

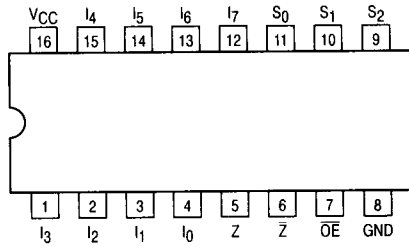


**MOTOROLA**

## 8-Input Multiplexer with 3-State Outputs

The MC74AC251/74ACT251 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. It can be used as a universal function generator to generate any logic function of four variables. Both true and complementary outputs are provided.

- Multifunctional Capability
- On-Chip Select Logic Decoding
- Inverting and Noninverting 3-State Outputs
- Outputs Source/Sink 24 mA
- 'ACT251 Has TTL Compatible Inputs



### PIN NAMES

- $S_0-S_2$  Select Inputs
- $\overline{OE}$  3-State Output Enable Input
- $I_0-I_7$  Multiplexer Inputs
- $Z$  3-State Multiplexer Output
- $\bar{Z}$  Complementary 3-State Multiplexer Output

### TRUTH TABLE

Inputs				Outputs	
$\overline{OE}$	$S_2$	$S_1$	$S_0$	$\bar{Z}$	$Z$
H	X	X	X	Z	Z
L	L	L	L	$I_0$	$I_0$
L	L	L	H	$I_1$	$I_1$
L	L	H	L	$I_2$	$I_2$
L	L	H	H	$I_3$	$I_3$
L	H	L	L	$I_4$	$I_4$
L	H	L	H	$I_5$	$I_5$
L	H	H	L	$I_6$	$I_6$
L	H	H	H	$I_7$	$I_7$

H = HIGH Voltage Level  
 L = LOW Voltage Level  
 X = Immaterial  
 Z = High Impedance

**MC74AC251  
MC74ACT251**

**8-INPUT  
MULTIPLEXER WITH  
3-STATE OUTPUTS**

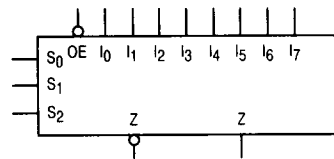


**N SUFFIX  
CASE 648-08  
PLASTIC**



**D SUFFIX  
CASE 751B-05  
PLASTIC**

### LOGIC SYMBOL



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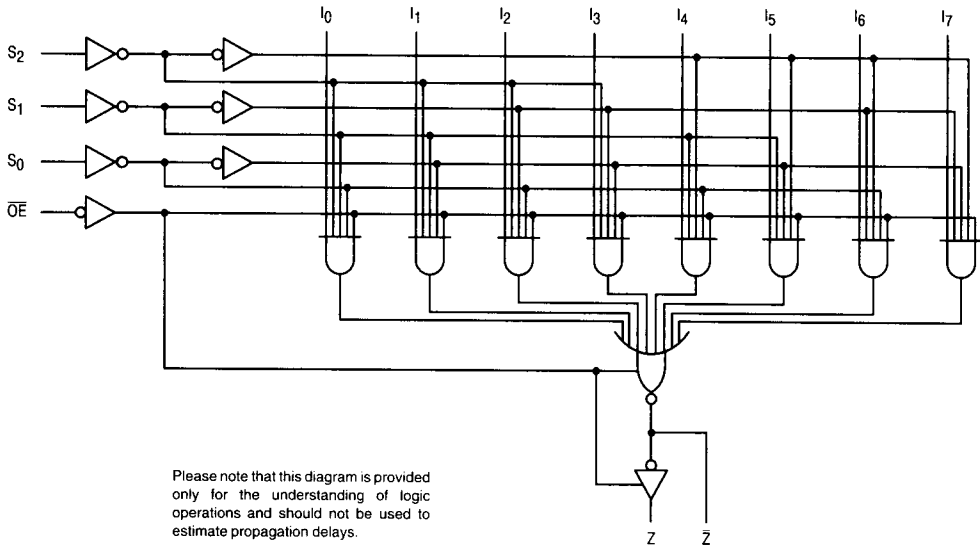
## FUNCTIONAL DESCRIPTION

This device 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 true and complementary outputs are provided. The Output Enable input ( $\overline{OE}$ ) is active LOW. When it is activated, the logic function provided at the output is:

$$Z = \overline{OE} \cdot (I_0 \cdot \overline{S_0} \cdot \overline{S_1} \cdot \overline{S_2} + I_1 \cdot S_0 \cdot \overline{S_1} \cdot \overline{S_2} + I_2 \cdot \overline{S_0} \cdot S_1 \cdot \overline{S_2} + I_3 \cdot S_0 \cdot S_1 \cdot \overline{S_2} + I_4 \cdot \overline{S_0} \cdot \overline{S_1} \cdot S_2 + I_5 \cdot S_0 \cdot \overline{S_1} \cdot S_2 + I_6 \cdot \overline{S_0} \cdot S_1 \cdot S_2 + I_7 \cdot S_0 \cdot S_1 \cdot S_2)$$

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 voltages.

### LOGIC DIAGRAM



Please note that this diagram is provided only for the understanding of logic operations and should not be used to estimate propagation delays.

## MC74AC251 • MC74ACT251

### MAXIMUM RATINGS\*

Symbol	Parameter	Value	Unit
$V_{CC}$	DC Supply Voltage (Referenced to GND)	-0.5 to +7.0	V
$V_{in}$	DC Input Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$V_{out}$	DC Output Voltage (Referenced to GND)	-0.5 to $V_{CC} + 0.5$	V
$I_{in}$	DC Input Current, per Pin	$\pm 20$	mA
$I_{out}$	DC Output Sink/Source Current, per Pin	$\pm 50$	mA
$I_{CC}$	DC $V_{CC}$ or GND Current per Output Pin	$\pm 50$	mA
$T_{stg}$	Storage Temperature	-65 to +150	$^{\circ}C$

\* Maximum Ratings are those values beyond which damage to the device may occur. Functional operation should be restricted to the Recommended Operating Conditions.

### RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Typ	Max	Unit	
$V_{CC}$	Supply Voltage	'AC	2.0	5.0	6.0	V
		'ACT	4.5	5.0	5.5	
$V_{in}, V_{out}$	DC Input Voltage, Output Voltage (Ref. to GND)	0		$V_{CC}$	V	
$t_r, t_f$	Input Rise and Fall Time (Note 1) 'AC Devices except Schmitt Inputs	$V_{CC} @ 3.0 V$		150		ns/V
		$V_{CC} @ 4.5 V$		40		
		$V_{CC} @ 5.5 V$		25		
$t_r, t_f$	Input Rise and Fall Time (Note 2) 'ACT Devices except Schmitt Inputs	$V_{CC} @ 4.5 V$		10		ns/V
		$V_{CC} @ 5.5 V$		8.0		
$T_J$	Junction Temperature (PDIP)			140	$^{\circ}C$	
$T_A$	Operating Ambient Temperature Range	-40	25	85	$^{\circ}C$	
$I_{OH}$	Output Current — High			-24	mA	
$I_{OL}$	Output Current — Low			24	mA	

1.  $V_{in}$  from 30% to 70%  $V_{CC}$ ; see individual Data Sheets for devices that differ from the typical input rise and fall times.
2.  $V_{in}$  from 0.8 V to 2.0 V; see individual Data Sheets for devices that differ from the typical input rise and fall times.

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## DC CHARACTERISTICS

Symbol	Parameter	V <sub>CC</sub> (V)	74AC		74ACT		Unit	Conditions
			T <sub>A</sub> = +25°C		T <sub>A</sub> = -40°C to +85°C			
			Typ	Guaranteed Limits				
V <sub>IH</sub>	Minimum High Level Input Voltage	3.0	1.5	2.1	2.1	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
		4.5	2.25	3.15	3.15			
		5.5	2.75	3.85	3.85			
V <sub>IL</sub>	Maximum Low Level Input Voltage	3.0	1.5	0.9	0.9	V	V <sub>OUT</sub> = 0.1 V or V <sub>CC</sub> - 0.1 V	
		4.5	2.25	1.35	1.35			
		5.5	2.75	1.65	1.65			
V <sub>OH</sub>	Minimum High Level Output Voltage	3.0	2.99	2.9	2.9	V	I <sub>OUT</sub> = -50 μA	
		4.5	4.49	4.4	4.4			
		5.5	5.49	5.4	5.4			
		3.0		2.56	2.46	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> -12 mA I <sub>OH</sub> -24 mA -24 mA	
		4.5		3.86	3.76			
		5.5		4.86	4.76			
V <sub>OL</sub>	Maximum Low Level Output Voltage	3.0	0.002	0.1	0.1	V	I <sub>OUT</sub> = 50 μA	
		4.5	0.001	0.1	0.1			
		5.5	0.001	0.1	0.1			
		3.0		0.36	0.44	V	*V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> 12 mA I <sub>OL</sub> 24 mA 24 mA	
		4.5		0.36	0.44			
		5.5		0.36	0.44			
I <sub>IN</sub>	Maximum Input Leakage Current	5.5		±0.1	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND	
I <sub>OZ</sub>	Maximum 3-State Current	5.5		±0.5	±5.0	μA	V <sub>I</sub> (OE) = V <sub>IL</sub> , V <sub>IH</sub> V <sub>I</sub> = V <sub>CC</sub> , GND V <sub>O</sub> = V <sub>CC</sub> , GND	
I <sub>OLD</sub>	†Minimum Dynamic Output Current	5.5			75	mA	V <sub>OLD</sub> = 1.65 V Max	
I <sub>OHD</sub>		5.5			-75	mA	V <sub>OHD</sub> = 3.85 V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5		8.0	80	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	

\* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

Note: I<sub>IN</sub> and I<sub>CC</sub> @ 3.0 V are guaranteed to be less than or equal to the respective limit @ 5.5 V V<sub>CC</sub>.

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**AC CHARACTERISTICS** (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V <sub>CC</sub> * (V)	74AC			74AC		Unit	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	11.5 8.5	17.5 12.5	1.5 1.5	19.0 13.5	ns	3-6
t <sub>PHL</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	11.0 8.0	17.5 12.5	1.5 1.5	19.0 13.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	10.0 7.0	14.0 10.0	1.5 1.5	15.5 11.0	ns	3-5
t <sub>PHL</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	9.0 6.5	14.0 10.0	1.5 1.5	15.5 11.0	ns	3-5
t <sub>PZH</sub>	Output Enable Time $\bar{O}E$ to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	7.5 5.5	11.0 8.0	1.5 1.5	12.0 9.0	ns	3-7
t <sub>PZL</sub>	Output Enable Time $\bar{O}E$ to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	7.5 5.5	11.0 8.0	1.5 1.5	12.0 9.0	ns	3-8
t <sub>PHZ</sub>	Output Disable Time OE to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	8.5 7.0	11.5 9.5	1.5 1.5	13.0 10.0	ns	3-7
t <sub>PLZ</sub>	Output Disable Time OE to Z or $\bar{Z}$	3.3 5.0	1.5 1.5	7.0 5.5	11.0 8.0	1.5 1.5	12.0 8.5	ns	3-8

\* Voltage Range 3.3 V is 3.3 V ±0.3 V.  
Voltage Range 5.0 V is 5.0 V ±0.5 V.

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## DC CHARACTERISTICS

Symbol	Parameter	VCC (V)	74ACT		74ACT		Unit	Conditions
			TA = +25°C		TA = -40°C to +85°C			
			Typ	Guaranteed Limits				
VIH	Minimum High Level Input Voltage	4.5	1.5	2.0	2.0	V	VOU = 0.1 V or VCC - 0.1 V	
		5.5	1.5	2.0	2.0			
VIL	Maximum Low Level Input Voltage	4.5	1.5	0.8	0.8	V	VOU = 0.1 V or VCC - 0.1 V	
		5.5	1.5	0.8	0.8			
VOH	Minimum High Level Output Voltage	4.5	4.49	4.4	4.4	V	IOU = -50 µA	
		5.5	5.49	5.4	5.4			
		4.5		3.86	3.76	V	*VIN = VIL or VIH IOH = -24 mA	
		5.5		4.86	4.76			
VOL	Maximum Low Level Output Voltage	4.5	0.001	0.1	0.1	V	IOU = 50 µA	
		5.5	0.001	0.1	0.1			
		4.5		0.36	0.44	V	*VIN = VIL or VIH IOL = 24 mA	
		5.5		0.36	0.44			
IIN	Maximum Input Leakage Current	5.5		±0.1	±1.0	µA	VI = VCC, GND	
ΔICCT	Additional Max. ICC/Input	5.5	0.6		1.5	mA	VI = VCC - 2.1 V	
IOZ	Maximum 3-State Current	5.5		±0.5	±5.0	µA	VI (OE) = VIL, VIH VI = VCC, GND VO = VCC, GND	
IOLD	†Minimum Dynamic Output Current	5.5			75	mA	VOLD = 1.65 V Max	
IOHD		5.5			-75	mA	VOHD = 3.85 V Min	
ICC	Maximum Quiescent Supply Current	5.5		8.0	80	µA	VIN = VCC or GND	

\* All outputs loaded; thresholds on input associated with output under test.

† Maximum test duration 2.0 ms, one output loaded at a time.

## MC74AC251 • MC74ACT251

**AC CHARACTERISTICS** (For Figures and Waveforms — See Section 3)

Symbol	Parameter	V <sub>CC</sub> * (V)	74ACT			74ACT		Unit	Fig. No.
			T <sub>A</sub> = +25°C C <sub>L</sub> = 50 pF			T <sub>A</sub> = -40°C to +85°C C <sub>L</sub> = 50 pF			
			Min	Typ	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	5.0	2.5	7.0	15.5	2.0	17.0	ns	3-6
t <sub>PHL</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	5.0	2.5	7.5	16.5	2.5	18.5	ns	3-6
t <sub>PLH</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	5.0	2.5	5.5	12.0	2.0	13.0	ns	3-5
t <sub>PHL</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	5.0	2.5	6.5	12.5	2.5	14.0	ns	3-5
t <sub>PZH</sub>	Output Enable Time $\bar{O}E$ to Z or $\bar{Z}$	5.0	1.5	5.0	8.5	1.5	9.0	ns	3-7
t <sub>PZL</sub>	Output Enable Time $\bar{O}E$ to Z or $\bar{Z}$	5.0	1.5	4.5	8.5	1.5	9.5	ns	3-8
t <sub>PHZ</sub>	Output Disable Time $\bar{O}E$ to Z or $\bar{Z}$	5.0	2.0	6.0	12.0	2.0	13.0	ns	3-7
t <sub>PLZ</sub>	Output Disable Time $\bar{O}E$ to Z or $\bar{Z}$	5.0	1.5	4.5	8.5	1.5	9.0	ns	3-8

\* Voltage Range 5.0 V is 5.0 V ±0.5 V.

### CAPACITANCE

Symbol	Parameter	Value Typ	Unit	Test Conditions
C <sub>IN</sub>	Input Capacitance	4.5	pF	V <sub>CC</sub> = 5.0 V
C <sub>PD</sub>	Power Dissipation Capacitance	70	pF	V <sub>CC</sub> = 5.0 V