

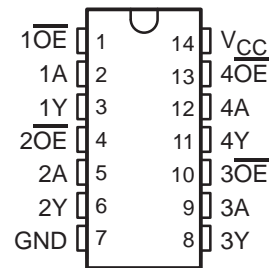
# SN74AHCT125-Q1 QUADRUPLE BUS BUFFER GATE WITH 3-STATE OUTPUTS

SCLS508 – JUNE 2003

- Qualification in Accordance With AEC-Q100†
- Qualified for Automotive Applications
- Customer-Specific Configuration Control Can Be Supported Along With Major-Change Approval
- ESD Protection Exceeds 2000 V Per MIL-STD-883, Method 3015; Exceeds 200 V Using Machine Model (C = 200 pF, R = 0)
- Inputs Are TTL-Voltage Compatible

† Contact factory for details. Q100 qualification data available on request.

D OR PW PACKAGE  
(TOP VIEW)



## description/ordering information

The SN74AHCT125 is a quadruple bus buffer gate featuring independent line drivers with 3-state outputs. Each output is disabled when the associated output-enable ( $\overline{OE}$ ) input is high. When  $\overline{OE}$  is low, the respective gate passes the data from the A input to its Y output.

To ensure the high-impedance state during power up or power down,  $\overline{OE}$  should be tied to  $V_{CC}$  through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE‡   |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|------------|---------------|-----------------------|------------------|
|                |            |               |                       |                  |
| –40°C to 125°C | SOIC – D   | Tape and reel | SN74AHCT125QDRQ1      | AHCT125Q         |
|                | TSSOP – PW | Tape and reel | SN74AHCT125QPWRQ1     | HB125Q           |

‡ 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 buffer)

| INPUTS          |   | OUTPUT |
|-----------------|---|--------|
| $\overline{OE}$ | A | Y      |
| L               | H | H      |
| L               | L | L      |
| H               | X | Z      |



Please be aware that an important notice concerning availability, standard warranty, and use in critical applications of Texas Instruments semiconductor products and disclaimers thereto appears at the end of this data sheet.

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**

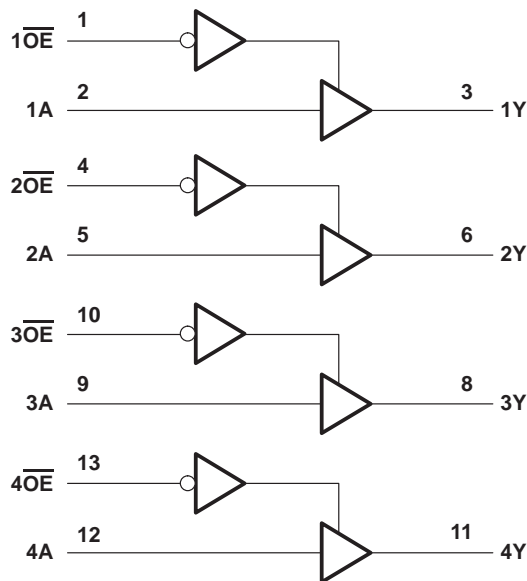
POST OFFICE BOX 655303 • DALLAS, TEXAS 75265

Copyright © 2003, Texas Instruments Incorporated

# SN74AHCT125-Q1 QUADRUPLE BUS BUFFER GATE WITH 3-STATE OUTPUTS

SCLS508 – JUNE 2003

## logic diagram (positive logic)



Pin numbers shown are for the D and PW packages.

## 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 $V_O > V_{CC}$ ) .....   | $\pm 20$ mA                |
| Continuous output current, $I_O$ ( $V_O = 0$ to $V_{CC}$ ) .....       | $\pm 25$ mA                |
| Continuous current through $V_{CC}$ or GND .....                       | $\pm 50$ mA                |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): D package ..... | 86°C/W                     |
| ..... PW package .....                                                 | 113°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.



**SN74AHCT125-Q1**  
**QUADRUPLE BUS BUFFER GATE**  
**WITH 3-STATE OUTPUTS**

SCLS508 – JUNE 2003

**recommended operating conditions (see Note 3)**

|                 |                                    | MIN | MAX             | UNIT |
|-----------------|------------------------------------|-----|-----------------|------|
| V <sub>CC</sub> | Supply voltage                     | 4.5 | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           | 2   |                 | V    |
| V <sub>IL</sub> | Low-level input voltage            |     | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                      | 0   | 5.5             | V    |
| V <sub>O</sub>  | Output voltage                     | 0   | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          |     | -8              | mA   |
| I <sub>OL</sub> | Low-level output current           |     | 8               | mA   |
| Δt/Δv           | Input transition rise or fall rate |     | 20              | ns/V |
| T <sub>A</sub>  | Operating free-air temperature     | -40 | 125             | °C   |

NOTE 3: All unused inputs of the device must be held at V<sub>CC</sub> or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number SCBA004.

**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 |     |       | MIN  | MAX | UNIT |
|--------------------|-------------------------------------------------------------|-----------------|-----------------------|-----|-------|------|-----|------|
|                    |                                                             |                 | MIN                   | TYP | MAX   |      |     |      |
| V <sub>OH</sub>    | I <sub>OH</sub> = -50 μA                                    | 4.5 V           | 4.4                   | 4.5 |       | 4.4  |     | V    |
|                    | I <sub>OH</sub> = -8 mA                                     |                 | 3.94                  |     |       | 3.8  |     |      |
| V <sub>OL</sub>    | I <sub>OL</sub> = 50 μA                                     | 4.5 V           |                       |     | 0.1   | 0.1  |     | V    |
|                    | I <sub>OL</sub> = 8 mA                                      |                 |                       |     | 0.36  | 0.44 |     |      |
| I <sub>I</sub>     | V <sub>I</sub> = 5.5 V or GND                               | 0 V to 5.5 V    |                       |     | ±0.1  | ±1   |     | μA   |
| I <sub>OZ</sub>    | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 5.5 V           |                       |     | ±0.25 | ±2.5 |     | μA   |
| I <sub>CC</sub>    | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0 | 5.5 V           |                       |     | 2     | 20   |     | μA   |
| ΔI <sub>CC</sub> † | One input at 3.4 V, Other inputs at V <sub>CC</sub> or GND  | 5.5 V           |                       |     | 1.35  | 1.5  |     | mA   |
| C <sub>i</sub>     | V <sub>I</sub> = V <sub>CC</sub> or GND                     | 5 V             |                       | 4   | 10    | 10   |     | pF   |
| C <sub>o</sub>     | V <sub>O</sub> = V <sub>CC</sub> or GND                     | 5 V             |                       | 15  |       |      |     | pF   |

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

# SN74AHCT125-Q1

## QUADRUPLE BUS BUFFER GATE

### WITH 3-STATE OUTPUTS

SCLS508 – JUNE 2003

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

| PARAMETER   | FROM (INPUT)    | TO (OUTPUT) | LOAD CAPACITANCE     | $T_A = 25^\circ\text{C}$ |     |     | MIN | MAX | UNIT |
|-------------|-----------------|-------------|----------------------|--------------------------|-----|-----|-----|-----|------|
|             |                 |             |                      | MIN                      | TYP | MAX |     |     |      |
| $t_{PLH}$   | A               | Y           | $C_L = 15\text{ pF}$ | 3.8                      | 5.5 | 1   | 6.5 | ns  |      |
| $t_{PHL}$   |                 |             |                      | 3.8                      | 5.5 | 1   | 6.5 |     |      |
| $t_{PZH}$   | $\overline{OE}$ | Y           | $C_L = 15\text{ pF}$ | 3.6                      | 5.1 | 1   | 6   | ns  |      |
| $t_{PZL}$   |                 |             |                      | 3.6                      | 5.1 | 1   | 6   |     |      |
| $t_{PHZ}$   | $\overline{OE}$ | Y           | $C_L = 15\text{ pF}$ | 4.6                      | 6.8 | 1   | 8   | ns  |      |
| $t_{PLZ}$   |                 |             |                      | 4.6                      | 6.8 | 1   | 8   |     |      |
| $t_{PLH}$   | A               | Y           | $C_L = 50\text{ pF}$ | 5.3                      | 7.5 | 1   | 8.5 | ns  |      |
| $t_{PHL}$   |                 |             |                      | 5.3                      | 7.5 | 1   | 8.5 |     |      |
| $t_{PZH}$   | $\overline{OE}$ | Y           | $C_L = 50\text{ pF}$ | 5.1                      | 7.1 | 1   | 8   | ns  |      |
| $t_{PZL}$   |                 |             |                      | 5.1                      | 7.1 | 1   | 8   |     |      |
| $t_{PHZ}$   | $\overline{OE}$ | Y           | $C_L = 50\text{ pF}$ | 6.1                      | 8.8 | 1   | 10  | ns  |      |
| $t_{PLZ}$   |                 |             |                      | 6.1                      | 8.8 | 1   | 10  |     |      |
| $t_{sk(o)}$ |                 |             | $C_L = 50\text{ pF}$ |                          |     | 1   | 1   | ns  |      |

noise characteristics,  $V_{CC} = 5\text{ V}$ ,  $C_L = 50\text{ pF}$ ,  $T_A = 25^\circ\text{C}$  (see Note 4)

| PARAMETER   |                                        | MIN | MAX  | UNIT |
|-------------|----------------------------------------|-----|------|------|
| $V_{OL(P)}$ | Quiet output, maximum dynamic $V_{OL}$ |     | 0.8  | V    |
| $V_{OL(V)}$ | Quiet output, minimum dynamic $V_{OL}$ |     | -0.8 | V    |
| $V_{OH(V)}$ | Quiet output, minimum dynamic $V_{OH}$ | 4.4 |      | V    |
| $V_{IH(D)}$ | High-level dynamic input voltage       | 2   |      | V    |
| $V_{IL(D)}$ | Low-level dynamic input voltage        |     | 0.8  | V    |

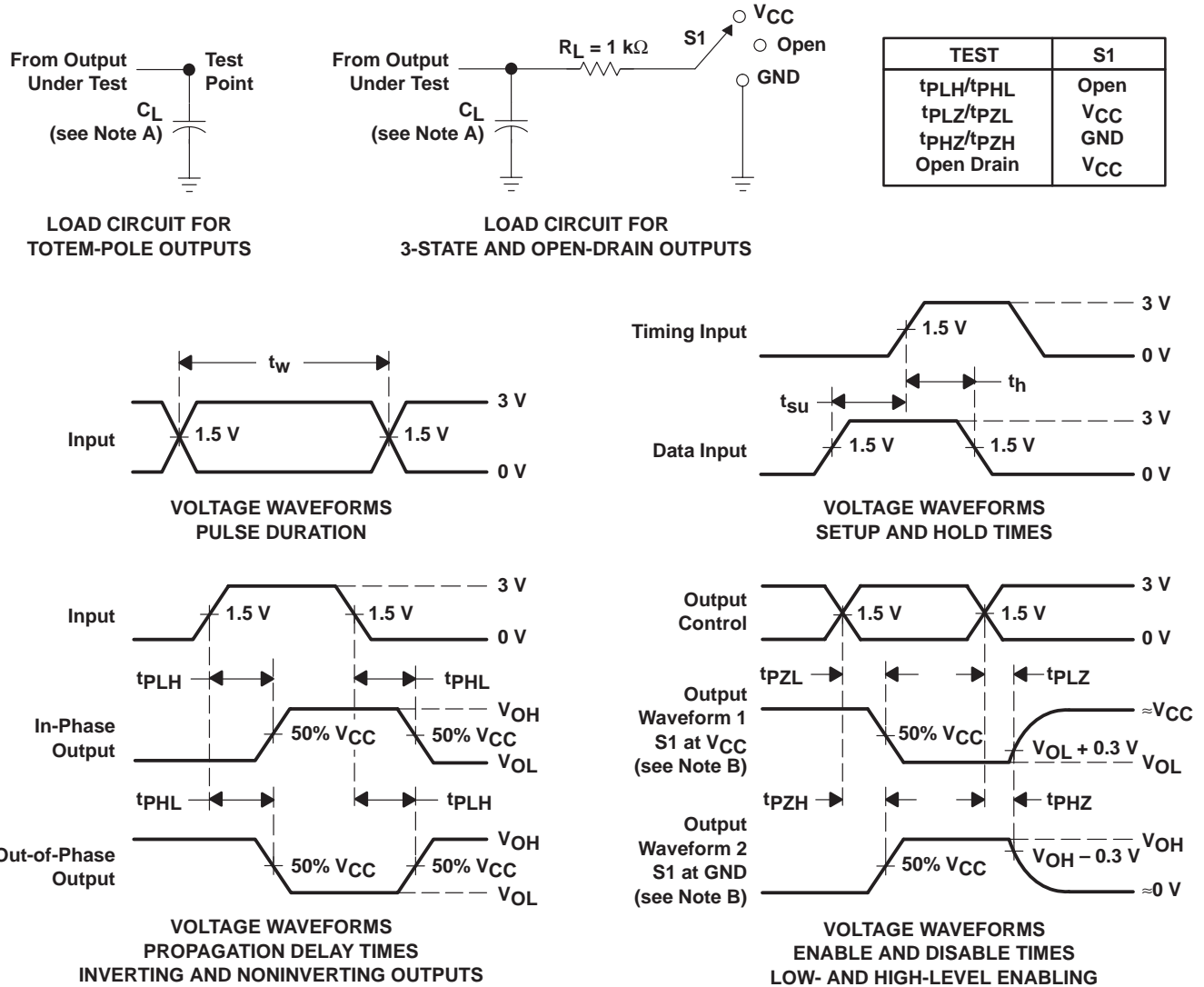
NOTE 4: Characteristics are for surface-mount packages only.

operating characteristics,  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$

| PARAMETER |                               | TEST CONDITIONS             | TYP | UNIT |
|-----------|-------------------------------|-----------------------------|-----|------|
| $C_{pd}$  | Power dissipation capacitance | No load, $f = 1\text{ MHz}$ | 14  | pF   |



PARAMETER MEASUREMENT INFORMATION



- 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.  
 E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**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>               |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|--------------------------------------------|
| SN74AHCT125QDRQ1  | ACTIVE                | SOIC         | D               | 14   | 2500        | Pb-Free (RoHS)          | CU NIPDAU        | Level-2-250C-1 YEAR/<br>Level-1-235C-UNLIM |
| SN74AHCT125QPWRQ1 | ACTIVE                | TSSOP        | PW              | 14   | 2000        | Pb-Free (RoHS)          | CU NIPDAU        | Level-1-250C-UNLIM                         |

<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.

<sup>(2)</sup> Eco Plan - May not be currently available - please check <http://www.ti.com/productcontent> for the latest availability information and additional product content details.

**None:** Not yet available Lead (Pb-Free).

**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.

**Green (RoHS & no Sb/Br):** TI defines "Green" to mean "Pb-Free" and in addition, uses package materials that do not contain halogens, including bromine (Br) or antimony (Sb) above 0.1% of total product weight.

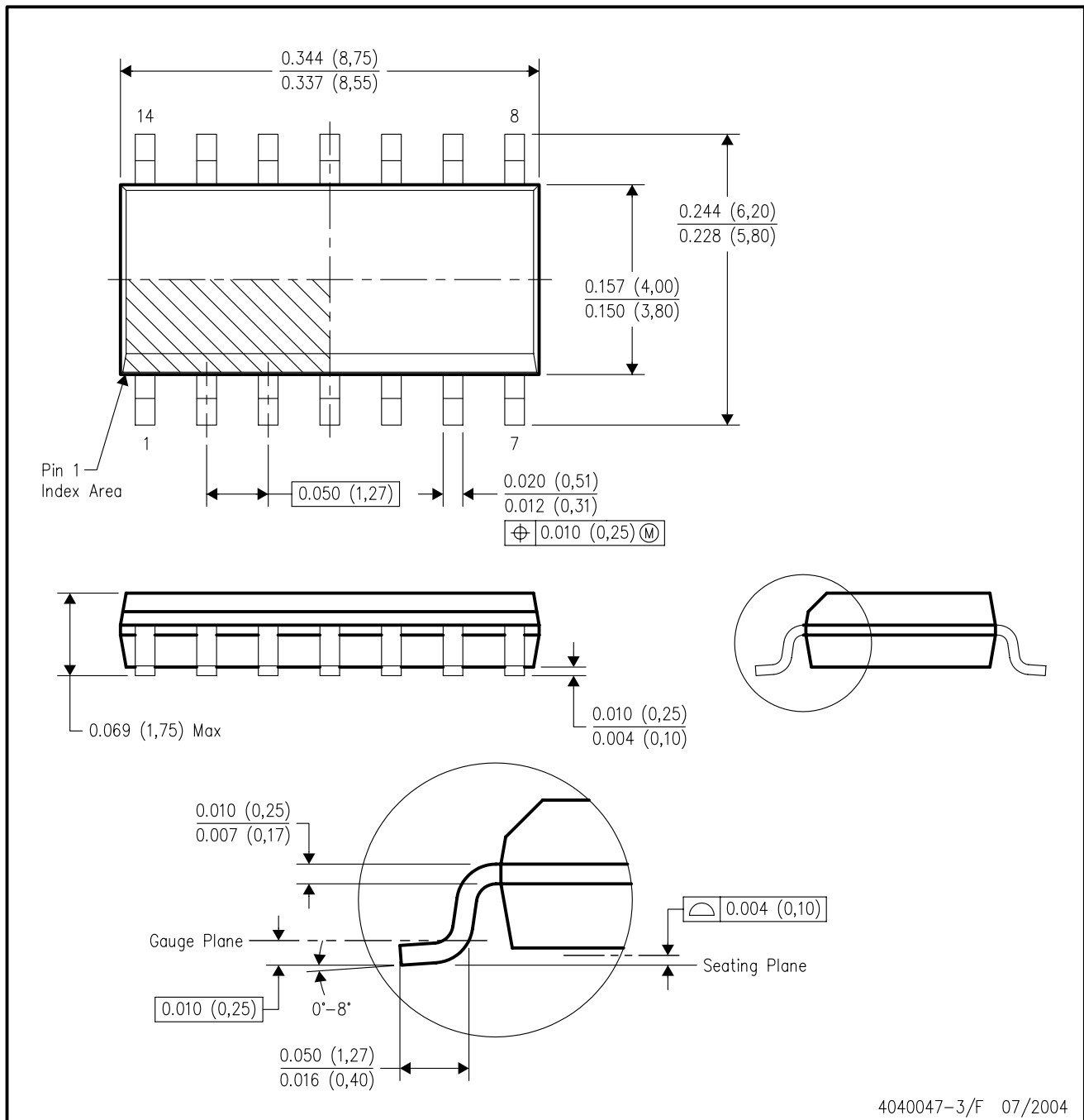
<sup>(3)</sup> MSL, Peak Temp. -- The Moisture Sensitivity Level rating according to the JEDEC industry standard classifications, and peak solder temperature.

**Important Information and Disclaimer:** The information provided on this page represents TI's knowledge and belief as of the date that it is provided. TI bases its knowledge and belief on information provided by third parties, and makes no representation or warranty as to the accuracy of such information. Efforts are underway to better integrate information from third parties. TI has taken and continues to take reasonable steps to provide representative and accurate information but may not have conducted destructive testing or chemical analysis on incoming materials and chemicals. TI and TI suppliers consider certain information to be proprietary, and thus CAS numbers and other limited information may not be available for release.

In no event shall TI's liability arising out of such information exceed the total purchase price of the TI part(s) at issue in this document sold by TI to Customer on an annual basis.

D (R-PDSO-G14)

PLASTIC SMALL-OUTLINE PACKAGE

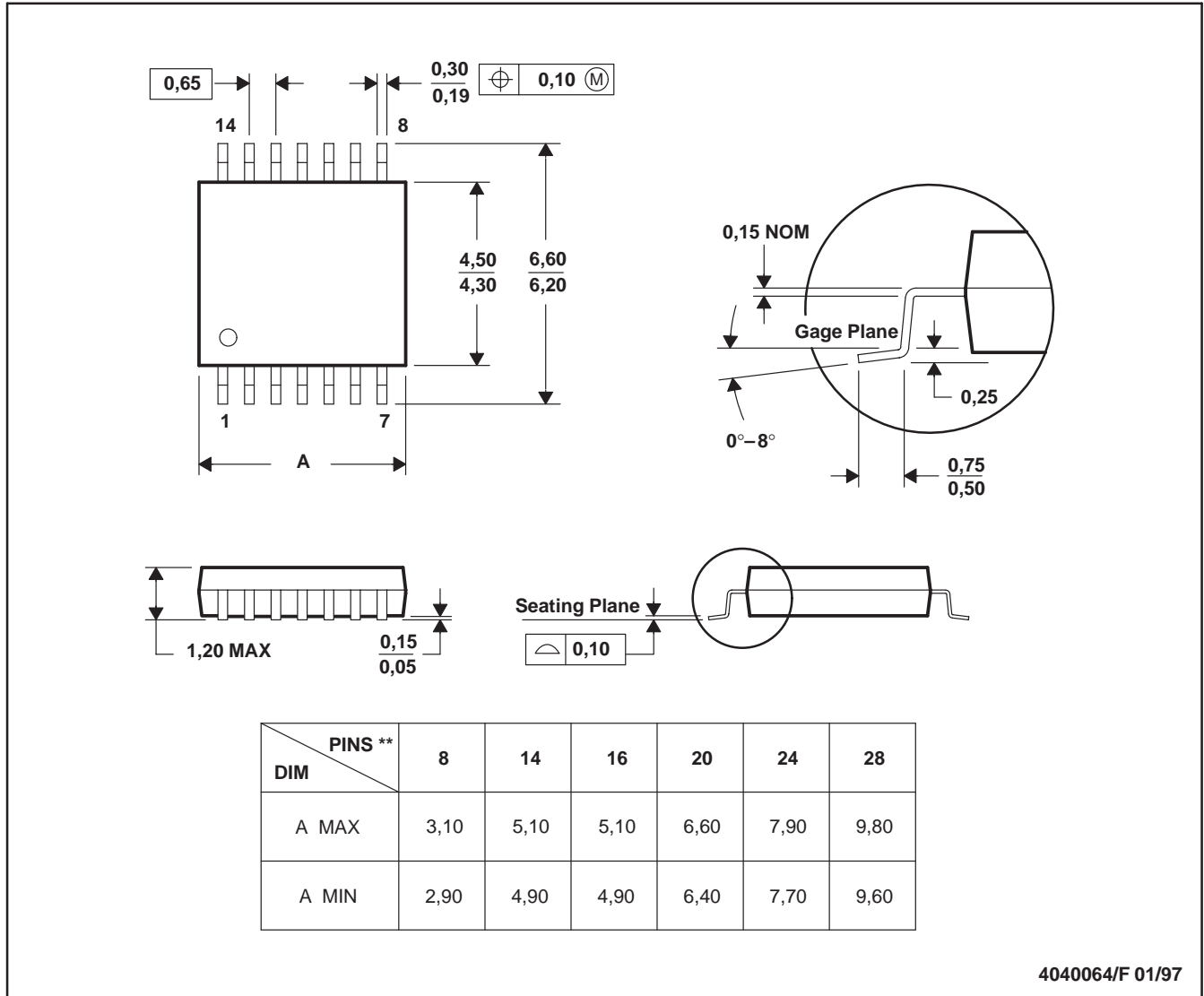


- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. Body dimensions do not include mold flash or protrusion not to exceed 0.006 (0,15).
  - D. Falls within JEDEC MS-012 variation AB.

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

## IMPORTANT NOTICE

Texas Instruments Incorporated and its subsidiaries (TI) reserve the right to make corrections, modifications, enhancements, improvements, and other changes to its products and services at any time and to discontinue any product or service without notice. Customers should obtain the latest relevant information before placing orders and should verify that such information is current and complete. All products are sold subject to TI's terms and conditions of sale supplied at the time of order acknowledgment.

TI warrants performance of its hardware products to the specifications applicable at the time of sale in accordance with TI's standard warranty. Testing and other quality control techniques are used to the extent TI deems necessary to support this warranty. Except where mandated by government requirements, testing of all parameters of each product is not necessarily performed.

TI assumes no liability for applications assistance or customer product design. Customers are responsible for their products and applications using TI components. To minimize the risks associated with customer products and applications, customers should provide adequate design and operating safeguards.

TI does not warrant or represent that any license, either express or implied, is granted under any TI patent right, copyright, mask work right, or other TI intellectual property right relating to any combination, machine, or process in which TI products or services are used. Information published by TI regarding third-party products or services does not constitute a license from TI to use such products or services or a warranty or endorsement thereof. Use of such information may require a license from a third party under the patents or other intellectual property of the third party, or a license from TI under the patents or other intellectual property of TI.

Reproduction of information in TI data books or data sheets is permissible only if reproduction is without alteration and is accompanied by all associated warranties, conditions, limitations, and notices. Reproduction of this information with alteration is an unfair and deceptive business practice. TI is not responsible or liable for such altered documentation.

Resale of TI products or services with statements different from or beyond the parameters stated by TI for that product or service voids all express and any implied warranties for the associated TI product or service and is an unfair and deceptive business practice. TI is not responsible or liable for any such statements.

Following are URLs where you can obtain information on other Texas Instruments products and application solutions:

| <b>Products</b>  |                                                                    | <b>Applications</b> |                                                                          |
|------------------|--------------------------------------------------------------------|---------------------|--------------------------------------------------------------------------|
| Amplifiers       | <a href="http://amplifier.ti.com">amplifier.ti.com</a>             | Audio               | <a href="http://www.ti.com/audio">www.ti.com/audio</a>                   |
| Data Converters  | <a href="http://dataconverter.ti.com">dataconverter.ti.com</a>     | Automotive          | <a href="http://www.ti.com/automotive">www.ti.com/automotive</a>         |
| DSP              | <a href="http://dsp.ti.com">dsp.ti.com</a>                         | Broadband           | <a href="http://www.ti.com/broadband">www.ti.com/broadband</a>           |
| Interface        | <a href="http://interface.ti.com">interface.ti.com</a>             | Digital Control     | <a href="http://www.ti.com/digitalcontrol">www.ti.com/digitalcontrol</a> |
| Logic            | <a href="http://logic.ti.com">logic.ti.com</a>                     | Military            | <a href="http://www.ti.com/military">www.ti.com/military</a>             |
| Power Mgmt       | <a href="http://power.ti.com">power.ti.com</a>                     | Optical Networking  | <a href="http://www.ti.com/opticalnetwork">www.ti.com/opticalnetwork</a> |
| Microcontrollers | <a href="http://microcontroller.ti.com">microcontroller.ti.com</a> | Security            | <a href="http://www.ti.com/security">www.ti.com/security</a>             |
|                  |                                                                    | Telephony           | <a href="http://www.ti.com/telephony">www.ti.com/telephony</a>           |
|                  |                                                                    | Video & Imaging     | <a href="http://www.ti.com/video">www.ti.com/video</a>                   |
|                  |                                                                    | Wireless            | <a href="http://www.ti.com/wireless">www.ti.com/wireless</a>             |

Mailing Address: Texas Instruments  
Post Office Box 655303 Dallas, Texas 75265