

December 1996

## High-Speed CMOS Dual 4-Input Multiplexers

### Features

- Advanced 0.8 micron CMOS Technology
- These Devices are Pin Compatible with Bipolar FAST™ Series at a Higher Speed and Lower Power Consumption
- 25Ω Series Resistor On All Outputs (FCT2XXX Only)
- TTL Input and Output Levels
- Low Ground Bounce Outputs (25Ω Series Only)
- Extremely Low Static Power
- Hysteresis on All Inputs

### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
CD74FCT153TM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT153ATM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT153CTM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT153TNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT153ATNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT153CTNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT153TQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT153ATQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT153CTQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT253TM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT253ATM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT253CTM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT253TNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT253ATNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT253CTNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT253TQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT253ATQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT253CTQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2153TM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2153ATM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2153CTM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2153TNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2153ATNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2153CTNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2153TQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2153ATQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2153CTQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2253TM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2253ATM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2253CTM	-40 to 85	16 Ld SOIC	M16.3-P
CD74FCT2253TNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2253ATNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2253CTNM	-40 to 85	16 Ld SOIC	M16.15-P
CD74FCT2253TQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2253ATQM	-40 to 85	16 Ld QSOP	M16.15A-P
CD74FCT2253CTQM	-40 to 85	16 Ld QSOP	M16.15A-P

NOTE: When ordering, use the entire part number. Add the suffix 96 to obtain the variant in the tape and reel.

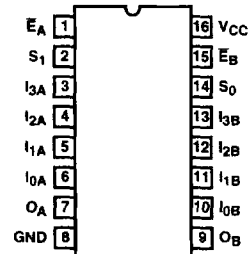
### Description

The CD74FCT153T, CD74FCT253T, CD74FCT2153T and CD74FCT2253T are high-speed dual 4-input multiplexers. The CD74FCT153T and CD74FCT2153T have TTL outputs, while the CD74FCT253T and CD74FCT2253T have three-state outputs. The output buffers are designed with a poweroff disable allowing 'live insertion' of boards when used as back-plane drivers.

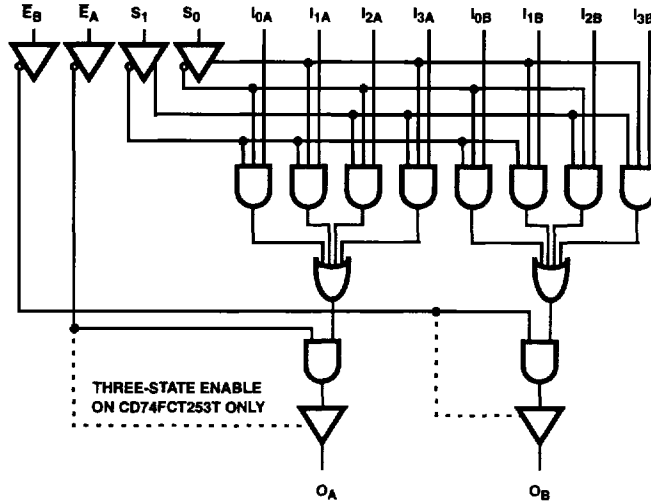
The CD74FCT2153T and CD74FCT2253T devices have a built-in 25Ω series resistor on all outputs to reduce noise due to reflections, thus eliminating the need for an external terminating resistor.

### Pinout

CD74FCT153T, CD74FCT253T,  
CD74FCT2153T, CD74FCT2253T  
(QSOP, SOIC)  
TOP VIEW



**Functional Block Diagram**



TRUTH TABLE (NOTE 1)

INPUTS				OUTPUTS			
				CD74FCT153, CD74FCT2153		CD74FCT253, CD74FCT2253	
EA	EB	S1	S0	OA	OB	OA	OB
H	X	X	X	L	X	Z	X
X	H	X	X	X	L	X	Z
L	L	L	L	I0A	I0B	I0A	I0B
L	L	L	H	I1A	I1B	I1A	I1B
L	L	H	L	I2A	I2B	I2A	I2B
L	L	H	H	I3A	I3B	I3A	I3B

NOTE:

- 1. H = High Voltage Level
- L = Low Voltage Level
- X = Don't Care
- Z = High Impedance

**Pin Description**

PIN NAME	DESCRIPTION
I0A-I3A, I0B-I3B	Data Inputs
S0, S1	Select Inputs
EA, EB	Enable Input
OA, OB	Data Outputs
GND	Ground
VCC	Power

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 OCTAL 5V FCT  
 5V FCT 25Ω

## CD74FCT153T, CD74FCT253T, CD74FCT2153T, CD74FCT2253T

### Absolute Maximum Ratings

DC Input Voltage	-0.5V to 7.0V
DC Output Current	120mA

### Operating Conditions

Operating Temperature Range	-40°C to 85°C
Supply Voltage to Ground Potential	
Inputs and V <sub>CC</sub> Only	-0.5V to 7.0V
Supply Voltage to Ground Potential	
Outputs and D/O Only	-0.5V to 7.0V

### Thermal Information

Thermal Resistance (Typical, Note 2)	$\theta_{JA}$ (°C/W)
16 Lead SOIC (150 mil) Package	110
16 Lead SOIC (300 mil) Package	97
16 Lead QSOP Package	140
Maximum Junction Temperature	150°C
Maximum Storage Temperature Range	-65°C to 150°C
Maximum Lead Temperature (Soldering 10s)	300°C
(Lead Tips Only)	

**CAUTION:** Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

NOTE:

- $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

### Electrical Specifications

PARAMETER	SYMBOL	(NOTE 3)		MIN	(NOTE 4)		UNITS
		TEST CONDITIONS			TYP	MAX	
<b>DC ELECTRICAL SPECIFICATIONS</b> Over the Operating Range, $T_A = -40^\circ\text{C}$ to $85^\circ\text{C}$ , $V_{CC} = 5.0\text{V} \pm 5\%$							
Output HIGH Voltage	$V_{OH}$	$V_{CC} = \text{Min}$ , $V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OH} = -15.0\text{mA}$	2.4	3.0	-	V
Output LOW Voltage	$V_{OL}$	$V_{CC} = \text{Min}$ , $V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 48\text{mA}$	-	0.3	0.50	V
Output LOW Voltage	$V_{OL}$	$V_{CC} = \text{Min}$ , $V_{IN} = V_{IH}$ or $V_{IL}$	$I_{OL} = 12\text{mA}$ (25 $\Omega$ series)	-	0.3	0.50	V
Input HIGH Voltage	$V_{IH}$	Guaranteed Logic HIGH Level		2.0	-	-	V
Input LOW Voltage	$V_{IL}$	Guaranteed Logic LOW Level		-	-	0.8	V
Input HIGH Current	$I_{IH}$	$V_{CC} = \text{Max}$	$V_{IN} = V_{CC}$	-	-	1	$\mu\text{A}$
Input LOW Current	$I_{IL}$	$V_{CC} = \text{Max}$	$V_{IN} = \text{GND}$	-	-	-1	$\mu\text{A}$
High Impedance Output Current	$I_{OZH}$ , $I_{OZL}$	$V_{CC} = \text{Max}$	$V_{OUT} = 2.7\text{V}$			1	$\mu\text{A}$
			$V_{OUT} = 0.5\text{V}$			-1	$\mu\text{A}$
Clamp Diode Voltage	$V_{IK}$	$V_{CC} = \text{Min}$ , $I_{IN} = -18\text{mA}$		-	-0.7	-1.2	V
Short Circuit Current	$I_{OS}$	$V_{CC} = \text{Max}$ (Note 5), $V_{OUT} = \text{GND}$		-60	-120	-	mA
Power Down Disable	$I_{OFF}$	$V_{CC} = \text{GND}$ , $V_{OUT} = 4.5\text{V}$		-	-	100	$\mu\text{A}$
Input Hysteresis	$V_H$			-	200	-	mV
<b>CAPACITANCE</b> $T_A = 25^\circ\text{C}$ , $f = 1\text{MHz}$							
Input Capacitance (Note 6)	$C_{IN}$	$V_{IN} = 0\text{V}$		-	6	10	pF
Output Capacitance (Note 6)	$C_{OUT}$	$V_{OUT} = 0\text{V}$		-	8	12	pF
<b>POWER SUPPLY SPECIFICATIONS</b>							
Quiescent Power Supply Current	$I_{CC}$	$V_{CC} = \text{Max}$	$V_{IN} = \text{GND}$ or $V_{CC}$	-	0.1	500	$\mu\text{A}$
Supply Current per Input at TTL HIGH	$\Delta I_{CC}$	$V_{CC} = \text{Max}$	$V_{IN} = 3.4\text{V}$ (Note 7)	-	0.5	2.0	mA
Supply Current per Input per MHz (Note 8)	$I_{CCD}$	$V_{CC} = \text{Max}$ , Outputs Open Other Inputs at GND One Bit Toggling 50% Duty Cycle	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	-	0.15	0.25	mA/ MHz
Total Power Supply Current (Note 10)	$I_C$	$V_{CC} = \text{Max}$ , Outputs Open $I_L = 10\text{MHz}$ , 50% Duty Cycle Other Inputs at GND One Bit Toggling	$V_{IN} = V_{CC}$ $V_{IN} = \text{GND}$	-	3.2	6.5 (Note 9)	mA
			$V_{IN} = 3.4\text{V}$ $V_{IN} = \text{GND}$	-	3.5	7.5 (Note 9)	mA

**CD74FCT153T, CD74FCT253T, CD74FCT2153T, CD74FCT2253T**

**Switching Specifications Over Operating Range**

PARAMETER	SYMBOL	(NOTE 11) TEST CONDITIONS	T		AT		CT		UNIT
			(NOTE 12) MIN	MAX	(NOTE 12) MIN	MAX	(NOTE 12) MIN	MAX	
<b>CD74FCT153T, CD74FCT2153T</b>									
Propagation Delay Sn to O	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	9.0	1.5	6.6	1.5	5.6	ns
Propagation Delay In to O	t <sub>PLH</sub> , t <sub>PHL</sub>		1.5	7.0	1.5	5.2	1.5	4.5	ns
Propagation Delay E to O	t <sub>PLH</sub> , t <sub>PHL</sub>		1.5	7.0	1.5	5.2	1.5	4.8	ns
<b>CD74FCT253T, CD74FCT2253T</b>									
Propagation Delay Sn to O	t <sub>PLH</sub> , t <sub>PHL</sub>	C <sub>L</sub> = 50pF R <sub>L</sub> = 500Ω	1.5	9.0	1.5	6.6	1.5	5.6	ns
Propagation Delay In to O	t <sub>PLH</sub> , t <sub>PHL</sub>		1.5	7.0	1.5	5.2	1.5	4.5	ns
Output Enable Time E to O	t <sub>PZH</sub> , t <sub>PZL</sub>		1.5	9.0	1.5	6.0	1.5	5.0	ns
Output Enable Time E to O (Note 13)	t <sub>PHZ</sub> , t <sub>PLZ</sub>		1.5	7.0	1.5	6.0	1.5	5.0	ns

**NOTES:**

- For conditions shown as Max or Min, use appropriate value specified under Electrical Specifications for the applicable device type.
- Typical values are at V<sub>CC</sub> = 5.0V, 25°C ambient and maximum loading.
- Not more than one output should be shorted at one time. Duration of the test should not exceed one second.
- This parameter is determined by device characterization but is not production tested.
- Per TTL driven input (V<sub>IN</sub> = 3.4V); all other inputs at V<sub>CC</sub> or GND.
- This parameter is not directly testable, but is derived for use in Total Power Supply Calculations.
- Values for these conditions are examples of the I<sub>CC</sub> formula. These limits are guaranteed but not tested.
- $$I_C = I_{\text{QUIESCENT}} + I_{\text{INPUTS}} + I_{\text{DYNAMIC}}$$

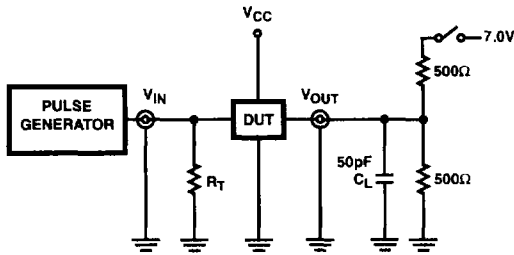
$$I_C = I_{CC} + \Delta I_{CC} D_H N_T + I_{CCD} (f_{CP}/2 + f_i N_i)$$

I<sub>CC</sub> = Quiescent Current  
 ΔI<sub>CC</sub> = Power Supply Current for a TTL High Input (V<sub>IN</sub> = 3.4V)  
 D<sub>H</sub> = Duty Cycle for TTL Inputs High  
 N<sub>T</sub> = Number of TTL Inputs at D<sub>H</sub>  
 I<sub>CCD</sub> = Dynamic Current Caused by an Input Transition Pair (HLH or LHL)  
 f<sub>CP</sub> = Clock Frequency for Register Devices (Zero for Non-Register Devices)  
 f<sub>i</sub> = Input Frequency  
 N<sub>i</sub> = Number of Inputs at f<sub>i</sub>  
 All currents are in milliamps and all frequencies are in megahertz.
- See test circuit and wave forms.
- Minimum limits are guaranteed but not tested on Propagation Delays.
- This parameter is guaranteed but not production tested.

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**OCTAL 5V FCT  
5V FCT 25Ω**

Test Circuits and Waveforms



SWITCH POSITION	
TEST	SWITCH
$t_{PLZ}, t_{PZL}$	Closed
$t_{PHZ}, t_{PZH}, t_{PLH}, t_{PHL}$	Open

DEFINITIONS:

$C_L$  = Load capacitance, includes jig and probe capacitance.  
 $R_T$  = Termination resistance, should be equal to  $Z_{OUT}$  of the Pulse Generator.

NOTE:

14. Pulse Generator for All Pulses: Rate  $\leq 1.0$ MHz;  $Z_{OUT} \leq 50\Omega$ ;  
 $t_r, t_f \leq 2.5$ ns.

FIGURE 1. TEST CIRCUIT

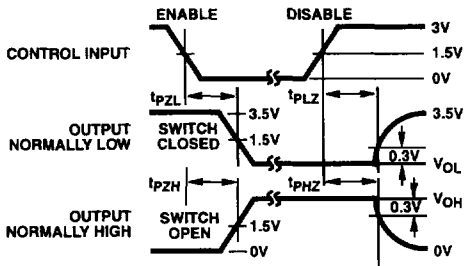


FIGURE 2. ENABLE AND DISABLE TIMING

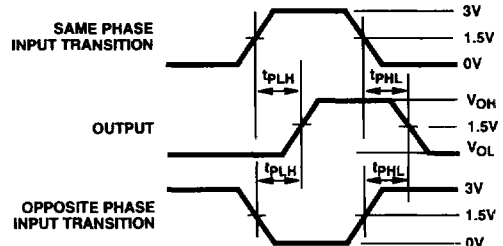


FIGURE 3. PROPAGATION DELAY