

# SN74LS153

## Dual 4-Input Multiplexer

The LSTTL/MSI SN74LS153 is a very high speed Dual 4-Input Multiplexer with common select inputs and individual enable inputs for each section. It can select two bits of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the LS153 can generate any two functions of three variables. The LS153 is fabricated with the Schottky barrier diode process for high speed and is completely compatible with all ON Semiconductor TTL families.

- Multifunction Capability
- Non-Inverting Outputs
- Separate Enable for Each Multiplexer
- Input Clamp Diodes Limit High Speed Termination Effects

### GUARANTEED OPERATING RANGES

| Symbol          | Parameter                           | Min  | Typ | Max  | Unit |
|-----------------|-------------------------------------|------|-----|------|------|
| V <sub>CC</sub> | Supply Voltage                      | 4.75 | 5.0 | 5.25 | V    |
| T <sub>A</sub>  | Operating Ambient Temperature Range | 0    | 25  | 70   | °C   |
| I <sub>OH</sub> | Output Current – High               |      |     | –0.4 | mA   |
| I <sub>OL</sub> | Output Current – Low                |      |     | 8.0  | mA   |

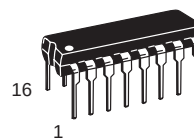


**ON Semiconductor**

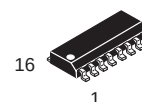
*Formerly a Division of Motorola*

<http://onsemi.com>

**LOW  
POWER  
SCHOTTKY**



**PLASTIC  
N SUFFIX  
CASE 648**



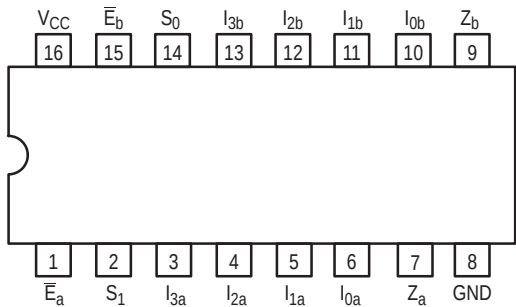
**SOIC  
D SUFFIX  
CASE 751B**

### ORDERING INFORMATION

| Device     | Package    | Shipping         |
|------------|------------|------------------|
| SN74LS153N | 16 Pin DIP | 2000 Units/Box   |
| SN74LS153D | 16 Pin     | 2500/Tape & Reel |

SN74LS153

CONNECTION DIAGRAM DIP (TOP VIEW)

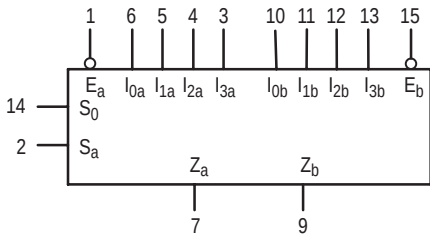


NOTE:  
The Flatpak version has the same pinouts (Connection Diagram) as the Dual In-Line Package.

| PIN NAMES  |                           | LOADING (Note a) |           |
|------------|---------------------------|------------------|-----------|
|            |                           | HIGH             | LOW       |
| $S_0$      | Common Select Input       | 0.5 U.L.         | 0.25 U.L. |
| $\bar{E}$  | Enable (Active LOW) Input | 0.5 U.L.         | 0.25 U.L. |
| $I_0, I_1$ | Multiplexer Inputs        | 0.5 U.L.         | 0.25 U.L. |
| $Z$        | Multiplexer Output        | 10 U.L.          | 5 U.L.    |

NOTES:  
a) 1 TTL Unit Load (U.L.) = 40  $\mu$ A HIGH/1.6 mA LOW.

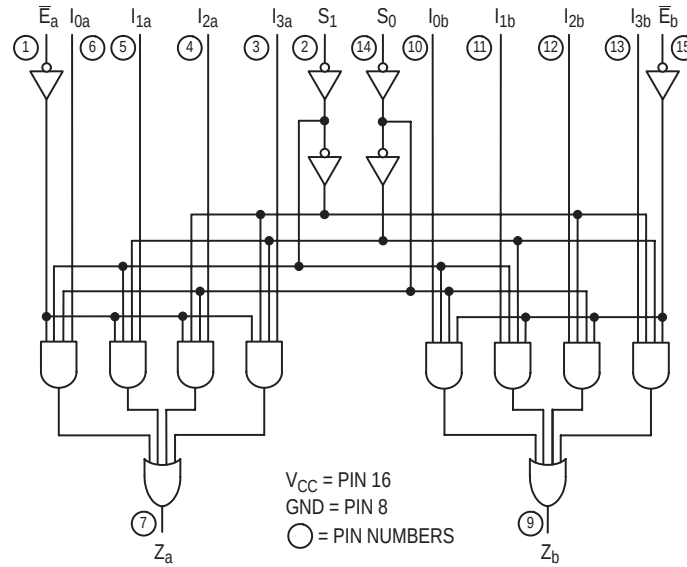
LOGIC SYMBOL



$V_{CC}$  = PIN 16  
GND = PIN 8

# SN74LS153

## LOGIC DIAGRAM



## FUNCTIONAL DESCRIPTION

The LS153 is a Dual 4-input Multiplexer fabricated with Low Power, Schottky barrier diode process for high speed. It can select two bits of data from up to four sources under the control of the common Select Inputs ( $S_0$ ,  $S_1$ ). The two 4-input multiplexer circuits have individual active LOW Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) which can be used to strobe the outputs independently. When the Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) are HIGH, the corresponding outputs ( $Z_a$ ,  $Z_b$ ) are forced LOW.

The LS153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the two Select Inputs. The logic equations for the outputs are shown below.

$$Z_a = \bar{E}_a \cdot (I_{0a} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1a} \cdot \bar{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot \bar{S}_0 + I_{3a} \cdot S_1 \cdot S_0)$$

$$Z_b = \bar{E}_b \cdot (I_{0b} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1b} \cdot \bar{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot \bar{S}_0 + I_{3b} \cdot S_1 \cdot S_0)$$

The LS153 can be used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the Select Inputs. A less obvious application is a function generator. The LS153 can generate two functions of three variables. This is useful for implementing highly irregular random logic.

## TRUTH TABLE

| SELECT INPUTS |       | INPUTS (a or b) |       |       |       |       |  | OUTPUT |
|---------------|-------|-----------------|-------|-------|-------|-------|--|--------|
| $S_0$         | $S_1$ | $\bar{E}$       | $I_0$ | $I_1$ | $I_2$ | $I_3$ |  | $Z$    |
| X             | X     | H               | X     | X     | X     | X     |  | L      |
| L             | L     | L               | L     | X     | X     | X     |  | L      |
| L             | L     | L               | H     | X     | X     | X     |  | H      |
| H             | L     | L               | X     | L     | X     | X     |  | L      |
| H             | L     | L               | X     | H     | X     | X     |  | H      |
| L             | H     | L               | X     | X     | L     | X     |  | L      |
| L             | H     | L               | X     | X     | H     | X     |  | H      |
| H             | H     | L               | X     | X     | X     | L     |  | L      |
| H             | H     | L               | X     | X     | X     | H     |  | H      |

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

# SN74LS153

## DC CHARACTERISTICS OVER OPERATING TEMPERATURE RANGE (unless otherwise specified)

| Symbol   | Parameter                      | Limits |       |      | Unit          | Test Conditions                                                                               |
|----------|--------------------------------|--------|-------|------|---------------|-----------------------------------------------------------------------------------------------|
|          |                                | Min    | Typ   | Max  |               |                                                                                               |
| $V_{IH}$ | Input HIGH Voltage             | 2.0    |       |      | V             | Guaranteed Input HIGH Voltage for All Inputs                                                  |
| $V_{IL}$ | Input LOW Voltage              |        |       | 0.8  | V             | Guaranteed Input LOW Voltage for All Inputs                                                   |
| $V_{IK}$ | Input Clamp Diode Voltage      |        | -0.65 | -1.5 | V             | $V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$                                             |
| $V_{OH}$ | Output HIGH Voltage            | 2.7    | 3.5   |      | V             | $V_{CC} = \text{MIN}$ , $I_{OH} = \text{MAX}$ , $V_{IN} = V_{IH}$ or $V_{IL}$ per Truth Table |
| $V_{OL}$ | Output LOW Voltage             |        | 0.25  | 0.4  | V             | $I_{OL} = 4.0 \text{ mA}$                                                                     |
|          |                                |        | 0.35  | 0.5  | V             | $I_{OL} = 8.0 \text{ mA}$                                                                     |
| $I_{IH}$ | Input HIGH Current             |        |       | 20   | $\mu\text{A}$ | $V_{CC} = \text{MAX}$ , $V_{IN} = 2.7 \text{ V}$                                              |
|          |                                |        |       | 0.1  | mA            | $V_{CC} = \text{MAX}$ , $V_{IN} = 7.0 \text{ V}$                                              |
| $I_{IL}$ | Input LOW Current              |        |       | -0.4 | mA            | $V_{CC} = \text{MAX}$ , $V_{IN} = 0.4 \text{ V}$                                              |
| $I_{OS}$ | Short Circuit Current (Note 1) | -20    |       | -100 | mA            | $V_{CC} = \text{MAX}$                                                                         |
| $I_{CC}$ | Power Supply Current           |        |       | 10   | mA            | $V_{CC} = \text{MAX}$                                                                         |

Note 1: Not more than one output should be shorted at a time, nor for more than 1 second.

## AC CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ )

| Symbol                 | Parameter                             | Limits |          |          | Unit | Test Conditions |
|------------------------|---------------------------------------|--------|----------|----------|------|-----------------|
|                        |                                       | Min    | Typ      | Max      |      |                 |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Data to Output   |        | 10<br>17 | 15<br>26 | ns   | Figure 2        |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Select to Output |        | 19<br>25 | 29<br>38 | ns   | Figure 1        |
| $t_{PLH}$<br>$t_{PHL}$ | Propagation Delay<br>Enable to Output |        | 16<br>21 | 24<br>32 | ns   | Figure 2        |

$V_{CC} = 5.0 \text{ V}$   
 $C_L = 15 \text{ pF}$

## AC WAVEFORMS

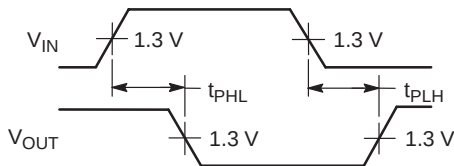


Figure 1.

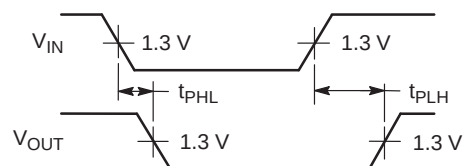
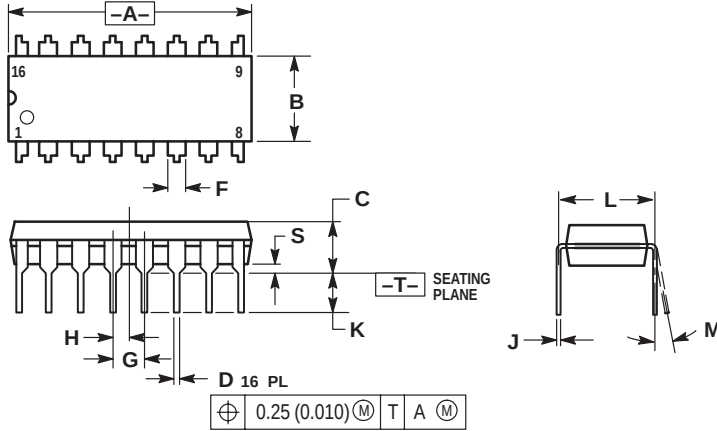


Figure 2.

# SN74LS153

## PACKAGE DIMENSIONS

**N SUFFIX**  
**PLASTIC PACKAGE**  
**CASE 648-08**  
**ISSUE R**



### NOTES:

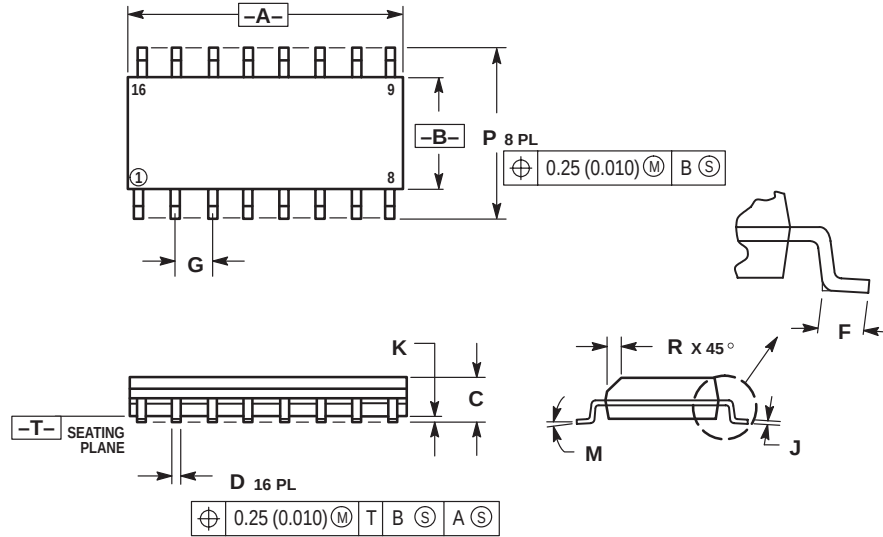
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.740     | 0.770 | 18.80       | 19.55 |
| B   | 0.250     | 0.270 | 6.35        | 6.85  |
| C   | 0.145     | 0.175 | 3.69        | 4.44  |
| D   | 0.015     | 0.021 | 0.39        | 0.53  |
| F   | 0.040     | 0.70  | 1.02        | 1.77  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.050 BSC |       | 1.27 BSC    |       |
| J   | 0.008     | 0.015 | 0.21        | 0.38  |
| K   | 0.110     | 0.130 | 2.80        | 3.30  |
| L   | 0.295     | 0.305 | 7.50        | 7.74  |
| M   | 0°        | 10°   | 0°          | 10°   |
| S   | 0.020     | 0.040 | 0.51        | 1.01  |

# SN74LS153

## PACKAGE DIMENSIONS

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751B-05 ISSUE J



- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: MILLIMETER.
  3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
  4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
  5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |       | INCHES    |       |
|-----|-------------|-------|-----------|-------|
|     | MIN         | MAX   | MIN       | MAX   |
| A   | 9.80        | 10.00 | 0.386     | 0.393 |
| B   | 3.80        | 4.00  | 0.150     | 0.157 |
| C   | 1.35        | 1.75  | 0.054     | 0.068 |
| D   | 0.35        | 0.49  | 0.014     | 0.019 |
| F   | 0.40        | 1.25  | 0.016     | 0.049 |
| G   | 1.27 BSC    |       | 0.050 BSC |       |
| J   | 0.19        | 0.25  | 0.008     | 0.009 |
| K   | 0.10        | 0.25  | 0.004     | 0.009 |
| M   | 0°          | 7°    | 0°        | 7°    |
| P   | 5.80        | 6.20  | 0.229     | 0.244 |
| R   | 0.25        | 0.50  | 0.010     | 0.019 |

## Notes

**ON Semiconductor** and  are trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer.

## PUBLICATION ORDERING INFORMATION

### North America Literature Fulfillment:

Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** [ONlit@hibbertco.com](mailto:ONlit@hibbertco.com)

**N. American Technical Support:** 800-282-9855 Toll Free USA/Canada

### EUROPE: LDC for ON Semiconductor – European Support

**German Phone:** (+1) 303-308-7140 (M–F 2:30pm to 5:00pm Munich Time)  
**Email:** [ONlit-german@hibbertco.com](mailto:ONlit-german@hibbertco.com)  
**French Phone:** (+1) 303-308-7141 (M–F 2:30pm to 5:00pm Toulouse Time)  
**Email:** [ONlit-french@hibbertco.com](mailto:ONlit-french@hibbertco.com)  
**English Phone:** (+1) 303-308-7142 (M–F 1:30pm to 5:00pm UK Time)  
**Email:** [ONlit@hibbertco.com](mailto:ONlit@hibbertco.com)

### ASIA/PACIFIC: LDC for ON Semiconductor – Asia Support

**Phone:** 303-675-2121 (Tue–Fri 9:00am to 1:00pm, Hong Kong Time)  
Toll Free from Hong Kong 800-4422-3781  
**Email:** [ONlit-asia@hibbertco.com](mailto:ONlit-asia@hibbertco.com)

**JAPAN:** ON Semiconductor, Japan Customer Focus Center  
4-32-1 Nishi-Gotanda, Shinagawa-ku, Tokyo, Japan 141-8549

**Phone:** 81-3-5487-8345  
**Email:** [r14153@onsemi.com](mailto:r14153@onsemi.com)

**Fax Response Line:** 303-675-2167  
800-344-3810 Toll Free USA/Canada

**ON Semiconductor Website:** <http://onsemi.com>

For additional information, please contact your local  
Sales Representative.