Package Information Guide

Version 5.0

Scope and Applicability

This Package Information Guide presents information about Cirrus Logic product package selection and availability.

Related Documents

- Data books for specific products
- Quality and Reliability Quarterly Reports

Notice

The information in this Package Information Guide has been carefully checked and is believed to be accurate. However, Cirrus Logic Inc. reserves the right to make changes without further notice to any products herein to improve reliability, function, or design, and makes no guarantee or warranty concerning the accuracy of said information, and shall not be responsible for any loss or damage of whatever nature resulting from the use of, or reliance upon, this document.

Cirrus Logic Inc. also does not guarantee that the use of any information contained herein will not infringe upon the patent or other rights of third parties, and no patent or other license is implied hereby. This document does not, in any way, extend our warranty on any products or specification beyond that set forth in its standard terms and conditions of sale.

Document Revision History

Since the previous release of this document (v4.0 April 1998), the following packages have been added:

8-Pin SSOP	16-Pin SSOP	20-Pin TSSOP	24-Pin TSSOP	8-Pin PDIP
16-Pin SOIC	32-Pin LQFP	44-Pin LQFP	48-Pin LQFP	64-Pin LQFP

1. INTRODUCTION

The purpose of this guide is to help the chip designer choose the appropriate package according to assembly die pad design rules and minimum and maximum die size. To evaluate package performance, thermal and electrical characteristics are provided. The following information is also included:

- New packages currently under development can be provided. Please contact the Packaging and Assembly Technologies Department for updates to new packages and their release dates.
- QFP shipping trays, dry-pack, and proper handling procedures are provided; these are vital for the safe arrival of packages at customer receiving departments. Cirrus Logic's dry-pack method has been thoroughly tested and is proven to withstand a 35 'G' drop test.
- IR (infrared) and VPS (vapor phase soldering) profiles are described. These profiles can serve as a reference to provide the ramp-up, ramp-down, and dwell times for each technique regarded as crucial to a successful surface-mount implementation.
- The Cirrus Logic Reliability Testing Specification is provided. It defines the standard tests that are performed to ensure long-term reliability in field applications before a new package is released.

1.1 Cirrus Logic Packages

To comply with JEDEC standards and simplify package designations (MQFP, LQFP, TQFP), the following package acronyms are used:

TQFP (Thin Quad Flat Pack)	A multi-pin, very thin (0.80- to less than 1.40-mm thick body) package with 0.50- or 0.40-mm lead pitch.
LQFP (Low-Profile Quad Flat Pack)	A multi-pin, thin (1.40- to 2.0-mm thick body) package with 0.50- or 0.40-mm lead pitch.
MQFP (Metric Quad Flat Pack)	A multi-pin, thin (2.10- to 3.50-mm thick body) package with 0.80-, 0.65-, or 0.50-mm lead pitch.
PBGA (Plastic Ball Grid Array)	A new form of MCM (multi-chip module) that offers high-density die packaging in a multi-pin format without the fine pitch. By using conventional surface-mount processes, PBGA provides mounting ease and flexibility.
FBGA (Fine-Pitch Ball Grid Array)	A Plastic Ball Grid Array package that has a ball pitch of 1.0 mm or smaller.
PDIP (Plastic Dual Inline Package)	A plastic package with straight leads at only two sides of the plastic body for thru-hole mounting.
SOIC (Small Outline Integrated Circuit)	A small outline plastic package with Gull wing leads at only two sides of the plastic body for surface mounting.
SSOP (Shrink Small Outline Package)	A compressed SOIC with tightened lead pitch.
PLCC (Plastic Leaded Chip Carrier)	A plastic quad package with 'J' leads at four sides of the plastic body.

PBGA

The Plastic Ball Grid Array is a popular package type, especially when lead count is greater than 208 or lead pitch for the QFP is less than 0.50 mm.

Since QFP coplanarity and bent leads can be a major yield loss in today's high-volume and high-throughput PCBA environment, end users are migrating to PBGAs because of the following:

- The process yield is generally higher since the coplanarity and bent lead problems is not as critical as in QFPs.
- PBGA foot print is slightly smaller than QFP when compared with the same lead count package.
- Better thermal performance can be attained with thermal via and thermal ball design than with QFPs.
- Better electrical performance is achieved since the PGBA ball-to-pad distance is shorter than in the QFP.

1.2 Plastic Package Materials

Materials for plastic packages are crucial to the performance and long-term reliability of the device. Copper lead frame has better thermal and electrical conductivity than Alloy 42. In the past, Alloy 42 lead frame was used because of its superior mechanical property for maintaining lead integrity. New copper lead frame materials (that is, MF202 and C7025) however, can provide tensile and yield strengths similar to that of Alloy 42. The coefficient of linear-expansion matching between the lead frame, molding compound, and die attach material is imperative. All materials should be considered to provide a reliable package in field applications.

Molding compounds are epoxy-novolac-encapsulation materials. Properties such as the thermal coefficient of expansion, low stress, low moisture absorption, and low alpha particle are important for high-performance semiconductor components; low modulus is also important because it provides solder-crack resistance. Other critical properties include rapid cure time for improving production throughput time, and crystal silica filler for enhancing thermal conductivity.

Handling, packing, and storage of moisture-sensitive QFPs are important to prevent cracking during surface-mount operation. The QFP package material absorbs moisture like any other molded package. This package is much thinner and smaller compared with other types of packages, and is susceptible to cracking and delamination during vapor phase or infrared reflow soldering on printed circuit boards. The QFP packages must be kept in airtight bags with desiccant during storage. The exposure time to ambient atmosphere for testing should be minimized. The airtight bags must be opened just before testing; after testing is complete, the units must be sealed immediately in the bags. This procedure requires proper scheduling for testing. Open the airtight bags *only* when the enclosed devices are to be tested immediately.

The RH (relative humidity) and temperature in the storage area must be monitored. The relative humidity should not exceed 60%, and the temperature should not exceed 86°F (30°C).

Table 1-1. Plastic Package Specifications

Material	Description
Lead Frame	Copper alloy
Die Attach	Ablestik® 84-1 or Hitachi® ENE series
Wire Bond	1.1- to 1.3-mil gold wire — 99% pure
Molding Compound	Sumitomo® 7XXX series or Toshiba® KE series
Lead Finish	Solder (Sn/Pb) plating (85/15 ~ 90/10 Sn/Pb)
Marking Ink	Markem® or AIS® oven- or UV-cure series
QFP Trays	JEDEC bakeable tray; conductive
Dry Pack	Moisture barrier/ESD protection bag

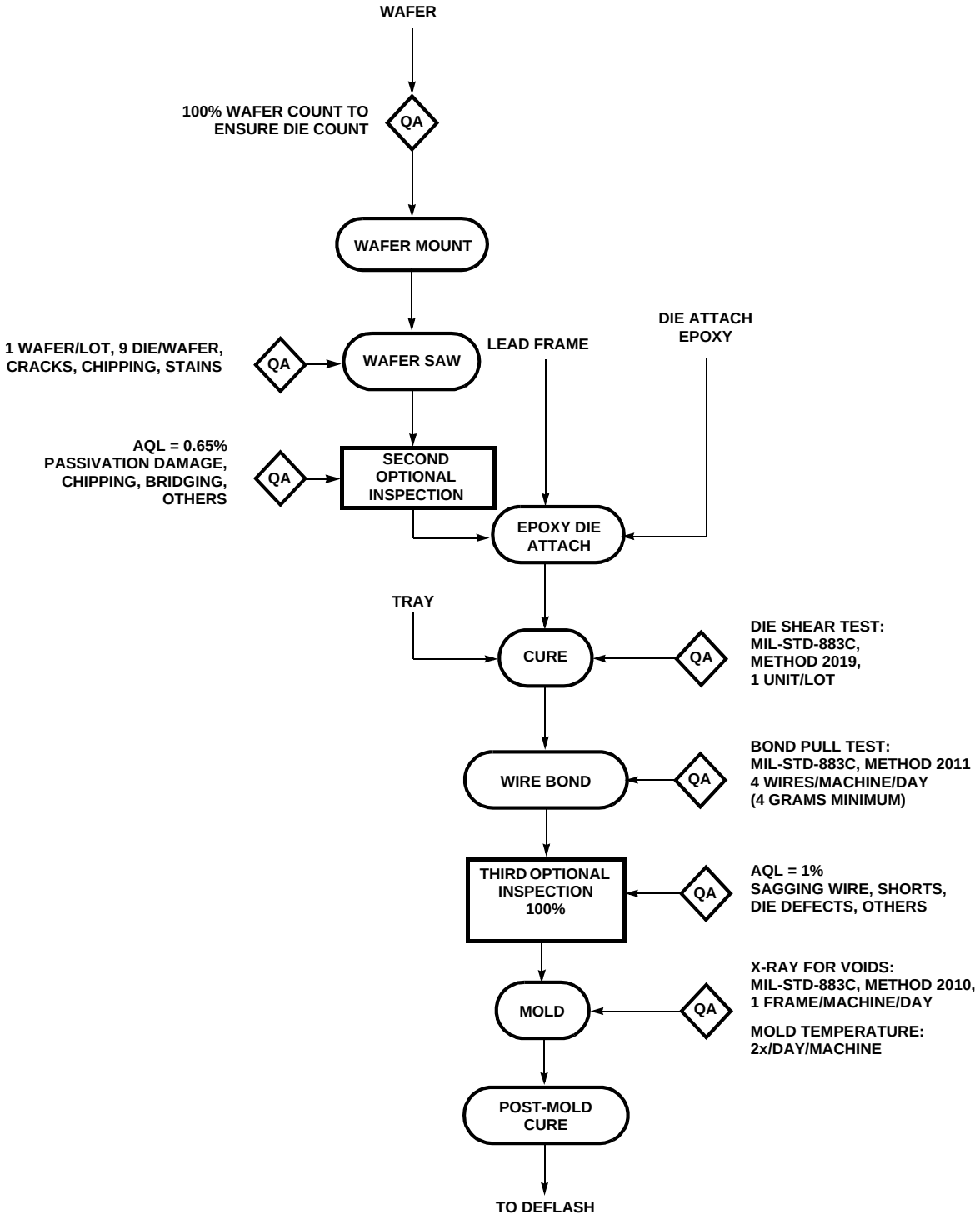


Figure 1-1. Generic QFP Assembly Flow

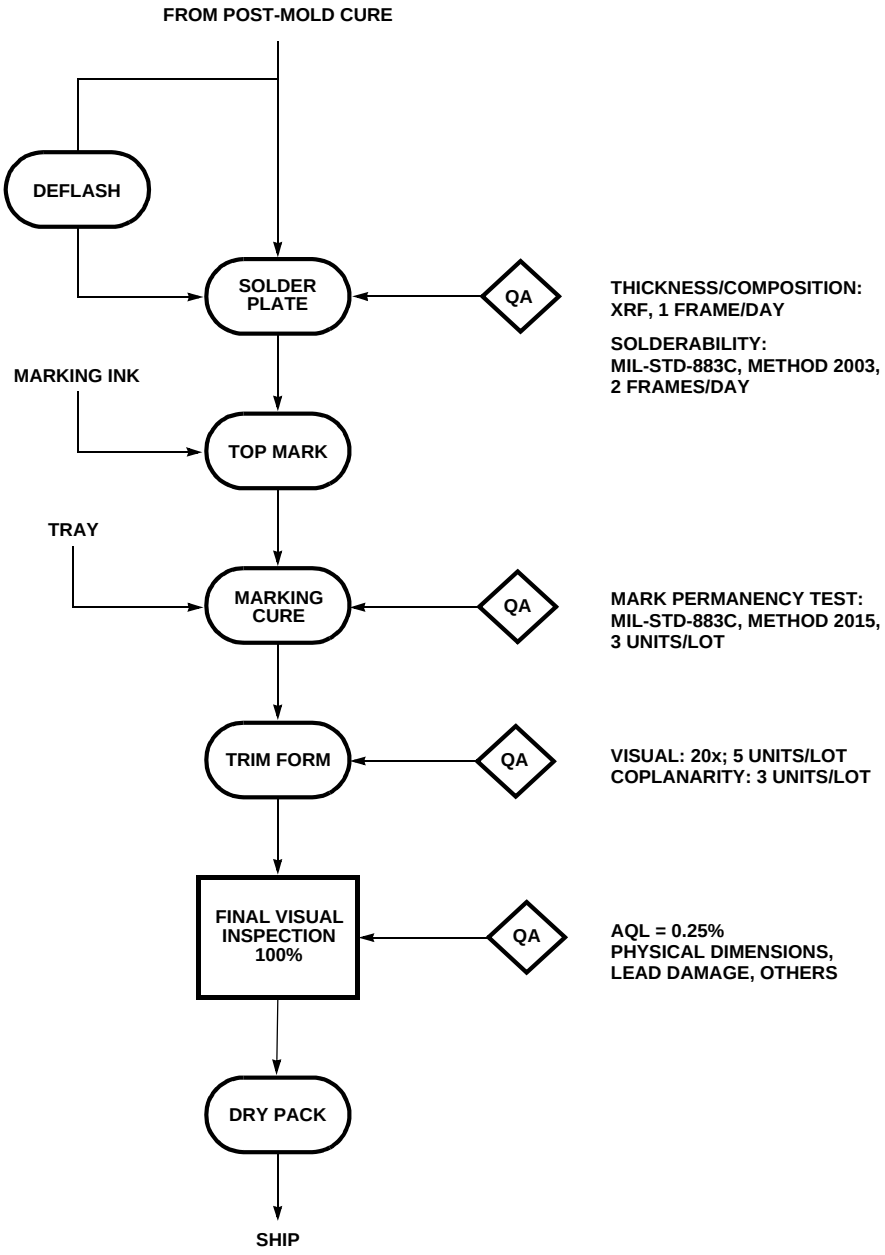


Figure 1-1. Generic QFP Assembly Flow *(cont.)*

Table 1-2. Minimum/Maximum Die Size

Package Type	Body Size	Lead Pitch	Bond Form	Pad Size (mm)	MAX Die Size (mm)	MIN Die Size (mm)
44-pin LQFP	10 × 10 × 1.40 mm	0.80 mm	—	6.0 × 6.0	5.48 × 5.48	3.70 × 3.70
64-pin TQFP	10 × 10 × 1.00 mm	0.50 mm	—	6.0 × 6.0	5.48 × 5.48	3.70 × 3.70
80-pin TQFP	12 × 12 × 1.00 mm	0.50 mm	843-6002	8.0 × 8.0	7.48 × 7.48	5.70 × 5.70
100-pin MQFP	14 × 20 × 2.70 mm	0.65 mm	843-5055	8.60 × 7.6	8.08 × 7.08	6.30 × 5.30
			843-5049	10.1 × 9.9	9.58 × 9.38	7.80 × 7.60
			843-5051	10.8 × 9.5	10.28 × 8.98	8.50 × 7.20
100-pin LQFP	14 × 14 × 1.40 mm	0.50 mm	843-5045	9.3 × 7.6	8.78 × 7.08	7.00 × 5.30
100-pin MQFP	14 × 20 × 2.70 mm	0.65 mm	843-5001	8.0 × 8.0	7.48 × 7.48	5.70 × 5.70
			843-5002	8.9 × 8.9	8.38 × 8.38	6.60 × 6.60
			843-5004	9.0 × 10.0	8.48 × 9.48	6.70 × 7.70
			843-5006	8.8 × 11.0	8.28 × 10.48	6.50 × 8.70
			843-5008	9.0 × 11.0	8.48 × 10.48	6.70 × 8.70
			843-5013	9.1 × 9.1	8.58 × 8.58	6.80 × 6.80
			843-5014	6.0 × 6.0	5.48 × 5.48	3.70 × 3.70
			843-5022	7.0 × 7.0	6.48 × 6.48	4.70 × 4.70
			843-5023	7.5 × 7.5	6.98 × 6.98	5.20 × 5.20
			843-5027	8.4 × 8.8	7.88 × 8.28	6.10 × 6.50
100-pin MQFP	14 × 20 × 2.70 mm	0.65 mm	843-5029	8.4 × 8.8	7.88 × 8.28	6.10 × 6.50
100-pin LQFP	14 × 14 × 1.40 mm	0.50 mm	843-5019	8.0 × 8.0	7.48 × 7.48	5.70 × 5.70
			843-5020	6.0 × 6.0	5.48 × 5.48	3.70 × 3.70
			843-5024	7.5 × 7.5	6.98 × 6.98	5.20 × 5.20
			843-5030	7.0 × 7.0	6.48 × 6.48	4.70 × 4.70
			843-5031	9.0 × 9.0	8.48 × 8.48	6.70 × 6.70
100-pin LQFP	14 × 14 × 1.40 mm	0.50 mm	843-5032	10.3 × 10.3	9.78 × 9.78	8.0 × 8.0
			843-5035	9.5 × 9.5	8.98 × 8.98	7.20 × 7.20
			843-5036	11.0 × 11.0	10.48 × 10.48	8.70 × 8.70
			843-5034	6.5 × 6.5	5.98 × 5.98	4.20 × 4.20
120-pin LQFP	14 × 14 × 1.40 mm	0.40 mm	843-5301	9.0 × 9.0	8.48 × 8.48	6.70 × 6.70
128-pin MQFP	28 × 28 × 3.50 mm	0.80 mm	843-5XXX	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
128-pin MQFP	14 × 20 × 2.70 mm	0.50 mm	843-5201	9.0 × 11.0	8.48 × 10.48	6.70 × 8.70
128-pin LQFP	14 × 14 × 1.40 mm	0.40 mm	—	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
144-pin MQFP	28 × 28 × 3.50 mm	0.65 mm	843-5XXX	9.2 × 9.2	8.68 × 8.68	6.90 × 6.90
			843-5104	11.4 × 11.4	10.88 × 10.88	9.10 × 9.10
			843-5105	12.7 × 12.7	12.18 × 12.18	10.40 × 10.40

Table 1-2. Minimum/Maximum Die Size *(cont.)*

Package Type	Body Size	Lead Pitch	Bond Form	Pad Size (mm)	MAX Die Size (mm)	MIN Die Size (mm)
144-pin LQFP	20 × 20 × 1.40 mm	0.50 mm	843-5402	9.0 × 9.0	8.48 × 8.48	6.70 × 6.70
			843-5403	11.0 × 11.0	10.48 × 10.48	8.70 × 8.70
160-pin MQFP	28 × 28 × 3.50 mm	0.65 mm	—	11.4 × 11.4	10.88 × 10.88	9.10 × 9.10
160-pin MQFP	28 × 28 × 3.50 mm	0.65 mm	843-5106	12.5 × 12.5	11.98 × 11.98	10.20 × 10.20
			843-51XX	10.28 × 10.28	9.76 × 9.76	7.98 × 7.98
			843-5XXX	10.28 × 10.28	9.76 × 9.76	7.98 × 7.98
176-pin LQFP	20 × 20 × 1.40 mm	0.40 mm	—	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
			—	13.2 × 13.2	12.68 × 12.68	10.90 × 10.90
176-pin LQFP	24 × 24 × 1.40 mm	0.50 mm	—	9.5 × 9.5	8.98 × 8.98	7.20 × 7.20
184-pin LQFP	20 × 20 × 1.40 mm	0.40 mm	—	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
208-pin MQFP	28 × 28 × 3.50 mm	0.50 mm	—	11.0 × 11.0	10.48 × 10.48	8.70 × 8.70
			—	12.0 × 12.0	11.48 × 11.48	9.70 × 9.70
208-pin MQFP	28 × 28 × 3.50 mm	0.50 mm	843-5XXX	11.0 × 11.0	10.48 × 10.48	8.70 × 8.70
			843-5XXX	9.0 × 9.0	8.48 × 8.48	6.70 × 6.70
208-pin LQFP	28 × 28 × 1.40 mm	0.50 mm	—	9.0 × 9.0	8.48 × 8.48	6.70 × 6.70
			—	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
			—	11.0 × 11.0	10.48 × 10.48	8.70 × 8.70
240-pin MQFP	32 × 32 × 3.50 mm	0.50 mm	—	10.0 × 10.0	9.48 × 9.48	7.70 × 7.70
256-pin LQFP	28 × 28 × 2.00 mm	0.40 mm	843-5701	12.0 × 12.0	11.48 × 11.48	9.70 × 9.70
256-pin LQFP	28 × 28 × 2.00 mm	0.40 mm	—	12.0 × 12.0	11.48 × 11.48	9.70 × 9.70
256-pin PBGA	27 × 27× 1.60 mm	1.27 mm	—	—	9.48 × 9.48	7.70 × 7.70
256-pin PBGA	17 × 17× 1.53 mm	1.00 mm	—	—	8.17 × 8.17	6.88 × 6.88
144-pin FBGA	12 × 12 × 1.20 mm	0.80 mm	—	—	7.60 × 7.60	4.70 × 4.70

NOTES:

1) Minimum/maximum die sizes are estimates.
2) Allow an extra 0.65 mm per side for down bond.

1.3 Assembly Die Pad Design Rules

The dimensions noted in this section refer to Figure 1-2 on page 12.

Bond Pad Size

The bond pad consists of metal 1 or 2 covered with oxide and/or nitride passivation, and an opening for bonding on the metal pad. In Figure 1-2, the minimum glass-free pad size ‘E’ required depends upon the bonding wire size to assure 75% coverage of the bond pad. The proper wire size and glass-free pad size are shown in Table 1-3.

Table 1-3. Bond Pad Size According to Package Type

Package Type	Wire Size	Bond Pad Size (MIN)
PLCC	1.3 mils	75 × 75 µm
PLCC	1.0 mils	75 × 75 µm
QFP	1.0 mils	68 × 68 µm
QFP	1.3 mils	75 × 75 µm

Oxide Overlap

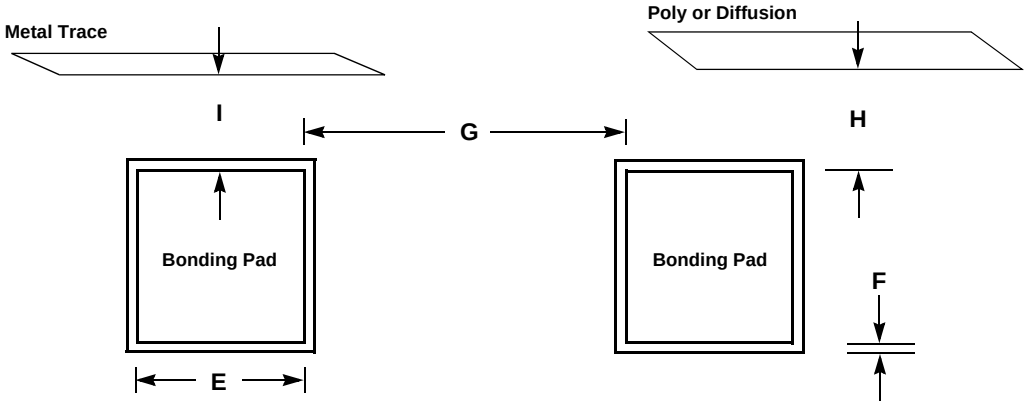
Minimum oxide and/or nitride passivation overlap ‘F’ is 3.0 microns.

Pad to Pad Clearance

The minimum separation ‘G’ is 13 microns, which gives a pitch of 91.1 microns (3.6 mils).

Pad to Adjacent Metal Clearance

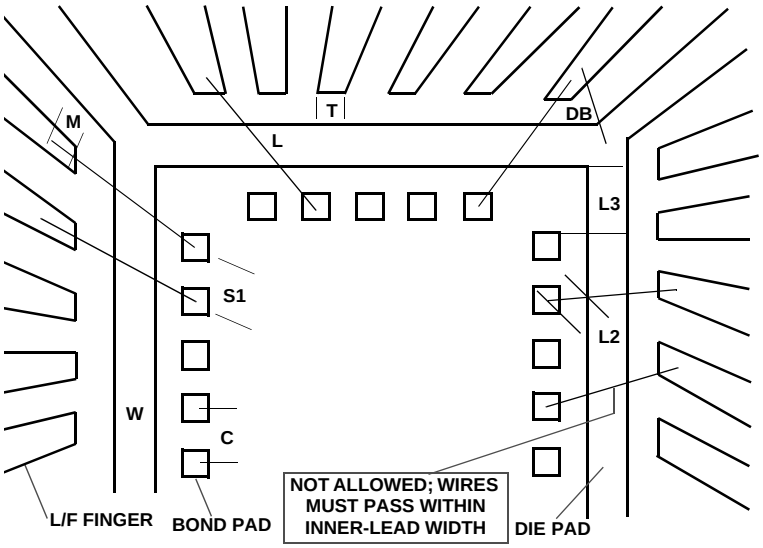
Minimum separation ‘H’ from the bonding pad edge to poly, diffusion well, contact, or via area should be 15 microns. The minimum separation between adjacent metal traces and bonding pad ‘I’ is also 15 microns.



Minimum Limit Table (in μm)

E	F	G	H	I
68	3.0	13	13	13

Figure 1-2. Bonding Pad Design Rules



General Wire Bonding Rules for Plastic QFP

- W = GAP BETWEEN DIE AND DIE PAD (ONE SIDE) IS 0.2 MM MINIMUM.
- L = BONDING DISTANCE IS 3.5 MM MAXIMUM (DEPENDING UPON PIN COUNT AND PACKAGE TYPE).
- M = SECOND BONDING POSITION ON LEAD FRAME (L/F) FINGER IS 0.3 MM MINIMUM.
- L3 = DISTANCE FROM BOND PAD EDGE TO DIE EDGE IS 0.25 MM.
- T = WIRES MUST PASS WITHIN INNER-LEAD WIDTH.
- S1 = GAP BETWEEN ADJACENT WIRES IS 0.09 MM MINIMUM.
- L2 = WIRE LENGTH FROM CENTER OF BOND PAD TO DIE EDGE IS 0.7 MM MAXIMUM.
- C = MINIMUM BOND PAD PITCH IS 91.1 MICRONS (3.6 MILS).
- DB = DOWN BONDS MUST BE LOCATED ON CORNER PINS ONLY.

Figure 1-3. Assembly Die Pad Design Rules

1.4 Package Thermal Resistance

Package Type	Lead Pitch	Pin Count[a]	Die Size	Θja °C	Θjc °C
10 × 10 × 1.40 mm	0.50 mm	44-pin LQFP	5 × 5 mm	68	17
10 × 10 × 1.00 mm	0.50 mm	64-pin TQFP	5 × 5 mm	80	15
12 × 12 × 1.0 mm	0.50 mm	80-pin TQFP	7 × 7 mm	65	10
14 × 20 × 2.70 mm	0.65 mm	100-pin MQFP (fused)	8.4 × 6.3 mm	38	7
14 × 14 × 1.40 mm	0.50 mm	100-pin LQFP (fused)	6.5 × 6.5 mm	44	11
14 × 20 × 2.70 mm	0.65 mm	100-pin MQFP	7 × 7 mm	60	15
14 × 20 × 2.70 mm	0.65 mm	100-pin MQFP	7 × 7 mm	48	10
14 × 14 × 1.40 mm	0.50 mm	100-pin LQFP	6.5 × 6.5 mm	60	9
14 × 14 × 1.40 mm	0.40 mm	120-pin LQFP	7 × 7 mm	55	9
28 × 28 × 3.50 mm	0.80 mm	128-pin MQFP	7 × 7 mm	43	10
14 × 20 × 2.75 mm	0.50 mm	128-pin MQFP	6.5 × 6.5 mm	45	10
14 × 20 × 1.40 mm	0.50 mm	128-pin LQFP	6.5 × 6.5 mm	60	10
28 × 28 × 3.50 mm	0.65 mm	144-pin MQFP	6.5 × 6.5 mm	40	10
20 × 20 × 1.40 mm	0.50 mm	144-pin LQFP	9 × 9 mm	65	10
28 × 28 × 3.50 mm	0.65 mm	160-pin MQFP (DPH)	7 × 7 mm	30	9
28 × 28 × 3.50 mm	0.65 mm	160-pin MQFP	7 × 7 mm	37	10
20 × 20 × 1.40 mm	0.40 mm	176-pin LQFP	7 × 7 mm	63	10
24 × 24 × 1.40 mm	0.50 mm	176-pin LQFP	7 × 7 mm	40	10–15
20 × 20 × 1.40 mm	0.40 mm	184-pin LQFP	6 × 6 mm	33	6
28 × 28 × 3.50 mm	0.50 mm	208-pin MQFP (DHS)	6.5 × 6.5 mm	27	9
28 × 28 × 3.50 mm	0.50 mm	208-pin MQFP	6.5 × 6.5 mm	34	9
28 × 28 × 1.40 mm	0.50 mm	208-pin LQFP	6.5 × 6.5 mm	39	13
32 × 32 × 3.50 mm	0.50 mm	240-pin MQFP	12 × 12 mm	25	9
28 × 28 × 3.37 mm	0.40 mm	256-pin LQFP	6.5 × 6.5 mm	22	8
28 × 28 × 2.0 mm	0.40 mm	256-pin LQFP	6.5 × 6.5 mm	25	7
27 × 27 × 1.60 mm	1.27 mm	256-pin PBGA	7 × 7 mm	23	9
17 × 17 × 1.53 mm	1.00 mm	256-pin PBGA	5 × 5 mm	33	7
12 × 12 × 1.20 mm	0.8 mm	144-pin FBGA	6 × 6 mm	50	8

[a] fused: fused lead
DHS: Dropped-in Heat Spreader
DPH: Die Pad Heat Spreader

NOTES:

1) All measurements were done in still air; values are estimates.
2) Θja/Θjc are in °C per watt.
3) Thermal resistance calculation is based on 50% PCB metallization.
4) T_A = 70°C; T_J = 125°C.
5) Lead frame may vary for high-performance packages; please consult Cirrus Logic before beginning any new design.

1.5 Package Electrical Characteristics

Package Type	Lead Pitch	Pin Count [a]	C (pF)	L (nH)	R (mΩ)
12 × 12 × 1.0 mm	0.50 mm	80-pin TQFP	<2.0	3–5	<100
14 × 20 × 2.75 mm	0.65 mm	100-pin MQFP (fused)	2.0–3.0	3–6	<50
14 × 14 × 1.40 mm	0.50 mm	100-pin LQFP (fused)	<2.0	3–6	<100
14 × 20 × 2.75 mm	0.65 mm	100-pin MQFP	2.0–3.0	5–15	75–250
14 × 20 × 2.75 mm	0.65 mm	100-pin MQFP	2.0–3.0	4–7	<50
14 × 14 × 1.40 mm	0.50 mm	100-pin LQFP	<2.0	5–10	<100
14 × 14 × 1.40 mm	0.40 mm	120-pin LQFP	<2.0	5–10	<100
28 × 28 × 3.50 mm	0.80 mm	128-pin MQFP	2.0–5.0	10–15	<75
14 × 20 × 2.75 mm	0.50 mm	128-pin MQFP	2.0–3.0	5–7	<50
14 × 14 × 1.40 mm	0.40 mm	128-pin LQFP	<2.0	5–10	<100
28 × 28 × 3.50 mm	0.65 mm	144-pin MQFP	2.0–5.0	10–18	<75
20 × 20 × 1.40 mm	0.50 mm	144-pin LQFP	2.0–7.0	7–10	<100
28 × 28 × 3.50 mm	0.65 mm	160-pin MQFP (DPH)	3.0–6.0	10–15	<100
28 × 28 × 3.50 mm	0.65 mm	160-pin MQFP	2.0–5.0	11–19	<100
20 × 20 × 1.40 mm	0.40 mm	176-pin LQFP	2.0–7.0	7–10	<100
24 × 24 × 1.40 mm	0.50 mm	176-pin LQFP	2.0–10.0	8–11	<75
20 × 20 × 1.40 mm	0.40 mm	184-pin LQFP	2.0–10.0	8–11	<75
28 × 28 × 3.50 mm	0.50 mm	208-pin MQFP (DHS)	3.0–6.0	10–15	<125
28 × 28 × 3.50 mm	0.50 mm	208-pin MQFP	2.0–5.0	12–20	<125
28 × 28 × 1.40 mm	0.50 mm	208-pin LQFP	<2.0	8–12	<50
32 × 32 × 3.50 mm	0.50 mm	240-pin MQFP	<1.5	10–12	<50
28 × 28 × 3.37 mm	0.40 mm	256-pin MQFP	<2.0	10–18	<80
28 × 28 × 2.0 mm	0.40 mm	256-pin LQFP	<2.0	8–10	<100
27 × 27 × 2.33 mm	1.27 mm	256-pin PBGA	<2.0	5–10	<25
17 × 17 × 1.53 mm	1.00 mm	256-pin PBGA	<1.4	2–4	<20
12 × 12 × 1.20 mm	0.80 mm	144-pin FBGA	<1.4	2–4	<20

[a] fused: fused lead
DHS: Dropped-in Heat Spreader
DPH: Die Pad Heat Spreader

NOTES:

1) Loading capacitance measured using SEMI Method G-25-89.
2) Inductance measured using SEMI Method G-23-89.
3) Resistance measured using SEMI Method G-24-89.

2. PACKAGE OUTLINE DRAWINGS

2.1 20-, 28-, 44-, 68-, and 84-Pin PLCC

(This drawing refers to dimensions in Table 2-1 on page 16.)

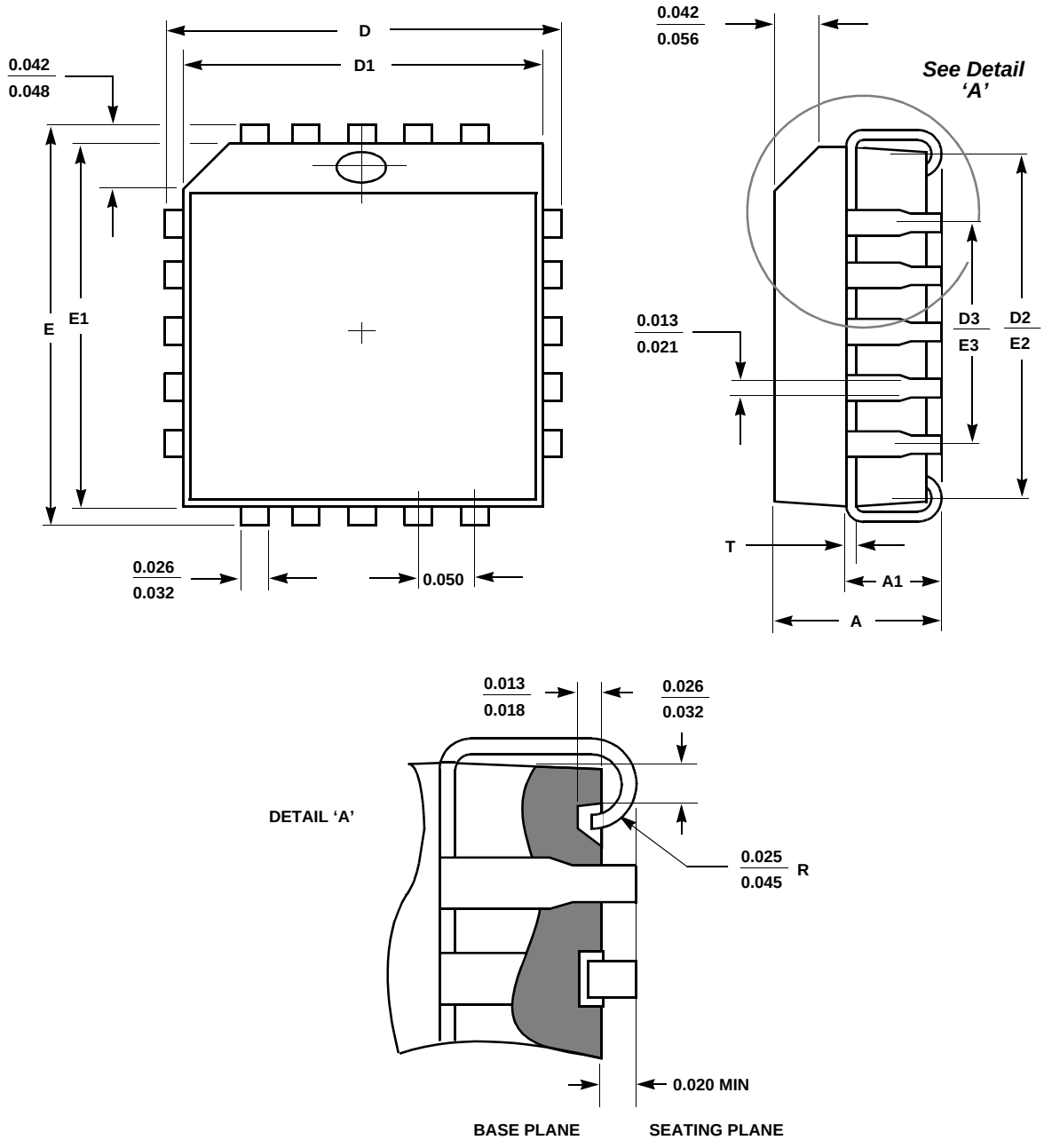


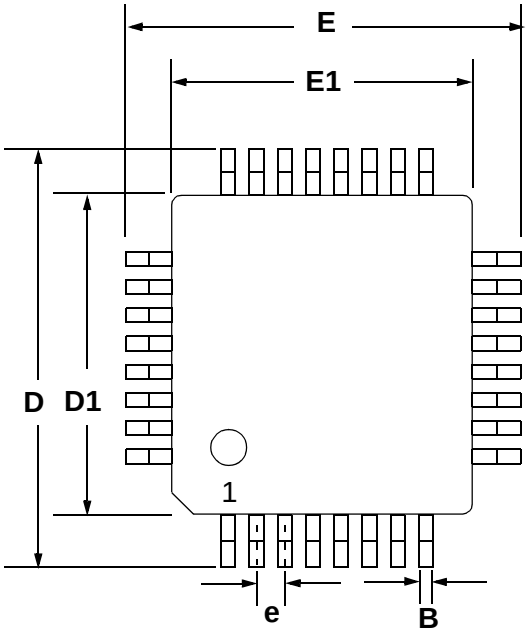
Table 2-1. 20-, 28-, 44-, 68-, and 84-Pin PLCC Package Dimensions

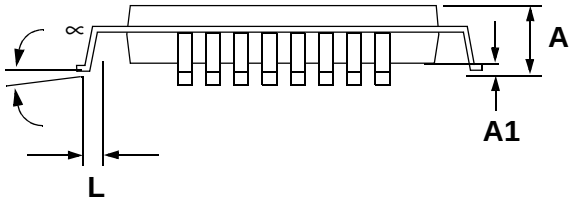
	Number of Pins									
	20		28		44		68		84	
	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX
A	0.165	0.180	0.165	0.180	0.165	0.180	0.165	0.200	0.165	0.200
A1	0.090	0.120	0.090	0.120	0.090	0.120	0.090	0.130	0.090	0.130
D	0.385	0.395	0.485	0.495	0.685	0.695	0.985	0.995	1.185	1.195
D1	0.350	0.356	0.450	0.456	0.650	0.656	0.950	0.958	1.150	1.158
D2	0.290	0.330	0.390	0.430	0.590	0.630	0.890	0.930	1.090	1.130
D3	0.200 REF		0.300 REF		0.500 REF		0.800 REF		1.000 REF	
E	0.385	0.395	0.485	0.495	0.685	0.695	0.985	0.995	1.185	1.195
E1	0.350	0.356	0.450	0.456	0.650	0.656	0.950	0.958	1.150	1.158
E2	0.290	0.330	0.390	0.430	0.590	0.630	0.890	0.930	1.090	1.130
E3	0.200 REF		0.300 REF		0.500 REF		0.800 REF		1.000 REF	
T	0.007	0.013	0.0077	0.0103	0.0077	0.0103	0.0077	0.0103	0.0077	0.0103

NOTES:

1) Refer to JEDEC Publication 95, 1993 for symbol descriptions.
2) All dimensions are in inches, and controlling dimension is inch.
3) D1 and E1 do not include mold flash, which is 0.010 inch maximum.
4) D2/E2 will be determined at the seating plane.
5) Copper lead frame and lead finish is solder plate or matte-tin plate.
6) Formed leads are planar within 0.004 inch with respect to one another.
7) The top-half of the package above the lead frame can be smaller than the bottom-half of the package by a maximum of 0.010 inch.

2.2 32-Pin LQFP



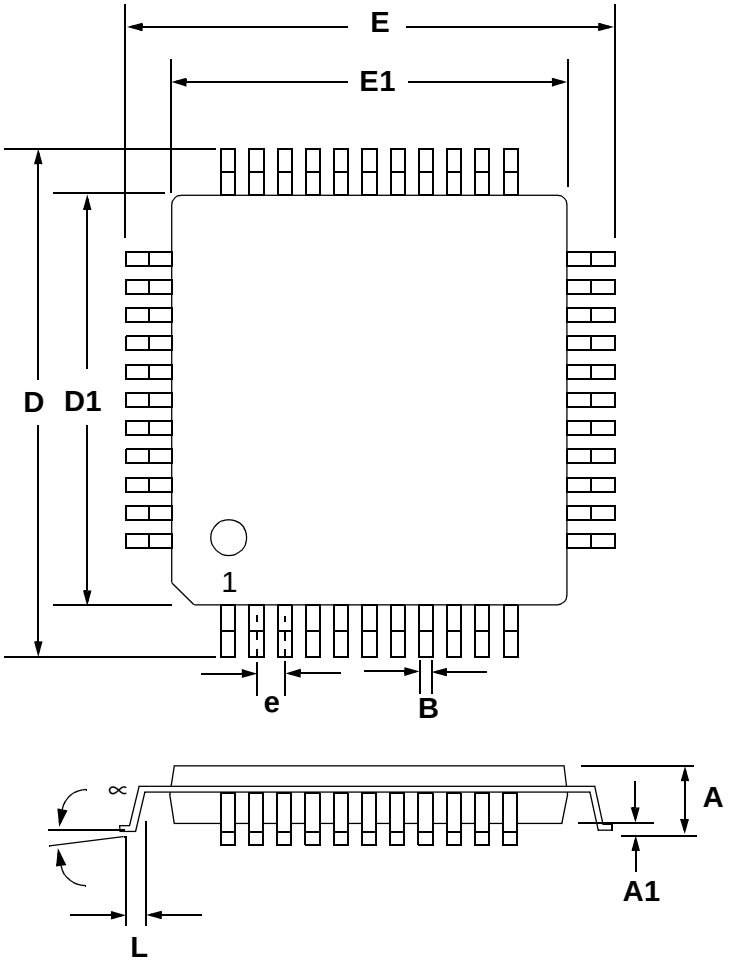


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	---	0.055	0.063	---	1.40	1.60
A1	0.002	0.004	0.006	0.05	0.10	0.15
B	0.012	0.014	0.018	0.30	0.35	0.45
D	0.343	0.354	0.366	8.70	9.0 BSC	9.30
D1	0.272	0.28	0.280	6.90	7.0 BSC	7.10
E	0.343	0.354	0.366	8.70	9.0 BSC	9.30
E1	0.272	0.28	0.280	6.90	7.0 BSC	7.10
e*	0.028	0.31 BSC	0.035	0.70	0.80 BSC	0.90
L	0.018	0.024	0.030	0.45	0.60	0.75
∝	0.000°	4°	7.000°	0.00°	4°	7.00°

* Nominal pin pitch is 0.50 mm

Controlling dimension is mm.
JEDEC Designation: MS-022

2.3 44-Pin LQFP

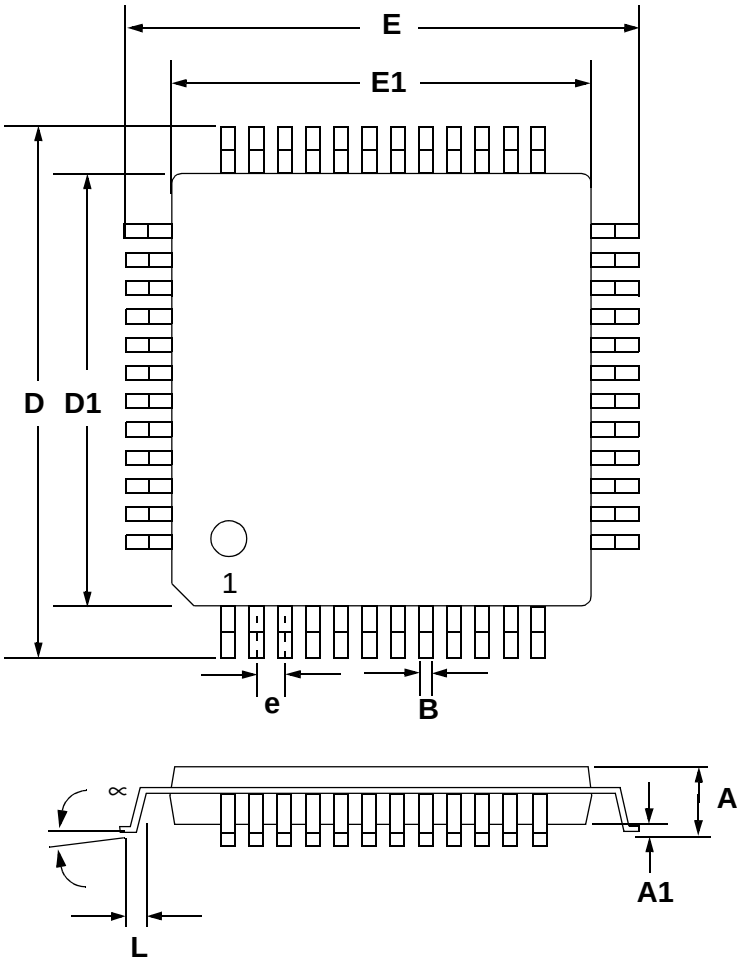


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	---	0.55	0.065	---	1.40	1.60
A1	0.002	0.004	0.006	0.05	0.10	0.15
B	0.009	0.012	0.015	0.022	0.030	0.038
D	0.478	0.472 BSC	0.502	11.70	12.0 BSC	12.30
D1	0.404	0.393 BSC	0.412	9.90	10.0 BSC	10.10
E	0.478	0.472 BSC	0.502	11.70	12.0 BSC	12.30
E1	0.404	0.393 BSC	0.412	9.90	10.0 BSC	10.10
e*	0.029	0.31 BSC	0.037	0.70	0.80 BSC	0.90
L	0.018	0.024	0.030	0.45	0.60	0.75
∝	0.000°	4°	7.000°	0.00°	4°	7.00°

* Nominal pin pitch is 0.80 mm

Controlling dimension is mm.
JEDEC Designation: MS-022

2.4 48-Pin LQFP

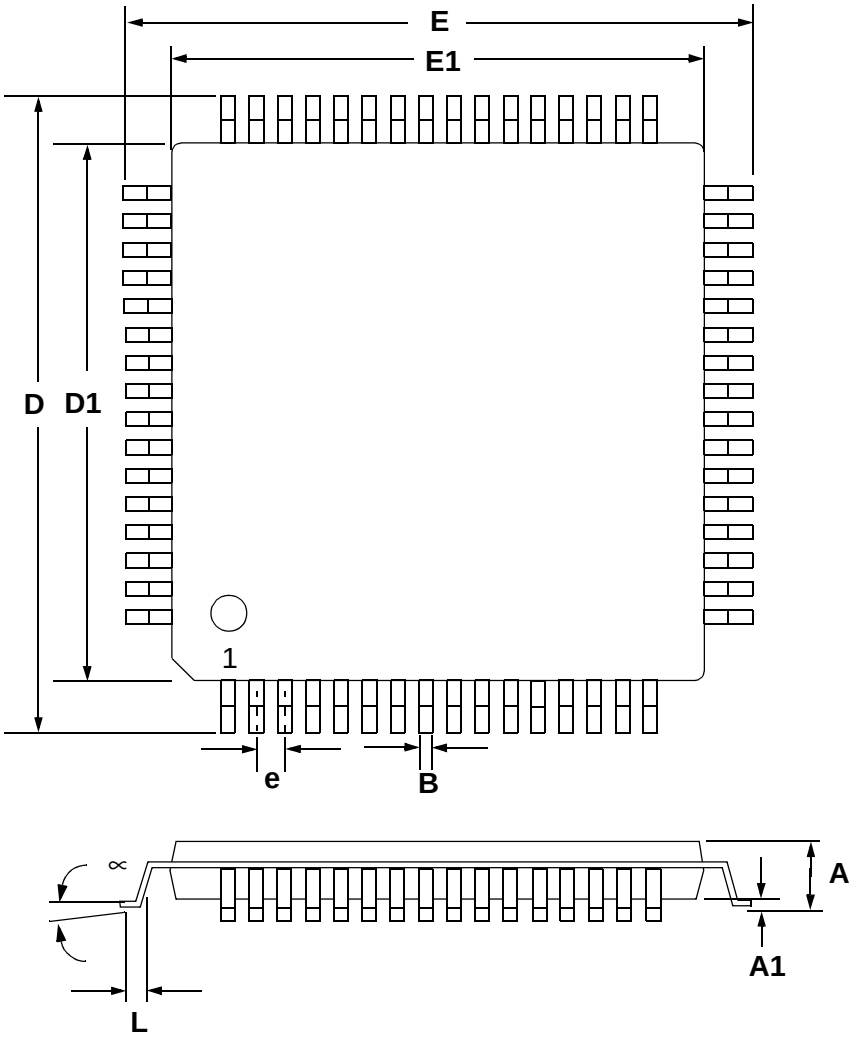


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	---	0.055	0.063	---	1.40	1.60
A1	0.002	0.004	0.006	0.05	0.10	0.15
B	0.007	0.009	0.011	0.17	0.22	0.27
D	0.343	0.354	0.366	8.70	9.0 BSC	9.30
D1	0.272	0.28	0.280	6.90	7.0 BSC	7.10
E	0.343	0.354	0.366	8.70	9.0 BSC	9.30
E1	0.272	0.28	0.280	6.90	7.0 BSC	7.10
e*	0.016	0.020	0.024	0.40	0.50 BSC	0.60
L	0.018	0.24	0.030	0.45	0.60	0.75
∝	0.000°	4°	7.000°	0.00°	4°	7.00°

* Nominal pin pitch is 0.50 mm

Controlling dimension is mm.
JEDEC Designation: MS022

2.5 64-Pin LQFP

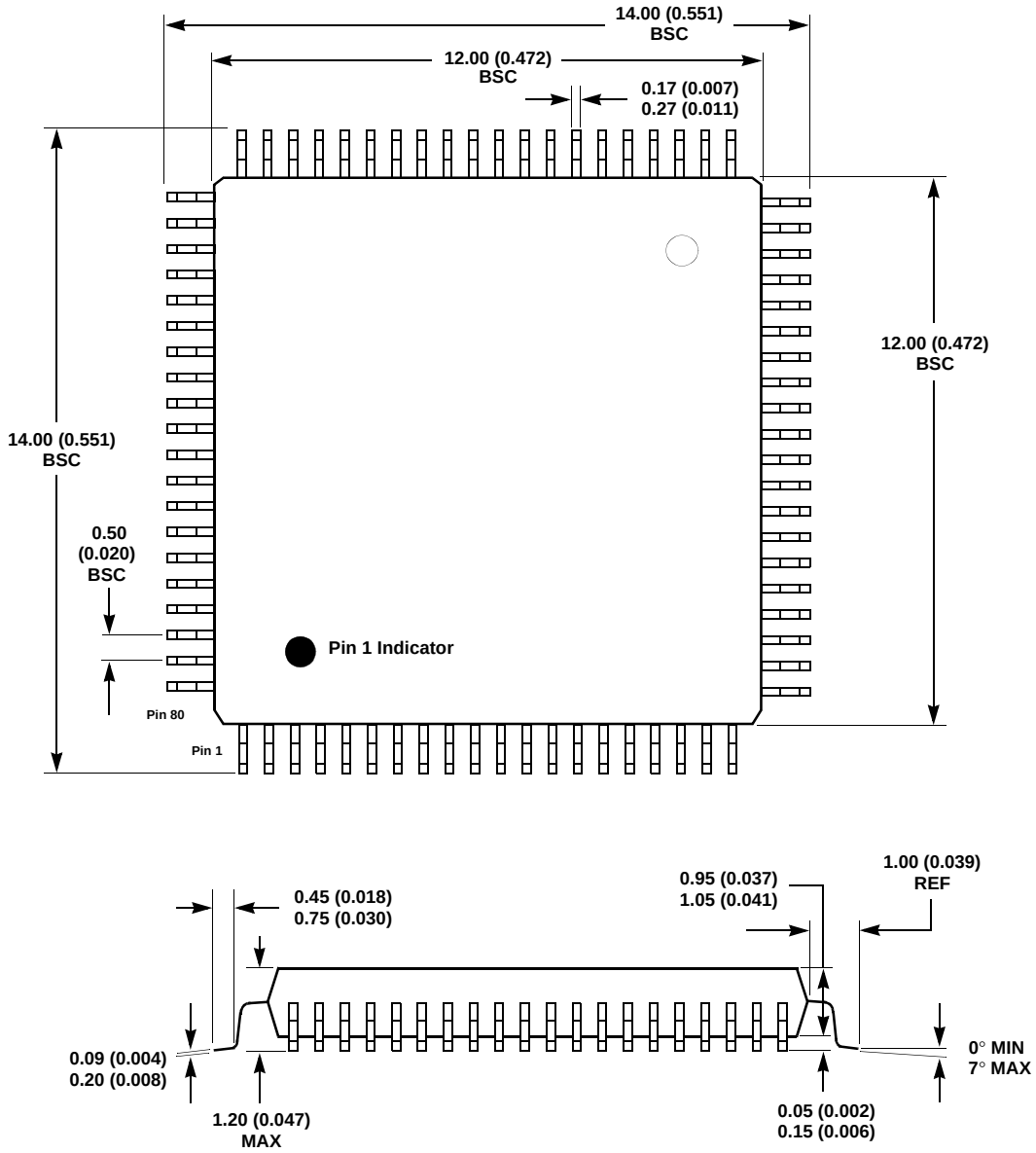


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	---	0.55	0.063	---	1.40	1.60
A1	0.002	0.004	0.006	0.05	0.10	0.15
B	0.007	0.008	0.011	0.17	0.20	0.27
D	0.461	0.472 BSC	0.484	11.70	12.0 BSC	12.30
D1	0.390	0.393 BSC	0.398	9.90	10.0 BSC	10.10
E	0.461	0.472 BSC	0.484	11.70	12.0 BSC	12.30
E1	0.390	0.393 BSC	0.398	9.90	10.0 BSC	10.10
e*	0.016	0.020 BSC	0.024	0.40	0.50 BSC	0.60
L	0.018	0.024	0.030	0.45	0.60	0.75
∝	0.000°	4°	7.000°	0.00°	4°	7.00°

* Nominal pin pitch is 0.50 mm

Controlling dimension is mm.
JEDEC Designation: MS022

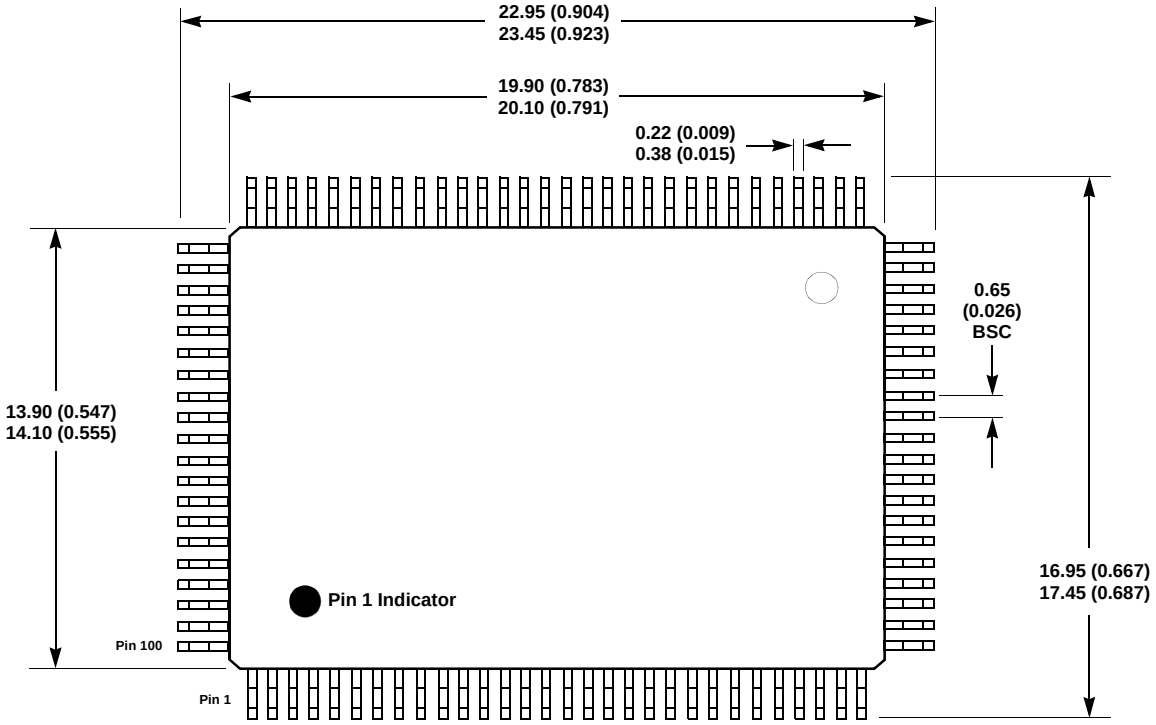
2.6 80-Pin TQFP (12 × 12 × 1.00-mm Body)

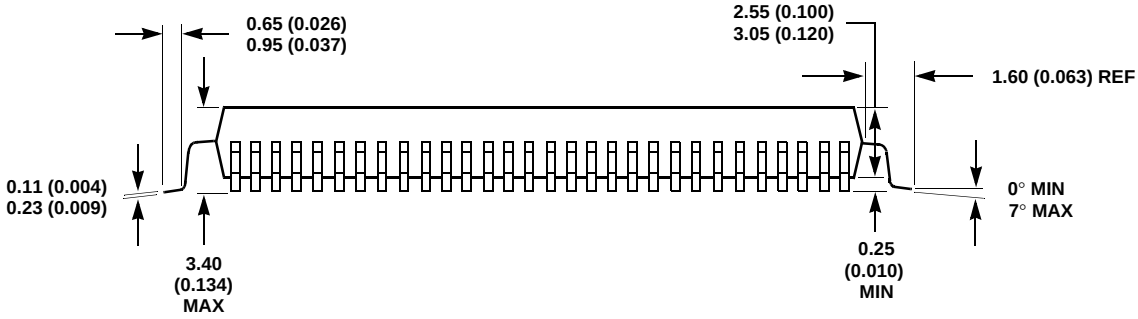


NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm.
3) Pin 1 identification may be either ink dot or dimple.
4) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
5) Ejector pin marks in molding are present on every package.

2.7 100-Pin MQFP (14 × 20 × 2.70-mm Body)

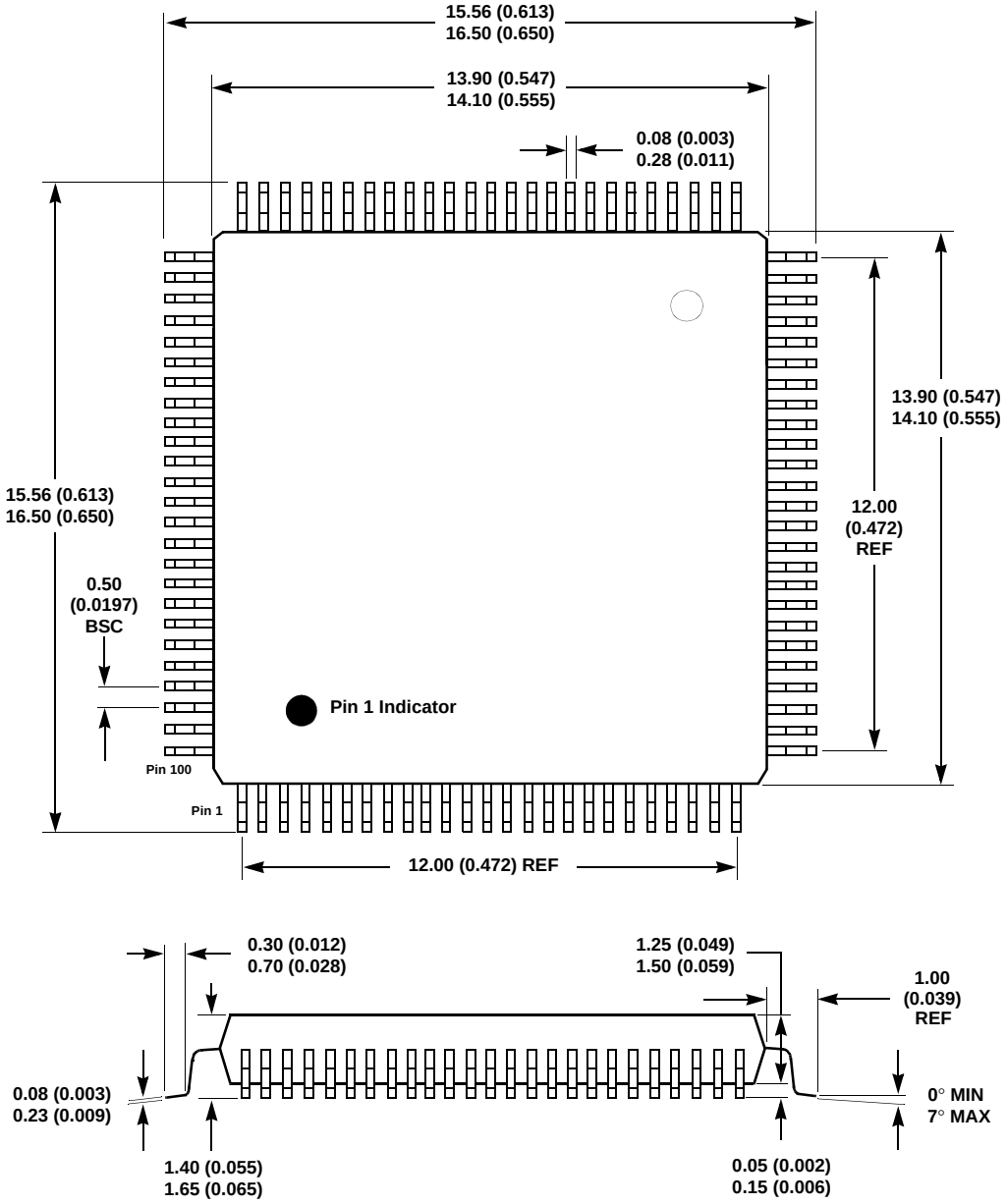




NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

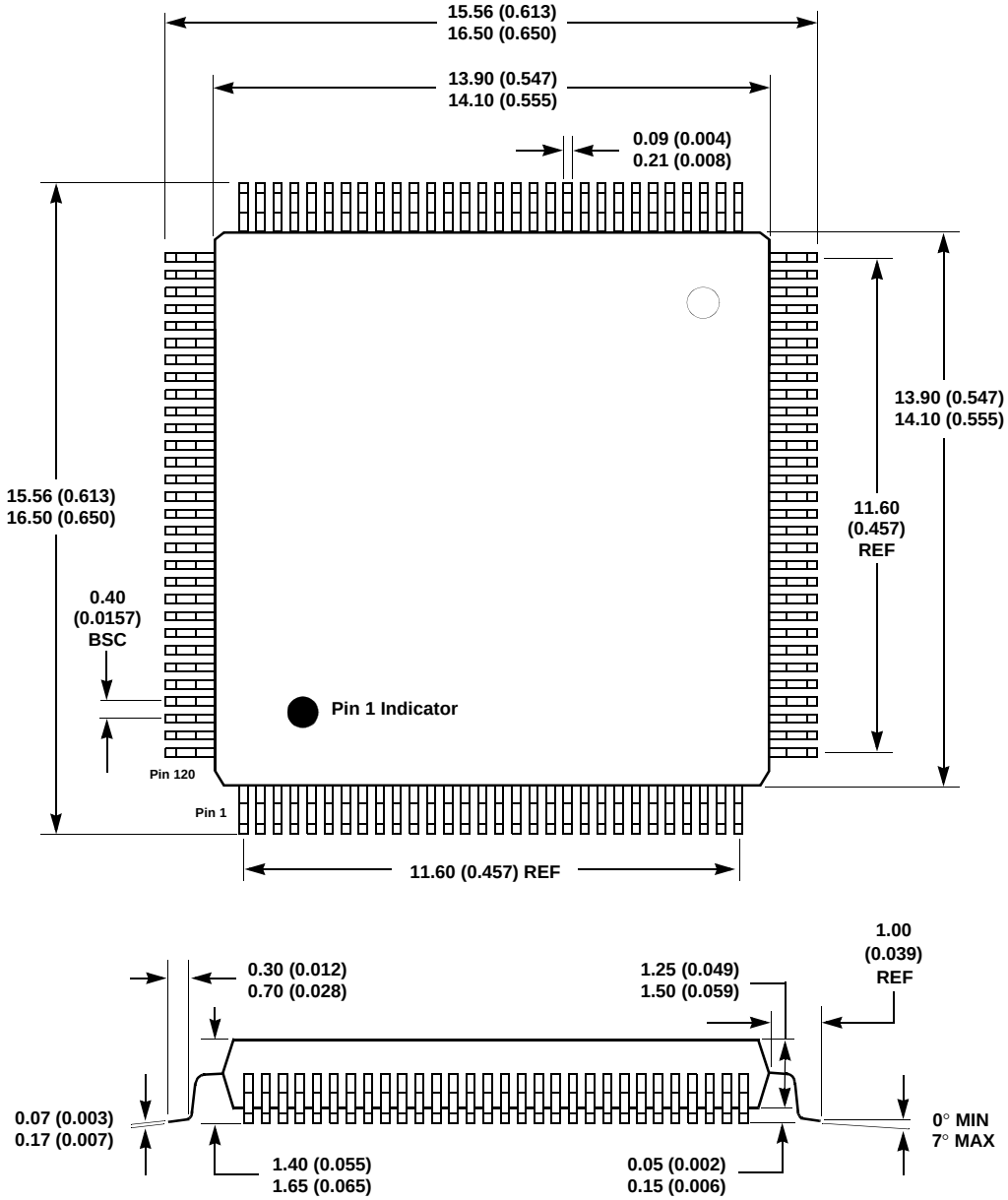
2.8 100-Pin LQFP (14 × 14 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

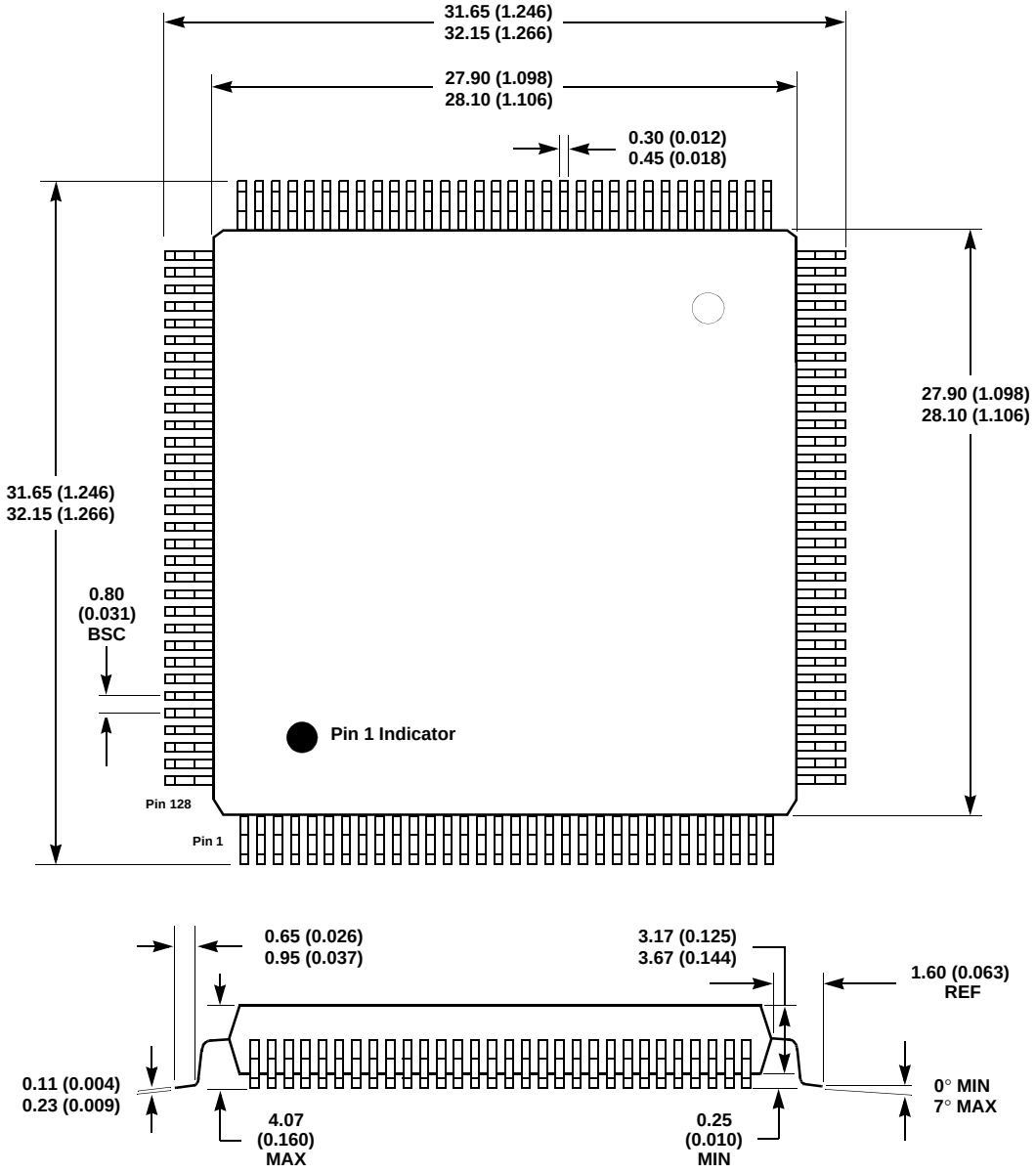
2.9 120-Pin LQFP (14 × 14 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

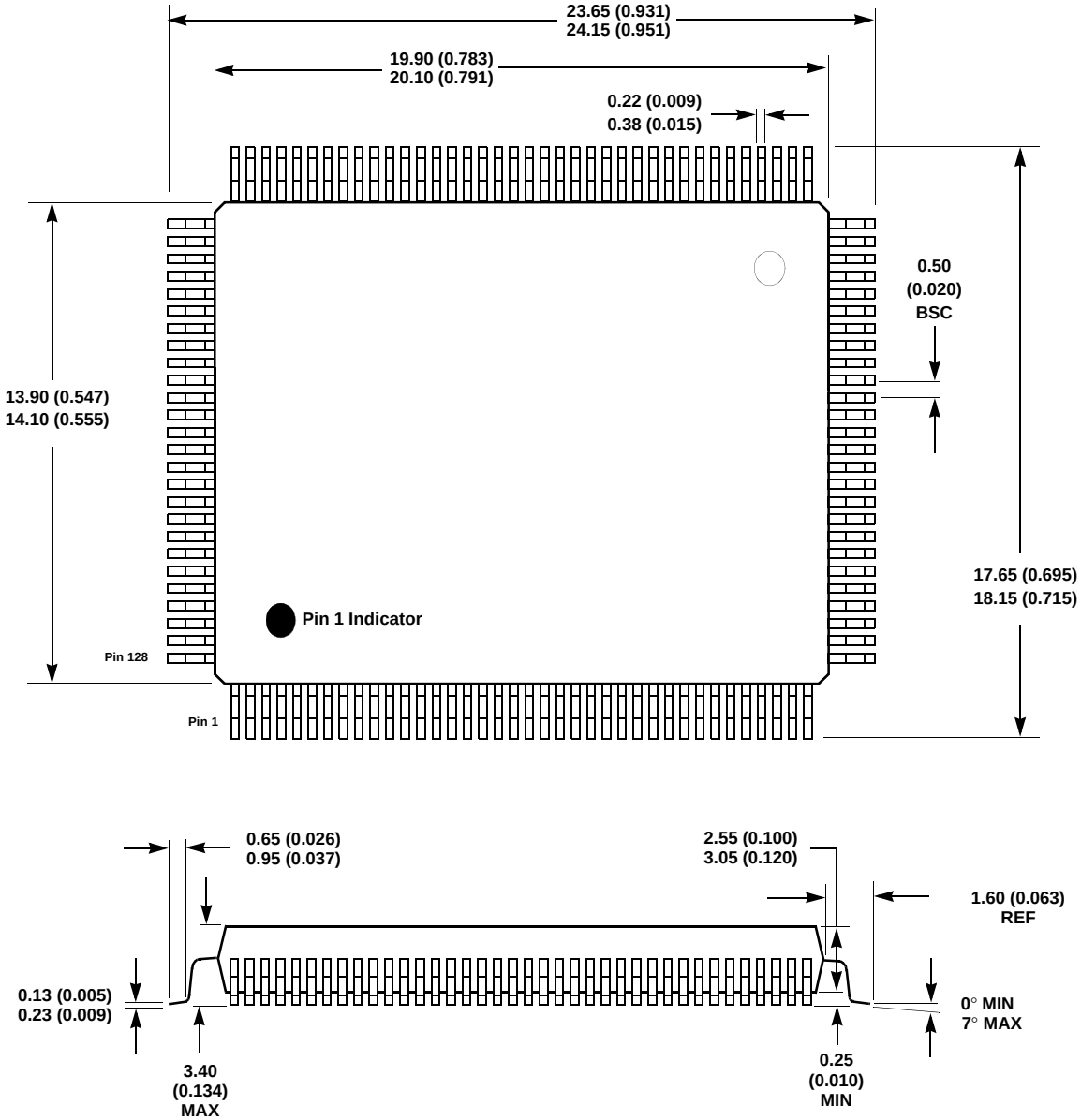
2.10 128-Pin MQFP (28 × 28 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

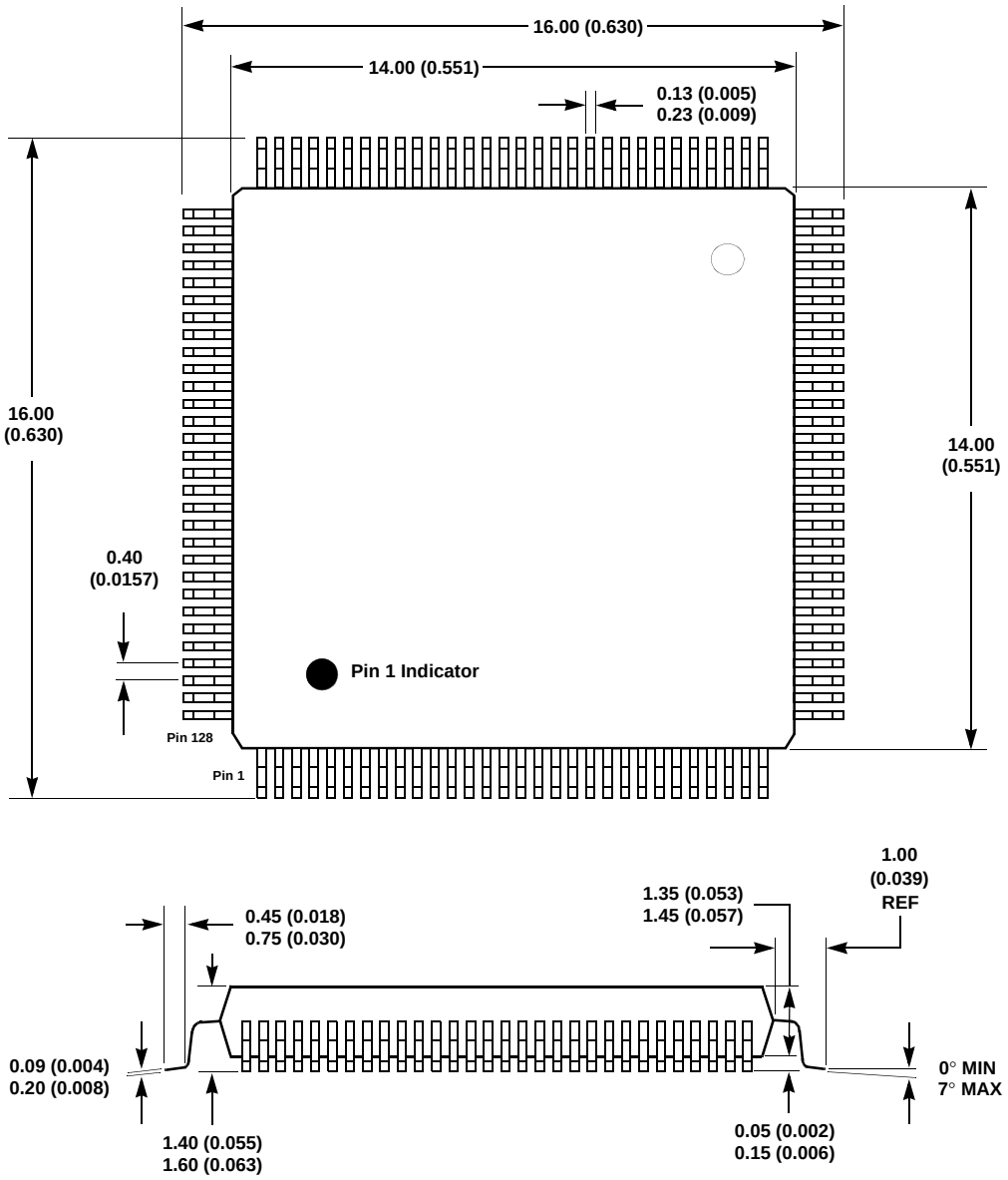
2.11 128-Pin MQFP (14 × 20 × 2.70-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

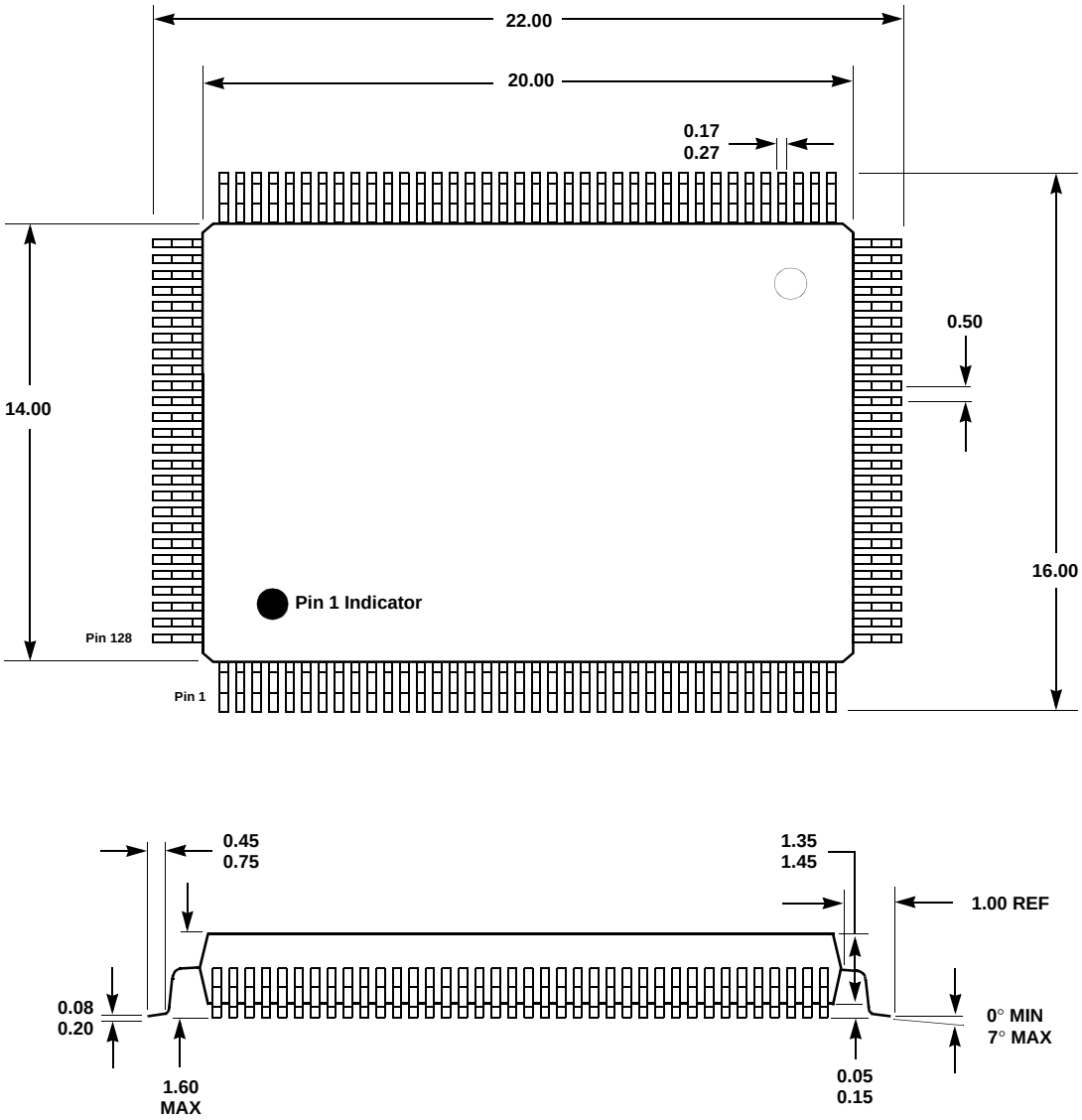
2.12 128-Pin LQFP (14 × 14 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

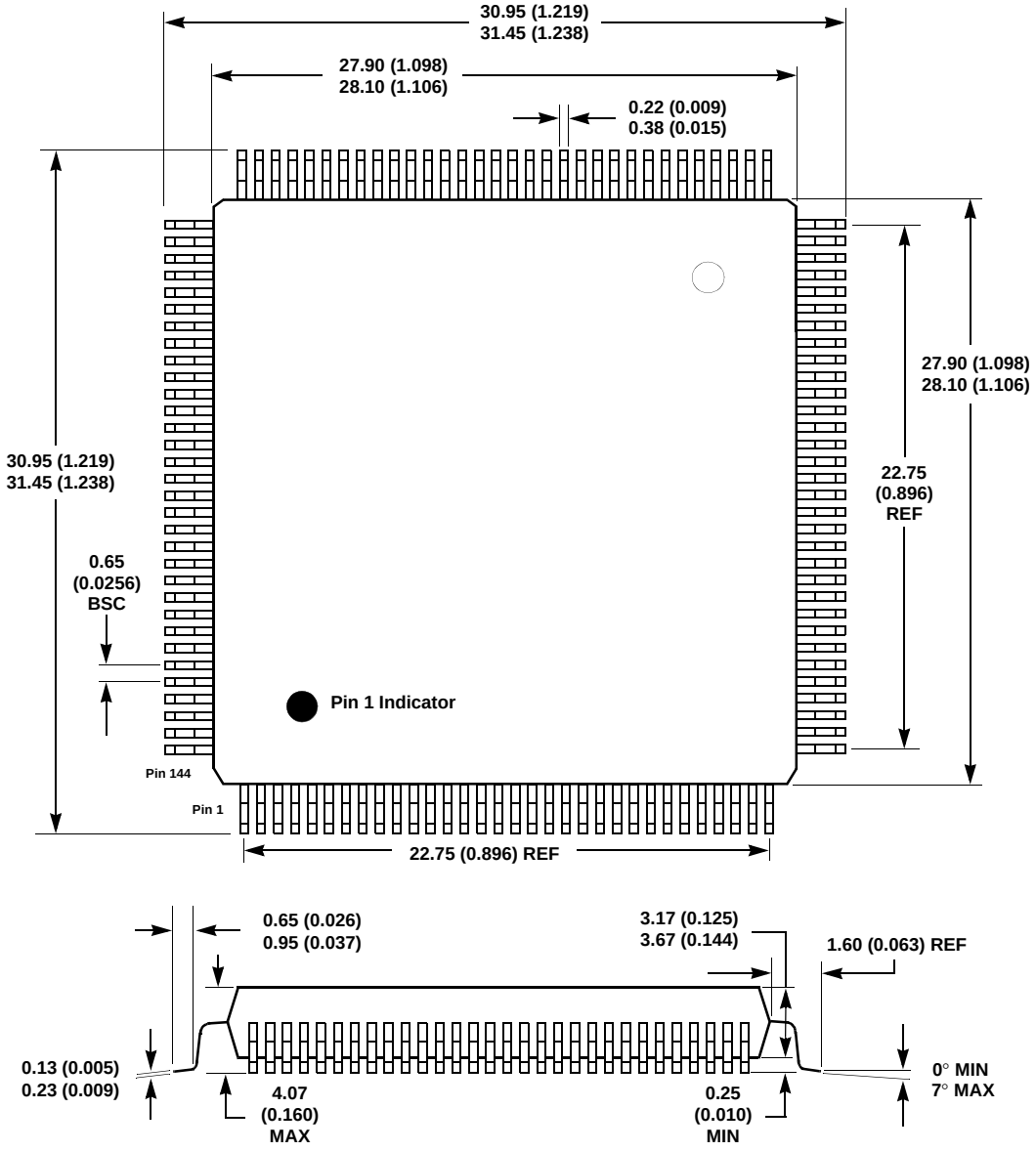
2.13 128-Pin LQFP (14 × 20 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

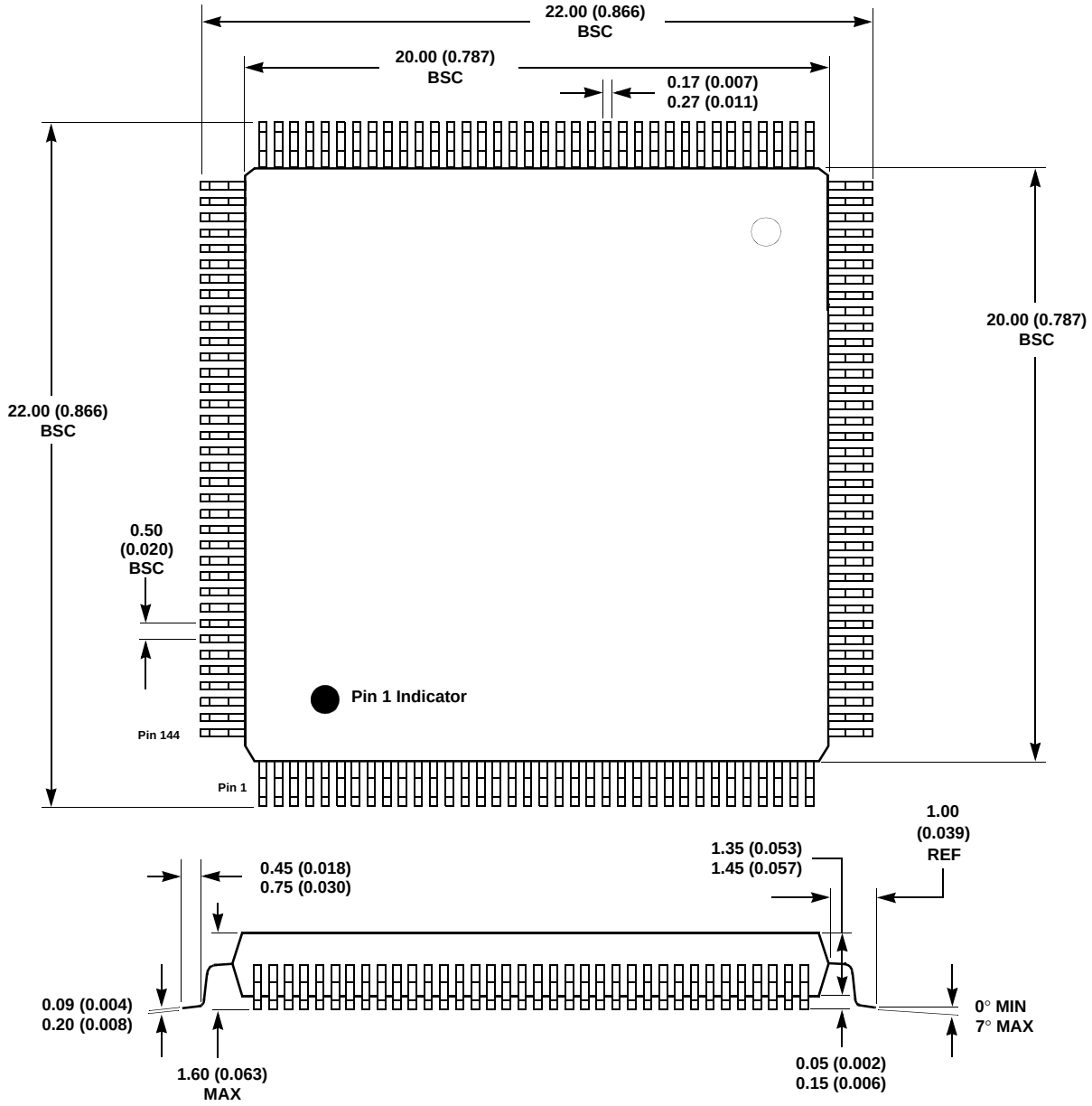
2.14 144-Pin MQFP (28 × 28 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

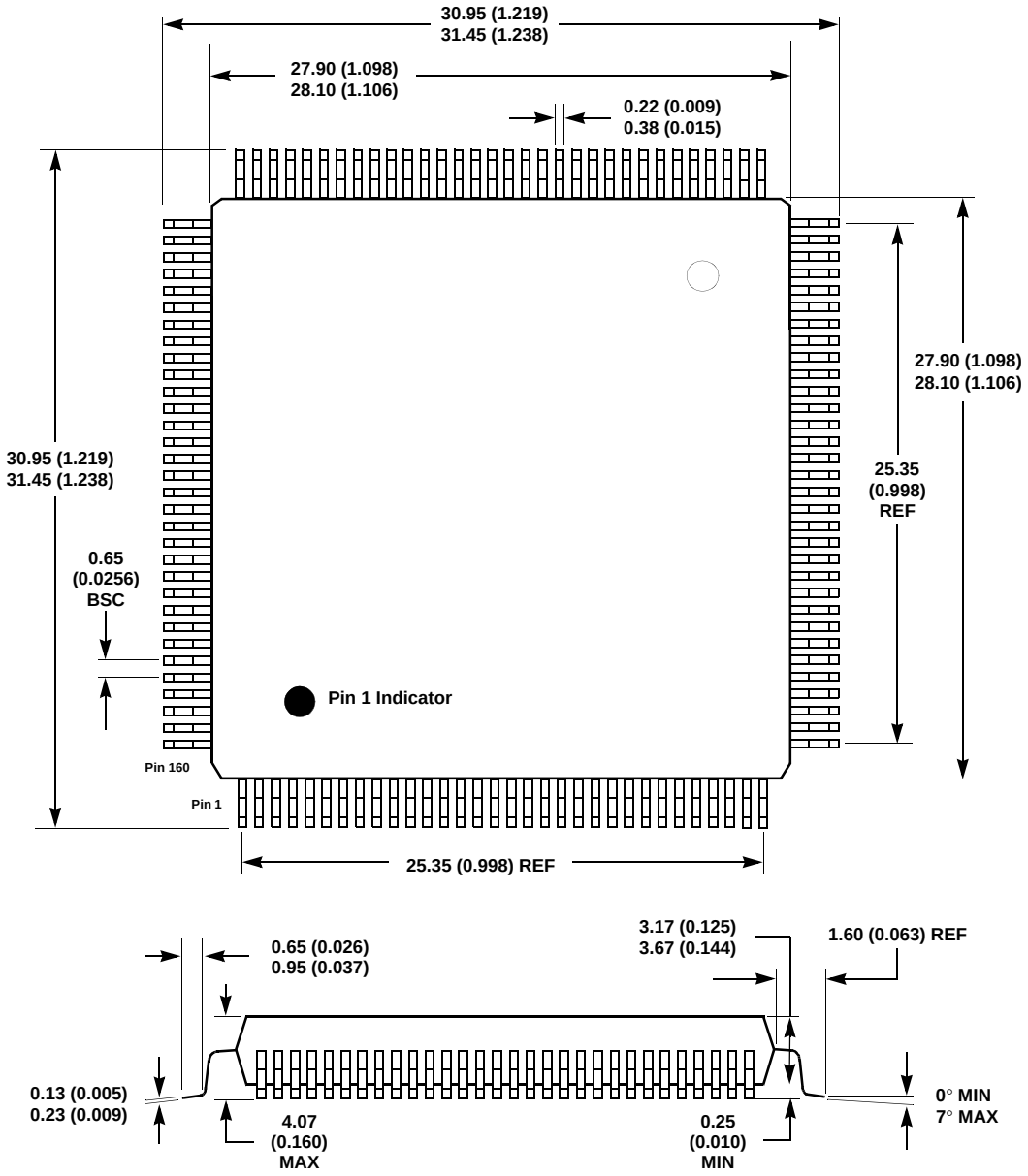
2.15 144-Pin LQFP (20 × 20 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.

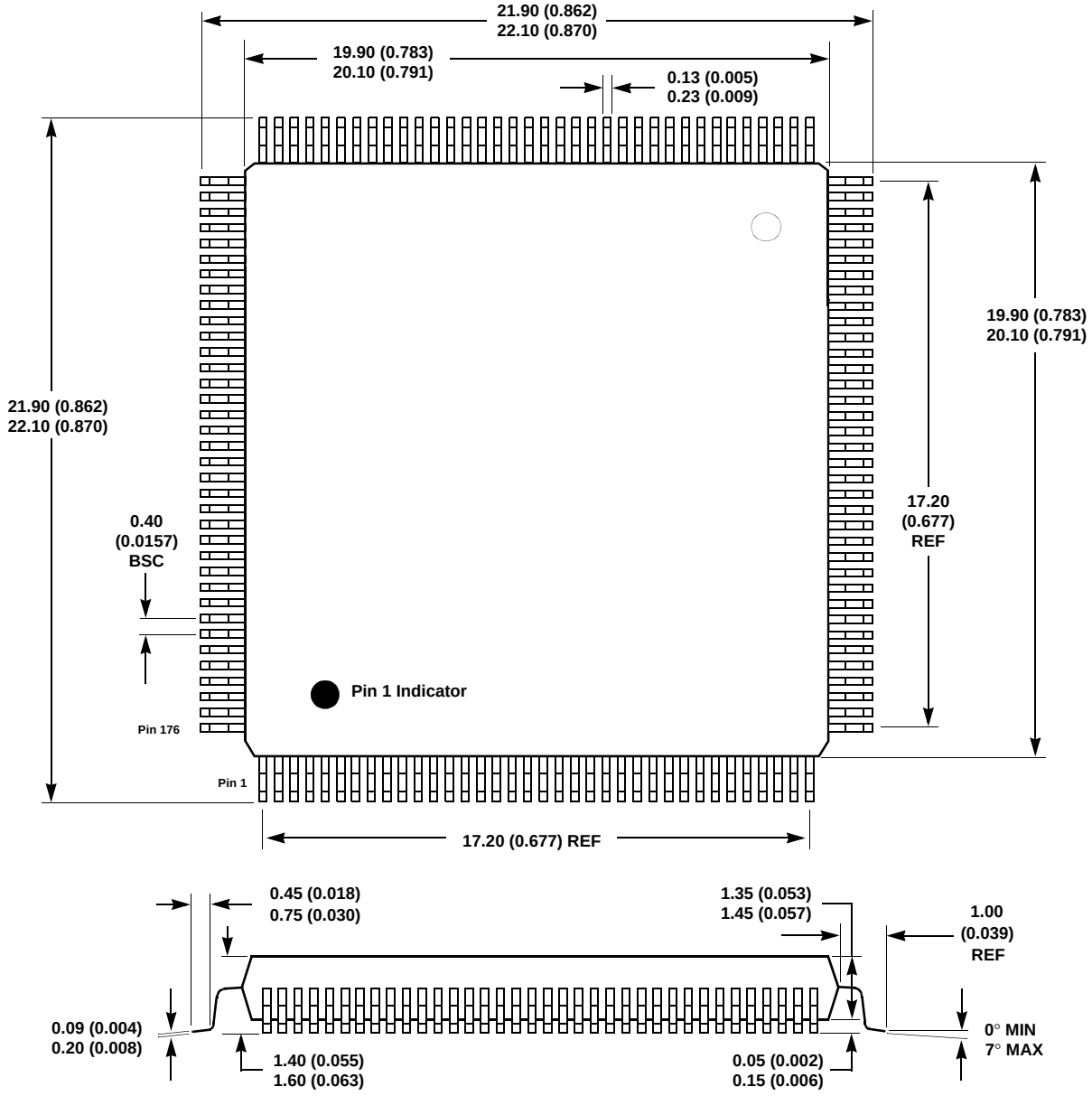
2.16 160-Pin MQFP (28 × 28 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

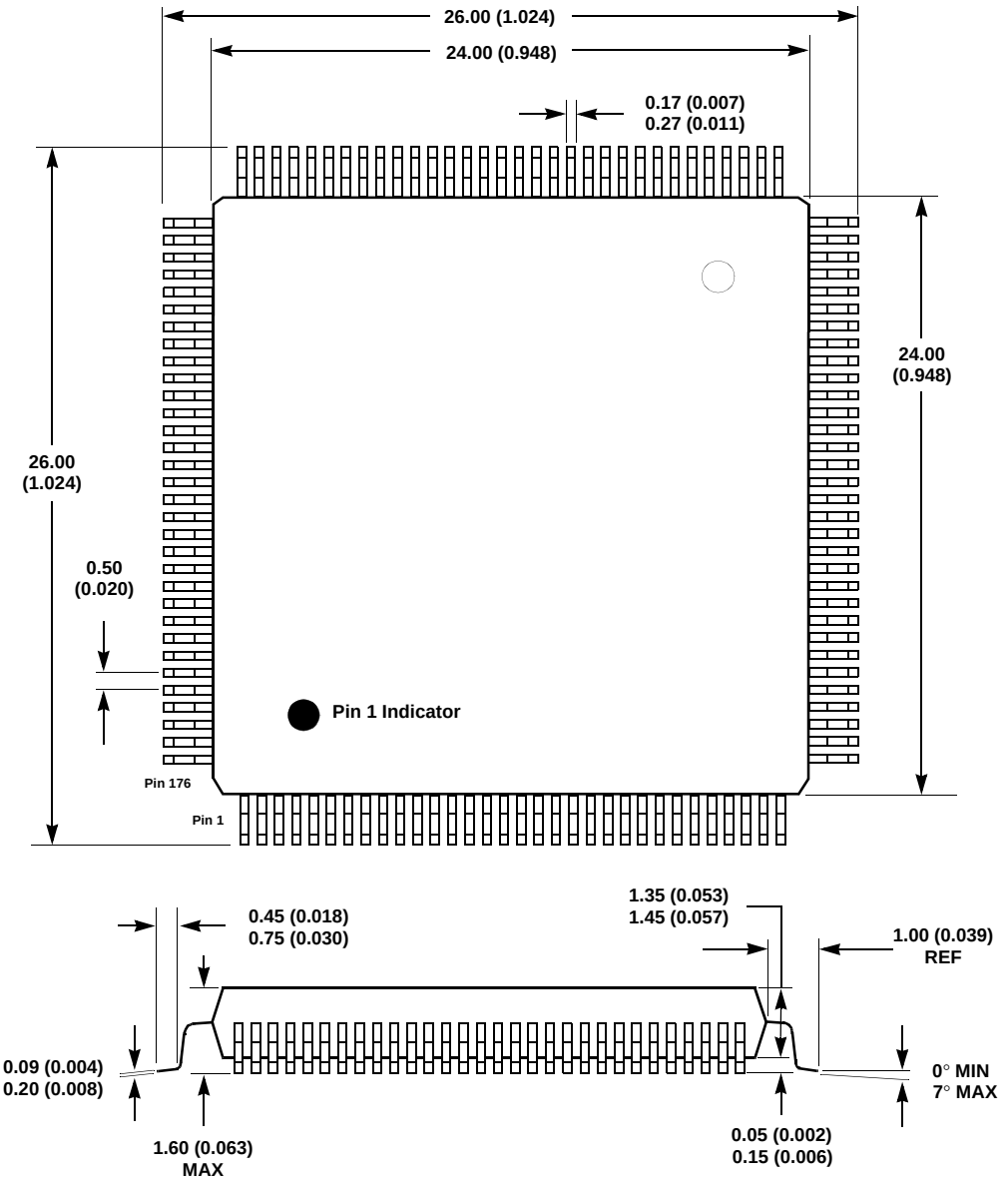
2.17 176-Pin LQFP (20 × 20 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing does not reflect the exact package pin count.

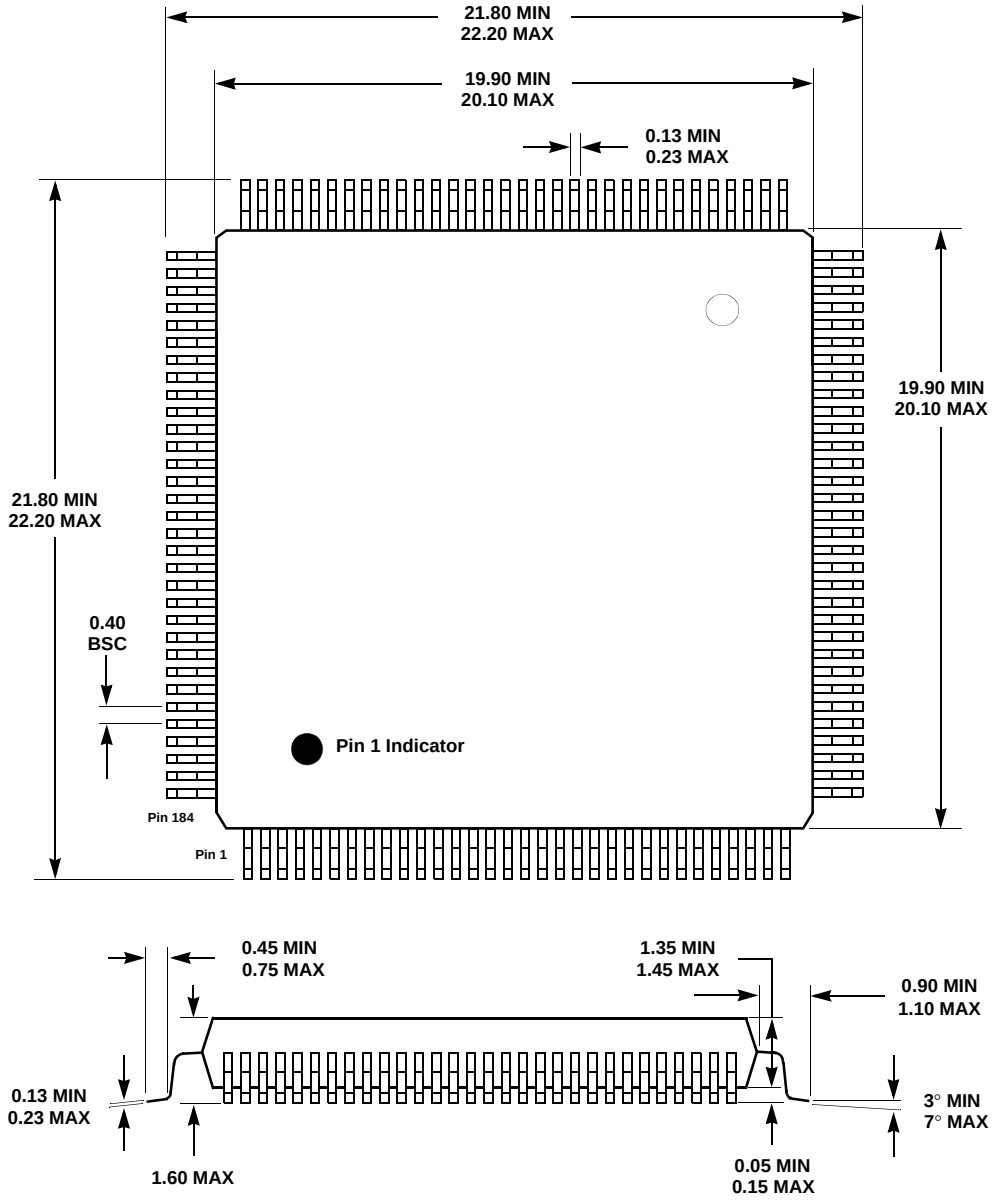
2.18 176-Pin LQFP (24 × 24 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing does not reflect the exact package pin count.

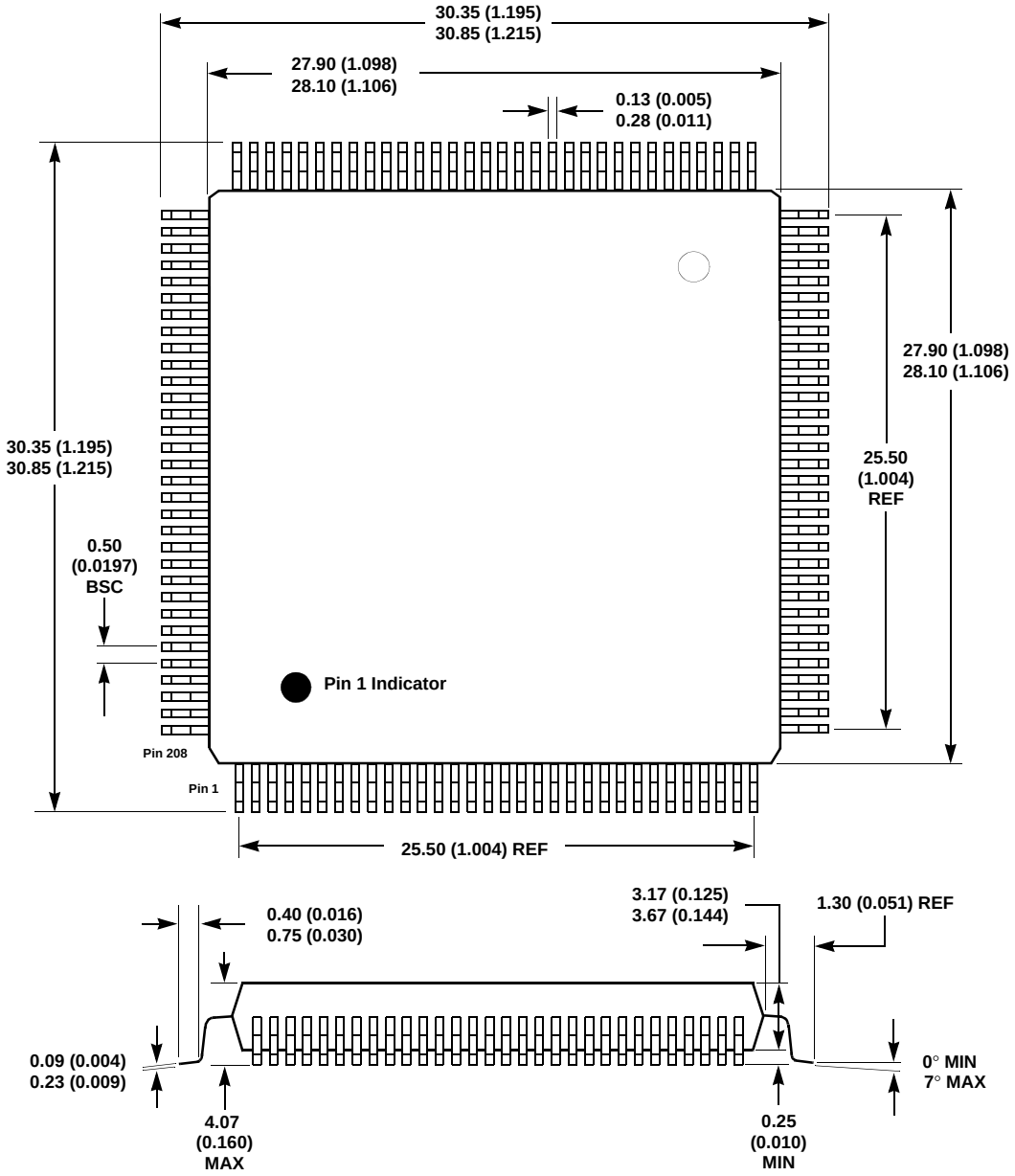
2.19 184-Pin LQFP (20 × 20 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

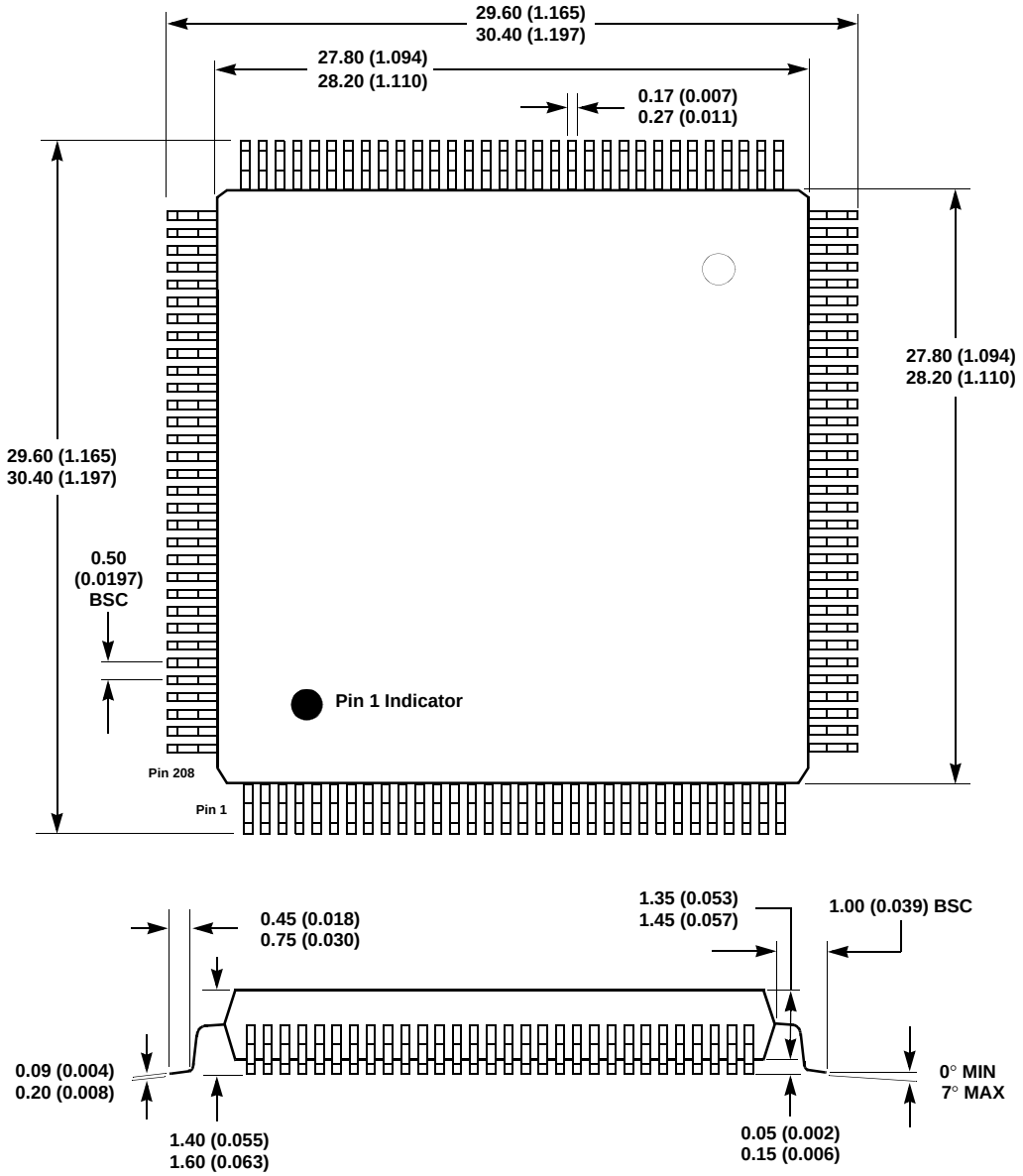
2.20 208-Pin MQFP (28 × 28 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

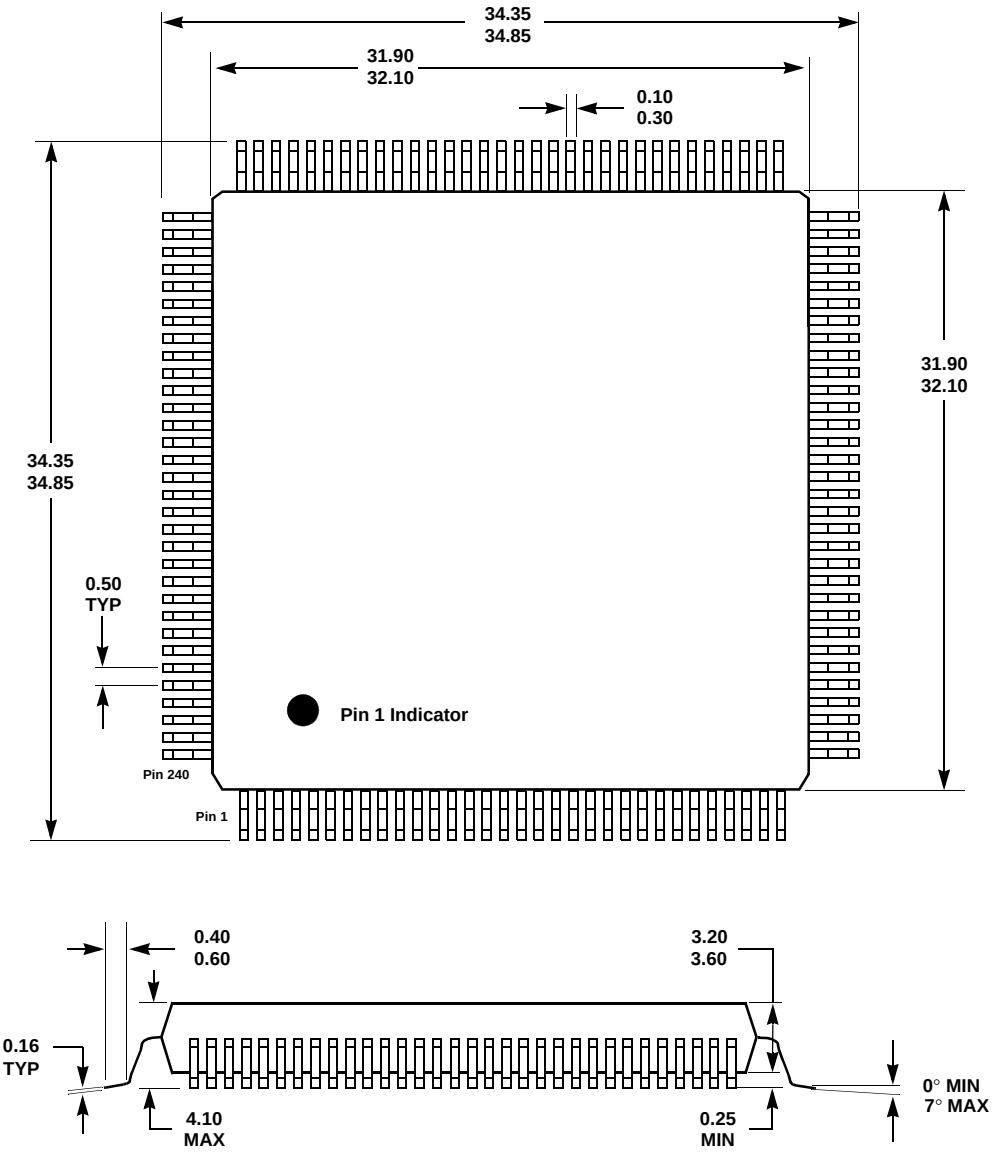
2.21 208-Pin LQFP (28 × 28 × 1.40-mm Body)



NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

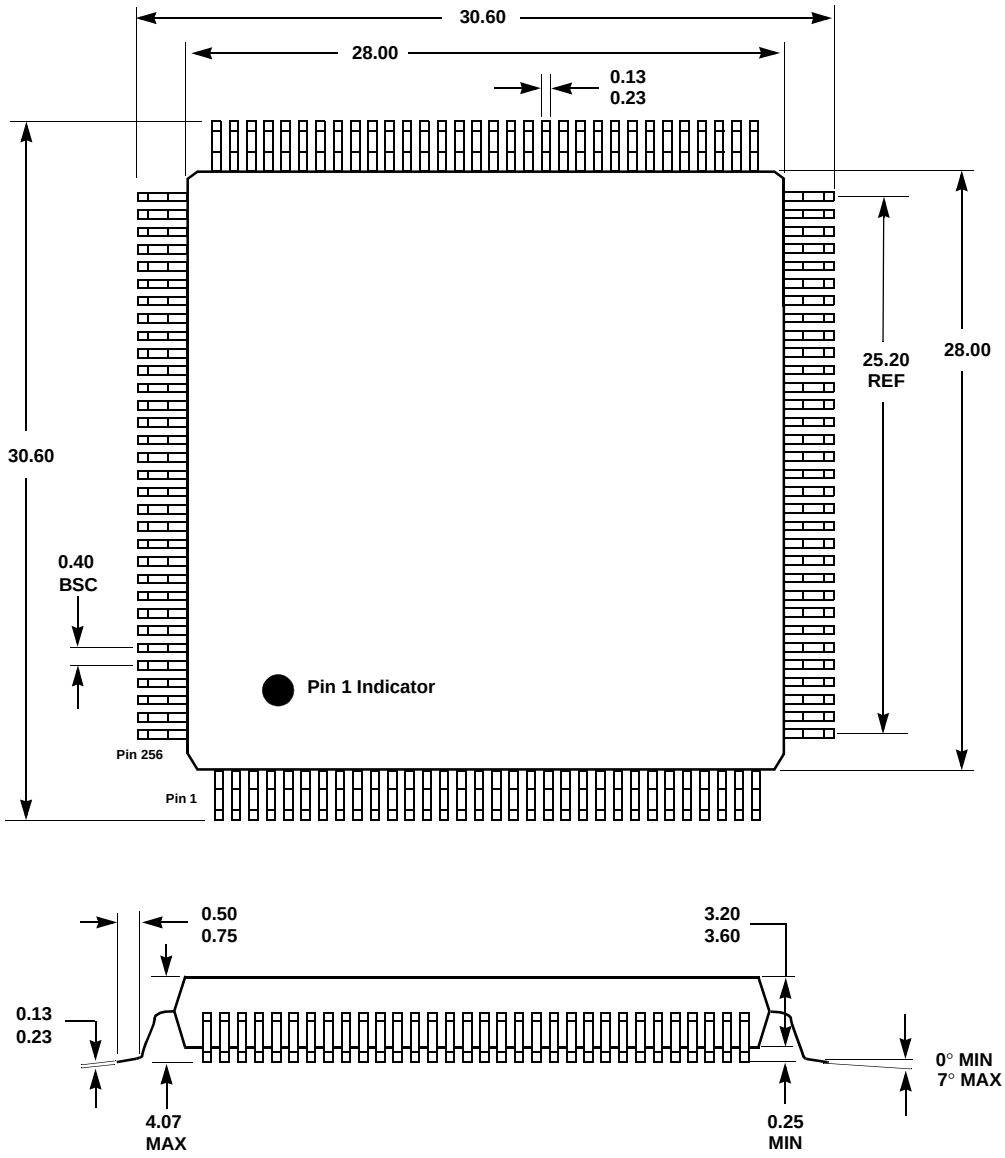
2.22 240-Pin MQFP 32 × 32 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

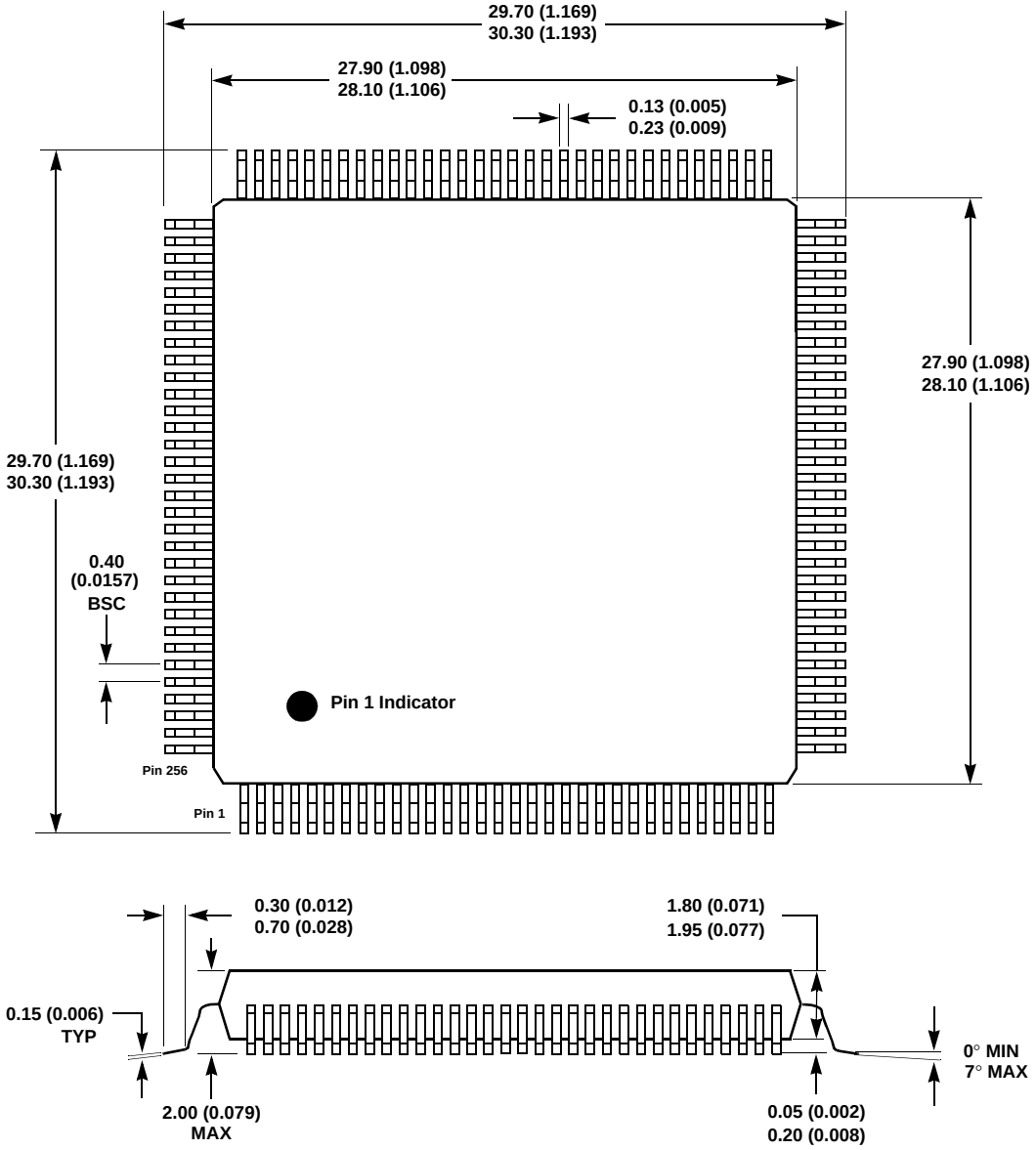
2.23 256-Pin MQFP (28 × 28 × 3.50-mm Body)



NOTES:

1) Dimensions are in millimeters, and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

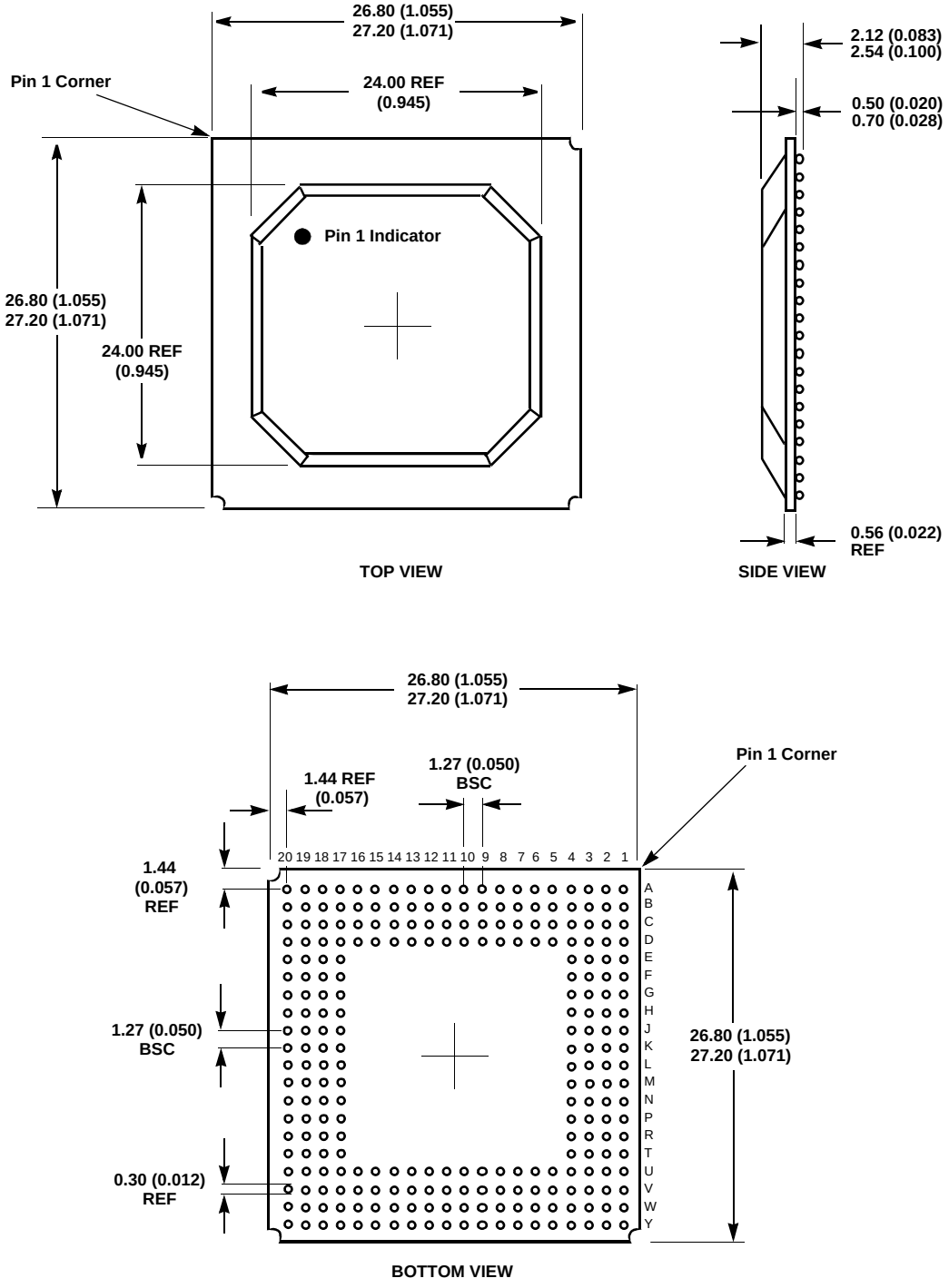
2.24 256-Pin LQFP (28 × 28 × 2.00-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Package body dimensions do not include mold protrusion, which is 0.25 mm (0.010 in).
3) Pin 1 identification may be either ink dot or dimple.
4) Package top dimensions can be smaller than bottom dimensions by 0.20 mm (0.008 in).
5) The 'lead width with plating' dimension does not include a total allowable dambar protrusion of 0.08 mm (at maximum material condition).
6) Ejector pin marks in molding are present on every package.
7) Drawing above does not reflect exact package pin count.

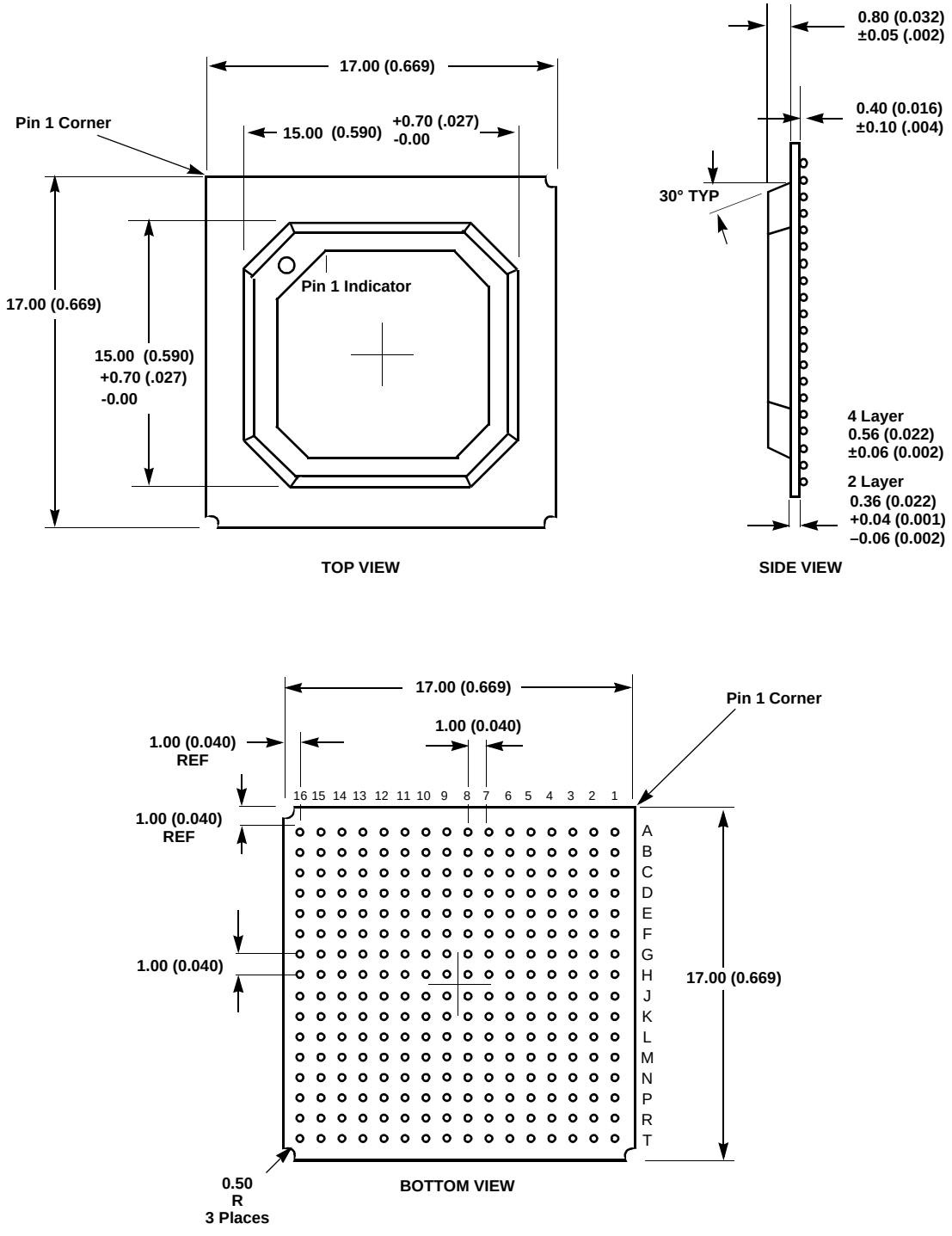
2.25 256-Pin PBGA (27 × 27 × 1.60-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Before beginning any new design with this device, please contact Cirrus Logic for the latest package information.

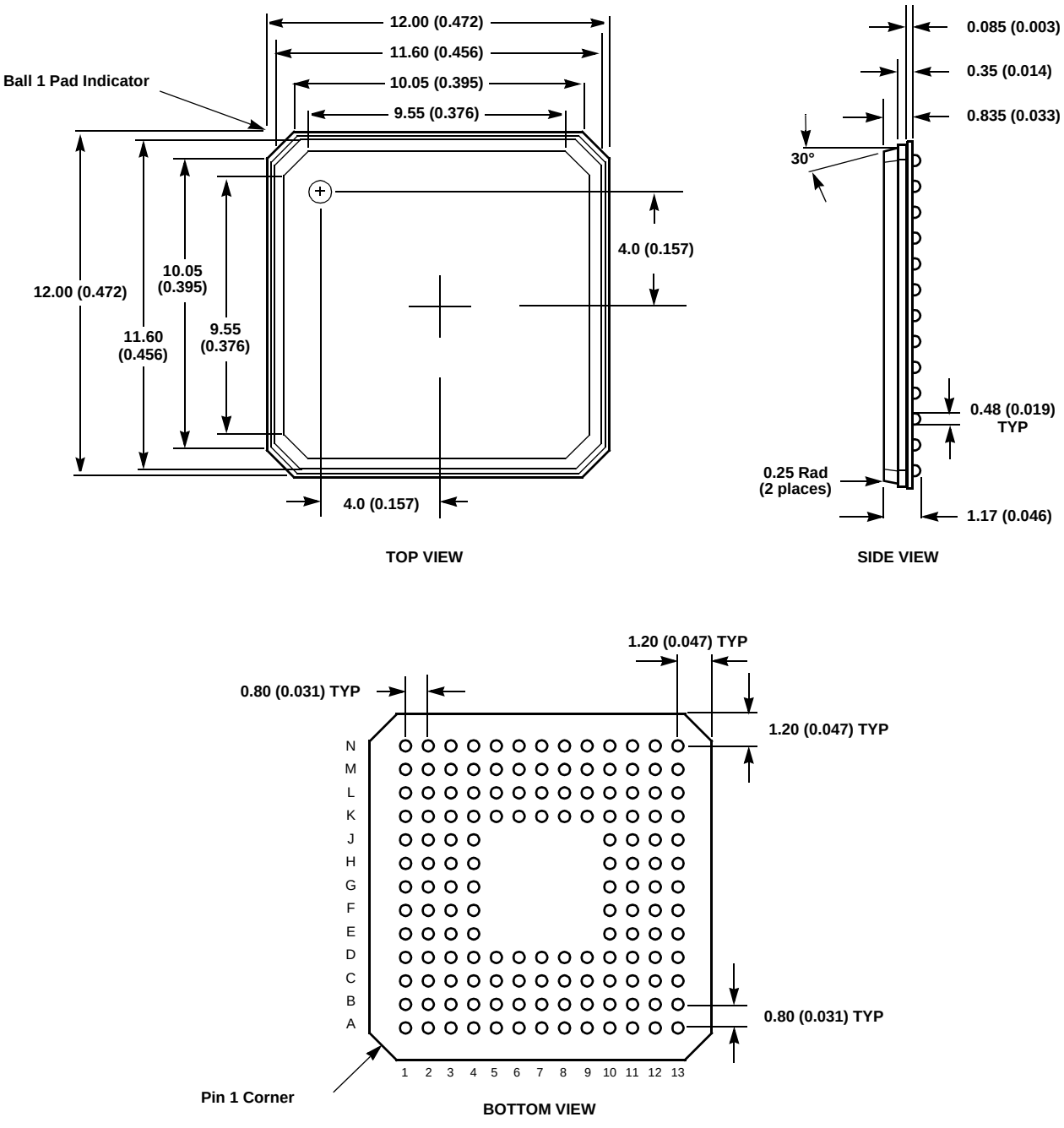
2.26 256-Pin PBGA (17 × 17 × 1.53-mm Body)



NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Before beginning any new design with this device, please contact Cirrus Logic for the latest package information.

2.27 144-Pin FBGA (12 × 12 × 1.20-mm Body)

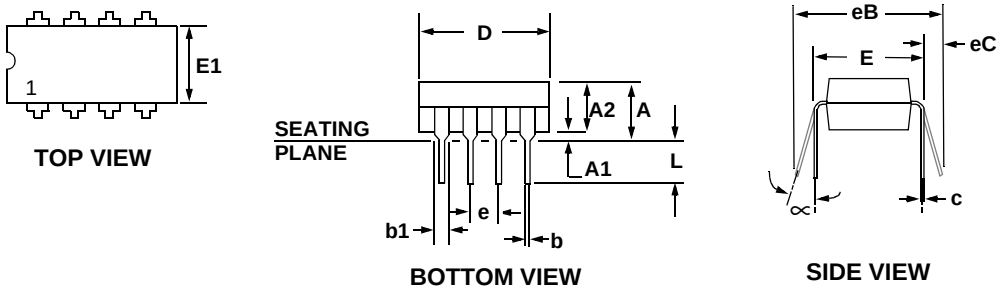


NOTES:

1) Dimensions are in millimeters (inches), and controlling dimension is millimeter.
2) Before beginning any new design with this device, please contact Cirrus Logic for the latest package information.

3. PACKAGE DRAWINGS – CRYSTAL SEMICONDUCTOR PRODUCTS DIVISION

3.1 8-Pin PDIP (300 -mm Body)

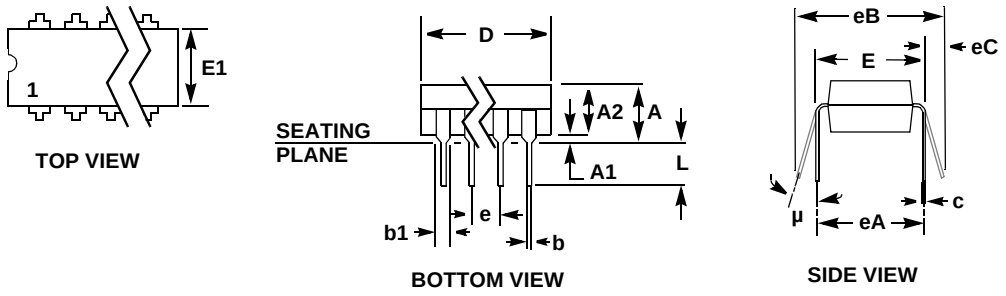


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	0.150	0.175	0.200	3.81	4.45	5.08
A1	0.015	0.028	0.040	0.38	0.71	1.02
A2	0.115	0.138	0.160	2.92	3.51	4.06
b	0.015	0.040	0.065	0.38	1.02	1.65
b1	0.045	0.055	0.065	1.14	1.40	1.65
c	0.008	0.012	0.015	0.20	0.30	0.38
D	0.355	0.365	0.400	9.017	9.27	10.16
E		0.300 BSC			7.62 BSC	
E1	0.240	0.25	0.260	6.10	6.35	6.60
e		0.100 BSC			2.54 BSC	
eB	0.330	0.35	0.370	8.38	8.89	9.40
eC	0.015	0.025	0.035	.38	0.635	.89
L	0.115	0.125	0.135	2.92	3.175	3.43
∝	0°	5°	10°	0°	5°	10°

JEDEC # : MS-001

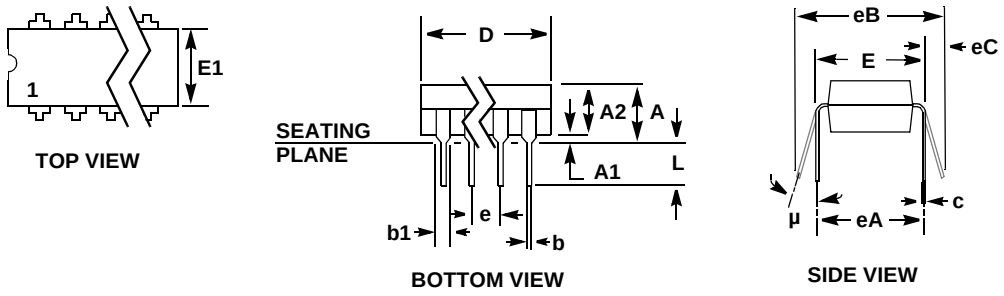
Controling Dimension is Inches

3.2 14-Pin PDIP



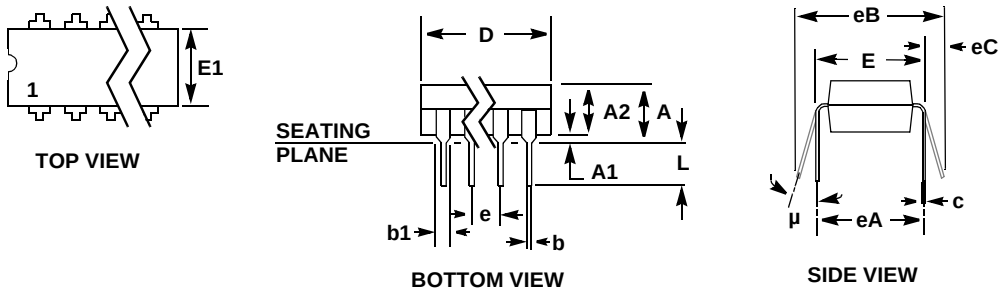
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.210	0.00	5.33
A1	0.015	0.025	0.38	0.64
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b1	0.045	0.070	1.14	1.78
c	0.008	0.014	0.20	0.36
D	0.735	0.775	18.67	19.69
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.090	0.110	2.29	2.79
eA	0.280	0.320	7.11	8.13
eB	0.300	0.430	7.62	10.92
eC	0.000	0.060	0.00	1.52
L	0.115	0.150	2.92	3.81
μ	0°	15°	0°	15°

3.3 16-Pin PDIP



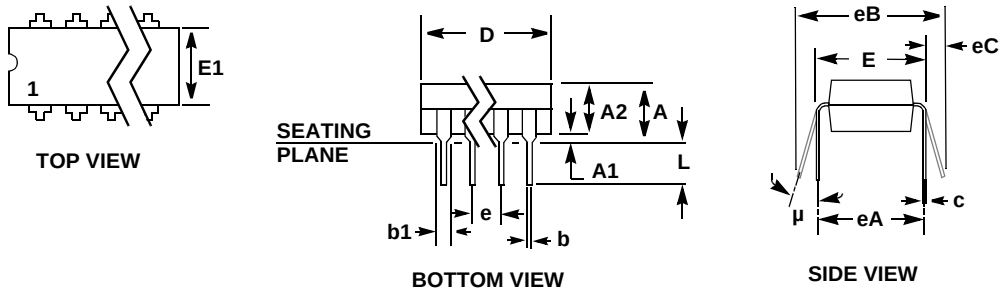
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.210	0.00	5.33
A1	0.015	0.025	0.38	0.64
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b1	0.045	0.070	1.14	1.78
c	0.008	0.014	0.20	0.36
D	0.780	0.800	19.81	20.32
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.090	0.110	2.29	2.79
eA	0.280	0.320	7.11	8.13
eB	0.300	0.430	7.62	10.92
eC	0.000	0.060	0.00	1.52
L	0.115	0.150	2.92	3.81
μ	0°	15°	0°	15°

3.4 18-Pin PDIP



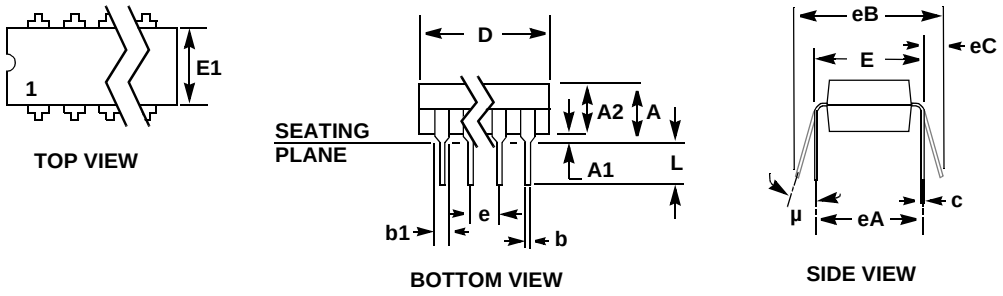
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.210	0.00	5.33
A1	0.015	0.025	0.38	0.64
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b1	0.045	0.070	1.14	1.78
c	0.008	0.014	0.20	0.36
D	0.880	0.920	22.35	23.37
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.090	0.110	2.29	2.79
eA	0.280	0.320	7.11	8.13
eB	0.300	0.430	7.62	10.92
eC	0.000	0.060	0.00	1.52
L	0.115	0.150	2.92	3.81
μ	0°	15°	0°	15°

3.5 20-Pin PDIP



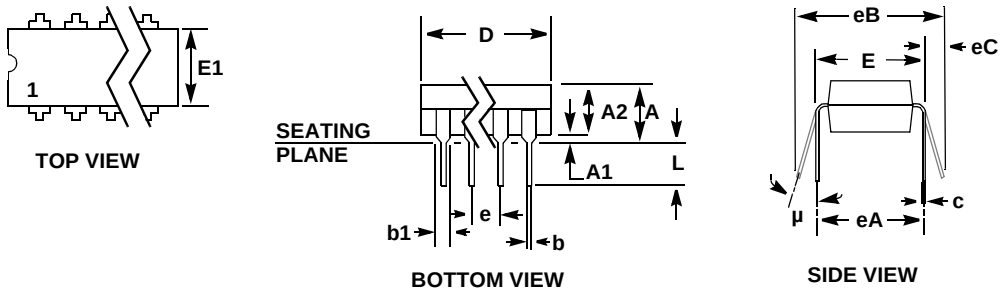
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.210	0.00	5.33
A1	0.015	0.025	0.38	0.64
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b1	0.045	0.070	1.14	1.78
c	0.008	0.014	0.20	0.36
D	0.980	1.060	24.89	26.92
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.090	0.110	2.29	2.79
eA	0.280	0.320	7.11	8.13
eB	0.300	0.430	7.62	10.92
eC	0.000	0.060	0.00	1.52
L	0.115	0.150	2.92	3.81
μ	0°	15°	0°	15°

3.6 24-Pin Skinny PDIP



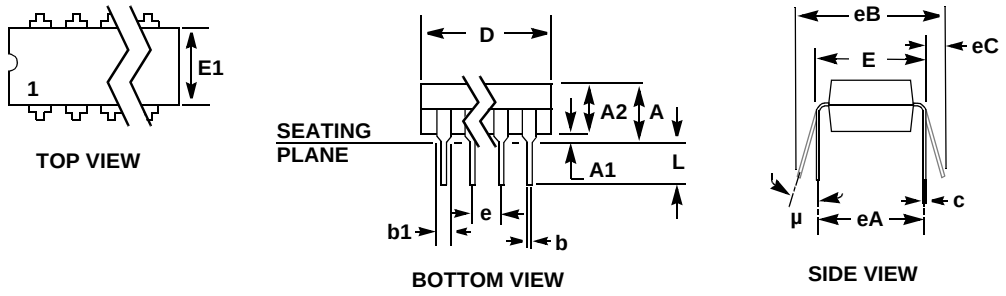
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.210	0.00	5.33
A1	0.015	0.025	0.38	0.64
A2	0.115	0.195	2.92	4.95
b	0.014	0.022	0.36	0.56
b1	0.045	0.070	1.14	1.78
c	0.008	0.014	0.20	0.36
D	1.230	1.280	31.24	32.51
E	0.300	0.325	7.62	8.26
E1	0.240	0.280	6.10	7.11
e	0.090	0.110	2.29	2.79
eA	0.280	0.320	7.11	8.13
eB	0.300	0.430	7.62	10.92
eC	0.000	0.060	0.00	1.52
L	0.115	0.150	2.92	3.81
μ	0°	15°	0°	15°

3.7 24-Pin PDIP (600-mm Body)



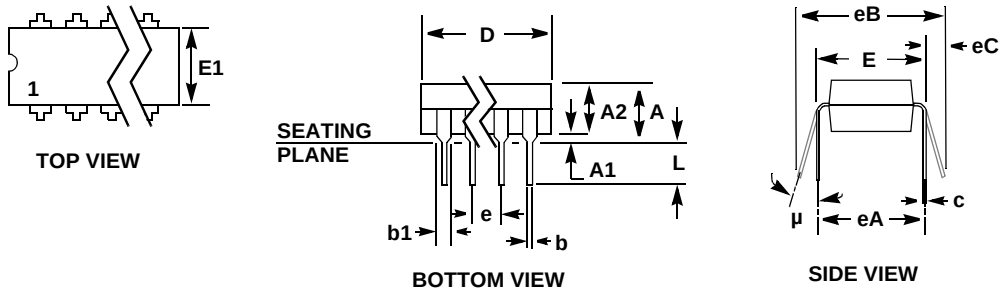
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.250	0.00	6.35
A1	0.015	0.025	0.38	0.64
A2	0.125	0.195	3.18	4.95
b	0.014	0.022	0.36	0.56
b1	0.030	0.070	0.76	1.78
c	0.008	0.014	0.20	0.36
D	1.150	1.290	29.21	32.77
E	0.600	0.625	15.24	15.88
E1	0.485	0.580	12.32	14.73
e	0.090	0.110	2.29	2.79
eA	0.580	0.620	14.73	15.75
eB	0.600	0.700	15.24	17.78
eC	0.000	0.060	0.00	1.52
L	0.115	0.200	2.92	5.08
μ	0°	15°	0°	15°

3.8 28-Pin PDIP (600-mm Body)



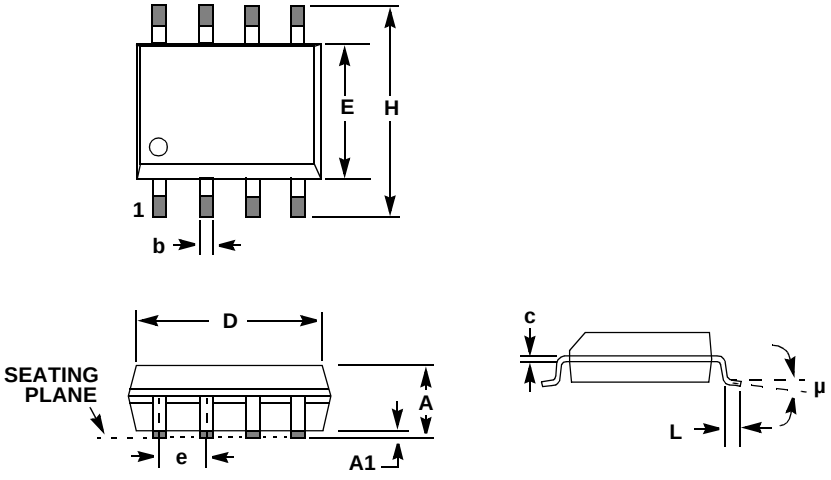
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.250	0.00	6.35
A1	0.015	0.025	0.38	0.64
A2	0.125	0.195	3.18	4.95
b	0.014	0.022	0.36	0.56
b1	0.030	0.070	0.76	1.78
c	0.008	0.014	0.20	0.36
D	1.380	1.565	35.05	39.75
E	0.600	0.625	15.24	15.88
E1	0.485	0.580	12.32	14.73
e	0.090	0.110	2.29	2.79
eA	0.580	0.620	14.73	15.75
eB	0.600	0.700	15.24	17.78
eC	0.000	0.060	0.00	1.52
L	0.115	0.200	2.92	5.08
μ	0°	15°	0°	15°

3.9 40-Pin PDIP (600-mm Body)



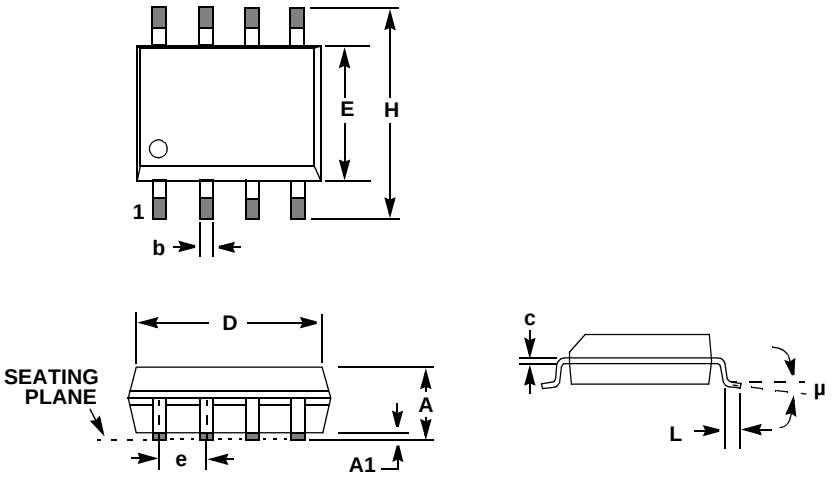
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.250	0.00	6.35
A1	0.015	0.025	0.38	0.64
A2	0.125	0.195	3.18	4.95
b	0.014	0.022	0.36	0.56
b1	0.030	0.070	0.76	1.78
c	0.008	0.014	0.20	0.36
D	1.980	2.095	50.29	53.21
E	0.600	0.625	15.24	15.88
E1	0.485	0.580	12.32	14.73
e	0.090	0.110	2.29	2.79
eA	0.580	0.620	14.73	15.75
eB	0.600	0.700	15.24	17.78
eC	0.000	0.060	0.00	1.52
L	0.115	0.200	2.92	5.08
μ	0°	15°	0°	15°

3.10 8-Pin SOIC (150-mm Body)



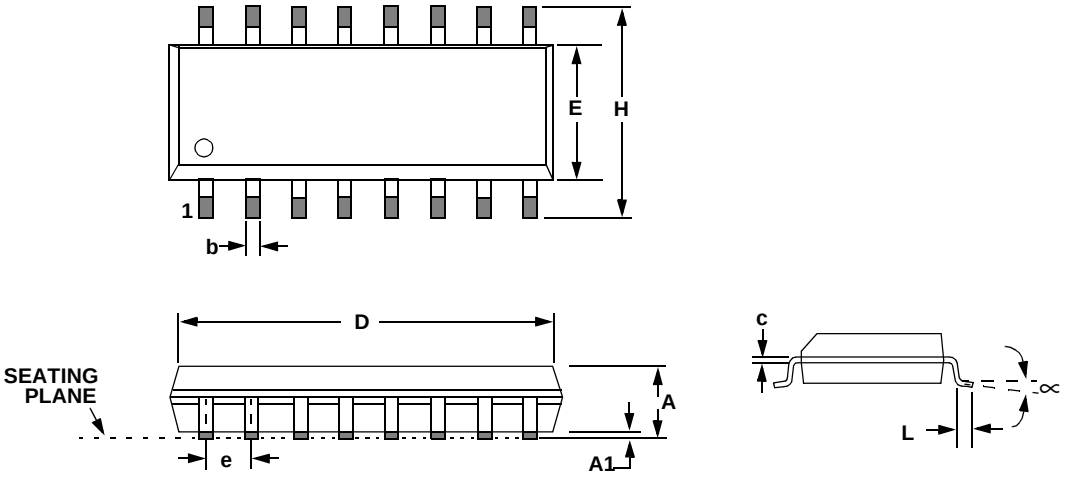
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.053	0.069	1.35	1.75
A1	0.004	0.010	0.10	0.25
b	0.013	0.020	0.33	0.51
c	0.007	0.010	0.19	0.25
D	0.189	0.197	4.80	5.00
E	0.150	0.157	3.80	4.00
e	0.040	0.060	1.02	1.52
H	0.228	0.244	5.80	6.20
L	0.016	0.050	0.40	1.27
μ	0°	8°	0°	8°

3.11 8-Pin SOIC (209-mm Body)



Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.076	0.084	1.93	2.13
A1	0.004	0.010	0.10	0.25
b	0.013	0.020	0.33	0.51
c	0.006	0.010	0.15	0.25
D	0.206	0.210	5.23	5.33
E	0.204	0.212	5.18	5.38
e	0.040	0.060	1.02	1.52
H	0.302	0.318	7.67	8.08
L	0.019	0.030	0.48	0.76
μ	0°	8°	0°	8°

3.12 16-Pin SOIC (150-mm Body)

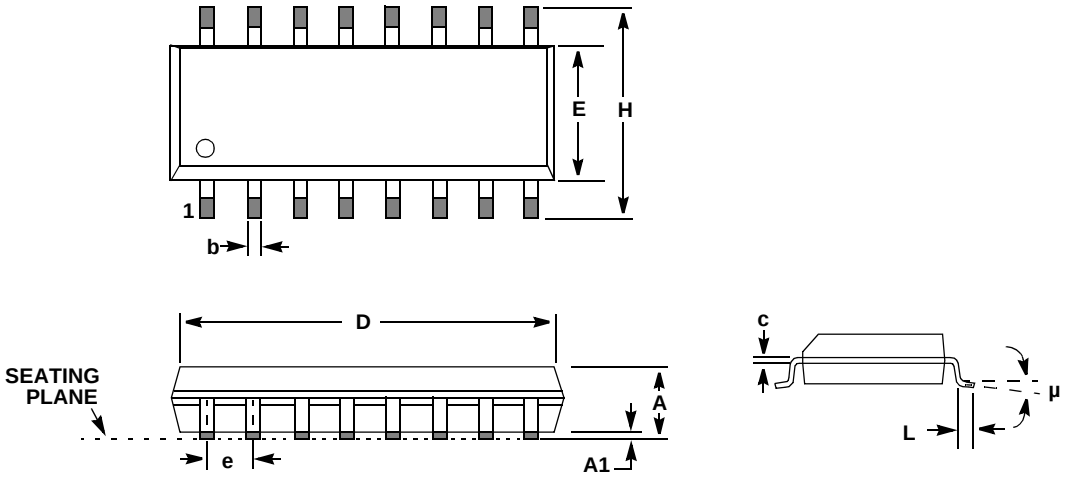


	INCHES			MILLIMETERS		
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**
A	0.053	0.064	0.069	1.35	1.63	1.75
A1	0.004	0.006	0.010	0.10	0.15	0.25
b	0.013	0.016	0.020	0.33	0.41	0.51
C	0.0075	0.008	0.010	0.19	0.20	0.25
D	0.386	0.390	0.394	9.80	9.91	10.00
E	0.150	0.154	0.157	3.80	3.90	4.00
e	0.040	0.050	0.060	1.02	1.27	1.52
H	0.228	0.236	0.244	5.80	6.0	6.20
L	0.016	0.025	0.050	0.40	0.64	1.27
∝	0°	4°	8°	0°	4°	8°

JEDEC # : MS-012

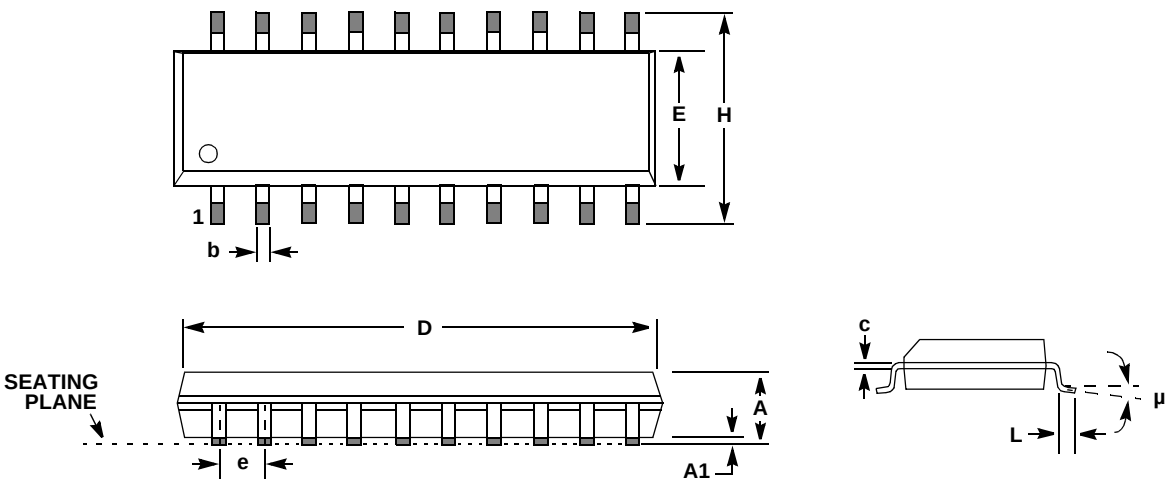
Controling Dimension is Millimeters

3.13 16-Pin SOIC (300-mm Body)



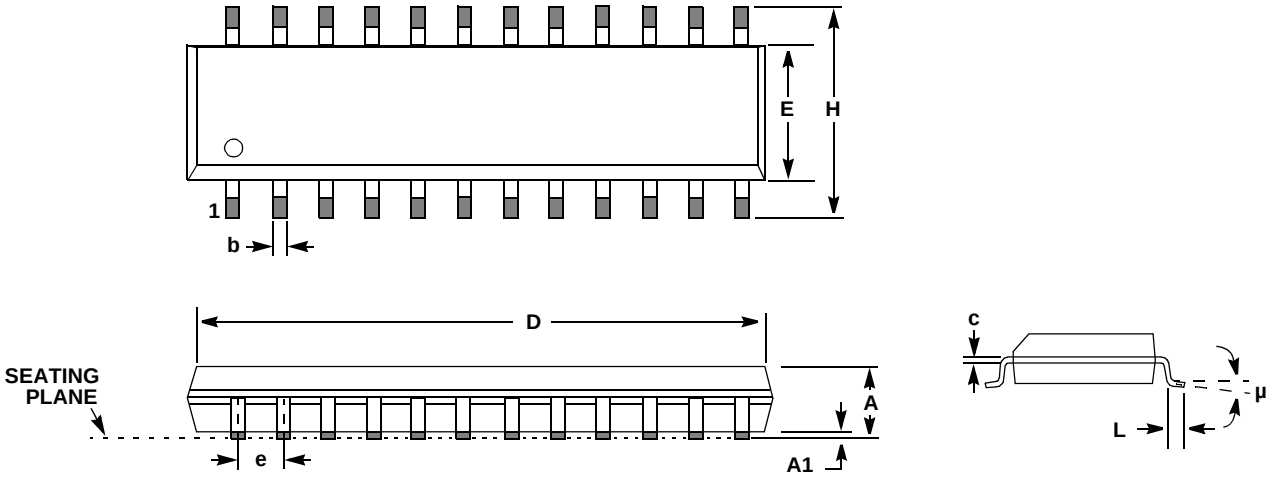
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
b	0.013	0.020	0.33	0.51
c	0.009	0.013	0.23	0.32
D	0.398	0.413	10.10	10.50
E	0.291	0.299	7.40	7.60
e	0.040	0.060	1.02	1.52
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27
μ	0°	8°	0°	8°

3.14 20-Pin SOIC (300-mm Body)



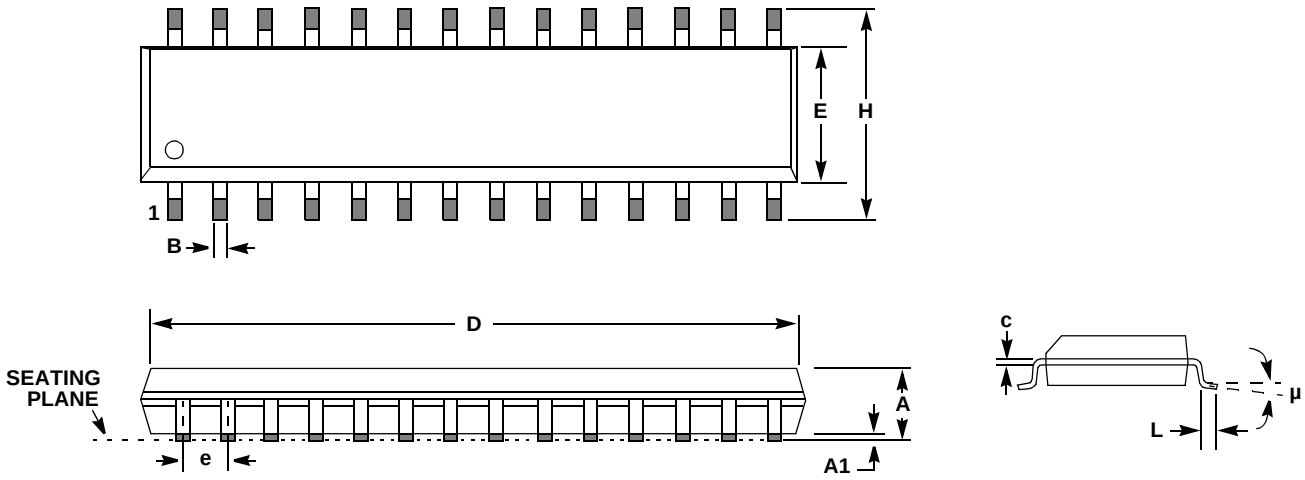
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
b	0.013	0.020	0.33	0.51
c	0.009	0.013	0.23	0.32
D	0.496	0.512	12.60	13.00
E	0.291	0.299	7.40	7.60
e	0.040	0.060	1.02	1.52
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27
μ	0°	8°	0°	8°

3.15 24-Pin SOIC (300-mm Body)



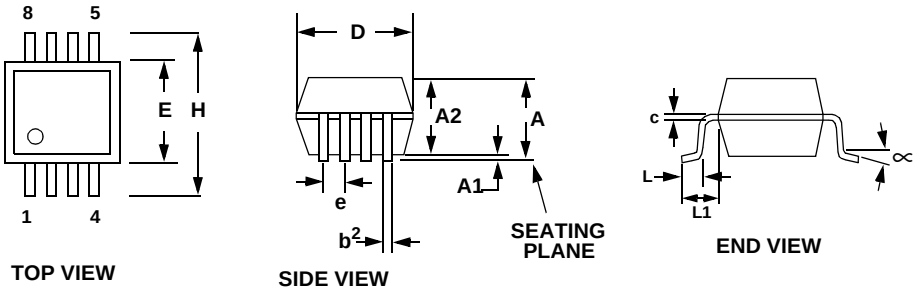
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
b	0.013	0.020	0.33	0.51
c	0.009	0.013	0.23	0.32
D	0.598	0.614	15.20	15.60
E	0.291	0.299	7.40	7.60
e	0.040	0.060	1.02	1.52
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27
μ	0°	8°	0°	8°

3.16 28-Pin SOIC (300-mm Body)



Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.093	0.104	2.35	2.65
A1	0.004	0.012	0.10	0.30
b	0.013	0.020	0.33	0.51
c	0.009	0.013	0.23	0.32
D	0.697	0.713	17.70	18.10
E	0.291	0.299	7.40	7.60
e	0.040	0.060	1.02	1.52
H	0.394	0.419	10.00	10.65
L	0.016	0.050	0.40	1.27
μ	0°	8°	0°	8°

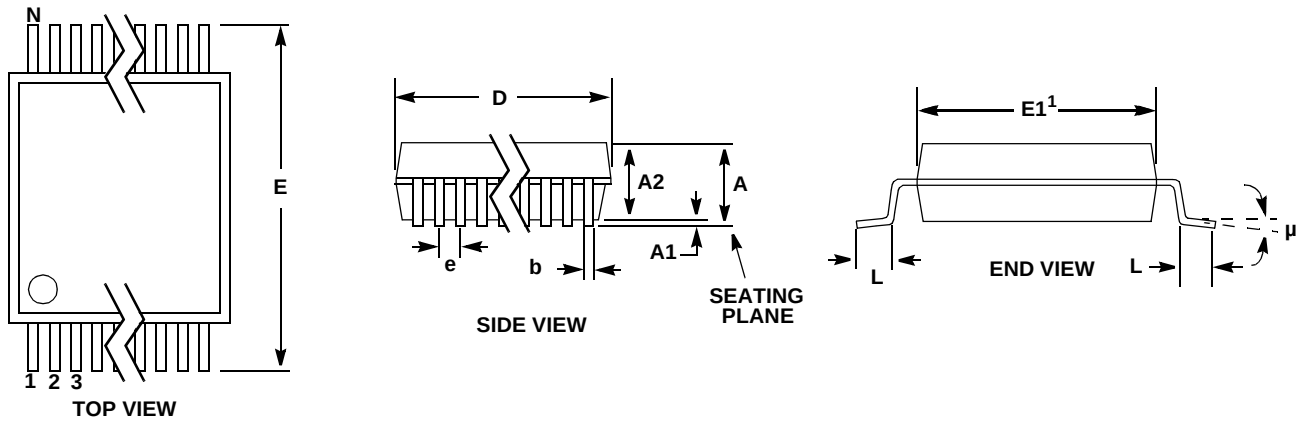
3.17 8-Pin SSOP



	INCHES			MILLIMETERS			NOTE
DIM	MIN	NOM	MAX	MIN	NOM	MAX	
A	0.053		0.069	1.35		1.75	
A1	0.004		0.010	0.10		0.25	
A2	0.051		0.059	1.30		1.50	
b	0.013		0.020	0.33		0.51	2,3
c	0.007		0.010	0.19		0.25	
D	0.189		0.197	4.80		5.00	1
E	0.150		0.157	3.80		4.00	
e	--		0.050	--		1.27	
H	0.228		0.244	5.80		6.20	
L	0.016		0.050	0.40		1.27	
L1	--		0.042	--		1.07	
∝	0°		8°	0°		8°	

Notes:
1. “D” and “E1” are reference datums and do not included mold flash or protrusions, but do include mold mismatch and are measured at the parting line, mold flash or protrusions shall not exceed 0.20 mm per side.
2. Dimension “b” does not include dambar protrusion/intrusion. Allowable dambar protrusion shall be 0.13 mm total in excess of “b” dimension at maximum material condition. Dambar intrusion shall not reduce dimension “b” by more than 0.07 mm at least material condition.
3. These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.18 16-Pin SSOP



Dimension	Inches		Millimeters		
	MIN	MAX	MIN	MAX	Note
A	–	0.084	–	2.13	
A1	0.002	0.010	0.05	0.25	
A2	0.064	0.074	1.62	1.88	
b	0.009	0.015	0.22	0.38	2,3
D	0.232	0.256	5.90	6.50	1
E	0.291	0.323	7.40	8.20	
E1	0.197	0.220	5.00	5.60	1
e	0.022	0.030	0.55	0.75	
L	0.025	0.041	0.63	1.03	
µ	0°	8°	0°	8°	

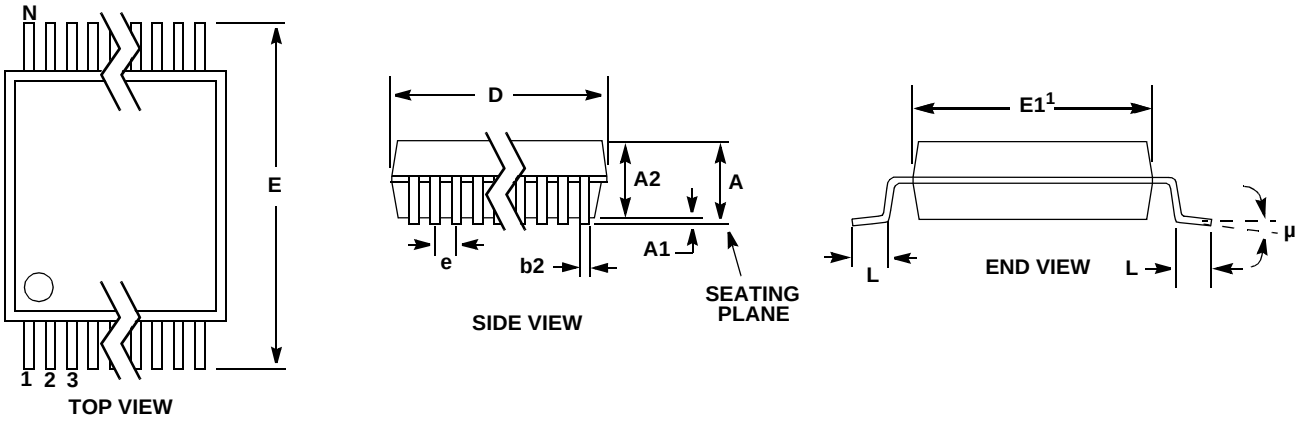
NOTES:

1) 'D' and 'E1' are reference points and do not include mold flash or protrusions, but do include mold mismatch and are measured at the parting line. Mold flash or protrusions must not exceed 0.20 mm per side.

2) Dimension 'b' does not include dambar protrusion/intrusion. Allowable dambar protrusion must be 0.13 mm total in excess of 'b' dimension at maximum material condition. Dambar intrusion must not reduce dimension 'b' by more than 0.07 mm at least material condition.

3) These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.19 20-Pin SSOP



Dimension	Inches		Millimeters		
	MIN	MAX	MIN	MAX	Note
A	–	0.084	–	2.13	
A1	0.002	0.010	0.05	0.25	
A2	0.064	0.074	1.62	1.88	
b	0.009	0.015	0.22	0.38	2,3
D	0.272	0.295	6.90	7.50	1
E	0.291	0.323	7.40	8.20	
E1	0.197	0.220	5.00	5.60	1
e	0.022	0.030	0.55	0.75	
L	0.025	0.041	0.63	1.03	
µ	0°	8°	0°	8°	

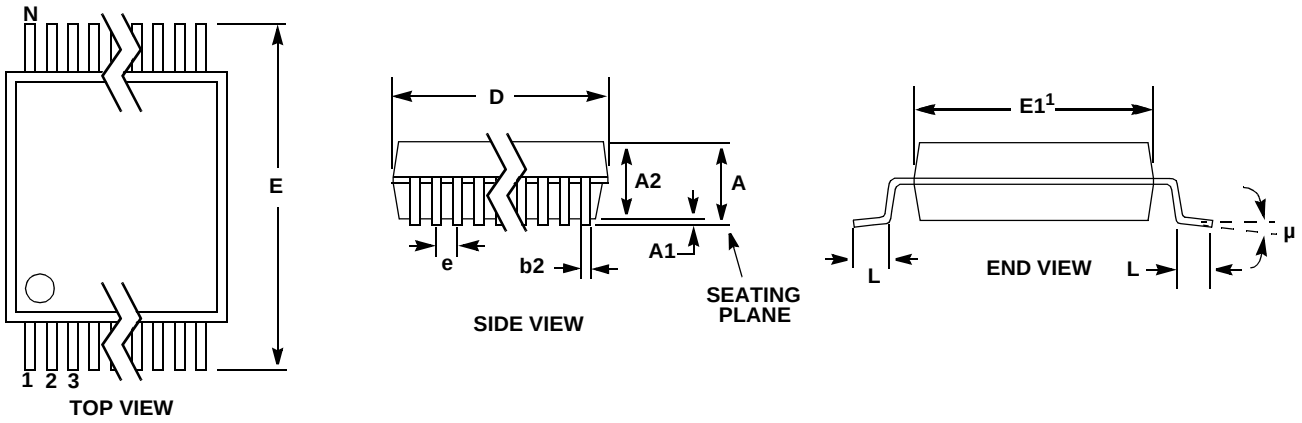
NOTES:

1) 'D' and 'E1' are reference points and do not include mold flash or protrusions, but do include mold mismatch and are measured at the parting line. Mold flash or protrusions must not exceed 0.20 mm per side.

2) Dimension 'b' does not include dambar protrusion/intrusion. Allowable dambar protrusion must be 0.13 mm total in excess of 'b' dimension at maximum material condition. Dambar intrusion must not reduce dimension 'b' by more than 0.07 mm at least material condition.

3) These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.20 24-Pin SSOP



Dimension	Inches		Millimeters		Note
	MIN	MAX	MIN	MAX	
A	–	0.084	–	2.13	
A1	0.002	0.010	0.05	0.25	
A2	0.064	0.074	1.62	1.88	
b	0.009	0.015	0.22	0.38	2,3
D	0.311	0.335	7.90	8.50	1
E	0.291	0.323	7.40	8.20	
E1	0.197	0.220	5.00	5.60	1
e	0.022	0.030	0.55	0.75	
L	0.025	0.041	0.63	1.03	
µ	0°	8°	0°	8°	

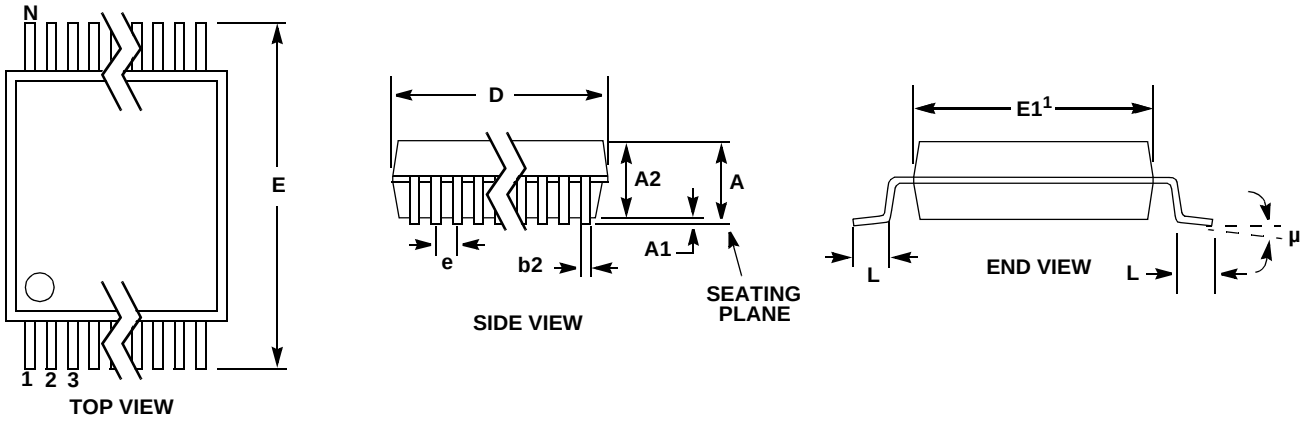
NOTES:

1) 'D' and 'E1' are reference points and do not include mold flash or protrusions, but do include mold mismatch and are measured at the parting line. Mold flash or protrusions must not exceed 0.20 mm per side.

2) Dimension 'b' does not include dambar protrusion/intrusion. Allowable dambar protrusion must be 0.13 mm total in excess of 'b' dimension at maximum material condition. Dambar intrusion must not reduce dimension 'b' by more than 0.07 mm at least material condition.

3) These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.21 28-Pin SSOP



Dimension	Inches		Millimeters		Note
	MIN	MAX	MIN	MAX	
A	–	0.084	–	2.13	
A1	0.002	0.010	0.05	0.25	
A2	0.064	0.074	1.62	1.88	
b	0.009	0.015	0.22	0.38	2,3
D	0.390	0.413	9.90	10.50	1
E	0.291	0.323	7.40	8.20	
E1	0.197	0.220	5.00	5.60	1
e	0.022	0.030	0.55	0.75	
L	0.025	0.041	0.63	1.03	
µ	0°	8°	0°	8°	

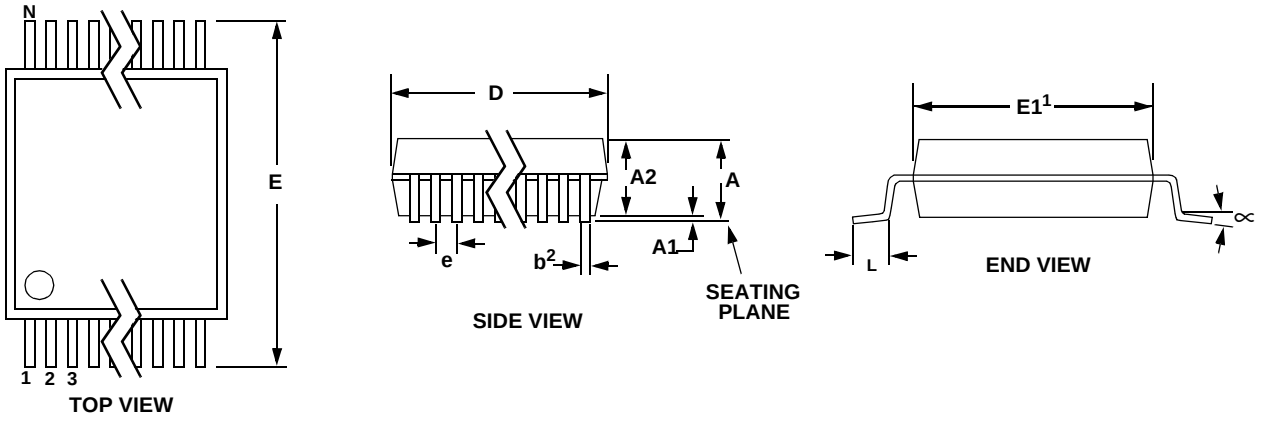
NOTES:

1) 'D' and 'E1' are reference points and do not include mold flash or protrusions, but do include mold mismatch and are measured at the parting line. Mold flash or protrusions must not exceed 0.20 mm per side.

2) Dimension 'b' does not include dambar protrusion/intrusion. Allowable dambar protrusion must be 0.13 mm total in excess of 'b' dimension at maximum material condition. Dambar intrusion must not reduce dimension 'b' by more than 0.07 mm at least material condition.

3) These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.22 16L TSSOP (4.4-mm Body)



	INCHES			MILLIMETERS			NOTE
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**	
A	--	--	0.043	--	--	1.10	
A1	0.002	0.004	0.006	0.05	--	0.15	
A2	0.03346	0.0354	0.037	0.85	0.90	0.95	
b	0.00748	0.0096	0.012	0.19	0.245	0.30	2,3
D	0.193	0.1969	0.201	4.90	5.00	5.10	1
E	0.248	0.2519	0.256	6.30	6.40	6.50	
E1	0.169	0.1732	0.177	4.30	4.40	4.50	1
e	--	0.026 BSC	--	--	0.065 BSC	--	
L	0.020	0.024	0.028	0.50	0.60	0.70	
∝	0°	4°	8°	0°	4°	8°	

JEDEC #: MO-153

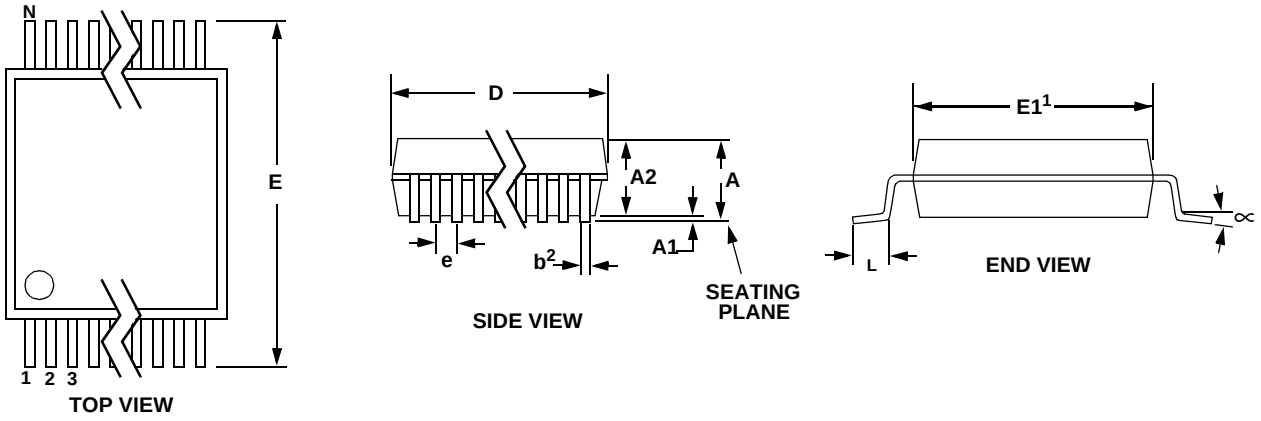
Controlling Dimension is Millimeters

Notes: 1. "D" and "E1" are reference datums and do not included mold flash or protrusions, but do include mold mismatch and are measured at the parting line, mold flash or protrusions shall not exceed 0.20 mm per side.

2. Dimension "b" does not include dambar protrusion/intrusion. Allowable dambar protrusion shall be 0.13 mm total in excess of "b" dimension at maximum material condition. Dambar intrusion shall not reduce dimension "b" by more than 0.07 mm at least material condition.

3. These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.23 20L TSSOP (4.4-mm Body)



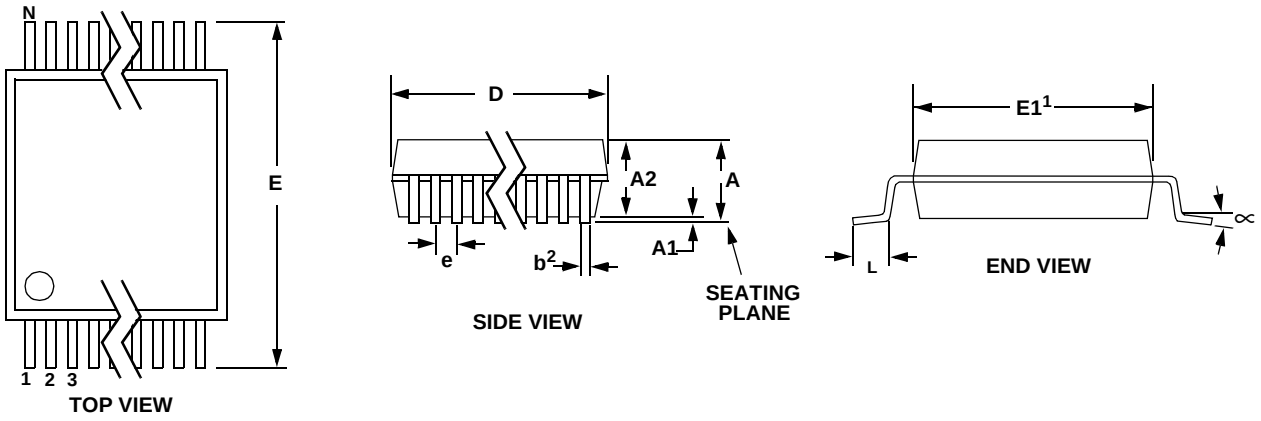
	INCHES			MILLIMETERS			NOTE
DIM	MIN	NOM	MAX	MIN	NOM	MAX	
A	--	--	0.043	--	--	1.10	
A1	0.002	0.004	0.006	0.05	--	0.15	
A2	0.03346	0.0354	0.037	0.85	0.90	0.95	
b	0.00748	0.0096	0.012	0.19	0.245	0.30	2,3
D	0.252	0.256	0.259	6.40	6.50	6.60	1
E	0.248	0.2519	0.256	6.30	6.40	6.50	
E1	0.169	0.1732	0.177	4.30	4.40	4.50	1
e	--	--	0.026	--	--	0.65	
L	0.020	0.024	0.028	0.50	0.60	0.70	
∝	0°	4°	8°	0°	4°	8°	

JEDEC #: MO-153

Controlling Dimension is Millimeters.

Notes:
1. "D" and "E1" are reference datums and do not included mold flash or protrusions, but do include mold mismatch and are measured at the parting line, mold flash or protrusions shall not exceed 0.20 mm per side.
2. Dimension "b" does not include dambar protrusion/intrusion. Allowable dambar protrusion shall be 0.13 mm total in excess of "b" dimension at maximum material condition. Dambar intrusion shall not reduce dimension "b" by more than 0.07 mm at least material condition.
3. These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.24 24L TSSOP (4.4-mm Body)

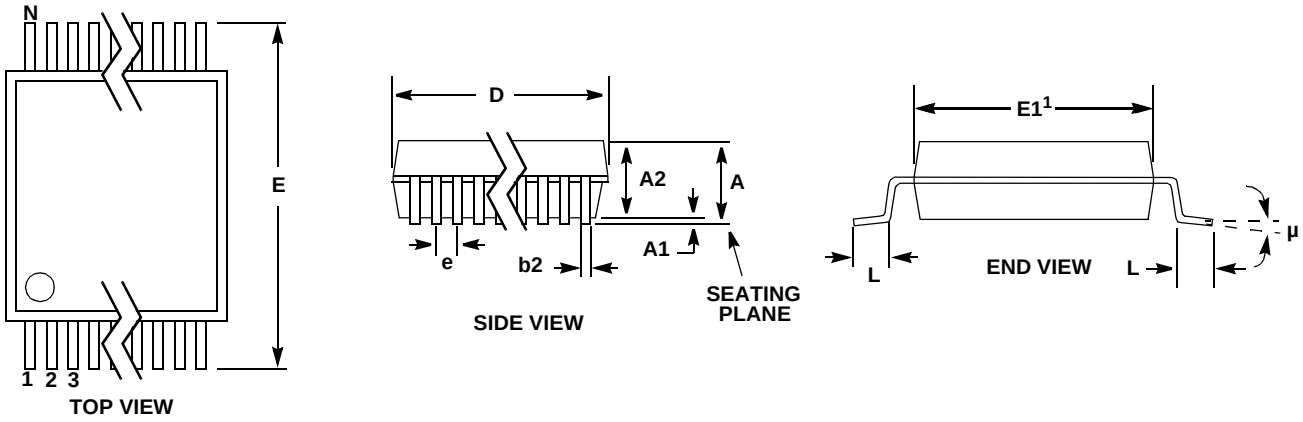


	INCHES			MILLIMETERS			NOTE
DIM	**MIN**	**NOM**	**MAX**	**MIN**	**NOM**	**MAX**	
A	--	--	0.043	--	--	1.10	
A1	0.002	0.004	0.006	0.05	--	0.15	
A2	0.03346	0.0354	0.037	0.85	0.90	0.95	
b	0.00748	0.0096	0.012	0.19	0.245	0.30	2,3
D	0.303	0.307	0.311	7.70	7.80	7.90	1
E	0.248	0.2519	0.256	6.30	6.40	6.50	
E1	0.169	0.1732	0.177	4.30	4.40	4.50	1
e	--	0.026 BSC	--	--	0.65 BSC	--	
L	0.020	0.024	0.028	0.50	0.60	0.70	
∝	0°	4°	8°	0°	4°	8°	

JEDEC #: MO-153
Controlling Dimension is Millimeters.

Notes:
1. "D" and "E1" are reference datums and do not included mold flash or protrusions, but do include mold mismatch and are measured at the parting line, mold flash or protrusions shall not exceed 0.20 mm per side.
2. Dimension "b" does not include dambar protrusion/intrusion. Allowable dambar protrusion shall be 0.13 mm total in excess of "b" dimension at maximum material condition. Dambar intrusion shall not reduce dimension "b" by more than 0.07 mm at least material condition.
3. These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.25 48-Pin TSSOP (6.1-mm Body)



Dimension	Inches		Millimeters		Note
	MIN	MAX	MIN	MAX	
A	–	0.047	–	1.20	
A1	0.002	0.006	0.05	0.15	
A2	0.031	0.041	0.80	1.05	
b	0.007	0.011	0.17	0.27	2,3
D	0.488	0.496	12.40	12.60	1
E	0.313	0.325	7.95	8.25	
E1	0.236	0.244	6.00	6.20	1
e	0.016	0.024	0.40	0.60	
L	0.018	0.030	0.45	0.75	
µ	0°	8°	0°	8°	

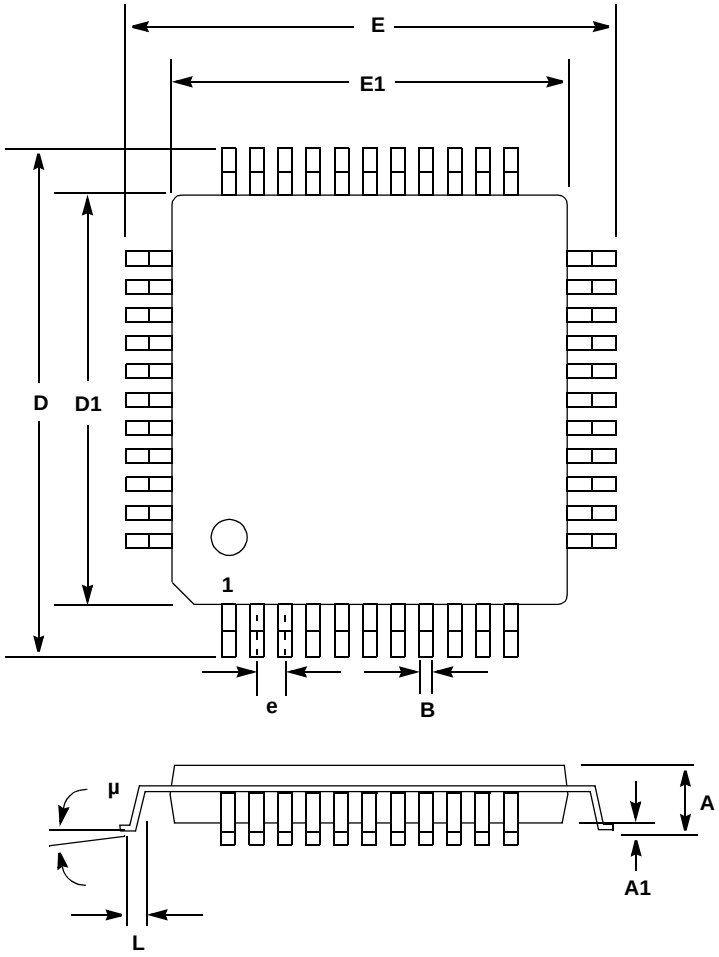
NOTES:

1) 'D' and 'E1' are reference points and do not include mold flash or protrusions, but do include mold mismatch and are measured at the parting line. Mold flash or protrusions must not exceed 0.20 mm per side.

2) Dimension 'b' does not include dambar protrusion/intrusion. Allowable dambar protrusion must be 0.13 mm total in excess of 'b' dimension at maximum material condition. Dambar intrusion must not reduce dimension 'b' by more than 0.07 mm at least material condition.

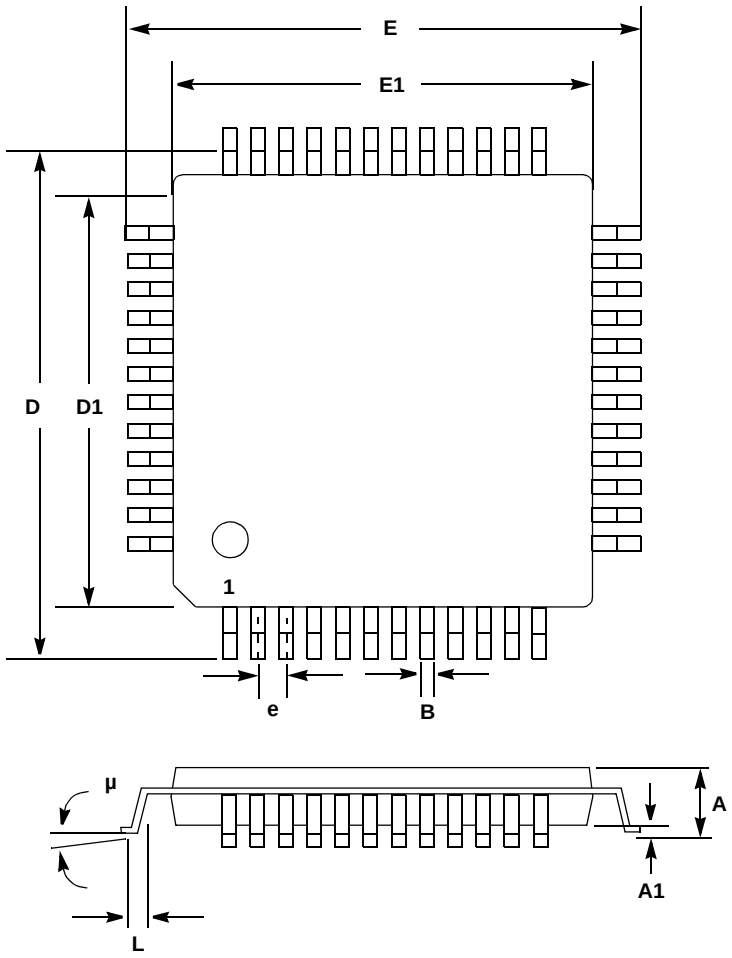
3) These dimensions apply to the flat section of the lead between 0.10 and 0.25 mm from lead tips.

3.26 44-Pin TQFP



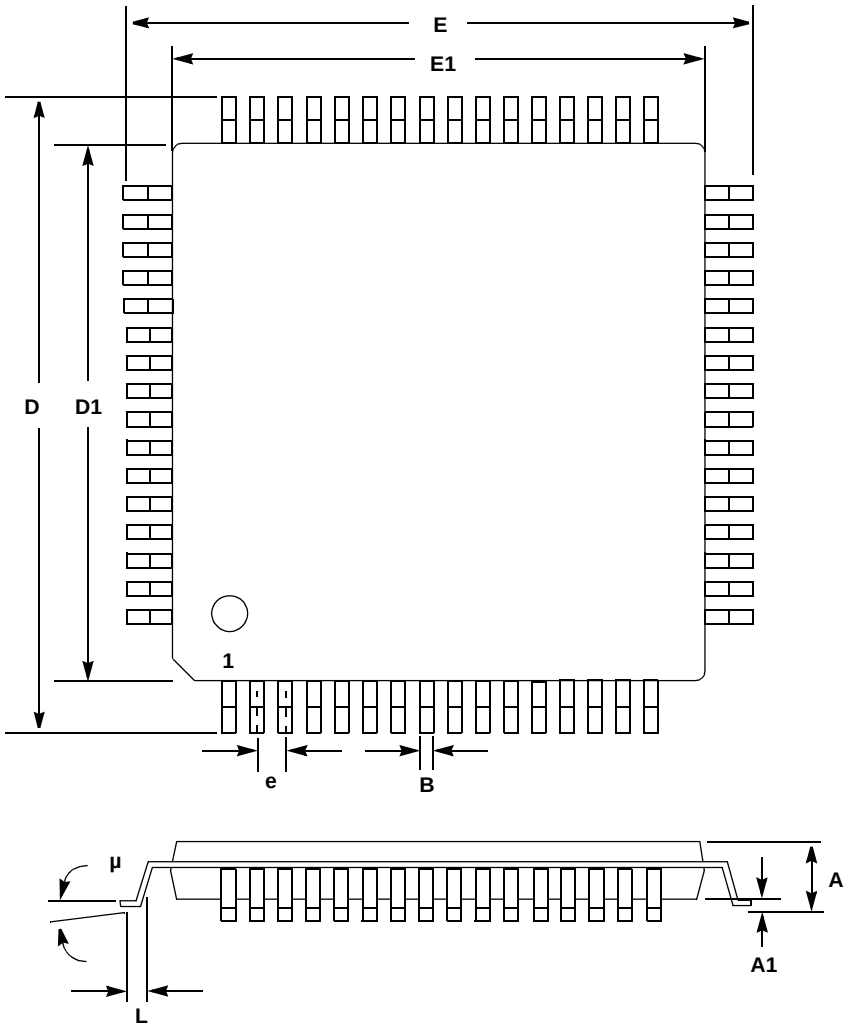
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.065	0.00	1.60
A1	0.002	0.006	0.05	0.15
B	0.012	0.018	0.30	0.45
D	0.478	0.502	11.70	12.30
D1	0.404	0.412	9.90	10.10
E	0.478	0.502	11.70	12.30
E1	0.404	0.412	9.90	10.10
e	0.029	0.037	0.70	0.90
L	0.018	0.030	0.45	0.75
μ	0°	7°	0°	7°

3.27 48-Pin TQFP



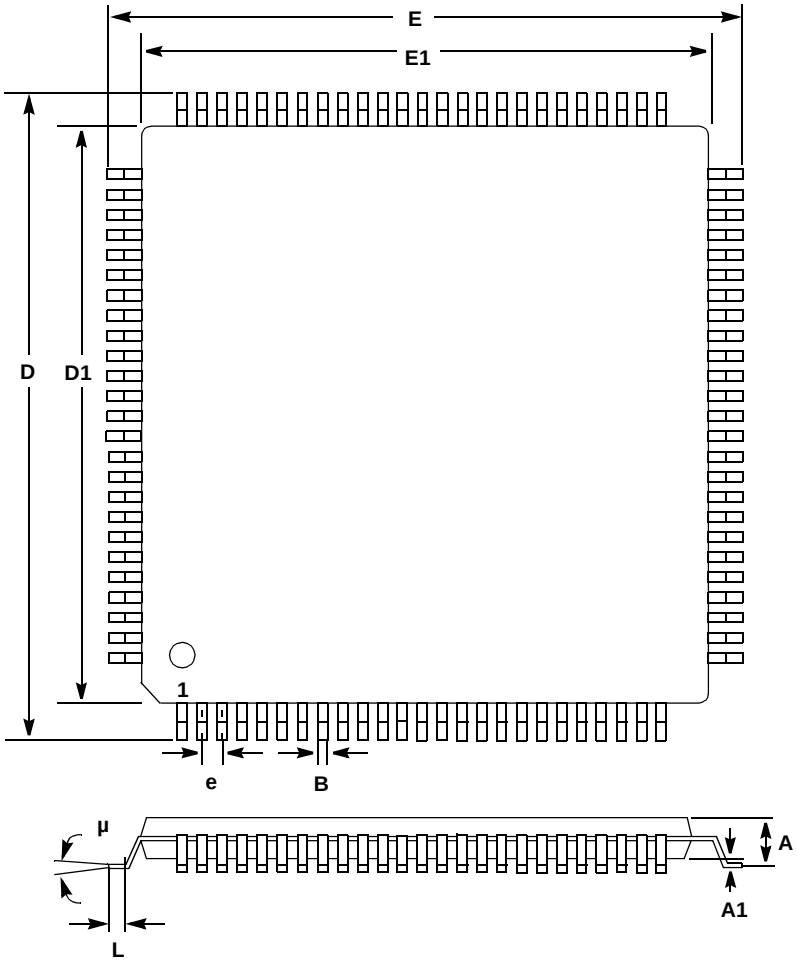
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.063	0.00	1.60
A1	0.002	0.006	0.05	0.15
B	0.007	0.011	0.17	0.27
D	0.343	0.366	8.70	9.30
D1	0.272	0.280	6.90	7.10
E	0.343	0.366	8.70	9.30
E1	0.272	0.280	6.90	7.10
e	0.016	0.024	0.40	0.60
L	0.018	0.030	0.45	0.75
μ	0°	7°	0°	7°

3.28 64-Pin TQFP



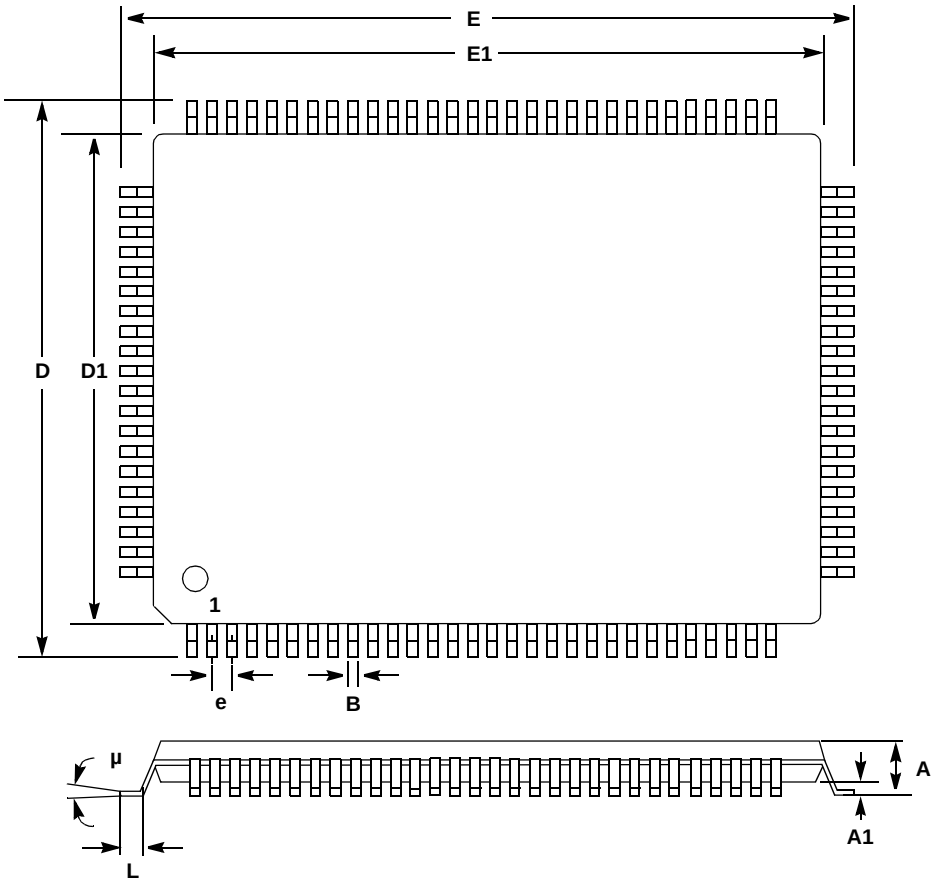
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.063	0.00	1.60
A1	0.002	0.006	0.05	0.15
B	0.007	0.011	0.17	0.27
D	0.461	0.484	11.70	12.30
D1	0.390	0.398	9.90	10.10
E	0.461	0.484	11.70	12.30
E1	0.390	0.398	9.90	10.10
e	0.016	0.024	0.40	0.60
L	0.018	0.030	0.45	0.75
μ	0°	7°	0°	7°

3.29 100-Pin TQFP



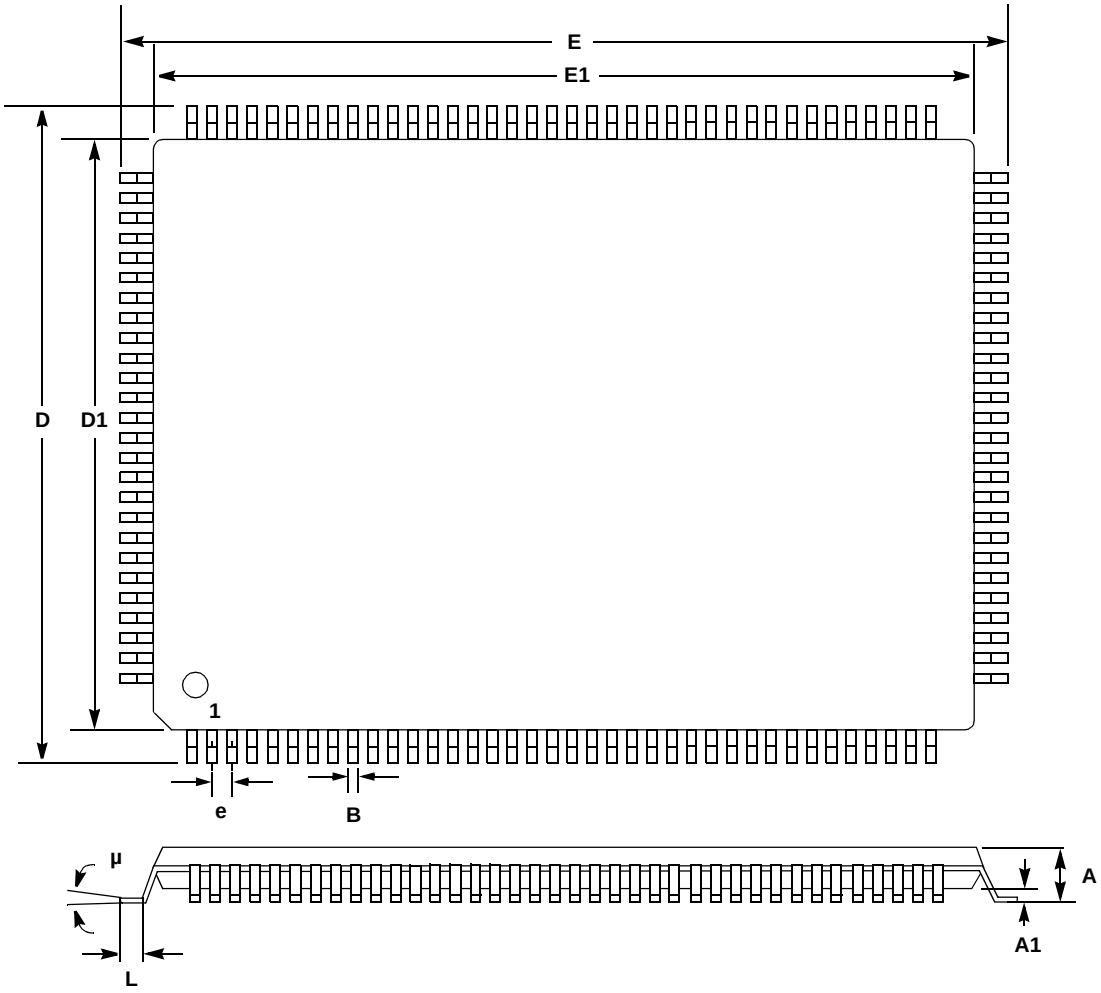
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.063	0.00	1.60
A1	0.002	0.006	0.05	0.15
B	0.007	0.011	0.17	0.27
D	0.618	0.642	15.70	16.30
D1	0.547	0.555	13.90	14.10
E	0.618	0.642	15.70	16.30
E1	0.547	0.555	13.90	14.10
e	0.016	0.024	0.40	0.60
L	0.018	0.030	0.45	0.75
μ	0°	7°	0°	7°

3.30 100-Pin MQFP



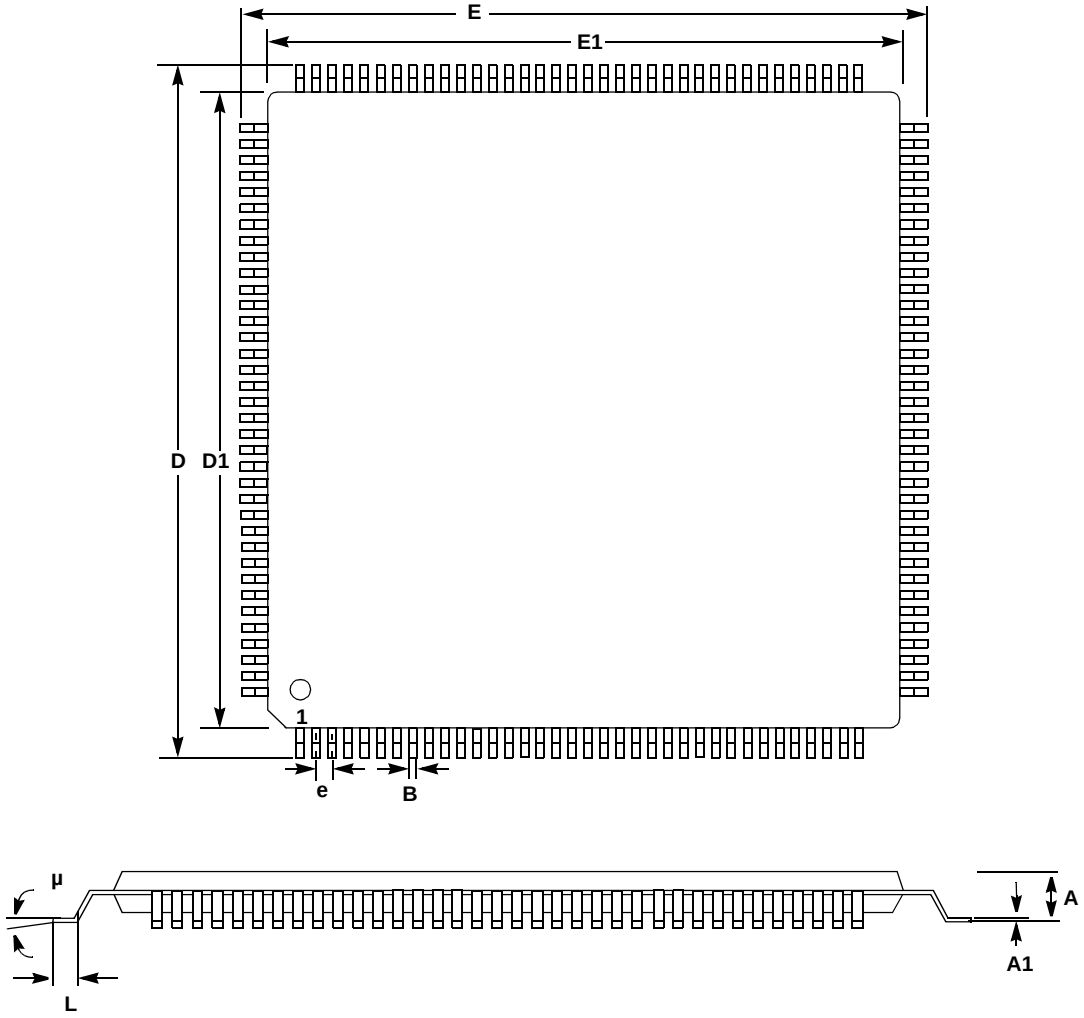
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.134	0.000	3.400
A1	0.010	0.014	0.250	0.350
B	0.009	0.015	0.220	0.380
D	0.667	0.687	16.950	17.450
D1	0.547	0.555	13.900	14.100
E	0.904	0.923	22.950	23.450
E1	0.783	0.791	19.900	20.100
e	0.022	0.030	0.550	0.750
µ	0°	7°	0°	7°
L	0.018	0.030	0.450	0.750

3.31 128-Pin TQFP



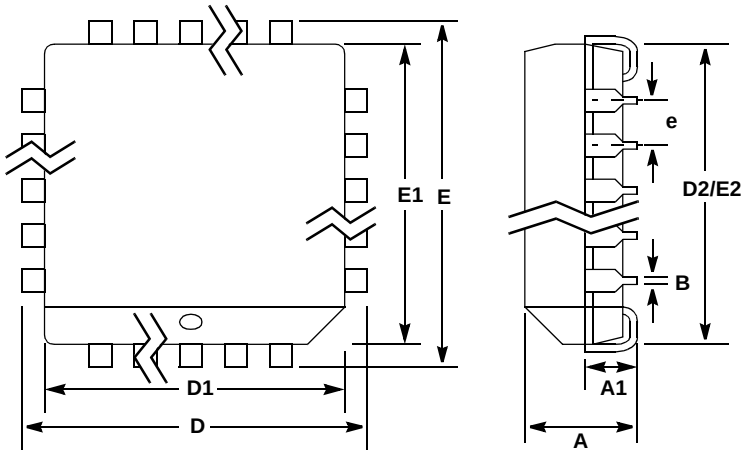
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.063	0.000	1.600
A1	0.002	0.006	0.050	0.150
B	0.007	0.011	0.170	0.270
D	0.626	0.634	15.900	16.100
D1	0.547	0.555	13.900	14.100
E	0.862	0.870	21.900	22.100
E1	0.783	0.791	19.900	20.100
e	0.016	0.024	0.400	0.600
µ	0°	7°	0°	7°
L	0.018	0.030	0.450	0.750

3.32 144-Pin TQFP



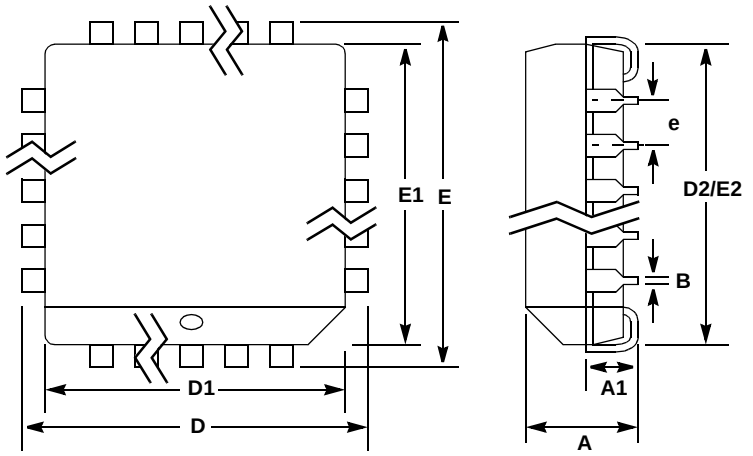
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.000	0.063	0.00	1.60
A1	0.002	0.006	0.05	0.15
B	0.007	0.011	0.17	0.27
D	0.854	0.878	21.70	22.30
D1	0.783	0.791	19.90	20.10
E	0.854	0.878	21.70	22.30
E1	0.783	0.791	19.90	20.10
e	0.016	0.024	0.40	0.60
L	0.018	0.030	0.45	0.75
μ	0°	7°	0°	7°

3.33 28-Pin PLCC



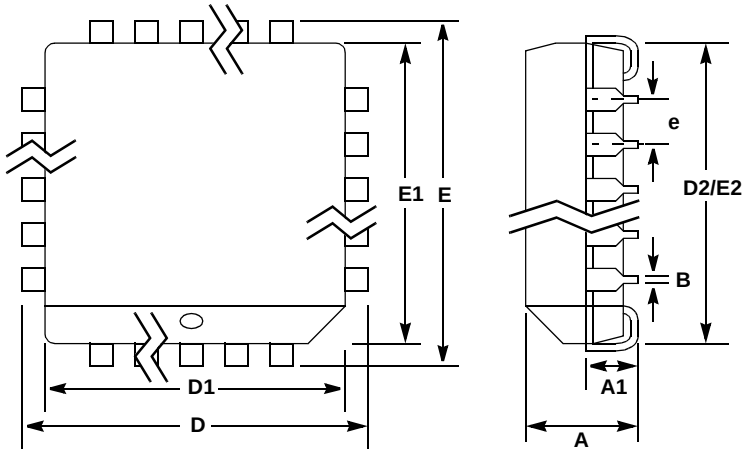
Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.165	0.180	4.043	4.572
A1	0.090	0.120	2.205	3.048
B	0.013	0.021	0.319	0.533
D	0.485	0.495	11.883	12.573
D1	0.450	0.456	11.025	11.582
D2	0.390	0.430	9.555	10.922
E	0.485	0.495	11.883	12.573
E1	0.450	0.456	11.025	11.582
E2	0.390	0.430	9.555	10.922
e	0.040	0.060	0.980	1.524

3.34 44-Pin PLCC



Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.165	0.180	4.043	4.572
A1	0.090	0.120	2.205	3.048
B	0.013	0.021	0.319	0.533
D	0.685	0.695	16.783	17.653
D1	0.650	0.656	15.925	16.662
D2	0.590	0.630	14.455	16.002
E	0.685	0.695	16.783	17.653
E1	0.650	0.656	15.925	16.662
E2	0.590	0.630	14.455	16.002
e	0.040	0.060	0.980	1.524

3.35 68-Pin PLCC



Dimension	Inches		Millimeters	
	MIN	MAX	MIN	MAX
A	0.165	0.180	4.043	4.572
A1	0.090	0.120	2.205	3.048
B	0.013	0.021	0.319	0.533
D	0.985	0.995	24.133	25.273
D1	0.950	0.958	23.275	24.333
D2	0.890	0.930	21.805	23.622
E	0.985	0.995	24.133	25.273
E1	0.950	0.958	23.275	24.333
E2	0.890	0.930	21.805	23.622
e	0.040	0.060	0.980	1.524

4. TRAY DRAWINGS

4.1 10 × 10 × 1.4-mm Body LQFP Tray

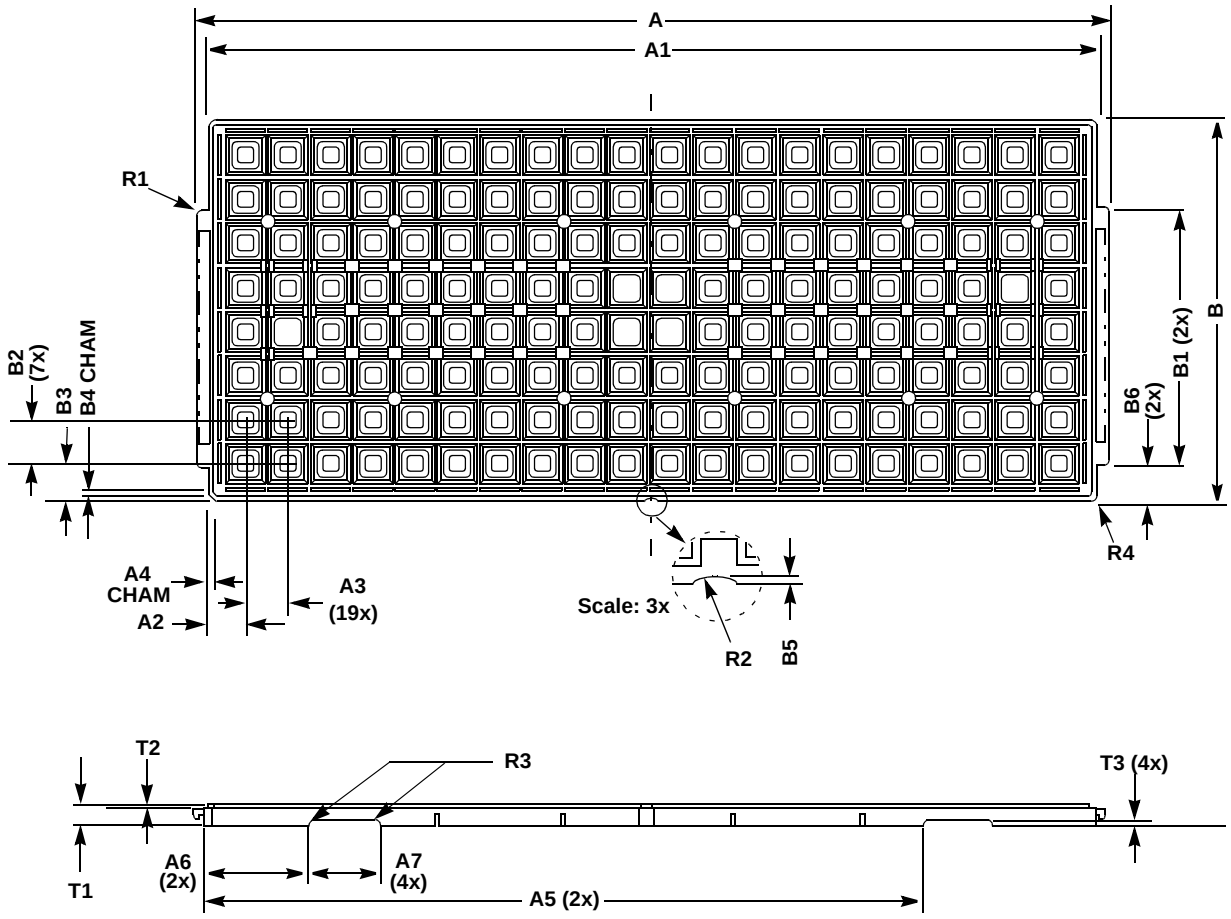


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	322.60	B3	13.00
A1	315.00	B4	2.0 × 45°
A2	13.10	B5	0.76
A3	15.20	B6	12.7
A4	3.0 × 45°	T1	7.62
A5	255.3	T2	1.27 ±0.13
A6	34.3	T3	2.54
A7	25.4	R1	2.54
B	135.90	R2	4.75
B1	92.10	R3	1.00
B2	15.70	R4	1.60

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1982.
3) Unless otherwise noted, 1°/2° draft on all vertical surfaces.
4) Locking notches. 4 places.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.2 10 × 10 × 1.0-mm Body TQFP Tray

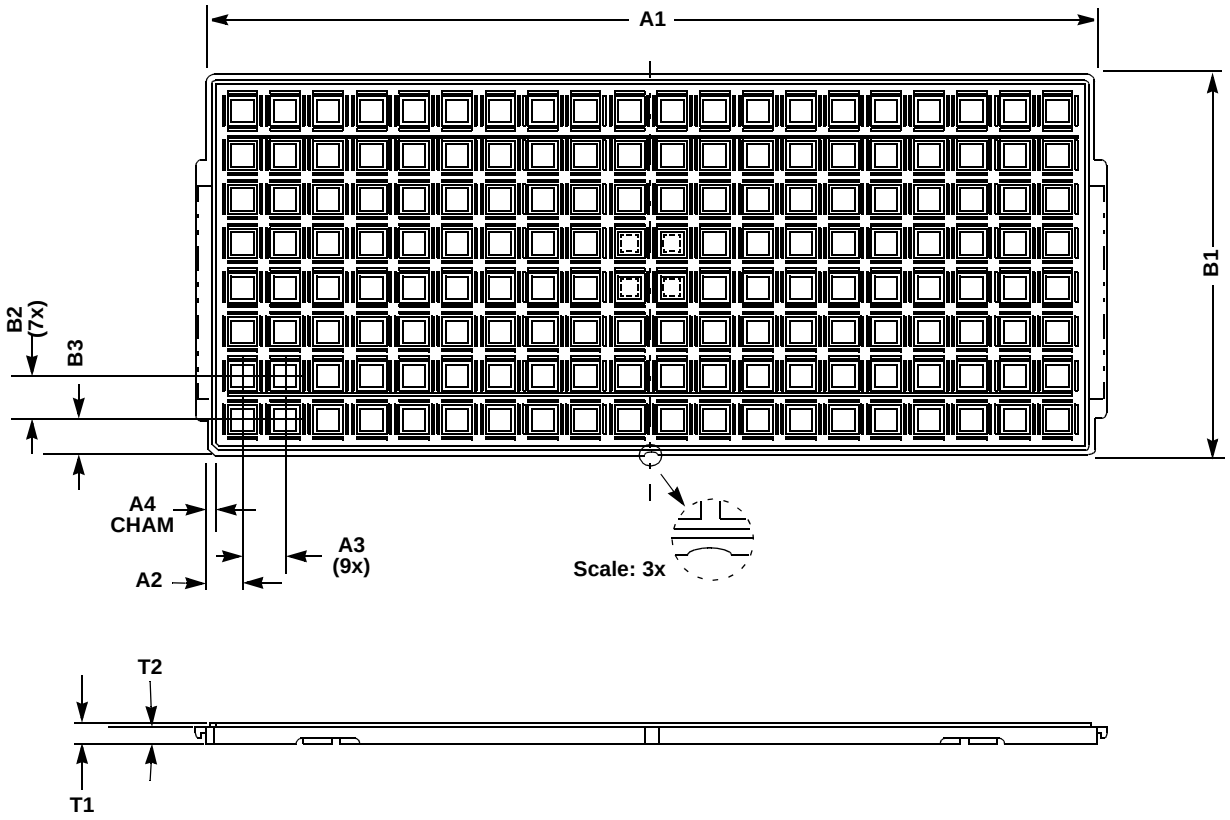


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A1	315.00	B2	15.70
A2	13.10	B3	13.00
A3	15.20	T1	7.62
A4	3.0 × 45°	T2	6.35
B1	135.90		

NOTES:

1) Closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted, 1°/2° draft on all vertical surfaces.
4) Locking mechanism. 4 places.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.3 12 × 12 × 1.0-mm Body TQFP Tray

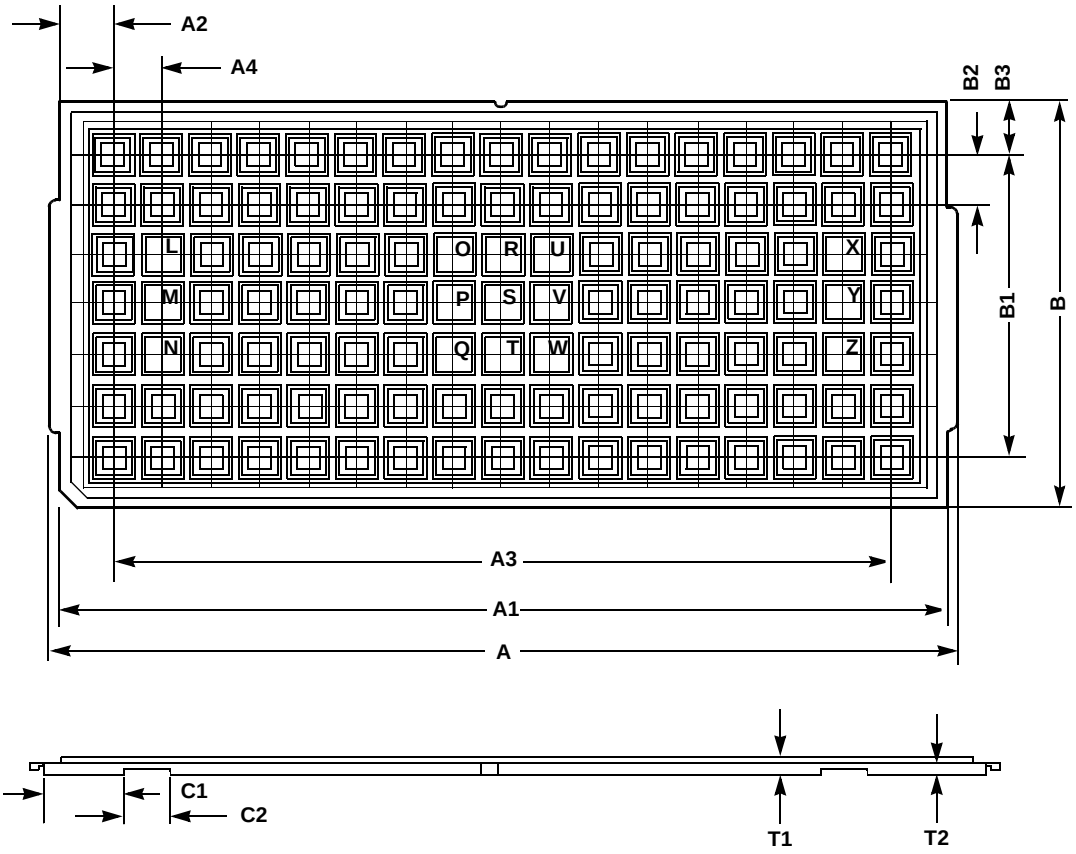


Figure Reference	MIN (mm)	MAX (mm)
A	322.40	322.80
A1	314.75	315.25
A2	14.10	14.50
A3	286.25	286.55
A4	17.70	18.10
B	135.65	136.15
B1	107.85	108.15
B2	17.80	18.20
B3	13.75	14.15
C1	34.10	34.50
C2	25.20	25.60
T1	7.47	7.77
T2	6.20	6.50

NOTES:

1) Total usable cell count is 119.
2) Package orientation in tray: With the tray chamfer in the bottom-left corner (as shown), package pin 1 is in the bottom-left corner.
3) Material is conductive dielectric resin.
4) Surface resistivity is maximum 10^{14} ohms/square; surfaces should be free of mold seams.
5) Locations 'L' to 'Z' indicate the positions of vacuum operations.
6) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.4 14 × 20 × 2.7-mm Body MQFP Tray

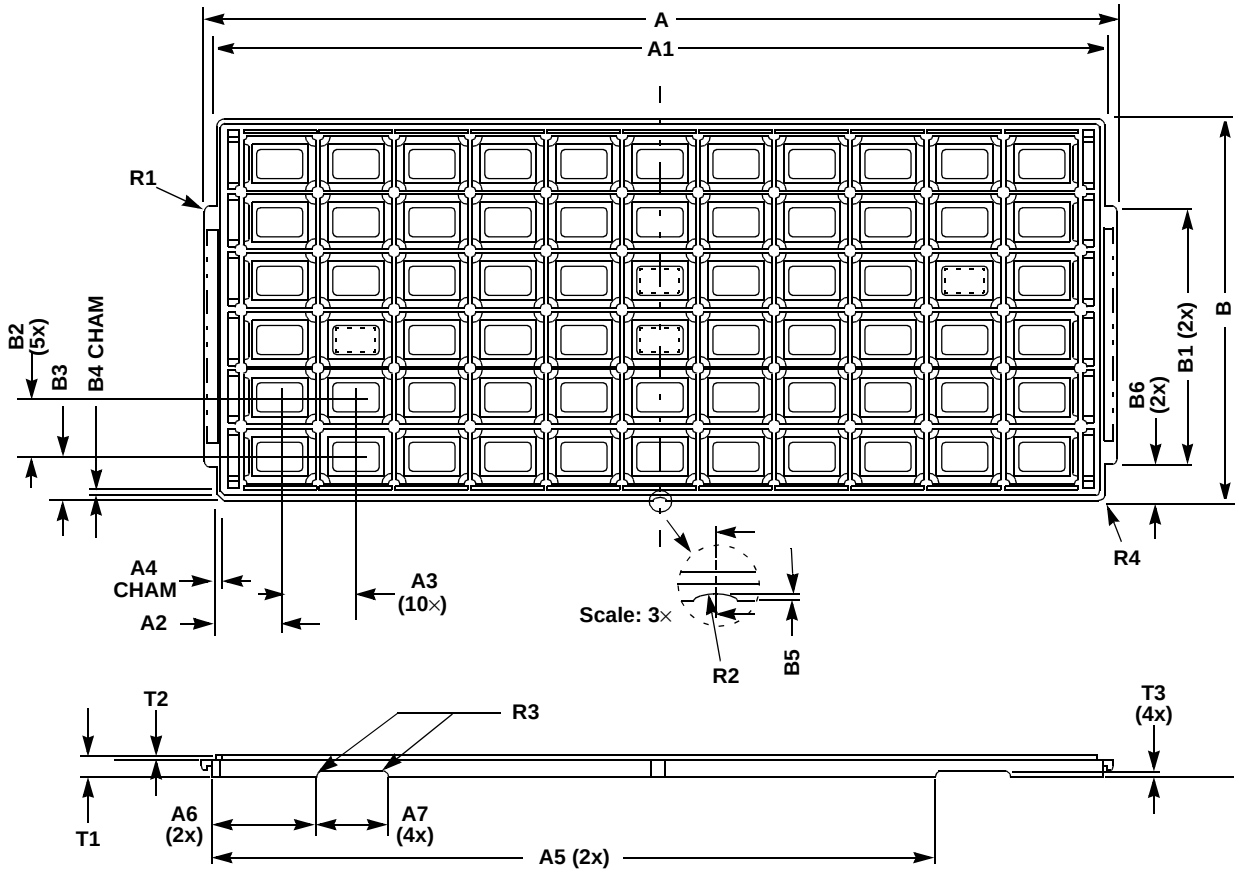


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	322.0	B3	15.45
A1	315.0	B4	2.0 × 45°
A2	22.50	B5	0.76
A3	27.00	B6	12.7
A4	3.0 × 45°	T1	7.62
A5	255.3	T2	1.27 ± 0.13
A6	34.3	T3	2.54
A7	25.4	R1	2.54
B	135.90	R2	4.75
B1	92.10	R3	1.00
B2	21.00	R4	1.60

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1982.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.5 28 × 28 × 3.5-mm Body MQFP Tray

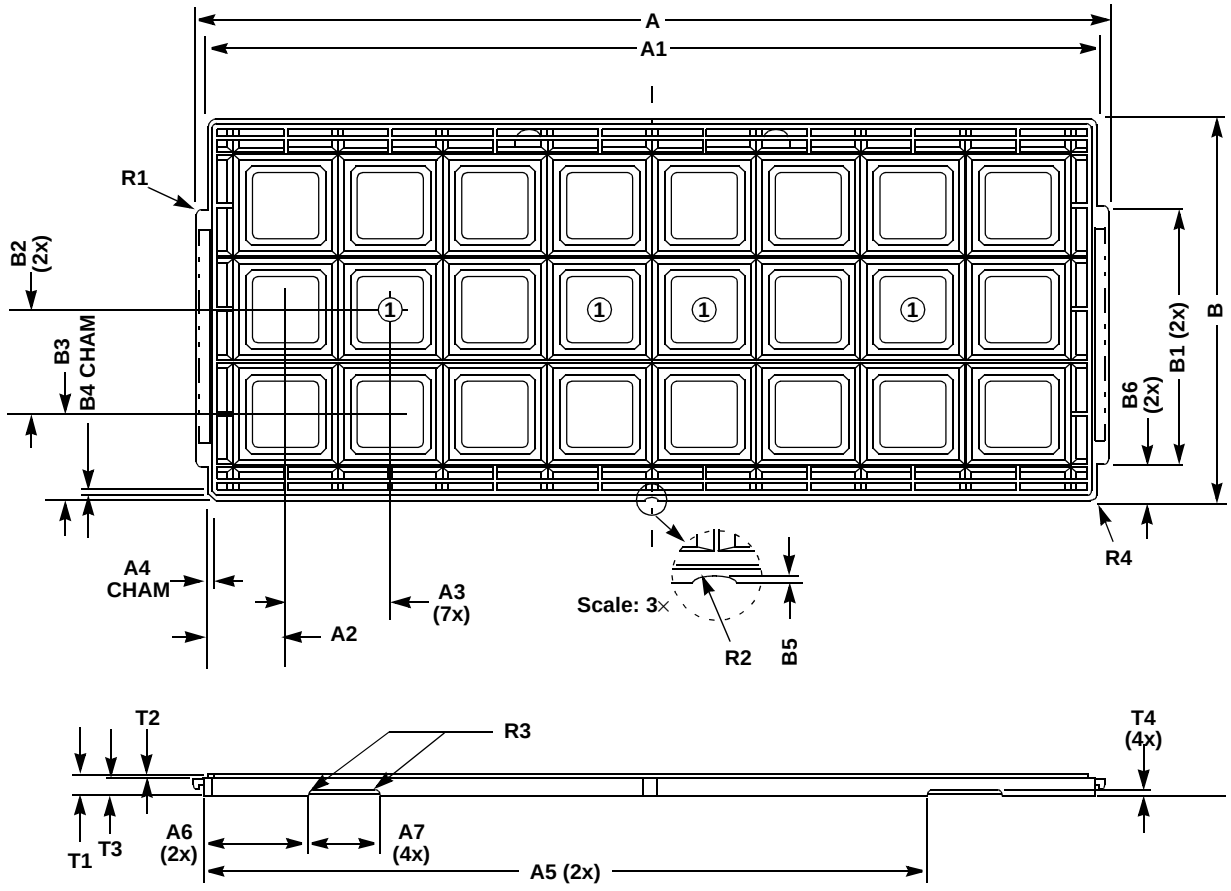


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	322.60	B4	2.0 × 45°
A1	315.00	B5	0.76
A2	27.94	B6	12.7
A3	37.02	T1	7.62
A4	3.0 × 45°	T2	1.27
A5	255.3	T3	6.35
A6	34.3	T4	2.54
A7	25.4	R1	2.54
B	135.90	R2	4.75
B1	92.10	R3	1.00
B2	37.01	R4	1.60
B3	30.94		

NOTES:

1) Closed nests '①' are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted 2° draft on all vertical surfaces.
4) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.6 32 × 32 × 3.5-mm Body MQFP Tray

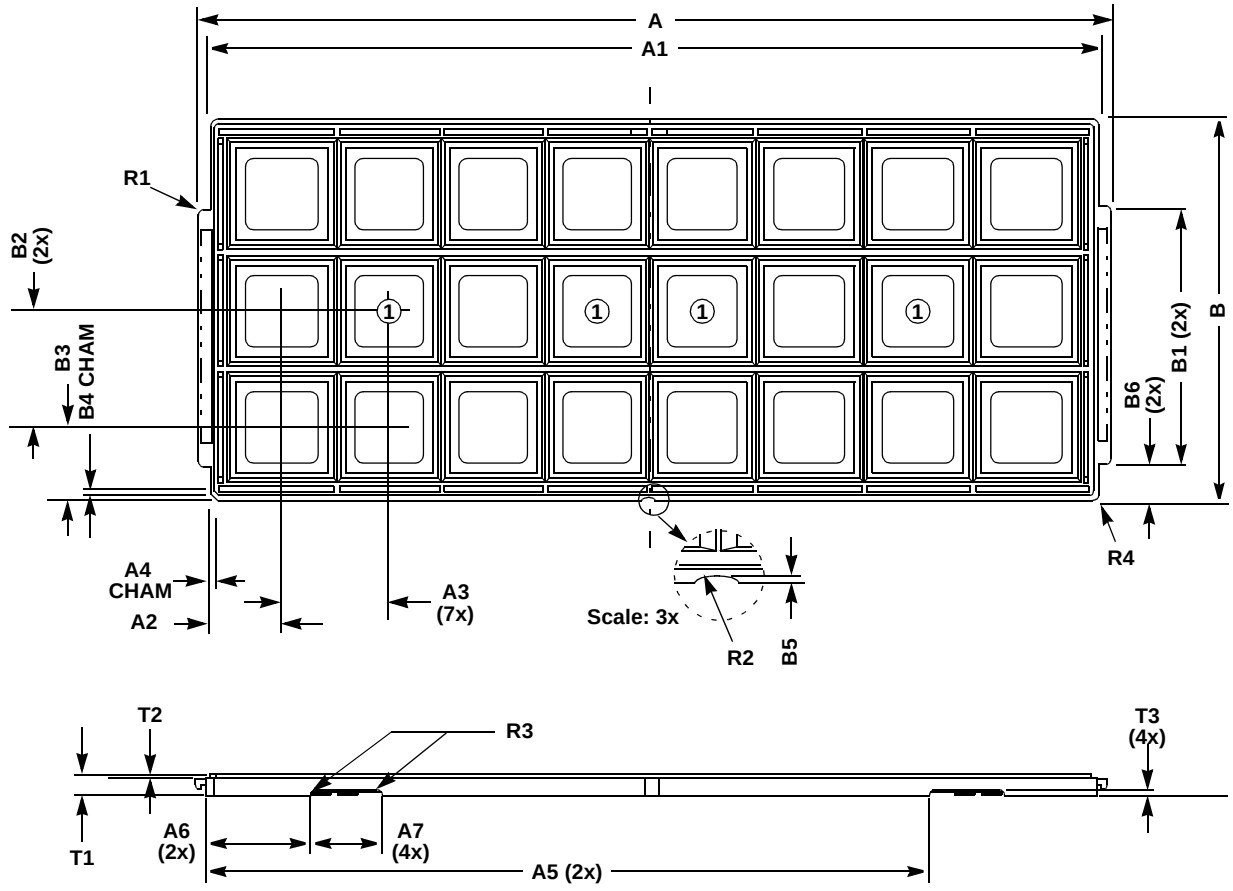


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	322.60	B3	26.57
A1	315.00	B4	2.0 × 45°
A2	25.13	B5	0.76
A3	37.82	B6	12.7 ±0.13
A4	3.0 × 45°	T1	7.62
A5	255.3	T2	1.27
A6	34.3	T3	2.54
A7	25.4	R1	2.54
B	135.90	R2	4.75
B1	92.10	R3	1.00
B2	41.38	R4	1.60

NOTES:

1) Closed nests '①' are for vacuum operations: 4 places.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1982.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Width-wise rib at these locations is 4.00 mm high.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.7 14 × 14 × 1.4-mm Body LQFP Tray

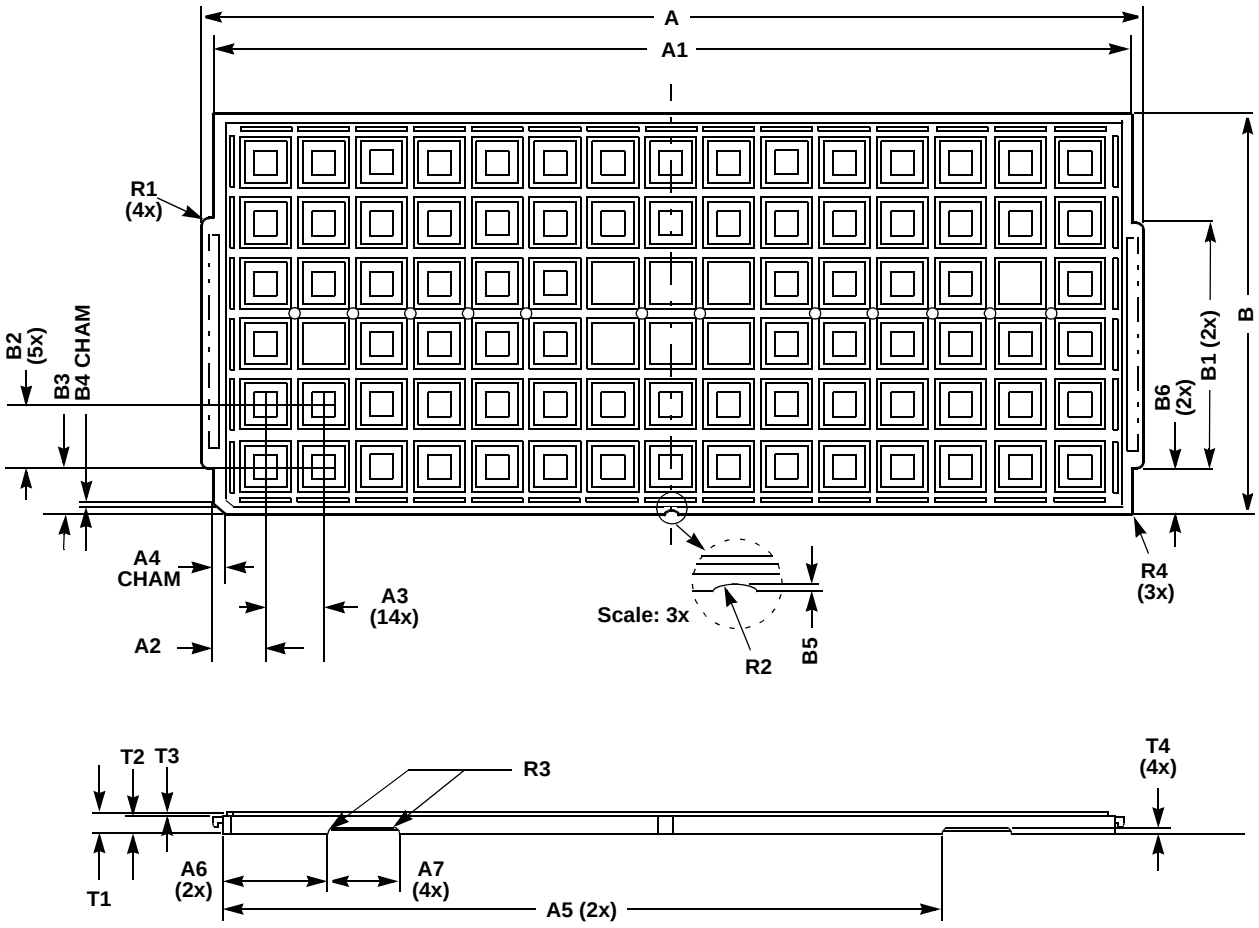


Figure Reference	TYP. (mm)	Figure Reference	TYP. (mm)
A	322.60	B4	2.0 × 45°
A1	315.00	B5	0.76
A2	15.40	B6	12.7
A3	20.20	T1	7.62
A4	3.0 × 45°	T2	6.35
A5	255.3	T3	1.27
A6	34.3	T4	2.54
A7	25.4	R1	2.54
B	135.90	R2	4.75
B1	92.10	R3	1.00
B2	21.00	R4	1.60
B3	15.45		

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1982.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.8 14 × 20 × 1.4-mm Body LQFP Tray

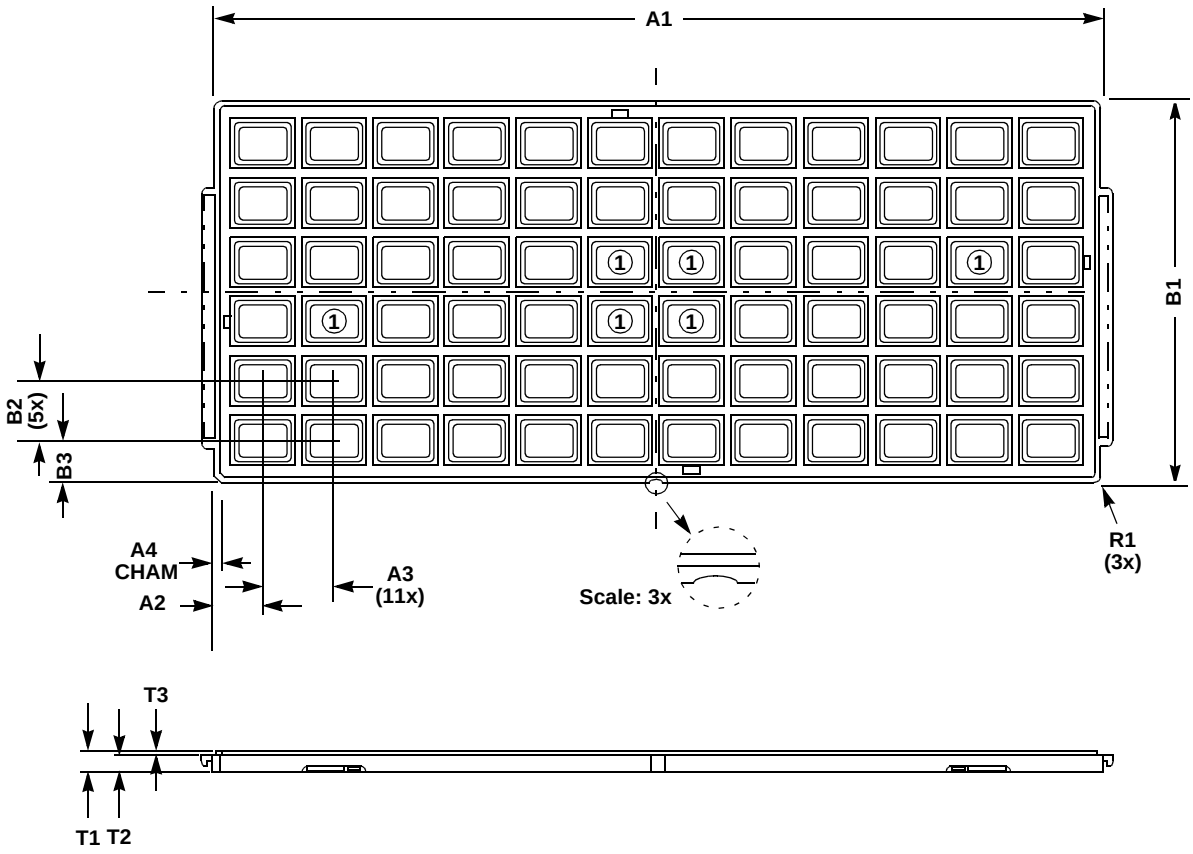


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A1	315.00	B3	15.45
A2	17.80	T1	7.62
A3	25.40	T2	6.35
A4	3.00 × 45°	T3	1.27
B1	135.90	R1	1.60
B2	21.00		

NOTES:

1) Closed nests '①' are for vacuum operations: 4 places.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Locking mechanism; 4 places.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.9 24 × 24 × 1.40-mm Body LQFP Tray

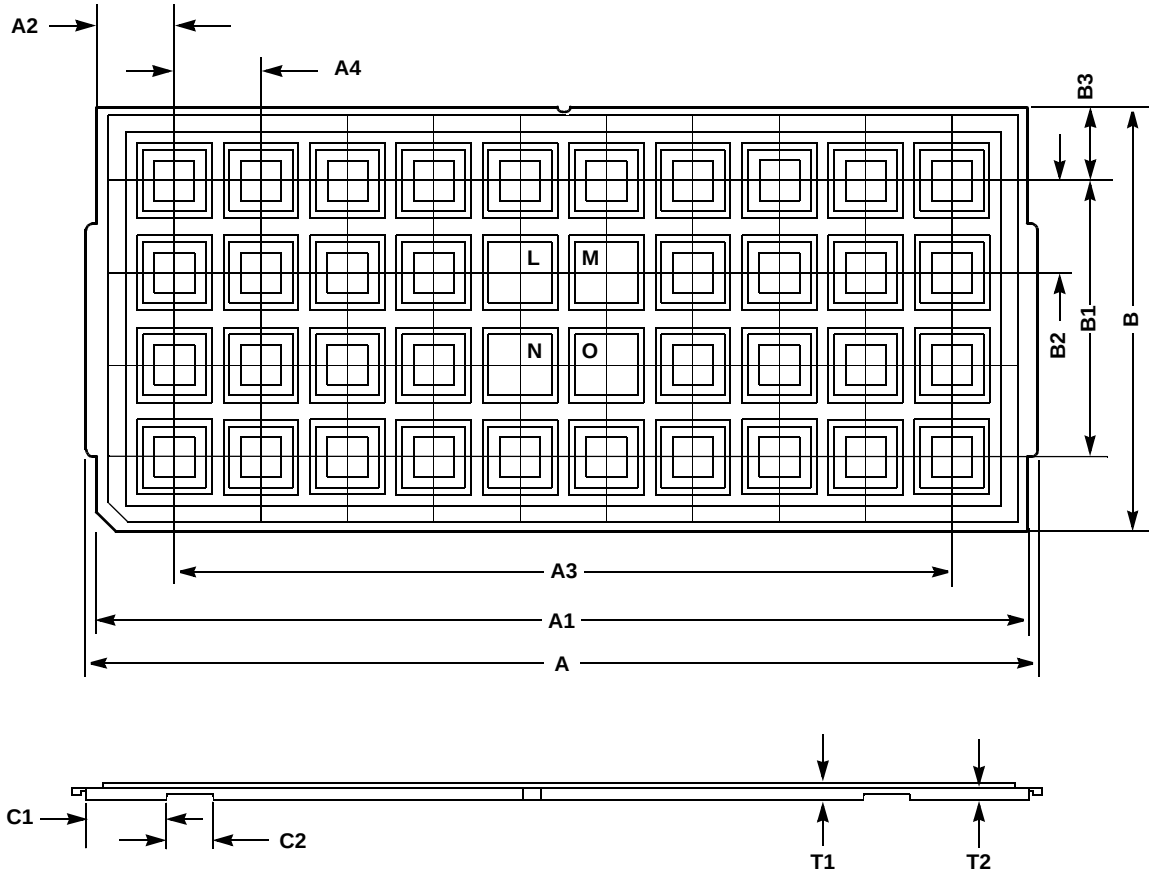


Figure Reference	MIN (mm)	MAX (mm)
A	322.40	322.80
A1	314.75	315.25
A2	20.60	20.80
A3	273.50	273.70
A4	30.30	30.50
B	135.65	136.15
B1	94.40	94.60
B2	31.40	31.60
B3	20.60	20.80
C1	34.20	34.40
C2	25.30	25.40
T1	7.52	7.72
T2	6.25	6.45

NOTES:

1) Package orientation in the tray: With the tray chamfer in the bottom-left corner (as shown), package pin 1 is in the bottom-left corner.
2) Material is conductive dielectric resin.
3) Surface resistivity is maximum 10^{14} ohms/square; surfaces should be free of mold seams.
4) Locations 'L' to 'O' indicate the positions of vacuum operations.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.10 28 × 28 × 1.40-mm Body LQFP Tray

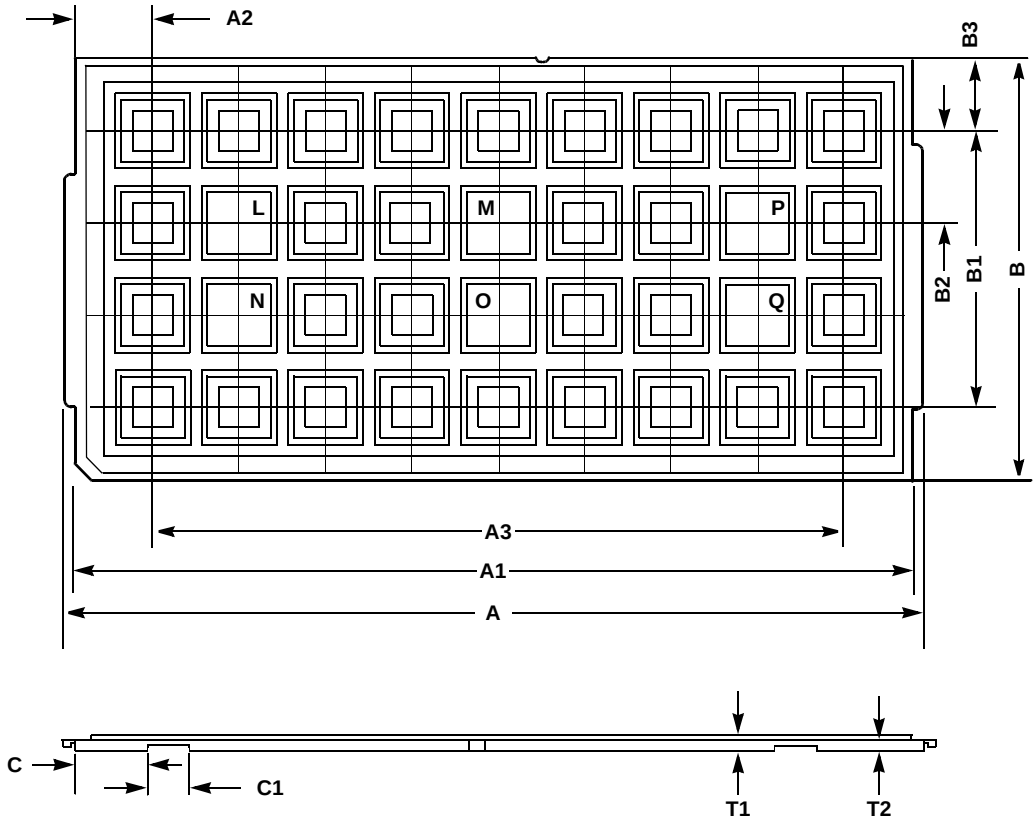


Figure Reference	MIN (mm)	MAX (mm)
A	322.35	322.85
A1	314.75	315.25
A2	28.57	28.83
A3	257.35	257.85
B	135.65	136.15
B1	96.35	96.85
B2	32.07	32.33
B3	19.52	19.78
T1	7.49	7.75
T2	6.09	6.35
C	34.05	34.55
C1	25.15	25.65

NOTES:

1) Surfaces should be free of mold seams.
2) Package orientation in tray: With the tray chamfer in the bottom-left corner (as shown), package pin 1 is in the bottom-left corner.
3) Material is conductive dielectric resin.
4) Surface resistivity is maximum 10^{14} ohms/square.
5) Locations 'L' to 'Q' indicate the positions (at the minimum) of vacuum operations.
6) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.11 28 × 28 × 2.00-mm Body LQFP Tray

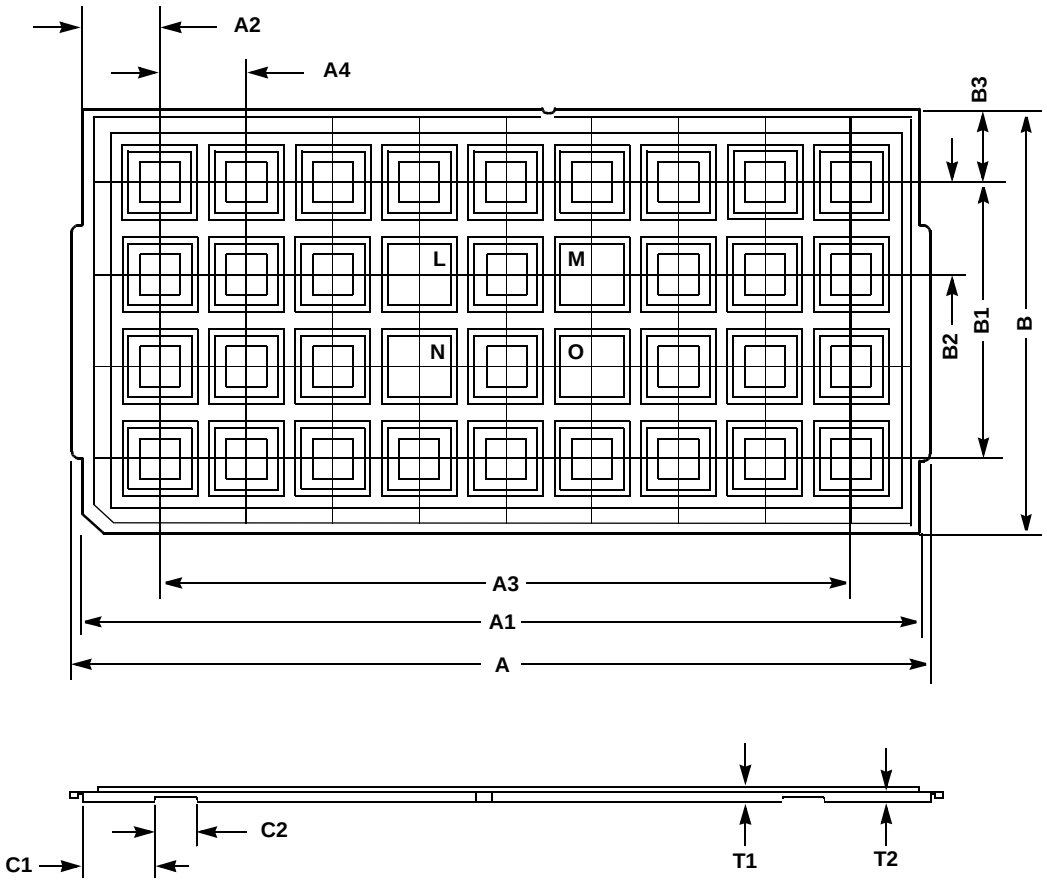


Figure Reference	MIN (mm)	MAX (mm)
A	322.40	322.80
A1	314.75	315.25
A2	32.30	32.70
A3	257.40	257.80
A4	32.00	32.40
B	135.65	136.15
B1	96.40	96.80
B2	32.10	32.30
B3	19.55	19.75
C1	34.20	34.40
C2	25.30	25.50
T1	7.67	7.97
T2	6.20	6.50

1) Surfaces should be free of mold seams.
2) Package orientation in the tray: With the tray chamfer in the bottom-left corner (as shown), package pin 1 is in the bottom-left corner.
3) Material is conductive dielectric resin.
4) Surface resistivity is maximum 10^{14} ohms/square.
5) Locations 'L' to 'O' indicate the positions of vacuum operations.
6) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

NOTES:

4.12 27 × 27 × 1.60-mm Body BGA Tray

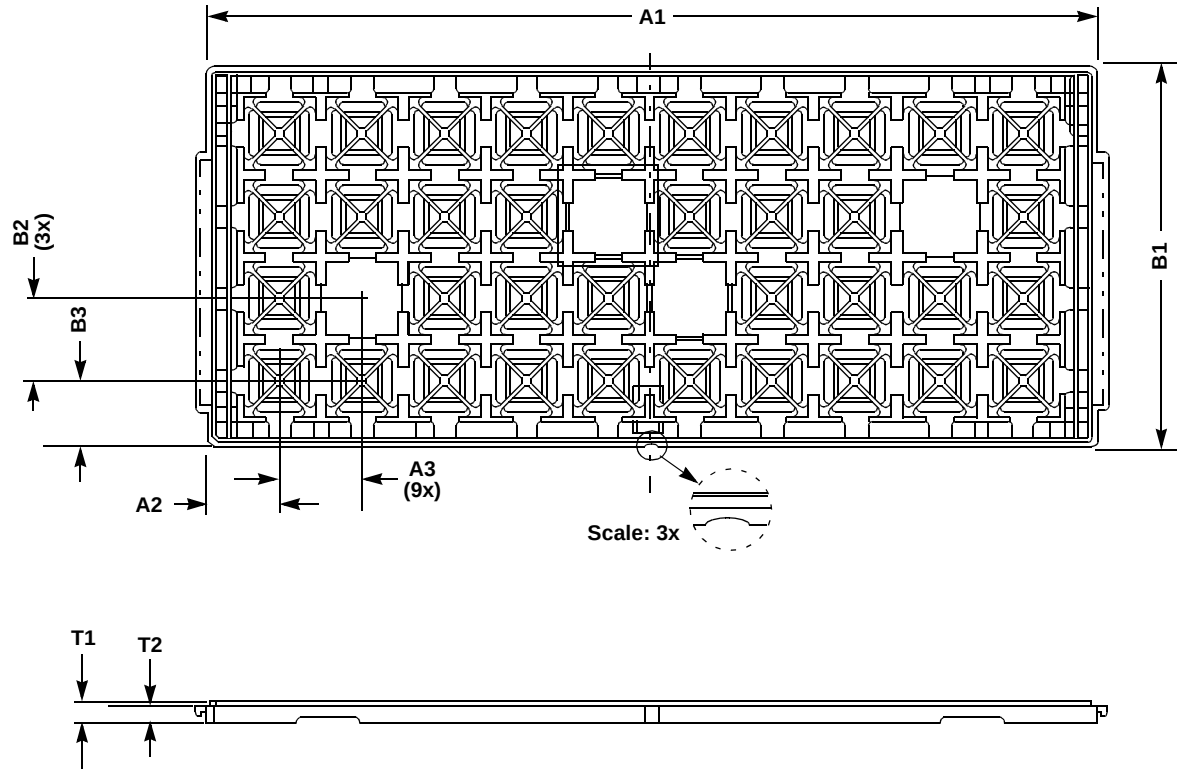


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A1	315.00	B2	29.20
A2	26.10	B3	24.15
A3	29.20	T1	7.62
B1	135.90	T2	6.35

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.13 17 × 17 × 1.53-mm Body BGA Tray

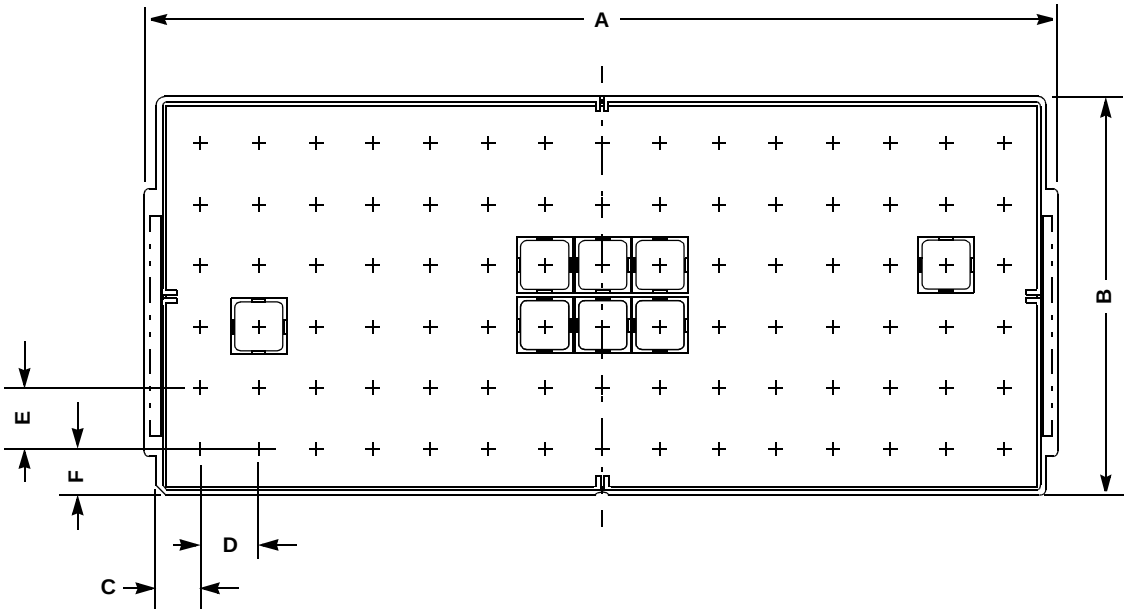


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	315.00	D	19.50
B	135.90	E	19.50
C	21.00	F	19.20

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Meets JEDEC CO-029.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

4.14 12 × 12 × 1.20-mm Body BGA Tray

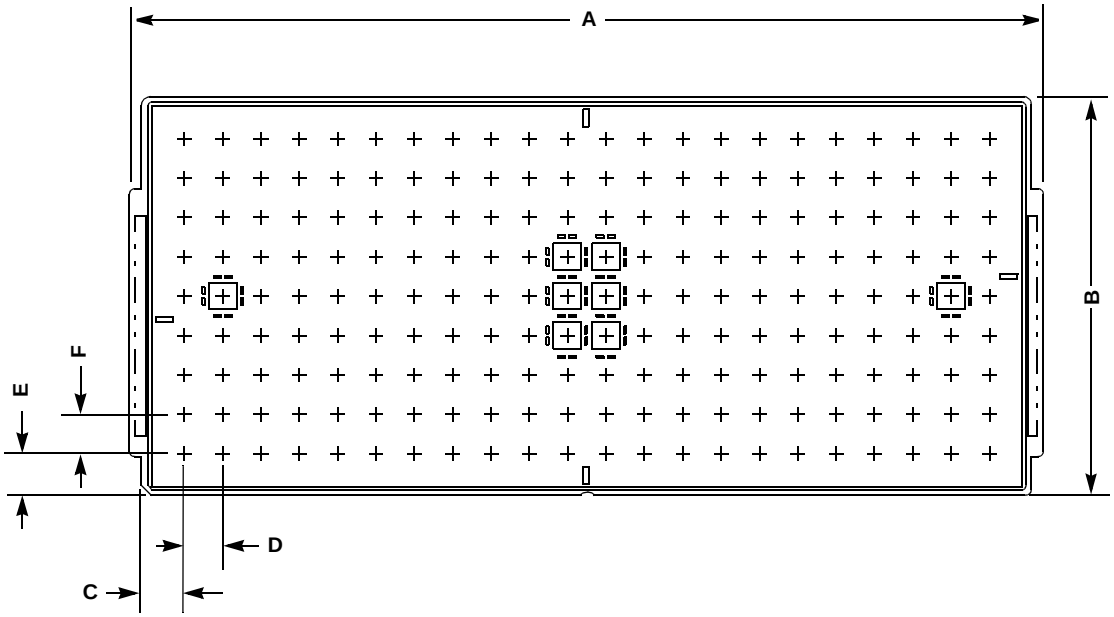


Figure Reference	TYP (mm)	Figure Reference	TYP (mm)
A	315.00	D	14.00
B	135.90	E	11.95
C	10.50	F	14.00

NOTES:

1) Center closed nests are for vacuum operations.
2) Interpret dimensions and tolerances in accordance with ANSI Y14.5M-1994.
3) Unless otherwise noted 1°/2° draft on all vertical surfaces.
4) Meets JEDEC CO-029.
5) Trays should not be exposed to temperatures greater than 125°C for 24 hours.

5. TECHNOLOGY ROADMAP

Please contact the Packaging and Assembly Technologies Department for updates to new packages and their release dates.

6. QFP HANDLING/DRY PACK INFORMATION

6.1 QFP Dry Pack Information

This information is provided to ensure proper QFP handling and packing for both storage and shipment. This applies to all QFP packages, including LQFP, MQFP, TQFP, FBGA, and PBGA.

6.2 Applicable Documents/Standards/Forms

MIL-Q-9858 — Quality Program Requirements.

6.3 Equipment/Materials

Following are some of the equipment and materials employed by Cirrus Logic to ensure proper storage and shipment.

- Vacuum sealer (VacuSave™)
- Pink antistatic foam
- Desiccant — moisture-absorbent package conforming to MIL-D-3464, Types 1 and 2; standard sizes, ½ and 3 units
- Conductive trays — FPC-5SB0 (normal) or FPC-1A1 (high temperature, 125°C)
- Nylon strapping machine
- Anti-static bubble-pack
- Conductive pads (top and bottom)
- Pad pack (recycled packing material)
- Chipboard box, QFP outer carton, and single QFP box

6.4 Definitions

Bag Sealer	Sealer specified for MBB bags.
Barcode Labels	Used to identify package contents. May include product, lot number, date code, quantity, mils, and company code (see Figure 6-1 on page 96).
Bent Leads	The lateral distance between the shoulder (where the lead touches the component body) and the lead tip.
Coplanarity	The distance between the seating plane and the lead tip.
Desiccant	A drying agent per MIL-STD-3464, Types I and II.
Humidity Indicator Cards (HIC)	Indicator cards used for Cirrus Logic products. These must meet MIL-I-8835A, with a range from 10% to 60%, and a resolution of 10%.
MBB	Moisture-barrier bags per MIL-B-81705 Type I that can shield EMI, static, RF, and have a moisture-vapor transmission rate less than 0.02 grams per day per 100 square inches.
QFP/PBGA	Quad Flat Pack/Plastic Ball Grid Array). Since these packages are much thinner and smaller than other types of packages, they are more susceptible to cracking and delamination during vapor phase or infrared reflow soldering on boards.
Warning Labels	Used to identify the electrostatic and humidity control of the product (see Figure 6-2 on page 97).

6.5 Scheduling Precautions

These packages require proper scheduling for testing. Only open the airtight bags when the enclosed devices are to be tested immediately. The exposure time to ambient atmosphere for testing should be minimized. The airtight bags must be opened just before testing; after the testing is complete, the units must be immediately sealed in the bags.

The QFP package material absorbs moisture like any other molded package. This package is much thinner and smaller compared with other types of packages and is susceptible to cracking and delamination during the vapor phase or IR (infrared reflow) soldering on printed circuit boards. The QFP packages must be kept in airtight bags with desiccant during storage.

The relative humidity and temperature in the storage area must be monitored. The relative humidity should not exceed 60%, and the temperature should not exceed 86°F (30°C).

6.6 Packing

All packages are inspected by material handlers, just prior to sealing, for proper count, lot number, device type, and date code. This information is printed on the labels placed on the inner bag, inner box, and outer carton. Stamps of approval is also put on a barcode label. Three levels of inspections and signatures (stamps) are required prior to sealing a carton or box.

NOTE: All partials opened during any process are visually inspected for coplanarity and bent leads. Inspections are done under lighted magnifications. If bent leads or coplanarity issues arise, Quality is called for disposition (refer to Figure 6-3 on page 98).

Packages are placed in the tray so that the notch in the tray is facing the top-left corner and the marking on the package is readable. Therefore, the pin-1 orientation is to the bottom-left corner.

Tray Stacks and Strapping

Only the same type and make of trays are stacked together. Bent leads and/or coplanarity problems can result if different trays are mixed in a stack. Also, partial trays are placed on the top of the stack. Two nylon straps are placed at the narrow side before bake; one nylon strap is placed at the long side after bake (see Figure 6-7 on page 101). JEDEC tray bundles are strapped at notches.

The tray stack is never turned in a sideways position during strapping. The four sides of the stacked trays are inspected after strapping to ensure there is no gap between adjacent trays. Trays are then packed in their specific approved packing method with a maximum bundle height of 75 mm.

NOTE: If uneven spacing is observed, product is reinspected prior to restrapping or rebanding.

Dry Pack Bags, HICs, and Desiccants

An HIC (humidity indicator card) is inserted in all dry pack bags (see Figure 6-8 on page 102). All dry packs must have either a three-unit desiccant or a one-half unit desiccant. Humidity cards must not exceed 30% humidity. Previously packaged product with HICs exceeding 30% humidity are placed on hold and forwarded to Quality Control for inspections. After inspection, the HIC and desiccant are discarded.

All HIC cards and desiccants are stored in sealed containers with one HIC provided in all sealed desiccant storage containers. If the HIC shows a 30% minimum humidity exposure reading, all HICs and desiccants in that container are discarded.

Packing and Labeling

One end of the bag is heat-sealed using a vacuum sealer and a barcode label is affixed to the moisture-barrier bag, indicating device, lot number, quantity, and date code (see Figure 6-8 on page 102). The primary packing configuration for two or more dry packs is the QFP outer carton (Figure 6-6 on page 100).

During stock processing, barcode labels are affixed on the front side (side #1) of the QFP inner box. During order processing, all cartons in the shipment conform to the front-end labeling unless specific conditions exist. For example, if product is shipped from existing inventory packed prior to March 30, 1998, labels are on the top side (side #4) but cartons are labeled according to procedures stated in this document.

A single dry pack can be shipped in the single QFP box with its proper labeling, as illustrated in Figure 6-4 and Figure 6-5 on page 99. This facilitates small quantity or prototype shipments.

NOTE: All shipping boxes have passed Cirrus Logic's strictest drop test requirements.

6.7 Storage

Dry packs should not be stacked more than four high to minimize accidental tip-over. If a lot requires opening to pull samples, it should be broken up into smaller lots to minimize moisture exposure. Attach a log outside the box as follows:

Lot No.	Opening	Resealing	Quantity
Balance	Date/Time	Date/Time	Amount removed

Especially after opening, the units should be stored in nitrogen cabinets, if available. Use a fresh desiccant and a new humidity indicator card each time a bag is opened and resealed.

Any product found with loose dry pack at any time must be evaluated for moisture content according to the guidelines in Table 6-1 on page 95.

Table 6-1. Product Date Code Procedures

Date Code	Moisture Content	Procedure
<104 weeks	<30% moisture content	Re-dry packed
ð104 weeks	Š30% moisture content	Placed on hold for Quality Control disposition
>104 weeks	N/A	Rebaked

NOTE: Any product that requires moisture evaluation is relieved from all inventories and Quality Control is notified for disposition.

6.8 Precautions Prior to Solder Reflow of Surface-Mount Packages

Plastic surface-mount components are exposed to high temperatures during IR or vapor-phase reflow soldering. During this process, plastic packages may crack due to internal stresses. These internal stresses are generated due to extreme temperature, causing rapid vaporization of previously absorbed moisture in the packages. To eliminate component damage due to internal stresses, it is important for the assemblers to follow the precautions outlined in Section 6.9 on page 95.

6.9 Storage Conditions Prior to the Solder Reflow Process

Storage Condition	Maximum Time Duration (for QFP)
After opening dry pack (<30°C, <60% RH (relative humidity)	168 hours

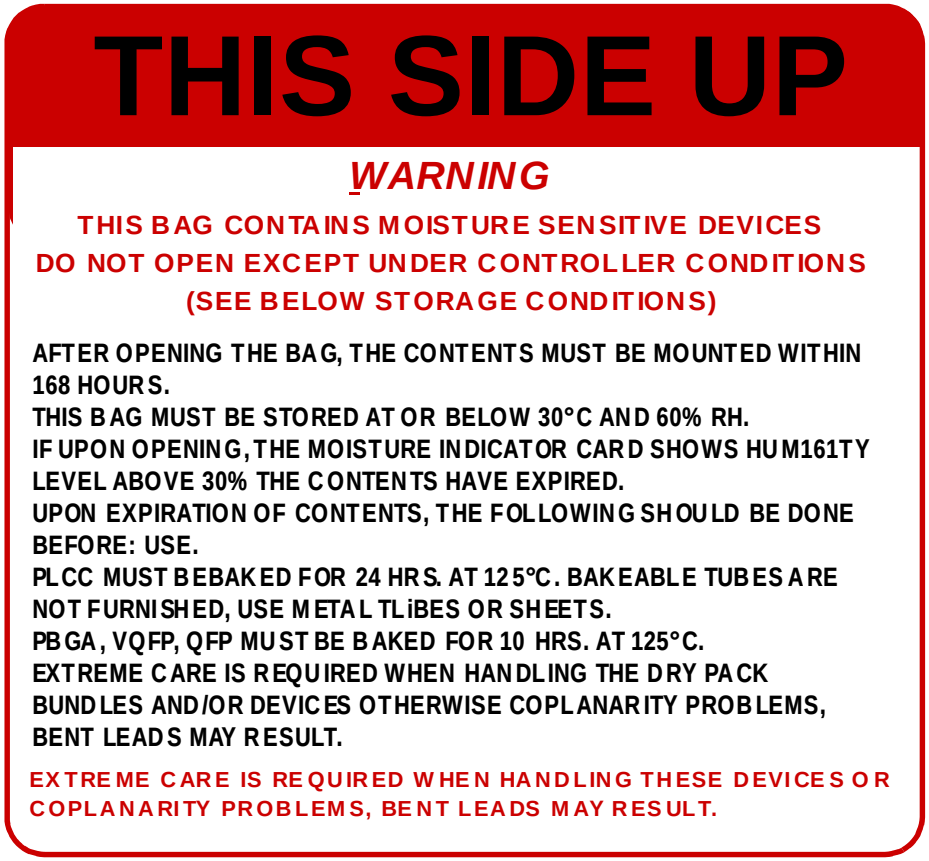
NOTE: If, upon opening, the moisture indicator card shows a humidity level above 30%, the dry pack conditions have exceeded the specification, and the bake-out procedure is required.

Bake-Out Procedure

This procedure is necessary for plastic packages that have exceeded the maximum storage conditions and time durations specified on the warning label shown in Figure 6-2 on page 97. The bake-out procedure prior to IR reflow soldering prevents the possibility of package fracturing/cracking.

Bake-Out Conditions

The following are bake-out conditions: in low temperature shipping trays/tubes 40°C, 8 days at <10% RH or follow bake condition specified on the warning label illustrated in Figure 6-2 on page 97.



WARNING LABEL

Figure 6-1. Warning Label

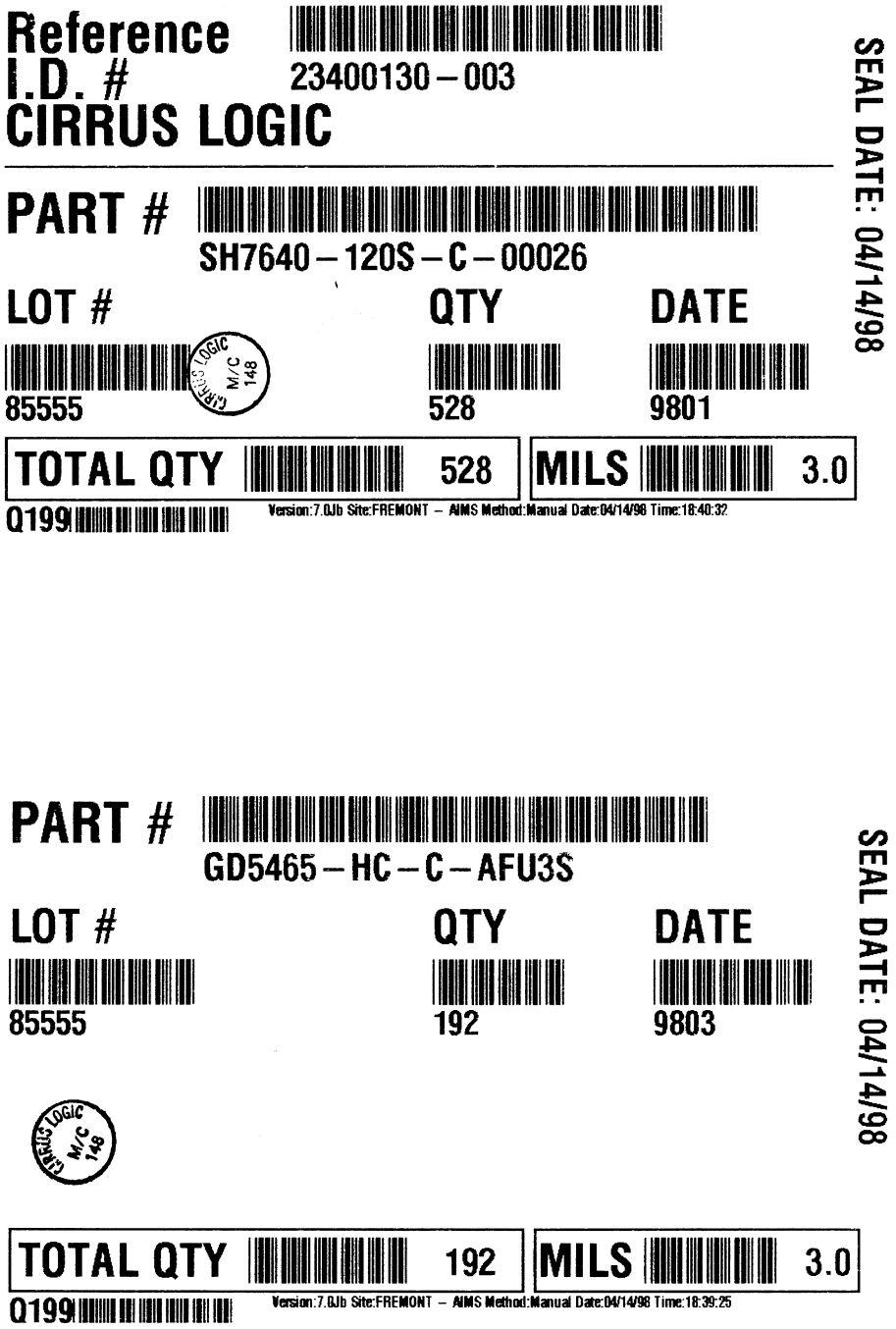


Figure 6-2. Barcode Labels

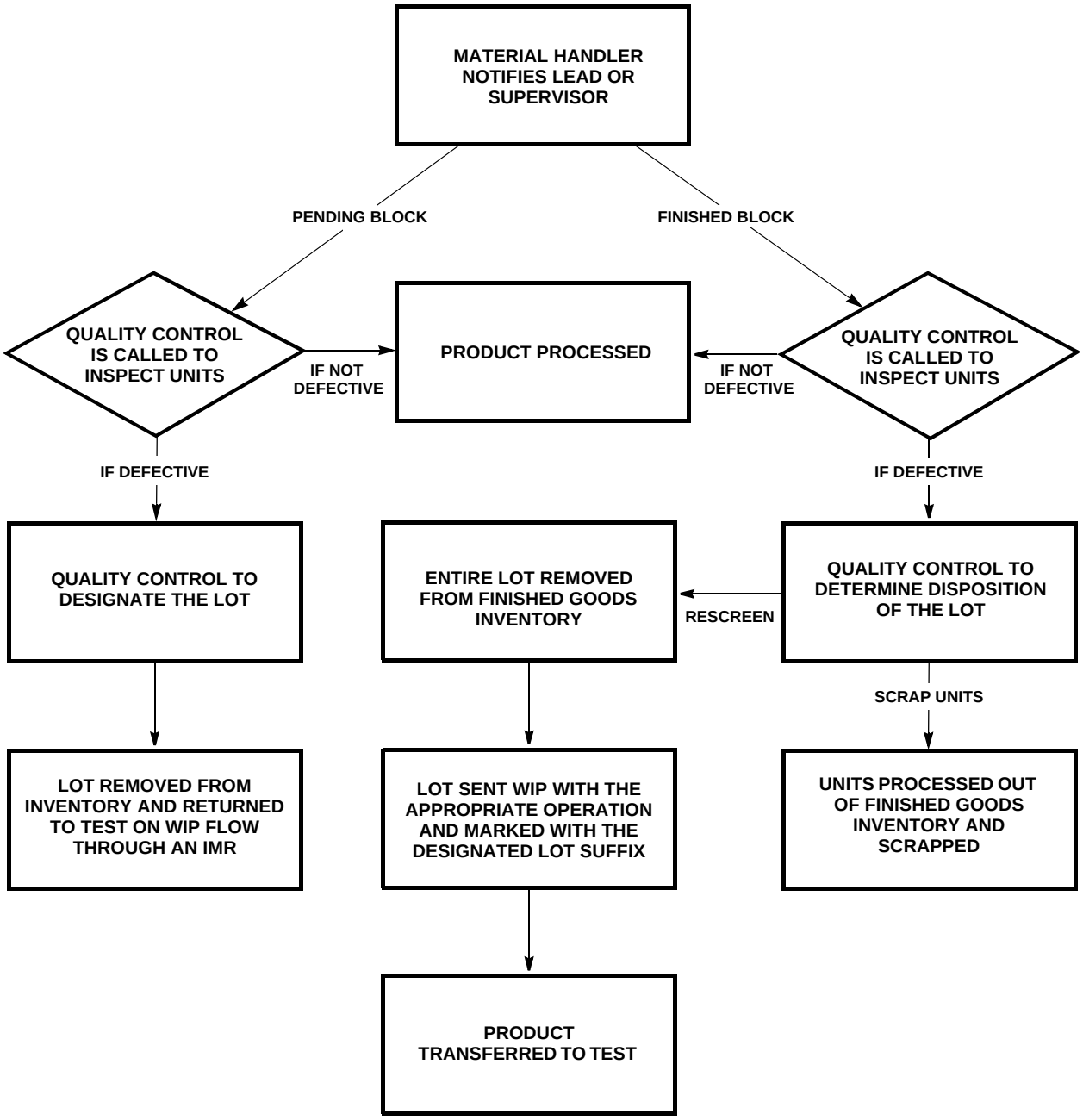


Figure 6-3. QFP-PBGA Dry Pack Procedure

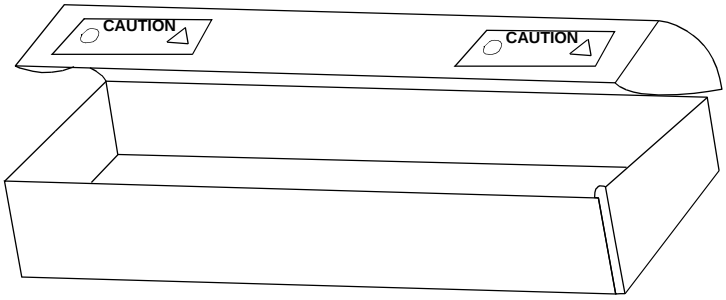


Figure 6-4. Single QFP Box

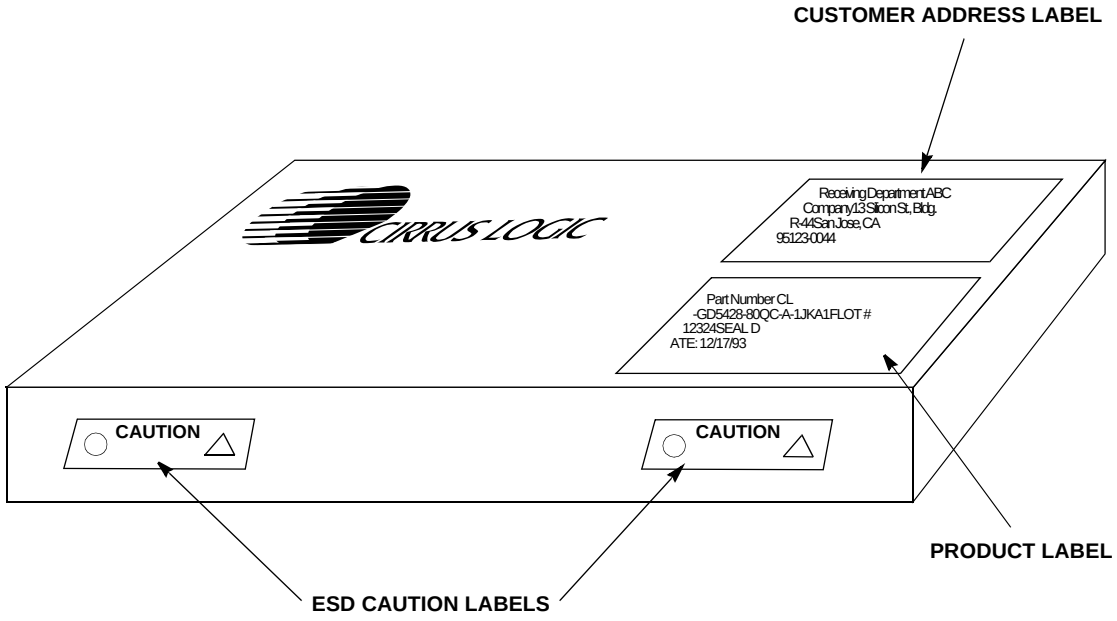


Figure 6-5. Labeling of a Single QFP Box

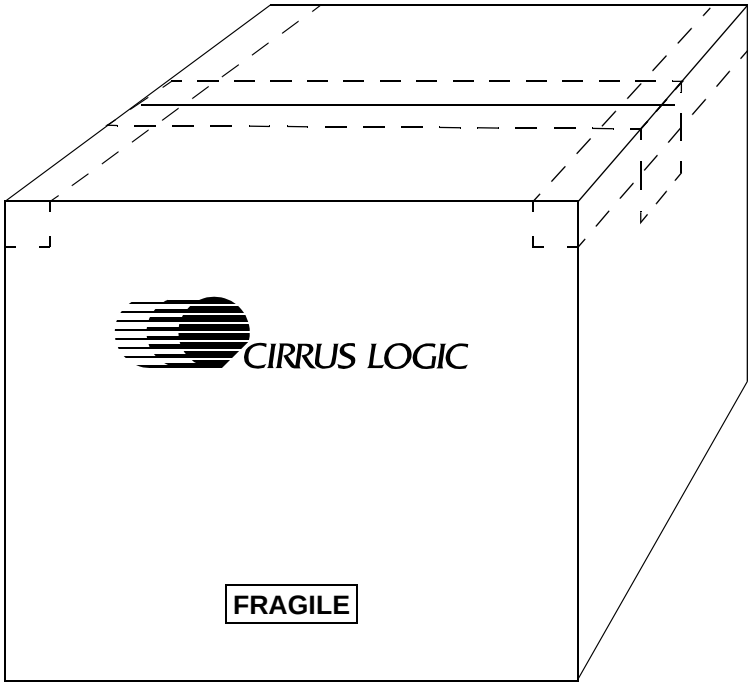


Figure 6-6. QFP Outer Carton

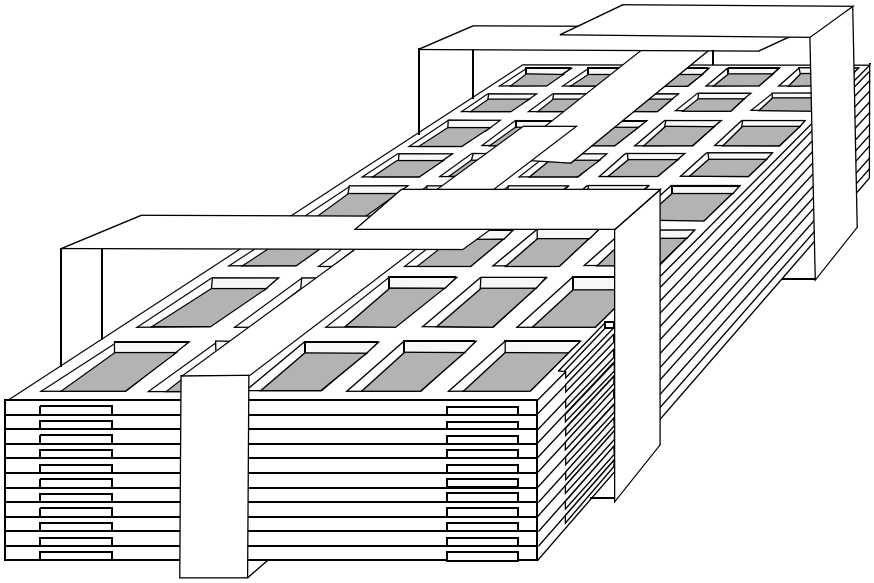


Figure 6-7. QFP-Tray Packaging Diagram

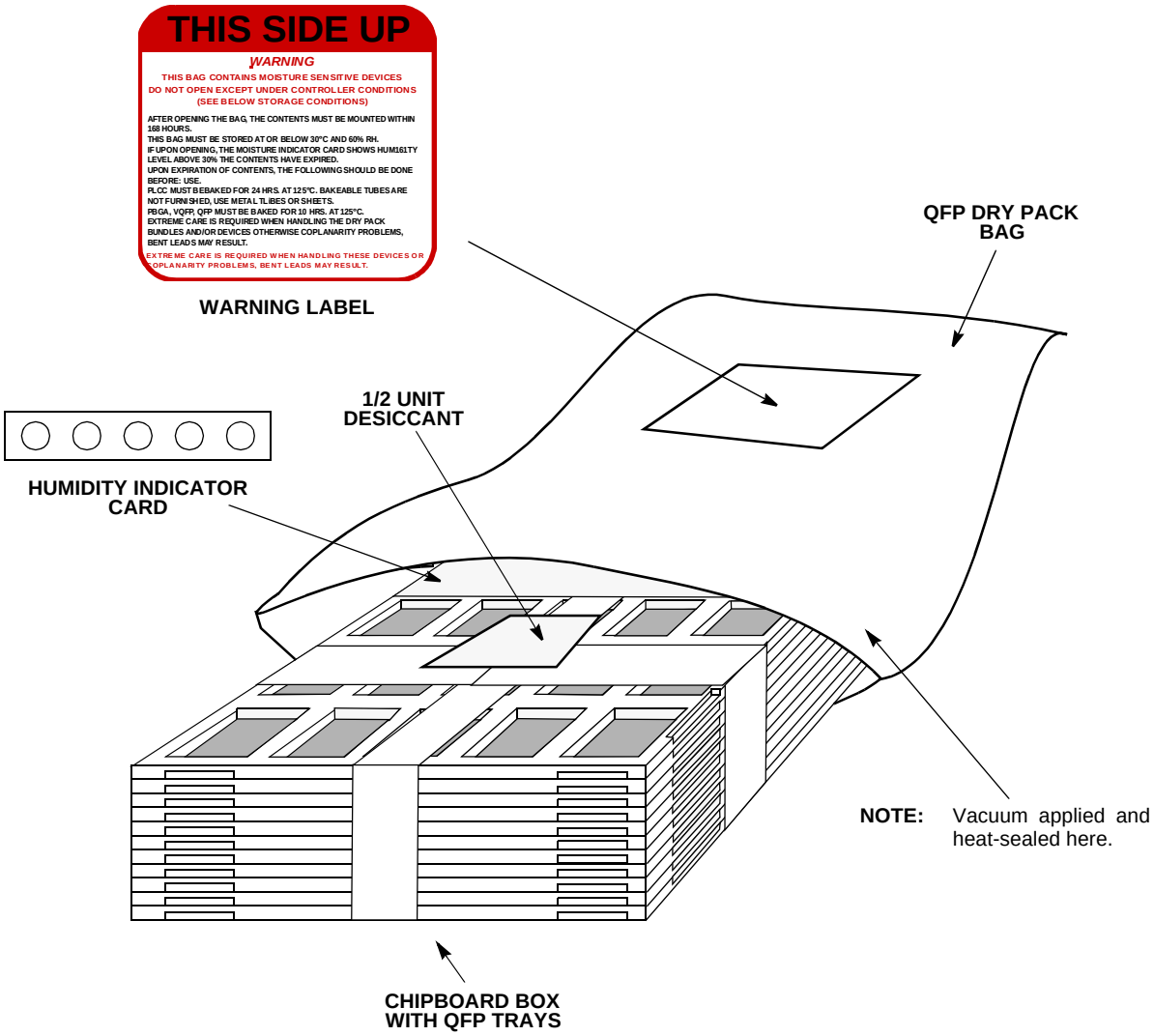


Figure 6-8. QFP Moisture-Barrier Bag Diagram

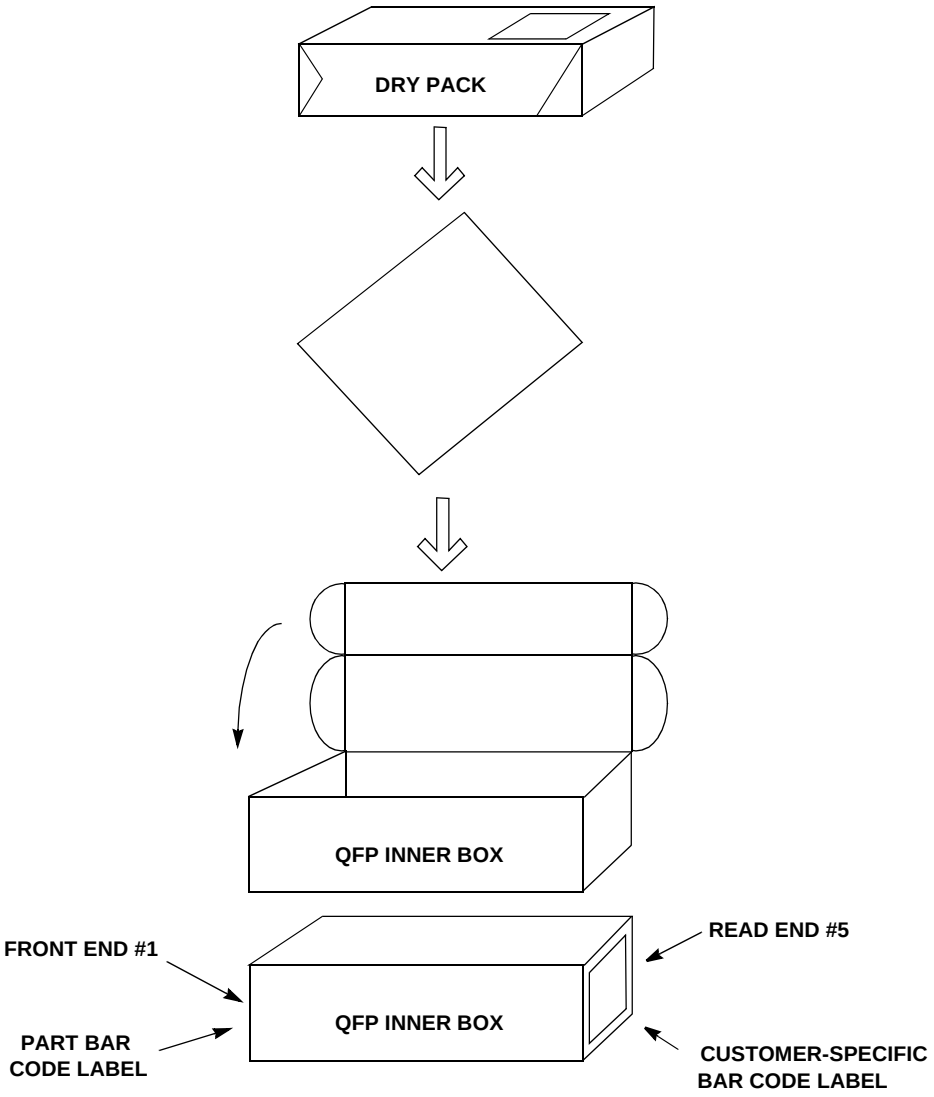


Figure 6-9. QFP Inner Box Packing and Labeling

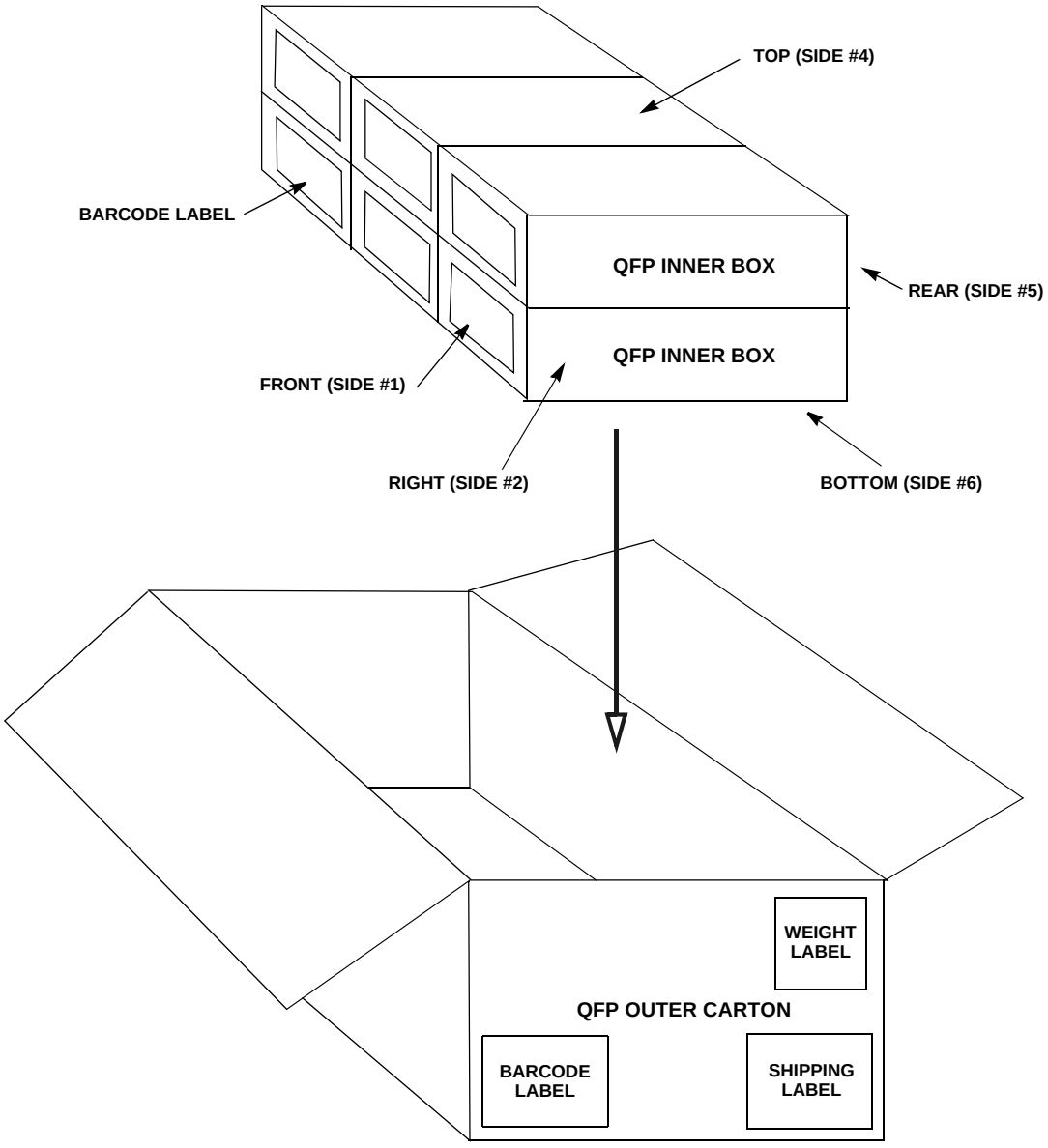


Figure 6-10. QFP Outer Carton Packing and Labeling

7. QFP SOLDER REFLOW RECOMMENDATIONS

7.1 Precautions for Plastic QFP Surface-Mount Packages

The purpose of this specification is to recommend specific precautions for solder reflow, storage, and bake-out conditions of plastic QFP packages. This precaution specification encompasses all plastic packages, including TQFP, LQFP, MQFP, PBGA, and FBGA.

7.2 Applicable Documents/Standards/Forms

ANSI/IPC-SM786.

7.3 Procedure for Solder Reflow

Plastic-packaged integrated circuits are exposed to high temperatures during the solder reflow process using IR reflow or vapor-phase soldering. The semiconductor industry has recognized that under certain conditions of temperature, time, and moisture content, plastic packages have cracked or exhibited reliability problems. The following precautions are recommended to assure that the integrated circuits are not damaged during the solder-reflow process.

7.4 Maximum Temperature and Time

7.4.1 IR Reflow Soldering

Peak temperatures of the plastic body and leads must not exceed 220°C. Time at peak temperature should be 30 seconds or less. Temperature profile must be maintained within the limits specified in Figure 7-1 on page 107.

7.4.2 Vapor Phase Soldering

Peak temperature of the plastic body and leads should not exceed 215°C. Time at peak temperature must be 50 seconds or less. Temperature profile must be maintained within the limits specified in Figure 7-2 on page 107.

7.5 Storage Conditions Prior to Solder Reflow Processing

Plastic packages absorb varying degrees of moisture when exposed to uncontrolled storage conditions. Semiconductor industry studies have shown that high levels of moisture absorption have been known to cause package cracking or other reliability concerns. The following storage conditions and maximum time durations are recommended based on experimental data and assembly subcontractor guidelines:

Storage Condition	Maximum Time Duration for QFP
Before opening dry pack (<40°C, <60% RH)	6 months
Before opening dry pack (<35°C, <90% RH)	2 months
After opening dry pack (<30°C, <60% RH)	168 hours

NOTE: If, upon opening, the moisture indicator card shows a humidity level above 30%, the dry pack conditions have exceeded the specification, and the bake-out procedure is required.

7.6 Bake-out Procedure and Conditions

Plastic packages that have exceeded the maximum storage conditions and time durations must be baked-out prior to solder reflow processing. This procedure prevents any possibility of package cracking or reliability problems associated with the moisture absorption. The following bake procedures have proven effective in reducing the absorbed moisture content to acceptable levels:

Bake-out Conditions

In low-temperature shipping trays	40°C, 8 days, at <10% RH
In high-temperature shipping trays or placed in 'cookie trays'	125°C, 10 hours

Maximum Exposure Time for Solder Reflow After Bake

Solder reflow is within 7 days if <30°C and <60% RH.

NOTE: ESD precautions must be observed during handling and baking operations. Humidity-controlled ovens and air ionizers may be required.

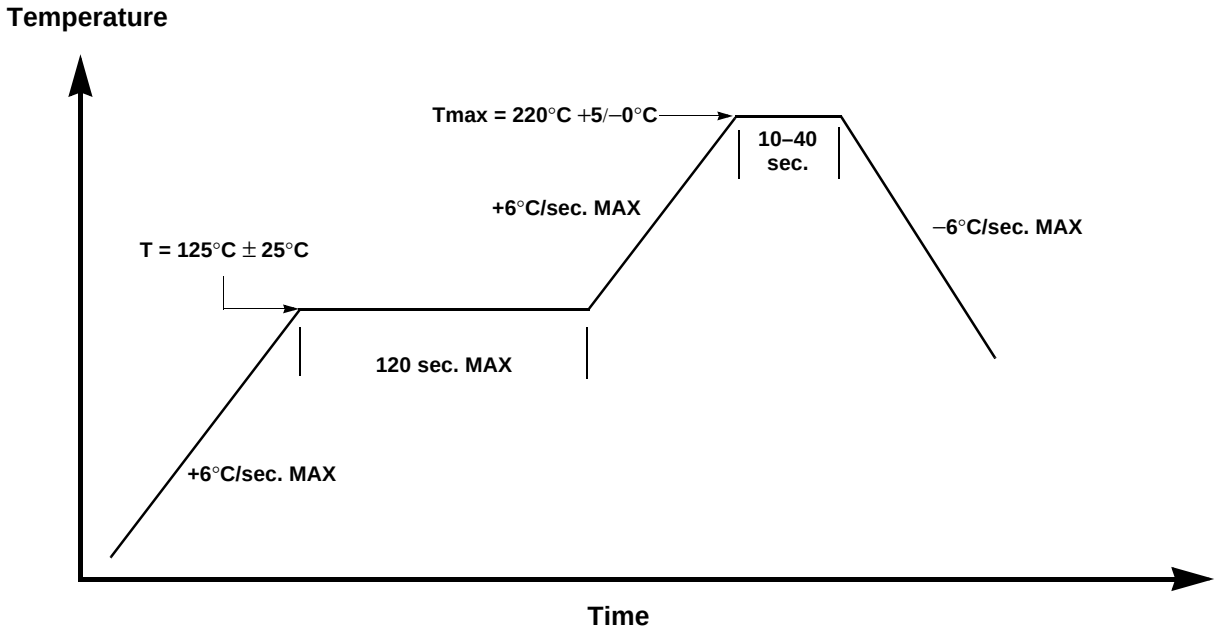


Figure 7-1. IR Reflow Temperature Profile

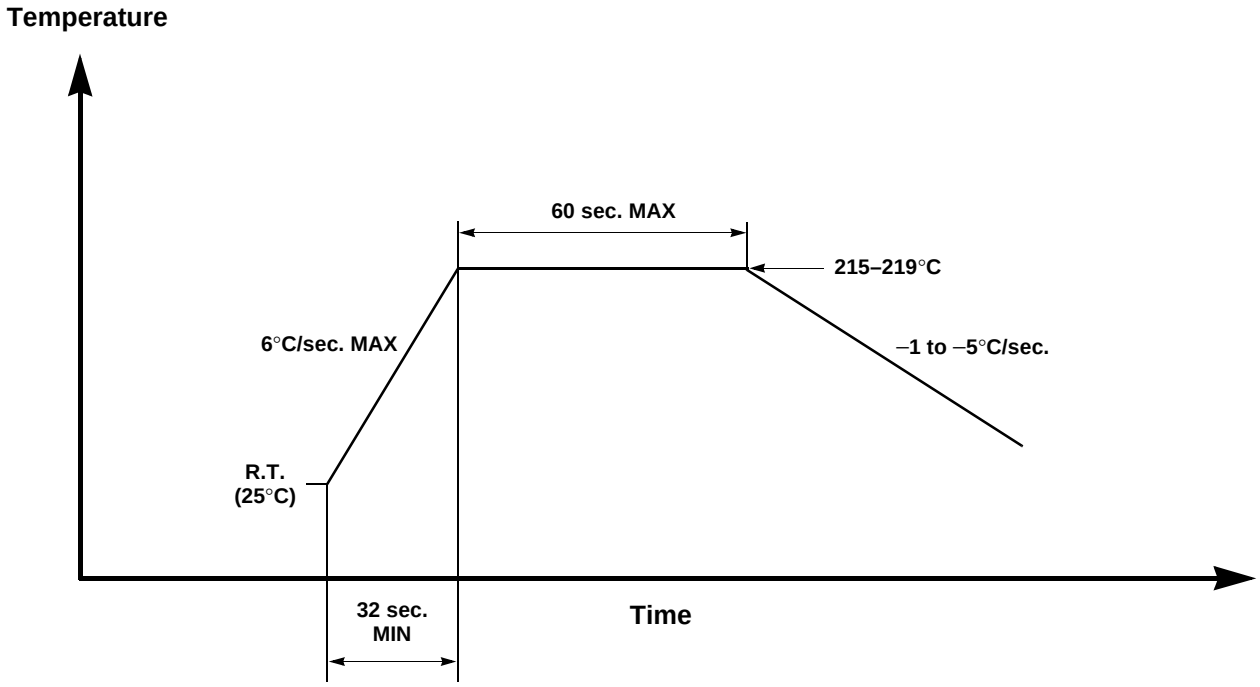


Figure 7-2. Vapor Phase Soldering Temperature Profile

8. RELIABILITY TESTING SPECIFICATION

8.1 Full Production Qualification (QPL II)—Sample Requirements

Qualification Test	Suggested Sample Size per Lot	New Plastic Package	New Hermetic Package (Commercial)	New Hermetic Package (MIL 883)
Construction Analysis - Process	1 wafer	–	–	–
Construction Analysis - Package	1	2 lots	–	–
Technology Stability	N/A	SPC Document	SPC Document	SPC Document
Physical Dimensions	5	3 lots	–	–
Infant Mortality	315	–	–	–
Early Life	154	–	–	–
Operating Life	77	–	–	–
Low Temperature Operating Life	100	–	–	–
Electrical Distribution (pre/post stress Cpk)	77	–	–	–
Moisture Resistance (THB)	77	3 lots	–	–
Autoclave Temperature Cycle	77	3 lots	–	–
Thermal Shock	77	3 lots	3 lots	–
Thermal Sequence	15	–	–	1 lot
Mechanical Sequence	77	3 lots	3 lots	–
ESD - Human Body Model	5	–	–	1 lot
ESD- Machine Model	5	–	–	–
Latch-up - I/O		–	–	–
Latch-up - Power Supply	2	–	–	–
Internal Water Vapor	2	–	–	1 lot
SEM Inspection/Metallization	3	–	–	1 lot
Thermal Resistance	1 wafer	Determine	Determine	Determine
Salt Atmosphere	1	–	–	1 lot
Mark Permanency	5	–	–	–
Resistance to Solvents	5	3 lots	3 lots	1 lot
Lead Integrity	5	–	–	–
Lead Finish Adhesion	5	–	3 lots	1 lot
Lid Torque	5	–	3 lots	1 lot
Lead Pull and Lead Fatigue	5	3 lot	–	–
Solderability	5	3 lot	3 lots	1 lot
Solder Heat	5	3 lots (Non-SMD)	1 lot	1 lot
X-ray	5	3 Lots	–	–
Soak and Vapor Phase Reflow	All Tests	SMD	–	–

8.2 Qualification Criteria Summary by Level

Moisture Performance				
Moisture resistance - THB (plastic packages)	N/A	500/3%	1K/3%	hours / %LTPD per lot[a]
Autoclave (plastic packages)	N/A	96/3%	144/3%	hours / %LTPD per lot[a]
Mechanical Performance				
Temperature cycle (plastic packages)	N/A	500/3%	1K/3%[b]	#cy / %LTPD per lot[a]
Thermal shock (plastic packages)	N/A	200/3%	500/3%[b]	#cy / %LTPD per lot[a]
Temperature cycle with hermeticity (hermetic packages)	N/A	500/3%	1K/3%[b]	#cy / %LTPD per lot[a]
Thermal shock with hermeticity (hermetic packages)	N/A	200/3%	500/3%[b]	#cy / %LTPD per lot[a]
Soak and VPR/IR(surface mount plastic packages)	N/A	3/1%	3/1%	#cy / %LTPD per lot[a]
X-ray	N/A	2.50%	2.50%	%AQL per lot[a]
Dimensions	N/A	2.50%	2.50%	%AQL per lot[a]
Solderability	N/A	2.50%	2.50%	%AQL per lot[a]
Lead integrity & lead pull	N/A	2.50%	2.50%	%AQL per lot[a]
Scanning acoustic tomography	N/A	2.50%	2.50%	%AQL per lot[a]
Mark permanency	N/A	2.50%	2.50%	%AQL per lot[a]
Product Integrity				
Design rule and LVS checks	yes	yes	yes	
Design for reliability and packaging	yes	yes	yes	
Product characterization	initial	limited	full	
Test guardbands	some	some	100%	
Construction Analysis				
Wafer cross section and topography	N/A	yes	yes	
SEM metallization	N/A	yes	yes	
Package	N/A	yes	yes	

[a] LTPD and AQL criteria in table above apply to each lot tested. CUM LTPD and AQL numbers are also required for full production:

Individual Lot	Cum Lot Requirement
3% LTPD	1% LTPD
2.5% AQL	1.0% AQL

[b] For surface-mount devices greater than 14 mm × 14 mm, the extended readings are for data collection purposes only.

Notes

Notes

Notes

Direct Sales Offices

Domestic

N. CALIFORNIA
Fremont
TEL: 510/623-8300
FAX: 510/252-6020

S. CALIFORNIA
Westlake Village
TEL: 805/371-5860
FAX: 805/371-5861

NORTHWESTERN AREA
Portland, OR
TEL: 503/620-5547
FAX: 503/620-5665

SOUTH CENTRAL AREA
Austin, TX
TEL: 512/255-0080
FAX: 512/255-0733

Irving, TX
TEL: 972/252-6698
FAX: 972/252-5681

Houston, TX
TEL: 281/257-2525
FAX: 281/257-2555

NORTHEASTERN AREA
Andover, MA
TEL: 978/794-9992
FAX: 978/794-9998

SOUTHEASTERN AREA
Raleigh, NC
TEL: 919/859-5210
FAX: 919/859-5334

Boca Raton, FL
TEL: 561/241-2364
FAX: 561/241-7990

International

CHINA
Beijing
TEL: 86/10-6428-0783
FAX: 86/10-6428-0786

FRANCE
Paris
TEL: 33/1-48-12-2812
FAX: 33/1-48-12-2810

GERMANY
Herrsching
TEL: 49/81-52-92460
FAX: 49/81-52-924699

HONG KONG
Tsimshatsui
TEL: 852/2376-0801
FAX: 852/2375-1202

ITALY
Milan
TEL: 39/2-3360-5458
FAX: 39/2-3360-5426

JAPAN
Tokyo
TEL: 81/3-3340-9111
FAX: 81/3-3340-9120

KOREA
Seoul
TEL: 82/2-565-8561
FAX: 82/2-565-8565

SINGAPORE
TEL: 65/743-4111
FAX: 65/742-4111

TAIWAN
Taipei
TEL: 886/2-2718-4533
FAX: 886/2-2718-4526

UNITED KINGDOM
London, England
TEL: 44/1727-872424
FAX: 44/1727-875919

High-Value Systems in Silicon

Cirrus Logic is a premier supplier of system-level integrated circuits that demand high-performance mixed-signal processing. Our company's software-rich 'systems in silicon' add high value to major brands worldwide. We apply our system expertise to enable high-volume applications in data storage, networking, and multimedia for both computing and consumer electronics markets as well as ultra-high-precision data acquisition applications for industrial automation and instrumentation markets.

Cirrus Logic's manufacturing strategy ensures maximum product quality and availability, as well as access to world-class processing technologies through joint ventures with IBM® and Lucent Technologies®.

Contact one of our systems and applications specialists to see how your company can benefit from the high value Cirrus Logic adds to its customers' products.

Cirrus Logic, Inc.
4210 S. Industrial Dr., Austin, TX 78744
TEL: 512/445-7222 FAX: 512/445-7581

Publications Ordering: 800/359-6414 (USA)
Worldwide Web: http://www.cirrus.com
939000-005