



# Package Characteristics and Mechanical Drawings

## Package Thermal Characteristics

Package Type	Pin Count	$\theta_{jc}$	$\theta_{ja}$ Still Air	$\theta_{ja}$ 300 ft/min	Unit
Plastic Leaded Chip Carrier (PLCC)	44	16	43	31	°C/W
	68	13	36	25	°C/W
	84	12	32	22	°C/W
Plastic Quad Flatpack (PQFP)	100	12	34	31	°C/W
	144	10	33	26	°C/W
	160	10	32	24	°C/W
	208	8	30	23	°C/W
Plastic Quad Flatpack (PQFP) with Embedded Heat Spreader	208	3.8	20	17	°C/W
	240	3.5	19	16	°C/W
Thin (1.4mm) Quad Flatpack (TQFP)	144	11	32	24	°C/W
	176	11	28	21	°C/W
Very Thin (1.0mm) Quad Flatpack (VQFP)	80	12	39	33	°C/W
	100	10	38	32	°C/W
Plastic Power Quad Flatpack (RQFP)	208	0.4	17	13	°C/W
	240	0.3	16	11	°C/W
Plastic Ball Grid Array (PBGA)	272	3	20	14.5	°C/W
	313	3	23	17	°C/W
	329	3	18	13.5	°C/W
Ceramic Pin Grid Array (CPGA)	84	6	33	20	°C/W
	100	5.2	27	17	°C/W
	132	4.8	25	15	°C/W
	133	4.8	25	15	°C/W
	175	4.6	23	12	°C/W
	176	4.6	23	12	°C/W
	207	3.5	21	10	°C/W
	257	2.8	15	8	°C/W
Ceramic Quad Flatpack (CQFP)	84	7.8	40	30	°C/W
	132	7.2	35	25	°C/W
	172	6.8	28	20	°C/W
	196	6.4	23	15	°C/W
	208	6.3	22	14	°C/W
	256	6.2	20	10	°C/W

## Package Weights

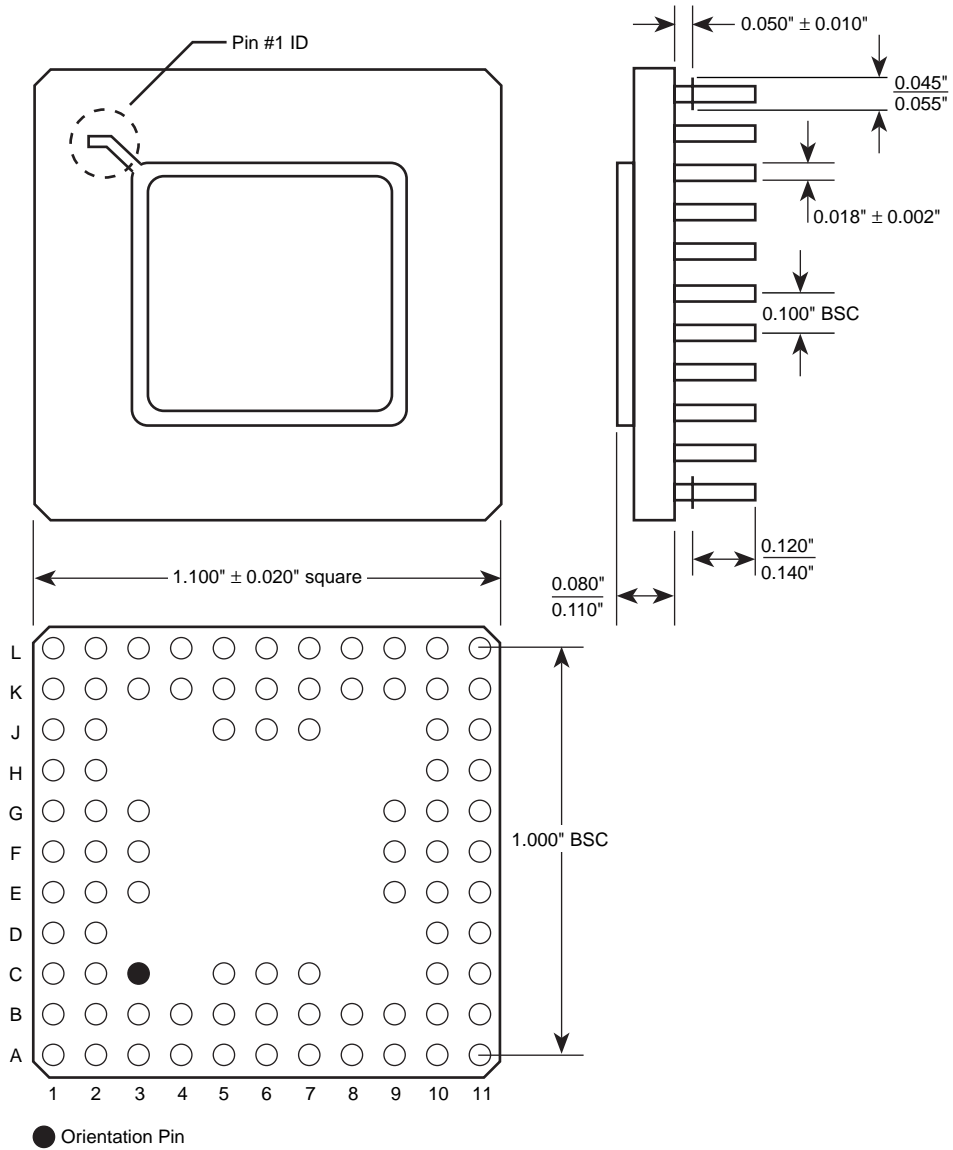
The following table gives approximate weights for Actel packages. Actel recommends that you weigh the parts yourself for more accurate values. Package weights may vary from lot to lot.

**Table 1 • Package Weights**

Package	Weight (grams)
84 CPGA	8.0
132 CPGA	11.0
176 CPGA	19
207 CPGA	24.5
257 CPGA	27.3
84 CQFP	2.2
132 CQFP	5.8
172 CQFP	8.8
172 CQFP RAD-PAK®	20
196 CQFP	11.1
208 CQFP DX	18.5
256 CQFP	13.0
256 CQFP DC	20.2 (with heat sink)
44 PLCC	2.4
68 PLCC	4.6
84 PLCC	6.8
100 PQFP	1.6
144 PQFP	5.2
160 PQFP	5.3
208 PQFP	5.2
208 PQFP DX	6.4
208 RQFP	10.0
240 RQFP	13.0
100 TQFP	0.4

## Ceramic Pin Grid Array

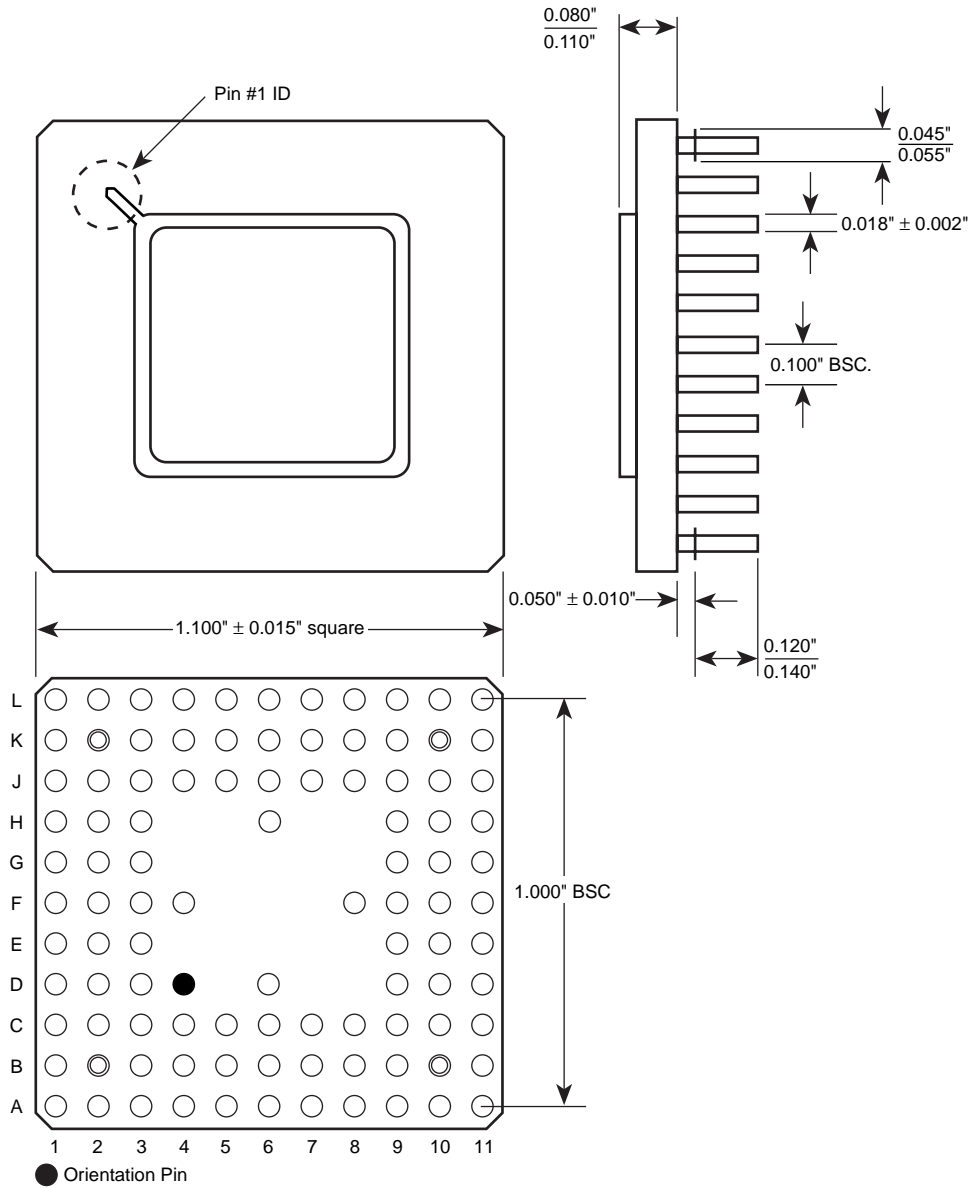
84-Pin CPGA



**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

Ceramic Pin Grid Array (continued)  
 100-Pin CPGA (continued)

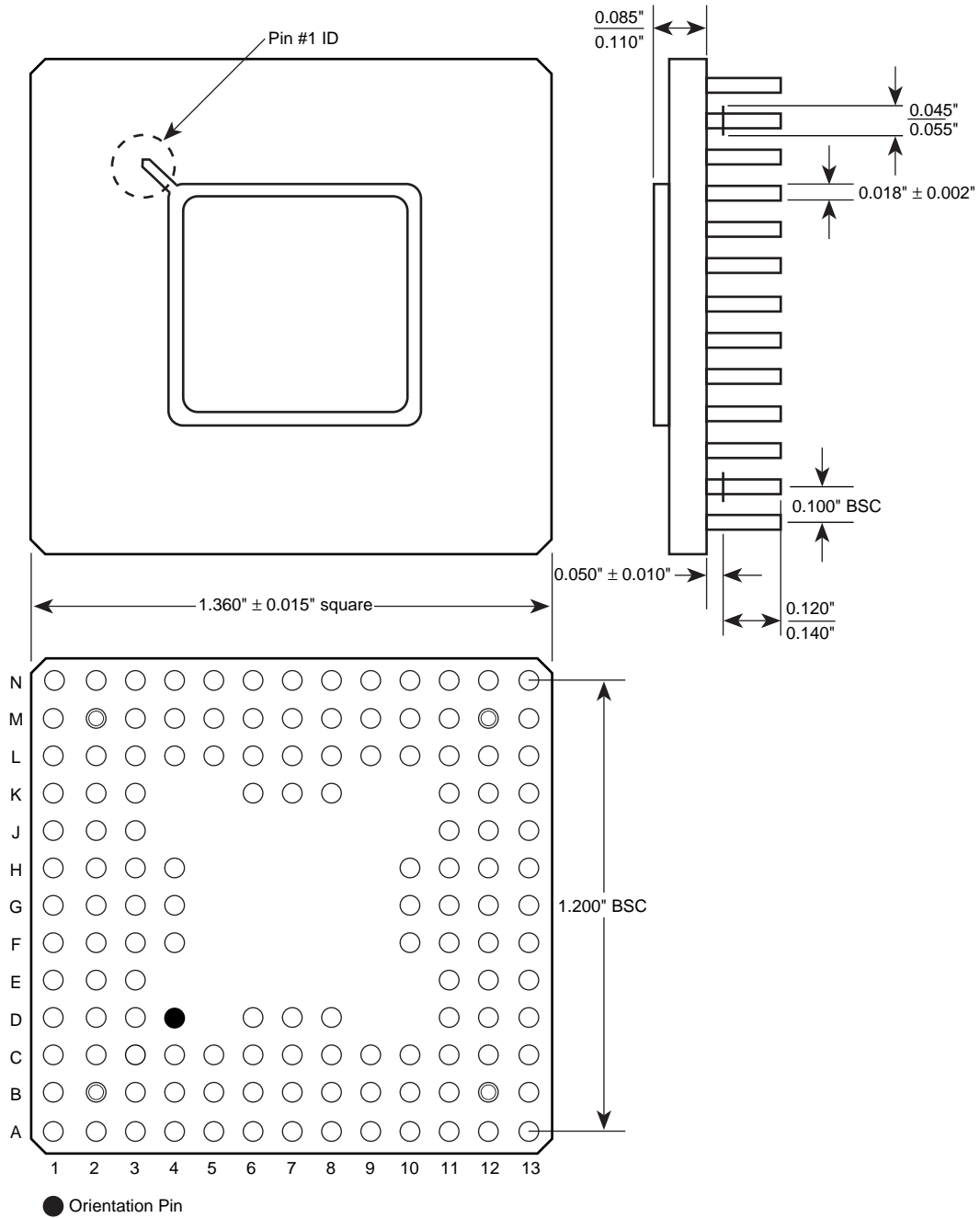


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

Ceramic Pin Grid Array (continued)

132-Pin CPGA

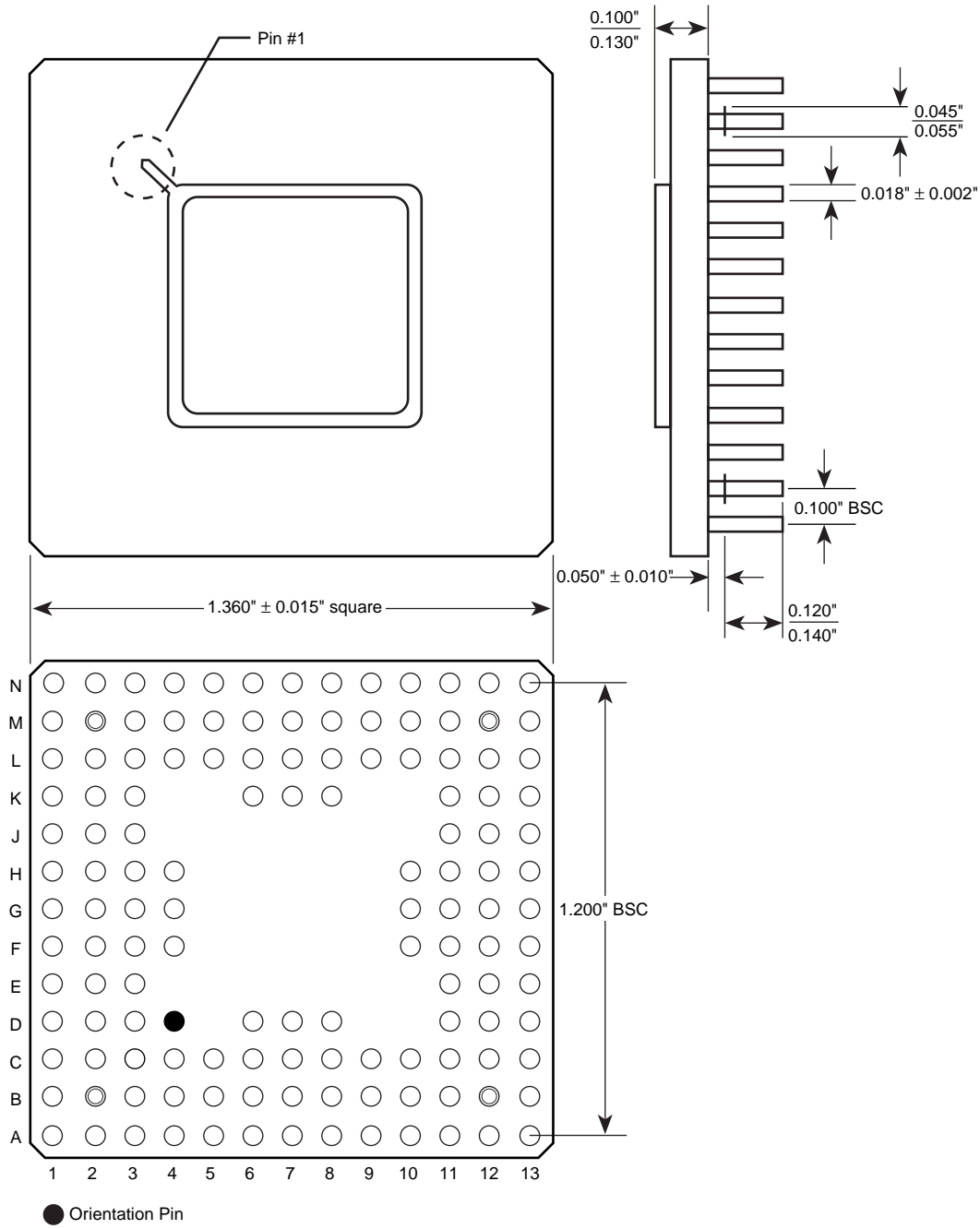


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

## Ceramic Pin Grid Array (continued)

133-Pin CPGA

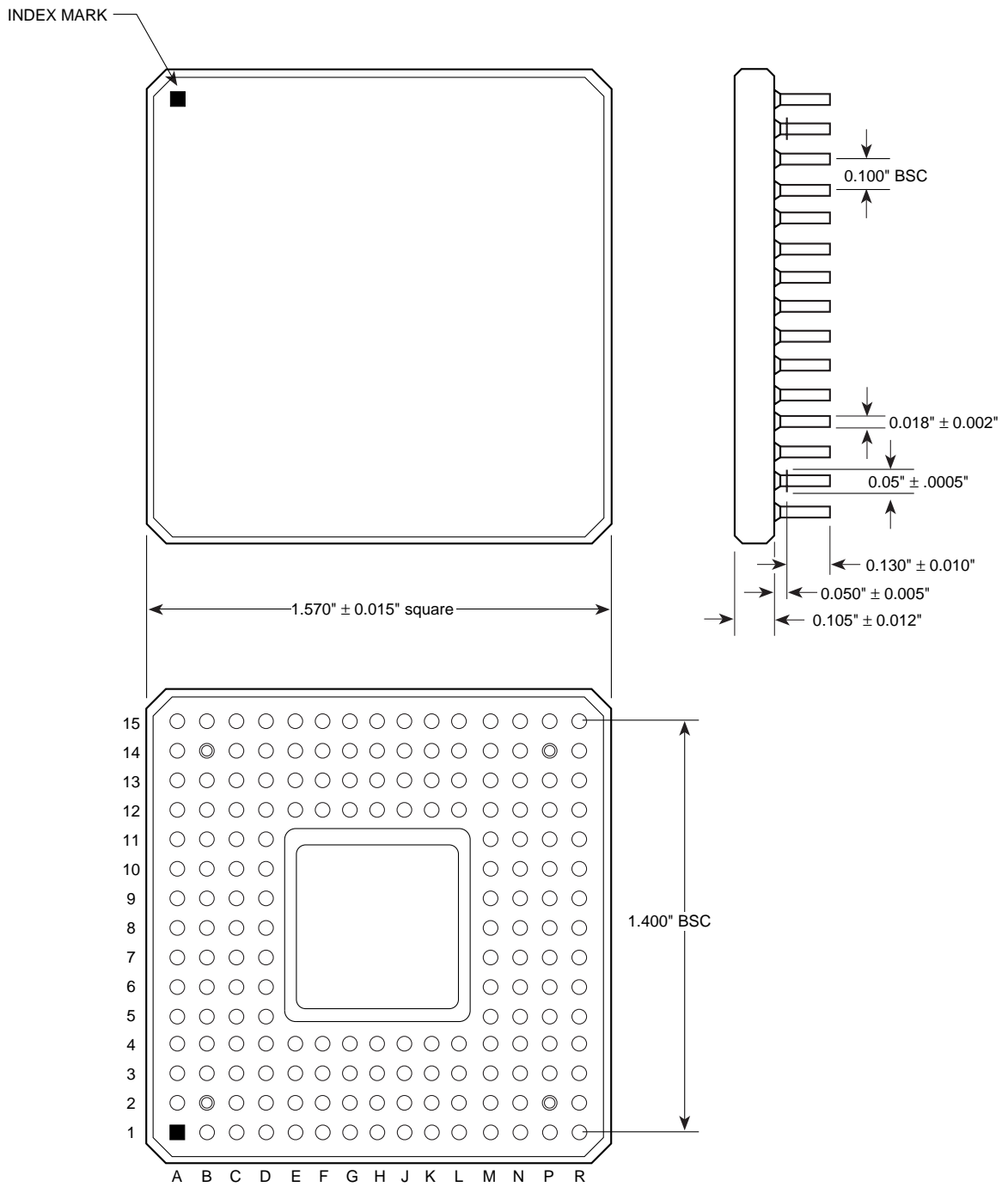


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

Ceramic Pin Grid Array (continued)

175-Pin CPGA

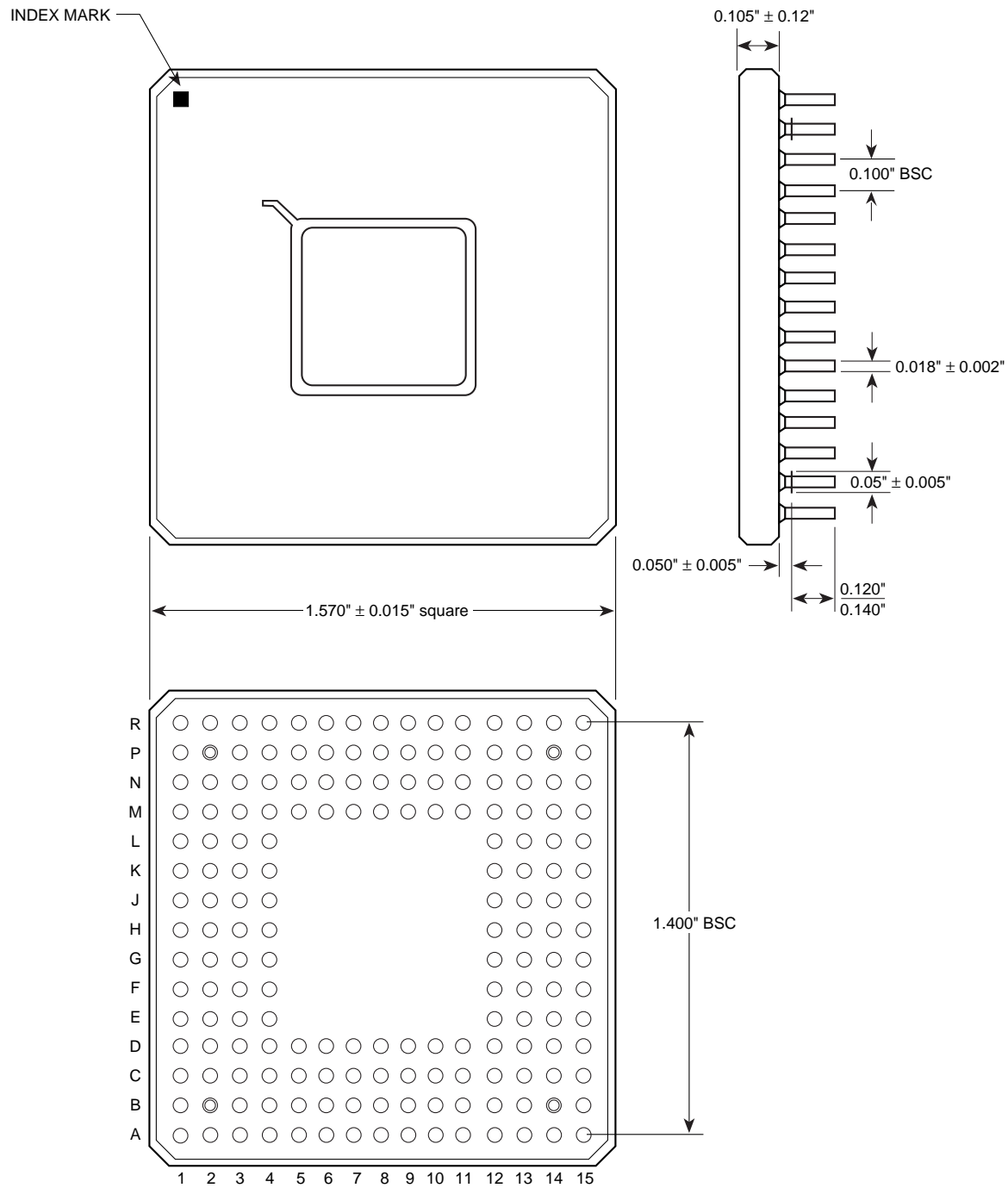


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

## Ceramic Pin Grid Array (continued)

176-Pin CPGA



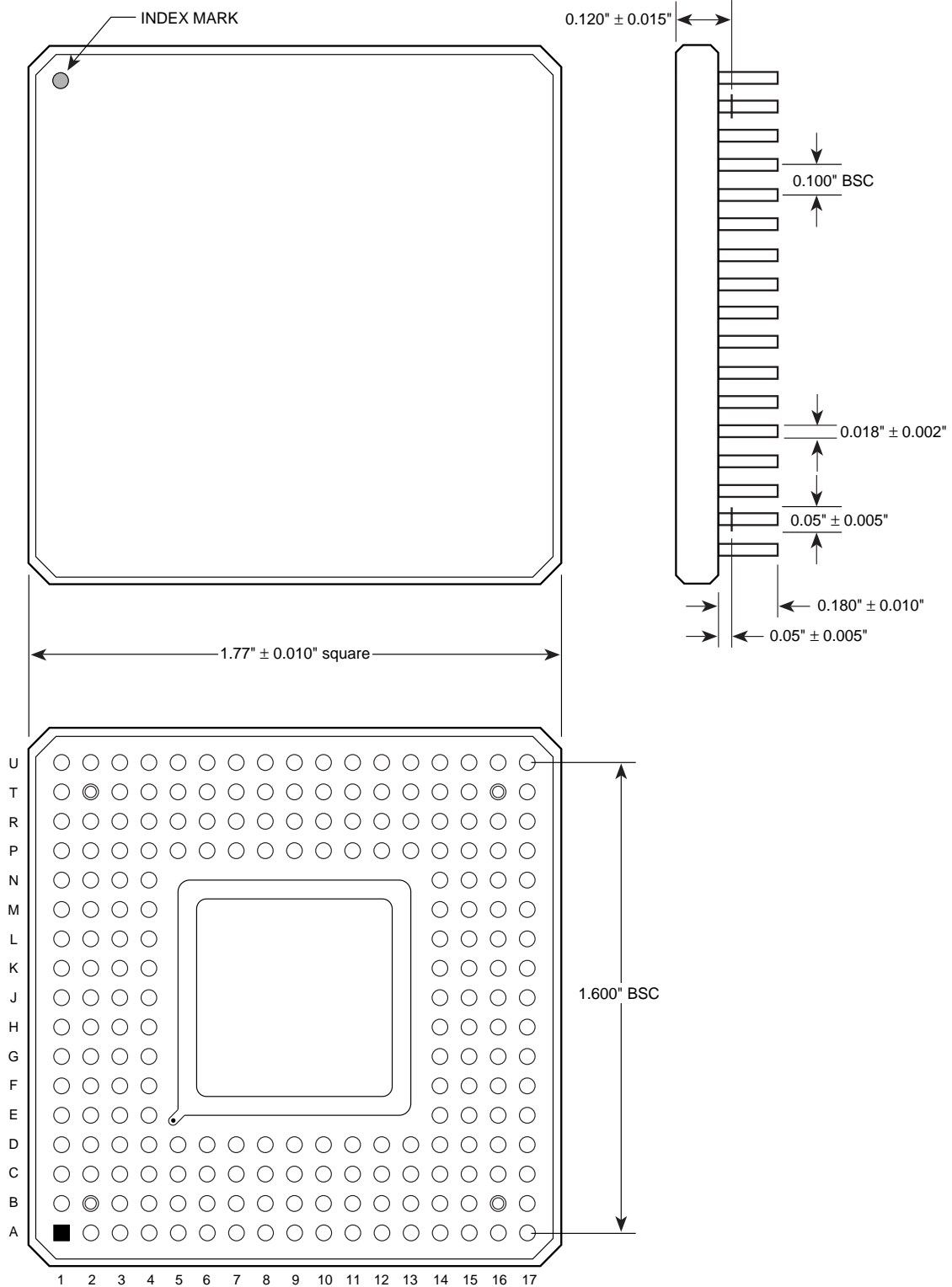
**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.



Ceramic Pin Grid Array (continued)

207-Pin CPGA

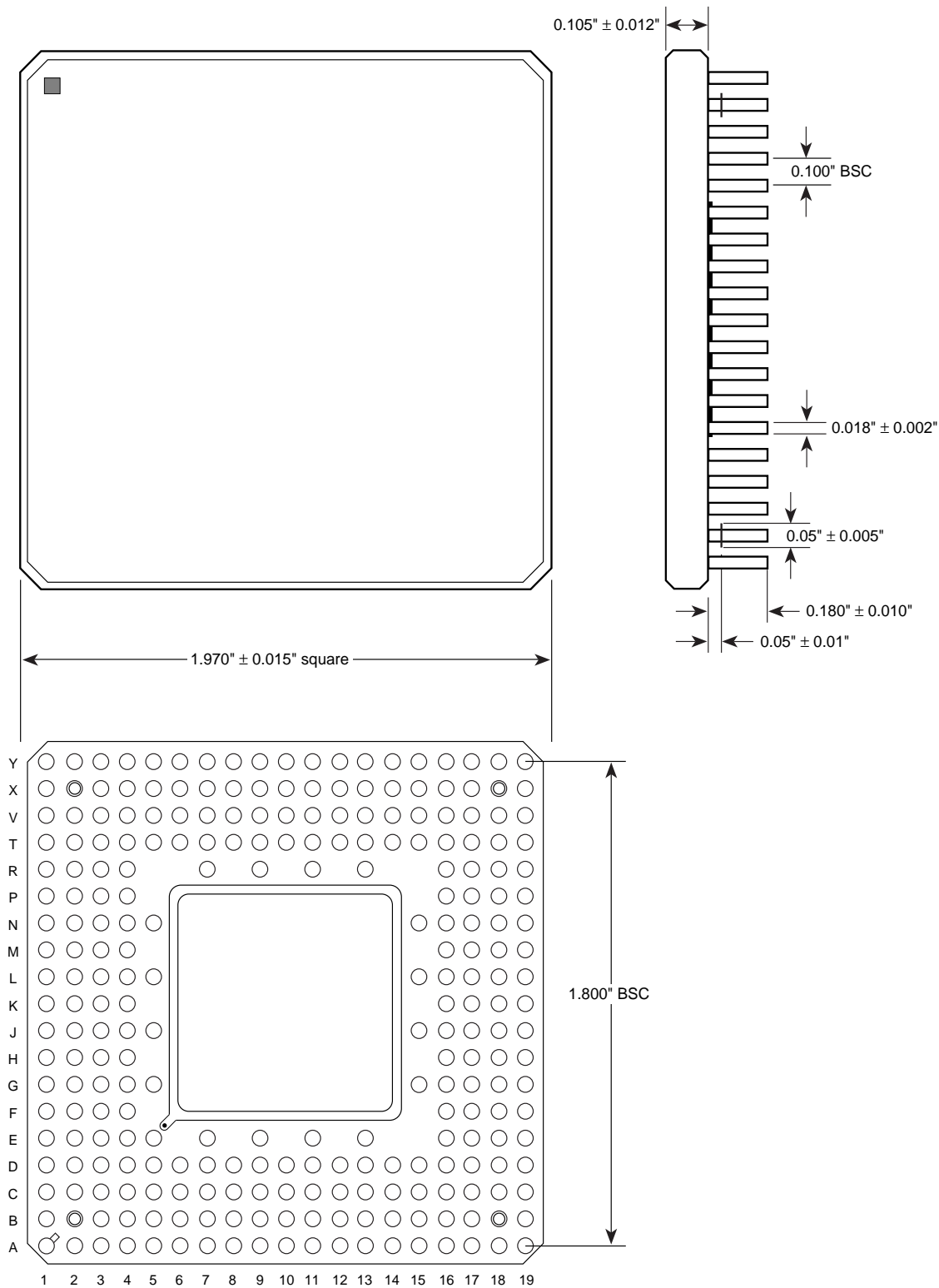


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

## Ceramic Pin Grid Array (continued)

257-Pin CPGA

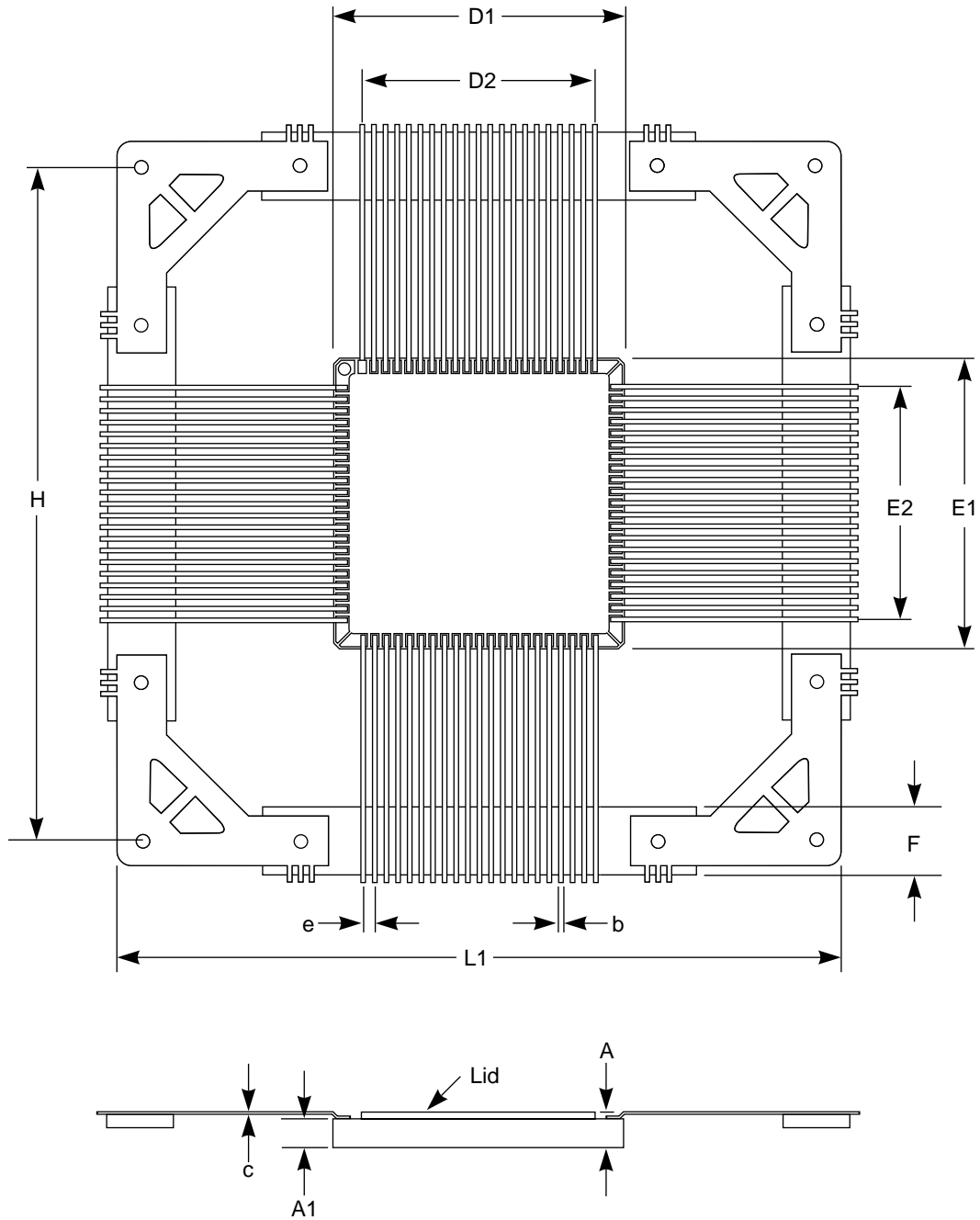


**Notes:**

1. All dimensions are in inches unless otherwise stated.
2. BSC—Basic Spacing between Centers.

## Ceramic Quad Flatpack (CQFP)

84-Pin CQFP

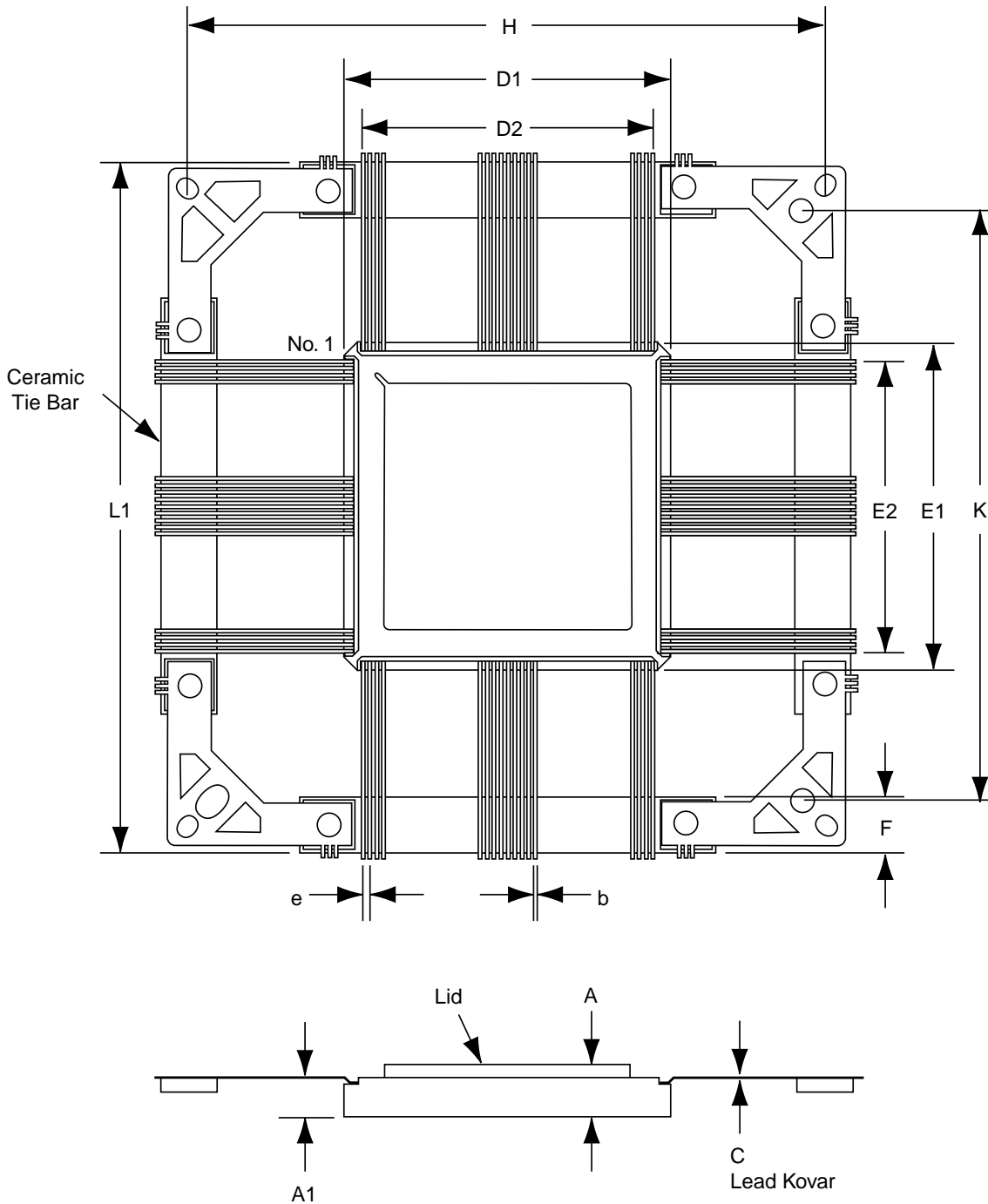


**Notes:**

1. Dimensions are in inches.
2. Seal Ring and Lid are connected to Ground.
3. Lead material is Kovar with gold plate over nickel.
4. Packages are shipped unformed with the ceramic tie bar in a test carrier.

## Ceramic Quad Flatpack (CQFP) (continued)

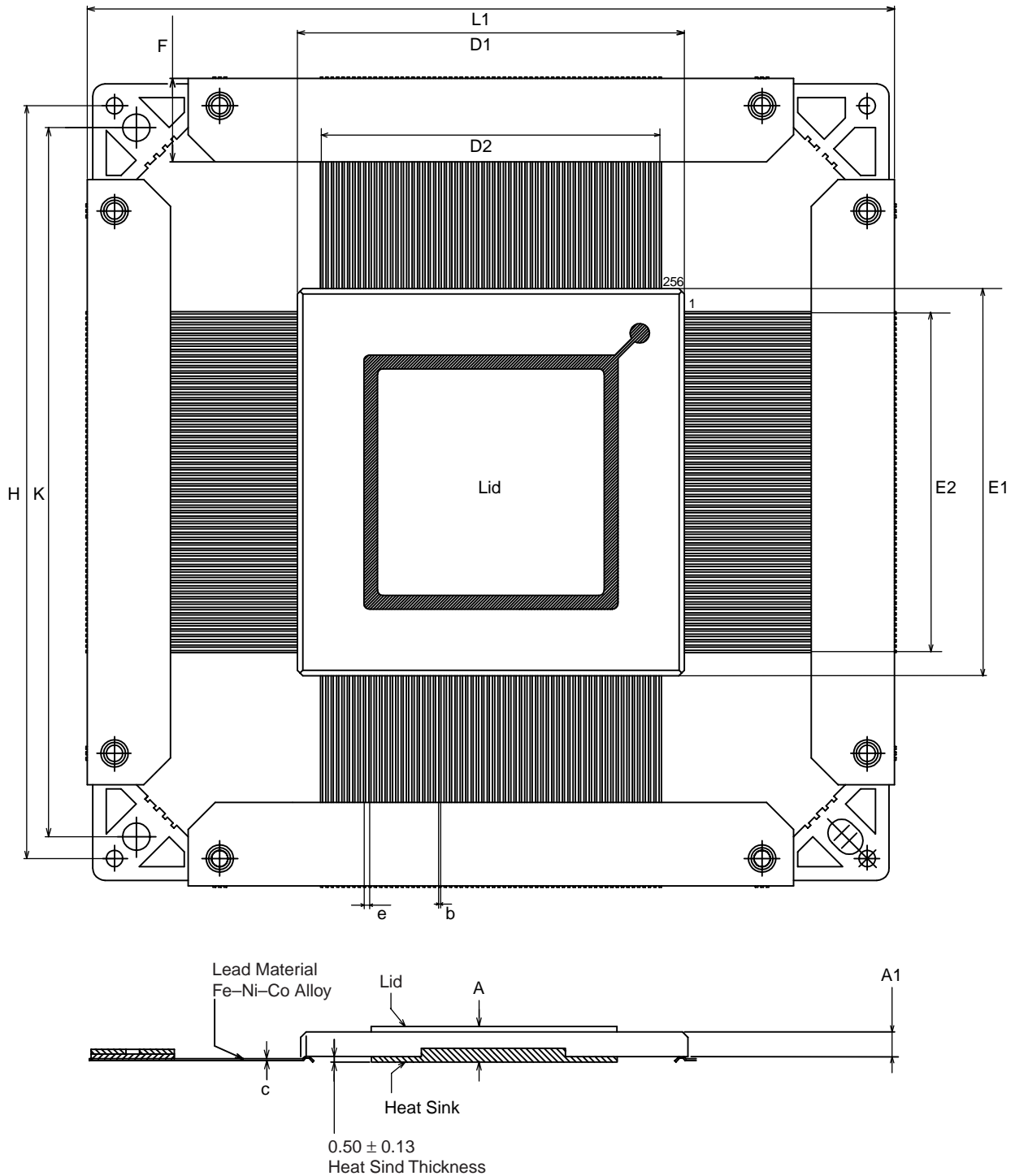
132-Pin, 172-Pin, 196-Pin, 208-Pin, and 256-Pin CQFP—Cavity Up



### Notes:

1. All dimensions are in inches except CQ208 and CQ256 which are in millimeters.
2. Outside leadframe holes (from dimension H) are circular for the CQ208 and CQ256.
3. Seal ring and lid are connected to Ground.
4. Lead material is Kovar with minimum 60 microniches gold over nickel.
5. Packages are shipped unformed with the ceramic tie bar.
6. 32200DX - CQ208 has heat sink on the backside.

Ceramic Quad Flatpack (CQFP) (continued)  
 256-Pin CQFP—DX Cavity Down

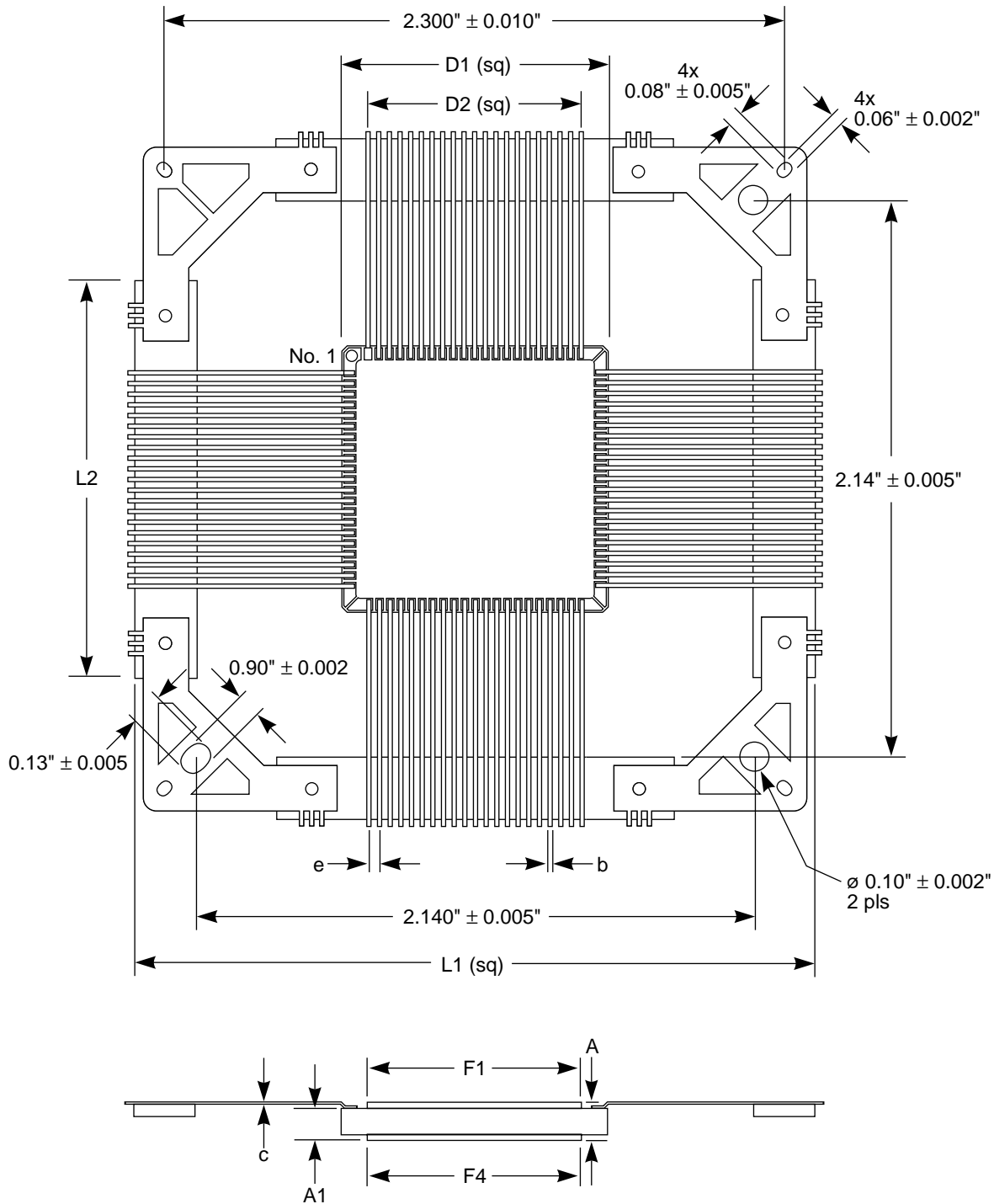


**Notes:**

1. Dimensions are in millimeters.
2. Seal Ring and Lid are connected to Ground.
3. Lead material is Kovar with gold plate over nickel.
4. Packages are shipped unformed with the ceramic tie bar.
5. Package is cavity down, with the lid facing the bottom of the package. However the leads can be formed on either side if application requires the lid to be facing the top.

Ceramic Quad Flatpack (CQFP) (continued)

172-Pin CQFP RAD-PAK<sup>®</sup>



**Notes:**

1. All dimensions are in inches.
2. Seal ring and lid are connected to Ground.
3. Lead material is Kovar with gold over nickel.
4. Packages are shipped unformed with the ceramic tie bar.

## Ceramic Quad Flatpack (CQFP)

	CQ84			CQ132			CQ172			CQ196		
Symbol	Min	Nom.	Max	Min	Nom.	Max	Min	Nom.	Max	Min	Nom.	Max
A	0.070	0.090	0.100	0.094	0.105	0.116	0.094	0.105	0.116	0.094	0.105	0.116
A1	0.060	0.075	0.080	0.080	0.090	0.100	0.080	0.090	0.100	0.080	0.090	0.100
b	0.008	0.010	0.012	0.007	0.008	0.010	0.007	0.008	0.010	0.007	0.008	0.010
c	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008	0.004	0.006	0.008
D1/E1	0.640	0.650	0.660	0.940	0.950	0.960	1.168	1.180	1.192	1.336	1.350	1.364
D2/E2	0.500 BSC			0.800 BSC			1.050 BSC			1.200 BSC		
e	0.025 BSC			0.025 BSC			0.025 BSC			0.025 BSC		
F	0.130	0.140	0.150	0.325	0.350	0.375	0.175	0.200	0.225	0.175	0.200	0.225
H	1.460 BSC			2.320 BSC			2.320 BSC			2.320 BSC		
K	—			2.140 BSC			2.140 BSC			2.140 BSC		
L1	1.595	1.600	1.615	2.485	2.500	2.505	2.485	2.495	2.505	2.485	2.495	2.505

**Note:**

1. All dimensions are in inches except CQ208 and CQ256, which is in millimeters.
2. BSC equals Basic Spacing between Centers. This is a theoretical true position dimension and so has no tolerance.

## Ceramic Quad Flatpack (CQFP) (continued)

	CQ208			CQ256			DX CQ256		
Symbol	Min	Nom.	Max	Min	Nom.	Max	Min	Nom.	Max
A	2.78	3.17	3.56	2.28	2.67	3.06	2.78	3.17	3.56
A1	2.43	2.79	3.15	1.93	2.29	2.65	2.43	2.79	3.15
b	0.18	0.20	0.22	0.18	0.20	0.22	0.18	0.20	0.22
c	0.11	0.15	0.17	0.11	0.15	0.18	0.11	0.15	0.18
D1/E1	28.96	29.21	29.46	35.64	36.00	36.36	35.64	36.00	36.36
D2/E2	25.5 BSC			31.5 BSC			31.5 BSC		
e	0.50 BSC			0.50 BSC			0.50 BSC		
F	7.05	7.75	8.45	7.05	7.75	8.45	7.05	7.75	8.45
H	70.00 BSC			70.00 BSC			70.00 BSC		
K	65.90 BSC			65.90 BSC			65.90 BSC		
L1	74.60	75.00	75.40	74.60	75.00	75.40	74.60	75.00	75.40

**Note:**

1. All dimensions are in inches except CQ208 and CQ256, which is in millimeters.
2. BSC equals Basic Spacing between Centers. This is a theoretical true position dimension and so has no tolerance.

## Ceramic Quad Flatpack (CQFP) (continued)

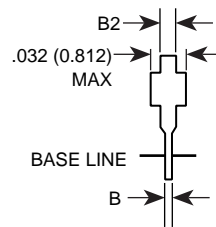
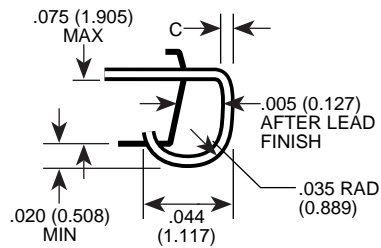
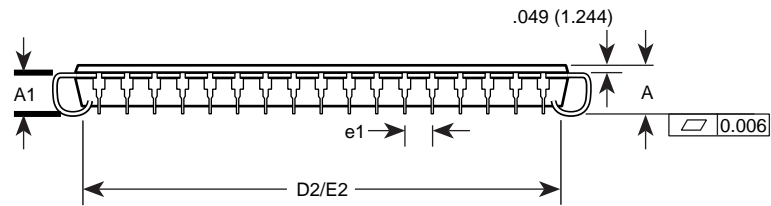
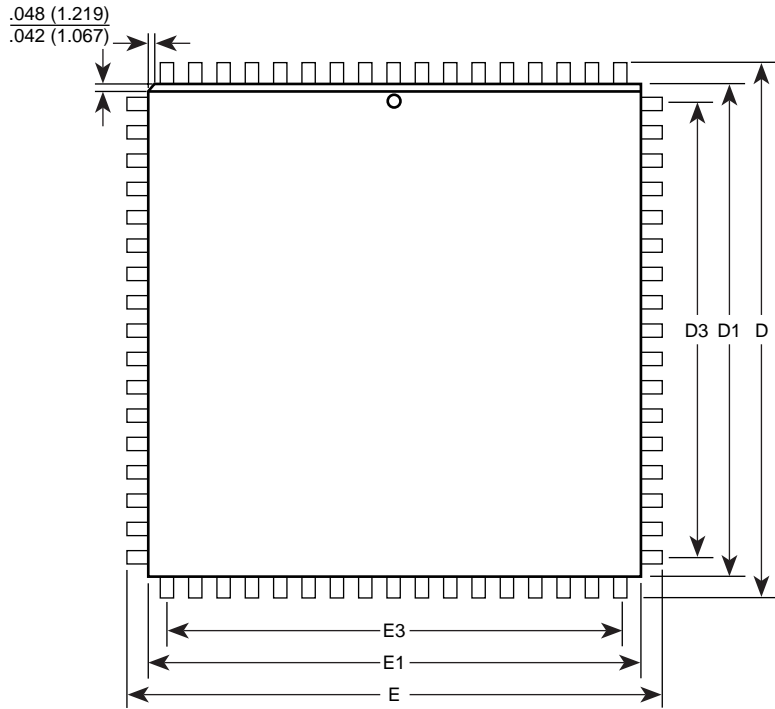
RAD-PAK <sup>®</sup> CQ172			
Symbol	Min	Nom.	Max
A	0.116	0.133	0.146
b	0.007	0.008	0.13
c	0.004	0.006	0.009
D1	1.137	1.150	1.162
D2	1.050 BSC		
e	0.025 BSC		
F1	0.890	0.895	0.900
F4	0.881	0.890	0.899
L1	2.485	2.500	2.5095
L2	1.690	1.700	1.710
A1	0.079	0.091	0.103

**Note:**

1. All dimensions are in inches.
2. BSC equals Basic Spacing between Centers. This is a theoretical true position dimension and so has no tolerance.



Plastic Leaded Chip Carrier (PLCC)



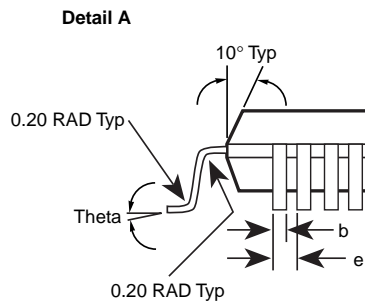
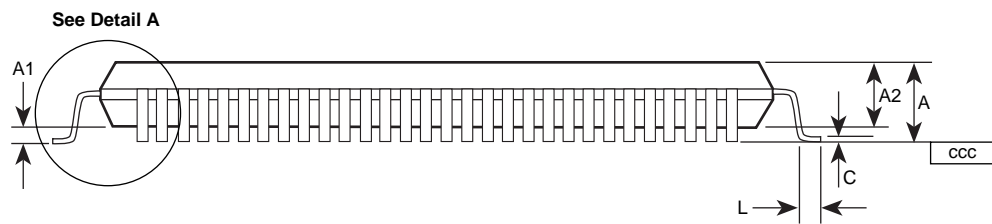
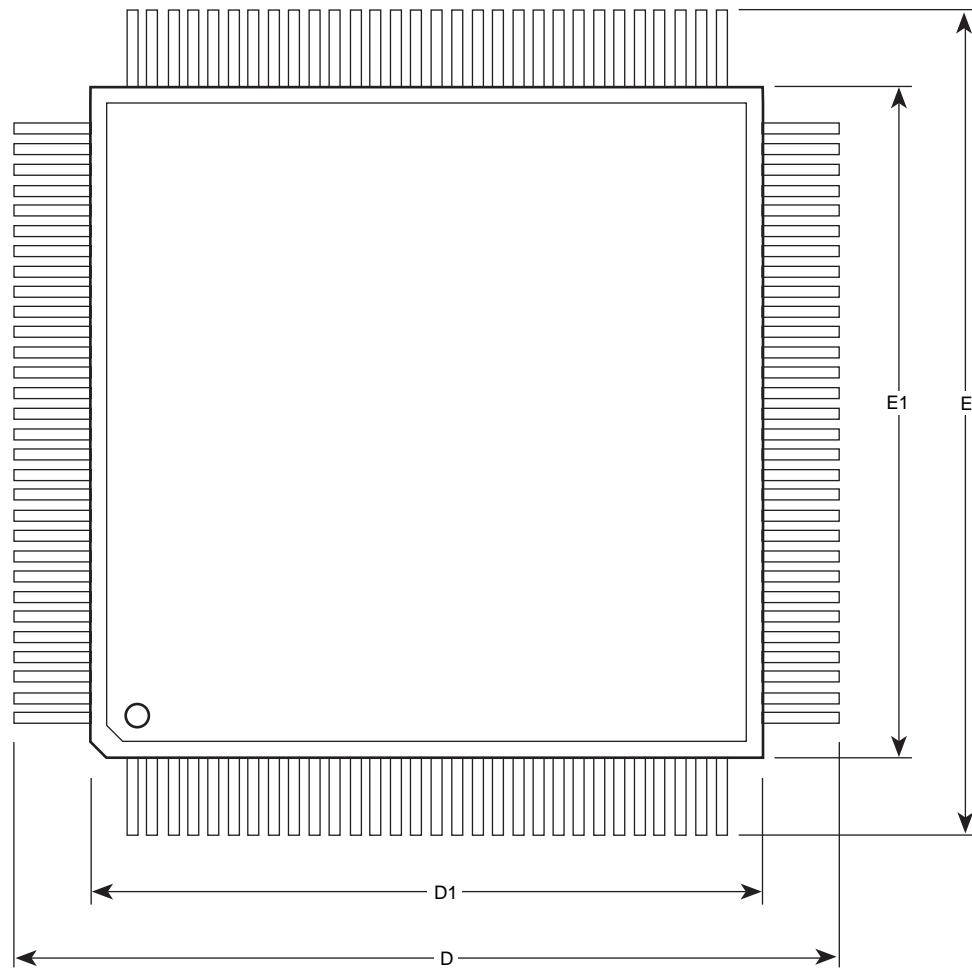
Plastic Leaded Chip Carrier Packages (PLCC)

Jedec Equiv	PLCC 44 MS007 AB VAR		PLCC 68 MS007 AD VAR		PLCC 84 MS007 AE VAR	
	Min	Max	Min	Max	Min	Max
A	0.155	0.175	0.155	0.175	0.155	0.175
A1	0.090	0.130	0.090	0.130	0.090	0.130
B	0.013	0.027	0.013	0.027	0.013	0.027
B2	0.026	0.032	0.026	0.032	0.026	0.032
C	0.007	0.013	0.005	0.011	0.005	0.011
D/E	0.670	0.710	0.970	1.010	1.170	1.210
D1/E1	0.640	0.660	0.940	0.960	1.140	1.160
D2/E2	0.590	0.630	0.890	0.930	1.090	1.130
D3/E3	0.50 nominal		0.80 nominal		1.00 nominal	
e1	0.050 BSC		0.050 BSC		0.050 BSC	

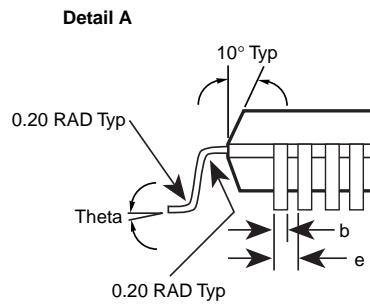
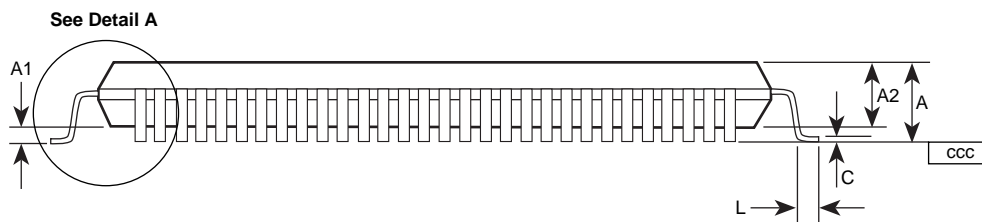
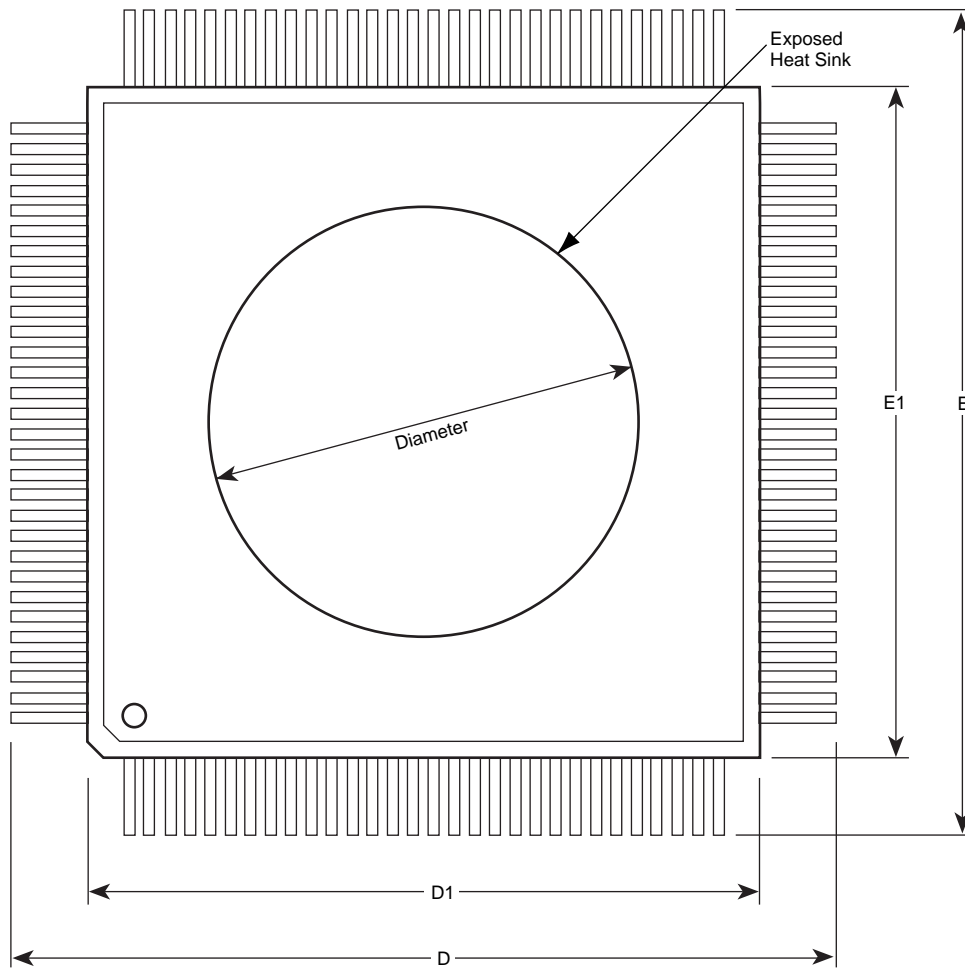
**Notes:**

1. All dimensions are in inches.
2. BSC—Basic Spacing between Centers.

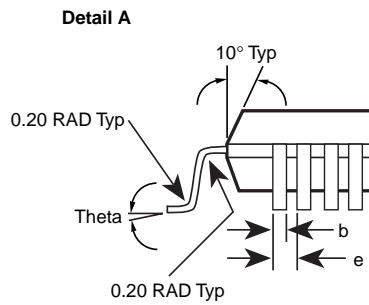
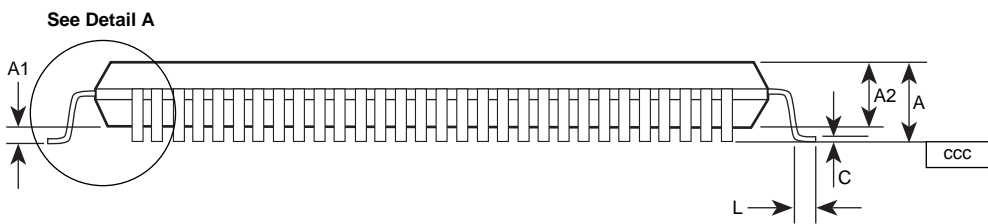
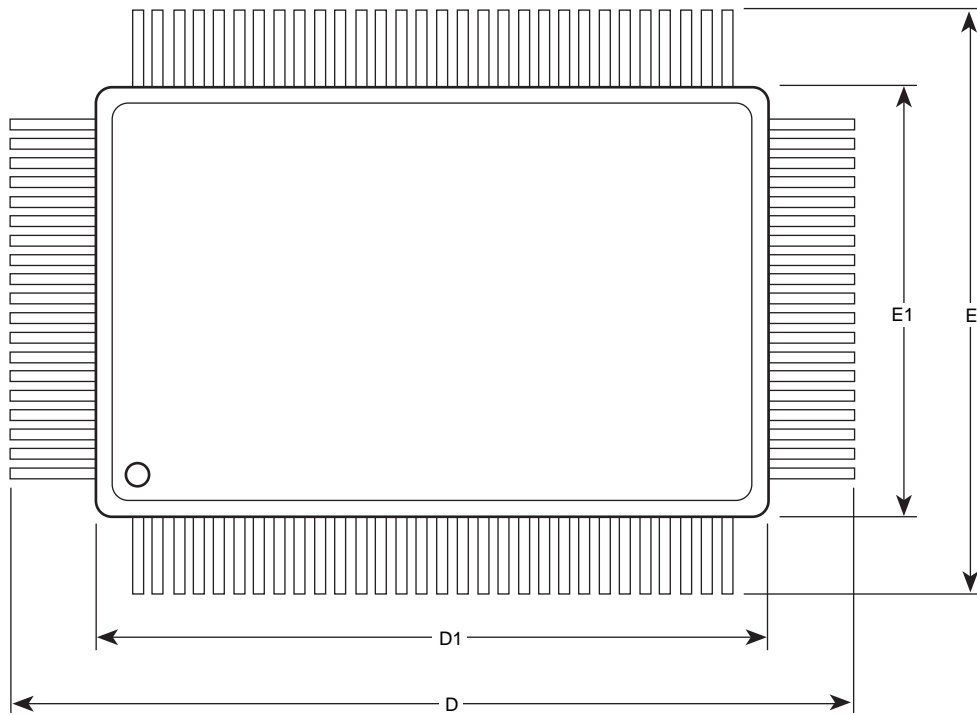
Plastic Quad Flatpack (PQFP, TQFP, VQFP)



# Plastic Quad Flatpack (RQFP)



Plastic Quad Flatpack  
Rectangular Package (PQ100)



Plastic Quad Flat Packages (PQFP)

Jedec Equiv	PQFP 100 MO-108			PQFP 144 MO-108			PQFP 160 MO-108		
Dimension	Min	Nom	Max	Min	Nom	Max	Min	Nom	Max
A			3.40		3.70	4.10		3.70	4.12
A1	0.25	0.33		0.25	0.33		0.25	0.33	
A2	2.55	2.80	3.05	3.17	3.37	3.67	3.17	3.37	3.67
b	0.22		0.38	0.22		0.38	0.22		0.38
c	0.13		0.23	0.13		0.23	0.13		0.23
D	22.95	23.20	23.45	30.95	31.20	31.45	30.95	31.20	31.45
D1	19.90	20.00	20.10	27.90	28.00	28.10	27.90	28.00	28.10
E	16.95	17.20	17.45	30.95	31.20	31.45	30.95	31.20	31.45
E1	13.90	14.00	14.01	27.90	28.00	28.10	27.90	28.00	28.10
e	0.65 BSC			0.65 BSC			0.65 BSC		
L	0.73	0.88	1.03	0.73	0.88	1.03	0.73	0.88	1.03
ccc			0.10			0.10			0.10
Theta	0		7 deg	0		7 deg	0		7 deg

Plastic Quad Flat Packages (RQFP)

Jedec Equiv	RQFP 208/PQFP 208 MO-143			RQFP 240/PQFP 240 MO-143		
Dimension	Min	Nom	Max	Min	Nom	Max
A		3.70	4.10		3.78	4.10
A1	0.25	0.38		0.25	0.38	
A2	3.20	3.40	3.60	3.20	3.40	3.60
b	0.17		0.27	0.17		0.27
c	0.09		0.20	0.09		0.20
D/E	30.25	30.60	30.85	34.35	34.60	34.85
D1/E1	27.90	28.00	28.10	31.90	32.10	32.10
e	0.50 BSC			0.50 BSC		
L	0.50	0.60	0.75	0.50	0.60	0.75
ccc			0.10			0.10
Theta	0		7 deg	0		7 deg
Diameter	19.82	20.32	20.82	23.63	24.13	24.63

**Notes:**

1. All dimensions are in millimeters.
2. BSC—Basic Spacing between Centers.

## Thin Quad Flatpacks (TQFP)

Jedec Equiv	TQFP 144 MO-136			TQFP 176 MO-136		
	Min	Nom	Max	Min	Nom	Max
A			1.60			1.60
A1	0.05	0.10	0.15	0.05	0.10	0.15
A2	1.35	1.40	1.45	1.35	1.40	1.45
b	0.17		0.27	0.17		0.27
c	0.09		0.20	0.09		0.20
D/E	21.75	22.00	22.25	25.75	26.00	26.25
D1/E1	19.90	20.00	20.10	23.90	24.00	24.10
e	0.50 BSC			0.50 BSC		
L	0.45	0.60	0.75	0.45	0.60	0.75
ccc			0.10			0.10
Theta	0		7 deg	0		7 deg

**Notes:**

1. All dimensions are in millimeters.
2. BSC—Basic Spacing between Centers.

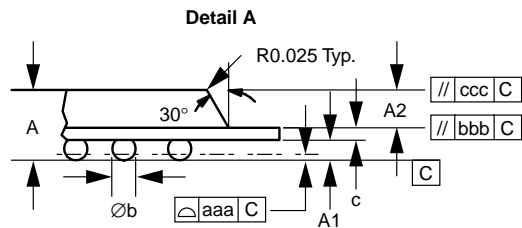
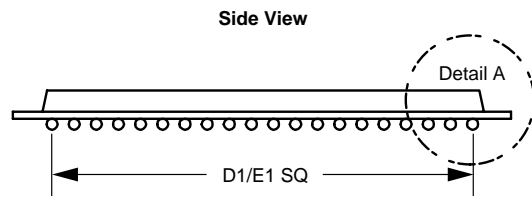
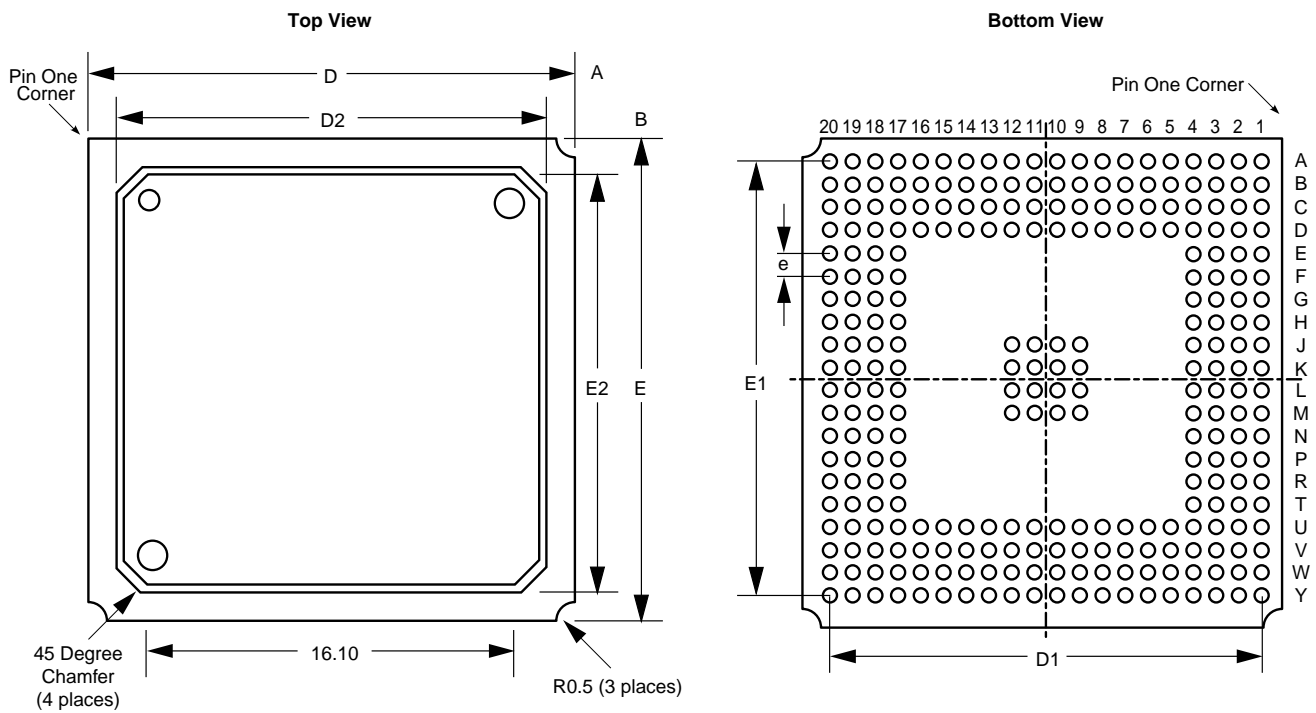
## Thin Quad Flatpacks (VQFP)

Jedec Equiv	VQFP 80 MO-136			VQFP 100 MO-136		
	Min	Nom	Max	Min	Nom	Max
A			1.20			1.20
A1	0.05	0.10	0.15	0.05	0.10	0.15
A2	0.95	1.00	1.05	0.95	1.00	1.05
b	0.22		0.38	0.17		0.27
c	0.09		0.20	0.09		0.20
D/E	15.75	16.00	16.25	15.75	16.00	16.25
D1/E1	13.90	14.00	14.10	13.90	14.00	14.10
e	0.65 BSC			0.50 BSC		
L	0.45	0.60	0.75	0.45	0.60	0.75
ccc			0.10			0.10
Theta	0		7 deg	0		7 deg

**Notes:**

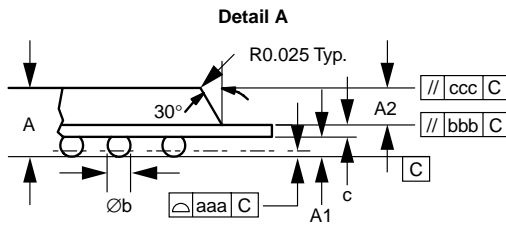
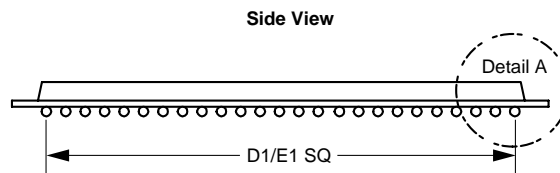
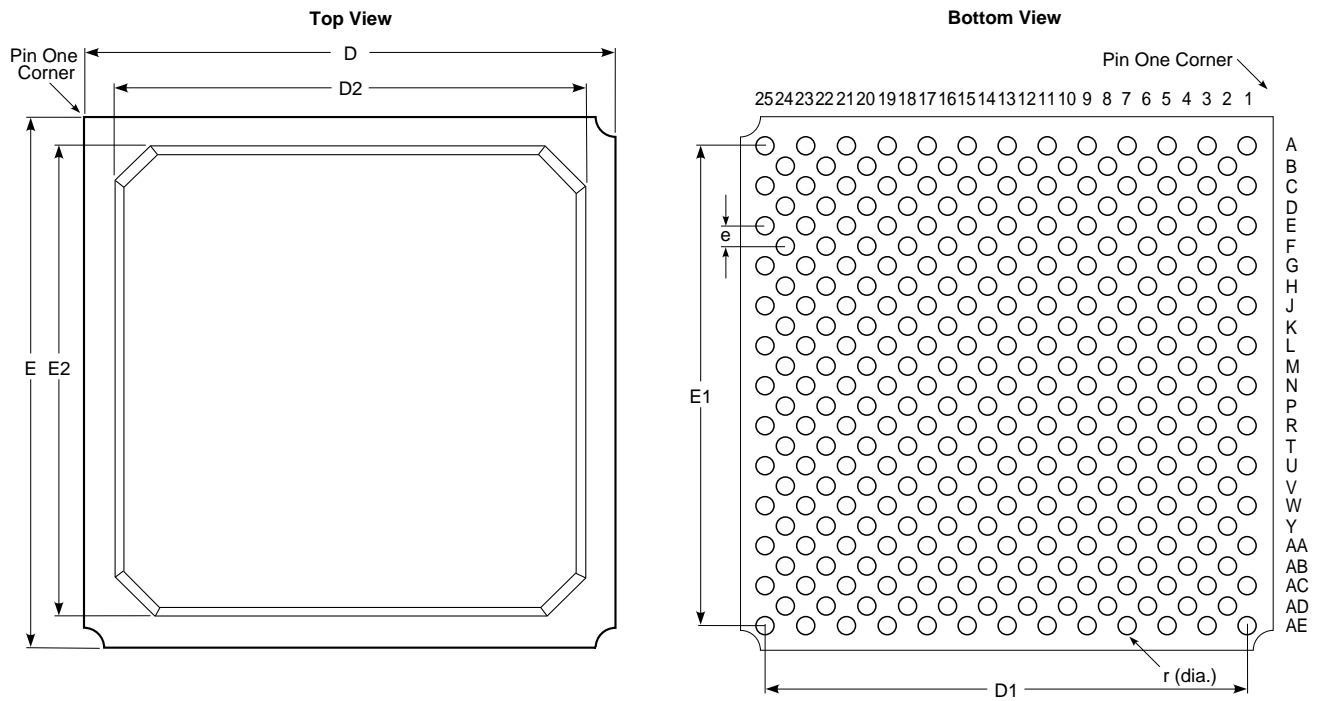
1. All dimensions are in millimeters.
2. BSC—Basic Spacing between Centers.

# Plastic Ball Grid Array (BGA272)

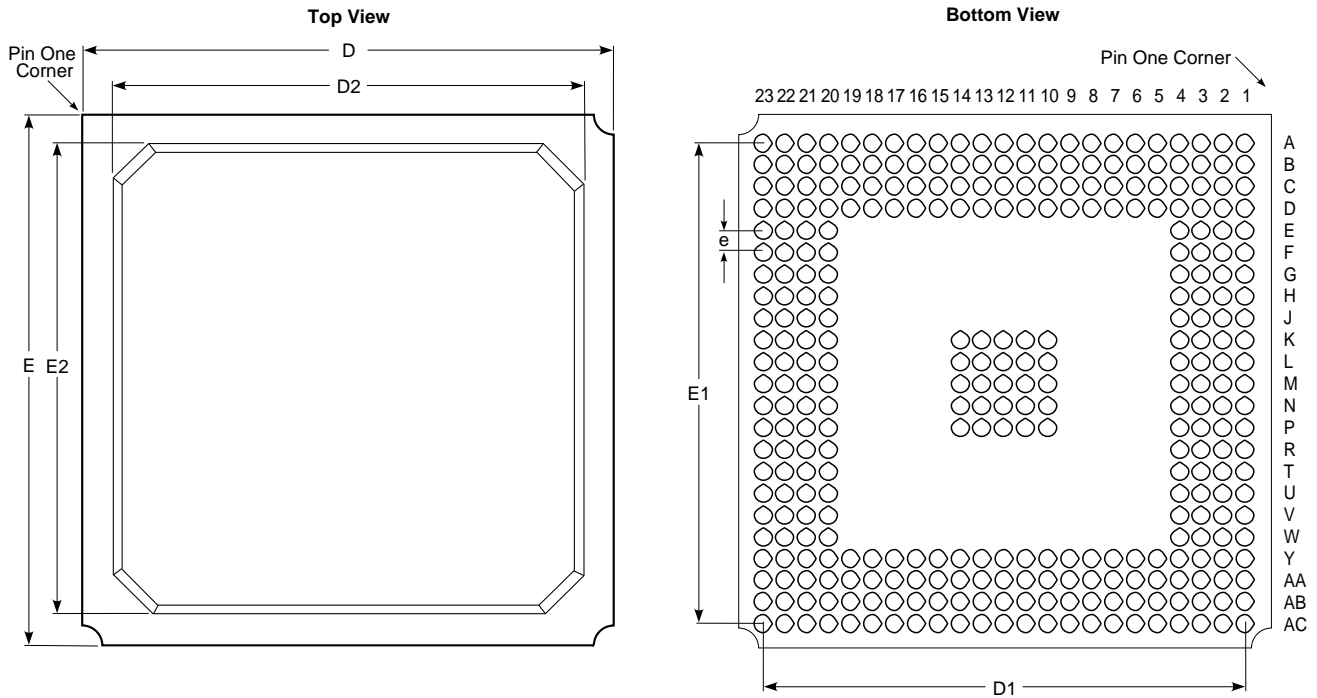




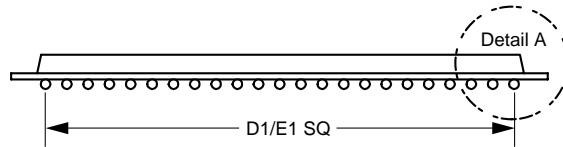
Plastic Ball Grid Array (BGA313)



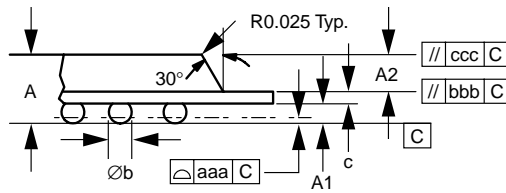
# Plastic Ball Grid Array (BGA329)



**Side View**



**Detail A**



## Plastic Ball Grid Array (PBGA)

JEDEC Equivalent	PBGA272			PBGA313			PBGA329		
	Min.	Nom.	Max.	Min.	Nom.	Max.	Min.	Nom.	Max.
A	2.18	2.33	2.50	2.12	2.33	2.52	2.17	2.33	2.70
A1	0.50	0.60	0.70	0.50	0.60	0.70	0.50	0.60	0.70
A2	1.15	1.17	1.19	1.12	1.17	1.22	1.10	1.20	1.30
D	26.80	27.00	27.20	34.80	35.00	35.20	30.80	31.00	31.20
D1	24.13 BSC			30.48 BSC			27.94 BSC		
D2	23.90	24.00	24.10	29.50	30.00	30.70	27.90	28.00	28.10
E	26.80	27.00	27.20	34.80	35.00	35.20	30.80	31.00	31.20
E1	24.13 BSC			30.48 BSC			27.94 BSC		
E2	23.90	24.00	24.10	29.50	30.00	30.70	27.90	28.00	28.10
b	0.60	0.75	0.90	0.60	0.76	0.90	0.60	0.76	0.90
c	0.53	0.56	0.61	0.53	0.56	0.61	0.53	0.60	0.70
aaa			0.15			0.15			0.20
bbb			0.20			N/A			0.20
ccc			0.25			0.35			0.25
e	1.27 typ.			1.27 typ.			1.27 typ.		

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