

## FEATURES

- Member of the Texas Instruments Widebus™ Family
- Operates From 1.65 V to 3.6 V
- Max  $t_{pd}$  of 4.2 ns at 3.3 V
- $\pm 12$ -mA Output Drive at 3.3 V
- All Outputs 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
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model (A114-A)
  - 200-V Machine Model (A115-A)

## DESCRIPTION/ORDERING INFORMATION

This 16-bit (dual-octal) noninverting bus transceiver is designed for 1.65-V to 3.6-V  $V_{CC}$  operation.

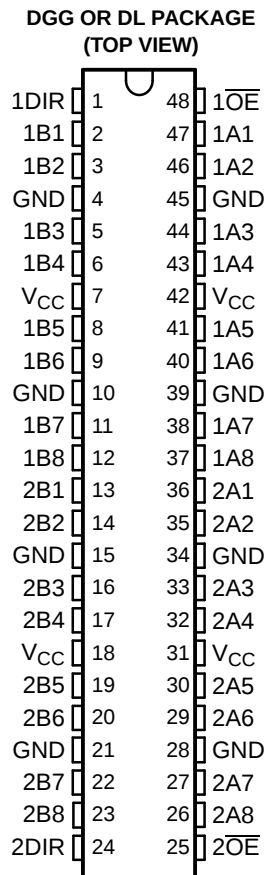
The SN74ALVCHR16245 is designed for asynchronous communication between data buses. The control-function implementation minimizes external timing requirements.

This device can be used as two 8-bit transceivers or one 16-bit transceiver. It allows data transmission from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input. The output-enable ( $\overline{OE}$ ) input can be used to disable the device so that the buses are effectively isolated.

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

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.

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.



## ORDERING INFORMATION

| $T_A$         | PACKAGE <sup>(1)</sup> |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------------------|---------------|-----------------------|------------------|
| -40°C to 85°C | SSOP - DL              | Tape and reel | SN74ALVCHR16245LR     | ALVCHR16245      |
|               | TSSOP - DGG            | Tape and reel | SN74ALVCHR16245GR     | ALVCHR16245      |
|               | VFBGA - GQL            | Tape and reel | SN74ALVCHR16245KR     | VR245            |
|               | VFBGA - ZQL (Pb-free)  |               | 74ALVCHR16245ZQLR     |                  |

(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.

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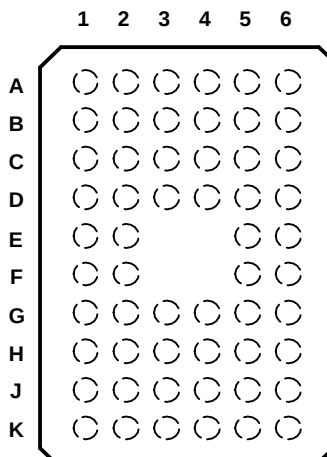
# SN74ALVCHR16245

## 16-BIT BUS TRANSCEIVER

### WITH 3-STATE OUTPUTS

SCES064G—DECEMBER 1995—REVISED OCTOBER 2004

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



**TERMINAL ASSIGNMENTS<sup>(1)</sup>**

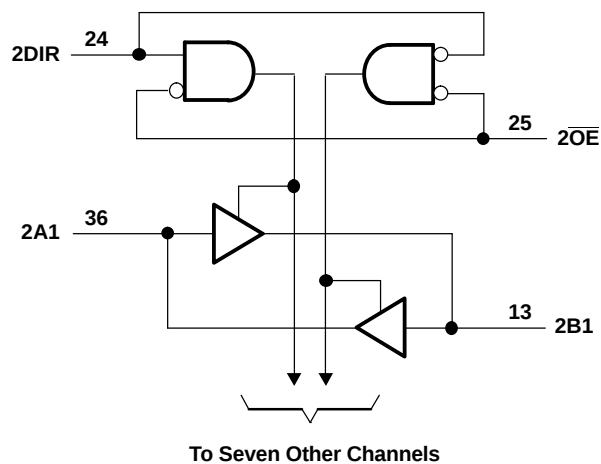
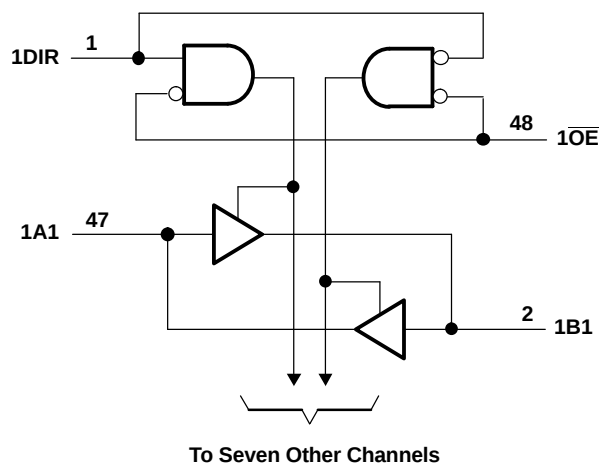
|          | 1    | 2   | 3               | 4               | 5   | 6                 |
|----------|------|-----|-----------------|-----------------|-----|-------------------|
| <b>A</b> | 1DIR | NC  | NC              | NC              | NC  | 1 $\overline{OE}$ |
| <b>B</b> | 1B2  | 1B1 | GND             | GND             | 1A1 | 1A2               |
| <b>C</b> | 1B4  | 1B3 | V <sub>CC</sub> | V <sub>CC</sub> | 1A3 | 1A4               |
| <b>D</b> | 1B6  | 1B5 | GND             | GND             | 1A5 | 1A6               |
| <b>E</b> | 1B8  | 1B7 |                 |                 | 1A7 | 1A8               |
| <b>F</b> | 2B1  | 2B2 |                 |                 | 2A2 | 2A1               |
| <b>G</b> | 2B3  | 2B4 | GND             | GND             | 2A4 | 2A3               |
| <b>H</b> | 2B5  | 2B6 | V <sub>CC</sub> | V <sub>CC</sub> | 2A6 | 2A5               |
| <b>J</b> | 2B7  | 2B8 | GND             | GND             | 2A8 | 2A7               |
| <b>K</b> | 2DIR | NC  | NC              | NC              | NC  | 2 $\overline{OE}$ |

(1) NC - No internal connection

**FUNCTION TABLE  
(each 8-bit section)**

| INPUTS          |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

### LOGIC DIAGRAM (POSITIVE LOGIC)



Pin numbers shown are for the DGG 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 | 4.6                   | V    |
| V <sub>I</sub>   | Input voltage range                                    | Except I/O ports <sup>(2)</sup> | -0.5 | 4.6                   | V    |
|                  |                                                        | I/O ports <sup>(2)(3)</sup>     | -0.5 | V <sub>CC</sub> + 0.5 |      |
| 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                     |      | 70                    | °C/W |
|                  |                                                        | DL package                      |      | 63                    |      |
|                  |                                                        | GQL/ZQL package                 |      | 42                    |      |
| 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 JEDEC 51-7.

**SN74ALVCHR16245**  
**16-BIT BUS TRANSCEIVER**  
**WITH 3-STATE OUTPUTS**

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**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                                                      |                                         | -25                   |                    |     |      |
|                                | V <sub>I</sub> = 0.7 V                                                       | 2.3 V                                   | 45                    |                    |     |      |
|                                | V <sub>I</sub> = 1.7 V                                                       |                                         | -45                   |                    |     |      |
|                                | V <sub>I</sub> = 0.8 V                                                       | 3 V                                     | 75                    |                    |     |      |
|                                | V <sub>I</sub> = 2 V                                                         |                                         | -75                   |                    |     |      |
|                                | V <sub>I</sub> = 0 to 3.6 V <sup>(2)</sup>                                   | 3.6 V                                   | ±500                  |                    |     |      |
| I <sub>OZ</sub> <sup>(3)</sup> | 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                 |                    | 4   | pF   |
| C <sub>io</sub>                | A or B ports                                                                 | V <sub>O</sub> = V <sub>CC</sub> or GND | 3.3 V                 |                    | 9   | 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.

(3) For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

## 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 | 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 |
|------------------|------------------------|-------------|-------------------------|---------------------------------|-----|-------------------------|-----|---------------------------------|-----|------|
|                  |                        |             | TYP                     | MIN                             | MAX | MIN                     | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A or B                 | B or A      | (1)                     | 1                               | 4.9 | 4.7                     |     | 1                               | 4.2 | ns   |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | B or A      | (1)                     | 1                               | 6.8 | 6.7                     |     | 1                               | 5.6 | ns   |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | B or A      | (1)                     | 1                               | 6.3 | 5.7                     |     | 1                               | 5.5 | ns   |

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

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## 16-BIT BUS TRANSCEIVER

### WITH 3-STATE OUTPUTS

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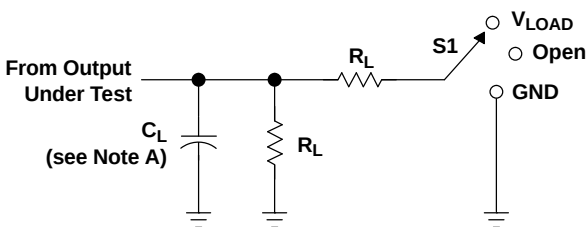
#### OPERATING CHARACTERISTICS

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

| 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  | $C_L = 50\text{ pF}, f = 10\text{ MHz}$ | (1)                     | 24                      | 32                      | pF   |
|           |                               | Outputs disabled |                                         | (1)                     | 4                       | 5                       |      |

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

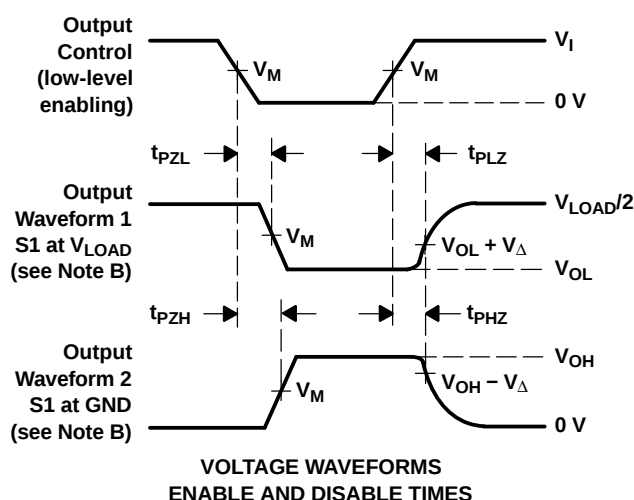
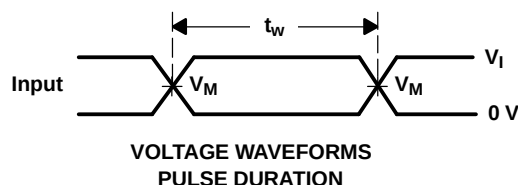
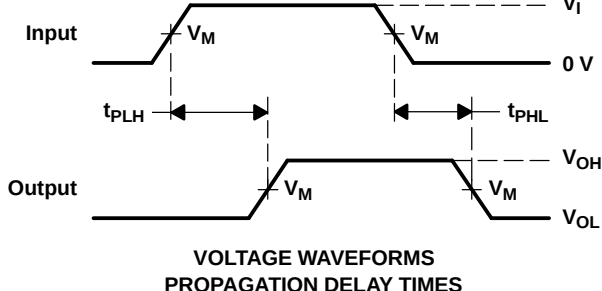
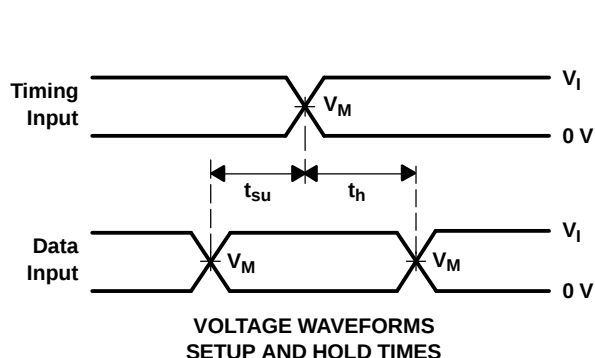
## PARAMETER MEASUREMENT INFORMATION



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 V             | $V_{CC}$ | $\leq 2$ ns   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V       |
| 2.5 V $\pm$ 0.2 V | $V_{CC}$ | $\leq 2$ ns   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V       |
| 2.7 V             | 2.7 V    | $\leq 2.5$ ns | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V        |
| 3.3 V $\pm$ 0.3 V | 2.7 V    | $\leq 2.5$ 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:  $PRR \leq 10$  MHz,  $Z_O = 50$   $\Omega$ .
  - 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/Ball Finish<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|-------------------|---------------|----------------------------|--------------------|------|----------------|----------------------------|-------------------------|----------------------|--------------|-------------------------|-------------------------|
| 74ALVCHR16245GRE4 | ACTIVE        | TSSOP                      | DGG                | 48   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | ALVCHR16245             | <a href="#">Samples</a> |
| 74ALVCHR16245LRG4 | ACTIVE        | SSOP                       | DL                 | 48   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | ALVCHR16245             | <a href="#">Samples</a> |
| 74ALVCHR16245ZQLR | ACTIVE        | BGA<br>MICROSTAR<br>JUNIOR | ZQL                | 56   | 1000           | Green (RoHS<br>& no Sb/Br) | SNAGCU                  | Level-1-260C-UNLIM   | -40 to 85    | VR245                   | <a href="#">Samples</a> |
| SN74ALVCHR16245GR | ACTIVE        | TSSOP                      | DGG                | 48   | 2000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | ALVCHR16245             | <a href="#">Samples</a> |
| SN74ALVCHR16245LR | ACTIVE        | SSOP                       | DL                 | 48   | 1000           | Green (RoHS<br>& no Sb/Br) | CU NIPDAU               | Level-1-260C-UNLIM   | -40 to 85    | ALVCHR16245             | <a href="#">Samples</a> |

(1) 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.

(2) 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)

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

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

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

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**TAPE AND REEL INFORMATION**
**REEL DIMENSIONS**

**TAPE DIMENSIONS**


|    |                                                           |
|----|-----------------------------------------------------------|
| A0 | Dimension designed to accommodate the component width     |
| B0 | Dimension designed to accommodate the component length    |
| K0 | Dimension designed to accommodate the component thickness |
| W  | Overall width of the carrier tape                         |
| P1 | Pitch between successive cavity centers                   |

**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 |
|-------------------|----------------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| 74ALVCHR16245ZQLR | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 330.0              | 16.4               | 4.8     | 7.3     | 1.5     | 8.0     | 16.0   | Q1            |
| SN74ALVCHR16245GR | TSSOP                | DGG             | 48   | 2000 | 330.0              | 24.4               | 8.6     | 15.8    | 1.8     | 12.0    | 24.0   | Q1            |
| SN74ALVCHR16245LR | SSOP                 | DL              | 48   | 1000 | 330.0              | 32.4               | 11.35   | 16.2    | 3.1     | 16.0    | 32.0   | Q1            |

## TAPE AND REEL BOX DIMENSIONS

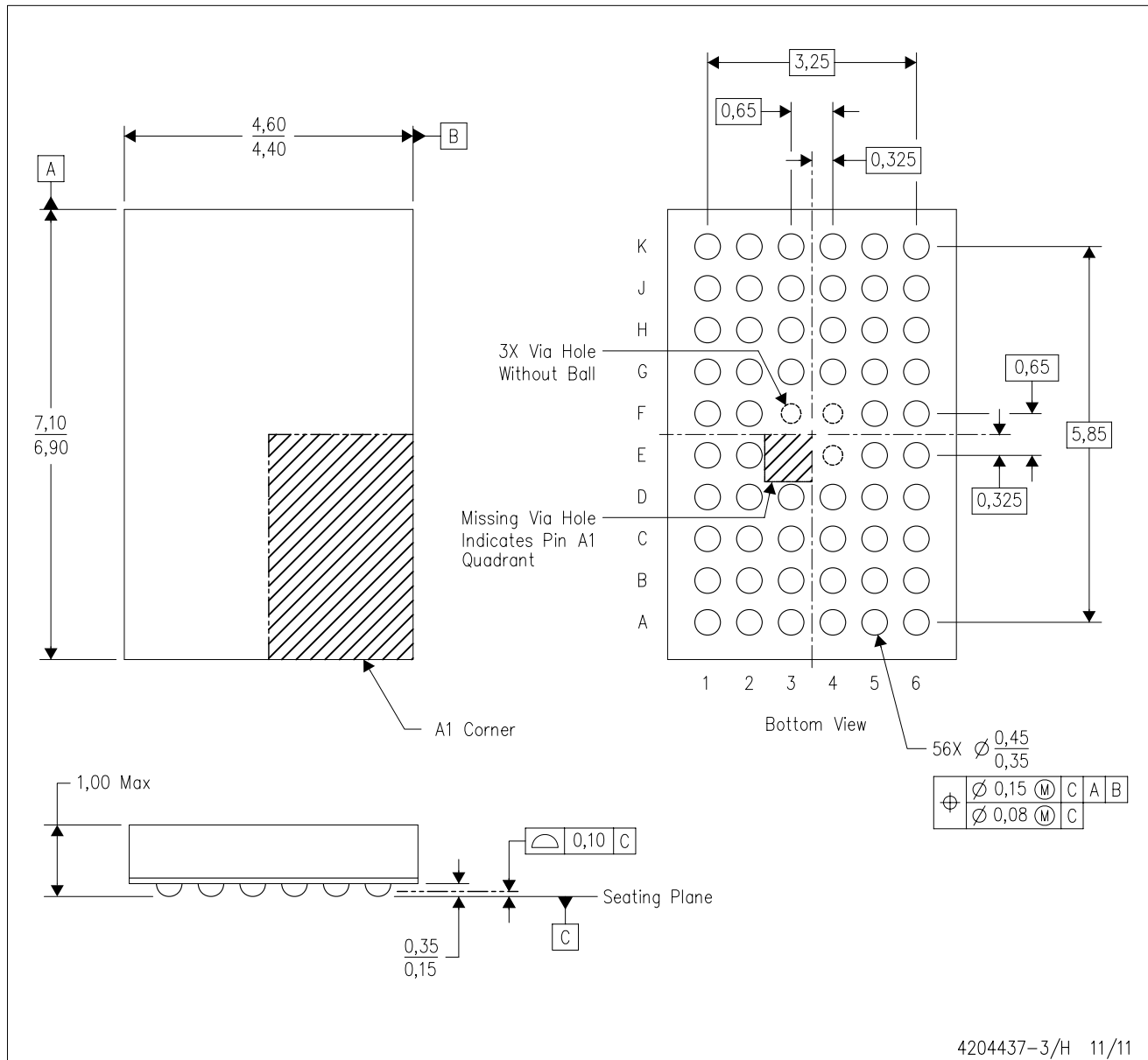


\*All dimensions are nominal

| Device            | Package Type         | Package Drawing | Pins | SPQ  | Length (mm) | Width (mm) | Height (mm) |
|-------------------|----------------------|-----------------|------|------|-------------|------------|-------------|
| 74ALVCHR16245ZQLR | BGA MICROSTAR JUNIOR | ZQL             | 56   | 1000 | 333.2       | 345.9      | 28.6        |
| SN74ALVCHR16245GR | TSSOP                | DGG             | 48   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74ALVCHR16245LR | SSOP                 | DL              | 48   | 1000 | 367.0       | 367.0      | 55.0        |

ZQL (R-PBGA-N56)

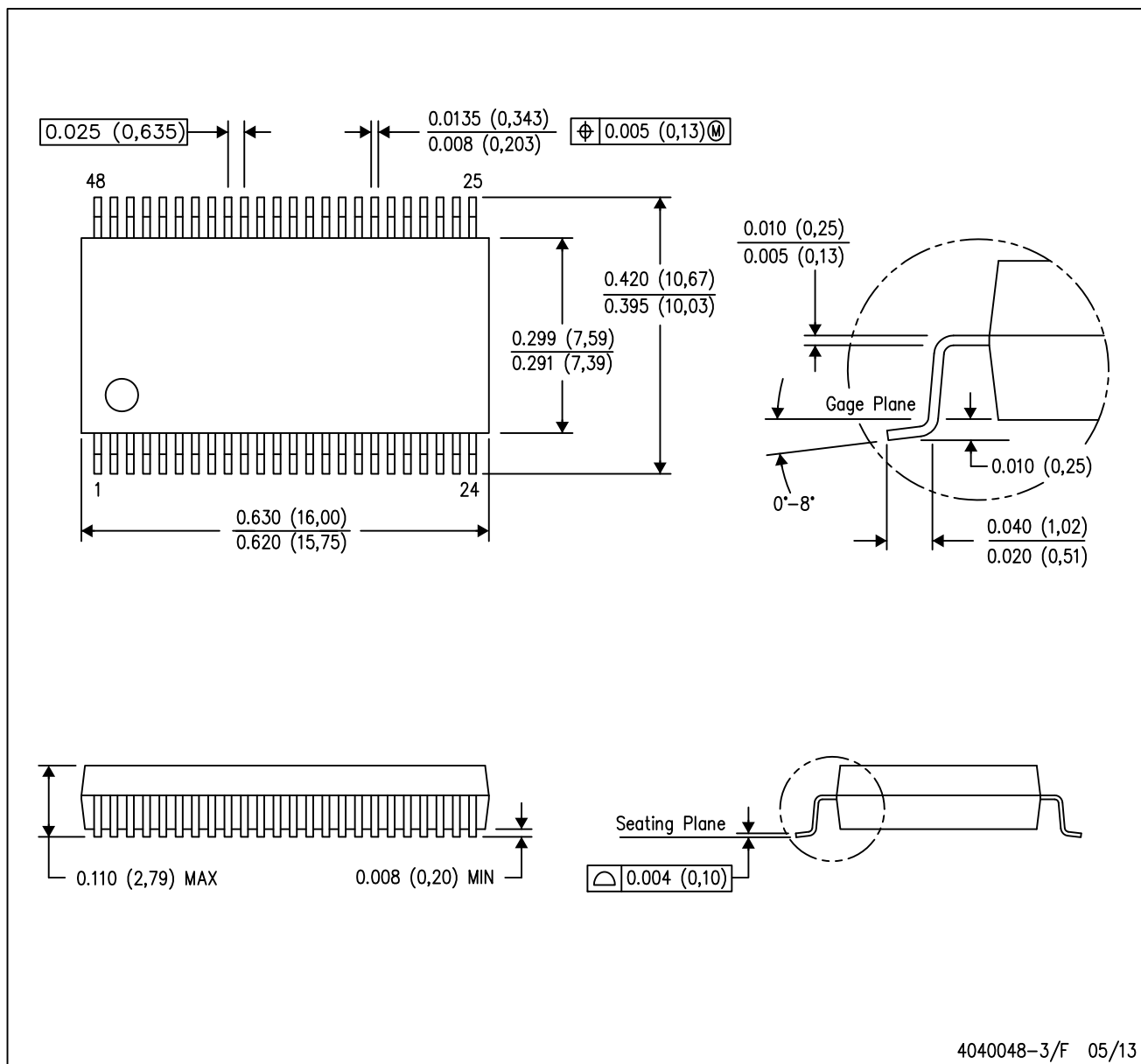
PLASTIC BALL GRID ARRAY



- 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).

DL (R-PDSO-G48)

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 MO-118

## 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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