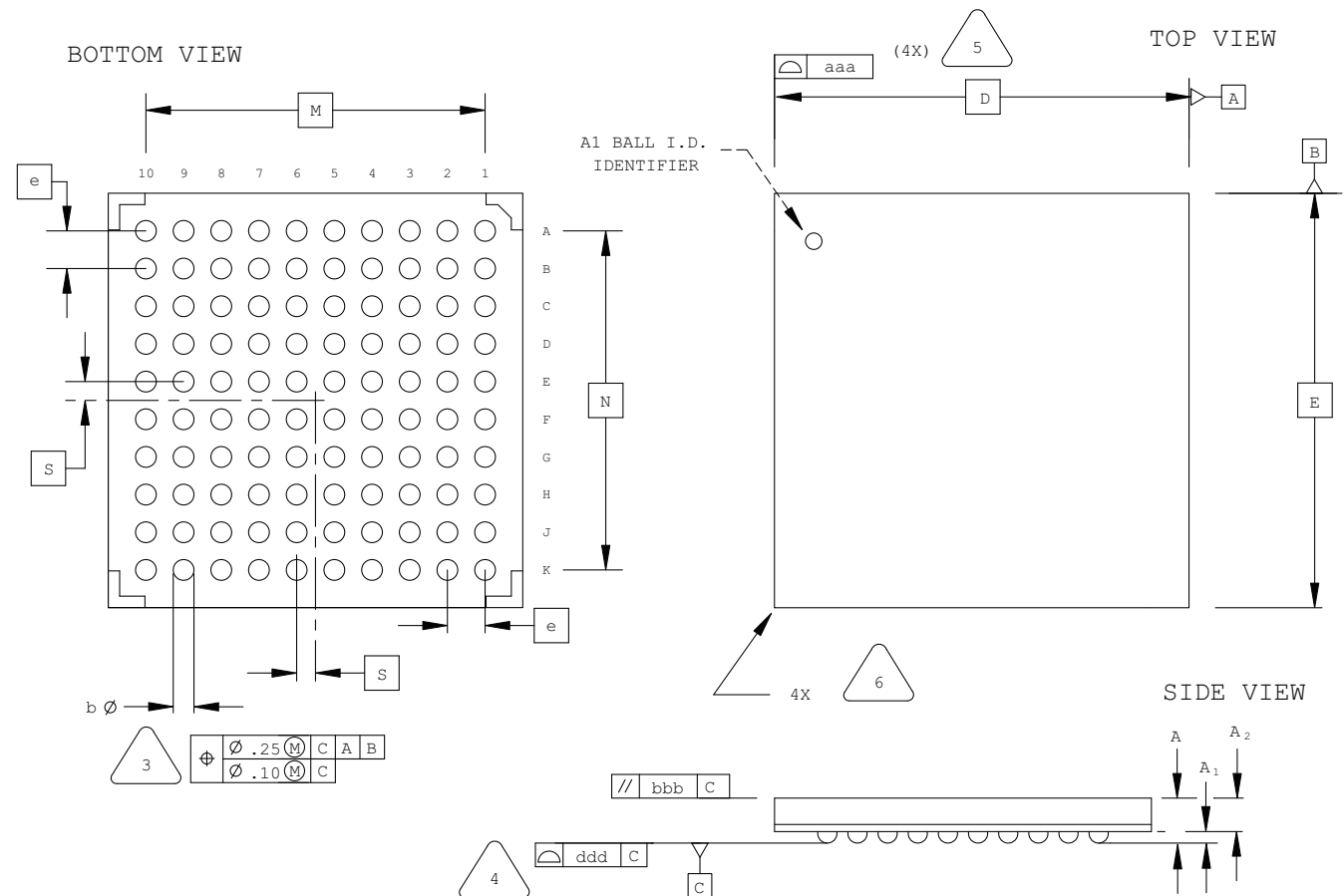


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

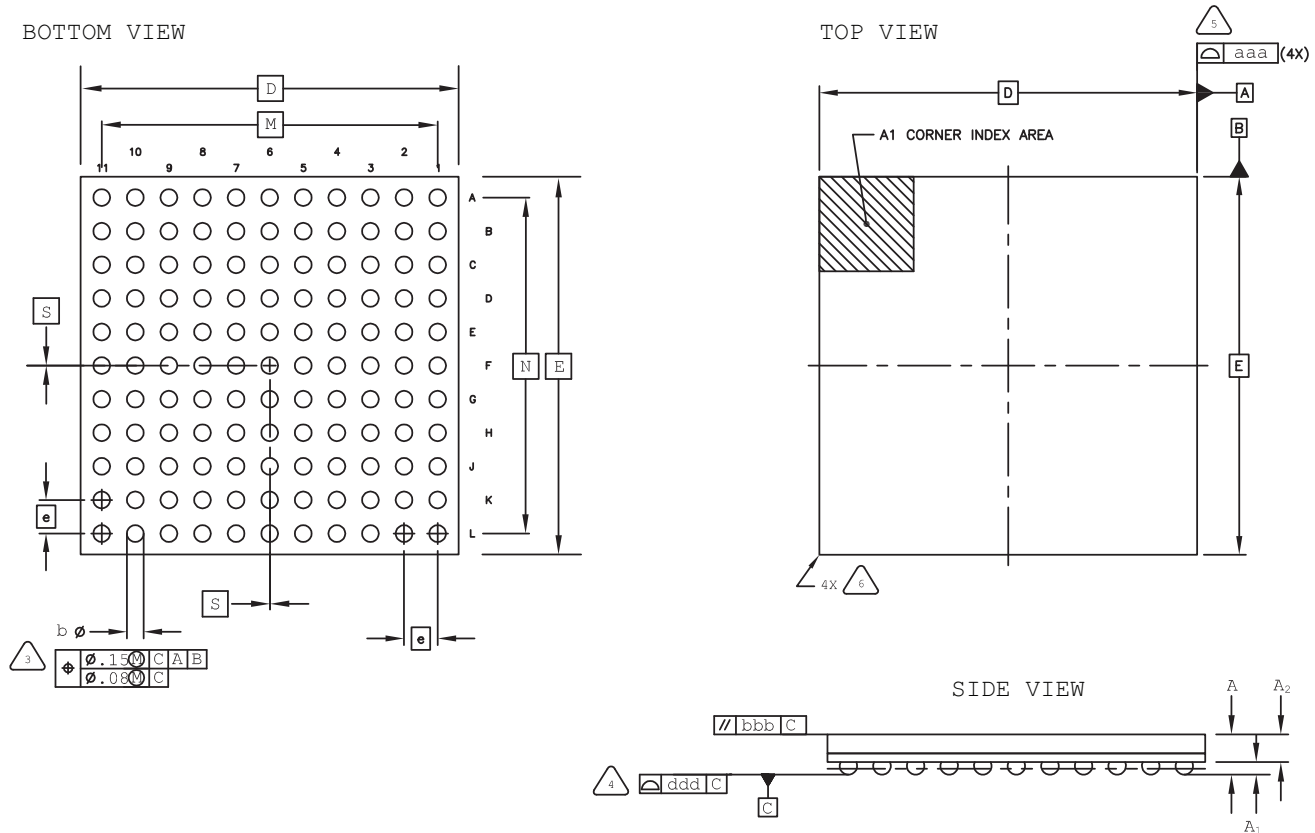
- DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
- ALL DIMENSIONS ARE IN MILLIMETERS.

- 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      | 1.30      | 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 |

## 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.

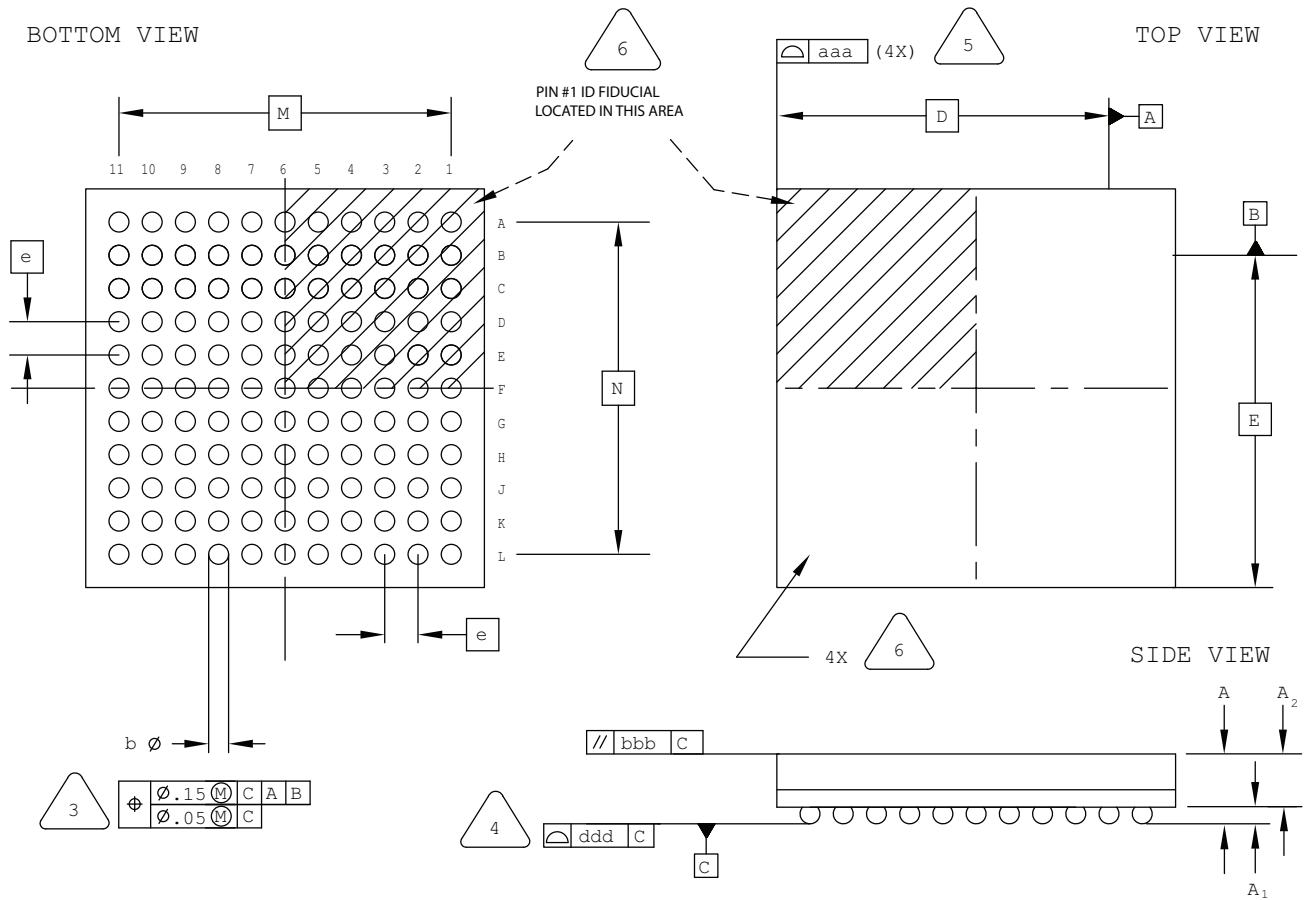


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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.

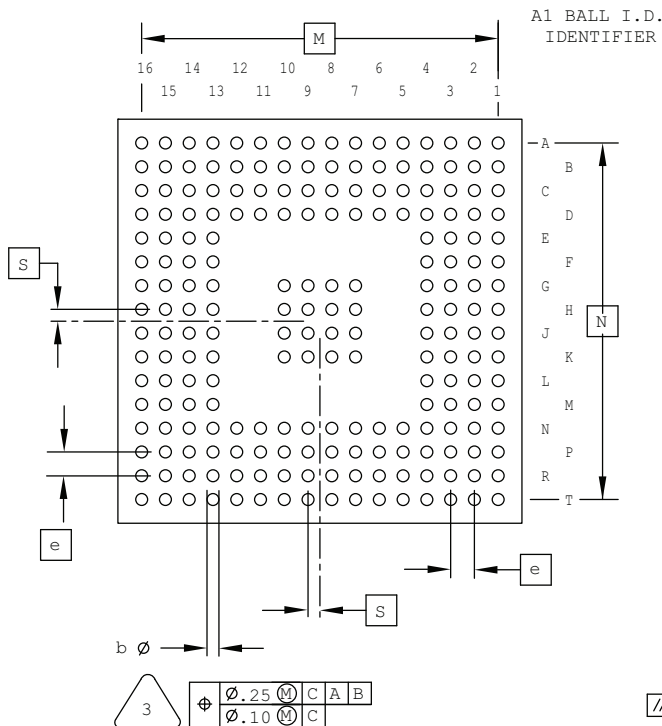
3. DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM [C]
4. PRIMARY DATUM [C] AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
6. EXACT SHAPE AND SIZE OF THIS FEATURE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

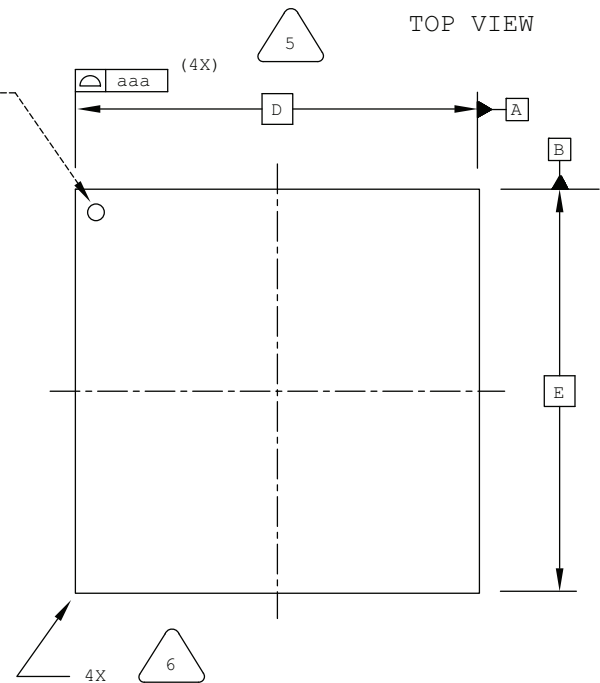
## 208-Ball ftBGA Package

Dimensions in Millimeters

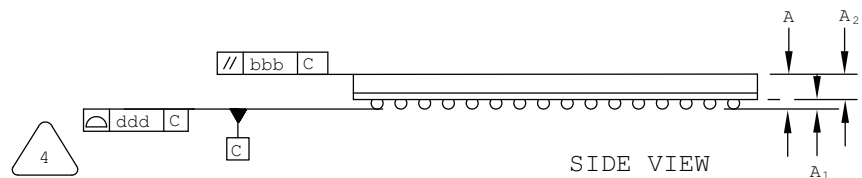
BOTTOM VIEW



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 [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.

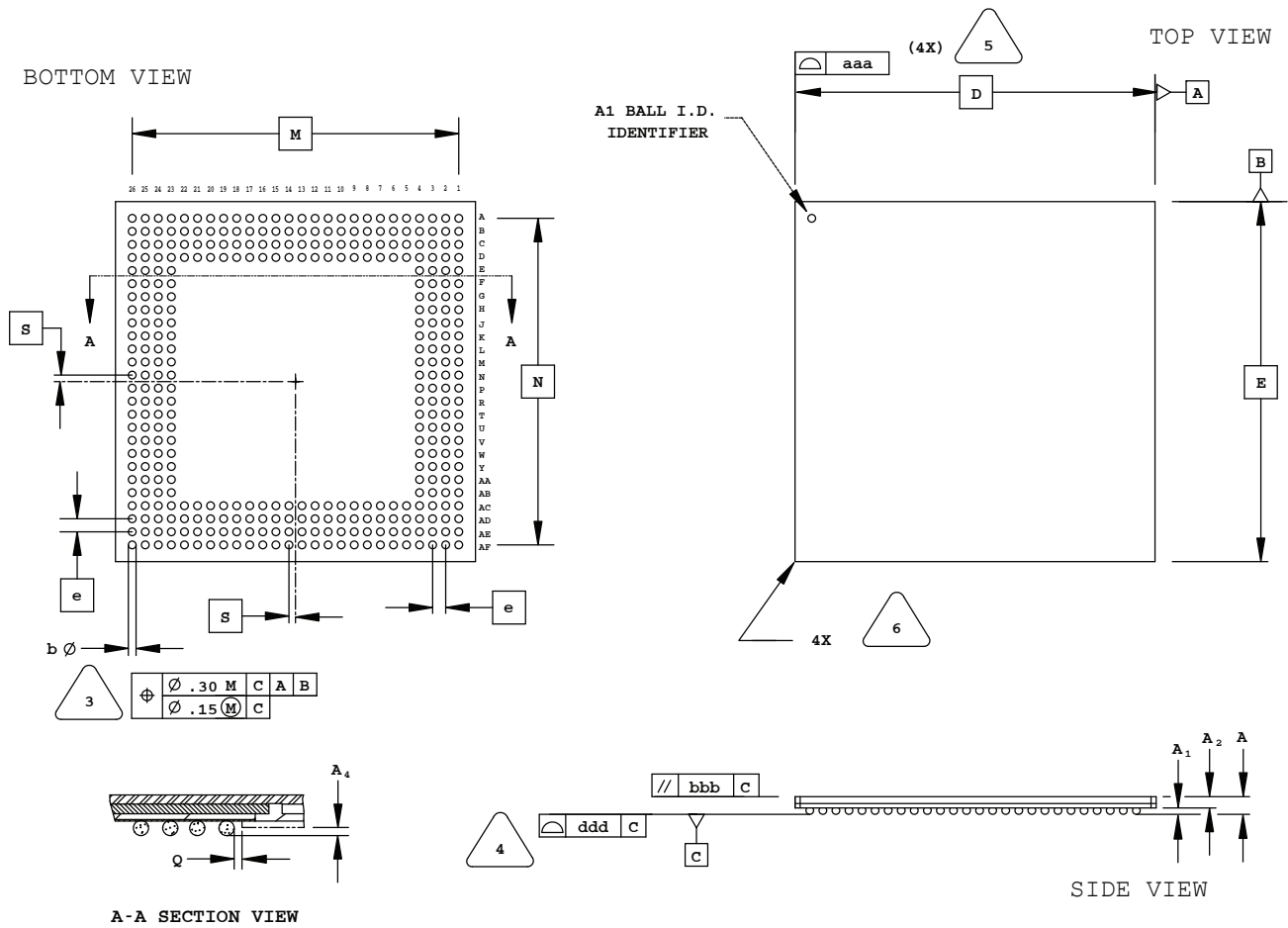


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

## 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.

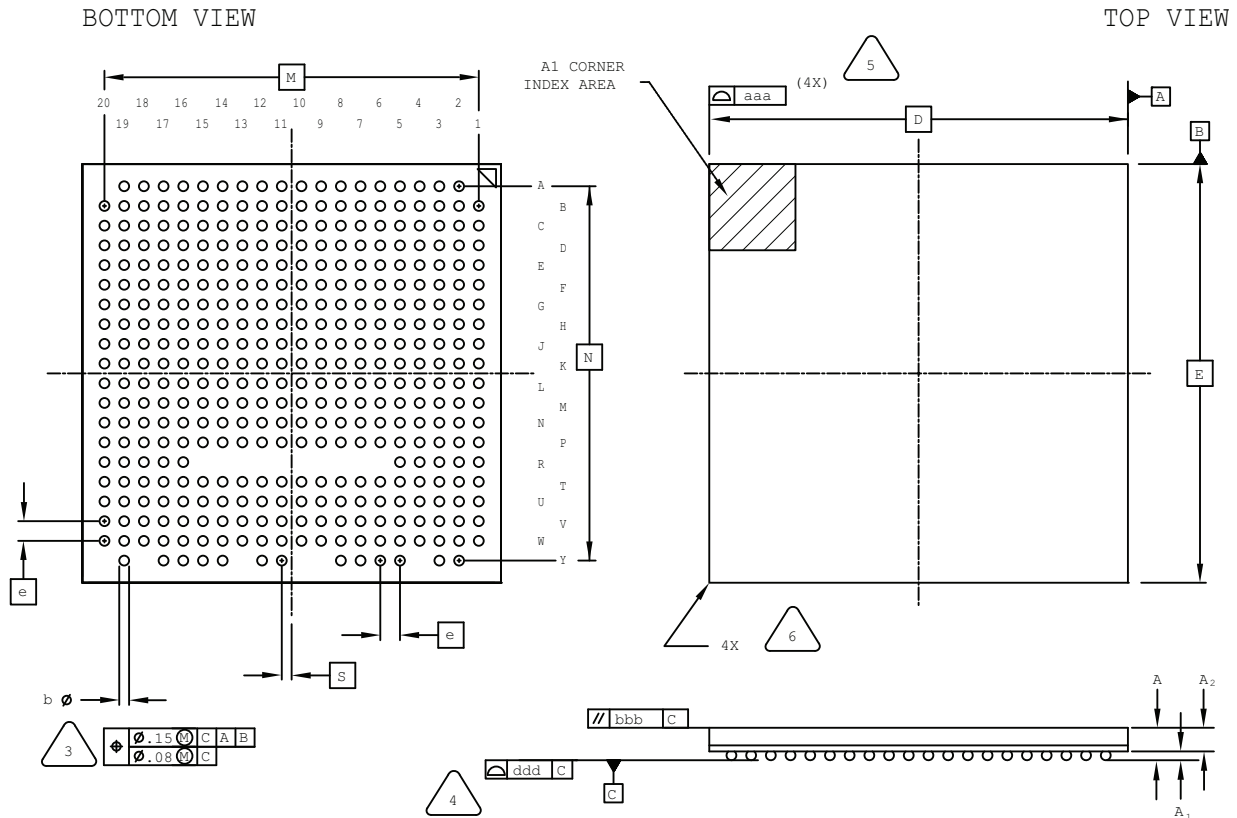


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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.

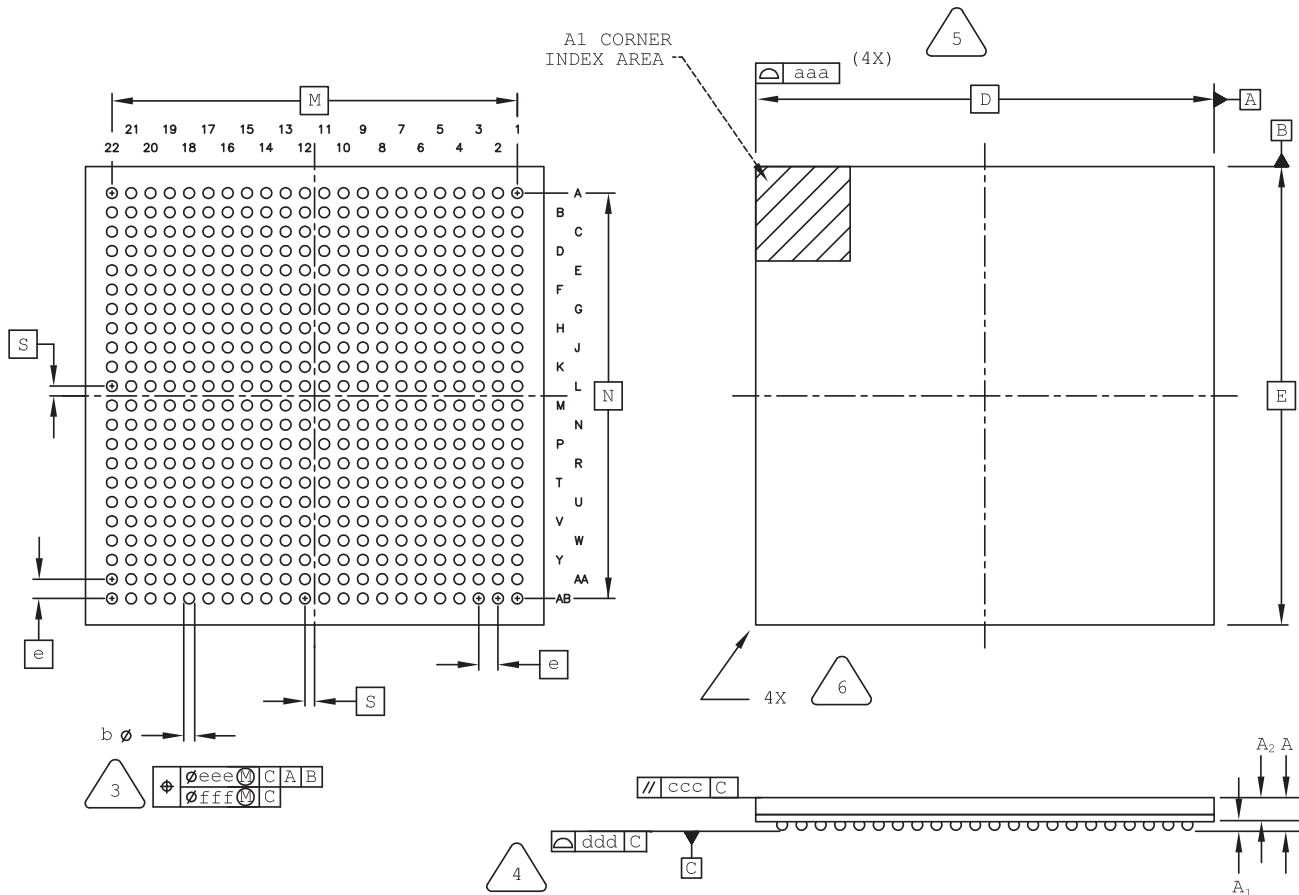
- 3** DIMENSION "b" IS MEASURED AT THE MAXIMUM SOLDER BALL DIAMETER, PARALLEL TO PRIMARY DATUM C
- 4** PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.
- 5** BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.
- 6** EXACT SHAPE AND SIZE OF THIS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



## 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.

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

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

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

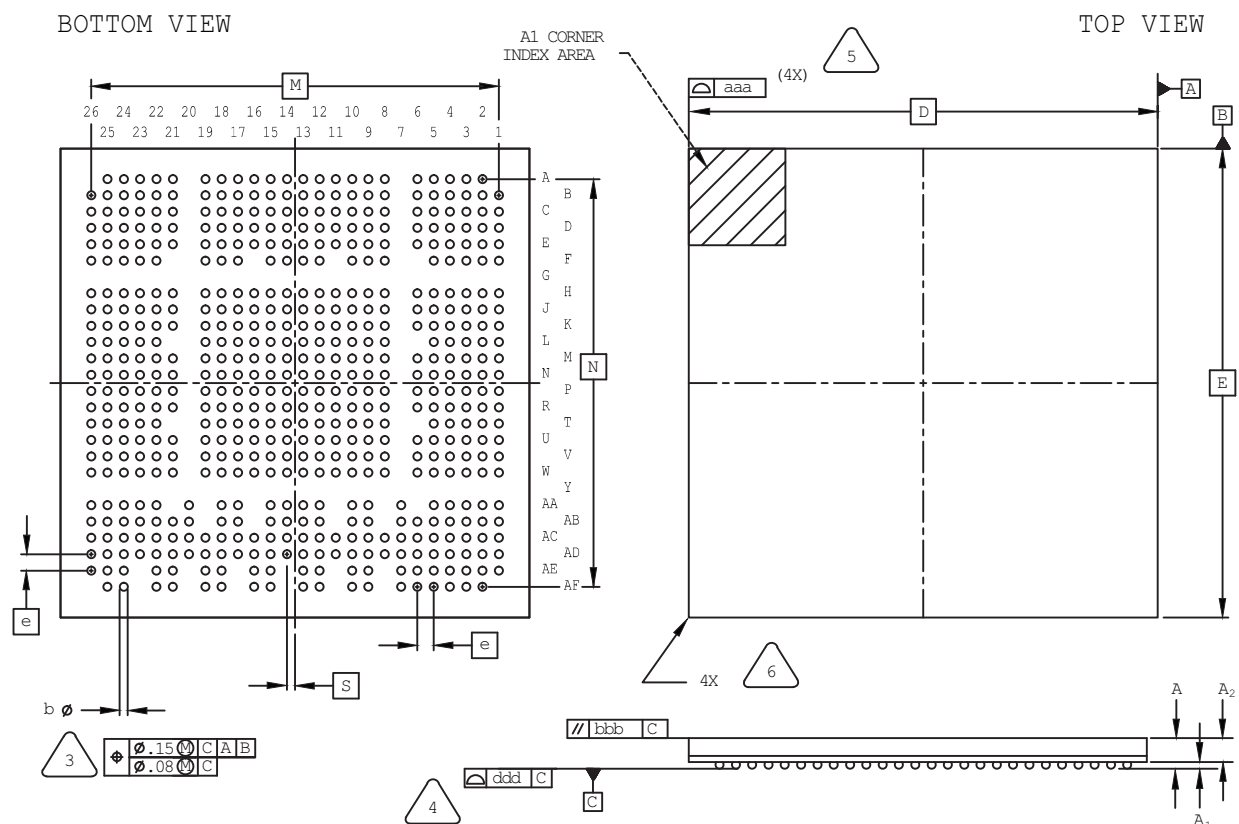
6. EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

7. JEDEC REFERENCE: MO-275A

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

## 554-Ball caBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

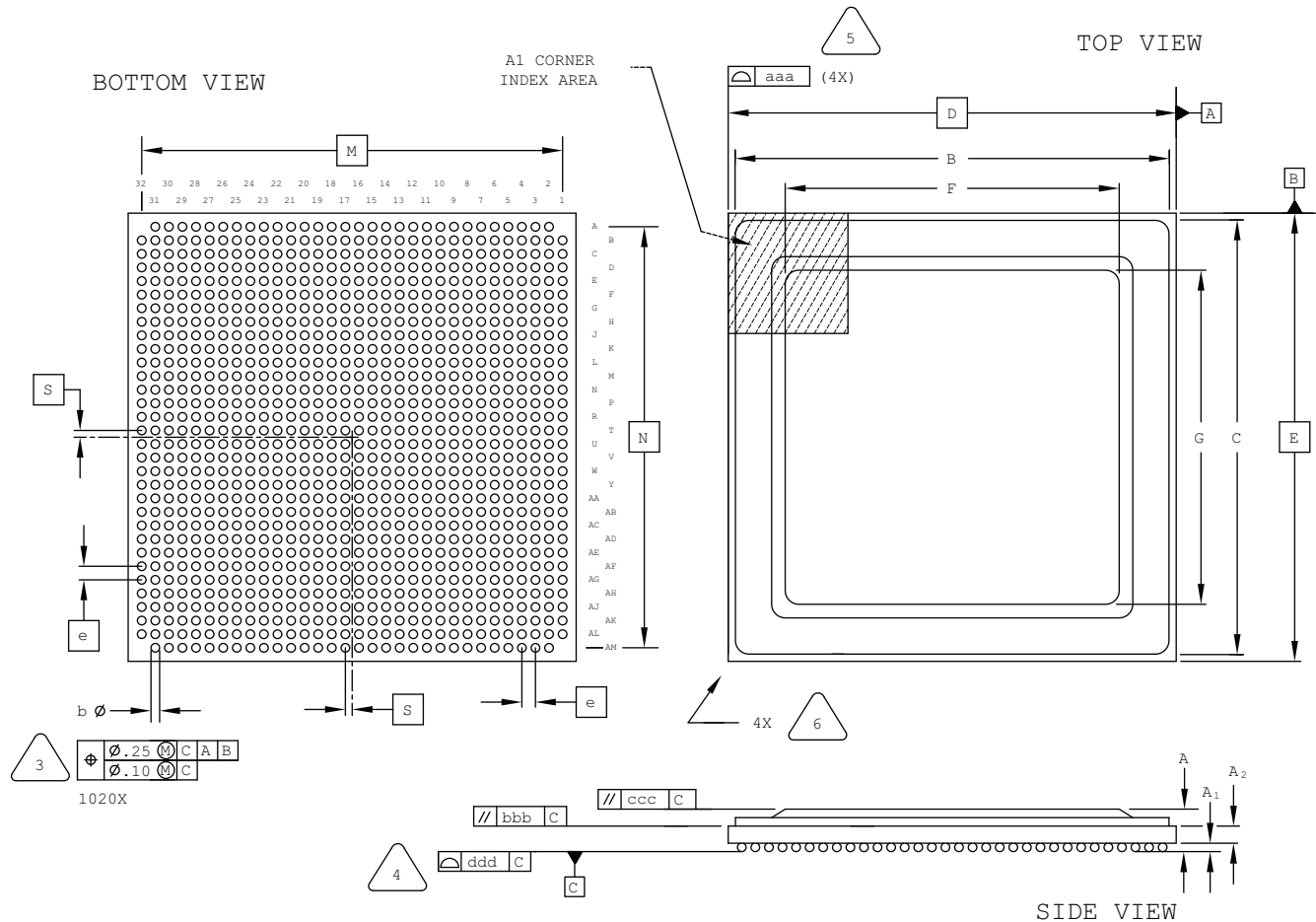
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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

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

# 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.

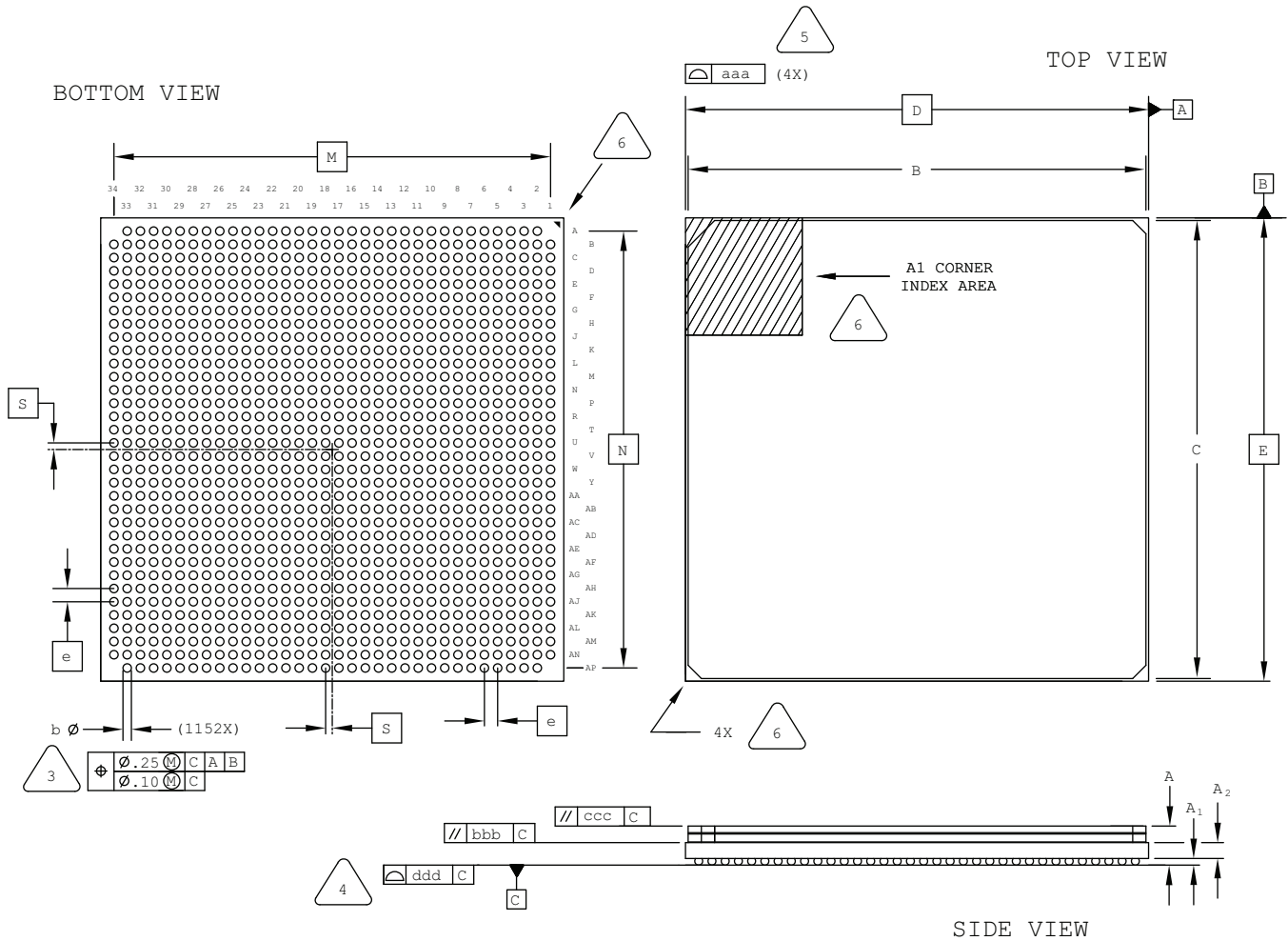


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 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.

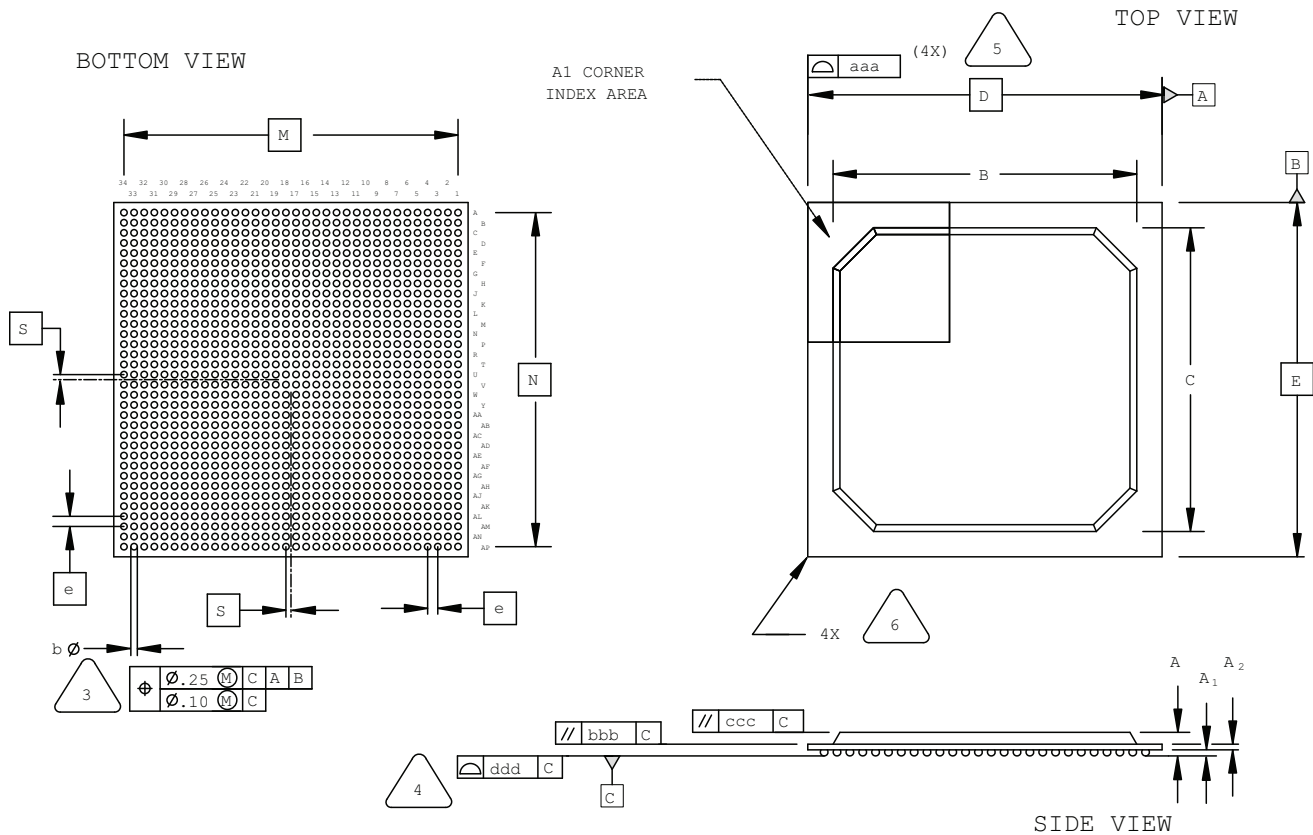


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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  |

## 1156-Ball fpBGA 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      | 1.90      | 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  |