

## SN74LVC4245A Octal Bus Transceiver and 3.3-V to 5-V Shifter With 3-State Outputs

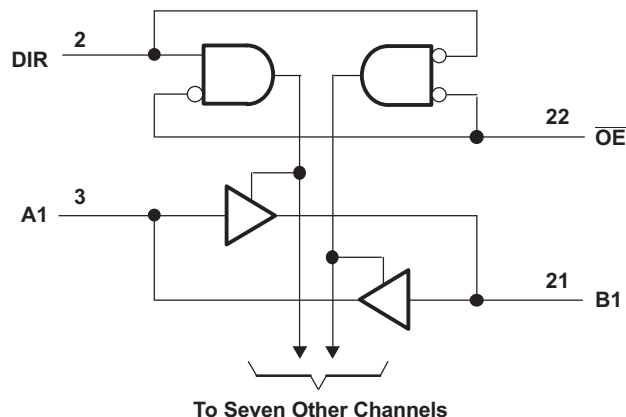
### 1 Features

- Bidirectional Voltage Translator
- 5.5 V on A Port and 2.7 V to 3.6 V on B Port
- Control Inputs  $V_{IH}/V_{IL}$  Levels Are Referenced to  $V_{CCA}$  Voltage
- Latch-Up Performance Exceeds 250 mA Per JESD 17
- ESD Protection Exceeds JESD 22
  - 2000-V Human-Body Model
  - 200-V Machine Model
  - 1000-V Charged-Device Model

### 2 Applications

- ATCA Solutions
- CPAP Machines
- Cameras: Surveillance Analog
- Chemical or Gas Sensors
- CT Scanners
- DLP 3D Machine Vision and Optical Networking
- Digital Signage
- ECGs: Electrocardiograms
- Field Transmitters: Pressure Sensors and Temperature Sensors
- High-Speed Data Acquisition and Generation
- HMI (Human Machine Interface)
- RF4CE Remote Controls
- Server Motherboards
- Software Defined Radios (SDR)
- Wireless LAN Cards and Data Access Cards
- X-ray: Medical, Dental, and Baggage Scanners

### 4 Simplified Schematic



### 3 Description

This 8-bit (octal) noninverting bus transceiver contains two separate supply rails; B port has  $V_{CCB}$ , which is set at 3.3 V, and A port has  $V_{CCA}$ , which is set at 5 V. This allows for translation from a 3.3-V to a 5-V environment, and vice versa.

The SN74LVC4245A device 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. The control circuitry (DIR,  $\overline{OE}$ ) is powered by  $V_{CCA}$ .

The SN74LVC4245A device terminal out allows the designer to switch to a normal all-3.3-V or all-5-V 20-terminal SN74LVC4245 device without board re-layout. The designer uses the data paths for pins 2–11 and 14–23 of the SN74LVC4245A device to align with the conventional '245 terminal out.

#### Device Information<sup>(1)</sup>

| PART NUMBER  | PACKAGE    | BODY SIZE (NOM)    |
|--------------|------------|--------------------|
| SN74LVC4245A | SSOP (24)  | 8.20 mm × 5.30 mm  |
|              | SOIC (24)  | 15.40 mm × 7.50 mm |
|              | TSSOP (24) | 7.80 mm × 4.40 mm  |

(1) For all available packages, see the orderable addendum at the end of the data sheet.



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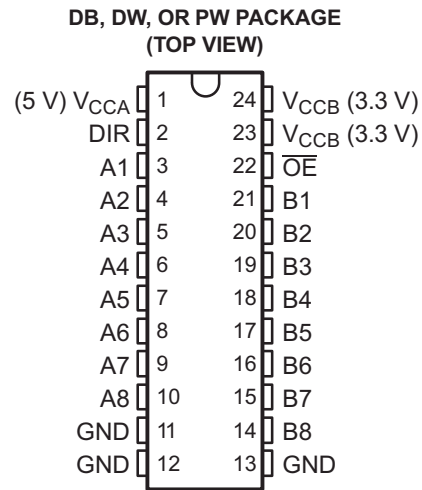
## 5 Revision History

### Changes from Revision H (March 2005) to Revision I

**Page**

- Added *Applications*, *Device Information* table, *Pin Functions* table, *ESD Ratings* table, *Thermal Information* table, *Typical Characteristics*, *Feature Description* section, *Device Functional Modes*, *Application and Implementation* section, *Power Supply Recommendations* section, *Layout* section, *Device and Documentation Support* section, and *Mechanical, Packaging, and Orderable Information* section. .... **1**
- Deleted *Ordering Information* table. .... **1**

## 6 Pin Configuration and Functions



### Pin Functions

| PIN |                 | TYPE | DESCRIPTION             |
|-----|-----------------|------|-------------------------|
| NO. | NAME            |      |                         |
| 1   | $V_{CCA}$       | —    | Power supply for side A |
| 2   | DIR             | I    | Direction control       |
| 3   | A1              | I/O  | Transceiver I/O pin     |
| 4   | A2              | I/O  | Transceiver I/O pin     |
| 5   | A3              | I/O  | Transceiver I/O pin     |
| 6   | A4              | I/O  | Transceiver I/O pin     |
| 7   | A5              | I/O  | Transceiver I/O pin     |
| 8   | A6              | I/O  | Transceiver I/O pin     |
| 9   | A7              | I/O  | Transceiver I/O pin     |
| 10  | A8              | I/O  | Transceiver I/O pin     |
| 11  | GND             | —    | Ground                  |
| 12  | GND             | —    | Ground                  |
| 13  | GND             | —    | Ground                  |
| 14  | B8              | I/O  | Transceiver I/O pin     |
| 15  | B7              | I/O  | Transceiver I/O pin     |
| 16  | B6              | I/O  | Transceiver I/O pin     |
| 17  | B5              | I/O  | Transceiver I/O pin     |
| 18  | B4              | I/O  | Transceiver I/O pin     |
| 19  | B3              | I/O  | Transceiver I/O pin     |
| 20  | B2              | I/O  | Transceiver I/O pin     |
| 21  | B1              | I/O  | Transceiver I/O pin     |
| 22  | $\overline{OE}$ | I    | Output Enable           |
| 23  | $V_{CCB}$       | —    | Power supply for side B |
| 24  | $V_{CCB}$       | —    | Power supply for side B |

## 7 Specifications

### 7.1 Absolute Maximum Ratings

over operating free-air temperature range for  $V_{CCA} = 4.5\text{ V to }5.5\text{ V}$  (unless otherwise noted)<sup>(1)</sup>

|           |  | MIN                   | MAX             | UNIT |
|-----------|--|-----------------------|-----------------|------|
| $V_{CCA}$ | Supply voltage range                             | -0.5                  | 6.5             | V    |
| $V_I$     | Input voltage range                              | A port <sup>(2)</sup> | $V_{CCA} + 0.5$ | V    |
|           |  | Control inputs        | 6               |      |
| $V_O$     | Output voltage range                             | -0.5                  | $V_{CCA} + 0.5$ | V    |
| $I_{IK}$  | Input clamp current                              | $V_I < 0$             | -50             | mA   |
| $I_{OK}$  | Output clamp current                             | $V_O < 0$             | -50             | mA   |
| $I_O$     | Continuous output current                        |                       | $\pm 50$        | mA   |
|           | Continuous current through each $V_{CCA}$ or GND |                       | $\pm 100$       |      |
| $T_{stg}$ | 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) This value is limited to 6 V maximum.

### 7.2 Absolute Maximum Ratings

over operating free-air temperature range for  $V_{CCB} = 2.7\text{ V to }3.6\text{ V}$  (unless otherwise noted)<sup>(1)</sup>

|           |   | MIN                   | MAX             | UNIT |
|-----------|---|-----------------------|-----------------|------|
| $V_{CCB}$ | Supply voltage range                        | -0.5                  | 4.6             | V    |
| $V_I$     | Input voltage range                         | B port <sup>(2)</sup> | $V_{CCB} + 0.5$ | V    |
|           |   |                       |                 |      |
| $V_O$     | Output voltage range                        | -0.5                  | $V_{CCB} + 0.5$ | V    |
| $I_{IK}$  | Input clamp current                         | $V_I < 0$             | -50             | mA   |
| $I_{OK}$  | Output clamp current                        | $V_O < 0$             | -50             | mA   |
| $I_O$     | Continuous output current                   |                       | $\pm 50$        | mA   |
|           | Continuous current through $V_{CCB}$ or GND |                       | $\pm 100$       |      |
| $T_{stg}$ | 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) This value is limited to 4.6 V maximum.

### 7.3 ESD Ratings

| PARAMETER   | DEFINITION              | VALUE  | UNIT |
|-------------|-------------------------|--|------|
| $V_{(ESD)}$ | Electrostatic discharge | Human body model (HBM), per ANSI/ESDA/JEDEC JS-001, all pins <sup>(1)</sup>              | 2000 |
|             |                         | Charged device model (CDM), per JEDEC specification JESD22-C101, all pins <sup>(2)</sup> | 1000 |

- (1) JEDEC document JEP155 states that 500-V HBM allows safe manufacturing with a standard ESD control process.
- (2) JEDEC document JEP157 states that 250-V CDM allows safe manufacturing with a standard ESD control process.

## 7.4 Recommended Operating Conditions

 for  $V_{CCA} = 4.5\text{ V to }5.5\text{ V}^{(1)}$ 

|           |                                | MIN | MAX       | UNIT |
|-----------|--------------------------------|-----|-----------|------|
| $V_{CCA}$ | Supply voltage                 | 4.5 | 5.5       | V    |
| $V_{IH}$  | High-level input voltage       | 2   |           | V    |
| $V_{IL}$  | Low-level input voltage        |     | 0.8       | V    |
| $V_{IA}$  | Input voltage                  | 0   | $V_{CCA}$ | V    |
| $V_{OA}$  | Output voltage                 | 0   | $V_{CCA}$ | V    |
| $I_{OH}$  | High-level output current      |     | -24       | mA   |
| $I_{OL}$  | Low-level output current       |     | 24        | mA   |
| $T_A$     | Operating free-air temperature | -40 | 85        | °C   |

(1) All unused inputs of the device must be held at the associated  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## 7.5 Recommended Operating Conditions

 for  $V_{CCB} = 2.7\text{ V to }3.6\text{ V}^{(1)}$ 

|           |                                |  | MIN | MAX       | UNIT |
|-----------|--------------------------------|--|-----|-----------|------|
| $V_{CCB}$ | Supply voltage                 |  | 2.7 | 3.6       | V    |
| $V_{IH}$  | High-level input voltage       | $V_{CCB} = 2.7\text{ V to }3.6\text{ V}$ | 2   |           | V    |
| $V_{IL}$  | Low-level input voltage        | $V_{CCB} = 2.7\text{ V to }3.6\text{ V}$ |     | 0.8       | V    |
| $V_{IB}$  | Input voltage                  |  | 0   | $V_{CCB}$ | V    |
| $V_{OB}$  | Output voltage                 |  | 0   | $V_{CCB}$ | V    |
| $I_{OH}$  | High-level output current      | $V_{CCB} = 2.7\text{ V}$                 |     | -12       | mA   |
|           |                                | $V_{CCB} = 3\text{ V}$                   |     | -24       |      |
| $I_{OL}$  | Low-level output current       | $V_{CCB} = 2.7\text{ V}$                 |     | 12        | mA   |
|           |                                | $V_{CCB} = 3\text{ V}$                   |     | 24        |      |
| $T_A$     | Operating free-air temperature |  | -40 | 85        | °C   |

(1) All unused inputs of the device must be held at the associated  $V_{CC}$  or GND to ensure proper device operation. Refer to the TI application report, *Implications of Slow or Floating CMOS Inputs*, literature number [SCBA004](#).

## 7.6 Thermal Information

| THERMAL METRIC <sup>(1)</sup> | SN74LVC4245A                           |    |    | UNIT |      |
|-------------------------------|--|----|----|------|------|
|                               | DB                                     | DW | PW |      |      |
|                               | 24 PINS                                |    |    |      |      |
| $R_{\theta JA}$               | Junction-to-ambient thermal resistance | 63 | 46 | 88   | °C/W |

(1) For more information about traditional and new thermal metrics, see the *IC Package Thermal Metrics* application report, [SPRA953](#).

## 7.7 Electrical Characteristics

 over recommended operating free-air temperature range for  $V_{CCA} = 4.5\text{ V}$  to  $5.5\text{ V}$  (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                       |                | TEST CONDITIONS                                      | $V_{CCA}$ | MIN  | TYP <sup>(2)</sup> | MAX     | UNIT          |
|---------------------------------|----------------|--|-----------|------|--------------------|---------|---------------|
| $V_{OH}$                        |                | $I_{OH} = -100\ \mu\text{A}$                         | 4.5 V     | 4.3  |                    | V       |               |
|                                 |                |  | 5.5 V     | 5.3  |                    |         |               |
|                                 |                | $I_{OH} = -24\ \text{mA}$                            | 4.5 V     | 3.7  |                    |         |               |
|                                 |                |  | 5.5 V     | 4.7  |                    |         |               |
| $V_{OL}$                        |                | $I_{OL} = 100\ \mu\text{A}$                          | 4.5 V     | 0.2  |                    | V       |               |
|                                 |                |  | 5.5 V     | 0.2  |                    |         |               |
|                                 |                | $I_{OL} = 24\ \text{mA}$                             | 4.5 V     | 0.55 |                    |         |               |
|                                 |                |  | 5.5 V     | 0.55 |                    |         |               |
| $I_i$                           | Control inputs | $V_i = V_{CCA}$ or GND                               | 5.5 V     |      |                    | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZ}$ <sup>(3)</sup>         | A port         | $V_O = V_{CCA}$ or GND                               | 5.5 V     |      |                    | $\pm 5$ | $\mu\text{A}$ |
| $I_{CCA}$                       |                | $V_i = V_{CCA}$ or GND, $I_O = 0$                    | 5.5 V     |      |                    | 80      | $\mu\text{A}$ |
| $\Delta I_{CCA}$ <sup>(4)</sup> |                | One input at 3.4 V, Other inputs at $V_{CCA}$ or GND | 5.5 V     |      |                    | 1.5     | mA            |
| $C_i$                           | Control inputs | $V_i = V_{CCA}$ or GND                               | Open      | 5    |                    |         | pF            |
| $C_{io}$                        | A port         | $V_O = V_{CCA}$ or GND                               | 5 V       | 11   |                    |         | pF            |

 (1)  $V_{CCB} = 2.7\text{ V}$  to  $3.6\text{ V}$ .

 (2) All typical values are measured at  $V_{CC} = 5\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

 (3) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

 (4) This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or the associated  $V_{CC}$ .

## 7.8 Electrical Characteristics

 over recommended operating free-air temperature range for  $V_{CCB} = 2.7\text{ V}$  to  $3.6\text{ V}$  (unless otherwise noted)<sup>(1)</sup>

| PARAMETER                       |        | TEST CONDITIONS  | $V_{CCB}$      | MIN            | TYP <sup>(2)</sup> | MAX     | UNIT          |
|---------------------------------|--------|--|----------------|----------------|--------------------|---------|---------------|
| $V_{OH}$                        |        | $I_{OH} = -100\ \mu\text{A}$   | 2.7 V to 3.6 V | $V_{CC} - 0.2$ |                    | V       |               |
|                                 |        |  | 2.7 V          | 2.2            |                    |         |               |
|                                 |        | $I_{OH} = -24\ \text{mA}$  | 3 V            | 2.4            |                    |         |               |
|                                 |        |  | 3 V            | 2              |                    |         |               |
| $V_{OL}$                        |        | $I_{OL} = 100\ \mu\text{A}$  | 2.7 V to 3.6 V | 0.2            |                    | V       |               |
|                                 |        |  | 2.7 V          | 0.4            |                    |         |               |
|                                 |        |  | 3 V            | 0.55           |                    |         |               |
| $I_{OZ}$ <sup>(3)</sup>         | B port | $V_O = V_{CCB}$ or GND   | 3.6 V          |                |                    | $\pm 5$ | $\mu\text{A}$ |
| $I_{CCB}$                       |        | $V_i = V_{CCB}$ or GND, $I_O = 0$  | 3.6 V          |                |                    | 50      | $\mu\text{A}$ |
| $\Delta I_{CCB}$ <sup>(4)</sup> |        | One input at $V_{CCB} - 0.6\text{ V}$ , Other inputs at $V_{CCB}$ or GND | 2.7 V to 3.6 V |                |                    | 0.5     | mA            |
| $C_{io}$                        | B port | $V_O = V_{CCB}$ or GND   | 3.3 V          | 11             |                    |         | pF            |

 (1)  $V_{CCA} = 5\text{ V} \pm 0.5\text{ V}$ .

 (2) All typical values are measured at  $V_{CC} = 3.3\text{ V}$ ,  $T_A = 25^\circ\text{C}$ .

 (3) For I/O ports, the parameter  $I_{OZ}$  includes the input leakage current.

 (4) This is the increase in supply current for each input that is at one of the specified TTL voltage levels, rather than 0 V or the associated  $V_{CC}$ .

### 7.9 Switching Characteristics

over recommended operating free-air temperature range,  $C_L = 50$  pF (unless otherwise noted) (see Figure 3 and Figure 4)

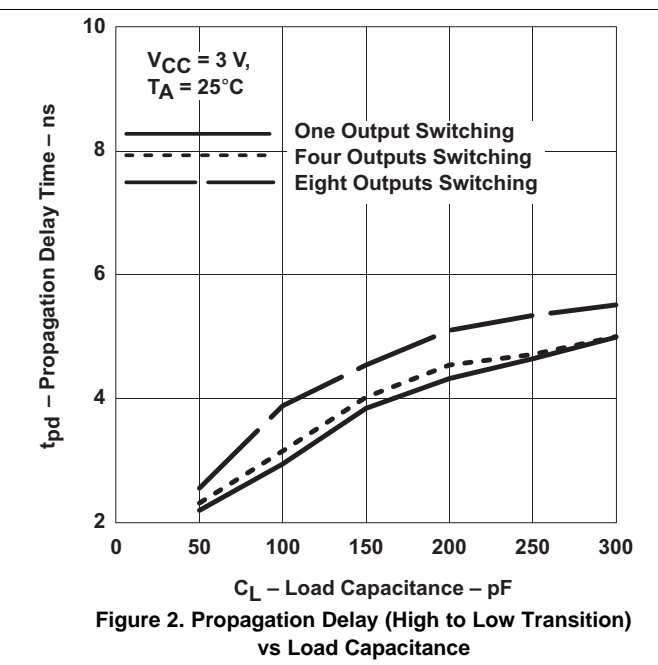
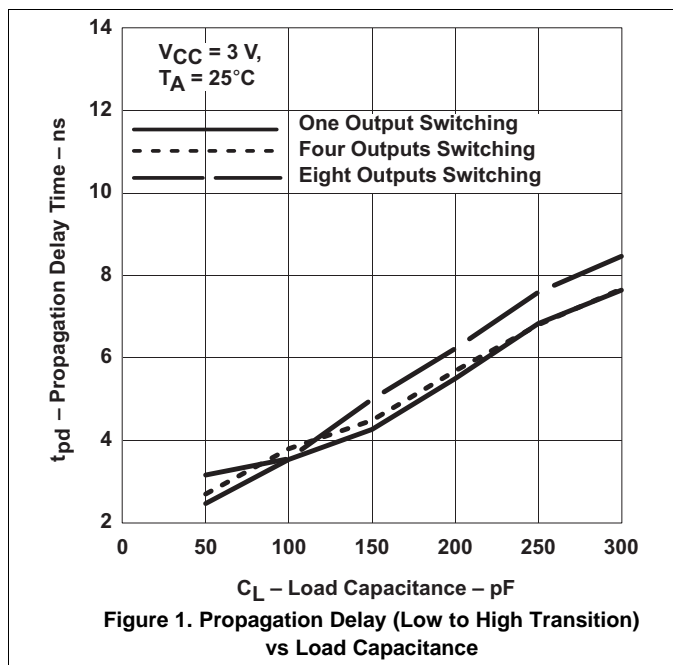
| PARAMETER | FROM (INPUT)    | TO (OUTPUT) | $V_{CCA} = 5 V \pm 0.5 V$ ,<br>$V_{CCB} = 2.7 V$ to $3.6 V$ |     | UNIT |
|-----------|-----------------|-------------|---|-----|------|
|           |                 |             | MIN   | MAX |      |
| $t_{PHL}$ | A               | B           | 1   | 6.3 | ns   |
| $t_{PLH}$ |                 |             | 1   | 6.7 |      |
| $t_{PHL}$ | B               | A           | 1   | 6.1 | ns   |
| $t_{PLH}$ |                 |             | 1   | 5   |      |
| $t_{PZL}$ | $\overline{OE}$ | A           | 1   | 9   | ns   |
| $t_{PZH}$ |                 |             | 1   | 8.1 |      |
| $t_{PZL}$ | $\overline{OE}$ | B           | 1   | 8.8 | ns   |
| $t_{PZH}$ |                 |             | 1   | 9.8 |      |
| $t_{PLZ}$ | $\overline{OE}$ | A           | 1   | 7   | ns   |
| $t_{PHZ}$ |                 |             | 1   | 5.8 |      |
| $t_{PLZ}$ | $\overline{OE}$ | B           | 1   | 7.7 | ns   |
| $t_{PHZ}$ |                 |             | 1   | 7.8 |      |

### 7.10 Operating Characteristics

$V_{CCA} = 4.5 V$  to  $5.5 V$ ,  $V_{CCB} = 2.7 V$  to  $3.6 V$ ,  $T_A = 25^\circ C$

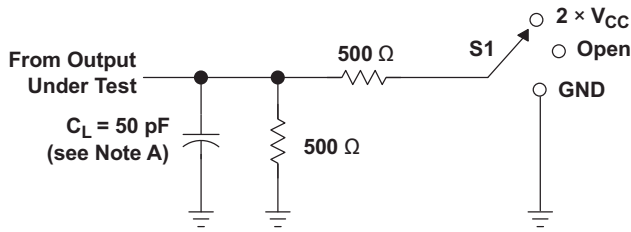
| PARAMETER |   | TEST CONDITIONS  |                             | TYP  | UNIT |
|-----------|---|------------------|-----------------------------|------|------|
| $C_{pd}$  | Power dissipation capacitance per transceiver | Outputs enabled  | $C_L = 0$ ,<br>$f = 10$ MHz | 39.5 | pF   |
|           |   | Outputs disabled |                             | 5    |      |

### 7.11 Typical Characteristics



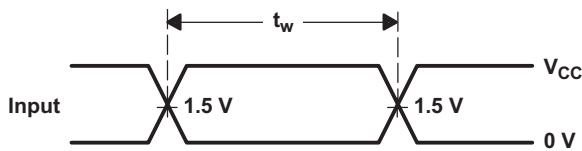
## 8 Parameter Measurement Information

### 8.1 A Port

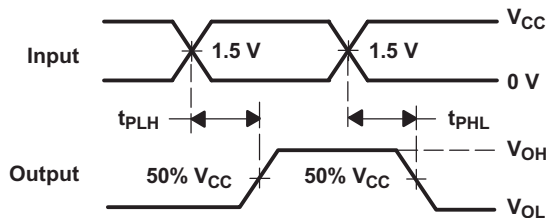


LOAD CIRCUIT

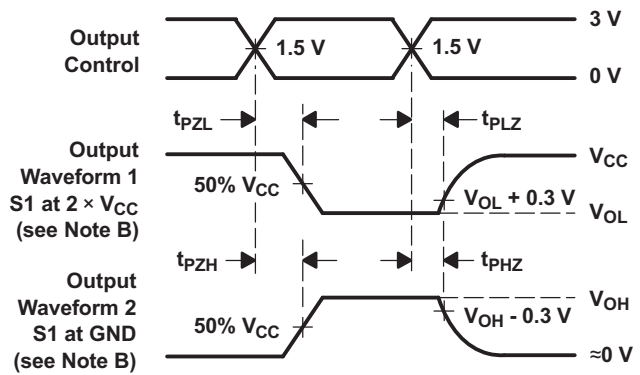
| TEST              | S1                |
|-------------------|-------------------|
| $t_{PLH}/t_{PHL}$ | Open              |
| $t_{PLZ}/t_{PZL}$ | $2 \times V_{CC}$ |
| $t_{PHZ}/t_{PZH}$ | GND               |



VOLTAGE WAVEFORMS  
PULSE DURATION



VOLTAGE WAVEFORMS  
PROPAGATION DELAY TIMES  
NONINVERTING OUTPUTS



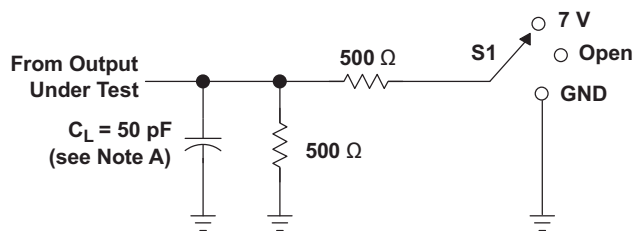
VOLTAGE WAVEFORMS  
ENABLE AND DISABLE TIMES  
LOW- AND HIGH-LEVEL ENABLING

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. 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.  
 C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

Figure 3. Load Circuit and Voltage Waveforms

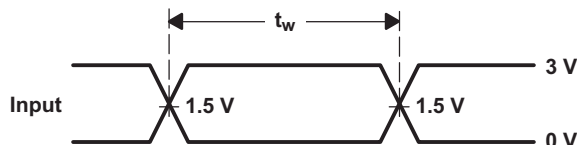


8.2 B Port

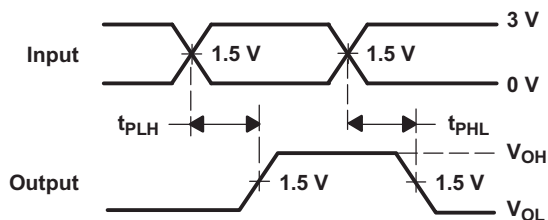


LOAD CIRCUIT

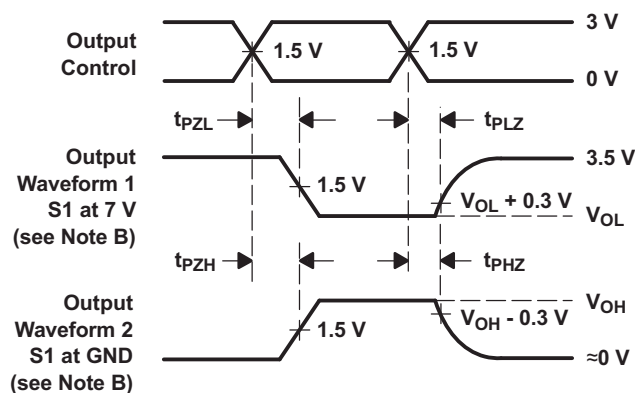
| TEST              | S1   |
|-------------------|------|
| $t_{PLH}/t_{PHL}$ | Open |
| $t_{PLZ}/t_{PZL}$ | 7 V  |
| $t_{PHZ}/t_{PZH}$ | GND  |



VOLTAGE WAVEFORMS PULSE DURATION



VOLTAGE WAVEFORMS PROPAGATION DELAY TIMES NONINVERTING OUTPUTS



VOLTAGE WAVEFORMS ENABLE AND DISABLE TIMES LOW- AND HIGH-LEVEL ENABLING

- NOTES: A.  $C_L$  includes probe and jig capacitance.  
 B. 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.  
 C. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10$  MHz,  $Z_O = 50 \Omega$ ,  $t_r \leq 2.5$  ns,  $t_f \leq 2.5$  ns.  
 D. The outputs are measured one at a time, with one transition per measurement.  
 E. All parameters and waveforms are not applicable to all devices.

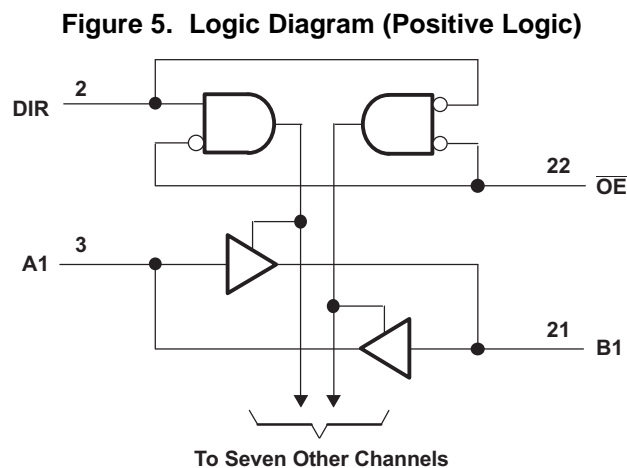
Figure 4. Load Circuit and Voltage Waveforms

## 9 Detailed Description

### 9.1 Overview

SN74LVC4245A is an 8-bit (octal) noninverting bus transceiver contains two separate supply rails; B port has  $V_{CCB}$ , which is set at 3.3 V, and A port has  $V_{CCA}$ , which is set at 5 V. This allows for translation from a 3.3-V to a 5-V environment, and vice versa, 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. The control circuitry (DIR,  $\overline{OE}$ ) is powered by  $V_{CCA}$ .

### 9.2 Functional Block Diagram



### 9.3 Feature Description

- 24 mA drive at 3-V supply
  - Good for heavier loads and longer traces
- Low  $V_{IH}$ 
  - Allows 3.3-V to 5-V translation

### 9.4 Device Functional Modes

**Function Table**

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

## 10 Application and Implementation

### 10.1 Application Information

The SN74LVC4245A device pinout allows the designer to switch to a normal all-3.3-V or all-5-V 20-pin '245 device without board re-layout. The designer uses the data paths for pins 2–11 and 14–23 of the SN74LVC4245A to align with the conventional SN74LVC4245 device's pinout. SN74LVC4245A is a high drive CMOS device that can be used for a multitude of bus interface type applications where output drive or PCB trace length is a concern.

### 10.2 Typical Application

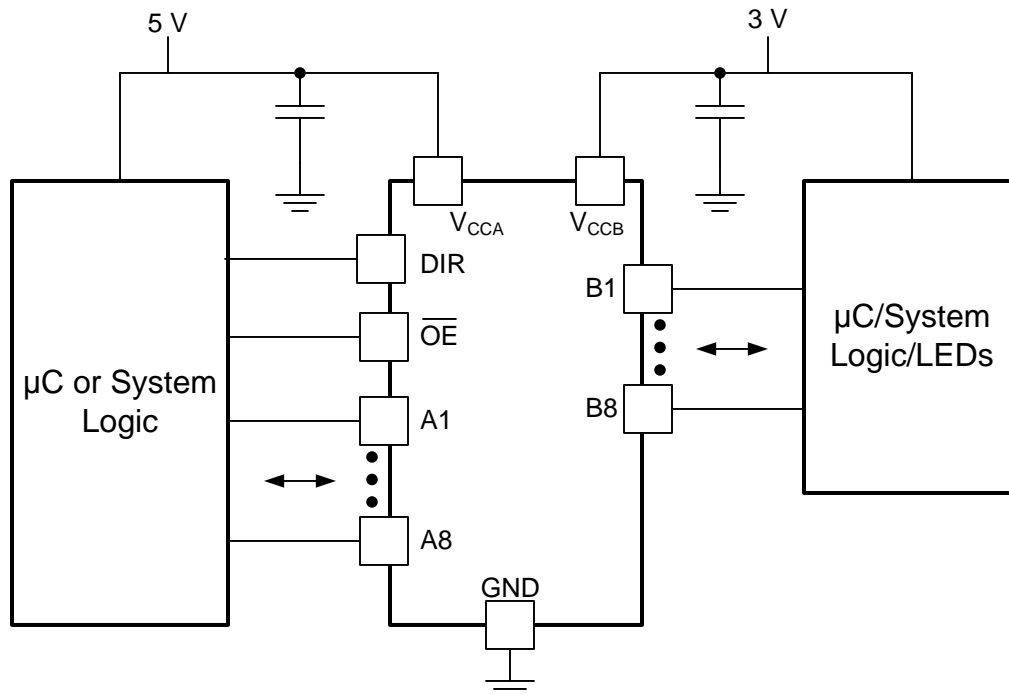


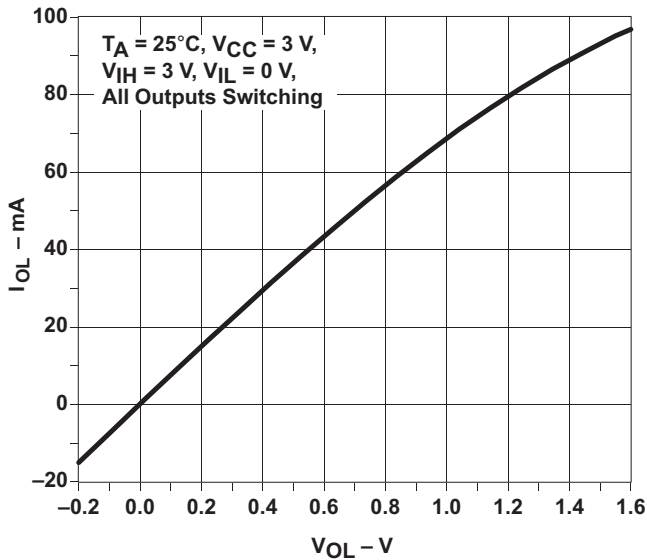
Figure 6. Typical Application Schematic

#### 10.2.1 Design Requirements

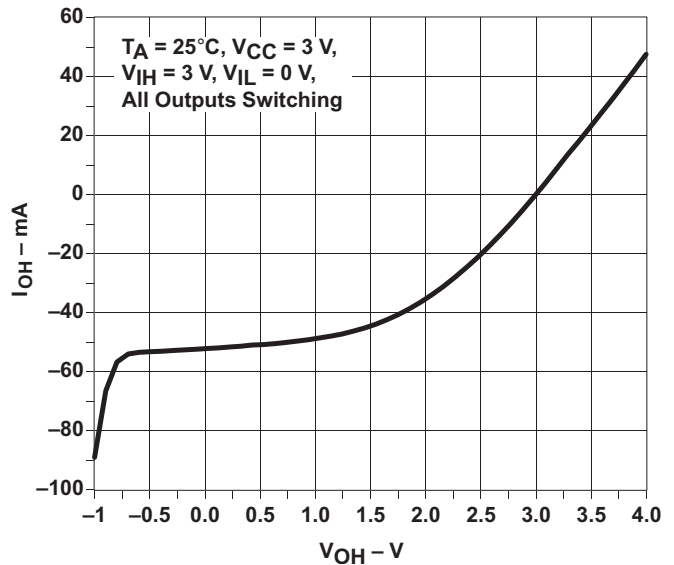
This device uses CMOS technology and has balanced output drive. Care should be taken to avoid bus contention because it can drive currents that would exceed maximum limits. The high drive will also create fast edges into light loads so routing and load conditions should be considered to prevent ringing.

#### 10.2.2 Detailed Design Procedure

1. Recommended Input Conditions:
  - For rise time and fall time specifications, see  $(\Delta t/\Delta V)$  in the [Recommended Operating Conditions](#) table.
  - For specified high and low levels, see  $(V_{IH}$  and  $V_{IL})$  in the [Recommended Operating Conditions](#) table.
2. Recommend Output Conditions:
  - Load currents should not exceed  $(I_O \text{ max})$  per output and should not exceed (Continuous current through  $V_{CC}$  or GND) total current for the part. These limits are located in the [Absolute Maximum Ratings](#) table.
  - Outputs should not be pulled above  $V_{CC}$ .
  - Series resistors on the output may be used if the user desires to slow the output edge signal or limit the output current.

**Typical Application (continued)**
**10.2.3 Application Curves**


**Figure 7. Output Drive Current ( $I_{OL}$ ) vs LOW-level Output Voltage ( $V_{OL}$ )**



**Figure 8. Output Drive Current ( $I_{OH}$ ) vs HIGH-level Output Voltage ( $V_{OH}$ )**

## 11 Power Supply Recommendations

### 11.1 Power-Up Consideration

<sup>(1)</sup>TI level-translation devices offer an opportunity for successful mixed-voltage signal design. A proper power-up sequence always should be followed to avoid excessive supply current, bus contention, oscillations, or other anomalies caused by improperly biased device terminals. Take these precautions to guard against such power-up problems:

1. Connect ground before any supply voltage is applied.
2. Power up the control side of the device ( $V_{CCA}$  for all four of these devices).
3. Tie  $\overline{OE}$  to  $V_{CCA}$  with a pullup resistor so that it ramps with  $V_{CCA}$ .
4. Depending on the direction of the data path, DIR can be high or low. If DIR high is needed (A data to B bus), ramp it with  $V_{CCA}$ . Otherwise, keep DIR low.

(1) Refer to the TI application report, *Texas Instruments Voltage-Level-Translation Devices*, literature number [SCEA021](#).

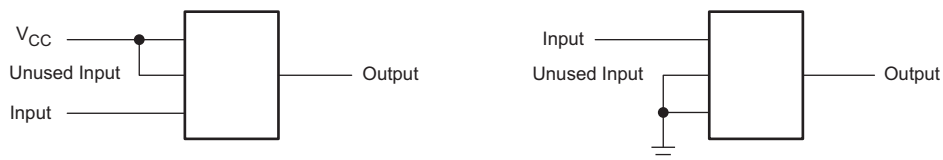
## 12 Layout

### 12.1 Layout Guidelines

When using multiple bit logic devices, inputs should not float. In many cases, functions or parts of functions of digital logic devices are unused. Some examples are when only two inputs of a triple-input AND gate are used, or when only 3 of the 4-buffer gates are used. Such input pins should not be left unconnected because the undefined voltages at the outside connections result in undefined operational states.

Specified in [Figure 9](#) are rules that must be observed under all circumstances. All unused inputs of digital logic devices must be connected to a high or low bias to prevent them from floating. The logic level that should be applied to any particular unused input depends on the function of the device. Generally they will be tied to GND or  $V_{CC}$ , whichever makes more sense or is more convenient.

### 12.2 Layout Example



**Figure 9. Layout Diagram**

## 13 Device and Documentation Support

### 13.1 Trademarks

All trademarks are the property of their respective owners.

### 13.2 Electrostatic Discharge Caution



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### 13.3 Glossary

[SLYZ022](#) — *TI Glossary*.

This glossary lists and explains terms, acronyms, and definitions.

## 14 Mechanical, Packaging, and Orderable Information

The following pages include mechanical, packaging, and orderable information. This information is the most current data available for the designated devices. This data is subject to change without notice and revision of this document. For browser-based versions of this data sheet, refer to the left-hand navigation.

**PACKAGING INFORMATION**

| Orderable Device  | Status<br>(1) | Package Type | Package Drawing | Pins | Package Qty | Eco Plan<br>(2) | Lead finish/<br>Ball material<br>(6) | MSL Peak Temp<br>(3) | Op Temp (°C) | Device Marking<br>(4/5) | Samples                 |
|-------------------|---------------|--------------|-----------------|------|-------------|-----------------|--------------------------------------|----------------------|--------------|-------------------------|-------------------------|
| SN74LVC4245ADBR   | ACTIVE        | SSOP         | DB              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245ADBRE4 | ACTIVE        | SSOP         | DB              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245ADW    | ACTIVE        | SOIC         | DW              | 24   | 25          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245ADWE4  | ACTIVE        | SOIC         | DW              | 24   | 25          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245ADWG4  | ACTIVE        | SOIC         | DW              | 24   | 25          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245ADWR   | ACTIVE        | SOIC         | DW              | 24   | 2000        | RoHS & Green    | NIPDAU   SN                          | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245ADWRE4 | ACTIVE        | SOIC         | DW              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245ADWRG4 | ACTIVE        | SOIC         | DW              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LVC4245A                | <a href="#">Samples</a> |
| SN74LVC4245APW    | ACTIVE        | TSSOP        | PW              | 24   | 60          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWG4  | ACTIVE        | TSSOP        | PW              | 24   | 60          | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWR   | ACTIVE        | TSSOP        | PW              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWRE4 | ACTIVE        | TSSOP        | PW              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWRG4 | ACTIVE        | TSSOP        | PW              | 24   | 2000        | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWT   | ACTIVE        | TSSOP        | PW              | 24   | 250         | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <a href="#">Samples</a> |
| SN74LVC4245APWTG4 | ACTIVE        | TSSOP        | PW              | 24   | 250         | RoHS & Green    | NIPDAU                               | Level-1-260C-UNLIM   | -40 to 85    | LJ245A                  | <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) **RoHS:** TI defines "RoHS" to mean semiconductor products that are compliant with the current EU RoHS requirements for all 10 RoHS substances, including the requirement that RoHS substance do not exceed 0.1% by weight in homogeneous materials. Where designed to be soldered at high temperatures, "RoHS" products are suitable for use in specified lead-free processes. TI may reference these types of products as "Pb-Free".

**RoHS Exempt:** TI defines "RoHS Exempt" to mean products that contain lead but are compliant with EU RoHS pursuant to a specific EU RoHS exemption.

**Green:** TI defines "Green" to mean the content of Chlorine (Cl) and Bromine (Br) based flame retardants meet JS709B low halogen requirements of  $\leq 1000$ ppm threshold. Antimony trioxide based flame retardants must also meet the  $\leq 1000$ ppm threshold requirement.

(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.

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

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#### **OTHER QUALIFIED VERSIONS OF SN74LVC4245A :**

- Enhanced Product: [SN74LVC4245A-EP](#)

NOTE: Qualified Version Definitions:

- Enhanced Product - Supports Defense, Aerospace and Medical Applications



**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 |
|-------------------|--------------|-----------------|------|------|--------------------|--------------------|---------|---------|---------|---------|--------|---------------|
| SN74LVC4245ADBR   | SSOP         | DB              | 24   | 2000 | 330.0              | 16.4               | 8.2     | 8.8     | 2.5     | 12.0    | 16.0   | Q1            |
| SN74LVC4245ADWR   | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LVC4245ADWR   | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LVC4245ADWRG4 | SOIC         | DW              | 24   | 2000 | 330.0              | 24.4               | 10.75   | 15.7    | 2.7     | 12.0    | 24.0   | Q1            |
| SN74LVC4245APWR   | TSSOP        | PW              | 24   | 2000 | 330.0              | 16.4               | 6.95    | 8.3     | 1.6     | 8.0     | 16.0   | Q1            |
| SN74LVC4245APWT   | TSSOP        | PW              | 24   | 250  | 330.0              | 16.4               | 6.95    | 8.3     | 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) |
|-------------------|--------------|-----------------|------|------|-------------|------------|-------------|
| SN74LVC4245ADBR   | SSOP         | DB              | 24   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LVC4245ADWR   | SOIC         | DW              | 24   | 2000 | 350.0       | 350.0      | 43.0        |
| SN74LVC4245ADWR   | SOIC         | DW              | 24   | 2000 | 364.0       | 361.0      | 36.0        |
| SN74LVC4245ADWRG4 | SOIC         | DW              | 24   | 2000 | 350.0       | 350.0      | 43.0        |
| SN74LVC4245APWR   | TSSOP        | PW              | 24   | 2000 | 356.0       | 356.0      | 35.0        |
| SN74LVC4245APWT   | TSSOP        | PW              | 24   | 250  | 356.0       | 356.0      | 35.0        |

**TUBE**


\*All dimensions are nominal

| Device           | Package Name | Package Type | Pins | SPQ | L (mm) | W (mm) | T (μm) | B (mm) |
|------------------|--------------|--------------|------|-----|--------|--------|--------|--------|
| SN74LVC4245ADW   | DW           | SOIC         | 24   | 25  | 506.98 | 12.7   | 4826   | 6.6    |
| SN74LVC4245ADWE4 | DW           | SOIC         | 24   | 25  | 506.98 | 12.7   | 4826   | 6.6    |
| SN74LVC4245ADWG4 | DW           | SOIC         | 24   | 25  | 506.98 | 12.7   | 4826   | 6.6    |
| SN74LVC4245APW   | PW           | TSSOP        | 24   | 60  | 530    | 10.2   | 3600   | 3.5    |
| SN74LVC4245APW   | PW           | TSSOP        | 24   | 60  | 530    | 10.2   | 3600   | 3.5    |
| SN74LVC4245APWG4 | PW           | TSSOP        | 24   | 60  | 530    | 10.2   | 3600   | 3.5    |
| SN74LVC4245APWG4 | PW           | TSSOP        | 24   | 60  | 530    | 10.2   | 3600   | 3.5    |

DW (R-PDSO-G24)

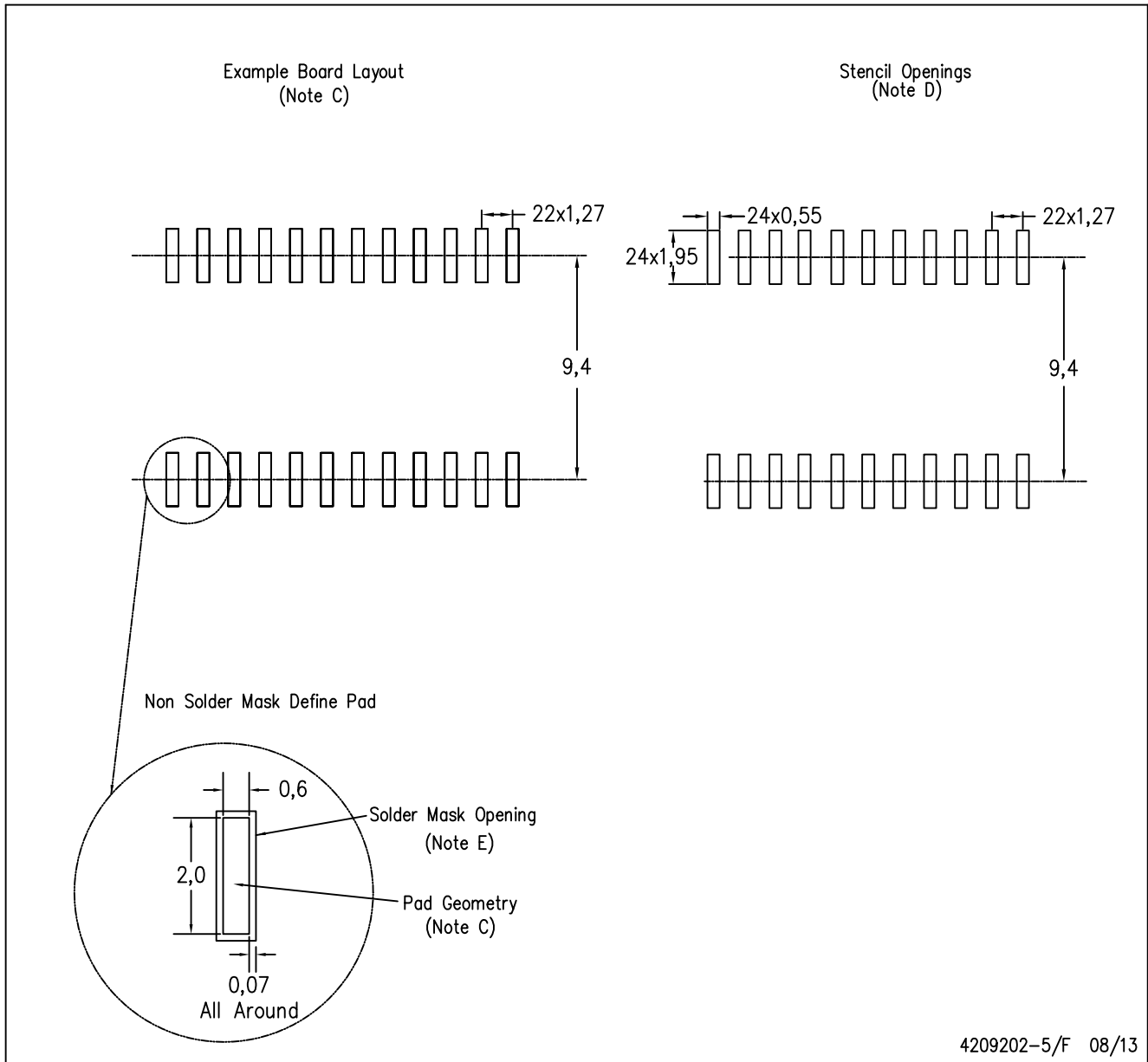
PLASTIC SMALL OUTLINE



- 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 AD.

DW (R-PDSO-G24)

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.

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

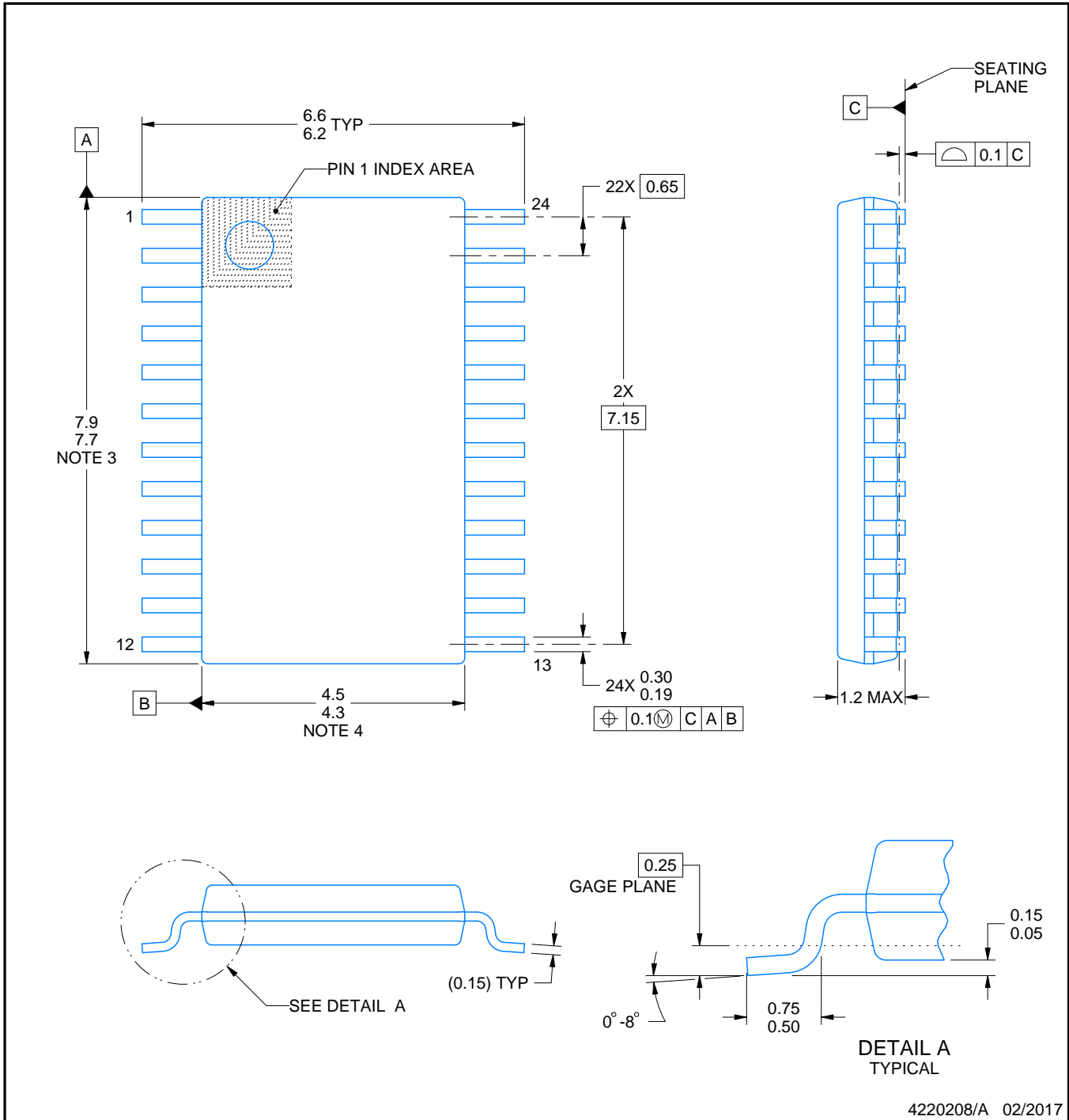
4040065 /E 12/01

PW0024A



**PACKAGE OUTLINE**  
**TSSOP - 1.2 mm max height**

SMALL OUTLINE PACKAGE



NOTES:

1. All linear dimensions are in millimeters. Any dimensions in parenthesis are for reference only. Dimensioning and tolerancing per ASME Y14.5M.
2. This drawing is subject to change without notice.
3. This dimension does not include mold flash, protrusions, or gate burrs. Mold flash, protrusions, or gate burrs shall not exceed 0.15 mm per side.
4. This dimension does not include interlead flash. Interlead flash shall not exceed 0.25 mm per side.
5. Reference JEDEC registration MO-153.

# EXAMPLE BOARD LAYOUT

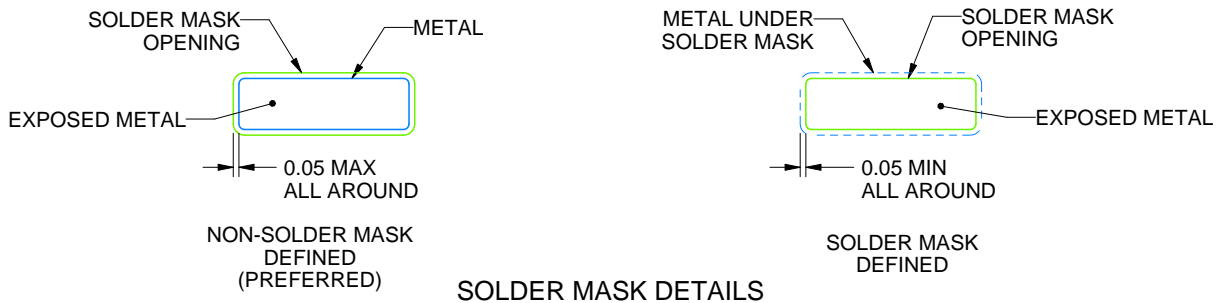
PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



LAND PATTERN EXAMPLE  
EXPOSED METAL SHOWN  
SCALE: 10X



SOLDER MASK DETAILS

4220208/A 02/2017

NOTES: (continued)

- 6. Publication IPC-7351 may have alternate designs.
- 7. Solder mask tolerances between and around signal pads can vary based on board fabrication site.



# EXAMPLE STENCIL DESIGN

PW0024A

TSSOP - 1.2 mm max height

SMALL OUTLINE PACKAGE



NOTES: (continued)

8. Laser cutting apertures with trapezoidal walls and rounded corners may offer better paste release. IPC-7525 may have alternate design recommendations.
9. Board assembly site may have different recommendations for stencil design.

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