

## 54AC151/54ACT151 8-Input Multiplexer

Check for Samples: [54AC151](#), [54ACT151](#)

### FEATURES

- $I_{CC}$  Reduced by 50%
- Outputs Source/Sink 24 mA
- 'ACT151 has TTL-Compatible Inputs
- Standard Microcircuit Drawing (SMD)
  - 'AC151: 5962-87691
  - 'ACT151: 5962-88756
- 54AC151 Now Qualified to 300Krad RHA Designation, Refer to the SMD for More Information

### DESCRIPTION

The 'AC/'ACT151 is a high-speed 8-input digital multiplexer. It provides, in one package, the ability to select one line of data from up to eight sources. The 'AC/'ACT151 can be used as a universal function generator to generate any logic function of four variables. Both true and complementary outputs are provided.

### Logic Symbols

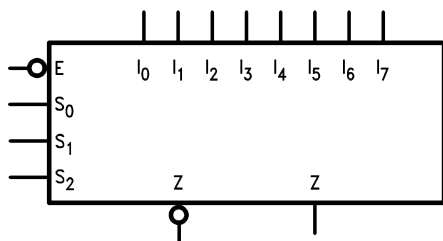


Figure 1.

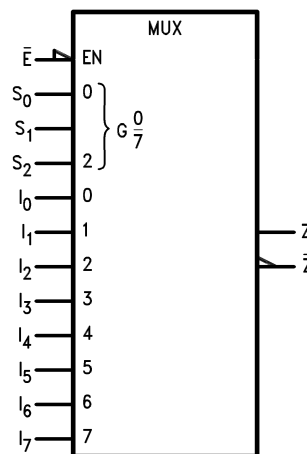


Figure 2. IEEE/IEC

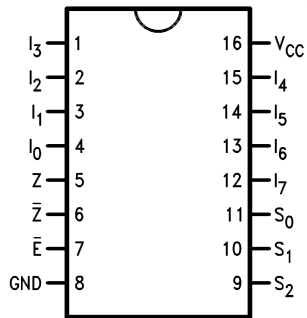
Pin Names	Description
$I_0$ – $I_7$	Data Inputs
$S_0$ – $S_2$	Select Inputs
$\bar{E}$	Enable Input
Z	Data Output
$\bar{Z}$	Inverted Data Output



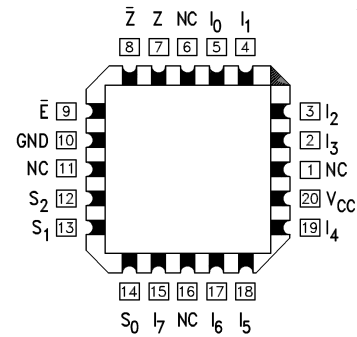
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## Connection Diagrams



**Figure 3. 16-Pin CDIP or CLGA**  
See NFE0016A or NAD0016A Package



**Figure 4. 20-Pin LCCC**  
See NAJ0020A Package

### Truth Table<sup>(1)</sup>

Inputs				Outputs	
$\bar{E}$	$S_2$	$S_1$	$S_0$	$\bar{Z}$	$Z$
H	X	X	X	H	L
L	L	L	L	$\bar{I}_0$	$I_0$
L	L	L	H	$\bar{I}_1$	$I_1$
L	L	H	L	$\bar{I}_2$	$I_2$
L	L	H	H	$\bar{I}_3$	$I_3$
L	H	L	L	$\bar{I}_4$	$I_4$
L	H	L	H	$\bar{I}_5$	$I_5$
L	H	H	L	$\bar{I}_6$	$I_6$
L	H	H	H	$\bar{I}_7$	$I_7$

- (1) H = HIGH Voltage Level  
L = LOW Voltage Level  
X = Immaterial

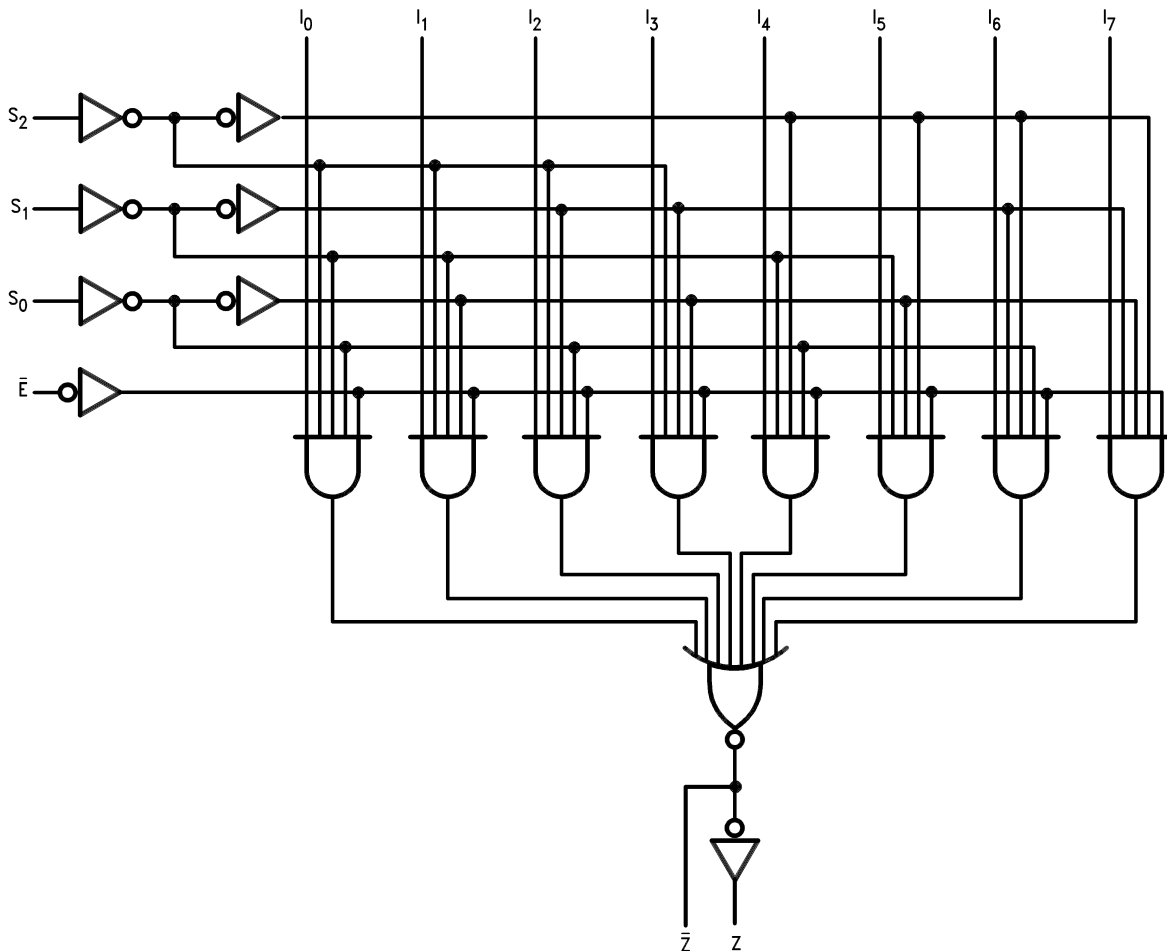
## Functional Description

The 'AC/'ACT151 is a logic 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 Enable input ( $\bar{E}$ ) is active LOW. When it is not activated, the complementary output is HIGH and the true output is LOW regardless of all other inputs. The logic function provided at the output is:

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

The 'AC/'ACT151 provides the ability, in one package to select from eight sources of data or control information. By proper manipulation of the inputs, the 'AC/'ACT151 can provide any logic function of four variables and its complement.

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.



These devices have limited built-in ESD protection. The leads should be shorted together or the device placed in conductive foam during storage or handling to prevent electrostatic damage to the MOS gates.

### Absolute Maximum Ratings<sup>(1)(2)</sup>

Supply Voltage ( $V_{CC}$ )		-0.5V to +7.0V
DC Input Diode Current ( $I_{IK}$ )	$V_I = -0.5V$	-20 mA
	$V_I = V_{CC} + 0.5V$	+20 mA
DC Input Voltage ( $V_I$ )		-0.5V to $V_{CC} + 0.5V$
DC Output Diode Current ( $I_{OK}$ )	$V_O = -0.5V$	-20 mA
	$V_O = V_{CC} + 0.5V$	+20 mA
DC Output Voltage ( $V_O$ )		-0.5V to $V_{CC} + 0.5V$
DC Output Source or Sink Current ( $I_O$ )		$\pm 50$ mA
DC $V_{CC}$ or Ground Current per Output Pin ( $I_{CC}$ or $I_{GND}$ )		$\pm 50$ mA
Storage Temperature ( $T_{STG}$ )		-65°C to +150°C
Junction Temperature ( $T_J$ )	CDIP	175°C

- (1) Absolute Maximum Ratings are those values beyond which damage to the device may occur. The databook specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. TI does not recommend operation of FACT<sup>®</sup> circuits outside databook specifications.
- (2) If Military/Aerospace specified devices are required, please contact the Texas Instruments Sales Office/Distributors for availability and specifications.

### Recommended Operating Conditions

Supply Voltage ( $V_{CC}$ )	'AC	2.0V to 6.0V
	'ACT	4.5V to 5.5V
Input Voltage ( $V_I$ )		0V to $V_{CC}$
Output Voltage ( $V_O$ )		0V to $V_{CC}$
Operating Temperature ( $T_A$ )	54AC/ACT	-55°C to +125°C
Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) 'AC Devices	$V_{IN}$ from 30% to 70% of $V_{CC}$	125 mV/ns
	$V_{CC}$ @ 3.3V, 4.5V, 5.5V	
Minimum Input Edge Rate ( $\Delta V/\Delta t$ ) 'ACT Devices	$V_{IN}$ from 0.8V to 2.0V	125 mV/ns
	$V_{CC}$ @ 4.5V, 5.5V	

### DC Characteristics for 'AC Family Devices

Symbol	Parameter	V <sub>CC</sub> (V)	54AC	Units	Conditions	
			T <sub>A</sub> = -55°C to +125°C			
			Ensured Limits			
V <sub>IH</sub>	Minimum High Level Input Voltage	3.0	2.1	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		4.5	3.15			
		5.5	3.85			
V <sub>IL</sub>	Maximum Low Level Input Voltage	3.0	0.9	V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V	
		4.5	1.35			
		5.5	1.65			
V <sub>OH</sub>	Minimum High Level Output Voltage	3.0	2.9	V	I <sub>OUT</sub> = -50 μA	
		4.5	4.4			
		5.5	5.4			
			3.0	2.4	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> <sup>(1)</sup> I <sub>OH</sub> = -12 mA I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA
			4.5	3.7		
			5.5	4.7		
			5.5	4.7		
V <sub>OL</sub>	Maximum Low Level Output Voltage	3.0	0.1	V	I <sub>OUT</sub> = 50 μA	
		4.5	0.1			
		5.5	0.1			
			3.0	0.50	V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> <sup>(1)</sup> I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA
			4.5	0.50		
			5.5	0.50		
			5.5	0.50		
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	±1.0	μA	V <sub>I</sub> = V <sub>CC</sub> , GND	
I <sub>OLD</sub>	Minimum Dynamic Output Current <sup>(2)</sup>	5.5	50	mA	V <sub>OLD</sub> = 1.65V Max	
I <sub>OHD</sub>		5.5	-50	mA	V <sub>OHD</sub> = 3.85V Min	
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	80.0	μA	V <sub>IN</sub> = V <sub>CC</sub> or GND	

(1) All outputs loaded; thresholds on input associated with output under test.

(2) Maximum test duration 2.0 ms, one output loaded at a time.

### DC Characteristics for 'ACT Family Devices

Symbol	Parameter	V <sub>CC</sub> (V)	54ACT		Units	Conditions
			T <sub>A</sub> = -55°C to +125°C			
			Ensured Limits			
V <sub>IH</sub>	Minimum High Level Input Voltage	4.5	2.0		V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	2.0			
V <sub>IL</sub>	Maximum Low Level Input Voltage	4.5	0.8		V	V <sub>OUT</sub> = 0.1V or V <sub>CC</sub> - 0.1V
		5.5	0.8			
V <sub>OH</sub>	Minimum High Level Output Voltage	4.5	4.4		V	I <sub>OUT</sub> = -50 μA
		5.5	5.4			
		4.5	3.70		V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> <sup>(1)</sup> I <sub>OH</sub> = -24 mA I <sub>OH</sub> = -24 mA
		5.5	4.70			
V <sub>OL</sub>	Maximum Low Level Output Voltage	4.5	0.1		V	I <sub>OUT</sub> = 50 μA
		5.5	0.1			
		4.5	0.50		V	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> <sup>(1)</sup> I <sub>OL</sub> = 24 mA I <sub>OL</sub> = 24 mA
		5.5	0.50			
I <sub>IN</sub>	Maximum Input Leakage Current	5.5	±1.0		μA	V <sub>I</sub> = V <sub>CC</sub> , GND
I <sub>CCT</sub>	Maximum I <sub>CC</sub> /Input	5.5	1.6		mA	V <sub>I</sub> = V <sub>CC</sub> - 2.1V
I <sub>OLD</sub>	Minimum Dynamic Output Current <sup>(2)</sup>	5.5	50		mA	V <sub>OLD</sub> = 1.65V Max
I <sub>OHD</sub>		5.5	-50		mA	V <sub>OHD</sub> = 3.85V Min
I <sub>CC</sub>	Maximum Quiescent Supply Current	5.5	80.0		μA	V <sub>IN</sub> = V <sub>CC</sub> or GND

(1) All outputs loaded; thresholds on input associated with output under test.

(2) Maximum test duration 2.0 ms, one output loaded at a time.

**AC Electrical Characteristics**

Symbol	Parameter	V <sub>CC</sub> (V) <sup>(1)</sup>	54AC		Units	Fig. No.
			T <sub>A</sub> = -55°C to +125°C C <sub>L</sub> = 50 pF			
			Min	Max		
t <sub>PLH</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	3.3	1.0	22.0	ns	
		5.0	1.0	15.5		
t <sub>PHL</sub>	Propagation Delay S <sub>n</sub> to Z or $\bar{Z}$	3.3	1.0	22.0	ns	
		5.0	1.0	15.5		
t <sub>PLH</sub>	Propagation Delay $\bar{E}$ to Z or $\bar{Z}$	3.3	1.0	15.5	ns	
		5.0	1.0	12.0		
t <sub>PHL</sub>	Propagation Delay $\bar{E}$ to Z or $\bar{Z}$	3.3	1.0	15.5	ns	
		5.0	1.0	12.0		
t <sub>PLH</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	3.3	1.0	16.0	ns	
		5.0	1.0	12.0		
t <sub>PHL</sub>	Propagation Delay I <sub>n</sub> to Z or $\bar{Z}$	3.3	1.0	18.0	ns	
		5.0	1.0	13.0		

- (1) Voltage Range 3.3 is 3.3V ±0.3V.  
Voltage Range 5.0 is 5.0V ±0.5V.

**AC Electrical Characteristics**

Symbol	Parameter	$V_{CC}$ (V) <sup>(1)</sup>	54ACT		Units	Fig. No.
			$T_A = -55^\circ\text{C to } +125^\circ\text{C}$ $C_L = 50\text{ pF}$			
			Min	Max		
$t_{PLH}$	Propagation Delay $S_n$ to Z	5.0	1.0	19.5	ns	
$t_{PHL}$	Propagation Delay $S_n$ to Z	5.0	1.0	20.0	ns	
$t_{PLH}$	Propagation Delay $S_n$ to $\bar{Z}$	5.0	1.0	19.5	ns	
$t_{PHL}$	Propagation Delay $S_n$ to $\bar{Z}$	5.0	1.0	20.0	ns	
$t_{PLH}$	Propagation Delay $\bar{E}$ to Z	5.0	1.0	12.0	ns	
$t_{PHL}$	Propagation Delay $\bar{E}$ to Z	5.0	1.0	12.5	ns	
$t_{PLH}$	Propagation Delay $\bar{E}$ to $\bar{Z}$	5.0	1.0	12.0	ns	
$t_{PHL}$	Propagation Delay $\bar{E}$ to $\bar{Z}$	5.0	1.0	12.5	ns	
$t_{PLH}$	Propagation Delay $I_n$ to Z	5.0	1.0	15.0	ns	
$t_{PHL}$	Propagation Delay $I_n$ to Z	5.0	1.0	16.0	ns	
$t_{PLH}$	Propagation Delay $I_n$ to $\bar{Z}$	5.0	1.0	15.0	ns	
$t_{PHL}$	Propagation Delay $I_n$ to $\bar{Z}$	5.0	1.0	16.0	ns	

(1) Voltage Range 5.0 is 5.0V  $\pm$ 0.5V.**Capacitance**

Symbol	Parameter	Typ	Units	Conditions
$C_{IN}$	Input Capacitance	4.5	pF	$V_{CC} = \text{OPEN}$
$C_{PD}$	Power Dissipation Capacitance	70.0	pF	$V_{CC} = 5.0\text{V}$



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**REVISION HISTORY**

<b>Changes from Revision B (April 2013) to Revision C</b>	<b>Page</b>
• Changed layout of National Data Sheet to TI format .....	<a href="#">8</a>

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