

- Member of the Texas Instruments Widebus™ Family
- Operates From 2.7 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max  $t_{pd}$  of 3.7 ns at 3.3 V
- $I_{off}$  and Power-Up 3-State Support Hot Insertion
- Supports Mixed-Mode Signal Operation on All Ports (5-V Input/Output Voltage With 3.3-V  $V_{CC}$ )
- 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 (dual-octal) noninverting bus transceiver is designed for 2.7-V to 3.6-V  $V_{CC}$  operation.

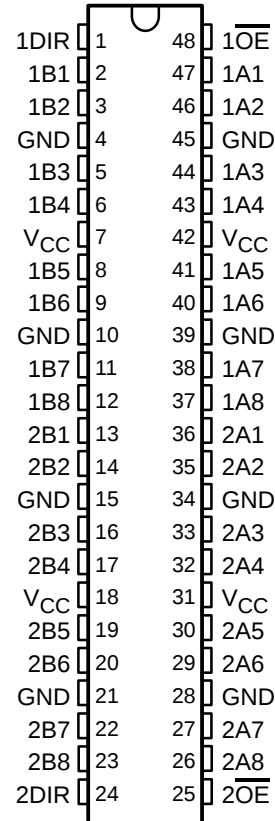
The SN74LVCZ16245A is designed for asynchronous communication between data buses. The control-function implementation minimizes external timing requirements.

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.

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

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

DGG, DGV, OR DL PACKAGE  
(TOP VIEW)



### ORDERING INFORMATION

| TA            | PACKAGE†    |               | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|-------------|---------------|-----------------------|------------------|
| –40°C to 85°C | SSOP – DL   | Tube          | SN74LVCZ16245ADL      | LVCZ16245A       |
|               |             | Tape and reel | SN74LVCZ16245ADLR     |                  |
|               | TSSOP – DGG | Tape and reel | SN74LVCZ16245ADGGR    | LVCZ16245A       |
|               | TVSOP – DGV | Tape and reel | SN74LVCZ16245ADGVR    | CW245A           |

† 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).



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## WITH 3-STATE OUTPUTS

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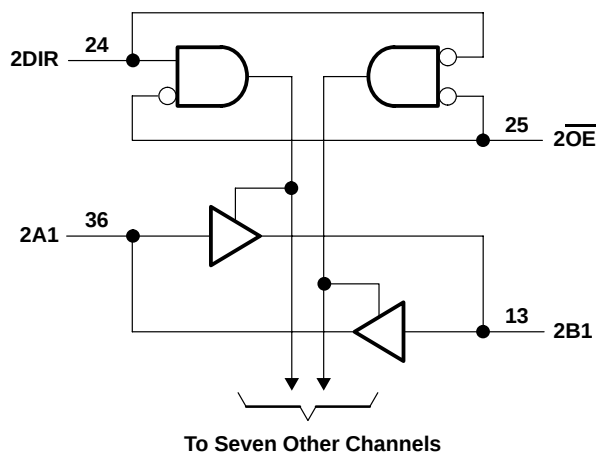
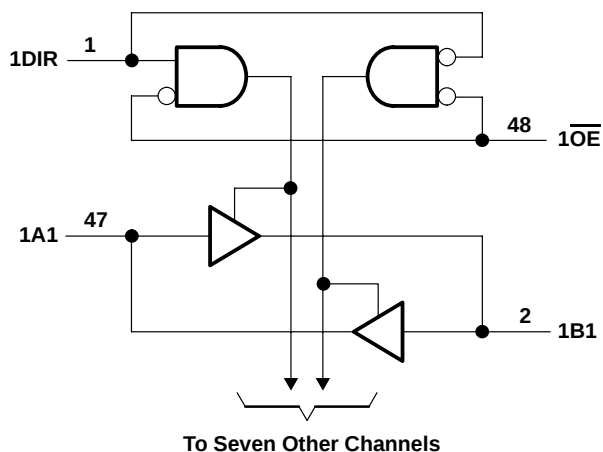
**description/ordering information (continued)**

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

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

| INPUTS |     | OPERATION       |
|--------|-----|-----------------|
| OE     | DIR |                 |
| L      | L   | B data to A bus |
| L      | H   | A data to B bus |
| H      | X   | Isolation       |

**logic diagram (positive logic)**



## 3

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

| PARAMETER                    |                | TEST CONDITIONS                                                              | V <sub>CC</sub> | MIN                  | TYP <sup>†</sup> | MAX  | UNIT |
|------------------------------|----------------|------------------------------------------------------------------------------|-----------------|----------------------|------------------|------|------|
| V <sub>OH</sub>              |                | I <sub>OH</sub> = –100 μA                                                    | 2.7 V to 3.6 V  | V <sub>CC</sub> –0.2 |                  |      | V    |
|                              |                | I <sub>OH</sub> = –12 mA                                                     | 2.7 V           | 2.2                  |                  |      |      |
|                              |                |                                                                              | 3 V             | 2.4                  |                  |      |      |
|                              |                | I <sub>OH</sub> = –24 mA                                                     | 3 V             | 2.2                  |                  |      |      |
| V <sub>OL</sub>              |                | I <sub>OL</sub> = 100 μA                                                     | 2.7 V to 3.6 V  |                      |                  | 0.2  | V    |
|                              |                | I <sub>OL</sub> = 12 mA                                                      | 2.7 V           |                      |                  | 0.4  |      |
|                              |                | I <sub>OL</sub> = 24 mA                                                      | 3 V             |                      |                  | 0.55 |      |
| I <sub>I</sub>               | Control inputs | 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               |                      |                  | ±5   | μA   |
| I <sub>OZ</sub> <sup>‡</sup> |                | V <sub>O</sub> = 0 to 5.5 V                                                  | 3.6 V           |                      |                  | ±5   | μA   |
| I <sub>OZPU</sub>            |                | V <sub>O</sub> = 0.5 V to 2.5 V, $\overline{\text{OE}}$ = don't care         | 0 to 1.5 V      |                      |                  | ±5   | μA   |
| I <sub>OZPD</sub>            |                | V <sub>O</sub> = 0.5 V to 2.5 V, $\overline{\text{OE}}$ = don't care         | 1.5 V to 0      |                      |                  | ±5   | μA   |
| I <sub>CC</sub>              |                | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.6 V           |                      |                  | 60   | μA   |
|                              |                | 3.6 V ≤ V <sub>I</sub> ≤ 5.5 V <sup>§</sup>                                  |                 |                      |                  | 60   |      |
| 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>               | Control inputs | V <sub>I</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           |                      |                  | 5    | pF   |
| C <sub>i0</sub>              | A or B ports   | V <sub>O</sub> = V <sub>CC</sub> or GND                                      | 3.3 V           |                      |                  | 6.5  | pF   |

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

<sup>‡</sup> For I/O ports, the parameter I<sub>OZ</sub> includes the input leakage current.

<sup>§</sup> This applies in the disabled state only.

**switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 50 pF (unless otherwise noted) (see Figure 1)**

| PARAMETER        | FROM (INPUT)           | TO (OUTPUT) | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | UNIT |
|------------------|------------------------|-------------|-------------------------|-----|---------------------------------|-----|------|
|                  |                        |             | MIN                     | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A or B                 | B or A      | 4.2                     |     | 1.3                             | 4   | ns   |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | A or B      | 6.1                     |     | 1.4                             | 5.6 | ns   |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | A or B      | 7.1                     |     | 2                               | 6.6 | ns   |

**switching characteristics over recommended operating free-air temperature range, C<sub>L</sub> = 30 pF (unless otherwise noted) (see Figure 1)**

| PARAMETER        | FROM (INPUT)           | TO (OUTPUT) | V <sub>CC</sub> = 2.7 V |     | V <sub>CC</sub> = 3.3 V ± 0.3 V |     | UNIT |
|------------------|------------------------|-------------|-------------------------|-----|---------------------------------|-----|------|
|                  |                        |             | MIN                     | MAX | MIN                             | MAX |      |
| t <sub>pd</sub>  | A or B                 | B or A      | 3.9                     |     | 1                               | 3.7 | ns   |
| t <sub>en</sub>  | $\overline{\text{OE}}$ | A or B      | 5.9                     |     | 1.1                             | 5.4 | ns   |
| t <sub>dis</sub> | $\overline{\text{OE}}$ | A or B      | 6.7                     |     | 1.6                             | 6.2 | ns   |

**SN74LVCZ16245A**  
**16-BIT BUS TRANSCEIVER**  
**WITH 3-STATE OUTPUTS**

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operating characteristics,  $T_A = 25^\circ\text{C}$

| PARAMETER                                                     |                  | TEST<br>CONDITIONS | $V_{CC} = 3.3\text{ V}$ | UNIT |
|---------------------------------------------------------------|------------------|--------------------|-------------------------|------|
|                                                               |                  |                    | TYP                     |      |
| C <sub>pd</sub> Power dissipation capacitance per transceiver | Outputs enabled  | f = 10 MHz         | 42                      | pF   |
|                                                               | Outputs disabled |                    | 4                       |      |



# SN74LVCZ16245A

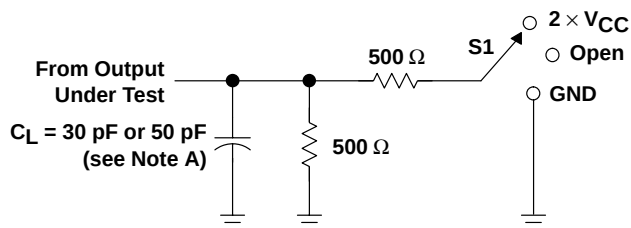
## 16-BIT BUS TRANSCEIVER

### WITH 3-STATE OUTPUTS

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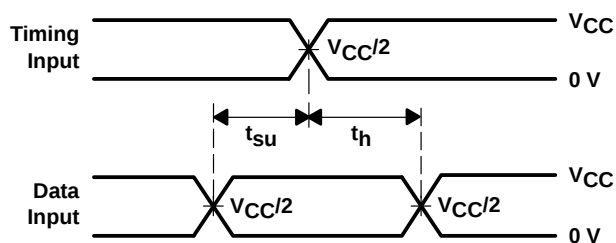
#### PARAMETER MEASUREMENT INFORMATION

$V_{CC} = 2.7\text{ V AND } 3.3\text{ V} \pm 0.3\text{ V}$

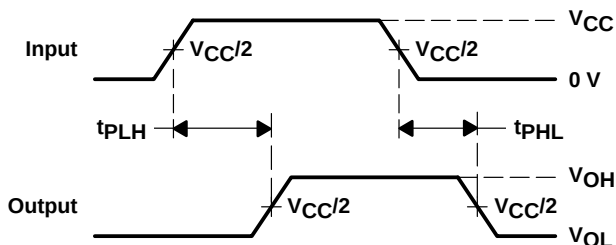


LOAD CIRCUIT

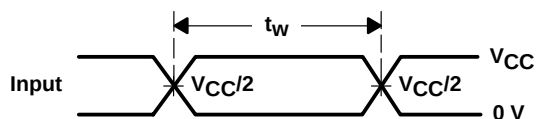
| TEST              | S1                |
|-------------------|-------------------|
| $t_{pd}$          | Open              |
| $t_{PLZ}/t_{PZL}$ | 2 $\times V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND               |



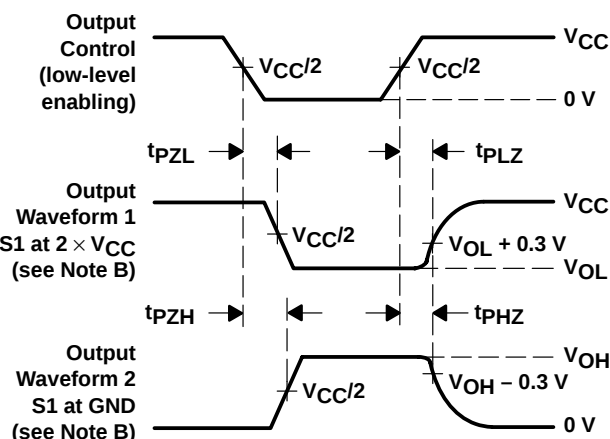
VOLTAGE WAVEFORMS  
SETUP AND HOLD TIMES



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES

- 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:  $PRR \leq 10\text{ MHz}$ ,  $Z_O = 50\ \Omega$ ,  $t_r \leq 2\text{ ns}$ ,  $t_f \leq 2\text{ ns}$ .
  - 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 <sup>(1)</sup> | Package Type | Package Drawing | Pins | Package Qty | Eco Plan <sup>(2)</sup> | Lead/Ball Finish | MSL Peak Temp <sup>(3)</sup> |
|---------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| 74LVCZ16245ADGGRE4  | ACTIVE                | TSSOP        | DGG             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| 74LVCZ16245ADGVRE4  | ACTIVE                | TVSOP        | DGV             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LVCZ16245ADGGGR | ACTIVE                | TSSOP        | DGG             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LVCZ16245ADGVR  | ACTIVE                | TVSOP        | DGV             | 48   | 2000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LVCZ16245ADL    | ACTIVE                | SSOP         | DL              | 48   | 25          | Green (RoHS & no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM           |
| SN74LVCZ16245ADLR   | ACTIVE                | SSOP         | DL              | 48   | 1000        | Green (RoHS & no Sb/Br) | CU NIPDAU        | 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.

<sup>(2)</sup> Eco Plan - The planned eco-friendly classification: Pb-Free (RoHS) 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.

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<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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## DGV (R-PDSO-G\*\*)

## PLASTIC SMALL-OUTLINE

24 PINS SHOWN

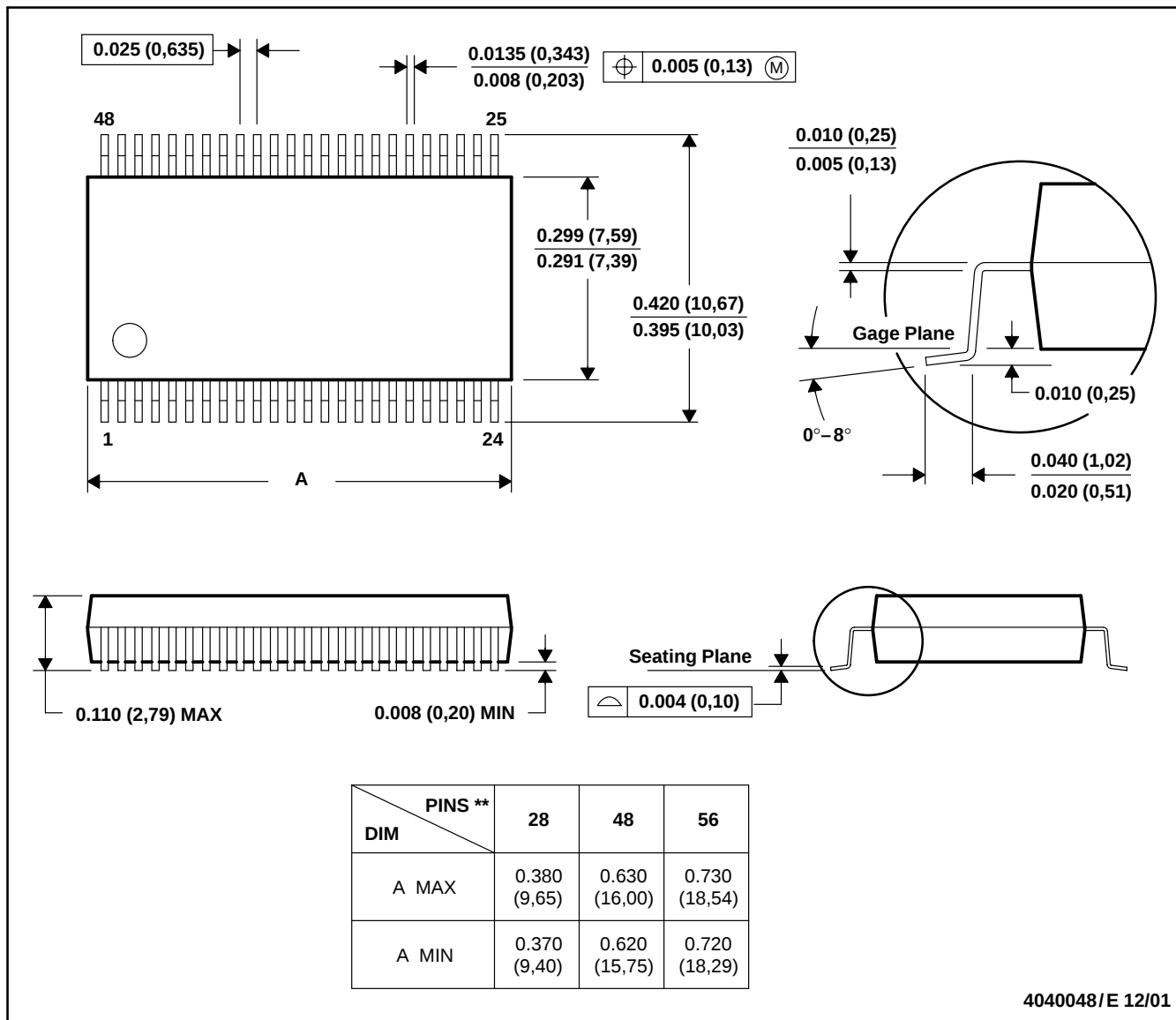


- NOTES: A. All linear dimensions are in millimeters.  
 B. This drawing is subject to change without notice.  
 C. Body dimensions do not include mold flash or protrusion, not to exceed 0,15 per side.  
 D. Falls within JEDEC: 24/48 Pins – MO-153  
 14/16/20/56 Pins – MO-194

## 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.  
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 C. Body dimensions do not include mold protrusion not to exceed 0,15.  
 D. Falls within JEDEC MO-153

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