



# CMOS OCTAL DUAL-SUPPLY BUS TRANSCEIVER WITH CONFIGURABLE OUTPUT VOLTAGE, 3-STATE OUTPUTS, 3.3V AND 5V I/O

**IDT74LVCC4245A**

## FEATURES:

- 0.5 MICRON CMOS Technology
- $V_{CCA} = 5V \pm 0.5V$
- $V_{CCB} = 2.7V$  to  $5.5V$
- CMOS power levels ( $0.4\mu W$  typ. static)
- Rail-to-rail output swing for increased noise margin
- All inputs, outputs, and I/O are 5V tolerant
- Supports hot insertion
- Available in SSOP, QSOP, and TSSOP packages

## DRIVE FEATURES:

- High Output Drivers:  $\pm 24mA$
- Reduced system switching noise

## APPLICATIONS:

- 5V and 3.3V mixed voltage systems
- Data communication and telecommunication systems

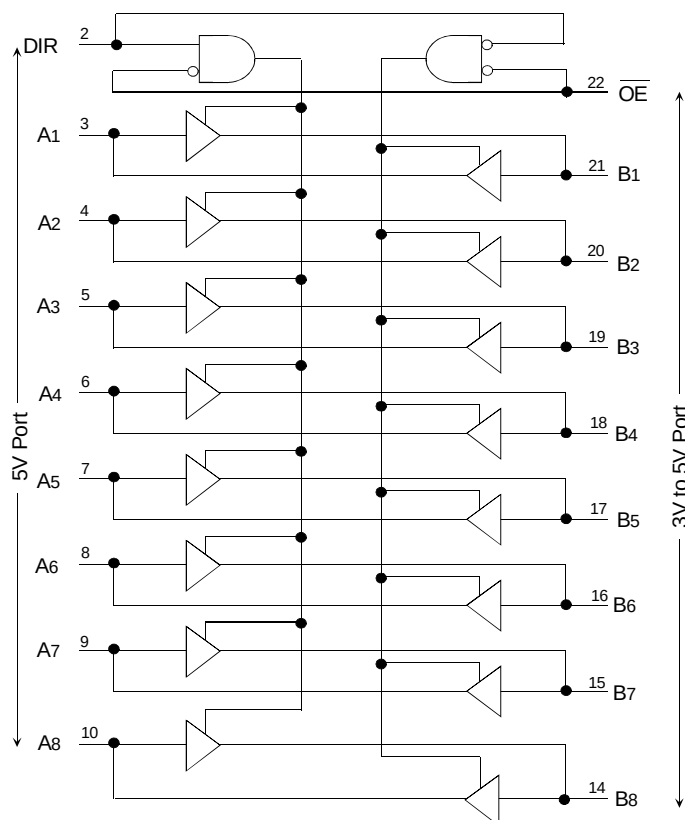
## DESCRIPTION:

The LVCC4245A is manufactured using advanced dual metal CMOS technology. This 8-bit (octal) noninverting bus transceiver contains two separate power-supply rails. The configurable B port is designed to track  $V_{CCB}$ , which accepts voltages from 3V to 5V, and the A port is dedicated to accept a 5V supply level. This allows for translation from a 3.3V to a 5V system environment and vice-versa.

This LVCC4245A is ideal for asynchronous communication between two data buses (A and B). The device transmits data from A to B or from B to A, 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 LVCC4245A has been designed with a  $\pm 24mA$  output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

## FUNCTIONAL BLOCK DIAGRAM

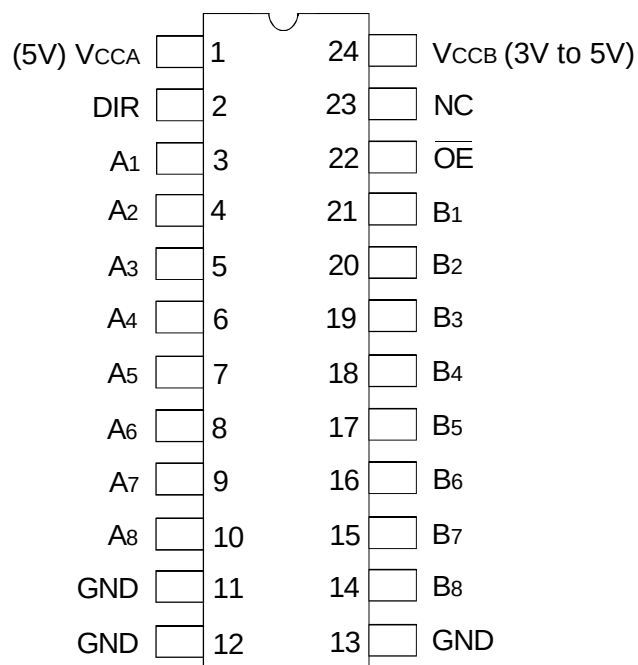


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**INDUSTRIAL TEMPERATURE RANGE**

**JANUARY 2004**

## PIN CONFIGURATION



SSOP/ QSOP/ TSSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS FOR V<sub>CCB</sub> OR V<sub>CCB</sub>(<sup>1</sup>)

| Symbol                             | Description                                                           | Max         | Unit |
|------------------------------------|-----------------------------------------------------------------------|-------------|------|
| V <sub>TERM</sub>                  | Terminal Voltage with Respect to GND                                  | −0.5 to +6  | V    |
| T <sub>STG</sub>                   | Storage Temperature                                                   | −65 to +150 | °C   |
| I <sub>OUT</sub>                   | DC Output Current                                                     | −50 to +50  | mA   |
| I <sub>IK</sub><br>I <sub>OK</sub> | Continuous Clamp Current,<br>V <sub>I</sub> < 0 or V <sub>O</sub> < 0 | −50         | mA   |
| I <sub>CC</sub><br>I <sub>SS</sub> | Continuous Current through each<br>V <sub>CC</sub> or GND             | ±100        | mA   |

### NOTE:

- Stresses greater than those listed under ABSOLUTE MAXIMUM RATINGS may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect reliability.

## CAPACITANCE (T<sub>A</sub> = +25°C, F = 1.0MHz)

| Symbol           | Parameter <sup>(1)</sup> | Conditions           | Typ. | Max. | Unit |
|------------------|--------------------------|----------------------|------|------|------|
| C <sub>IN</sub>  | Input Capacitance        | V <sub>IN</sub> = 0V | 5    | —    | pF   |
| C <sub>I/O</sub> | I/O Port Capacitance     | V <sub>IN</sub> = 0V | 11   | —    | pF   |

### NOTE:

- As applicable to the device type.

## PIN DESCRIPTION

| Pin Names      | Description                      |
|----------------|----------------------------------|
| OE             | Output Enable Input (Active LOW) |
| DIR            | Direction Control Input          |
| A <sub>x</sub> | Port A Inputs or 3-State Outputs |
| B <sub>x</sub> | Port B Inputs or 3-State Outputs |
| NC             | No Internal Connection           |

## FUNCTION TABLE<sup>(1)</sup>

| Inputs |     | Outputs             |
|--------|-----|---------------------|
| OE     | DIR |                     |
| L      | L   | Bus B Data to Bus A |
| L      | H   | Bus A Data to Bus B |
| H      | X   | High Z state        |

### NOTE:

- H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Don't Care

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (A PORT)

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CCA} = 4.5\text{V}$  to  $5.5\text{V}^{(1)}$

| Symbol                 | Parameter                                              | Test Conditions                                                        |                                                                     | Min. | Typ. <sup>(2)</sup> | Max.    | Unit          |
|------------------------|--------------------------------------------------------|------------------------------------------------------------------------|---------------------------------------------------------------------|------|---------------------|---------|---------------|
| $V_{IH}$               | Input HIGH Voltage Level                               | $V_{CCA} = 4.5\text{V}$ , $V_{CCB} = 2.7\text{V}$                      | $V_{OB} \leq 0.1\text{V}$ or<br>$V_{OB} \geq V_{CCB} - 0.1\text{V}$ | 2    | —                   | —       | V             |
|                        |                                                        | $V_{CCA} = 4.5\text{V}$ , $V_{CCB} = 3.6\text{V}$                      |                                                                     | 2    | —                   | —       |               |
|                        |                                                        | $V_{CCA} = 5.5\text{V}$ , $V_{CCB} = 5.5\text{V}$                      |                                                                     | 2    | —                   | —       |               |
| $V_{IL}$               | Input LOW Voltage Level                                | $V_{CCA} = 4.5\text{V}$ , $V_{CCB} = 2.7\text{V}$                      | $V_{OB} \leq 0.1\text{V}$ or<br>$V_{OB} \geq V_{CCB} - 0.1\text{V}$ | —    | —                   | 0.8     | V             |
|                        |                                                        | $V_{CCA} = 4.5\text{V}$ , $V_{CCB} = 3.6\text{V}$                      |                                                                     | —    | —                   | 0.8     |               |
|                        |                                                        | $V_{CCA} = 5.5\text{V}$ , $V_{CCB} = 5.5\text{V}$                      |                                                                     | —    | —                   | 0.8     |               |
| $I_{IH}$<br>$I_{IL}$   | Input Leakage Current<br>(Control Inputs)              | $V_{CCA} = 5.5\text{V}$<br>$V_{CCB} = 3.6\text{V}$ or $5.5\text{V}$    | $V_I = 0$ to $5.5\text{V}$                                          | —    | —                   | $\pm 1$ | $\mu\text{A}$ |
| $I_{OZH}$<br>$I_{OZL}$ | High Impedance Output Current<br>(3-State Output pins) | $V_{CCA} = 5.5\text{V}$<br>$V_{CCB} = 3.6\text{V}$                     | $V_O = 0$ to $5.5\text{V}$                                          | —    | —                   | $\pm 5$ | $\mu\text{A}$ |
| $V_H$                  | Input Hysteresis                                       | $V_{CCA} = 5.0\text{V}$                                                |                                                                     | —    | 100                 | —       | mV            |
| $I_{CCL}$<br>$I_{CCH}$ | Quiescent Power Supply Current                         | $V_{CCA} = 5.5\text{V}$<br>$V_{CCB} = 3.6\text{V}$ or $5.5\text{V}$    | $V_{IN} = \text{GND}$ or $V_{CCA}$<br>$I_{OB} = 0$                  | —    | —                   | 80      | $\mu\text{A}$ |
| $\Delta I_{CC}$        | Quiescent Power Supply Current Variation               | One input at $3.4\text{V}$ , other inputs at $V_{CCA}$ or $\text{GND}$ |                                                                     | —    | —                   | 1.5     | mA            |

**NOTES:**

- $V_{CCB} = 2.7\text{V}$  to  $5.5\text{V}$  unless otherwise noted.
- Typical values are at  $V_{CCA} = 5\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE (B PORT)

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ ,  $V_{CCB} = 2.7\text{V}$  to  $5.5\text{V}^{(1)}$

| Symbol                 | Parameter                                              | Test Conditions                                                                  |                                                                     | Min. | Typ. <sup>(2)</sup> | Max.    | Unit          |
|------------------------|--------------------------------------------------------|----------------------------------------------------------------------------------|---------------------------------------------------------------------|------|---------------------|---------|---------------|
| $V_{IH}$               | Input HIGH Voltage Level                               | $V_{CCB} = 2.7\text{V}$ , $V_{CCA} = 4.5\text{V}$                                | $V_{OA} \leq 0.1\text{V}$ or<br>$V_{OA} \geq V_{CCA} - 0.1\text{V}$ | 2    | —                   | —       | V             |
|                        |                                                        | $V_{CCB} = 3.6\text{V}$ , $V_{CCA} = 4.5\text{V}$                                |                                                                     | 2    | —                   | —       |               |
|                        |                                                        | $V_{CCB} = 5.5\text{V}$ , $V_{CCA} = 5.5\text{V}$                                |                                                                     | 3.85 | —                   | —       |               |
| $V_{IL}$               | Input LOW Voltage Level                                | $V_{CCB} = 2.7\text{V}$ , $V_{CCA} = 4.5\text{V}$                                | $V_{OA} \leq 0.1\text{V}$ or<br>$V_{OA} \geq V_{CCA} - 0.1\text{V}$ | —    | —                   | 0.8     | V             |
|                        |                                                        | $V_{CCB} = 3.6\text{V}$ , $V_{CCA} = 4.5\text{V}$                                |                                                                     | —    | —                   | 0.8     |               |
|                        |                                                        | $V_{CCB} = 5.5\text{V}$ , $V_{CCA} = 5.5\text{V}$                                |                                                                     | —    | —                   | 1.65    |               |
| $I_{OZH}$<br>$I_{OZL}$ | High Impedance Output Current<br>(3-State Output pins) | $V_{CCB} = 3.6\text{V}$<br>$V_{CCA} = 5.5\text{V}$                               | $V_O = 0$ to $5.5\text{V}$                                          | —    | —                   | $\pm 5$ | $\mu\text{A}$ |
| $V_H$                  | Input Hysteresis                                       | $V_{CCB} = 3.3\text{V}$                                                          |                                                                     | —    | 100                 | —       | mV            |
| $I_{CCL}$<br>$I_{CCH}$ | Quiescent Power Supply Current                         | $V_{CCB} = 3.6\text{V}$ or $5.5\text{V}$<br>$V_{CCA} = 5.5\text{V}$              | $V_{IN} = \text{GND}$ or $V_{CCB}$<br>$I_{OA} = 0$                  | —    | —                   | 80      | $\mu\text{A}$ |
| $\Delta I_{CC}$        | Quiescent Power Supply Current Variation               | One input at $V_{CCB} - 0.6\text{V}$ , other inputs at $V_{CCB}$ or $\text{GND}$ |                                                                     | —    | —                   | 500     | $\mu\text{A}$ |

**NOTES:**

- $V_{CCA} = 4.5\text{V}$  to  $5.5\text{V}$  unless otherwise noted.
- Typical values are at  $V_{CCB} = 3.3\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.

## OUTPUT DRIVE CHARACTERISTICS (A PORT)

| Symbol | Parameter                                 | Test Conditions <sup>(1)</sup> |           |               | Min. | Max. | Unit |
|--------|-------------------------------------------|--------------------------------|-----------|---------------|------|------|------|
| VOH    | Output HIGH Voltage<br>(B port to A port) | VCCA = 4.5V                    | VCCB = 3V | IOH = - 0.1mA | 4.4  | —    | V    |
|        |                                           |                                |           | IOH = - 24mA  | 3.76 | —    |      |
| VOL    | Output LOW Voltage<br>(B port to A port)  | VCCA = 4.5V                    | VCCB = 3V | IOL = 0.1mA   | —    | 0.1  | V    |
|        |                                           |                                |           | IOL = 24mA    | —    | 0.44 |      |

**NOTE:**

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate Vcc range.  
TA = - 40°C to + 85°C.

## OUTPUT DRIVE CHARACTERISTICS (B PORT)

| Symbol | Parameter                                 | Test Conditions <sup>(1)</sup> |             |               | Min. | Max. | Unit |
|--------|-------------------------------------------|--------------------------------|-------------|---------------|------|------|------|
| VOH    | Output HIGH Voltage<br>(A port to B port) | VCCB = 3V                      | VCCA = 4.5V | IOH = - 0.1mA | 2.9  | —    | V    |
|        |                                           | VCCB = 2.7V                    | VCCA = 4.5V | IOH = - 12mA  | 2.2  | —    |      |
|        |                                           | VCCB = 3V                      | VCCA = 4.5V |               | 2.46 | —    |      |
|        |                                           | VCCB = 2.7V                    | VCCA = 4.5V | IOH = - 24mA  | 2.1  | —    |      |
|        |                                           | VCCB = 3V                      | VCCA = 4.5V |               | 2.25 | —    |      |
|        |                                           | VCCB = 4.5V                    | VCCA = 4.5V |               | 3.76 | —    |      |
| VOL    | Output LOW Voltage<br>(A port to B port)  | VCCB = 3V                      | VCCA = 4.5V | IOL = 0.1mA   | —    | 0.1  | V    |
|        |                                           | VCCB = 2.7V                    | VCCA = 4.5V | IOL = 12mA    | —    | 0.44 |      |
|        |                                           | VCCB = 2.7V                    | VCCA = 4.5V | IOL = 24mA    | —    | 0.5  |      |
|        |                                           | VCCB = 3V                      | VCCA = 4.5V |               | —    | 0.44 |      |
|        |                                           | VCCB = 4.5V                    | VCCA = 4.5V |               | —    | 0.44 |      |

**NOTE:**

1. VIH and VIL must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate Vcc range.  
TA = - 40°C to + 85°C, VCCA = 4.5V.

## OPERATING CHARACTERISTICS, TA = 25°C

| Symbol | Parameter                                                      | Test Conditions     | VCCA = 5V, VCCB = 3.3V | Unit |
|--------|----------------------------------------------------------------|---------------------|------------------------|------|
|        |                                                                |                     | Typical                |      |
| CPD    | Power Dissipation Capacitance per Transceiver Outputs enabled  | CL = 0pF, f = 10Mhz | 20                     | pF   |
| CPD    | Power Dissipation Capacitance per Transceiver Outputs disabled |                     | 6.5                    |      |

## SWITCHING CHARACTERISTICS<sup>(1)</sup>

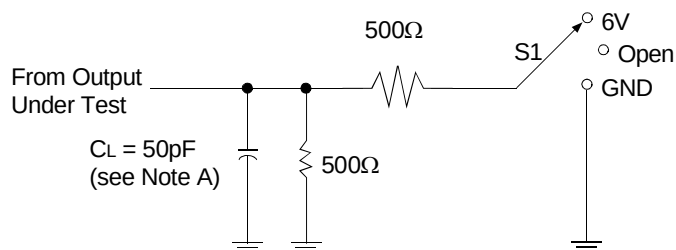
| Symbol | Parameter             | VCCA = 5V ± 0.5V |      |                     |      | Unit |
|--------|-----------------------|------------------|------|---------------------|------|------|
|        |                       | VCCB = 5V ± 0.5V |      | VCCB = 2.7V to 3.6V |      |      |
|        |                       | Min.             | Max. | Min.                | Max. |      |
| tPLH   | Propagation Delay     | 1                | 7.1  | 1                   | 7    | ns   |
| tPHL   | Ax to Bx              | 1                | 6    | 1                   | 7    |      |
| tPLH   | Propagation Delay     | 1                | 6.8  | 1                   | 6.2  | ns   |
| tPHL   | Bx to Ax              | 1                | 6.1  | 1                   | 5.3  |      |
| tPZL   | Output Enable Time    | 1                | 8.2  | 1                   | 10   | ns   |
| tPZH   | $\overline{OE}$ to Bx | 1                | 8.1  | 1                   | 10.2 |      |
| tPZL   | Output Enable Time    | 1                | 9    | 1                   | 9    | ns   |
| tPZH   | $\overline{OE}$ to Ax | 1                | 8.3  | 1                   | 8    |      |
| tPLZ   | Output Disable Time   | 1                | 4.7  | 1                   | 5.2  | ns   |
| tPHZ   | $\overline{OE}$ to Ax | 1                | 4.9  | 1                   | 5.2  |      |
| tPLZ   | Output Disable Time   | 1                | 5.4  | 1                   | 5.4  | ns   |
| tPHZ   | $\overline{OE}$ to Bx | 1                | 6.3  | 1                   | 7.4  |      |

### NOTE:

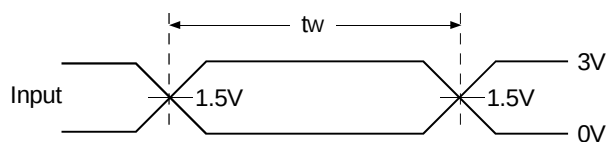
1. See TEST CIRCUITS AND WAVEFORMS. T<sub>A</sub> = – 40°C to + 85°C.

# LOAD CIRCUIT AND VOLTAGE WAVEFORMS PARAMETER MEASUREMENT INFORMATION FOR A TO B

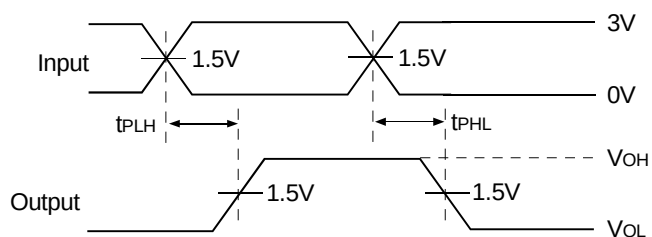
$V_{CCA} = 4.5V$  to  $5.5V$  and  $V_{CCB} = 2.7V$  to  $3.6V$



**Load Circuit**



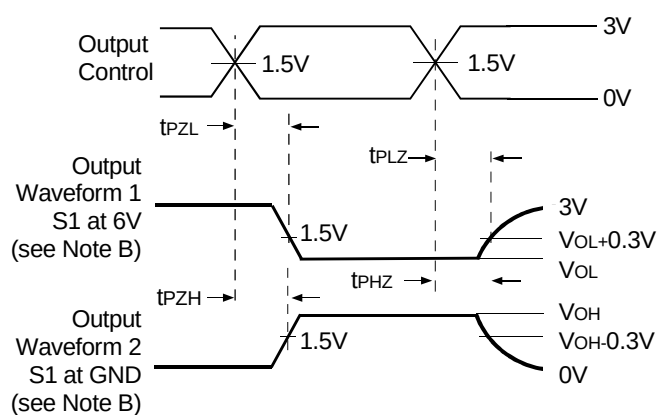
**Voltage Waveforms Pulse Duration**



**Voltage Waveforms Propagation Delay Times  
Noninverting Outputs**

## TEST CONDITIONS

| TEST                | S1   |
|---------------------|------|
| $t_{PLH} / t_{PHL}$ | Open |
| $t_{PLZ} / t_{PZL}$ | 6V   |
| $t_{PHZ} / t_{PZH}$ | GND  |



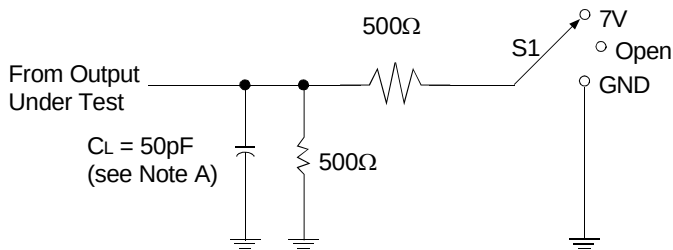
**Voltage Waveforms Enable and Disable Times  
Low- and High-Level Enabling**

### NOTES:

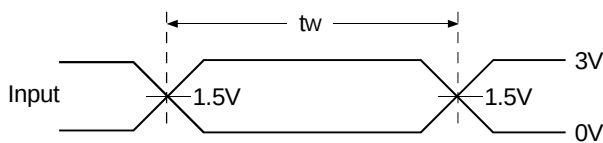
- $C_L$  includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.  
Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10MHz$ ;  $Z_o = 50\Omega$ ;  $t_r \leq 2.5ns$ ;  $t_f \leq 2.5ns$ .
- The outputs are measured one at a time with one transition per measurement.

## LOAD CIRCUIT AND VOLTAGE WAVEFORMS PARAMETER MEASUREMENT INFORMATION FOR A TO B

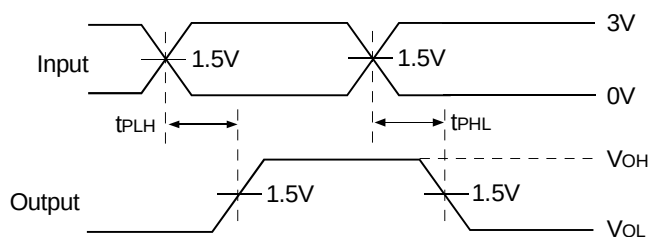
$V_{CCA} = 4.5V$  to  $5.5V$  and  $V_{CCB} = 3.6V$  to  $5.5V$



**Load Circuit**



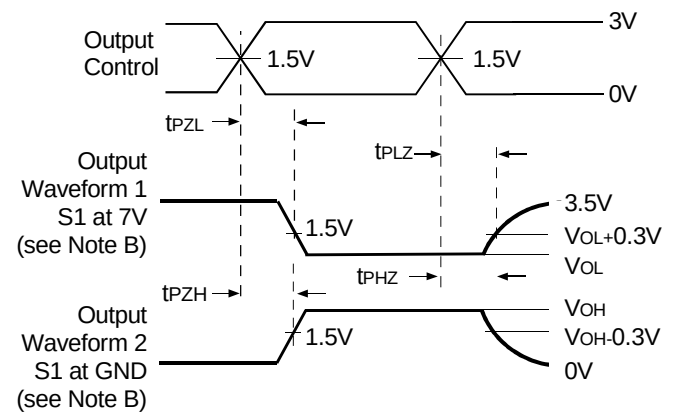
**Voltage Waveforms Pulse Duration**



**Voltage Waveforms Propagation Delay Times  
Noninverting Outputs**

## TEST CONDITIONS

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



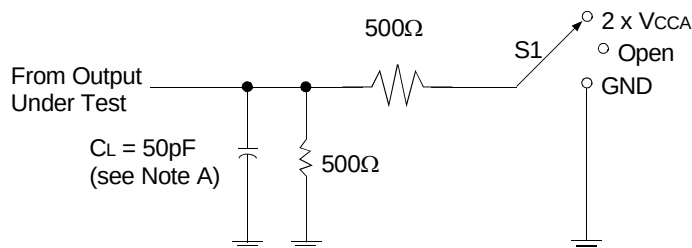
**Voltage Waveforms Enable and Disable Times  
Low- and High-Level Enabling**

### NOTES:

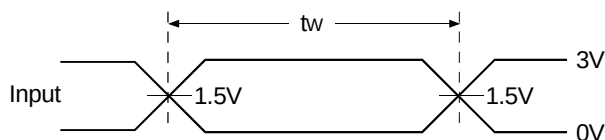
- $C_L$  includes probe and jig capacitance.
- Waveform 1 is for an output with internal conditions such that the output is LOW except when disabled by the output control.  
Waveform 2 is for an output with internal conditions such that the output is HIGH except when disabled by the output control.
- All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10MHz$ ;  $Z_o = 50\Omega$ ;  $t_r \leq 2.5ns$ ;  $t_f \leq 2.5ns$ .
- The outputs are measured one at a time with one transition per measurement.

# LOAD CIRCUIT AND VOLTAGE WAVEFORMS PARAMETER MEASUREMENT INFORMATION FOR B TO A

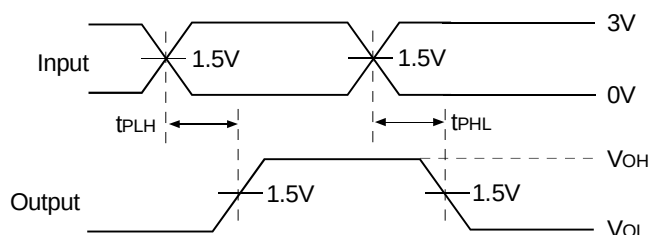
$V_{CCA} = 4.5V$  to  $5.5V$  and  $V_{CCB} = 2.7V$  to  $3.6V$



Load Circuit



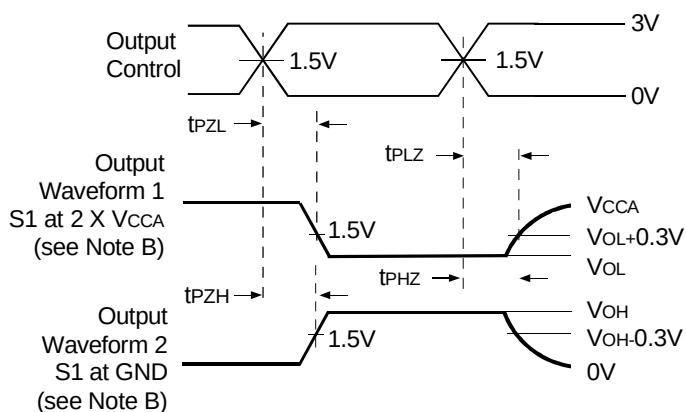
Voltage Waveforms Pulse Duration



Voltage Waveforms Propagation Delay Times  
Noninverting Outputs

## TEST CONDITIONS

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



Voltage Waveforms Enable and Disable Times  
Low- and High-Level Enabling

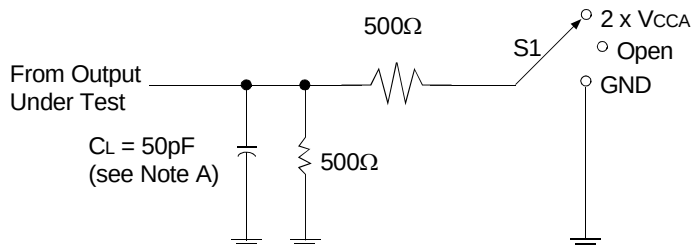
### NOTES:

- $C_L$  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:  $PRR \leq 10MHz$ ;  $Z_o = 50\Omega$ ;  $t_r \leq 2.5ns$ ;  $t_f \leq 2.5ns$ .
- The outputs are measured one at a time with one transition per measurement.

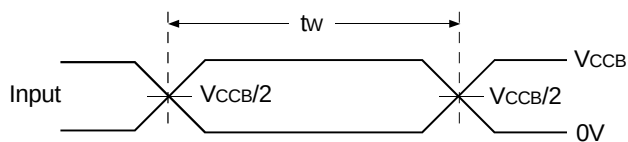


## LOAD CIRCUIT AND VOLTAGE WAVEFORMS PARAMETER MEASUREMENT INFORMATION FOR B TO A

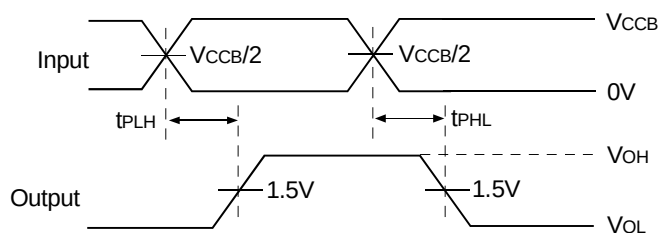
$V_{CCA} = 4.5V$  to  $5.5V$  and  $V_{CCB} = 3.6V$  to  $5.5V$



**Load Circuit**



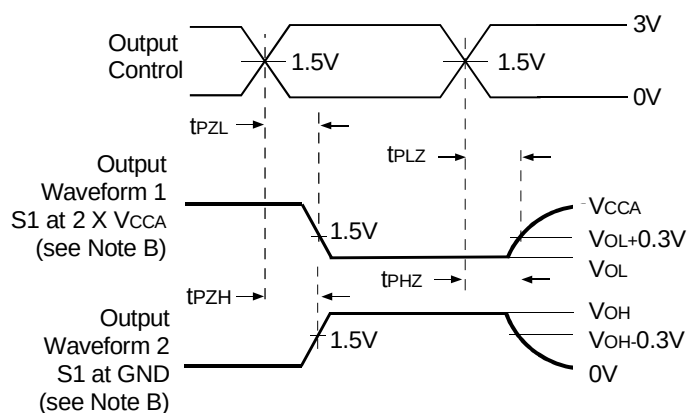
**Voltage Waveforms Pulse Duration**



**Voltage Waveforms Propagation Delay Times  
Noninverting Outputs**

## TEST CONDITIONS

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



**Voltage Waveforms Enable and Disable Times  
Low- and High-Level Enabling**

### NOTES:

- $CL$  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:  $PRR \leq 10MHz$ ;  $Z_o = 50\Omega$ ;  $t_r \leq 2.5ns$ ;  $t_f \leq 2.5ns$ .
- The outputs are measured one at a time with one transition per measurement.

## ORDERING INFORMATION

| IDT         | XX | LVC | X        | XXXX        | XX      |                                                                                                           |
|-------------|----|-----|----------|-------------|---------|-----------------------------------------------------------------------------------------------------------|
| Temp. Range |    |     | Bus-Hold | Device Type | Package |                                                                                                           |
|             |    |     |          |             | PY      | Shrink Small Outline Package                                                                              |
|             |    |     |          |             | Q       | Quarter Size Small Outline Package                                                                        |
|             |    |     |          |             | PG      | Thin Shrink Small Outline Package                                                                         |
|             |    |     |          | C4245A      |         | Octal Dual-Supply Bus Transceiver with Configurable Output Voltage and 3-State Outputs, $\pm 24\text{mA}$ |
|             |    |     | Blank    |             |         | No Bus-Hold                                                                                               |
|             |    |     |          | 74          |         | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$                                                            |



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