

# DATA SHEET

## 74LVC157A Quad 2-input multiplexer

Product specification  
Supercedes data of 1997 Nov 07  
IC24 Data Handbook

1998 Jul 29

## Quad 2-input multiplexer

## 74LVC157A

## FEATURES

- Wide supply voltage range of 1.2 to 3.6 V
- In accordance with JEDEC standard no. 8-1A
- CMOS lower power consumption
- Direct interface with TTL levels
- 5 Volt tolerant inputs, for interfacing with 5 Volt logic

## DESCRIPTION

The 74LVC157A is a high-performance, low-power, Si-gate CMOS device, superior to most advanced CMOS compatible TTL families.

Inputs can be driven from either 3.3V or 5.0V devices. In 3-State operation, outputs can handle 5V. This feature allows the use of these devices as translators in a mixed 3.3V/5V environment.

The 74LVC157A is a quad 2-input multiplexer which select 4 bits of data from two sources under the control of a common data select

input (S). The four outputs present the selected data in the true (non-inverted) form. The enable input ( $\bar{E}$ ) is active LOW. When  $\bar{E}$  is HIGH, all of the outputs (1Y to 4Y) are forced LOW regardless of all other input conditions. Moving the data from two groups of registers to four common output buses is a common use of the 74LVC157. The state of the common data select input (S) determines the particular register from which the data comes. It can also be used as function generator.

The device is useful for implementing highly irregular logic by generating any four of the 16 different functions of two variables with one variable common.

The 74LVC157A is the logic implementation of a 4-pole, 2-position switch, where the position of the switch is determined by the logic levels applied to S.

## QUICK REFERENCE DATA

$GND = 0 \text{ V}$ ;  $T_{amb} = 25^\circ\text{C}$ ;  $t_r = t_f \leq 2.5 \text{ ns}$

| SYMBOL            | PARAMETER   | CONDITIONS  | TYPICAL           | UNIT |
|-------------------|---|---|-------------------|------|
| $t_{PHL}/t_{PLH}$ | Propagation delay<br>$nI_0, nI_1, \text{ to } nY$<br>$\bar{E} \text{ to } nY$<br>$S \text{ to } nY$ | $C_L = 50 \text{ pF}$<br>$V_{CC} = 3.3 \text{ V}$ | 3.1<br>3.0<br>3.3 | ns   |
| $C_I$             | Input capacitance   |   | 5.0               | pF   |
| $C_{PD}$          | Power dissipation capacitance per gate  | $V_I = GND \text{ to } V_{CC}^1$                  | 33                | pF   |

## NOTES:

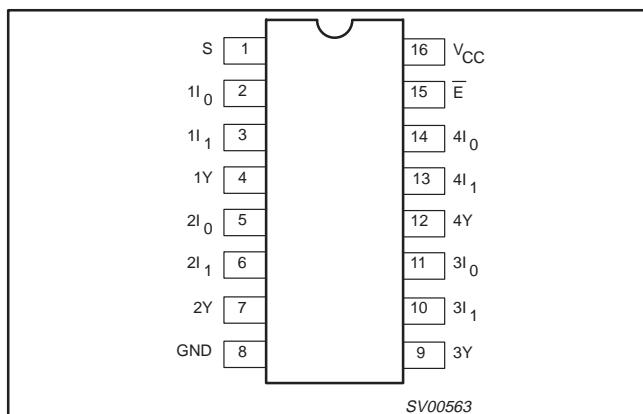
1.  $C_{PD}$  is used to determine the dynamic power dissipation ( $P_D$  in  $\mu\text{W}$ )  

$$P_D = C_{PD} \times V_{CC}^2 \times f_i + \sum (C_L \times V_{CC}^2 \times f_o)$$
 where:  
 $f_i$  = input frequency in MHz;  $C_L$  = output load capacitance in pF;  
 $f_o$  = output frequency in MHz;  $V_{CC}$  = supply voltage in V;  
 $\sum (C_L \times V_{CC}^2 \times f_o)$  = sum of the outputs.

## ORDERING INFORMATION

| PACKAGES                    | TEMPERATURE RANGE                                 | OUTSIDE NORTH AMERICA | NORTH AMERICA  | PKG. DWG. # |
|-----------------------------|---|-----------------------|----------------|-------------|
| 16-Pin Plastic SO           | $-40^\circ\text{C} \text{ to } +85^\circ\text{C}$ | 74LVC157A D           | 74LVC157A D    | SOT109-1    |
| 16-Pin Plastic SSOP Type II | $-40^\circ\text{C} \text{ to } +85^\circ\text{C}$ | 74LVC157A DB          | 74LVC157A DB   | SOT338-1    |
| 16-Pin Plastic TSSOP Type I | $-40^\circ\text{C} \text{ to } +85^\circ\text{C}$ | 74LVC157A PW          | 74LVC157APW DH | SOT403-1    |

## PIN CONFIGURATION



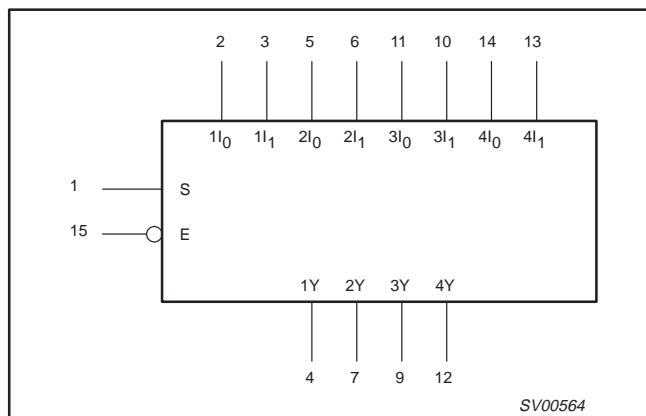
## PIN DESCRIPTION

| PIN NUMBER   | SYMBOL                  | FUNCTION                   |
|--------------|-------------------------|----------------------------|
| 1            | S                       | Common data select input   |
| 2, 5, 11, 14 | $1I_0 \text{ to } 4I_0$ | Data inputs from sources 0 |
| 3, 6, 10, 13 | $1I_1 \text{ to } 4I_1$ | Data inputs from sources 1 |
| 4, 7, 9, 12  | 1Y to 4Y                | Multiplexer outputs        |
| 8            | GND                     | Ground (0 V)               |
| 15           | $\bar{E}$               | Enable input (active LOW)  |
| 16           | $V_{CC}$                | Positive supply voltage    |

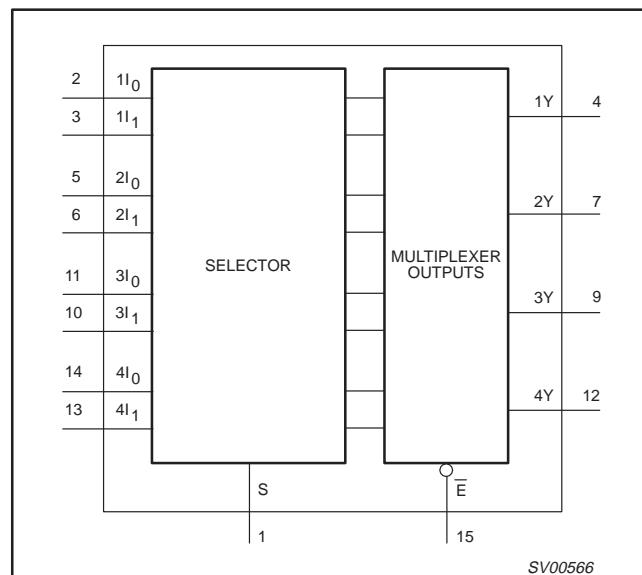
## Quad 2-input multiplexer

74LVC157A

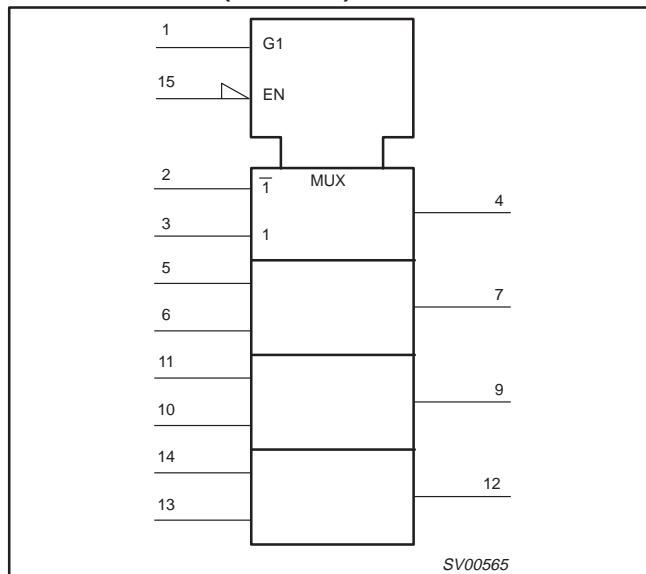
## LOGIC SYMBOL



## FUNCTIONAL DIAGRAM



## LOGIC SYMBOL (IEEE/IEC)



## FUNCTION TABLE

|           |   | INPUTS |        | OUTPUTS |
|-----------|---|--------|--------|---------|
| $\bar{E}$ | S | $nI_0$ | $nI_1$ | $nY$    |
| 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       |

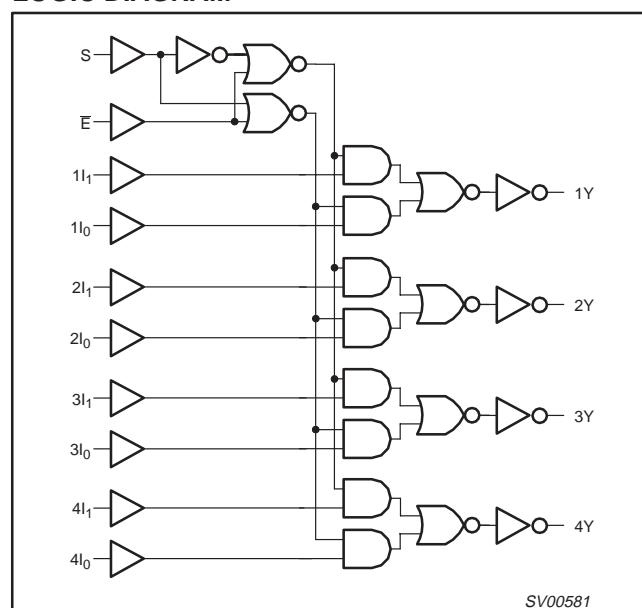
## NOTES:

H = HIGH voltage level

L = LOW voltage level

X = don't care

## LOGIC DIAGRAM



## Quad 2-input multiplexer

74LVC157A

## RECOMMENDED OPERATING CONDITIONS

| SYMBOL     | PARAMETER  | CONDITIONS   | LIMITS |          | UNIT |
|------------|--|--|--------|----------|------|
|            |  |  | MIN    | MAX      |      |
| $V_{CC}$   | DC supply voltage (for max. speed performance)   |  | 2.7    | 3.6      | V    |
|            | DC supply voltage (for low-voltage applications) |  | 1.2    | 3.6      |      |
| $V_I$      | DC input voltage range                           |  | 0      | 5.5      | V    |
| $V_O$      | DC output voltage range                          |  | 0      | $V_{CC}$ | V    |
| $T_{amb}$  | Operating free-air temperature range             |  | -40    | +85      | °C   |
| $t_r, t_f$ | Input rise and fall times                        | $V_{CC} = 1.2$ to $2.7V$<br>$V_{CC} = 2.7$ to $3.6V$ | 0      | 20       | ns/V |
|            |  |  | 0      | 10       |      |

ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

In accordance with the Absolute Maximum Rating System (IEC 134).

Voltages are referenced to GND (ground = 0V).

| SYMBOL            | PARAMETER   | CONDITIONS   | RATING                | UNIT |
|-------------------|---|--|-----------------------|------|
| $V_{CC}$          | DC supply voltage   |  | -0.5 to +6.5          | V    |
| $I_{IK}$          | DC input diode current  | $V_I < 0$  | -50                   | mA   |
| $V_I$             | DC input voltage  | Note 2   | -0.5 to +5.5          | V    |
| $I_{OK}$          | DC output diode current   | $V_O > V_{CC}$ or $V_O < 0$  | ±50                   | mA   |
| $V_O$             | DC output voltage   | Note 2   | -0.5 to $V_{CC}$ +0.5 | V    |
| $I_O$             | DC output diode current   | $V_O = 0$ to $V_{CC}$  | ±50                   | mA   |
| $I_{GND}, I_{CC}$ | DC $V_{CC}$ or GND current  |  | ±100                  | mA   |
| $T_{stg}$         | Storage temperature range   |  | -65 to +150           | °C   |
| $P_{TOT}$         | Power dissipation per package   | above +70°C derate linearly with 8 mW/K<br>above +60°C derate linearly with 5.5 mW/K | 500                   | mW   |
|                   | – plastic mini-pack (SO)<br>– plastic shrink mini-pack (SSOP and TSSOP) |  | 500                   |      |

## NOTES:

1. Stresses beyond those listed may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions beyond those indicated under "recommended operating conditions" is not implied. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.
2. The input and output voltage ratings may be exceeded if the input and output current ratings are observed.

## Quad 2-input multiplexer

74LVC157A

## DC ELECTRICAL CHARACTERISTICS

Over recommended operating conditions. Voltages are referenced to GND (ground = 0V).

| SYMBOL           | PARAMETER   | TEST CONDITIONS   | LIMITS                |                  |      | UNIT |  |
|------------------|---|---|-----------------------|------------------|------|------|--|
|                  |   |   | Temp = -40°C to +85°C |                  |      |      |  |
|                  |   |   | MIN                   | TYP <sup>1</sup> | MAX  |      |  |
| V <sub>IH</sub>  | HIGH level Input voltage                          | V <sub>CC</sub> = 1.2V  | V <sub>CC</sub>       |                  |      | V    |  |
|                  |   | V <sub>CC</sub> = 2.7 to 3.6V   | 2.0                   |                  |      |      |  |
| V <sub>IL</sub>  | LOW level Input voltage                           | V <sub>CC</sub> = 1.2V  |                       |                  | GND  | V    |  |
|                  |   | V <sub>CC</sub> = 2.7 to 3.6V   |                       |                  | 0.8  |      |  |
| V <sub>OH</sub>  | HIGH level output voltage                         | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -12mA  | V <sub>CC</sub> - 0.5 |                  |      | V    |  |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -100µA | V <sub>CC</sub> - 0.2 | V <sub>CC</sub>  |      |      |  |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -18mA  | V <sub>CC</sub> - 0.6 |                  |      |      |  |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = -24mA  | V <sub>CC</sub> - 0.8 |                  |      |      |  |
| V <sub>OL</sub>  | LOW level output voltage                          | V <sub>CC</sub> = 2.7V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 12mA   |                       |                  | 0.40 | V    |  |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 100µA  |                       | GND              | 0.20 |      |  |
|                  |   | V <sub>CC</sub> = 3.0V; V <sub>I</sub> = V <sub>IH</sub> or V <sub>IL</sub> ; I <sub>O</sub> = 24mA   |                       |                  | 0.55 |      |  |
| I <sub>I</sub>   | Input leakage current                             | V <sub>CC</sub> = 3.6V; V <sub>I</sub> = 5.5V or GND  |                       | ± 0.1            | ± 5  | µA   |  |
| I <sub>CC</sub>  | Quiescent supply current                          | V <sub>CC</sub> = 3.6V; V <sub>I</sub> = V <sub>CC</sub> or GND; I <sub>O</sub> = 0                   |                       | 0.1              | 10   | µA   |  |
| ΔI <sub>CC</sub> | Additional quiescent supply current per input pin | V <sub>CC</sub> = 2.7V to 3.6V; V <sub>I</sub> = V <sub>CC</sub> - 0.6V; I <sub>O</sub> = 0           |                       | 5                | 500  | µA   |  |

## NOTE:

1. All typical values are measured at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25°C.

## AC CHARACTERISTICS

GND = 0 V; t<sub>r</sub> = t<sub>f</sub> ≤ 2.5 ns; C<sub>L</sub> = 50 pF; R<sub>L</sub> = 500Ω; T<sub>amb</sub> = -40°C to +85°C

| SYMBOL                             | PARAMETER  | WAVEFORM    | LIMITS                       |                  |     |                        |     |                        | UNIT |  |  |
|------------------------------------|--|-------------|------------------------------|------------------|-----|------------------------|-----|------------------------|------|--|--|
|                                    |  |             | V <sub>CC</sub> = 3.3V ±0.3V |                  |     | V <sub>CC</sub> = 2.7V |     | V <sub>CC</sub> = 1.2V |      |  |  |
|                                    |  |             | MIN                          | TYP <sup>1</sup> | MAX | MIN                    | MAX | TYP                    |      |  |  |
| t <sub>PHL</sub> /t <sub>PLH</sub> | Propagation delay n <sub>l0</sub> to n <sub>Y</sub> ;<br>n <sub>l1</sub> to n <sub>Y</sub> | Figure 2, 3 | 1.5                          | 3.1              | 5.7 | 1.5                    | 6.7 | 12                     | ns   |  |  |
| t <sub>PHL</sub> /t <sub>PLH</sub> | Propagation delay E to n <sub>Y</sub>  | Figure 1, 3 | 1.5                          | 3.0              | 6.3 | 1.5                    | 7.3 | 11                     | ns   |  |  |
| t <sub>PHL</sub> /t <sub>PLH</sub> | Propagation delay S to n <sub>Y</sub>  | Figure 2, 3 | 1.5                          | 3.3              | 6.8 | 1.5                    | 7.8 | 13                     | ns   |  |  |

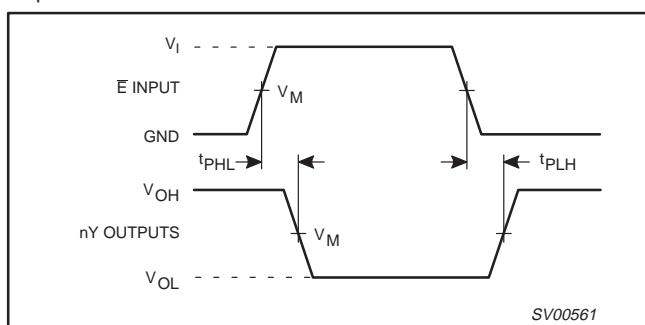
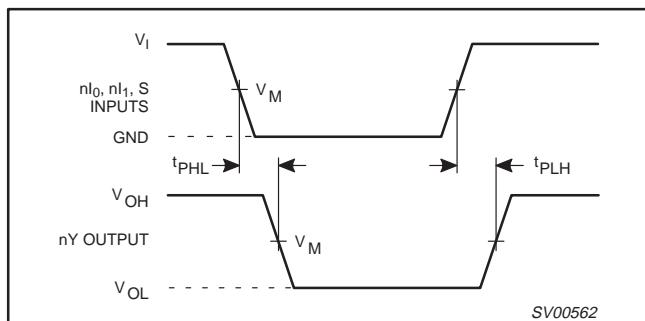
## NOTE:

1. These typical values are at V<sub>CC</sub> = 3.3V and T<sub>amb</sub> = 25°C.

## Quad 2-input multiplexer

74LVC157A

## AC WAVEFORMS

 $V_M = 0.5 \times V_{CC}$  at  $V_{CC} < 2.7$  V $V_M = 1.5$  V at  $V_{CC} \geq 2.7$  V $V_X = V_{OL} + 0.3$  V at  $V_{CC} \geq 2.7$  V $V_X = V_{OL} + 0.1 \times V_{CC}$  at  $V_{CC} < 2.7$  V $V_Y = V_{OH} - 0.3$  V at  $V_{CC} \geq 2.7$  V $V_Y = V_{OH} - 0.1 \times V_{CC}$  at  $V_{CC} < 2.7$  V $V_{OL}$  and  $V_{OH}$  are the typical output voltage drop that occur with the output load.Figure 1. Enable input ( $\bar{E}$ ) to output ( $nY$ ) propagation delays.Figure 2. Data inputs ( $nl_0, nl_1$ ) and common data select input ( $S$ ) to output ( $nY$ ) propagation delays.

## TEST CIRCUIT

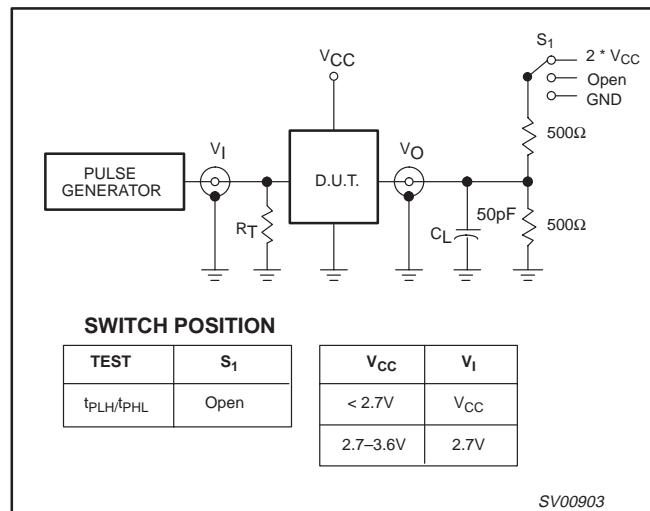


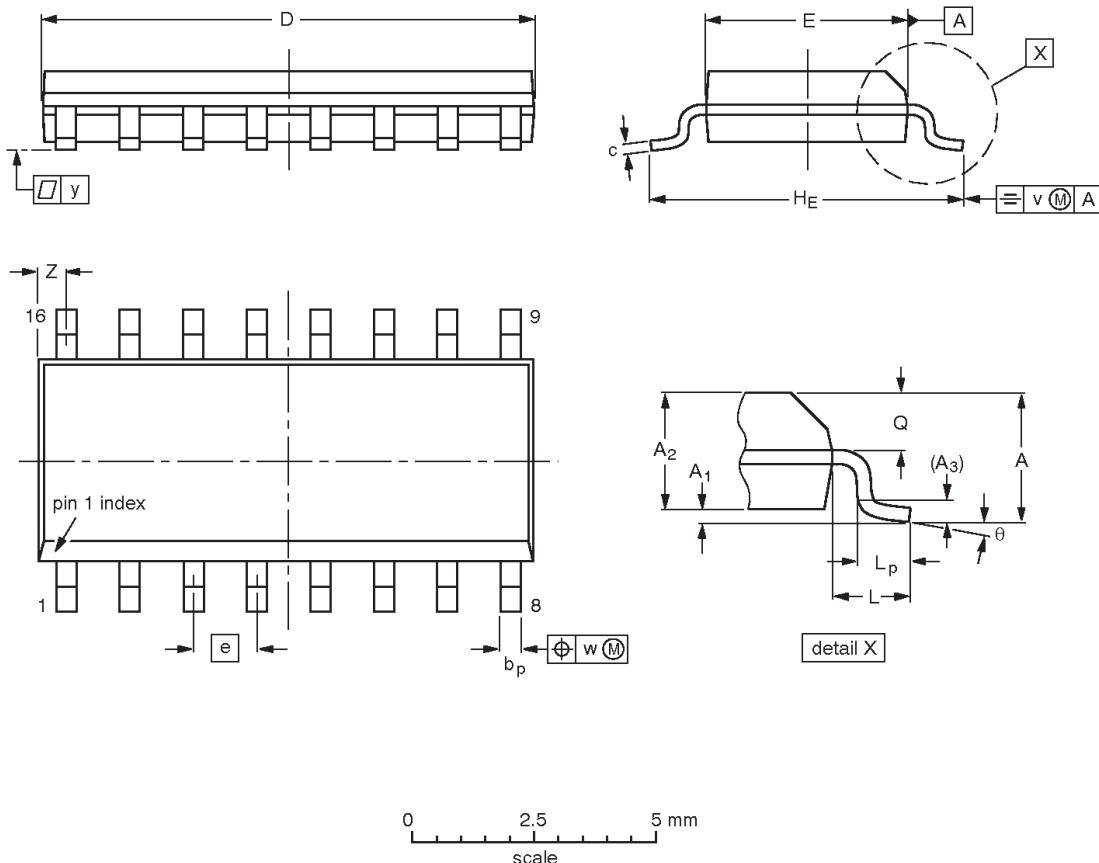
Figure 3. Load circuitry for switching times.

## Quad 2-input multiplexer

74LVC157A

**SO16: plastic small outline package; 16 leads; body width 3.9 mm**

SOT109-1



**DIMENSIONS** (inch dimensions are derived from the original mm dimensions)

| Dimensions (Inch dimensions are derived from the original mm dimensions) |                   |                |                |                |                |                  |                  |                  |       |                |       |                |                |      |      |       |                  |          |
|--|-------------------|----------------|----------------|----------------|----------------|------------------|------------------|------------------|-------|----------------|-------|----------------|----------------|------|------|-------|------------------|----------|
| Unit   | A <sub>max.</sub> | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c                | D <sup>(1)</sup> | E <sup>(1)</sup> | e     | H <sub>E</sub> | L     | L <sub>p</sub> | Q              | v    | w    | y     | Z <sup>(1)</sup> | θ        |
| mm   | 1.75              | 0.25<br>0.10   | 1.45<br>1.25   | 0.25           | 0.49<br>0.36   | 0.25<br>0.19     | 10.0<br>9.8      | 4.0<br>3.8       | 1.27  | 6.2<br>5.8     | 1.05  | 1.0<br>0.4     | 0.7<br>0.6     | 0.25 | 0.25 | 0.1   | 0.7<br>0.3       | 8°<br>0° |
| inches   | 0.069             | 0.010<br>0.004 | 0.057<br>0.049 | 0.01           | 0.019<br>0.014 | 0.0100<br>0.0075 | 0.39<br>0.38     | 0.16<br>0.15     | 0.050 | 0.244<br>0.228 | 0.041 | 0.039<br>0.016 | 0.028<br>0.020 | 0.01 | 0.01 | 0.004 | 0.028<br>0.012   |          |

### Note

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.

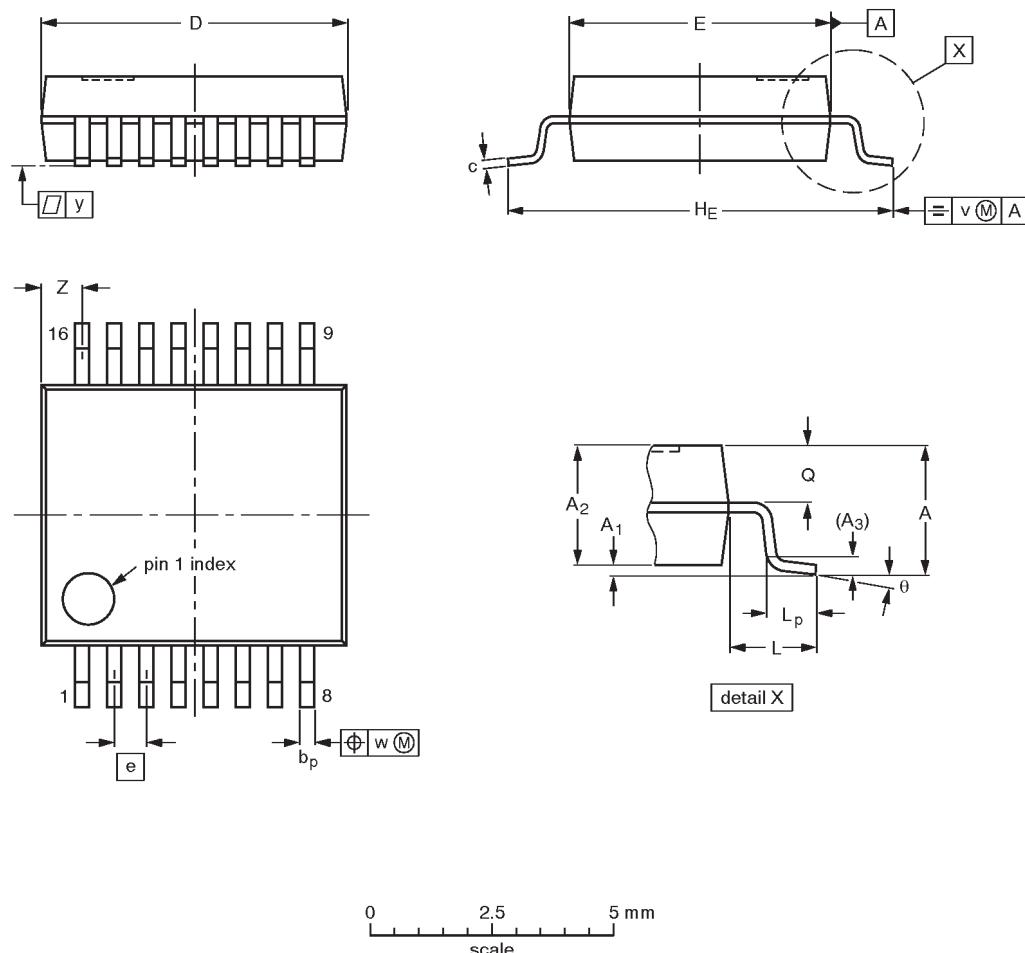
| OUTLINE VERSION | REFERENCES |          |      |  | EUROPEAN PROJECTION   | ISSUE DATE           |
|-----------------|------------|----------|------|--|---|----------------------|
|                 | IEC        | JEDEC    | EIAJ |  |   |                      |
| SOT109-1        | 076E07S    | MS-012AC |      |  |  | 95-01-29<br>97-05-22 |

## Quad 2-input multiplexer

74LVC157A

SSOP16: plastic shrink small outline package; 16 leads; body width 5.3 mm

SOT338-1



## DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max.   | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c            | D <sup>(1)</sup> | E <sup>(1)</sup> | e    | H <sub>E</sub> | L    | L <sub>p</sub> | Q          | v   | w    | y   | z <sup>(1)</sup> | θ        |
|------|-------------|----------------|----------------|----------------|----------------|--------------|------------------|------------------|------|----------------|------|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 2.0<br>0.05 | 0.21<br>1.65   | 1.80           | 0.25           | 0.38<br>0.25   | 0.20<br>0.09 | 6.4<br>6.0       | 5.4<br>5.2       | 0.65 | 7.9<br>7.6     | 1.25 | 1.03<br>0.63   | 0.9<br>0.7 | 0.2 | 0.13 | 0.1 | 1.00<br>0.55     | 8°<br>0° |

## Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

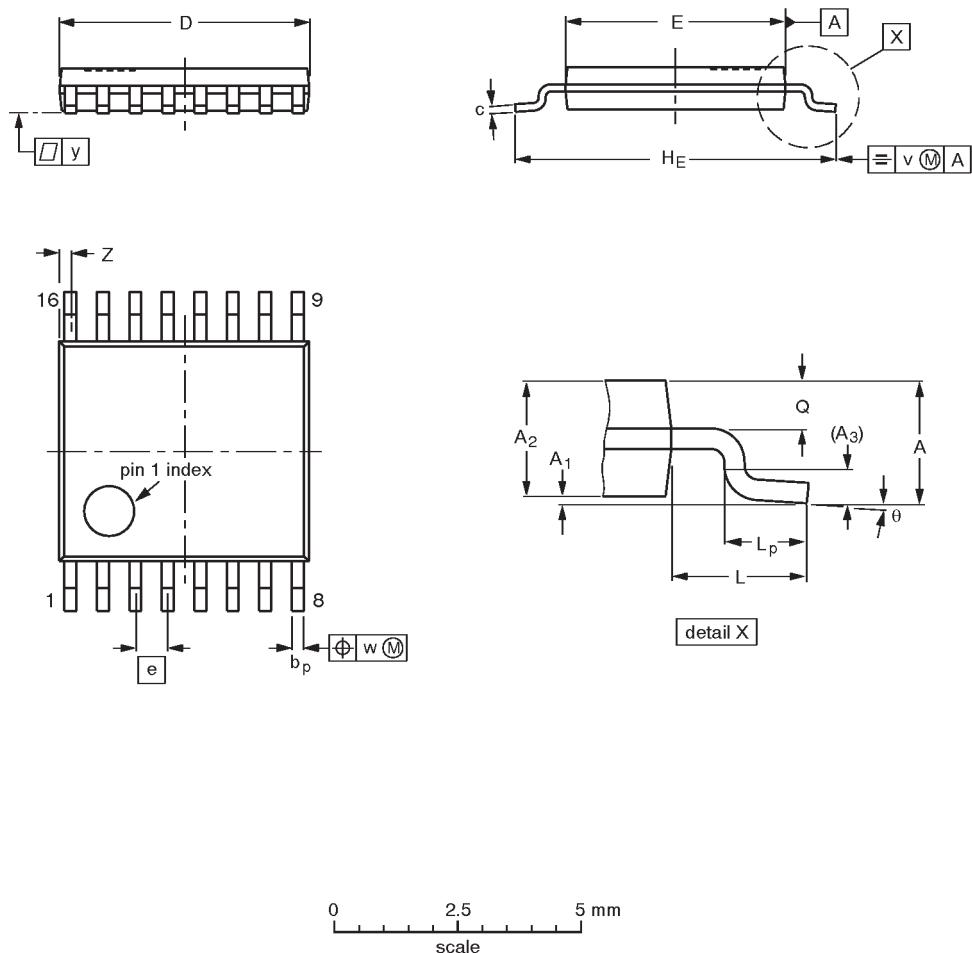
| OUTLINE<br>VERSION | REFERENCES |          |      |  | EUROPEAN<br>PROJECTION | ISSUE DATE           |
|--------------------|------------|----------|------|--|------------------------|----------------------|
|                    | IEC        | JEDEC    | EIAJ |  |                        |                      |
| SOT338-1           |            | MO-150AC |      |  |                        | 94-01-14<br>95-02-04 |

## Quad 2-input multiplexer

74LVC157A

TSSOP16: plastic thin shrink small outline package; 16 leads; body width 4.4 mm

SOT403-1



## DIMENSIONS (mm are the original dimensions)

| UNIT | A<br>max.    | A <sub>1</sub> | A <sub>2</sub> | A <sub>3</sub> | b <sub>p</sub> | c          | D <sup>(1)</sup> | E <sup>(2)</sup> | e    | H <sub>E</sub> | L   | L <sub>p</sub> | Q          | v   | w    | y   | Z <sup>(1)</sup> | θ        |
|------|--------------|----------------|----------------|----------------|----------------|------------|------------------|------------------|------|----------------|-----|----------------|------------|-----|------|-----|------------------|----------|
| mm   | 1.10<br>0.05 | 0.15<br>0.80   | 0.95           | 0.25           | 0.30<br>0.19   | 0.2<br>0.1 | 5.1<br>4.9       | 4.5<br>4.3       | 0.65 | 6.6<br>6.2     | 1.0 | 0.75<br>0.50   | 0.4<br>0.3 | 0.2 | 0.13 | 0.1 | 0.40<br>0.06     | 8°<br>0° |

## Notes

1. Plastic or metal protrusions of 0.15 mm maximum per side are not included.
2. Plastic interlead protrusions of 0.25 mm maximum per side are not included.

| OUTLINE<br>VERSION | REFERENCES |        |      | EUROPEAN<br>PROJECTION | ISSUE DATE            |
|--------------------|------------|--------|------|------------------------|-----------------------|
|                    | IEC        | JEDEC  | EIAJ |                        |                       |
| SOT403-1           |            | MO-153 |      |                        | -94-07-12<br>95-04-04 |

## Quad 2-input multiplexer

74LVC157A

**Data sheet status**

| Data sheet status         | Product status | Definition [1]   |
|---------------------------|----------------|--|
| Objective specification   | Development    | This data sheet contains the design target or goal specifications for product development. Specification may change in any manner without notice.  |
| Preliminary specification | Qualification  | This data sheet contains preliminary data, and supplementary data will be published at a later date. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product. |
| Product specification     | Production     | This data sheet contains final specifications. Philips Semiconductors reserves the right to make changes at any time without notice in order to improve design and supply the best possible product.   |

[1] Please consult the most recently issued datasheet before initiating or completing a design.

**Definitions**

**Short-form specification** — The data in a short-form specification is extracted from a full data sheet with the same type number and title. For detailed information see the relevant data sheet or data handbook.

**Limiting values definition** — Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.

**Application information** — Applications that are described herein for any of these products are for illustrative purposes only. Philips Semiconductors make no representation or warranty that such applications will be suitable for the specified use without further testing or modification.

**Disclaimers**

**Life support** — These products are not designed for use in life support appliances, devices or systems where malfunction of these products can reasonably be expected to result in personal injury. Philips Semiconductors customers using or selling these products for use in such applications do so at their own risk and agree to fully indemnify Philips Semiconductors for any damages resulting from such application.

**Right to make changes** — Philips Semiconductors reserves the right to make changes, without notice, in the products, including circuits, standard cells, and/or software, described or contained herein in order to improve design and/or performance. Philips Semiconductors assumes no responsibility or liability for the use of any of these products, conveys no license or title under any patent, copyright, or mask work right to these products, and makes no representations or warranties that these products are free from patent, copyright, or mask work right infringement, unless otherwise specified.

Philips Semiconductors  
811 East Arques Avenue  
P.O. Box 3409  
Sunnyvale, California 94088-3409  
Telephone 800-234-7381

© Copyright Philips Electronics North America Corporation 1998  
All rights reserved. Printed in U.S.A.

print code

Document order number:

Date of release: 08-98

9297-750-04495

*Let's make things better.*

Philips  
Semiconductors



**PHILIPS**