

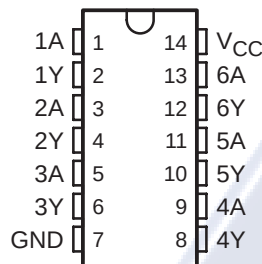
# SN54ACT14, SN74ACT14

## HEX SCHMITT-TRIGGER INVERTER

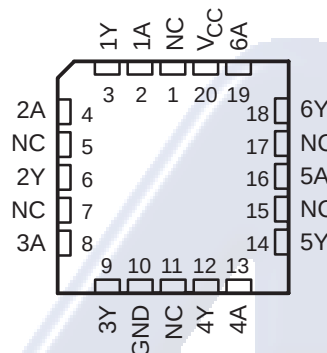
SCAS557H – DECEMBER 1995 – REVISED NOVEMBER 2004

- 4.5-V to 5.5-V  $V_{CC}$  Operation
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 11 ns at 5 V
- Inputs Are TTL-Voltage Compatible

SN54ACT14 ... J OR W PACKAGE  
SN74ACT14 ... D, DB, N, NS, OR PW PACKAGE  
(TOP VIEW)



SN54ACT14 ... FK PACKAGE  
(TOP VIEW)



NC – No internal connection

### description/ordering information

These Schmitt-trigger devices contain six independent inverters. They perform the Boolean function  $Y = \bar{A}$ . Because of the Schmitt action, they have different input threshold levels for positive-going ( $V_{T+}$ ) and for negative-going ( $V_{T-}$ ) signals.

These circuits are temperature compensated and can be triggered from the slowest of input ramps and still give clean, jitter-free output signals. They also have a greater noise margin than conventional inverters.

### ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE <sup>†</sup> |               | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|----------------|----------------------|---------------|--------------------------|---------------------|
| –40°C to 85°C  | PDIP – N             | Tube          | SN74ACT14N               | SN74ACT14N          |
|                | SOIC – D             | Tube          | SN74ACT14D               | ACT14               |
|                |                      | Tape and reel | SN74ACT14DR              |                     |
|                | SOP – NS             | Tape and reel | SN74ACT14NSR             | ACT14               |
|                | SSOP – DB            | Tape and reel | SN74ACT14DBR             | AD14                |
|                | TSSOP – PW           | Tube          | SN74ACT14PW              | AD14                |
| Tape and reel  |                      | SN74ACT14PWR  |                          |                     |
| –55°C to 125°C | CDIP – J             | Tube          | SNJ54ACT14J              | SNJ54ACT14J         |
|                | CFP – W              | Tube          | SNJ54ACT14W              | SNJ54ACT14W         |
|                | LCCC – FK            | Tube          | SNJ54ACT14FK             | SNJ54ACT14FK        |

<sup>†</sup> Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at [www.ti.com/sc/package](http://www.ti.com/sc/package).

### FUNCTION TABLE (each inverter)

| INPUT<br>A | OUTPUT<br>Y |
|------------|-------------|
| H          | L           |
| L          | H           |



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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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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

# SN54ACT14, SN74ACT14

## HEX SCHMITT-TRIGGER INVERTER

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logic diagram, each inverter (positive logic)



absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                                |                            |
|----------------------------------------------------------------|----------------------------|
| Supply voltage range, $V_{CC}$                                 | –0.5 V to 7 V              |
| Input voltage range, $V_I$ (see Note 1)                        | –0.5 V to $V_{CC} + 0.5$ V |
| Output voltage range, $V_O$ (see Note 1)                       | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ or $V_I > V_{CC}$ )  | ±20 mA                     |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ or $V_O > V_{CC}$ ) | ±20 mA                     |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ )     | ±50 mA                     |
| Continuous current through $V_{CC}$ or GND                     | ±200 mA                    |
| Package thermal impedance, $\theta_{JA}$ (see Note 2):         |                            |
| D package                                                      | 86°C/W                     |
| DB package                                                     | 96°C/W                     |
| N package                                                      | 80°C/W                     |
| NS package                                                     | 76°C/W                     |
| PW package                                                     | 113°C/W                    |
| Storage temperature range, $T_{stg}$                           | –65°C to 150°C             |

<sup>†</sup> Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTES: 1. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.  
2. The package thermal impedance is calculated in accordance with JESD 51-7.

recommended operating conditions (see Note 3)

|          |                                | SN54ACT14 |          | SN74ACT14 |          | UNIT |
|----------|--------------------------------|-----------|----------|-----------|----------|------|
|          |                                | MIN       | MAX      | MIN       | MAX      |      |
| $V_{CC}$ | Supply voltage                 | 4.5       | 5.5      | 4.5       | 5.5      | V    |
| $V_I$    | Input voltage                  | 0         | $V_{CC}$ | 0         | $V_{CC}$ | V    |
| $V_O$    | Output voltage                 | 0         | $V_{CC}$ | 0         | $V_{CC}$ | V    |
| $I_{OH}$ | High-level output current      |           | –24      |           | –24      | mA   |
| $I_{OL}$ | Low-level output current       |           | 24       |           | 24       | mA   |
| $T_A$    | Operating free-air temperature | –55       | 125      | –40       | 85       | °C   |

NOTE 3: All unused inputs of the device must be held at  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

# SN54ACT14, SN74ACT14

## HEX SCHMITT-TRIGGER INVERTER

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

| PARAMETER                                                       | TEST CONDITIONS                                               | V <sub>CC</sub> | T <sub>A</sub> = 25°C |       |      | SN54ACT14 |      | SN74ACT14 |      | UNIT    |
|-----------------------------------------------------------------|---------------------------------------------------------------|-----------------|-----------------------|-------|------|-----------|------|-----------|------|---------|
|                                                                 |                                                               |                 | MIN                   | TYP   | MAX  | MIN       | MAX  | MIN       | MAX  |         |
| V <sub>T+</sub><br>Positive-going threshold                     |                                                               | 4.5 V           | 1.2                   | 1.5   | 1.9  | 1.2       | 1.9  | 1.2       | 1.9  | V       |
|                                                                 |                                                               | 5.5 V           | 1.4                   | 1.7   | 2.1  | 1.4       | 2.1  | 1.4       | 2.1  |         |
| V <sub>T-</sub><br>Negative-going threshold                     |                                                               | 4.5 V           | 0.5                   | 0.9   | 1.2  | 0.5       | 1.2  | 0.5       | 1.2  | V       |
|                                                                 |                                                               | 5.5 V           | 0.6                   | 1     | 1.4  | 0.6       | 1.4  | 0.6       | 1.4  |         |
| $\Delta V_T$<br>Hysteresis (V <sub>T+</sub> – V <sub>T-</sub> ) |                                                               | 4.5 V           | 0.4                   | 0.6   | 1.4  | 0.4       | 1.4  | 0.4       | 1.4  | V       |
|                                                                 |                                                               | 5.5 V           | 0.4                   | 0.6   | 1.5  | 0.4       | 1.5  | 0.4       | 1.5  |         |
| V <sub>OH</sub>                                                 | I <sub>OH</sub> = –50 $\mu$ A                                 | 4.5 V           | 4.4                   | 4.49  |      | 4.4       |      | 4.4       |      | V       |
|                                                                 |                                                               | 5.5 V           | 5.4                   | 5.49  |      | 5.4       |      | 5.4       |      |         |
|                                                                 | I <sub>OH</sub> = –24 mA                                      | 4.5 V           | 3.86                  |       |      | 3.7       |      | 3.76      |      |         |
|                                                                 |                                                               | 5.5 V           | 4.86                  |       |      | 4.7       |      | 4.76      |      |         |
|                                                                 | I <sub>OH</sub> = –50 mA <sup>†</sup>                         | 5.5 V           |                       |       |      | 3.85      |      |           |      |         |
|                                                                 | I <sub>OH</sub> = –75 mA <sup>†</sup>                         | 5.5 V           |                       |       |      |           |      | 3.85      |      |         |
| V <sub>OL</sub>                                                 | I <sub>OL</sub> = 50 $\mu$ A                                  | 4.5 V           |                       | 0.001 | 0.1  |           | 0.1  |           | 0.1  | V       |
|                                                                 |                                                               | 5.5 V           |                       | 0.001 | 0.1  |           | 0.1  |           | 0.1  |         |
|                                                                 | I <sub>OL</sub> = 24 mA                                       | 4.5 V           |                       |       | 0.36 |           | 0.5  |           | 0.44 |         |
|                                                                 |                                                               | 5.5 V           |                       |       | 0.36 |           | 0.5  |           | 0.44 |         |
|                                                                 | I <sub>OL</sub> = 50 mA <sup>†</sup>                          | 5.5 V           |                       |       |      |           | 1.65 |           |      |         |
|                                                                 | I <sub>OL</sub> = 75 mA <sup>†</sup>                          | 5.5 V           |                       |       |      |           |      |           | 1.65 |         |
| I <sub>I</sub>                                                  | V <sub>I</sub> = V <sub>CC</sub> or GND                       | 5.5 V           |                       |       | ±0.1 |           | ±1   |           | ±1   | $\mu$ A |
| I <sub>CC</sub>                                                 | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0   | 5.5 V           |                       |       | 2    |           | 40   |           | 20   | $\mu$ A |
| $\Delta I_{CC}^{\ddagger}$                                      | One input at 3.4 V,<br>Other inputs at GND or V <sub>CC</sub> | 5.5 V           |                       | 0.6   |      |           | 1.6  |           | 1.5  | mA      |
| C <sub>i</sub>                                                  | V <sub>I</sub> = V <sub>CC</sub> or GND                       | 5 V             |                       | 4.5   |      |           |      |           |      | pF      |

<sup>†</sup> Not more than one output should be tested at a time, and the duration of the test should not exceed 2 ms.

<sup>‡</sup> This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or V<sub>CC</sub>.

switching characteristics over recommended operating free-air temperature range,  
V<sub>CC</sub> = 5 V  $\pm$  0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER        | FROM<br>(INPUT) | TO<br>(OUTPUT) | T <sub>A</sub> = 25°C |      | SN54ACT14 |     | SN74ACT14 |      | UNIT |
|------------------|-----------------|----------------|-----------------------|------|-----------|-----|-----------|------|------|
|                  |                 |                | MIN                   | MAX  | MIN       | MAX | MIN       | MAX  |      |
| t <sub>PLH</sub> | A               | Y              | 1.5                   | 11.5 | 1         | 14  | 1         | 12.5 | ns   |
| t <sub>PHL</sub> |                 |                | 1.5                   | 10   | 1         | 13  | 1         | 11   |      |

operating characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C

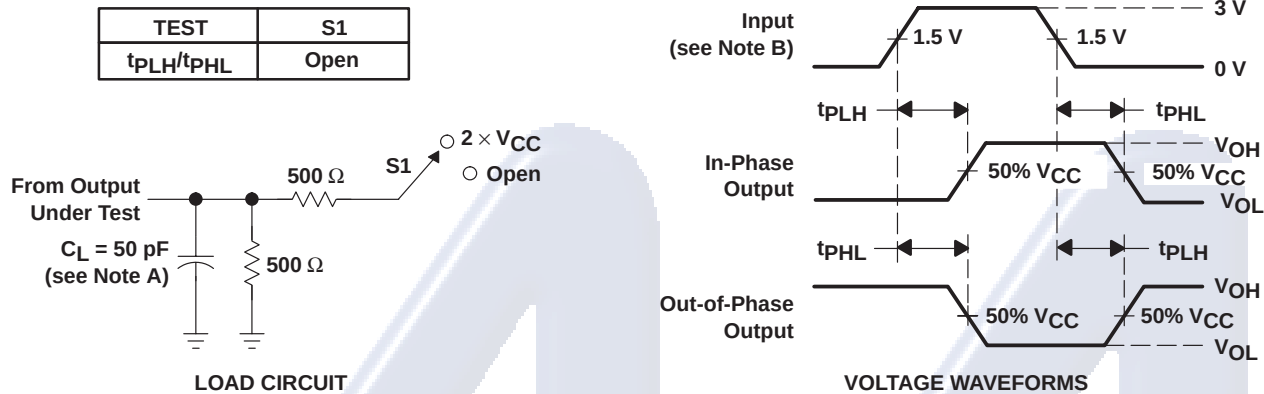
| PARAMETER       |                               | TEST CONDITIONS                   |  | TYP | UNIT |
|-----------------|-------------------------------|-----------------------------------|--|-----|------|
| C <sub>pd</sub> | Power dissipation capacitance | C <sub>L</sub> = 50 pF, f = 1 MHz |  | 20  | pF   |



SN54ACT14, SN74ACT14  
HEX SCHMITT-TRIGGER INVERTER

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PARAMETER MEASUREMENT INFORMATION



- NOTES: A. C<sub>L</sub> includes probe and jig capacitance.  
B. All input pulses are supplied by generators having the following characteristics: PRR ≤ 1 MHz, Z<sub>O</sub> = 50 Ω, t<sub>r</sub> ≤ 2.5 ns, t<sub>f</sub> ≤ 2.5 ns.  
C. The outputs are measured one at a time, with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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**PACKAGING INFORMATION**

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 5962-9218301M2A  | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| 5962-9218301MCA  | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| 5962-9218301MDA  | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SN74ACT14D       | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14DBLE    | OBSOLETE              | SSOP         | DB              | 14   |             | TBD                     | Call TI          | Call TI                      |
| SN74ACT14DBR     | ACTIVE                | SSOP         | DB              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14DBRE4   | ACTIVE                | SSOP         | DB              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14DE4     | ACTIVE                | SOIC         | D               | 14   | 50          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14DR      | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14DRE4    | ACTIVE                | SOIC         | D               | 14   | 2500        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14N       | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74ACT14NE4     | ACTIVE                | PDIP         | N               | 14   | 25          | Pb-Free (RoHS)          | CU NIPDAU        | N / A for Pkg Type           |
| SN74ACT14NSR     | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14NSRE4   | ACTIVE                | SO           | NS              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PW      | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PWE4    | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PWG4    | ACTIVE                | TSSOP        | PW              | 14   | 90          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PWLE    | OBSOLETE              | TSSOP        | PW              | 14   |             | TBD                     | Call TI          | Call TI                      |
| SN74ACT14PWR     | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PWRE4   | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74ACT14PWRG4   | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SNJ54ACT14FK     | ACTIVE                | LCCC         | FK              | 20   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SNJ54ACT14J      | ACTIVE                | CDIP         | J               | 14   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |
| SNJ54ACT14W      | ACTIVE                | CFP          | W               | 14   | 1           | TBD                     | Call TI          | N / A for Pkg Type           |

<sup>(1)</sup> 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.

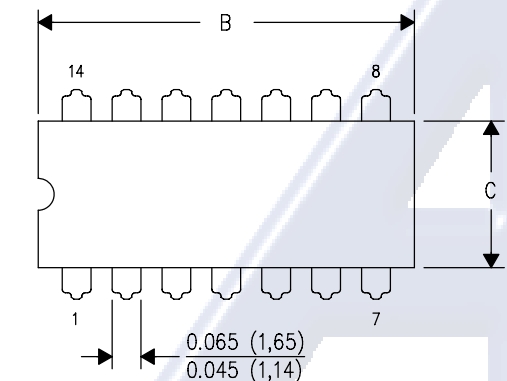
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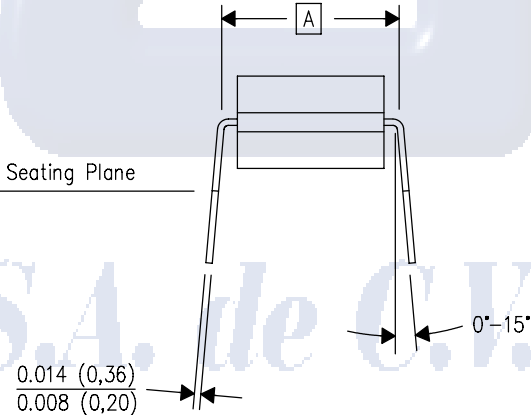
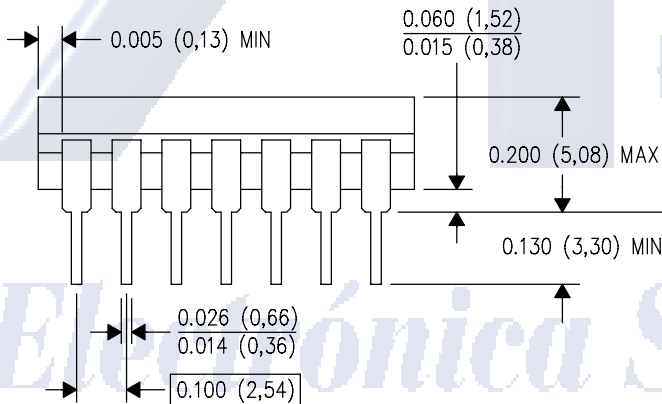
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J (R-GDIP-T\*\*) 14 LEADS SHOWN

CERAMIC DUAL IN-LINE PACKAGE



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



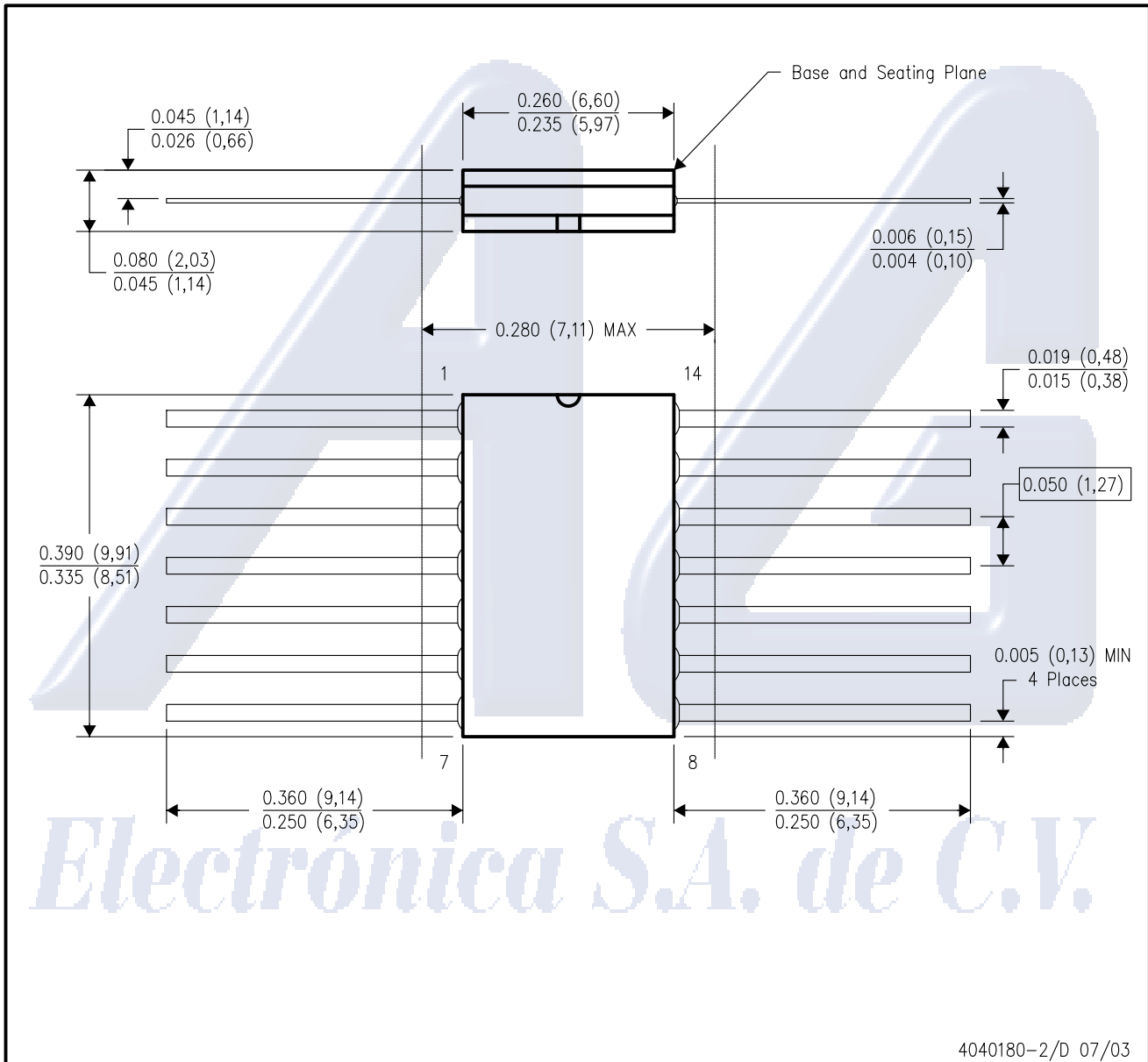
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- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal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

## MECHANICAL DATA

W (R-GDFP-F14)

CERAMIC DUAL FLATPACK



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



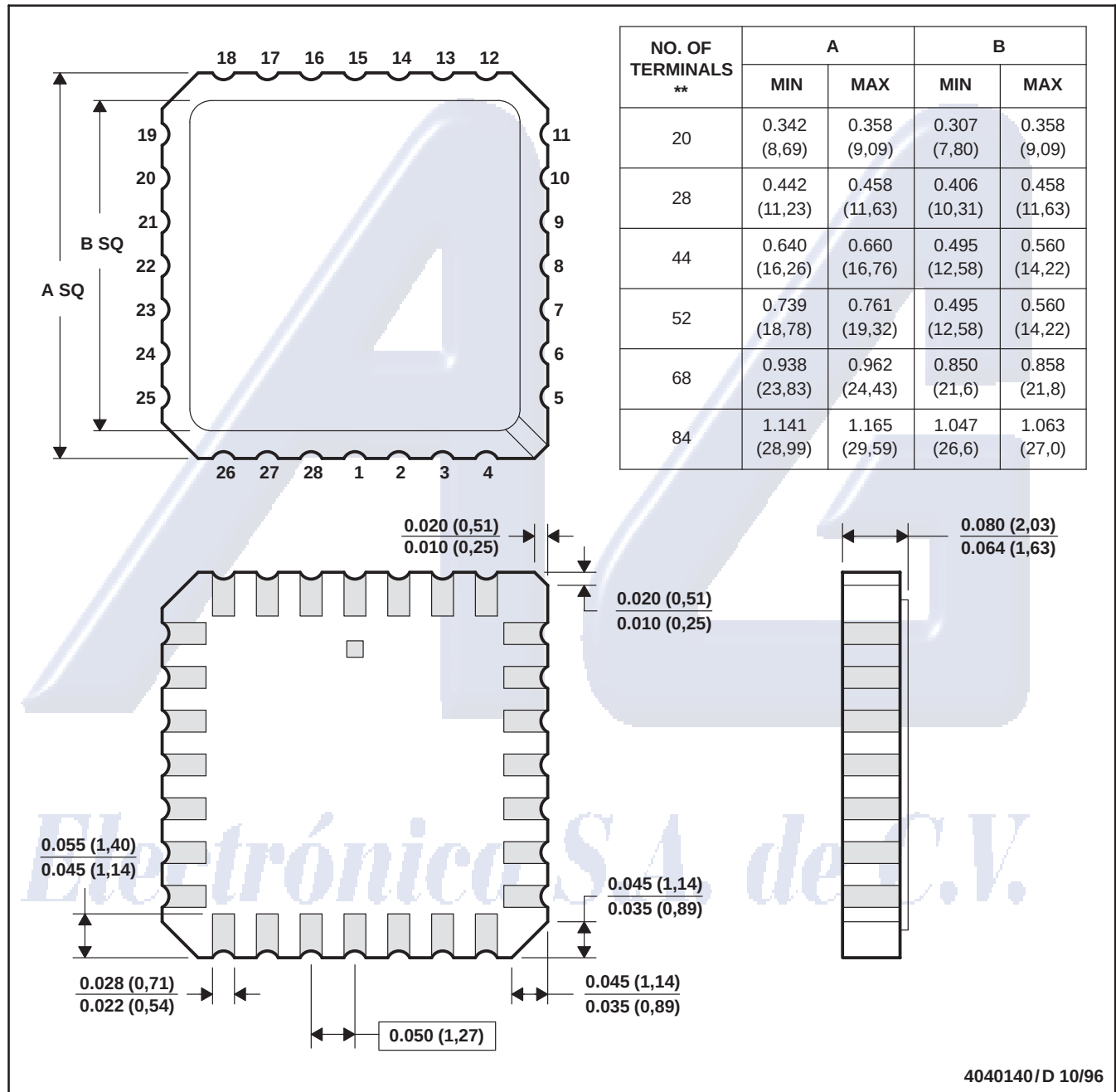
## MECHANICAL DATA

MLCC006B – OCTOBER 1996

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



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



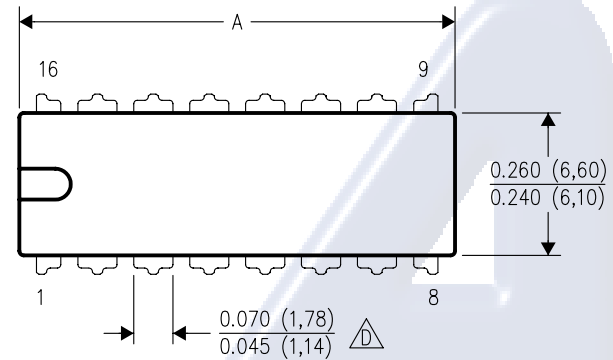
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## MECHANICAL DATA

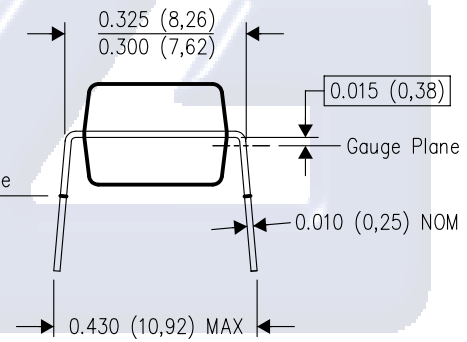
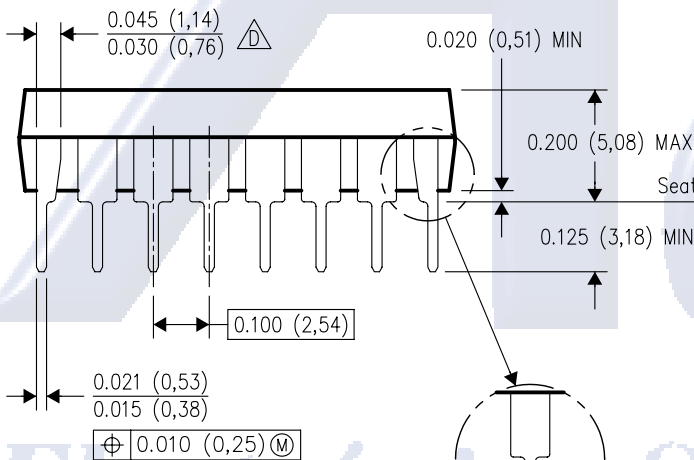
## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



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14/18 Pin Only  
20 Pin vendor option

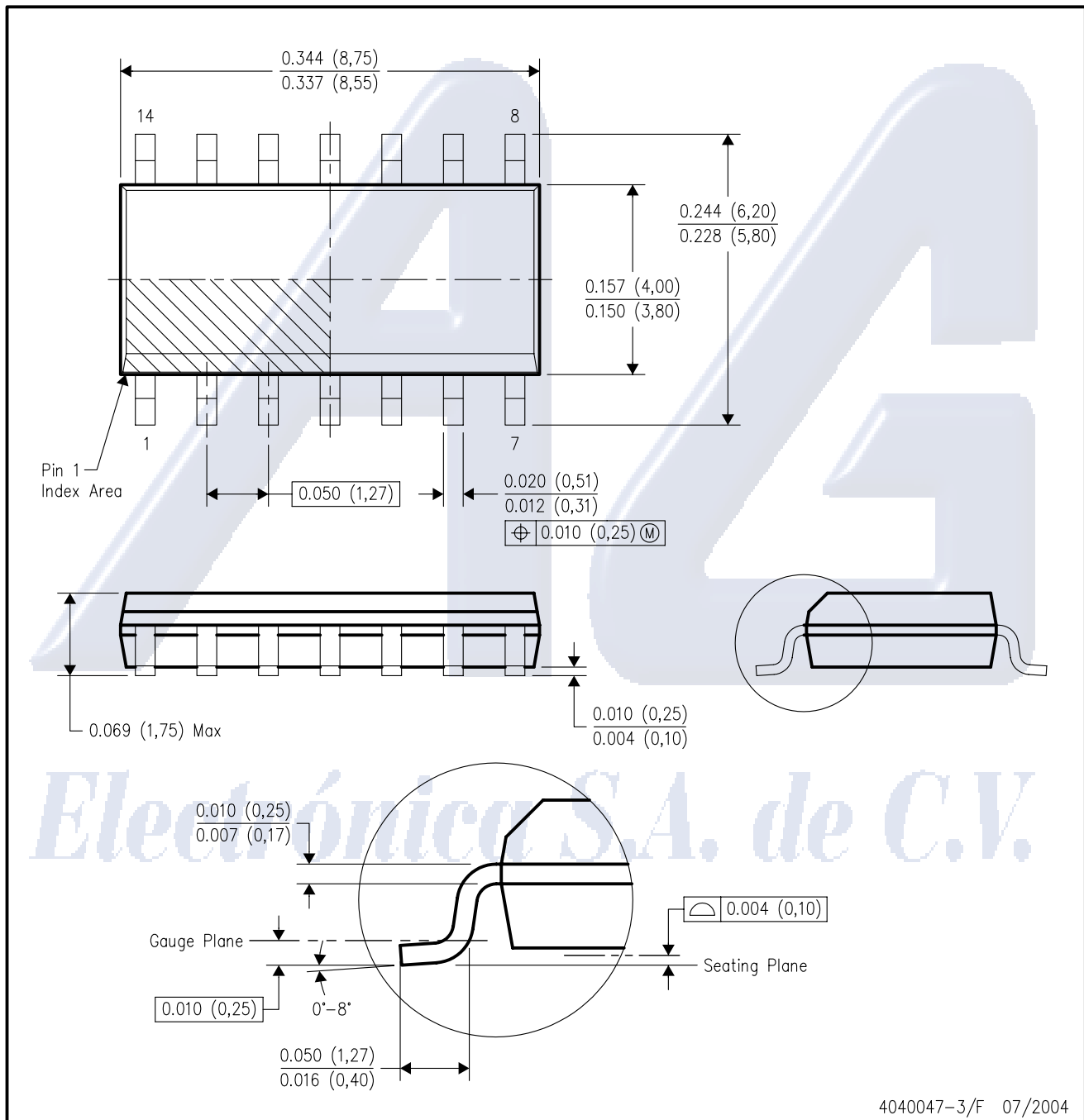
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- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
  - D. The 20 pin end lead shoulder width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

## MECHANICAL DATA

## D (R-PDSO-G14)

## PLASTIC SMALL-OUTLINE PACKAGE



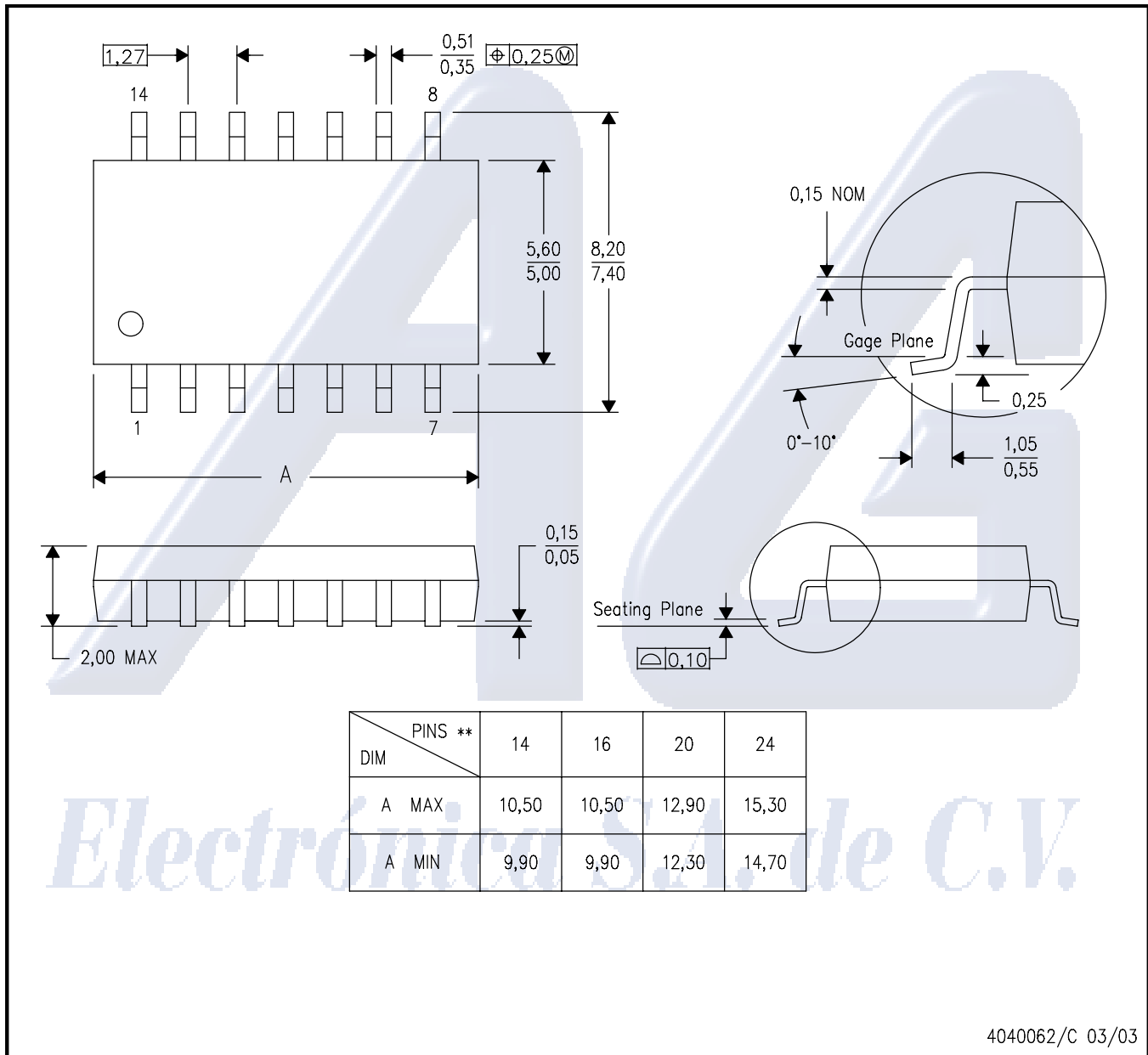
- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - Falls within JEDEC MS-012 variation AB.

## MECHANICAL DATA

NS (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



- 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.

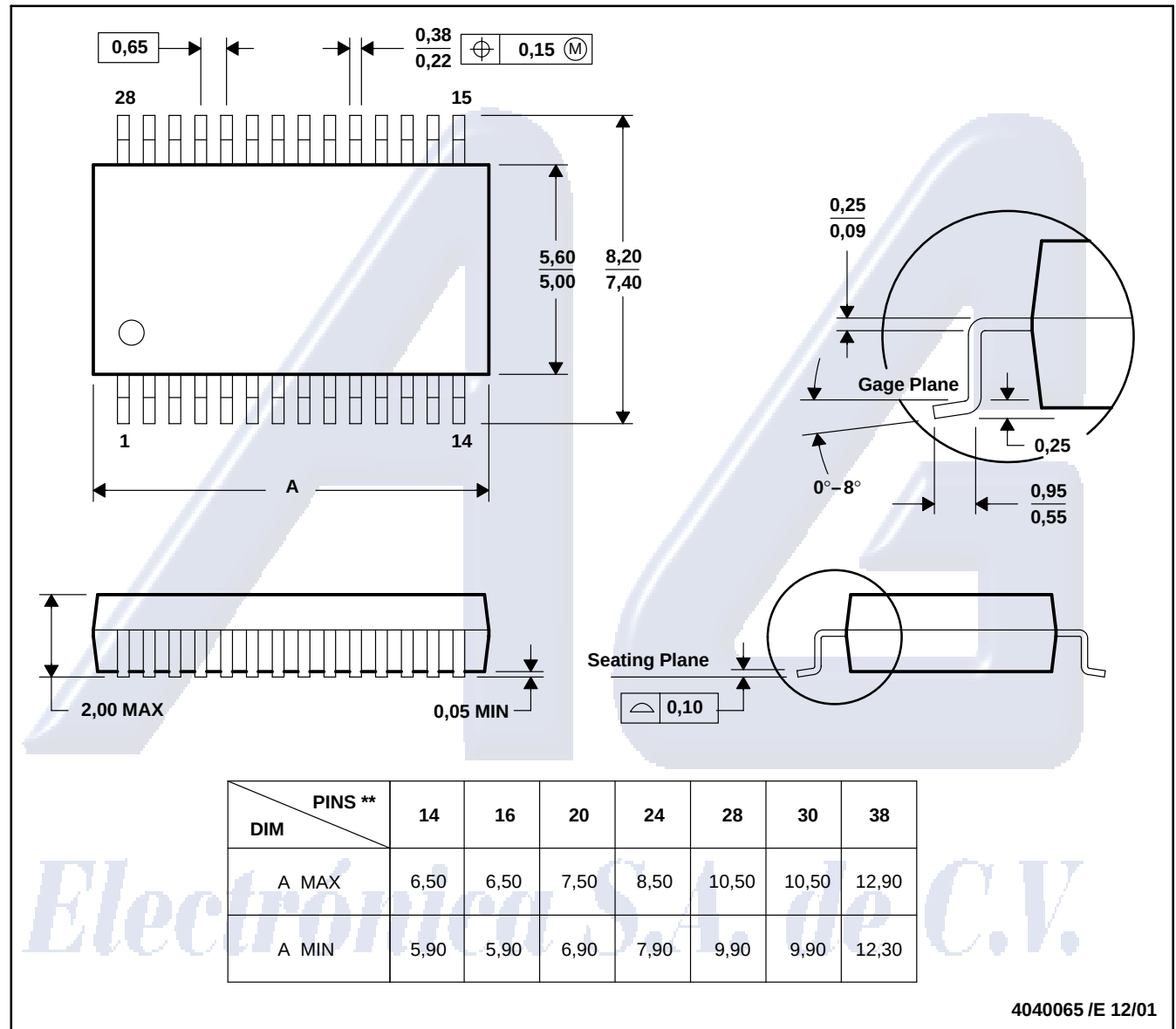
## MECHANICAL DATA

MSS0002E – JANUARY 1995 – REVISED DECEMBER 2001

## DB (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

28 PINS SHOWN



- 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



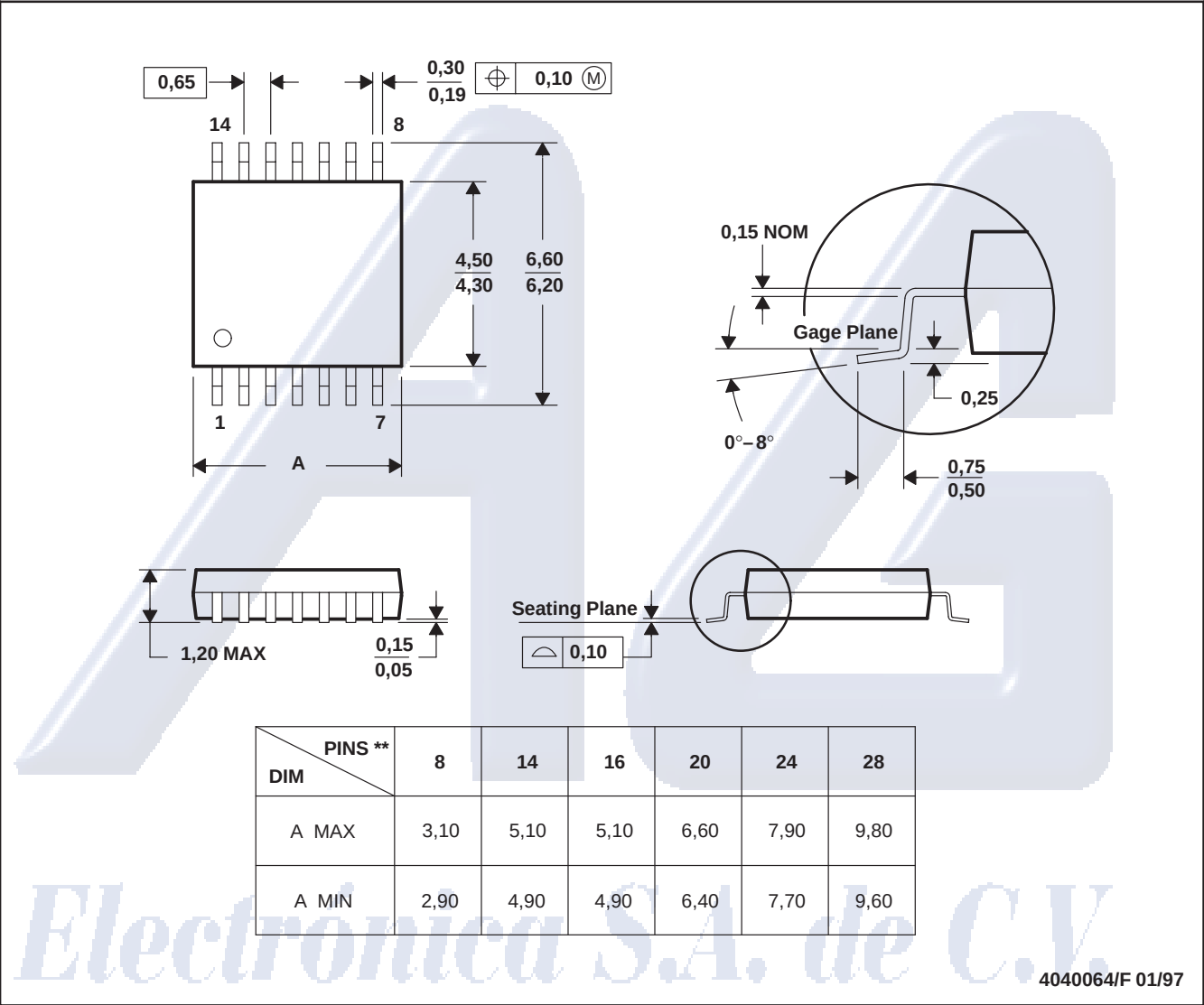
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MECHANICAL DATA

MTSS001C – JANUARY 1995 – REVISED FEBRUARY 1999

PW (R-PDSO-G\*\*)  
14 PINS SHOWN

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.  
D. Falls within JEDEC MO-153



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