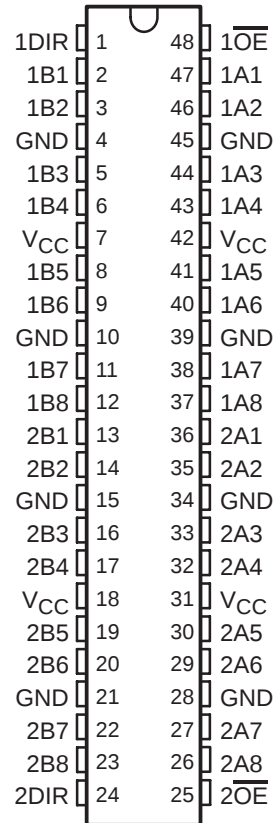


# SN54ABT16245, SN74ABT16245 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SCBS084B – D3712, JANUARY 1991 – REVISED DECEMBER 1992

- Members of the Texas Instruments *Widebus*™ Family
- State-of-the-Art *EPIC-II*B™ BiCMOS Design Significantly Reduces Power Dissipation
- Latch-Up Performance Exceeds 500 mA Per JEDEC Standard JESD-17
- Typical  $V_{OLP}$  (Output Ground Bounce)  $< 1$  V at  $V_{CC} = 5$  V,  $T_A = 25^\circ\text{C}$
- Distributed  $V_{CC}$  and GND Pin Configuration Minimizes High-Speed Switching Noise
- Flow-Through Architecture Optimizes PCB Layout
- High-Drive Outputs ( $-32\text{-mA } I_{OH}$ ,  $64\text{-mA } I_{OL}$ )
- Packaged in Plastic 300-mil Shrink Small-Outline and Thin Shrink Small-Outline Packages and 380-mil Fine-Pitch Ceramic Flat Packages Using 25-mil Center-to-Center Spacings

SN54ABT16245 . . . WD PACKAGE  
SN74ABT16245 . . . DGG OR DL PACKAGE  
(TOP VIEW)



## description

The 'ABT16245 is a 16-bit (dual-octal) noninverting 3-state transceiver designed for synchronous two-way 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 upon 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.

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.

The SN74ABT16245 is available in TI's shrink small-outline package (DL), which provides twice the I/O pin count and functionality of standard small-outline packages in the same printed-circuit-board area.

The SN54ABT16245 is characterized for operation over the full military temperature range of  $-55^\circ\text{C}$  to  $125^\circ\text{C}$ . The SN74ABT16245 is characterized for operation from  $-40^\circ\text{C}$  to  $85^\circ\text{C}$ .

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       |

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PRODUCTION DATA information is current as of publication date. Products conform to specifications per the terms of Texas Instruments standard warranty. Production processing does not necessarily include testing of all parameters.



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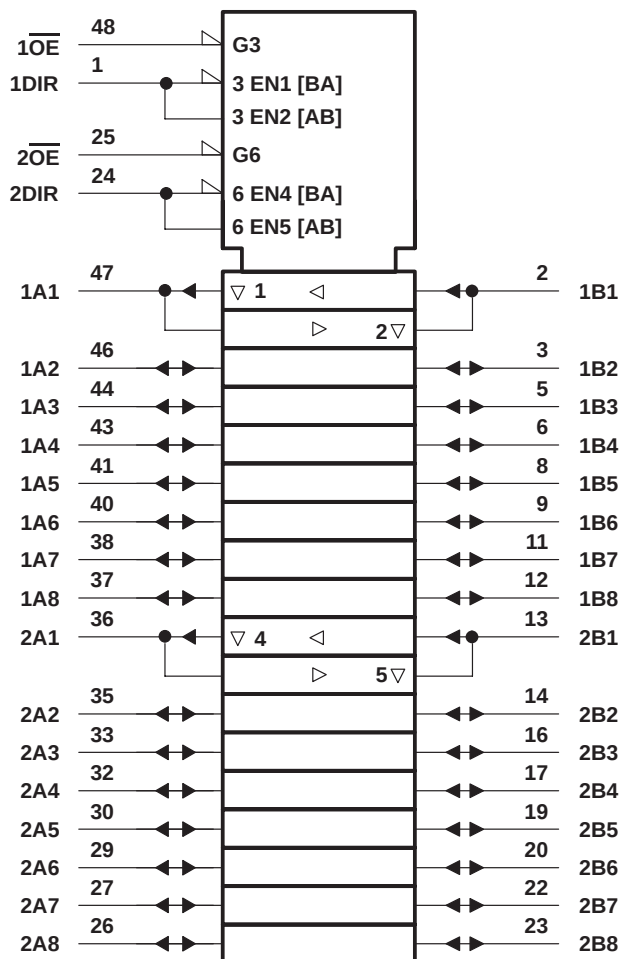
# SN54ABT16245, SN74ABT16245

## 16-BIT BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

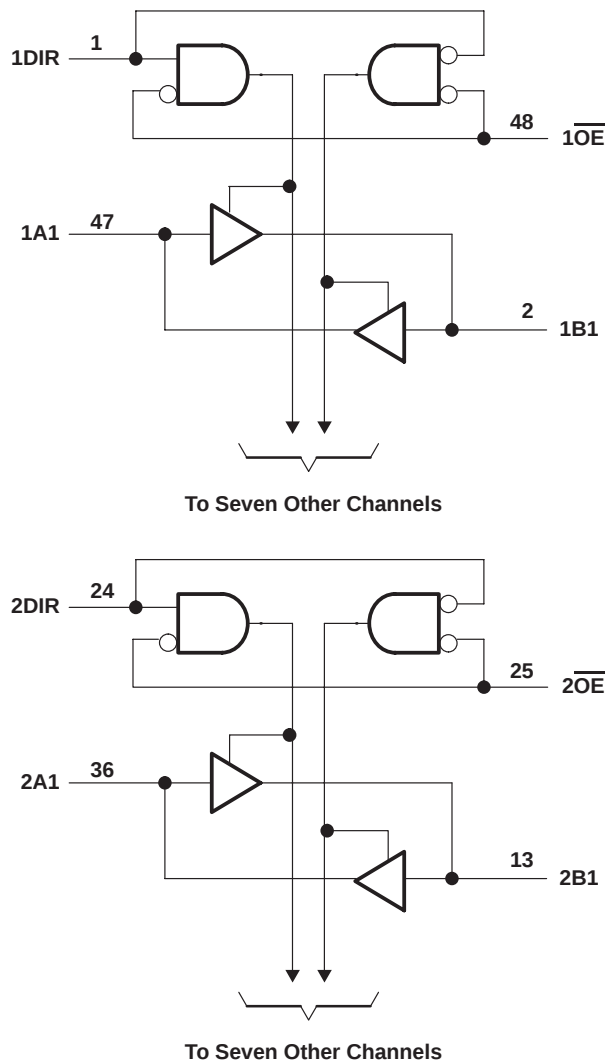
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#### logic symbol†



† This symbol is in accordance with ANSI/IEEE Std 91-1984 and IEC Publication 617-12.

#### logic diagram (positive logic)



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

|                                                                                   |                 |
|-----------------------------------------------------------------------------------|-----------------|
| Supply voltage range, $V_{CC}$                                                    | –0.5 V to 7 V   |
| Input voltage range, $V_I$ (except I/O ports) (see Note 1)                        | –0.5 V to 7 V   |
| Voltage range applied to any output in the high state or power-off state, $V_O$   | –0.5 V to 5.5 V |
| Current into any output in the low state, $I_O$ : SN54ABT16245                    | 96 mA           |
| SN74ABT16245                                                                      | 128 mA          |
| Input clamp current, $I_{IK}$ ( $V_I < 0$ )                                       | –18 mA          |
| Output clamp current, $I_{OK}$ ( $V_O < 0$ )                                      | –50 mA          |
| Maximum power dissipation at $T_A = 55^\circ\text{C}$ (in still air): DGG package | 0.8 W           |
| DL package                                                                        | 0.85 W          |
| Storage temperature range                                                         | –65°C to 150°C  |

‡ Stresses beyond those listed under “absolute maximum ratings” may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated under “recommended operating conditions” is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

NOTE 1: The input and output negative-voltage ratings may be exceeded if the input and output clamp-current ratings are observed.



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# SN54ABT16245, SN74ABT16245 16-BIT BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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## recommended operating conditions (see Note 2)

|                 |                                    |                 | SN54ABT16245 |                 | SN74ABT16245 |                 | UNIT |
|-----------------|------------------------------------|-----------------|--------------|-----------------|--------------|-----------------|------|
|                 |                                    |                 | MIN          | MAX             | MIN          | MAX             |      |
| V <sub>CC</sub> | Supply voltage                     |                 | 4.5          | 5.5             | 4.5          | 5.5             | V    |
| V <sub>IH</sub> | High-level input voltage           |                 | 2            |                 | 2            |                 | V    |
| V <sub>IL</sub> | Low-level input voltage            |                 |              | 0.8             |              | 0.8             | V    |
| V <sub>I</sub>  | Input voltage                      |                 | 0            | V <sub>CC</sub> | 0            | V <sub>CC</sub> | V    |
| I <sub>OH</sub> | High-level output current          |                 |              | –24             |              | –32             | mA   |
| I <sub>OL</sub> | Low-level output current           |                 |              | 48              |              | 64              | mA   |
| Δt/Δv           | Input transition rise or fall rate | Outputs enabled |              | 10              |              | 10              | ns/V |
| T <sub>A</sub>  | Operating free-air temperature     |                 | –55          | 125             | –40          | 85              | °C   |

NOTE 2: Unused or floating pins (input or I/O) must be held high or low.

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

| PARAMETER                     | TEST CONDITIONS                                                                              |                | T <sub>A</sub> = 25°C |      |      | SN54ABT16245 |      | SN74ABT16245 |      | UNIT |    |
|-------------------------------|----------------------------------------------------------------------------------------------|----------------|-----------------------|------|------|--------------|------|--------------|------|------|----|
|                               |                                                                                              |                | MIN                   | TYP† | MAX  | MIN          | MAX  | MIN          | MAX  |      |    |
| V <sub>IK</sub>               | V <sub>CC</sub> = 4.5 V, I <sub>I</sub> = –18 mA                                             |                | –1.2                  |      |      | –1.2         |      | –1.2         |      | V    |    |
| V <sub>OH</sub>               | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –3 mA                                             |                | 2.5                   |      |      | 2.5          |      | 2.5          |      | V    |    |
|                               | V <sub>CC</sub> = 5 V, I <sub>OH</sub> = –3 mA                                               |                | 3                     |      |      | 3            |      | 3            |      |      |    |
|                               | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –24 mA                                            |                | 2                     |      |      | 2            |      |              |      |      |    |
|                               | V <sub>CC</sub> = 4.5 V, I <sub>OH</sub> = –32 mA                                            |                | 2‡                    |      |      |              |      | 2            |      |      |    |
| V <sub>OL</sub>               | V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 48 mA                                             |                | 0.55                  |      |      | 0.55         |      |              |      | V    |    |
|                               | V <sub>CC</sub> = 4.5 V, I <sub>OL</sub> = 64 mA                                             |                | 0.55‡                 |      |      |              |      | 0.55         |      |      |    |
| I <sub>I</sub>                | V <sub>CC</sub> = 5.5 V,<br>V <sub>I</sub> = V <sub>CC</sub> or GND                          |                | Control inputs        | ±1   |      |              | ±1   |              | ±1   |      | μA |
|                               |                                                                                              |                | A or B ports          | ±100 |      |              | ±100 |              | ±100 |      |    |
| I <sub>OZH</sub> <sup>§</sup> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.7 V                                              |                | 10¶                   |      |      | 10           |      | 10¶          |      | μA   |    |
| I <sub>OZL</sub> <sup>§</sup> | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 0.5 V                                              |                | –10¶                  |      |      | –10          |      | –10¶         |      | μA   |    |
| I <sub>off</sub>              | V <sub>CC</sub> = 0, V <sub>I</sub> or V <sub>O</sub> ≤ 4.5 V                                |                | ±100                  |      |      |              |      | ±100         |      | μA   |    |
| I <sub>CEX</sub>              | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 5.5 V                                              |                | 50                    |      |      | 50           |      | 50           |      | μA   |    |
| I <sub>O</sub> <sup>#</sup>   | V <sub>CC</sub> = 5.5 V, V <sub>O</sub> = 2.5 V                                              |                | –50                   | –100 | –180 | –50          | –180 | –50          | –180 | mA   |    |
| I <sub>CC</sub>               | V <sub>CC</sub> = 5.5 V,<br>I <sub>O</sub> = 0,<br>V <sub>I</sub> = V <sub>CC</sub> or GND   | A or B ports   | Outputs high          |      | 2    |              | 2    |              | 2    |      | mA |
|                               |                                                                                              |                | Outputs low           |      | 32   |              | 32   |              | 32   |      |    |
|                               |                                                                                              |                | Outputs disabled      |      | 2    |              | 2    |              | 2    |      |    |
| ΔI <sub>CC</sub>              | V <sub>CC</sub> = 5.5 V,<br>One input at 3.4 V,<br>Other inputs at<br>V <sub>CC</sub> or GND | Data inputs    | Outputs enabled       |      | 1    |              | 1.5  |              | 1    |      | mA |
|                               |                                                                                              |                | Outputs disabled      |      | 0.05 |              | 1    |              | 0.05 |      |    |
|                               |                                                                                              | Control inputs |                       | 1.5  |      | 1.5          |      | 1.5          |      |      |    |
| C <sub>i</sub>                | V <sub>I</sub> = 2.5 V or 0.5 V                                                              |                | Control inputs        |      | 3    |              |      |              |      |      | pF |
| C <sub>io</sub>               | V <sub>O</sub> = 2.5 V or 0.5 V                                                              |                | A or B ports          |      | 8.5  |              |      |              |      |      | pF |

† All typical values are at V<sub>CC</sub> = 5 V.

‡ On products compliant to MIL-STD-883, Class B, this parameter does not apply.

§ The parameters I<sub>OZH</sub> and I<sub>OZL</sub> include the input leakage current.

¶ This data sheet limit may vary among suppliers.

# Not more than one output should be tested at a time, and the duration of the test should not exceed one second.

|| This is the increase in supply current for each input that is at the specified TTL voltage level rather than V<sub>CC</sub> or GND.



# SN54ABT16245, SN74ABT16245

## 16-BIT BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

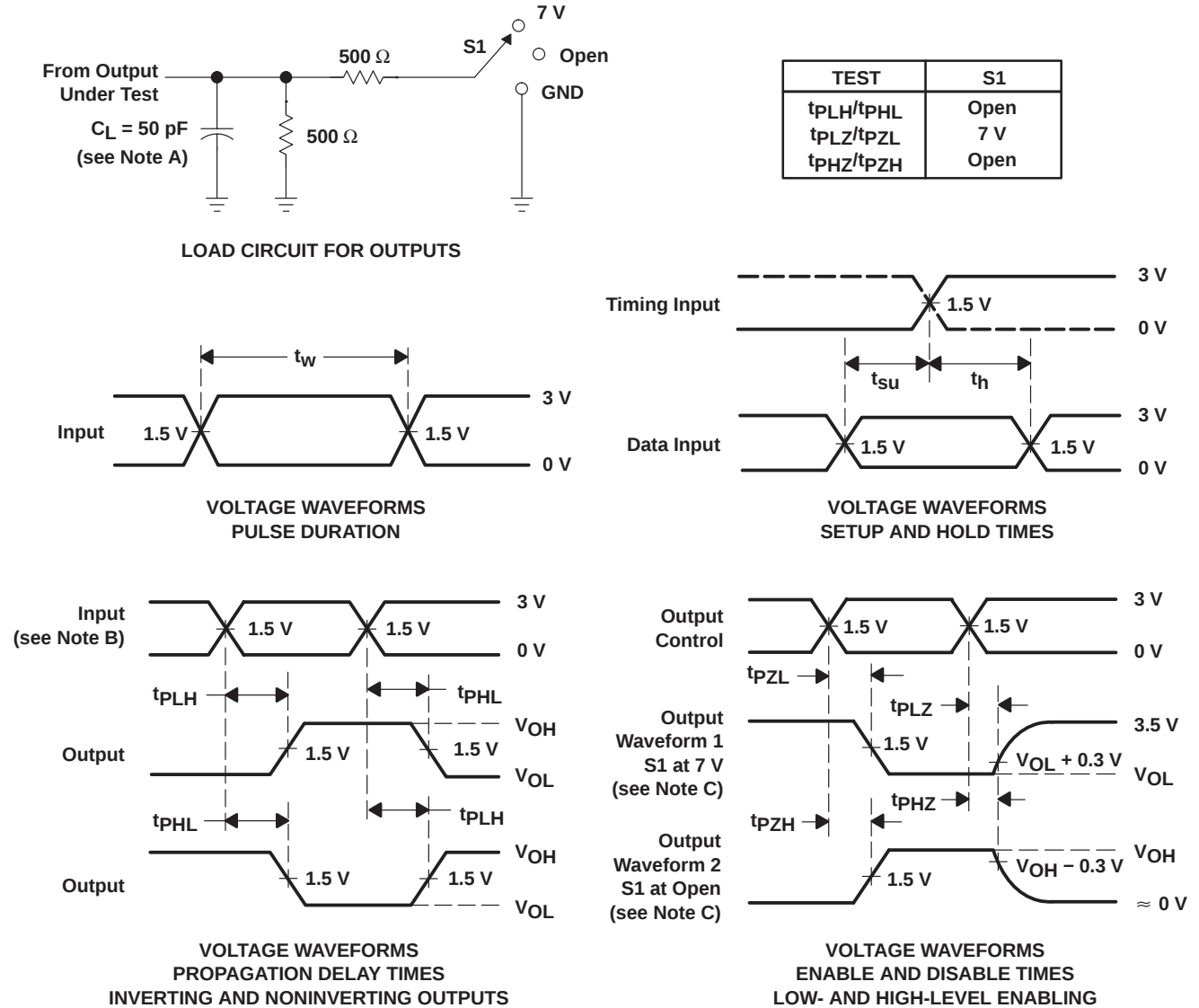
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switching characteristics over recommended ranges of supply voltage and operating free-air temperature,  $C_L = 50$  pF (unless otherwise noted) (see Figure 1)

| PARAMETER | FROM<br>(INPUT) | TO<br>(OUTPUT) | $V_{CC} = 5$ V,<br>$T_A = 25^\circ\text{C}$ |     |     | SN54ABT16245 |     | SN74ABT16245 |     | UNIT |
|-----------|-----------------|----------------|---------------------------------------------|-----|-----|--------------|-----|--------------|-----|------|
|           |                 |                | MIN                                         | TYP | MAX | MIN          | MAX | MIN          | MAX |      |
| $t_{PLH}$ | A or B          | B or A         | 1                                           | 2.2 | 3.4 | 0.5          | 4   | 1            | 3.9 | ns   |
| $t_{PHL}$ |                 |                | 1                                           | 2.1 | 3.8 | 0.5          | 4.6 | 1            | 4.5 |      |
| $t_{PZH}$ | $\overline{OE}$ | B or A         | 1                                           | 3.1 | 4.4 | 0.8          | 5.5 | 1            | 5.4 | ns   |
| $t_{PZL}$ |                 |                | 1                                           | 3   | 6.1 | 0.9          | 7.3 | 1            | 7.2 |      |
| $t_{PHZ}$ | $\overline{OE}$ | B or A         | 1.3                                         | 3.5 | 4.7 | 1.3          | 6.3 | 1.3          | 5.5 | ns   |
| $t_{PLZ}$ |                 |                | 1.4                                         | 3.2 | 4.7 | 1.4          | 5.3 | 1.4          | 5.2 |      |



**PARAMETER MEASUREMENT INFORMATION**



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5 \text{ ns}$ ,  $t_f \leq 2.5 \text{ ns}$ .  
 C. 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.  
 D. The outputs are measured one at a time with one transition per measurement.

**Figure 1. Load Circuit and Voltage Waveforms**



## PACKAGING INFORMATION

| Orderable Device | Status <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74ABT16245DGGR | OBSOLETE              | TSSOP        | DGG             | 48   |             | TBD                     | Call TI          | Call TI                      |
| SN74ABT16245DL   | OBSOLETE              | SSOP         | DL              | 48   |             | TBD                     | Call TI          | Call TI                      |
| SN74ABT16245DLR  | OBSOLETE              | SSOP         | DL              | 48   |             | TBD                     | Call TI          | Call TI                      |

<sup>(1)</sup> The marketing status values are defined as follows:

**ACTIVE:** Product device recommended for new designs.

**LIFEBUY:** TI has announced that the device will be discontinued, and a lifetime-buy period is in effect.

**NRND:** Not recommended for new designs. Device is in production to support existing customers, but TI does not recommend using this part in a new design.

**PREVIEW:** Device has been announced but is not in production. Samples may or may not be available.

**OBSOLETE:** TI has discontinued the production of the device.

<sup>(2)</sup> Eco Plan - 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.

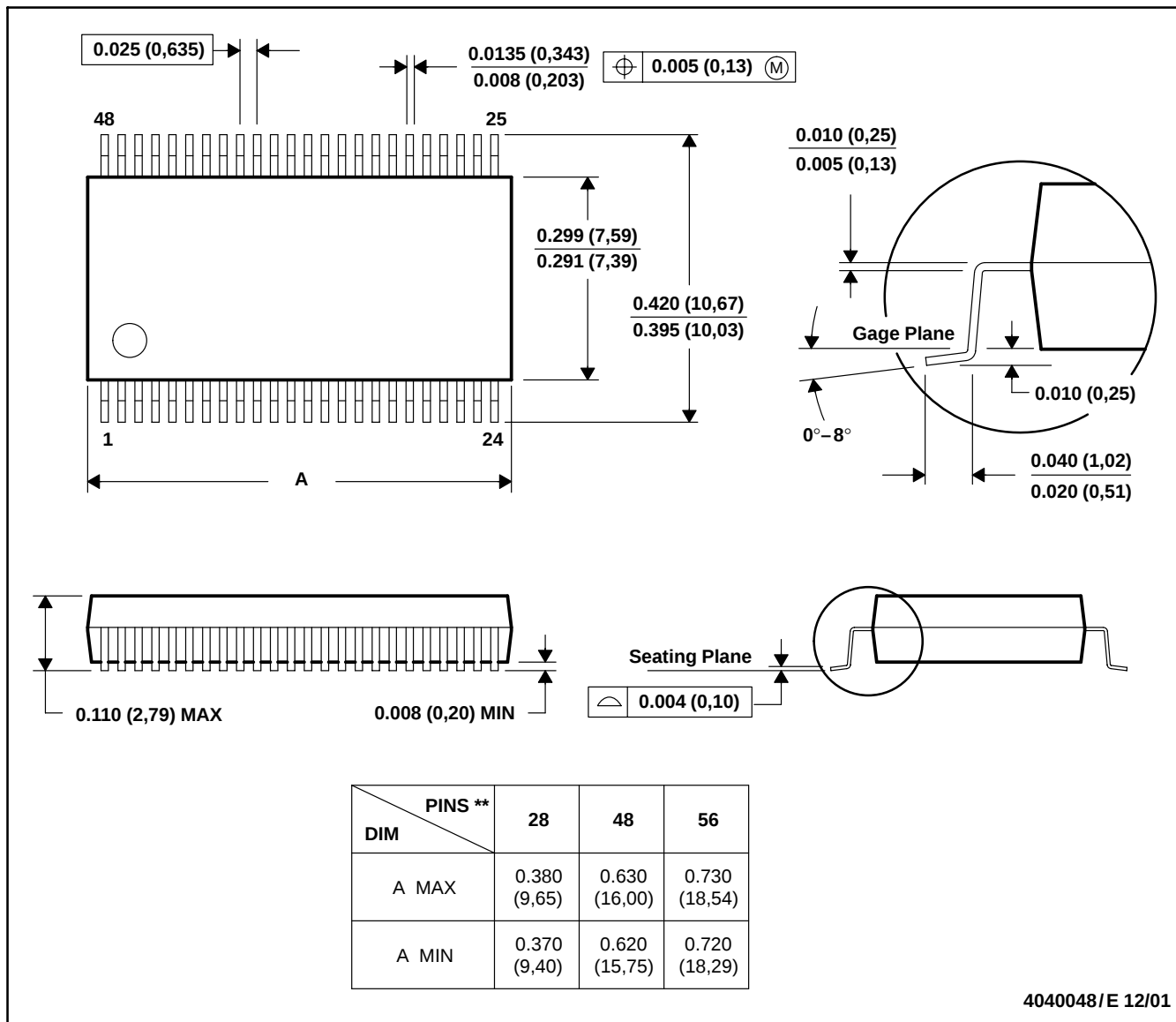
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DL (R-PDSO-G\*\*)

PLASTIC SMALL-OUTLINE PACKAGE

48 PINS SHOWN



- 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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