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Understanding [Embedded - FPGAs \(Field Programmable Gate Array\)](#)

Embedded - FPGAs, or Field Programmable Gate Arrays, are advanced integrated circuits that offer unparalleled flexibility and performance for digital systems. Unlike traditional fixed-function logic devices, FPGAs can be programmed and reprogrammed to execute a wide array of logical operations, enabling customized functionality tailored to specific applications. This reprogrammability allows developers to iterate designs quickly and implement complex functions without the need for custom hardware.

Applications of Embedded - FPGAs

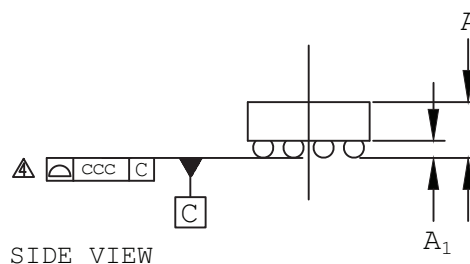
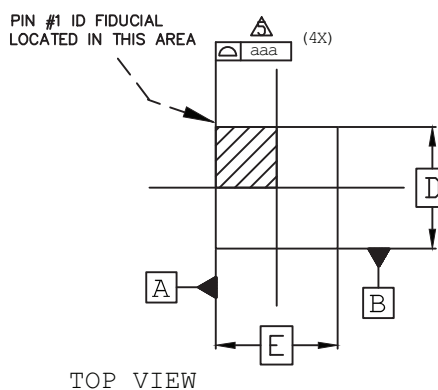
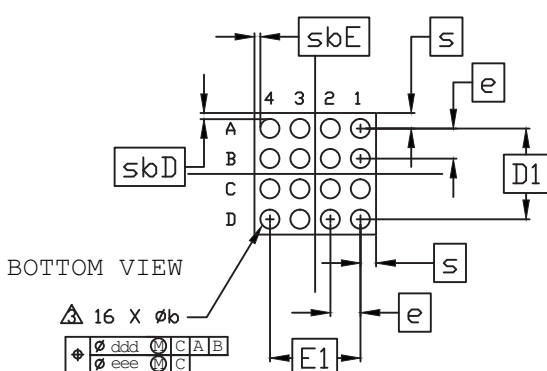
The versatility of Embedded - FPGAs makes them indispensable in numerous fields. In telecommunications.

Details

| | |
|--------------------------------|---|
| Product Status | Obsolete |
| Number of LABs/CLBs | - |
| Number of Logic Elements/Cells | 6100 |
| Total RAM Bits | 94208 |
| Number of I/O | 147 |
| Number of Gates | - |
| Voltage - Supply | 1.14V ~ 1.26V |
| Mounting Type | Surface Mount |
| Operating Temperature | -40°C ~ 100°C (TJ) |
| Package / Case | 208-BFQFP |
| Supplier Device Package | 208-PQFP (28x28) |
| Purchase URL | https://www.e-xfl.com/product-detail/lattice-semiconductor/lfec6e-3q208i |

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.

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

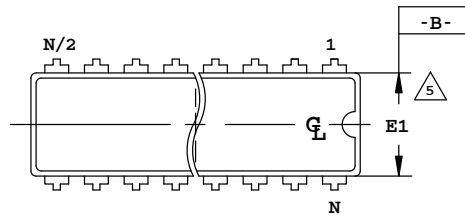
A PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

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

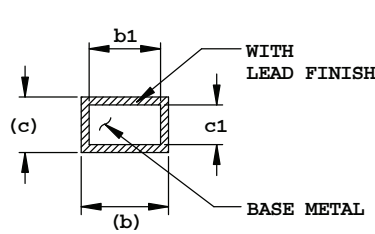
| REF. | Min. | Nom. | Max. |
|------|-----------|-------|-------|
| A | 0.413 | 0.452 | 0.491 |
| A1 | 0.122 | 0.152 | 0.182 |
| b | 0.188 | 0.218 | 0.248 |
| D | 1.409 BSC | | |
| E | 1.409 BSC | | |
| D1 | 1.05 BSC | | |
| E1 | 1.05 BSC | | |
| e | 0.35 BSC | | |
| s | - | 0.180 | - |
| skD | 0.067 | 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 Plastic DIP Package

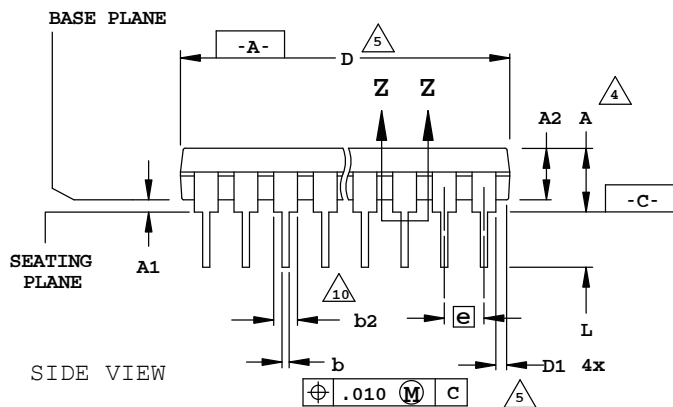
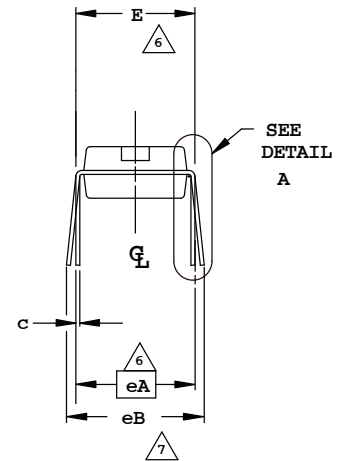
Dimensions in Inches



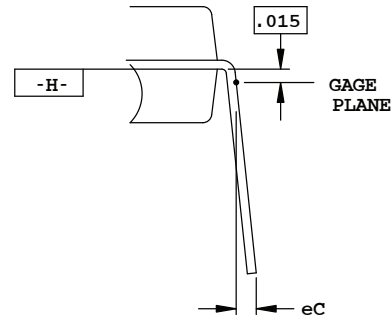
TOP VIEW



SECTION Z-Z



SIDE VIEW



DETAIL A

NOTES:

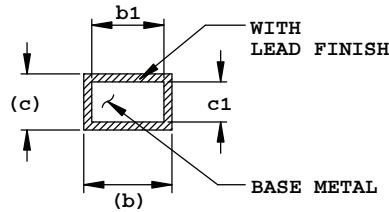
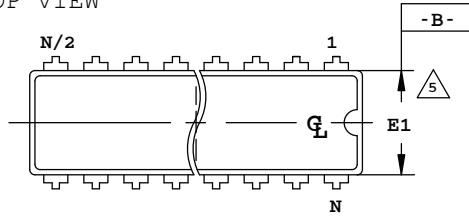
1. CONTROLLING DIMENSION: INCH.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M
3. DISTANCE BETWEEN LEADS INCLUDING DAMBAR PROTRUSIONS TO BE .005 MINIMUM.
4. DIMENSIONS A, A1 & L ARE MEASURED WITH THE PACKAGE SEATED IN JEDEC SEATING PLANE GAUGE GS-3.
5. DIMENSIONS D, D1 AND E1 DO NOT INCLUDE MOLD FLASH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

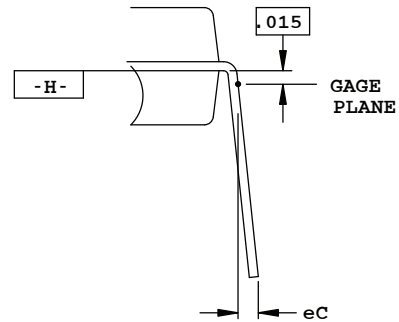
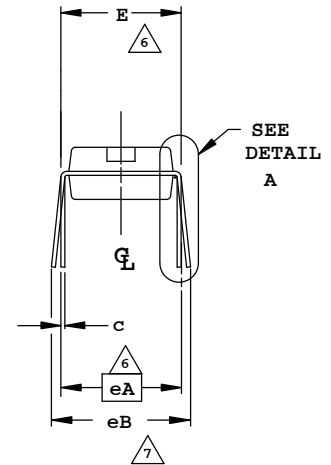
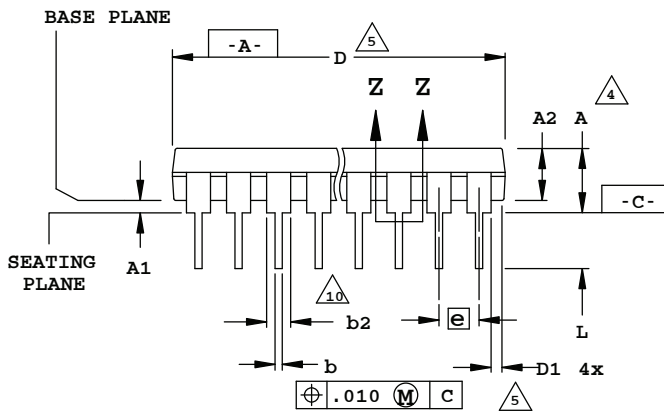
Dimensions in Inches

TOP VIEW



SECTION Z-Z

SIDE VIEW



DETAIL A

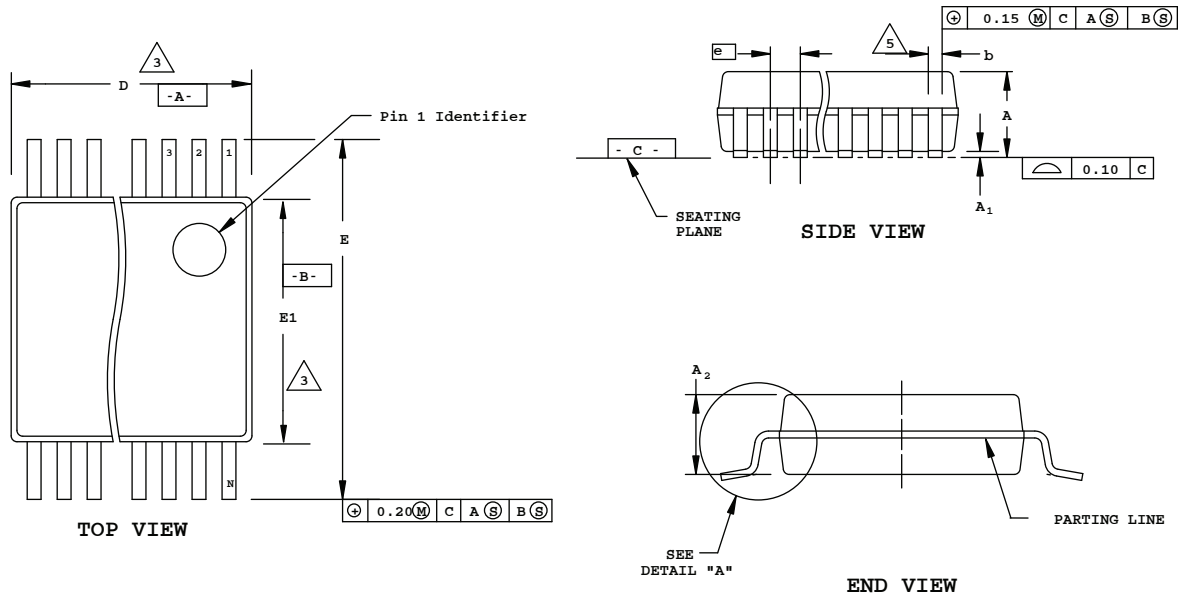
NOTES:

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 SSOP Package

Dimensions in Millimeters



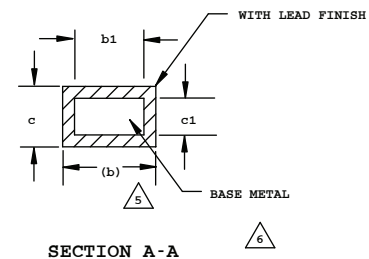
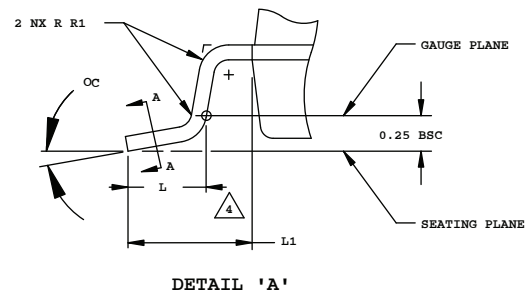
| SYMBOL | COMMON DIMENSIONS | | |
|----------------|-------------------|-------|-------|
| | MIN. | NOM. | MAX. |
| A | -- | -- | 2.0 |
| A ₁ | 0.05 | -- | -- |
| A ₂ | 1.65 | 1.75 | 1.85 |
| b | 0.22 | -- | 0.38 |
| b ₁ | 0.22 | 0.30 | 0.33 |
| c | 0.09 | -- | 0.25 |
| c ₁ | 0.09 | 0.15 | 0.21 |
| 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



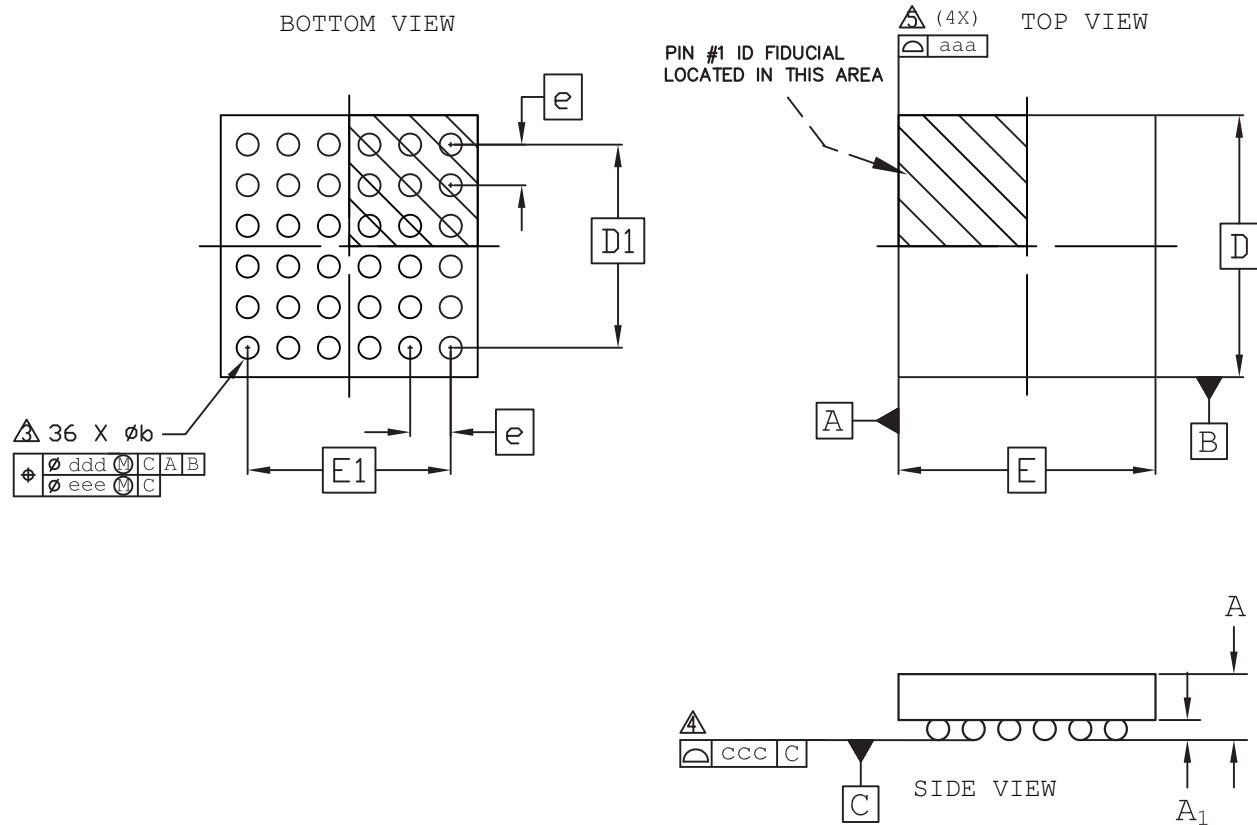
5. DIMENSION b DOES NOT INCLUDE DAMBAR PROTRUSION/INTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13mm TOTAL IN EXCESS OF b DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR INTRUSION SHALL NOT REDUCE DIMENSION b BY MORE THAN 0.07mm AT LEAST MATERIAL CONDITION.

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

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.

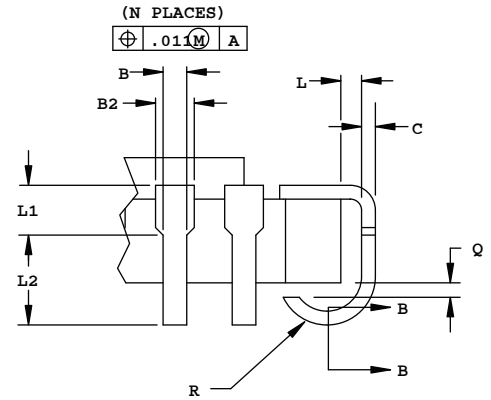
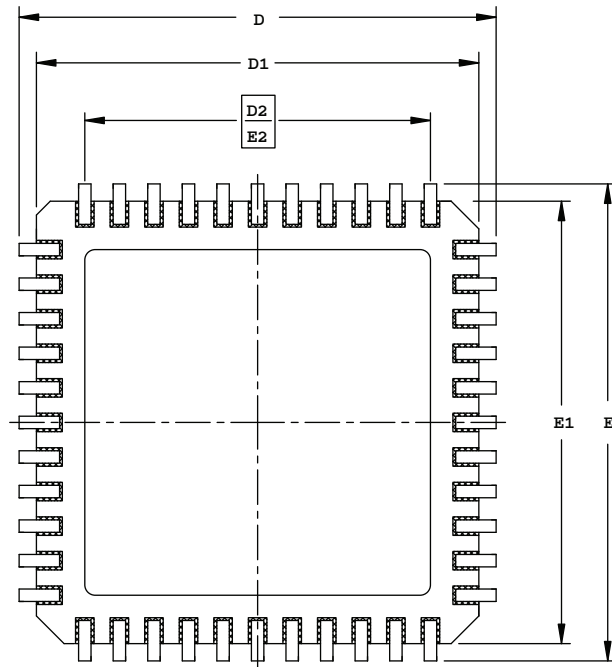
△ BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

| 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 | | |

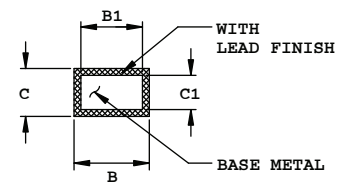
44-Pin JLCC Package

Dimensions in Inches

BOTTOM VIEW

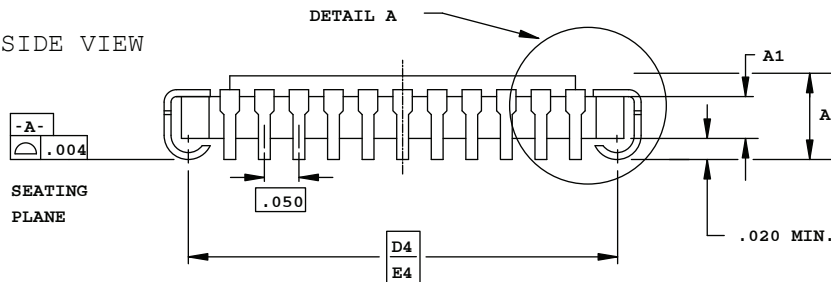


DETAIL A



SECTION B-B

SIDE VIEW



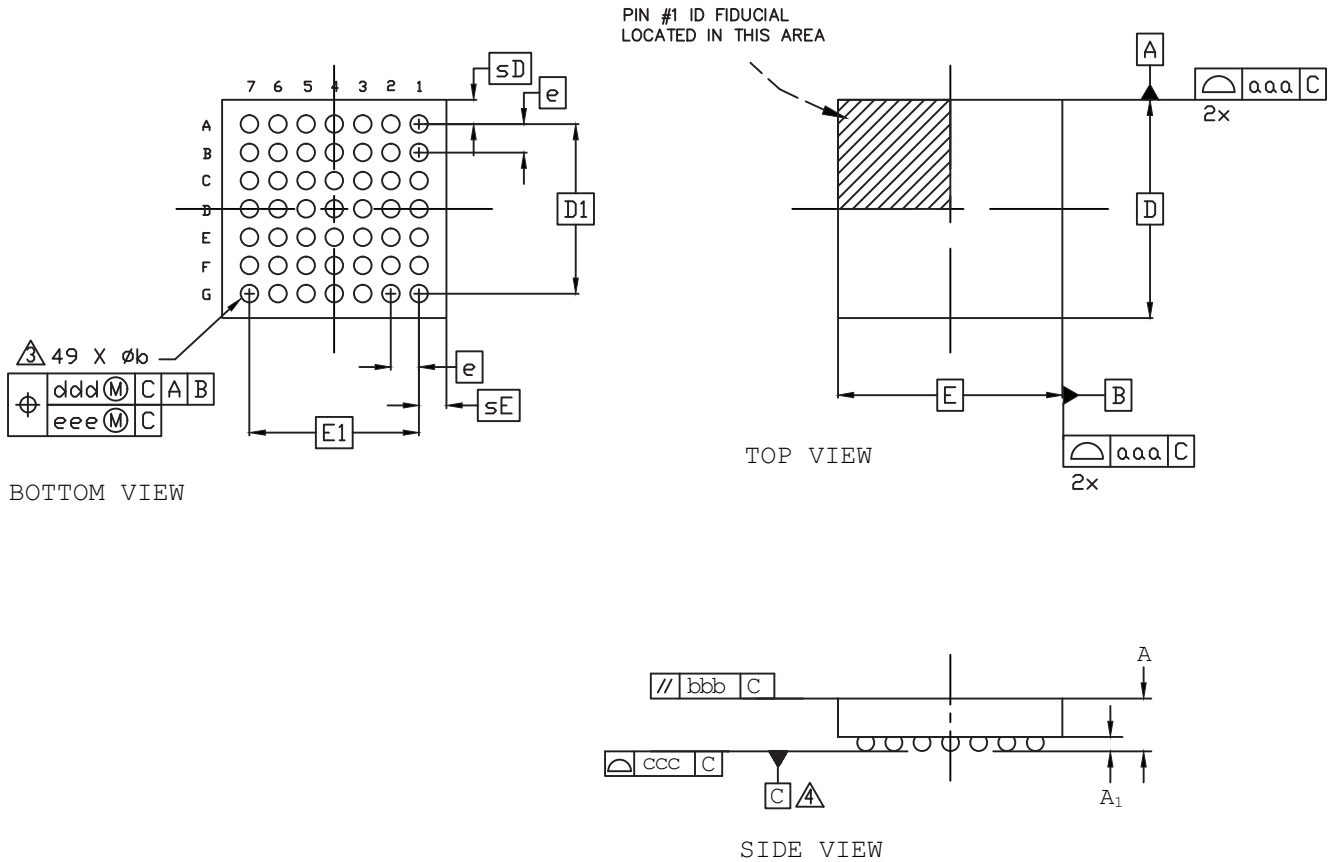
NOTES :

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 | .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 | | |

49-Ball WLCS Package

Dimensions in Millimeters



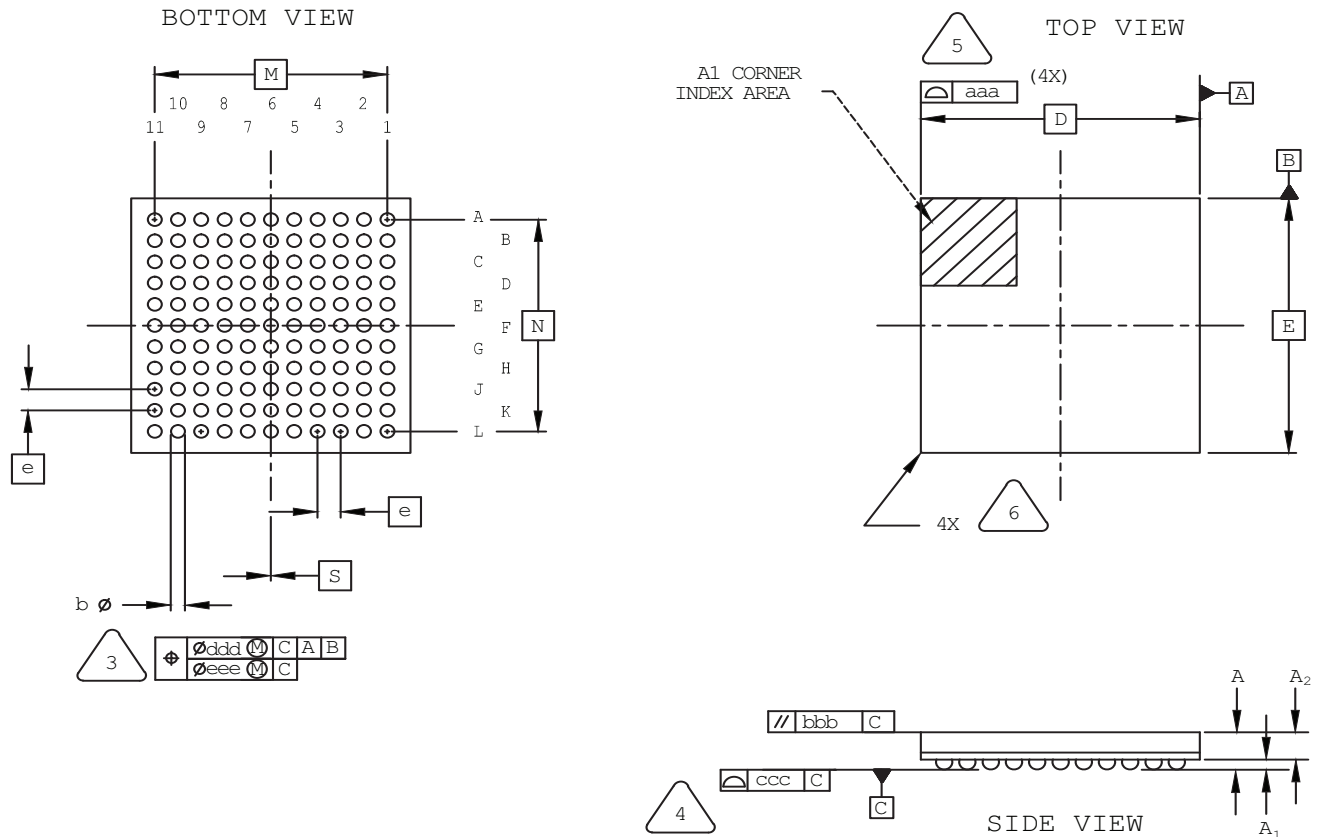
Notes:

- 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 | | |

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.

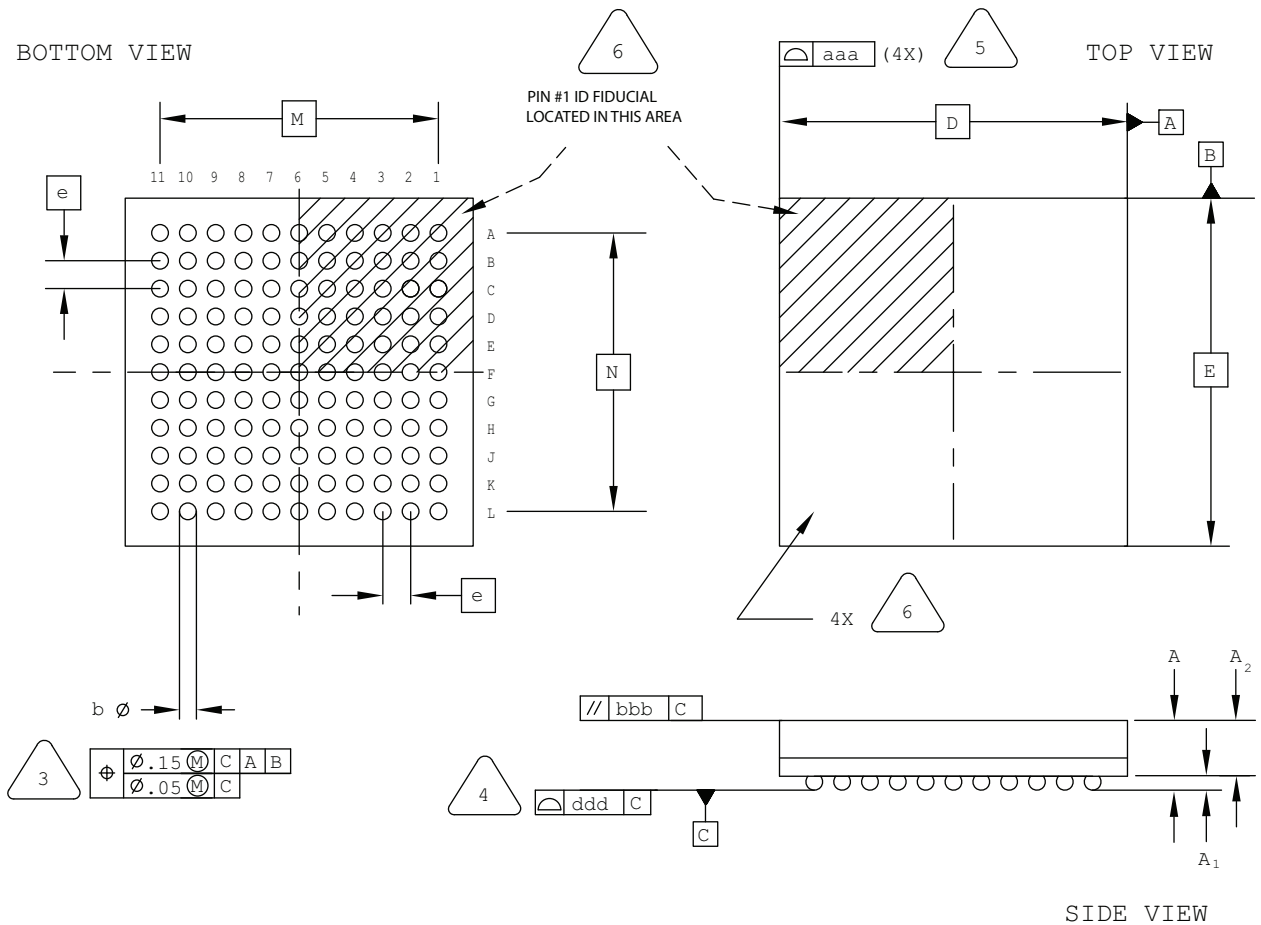
5. BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY.

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

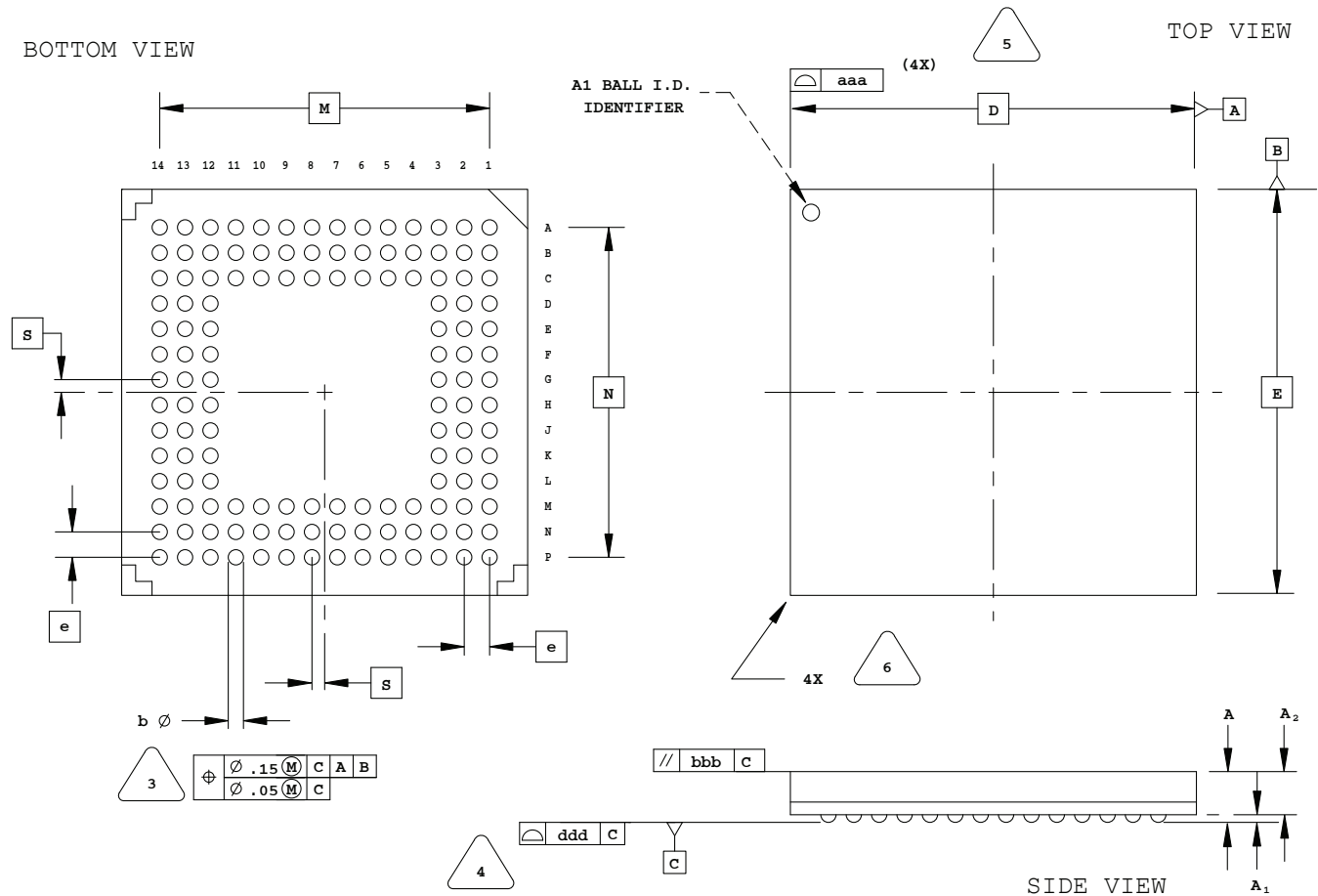
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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

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

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 [C]



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



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

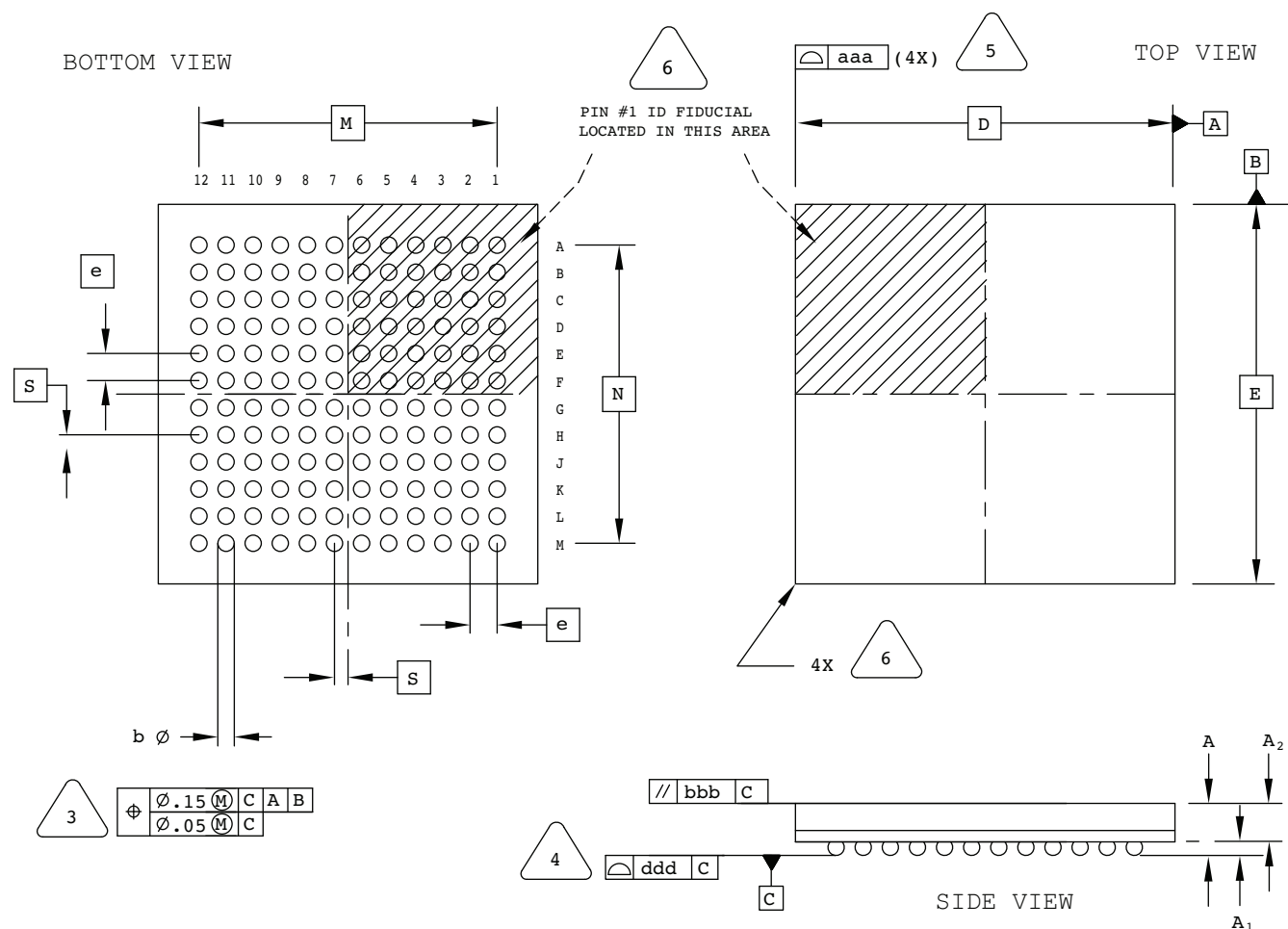


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

144-Ball csBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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



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.

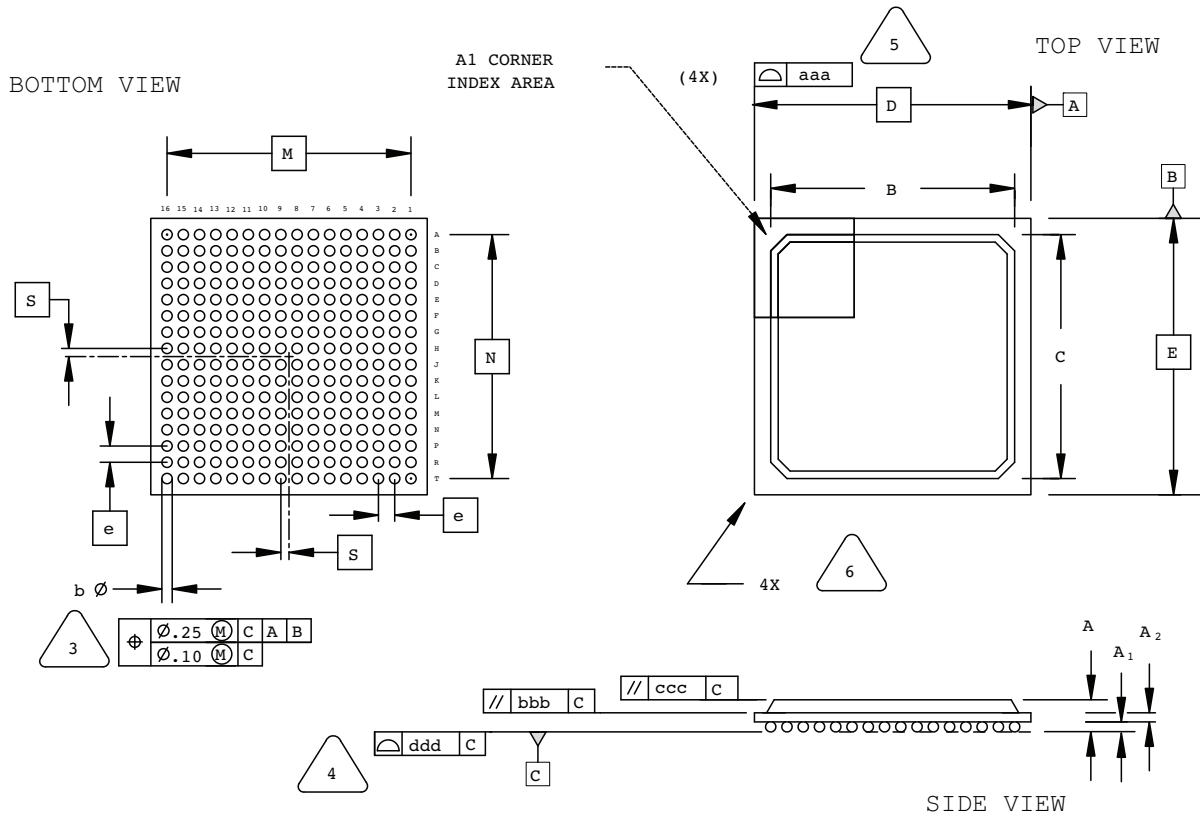


EXACT SHAPE AND SIZE OF THIS FEATURE
IS OPTIONAL.

| 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 |

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.

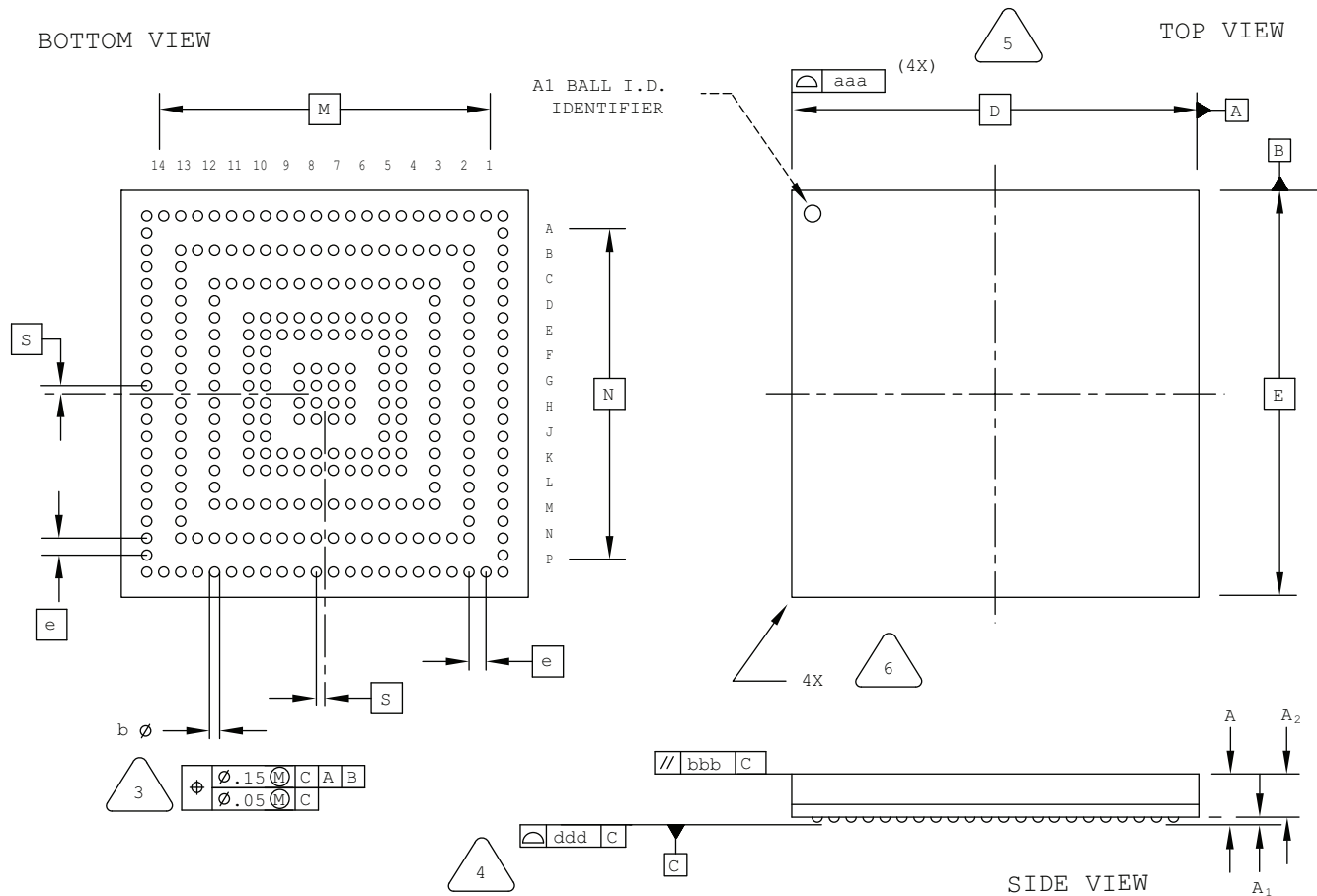


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 |


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.

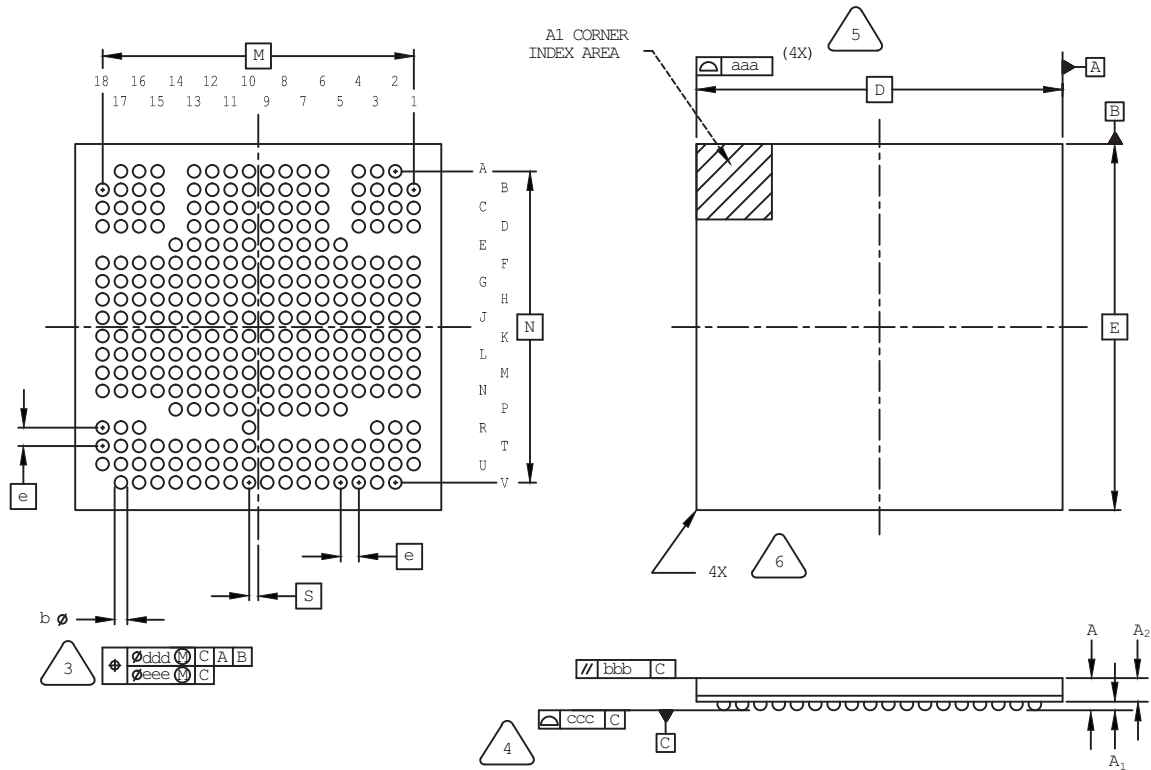

 BILATERAL TOLERANCE ZONE IS APPLIED
 TO EACH SIDE OF THE PACKAGE BODY.


 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.

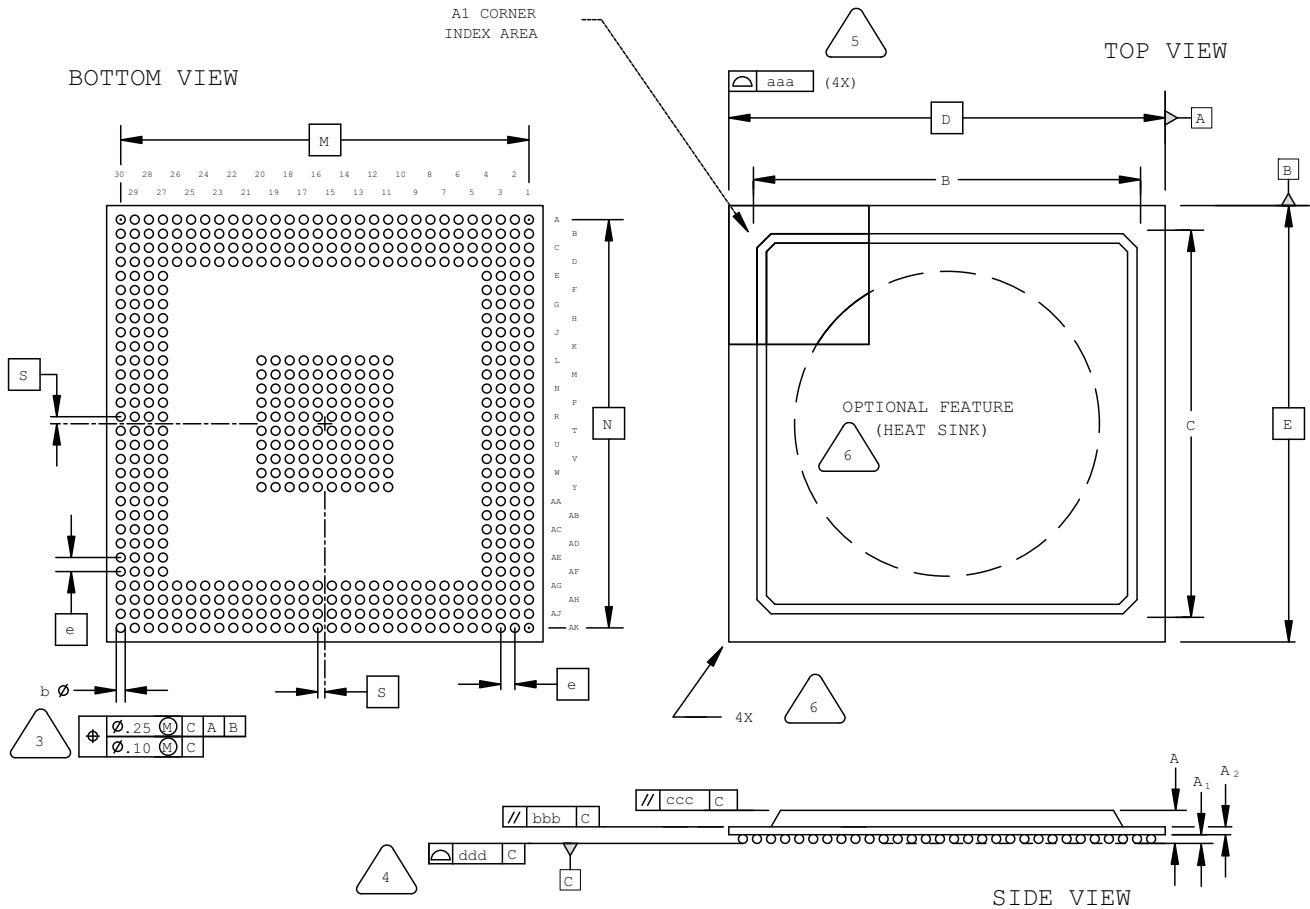


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

| 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 | | |

516-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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



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



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



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

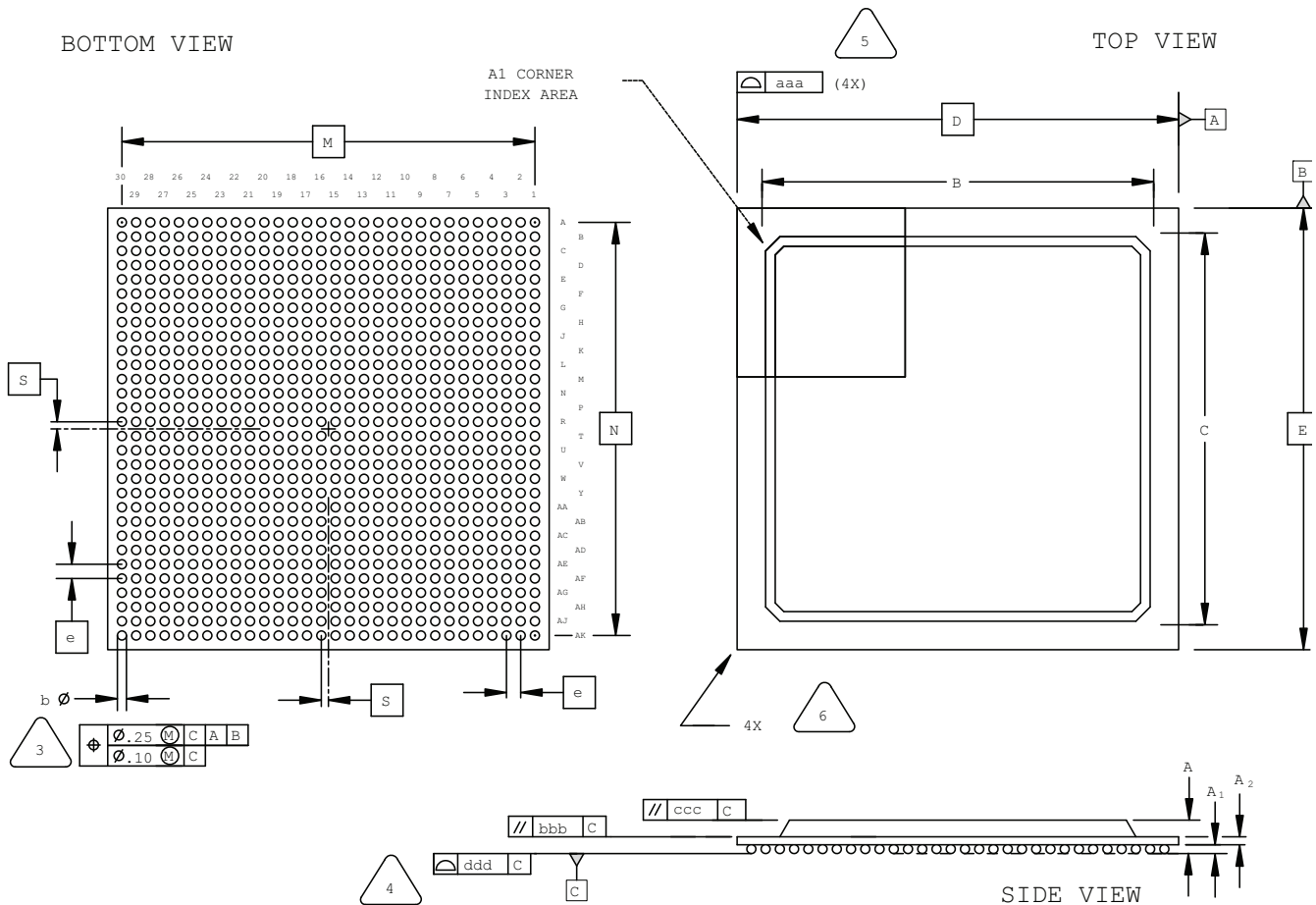


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

900-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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



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



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



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

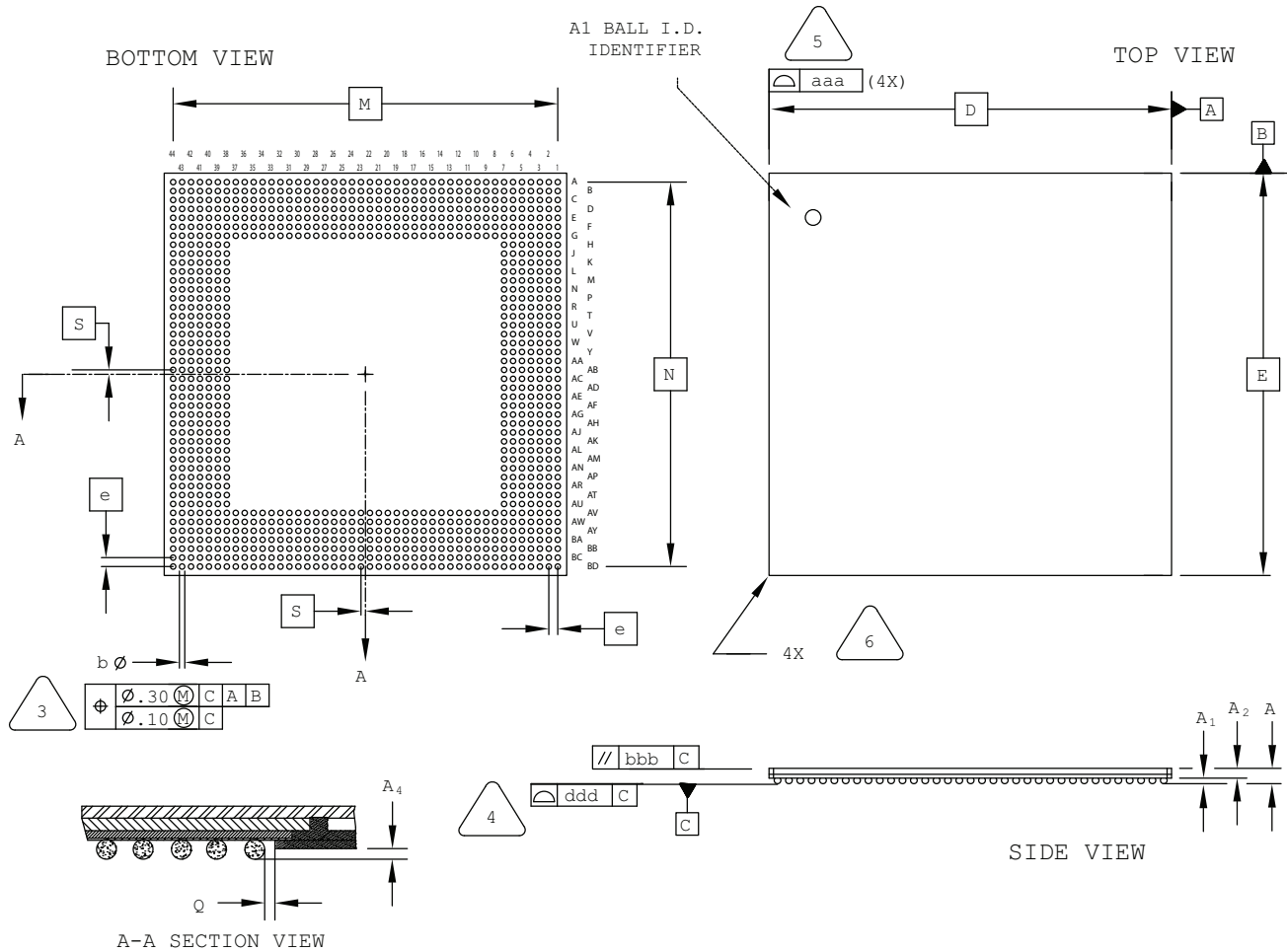


EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

1036-Ball ftSBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

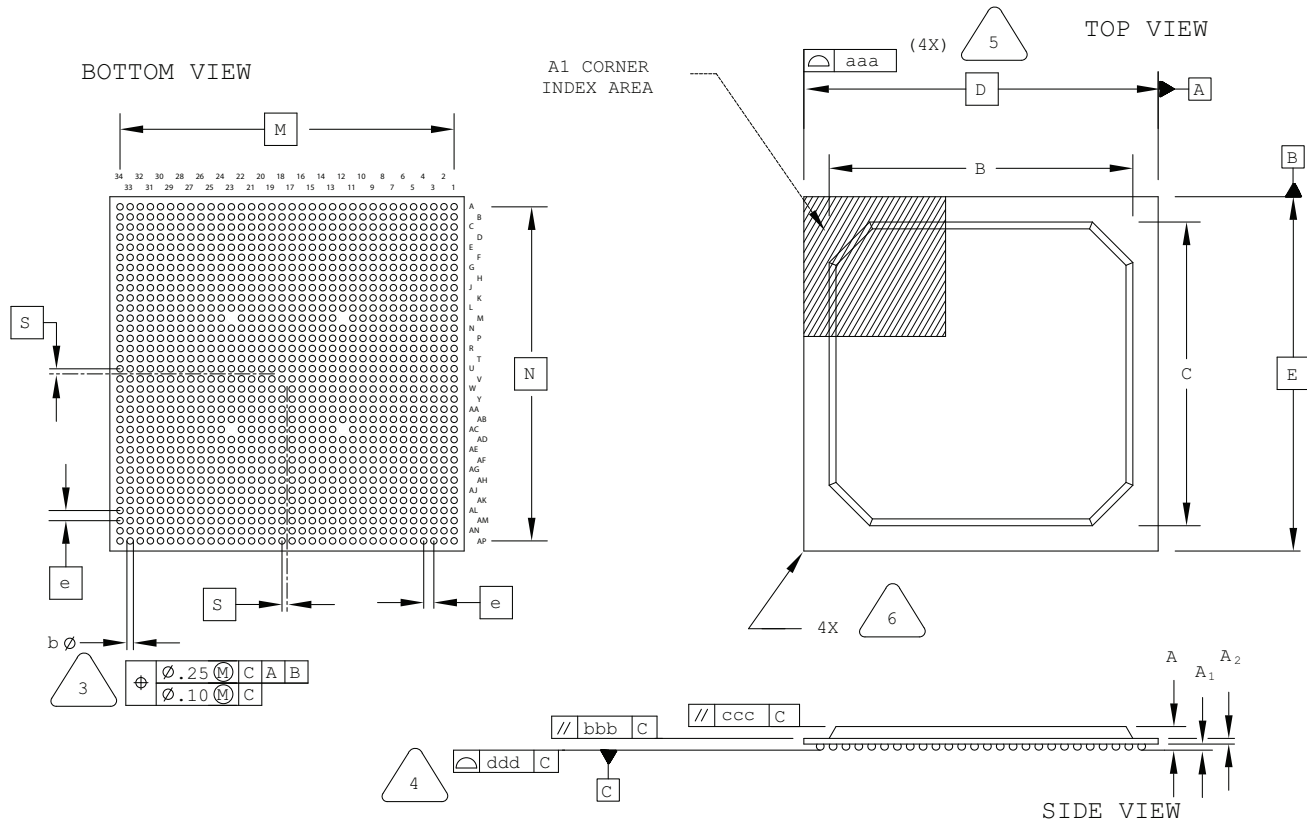
1. DIMENSIONS AND TOLERANCES PER ANSI Y14.5M.
2. ALL DIMENSIONS ARE IN MILLIMETERS.

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

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

1152-Ball fpBGA Package

Dimensions in Millimeters



NOTES: UNLESS OTHERWISE SPECIFIED

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



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



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



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



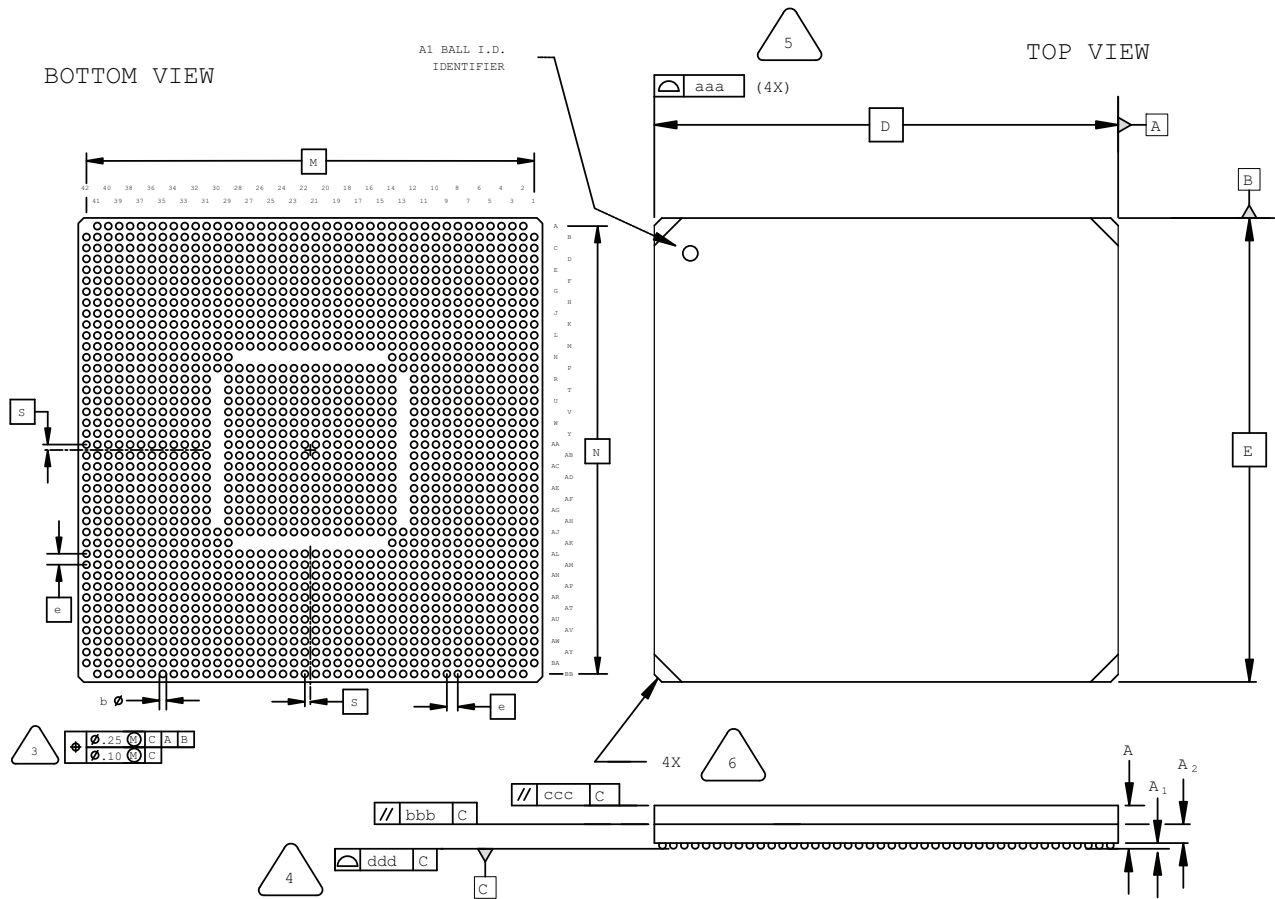
EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

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

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.



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

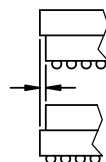


PRIMARY DATUM **C** AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BALLS.



BILATERAL TOLERANCE ZONE IS APPLIED TO EACH SIDE OF THE PACKAGE BODY. PACKAGE BODY INCLUDES SUBSTRATE AND LID.

MAXIMUM OFFSET: 0.20 mm



EXACT SHAPE AND SIZE OF THIS FEATURE IS OPTIONAL.

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

Revision History

| Date | Version | Change Summary |
|----------------|---------|---|
| March 2017 | 5.4 | Added ispMACH 4000 to 100-Pin TQFP Package Option 1: MachXO2, MachXO™, ispMACH® 4000. |
| | | Added 121-Ball caBGA Package (9x9 mm Body). |
| December 2016 | 5.3 | Updated “32-Pin QFNS Package” headings to “32-Pin QFN Package”. |
| | | Added 32-Pin QFN Package Option 3: MachXO2 SG32C. |
| | | Added 30-Ball WLSC Package. |
| | | Added iCE40 UltraPlus and MachXO2 to 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2. |
| | | Added 484-Ball caBGA Package. |
| June 2016 | 5.2 | Updated 285-ball csfBGA package outline drawing. |
| | | Added 36-Ball WLCS Package Option 3: LIFMD™. |
| | | Fixed typo in 48-Pin QFN Package Option 2: L-ASC10, iCE40 Ultra, iCE40 UltraPlus, MachXO2. |
| | | Added 64-Ball ucfBGA Package. |
| | | Added 80-Ball ctfBGA Package. |
| | | Added 81-Ball csfBGA Package. |
| February 2015 | 5.1 | Added 36-Ball ucfBGA Package: iCE40 Ultra. |
| | | Updated 36-Ball ucBGA Package heading to 36-Ball ucBGA Package Option 1. |
| | | 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. |
| | | 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. |
| | | Updated 36-Ball WLCS Package Option 1: iCE40 Ultra heading. |
| | | Added 36-Ball WLCS Package Option 2: MachXO3. |
| | | Added 81-Ball WLCS Package. |
| | | Added 121-Ball csfBGA Package. |
| | | Added 256-Ball csfBGA Package. |
| | | Added 324-Ball caBGA Package. |
| | | Added 324-Ball csfBGA Package. |
| | | Added 400-Ball caBGA Package. |
| | | Updated 84-Pin QFN Package. Revised dimension “b” maximum value. |
| | | Updated 256-Ball ftBGA Package Option 1: ispMACH 4000, MachXO, LatticeXP2. Revised dimension “A” values. |