

# 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

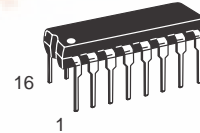
### GUARANTEED OPERATING RANGES

Symbol	Parameter	Min	Typ	Max	Unit
V <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			-2.6	mA
I <sub>OL</sub>	Output Current – Low			24	mA

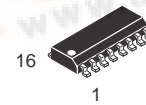


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**LOW  
POWER  
SCHOTTKY**



**PLASTIC  
N SUFFIX  
CASE 648**



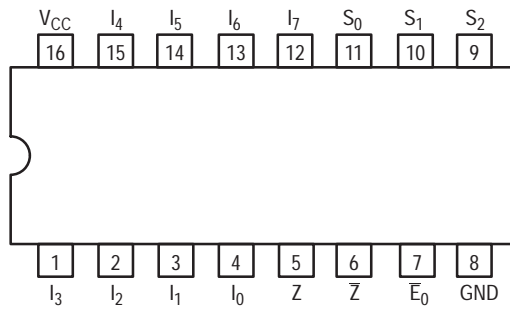
**SOIC  
D SUFFIX  
CASE 751B**

### 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

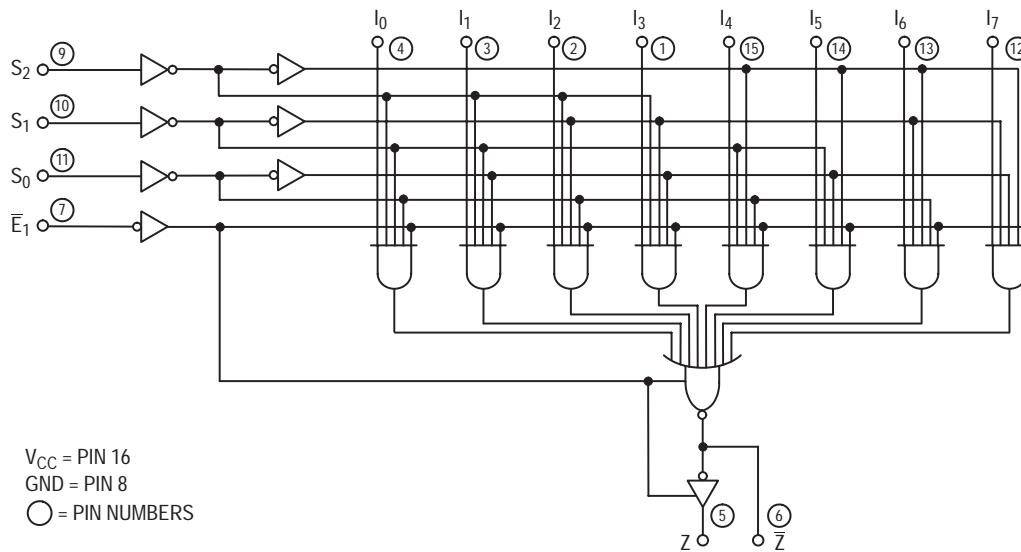
### LOADING (Note a)

	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  $\mu$ 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 ( $\overline{E}_0$ ) is active LOW. When it is activated, the logic function provided at the output is:

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

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

$\overline{E}_0$	$S_2$	$S_1$	$S_0$	$I_0$	$I_1$	$I_2$	$I_3$	$I_4$	$I_5$	$I_6$	$I_7$	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	$V_{CC} = \text{MIN}$ , $I_{IN} = -18 \text{ mA}$
$V_{OH}$	Output HIGH Voltage	2.4	3.1		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	$I_{OL} = 12 \text{ mA}$
			0.35	0.5	V	$I_{OL} = 24 \text{ mA}$
$I_{OZH}$	Output Off Current HIGH			20	$\mu\text{A}$	$V_{CC} = \text{MAX}$ , $V_{OUT} = 2.7 \text{ V}$
$I_{OZL}$	Output Off Current LOW			-20	$\mu\text{A}$	$V_{CC} = \text{MAX}$ , $V_{OUT} = 0.4 \text{ V}$
$I_{IH}$	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)	-30		-130	mA	$V_{CC} = \text{MAX}$
$I_{CC}$	Power Supply Current			10	mA	$V_{CC} = \text{MAX}$ , $V_E = 0 \text{ V}$
				12	mA	$V_{CC} = \text{MAX}$ , $V_E = 4.5 \text{ V}$

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

## AC CHARACTERISTICS ( $T_A = 25^\circ\text{C}$ , $V_{CC} = 5.0 \text{ V}$ )

Symbol	Parameter	Limits			Unit	Test Conditions
		Min	Typ	Max		
$t_{PLH}$ $t_{PHL}$	Propagation Delay, Select to $\bar{Z}$ 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 $\bar{Z}$ 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 $\bar{Z}$ 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 $\bar{Z}$ 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

$C_L = 15 \text{ pF}$ ,  
 $R_L = 2.0 \text{ k}\Omega$

$C_L = 5.0 \text{ pF}$ ,  
 $R_L = 667 \text{ k}\Omega$

# SN74LS251

## 3-STATE AC WAVEFORMS

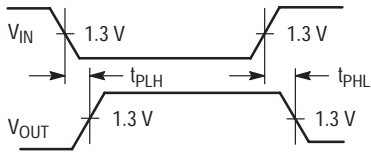


Figure 1.

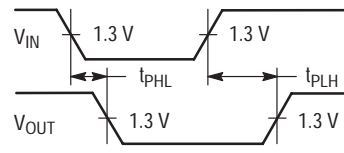


Figure 2.

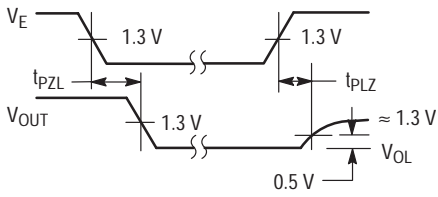


Figure 3.

0.5 V

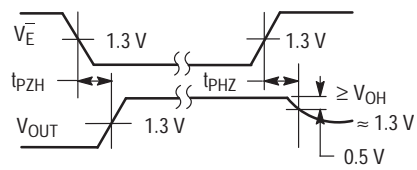
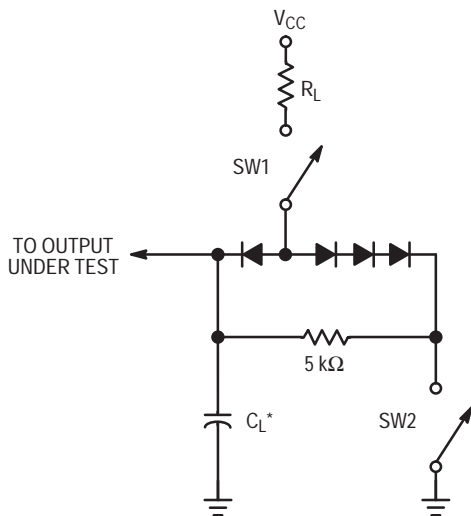


Figure 4.

## AC LOAD CIRCUIT



\* Includes Jig and Probe Capacitance.

### SWITCH POSITIONS

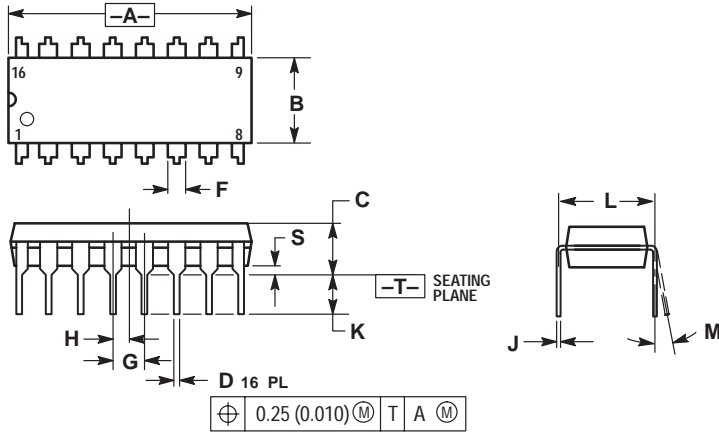
SYMBOL	SW1	SW2
$t_{PZH}$	Open	Closed
$t_{PZL}$	Closed	Open
$t_{PLZ}$	Closed	Closed
$t_{PHZ}$	Closed	Closed

Figure 5.

# SN74LS251

## PACKAGE DIMENSIONS

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



**NOTES:**

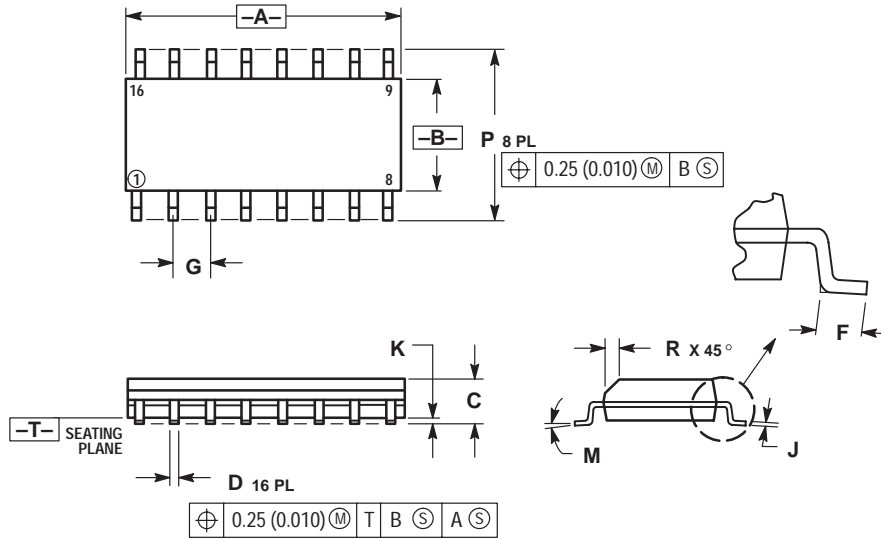
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

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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