FEATURES:
- 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 ± 0.3V, Normal Range
- VCC = 2.7V to 3.6V, Extended Range
- CMOS power levels (0.4μW typ. static)
- All inputs, outputs, and I/O are 5V tolerant
- Supports hot insertion
- Available in SSOP and TSSOP packages

DRIVE FEATURES:
- High Output Drivers: ±24mA
- Reduced system switching noise

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

DESCRIPTION:
This 16-bit bus transceiver is built using advanced dual metal CMOS technology. This high-speed, low power transceiver is ideal for asynchronous communication between two busses (A and B). The Direction and Output Enable controls are designed to operate this device as either two independent 8-bit transceivers or one 16-bit transceiver. The direction control pin (DIR) controls the direction of data flow. The output enable pin (OE) overrides the direction control and disables both ports. All inputs are designed with hysteresis for improved noise margin.

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

The LVC16245A has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.
### Pin Configuration

```
1DIR  1  48  1OE
1B1   2  47  1A1
1B2   3  46  1A2
GND   4  45  GND
1B3   5  44  1A3
1B4   6  43  1A4
VCC   7  42  VCC
1B5   8  41  1A5
1B6   9  40  1A6
GND   10 39  GND
1B7   11 38  1A7
1B8   12 37  1A8
2B1   13 36  2A1
2B2   14 35  2A2
GND   15 34  GND
2B3   16 33  2A3
2B4   17 32  2A4
VCC   18 31  VCC
2B5   19 30  2A5
2B6   20 29  2A6
GND   21 28  GND
2B7   22 27  2A7
2B8   23 26  2A8
2DIR  24 25  2OE
```

### Absolute Maximum Ratings (1)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Max</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTERM(2)</td>
<td>Terminal Voltage with Respect to GND</td>
<td>–0.5 to +6.5</td>
<td>V</td>
</tr>
<tr>
<td>VTERM(3)</td>
<td>Terminal Voltage with Respect to GND</td>
<td>–0.5 to +6.5</td>
<td>V</td>
</tr>
<tr>
<td>TSTG</td>
<td>Storage Temperature</td>
<td>–65 to +150</td>
<td>°C</td>
</tr>
<tr>
<td>IOUT</td>
<td>DC Output Current</td>
<td>–50 to +50</td>
<td>mA</td>
</tr>
<tr>
<td>Iok</td>
<td>Continuous Clamp Current, Vi &lt; 0 or V0 &lt; 0</td>
<td>–50</td>
<td>mA</td>
</tr>
<tr>
<td>ICC</td>
<td>Continuous Current through each Vcc or GND</td>
<td>±100</td>
<td>mA</td>
</tr>
</tbody>
</table>

### Notes:
1. 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.
2. Vcc terminals.
3. All terminals except Vcc.

### Capacitance (TA = +25°C, F = 1.0MHz)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter(1)</th>
<th>Conditions</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CIN</td>
<td>Input Capacitance</td>
<td>VIN = 0V</td>
<td>4.5</td>
<td>6</td>
<td>pF</td>
</tr>
<tr>
<td>COUT</td>
<td>Output Capacitance</td>
<td>VOUT = 0V</td>
<td>6.5</td>
<td>8</td>
<td>pF</td>
</tr>
<tr>
<td>CIO</td>
<td>I/O Port Capacitance</td>
<td>VIN = 0V</td>
<td>6.5</td>
<td>8</td>
<td>pF</td>
</tr>
</tbody>
</table>

### Notes:
1. As applicable to the device type.

### Pin Description

<table>
<thead>
<tr>
<th>Pin Names</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xŒ</td>
<td>Output Enable Inputs (Active LOW)</td>
</tr>
<tr>
<td>xDIR</td>
<td>Direction Control Input</td>
</tr>
<tr>
<td>xAx</td>
<td>Side A Inputs or 3-State Outputs</td>
</tr>
<tr>
<td>xBx</td>
<td>Side B Inputs or 3-State Outputs</td>
</tr>
</tbody>
</table>

### Function Table (Each 8-Bit Section)(1)

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>L</td>
</tr>
<tr>
<td>L</td>
<td>H</td>
</tr>
<tr>
<td>H</td>
<td>X</td>
</tr>
</tbody>
</table>

### Notes:
1. H = HIGH Voltage Level
2. X = Don’t Care
3. L = LOW Voltage Level
4. Z = High-Impedance
## DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE

Following Conditions Apply Unless Otherwise Specified:

Operating Condition: \( Ta = -40°C \) to +85°C

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Min.</th>
<th>Typ.(^{(1)})</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{IH} )</td>
<td>Input HIGH Voltage Level</td>
<td>( V_{CC} = 2.3V ) to 2.7V</td>
<td>1.7</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.7V ) to 3.6V</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td>( V_{IL} )</td>
<td>Input LOW Voltage Level</td>
<td>( V_{CC} = 2.3V ) to 2.7V</td>
<td>—</td>
<td>—</td>
<td>0.7</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.7V ) to 3.6V</td>
<td>—</td>
<td>—</td>
<td>0.8</td>
<td>V</td>
</tr>
<tr>
<td>( I_{IH} )</td>
<td>Input Leakage Current</td>
<td>( V_{CC} = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>±5</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{IL} )</td>
<td></td>
<td>( V_{I} = 0 ) to 5.5V</td>
<td>—</td>
<td>—</td>
<td>±10</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{OZH} )</td>
<td>High Impedance Output Current (3-State Output pins)</td>
<td>( V_{CC} = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>±10</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{OFL} )</td>
<td></td>
<td>( V_{O} = 0 ) to 5.5V</td>
<td>—</td>
<td>—</td>
<td>±50</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( V_{IK} )</td>
<td>Clamp Diode Voltage</td>
<td>( V_{CC} = 2.3V ), ( I_{IN} = -18mA )</td>
<td>—</td>
<td>—</td>
<td>−0.7</td>
<td>V</td>
</tr>
<tr>
<td>( V_{IH} )</td>
<td>Input Hysteresis</td>
<td>( V_{CC} = 3.3V )</td>
<td>—</td>
<td>100</td>
<td>—</td>
<td>mV</td>
</tr>
<tr>
<td>( I_{CCL} )</td>
<td>Quiescent Power Supply Current</td>
<td>( V_{CC} = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( I_{CC} )</td>
<td></td>
<td>( 3.6 \leq V_{IN} \leq 5.5V )</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>( \mu A )</td>
</tr>
<tr>
<td>( \Delta I_{CC} )</td>
<td>Quiescent Power Supply Current Variation</td>
<td>One input at ( V_{CC} - 0.6V ), other inputs at ( V_{CC} ) or GND</td>
<td>—</td>
<td>—</td>
<td>500</td>
<td>( \mu A )</td>
</tr>
</tbody>
</table>

**NOTES:**

1. Typical values are at \( V_{CC} = 3.3V \), +25°C ambient.
2. This applies in the disabled state only.

## OUTPUT DRIVE CHARACTERISTICS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions(^{(1)})</th>
<th>Min.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( V_{OH} )</td>
<td>Output HIGH Voltage</td>
<td>( V_{CC} = 2.3V ) to 3.6V</td>
<td>( I_{OH} = -0.1mA )</td>
<td>( V_{CC} - 0.2 )</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.3V )</td>
<td>( I_{OH} = -6mA )</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.3V )</td>
<td>( I_{OH} = -12mA )</td>
<td>1.7</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.7V )</td>
<td>—</td>
<td>—</td>
<td>2.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 3V )</td>
<td>—</td>
<td>—</td>
<td>2.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 3V )</td>
<td>( I_{OH} = -24mA )</td>
<td>2.2</td>
<td>—</td>
</tr>
<tr>
<td>( V_{OL} )</td>
<td>Output LOW Voltage</td>
<td>( V_{CC} = 2.3V ) to 3.6V</td>
<td>( I_{OL} = 0.1mA )</td>
<td>—</td>
<td>0.2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.3V )</td>
<td>( I_{OL} = 6mA )</td>
<td>—</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.3V )</td>
<td>( I_{OL} = 12mA )</td>
<td>—</td>
<td>0.7</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 2.7V )</td>
<td>( I_{OL} = 12mA )</td>
<td>—</td>
<td>0.4</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V_{CC} = 3V )</td>
<td>( I_{OL} = 24mA )</td>
<td>—</td>
<td>0.55</td>
</tr>
</tbody>
</table>

**NOTE:**

1. \( V_{OH} \) and \( V_{OL} \) must be within the min. or max. range shown in the DC ELECTRICAL CHARACTERISTICS OVER OPERATING RANGE table for the appropriate \( V_{CC} \) range. \( Ta = -40°C \) to +85°C.
### OPERATING CHARACTERISTICS, \( V_{CC} = 3.3\, V \pm 0.3\, V, T_A = 25^\circ C \)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>Test Conditions</th>
<th>Typical</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPD</td>
<td>Power Dissipation Capacitance per Transceiver Outputs enabled</td>
<td>( C_L = 0, pF, f = 10, MHz )</td>
<td>38</td>
<td>pF</td>
</tr>
<tr>
<td>CPD</td>
<td>Power Dissipation Capacitance per Transceiver Outputs disabled</td>
<td></td>
<td>4</td>
<td>pF</td>
</tr>
</tbody>
</table>

### SWITCHING CHARACTERISTICS\(^{(1)}\)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>( V_{CC} = 2.7, V )</th>
<th>( V_{CC} = 3.3, V \pm 0.3, V )</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( t_{PLH} )</td>
<td>Propagation Delay ( xA_x ) to ( xB_x ) to ( xA_x )</td>
<td>—</td>
<td>4.7</td>
<td>1</td>
</tr>
<tr>
<td>( t_{PHL} )</td>
<td></td>
<td>—</td>
<td>6.7</td>
<td>1.5</td>
</tr>
<tr>
<td>( t_{PZH} )</td>
<td>Output Enable Time ( xO\bar{E} ) to ( xA_x ) or ( xB_x )</td>
<td>—</td>
<td>7.1</td>
<td>1.5</td>
</tr>
<tr>
<td>( t_{PZH} )</td>
<td>Output Disable Time ( xO\bar{E} ) to ( xA_x ) or ( xB_x )</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**NOTES:**

1. See TEST CIRCUITS AND WAVEFORMS.  \( T_A = –40^\circ C \) to +85°C.
2. Skew between any two outputs of the same package and switching in the same direction.
TEST CIRCUITS AND WAVEFORMS

TEST CONDITIONS

<table>
<thead>
<tr>
<th>Symbol</th>
<th>$V_{CC(1)}=3.3\text{V±0.3V}$</th>
<th>$V_{CC(1)}=2.7\text{V}$</th>
<th>$V_{CC(2)}=2.5\text{V±0.2V}$</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{LOAD}$</td>
<td>6</td>
<td>6</td>
<td>$2 \times V_{CC}$</td>
<td>V</td>
</tr>
<tr>
<td>$V_{IH}$</td>
<td>2.7</td>
<td>2.7</td>
<td>$V_{CC}$</td>
<td>V</td>
</tr>
<tr>
<td>$V_{T}$</td>
<td>1.5</td>
<td>1.5</td>
<td>$V_{CC}/2$</td>
<td>V</td>
</tr>
<tr>
<td>$V_{LZ}$</td>
<td>300</td>
<td>300</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td>$V_{HZ}$</td>
<td>300</td>
<td>300</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td>$C_L$</td>
<td>50</td>
<td>50</td>
<td>30</td>
<td>pF</td>
</tr>
</tbody>
</table>

DEFINITIONS:

$C_L$ = Load capacitance: includes jig and probe capacitance.
$R_T$ = Termination resistance: should be equal to $Z_{OUT}$ of the Pulse Generator.

NOTES:

1. Pulse Generator for All Pulses: Rate $\leq 10\text{MHz}$; $t_f \leq 2.5\text{ns}$; $t_R \leq 2.5\text{ns}$.
2. Pulse Generator for All Pulses: Rate $\leq 10\text{MHz}$; $t_f \leq 2\text{ns}$; $t_R \leq 2\text{ns}$.

SWITCH POSITION

<table>
<thead>
<tr>
<th>Test</th>
<th>Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Drain</td>
<td>$V_{LOAD}$</td>
</tr>
<tr>
<td>Disable Low</td>
<td>$GND$</td>
</tr>
<tr>
<td>Enable Low</td>
<td>$V_{LOAD}$</td>
</tr>
<tr>
<td>Disable High</td>
<td>$GND$</td>
</tr>
<tr>
<td>Enable High</td>
<td>$V_{LOAD}$</td>
</tr>
<tr>
<td>All Other Tests</td>
<td>Open</td>
</tr>
</tbody>
</table>

NOTES:

1. Diagram shown for input Control Enable-LOW and input Control Disable-HIGH.

Define and Disable Times

| DATA INPUT | $V_{IH}$ | $V_T$ | $0\text{V}$ |
| ASYNCHRONOUS CONTROL | $V_{IH}$ | $V_T$ | $0\text{V}$ |
| SYNCHRONOUS CONTROL   | $V_{IH}$ | $V_T$ | $0\text{V}$ |

Set-up, Hold, and Release Times

Pulse Width

Output Skew - $t_{SK(x)}$

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

NOTES:

1. For $t_{SK(o)}$ OUTPUT1 and OUTPUT2 are any two outputs.
2. For $t_{SK(b)}$ OUTPUT1 and OUTPUT2 are in the same bank.
INDUSTRIAL TEMPERATURE RANGE

IDT74LVC16245A
3.3V CMOS 16-BIT BUS TRANSCEIVER WITH 3-STATE OUTPUTS

ORDERING INFORMATION

<table>
<thead>
<tr>
<th>XX</th>
<th>LVC</th>
<th>X</th>
<th>XX</th>
<th>XXXX</th>
<th>XX</th>
<th>X</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. Range</td>
<td></td>
<td>Bus-Hold</td>
<td>Family</td>
<td>Device Type</td>
<td>Package</td>
<td></td>
</tr>
</tbody>
</table>

- **Blank** Tube or Tray
- **Blank** Tape and Reel
- **PVG** Shrink Small Outline Package - Green
- **PAG** Thin Shrink Small Outline Package - Green
- **245A** 16-Bit Bus Transceiver with 3-State Outputs
- **16** Double-Density, ±24mA
- **Blank** No Bus-hold
- **74** -40°C to +85°C
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(Rev.4.0-1 November 2017)

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