

# SN54LS245, SN74LS245 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

SDLS146A – OCTOBER 1976 – REVISED FEBRUARY 2002

- 3-State Outputs Drive Bus Lines Directly
- PNP Inputs Reduce dc Loading on Bus Lines
- Hysteresis at Bus Inputs Improves Noise Margins
- Typical Propagation Delay Times Port to Port, 8 ns

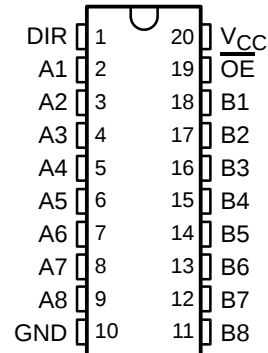
| TYPE      | I <sub>OL</sub><br>(SINK<br>CURRENT) | I <sub>OH</sub><br>(SOURCE<br>CURRENT) |
|-----------|--------------------------------------|----------------------------------------|
| SN54LS245 | 12 mA                                | –12 mA                                 |
| SN74LS245 | 24 mA                                | –15 mA                                 |

## description

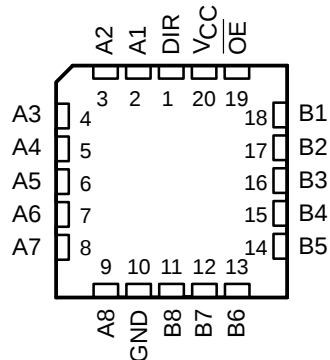
These octal bus transceivers are designed for asynchronous two-way communication between data buses. The control-function implementation minimizes external timing requirements.

The devices allow 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 disable the device so that the buses are effectively isolated.

SN54LS245 . . . J OR W PACKAGE  
SN74LS245 . . . DB, DW, N, OR NS PACKAGE  
(TOP VIEW)



SN54LS245 . . . FK PACKAGE  
(TOP VIEW)



## ORDERING INFORMATION

| T <sub>A</sub> | PACKAGE†  |               | ORDERABLE<br>PART NUMBER | TOP-SIDE<br>MARKING |
|----------------|-----------|---------------|--------------------------|---------------------|
| 0°C to 70°C    | PDIP – N  | Tube          | SN74LS245N               | SN74LS245N          |
|                | SOIC – DW | Tube          | SN74LS245DW              | LS245               |
|                |           | Tape and reel | SN74LS245DWR             |                     |
|                | SOP – NS  | Tape and reel | SN74LS245NSR             | 74LS245             |
| –55°C to 125°C | SSOP – DB | Tape and reel | SN74LS245DBR             | LS245               |
|                | CDIP – J  | Tube          | SN54LS245J               | SN54LS245J          |
|                |           | Tube          | SNJ54LS245J              | SNJ54LS245J         |
|                | CFP – W   | Tube          | SNJ54LS245W              | SNJ54LS245W         |
|                | LCCC – FK | Tube          | SN54LS245FK              | SN54LS245FK         |

† 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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**TEXAS  
INSTRUMENTS**

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On products compliant to MIL-PRF-38535, all parameters are tested unless otherwise noted. On all other products, production processing does not necessarily include testing of all parameters.

## SN54LS245, SN74LS245 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

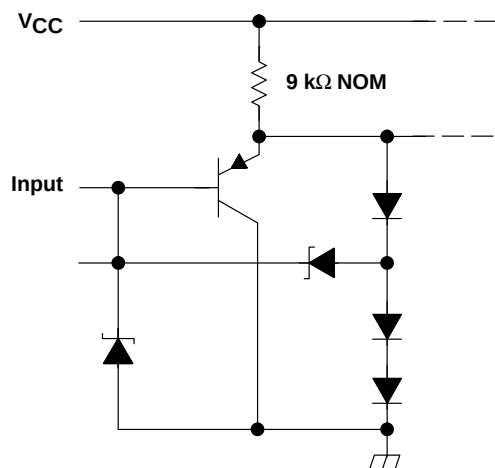
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## FUNCTION TABLE

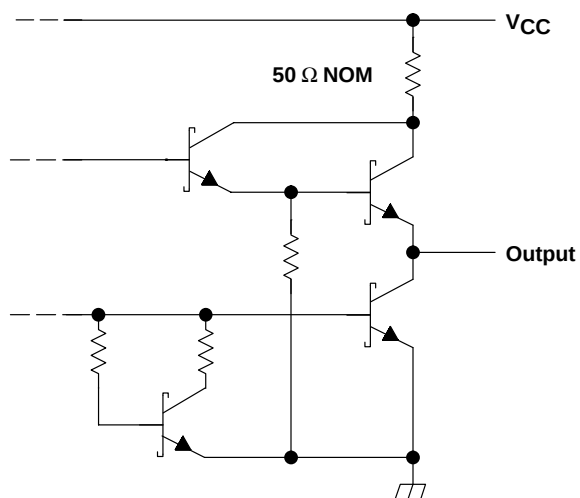
| INPUTS          |     | OPERATION       |
|-----------------|-----|-----------------|
| $\overline{OE}$ | DIR |                 |
| L               | L   | B data to A bus |
| L               | H   | A data to B bus |
| H               | X   | Isolation       |

## schematics of inputs and outputs

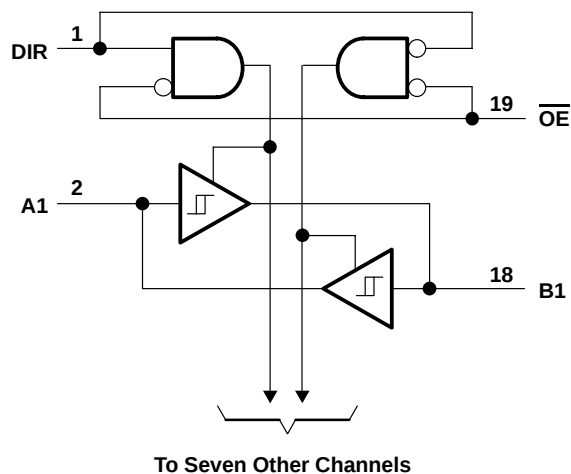
### EQUIVALENT OF EACH INPUT



**TYPICAL OF ALL OUTPUTS**



**logic diagram (positive logic)**



# SN54LS245, SN74LS245 OCTAL BUS TRANSCEIVERS WITH 3-STATE OUTPUTS

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## absolute maximum ratings over operating free-air temperature range (unless otherwise noted)<sup>†</sup>

|                                                        |                |
|--------------------------------------------------------|----------------|
| Supply voltage, $V_{CC}$                               | 7 V            |
| Input voltage, $V_I$ (see Note 1)                      | 7 V            |
| Package thermal impedance, $\theta_{JA}$ (see Note 2): |                |
| DB package                                             | 70°C/W         |
| DW package                                             | 58°C/W         |
| N package                                              | 69°C/W         |
| NS package                                             | 60°C/W         |
| Storage temperature range, $T_{stg}$                   | –65°C to 150°C |

<sup>†</sup> 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. All voltage values are with respect to GND.

2. The package thermal impedance is calculated in accordance with JESD 51-7.

## recommended operating conditions

|          |                                | SN54LS245 |     |     | SN74LS245 |     |      | UNIT |
|----------|--------------------------------|-----------|-----|-----|-----------|-----|------|------|
|          |                                | MIN       | NOM | MAX | MIN       | NOM | MAX  |      |
| $V_{CC}$ | Supply voltage                 | 4.5       | 5   | 5.5 | 4.75      | 5   | 5.25 | V    |
| $I_{OH}$ | High-level output current      |           |     | –12 |           |     | –15  | mA   |
| $I_{OL}$ | Low-level output current       |           |     | 12  |           |     | 24   | mA   |
| $T_A$    | Operating free-air temperature | –55       |     | 125 | 0         |     | 70   | °C   |



# SN54LS245, SN74LS245

## OCTAL BUS TRANSCEIVERS

### WITH 3-STATE OUTPUTS

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

| PARAMETER                                       |                                                      | TEST CONDITIONS†                                                                     | SN54LS245               |      |      | SN74LS245 |      |      | UNIT |
|-------------------------------------------------|------------------------------------------------------|--------------------------------------------------------------------------------------|-------------------------|------|------|-----------|------|------|------|
|                                                 |                                                      |                                                                                      | MIN                     | TYP‡ | MAX  | MIN       | TYP‡ | MAX  |      |
| V <sub>IH</sub>                                 | High-level input voltage                             |                                                                                      | 2                       |      |      | 2         |      |      | V    |
| V <sub>IL</sub>                                 | Low-level input voltage                              |                                                                                      |                         |      | 0.7  |           |      | 0.8  | V    |
| V <sub>IK</sub>                                 | Input clamp voltage                                  | V <sub>CC</sub> = MIN, I <sub>I</sub> = -18 mA                                       |                         |      | -1.5 |           |      | -1.5 | V    |
| Hysteresis (V <sub>T+</sub> - V <sub>T-</sub> ) |                                                      | A or B                                                                               | V <sub>CC</sub> = MIN   | 0.2  | 0.4  | 0.2       | 0.4  |      | V    |
| V <sub>OH</sub>                                 | High-level output voltage                            | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL(max)</sub> | I <sub>OH</sub> = -3 mA |      | 2.4  | 3.4       | 2.4  | 3.4  | V    |
|                                                 |                                                      |                                                                                      | I <sub>OH</sub> = MAX   |      | 2    |           | 2    |      |      |
| V <sub>OL</sub>                                 | Low-level output voltage                             | V <sub>CC</sub> = MIN, V <sub>IH</sub> = 2 V, V <sub>IL</sub> = V <sub>IL(max)</sub> | I <sub>OL</sub> = 12 mA |      | 0.4  |           |      | 0.4  | V    |
|                                                 |                                                      |                                                                                      | I <sub>OL</sub> = 24 mA |      |      |           |      | 0.5  |      |
| I <sub>OZH</sub>                                | Off-state output current, high-level voltage applied | V <sub>CC</sub> = MAX, OE at 2 V                                                     | V <sub>O</sub> = 2.7 V  |      | 20   |           |      | 20   | μA   |
| I <sub>OZL</sub>                                | Off-state output current, low-level voltage applied  | V <sub>CC</sub> = MAX, OE at 2 V                                                     | V <sub>O</sub> = 0.4 V  |      | -200 |           |      | -200 | μA   |
| I <sub>I</sub>                                  | Input current at maximum input voltage               | A or B<br>DIR or $\overline{\text{OE}}$                                              | V <sub>CC</sub> = MAX   |      |      |           |      |      | mA   |
|                                                 |                                                      |                                                                                      | V <sub>I</sub> = 5.5 V  |      | 0.1  |           |      | 0.1  |      |
|                                                 |                                                      |                                                                                      | V <sub>I</sub> = 7 V    |      | 0.1  |           |      | 0.1  |      |
| I <sub>IH</sub>                                 | High-level input current                             | V <sub>CC</sub> = MAX, V <sub>IH</sub> = 2.7 V                                       |                         |      | 20   |           |      | 20   | μA   |
| I <sub>IL</sub>                                 | Low-level input current                              | V <sub>CC</sub> = MAX, V <sub>IL</sub> = 0.4 V                                       |                         |      | -0.2 |           |      | -0.2 | mA   |
| I <sub>OS</sub>                                 | Short-circuit output current§                        | V <sub>CC</sub> = MAX                                                                | -40                     |      | -225 | 40        |      | -225 | mA   |
| I <sub>CC</sub>                                 | Supply current                                       | Total, outputs high                                                                  |                         |      | 48   | 70        | 48   | 70   | mA   |
|                                                 |                                                      | Total, outputs low                                                                   |                         |      | 62   | 90        | 62   | 90   |      |
|                                                 |                                                      | Outputs at high Z                                                                    |                         |      | 64   | 95        | 64   | 95   |      |

† For conditions shown as MIN or MAX, use the appropriate values specified under recommended operating conditions.

‡ All typical values are at V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C.

§ Not more than one output should be shorted at a time, and duration of the short circuit should not exceed one second.

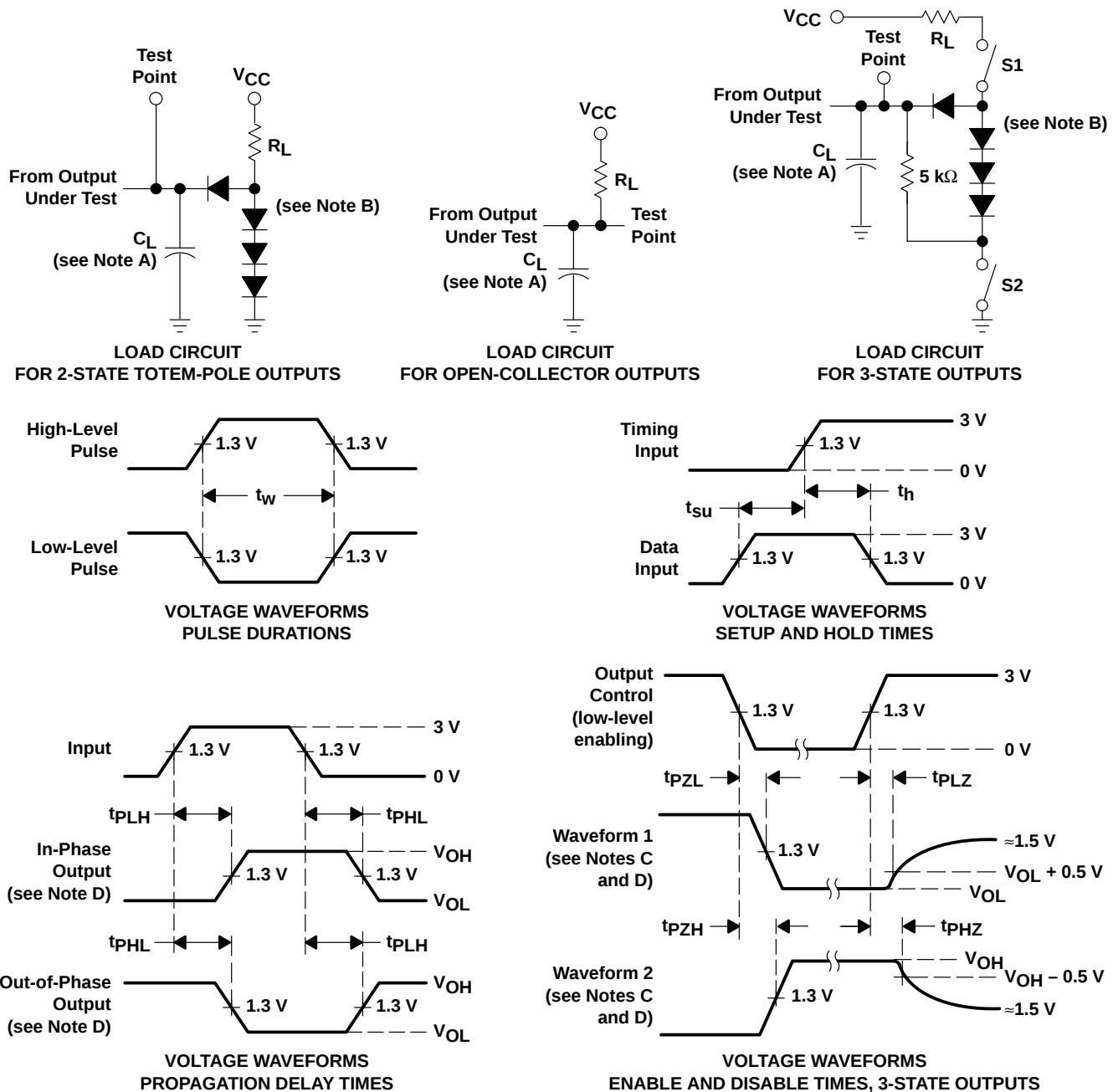
### switching characteristics, V<sub>CC</sub> = 5 V, T<sub>A</sub> = 25°C (see Figure 1)

| PARAMETER        |                                                   | TEST CONDITIONS                                |  | MIN | TYP | MAX | UNIT |
|------------------|---------------------------------------------------|------------------------------------------------|--|-----|-----|-----|------|
| t <sub>PLH</sub> | Propagation delay time, low- to high-level output | C <sub>L</sub> = 45 pF, R <sub>L</sub> = 667 Ω |  |     | 8   | 12  | ns   |
| t <sub>PHL</sub> | Propagation delay time, high- to low-level output |                                                |  |     | 8   | 12  |      |
| t <sub>PZL</sub> | Output enable time to low level                   | C <sub>L</sub> = 45 pF, R <sub>L</sub> = 667 Ω |  |     | 27  | 40  | ns   |
| t <sub>PZH</sub> | Output enable time to high level                  |                                                |  |     | 25  | 40  |      |
| t <sub>PLZ</sub> | Output disable time from low level                | C <sub>L</sub> = 5 pF, R <sub>L</sub> = 667 Ω  |  |     | 15  | 25  | ns   |
| t <sub>PHZ</sub> | Output disable time from high level               |                                                |  |     | 15  | 28  |      |



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PARAMETER MEASUREMENT INFORMATION  
SERIES 54LS/74LS DEVICES



- NOTES: A.  $C_L$  includes probe and jig capacitance.  
B. All diodes are 1N3064 or equivalent.  
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. S1 and S2 are closed for  $t_{PLH}$ ,  $t_{PHL}$ ,  $t_{PHZ}$ , and  $t_{PLZ}$ ; S1 is open and S2 is closed for  $t_{pZH}$ ; S1 is closed and S2 is open for  $t_{pZL}$ .  
E. Phase relationships between inputs and outputs have been chosen arbitrarily for these examples.  
F. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 1$  MHz,  $Z_O \approx 50 \Omega$ ,  $t_r \leq 1.5$  ns,  $t_f \leq 2.6$  ns.  
G. The outputs are measured one at a time with one input transition per measurement.

Figure 1. Load Circuits and Voltage Waveforms

**PACKAGING INFORMATION**

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Top-Side Markings<br>(4)           | Samples                 |
|------------------|---------------|--------------|--------------------|------|-------------|----------------------------|------------------|----------------------|--------------|------------------------------------|-------------------------|
| 5962-8002101VRA  | ACTIVE        | CDIP         | J                  | 20   | 20          | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | 5962-8002101VR<br>A<br>SNV54LS245J | <a href="#">Samples</a> |
| 5962-8002101VSA  | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | N / A for Pkg Type   | -55 to 125   | 5962-8002101VS<br>A<br>SNV54LS245W | <a href="#">Samples</a> |
| 80021012A        | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | Call TI          | Call TI              | -55 to 125   | 80021012A<br>SNJ54LS<br>245FK      | <a href="#">Samples</a> |
| 8002101SA        | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | Call TI              | -55 to 125   | 8002101SA<br>SNJ54LS245W           | <a href="#">Samples</a> |
| JM38510/32803B2A | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | POST-PLATE       | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803B2A               | <a href="#">Samples</a> |
| JM38510/32803BRA | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803BRA               | <a href="#">Samples</a> |
| JM38510/32803BSA | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803BSA               | <a href="#">Samples</a> |
| M38510/32803B2A  | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | POST-PLATE       | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803B2A               | <a href="#">Samples</a> |
| M38510/32803BRA  | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803BRA               | <a href="#">Samples</a> |
| M38510/32803BSA  | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | N / A for Pkg Type   | -55 to 125   | JM38510/<br>32803BSA               | <a href="#">Samples</a> |
| SN54LS245J       | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | SN54LS245J                         | <a href="#">Samples</a> |
| SN74LS245DBR     | ACTIVE        | SSOP         | DB                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                              | <a href="#">Samples</a> |
| SN74LS245DBRE4   | ACTIVE        | SSOP         | DB                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                              | <a href="#">Samples</a> |
| SN74LS245DBRG4   | ACTIVE        | SSOP         | DB                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                              | <a href="#">Samples</a> |
| SN74LS245DW      | ACTIVE        | SOIC         | DW                 | 20   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                              | <a href="#">Samples</a> |
| SN74LS245DWG4    | ACTIVE        | SOIC         | DW                 | 20   | 25          | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                              | <a href="#">Samples</a> |

| Orderable Device | Status<br>(1) | Package Type | Package<br>Drawing | Pins | Package Qty | Eco Plan<br>(2)            | Lead/Ball Finish | MSL Peak Temp<br>(3) | Op Temp (°C) | Top-Side Markings<br>(4)      | Samples                 |
|------------------|---------------|--------------|--------------------|------|-------------|----------------------------|------------------|----------------------|--------------|-------------------------------|-------------------------|
| SN74LS245DWR     | ACTIVE        | SOIC         | DW                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                         | <a href="#">Samples</a> |
| SN74LS245DWRG4   | ACTIVE        | SOIC         | DW                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | LS245                         | <a href="#">Samples</a> |
| SN74LS245J       | OBSOLETE      | CDIP         | J                  | 20   |             | TBD                        | Call TI          | Call TI              | 0 to 70      |                               |                         |
| SN74LS245N       | ACTIVE        | PDIP         | N                  | 20   | 20          | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | 0 to 70      | SN74LS245N                    | <a href="#">Samples</a> |
| SN74LS245N3      | OBSOLETE      | PDIP         | N                  | 20   |             | TBD                        | Call TI          | Call TI              | 0 to 70      |                               |                         |
| SN74LS245NE4     | ACTIVE        | PDIP         | N                  | 20   | 20          | Pb-Free<br>(RoHS)          | CU NIPDAU        | N / A for Pkg Type   | 0 to 70      | SN74LS245N                    | <a href="#">Samples</a> |
| SN74LS245NSR     | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | 74LS245                       | <a href="#">Samples</a> |
| SN74LS245NSRE4   | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | 74LS245                       | <a href="#">Samples</a> |
| SN74LS245NSRG4   | ACTIVE        | SO           | NS                 | 20   | 2000        | Green (RoHS<br>& no Sb/Br) | CU NIPDAU        | Level-1-260C-UNLIM   | 0 to 70      | 74LS245                       | <a href="#">Samples</a> |
| SNJ54LS245FK     | ACTIVE        | LCCC         | FK                 | 20   | 1           | TBD                        | POST-PLATE       | N / A for Pkg Type   | -55 to 125   | 80021012A<br>SNJ54LS<br>245FK | <a href="#">Samples</a> |
| SNJ54LS245J      | ACTIVE        | CDIP         | J                  | 20   | 1           | TBD                        | A42              | N / A for Pkg Type   | -55 to 125   | SNJ54LS245J                   | <a href="#">Samples</a> |
| SNJ54LS245W      | ACTIVE        | CFP          | W                  | 20   | 1           | TBD                        | Call TI          | N / A for Pkg Type   | -55 to 125   | 8002101SA<br>SNJ54LS245W      | <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.

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**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.

<sup>(4)</sup> Only one of markings shown within the brackets will appear on the physical device.

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**OTHER QUALIFIED VERSIONS OF SN54LS245, SN54LS245-SP, SN74LS245 :**

- Catalog: [SN74LS245](#), [SN54LS245](#)
- Military: [SN54LS245](#)
- Space: [SN54LS245-SP](#)

**NOTE: Qualified Version Definitions:**

- Catalog - TI's standard catalog product
- Military - QML certified for Military and Defense Applications
- Space - Radiation tolerant, ceramic packaging and qualified for use in Space-based application

**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 |
|--------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LS245DBR | SSOP         | DB              | 20   | 2000 | 330.0              | 16.4               | 8.2     | 7.5     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LS245DWR | SOIC         | DW              | 20   | 2000 | 330.0              | 24.4               | 10.8    | 13.0    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LS245NSR | SO           | NS              | 20   | 2000 | 330.0              | 24.4               | 8.2     | 13.0    | 2.5     | 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) |
|--------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LS245DBR | SSOP         | DB              | 20   | 2000 | 367.0       | 367.0      | 38.0        |
| SN74LS245DWR | SOIC         | DW              | 20   | 2000 | 367.0       | 367.0      | 45.0        |
| SN74LS245NSR | SO           | NS              | 20   | 2000 | 367.0       | 367.0      | 45.0        |

J (R-GDIP-T\*\*)

14 LEADS SHOWN

# CERAMIC DUAL IN-LINE PACKAGE



| PINS **<br>DIM | 14                     | 16                     | 18                     | 20                     |
|----------------|------------------------|------------------------|------------------------|------------------------|
| A              | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC | 0.300<br>(7,62)<br>BSC |
| B MAX          | 0.785<br>(19,94)       | .840<br>(21,34)        | 0.960<br>(24,38)       | 1.060<br>(26,92)       |
| B MIN          | —                      | —                      | —                      | —                      |
| C MAX          | 0.300<br>(7,62)        | 0.300<br>(7,62)        | 0.310<br>(7,87)        | 0.300<br>(7,62)        |
| C MIN          | 0.245<br>(6,22)        | 0.245<br>(6,22)        | 0.220<br>(5,59)        | 0.245<br>(6,22)        |



4040083/F 03/03

- NOTES:
- A. All linear dimensions are in inches (millimeters).
  - B. This drawing is subject to change without notice.
  - C. This package is hermetically sealed with a ceramic lid using glass frit.
  - D. Index point is provided on cap for terminal identification only on press ceramic glass frit seal only.
  - E. Falls within MIL STD 1835 GDIP1-T14, GDIP1-T16, GDIP1-T18 and GDIP1-T20.

W (R-GDFP-F20)

CERAMIC DUAL FLATPACK



- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a ceramic lid using glass frit.
  - Index point is provided on cap for terminal identification only.
  - Falls within Mil-Std 1835 GDFP2-F20

FK (S-CQCC-N\*\*)

LEADLESS CERAMIC CHIP CARRIER

28 TERMINAL SHOWN



| NO. OF<br>TERMINALS<br>** | A                |                  | B                |                  |
|---------------------------|------------------|------------------|------------------|------------------|
|                           | MIN              | MAX              | MIN              | MAX              |
| 20                        | 0.342<br>(8,69)  | 0.358<br>(9,09)  | 0.307<br>(7,80)  | 0.358<br>(9,09)  |
| 28                        | 0.442<br>(11,23) | 0.458<br>(11,63) | 0.406<br>(10,31) | 0.458<br>(11,63) |
| 44                        | 0.640<br>(16,26) | 0.660<br>(16,76) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 52                        | 0.740<br>(18,78) | 0.761<br>(19,32) | 0.495<br>(12,58) | 0.560<br>(14,22) |
| 68                        | 0.938<br>(23,83) | 0.962<br>(24,43) | 0.850<br>(21,6)  | 0.858<br>(21,8)  |
| 84                        | 1.141<br>(28,99) | 1.165<br>(29,59) | 1.047<br>(26,6)  | 1.063<br>(27,0)  |



4040140/D 01/11

- NOTES:
- All linear dimensions are in inches (millimeters).
  - This drawing is subject to change without notice.
  - This package can be hermetically sealed with a metal lid.
  - Falls within JEDEC MS-004

## N (R-PDIP-T\*\*)

16 PINS SHOWN

## PLASTIC DUAL-IN-LINE PACKAGE



| PINS **             | 14               | 16               | 18               | 20               |
|---------------------|------------------|------------------|------------------|------------------|
| DIM                 |                  |                  |                  |                  |
| A MAX               | 0.775<br>(19,69) | 0.775<br>(19,69) | 0.920<br>(23,37) | 1.060<br>(26,92) |
| A MIN               | 0.745<br>(18,92) | 0.745<br>(18,92) | 0.850<br>(21,59) | 0.940<br>(23,88) |
| MS-001<br>VARIATION | AA               | BB               | AC               | AD               |



4040049/E 12/2002

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

DW (R-PDSO-G20)

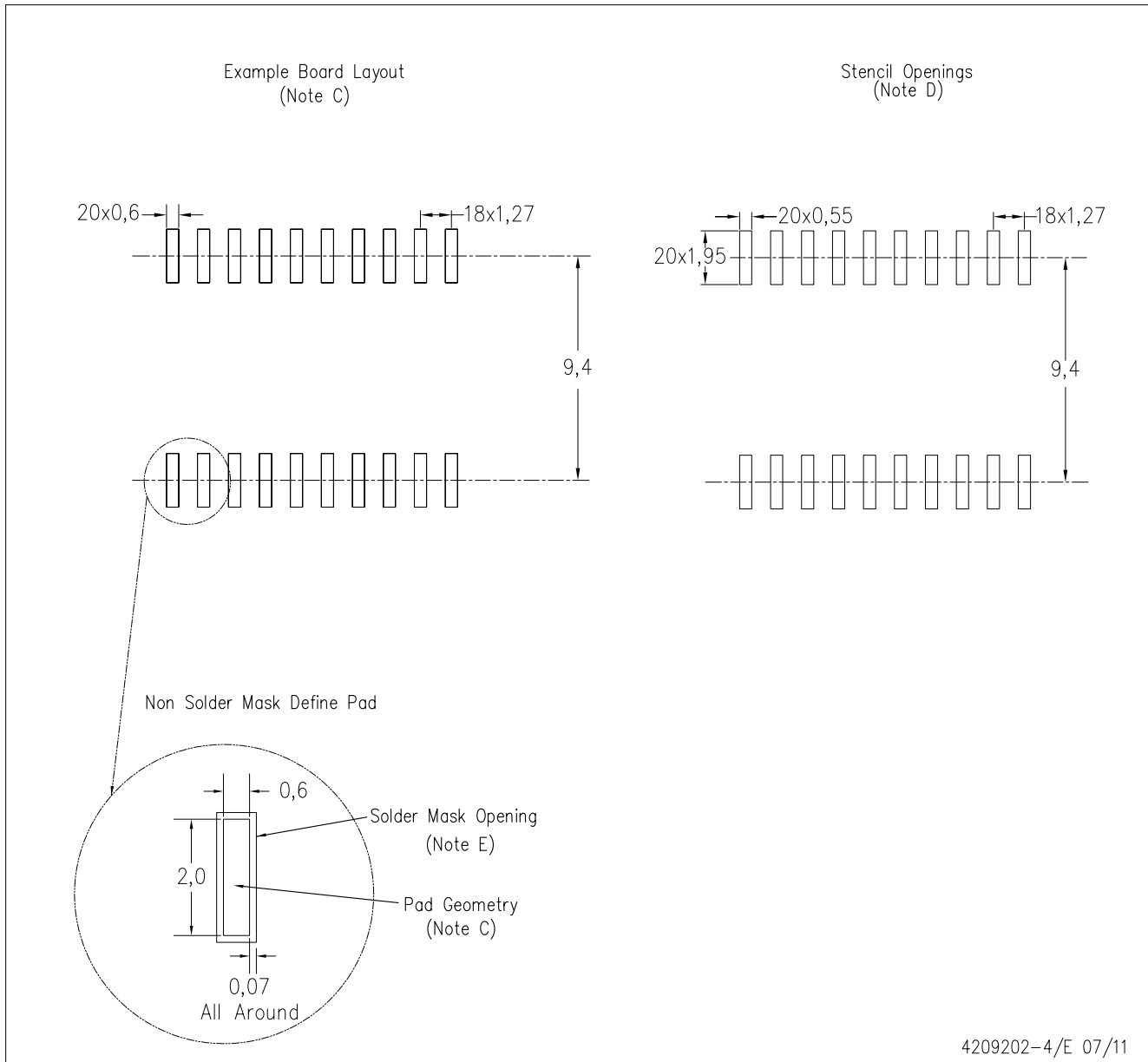
PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in inches (millimeters). Dimensioning and tolerancing per ASME Y14.5M-1994.
  - 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.

DW (R-PDSO-G20)

PLASTIC SMALL OUTLINE



- NOTES:
- A. All linear dimensions are in millimeters.
  - B. This drawing is subject to change without notice.
  - C. Refer to IPC7351 for alternate board design.
  - D. Laser cutting apertures with trapezoidal walls and also rounding corners will offer better paste release. Customers should contact their board assembly site for stencil design recommendations. Refer to IPC-7525
  - E. Customers should contact their board fabrication site for solder mask tolerances between and around signal pads.

# MECHANICAL DATA

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

PLASTIC SMALL-OUTLINE PACKAGE

14-PINS SHOWN



| DIM \ PINS ** | 14    | 16    | 20    | 24    |
|---------------|-------|-------|-------|-------|
| A MAX         | 10,50 | 10,50 | 12,90 | 15,30 |
| A MIN         | 9,90  | 9,90  | 12,30 | 14,70 |

4040062/C 03/03

- 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.

## 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

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|                               |                                                                                          |
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