MOTOROLA

SN54/74LS251

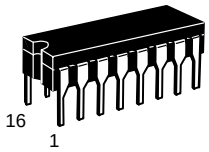
8-INPUT MULTIPLEXER WITH 3-STATE OUTPUTS

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.

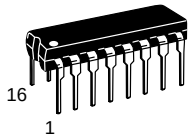
- Schottky Process for High Speed
- Multifunction Capability
- On-Chip Select Logic Decoding
- Inverting and Non-Inverting 3-State Outputs
- Input Clamp Diodes Limit High Speed Termination Effects

8-INPUT MULTIPLEXER WITH 3-STATE OUTPUTS

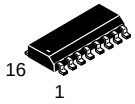
LOW POWER SCHOTTKY



J SUFFIX
CERAMIC
CASE 620-09

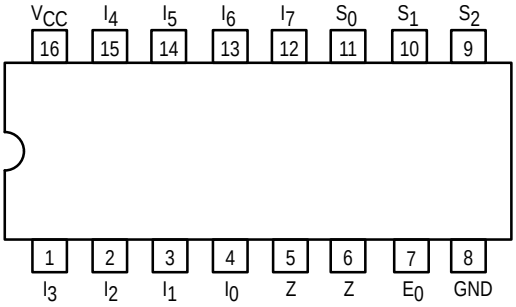


N SUFFIX
PLASTIC
CASE 648-08



D SUFFIX
SOIC
CASE 751B-03

CONNECTION DIAGRAM DIP (TOP VIEW)



PIN NAMES

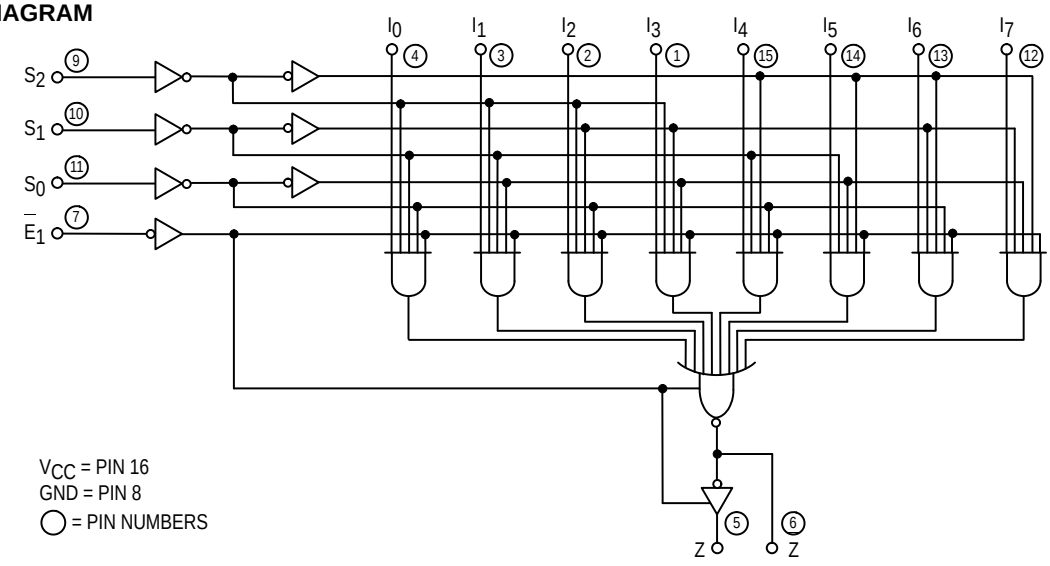
		LOADING (Note a)	
		HIGH	LOW
$\overline{S}_0$–S_2	Select Inputs	0.5 U.L.	0.25 U.L.
E_0	Output Enable (Active LOW) Inputs	0.5 U.L.	0.25 U.L.
I_0–I_7	Multiplexer Inputs	0.5 U.L.	0.25 U.L.
$\overline{Z}$	Multiplexer Output	65 U.L.	15 U.L.
Z	Complementary Multiplexer Output	65 U.L.	15 U.L.

NOTES:
a. 1 TTL Unit Load (U.L.) = 40 μA HIGH/1.6 mA LOW.

ORDERING INFORMATION

SN54LSXXXJ	Ceramic
SN74LSXXXN	Plastic
SN74LSXXXDW	SOIC

LOGIC DIAGRAM



VCC = PIN 16
GND = PIN 8
◯ = PIN NUMBERS

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

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

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	$\overline{Z}$	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)

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

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	I_{OL} = 12 mA	V_{CC} = V_{CC} MIN, V_{IN} = V_{IL} or V_{IH} per Truth Table
			0.35	0.5	V	I_{OL} = 24 mA	
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, $V_{\overline{E}}$ = 0 V	
				12	mA	V_{CC} = MAX, $V_{\overline{E}}$ = 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	C_L = 15 pF, R_L = 2.0 kΩ
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	C_L = 5.0 pF, R_L = 667 kΩ
t_{PHZ} t_{PLZ}	Output Disable Time to Z Output		30 15	45 25	ns	Figures 4, 5	

3-STATE AC WAVEFORMS

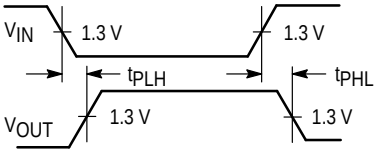


Figure 1

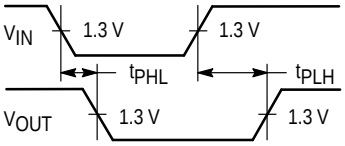


Figure 2

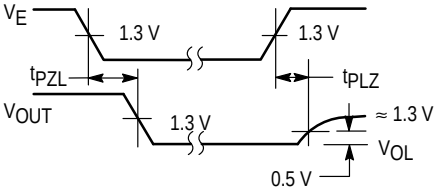


Figure 3

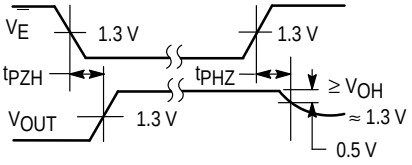
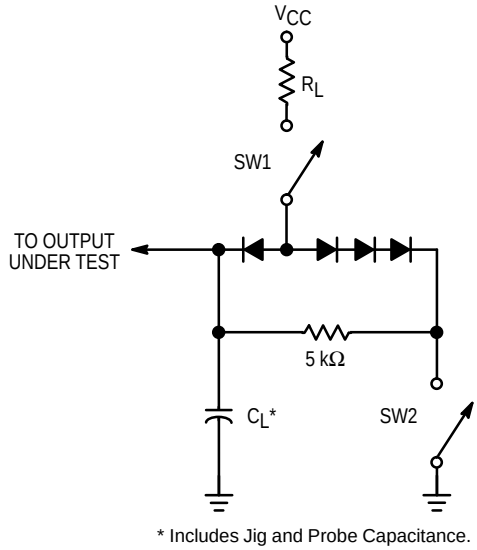


Figure 4

0.5 V

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