FEATURES:
- Typical $t_{SK(o)}$ (Output Skew) < 250ps
- ESD > 2000V per MIL-STD-883, Method 3015; > 200V using machine model ($C = 200pF, R = 0$)
- $V_{CC} = 3.3V \pm 0.3V$, Normal Range
- $V_{CC} = 2.7V$ 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 TSSOP package

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

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

DESCRIPTION:
The LVC16374A 16-bit edge-triggered D-type flip-flop is built using advanced dual metal CMOS technology. This high-speed, low-power register is ideal for use as a buffer register for data synchronization and storage. The Output Enable ($OE$) and clock ($CLK$) controls are organized to operate this device as two 8-bit registers or one 16-bit register with common clock. Flow-through organization of signal pins simplifies layout. All inputs are designed with hysteresis for improved noise margin.

All pins of the LVC16374A 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 LVC16374A has been designed with a ±24mA output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.
INDUSTRIAL TEMPERATURE RANGE

IDT74LVC16374A
3.3V CMOS 16-BIT EDGE-TRIGGERED D-TYPE FLIP-FLOP

PIN CONFIGURATION

ABSOLUTE MAXIMUM RATINGS (1)

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Description</th>
<th>Conditions</th>
<th>Typ.</th>
<th>Max.</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VTERM</td>
<td>Terminal Voltage with Respect to GND</td>
<td>–0.5 to +6.5 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TSTG</td>
<td>Storage Temperature</td>
<td>–65 to +150 °C</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOUT</td>
<td>DC Output Current</td>
<td>–50 to +50 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOK</td>
<td>Continuous Clamp Current, V&lt;0 or V&lt;0</td>
<td>–50 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IOK</td>
<td>Continuous Current through each Vcc or Gnd</td>
<td>±100 mA</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

NOTE:
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.

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>CI/O</td>
<td>I/O Port Capacitance</td>
<td>Vin = 0V</td>
<td>6.5</td>
<td>8</td>
<td>pF</td>
</tr>
</tbody>
</table>

NOTE:
1. As applicable to the device type.

PIN DESCRIPTION

<table>
<thead>
<tr>
<th>Pin Names</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>xDx</td>
<td>Data Inputs</td>
</tr>
<tr>
<td>xCLK</td>
<td>Clock Inputs</td>
</tr>
<tr>
<td>xØE</td>
<td>3-State Output Enable Inputs (Active LOW)</td>
</tr>
<tr>
<td>xQx</td>
<td>3-State Outputs</td>
</tr>
</tbody>
</table>

FUNCTION TABLE (EACH FLIP-FLOP) (1)

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

NOTES:
1. H = HIGH Voltage Level
   X = Don’t Care
   L = LOW Voltage Level
   Z = High-Impedance
2. Output level before the indicated steady-state input conditions were established.

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## 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>VIH</td>
<td>Input HIGH Voltage Level</td>
<td>( VCC = 2.3V ) to ( 2.7V )</td>
<td>1.7</td>
<td>—</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.7V ) to ( 3.6V )</td>
<td>2</td>
<td>—</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>VIL</td>
<td>Input LOW Voltage Level</td>
<td>( VCC = 2.3V ) to ( 2.7V )</td>
<td>—</td>
<td>0.7</td>
<td>—</td>
<td>V</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.7V ) to ( 3.6V )</td>
<td>—</td>
<td>—</td>
<td>0.8</td>
<td></td>
</tr>
<tr>
<td>IIL</td>
<td>Input Leakage Current</td>
<td>( VCC = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±5μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( V ) = 0 to ( 5.5V )</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±5μA</td>
</tr>
<tr>
<td>IOZH</td>
<td>High Impedance Output Current</td>
<td>( VCC = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±10μA</td>
</tr>
<tr>
<td></td>
<td>(3-State Output pins)</td>
<td>( V ) = 0 to ( 5.5V )</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>±10μA</td>
</tr>
<tr>
<td>IOFF</td>
<td>Input/Output Power Off Leakage</td>
<td>( VCC = 0V ), ( VIN ) or ( VO ) ( \leq ) ( 5.5V )</td>
<td>—</td>
<td>—</td>
<td>0.5</td>
<td>μA</td>
</tr>
<tr>
<td>VIH</td>
<td>Input Hysteresis</td>
<td>( VCC = 3.3V )</td>
<td>—</td>
<td>—</td>
<td>0.7</td>
<td>mV</td>
</tr>
<tr>
<td>ICCL</td>
<td>Quiescent Power Supply Current</td>
<td>( VCC = 3.6V )</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VIN = GND ) or ( VCC )</td>
<td>—</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( 3.6 \leq VIN \leq 5.5V^{(2)} )</td>
<td>—</td>
<td>—</td>
<td>10</td>
<td>μA</td>
</tr>
<tr>
<td>ΔICC</td>
<td>Quiescent Power Supply Current Variation</td>
<td>One input at ( VCC - 0.6V ), other inputs at ( VCC ) or ( GND )</td>
<td>—</td>
<td>500</td>
<td>—</td>
<td>μA</td>
</tr>
</tbody>
</table>

**NOTES:**
1. Typical values are at \( VCC = 3.3V \), \( +25°C \) 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>VOH</td>
<td>Output HIGH Voltage</td>
<td>( VCC = 2.3V ) to ( 3.6V )</td>
<td>( IOH = -0.1mA )</td>
<td>( VCC - 0.2 )</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.3V )</td>
<td>( IOH = -6mA )</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.3V )</td>
<td>( IOH = -12mA )</td>
<td>1.7</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.7V )</td>
<td>—</td>
<td>2.2</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 3V )</td>
<td>( IOH = -24mA )</td>
<td>2.2</td>
<td>—</td>
</tr>
<tr>
<td>VOL</td>
<td>Output LOW Voltage</td>
<td>( VCC = 2.3V ) to ( 3.6V )</td>
<td>( IOL = 0.1mA )</td>
<td>0.2</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.3V )</td>
<td>( IOL = 6mA )</td>
<td>0.4</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.3V )</td>
<td>( IOL = 12mA )</td>
<td>0.7</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 2.7V )</td>
<td>( IOL = 12mA )</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td></td>
<td>( VCC = 3V )</td>
<td>( IOL = 24mA )</td>
<td>—</td>
<td>—</td>
</tr>
</tbody>
</table>

**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 \( VCC \) range. \( TA = -40°C \) to \( +85°C \).
### OPERATING CHARACTERISTICS, \( V_{CC} = 3.3V \pm 0.3V, \ TA = 25°C \)

<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 Flip-Flop Outputs enabled</td>
<td>( C_L = 0pF, f = 10Mhz )</td>
<td>58</td>
<td>pF</td>
</tr>
<tr>
<td>CPD</td>
<td>Power Dissipation Capacitance per Flip-Flop Outputs disabled</td>
<td></td>
<td>24</td>
<td>pF</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Symbol</th>
<th>Parameter</th>
<th>( V_{CC} = 2.7V )</th>
<th></th>
<th>( V_{CC} = 3.3V \pm 0.3V )</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f_{\text{MAX}} )</td>
<td>Propagation Delay</td>
<td>( x_{\text{CLK}} ) to ( x_{\text{Q}} )</td>
<td>( \infty )</td>
<td>4.9</td>
<td>1.5</td>
</tr>
<tr>
<td>( t_{\text{PLH}} )</td>
<td>Output Enable Time</td>
<td>( x_{\text{OE}} ) to ( x_{\text{Q}} )</td>
<td>( \infty )</td>
<td>5.3</td>
<td>1.5</td>
</tr>
<tr>
<td>( t_{\text{PHZ}} )</td>
<td>Output Disable Time</td>
<td>( x_{\text{OE}} ) to ( x_{\text{Q}} )</td>
<td>( \infty )</td>
<td>6.1</td>
<td>1.5</td>
</tr>
<tr>
<td>( t_{\text{SU}} )</td>
<td>Set-up Time HIGH or LOW, ( x_{\text{D}} ) to ( x_{\text{CLK}} )</td>
<td></td>
<td>1.9</td>
<td>( \infty )</td>
<td>1.9</td>
</tr>
<tr>
<td>( t_{\text{HH}} )</td>
<td>Hold Time HIGH or LOW, ( x_{\text{D}} ) after ( x_{\text{CLK}} )</td>
<td></td>
<td>1.1</td>
<td>( \infty )</td>
<td>1.1</td>
</tr>
<tr>
<td>( t_{\text{PW}} )</td>
<td>( x_{\text{CLK}} ) Pulse Width HIGH or LOW</td>
<td></td>
<td>3.3</td>
<td>( \infty )</td>
<td>3.3</td>
</tr>
<tr>
<td>( t_{\text{SK(o)}} )</td>
<td>Output Skew(^{(2)})</td>
<td></td>
<td>( \infty )</td>
<td>( \infty )</td>
<td>( \infty )</td>
</tr>
</tbody>
</table>

**NOTES:**
1. See TEST CIRCUITS AND WAVEFORMS. \( TA = – 40°C \) 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>VCC(1)=3.3V±0.3V</th>
<th>VCC(2)=2.7V</th>
<th>VCC(3)=2.5V±0.2V</th>
<th>Unit</th>
</tr>
</thead>
<tbody>
<tr>
<td>VLOAD</td>
<td>6</td>
<td>6</td>
<td>2xVCC</td>
<td>V</td>
</tr>
<tr>
<td>Vih</td>
<td>2.7</td>
<td>2.7</td>
<td>VCC</td>
<td>V</td>
</tr>
<tr>
<td>Vt</td>
<td>1.5</td>
<td>1.5</td>
<td>VCC/2</td>
<td>V</td>
</tr>
<tr>
<td>VLZ</td>
<td>300</td>
<td>300</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td>VHZ</td>
<td>300</td>
<td>300</td>
<td>150</td>
<td>mV</td>
</tr>
<tr>
<td>CL</td>
<td>50</td>
<td>50</td>
<td>30</td>
<td>pF</td>
</tr>
</tbody>
</table>

DEFINITIONS:
CL = Load capacitance: includes jig and probe capacitance.
RT = Termination resistance: should be equal to ZOUT of the Pulse Generator.

NOTES:
1. Pulse Generator for All Pulses: Rate ≤ 10MHz; tr ≤ 2.5ns; ts ≤ 2 ns.
2. Pulse Generator for All Pulses: Rate ≤ 10MHz; tr ≤ 2ns; ts ≤ 2ns.

SWITCH POSITION

<table>
<thead>
<tr>
<th>Test</th>
<th>Switch</th>
</tr>
</thead>
<tbody>
<tr>
<td>Open Drain</td>
<td>VLOAD</td>
</tr>
<tr>
<td>Disable Low</td>
<td>GND</td>
</tr>
<tr>
<td>Enable Low</td>
<td>Open</td>
</tr>
<tr>
<td>Disable High</td>
<td></td>
</tr>
<tr>
<td>Enable High</td>
<td></td>
</tr>
<tr>
<td>All Other Tests</td>
<td>Open</td>
</tr>
</tbody>
</table>

NOTES:
1. For ts(x) OUTPUT1 and OUTPUT2 are any two outputs.
2. For ts(x) OUTPUT1 and OUTPUT2 are in the same outputs.
ORDERING INFORMATION

XX  LVC  X  XX  XXXX  XX  X
Temp. Range  Bus-Hold  Family  Device Type  Package

Blank  Blank  8
Tape and Reel  Tube or Tray
PAG  Thin Shrink Small Outline Package - Green

374A  16-Bit Edge-Triggered D-Type Flip-Flop with 3-State Outputs, 5 Volt Tolerant I/O

16  Double-Density, ±24mA

Blank  No Bus-hold

74  -40°C to +85°C

DATASHEET DOCUMENT HISTORY

08/20/2015  Pg. 6  Updated the ordering information by removing SSOP, TVSOP, non RoHS parts and adding Tape and Reel information.
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