

SN5440, SN54LS40, SN54S40 SN7440, SN74LS40, SN74S40 DUAL 4-INPUT POSITIVE-NAND BUFFERS

SDLS108A – APRIL 1985 – REVISED OCTOBER 2004

- Package Options Include Plastic "Small Outline" Packages, Ceramic Chip Carriers and Flat Packages in Addition to Plastic and Ceramic DIPs
- Dependable Texas Instruments Quality and Reliability

description

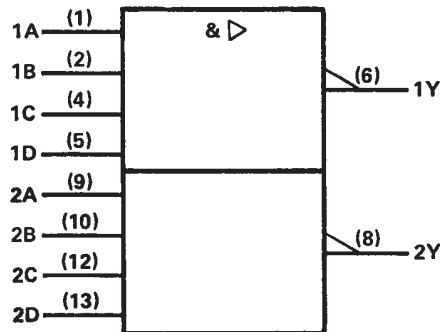
These devices contain two independent 4-input NAND buffer gates.

The SN5440, SN54LS40, and SN54S40 are characterized for operation over the full military temperature range of -55°C to 125°C . The SN7440, SN74LS40, and SN74S40 are characterized for operation from 0°C to 70°C .

FUNCTION TABLE (each gate)

| INPUTS | | | | OUTPUT |
|--------|---|---|---|--------|
| A | B | C | D | Y |
| H | H | H | H | L |
| L | X | X | X | H |
| X | L | X | X | H |
| X | X | L | X | H |
| X | X | X | L | H |

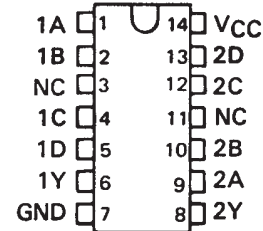
logic symbol†



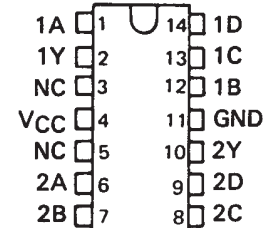
†This symbol is in accordance with ANSI/IEEE Std. 91-1984 and IEC Publication 617-12.

Pin numbers shown are for D, J, and N packages.

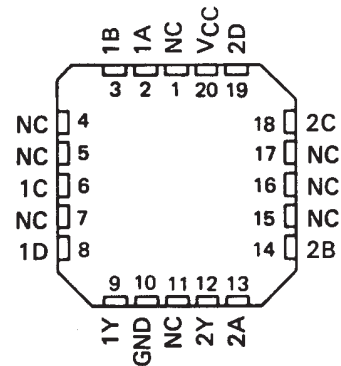
SN5440 . . . J PACKAGE
SN54LS40, SN54S40 . . . J OR W PACKAGE
SN7440 . . . N PACKAGE
SN74LS40, SN74S40 . . . D OR N PACKAGE
(TOP VIEW)



SN5440 . . . W PACKAGE
(TOP VIEW)

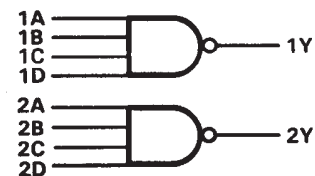


SN54LS40, SN54S40 . . . FK PACKAGE
(TOP VIEW)



NC - No internal connection

logic diagram



positive logic

$$Y = A \cdot B \cdot C \cdot D \text{ or } Y = \overline{A + B + C + D}$$

PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.

 **TEXAS
INSTRUMENTS**

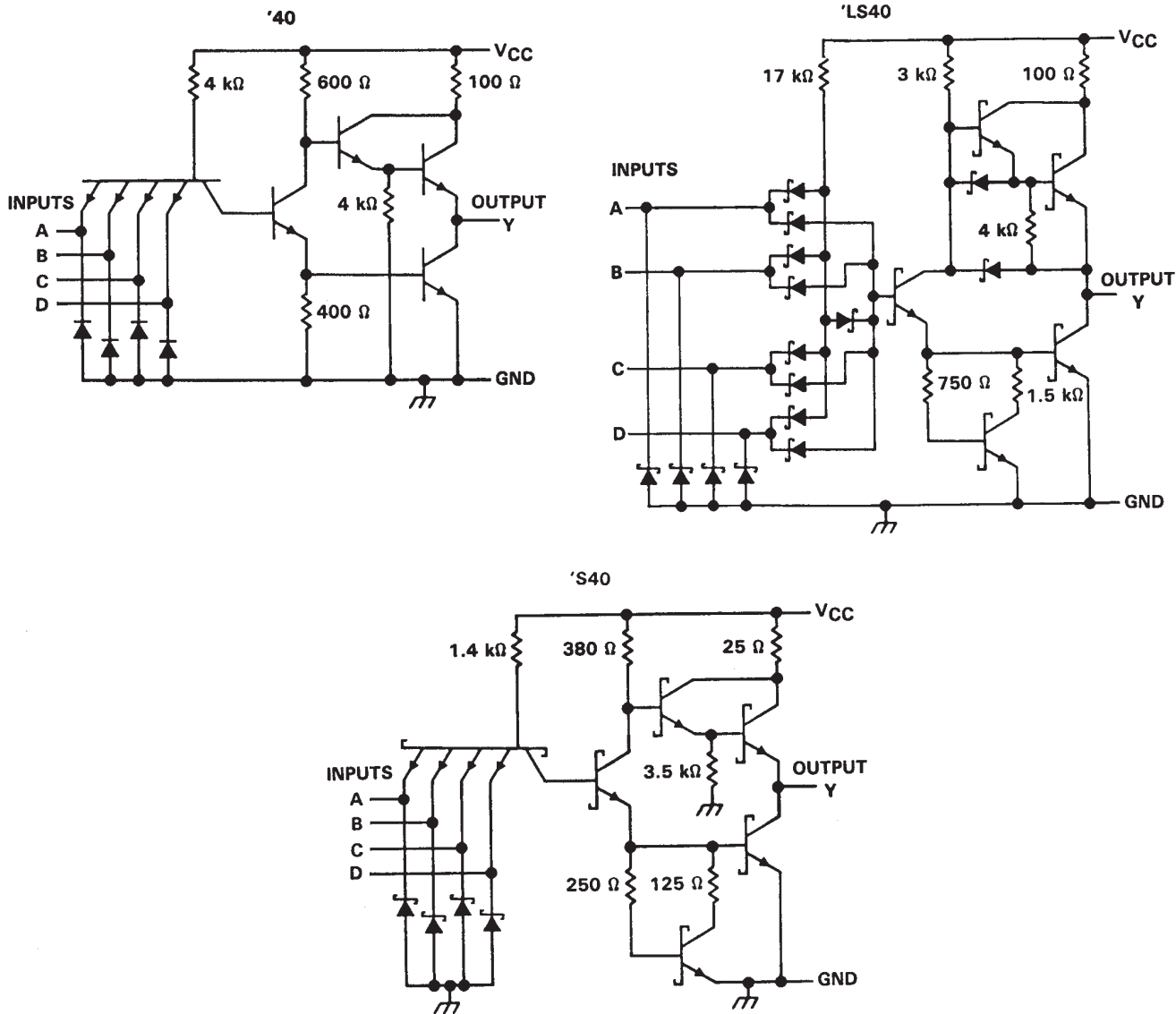
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SN5440, SN54LS40, SN54S40 SN7440, SN74LS40, SN74S40 DUAL 4-INPUT POSITIVE-NAND BUFFERS

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schematics (each gate)



Resistor values shown are nominal.

absolute maximum ratings over operating free-air temperature range (unless otherwise noted)

| | |
|---|----------------|
| Supply voltage, V_{CC} (see Note 1) | 7 V |
| Input voltage: '40, 'S40 | 5.5 V |
| 'LS40 | 7 V |
| Operating free-air temperature range: SN54' | -55°C to 125°C |
| SN74' | 0°C to 70°C |
| Storage temperature range | -65°C to 150°C |

NOTE 1: Voltage values are with respect to network ground terminal.



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SN7440, SN74LS40, SN74S40
DUAL 4-INPUT POSITIVE-NAND BUFFERS
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recommended operating conditions

| | SN5440 | | | SN7440 | | | UNIT |
|---|--------|-----|-----|--------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} Low-level input voltage | 0.8 | | | 0.8 | | | V |
| I _{OH} High-level output current | - 1.2 | | | - 1.2 | | | mA |
| I _{OL} Low-level output current | 48 | | | 48 | | | mA |
| T _A Operating free-air temperature | - 55 | | | 125 | | | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS † | SN5440 | | | SN7440 | | | UNIT |
|-------------------|--|--------|-------|------|--------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = - 12 mA | - 1.5 | | | - 1.5 | | | V |
| V _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = - 1.2 mA | 2.4 | 3.3 | | 2.4 | 3.3 | | V |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 48 mA | 0.2 | 0.4 | | 0.2 | 0.4 | | V |
| I _I | V _{CC} = MAX, V _I = 5.5 V | 1 | | | 1 | | | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.4 V | 40 | | | 40 | | | µA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | - 1.6 | | | - 1.6 | | | mA |
| I _{OS} § | V _{CC} = MAX | - 20 | | - 70 | - 18 | | - 70 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | 4 | 8 | | 4 | 8 | | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 V | 17 | 27 | | 17 | 27 | | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed 100 milliseconds.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|--|-----|-----|-----|------|
| t _{PLH} | Any | Y | R _L = 133 Ω, C _L = 15 pF | | 13 | 22 | ns |
| t _{PHL} | | | | 8 | 15 | ns | |

**SN5440, SN54LS40, SN54S40
SN7440, SN74LS40, SN74S40
DUAL 4-INPUT POSITIVE-NAND BUFFERS**

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recommended operating conditions

| | SN54LS40 | | | SN74LS40 | | | UNIT |
|---|----------|-----|------|----------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} Low-level input voltage | | | 0.7 | | | 0.8 | V |
| I _{OH} High-level output current | | | -1.2 | | | -1.2 | mA |
| I _{OL} Low-level output current | | | 12 | | | 24 | mA |
| T _A Operating free-air temperature | -55 | | 125 | 0 | | 70 | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS † | SN54LS40 | | | SN74LS40 | | | UNIT |
|-------------------|---|----------|-------|------|----------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | | | -1.5 | | | -1.5 | V |
| V _{OH} | V _{CC} = MIN, V _{IL} = MAX, I _{OH} = -1.2 mA | 2.5 | 3.4 | | 2.7 | 3.4 | | V |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 12 mA | | 0.25 | 0.4 | | 0.25 | 0.4 | V |
| | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 24 mA | | | | | 0.35 | 0.5 | |
| I _I | V _{CC} = MAX, V _I = 7 V | | | 0.1 | | | 0.1 | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.7 V | | | 20 | | | 20 | µA |
| I _{IL} | V _{CC} = MAX, V _I = 0.4 V | | | -0.4 | | | -0.4 | mA |
| I _{OS} § | V _{CC} = MAX | -30 | | -130 | -30 | | -130 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | | 0.45 | 1 | | 0.45 | 1 | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 V | | 3 | 6 | | 3 | 6 | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed one second.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|--|-----|-----|-----|------|
| t _{PLH} | Any | Y | R _L = 667 Ω, C _L = 45 pF | | 12 | 24 | ns |
| t _{PHL} | | | | | 12 | 24 | |



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SN7440, SN74LS40, SN74S40
DUAL 4-INPUT POSITIVE-NAND BUFFERS

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recommended operating conditions

| | SN54S40 | | | SN74S40 | | | UNIT |
|---|---------|-----|-----|---------|-----|------|------|
| | MIN | NOM | MAX | MIN | NOM | MAX | |
| V _{CC} Supply voltage | 4.5 | 5 | 5.5 | 4.75 | 5 | 5.25 | V |
| V _{IH} High-level input voltage | 2 | | | 2 | | | V |
| V _{IL} Low-level input voltage | 0.8 | | | 0.8 | | | V |
| I _{OH} High-level output current | -3 | | | -3 | | | mA |
| I _{OL} Low-level output current | 60 | | | 60 | | | mA |
| T _A Operating free-air temperature | -55 | | | 125 | | | °C |

electrical characteristics over recommended operating free-air temperature range (unless otherwise noted)

| PARAMETER | TEST CONDITIONS † | SN54S40 | | | SN74S40 | | | UNIT |
|-------------------|---|---------|-------|------|---------|-------|------|------|
| | | MIN | TYP ‡ | MAX | MIN | TYP ‡ | MAX | |
| V _{IK} | V _{CC} = MIN, I _I = -18 mA | -1.2 | | | -1.2 | | | V |
| V _{OH} | V _{CC} = MIN, V _{IL} = 0.8 V, I _{OH} = -3 mA | 2.5 | 3.4 | | 2.7 | 3.4 | V | |
| V _{OL} | V _{CC} = MIN, V _{IH} = 2 V, I _{OL} = 60 mA | 0.5 | | | 0.5 | | | V |
| I _I | V _{CC} = MAX, V _I = 5.5 V | 1 | | | 1 | | | mA |
| I _{IH} | V _{CC} = MAX, V _I = 2.7 V | 0.1 | | | 0.1 | | | mA |
| I _{IL} | V _{CC} = MAX, V _I = 0.5 V | -4 | | | -4 | | | mA |
| I _{OS} § | V _{CC} = MAX | -50 | | -225 | -50 | | -225 | mA |
| I _{CCH} | V _{CC} = MAX, V _I = 0 | 10 18 | | | 10 18 | | | mA |
| I _{CCL} | V _{CC} = MAX, V _I = 4.5 V | 25 44 | | | 25 44 | | | mA |

† For conditions shown as MIN or MAX, use the appropriate value specified under recommended operating conditions.

‡ All typical values are at V_{CC} = 5 V, T_A = 25°C.

§ Not more than one output should be shorted at a time, and the duration of the short circuit should not exceed 100 milliseconds.

switching characteristics, V_{CC} = 5 V, T_A = 25°C

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | TEST CONDITIONS | MIN | TYP | MAX | UNIT |
|------------------|--------------|-------------|--|-----|-----|-----|------|
| t _{PLH} | Any | Y | R _L = 93 Ω, C _L = 50 pF | 4 | | 6.5 | ns |
| t _{PHL} | | | | 4 | | 6.5 | ns |
| t _{PLH} | | | R _L = 93 Ω, C _L = 150 pF | 6 | | | ns |
| t _{PHL} | | | | 6 | | | ns |



PACKAGING INFORMATION

| Orderable Device | Status ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN5440J | OBSOLETE | CDIP | J | 14 | | TBD | Call TI | Call TI |
| SN7440N | OBSOLETE | PDIP | N | 14 | | TBD | Call TI | Call TI |
| SN74LS40N | OBSOLETE | PDIP | N | 14 | | TBD | Call TI | Call TI |
| SN74S40D | OBSOLETE | SOIC | D | 14 | | TBD | Call TI | Call TI |
| SN74S40N | OBSOLETE | PDIP | N | 14 | | TBD | Call TI | Call TI |
| SNJ5440J | OBSOLETE | CDIP | J | 14 | | TBD | Call TI | Call TI |
| SNJ5440W | OBSOLETE | CFP | W | 14 | | TBD | Call TI | Call TI |

⁽¹⁾ The marketing status values are defined as follows:

ACTIVE: Product device recommended for new designs.

LIFEBUY: TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

NRND: Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

PREVIEW: Device has been announced but is not in production. Samples may or may not be available.

OBSOLETE: TI has discontinued the production of the device.

⁽²⁾ Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS), Pb-Free (RoHS Exempt), or Green (RoHS & no Sb/Br) - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

TBD: The Pb-Free/Green conversion plan has not been defined.

Pb-Free (RoHS): TI's terms "Lead-Free" or "Pb-Free" mean semiconductor products that are compatible with the current RoHS requirements for all 6 substances, including the requirement that lead not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, TI Pb-Free products are suitable for use in specified lead-free processes.

Pb-Free (RoHS Exempt): This component has a RoHS exemption for either 1) lead-based flip-chip solder bumps used between the die and package, or 2) lead-based die adhesive used between the die and leadframe. The component is otherwise considered Pb-Free (RoHS compatible) as defined above.

Green (RoHS & no Sb/Br): TI defines "Green" to mean Pb-Free (RoHS compatible), and free of Bromine (Br) and Antimony (Sb) based flame retardants (Br or Sb do not exceed 0.1% by weight in homogeneous material)

⁽³⁾ MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

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J (R-GDIP-T**)

14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



| DIM \ PINS ** | 14 | 16 | 18 | 20 |
|---------------|------------------------|------------------------|------------------------|------------------------|
| A | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC | 0.300 (7,62) BSC |
| B MAX | 0.785 (19,94) | .840 (21,34) | 0.960 (24,38) | 1.060 (26,92) |
| B MIN | — | — | — | — |
| C MAX | 0.300 (7,62) | 0.300 (7,62) | 0.310 (7,87) | 0.300 (7,62) |
| C MIN | 0.245 (6,22) | 0.245 (6,22) | 0.220 (5,59) | 0.245 (6,22) |

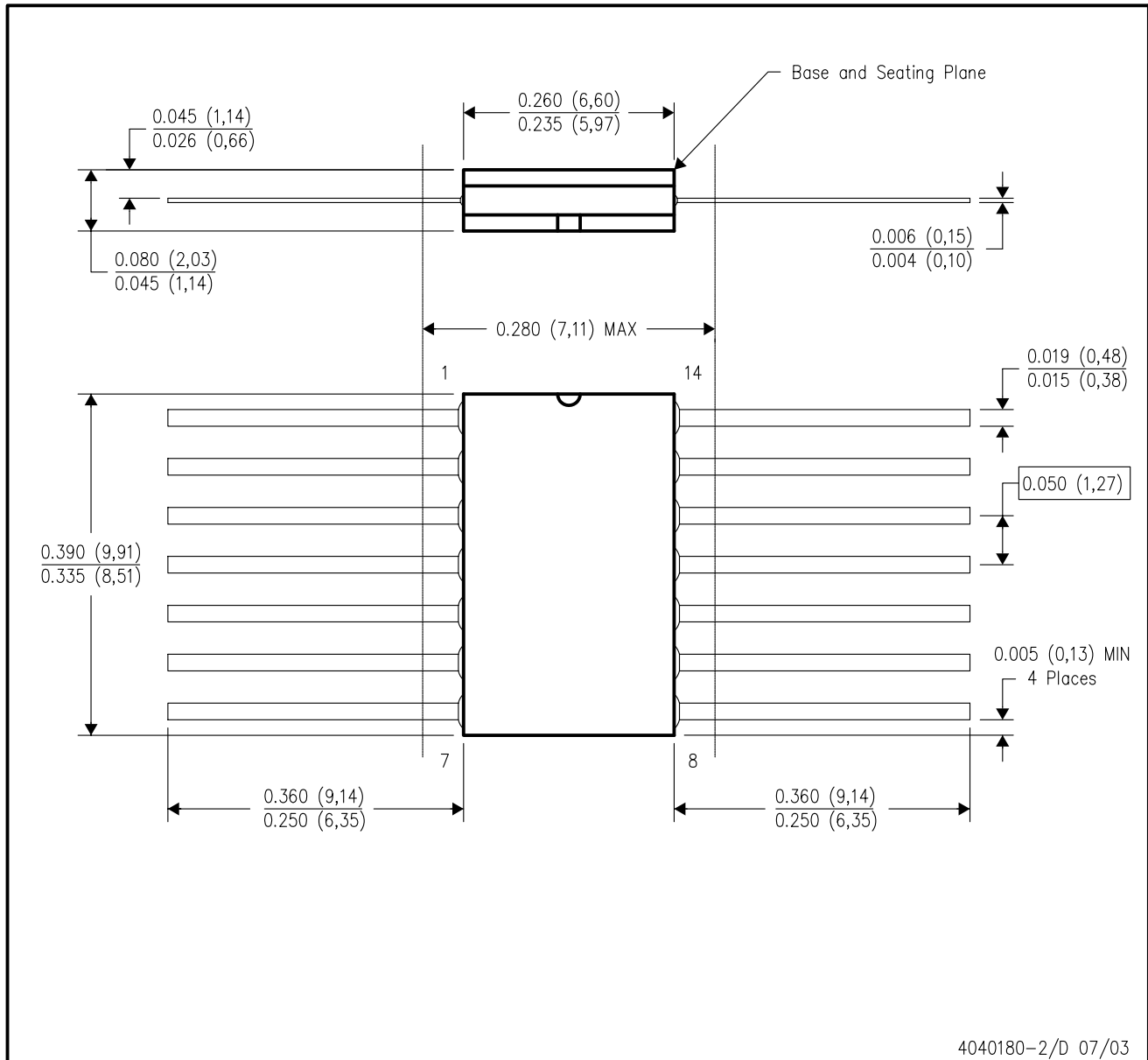


4040083/F 03/03

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

W (R-GDFP-F14)

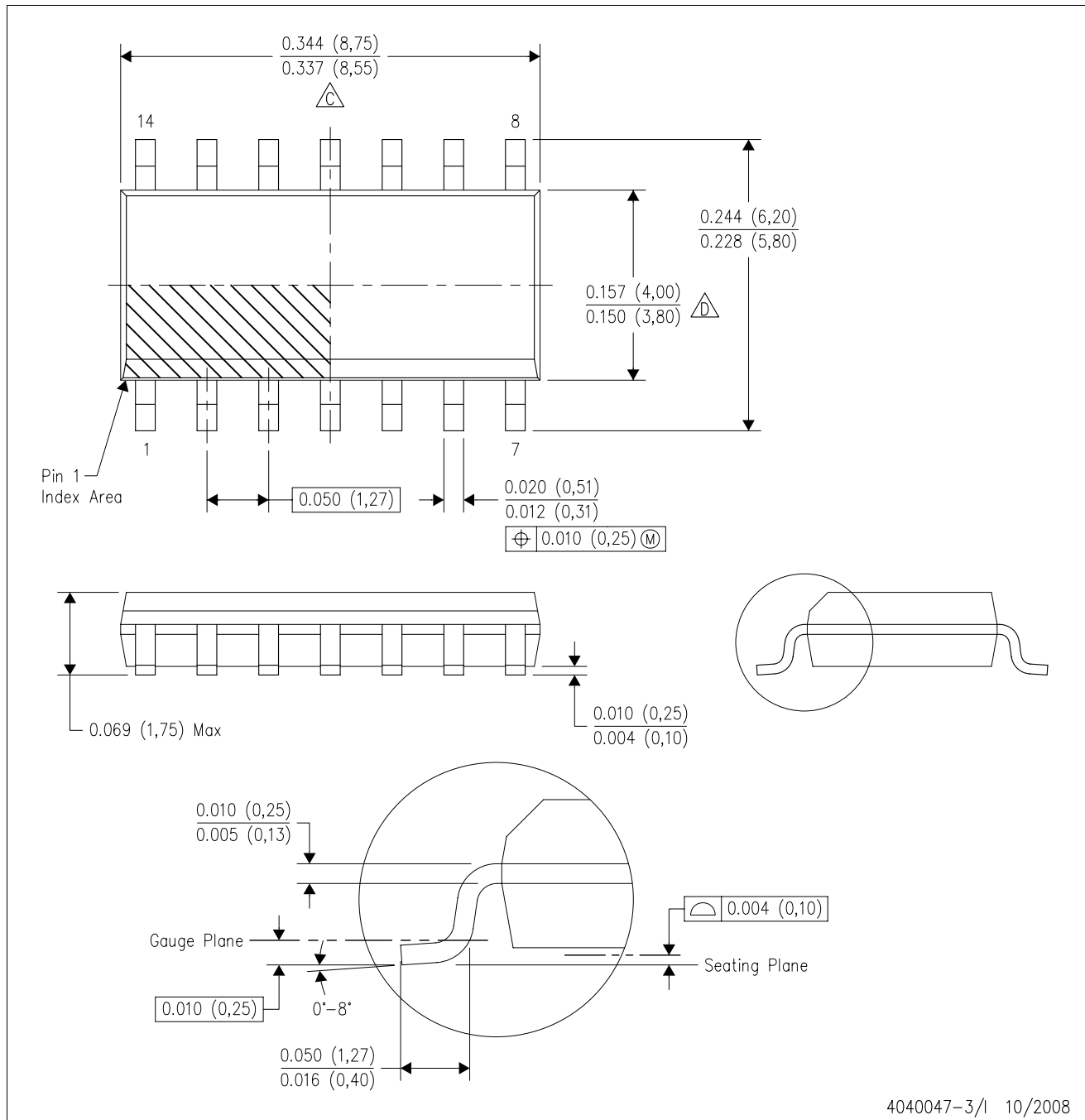
CERAMIC DUAL FLATPACK



- 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

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - C. Body length does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed .006 (0,15) per end.
 - D. Body width does not include interlead flash. Interlead flash shall not exceed .017 (0,43) per side.
 - E. Reference JEDEC MS-012 variation AB.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - $\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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