

# MM54HC153/MM74HC153 Dual 4-Input Multiplexer

## General Description

This 4-to-1 line multiplexer utilizes advanced silicon-gate CMOS technology. It has the low power consumption and high noise immunity of standard CMOS integrated circuits. This device is fully buffered, allowing it to drive 10 LS-TTL loads. Information on the data inputs of each multiplexer is selected by the address on the A and B inputs, and is presented on the Y outputs. Each multiplexer possesses a strobe input which enables it when taken to a low logic level. When a high logic level is applied to a strobe input, the output of its associated multiplexer is taken low.

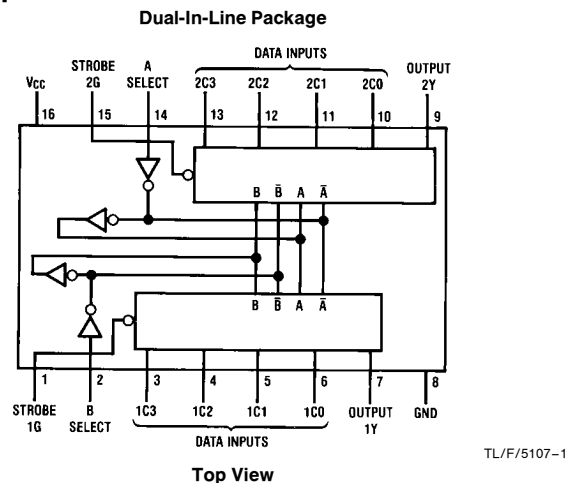
The 54HC/74HC logic family is functionally and pinout compatible with the standard 54LS/74LS logic family. All inputs

are protected from damage due to static discharge by internal diode clamps to  $V_{CC}$  and ground.

## Features

- Typical propagation delay: 24 ns
- Wide power supply range: 2V–6V
- Low quiescent current: 80  $\mu$ A maximum (74HC Series)
- Low input current: 1  $\mu$ A maximum
- Fanout of 10 LS-TTL loads

## Connection Diagram



## Truth Table

Select Inputs		Data Inputs				Strobe	Output
B	A	C0	C1	C2	C3	G	Y
X	X	X	X	X	X	H	L
L	L	L	X	X	X	L	L
L	L	H	X	X	X	L	H
L	H	X	L	X	X	L	L
L	H	X	H	X	X	L	H
H	L	X	X	L	X	L	L
H	L	X	X	H	X	L	H
H	H	X	X	X	L	L	L
H	H	X	X	X	H	L	H

Select inputs A and B are common to both sections.  
H = high level, L = low level, X = don't care.

## Absolute Maximum Ratings (Notes 1 & 2)

If Military/Aerospace specified devices are required, please contact the National Semiconductor Sales Office/Distributors for availability and specifications.

Supply Voltage ( $V_{CC}$ )	-0.5 to +7.0V
DC Input Voltage ( $V_{IN}$ )	-1.5 to $V_{CC} + 1.5V$
DC Output Voltage ( $V_{OUT}$ )	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current ( $I_{IK}, I_{OK}$ )	$\pm 20$ mA
DC Output Current, per pin ( $I_{OUT}$ )	$\pm 25$ mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	$\pm 50$ mA
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C
Power Dissipation ( $P_D$ ) (Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature ( $T_L$ ) (Soldering 10 seconds)	260°C

## Operating Conditions

	Min	Max	Units
Supply Voltage ( $V_{CC}$ )	2	6	V
DC Input or Output Voltage ( $V_{IN}, V_{OUT}$ )	0	$V_{CC}$	V
Operating Temp. Range ( $T_A$ )			
MM74HC	-40	+85	°C
MM54HC	-55	+125	°C
Input Rise or Fall Times ( $t_r, t_f$ )			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

## DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A = 25^\circ C$			74HC	54HC	Units
							$T_A = -40$ to $85^\circ C$	$T_A = -55$ to $125^\circ C$	
				Typ	Guaranteed Limits				
$V_{IH}$	Minimum High Level Input Voltage		2.0V		1.5	1.5	1.5	V	
			4.5V		3.15	3.15	3.15	V	
			6.0V		4.2	4.2	4.2	V	
$V_{IL}$	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	V	
			4.5V		1.35	1.35	1.35	V	
			6.0V		1.8	1.8	1.8	V	
$V_{OH}$	Minimum High Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	2.0	1.9	1.9	1.9	V	
			4.5V	4.5	4.4	4.4	4.4	V	
			6.0V	6.0	5.9	5.9	5.9	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 4.0$ mA $ I_{OUT}  \leq 5.2$ mA	4.5V	4.2	3.98	3.84	3.7	V	
			6.0V	5.3	5.48	5.34	5.2	V	
$V_{OL}$	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	0	0.1	0.1	0.1	V	
			4.5V	0	0.1	0.1	0.1	V	
			6.0V	0	0.1	0.1	0.1	V	
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 4.0$ mA $ I_{OUT}  \leq 5.2$ mA	4.5V	0.2	0.26	0.33	0.4	V	
			6.0V	0.2	0.26	0.33	0.4	V	
$I_{IN}$	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu A$	
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0V		8.0	80	160	$\mu A$	

**Note 1:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C; ceramic "J" package: -12 mW/°C from 100°C to 125°C.

**Note 4:** For a power supply of  $5V \pm 10\%$  the worst case output voltages ( $V_{OH}$ , and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ , and  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

\*\* $V_{IL}$  limits are currently tested at 20% of  $V_{CC}$ . The above  $V_{IL}$  specification (30% of  $V_{CC}$ ) will be implemented no later than Q1, CY'89.

### AC Electrical Characteristics $V_{CC}=5V, T_A=25^{\circ}C, C_L=15\text{ pF}, t_r=t_f=6\text{ ns}$

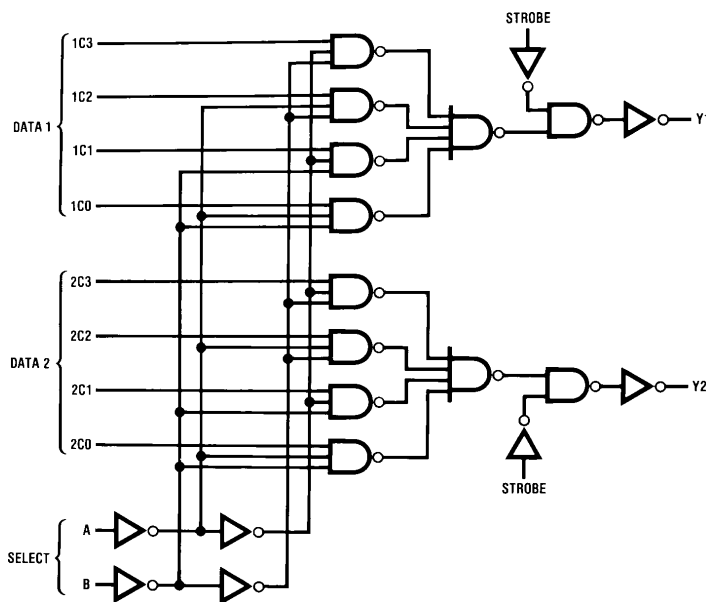
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select A or B to Y		26	30	ns
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, any Data to Y		20	23	ns
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Strobe to Y		8	15	ns

### AC Electrical Characteristics $C_L=50\text{ pF}, t_r=t_f=6\text{ ns}$ (unless otherwise specified)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A=25^{\circ}C$		74HC $T_A=-40\text{ to }85^{\circ}C$		54HC $T_A=-55\text{ to }125^{\circ}C$		Units
				Typ	Guaranteed Limits	Typ	Guaranteed Limits	Typ	Guaranteed Limits	
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select A or B to Y		2.0V	131	158	198	237	ns		
			4.5V	29	35	44	52	ns		
			6.0V	25	30	38	45	ns		
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, any Data to Y		2.0V	99	126	158	189	ns		
			4.5V	22	28	35	42	ns		
			6.0V	19	23	29	35	ns		
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Strobe to Y		2.0V	50	86	108	129	ns		
			4.5V	12	19	24	29	ns		
			6.0V	10	16	20	24	ns		
$t_{TLH}, t_{THL}$	Maximum Output Rise and Fall Time		2.0V	30	75	95	110	ns		
			4.5V	8	15	19	22	ns		
			6.0V	7	13	16	19	ns		
$C_{IN}$	Maximum Input Capacitance			5	10	10	10	pF		
$C_{PD}$	Power Dissipation Capacitance	(Note 5)(per package) Outputs Enabled Outputs Disabled		90				pF		
				25				pF		

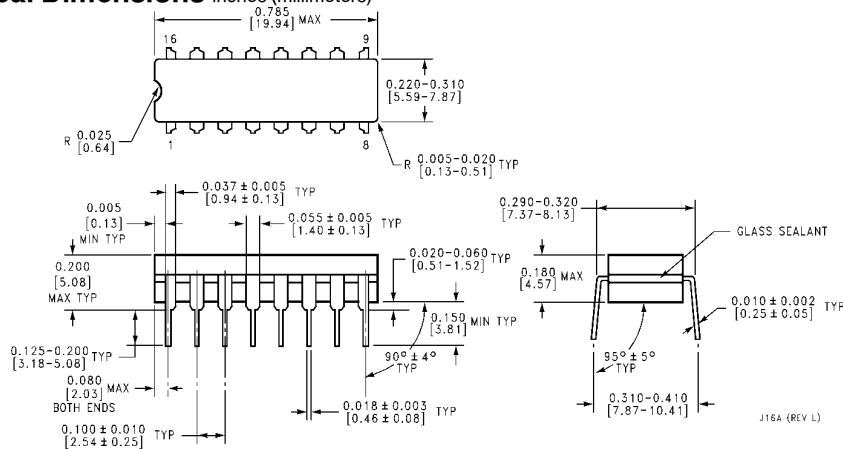
Note 5:  $C_{PD}$  determines the no load dynamic power consumption,  $P_D=C_{PD} V_{CC}^2 f+I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S=C_{PD} V_{CC} f+I_{CC}$ .

### Logic Diagram

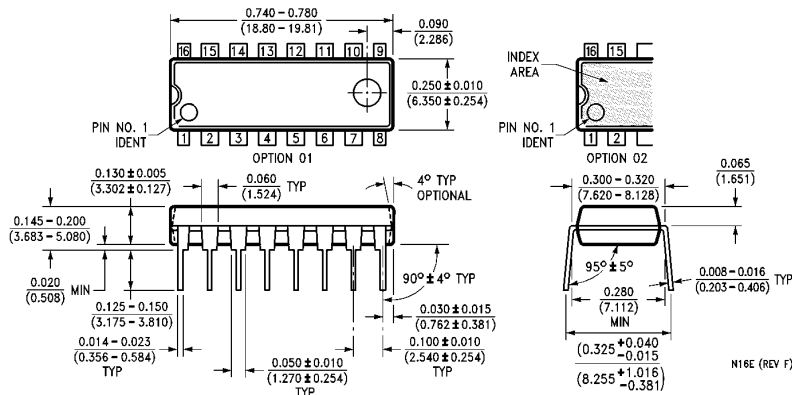


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**Physical Dimensions** inches (millimeters)



**Ceramic Dual-In-Line Package (J)**  
**Order Number MM54HC153J or MM74HC153J**  
**NS Package J16A**



**Molded Dual-In-Line Package (N)**  
**Order Number MM74HC153N**  
**NS Package N16E**

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