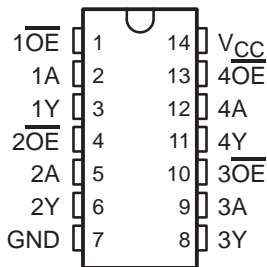


SN54LVTH125, SN74LVTH125 3.3-V ABT QUADRUPLE BUS BUFFERS WITH 3-STATE OUTPUTS

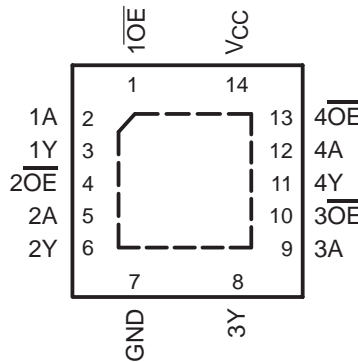
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- Support Mixed-Mode Signal Operation (5-V Input and Output Voltages With 3.3-V V_{CC})
- Support Unregulated Battery Operation Down to 2.7 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- I_{off} and Power-Up 3-State Support Hot Insertion
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Latch-Up Performance Exceeds 500 mA Per JESD 17
- ESD Protection Exceeds JESD 22
 - 2000-V Human-Body Model (A114-A)
 - 200-V Machine Model (A115-A)

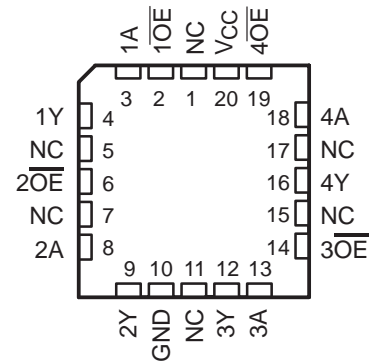
SN54LVTH125 . . . J OR W PACKAGE
SN74LVTH125 . . . D, DB, DGV, NS,
OR PW PACKAGE
(TOP VIEW)



SN74LVTH125 . . . RGY PACKAGE
(TOP VIEW)



SN54LVTH125 . . . FK PACKAGE
(TOP VIEW)



NC – No internal connection

description/ordering information

These bus buffers are designed specifically for low-voltage (3.3-V) V_{CC} operation, but with the capability to provide a TTL interface to a 5-V system environment.

The 'LVTH125 devices feature independent line drivers with 3-state outputs. Each output is in the high-impedance state when the associated output-enable (\overline{OE}) input is high.

ORDERING INFORMATION

| T_A | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|----------------|---------------|-----------------|-----------------------|------------------|
| –40°C to 85°C | QFN – RGY | Tape and reel | SN74LVTH125RGYR | LXH125 |
| | SOIC – D | Tube | SN74LVTH125D | LVTH125 |
| | | Tape and reel | SN74LVTH125DR | |
| | SOP – NS | Tape and reel | SN74LVTH125NSR | LVTH125 |
| | SSOP – DB | Tape and reel | SN74LVTH125DBR | LXH125 |
| | TSSOP – PW | Tube | SN74LVTH125PW | LXH125 |
| | | Tape and reel | SN74LVTH125PWR | |
| TVSOP – DGV | Tape and reel | SN74LVTH125DGVR | LXH125 | |
| –55°C to 125°C | CDIP – J | Tube | SNJ54LVTH125J | SNJ54LVTH125J |
| | CFP – W | Tube | SNJ54LVTH125W | SNJ54LVTH125W |
| | LCCC – FK | Tube | SNJ54LVTH125FK | SNJ54LVTH125FK |

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



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TEXAS
INSTRUMENTS

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SN54LVTH125, SN74LVTH125

3.3-V ABT QUADRUPLE BUS BUFFERS WITH 3-STATE OUTPUTS

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description/ordering information (continued)

Active bus-hold circuitry holds unused or undriven inputs at a valid logic state. Use of pullup or pulldown resistors with the bus-hold circuitry is not recommended.

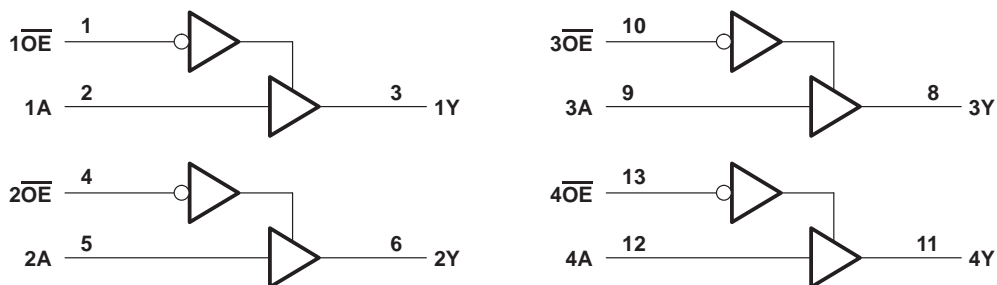
When V_{CC} is between 0 and 1.5 V, the devices are in the high-impedance state during power up or power down. However, to ensure the high-impedance state above 1.5 V, \overline{OE} should be tied to V_{CC} through a pullup resistor; the minimum value of the resistor is determined by the current-sinking capability of the driver.

These devices are fully specified for hot-insertion applications using I_{off} and power-up 3-state. The I_{off} circuitry disables the outputs, preventing damaging current backflow through the devices when they are powered down. The power-up 3-state circuitry places the outputs in the high-impedance state during power up and power down, which prevents driver conflict.

FUNCTION TABLE
(each buffer)

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

logic diagram (positive logic)



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

SN54LVTH125, SN74LVTH125 3.3-V ABT QUADRUPLE BUS BUFFERS WITH 3-STATE OUTPUTS

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

| | |
|---|----------------------------|
| Supply voltage range, V_{CC} | –0.5 V to 4.6 V |
| Input voltage range, V_I (see Note 1) | –0.5 V to 7 V |
| Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1) | –0.5 V to 7 V |
| Voltage range applied to any output in the high state, V_O (see Note 1) | –0.5 V to $V_{CC} + 0.5$ V |
| Current into any output in the low state, I_O : SN54LVTH125 | 96 mA |
| SN74LVTH125 | 128 mA |
| Current into any output in the high state, I_O (see Note 2): SN54LVTH125 | 48 mA |
| SN74LVTH125 | 64 mA |
| Input clamp current, I_{IK} ($V_I < 0$) | –50 mA |
| Output clamp current, I_{OK} ($V_O < 0$) | –50 mA |
| Package thermal impedance, θ_{JA} (see Note 3): D package | 86°C/W |
| (see Note 3): DB package | 96°C/W |
| (see Note 3): DGV package | 127°C/W |
| (see Note 3): NS package | 76°C/W |
| (see Note 3): PW package | 113°C/W |
| (see Note 4): RGY package | 47°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 negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.
 2. This current flows only when the output is in the high state and $V_O > V_{CC}$.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.
 4. The package thermal impedance is calculated in accordance with JESD 51-5.

recommended operating conditions (see Note 5)

| | | SN54LVTH125 | | SN74LVTH125 | | UNIT |
|--------------------------|------------------------------------|-----------------|-----|-------------|-----|------|
| | | MIN | MAX | MIN | MAX | |
| V_{CC} | Supply voltage | 2.7 | 3.6 | 2.7 | 3.6 | 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 | | 5.5 | | 5.5 | V |
| I_{OH} | High-level output current | | –24 | | –32 | mA |
| I_{OL} | Low-level output current | | 48 | | 64 | mA |
| $\Delta t/\Delta v$ | Input transition rise or fall rate | Outputs enabled | | | 10 | ns/V |
| $\Delta t/\Delta V_{CC}$ | Power-up ramp rate | | 200 | | 200 | μs/V |
| T_A | Operating free-air temperature | –55 | 125 | –40 | 85 | °C |

NOTE 5: All unused control 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.

SN54LVTH125, SN74LVTH125

3.3-V ABT QUADRUPLE BUS BUFFERS

WITH 3-STATE OUTPUTS

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

| PARAMETER | TEST CONDITIONS | | SN54LVTH125 | | | SN74LVTH125 | | | UNIT | |
|--------------------------|--|--|----------------------|---------|-----------|--------------|-----------|-----|---------------|---------------|
| | | | MIN | TYP† | MAX | MIN | TYP† | MAX | | |
| V_{IK} | $V_{CC} = 2.7\text{ V}$, $I_I = -18\text{ mA}$ | | -1.2 | | | -1.2 | | | V | |
| V_{OH} | $V_{CC} = 2.7\text{ V to }3.6\text{ V}$, $I_{OH} = -100\text{ }\mu\text{A}$ | | $V_{CC}-0.2$ | | | $V_{CC}-0.2$ | | | V | |
| | $V_{CC} = 2.7\text{ V}$, $I_{OH} = -8\text{ mA}$ | | 2.4 | | | 2.4 | | | | |
| | $V_{CC} = 3\text{ V}$ | $I_{OH} = -24\text{ mA}$ | 2 | | | | | | | |
| $I_{OH} = -32\text{ mA}$ | | | | | 2 | | | | | |
| V_{OL} | $V_{CC} = 2.7\text{ V}$ | $I_{OL} = 100\text{ }\mu\text{A}$ | | | | 0.2 | | | V | |
| | | $I_{OL} = 24\text{ mA}$ | | | | 0.5 | | | | |
| | $V_{CC} = 3\text{ V}$ | $I_{OL} = 16\text{ mA}$ | | | | 0.4 | | | | |
| | | $I_{OL} = 32\text{ mA}$ | | | | 0.5 | | | | |
| | | $I_{OL} = 48\text{ mA}$ | | | | 0.55 | | | | |
| | | $I_{OL} = 64\text{ mA}$ | | | | 0.55 | | | | |
| I_I | Control inputs | $V_{CC} = 0\text{ or }3.6\text{ V}$, $V_I = 5.5\text{ V}$ | | 10 | | | 10 | | | μA |
| | | $V_{CC} = 3.6\text{ V}$, $V_I = V_{CC}\text{ or GND}$ | | ± 1 | | | ± 1 | | | |
| | Data inputs | $V_{CC} = 3.6\text{ V}$ | $V_I = V_{CC}$ | 1 | | | 1 | | | |
| $V_I = 0$ | -5 | | | -5 | | | | | | |
| I_{off} | $V_{CC} = 0$, $V_I\text{ or }V_O = 0\text{ to }4.5\text{ V}$ | | | | | ± 100 | | | μA | |
| $I_I(\text{hold})$ | Data inputs | $V_{CC} = 3\text{ V}$ | $V_I = 0.8\text{ V}$ | 75 | | | 75 | | | μA |
| | | | $V_I = 2\text{ V}$ | -75 | | | -75 | | | |
| | | $V_{CC} = 3.6\text{ V}\ddagger$, $V_I = 0\text{ to }3.6\text{ V}$ | | | | | ± 500 | | | |
| I_{OZH} | $V_{CC} = 3.6\text{ V}$, $V_O = 3\text{ V}$ | | 5 | | | 5 | | | μA | |
| I_{OZL} | $V_{CC} = 3.6\text{ V}$, $V_O = 0.5\text{ V}$ | | -5 | | | -5 | | | μA | |
| I_{OZPU} | $V_{CC} = 0\text{ to }1.5\text{ V}$, $V_O = 0.5\text{ V to }3\text{ V}$, $OE = \text{don't care}$ | | $\pm 50^*$ | | | ± 50 | | | μA | |
| I_{OZPD} | $V_{CC} = 1.5\text{ V to }0$, $V_O = 0.5\text{ V to }3\text{ V}$, $OE = \text{don't care}$ | | $\pm 50^*$ | | | ± 50 | | | μA | |
| I_{CC} | $V_{CC} = 3.6\text{ V}$, $I_O = 0$, $V_I = V_{CC}\text{ or GND}$ | Outputs high | 0.12 0.19 | | 0.12 0.19 | | | | mA | |
| | | Outputs low | 4.5 7 | | 4.5 7 | | | | | |
| | | Outputs disabled | 0.12 0.19 | | 0.12 0.19 | | | | | |
| $\Delta I_{CC}\S$ | $V_{CC} = 3\text{ V to }3.6\text{ V}$, One input at $V_{CC} - 0.6\text{ V}$, Other inputs at $V_{CC}\text{ or GND}$ | | 0.3 | | | 0.2 | | | mA | |
| C_i | $V_I = 3\text{ V or }0$ | | 4 | | | 4 | | | pF | |
| C_o | $V_O = 3\text{ V or }0$ | | 6.5 | | | 6.5 | | | pF | |

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

† All typical values are at $V_{CC} = 3.3\text{ V}$, $T_A = 25^\circ\text{C}$.

‡ This is the bus-hold maximum dynamic current. It is the minimum overdrive current required to switch the input from one state to another.

§ This is the increase in supply current for each input that is at the specified TTL voltage level, rather than V_{CC} or GND.

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SN54LVTH125, SN74LVTH125 3.3-V ABT QUADRUPLE BUS BUFFERS WITH 3-STATE OUTPUTS

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switching characteristics over recommended operating free-air temperature range, $C_L = 50 \text{ pF}$ (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | SN54LVTH125 | | | | SN74LVTH125 | | | | UNIT | |
|-----------|-----------------|-------------|--|-----|--------------------------|-----|--|------|-----|--------------------------|------|-----|
| | | | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | $V_{CC} = 2.7 \text{ V}$ | | $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ | | | $V_{CC} = 2.7 \text{ V}$ | | |
| | | | MIN | MAX | MIN | MAX | MIN | TYP† | MAX | MIN | | MAX |
| t_{PLH} | A | Y | 1 | 4.2 | | 4.7 | 1 | 2 | 3.5 | | 4.5 | ns |
| t_{PHL} | | | 1 | 4.1 | | 5.1 | 1 | 2.1 | 3.9 | | 4.9 | |
| t_{PZH} | \overline{OE} | Y | 1 | 4.9 | | 5.6 | 1 | 2 | 4 | | 5.5 | ns |
| t_{PZL} | | | 1.1 | 4.9 | | 5.6 | 1.1 | 2.1 | 4 | | 5.4 | |
| t_{PHZ} | \overline{OE} | Y | 1.5 | 5.3 | | 5.9 | 1.5 | 2.3 | 4.5 | | 5.7 | ns |
| t_{PLZ} | | | 1.3 | 4.7 | | 4.2 | 1.3 | 2.8 | 4.5 | | 4 | |

† All typical values are at $V_{CC} = 3.3 \text{ V}$, $T_A = 25^\circ\text{C}$.

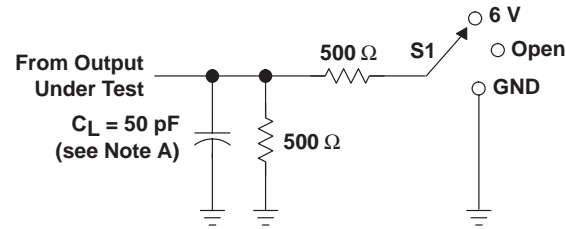
SN54LVTH125, SN74LVTH125

3.3-V ABT QUADRUPLE BUS BUFFERS

WITH 3-STATE OUTPUTS

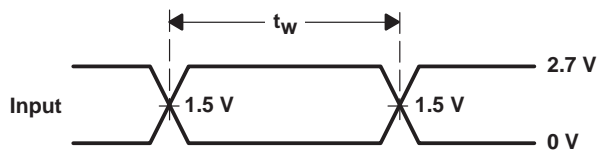
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PARAMETER MEASUREMENT INFORMATION

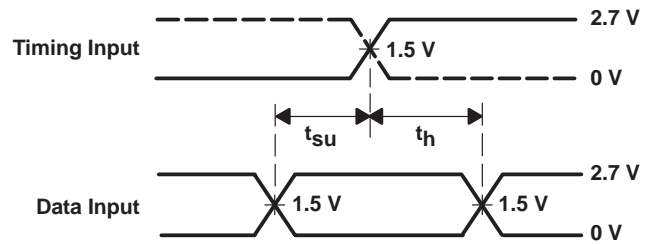


LOAD CIRCUIT

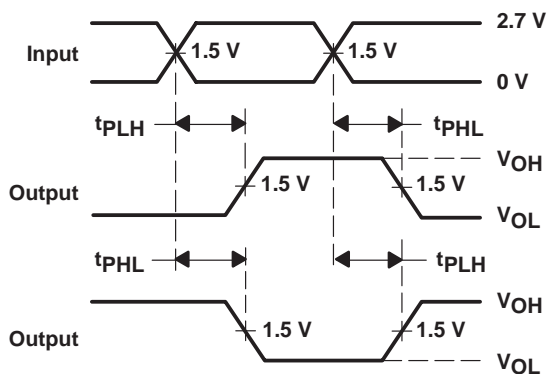
| TEST | S1 |
|-------------------|------|
| t_{PLH}/t_{PHL} | Open |
| t_{PLZ}/t_{PZL} | 6 V |
| t_{PHZ}/t_{PZH} | GND |



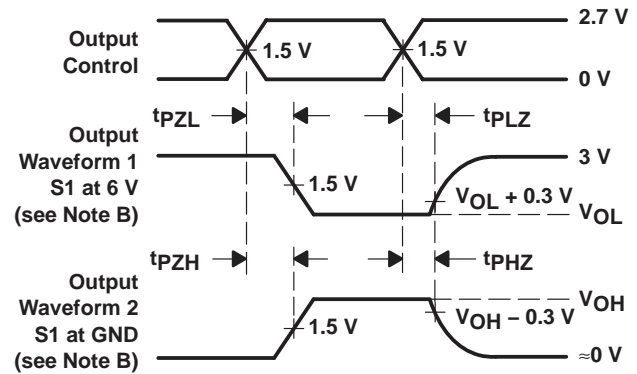
VOLTAGE WAVEFORMS
PULSE DURATION



VOLTAGE WAVEFORMS
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS
PROPAGATION DELAY TIMES
INVERTING AND NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS
ENABLE AND DISABLE TIMES
LOW- AND HIGH-LEVEL ENABLING

- 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: $PRR \leq 10 \text{ MHz}$, $Z_O = 50 \Omega$, $t_r \leq 2.5 \text{ ns}$, $t_f \leq 2.5 \text{ ns}$.
 D. The outputs are measured one at a time with one transition per measurement.
 E. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

DGV (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

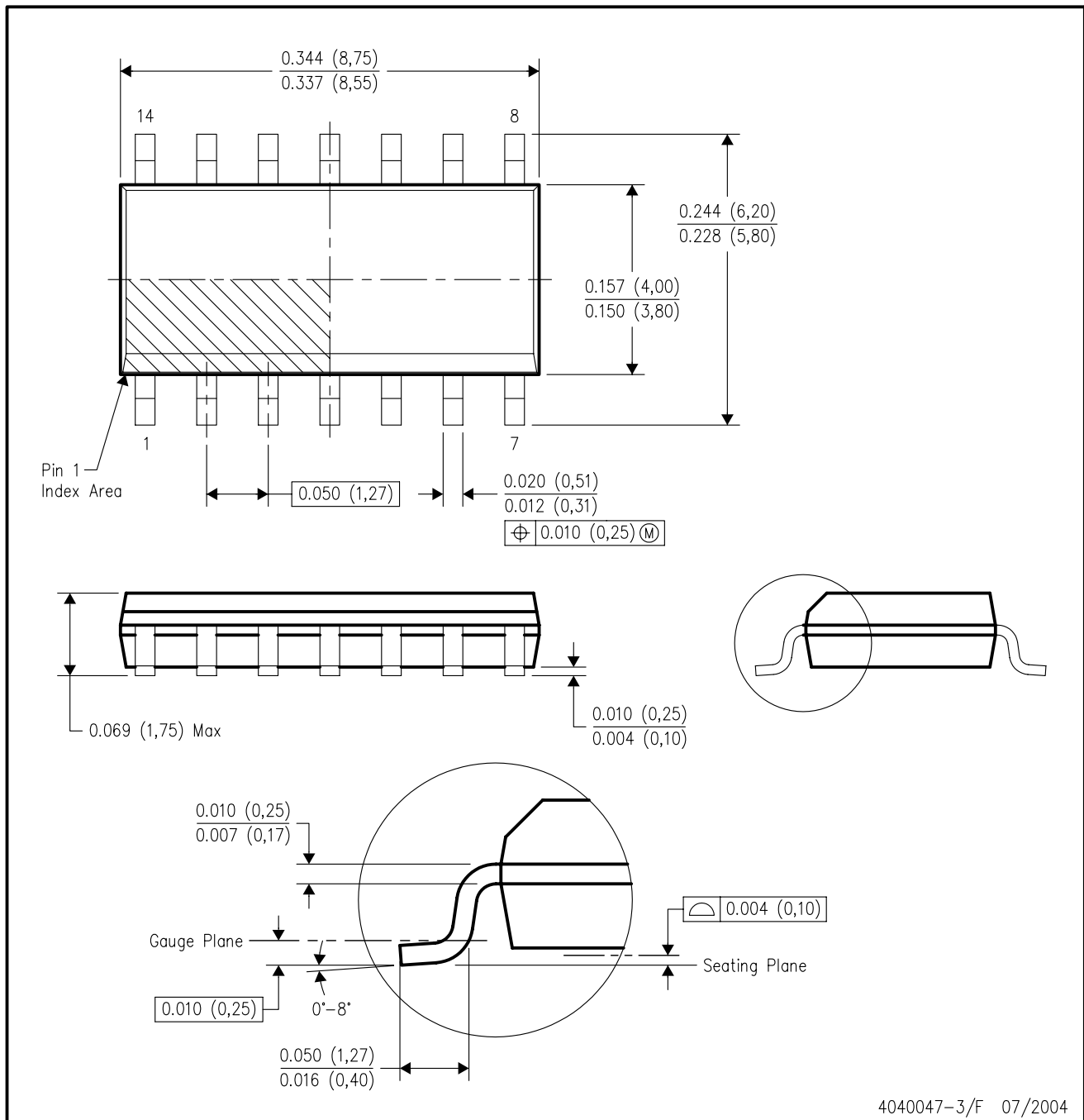
24 PINS SHOWN



- 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-G14)

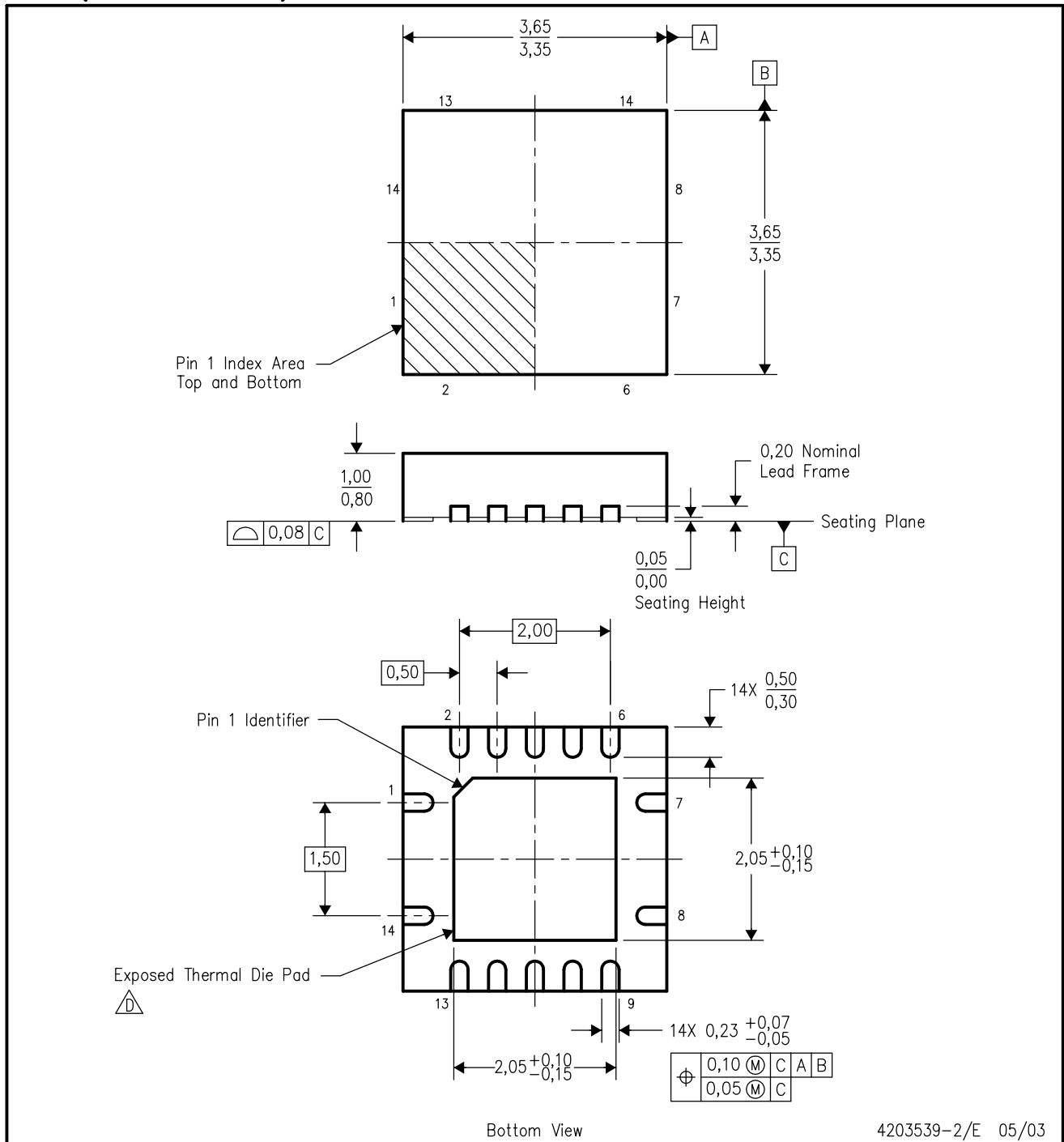
PLASTIC SMALL-OUTLINE PACKAGE



- 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.

RGY (S-PQFP-N14)

PLASTIC QUAD FLATPACK



Bottom View

4203539-2/E 05/03

- NOTES:
- A. All linear dimensions are in millimeters.
 - B. This drawing is subject to change without notice.
 - C. QFN (Quad Flatpack No-Lead) package configuration.
 - \triangle The package thermal performance may be enhanced by bonding the thermal die pad to an external thermal plane. This pad is electrically and thermally connected to the backside of the die and possibly selected ground leads.
 - E. Package complies to JEDEC MO-241 variation BA.

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.

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 PINS SHOWN

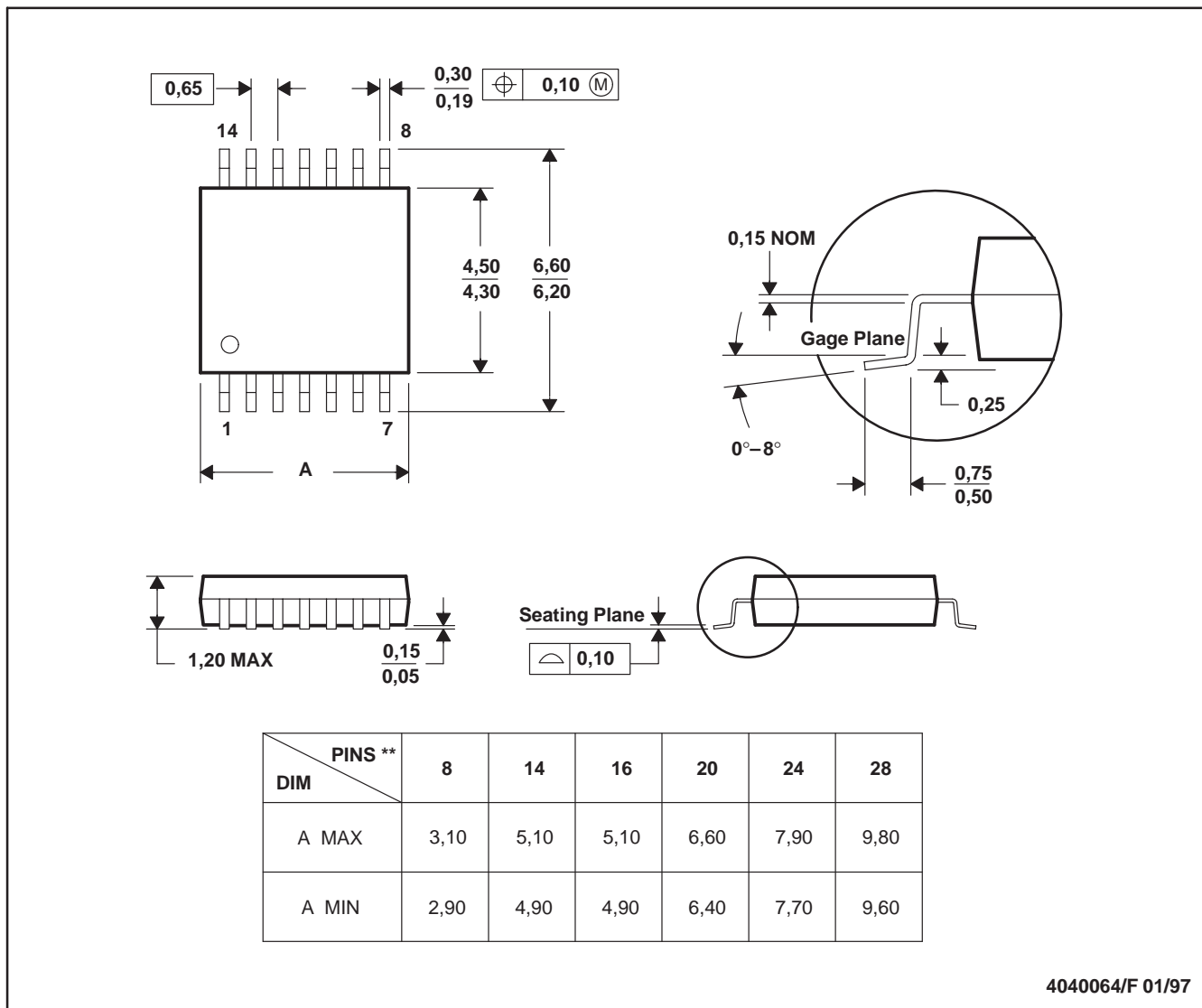


- NOTES: A. All linear dimensions are in millimeters.
 B. This drawing is subject to change without notice.
 C. Body dimensions do not include mold flash or protrusion not to exceed 0,15.
 D. Falls within JEDEC MO-150

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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