

# MM54HC253/MM74HC253

## Dual 4-Channel TRI-STATE® Multiplexer

### General Description

The MM54HC253/MM74HC253 utilizes advanced silicon-gate CMOS technology to achieve the low power consumption and high noise immunity of standard CMOS integrated circuits, along with the capability to drive 10 LS-TTL loads. The large output drive and TRI-STATE features of this device make it ideally suited for interfacing with bus lines in bus organized systems. When the output control input is taken high, the multiplexer outputs are sent into a high impedance state.

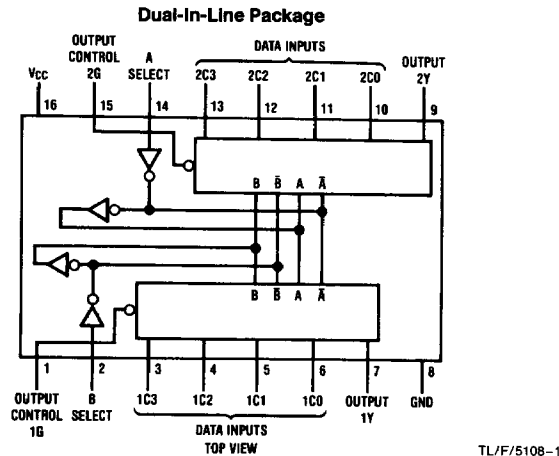
When the output control is held low, the associated multiplexer chooses the correct output channel for the given input signals determined by the select A and B inputs.

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				Output Control	Output
B	A	C0	C1	C2	C3	G	Y
X	X	X	X	X	X	H	Z
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 = irrelevant, Z = high impedance (off).

**Absolute Maximum Ratings** (Notes 1 & 2)

If Military/Aerospace specified devices are required, 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 $T_A = -40$ to $85^\circ C$		54HC $T_A = -55$ to $125^\circ C$		Units
				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	5.7	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		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu A$		
$I_{OZ}$	Maximum TRI-STATE Output Leakage Current	Strobe = $V_{CC}$ $V_{OUT} = V_{CC}$ or GND	6.0V		$\pm 0.5$	$\pm 5.0$	$\pm 10$	$\mu A$		
$I_{CC}$	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 85°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 $V_{CC} = 5V, T_A = 25^{\circ}C, t_r = t_f = 6 ns, C_L = 15 pF$

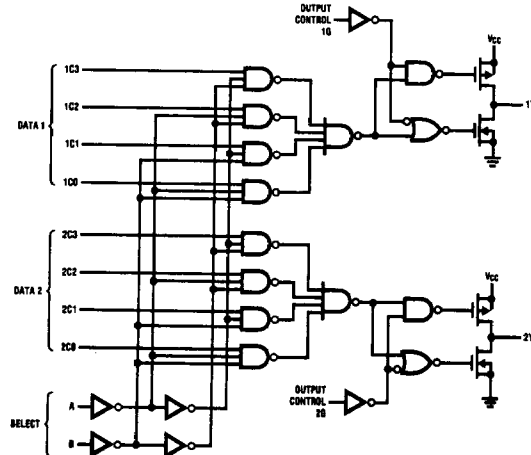
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select A or B to Y		24	30	ns
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, any Data to Y		18	23	ns
$t_{PZH}, t_{PZL}$	Maximum Output Enable Time Y Output to a Logic Level	$R_L = 1 k\Omega$	13	18	ns
$t_{PHZ}, t_{PLZ}$	Maximum Output Disable Time Y Output to High Impedance State	$R_L = 1 k\Omega$	18	27	ns

### AC Electrical Characteristics $C_L = 50 pF, t_r = t_f = 6 ns$ (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					
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select A or B to Y		2.0V	131	158	198		237		ns
			4.5V	29	35	44		53		ns
			6.0V	24	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
$t_{PZH}, t_{PZL}$	Maximum Output Enable Time	$R_L = 1 k\Omega$	2.0V	63	90	113		135		ns
			4.5V	14	20	25		30		ns
			6.0V	12	17	21		26		ns
$t_{PHZ}, t_{PLZ}$	Maximum Output Disable Time	$R_L = 1 k\Omega$	2.0V	90	135	169		203		ns
			4.5V	20	30	38		45		ns
			6.0V	17	25	31		38		ns
$t_{THL}, t_{TLH}$	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		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



TL/F/5108-2