Semiconductor Group
Package Outlines

Reference Guide

1995

Semiconductor Group Package Outlines Reference Guide

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Preface

This document is a reference guide for packages used by the Texas Instruments Semiconductor Group in the manufacture of its integrated circuits.

Section 1 contains general information on the guide's content and description of package types available. It also includes information on packaging trends.

Sections 2 through 6 contain package outline drawings organized into five major sections: plastic/metal surface mount, plastic through-hole, ceramic surface mount, ceramic through-hole, and other packages. At the beginning of each section is a table of contents listing key information on each package.

The Appendix includes an alphanumeric cross-reference listing of packages by TI identification code. Also included is a glossary of packaging terms and other packaging handling and processing information.

1 General Information

Purpose and Content

This document is a reference guide for packages used by the Texas Instruments Semiconductor Group in the manufacture of its integrated circuits. It includes outline drawings for 400+ packages currently available as well as other information to aid the customer in selecting the appropriate package for a specific application.

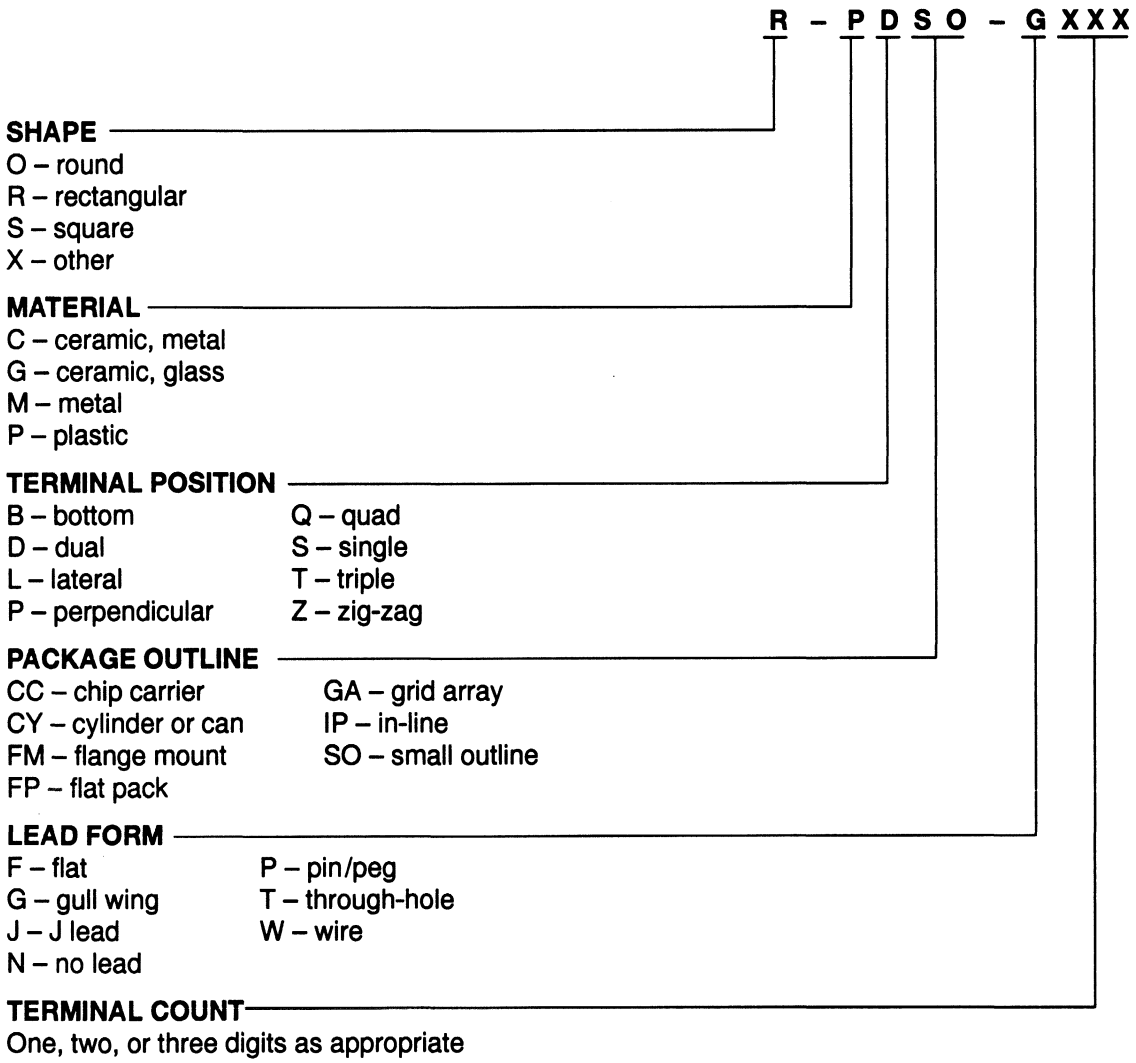
This guide is organized as follows:

At the beginning of each package outline section is a table of contents that lists for each package the number of pins, descriptive remarks, TI package identification code, drawing and page references.

Drawings typically include the following dimensions: lead pitch (tip-to-tip); body width and length; shoulder-to-shoulder insertion; lead width, thickness, and angles; and package maximum height and stand-off clearance from seating plane to bottom of the package.

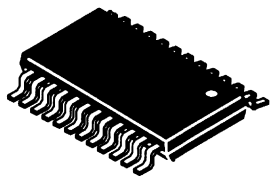
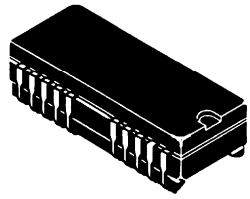
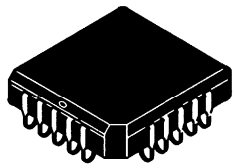
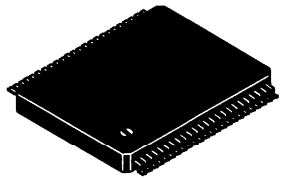
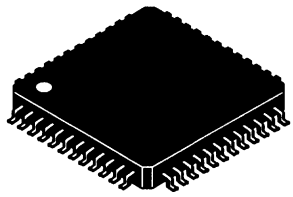
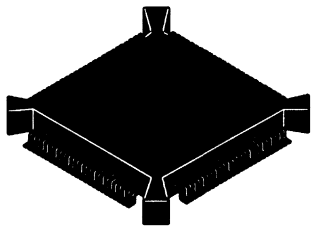
For packages designed in metric units, only millimeter dimensions are shown. For packages designed in English units, inch dimensions are shown first followed by millimeter dimensions in parentheses. A period is used as the English units decimal point, and a comma is used as the metric units decimal point.

Each package drawing contains a JEDEC Std 30 descriptor in the title line. This descriptor uses the following convention: shape, material, terminal position, package outline, lead form, and terminal count. The codes for each element in the JEDEC Std 30 descriptor are as follows:



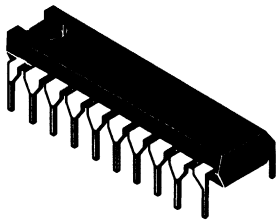
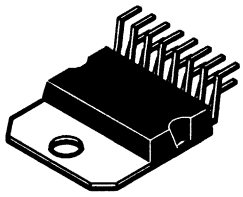
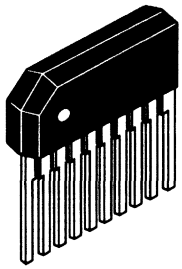
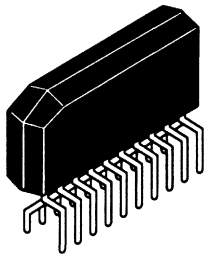
PACKAGE OUTLINES

SECTION 2 (Plastic Surface-Mount)

DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
SOIC: Small-Outline IC **HSOIC:** Small-Outline IC (Thermally Enhanced) **SOP:** Small-Outline Package (Japan) **HSOP:** Small-Outline Package (Thermally Enhanced) **SSOP:** Shrink Small-Outline Package **HSSOP:** Shrink Small-Outline Package (Thermally Enhanced) **TSOP:** Thin Small-Outline Package **TSSOP:** Thin Shrink Small-Outline Package **HTSSOP:** Thin Shrink Small-Outline Package (Thermally Enhanced)	R-PDSO-G	
SOJ: J-Leaded Small-Outline Package	R-PDSO-J	
PLCC: Plastic Leaded Chip Carrier **HPLCC:** Plastic Leaded Chip Carrier (Thermally Enhanced)	R-PQCC-J or S-PQCC-J	
DFP: Dual Flat Package **TFP:** Triple Flat Package	R-PDFP-G	
QFP: Quad Flat Package **TQFP:** Thin Quad Flat Package **JM QFP:** JEDEC Metric Quad Flat Package **HQFP:** Quad Flat Package With Heat Sink	R-PQFP-G or S-PQFP-G	
BQFP: Bumpered Quad Flat Package	S-PQFP-G	

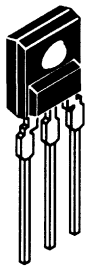
PACKAGE OUTLINES

SECTION 3 (Plastic Through-Hole)

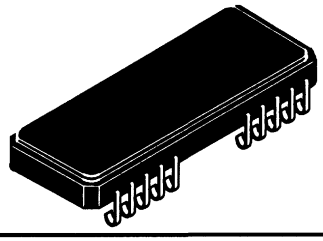
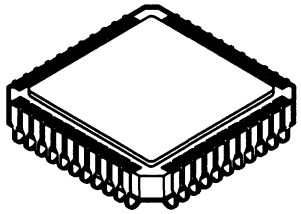
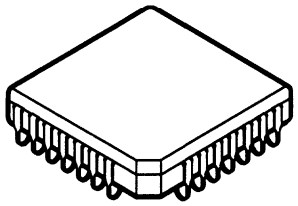
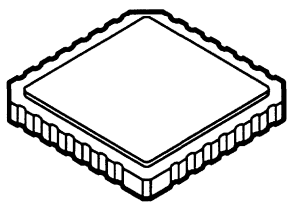
DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
PDIP: Plastic Dual-in-Line Package **SDIP:** Shrink Dual-in-Line Package	R-PDIP-T	
TO/SOT: Cylindrical Package	O-PBCY-W	
PFM: Plastic Flange Mount	R-PSFM-T or R-PZFM-T	
SIP: Single-in-Line Package **HSIP:** Single-in-Line Package (Thermally Enhanced)	R-PSIP-T	
ZIP: Zig-Zag Package	R-PZIP-T	

PACKAGE OUTLINES

SECTION 3 (Plastic Through-Hole) (Continued)

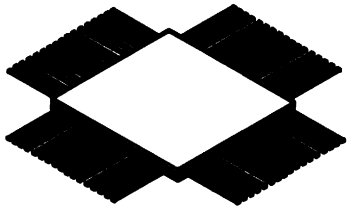
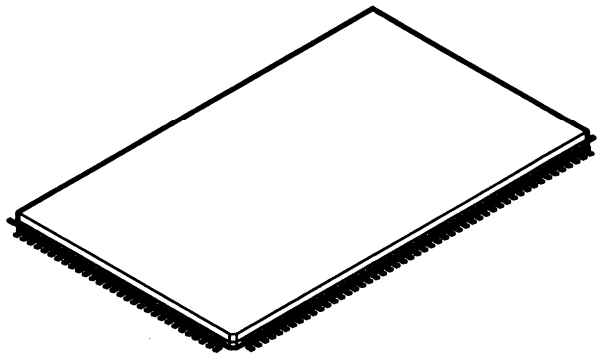
DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
OPTO: Light Sensor Package	R-PSIP-T or R-PDIP-T	

SECTION 4 (Ceramic Surface-Mount)

DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
JLCC: J-Leaded Chip Carrier	R-CDCC-J	
	R-CQCC-J	
	R-GQCC-J	
LCCC: Leadless Ceramic Chip Carrier	R-CDCC-N or R-CQCC-N	

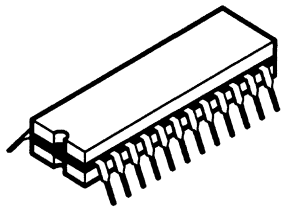
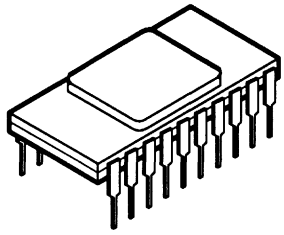
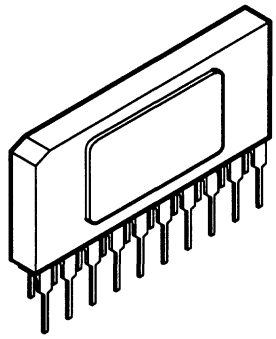
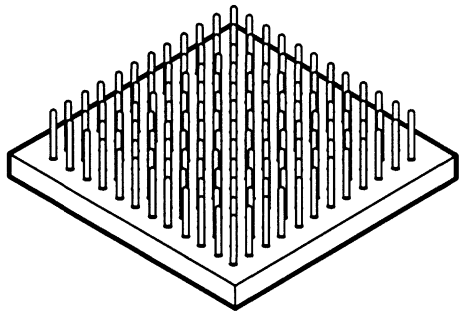
PACKAGE OUTLINES

SECTION 4 (Ceramic Surface-Mount) (Continued)

DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
CFP: Unformed Ceramic Flat Package	R/S-CDFP-F R/S-GDFP-F R/S-CQFP-F R/S-GQFP-F	
CFP: Formed Multilayer Ceramic Flat Package	R/S-CDFP-G R/S-CQFP-G R/S-GQFP-G	

PACKAGE OUTLINES

SECTION 5 (Ceramic Through-Hole)

DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
CDIP: Glass-Sealed Ceramic Dip Package	R-GDIP-T	
CDIP SB: Side-Braze Ceramic Dip Package	R-CDIP-T	
CZIP: Ceramic Zig-Zag Package	R-CZIP-T	
CPGA: Ceramic Pin Grid Array	S-CPGA-P	

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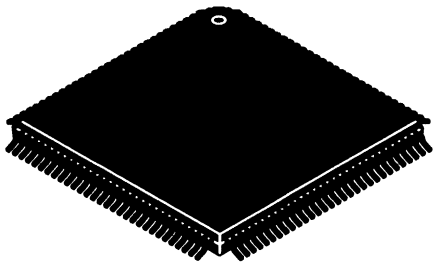
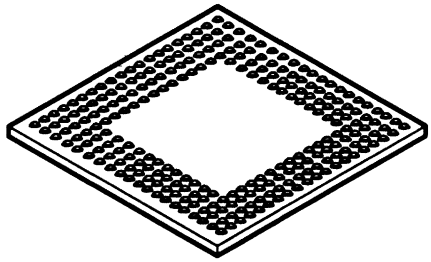
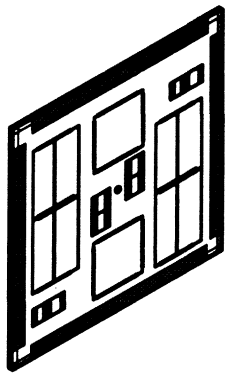
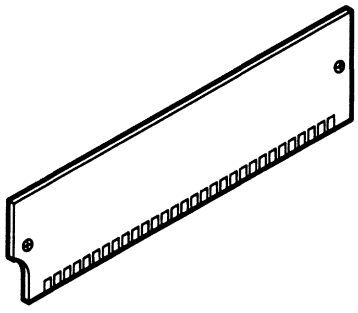
PACKAGE OUTLINES

SECTION 6 (Other Packages)

DESCRIPTION	JEDEC DESCRIPTOR	PACKAGE EXAMPLE
MQFP: Metal Quad Flat Package	R-MQFP-G or S-MQFP-G	
BGA: Ball Grid Array	S-PBGA-N	
MCM: Multichip Module	Varies	
MEM MOD: Memory Module	R-CDIP-N	

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4040047	D	8/14/16	SOIC	2–8
4040066	DA	28/30/32/38	TSSOP	2–50
4040065	DB	14/16/20/24/28/30/38	SSOP	2–32
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4040212	DBB	80	TSSOP	2–53
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4040094-4	DZ	32	SOJ	2–60
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SEMICONDUCTOR PACKAGING TRENDS

Packaging bridges the gap between silicon and systems. With this new definition of semiconductor packaging, it is obvious that the continuing compression of the life cycle of end equipment means reduced time-to-market of semiconductor components. It is, therefore, timely that this updated version of the TI Semiconductor Group *Package Outlines Reference Guide* be issued now. It also calls for a brief overview of the packaging trends that will highlight TI's emphasis on concurrent technology development, aiming at just-in-time technology. Furthermore, it will highlight what semiconductor assembly and packaging can contribute to harmonization of processes and semiconductor products and to mastering the design challenges and the custom system needs of the future.

To illustrate the overall trend in semiconductor products (see Figure 1 – Packaging Roadmap), the composite parameter *package performance density* is used to arrange the sequence of products in time. The contributions that add up to the package performance density and their relative weights are listed on the right hand side of the illustration. Besides form factors such as lead count, package size, thickness, and the footprint, the list also contains prominent performance characteristics such as power dissipation and signal frequency. Last, but definitely not least, a column marks the cost sensitivity of a package. It is well known that many factors enter into cost, notably manufacturing volume, cost of chip and piece parts such as lead frame and materials, production process complexity, and reliability requirements.

This book is a compilation of drawings for all standard TI packages, but it also shows the customer TI's high standards of technology and manufacturing flexibility that permit the production of specialty product beyond the scope of this book.

The dual-in-line packages (DIPs) that were dominant in the 1970s retained their pre-eminence through most of the 1980s. Their sturdy leads are well suited for through-hole board assembly but are limited in the number that can be accommodated without unduly elongating the package. Consequently, higher pin counts for through-hole mounting applications had to be arranged in a two-dimensional pattern, resulting in the so-called pin-grid arrays (PGAs). There are, however, practical limitations. Finer pitch sizes result in thinner pins, which are more sensitive to handling and to insertion by machines into sockets and are generally more difficult to straighten. The trend, therefore, leads to ball grid arrays, in which the pins have shrunk to contact balls. They are slowly gaining wider acceptance; cost and reliability issues need to be considered carefully.

The conversion of through-hole packages to surface-mount packages has accelerated each year since the mid 1980s but has not moved quite as quickly as predicted earlier because it took longer than anticipated for users to transform the logistics, especially for pick-and-place machines and solder reflow facilities. It is important to note that surface-mount packages have been accompanied by a much reduced pitch of their leads. This trend is continuing for both gull wing shaped leads and J-shaped leads. With its leadframe producing factory and superior preplated lead finishing technology, Texas Instruments has the capability of producing high lead-count semiconductor devices.

Tape automated bonding (TAB) is the preferred technology for assembling chips that need from 300 to 1000 connections and beyond. While TAB presently is still restricted to bonding the chip periphery, the alternative technology of flip-chip assembly uses metallic bumps distributed two-dimensionally over the chip area. Both TAB and flip-chip assembly are being pursued intensively by Texas Instruments to achieve higher numbers of interconnections to the outside world.

In contrast, the approach of limiting the number of outside connections to a modest number (about 50 to 150) has only recently received attention. This need is now under accelerated investigation by several industrial research centers for the electrical and thermal performance advantages and potential low cost. QFP's currently support up to 304 pins, but this will not meet future needs.This aproach involves combining several active and passive devices (with or without individual housing) on a substrate with customized interconnection and then encapsulatung this assembled subsystem or system as a new customized product. So-called single-in-line package (SIP) with SOJ memory devices surface mounted on a substrate with double layered interconnect have been manufactured by TI for almost 10 years. An extension of SIP is the slim memory card. The multichip module, which TI produced for special Japanese customers, represents a plastic version of the earlier ceramic hybrid systems still manufactured preferentially for military customers.

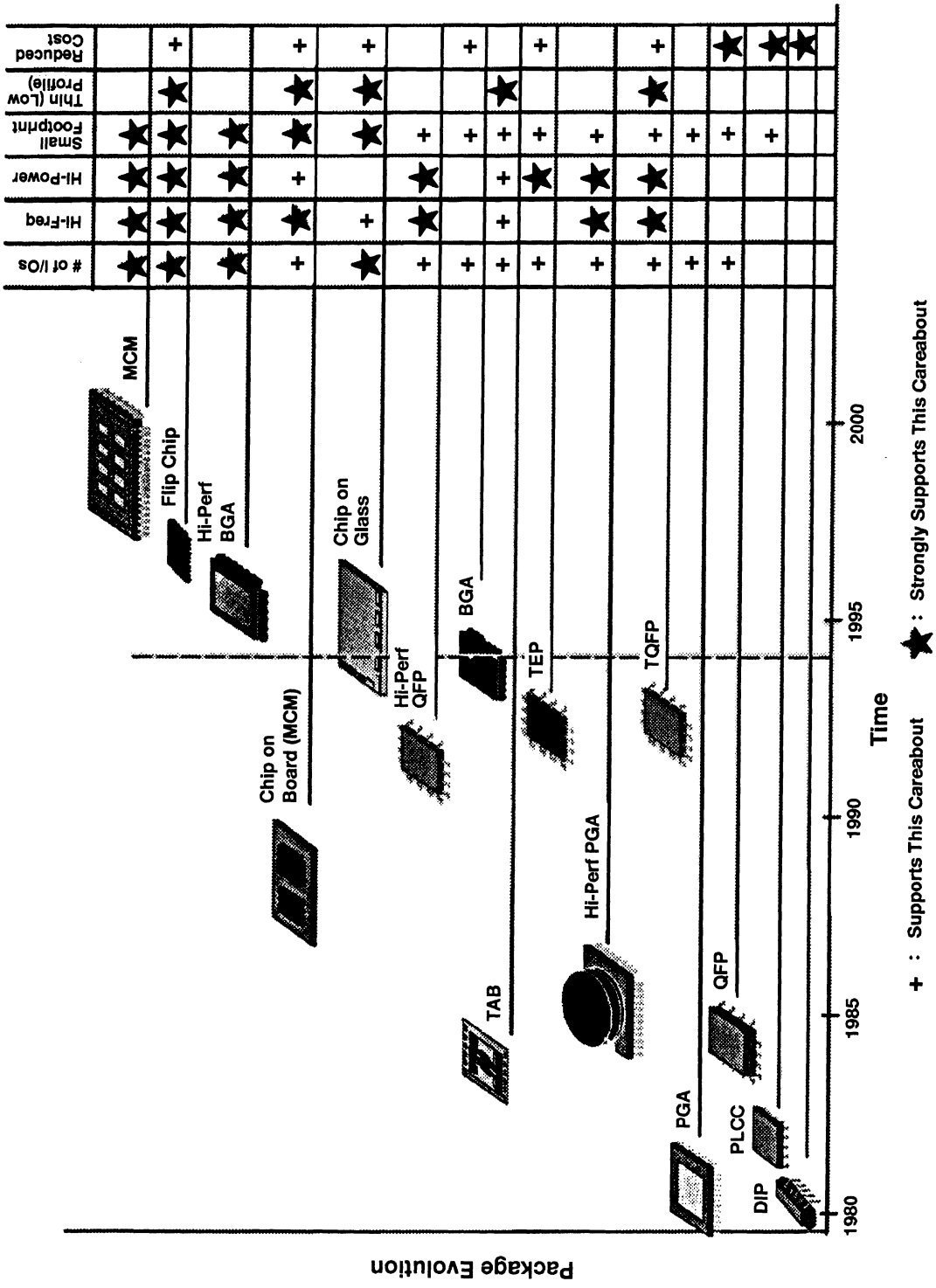

Figure 1. Packaging Roadmap

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The best electrical and perhaps thermal performances and the most flexible assembly are expected from flip-chip technology (by combining, for instance, digital and analog chips or silicon and gallium arsenide [GaAs] materials). This technology also promises the capability for true three-dimensional assembly, which produces customized systems at optimum packaging density. At the present time vertical assemblies are introduced by ZIPs, which are inserted into or surface mounted on boards. The trend of multichip modules (MCM) is expected to continue beyond the year 2000, with applications pervasive in computer, automotive, telecommunications, and consumer products.

Through-Hole and Surface-Mount Assembly

Dual-In-Line Packages. Plastic DIPs still account for close to 50% of the world semiconductor output. For almost two decades, they have been and still are the work horse of the high-volume and general purpose logic products. They cover only a restricted number of pins (8 to 64), package dimensions, and types of packages.

The leadframes are made of copper or Alloy 42. The lead finish is either solder applied by a dipping or plating process or palladium†. Because DIPs are used for relatively low-cost chips, there is continued pressure to implement cost reduction. This endeavor drives material, labor, and yield loss savings as well as the potential conversion to copper wire bonding from present gold wire bonding.

Surface-Mount Packages. In the early 1980s, a trend started that is still accelerating today: to design new semiconductor products for board attach by surface-mount technology (SMT) rather than by through-hole soldering. The reason is an increase of board density and a decrease in board cost by a factor of 3 to 5 compared to through-hole assembly. This significant savings justified the investment by users in new pick-and-place machinery and solder reflow equipment.

Gull wing shaped leads offer the advantage of easy lead inspection but are sensitive to transport and socket insertion. They require, therefore, shipment in trays rather than on the traditional rails. J-shaped leads, on the other hand, are more robust in handling but are more difficult to inspect after board attach.

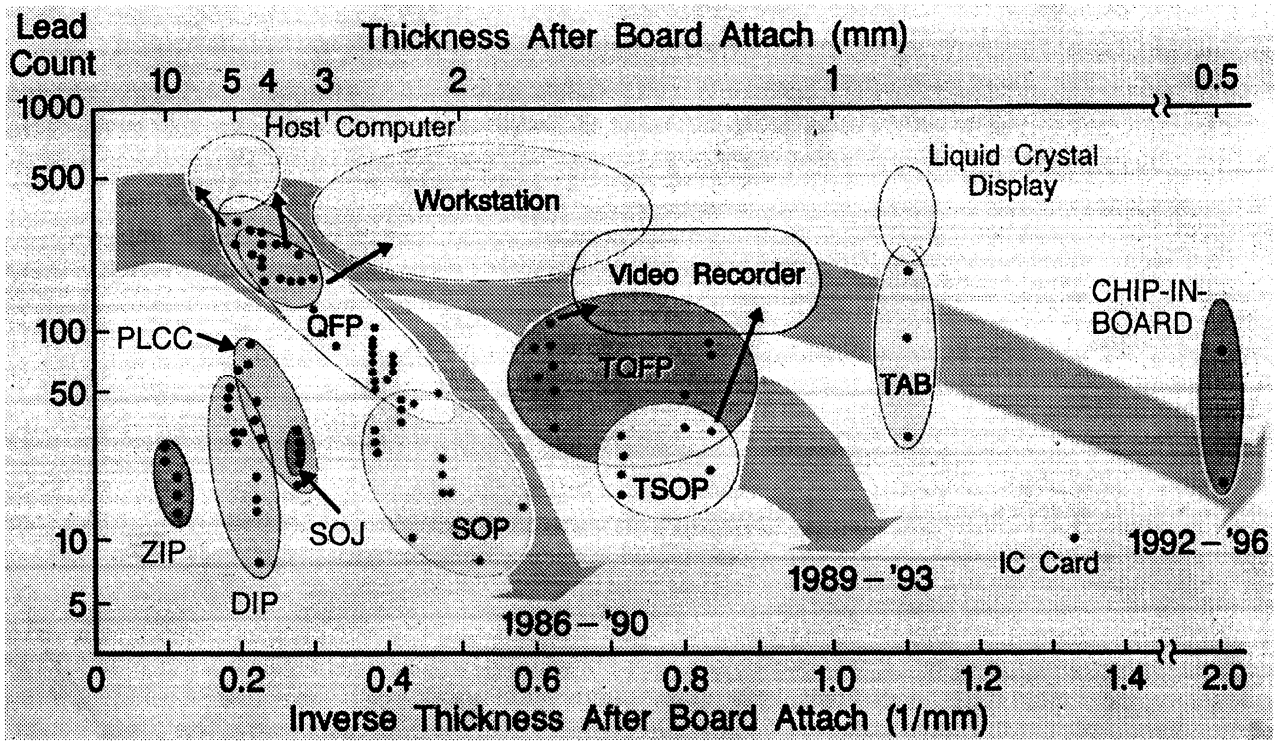
In addition to the economic advantage, surface-mount technology offers a number of technical advantages for device manufacturing as well as board assembly. Consequently, it is projected to be the overwhelmingly dominant packaging and assembly technology in the second half of this decade. For a more detailed discussion of the packaging trends, it is, therefore, sufficient to consider these trends in the light of surface-mount technology. The major trends in assembly and packaging are as follows:

- A push towards higher lead counts
- A trend toward smaller packages (reduction of two dimensions)
- A combination of the two trends above resulting in finer lead pitch
- An additional trend towards thinner packages (reduction of the third dimension)
- A need to harmonize chip characteristics with package characteristics to end up with the desired device parameters (especially electrical, thermal and reliability performance)
- A need to tolerate higher power density and dissipate more heat
- A demand for drastically higher reliability, especially for package integrity and minimum stress
- A drive towards time-to-market

† Palladium is used on lead frames (dips and surface-mount packages) to eliminate chemically aggressive fluxes used during solder finishing as well as eliminating lead from the assembly process.

Trend Towards Higher Lead Counts and Thinner Packages

Figure 2 plots the lead count (on a logarithmic scale) versus the assembled height of the semiconductor device over the assembly board (abscissa is linear for inverse thickness after board attach). The dots representing products in the TI device portfolio clearly group into major device families. The families arrange themselves to an evolutionary sequence in time, stretching to the end of this decade.



ZIP:	**Zig-Zag In-Line Package**	**QFP:**	**Quad Flat Pack**
DIP:	**Dual-In-Line Package**	**SOP:**	**Small-Outline Package**
PLCC:	**Plastic Leaded Chip Carrier**	**TSOP:**	**Thin Small-Outline Package**
PGA:	**Pin Grid Array**	**TQFP:**	**Thin Quad Flat Package**
SOJ:	**Small-Outline J-Leaded Package**	**TAB:**	**Tape Automated Bonding**

Figure 2. Applications Drive Lead Count

The applications (host computer, workstation, etc.) listed in Figure 2 symbolize the lead count needs of major device systems. They are grouped according to the thickness of the device boards, with the devices of liquid crystal display drivers occupying less than 1 mm height over the board. The remarkable feature of Figure 2 is the observation that none of the semiconductor device families satisfy the lead count needs of the application systems. Consequently, a strong and persistent push is currently exerted, indicated by the arrows, to drive the device families to ever more numerous connections to the outside world. This push is expected to persist for the next several years. It will be highlighted in a later section that surface-mount devices are particularly well suited to respond to the drive towards higher lead counts.

Furthermore, Figure 2 shows a few product families with extraordinarily thin device body and thus height after board attach. Tape automated bonding enables a reduction of the device thickness to less than 1 mm height over the board. As the final stage of this development, unencapsulated chips allow a chip-in-board assembly with the overall board thickness not more than the chip itself, i.e., less than 0.5 mm.

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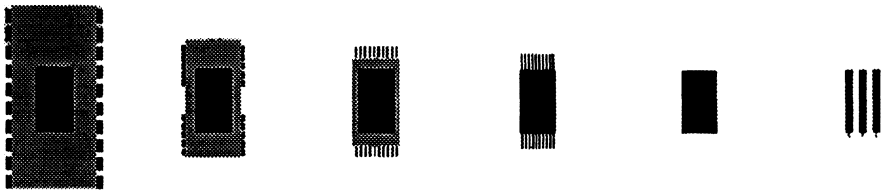
With surface-mount technology offering design and process flexibility to reduce the package size, strong economic pressure developed several years ago to shrink package sizes so that valuable board area is saved in assembly. The board utilization gains achievable are shown in Figure 3 by following the package shrinkage of a 1M/4M DRAM chip. The memory chip encapsulated in a 20-pin dual-in-line package (DIP) utilizes only 12% of the board area consumed by the package area, while for a thin small-outline package (TSOP) the utilization improved to 40% of the board area needed for the package. In flip-chip bonding, all the board area consumed is used by the chip itself; this technology represents optimum (100%) board utilization. It requires the trick of positioning the chips on their small sides to achieve several factors (300% and up) higher board usage for chip function per given chip area at flat assembly. Consequently, vertical assembly will be needed for future economic gains in valuable board area.



	DIP	SOJ	TSOP	Tape Bonding	Flip-Chip Bonding	Vertical Bonding
Board Attach Area	1.00	0.43	0.30	0.22	0.12	3 x 0.02
Chip Area % of Board	12	28	40	54	100	300
Lead Pitch (mm)	2.54	1.27	0.65	0.50	0.40	0.30

Package-Related Failure Mechanisms	
Increasing Importance	Diminishing Importance
• Package Integrity	• Stress in Chip
• Popcorn Effect	• Bond Chip-Out
• Material Fatigue/Crack	• Metallization Shifts
• Electrical and Thermal Failure	• Corrosion

Figure 3. Smaller Packages Demand Less Plastic With No Degradation of Reliability

It is important to realize the nonnegotiable precondition underlying this package shrinkage: the reliability of the device must not degrade. On the contrary, much effort is being expended by the industry to improve the reliability for less or even no plastic material around the chip. As listed in Figure 3, emphasis is placed on enhanced package integrity by eliminating separation of molding compound from chip and leadframe (popcorn effect), enhancing adhesion, suppressing material fatigue or cracking, and avoiding failures caused by electrical, thermal or moisture effects. In all these endeavors, Texas Instruments has been and is a leader in the industry, as the remarkably improved reliability data for accelerated testing of semiconductor surface-mount products has demonstrated.

To ensure this pivotal adhesion and moisture/temperature robustness, several product-type-specific materials/process criteria and design features have proven successful.

- Molding compounds have to be selected and routinely controlled to maximize chemical adhesion and strain/stress inner energy, especially at elevated temperature

  Quantitative tests are:

  – Lead pull force, to determine how lead design and mold compound affects adhesion

  – Strain/stress diagram of rods of polymerized molding compound as a function of the temperature

- Leadframe surfaces have to be clean and unoxidized.
- For leadframes with large chip pads, the bottom side should exhibit texturing, e.g., dimples or grooves, to allow mechanical anchoring of the molding material.
- Polyimide layers on the chip surface and on the bottom of the leadframe may enhance chemical adhesion to molding compounds.

In order to retain perfect adhesion after temperature cycling of the device (especially after water absorption by the plastic in steam exposure and preconditioning), the following features have proven helpful.

- The package has to be designed so that the plastic shows equal thickness above the chip and below the leadframe. This will produce equal compressive forces of the molding compound after polymerization.
- The coefficients of thermal expansion (CTE) of all parts should approach that of the molding material (20 ±8 ppm) if cracking of the plastic is a risk. Usually this drives a requirement for copper leadframe material.
- CTE should approach that of silicon (2 ppm) if fracturing of the silicon chip is a risk. Usually this drives a requirement for Alloy 42 leadframe material.
- Dry packing and shipping may be required for preventing moisture absorption in plastic.

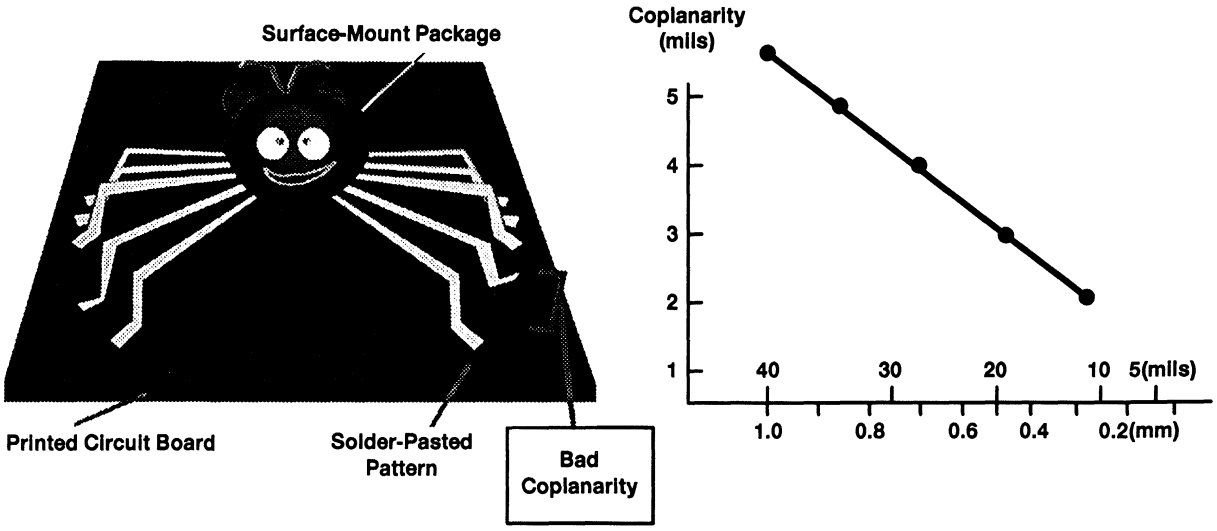
Accelerated tests for product reliability include temperature cycling, usually –65°C to 150°C, and thermal shock after moisture preconditioning. In addition, dynamic simulation of molding compound flow helps to define the characteristics of void-free filling of narrow cavities, like the molds of 1-mm and 0.5-mm thin packages.

Lead Pitch and Coplanarity

As long as the pitch of the metallic leads remains at 0.50 mm, the device is still easy to handle. How does one perform surface mounting, though, if the lead pitch shrinks to 0.3 mm or even 0.15 mm as predicted by roadmaps in Japan? Handling, transport, and pick-and-place operations will be difficult without some method of support such as a flexible leadframe material underlying the leads. After all, these lead pitches are of the order of magnitude of the diameter of the human hair.

Another method for easing the handling of ultra-fine leads is the molded frame or molded ring approach. In this method, both the chip encapsulation and the robust support frame are molded in one process step. The metallic leads, bent around the frame, permit device testing and burn-in without touching the actual leads. They will be excised and formed right before assembly so that undisturbed leads will undergo the surface-mount soldering process without risk of coplanarity problems.

Figure 4 highlights the serious coplanarity problem. It also shows quantitative data, collected from large-scale users, on acceptable tolerances for lead coplanarity as a function lead pitch. As can be seen from this graph, a coplanarity of 2 mils, representing a tolerance window of ±1 mil, is required for the lead pitch of 0.3 mm. Smaller pitch sizes will demand even tighter coplanarity windows – a tough feature to maintain.



TI Innovations

- **Lead inspection system**
- **Lead conditioner system**
- **Palladium preplated leadframes**
- **Delayed-reflow solder paste**

Figure 4. Lead Coplanarity of Surface-Mount Devices

Texas Instruments is offering several innovative approaches to support coplanarity solutions. An automated lead inspection system, available in the open market, measures the coplanarity quantitatively and determines whether any lead violates the allowed tolerance. The automated lead conditioner system corrects lead deviations by planarizing and straightening the leads. Both quality assurance systems are benchmark product lines.

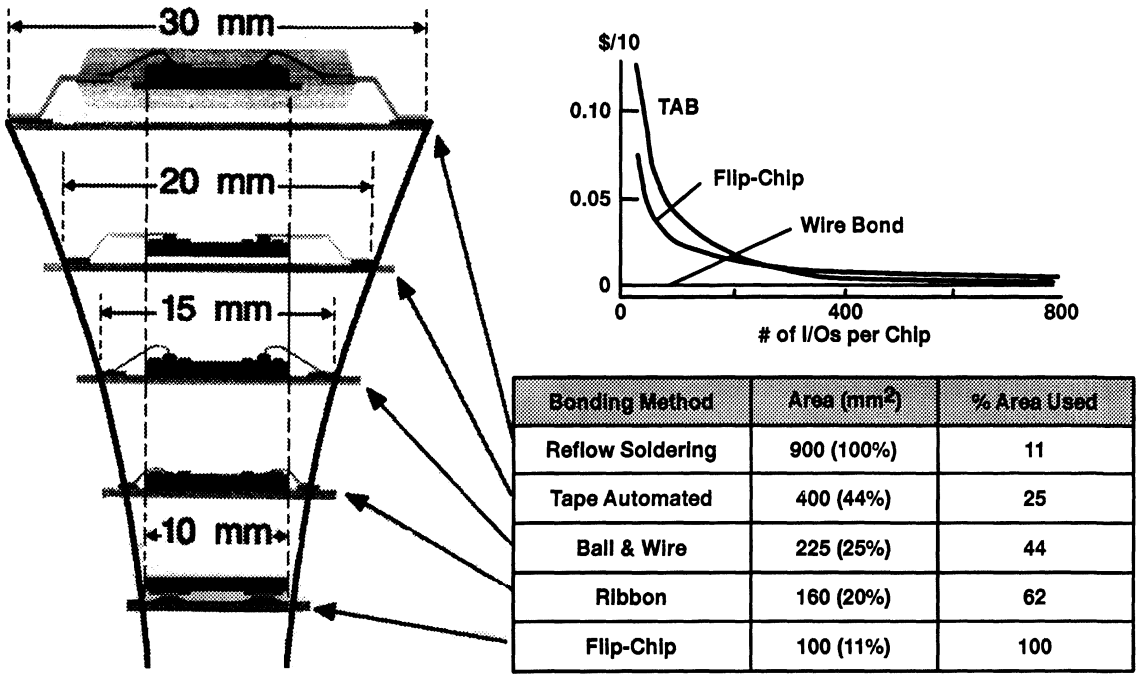
Furthermore, preplating of nickel-plated copper leadframes with a noble metal, such as palladium, simplifies solder wetting and supports problem-free surface mounting. Finally, for customers who still use vapor phase reflow, a delayed-reflow solder paste will help establish thermal equilibrium and a more uniform solder flow. (The palladium preplated lead frame is discussed in more detail in the chapter titled Principles of Surface Mount.)

From the standpoint of maximum board utilization, it can be anticipated that flip-chip assembly will eventually be adopted. Figure 5 dramatizes the advantage of flip-chip assembly (100% board area used for functionality) when it is compared to more conventional board attach techniques. Even the almost flat-looping ribbon wedge technique still wastes some board space around the chip for affixing the outer wedge connections. In contrast, from a cost standpoint, no assembly technique is as inexpensive as wire bonding so far. This may change, though, if low-cost reflow bumps become available and gang bonding (all connections of a chip made at one time) can be performed reliably.

Lead-Over-Chip (LOC) Package

The new LOC package, developed jointly by Texas Instruments and Hitachi, Ltd. for use with the 16M DRAM and applied to shrink 4M and 64M DRAMs, increases the silicon area that can be enclosed in a standard package, minimizes on-chip noise, and makes the electrical characteristics of the leads more uniform.

These advances are made possible by a unique system for connecting the chip to the pins of the package. This new lead frame design features leads that are equal distance from one another and equal length. Nonuniform spacing of leads in today's typical small-outline J-lead (SOJ) package can allow as much as a 23% variation in lead-to-lead capacitance.



Bonding Method	Area (mm^2)	% Area Used
Reflow Soldering	900 (100%)	11
Tape Automated	400 (44%)	25
Ball & Wire	225 (25%)	44
Ribbon	160 (20%)	62
Flip-Chip	100 (11%)	100

Figure 5. Board Usage Drives Interconnection Technology

The new package is a 28-/24-pin lead-on-chip with center bond (LOCCB) plastic SOJ (PSOJ). The 28-/24-pin SOJ package houses chips as large as 330 × 660 mils, conforms to JEDEC standards of 400 × 725 mils, and has dual power (V_{CC}) and ground (V_{SS}) pins. The LOC package also provides the most area-efficient chip design by minimizing the size of the on-chip power buses. The package leadframe itself routes power above the chip surface. Efficient use of the LOC package and effective power distribution require that the bond pads be in the chip's center rather than on its periphery (see Figure 6).

Voltage drops (IR) and difficult-to-manage thermal and mechanical stresses are foremost concerns. Thus the project makes wide use of the modeling and simulation strengths of both companies to design the LOCCB package. These joint efforts led to a 16M DRAM SOJ package exhibiting low-noise power distribution on-chip, less than 0.2 V drop, and less than 10 mΩ resistance and 6 nH inductance.

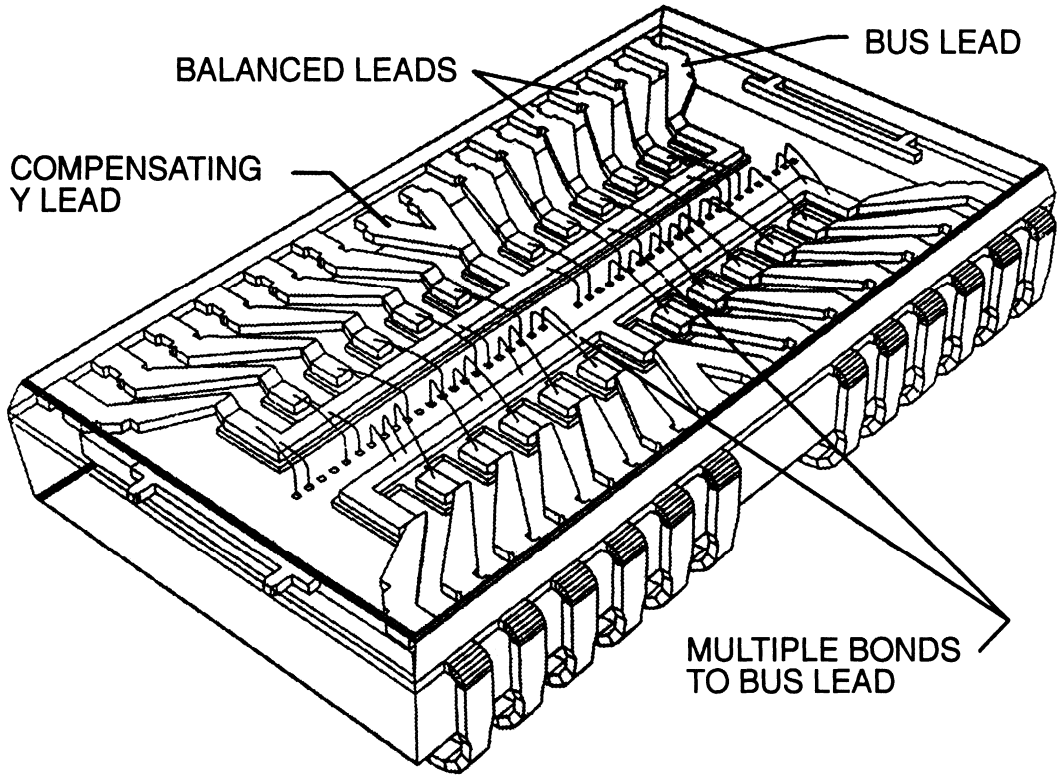


Figure 6. Lead-Over-Chip 16M DRAM Package

A unique balanced capacitance lead frame for maintaining uniform input pin capacitance is at the heart of the TI/Hitachi LOCCB design. All internal leads are equal distance from one another. A passive Y lead in the middle of the lead frame and on either side minimizes differences in pin-to-pin capacitance.

Two metal bus lines, integral to the lead frame structure, run parallel above the length of the chip. One links the dual V_{SS} pins located at the ends of the package while the other bus line links the corner dual V_{CC} pins on the other side of the chip. Multiple bonds are thus provided off the V_{SS} and V_{CC} bus lines to the circuit. With dual pins for each bus, resistance is reduced to less than 10 mΩ, effective inductance to about 6 nH, and electrical noise is less than 0.2 V.

2 Plastic Surface-Mount

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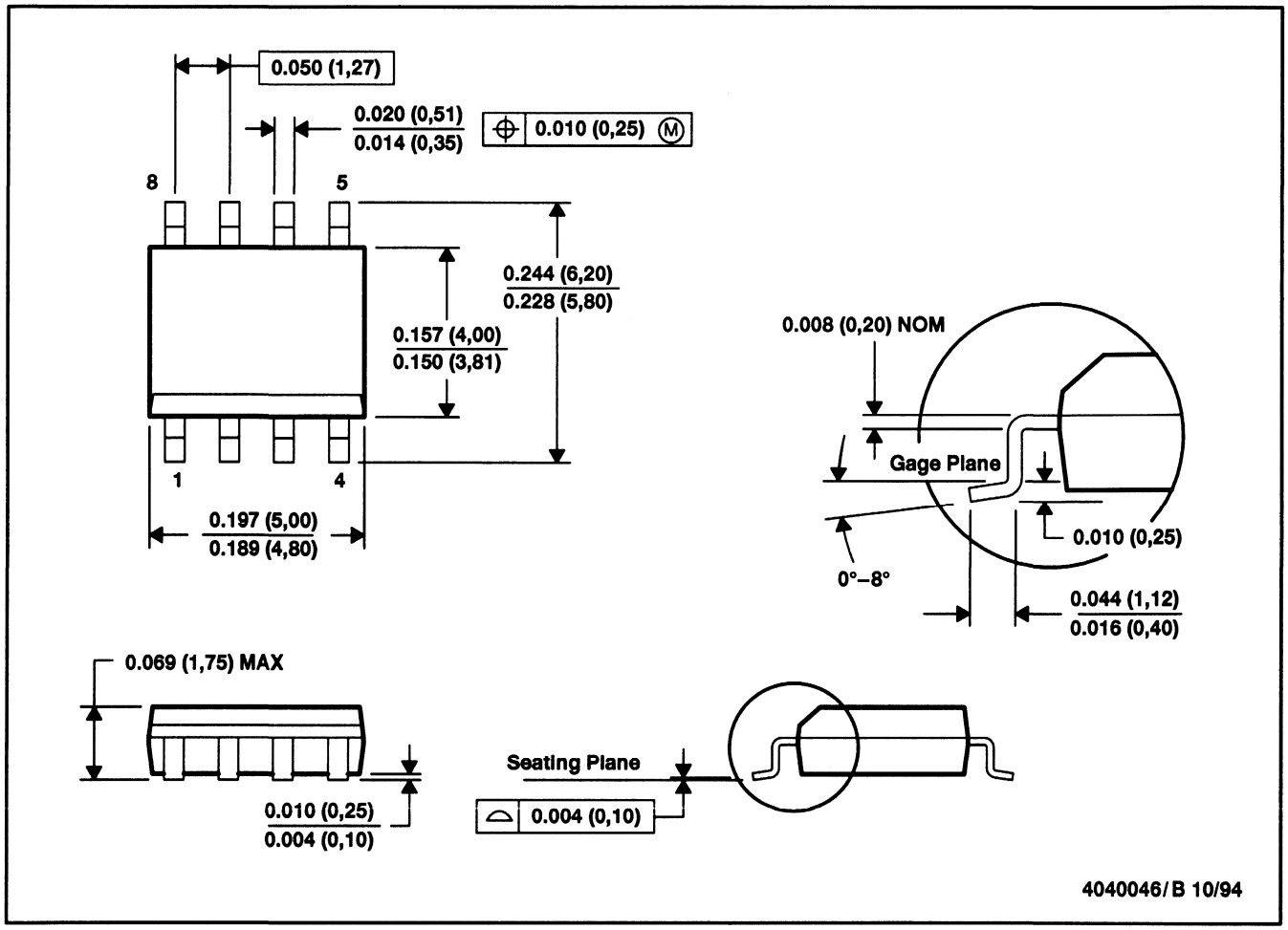
DNA (R-PDSO-G8) **PLASTIC SMALL-OUTLINE PACKAGE**



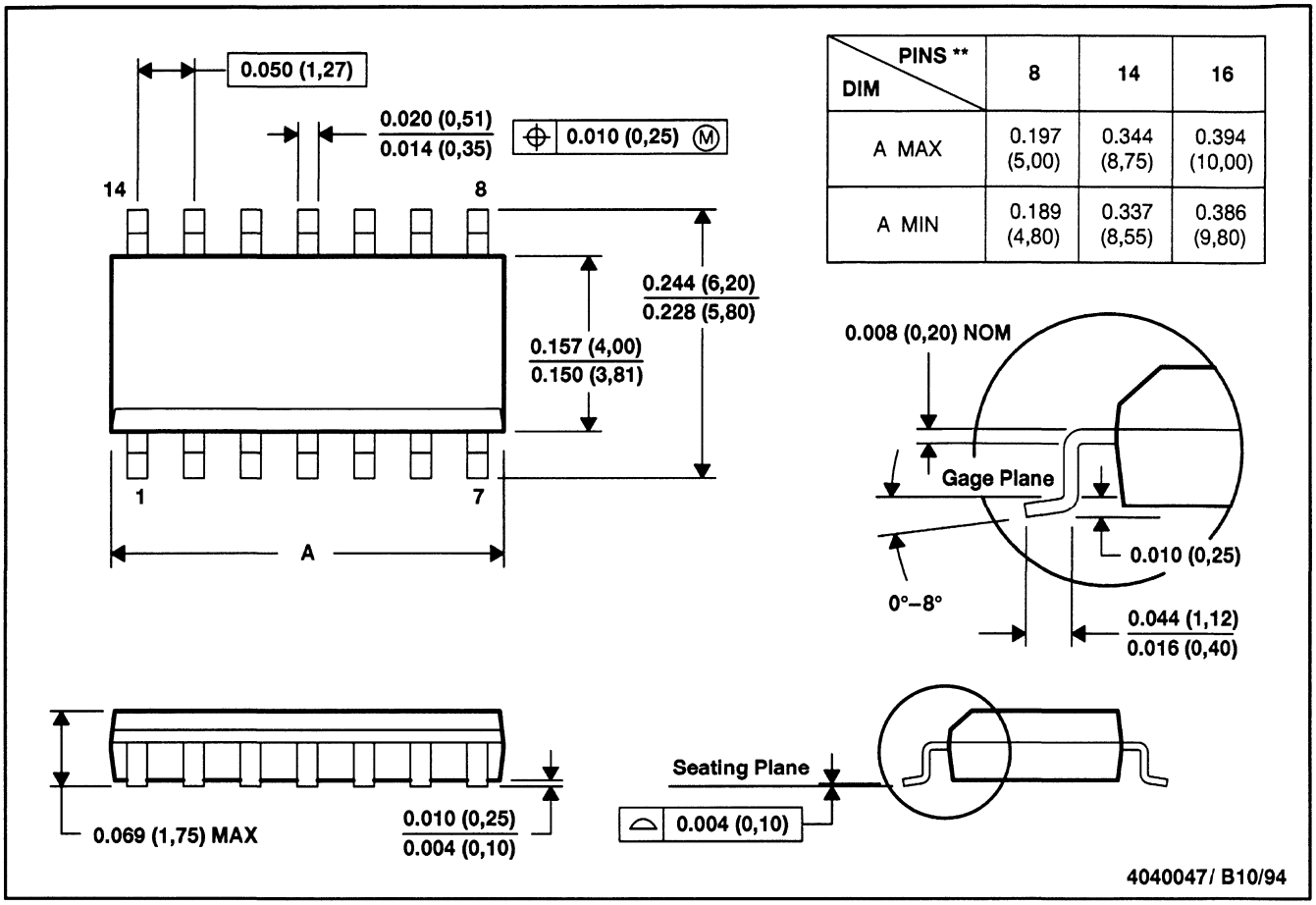
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not exceed 0.006 (0,15).
D. Four center pins are connected to die mount pad
E. Falls within JEDEC MS-013

OCTOBER 1994

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PIN SHOWN



DIM \ PINS **	8	14	16
A MAX	0.197 (5,00)	0.344 (8,75)	0.394 (10,00)
A MIN	0.189 (4,80)	0.337 (8,55)	0.386 (9,80)

NOTES: A. All linear dimensions are in inches (millimeters).
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C. Body dimensions do not include mold flash or protrusion, not exceed 0.006 (0,15).
D. Four center pins are connected to die mount pad
E. Falls within JEDEC MS-012

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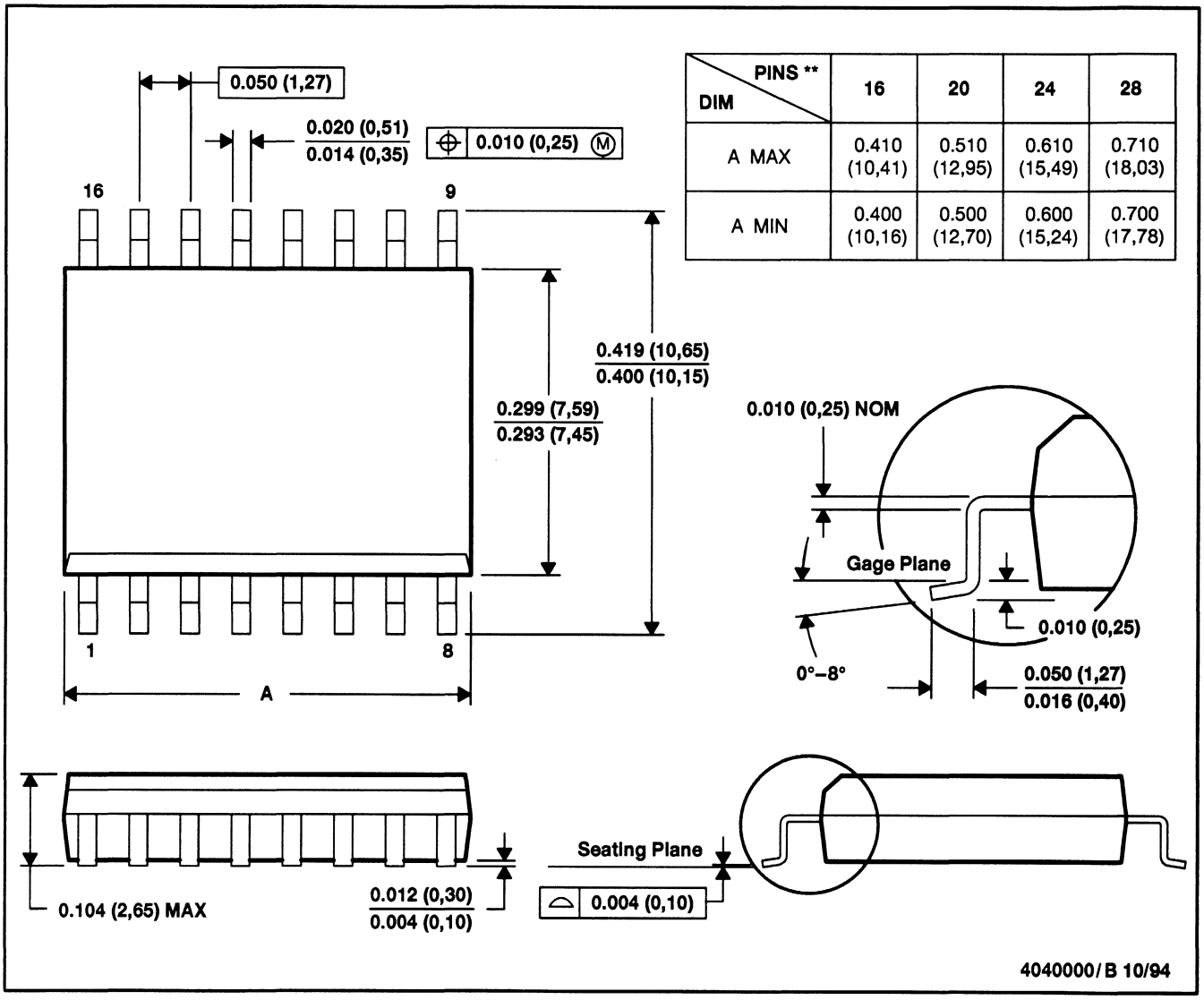
DW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

16 PIN SHOWN



DIM \ PINS **	16	20	24	28
A MAX	0.410 (10,41)	0.510 (12,95)	0.610 (15,49)	0.710 (18,03)
A MIN	0.400 (10,16)	0.500 (12,70)	0.600 (15,24)	0.700 (17,78)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-013

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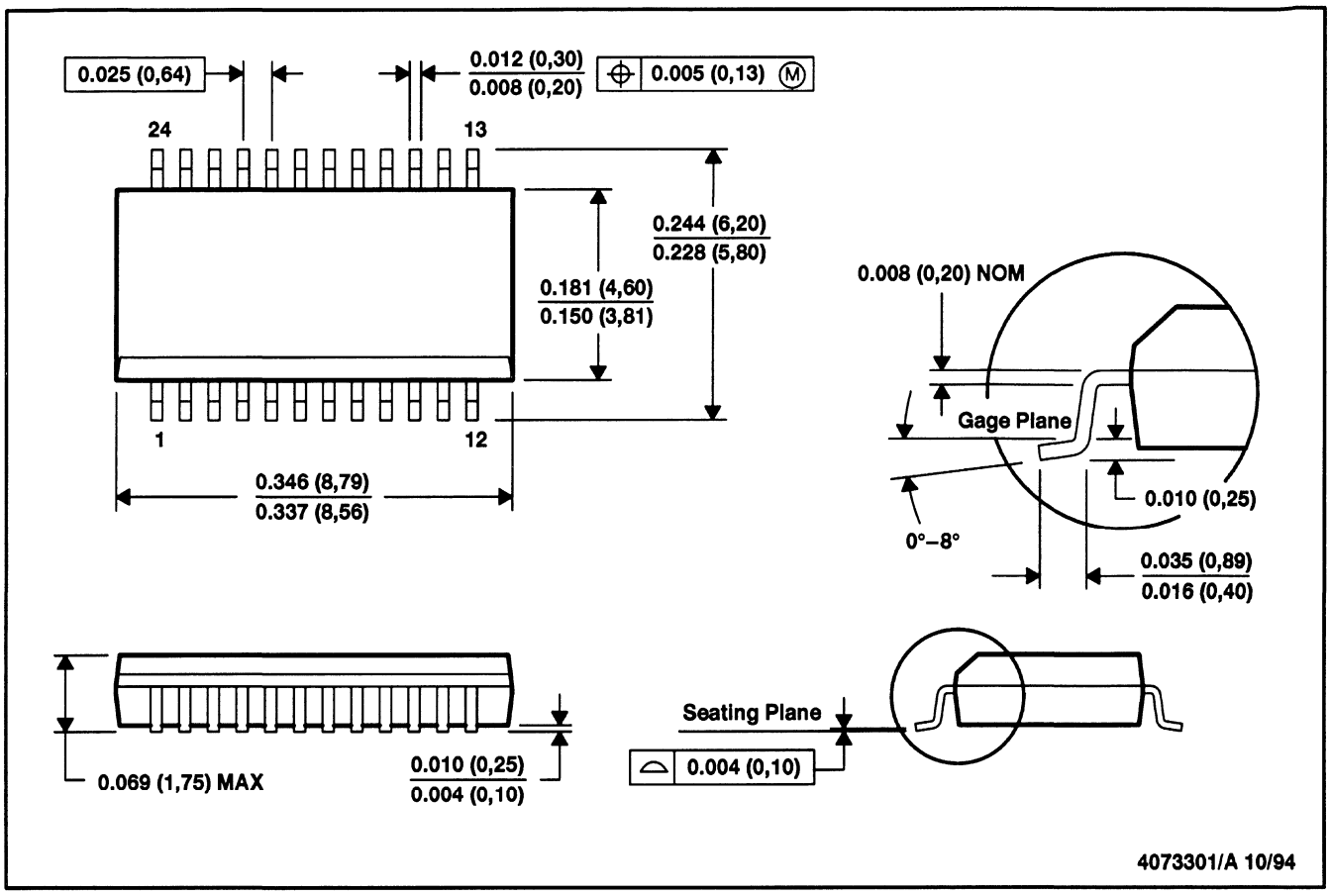
DBQ (R-PDSO-G20/24) PLASTIC SMALL-OUTLINE PACKAGE

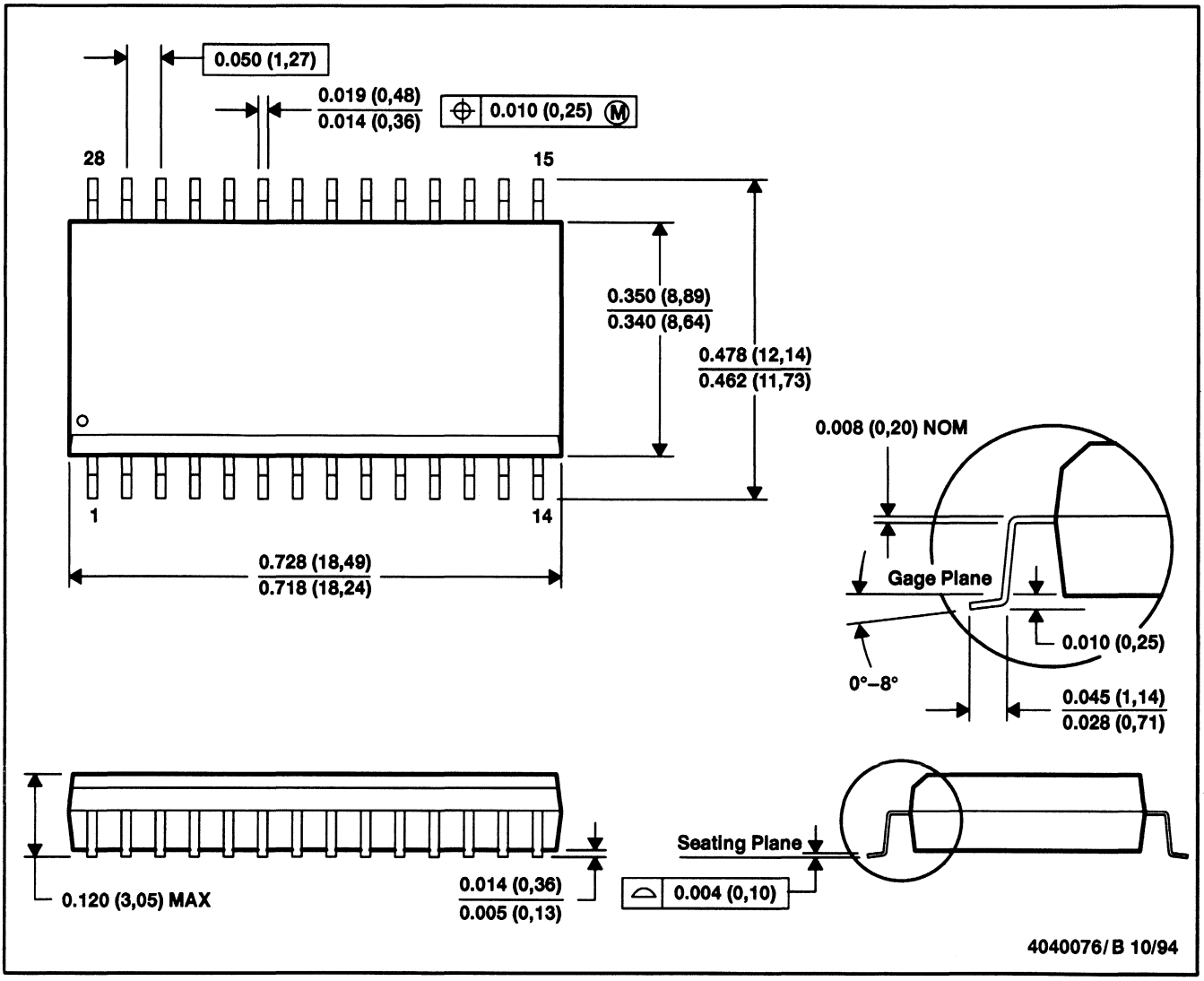
16 PIN SHOWN



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).
D. Falls within JEDEC MS-137

OCTOBER 1994

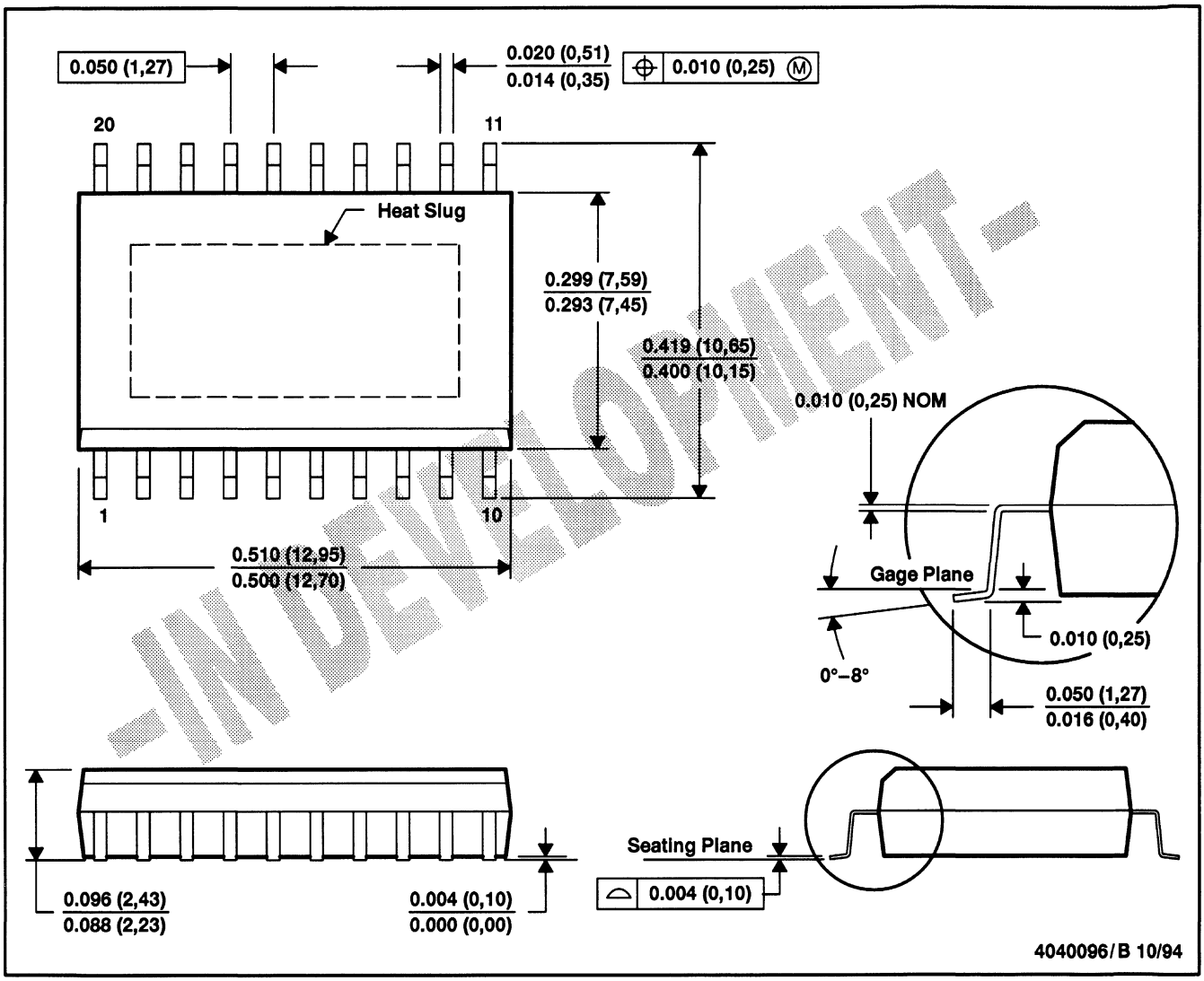
DV (R-PDSO-G28) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

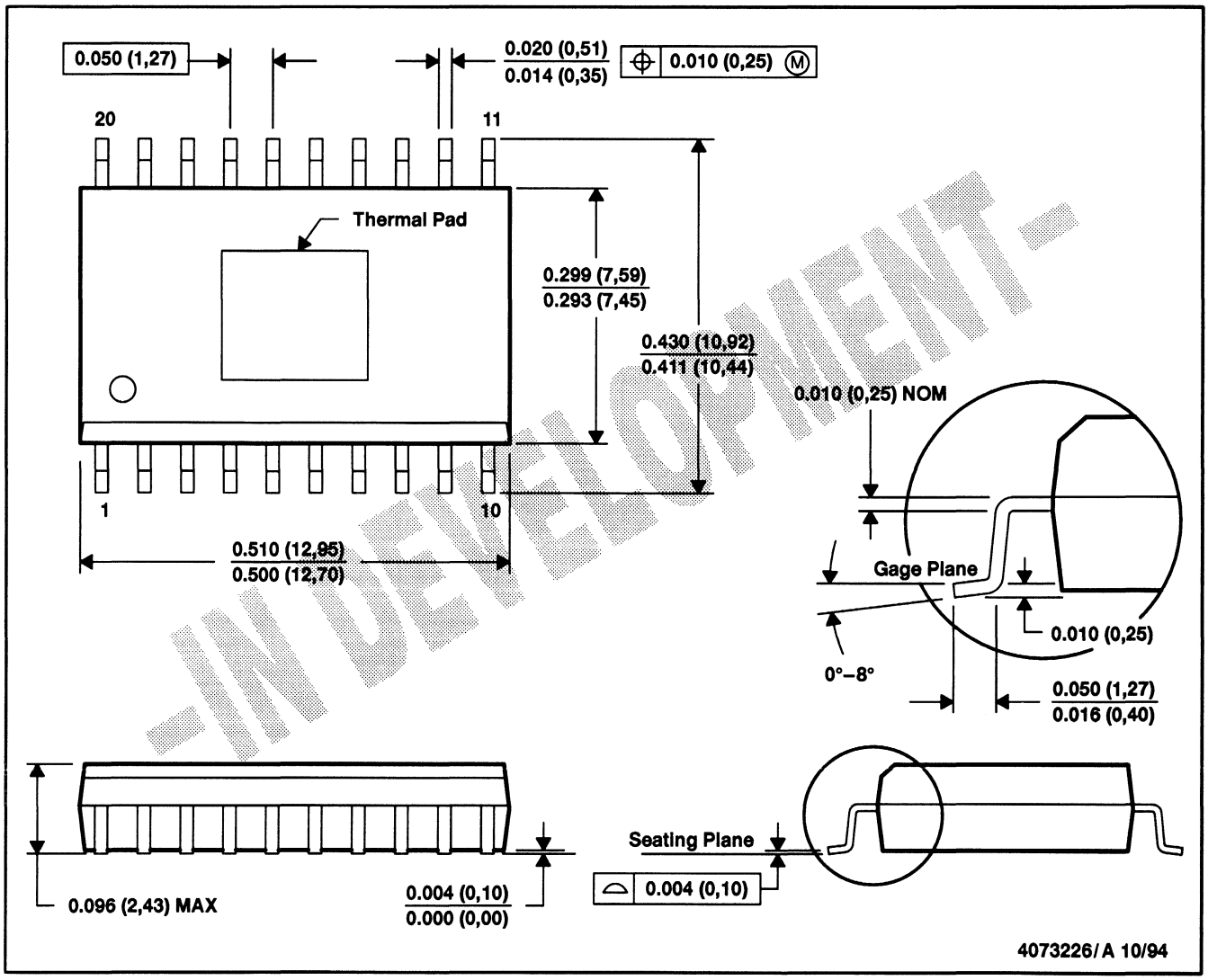
DWH (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.006 (0,15).
D. Thermally enhanced molded plastic package with a heat slug (HSL) exposed on package bottom is electrically and thermally connected to the backside of the die and leads 3,4,7,8,12,13,16 and 17.

OCTOBER 1994

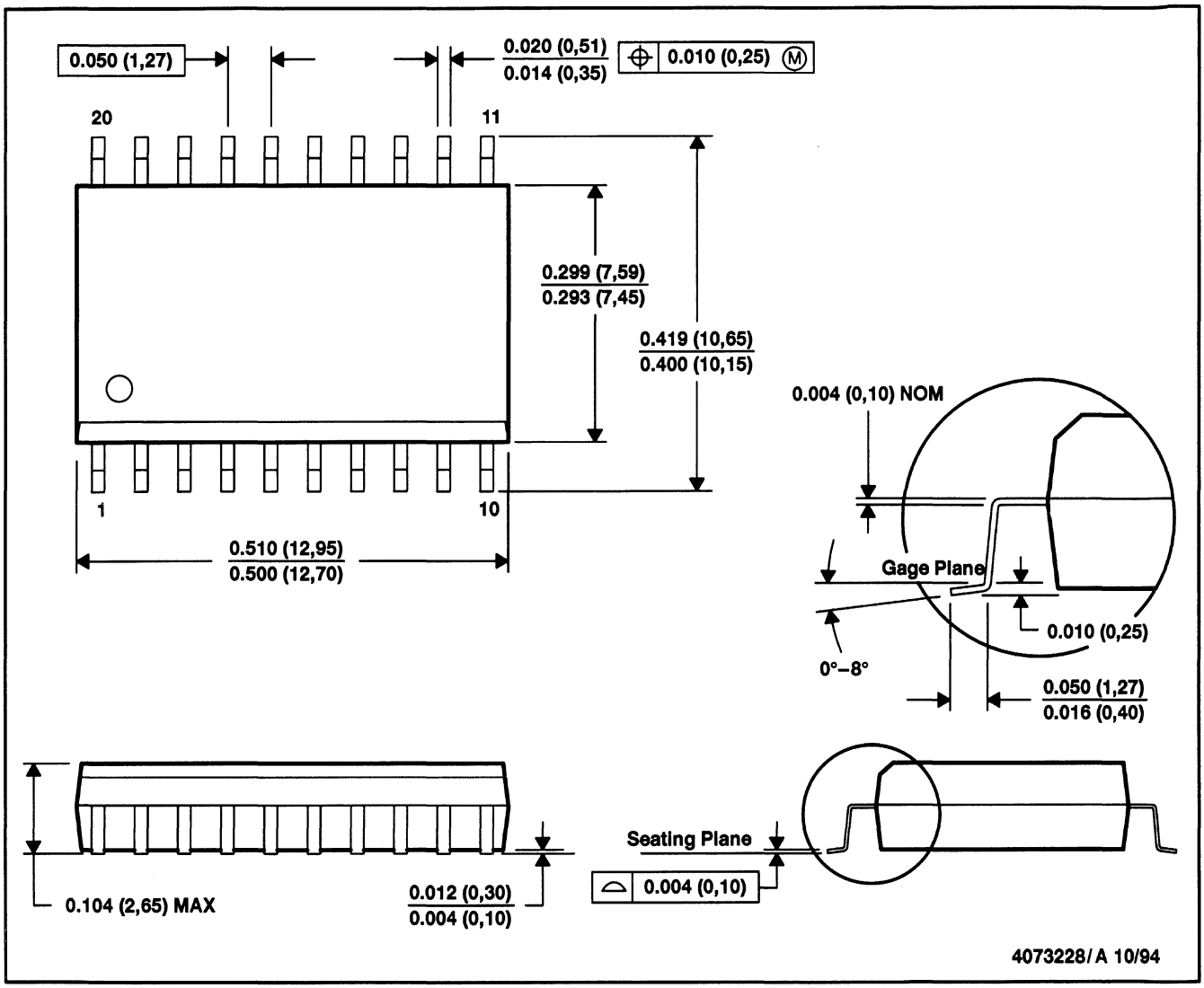
DWP (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The package thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. The solderable pad is electrically and thermally connected to the backside of the die and leads 1, 10, 11 and 20.

OCTOBER 1994

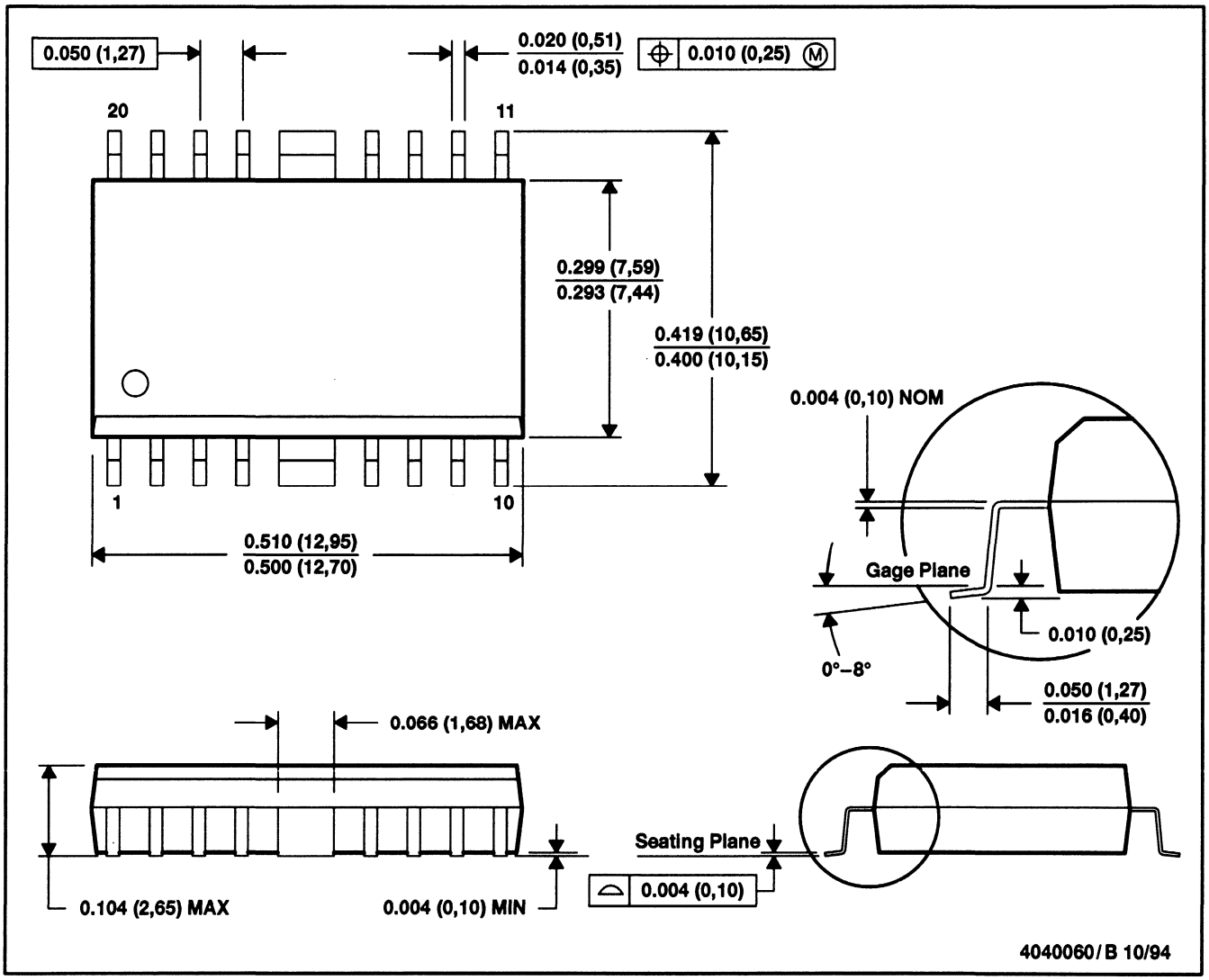
DWT (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with four center leads connected to die pad
D. Falls within JEDEC MS-013

OCTOBER 1994

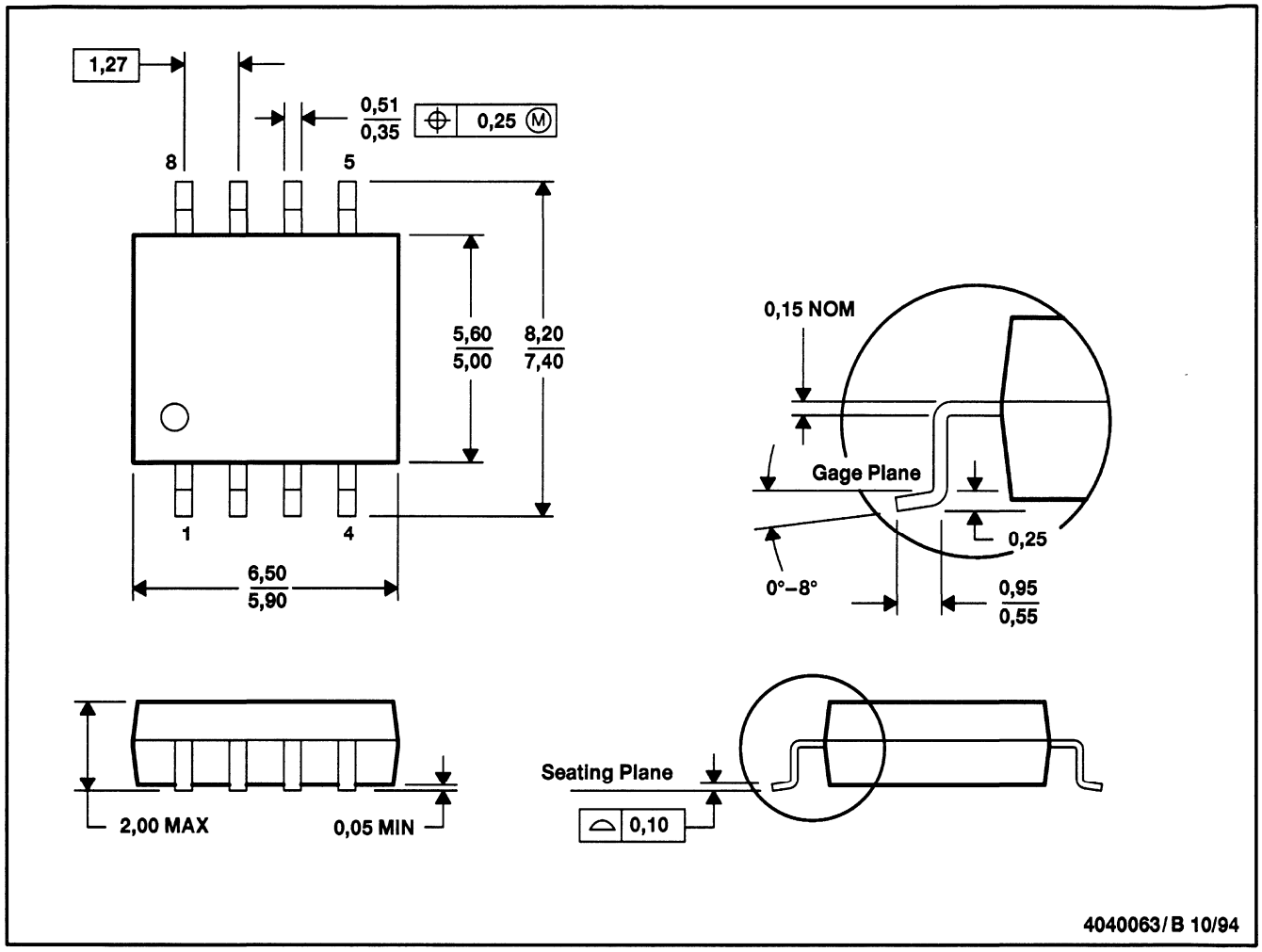
DZA (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.
D. Thermally enhanced molded plastic package with a heatsink

OCTOBER 1994

PS (R-PDSO-G8) **PLASTIC SMALL-OUTLINE PACKAGE**

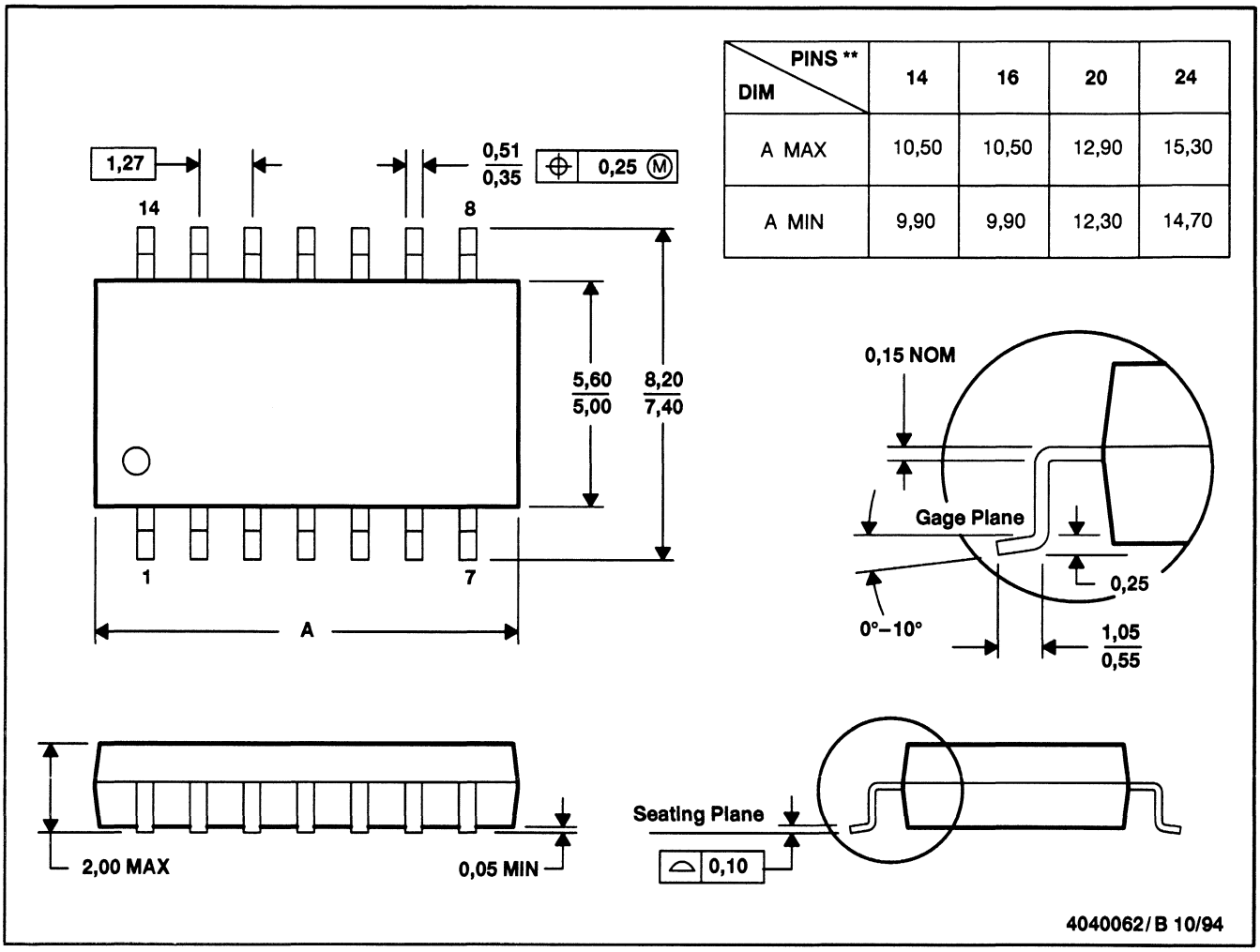


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

OCTOBER 1994

NS (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN

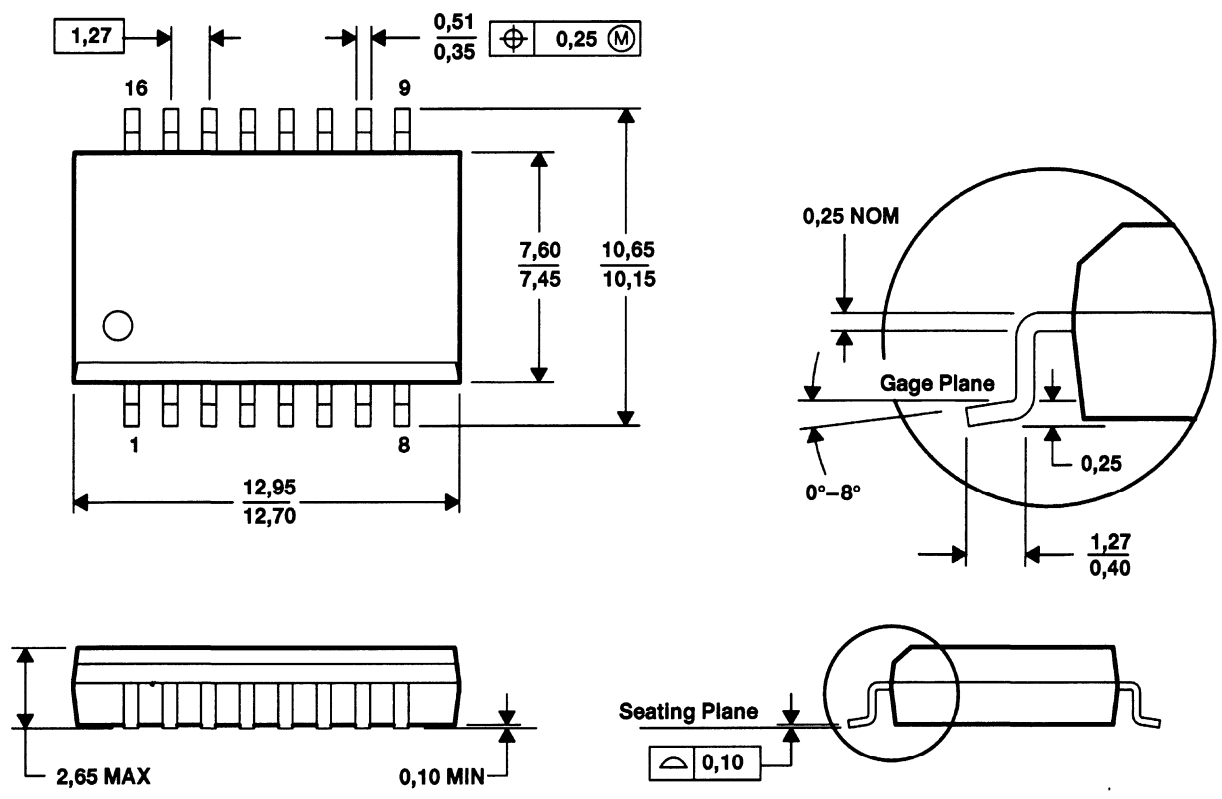


DIM \ PINS **	14	16	20	24
A MAX	10,50	10,50	12,90	15,30
A MIN	9,90	9,90	12,30	14,70

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

OCTOBER 1994

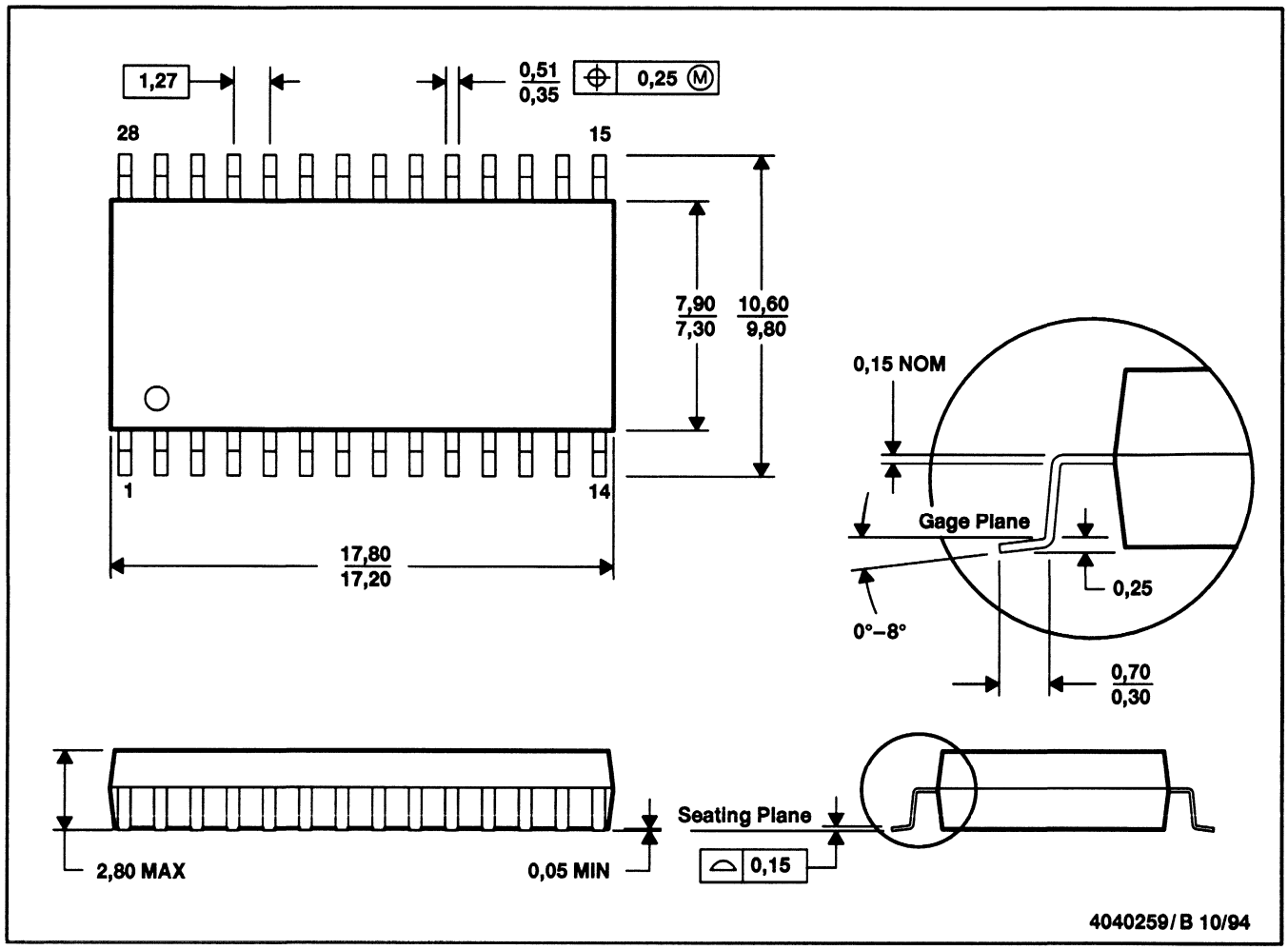
DWA (R-PDSO-G16) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

OCTOBER 1994

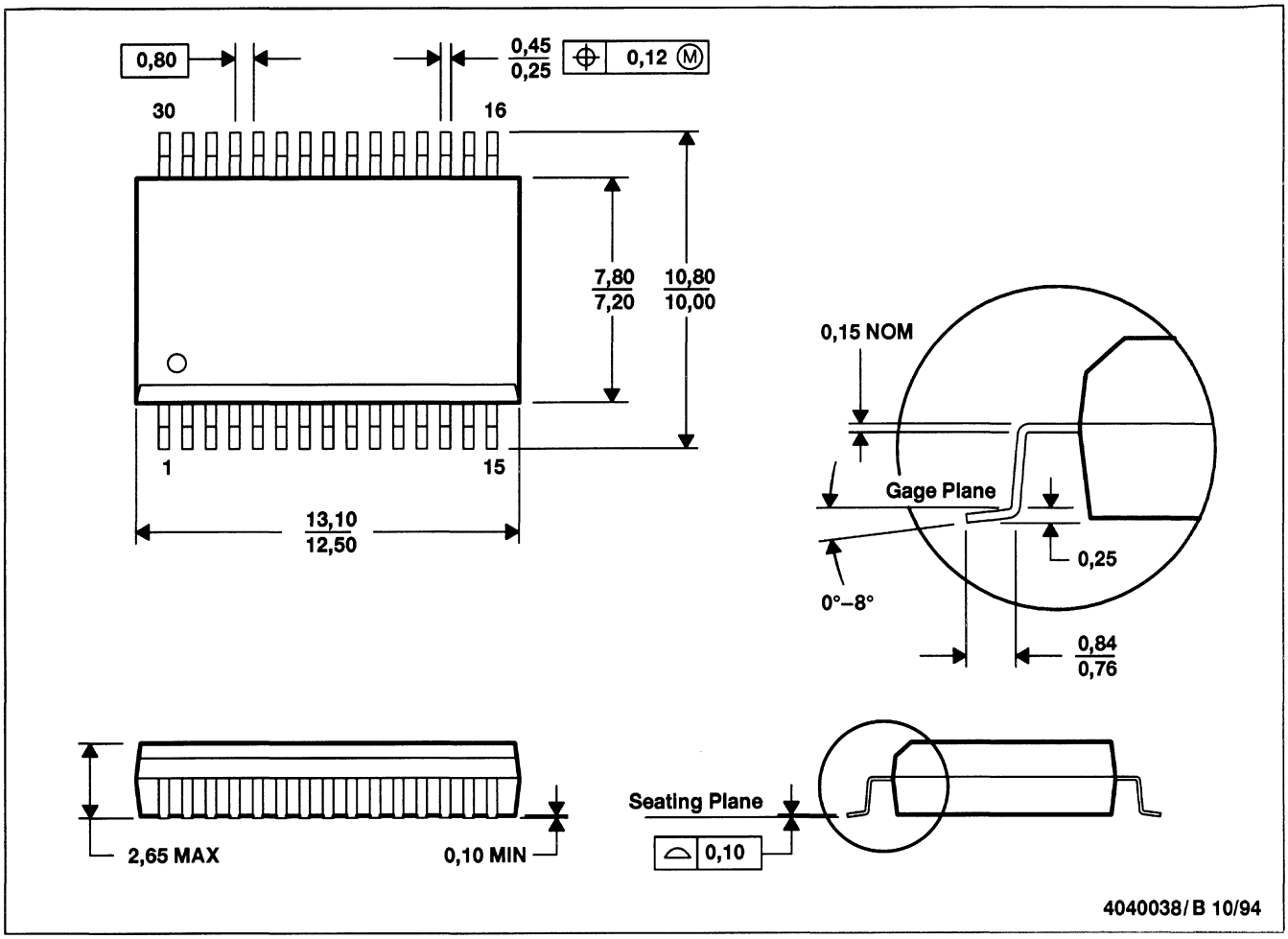
DWB (R-PDSO-G28) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

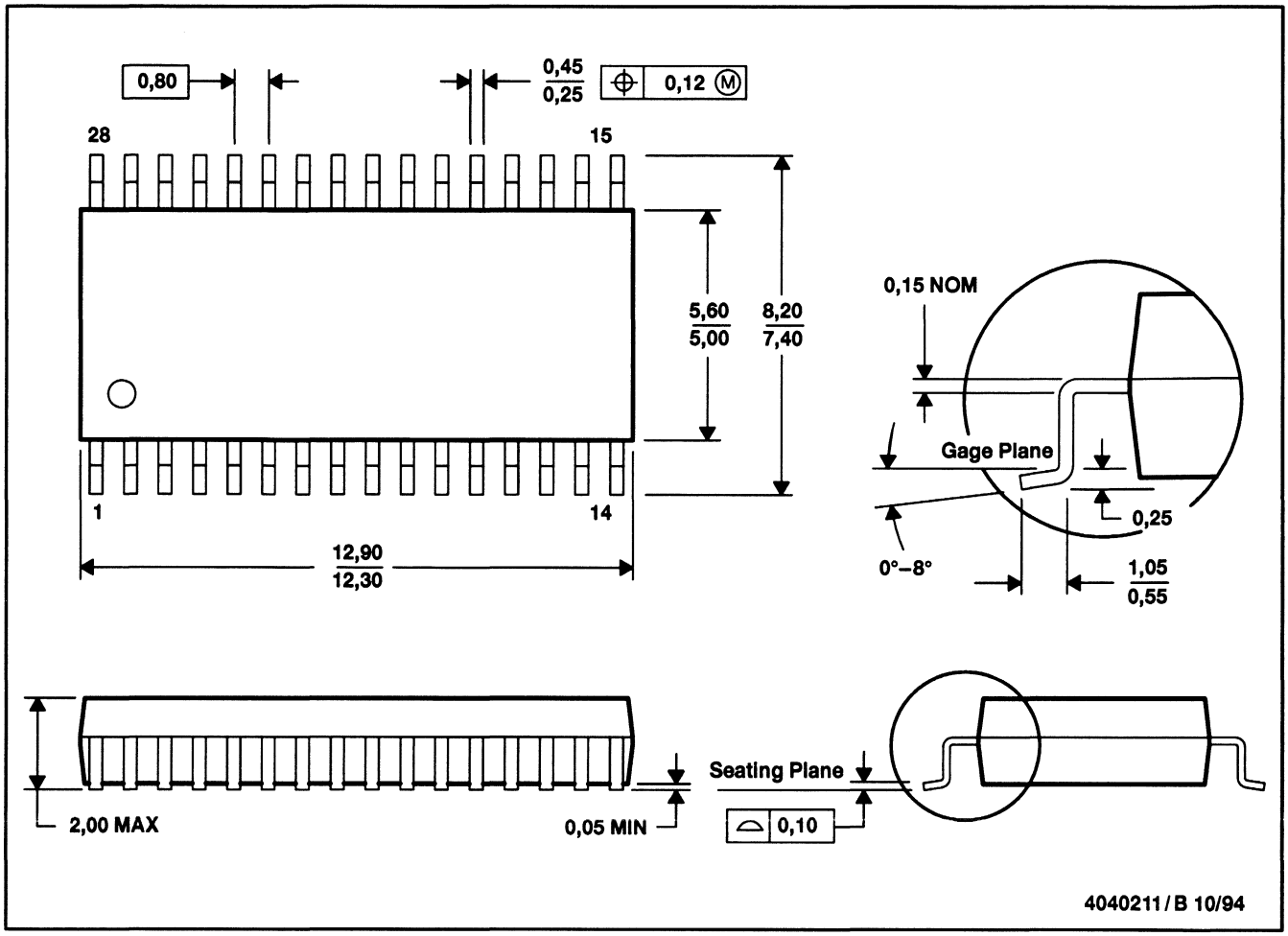
DF (R-PDSO-G30) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

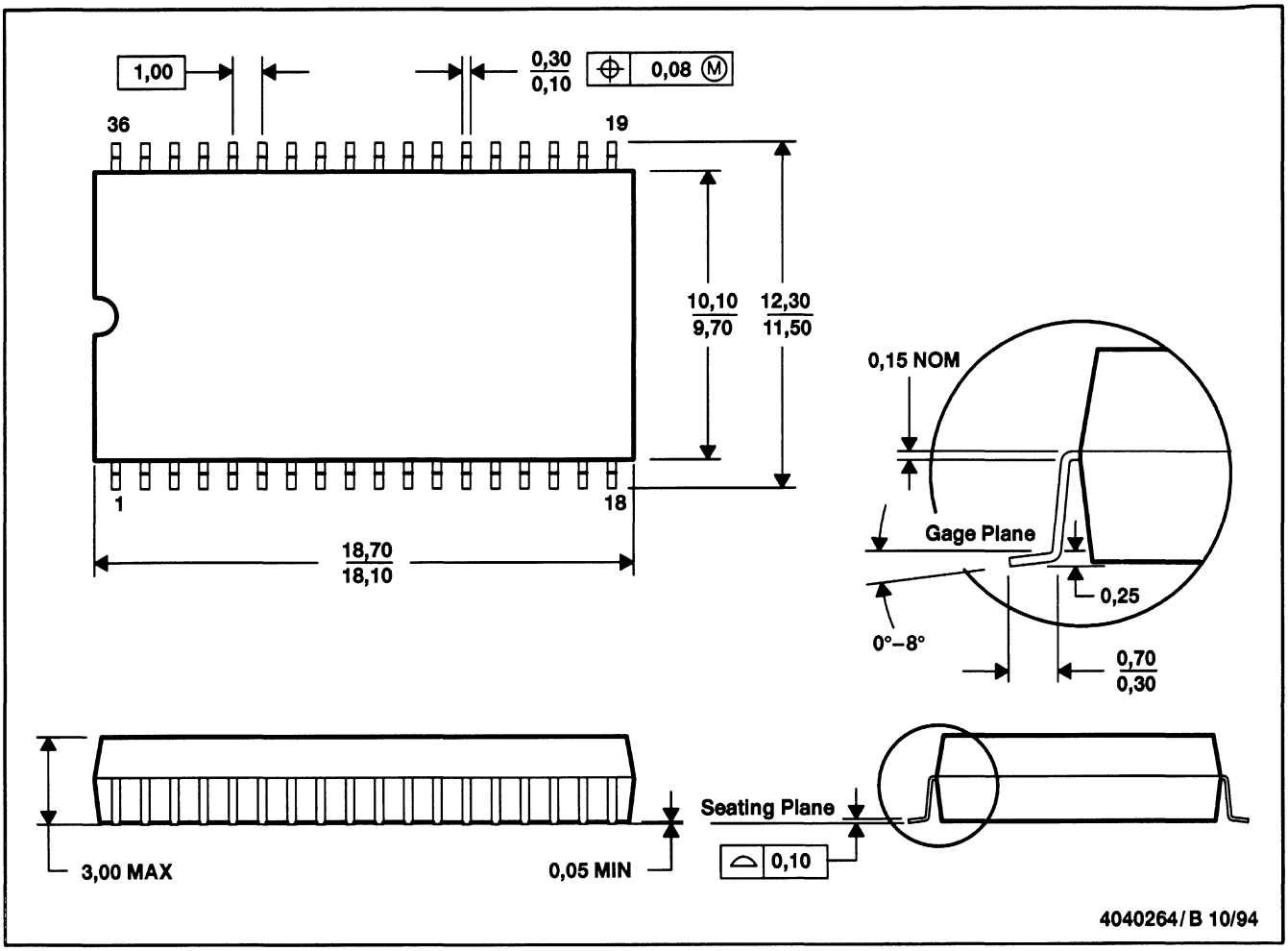
DBA (R-PDSO-G32) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

OCTOBER 1994

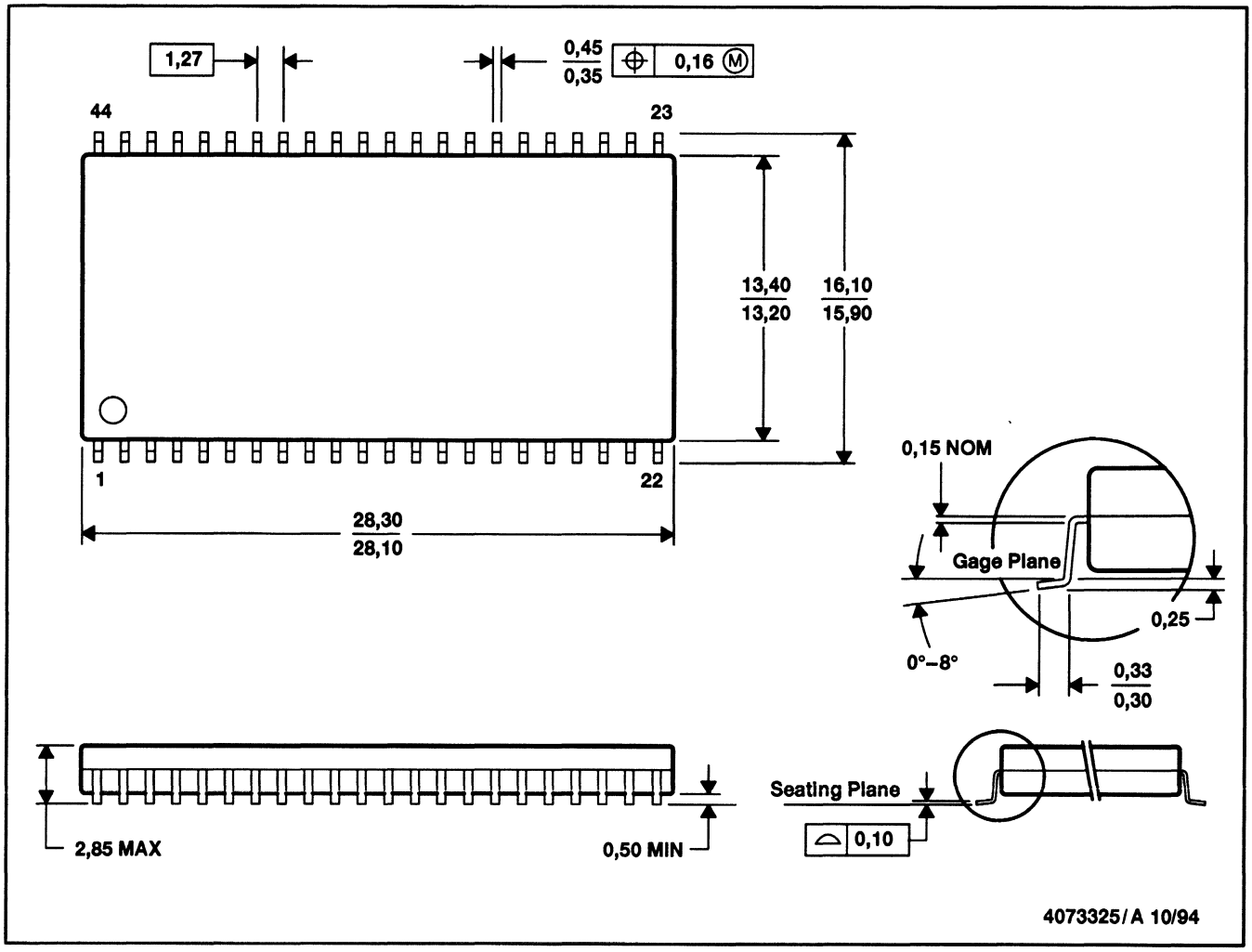
DT (R-PDSO-G36) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

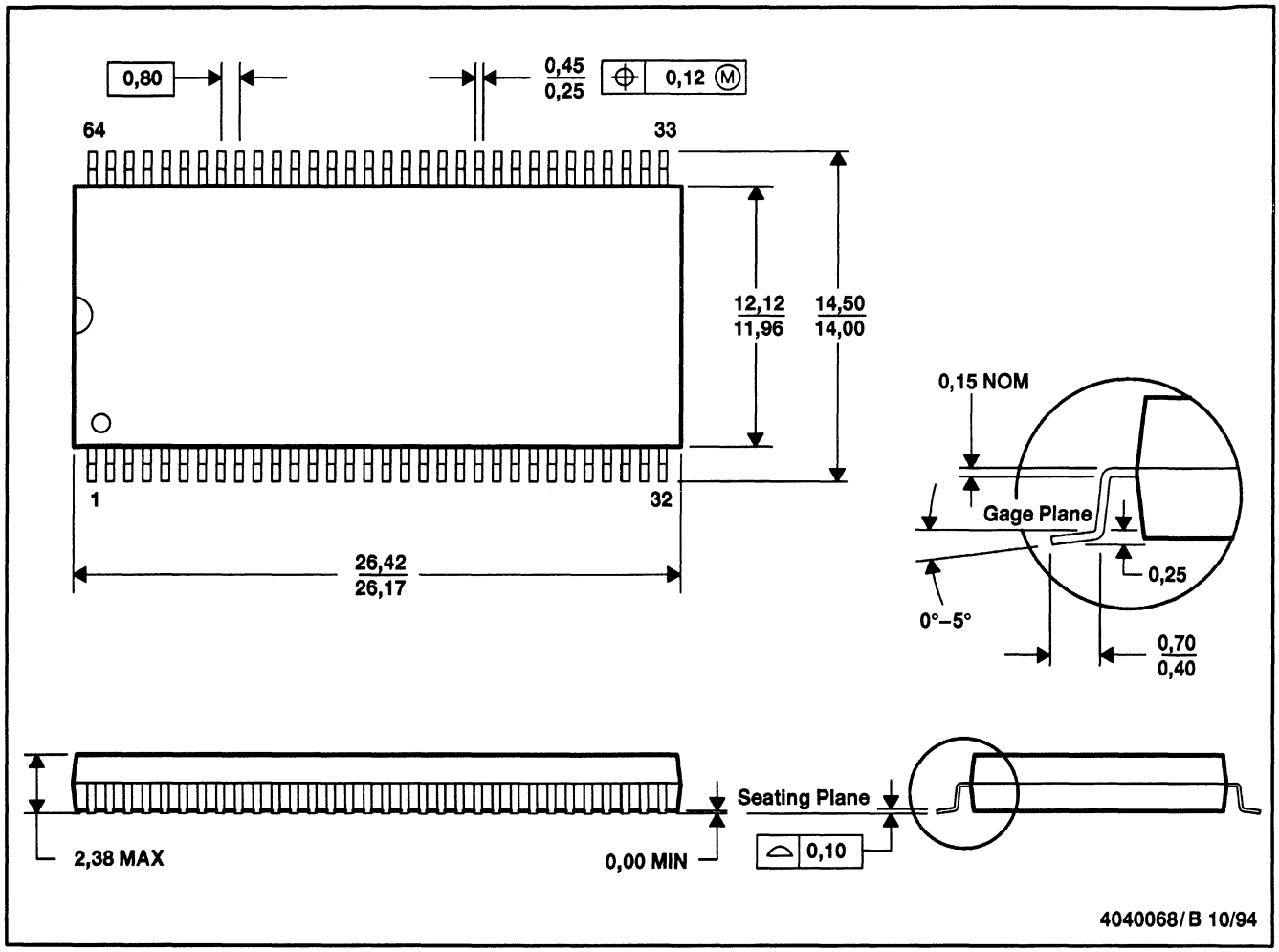
DBJ (R-PDSO-G44) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

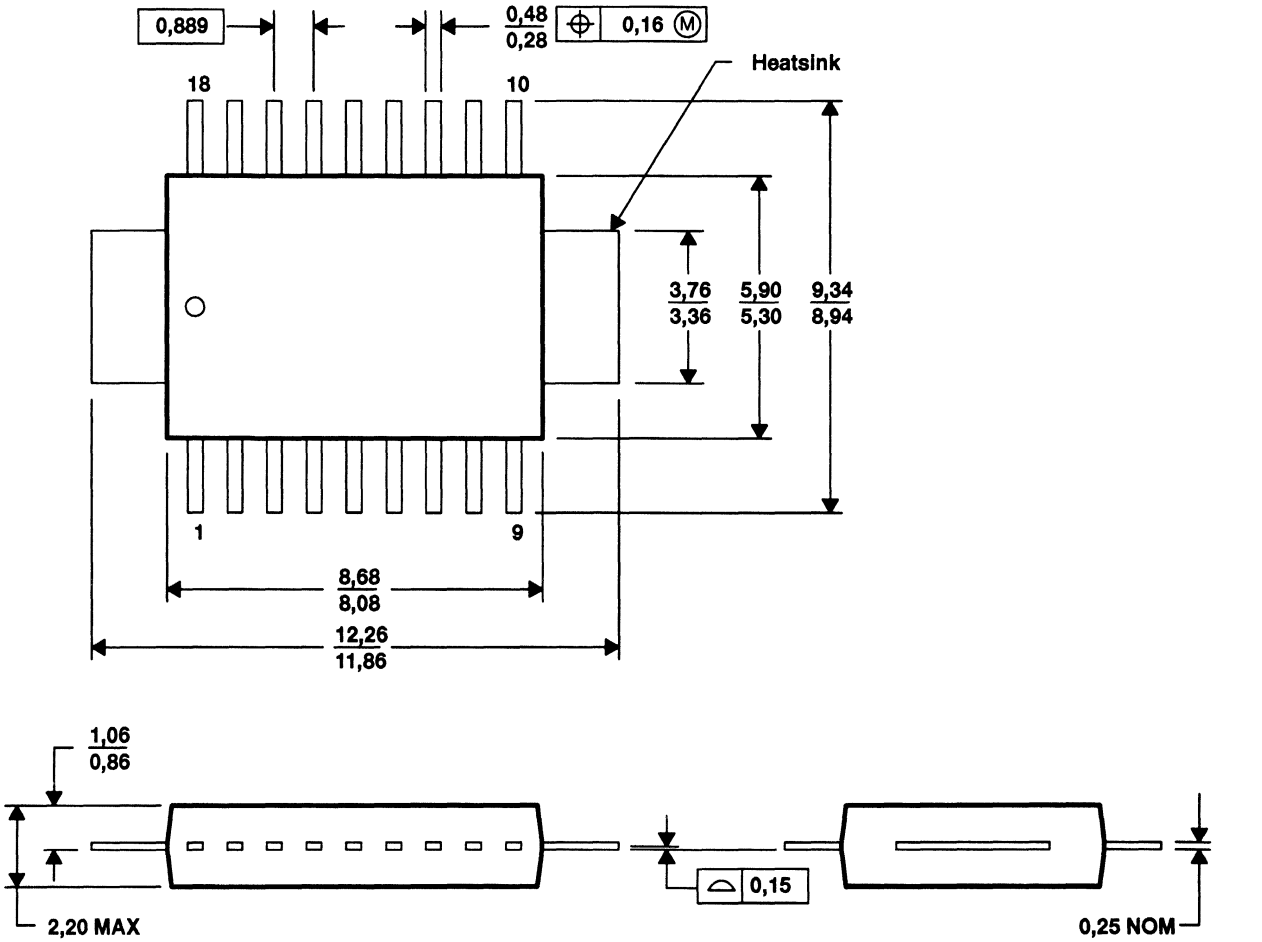
DGH (R-PDSO-G64) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold flash or protrusion. Maximum mold protrusion is 0,125.

OCTOBER 1994

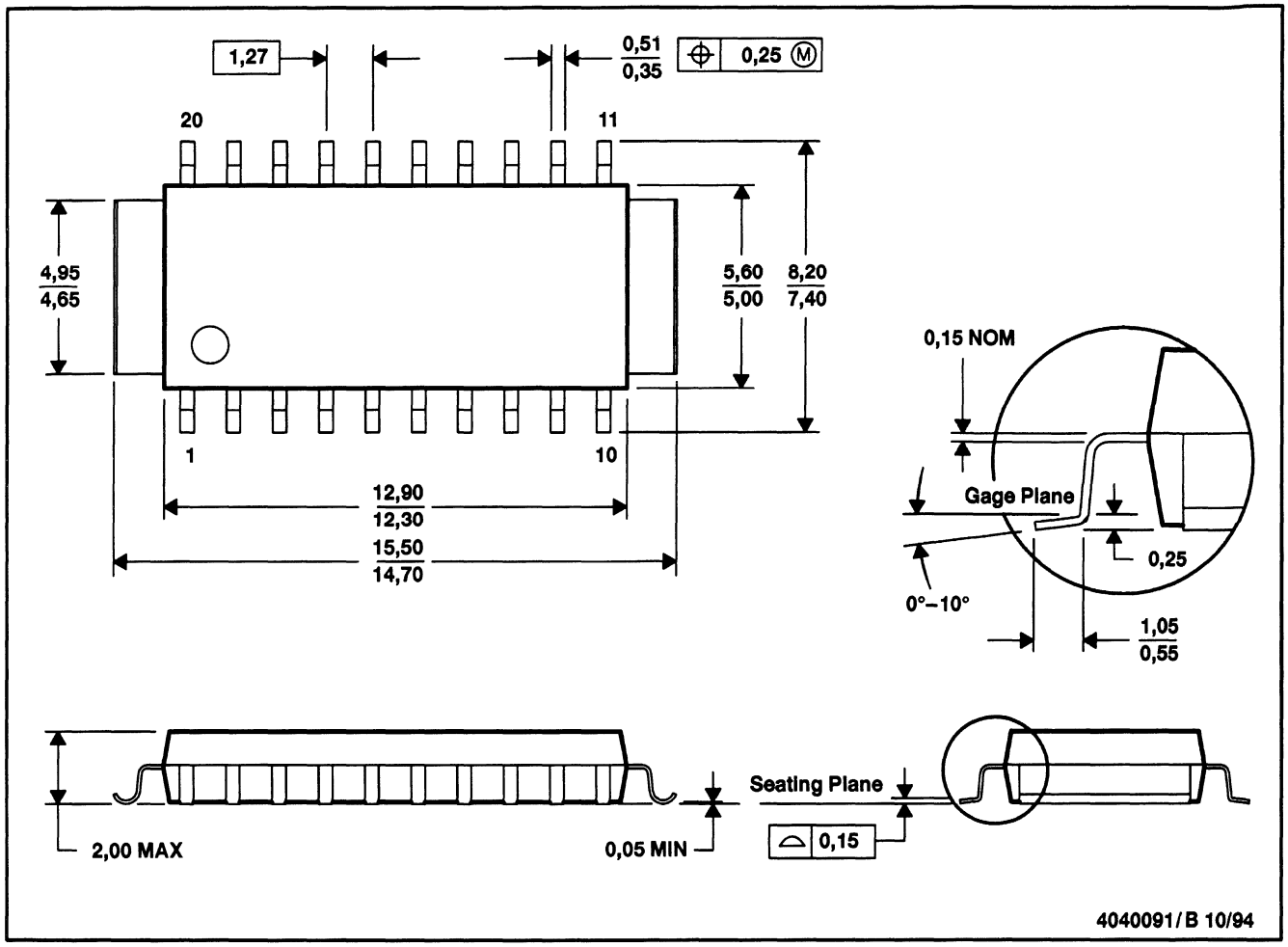
KL (R-PDFP-F18) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with end tabs connected to die pad

OCTOBER 1994

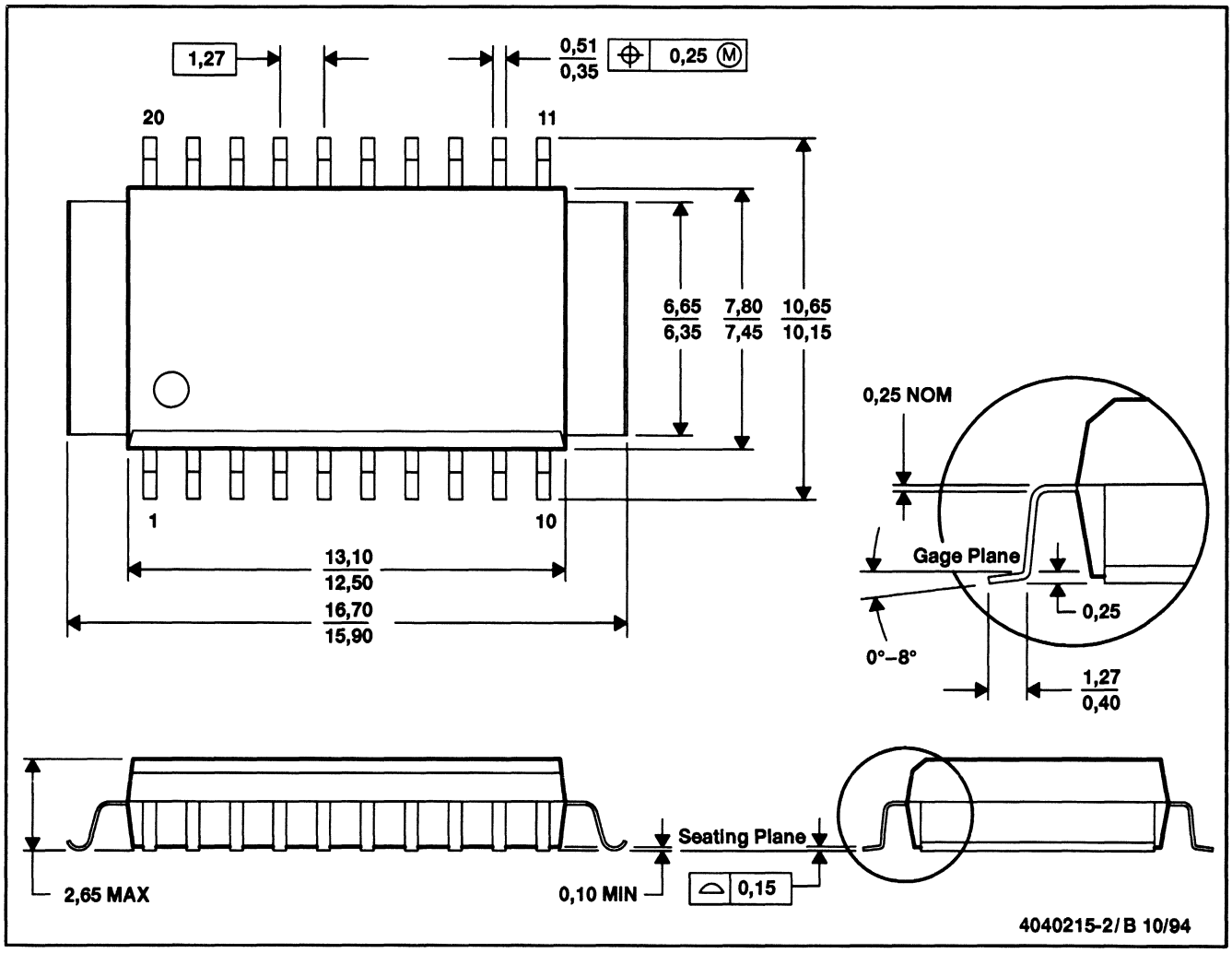
DSA (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Thermally enhanced molded plastic package with end tabs connected to die pad

OCTOBER 1994

DSB (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**

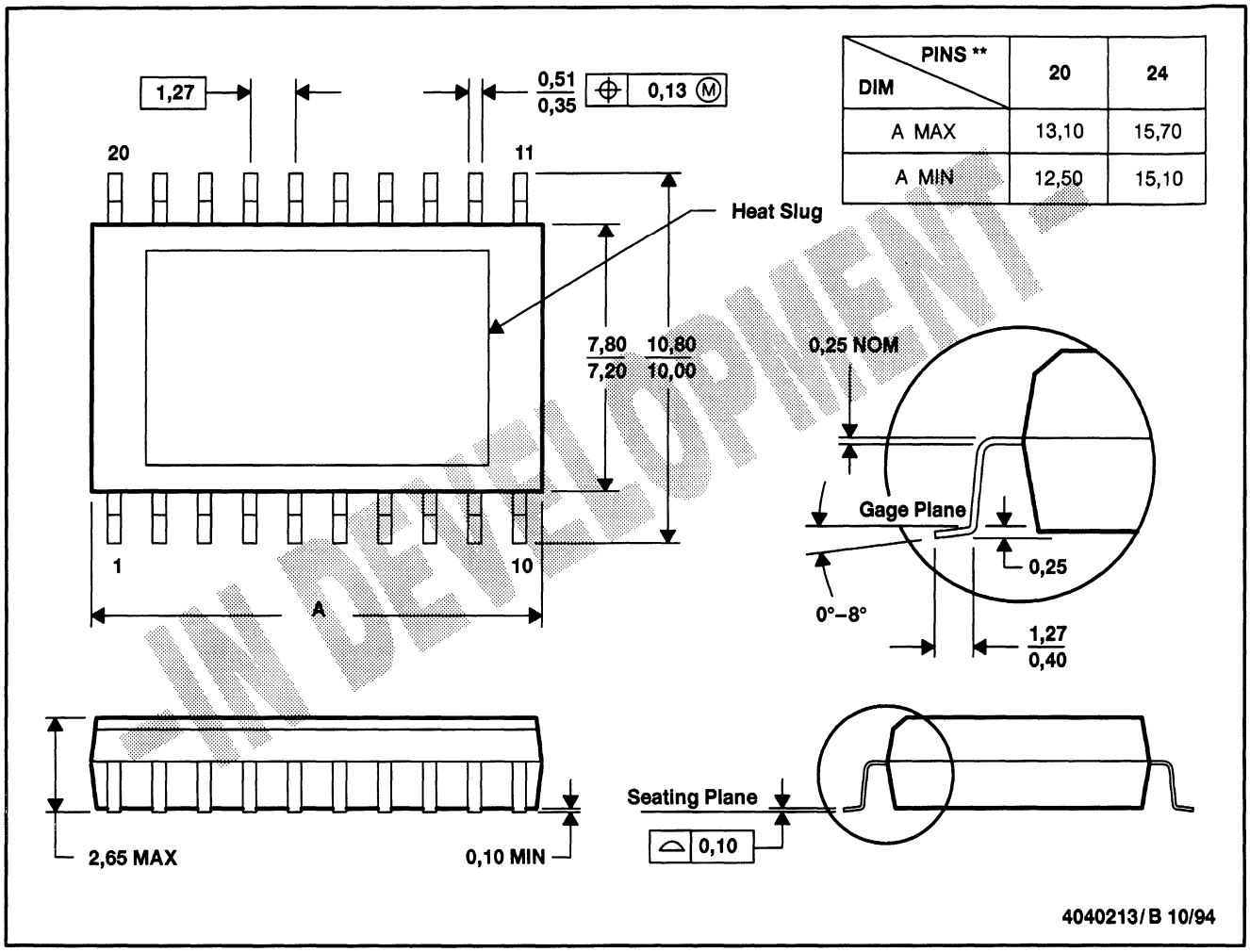


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not inc!ude mold flash or protrusion.
D. Thermally enhanced molded plastic package with end tabs connected to die pad

OCTOBER 1994

DBC (R-PDSO-G**) PLASTIC SMALL-OUTLINE PACKAGE (DIE-DOWN)

20 PIN SHOWN

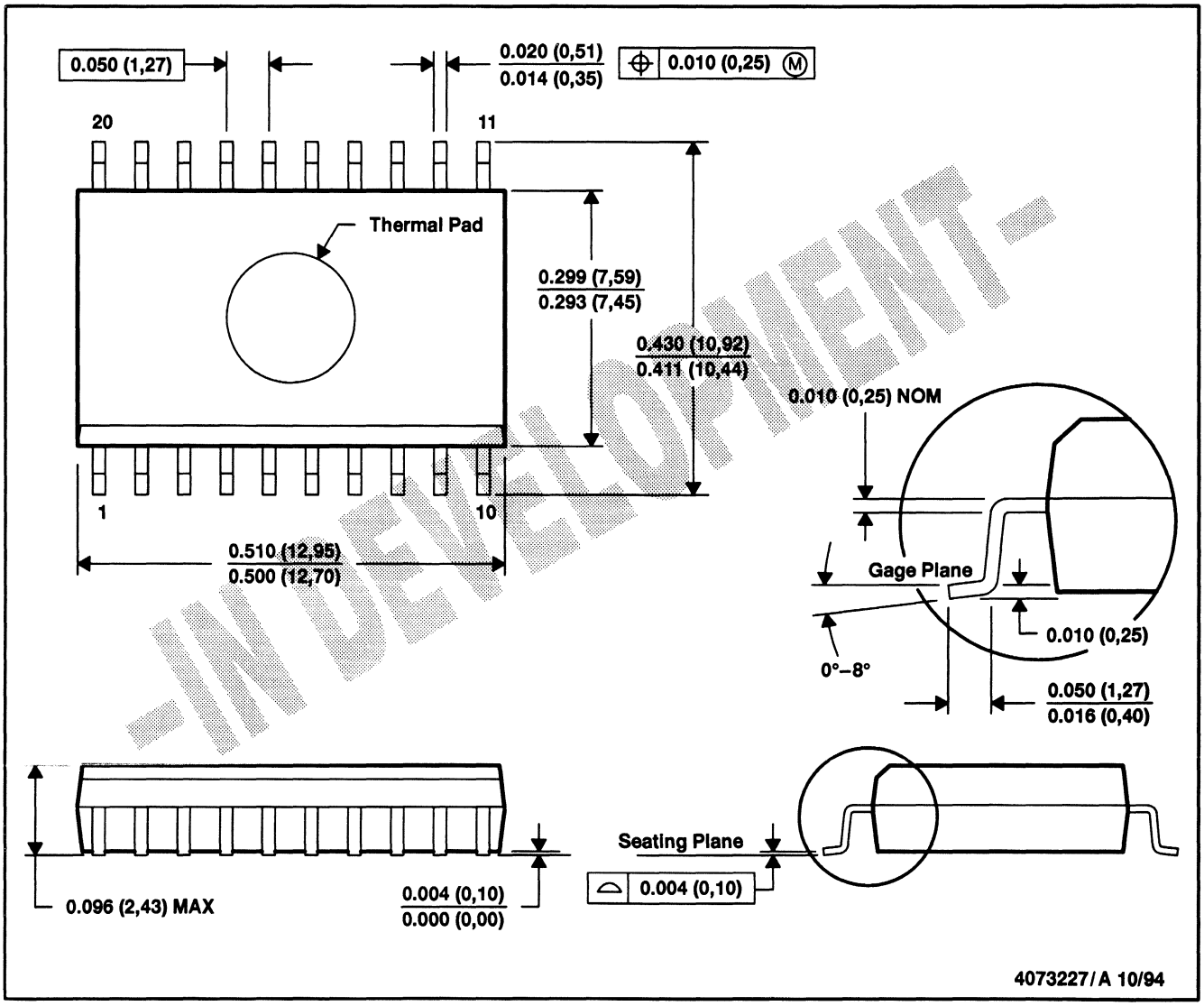


DIM \ PINS **	20	24
A MAX	13,10	15,70
A MIN	12,50	15,10

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)

OCTOBER 1994

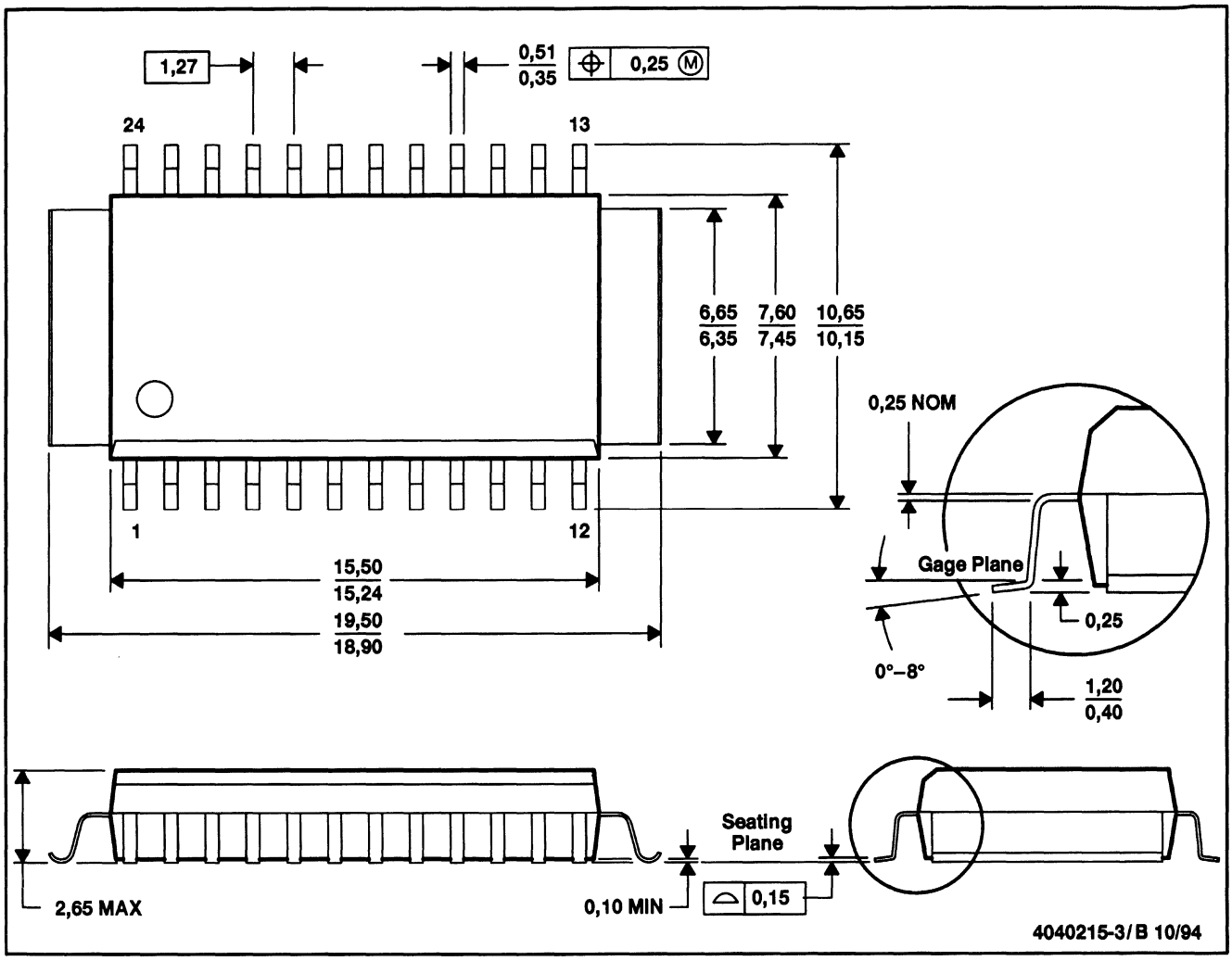
DWS (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. The solderable pad is electrically and thermally connected to the backside of the die and leads 1, 10, 11 and 20.

OCTOBER 1994

DSB (R-PDSO-G24) **PLASTIC SMALL-OUTLINE PACKAGE**



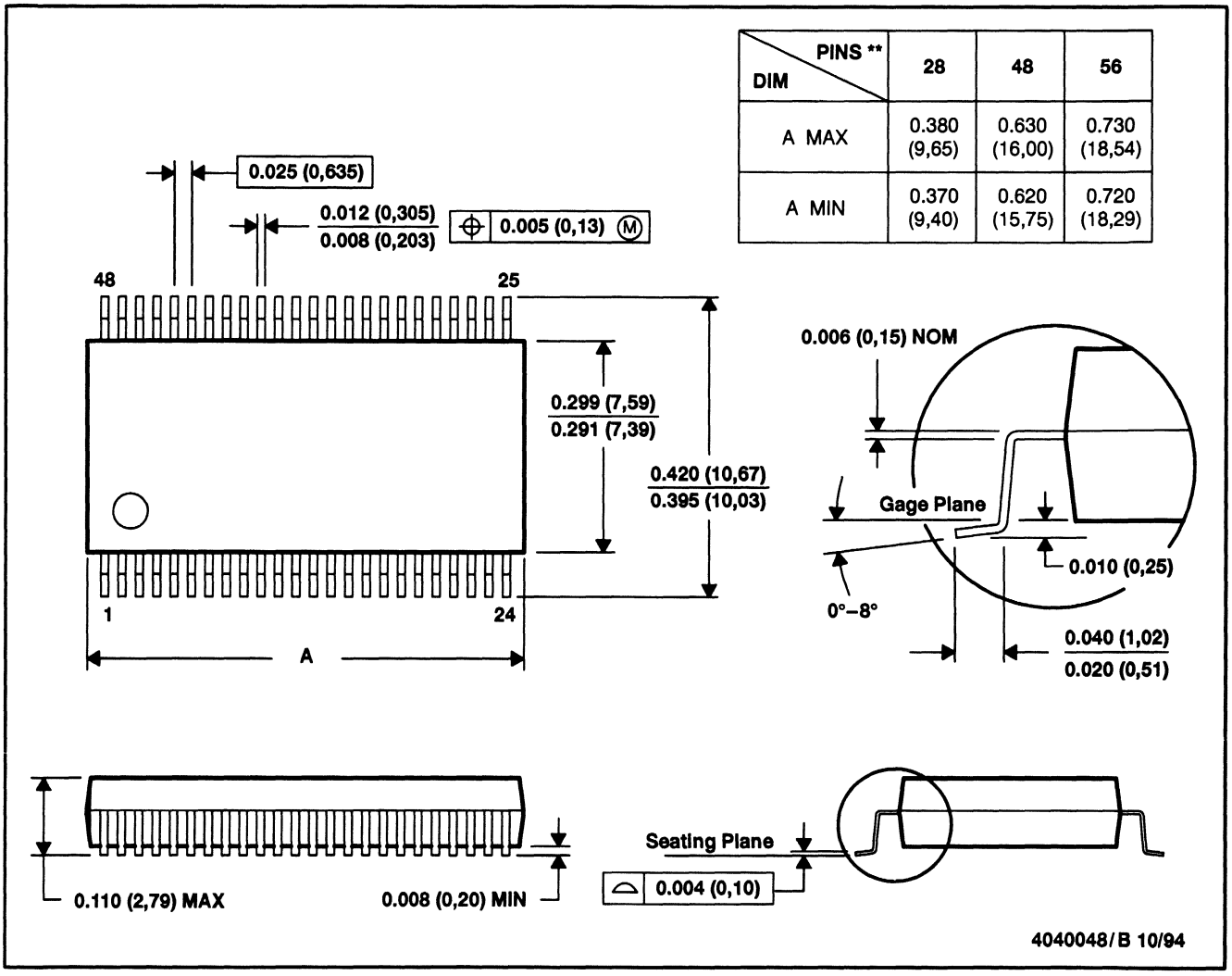
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.
D. Thermally enhanced molded plastic package with end tabs connected to die pad

OCTOBER 1994

DL (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PIN SHOWN

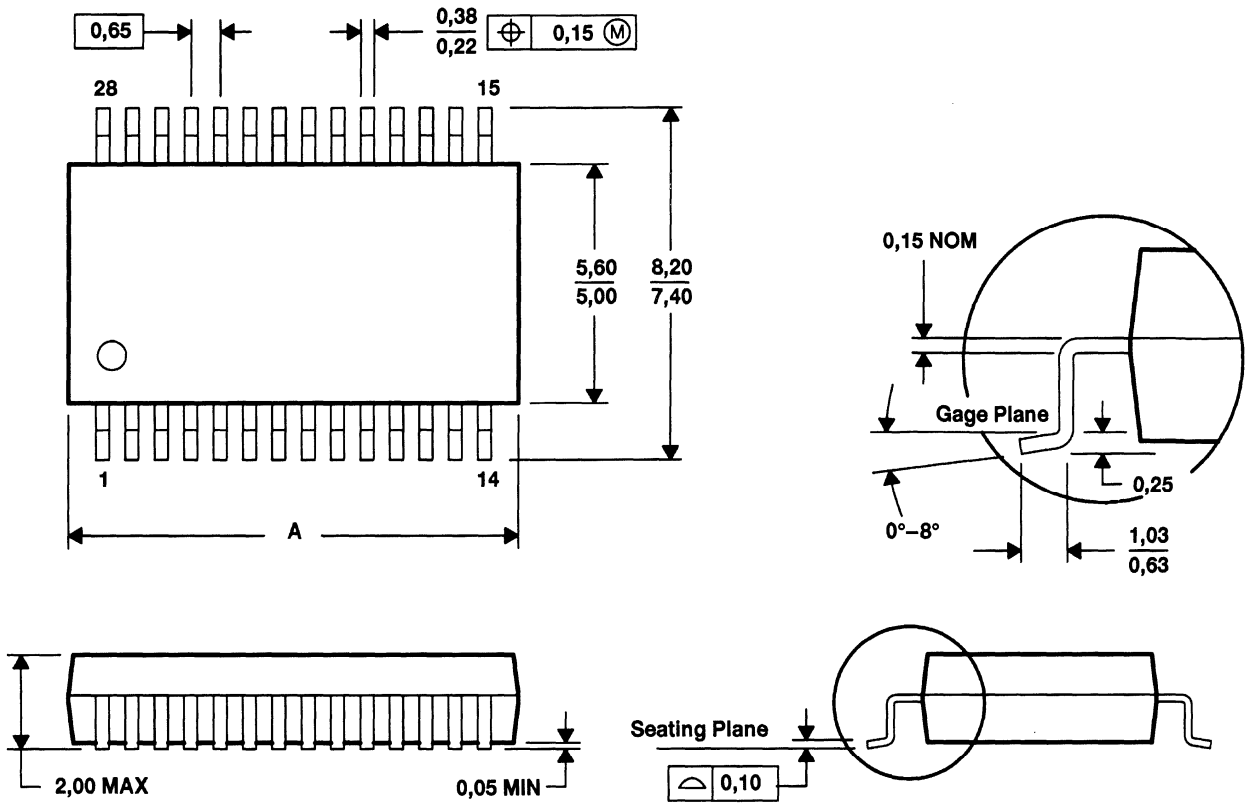


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0.006 (0,15).

OCTOBER 1994

DB (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

28 PIN SHOWN



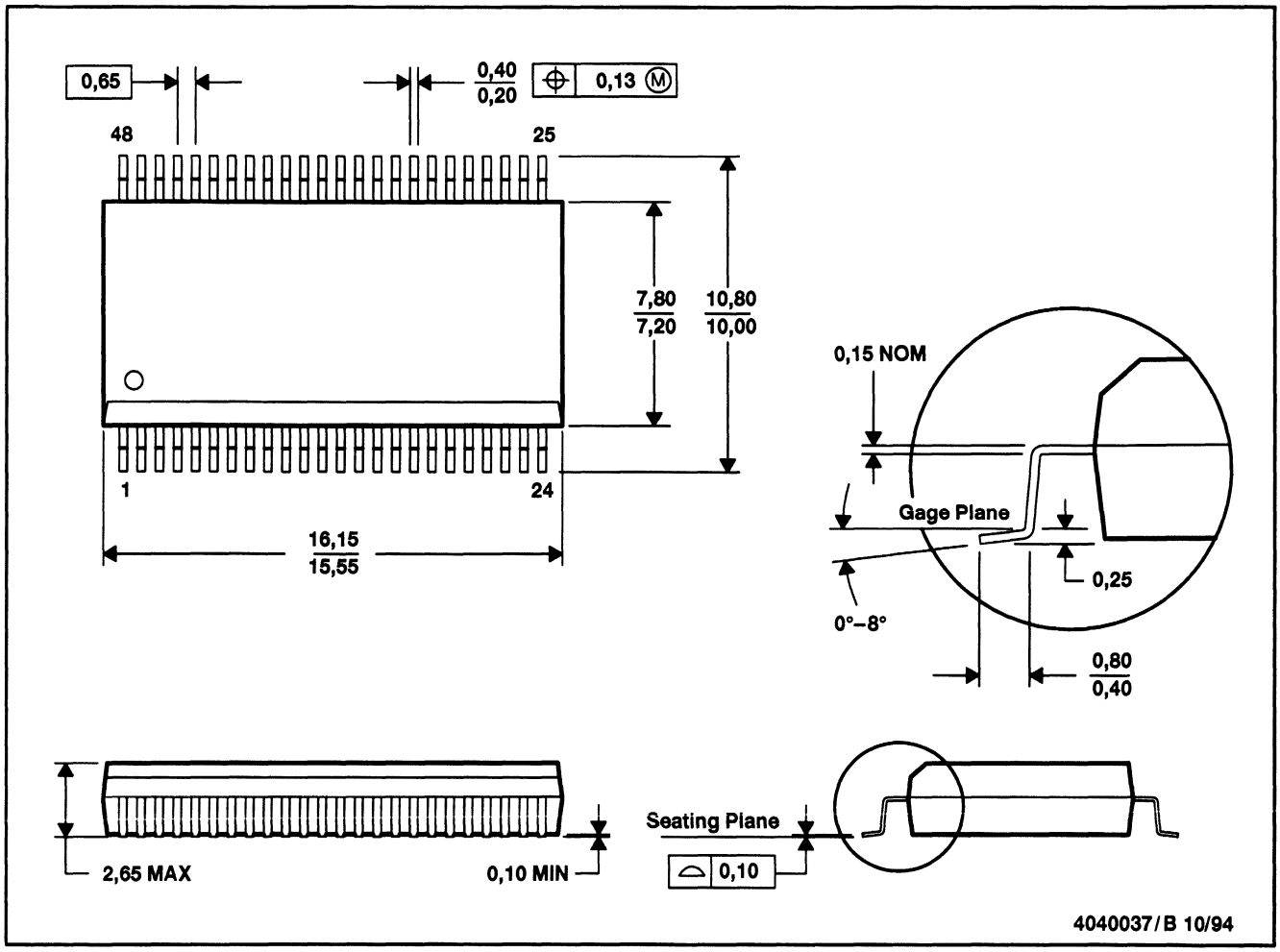
DIM \ PINS **	14	16	20	24	28	30	38
A MAX	6,50	6,50	7,50	8,50	10,50	10,50	12,90
A MIN	5,90	5,90	6,90	7,90	9,90	9,90	12,30

4040065 / B 10/94

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.
D. Falls within JEDEC MO-150

OCTOBER 1994

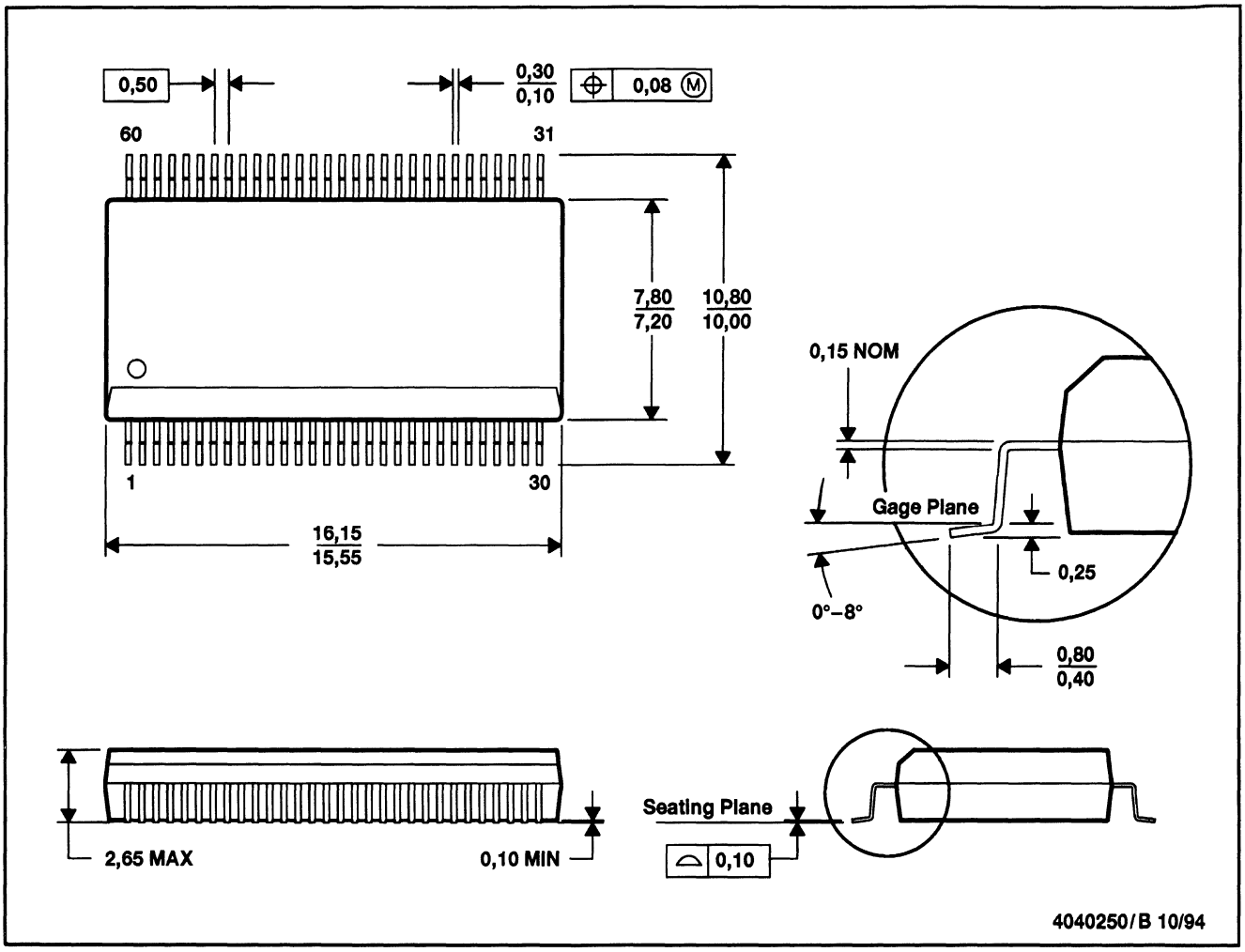
DP (R-PDSO-G48) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

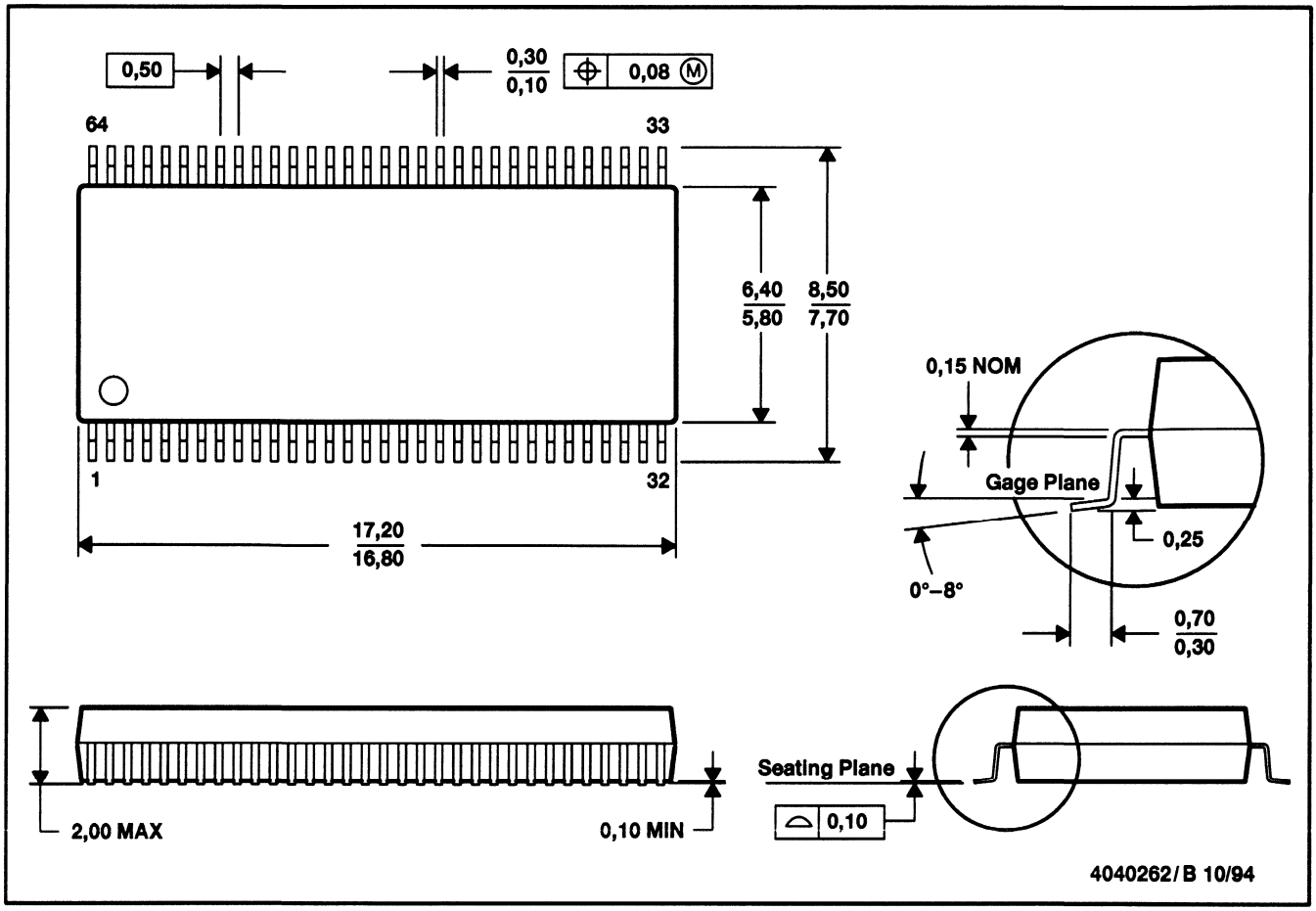
DQ (R-PDSO-G60) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

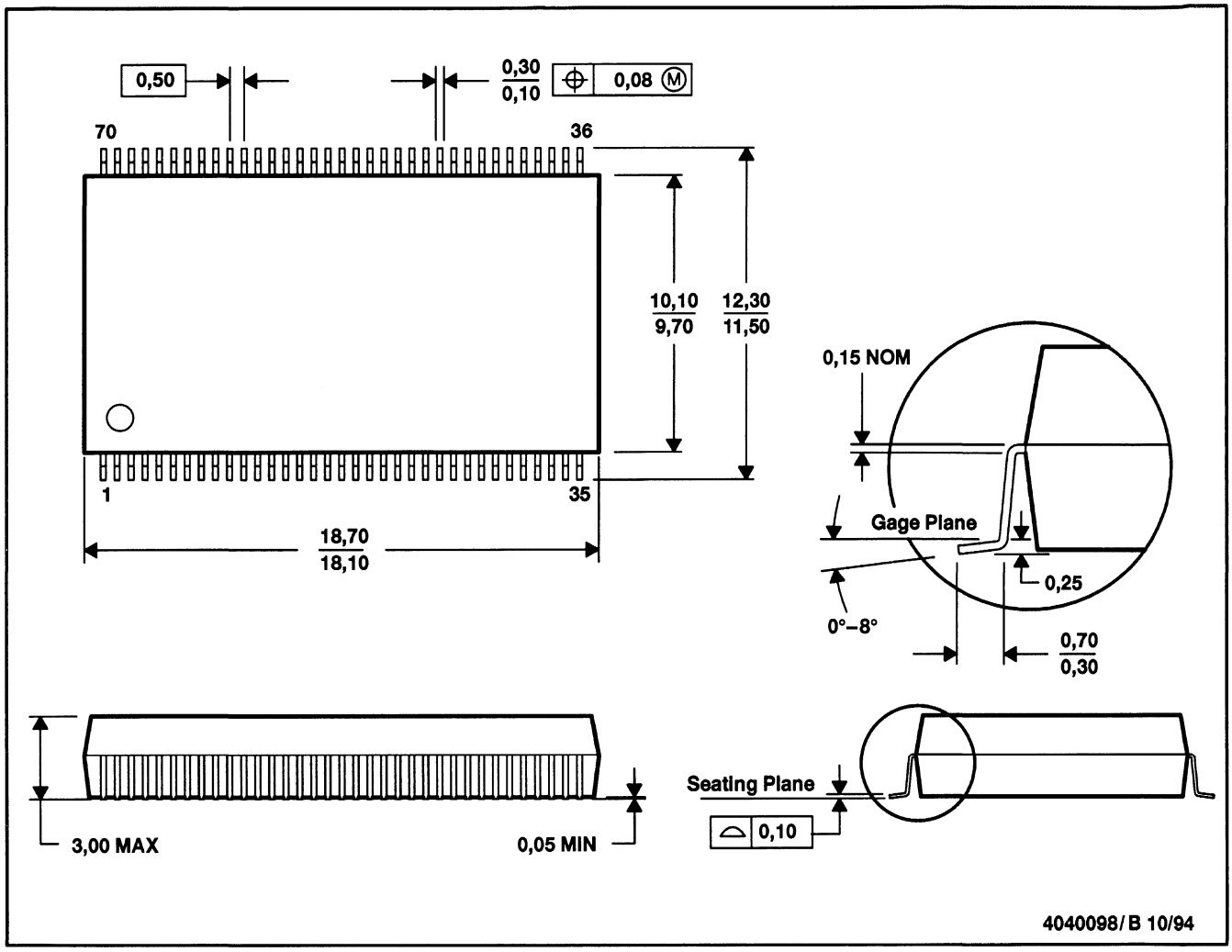
DBE (R-PDSO-G64) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

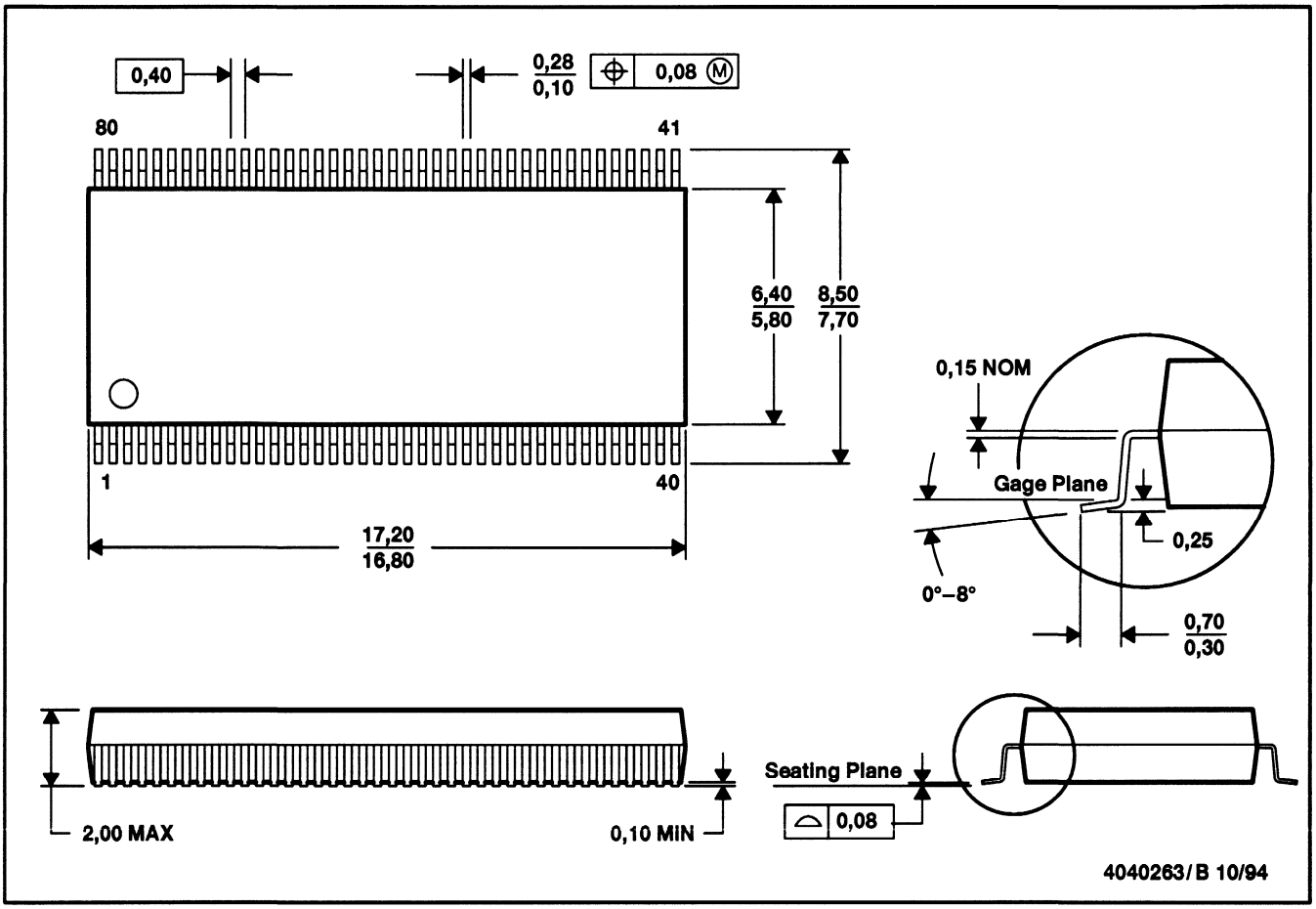
DT (R-PDSO-G70) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

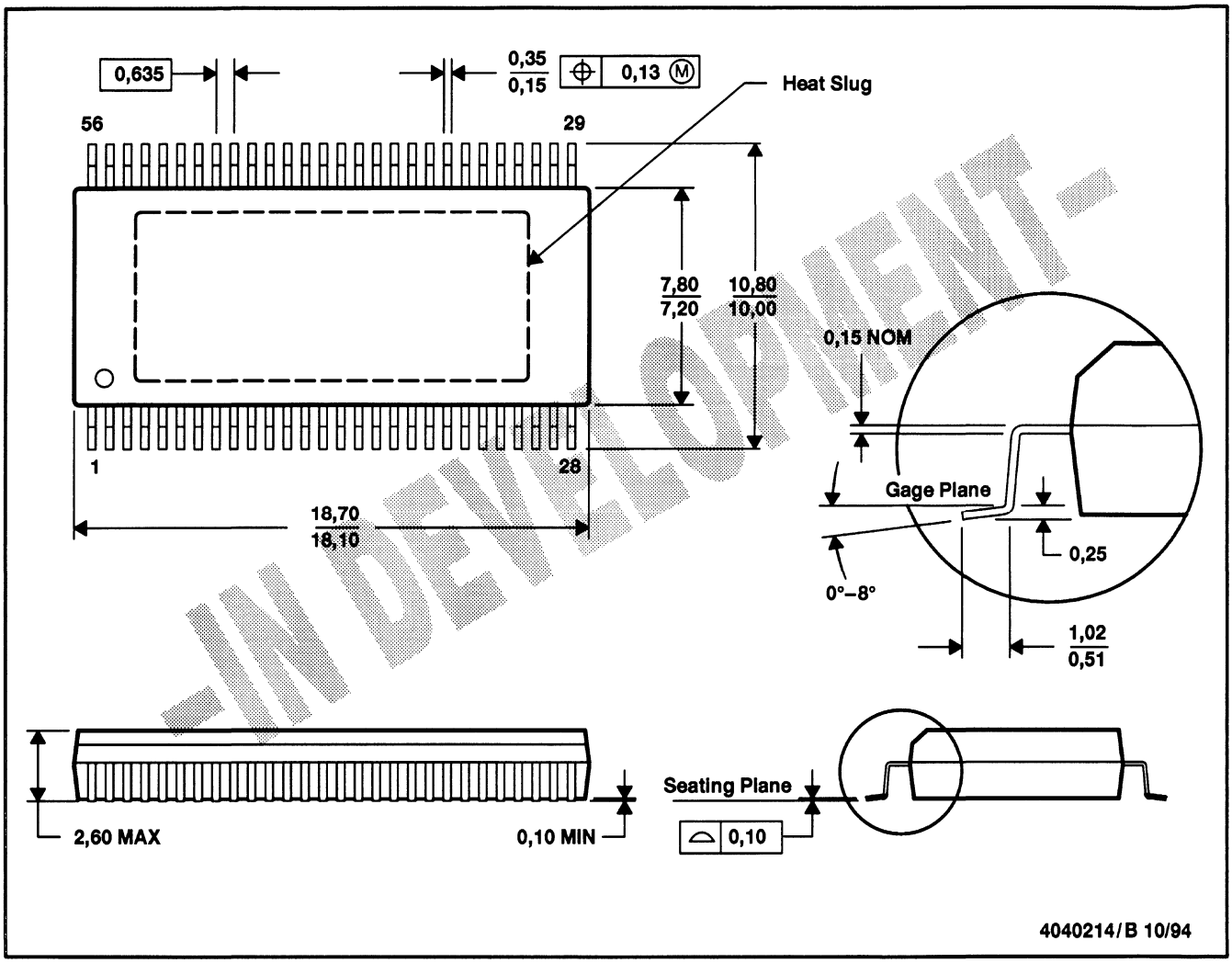
DBF (R-PDSO-G80) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

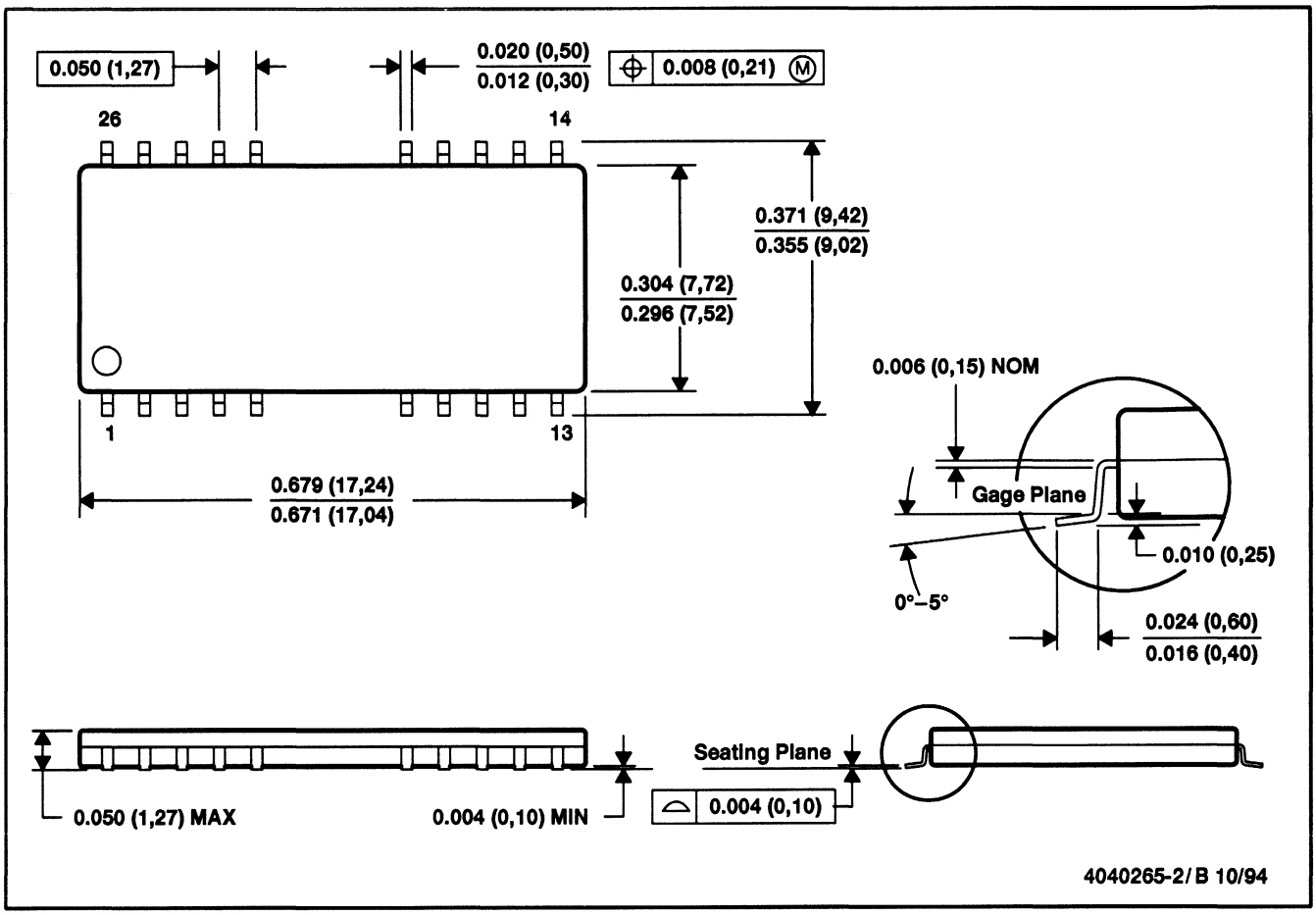
DBD (R-PDSO-G56) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL) exposed on bottom of package

OCTOBER 1994

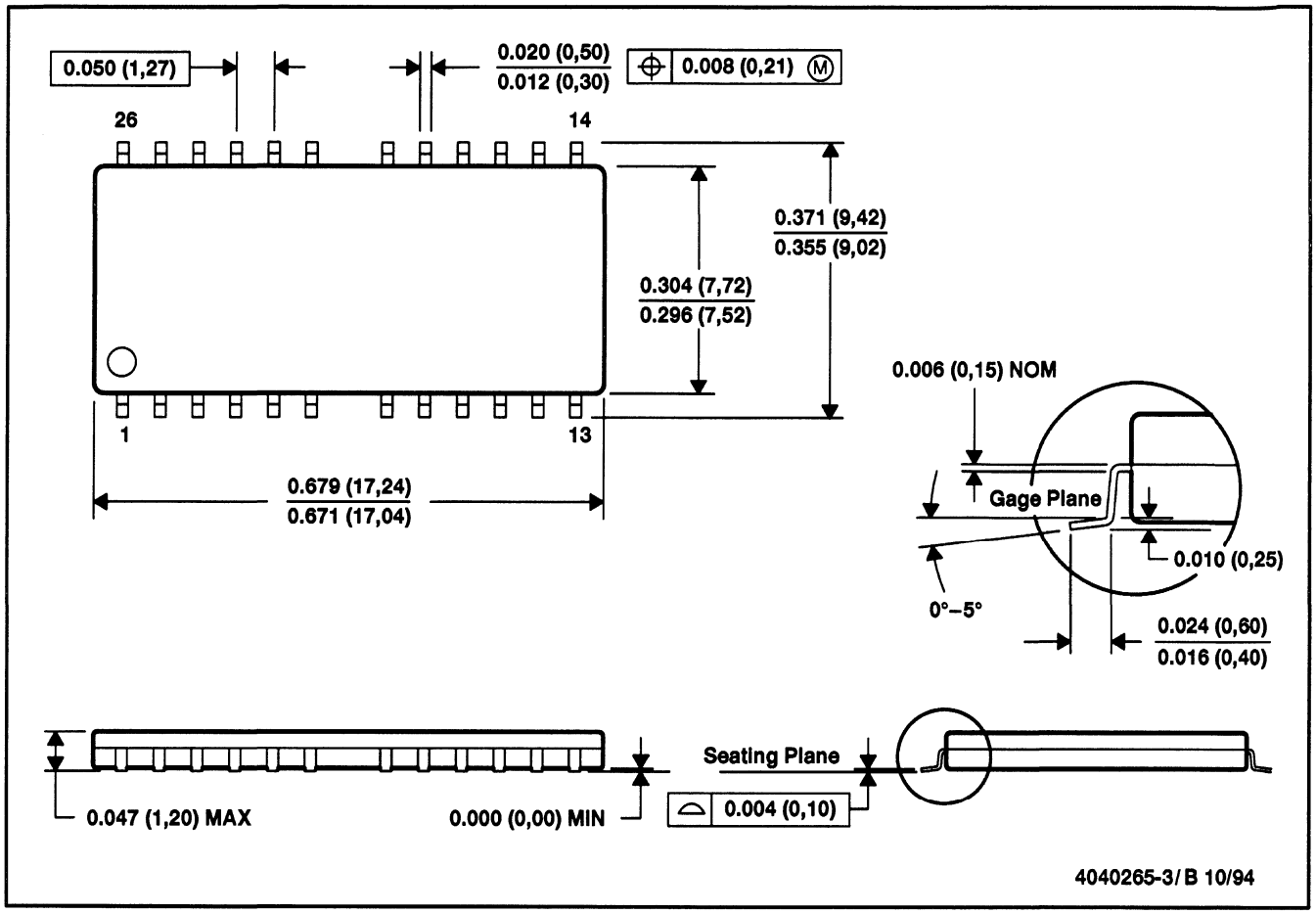
DGA (R-PDSO-G20/26) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

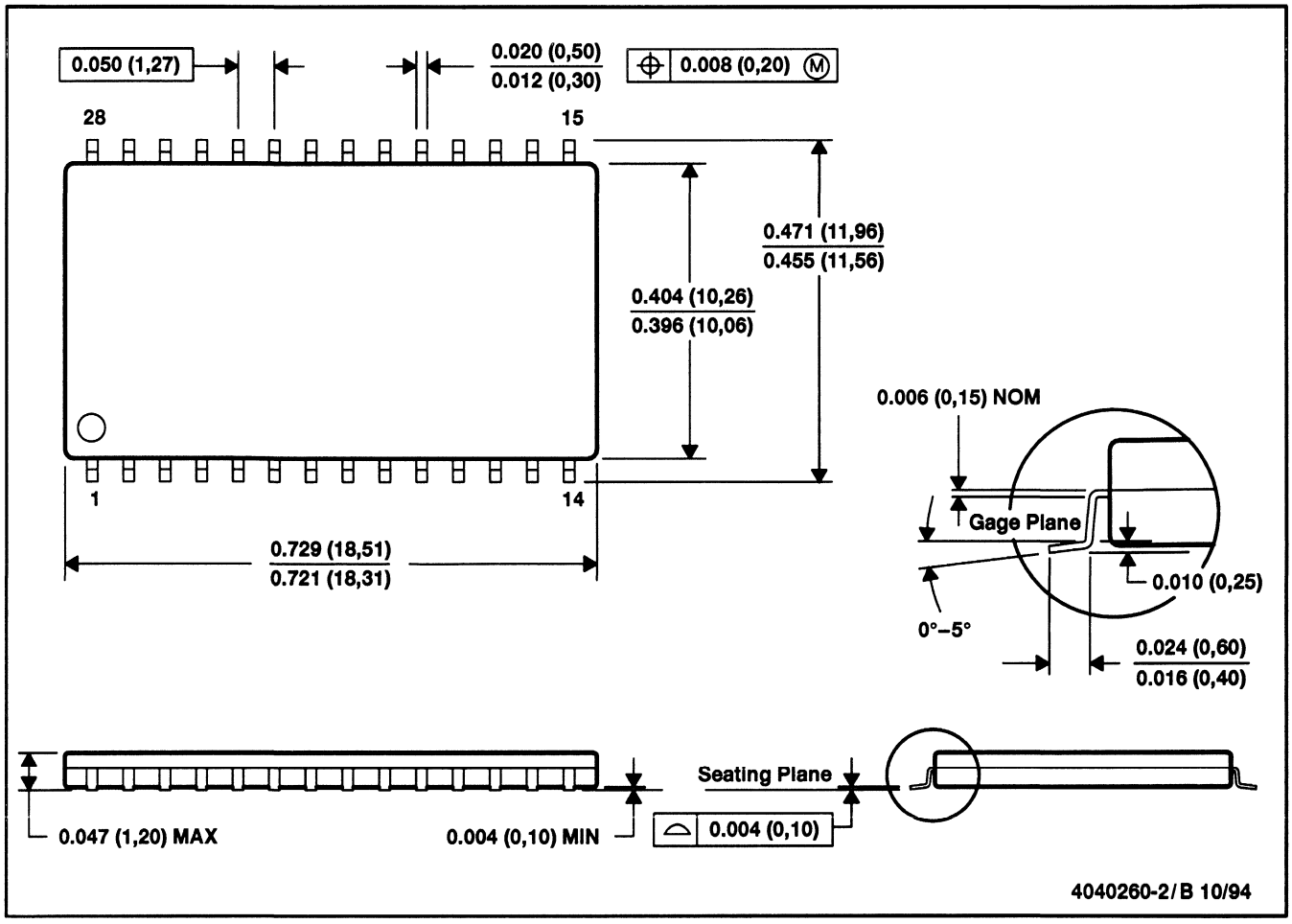
DGA (R-PDSO-G24/26) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

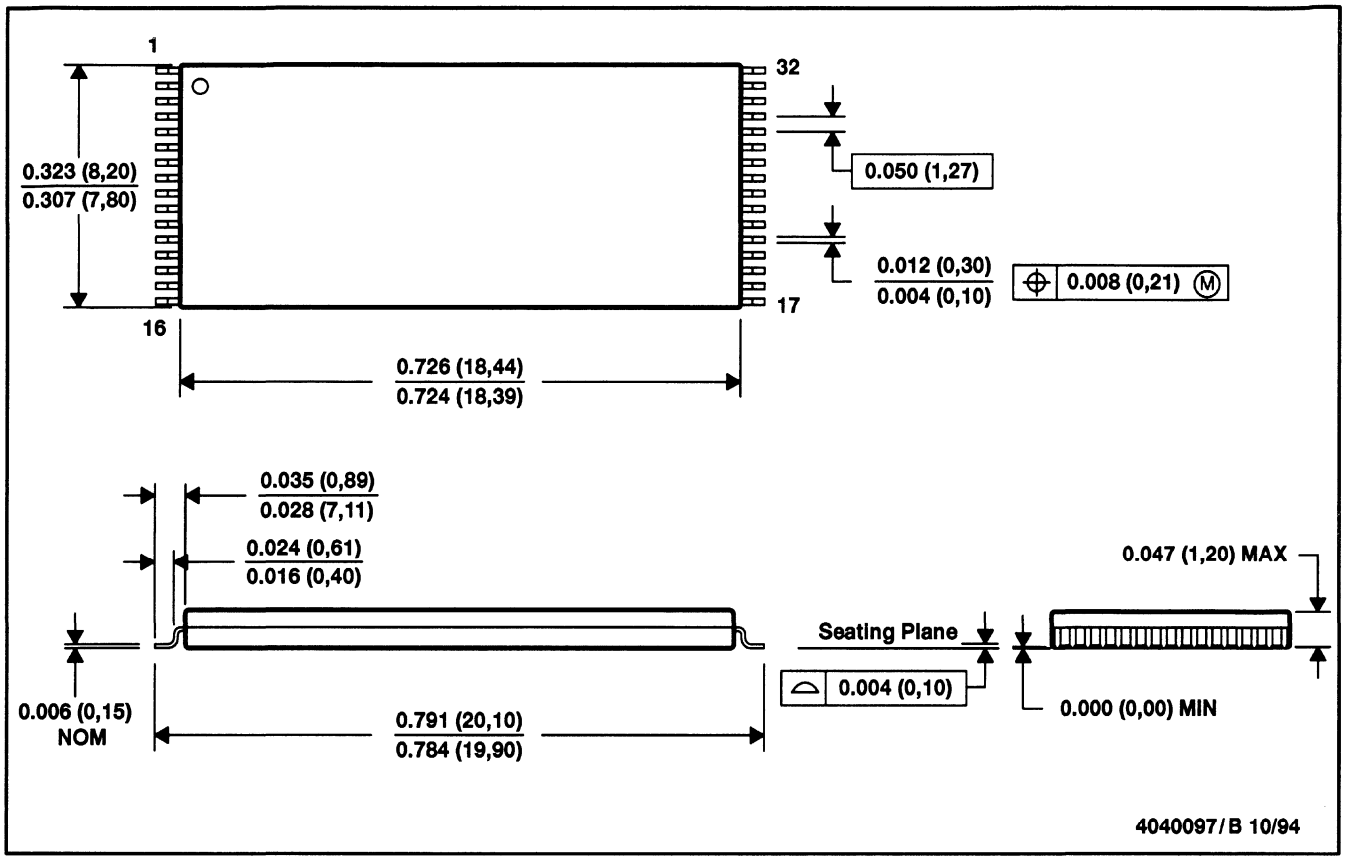
DGC (R-PDSO-G28) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

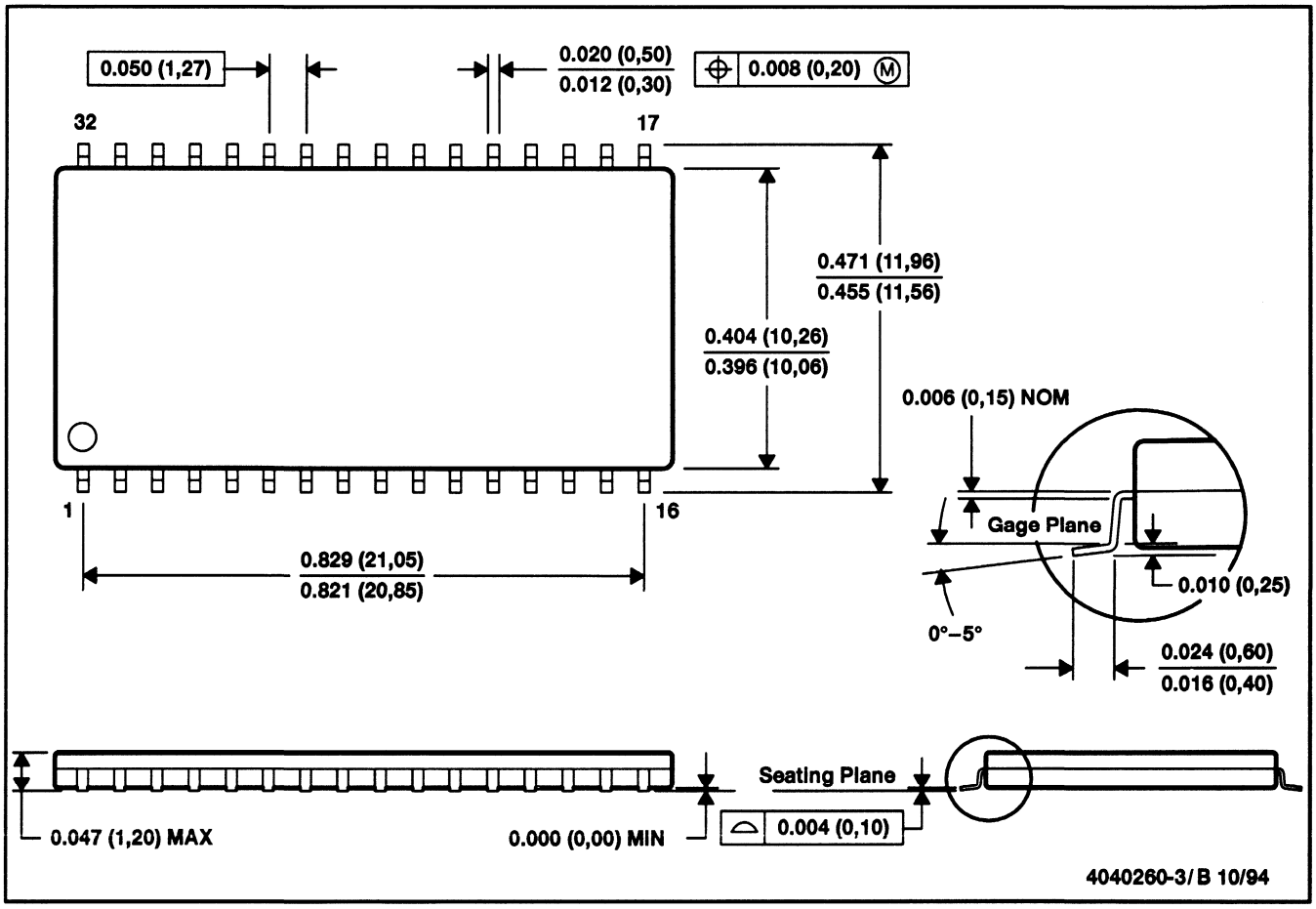
DD (R-PDSO-G32) **FLASH EPROM SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

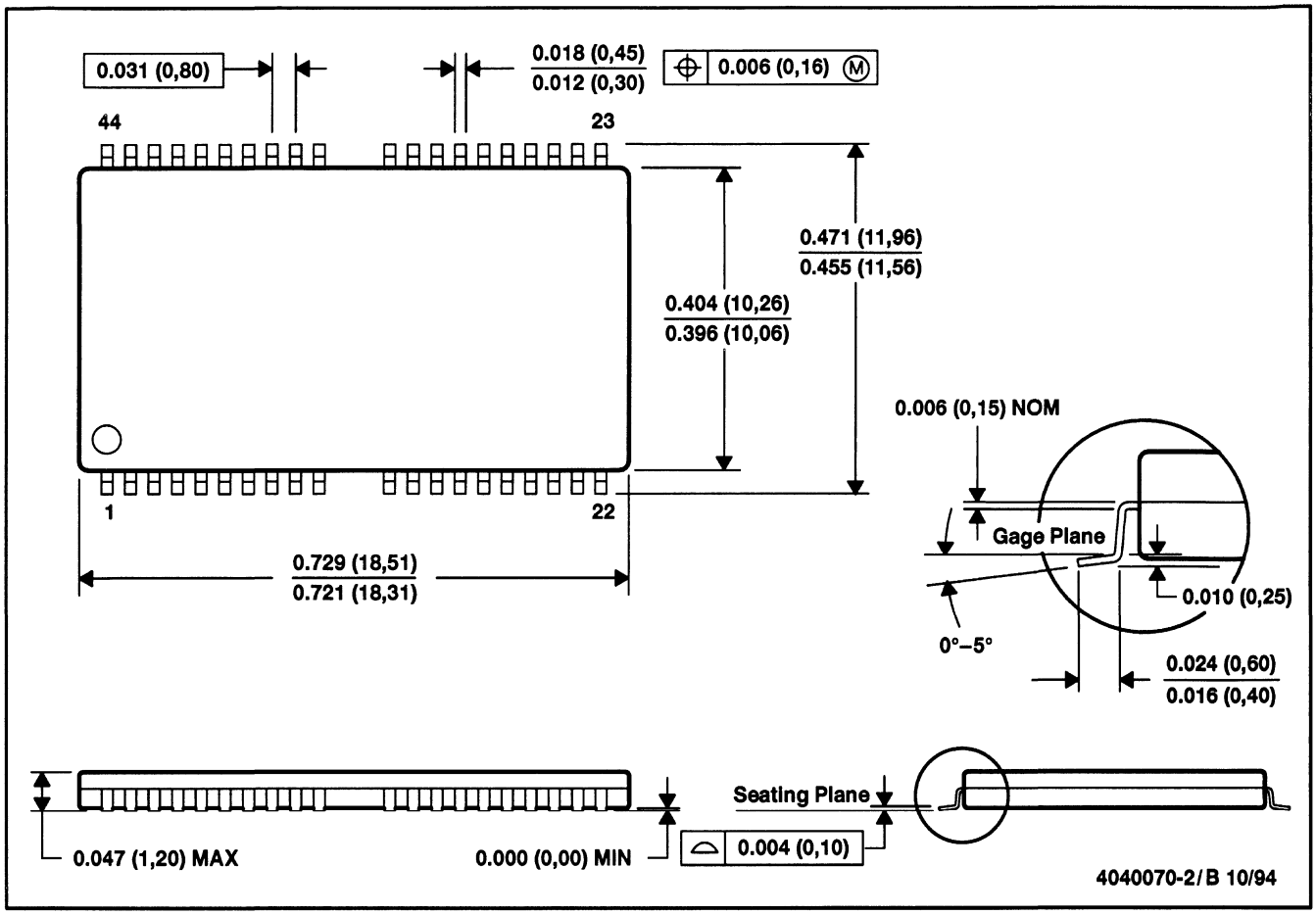
DGC (R-PDSO-G32) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

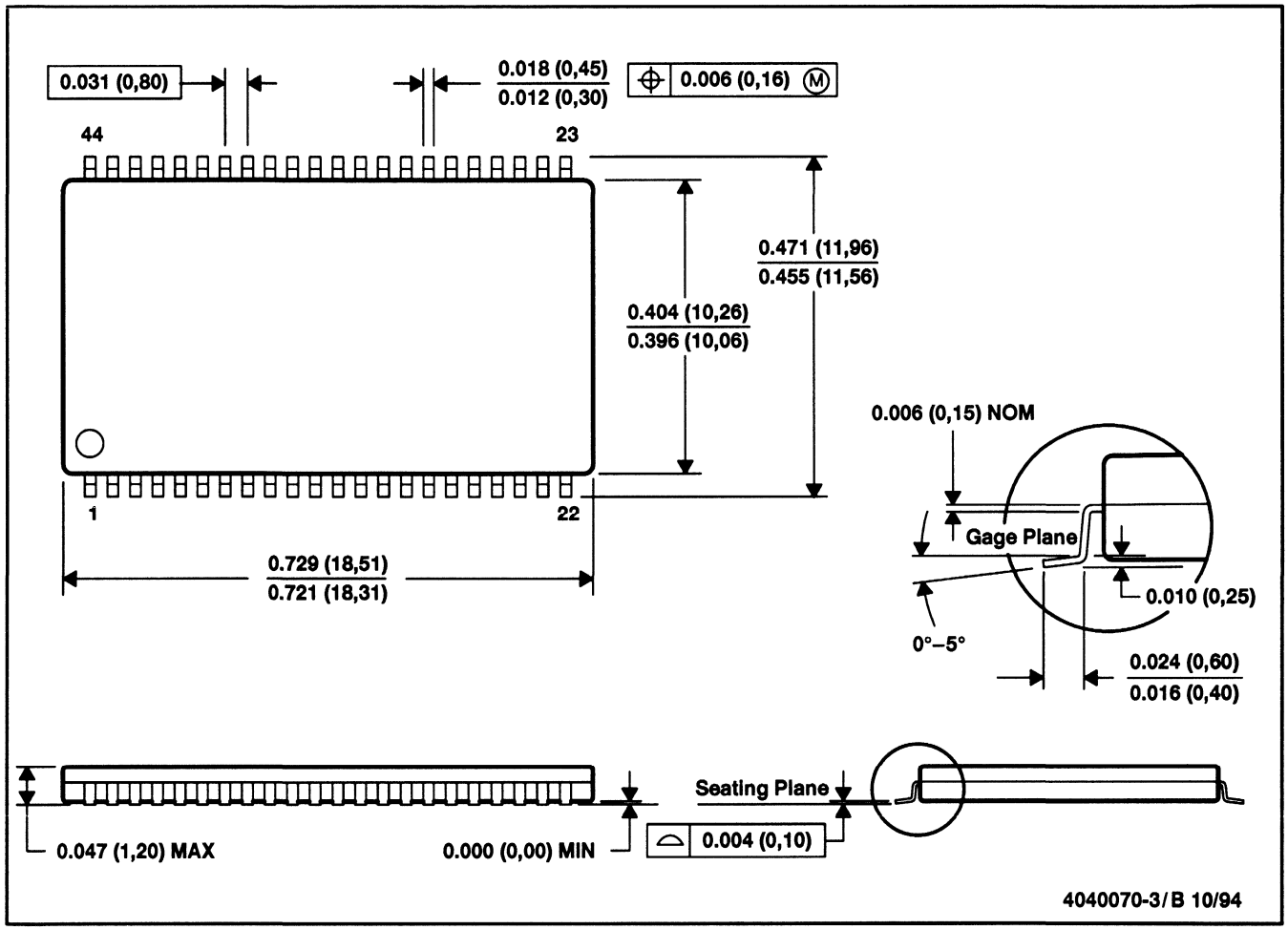
DGE (R-PDSO-G40/44) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

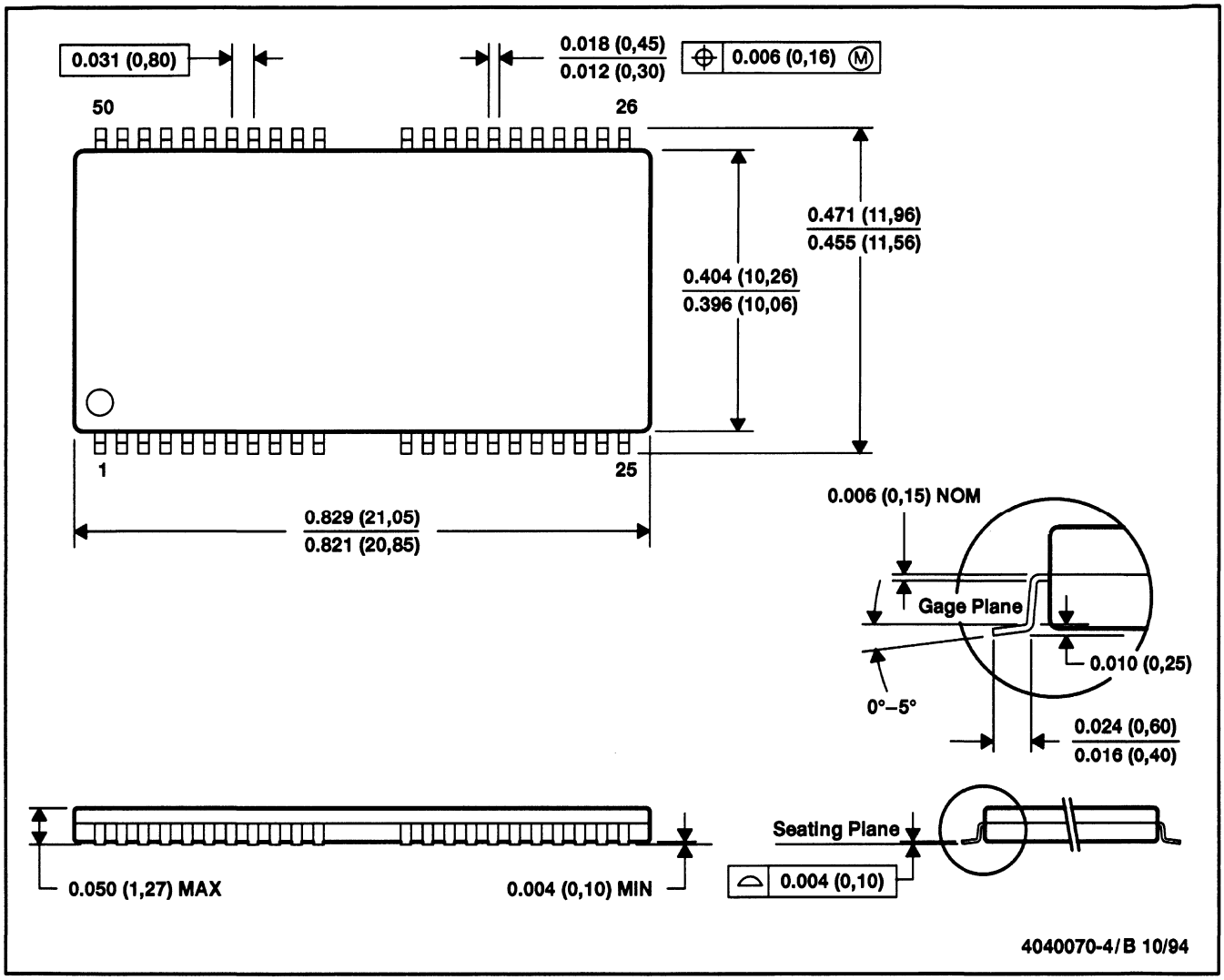
DGE (R-PDSO-G44) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

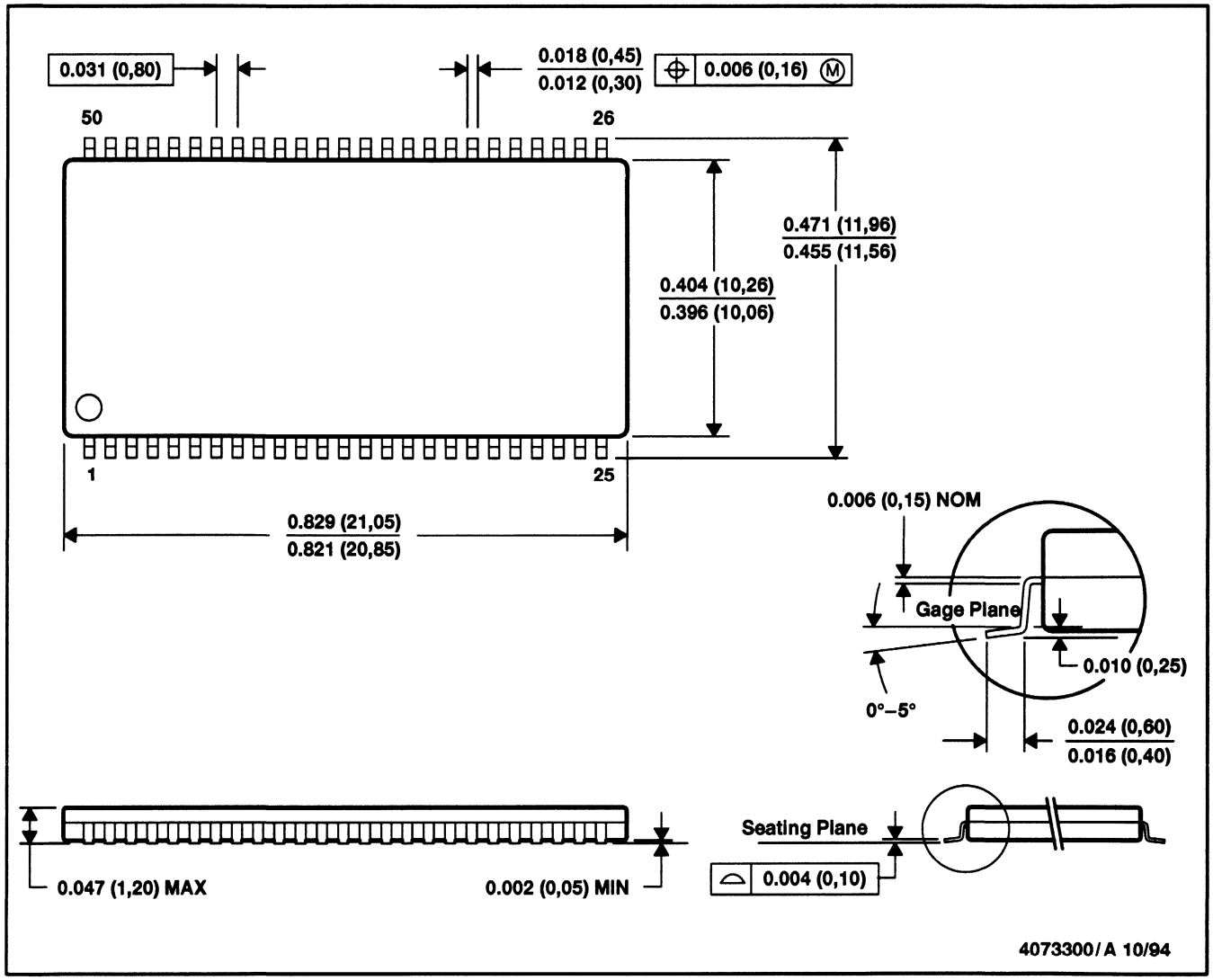
DGE (R-PDSO-G44/50) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

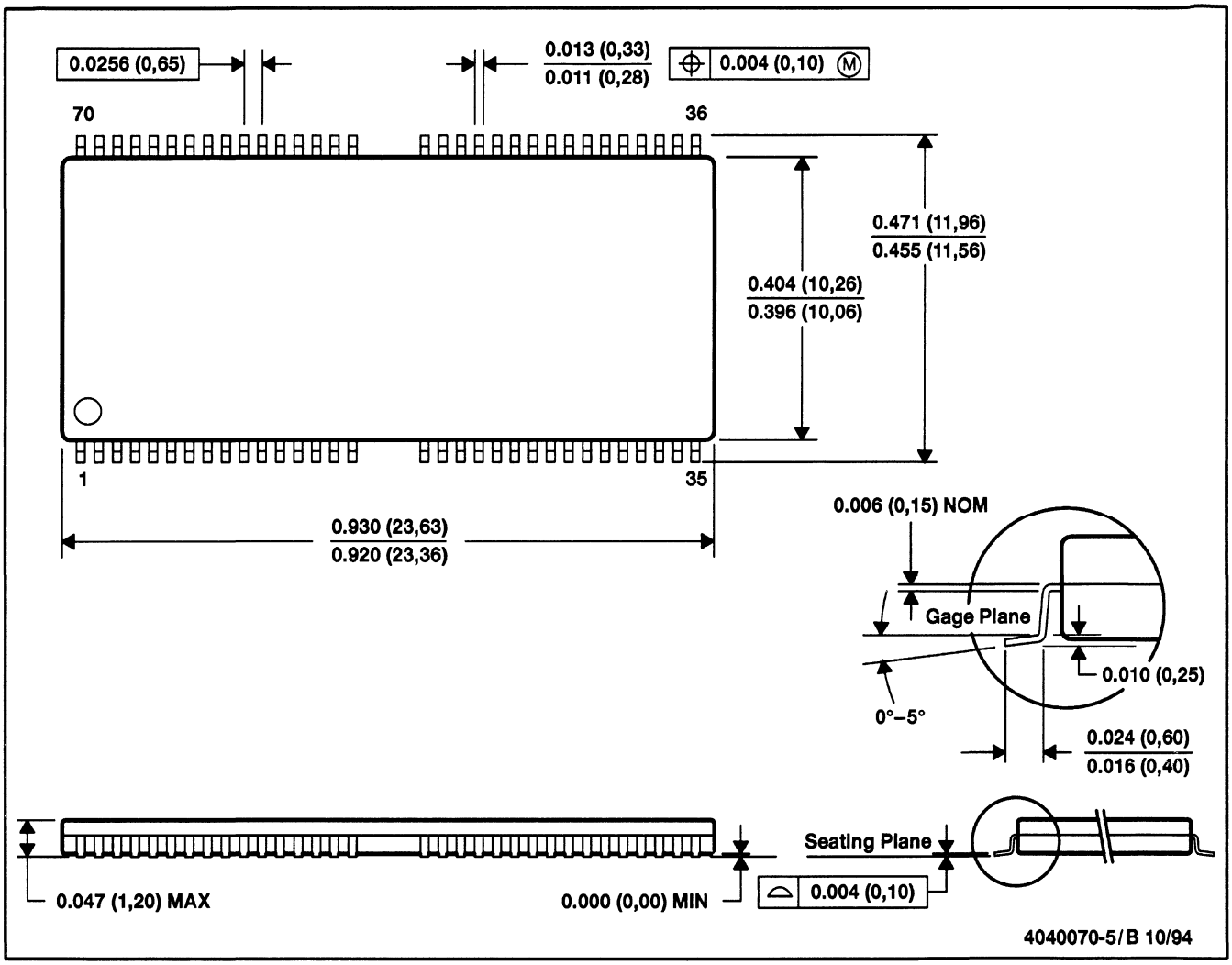
DGJ (R-PDSO-G50) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.
D. Lead dimensions include plating thickness.

OCTOBER 1994

DGE (R-PDSO-G64/70) **PLASTIC SMALL-OUTLINE PACKAGE**

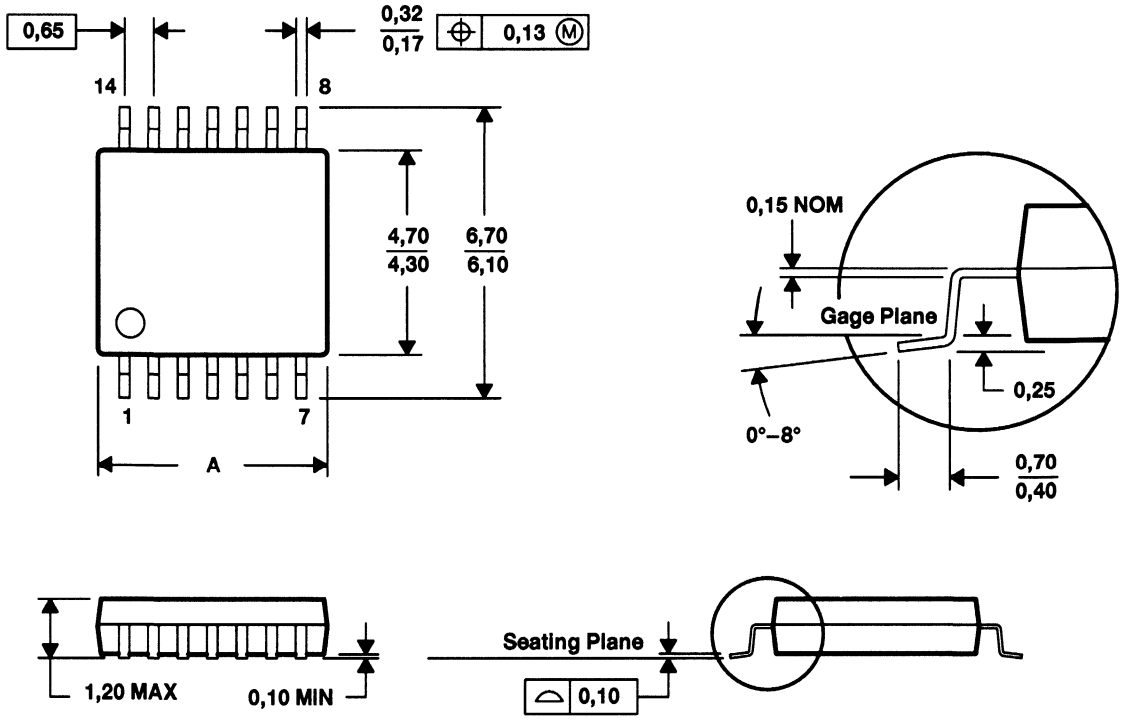


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

PW (R-PDSO-G)** **PLASTIC SMALL-OUTLINE PACKAGE**

14 PIN SHOWN



DIM \ PINS **	8	14	16	20	24	28
A MAX	3,30	5,30	5,30	6,80	8,10	10,00
A MIN	2,90	4,90	4,90	6,40	7,70	9,60

4040064/B 10/94

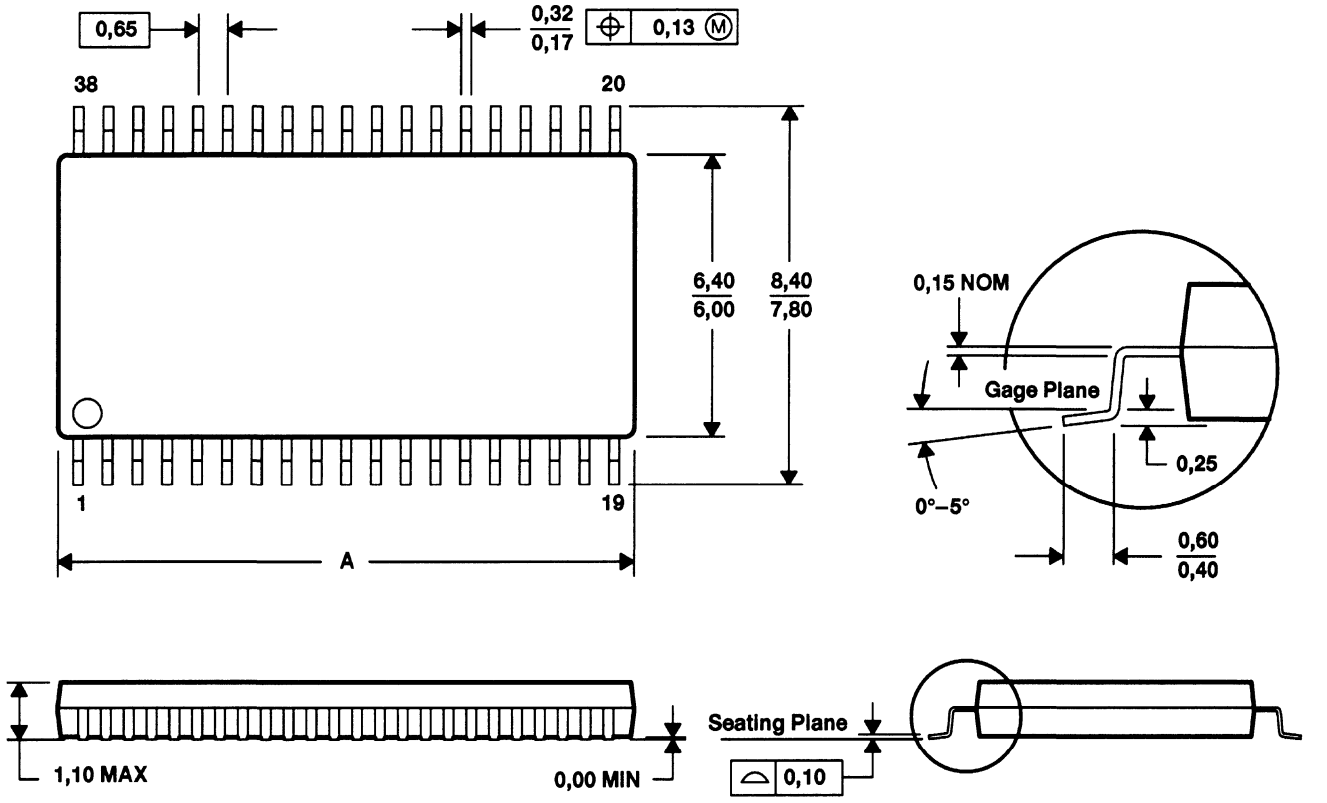
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15.

OCTOBER 1994

DA (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

38 PIN SHOWN



DIM \ PINS **	28	30	32	38
A MAX	10,00	11,30	11,30	12,80
A MIN	9,60	10,90	10,90	12,40

4040066/B 10/94

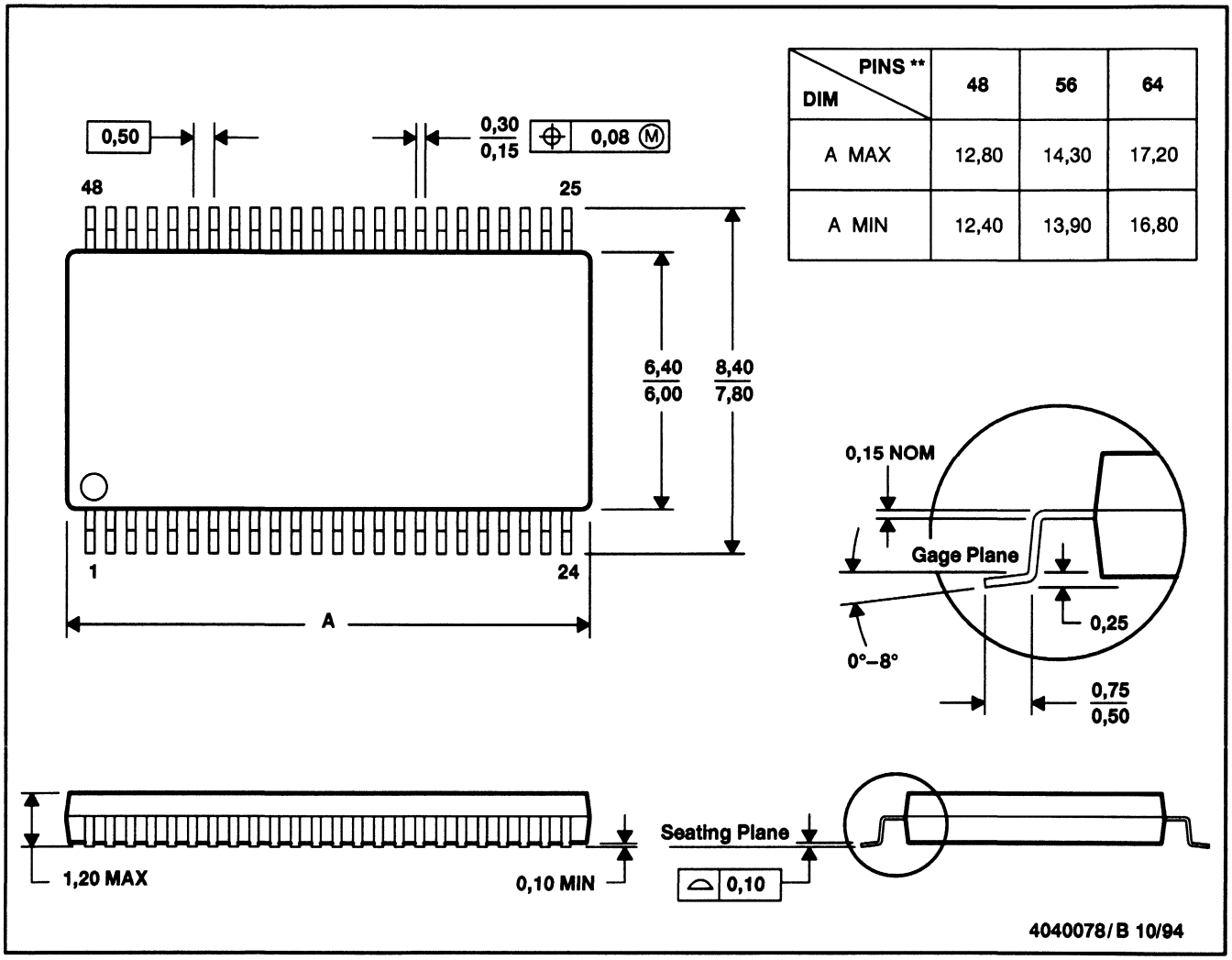
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

DGG (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

48 PIN SHOWN

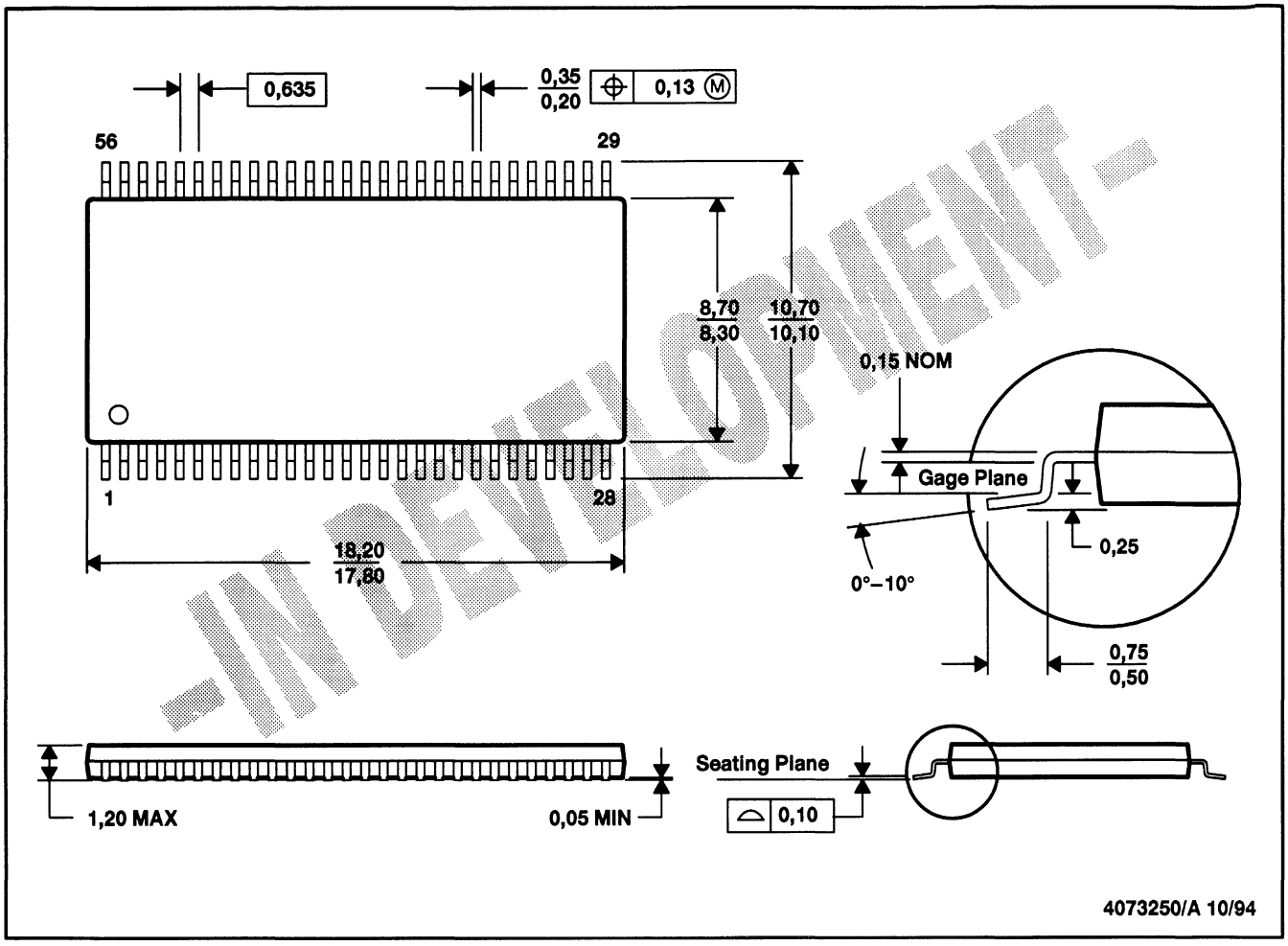


DIM \ PINS **	48	56	64
A MAX	12,80	14,30	17,20
A MIN	12,40	13,90	16,80

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

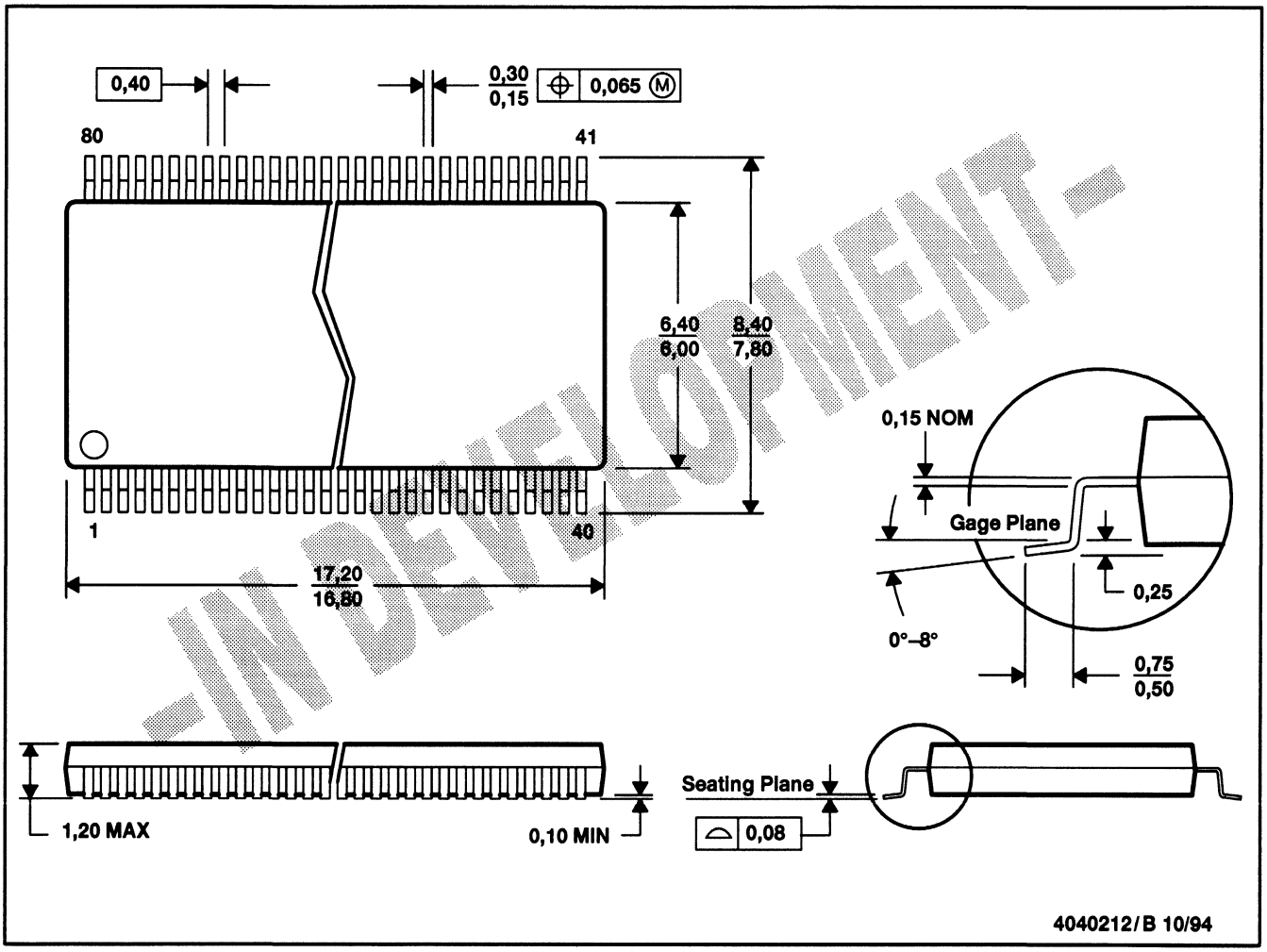
DLT (R-PDSO-G56) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

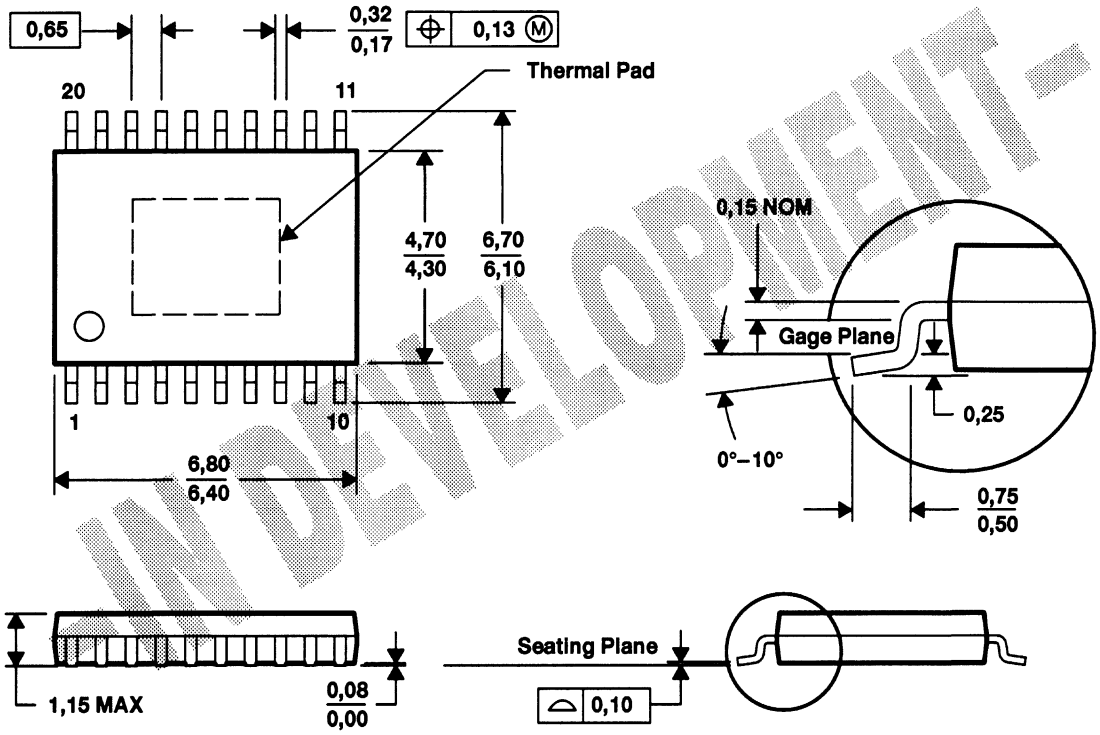
DBB (R-PDSO-G80) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

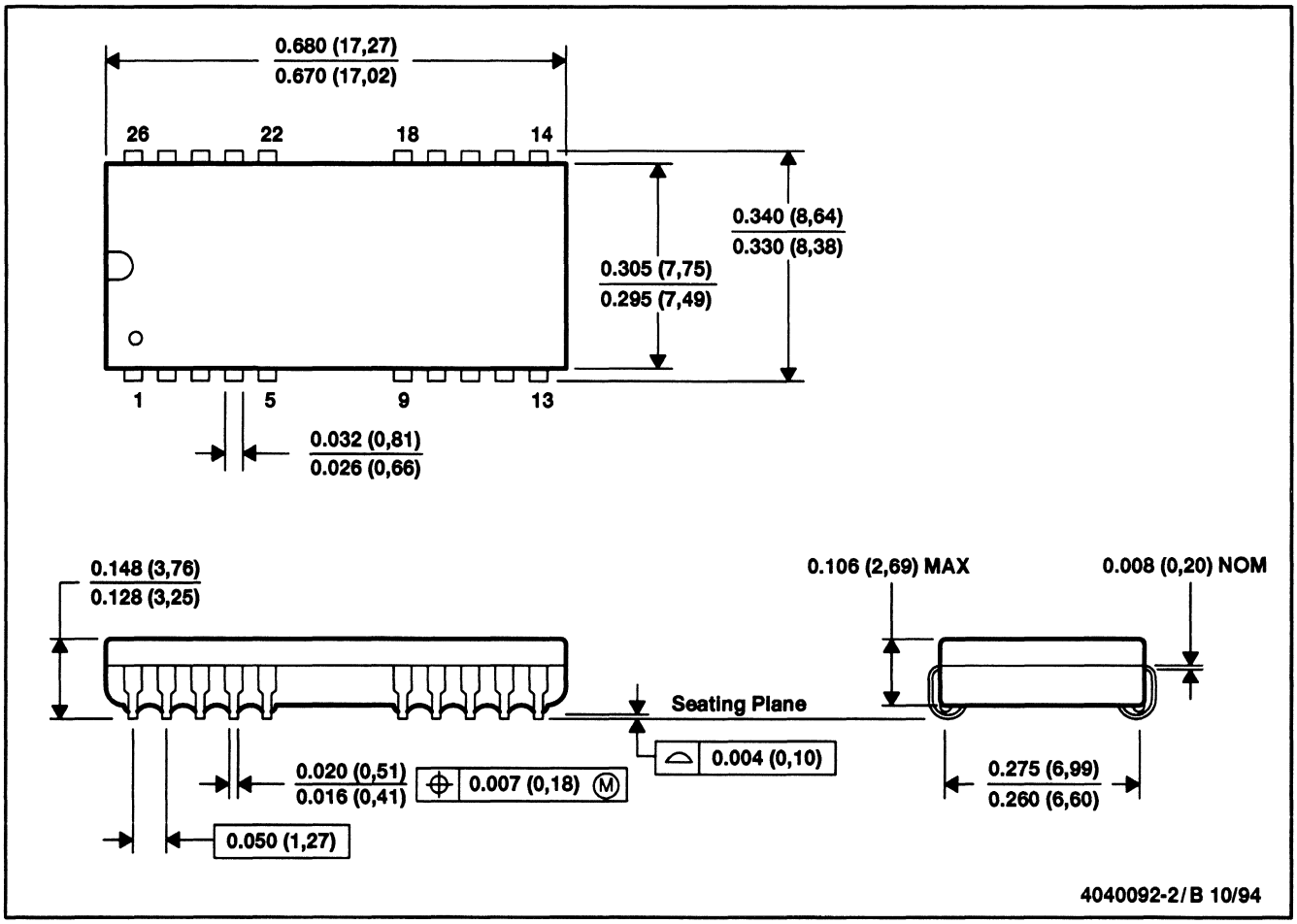
PWP (R-PDSO-G20) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. The package thermal performance may be enhanced by bonding the thermal pad to an external thermal plane. The solderable pad is electrically and thermally connected to the backside of the die and leads 1, 2, 9, 10, 11, 12, 19 and 20.

OCTOBER 1994

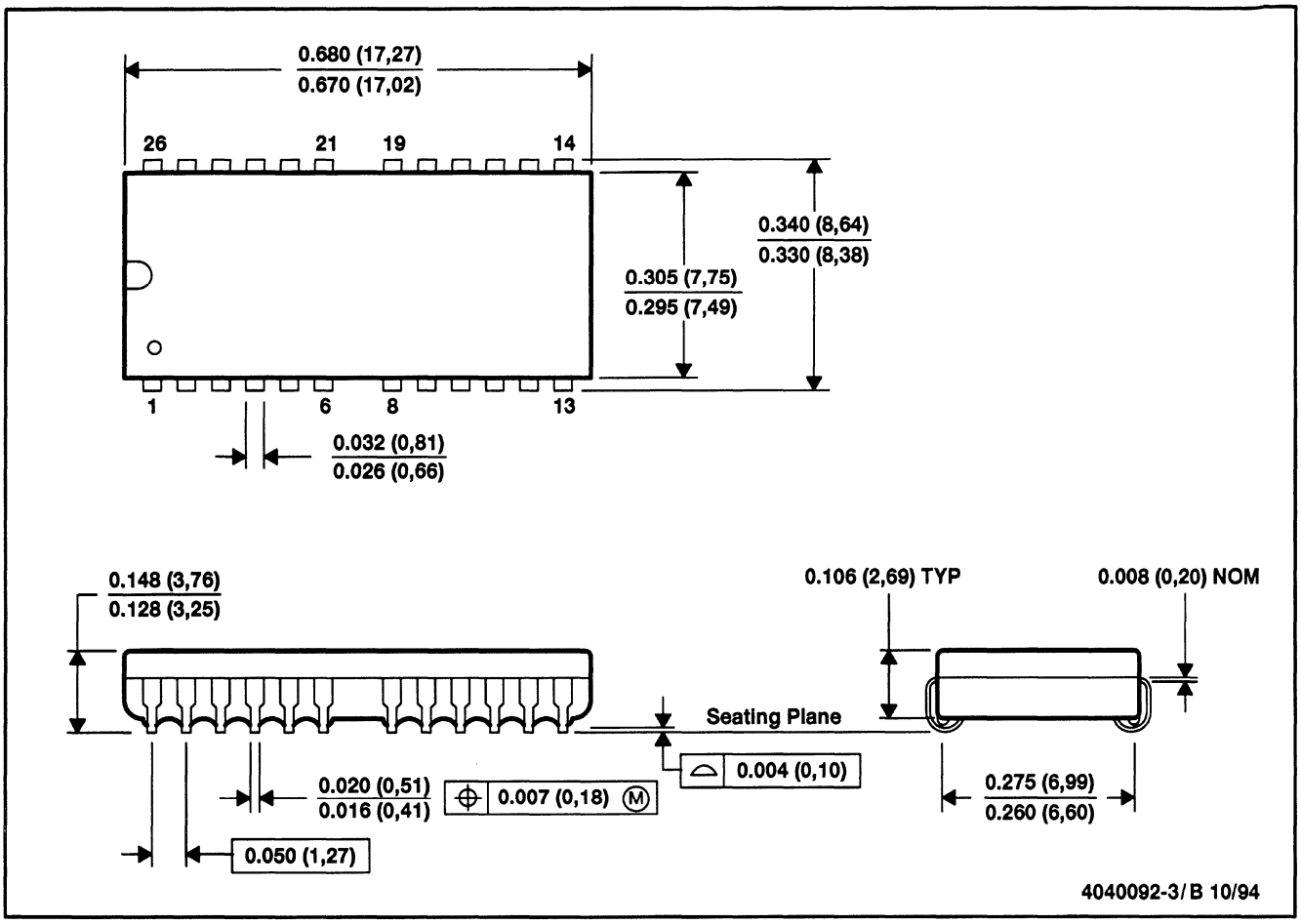
DJ (R-PDSO-J20/26) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

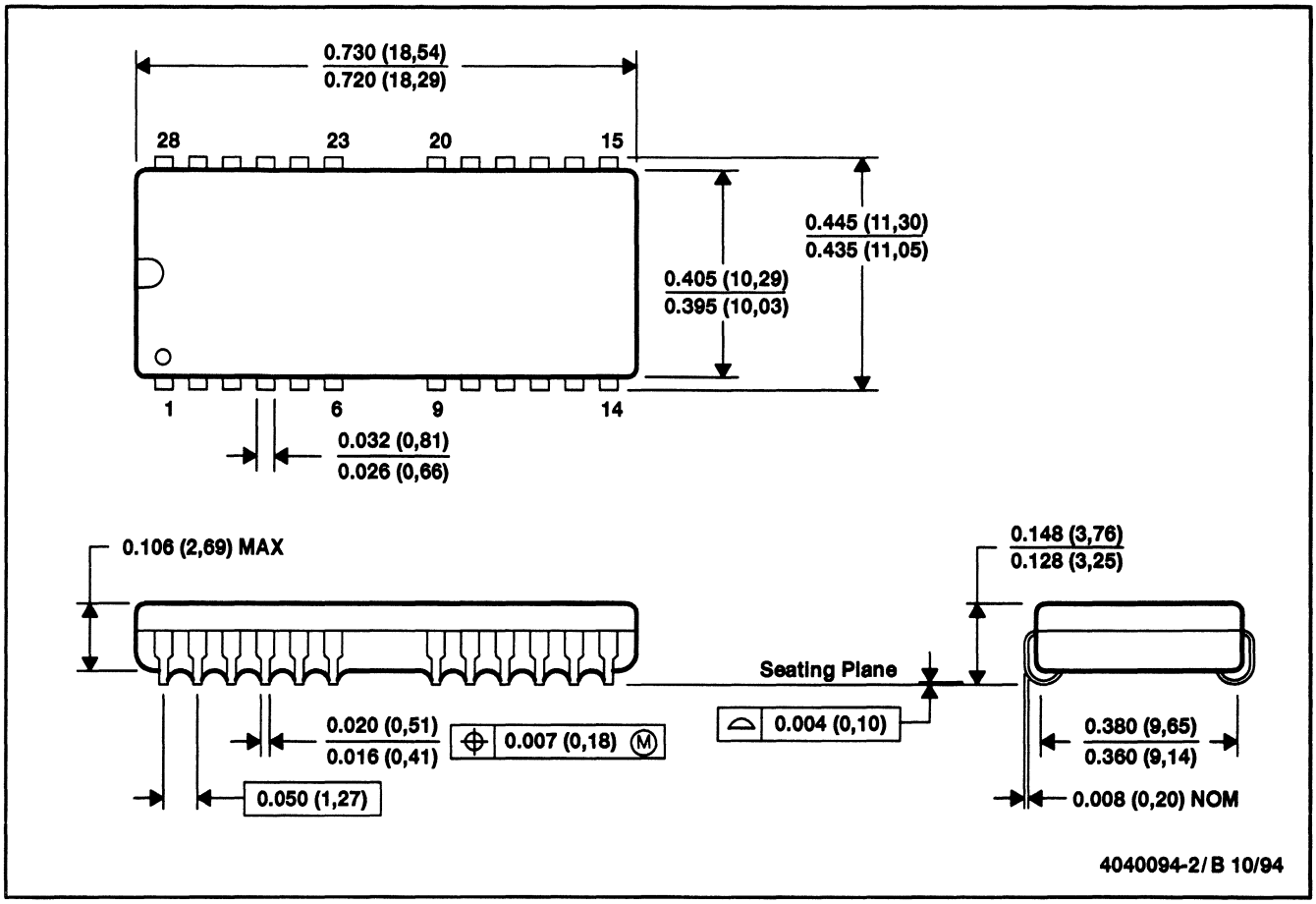
DJ (R-PDSO-J24/26) PLASTIC SMALL-OUTLINE J-LEAD PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

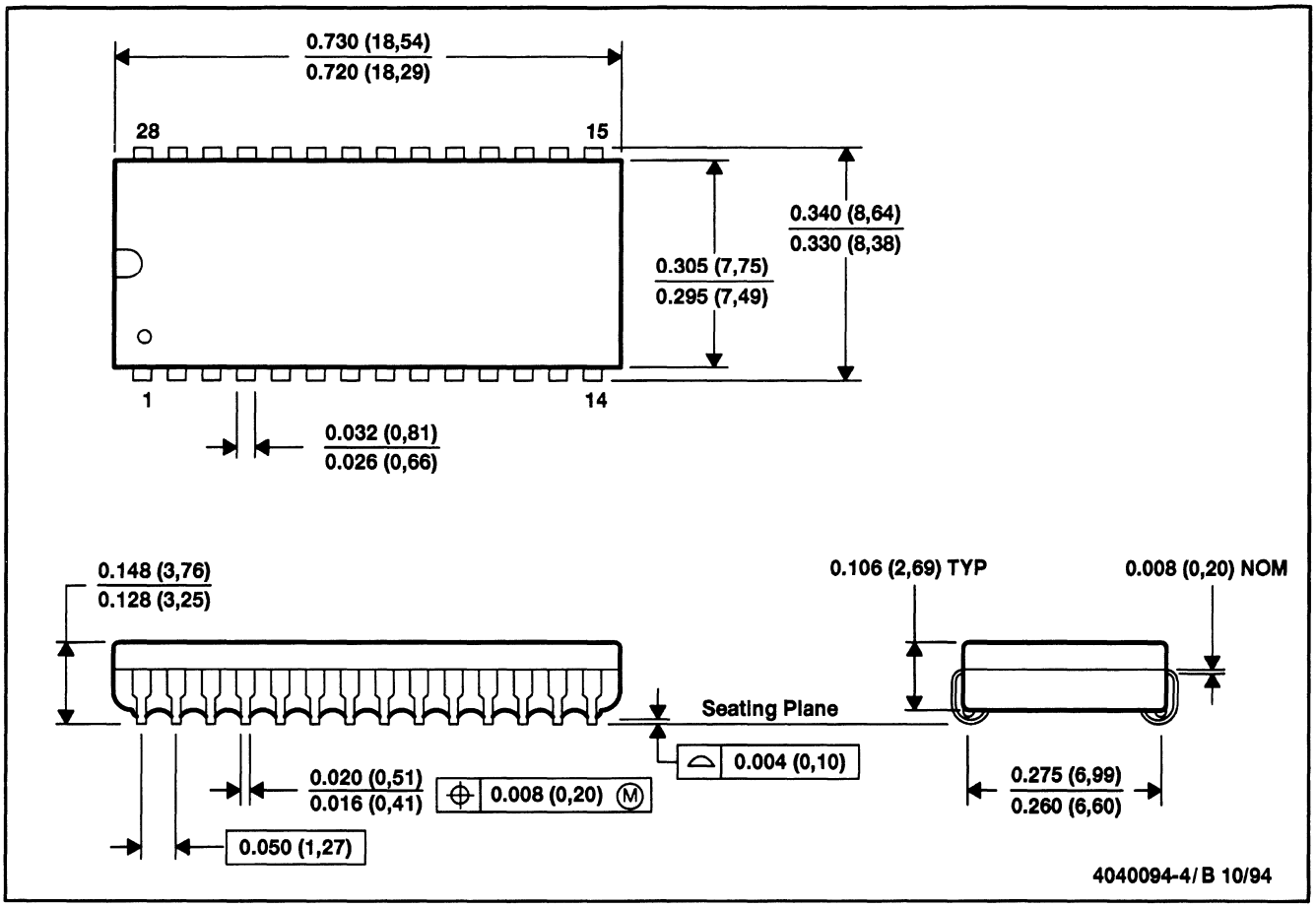
DZ (R-PDSO-J24/28) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

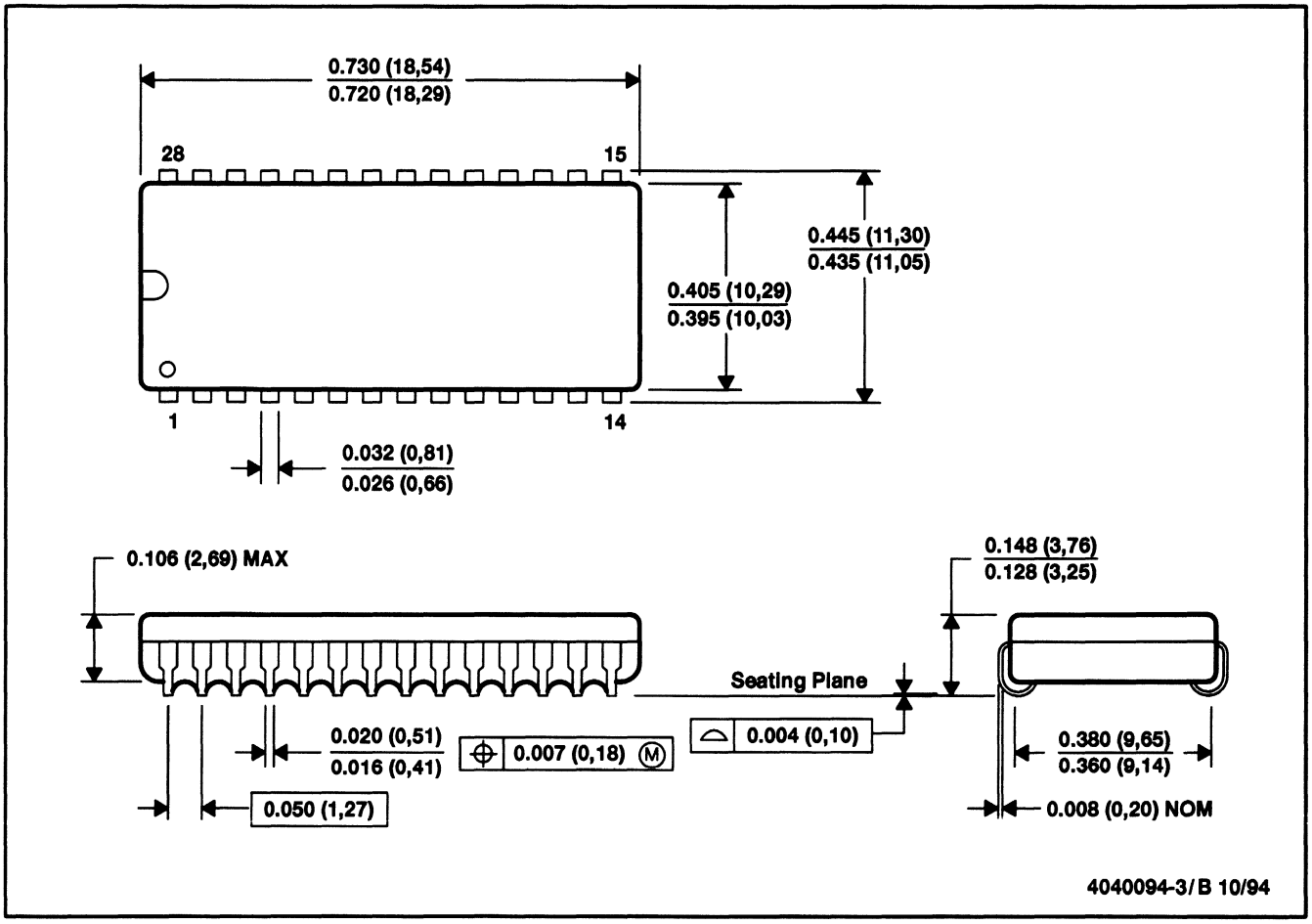
DJ (R-PDSO-J28) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

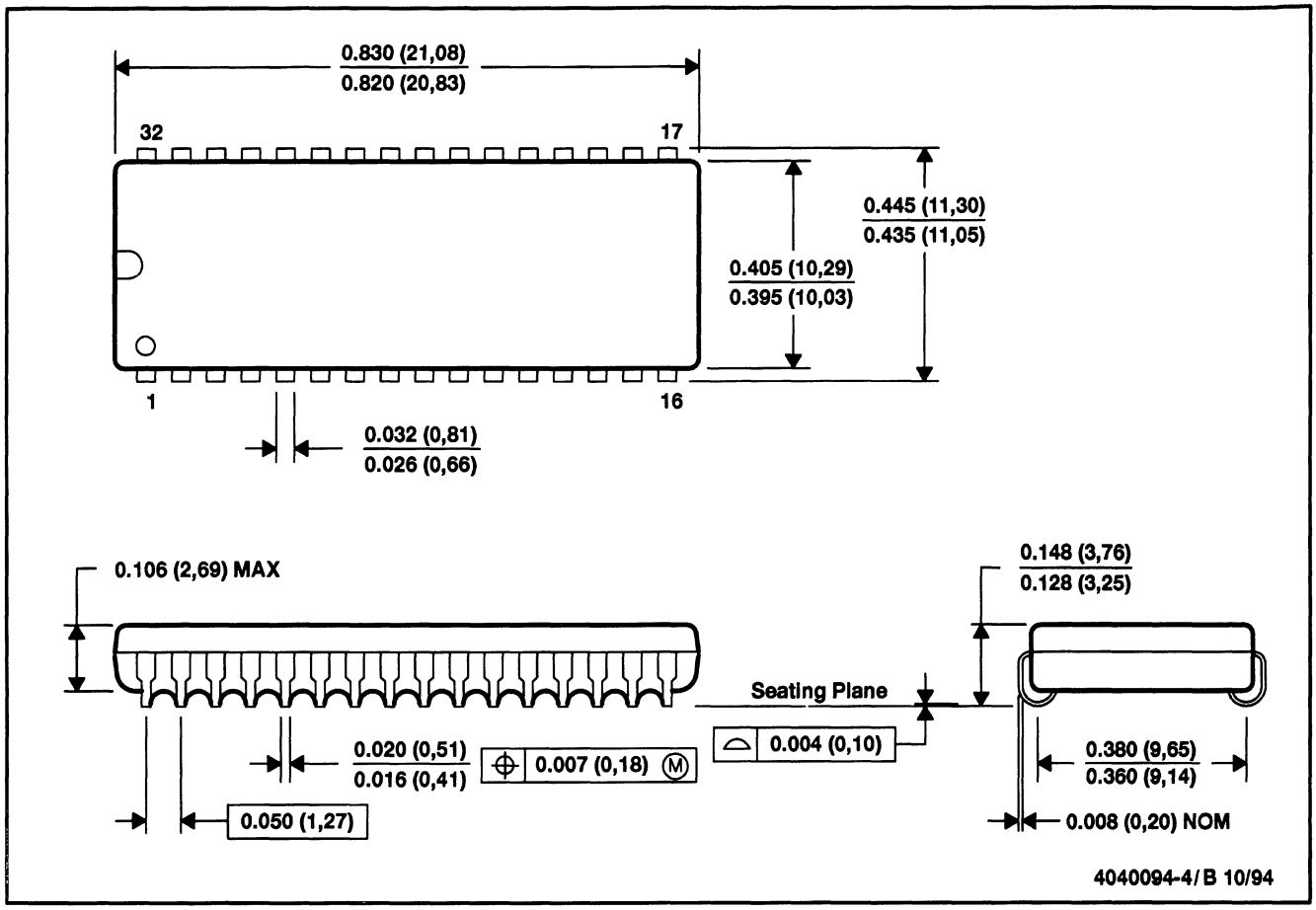
DZ (R-PDSO-J28) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

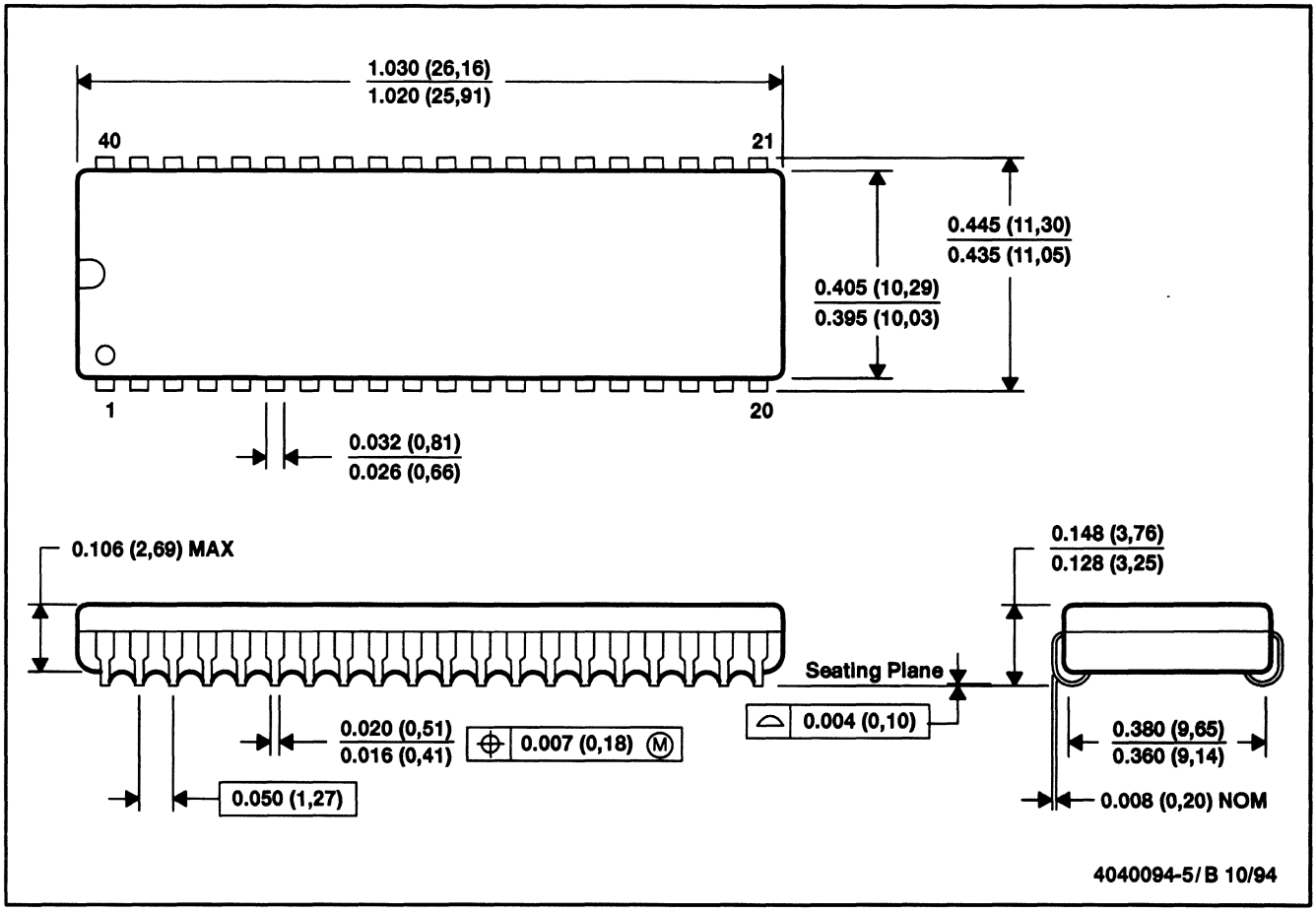
DZ (R-PDSO-J32) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

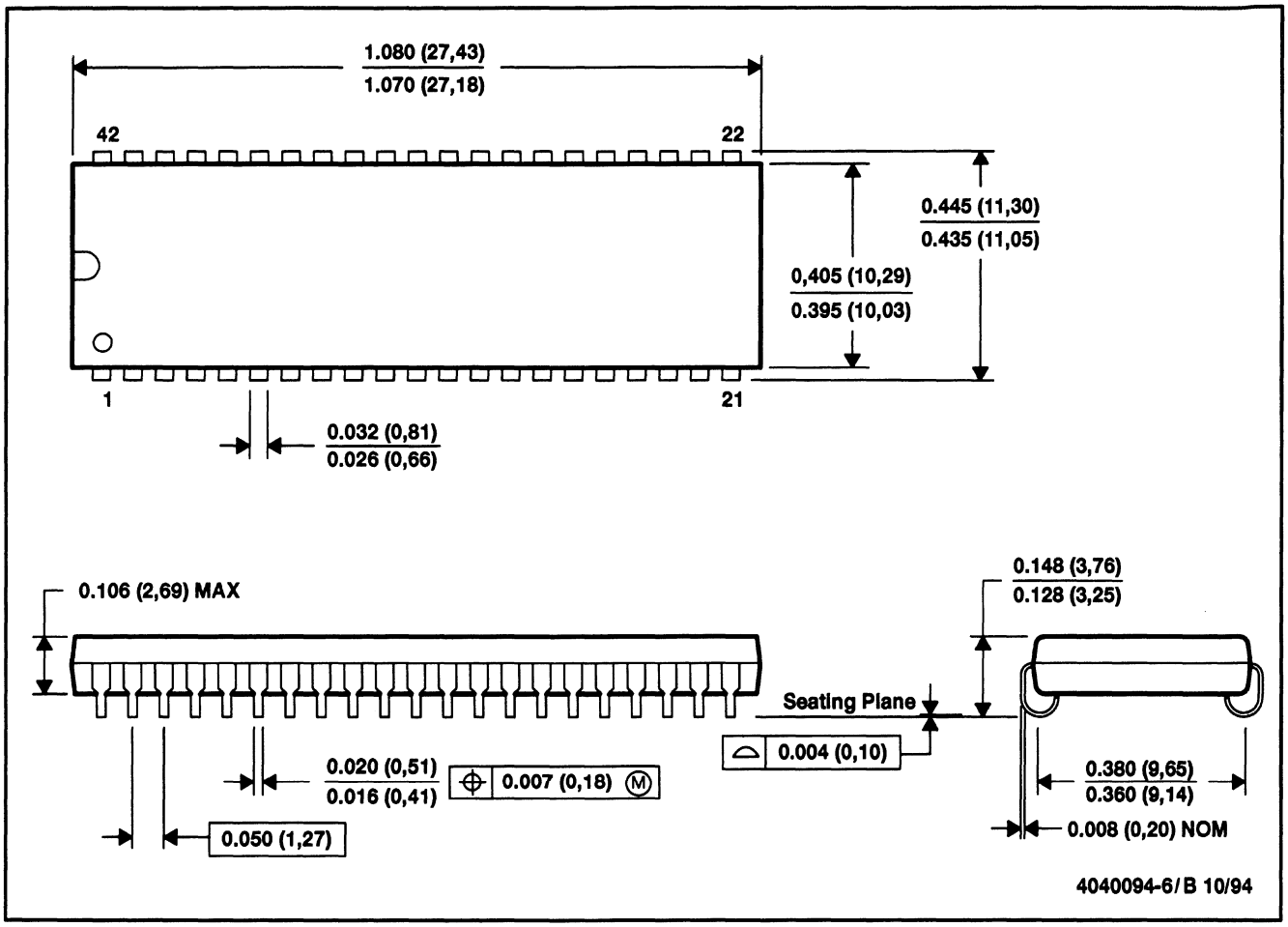
DZ (R-PDSO-J40) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

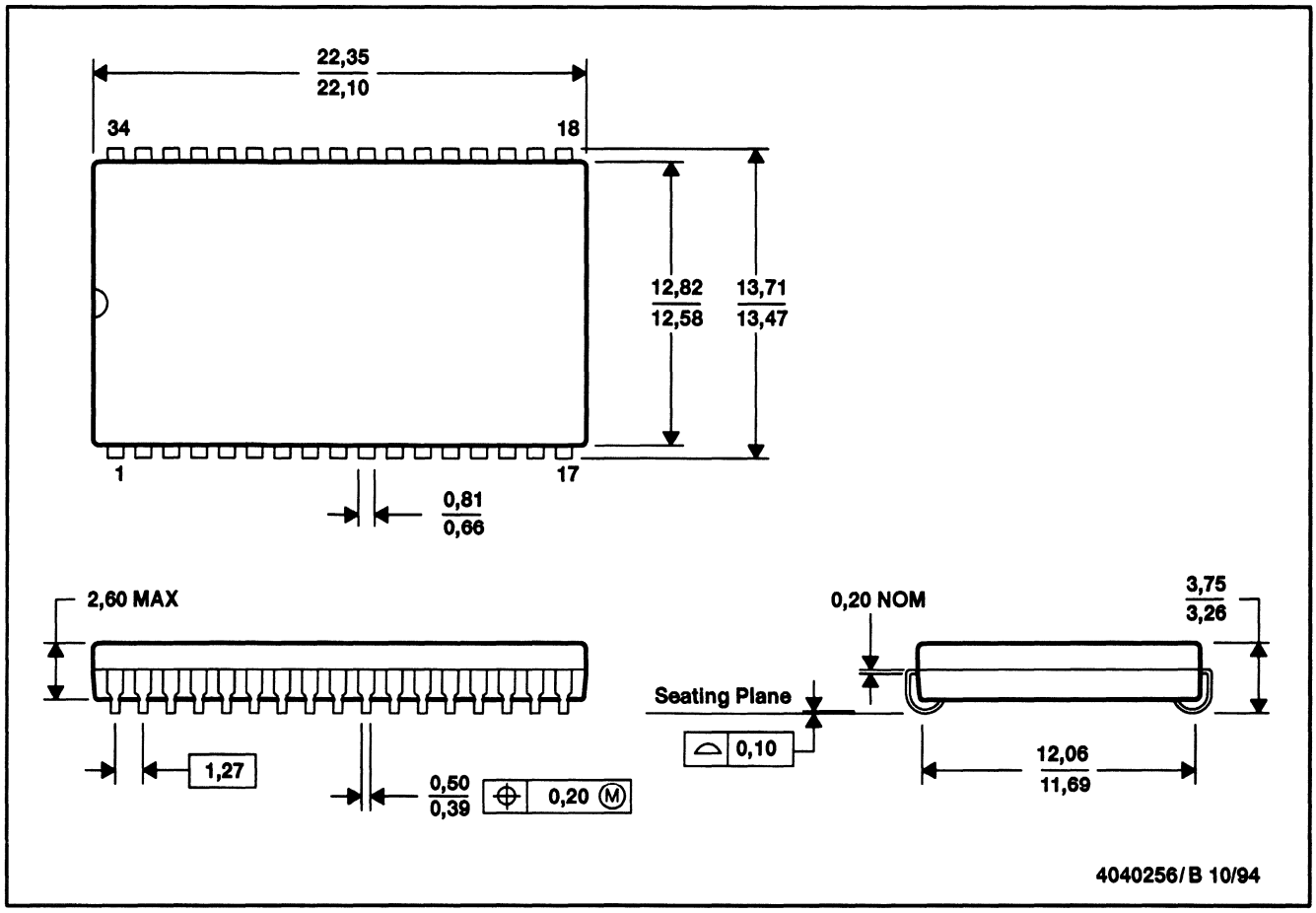
DZ (R-PDSO-J42) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,125).

OCTOBER 1994

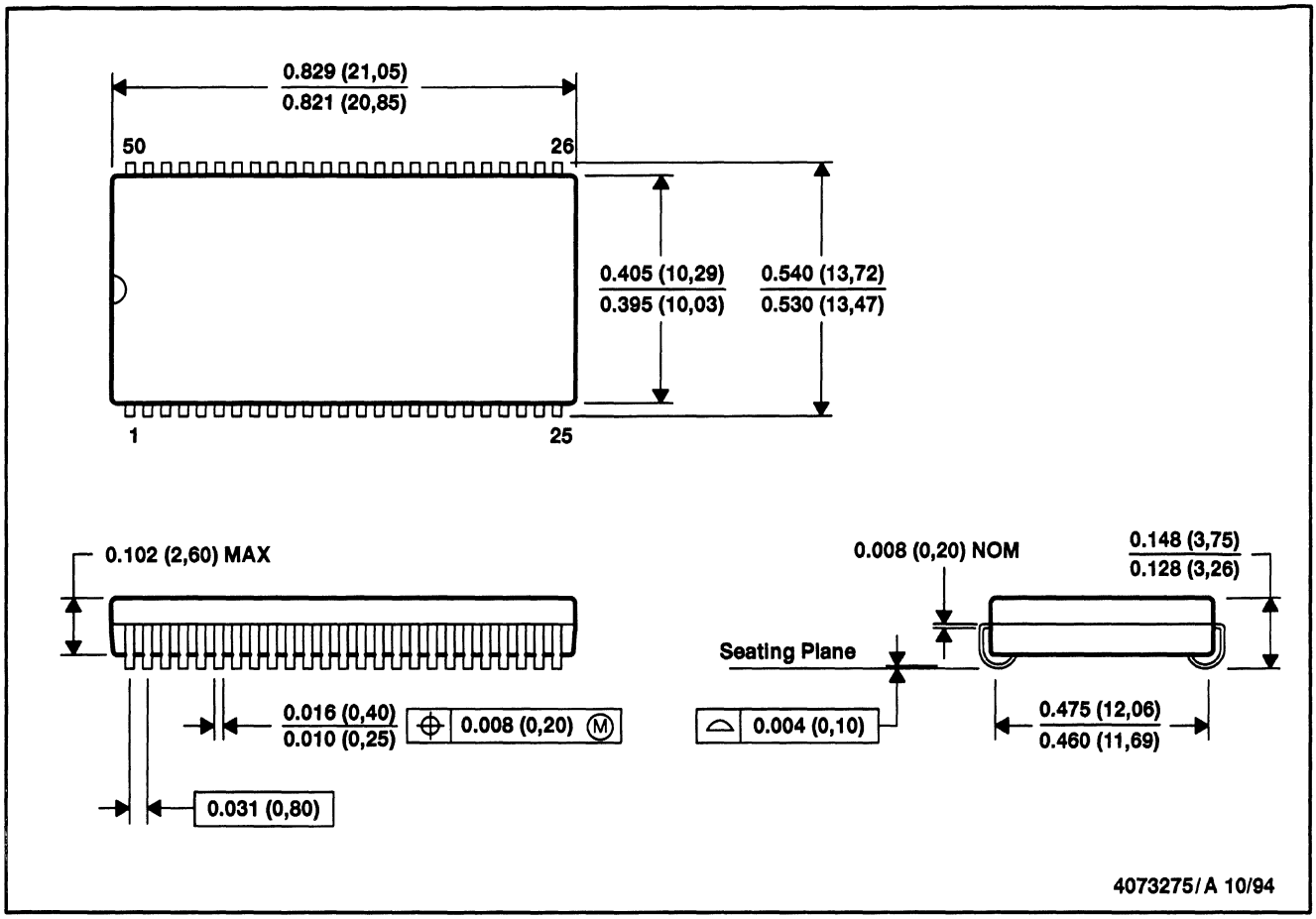
DBG (R-PDSO-J34) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.28.

OCTOBER 1994

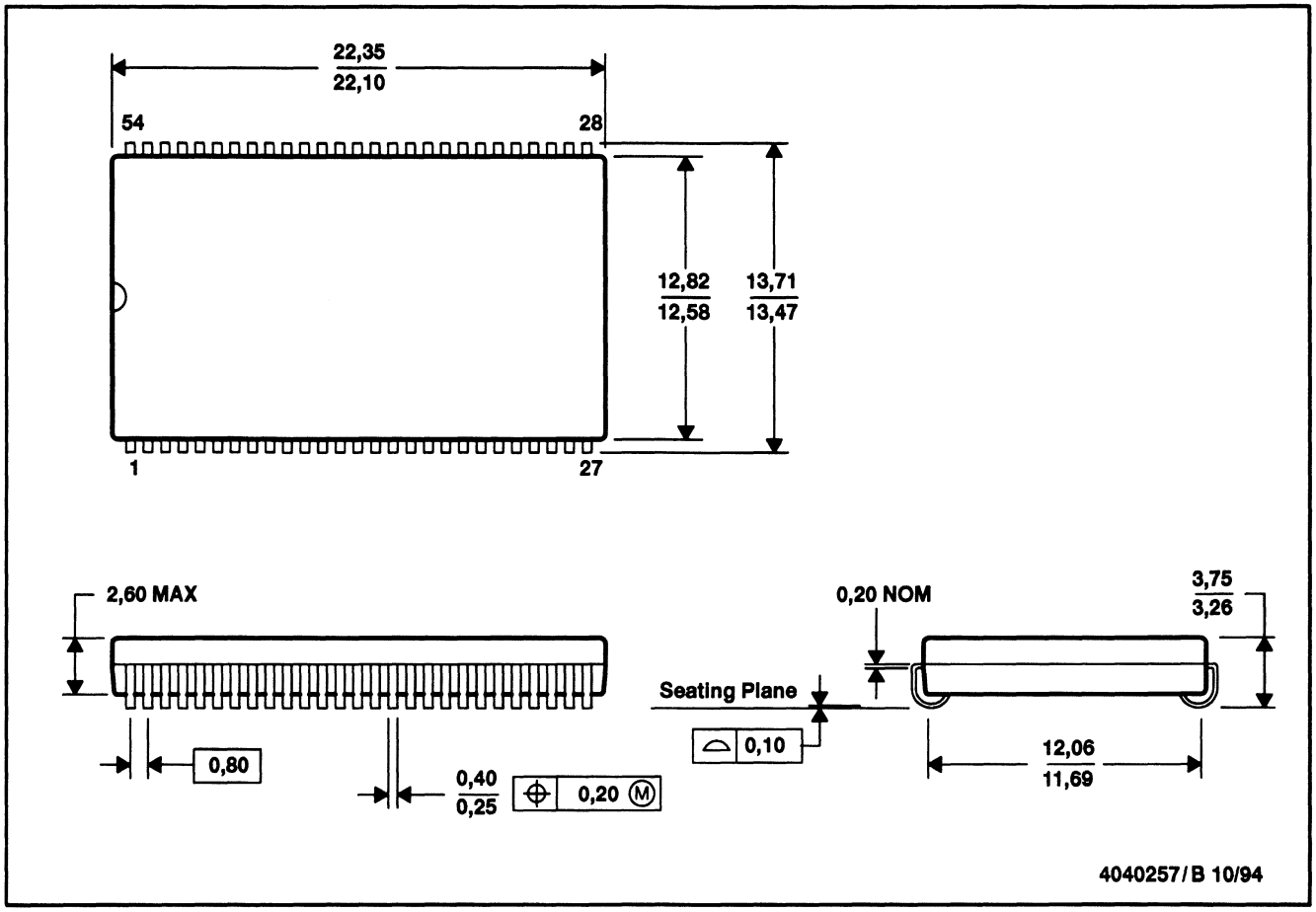
DZC (R-PDSO-J50) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.005 (0,28).

OCTOBER 1994

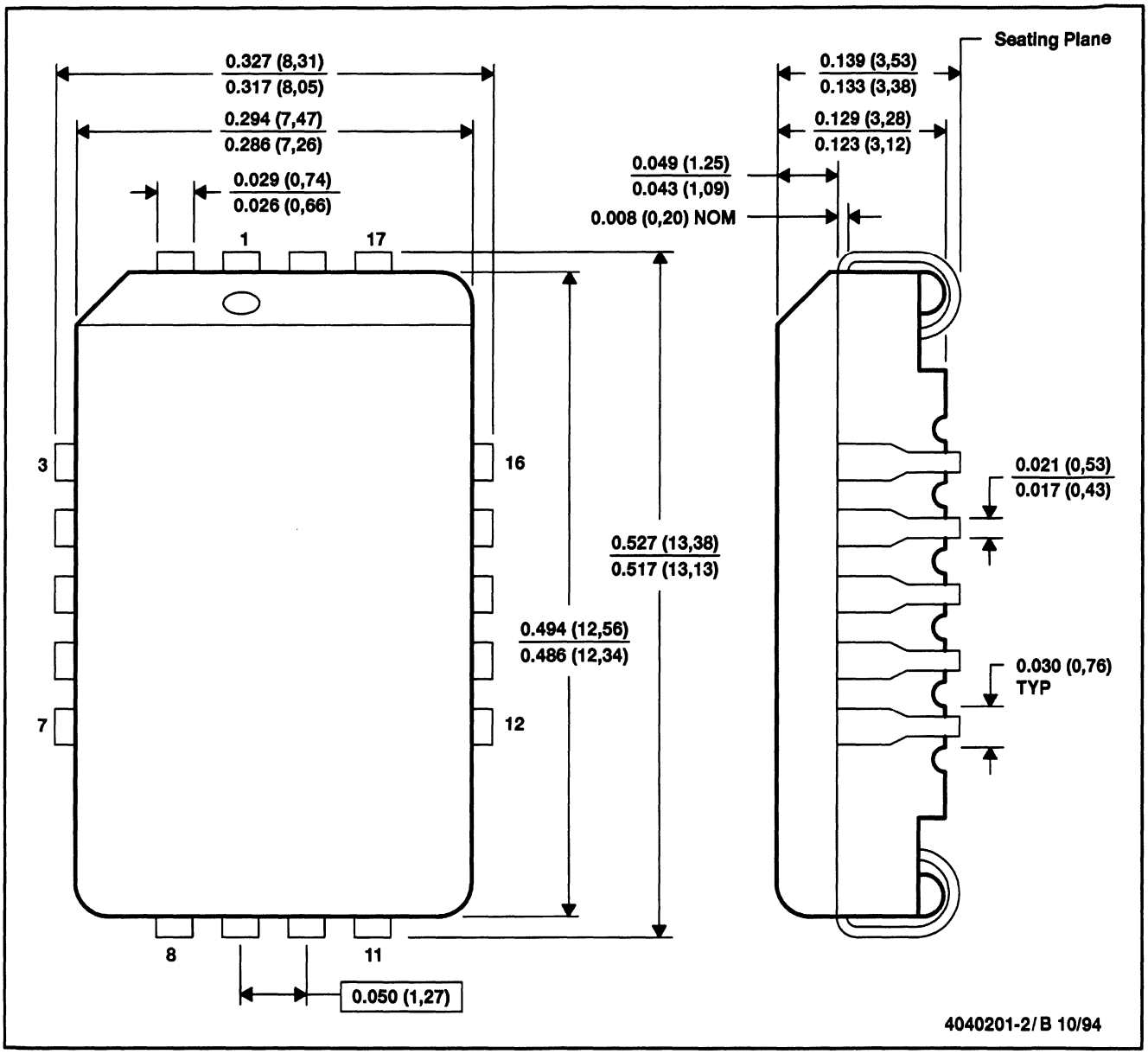
DBG (R-PDSO-J54) **PLASTIC SMALL-OUTLINE J-LEAD PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Plastic body dimensions do not include mold protrusion. Maximum mold protrusion is 0.28.

OCTOBER 1994

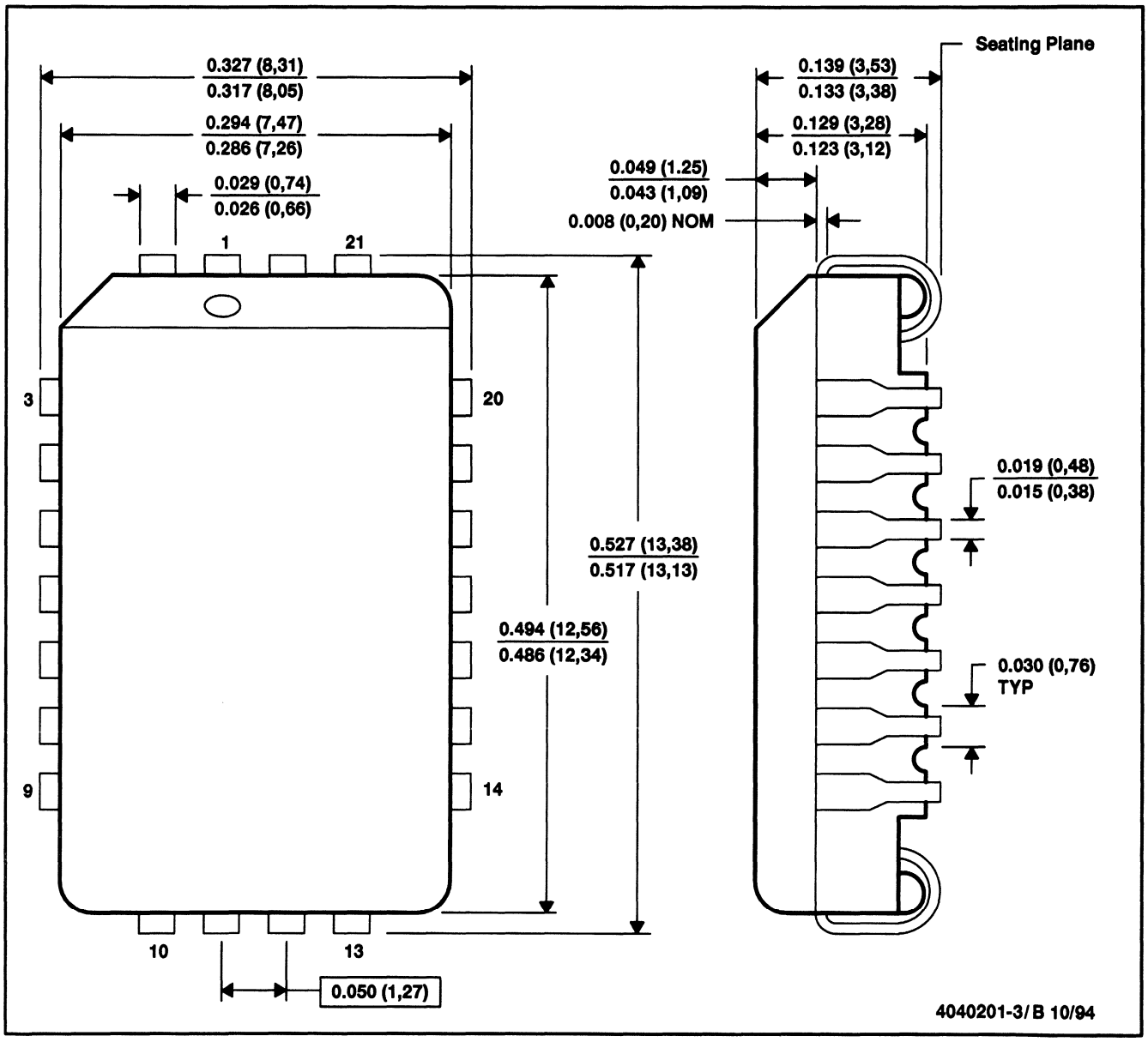
FM (R-PQCC-J18) **PLASTIC J-LEADED CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

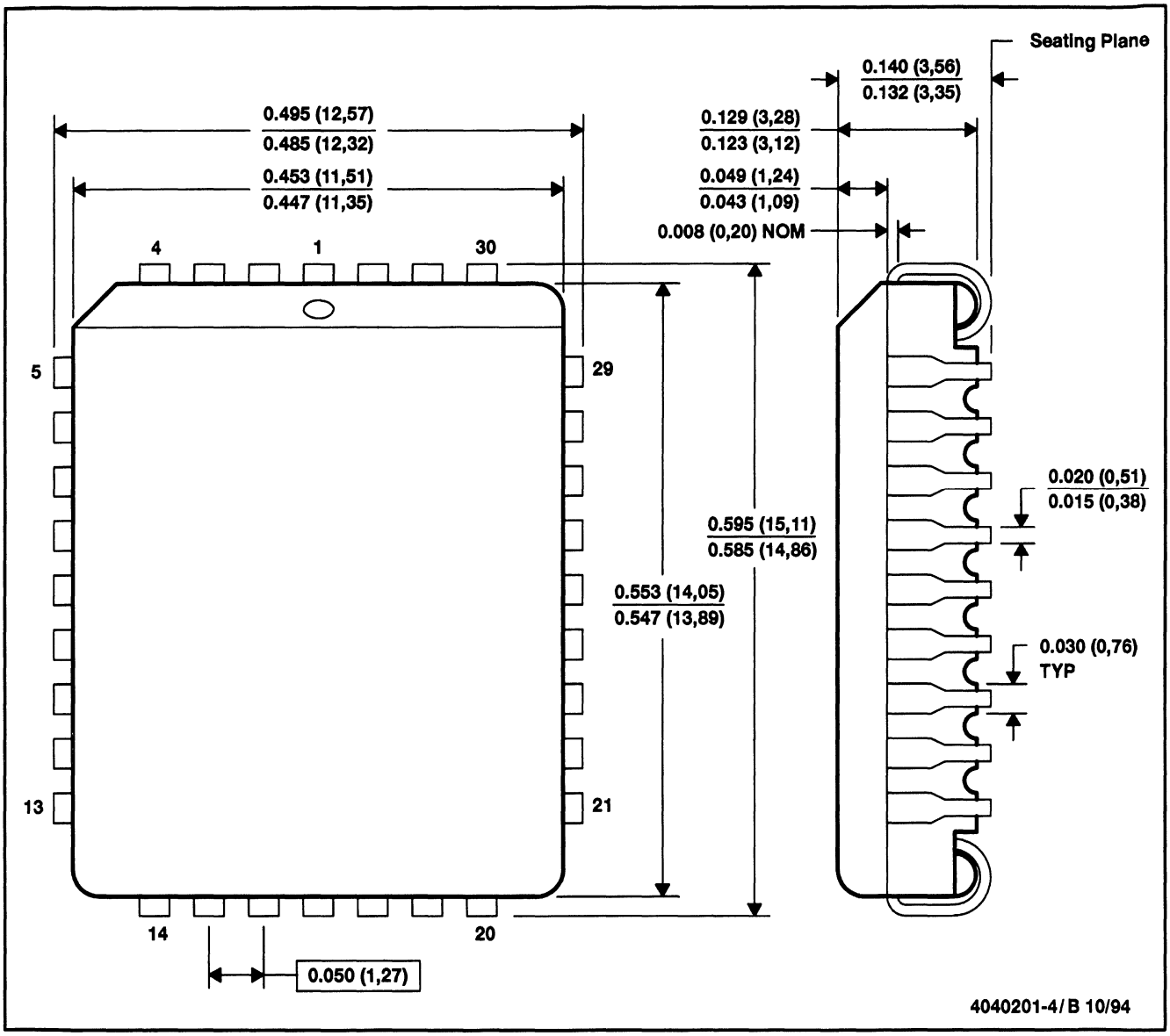
FM (R-PQCC-J22) **PLASTIC J-LEADED CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

FM (R-PQCC-J32) **PLASTIC J-LEADED CHIP CARRIER**

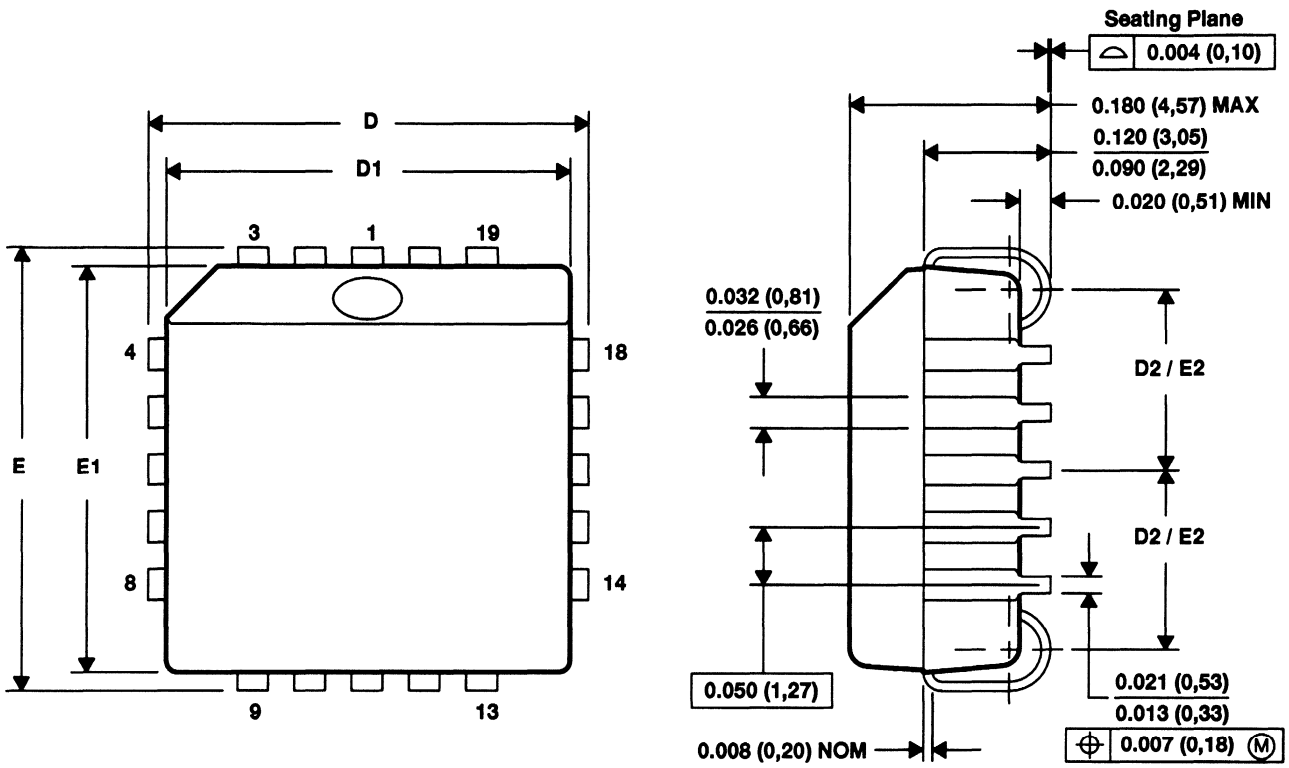


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

FN (S-PQCC-J)** **PLASTIC J-LEADED CHIP CARRIER**

20 PIN SHOWN



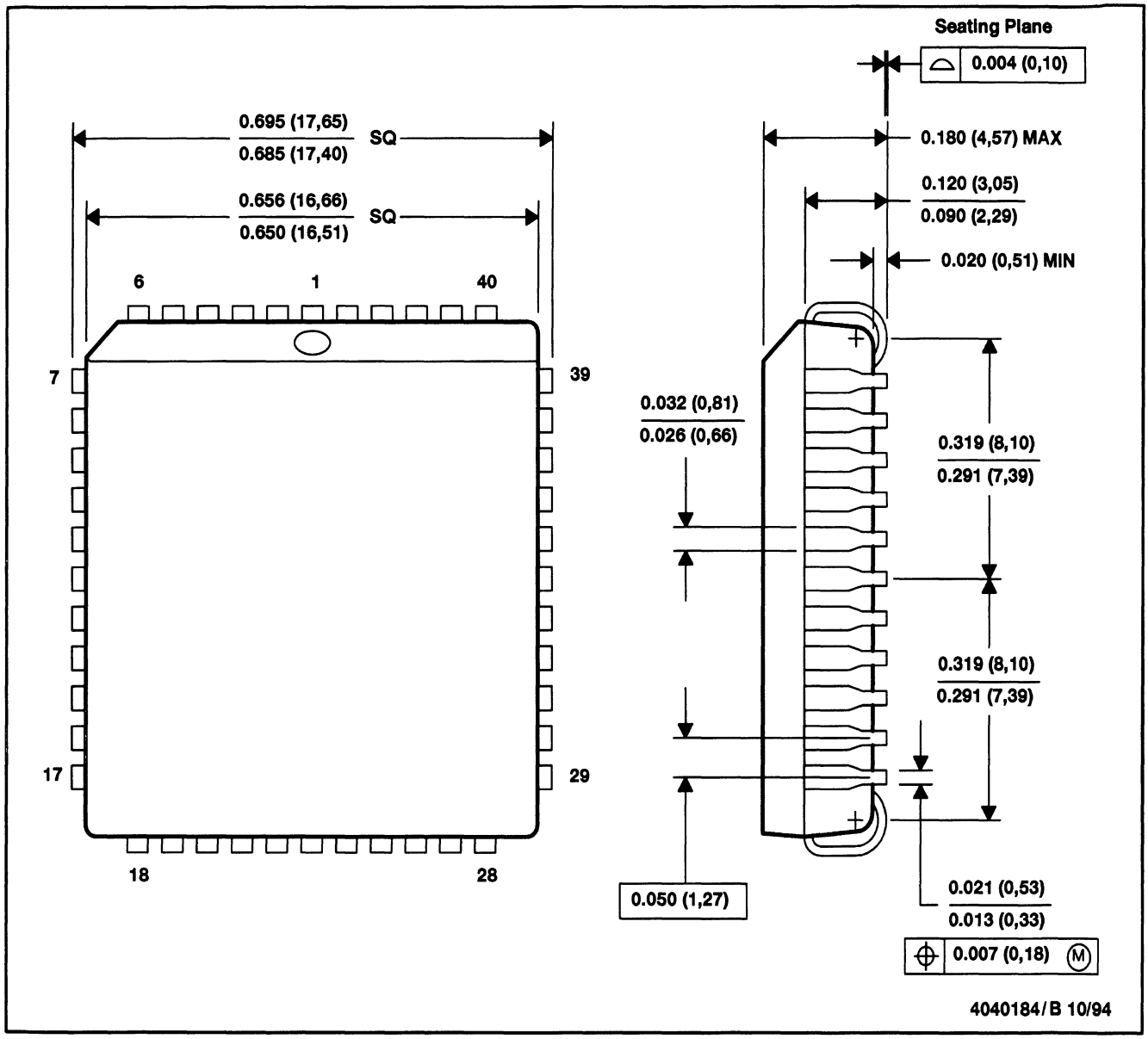
NO. OF PINS **	D / E		D1 / E1		D2 / E2	
	MIN	MAX	MIN	MAX	MIN	MAX
20	0.385 (9,78)	0.395 (10,03)	0.350 (8,89)	0.356 (9,04)	0.141 (3,58)	0.169 (4,29)
28	0.485 (12,32)	0.495 (12,57)	0.450 (11,43)	0.456 (11,58)	0.191 (4,85)	0.219 (5,56)
44	0.685 (17,40)	0.695 (17,65)	0.650 (16,51)	0.656 (16,66)	0.291 (7,39)	0.319 (8,10)
52	0.785 (19,94)	0.795 (20,19)	0.750 (19,05)	0.756 (19,20)	0.341 (8,66)	0.369 (9,37)
68	0.985 (25,02)	0.995 (25,27)	0.950 (24,13)	0.958 (24,33)	0.441 (11,20)	0.469 (11,91)
84	1.185 (30,10)	1.195 (30,35)	1.150 (29,21)	1.158 (29,41)	0.541 (13,74)	0.569 (14,45)

4040005/B 10/94

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-018

OCTOBER 1994

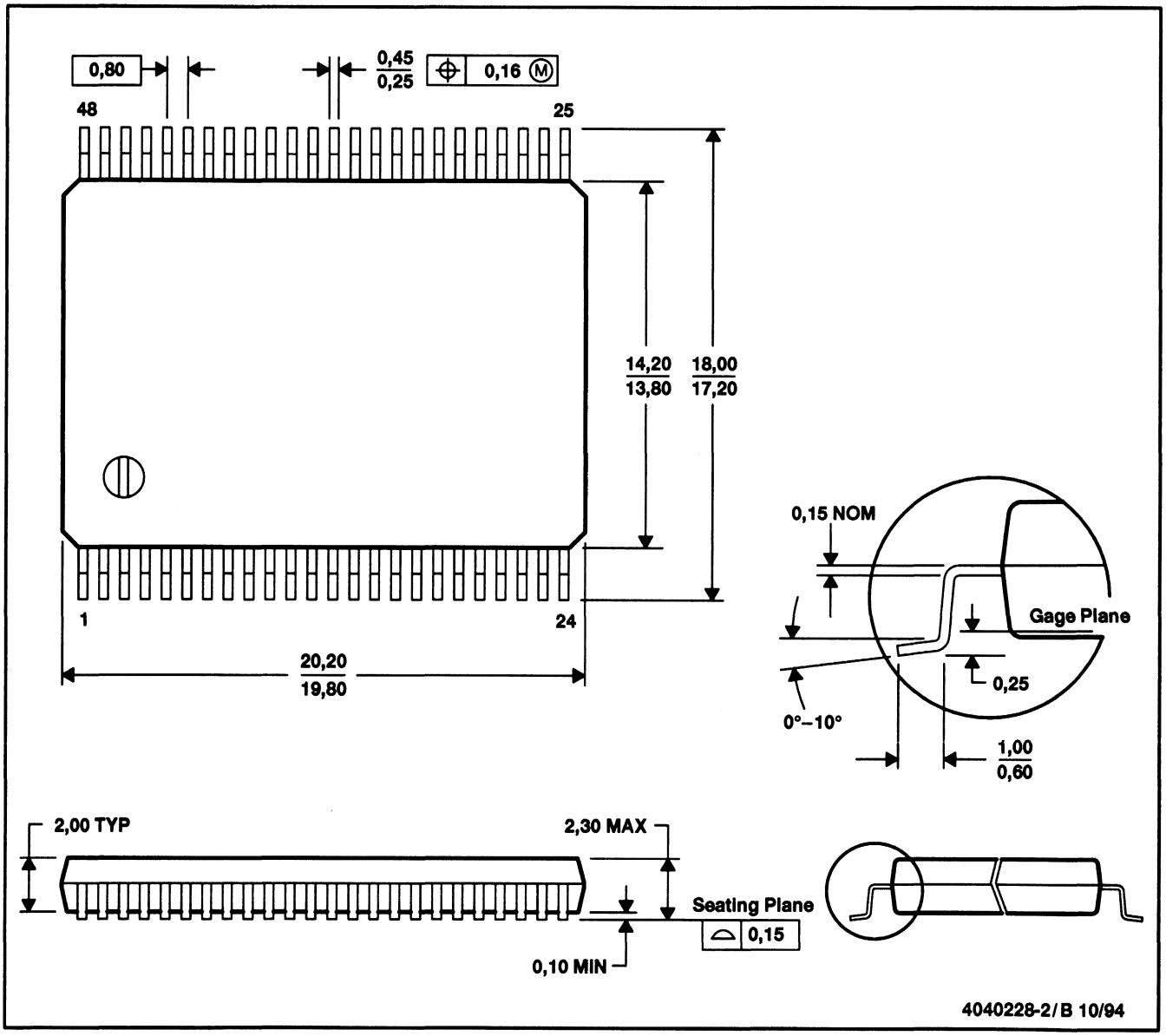
FNH (S-PQCC-J44) **PLASTIC J-LEADED CHIP CARRIER**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-018
D. Thermally enhanced molded plastic package with leads 19 through 27 connected to the die pad

OCTOBER 1994

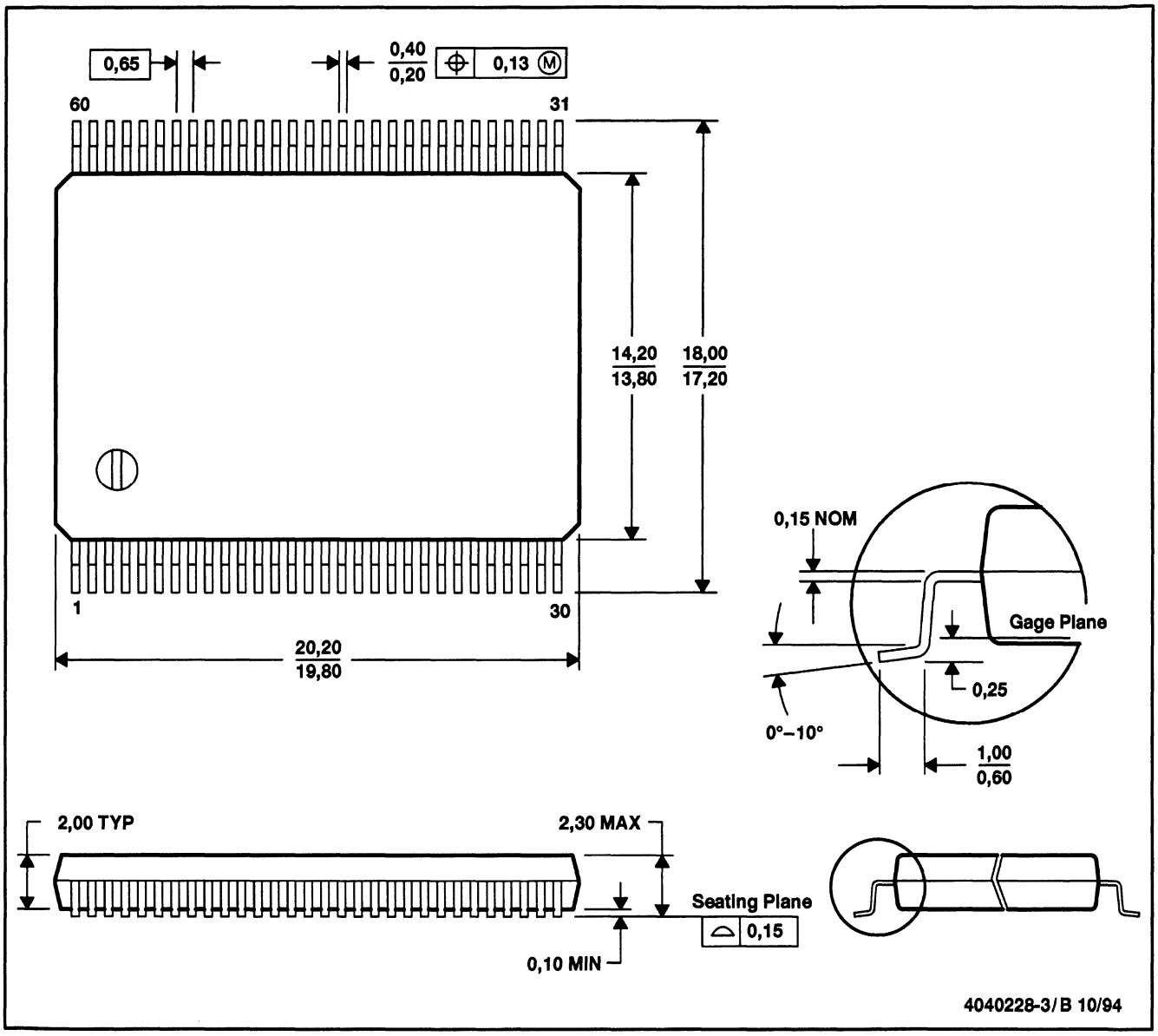
FT (R-PDFP-G48) **PLASTIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

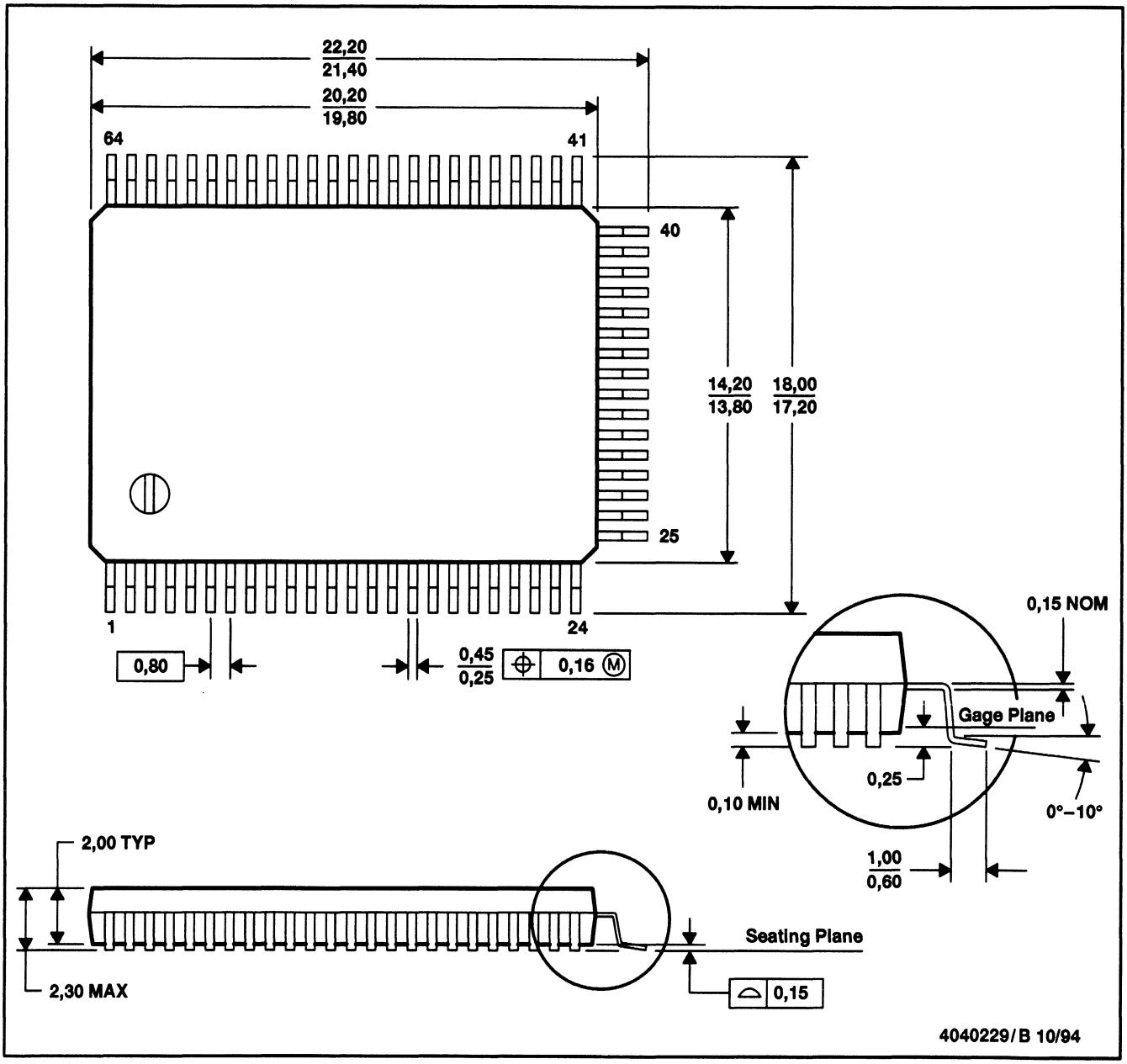
FT (R-PDFP-G60) **PLASTIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

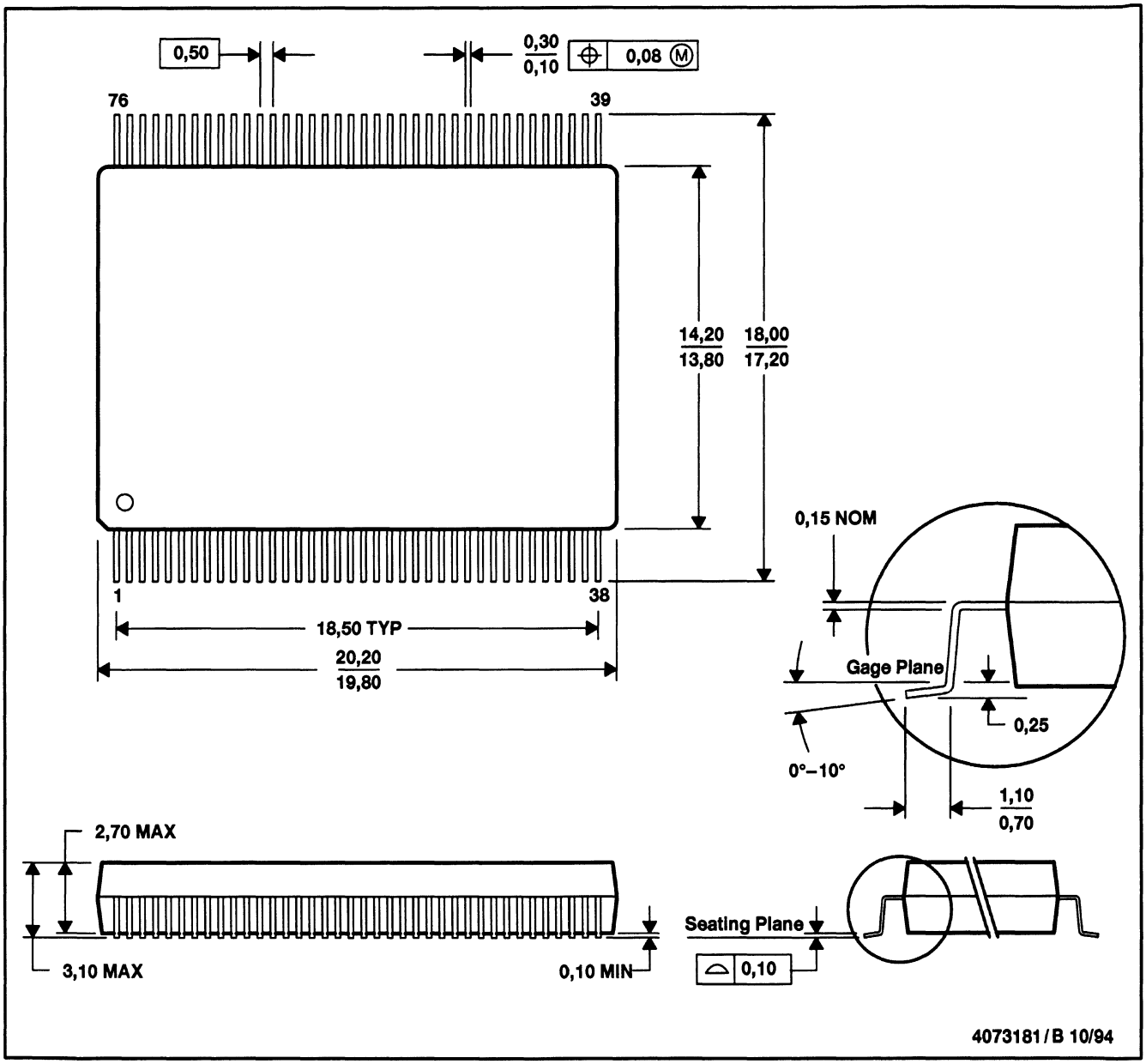
FT (R-PTFP-G64) **PLASTIC TRIPLE FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

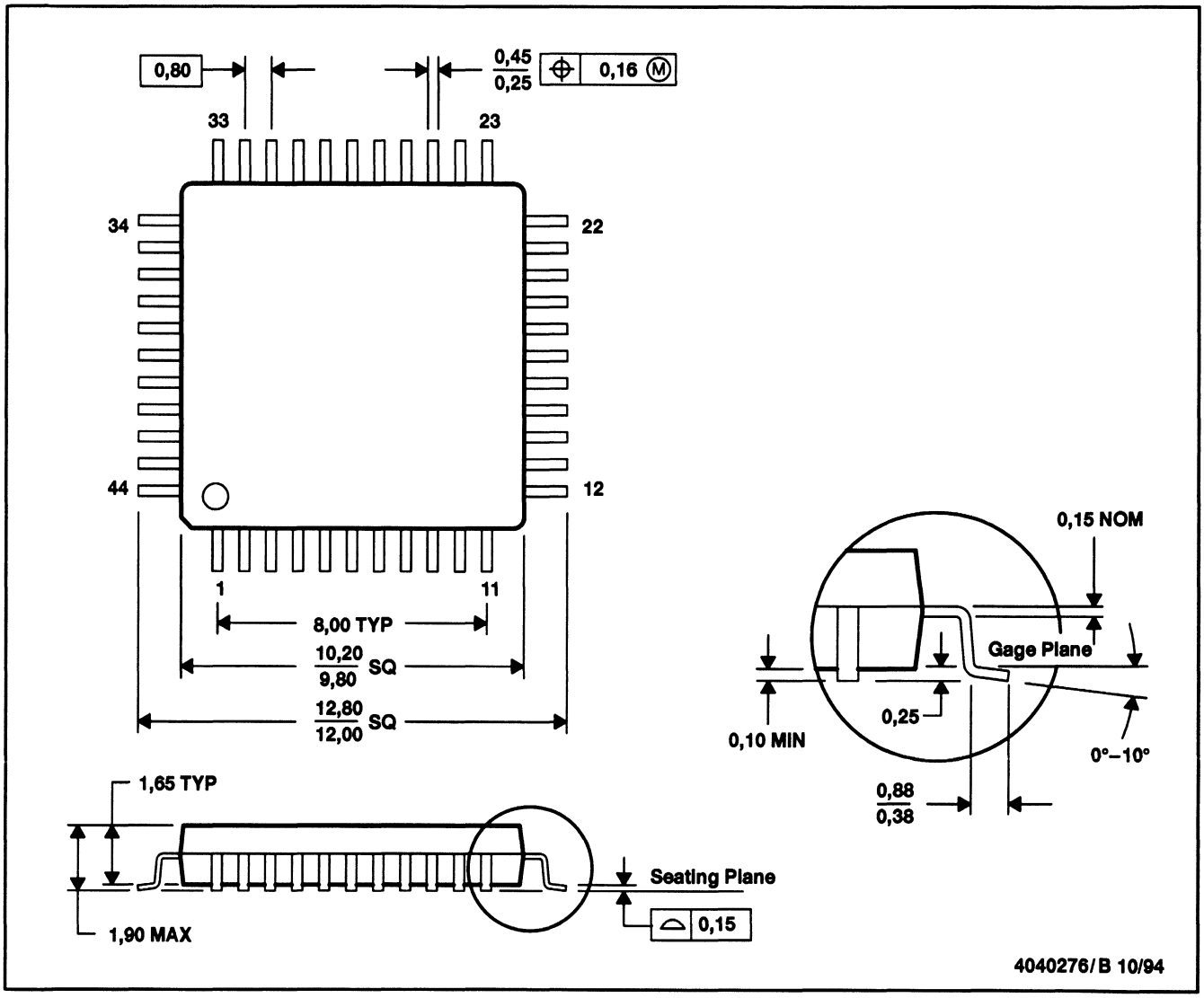
PDR (R-PDFP-G76) **PLASTIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

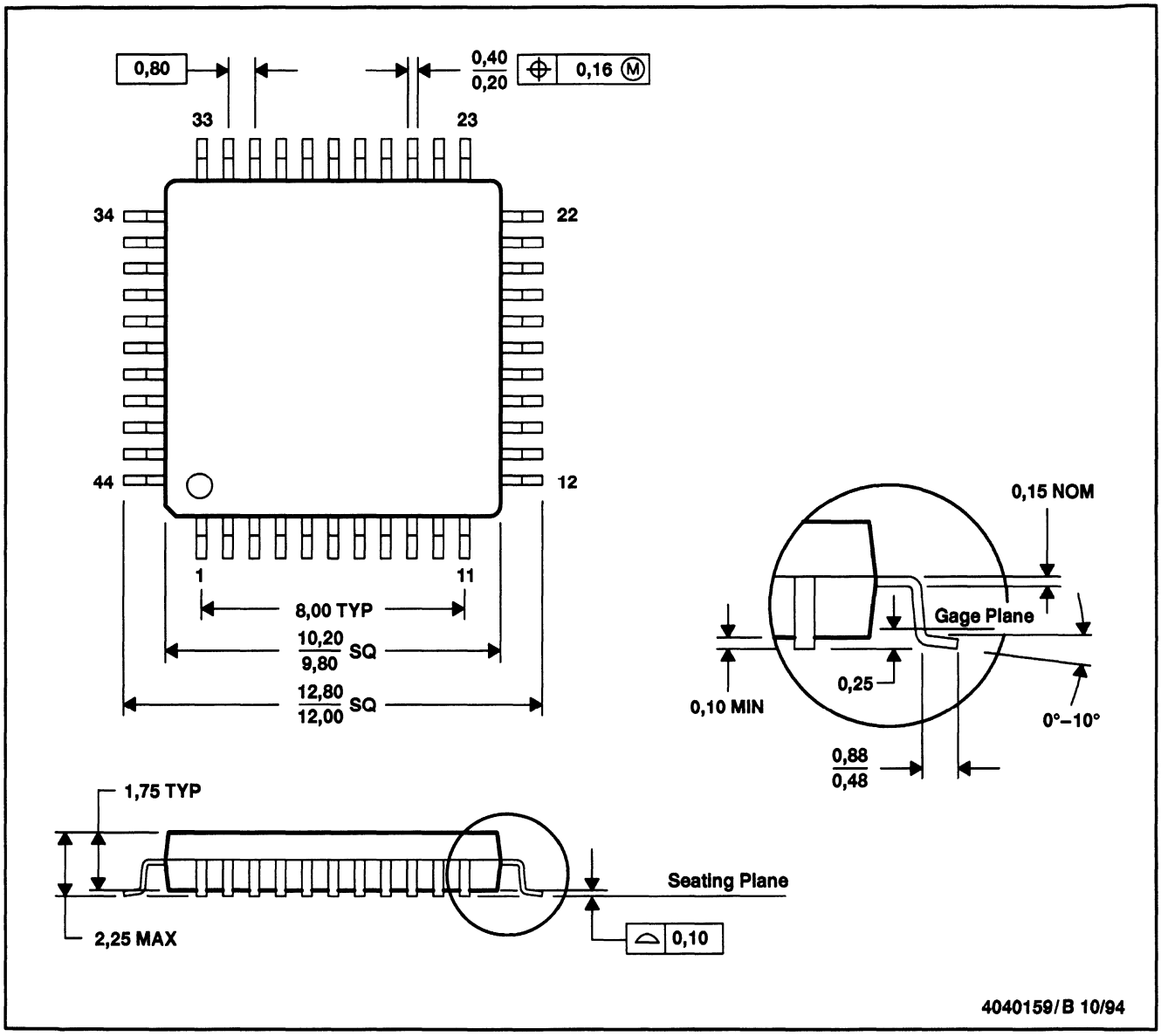
PAD (S-PQFP-G44) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

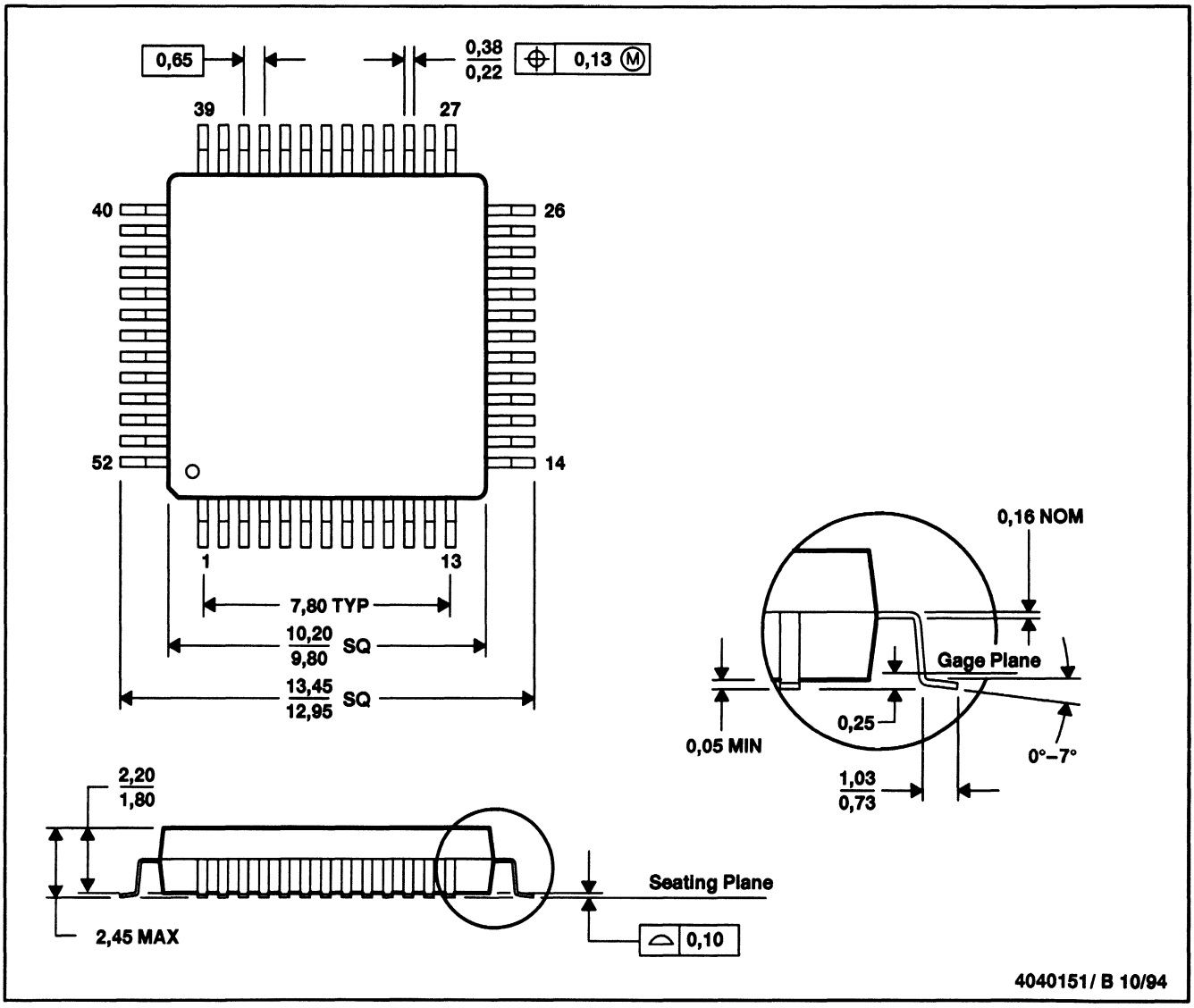
FR (S-PDFP-G44) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

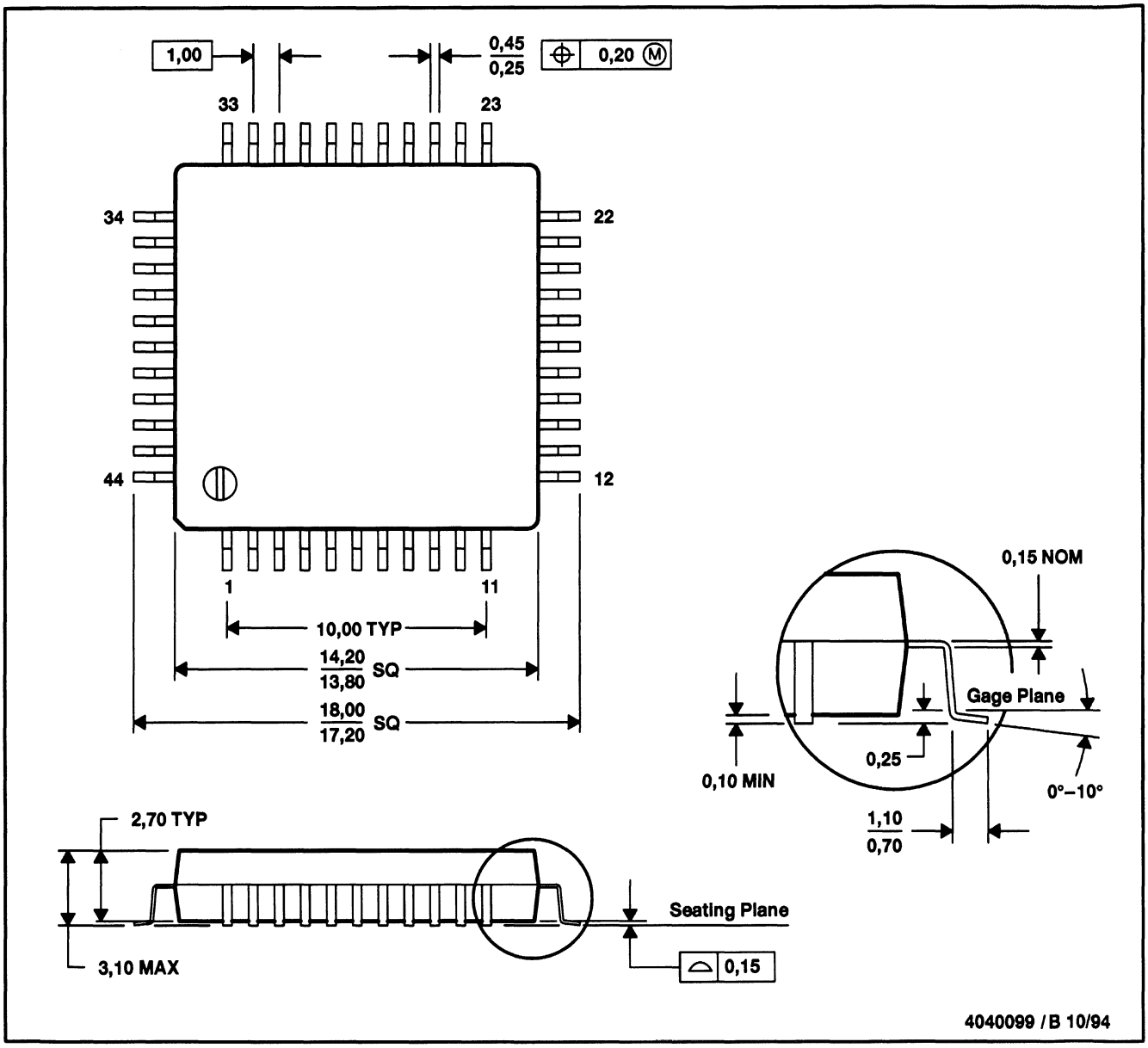
RC (S-PQFP-G52) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-022

OCTOBER 1994

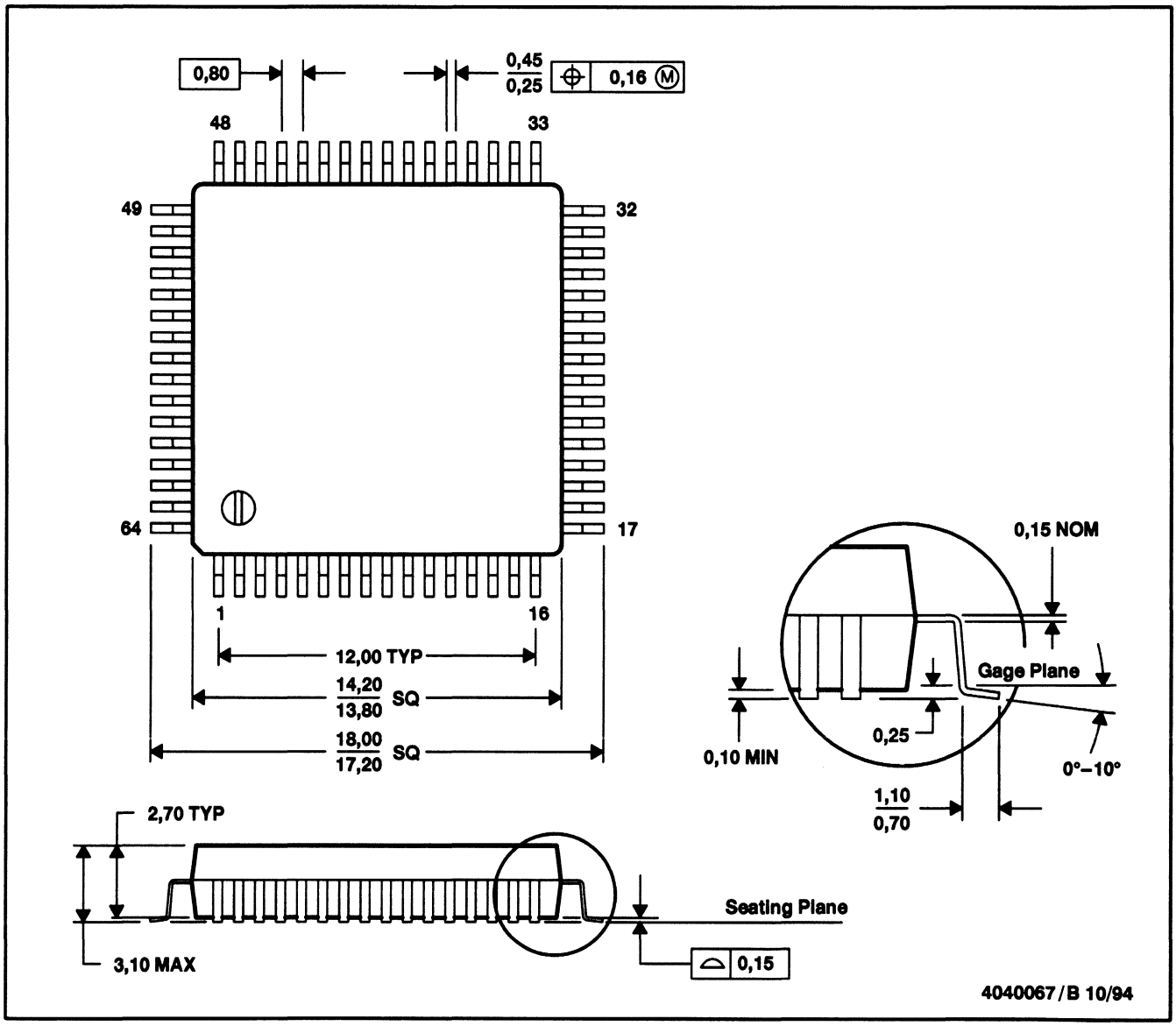
PE (S-PQFP-G44) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

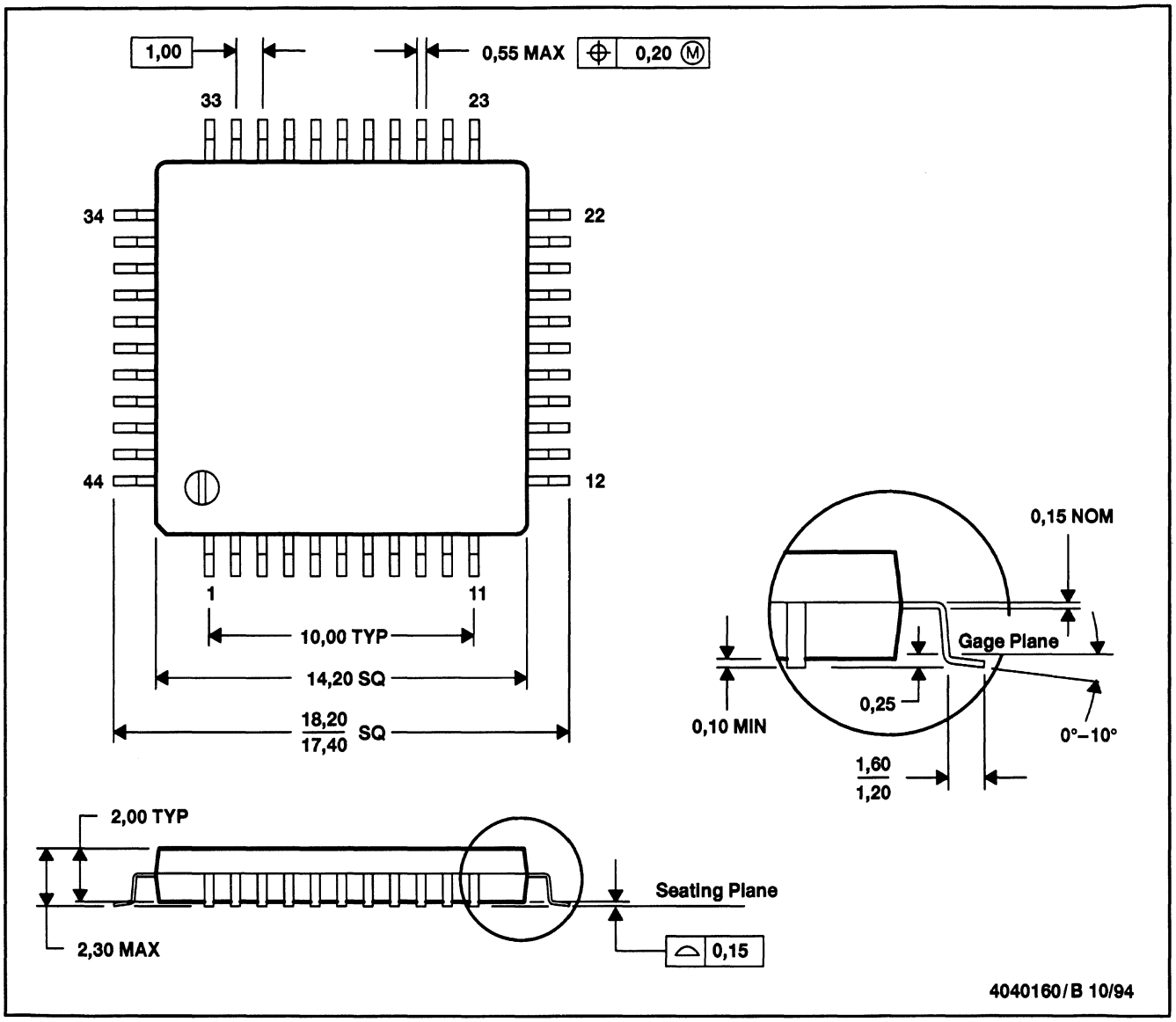
PF (S-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

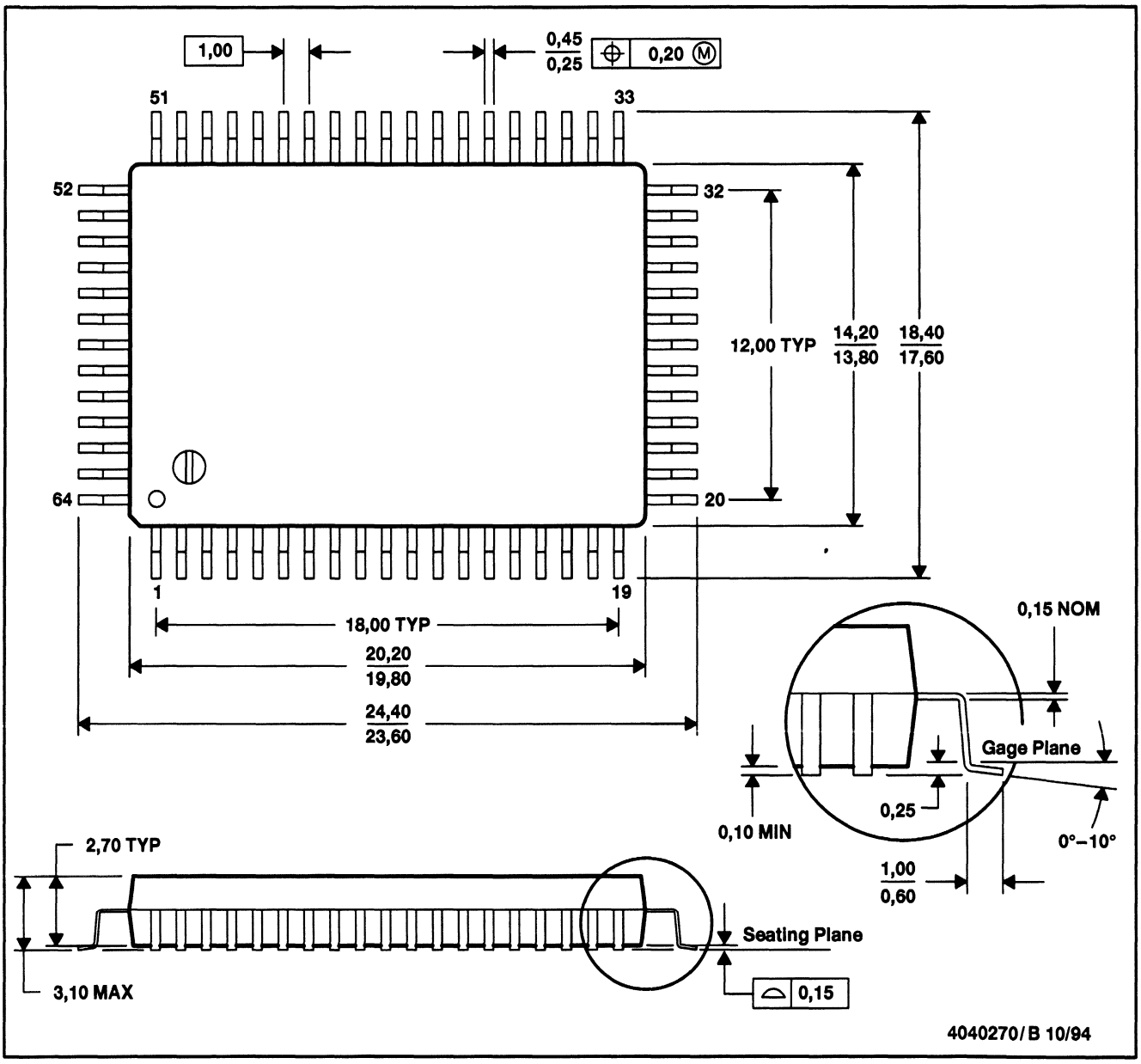
FS (S-PQFP-G44) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

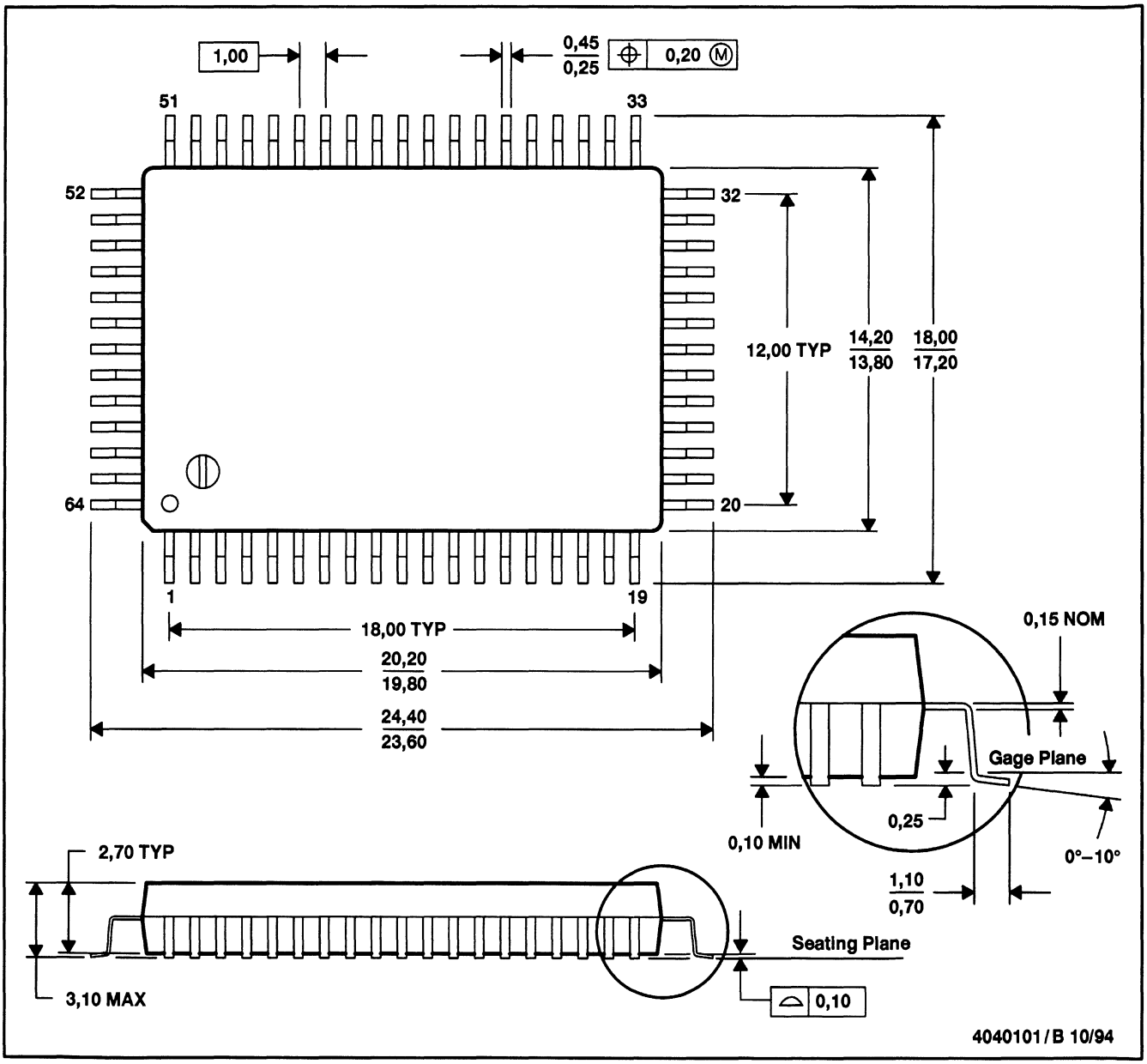
PAK (R-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

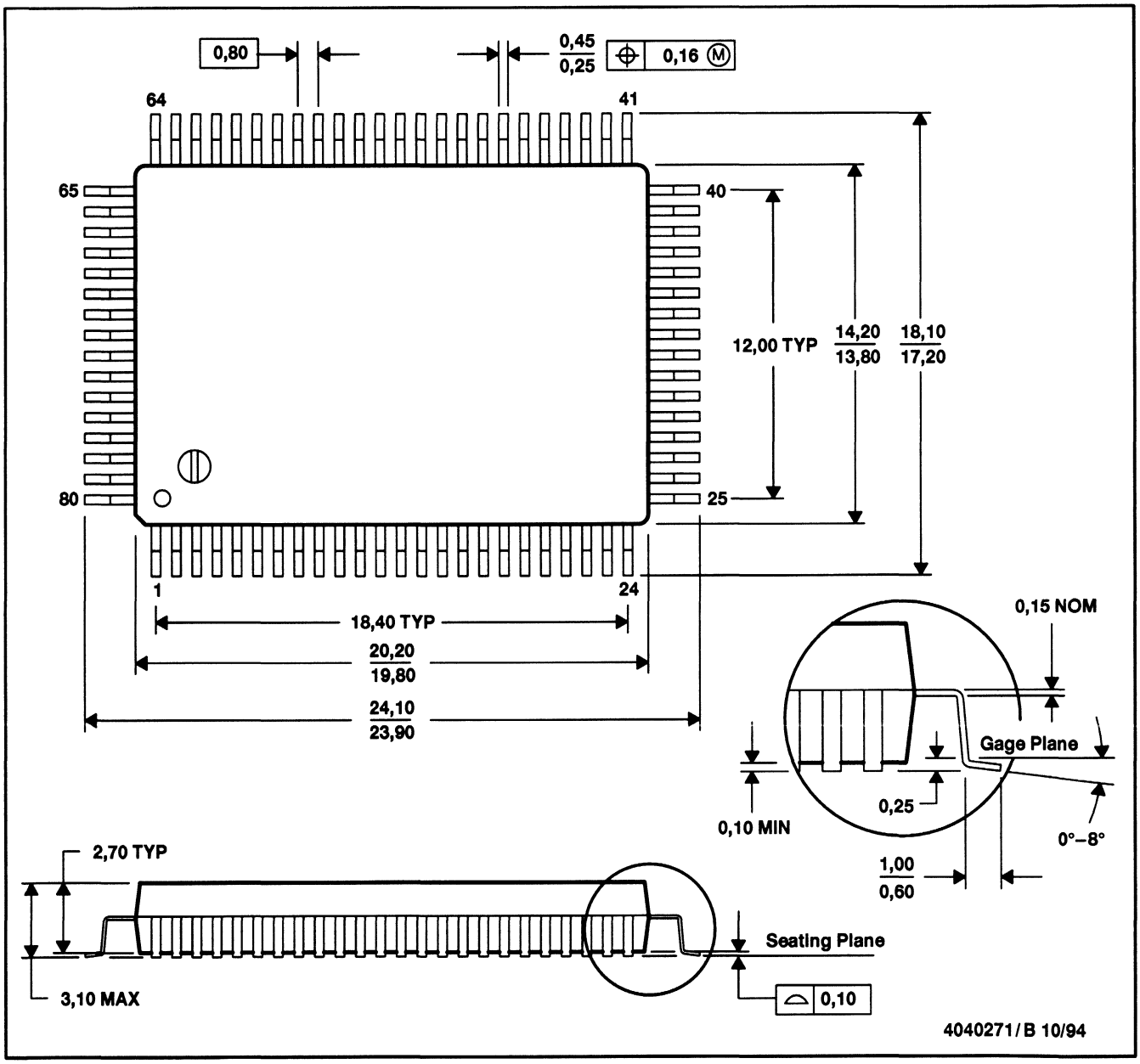
PG (R-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

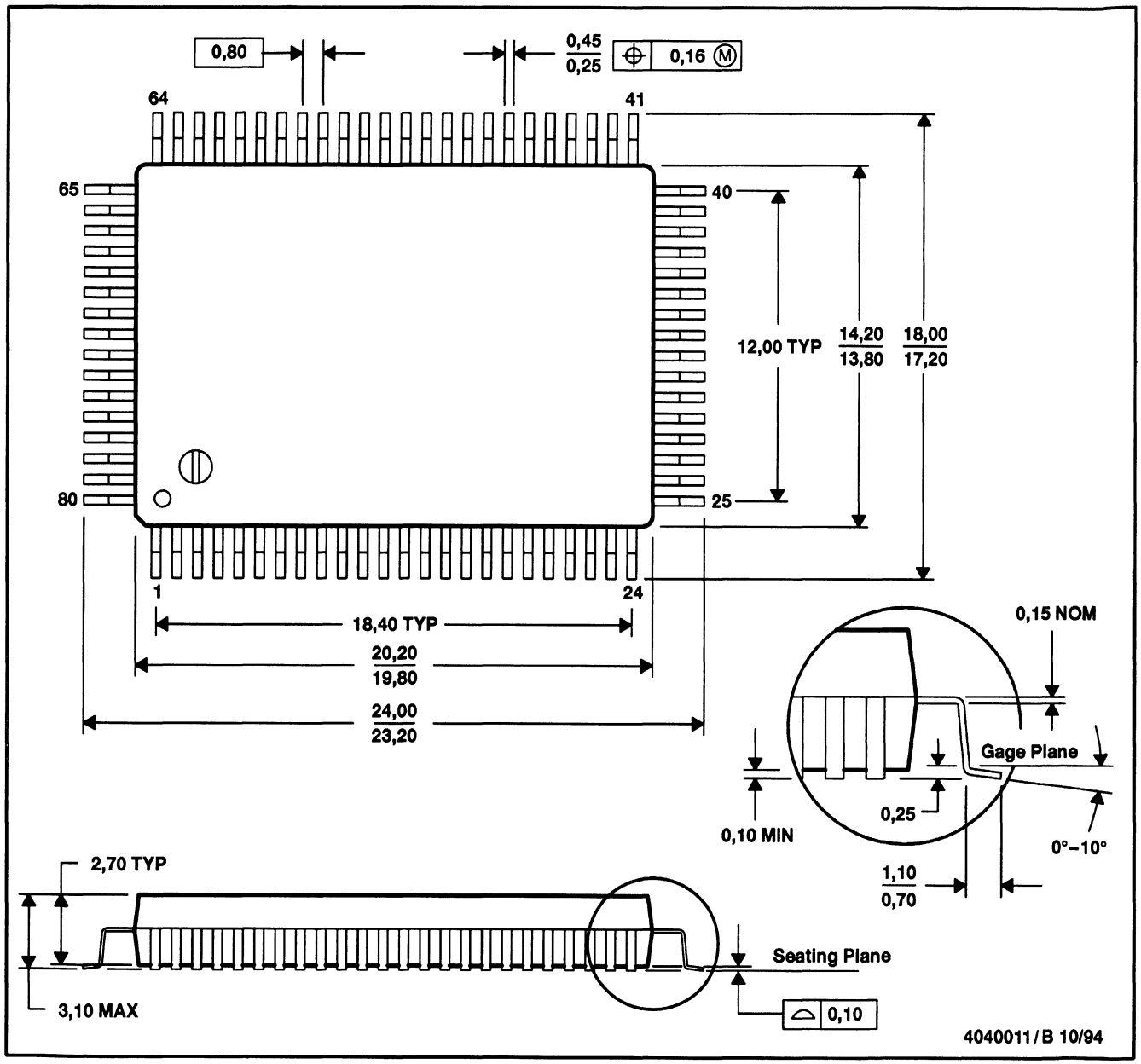
PAF (R-PQFP-G80) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

PH (R-PQFP-G80) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

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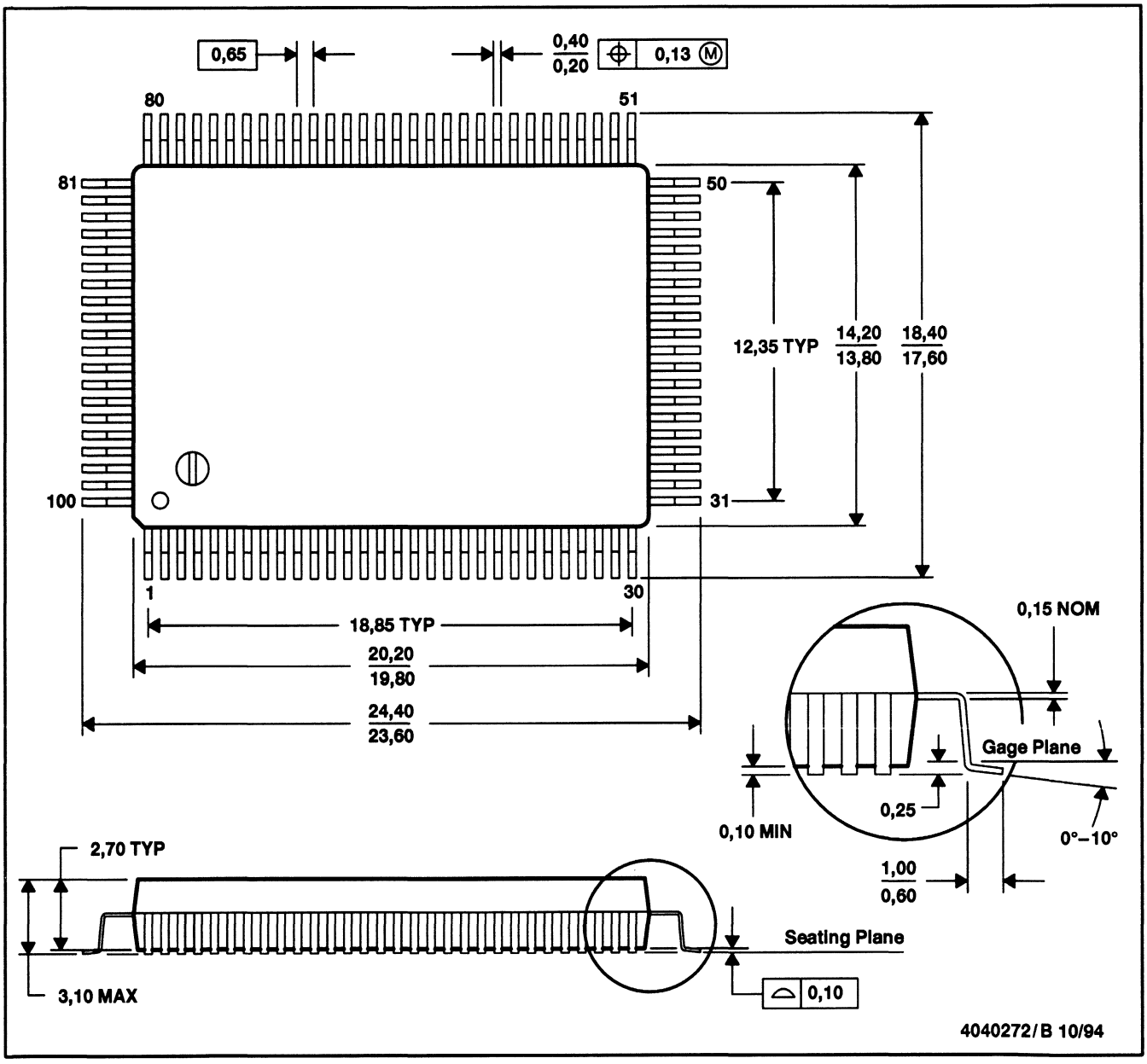
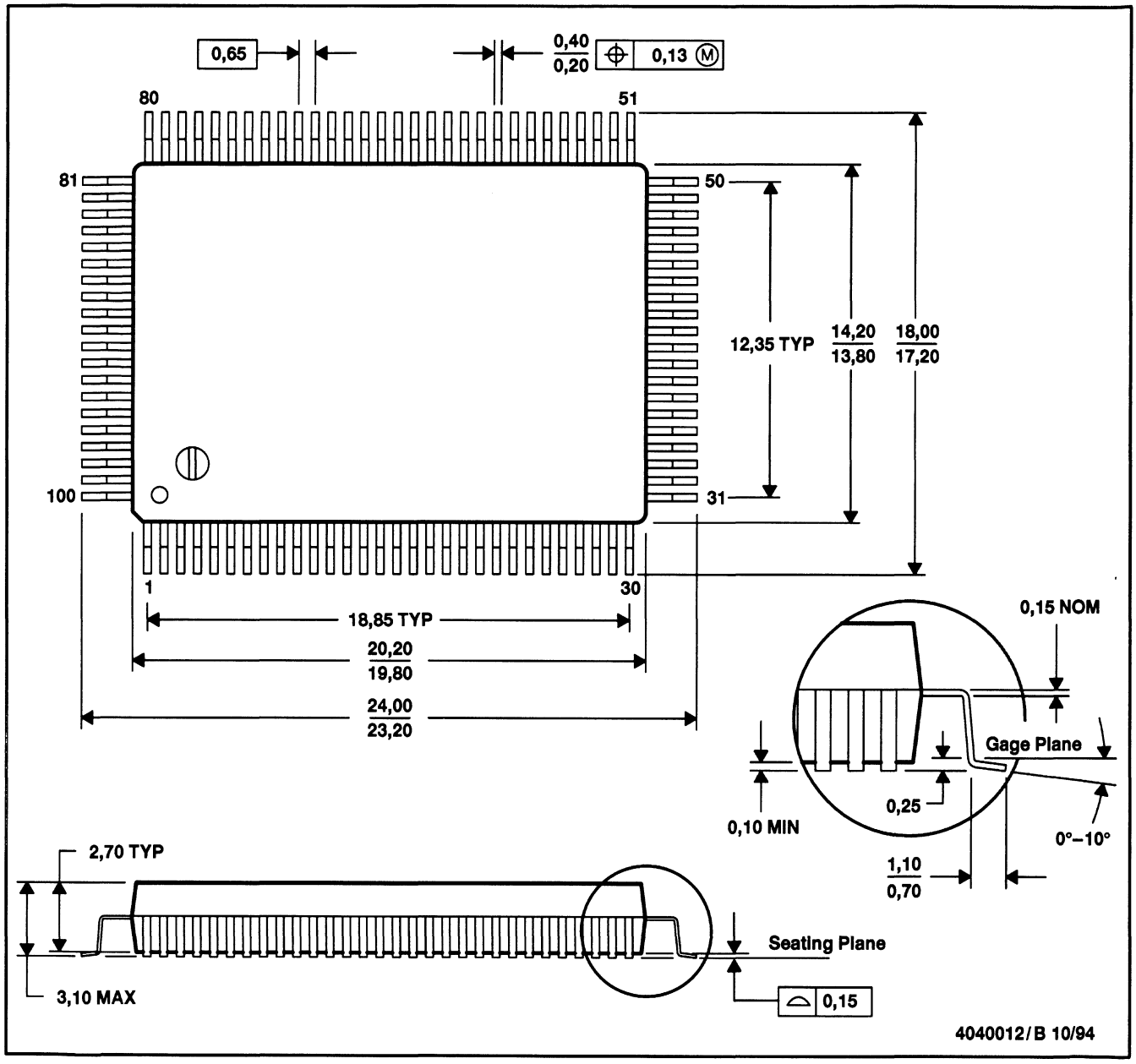
PAL (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

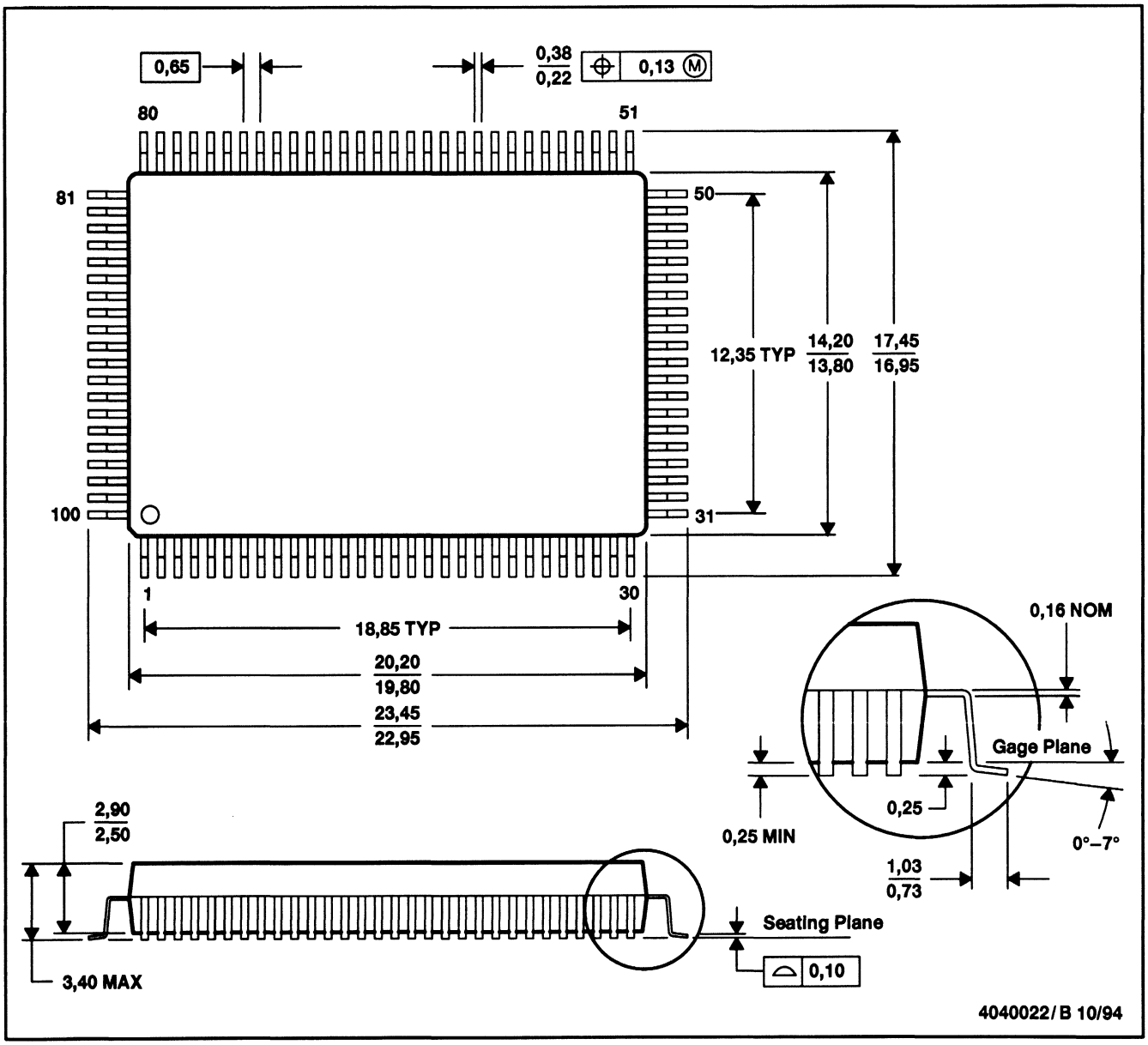
PJ (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

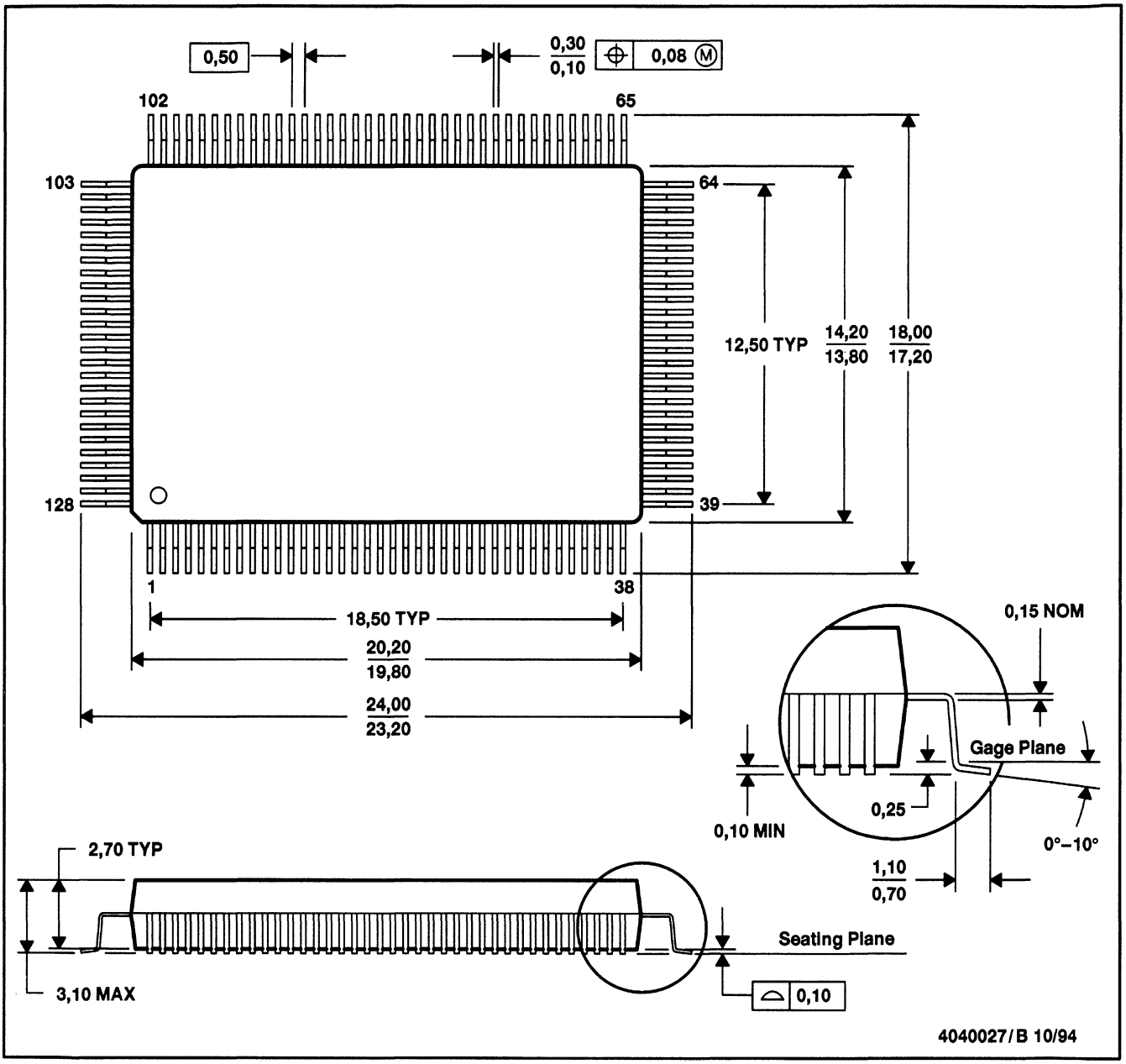
PJM (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-022

OCTOBER 1994

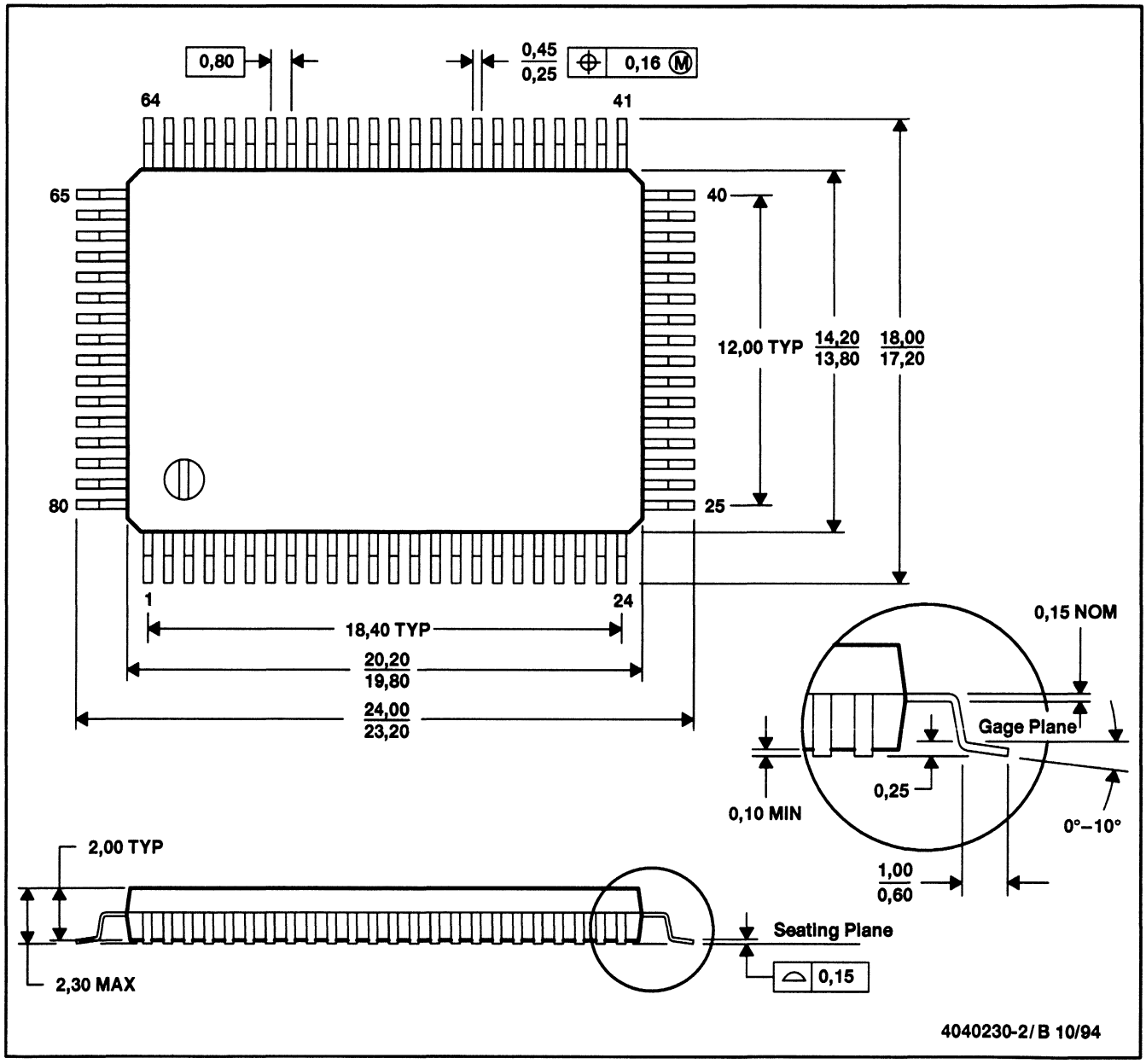
PR (R-PQFP-G128) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

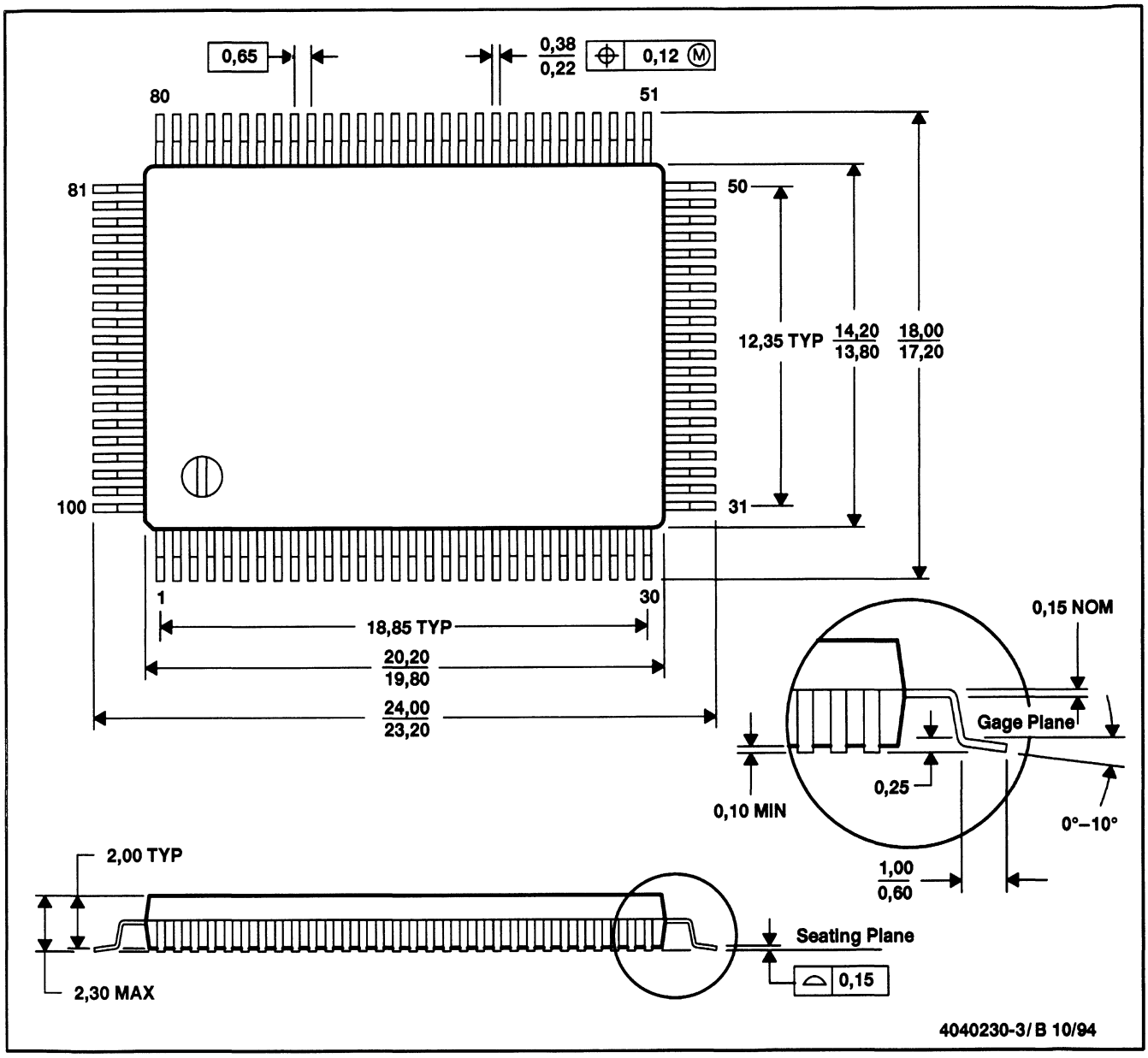
FT (R-PQFP-G80) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

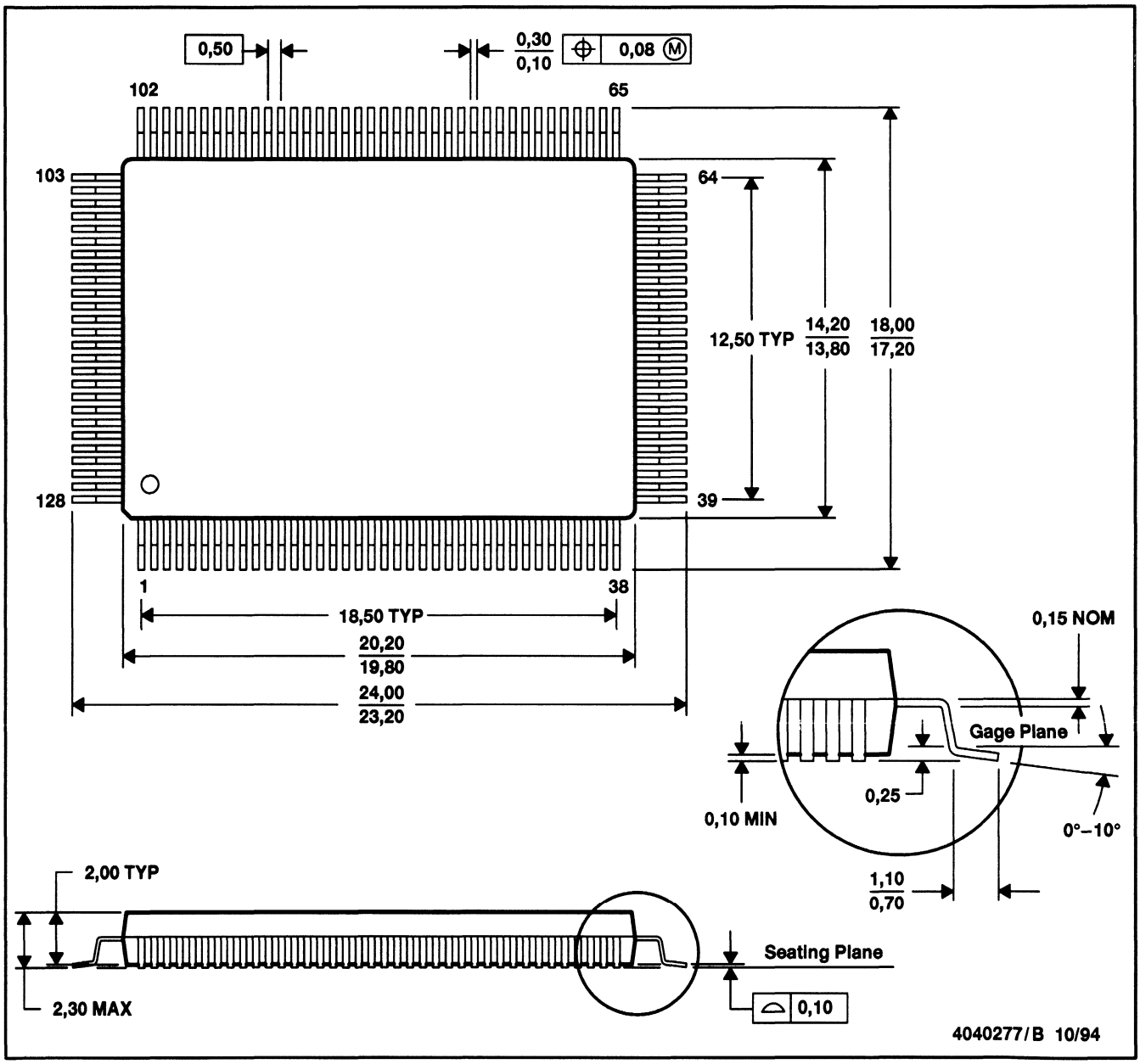
FT (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

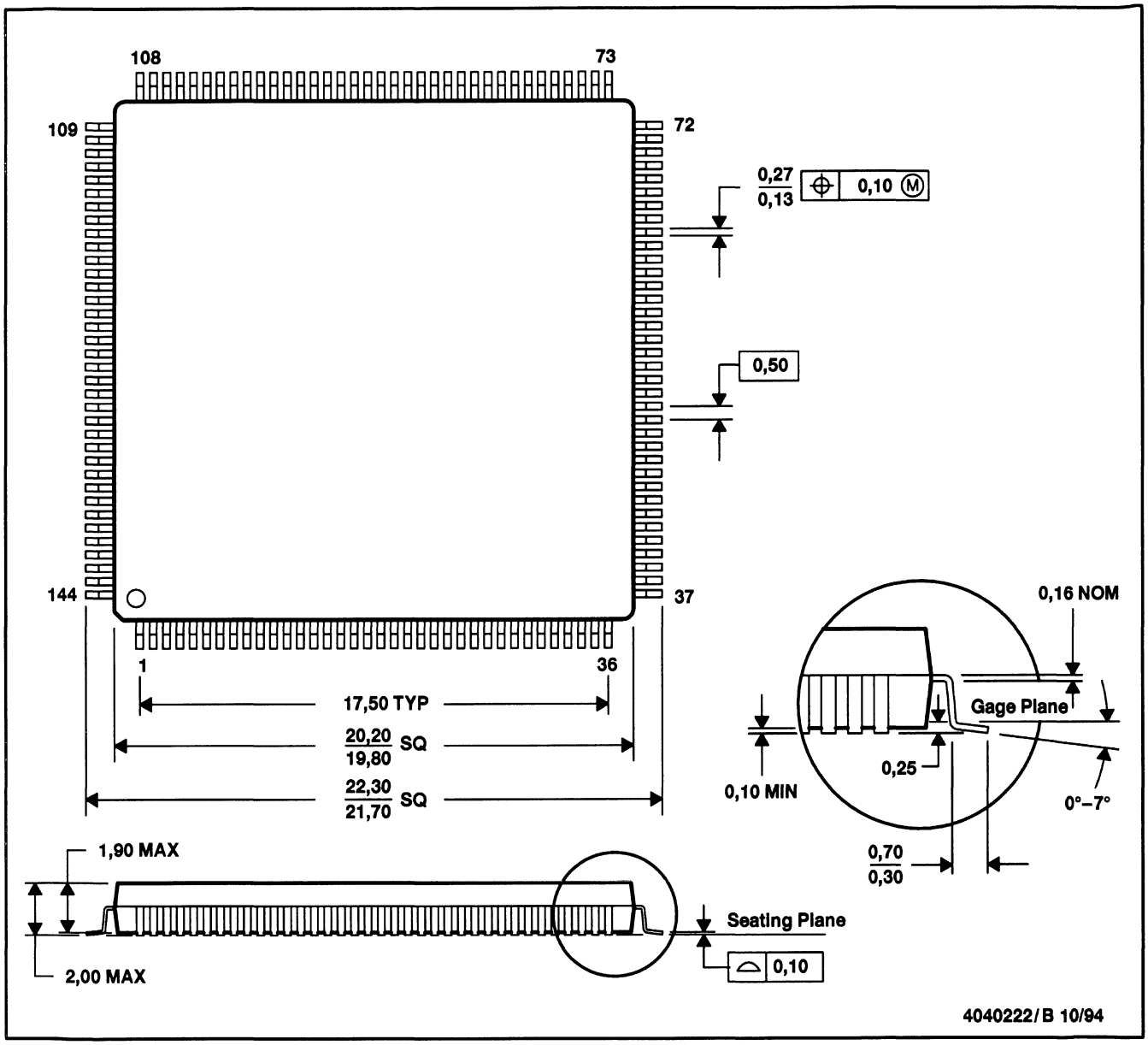
PGJ (R-PQFP-G128) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

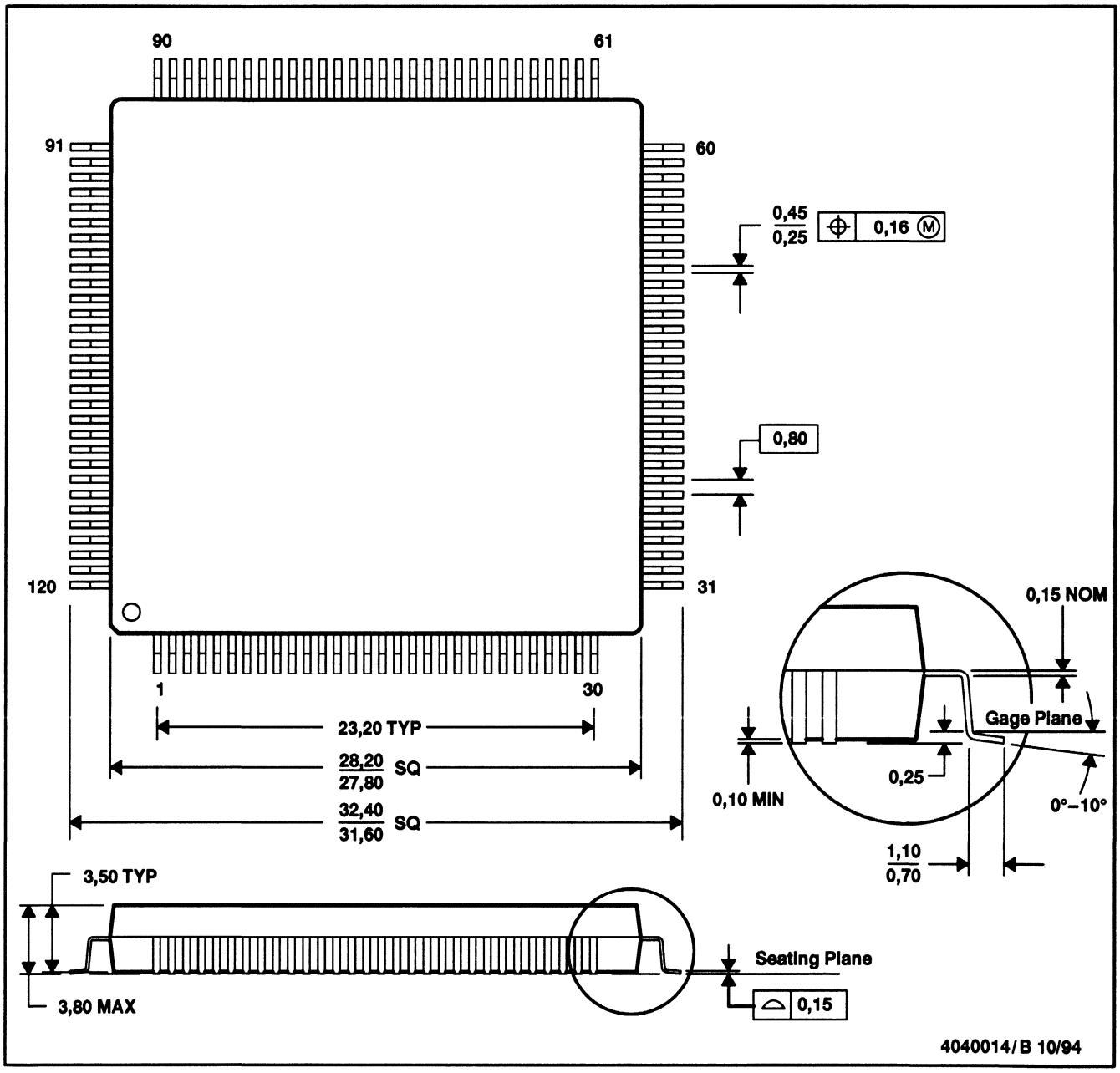
PGG (S-PQFP-G144) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

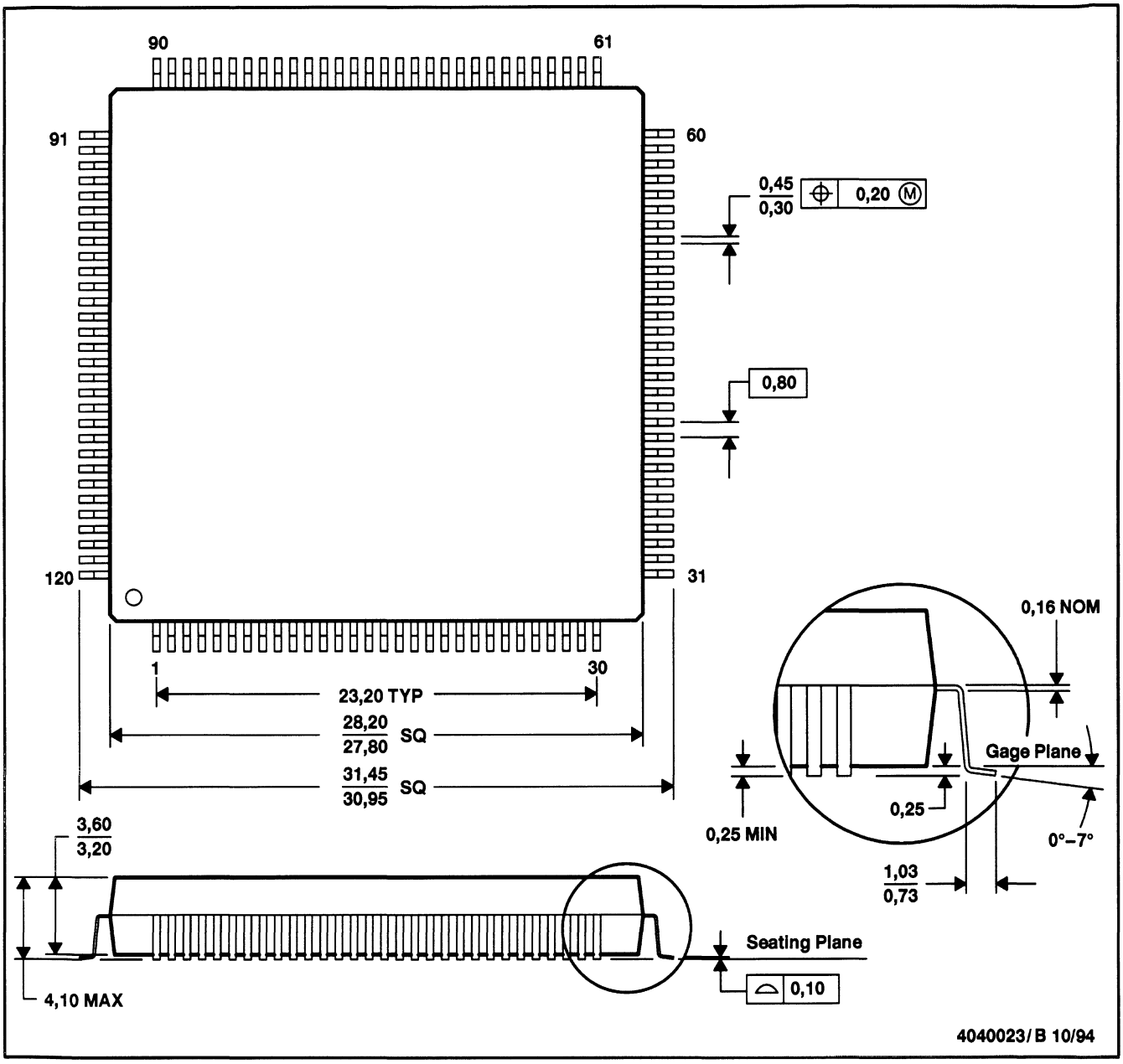
PB (S-PQFP-G120) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

PBM (S-PQFP-G120) **PLASTIC QUAD FLATPACK**



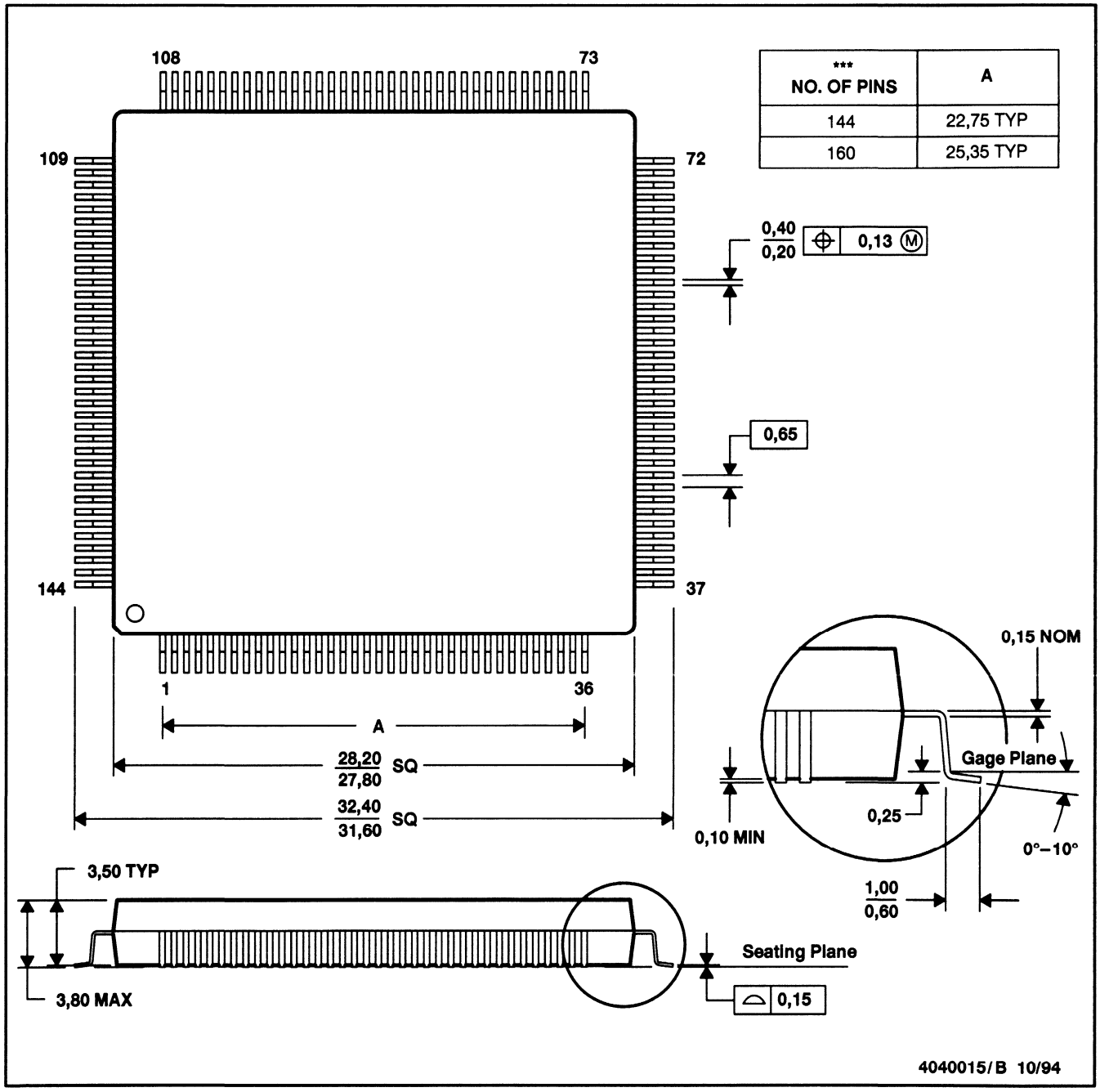
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-022

OCTOBER 1994

PC (S-PQFP-G***)

PLASTIC QUAD FLATPACK

144 PIN SHOWN



*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

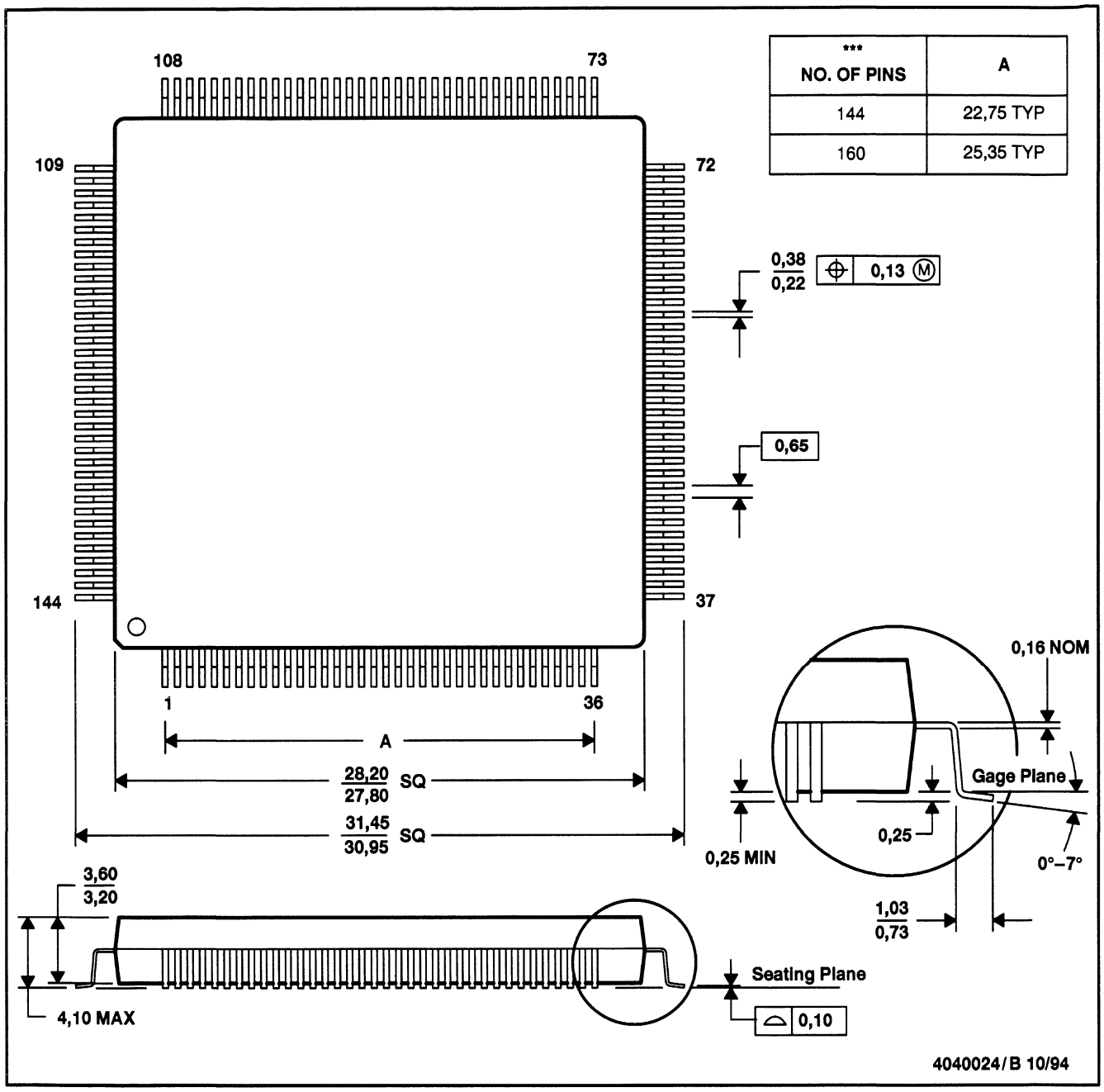
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

PCM (S-PQFP-G***)

PLASTIC QUAD FLATPACK

144 PIN SHOWN

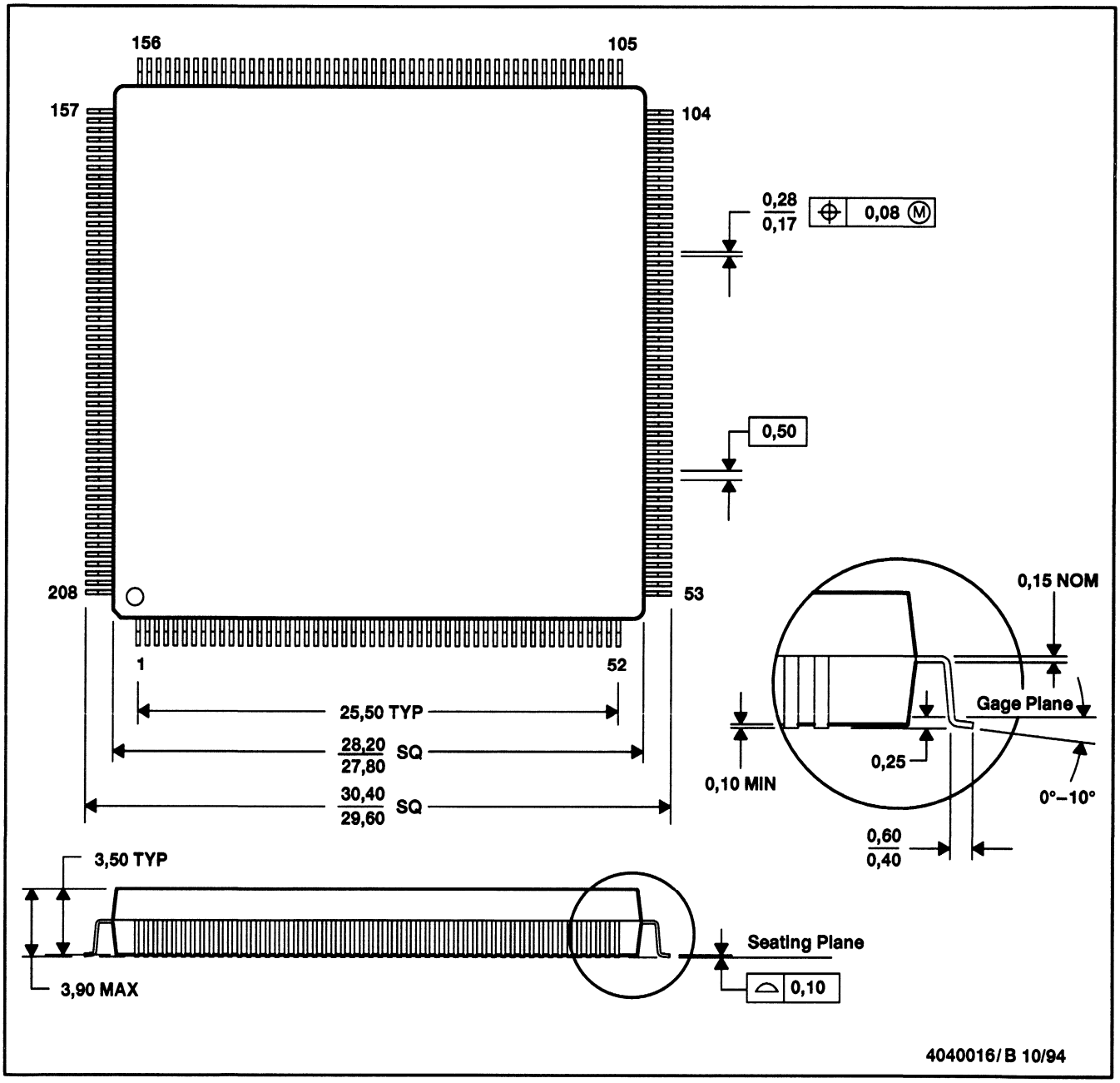


*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-022
D. The 144 PCM is identical to the 160 PCM except that four leads per corner are removed.

OCTOBER 1994

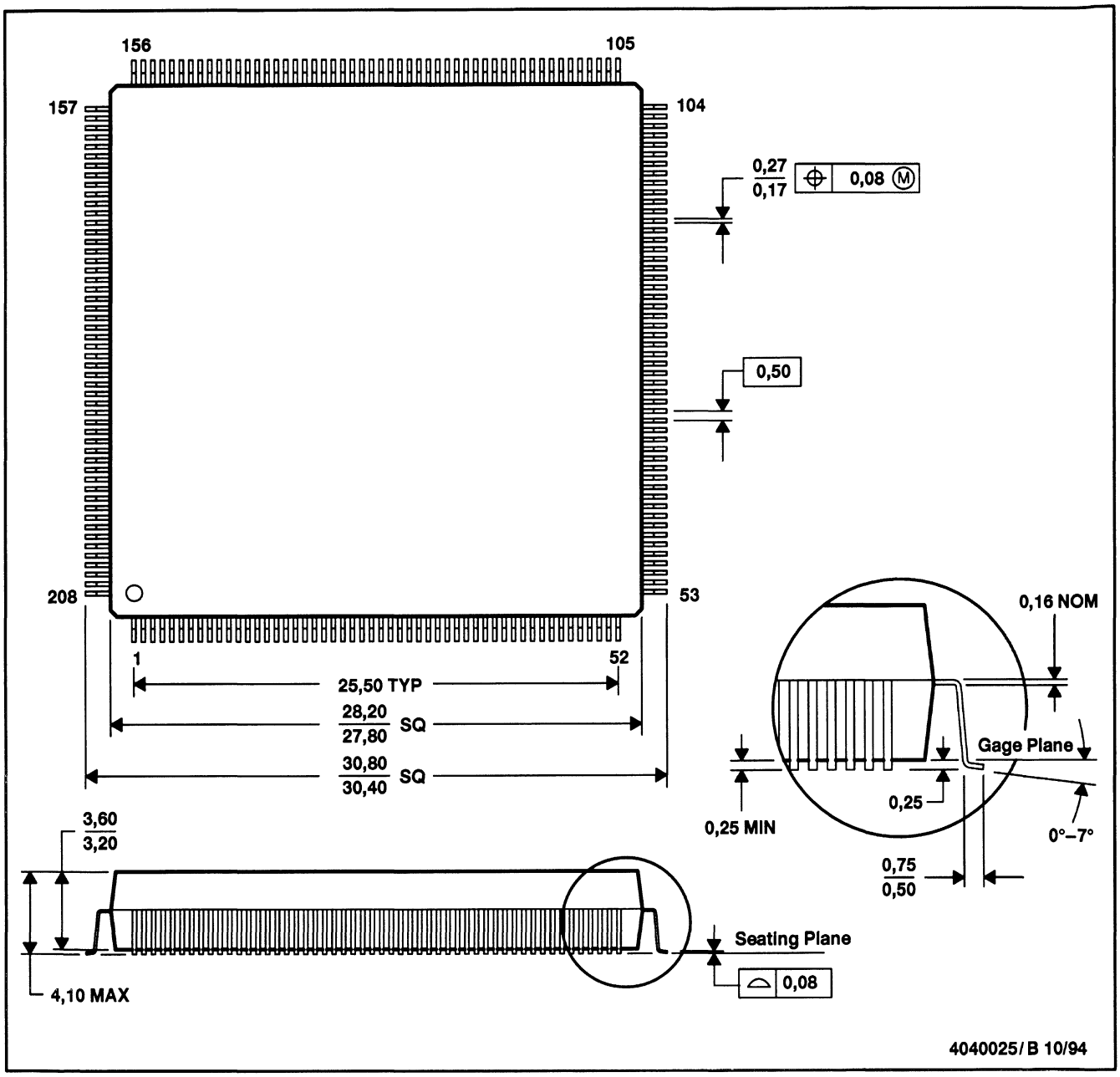
PP (S-PQFP-G208) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

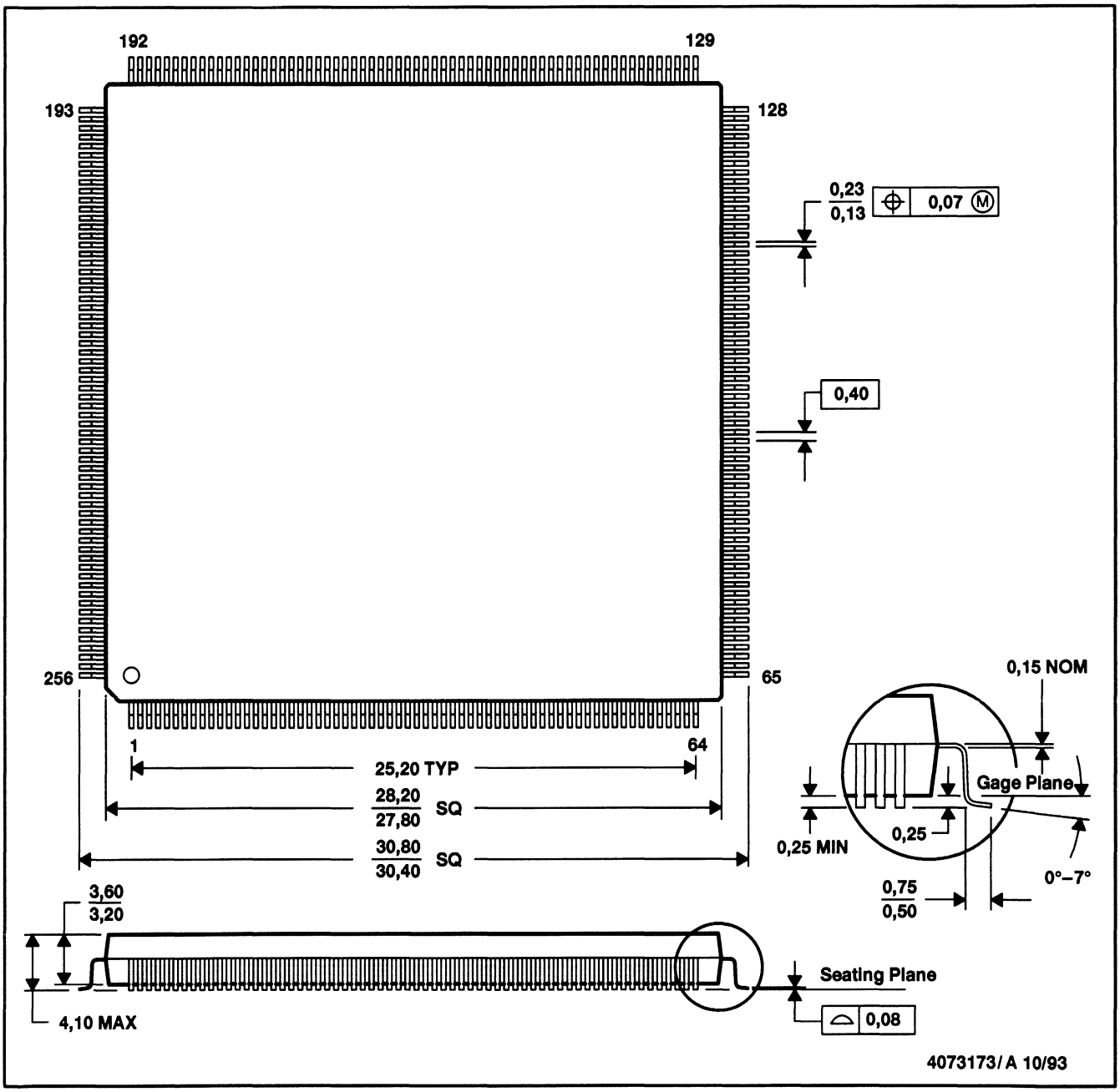
PPM (S-PQFP-G208) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-143

OCTOBER 1994

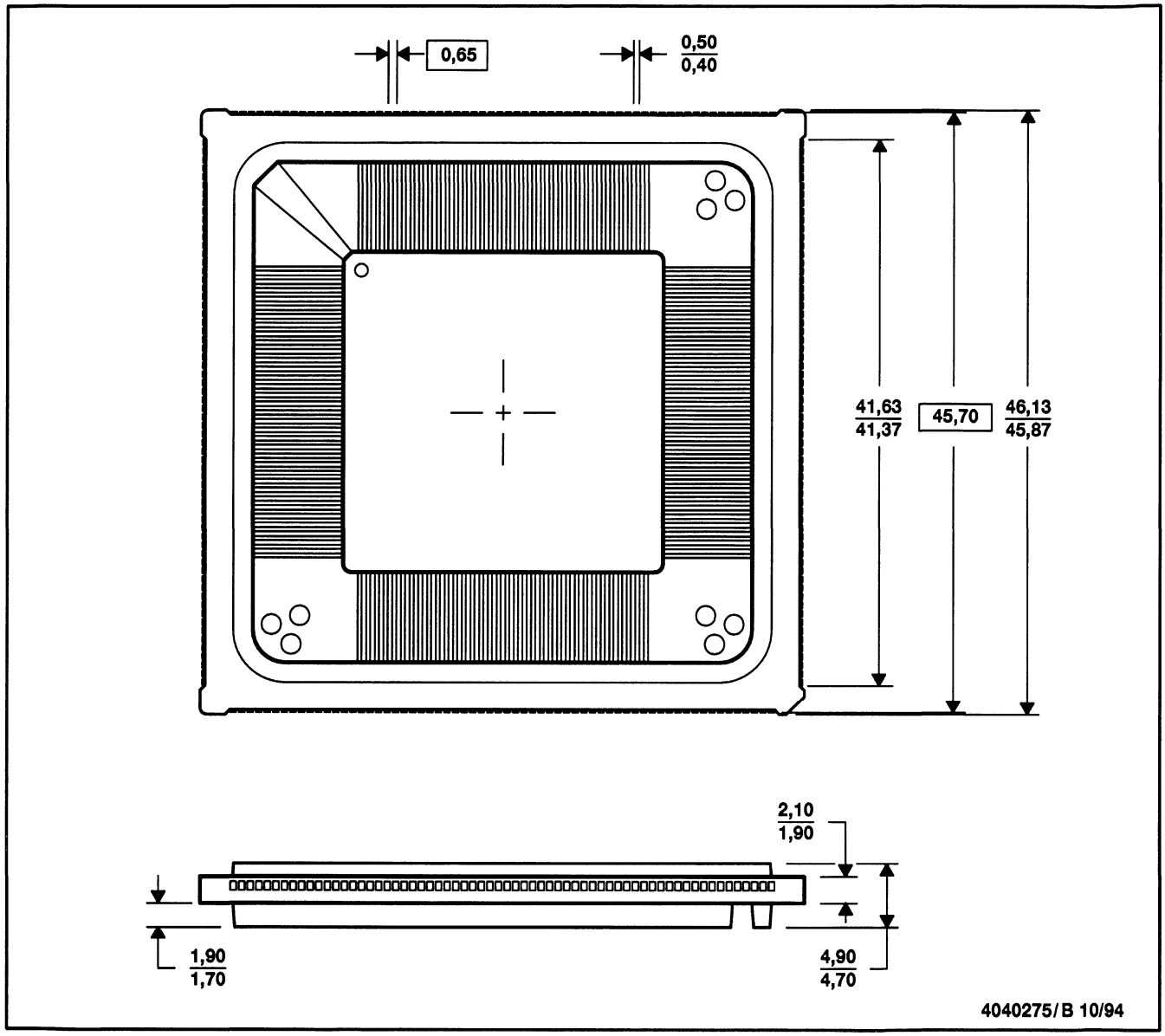
PGH (S-PQFP-G256) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-143

OCTOBER 1994

PAB (S-PQFP-F136) **PLASTIC QUAD FLATPACK (CARRIER RING)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

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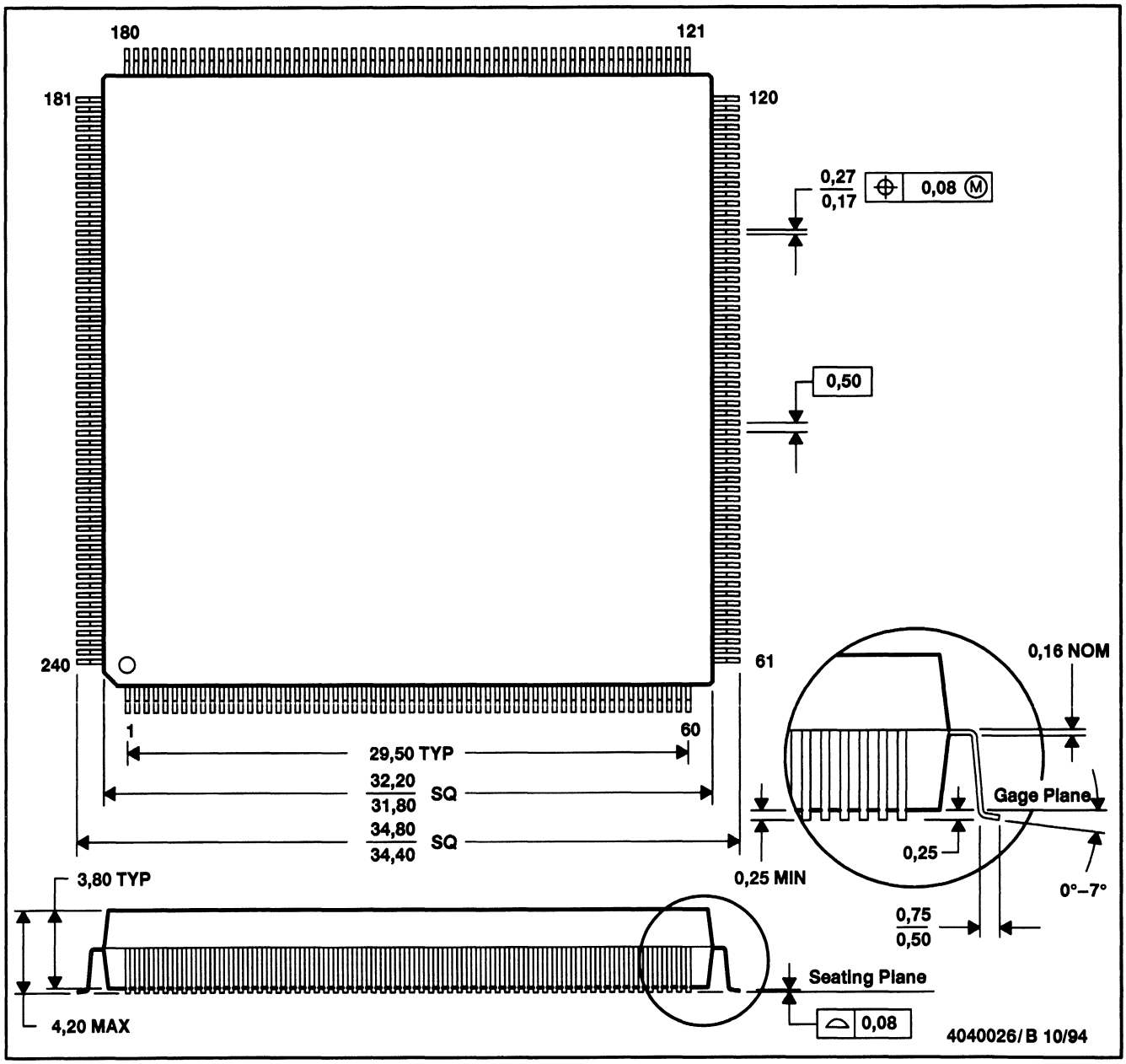
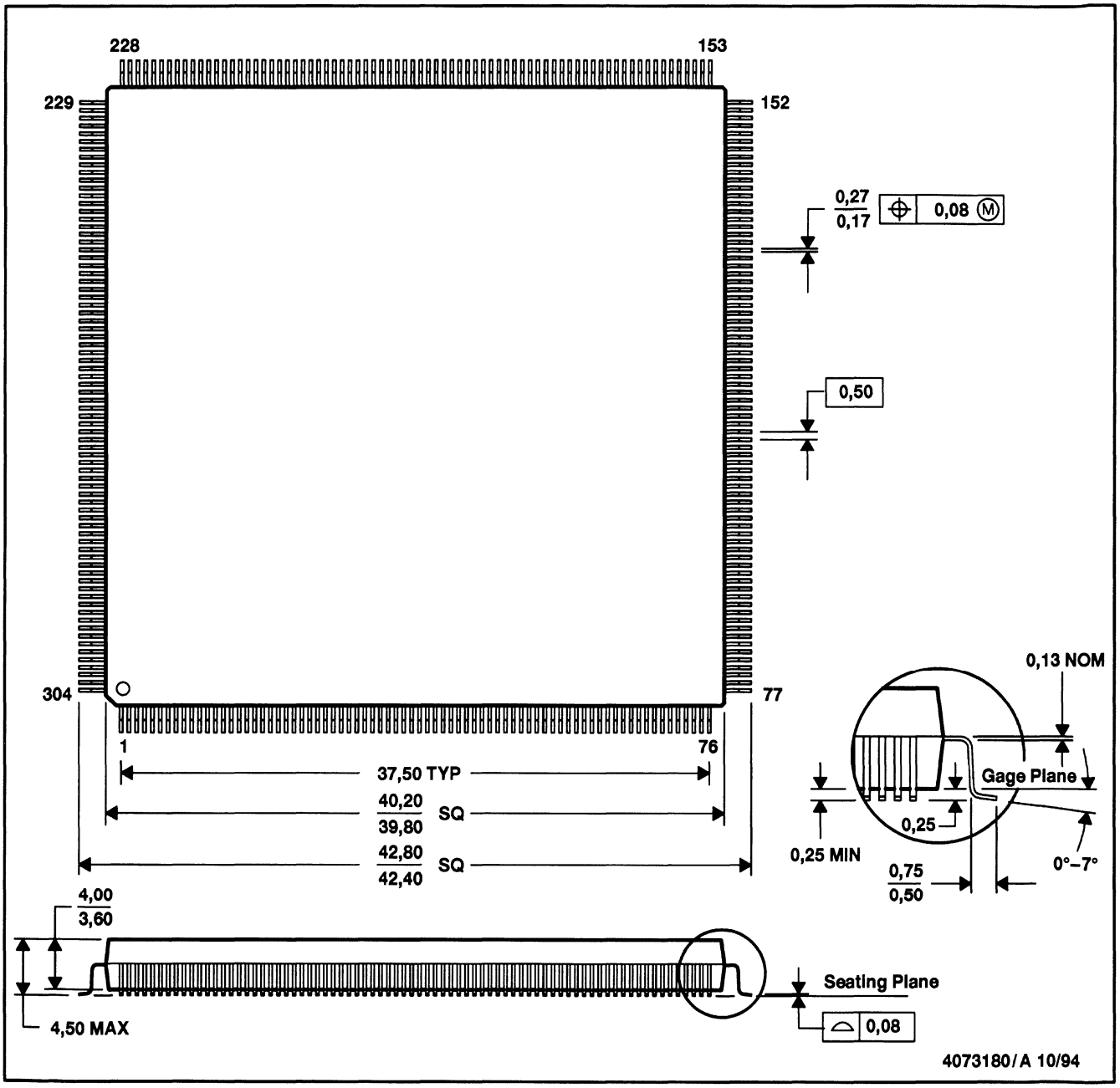
PGC (S-PQFP-G240) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

PDN (S-PQFP-G304) **PLASTIC QUAD FLATPACK (DIE–DOWN)**

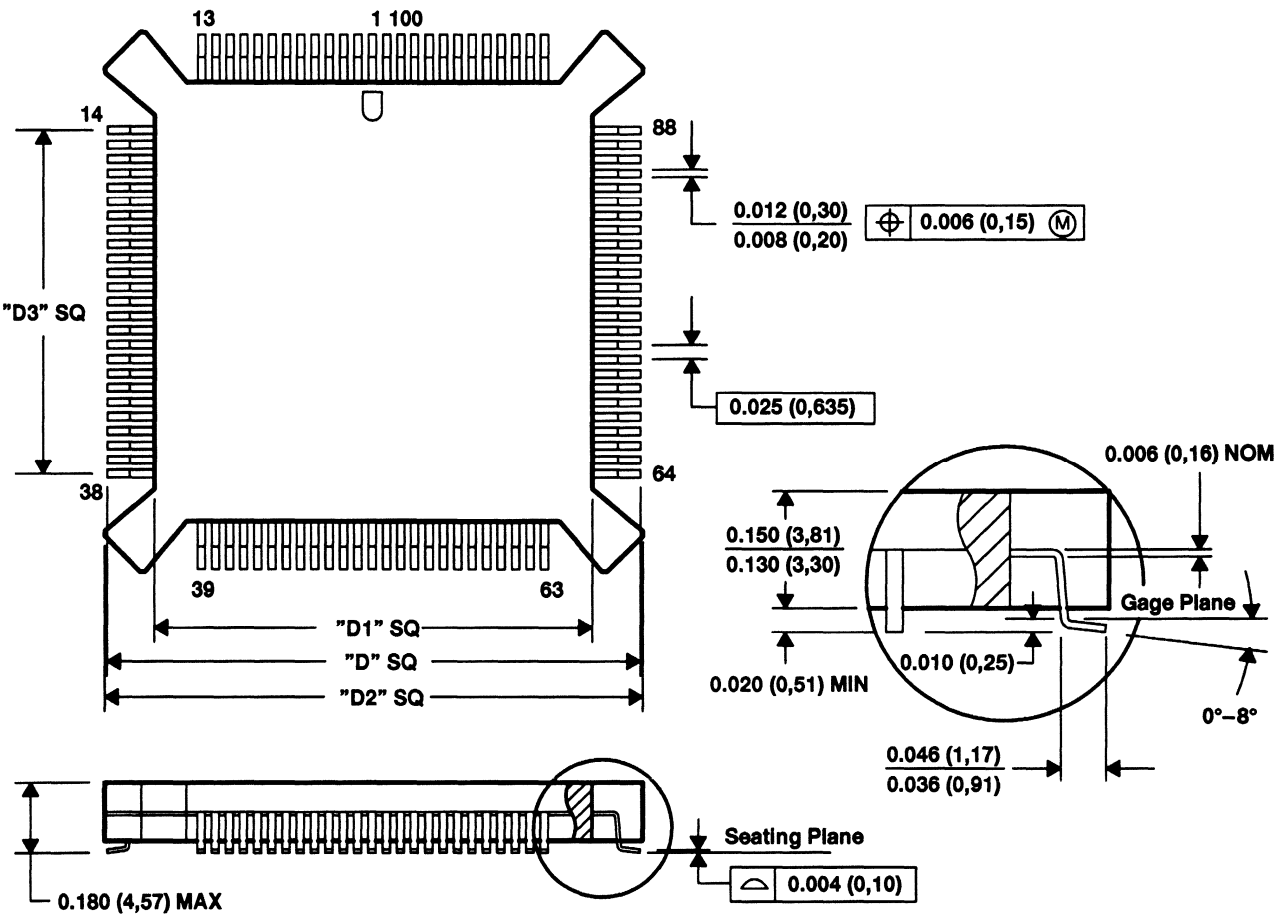


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-143

OCTOBER 1994

PQ (S-PQFP-G*)** **PLASTIC QUAD FLATPACK**

100 LEAD SHOWN



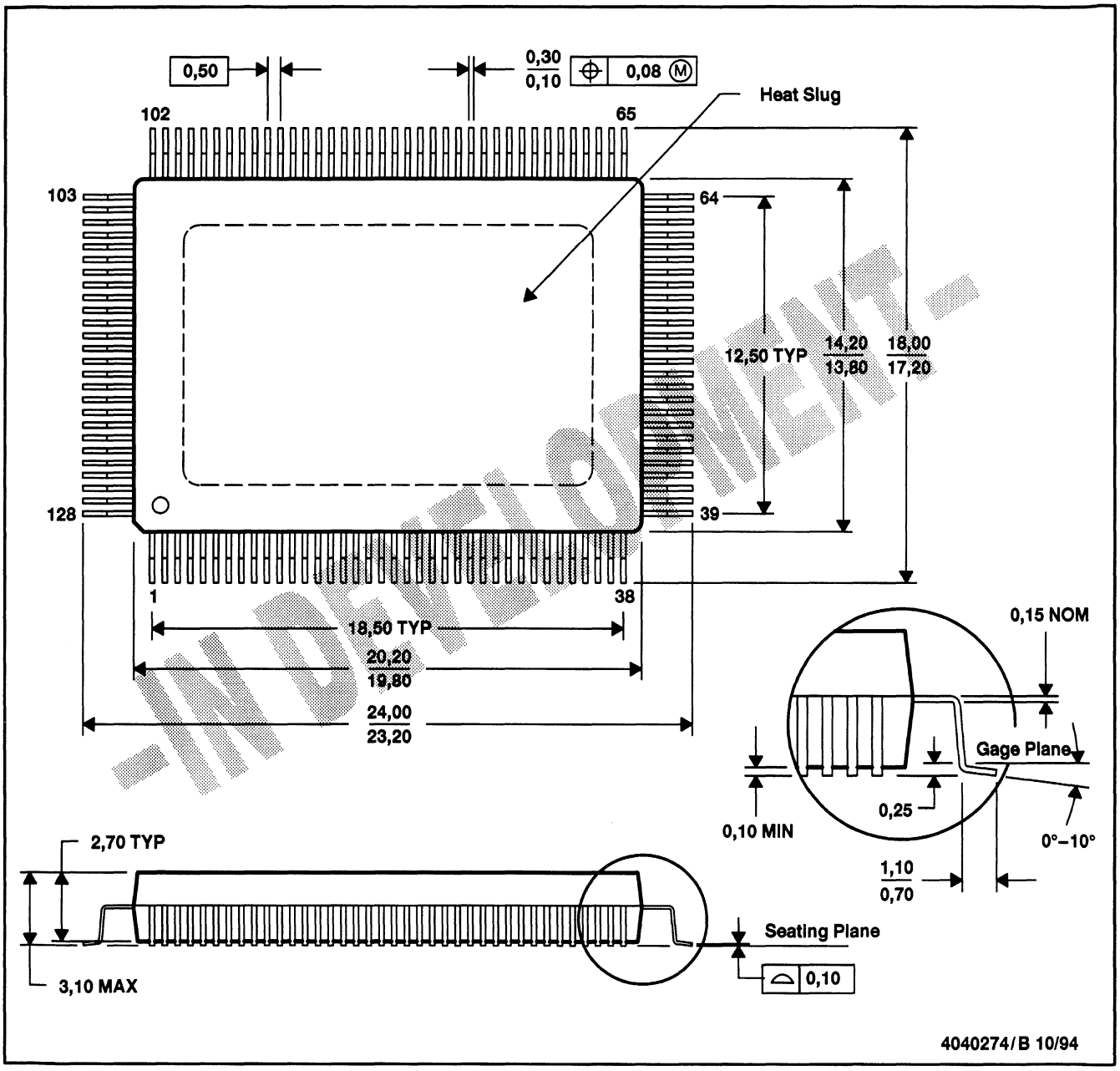
DIM \ LEADS ***		100 PQ	132 PQ
"D"	MAX	0.890 (22,61)	1.090 (27,69)
	MIN	0.870 (22,10)	1.070 (27,18)
"D1"	MAX	0.766 (19,46)	0.966 (24,54)
	MIN	0.734 (18,64)	0.934 (23,72)
"D2"	MAX	0.912 (23,16)	1.112 (28,25)
	MIN	0.888 (22,56)	1.088 (27,64)
"D3"	NOM	0.600 (15,24)	0.800 (20,32)

4040045/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-069

OCTOBER 1994

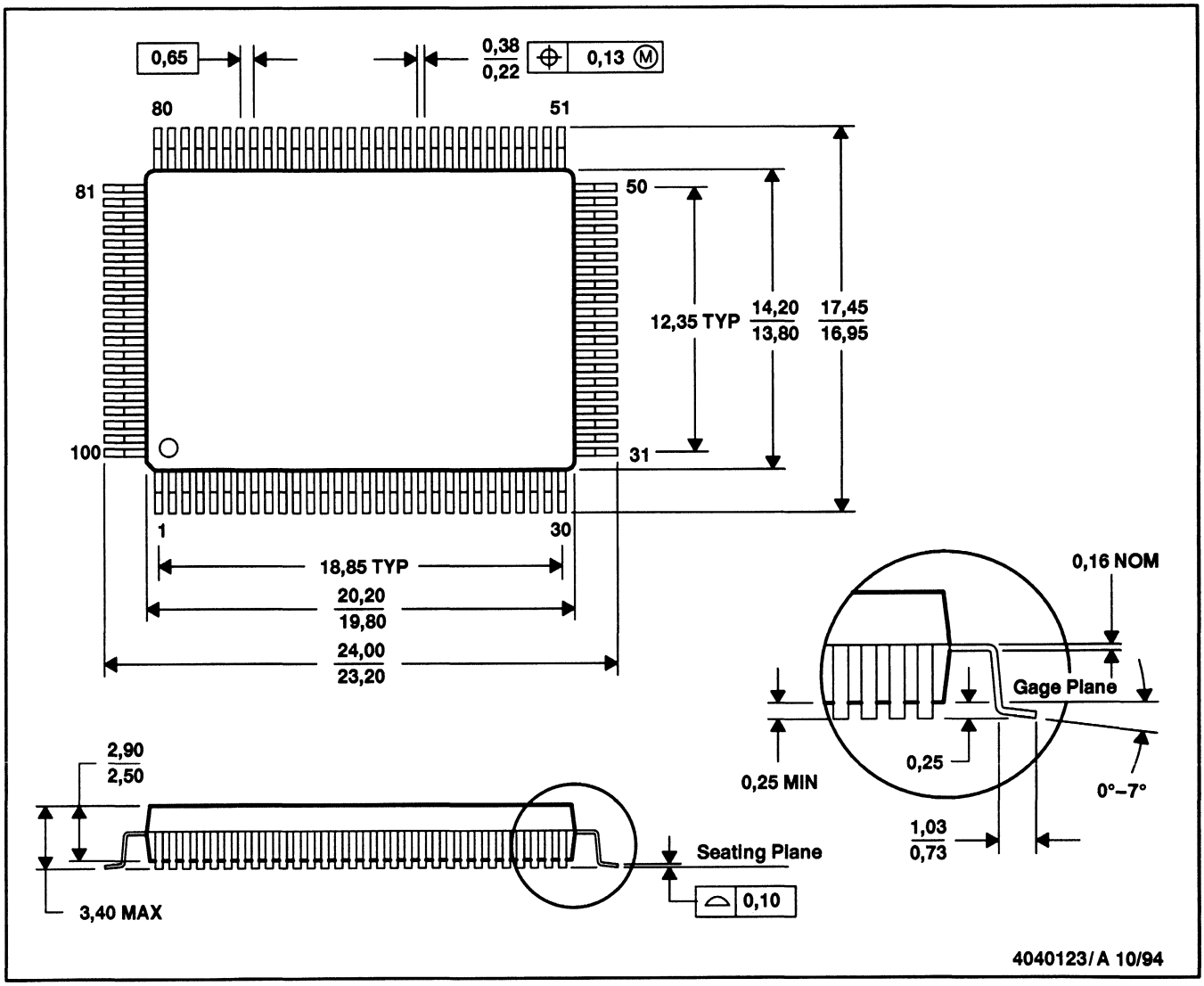
PAC (R-PQFP-G128) **PLASTIC QUAD FLATPACK (DIE-DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package (HSL) exposed on package bottom
D. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.

OCTOBER 1994

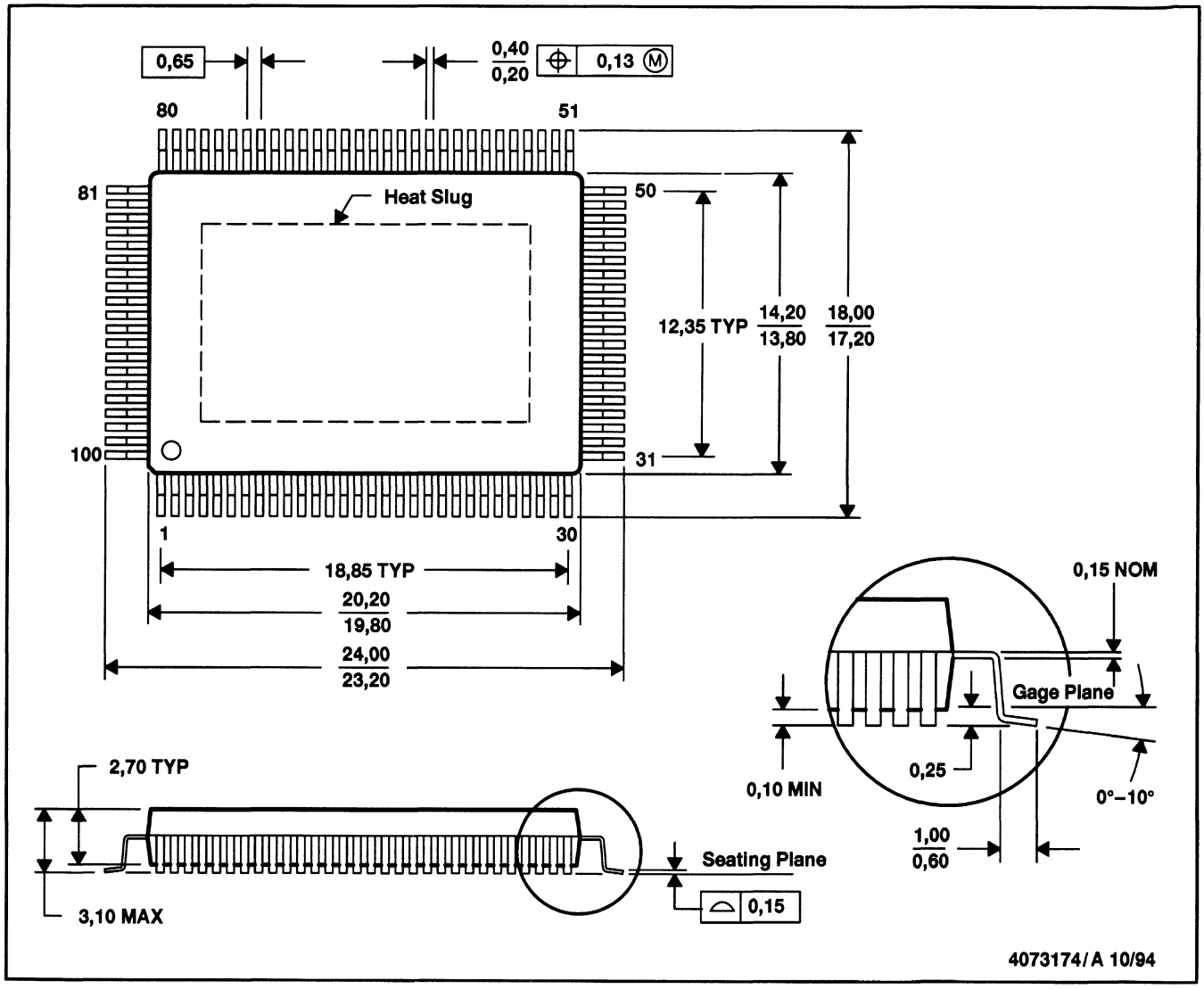
PJE (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MS-022

OCTOBER 1994

PJG (R-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Contact field sales office to determine if a tighter coplanarity requirement is available for this package.
D. Thermally enhanced molded plastic package with a heat slug (HSL) exposed on package bottom

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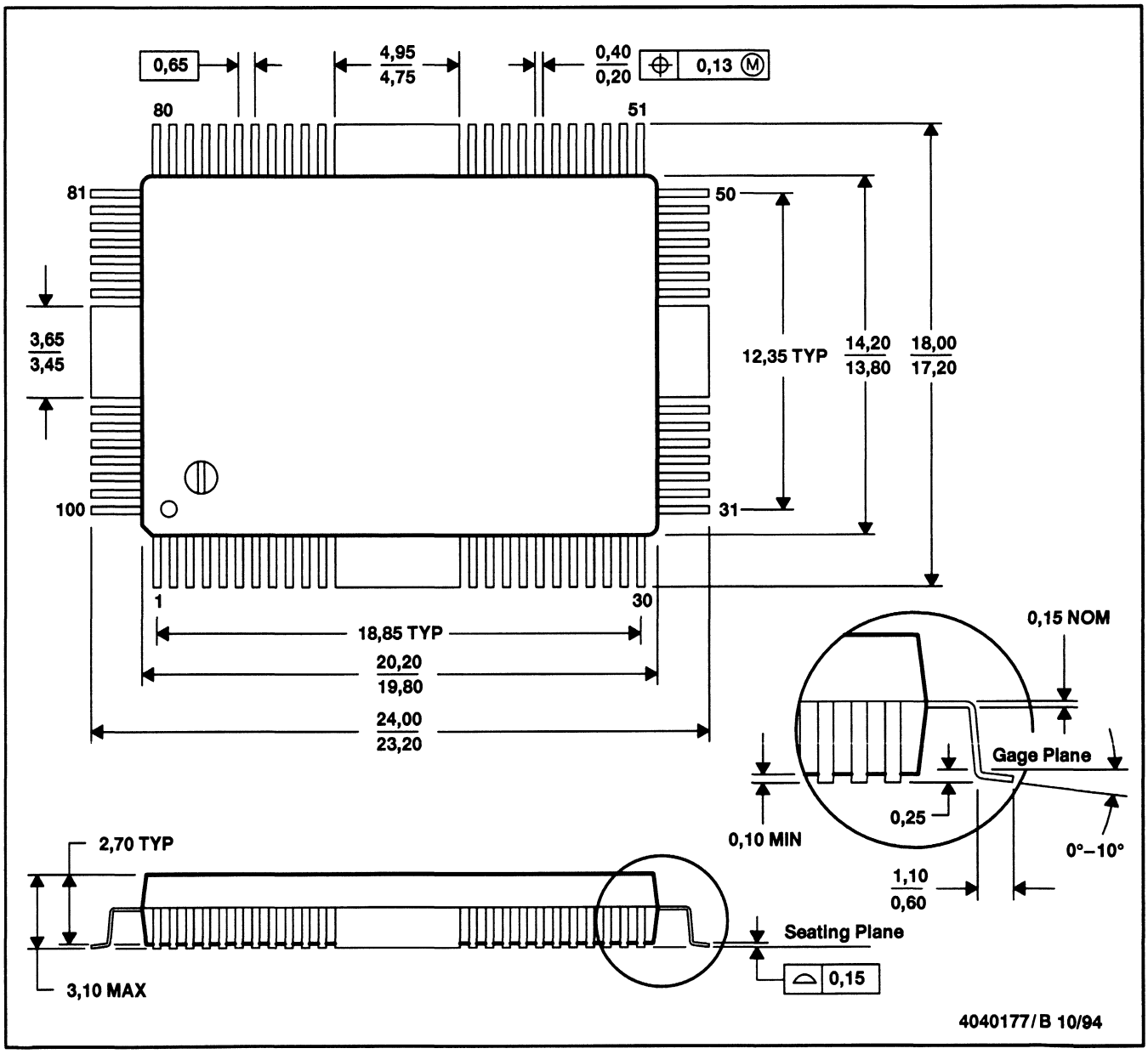
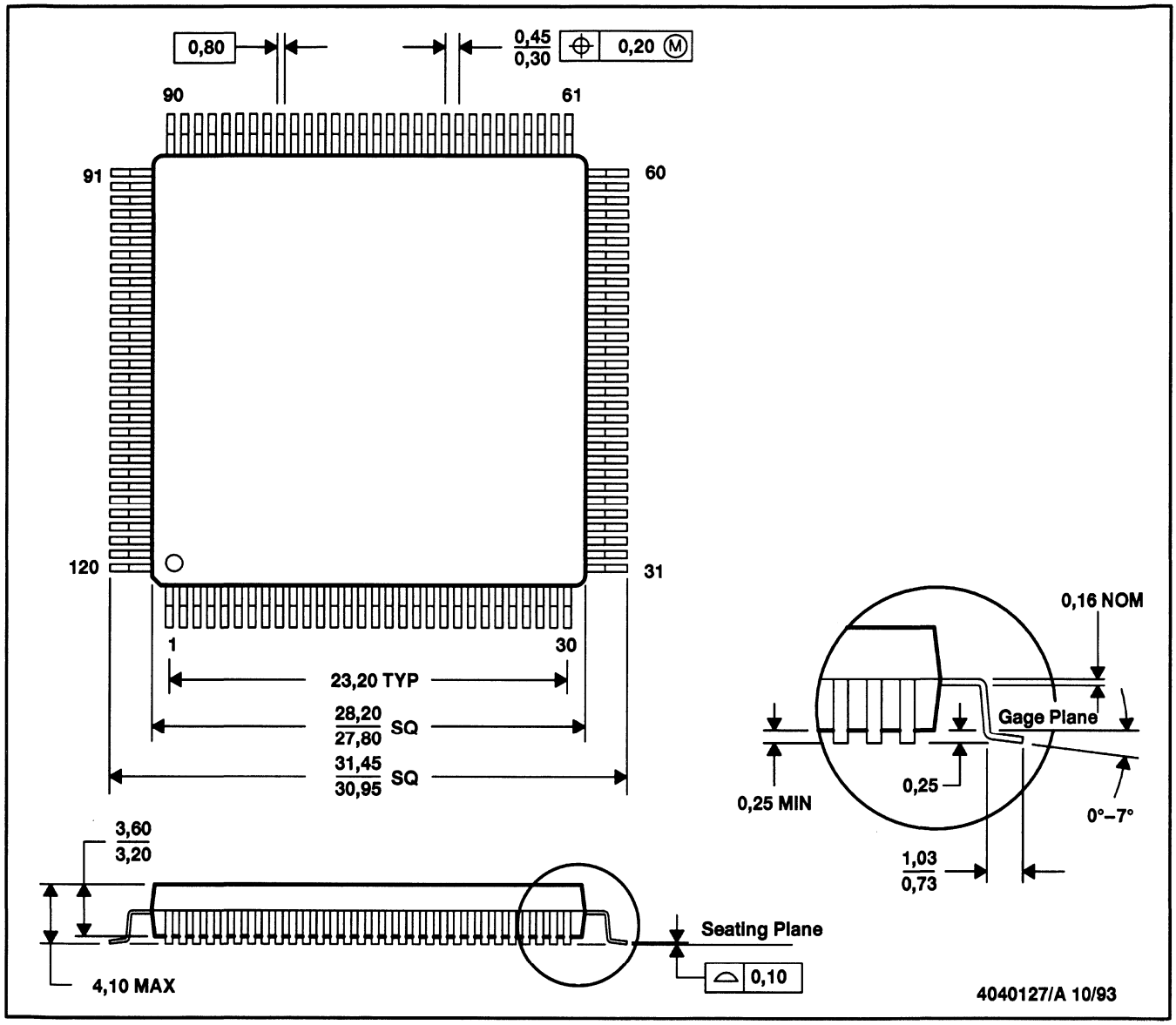
VH (S-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermal enhancement with fins attached to faced heat spreader

OCTOBER 1994

PBE (S-PQFP-G120) **PLASTIC QUAD FLATPACK**



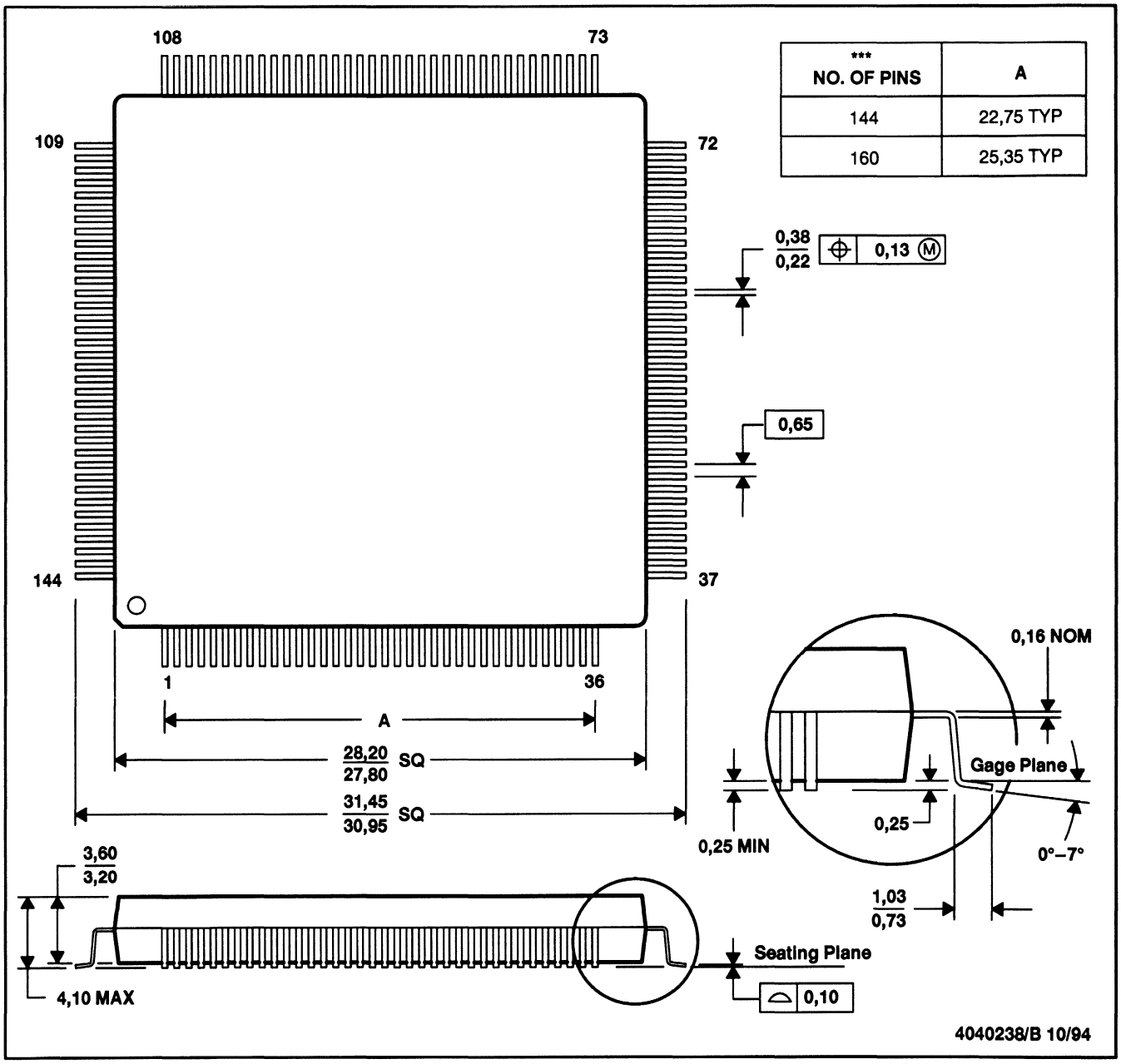
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MS-022

OCTOBER 1994

PCD (S-PQFP-G***)

PLASTIC QUAD FLATPACK (DIE-DOWN)

144 PIN SHOWN



*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

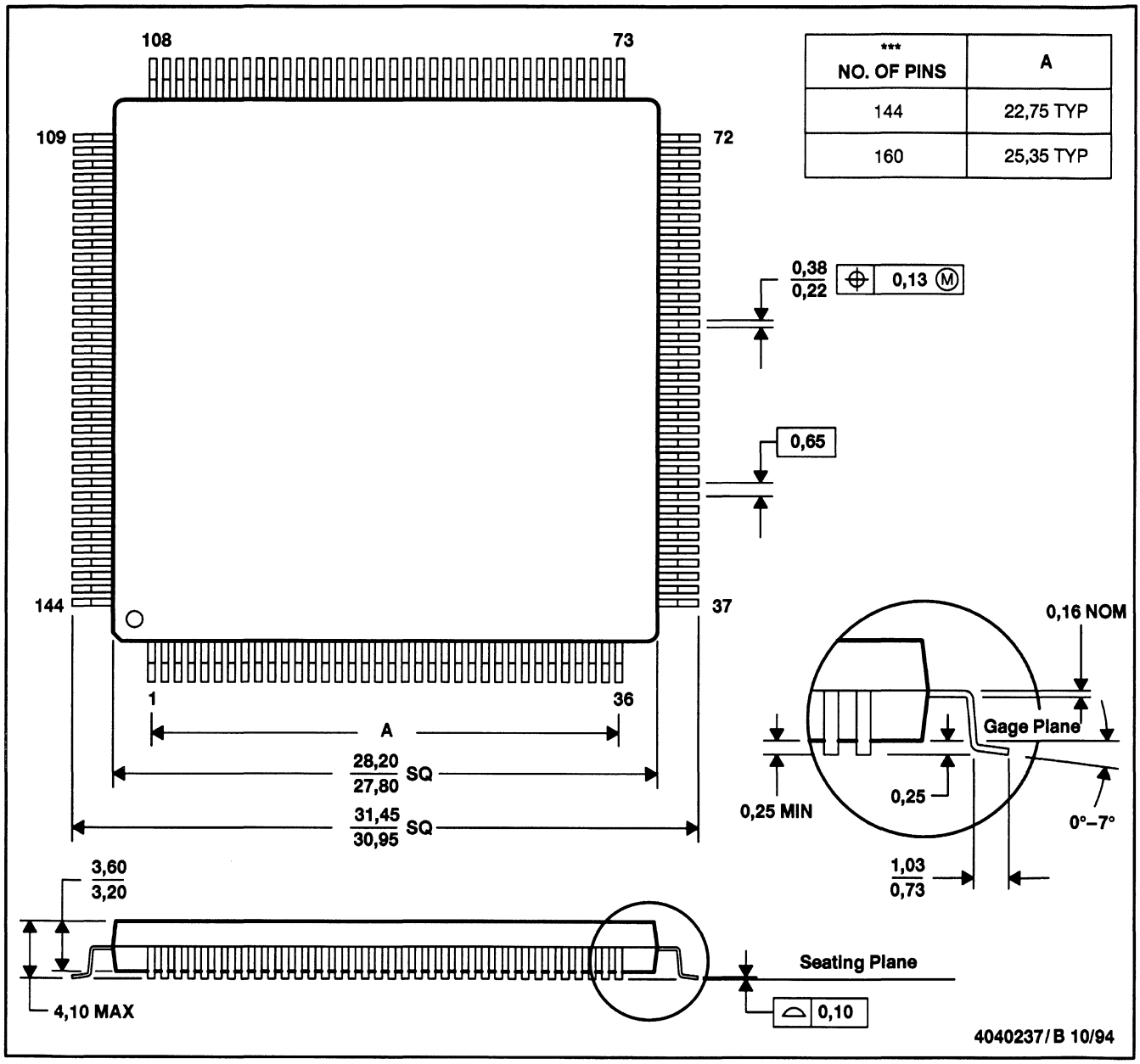
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MS-022
E. The 144 PCD is identical to the 160 PCD except that four leads per corner are removed.

OCTOBER 1994

PCE (S-PQFP-G***)

PLASTIC QUAD FLATPACK

144 PIN SHOWN



*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MS-022
E. The 144 PCE is identical to the 160 PCE except that four leads per corner are removed.

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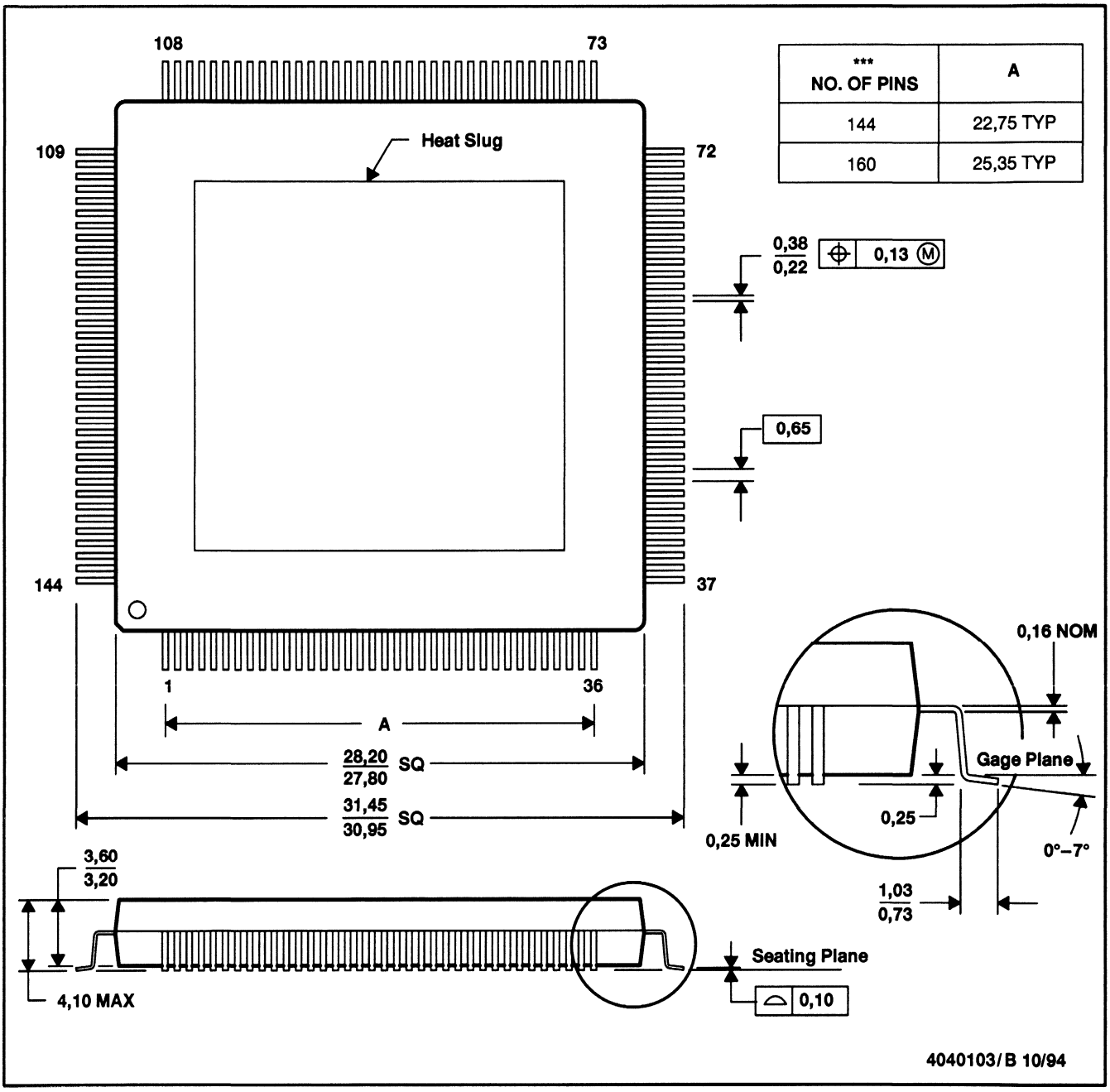
OCTOBER 1994

PCY (S-PQFP-G***)

PLASTIC QUAD FLATPACK

144 PIN SHOWN



*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

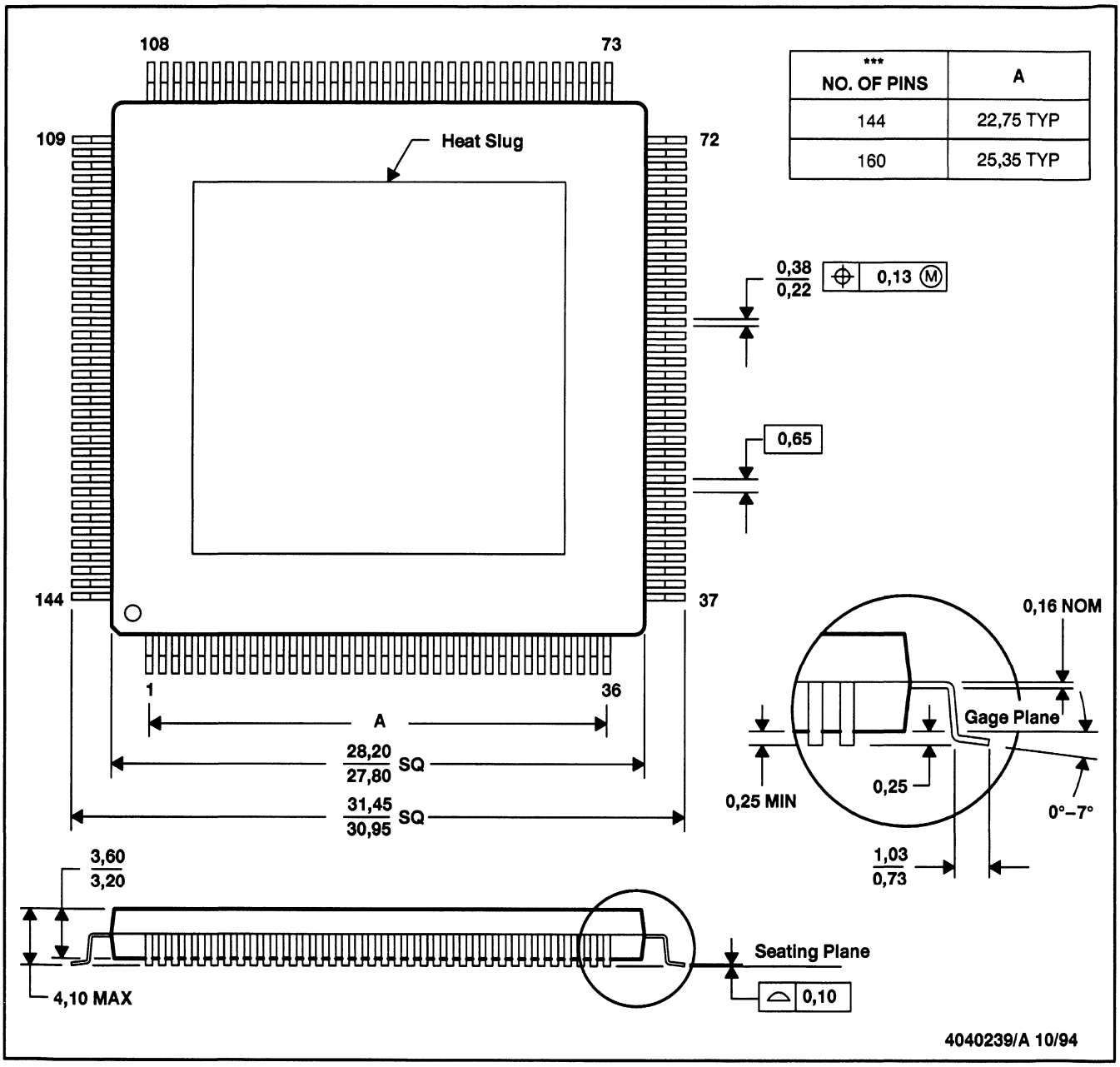
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)
D. Falls within JEDEC MS-022
E. The 144 PCY is identical to the 160 PCY except that four leads per corner are removed.

OCTOBER 1994

PCZ (S-PQFP-G**)

PLASTIC QUAD FLATPACK (DIE–DOWN)

144 PIN SHOWN

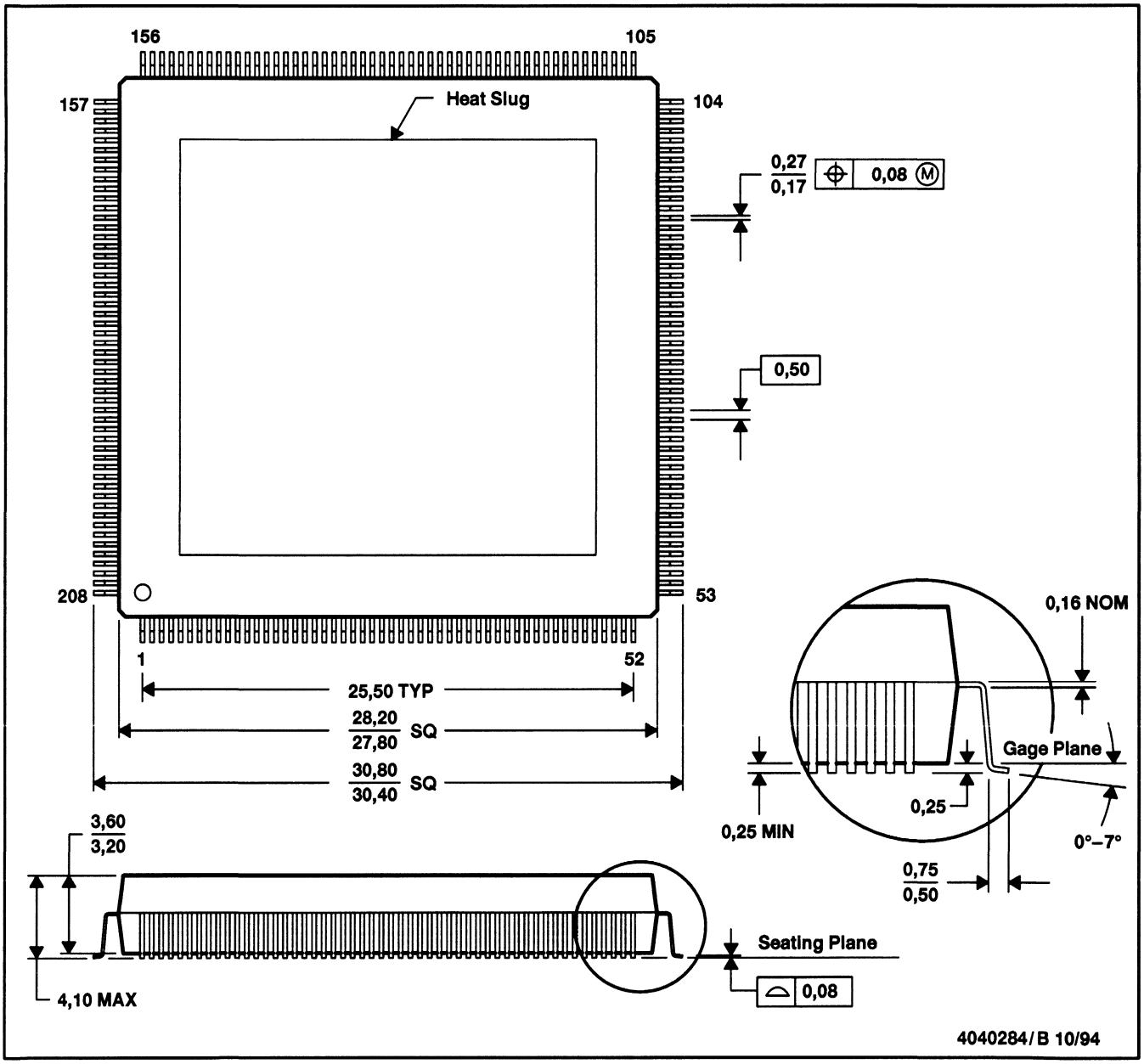


*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)
D. Falls within JEDEC MS-022
E. The 144 PCZ is identical to the 160 PCZ except that four leads per corner are removed.

OCTOBER 1994

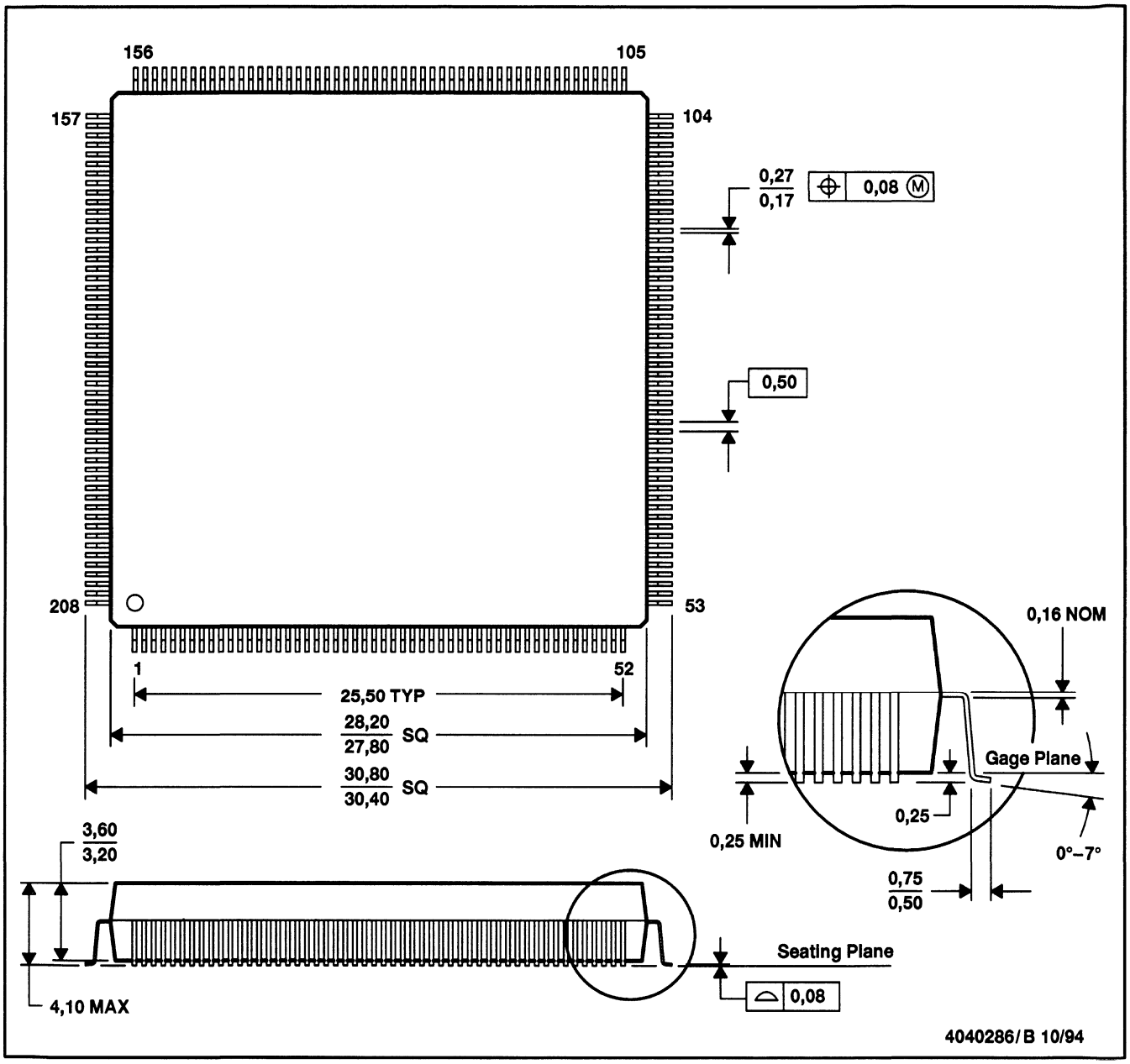
PPB (S-PQFP-G208) **PLASTIC QUAD FLATPACK (DIE-DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)
D. Falls within JEDEC MO-143

OCTOBER 1994

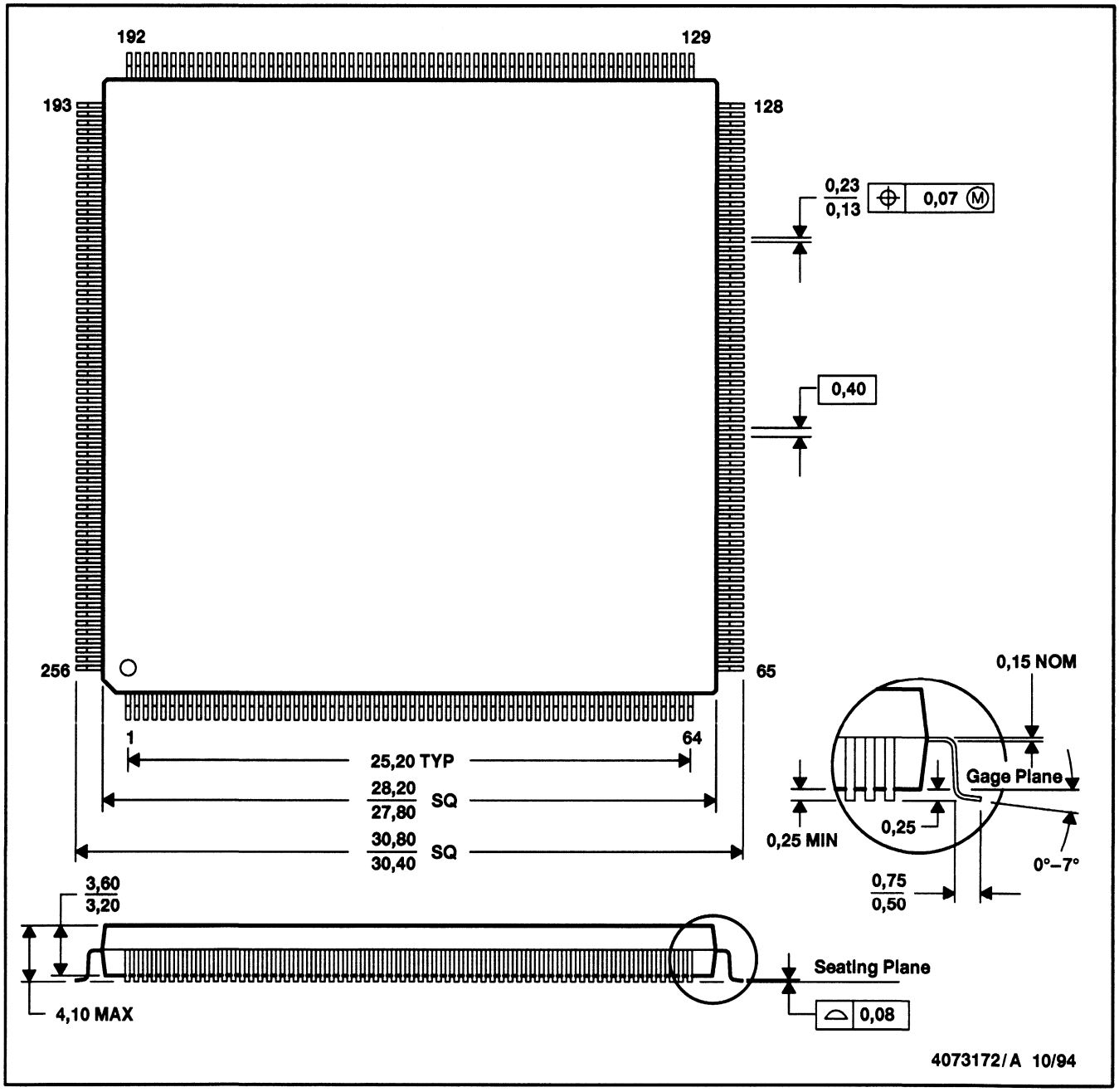
PPE (S-PQFP-G208) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MO-143

OCTOBER 1994

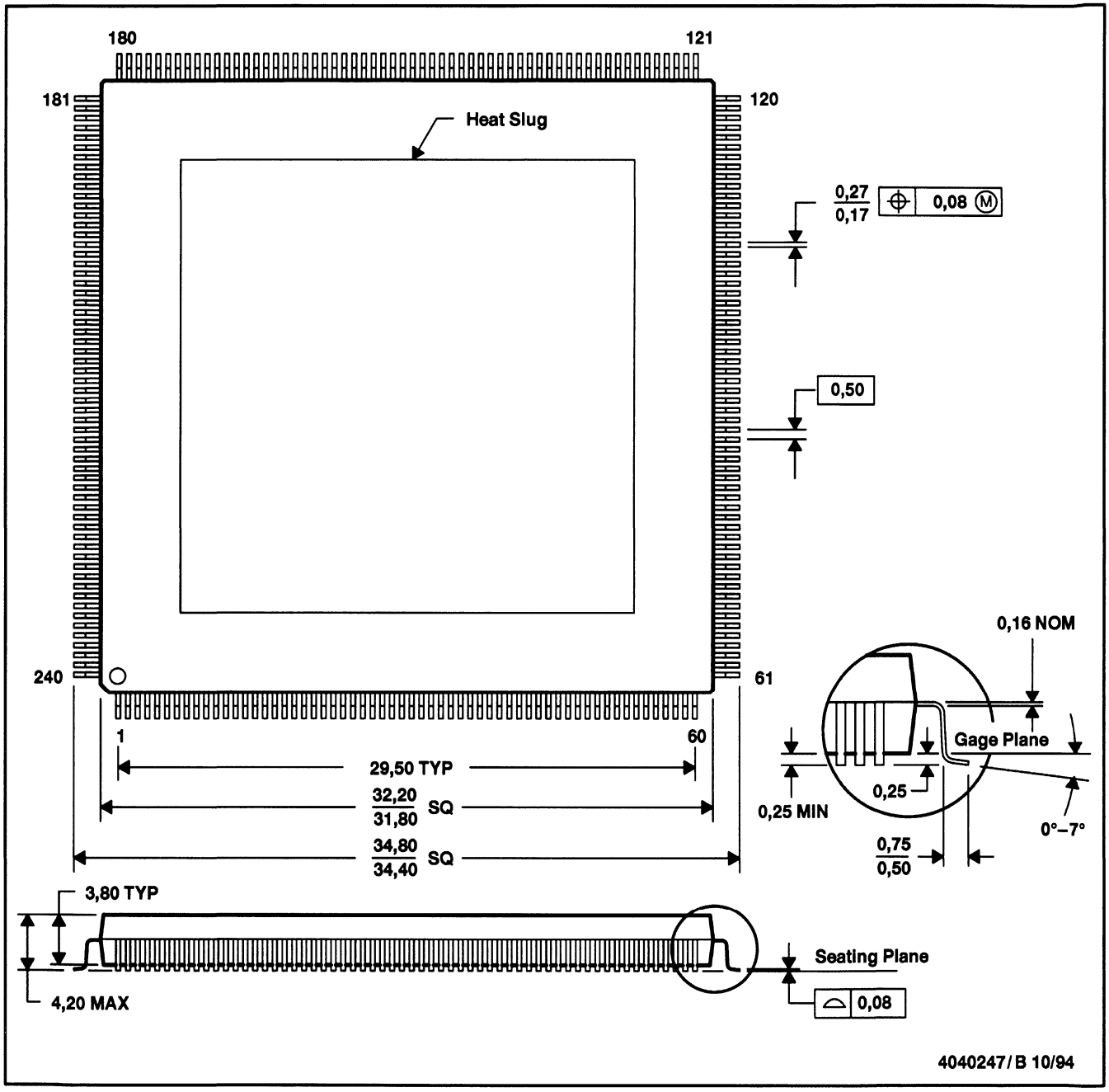
PGK (S-PQFP-G256) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)
D. Falls within JEDEC MO-143

OCTOBER 1994

PGV (S-PQFP-G240) **PLASTIC QUAD FLATPACK (DIE–DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)

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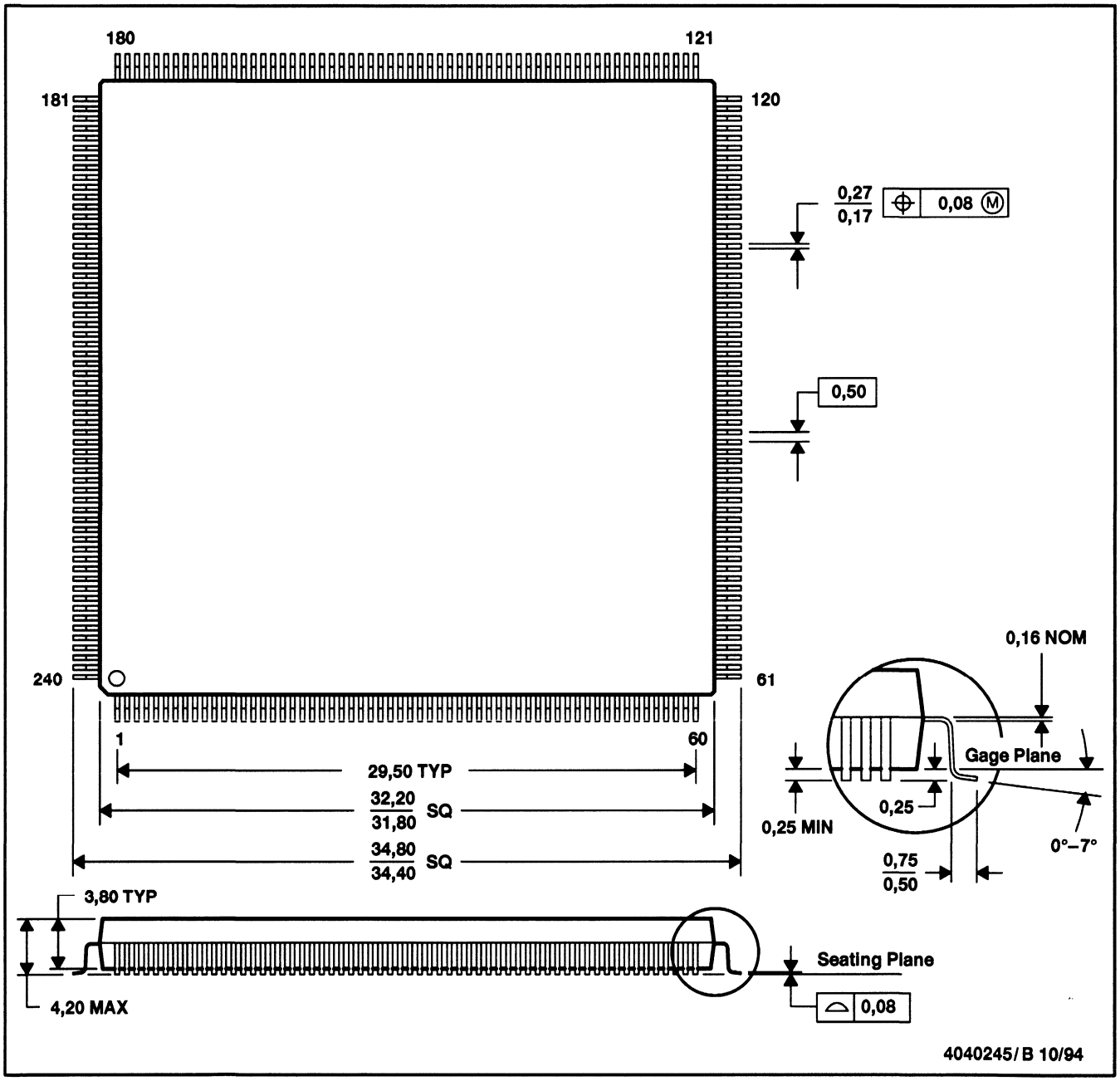
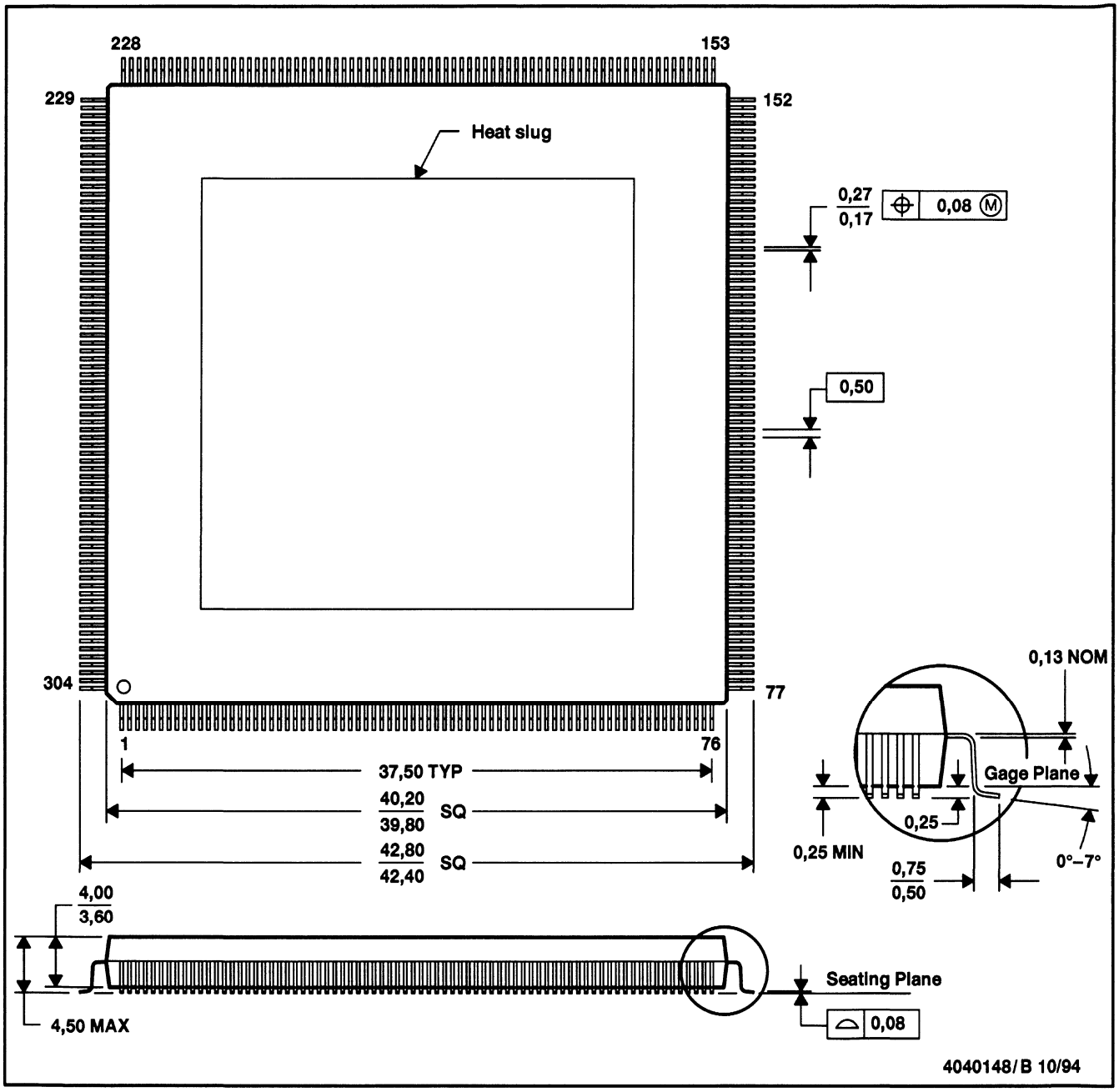
PGY (S-PQFP-G240) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat spreader (HSP)

OCTOBER 1994

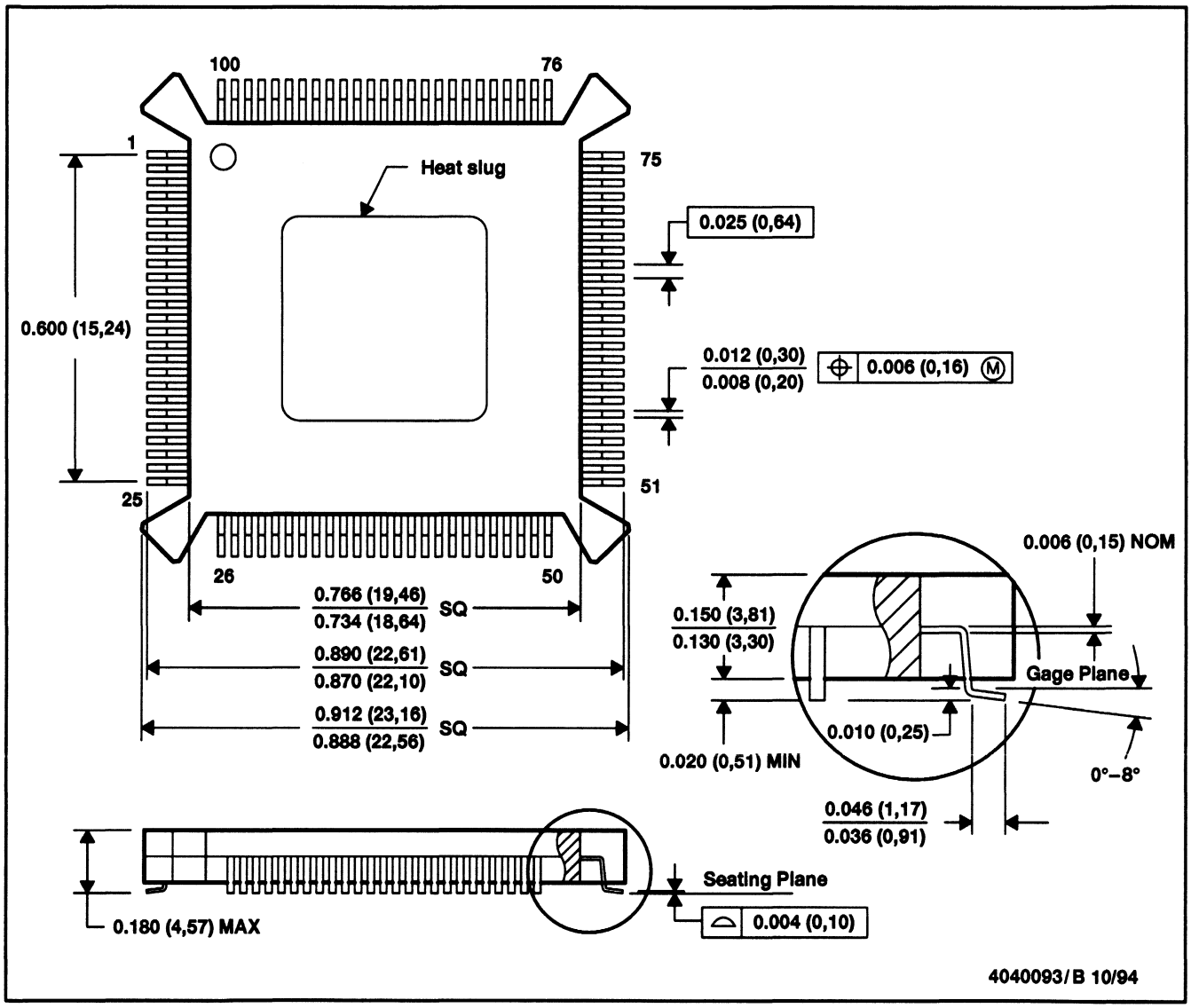
PDB (S-PQFP-G304) **PLASTIC QUAD FLATPACK (DIE-DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)
D. Falls within JEDEC MO-143

OCTOBER 1994

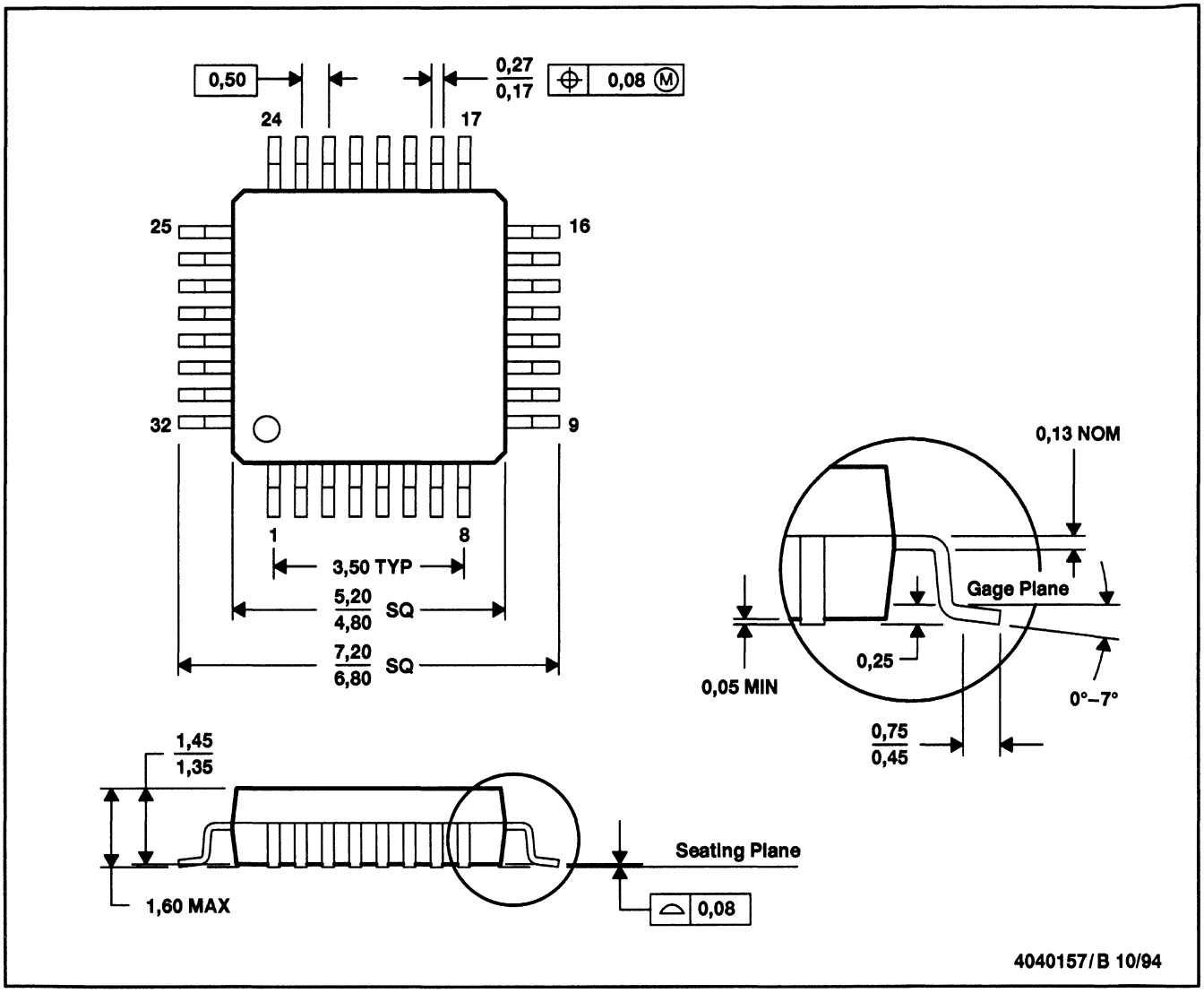
PJF (S-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-143
D. Thermally enhanced molded plastic package with a heat slug (HSL)

OCTOBER 1994

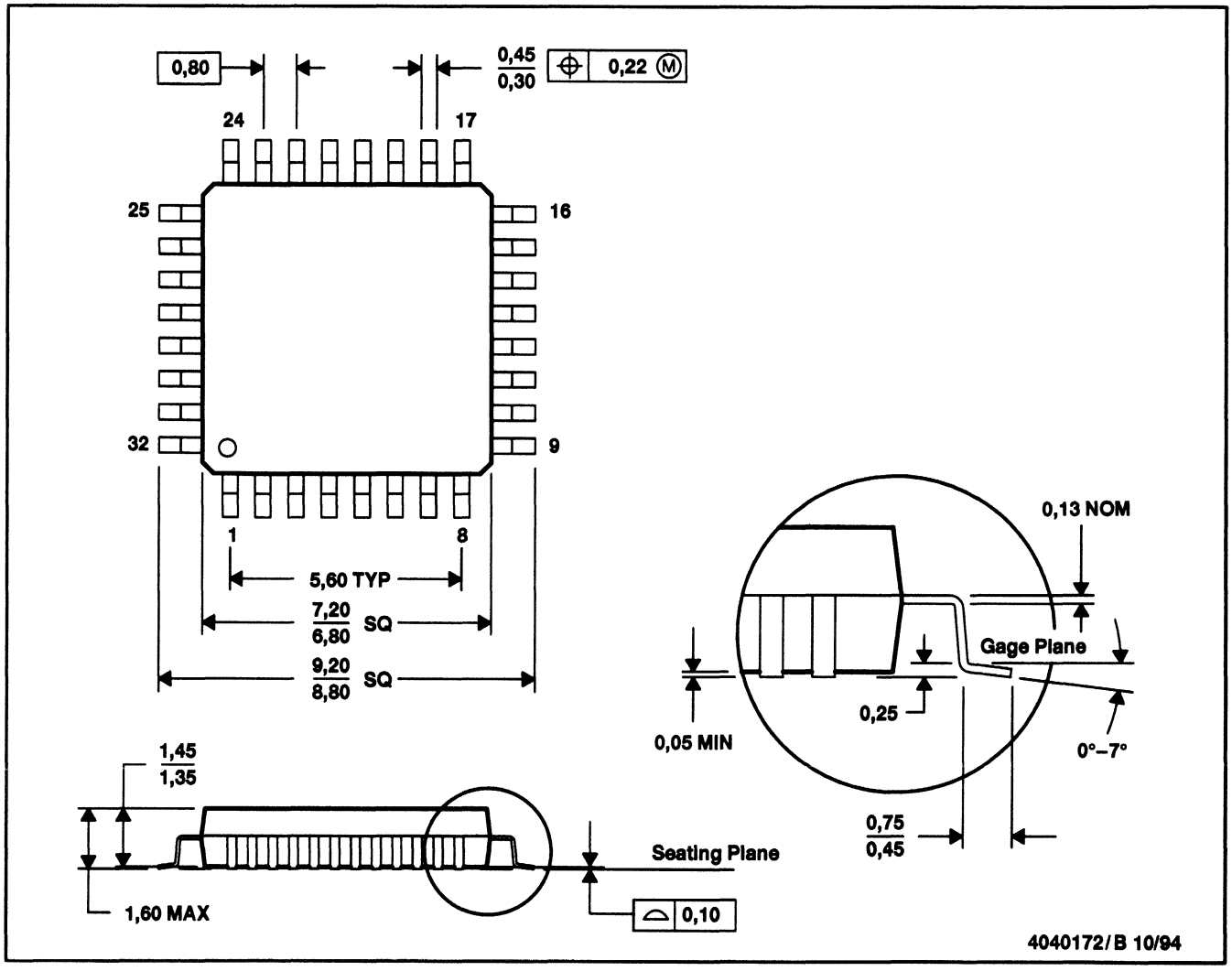
PU (S-PQFP-G32) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

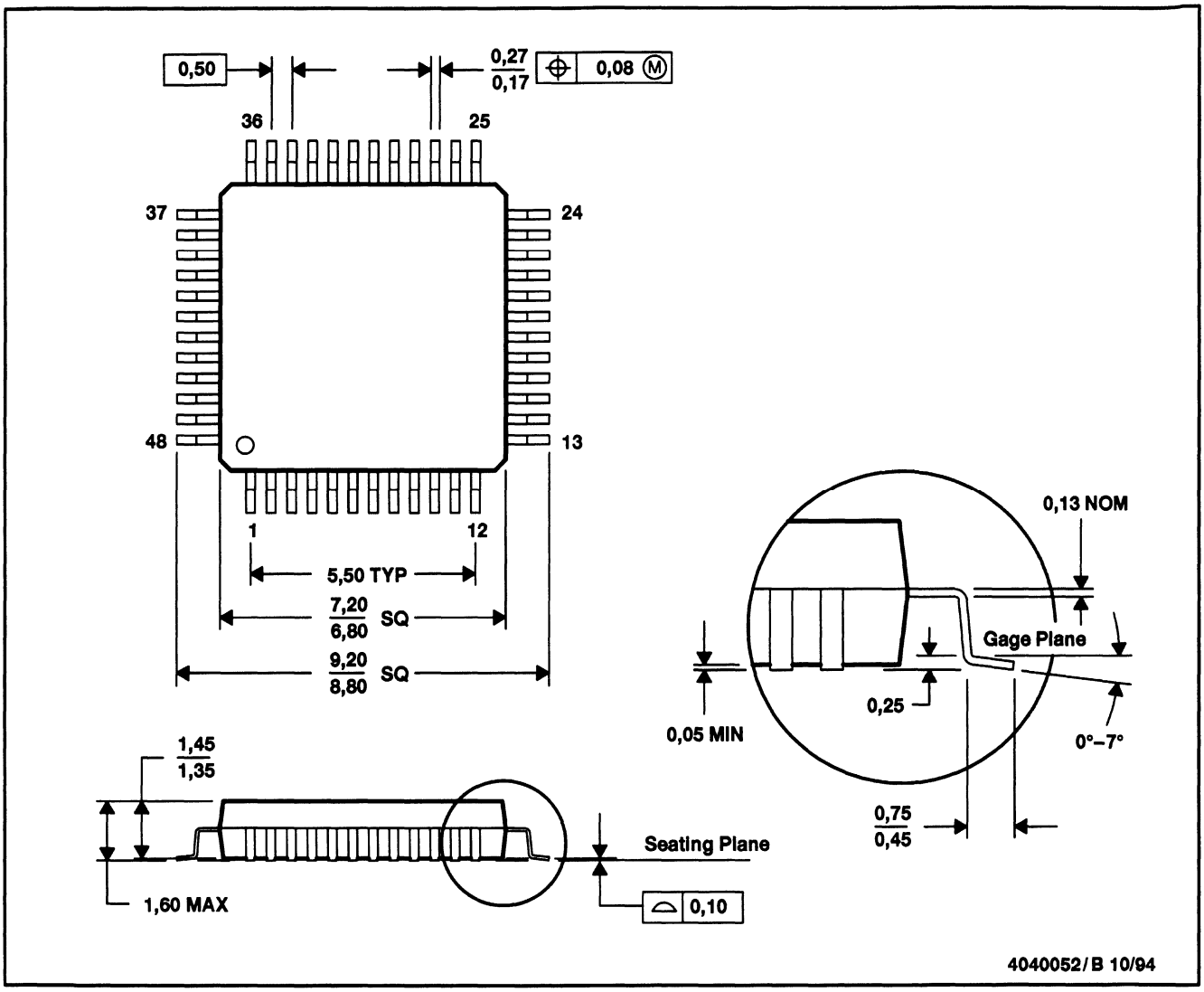
VF (S-PQFP-G32) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

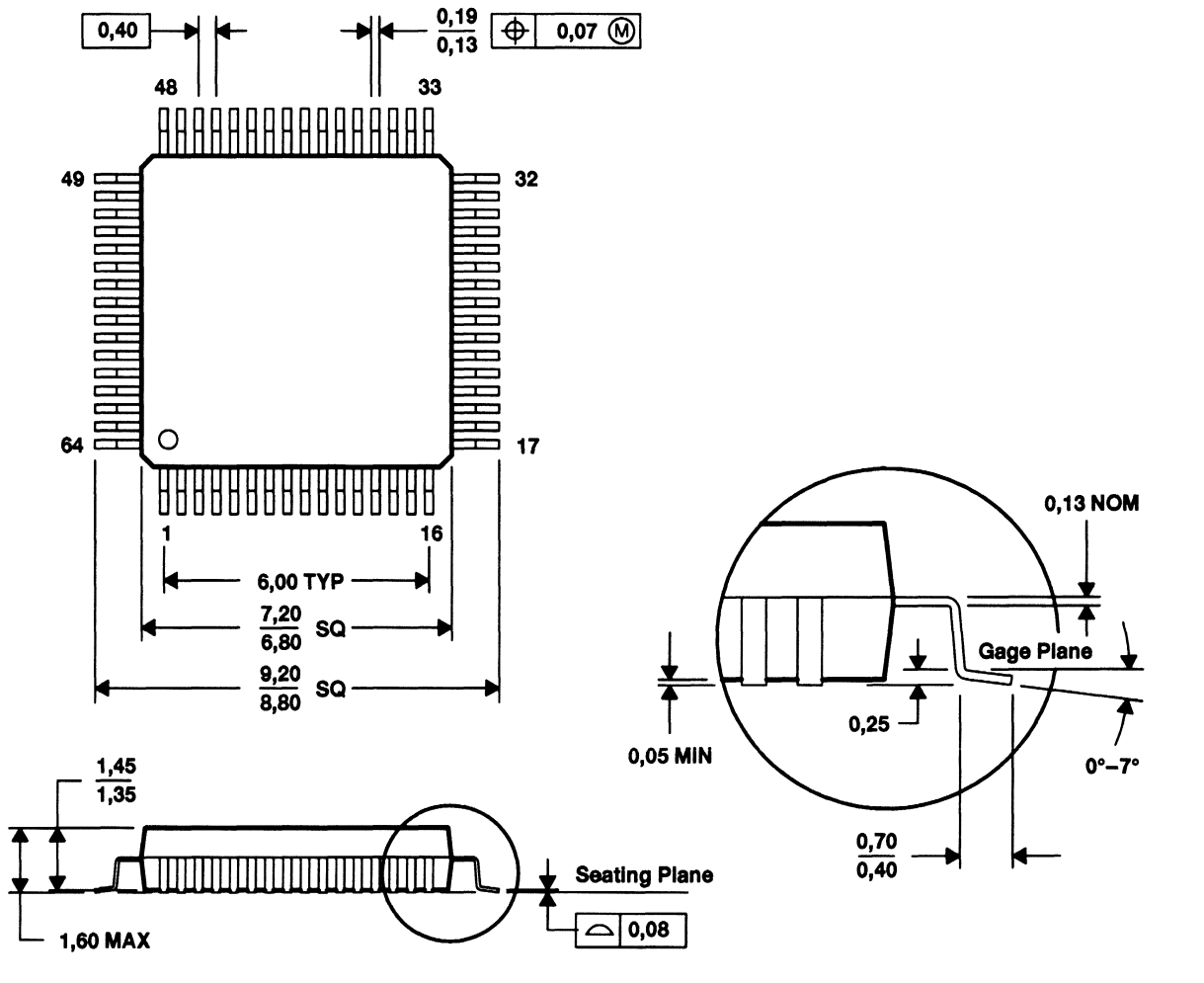
PT (S-PQFP-G48) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136
D. Also may be a thermally enhanced plastic package with leads conected to the die pads

OCTOBER 1994

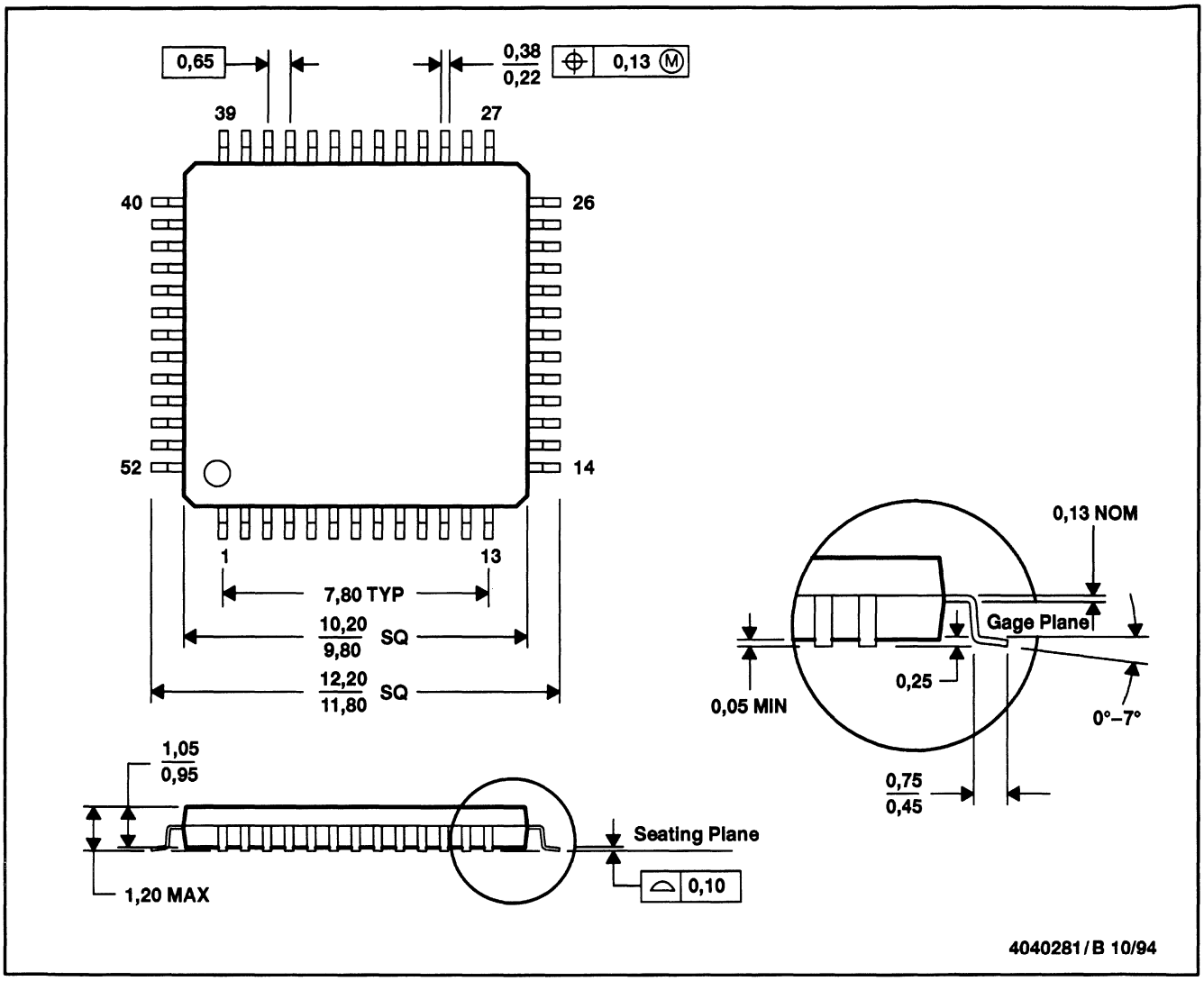
PTA (S-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

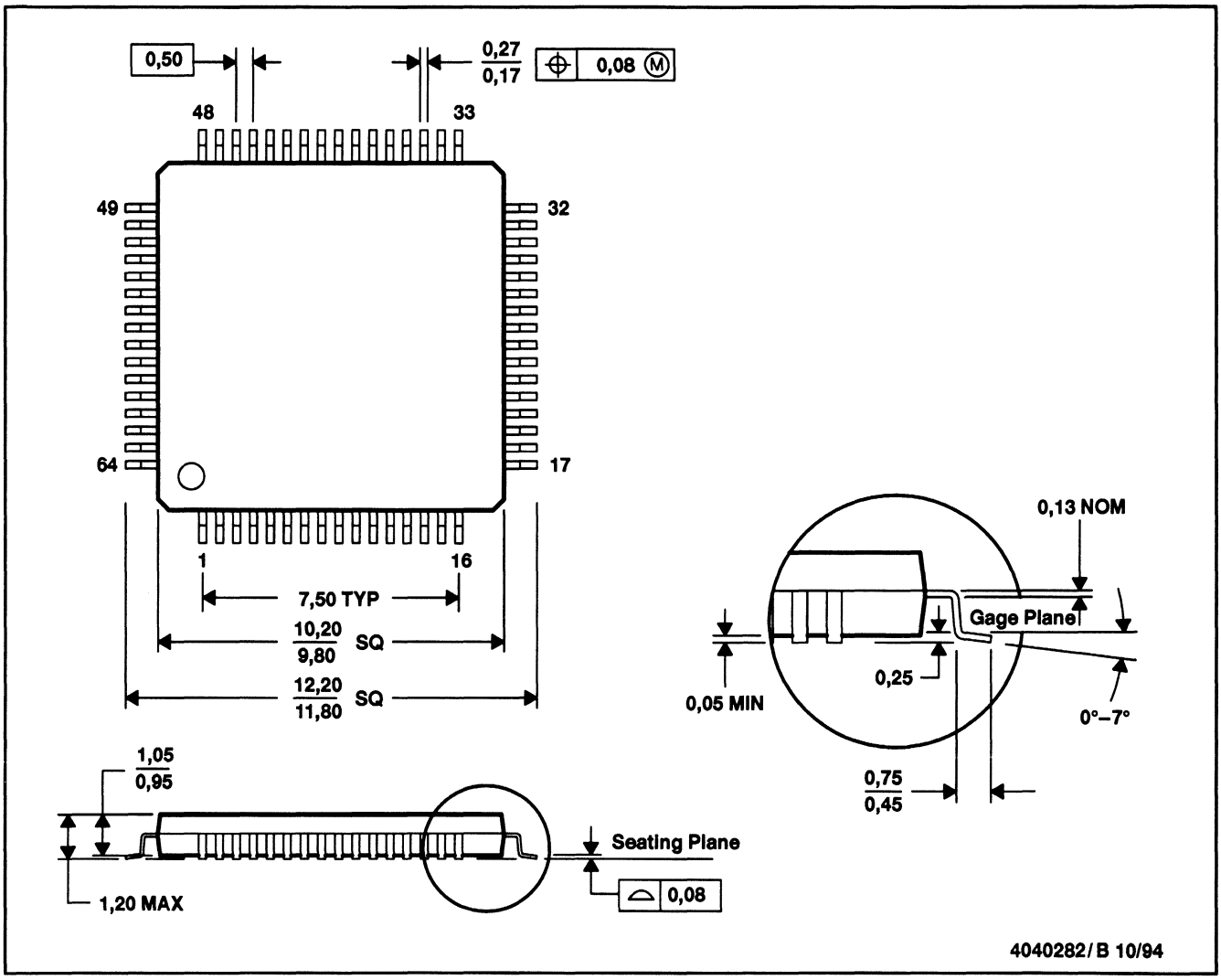
PAH (S-PQFP-G52) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

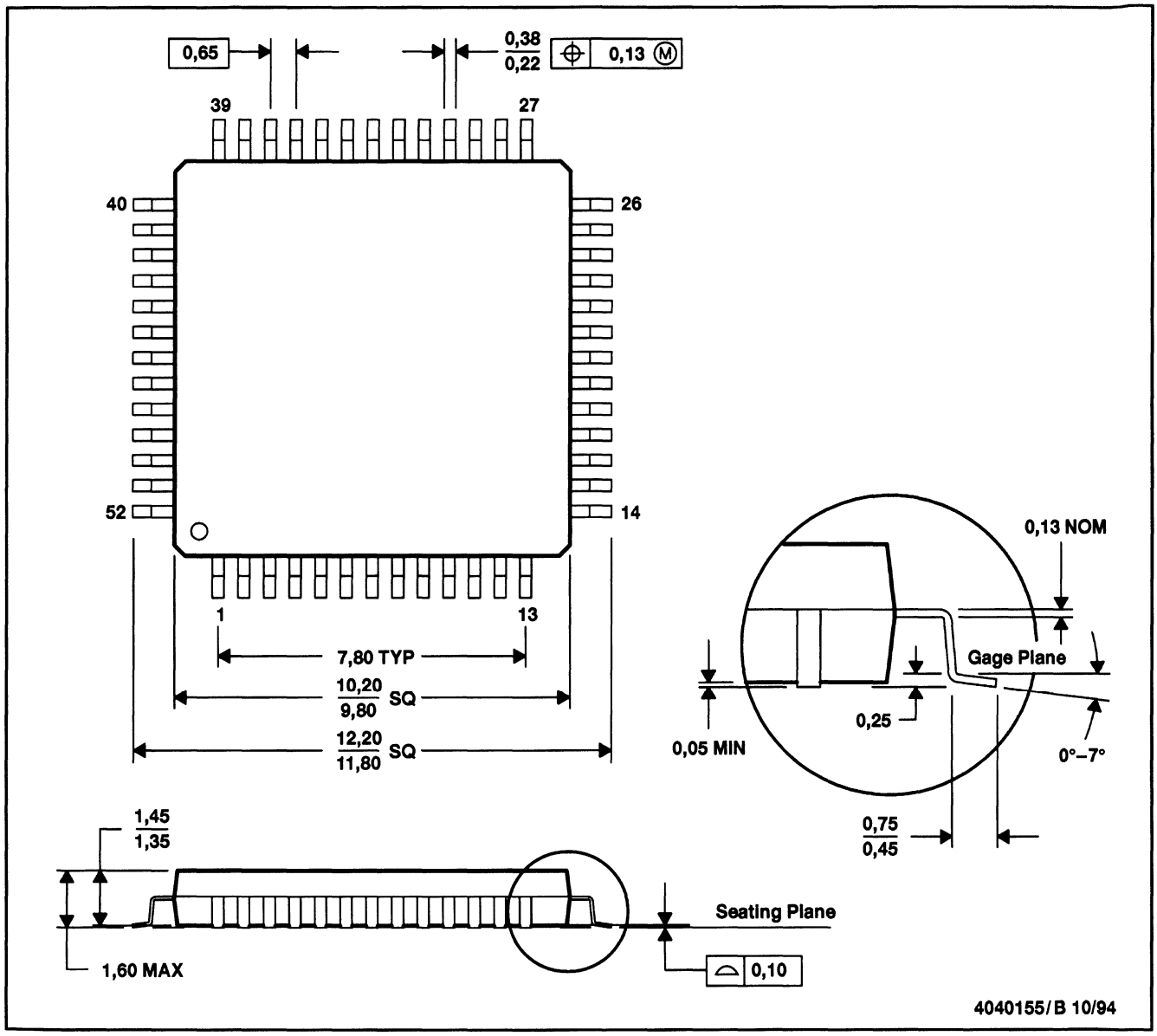
PAG (S-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

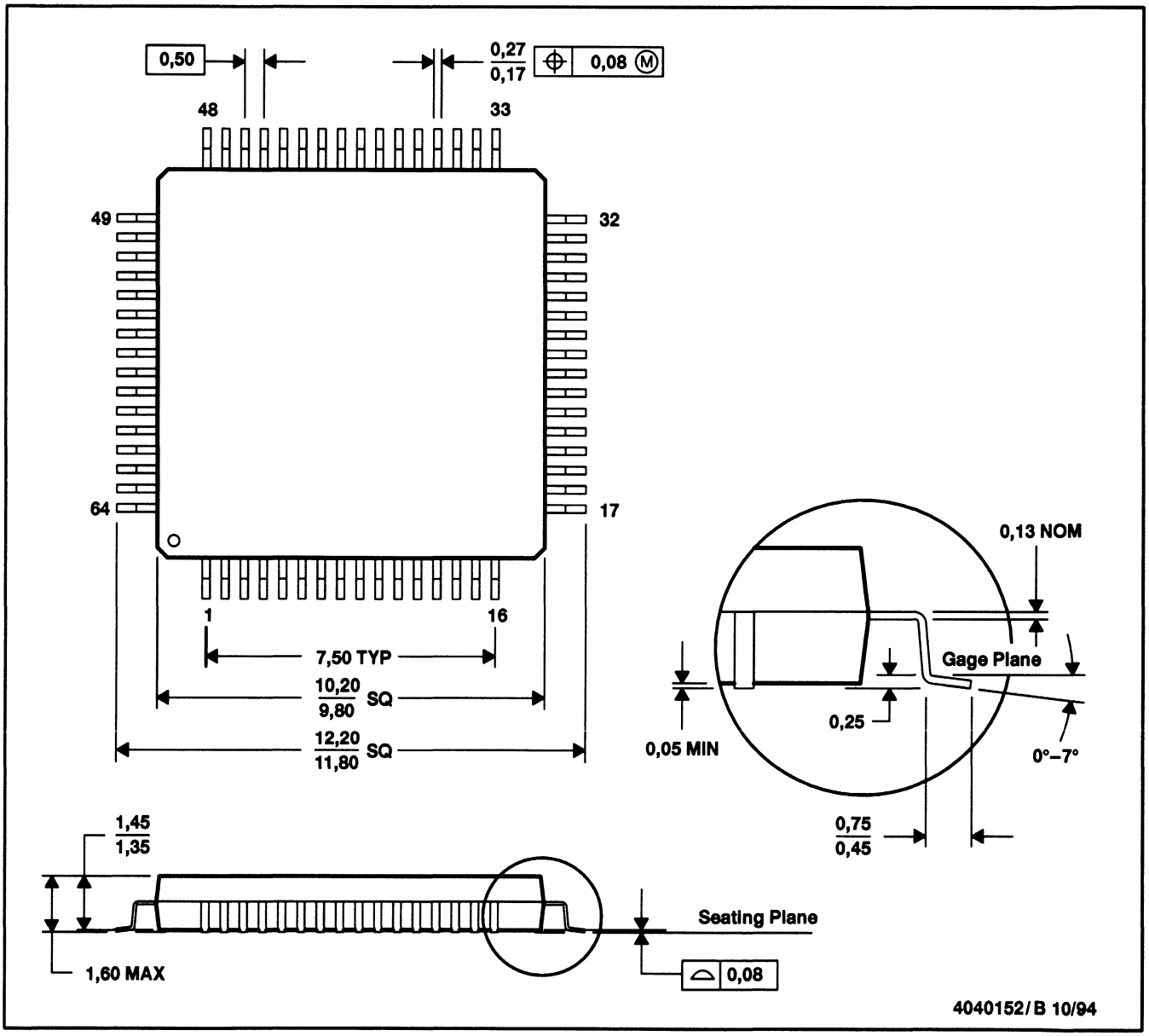
PBG (S-PQFP-G52) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

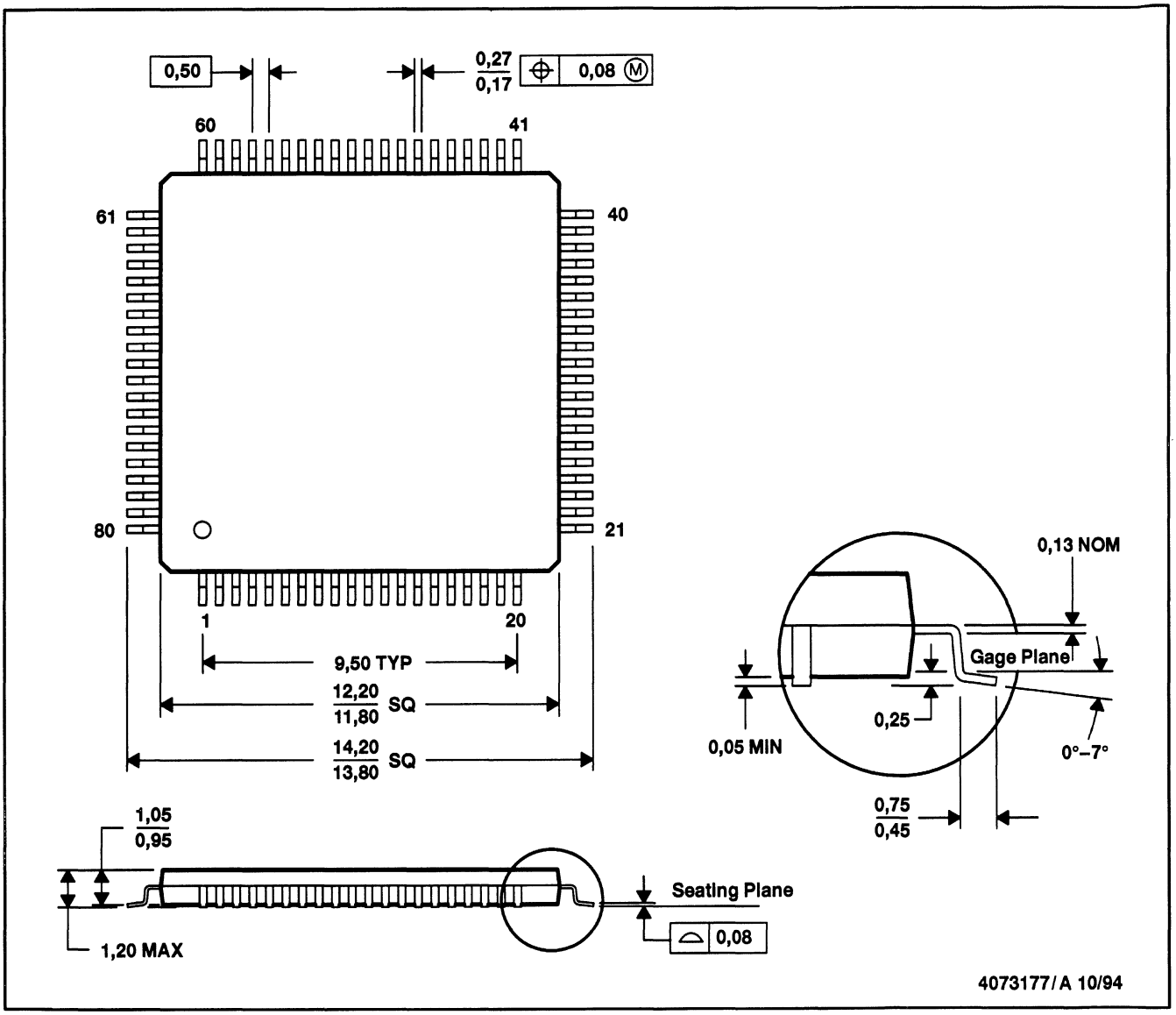
PM (S-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

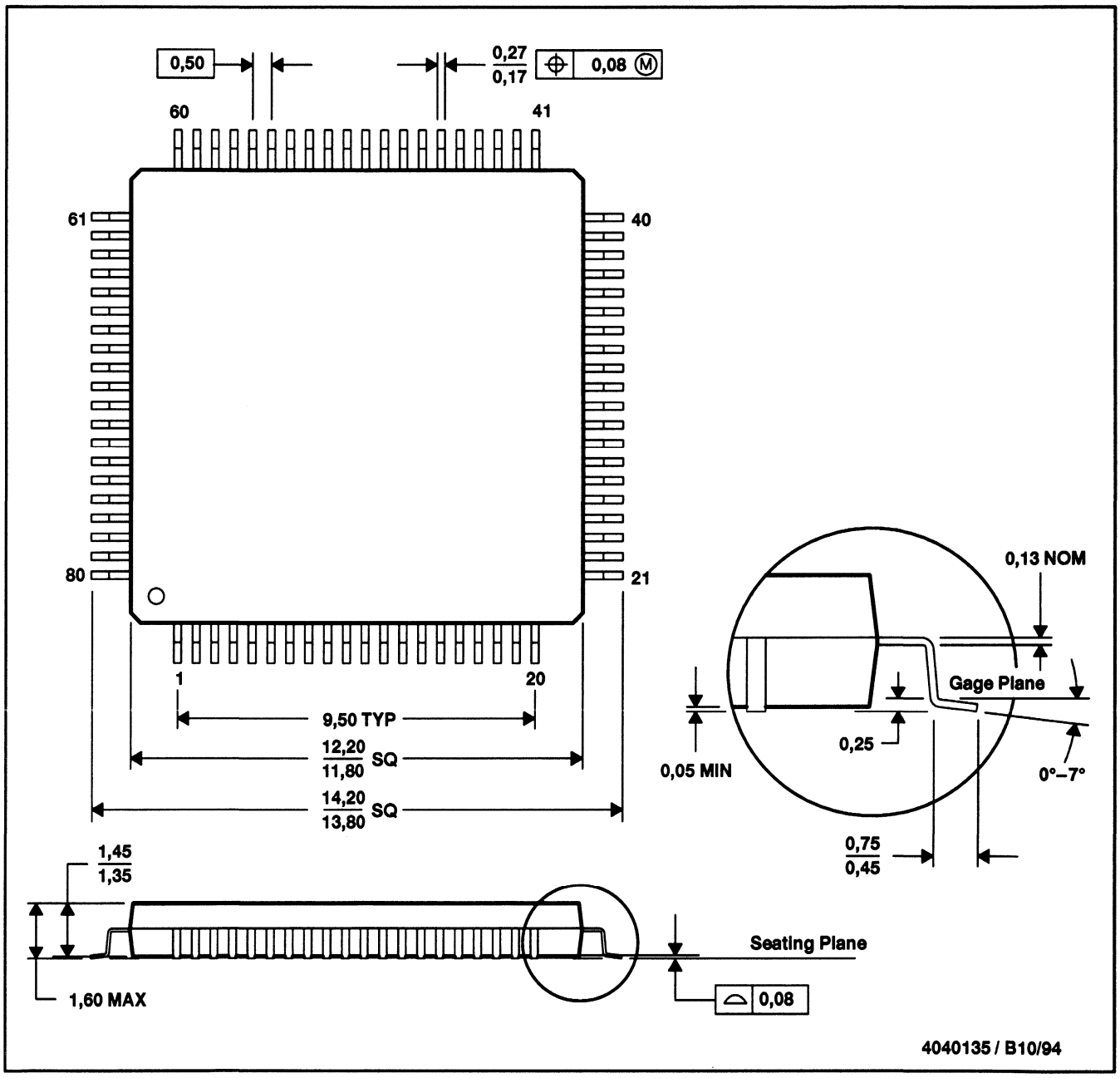
PFC (S-PQFP-G80) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

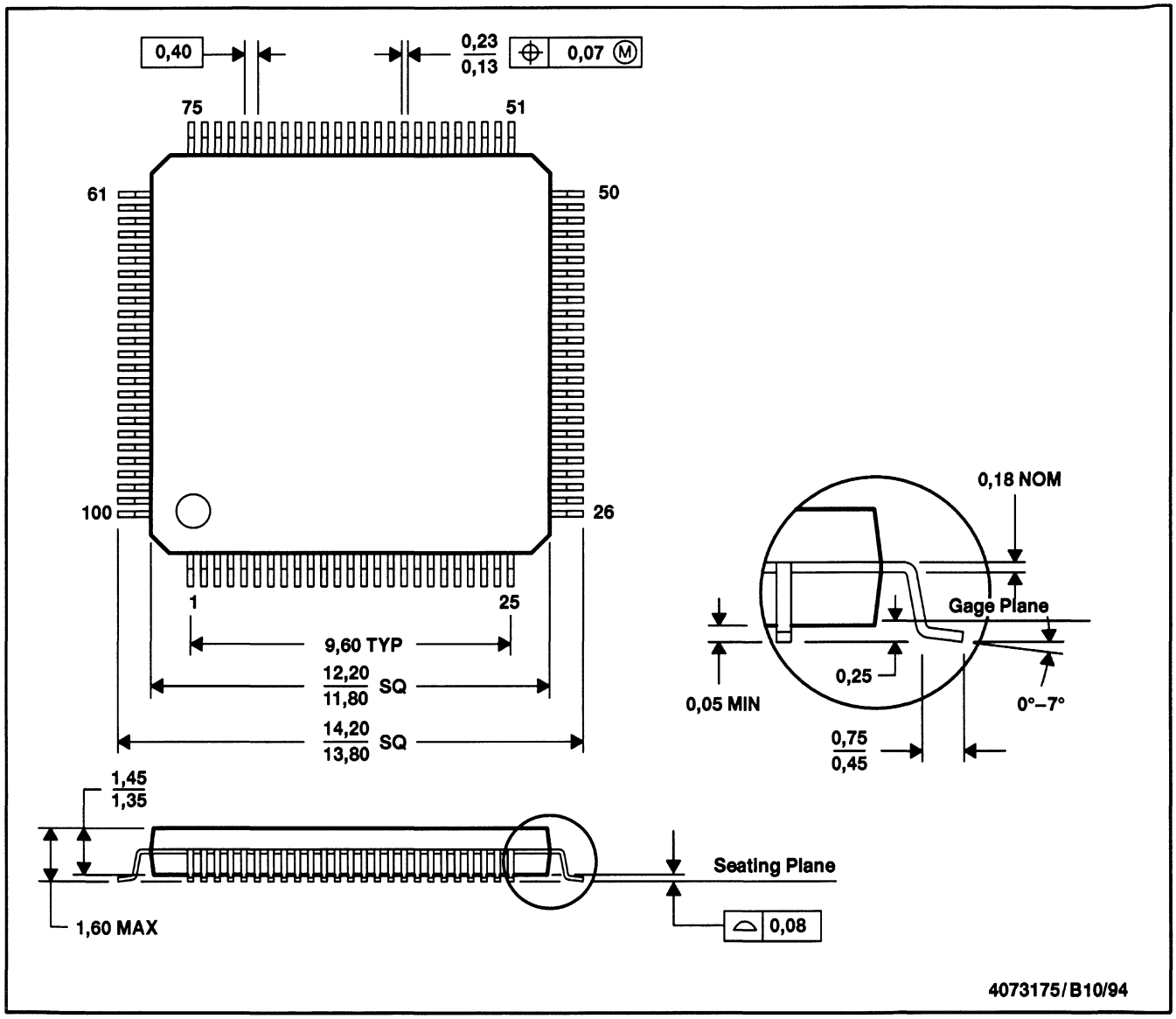
PN (S-PQFP-G80) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

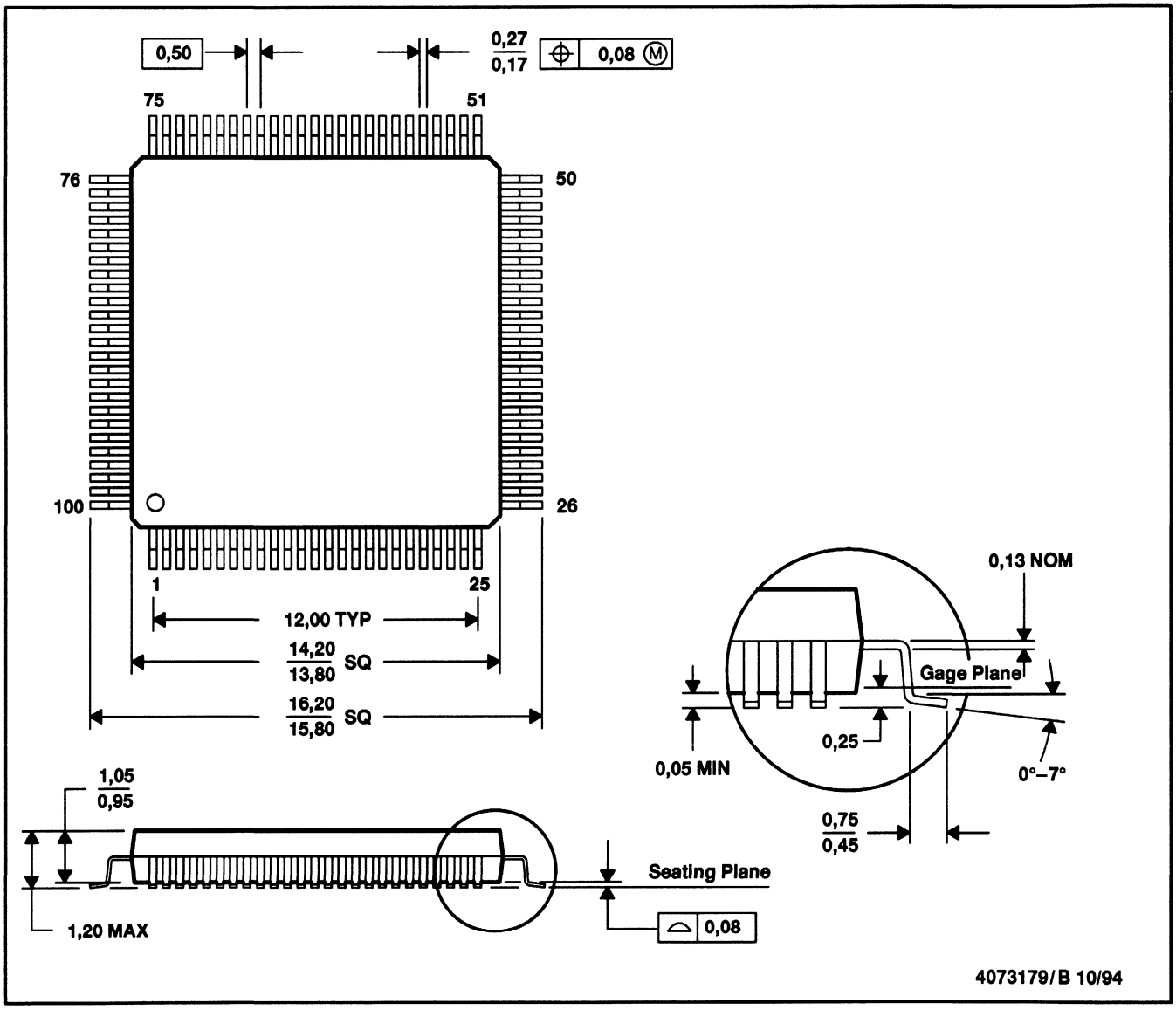
PFA (S-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO–136

OCTOBER 1994

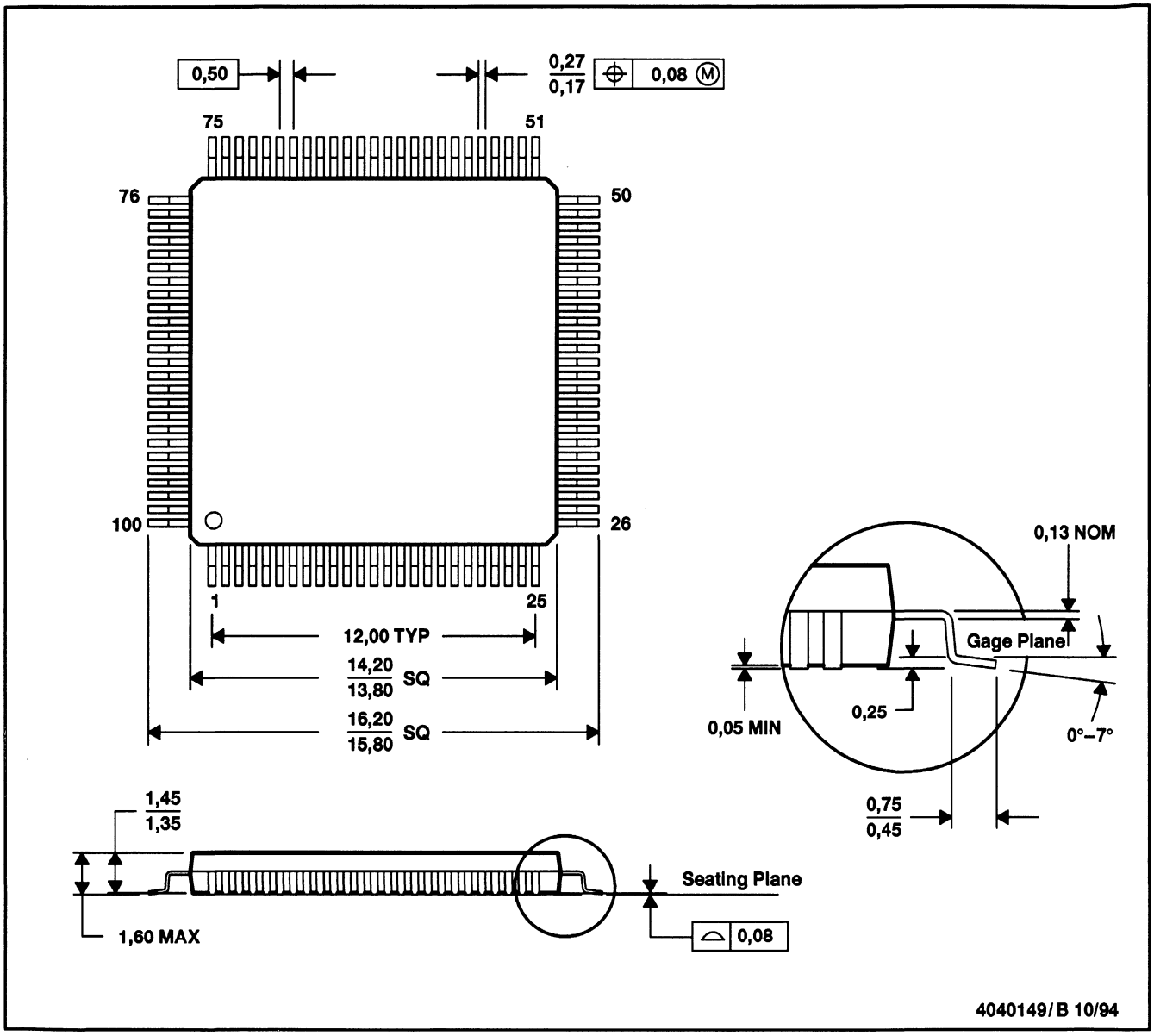
PZT (S-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

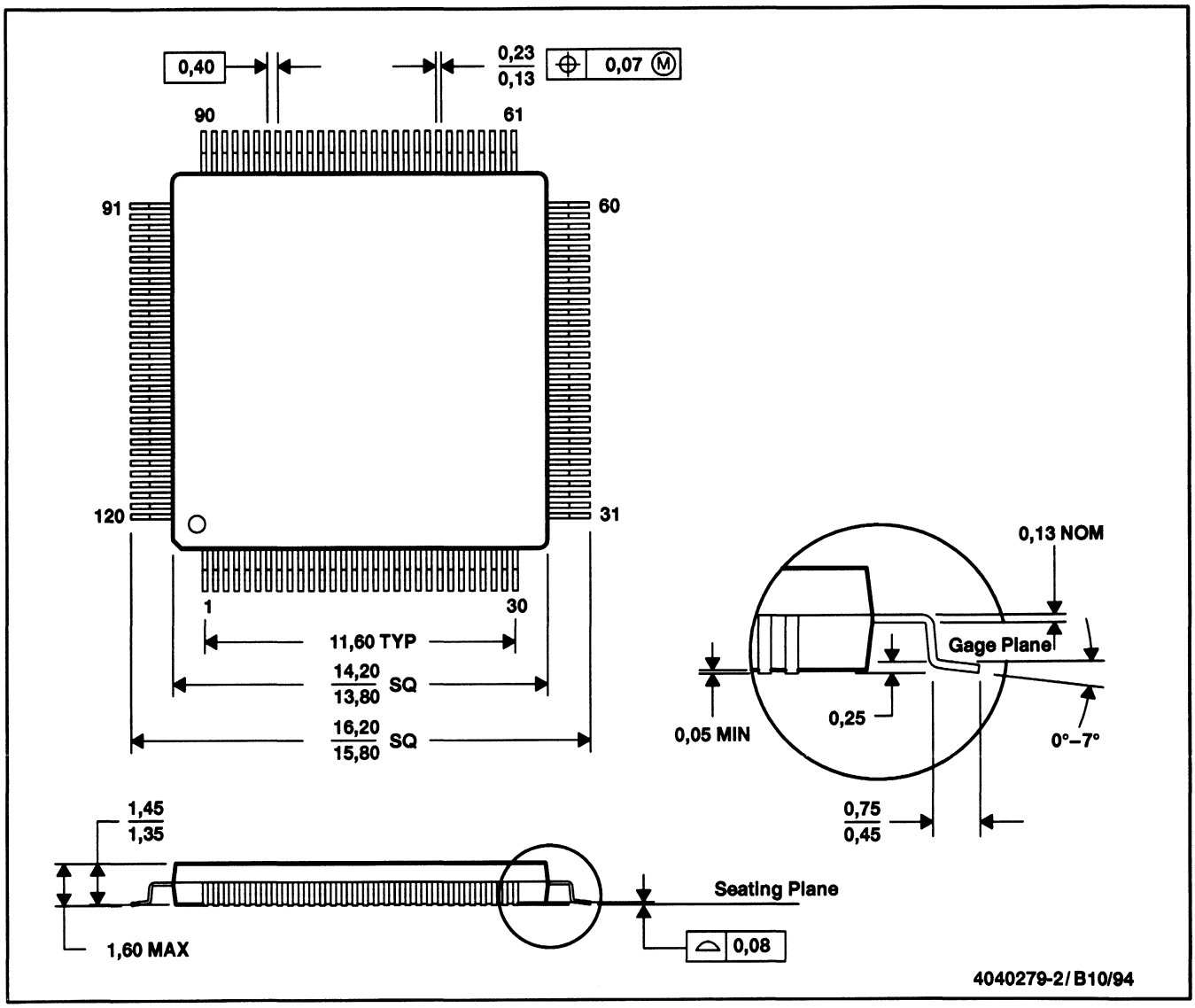
PZ (S-PQFP-G100) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

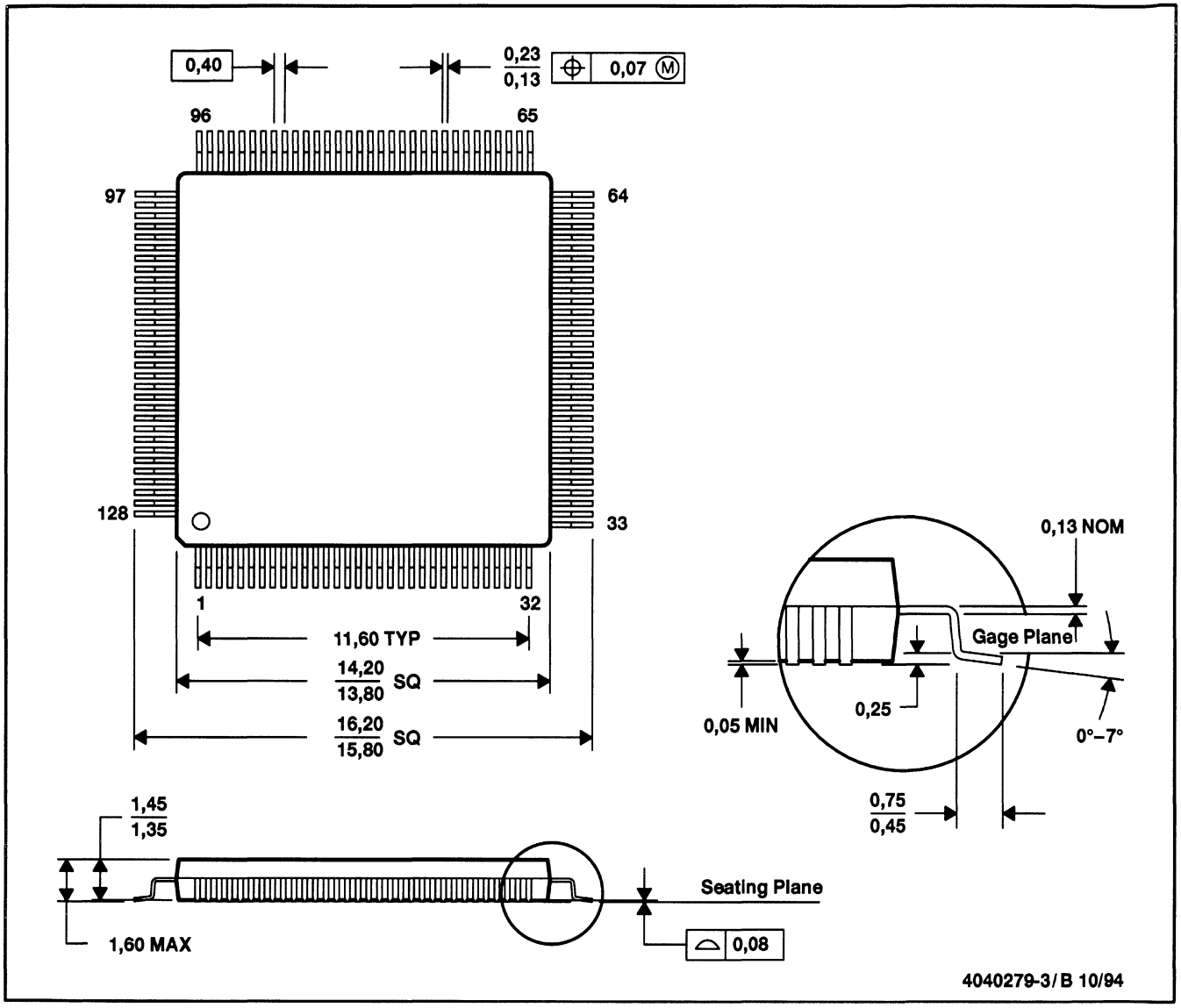
PBK (S-PQFP-G120) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

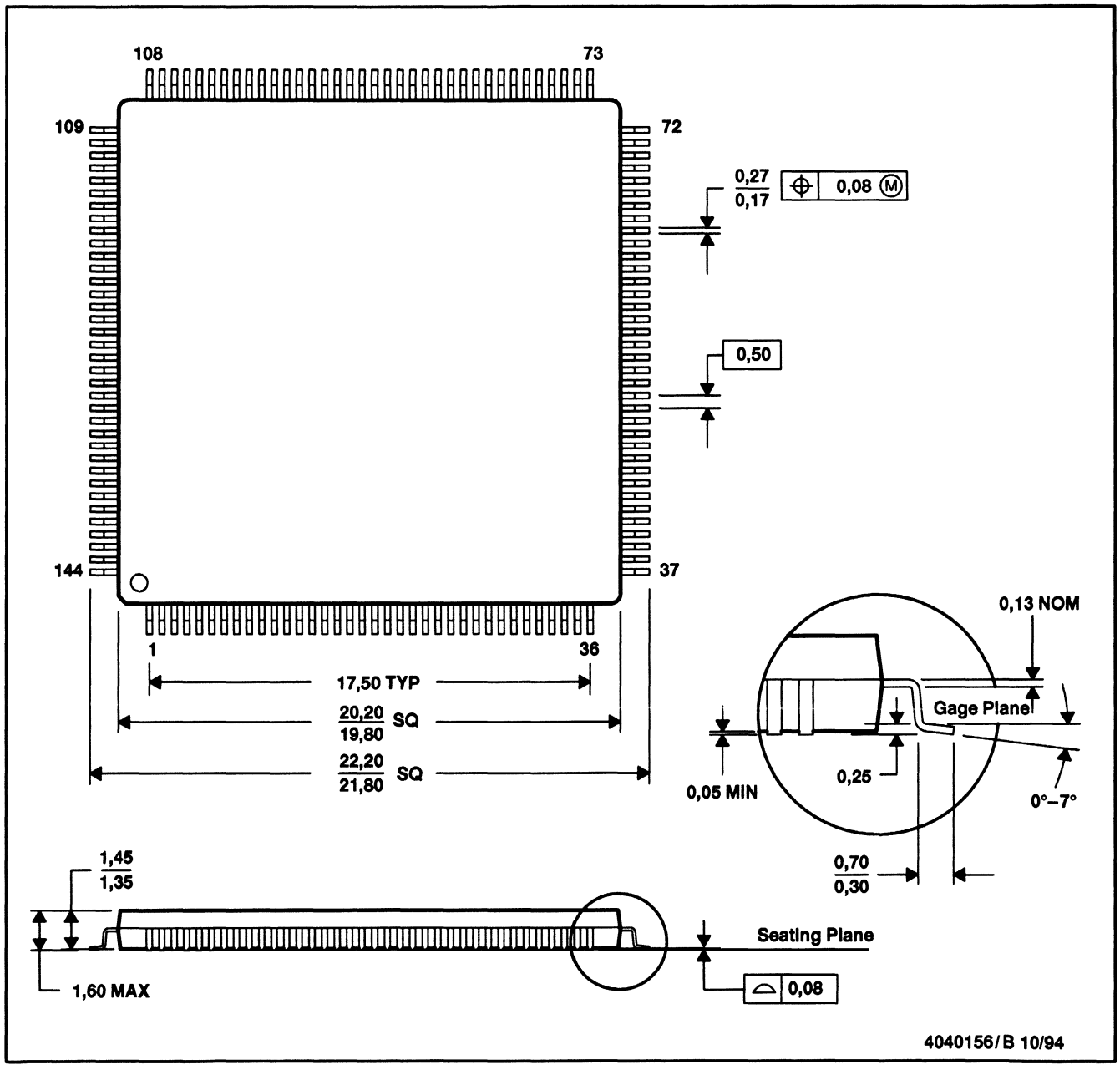
PBK (S-PQFP-G128) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

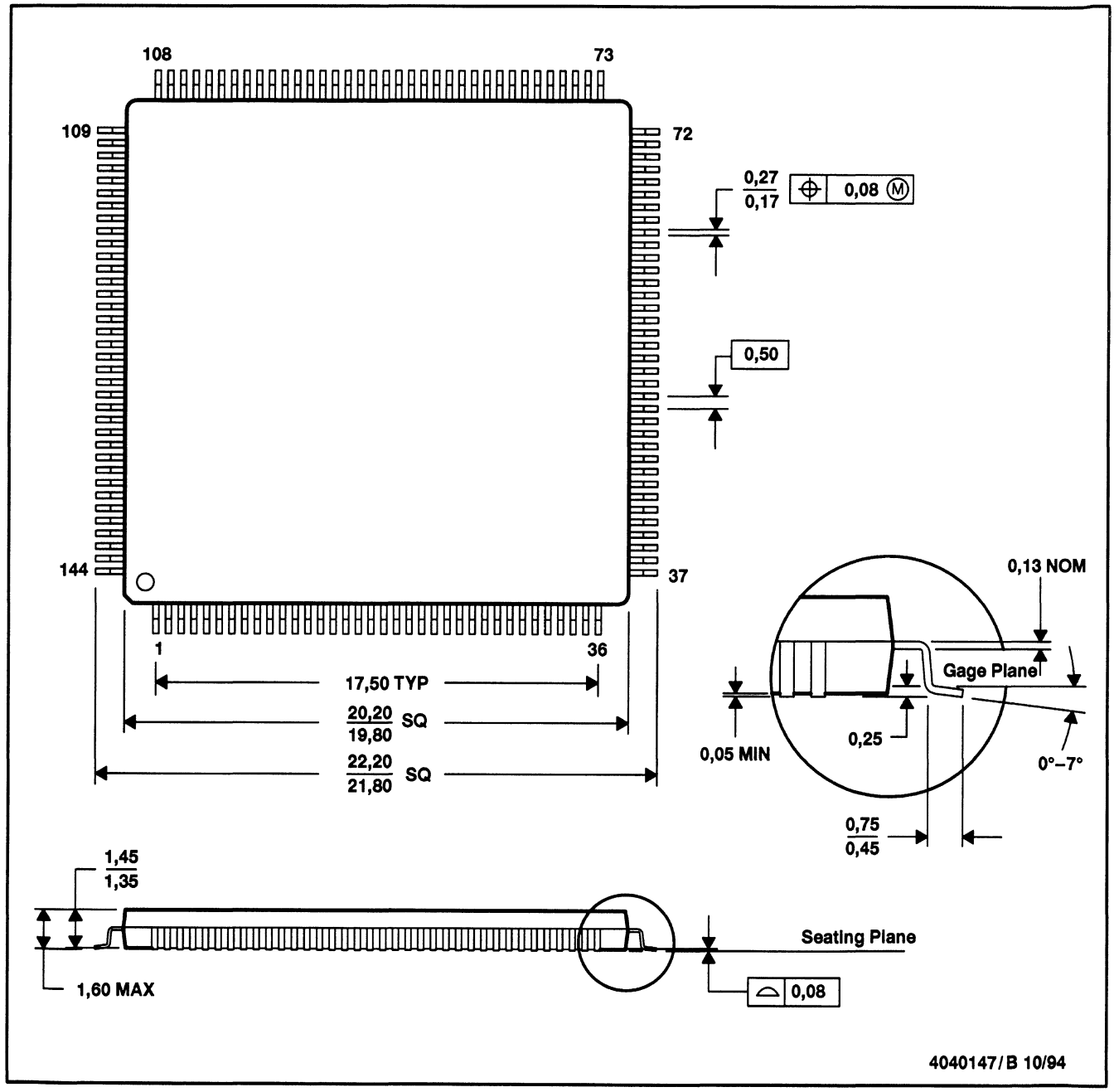
PGD (S-PQFP-G144) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

PGE (S-PQFP-G144) **PLASTIC QUAD FLATPACK**



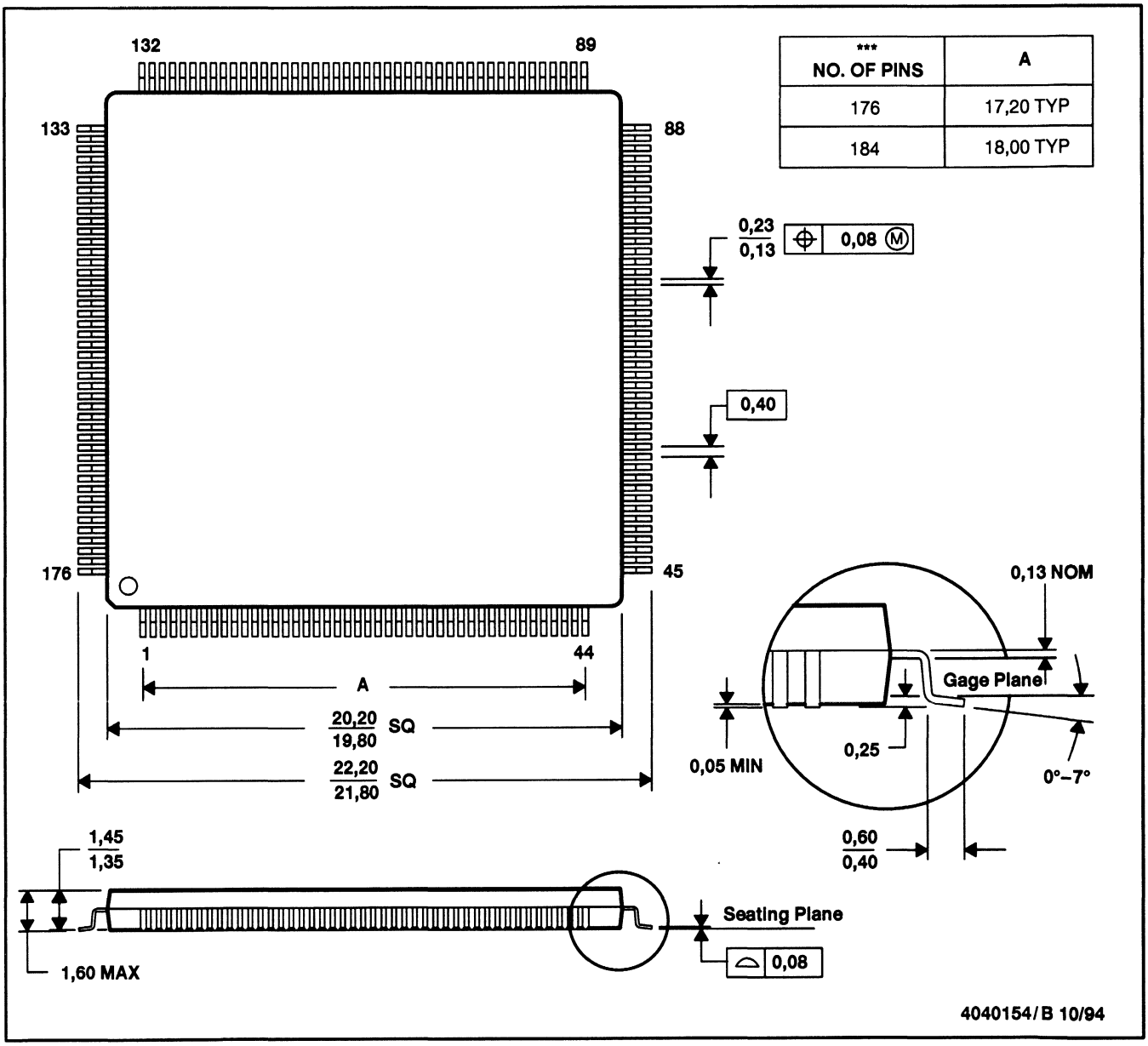
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

PBL (S-PQFP-G***)

PLASTIC QUAD FLATPACK

176 PIN SHOWN

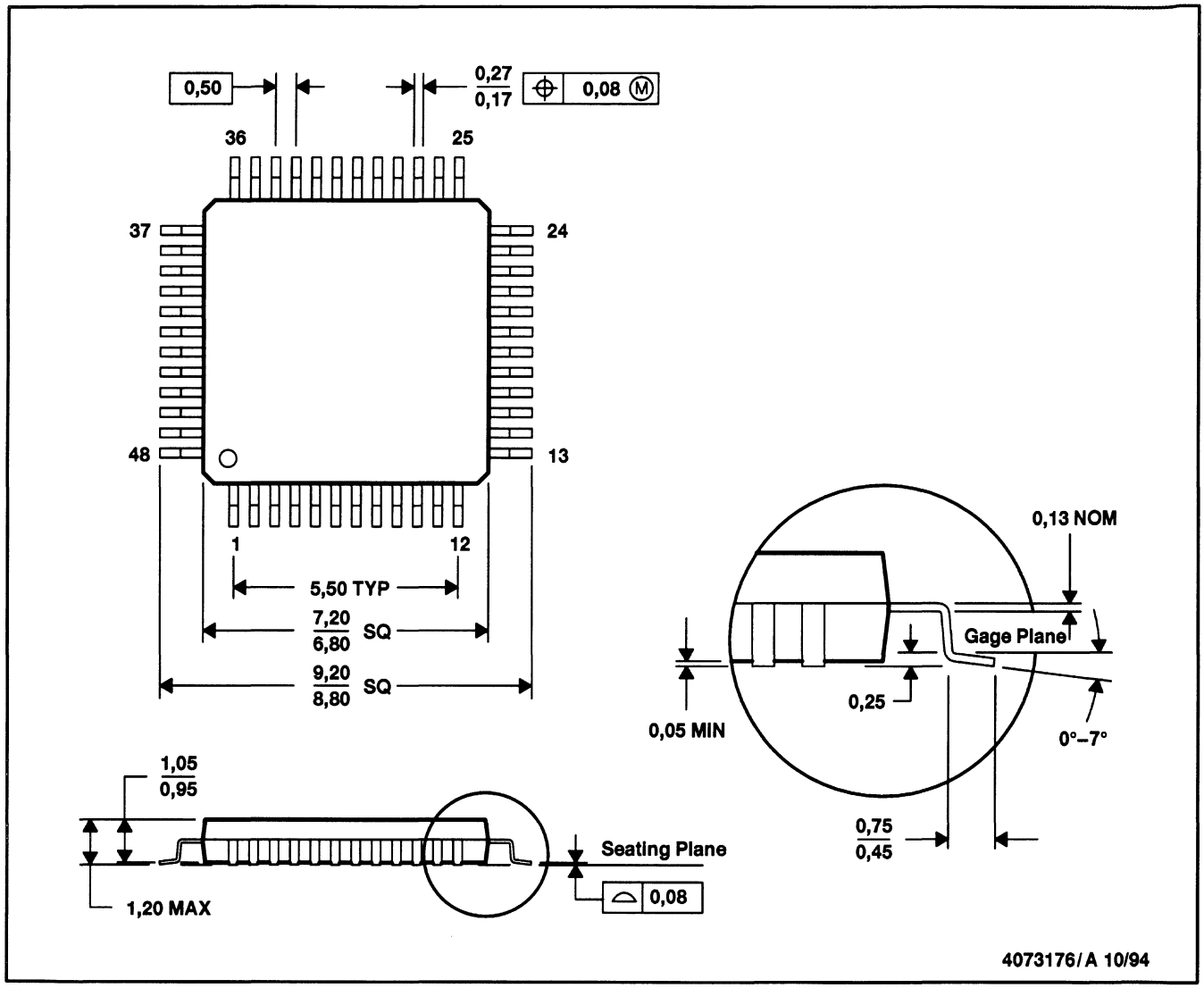


*** NO. OF PINS	A
176	17,20 TYP
184	18,00 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

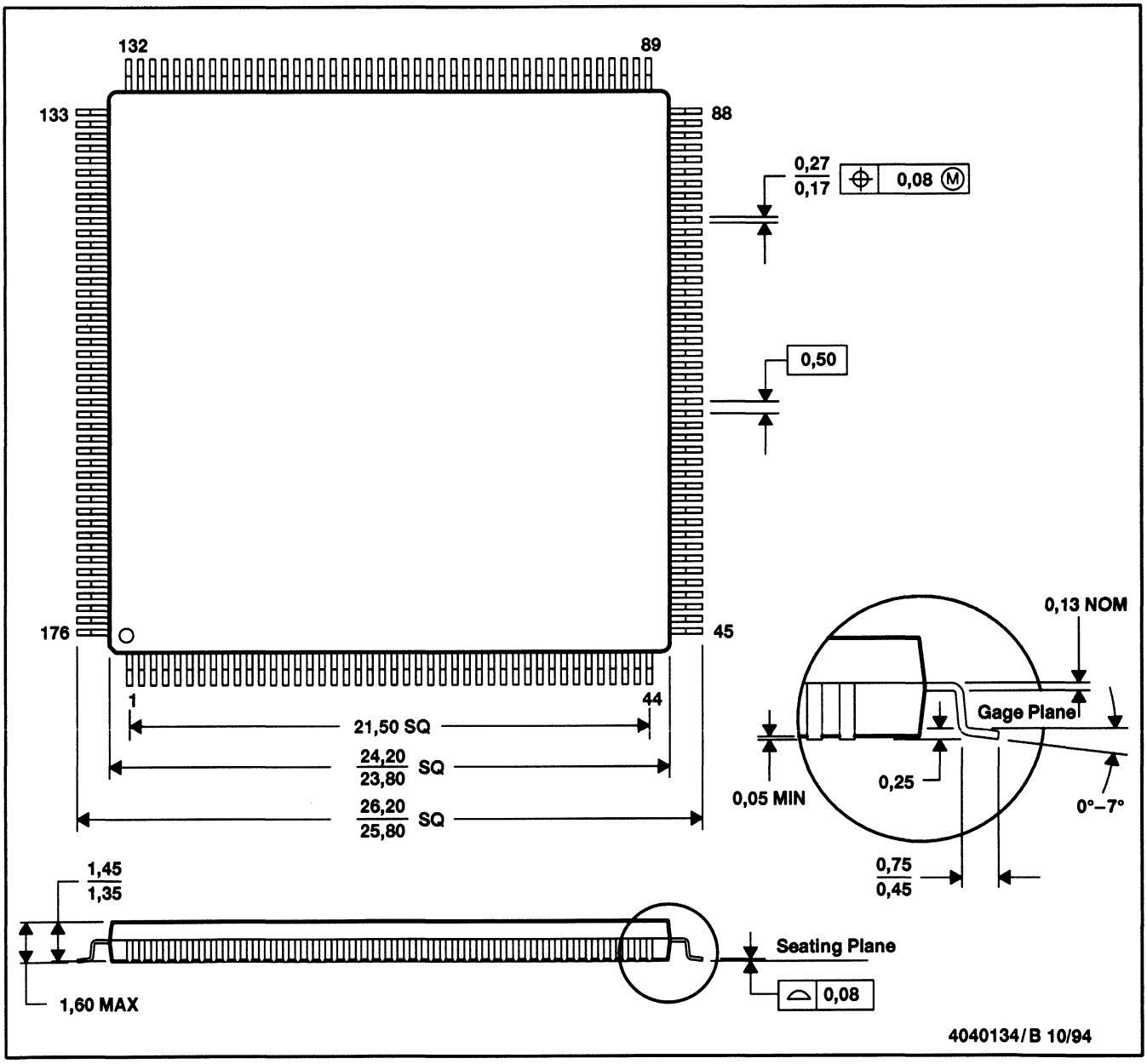
PFB (S-PQFP-G48) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

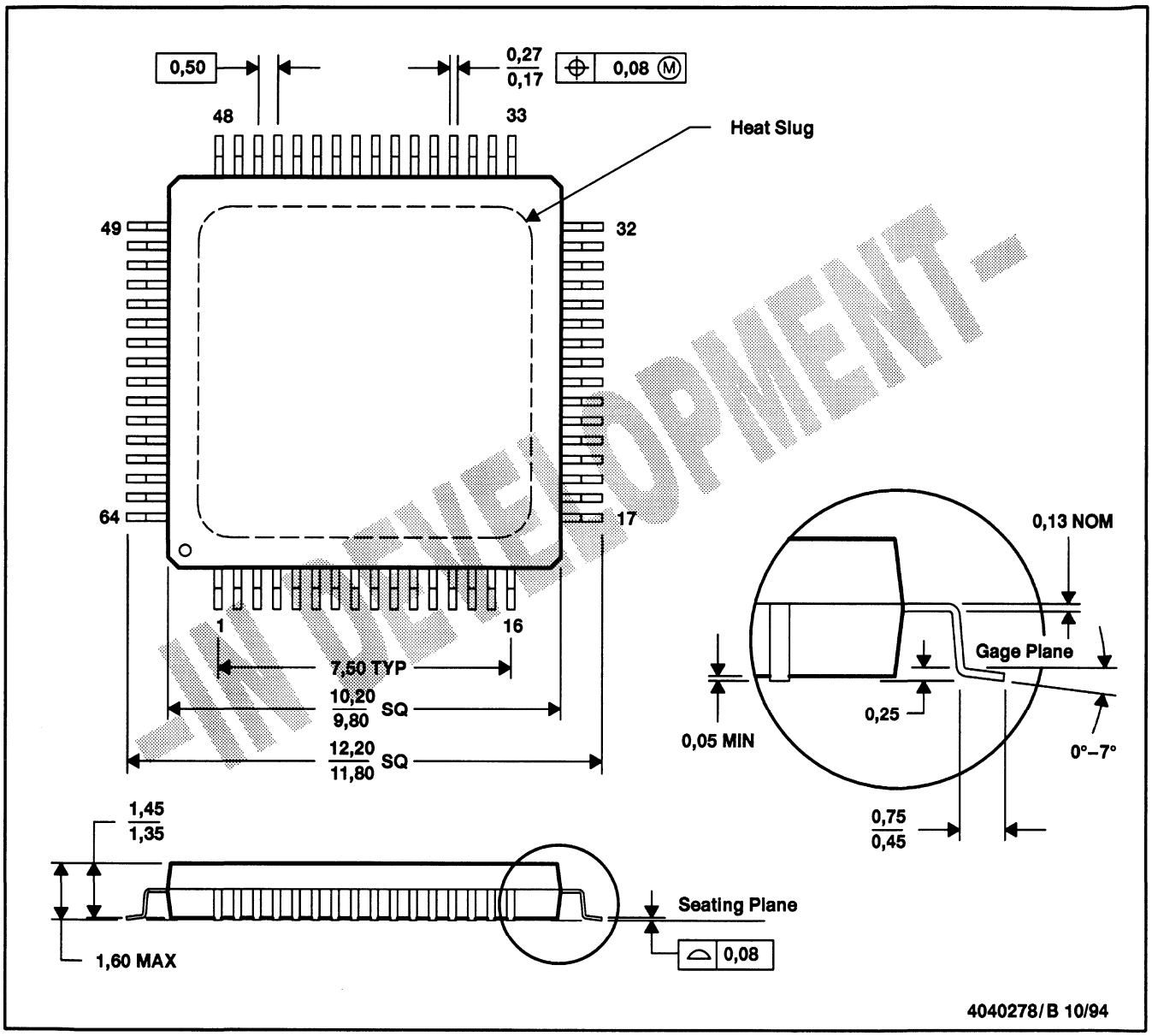
PGF (S-PQFP-G176) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136

OCTOBER 1994

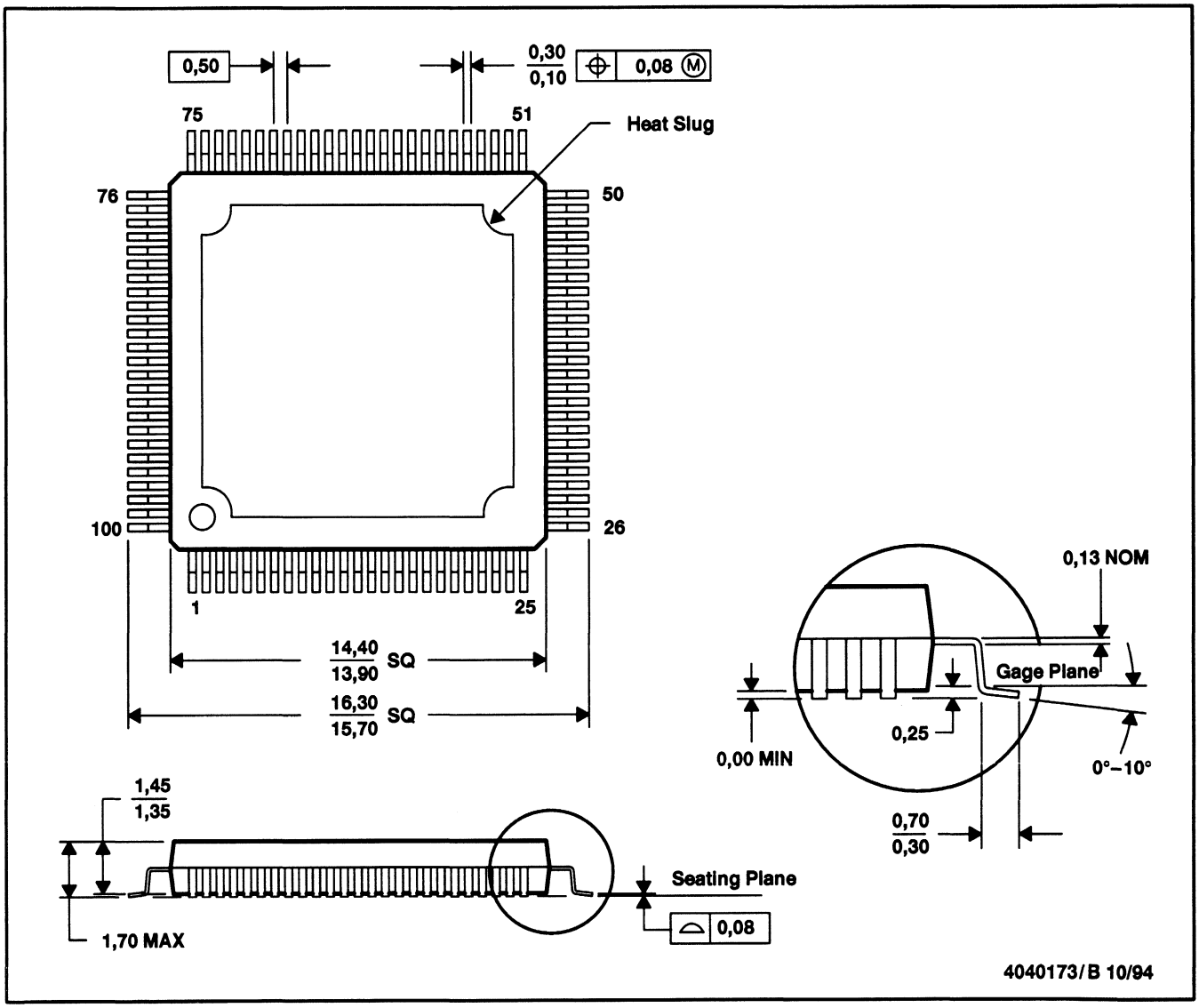
PAJ (S-PQFP-G64) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced plastic package with a heat slug (HSL) exposed on package bottom
D. Falls within JEDEC MO-136

OCTOBER 1994

VG (S-PQFP-G100) **PLASTIC QUAD FLATPACK (DIE-DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)

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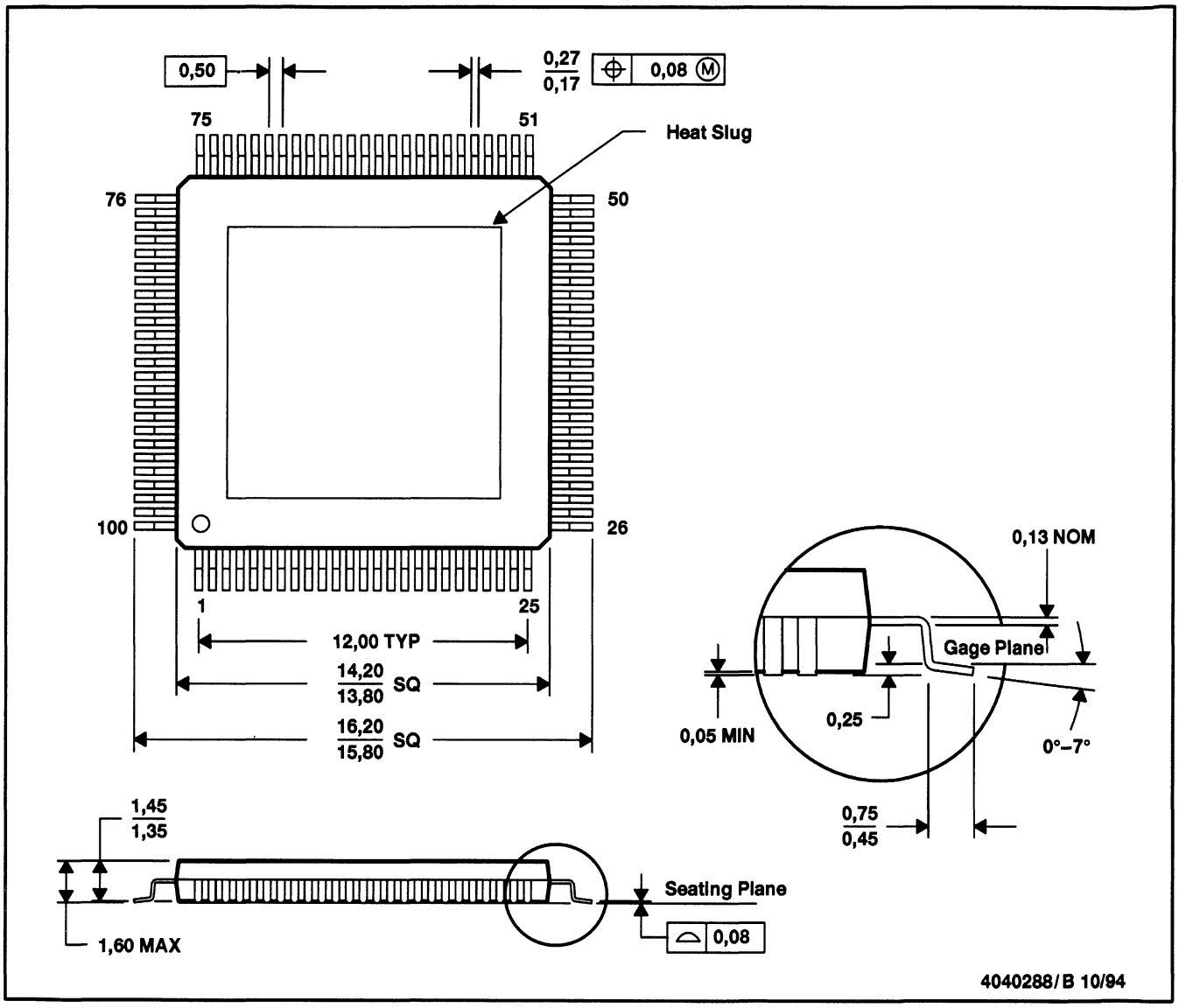
PCA (S-PQFP-G100) **PLASTIC QUAD FLATPACK (DIE-DOWN)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Thermally enhanced molded plastic package with a heat slug (HSL)
D. Falls within JEDEC MO-136

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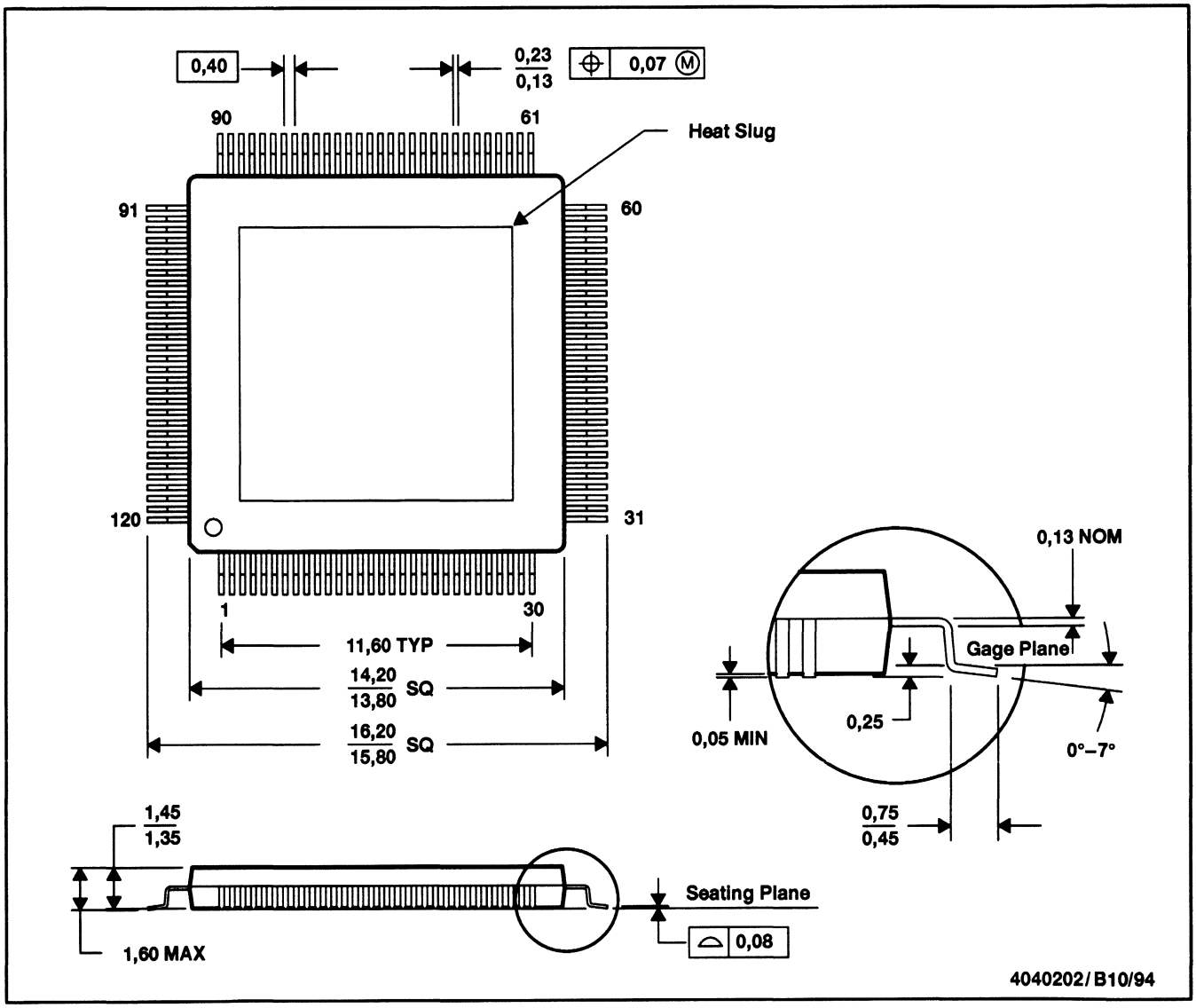
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

OCTOBER 1994

PCB (S-PQFP-G120) **PLASTIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-136
D. Thermally enhanced molded plastic package with a heat slug (HSL)

3 Plastic Through-Hole

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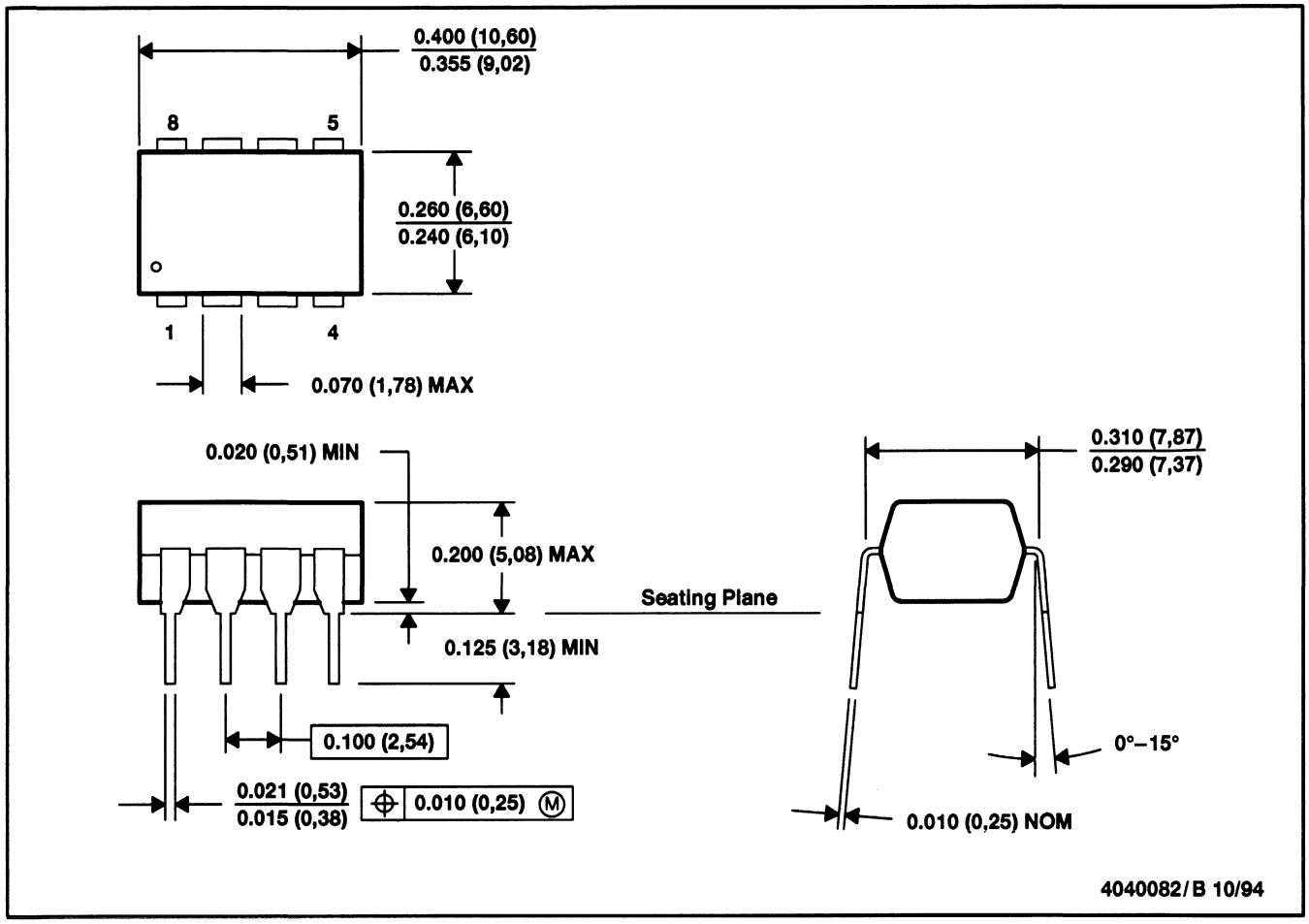
TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

OCTOBER 1994

P (R-PDIP-T8) **PLASTIC DUAL-IN-LINE PACKAGE**



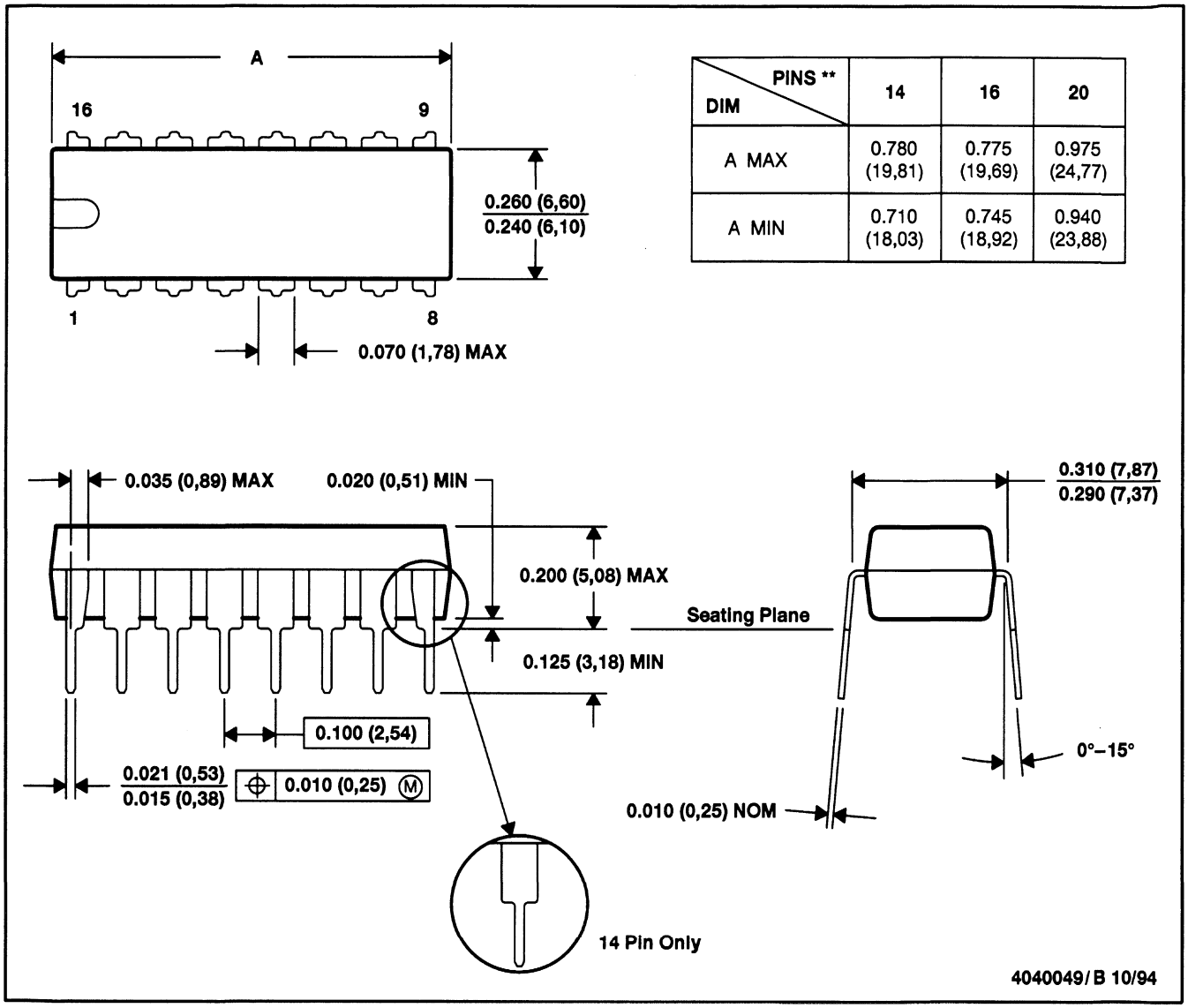
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001

OCTOBER 1994

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PIN SHOWN



DIM \ PINS **	14	16	20
A MAX	0.780 (19,81)	0.775 (19,69)	0.975 (24,77)
A MIN	0.710 (18,03)	0.745 (18,92)	0.940 (23,88)

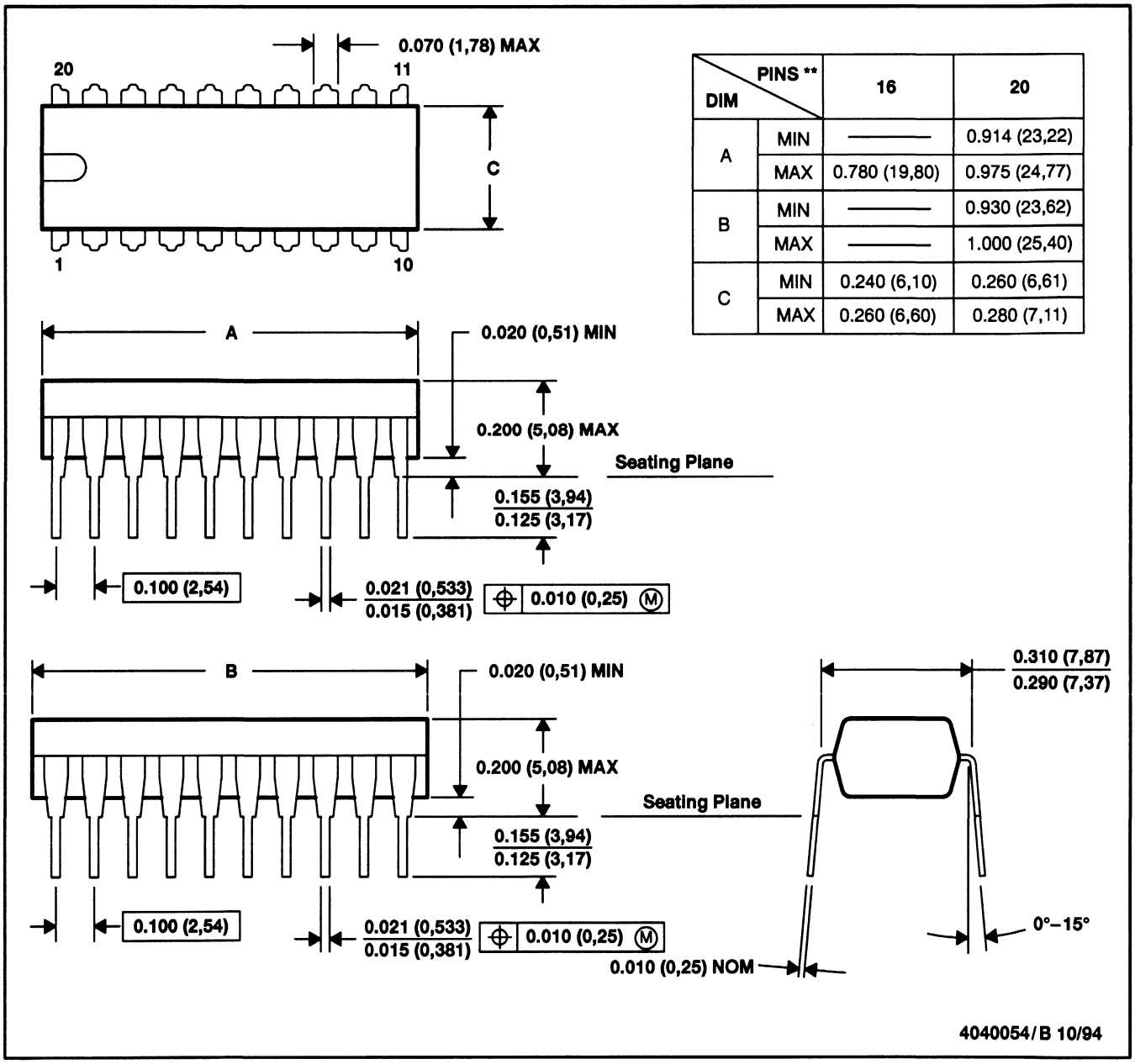
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001 (20-pin package is shorter then MS-001)

OCTOBER 1994

NE (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

20 PIN SHOWN



DIM \ PINS **		16	20
A	MIN	———	0.914 (23,22)
	MAX	0.780 (19,80)	0.975 (24,77)
B	MIN	———	0.930 (23,62)
	MAX	———	1.000 (25,40)
C	MIN	0.240 (6,10)	0.260 (6,61)
	MAX	0.260 (6,60)	0.280 (7,11)

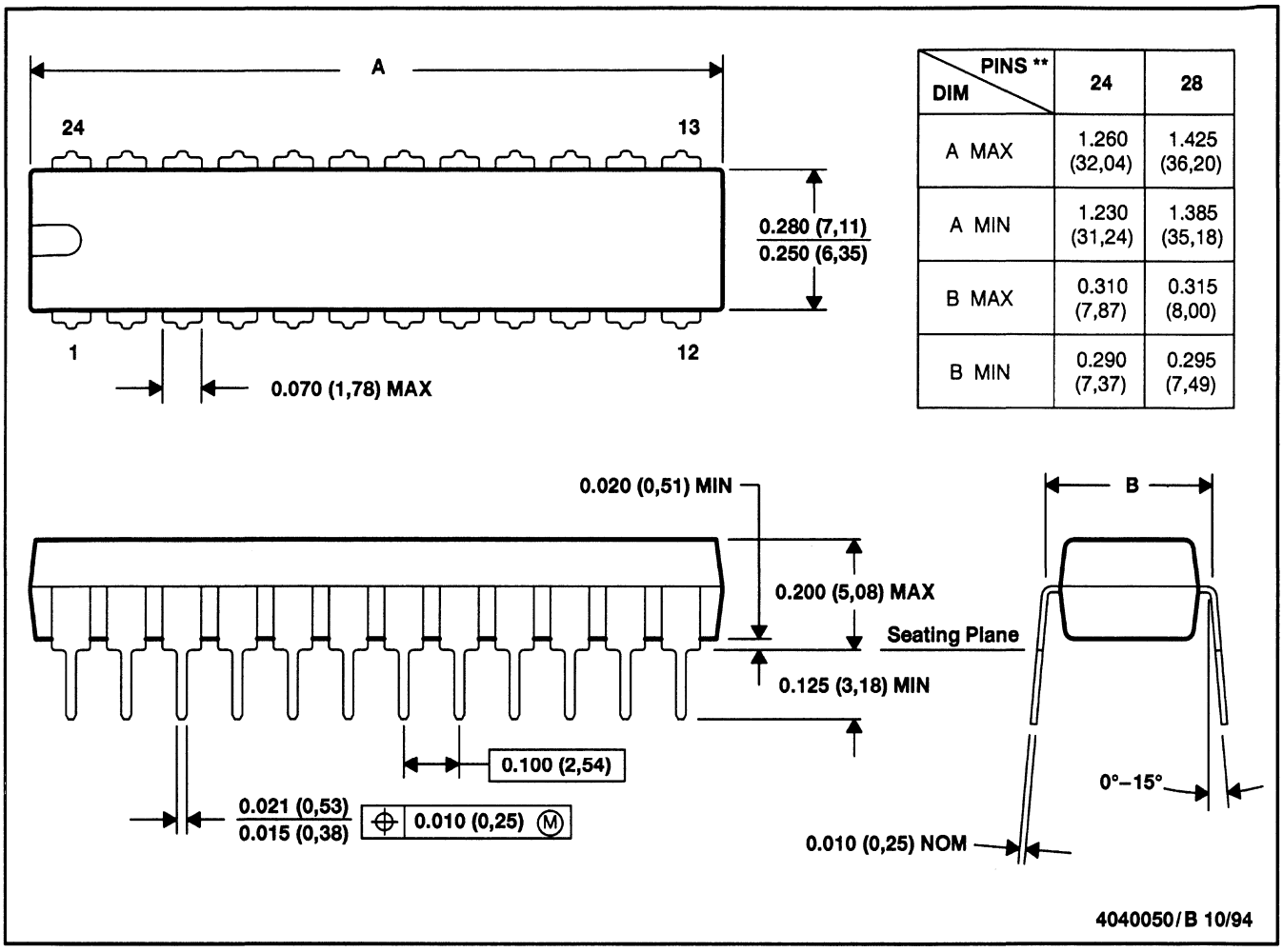
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-001 (16 pin only)

OCTOBER 1994

NT (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN

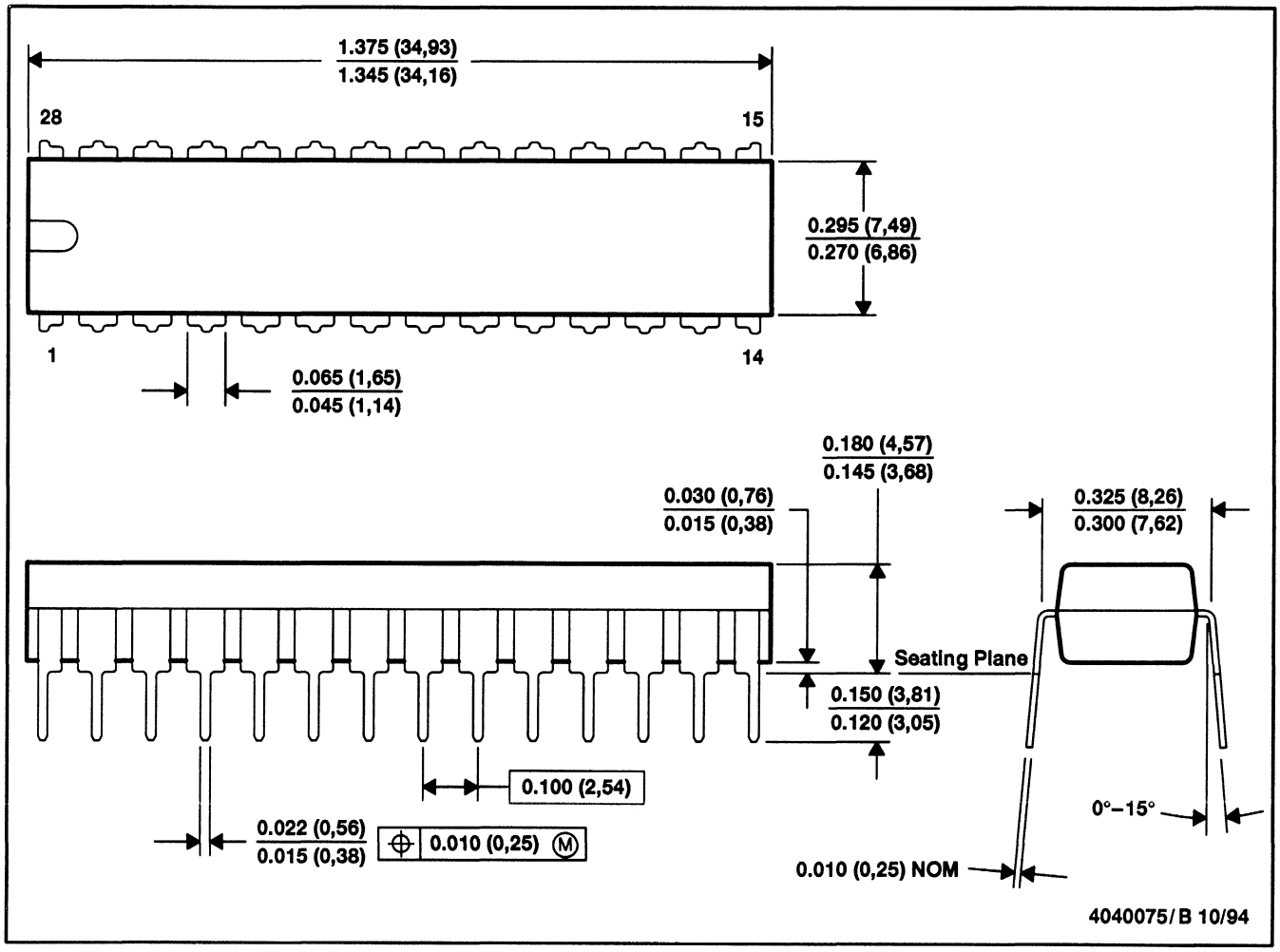


DIM \ PINS **	24	28
A MAX	1.260 (32,04)	1.425 (36,20)
A MIN	1.230 (31,24)	1.385 (35,18)
B MAX	0.310 (7,87)	0.315 (8,00)
B MIN	0.290 (7,37)	0.295 (7,49)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

NP (R-PDIP-T28) **PLASTIC DUAL-IN-LINE PACKAGE**



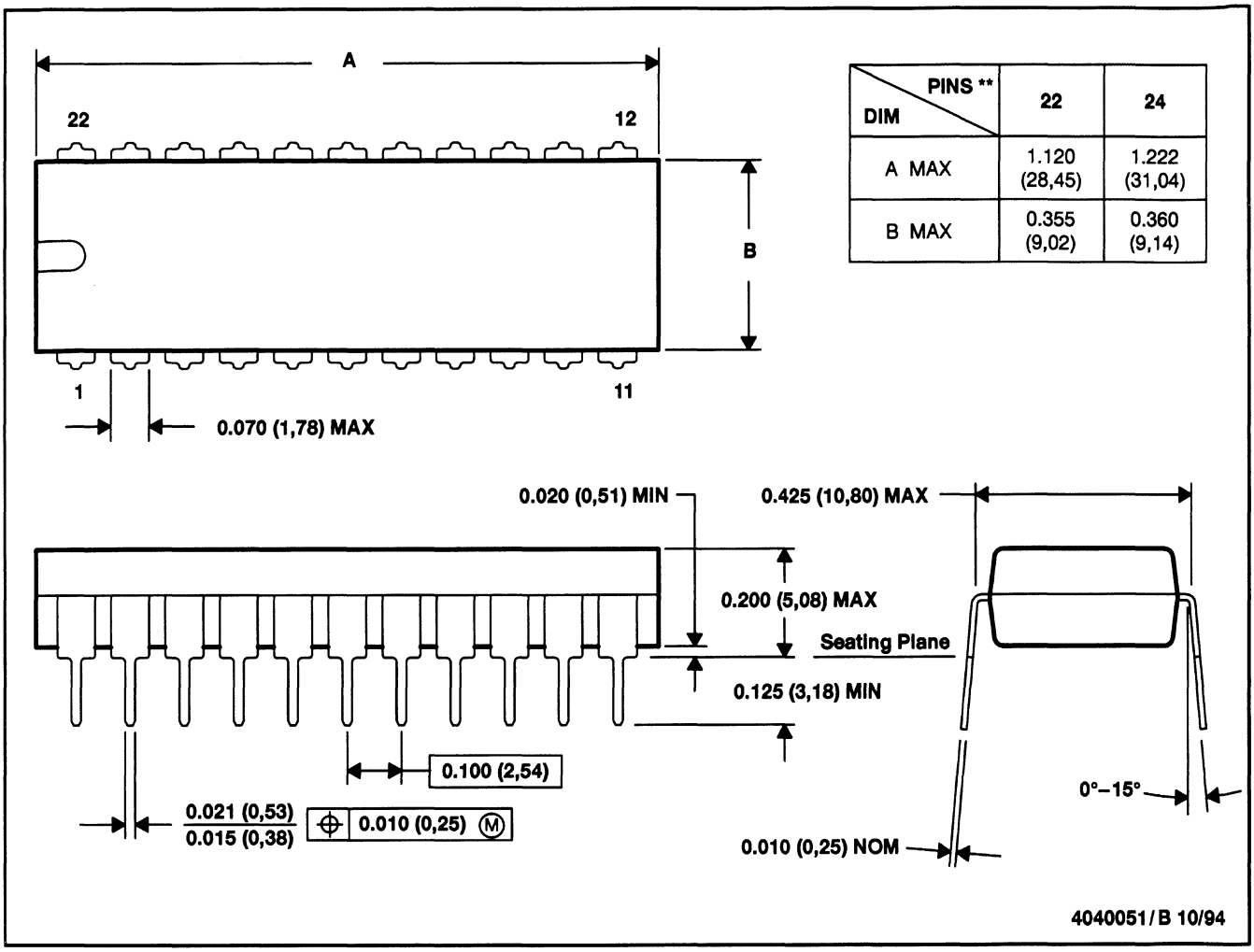
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimemsions do not include mold flash or protrusion.
D. Falls within JEDEC MO-095

OCTOBER 1994

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

22 PIN SHOWN

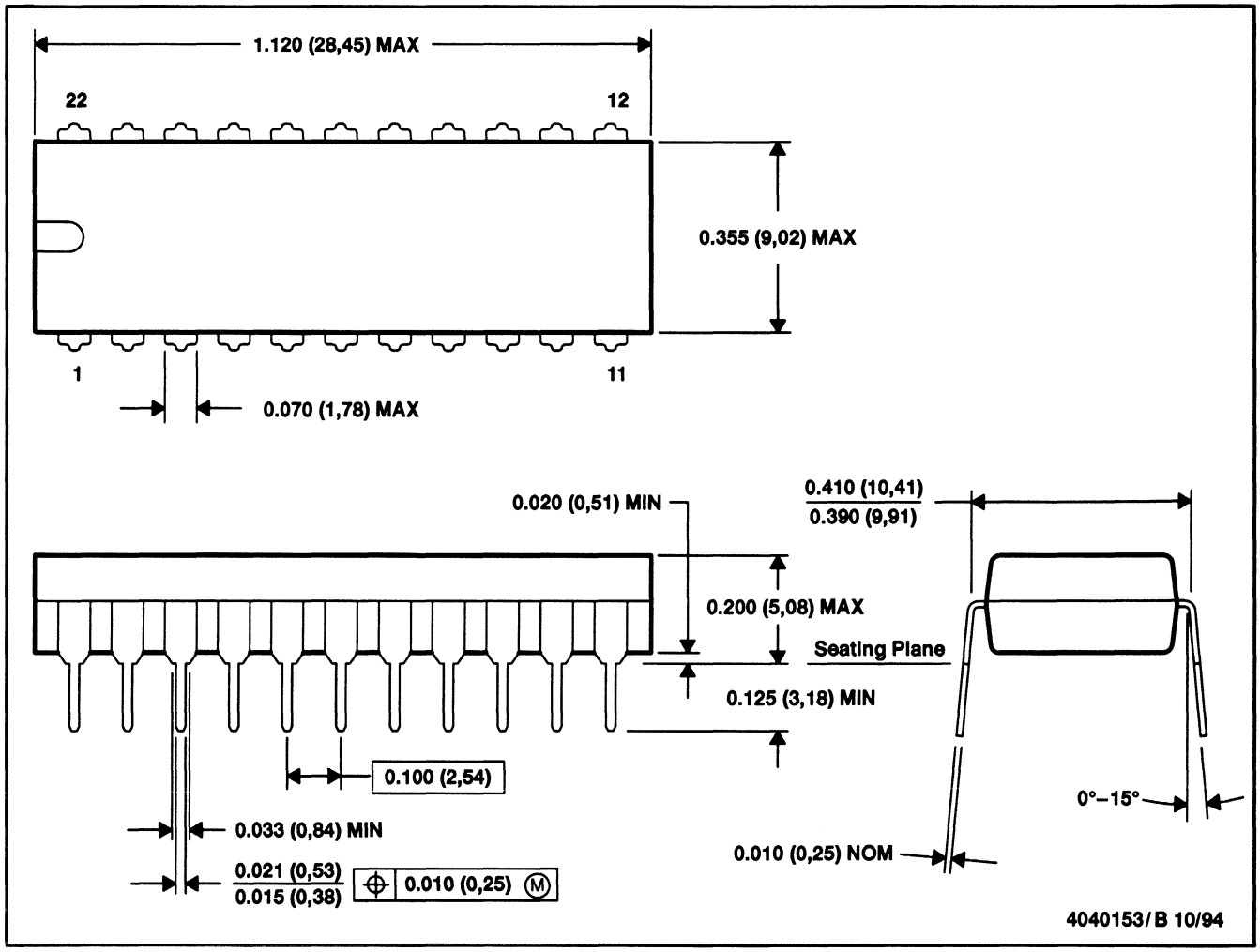


DIM \ PINS **	22	24
A MAX	1.120 (28,45)	1.222 (31,04)
B MAX	0.355 (9,02)	0.360 (9,14)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-010

OCTOBER 1994

NK (R-PDIP-T22) **PLASTIC DUAL-IN-LINE PACKAGE**



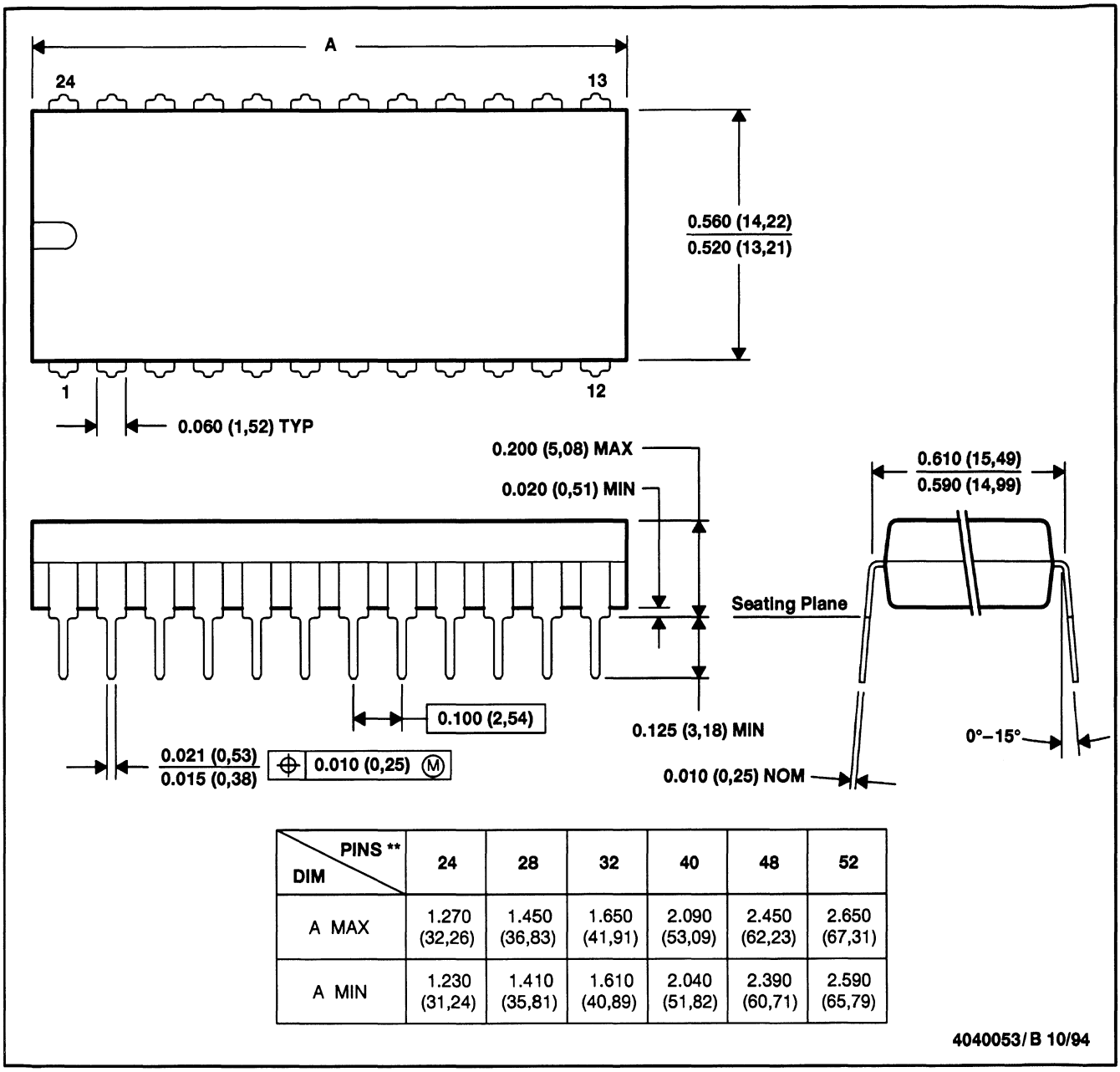
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-010

OCTOBER 1994

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN



DIM \ PINS **	24	28	32	40	48	52
A MAX	1.270 (32,26)	1.450 (36,83)	1.650 (41,91)	2.090 (53,09)	2.450 (62,23)	2.650 (67,31)
A MIN	1.230 (31,24)	1.410 (35,81)	1.610 (40,89)	2.040 (51,82)	2.390 (60,71)	2.590 (65,79)

4040053/B 10/94

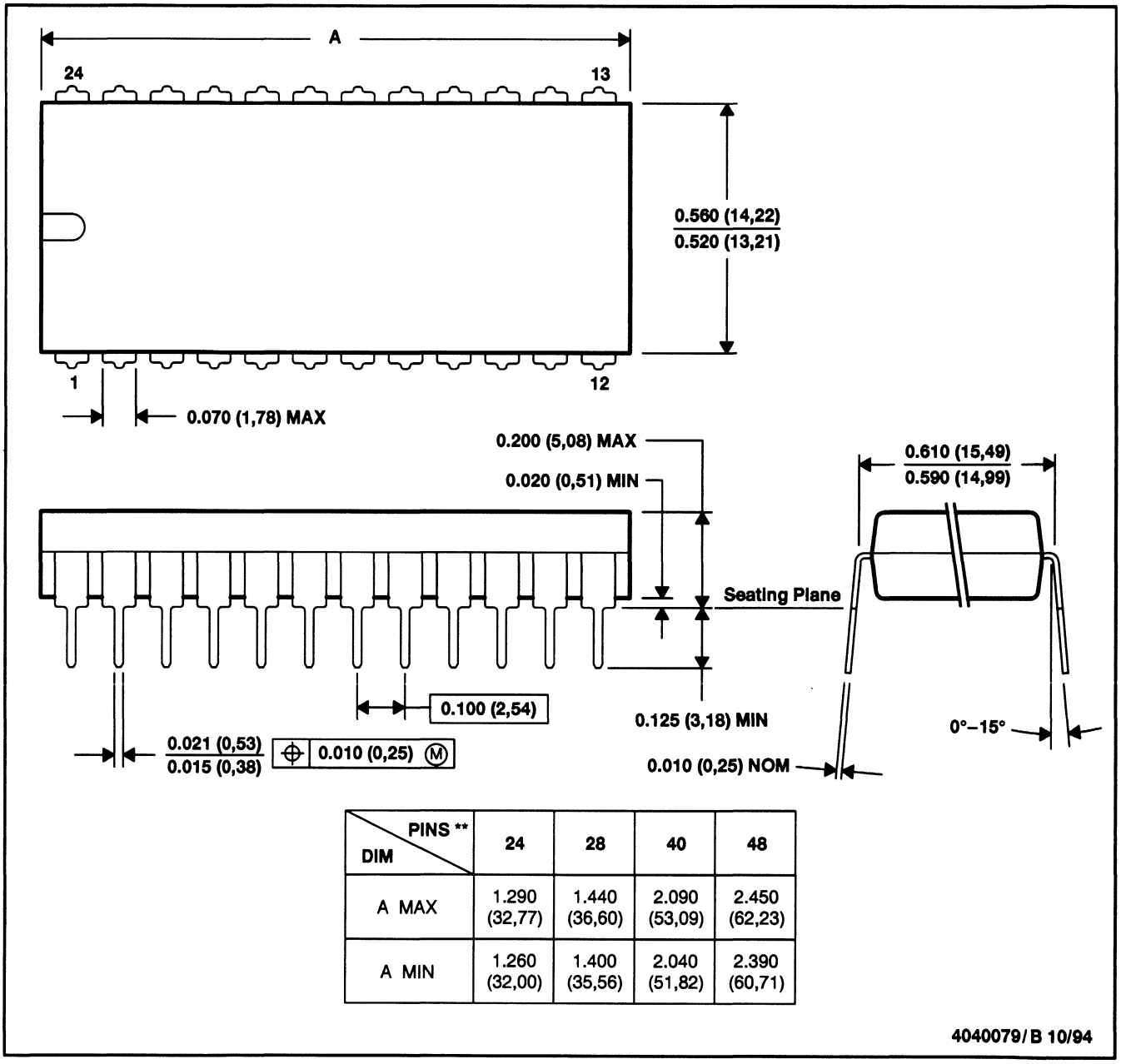
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-011
D. Falls within JEDEC MS-015 (32 pin only)

OCTOBER 1994

NW (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN

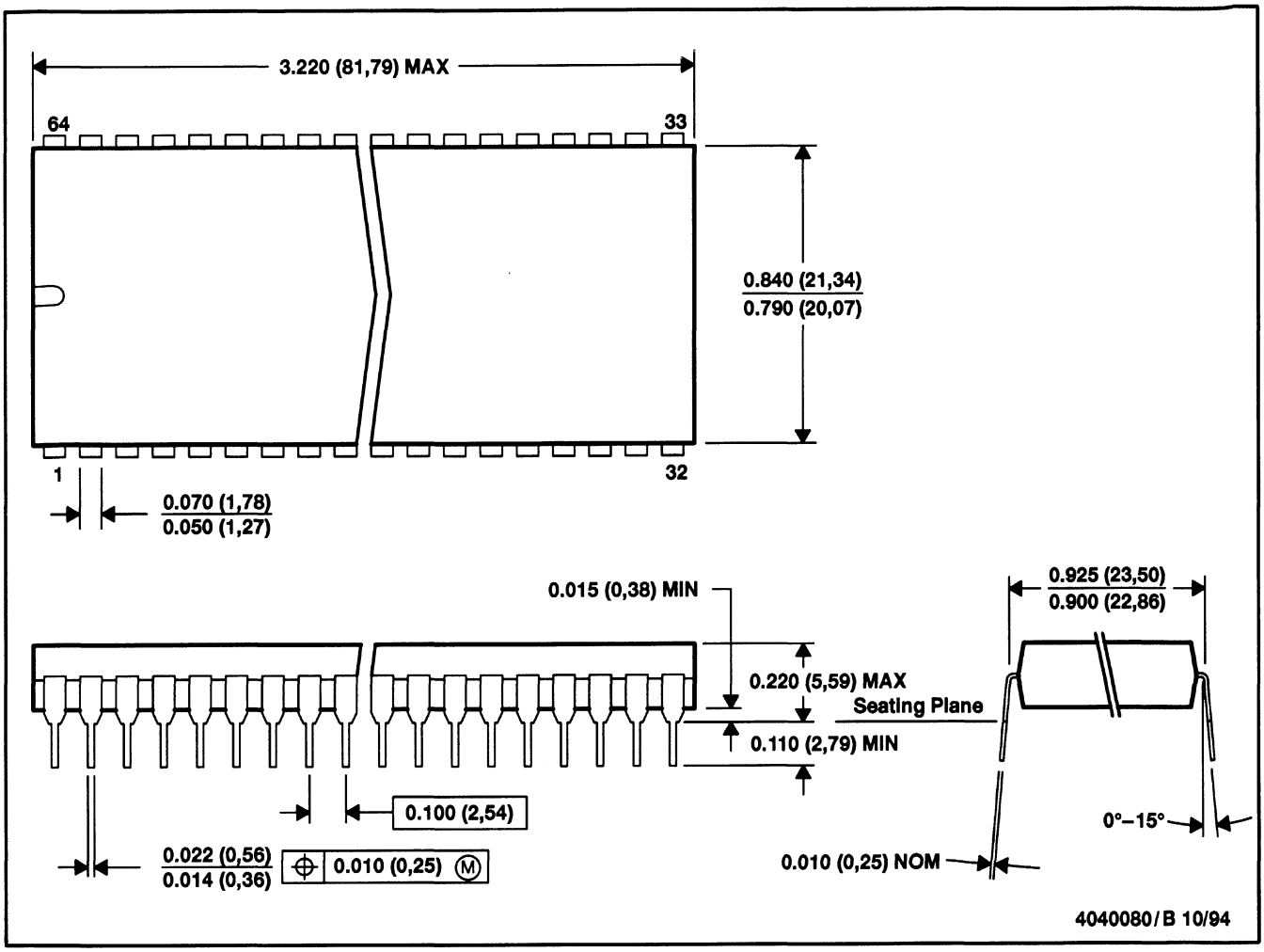


DIM \ PINS **	24	28	40	48
A MAX	1.290 (32,77)	1.440 (36,60)	2.090 (53,09)	2.450 (62,23)
A MIN	1.260 (32,00)	1.400 (35,56)	2.040 (51,82)	2.390 (60,71)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MS-011

OCTOBER 1994

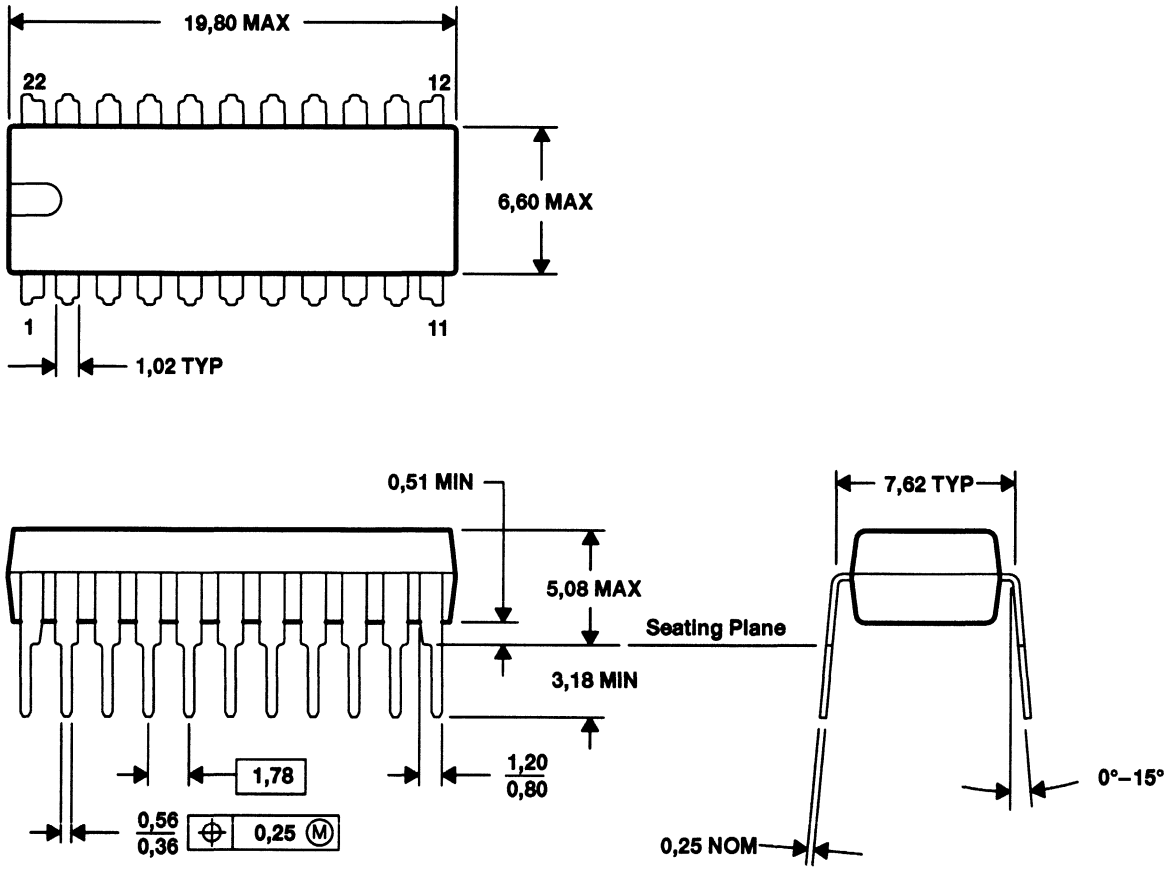
N (R-PDIP-T64) **PLASTIC DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within JEDEC MO-016

OCTOBER 1994

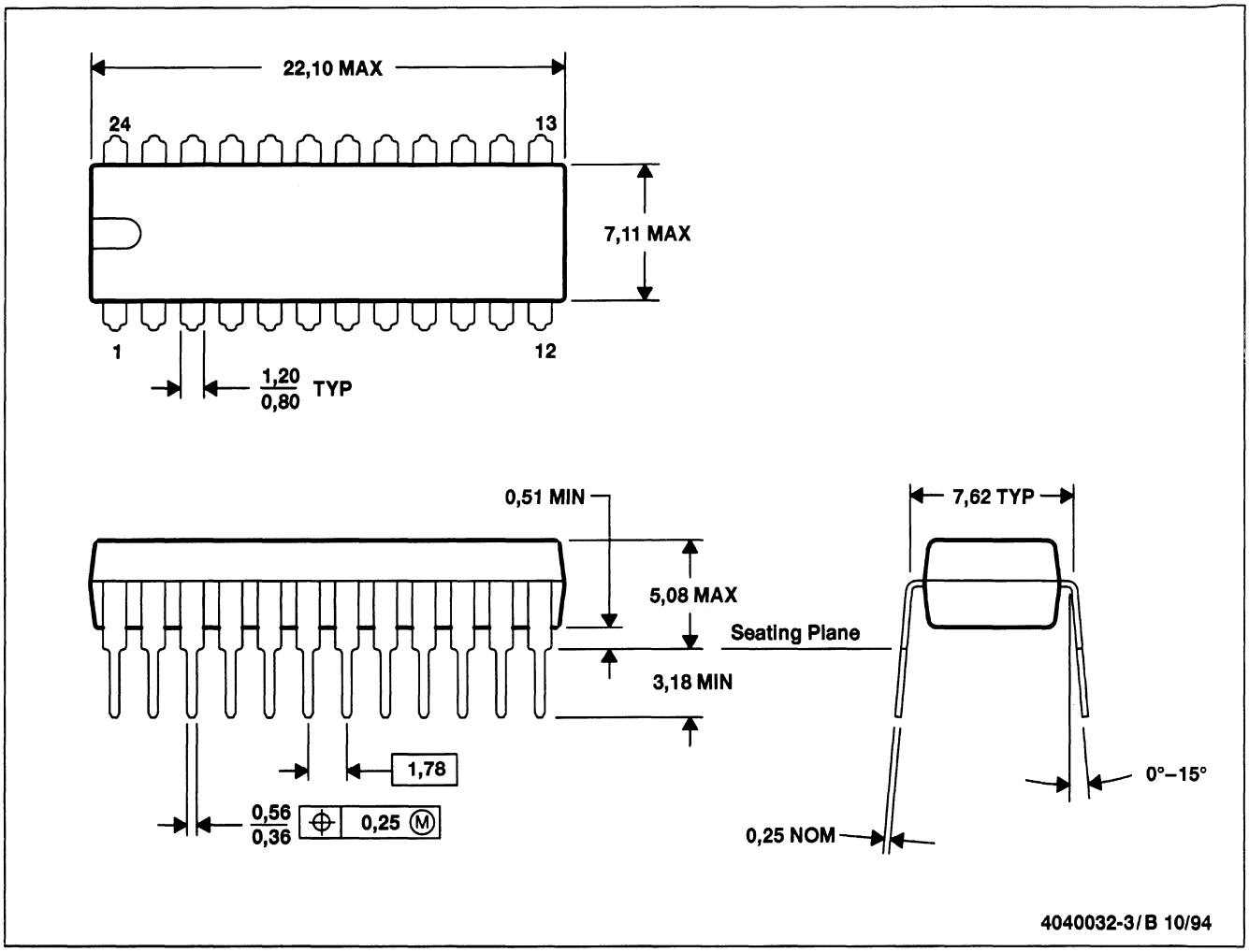
NN (R-PDIP-T22) **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

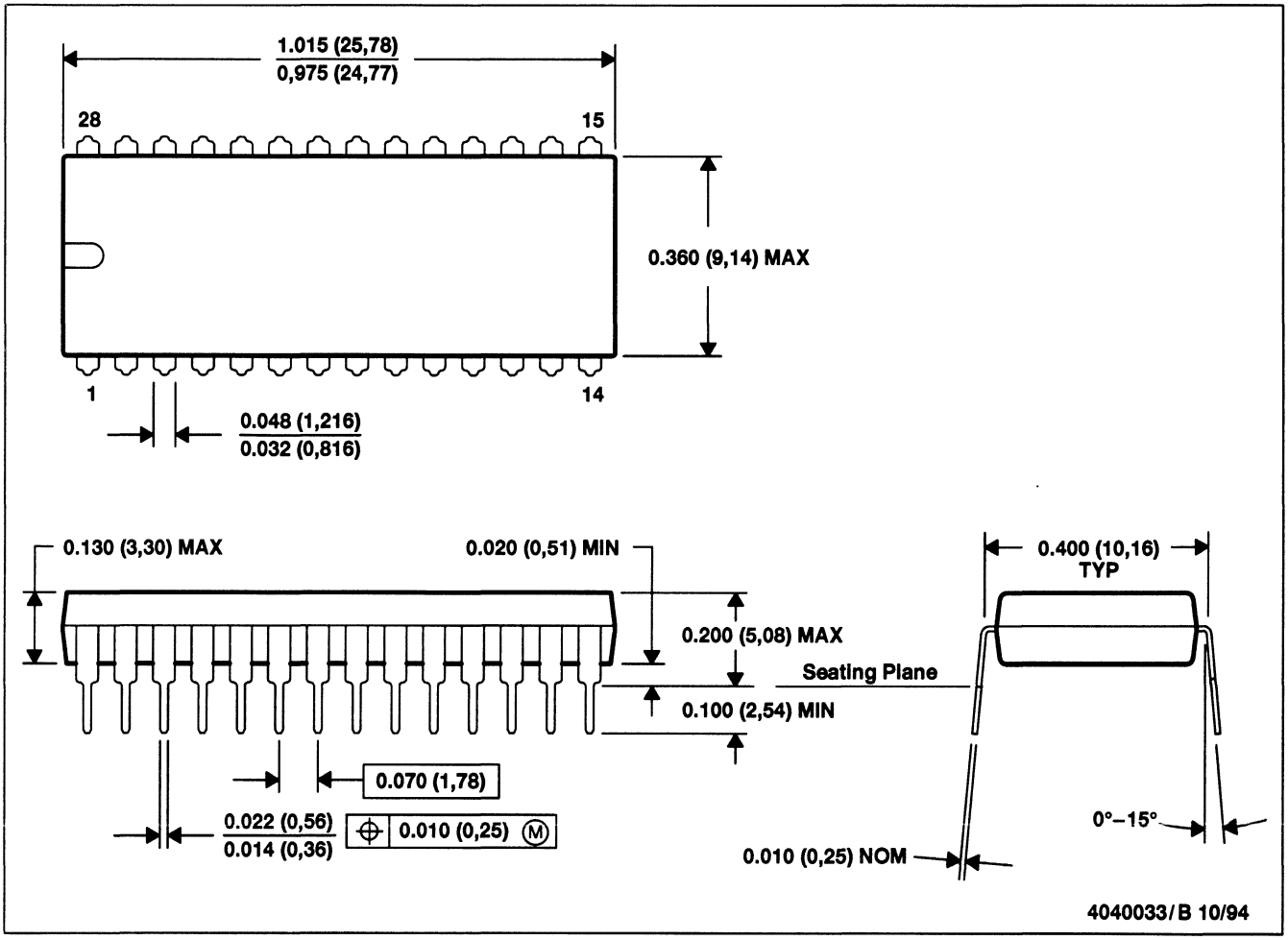
NN (R-PDIP-T24) **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

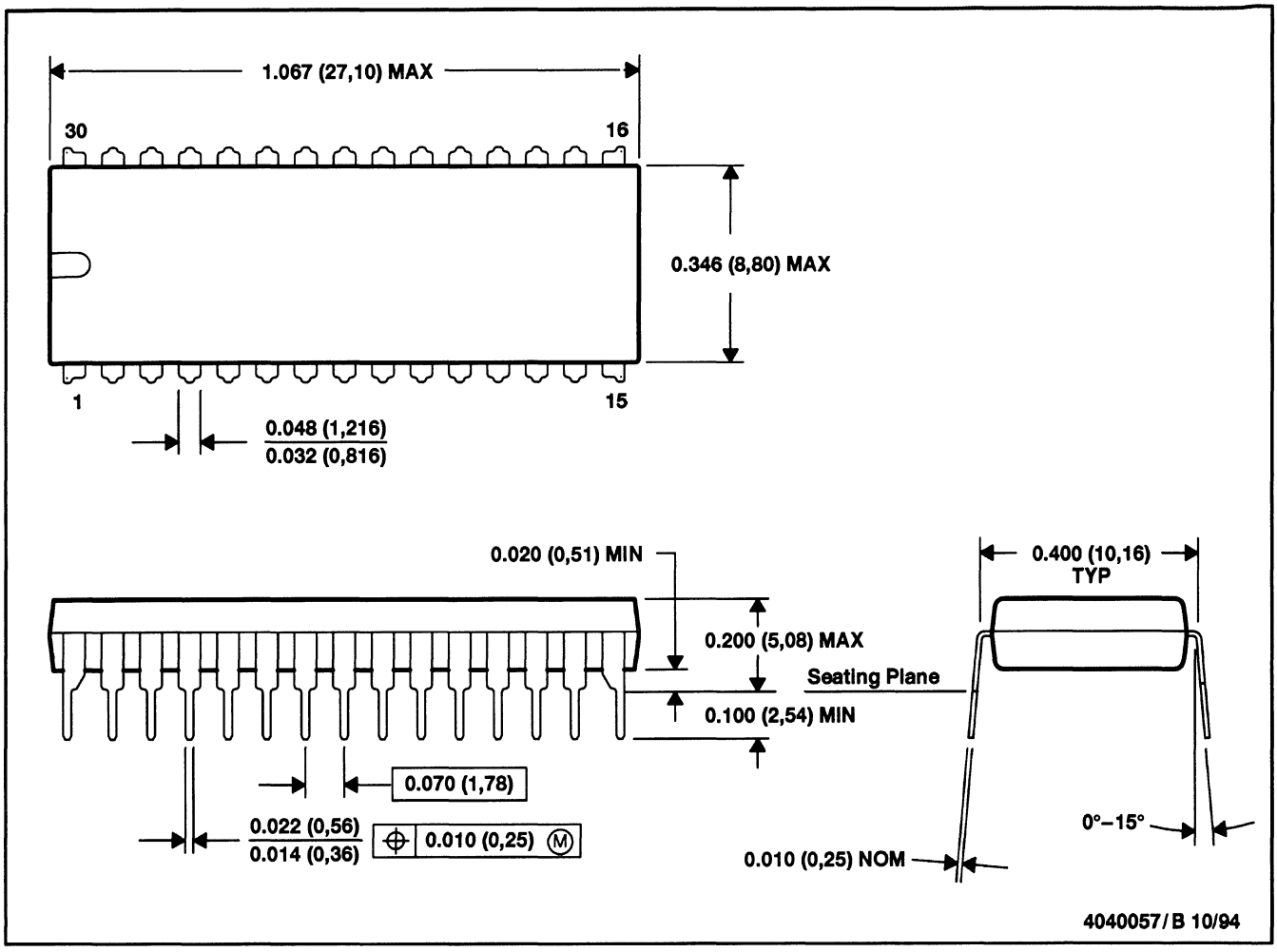
NF (R-PDIP-T28) **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

NF (R-PDIP-T30) **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**

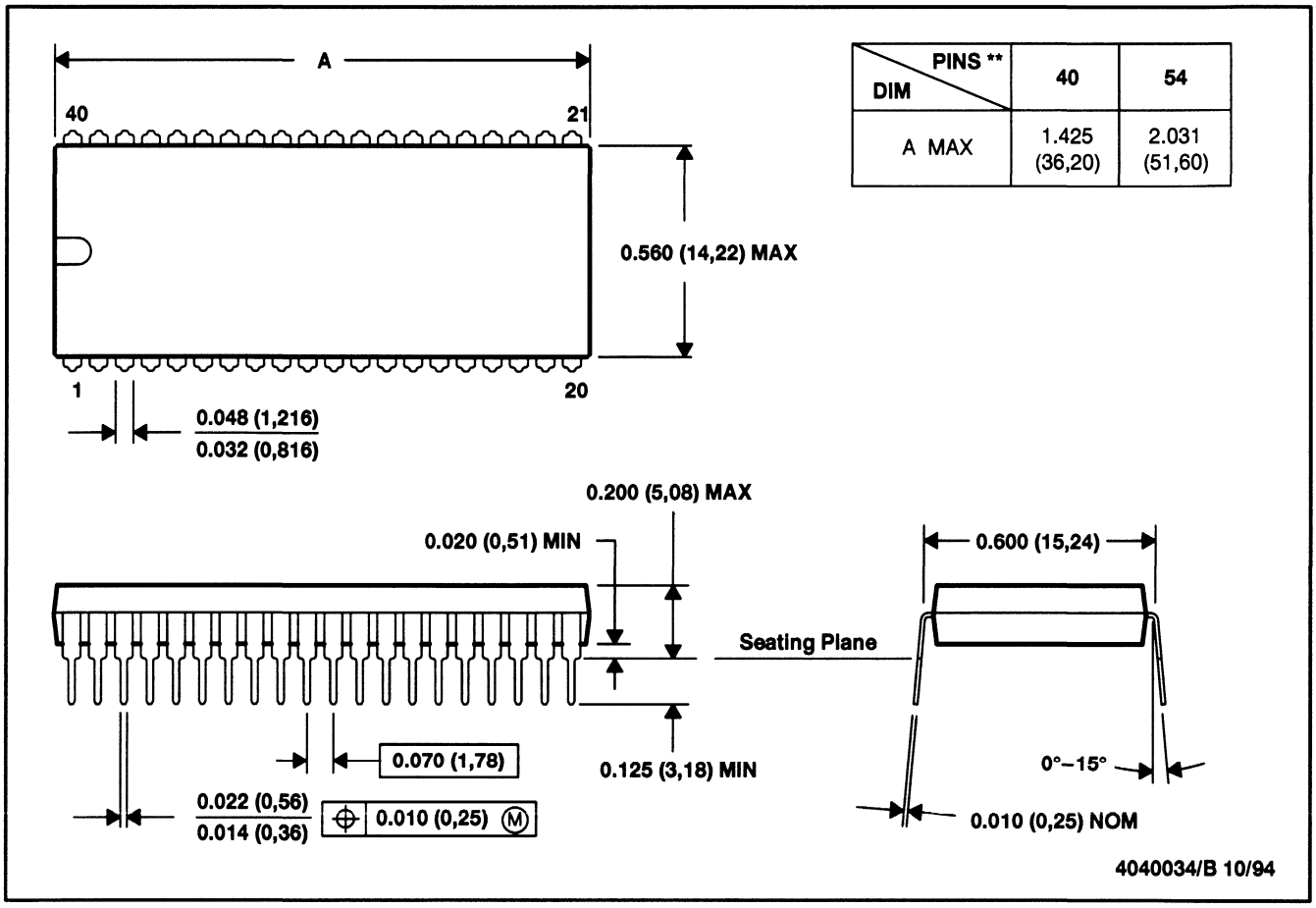


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

NJ (R-PDIP-T)** **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**

40 PIN SHOWN

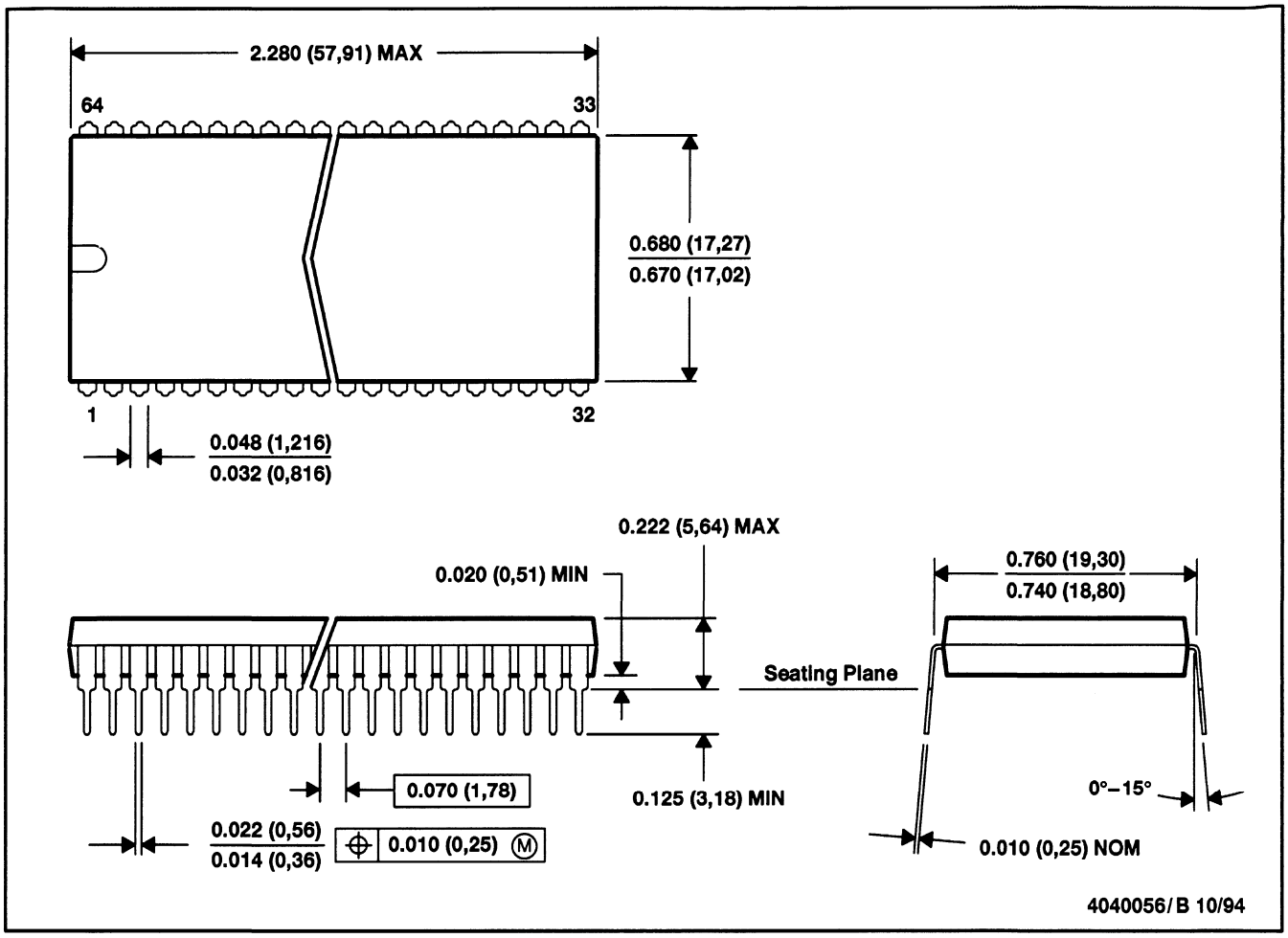


DIM \ PINS **	40	54
A MAX	1.425 (36,20)	2.031 (51,60)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

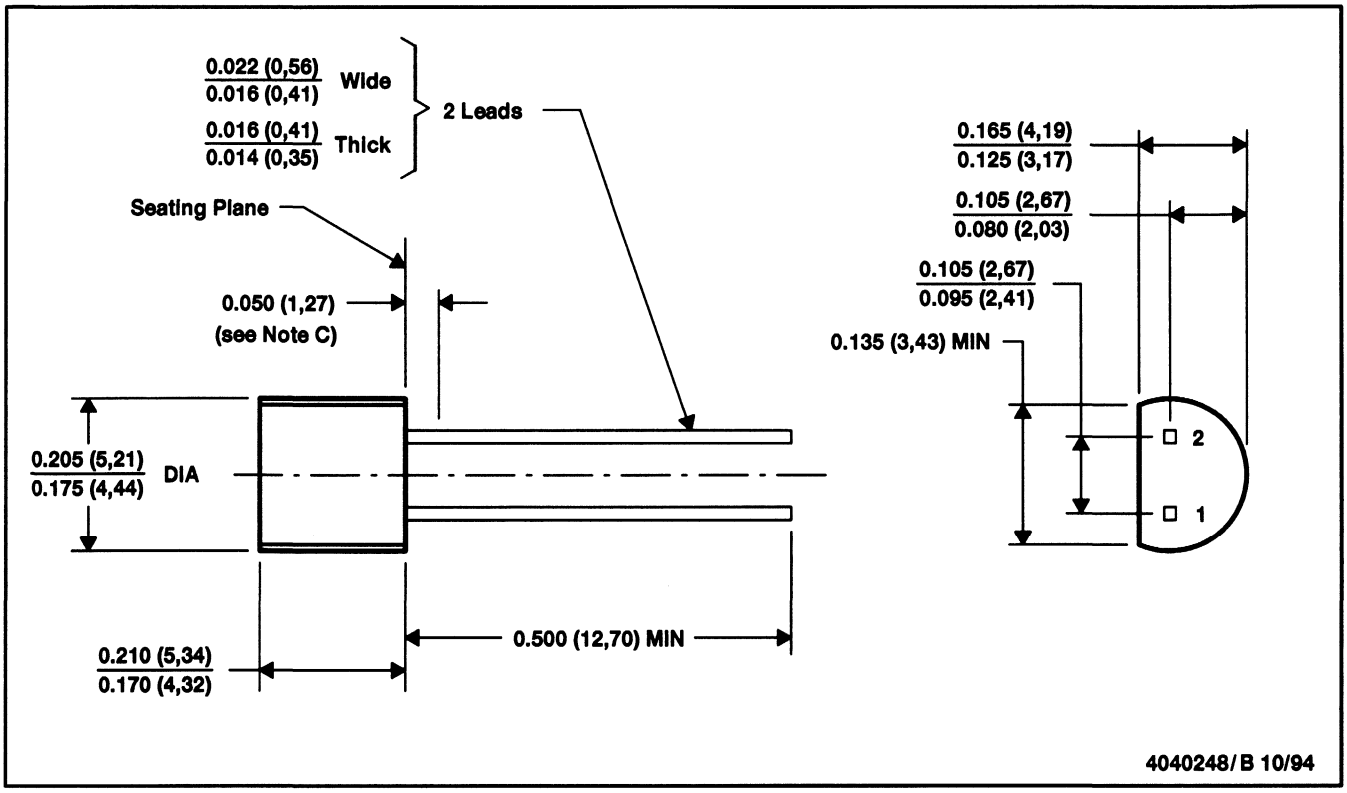
NM (R-PDIP-T64) **PLASTIC SHRINK DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

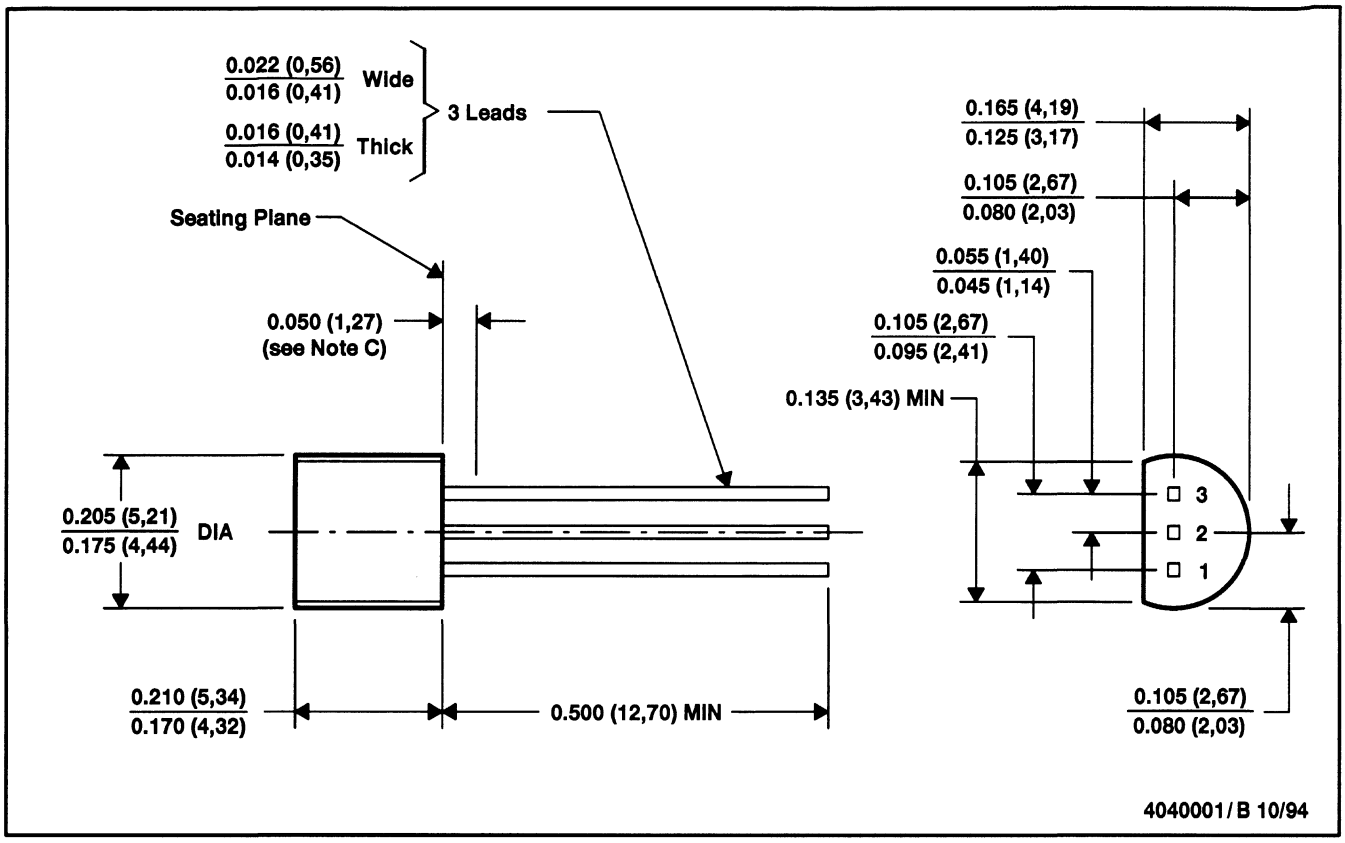
LP (O-PBCY-W2) **PLASTIC CYLINDRICAL PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. Falls within JEDEC TO-226AC (TO-226AC replaces TO-92)

OCTOBER 1994

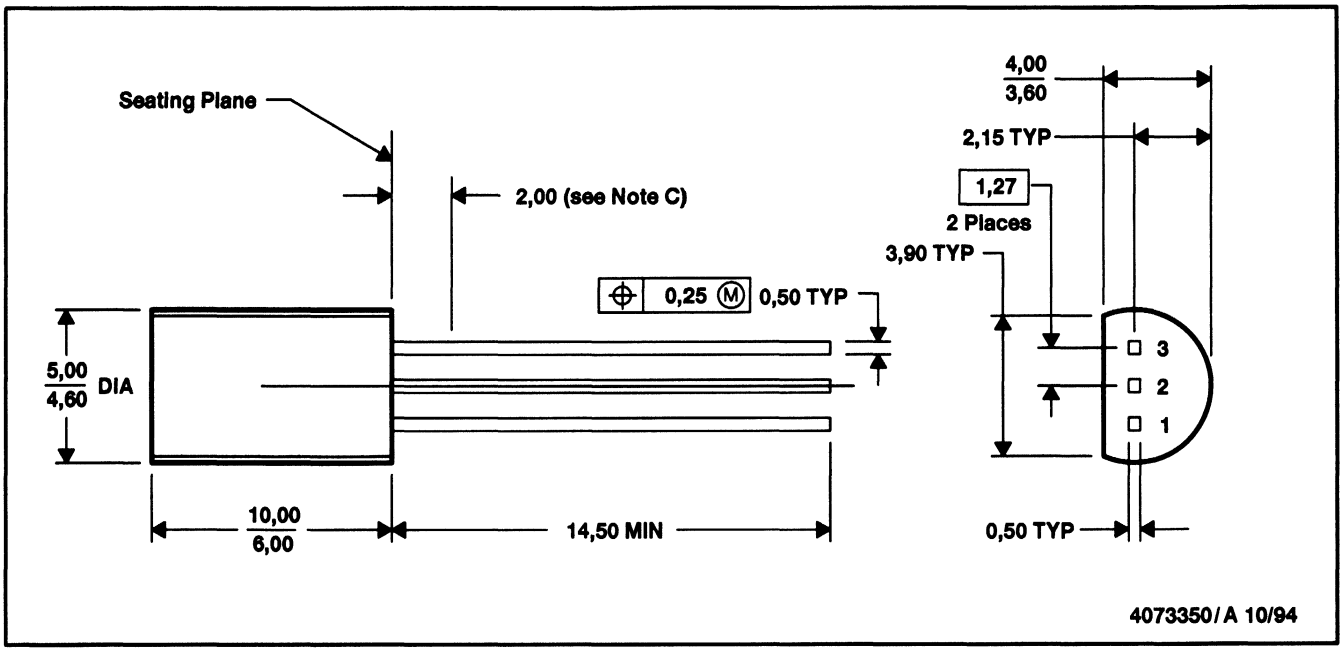
LP (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. Falls within JEDEC TO-226AA (TO-226AA replaces TO-92)

OCTOBER 1994

LPB (O-PBCY-W3) **PLASTIC CYLINDRICAL PACKAGE**

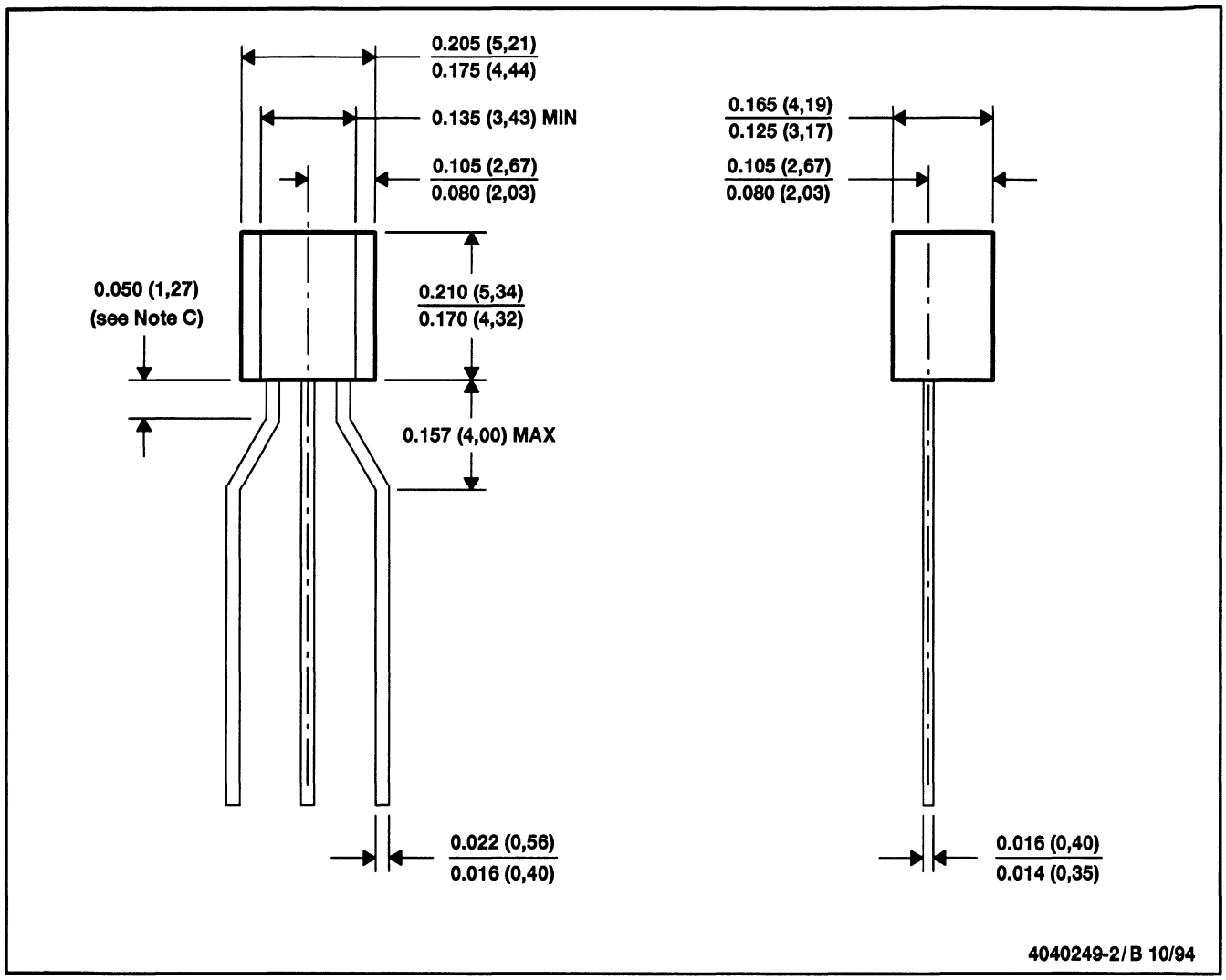


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.

OCTOBER 1994

LPF (O-PBCY-W3) PLASTIC CYLINDRICAL PACKAGE

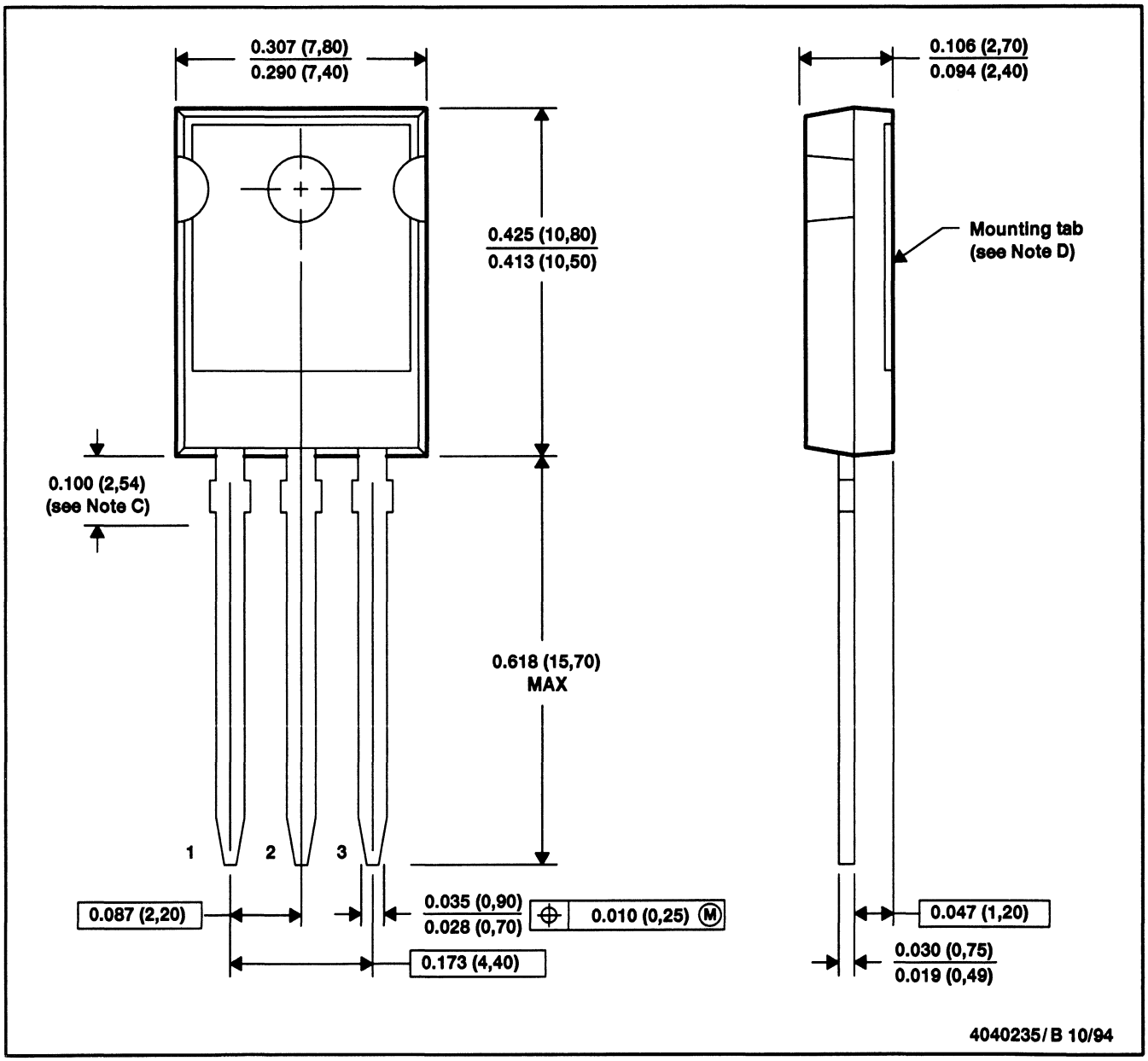
FORMED LEADS



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.

OCTOBER 1994

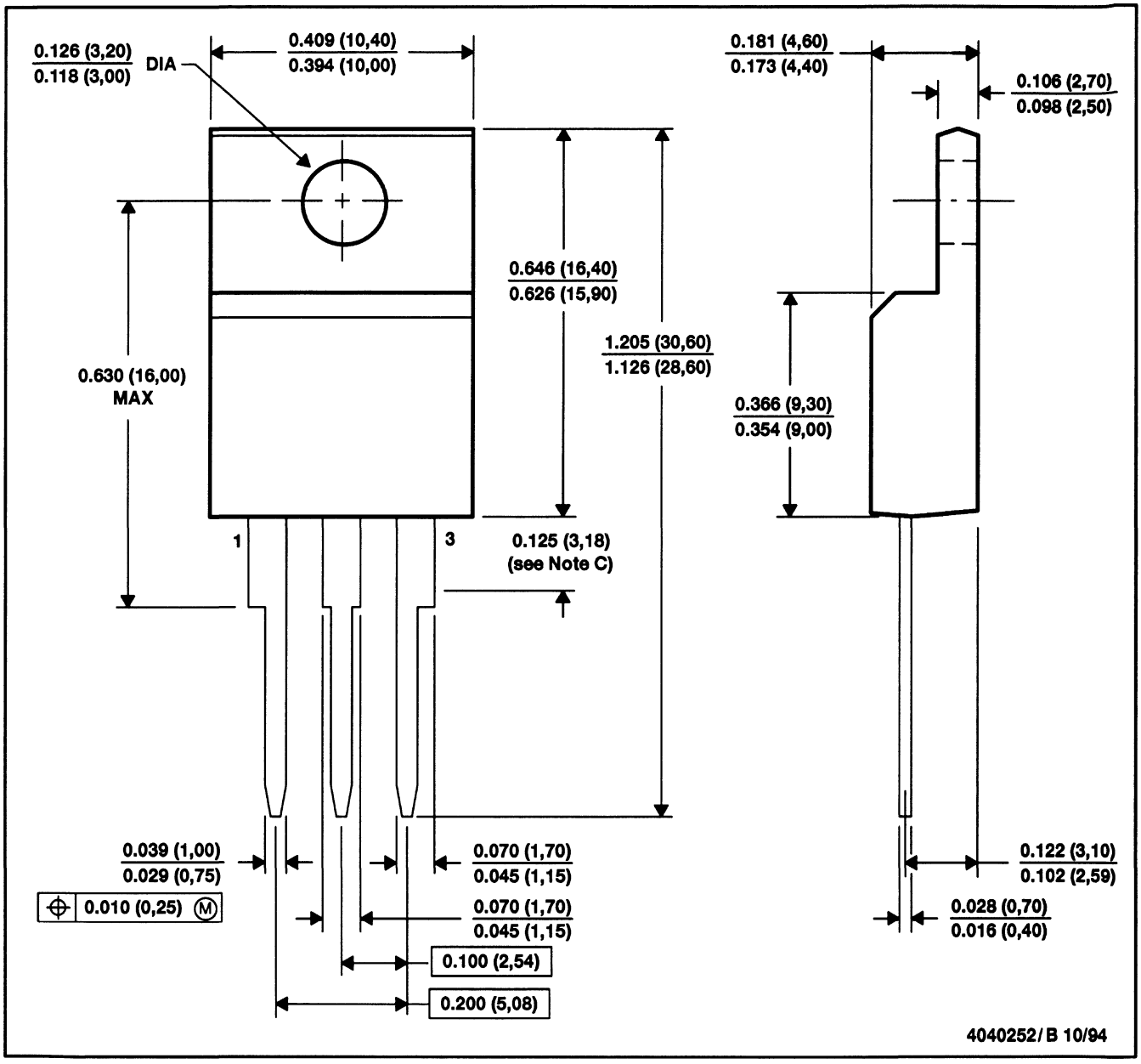
LL (R-PSFM-T3) **PLASTIC CLIP-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. The center lead is in electrical contact with the exposed mounting tab.
E. All lead dimensions apply before solder dip.

OCTOBER 1994

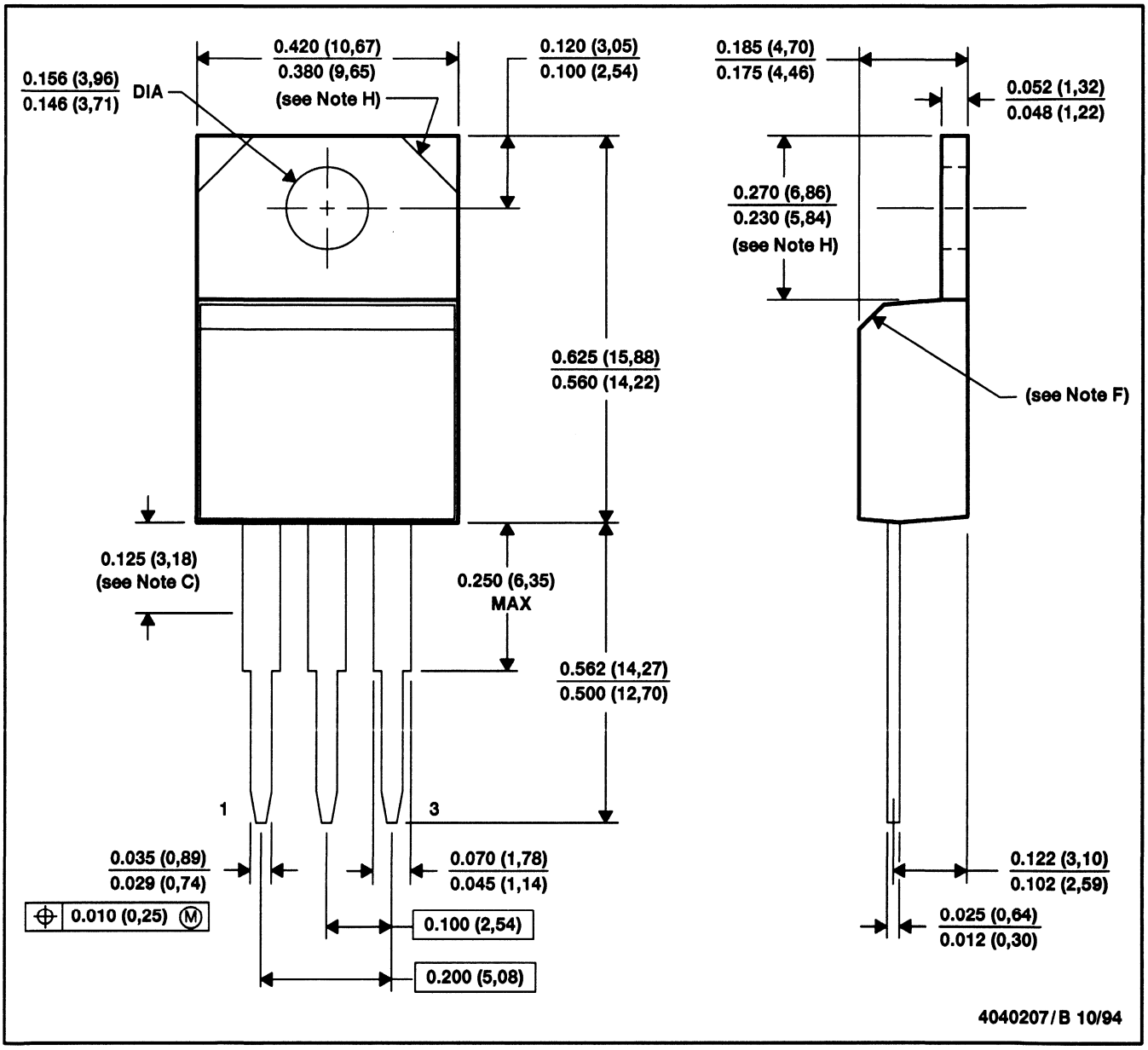
KPA (R-PSFM-T3) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The mounting tab is isolated.

OCTOBER 1994

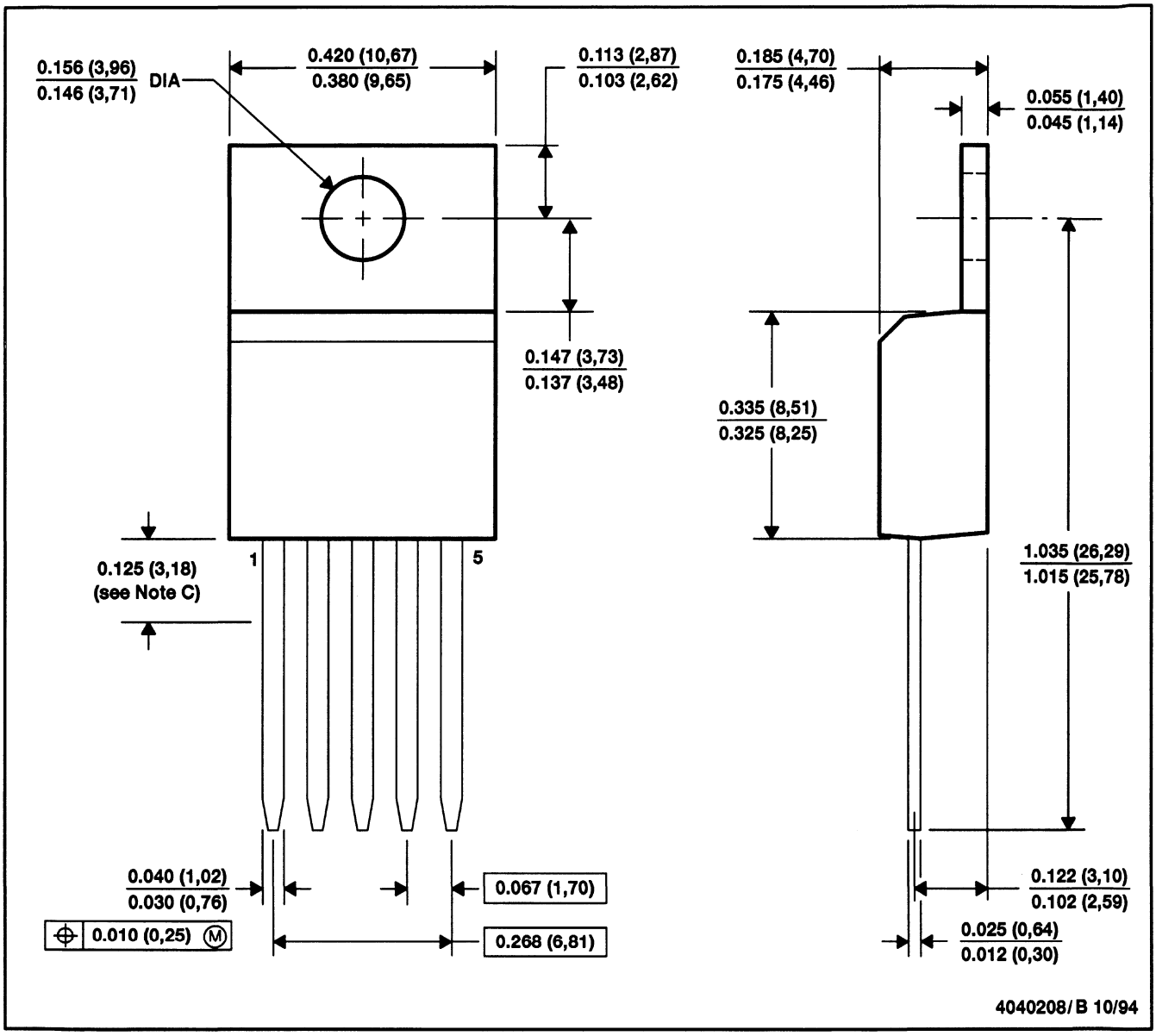
KC (R-PSFM-T3) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The center lead is in electrical contact with the mounting tab.
F. The chamfer is optional.
G. Falls within JEDEC TO-220AB
H. Tab contour optional within these dimensions

OCTOBER 1994

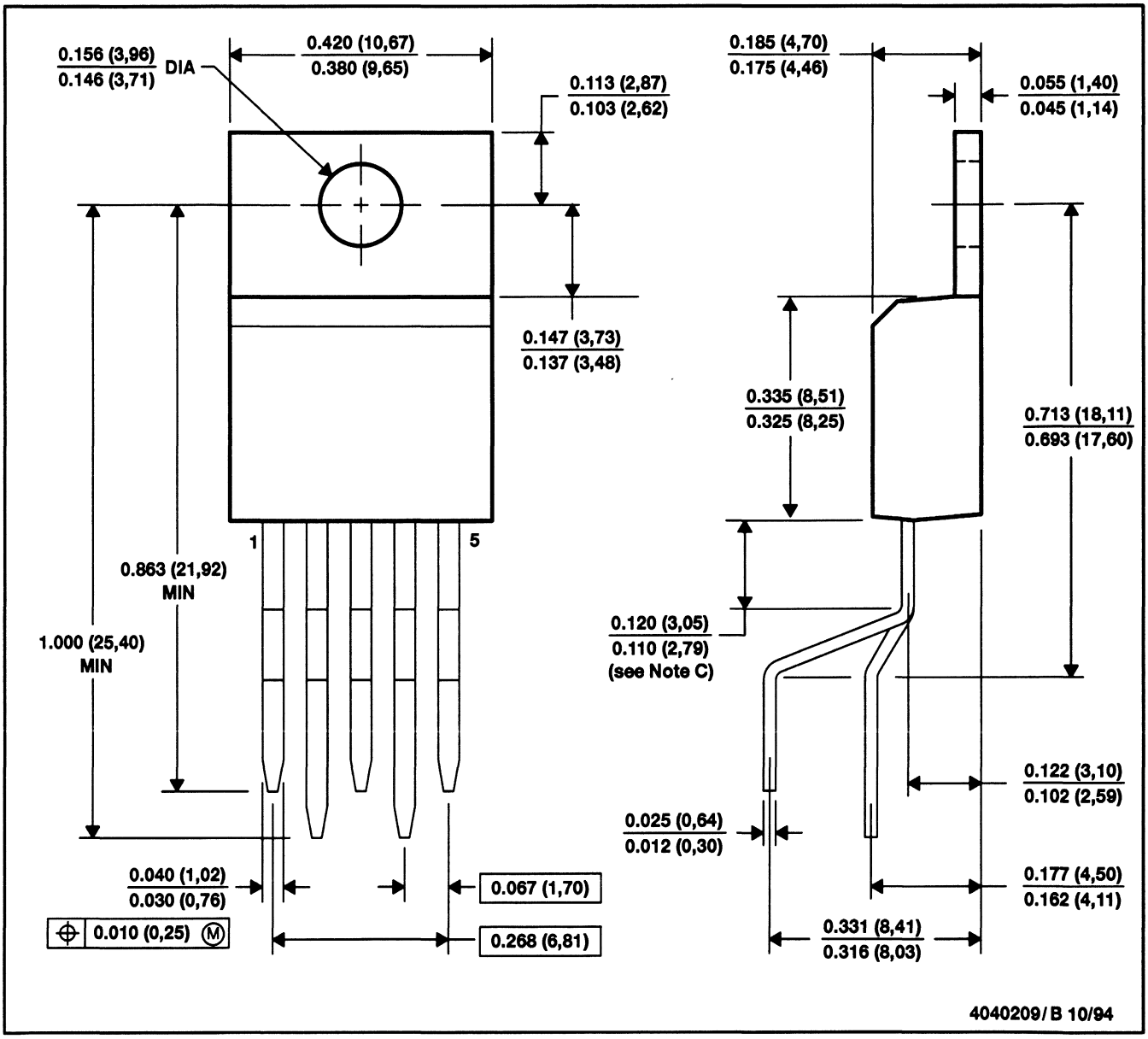
KC (R-PSFM-T5) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The center lead is in electrical contact with the mounting tab.

OCTOBER 1994

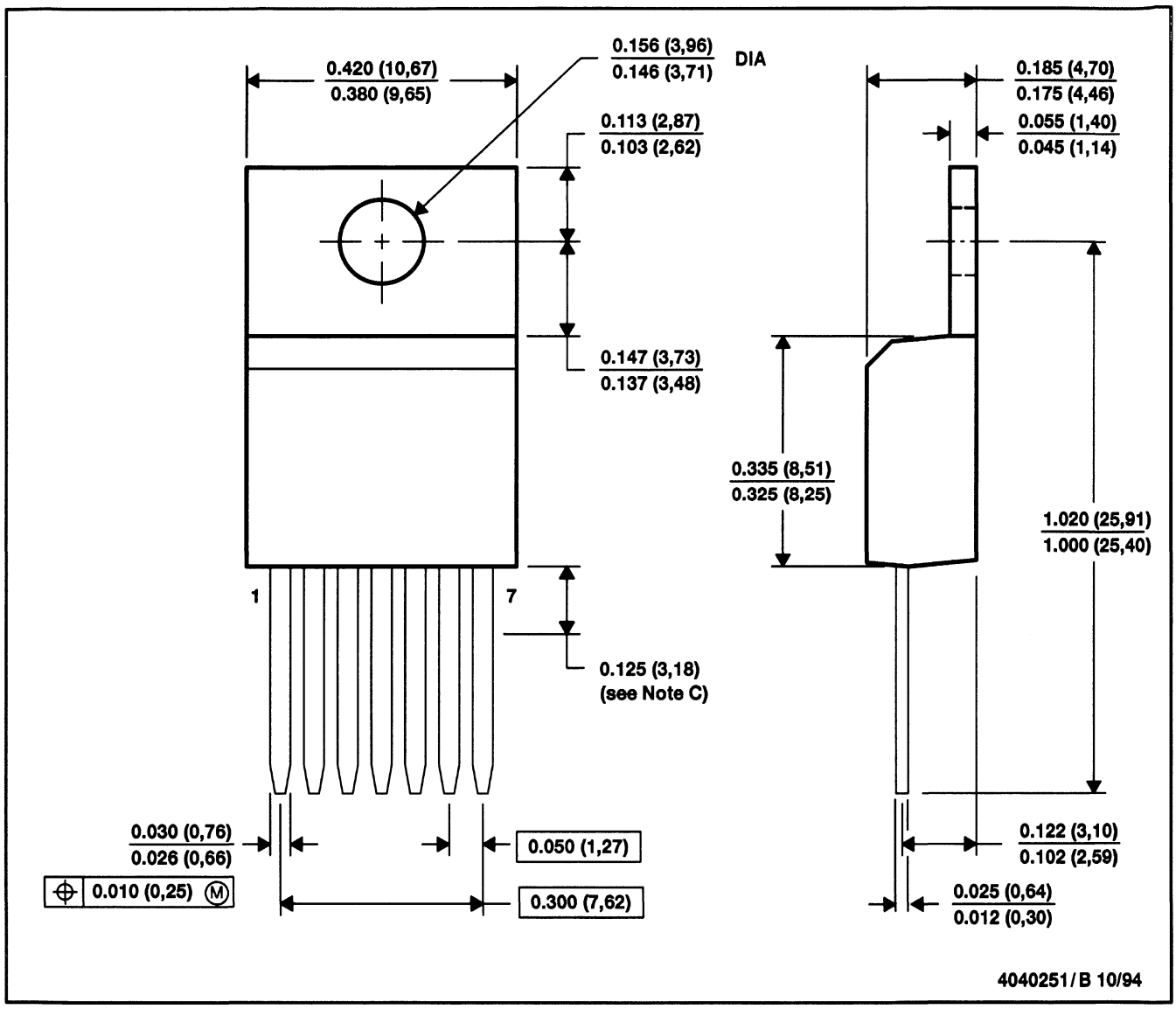
KV (R-PZFM-T5) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The center lead is in electrical contact with the mounting tab.

OCTOBER 1994

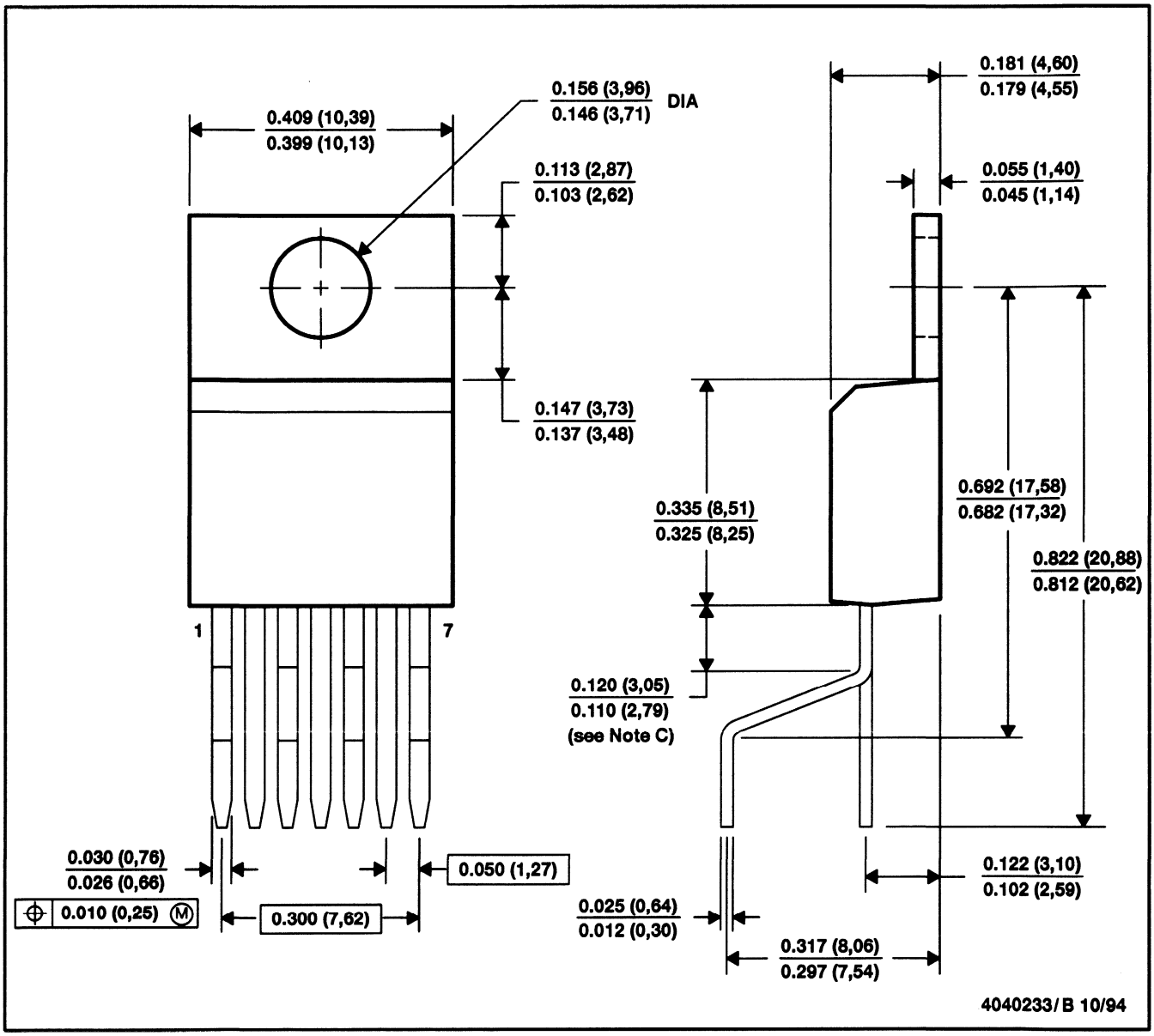
KC (R-PSFM-T7) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.
E. The center lead is in electrical contact with the mounting tab.

OCTOBER 1994

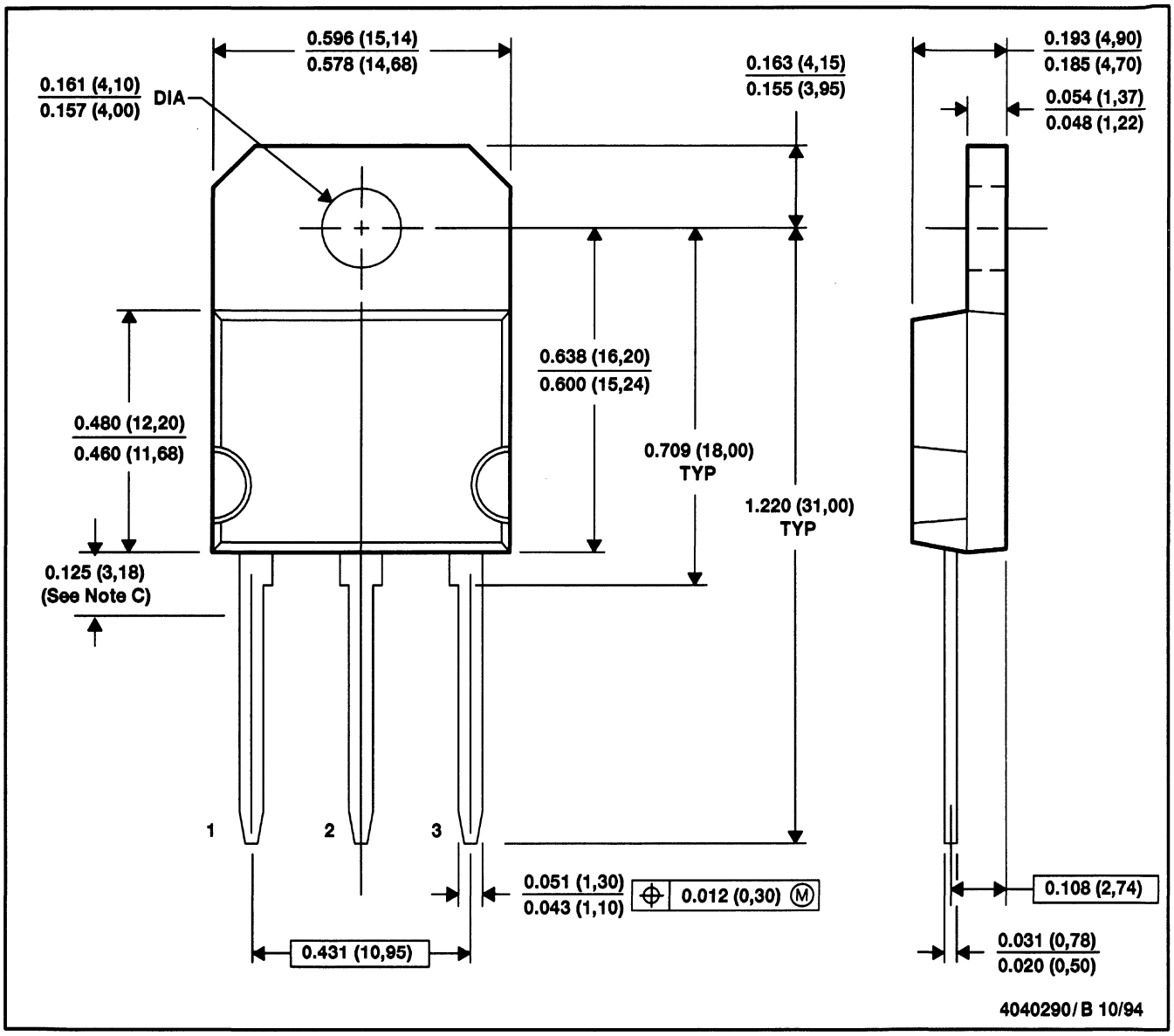
KV (R-PZFM-T7) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.

OCTOBER 1994

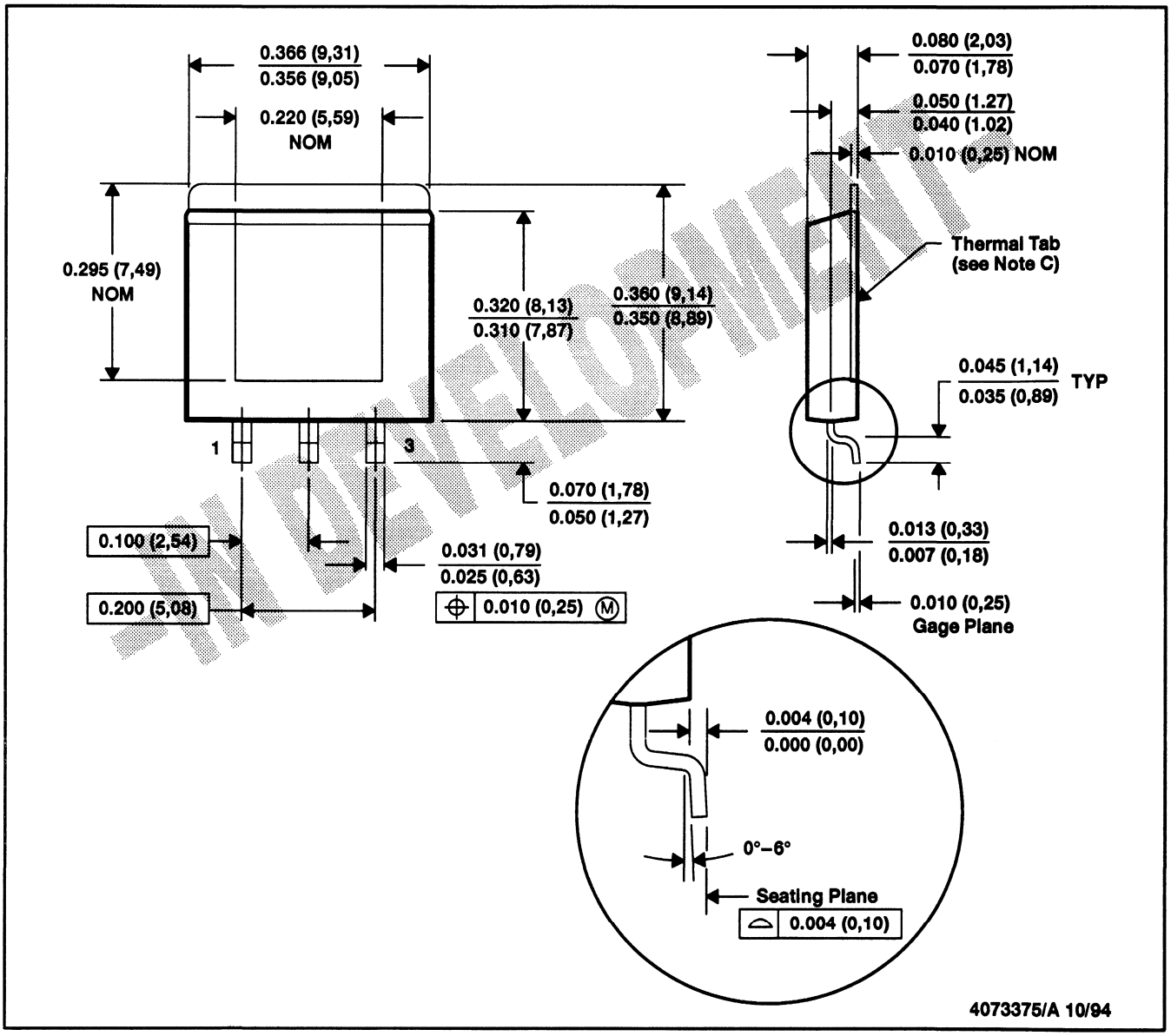
KCB (R-PSFM-T3) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.

OCTOBER 1994

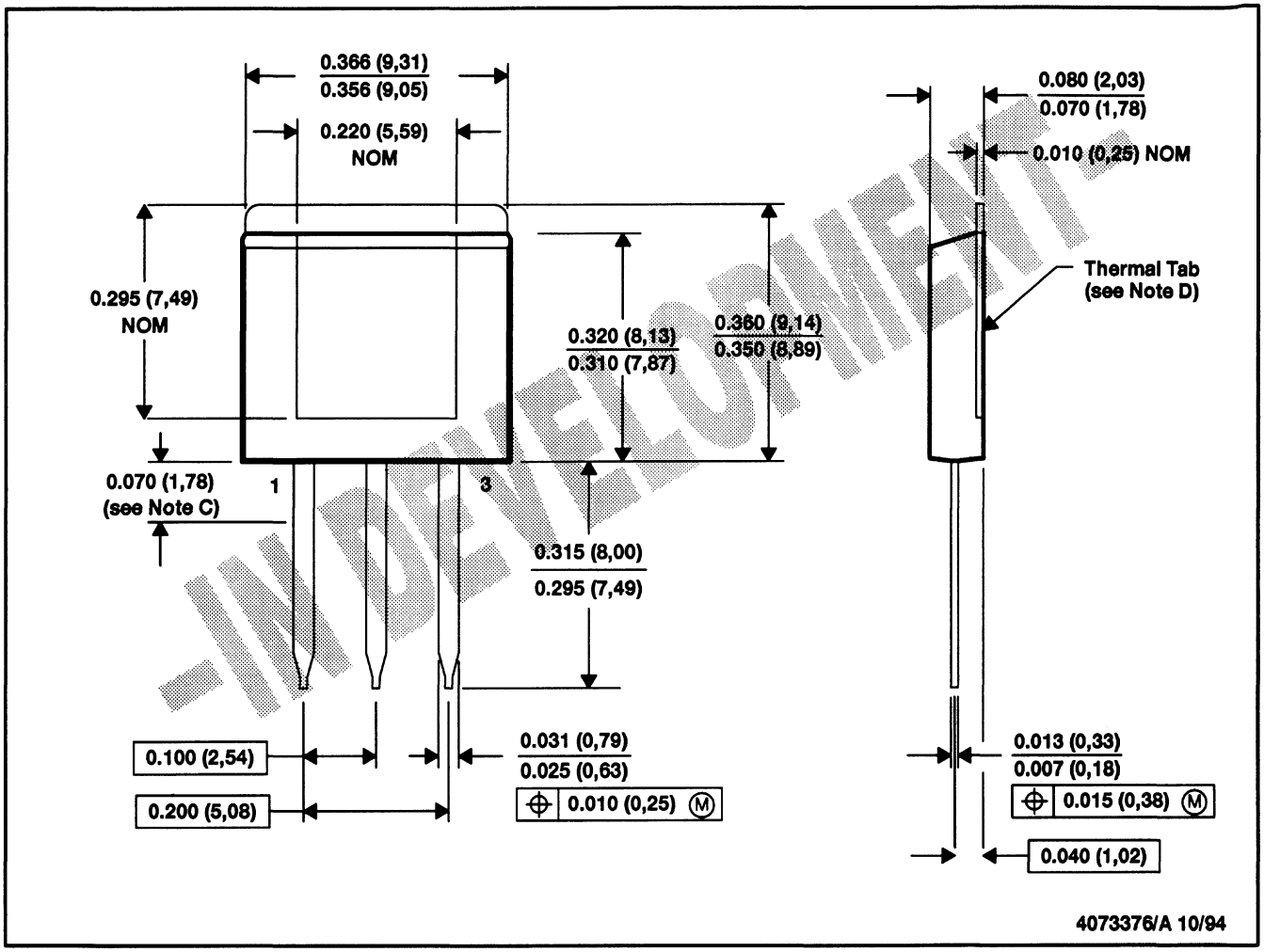
KTE (R-PSFM-T3) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

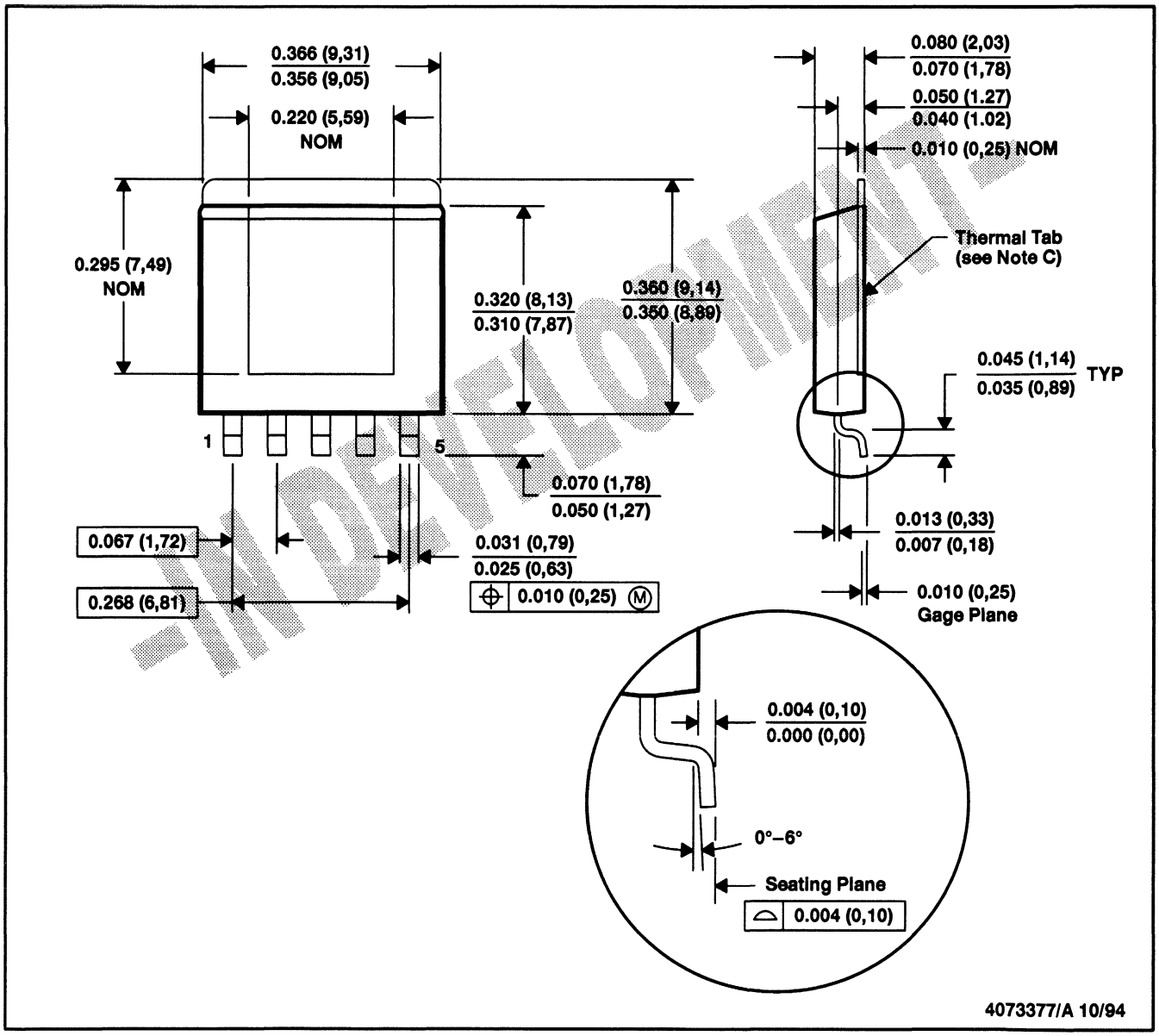
KTF (R-PSFM-T3) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead width not controlled in this area.
D. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

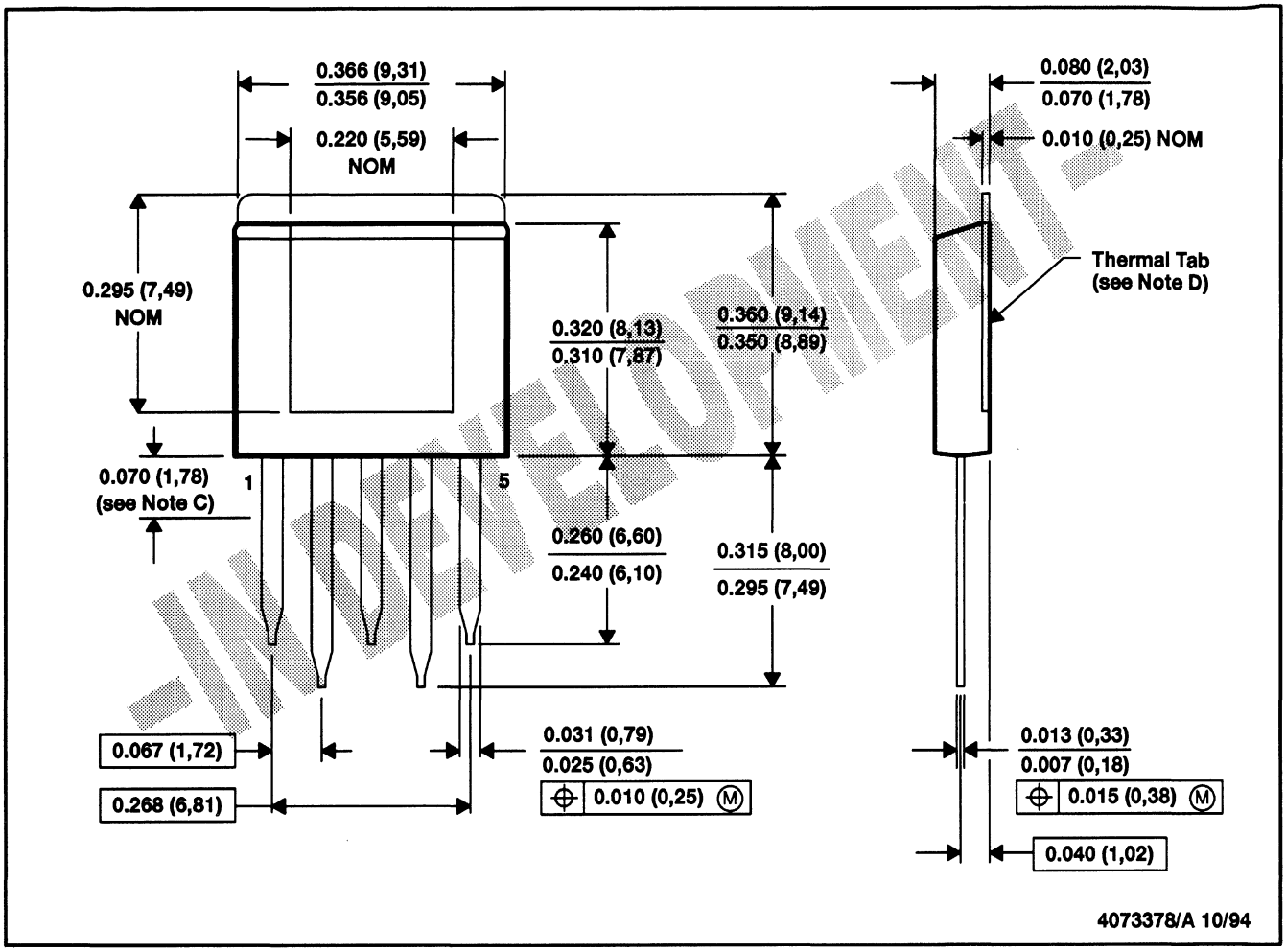
KTG (R-PSFM-G5) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

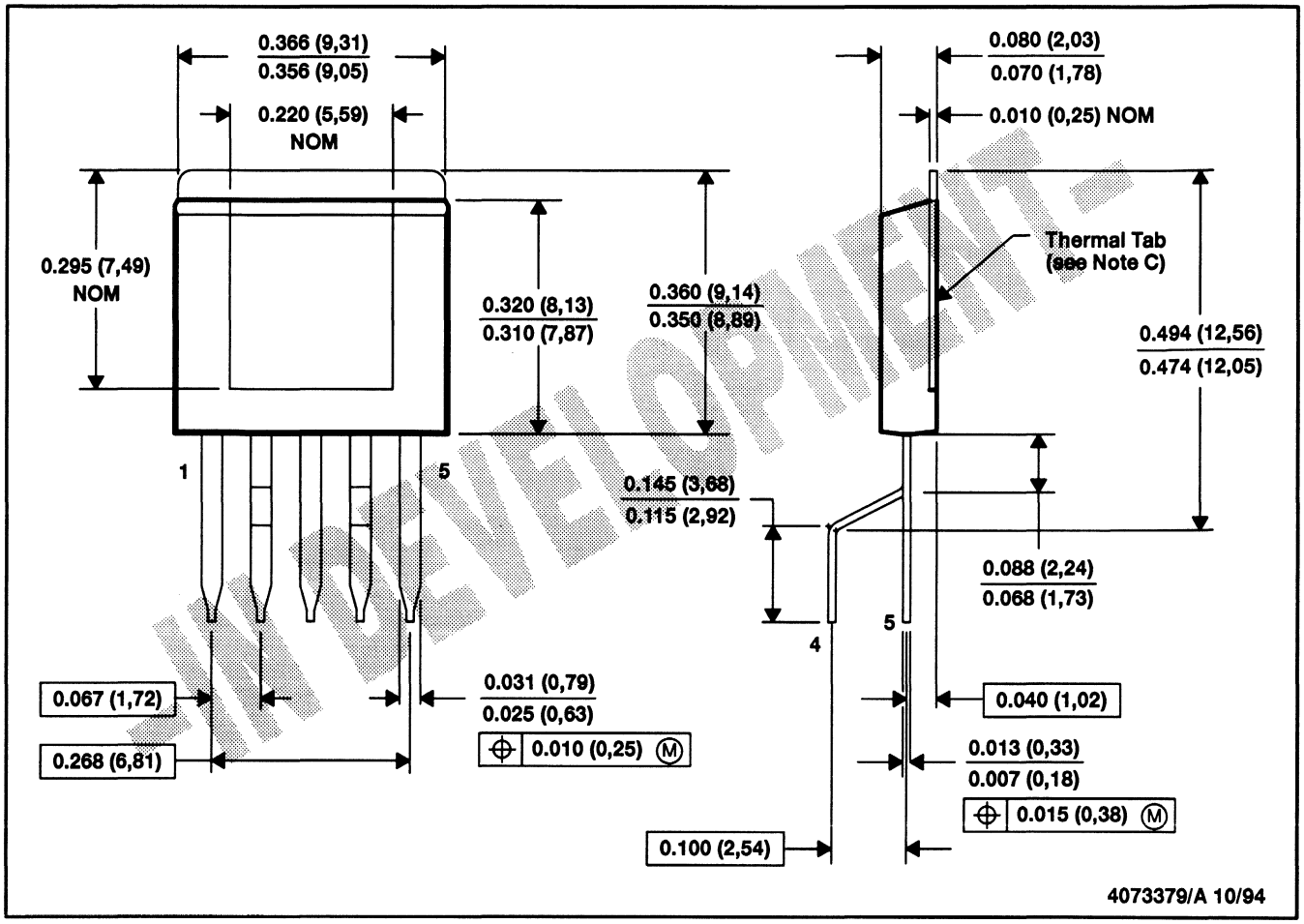
KTH (R-PSFM-T5) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead width not controlled in this area
D. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

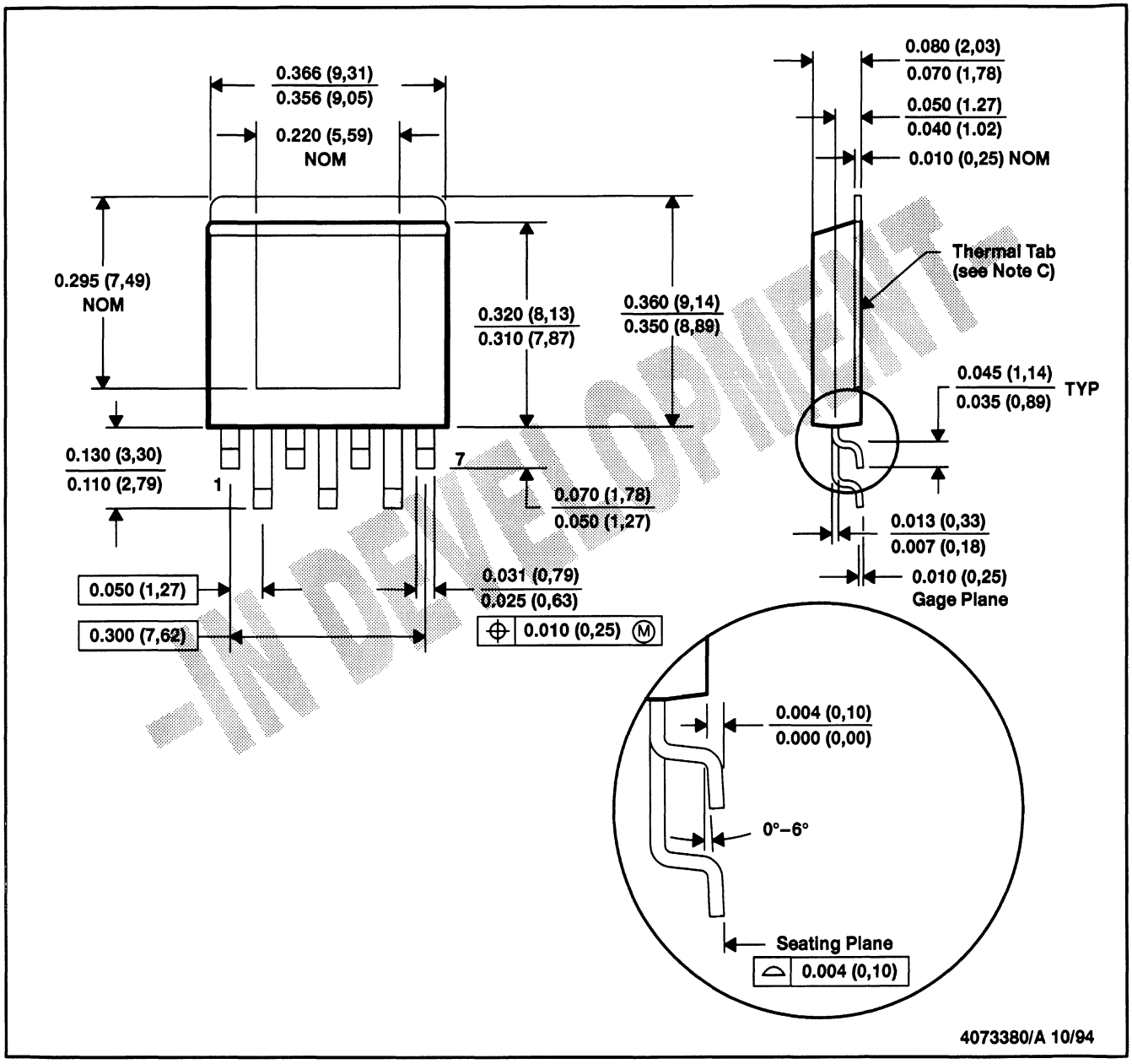
KTJ (R-PSFM-T5) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

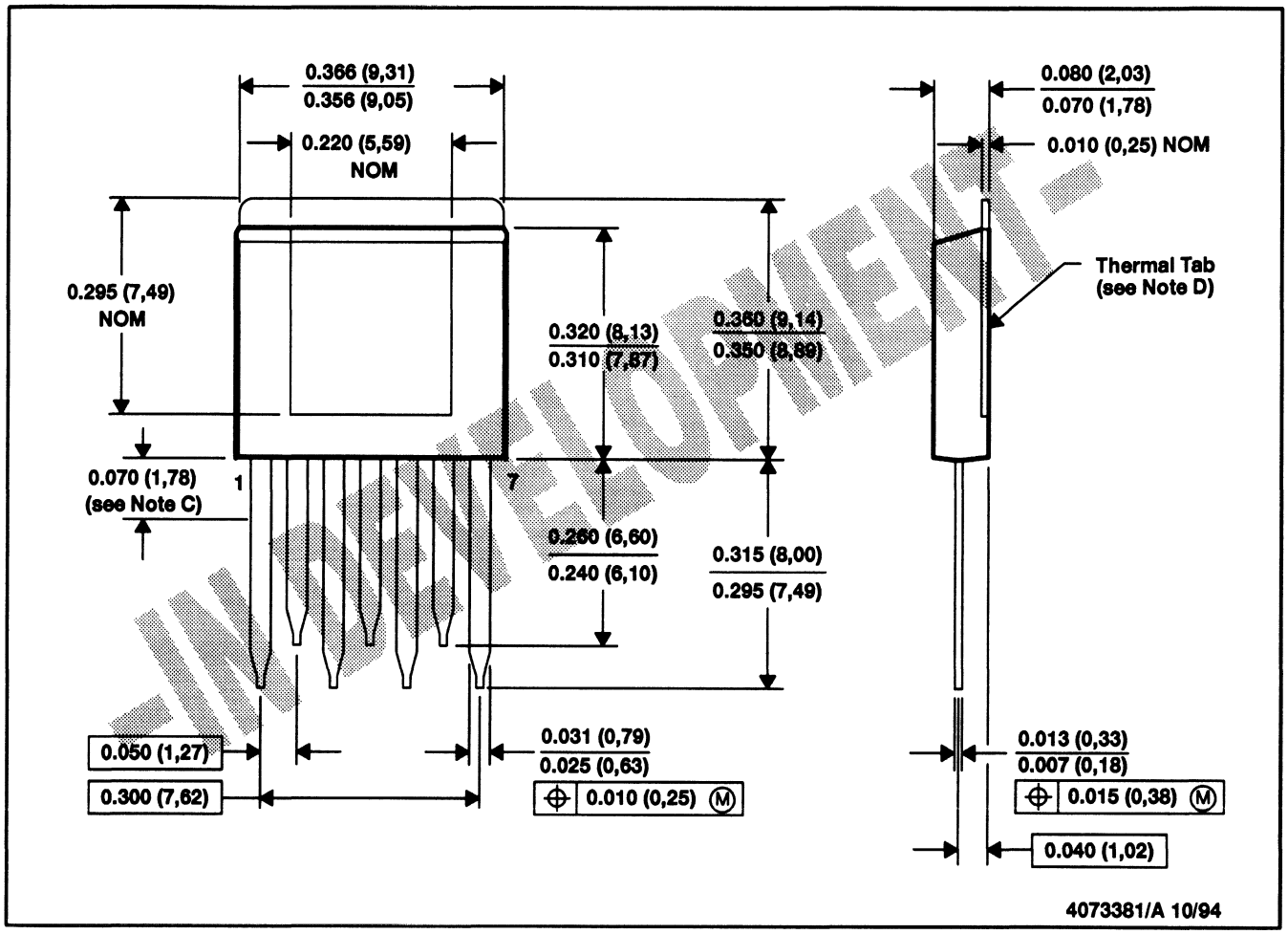
KTK (R-PSFM-G7) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

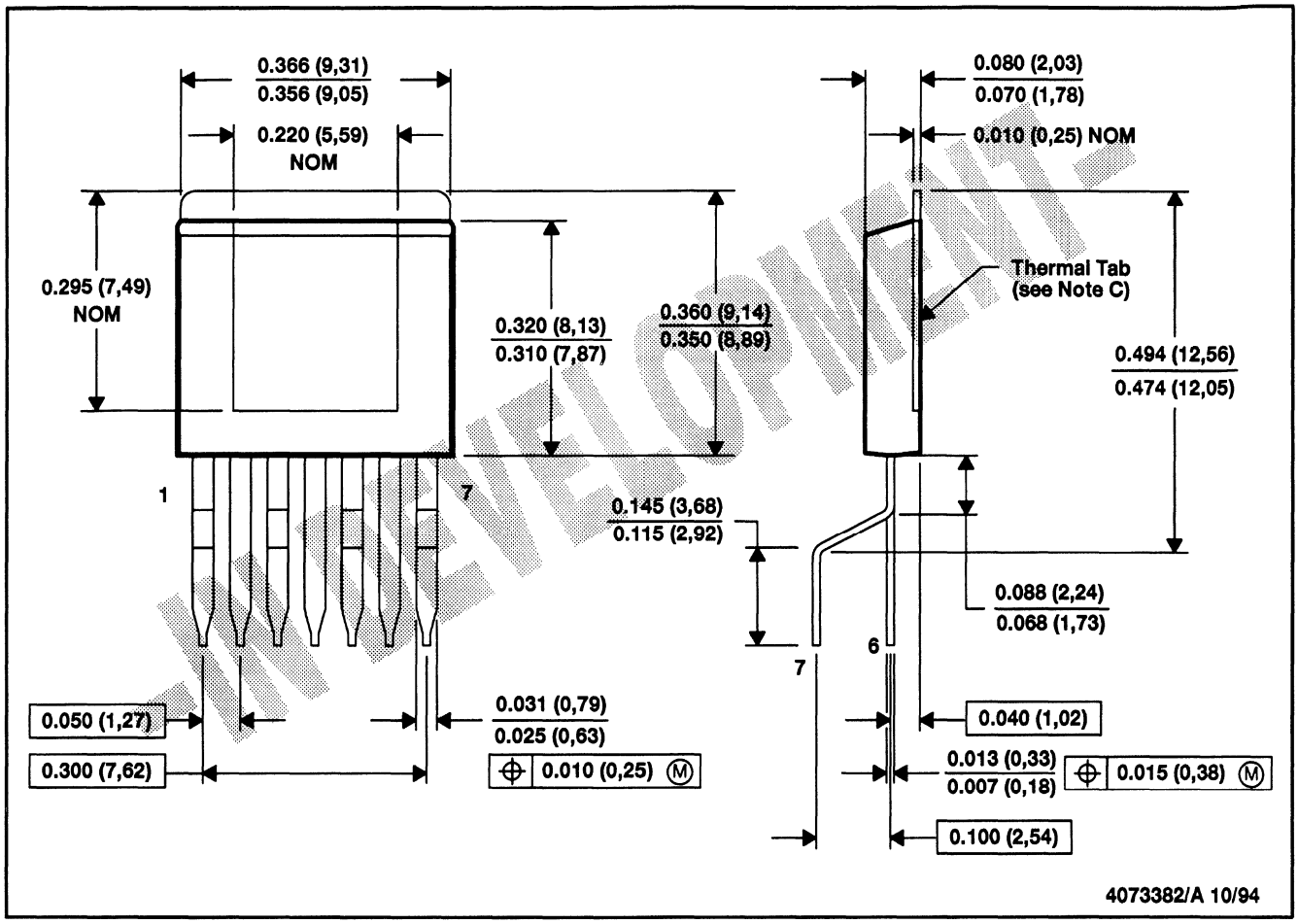
KTL (R-PSFM-T7) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead width not controlled in this area
D. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

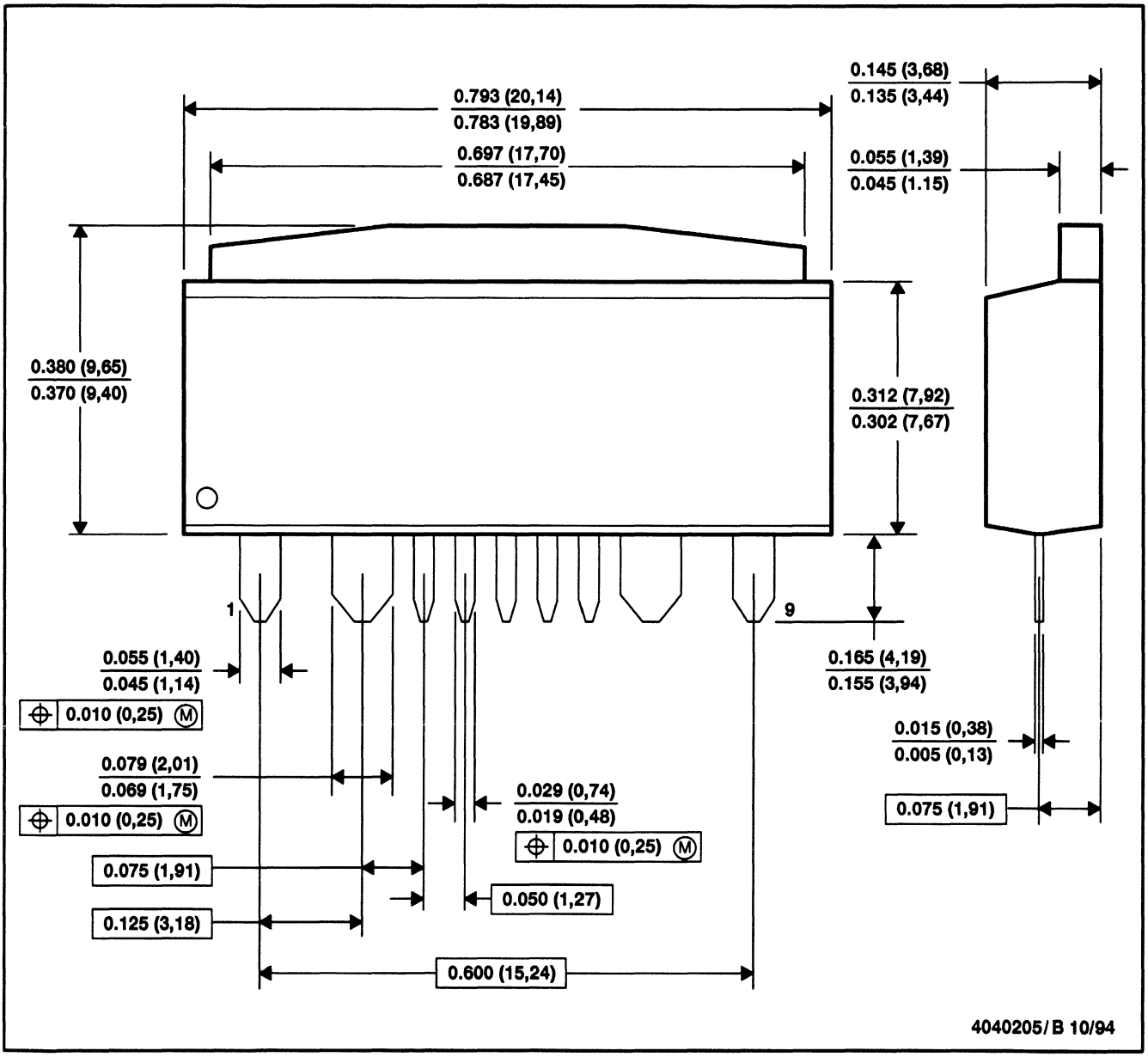
KTM (R-PSFM-T7) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the thermal tab.

OCTOBER 1994

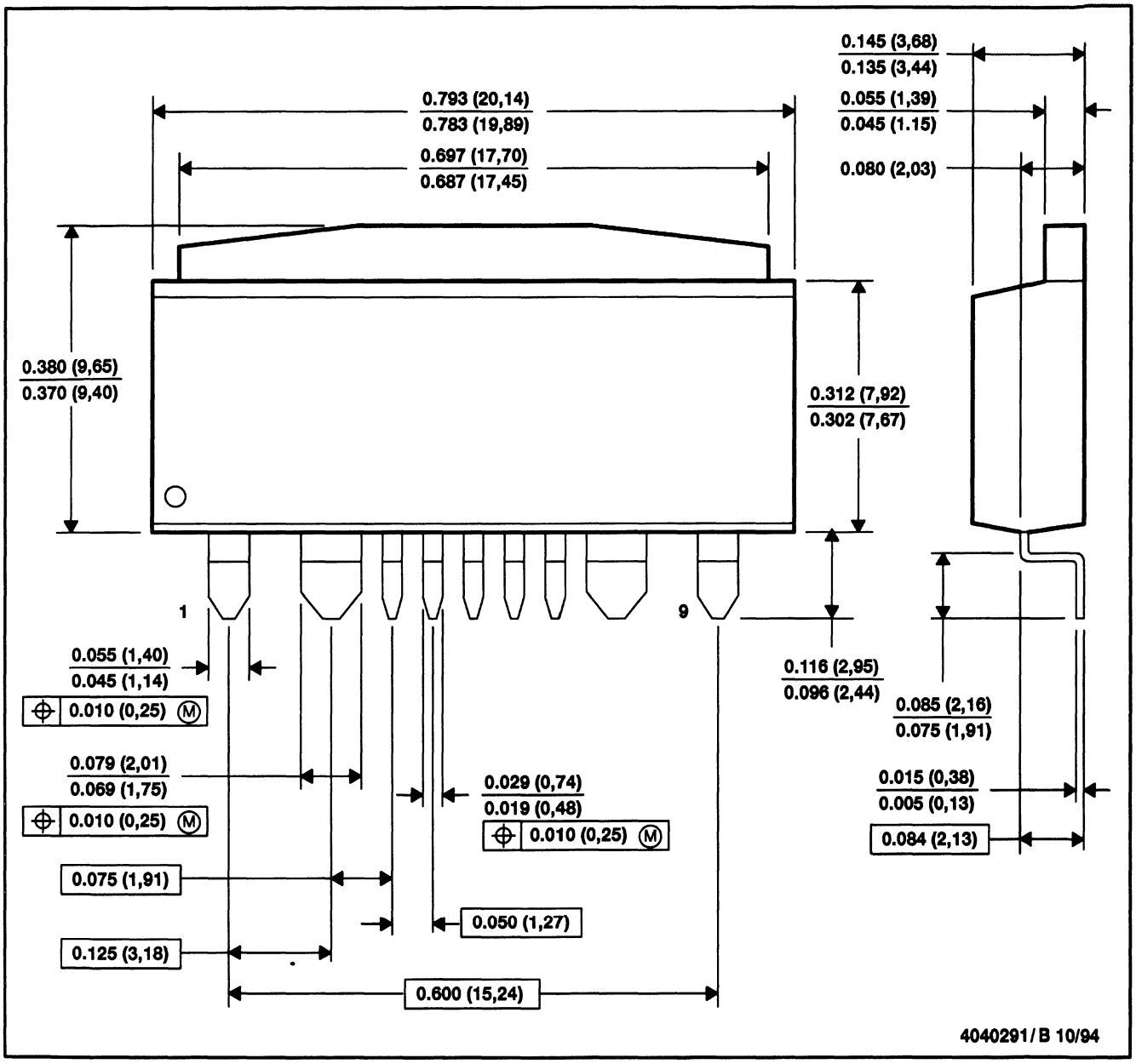
KFA (R-PSFM-T9) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All lead dimensions apply before solder dip.
D. Leads 2 and 8 are in electrical contact with the mounting tab.

OCTOBER 1994

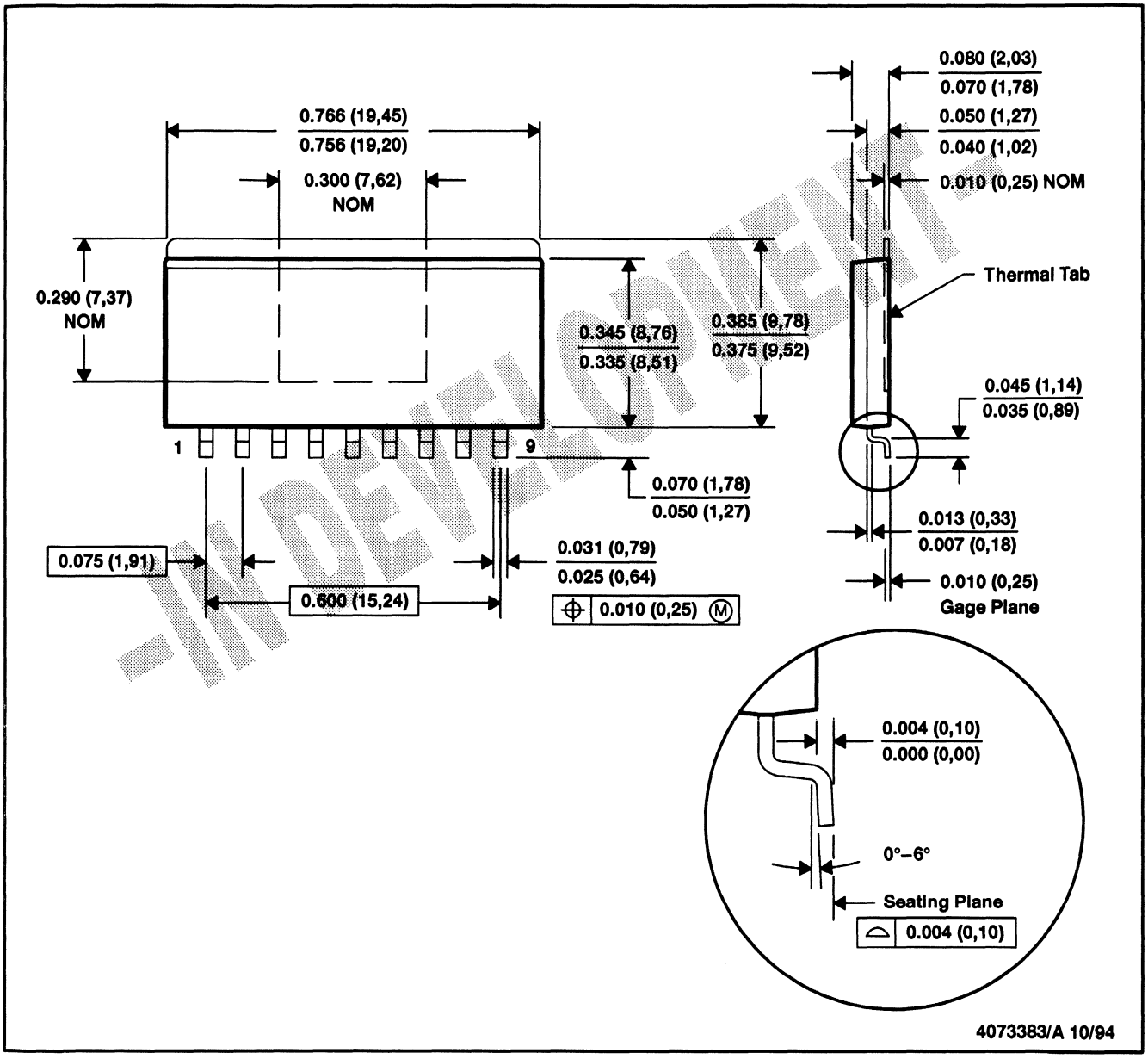
KGC (R-PSFM-G9) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All dimensions apply before solder dip.
D. Leads 2 and 8 are in electrical contact with the mounting tab.

OCTOBER 1994

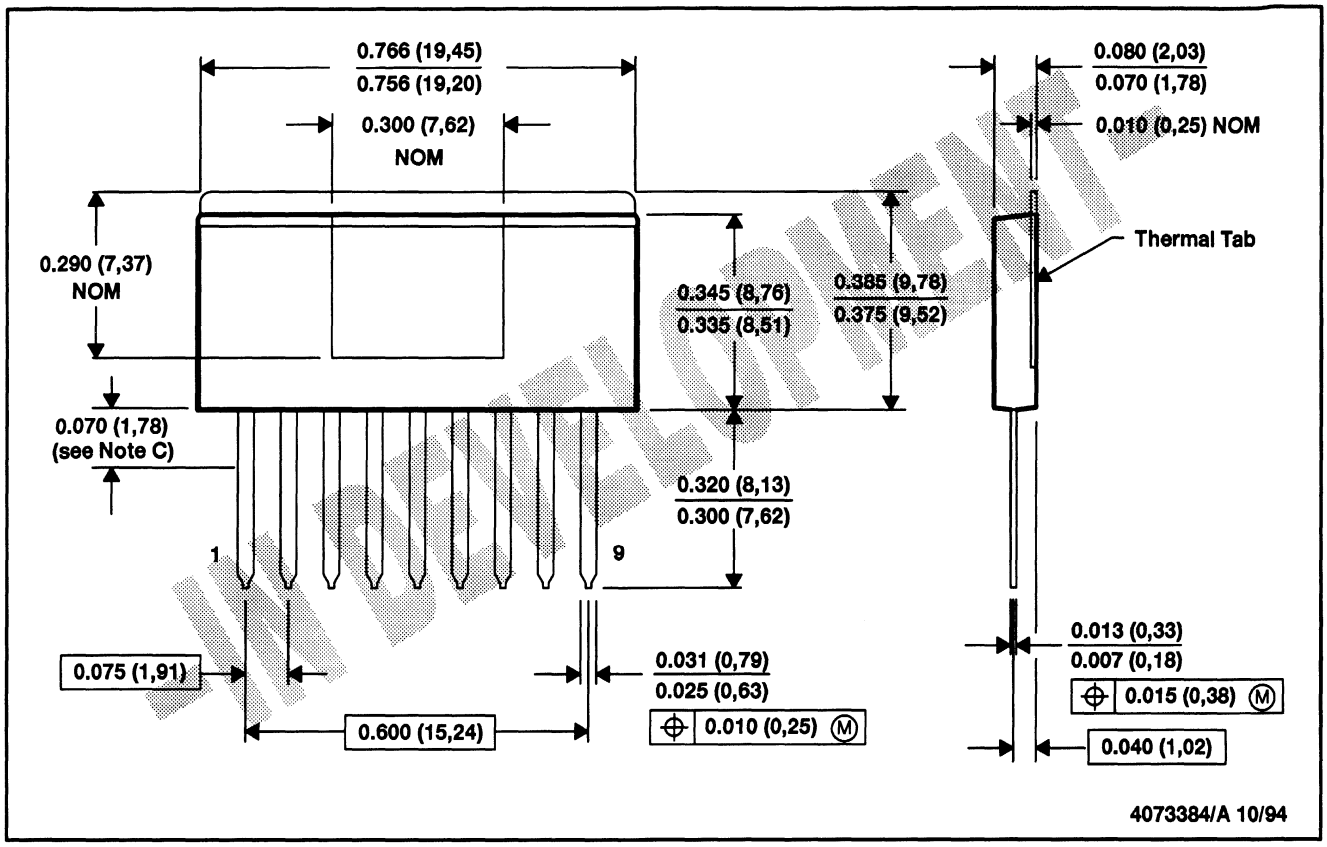
KTA (R-PSFM-G9) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

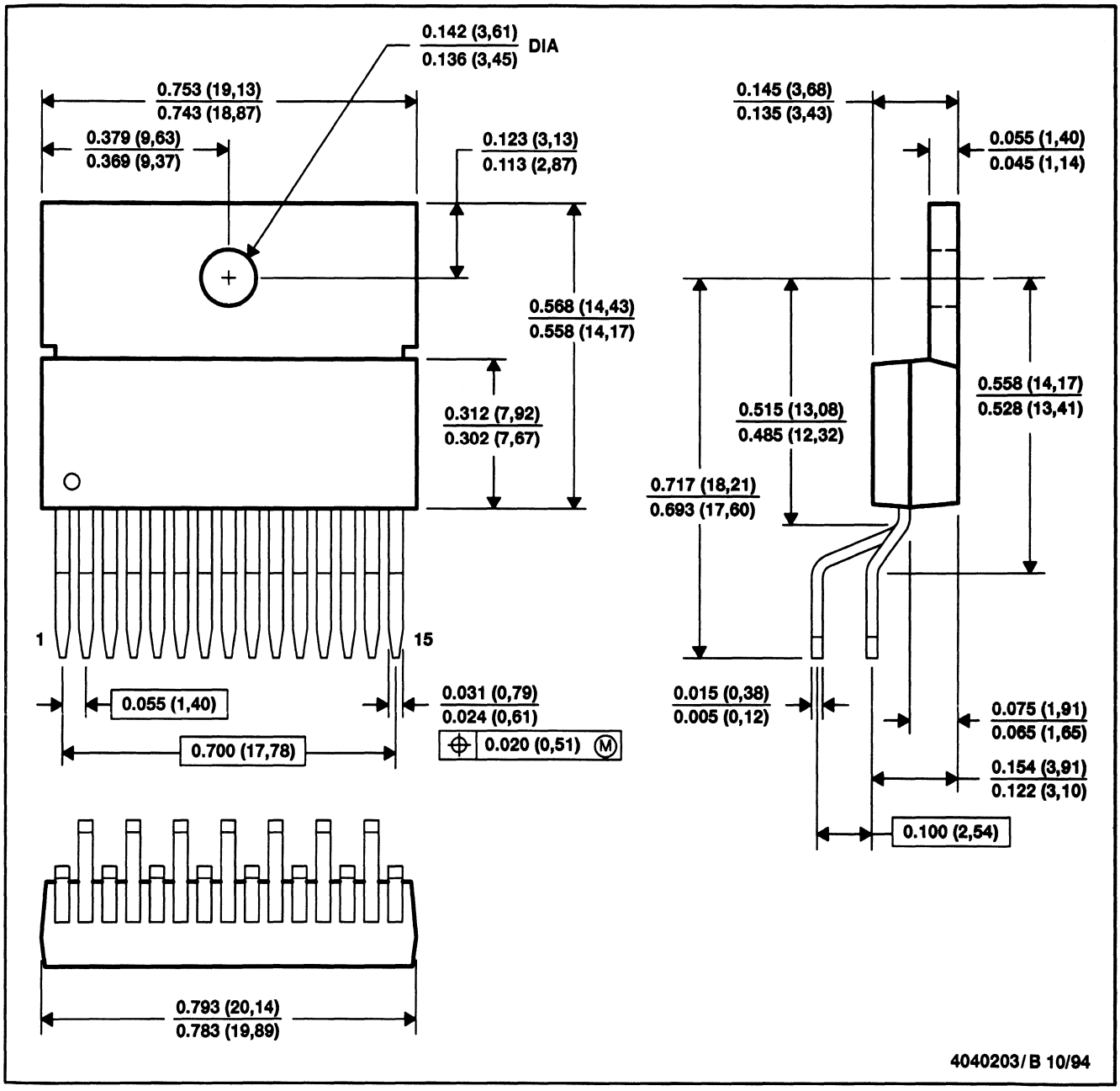
KTB (R-PSFM-T9) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead width not controlled in this area

OCTOBER 1994

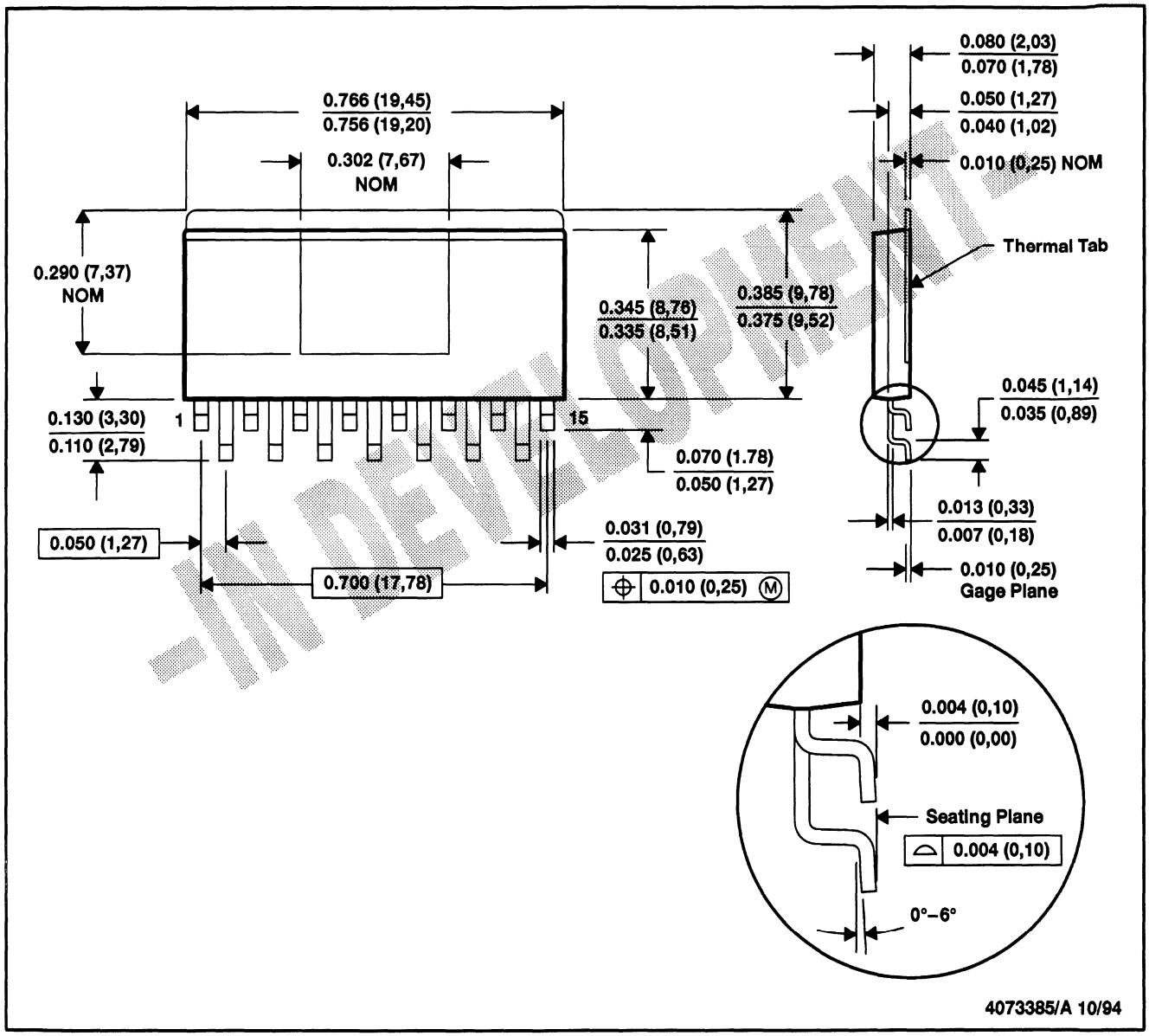
KN (R-PZFM-T15) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All lead dimensions apply before solder dip.

OCTOBER 1994

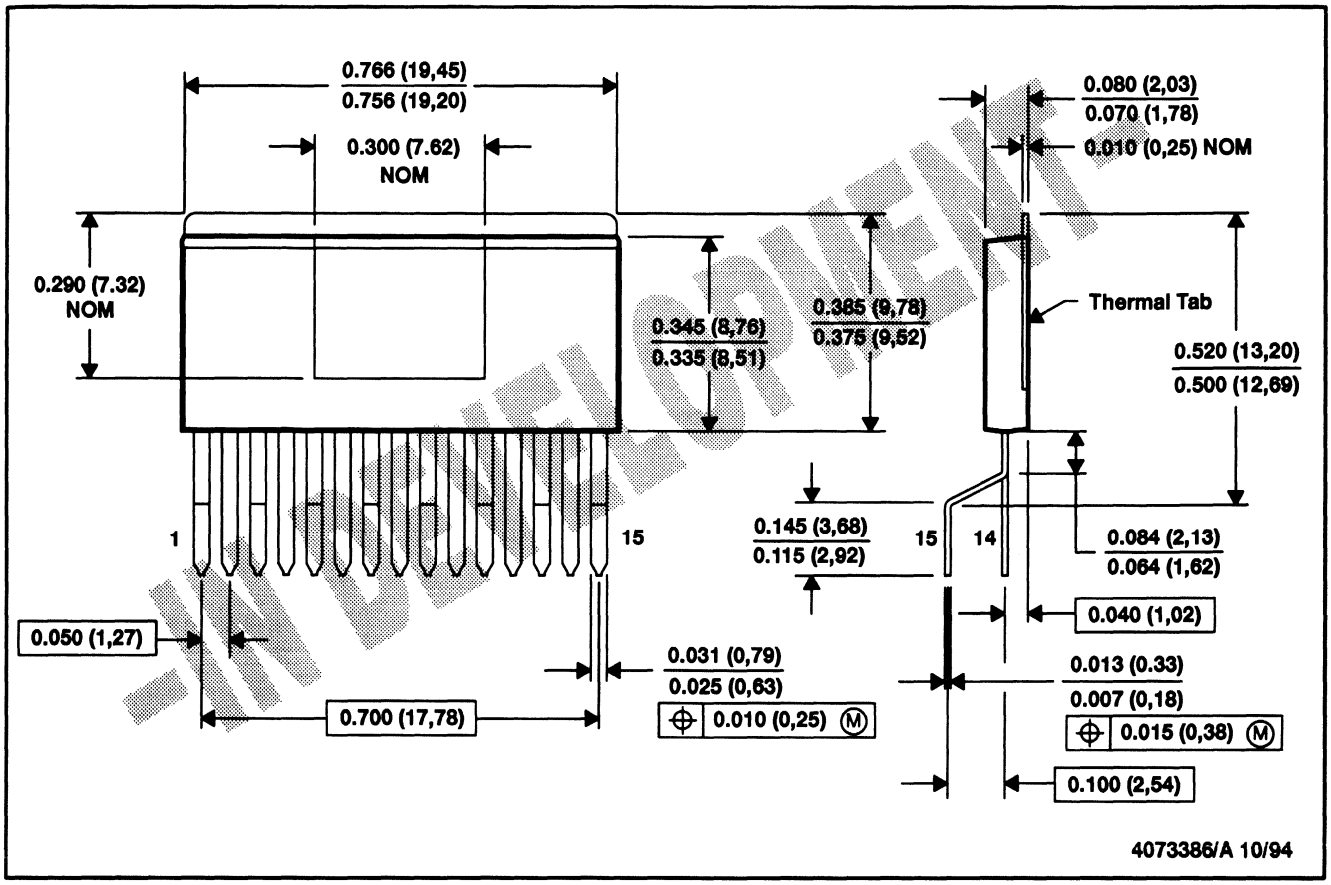
KTC (R-PSFM-G15) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

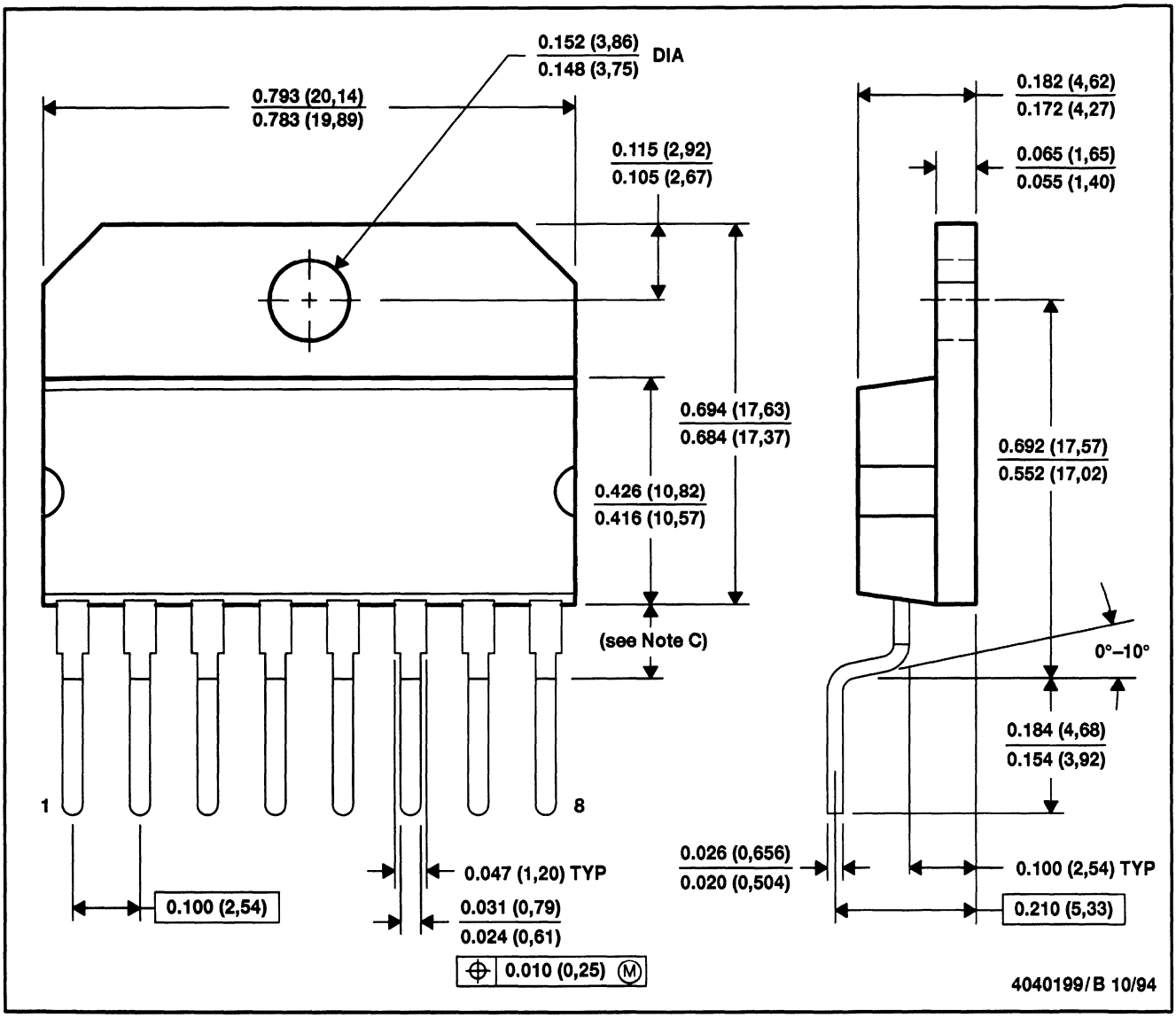
KTD (R-PSFM-T15) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

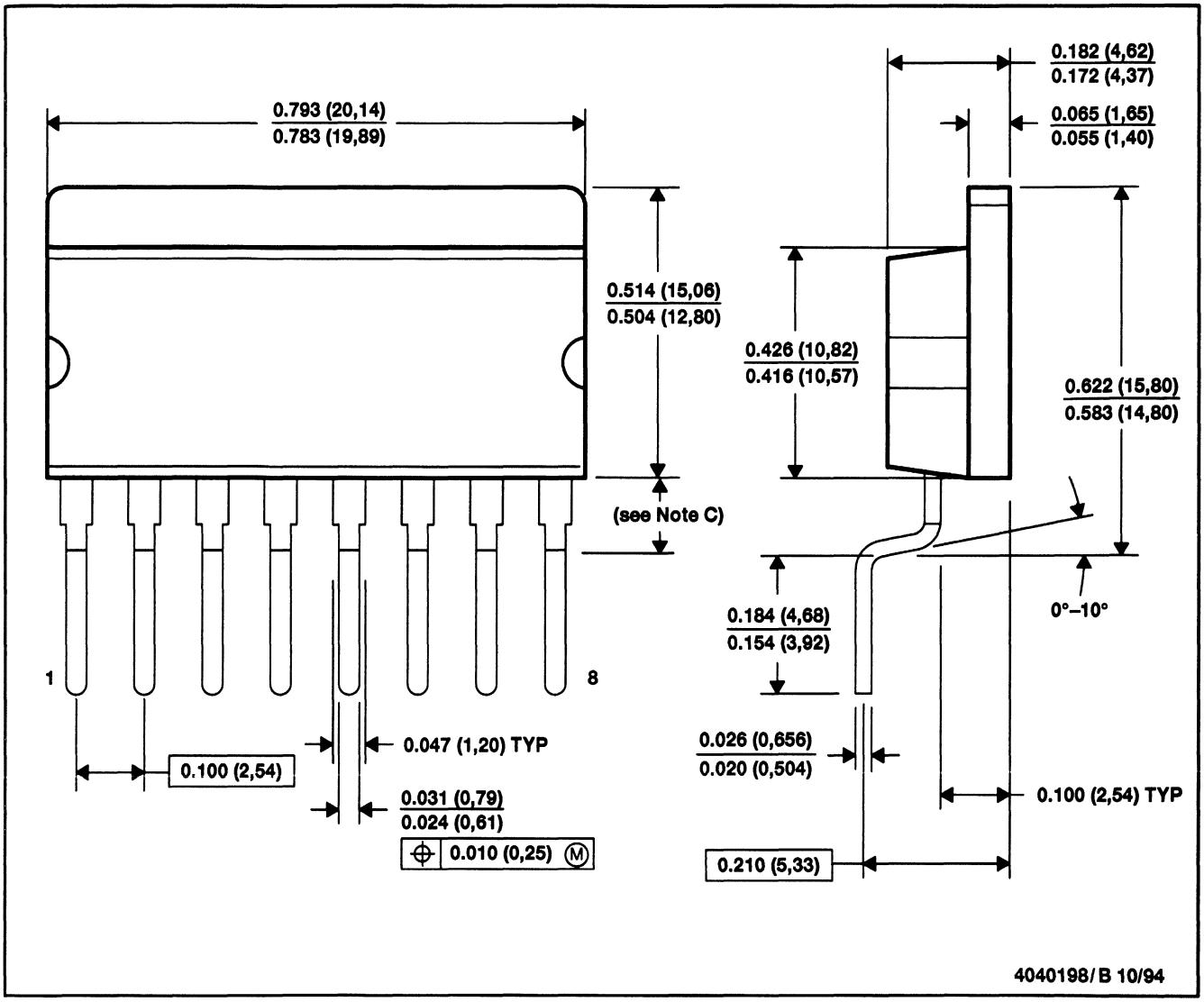
KWV (R-PSFM-T8) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.

OCTOBER 1994

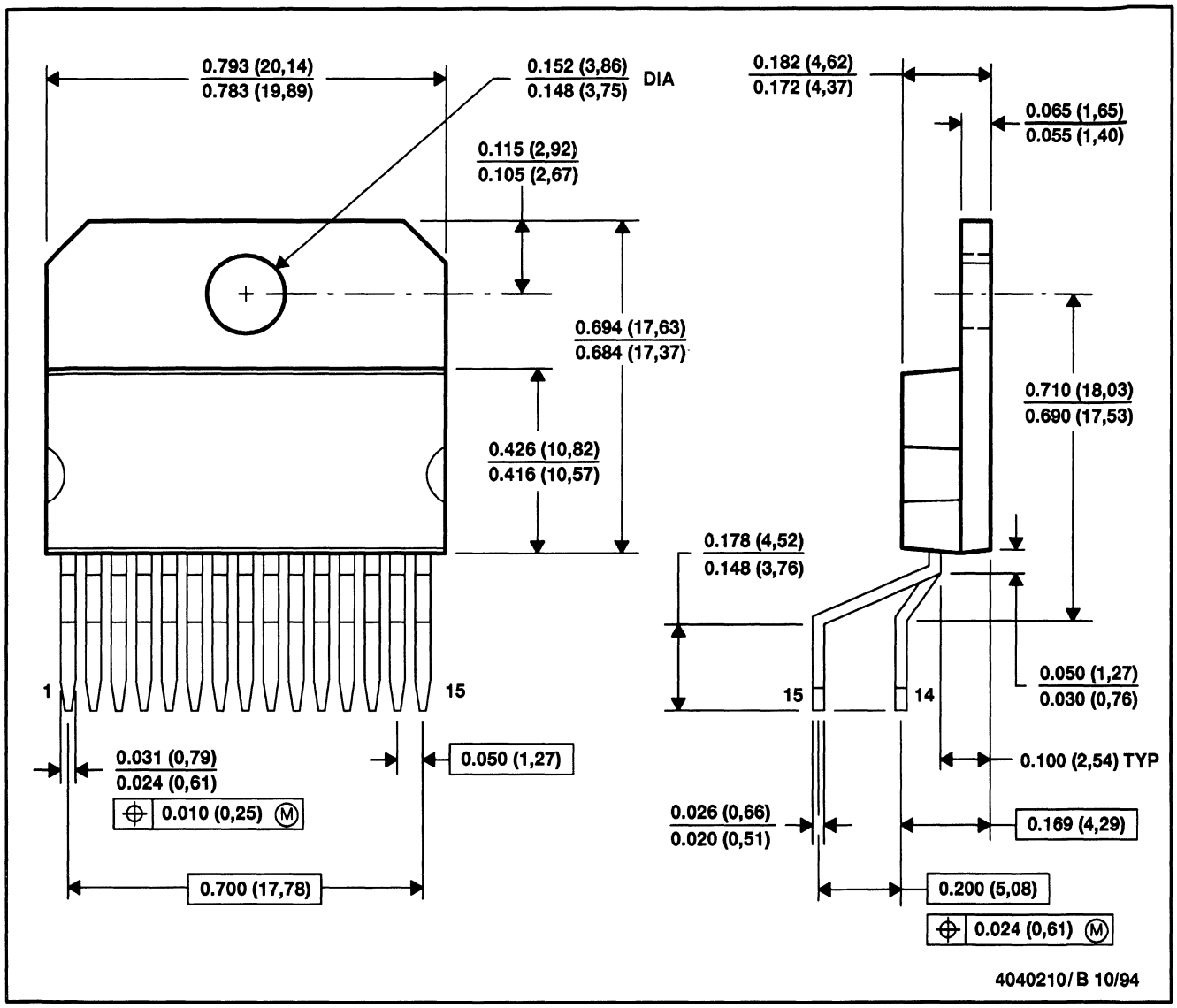
KW (R-PSFM-T8) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All lead dimensions apply before solder dip.

OCTOBER 1994

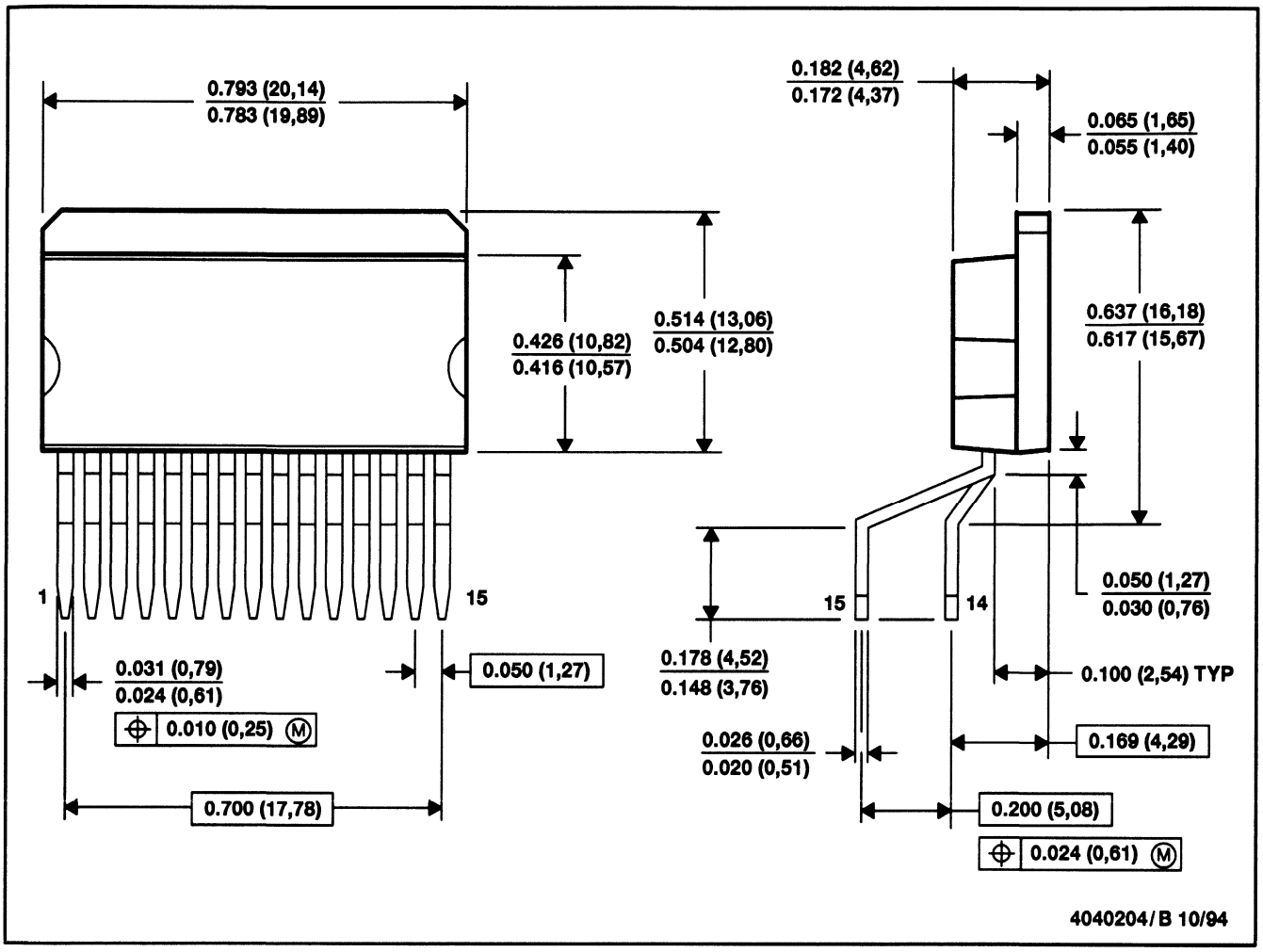
KV (R-PZFM-T15) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All lead dimensions apply before solder dip.
D. Falls within JEDEC MO-048AB

OCTOBER 1994

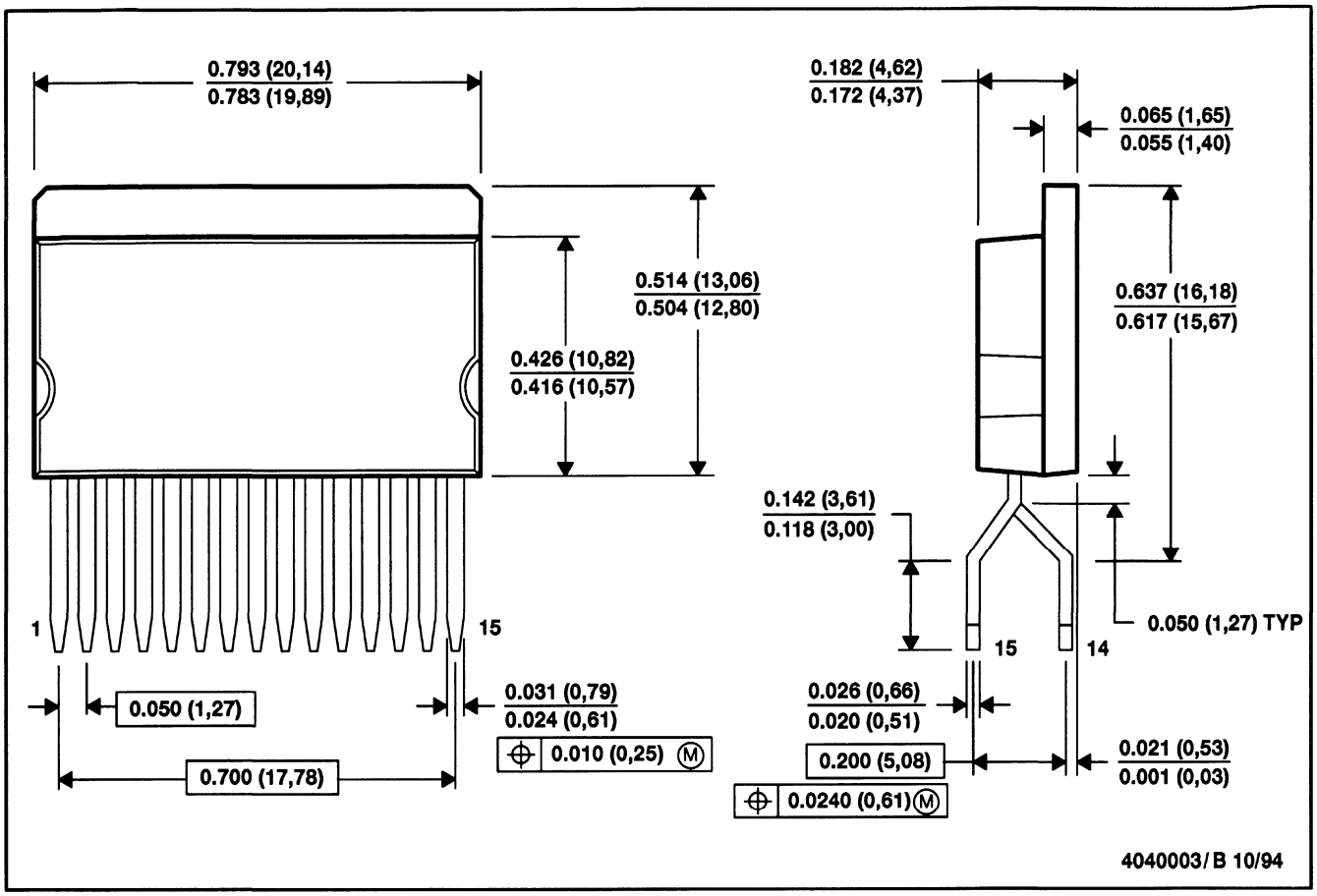
KVS (R-PZFM-T15) **PLASTIC FLANGE-MOUNT PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All lead dimensions apply before solder dip.

OCTOBER 1994

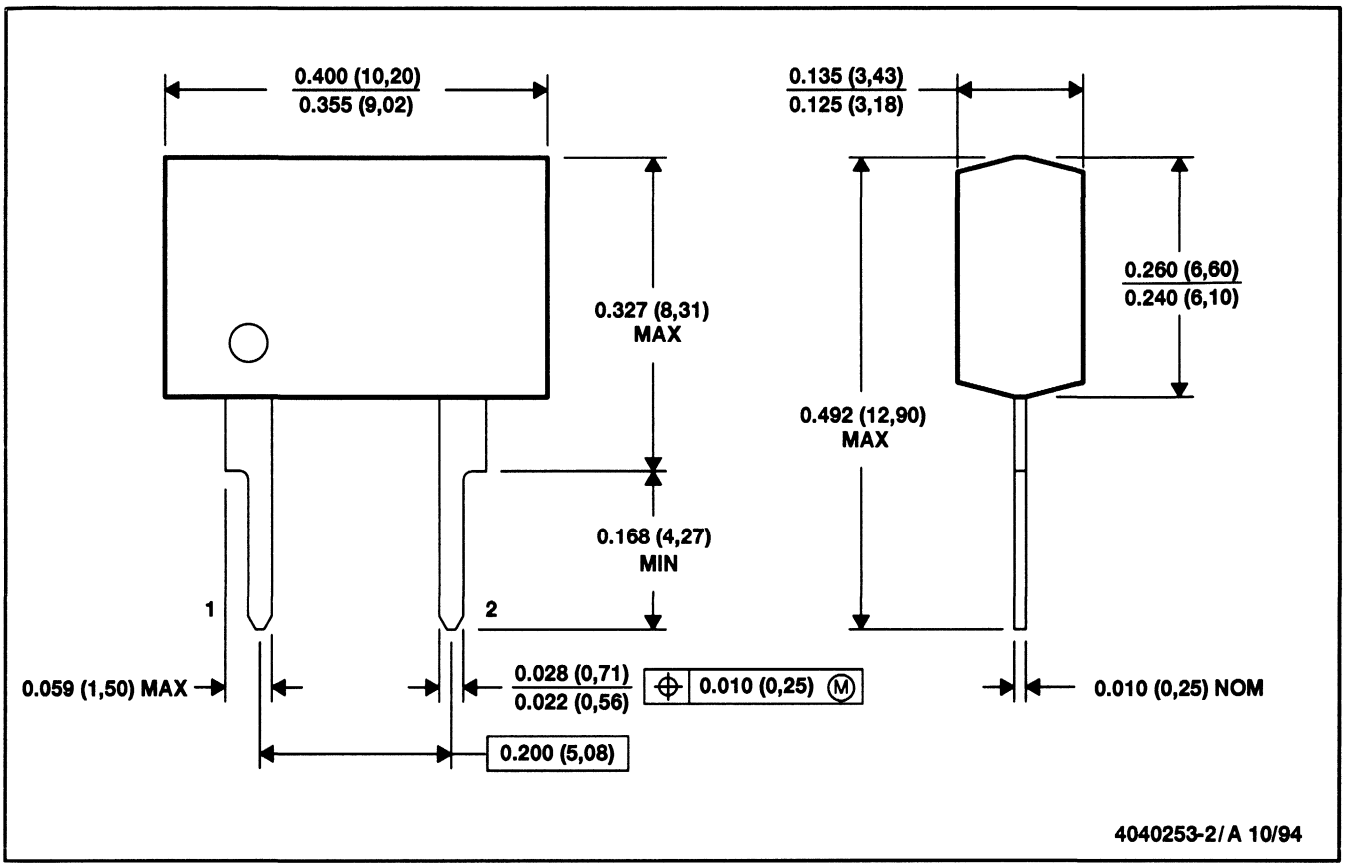
KVA (R-PZFM-T15) PLASTIC FLANGE-MOUNT PACKAGE



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All lead dimensions apply before solder dip.

OCTOBER 1994

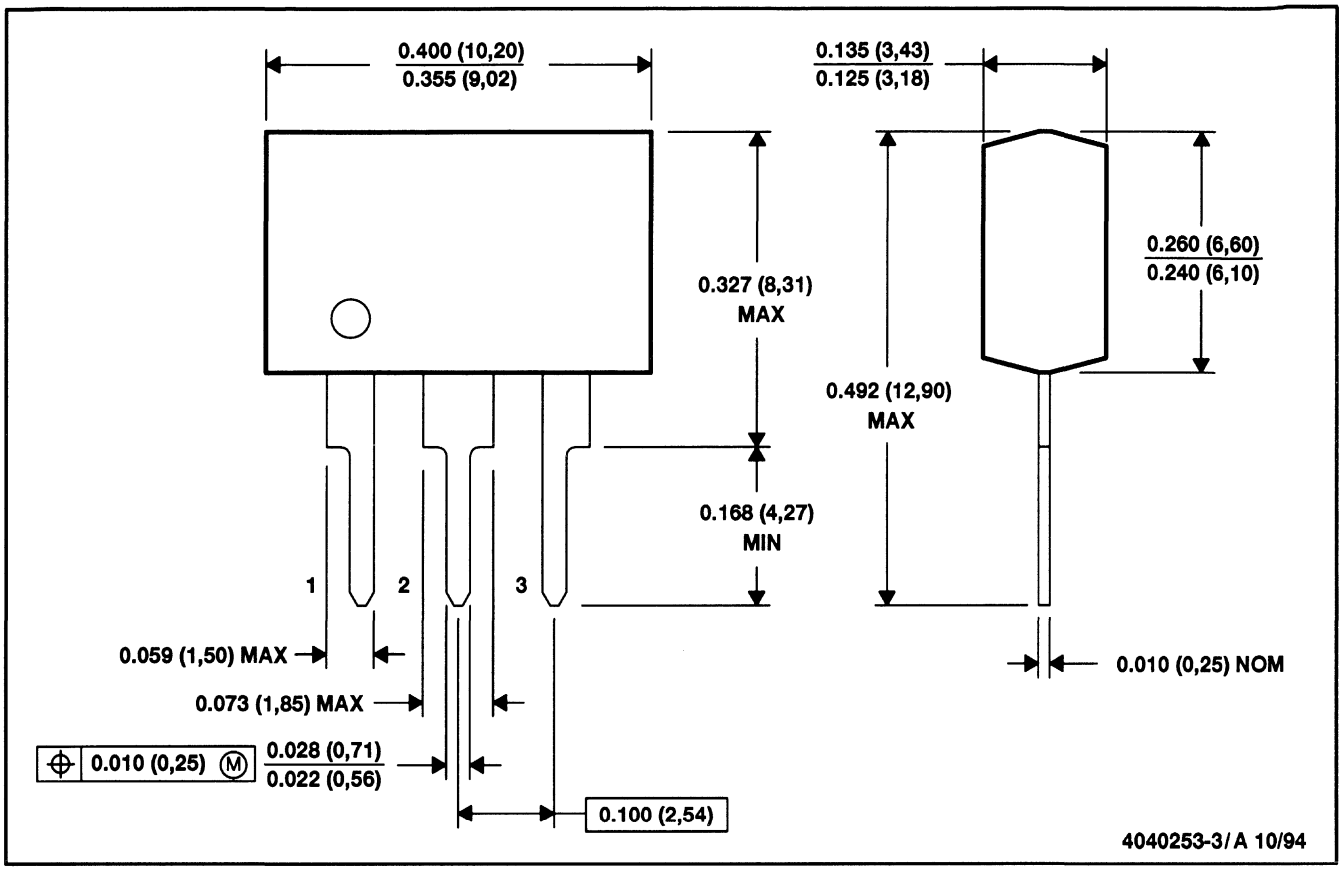
SL (R-PSIP-T2) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

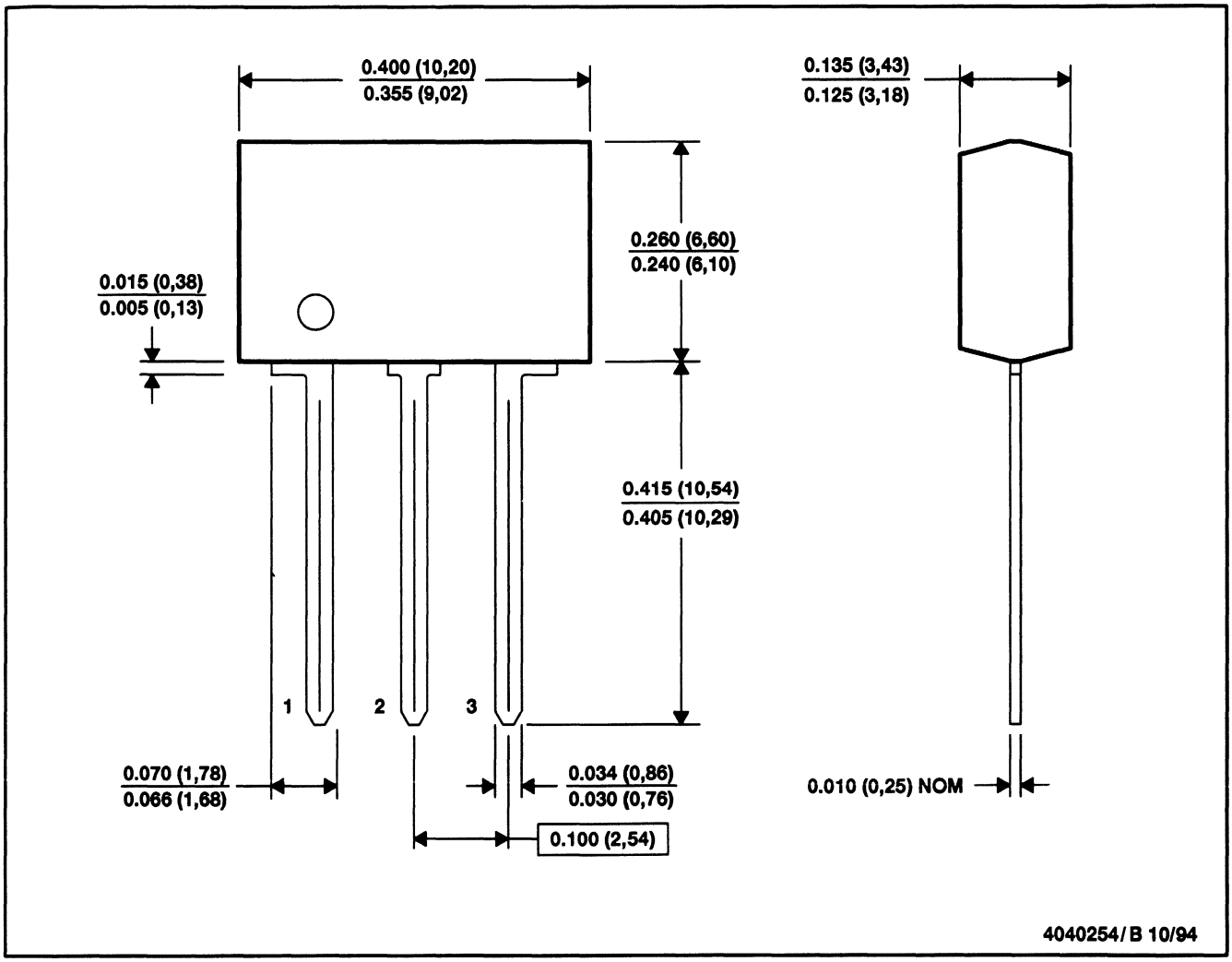
SL (R-PSIP-T3) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

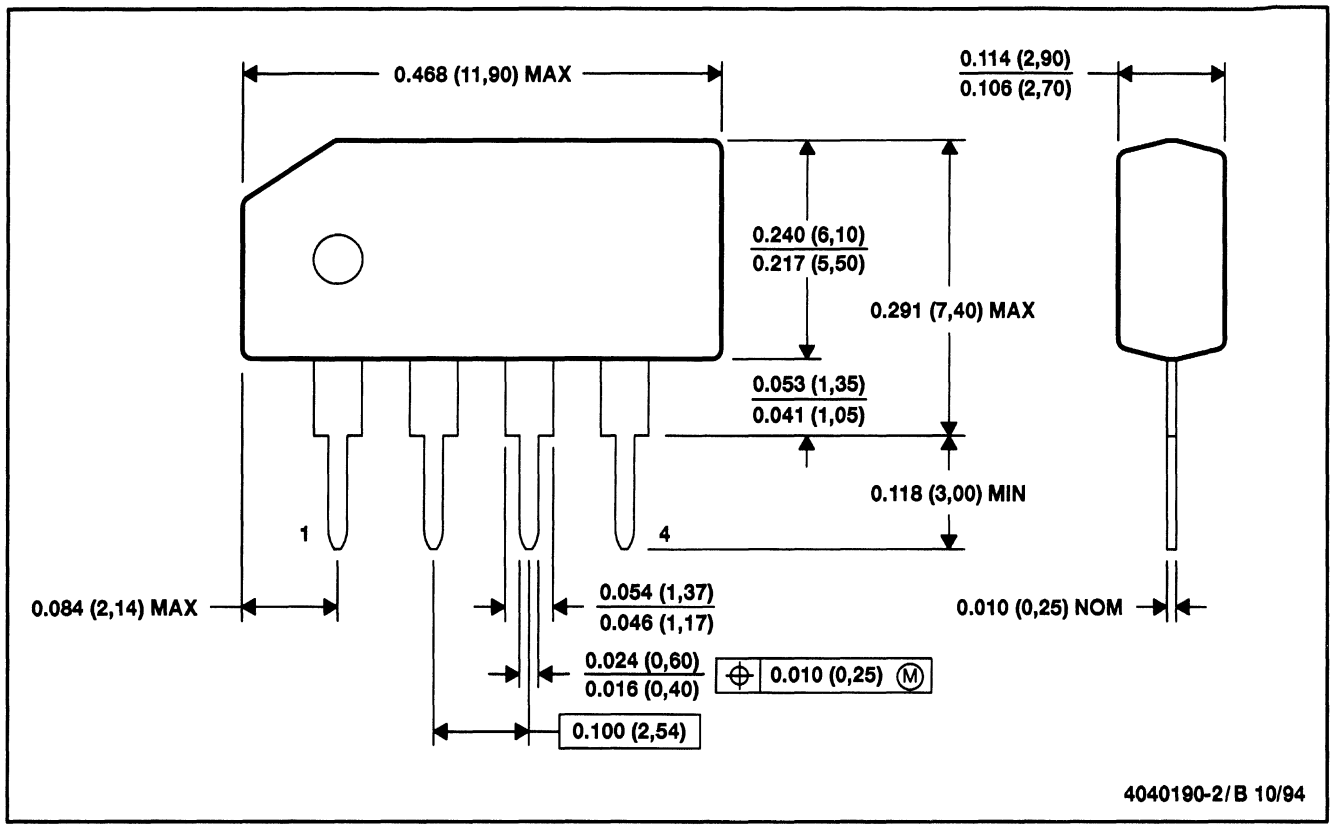
SLL (R-PSIP-T3) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

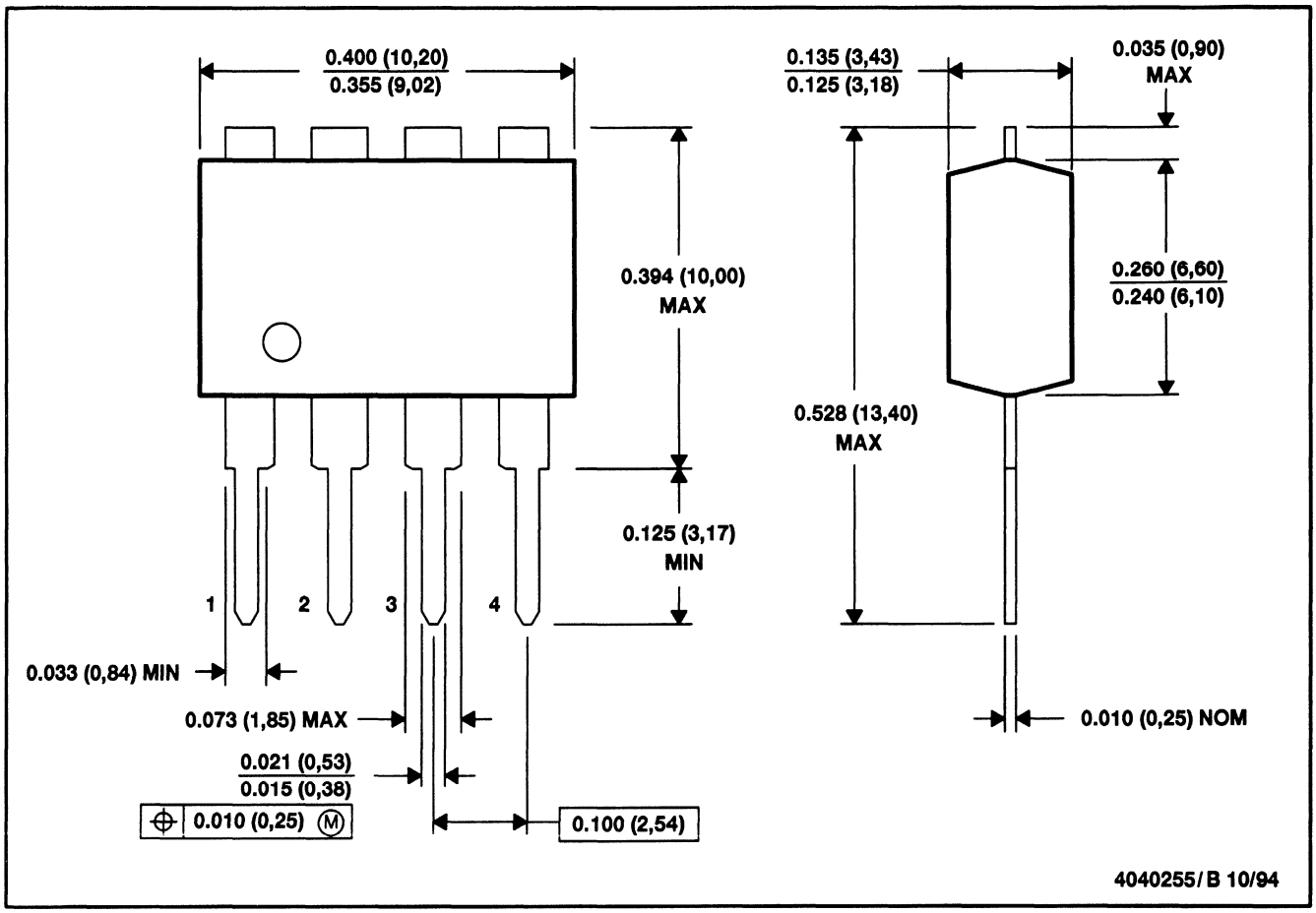
SC (R-PSIP-T4) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

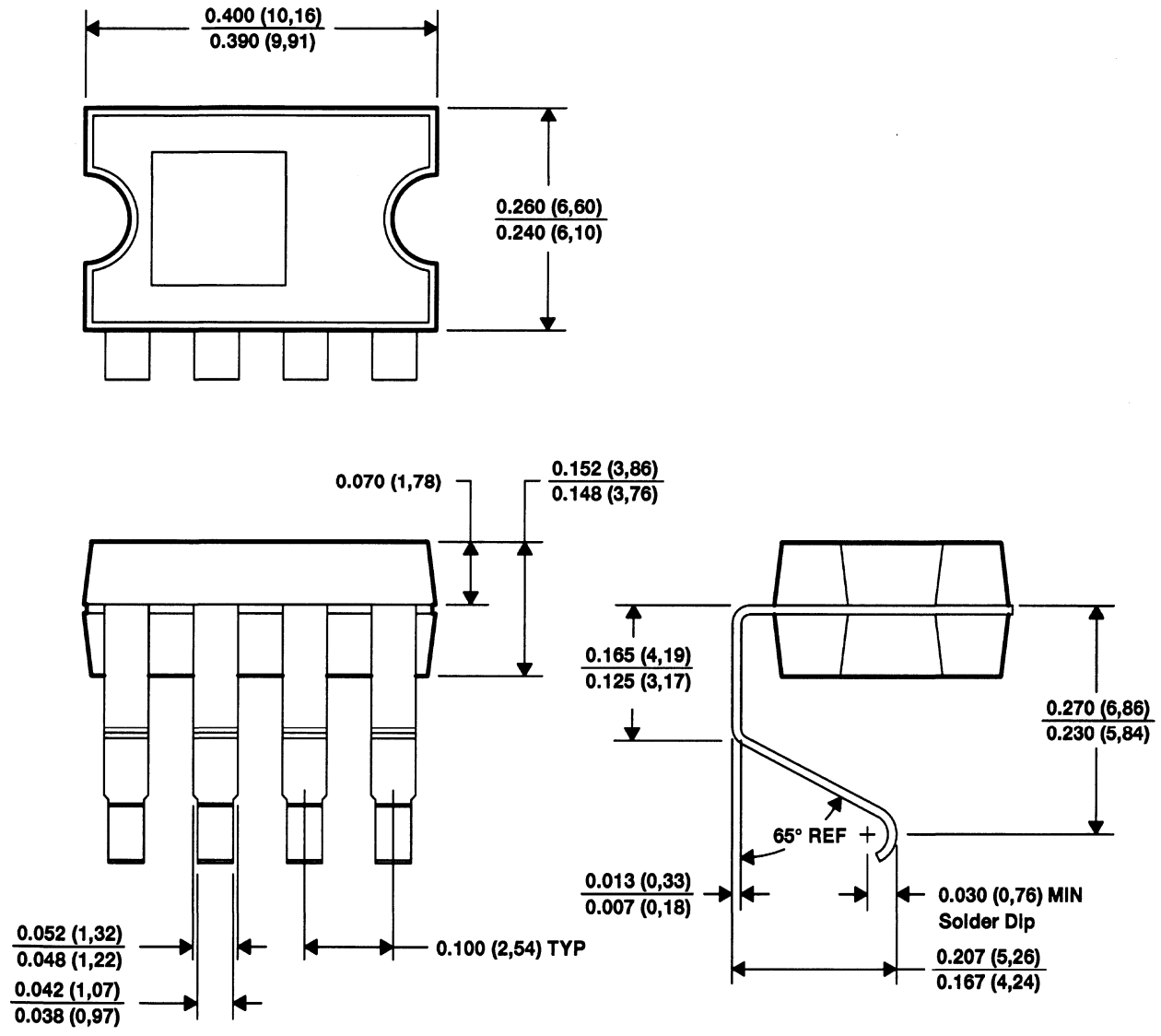
SE (R-PSIP-T4) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

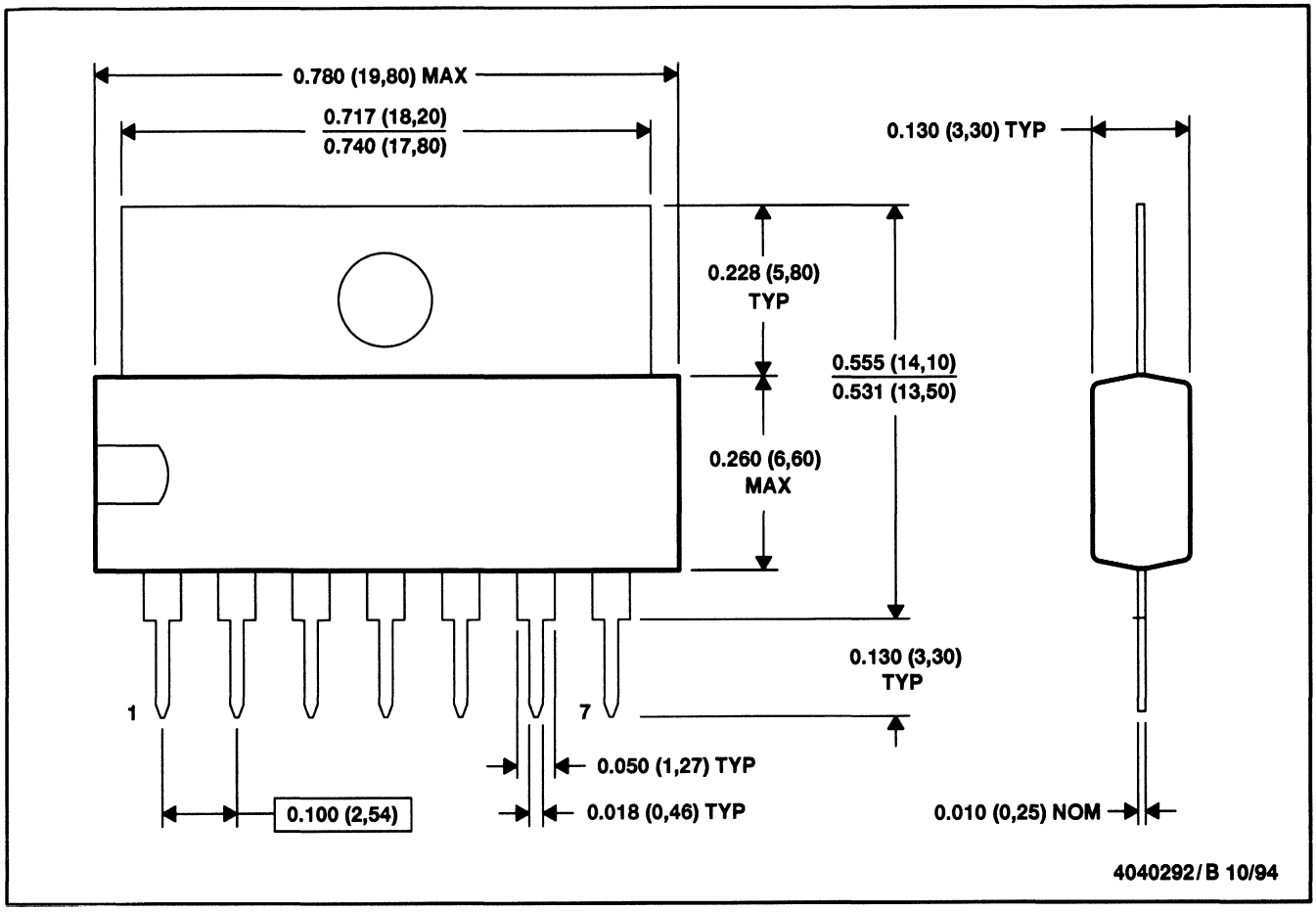
SP (R-PSIP-T4) **CUSTOM PHOTO-AMP PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

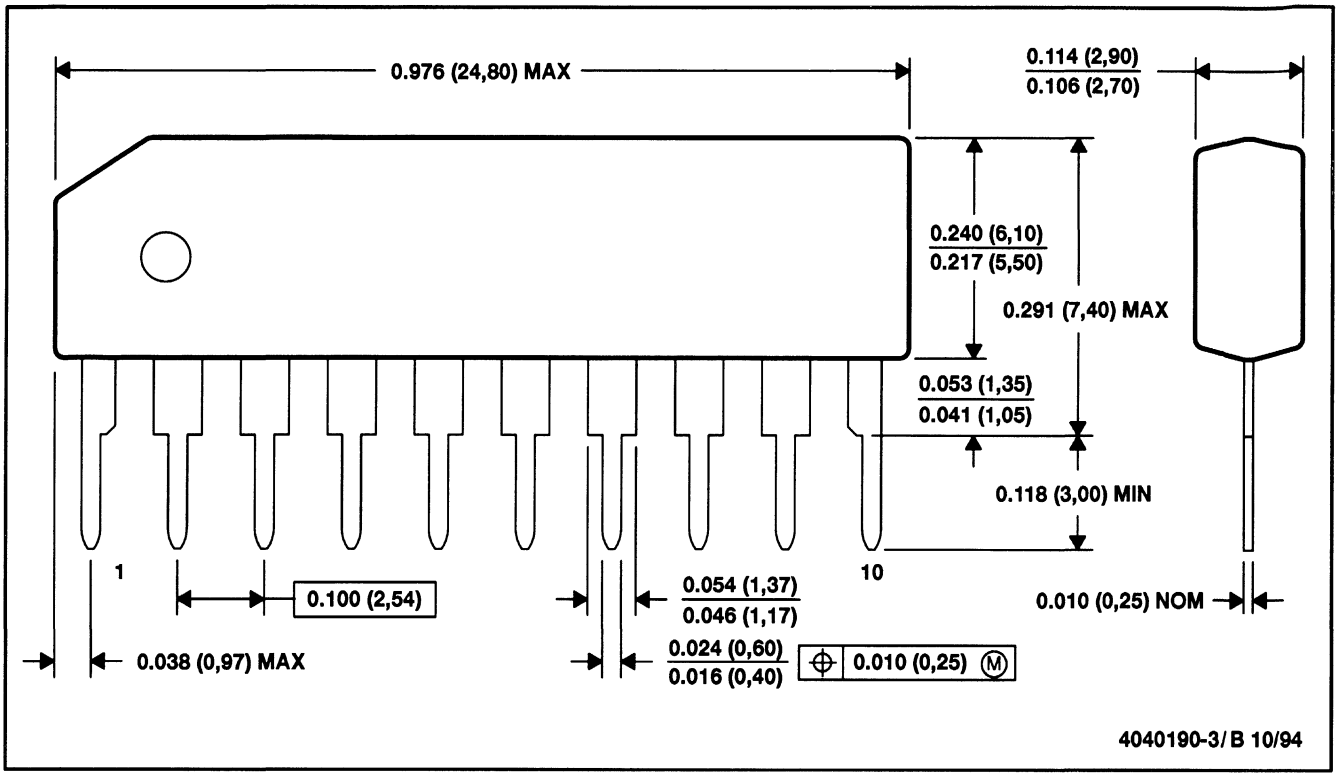
SK (R-PSIP-T7) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

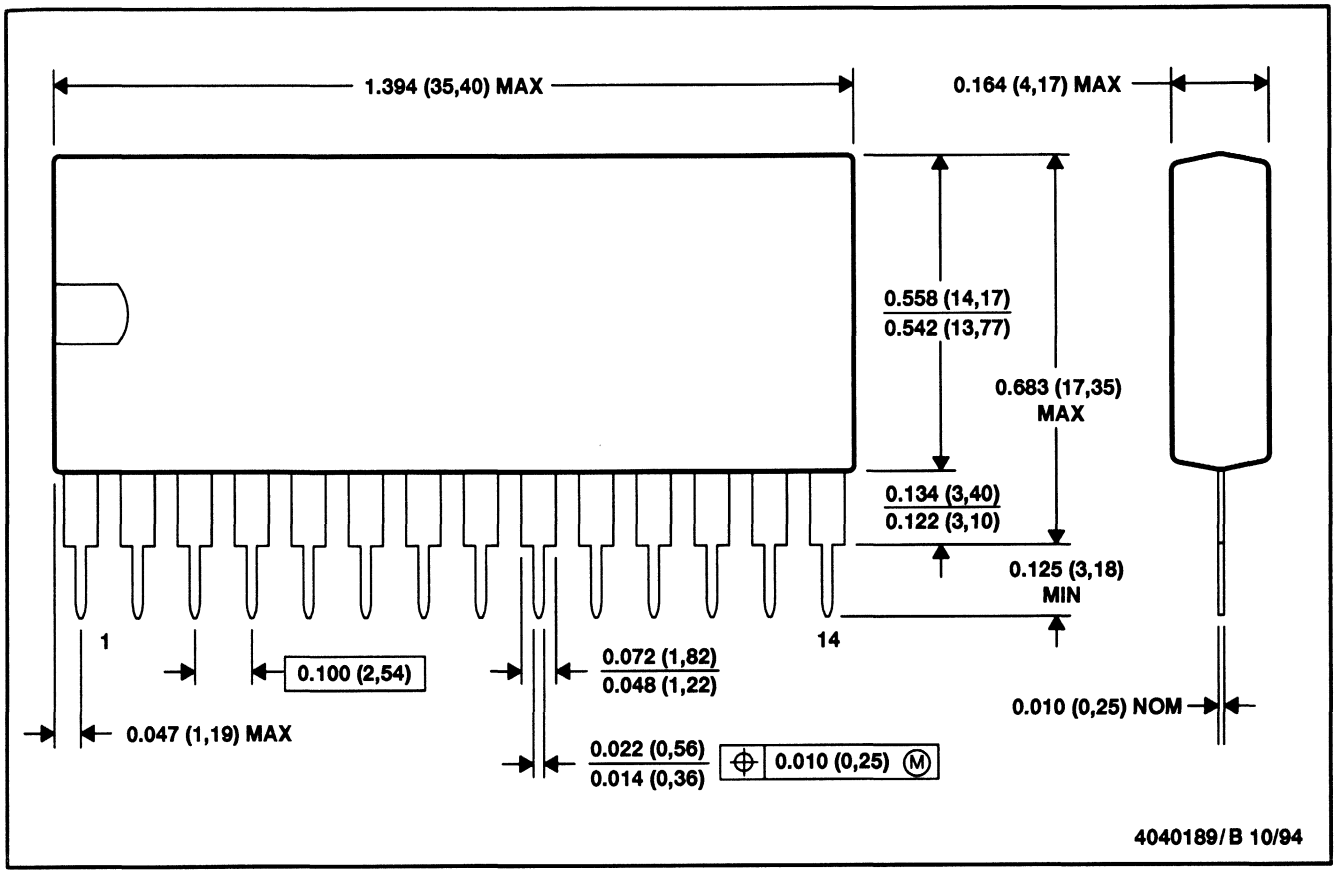
SC (R-PSIP-T10) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

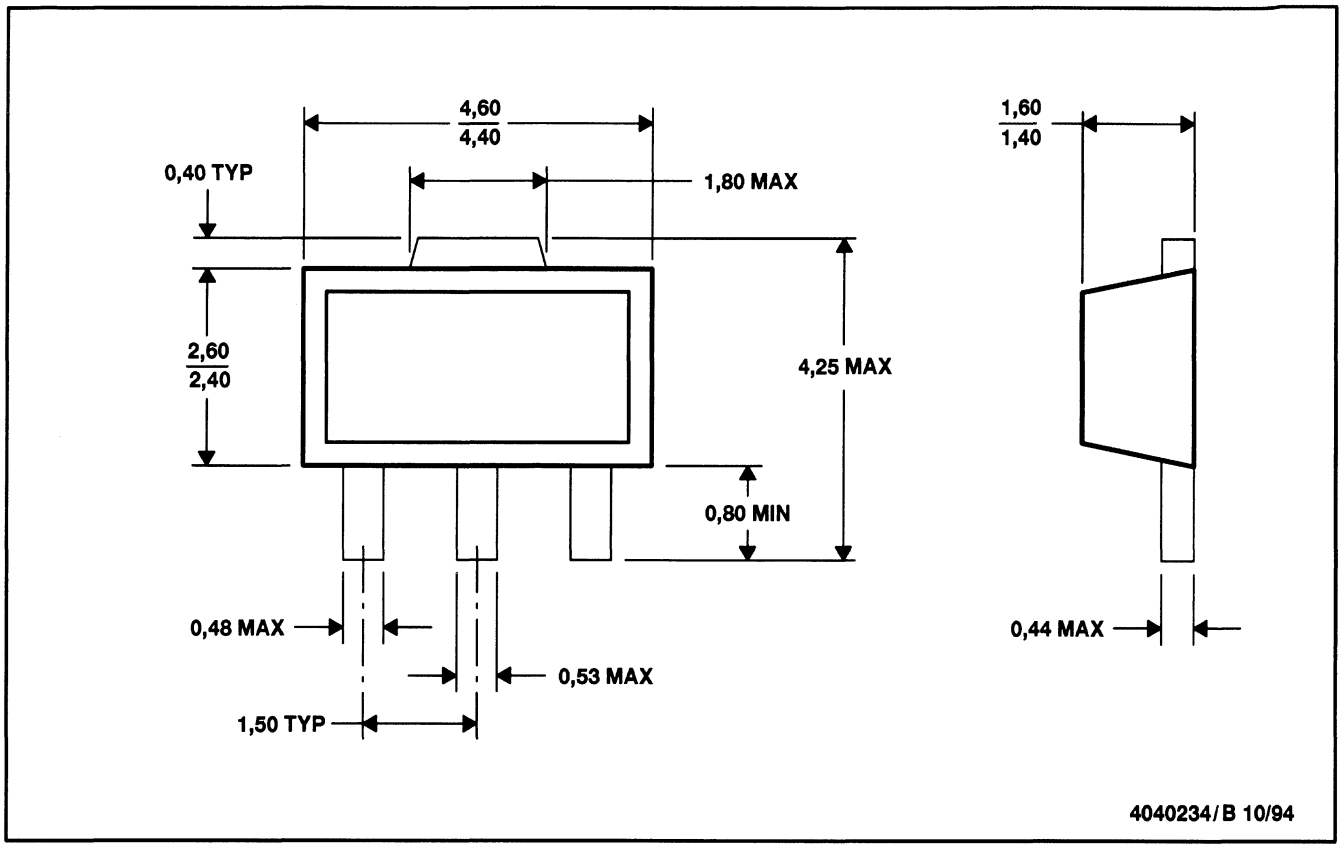
SM (R-PSIP-T14) **PLASTIC SINGLE-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

PK (R-PSSO-F3) **PLASTIC SINGLE-IN-LINE PACKAGE**

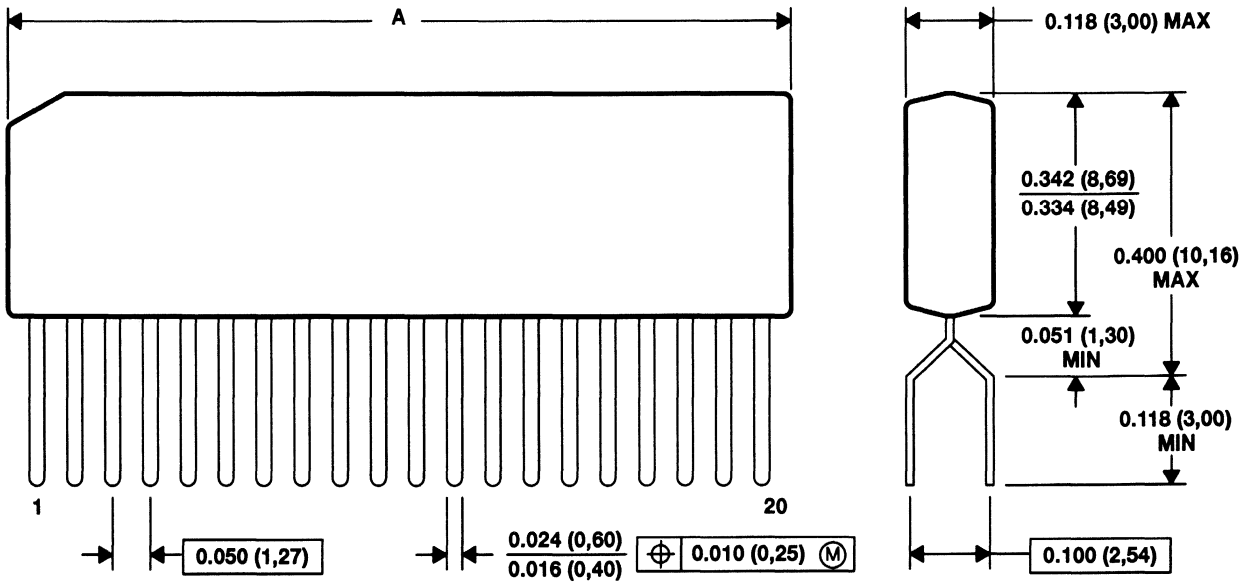


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. The center lead is in electrical contact with the tab.

OCTOBER 1994

SD (R-PZIP-T)** **PLASTIC ZIG-ZAG IN-LINE PACKAGE**

20 PIN SHOWN



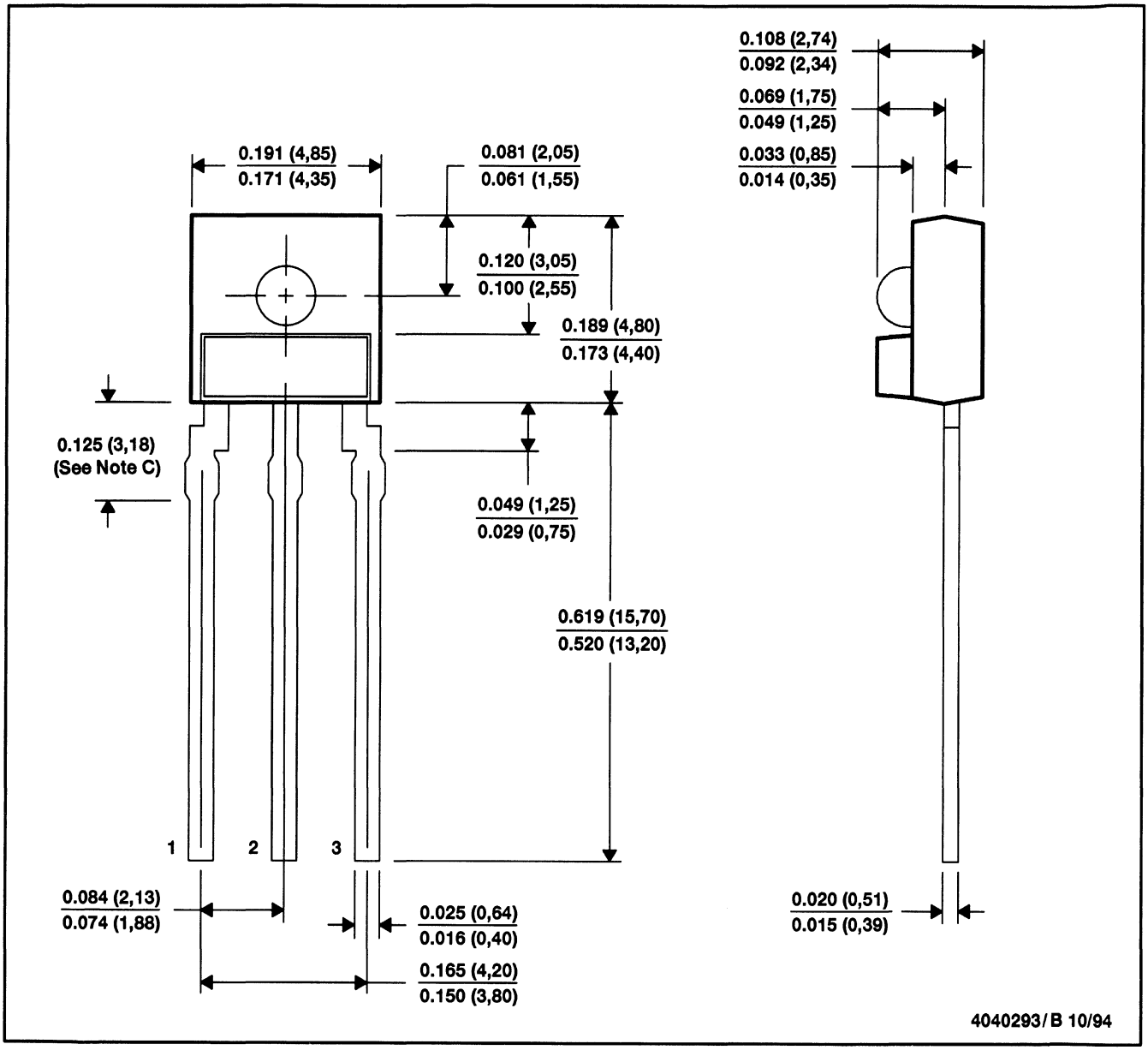
DIM \ PINS **	20	24	28
A MAX	1.050 (26,67)	1.250 (31,75)	1.450 (36,83)

4040206/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

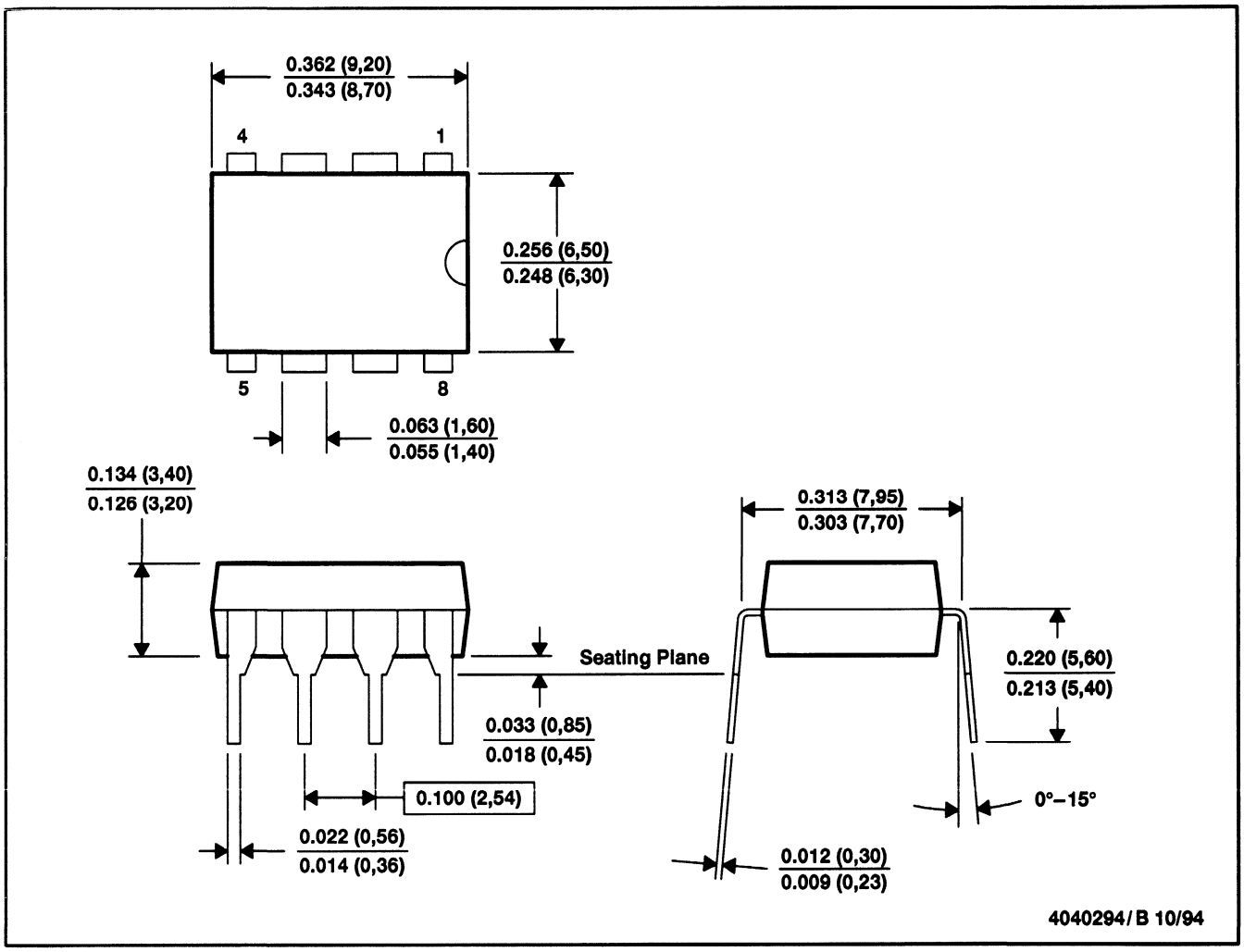
SR (R-PSIP-T3) **PLASTIC SINGLE-IN-LINE PACKAGE (OPTO)**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Lead dimensions are not controlled within this area.
D. All dimensions apply before solder dip.
E. Package body is a clear nonfilled optically transparent material

OCTOBER 1994

NU (R-PDIP-T8) **PLASTIC DUAL-IN-LINE PACKAGE (OPTO)**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. All dimensions apply before solder dip.
D. Package body is a clear non-filled optically transparent material.
E. Optical center is determined by lead frame design.

4 Ceramic Surface-Mount

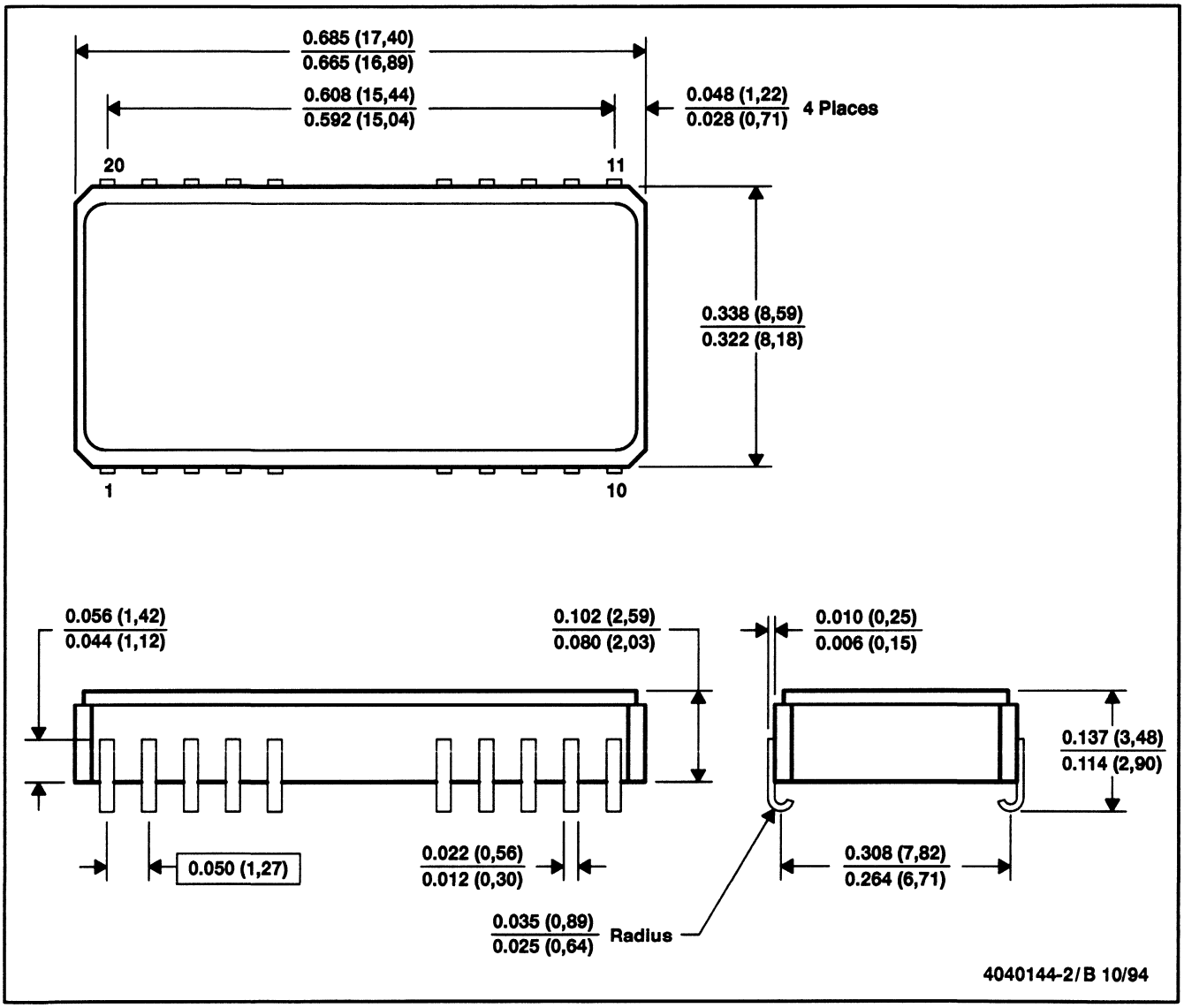
CONTENTS

CONTENTS

TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

OCTOBER 1994

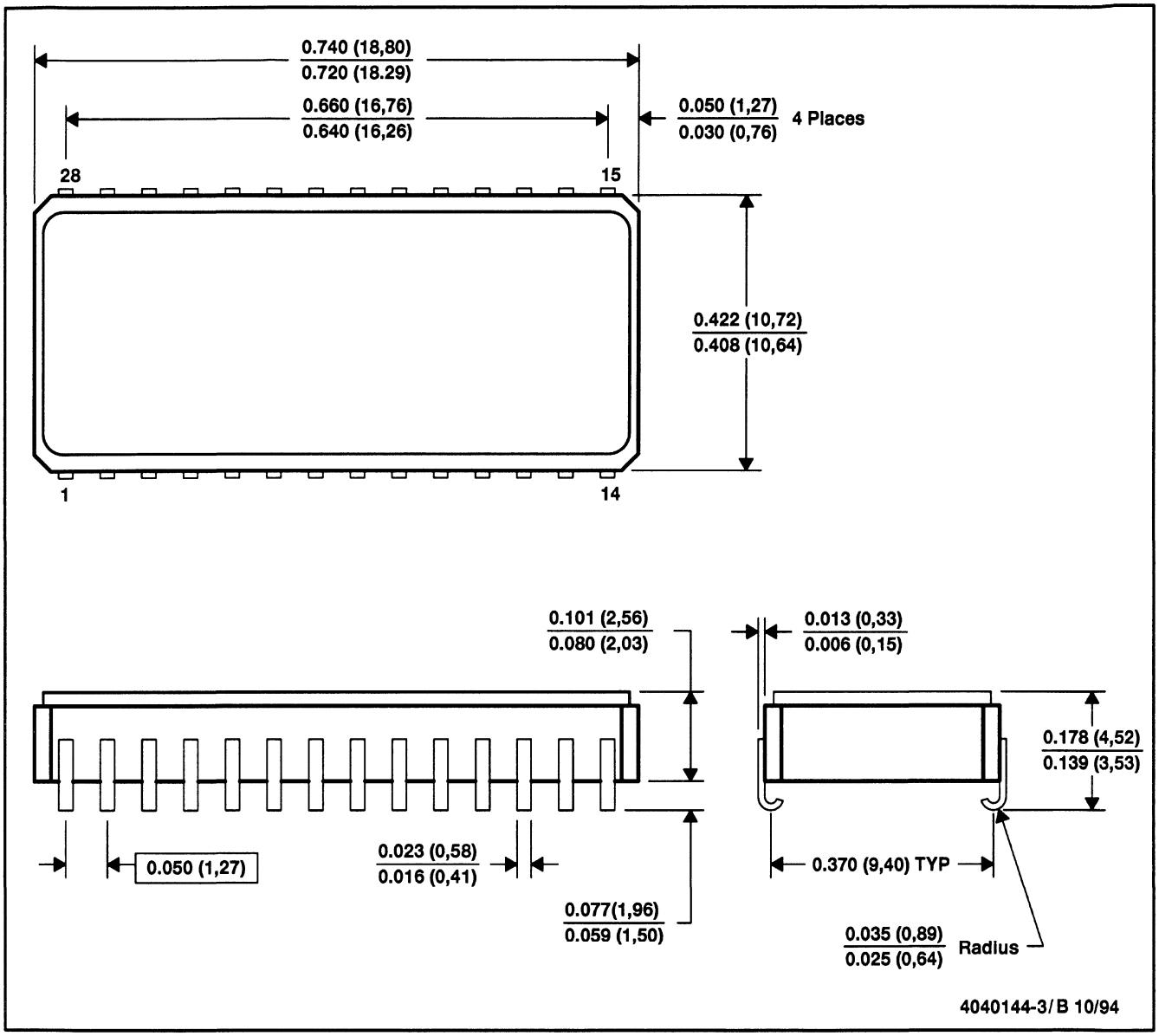
HJ (R-CDCC-J20) **J-LEADED CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals will be gold plated.

OCTOBER 1994

HJ (R-CDCC-J28) J-LEADED CERAMIC CHIP CARRIER



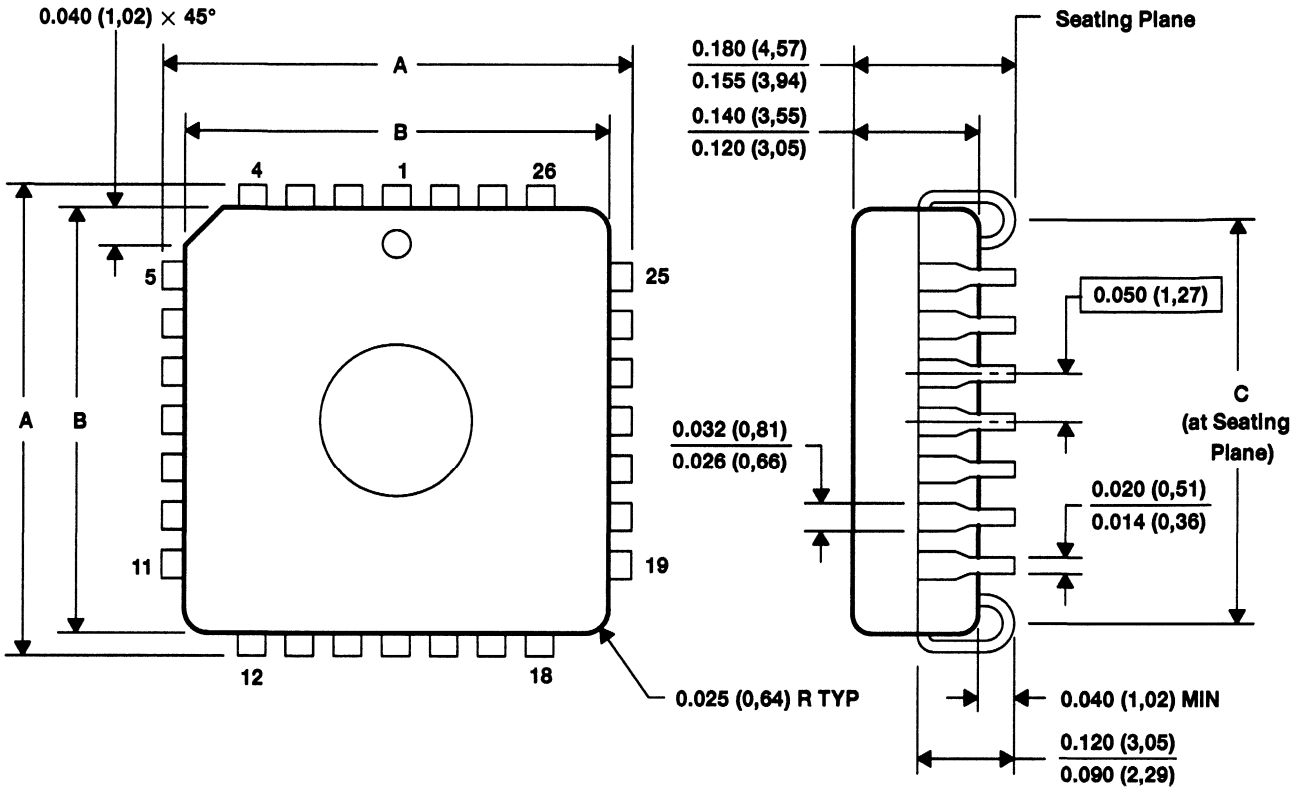
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals will be gold plated.

OCTOBER 1994

FZ (S-CQCC-J**)

J-LEADED CERAMIC CHIP CARRIER

28 LEAD SHOWN



JEDEC OUTLINE	NO. OF PINS**	A		B		C	
		MIN	MAX	MIN	MAX	MIN	MAX
MO-087AA	28	0.485 (12,32)	0.495 (12,57)	0.430 (10,92)	0.455 (11,56)	0.410 (10,41)	0.430 (10,92)
MO-087AB	44	0.685 (17,40)	0.695 (17,65)	0.630 (16,00)	0.655 (16,64)	0.610 (15,49)	0.630 (16,00)
MO-087AD	68	0.985 (25,02)	0.995 (25,27)	0.930 (23,62)	0.955 (24,26)	0.910 (23,11)	0.930 (23,62)

4040219/B 10/94

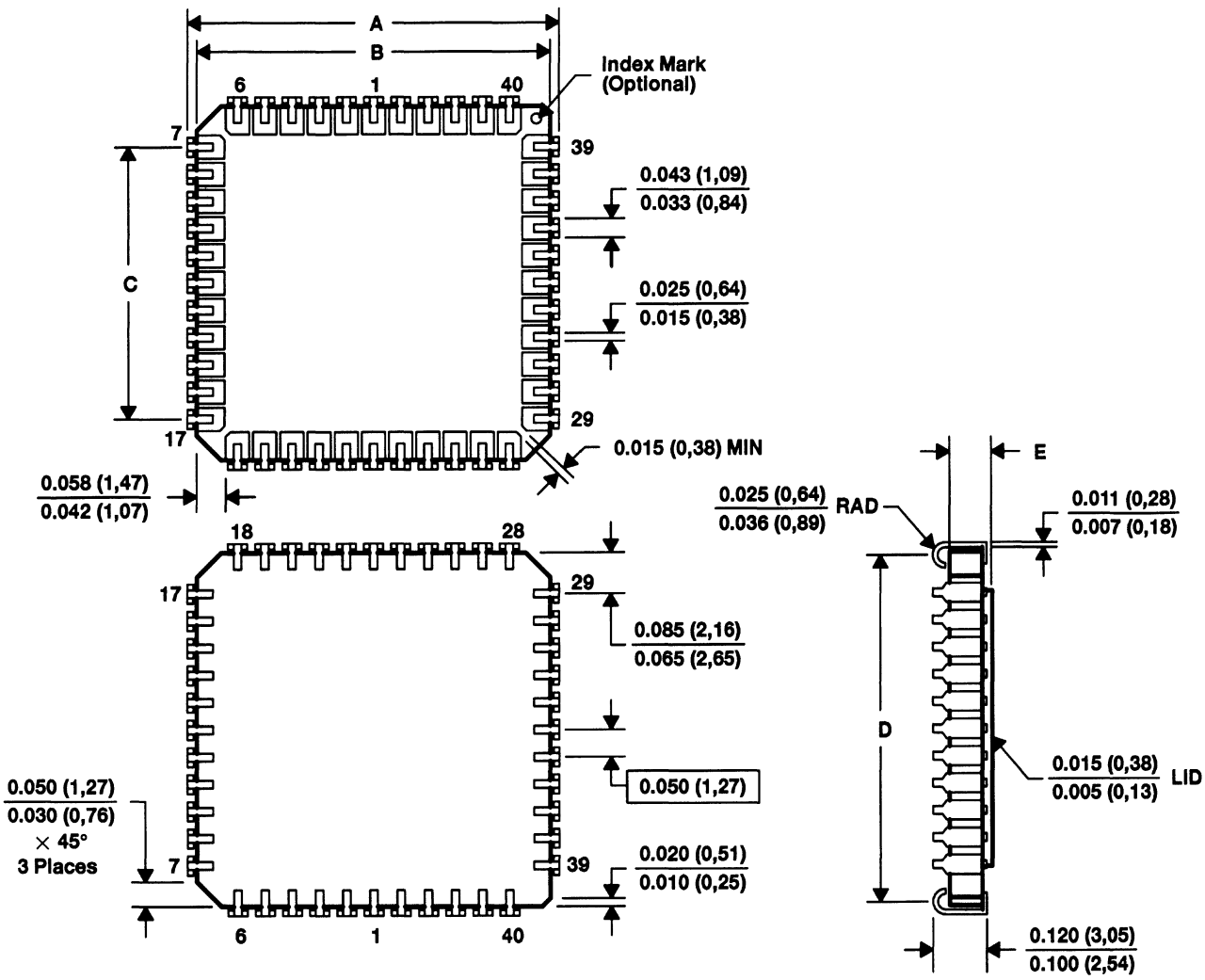
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.

OCTOBER 1994

FJ (S-CQCC-J**)

J-LEADED CERAMIC CHIP CARRIER

44 PIN SHOWN



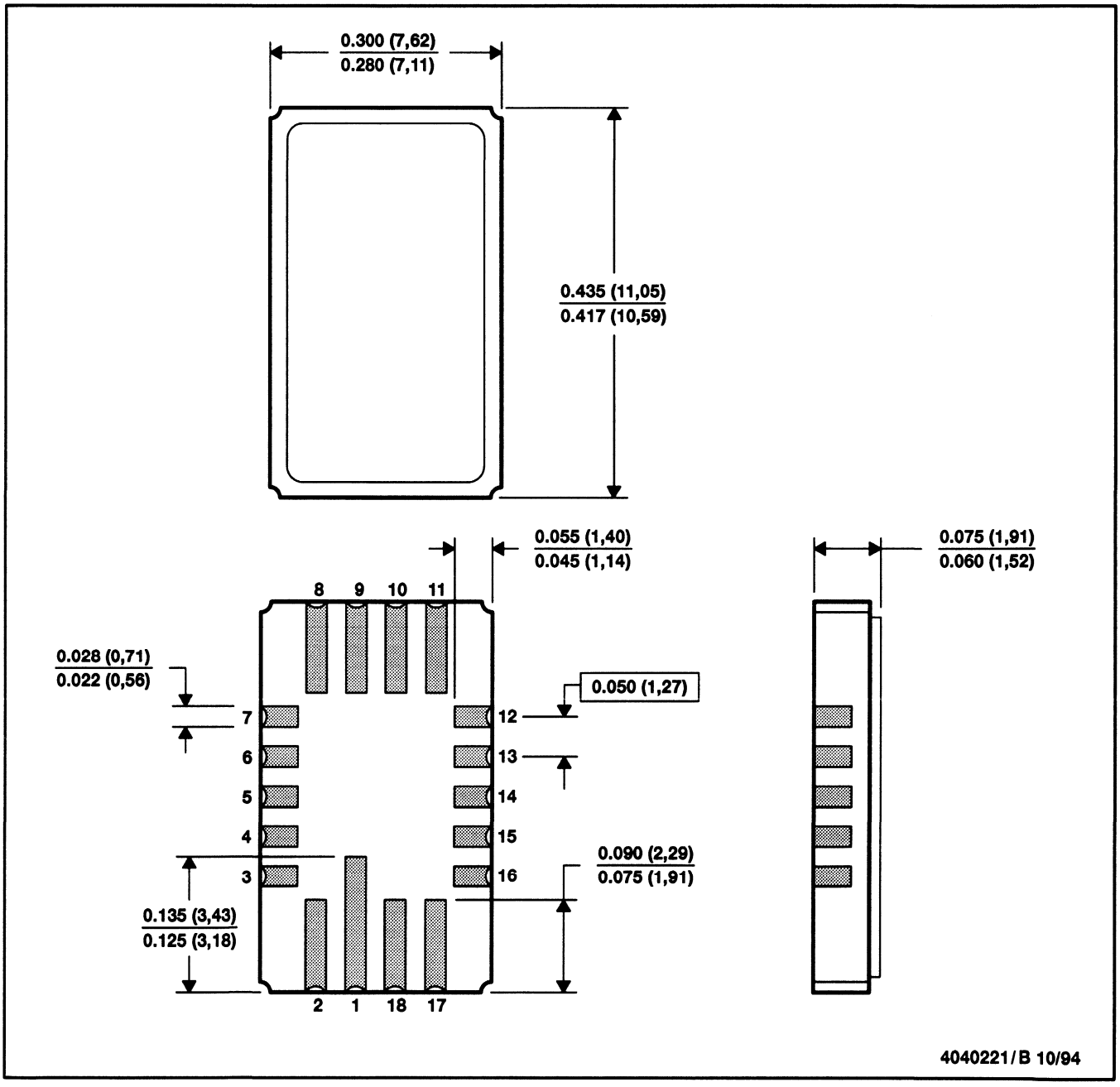
DIM / PINS **	A		B		C		D		E	
	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
44	0.700 (17,78)	0.680 (17,27)	0.659 (16,74)	0.641 (16,28)	0.507 (12,88)	0.495 (12,57)	0.650 (16,51)	0.610 (15,49)	0.080 (2,03)	0.060 (1,52)
68	1.000 (25,40)	0.980 (24,89)	0.965 (24,51)	0.940 (23,88)	0.808 (20,52)	0.795 (20,19)	0.950 (24,13)	0.910 (23,11)	0.095 (2,41)	0.075 (1,91)

4040139/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor

OCTOBER 1994

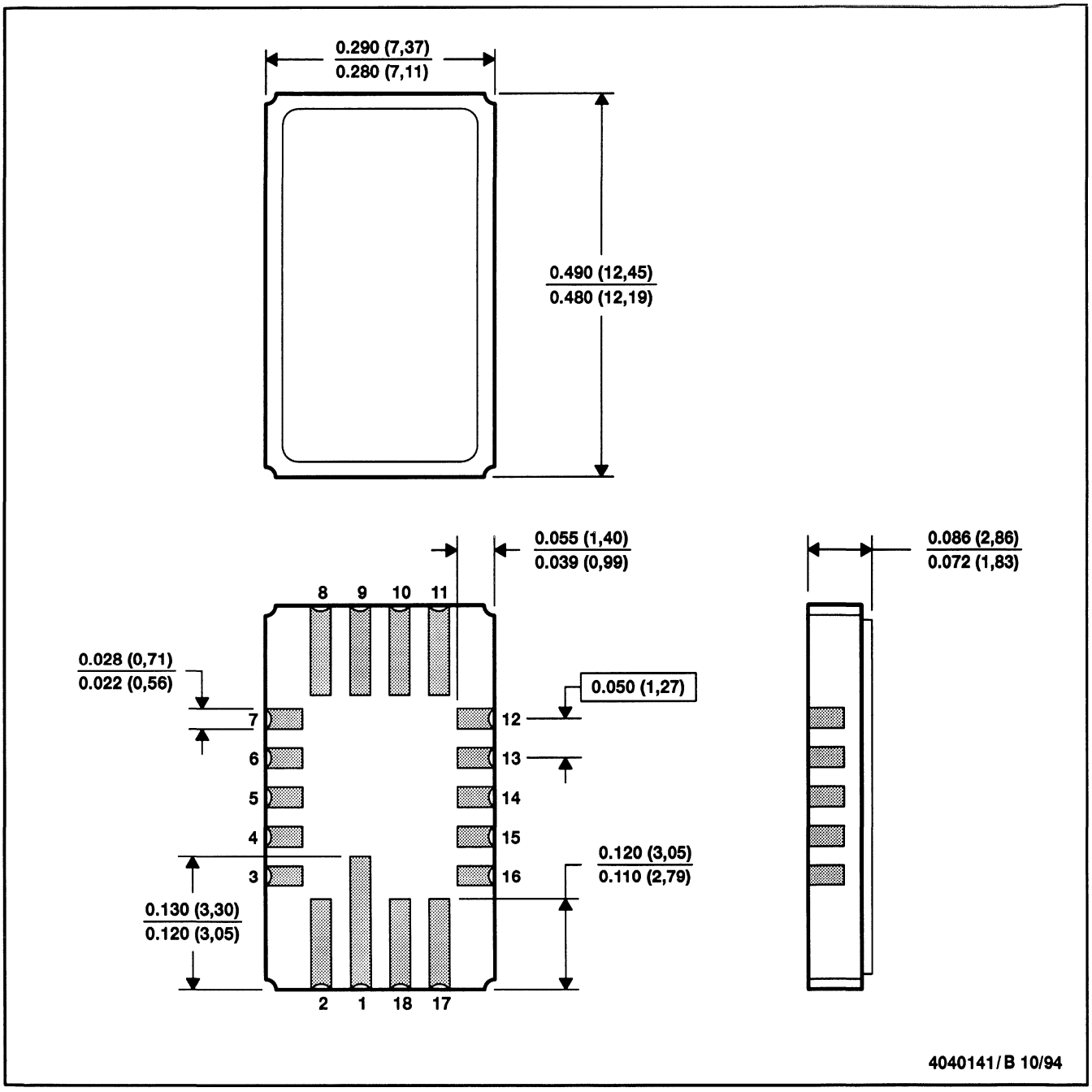
FG (R-CQCC-N18) **LEADLESS CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within MIL STD 1835 CQCC4-N18 and JEDEC MO-041AC

OCTOBER 1994

FV (R-CQCC-N18) **LEADLESS CERAMIC CHIP CARRIER**



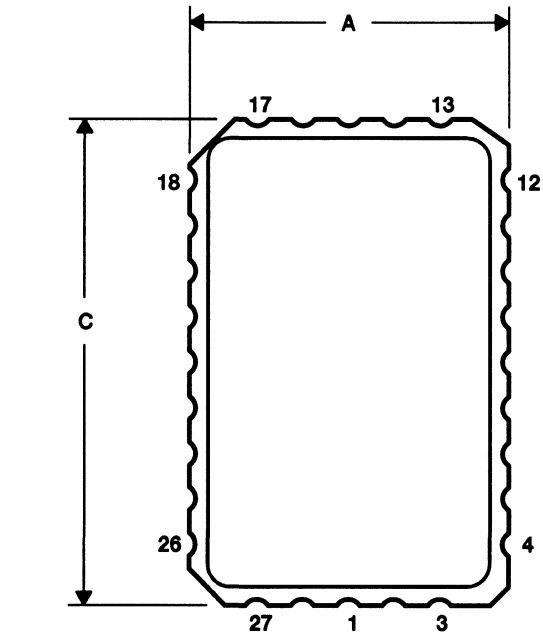
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

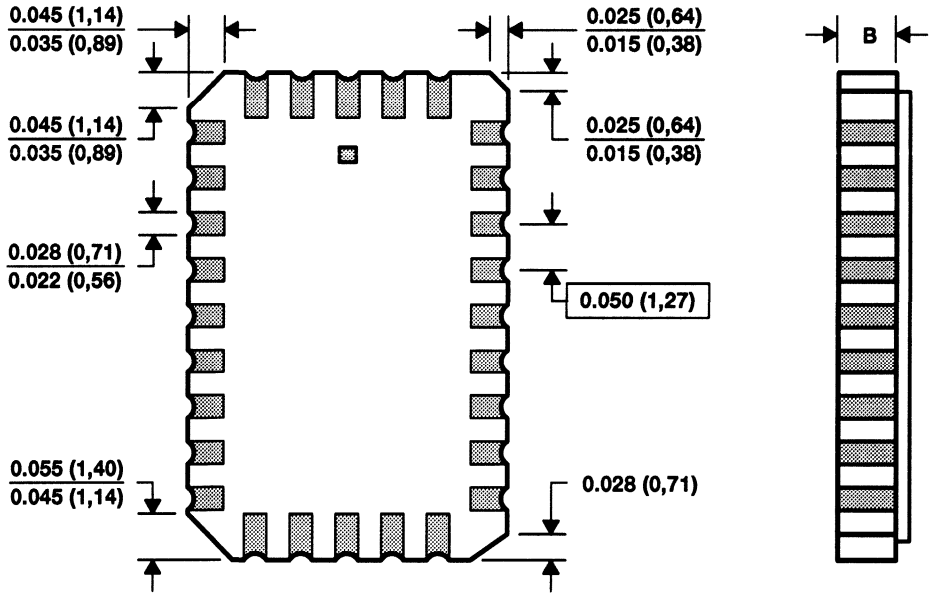
FE (R-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B		C	
	MIN	MAX	MIN	MAX	MIN	MAX
18	0.285 (7,24)	0.295 (7,49)	0.061 (1,55)	0.073 (1,85)	0.345 (8,76)	0.365 (9,27)
28	0.345 (8,76)	0.355 (9,02)	0.065 (1,65)	0.079 (2,01)	0.540 (13,72)	0.560 (14,22)
32	0.445 (11,30)	0.455 (11,56)	0.065 (1,65)	0.079 (2,21)	0.540 (13,72)	0.560 (14,22)



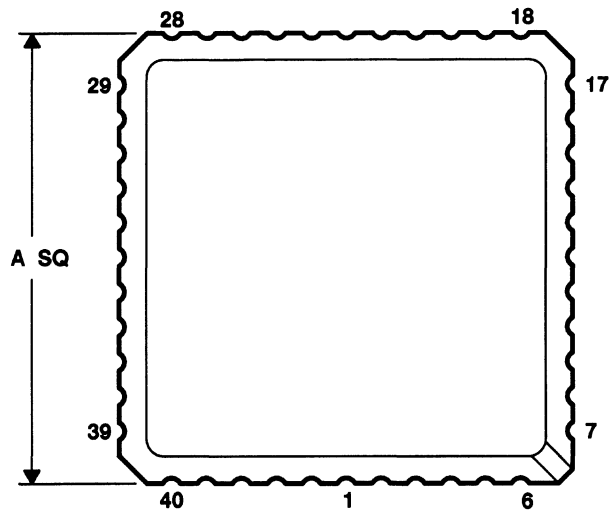
4040137/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

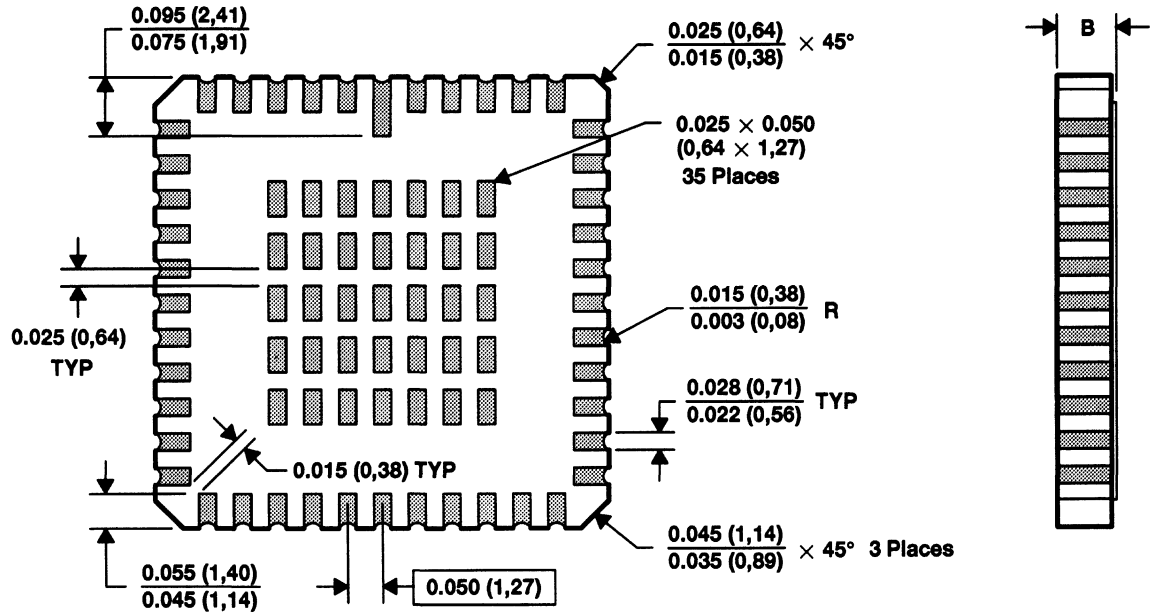
OCTOBER 1994

FD (S-CQCC-N**) LEADLESS CERAMIC CHIP CARRIER

44 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.064 (1,63)	0.080 (2,03)
28	0.442 (11,23)	0.458 (11,63)	0.064 (1,63)	0.080 (2,03)
44	0.640 (16,26)	0.660 (16,76)	0.069 (1,75)	0.120 (3,05)
52	0.739 (18,78)	0.761 (19,33)	0.082 (2,08)	0.120 (3,05)
68	0.938 (28,83)	0.962 (24,43)	0.082 (2,08)	0.120 (3,05)
84	1.135 (28,83)	1.165 (29,59)	0.082 (2,08)	0.120 (3,05)



4040136/B 10/94

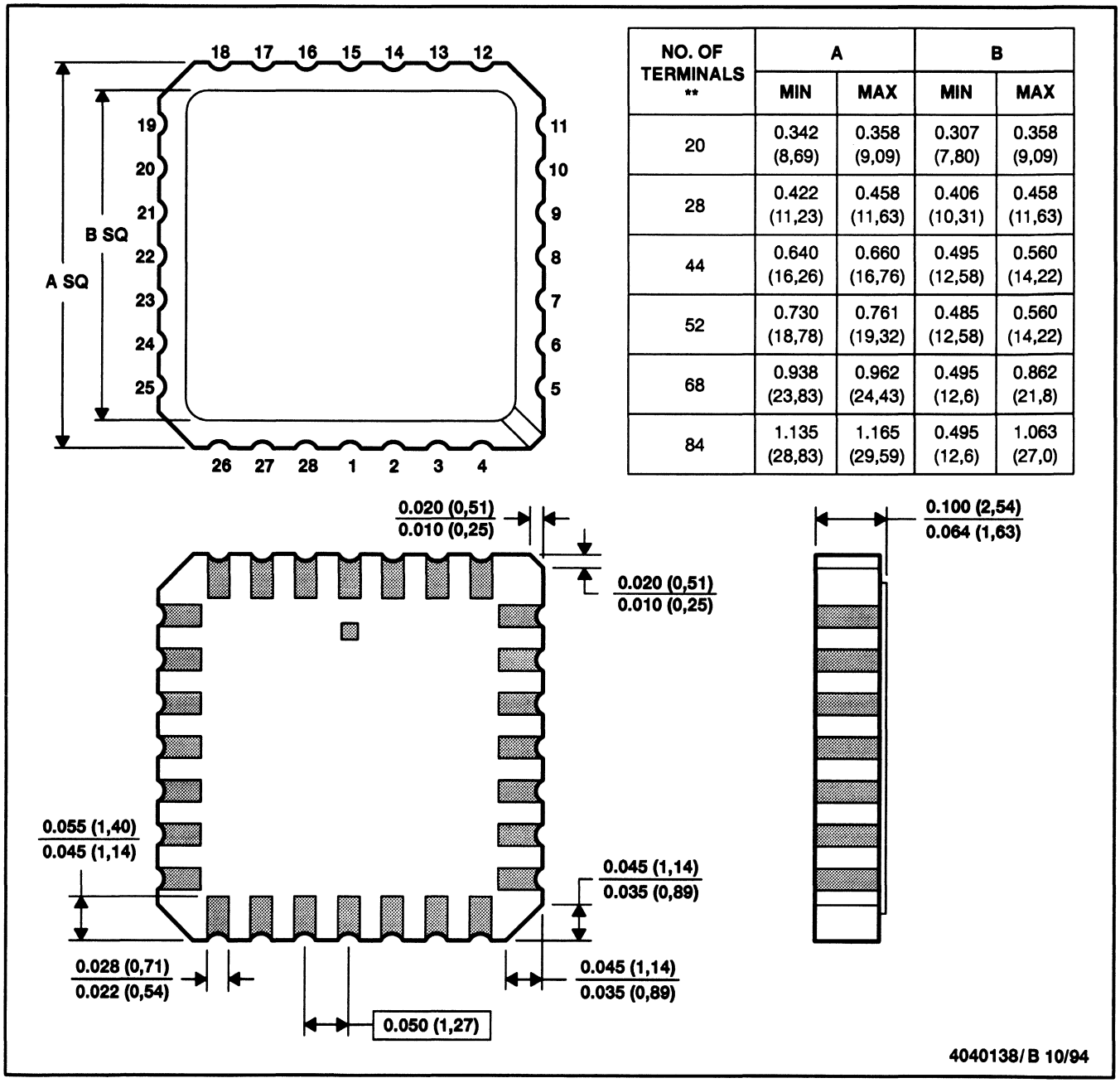
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

OCTOBER 1994

FH (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.422 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.730 (18,78)	0.761 (19,32)	0.485 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.495 (12,6)	0.862 (21,8)
84	1.135 (28,83)	1.165 (29,59)	0.495 (12,6)	1.063 (27,0)

4040138/B 10/94

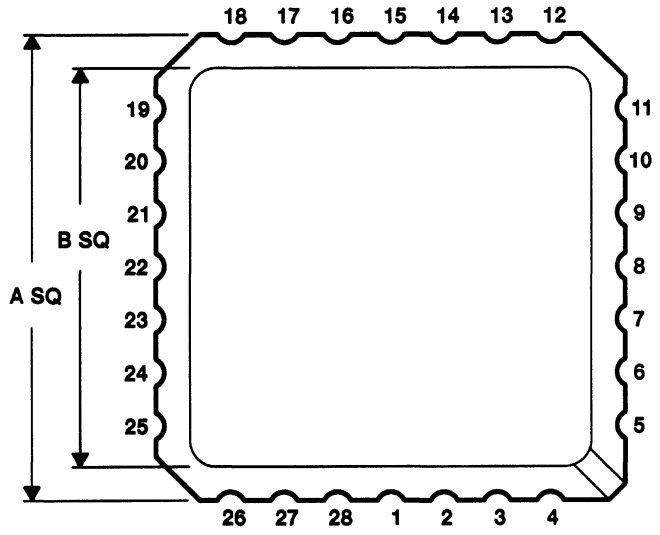
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

OCTOBER 1994

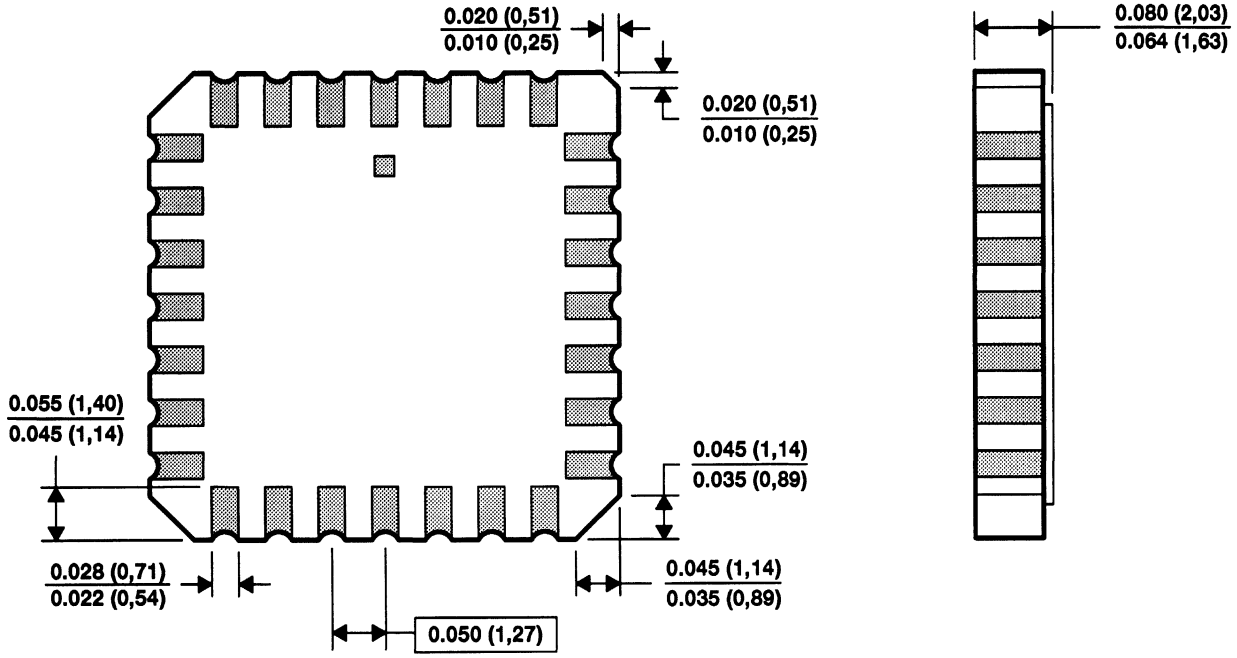
FK (S-CQCC-N**)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



NO. OF TERMINALS **	A		B	
	MIN	MAX	MIN	MAX
20	0.342 (8,69)	0.358 (9,09)	0.307 (7,80)	0.358 (9,09)
28	0.422 (11,23)	0.458 (11,63)	0.406 (10,31)	0.458 (11,63)
44	0.640 (16,26)	0.660 (16,76)	0.495 (12,58)	0.560 (14,22)
52	0.730 (18,78)	0.761 (19,32)	0.485 (12,58)	0.560 (14,22)
68	0.938 (23,83)	0.962 (24,43)	0.850 (21,6)	0.858 (21,8)
84	1.141 (28,99)	1.165 (29,59)	1.047 (26,6)	1.063 (27,0)

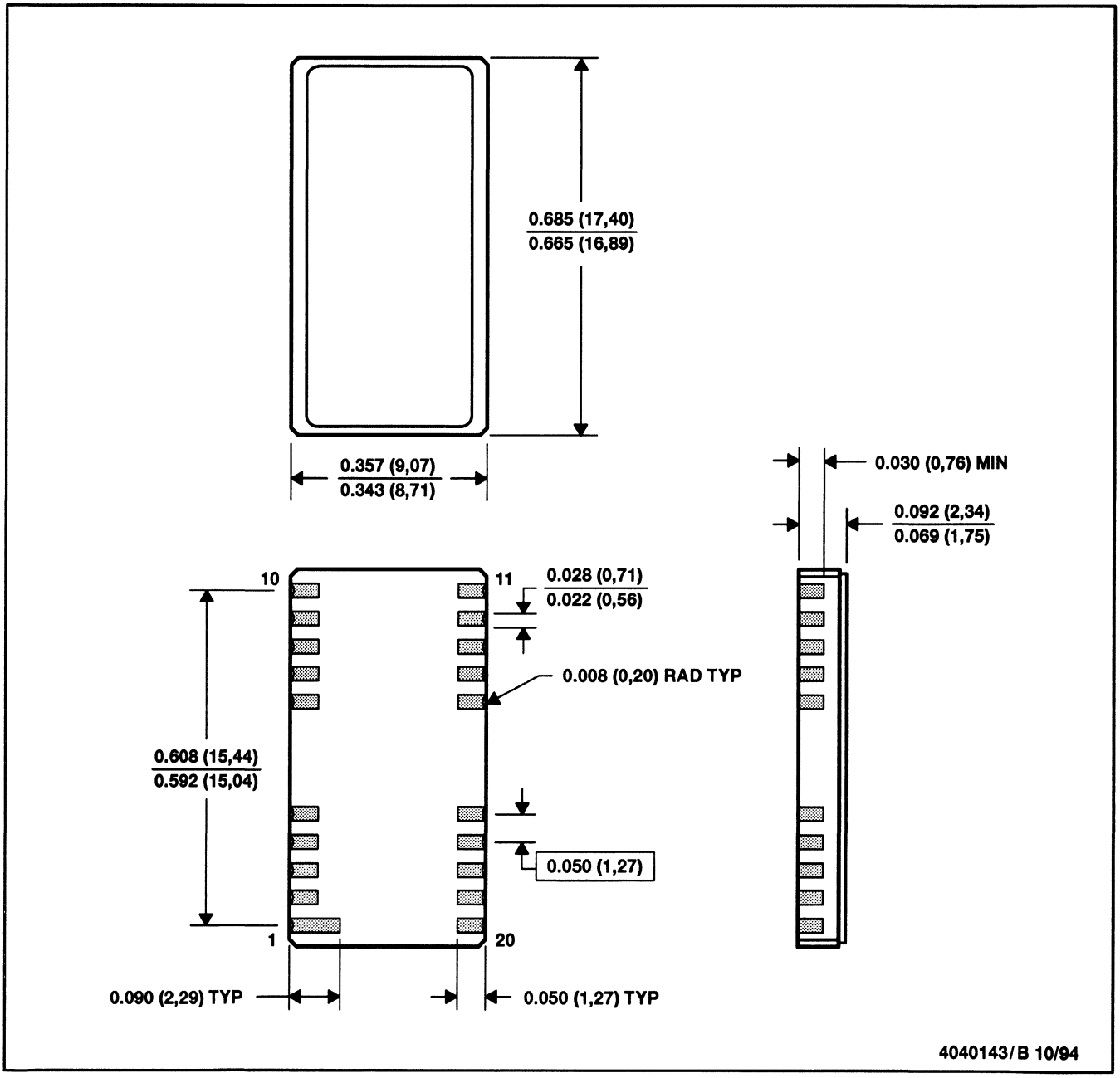


4040140/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MS-004

OCTOBER 1994

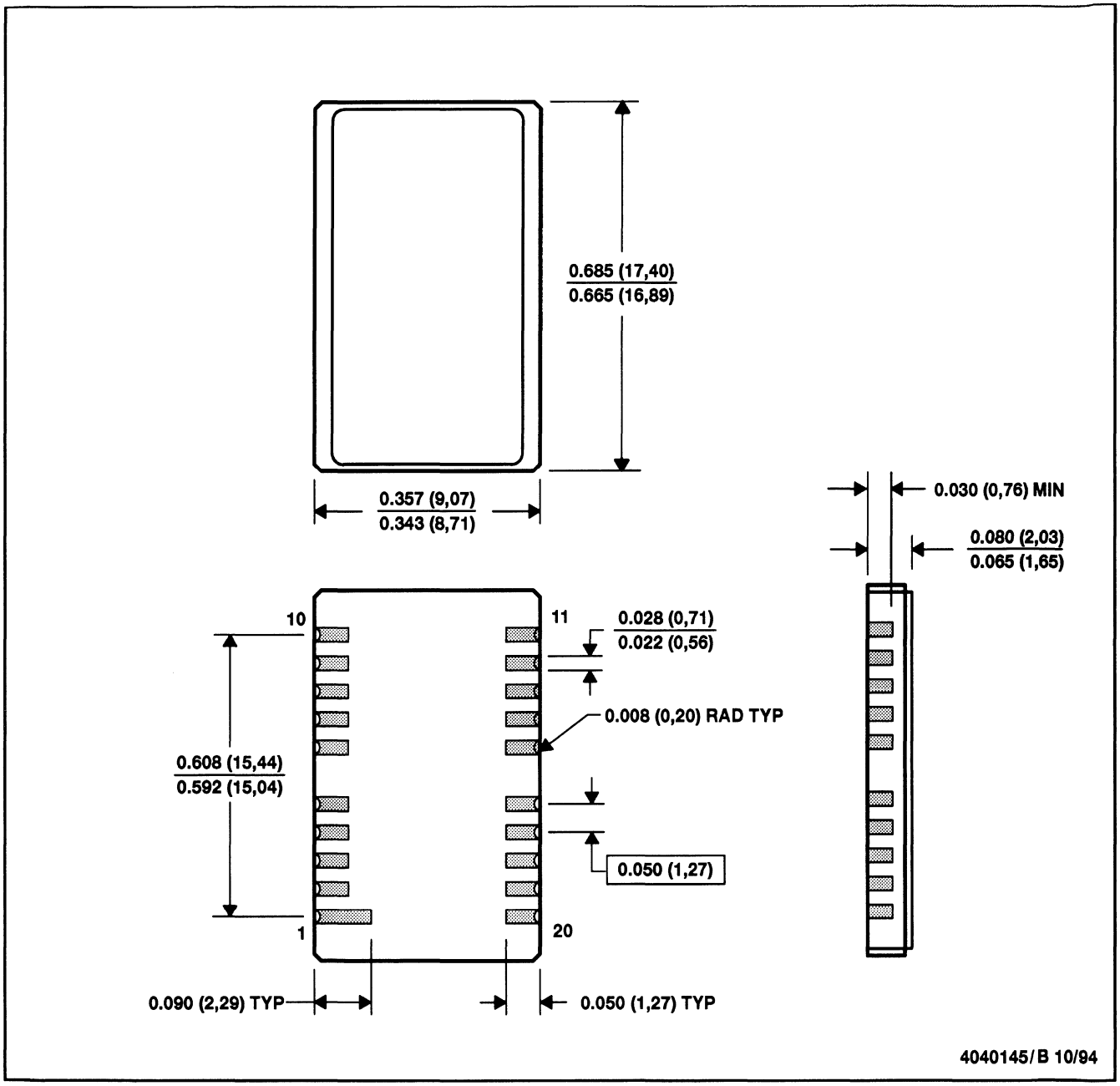
FQ (R-CDCC-N20) **LEADLESS CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

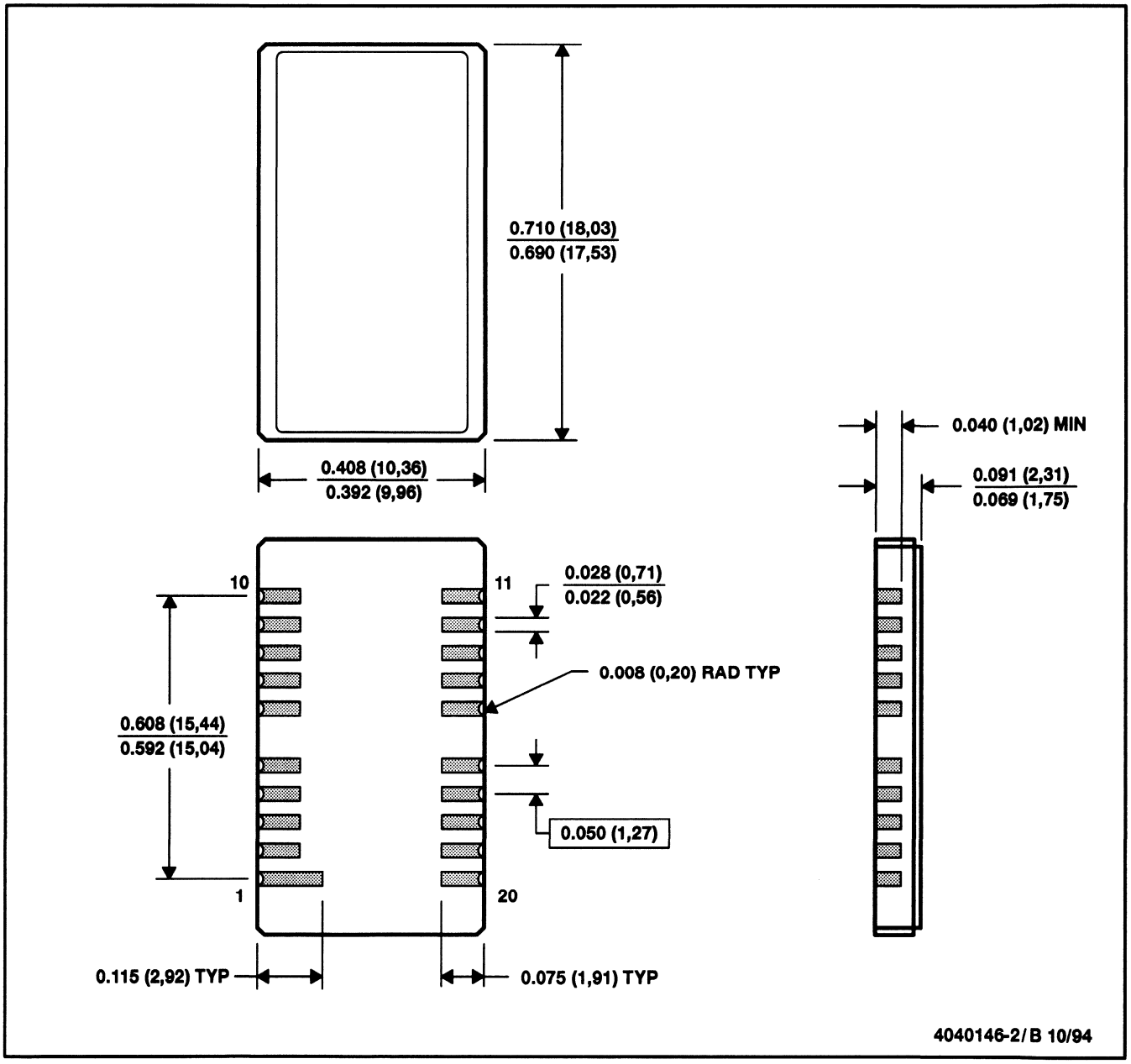
HL (R-CDCC-N20) LEADLESS CERAMIC CHIP CARRIER



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

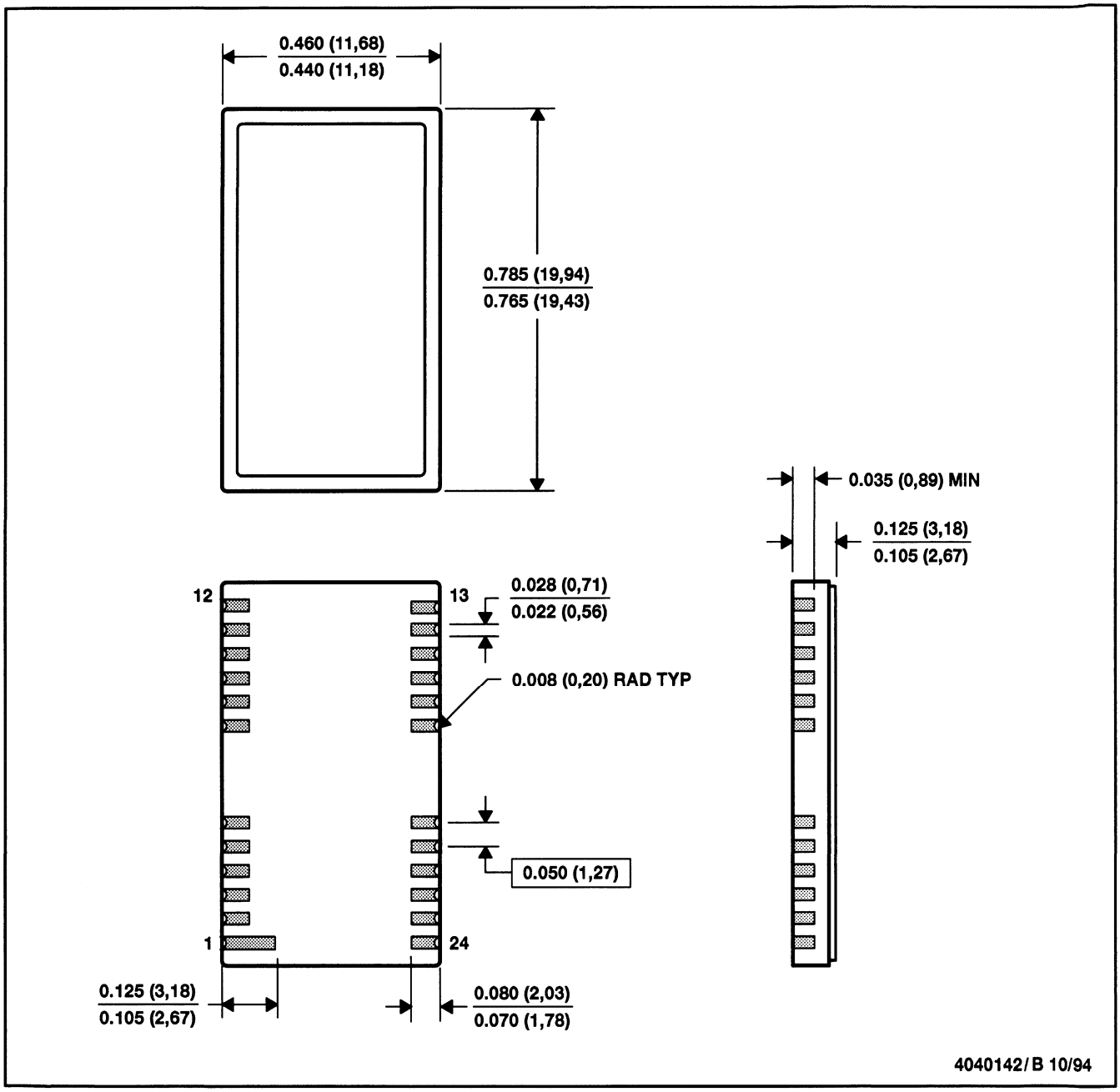
HM (R-CDCC-N20) **LEADLESS CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

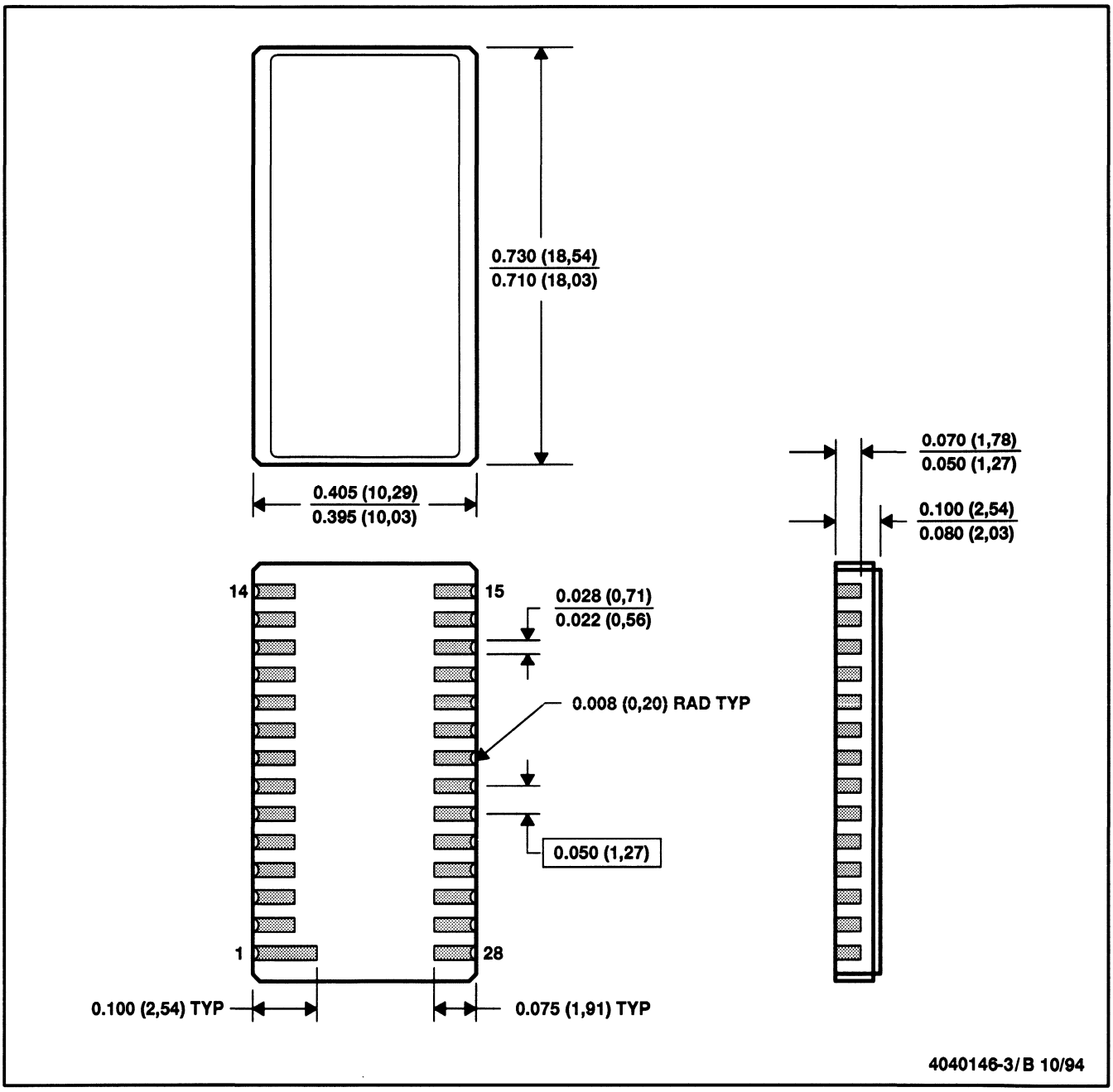
FNC (R-CDCC-N24/28) **LEADLESS CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

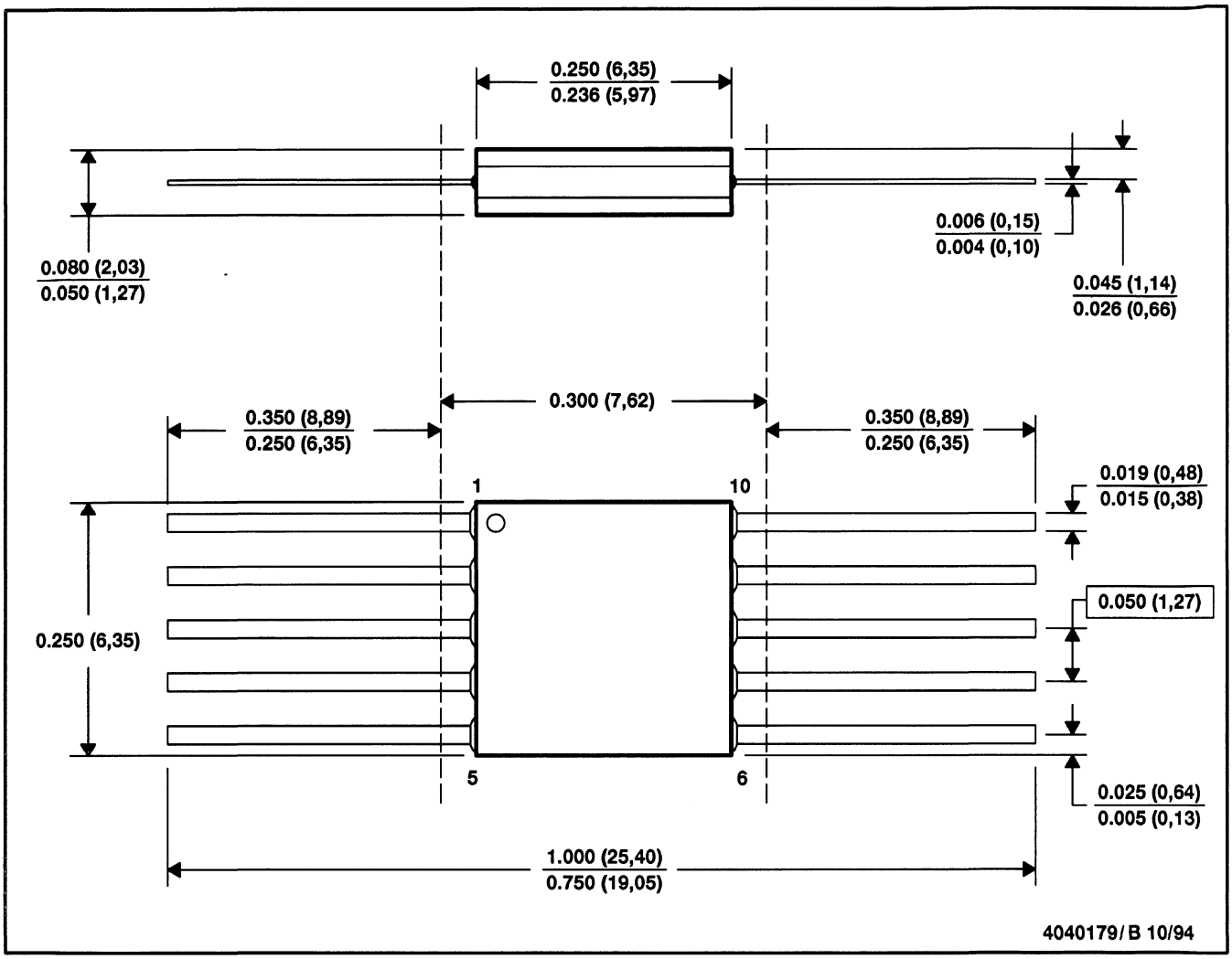
HM (R-CDCC-N28) **LEADLESS CERAMIC CHIP CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

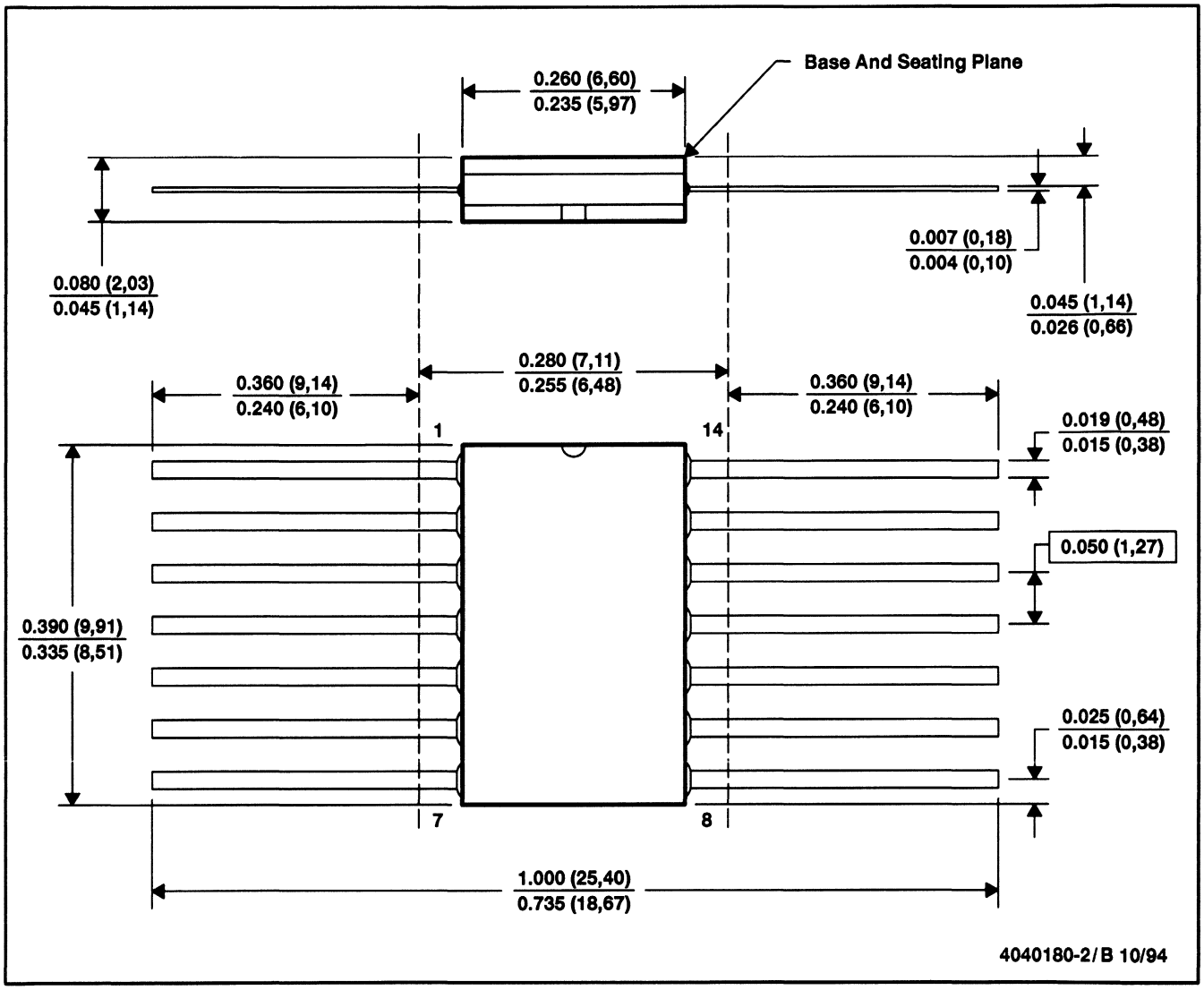
U (S-GDFP-F10) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Falls within MIL STD 1835 GDFP1-F10 and JEDEC MO-092AA

OCTOBER 1994

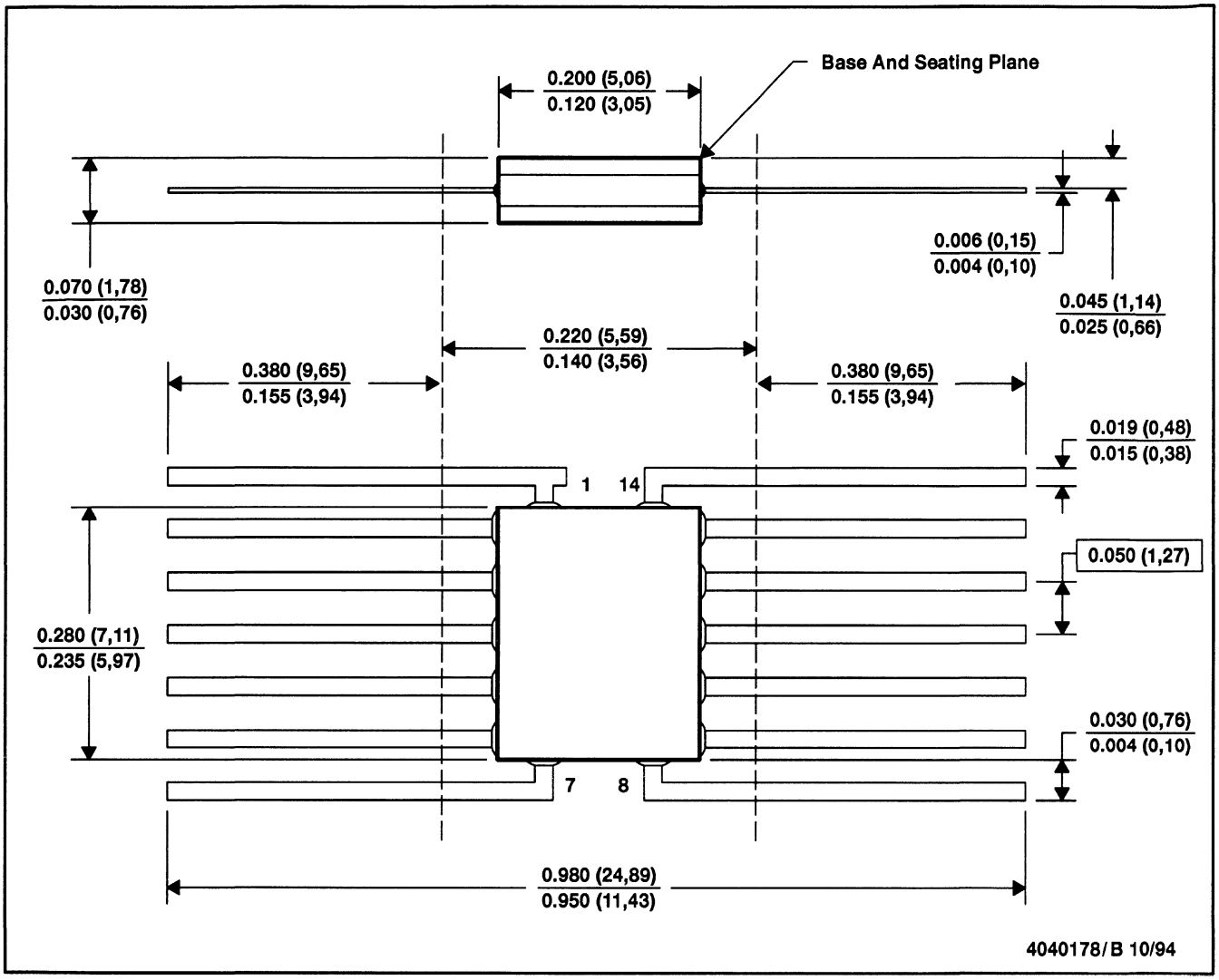
W (R-GDFP-F14) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only
E. Falls within MIL STD 1835 GDFP1-F14 and JEDEC MO-092AB

OCTOBER 1994

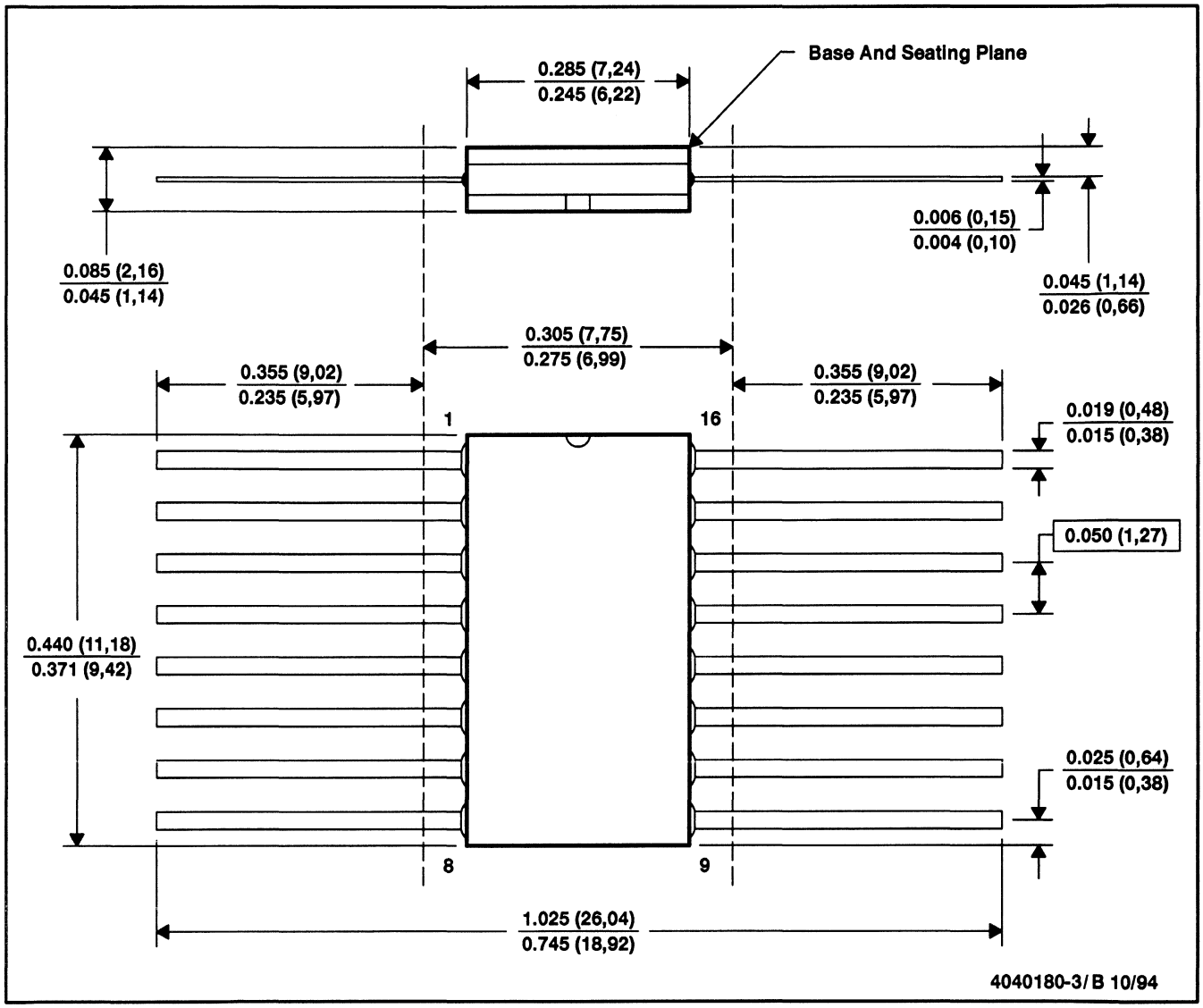
WA (R-GDFP-F14) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

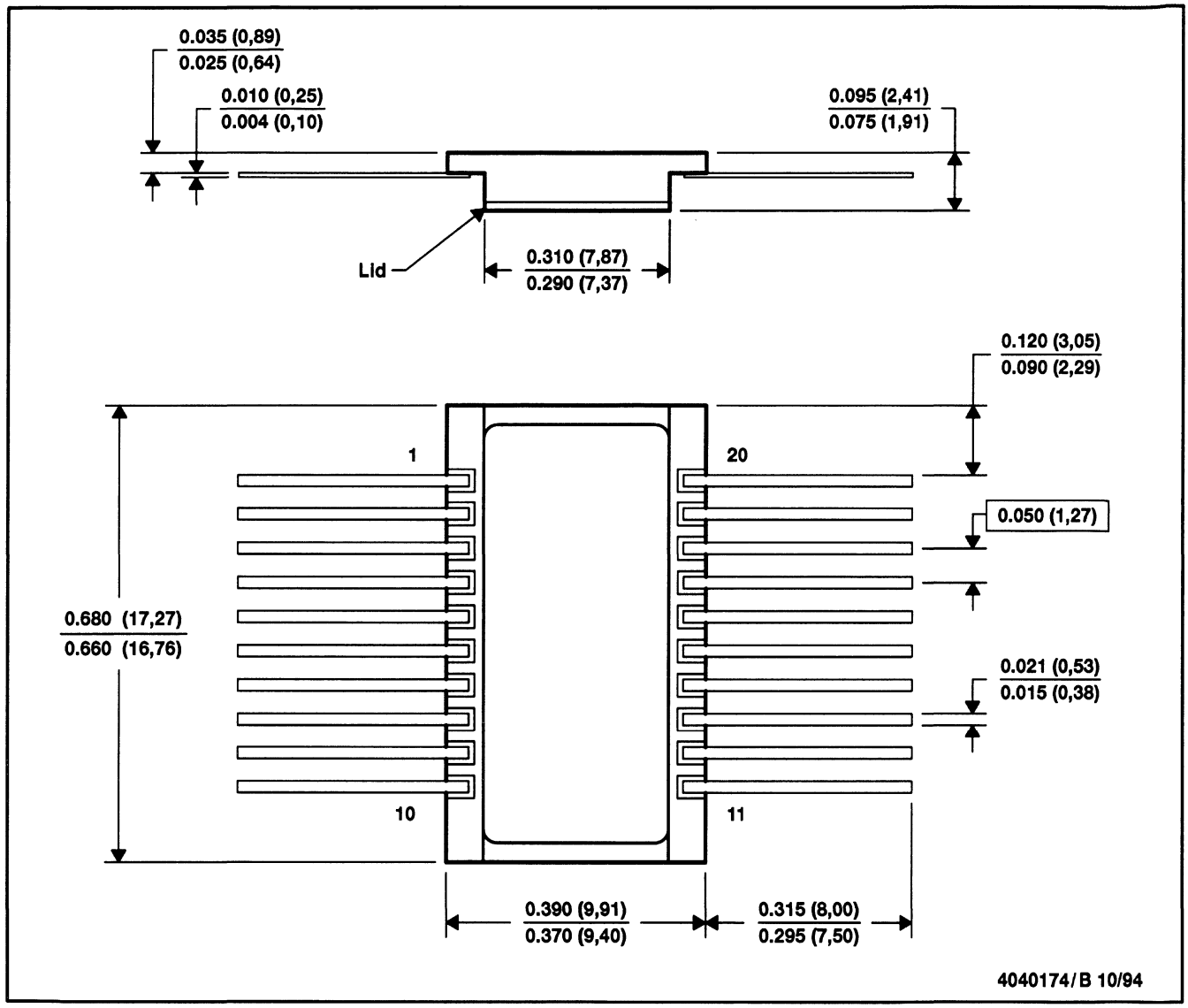
W (R-GDFP-F16) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only
E. Falls within MIL-STD-1835 GDFP1-F16 and JEDEC MO-092AC

OCTOBER 1994

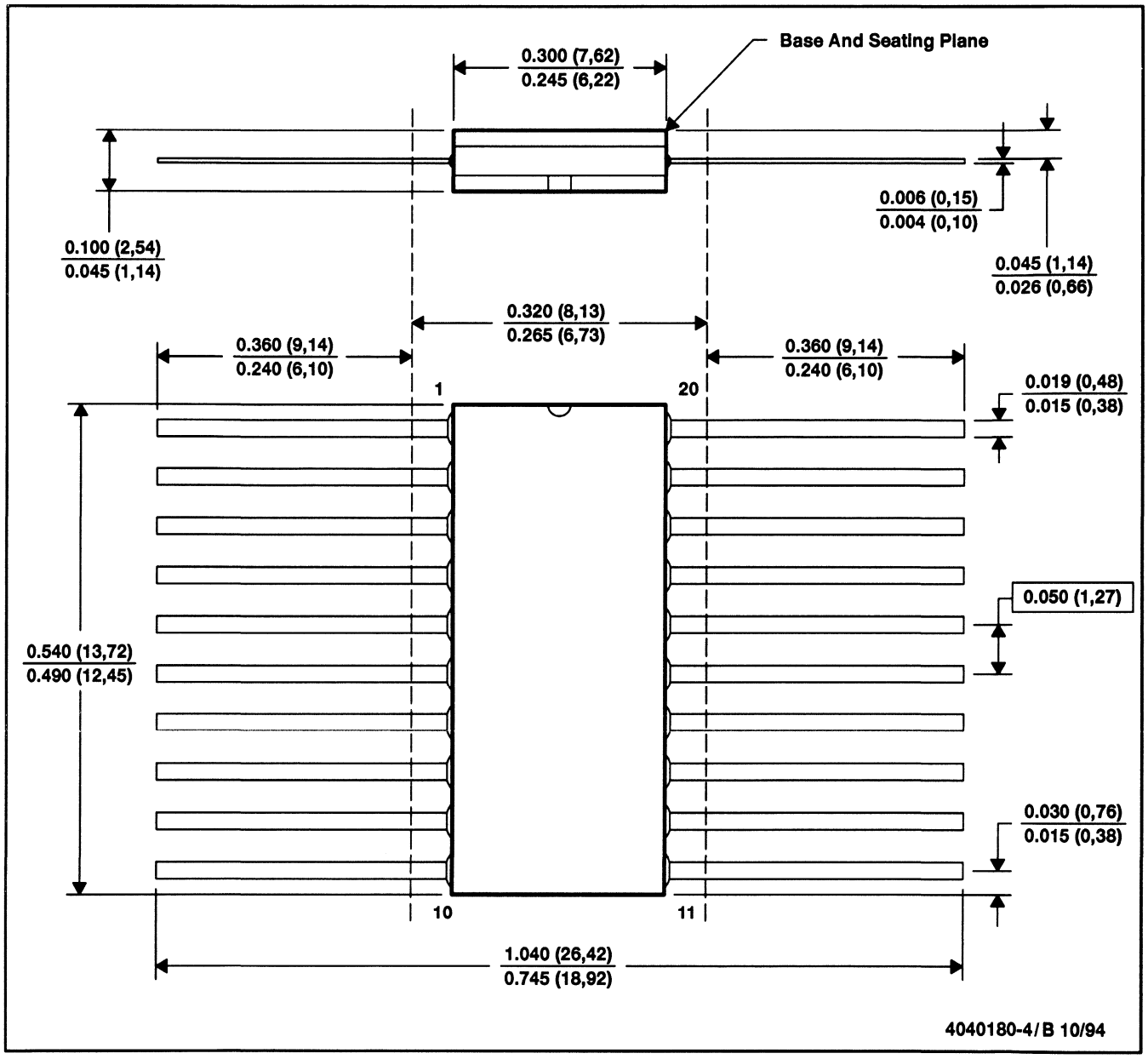
HK (R-CDFP-F20) CERAMIC DUAL FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

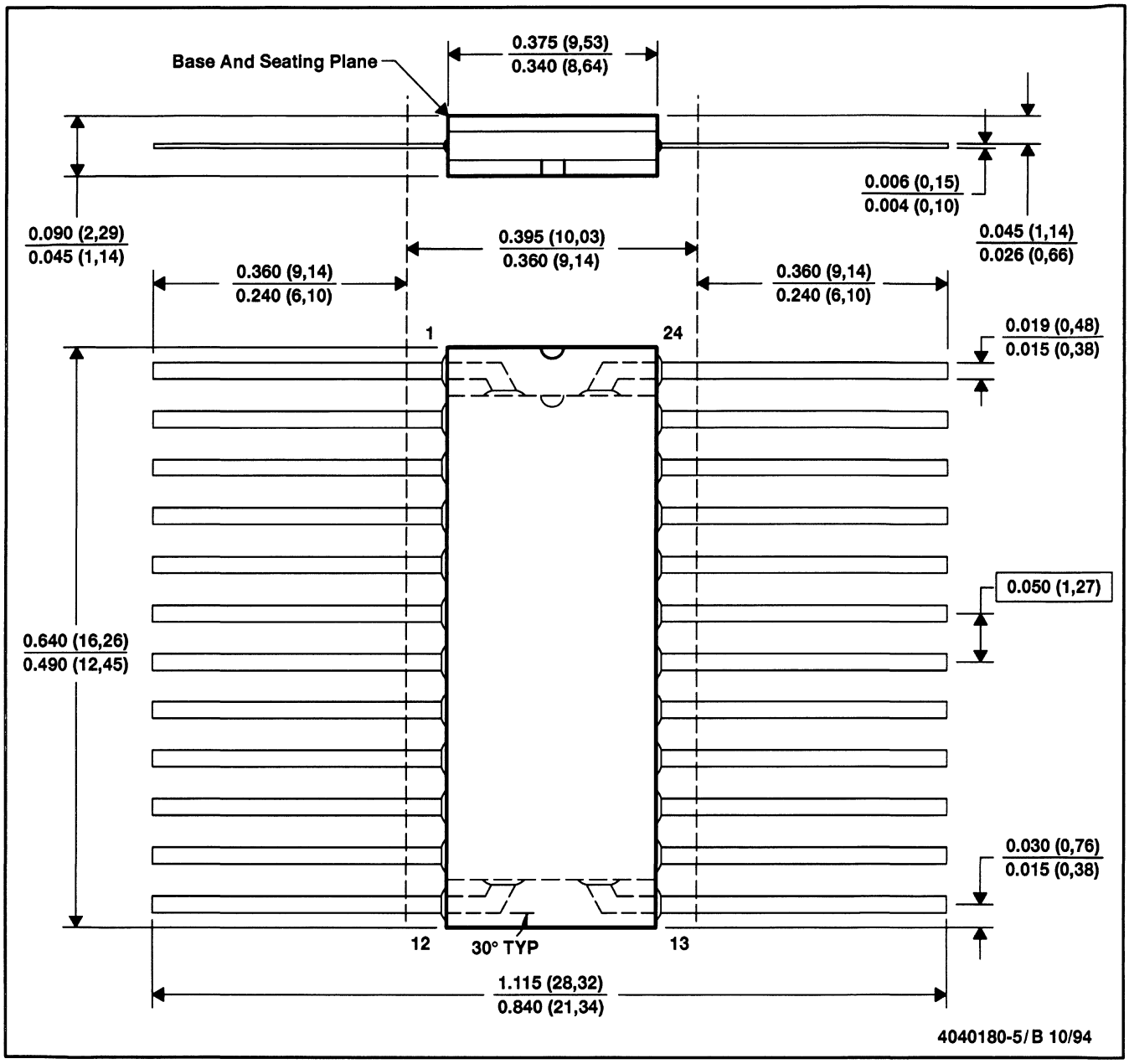
W (R-GDFP-F20) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only
E. Falls within MIL-STD-1835 GDFP2-F20

OCTOBER 1994

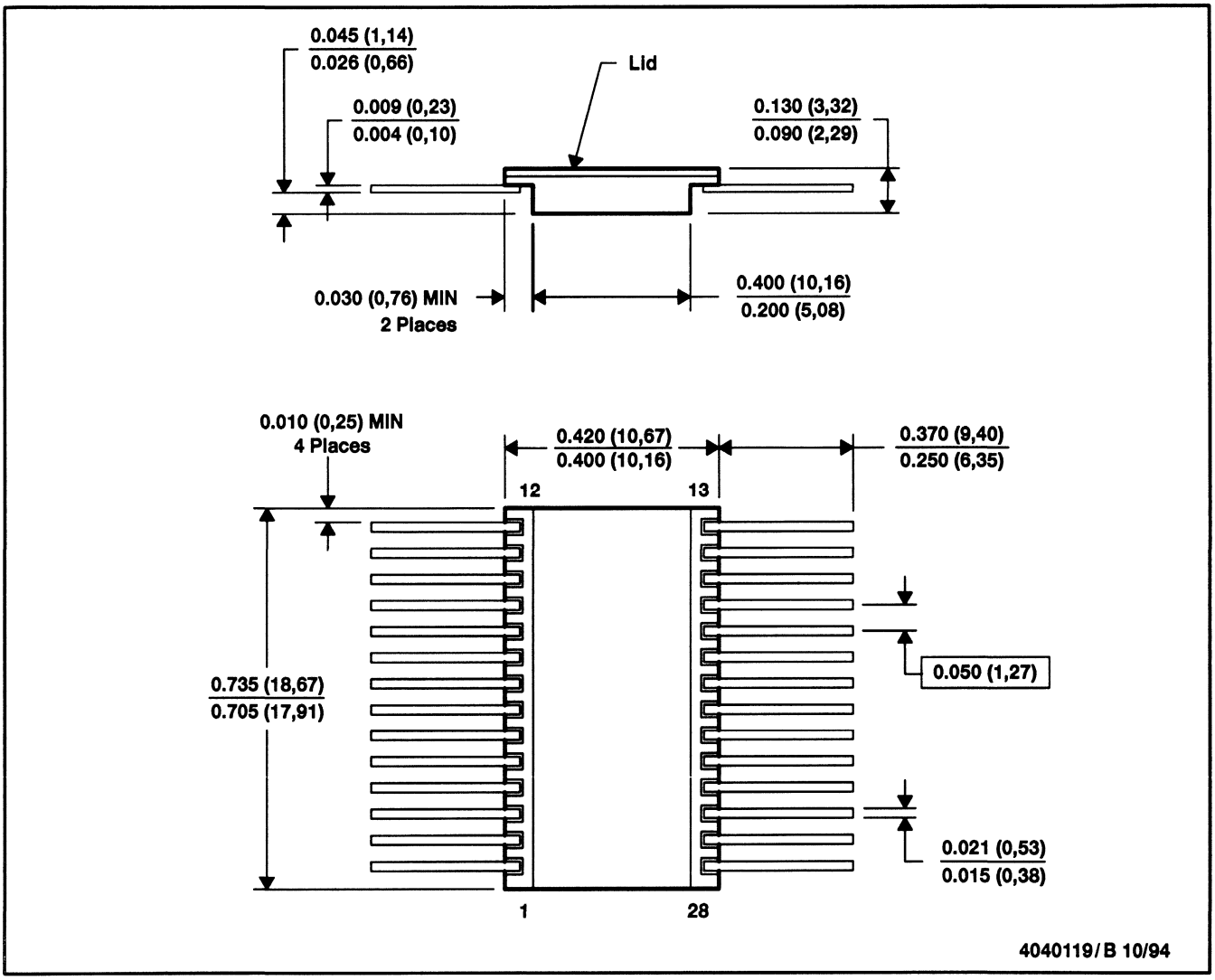
W (R-GDFP-F24) CERAMIC DUAL FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Falls within MIL-STD-1835 GDFP2-F24 and JEDEC MO-070AD
E. Index point is provided on cap for terminal identification only

OCTOBER 1994

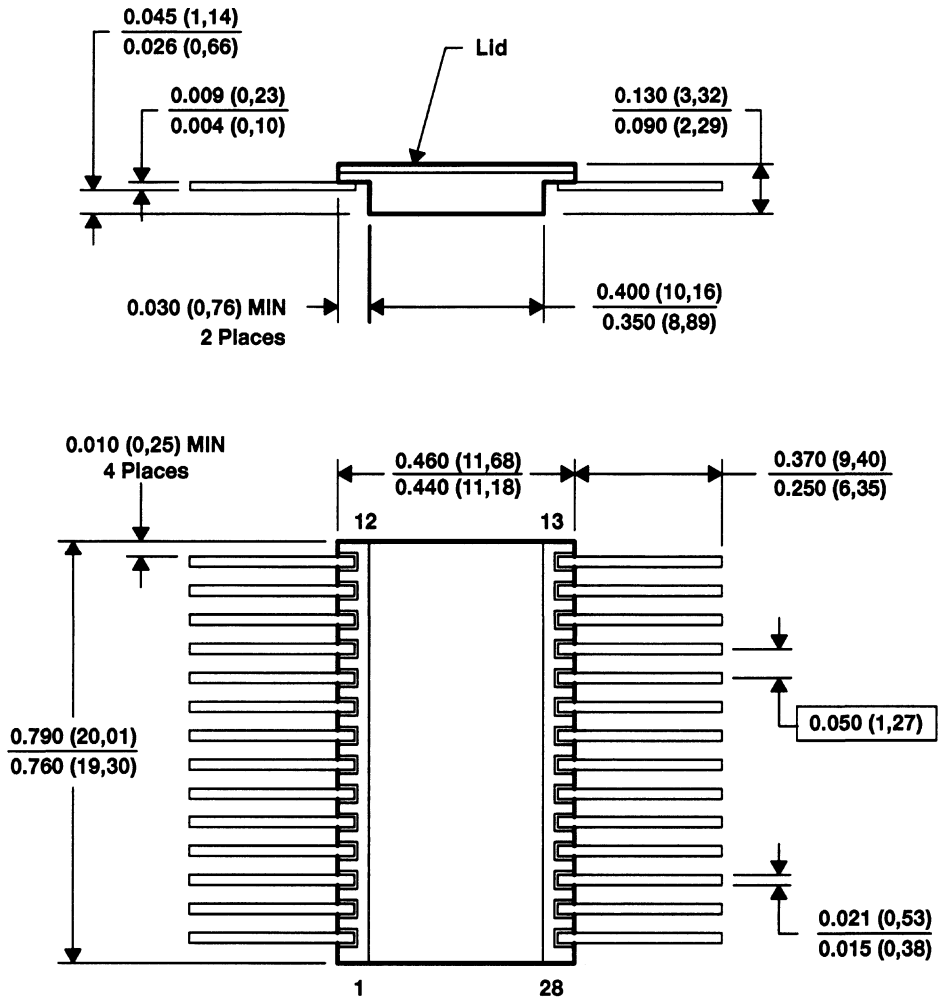
HKA (R-CDFP-F28) **CERAMIC DUAL FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

HKB (R-CDFP-F28) CERAMIC DUAL FLATPACK

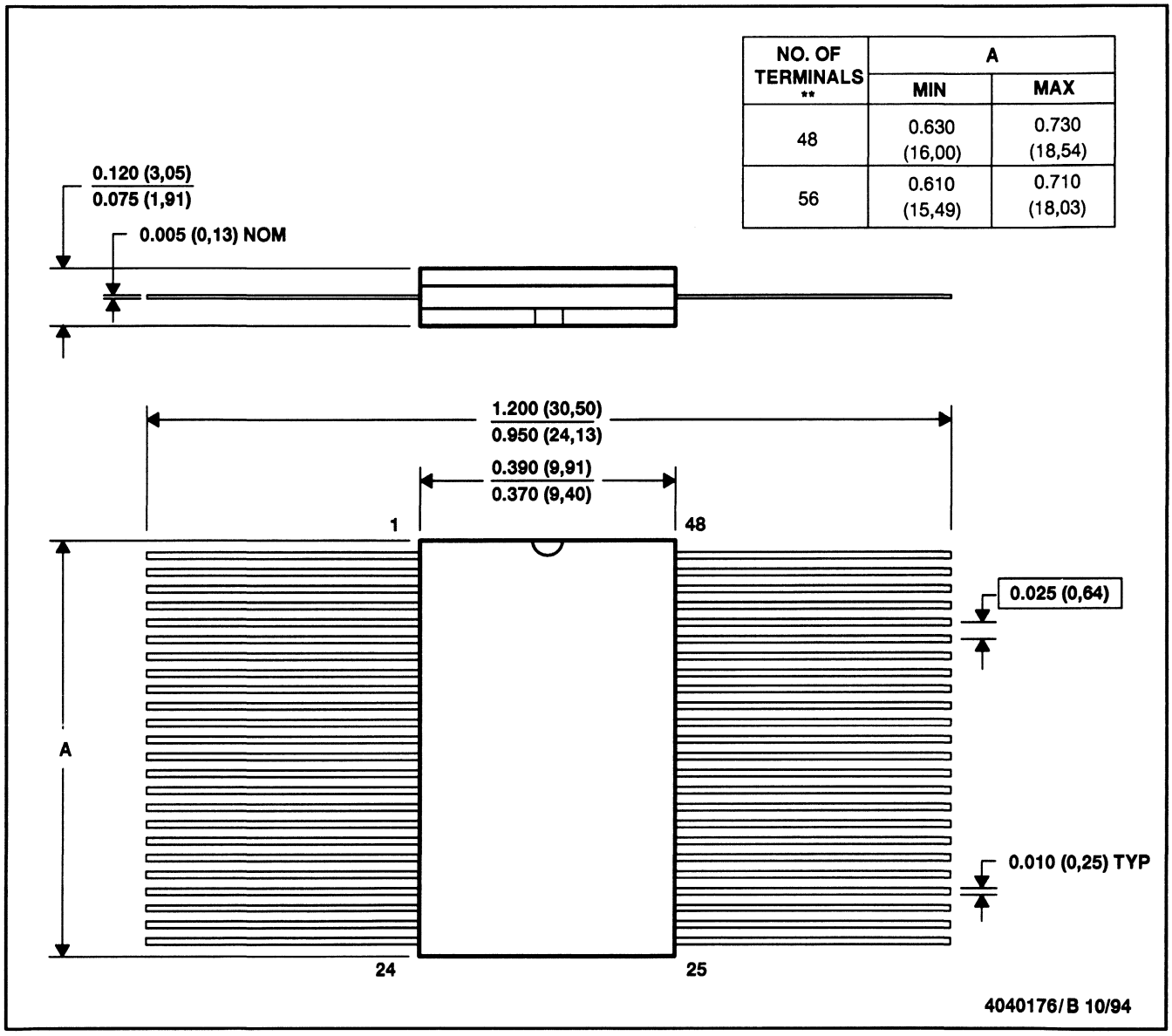


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

WD (R-GDFP-F)** **CERAMIC DUAL FLATPACK**

48 PIN SHOWN

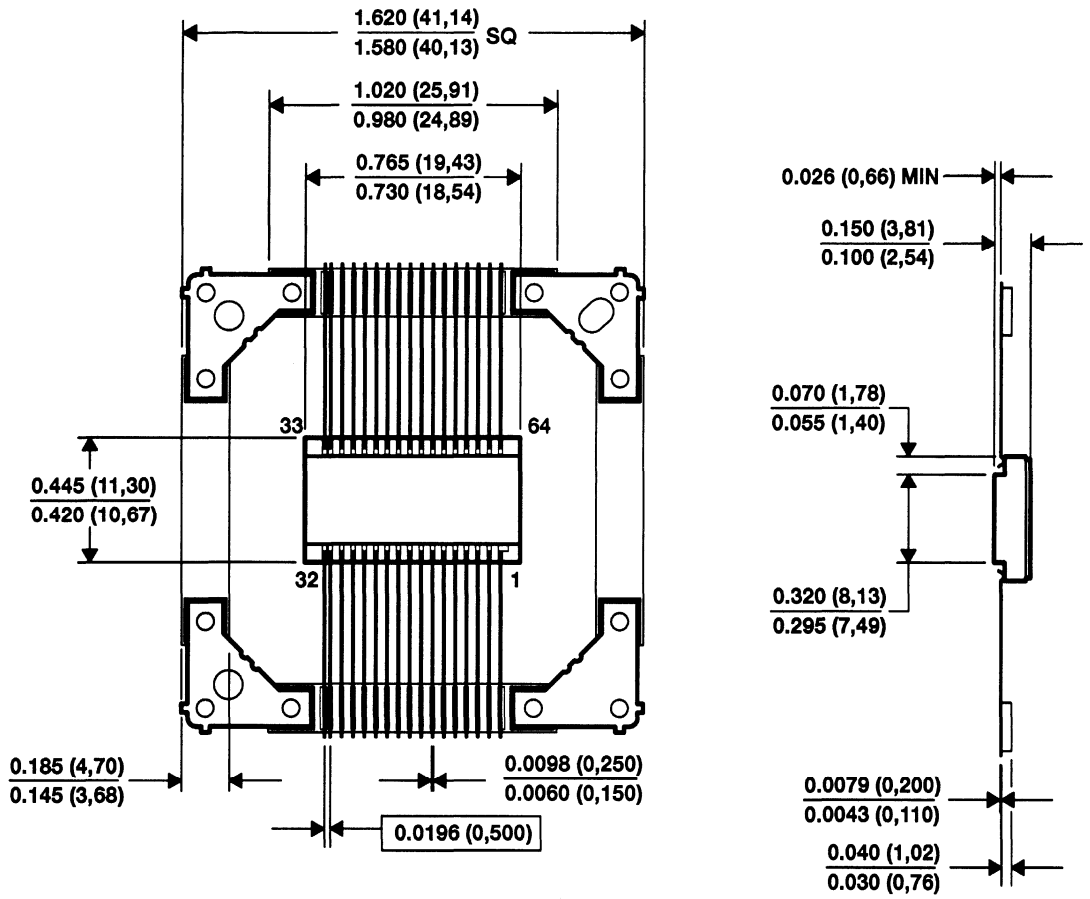


NO. OF TERMINALS **	A	
	MIN	MAX
48	0.630 (16,00)	0.730 (18,54)
56	0.610 (15,49)	0.710 (18,03)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only
E. Falls within MIL-STD-1835: GDFP1-F48 and JEDEC MO-146AA
GDFP1-F56 and JEDEC MO-146AB

OCTOBER 1994

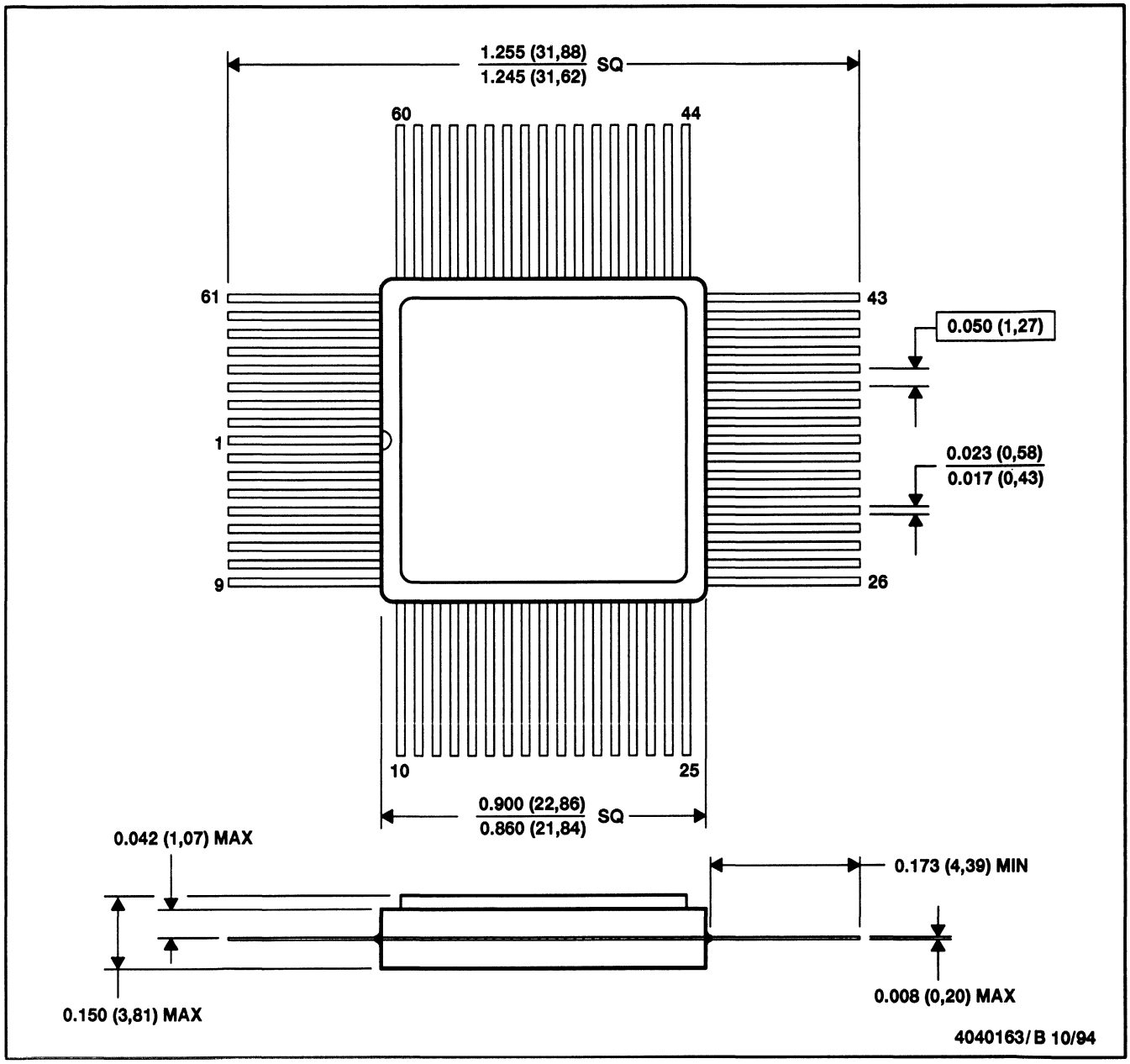
HKC (R-CDFP-F64) **CERAMIC DUAL FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. All leads not shown for clarity purposes.

OCTOBER 1994

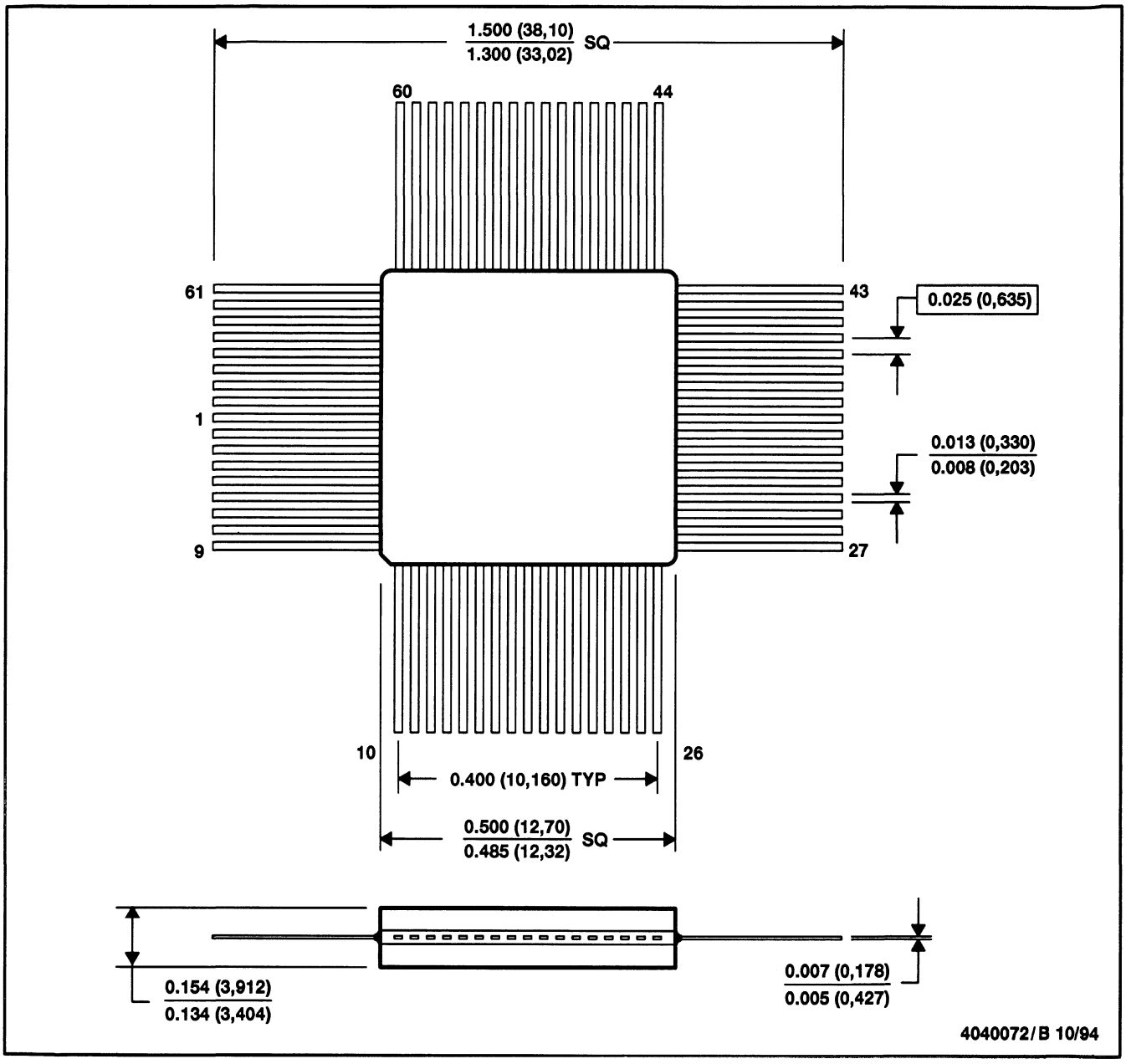
HB (S-GDFP-G68) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.

OCTOBER 1994

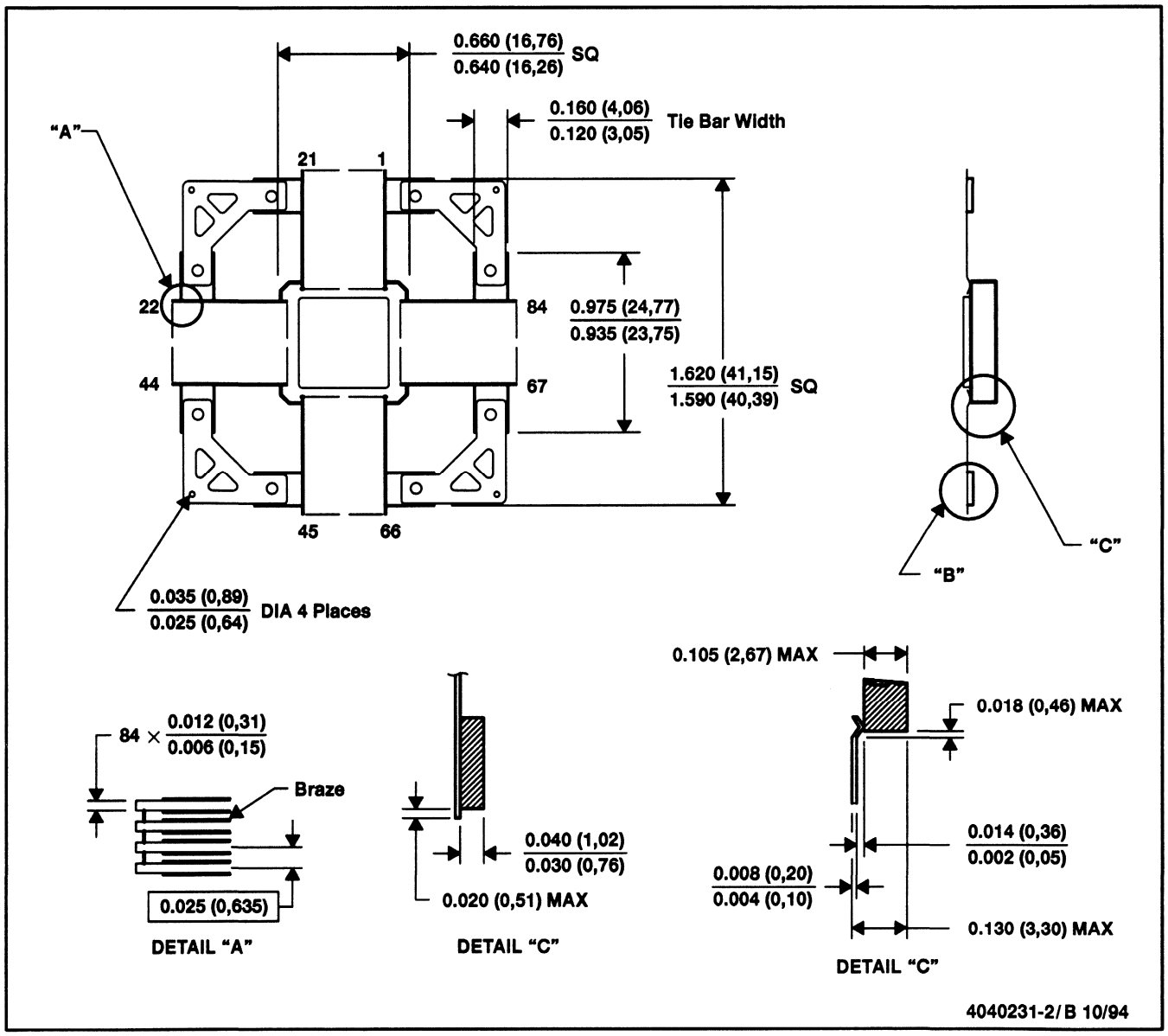
HV (S-GDFP-F68) CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

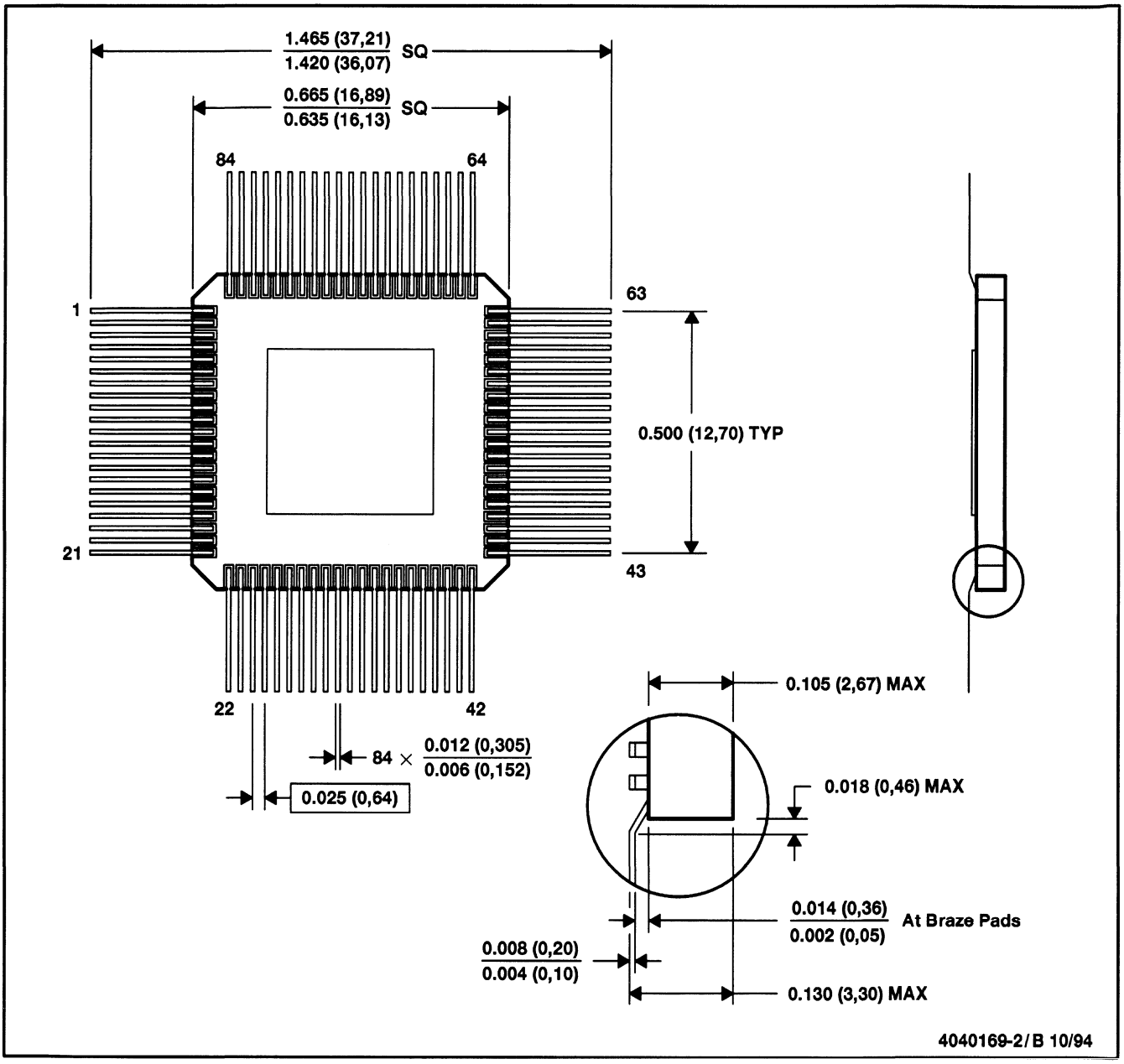
HFG (S-CQFP-F84) **CERAMIC QUAD FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Ceramic quad flatpack with flat leads brazed to nonconductive tie bar carrier
D. This package can be hermetically sealed with a metal lid.
E. The terminals are gold plated.

OCTOBER 1994

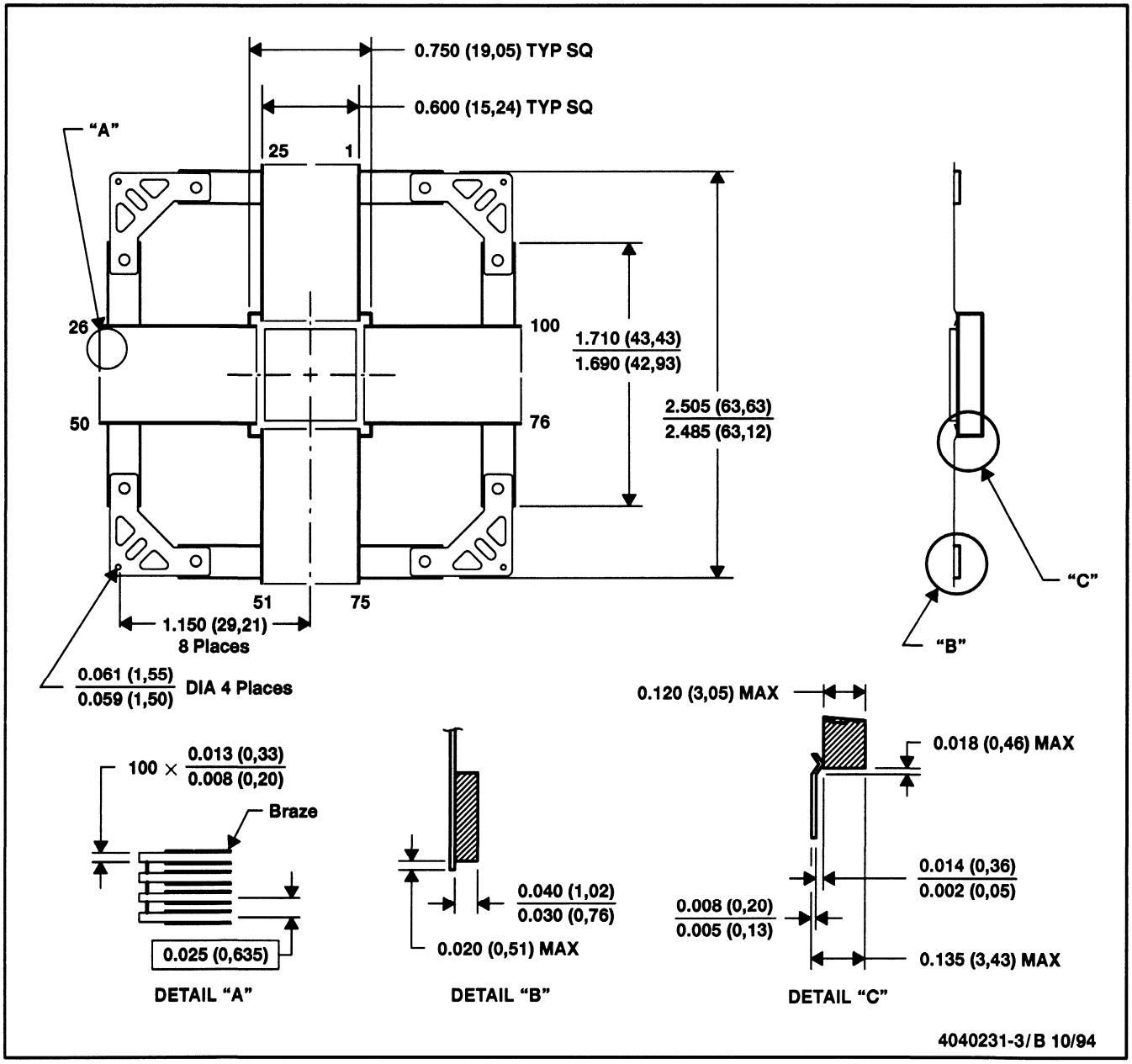
HT (S-CQFP-F84) CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-090 AA

OCTOBER 1994

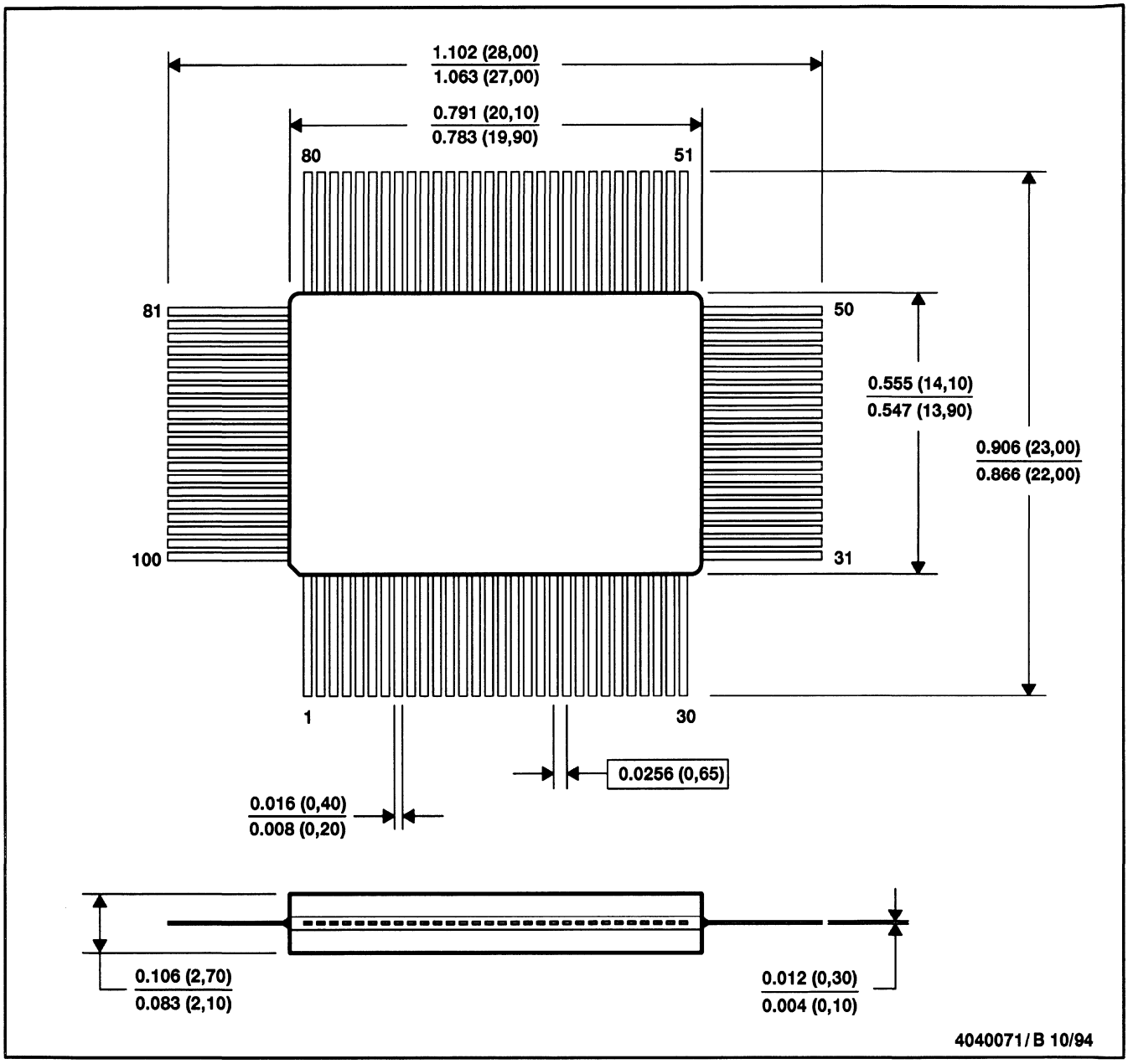
HFG (S-CQFP-F100) **CERAMIC QUAD FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Ceramic quad flatpack with flat leads brazed to nonconductive tie-bar carrier
D. This package can be hermetically sealed with a metal lid.
E. The terminals are gold plated.
F. Falls within JEDEC MO-113 AD

OCTOBER 1994

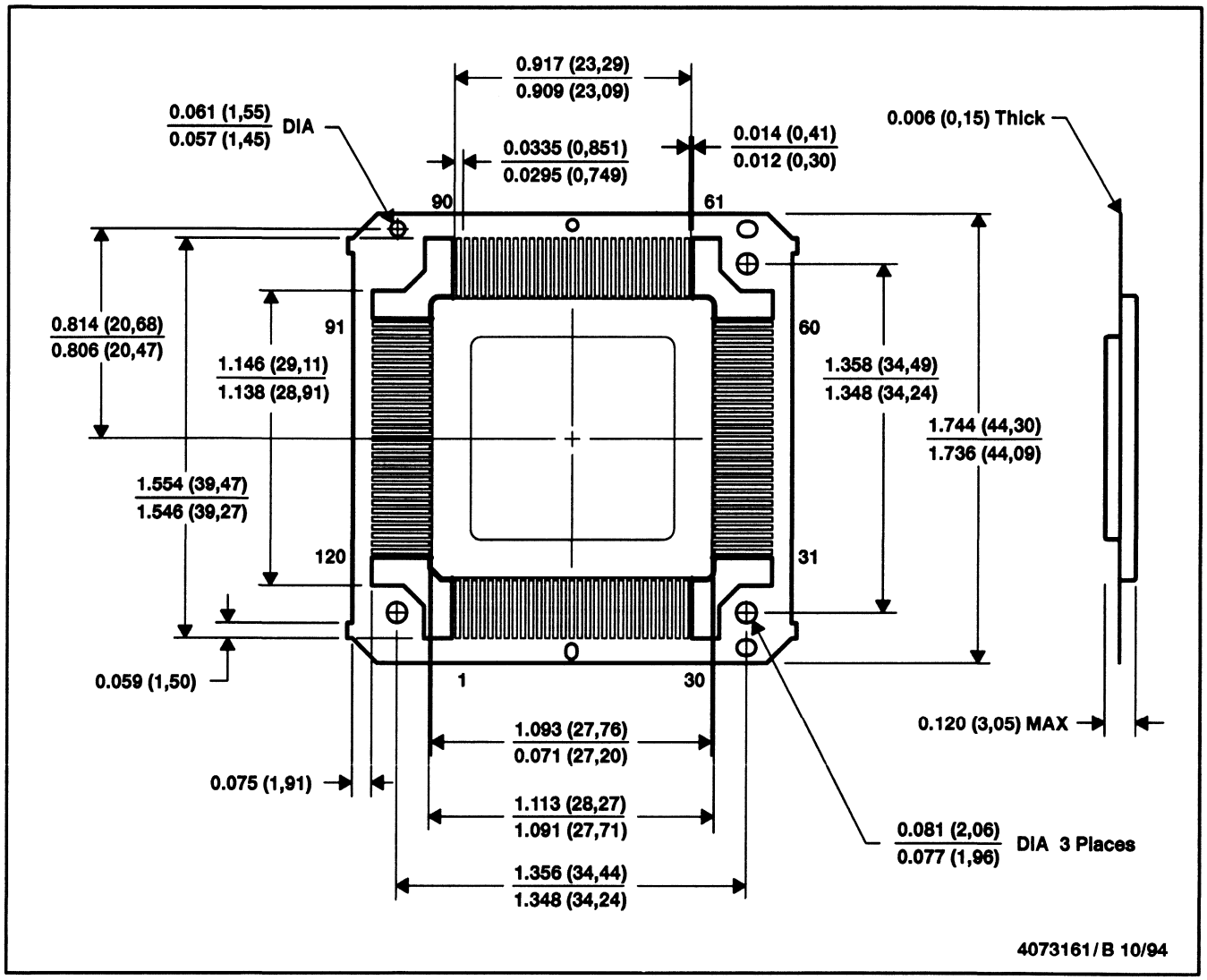
HS (R-GQFP-F100) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

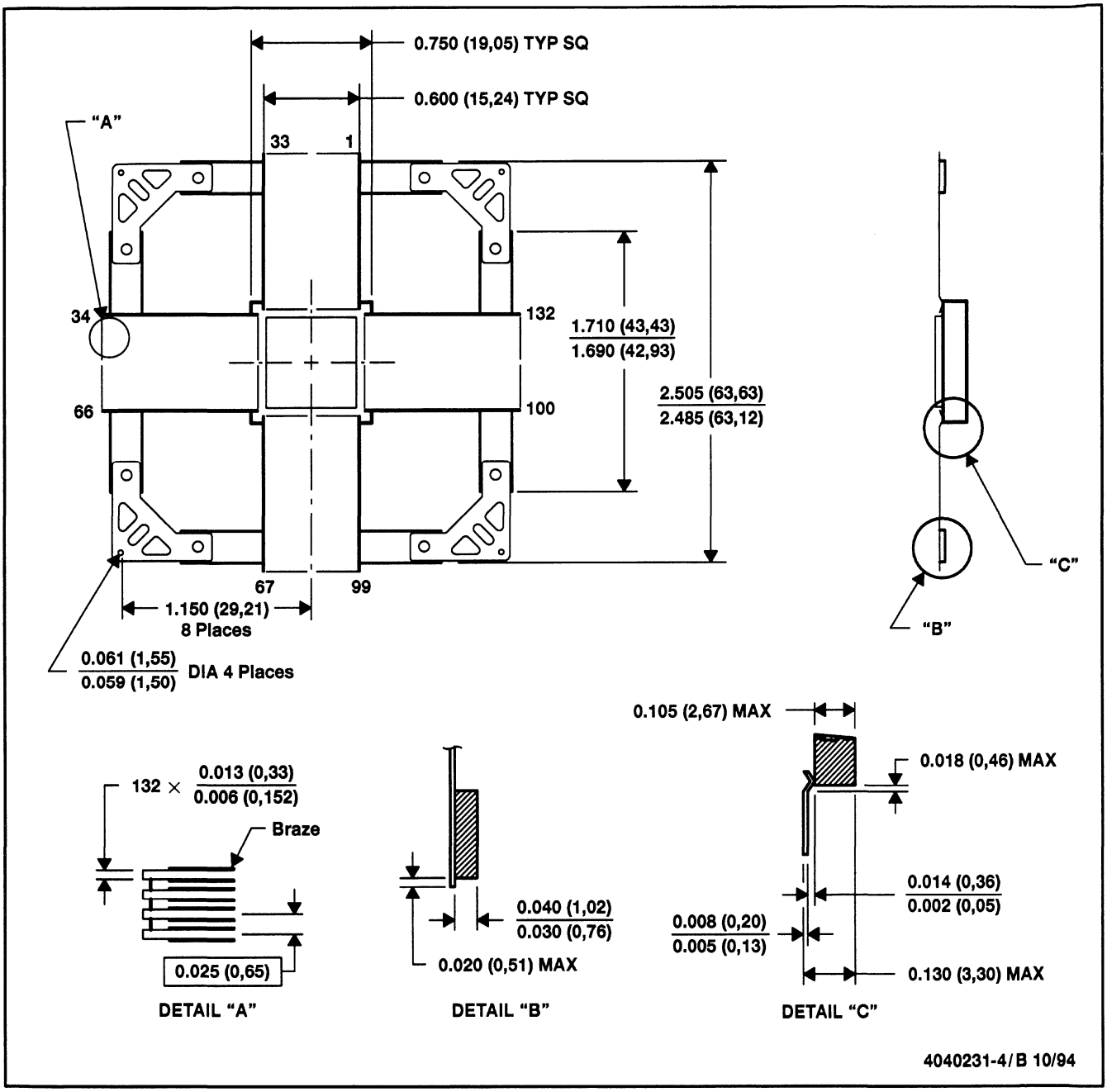
HBG (S-CQFP-F120) **CERAMIC FLATPACK WITH TIE-BAR CARRIER**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

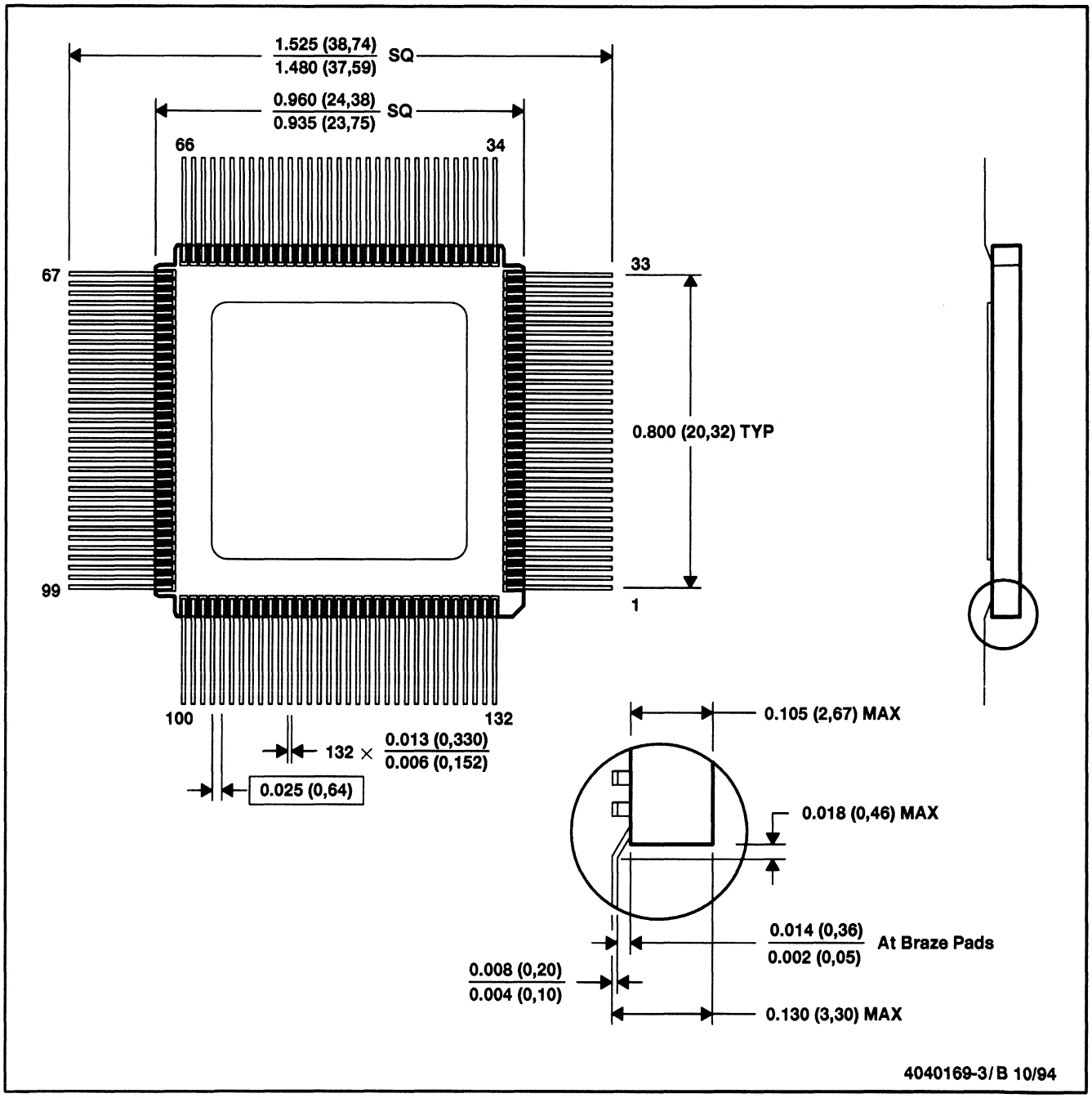
HFG (S-CQFP-F132) **CERAMIC QUAD FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Ceramic quad flatpack with flat leads brazed to nonconductive tie-bar carrier
D. This package can be hermetically sealed with a metal lid.
E. The terminals are gold plated.
F. Falls within JEDEC MO-113 AC

OCTOBER 1994

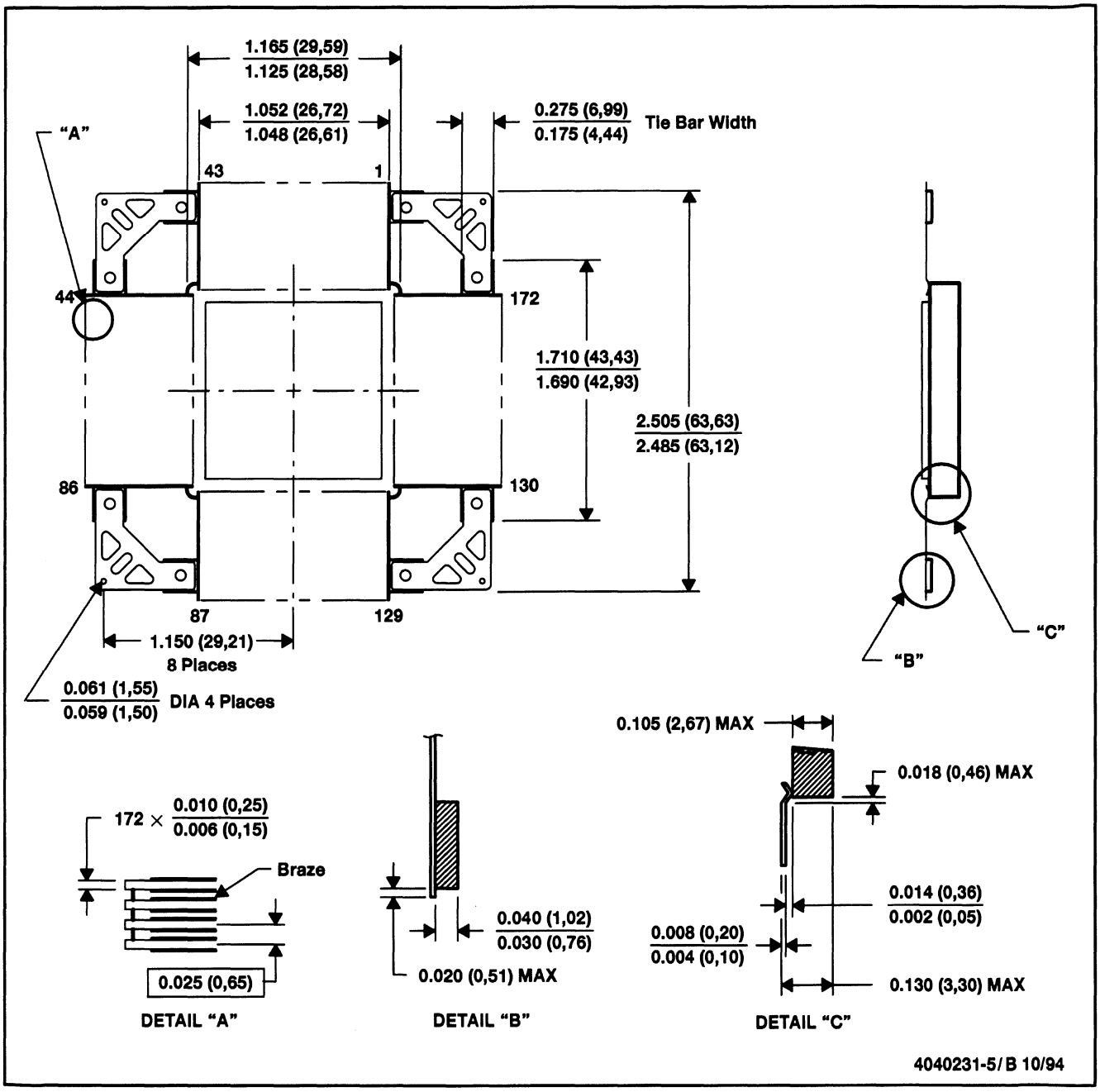
HT (S-CQFP-F132) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-090 AB

OCTOBER 1994

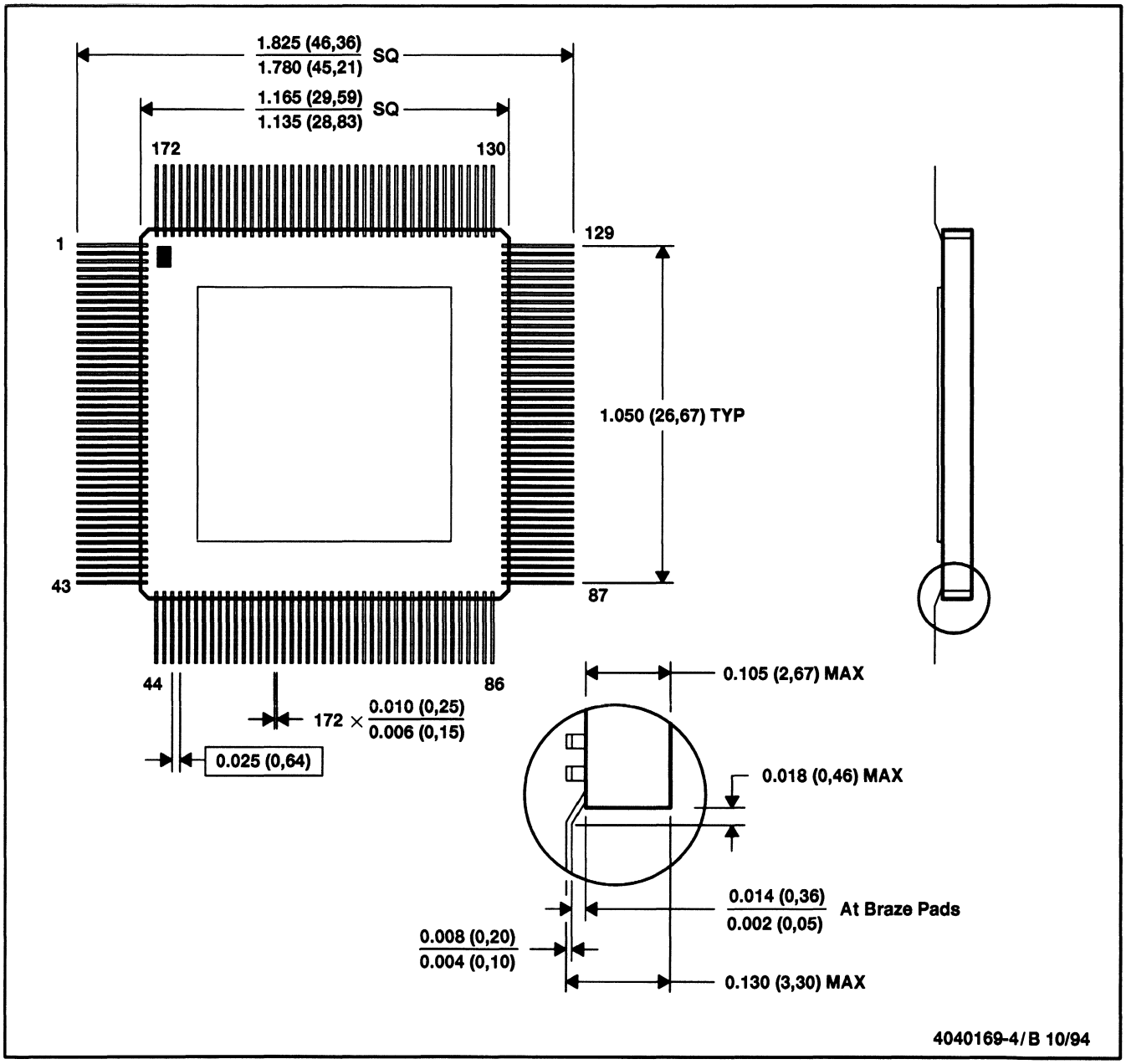
HFG (S-CQFP-F172) CERAMIC QUAD FLATPACK WITH TIE BAR



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Ceramic quad flatpack with flat leads brazed to nonconductive tie-bar carrier
D. This package can be hermetically sealed with a metal lid.
E. The terminals are gold plated.
F. Falls within JEDEC MO-113 AE

OCTOBER 1994

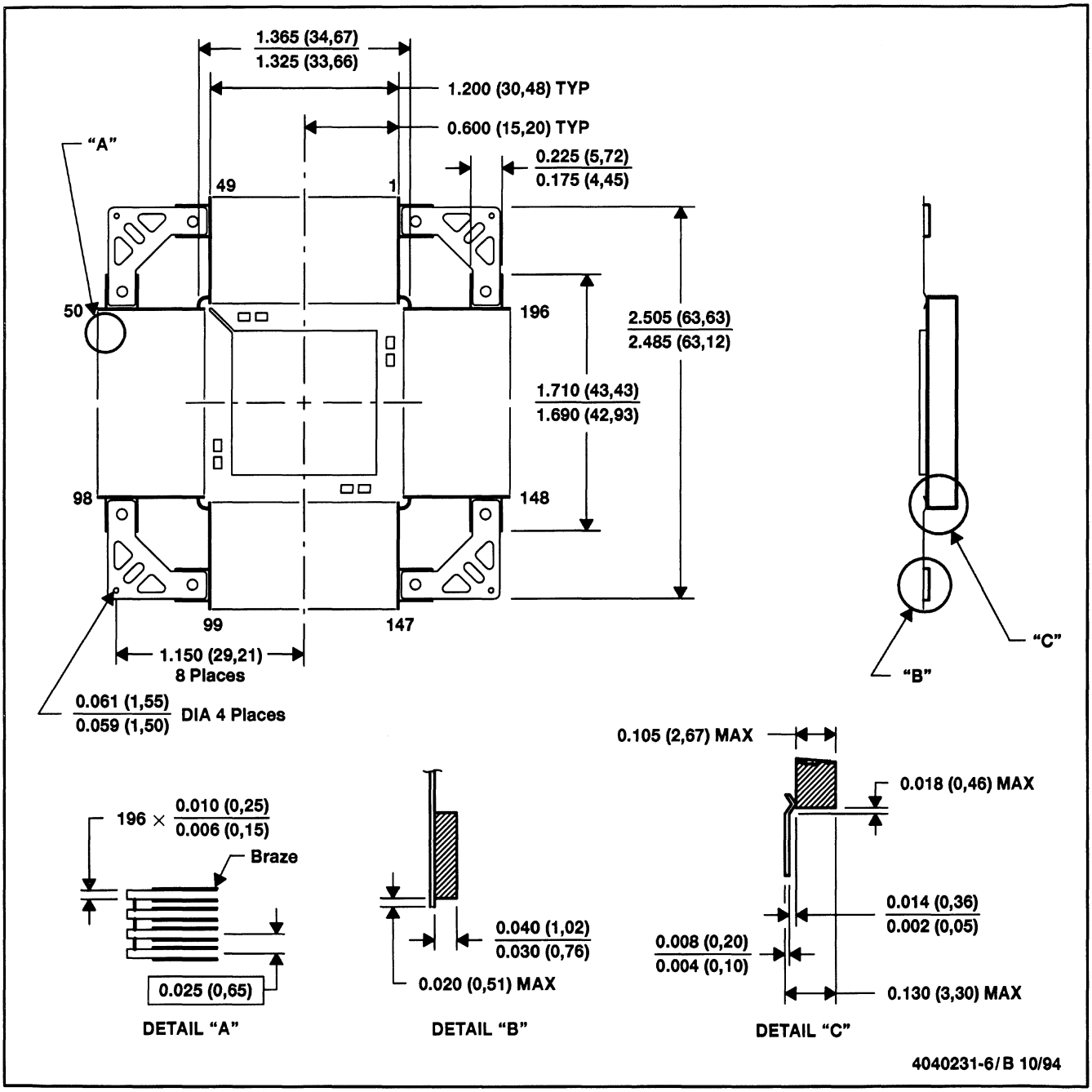
HT (S-CQFP-F172) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-090 AD

OCTOBER 1994

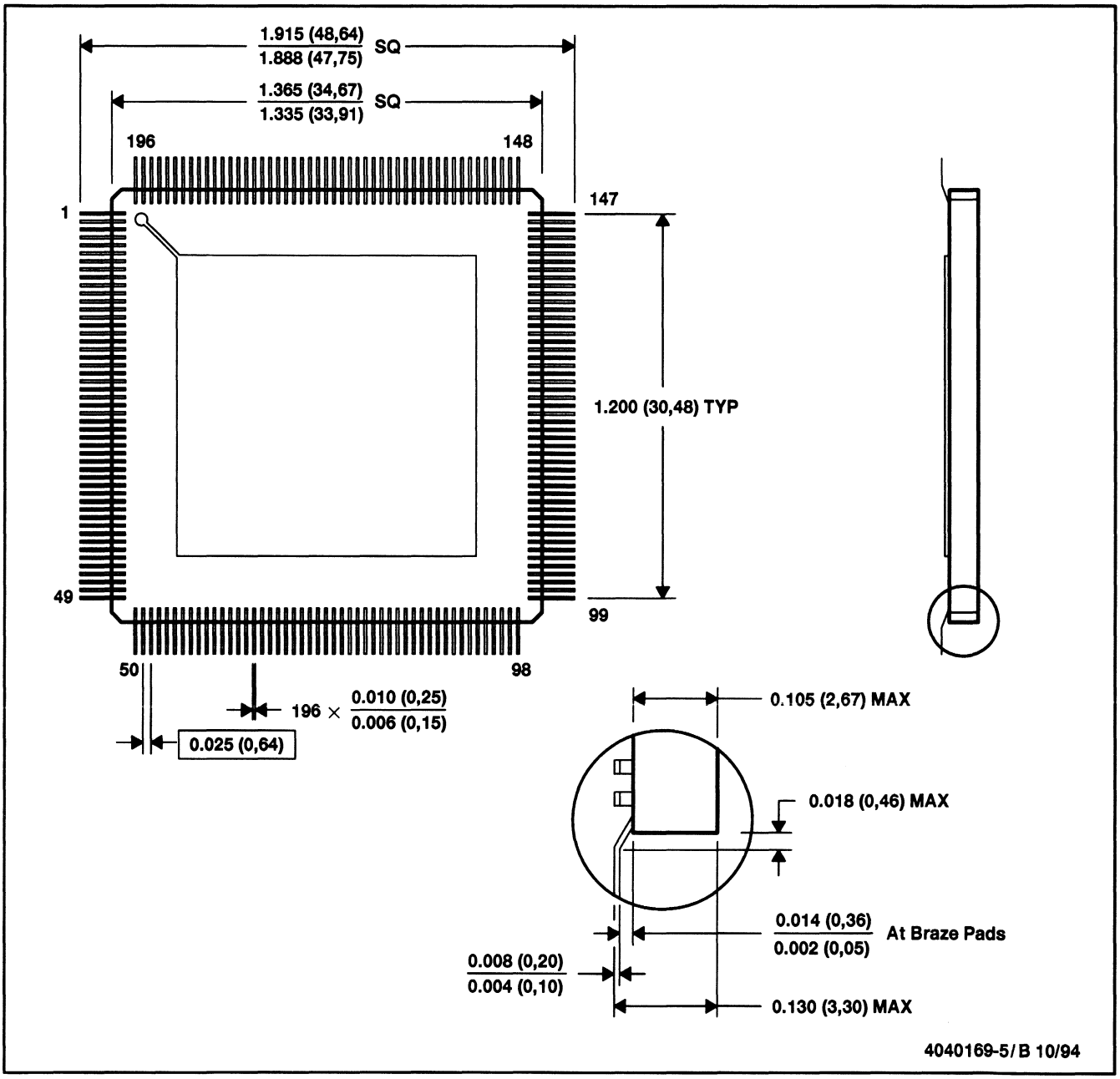
HFG (S-CQFP-F196) CERAMIC QUAD FLATPACK WITH TIE BAR



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Ceramic quad flatpack with flat leads brazed to nonconductive tie-bar carrier
D. This package can be hermetically sealed with a metal lid.
E. The terminals are gold plated.
F. Falls within JEDEC MO-113 AB

OCTOBER 1994

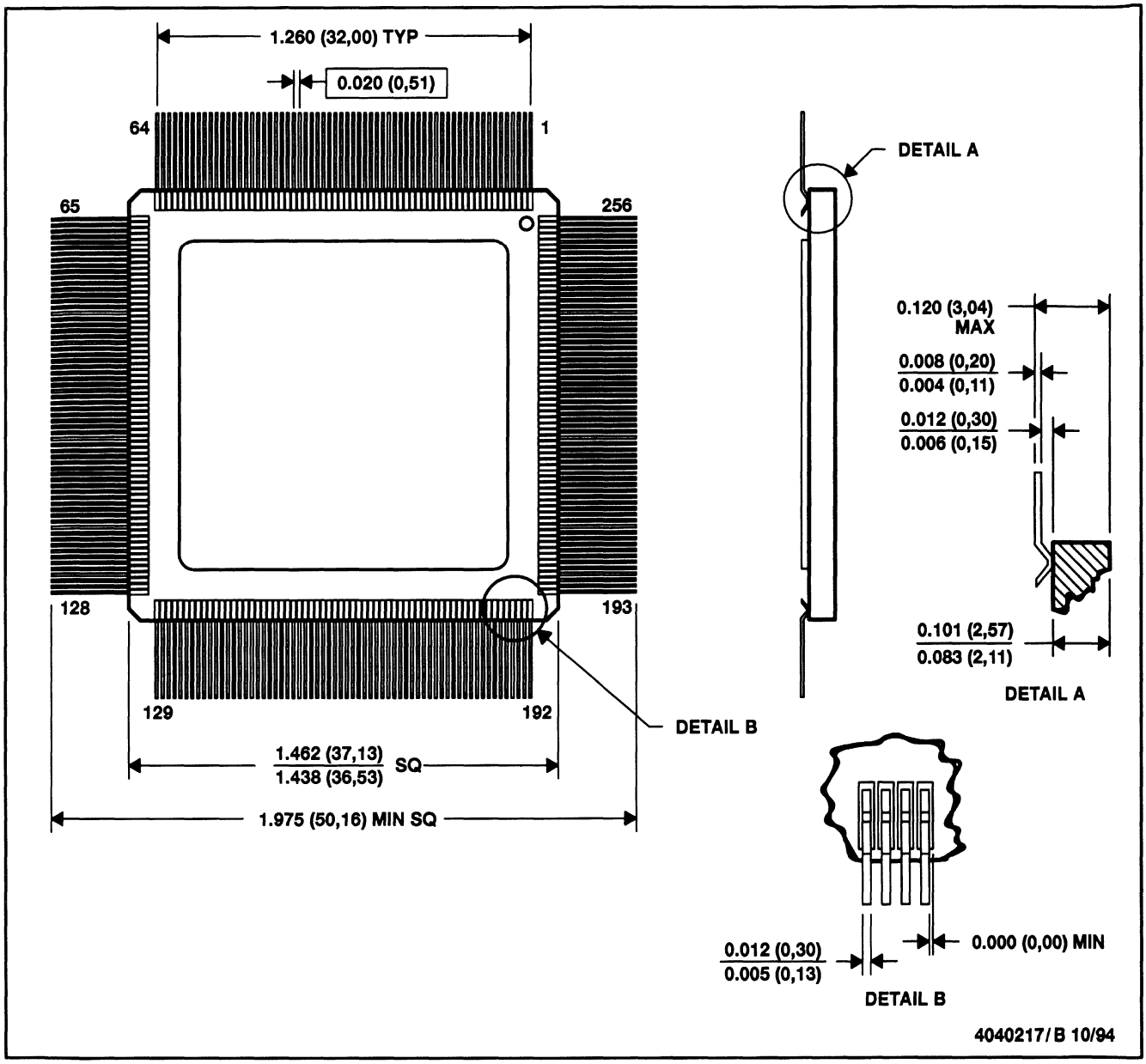
HT (S-CQFP-F196) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-090 AE

OCTOBER 1994

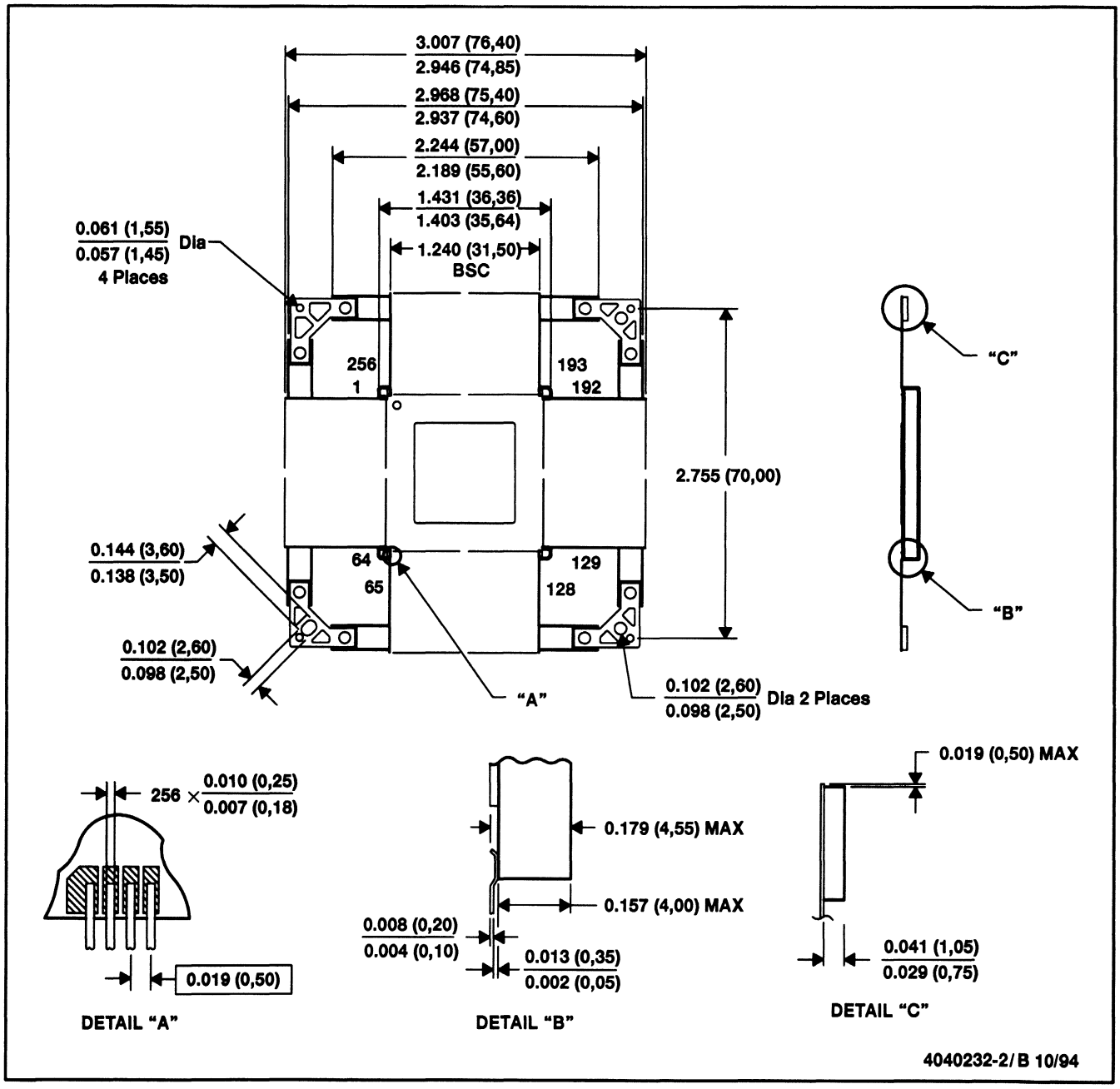
HFA (S-CQFP-F256) CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

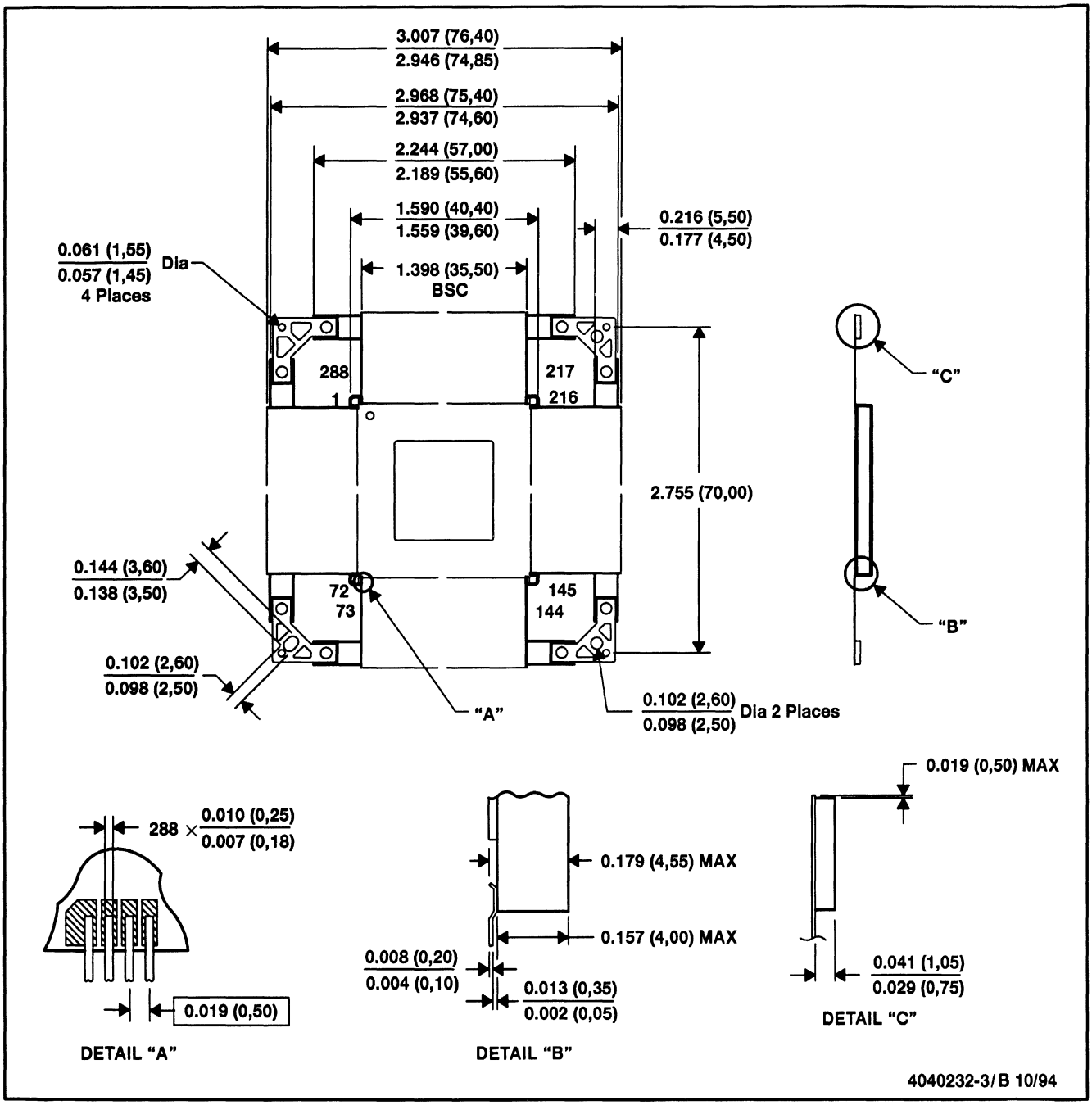
HFH (R-CQFP-F256) **CERAMIC QUAD FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-134 AB

OCTOBER 1994

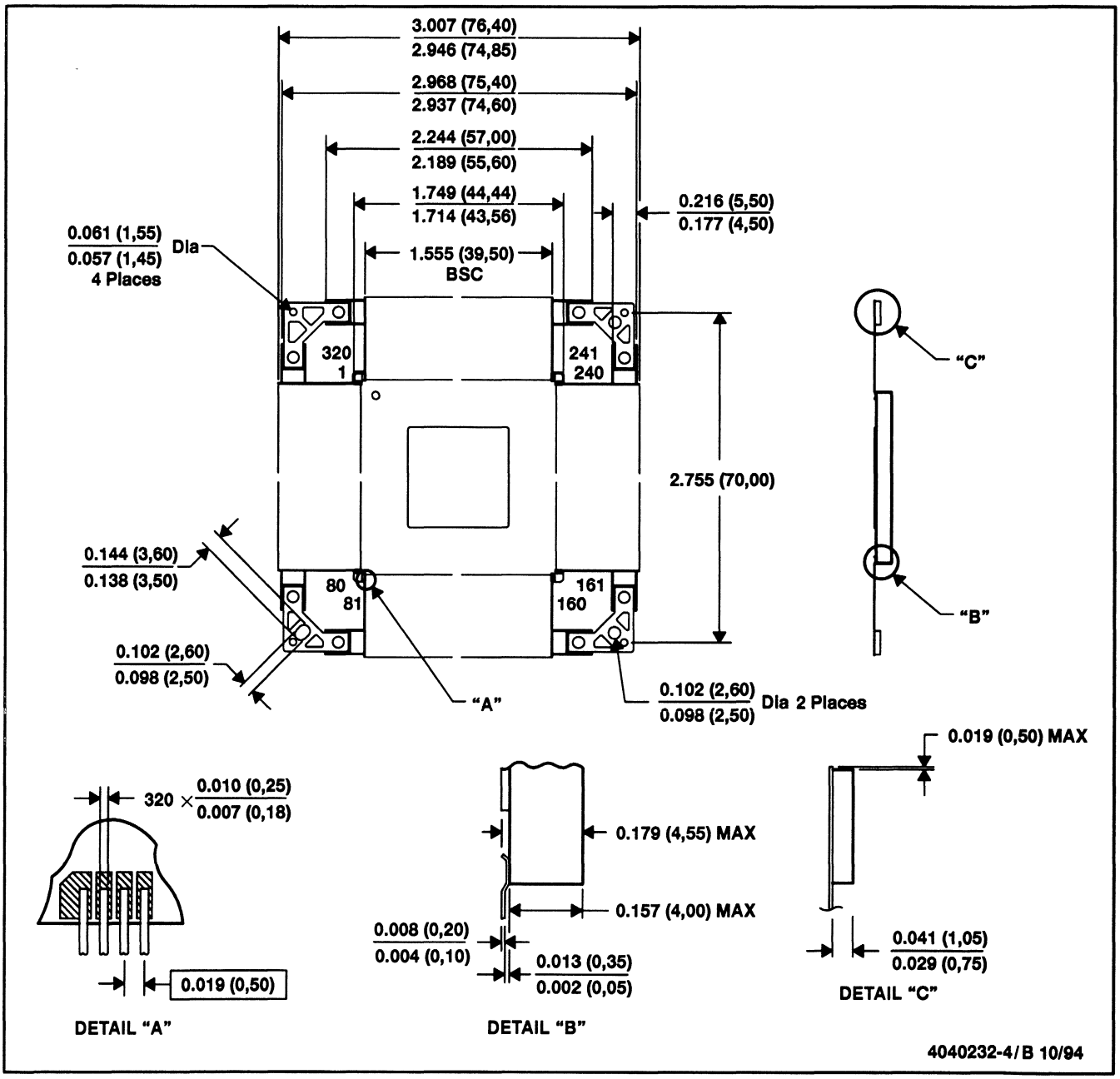
HFH (R-CQFP-F288) CERAMIC QUAD FLATPACK WITH TIE BAR



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-134 AC

OCTOBER 1994

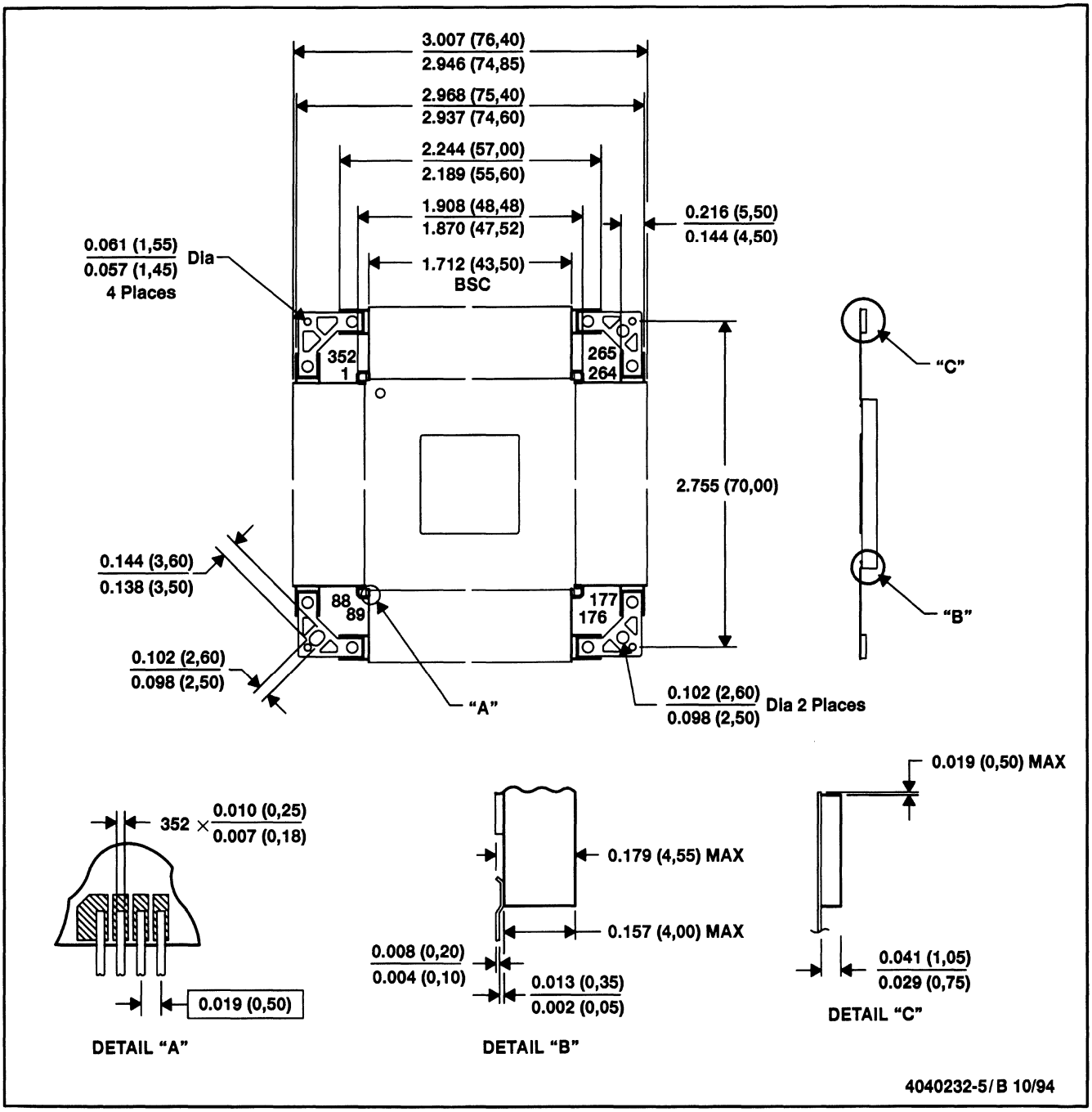
HFH (R-CQFP-F320) **CERAMIC QUAD FLATPACK WITH TIE BAR**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-134 AD

OCTOBER 1994

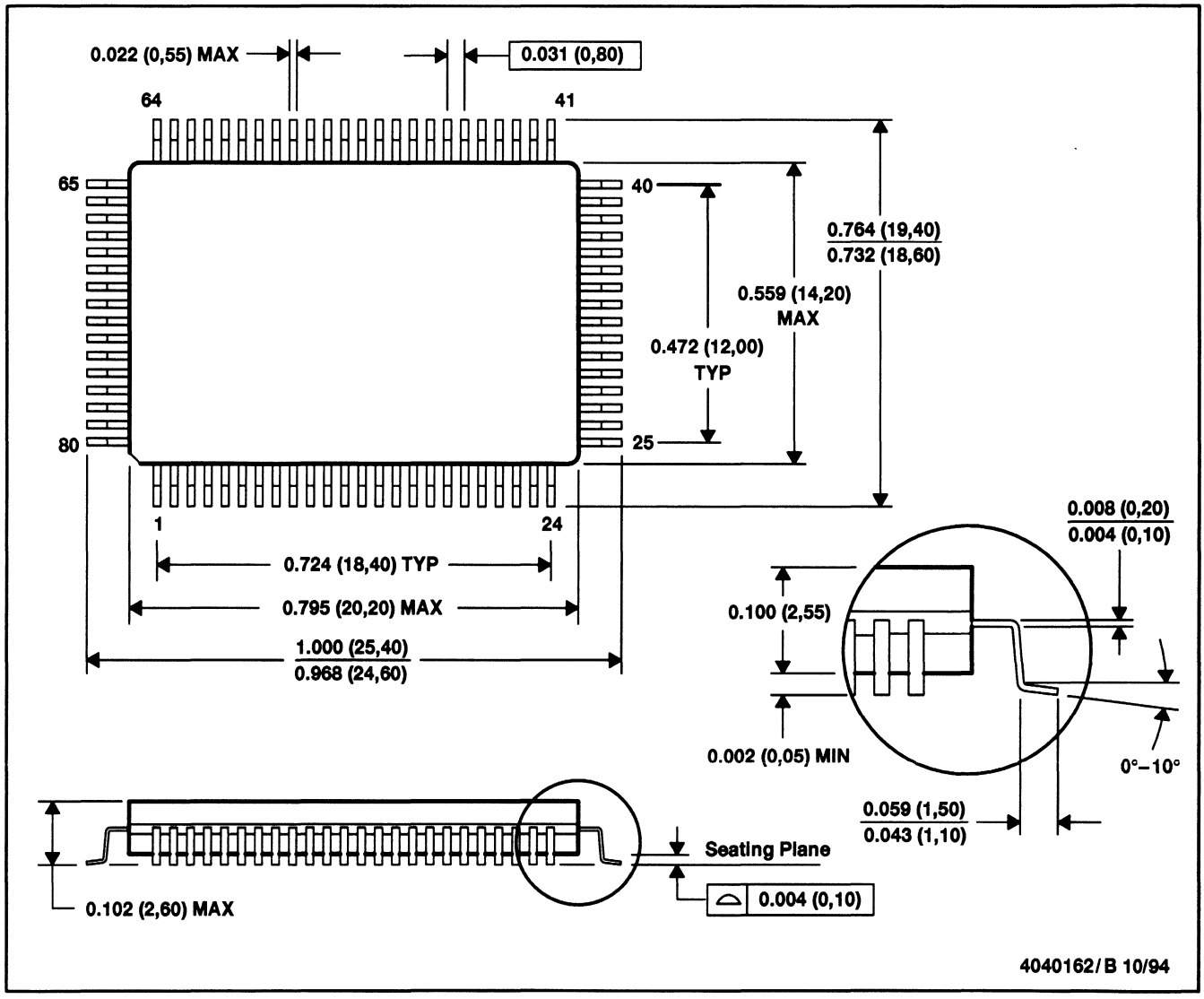
HFH (S-CQFP-F352) CERAMIC QUAD FLATPACK WITH TIE BAR



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.
E. Falls within JEDEC MO-134 AE

OCTOBER 1994

HD (R-GQFP-G80) **CERAMIC QUAD FLATPACK**

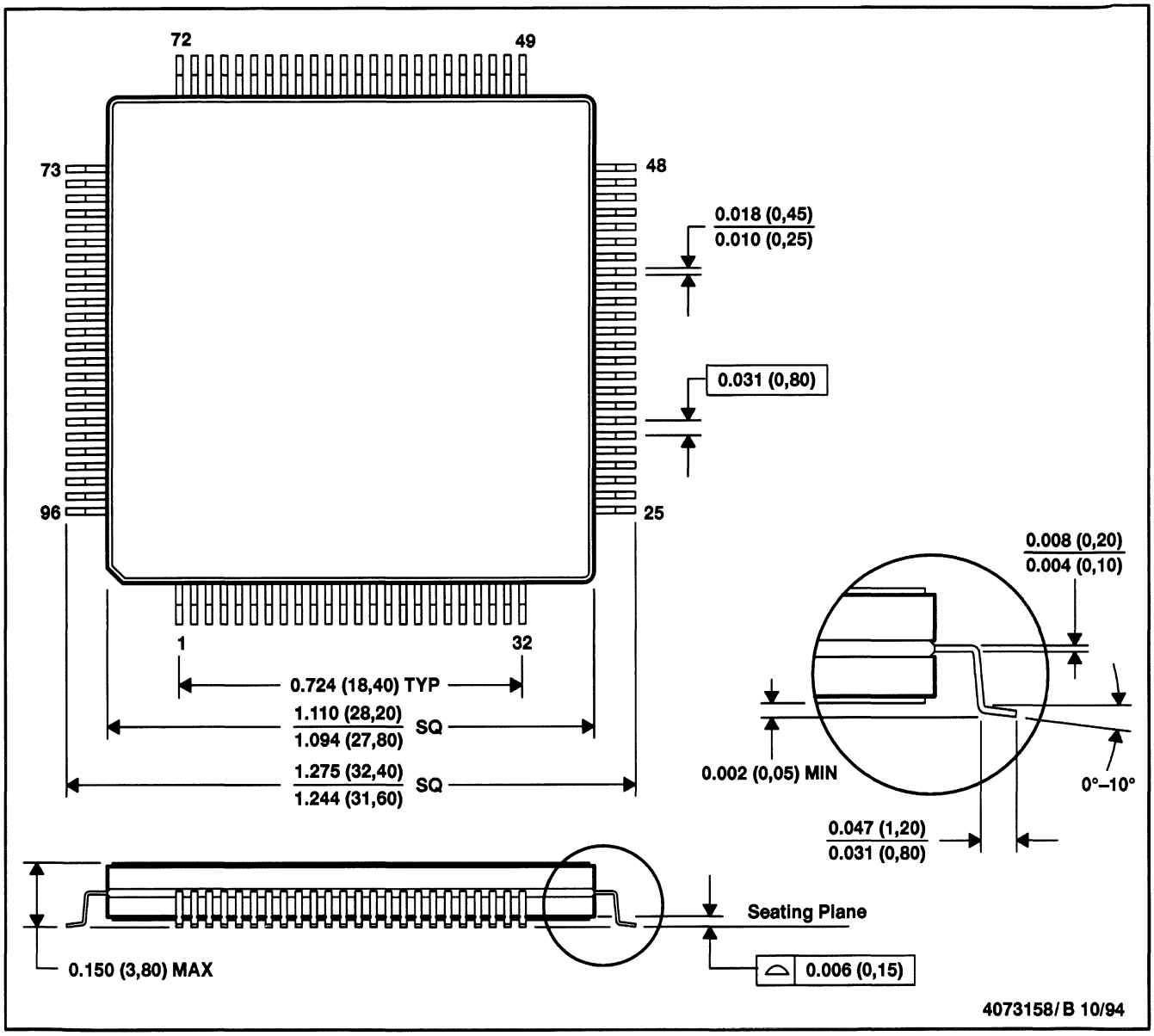


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

HH (S-GQFP-G96)

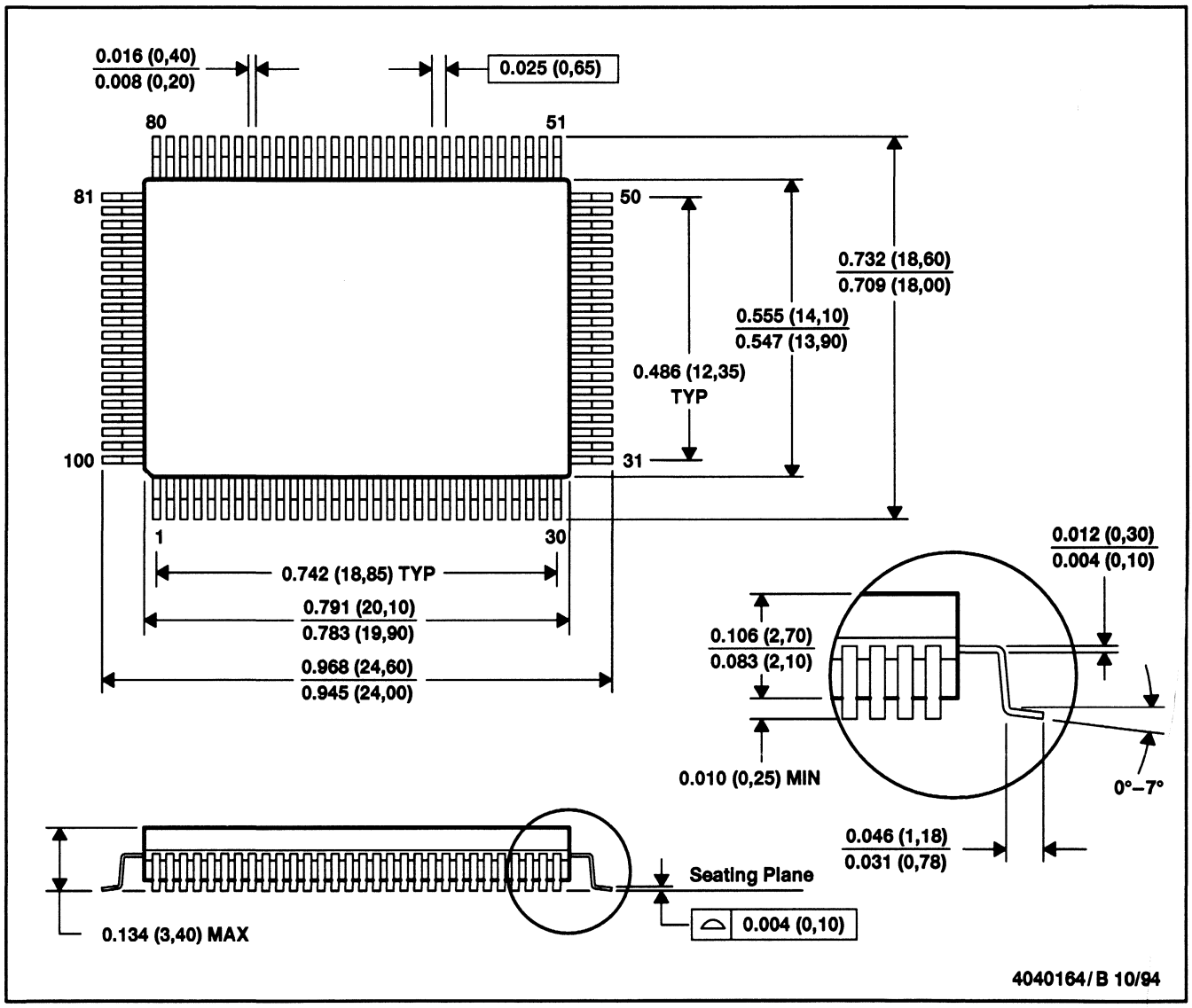
CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

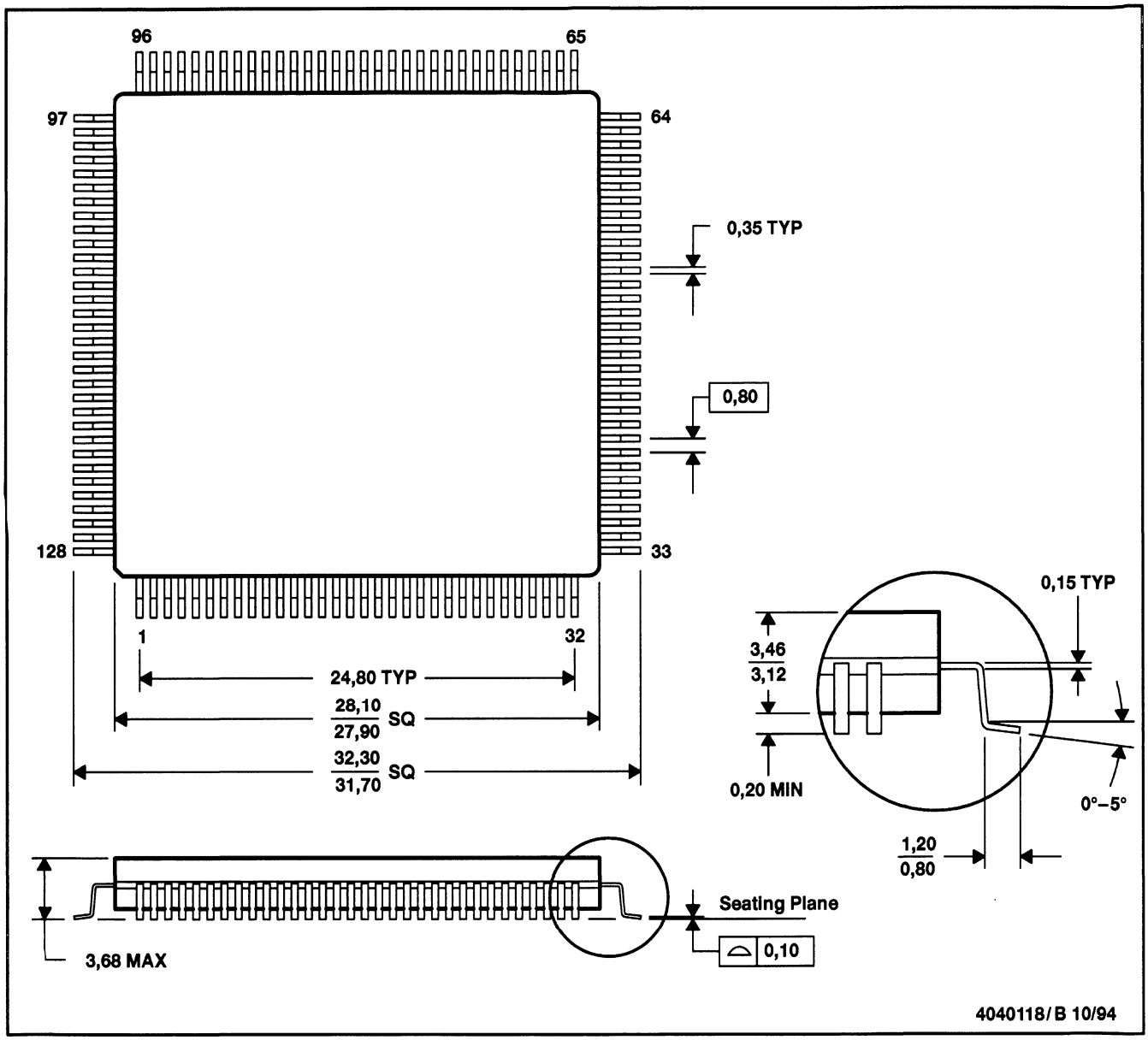
HE (R-GQFP-G100) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.

OCTOBER 1994

HGA (S-CQFP-F128) CERAMIC QUAD FLATPACK

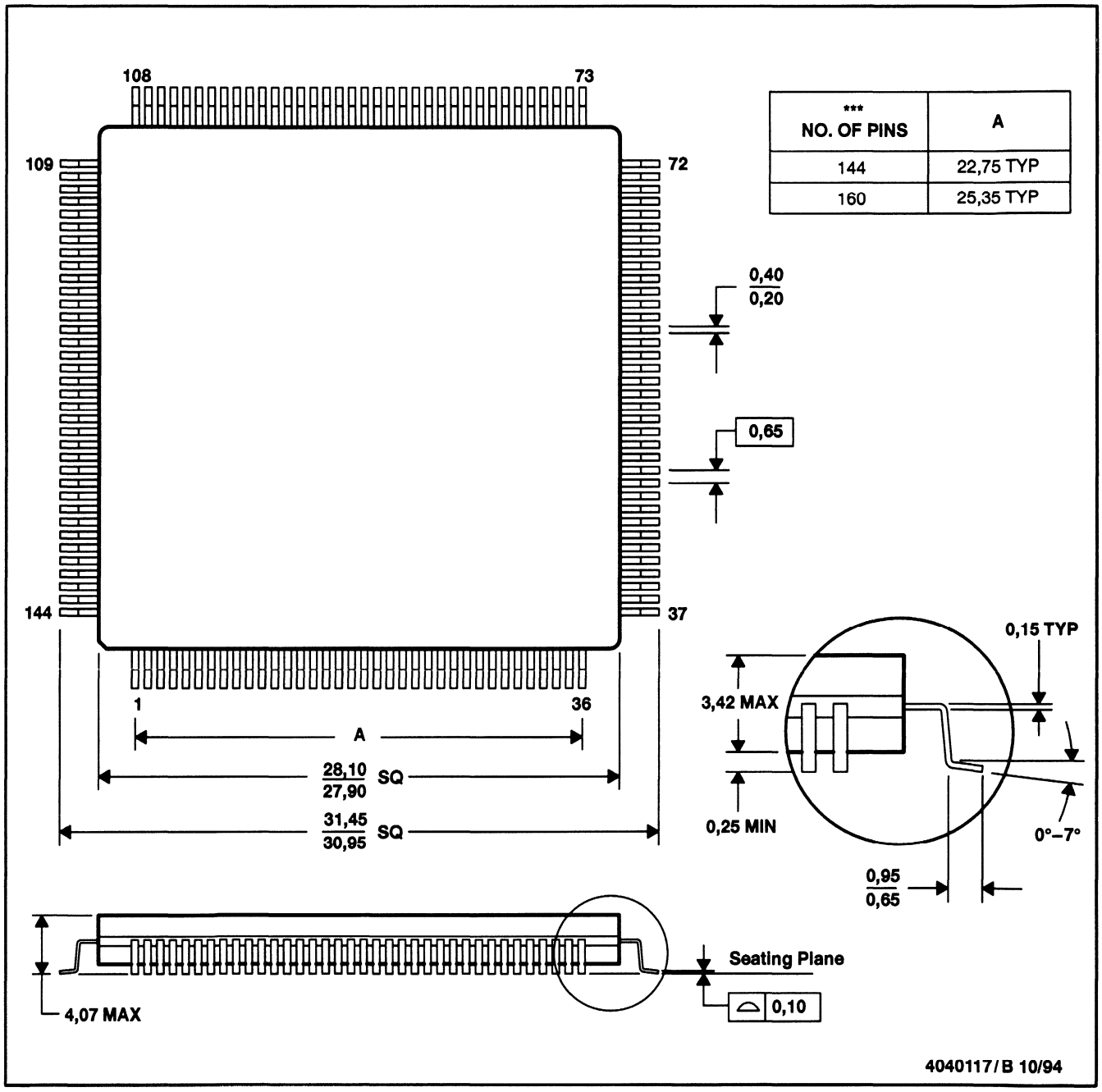


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

HP (S-GQFP-G*)** **CERAMIC QUAD FLATPACK**

144 PIN SHOWN

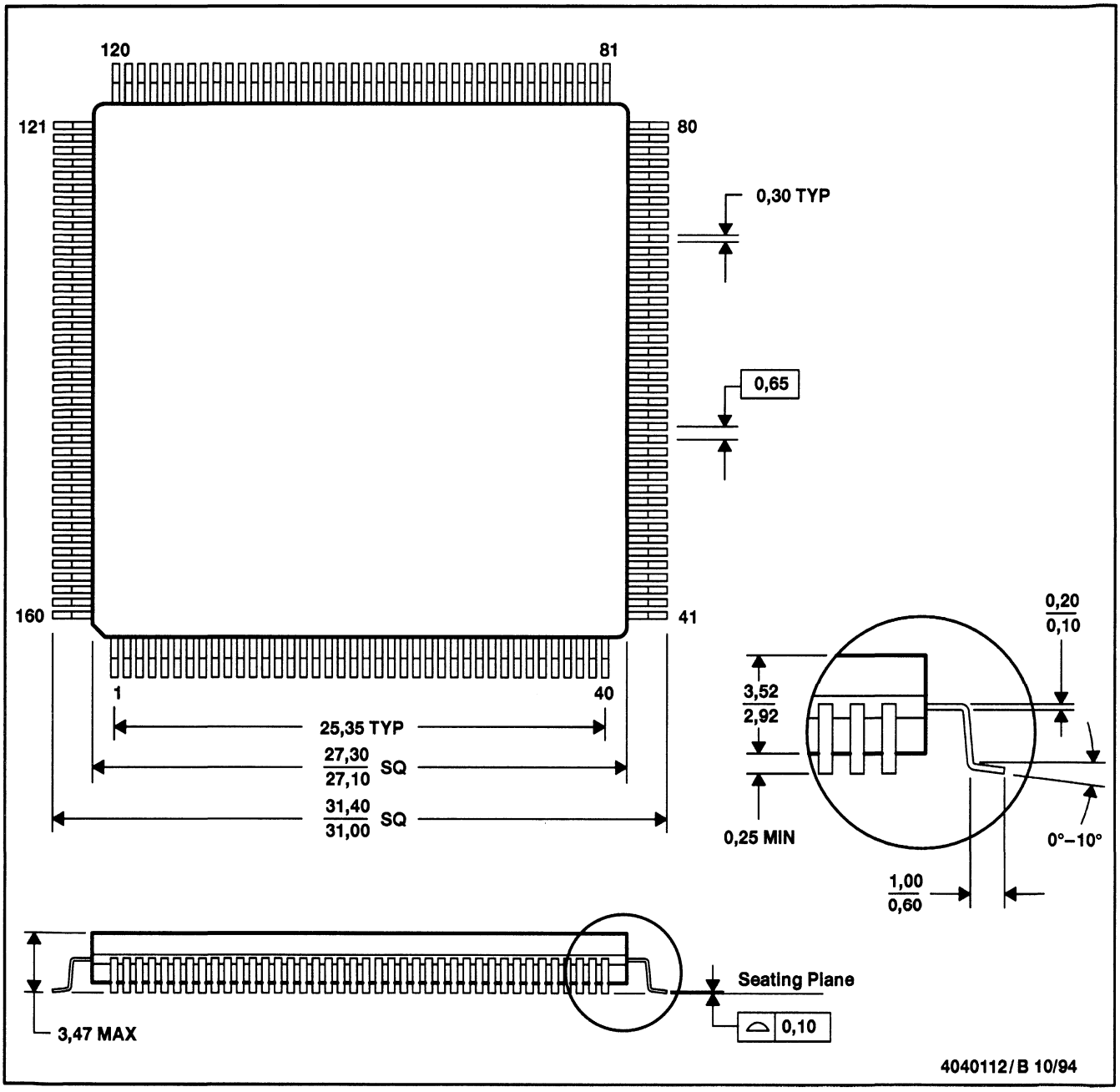


*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

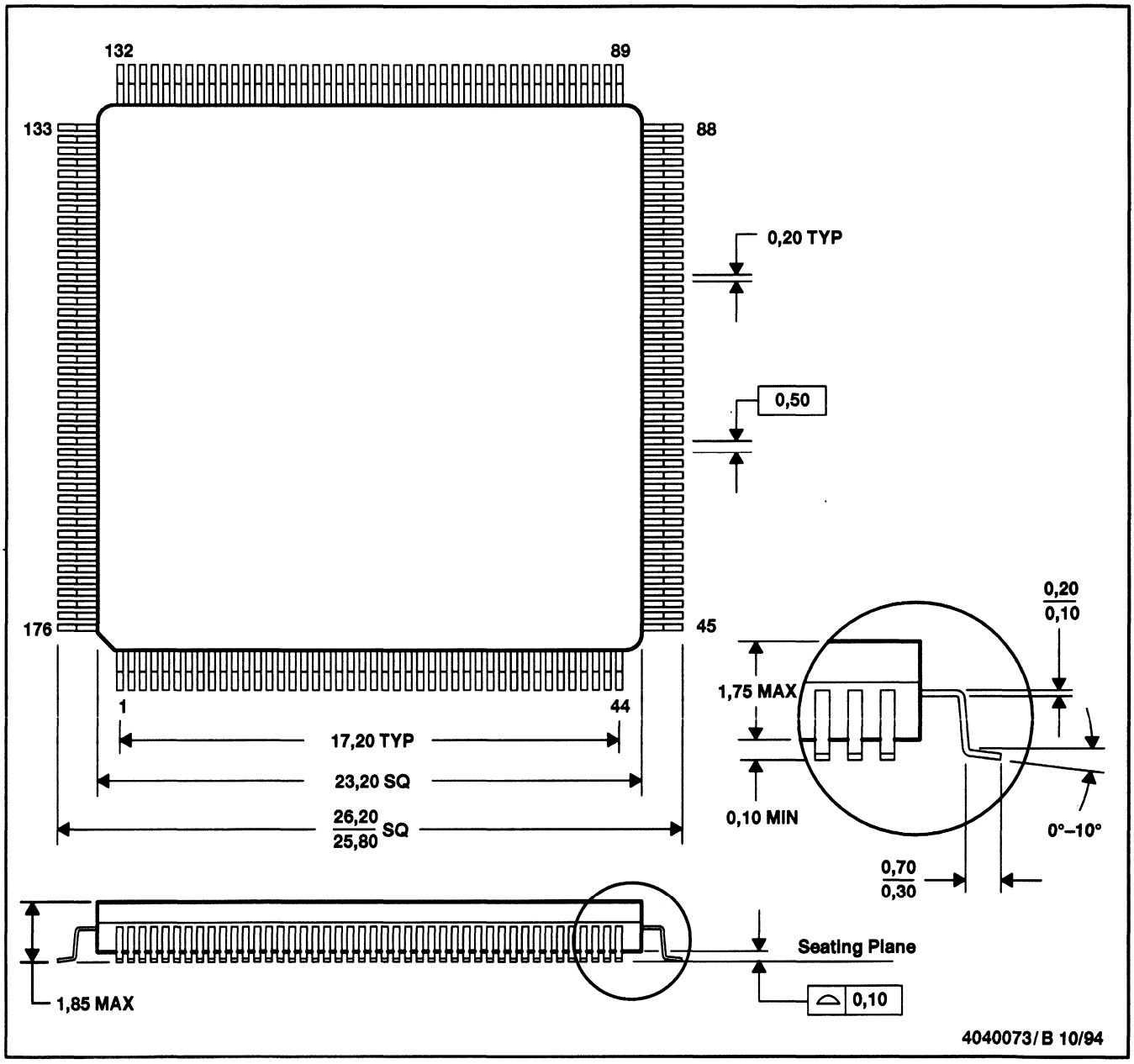
HY (S-CQFP-G160) CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

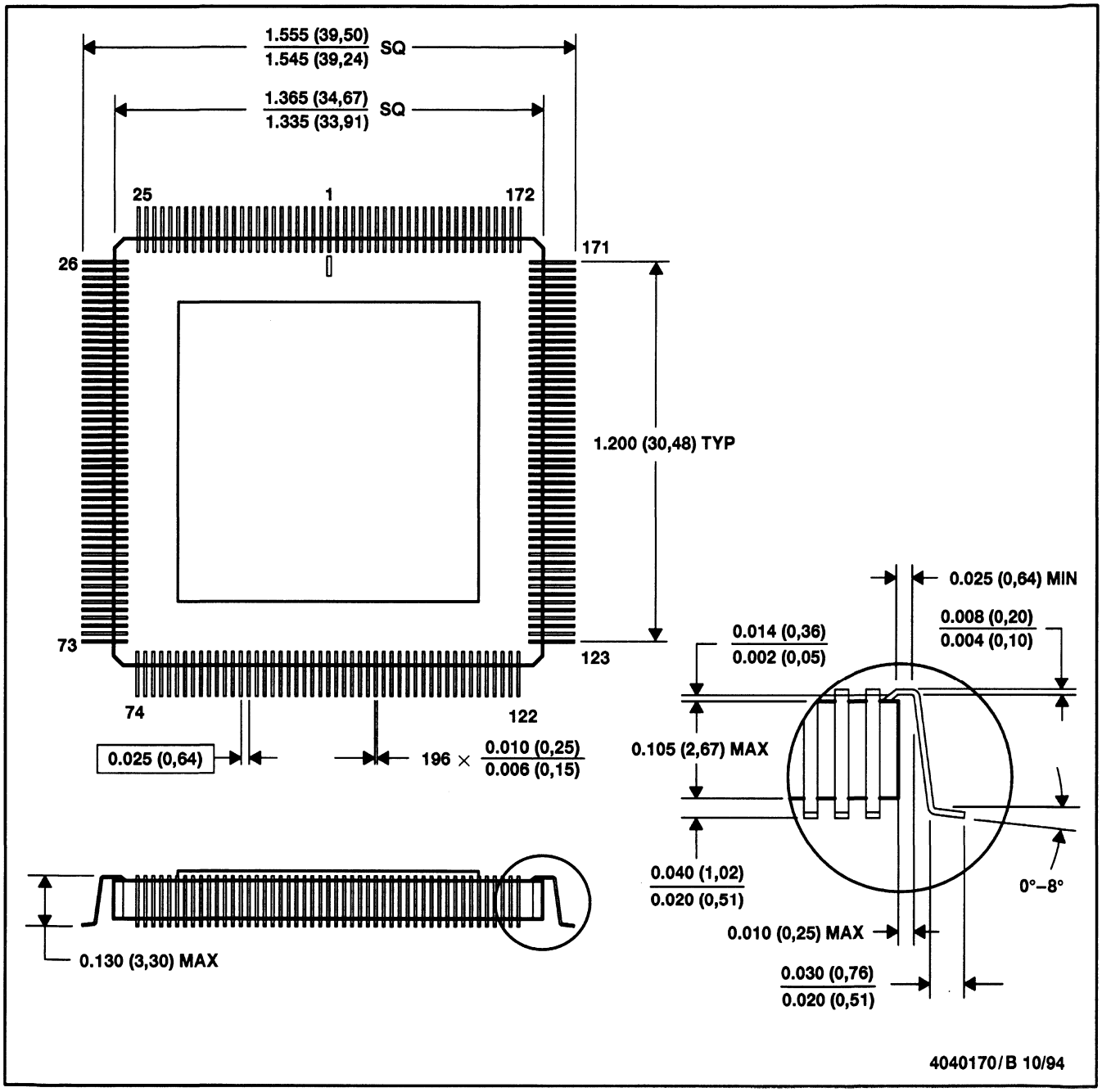
HZ (S-CQFP-G176) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

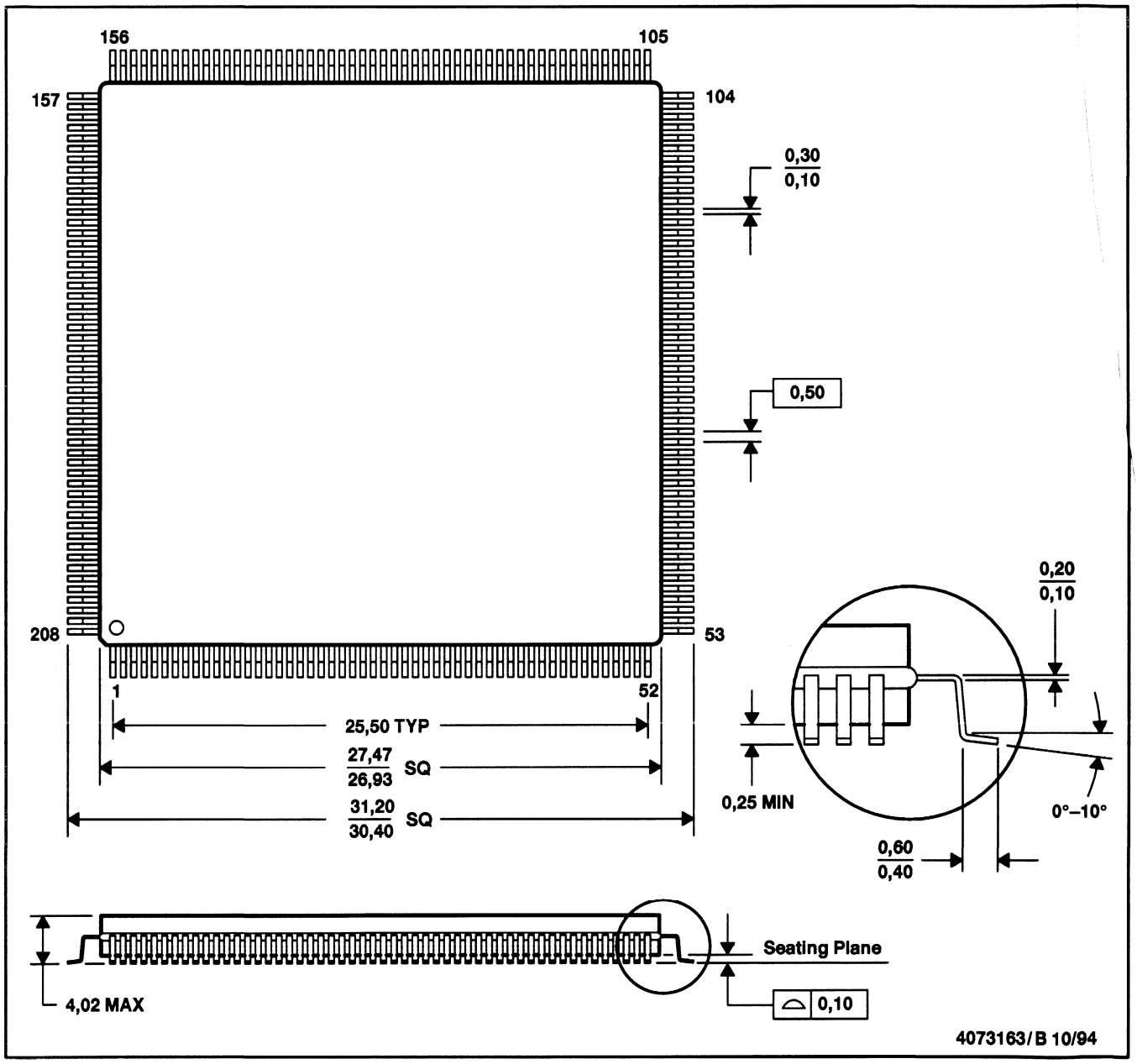
HU (S-CQFP-F196) CERAMIC QUAD FLATPACK



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

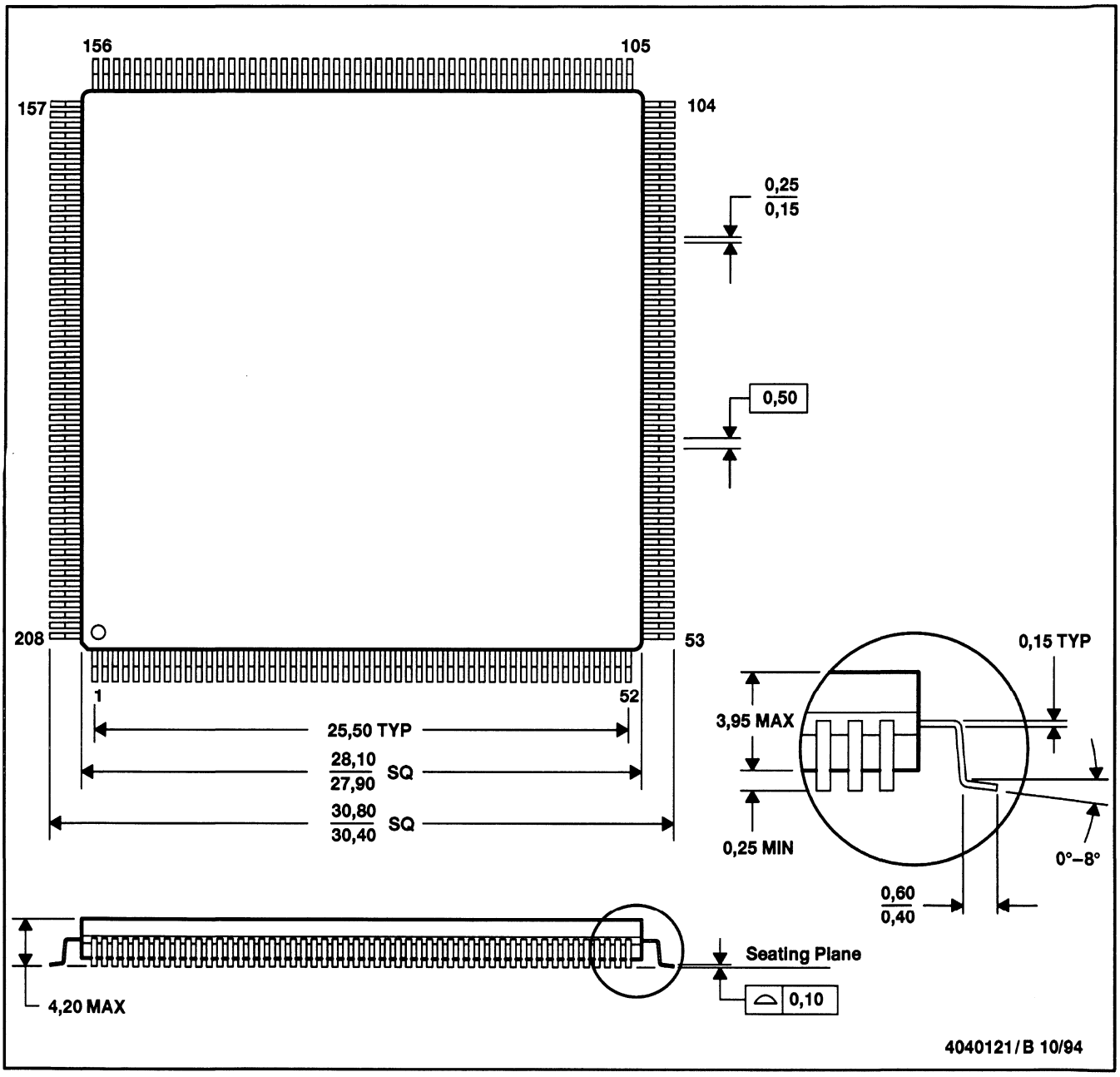
HAF (S-GQFP-G208) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

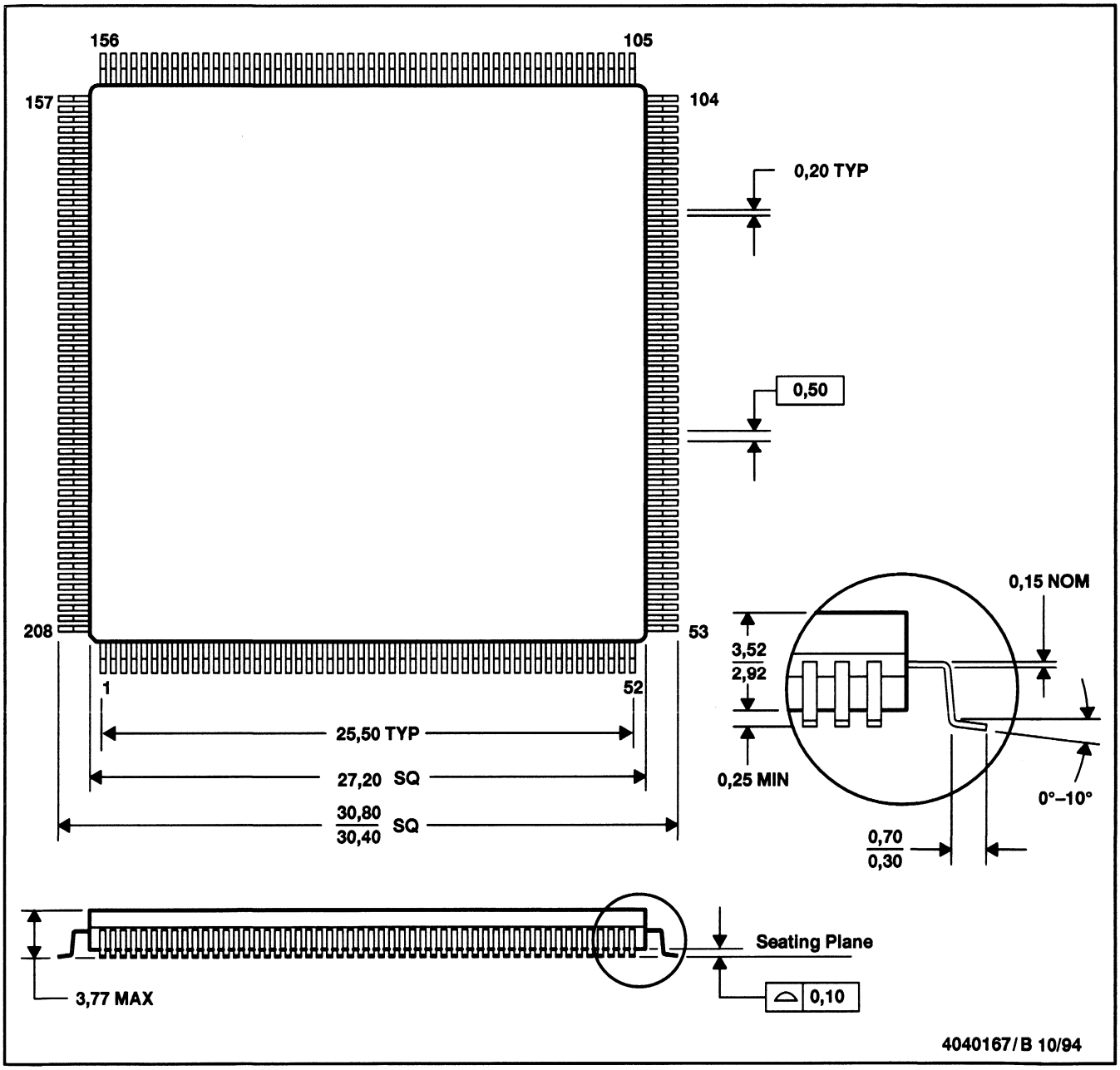
HPA (S-GQFP-G208) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

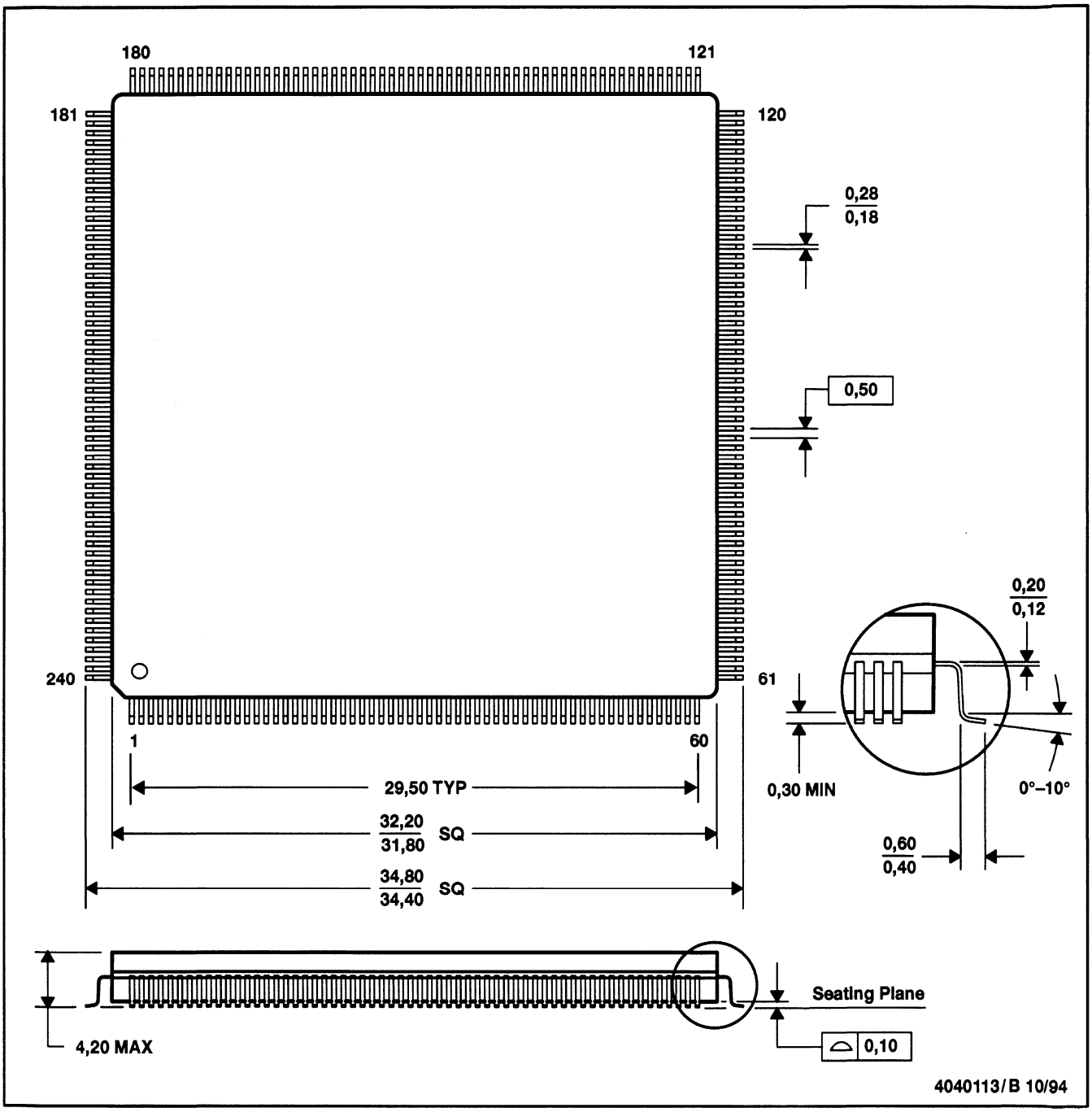
WF (S-GQFP-G208) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

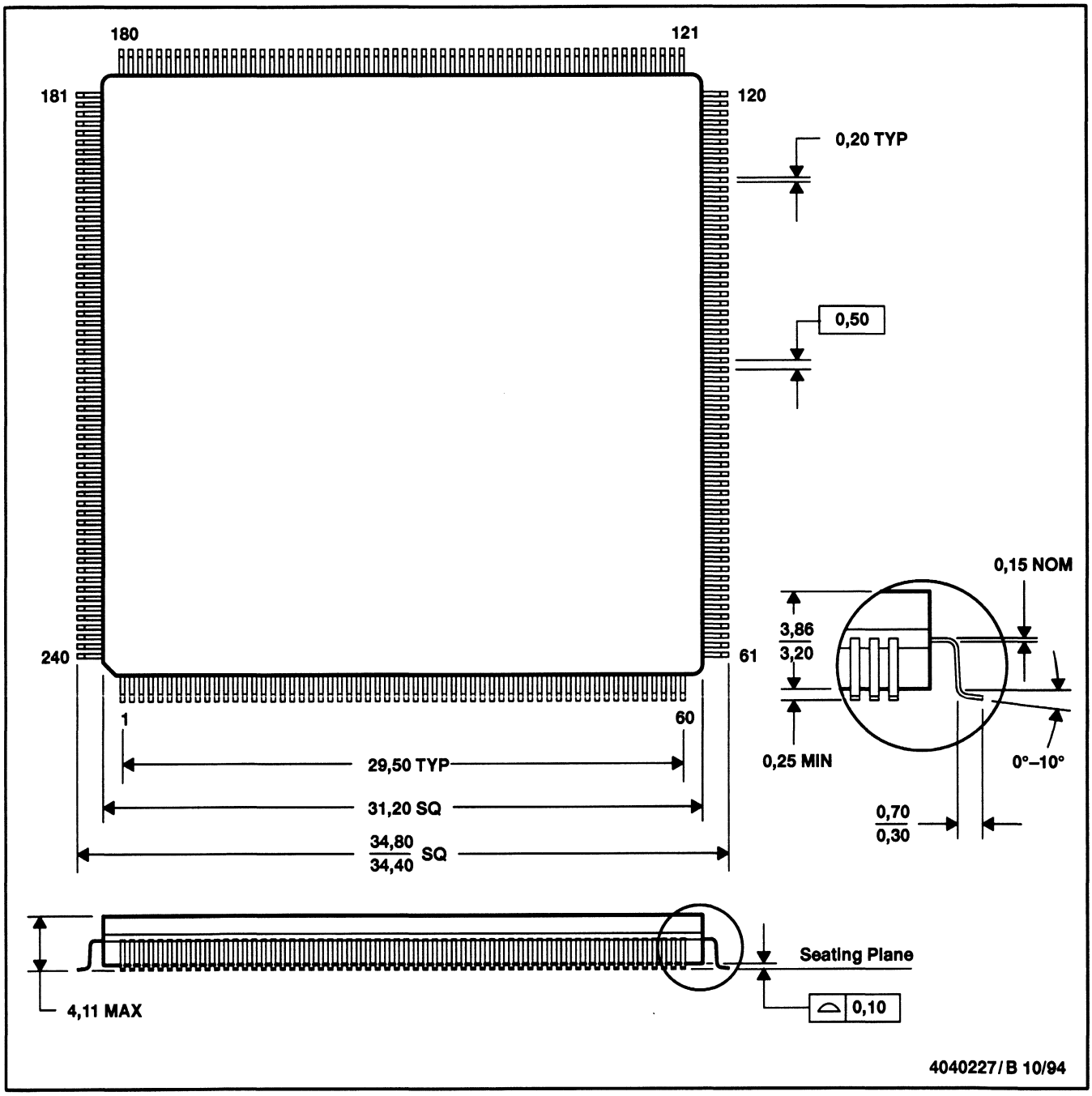
HPC (S-GQFP-G240) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

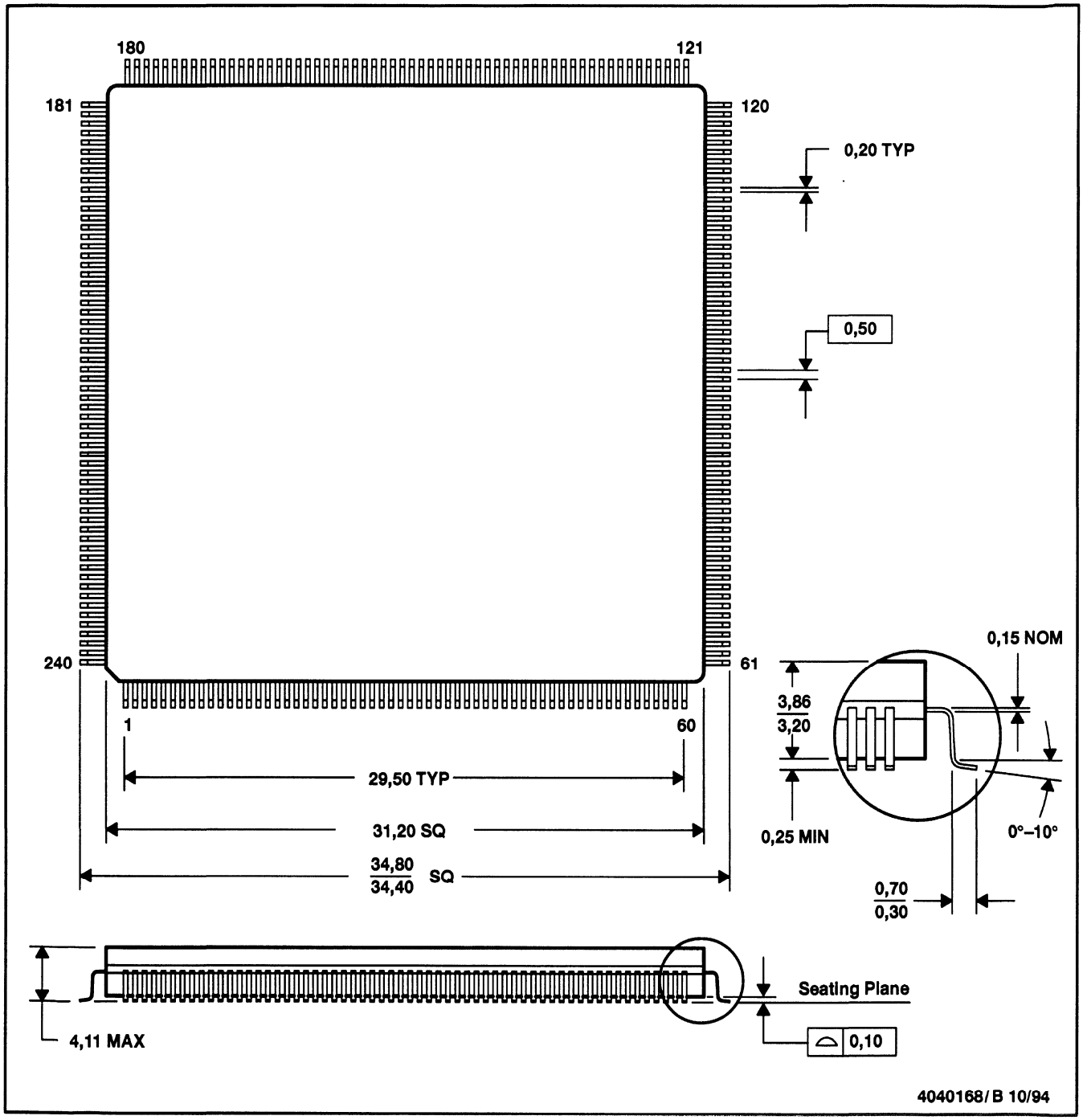
WG (S-GQFP-G240) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

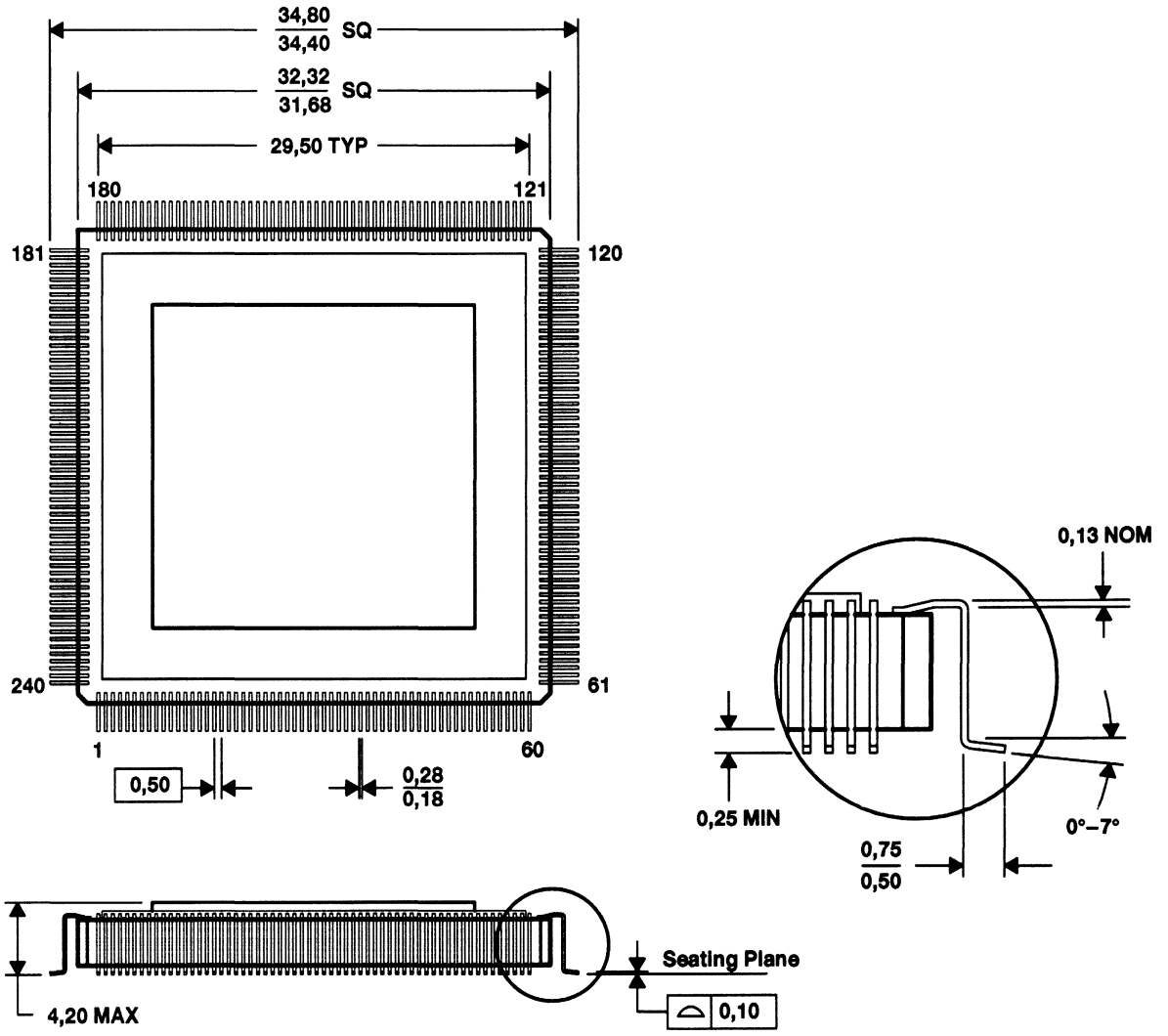
WH (S-GQFP-G240) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Ceramic material is ALN.

OCTOBER 1994

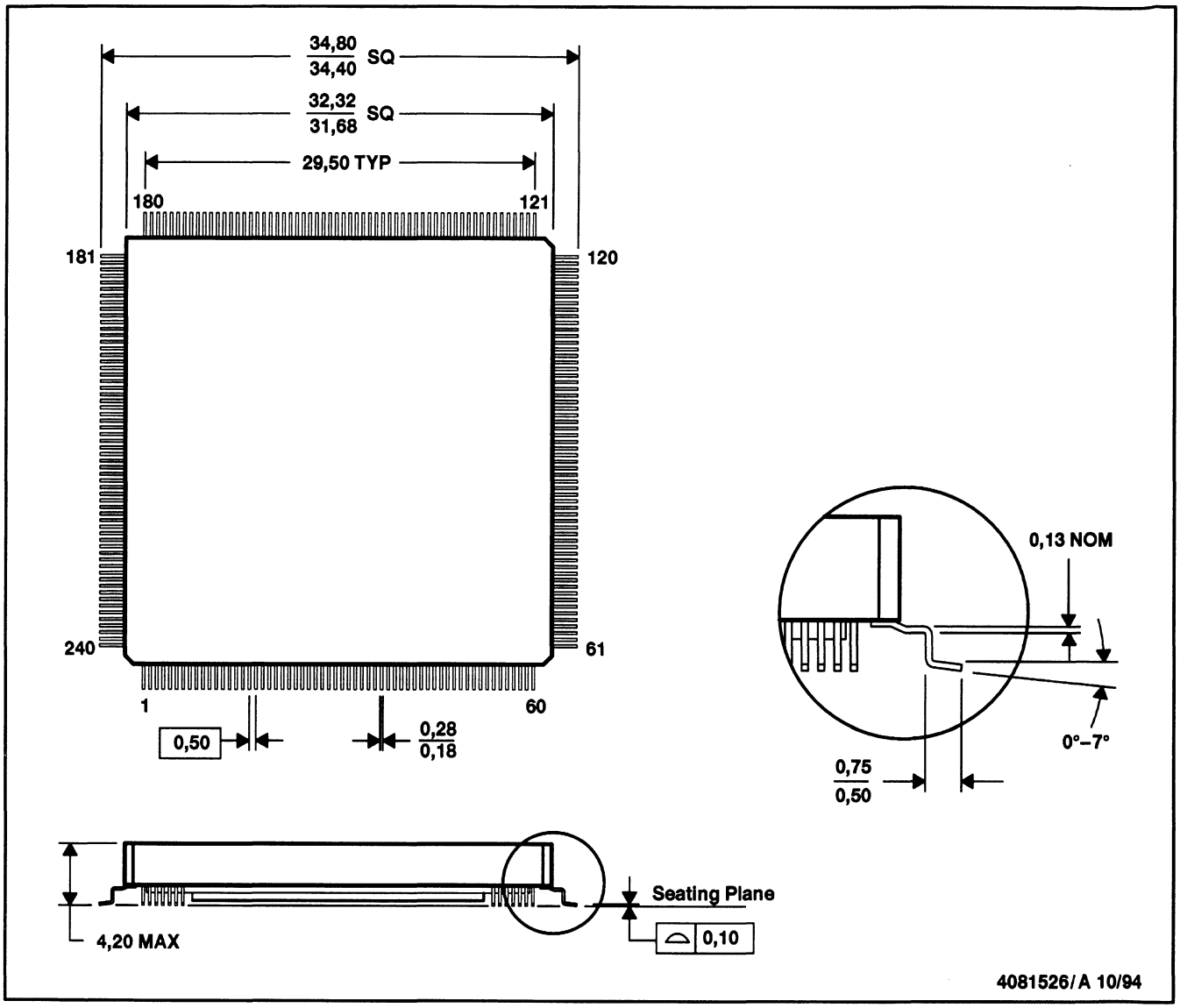
WK (S-CQFP-G240) **CERAMIC QUAD FLATPACK (CAVITY-UP)**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

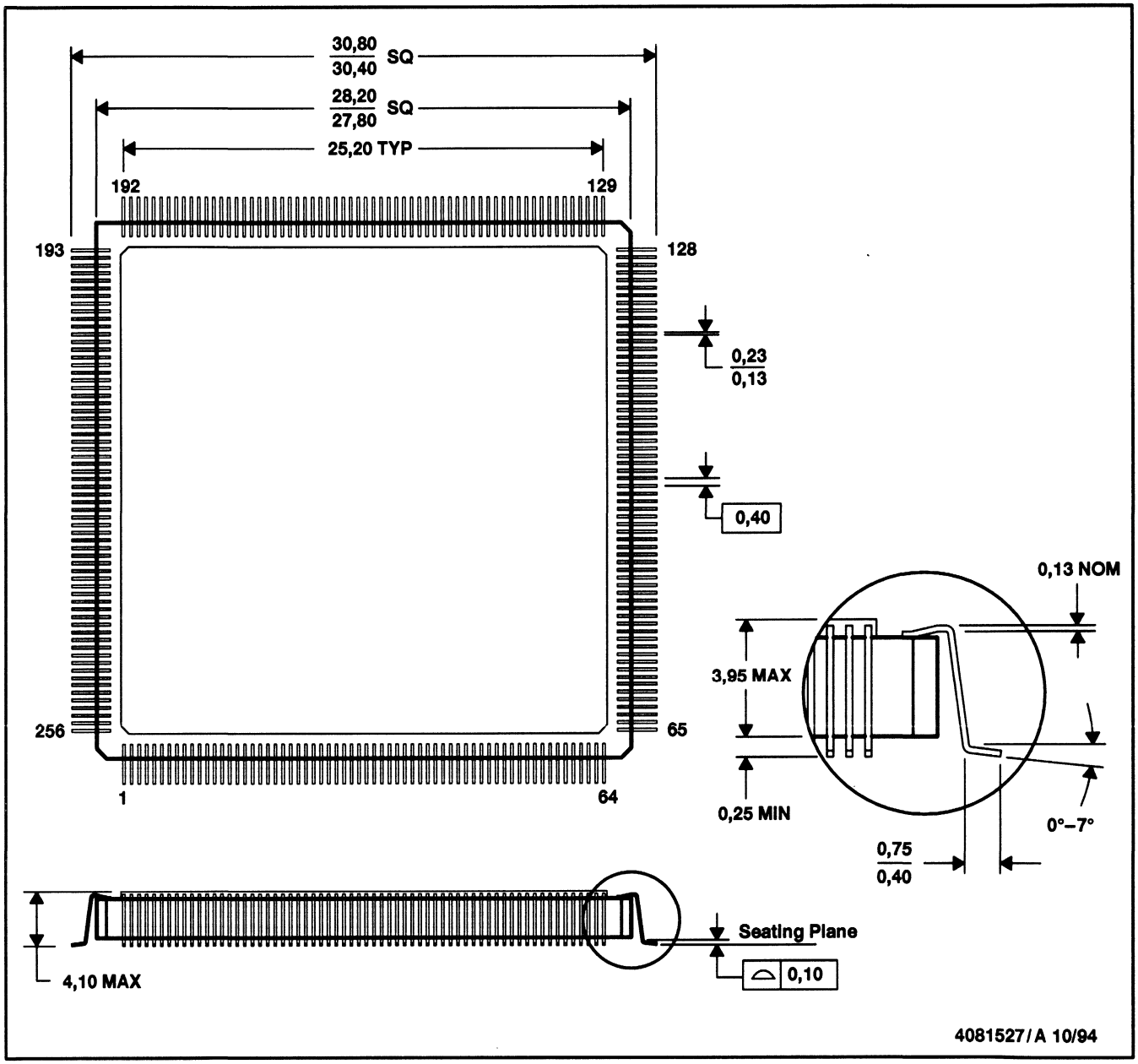
WM (S-CQFP-G240) **CERAMIC QUAD FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

HBM (S-CQFP-G256) **CERAMIC QUAD FLATPACK**



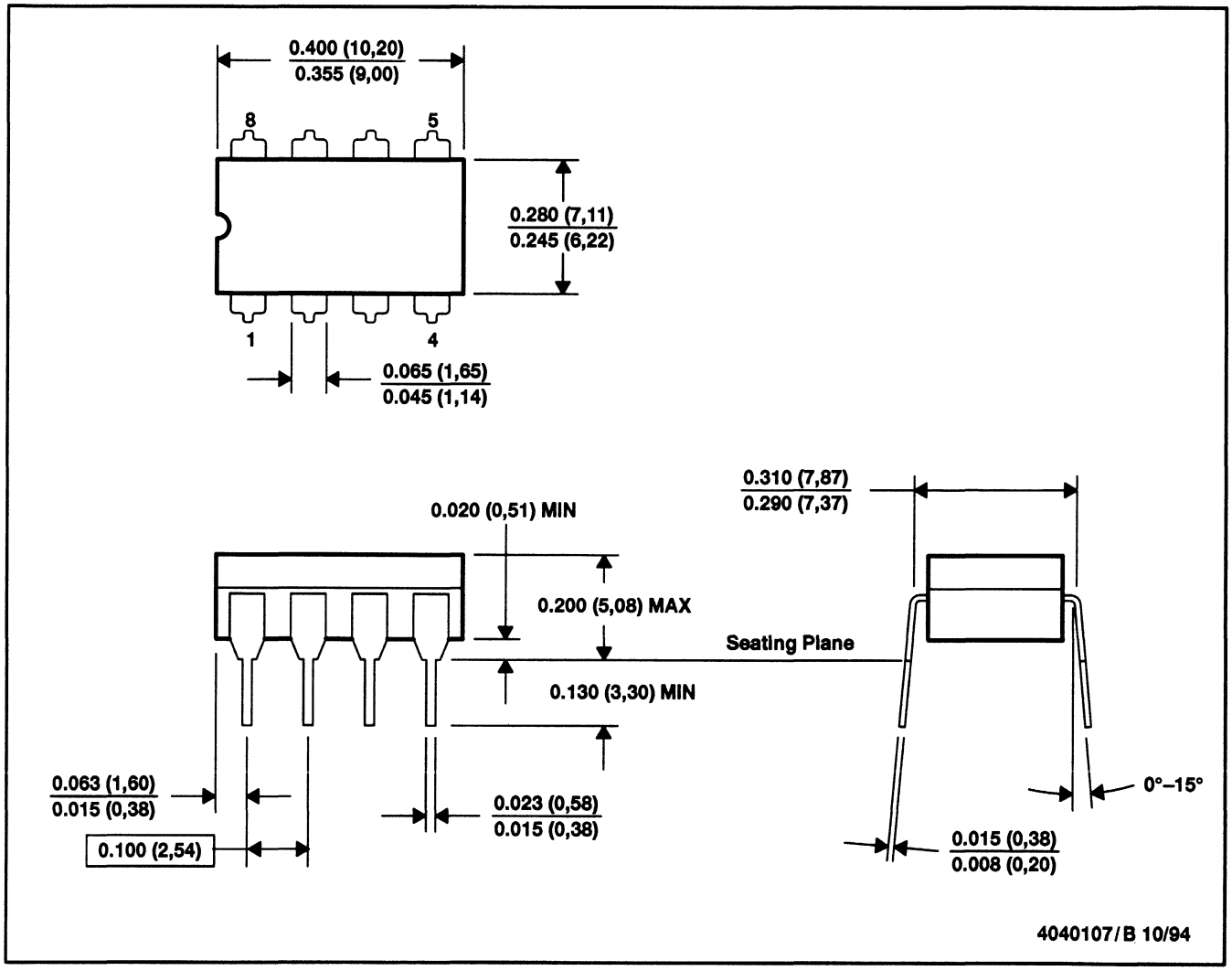
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

5 Ceramic Through-Hole

CONTENTS

OCTOBER 1994

JG (R-GDIP-T8) **CERAMIC DUAL-IN-LINE PACKAGE**



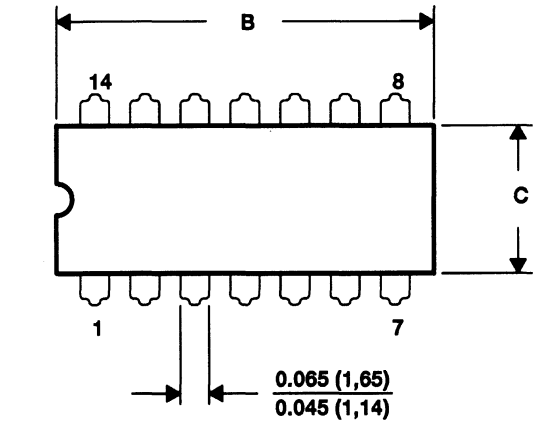
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP1-T8

OCTOBER 1994

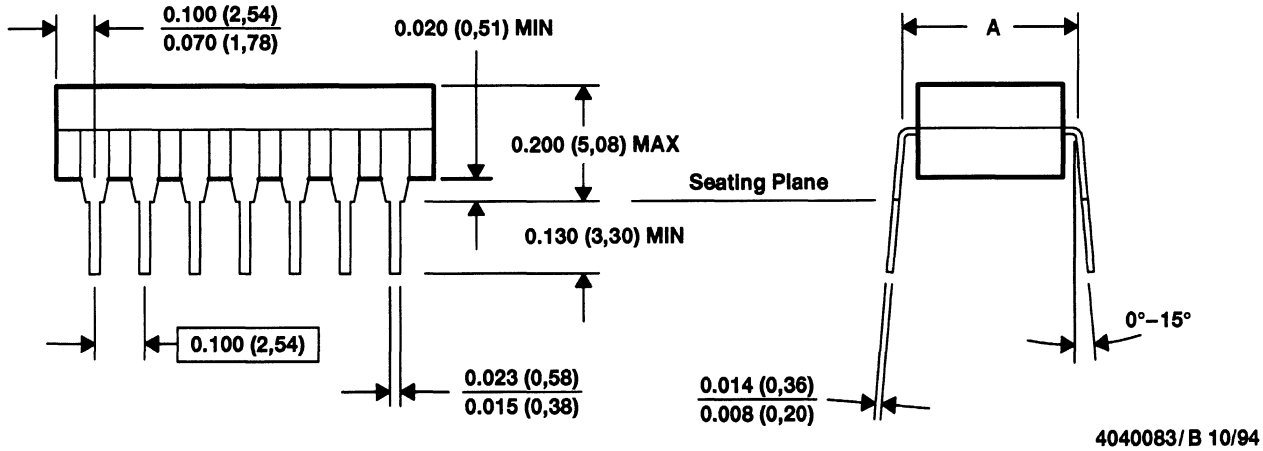
J (R-GDIP-T**)

CERAMIC DUAL-IN-LINE PACKAGE

14 PIN SHOWN



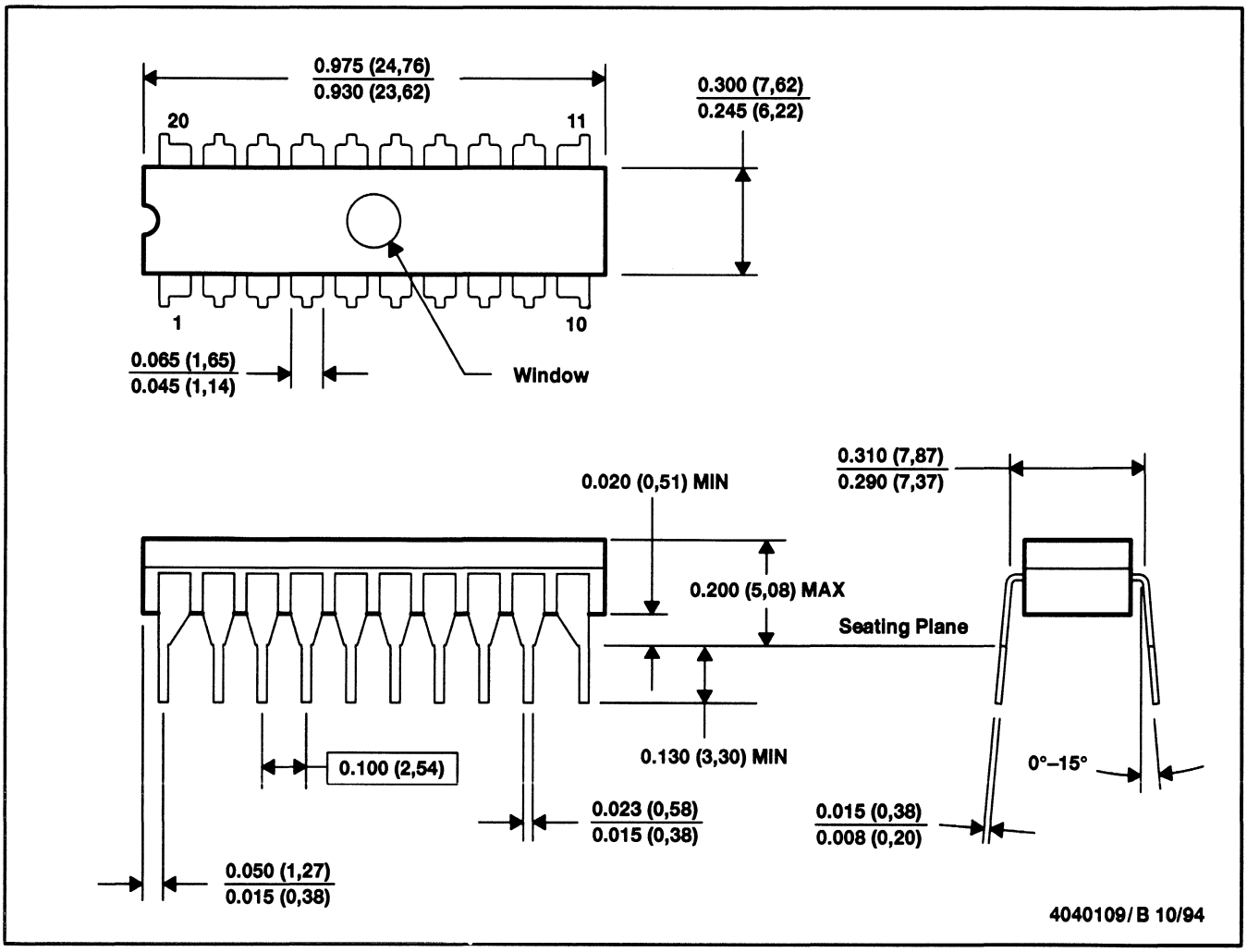
DIM \ PINS **	14	16	18	20	22
A MAX	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)	0.310 (7,87)	0.410 (10,41)
A MIN	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)	0.290 (7,37)	0.390 (9,91)
B MAX	0.785 (19,94)	0.785 (19,94)	0.910 (23,10)	0.975 (24,77)	1.100 (28,00)
B MIN	0.755 (19,18)	0.755 (19,18)	—	0.930 (23,62)	—
C MAX	0.280 (7,11)	0.300 (7,62)	0.300 (7,62)	0.300 (7,62)	0.388 (9,65)
C MIN	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)	0.245 (6,22)	—



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP1-T14, GDIP1-T16, GDIP1-T18, GDIP1-T20, and GDIP1-T22

OCTOBER 1994

JL (R-GDIP-T20) **CERAMIC DUAL-IN-LINE PACKAGE**



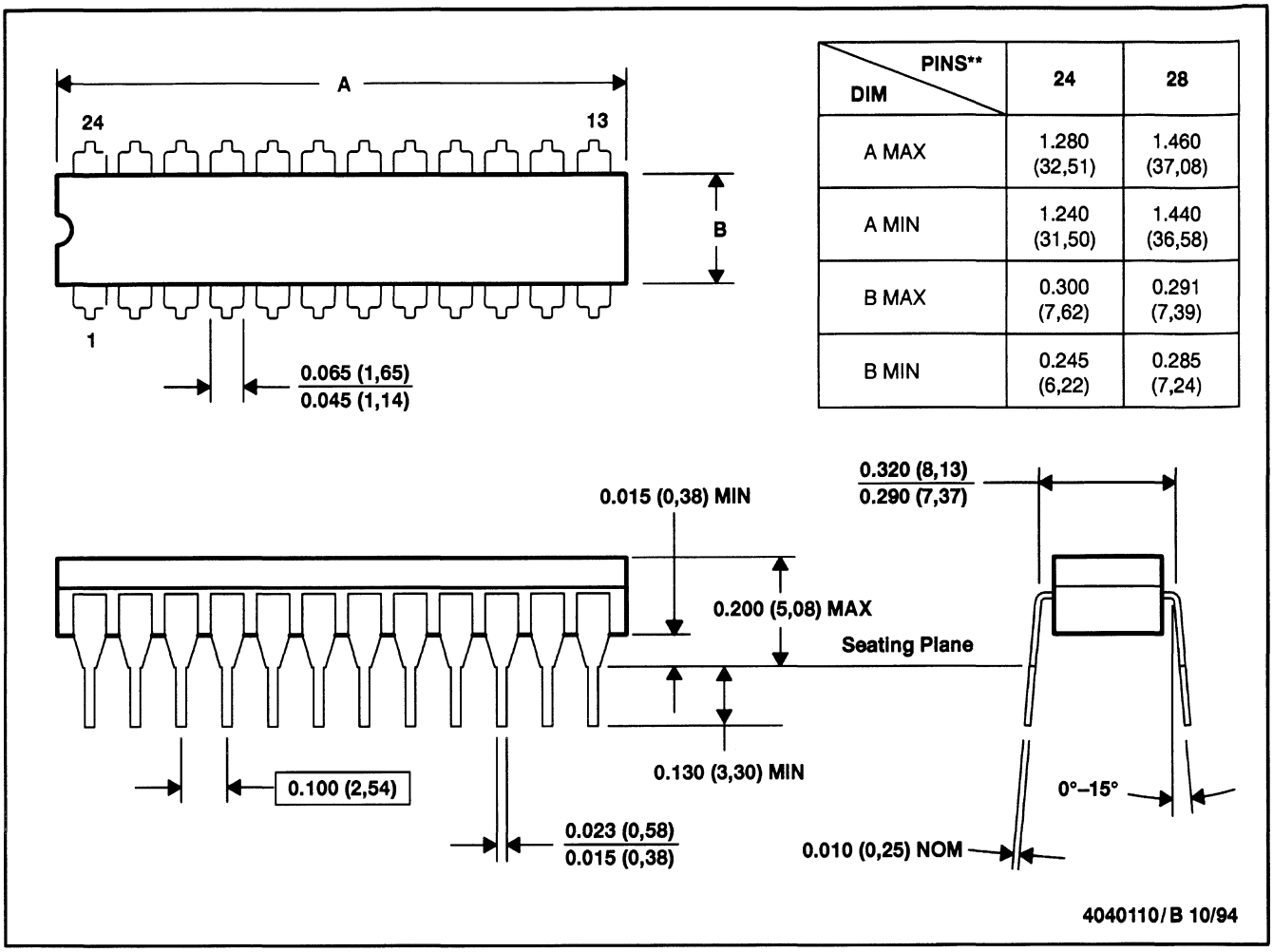
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP1-T20

OCTOBER 1994

JT (R-GDIP-T**)

CERAMIC DUAL-IN-LINE PACKAGE

24 PIN SHOWN

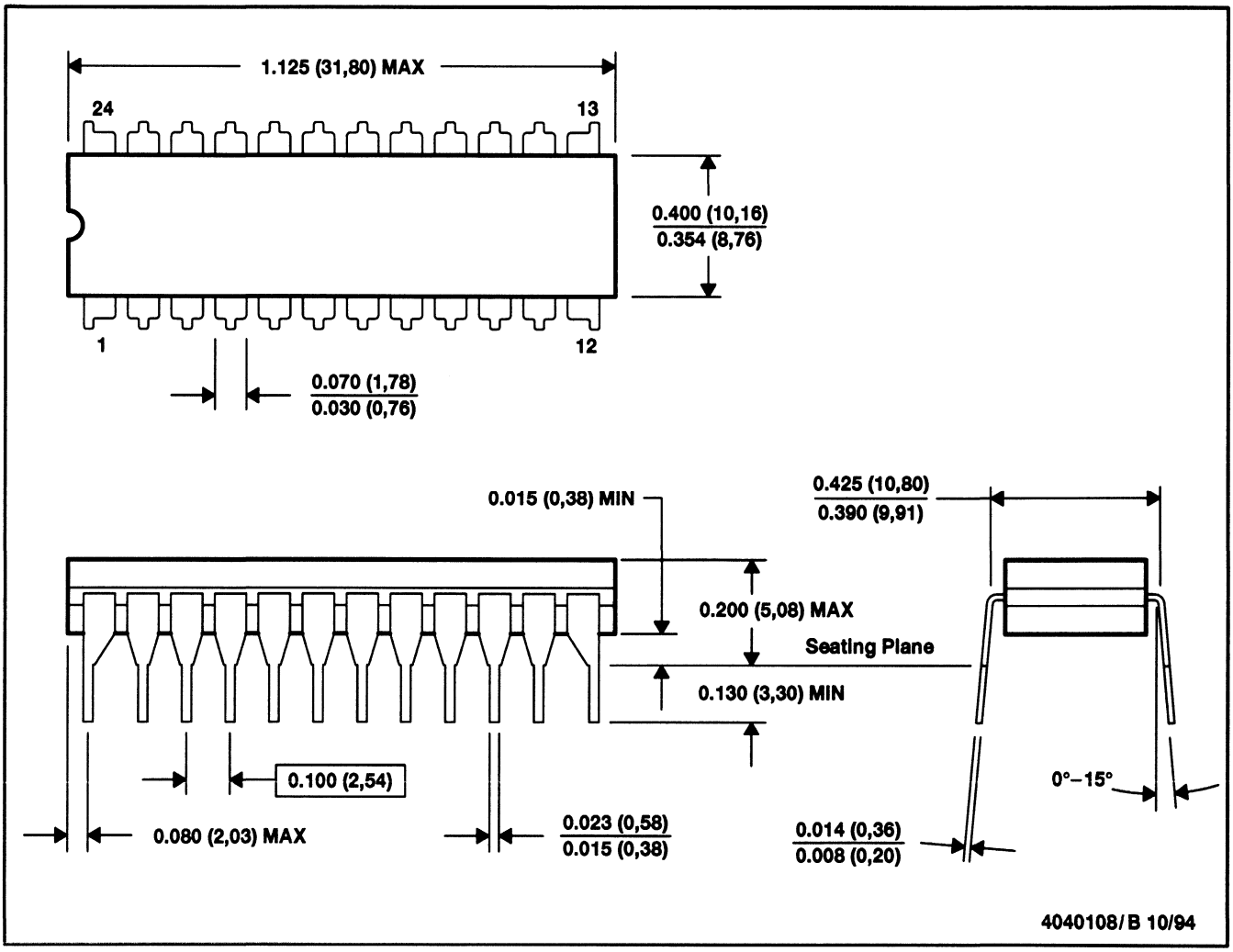


DIM \ PINS**	24	28
A MAX	1.280 (32,51)	1.460 (37,08)
A MIN	1.240 (31,50)	1.440 (36,58)
B MAX	0.300 (7,62)	0.291 (7,39)
B MIN	0.245 (6,22)	0.285 (7,24)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP-T24 and GDIP-T28 and JEDEC MO-058AA and MO-058AB

OCTOBER 1994

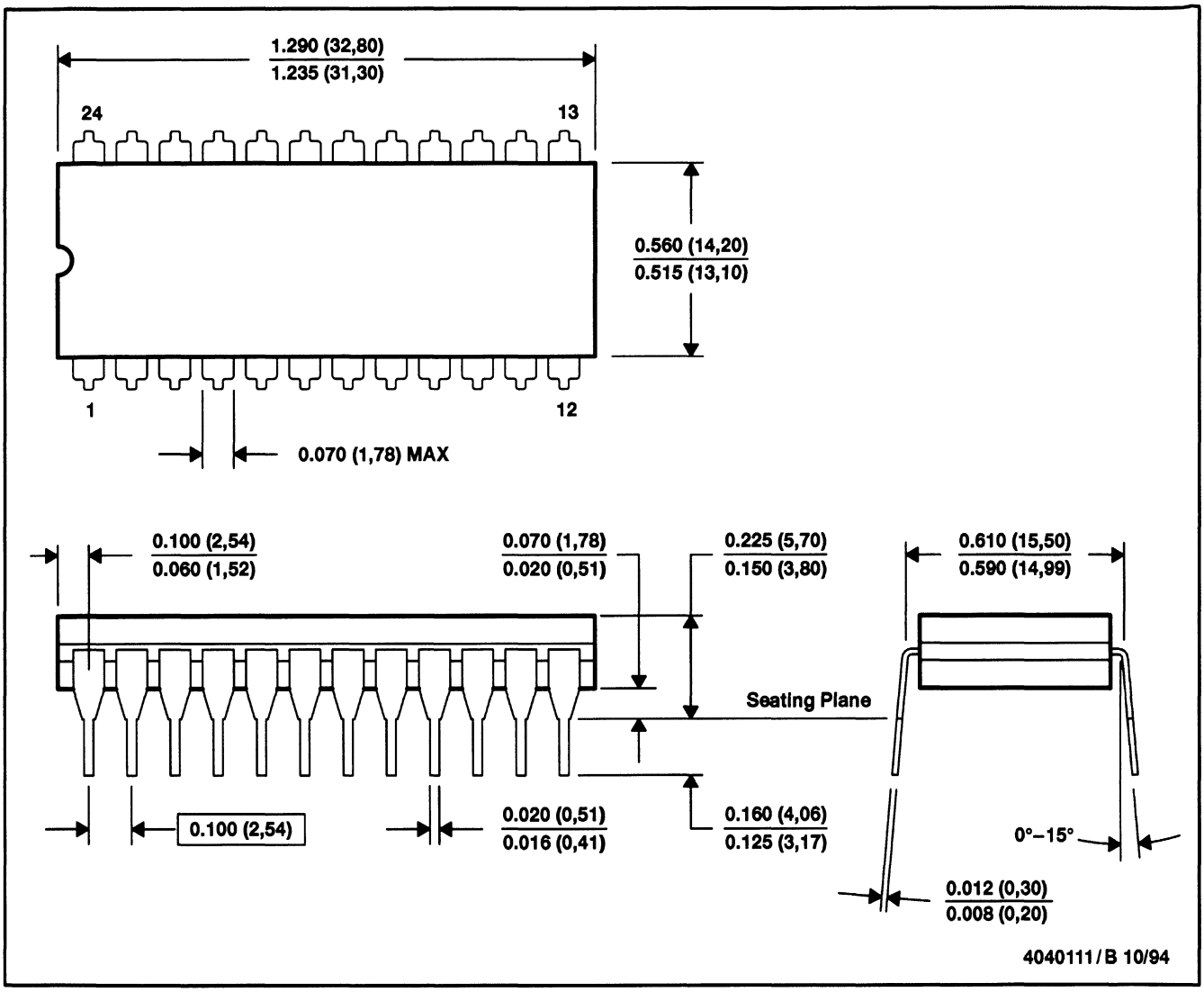
JK (R-GDIP-T24) **CERAMIC DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP5-T24

OCTOBER 1994

JW (R-GDIP-T24) **CERAMIC DUAL-IN-LINE PACKAGE**



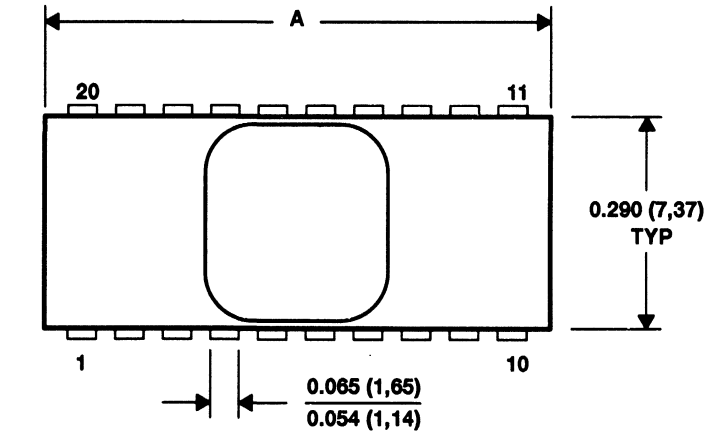
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only
E. Falls within MIL-STD-1835 GDIP5-T24

OCTOBER 1994

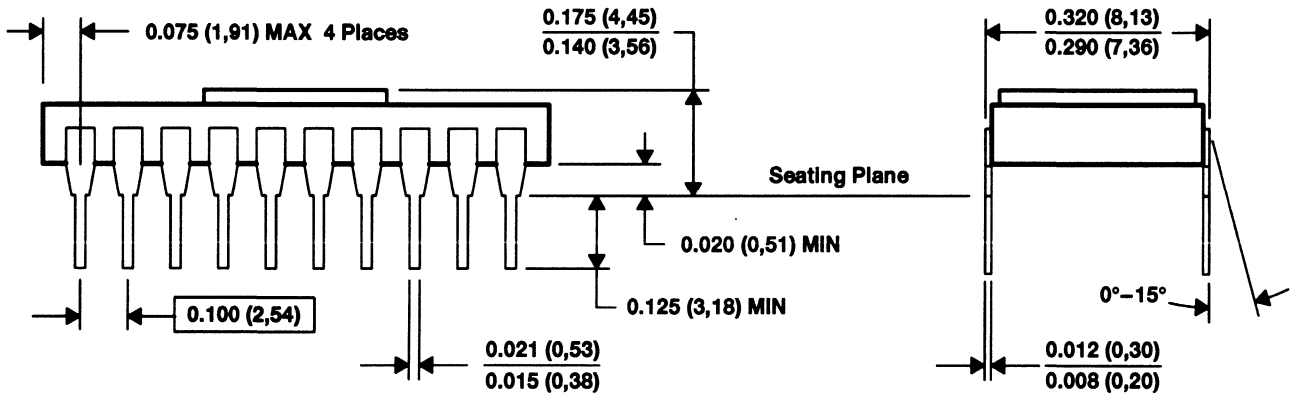
JD (R-CDIP-T**)

CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE

20 PIN SHOWN



DIM \ PINS **	16	18	20	24
A MAX	0.810 (20,57)	0.910 (23,11)	1.010 (25,65)	1.100 (27,94)

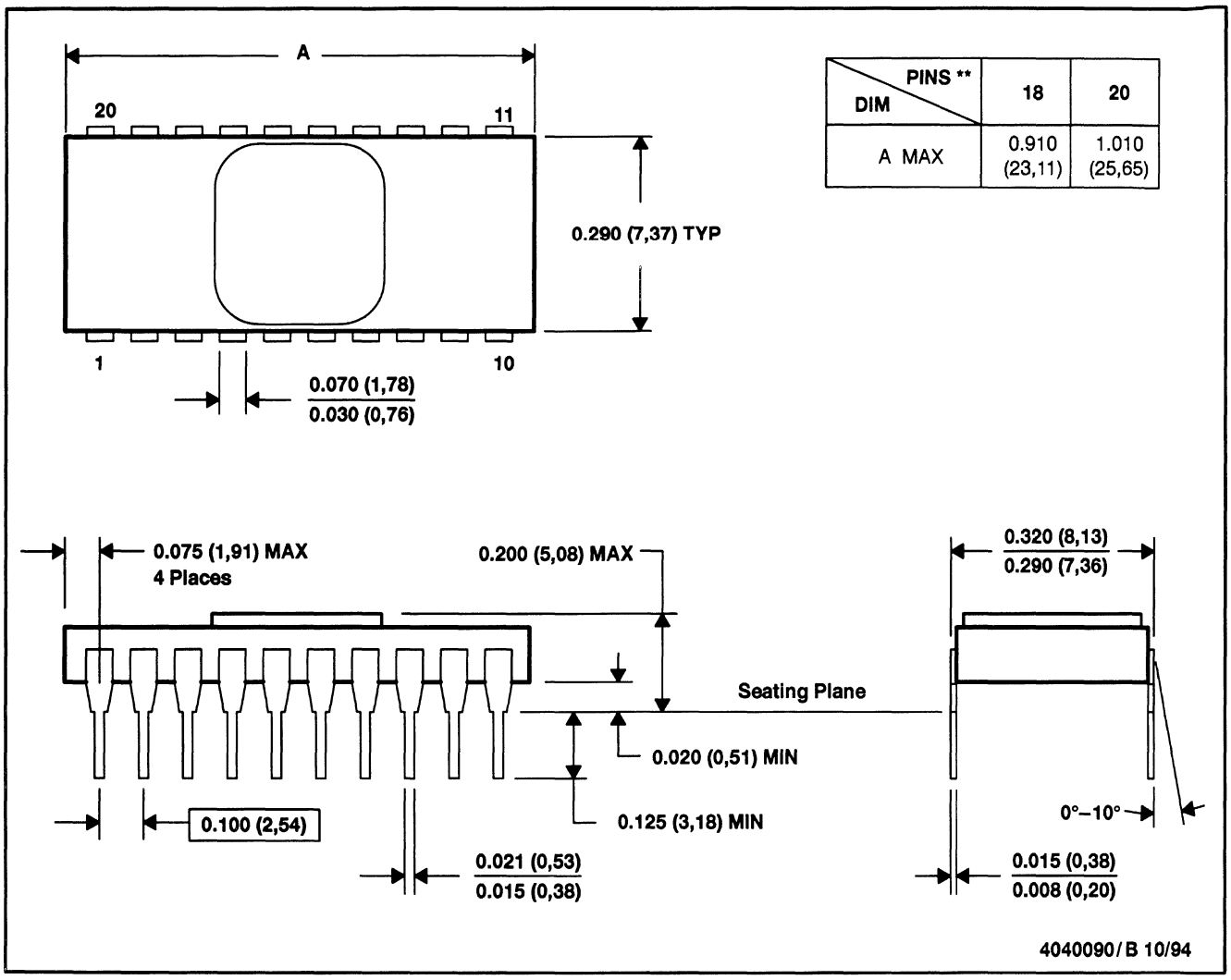


NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

JDB (R-CDIP-T)** **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**

20 PIN SHOWN



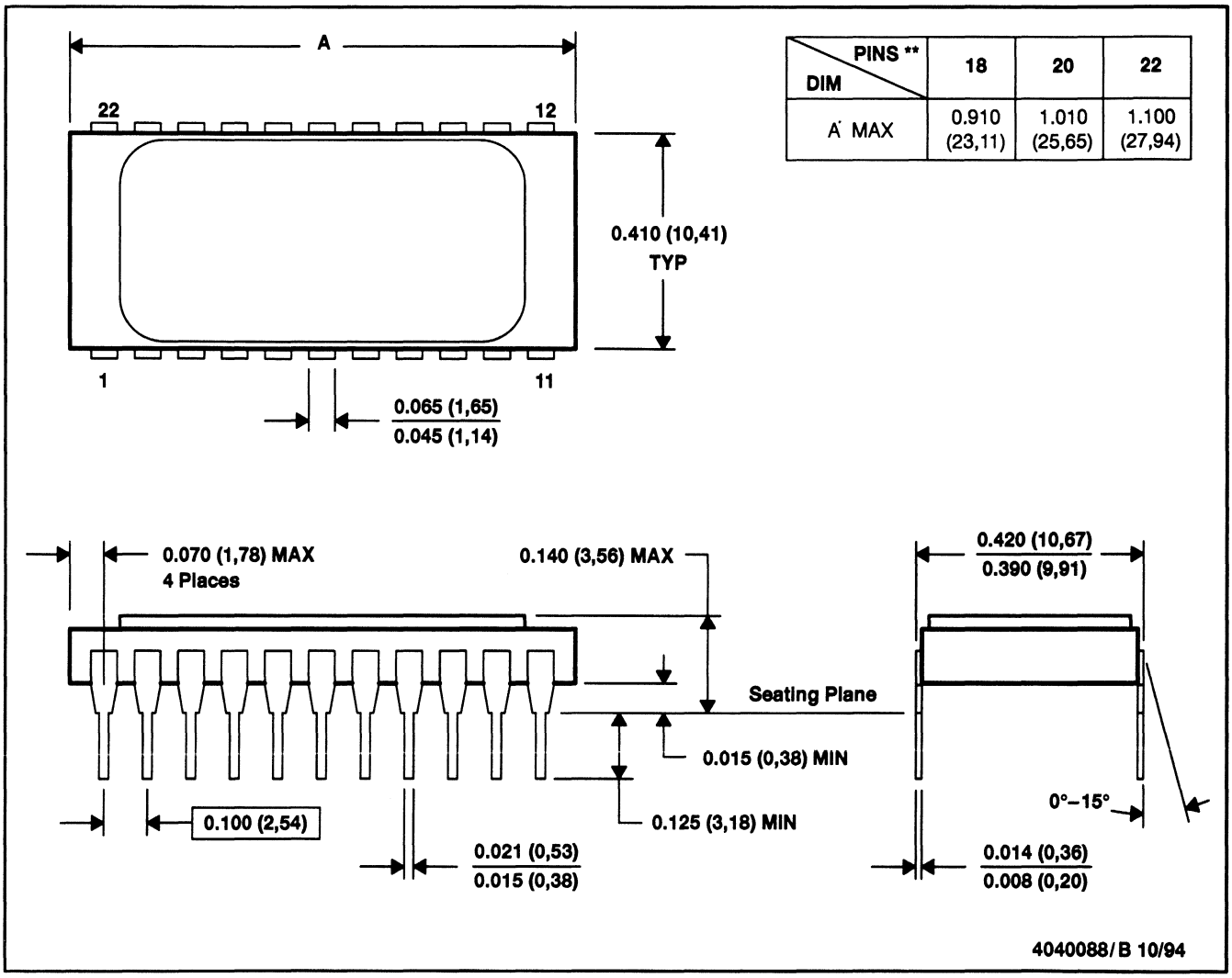
DIM \ PINS **	18	20
A MAX	0.910 (23,11)	1.010 (25,65)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Falls within MIL-STD-1835 GDIP1-T18, GDIP1-T20 and JEDEC MS-015 AD, MS-015 AE

OCTOBER 1994

JD(R-CDIP-T)** **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**

22 PIN SHOWN



DIM \ PINS **	18	20	22
A MAX	0.910 (23,11)	1.010 (25,65)	1.100 (27,94)

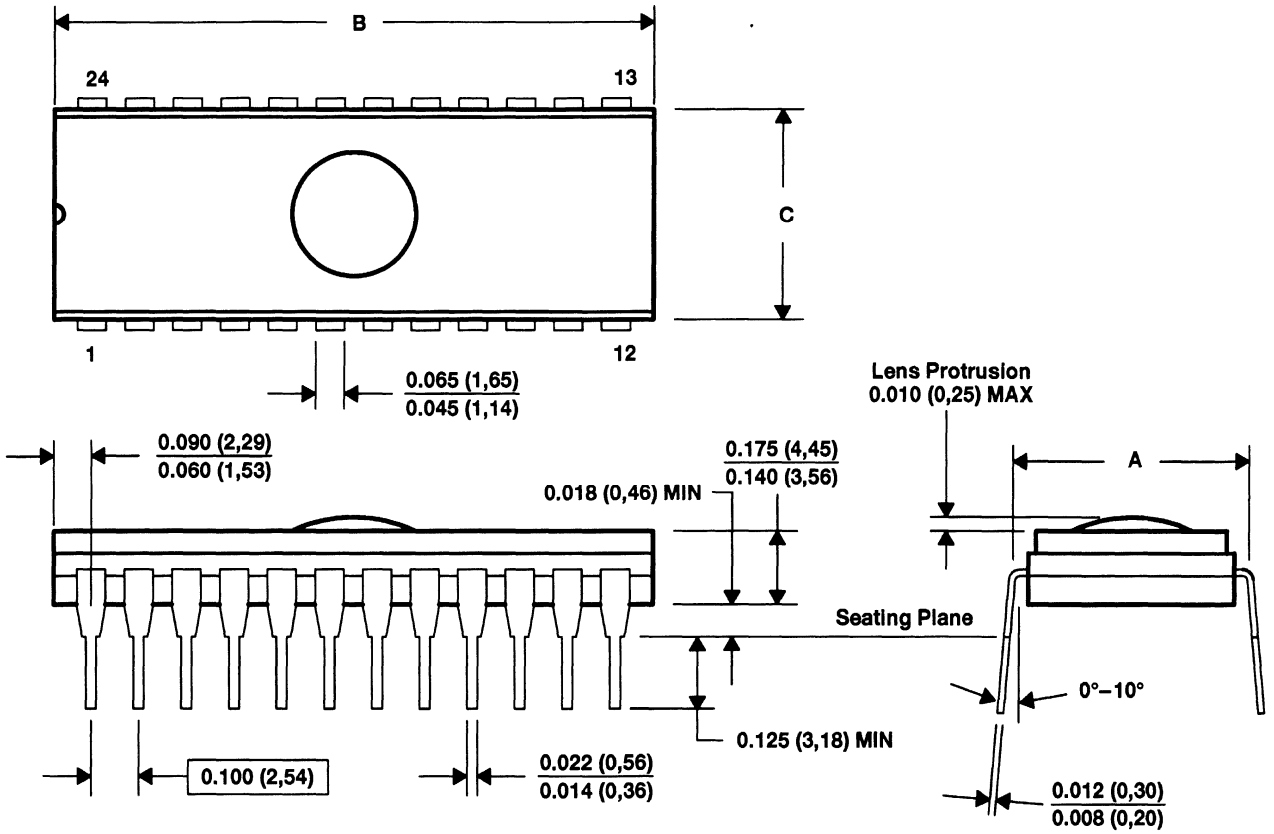
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

J (R-CDIP-T**)

CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE

24 PIN SHOWN



DIM \ PINS**		24		28		32		40	
		NARR	WIDE	NARR	WIDE	NARR	WIDE	NARR	WIDE
A	MAX	0.624(15,85)	0.624(15,85)	0.624(15,85)	0.624(15,85)	0.624(15,85)	0.624(15,85)	0.624(15,85)	0.624(15,85)
	MIN	0.590(14,99)	0.590(14,99)	0.590(14,99)	0.590(14,99)	0.590(14,99)	0.590(14,99)	0.590(14,99)	0.590(14,99)
B	MAX	1.265(32,13)	1.265(32,13)	1.465(37,21)	1.465(37,21)	1.668(42,37)	1.668(42,37)	2.068(52,53)	2.068(52,53)
	MIN	1.235(31,37)	1.235(31,37)	1.435(36,45)	1.435(36,45)	1.632(41,45)	1.632(41,45)	2.032(51,61)	2.032(51,61)
C	MAX	0.541(13,74)	0.598(15,19)	0.541(13,74)	0.598(15,19)	0.541(13,74)	0.598(15,19)	0.541(13,74)	0.598(15,19)
	MIN	0.514(13,06)	0.571(14,50)	0.514(13,06)	0.571(14,50)	0.514(13,06)	0.571(14,50)	0.514(13,06)	0.571(14,50)

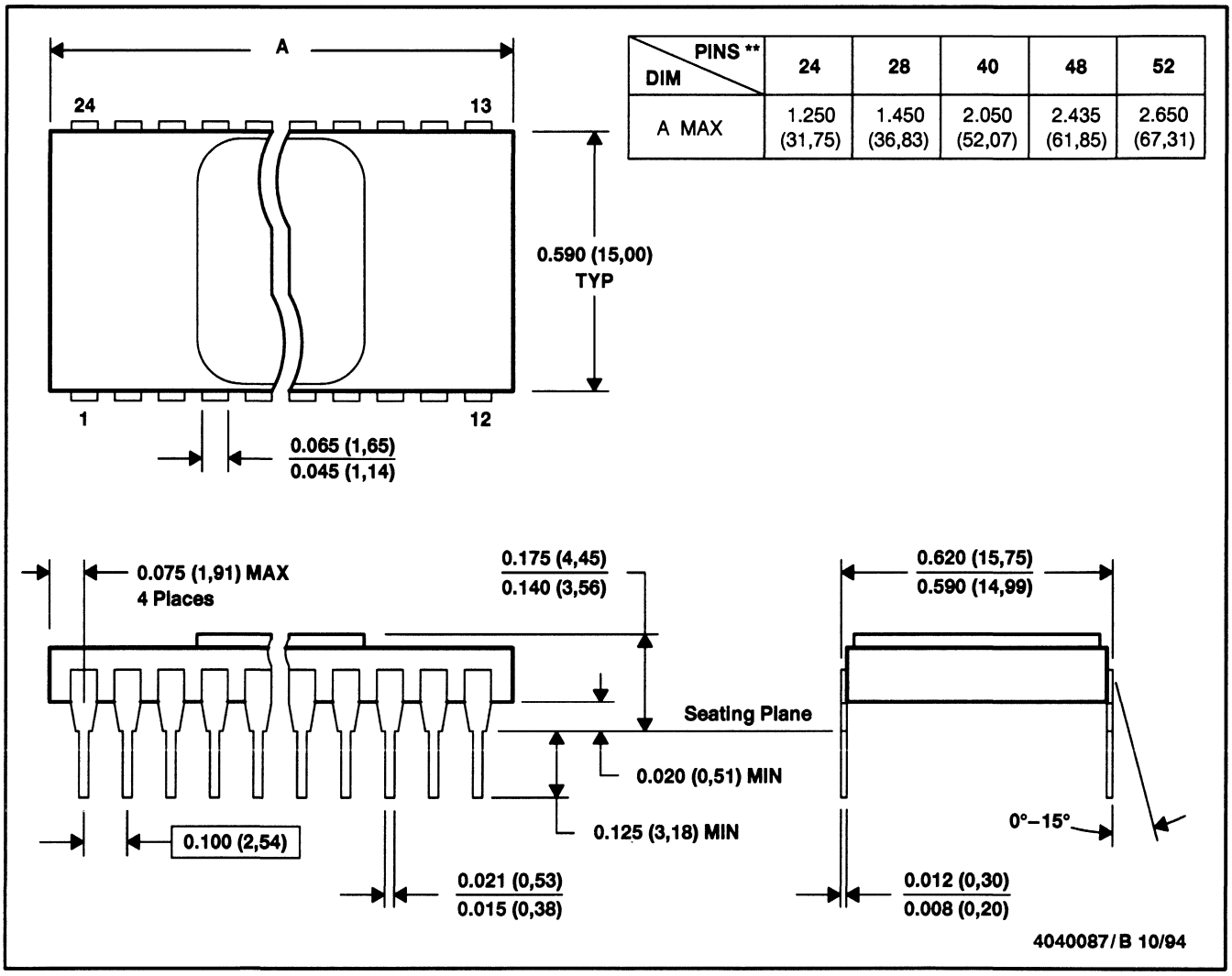
4040084/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a ceramic lid using glass frit.
D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only

OCTOBER 1994

JD (R-CDIP-T)** **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**

24 PIN SHOWN

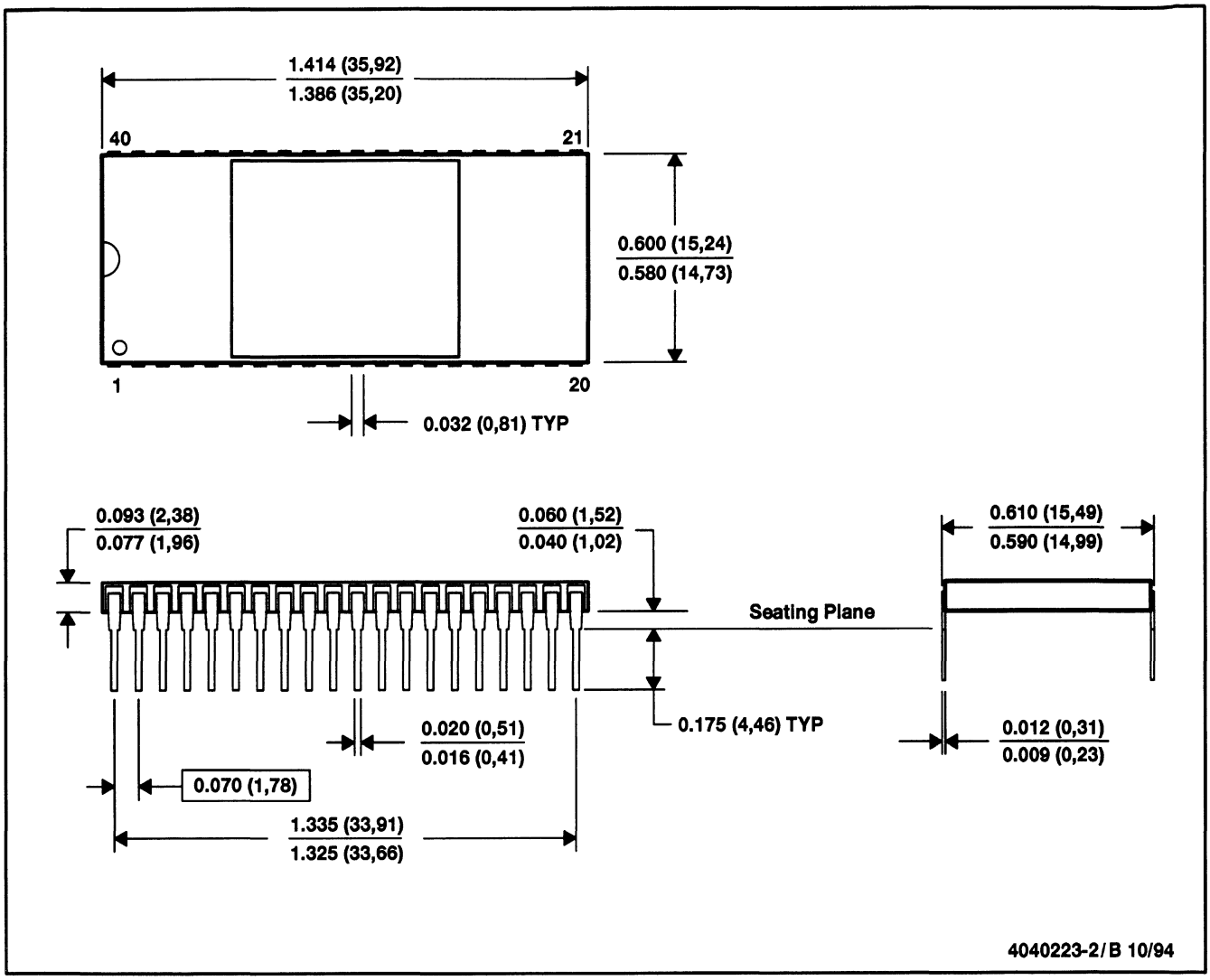


DIM \ PINS **	24	28	40	48	52
A MAX	1.250 (31,75)	1.450 (36,83)	2.050 (52,07)	2.435 (61,85)	2.650 (67,31)

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

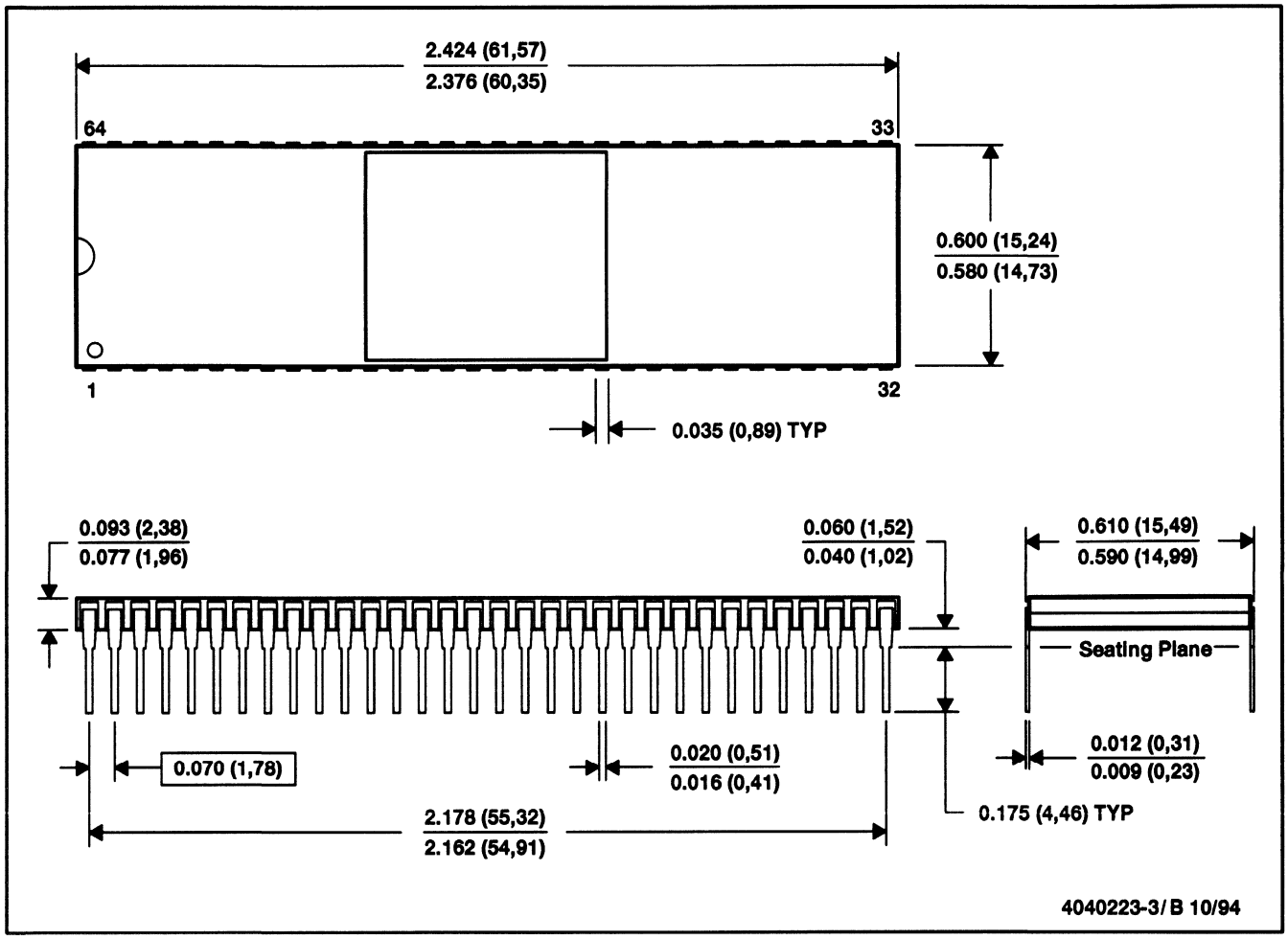
JC (R-CDIP-T40) **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

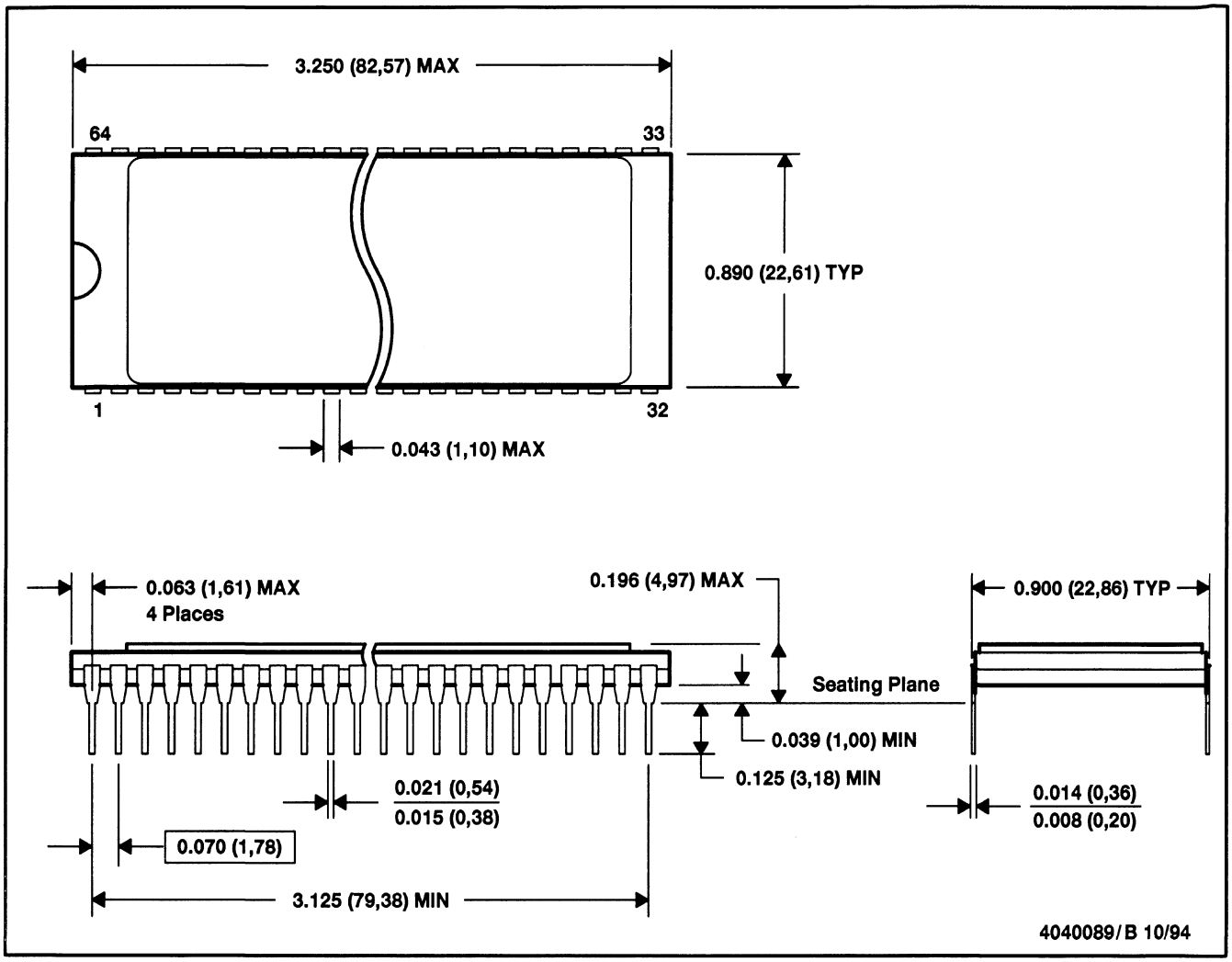
JC (R-CDIP-T64) **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package can be hermetically sealed with a metal lid.
D. The terminals are gold plated.

OCTOBER 1994

JD (R-CDIP-T64) **CERAMIC SIDE-BRAZE DUAL-IN-LINE PACKAGE**



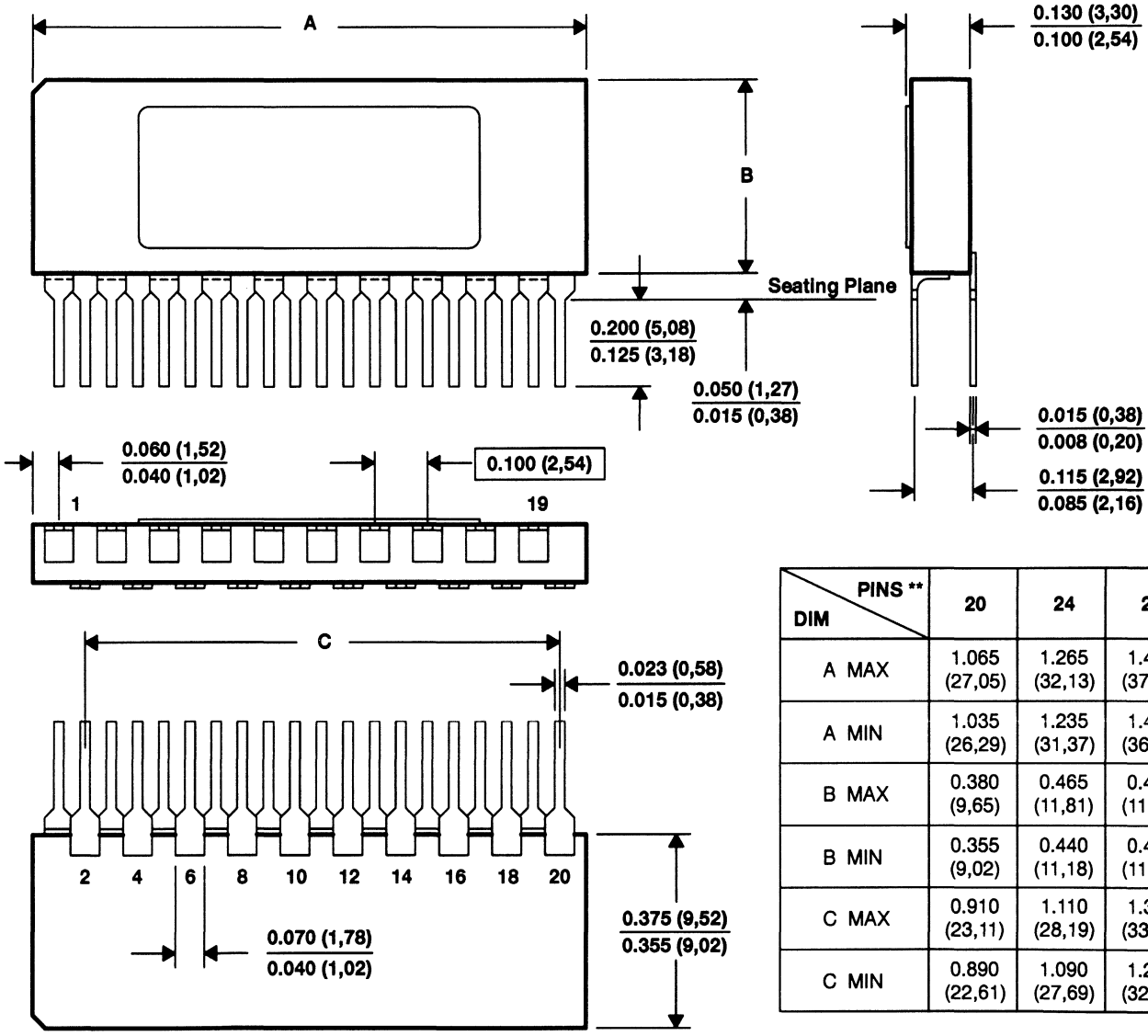
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

SV (R-CZIP-T**)

CERAMIC ZIG-ZAG PACKAGE

20 PIN SHOWN



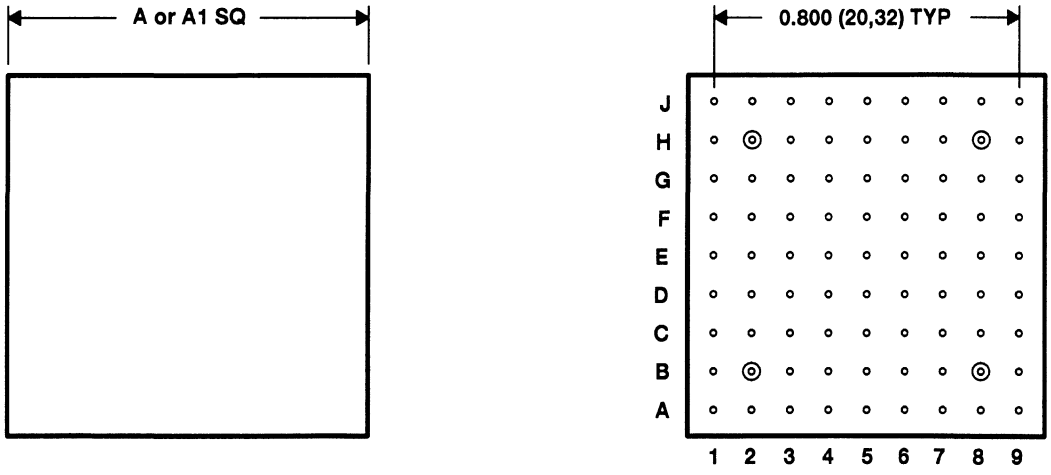
DIM \ PINS **	20	24	28
A MAX	1.065 (27,05)	1.265 (32,13)	1.465 (37,21)
A MIN	1.035 (26,29)	1.235 (31,37)	1.435 (36,45)
B MAX	0.380 (9,65)	0.465 (11,81)	0.465 (11,81)
B MIN	0.355 (9,02)	0.440 (11,18)	0.440 (11,18)
C MAX	0.910 (23,11)	1.110 (28,19)	1.310 (33,27)
C MIN	0.890 (22,61)	1.090 (27,69)	1.290 (32,77)

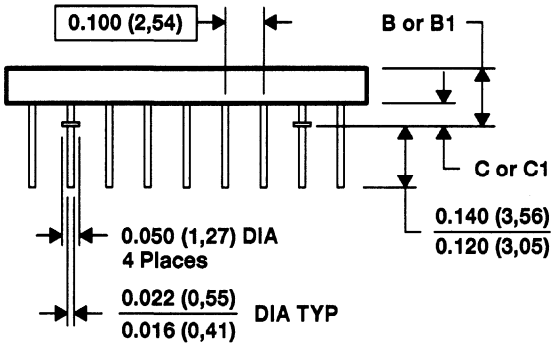
4040002/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

GA-GB (S-CPGA-P9 X 9) CERAMIC PIN GRID ARRAY PACKAGE





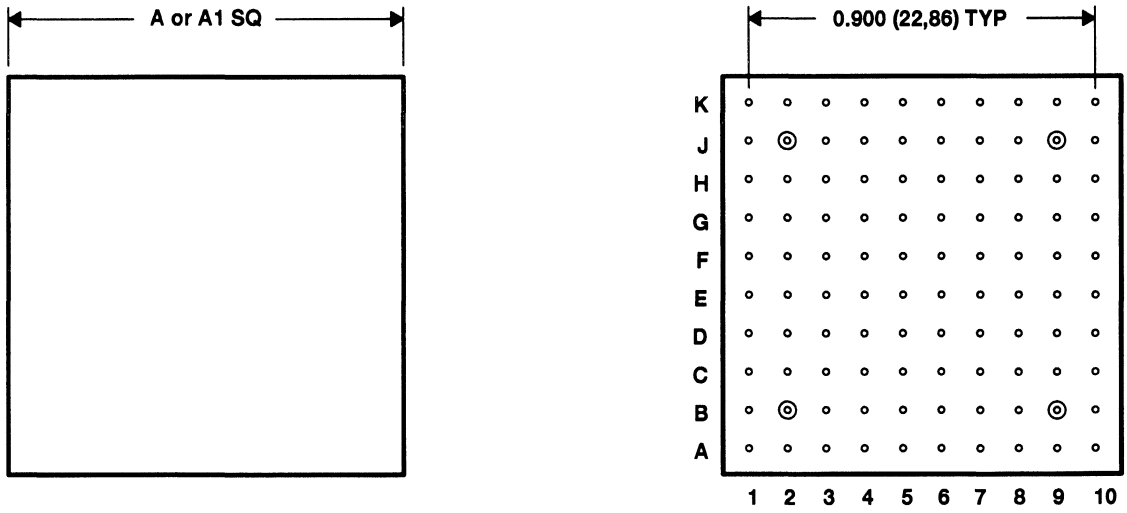
DIM	MIN	MAX	Notes
A	0.940 (23,88)	0.980 (24,89)	Large Outline
A1	0.880 (22,35)	0.935 (23,75)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 81			

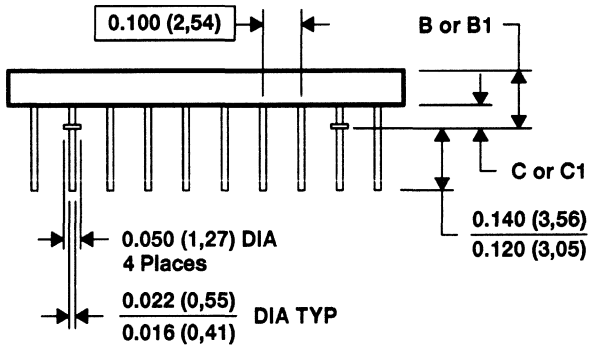
4040114-2/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA1-PN and CMGA13-PN and JEDEC MO-067AA and MO-066AA, respectively

OCTOBER 1994

GA-GB (S-CPGA-P10 X 10) CERAMIC PIN GRID ARRAY PACKAGE





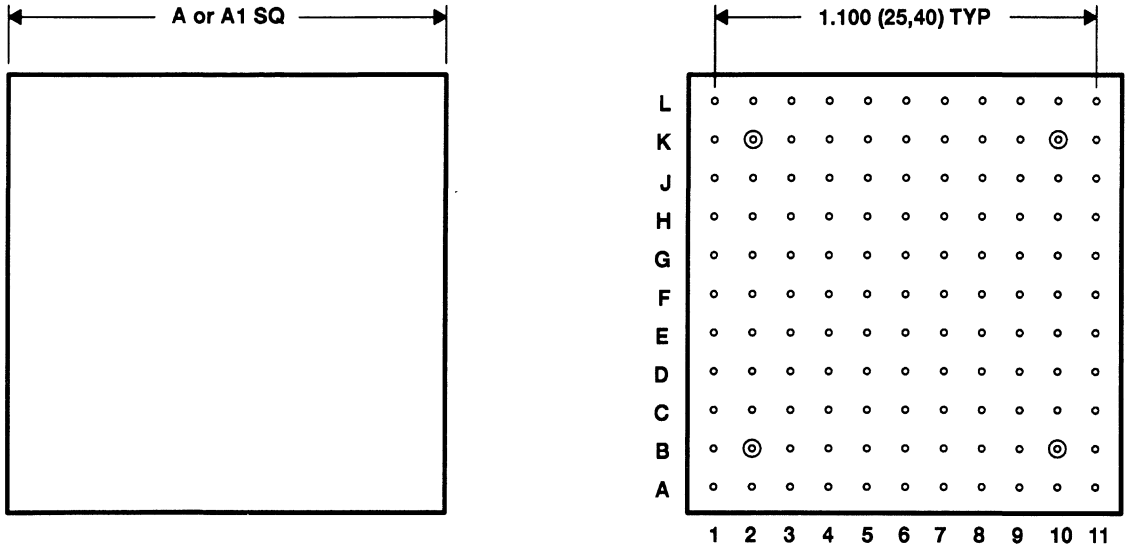
DIM	MIN	MAX	Notes
A	1.040 (26,42)	1.080 (27,43)	Large Outline
A1	0.980 (24,89)	1.035 (26,29)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 100			

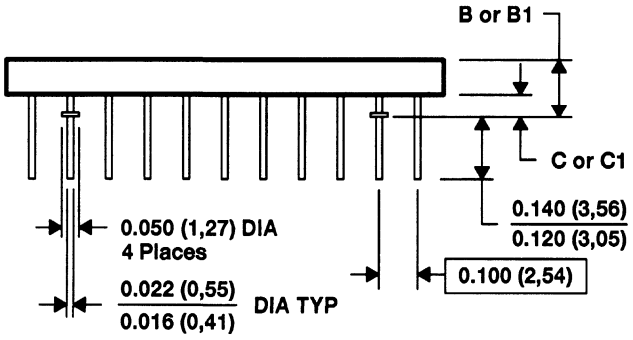
4040114-3/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA2-PN and CMGA12-PN and JEDEC MO-067AB and MO-066AB, respectively

OCTOBER 1994

GA-GB (S-CPGA-P11 X 11) CERAMIC PIN GRID ARRAY PACKAGE





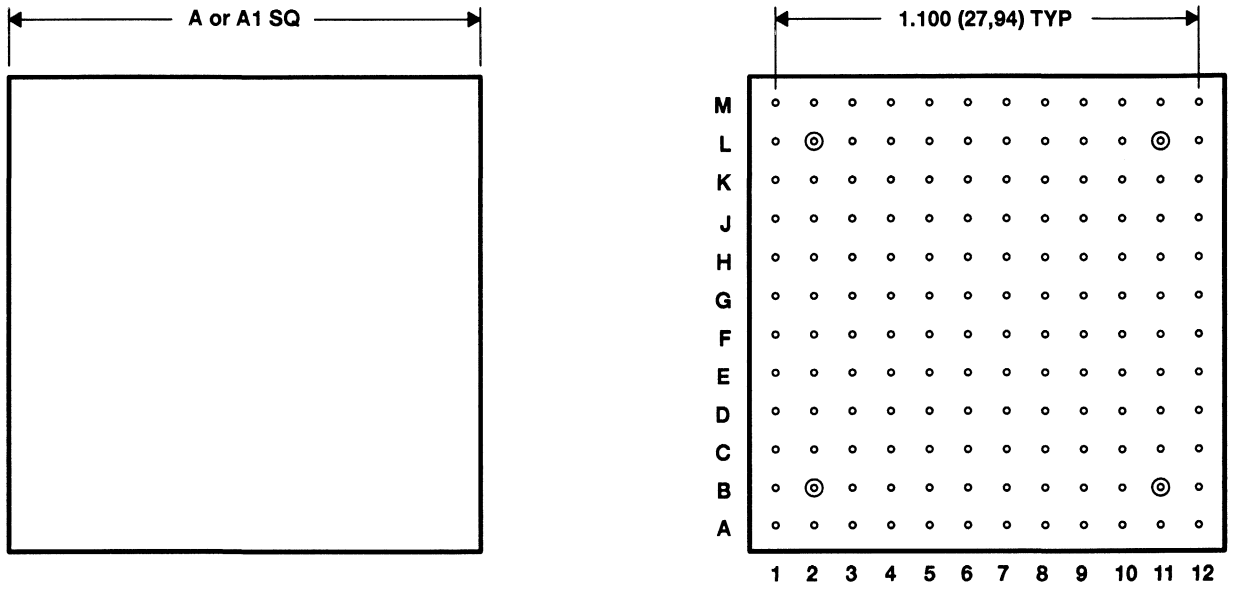
DIM	MIN	MAX	Notes
A	1.140 (28,96)	1.180 (29,97)	Large Outline
A1	1.080 (27,43)	1.135 (28,83)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 121			

4040114-4/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA3-PN and CMGA15-PN and JEDEC MO-067AC and MO-066AC, respectively

OCTOBER 1994

GA-GB (S-CPGA-P12 X 12) CERAMIC PIN GRID ARRAY PACKAGE



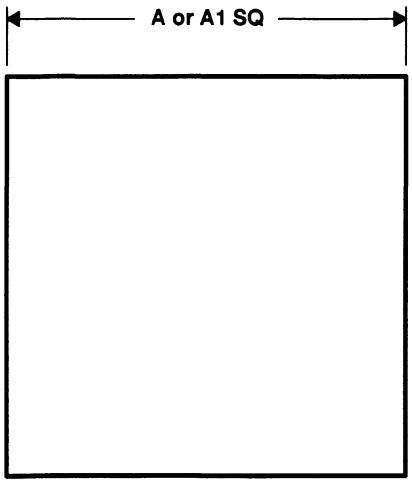
DIM	MIN	MAX	Notes
A	1.240 (31,50)	1.280 (32,51)	Large Outline
A1	1.180 (29,97)	1.235 (31,37)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 144			

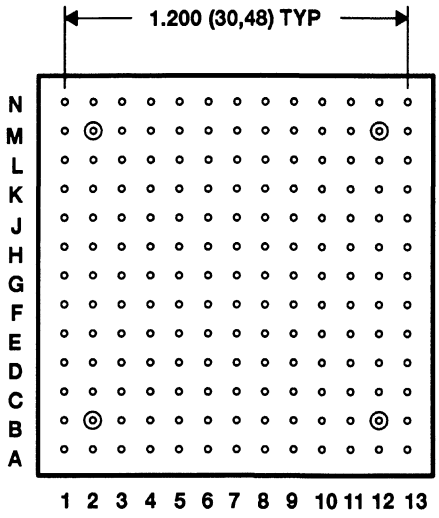
4040114-5/B 10/94

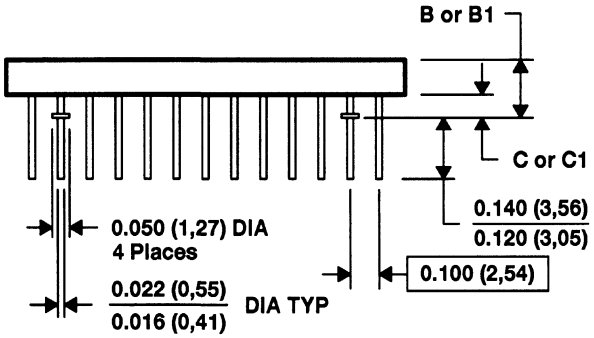
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA4-PN and CMGA16-PN and JEDEC MO-067AD and MO-066AD, respectively

OCTOBER 1994

GA-GB (S-CPGA-P13 X 13) CERAMIC PIN GRID ARRAY PACKAGE







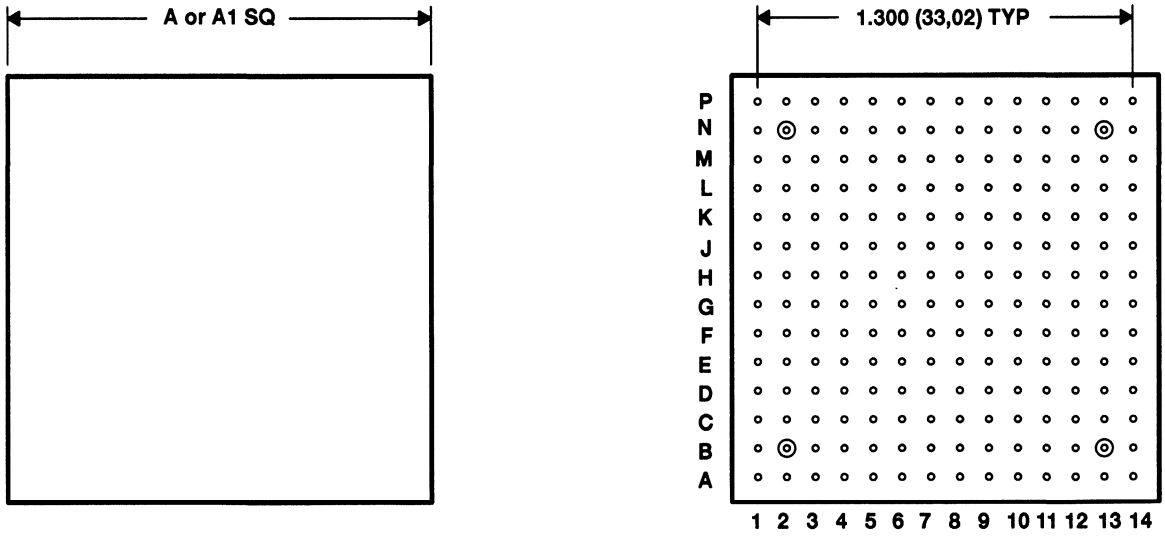
DIM	MIN	MAX	Notes
A	1.340 (34,04)	1.380 (35,05)	Large Outline
A1	1.280 (32,51)	1.335 (33,91)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 169			

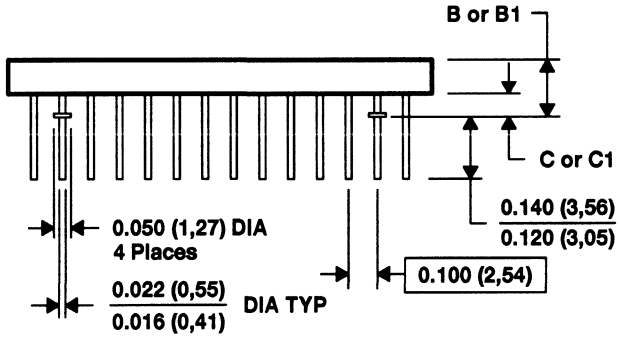
4040114-6/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA5-PN and CMGA17-PN and JEDEC MO-067AE and MO-066AE, respectively

OCTOBER 1994

GA-GB (S-CPGA-P14 X 14) CERAMIC PIN GRID ARRAY PACKAGE





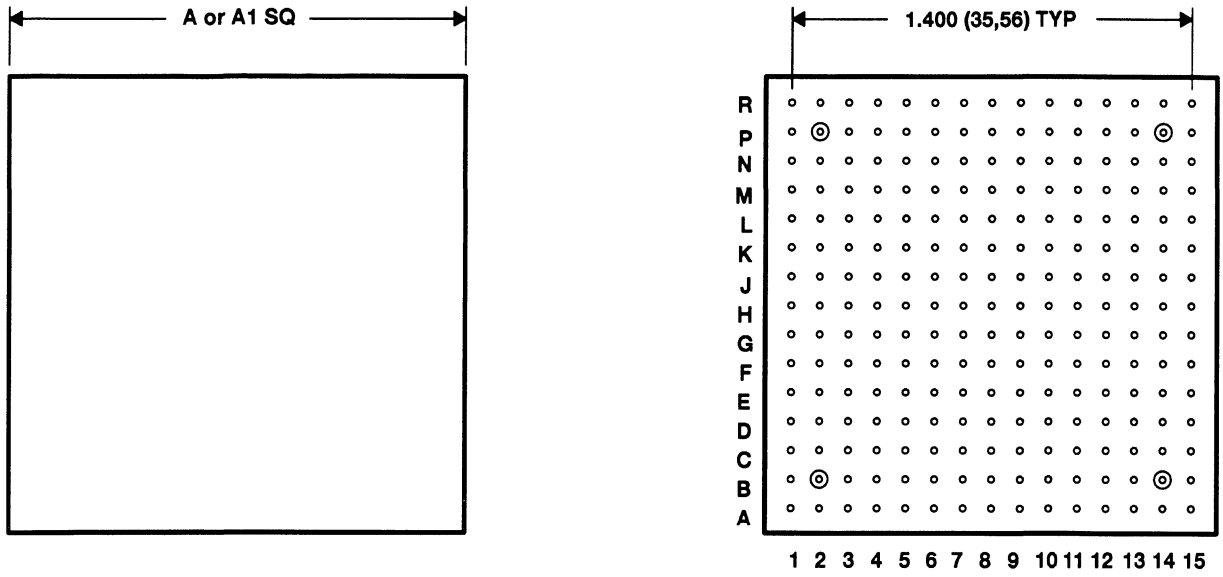
DIM	MIN	MAX	Notes
A	1.440 (33,58)	1.480 (37,59)	Large Outline
A1	1.380 (35,05)	1.435 (36,45)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 196			

4040114-7/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA6-PN and CMGA18-PN and JEDEC MO-067AF and MO-066AF, respectively

OCTOBER 1994

GA-GB (S-CPGA-P15 X 15) CERAMIC PIN GRID ARRAY PACKAGE



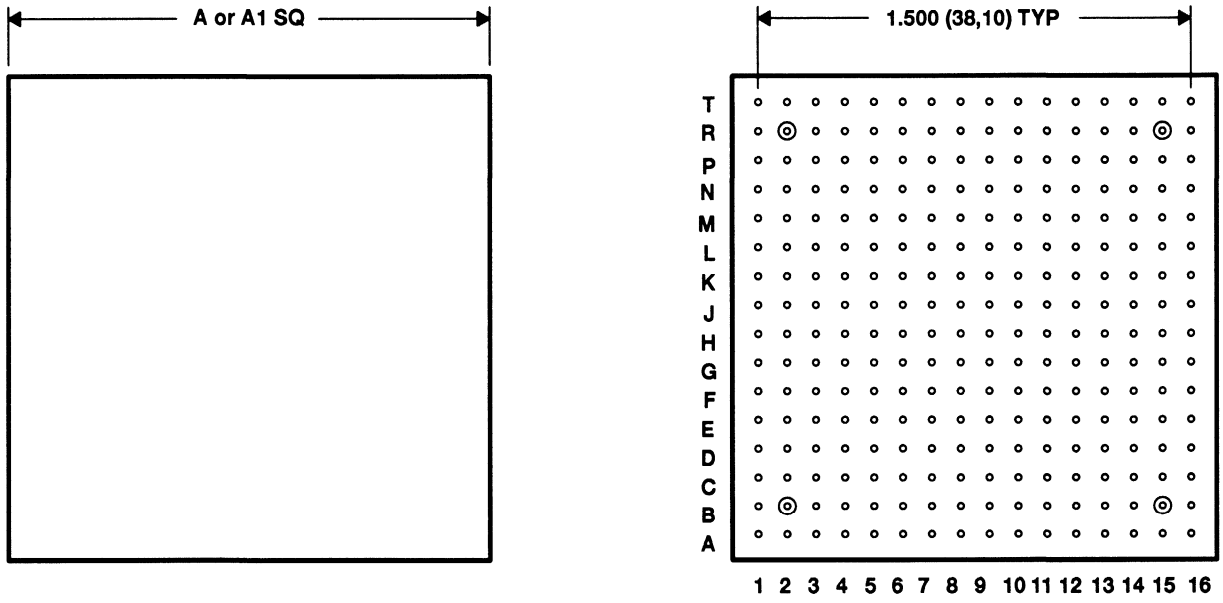
DIM	MIN	MAX	Notes
A	1.540 (39,12)	1.590 (40,38)	Large Outline
A1	1.480 (37,59)	1.535 (38,99)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 225			

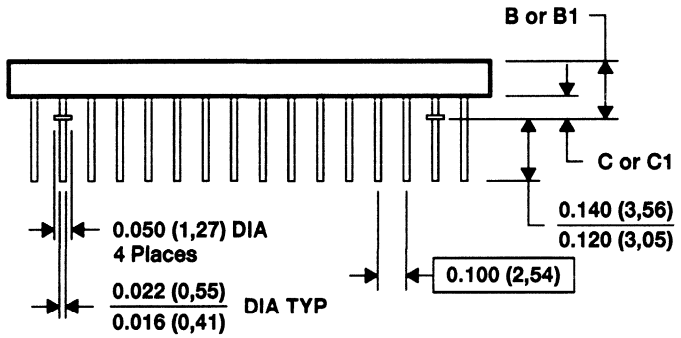
4040114-8/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA7-PN and CMGA19-PN and JEDEC MO-067AG and MO-066AG, respectively

OCTOBER 1994

GA-GB (S1-CPGA-P16 X 16) CERAMIC PIN GRID ARRAY PACKAGE





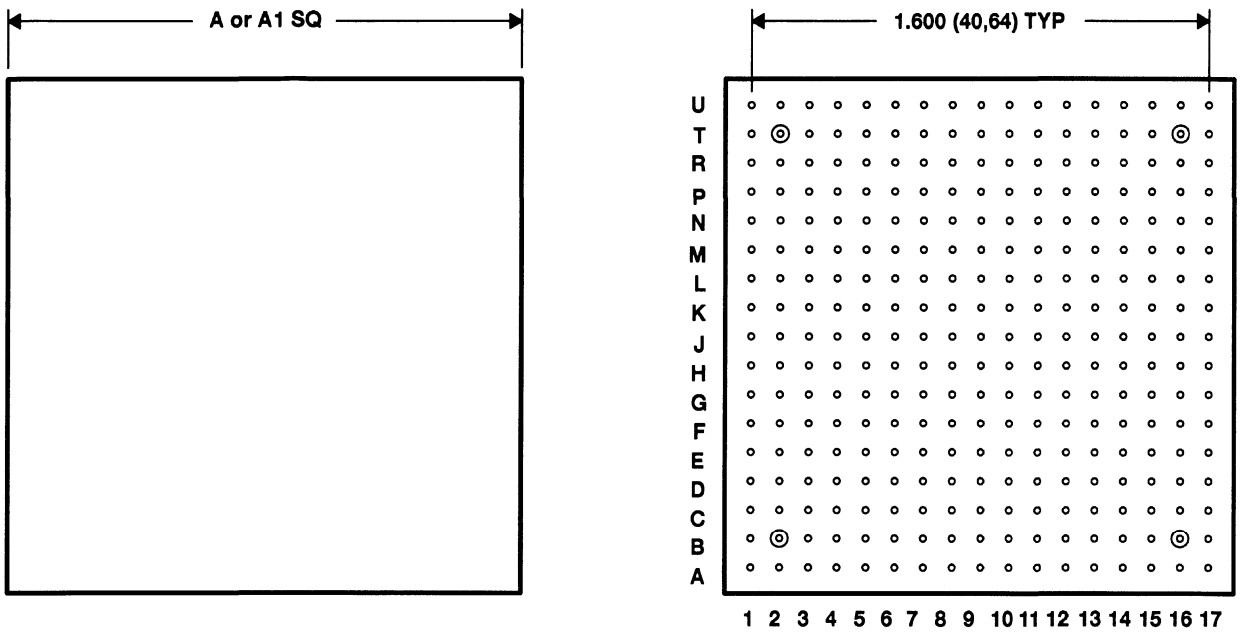
DIM	MIN	MAX	Notes
A	1.640 (41,66)	1.680 (42,67)	Large Outline
A1	1.580 (40,13)	1.635 (41,53)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 256			

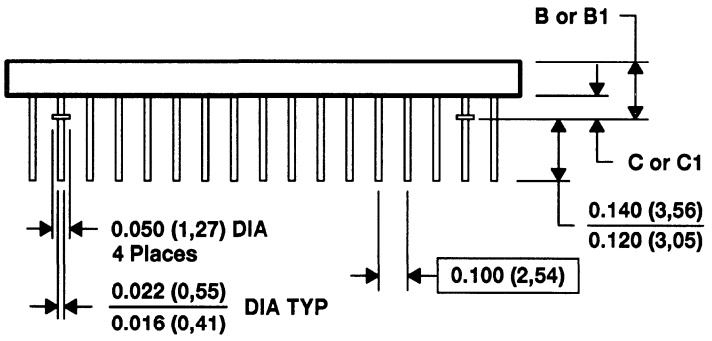
4040114-9/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA8-PN and CMGA20-PN and JEDEC MO-067AH and MO-066AH, respectively

OCTOBER 1994

GA-GB (S-CPGA-P17 X 17) CERAMIC PIN GRID ARRAY PACKAGE





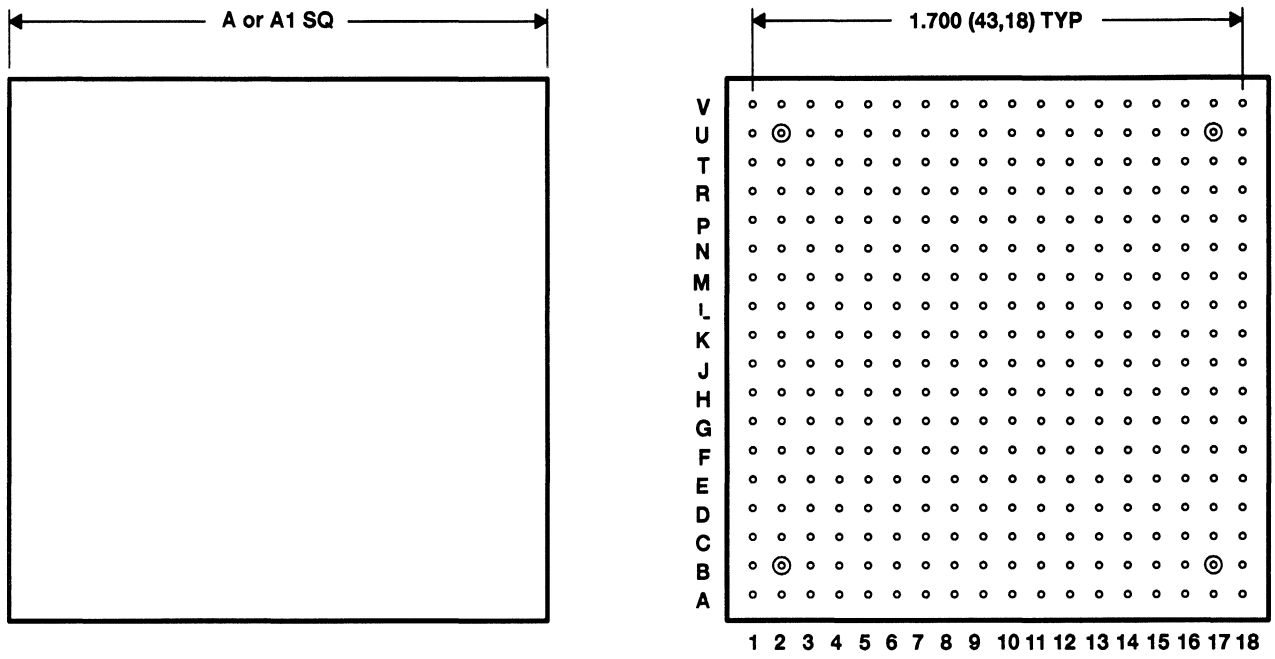
DIM	MIN	MAX	Notes
A	1.732 (44,00)	1.780 (45,21)	Large Outline
A1	1.680 (42,67)	1.735 (44,07)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 289			

4040114-10/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA9-PN and CMGA21-PN and JEDEC MO-067AJ and MO-066AJ, respectively

OCTOBER 1994

GA-GB (S-CPGA-P18 X 18) CERAMIC PIN GRID ARRAY PACKAGE



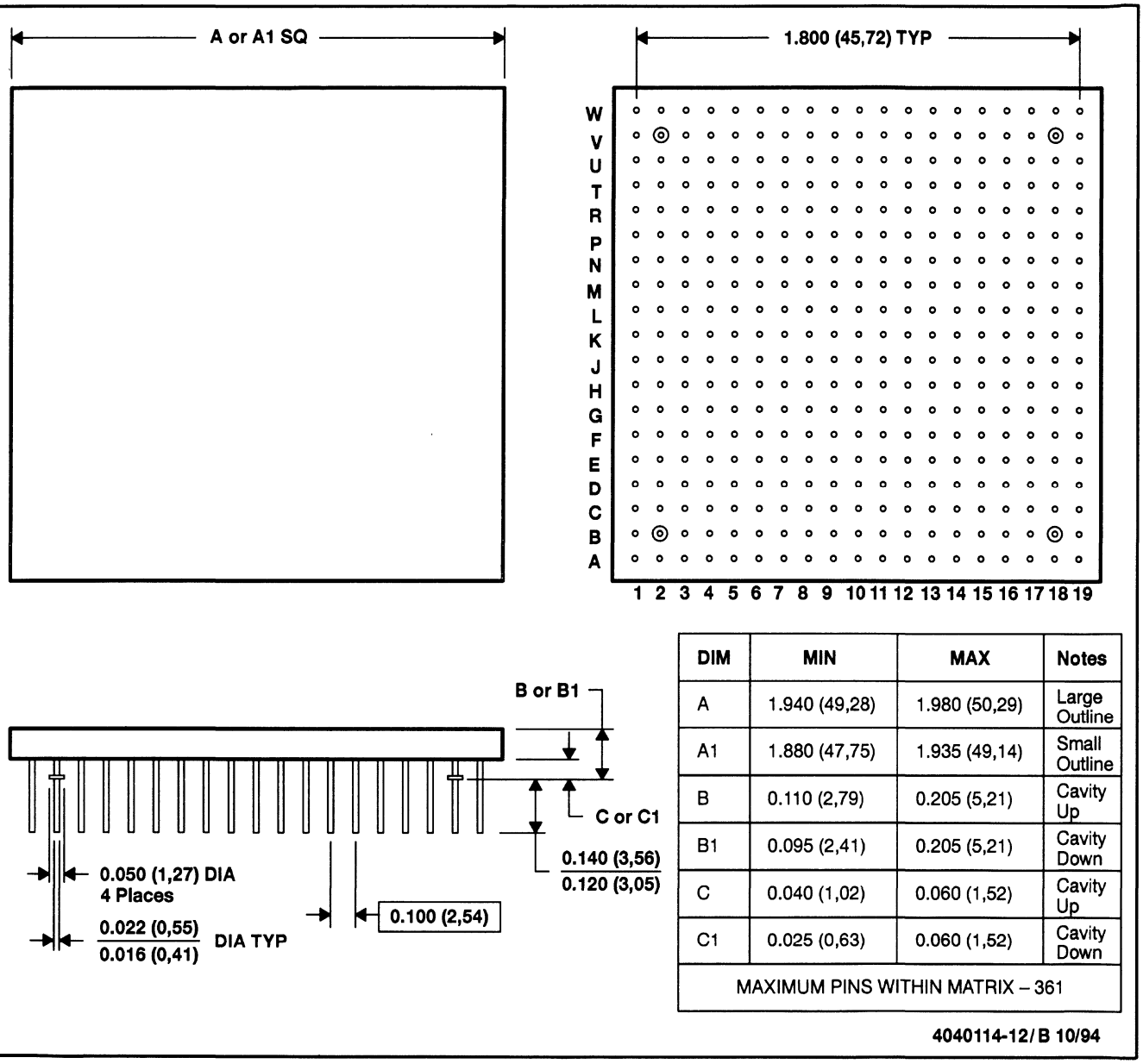
DIM	MIN	MAX	Notes
A	1.840 (46,74)	1.880 (47,75)	Large Outline
A1	1.780 (45,21)	1.835 (46,61)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 324			

4040114-11/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA10-PN and CMGA22-PN and JEDEC MO-067AK and MO-066AK, respectively

OCTOBER 1994

GA-GB (S-CPGA-P19 X 19) CERAMIC PIN GRID ARRAY PACKAGE



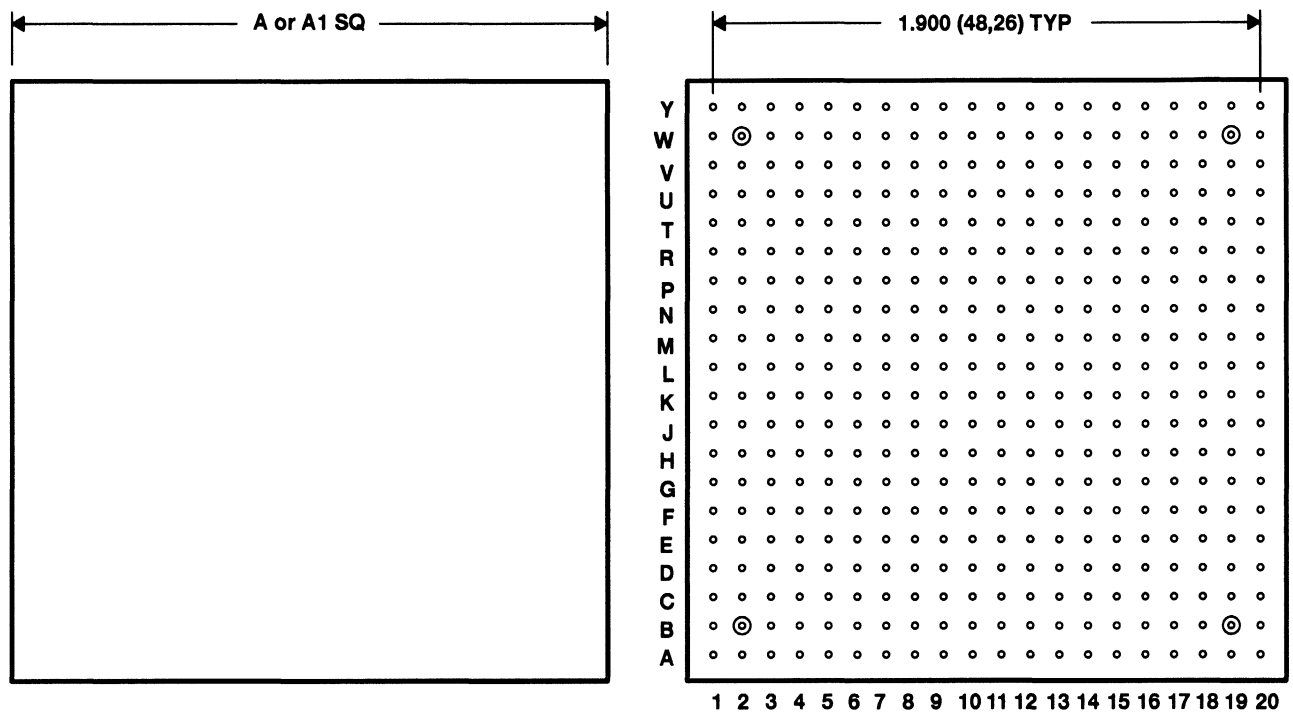
DIM	MIN	MAX	Notes
A	1.940 (49,28)	1.980 (50,29)	Large Outline
A1	1.880 (47,75)	1.935 (49,14)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 361			

4040114-12/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA11-PN and CMGA23-PN and JEDEC MO-067AL and MO-066AL, respectively

OCTOBER 1994

GA-GB (S-CPGA-P20 X 20) CERAMIC PIN GRID ARRAY PACKAGE



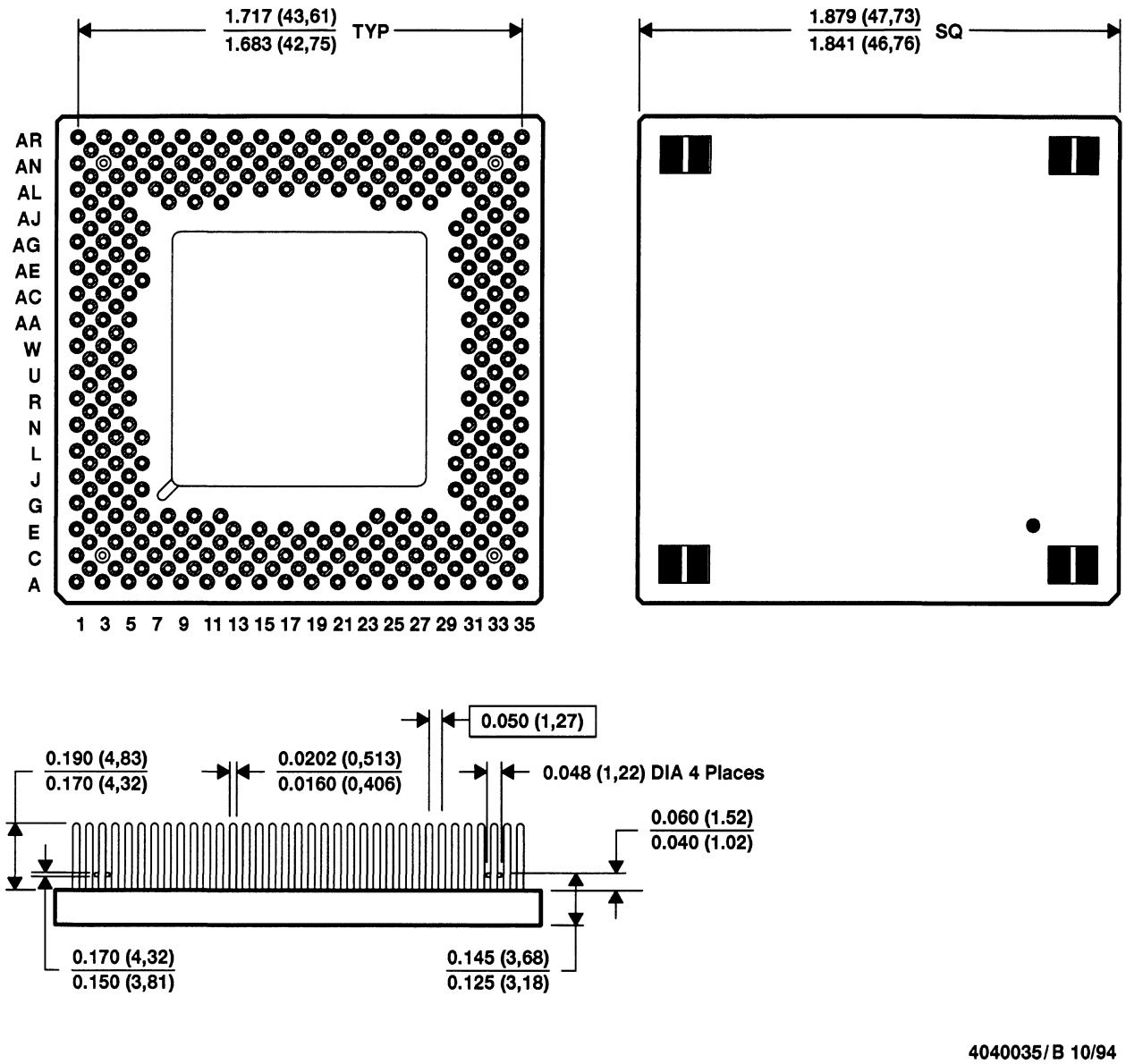
DIM	MIN	MAX	Notes
A	2.040 (51,82)	2.080 (52,82)	Large Outline
A1	1.980 (50,29)	2.035 (51,69)	Small Outline
B	0.110 (2,79)	0.205 (5,21)	Cavity Up
B1	0.095 (2,41)	0.205 (5,21)	Cavity Down
C	0.040 (1,02)	0.060 (1,52)	Cavity Up
C1	0.025 (0,63)	0.060 (1,52)	Cavity Down
MAXIMUM PINS WITHIN MATRIX – 400			

4040114-13/B 10/94

NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Index mark may appear on top or bottom depending on package vendor.
D. Pins are located within 0.005 (0,13) radius of true position relative to each other at maximum material condition and within 0.015 (0,38) radius relative to the center of the ceramic.
E. This package can be hermetically sealed with metal lids or with ceramic lids using glass frit.
F. The pins can be gold plated or solder dipped.
G. Falls within MIL-STD-1835 CMGA12-PN and CMGA24-PN and JEDEC MO-067AM and MO-066AM, respectively

OCTOBER 1994

GF (S-CPGA-P325) **CERAMIC PIN GRID ARRAY PACKAGE**



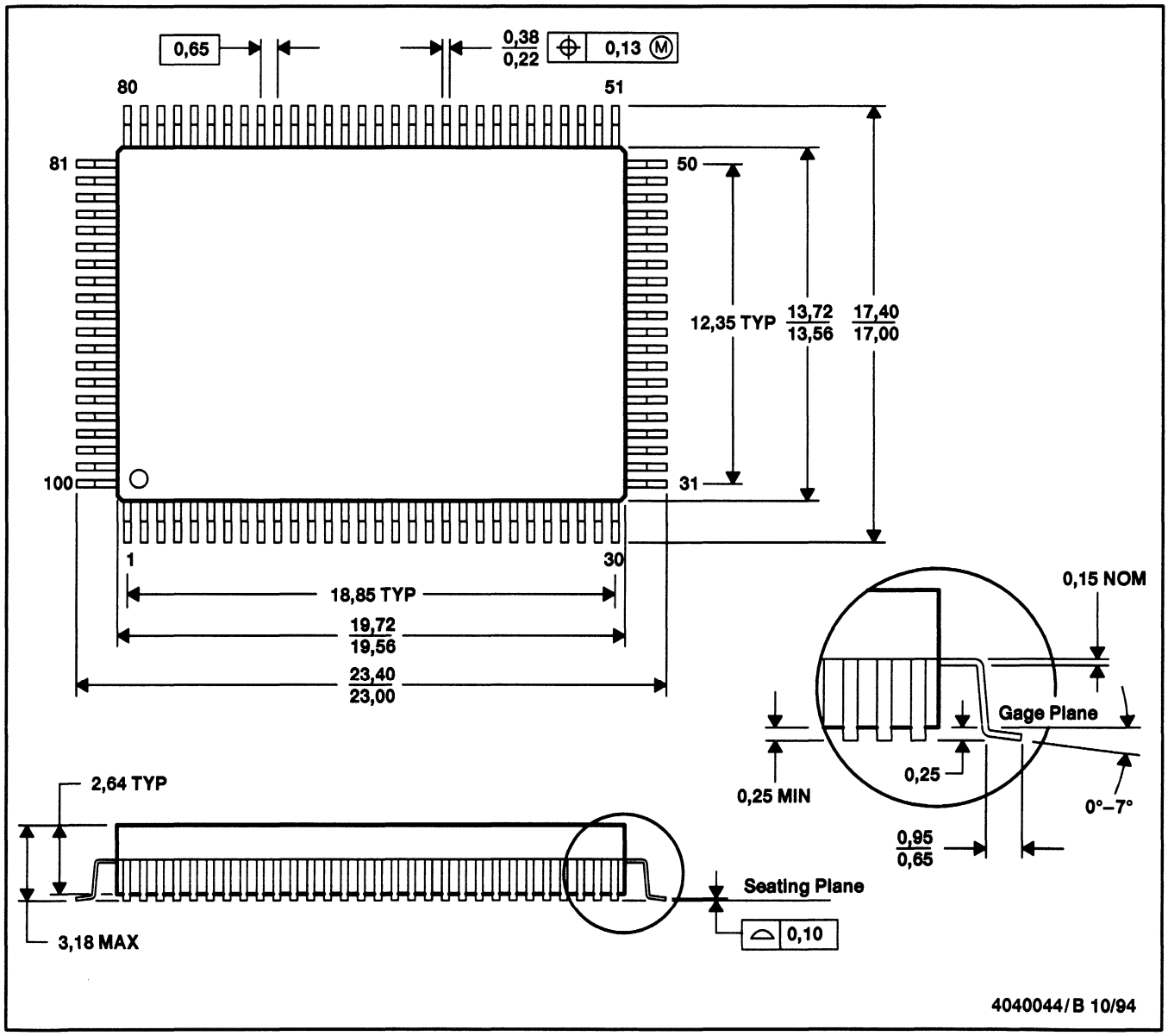
NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

6 Other Packages

CONTENTS

OCTOBER 1994

MBM (R-MQFP-G100) **METAL QUAD (MQUAD®) FLATPACK (DIE-DOWN)**

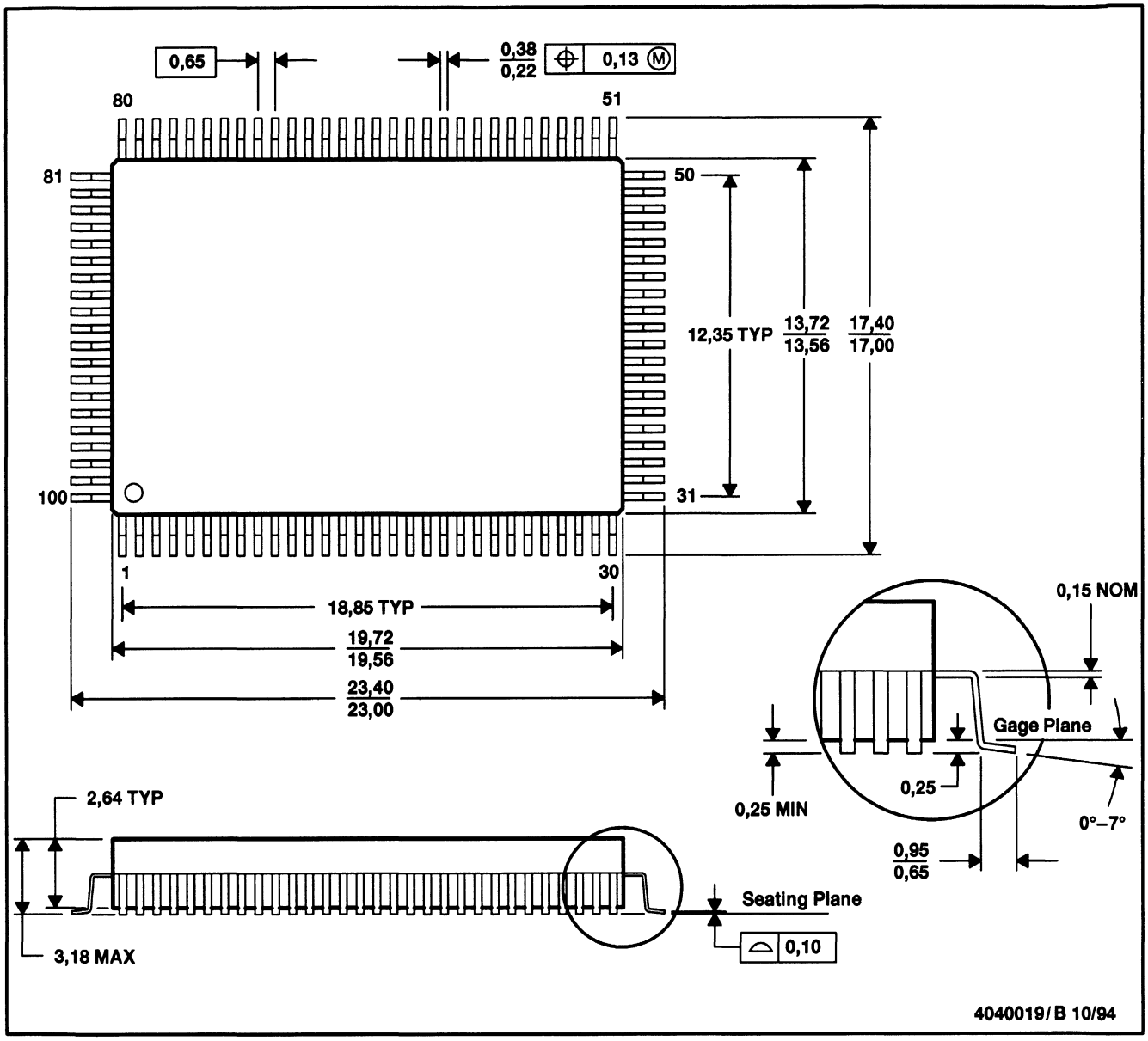


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MBN (R-MQFP-G100) **METAL QUAD (MQUAD®) FLATPACK**



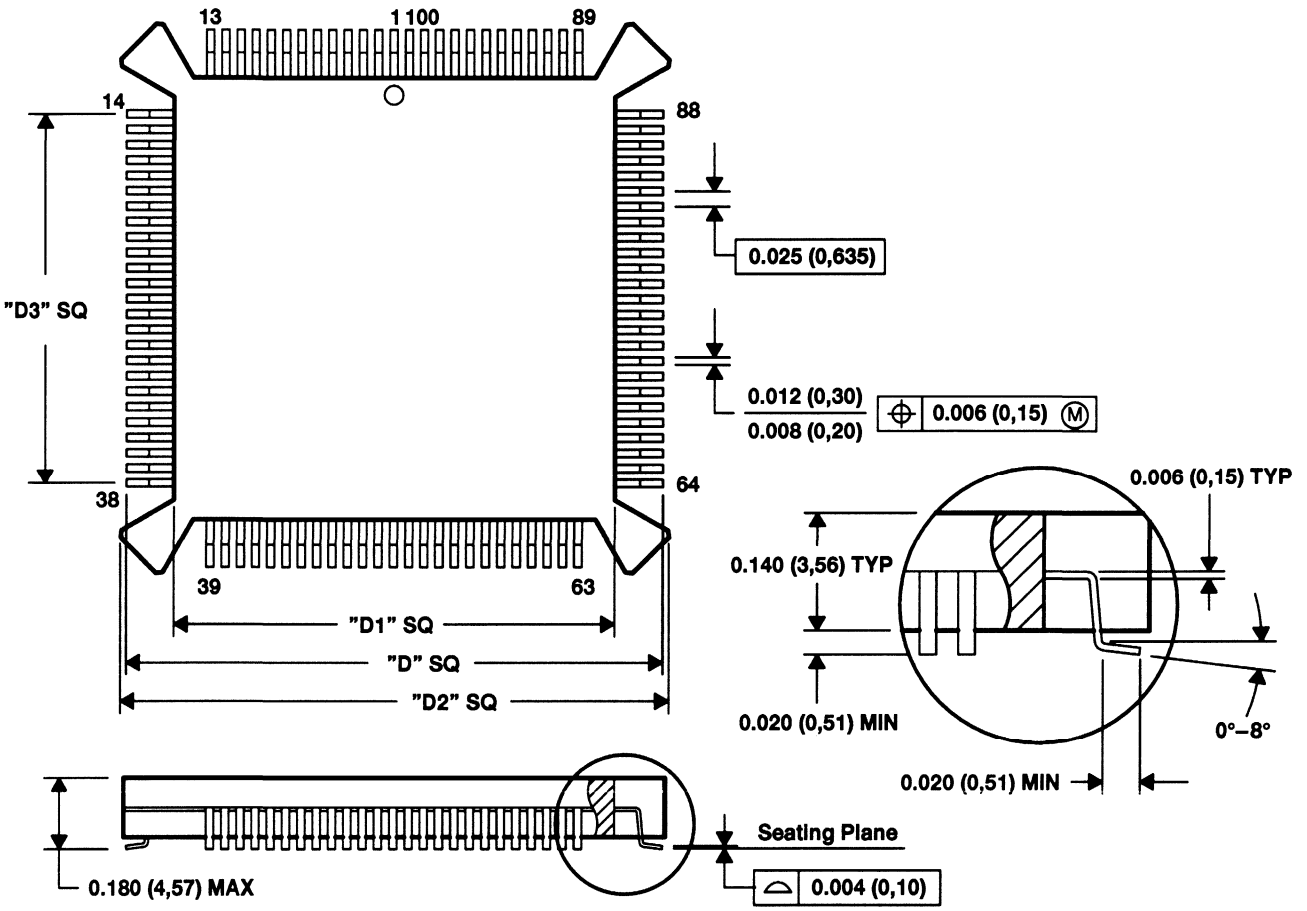
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MAA (S-MQFP-G*)** **METAL QUAD (MQUAD®) FLATPACK (DIE-DOWN)**

100 PIN SHOWN



*** NO. OF PINS	"D"		"D1"		"D2"		"D3"
	MAX	MIN	MAX	MIN	MAX	MIN	TYP
100	0.885 (22,48)	0.875 (22,23)	0.738 (18,75)	0.732 (18,59)	0.903 (22,94)	0.897 (22,78)	0.600 (15,24)
132	1.085 (27,56)	1.075 (27,31)	0.938 (23,83)	0.932 (23,67)	1.103 (28,01)	1.097 (27,86)	0.800 (20,32)
196	1.485 (37,72)	1.475 (37,47)	1.338 (33,99)	1.332 (33,83)	1.503 (38,18)	1.497 (38,02)	1.200 (30,48)

4040020/B 10/94

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

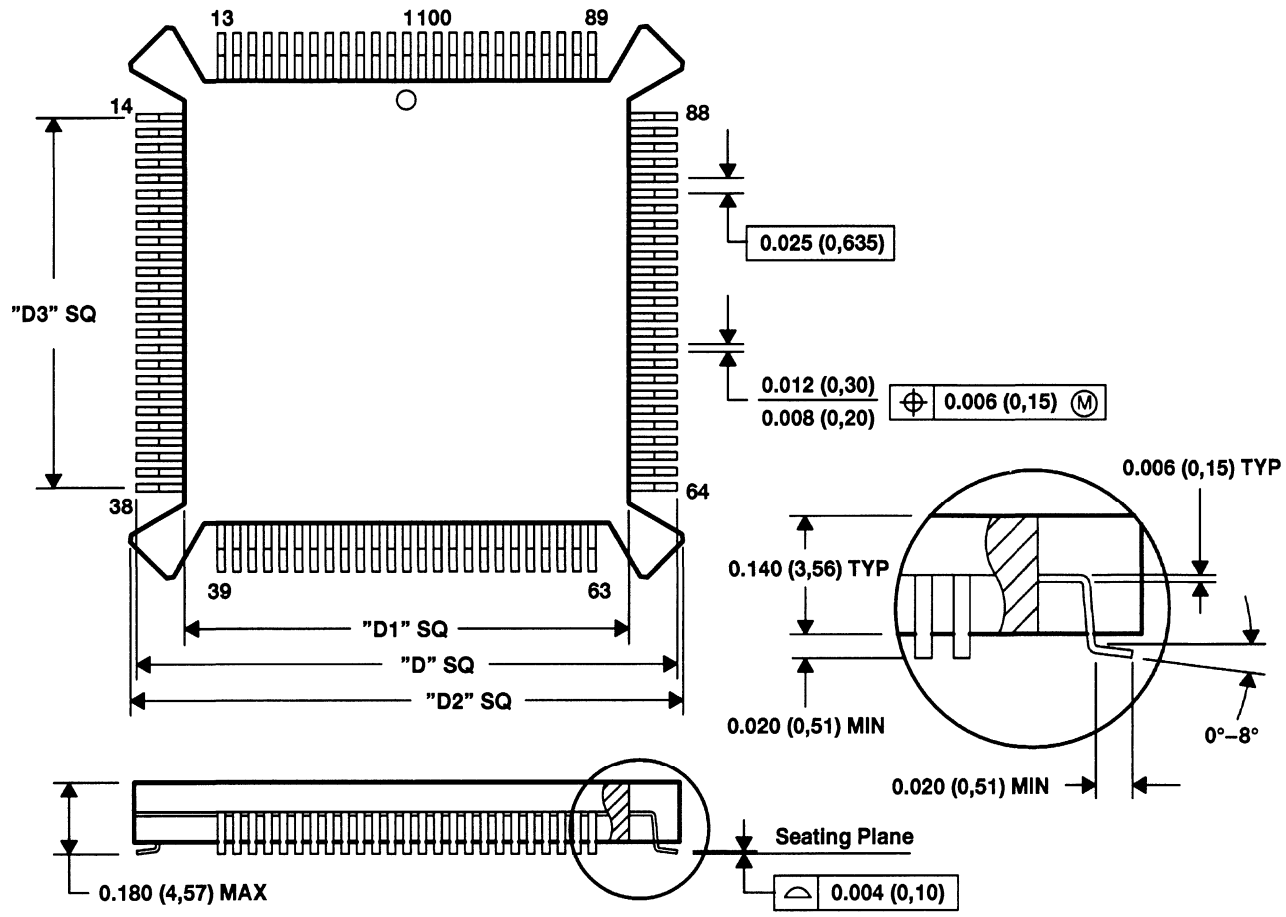
CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MAB (S-MQFP-G***)

METAL QUAD (MQUAD®) FLATPACK

100 PIN SHOWN



*** NO. OF PINS	"D"		"D1"		"D2"		"D3"
	MAX	MIN	MAX	MIN	MAX	MIN	TYP
100	0.885 (22,48)	0.875 (22,23)	0.738 (18,75)	0.732 (18,59)	0.903 (22,94)	0.897 (22,78)	0.600 (15,24)
132	1.085 (27,56)	1.075 (27,31)	0.938 (23,83)	0.932 (23,67)	1.103 (28,01)	1.097 (27,86)	0.800 (20,32)
196	1.485 (37,72)	1.475 (37,47)	1.338 (33,99)	1.332 (33,83)	1.503 (38,18)	1.497 (38,02)	1.200 (30,48)

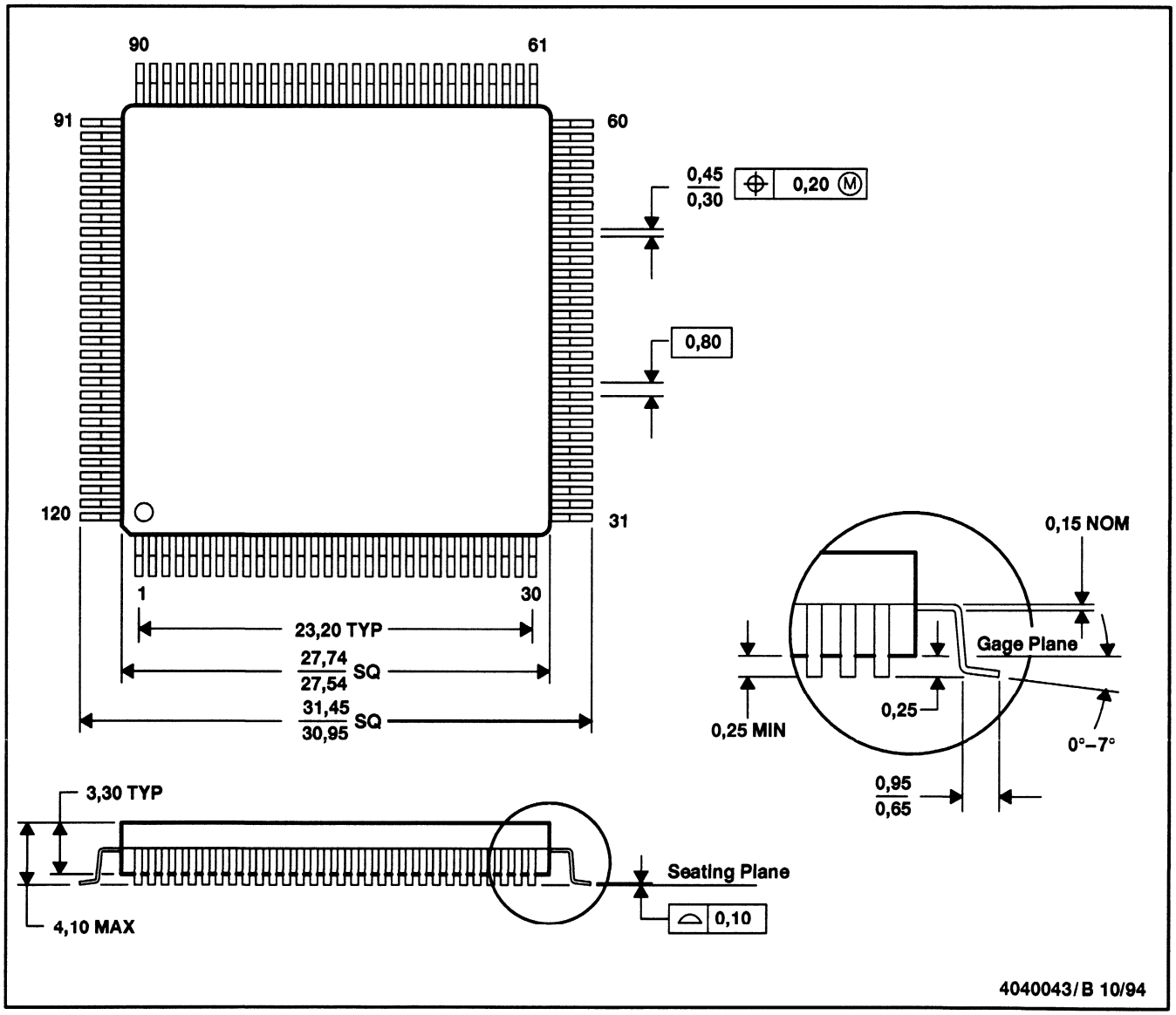
4040021/B 10/94

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MCM (S-MQFP-G120) **METAL QUAD (MQUAD®) FLATPACK (DIE-DOWN)**

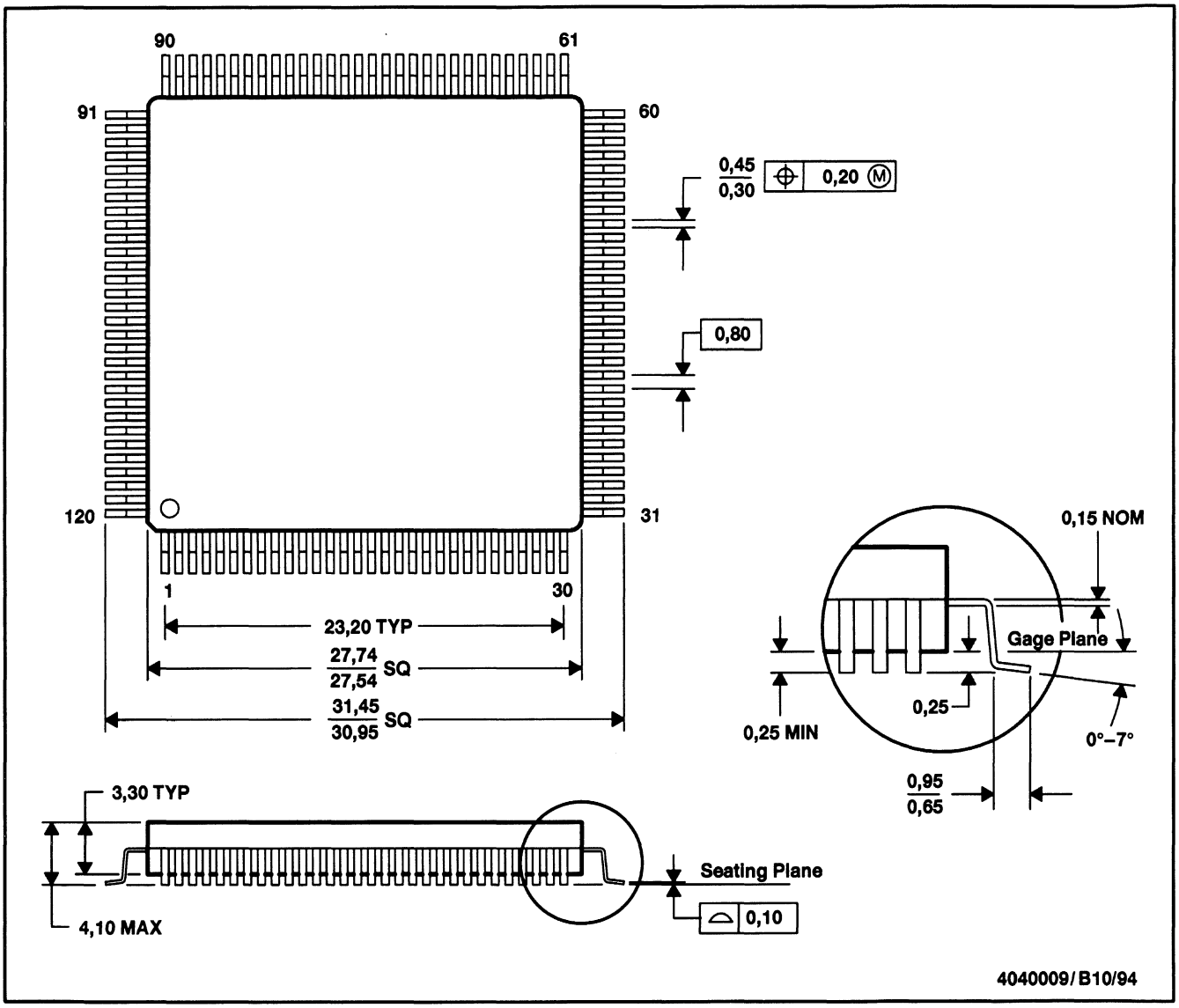


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MCN (S-MQFP-G120) **METAL QUAD (MQUAD®) FLATPACK**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

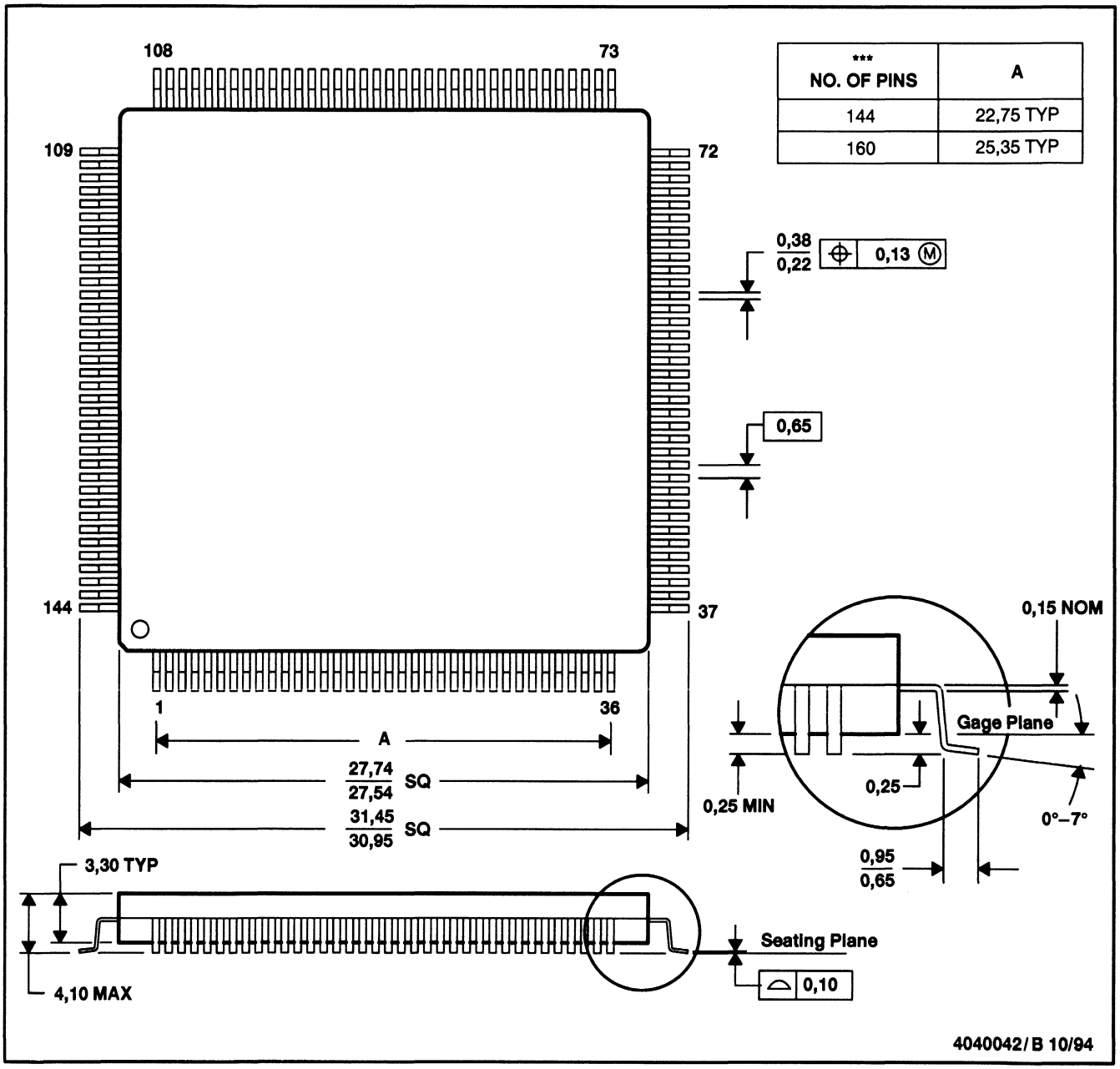
TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

OCTOBER 1994

MDM (S-MQFP-G***)

METAL QUAD (MQUAD®) FLATPACK

144 PIN SHOWN



*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.
E. The 144 MDM is identical to the 160 MDM except four leads per corner are removed.

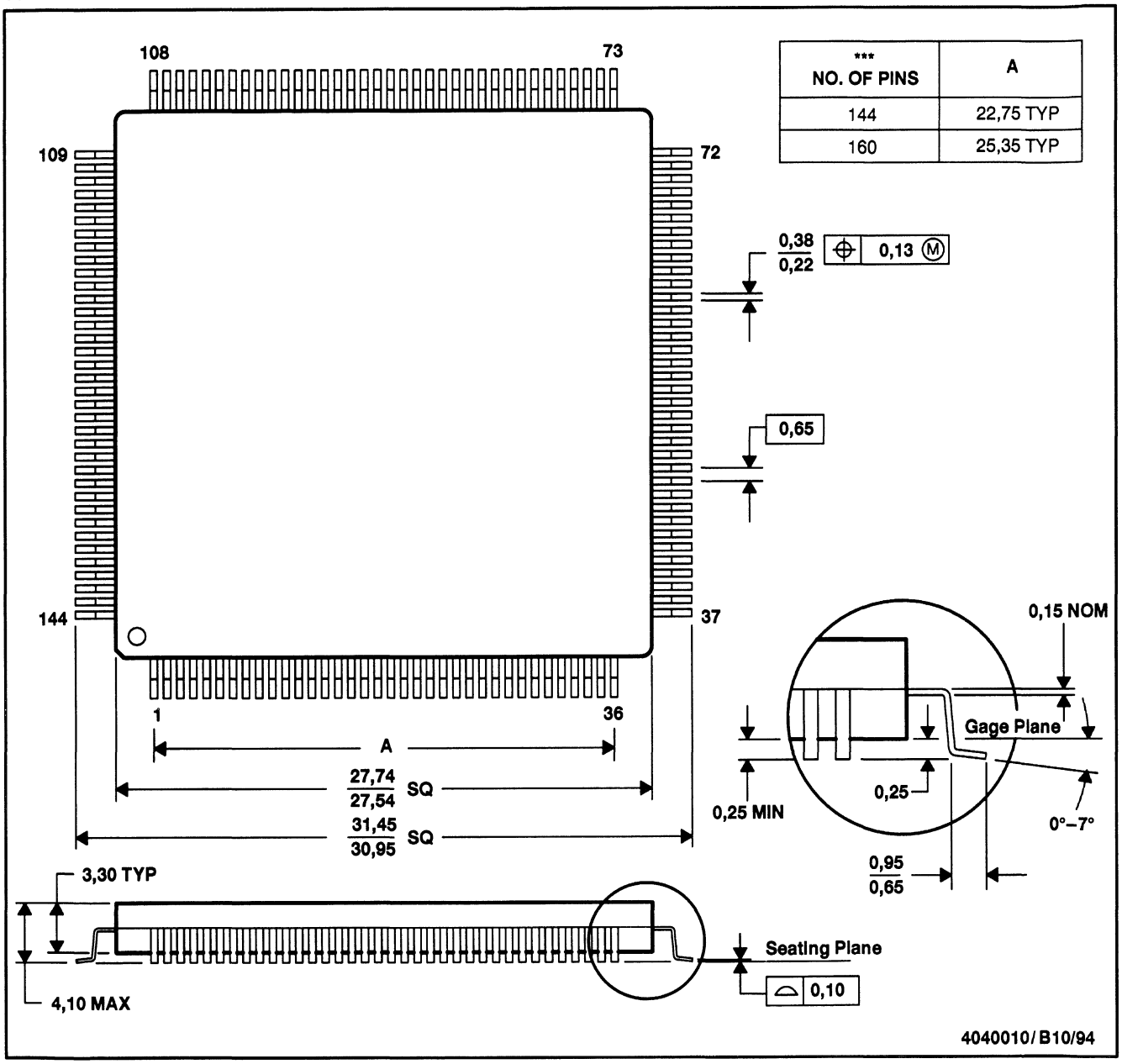
CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MDN (S-MQFP-G***)

METAL QUAD (MQUAD®) FLATPACK

144 PIN SHOWN



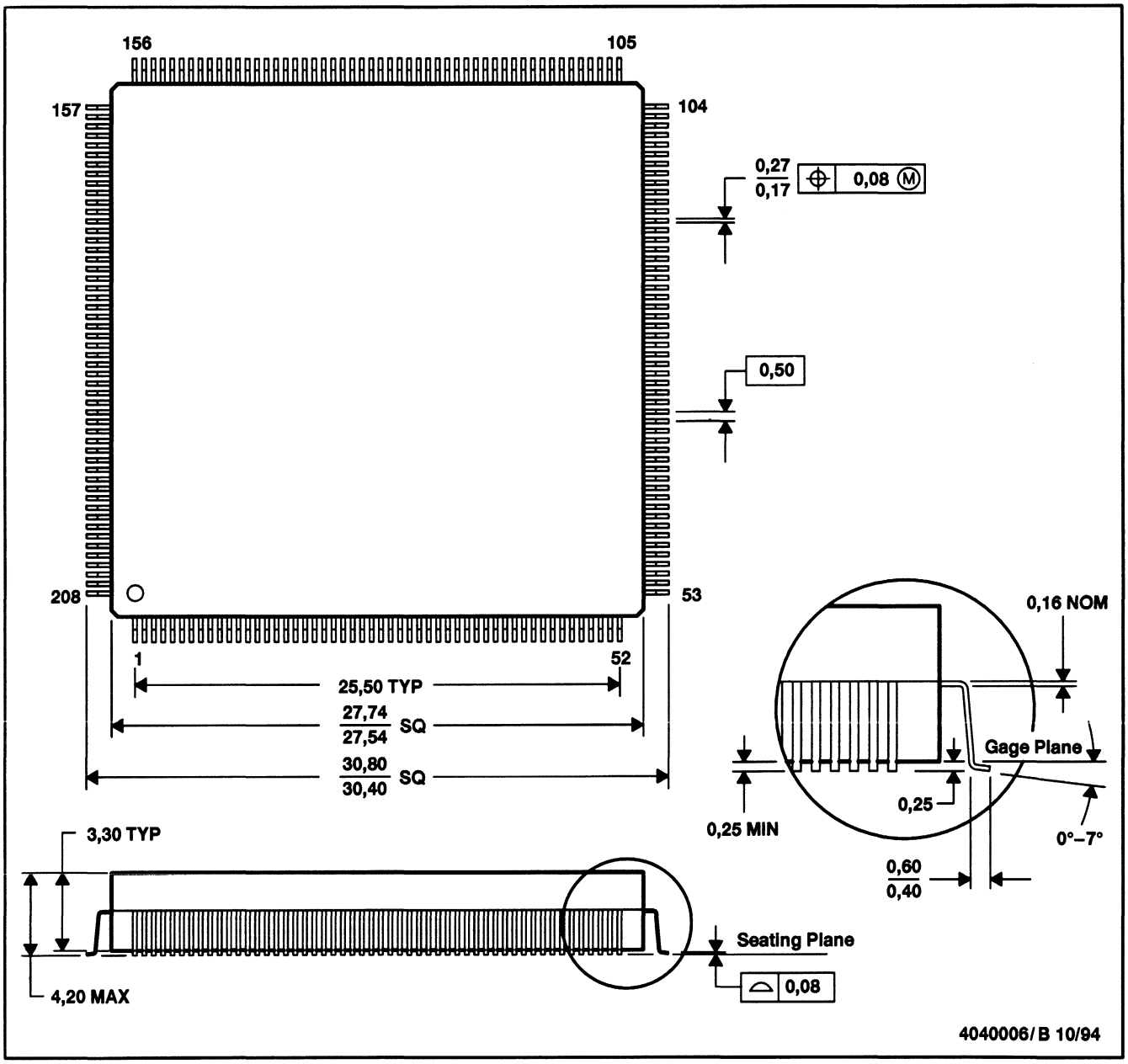
*** NO. OF PINS	A
144	22,75 TYP
160	25,35 TYP

NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.
E. The 144 MDN is identical to the 160 MDN except four leads per corner are removed.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MEO (S-MQFP-G208) **METAL QUAD (MQUAD®) FLATPACK (DIE-DOWN)**

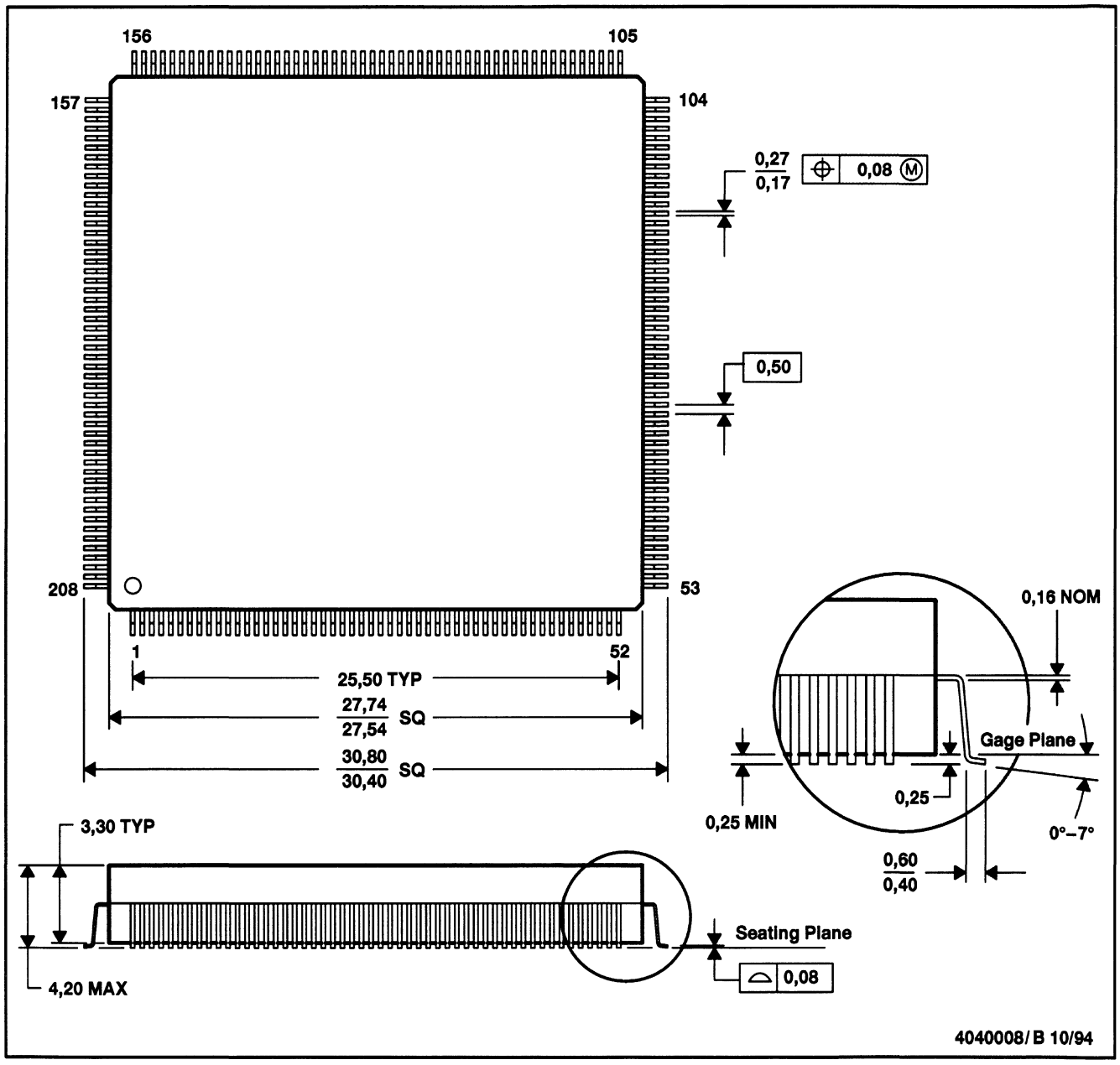


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MEP (S-MQFP-G208) **METAL QUAD (MQUAD®) FLATPACK**

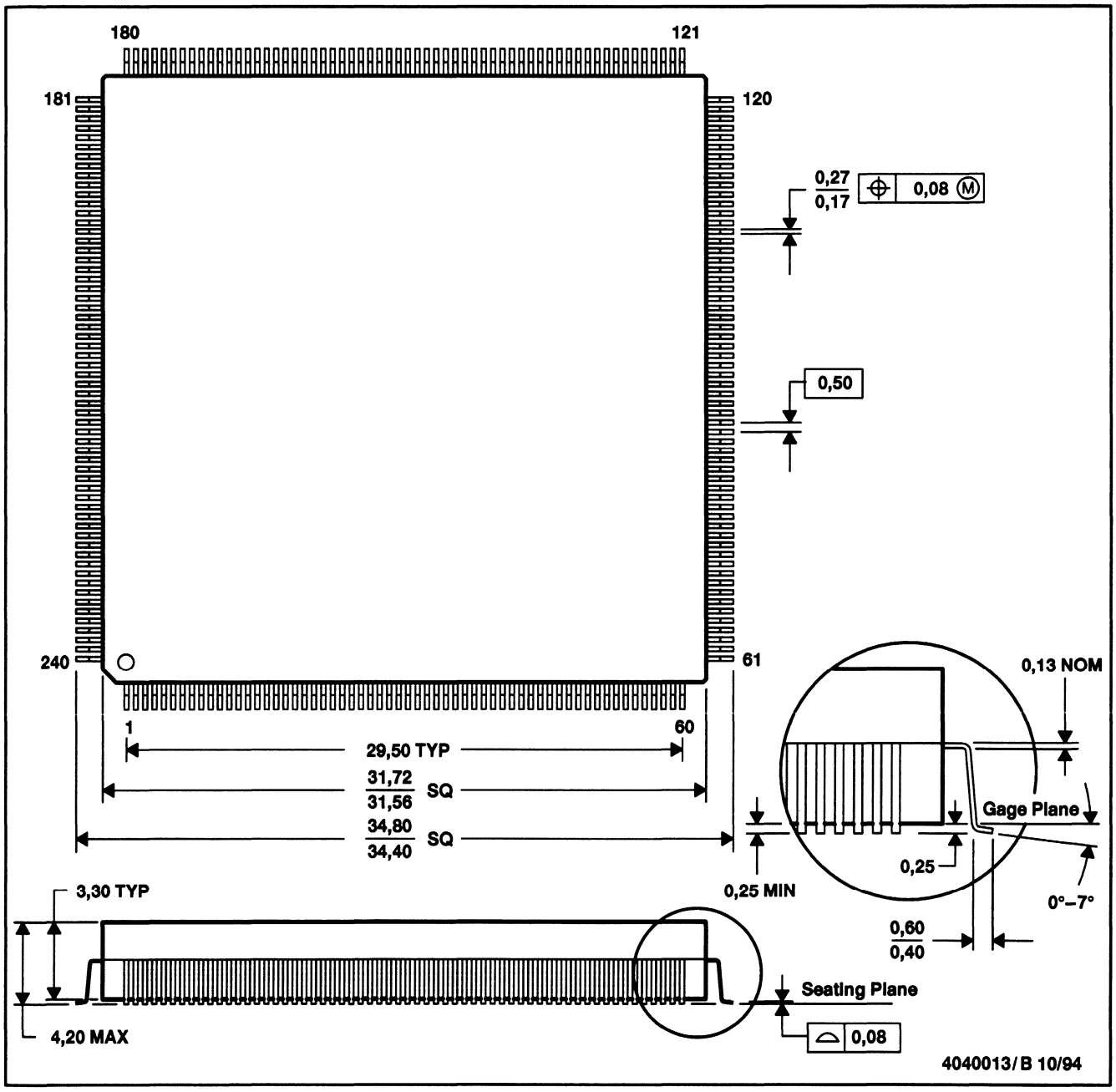


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MFO (S-MQFP-G240) **METAL QUAD (MQUAD®) FLATPACK (DIE-DOWN)**

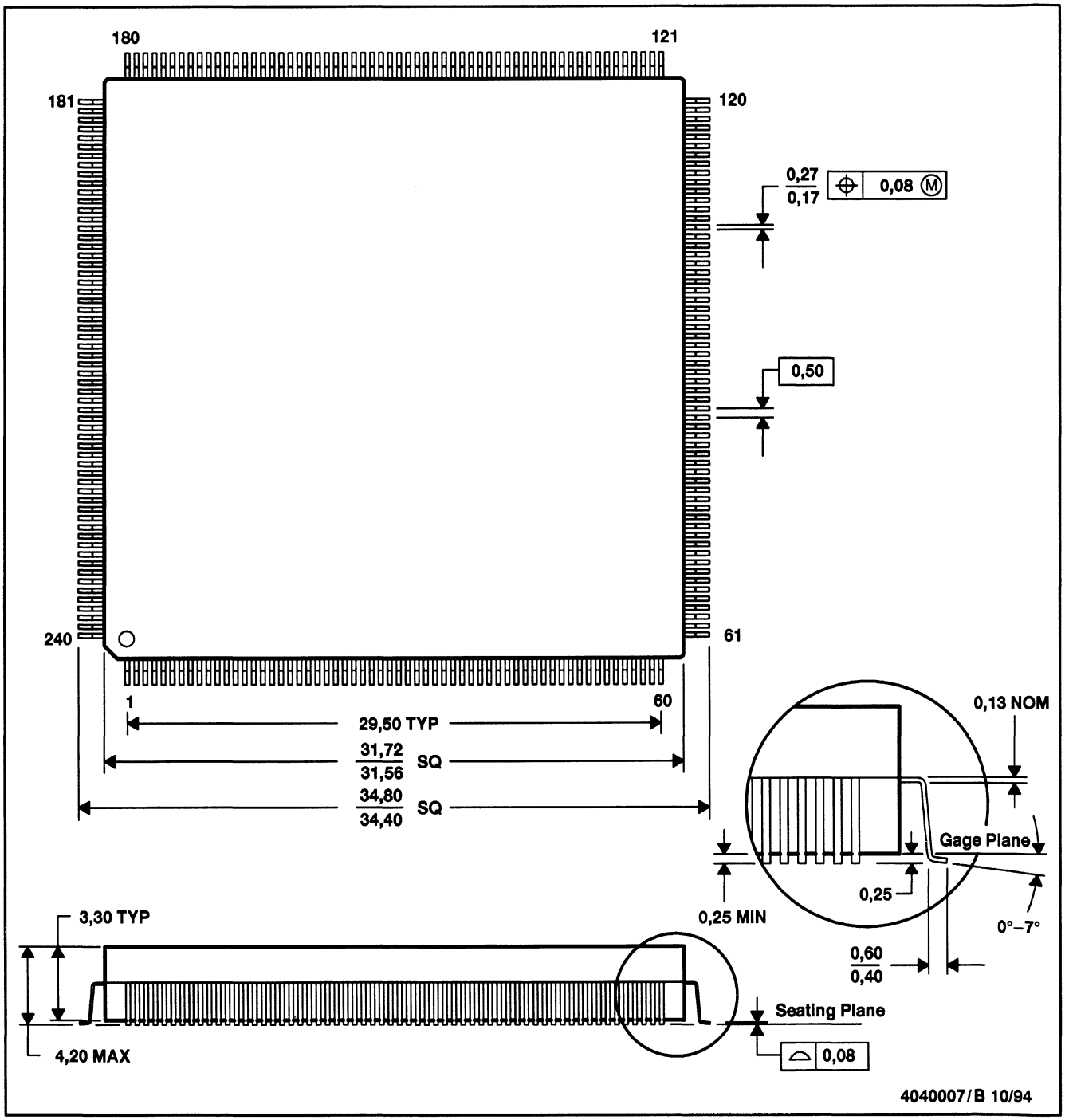


NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

OCTOBER 1994

MFP (S-MQFP-G240) **METAL QUAD (MQUAD®) FLATPACK**



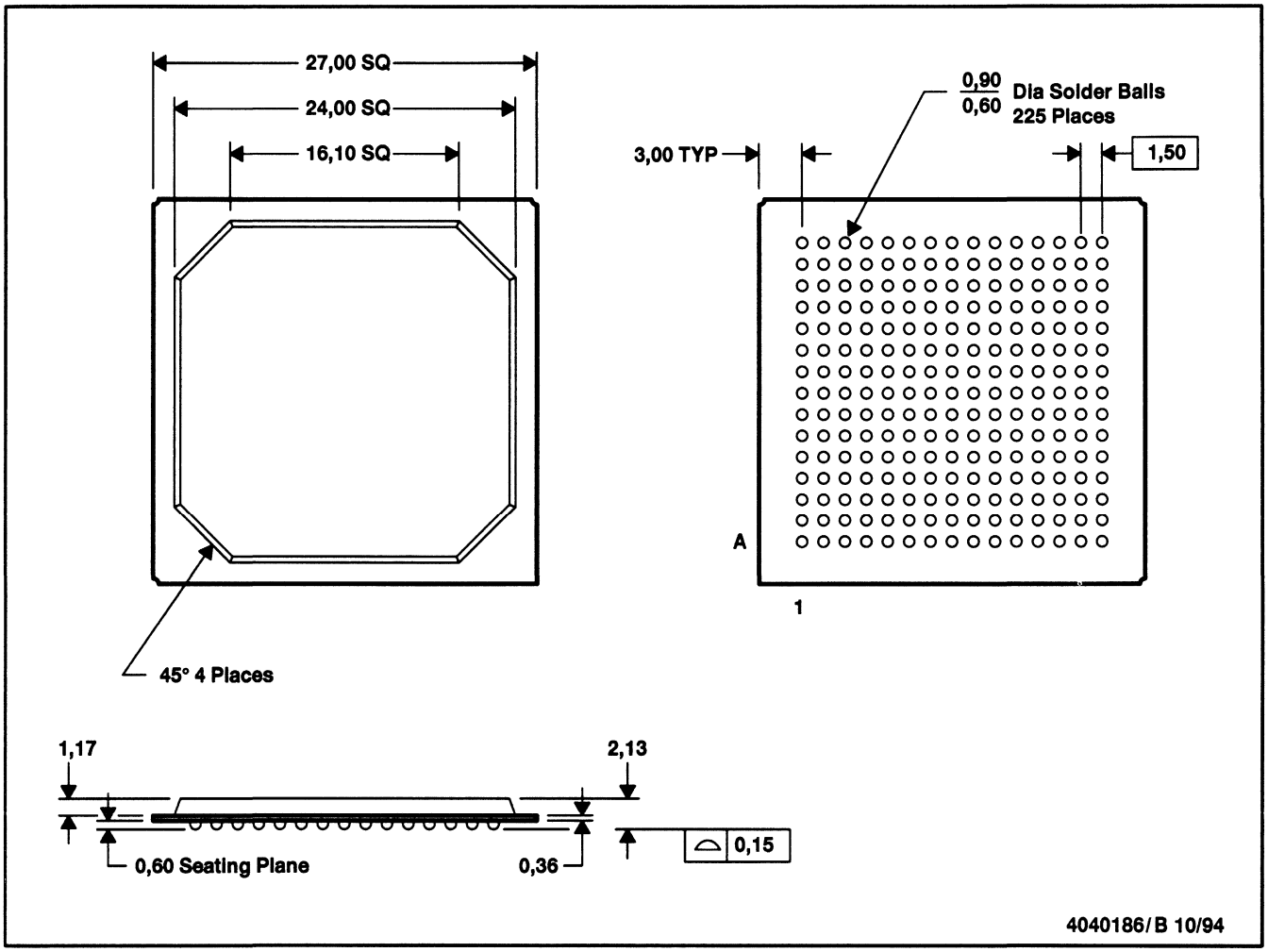
NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. MQUAD is a registered trademark of Olin Corporation.
D. This quad flatpack consists of a circuit mounted on a leadframe and encased within an anodized aluminum shell. The package is intended for parts requiring either a lower stress environment or higher thermal dissipation capabilities than can be supplied by plastic.

CAUTION: Ultrasonic cleaning of this package or boards with this package is not permitted.

TEXAS INSTRUMENTS
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

OCTOBER 1994

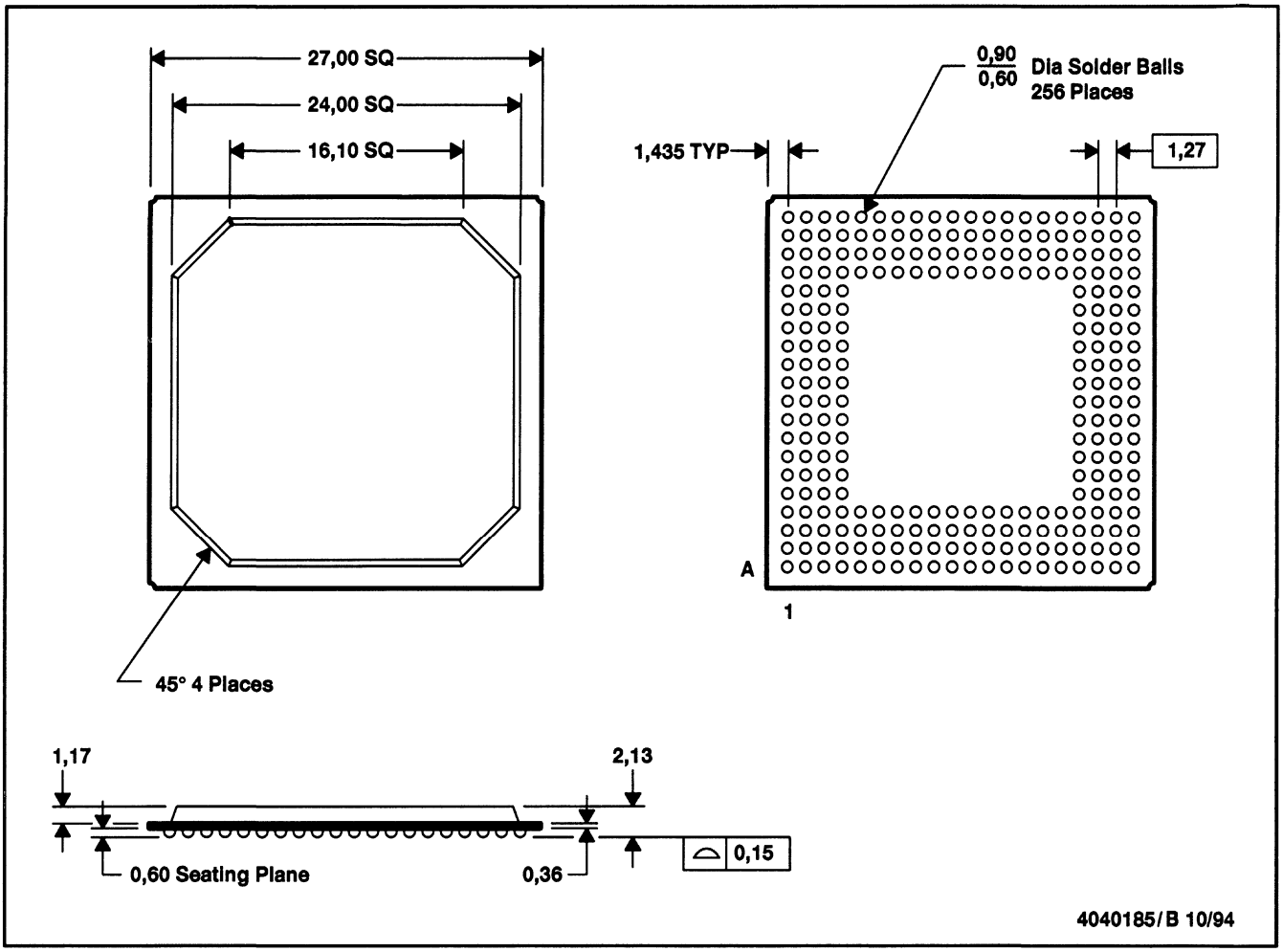
GFM (S-PBGA-N225) **PLASTIC BALL GRID ARRAY**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

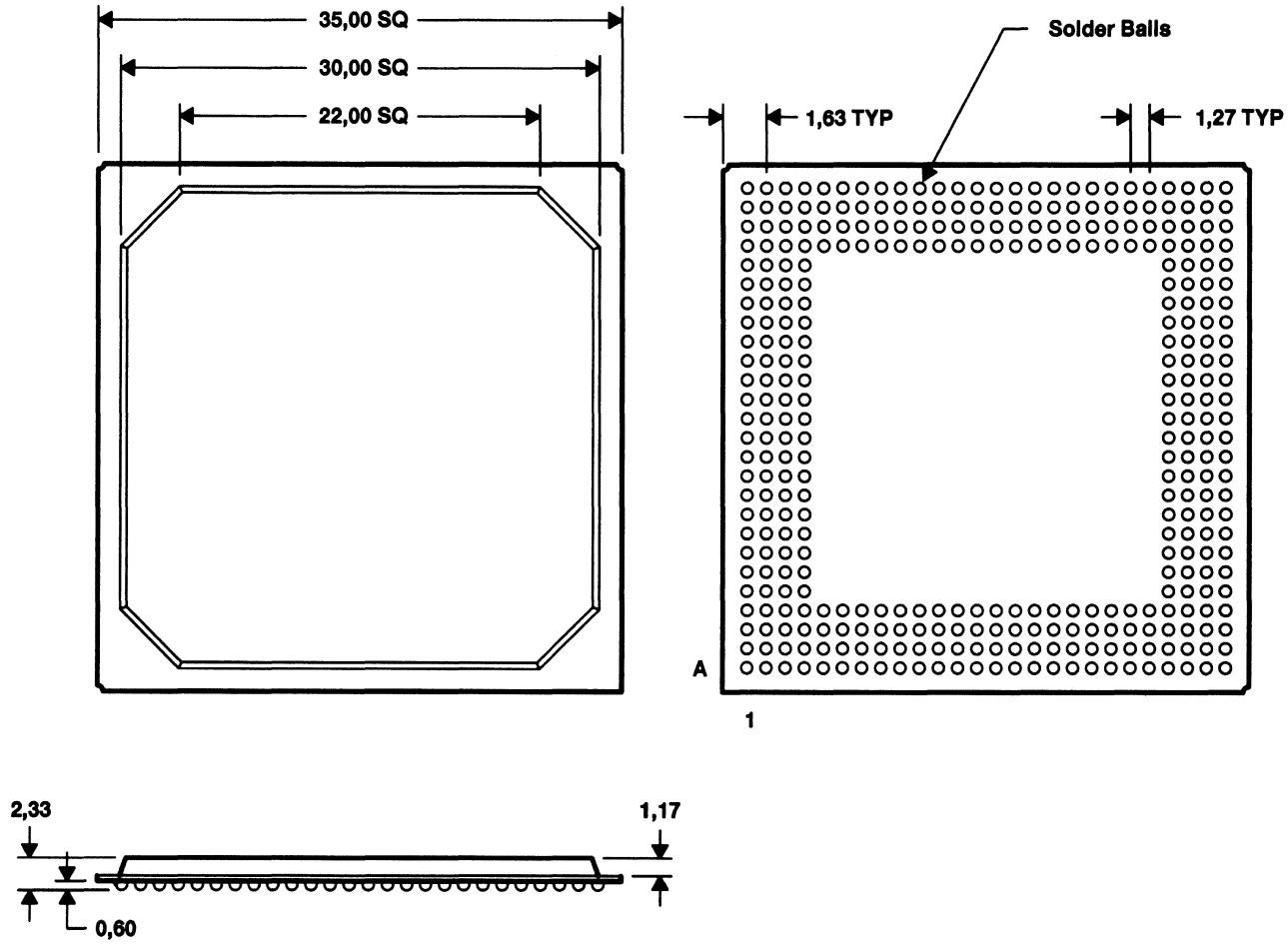
GFN (S-PBGA-N256) **PLASTIC BALL GRID ARRAY**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

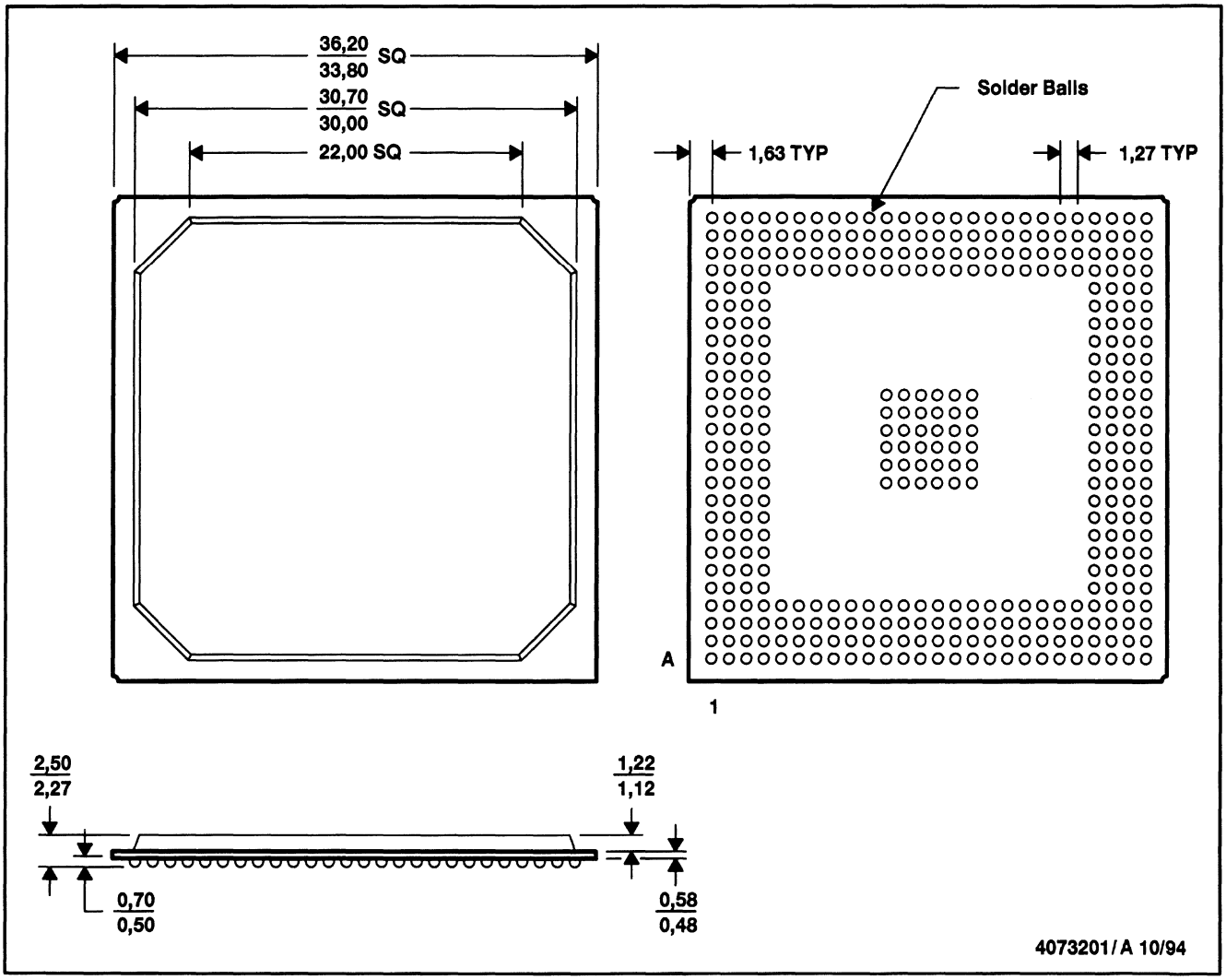
GFT (S-PBGA-N352) **PLASTIC BALL GRID ARRAY**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

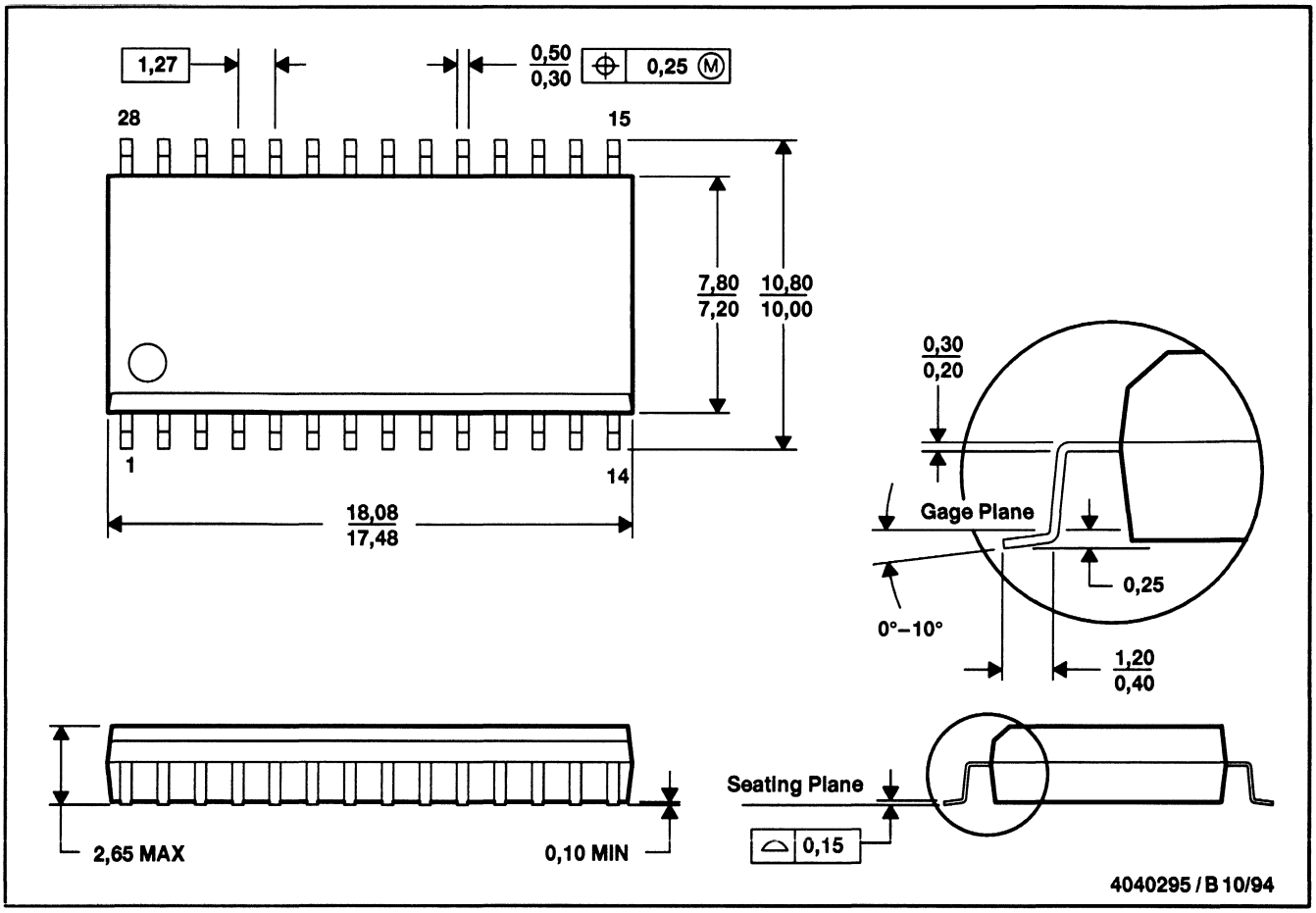
GFW (S-PBGA-N388) **PLASTIC BALL GRID ARRAY**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

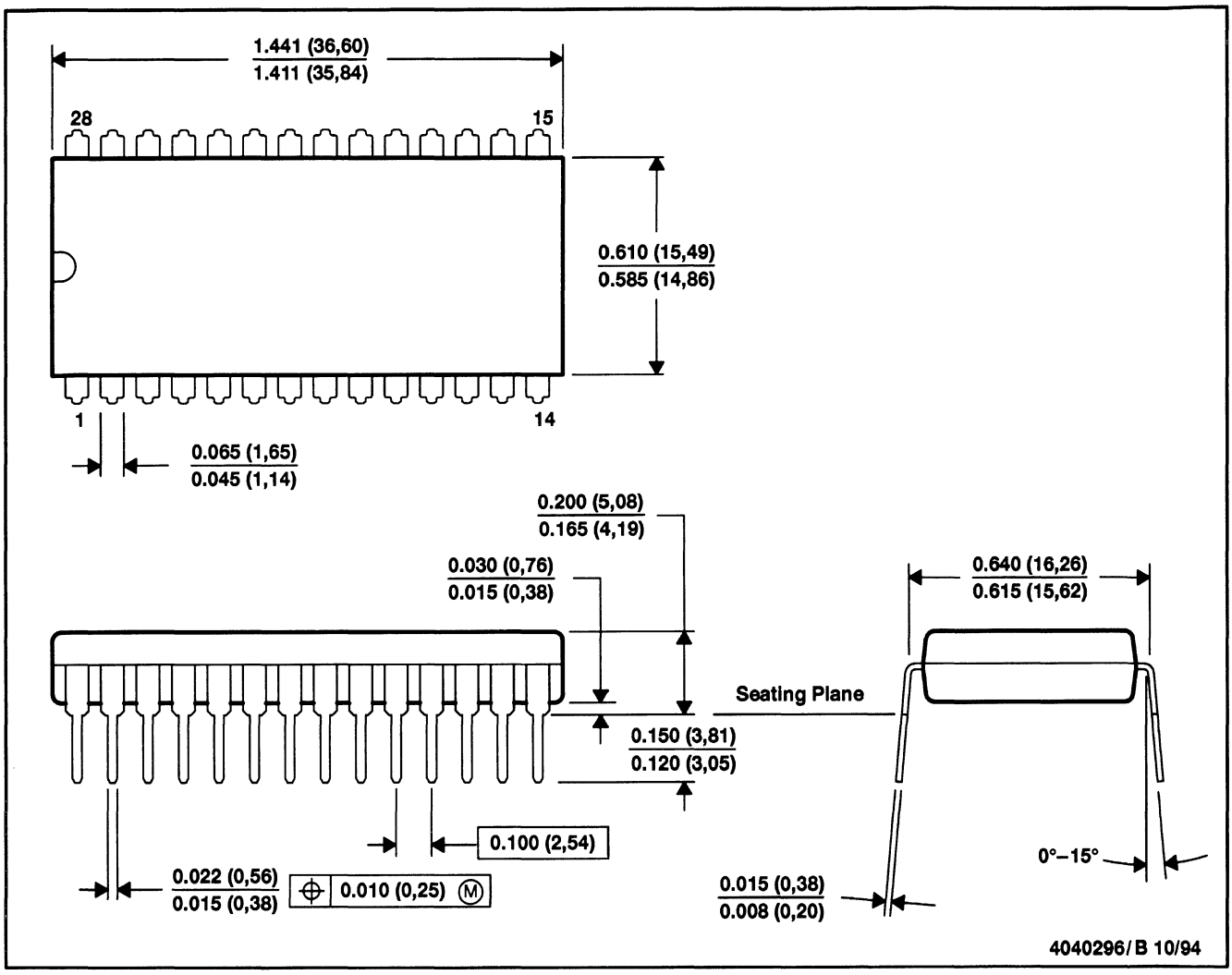
DWM (R-PDSO-G28) **PLASTIC SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. Body dimensions include mold flash or protrusion.

OCTOBER 1994

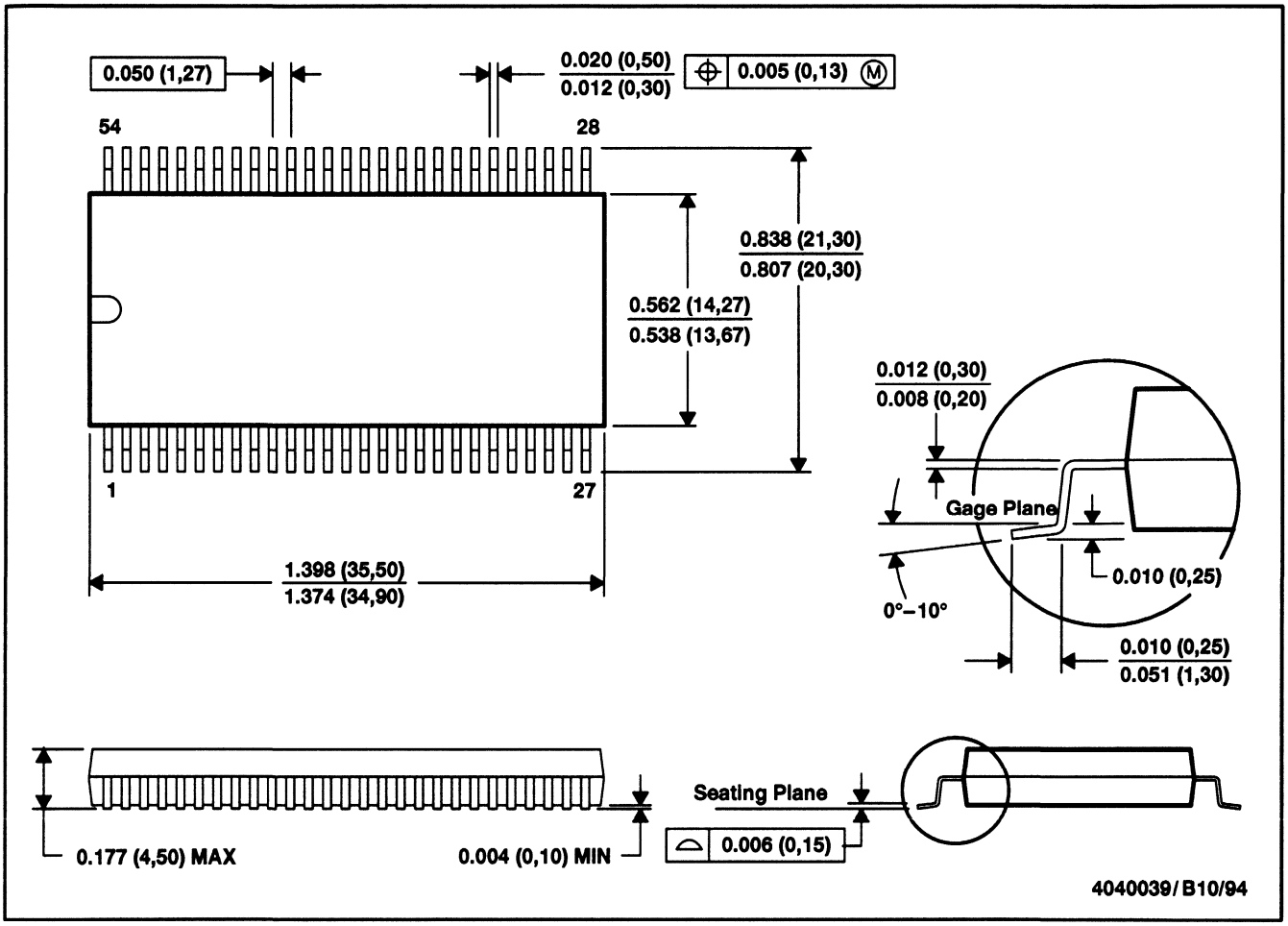
NWM (R-PDIP-T28) **PLASTIC DUAL-IN-LINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. Body dimensions do not include mold flash or protrusion.

OCTOBER 1994

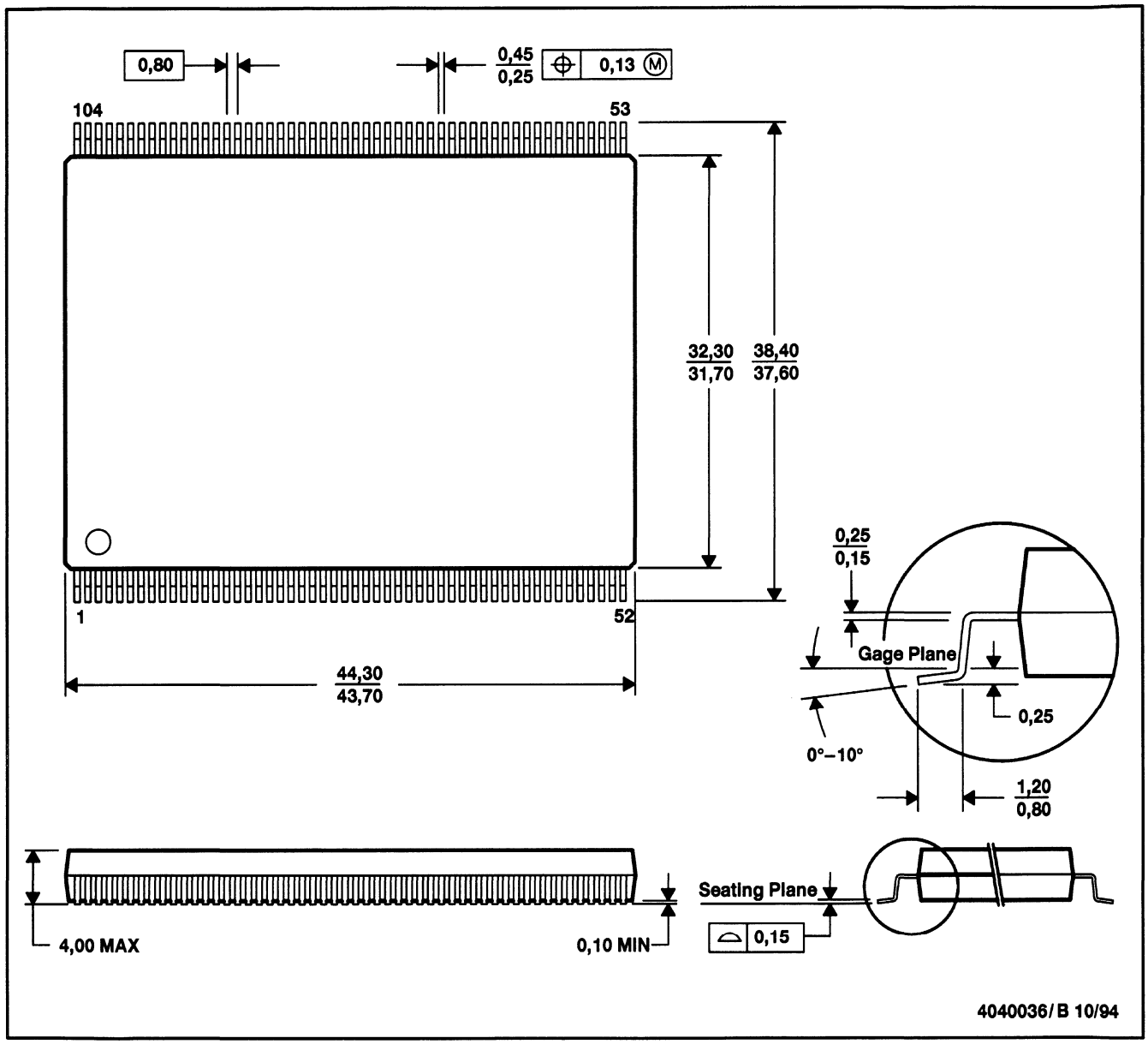
PD (R-PDSO-G54) **PLASTIC DUAL SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.
C. This package is designed for a ceramic MCM substrate to be mounted on the lead frame pad and wire bonded to the lead fingers.

OCTOBER 1994

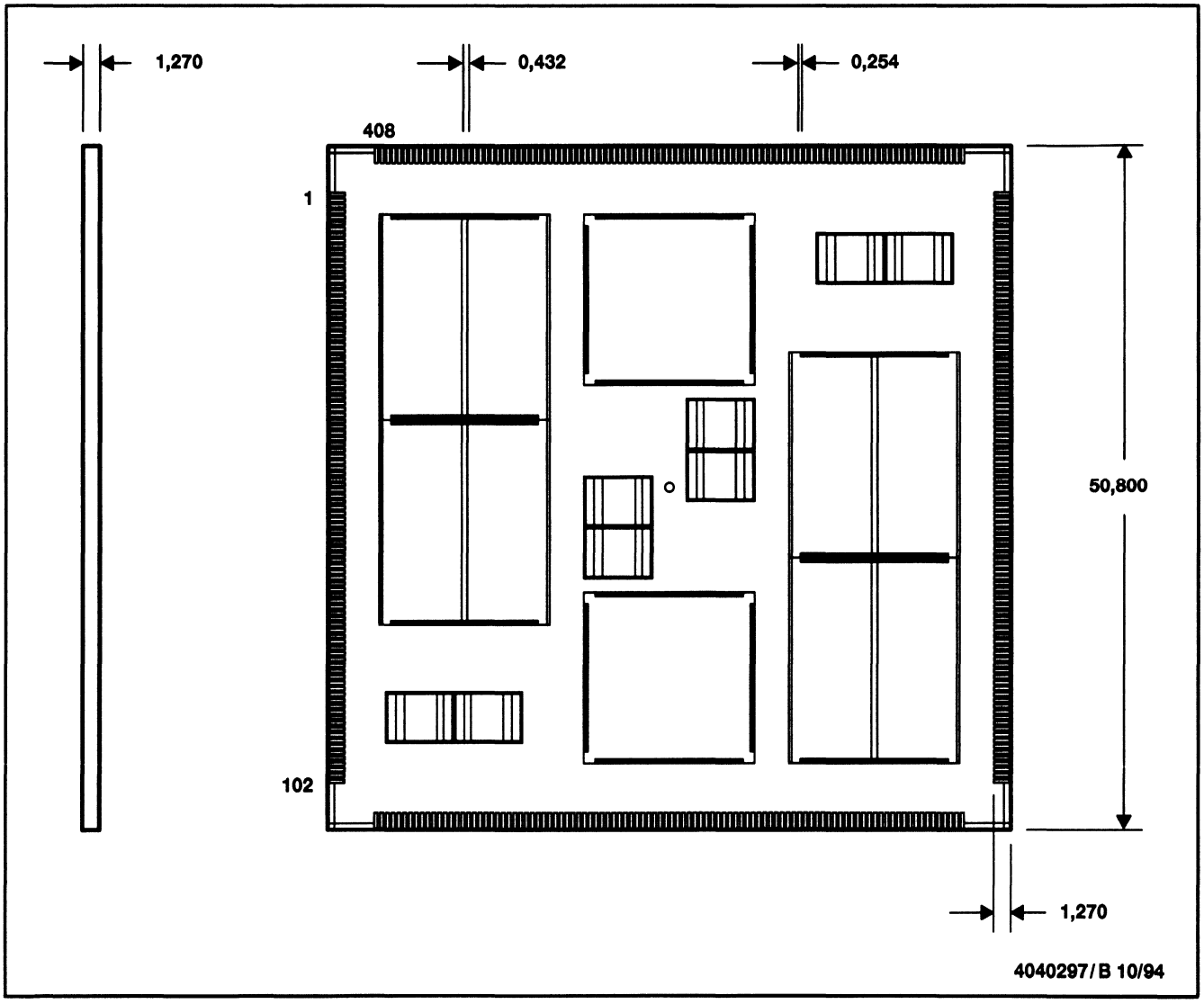
PA (R-PDSO-G104) **PLASTIC DUAL SMALL-OUTLINE PACKAGE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.
C. This package is designed for a ceramic MCM substrate to be mounted on the lead frame pad and wire bonded to the lead fingers.

OCTOBER 1994

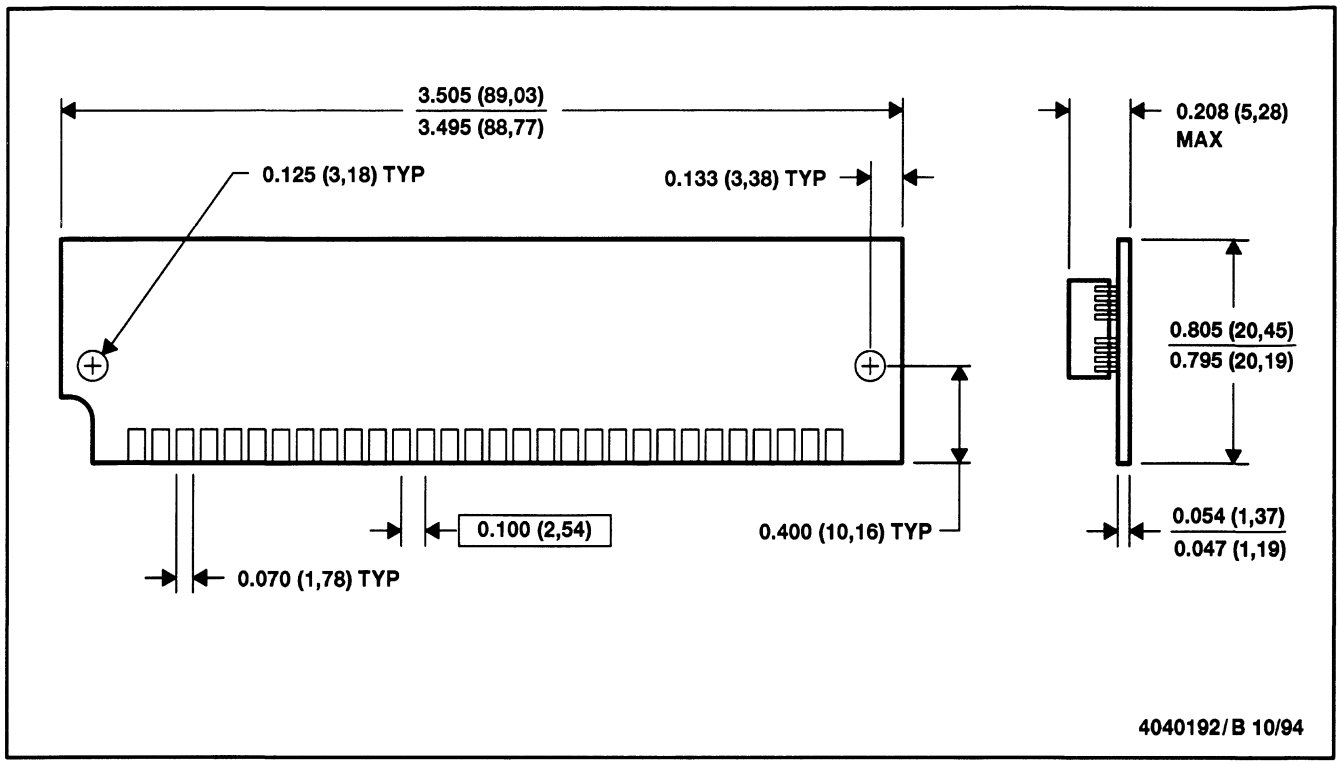
HDI (S-CQCC-N408) **CERAMIC MULTICHIP MODULE**



NOTES: A. All linear dimensions are in millimeters.
B. This drawing is subject to change without notice.

OCTOBER 1994

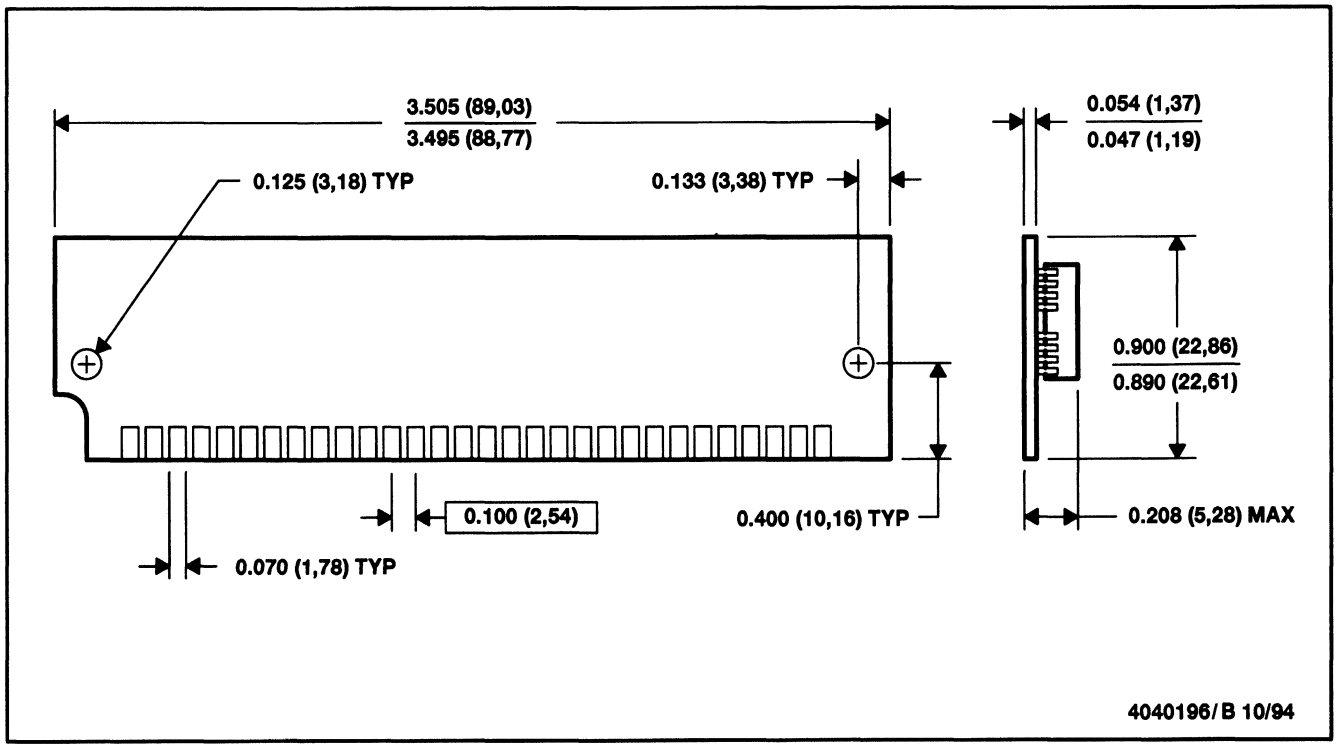
AD (R-CSIP-N30) **SINGLE-IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

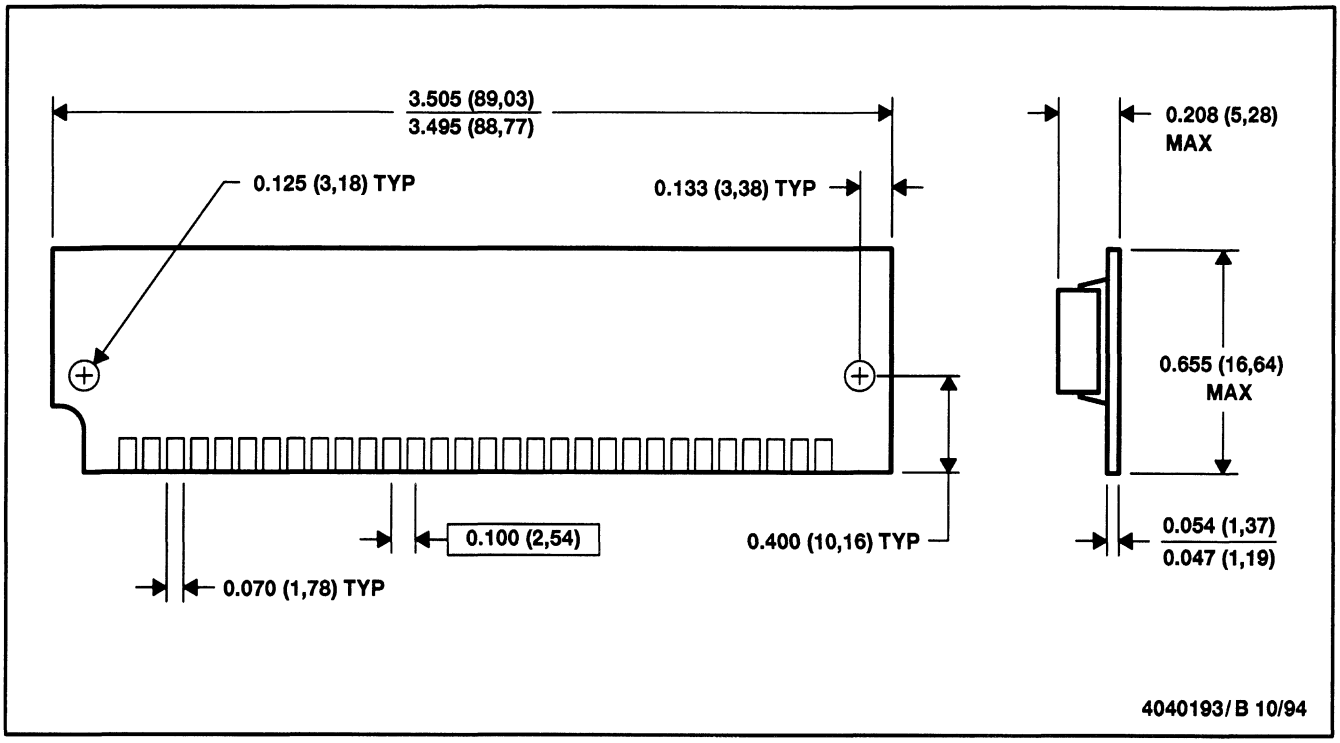
BD (R-CSIP-N30) **SINGLE-IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

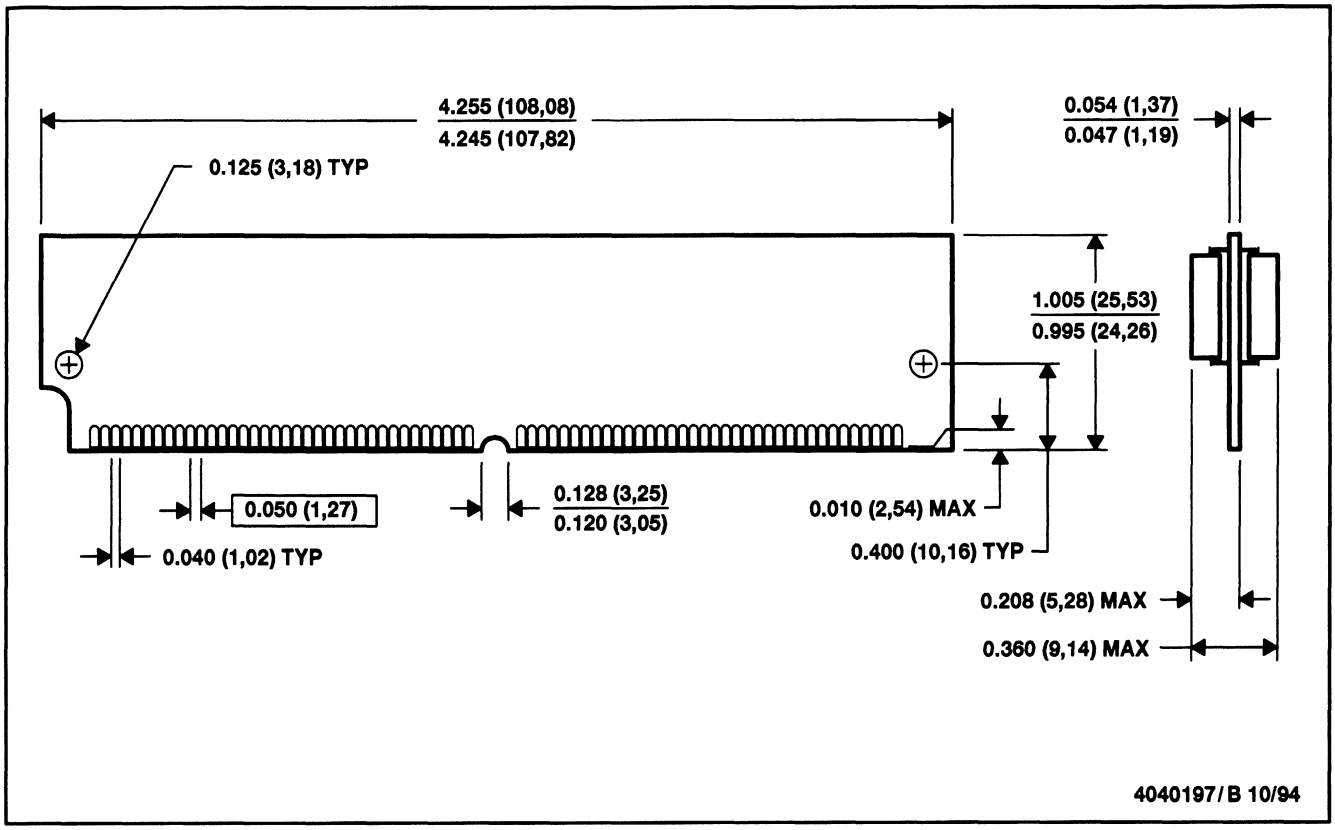
U (R-CSIP-N30) **SINGLE-IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

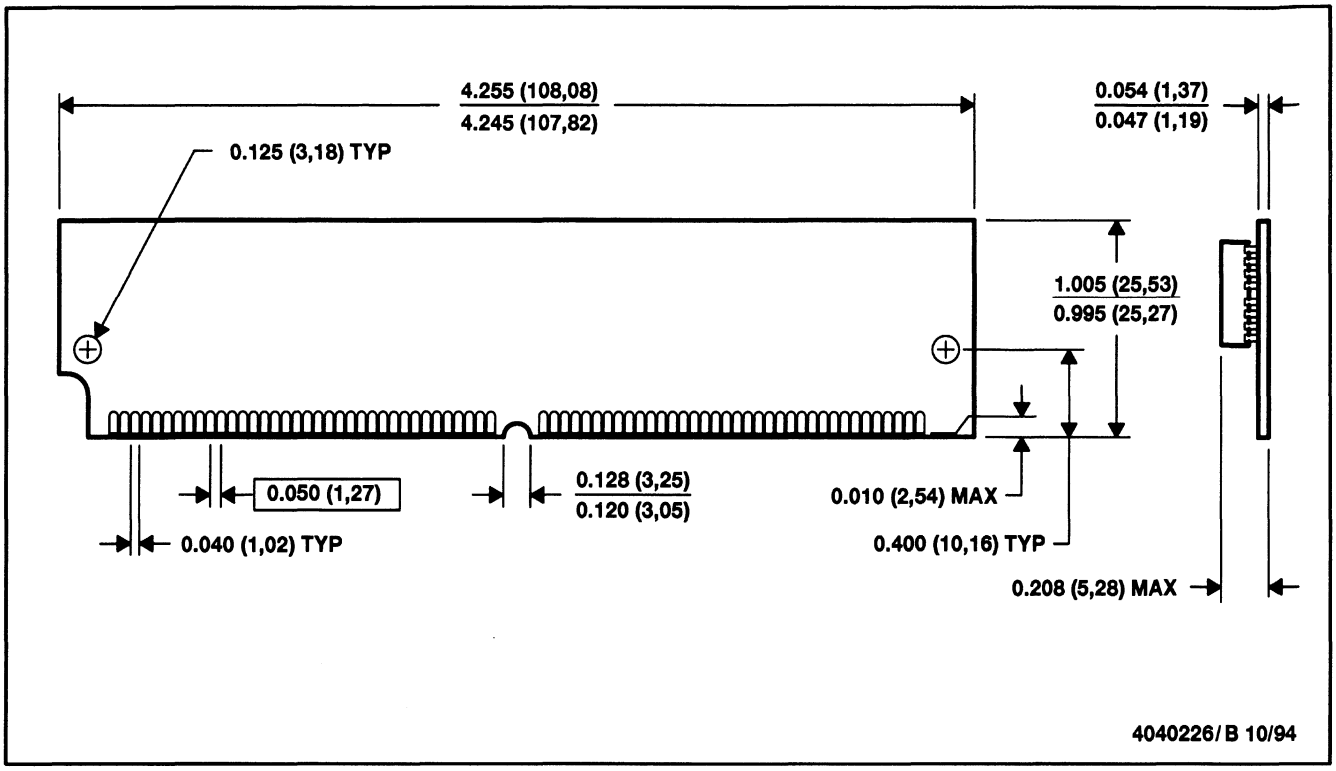
BK (R-CSIP-N72) **DOUBLE-SIDED SINGLE-IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

OCTOBER 1994

BK (R-CSIP-N72) **SINGLE-IN-LINE MEMORY MODULE**



NOTES: A. All linear dimensions are in inches (millimeters).
B. This drawing is subject to change without notice.

7 Appendix

Surface Mount Using Preplated Leadframes

To extend the life of surface-mount technology, the semiconductor industry is looking for methods to use lead-free solders and minimize the usage of chemicals, to reduce the outer pitch of surface-mount components without generating solder reflow problems, and to reduce cost, all without causing changes for customers. After several years of manufacturing experience, it can be stated that copper leadframes with palladium preplating fulfill these requirements and expectations.

Instead of conventional silver spot plating and post assembly solder plating, copper base metal leadframes can be flood plated with nickel and palladium to make a finish that is both wire bondable and solderable. A comparison between palladium finish and standard silver spot finish is schematically shown in Figure 1.

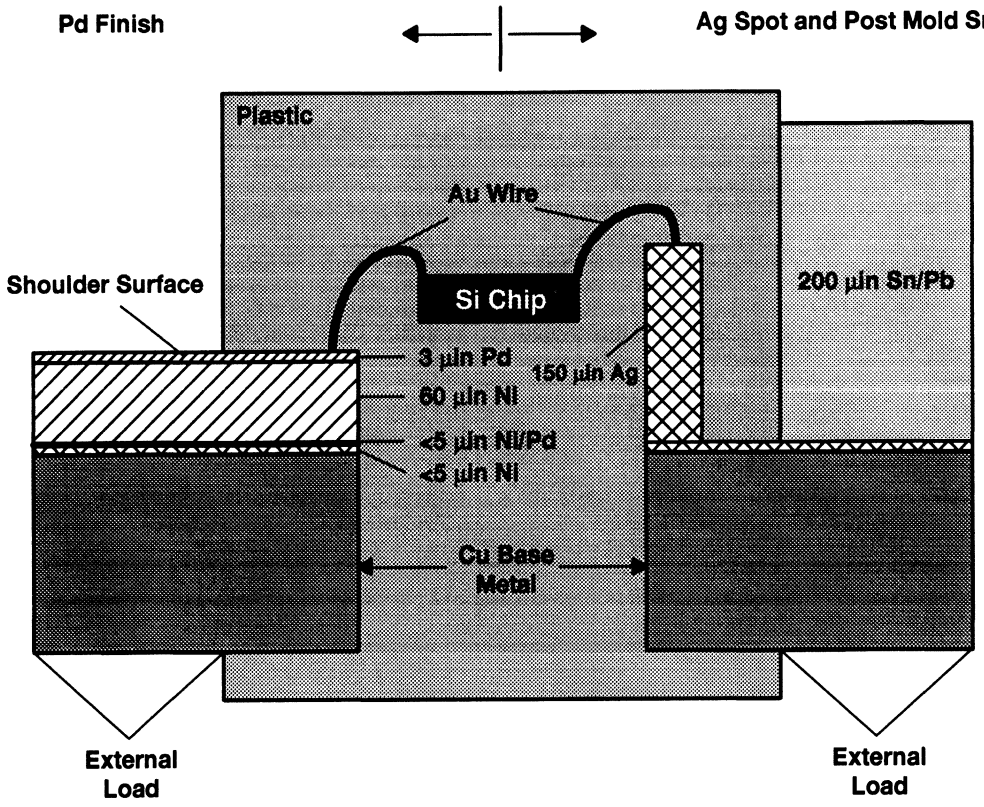


Figure 1. Palladium Versus Silver Spot Finish

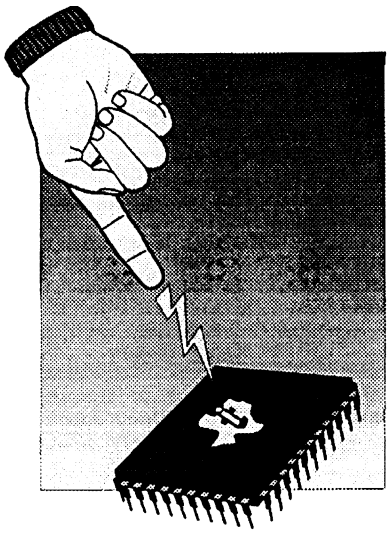
With close to six billion palladium-finished devices in the field, the favorable experience can be summarized as follows:

- Eliminates Sn/Pb plating after molding
- No wet chemical exposure or thermal shock to finished device
- No Ag to Sn/Pb spot tolerance stack-up in preplated frames
- No solder flakes/burrs at trim/form
- Reduced mechanical damage
- Conformal coating minimizes handling transport jams
- Very thin coating with less absolute variability than Sn/Pb plate gives better lead tip planarity
- No cost for disposal of lead contaminated scrap
- No lead in manufacturing process and product
- No requirements for space, personnel, equipment, waste treatment, process water, utilities, or exhaust for Sn/Pb plating
- No environment permitting for solder plate process
- No QC for secondary process
- Reduces manufacturing cycle time
- Trim scrap value: roughly $4 of Pd for every $1 of Cu scrap. This must be netted against leadframe cost as well as cost for disposal of PB contaminated scrap.
- Excellent solderability of finished package
- Excellent adhesion for most molding compounds
- No dendritic Ag growth
- Compatible with existing assembly process, mount cure and mold, and with higher temperature bonding process, not limited by Sn/Pb eutectic
- Superior board mount results-strength and uniformity
- Particularly applicable to fine pitch packages. Very uniform solder joints. The only solder brought to the joint is that which is screened onto the board. Works well with lead-free solders.

ELECTROSTATIC DISCHARGE (ESD)

Introduction

In recent years, the semiconductor industry has made great strides in developing faster, lower power, and smaller devices. During the '90s, many devices will be produced with minimum feature size of structures on the silicon chip of 0.25 micron. To put this in perspective, a typical human hair is about 75 microns in diameter. However, as feature sizes get smaller and smaller, ESD sensitivity (voltage level at which the device will sustain damage) also gets lower. This means that ESD protection and ESD handling procedures will become even more important in the future to avoid ESD damage.



All semiconductor devices have an ESD voltage threshold above which they will sustain damage. While circuit designers can provide some on-circuit ESD protection (typically in the 2,000–4,000 volt range for the human body model and 200–300 volts for the machine model), this is well below the static voltage levels found in work areas without ESD protection. Proper ESD handling and packaging procedures must be utilized throughout the processing, handling, and storing of unmounted ICs and ICs mounted on circuit boards.

What is ESD and how does it occur?

Static charge is an unbalanced electrical charge at rest. It is created by insulator surfaces rubbing together or pulling apart. One surface gains electrons while the other surface loses electrons. This results in an unbalanced electrical condition recognized as static charge.

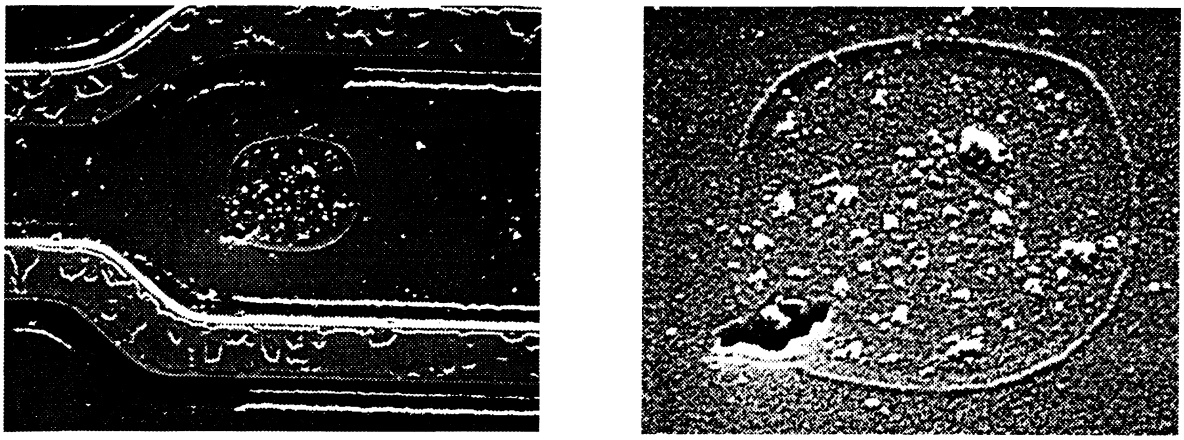
When static charge moves from one surface to another, it becomes ESD. ESD is a miniature lightning bolt of static charge that moves between two surfaces that have different potentials. It can only occur when the voltage differential between the two surfaces is sufficiently high to break down the dielectric strength of the medium separating the two surfaces. When static charge moves, it becomes a current that damages or destroys oxides, metallizations, and junctions. ESD can occur in any one of four different ways: a charged body can touch an IC, a charged IC can touch a grounded surface, a charged machine can touch an IC, or an electrostatic field can induce a voltage across a dielectric sufficient to break it down.

Latent Defects

Devices with latent ESD defects are called "walking wounded" because they have been degraded but not destroyed by ESD. THis occurs when an ESD pulse is not sufficiently strong to destroy a device but nevertheless causes damage. Often, the device suffers junction degradation through increased leakage or a decreased reverse breakdown, but the device still functions and is still within data sheet limits. A device may be subjected to numerous weak ESD pulses, with each one further degrading a device before it finally becomes a catastrophic failure. There is no known practical screen for walking wounded devices. In order to avoid this type of damage, devices must be continually accorded ESD protection as outlined later.

What voltage levels of ESD are possible?

It has been shown that human beings can be charged up to 38,000 volts just by walking across a rug on a low-humidity day. In order for an ESD pulse to be seen, felt, or heard, it must be in the range of 3000–4000 volts. Many devices can be damaged well below this threshold. ESD damage is shown in the failure analysis pictures on the next page.



Punctured Barrier Junction After ESD Test at 4000 Volts.

How to avoid ESD damage to ICs

Since ESD can occur only when different potentials are involved, the best way to avoid ESD damage is to keep the ICs at the same potential as their surroundings. The logical reference potential is ESD ground. So the first and most important rule in avoiding ESD damage is to keep ICs and everything that comes in close proximity to them maintained at ESD ground potential. There are four supplementary rules that support this first rule.

- Any person handling the ICs should be grounded either with a wrist strap or ESD protective footwear used in conjunction with a conductive or static-dissipative floor or floor mat.
- The work surface where devices are placed for handling, processing, testing, etc., must, be made of static dissipative material and be grounded to ESD ground.
- All insulator materials must either be removed from the work area or they must be neutralized with an ionizer. Static generating clothing may be covered up with an ESD protective smock.
- When ICs are being stored, transferred between operations or workstations, or shipped, they must be maintained in a Faraday shield container whose inside surface (touching the ICs) is static dissipative.

Humidity

Where insulators are present, humidity is a very important factor in the generation of static electricity. Humidity affects the surface resistivity of insulator materials. As humidity increases, the surface resistivity decreases. This means that insulator materials rubbed together or pulled apart in a humid environment generate lower static charges than the same materials rubbed together or pulled apart in a dry environment. Where it is possible to control humidity, it is recommended that relative humidity be maintained between 40 percent and 60 percent. Higher humidity becomes very uncomfortable for humans, and lower humidity increases the risk of static generation from insulators. Humidity is a supplementary control and is not sufficient by itself to reduce static voltages to safe levels.

Training

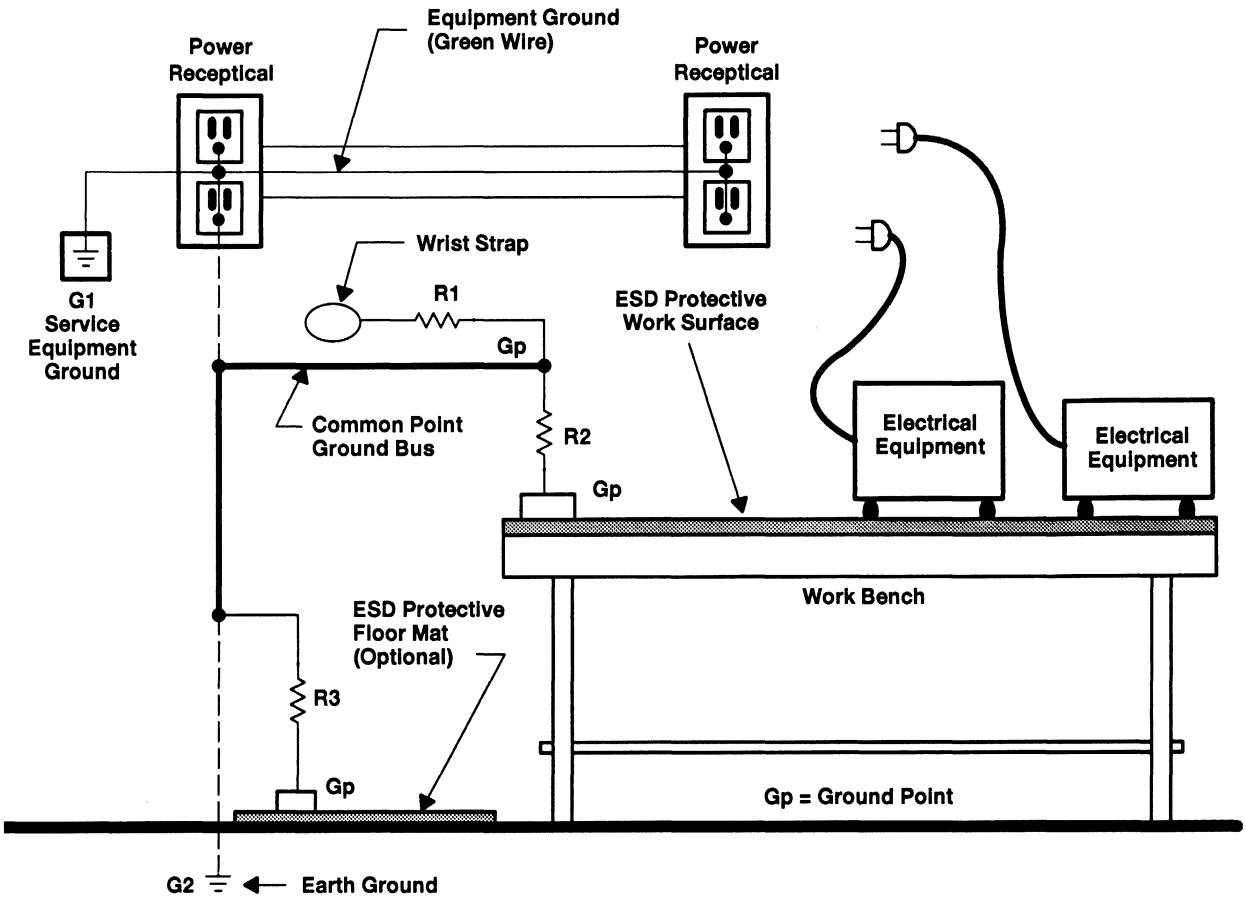
All personnel who come in close proximity with ESD-sensitive ICs must receive ESD training initially and then again each year as a minimum. No ESD program can be successful unless the people who handle the ICs understand the need for ESD controls.

ESD Specification

Each area handling ESD-sensitive devices is operated in accordance with the established ESD Handling Procedure. THe latest version of this controlled document is maintained in each area and is accessible to all area personnel.

ESD Coordinator

One person is identified who has overall responsibility for the ESD program. This person is responsible for writing the ESD Handling Procedure, keeping it updated, ESD training, and material evaluation.



NOTES: 5. G1 (equipment ground) or G2 (earth ground) is acceptable for ESD ground. Where both grounds are used, they shall be connected (bonded) together.
6. R1 is mandatory for all wrist straps.
7. R2 (for static dissipative work surfaces) and R3 (for ESD protective floor mats) are optional. ESD protective flooring shall be connected directly to the ESD ground without R3.
8. This ESD-protected workstation complies with JEDEC Standard No. 42.

Figure 6. ESD-Protected Workstation (Side View)

Audits

Periodic audits ranging from daily to yearly are held to ensure that all ESD handling procedures are being followed and that all ESD materials (wrist straps, heel straps, ionizers, table mats, floor mats, etc.) are functioning properly.

TI ESD Handling Procedure

The TI worldwide ESD Handling Procedure is available to customers upon request.

Moisture Sensitivity of Plastic Surface-Mount Packages

Some plastic surface-mount packages are classified as moisture sensitive because the moisture that has been absorbed inside the package can expand rapidly during exposure to the high temperature stress of reflow soldering and create mechanical damage to the package (often referred to as popcorn). Surface-mount packages are subjected to much higher solder reflow temperatures than their through-hole counterparts. The bodies of the through-hole parts are shielded from the hot wave solder by the PC board, while surface-mount parts have their bodies subjected to the solder reflow temperature.

All plastic packages absorb some moisture at room ambient conditions. The amount of moisture that is absorbed is based on a number of factors including the room temperature and humidity. However, there is no threshold level of moisture absorption or gain that applies to all plastic surface-mount packages and makes them moisture sensitive. Conversely, all plastic surface-mount packages that are essentially moisture free at the time of reflow solder will be free of moisture-induced stress failures.

It is important, therefore, to know which packages are tested for moisture sensitivity so they can receive special care in handling to minimize moisture absorption and subsequent moisture-induced stress damage during the reflow solder operation.

At Texas Instruments, plastic surface-mount packages are tested for moisture sensitivity using JEDEC Test Method A112, Moisture-Induced Stress Sensitivity for Plastic Surface-Mount Devices. Packages that are found to be moisture sensitive are baked (to drive out the moisture) and then placed in a protective dry-pack bag that contains a humidity indicator card and sufficient desiccant to maintain a very low humidity level in the bag. A caution label (as defined in JEDEC Publication No. 113) is attached to the bag and indicates the minimum floor life of the packages once they are removed from the protective dry environment of the bag.

Plastic surface-mount packages that are not moisture sensitive per JEDEC Test Method A112 do not need to be dry packed or handled in a special way to minimize moisture absorption prior to reflow soldering provided that the package body temperature does not exceed 220°C (this is the JEDEC Test Method A112 evaluation temperature).

Test Structures

Test structures for packaging applications are designed to either measure a particular quantity directly or to detect a failure mechanism. Strain gauges that give quantitative values of either compressive or tensile stresses are an example of the first type of structure. Moisture sensors that measure the amount of harmful ionic contaminates within a package by resistively monitoring aluminum corrosion are an example of the second type of test structure[1], [2], [3].

Characteristics of a well designed package test structure are: 1) the structure should be sensitive only to the effect to be measured, 2) the structure should give repeatable quantitative results, and 3) the structure should be positioned on the chip for maximum sensitivity. The first goal can be achieved by designing the structure to be more sensitive to the measured quantity than to anything else. For example, a strain gauge should have a high enough resistance to minimize experimental errors that might result from contact resistances or resolution limitations of the test instrument. The second goal is sometimes more elusive but can usually be achieved by simplification of the structure or by the inclusion of on-chip buffer circuitry to isolate the structure from the vagaries of test fixtures. For example, corrosion due to contamination can be monitored by measuring the continuity of a narrow, long metal line without on-chip circuity. On the other hand, to monitor the impact of packaging on device speed, buffers would be required to isolate the on-chip oscillator from capacitance loading by the test fixture.

Results are obtained through experimentation. The structures are packaged in the materials and designs of interest. Comparisons are made between results with the new materials or designs and control groups using known materials or designs. Acceleration of failure mechanisms is usually required to assess the reliability of the new assemblies. Selection is then made of the best materials and designs, resulting in a package ready for qualification.

Stress Sensitive Test Structures Used by Industry

Diffused Strain Gauges. Diffused strain gauges have been widely used for the past seven or eight years to measure package stresses [3]–[7]. Each diffused strain gauge measures the stress averaged across the gauge at its position on the chip. Small gauges locate the stress quantity more precisely than do large gauges. A mapping of stress on the chip can be made by placing a number of gauges at different locations; for example, in the corner of the chip, along the edges, and at the center. Designers should ensure that interconnect resistance is orders of magnitudes less than the resistance of the gauge itself.

The diffused strain gauge detailed in Figure 1 is typical. It is formed by an implanted N-type resistor on (100) silicon. Since crystalline silicon is a piezoresistive material, the mobility of charge carriers, and hence the resistance of the diffusion, is modulated by the mechanical stress applied to the crystal lattice. The amplitude and sign of the resistance modulation is a function of the following factors: dopant type and concentration profile, the crystalline orientation of the silicon, and the nature of the stress, either compressive or tensile. For N-type diffusions or implants, positive resistance changes are indicative of compressive stress applied to the chip during the assembly operation. Negative resistance changes indicate tensile stress. The resistance shifts for this gauge are related to the stress in the various crystalline axes by the following equations [11].

$$\frac{\Delta R}{R_{o1'}} = \pi_{11'}\sigma_{1'} + \pi_{12'}\sigma_{2'} + \pi_{13'}\sigma_{3'} \qquad [8]$$

$$\frac{\Delta R}{R_{o2'}} = \pi_{21'}\sigma_{1'} + \pi_{22'}\sigma_{2'} + \pi_{23'}\sigma_{3'}$$

Where:

$\pi_{11'}$ = piezoresistance coefficient

$\sigma_{1'}$ = compressive (negative) or tensile (positive) stress

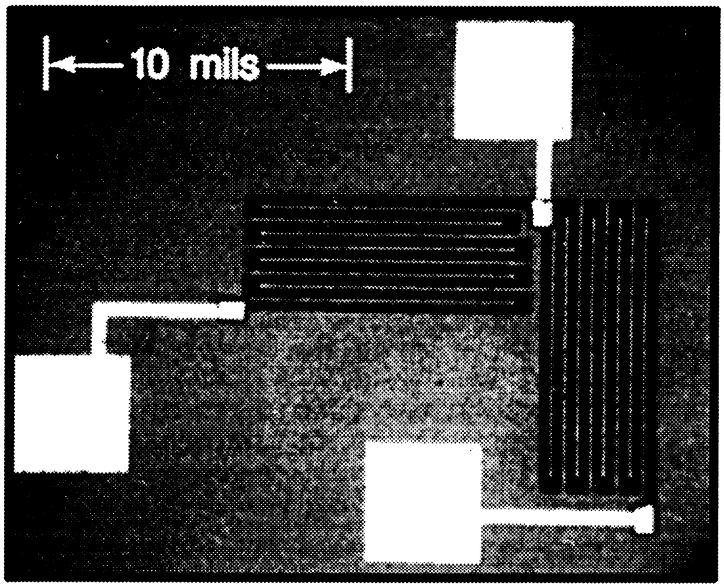


Figure 1. Detail of Diffused Strain Gauge

Note that there are three unknown stresses and only two equations. A third equation would represent the resistance shift in the direction perpendicular to the chip surface. Since it is impossible to measure this shift with planar processing, finite element analysis (FEA) calculated average value of perpendicular stress is chosen so that the remaining stresses may be estimated. Typically, this normal stress is an order of magnitude less than the planar stress at any point on the chip except at the edges (see Figure 2). This assumption leads to error in the quantitative stress measured by the strain gauge.

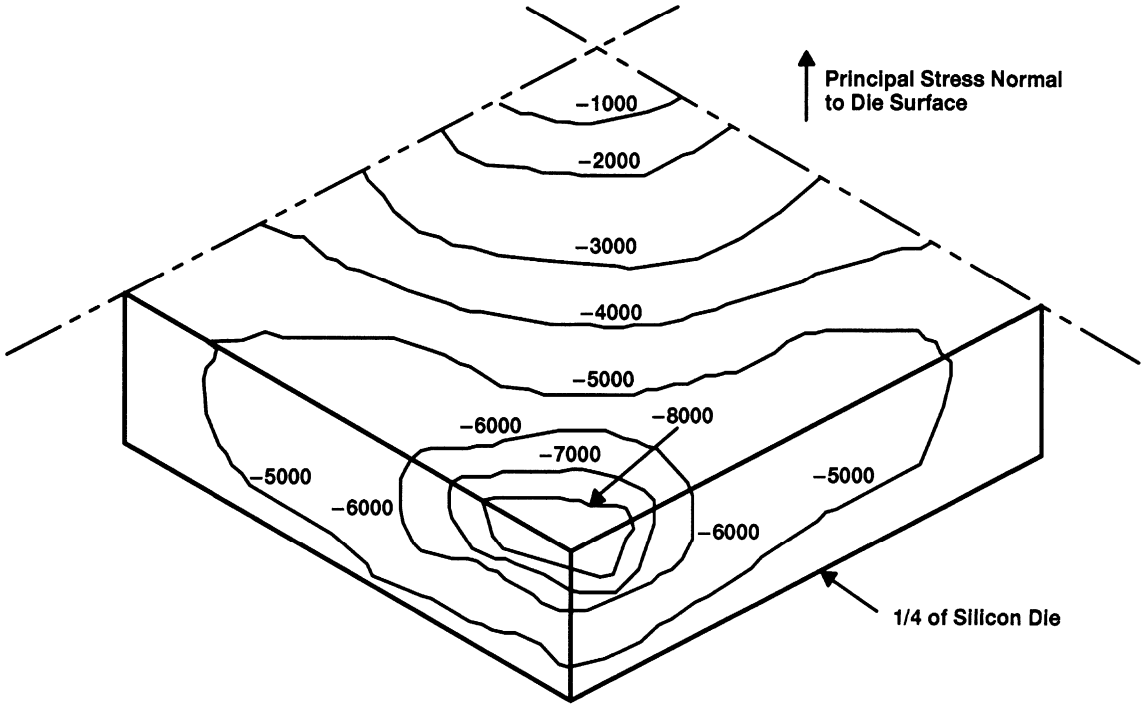


Figure 2. Contours for Compressive Stress Normal to Chip Surface

Note also that no torque or shear stresses show up in the equations above. These terms are a function of the crystalline orientations and dopant types chosen for the strain gauges. For this particular gauge in (100) silicon, these terms were zero. Others have used gauges in different orientations, giving different sensitivities [7], [12]. One unique strain gauge uses both N- and P-type diffusions, which allows calculation of both the shear stress and the normal stress [9]. There is a trade-off, however, in that more complex gauges require more leads, limiting the number of gauges that can be arrayed on the chip and bonded at one time. Much interesting information can be found by examining the mapping of stress as found through a strain gauge array (see Figure 3).

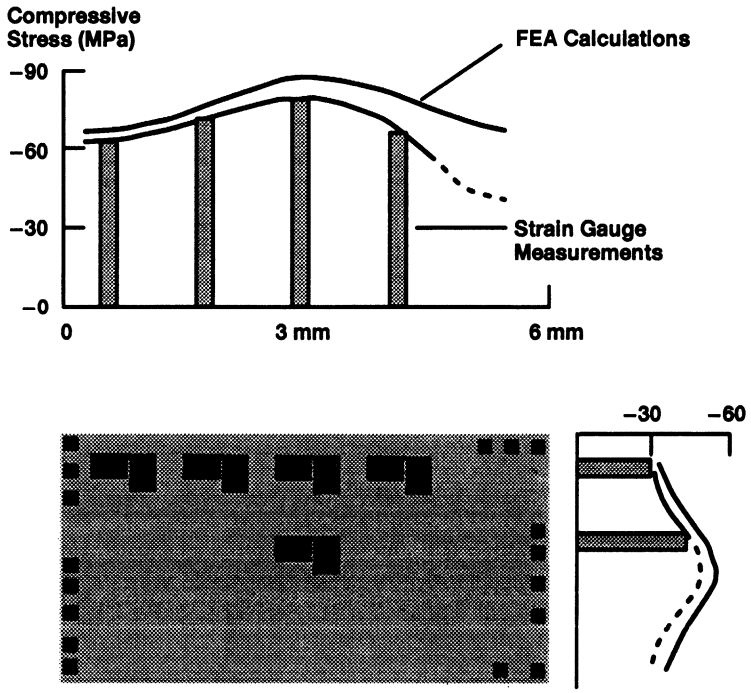
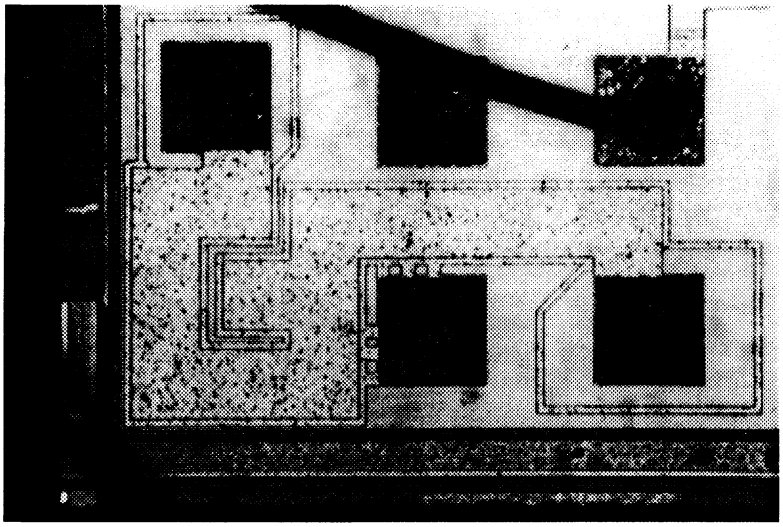


Figure 3. Mapping of Stress Using Strain Gauges Arrayed on Chip. Comparison Made to FEA Results.

Experimental details to bear in mind when using diffused strain gauges include correcting for temperature shifts. This can be done by using on-chip bridge arrangements or by measuring the chip temperature at test and correcting the data based on known temperature sensitivity.

Shear Stress Sensitive Test Structures. The shear stress structures discussed here are typical of those used throughout the industry [10], [11]. Since shear stress affects the passivation over wide metal and the circuitry beneath, a major feature of both structures is a wide metal line. Since the shear stress is greatest at the corner of the chip, both are designed in the corner. They detect the effects of shear stress rather than measuring the absolute magnitude of the shear stress. They provide both electrical and visual data on the shear stress effects.

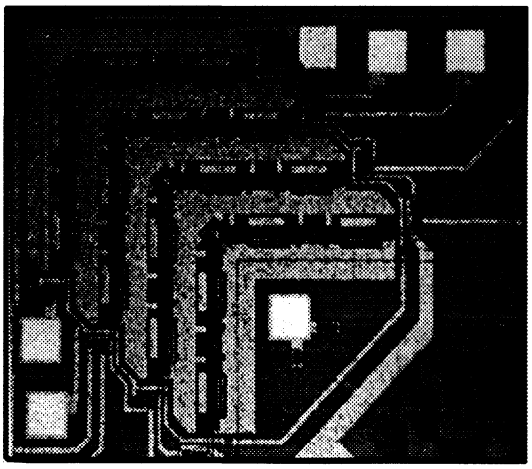
The first shear stress structure (see Figure 4) was designed to detect shorting between a wide metal line subject to shear stress damage and a narrow sense line. The wide line, designed to simulate a worst case power bus layout was 102 microns across. The 10-micron sense line was separated from the wide bus by a 3-micron space.

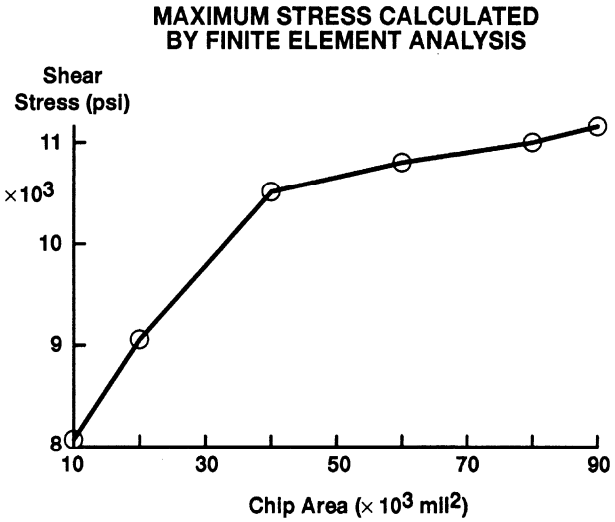


NOTE A: The 102-micron bus line surrounded by the 10-micron sense line. This was intended to be a worst case design and is intentionally close to the corner.

Figure 4. Wide Metal Visual Shear Structure in Corner of Chip

The second shear stress structure (see Figure 5) was designed to detect damage to polysilicon running under the edges of wide metal. The major unit of the structure was a 100-micron-wide metal line with an extensive poly snake running under it. The poly snake was 3.5 microns wide with 3.5 microns spacing. Electrical contact was made to both ends of the poly snake, allowing continuity measurements. This unit was then duplicated four times at multiples of 150 microns, which allowed a determination of the shear damage as a function of distance from the corner. The extra leads seen in the figure contact source and drain diffusions under the poly snakes and allowed measurement of transistor characteristics during test.





- **Test structures measure shear stress in critical chip zones**
- **Stress data are compared for chips of various areas**
- **Stress failures minimized by design rules and material selection**

Figure 5.

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Glossary

Ball Grid Array (BGA)

Surface mountable package with solder balls as leads attached to the bottom of the package

Ceramic

Inorganic, nonmetallic material, such as alumina or beryllia

CERDIP

Dual-in-line package consisting of a leadframe encased with a ceramic shell

Coplanarity

Distance from the seating plane to the lead farthest from the seating plane

DIP

Dual-in-line package designed with leads for through-hole mounting. Lead pitch is 2.54 mm (0.100 inch)

Gage Plane

A plane established above the seating plane to be used as a standard for measuring lead length

Heat Sink

Heat conductive material used to transmit heat from the silicon chip to the external environment. Usually a heat sink is made of metal.

Heat Slug

Heat sink that is exposed to the external environment

Heat Spreader

Heat sink that is internal to the package

Heat Dissipating QFP (HQFP)

Quad flat pack designed with a heat sink

Heat Dissipating SOP (HSOP)

Small-outline package designed with a heat sink

Heat Dissipating SSOP (HSSOP)

Shrink small-outline package designed with a heat sink

Hermetic

Seal so that package is not penetrable by moisture vapor or other gases

JEDEC

Joint Electronic Device Engineering Council

J-Lead

Leads formed into a J pattern

Lead Frame

The metallic portion of the package that completes the electrical path from the internal package to the external

Leadless Ceramic Chip Carrier (LCCC)

Ceramic package having metalized contacts at its periphery instead of wire leads

Mold Flash

Thin layer of mold compound that extends from the sides of the package onto the leads and/or between the leads generated during encapsulation

MQUAD™

Quad flat pack style package with a metal shell as opposed to plastic

Multichip Model

A module or package capable of supporting several chips on a package

Nom

Abbreviation for nominal

Nominal

Average value for a given measurement

Pin Grid Array (PGA)

A package with pins extending from the bottom of the package

Plastic

A polymeric material used for encapsulation. Also known as mold compound

Plastic Flange Mount (PFM)

Through-hole package with a tab for thermal heat dissipation

Plastic Leaded Chip Carrier (PLCC)

Plastic package designed for surface mounting with J-lead configuration

Quad Flat Pack (QFP)

Package with leads extending from four sides in a gull lead form

Seating Plane

A plane generated, when the package is at rest, between the bottom of leads and the contact surface

Shrink Dual-In-Line Package (SDIP)

Package designed with leads for through-hole mounting. Lead pitch is 1.78 mm (0.70 inches).

Side Brazed

Technique where leads are attached to the ceramic package by brazing instead of being part of a lead frame

Single In-Line Package (SIP)

Package with leads only on a single side in one row

Small-Outline Package (SOP)

Plastic dual-in-line package with gull lead form that has a lead pitch less or equal to 0.65 mm (0.026 inches)

Solder Dip

Solder lead finish that is applied by dipping the leads into solder

Surface-Mount Package

Packages designed to mount onto, rather than into, the printed circuit board

Thin Quad Flat Pack (TQFP)

Quad flat pack with a total maximum height of 1.6 mm (0.63 inches)

Thin Shrink Small-Outline Package (TSSOP)

Plastic dual-in-line package with gull lead form that has a maximum height of 1.2 mm (0.048 inches) and a lead pitch less than or equal to 0.65 mm (0.026 inches)

Thin Small-Outline Package (TSOP)

Plastic dual-in-line package with gull lead form that has a maximum height of 1.2 mm (0.048 inches)

Through-Hole Package

Package designed to mount into the printed circuit board via plated holes in the board

Typ

Abbreviation for typical

Typical

Dimension or measurement is applicable for all other similar features

Zig-Zag In-Line Package (ZIP)

Package with leads from one side but the leads are formed into two rows, creating a zig-zag affect

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