Altera Device Package Information

August 2000, ver. 8.03 Data Sheet

Introduction

This data sheet provides the following package information for all Altera® devices:

- Lead materials
- Thermal resistance
- Package weights
- Package outlines

In this data sheet, packages are listed in order of ascending pin count.

Lead Materials

Table 1 shows the available package types, package acronyms, lead materials, and lead finishes for all Altera device packages.

Table 1. Altera Device Lead Materials

Package Type	Package Acronym	Lead Material	Lead Finish *(1)*
Ceramic dual in-line	CerDIP	Alloy 42	Solder dip
Plastic dual in-line	PDIP	Copper	Solder plate
Ceramic J-lead chip carrier	JLCC	Alloy 42	Solder dip
Plastic J-lead chip carrier	PLCC	Copper	Solder plate
Ceramic pin-grid array *(2)*	PGA	Alloy 42	Gold over nickel plate
Plastic small-outline integrated circuit	SOIC	Copper	Solder plate
Plastic quad flat pack	PQFP	Copper	Solder plate
Plastic thin quad flat pack	TQFP	Copper	Solder plate
Power quad flat pack	RQFP	Copper	Solder plate
Ball-grid array	BGA	Tin-lead alloy (63/37)	–
FineLine BGA™	FineLine BGA	Tin-lead alloy (63/37)	–
Ultra FineLine BGA™	Ultra FineLine BGA	Tin-lead alloy (63/37)	–

Notes:
(1) Solder dip lead finishes are 60/40 typical, and solder plate lead finished are 85/15 typical.
(2) An industry-standard lead glass called T-187 (lead oxide glass) is used to seal PGA packages. This material is manufactured by Sumitomo Corporation.

Thermal Resistance

Tables 2 through 11 provide θ_{JA} (junction-to-ambient thermal resistance) and θ_{JC} (junction-to-case thermal resistance) values for Altera APEX™ 20K and APEX 20KE, FLEX® 10K and FLEX 10KE, FLEX 8000, FLEX 6000, MAX® 9000, MAX 7000, MAX 5000, MAX 3000A, Classic™, and configuration devices.

Table 2. Thermal Resistance of APEX 20K & APEX 20KE Devices (Part 1 of 2)

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EP20K60E	144	TQFP	9.0	33.0	26.0	22.0	20.0
	196	FineLine BGA	6.3	30.6	29.5	28.2	25.4
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	324	Fineline BGA	5.8	27.6	26.3	24.9	22.2
	356	BGA	2.0	15.0	12.0	9.0	8.0
EP20K100 EP20K100E	144	TQFP	9.0	33.0	26.0	22.0	20.0
	196	FineLine BGA	6.3	30.6	29.5	28.2	25.4
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	324	FineLine BGA	5.8	27.6	26.3	24.9	22.2
	356	BGA	2.0	15.0	12.0	9.0	8.0
EP20K160E	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	6.0	21.0	17.0	14.0	13.0
EP20K200	208	RQFP	2.0	18.0	12.0	9.0	7.0
	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	6.0	21.0	17.0	14.0	13.0
EP20K200E	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	6.0	21.0	17.0	14.0	13.0
	652	BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	672	FineLine BGA	5.2	17.5	17.1	16.8	16.3
EP20K300E	208	RQFP	2.0	18.0	12.0	9.0	7.0
	240	RQFP	2.0	20.0	13.0	10.0	8.0
	652	BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	672	FineLine BGA	5.2	17.5	17.1	16.8	16.3

Table 2. Thermal Resistance of APEX 20K & APEX 20KE Devices (Part 2 of 2)

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EP20K400	652	BGA	2.0	13.0	10.0	8.0	7.0
	655	PGA	1.0	8.0	7.0	6.0	4.0
	672	FineLine BGA	5.2	17.5	17.1	16.8	16.3
	672	Flip Chip	0.3	12.3	6.7	5.7	4.8
	672	Flip Chip w/ fin	0.3	6.7	4.1	3.3	2.6
EP20K400E	652	BGA	2.0	13.0	10.0	8.0	7.0
	672	FineLine BGA	4.8	19.0	18.0	17.0	16.0
	672	Flip Chip	0.3	12.3	6.7	5.7	4.8
	672	Flip Chip w/ fin	0.3	6.7	4.1	3.3	2.6
EP20K600E	652	BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	672	FineLine BGA	4.8	18.0	17.0	16.0	15.0
	672	Flip Chip	0.3	11.7	6.6	5.8	4.7
	672	Flip Chip w/ fin	0.3	6.2	4.0	3.2	2.5
	1,020	FineLine BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	1,020	Flip Chip	0.3	10.7	6.1	5.1	4.2
	1,020	Flip Chip w/ fin	0.3	5.1	3.4	2.7	2.2
EP20K1000E	652	BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	652	Flip Chip	0.2	9.1	5.9	4.8	4.0
	652	Flip Chip w/ fin	0.2	3.4	2.7	2.1	1.7
	672	FineLine BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	672	Flip Chip	0.2	10.9	6.4	5.4	4.5
	672	Flip Chip w/ fin	0.2	5.7	3.9	3.1	2.4
	984	PGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	1,020	FineLine BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
EP20K1500E	652	BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	652	Flip Chip	0.2	8.7	5.8	4.7	3.9
		Flip Chip w/ fin	0.2	3.4	3.2	2.5	2.0
	984	PGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	1,020	FineLine BGA	*(1)*	*(1)*	*(1)*	*(1)*	*(1)*
	1.020	Flip Chip	0.2	9.4	5.8	4.8	3.9
	1,020	Flip Chip w/ fin	0.2	4.4	3.3	2.5	2.0

Note:
(1) For thermal resistance values, contact Altera Applications.

Table 3. Thermal Resistance of FLEX 10K Devices (Part 1 of 3) *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPF10K10	84	PLCC	11.0	35.0	23.0	18.0	14.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
EPF10K10A	100	TQFP	10.0	44.0	38.0	34.0	31.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	**6.7**	**33.0**	**30.0**	**28.0**	**26.0**
EPF10K20	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	RQFP	2.0	18.0	12.0	9.0	7.0
	240	RQFP	2.0	20.0	13.0	10.0	8.0
EPF10K30	208	RQFP	2.0	18.0	12.0	9.0	7.0
	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
EPF10K30A	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	FineLine BGA	**5.7**	**28.0**	**26.0**	**24.0**	**23.0**
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	**5.4**	**23.9**	**22.0**	**20.7**	**19.5**
EPF10K30E	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	**5.7**	**28.0**	**26.0**	**24.0**	**23.0**
	484	FineLine BGA	**5.4**	**23.9**	**22.0**	**20.7**	**19.5**
EPF10K40	208	RQFP	2.0	18.0	12.0	9.0	7.0
	240	RQFP	2.0	20.0	13.0	10.0	8.0
EPF10K50	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	403	PGA	**3.0**	**12.0**	**10.0**	**9.0**	**8.0**
		PGA *(2)*	**3.0**	**10.0**	**8.0**	**7.0**	**6.0**
EPF10K50V	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	4.9	23.0	22.0	21.5	20.0

Table 3. Thermal Resistance of FLEX 10K Devices (Part 2 of 3) *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPF10K50E	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	FineLine BGA	7.1	29.7	28.0	26.6	24.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	5.5	23.5	22.2	21.0	19.2
EPF10K50S	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	FineLine BGA	7.1	29.7	28.0	26.6	24.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	5.4	25.0	24.0	23.0	21.5
EPF10K70	240	RQFP	2.0	20.0	13.0	10.0	8.0
	503	PGA	1.0	8.0	7.0	6.0	4.0
EPF10K100	503	PGA	**1.0**	**8.0**	**7.0**	**6.0**	**4.0**
		PGA *(2)*	1.0	6.0	5.0	4.0	3.0
		PGA *(3)*	–	**2.0**	–	–	–
EPF10K100A	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	5.2	21.7	20.6	19.6	18.2
	600	BGA	2.0	13.0	10.0	8.0	7.0
EPF10K100E	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	FineLine BGA	5.6	28.8	27.5	26.1	23.4
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	5.4	23.0	21.8	20.7	18.9
EPF10K130V	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	2.0	13.0	10.0	8.0	7.0
EPF10K130E	240	PQFP	7.0	30.0	22.0	17.0	14.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	5.3	22.4	21.2	20.2	18.5
	600	BGA	2.0	13.0	10.0	8.0	7.0
	672	FineLine BGA	5.2	18.9	18.2	17.6	16.9
EPF10K200E	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	2.0	13.0	10.0	8.0	7.0
	672	FineLine BGA	5.2	17.8	17.3	17.0	16.4

Table 3. Thermal Resistance of FLEX 10K Devices (Part 3 of 3) *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPF10K200S	240	RQFP	2.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
	484	FineLine BGA	6.0	21.0	17.0	14.0	13.0
	600	BGA	2.0	13.0	10.0	8.0	7.0
	672	FineLine BGA	4.8	20.0	19.7	19.4	19.0
EPF10K250A	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	2.0	13.0	10.0	8.0	7.0

Notes:
(1) Bold type designates measured values. FLEX 10KA and FLEX 10KE devices are not measured.
(2) Attached pin-fin heat sink.
(3) Attached motor driven fan heat sink.

Table 4. Thermal Resistance of FLEX 8000 Devices *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPF8282A	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	**10.0**	**44.0**	**38.0**	**34.0**	**31.0**
EPF8282AV	100	TQFP	**10.0**	**44.0**	**38.0**	**34.0**	**31.0**
EPF8452A	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	**10.0**	**44.0**	**38.0**	**34.0**	**31.0**
	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
	160	PGA	**6.0**	**20.0**	**13.0**	**10.0**	**8.0**
EPF8636A	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	160	PQFP	**6.0**	**20.0**	**13.0**	**10.0**	**8.0**
	192	PGA	**6.0**	**16.0**	**11.0**	**8.0**	**6.0**
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
EPF8820A	144	TQFP	9.0	33.0	26.0	22.0	20.0
	160	PQFP	**6.0**	**20.0**	**13.0**	**10.0**	**8.0**
	192	PGA	**6.0**	**16.0**	**11.0**	**8.0**	**6.0**
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	225	BGA	**6.0**	**28.0**	**19.0**	**14.0**	**11.0**
EPF81188A	208	PQFP	7.0	35.0	24.0	18.0	14.0
	232	PGA	**2.0**	**14.0**	**10.0**	**7.0**	**5.0**
	240	PQFP	**7.0**	**30.0**	**22.0**	**17.0**	**14.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
EPF81500A	240	PQFP	**7.0**	**30.0**	**22.0**	**17.0**	**14.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
	280	PGA	**2.0**	**14.0**	**10.0**	**7.0**	**5.0**
	304	RQFP	**1.0**	**20.0**	**13.0**	**10.0**	**8.0**

Note:
(1) Bold type designates measured values.

Table 5. Thermal Resistance of FLEX 6000 Devices

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPF6010A	100	TQFP	10.0	44.0	38.0	34.0	31.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
EPF6016	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
EPF6016A	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	10.0	33.0	29.0	26.0	24.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	9.0	27.0	23.0	21.0	19.0
EPF6024A	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	240	PQFP	7.0	30.0	22.0	17.0	14.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
		FineLine BGA	9.0	27.0	23.0	21.0	19.0

Table 6. Thermal Resistance of MAX 9000 Devices *Notes (1), (2)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM9320	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	280	PGA	**2.0**	**14.0**	**10.0**	**7.0**	**5.0**
	356	BGA	2.0	15.0	12.0	9.0	8.0
EPM9320A	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	356	BGA	2.0	15.0	12.0	9.0	8.0
EPM9400	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
EPM9480	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
EPM9560	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
	280	PGA	**2.0**	**14.0**	**10.0**	**7.0**	**5.0**
	304	RQFP	1.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0
EPM9560A	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
	240	RQFP	**2.0**	**20.0**	**13.0**	**10.0**	**8.0**
	304	RQFP	1.0	20.0	13.0	10.0	8.0
	356	BGA	2.0	15.0	12.0	9.0	8.0

Notes:
(1) Bold type designates measured values.
(2) Thermal resistance values for MAX 9000 devices are preliminary.

Table 7. Thermal Resistance of MAX 7000 Devices (Part 1 of 4) *Notes (1), (2)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM7032	44	PLCC	9.0	52.0	45.0	41.0	36.0
		PQFP	18.0	63.0	55.0	48.0	43.0
		TQFP	19.0	64.0	56.0	50.0	45.0
EPM7032B	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
	49	Ultra FineLine BGA	23.0	69.0	67.0	66.0	62.0

Table 7. Thermal Resistance of MAX 7000 Devices (Part 2 of 4) *Notes (1), (2)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM7032S	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
EPM7032AE	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
EPM7064S	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	10.0	44.0	38.0	34.0	31.0
EPM7064	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
	68	PLCC	**12.0**	**44.0**	33.0	25.0	20.0
	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	PQFP	**11.0**	**50.0**	43.0	38.0	34.0
EPM7064AE EPM7064B	44	PLCC	9.0	52.0	45.0	41.0	36.0
		TQFP	19.0	64.0	56.0	50.0	45.0
	49	Ultra FineLine BGA	23.0	65.0	63.0	61.0	57.0
	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	**25.2**	**65.0**	**61.0**	**58.0**	**55.0**
EPM7096	68	PLCC	**12.0**	44.0	33.0	25.0	20.0
	84	PLCC	11.0	35.0	23.0	18.0	14.0
	100	PQFP	**11.0**	**50.0**	43.0	38.0	34.0
EPM7128A	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	**14.7**	**42.0**	**39.0**	**37.0**	**36.0**
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	256	FineLine BGA	9.4	35.0	33.3	31.6	28.0
EPM7128B	49	Ultra FineLine BGA	22.0	56.0	54.0	52.0	47.0
	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	10.0	33.0	29.0	26.0	24.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	169	Ultra FineLine BGA	17.0	51.0	49.0	46.0	42.0
	256	FineLine BGA	9.0	27.0	23.0	21.0	19.0

Table 7. Thermal Resistance of MAX 7000 Devices (Part 3 of 4) *Notes (1), (2)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM7128E	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	PQFP	11.0	50.0	43.0	38.0	34.0
	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7128S	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	10.0	44.0	38.0	34.0	31.0
		PQFP	11.0	50.0	43.0	38.0	34.0
	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7128AE	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	**19.3**	**50.1**	**47.9**	**45.6**	**41.1**
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	169	Ultra FineLine BGA	16.0	47.0	45.0	43.0	38.0
	256	FineLine BGA	**12.9**	**43.6**	**41.4**	**39.2**	**35.3**
EPM7160E	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	PQFP	**11.0**	**50.0**	43.0	38.0	34.0
	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7160S	84	PLCC	**11.0**	**35.0**	**23.0**	**18.0**	**14.0**
	100	TQFP	10.0	44.0	38.0	34.0	31.0
	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7192S	160	PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7192E	160	PGA	**6.0**	**20.0**	**13.0**	**10.0**	**8.0**
		PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
EPM7256A	100	TQFP	10.0	44.0	38.0	34.0	31.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	6.2	34.0	32.0	29.0	28.0
EPM7256B	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	10.0	33.0	29.0	26.0	24.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	169	Ultra FineLine BGA	14.0	38.0	36.0	34.0	30.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	6.2	34.0	32.0	29.0	28.0

Table 7. Thermal Resistance of MAX 7000 Devices (Part 4 of 4) *Notes (1), (2)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM7256E	160	PGA	**6.0**	**20.0**	**13.0**	**10.0**	**8.0**
		PQFP	**7.0**	**35.0**	**26.0**	**20.0**	**16.0**
	208	RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
EPM7256S	208	PQFP	7.0	35.0	24.0	18.0	14.0
		RQFP	**2.0**	**18.0**	**12.0**	**9.0**	**7.0**
EPM7256AE	100	TQFP	10.0	44.0	38.0	34.0	31.0
		FineLine BGA	10.0	33.0	29.0	26.0	24.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	**10.3**	**33.0**	**31.0**	**29.5**	**26.6**
EPM7512AE	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
		FineLine BGA	6.5	29.6	28.4	27.0	24.2
EPM7512B	144	TQFP	9.0	33.0	26.0	22.0	20.0
	169	Ultra FineLine BGA	10.0	33.0	31.0	29.0	26.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0
	256	FineLine BGA	6.5	29.6	28.4	27.0	24.2

Notes:
(1) Bold type designates measured values. Values are not measured for MAX 7000A devices.
(2) Thermal resistance values for MAX 7000A devices are preliminary.

Table 8. Thermal Resistance of MAX 5000 Devices *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W)
EPM5032	28	CerDIP	**12.0**	**44.0**
		PDIP	**19.0**	**48.0**
		JLCC	**9.0**	**69.0**
		PLCC	**10.0**	**59.0**
EPM5064	44	JLCC	**15.0**	**62.0**
		PLCC	**9.0**	**52.0**
EPM5128	68	JLCC	**11.0**	**39.0**
		PLCC	**12.0**	**44.0**
		PGA	**2.0**	**32.0**
EPM5128A	68	PLCC	**12.0**	**44.0**
EPM5130	84	JLCC	**4.0**	**30.0**
		PLCC	**11.0**	**35.0**
	100	PQFP	**10.0**	**50.0**
		PGA	**4.0**	**26.0**
EPM5192	84	JLCC	**4.0**	**30.0**
		PLCC	**11.0**	**35.0**
		PGA	**2.0**	**27.0**

Note:
(1) Bold type designates measured values.

Table 9. Thermal Resistance of MAX 3000A Devices

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W) Still Air	θ_{JA} (° C/W) 100 ft./min.	θ_{JA} (° C/W) 200 ft./min.	θ_{JA} (° C/W) 400 ft./min.
EPM3032A	44	TQFP	19.0	64.0	56.0	50.0	45.0
		PLCC	9.0	52.0	45.0	41.0	36.0
EPM3064A	44	TQFP	10.0	44.0	38.0	34.0	31.0
		PLCC	11.0	35.0	23.0	18.0	14.0
	100	TQFP	10.0	44.0	38.0	34.0	31.0
EPM3128A	100	TQFP	10.0	44.0	38.0	34.0	31.0
	144	TQFP	9.0	33.0	26.0	22.0	20.0
EPM3256A	144	TQFP	9.0	33.0	26.0	22.0	20.0
	208	PQFP	7.0	35.0	24.0	18.0	14.0

Table 10. Thermal Resistance of Classic Devices *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W)
EP600I	24	PDIP	22.0	67.0
		CerDIP	18.0	60.0
	28	PLCC	16.0	64.0
EP610	24	CerDIP	**10.0**	**60.0**
		PDIP	**18.0**	**55.0**
		SOIC	**17.0**	**77.0**
	28	PLCC	**13.0**	**74.0**
EP610I	24	CerDIP	**18.0**	**60.0**
		PDIP	**22.0**	**67.0**
	28	PLCC	**16.0**	**64.0**
EP900I	40	PDIP	23.0	49.0
	44	PLCC	10.0	58.0
EP910	40	CerDIP	**12.0**	**40.0**
		PDIP	**23.0**	**49.0**
	44	PLCC	**10.0**	**58.0**
EP910I	40	CerDIP	**17.0**	**44.0**
		PDIP	**29.0**	**51.0**
	44	PLCC	**16.0**	**55.0**
EP1800I	68	PLCC	13.0	44.0
EP1810	68	JLCC	**12.0**	**47.0**
		PLCC	**13.0**	**44.0**
		PGA	**6.0**	**38.0**

Table 11. Thermal Resistance of Configuration Devices (Part 1 of 2) *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W)
EPC1064 EPC1064V	8	PDIP	**19**	**48**
	20	PLCC	**18**	**80**
	32	TQFP	**17**	**75**
EPC1213	8	PDIP	**19**	**48**
	20	PLCC	**18**	**80**

Table 11. Thermal Resistance of Configuration Devices (Part 2 of 2) *Note (1)*

Device	Pin Count	Package	θ_{JC} (° C/W)	θ_{JA} (° C/W)
EPC1441	8	PDIP	**19**	**48**
	20	PLCC	**18**	**80**
	32	TQFP	**17**	**75**
EPC1	8	PDIP	**16**	**70**
	20	PLCC	**18**	**80**
EPC2	20	PLCC	18	80
	32	TQFP	17	75

Note to tables:
(1) Bold type designates measured values.

Package Weights

Table 12 shows the package weights for Altera devices. The die of a device adds an insignificant amount of weight; therefore, these weights can be used for any device in that package.

Table 12. Package Weights for Altera Devices (Part 1 of 2)

Pins	Package	Weight (grams)
8	PDIP	0.5
20	PLCC	0.8
24	CerDIP	4.1
24	PDIP	1.7
24	SOIC	0.6
28	PLCC	1.1
28	PDIP	1.7
28	CerDIP	4.1
32	TQFP	0.2
40	PDIP	6.0
40	CerDIP	13.2
44	PLCC	2.3
44	JLCC	2.8
44	PQFP	0.5
44	TQFP	0.3
49	Ultra FineLine BGA	0.1
68	PGA	10.4
68	JLCC	7.1
68	PLCC	4.6
84	PLCC	6.8

Table 12. Package Weights for Altera Devices (Part 2 of 2)

Pins	Package	Weight (grams)
84	JLCC	10.9
84	PGA	10.6
100	PQFP	1.6
100	PGA	14.2
100	TQFP	0.5
100	FineLine BGA	0.2
144	TQFP	1.3
160	PQFP	5.4
160	PGA	19.9
169	Ultra FineLine BGA	0.3
192	PGA	24.1
196	FineLine BGA	0.3
208	PQFP	5.7
208	RQFP	10.8
225	BGA	2.1
232	PGA	25.5
240	RQFP	15.1
240	PQFP	7.0
256	BGA	2.1
256	FineLine BGA	0.4
280	PGA	29.5
304	RQFP	26.3
324	FineLine BGA	0.6
356	BGA	7.0
403	PGA	29.5
484	FineLine BGA	0.7
503	PGA	59.0
599	PGA	69.0
600	BGA	12.0
652	BGA	14.9
655	PGA	74.9
672	FineLine BGA	1.2
984	PGA	*(1)*
1,020	FineLine BGA	*(1)*

Note:
(1) For package weight information, contact Altera Applications.

Package Outlines

Package outlines are listed in order of ascending pin count. Altera package outlines meet the requirements of ***JEDEC Publication No. 95***. Table 13 lists the JEDEC package outlines that are used with Altera devices.

Table 13. JEDEC Package Outline Cross Reference (Part 1 of 2) *Note (1)*

Pins	Package	JEDEC Outline
8	PDIP	MS-001
20	PLCC	MS-018
24	CerDIP	MO-036
24	PDIP	MS-001
24	SOIC	MS-013
28	SOIC	MS-013
28	PLCC	MS-018
28	JLCC	MO-087
28	PDIP	MS-001
28	CerDIP	MO-058
32	TQFP	MO-136
40	PDIP	MS-011
40	CerDIP	MS-103
44	PLCC	MS-018
44	JLCC	MO-087
44	PQFP	MO-108
44	TQFP	MO-136
49	Ultra FineLine BGA	*(1)*
68	PGA	MO-067
68	JLCC	MO-087
68	PLCC	MS-018
84	JLCC	MO-087
84	PLCC	MS-018
84	PGA	MO-067
100	PQFP	MO-108
100	TQFP	MO-136
100	PGA	MO-067
100	FineLine BGA	MO-192
144	TQFP	MO-136
160	PQFP	MO-108
160	PGA	MO-067
169	Ultra FineLine BGA	*(1)*

Table 13. JEDEC Package Outline Cross Reference (Part 2 of 2) *Note (1)*

Pins	Package	JEDEC Outline
192	PGA	MO-067
196	FineLine BGA	MO-192
208	PQFP	MO-143
208	RQFP	MO-143
225	BGA	MO-151
232	PGA	MO-067
240	RQFP	MO-143
240	PQFP	MO-143
256	BGA	MO-151
256	FineLine BGA	MO-192
280	PGA	MO-067
304	RQFP	MO-143
324	FineLine BGA	MO-192
356	BGA	MO-192
403	PGA	–
484	FineLine BGA	MO-192 *(2)*
503	PGA	–
599	PGA	–
600	BGA	MO-192
652	BGA	MO-192
655	PGA	–
672	FineLine BGA	MO-192 *(2)*
672	Flip Chip	–
984	PGA	–
1,020	FineLine BGA	–

Notes:
(1) For more information, contact Altera Applications at (800) 800-EPLD.
(2) These packages exceed the JEDEC "A" dimension in height.

Table 14 shows the different packages and pin counts for Altera devices.

Table 14. Packages & Pin Counts (Part 1 of 2)

Package	Code	Pin Count
BGA	B	225
		256
		356
		600
		652
FineLine BGA	F	100
		196
		256
		324
		484
		672
		1,020
Ultra FineLine BGA	U	49
		169
CerDIP	D	24
		40
PGA	G	68
		84
		100
		160
		192
		232
		280
		403
		503
		599
		655
		984
JLCC	J	28
		44
		68
		84

Table 14. Packages & Pin Counts (Part 2 of 2)

Package	Code	Pin Count
PLCC	L	20
		28
		44
		68
		84
PDIP	P	8
		24
		40
PQFP	Q	44
		100
		160
		208
		240
RQFP	R	208
		240
		304
SOIC	S	24
TQFP	T	32
		44
		100
		144

Table 15 summarizes the maximum lead coplanarity for Altera J-lead and QFP packages.

Table 15. Maximum Lead Coplanarity for J-Lead, PLCC, BGA, FineLine BGA & QFP Packages

Package	Maximum Lead Coplanarity
JLCC	0.006 inches (0.15 mm)
PLCC	0.004 inches (0.10 mm)
QFP packages with a lead pitch of 0.65 mm or greater	0.004 inches (0.10 mm)
QFP packages with a lead pitch of 0.5 mm	0.003 inches (0.08 mm)
QFP packages with 208 pins or greater	0.003 inches (0.08 mm)
BGA	0.008 inches (0.20 mm)
FineLine BGA	0.008 inches (0.20 mm)

For information on device package ordering codes, see *Ordering Information* in this data book.

Dimension Formats

Package outline dimensions are shown in the following formats:

min. inches (min. millimeters)
max. inches (max. millimeters)

or:

nominal inches ± tolerance
(nominal millimeters ± tolerance)

or:

inches
(millimeters) BSC, Min., Max., Ref., Typ., R, Dia., Sq.

Table 16 shows the units used to describe package outline dimensions.

Table 16. Package Outline Units

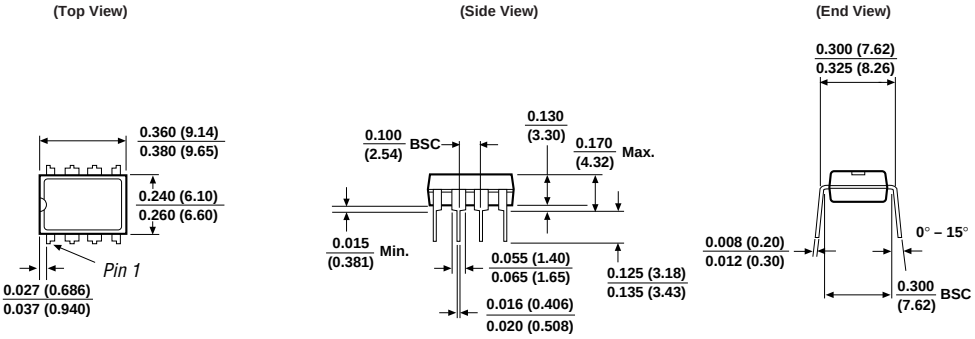
Unit	Description
BSC	Basic. Represents theoretical exact dimension or dimension target.
Min.	Minimum dimension specified.
Max.	Maximum dimension specified.
Ref.	Reference. Represents dimension for reference use only. This value is not a device specification.
Typ.	Typical. Provided as a general value. This value is not a device specification.
R	Radius. Represents curve dimension.
Dia.	Diameter. Represents curve dimension.
Sq.	Square. Indicates a square feature for a package with equal length and width dimensions.

The following figures show the package outlines for all Altera devices.

Controlling dimensions are noted on package outline drawings. The 984-pin PGA and the 1,020-pin FineLine BGA package outline drawings will be available in future revisions of this document.

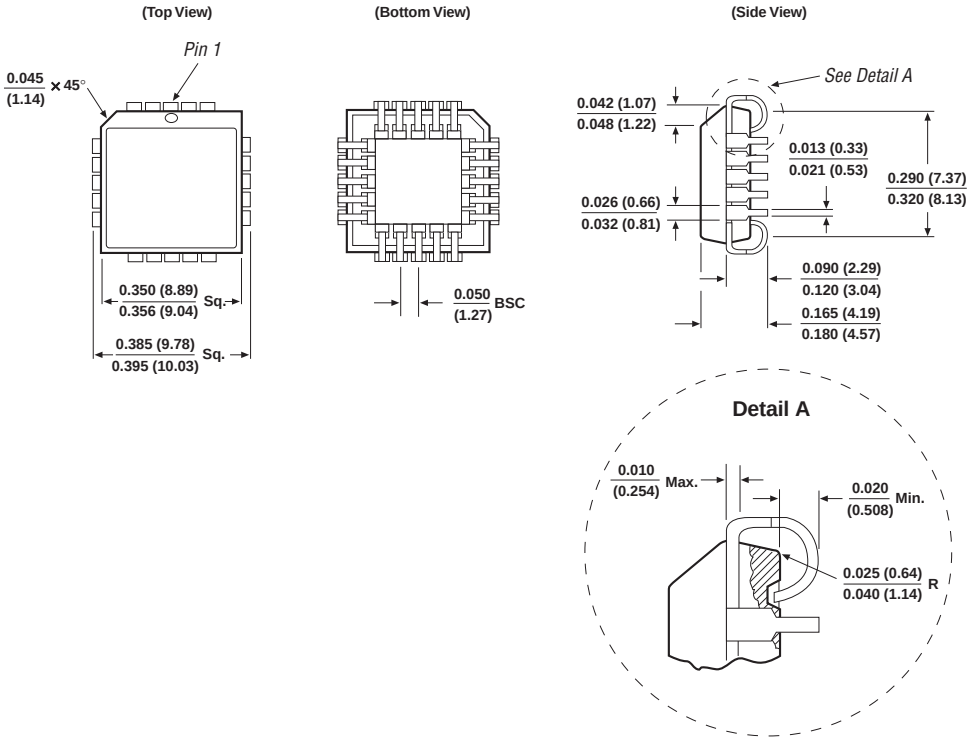
8-Pin Plastic Dual In-Line Package (PDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



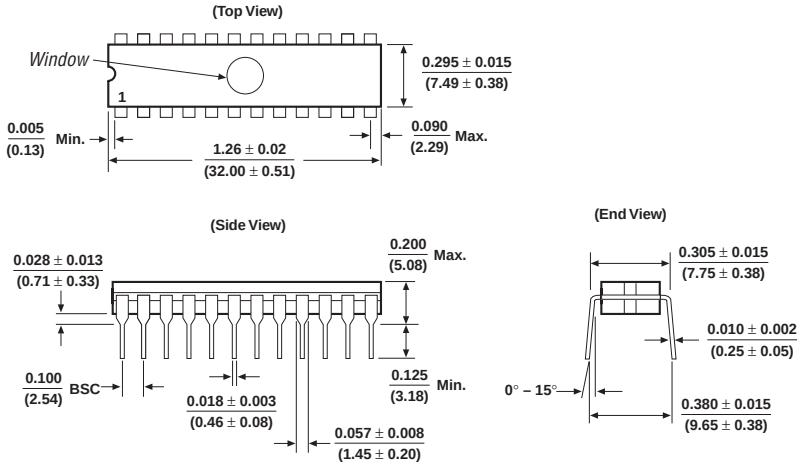
20-Pin Plastic J-Lead Chip Carrier (PLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



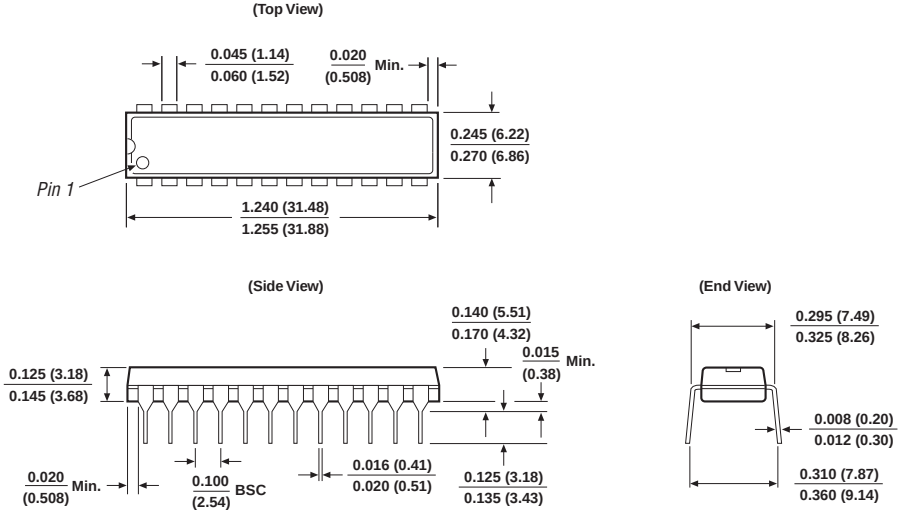
24-Pin Ceramic Dual In-Line Package (CerDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



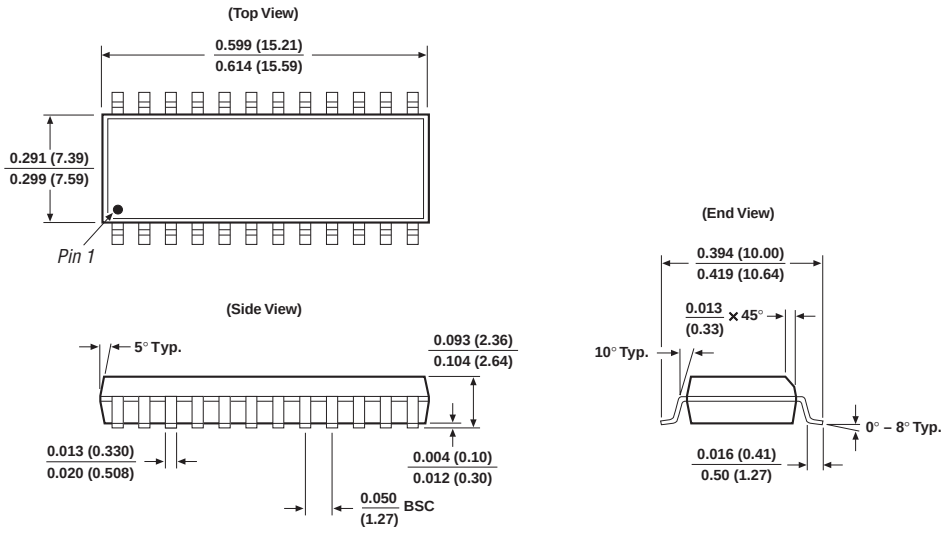
24-Pin Plastic Dual In-Line Package (PDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



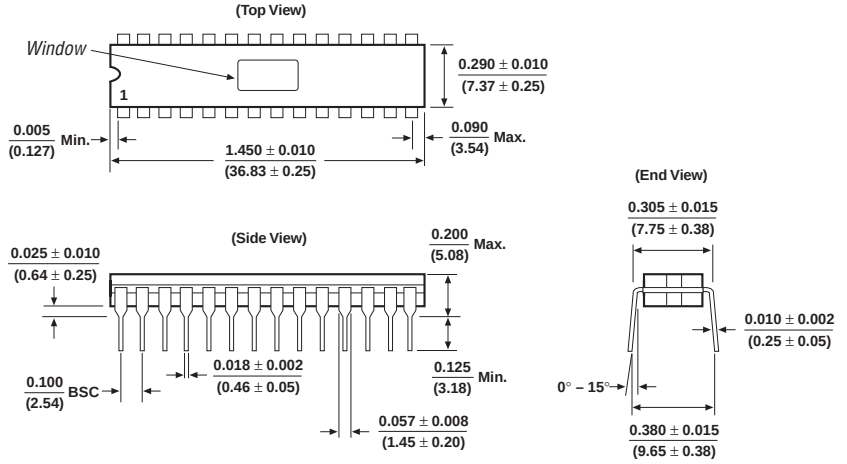
24-Pin Plastic Small-Outline Integrated Circuit (SOIC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



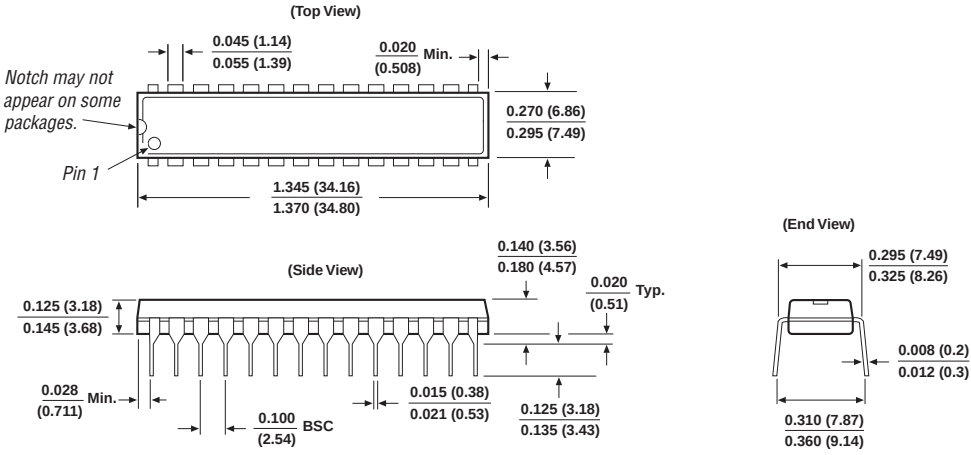
28-Pin Ceramic Dual In-Line Package (CerDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



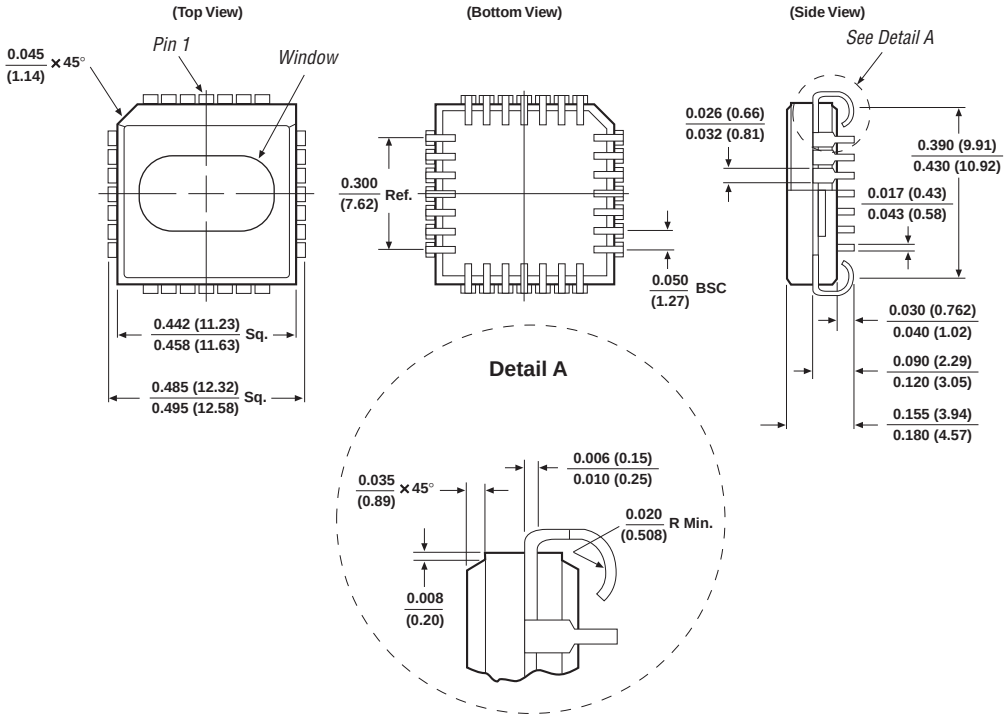
28-Pin Plastic Dual In-Line Package (PDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



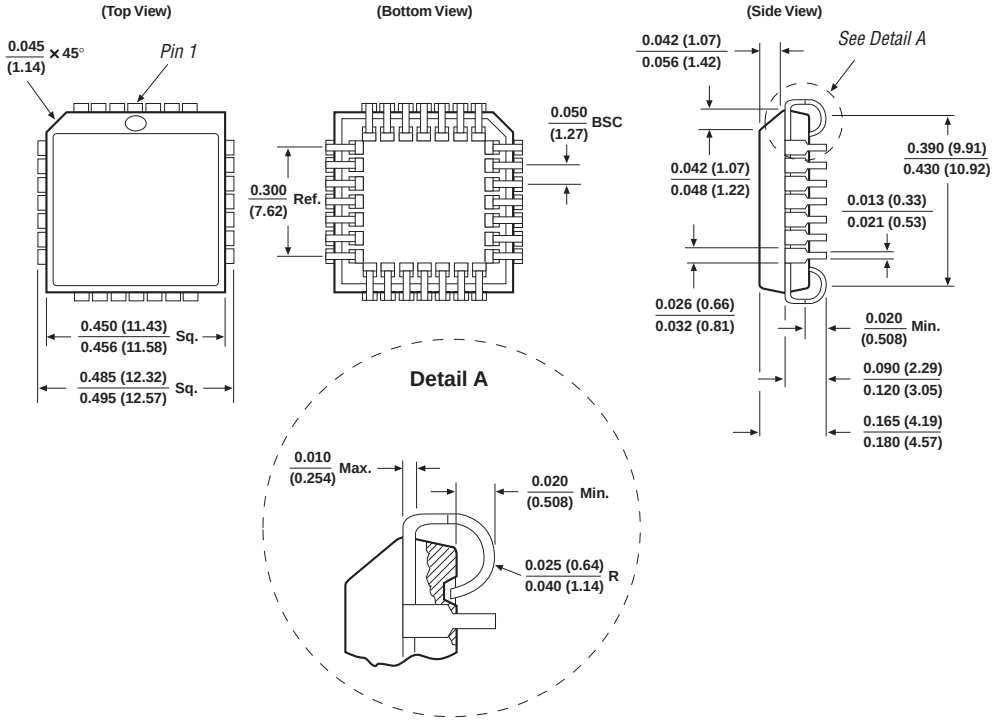
28-Pin Ceramic J-Lead Chip Carrier (JLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



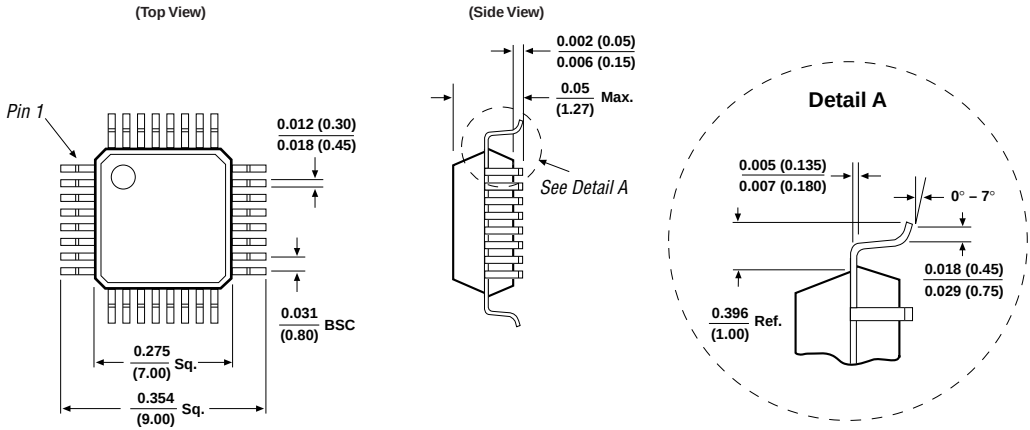
28-Pin Plastic J-Lead Chip Carrier (PLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



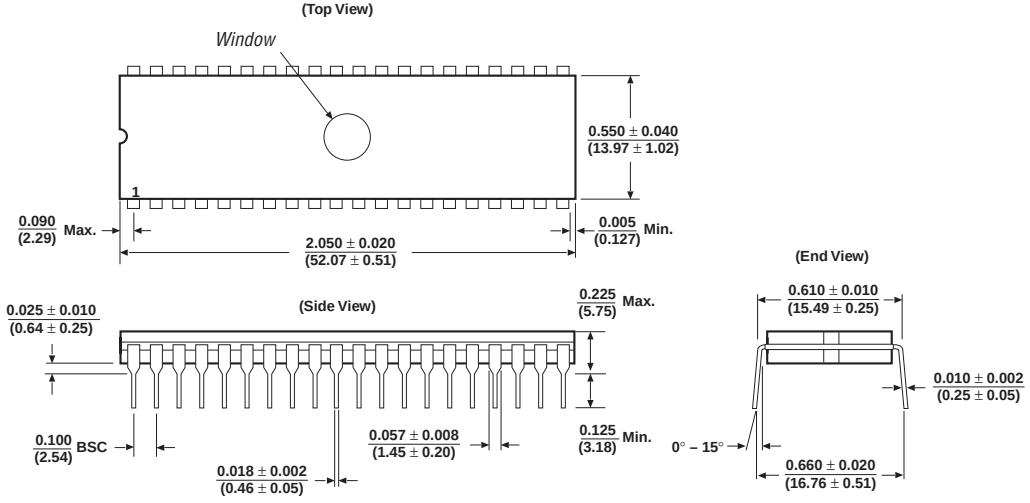
32-Pin Plastic Thin Quad Flat Pack (TQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



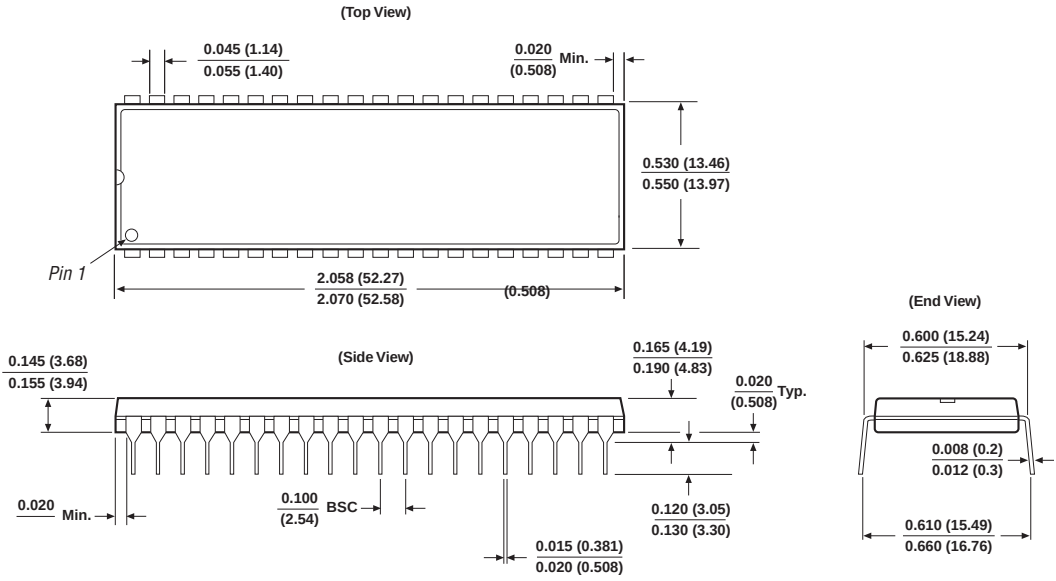
40-Pin Ceramic Dual In-Line Package (CerDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



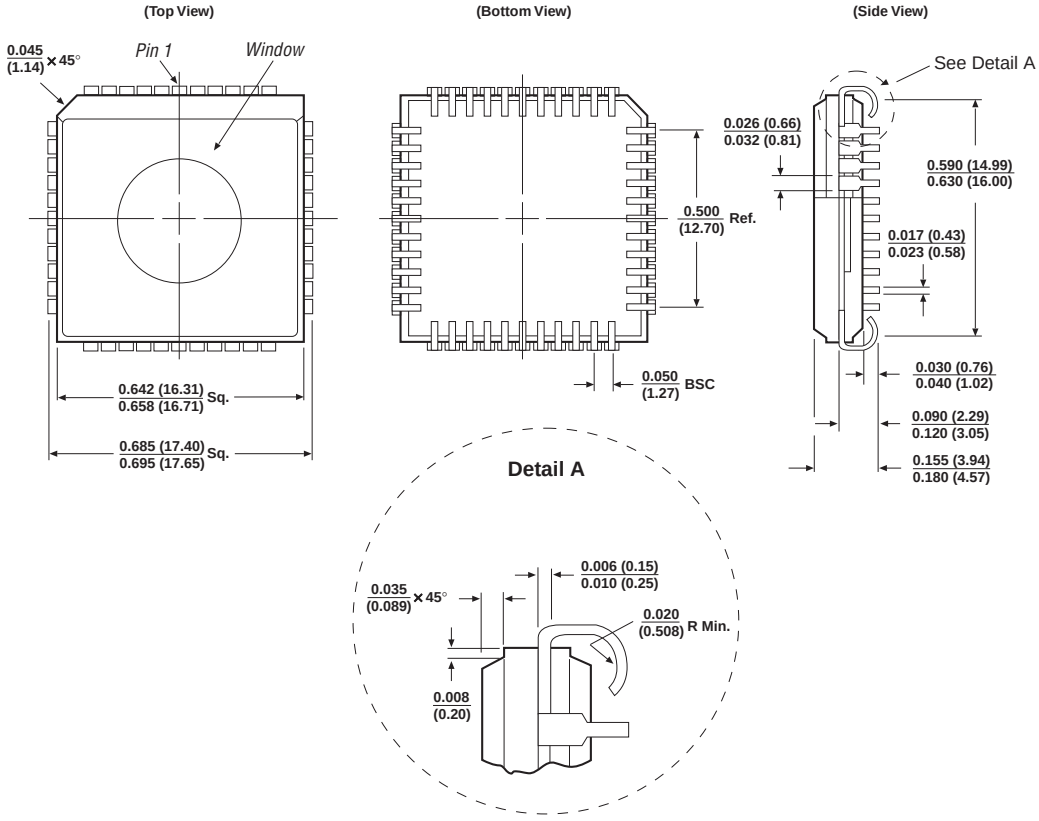
40-Pin Plastic Dual In-Line Package (PDIP)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



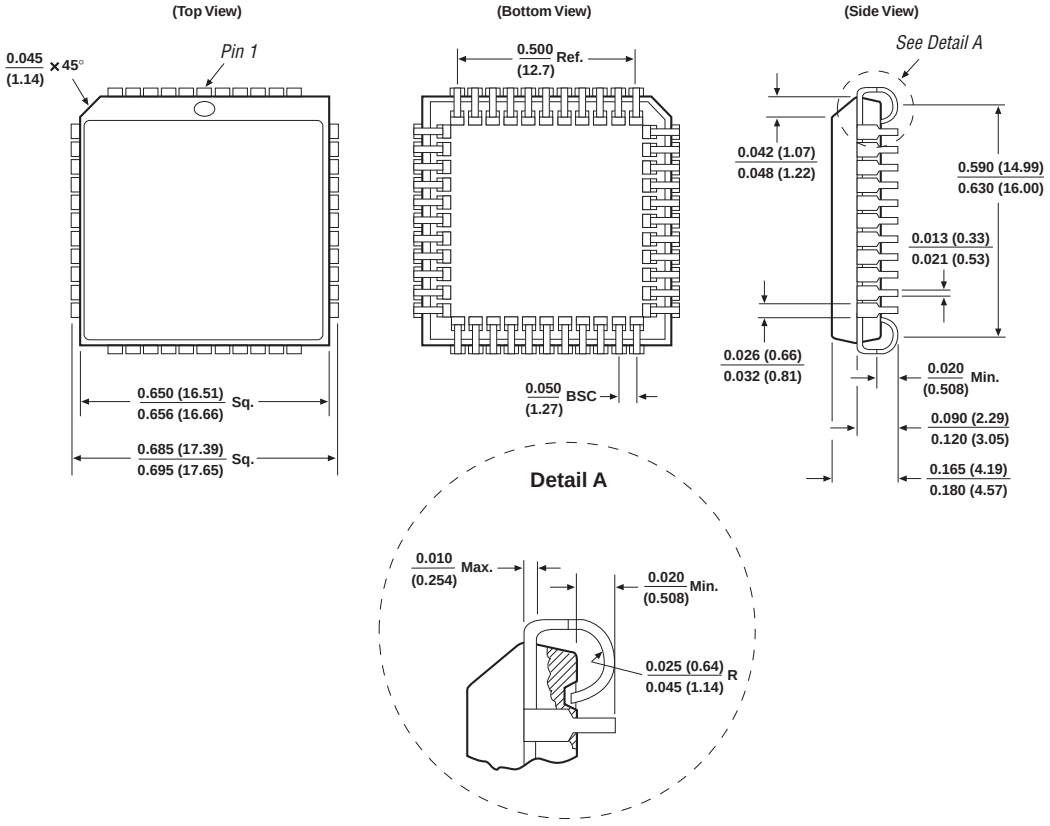
44-Pin Ceramic J-Lead Chip Carrier (JLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



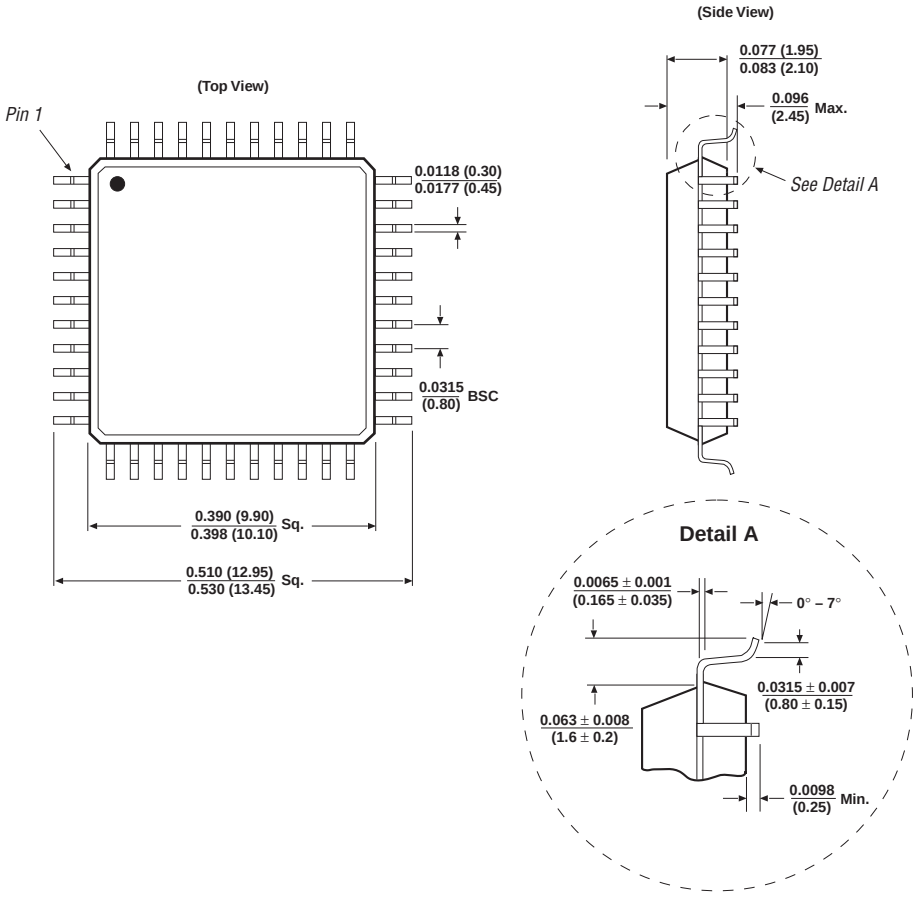
44-Pin Plastic J-Lead Chip Carrier (PLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



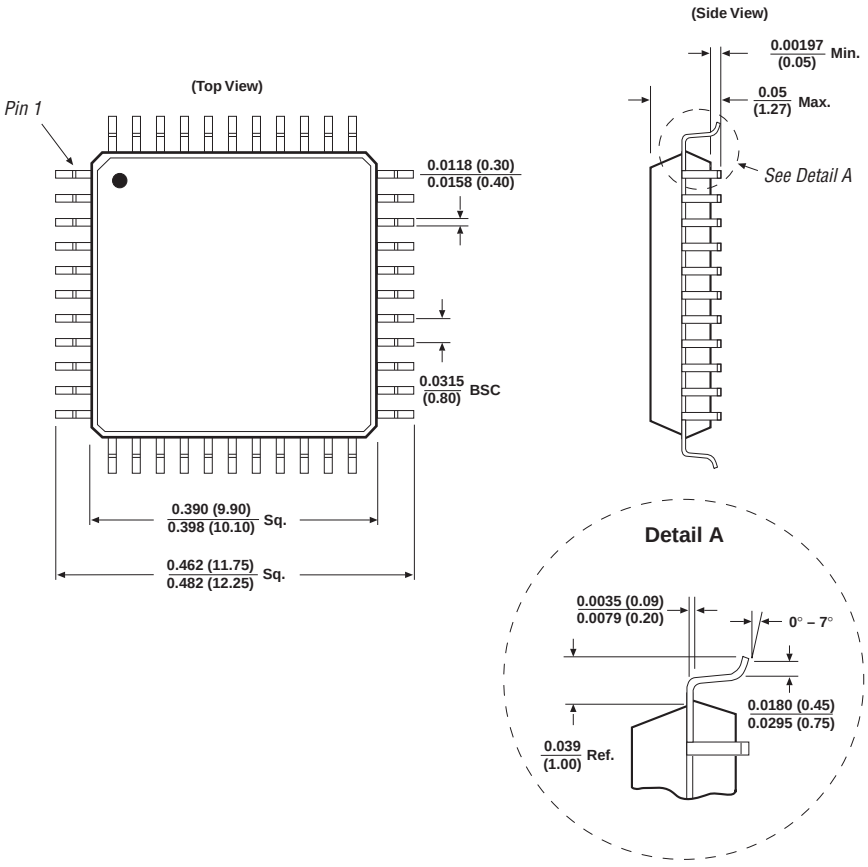
44-Pin Plastic Quad Flat Pack (PQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



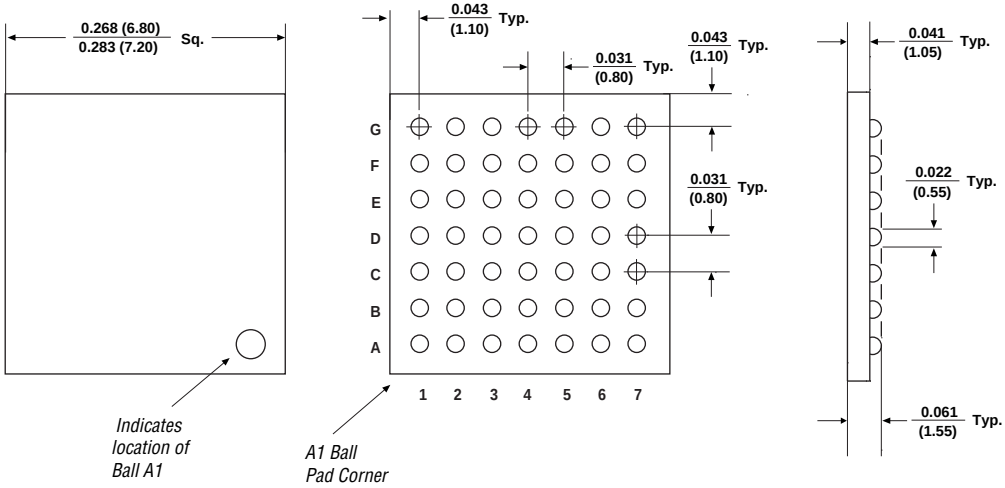
44-Pin Plastic Thin Quad Flat Pack (TQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



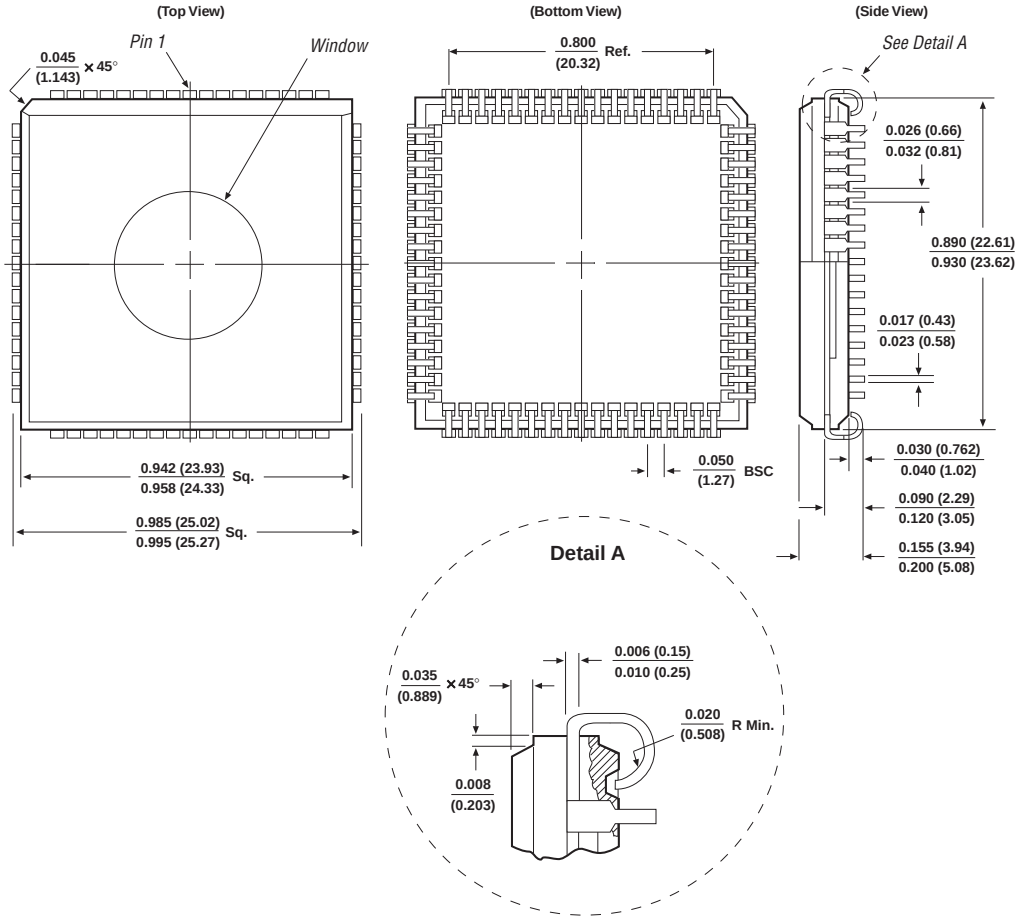
49-Ultra FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



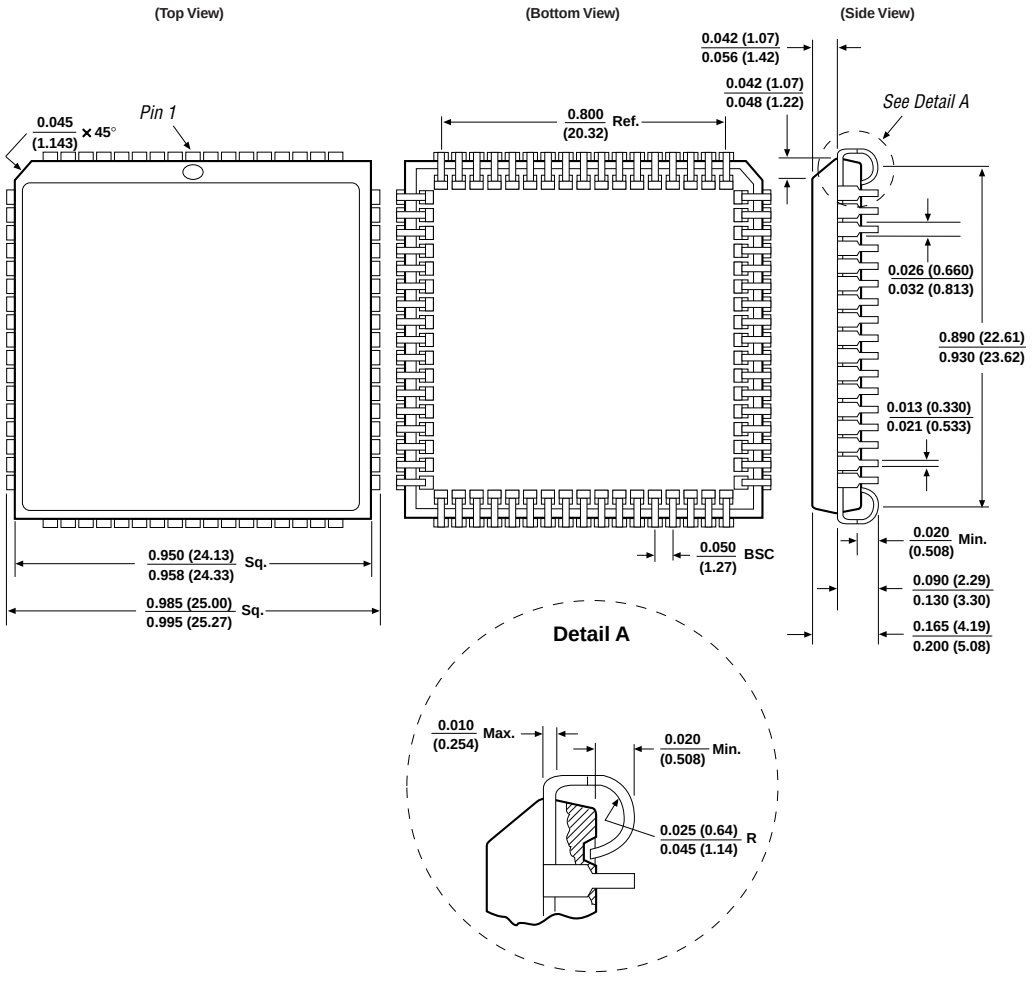
68-Pin Ceramic J-Lead Chip Carrier (JLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



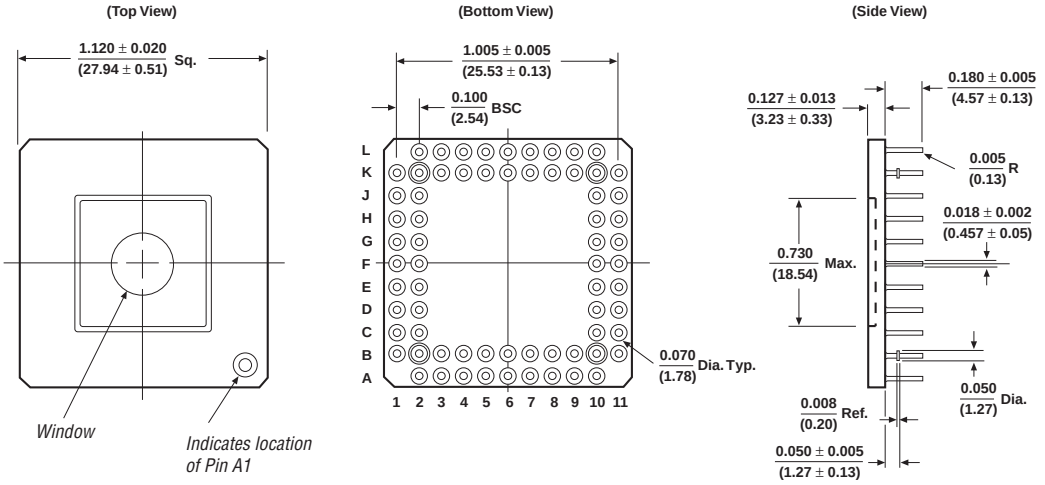
68-Pin Plastic J-Lead Chip Carrier (PLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



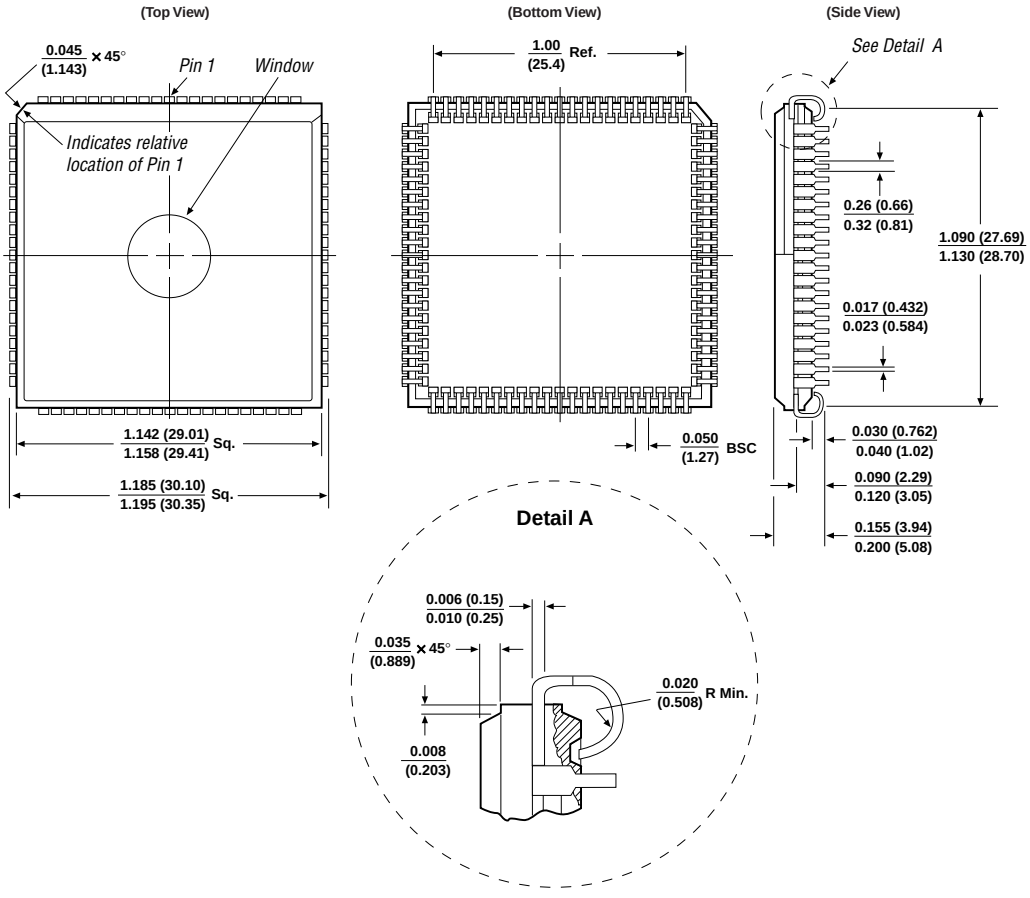
68-Pin Small Outline Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



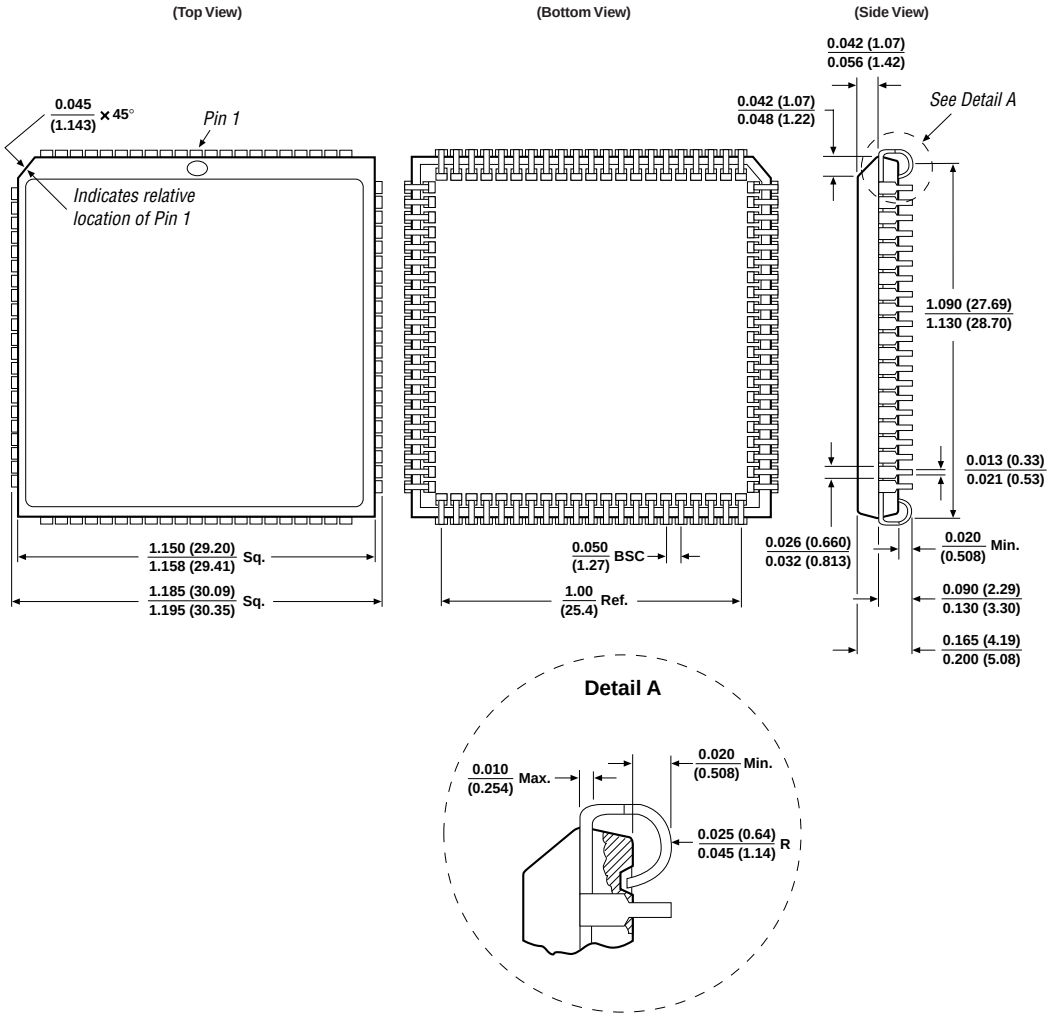
84-Pin Ceramic J-Lead Chip Carrier (JLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



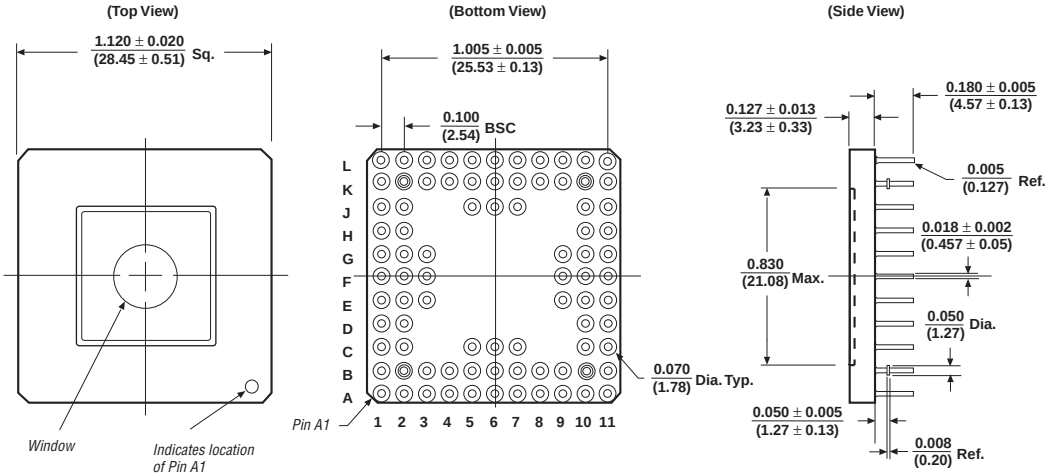
84-Pin Plastic J-Lead Chip Carrier (PLCC)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



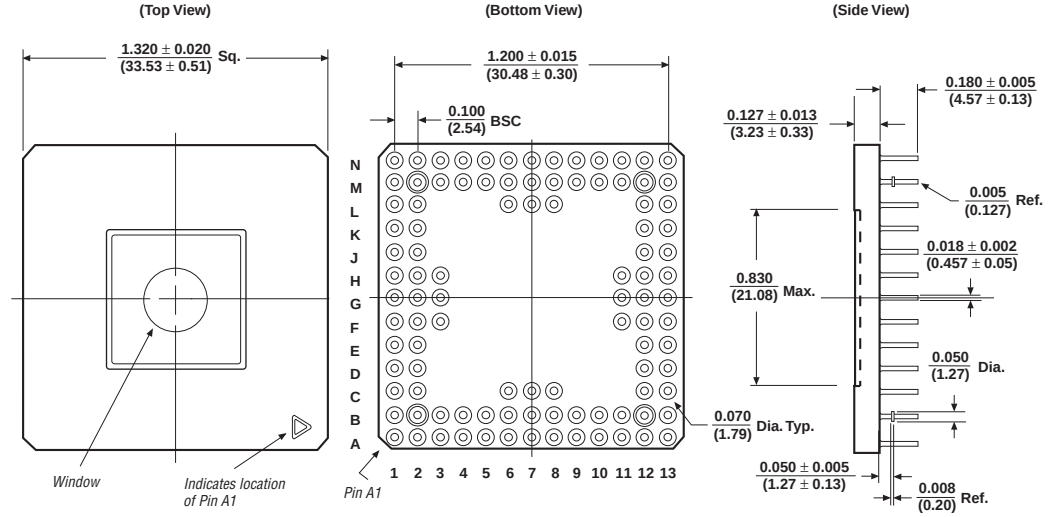
84-Pin Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



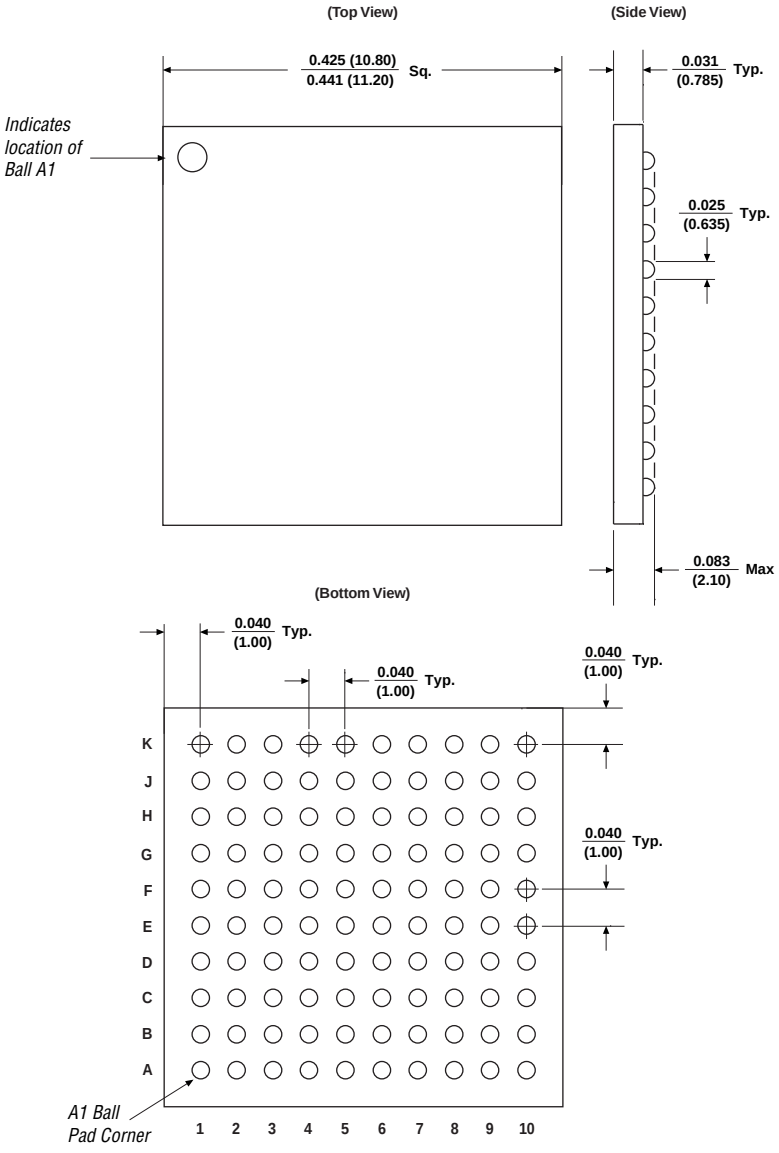
100-Pin Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



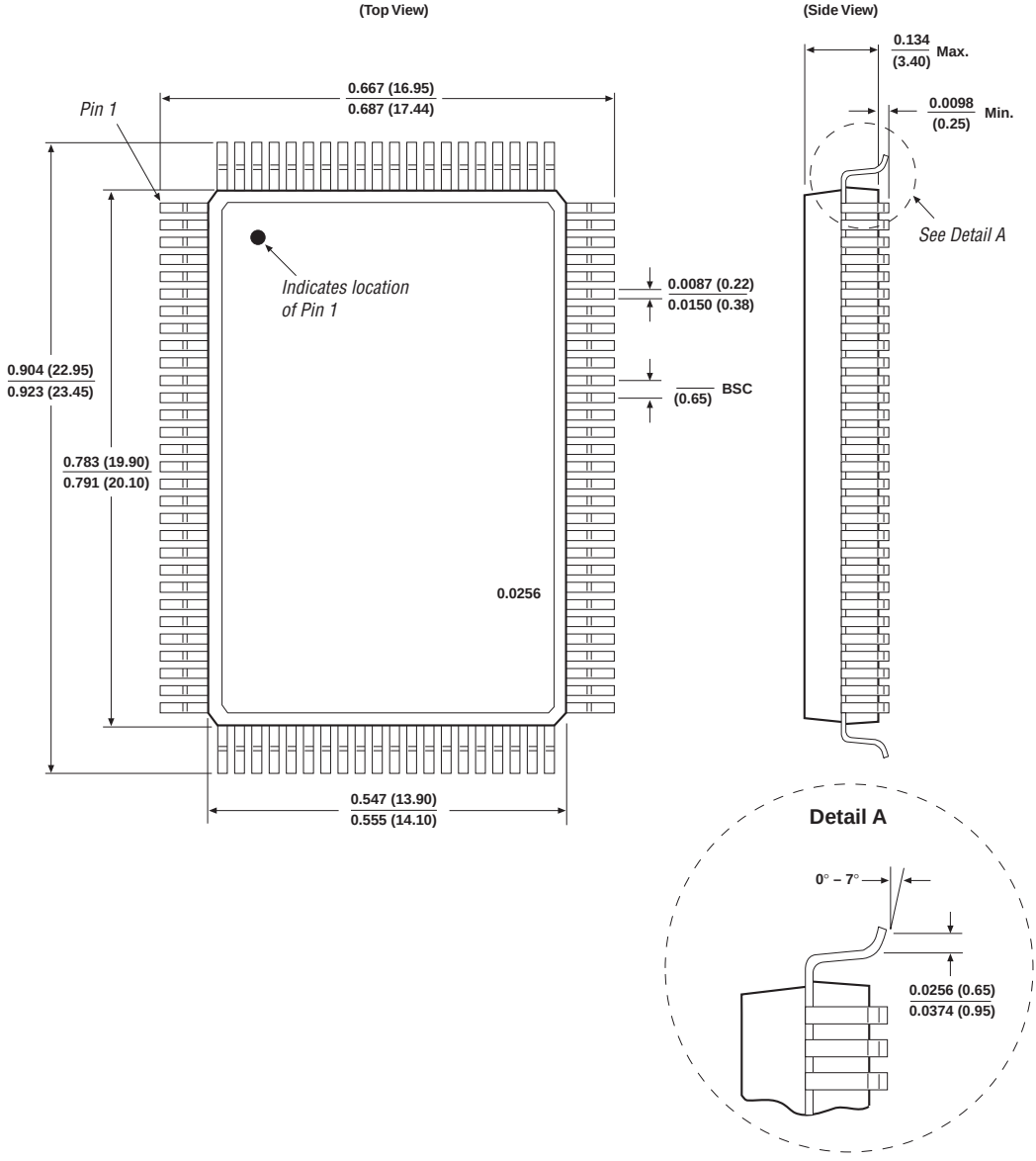
100-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



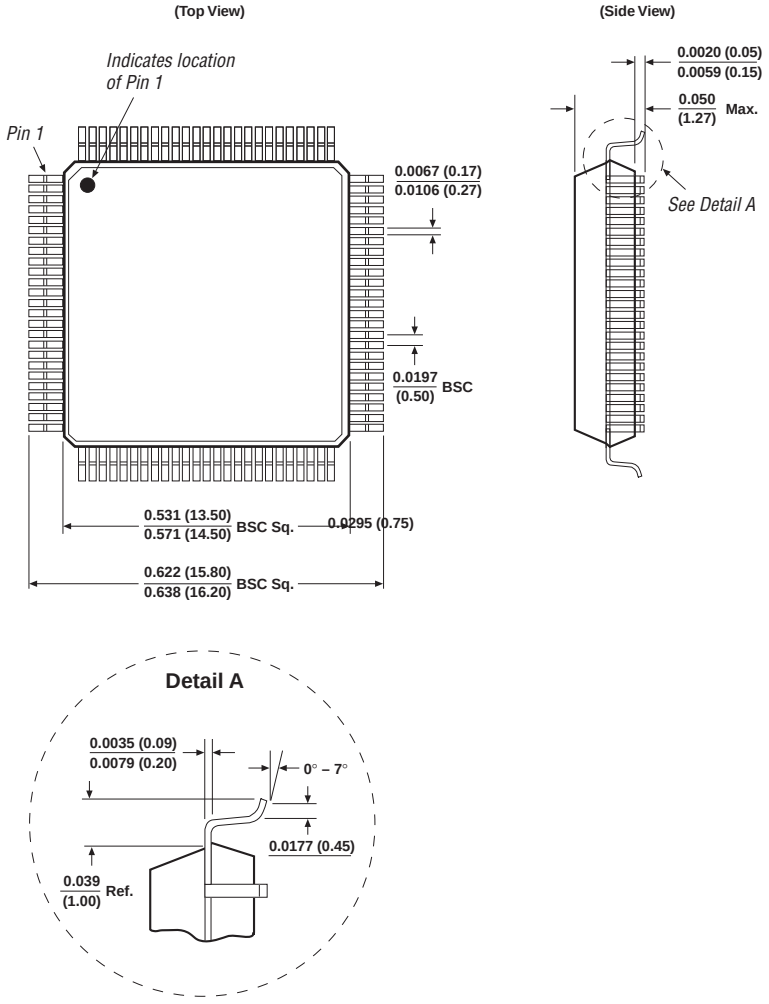
100-Pin Plastic Quad Flat Pack (PQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



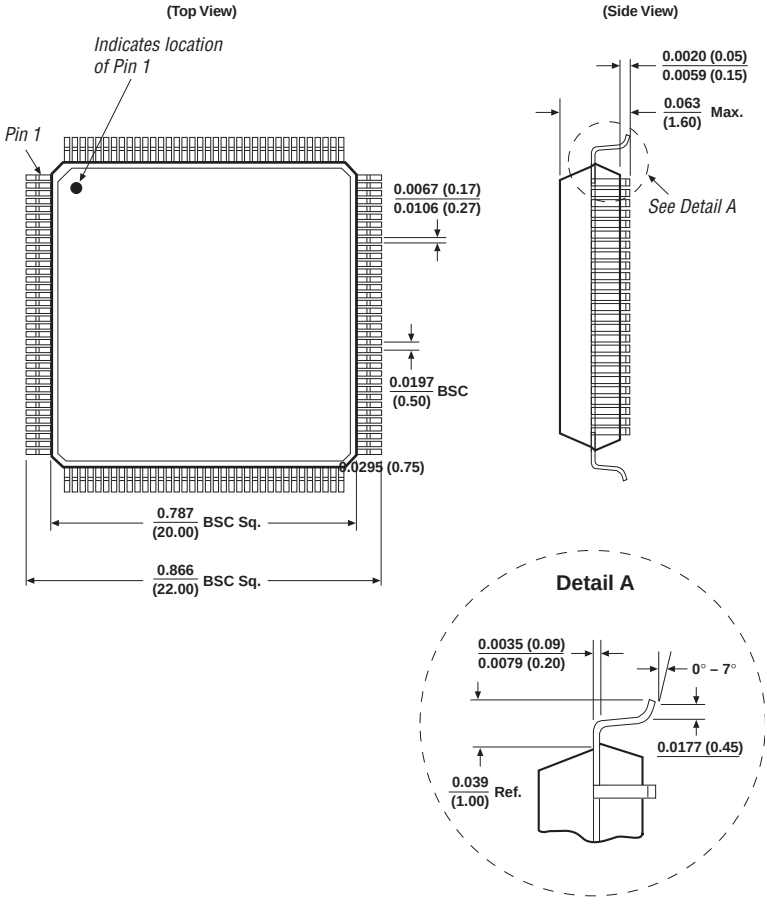
100-Pin Plastic Thin Quad Flat Pack (TQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



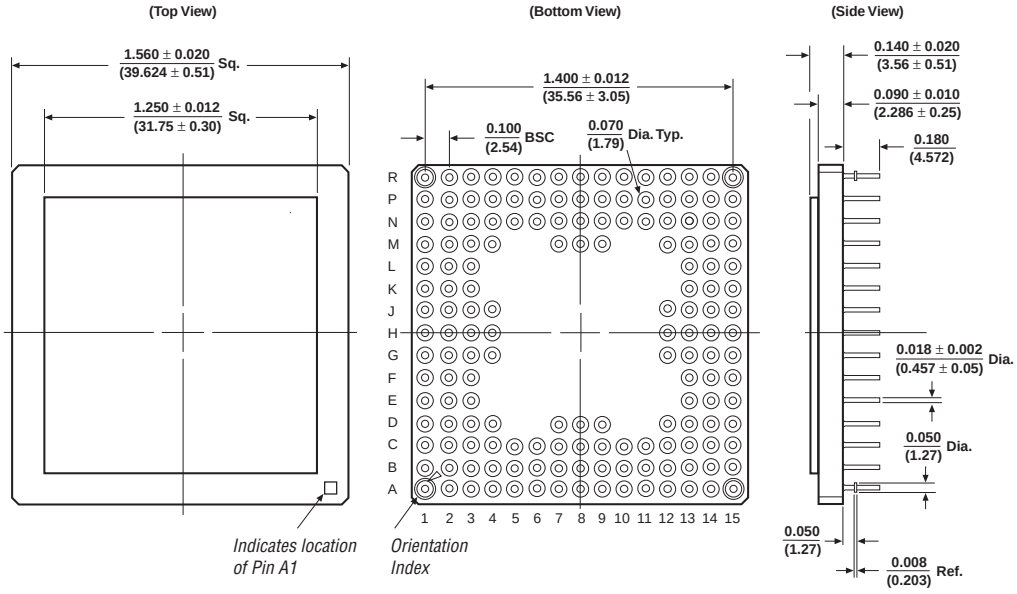
144-Pin Plastic Thin Quad Flat Pack (TQFP)

Controlling measurement is in millimeters, shown in parenthesis. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



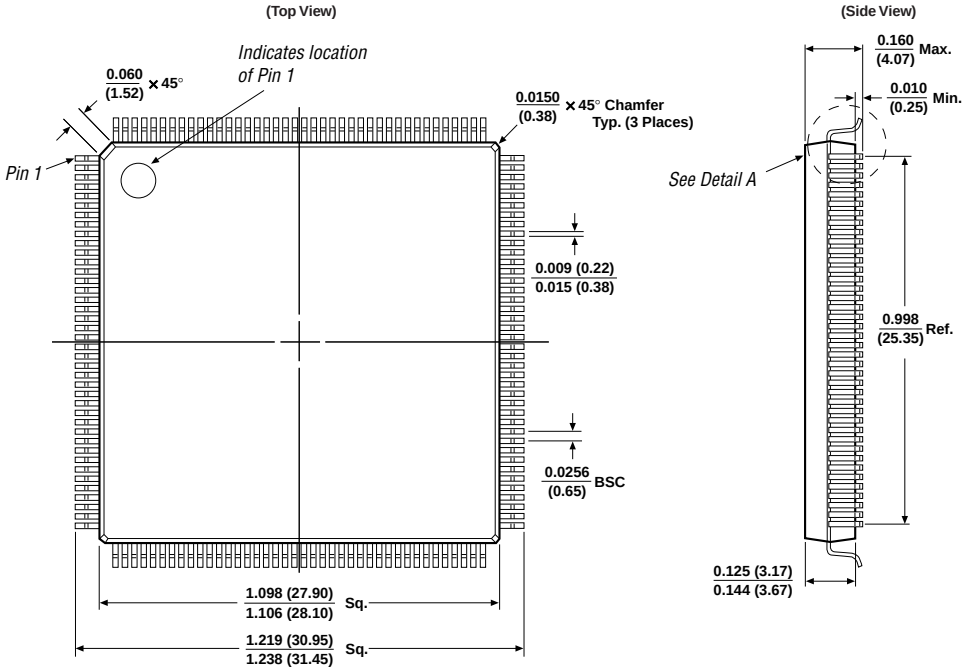
160-Pin Ceramic Pin-Grid Array (PGA)

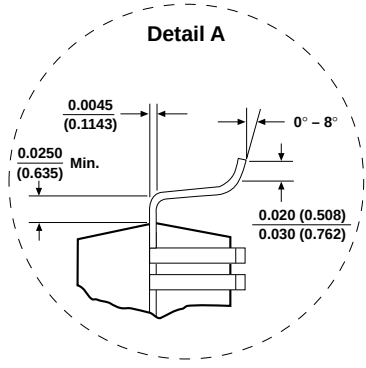
Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



160-Pin Plastic Quad Flat Pack (PQFP)

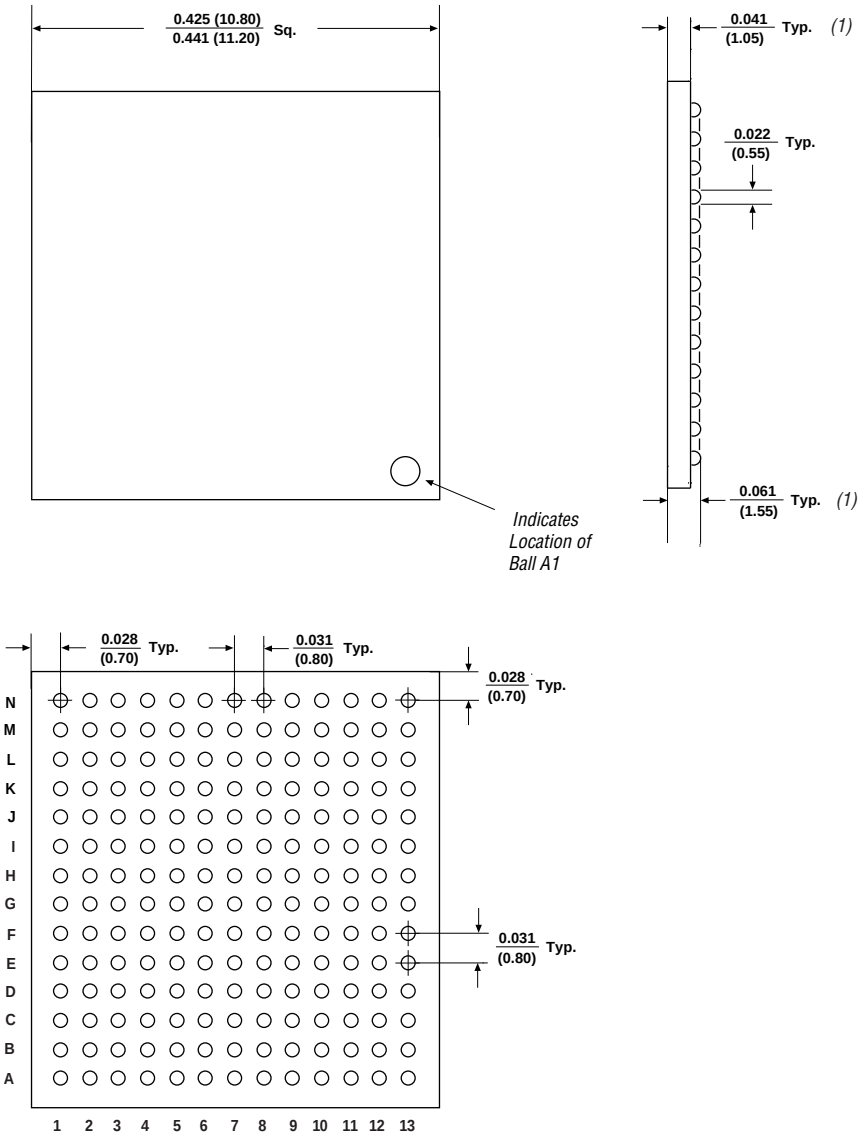
Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.





169-Pin Ultra FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.

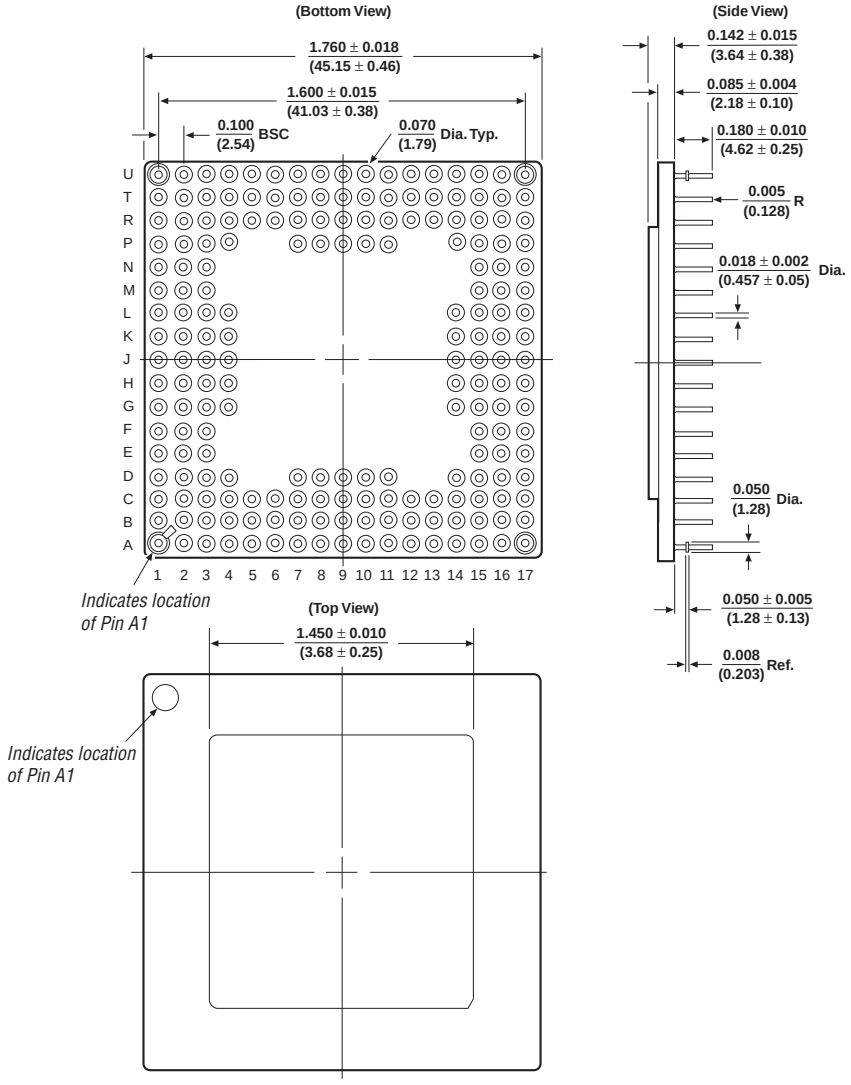


Note:

(1) The EPM7512B uses a thicker version of this package. Package thickness of this EPM7512B device is 1.6 mm typical and total package height is 2.2 mm maximum.

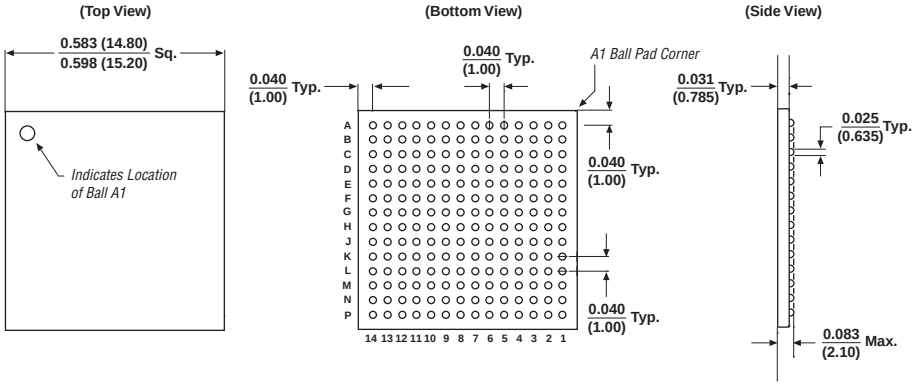
192-Pin Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



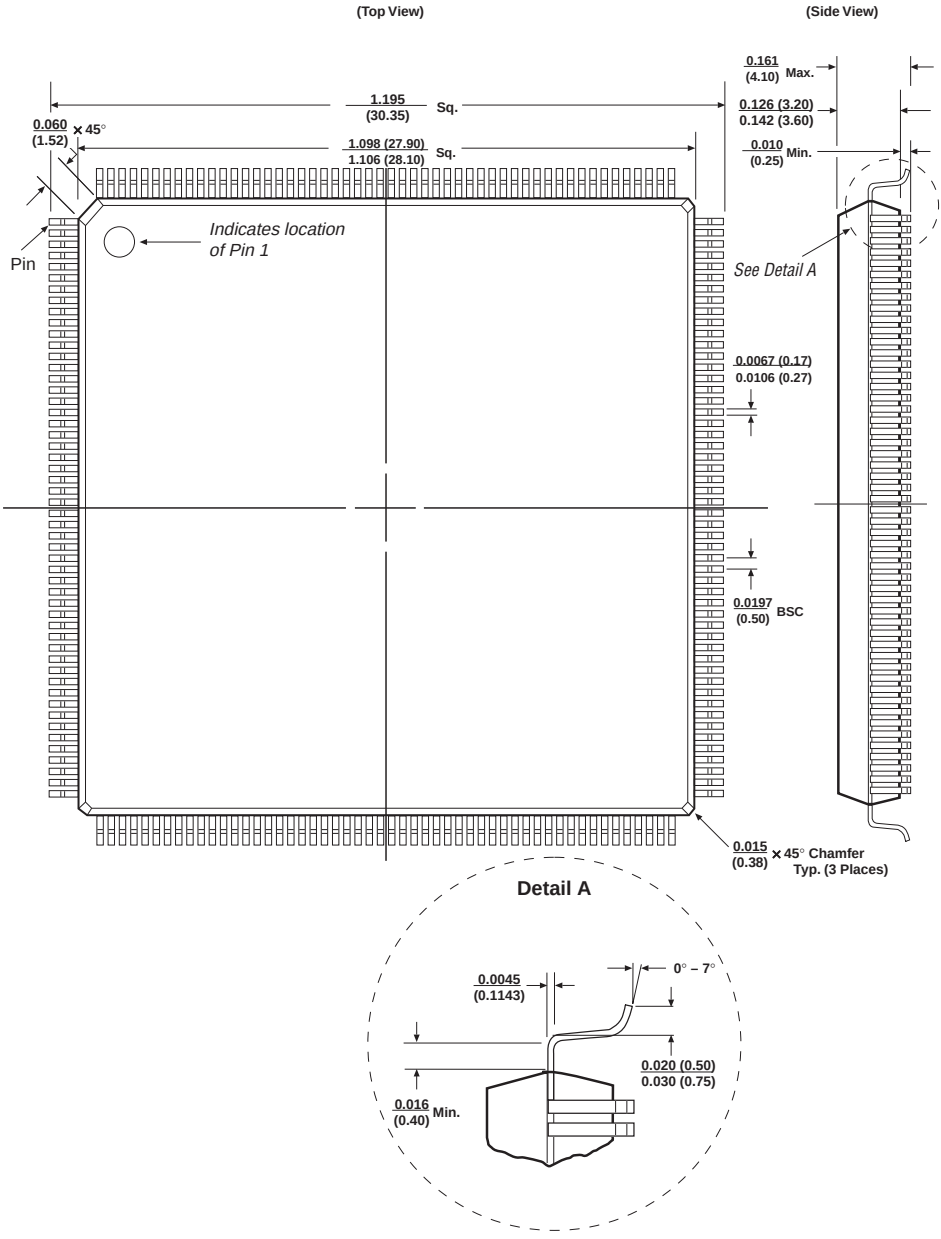
196-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



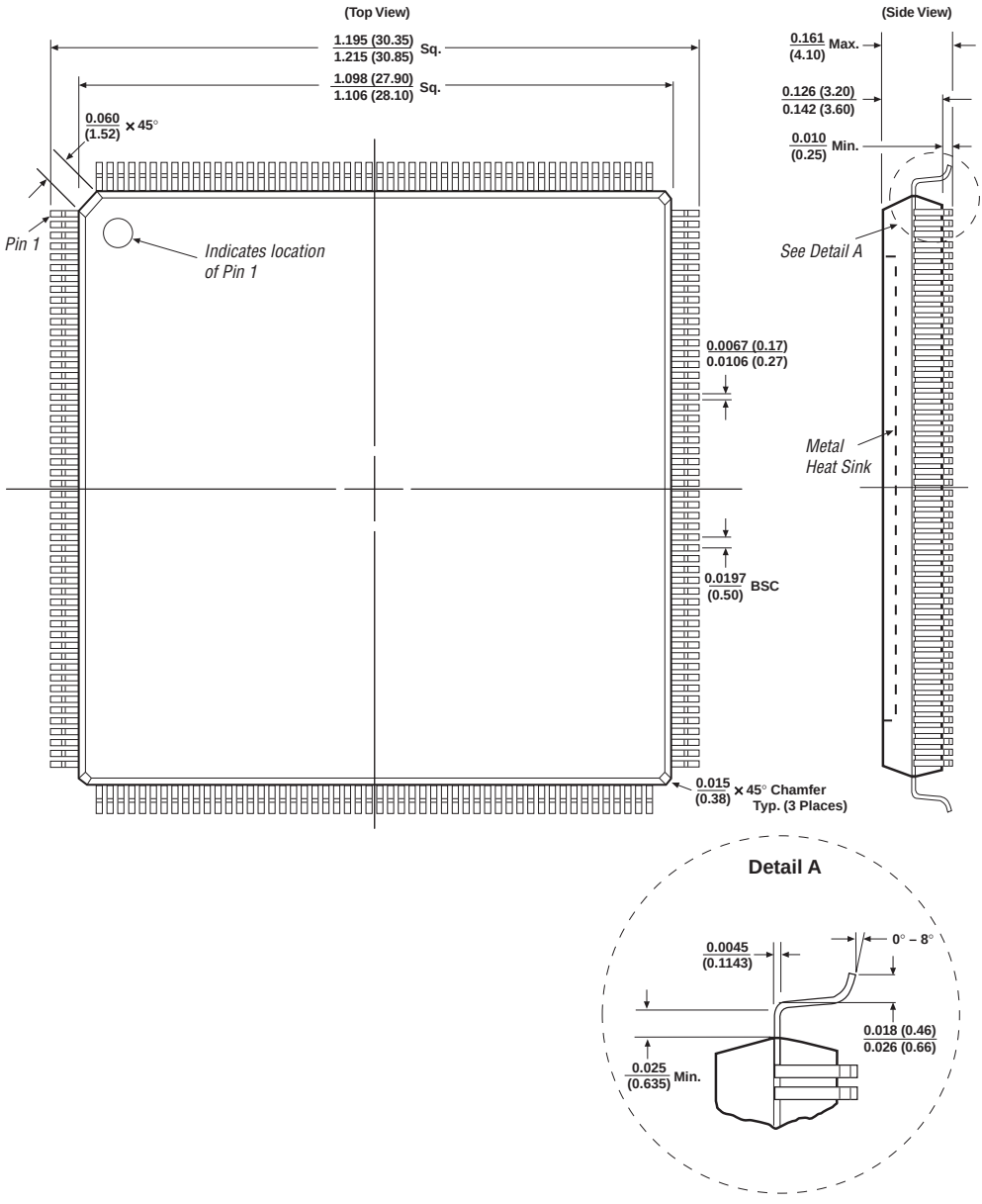
208-Pin Plastic Quad Flat Pack (PQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



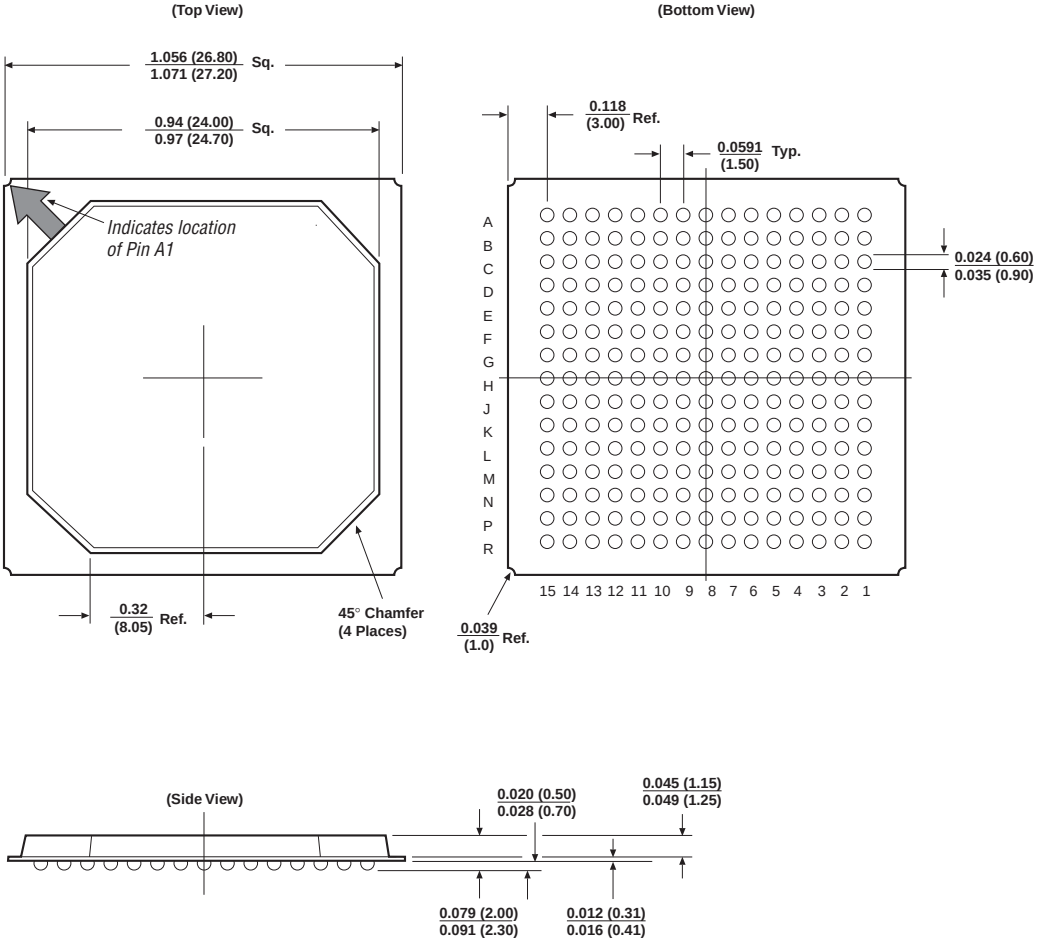
208-Pin Power Quad Flat Pack (RQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



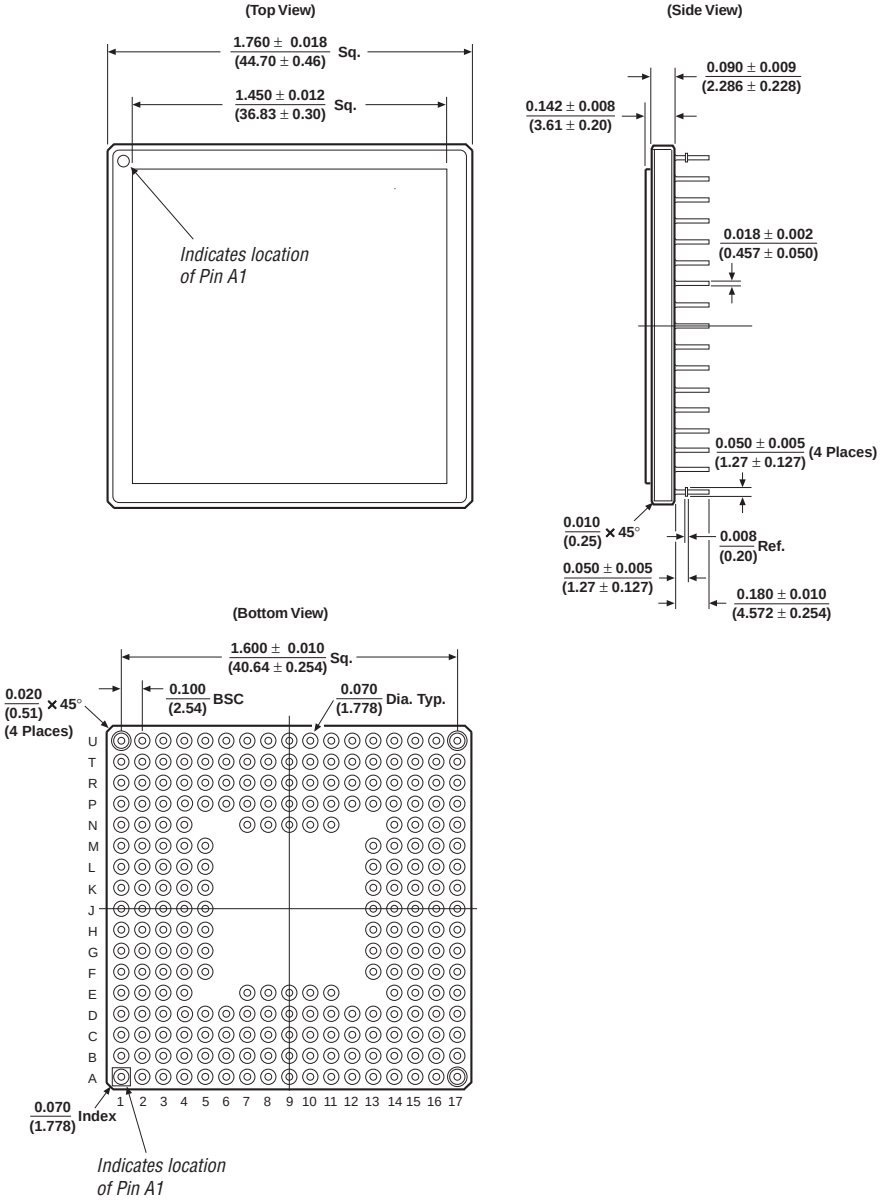
225-Pin Ball-Grid Array (BGA)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



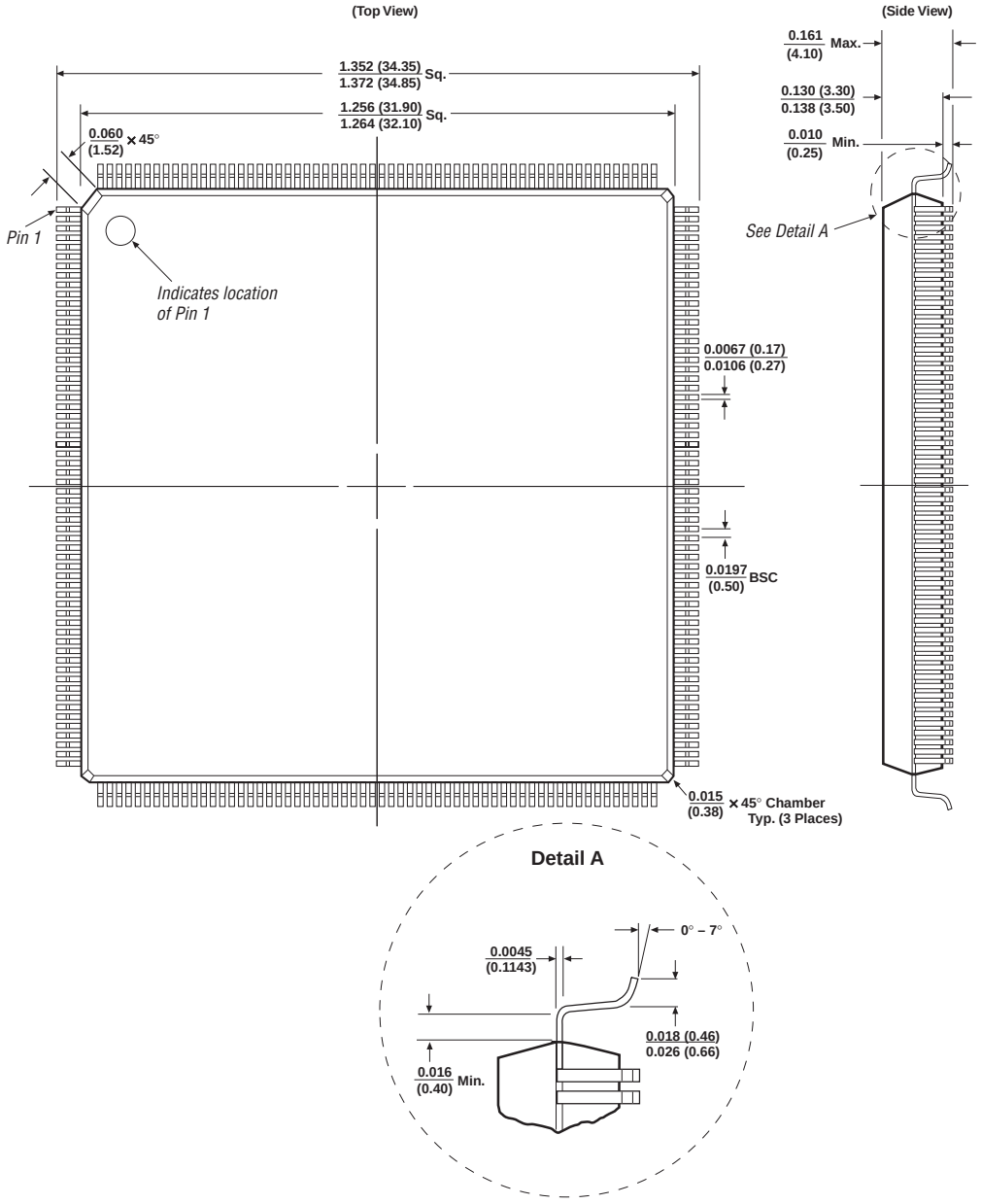
232-Pin Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



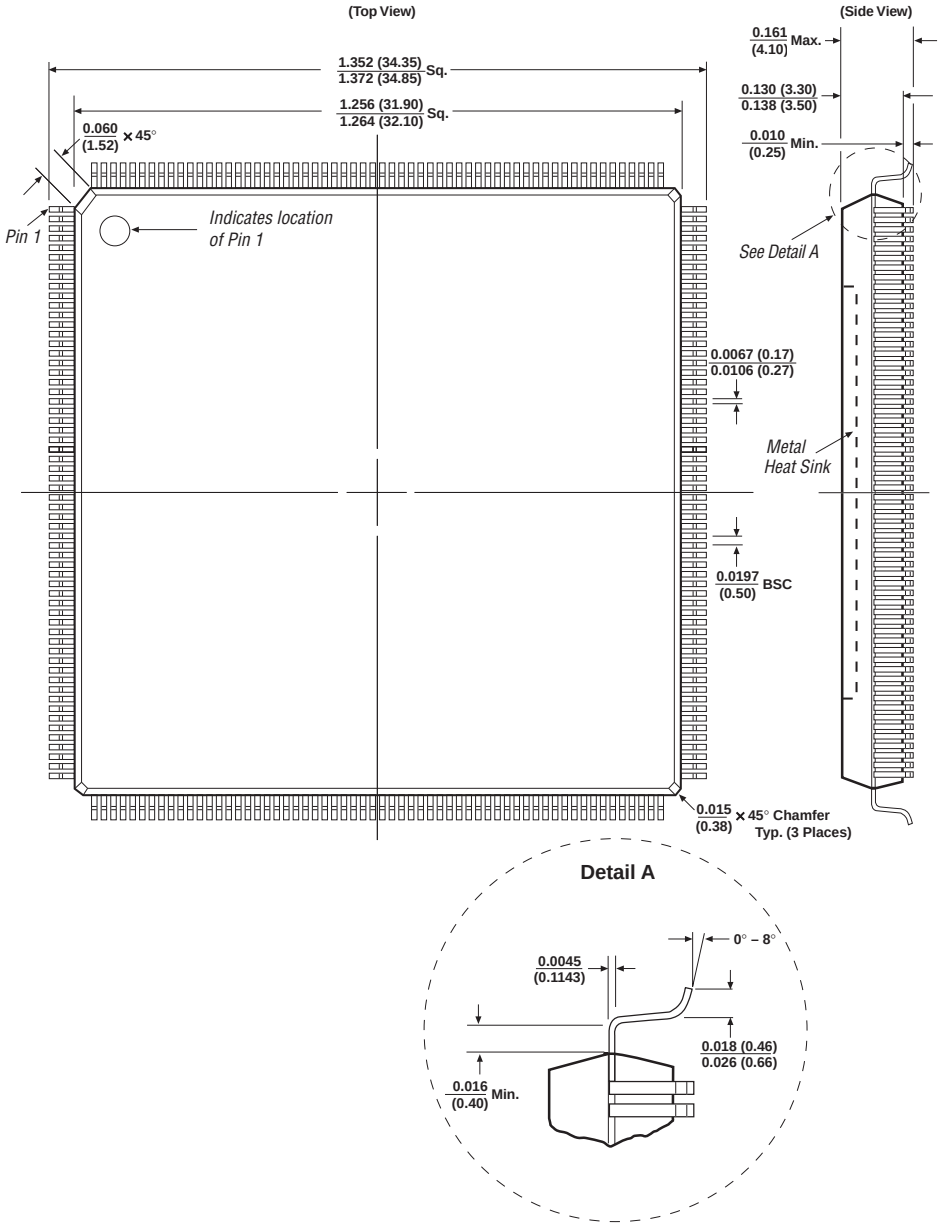
240-Pin Plastic Quad Flat Pack (PQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



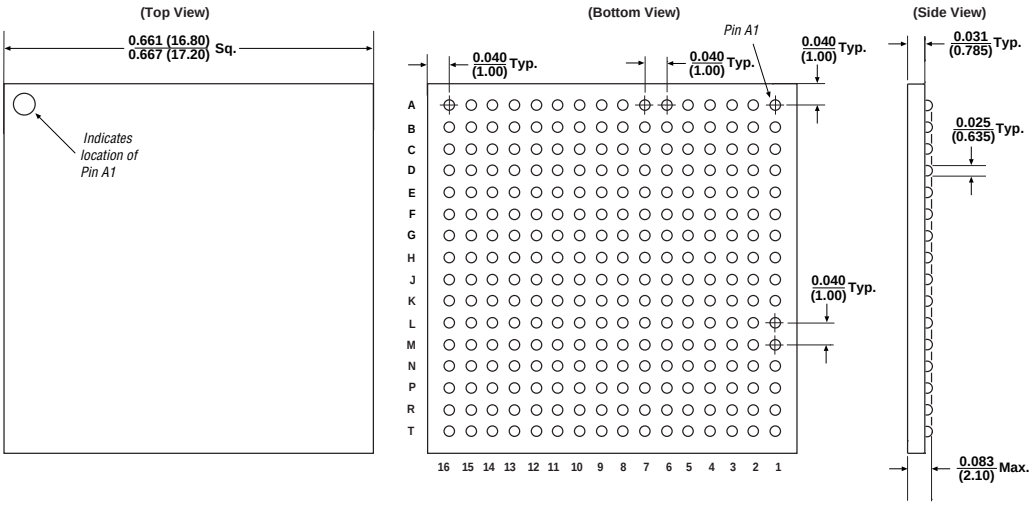
240-Pin Power Quad Flat Pack (RQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



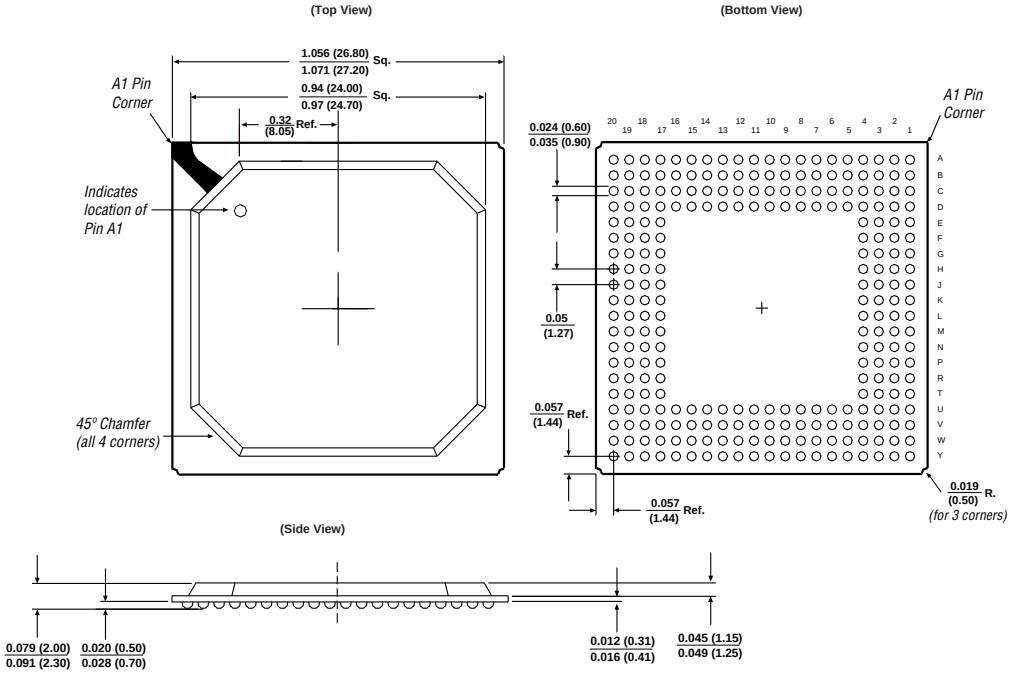
256-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



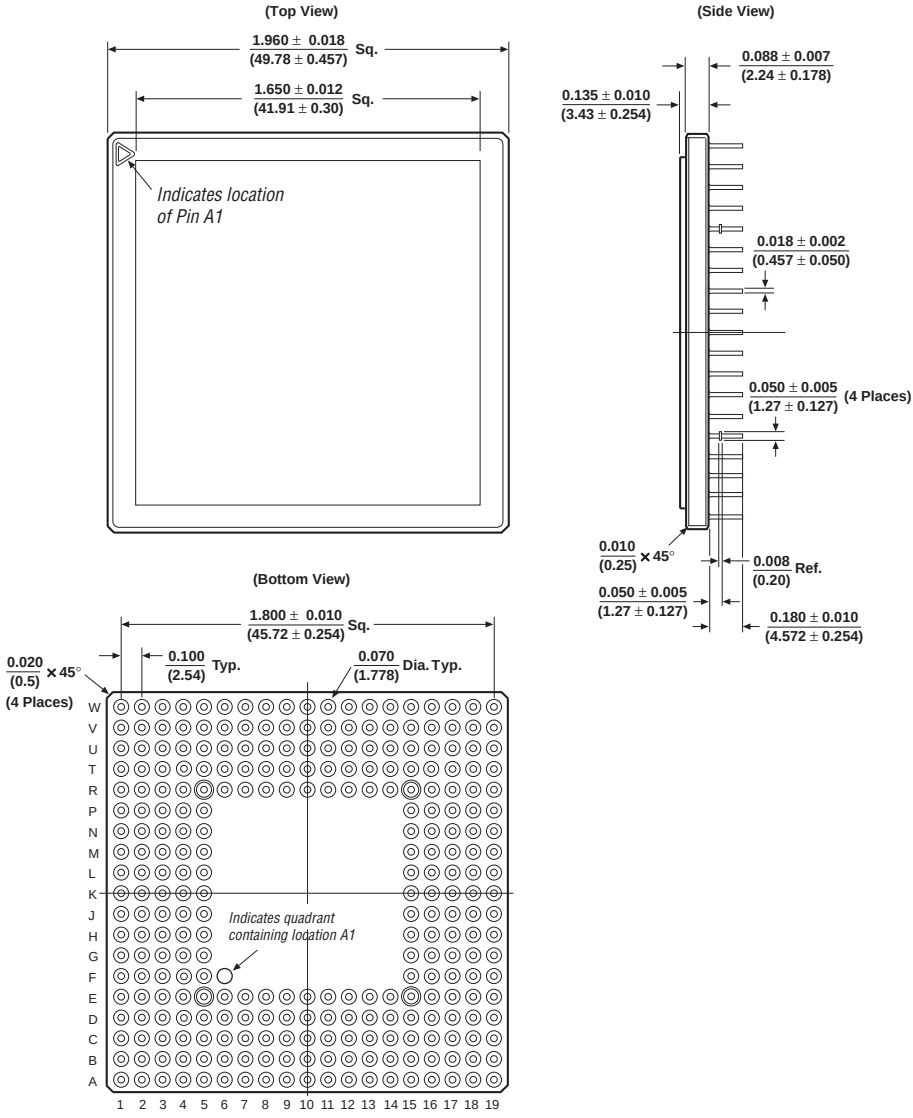
256-Pin Ball-Grid Array (BGA)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



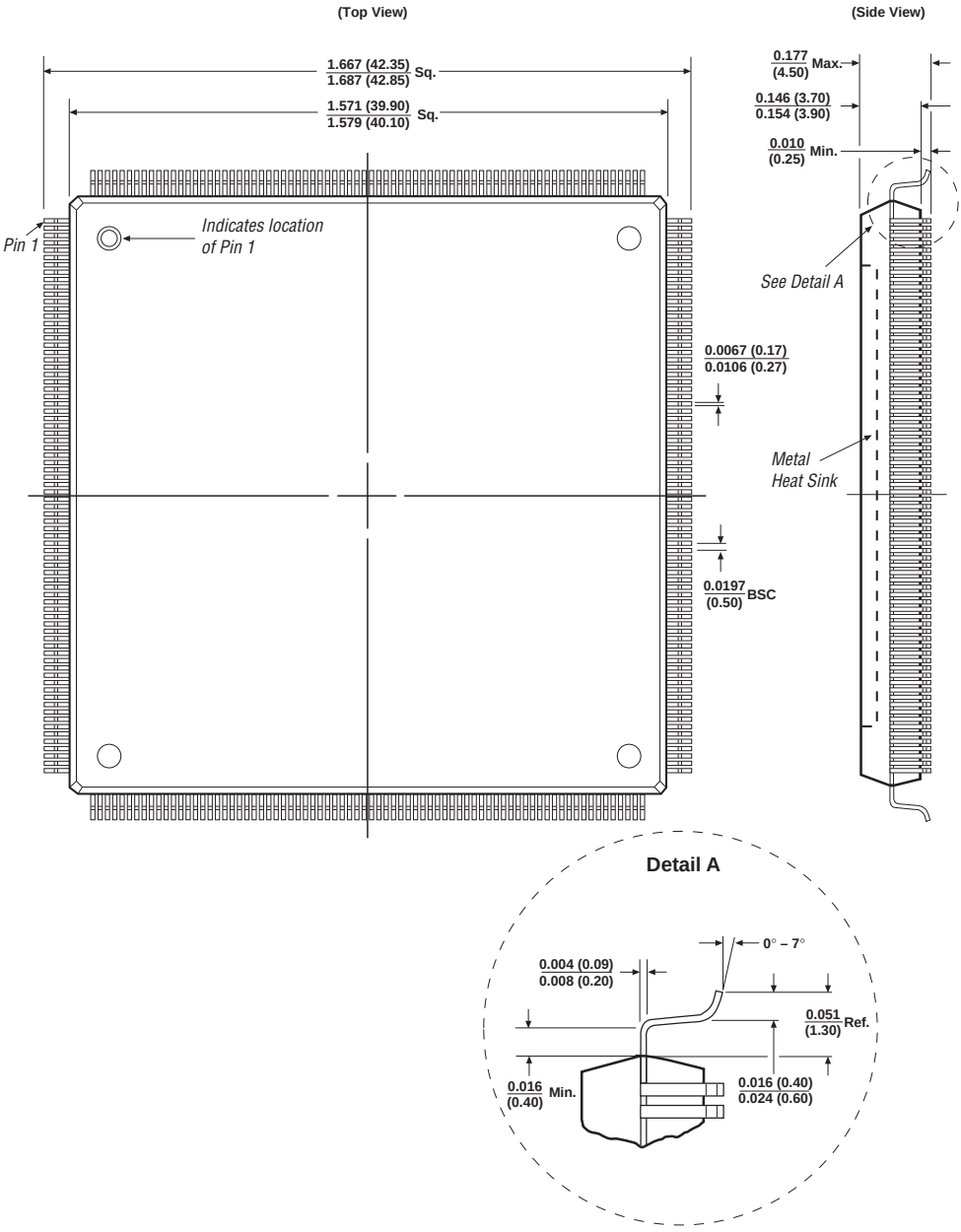
280-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



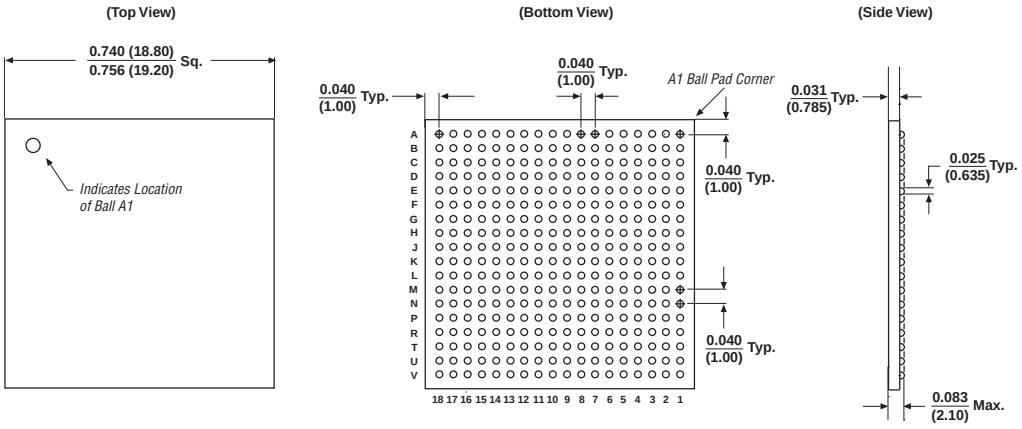
304-Pin Power Quad Flat Pack (RQFP)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



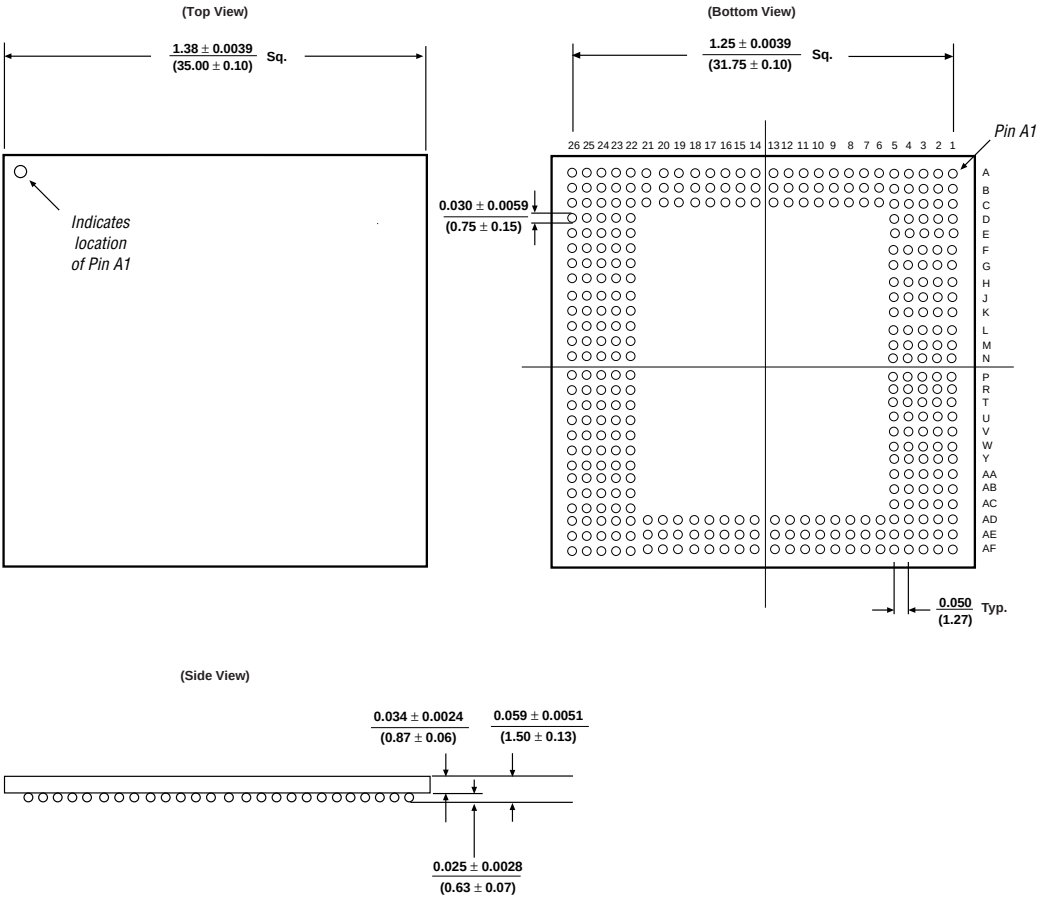
324-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



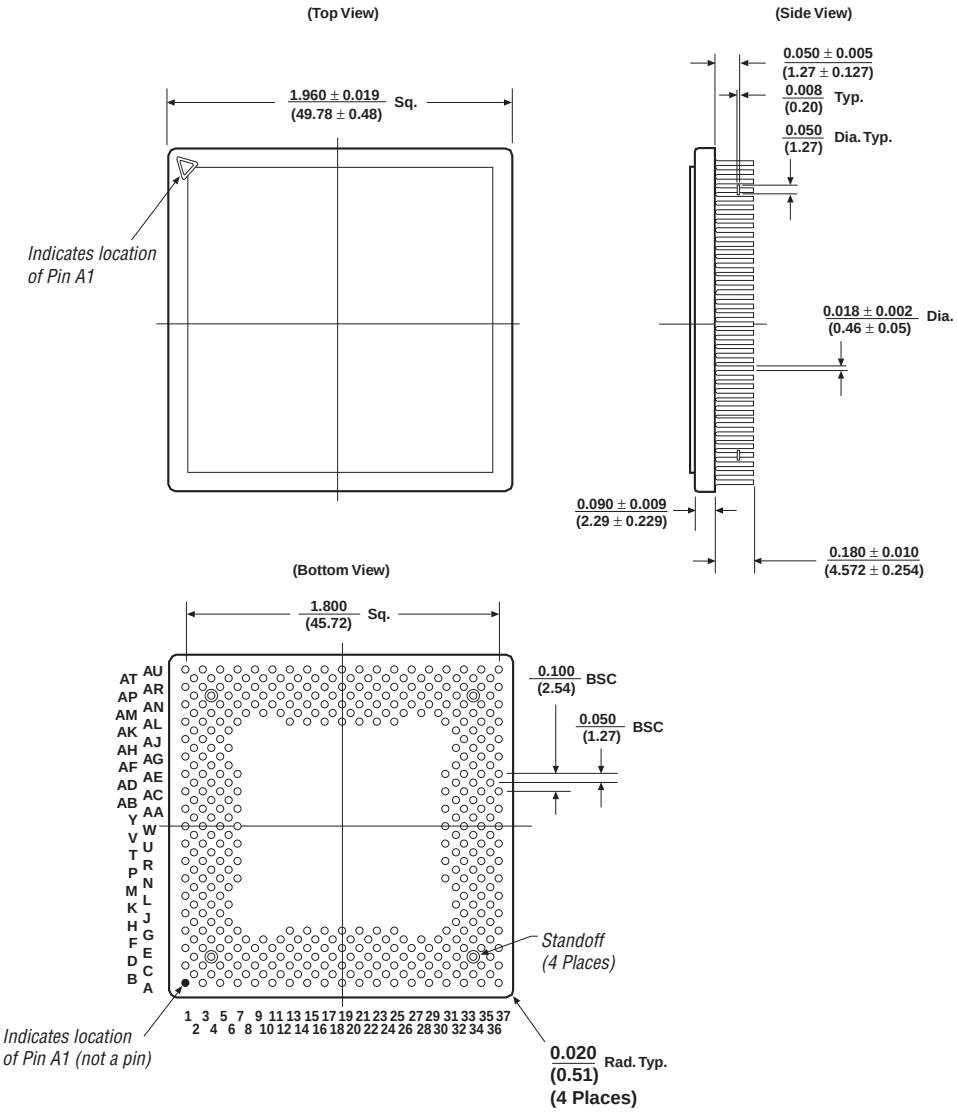
356-Pin Ball-Grid Array (BGA)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



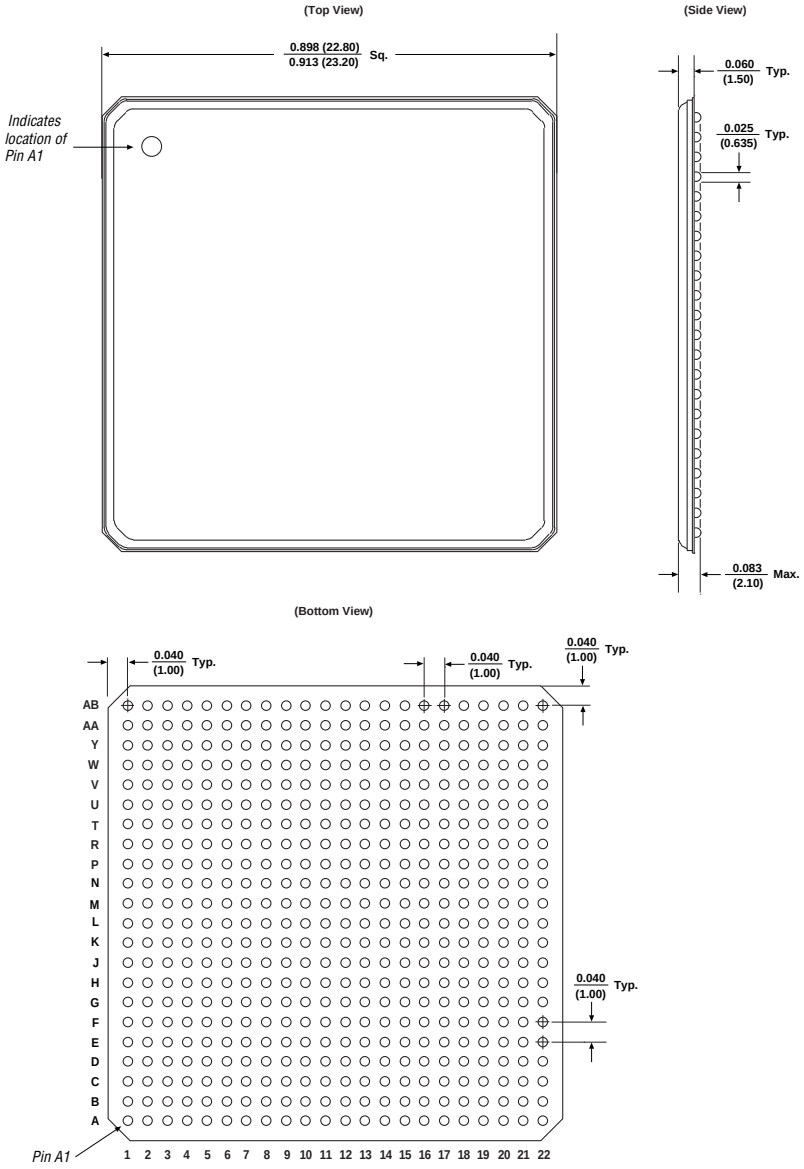
403-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



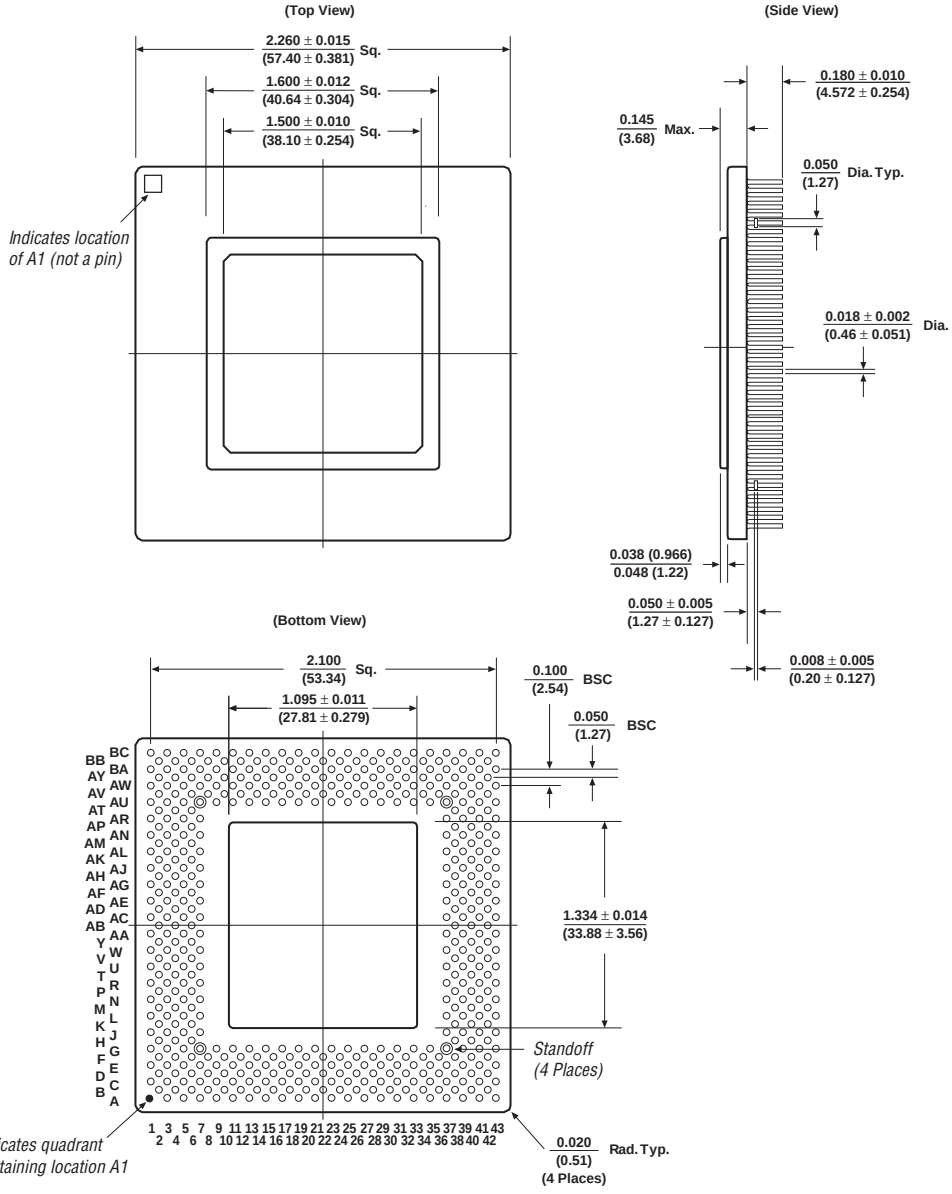
484-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



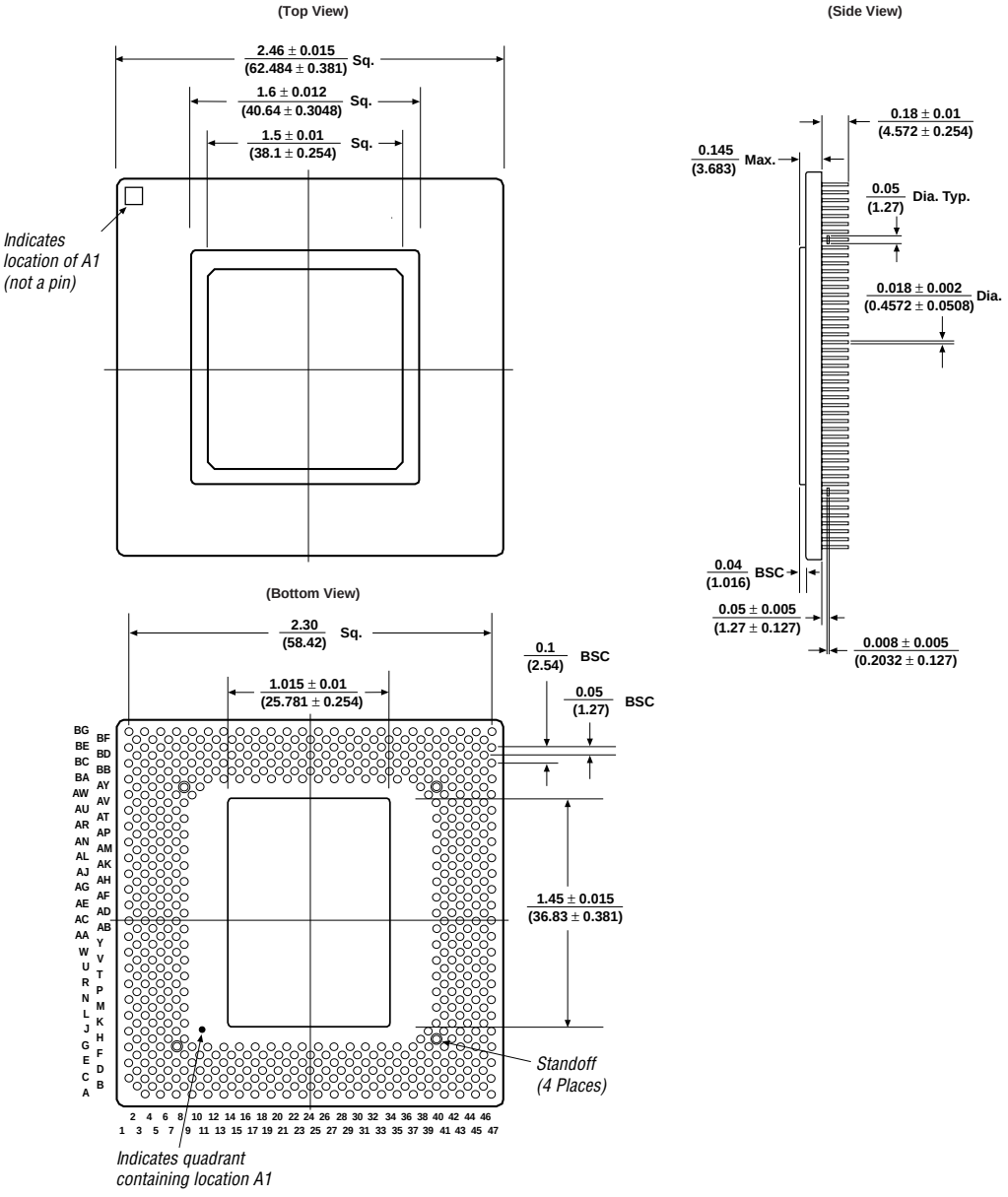
503-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



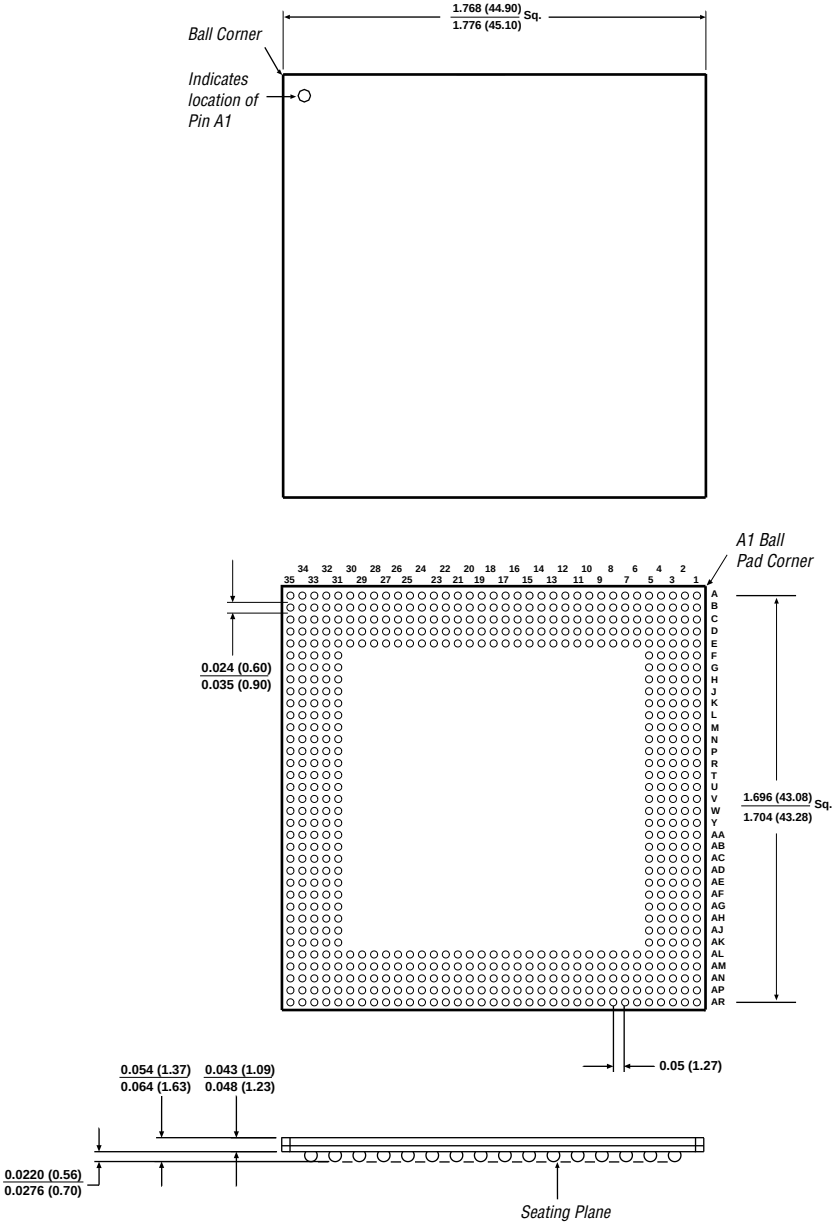
599-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



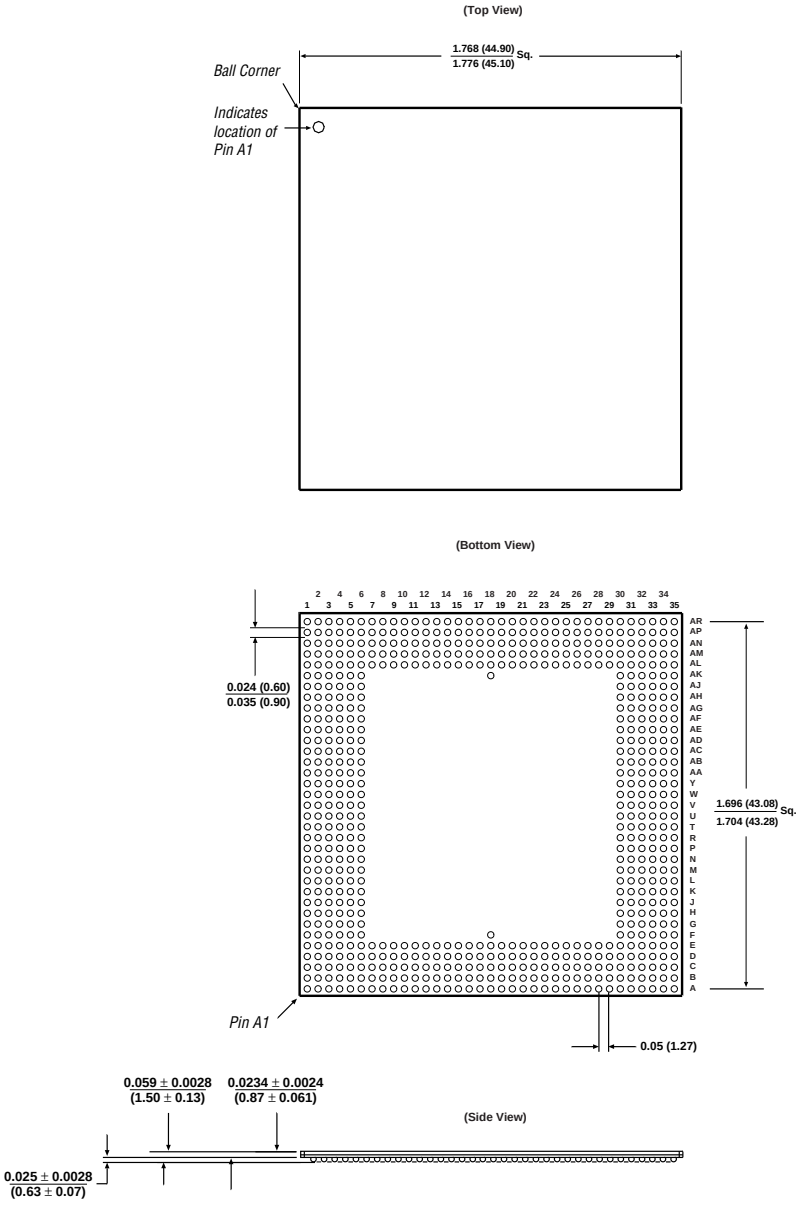
600-Pin Ball-Grid Array (BGA)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats. Metal heat sink is shown in the side view.



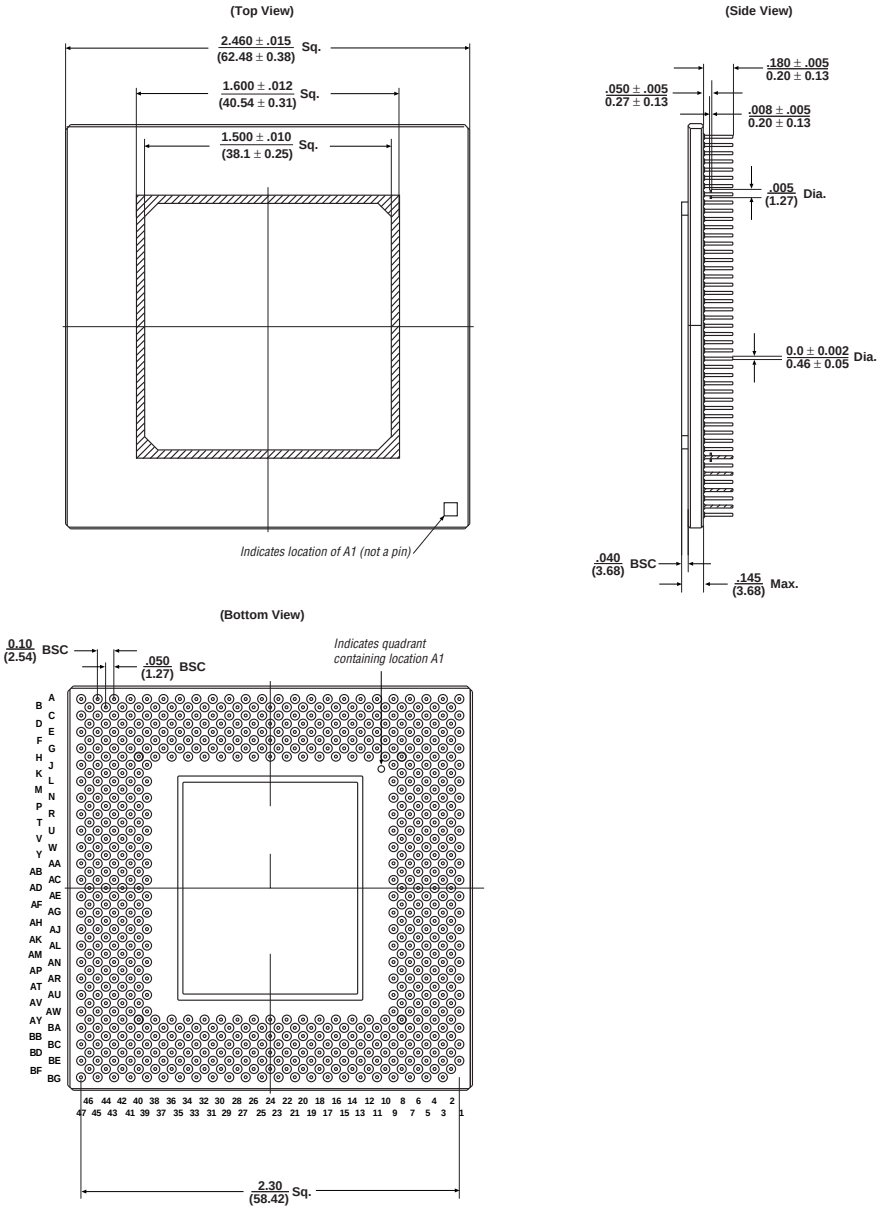
652-Pin Ball-Grid Array (BGA)

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



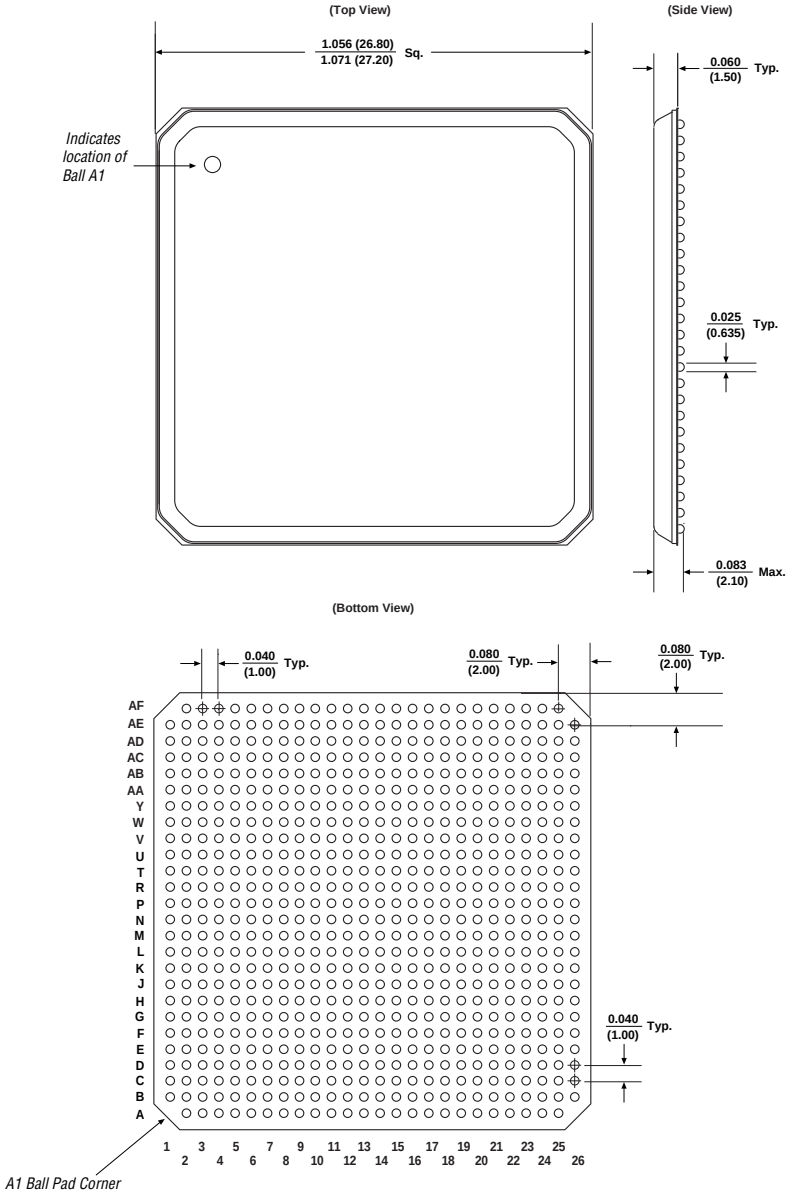
655-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parentheses, are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



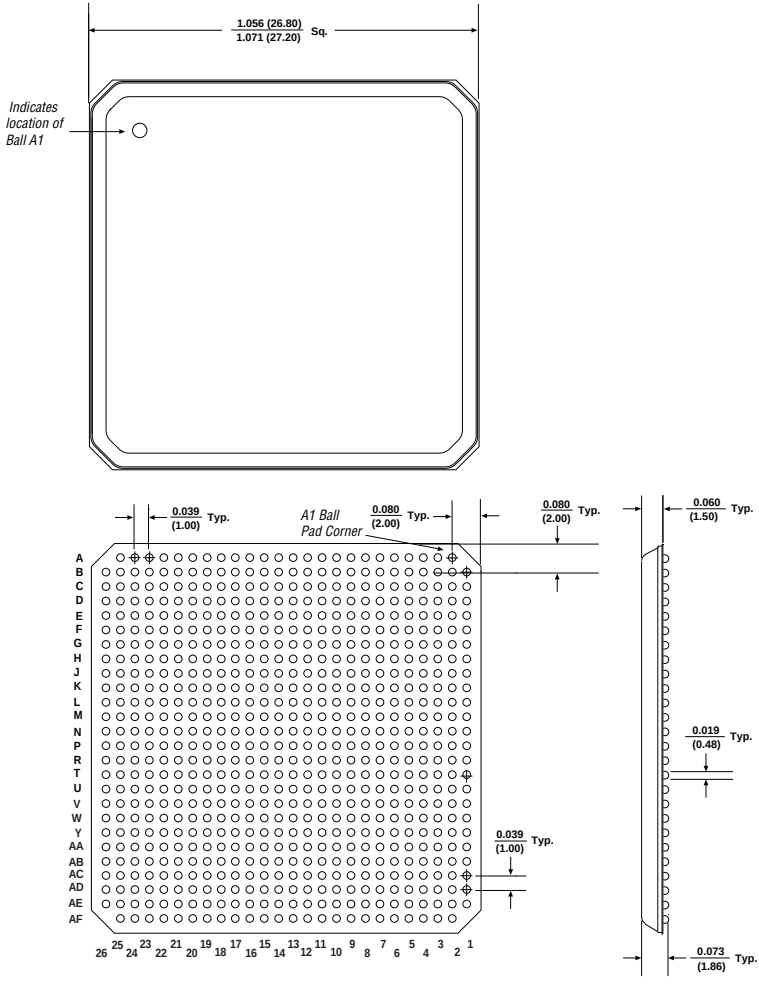
672-Pin FineLine BGA

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



672-Pin Thermally Enhanced FineLine BGA *Note (1)*

Controlling measurement is in millimeters, shown in parentheses. Inch measurements are for reference only. See "Dimension Formats" on page 2-22 of this data sheet for dimension formats.



Note:
(1) Only available in APEX 20K devices.

Revision History

The information contained in the Device Package Information Data Sheet version 8.03 supersedes information published in previous versions.

Version 8.03 contains the following changes:

- Included thermal resistance values for the flip chip device package in Table 2 on page 2.
- Updated A1 ball pad corner placement on page 2-62.
- Adjusted arrow placement on page 2-68.
- Updated figure on page 2-68 with the proper side view values.
- Added 49-pin Ultra FineLine figure on page 2-36.
- Added 169-pin Ultra FineLine figure on page 2-49.
- Included Ultra FineLine BGA information in Table 1 on page 1.
- Updated Table 7 on page 9 with Ultra FineLine BGA information.
- Updated Tables 12, 13 and 14 page 2-16 with Ultra FineLine BGA information.