

## FEATURES

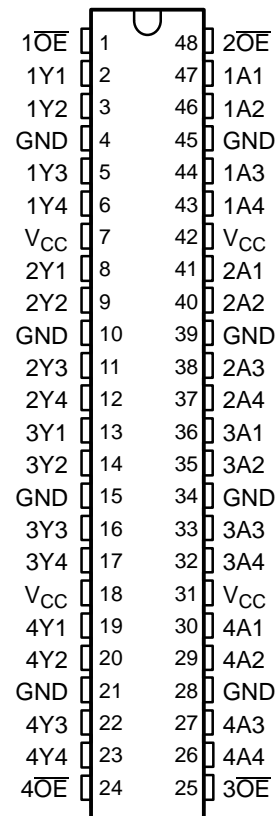
- Member of the Texas Instruments Widebus™ Family
- Operates From 1.65 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 4.4 ns at 3.3 V
- Typical  $V_{OLP}$  (Output Ground Bounce) <0.8 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Typical  $V_{OHV}$  (Output  $V_{OH}$  Undershoot) >2 V at  $V_{CC} = 3.3$  V,  $T_A = 25^\circ\text{C}$
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- Output Ports Have Equivalent 26- $\Omega$  Series Resistors, So No External Resistors Are Required
- $I_{off}$  Supports Partial-Power-Down Mode Operation
- Latch-Up Performance Exceeds 100 mA Per JESD 78, Class II
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 1000-V Charged-Device Model (C101)

## DESCRIPTION/ORDERING INFORMATION

This 16-bit buffer/driver is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

The SN74LVC162244A is designed specifically to improve both the performance and density of 3-state memory address drivers, clock drivers, and bus-oriented receivers and transmitters. The device can be used as four 4-bit buffers, two 8-bit buffers, or one 16-bit buffer. It provides true outputs and symmetrical active-low output-enable ( $\overline{OE}$ ) inputs.

DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



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.

Widebus is a trademark of Texas Instruments.

**SN74LVC162244A**  
**16-BIT BUFFER/DRIVER**  
**WITH 3-STATE OUTPUTS**



SCAS758A–DECEMBER 2003–REVISED OCTOBER 2005

**ORDERING INFORMATION**

| $T_A$         | PACKAGE (1)           |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|-----------------------|---------------|-----------------------|------------------|
| –40°C to 85°C | FBGA – GRD            | Tape and reel | SN74LVC162244AGRDR    | LD2244A          |
|               | FBGA – ZRD (Pb-free)  |               | SN74LVC162244AZRDR    |                  |
|               | SSOP – DL             | Tube          | SN74LVC162244ADL      | LVC162244A       |
|               |                       | Tape and reel | SN74LVC162244ADLR     |                  |
|               | TSSOP – DGG           | Tape and reel | SN74LVC162244ADGGR    | LVC162244A       |
|               |                       |               | 74LVC162244ADGGRG4    |                  |
|               | TVSOP – DGV           | Tape and reel | SN74LVC162244ADGVR    | LD2244A          |
|               |                       |               | 74LVC162244ADGVRE4    |                  |
|               | VFBGA – GQL           | Tape and reel | SN74LVC162244AGQLR    | LD2244A          |
|               | VFBGA – ZQL (Pb-free) |               | SN74LVC162244AZQLR    |                  |

(1) 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).

## DESCRIPTION/ORDERING INFORMATION (CONTINUED)

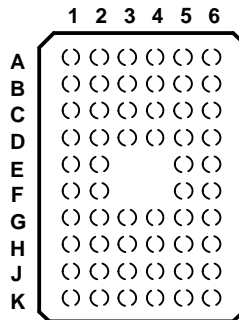
The outputs, which are designed to sink up to 12 mA, include equivalent 26-Ω resistors to reduce overshoot and undershoot.

Inputs can be driven from either 3.3-V or 5-V devices. This feature allows the use of this device as a translator in a mixed 3.3-V/5-V system environment.

This device is fully specified for partial-power-down applications using  $I_{off}$ . The  $I_{off}$  circuitry disables the outputs, preventing damaging current backflow through the device when it is powered down.

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.

**GQL OR ZQL PACKAGE  
(TOP VIEW)**

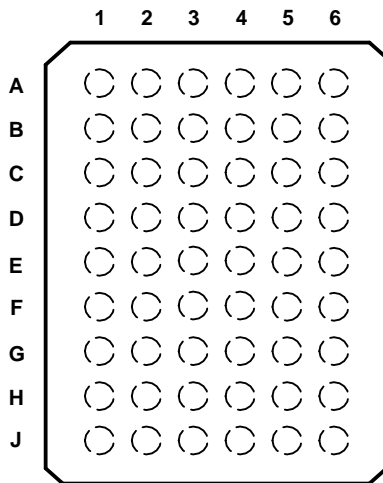


**TERMINAL ASSIGNMENTS<sup>(1)</sup>  
(56-Ball GQL/ZQL Package)**

|          | 1                | 2   | 3        | 4        | 5   | 6                |
|----------|------------------|-----|----------|----------|-----|------------------|
| <b>A</b> | $1\overline{OE}$ | NC  | NC       | NC       | NC  | $2\overline{OE}$ |
| <b>B</b> | 1Y2              | 1Y1 | GND      | GND      | 1A1 | 1A2              |
| <b>C</b> | 1Y4              | 1Y3 | $V_{CC}$ | $V_{CC}$ | 1A3 | 1A4              |
| <b>D</b> | 2Y2              | 2Y1 | GND      | GND      | 2A1 | 2A2              |
| <b>E</b> | 2Y4              | 2Y3 |          |          | 2A3 | 2A4              |
| <b>F</b> | 3Y1              | 3Y2 |          |          | 3A2 | 3A1              |
| <b>G</b> | 3Y3              | 3Y4 | GND      | GND      | 3A4 | 3A3              |
| <b>H</b> | 4Y1              | 4Y2 | $V_{CC}$ | $V_{CC}$ | 4A2 | 4A1              |
| <b>J</b> | 4Y3              | 4Y4 | GND      | GND      | 4A4 | 4A3              |
| <b>K</b> | $4\overline{OE}$ | NC  | NC       | NC       | NC  | $3\overline{OE}$ |

(1) NC - No internal connection

**GRD OR ZRD PACKAGE  
(TOP VIEW)**



**TERMINAL ASSIGNMENTS<sup>(1)</sup>  
(54-Ball GRD/ZRD Package)**

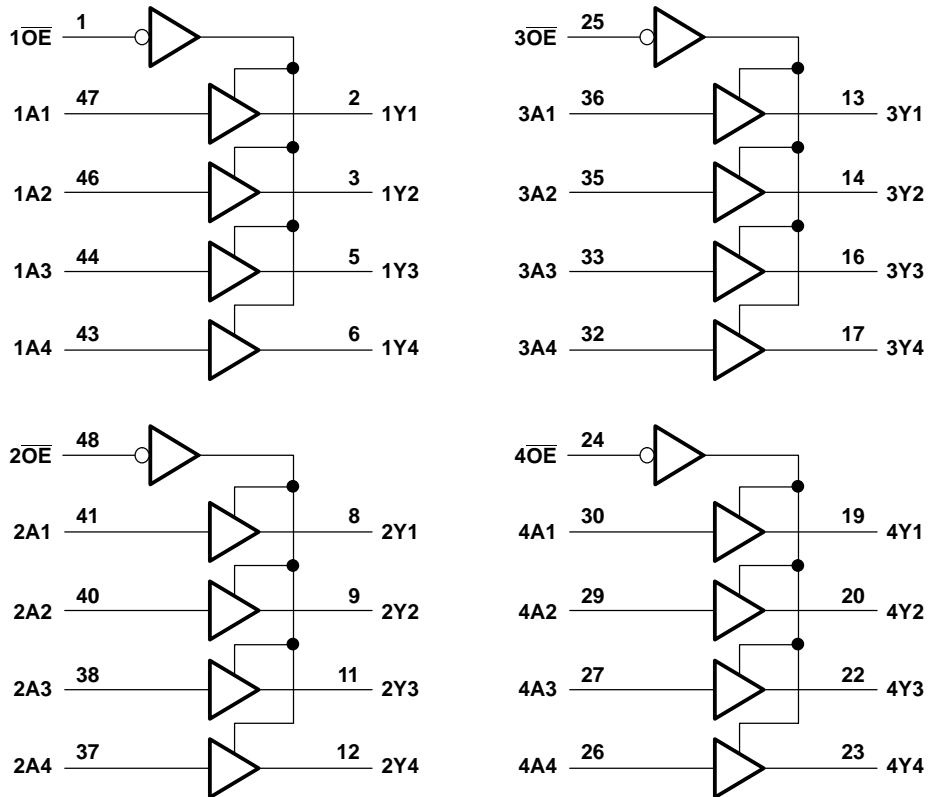
|          | 1   | 2   | 3                | 4                | 5   | 6   |
|----------|-----|-----|------------------|------------------|-----|-----|
| <b>A</b> | 1Y1 | NC  | $1\overline{OE}$ | $2\overline{OE}$ | NC  | 1A1 |
| <b>B</b> | 1Y3 | 1Y2 | NC               | NC               | 1A2 | 1A3 |
| <b>C</b> | 2Y1 | 1Y4 | $V_{CC}$         | $V_{CC}$         | 1A4 | 2A1 |
| <b>D</b> | 2Y3 | 2Y2 | GND              | GND              | 2A2 | 2A3 |
| <b>E</b> | 3Y1 | 2Y4 | GND              | GND              | 2A4 | 3A1 |
| <b>F</b> | 3Y3 | 3Y2 | GND              | GND              | 3A2 | 3A3 |
| <b>G</b> | 4Y1 | 3Y4 | $V_{CC}$         | $V_{CC}$         | 3A4 | 4A1 |
| <b>H</b> | 4Y3 | 4Y2 | NC               | NC               | 4A2 | 4A3 |
| <b>J</b> | 4Y4 | NC  | $4\overline{OE}$ | $3\overline{OE}$ | NC  | 4A4 |

(1) NC - No internal connection

**FUNCTION TABLE**  
**(EACH 4-BIT BUFFER)**

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

**LOGIC DIAGRAM (POSITIVE LOGIC)**



Pin numbers shown are for the DGG, DGV, and DL packages.

## Absolute Maximum Ratings<sup>(1)</sup>

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

|                  |   | MIN                | MAX                   | UNIT |
|------------------|---|--------------------|-----------------------|------|
| V <sub>CC</sub>  | Supply voltage range  | −0.5               | 6.5                   | V    |
| V <sub>I</sub>   | Input voltage range <sup>(2)</sup>  | −0.5               | 6.5                   | V    |
| V <sub>O</sub>   | Voltage range applied to any output in the high-impedance or power-off state <sup>(2)</sup> | −0.5               | 6.5                   | V    |
| V <sub>O</sub>   | Voltage range applied to any output in the high or low state <sup>(2)(3)</sup>              | −0.5               | V <sub>CC</sub> + 0.5 | V    |
| I <sub>IK</sub>  | Input clamp current   | V <sub>I</sub> < 0 | −50                   | mA   |
| I <sub>OK</sub>  | Output clamp current  | V <sub>O</sub> < 0 | −50                   | mA   |
| I <sub>O</sub>   | Continuous output current   |                    | ±50                   | mA   |
|                  | Continuous current through each V <sub>CC</sub> or GND                                      |                    | ±100                  | mA   |
| θ <sub>JA</sub>  | Package thermal impedance <sup>(4)</sup>  | DGG package        | 70                    | °C/W |
|                  |   | DGV package        | 58                    |      |
|                  |   | DL package         | 63                    |      |
|                  |   | GQL/ZQL package    | 42                    |      |
|                  |   | GRD/ZRD package    | 36                    |      |
| T <sub>stg</sub> | Storage temperature range   | −65                | 150                   | °C   |

- (1) 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.
- (2) The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
- (3) The value of V<sub>CC</sub> is provided in the recommended operating conditions table.
- (4) The package thermal impedance is calculated in accordance with JESD 51-7.

## Recommended Operating Conditions<sup>(1)</sup>

|                 |                                    | MIN                                | MAX                    | UNIT                   |    |
|-----------------|------------------------------------|------------------------------------|------------------------|------------------------|----|
| V <sub>CC</sub> | Supply voltage                     | Operating                          | 1.65                   | 3.6                    | V  |
|                 |                                    | Data retention only                | 1.5                    |                        |    |
| V <sub>IH</sub> | High-level input voltage           | V <sub>CC</sub> = 1.65 V to 1.95 V | 0.65 × V <sub>CC</sub> |                        | V  |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   | 1.7                    |                        |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   | 2                      |                        |    |
| V <sub>IL</sub> | Low-level input voltage            | V <sub>CC</sub> = 1.65 V to 1.95 V |                        | 0.35 × V <sub>CC</sub> | V  |
|                 |                                    | V <sub>CC</sub> = 2.3 V to 2.7 V   |                        | 0.7                    |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V to 3.6 V   |                        | 0.8                    |    |
| V <sub>I</sub>  | Input voltage                      | 0                                  | 5.5                    | V                      |    |
| V <sub>O</sub>  | Output voltage                     | High or low state                  | 0                      | V <sub>CC</sub>        | V  |
|                 |                                    | High-impedance state               | 0                      | 5.5                    |    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V           |                        | −2                     | mA |
|                 |                                    | V <sub>CC</sub> = 2.3 V            |                        | −4                     |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V            |                        | −8                     |    |
|                 |                                    | V <sub>CC</sub> = 3 V              |                        | −12                    |    |
| I <sub>OL</sub> | Low-level output current           | V <sub>CC</sub> = 1.65 V           |                        | 2                      | mA |
|                 |                                    | V <sub>CC</sub> = 2.3 V            |                        | 4                      |    |
|                 |                                    | V <sub>CC</sub> = 2.7 V            |                        | 8                      |    |
|                 |                                    | V <sub>CC</sub> = 3 V              |                        | 12                     |    |
| Δt/Δv           | Input transition rise or fall rate |                                    | 10                     | ns/V                   |    |
| T <sub>A</sub>  | Operating free-air temperature     | −40                                | 85                     | °C                     |    |

- (1) 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.

# SN74LVC162244A

## 16-BIT BUFFER/DRIVER

### WITH 3-STATE OUTPUTS

SCAS758A–DECEMBER 2003–REVISED OCTOBER 2005

### Electrical Characteristics

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

| PARAMETER        | TEST CONDITIONS  | V <sub>CC</sub> | MIN                   | TYP <sup>(1)</sup> | MAX  | UNIT |    |
|------------------|--|-----------------|-----------------------|--------------------|------|------|----|
| V <sub>OH</sub>  | I <sub>OH</sub> = -100 μA  | 1.65 V to 3.6 V | V <sub>CC</sub> - 0.2 |                    |      | V    |    |
|                  | I <sub>OH</sub> = -2 mA  | 1.65 V          | 1.2                   |                    |      |      |    |
|                  | I <sub>OH</sub> = -4 mA  | 2.3 V           | 1.7                   |                    |      |      |    |
|                  |  | 2.7 V           | 2.2                   |                    |      |      |    |
|                  | I <sub>OH</sub> = -6 mA  | 3 V             | 2.4                   |                    |      |      |    |
|                  | I <sub>OH</sub> = -8 mA  | 2.7 V           | 2                     |                    |      |      |    |
| V <sub>OL</sub>  | I <sub>OL</sub> = 100 μA   | 1.65 V to 3.6 V |                       |                    | 0.2  | V    |    |
|                  | I <sub>OL</sub> = 2 mA   | 1.65 V          |                       |                    | 0.45 |      |    |
|                  | I <sub>OL</sub> = 4 mA   | 2.3 V           |                       |                    | 0.7  |      |    |
|                  |  | 2.7 V           |                       |                    | 0.4  |      |    |
|                  | I <sub>OL</sub> = 6 mA   | 3 V             |                       |                    | 0.55 |      |    |
|                  | I <sub>OL</sub> = 8 mA   | 2.7 V           |                       |                    | 0.6  |      |    |
| I <sub>I</sub>   | V <sub>I</sub> = 0 to 5.5 V  | 3.6 V           |                       |                    | ±5   | μA   |    |
|                  |  |                 |                       |                    |      |      |    |
| I <sub>off</sub> | V <sub>I</sub> or V <sub>O</sub> = 5.5 V                                     | 0               |                       |                    | ±10  | μA   |    |
| I <sub>OZ</sub>  | V <sub>O</sub> = 0 to 5.5 V  | 3.6 V           |                       |                    | ±10  | μA   |    |
| I <sub>CC</sub>  | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.6 V           | I <sub>O</sub> = 0    |                    |      | 20   | μA |
|                  | 3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>(2)</sup>                                |                 |                       |                    |      | 20   |    |
| ΔI <sub>CC</sub> | One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND | 2.7 V to 3.6 V  |                       |                    | 500  | μA   |    |
| C <sub>i</sub>   | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           |                       |                    | 5.5  | pF   |    |
| C <sub>o</sub>   | V <sub>O</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           |                       |                    | 6    | pF   |    |

(1) All typical values are at V<sub>CC</sub> = 3.3 V, T<sub>A</sub> = 25°C.

(2) This applies in the disabled state only.

### Switching Characteristics

over recommended operating free-air temperature range (unless otherwise noted) (see Figure 1)

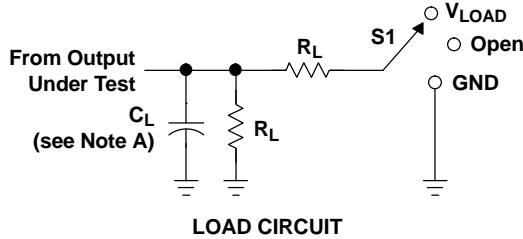
| PARAMETER        | FROM (INPUT)    | TO (OUTPUT) | V <sub>CC</sub> = 1.8 V ± 0.15 V |     | V <sub>CC</sub> = 2.5 V ± 0.2 V |     | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | UNIT |
|------------------|-----------------|-------------|----------------------------------|-----|---------------------------------|-----|-------------------------|-----|---------------------------------|-----|------|
|                  |                 |             | MIN                              | MAX | MIN                             | MAX | MIN                     | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A               | Y           | 1.5                              | 6   | 1                               | 4.3 | 1                       | 5.6 | 1.1                             | 4.4 | ns   |
| t <sub>en</sub>  | $\overline{OE}$ | Y           | 1.5                              | 7.3 | 1                               | 5   | 1                       | 6.9 | 1                               | 5.5 | ns   |
| t <sub>dis</sub> | $\overline{OE}$ | Y           | 1.5                              | 8.9 | 1                               | 5.5 | 1                       | 6.8 | 1.8                             | 6.3 | ns   |

### Operating Characteristics

T<sub>A</sub> = 25°C

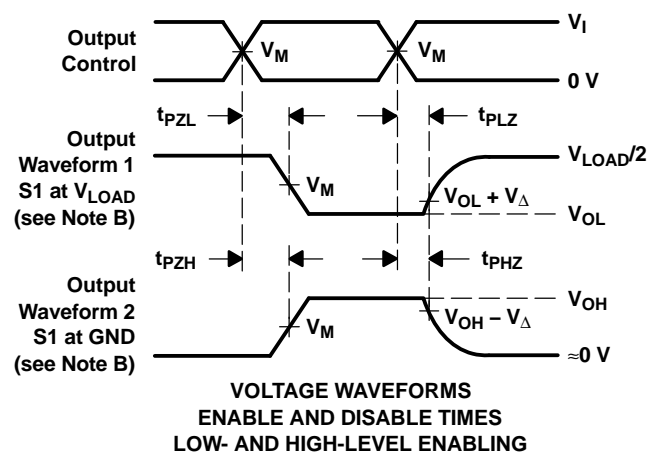
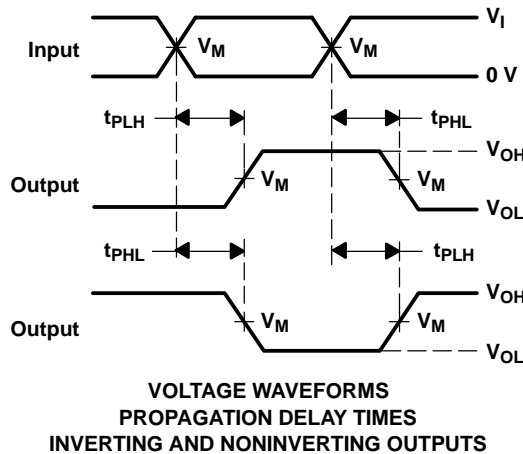
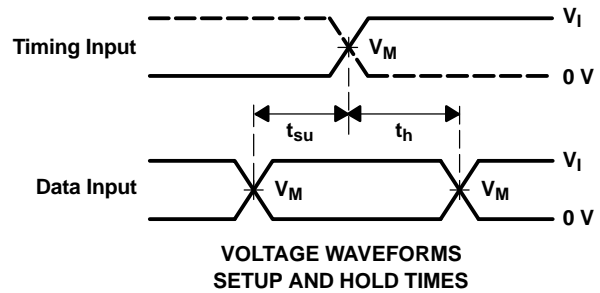
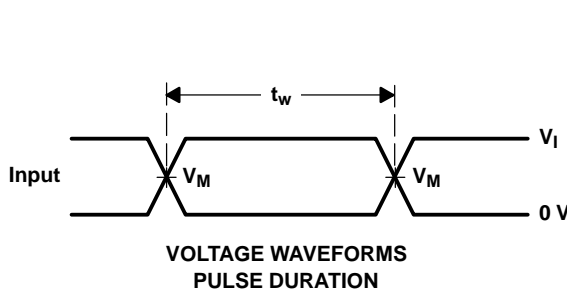
| PARAMETER   | TEST CONDITIONS  | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V | V <sub>CC</sub> = 3.3 V | UNIT |
|---|------------------|-------------------------|-------------------------|-------------------------|------|
|   |                  | TYP                     | TYP                     | TYP                     |      |
| C <sub>pd</sub> Power dissipation capacitance per buffer/driver | Outputs enabled  | 31                      | 33                      | 35                      | pF   |
|   | Outputs disabled | 2                       | 3                       | 4                       |      |

PARAMETER MEASUREMENT INFORMATION



| TEST              | S1         |
|-------------------|------------|
| $t_{PLH}/t_{PHL}$ | Open       |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND        |

| $V_{CC}$                         | INPUTS   |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V       |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V       |
| 2.7 V                            | 2.7 V    | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 2.7 V    | $\leq 2.5\text{ ns}$ | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |



- 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:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ .
  - D. The outputs are measured one at a time, with one transition per measurement.
  - E.  $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - F.  $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - G.  $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - H. All parameters and waveforms are not applicable to all devices.

Figure 1. Load Circuit and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device   | Status<br>(1) | Package Type               | Package Drawing | Pins | Package Qty | Eco Plan<br>(2)         | Lead/Ball Finish | MSL Peak Temp<br>(3) | Samples<br>(Requires Login) |
|--------------------|---------------|----------------------------|-----------------|------|-------------|-------------------------|------------------|----------------------|-----------------------------|
| 74LVC162244ADGGRE4 | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| 74LVC162244ADGGRG4 | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| 74LVC162244ADGVRE4 | ACTIVE        | TVSOP                      | DGV             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| 74LVC162244ADGVRG4 | ACTIVE        | TVSOP                      | DGV             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| 74LVC162244ADLRG4  | ACTIVE        | SSOP                       | DL              | 48   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244ADGGR | ACTIVE        | TSSOP                      | DGG             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244ADGVR | ACTIVE        | TVSOP                      | DGV             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244ADL   | ACTIVE        | SSOP                       | DL              | 48   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244ADLG4 | ACTIVE        | SSOP                       | DL              | 48   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244ADLR  | ACTIVE        | SSOP                       | DL              | 48   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   |                             |
| SN74LVC162244AGQLR | OBSOLETE      | BGA<br>MICROSTAR<br>JUNIOR | GQL             | 56   |             | TBD                     | Call TI          | Call TI              |                             |
| SN74LVC162244AZQLR | ACTIVE        | BGA<br>MICROSTAR<br>JUNIOR | ZQL             | 56   | 1000        | Green (RoHS & no Sb/Br) | SNAGCU           | Level-1-260C-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.



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<sup>(2)</sup> 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)

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

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**TAPE AND REEL INFORMATION**

**QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE**


\*All dimensions are nominal

| Device             | Package Type         | Package Drawing | Pins | SPQ  | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|--------------------|----------------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC162244ADGGR | TSSOP                | DGG             | 48   | 2000 | 330.0              | 24.4               | 8.6     | 15.8    | 1.8     | 12.0    | 24.0   | Q1            |
| SN74LVC162244ADGVR | TVSOP                | DGV             | 48   | 2000 | 330.0              | 16.4               | 7.1     | 10.2    | 1.6     | 12.0    | 16.0   | Q1            |
| SN74LVC162244ADLR  | SSOP                 | DL              | 48   | 1000 | 330.0              | 32.4               | 11.35   | 16.2    | 3.1     | 16.0    | 32.0   | Q1            |
| SN74LVC162244AZQLR | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 330.0              | 16.4               | 4.8     | 7.3     | 1.5     | 8.0     | 16.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

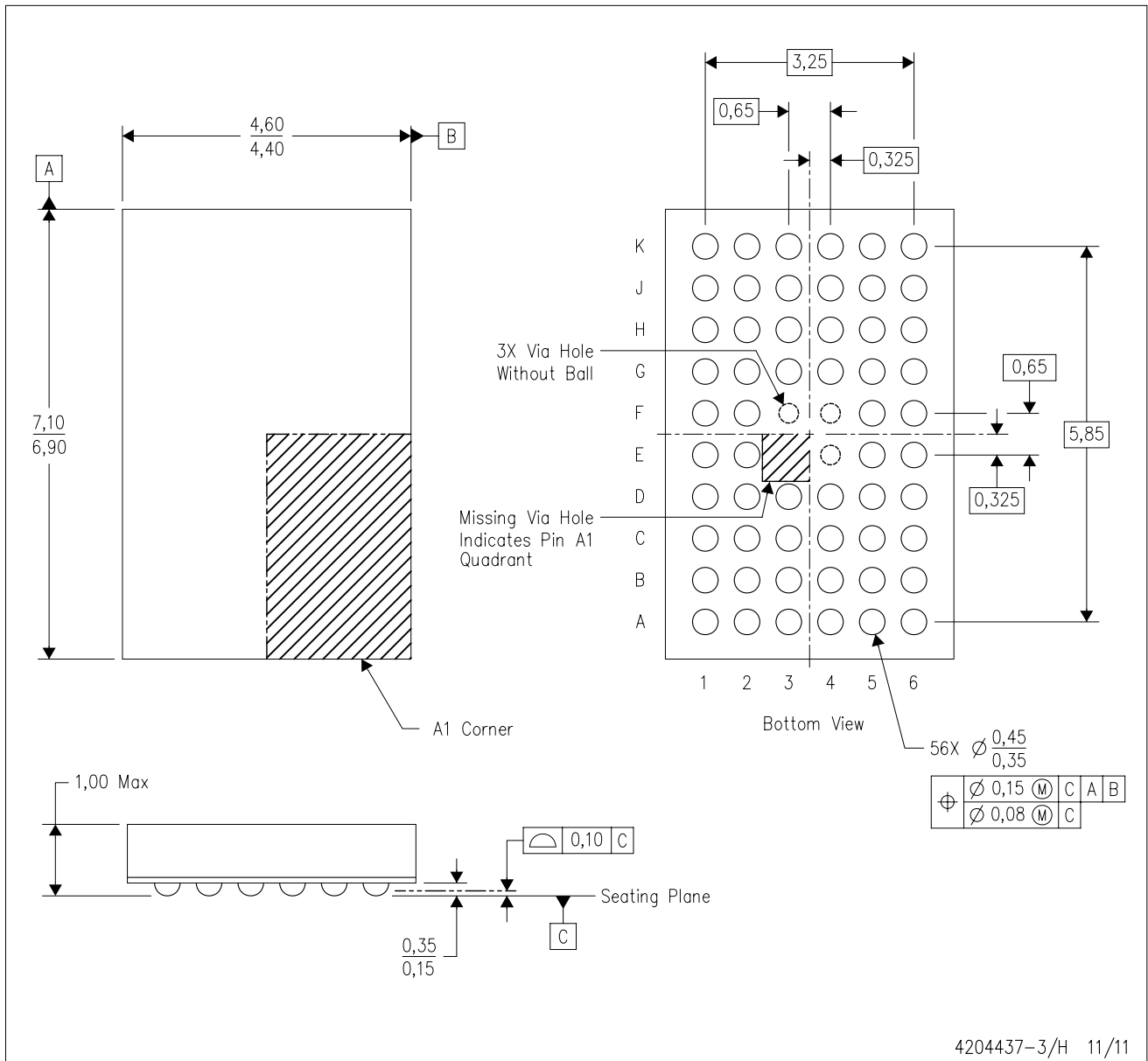


\*All dimensions are nominal

| Device             | Package Type         | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|--------------------|----------------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC162244ADGGR | TSSOP                | DGG             | 48   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LVC162244ADGVR | TVSOP                | DGV             | 48   | 2000 | 367.0       | 367.0      | 38.0        |
| SN74LVC162244ADLR  | SSOP                 | DL              | 48   | 1000 | 367.0       | 367.0      | 55.0        |
| SN74LVC162244AZQLR | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 333.2       | 345.9      | 28.6        |

ZQL (R-PBGA-N56)

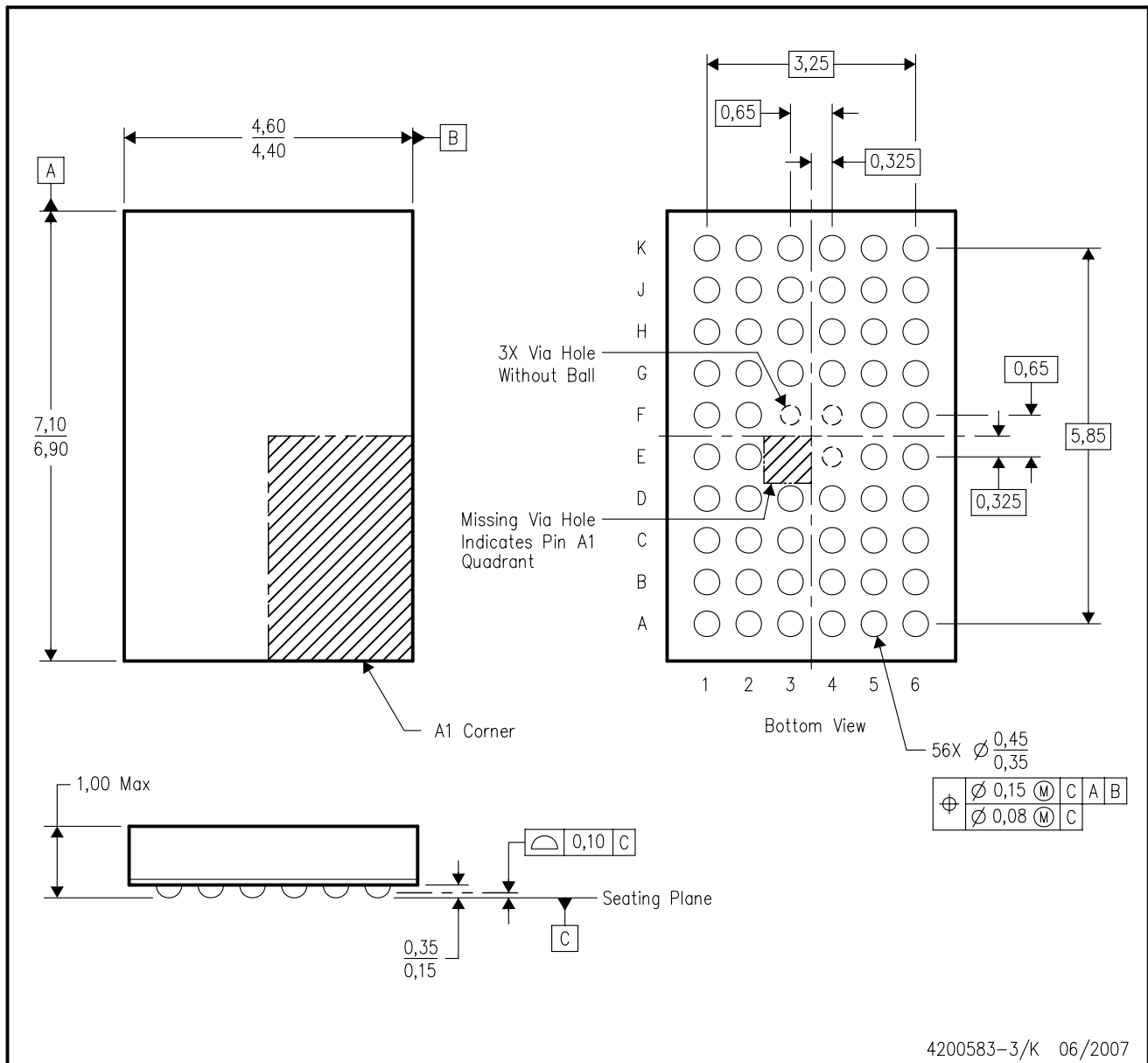
PLASTIC BALL GRID ARRAY



- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BA-2.
  - D. This package is Pb-free. Refer to the 56 GQL package (drawing 4200583) for tin-lead (SnPb).

GQL (R-PBGA-N56)

PLASTIC BALL GRID ARRAY

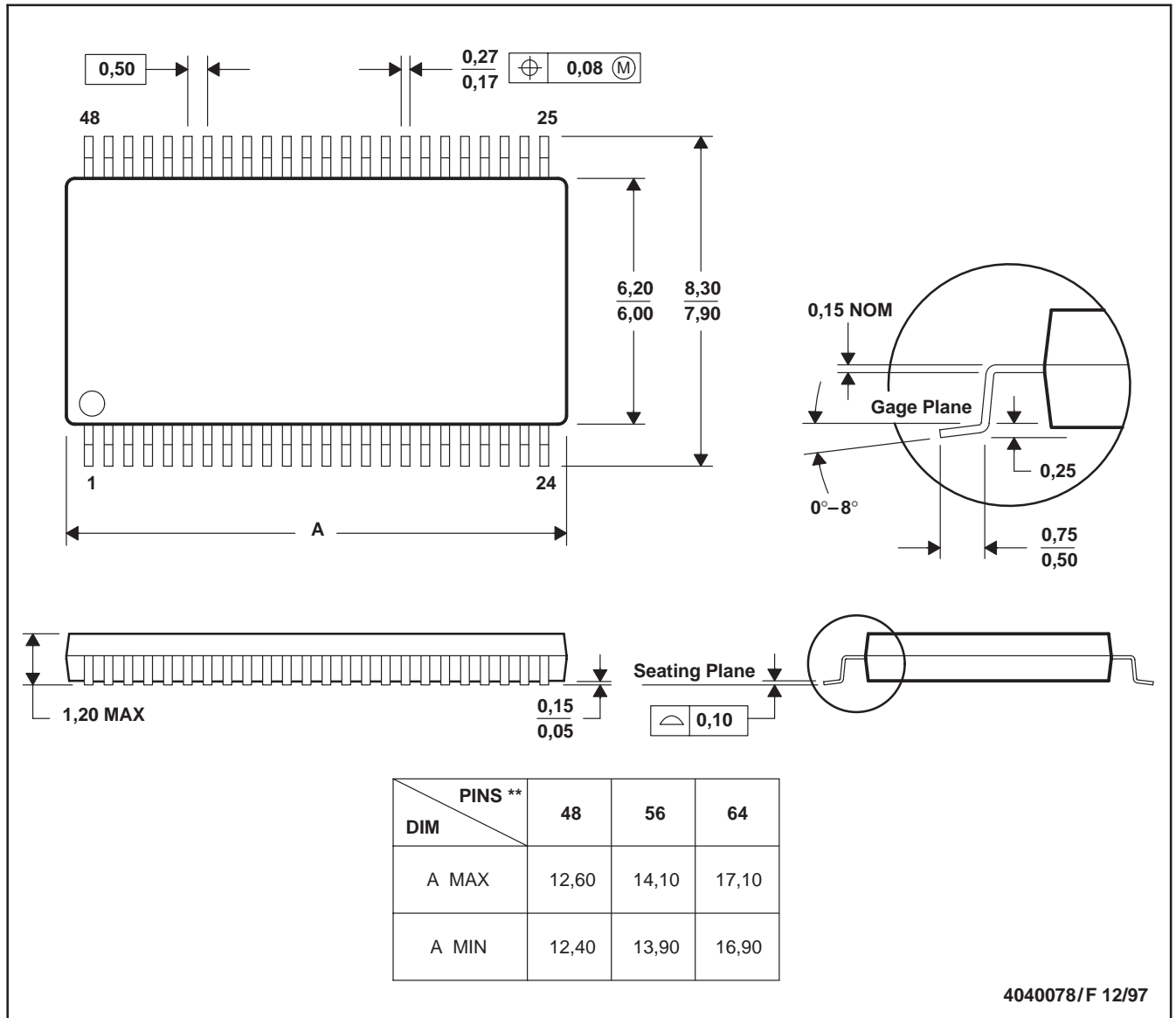


- NOTES:
- A. All linear dimensions are in millimeters. Dimensioning and tolerancing per ASME Y14.5M-1994.
  - B. This drawing is subject to change without notice.
  - C. Falls within JEDEC MO-285 variation BA-2.
  - D. This package is tin-lead (SnPb). Refer to the 56 ZQL package (drawing 4204437) for lead-free.

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

PLASTIC SMALL-OUTLINE PACKAGE

48 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 protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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|                               |  |
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