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## FAIRCHILD

SEMICONDUCTOR

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

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

### **Logic Symbols**



### **Connection Diagram**

Ē <sub>a</sub> —	1	$\bigcirc$	16	-v <sub>cc</sub>
s <sub>1</sub> -	2		15	— Ē <sub>b</sub>
I <sub>3a</sub> —	3		14	-s <sub>o</sub>
I <sub>2a</sub> —	4		13	—I <sub>ЗЬ</sub>
I <sub>1a</sub> —	5		12	— I <sub>2b</sub>
1 <sub>0a</sub> —	6		- 11	—I <sub>1ь</sub>
Z <sub>a</sub> -	7		10	—I <sub>ОЬ</sub>
GND -	8		9	— Zь

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### **Unit Loading/Fan Out**

Pin Names	Description	U.L.	Input I <sub>IH</sub> /I <sub>IL</sub>	
	Description	HIGH/LOW	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	
Ea	Side A Enable Input (Active LOW)	1.0/1.0	20 µA/–0.6 mA	
Eb	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			Output				
S <sub>0</sub>	S <sub>1</sub>	Ē	I <sub>0</sub>	I <sub>1</sub>	I <sub>2</sub>	I <sub>3</sub>	z
Х	Х	Н	Х	Х	Х	Х	L
L	L	L	L	Х	Х	Х	L
L	L	L	н	Х	Х	Х	н
н	L	L	х	L	Х	Х	L
н	L	L	Х	н	Х	Х	н
L	н	L	Х	Х	L	Х	L
L	н	L	х	Х	н	Х	н
н	н	L	Х	Х	Х	L	L
н	Н	L	Х	Х	Х	н	н

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 $_0$ , S $_1$ ). The two 4-input multiplexer circuits have individual active LOW Enables ( $\overline{E}_a,\,\overline{E}_b)$  which can be used to strobe the outputs independently. When the Enables ( $\overline{E}_a$ ,  $\overline{E}_b$ ) are HIGH, the corresponding outputs ( $Z_a$ , 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:

$$\begin{aligned} Z_a &= \overline{E}_a \bullet (I_{0a} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1a} \bullet \overline{S}_1 \bullet S_0 + \\ &I_{2a} \bullet S_1 \bullet \overline{S}_0 + I_{3a} \bullet S_1 \bullet S_0) \\ Z_b &= \overline{E}_b \bullet (I_{0b} \bullet \overline{S}_1 \bullet \overline{S}_0 + I_{1b} \bullet \overline{S}_1 \bullet S_0 + \\ &I_{2b} \bullet S_1 \bullet \overline{S}_0 + I_{2b} \bullet S_1 \bullet S_0) \end{aligned}$$

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.





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(Note 1)

Storage Temperature Ambient Temperature under Bias Junction Temperature under Bias  $V_{CC}$  Pin Potential to Ground Pin Input Voltage (Note 2) Input Current (Note 2) Voltage Applied to Output in HIGH State (with  $V_{CC} = 0V$ ) Standard Output 3-STATE Output Current Applied to Output in LOW State (Max) -65°C to +150°C -55°C to +125°C -55°C to +150°C -0.5V to +7.0V -0.5V to +7.0V -30 mA to +5.0 mA

twice the rated  $I_{OL}\left(mA\right)$ 

Recommended Operating Conditions

Free Air Ambient Temperature Supply Voltage 74F153

0°C to +70°C +4.5V to +5.5V

-0.5V to V<sub>CC</sub> Note 1: Absolute maximum ratings are values beyond which the device -0.5V to +5.5V 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	Paramete	r	Min	Тур	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 Voltag	e			-1.2	V	Min	I <sub>IN</sub> = -18 mA
V <sub>OH</sub>	Output HIGH Voltage	10% V <sub>CC</sub>	2.5			v	Min	I <sub>OH</sub> = -1 mA
		5% $V_{CC}$	2.7			v	IVIIII	$I_{OH} = -1 \text{ mA}$
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	μΑ	Max	$V_{IN} = 2.7V$
I <sub>BVI</sub>	Input HIGH Current Break	down Test			7.0	μA	Max	V <sub>IN</sub> = 7.0V
I <sub>CEX</sub>	Output High Leakage Cur	rent			50	μΑ	Max	$V_{OUT} = V_{CC}$
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 C	urrent			3.75	μΑ	0.0	$V_{IOD} = 150 \text{ mV}$
								All Other Pins Grounded
I <sub>IL</sub>	Input LOW Current				-0.6	mA	Max	V <sub>IN</sub> = 0.5V
los	Output Short-Circuit Curre	ent	-60		-150	mA	Max	$V_{OUT} = 0V$
I <sub>CCL</sub>	Power Supply Current			12	20	mA	Max	$V_0 = LOW$

### **AC Electrical Characteristics**

Symbol	Parameter		T <sub>A</sub> = +25°C V <sub>CC</sub> = +5.0V C <sub>L</sub> = 50 pF			$T_A = 0^{\circ}C \text{ to } +70^{\circ}C$ $V_{CC} = +5.0V$ $C_L = 50 \text{ pF}$		
		Min	Тур	Max	Min	Max		
t <sub>PLH</sub>	Propagation Delay	4.5	8.1	10.5	4.5	12.0		
t <sub>PHL</sub>	S <sub>n</sub> to Z <sub>n</sub>	3.5	7.0	9.0	3.5	10.5	ns	
t <sub>PLH</sub>	Propagation Delay	4.5	7.1	9.0	4.5	10.5		
t <sub>PHL</sub>	Ē <sub>n</sub> to Z <sub>n</sub>	3.0	5.7	7.0	2.5	8.0	ns	
t <sub>PLH</sub>	Propagation Delay	3.0	5.3	7.0	3.0	8.0	nc	
t <sub>PHL</sub>	I <sub>n</sub> to Z <sub>n</sub>	2.5	5.1	6.5	2.5	7.5	ns	





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