

# 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

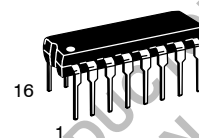
| Symbol          | Parameter                           | Min  | Typ | Max  | Unit |
|-----------------|-------------------------------------|------|-----|------|------|
| V <sub>CC</sub> | Supply Voltage                      | 4.75 | 5.0 | 5.25 | V    |
| T <sub>A</sub>  | Operating Ambient Temperature 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   |



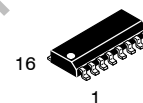
ON Semiconductor™

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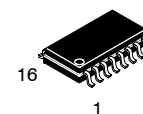
### LOW POWER SCHOTTKY



PLASTIC  
N SUFFIX  
CASE 648



SOIC  
D SUFFIX  
CASE 751B



SOEIAJ  
M SUFFIX  
CASE 966

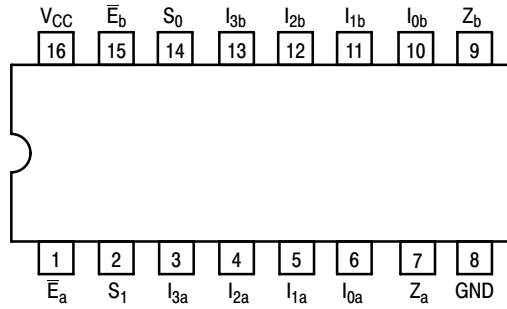
### ORDERING INFORMATION

| Device       | Package    | Shipping         |
|--------------|------------|------------------|
| SN74LS153N   | 16 Pin DIP | 2000 Units/Box   |
| SN74LS153D   | SOIC–16    | 38 Units/Rail    |
| SN74LS153DR2 | SOIC–16    | 2500/Tape & Reel |
| SN74LS153M   | SOEIAJ–16  | See Note 1       |
| SN74LS153MEL | SOEIAJ–16  | See Note 1       |

1. For ordering information on the EIAJ version of the SOIC package, please contact your local ON Semiconductor representative.

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## CONNECTION DIAGRAM DIP (TOP VIEW)



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

### PIN NAMES

|            |                           |
|------------|---------------------------|
| $S_0$      | Common Select Input       |
| $\bar{E}$  | Enable (Active LOW) Input |
| $I_0, I_1$ | Multiplexer Inputs        |
| $Z$        | Multiplexer Output        |

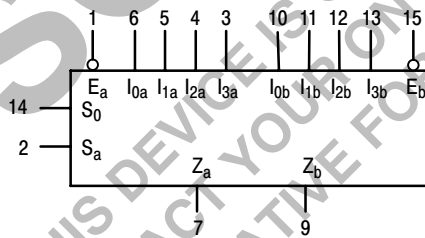
### LOADING (Note a)

|            | HIGH     | LOW       |
|------------|----------|-----------|
| $S_0$      | 0.5 U.L. | 0.25 U.L. |
| $\bar{E}$  | 0.5 U.L. | 0.25 U.L. |
| $I_0, I_1$ | 0.5 U.L. | 0.25 U.L. |
| $Z$        | 10 U.L.  | 5 U.L.    |

### NOTES:

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

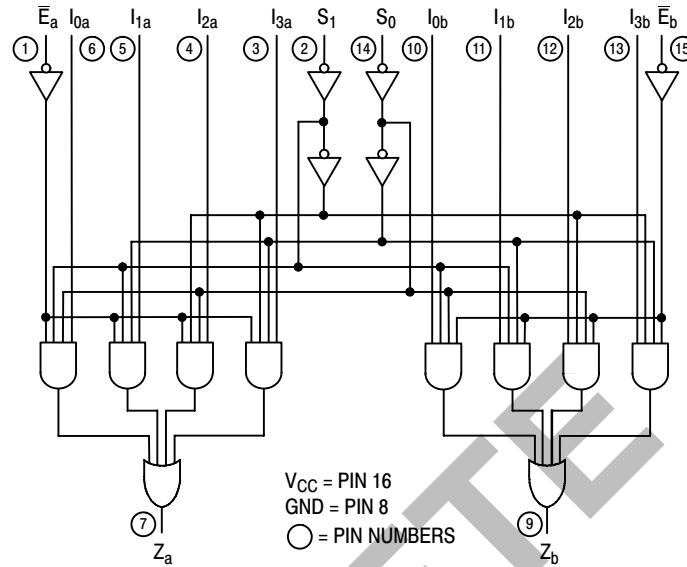
### LOGIC SYMBOL



$V_{CC}$  = 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 2) | -20    |       | -100 | mA            | $V_{CC} = \text{MAX}$   |
| $I_{CC}$ | Power Supply Current           |        |       | 10   | mA            | $V_{CC} = \text{MAX}$   |

2. 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        |

## AC WAVEFORMS

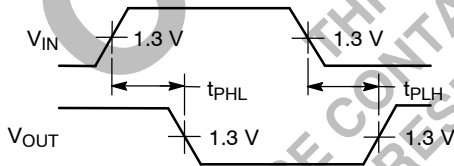


Figure 1.

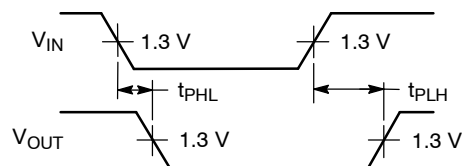
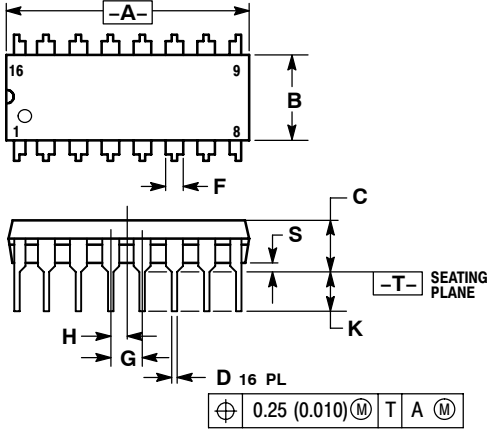


Figure 2.

# SN74LS153

## PACKAGE DIMENSIONS

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



### NOTES:

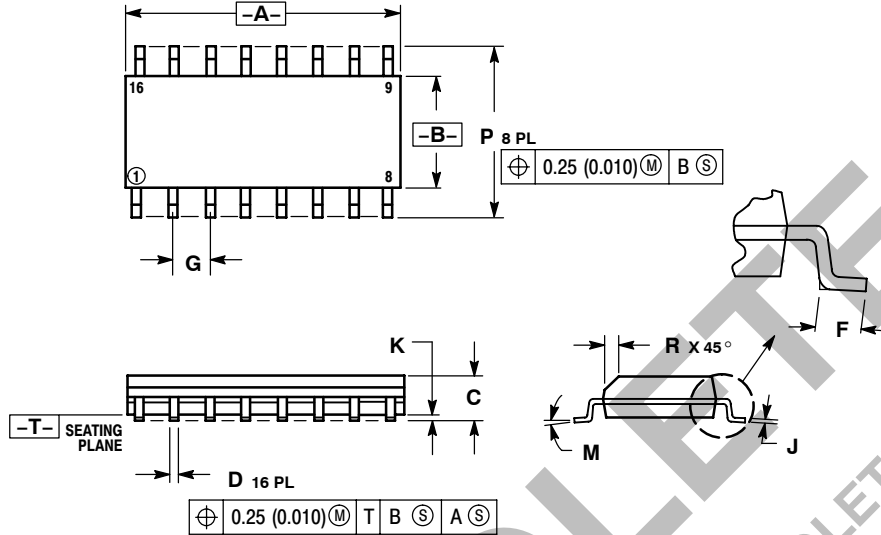
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

| 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:

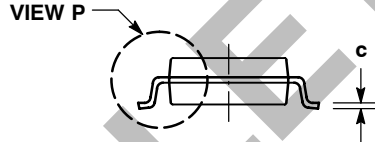
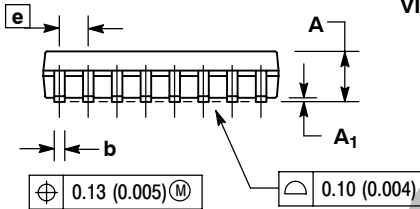
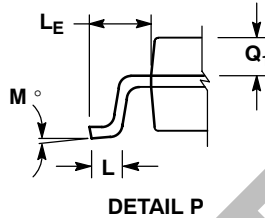
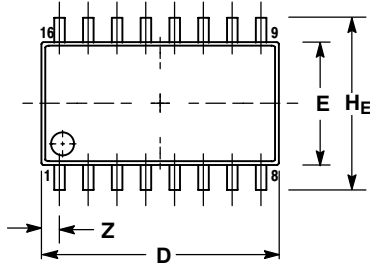
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.127 (0.005) TOTAL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

# SN74LS153

## PACKAGE DIMENSIONS


### M SUFFIX SOEIAJ PACKAGE CASE 966-01 ISSUE O



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS D AND E DO NOT INCLUDE MOLD FLASH OR PROTRUSIONS AND ARE MEASURED AT THE PARTING LINE. MOLD FLASH OR PROTRUSIONS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
5. THE LEAD WIDTH DIMENSION (b) DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.08 (0.003) TOTAL IN EXCESS OF THE LEAD WIDTH DIMENSION AT MAXIMUM MATERIAL CONDITION. DAMBAR CANNOT BE LOCATED ON THE LOWER RADIUS OR THE FOOT. MINIMUM SPACE BETWEEN PROTRUSIONS AND ADJACENT LEAD TO BE 0.46 (0.018).

| DIM            | MILLIMETERS |       | INCHES    |       |
|----------------|-------------|-------|-----------|-------|
|                | MIN         | MAX   | MIN       | MAX   |
| A              | ---         | 2.05  | ---       | 0.081 |
| A <sub>1</sub> | 0.05        | 0.20  | 0.002     | 0.008 |
| b              | 0.35        | 0.50  | 0.014     | 0.020 |
| c              | 0.18        | 0.27  | 0.007     | 0.011 |
| D              | 9.90        | 10.50 | 0.390     | 0.413 |
| E              | 5.10        | 5.45  | 0.201     | 0.215 |
| e              | 1.27 BSC    |       | 0.050 BSC |       |
| HE             | 7.40        | 8.20  | 0.291     | 0.323 |
| L              | 0.50        | 0.85  | 0.020     | 0.033 |
| LE             | 1.10        | 1.50  | 0.043     | 0.059 |
| M              | 0°          | 10°   | 0°        | 10°   |
| Q <sub>1</sub> | 0.70        | 0.90  | 0.028     | 0.035 |
| Z              | ---         | 0.78  | ---       | 0.031 |

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