

## FEATURES

- Member of the Texas Instruments Widebus™ Family
- Operates From 1.65 V to 3.6 V
- Max  $t_{pd}$  of 4.4 ns at 3.3 V
- $\pm 12$ -mA Output Drive at 3.3 V
- Output Ports Have Equivalent 26- $\Omega$  Series Resistors, So No External Resistors Are Required
- Bus Hold on Data Inputs Eliminates the Need for External Pullup/Pulldown Resistors
- Latch-Up Performance Exceeds 250 mA Per JESD 17

## DESCRIPTION/ORDERING INFORMATION

This 1-bit to 4-bit address driver is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

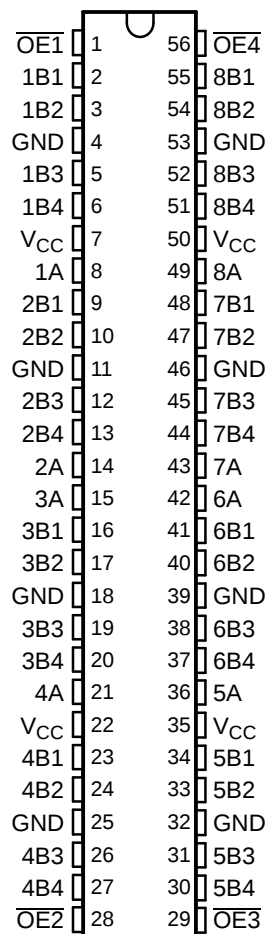
The SN74ALVCH162344 is used in applications in which four separate memory locations must be addressed by a single address.

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

To ensure the high-impedance state during power up or power down, the output-enable ( $\overline{OE}$ ) inputs 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.

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.

DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| -40°C to 85°C | SSOP - DL              | Tube          | SN74ALVCH162344DL     | ALVCH162344      |
|               |                        | Tape and reel | SN74ALVCH162344DLR    |                  |
|               | TSSOP - DGG            | Tape and reel | SN74ALVCH162344GR     | ALVCH162344      |
|               | TVSOP - DGV            | Tape and reel | SN74ALVCH162344VR     | VH2344           |

(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).



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.

**SN74ALVCH162344**  
**1-BIT TO 4-BIT ADDRESS DRIVER**  
**WITH 3-STATE OUTPUTS**

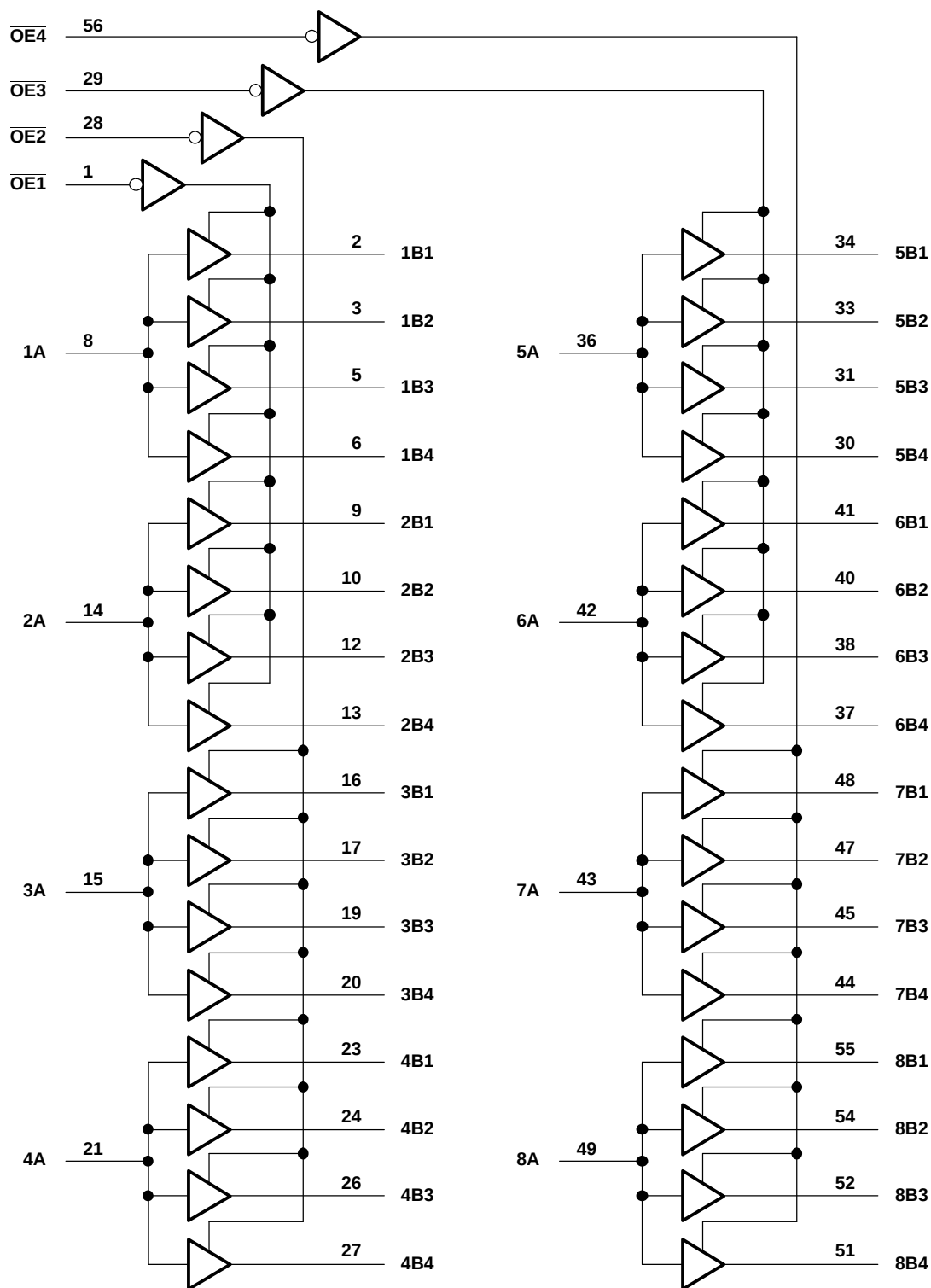
SCES085I–AUGUST 1996–REVISED OCTOBER 2004

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**A-TO-B FUNCTION TABLE**

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

**LOGIC DIAGRAM (POSITIVE LOGIC)**



# SN74ALVCH162344

## 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

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### 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               | 4.6                   | V      |
| V <sub>I</sub>   | Input voltage range <sup>(2)</sup>                     | -0.5               | 4.6                   | V      |
| V <sub>O</sub>   | Output voltage range <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        |                       | 64     |
|                  |                                                        | DGV package        |                       | 48     |
|                  |                                                        | DL package         |                       | 56     |
| 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) This value is limited to 4.6 V maximum.
- (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                     | 1.65                               | 3.6                    | V    |
| 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                                  | V <sub>CC</sub>        | V    |
| V <sub>O</sub>  | Output voltage                     | 0                                  | V <sub>CC</sub>        | V    |
| I <sub>OH</sub> | High-level output current          | V <sub>CC</sub> = 1.65 V           | -2                     | mA   |
|                 |                                    | V <sub>CC</sub> = 2.3 V            | -6                     |      |
|                 |                                    | 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            | 6                      |      |
|                 |                                    | 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 control 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> | 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           | 1.9                   |                    |      |      |
|                      |                                                                              | I <sub>OH</sub> = -6 mA                    | 2.3 V           | 1.7                   |                    |      |      |
|                      |                                                                              |                                            | 3 V             | 2.4                   |                    |      |      |
|                      |                                                                              | I <sub>OH</sub> = -8 mA                    | 2.7 V           | 2                     |                    |      |      |
|                      |                                                                              | I <sub>OH</sub> = -12 mA                   | 3 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           |                       |                    | 0.4  |      |
|                      |                                                                              | I <sub>OL</sub> = 6 mA                     | 2.3 V           |                       |                    | 0.55 |      |
|                      |                                                                              |                                            | 3 V             |                       |                    | 0.55 |      |
|                      |                                                                              | I <sub>OL</sub> = 8 mA                     | 2.7 V           |                       |                    | 0.6  |      |
|                      |                                                                              | I <sub>OL</sub> = 12 mA                    | 3 V             |                       |                    | 0.8  |      |
| I <sub>I</sub>       | V <sub>I</sub> = V <sub>CC</sub> or GND                                      |                                            | 3.6 V           |                       |                    | ±5   | μA   |
| I <sub>I(hold)</sub> |                                                                              | V <sub>I</sub> = 0.58 V                    | 1.65 V          | 25                    |                    |      | μA   |
|                      |                                                                              | V <sub>I</sub> = 1.07 V                    | 1.65 V          | -25                   |                    |      |      |
|                      |                                                                              | V <sub>I</sub> = 0.7 V                     | 2.3 V           | 45                    |                    |      |      |
|                      |                                                                              | V <sub>I</sub> = 1.7 V                     | 2.3 V           | -45                   |                    |      |      |
|                      |                                                                              | V <sub>I</sub> = 0.8 V                     | 3 V             | 75                    |                    |      |      |
|                      |                                                                              | V <sub>I</sub> = 2 V                       | 3 V             | -75                   |                    |      |      |
|                      |                                                                              | V <sub>I</sub> = 0 to 3.6 V <sup>(2)</sup> | 3.6 V           |                       |                    | ±500 |      |
| I <sub>OZ</sub>      | V <sub>O</sub> = V <sub>CC</sub> or GND                                      |                                            | 3.6 V           |                       |                    | ±10  | μA   |
| I <sub>CC</sub>      | V <sub>I</sub> = V <sub>CC</sub> or GND, I <sub>O</sub> = 0                  |                                            | 3.6 V           |                       |                    | 40   | μA   |
| ΔI <sub>CC</sub>     | One input at V <sub>CC</sub> - 0.6 V, Other inputs at V <sub>CC</sub> or GND |                                            | 3 V to 3.6 V    |                       |                    | 750  | μA   |
| C <sub>i</sub>       | Control inputs                                                               | V <sub>I</sub> = V <sub>CC</sub> or GND    | 3.3 V           | 2.5                   |                    |      | pF   |
|                      | Data inputs                                                                  |                                            |                 | 3.5                   |                    |      |      |
| C <sub>o</sub>       | Outputs                                                                      | V <sub>O</sub> = V <sub>CC</sub> or GND    | 3.3 V           | 4                     |                    |      | pF   |

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

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

## SWITCHING CHARACTERISTICS

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

| PARAMETER                         | FROM<br>(INPUT) | TO<br>(OUTPUT) | V <sub>CC</sub> = 1.8 V | V <sub>CC</sub> = 2.5 V<br>± 0.2 V |     | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V<br>± 0.3 V |     | UNIT |
|-----------------------------------|-----------------|----------------|-------------------------|------------------------------------|-----|-------------------------|-----|------------------------------------|-----|------|
|                                   |                 |                | TYP                     | MIN                                | MAX | MIN                     | MAX | MIN                                | MAX |      |
| t <sub>pd</sub>                   | A               | B              | (1)                     | 1                                  | 4.9 | 5.1                     |     | 1.4                                | 4.4 | ns   |
| t <sub>en</sub>                   | $\overline{OE}$ | B              | (1)                     | 1                                  | 6.4 | 6.6                     |     | 1.2                                | 5.7 | ns   |
| t <sub>dis</sub>                  | $\overline{OE}$ | B              | (1)                     | 1                                  | 5.4 | 4.7                     |     | 1.2                                | 4.5 | ns   |
| t <sub>sk(o)</sub> <sup>(2)</sup> |                 |                |                         |                                    |     |                         |     | 0.35                               |     | ns   |
| t <sub>sk(o)</sub> <sup>(3)</sup> |                 |                |                         |                                    |     |                         |     | 0.5                                |     | ns   |

(1) This information was not available at the time of publication.

(2) Skew between outputs of the same bank and same package (same transition)

(3) Skew between outputs of all banks of same package (A1–A8 tied together)

# SN74ALVCH162344

## 1-BIT TO 4-BIT ADDRESS DRIVER WITH 3-STATE OUTPUTS

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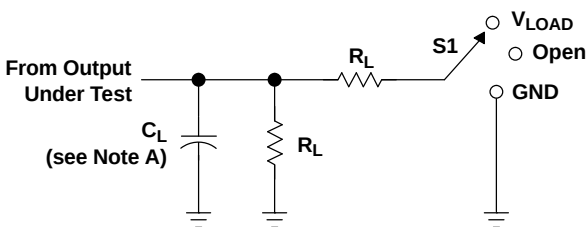
### OPERATING CHARACTERISTICS

$T_A = 25^\circ\text{C}$

| PARAMETER                              |                  | TEST CONDITIONS                           | $V_{CC} = 1.8\text{ V}$ | $V_{CC} = 2.5\text{ V}$ | $V_{CC} = 3.3\text{ V}$ | UNIT |
|----------------------------------------|------------------|-------------------------------------------|-------------------------|-------------------------|-------------------------|------|
|                                        |                  |                                           | TYP                     | TYP                     | TYP                     |      |
| $C_{pd}$ Power dissipation capacitance | Outputs enabled  | $C_L = 0\text{ pF}$ , $f = 10\text{ MHz}$ | (1)                     | 68                      | 82                      | pF   |
|                                        | Outputs disabled |                                           | (1)                     | 12                      | 14                      |      |

(1) This information was not available at the time of publication.

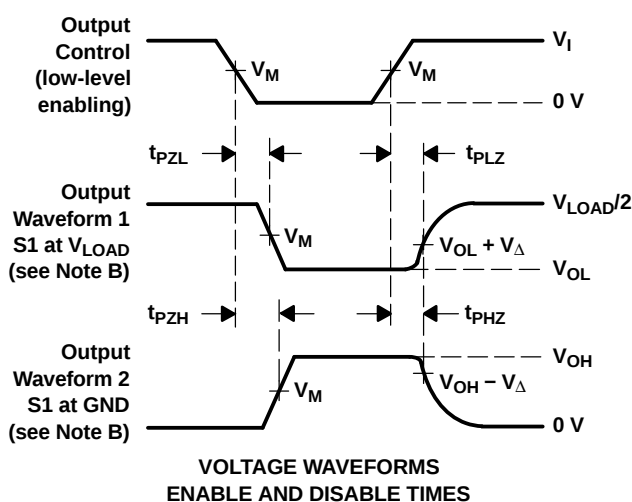
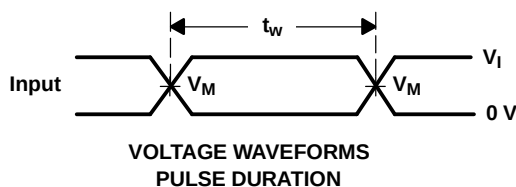
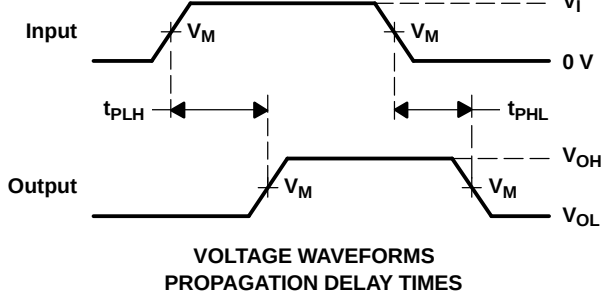
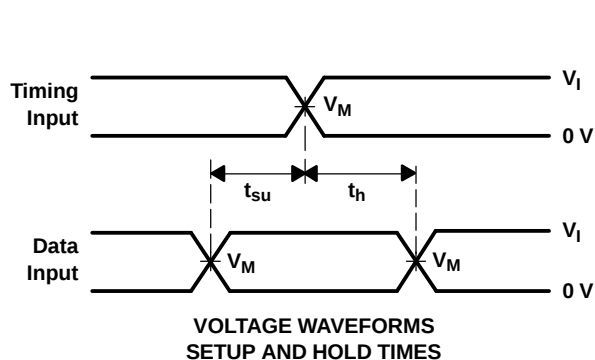
## PARAMETER MEASUREMENT INFORMATION



LOAD CIRCUIT

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

| $V_{CC}$                         | INPUT    |                      | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_{\Delta}$ |
|----------------------------------|----------|----------------------|------------|-------------------|-------|--------------|--------------|
|                                  | $V_I$    | $t_r/t_f$            |            |                   |       |              |              |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2\text{ ns}$   | $V_{CC}/2$ | $2 \times V_{CC}$ | 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:
- $C_L$  includes probe and jig capacitance.
  - 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.
  - All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\text{ }\Omega$ .
  - The outputs are measured one at a time, with one transition per measurement.
  - $t_{PLZ}$  and  $t_{PHZ}$  are the same as  $t_{dis}$ .
  - $t_{PZL}$  and  $t_{PZH}$  are the same as  $t_{en}$ .
  - $t_{PLH}$  and  $t_{PHL}$  are the same as  $t_{pd}$ .
  - 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<br>Drawing | Pins | Package<br>Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|-------------------|---------------|--------------|--------------------|------|----------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74ALVCH162344DL | ACTIVE        | SSOP         | DL                 | 56   | 20             | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | ALVCH162344             | <a href="#">Samples</a> |
| SN74ALVCH162344GR | ACTIVE        | TSSOP        | DGG                | 56   | 2000           | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | ALVCH162344             | <a href="#">Samples</a> |

<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> **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of <=1000ppm threshold. Antimony trioxide based flame retardants must also meet the <=1000ppm threshold requirement.

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

<sup>(4)</sup> There may be additional marking, which relates to the logo, the lot trace code information, or the environmental category on the device.

<sup>(5)</sup> Multiple Device Markings will be inside parentheses. Only one Device Marking contained in parentheses and separated by a "~" will appear on a device. If a line is indented then it is a continuation of the previous line and the two combined represent the entire Device Marking for that device.

<sup>(6)</sup> Lead finish/Ball material - Orderable Devices may have multiple material finish options. Finish options are separated by a vertical ruled line. Lead finish/Ball material values may wrap to two lines if the finish value exceeds the maximum column width.

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## TAPE AND REEL INFORMATION



\*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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74ALVCH162344GR | TSSOP        | DGG             | 56   | 2000 | 330.0              | 24.4               | 8.6     | 15.6    | 1.8     | 12.0    | 24.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS



\*All dimensions are nominal

| Device            | Package Type | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74ALVCH162344GR | TSSOP        | DGG             | 56   | 2000 | 367.0       | 367.0      | 45.0        |

## TUBE

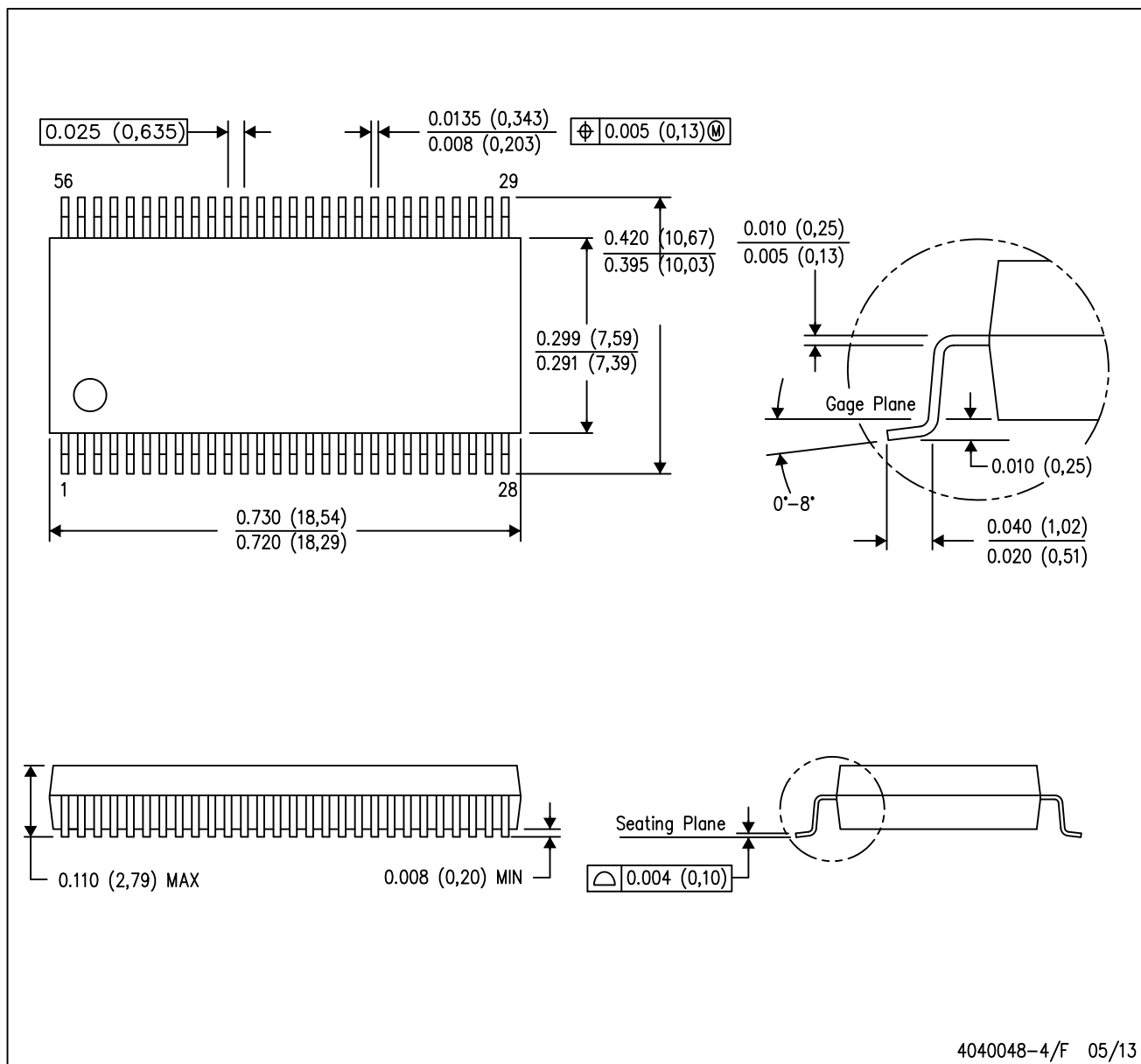


\*All dimensions are nominal

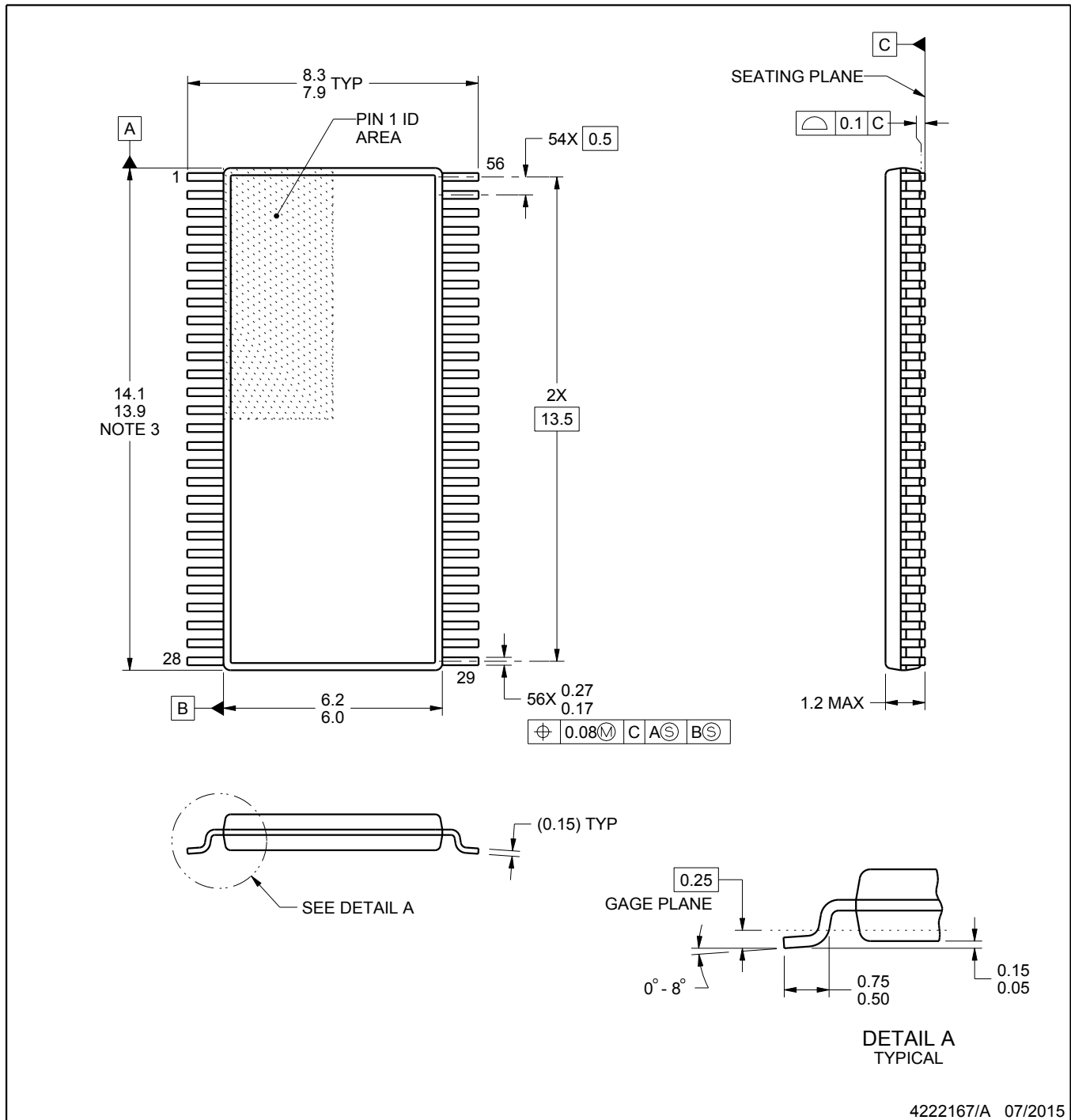
| Device            | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|-------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74ALVCH162344DL | DL           | SSOP         | 56   | 20  | 473.7  | 14.24  | 5110   | 7.87   |

DL (R-PDSO-G56)

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 MO-118



4222167/A 07/2015

## NOTES:

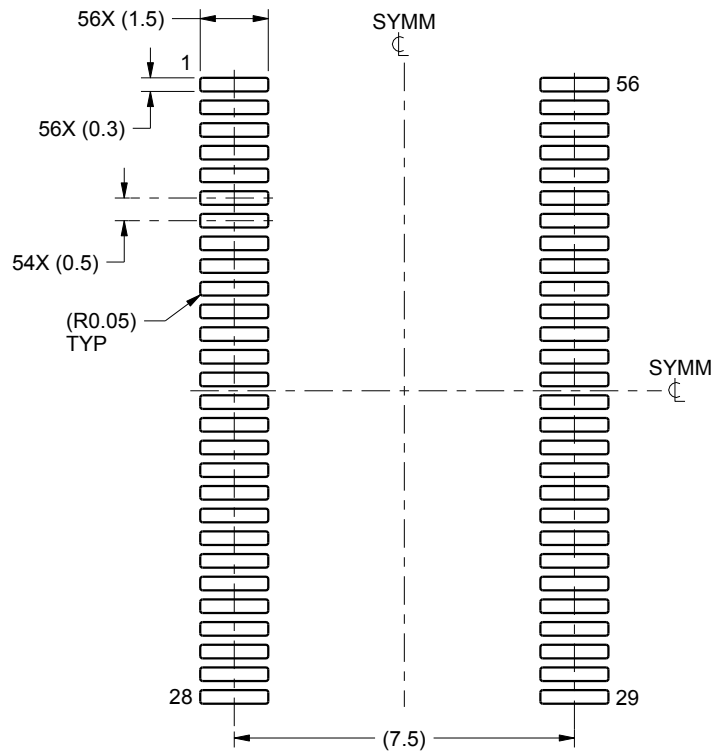
1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

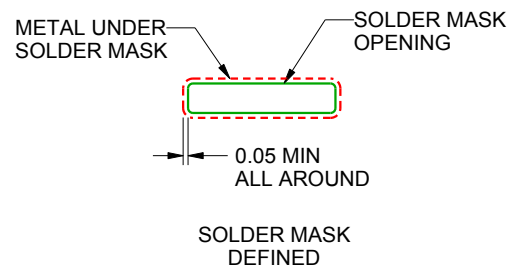
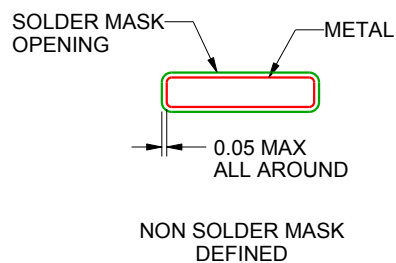
DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
SCALE:6X



SOLDER MASK DETAILS

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NOTES: (continued)

5. Publication IPC-7351 may have alternate designs.

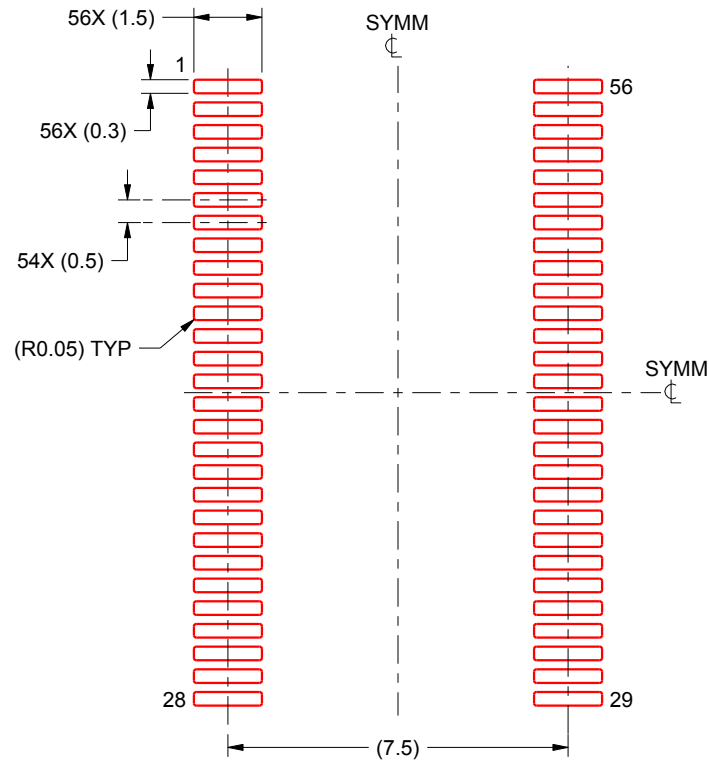
6. Solder mask tolerances between and around signal pads can vary based on board fabrication site.

# EXAMPLE STENCIL DESIGN

DGG0056A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



SOLDER PASTE EXAMPLE  
BASED ON 0.125 mm THICK STENCIL  
SCALE:6X

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NOTES: (continued)

7. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
8. Board assembly site may have different recommendations for stencil design.

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