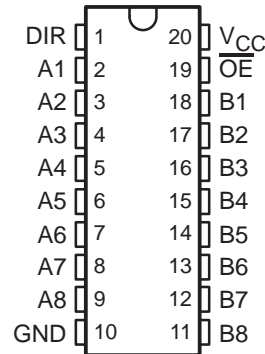


SN74LVCZ245A OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

SCES275G – JUNE 1999 – REVISED AUGUST 2003

- Operates From 2.7 V to 3.6 V
- Inputs Accept Voltages to 5.5 V
- Max t_{pd} of 6.3 ns at 3.3 V
- Typical V_{OLP} (Output Ground Bounce) <0.8 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- Typical V_{OHV} (Output V_{OH} Undershoot) >2 V at $V_{CC} = 3.3$ V, $T_A = 25^\circ\text{C}$
- 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

DB, DW, N, NS, OR PW PACKAGE
(TOP VIEW)



description/ordering information

This octal bus transceiver is designed for 2.7-V to 3.6-V V_{CC} operation.

The SN74LVCZ245A is designed for asynchronous communication between data buses. The device transmits data 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 the buses are effectively isolated.

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

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.

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.

ORDERING INFORMATION

| TA | PACKAGE† | | ORDERABLE PART NUMBER | TOP-SIDE MARKING |
|---------------|------------|-----------------|-----------------------|------------------|
| -40°C to 85°C | PDIP – N | Tube of 20 | SN74LVCZ245AN | SN74LVCZ245AN |
| | SOIC – DW | Tube of 25 | SN74LVCZ245ADW | LVCZ245A |
| | | Reel of 2000 | SN74LVCZ245ADWR | |
| | SOP – NS | Reel of 2000 | SN74LVCZ245ANSR | LVCZ245A |
| | SSOP – DB | Reel of 2000 | SN74LVCZ245ADBR | CV245A |
| | TSSOP – PW | Tube of 70 | SN74LVCZ245APW | CV245A |
| | | Reel of 2000 | SN74LVCZ245APWR | CV245A |
| Reel of 250 | | SN74LVCZ245APWT | CV245A | |

† Package drawings, standard packing quantities, thermal data, symbolization, and PCB design guidelines are available at www.ti.com/sc/package.



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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.

 **TEXAS
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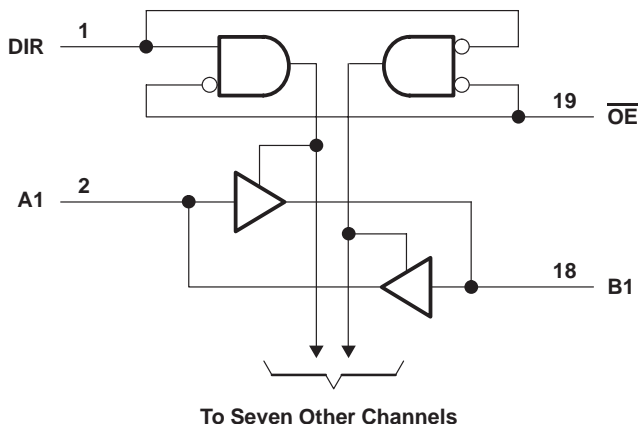
SN74LVCZ245A
OCTAL BUS TRANSCEIVER
WITH 3-STATE OUTPUTS

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FUNCTION TABLE

| 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)



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

| | |
|---|----------------------------|
| Supply voltage range, V_{CC} | -0.5 V to 6.5 V |
| Input voltage range, V_I (see Note 1) | -0.5 V to 6.5 V |
| Voltage range applied to any output in the high-impedance or power-off state, V_O (see Note 1) | -0.5 V to 6.5 V |
| Voltage range applied to any output in the high or low state, V_O (see Notes 1 and 2) | -0.5 V to $V_{CC} + 0.5$ V |
| Input clamp current, I_{IK} ($V_I < 0$) | -50 mA |
| Output clamp current, I_{OK} ($V_O < 0$) | -50 mA |
| Continuous output current, I_O | ± 50 mA |
| Continuous current through V_{CC} or GND | ± 100 mA |
| Package thermal impedance, θ_{JA} (see Note 3): | |
| DB package | 70°C/W |
| DW package | 58°C/W |
| N package | 89°C/W |
| NS package | 60°C/W |
| PW package | 83°C/W |
| Storage temperature range, T_{stg} | -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.

- NOTES: 1. The input negative-voltage and output voltage ratings may be exceeded if the input and output current ratings are observed.
 2. The value of V_{CC} is provided in the recommended operating conditions table.
 3. The package thermal impedance is calculated in accordance with JESD 51-7.



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OCTAL BUS TRANSCEIVER
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recommended operating conditions (see Note 4)

| | | | MIN | MAX | UNIT |
|---------------------|------------------------------------|----------------------------------|-----|-----------------|------|
| V _{CC} | Supply voltage | | 2.7 | 3.6 | V |
| V _{IH} | High-level input voltage | V _{CC} = 2.7 V to 3.6 V | 2 | | V |
| V _{IL} | Low-level input voltage | V _{CC} = 2.7 V to 3.6 V | | 0.8 | V |
| V _I | Input voltage | | 0 | 5.5 | V |
| V _O | Output voltage | High or low state | 0 | V _{CC} | V |
| | | 3-state | 0 | 5.5 | |
| I _{OH} | High-level output current | V _{CC} = 2.7 V | | -12 | mA |
| | | V _{CC} = 3 V | | -24 | |
| I _{OL} | Low-level output current | V _{CC} = 2.7 V | | 12 | mA |
| | | V _{CC} = 3 V | | 24 | |
| Δt/Δv | Input transition rise or fall rate | | | 6 | ns/V |
| Δt/ΔV _{CC} | Power-up ramp rate | | 150 | | μs/V |
| T _A | Operating free-air temperature | | -40 | 85 | °C |

NOTE 4: All unused inputs of the device must be held at V_{CC} 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 _{CC} | MIN | TYP† | MAX | UNIT |
|-------------------|--|-----------------|----------------------|------|------|------|
| V _{OH} | I _{OH} = -100 μA | 2.7 V to 3.6 V | V _{CC} -0.2 | | | V |
| | I _{OH} = -12 mA | 2.7 V | 2.2 | | | |
| | | 3 V | 2.4 | | | |
| | I _{OH} = -24 mA | 3 V | 2.2 | | | |
| V _{OL} | I _{OL} = 100 μA | 2.7 V to 3.6 V | | | 0.2 | V |
| | I _{OL} = 12 mA | 2.7 V | | | 0.4 | |
| | I _{OL} = 24 mA | 3 V | | | 0.55 | |
| I _I | Control inputs V _I = 0 to 5.5 V | 3.6 V | | | ±5 | μA |
| I _{off} | V _I or V _O = 5.5 V | 0 | | | ±5 | μA |
| I _{OZ} ‡ | V _O = 0 to 5.5 V | 3.6 V | | | ±5 | μA |
| I _{OZPU} | V _O = 0.5 V to 2.5 V, \overline{OE} = don't care | 0 to 1.5 V | | | ±5 | μA |
| I _{OZPD} | V _O = 0.5 V to 2.5 V, \overline{OE} = don't care | 1.5 V to 0 | | | ±5 | μA |
| I _{CC} | V _I = V _{CC} or GND | 3.6 V | | | 100 | μA |
| | 3.6 V ≤ V _I ≤ 5.5 V§ | | | | | |
| ΔI _{CC} | One input at V _{CC} - 0.6 V, Other inputs at V _{CC} or GND | 2.7 V to 3.6 V | | | 100 | μA |
| C _i | Control inputs V _I = V _{CC} or GND | 3.3 V | | 4 | | pF |
| C _{io} | A or B ports V _O = V _{CC} or GND | 3.3 V | | 6 | | pF |

† All typical values are at V_{CC} = 3.3 V, T_A = 25°C.

‡ For I/O ports, the parameter I_{OZ} includes the input leakage current.

§ This applies in the disabled state only.



SN74LVCZ245A
OCTAL BUS TRANSCEIVER
WITH 3-STATE OUTPUTS

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

| PARAMETER | FROM (INPUT) | TO (OUTPUT) | V _{CC} = 2.7 V | | V _{CC} = 3.3 V ± 0.3 V | | UNIT |
|------------------|-----------------|-------------|-------------------------|-----|---------------------------------|-----|------|
| | | | MIN | MAX | MIN | MAX | |
| t _{pd} | A or B | B or A | | 7.3 | 1.5 | 6.3 | ns |
| t _{en} | \overline{OE} | A or B | | 9.5 | 1.5 | 8.5 | ns |
| t _{dis} | \overline{OE} | A or B | | 8.5 | 1.7 | 7.5 | ns |

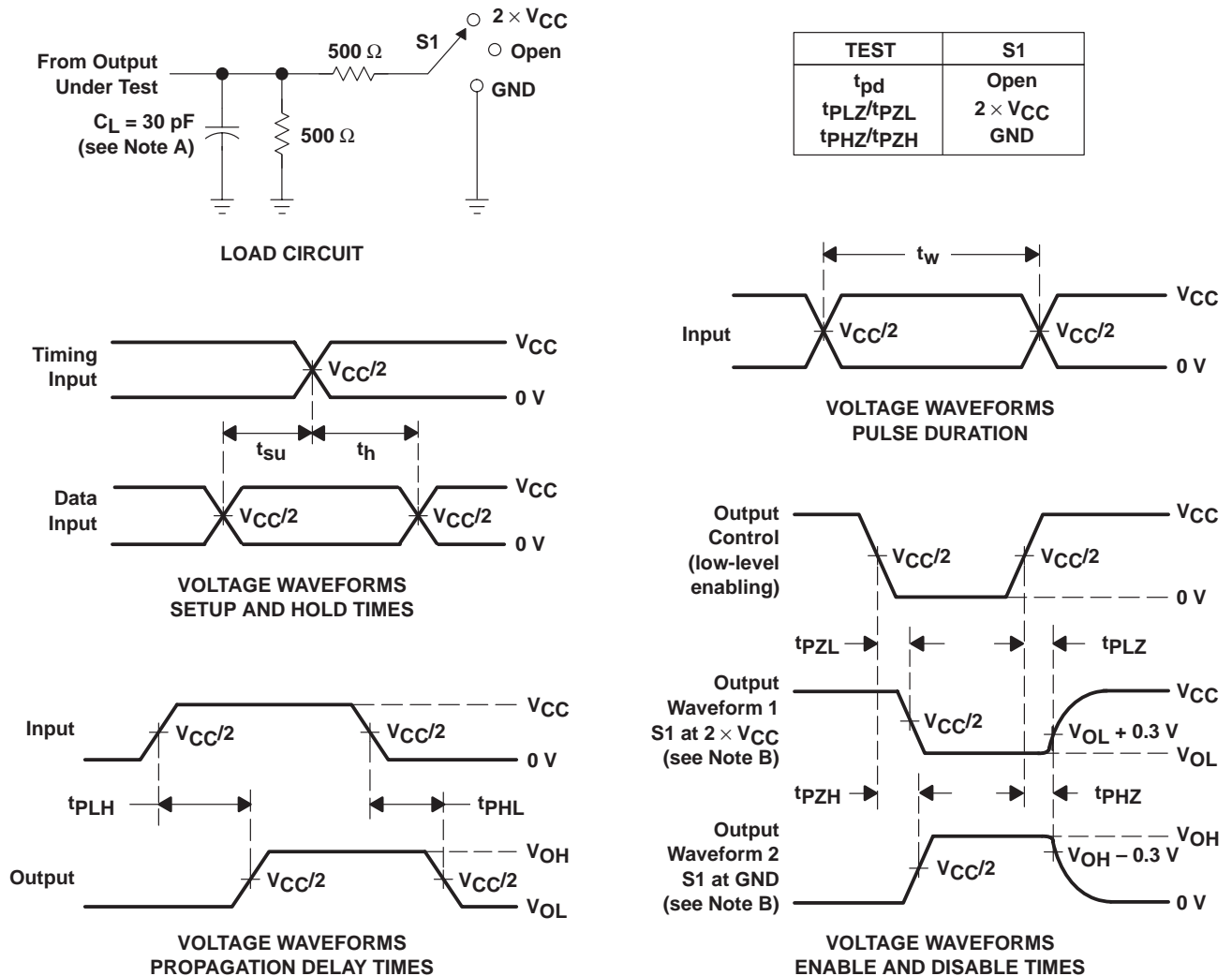
operating characteristics, T_A = 25°C

| PARAMETER | | TEST CONDITIONS | V _{CC} = 3.3 V | UNIT |
|-----------------|---|------------------|-------------------------|------|
| | | | TYP | |
| C _{pd} | Power dissipation capacitance per transceiver | Outputs enabled | 42 | pF |
| | | Outputs disabled | 3 | |



PARAMETER MEASUREMENT INFORMATION

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



- 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 $\leq 10\text{ MHz}$, $Z_O = 50\ \Omega$, $t_r \leq 2\text{ ns}$, $t_f \leq 2\text{ ns}$.
 - 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 ⁽¹⁾ | Package Type | Package Drawing | Pins | Package Qty | Eco Plan ⁽²⁾ | Lead/Ball Finish | MSL Peak Temp ⁽³⁾ |
|-------------------|-----------------------|--------------|-----------------|------|-------------|-------------------------|------------------|------------------------------|
| SN74LVCZ245ADBR | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADBRE4 | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADBRG4 | ACTIVE | SSOP | DB | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADW | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADWE4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADWG4 | ACTIVE | SOIC | DW | 20 | 25 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADWR | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADWRE4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ADWRG4 | ACTIVE | SOIC | DW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245AN | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74LVCZ245ANE4 | ACTIVE | PDIP | N | 20 | 20 | Pb-Free (RoHS) | CU NIPDAU | N / A for Pkg Type |
| SN74LVCZ245ANSR | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ANSRE4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245ANSRG4 | ACTIVE | SO | NS | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APW | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWE4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWG4 | ACTIVE | TSSOP | PW | 20 | 70 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWR | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWRE4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWRG4 | ACTIVE | TSSOP | PW | 20 | 2000 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWT | ACTIVE | TSSOP | PW | 20 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWTE4 | ACTIVE | TSSOP | PW | 20 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |
| SN74LVCZ245APWTG4 | ACTIVE | TSSOP | PW | 20 | 250 | Green (RoHS & no Sb/Br) | CU NIPDAU | Level-1-260C-UNLIM |

⁽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.

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TAPE AND REEL INFORMATION



QUADRANT ASSIGNMENTS FOR PIN 1 ORIENTATION IN TAPE



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Reel Diameter (mm) | Reel Width W1 (mm) | A0 (mm) | B0 (mm) | K0 (mm) | P1 (mm) | W (mm) | Pin1 Quadrant |
|-----------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVCZ245ADBR | SSOP | DB | 20 | 2000 | 330.0 | 16.4 | 8.2 | 7.5 | 2.5 | 12.0 | 16.0 | Q1 |
| SN74LVCZ245ADWR | SOIC | DW | 20 | 2000 | 330.0 | 24.4 | 10.8 | 13.0 | 2.7 | 12.0 | 24.0 | Q1 |
| SN74LVCZ245ANSR | SO | NS | 20 | 2000 | 330.0 | 24.4 | 8.2 | 13.0 | 2.5 | 12.0 | 24.0 | Q1 |
| SN74LVCZ245APWR | TSSOP | PW | 20 | 2000 | 330.0 | 16.4 | 6.95 | 7.1 | 1.6 | 8.0 | 16.0 | Q1 |

TAPE AND REEL BOX DIMENSIONS



*All dimensions are nominal

| Device | Package Type | Package Drawing | Pins | SPQ | Length (mm) | Width (mm) | Height (mm) |
|-----------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVCZ245ADBR | SSOP | DB | 20 | 2000 | 346.0 | 346.0 | 33.0 |
| SN74LVCZ245ADWR | SOIC | DW | 20 | 2000 | 346.0 | 346.0 | 41.0 |
| SN74LVCZ245ANSR | SO | NS | 20 | 2000 | 346.0 | 346.0 | 41.0 |
| SN74LVCZ245APWR | TSSOP | PW | 20 | 2000 | 346.0 | 346.0 | 33.0 |

DB (R-PDSO-G**)

PLASTIC SMALL-OUTLINE

28 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.
 D. Falls within JEDEC MO-150

PW (R-PDSO-G**)

PLASTIC SMALL-OUTLINE PACKAGE

14 PINS SHOWN



4040064/F 01/97

- 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.
 D. Falls within JEDEC MO-153

MECHANICAL DATA

NS (R-PDSO-G)**

PLASTIC SMALL-OUTLINE PACKAGE

14-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.

DW (R-PDSO-G20)

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 MS-013 variation AC.

N (R-PDIP-T**)

PLASTIC DUAL-IN-LINE PACKAGE

16 PINS SHOWN



- NOTES:
- A. All linear dimensions are in inches (millimeters).
 - B. This drawing is subject to change without notice.
 - $\triangle C$ Falls within JEDEC MS-001, except 18 and 20 pin minimum body length (Dim A).
 - $\triangle D$ The 20 pin end lead shoulder width is a vendor option, either half or full width.

4040049/E 12/2002

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