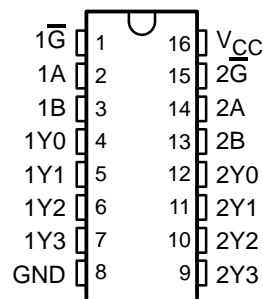


SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS267M – DECEMBER 1995 – REVISED MARCH 2003

- **Inputs Are TTL-Voltage Compatible**
- **Designed Specifically for High-Speed Memory Decoders and Data-Transmission Systems**
- **Incorporate Two Enable Inputs to Simplify Cascading and/or Data Reception**
- **Latch-Up Performance Exceeds 250 mA Per JESD 17**
- **ESD Protection Exceeds JESD 22**
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)
 - 1000-V Charged-Device Model (C101)

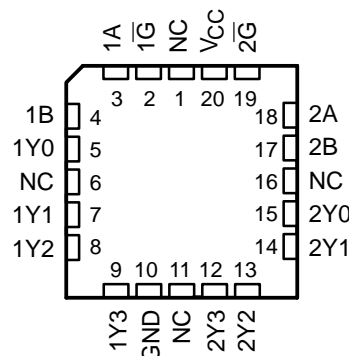
**SN54AHCT139 . . . J OR W PACKAGE
SN74AHCT139 . . . D, DB, DGV, N, NS, OR PW PACKAGE
(TOP VIEW)**



description/ordering information

The 'AHCT139 devices are dual 2-line to 4-line decoders/demultiplexers designed for 4.5-V to 5.5-V V_{CC} operation. These devices are designed to be used in high-performance memory-decoding or data-routing applications requiring very short propagation delay times. In high-performance memory systems, these decoders can be used to minimize the effects of system decoding. When used with high-speed memories utilizing a fast enable circuit, the delay times of these decoders and the enable time of the memory usually are less than the typical access time of the memory. This means that the effective system delay introduced by the decoders is negligible.

**SN54AHCT139 . . . FK PACKAGE
(TOP VIEW)**



NC – No internal connection

ORDERING INFORMATION

| T_A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|---------------|-----------------|-----------------------|------------------|
| –40°C to 85°C | PDIP – N | Tube | SN74AHCT139N | SN74AHCT139N |
| | SOIC – D | Tube | SN74AHCT139D | AHCT139 |
| | | Tape and reel | SN74AHCT139DR | |
| | SOP – NS | Tape and reel | SN74AHCT139NSR | AHCT139 |
| | SSOP – DB | Tape and reel | SN74AHCT139DBR | HB139 |
| | TSSOP – PW | Tube | SN74AHCT139PW | HB139 |
| Tape and reel | | SN74AHCT139PWR | | |
| TVSOP – DGV | Tape and reel | SN74AHCT139DGVR | HB139 | |
| –55°C to 125°C | CDIP – J | Tube | SNJ54AHCT139J | SNJ54AHCT139J |
| | CFP – W | Tube | SNJ54AHCT139W | SNJ54AHCT139W |
| | LCCC – FK | Tube | SNJ54AHCT139FK | SNJ54AHCT139FK |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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UNLESS OTHERWISE NOTED this document contains PRODUCTION DATA information 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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SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULPLEXERS

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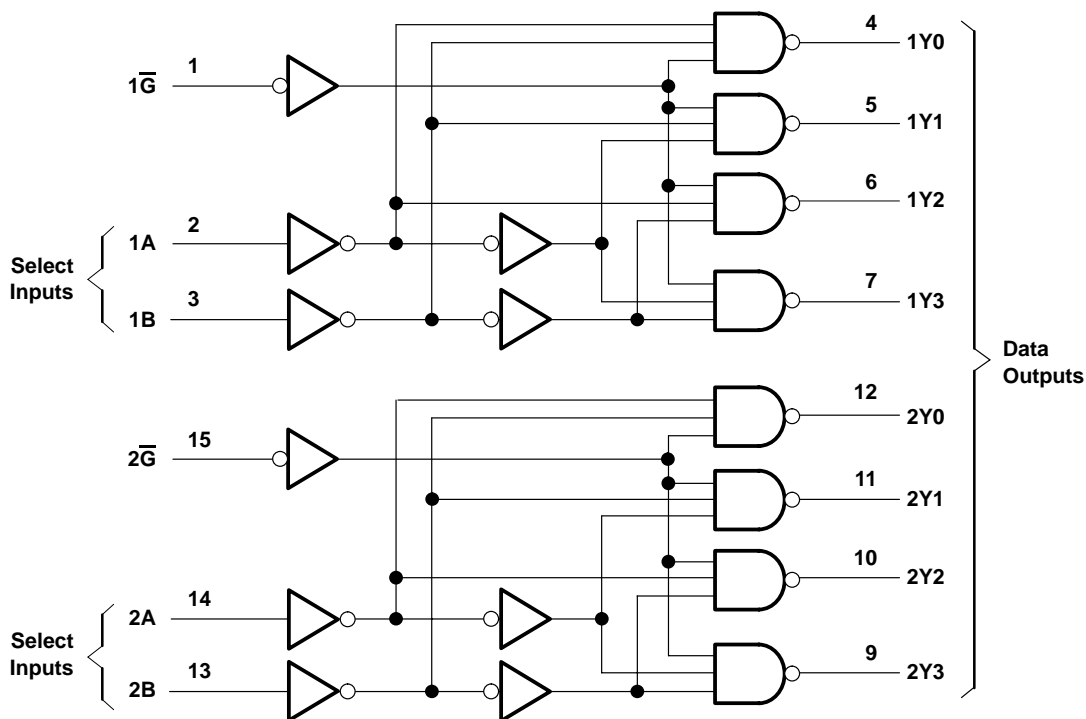
description/ordering information (continued)

The active-low enable (\overline{G}) input can be used as a data line in demultiplexing applications. These decoders/demultiplexers feature fully buffered inputs, each of which represents only one normalized load to its driving circuit.

FUNCTION TABLE
(each decoder/demultiplexer)

| \overline{G} | INPUTS | | OUTPUTS | | | |
|----------------|--------|---|---------|----|----|----|
| | SELECT | | Y0 | Y1 | Y2 | Y3 |
| | B | A | | | | |
| H | X | X | H | H | H | H |
| L | L | L | L | H | H | H |
| L | L | H | H | L | H | H |
| L | H | L | H | H | L | H |
| L | H | H | H | H | H | L |

logic diagram (positive logic)



Pin numbers shown are for the D, DB, DGV, J, N, NS, PW, and W packages.

SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS267M – DECEMBER 1995 – REVISED MARCH 2003

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

| | |
|--|----------------------------|
| Supply voltage range, V_{CC} | –0.5 V to 7 V |
| Input voltage range, V_I (see Note 1) | –0.5 V to 7 V |
| Output voltage range, V_O (see Note 1) | –0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$) | –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}) | ±25 mA |
| Continuous current through V_{CC} or GND | ±75 mA |
| Package thermal impedance, θ_{JA} (see Note 2): | |
| D package | 73°C/W |
| DB package | 82°C/W |
| DGV package | 120°C/W |
| N package | 67°C/W |
| NS package | 64°C/W |
| PW package | 108°C/W |
| Storage temperature range, T_{stg} | –65°C to 150°C |

† 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)

| | SN54AHCT139 | | SN74AHCT139 | | UNIT |
|--|-------------|----------|-------------|----------|------|
| | MIN | MAX | MIN | MAX | |
| V_{CC} Supply voltage | 4.5 | 5.5 | 4.5 | 5.5 | V |
| V_{IH} High-level input voltage | 2 | | 2 | | V |
| V_{IL} Low-level input voltage | | 0.8 | | 0.8 | V |
| V_I Input voltage | 0 | 5.5 | 0 | 5.5 | V |
| V_O Output voltage | 0 | V_{CC} | 0 | V_{CC} | V |
| I_{OH} High-level output current | | –8 | | –8 | mA |
| I_{OL} Low-level output current | | 8 | | 8 | mA |
| $\Delta t/\Delta v$ Input transition rise or fall rate | | 20 | | 20 | ns/V |
| 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.

SN54AHCT139, SN74AHCT139 DUAL 2-LINE TO 4-LINE DECODERS/DEMULTIPLEXERS

SCLS267M – DECEMBER 1995 – REVISED MARCH 2003

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

| PARAMETER | TEST CONDITIONS | V _{CC} | T _A = 25°C | | | SN54AHCT139 | | SN74AHCT139 | | UNIT |
|--------------------|---|-----------------|-----------------------|-----|------|-------------|------|-------------|-----|------|
| | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| V _{OH} | I _{OH} = -50 μA | 4.5 V | 4.4 | 4.5 | | 4.4 | | 4.4 | V | |
| | I _{OH} = -8 mA | | 3.94 | | | 3.8 | | 3.8 | | |
| V _{OL} | I _{OL} = 50 μA | 4.5 V | | | 0.1 | | | 0.1 | V | |
| | I _{OL} = 8 mA | | | | 0.36 | | 0.44 | 0.44 | | |
| I _I | V _I = 5.5 V or GND | 0 V to 5.5 V | | | ±0.1 | | | ±1 | μA | |
| I _{CC} | V _I = V _{CC} or GND, I _O = 0 | 5.5 V | | | 2 | | 20 | 20 | μA | |
| ΔI _{CC} † | One input at 3.4 V, Other inputs at V _{CC} or GND | 5.5 V | | | 1.35 | | 1.5 | 1.5 | mA | |
| C _i | V _I = V _{CC} or GND | 5 V | | 2 | 10 | | | 10 | pF | |

* On products compliant to MIL-PRF-38535, this parameter is not production tested at V_{CC} = 0 V.

† This is the increase in supply current for each input at one of the specified TTL voltage levels rather than 0 V or V_{CC}.

switching characteristics over recommended operating free-air temperature range, V_{CC} = 5 V ± 0.5 V (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | LOAD CAPACITANCE | T _A = 25°C | | | SN54AHCT139 | | SN74AHCT139 | | UNIT |
|------------------|--------------|-------------|------------------------|-----------------------|-------|-----|-------------|-------|-------------|------|------|
| | | | | MIN | TYP | MAX | MIN | MAX | MIN | MAX | |
| t _{PLH} | A or B | Y | C _L = 15 pF | 5** | 7.2** | | 1** | 8.5** | 1 | 8.5 | ns |
| t _{PHL} | | | | 5** | 7.2** | | 1** | 8.5** | 1 | 8.5 | |
| t _{PLH} | \bar{G} | Y | C _L = 15 pF | 4.4** | 6.3** | | 1** | 7.5** | 1 | 7.5 | ns |
| t _{PHL} | | | | 4.4** | 6.3** | | 1** | 7.5** | 1 | 7.5 | |
| t _{PLH} | A or B | Y | C _L = 50 pF | 6.5 | 9.2 | | 1 | 10.5 | 1 | 10.5 | ns |
| t _{PHL} | | | | 6.5 | 9.2 | | 1 | 10.5 | 1 | 10.5 | |
| t _{PLH} | \bar{G} | Y | C _L = 50 pF | 5.9 | 8.3 | | 1 | 9.5 | 1 | 9.5 | ns |
| t _{PHL} | | | | 5.9 | 8.3 | | 1 | 9.5 | 1 | 9.5 | |

** On products compliant to MIL-PRF-38535, this parameter is not production tested.

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

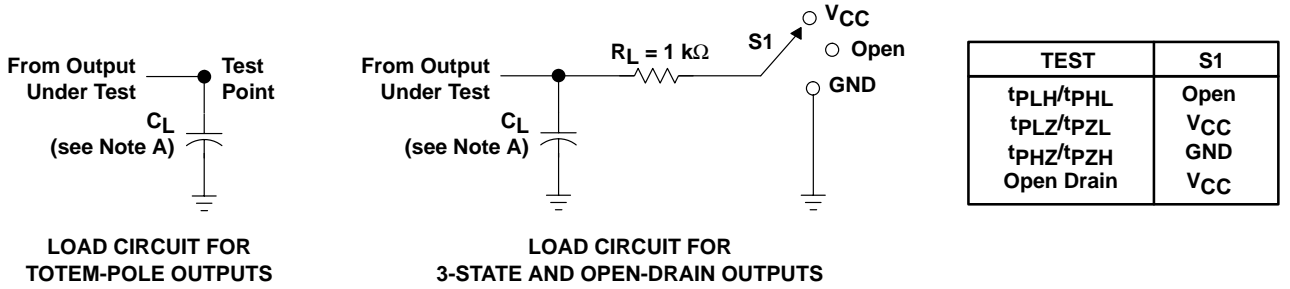
| PARAMETER | TEST CONDITIONS | TYP | UNIT |
|---|--------------------|-----|------|
| C _{pd} Power dissipation capacitance | No load, f = 1 MHz | 13 | pF |

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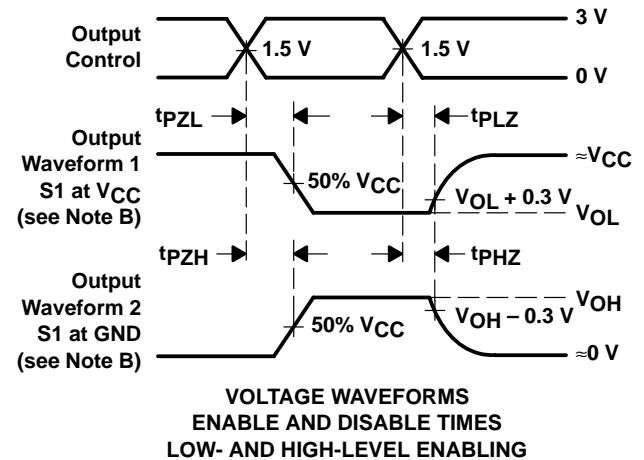
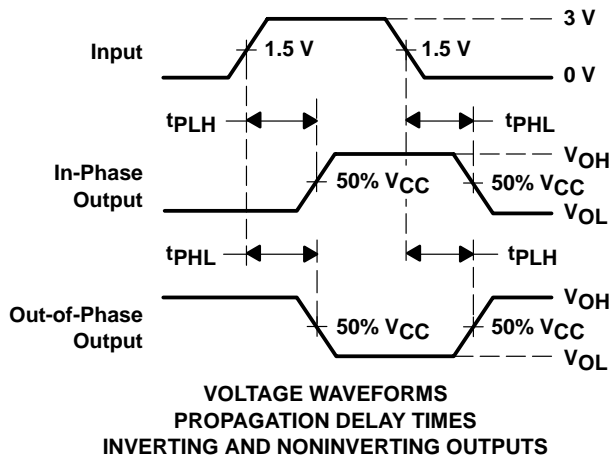
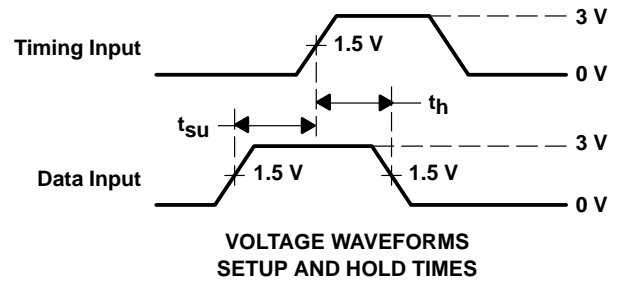
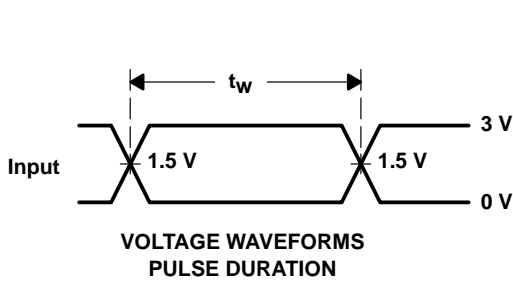
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PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT FOR TOTEM-POLE OUTPUTS

LOAD CIRCUIT FOR 3-STATE AND OPEN-DRAIN OUTPUTS



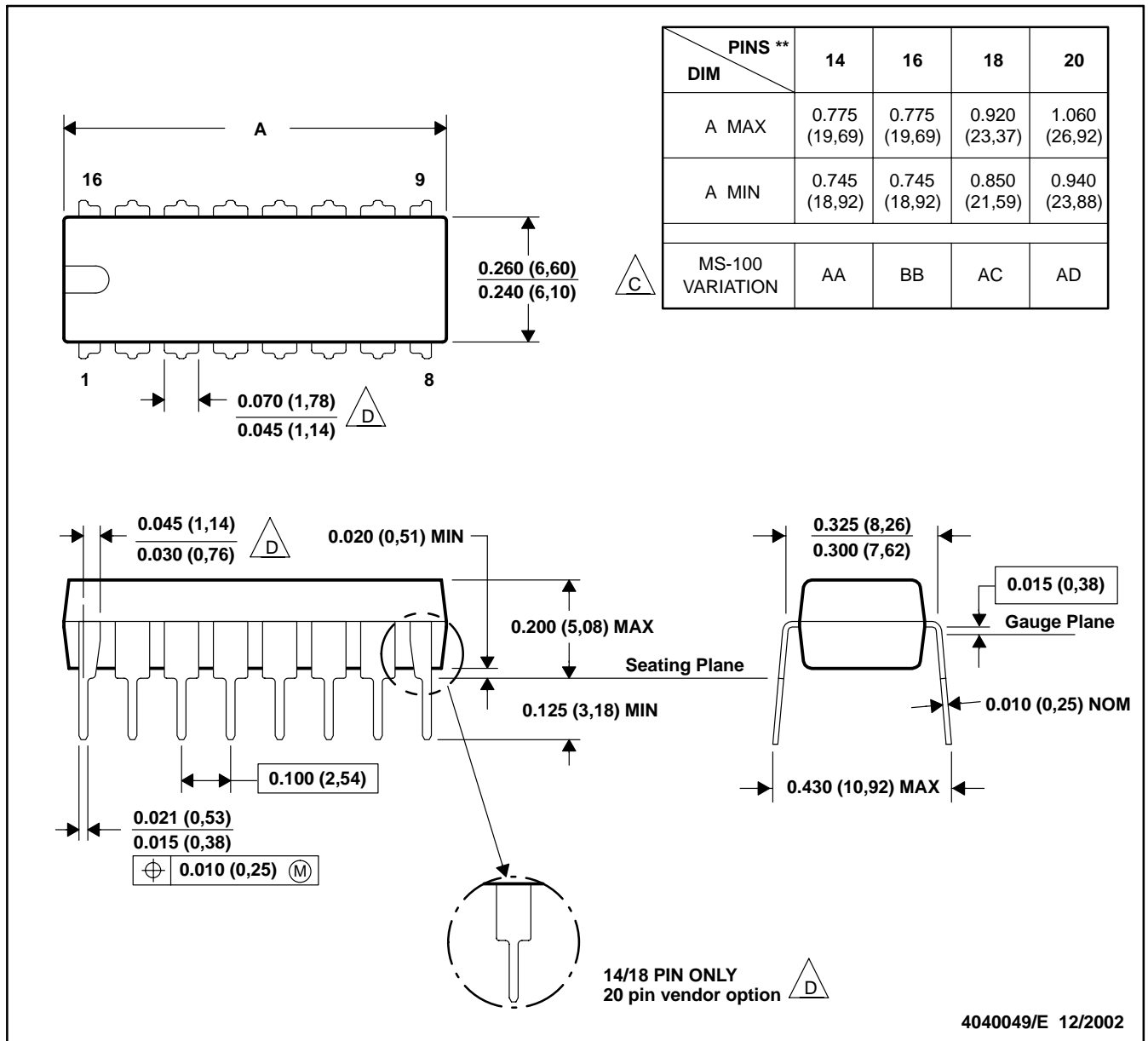
- NOTES: A. C_L includes probe and jig capacitance.
 B. Waveform 1 is for an output with internal conditions such that the output is low except when disabled by the output control. Waveform 2 is for an output with internal conditions such that the output is high except when disabled by the output control.
 C. All input pulses are supplied by generators having the following characteristics: $PRR \leq 1 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 3 \text{ ns}$, $t_f \leq 3 \text{ ns}$.
 D. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuit and Voltage Waveforms

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.
 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.

4040049/E 12/2002

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

24 PINS SHOWN

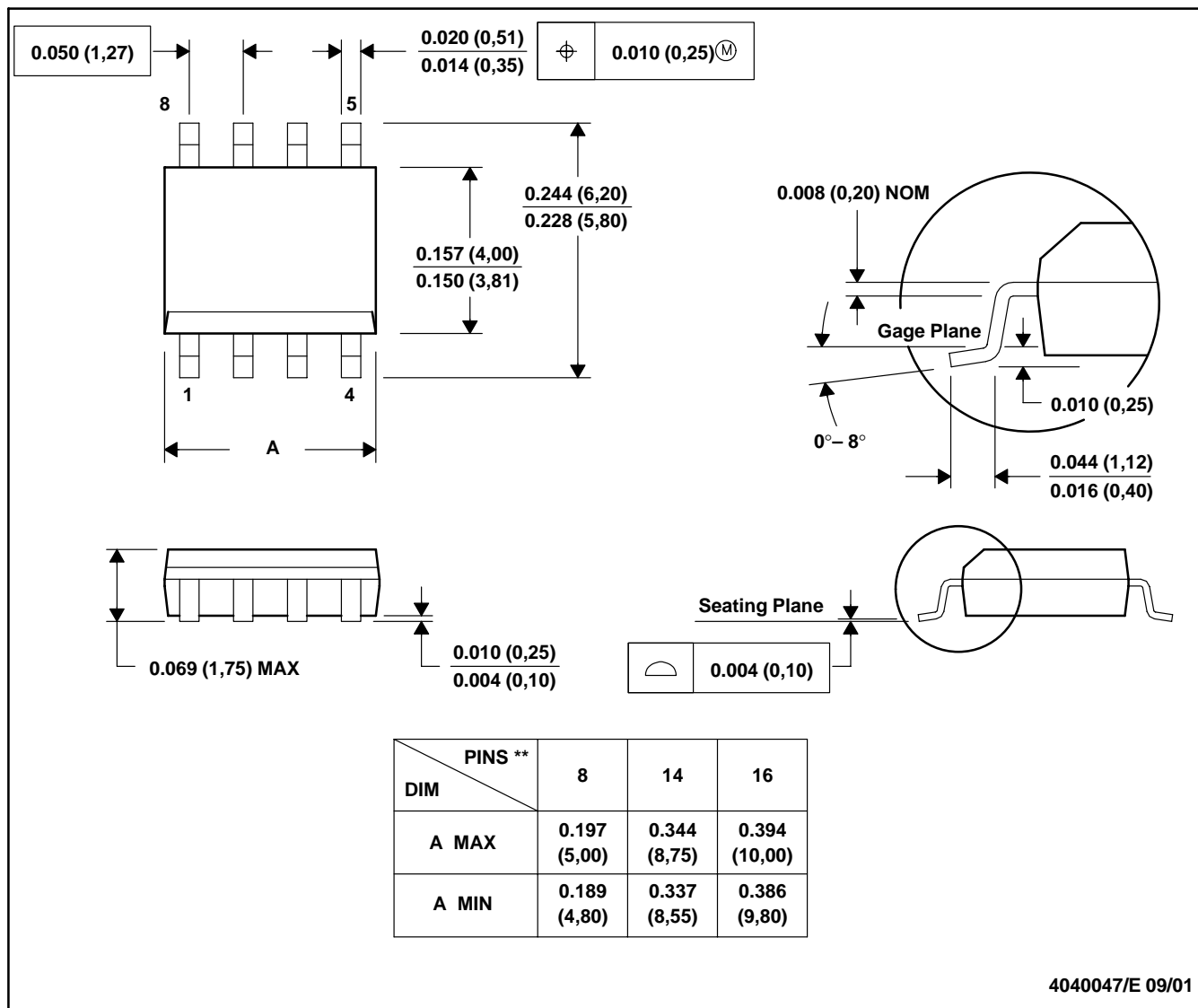


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.
 D. Falls within JEDEC: 24/48 Pins – MO-153
 14/16/20/56 Pins – MO-194

D (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

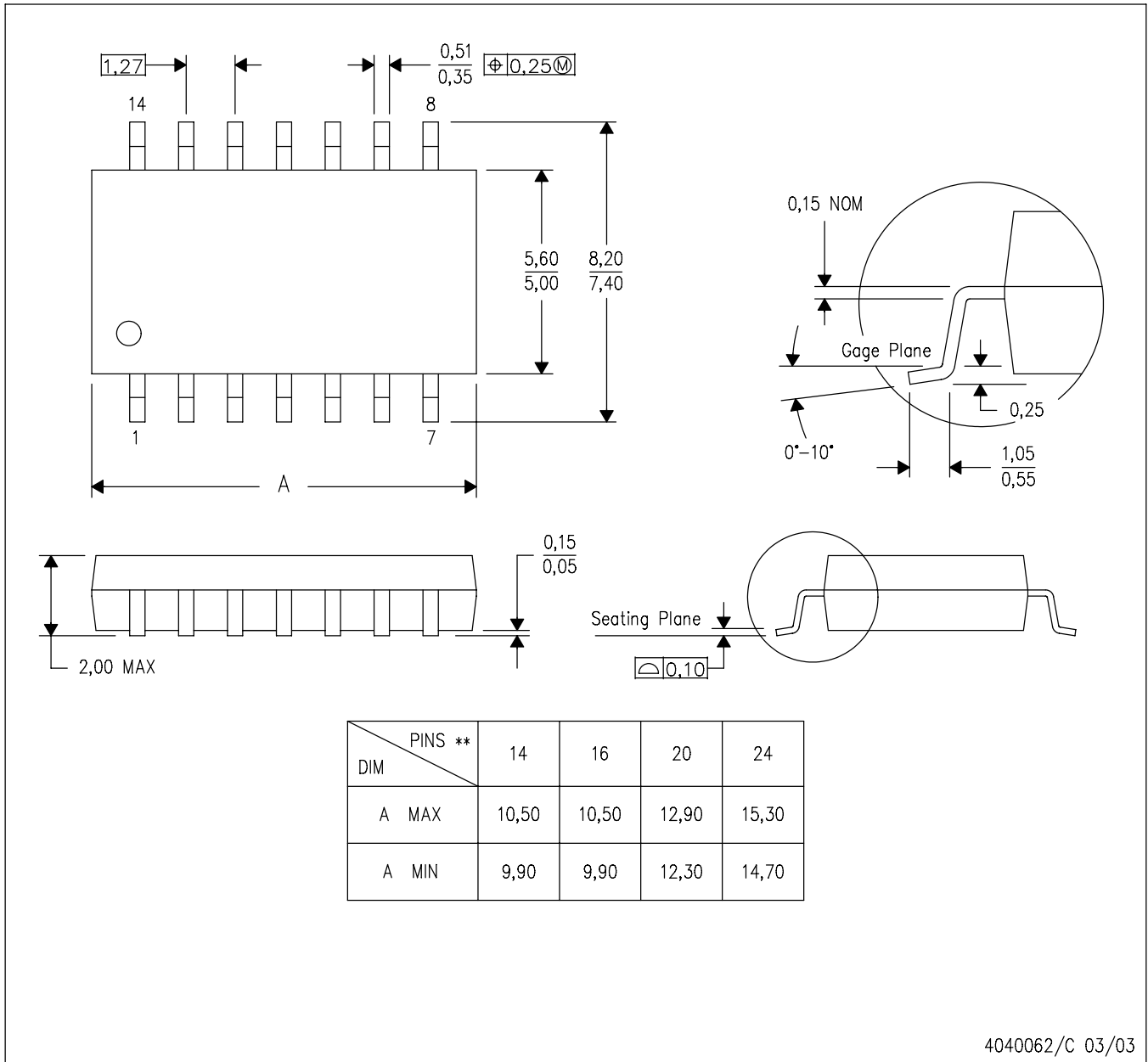
8 PINS SHOWN



- 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-012

NS (R-PDSO-G**)
 14-PIN SHOWN

PLASTIC SMALL-OUTLINE PACKAGE



4040062/C 03/03

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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

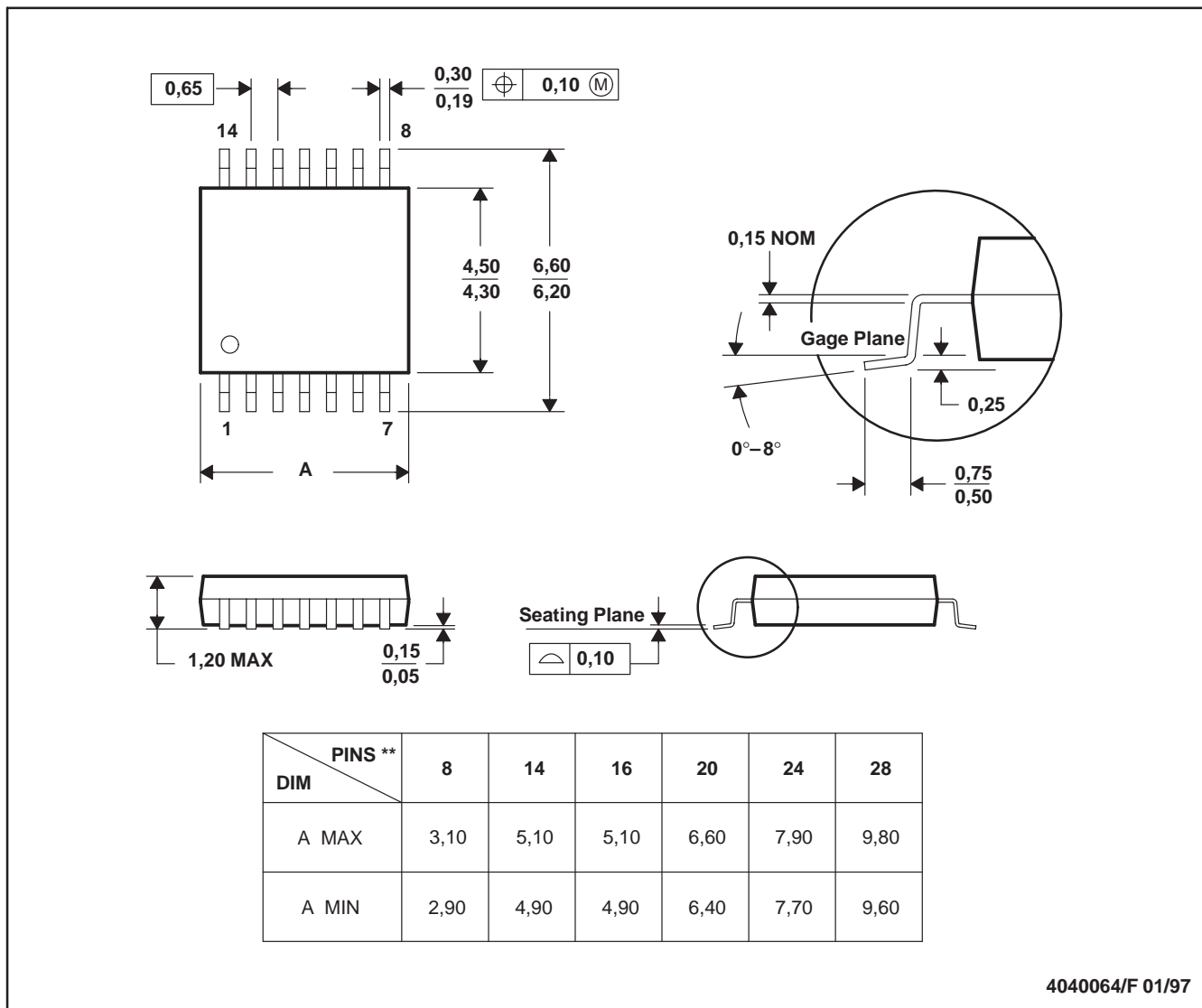


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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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