



## 3.3V CMOS OCTAL BUS TRANSCEIVER WITH 3-STATE OUTPUTS

**IDT74ALVC245**

### FEATURES:

- 0.5 MICRON CMOS Technology
- Typical tsk(o) (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015;  
> 200V using machine model (C = 200pF, R = 0)
- Vcc = 3.3V  $\pm$  0.3V, Normal Range
- Vcc = 2.7V to 3.6V, Extended Range
- Vcc = 2.5V  $\pm$  0.2V
- CMOS power levels (0.4 $\mu$ W typ. static)
- Rail-to-Rail output swing for increased noise margin
- Available in SOIC, SSOP, QSOP, and TSSOP packages

### Drive Features for ALVC245:

- High Output Drivers:  $\pm$ 24mA
- Suitable for heavy loads

### APPLICATIONS:

- 3.3V High Speed Systems
- 3.3V and lower voltage computing systems

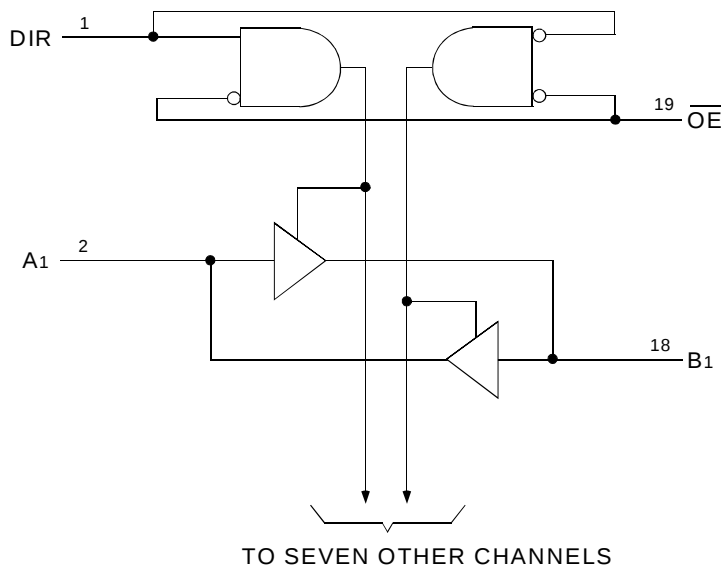
### DESCRIPTION:

This octal bus transceiver is built using advanced dual metal CMOS technology. The three-state controls are designed to operate this device in a single-byte mode. All inputs are designed with hysteresis for improved noise margin.

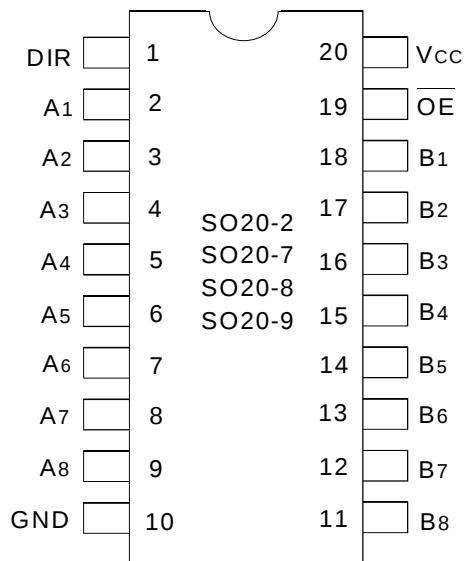
The ALVC245 is designed for asynchronous communication between data buses. The device transmits data from the A bus to the B bus or from the B bus to the A bus, depending on the logic level at the direction-control (DIR) input.

The ALVC245 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



## PIN CONFIGURATION



SSOP/ TVSOP/ TSSOP/ QSOP  
TOP VIEW

## ABSOLUTE MAXIMUM RATINGS <sup>(1)</sup>

| Symbol                             | Description                                                                      | Max.                         | Unit |
|------------------------------------|----------------------------------------------------------------------------------|------------------------------|------|
| V <sub>TERM</sub> <sup>(2)</sup>   | Terminal Voltage with Respect to GND                                             | – 0.5 to +4.6                | V    |
| V <sub>TERM</sub> <sup>(3)</sup>   | Terminal Voltage with Respect to GND                                             | –0.5 to V <sub>CC</sub> +0.5 | V    |
| I <sub>OUT</sub>                   | DC Output Current                                                                | – 50 to +50                  | mA   |
| I <sub>IK</sub>                    | Continuous Clamp Current, V <sub>I</sub> < 0 or V <sub>I</sub> > V <sub>CC</sub> | ±50                          | mA   |
| I <sub>OK</sub>                    | Continuous Clamp Current, V <sub>O</sub> < 0                                     | –50                          | mA   |
| I <sub>CC</sub><br>I <sub>SS</sub> | Continuous Current through each V <sub>CC</sub> or GND                           | ±100                         | mA   |
| T <sub>STG</sub>                   | Storage Temperature                                                              | – 65 to +150                 | °C   |

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### NOTES:

- 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.
- V<sub>CC</sub> terminals.
- All terminals except V<sub>CC</sub>.

## 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    | 7    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 7    | 9    | pF   |
| C <sub>I/O</sub> | I/O Port Capacitance     | V <sub>IN</sub> = 0V  | 7    | 9    | pF   |

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### NOTE:

- As applicable to the device type.

## PIN DESCRIPTION

| Pin Names       | Description                              |
|-----------------|------------------------------------------|
| $\overline{OE}$ | 3-State Output Enable Input (Active LOW) |
| DIR             | Direction-control Input                  |
| A <sub>x</sub>  | Side A Inputs or 3-State Outputs         |
| B <sub>x</sub>  | Side B Inputs or 3-State Outputs         |

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

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

### NOTE:

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

## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition:  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$

| Symbol                              | Parameter                                              | Test Conditions                                                                   |                    | Min. | Typ. <sup>(1)</sup> | Max.     | Unit          |
|-------------------------------------|--------------------------------------------------------|-----------------------------------------------------------------------------------|--------------------|------|---------------------|----------|---------------|
| $V_{IH}$                            | Input HIGH Voltage Level                               | $V_{CC} = 2.3\text{V}$ to $2.7\text{V}$                                           |                    | 1.7  | —                   | —        | V             |
|                                     |                                                        | $V_{CC} = 2.7\text{V}$ to $3.6\text{V}$                                           |                    | 2    | —                   | —        |               |
| $V_{IL}$                            | Input LOW Voltage Level                                | $V_{CC} = 2.3\text{V}$ to $2.7\text{V}$                                           |                    | —    | —                   | 0.7      | V             |
|                                     |                                                        | $V_{CC} = 2.7\text{V}$ to $3.6\text{V}$                                           |                    | —    | —                   | 0.8      |               |
| $I_{IH}$                            | Input HIGH Current                                     | $V_{CC} = 3.6\text{V}$                                                            | $V_I = V_{CC}$     | —    | —                   | $\pm 5$  | $\mu\text{A}$ |
| $I_{IL}$                            | Input LOW Current                                      | $V_{CC} = 3.6\text{V}$                                                            | $V_I = \text{GND}$ | —    | —                   | $\pm 5$  |               |
| $I_{OZH}$                           | High Impedance Output Current<br>(3-State Output pins) | $V_{CC} = 3.6\text{V}$                                                            | $V_O = V_{CC}$     | —    | —                   | $\pm 10$ | $\mu\text{A}$ |
| $I_{OZL}$                           |                                                        |                                                                                   | $V_O = \text{GND}$ | —    | —                   | $\pm 10$ | $\mu\text{A}$ |
| $V_{IK}$                            | Clamp Diode Voltage                                    | $V_{CC} = 2.3\text{V}$ , $I_{IN} = -18\text{mA}$                                  |                    | —    | -0.7                | -1.2     | V             |
| $V_H$                               | Input Hysteresis                                       | $V_{CC} = 3.3\text{V}$                                                            |                    | —    | 100                 | —        | mV            |
| $I_{CCL}$<br>$I_{CCH}$<br>$I_{CCZ}$ | Quiescent Power Supply Current                         | $V_{CC} = 3.6\text{V}$<br>$V_{IN} = \text{GND}$ or $V_{CC}$                       |                    | —    | 0.1                 | 10       | $\mu\text{A}$ |
| $\Delta I_{CC}$                     | Quiescent Power Supply Current Variation               | One input at $V_{CC} - 0.6\text{V}$ ,<br>other inputs at $V_{CC}$ or $\text{GND}$ |                    | —    | —                   | 750      | $\mu\text{A}$ |

### NOTE:

1. Typical values are at  $V_{CC} = 3.3\text{V}$ ,  $+25^{\circ}\text{C}$  ambient.

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## OUTPUT DRIVE CHARACTERISTICS

| Symbol   | Parameter           | Test Conditions <sup>(1)</sup>          |                          | Min.           | Max. | Unit |
|----------|---------------------|-----------------------------------------|--------------------------|----------------|------|------|
| $V_{OH}$ | Output HIGH Voltage | $V_{CC} = 2.3\text{V}$ to $3.6\text{V}$ | $I_{OH} = -0.1\text{mA}$ | $V_{CC} - 0.2$ | —    | V    |
|          |                     | $V_{CC} = 2.3\text{V}$                  | $I_{OH} = -6\text{mA}$   | 2              | —    |      |
|          |                     | $V_{CC} = 2.3\text{V}$                  | $I_{OH} = -12\text{mA}$  | 1.7            | —    |      |
|          |                     | $V_{CC} = 2.7\text{V}$                  |                          | 2.2            | —    |      |
|          |                     | $V_{CC} = 3.0\text{V}$                  |                          | 2.4            | —    |      |
|          |                     | $V_{CC} = 3.0\text{V}$                  | $I_{OH} = -24\text{mA}$  | 2              | —    |      |
| $V_{OL}$ | Output LOW Voltage  | $V_{CC} = 2.3\text{V}$ to $3.6\text{V}$ | $I_{OL} = 0.1\text{mA}$  | —              | 0.2  | V    |
|          |                     | $V_{CC} = 2.3\text{V}$                  | $I_{OL} = 6\text{mA}$    | —              | 0.4  |      |
|          |                     |                                         | $I_{OL} = 12\text{mA}$   | —              | 0.7  |      |
|          |                     | $V_{CC} = 2.7\text{V}$                  | $I_{OL} = 12\text{mA}$   | —              | 0.4  |      |
|          |                     | $V_{CC} = 3.0\text{V}$                  | $I_{OL} = 24\text{mA}$   | —              | 0.55 |      |

### NOTE:

1.  $V_{IH}$  and  $V_{IL}$  must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate  $V_{CC}$  range.  $T_A = -40^{\circ}\text{C}$  to  $+85^{\circ}\text{C}$ .

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## OPERATING CHARACTERISTICS, $T_A = 25^\circ\text{C}$

| Symbol | Parameter                                      | Test Conditions                         | $V_{CC} = 2.5V \pm 0.2V$ | $V_{CC} = 3.3V \pm 0.3V$ | Unit |
|--------|------------------------------------------------|-----------------------------------------|--------------------------|--------------------------|------|
|        |                                                |                                         | Typical                  | Typical                  |      |
| CPD    | Power Dissipation Capacitance Outputs enabled  | $C_L = 0\text{pF}$ , $f = 10\text{MHz}$ | 22                       | 28                       | pF   |
| CPD    | Power Dissipation Capacitance Outputs disabled |                                         | 1.5                      | 4                        | pF   |

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

| Symbol                               | Parameter                                          | $V_{CC} = 2.5V \pm 0.2V$ |      | $V_{CC} = 2.7V$ |      | $V_{CC} = 3.3V \pm 0.3V$ |      | Unit |
|--------------------------------------|----------------------------------------------------|--------------------------|------|-----------------|------|--------------------------|------|------|
|                                      |                                                    | Min.                     | Max. | Min.            | Max. | Min.                     | Max. |      |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>Ax to Bx or Bx to Ax          | 1.5                      | 7    | 1.5             | 5.6  | 1.5                      | 5    | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>$\overline{OE}$ to Ax or Bx  | 1.5                      | 9.5  | 1.5             | 6.2  | 1.5                      | 5.8  | ns   |
| t <sub>PZH</sub><br>t <sub>PZL</sub> | Output Enable Time<br>DIR to Ax or Bx              | 1.5                      | 9.5  | 1.5             | 6.2  | 1.5                      | 5.8  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>$\overline{OE}$ to Ax or Bx | 1.5                      | 7.5  | 1.5             | 5    | 1.5                      | 4.8  | ns   |
| t <sub>PHZ</sub><br>t <sub>PLZ</sub> | Output Disable Time<br>DIR to Ax or Bx             | 1.5                      | 7.5  | 1.5             | 5    | 1.5                      | 4.8  | ns   |
| tsk(0)                               | Output Skew <sup>(2)</sup>                         | —                        | —    | —               | —    | —                        | 500  | ps   |

### NOTES:

- See test circuits and waveforms.  $T_A = -40^\circ\text{C}$  to  $+85^\circ\text{C}$ .
- Skew between any two outputs of the same package and switching in the same direction.

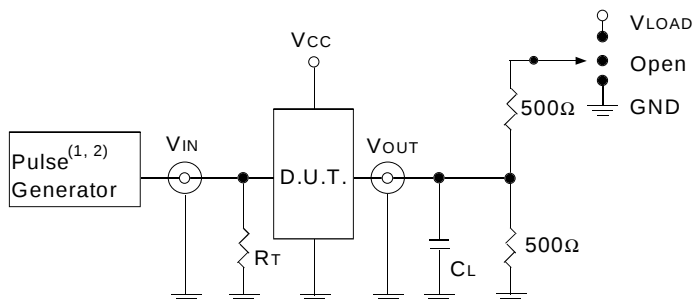
## TEST CIRCUITS AND WAVEFORMS

### TEST CONDITIONS

| Symbol            | V <sub>CC</sub> (1) = 3.3V ± 0.3V | V <sub>CC</sub> (1) = 2.7V | V <sub>CC</sub> (2) = 2.5V ± 0.2V | Unit |
|-------------------|-----------------------------------|----------------------------|-----------------------------------|------|
| V <sub>LOAD</sub> | 6                                 | 6                          | 2 x V <sub>CC</sub>               | V    |
| V <sub>IH</sub>   | 2.7                               | 2.7                        | V <sub>CC</sub>                   | V    |
| V <sub>T</sub>    | 1.5                               | 1.5                        | V <sub>CC</sub> / 2               | V    |
| V <sub>LZ</sub>   | 300                               | 300                        | 150                               | mV   |
| V <sub>HZ</sub>   | 300                               | 300                        | 150                               | mV   |
| C <sub>L</sub>    | 50                                | 50                         | 30                                | pF   |

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### TEST CIRCUITS FOR ALL OUTPUTS



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#### DEFINITIONS:

C<sub>L</sub> = Load capacitance: includes jig and probe capacitance.  
R<sub>T</sub> = Termination resistance: should be equal to Z<sub>OUT</sub> of the Pulse Generator.

#### NOTES:

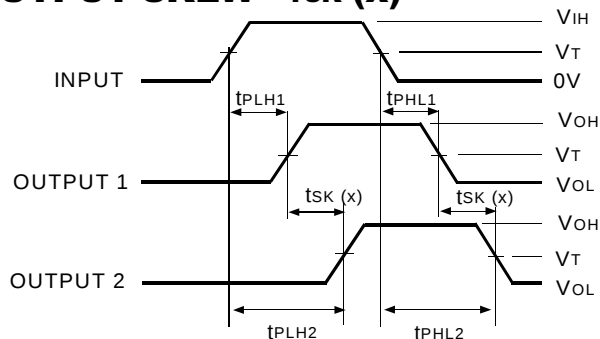
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>F</sub> ≤ 2.5ns; t<sub>R</sub> ≤ 2.5ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; t<sub>F</sub> ≤ 2ns; t<sub>R</sub> ≤ 2ns.

### SWITCH POSITION

| Test                                    | Switch            |
|-----------------------------------------|-------------------|
| Open Drain<br>Disable Low<br>Enable Low | V <sub>LOAD</sub> |
| Disable High<br>Enable High             | GND               |
| All Other tests                         | Open              |

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### OUTPUT SKEW - t<sub>SK</sub> (x)



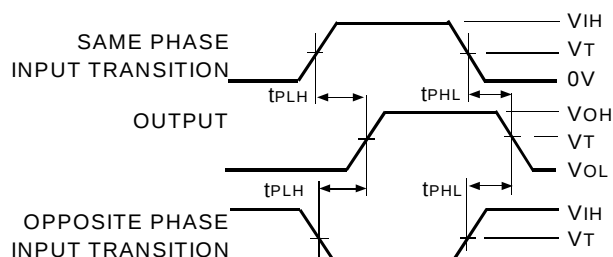
$$t_{SK}(x) = |t_{PLH2} - t_{PLH1}| \text{ or } |t_{PHL2} - t_{PHL1}|$$

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#### NOTES:

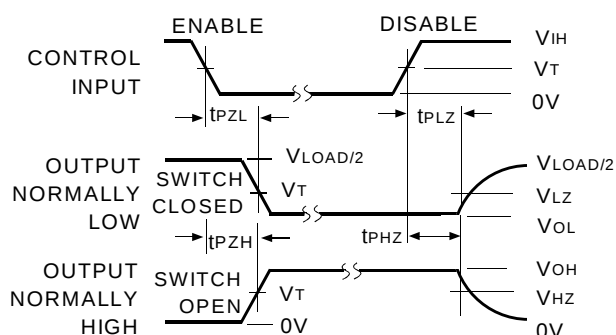
1. For t<sub>SK(o)</sub> OUTPUT1 and OUTPUT2 are any two outputs.
2. For t<sub>SK(b)</sub> OUTPUT1 and OUTPUT2 are in the same bank.

### PROPAGATION DELAY



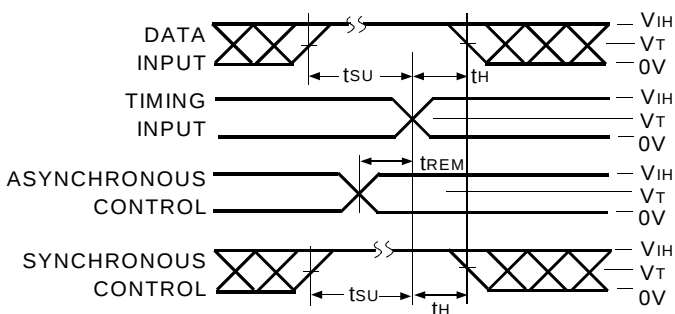
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### ENABLE AND DISABLE TIMES



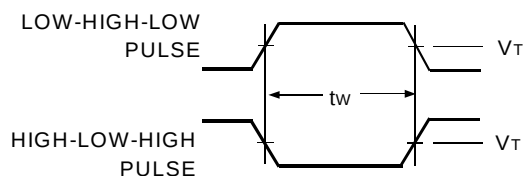
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### SET-UP, HOLD, AND RELEASE TIMES



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### PULSE WIDTH



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## ORDERING INFORMATION

| IDT | XX          | ALVC | X        | XXX         | XX      |                                                               |
|-----|-------------|------|----------|-------------|---------|---------------------------------------------------------------|
|     | Temp. Range |      | Bus-Hold | Device Type | Package |                                                               |
|     |             |      |          |             | SO      | Small Outline IC (SO20-2)                                     |
|     |             |      |          |             | PY      | Shrink Small Outline Package (SO20-7)                         |
|     |             |      |          |             | Q       | Quarter-size Small Outline Package (SO20-8)                   |
|     |             |      |          |             | PG      | Thin Shrink Small Outline Package (SO20-9)                    |
|     |             |      |          | 245         |         | Octal Bus Transceiver with 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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