



## 3.3V CMOS QUADRUPLE 2-LINE TO 1-LINE DATA SELECTOR/MULTIPLEXER, 5 VOLT TOLERANT I/O

**IDT74LVC157A**

### FEATURES:

- 0.5 MICRON CMOS Technology
- 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 ( $0.4\mu W$  typ. static)
- Rail-to-Rail output swing for increased noise margin
- All inputs, outputs, and I/Os are 5V tolerant
- Supports hot insertion
- Available in QSOP, SOIC, SSOP, and TSSOP packages

### DRIVE FEATURES:

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

### DESCRIPTION:

This quadruple 2-line to 1-line data selector/multiplexer is built using advanced dual metal CMOS technology. The LVC157A features a common strobe ( $\bar{G}$ ) input. When the strobe is high, all outputs are low. When the strobe is low, a 4-bit word is selected from one of two sources and is routed to the four outputs. The device provides true data.

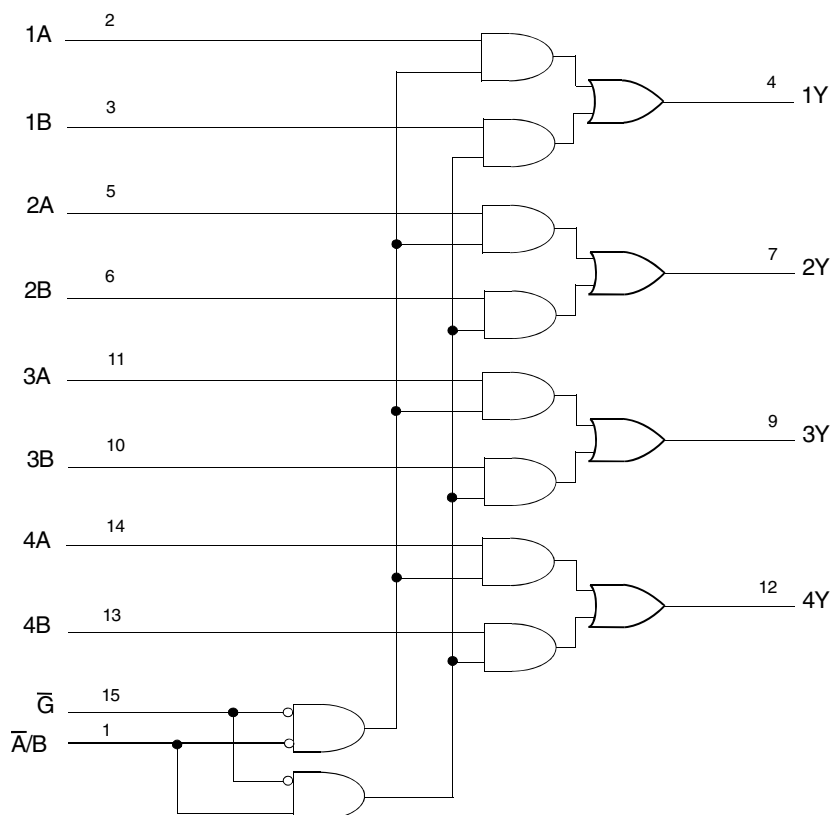
Inputs can be driven from either 3.3V or 5V devices. This feature allows the use of this device as a translator in a mixed 3.3V/5V supply system.

The LVC157A has been designed with a  $\pm 24mA$  output driver. This driver is capable of driving a moderate to heavy load while maintaining speed performance.

### APPLICATIONS:

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

### FUNCTIONAL BLOCK DIAGRAM

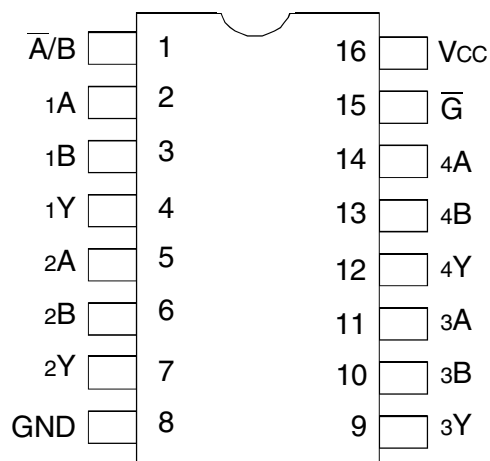


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INDUSTRIAL TEMPERATURE RANGE

FEBRUARY 2000

## PIN CONFIGURATION



QSOP/ SOIC/ SSOP/ TSSOP  
TOP VIEW

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

| Symbol                             | Description                                                           | Max          | Unit |
|------------------------------------|-----------------------------------------------------------------------|--------------|------|
| V <sub>TERM</sub>                  | Terminal Voltage with Respect to GND                                  | -0.5 to +6.5 | 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>Vcc 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  | 4.5  | 6    | pF   |
| C <sub>OUT</sub> | Output Capacitance       | V <sub>OUT</sub> = 0V | 5.5  | 8    | pF   |
| C <sub>I/O</sub> | I/O Port Capacitance     | V <sub>IN</sub> = 0V  | 6.5  | 8    | pF   |

### NOTE:

- As applicable to the device type.

## PIN DESCRIPTION

| Pin Names        | Description                      |
|------------------|----------------------------------|
| $\overline{A/B}$ | Select Input (Active LOW)        |
| $\overline{G}$   | Common Strobe Input (Active LOW) |
| xY               | Data Outputs                     |
| xA, xB           | Data Inputs                      |

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

| Inputs         |                  |    |    | Outputs |
|----------------|------------------|----|----|---------|
| $\overline{G}$ | $\overline{A/B}$ | xA | xB | xY      |
| H              | X                | X  | X  | L       |
| L              | L                | L  | X  | L       |
| L              | L                | H  | X  | H       |
| L              | H                | X  | L  | L       |
| L              | H                | X  | H  | H       |

### 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      |               |
| $I_{IH}$<br>$I_{IL}$                | Input Leakage Current                                  | $V_{CC} = 3.6\text{V}$                                                | $V_i = 0 \text{ to } 5.5\text{V}$ | —    | —                   | $\pm 5$  | $\mu\text{A}$ |
| $I_{OZH}$<br>$I_{OZL}$              | High Impedance Output Current<br>(3-State Output pins) | $V_{CC} = 3.6\text{V}$                                                | $V_o = 0 \text{ to } 5.5\text{V}$ | —    | —                   | $\pm 10$ | $\mu\text{A}$ |
| $I_{OFF}$                           | Input/Output Power Off Leakage                         | $V_{CC} = 0\text{V}$ , $V_{IN}$ or $V_o \leq 5.5\text{V}$             |                                   | —    | —                   | $\pm 50$ | $\mu\text{A}$ |
| $V_{IK}$                            | 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                         | $V_{CC} = 3.6\text{V}$ , $V_{IN} = \text{GND or } V_{CC}$             |                                   | —    | —                   | 10       | $\mu\text{A}$ |
| $\Delta I_{CC}$                     | Quiescent Power Supply Current Variation               | One input at $V_{CC} - 0.6\text{V}$ , other inputs at $V_{CC}$ or GND |                                   | —    | —                   | 500      | $\mu\text{A}$ |

**NOTE:**

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

## 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            | —    |      |
|          |                     | $V_{CC} = 3\text{V}$                   |                          | 2.4            | —    |      |
|          |                     | $V_{CC} = 3\text{V}$                   | $I_{OH} = -24\text{mA}$  | 2.2            | —    |      |
| $V_{OL}$ | 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  |      |
|          |                     | $V_{CC} = 3\text{V}$                   | $I_{OL} = 24\text{mA}$   | —              | 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  $+85^{\circ}\text{C}$ .

# OPERATING CHARACTERISTICS, $V_{CC} = 3.3V \pm 0.3V$ , $T_A = 25^\circ C$

| Symbol | Parameter                     | Test Conditions           | Typical | Unit |
|--------|-------------------------------|---------------------------|---------|------|
| CPD    | Power Dissipation Capacitance | $C_L = 0pF$ , $f = 10MHz$ | 16      | pF   |

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

| Symbol                 | Parameter                              | $V_{CC} = 2.7V$ |      | $V_{CC} = 3.3V \pm 0.3V$ |      | Unit |
|------------------------|----------------------------------------|-----------------|------|--------------------------|------|------|
|                        |                                        | Min.            | Max. | Min.                     | Max. |      |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>xA or xB to xY    | —               | 5.9  | 1                        | 5.2  | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$\bar{A}/B$ to xY | —               | 8.1  | 1                        | 6.8  | ns   |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>$\bar{G}$ to xY   | —               | 7.8  | 1                        | 6.5  | ns   |
| $t_{sk(0)}$            | Output Skew <sup>(2)</sup>             | —               | —    | —                        | 1    | ns   |

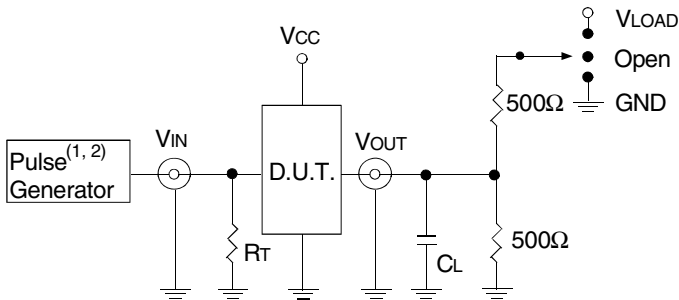
### NOTES:

- See TEST CIRCUITS AND WAVEFORMS.  $T_A = -40^\circ C$  to  $+85^\circ C$ .
- Skew between any two outputs of the same package and switching in the same direction.

## TEST CIRCUITS AND WAVEFORMS

### TEST CONDITIONS

| Symbol     | $V_{CC}^{(1)} = 2.5V \pm 0.2V$ | $V_{CC}^{(2)} = 3.3V \pm 0.3V \text{ \& } 2.7V$ | Unit |
|------------|--------------------------------|-------------------------------------------------|------|
| $V_{LOAD}$ | $2 \times V_{CC}$              | 6                                               | V    |
| $V_{IH}$   | $V_{CC}$                       | 2.7                                             | V    |
| $V_T$      | $V_{CC} / 2$                   | 1.5                                             | V    |
| $V_{LZ}$   | 150                            | 300                                             | mV   |
| $V_{HZ}$   | 150                            | 300                                             | mV   |
| $C_L$      | 30                             | 50                                              | pF   |



Test Circuit for All Outputs

#### DEFINITIONS:

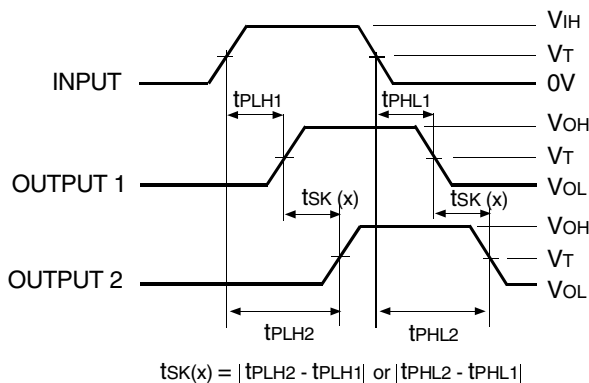
$C_L$  = Load capacitance: includes jig and probe capacitance.  
 $R_T$  = Termination resistance: should be equal to  $Z_{OUT}$  of the Pulse Generator.

#### NOTES:

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

## SWITCH POSITION

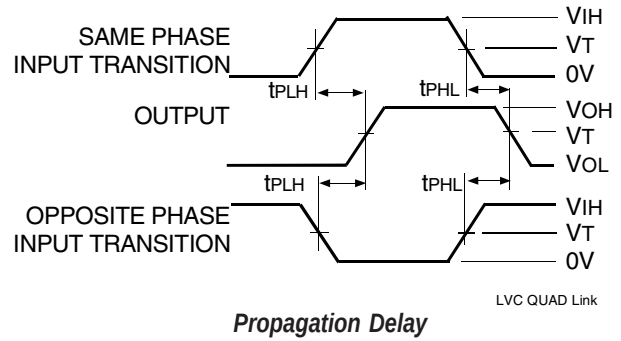
| Test                                    | Switch     |
|-----------------------------------------|------------|
| Open Drain<br>Disable Low<br>Enable Low | $V_{LOAD}$ |
| Disable High<br>Enable High             | GND        |
| All Other Tests                         | Open       |



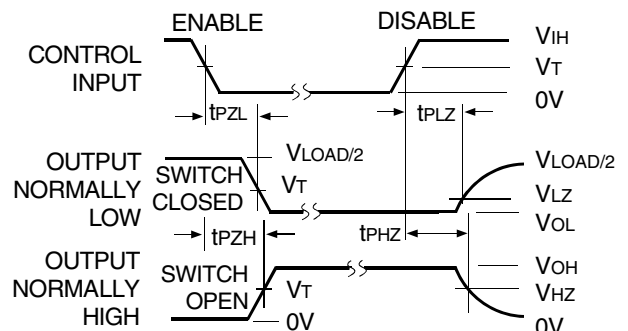
Output Skew -  $tsK(x)$

#### NOTES:

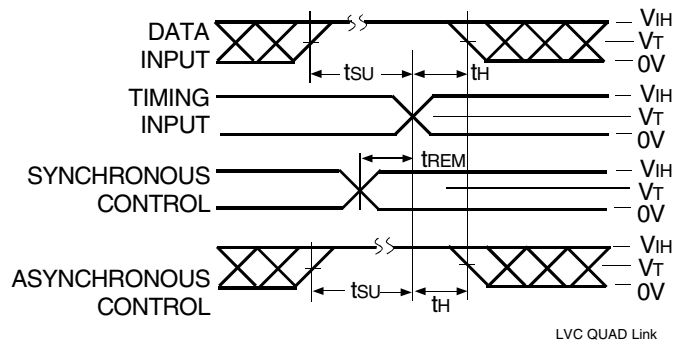
1. For  $tsK(o)$  OUTPUT1 and OUTPUT2 are any two outputs.
2. For  $tsK(b)$  OUTPUT1 and OUTPUT2 are in the same bank.



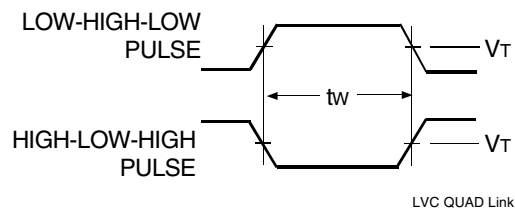
Propagation Delay



Enable and Disable Times



Set-up, Hold, and Release Times



Pulse Width

## ORDERING INFORMATION

IDT    XX    LVC    XXXX    XX  
Temp. Range    Device Type    Package

|      |                                                                         |
|------|-------------------------------------------------------------------------|
| Q    | Quarter Size Outline Package                                            |
| DC   | Small Outline Package                                                   |
| PY   | Shrink Small Outline Package                                            |
| PG   | Thin Shrink Small Outline Package                                       |
| 157A | Quadruple 2-Line to 1-Line Data Selector/Multiplexer, $\pm 24\text{mA}$ |
| 74   | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$                          |



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