JEDEC DESIGN STANDARD

DESIGN REQUIREMENTS FOR OUTLINES OF SOLID STATE AND RELATED PRODUCTS

JEDEC STANDARD

NO. 95-1

SECTION 4

QUAD FLATPACK

JEDEC
Solid State Products Engineering Council

4 QUAD FLAT PACK

4.1 Illustrations

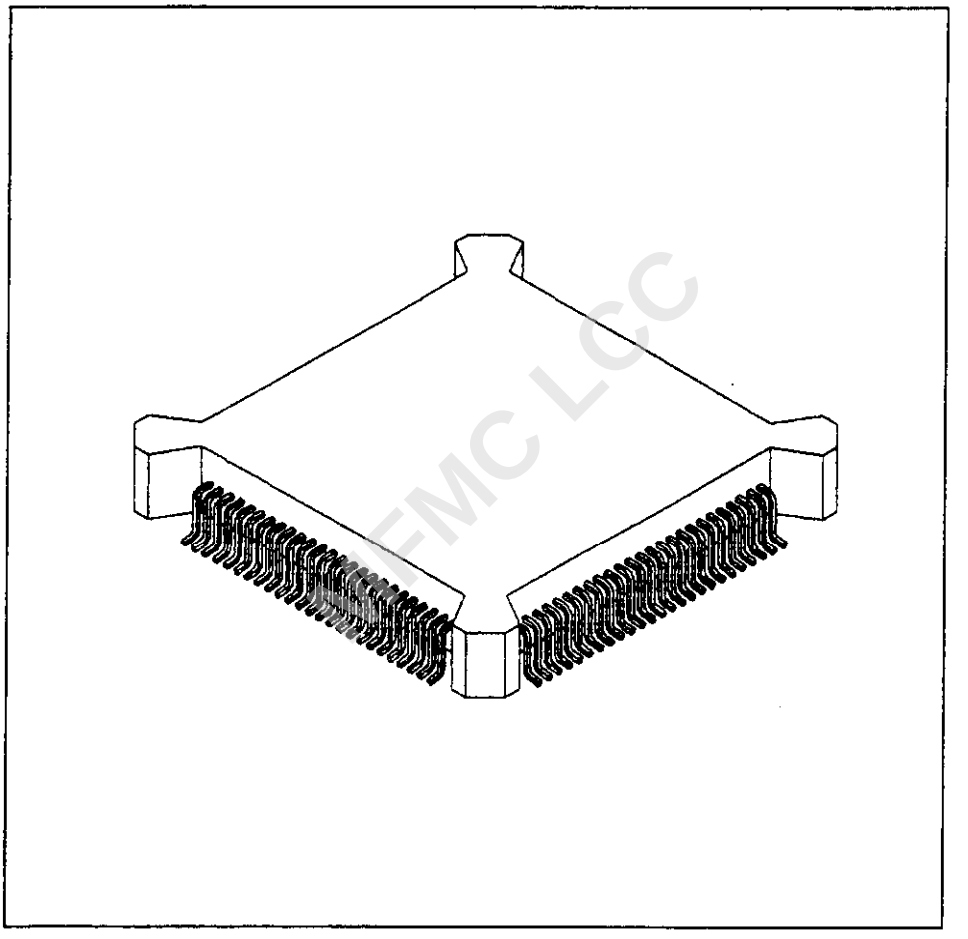


Figure 4-1
Quad Flatpack
with
Bumpers

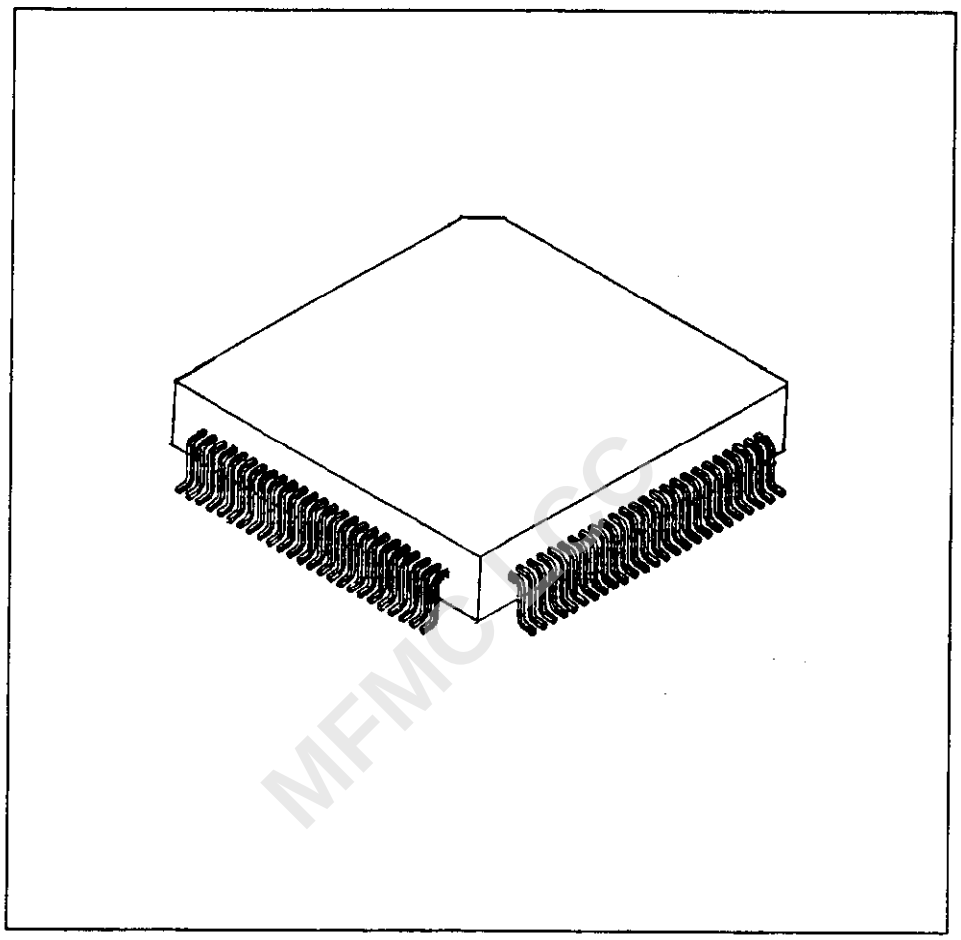


Figure 4-2
Quad Flatpack

4.2 Quad Flatpack (QFP)

A Quad Flatpack is a rectangular or square package with leads extending from each side of the package. The true position centerlines of the leads lie in planes that are established by the datum reference frame "A-B","D","C" (see Figure 4-3).

This section deals with outline drawing and dimensions that are to be specified for QFP. The principles outlined in Section 2 and ANSI Y14.5M are to be followed in establishing dimensions and tolerances. Note that it is important to consider the effect of dimensions and tolerances on the system as a whole. These include the interaction with handling and test systems, sockets and mounting on PC boards.

4.2.1 Terms and Definitions

Numbers in triangles of the following paragraphs correspond to the numbers in triangles of **Figures 4-3, 4-4, 4-5, 4-6, 4-7, 4-8, 4-9, 4-10 and 4-11.**

△1 **Seating Plane,Datum -C-** The plane established by the contact points of three or more leads that support the device when it is placed on top of a horizontal planar surface (see Figure 4-3).
NOTE: This is the plane on which the package may be mounted on printed wiring board, in a socket, etc. The feet of the leads are datum features that, when used with suitable tooling, establish the datum plane -C- . If multiple seating planes exist, i.e, the device can rock on the seating plane, then all must be considered. The most stable plane shall be used for all measurements.

△2 **Datum Plane -H-** The plane coincident with the bottom surface of those leads that establish datums -A-B- and -D- , as they exit the body. See **Figures 4-3 and 4-5**. The bottom of the leads are datum features that, when used with suitable inspection equipment, establish datum plane -H-

△3 **Base Plane** The plane, parallel to the seating plane, established by the lowest point of the package body.

△4 **Datums** -A-B- and -D- The datum planes established by the centers of the center leads (for an odd number of leads per side) and the center space between leads (for an even number of leads per side; see item "37" and Figure 4-10) where they exit the body. These two datum planes are mutually perpendicular to each other and to datum plane -C- . They form a Datum Reference Frame. This reference frame exists in theory only and not on the part. Suitable tooling or inspection equipment must be used to establish the datum reference frame. An overlay can be used to establish datums -A-B- and -D- . Datums -A-B- and -D- do not necessarily coincide with the centerlines of the body.

△5 **Dimensions "D1" and "E1"** The body dimensions measured in a plane (at Datum -H-) parallel to the seating plane. These dimensions do not include allowable protrusions or flash,but do

include offset between top and bottom halves of the body. Offset is the displacement of the centerline of the upper half of the body with respect to the centerline of the lower half of the body.

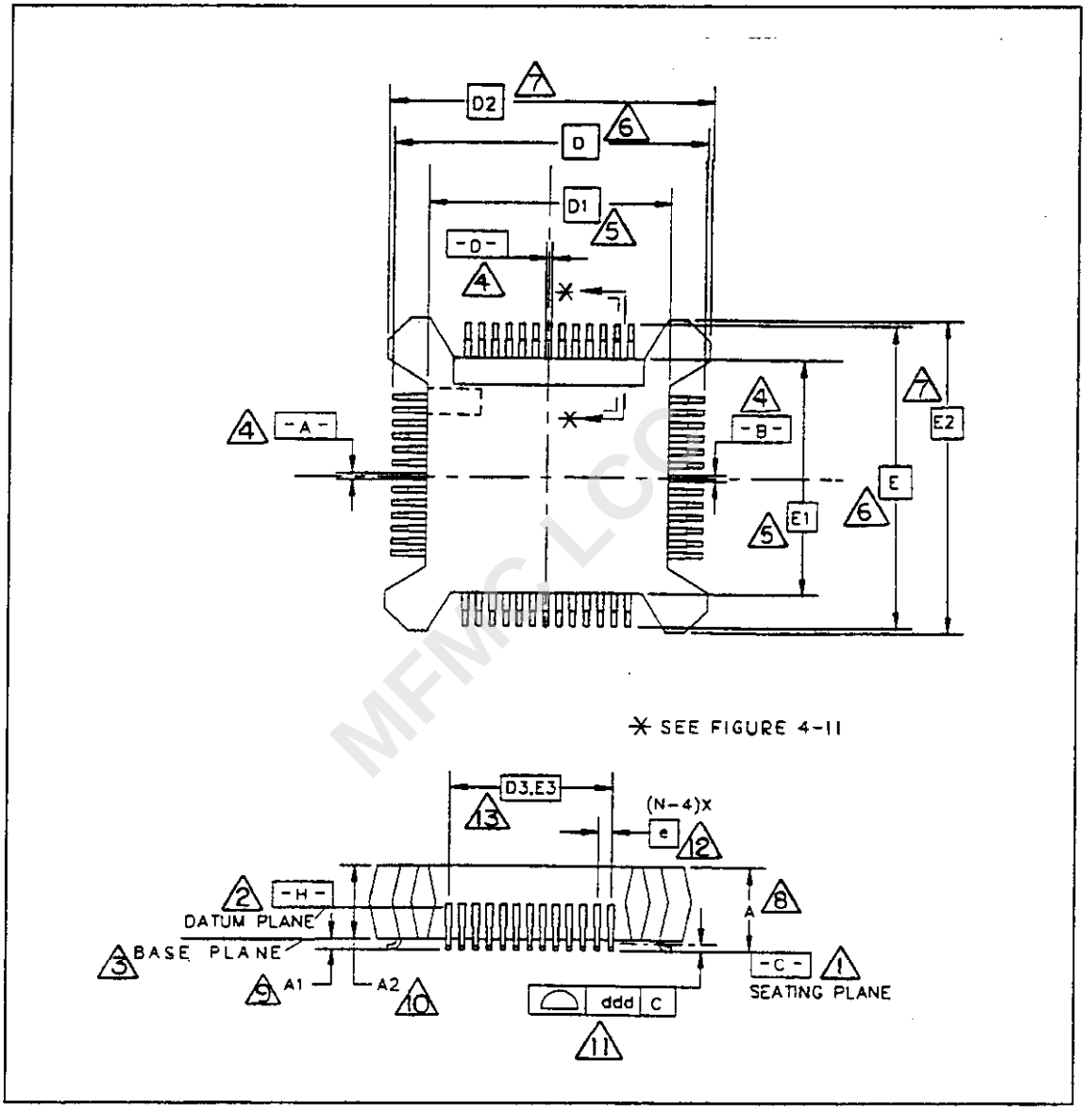


Figure 4-3
Principal Dimensions and Datums

Depending on the amount of offset and the difference in size between upper and lower body halves, the following may occur: an edge of the upper part may extend beyond the edge of the lower part; on the opposite side of the body, the reverse condition may exist. An appendix will be added in the future which will discuss protrusion; see also dimension "Z".

(6) **Dimensions "D" and "E"** Lead-tip to lead-tip dimensions measured parallel to D1 and E1.

(7) **Dimensions "D2" and "E2"** The dimensions that control the size of the bumpers, which are optional. When bumpers are used "D" and "E" must always be less than "D2" and "E2".

(8) **Dimension "A"** The distance from the seating plane to the highest point of the package.

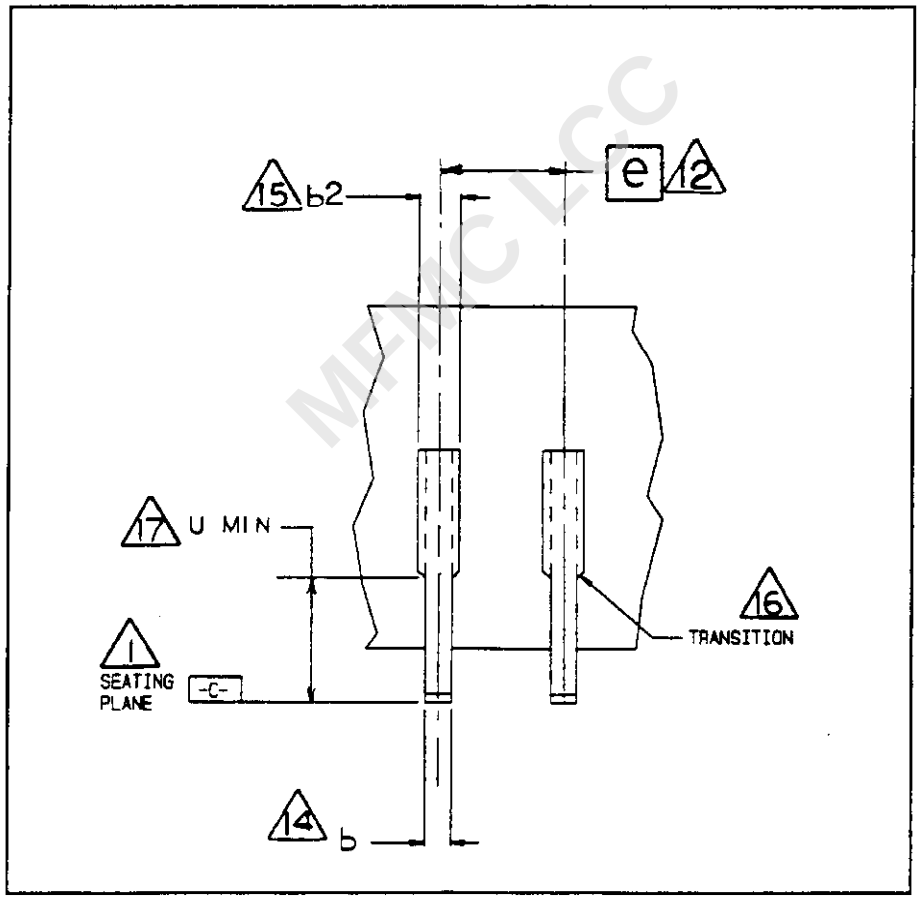


Figure 4-4
Terminal Front View

(9) **Dimension "A1"** The distance between the seating plane and the base plane.

(10) **Dimension "A2"** The distance between the base plane and the highest point of the package.

(11) **Coplanarity of Formed Leads "ddd"** The lead tips must lie within a specified tolerance zone. This tolerance zone is defined by two parallel planes. One plane is the seating plane, datum [-C-]; the other plane is at the specified distance from [-C-] in the direction indicated. See Appendix B for more details. If the device, when seated on a plane surface, can rock or assume more than one position, then all positions must meet the specified tolerance (see Figure 4-3).

(12) **Dimension "e", Pitch** is the basic dimension that establishes the spacing between the true position of the centerlines of the leads. The specified positional tolerance establishes a tolerance zone into which the centerline of each lead must fall.

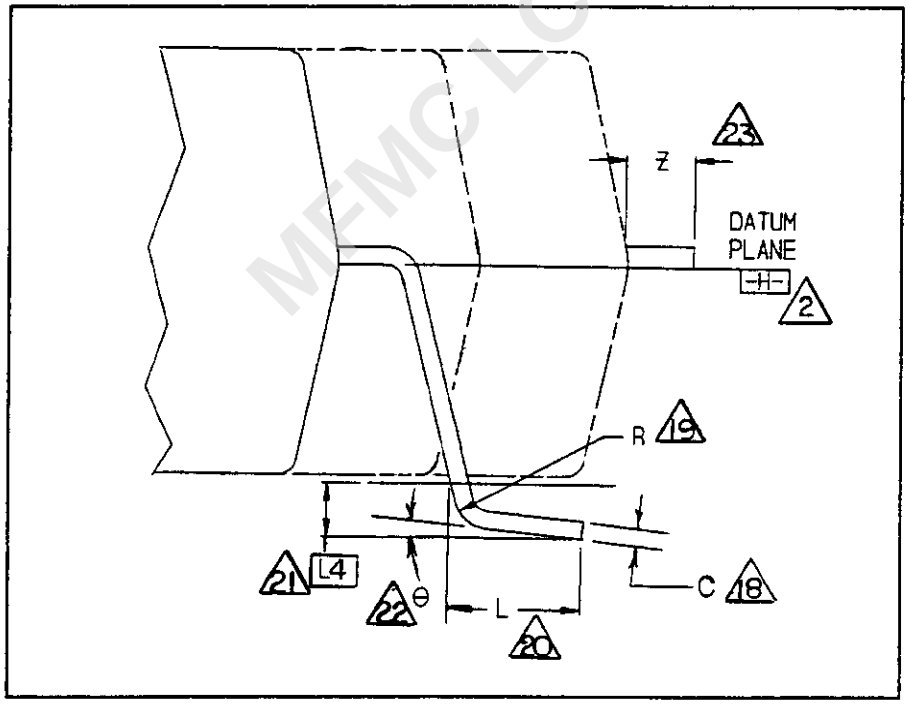


Figure 4-5
Terminal Side View

(13) **Dimension "D3 and E3"** is the basic distance between centerlines of the first and last leads on a side of the package. This distance is equal to pitch multiplied by the number of leads, less one, per side. These dimensions are optional.

14 **Dimension "b"** is the width of the lead, including lead finish, but excluding dambar protrusion and/or intrusion.

15 **Dimension "b2"** The shoulder or upper part of the lead may be wider than the foot or lower part of the lead. This width variation is an optional feature.

16 **Transition** The presence and shape of the transition is optional.

17 **Dimension "U"** specifies the minimum distance from the seating plane -C- to the start of the transition, if present, and includes lead finish.

18 **Dimension "c"** specifies the lead thickness. The lead thickness includes lead finish. This should be measured at the midpoint of "L" (see Figure 4-8). The lead finish should be of reasonably uniform thickness from lead tip to top of bend at heel.

19 **Dimension "R"** is the outside radius of the bend at the foot. (This dimension is necessary in order to control the flat of the foot.)

20 **Dimension "L"** is the horizontal projection of the distance from the upper edge of tip of the lead to the intersection of the inner surface of the lead with the gage plane defined by basic dimension "L4".

21 **Dimension "L4"** is the distance between a plane, touching the bottom-most part of the foot and parallel to the seating plane, datum -C- , and the gage plane that is parallel to the seating plane. In conjunction with dimension "L" it establishes the point of intersection of the lead profile and the gage plane.

22 **Dimension** "θ" is the angle, in a positive direction, between the flat of the foot of the lead and the seating plane. The positive direction is indicated in Figure 4-5.

23 **Dimension "Z"** is the protrusion from the body proper. It applies to mold flash, ceramic burrs, glass and braze runout. This should not be confused with mold or ceramic offset.

24 **Tolerance "aaa"** is a bilateral profile tolerance that controls the position and orientation of the tips of the leads in a plane parallel to the seating plane. The center of the tolerance zone is established by a basic dimensions "D"/"E".

25 **Tolerance "bbb"** is a bilateral profile tolerance that controls the position and orientation of the sides of the bumpers in plane -H- . The center of the tolerance zone is established by basic dimensions "D2"/"E2".

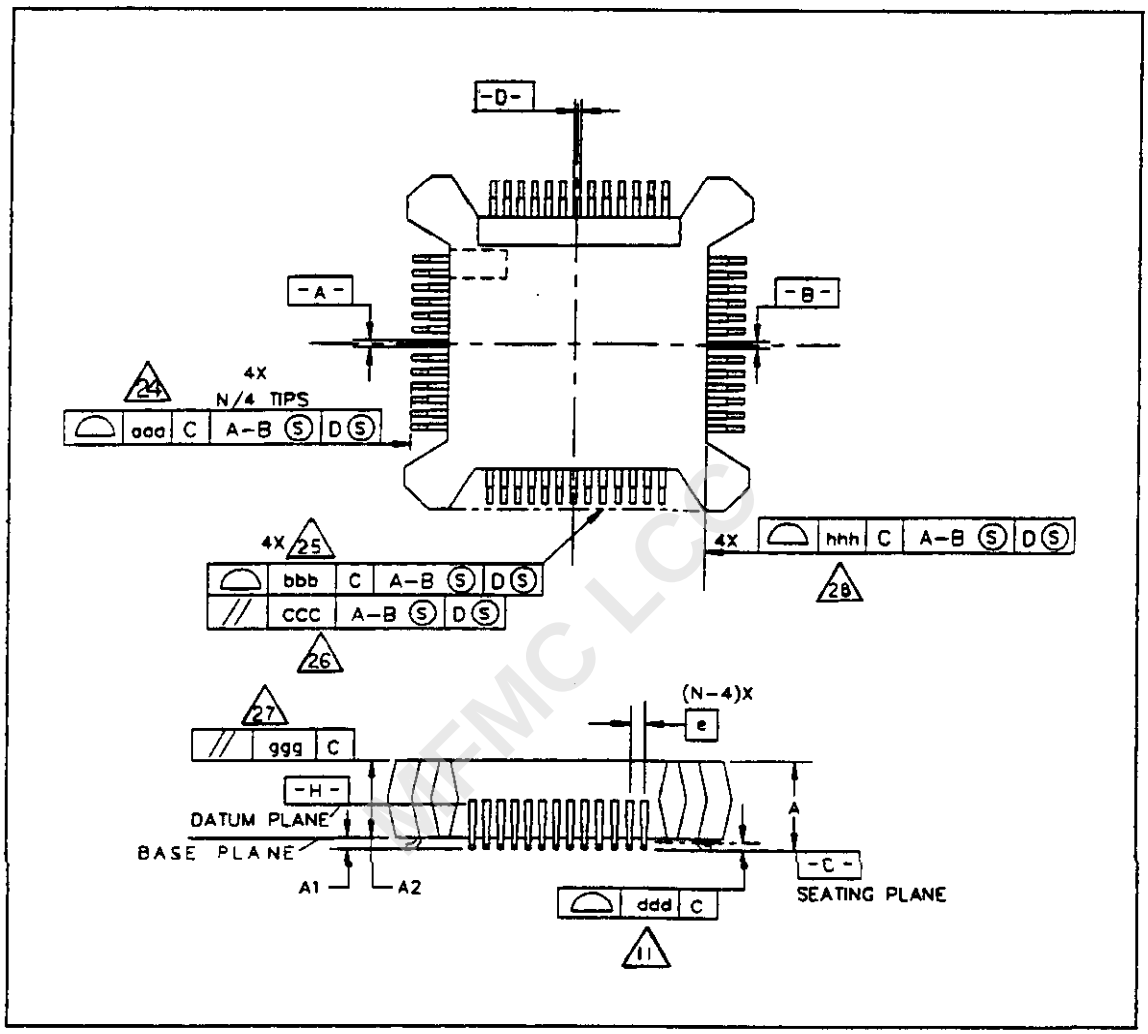


Figure 4-6
Principal Tolerances

26 **Tolerance "ccc"** controls the parallelism of the sides of the bumpers with respect to the datums -A-B- and -D-. This is used in order to control the parallelism to a tighter degree than that of profile tolerance "bbb".

27 **Tolerance "ggg"** controls the parallelism of the top of the package with respect to the seating plane -C- .

(28) **Tolerance " hhh"** is a profile tolerance that controls the position and orientation of the sides of the package. The center of the tolerance zone is established by the basic dimensions "D1"/"E1".

(29) **Tolerance "eee"** is a positional tolerance for shoulder of the terminal, dimension B1. The center of the tolerance zone is on true position as established by basic dimensions with respect to datum reference frame -A-B- , -D- and -C- . The centerline of dimension "b2" must fall inside of the tolerance zone.

(30) **Tolerance "fff"** is a positional tolerance zone for the foot of the terminal. The center of the tolerance zone is on true position as established by basic dimensions with respect to datum reference frame -A-B- , -D- and -C- . The centerline of dimension "b" must fall inside of the tolerance zone.

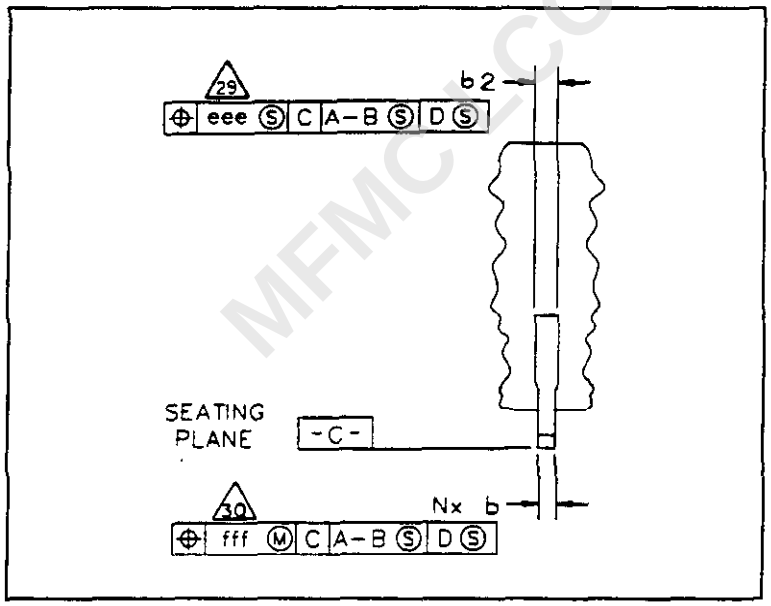


Figure 4-7
Terminal Tolerances

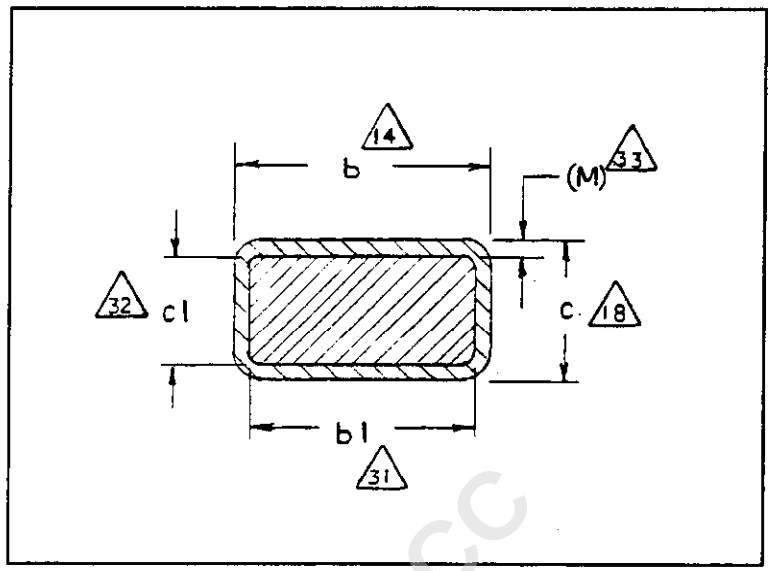


Figure 4-8
Terminal Cross Section
Center of Dimension "L"

31 **Dimension "b1"** is the bare metal terminal width measured at the midpoint of the "L" dimension.

32 **Dimension "c1"** is the bare metal terminal thickness measured at the midpoint of the "L" dimension.

33 **Dimension "M"** is the nominal thickness of the coating. This dimension may be included as a reference dimension.

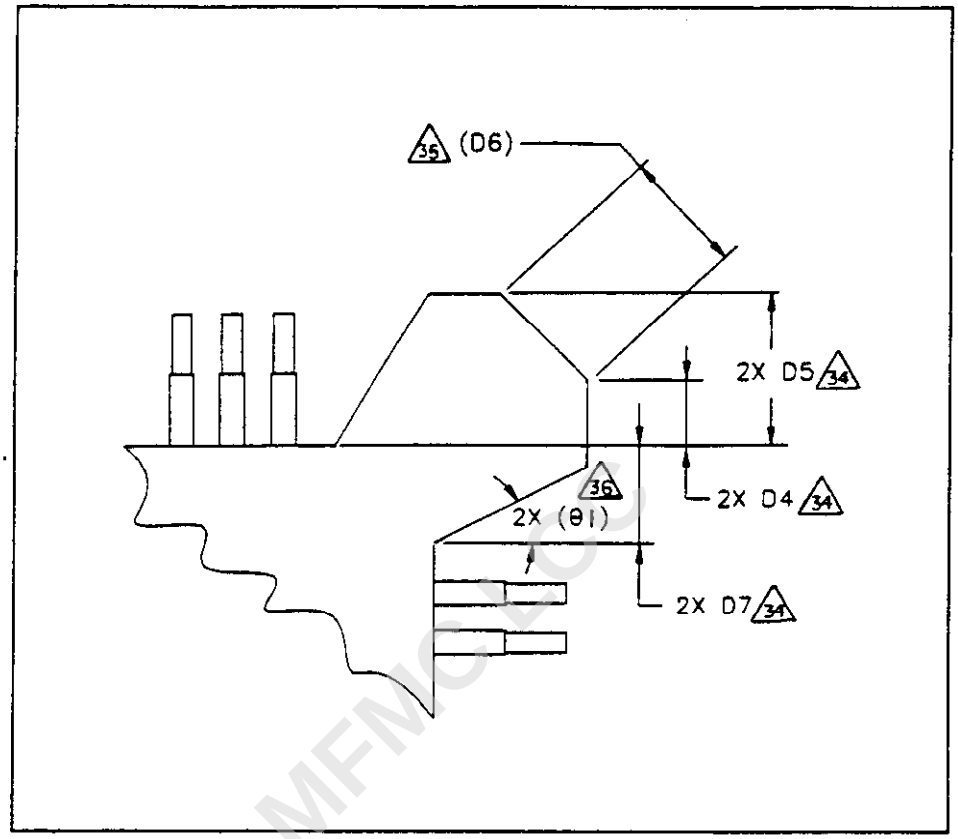


Figure 4-9
Bumper Dimensions

34 **Dimensions "D4","D5" and "D7"** establish the outline of the bumper.

35 **Dimension "D6"** is a reference dimension that indicates the length of the bevel.

36 **Dimension "θ1"** is the angle between the side of the bumper and a line parallel to the side of the package.

△37 **Datums -A-B- and -D-** , for an even number of leads per side, are established by the centers of the spaces between three pairs of center leads where the center leads leave the body. These two datum planes are mutually perpendicular to each other and to datum plane -C- . They form a Datum Reference Frame. This reference frame exists in theory only and not on the part. Suitable tooling or inspection equipment must be used to establish the datum reference frame. The space between leads, as a reference, is preferred to that of the half-pitch offset from a lead. The former method eliminates the ambiguity of which lead to use or the possible error of picking the wrong lead as the reference. Datums -A-B- and -D- do not necessarily coincide with the centerlines of the body. For odd leads per side see item "4" and Figure 4-3

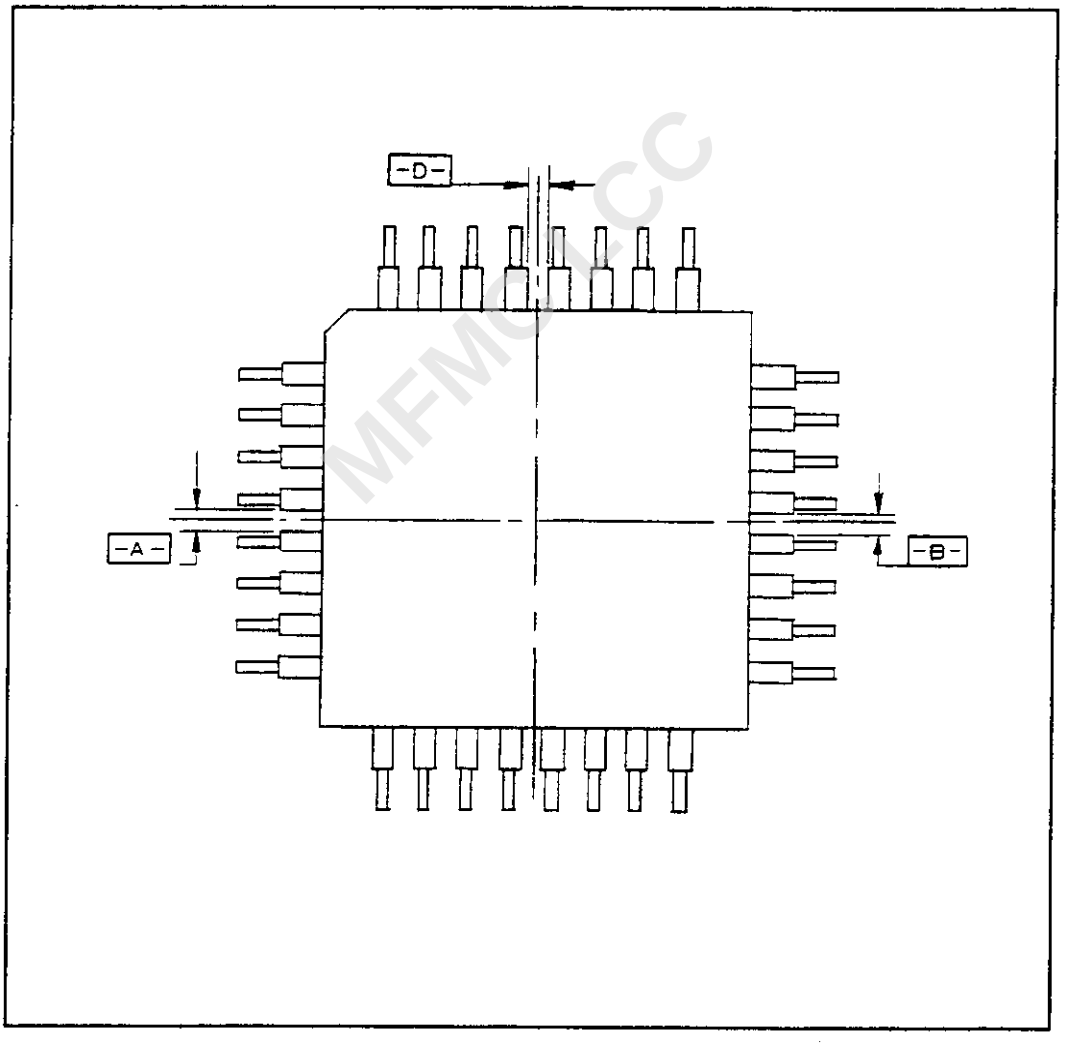


Figure 4-10
Even Leads per Side
Datum Reference

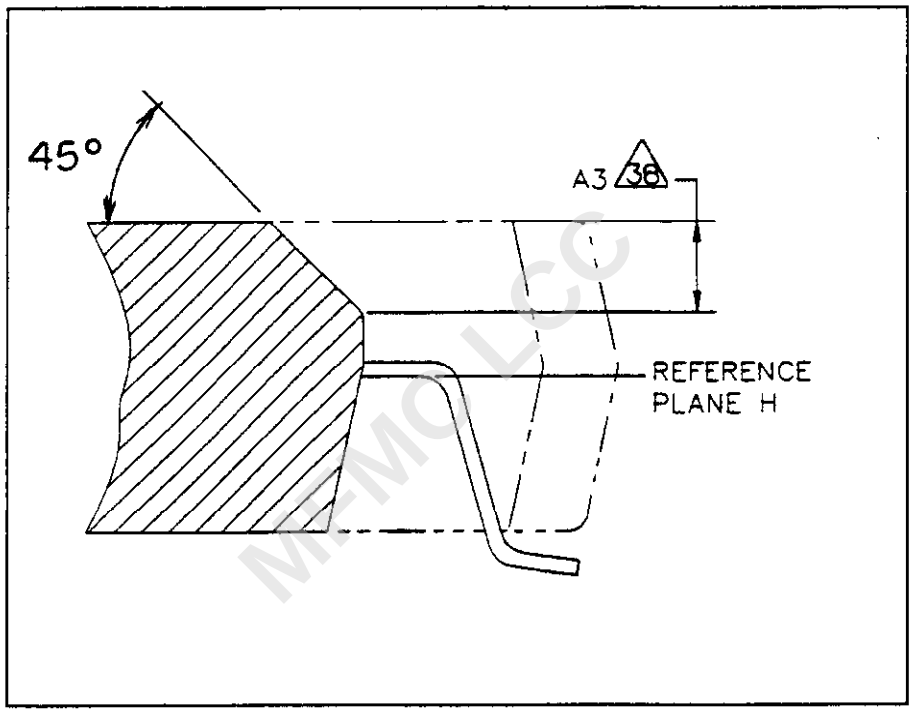


Figure 4-11
Chamfer

38 **Dimension A3** establishes the chamfer for mechanical sensing. This is an optional feature.

4.2.2 Guidelines for Establishing PC Board Land Patterns

Figures 4-12 and 4-13 show the gage outlines for the terminal tips; the tips must fall within these outlines. These outlines should be used to establish the land pattern for the QFP package. The actual design of the land pattern should be based on good design practice such as the IPC Guidelines.

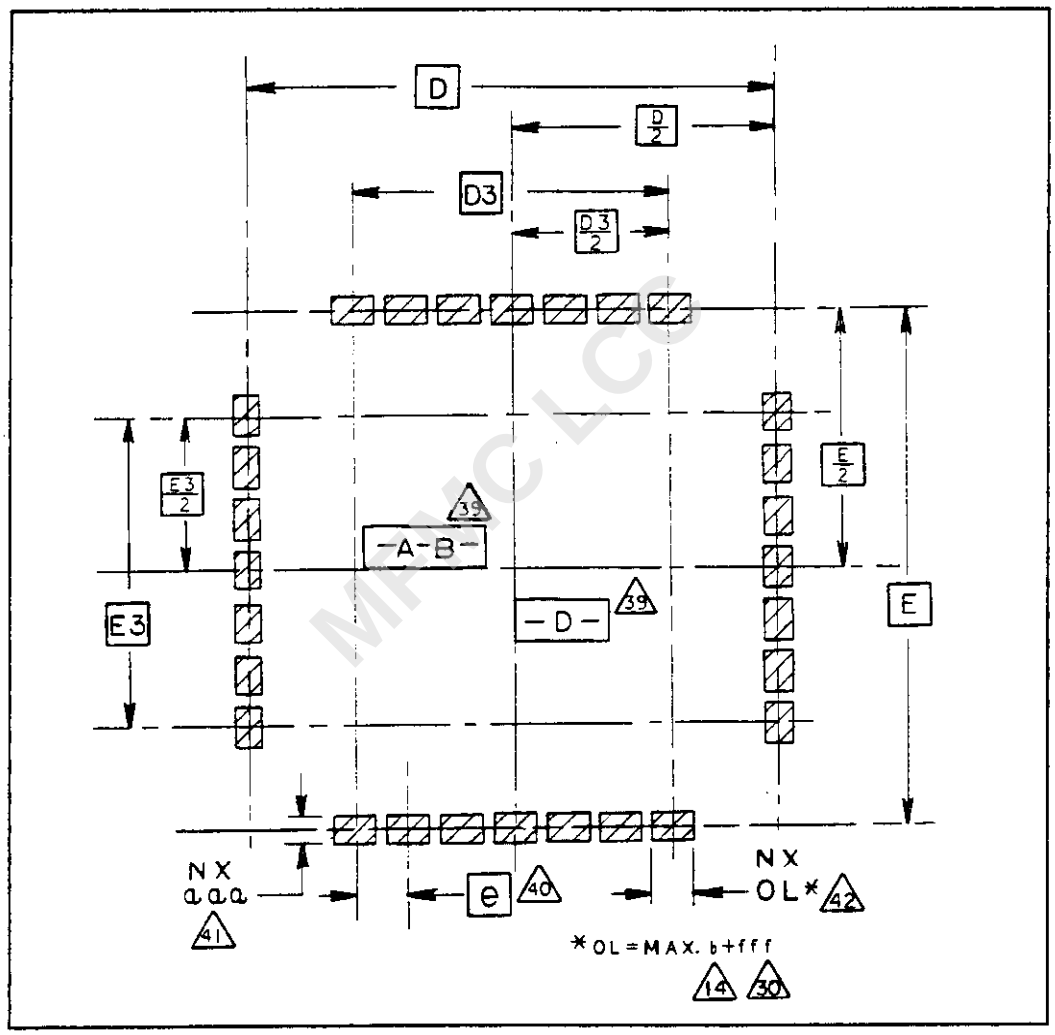


Figure 4-12
Terminal Tip - Gage Outlines
Odd Number of Leads per Side

39 **Datums -A-B- and -D-** are the center lines of the pattern of gage outlines and correspond

39 **Datums -A-B- and -D-** are the center lines of the pattern of gage outlines and correspond to those shown in **Figures 4-3, 4-6 and 4-10**. The above dimensioning format for the gage outlines is recommended for the land pattern; this will simplify the design and dimensioning of the land pattern. The comments of item "4" and item "37" apply here except that datum -C- is now the surface of the gage outline. The actual design of the land pattern should be based on good design practice such as the IPC Guidelines.

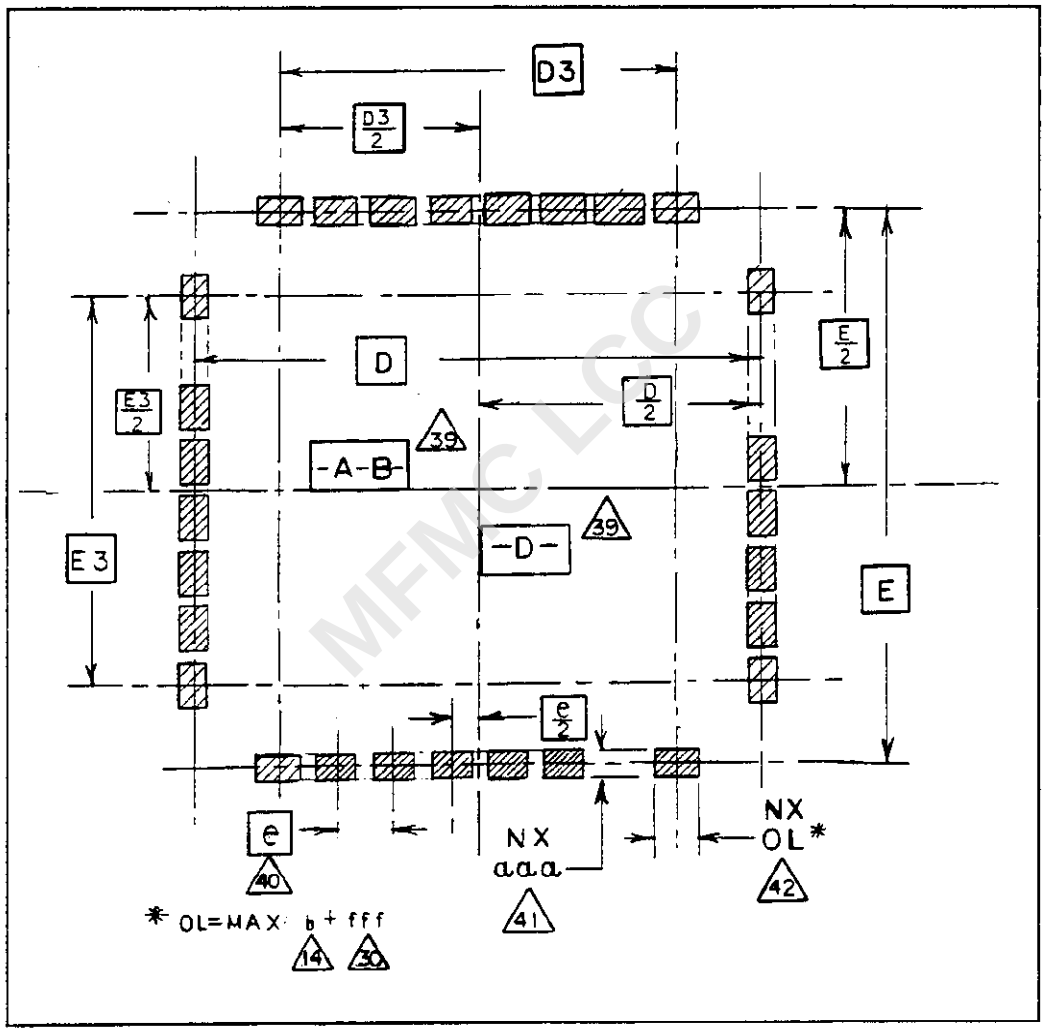


Figure 4-13
Terminal Tip - Gage Outlines
Even Number of Leads per Side

(40) **Dimension "e", Pitch** is a basic dimension that establishes the spacing between the centerlines of the gage outlines and is equal in value to that of item "12", dimension "e".

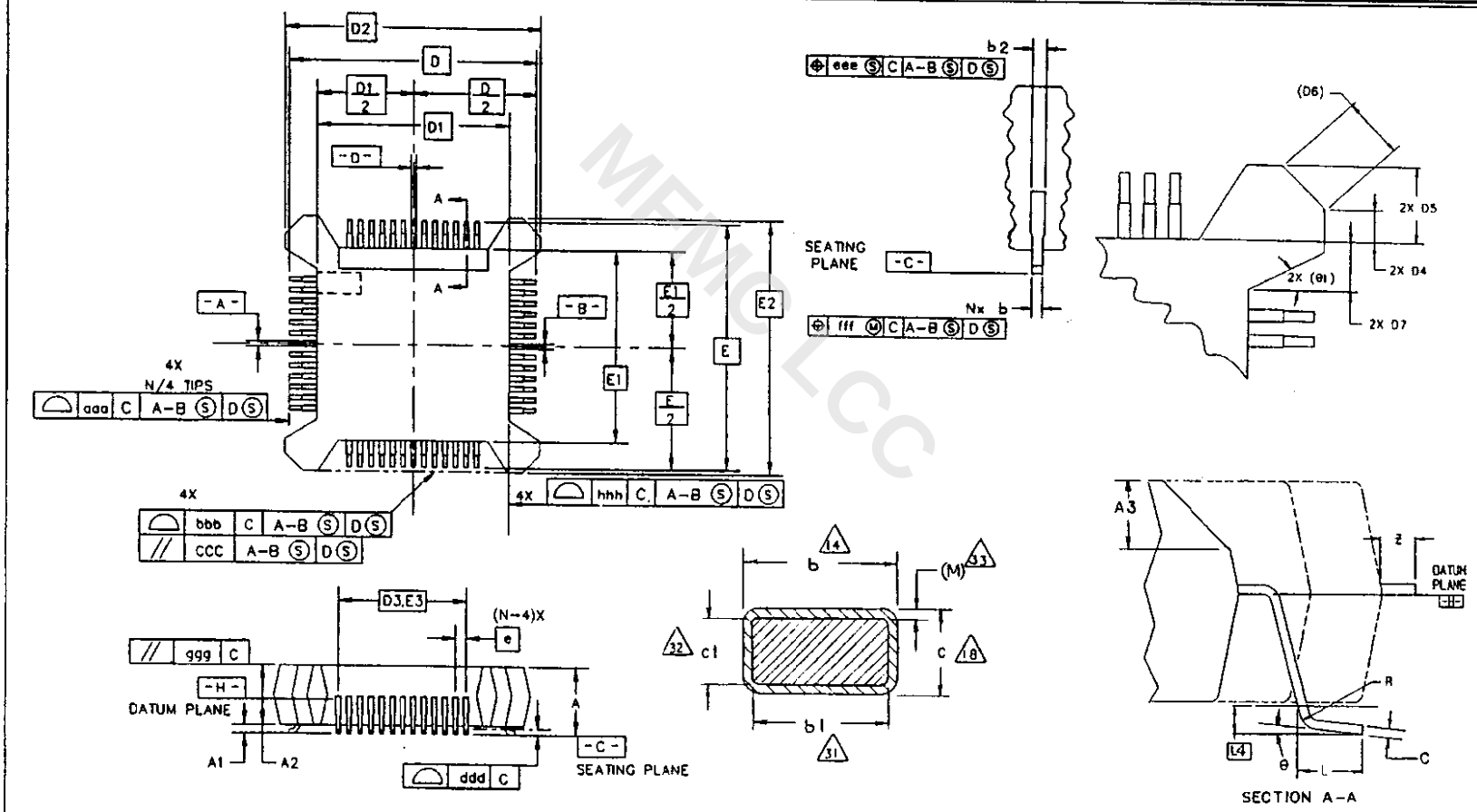
(41) **Dimension "aaa"** establishes the extent of the gage outline and is equal to item "24", tolerance "aaa".

(42) **Dimension "OL"** is the Outer Locus (OL) of the tip of the terminal. The OL is equal to the sum of the maximum values of item "14", dimension "b", and the positional tolerance, under maximum material condition, item "30", tolerance "fff". The OL is the envelope of the maximum positions of the tip in a direction parallel to item "14", dimension "b".

4.3 **Plastic Quadflat Pack (PQFP) (.025 Pitch Family) Dimensional Specifications and Recommended Values:**

(SEE NEXT PAGE)

TABLE OF DIMENSIONS AND TOLERANCES (.025 PITCH FAMILY)
and
RECOMMENDED VALUES



DIM	DESCRIPTION	MIN[1]	NOM[1]	MAX[1]	NOTES
A	Total seated package height. (8)[2]	----	----	0.180	
A1	Distance between seating plane and base plane. (9)	0.020	0.030	0.040	
A2	Distance between base plane and the highest point of the package. (10)	0.130	0.140	.150	
A3	Chamfer (38)	0.042		0.056	Optional Feature
b	The width of the lead, including lead finish, measured at the midpoint of Dimension "L". (14)	0.008	0.010	0.012	
b1	The bare metal terminal width of the foot (31)	0.0075	-----	0.0115	
b2	The width of the shoulder or upper part of the lead (15)	0.008	0.012	0.016	Optional Feature
c	This is the thickness of the lead, including lead finish. (18)	0.0055	0.0068	0.008	
c1	The bare metal thickness of the terminal. (32)	0.0047	----	0.0075	
e	The pitch or distance between the centerlines of the leads. (12)	----	0.025 (Basic)	----	Dimension is basic
D/E	Lead tip to lead tip dimensions. (6)	----	Basic	----	(N/4 -1)x.025 + .280; Basic dimension To be determined at seating plane -C-.

[1] Dimensions are in inches

[2] Numbers in triangles refer to corresponding numbers in paragraph 4.2.1

JEDEC STANDARD No. 95-1
PAGE 4-19 (.025 Pitch Family)

DIM	DESCRIPTION	MIN	NOM	MAX	NOTES
D1/E1	Body dimension; does not include mold protrusion or bumpers. 5	----	Basic	----	(N/4 -1)x.025 + .150; Basic dimension. To be determined at datum plane -H-.
D2/E2	The distance over the ends of the bumpers. 7	----	Basic	----	(N/4 -1)x.025 + .300; Basic dimension. To be determined at datum plane -h-.
D3/E3	The distance between the first and last leads on any one side of the package. 13	----	Basic	----	(N/4 -1)x.025; basic dimension
D4	Bumper Dimension 34	0.035	----	----	Optional feature.
D5	Bumper Dimension 34	0.076	0.078	0.080	Optional feature.
D6	Bevel on corner bumpers 34	----	(0.060)	----	Reference dimension, optional feature.
D7	Bumper Dimension 34	0.048	0.050	0.052	Optional feature
L	The horizontal projection of the distance from the tip of the lead to the intersection of the lead and the gage plane defined by L4. 20	0.036	0.041	0.046	
L4	The distance between a plane, touching the bottom-most part of the foot and parallel to the seating plane -C-, and the gage plane. 21	----	0.010 (Basic)	----	Basic dimension
M	The thickness of the finish of the terminals 33	----	0.00025	----	May be a reference dimension. User may also specify a minimum, maximum or both.
N	The total number of leads of the package	----	----	----	
R	The outside radius of the bend at the foot of the terminal. 19	----	----	0.020	This maximum will allow a reasonable minimum flat of the foot.

DIM	DESCRIPTION	MIN	NOM	MAX	NOTES
U	The minimum distance from the seating plane -C- to the start of the transition, if present, and includes lead finish 17	0.035	----	----	
Z	The protrusion from the body proper. 23	----	----	0.005	
θ	The angle, in a positive direction, be-tween the flat of the foot of the lead and the seating plane -C-. 22	0°	4°	8°	
θ1	The angle between the side of the bumper and the side of the package 36	----	(32)	----	Reference dimension.
aaa	Bilateral profile tolerance of the tips of the leads in a plane perpendicular to the datum plane -C-. 24	----	----	0.010	This is the tolerance of size and shape of basic dimensions D and E.
bbb	Bilateral profile tolerance of sides of bumpers. 25	----	----	0.012	This controls the size and orientation of the sides of the bumpers in plane -H-. This is re-ferenced to basic dimensions D2 and E2.
ccc	The tolerance that controls the parallelism of the sides of the bumpers with respect to the datum reference frame. 26	----	----	0.002	
ddd	Unilateral coplanarity tolerance of the bottom of the tips of the terminals. 11	----	----	0.004	The tolerance zone extends in a direction perpendicular to the seating plane -C-. See Appendix B for more details.

DIM	DESCRIPTION	MIN	NOM	MAX	NOTES
eee	The tolerance of position of the shoulder of the terminal. 29	----	----	0.006	
fff	The tolerance of position of the foot or tip of the terminal. 30	----	----	0.006	
ggg	Controls the parallelism of the the top of the package with respect to seating plane -C-. 27	----	----	0.006	Maximum value is per inch of body size. Actual value to be specified is a function of body size and application
hhh	Bilateral profile tolerance that controls position and orientation of the side of the package. 28	----	----	0.016	This is the tolerance of size and shape of basic dimensions D1 and E1