

SN74LS251

8-Input Multiplexer with 3-State Outputs

The TTL/MSI SN74LS251 is a high speed 8-Input Digital Multiplexer. It provides, in one package, the ability to select one bit of data from up to eight sources. The LS251 can be used as a universal function generator to generate any logic function of four variables. Both assertion and negation outputs are provided.

- Schottky Process for High Speed
- Multifunction Capability
- On-Chip Select Logic Decoding
- Inverting and Non-Inverting 3-State Outputs
- Input Clamp Diodes Limit High Speed Termination Effects

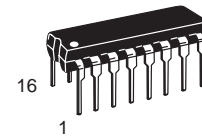
GUARANTEED OPERATING RANGES

| Symbol | Parameter | Min | Typ | Max | Unit |
|-----------------|-------------------------------------|------|-----|------|------|
| V _{CC} | Supply Voltage | 4.75 | 5.0 | 5.25 | V |
| T _A | Operating Ambient Temperature Range | 0 | 25 | 70 | °C |
| I _{OH} | Output Current – High | | | –2.6 | mA |
| I _{OL} | Output Current – Low | | | 24 | mA |

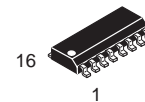


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**LOW
POWER
SCHOTTKY**



**PLASTIC
N SUFFIX
CASE 648**



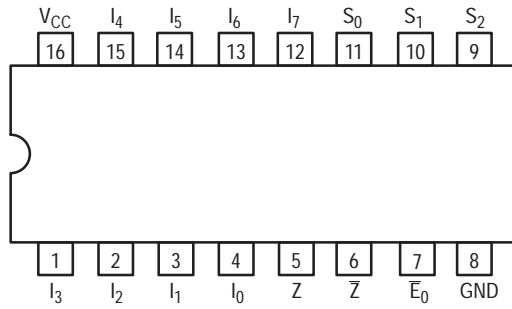
**SOIC
D SUFFIX
CASE 751B**

ORDERING INFORMATION

| Device | Package | Shipping |
|------------|------------|------------------|
| SN74LS251N | 16 Pin DIP | 2000 Units/Box |
| SN74LS251D | 16 Pin | 2500/Tape & Reel |

SN74LS251

CONNECTION DIAGRAM DIP (TOP VIEW)



PIN NAMES

| | |
|-------------|-----------------------------------|
| $S_0 - S_2$ | Select Inputs |
| \bar{E}_0 | Output Enable (Active LOW) Inputs |
| $I_0 - I_7$ | Multiplexer Inputs |
| Z | Multiplexer Output |
| \bar{Z} | Complementary Multiplexer Output |

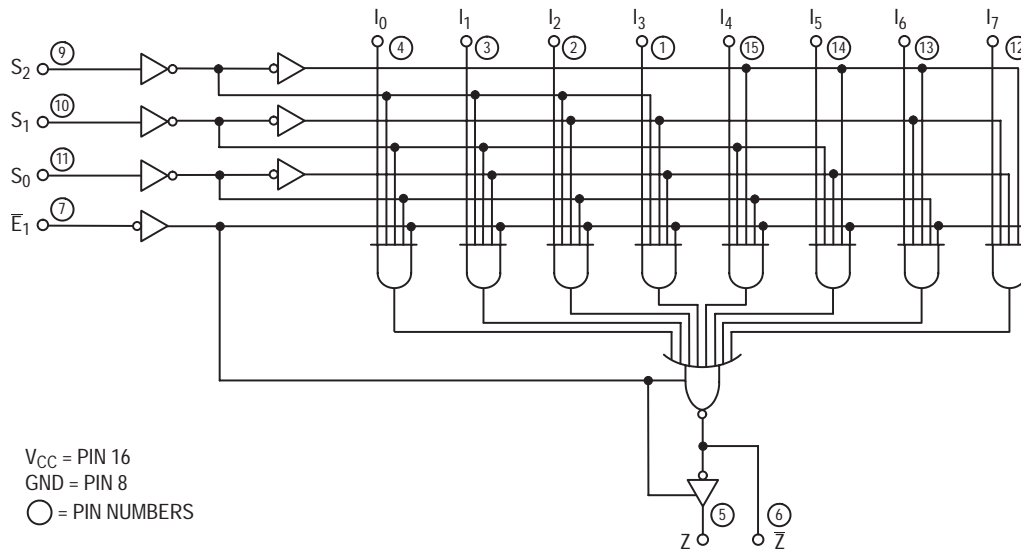
LOADING (Note a)

| | HIGH | LOW |
|-------------|----------|-----------|
| $S_0 - S_2$ | 0.5 U.L. | 0.25 U.L. |
| \bar{E}_0 | 0.5 U.L. | 0.25 U.L. |
| $I_0 - I_7$ | 0.5 U.L. | 0.25 U.L. |
| Z | 65 U.L. | 15 U.L. |
| \bar{Z} | 65 U.L. | 15 U.L. |

NOTES:

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

LOGIC DIAGRAM



SN74LS251

FUNCTIONAL DESCRIPTION

The LS251 is a logical implementation of a single pole, 8-position switch with the switch position controlled by the state of three Select inputs, S_0 , S_1 , S_2 . Both assertion and negation outputs are provided. The Output Enable input (\bar{E}_O) is active LOW. When it is activated, the logic function provided at the output is:

$$Z = \bar{E}_O \cdot (I_0 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_1 \cdot S_0 \cdot \bar{S}_1 \cdot \bar{S}_2 + I_2 \cdot \bar{S}_0 \cdot S_1 \cdot \bar{S}_2 + I_3 \cdot S_0 \cdot S_1 \cdot \bar{S}_2 + I_4 \cdot \bar{S}_0 \cdot \bar{S}_1 \cdot S_2 + I_5 \cdot S_0 \cdot \bar{S}_1 \cdot S_2 + I_6 \cdot \bar{S}_0 \cdot S_1 \cdot S_2 + I_7 \cdot S_0 \cdot S_1 \cdot S_2).$$

When the Output Enable is HIGH, both outputs are in the high impedance (high Z) state. This feature allows multiplexer expansion by tying the outputs of up to 128 devices together. When the outputs of the 3-state devices are tied together, all but one device must be in the high impedance state to avoid high currents that would exceed the maximum ratings. The Output Enable signals should be designed to ensure there is no overlap in the active LOW portion of the enable voltage.

TRUTH TABLE

| \bar{E}_O | S_2 | S_1 | S_0 | I_0 | I_1 | I_2 | I_3 | I_4 | I_5 | I_6 | I_7 | \bar{Z} | Z |
|-------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------|-----|
| H | X | X | X | X | X | X | X | X | X | X | X | (Z) | (Z) |
| L | L | L | L | L | X | X | X | X | X | X | X | H | L |
| L | L | L | L | H | X | X | X | X | X | X | X | L | H |
| L | L | L | H | X | L | X | X | X | X | X | X | H | L |
| L | L | L | H | X | H | X | X | X | X | X | X | L | H |
| L | L | H | L | X | X | L | X | X | X | X | X | H | L |
| L | L | H | L | X | X | H | X | X | X | X | X | L | H |
| L | L | H | H | X | X | X | L | X | X | X | X | H | L |
| L | L | H | H | X | X | X | H | X | X | X | X | L | H |
| L | H | L | L | X | X | X | X | L | X | X | X | H | L |
| L | H | L | L | X | X | X | X | H | X | X | X | L | H |
| L | H | L | H | X | X | X | X | X | L | X | X | H | L |
| L | H | L | H | X | X | X | X | X | H | X | X | L | H |
| L | H | H | L | X | X | X | X | X | X | L | X | H | L |
| L | H | H | L | X | X | X | X | X | X | H | X | L | H |
| L | H | H | H | X | X | X | X | X | X | X | L | H | L |
| L | H | H | H | X | X | X | X | X | X | X | H | L | H |

H = HIGH Voltage Level
L = LOW Voltage Level
X = Don't Care
(Z) = High impedance (Off)

SN74LS251

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} = MIN, I _{IN} = -18 mA |
| V _{OH} | Output HIGH Voltage | 2.4 | 3.1 | | V | V _{CC} = MIN, I _{OH} = MAX, V _{IN} = V _{IH} or V _{IL} per Truth Table |
| V _{OL} | Output LOW Voltage | | 0.25 | 0.4 | V | V _{CC} = V _{CC} MIN, V _{IN} = V _{IL} or V _{IH} per Truth Table |
| | | | 0.35 | 0.5 | V | |
| I _{OZH} | Output Off Current HIGH | | | 20 | μA | V _{CC} = MAX, V _{OUT} = 2.7 V |
| I _{OZL} | Output Off Current LOW | | | -20 | μA | V _{CC} = MAX, V _{OUT} = 0.4 V |
| I _{IH} | Input HIGH Current | | | 20 | μA | V _{CC} = MAX, V _{IN} = 2.7 V |
| | | | | 0.1 | mA | V _{CC} = MAX, V _{IN} = 7.0 V |
| I _{IL} | Input LOW Current | | | -0.4 | mA | V _{CC} = MAX, V _{IN} = 0.4 V |
| I _{OS} | Short Circuit Current (Note 1) | -30 | | -130 | mA | V _{CC} = MAX |
| I _{CC} | Power Supply Current | | | 10 | mA | V _{CC} = MAX, V _E = 0 V |
| | | | | 12 | mA | V _{CC} = MAX, V _E = 4.5 V |

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

AC CHARACTERISTICS (T_A = 25°C, V_{CC} = 5.0 V)

| Symbol | Parameter | Limits | | | Unit | Test Conditions |
|--------------------------------------|--|--------|-----------|----------|------|-----------------|
| | | Min | Typ | Max | | |
| t _{PLH} t _{PHL} | Propagation Delay, Select to Z Output | | 20 21 | 33 33 | ns | Figure 1 |
| t _{PLH} t _{PHL} | Propagation Delay, Select to Z Output | | 29 28 | 45 45 | ns | Figure 2 |
| t _{PLH} t _{PHL} | Propagation Delay, Data to Z Output | | 10 9.0 | 15 15 | ns | Figure 1 |
| t _{PLH} t _{PHL} | Propagation Delay, Data to Z Output | | 17 18 | 28 28 | ns | Figures 2 |
| t _{PZH} t _{PZL} | Output Enable Time to Z Output | | 17 24 | 27 40 | ns | Figures 4, 5 |
| t _{PZH} t _{PZL} | Output Enable Time to Z Output | | 30 26 | 45 40 | ns | Figures 3, 5 |
| t _{PHZ} t _{PLZ} | Output Disable Time to Z Output | | 37 15 | 55 25 | ns | Figures 3, 5 |
| t _{PHZ} t _{PLZ} | Output Disable Time to Z Output | | 30 15 | 45 25 | ns | Figures 4, 5 |

C_L = 15 pF,
R_L = 2.0 kΩ

C_L = 5.0 pF,
R_L = 667 kΩ

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3-STATE AC WAVEFORMS

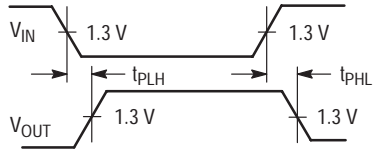


Figure 1.

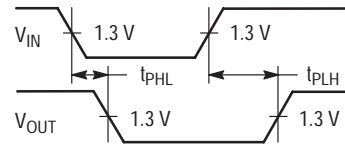


Figure 2.

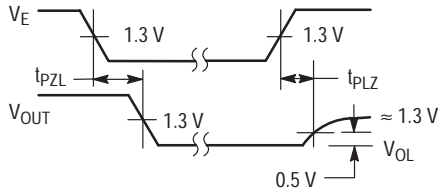


Figure 3.

0.5 V

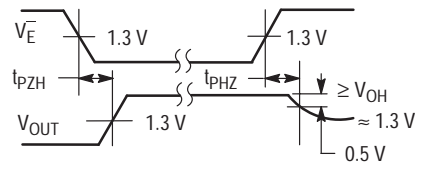
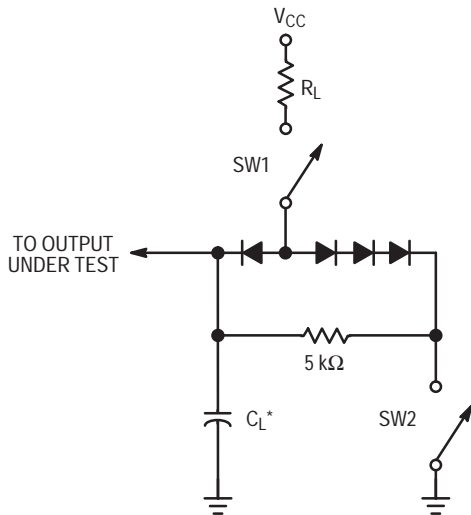


Figure 4.

AC LOAD CIRCUIT



* Includes Jig and Probe Capacitance.

Figure 5.

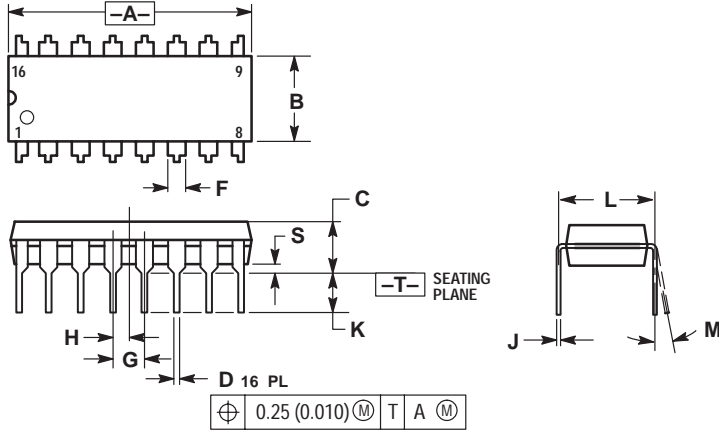
SWITCH POSITIONS

| SYMBOL | SW1 | SW2 |
|-----------|--------|--------|
| t_{PZH} | Open | Closed |
| t_{PZL} | Closed | Open |
| t_{PLZ} | Closed | Closed |
| t_{PHZ} | Closed | Closed |

SN74LS251

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 |

SN74LS251

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 |

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