

## 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.

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 the Sumitomo Corporation.

## Thermal Resistance

Tables 2 through 11 provide  $\theta_{JA}$  (junction-to-ambient thermal resistance) and  $\theta_{JC}$  (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 3000A, Classic™, and configuration devices.

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

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EP20K30E	144	TQFP	8.0	29.0	28.0	26.0	25.0
	208	PQFP	5.0	30.0	29.0	27.0	22.0
	144	FineLine BGA	14.0	36.0	34.0	32.0	29.0
	324	FineLine BGA	9.0	31.0	29.0	28.0	25.0
EP20K60E	144	TQFP	7.0	28.0	26.0	25.0	24.0
	144	FineLine BGA	11.0	33.0	32.0	30.0	27.0
	208	PQFP	5.0	30.0	28.0	26.0	21.0
	240	PQFP	4.0	26.0	24.0	21.0	17.0
	324	FineLine BGA	7.0	29.0	28.0	26.0	24.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
EP20K100 EP20K100E	144	TQFP	7.0	26.0	25.0	24.0	23.0
	144	FineLine BGA	9.0	32.0	30.0	29.0	26.0
	208	PQFP	5.0	29.0	27.0	25.0	20.0
	240	PQFP	4.0	25.0	23.0	20.0	17.0
	324	FineLine BGA	6.0	28.0	26.0	25.0	23.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
EP20K160E	144	TQFP	6.0	25.0	24.0	23.0	22.0
	208	PQFP	5.0	28.0	26.0	23.0	19.0
	240	PQFP	4.0	24.0	21.0	19.0	16.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	24.0	23.0	22.0	21.0
EP20K200	208	PQFP	4.0	25.0	23.0	20.0	17.0
	240	PQFP	3.0	21.0	19.0	17.0	15.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	22.0	21.0	20.0	19.0
EP20K200E	240	PQFP	3.0	22.0	19.0	18.0	16.0
	356	BGA	2.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	23.0	22.0	21.0	20.0
	652	BGA	1.0	12.0	11.0	10.0	9.0
	672	FineLine BGA	5.0	21.0	20.0	19.0	18.0

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

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EP20K300E	208	PQFP	4.0	26.0	21.0	19.0	16.0
	240	PQFP	3.0	19.0	18.0	16.0	15.0
	652	BGA	1.0	12.0	11.0	10.0	9.0
	672	FineLine BGA	5.0	20.0	19.0	18.0	17.0
EP20K400	652	BGA	0.5	9.0	8.0	7.0	6.0
	655	PGA	1.0	8.0	7.0	6.0	4.0
	672	Flip Chip (3)	0.5	12.0	9.0	8.0	7.0
	672	Flip Chip w/ fin (2), (3)	0.5	7.0	4.0	3.0	2.6
EP20K400E	652	BGA	0.5	9.0	8.0	7.0	6.0
	672	Flip Chip (3)	0.5	12.0	9.0	8.0	7.0
	672	Flip Chip w/ fin (2), (3)	0.5	7.0	4.0	3.0	2.6
EP20K600E	652	BGA	0.5	9.0	8.0	7.0	6.0
	672	Flip Chip (3)	0.5	12.0	9.0	8.0	7.0
	672	Flip Chip w/ fin (2), (3)	0.5	5.0	3.0	3.0	2.0
	1,020	Flip Chip (3)	0.5	11.0	8.0	7.0	6.0
	1,020	Flip Chip w/ fin (2), (3)	0.5	5.0	3.0	3.0	2.0
EP20K1000E	652	Flip Chip (4)	0.5	9.0	6.0	5.0	4.0
	652	Flip Chip w/ fin (2), (3)	0.5	4.0	3.0	3.0	2.0
	672	Flip Chip (3)	0.5	11.0	8.0	7.0	6.0
	672	Flip Chip w/ fin (2), (4)	0.5	6.0	4.0	3.0	2.0
	1,020	Flip Chip (3)	0.5	10.0	7.0	6.0	5.0
	1,020	Flip Chip w/ fin (3)	0.5	5.0	3.0	2.0	2.0
EP20K1500E	652	Flip Chip (4)	0.5	9.0	6.0	5.0	4.0
	652	Flip Chip w/ fin (2), (4)	0.5	4.0	3.0	2.5	2.0
	1,020	Flip Chip	0.5	10.0	7.0	6.0	5.0
	1,020	Flip Chip w/ fin (2), (3)	0.5	5.0	3.0	2.5	2.0

**Notes:**

- (1) For thermal resistance values, contact Altera Applications.
- (2) The fin specifications are as follows: width: 0.25 mm; height: 7.0 mm; height: 7.0 mm; pitch: 1.5 mm; base thickness: 0.5 mm.
- (3) Flip Chip packages are based on Altera FineLine BGA packages
- (4) This package is a standard BGA device package.

**Table 3. Thermal Resistance of ACEX 1K Devices**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EP1K10	100	TQFP	11.0	37.0	35.0	33.0	29.0
	144	TQFP	8.0	31.0	29.0	28.0	25.0
	208	PQFP	6.0	30.0	29.0	27.0	22.0
	256	FineLine BGA	12.0	37.0	35.0	33.0	30.0
	484	FineLine BGA	7.0	30.0	29.0	28.0	25.0
EP1K30	144	TQFP	8.0	28.0	27.0	26.0	24.0
	208	PQFP	5.0	30.0	28.0	26.0	21.0
	256	FineLine BGA	9.0	31.0	29.0	28.0	25.0
EP1K50	144	TQFP	7.0	26.0	25.0	24.0	23.0
	208	PQFP	5.0	29.0	28.0	25.0	20.0
	256	FineLine BGA	7.0	30.0	28.0	27.0	24.0
	484	FineLine BGA	5.0	25.0	24.0	23.0	22.0
EP1K100	208	PQFP	5.0	28.0	26.0	23.0	18.0
	256	FineLine BGA	6.0	28.0	26.0	25.0	23.0
	484	FineLine BGA	5.0	24.0	23.0	22.0	21.0

**Table 4. Thermal Resistance of FLEX 10K Devices (Part 1 of 3)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPF10K10	84	PLCC	9.0	28.0	26.0	24.0	22.0
	144	TQFP	7.0	26.0	25.0	24.0	23.0
	208	PQFP	5.0	29.0	27.0	25.0	20.0
EPF10K10A	100	TQFP	10.0	35.0	33.0	31.0	28.0
	144	TQFP	7.0	29.0	28.0	26.0	25.0
	208	PQFP	5.0	30.0	29.0	27.0	21.0
	256	FineLine BGA	7.0	33.0	30.0	28.0	26.0
EPF10K20	144	TQFP	6.0	24.0	23.0	22.0	21.0
	208	RQFP	1.0	17.0	16.0	15.0	13.0
	240	RQFP	1.0	14.0	12.0	11.0	10.0

**Table 4. Thermal Resistance of FLEX 10K Devices (Part 2 of 3)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPF10K30	208	RQFP	1.0	17.0	16.0	15.0	12.0
	240	RQFP	1.0	13.0	12.0	11.0	10.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
EPF10K30A	144	TQFP	7.0	25.0	24.0	23.0	22.0
	208	PQFP	5.0	29.0	27.0	24.0	19.0
	240	PQFP	4.0	25.0	22.0	20.0	17.0
	256	FineLine BGA	6.0	28.0	26.0	24.0	23.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	24.0	22.0	21.0	20.0
EPF10K30E	144	TQFP	9.0	28.0	27.0	26.0	24.0
	208	PQFP	5.0	30.0	28.0	26.0	21.0
	256	FineLine BGA	9.0	31.0	29.0	28.0	25.0
	484	FineLine BGA	6.0	26.0	25.0	24.0	22.0
EPF10K40	208	RQFP	1.0	17.0	16.0	15.0	12.0
	240	RQFP	1.0	13.0	12.0	11.0	10.0
EPF10K50	240	RQFP	1.0	12.0	11.0	10.0	9.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	403	PGA	3.0	12.0	10.0	9.0	8.0
		PGA (1)	3.0	10.0	8.0	7.0	6.0
EPF10K50V	240	RQFP	1.0	13.0	12.0	11.0	10.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	23.0	22.0	21.0	20.0
EPF10K50E	144	TQFP	9.0	26.0	25.0	24.0	23.0
	208	PQFP	5.0	29.0	27.0	24.0	19.0
	240	PQFP	4.0	25.0	22.0	20.0	17.0
	256	FineLine BGA	6.0	29.0	27.0	26.0	24.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	25.0	24.0	23.0	21.0
EPF10K50S	144	TQFP	9.0	26.0	25.0	24.0	23.0
	208	PQFP	5.0	29.0	28.0	25.0	20.0
	240	PQFP	4.0	26.0	23.0	20.0	17.0
	256	FineLine BGA	7.0	30.0	28.0	27.0	24.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	25.0	24.0	23.0	22.0
EPF10K70	240	RQFP	1.0	12.0	11.0	10.0	9.0
	503	PGA	1.0	8.0	7.0	6.0	4.0

**Table 4. Thermal Resistance of FLEX 10K Devices (Part 3 of 3)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPF10K100	503	PGA	1.0	8.0	7.0	6.0	4.0
		PGA (1)	1.0	6.0	5.0	4.0	3.0
		PGA (2)	–	2.0	–	–	–
EPF10K100A	240	RQFP	1.0	13.0	11.0	10.0	9.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	22.0	21.0	20.0	18.0
	600	BGA	0.5	10.0	9.0	8.0	7.0
EPF10K100E	208	PQFP	5.0	28.0	26.0	23.0	18.0
	240	PQFP	4.0	23.0	21.0	19.0	16.0
	256	FineLine BGA	6.0	28.0	26.0	25.0	23.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	24.0	23.0	22.0	21.0
EPF10K130V	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	0.5	10.0	9.0	8.0	7.0
EPF10K130E	240	PQFP	4.0	21.0	19.0	17.0	15.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	23.0	22.0	21.0	20.0
	600	BGA	0.5	10.0	9.0	8.0	7.0
	672	FineLine BGA	5.0	21.0	20.0	19.0	18.0
EPF10K200E	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	0.5	10.0	9.0	8.0	7.0
	672	FineLine BGA	5.0	20.0	19.0	18.0	17.0
EPF10K200S	240	RQFP	1.0	13.0	11.0	10.0	9.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
	484	FineLine BGA	5.0	22.0	21.0	20.0	19.0
	600	BGA	0.5	10.0	9.0	8.0	7.0
	672	FineLine BGA	5.0	21.0	20.0	19.0	18.0
EPF10K250A	599	PGA	1.0	8.0	7.0	6.0	4.0
	600	BGA	0.5	10.0	9.0	8.0	7.0

**Notes:**

- (1) Attached pin-fin heat sink.  
(2) Attached motor driven fan heat sink.

**Table 5. Thermal Resistance of FLEX 8000 Devices**

Device	Pin Count	Package	$\theta_{JC}$ ( $^{\circ}$ C/W)	$\theta_{JA}$ ( $^{\circ}$ C/W) Still Air	$\theta_{JA}$ ( $^{\circ}$ C/W) 100 ft./min.	$\theta_{JA}$ ( $^{\circ}$ C/W) 200 ft./min.	$\theta_{JA}$ ( $^{\circ}$ C/W) 400 ft./min.
EPF8282A	84	PLCC	10.0	30.0	28.0	26.0	23.0
	100	TQFP	11.0	36.0	34.0	32.0	29.0
EPF8452A	84	PLCC	10.0	30.0	28.0	26.0	23.0
	100	TQFP	11.0	35.0	33.0	31.0	28.0
	160	PQFP	6.0	32.0	31.0	30.0	28.0
	160	PGA	6.0	20.0	13.0	10.0	8.0
EPF8636A	84	PLCC	10.0	29.0	28.0	26.0	23.0
	160	PQFP	6.0	32.0	31.0	30.0	27.0
	192	PGA	6.0	16.0	11.0	8.0	6.0
	208	PQFP	5.0	30.0	38.0	26.0	20.0
	208	RQFP	1.0	17.0	16.0	15.0	14.0
EPF8820A	144	TQFP	9.0	26.0	25.0	24.0	23.0
	160	PQFP	6.0	32.0	31.0	30.0	27.0
	192	PGA	6.0	16.0	11.0	8.0	6.0
	208	PQFP	5.0	29.0	27.0	25.0	20.0
	208	RQFP	1.0	17.0	16.0	15.0	14.0
	225	BGA	6.0	28.0	19.0	14.0	11.0
EPF81188A	208	PQFP	5.0	28.0	26.0	24.0	19.0
	232	PGA	2.0	14.0	10.0	7.0	5.0
	240	PQFP	4.0	24.0	21.0	19.0	16.0
	240	RQFP	1.0	14.0	12.0	11.0	10.0
EPF81500A	240	PQFP	4.0	22.0	20.0	19.0	16.0
	240	RQFP	1.0	13.0	12.0	11.0	10.0
	280	PGA	2.0	14.0	10.0	7.0	5.0
	304	RQFP	1.0	11.0	10.0	9.0	8.0

**Table 6. Thermal Resistance of FLEX 6000 Devices**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPF6016	144	TQFP	10.0	28.0	26.0	25.0	24.0
	208	PQFP	5.0	30.0	28.0	26.0	21.0
	240	PQFP	4.0	26.0	24.0	21.0	17.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
EPF6016A	100	TQFP	11.0	35.0	33.0	31.0	28.0
		FineLine BGA	14.0	36.0	34.0	32.0	29.0
	144	TQFP	10.0	29.0	28.0	26.0	24.0
	208	PQFP	5.0	30.0	29.0	26.0	21.0
	256	FineLine BGA	10.0	32.0	30.0	29.0	26.0
EPF6024A	144	TQFP	10.0	27.0	26.0	25.0	24.0
	208	PQFP	5.0	29.0	28.0	26.0	20.0
	240	PQFP	4.0	26.0	23.0	21.0	17.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
		FineLine BGA	8.0	30.0	29.0	27.0	25.0



**Table 7. Thermal Resistance of MAX 9000 Devices**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPM9320	84	PLCC	9.0	29.0	27.0	25.0	23.0
	208	RQFP	1.0	17.0	16.0	15.0	13.0
	280	PGA	2.0	14.0	10.0	7.0	5.0
	356	BGA	2.0	14.0	12.0	11.0	10.0
EPM9320A	84	PLCC	9.0	29.0	27.0	26.0	23.0
	208	RQFP	2.0	17.0	16.0	15.0	13.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
EPM9400	84	PLCC	9.0	29.0	27.0	25.0	23.0
	208	RQFP	1.0	17.0	16.0	15.0	13.0
	240	RQFP	1.0	14.0	12.0	11.0	10.0
EPM9480	208	RQFP	1.0	17.0	16.0	15.0	12.0
	240	RQFP	1.0	12.0	11.0	10.0	9.0
EPM9480A	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	1.0	17.0	16.0	15.0	12.0
	240	RQFP	1.0	12.0	11.0	10.0	9.0
	280	PGA	2.0	14.0	10.0	7.0	5.0
	304	RQFP	1.0	12.0	11.0	10.0	9.0
	356	BGA	1.0	12.0	11.0	10.0	9.0
EPM9560A	208	RQFP	1.0	17.0	16.0	15.0	12.0
	240	RQFP	1.0	11.0	10.0	9.0	8.0
	356	BGA	1.0	12.0	11.0	10.0	9.0

**Table 8. Thermal Resistance of MAX 7000 Devices (Part 1 of 4)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPM7032	44	PLCC	10.0	33.0	31.0	30.0	27.0
		PQFP	15.0	48.0	46.0	45.0	42.0
		TQFP	14.0	46.0	44.0	43.0	40.0
EPM7032B	44	PLCC	10.0	33.0	31.0	30.0	27.0
		TQFP	14.0	46.0	44.0	43.0	40.0
	49	Ultra FineLine BGA	23.0	69.0	67.0	66.0	62.0
EPM7032S	44	PLCC	10.0	33.0	31.0	30.0	27.0
		TQFP	14.0	46.0	44.0	43.0	40.0

**Table 8. Thermal Resistance of MAX 7000 Devices (Part 2 of 4)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPM7032V	44	PLCC	9.0	31.0	30.0	28.0	25.0
		TQFP	14.0	45.0	44.0	42.0	39.0
EPM7032AE	44	PLCC	9.0	31.0	30.0	28.0	25.0
		TQFP	14.0	46.0	45.0	43.0	40.0
EPM7064S	44	PLCC	9.0	31.0	30.0	28.0	25.0
		TQFP	14.0	46.0	44.0	43.0	40.0
	84	PLCC	9.0	28.0	26.0	25.0	23.0
EPM7064	100	TQFP	11.0	39.0	37.0	35.0	32.0
	44	PLCC	9.0	31.0	30.0	28.0	25.0
		TQFP	13.0	44.0	43.0	41.0	38.0
	68	PLCC	9.0	29.0	28.0	26.0	23.0
84	PLCC	9.0	28.0	26.0	25.0	22.0	
100	PQFP	6.0	33.0	32.0	31.0	30.0	
EPM7064AE EPM7064B	44	PLCC	9.0	31.0	30.0	28.0	25.0
		TQFP	14.0	46.0	45.0	43.0	40.0
	49	Ultra FineLine BGA	23.0	56.0	53.0	51.0	47.0
		100	TQFP	12.0	39.0	37.0	35.0
		FineLine BGA	21.0	49.0	47.0	44.0	40.0
EPM7096	68	PLCC	9.0	29.0	27.0	26.0	23.0
	84	PLCC	9.0	28.0	26.0	24.0	22.0
	100	PQFP	6.0	32.0	31.0	30.0	29.0
EPM7128A	84	PLCC	9.0	28.0	26.0	25.0	22.0
		100	TQFP	11.0	37.0	35.0	33.0
		FineLine BGA	18.0	44.0	42.0	39.0	35.0
	144	TQFP	9.0	31.0	29.0	28.0	25.0
256	FineLine BGA	12.0	38.0	36.0	34.0	31.0	
EPM7128B	49	Ultra FineLine BGA	22.0	53.0	50.0	48.0	44.0
		100	TQFP	11.0	38.0	36.0	34.0
		FineLine BGA	19.0	46.0	44.0	41.0	37.0
	144	TQFP	9.0	32.0	30.0	29.0	26.0
	169	Ultra FineLine BGA	16.0	44.0	42.0	39.0	35.0
256	FineLine BGA	13.0	40.0	38.0	36.0	33.0	

**Table 8. Thermal Resistance of MAX 7000 Devices (Part 3 of 4)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPM7128E	84	PLCC	10.0	29.0	28.0	26.0	23.0
	100	PQFP	6.0	32.0	31.0	30.0	29.0
	160	PQFP	6.0	32.0	31.0	30.0	28.0
EPM7128S	84	PLCC	10.0	30.0	28.0	26.0	23.0
	100	TQFP	12.0	38.0	36.0	34.0	30.0
		PQFP	10.0	35.0	34.0	33.0	32.0
	160	PQFP	7.0	33.0	32.0	31.0	30.0
EPM7128AE	84	PLCC	11.0	30.0	28.0	26.0	23.0
	100	TQFP	12.0	38.0	36.0	34.0	30.0
		FineLine BGA	14.0	43.0	40.0	38.0	37.0
	144	TQFP	11.0	33.0	30.0	28.0	26.0
	169	Ultra FineLine BGA	14.0	42.0	40.0	38.0	36.0
	256	FineLine BGA	12.0	39.0	37.0	35.0	31.0
EPM7160E	84	PLCC	10.0	29.0	28.0	26.0	23.0
	100	PQFP	6.0	32.0	31.0	30.0	29.0
	160	PQFP	6.0	33.0	32.0	31.0	30.0
EPM7160S	84	PLCC	10.0	35.0	28.0	26.0	23.0
	100	TQFP	12.0	37.0	35.0	33.0	30.0
	160	PQFP	6.0	33.0	32.0	31.0	30.0
EPM7192S	160	PQFP	6.0	32.0	31.0	30.0	29.0
EPM7192E	160	PGA	6.0	20.0	13.0	10.0	8.0
		PQFP	6.0	32.0	31.0	30.0	26.0
EPM7256A	100	TQFP	9.0	36.0	34.0	32.0	30.0
	144	TQFP	8.0	32.0	27.0	25.0	24.0
	208	PQFP	5.0	30.0	28.0	26.0	21.0
	256	FineLine BGA	12.0	34.0	32.0	29.0	28.0
EPM7256B	100	TQFP	12.0	37.0	35.0	33.0	30.0
		FineLine BGA	13.0	42.0	39.0	37.0	36.0
	144	TQFP	9.0	33.0	29.0	27.0	25.0
	169	Ultra FineLine BGA	13.0	40.0	38.0	36.0	34.0
	208	PQFP	5.0	31.0	29.0	27.0	22.0
	256	FineLine BGA	9.0	34.0	32.0	30.0	28.0

**Table 8. Thermal Resistance of MAX 7000 Devices (Part 4 of 4)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° C/W) 400 ft./min.
EPM7256E	192	PGA	6.0	20.0	13.0	10.0	8.0
	160	PQFP	6.0	31.0	30.0	29.0	25.0
	208	RQFP	1.0	17.0	16.0	15.0	13.0
EPM7256S	208	PQFP	5.0	30.0	29.0	26.0	21.0
		RQFP	1.0	18.0	17.0	16.0	15.0
EPM7256AE	100	TQFP	12.0	37.0	35.0	33.0	30.0
	144	TQFP	9.0	33.0	29.0	27.0	25.0
	208	PQFP	5.0	31.0	29.0	27.0	22.0
	256	FineLine BGA	9.0	34.0	32.0	30.0	28.0
EPM7512AE	144	TQFP	10.0	32.0	27.0	25.0	23.0
	208	PQFP	5.0	30.0	28.0	25.0	21.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
		FineLine BGA	11.0	32.0	30.0	28.0	22.0
EPM7512B	144	TQFP	10.0	32.0	27.0	25.0	24.0
	169	Ultra FineLine BGA	12.0	35.0	33.0	31.0	30.0
	208	PQFP	5.0	30.0	28.0	25.0	21.0
	256	BGA	6.0	28.0	22.0	20.0	19.0
	256	FineLine BGA	11.0	32.0	30.0	28.0	27.0

**Table 9. Thermal Resistance of MAX 3000A Devices**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° C/W) Still Air	$\theta_{JA}$ (° C/W) 100 ft./min.	$\theta_{JA}$ (° C/W) 200 ft./min.	$\theta_{JA}$ (° 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**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° 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)**

Device	Pin Count	Package	$\theta_{JC}$ (° C/W)	$\theta_{JA}$ (° 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
	32	TQFP	17	75
EPC1441	8	PDIP	19	48
	20	PLCC	18	80
	32	TQFP	17	75

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

Device	Pin Count	Package	$\theta_{JC}$ ( $^{\circ}$ C/W)	$\theta_{JA}$ ( $^{\circ}$ C/W)
EPC1	8	PDIP	16	70
	20	PLCC	18	80
EPC2	20	PLCC	18	80
	32	TQFP	17	75
EPC4	44	PLCC	9	52
	144	FineLine BGA	17	75
EPC16	88	Ultra FineLine BGA	(1)	(1)

**Note:**

(1) Contact Altera Applications for this information.

## 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)**

<b>Pins</b>	<b>Package</b>	<b>Weight (grams)</b>
84	JLCC	10.9
84	PGA	10.6
100	PQFP	1.6
100	PGA	14.2
100	TQFP	0.5
100	FineLine BGA	0.5
144	TQFP	1.3
144	FineLine BGA	0.7
160	PQFP	5.4
160	PGA	19.9
169	Ultra FineLine BGA	0.5
192	PGA	21.0
196	FineLine BGA	0.5
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	1.2
280	PGA	29.5
304	RQFP	26.3
324	FineLine BGA	1.5
356	BGA	7.0
403	PGA	47.7
484	FineLine BGA	2.2
484	Flip Chip (2)	3.6
503	PGA	59.0
599	PGA	69.0
600	BGA	12.0
652	BGA	14.9
652	Flip Chip (3)	9.6
672	FineLine BGA	3.0
672	Flip Chip (2)	4.9
1,020	Flip Chip (2)	7.7

**Notes:**

- (1) For package weight information, contact Altera Applications.
- (2) Flip Chip packages are based on Altera FineLine BGA packages.
- (3) This package is a standard BGA device package.

## 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.

<b>Pins</b>	<b>Package</b>	<b>JEDEC Outline</b>	<b>Option</b>
8	PDIP	MS-001	BA
20	PLCC	MS-018	AA
24	CerDIP	MO-030	AF
24	PDIP	MS-001	AF
28	SOIC	MS-013	AE
28	PLCC	MS-018	AB
28	PDIP	MS-001	AG
32	TQFP	MO-026	BBA
40	PDIP	MS-011	AC
44	PLCC	MS-018	AC
44	PQFP	MO-022	AB
44	TQFP	MO-026	BCB
49	Ultra FineLine BGA	MS-216	BAB-2
68	PGA	MO-066	AC
68	PLCC	MS-018	AE
84	PLCC	MS-018	AF
100	PQFP	MO-022	GC-1
100	TQFP	MO-026	BED
100	FineLine BGA	MO-192	AAC-1
144	FineLine BGA	MO-192	AAD-1
144	TQFP	MS-026	BFB
160	PQFP	MS-022	DD-1
160	PGA	MO-067	AG
169	Ultra FineLine BGA	MO-216	BAF-1
192	PGA	MO-067	AJ
208	PQFP	MS-029	FA-1
208	RQFP	MS-029	FA-1
232	PGA	MO-067	AJ
240	RQFP	MS-029	GA



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

Pins	Package	JEDEC Outline	Option
240	PQFP	MS-029	GA
256	FineLine BGA	MS-034	AAF-1
256	SBGA	MO-192	BAL-2
280	PGA	MO-067	AL
304	RQFP	MS-029	JA
324	FineLine BGA	MS-034	AAG-1
356	SBGA	MO-192	BAR-2
403	PGA	MO-128	AL
484	FineLine BGA	MS-034	AAJ-1
484	Flip Chip (3)	MS-034	AAJ-1
503	PGA	MO-128	AN
599	PGA	MO-128	AP
600	SBGA	MO-192	BAW-1
652	BGA	MS-034	BAW-1
652	Flip Chip (4)	MS-034	BAW-1
652	SBGA	MO-192	BAW-1
655	PGA	MO-128	AP
672	FineLine BGA	MO-034	AAL-1
672	Flip Chip (3)	MO-034	AAL-1
1,020	FineLine BGA	MS-034	AAP-1

**Notes:**

- (1) For more information, contact Altera Applications at (800) 800-EPLD.
- (2) These packages exceed the JEDEC "A" dimension in height.
- (3) Flip Chip packages are based on Altera FineLine BGA packages.
- (4) This package is a standard BGA device package.

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

<b>Table 14. Packages &amp; Pin Counts (Part 1 of 2)</b>		
<b>Package</b>	<b>Code</b>	<b>Pin Count</b>
BGA	B	225
		256
		356
		600
		652
FineLine BGA	F	100
		144
		196
		256
		324
		484
		672
		780
	1,020	
Ultra FineLine BGA	U	49
		88
		169
CerDIP	D	24
		40
PGA	G	68
		84
		100
		160
		192
		232
		280
		403
		503
		599
	655	
JLCC	J	28
		44
		68
		84

<b>Table 14. Packages &amp; Pin Counts (Part 2 of 2)</b>		
<b>Package</b>	<b>Code</b>	<b>Pin Count</b>
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

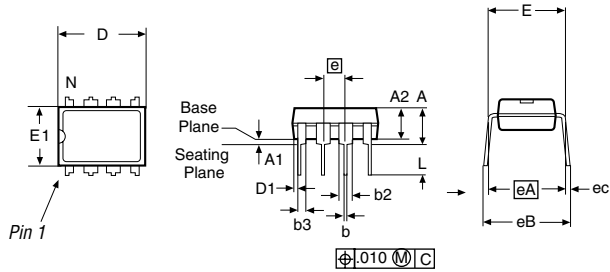
Table 15 summarizes the maximum lead coplanarity for Altera J-lead and QFP packages.

<b>Table 15. Maximum Lead Coplanarity for J-Lead, PLCC, BGA, FineLine BGA &amp; QFP Packages</b>	
<b>Package</b>	<b>Maximum Lead Coplanarity</b>
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](#).

Figure 1. 8-Pin Plastic Dual In-Line Package (PDIP)

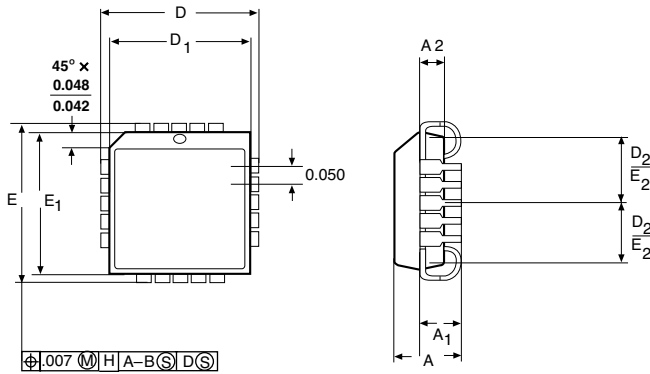


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	—	—	.210
A1	.015	—	—
A2	.115	.130	.195
b	.014	.018	.022
b2	.045	.060	.070
b3	.030	.039	.045
c	.008	.010	.014
D	.355	.365	.400
D1	.005	—	—
E	.300	.310	.325
E1	.240	.250	.280
e	.100 BSC		
eA	.300 BSC		
eB	—	—	.430
eC	.000	—	.060
L	.115	.130	.150
N	8		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-001 option BA.

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

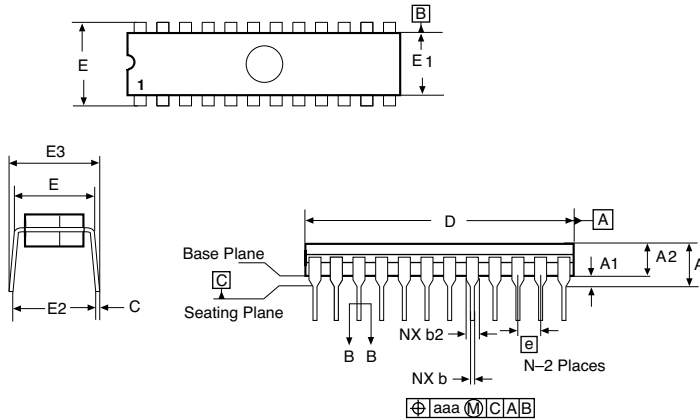


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	.165	.172	.180
A1	.090	.105	.120
A2	.062	—	.083
D	.385	.390	.395
D1	.350	.353	.356
D2	.141	.155	.169
E	.385	.390	.395
E1	.350	.353	.356
E2	.141	.155	.169
N	—	20	—

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-018 option AA.

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

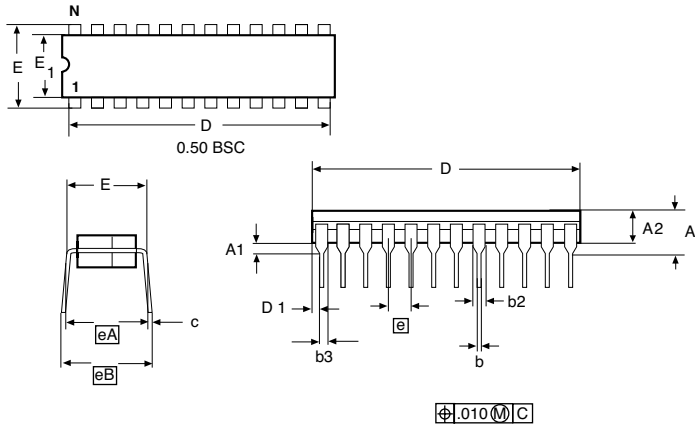


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	-	-	0.210
A1	0.150	-	-
A2	0.140	-	0.175
b	0.150	-	0.023
b2	0.045	-	0.065
E2	0.300 REF		
e	0.100 BSC		
L	0.125	-	0.200
aaa	0.100		
D	1.242	1.250	1.270
E	0.308	-	0.325
E1	0.280	0.288	0.296
E3	0.325	-	0.410
N	24		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: inches.
3. JEDEC reference MS-030 option AF.

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

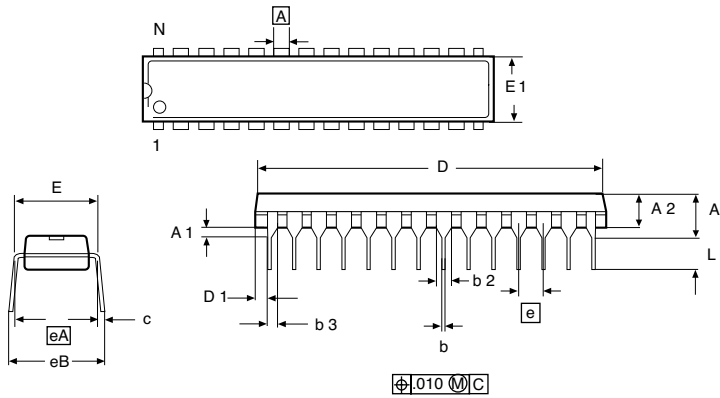


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	—	—	0.210
A1	0.015	—	—
A2	0.115	0.130	0.195
b	0.014	0.018	0.022
b2	0.045	0.060	0.070
b3	0.030	0.039	0.045
c	0.008	0.010	0.014
c1	0.008	0.010	0.011
D	1.230	1.250	1.280
D1	0.005	—	—
E	0.300	0.310	0.325
E1	0.240	0.250	0.280
e	0.100 BSC		
eA	0.300 BSC		
eB	—	—	0.430
eC	0.000	—	0.060
L	0.115	0.130	0.150
N	24		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-001 option AF.

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



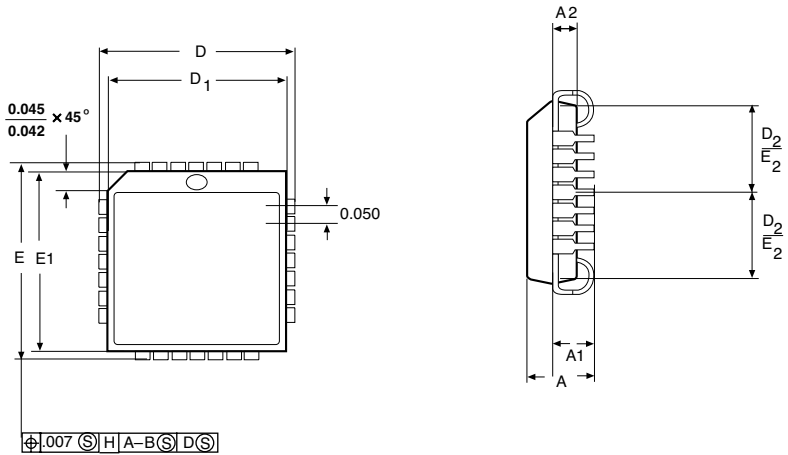
SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	—	—	0.210
A1	0.015	—	—
A2	0.115	0.130	0.195
b	0.014	0.018	0.022
b2	0.045	0.060	0.070
b3	0.030	0.039	0.045
c	0.008	0.010	0.014
D	1.385	1.405	1.425
D1	0.005	—	—
E	0.300	0.310	0.325
E1	0.240	0.250	0.280
e	0.100 BSC		
eA	0.300 BSC		
eB	—	—	0.430
eC	0.000	—	0.060
L	0.115	0.130	0.150
N	28		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-001 option AG.



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

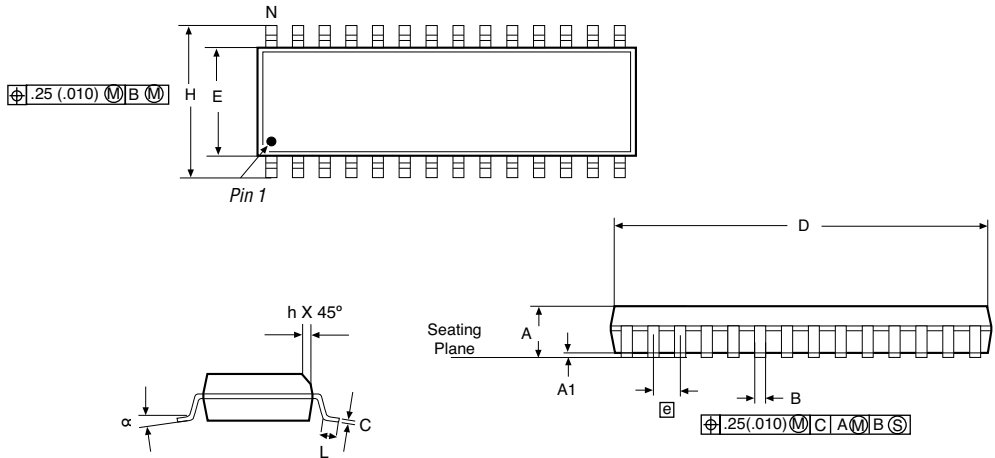


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	0.165	0.172	0.180
A1	0.090	0.105	0.120
A2	0.062	—	0.083
D	0.485	0.490	0.495
D1	0.450	0.453	0.456
D2	0.191	0.205	0.219
E	0.485	0.490	0.495
E1	0.450	0.453	0.456
E2	0.191	0.205	0.219
N	—	28	—

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-018 option AB.

28-Pin Small-Outline Integrated Circuit (SOIC)

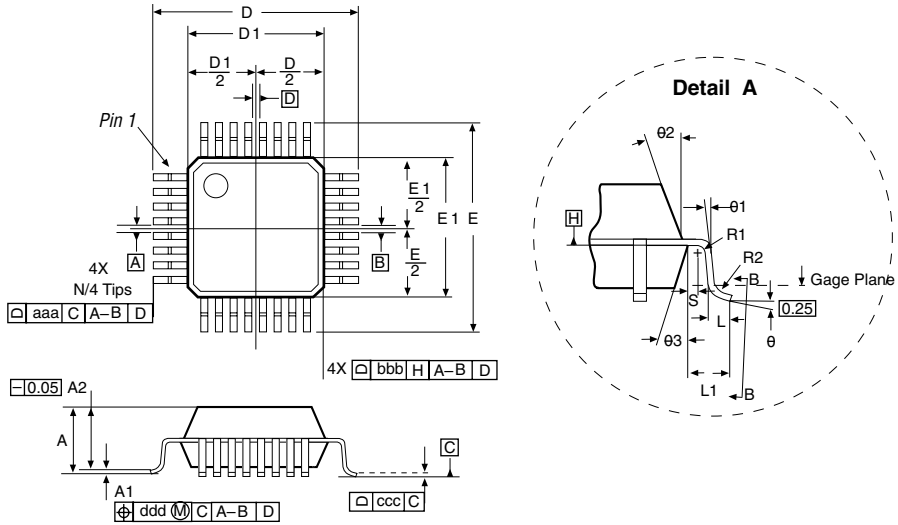


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	2.35	—	2.65
A1	0.10	—	0.30
B	0.33	—	0.51
C	0.23	—	0.32
D	17.70	—	18.10
E	7.40	—	7.60
e	1.27 BSC		
H	10.00	—	10.65
h	.25	—	.75
L	.40	—	1.27
N	28		
$\alpha$	0°	8°	

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982.
2. Controlling dimension: millimeters.
3. JEDEC reference MS-013 option AE.

**32-Pin Plastic Thin Quad Flat Pack (TQFP).**

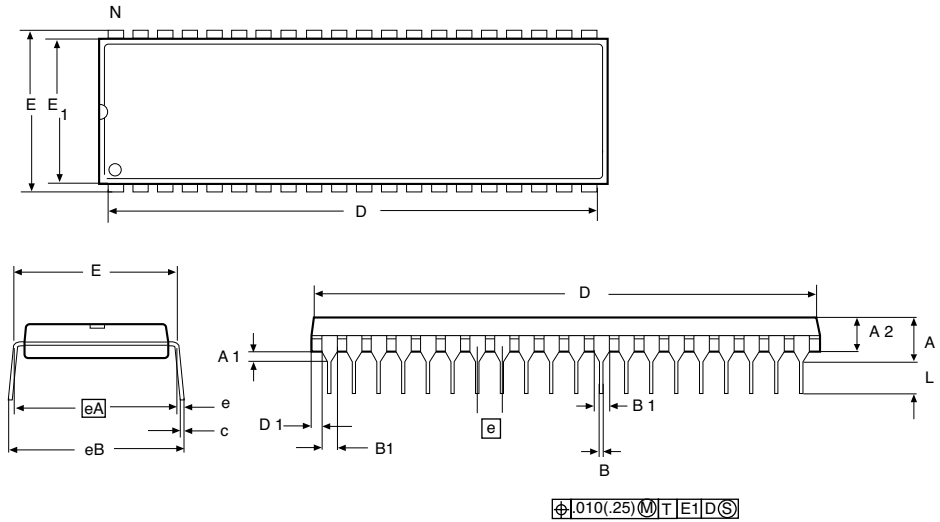


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.60
A1	0.05	-	0.15
A2	1.35	1.40	1.45
b	0.30	0.37	0.45
b1	0.30	0.35	0.40
D	9.00 BSC		
D1	7.00 BSC		
e	0.80 BSC		
E	9.00 BSC		
E1	7.00 BSC		
N	32		
ccc	0.10		
ddd	0.20		
$\theta$	0°	3.5°	7°
$\theta 1$	0°	-	-
$\theta 2$	11°	12°	13°
$\theta 3$	11°	12°	13°
C	0.09	-	0.20
C1	0.09	-	0.16
C2	2.00	-	-
E2	2.00	-	-
L	0.45	0.60	0.75
L1	1.00 REF		
R1	0.08	-	-
R2	0.08	-	0.20
S	0.20	-	-
aaa	0.20		
bbb	0.20		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: inches.
3. JEDEC reference MS-026 option BBA.

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

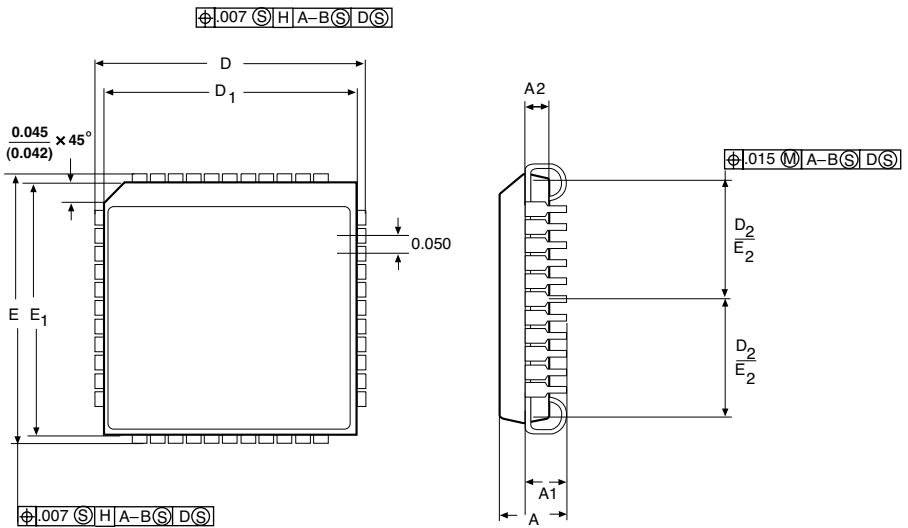


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	—	—	0.250
A1	0.150	—	0.250
A2	0.125	—	0.195
B	0.014	—	0.022
B1	0.030	—	0.070
C	0.008	—	0.015
D	1.980	—	2.095
D1	0.005	—	—
E	0.600	—	0.625
E1	0.485	—	0.580
e	0.100 BSC		
eA	0.600 BSC		
eB	—	—	0.700
L	0.115	—	0.200
N	40		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982.
2. Controlling dimension: inches.
3. JEDEC reference MS-011 option AC.

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

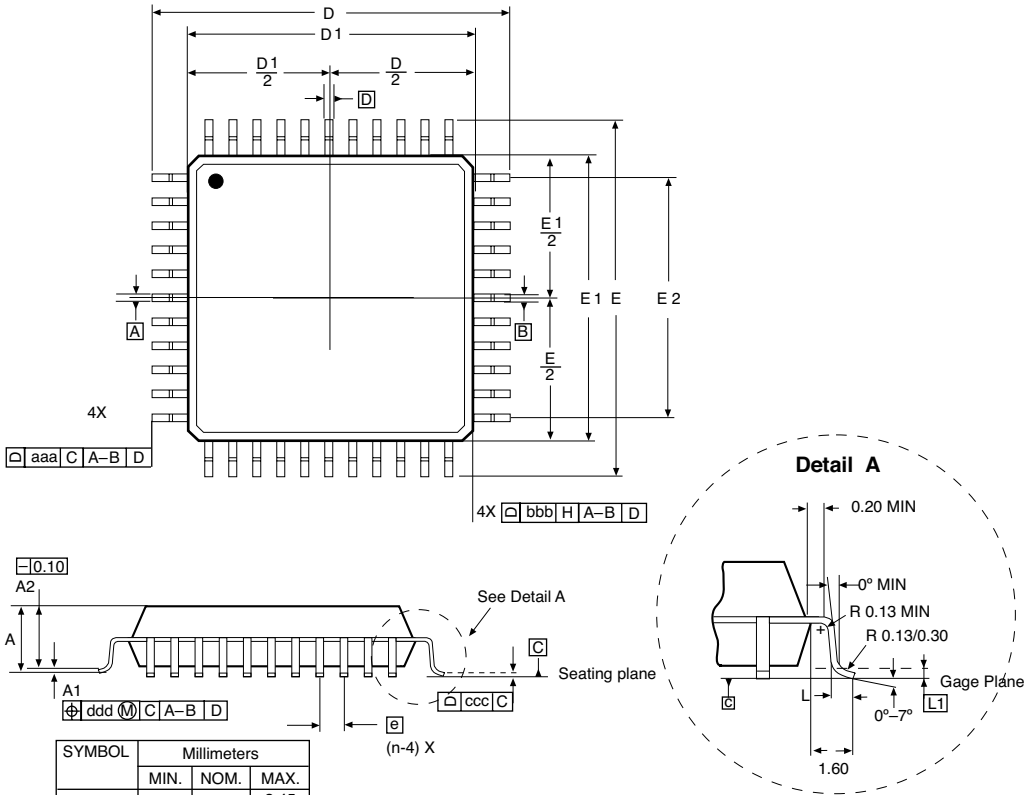


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	0.165	0.172	0.180
A1	0.090	0.105	0.120
A2	0.062	—	0.083
D	0.685	0.690	0.695
D1	0.650	0.653	0.656
D2	0.291	0.305	0.319
E	0.685	0.690	0.695
E1	0.650	0.653	0.656
E2	0.291	0.305	0.319
N	—	44	—

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-018 option AC.

44-Pin Plastic Quad Flat Pack (PQFP)

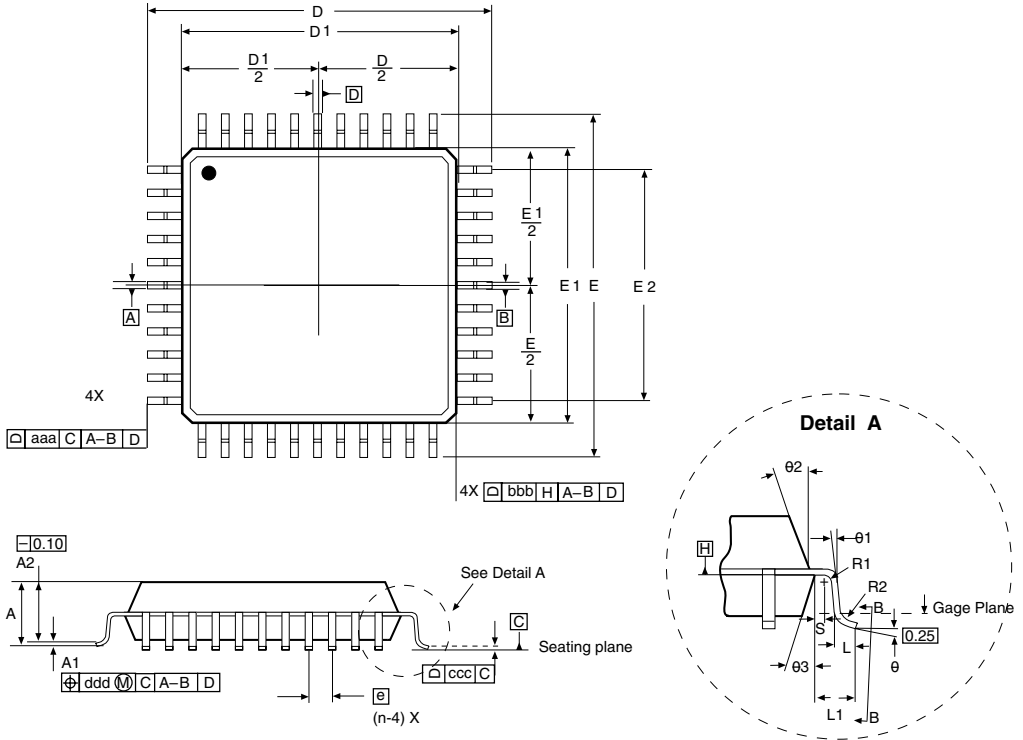


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	2.45
A1	0.00	-	0.25
A2	1.80	2.00	2.20
b	0.29	-	0.45
b1	0.29	0.35	0.41
D	13.20 BASIC		
D1	10.00 BASIC		
D2	8.00 REF		
E	13.20 BASIC		
E1	10.00 BASIC		
E2	8.00 REF		
ccc	0.20		
e	0.80 BASIC		
N	44		
c	0.11	-	0.23
c1	0.11	0.15	0.19
L	0.73	0.88	1.03
L1	0.25 Basic		
aaa	-	-	0.25
bbb	-	-	0.20

Notes:

1. All dimensions and tolerances conform to ASMI Y14.5M - 1994
2. All dimensions are in millimeters.
3. N is the number of leads.
4. JEDEC reference MS-022 option AB.

44-Pin Plastic Thin Quad Flat Pack (TQFP)

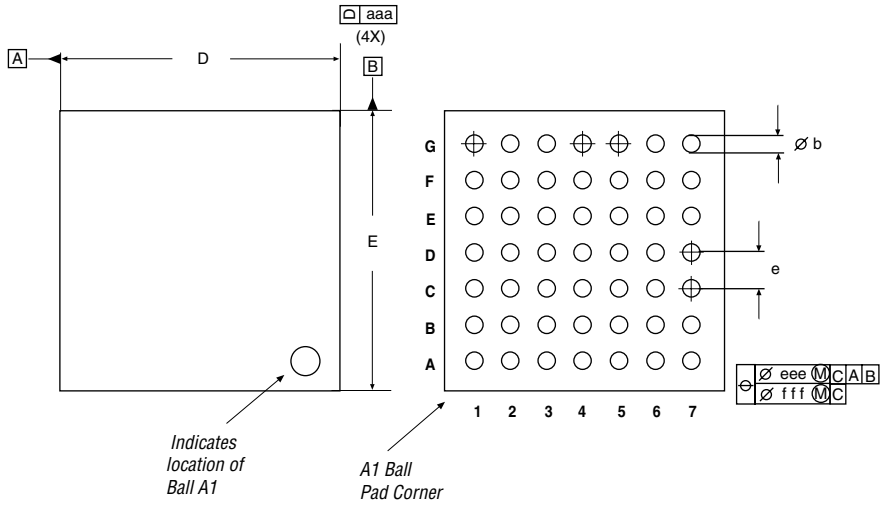


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
b	0.30	0.37	0.45
b1	0.30	0.35	0.40
D	12.00 BSC		
D1	10.00 BSC		
e	0.80 BSC		
E	12.00 BSC		
E1	10.00 BSC		
N	44		
ccc	0.10		
ddd	0.20		
θ	0°	3.5°	7°
θ1	0°	—	—
θ2	11°	12°	13°
θ3	11°	12°	13°
C	0.09	—	0.20
C1	0.09	—	0.16
C2	2.00	—	—
E2	2.00	—	—
L	0.45	0.60	0.75
L1	1.00 REF		
R1	0.08	—	—
R2	0.08	—	0.20
S	0.20	—	—
aaa	0.20		
bbb	0.20		

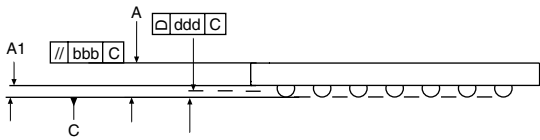
Notes:

1. All dimensions and tolerances conform to ASMI Y14.5M - 1994
2. All dimensions are in millimeters.
3. N is the number of leads.
4. JEDEC reference MS-026 option BCB.

49-Ultra FineLine BGA



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.20	-	-
A2	0.65	-	-
b	0.40	0.45	0.50
aaa	-	0.10	-
bbb	-	0.20	-
ddd	-	0.15	-
eee	-	0.08	-
N1	-	49	-

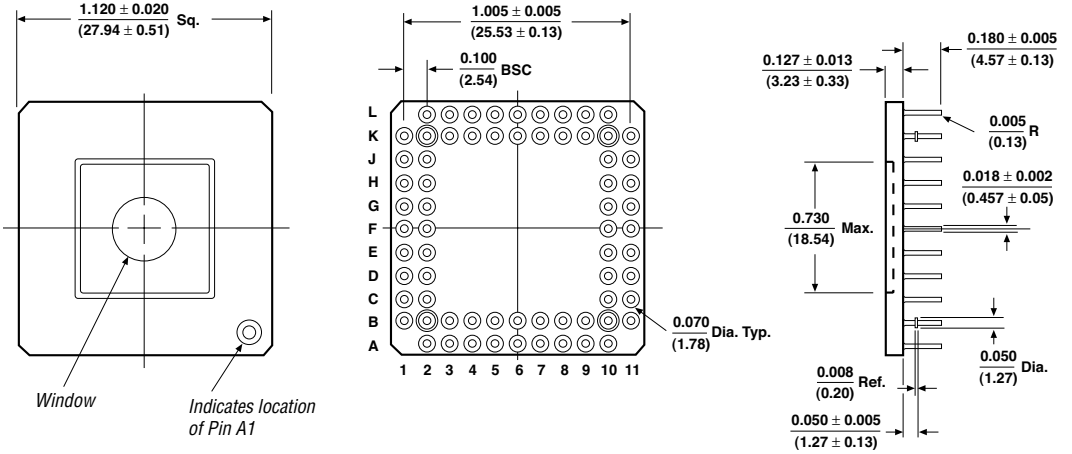


- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. N1 represents the number of solder balls.
  3. JEDEC reference: M0-216 option BAB-2.

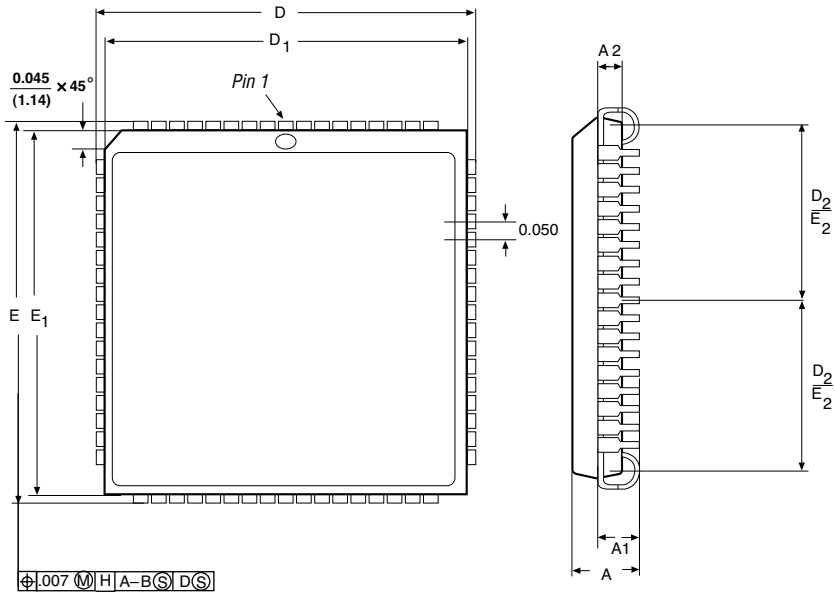


**68-Pin Small Outline Ceramic Pin-Grid Array (PGA)**

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



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

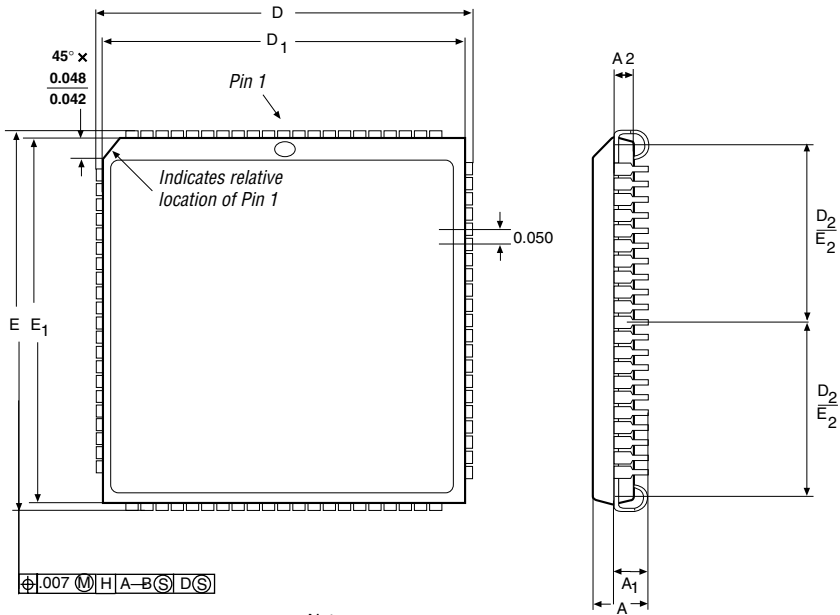


SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	0.165	0.172	0.180
A1	0.090	0.105	0.120
A2	0.062	—	0.083
D	0.985	0.990	0.995
D1	0.950	0.954	0.958
D2	0.441	0.455	0.469
E	0.985	0.990	0.995
E1	0.950	0.954	1.150
E2	0.441	0.455	0.469
N	—	68	—

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-018 option AE.

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

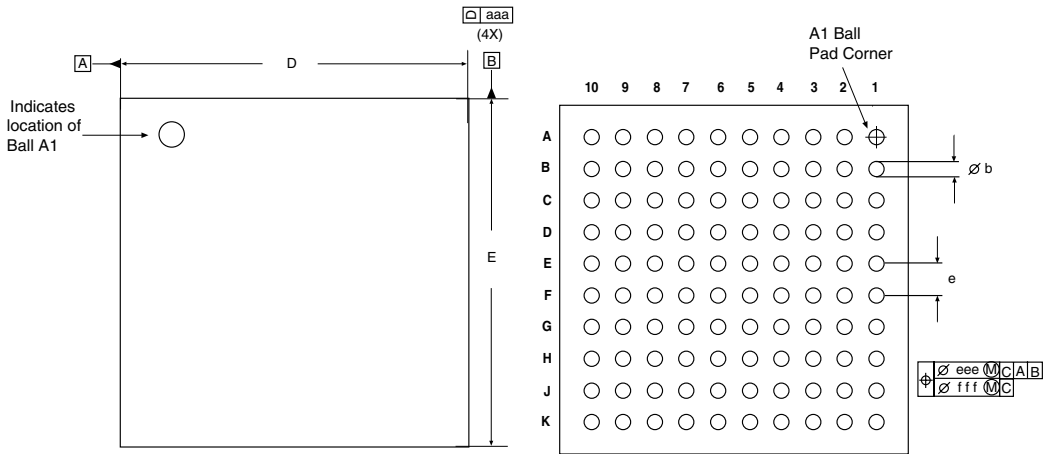


Notes:

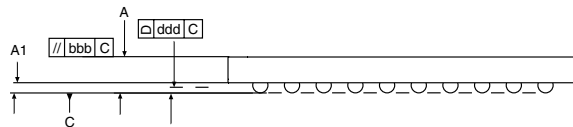
1. All dimensions and tolerances conform to ANSI Y14.5M - 1982
2. Controlling dimension: inches.
3. JEDEC reference MS-018 option AF.

SYMBOL	Inches		
	MIN.	NOM.	MAX.
A	0.165	0.172	0.180
A1	0.090	0.105	0.120
A2	0.059	—	0.080
D	1.185	1.190	1.195
D1	1.150	1.154	1.158
D2	0.541	0.555	0.569
E	1.185	1.190	1.195
E1	1.150	1.154	1.158
E2	0.541	0.555	0.569
N	—	84	—

100-Pin FineLine BGA



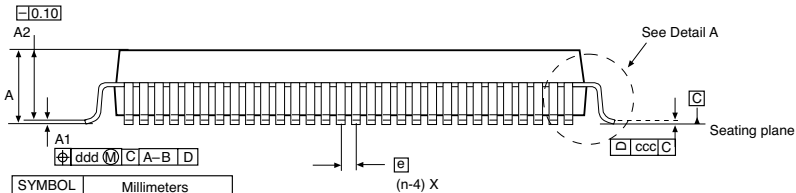
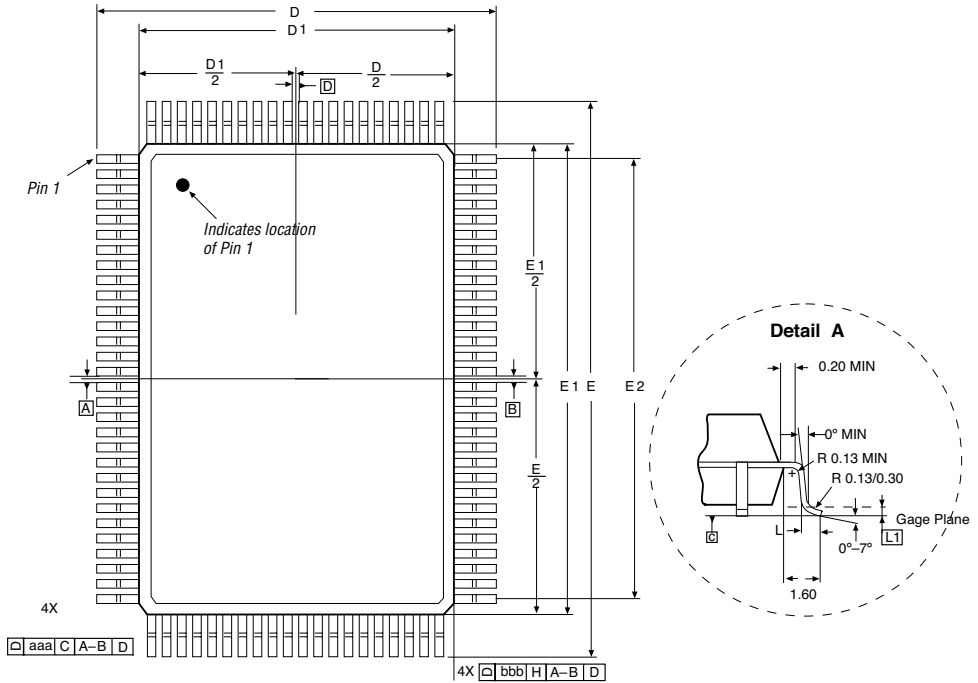
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.30	-	-
D/E	11.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	10		
e	1.00 BSC		



Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the maximum solder ball matrix size.
3. JEDEC reference: MO-192 option AAC-1.

100-Pin Plastic Quad Flat Pack (PQFP)

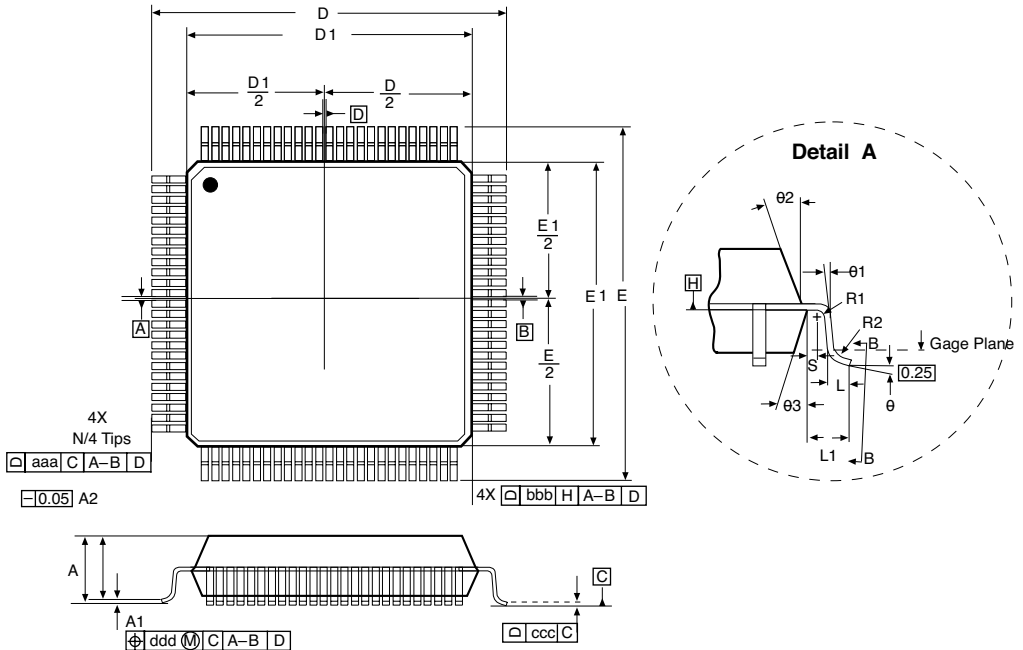


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.40
A1	0.25	-	0.50
A2	2.50	2.70	2.90
b	0.22	-	0.40
b1	0.22	0.30	0.36
D	23.20 BASIC		
D1	20.00 BASIC		
D2	18.85 REF		
E	17.20 BASIC		
E1	14.00 BASIC		
E2	12.35 REF		
ccc	0.13		
e	0.65 BASIC		
N	100		
N <sub>b</sub>	30		
N <sub>E</sub>	20		
c	0.11	-	0.23
c1	0.11	0.15	0.19
L	0.73	0.88	1.03
L1	0.25 Basic		
aaa	-	-	0.25
bbb	-	-	0.20

Notes:

1. All dimensions and tolerances conform to ASMI Y14.5M - 1994
2. All dimensions are in millimeters.
3. N is the number of leads.
4. JEDEC reference MS-022 option GC-1.

100-Pin Plastic Thin Quad Flat Pack (TQFP)

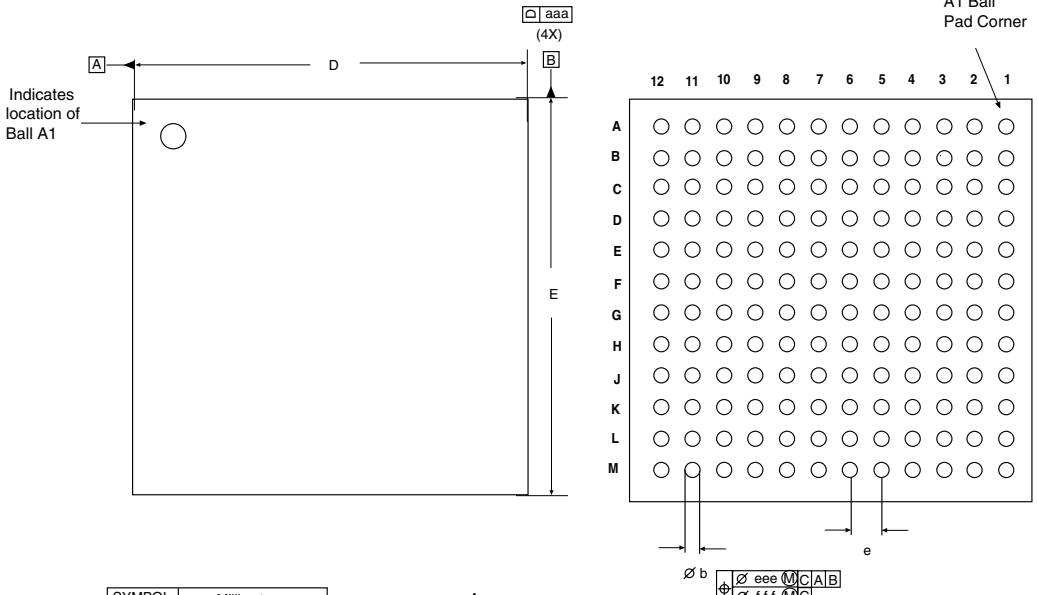


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
D	16.00 BSC		
D1	14.00 BSC		
e	0.50 BSC		
E	16.00 BSC		
E1	14.00 BSC		
N	100		
ccc	0.08		
ddd	0.08		
θ	0°	3.5°	7°
θ1	0°	—	—
θ2	11°	12°	13°
θ3	11°	12°	13°
C	0.09	—	0.20
C1	0.09	—	0.16
C2	2.00	—	—
E2	2.00	—	—
L	0.45	0.60	0.75
L1	1.00 REF		
R1	0.08	—	—
R2	0.08	—	0.20
S	0.20	—	—
aaa	0.20		
bbb	0.20		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: inches.
3. JEDEC reference MS-026 option BED.

144-Pin FineLine BGA

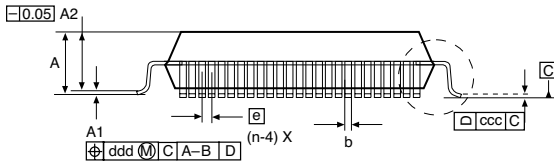
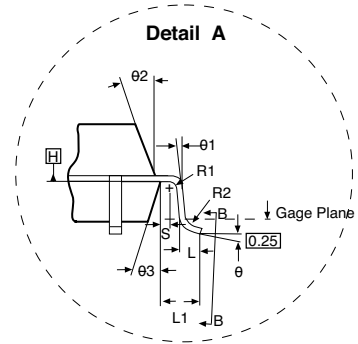
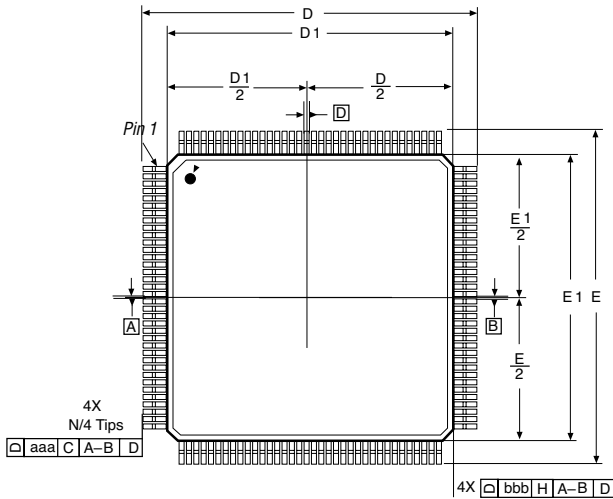


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.30	-	-
D/E	13.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	12		
e	1.00 BSC		

Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix.
3. JEDEC reference: M0-192 option AAD-1, depopulated.

144-Pin Plastic Thin Quad Flat Pack (TQFP)



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	1.60
A1	0.05	—	0.15
A2	1.35	1.40	1.45
b	0.17	0.22	0.27
b1	0.17	0.20	0.23
D	22.00 BSC		
D1	20.00 BSC		
e	0.50 BSC		
E	22.00 BSC		
E1	20.00 BSC		
N	144		
ccc	0.08		
ddd	0.08		
θ	0°	3.5°	7°
θ1	0°	—	—
θ2	11°	12°	13°
θ3	11°	12°	13°
C	0.09	—	0.20
C1	0.09	—	0.16
C2	2.00	—	—
E2	2.00	—	—
L	0.45	0.60	0.75
L1	1.00 REF		
R1	0.08	—	—
R2	0.08	—	0.20
S	0.20	—	—
aaa	0.20		
bbb	0.20		

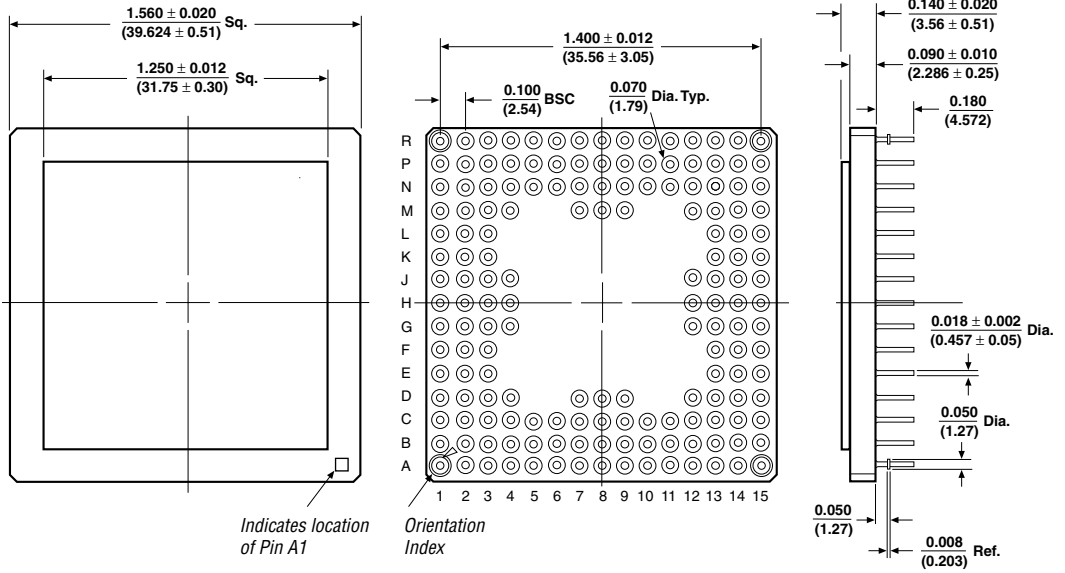
Notes:

1. All dimensions and tolerances conform to ASME Y14.5M - 1994
2. Controlling dimension: millimeters.
3. JEDEC reference MS-026 option BFB

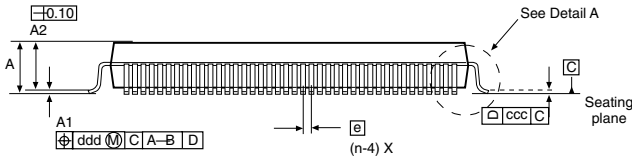
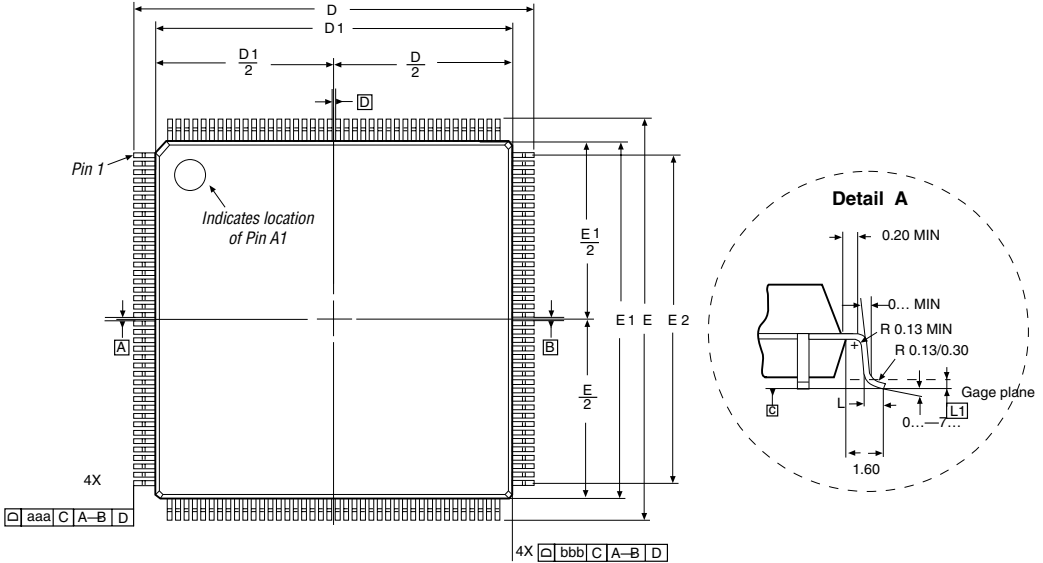


**160-Pin Ceramic Pin-Grid Array (PGA)**

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



160-Pin Plastic Quad Flat Pack (PQFP)

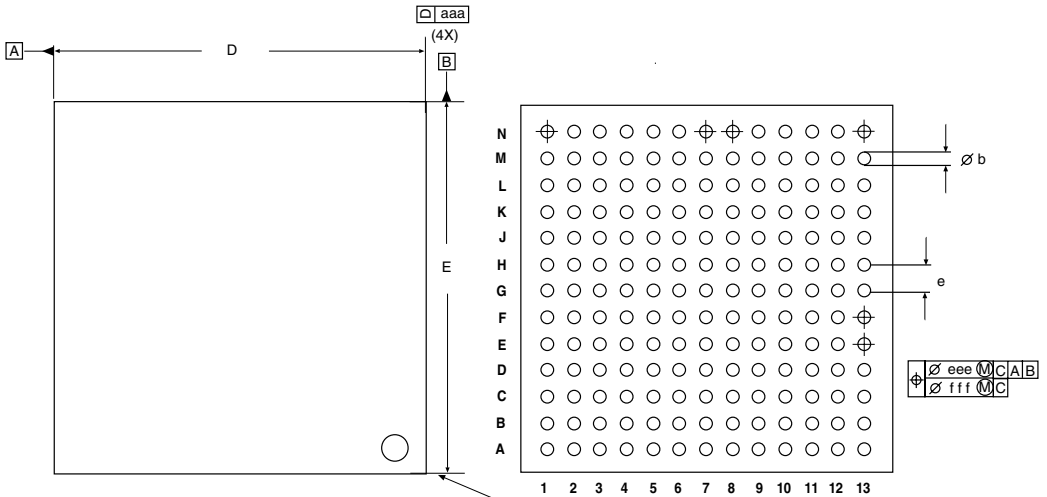


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	4.10
A1	0.25	-	0.50
A2	3.20	3.40	3.60
b	0.22	-	0.40
b1	0.22	0.30	0.36
D	31.20 BASIC		
D1	28.00 BASIC		
D2	25.35 REF		
E	31.20 BASIC		
E1	28.00 BASIC		
E2	25.35 REF		
ccc	0.13		
e	0.65 BASIC		
N	160		
c	0.11	-	0.23
c1	0.11	0.15	0.19
L	0.73	0.88	1.03
L1	0.25 Basic		
aaa	-	-	0.25
bbb	-	-	0.20

Notes:

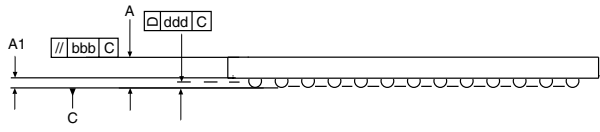
1. All dimensions and tolerances conform to ASMI Y14.5M - 1994
2. All dimensions are in millimeters.
3. N is the number of leads.
4. JEDEC reference MS-022 option DD-1.

169-Pin Ultra FineLine BGA Package *Note (1)*



Indicates Location of Ball A1

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.20
A1	0.20	-	-
A2	0.65	-	-
b	0.40	0.45	0.50
aaa		0.10	
bbb		0.20	
ddd		0.15	
eee		0.08	
N1		169	



Notes:

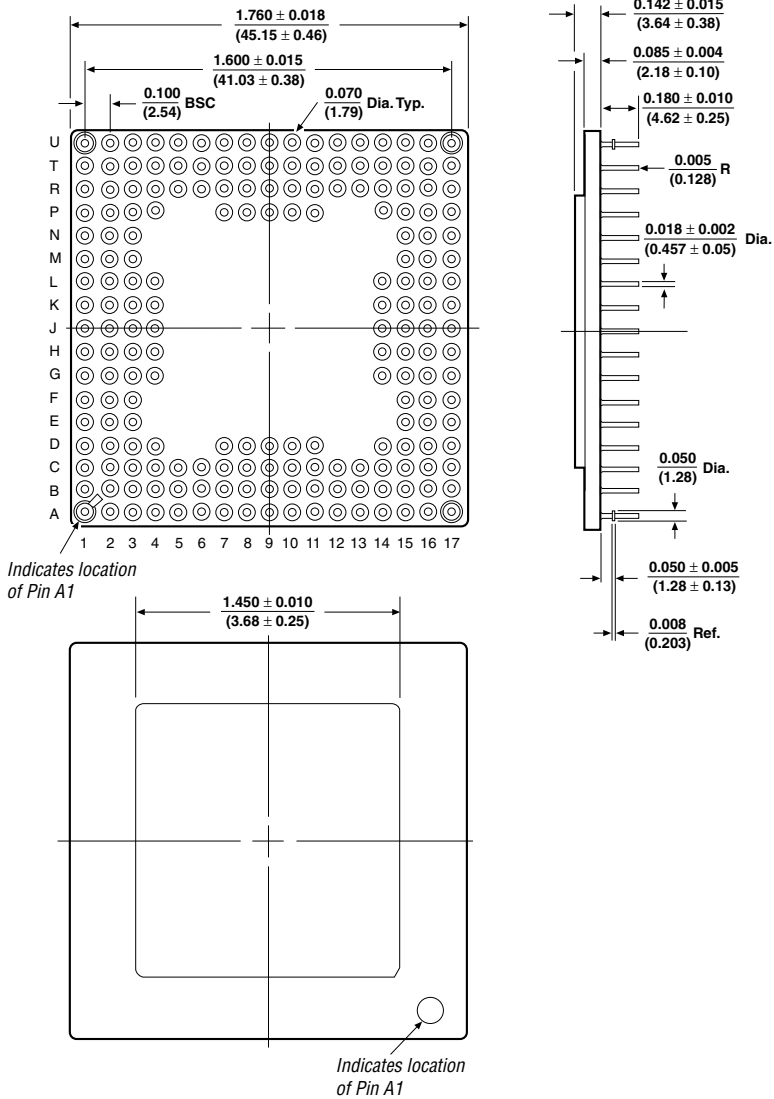
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. N1 represents the number of solder balls.
3. JEDEC reference: M0-216 option BAF-1.

**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.

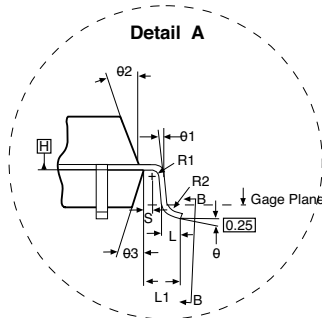
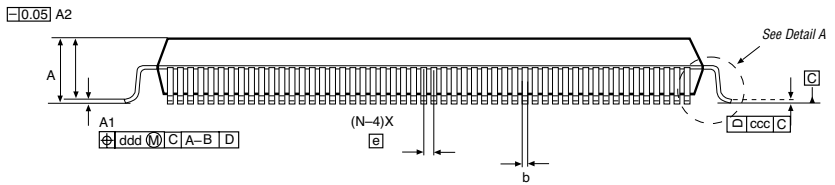
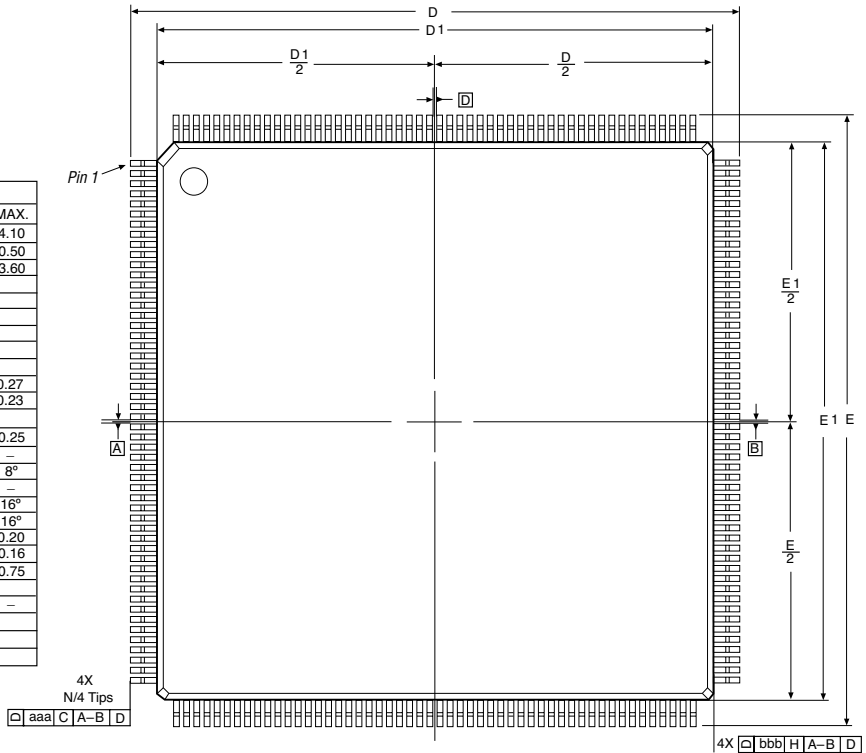
192-Pin Ceramic Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



208-Pin Plastic Quad Flat Pack (PQFP)

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	4.10
A1	0.25	—	0.50
A2	3.20	3.40	3.60
D	30.60 BSC		
D1	28.00 BSC		
E	30.60 BSC		
E1	28.00 BSC		
N	208		
e	0.50 BSC		
b	0.17	—	0.27
b1	0.17	0.20	0.23
ddd	0.08		
R2	0.08	—	0.25
R1	0.08	—	—
θ	0°	3.5°	8°
θ1	0°	—	—
θ2	5°	—	16°
θ3	5°	—	16°
c	0.09	—	0.20
c1	0.09	—	0.16
L	—	0.60	0.75
L1	1.30 REF		
S	0.20	—	—
aaa	0.25		
bbb	0.20		
ccc	0.08		

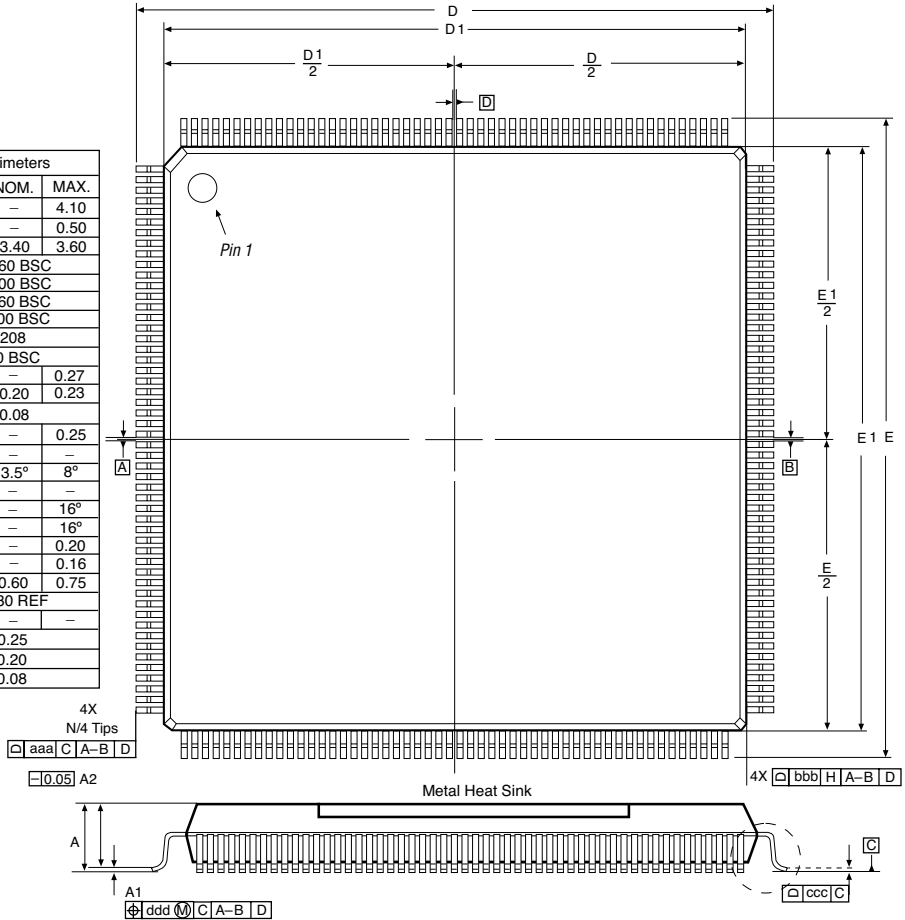


Notes:

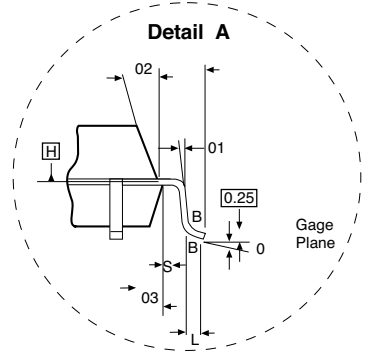
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: inches.
3. JEDEC reference MS-029 option FA-1.

208-Pin Power Quad Flat Pack (RQFP)

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	4.10
A1	0.25	—	0.50
A2	3.20	3.40	3.60
D	30.60 BSC		
D1	28.00 BSC		
E	30.60 BSC		
E1	28.00 BSC		
N	208		
e	0.50 BSC		
b	0.17	—	0.27
b1	0.17	0.20	0.23
ddd	0.08		
R2	0.08	—	0.25
R1	0.08	—	—
θ	0°	3.5°	8°
θ1	0°	—	—
θ2	5°	—	16°
θ3	5°	—	16°
c	0.09	—	0.20
c1	0.09	— <td 0.16	
L	—	0.60	0.75
L1	1.30 REF		
S	0.20	—	—
aaa	0.25		
bbb	0.20		
ccc	0.08		

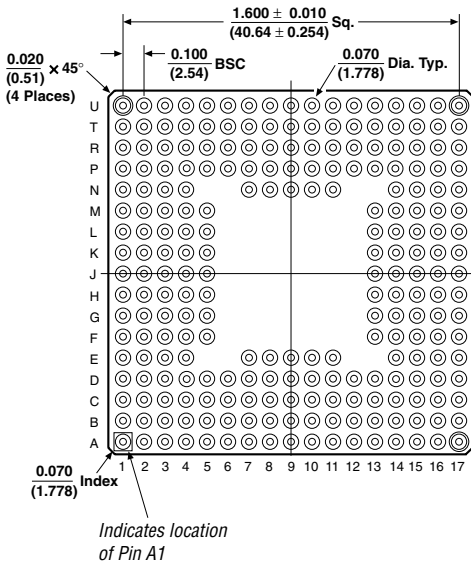
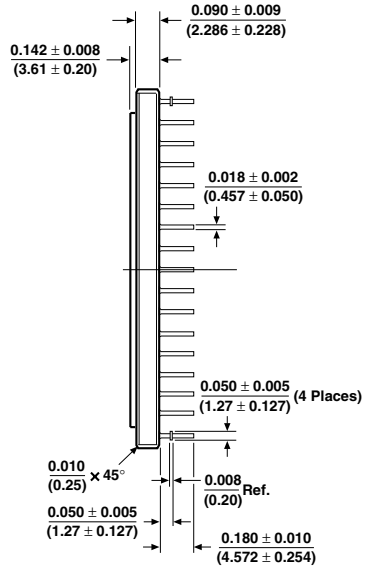
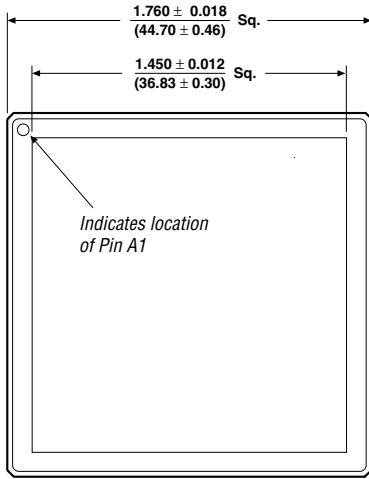


- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. Controlling dimension: inches.
  3. JEDEC reference MS-029 option FA-1



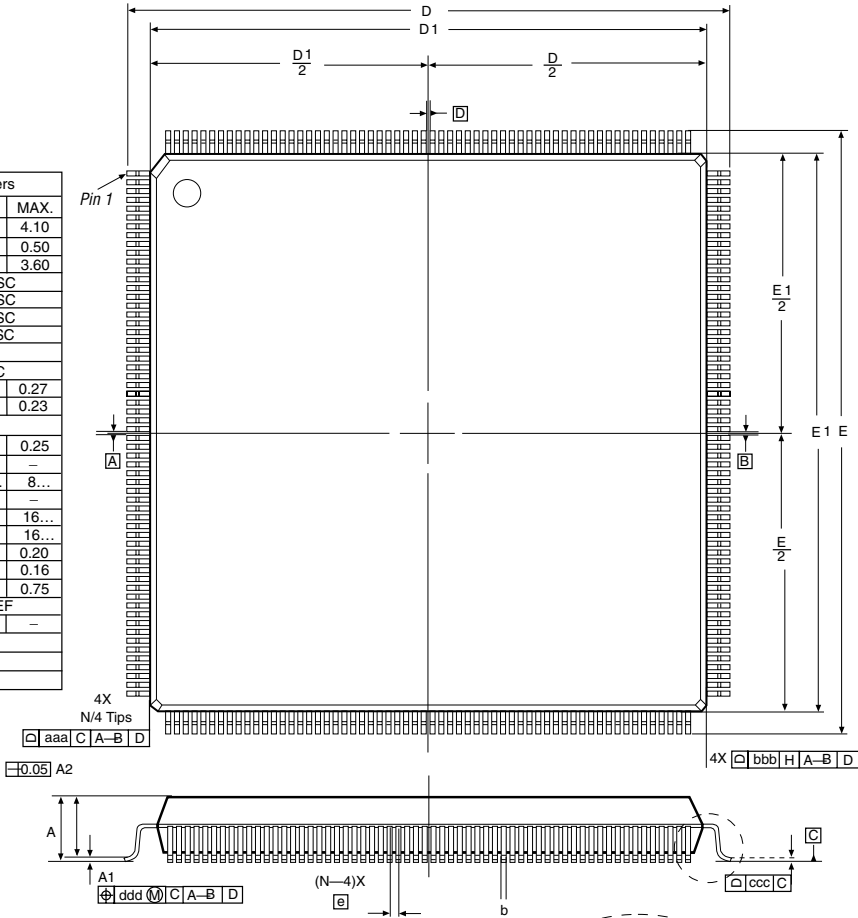
**232-Pin Ceramic Pin-Grid Array (PGA)**

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



240-Pin Plastic Quad Flat Pack (PQFP)

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	4.10
A1	0.25	—	0.50
A2	3.20	3.40	3.60
D	34.60 BSC		
D1	32.00 BSC		
E	34.60 BSC		
E1	32.00 BSC		
N	240		
e	0.50 BSC		
b	0.17	—	0.27
b1	0.17	0.20	0.23
ddd	0.08		
R2	0.08	—	0.25
R1	0.08	— </td <td>—</td>	—
θ	0...	3.5...	8...
θ1	0...	—	—
θ2	5...	—	16...
θ3	5...	—	16...
c	0.09	—	0.20
c1	0.09	—	0.16
L	—	0.60	0.75
L1	1.30 REF		
s	0.20	—	—
aaa	0.25		
bbb	0.20		
ccc	0.08		

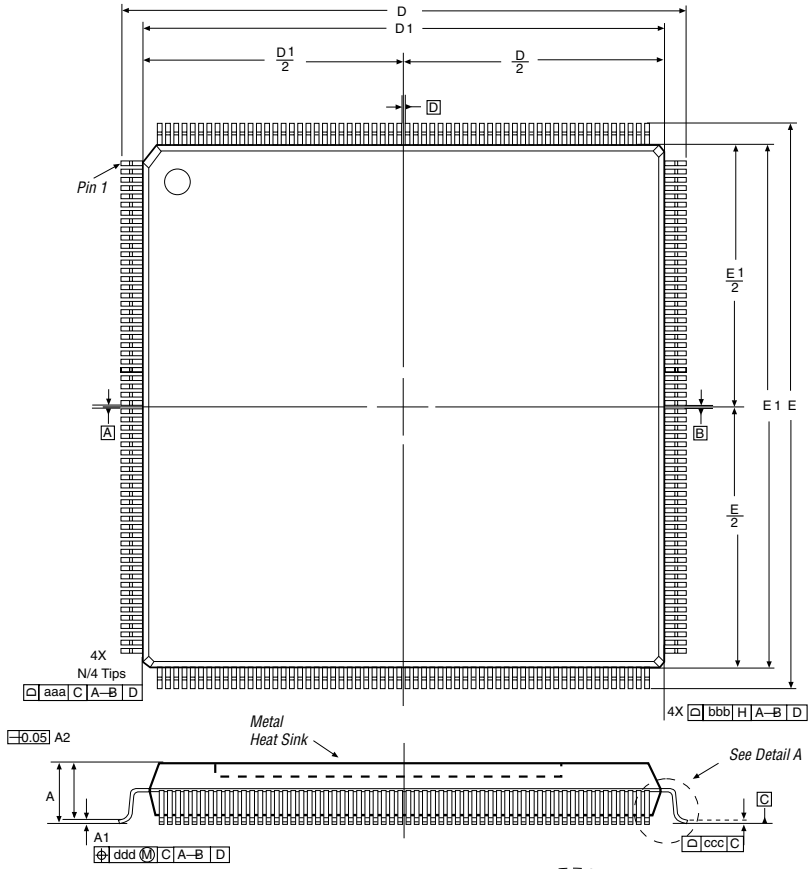


Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: inches.
3. JEDEC reference MS-029 option GA.



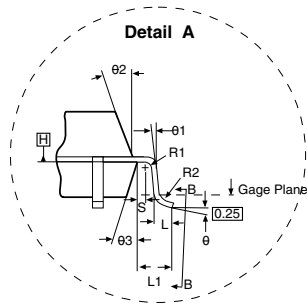
240-Pin Power Quad Flat Pack (RQFP)



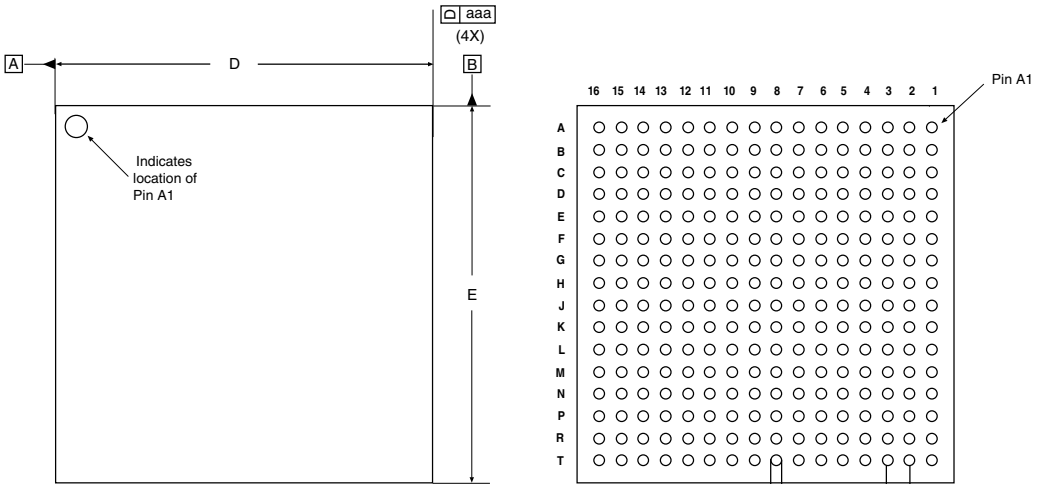
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	4.10
A1	0.25	—	0.50
A2	3.20	3.40	3.60
D	34.60 BSC		
D1	32.00 BSC		
E	34.60 BSC		
E1	32.00 BSC		
N	240		
e	0.50 BSC		
b	0.17	—	0.27
b1	0.17	0.20	0.23
ddd	0.08		
R2	0.08	—	0.25
R1	0.08	—	—
θ	0...	3.5...	8...
θ1	0...	—	—
θ2	5...	—	16...
θ3	5...	—	16...
c	0.09	—	0.20
c1	0.09	—	0.16
L	—	0.60	0.75
L1	1.30 REF		
S	0.20	—	—
aaa	0.25		
bbb	0.20		
ccc	0.08		

Notes:

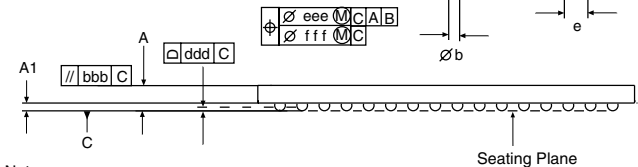
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. Controlling dimension: millimeters.
3. JEDEC reference MS-029 option GA.



256-Pin FineLine BGA

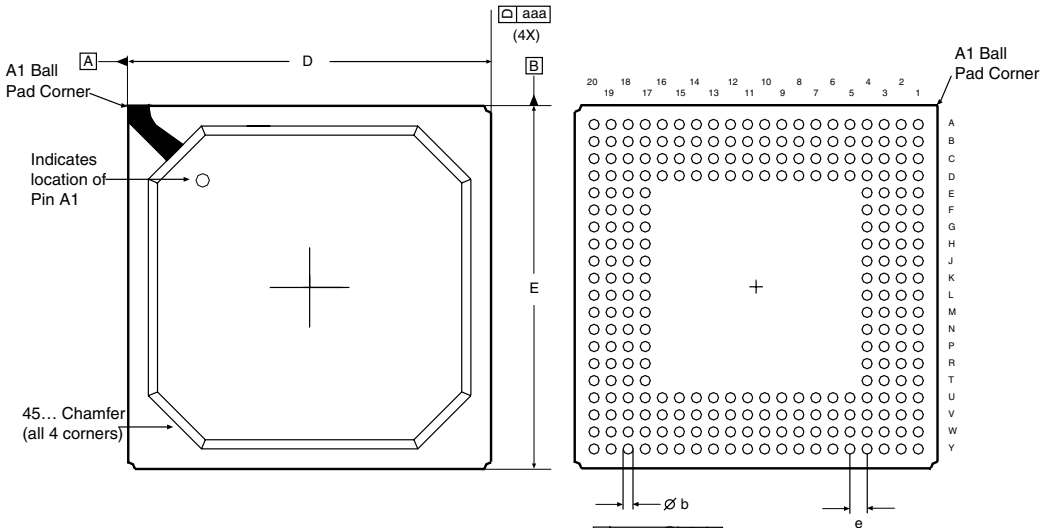


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	17.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	16		
e	1.00 BSC		

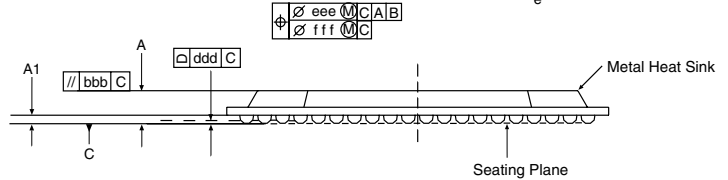


- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. M represents the the maximum solder ball matrix size.
  3. JEDEC reference: M0-034 option AAF-1.

256-Pin Super Ball-Grid Array (SBGA)



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.35	-	-
D/E	27.00 BSC		
b	0.60	0.75	0.90
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.30
fff	-	-	0.15
M	20		
e	1.27 BSC		

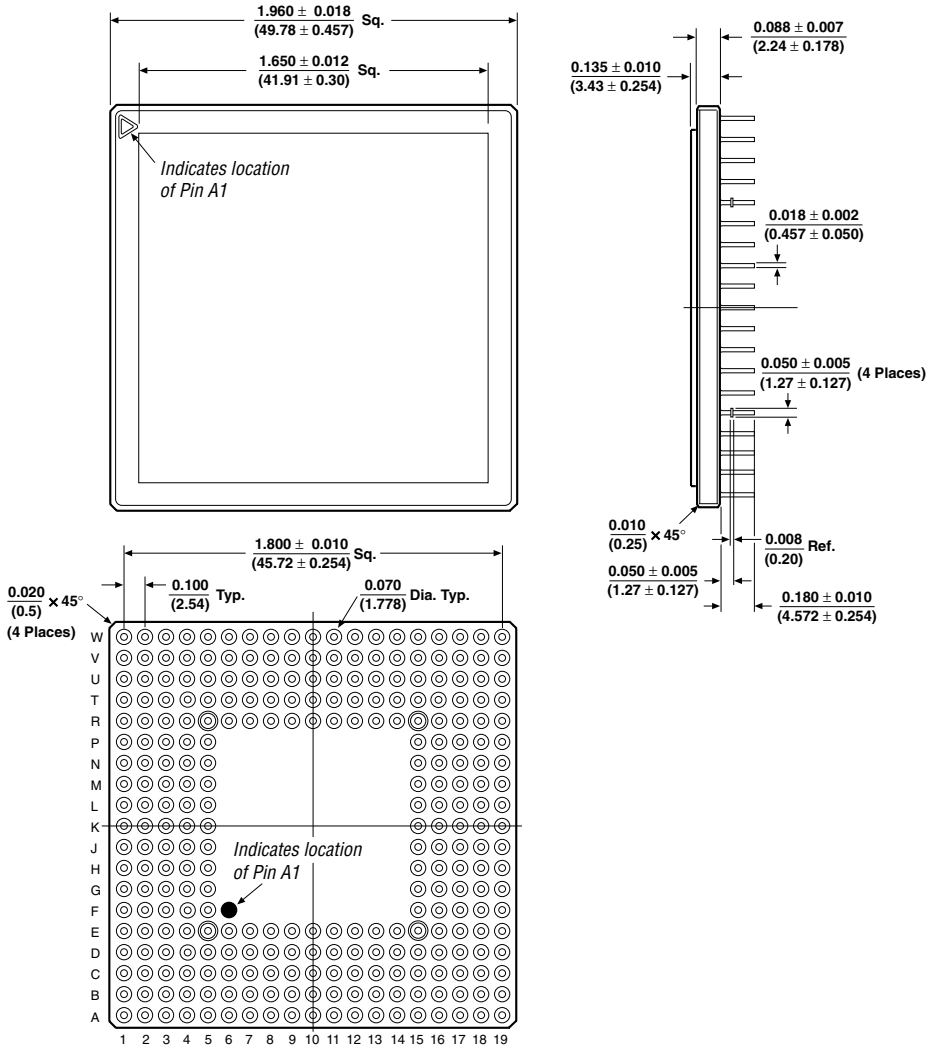


Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: M0-192 option BAW-1, depopulated.

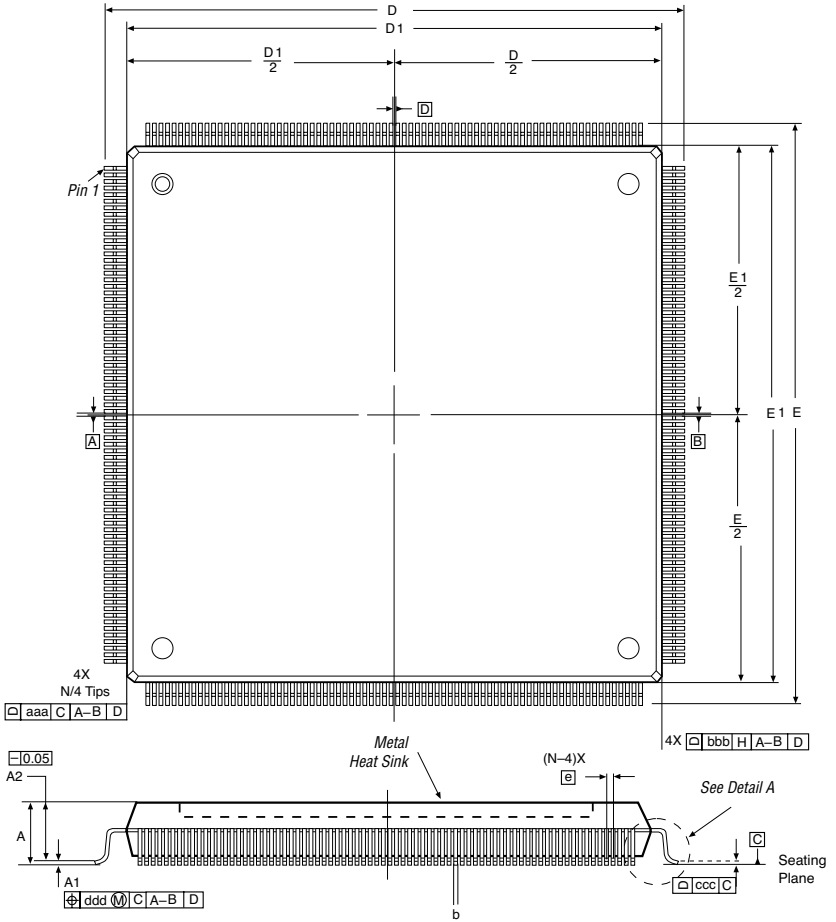
280-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



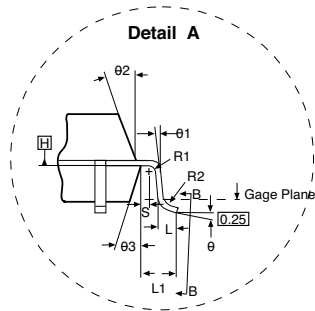
304-Pin Power Quad Flat Pack (RQFP)

SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	4.50
A1	0.25	—	0.50
A2	3.55	3.80	4.05
D	42.60 BSC		
D1	40.00 BSC		
E	42.60 BSC		
E1	40.00 BSC		
N	304		
e	0.50 BSC		
b	0.17	—	0.27
b1	0.17	0.20	0.23
ddd	0.08		
R2	0.08	—	0.25
R1	0.08	—	—
θ	0°	3.5°	8°
θ1	0°	—	—
θ2	5°	—	16°
θ3	5°	—	16°
c	0.09	—	0.20
c1	0.09	—	0.16
L	—	0.60	0.75
L1	1.30 REF		
S	0.20	—	—
aaa	0.25		
bbb	0.20		
ccc	0.08		

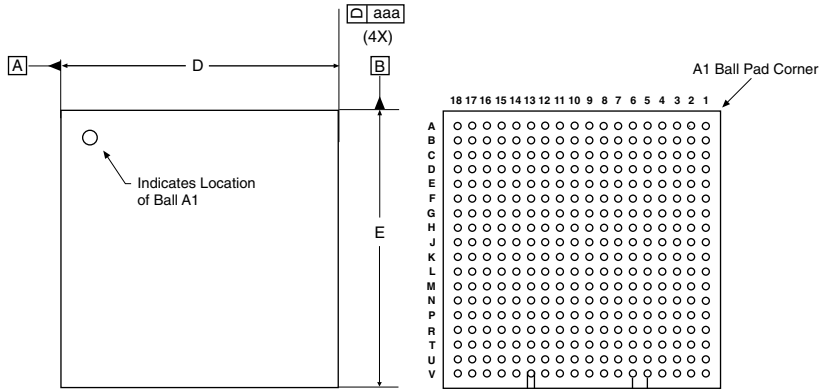


Notes:

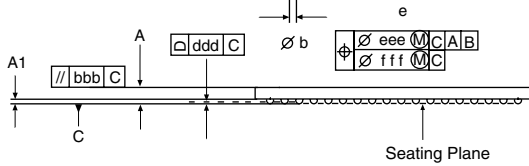
1. All dimensions and tolerances conform to ASME Y14.5M - 1994
2. Controlling dimension: millimeters.
3. JEDEC reference MS-029 option JA.



324-Pin FineLine BGA



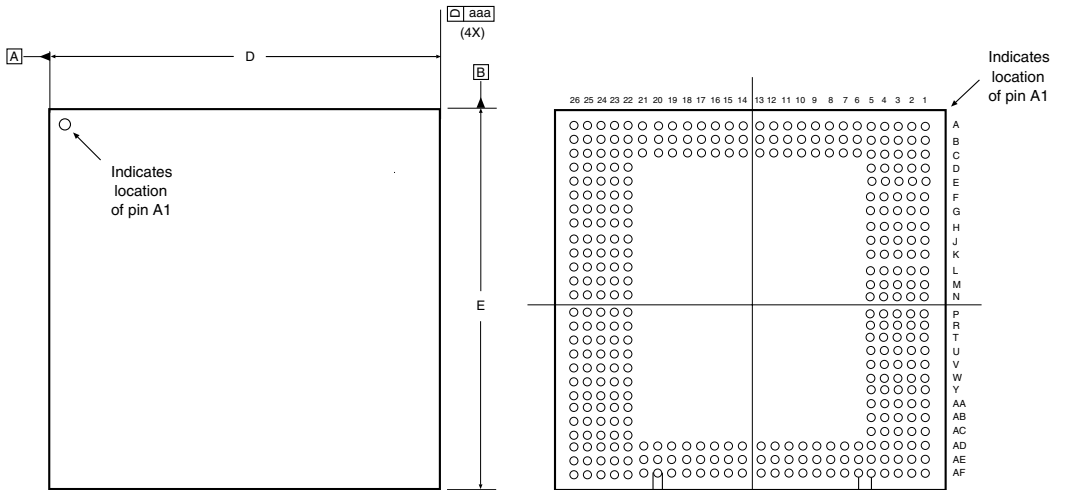
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	19.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	18		
e	1.00 BSC		



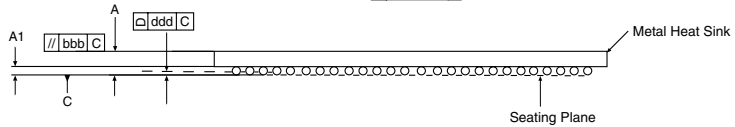
Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: M0-034 option AAG-1.

356-Pin Ball-Grid Array (BGA)



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.35	-	-
D/E	35.00 BSC		
b	0.60	0.75	0.90
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.30
fff	-	-	0.15
M	26		
e	1.27 BSC		

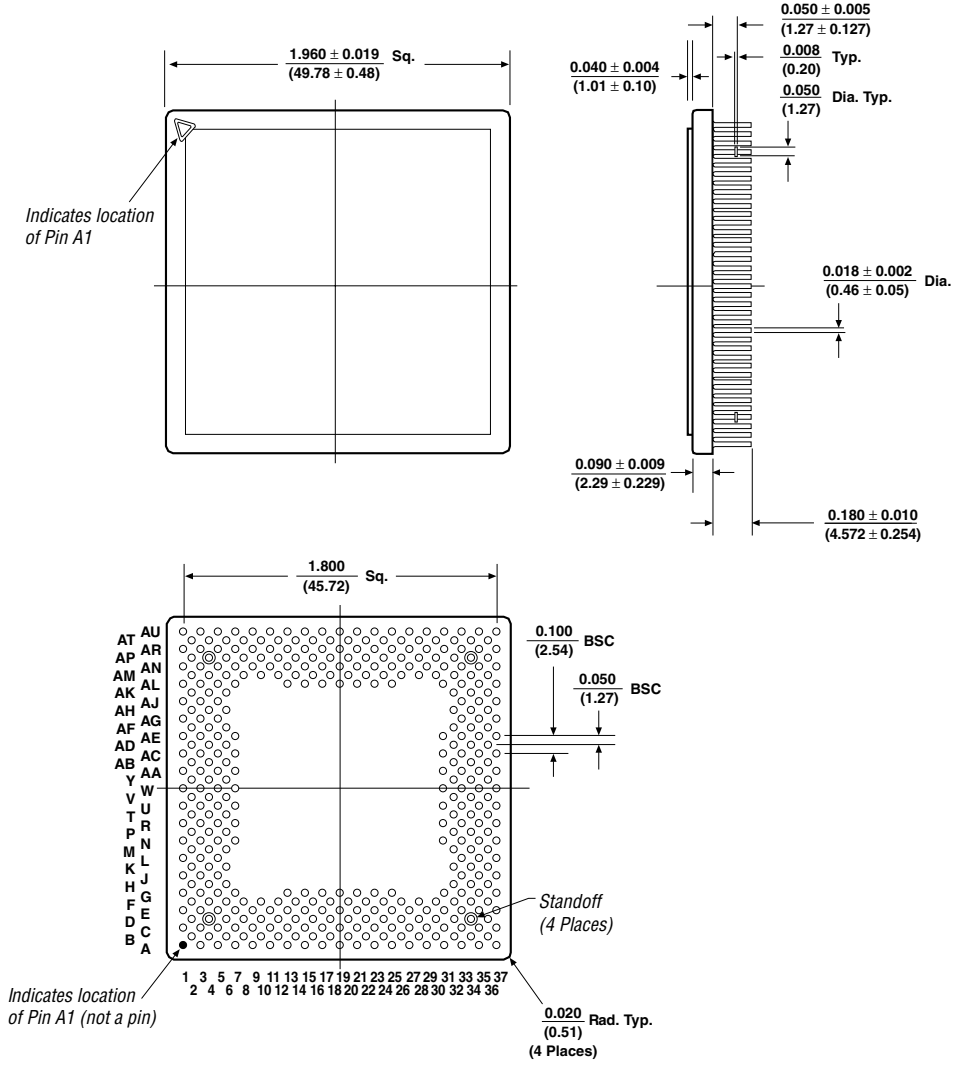


Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: M0-192 option BAR-2, depopulated.

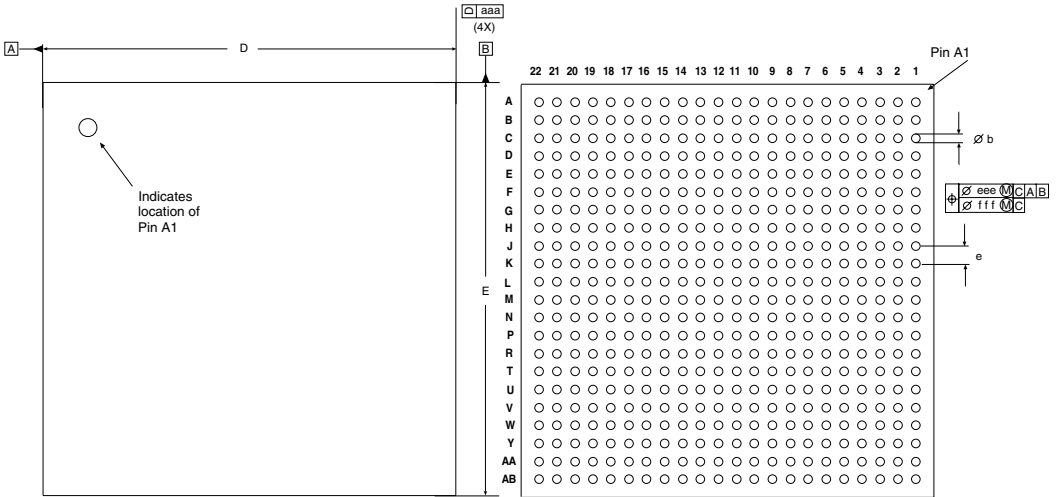
403-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.

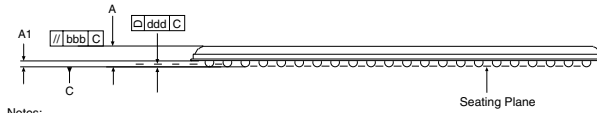




484-Pin FineLine BGA

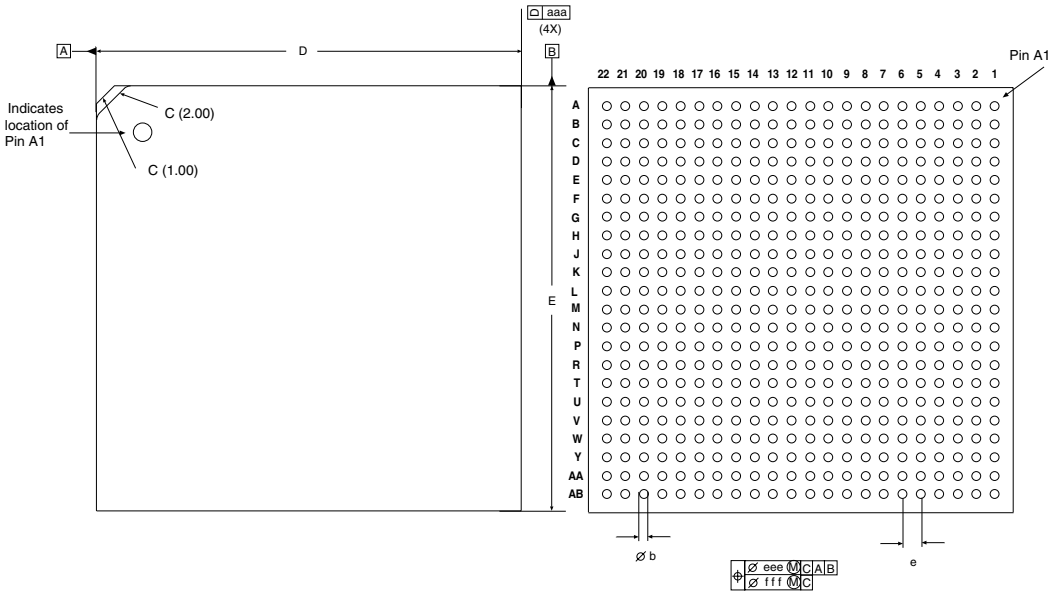


SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	23.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	22		
e	1.00 BSC		

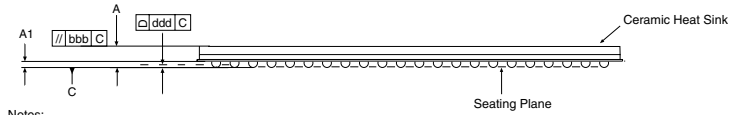


- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. M represents the the maximum solder ball matrix size.
  3. JEDEC reference: M0-034 option AAJ-1.

484-Pin Flip-Chip FineLine BGA



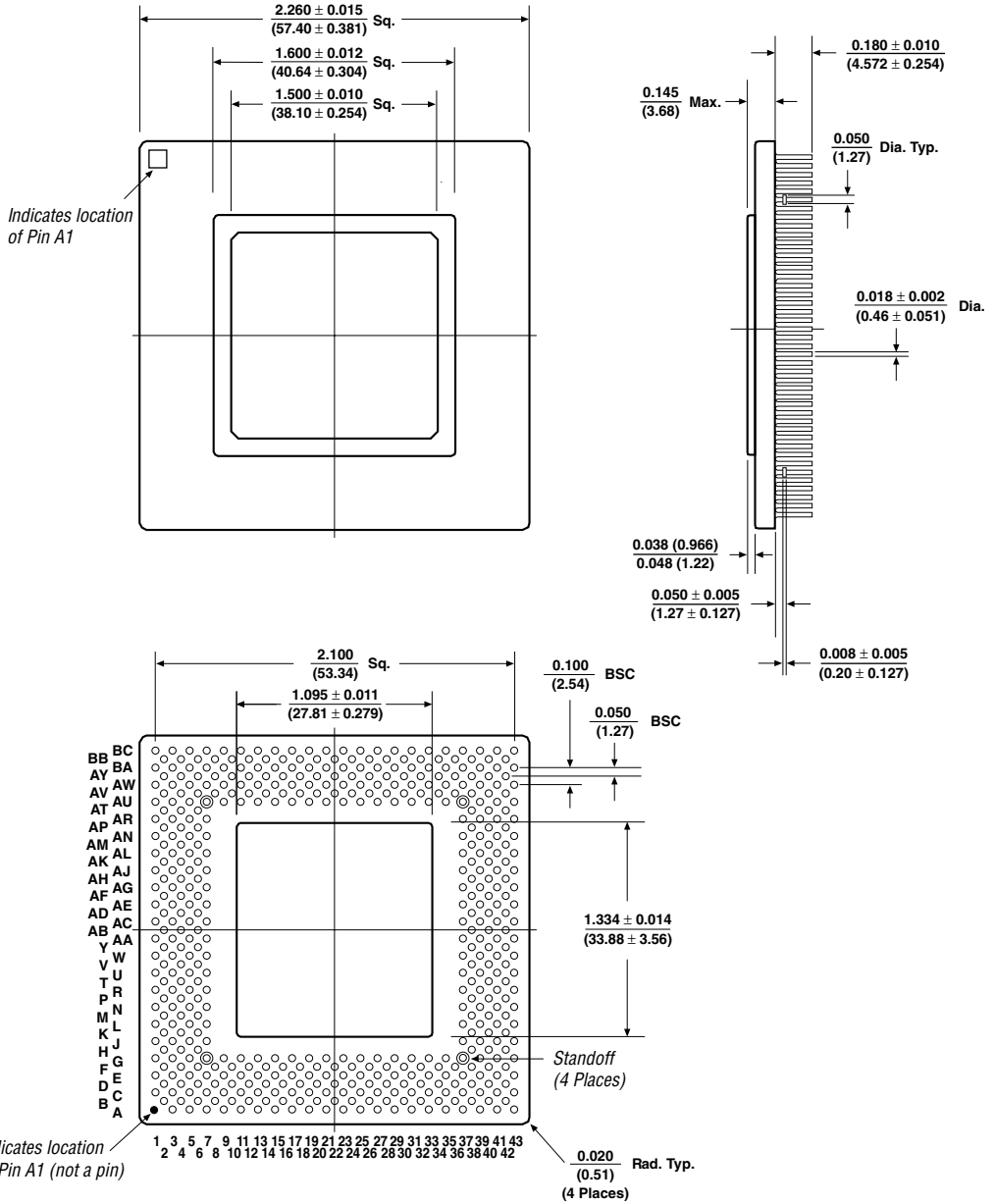
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	23.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	22		
e	1.00 BSC		



- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. M represents the the maximum solder ball matrix size.
  3. JEDEC reference: M0-034 option AAJ-1.
  4. Some devices have a chamfered corner at the A-1 ball location.

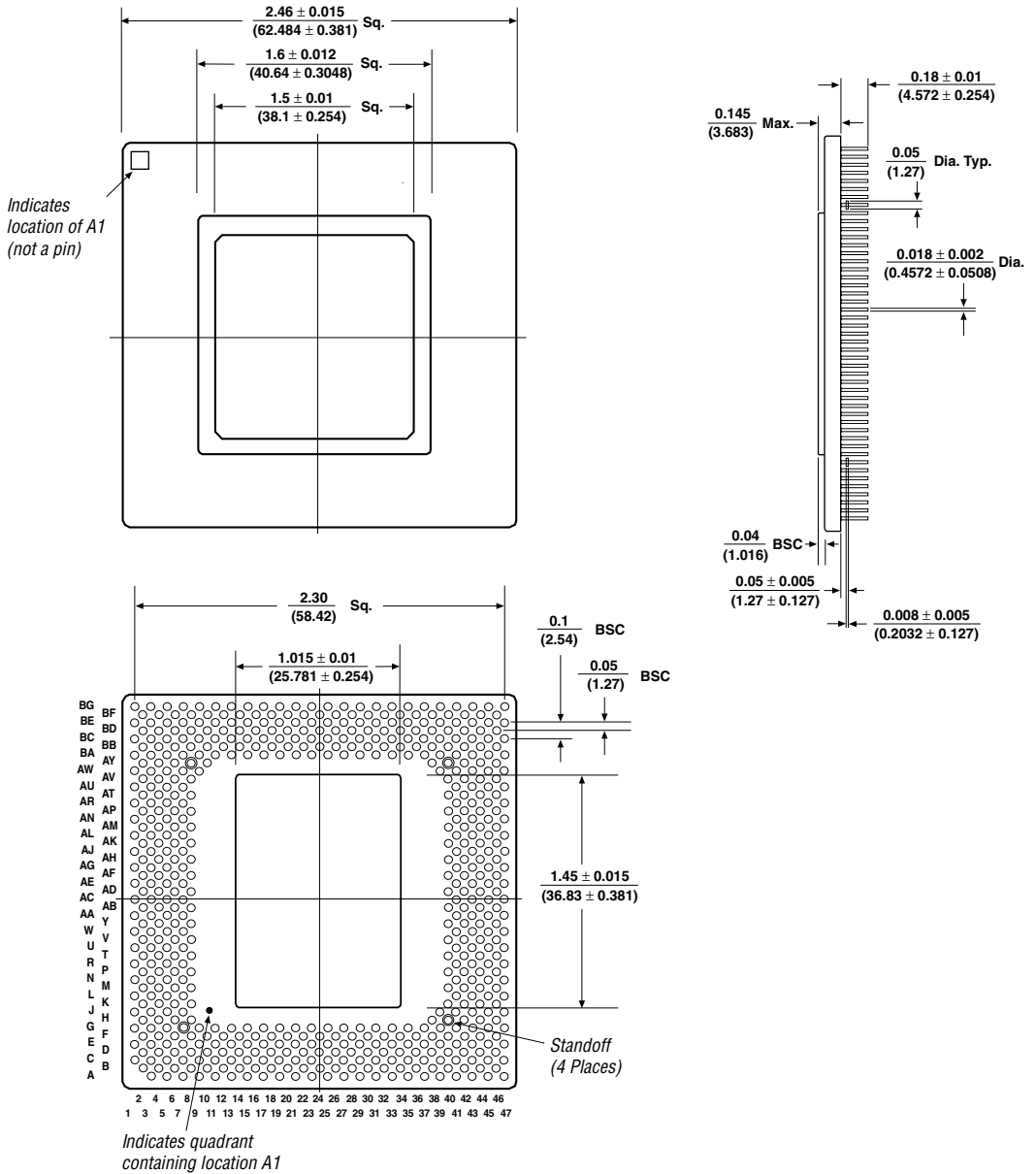
503-Pin Pin-Grid Array (PGA)

Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.

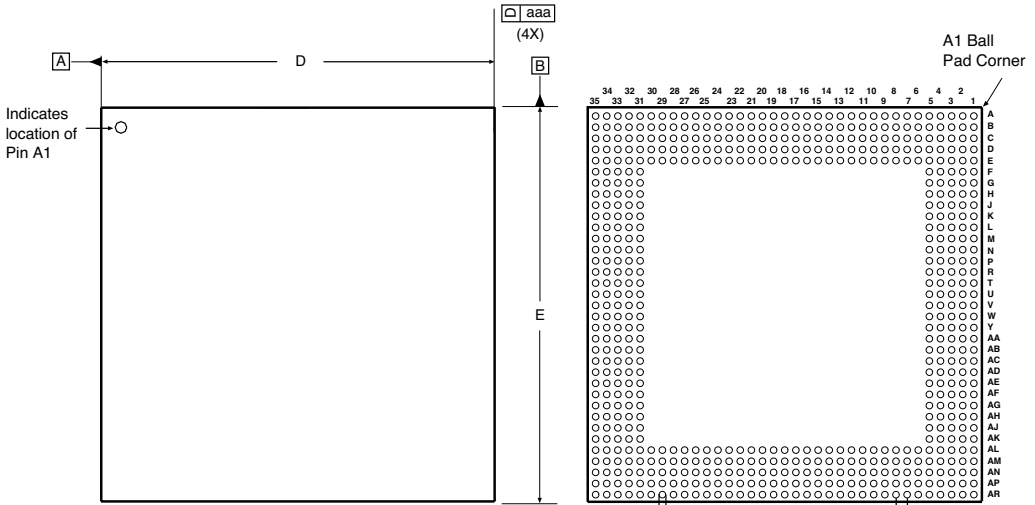


599-Pin Pin-Grid Array (PGA)

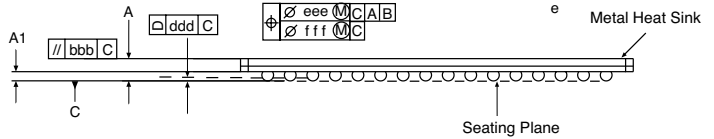
Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



600-Pin Ball-Grid Array (BGA)



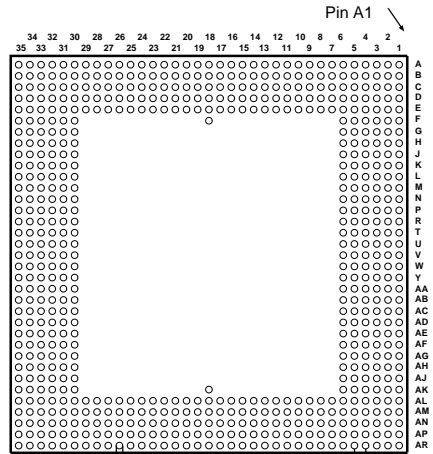
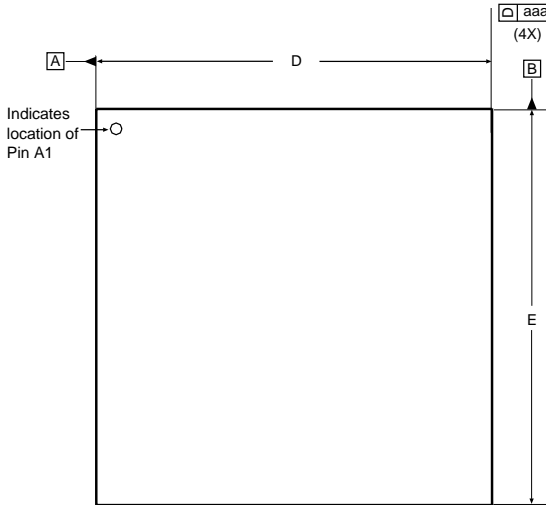
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	—	—	1.70
A1	0.35	—	—
D/E	45.00 BSC		
b	0.60	0.75	0.90
aaa	—	—	0.20
bbb	—	—	0.25
ddd	—	—	0.20
eee	—	—	0.30
fff	—	—	0.15
M	35		
e	1.27 BSC		



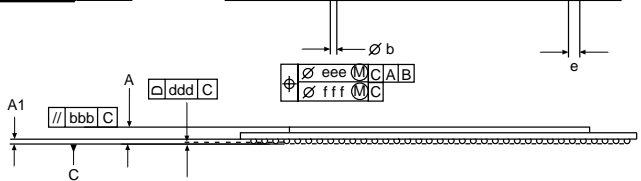
Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: M0-192 option BAW-1, depopulated.

652-Pin Ball-Grid Array (BGA)



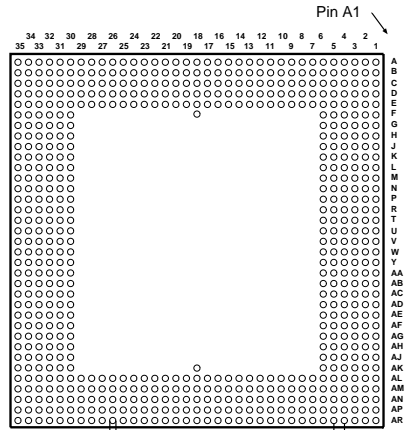
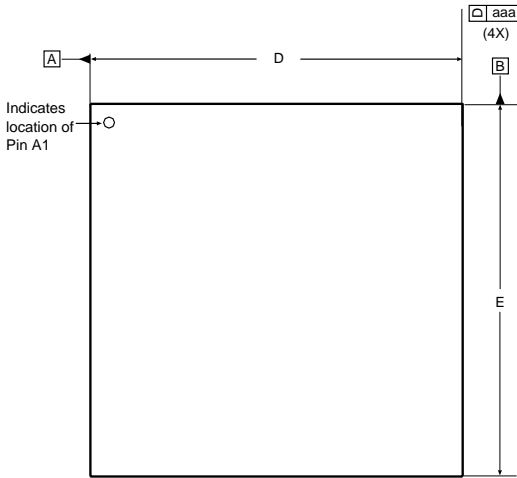
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.35	-	-
D/E	45.00 BSC		
b	0.60	0.75	0.90
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.30
fff	-	-	0.15
M	35		
e	1.27 BSC		



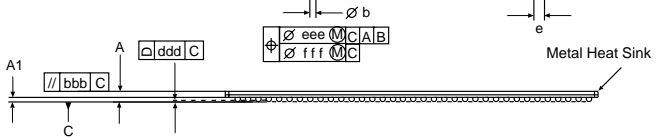
Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: MS-034 option BAW-1, depopulated.

652-Pin Super Ball-Grid Array (SBGA)



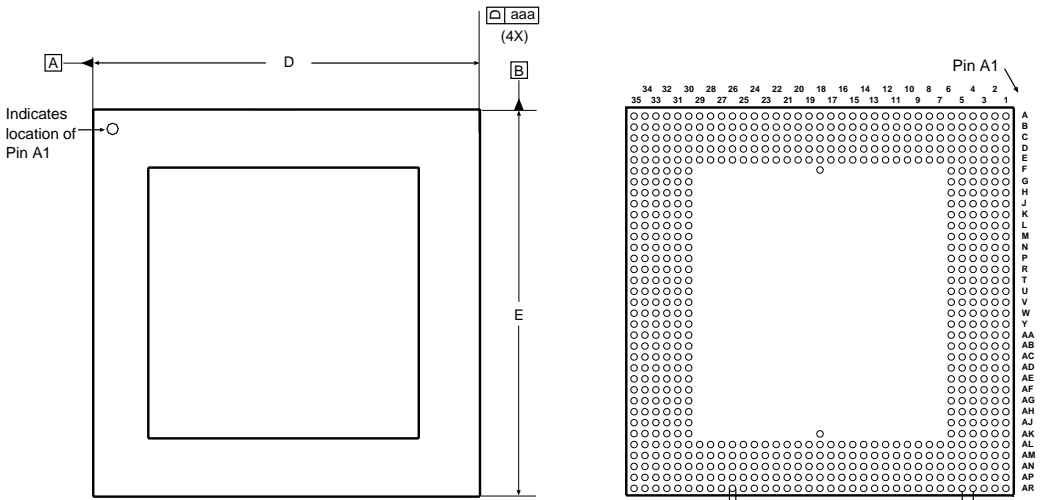
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	1.70
A1	0.35	-	-
D/E	45.00 BSC		
b	0.60	0.75	0.90
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.30
fff	-	-	0.15
M	35		
e	1.27 BSC		



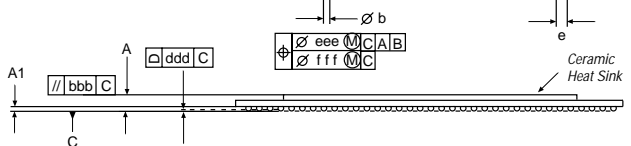
Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: M0-192 option BAW-1, depopulated.

652-Pin Flip-Chip FineLine BGA Package



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.35	-	-
D/E	45.00 BSC		
b	0.60	0.75	0.90
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.30
fff	-	-	0.15
M	35		
e	1.27 BSC		



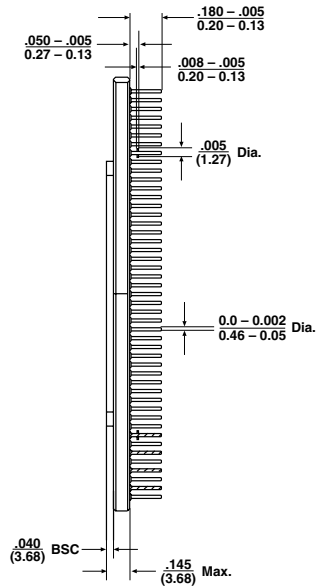
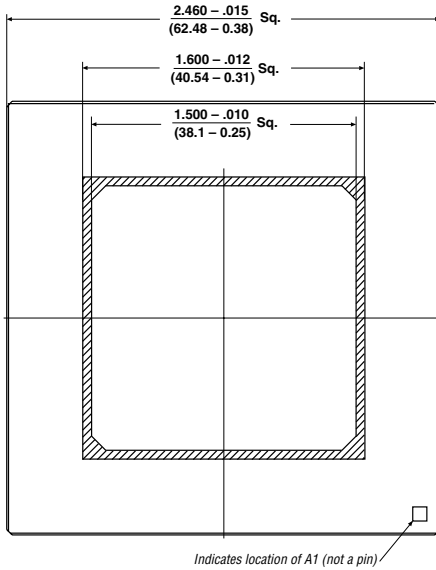
Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: MS-034 option BAW-1, depopulated.
4. Some devices have a chamfered corner at the A-1 ball location.

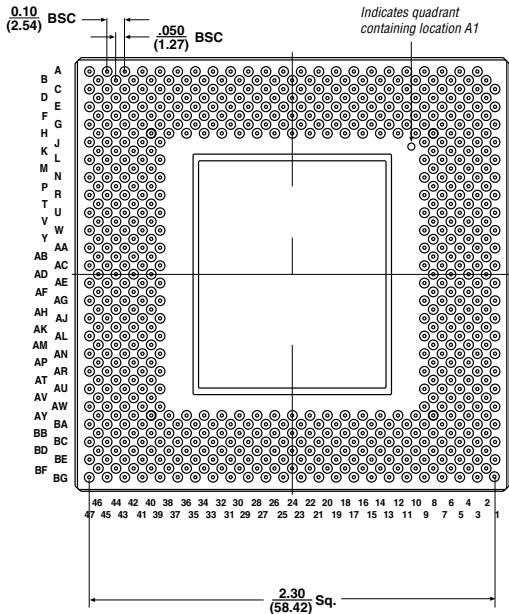


655-Pin Pin-Grid Array (PGA)

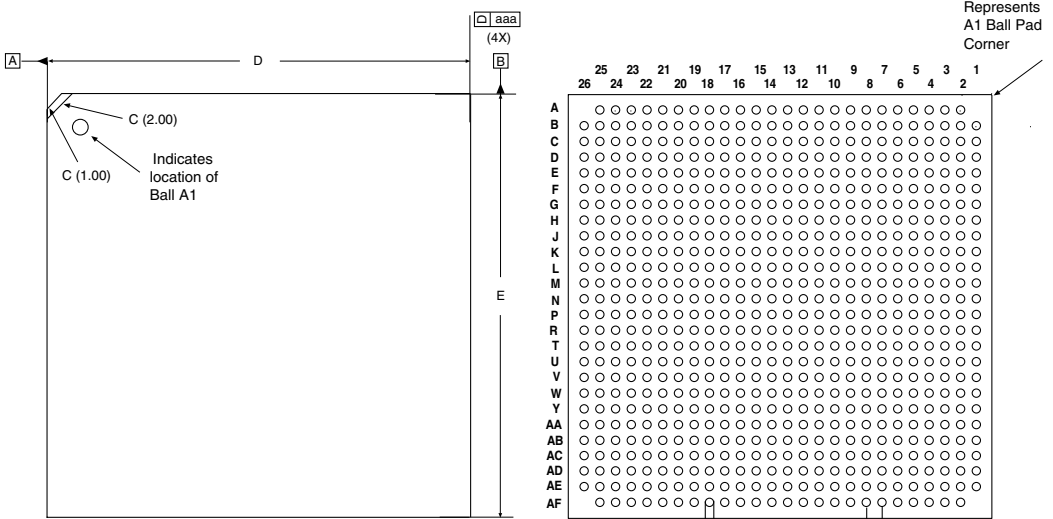
Controlling measurement is in inches. Millimeter measurements, shown in parenthesis, are for reference only.



(Bottom View)



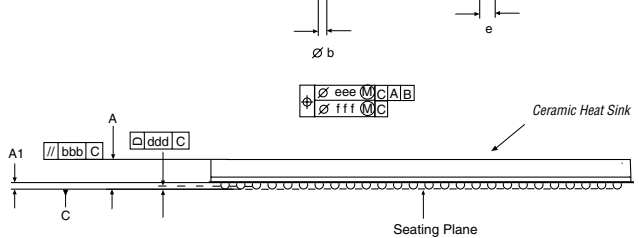
672-Pin FineLine BGA



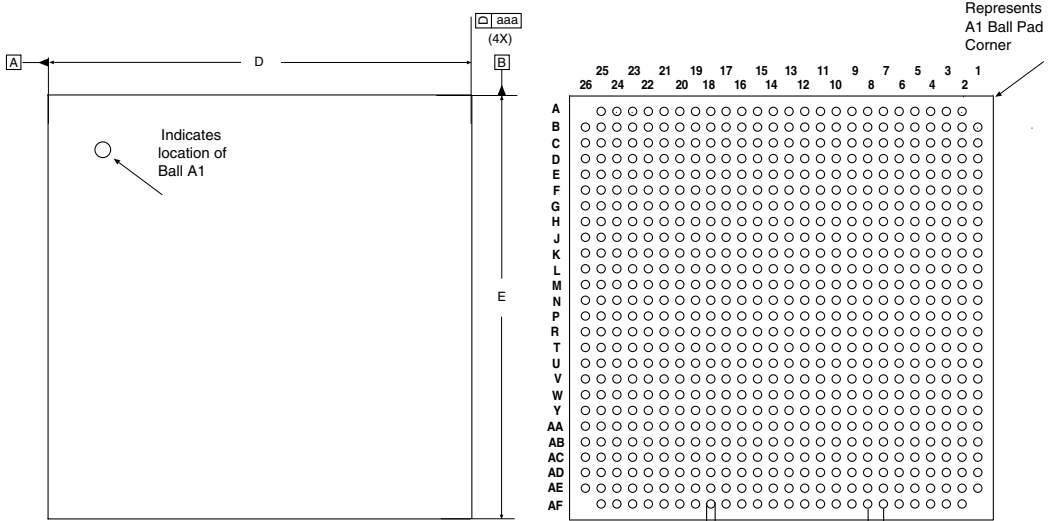
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	27.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	26		
e	1.00 BSC		

Notes:

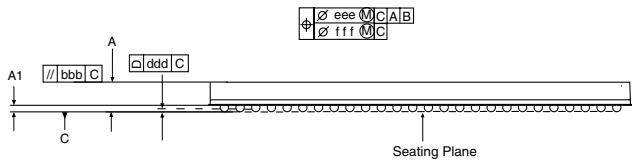
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: MS-034 AAL-1, depopulated.



672-Pin Flip-Chip FineLine BGA Package



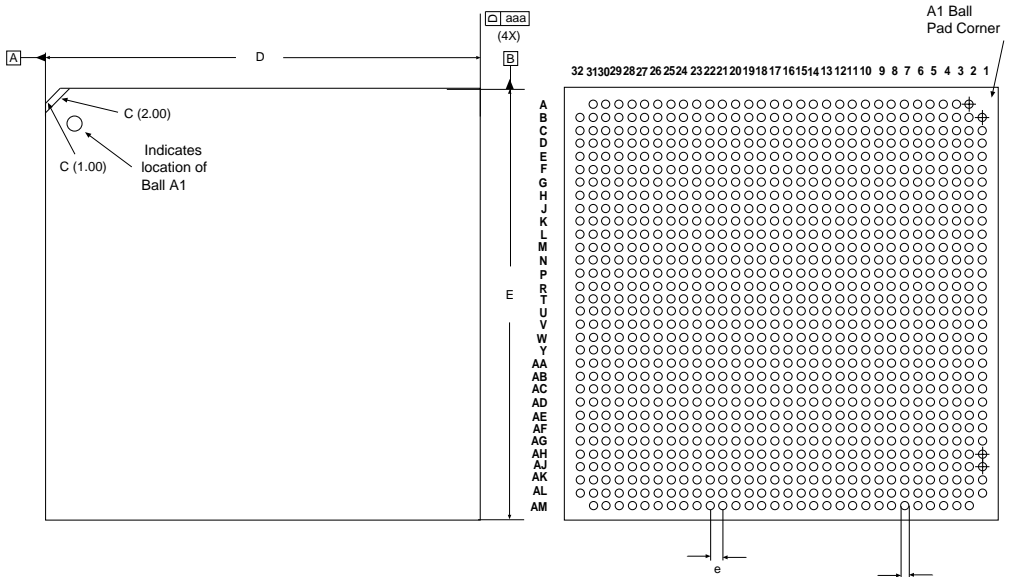
SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	27.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	26		
e	1.00 BSC		



Notes:

1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
2. M represents the the maximum solder ball matrix size.
3. JEDEC reference: MS-034 AAL-1, depopulated.
4. Some devices have a chamfered corner at the A-1 ball location.

1020-Pin Flip-Chip FineLine BGA Package



SYMBOL	Millimeters		
	MIN.	NOM.	MAX.
A	-	-	3.50
A1	0.30	-	-
D/E	33.00 BSC		
b	0.50	0.60	0.70
aaa	-	-	0.20
bbb	-	-	0.25
ddd	-	-	0.20
eee	-	-	0.25
fff	-	-	0.10
M	32		
e	1.00 BSC		

- Notes:
1. All dimensions and tolerances conform to ANSI Y14.5M - 1994
  2. M represents the the maximum solder ball matrix size.
  3. JEDEC reference: MS-034 option AAP-1, depopulated.
  4. Some devices have a chamfered corner at the A-1 ball location.

## Revision History

The information contained in the *Altera Device Package Information Data Sheet* version 9.1 supersedes information published in previous versions.

The following changes were made to the *Altera Device Package Information Data Sheet* version 9.1. Corrected pin locations from F17 and AK17 to F18 and AK18 in the following packages: 652-pin BGA, 652-pin super BGA, and 652-pin flip-chip FineLine BGA packages.



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