

## 74F153 Dual 4-Input Multiplexer

### General Description

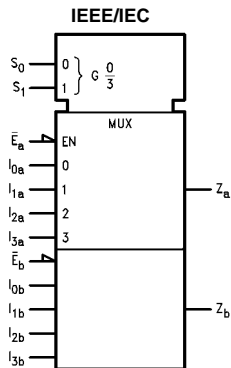
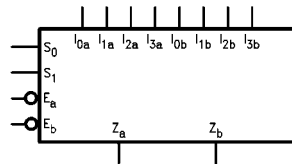
The F153 is a high-speed dual 4-input multiplexer with common select inputs and individual enable inputs for each section. It can select two lines of data from four sources. The two buffered outputs present data in the true (non-inverted) form. In addition to multiplexer operation, the F153 can generate any two functions of three variables.

### Ordering Code:

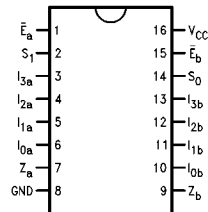
Order Number	Package Number	Package Description
74F153SC	M16A	16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150 Narrow
74F153SJ	M16D	16-Lead Small Outline Package (SOP), EIAJ TYPE II, 5.3mm Wide
74F153PC	N16E	16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300 Wide

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

### Logic Symbols



### Connection Diagram



### Unit Loading/Fan Out

Pin Names	Description	U.L.	
		HIGH/LOW	Input I <sub>IH</sub> /I <sub>IL</sub> Output I <sub>OH</sub> /I <sub>OL</sub>
I <sub>0a</sub> -I <sub>3a</sub>	Side A Data Inputs	1.0/1.0	20 μA/-0.6 mA
I <sub>0b</sub> -I <sub>3b</sub>	Side B Data Inputs	1.0/1.0	20 μA/-0.6 mA
S <sub>0</sub> , S <sub>1</sub>	Common Select Inputs	1.0/1.0	20 μA/-0.6 mA
$\bar{E}_a$	Side A Enable Input (Active LOW)	1.0/1.0	20 μA/-0.6 mA
$\bar{E}_b$	Side B Enable Input (Active LOW)	1.0/1.0	20 μA/-0.6 mA
Z <sub>a</sub>	Side A Output	50/33.3	-1 mA/20 mA
Z <sub>b</sub>	Side B Output	50/33.3	-1 mA/20 mA

### Truth Table

Select Inputs		Inputs (a or b)				Output	
S <sub>0</sub>	S <sub>1</sub>	$\bar{E}$	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	Z
X	X	H	X	X	X	X	L
L	L	L	L	X	X	X	L
L	L	L	H	X	X	X	H
H	L	L	X	L	X	X	L
H	L	L	X	H	X	X	H
L	H	L	X	X	L	X	L
L	H	L	X	X	H	X	H
H	H	L	X	X	X	L	L
H	H	L	X	X	X	H	H

H = HIGH Voltage Level  
L = LOW  
X = Immaterial

### Functional Description

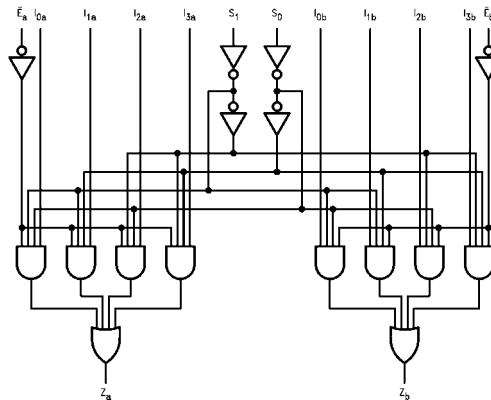
The F153 is a dual 4-input multiplexer. It can select two bits of data from up to four sources under the control of the common Select inputs (S<sub>0</sub>, S<sub>1</sub>). The two 4-input multiplexer circuits have individual active LOW Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) which can be used to strobe the outputs independently. When the Enables ( $\bar{E}_a$ ,  $\bar{E}_b$ ) are HIGH, the corresponding outputs (Z<sub>a</sub>, Z<sub>b</sub>) are forced LOW. The F153 is the logic implementation of a 2-pole, 4-position switch, where the position of the switch is determined by the logic levels supplied to the two Select inputs. The logic equations for the outputs are as follows:

$$Z_a = \bar{E}_a \cdot (I_{0a} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1a} \cdot \bar{S}_1 \cdot S_0 + I_{2a} \cdot S_1 \cdot \bar{S}_0 + I_{3a} \cdot S_1 \cdot S_0)$$

$$Z_b = \bar{E}_b \cdot (I_{0b} \cdot \bar{S}_1 \cdot \bar{S}_0 + I_{1b} \cdot \bar{S}_1 \cdot S_0 + I_{2b} \cdot S_1 \cdot \bar{S}_0 + I_{3b} \cdot S_1 \cdot S_0)$$

The F153 can be used to move data from a group of registers to a common output bus. The particular register from which the data came would be determined by the state of the Select inputs. A less obvious application is as a function generator. The F153 can generate two functions of three variables. This is useful for implementing highly irregular random logic.

### 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.

Absolute Maximum Ratings <sup>(Note 1)</sup>		Recommended Operating Conditions	
Storage Temperature	-65°C to +150°C	Free Air Ambient Temperature	0°C to +70°C
Ambient Temperature under Bias	-55°C to +125°C	Supply Voltage	+4.5V to +5.5V
Junction Temperature under Bias	-55°C to +150°C		
V <sub>CC</sub> Pin Potential to Ground Pin	-0.5V to +7.0V		
Input Voltage (Note 2)	-0.5V to +7.0V		
Input Current (Note 2)	-30 mA to +5.0 mA		
Voltage Applied to Output in HIGH State (with V <sub>CC</sub> = 0V)			
Standard Output	-0.5V to V <sub>CC</sub>		
3-STATE Output	-0.5V to +5.5V		
Current Applied to Output in LOW State (Max)	twice the rated I <sub>OL</sub> (mA)		

**Note 1:** Absolute maximum ratings are values beyond which the device may be damaged or have its useful life impaired. Functional operation under these conditions is not implied.

**Note 2:** Either voltage limit or current limit is sufficient to protect inputs.

### DC Electrical Characteristics

Symbol	Parameter	Min	Typ	Max	Units	V <sub>CC</sub>	Conditions
V <sub>IH</sub>	Input HIGH Voltage	2.0			V		Recognized as a HIGH Signal
V <sub>IL</sub>	Input LOW Voltage			0.8	V		Recognized as a LOW Signal
V <sub>CD</sub>	Input Clamp Diode Voltage			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	10% V <sub>CC</sub> 5% V <sub>CC</sub>	2.5 2.7		V	Min	I <sub>OH</sub> = -1 mA I <sub>OH</sub> = -1 mA
V <sub>OL</sub>	Output LOW Voltage	10% V <sub>CC</sub>		0.5	V	Min	I <sub>OL</sub> = 20 mA
I <sub>IH</sub>	Input HIGH Current			5.0	μA	Max	V <sub>IN</sub> = 2.7V
I <sub>BVI</sub>	Input HIGH Current Breakdown Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output High Leakage Current			50	μA	Max	V <sub>OUT</sub> = V <sub>CC</sub>
V <sub>ID</sub>	Input Leakage Test	4.75			V	0.0	I <sub>ID</sub> = 1.9 μA All Other Pins Grounded
I <sub>OD</sub>	Output Leakage Circuit Current			3.75	μA	0.0	V <sub>IOD</sub> = 150 mV All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current			-0.6	mA	Max	V <sub>IN</sub> = 0.5V
I <sub>OS</sub>	Output Short-Circuit Current	-60		-150	mA	Max	V <sub>OUT</sub> = 0V
I <sub>CCL</sub>	Power Supply Current		12	20	mA	Max	V <sub>O</sub> = LOW

### AC Electrical Characteristics

Symbol	Parameter	T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			T <sub>A</sub> = 0°C to +70°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF		Units
		Min	Typ	Max	Min	Max	
t <sub>PLH</sub>	Propagation Delay	4.5	8.1	10.5	4.5	12.0	ns
t <sub>PHL</sub>	S <sub>n</sub> to Z <sub>n</sub>	3.5	7.0	9.0	3.5	10.5	
t <sub>PLH</sub>	Propagation Delay	4.5	7.1	9.0	4.5	10.5	ns
t <sub>PHL</sub>	$\bar{E}_n$ to Z <sub>n</sub>	3.0	5.7	7.0	2.5	8.0	
t <sub>PLH</sub>	Propagation Delay	3.0	5.3	7.0	3.0	8.0	ns
t <sub>PHL</sub>	I <sub>n</sub> to Z <sub>n</sub>	2.5	5.1	6.5	2.5	7.5	