### **Lattice Semiconductor Corporation - LFEC1E-4T144I Datasheet**



Welcome to **E-XFL.COM** 

# **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	1500
Total RAM Bits	18432
Number of I/O	97
Number of Gates	-
Voltage - Supply	1.14V ~ 1.26V
Mounting Type	Surface Mount
Operating Temperature	-40°C ~ 100°C (TJ)
Package / Case	144-LQFP
Supplier Device Package	144-TQFP (20x20)
Purchase URL	https://www.e-xfl.com/product-detail/lattice-semiconductor/lfec1e-4t144i

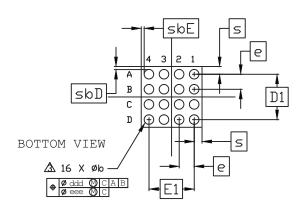
Email: info@E-XFL.COM

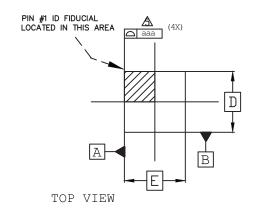
Address: Room A, 16/F, Full Win Commercial Centre, 573 Nathan Road, Mongkok, Hong Kong

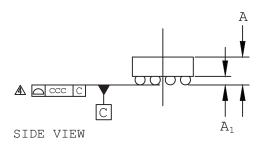


# 16-Ball WLCS Package Option 2: iCE40 UltraLite™

### **Dimensions in Millimeters**







#### NOTES:

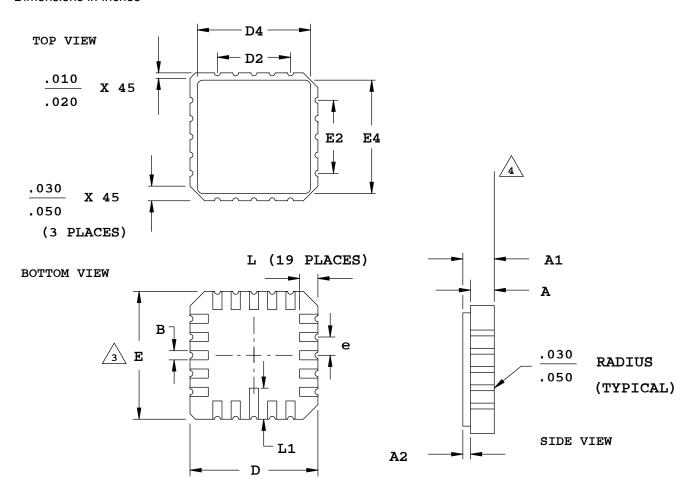
- 1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M 1994.
- 2. ALL DIMENSIONS ARE IN MILLIMETERS.
- △ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- $\triangle$  PRIMARY DATUM C AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.
- $\underline{\mathbb{A}}$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

REF.	Min.	Nom.	Max.	
Α	0.413	0.452	0.491	
A1	0.122	0.152	0.182	
b	0.188	0.218	0.248	
D	1.	409 BS	С	
Ε	1.	409 BS	С	
D1		1.05 BSC	)	
E1	1.05 BSC			
е	(	0.35 BS0	)	
S	-	0.180	-	
sbD	0.067	0.071	0.072	
sbE	0.067	0.071	0.072	
ممم	0.03			
CCC	0.03			
ddd	0.050			
eee		0.015		



## 20-Pin LCC Package

Dimensions in Inches



### NOTES:

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

**3** 



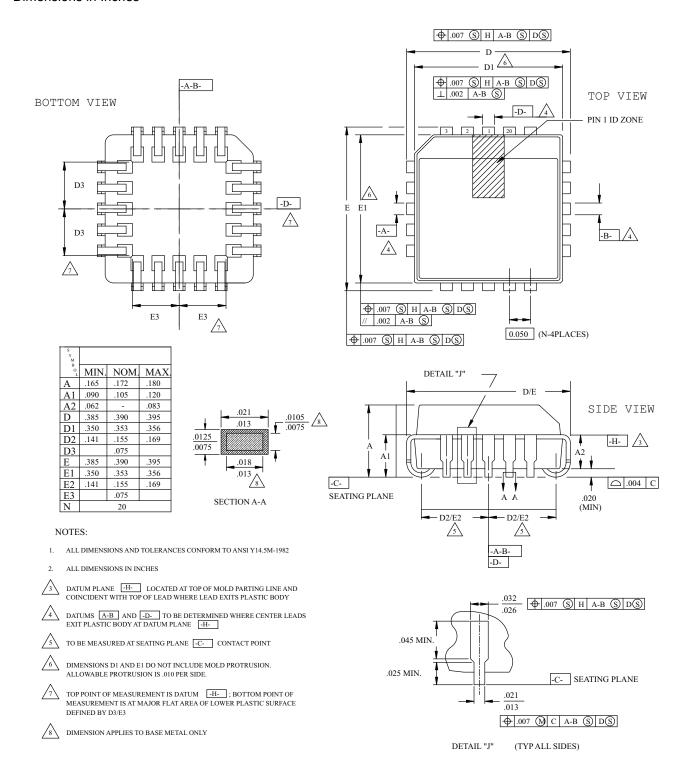
FLATNESS TOLERANCE IS .004 INCHES PER INCH.

S Y M B	INCHES				
O L	MIN.		MAX.		
A	.054		.074		
<b>A1</b>	.064		.089		
<b>A</b> 2	.007		.015		
В	.022		.028		
D	.342		.358		
D2		.200			
D4	.270		.315		
E	.342		.358		
E2		.200			
E4	.270		.315		
е	.050 BSC				
L	.042		.058		
L1	.075		.095		



## 20-Pin PLCC Package

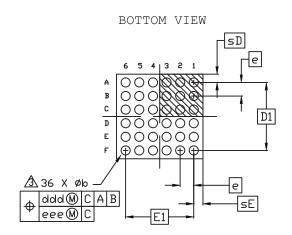
### Dimensions in Inches

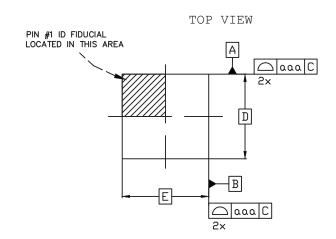


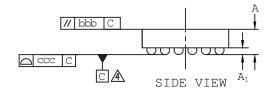


## 36-Ball WLCS Package Option 2: MachXO3<sup>™</sup>

### **Dimensions in Millimeters**







#### NOTES:

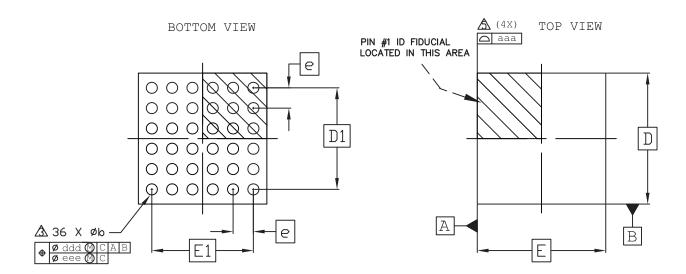
- 1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M 1994.
- 2. ALL DIMENSIONS ARE IN MILLIMETERS.
- △ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM [C].
- $\triangle$  PRIMARY DATUM  $\boxed{\text{C}}$  AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER BUMPS.

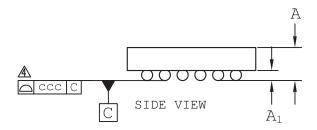
REF.	Min.	Nom.	Max.	
A	0.510	0.543	0.576	
A1	0.167	0.196	0.225	
b	0.239	0.266	0.319	
D		2.487 BS	C	
E		2.541 BS	C	
D1		2.00 BSC	:	
E1	2.00 BSC			
е		0.40 BSC	:	
sD	ı	0.244	1	
sE	ı	0.271	-	
aaa		0.025		
bbb	0.060			
ccc	0.030			
ddd	0.0150			
eee		0.050		



# 36-Ball WLCS Package Option 3: LIFMD™

### **Dimensions in Millimeters**





#### NOTES:

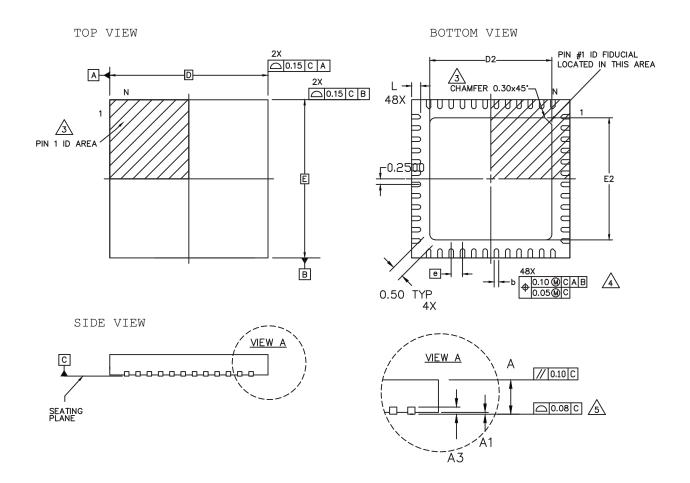
- 1. ALL DIMENSIONS AND TOLERANCE PER ASME Y 14.5M 1994.
- 2. ALL DIMENSIONS ARE IN MILLIMETERS.
- △ DIMENSION "b" IS MEASURES AT THE MAXIMUM BUMP DIAMETER PARALLEL TO PRIMARY DATUM C.
- $\triangle$  PRIMARY DATUM  $\boxed{\text{C}}$  AND SEATING PLANE ARE DEFINED BY THE SPHERICAL CROWNS OF THE SOLDER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

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



## 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.

<u>3</u>

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.

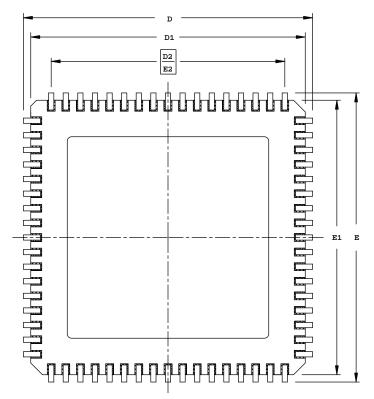
SYMBOL	MIN.	NOM.	MAX.	
А	0.80	0.90	1.00	
A1	0.00	0.02	0.05	
A3		0.2 REF		
D	7.0 BSC			
D2	5.30	5.40	5.50	
E	7.0 BSC			
E2	5.30	5.40	5.50	
b	0.15	0.20	0.25	
е	0.50 BSC			
L	0.35	0.40	0.45	

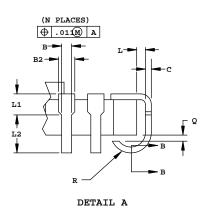


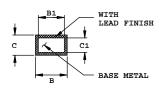
## 68-Pin JLCC Package

### Dimensions in Inches

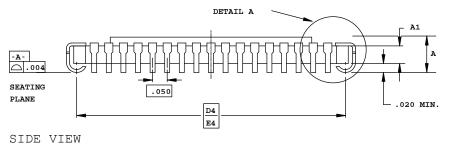
#### BOTTOM VIEW







SECTION B-B



#### NOTES:

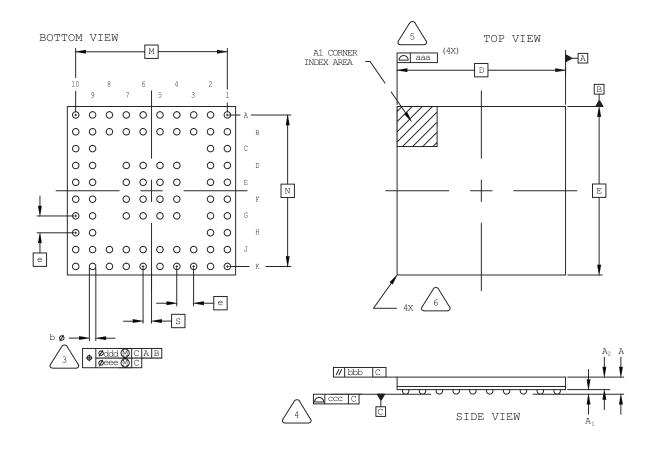
- 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M.
- 2. ALL DIMENSIONS ARE IN INCHES.
- 3. CORNER CHAMFERS AND/OR NOTCHES ARE OPTIONAL.

S M B O L	INCHES					
o r	MIN.		MAX.			
A	.115	ı	.190			
A1	. (	80 RE	F			
В	.013	-	.023			
B1	.013	-	.020			
B2	.022	-	.035			
С	.007	-	.013			
C1	.007	-	.010			
D/E	.975	.990	1.000			
D1/E1	.920	1	.960			
D2/E2	. 8	00 BS	С			
D4/E4	. 9	30 BS	C			
L	.005	-	-			
L1	.020	-	-			
L2	.025	-	-			
Q	.003	•	1			
R	.020	-	.040			
N	68					



## 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.



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.



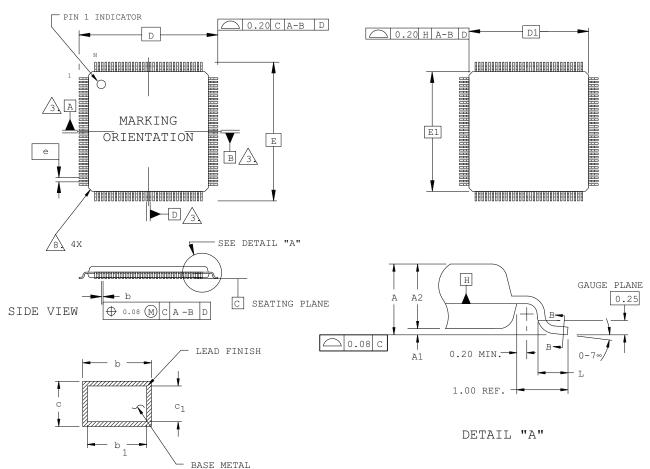
SYMBOL	MIN.	NOM.	MAX.	
А	-	-	1.00	
A1	0.11	-	-	
A2	0.61	-	-	
D/E		6.50 BSC		
M/N		5.85 BSC		
S	0.325 BSC			
b	0.20 0.25 0.30			
е	0.65 BSC			
aaa	0.10			
bbb	0.10			
ccc	0.08			
ddd	0.15			
eee		0.05		



## 176-Pin TQFP Package

### **Dimensions in Millimeters**

TOP VIEW BOTTOM VIEW



SECTION B - B

#### NOTES:

- 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5 1982.
- 2. ALL DIMENSIONS ARE IN MILLIMETERS.

 $\sqrt{_3}$  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.

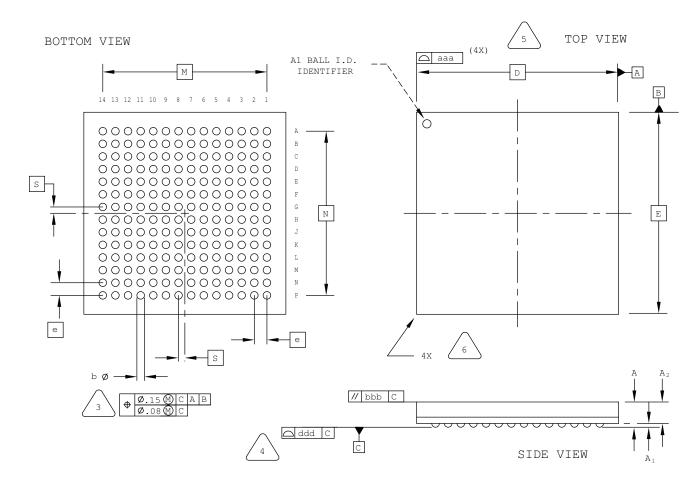
/\								
/8	7	EXACT	SHAPE	OF	EACH	CORNER	IS	OPTIONAL.

SYMBOL	MIN.	NOM.	MAX.	
А	-	-	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	0.75		
N	176			
е		0.50 BSC		
b	0.17 0.22 0.27			
b1	0.17	0.17 0.20		
С	0.09	0.15	0.20	
c1	0.09	0.13	0.16	



### 196-Ball csBGA Package

### **Dimensions in Millimeters**



NOTES: UNLESS OTHERWISE SPECIFIED

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



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.

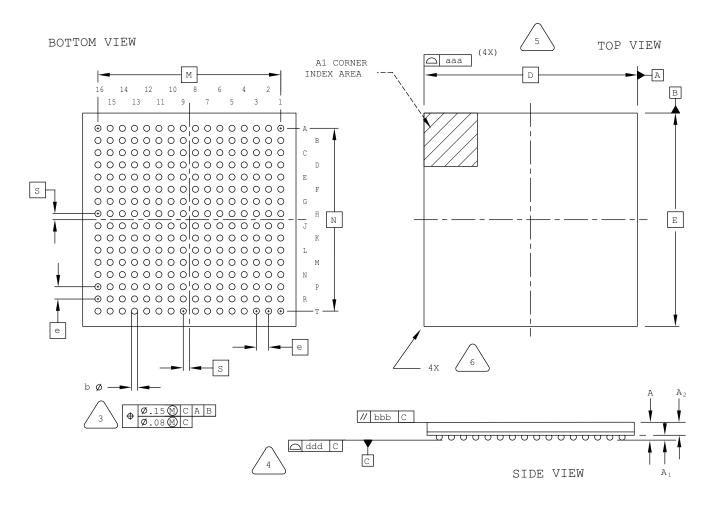


SYMBOL	MIN.	NOM.	MAX.		
А	-	-	1.00		
A1	0.15	_	_		
A2	_	_	0.85		
D/E	8.00 BSC				
M/N	6.50 BSC				
S	0	.25 BSC			
b	0.25	0.30	0.35		
е	0	.50 BSC			
aaa	_	_	0.10		
bbb	_	_	0.10		
ddd	_	_	0.08		



### 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.



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.

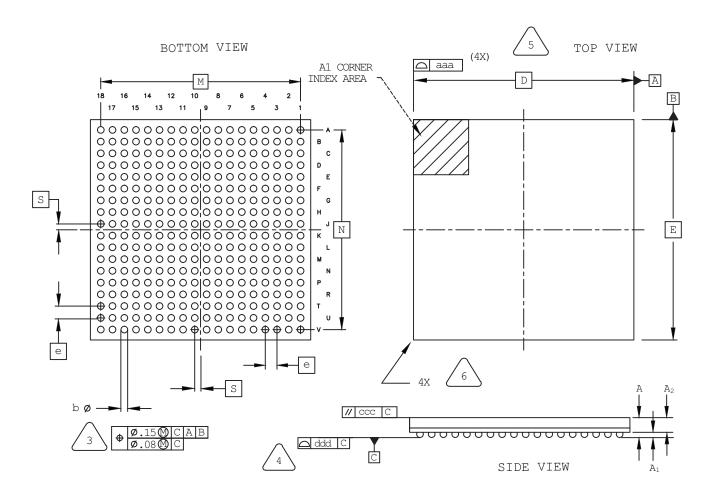
7. REFERENCE JEDEC MO-275, VARIATION JJAB-2.

SYMBOL	MIN.	NOM.	MAX.		
А	_	-	1.70		
A1	0.25	1	_		
A2	0.65	ı	-		
D/E	14.0 BSC				
M/N	12.0 BSC				
S	0	.40 BSC			
b	0.40	0.45	0.50		
е	0	.80 BSC			
aaa	_	_	0.15		
bbb	_	_	0.20		
ddd	_	_	0.20		



### 324-Ball caBGA Package

#### **Dimensions in Millimeters**



NOTES: UNLESS OTHERWISE SPECIFIED

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



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.

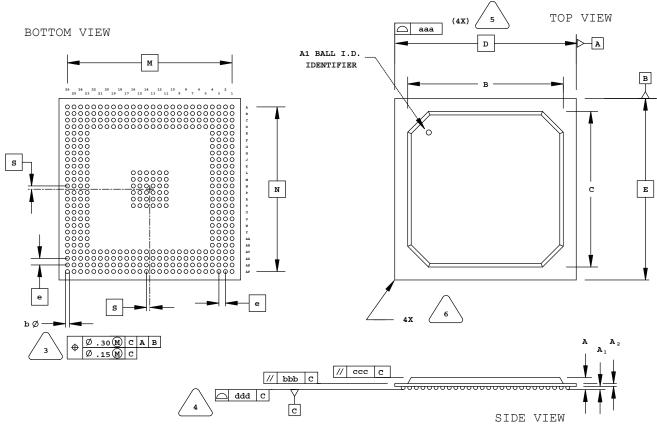


SYMBOL	MIN.	NOM.	MAX.
А	-	-	1.70
A1	0.25	0.35	-
A2	0.80	1.00	_
D/E	15.0 BSC		
M/N	13.6 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
е	0.80 BSC		
aaa	0.15		0.15
ccc	_	_	0.20
ddd	_	_	0.20



## 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.

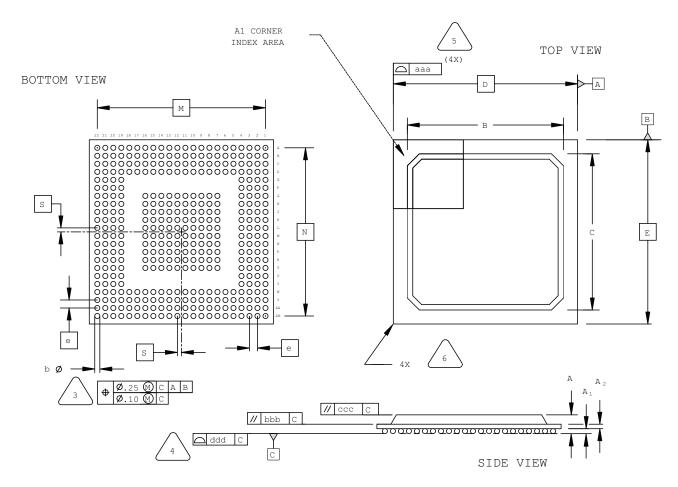


SYMBOL	MIN.	NOM.	MAX.
A	1.90	2.80	3.25
A1	0.50	0.65	0.80
A2	0.28	0.54	0.80
B/C	29.80	31.80	33.80
D/E	35.00 BSC		
M/N	31.75 BSC		
s	0.635 BSC		
b	0.60	0.75	0.90
е	1.27 BSC		
aaa	-	-	0.20
bbb	-	-	0.25
ccc	-	-	0.35
ddd	-	-	0.20



## 388-Ball fpBGA Package

### **Dimensions in Millimeters**



NOTES: UNLESS OTHERWISE SPECIFIED

- 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.

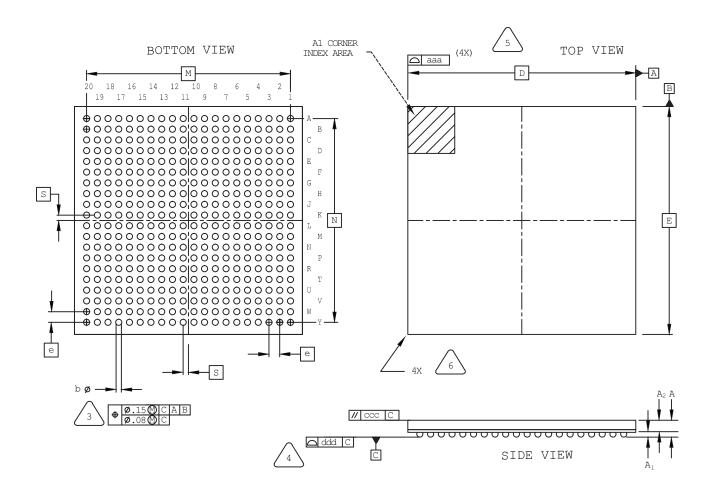


SYMBOL	MIN.	NOM.	MAX.
А	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	19.30	19.80	20.30
D/E	23.00 BSC		
M/N	21.00 BSC		
S	0.50 BSC		
b	0.50 0.60		0.70
е	1.00 BSC		
aaa			0.20
bbb			0.25
ccc	-	-	0.35
ddd	-	-	0.20



### 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  $\boxed{\mathbb{C}}$ 



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.

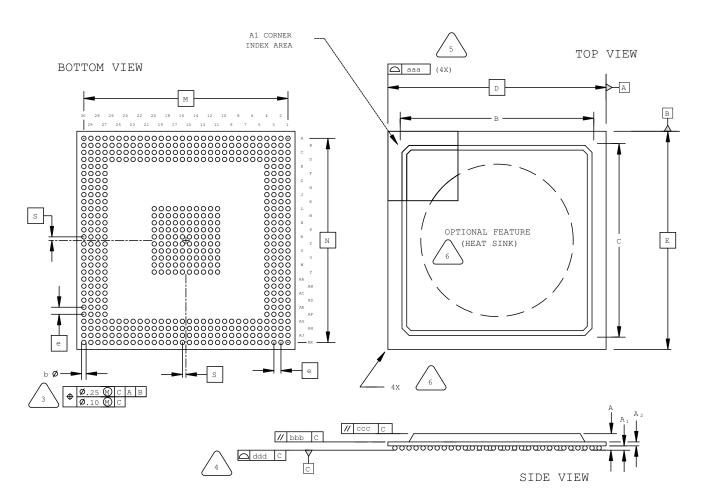


SYMBOL	MIN.	NOM.	MAX.
А	ı	-	1.70
A1	0.25	0.35	-
A2	0.80	1.00	_
D/E	17.0 BSC		
M/N	15.2 BSC		
S	0.40 BSC		
b	0.40	0.45	0.50
е	0.80 BSC		
aaa	_	_	0.15
ccc	_	_	0.20
ddd	_	_	0.20



## 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.

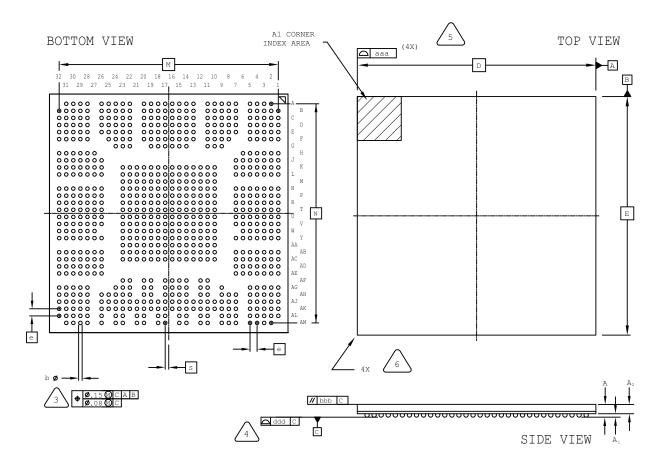


SYMBOL	MIN.	NOM.	MAX.
А	1.70	2.15	2.60
A1	0.30	0.50	0.70
A2	0.30	0.50	0.70
B/C	25.80	27.55	29.30
D/E	31.00 BSC		
M/N	29.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
е	1.00 BSC		
aaa	0.20		0.20
bbb	_	_	0.25
ccc	-	-	0.35
ddd	-	-	0.20



## 756-Ball caBGA Package

### **Dimensions in Millimeters**



NOTES: UNLESS OTHERWISE SPECIFIED

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



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



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



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

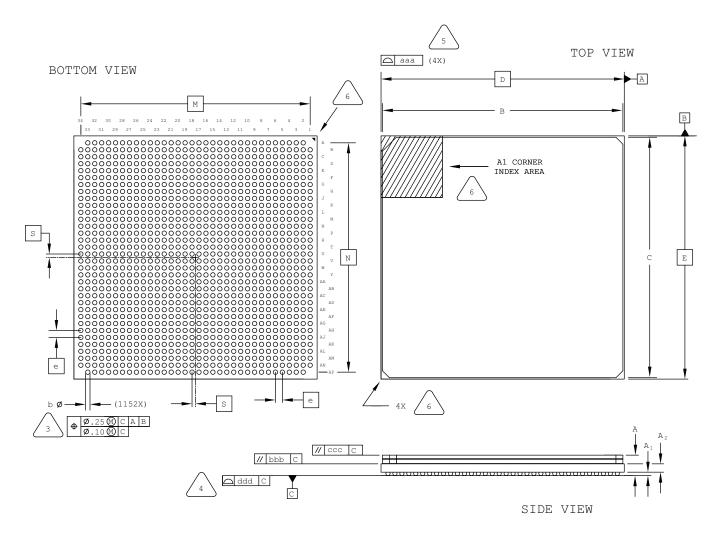


SYMBOL	MIN.	NOM.	MAX.
A	-	-	1.76
A1	0.25	0.30	0.35
A2	0.80	-	-
D/E	2	7.00 BSC	
M/N	24.80 BSC		
S	0.40 BSC		
b	0.35	0.40	0.45
е	0.80 BSC		
aaa	_	-	0.15
bbb	_	-	0.20
ddd	_	-	0.12



## 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.

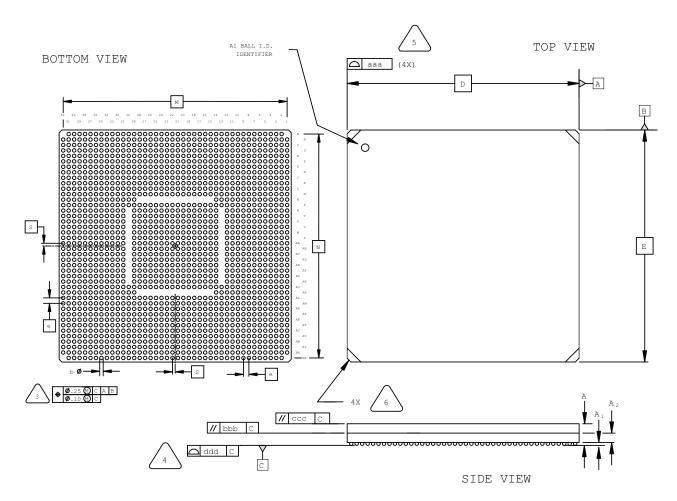


SYMBOL	MIN.	NOM.	MAX.
A	2.80	3.15	3.50
A1	0.35	0.50	0.65
A2	1	1.20 REF	
B/C	34.30	34.60	34.90
D/E	35.00 BSC		
M/N	33.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
е	1.00 BSC		
aaa	-	-	0.20
bbb			0.25
ccc	-	_	0.35
ddd	_	_	0.23



## 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.



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.





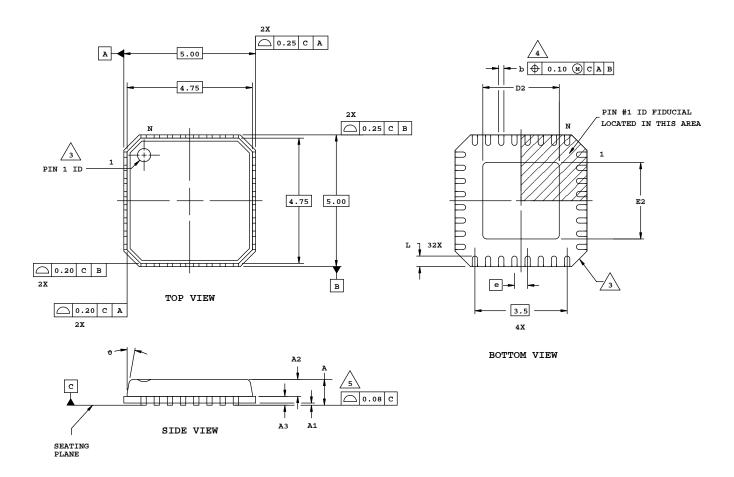
SYMBOL	MIN.	NOM.	MAX.
A	4.30	4.80	5.30
A1	0.30	0.50	0.70
A2	1.30	1.60	1.90
D/E	42.50 BSC		
M/N	41.00 BSC		
S	0.50 BSC		
b	0.50	0.60	0.70
е	1.00 BSC		
aaa			0.20
bbb			0.25
ccc	-	-	0.35
ddd	-	-	0.20



## Appendix A. Package Archive

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

**Dimensions in Millimeters** 



NOTES: UNLESS OTHERWISE SPECIFIED

- 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

0.20 AND 0.25 mm FROM TERMINAL TIP.

APPLIES TO EXPOSED PORTION OF TERMINALS.

SYMBOL	MIN.	NOM.	MAX.
A	-	0.85	1.00
<b>A</b> 1	0.00	0.01	0.05
<b>A</b> 2	0.00	0.65	1.00
<b>A</b> 3	0.20 REF		
D2	1.25	2.70	3.25
E2	1.25	2.70	3.25
е	0.50 BSC		
b	0.18	0.24	0.30
L	0.30	0.40	0.50
0	-	-	12