

# MM54HC257/MM74HC257 Quad 2-Channel TRI-STATE® Multiplexer

## General Description

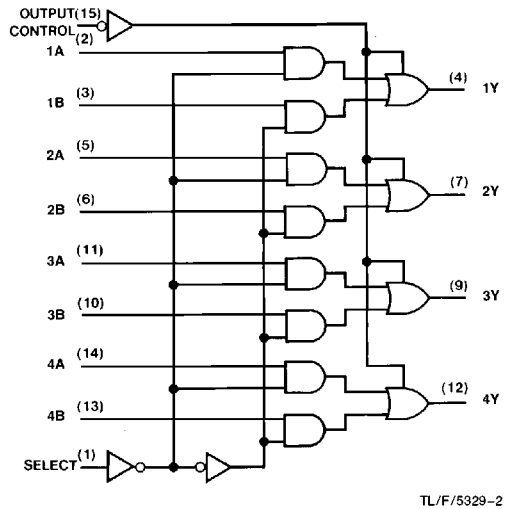
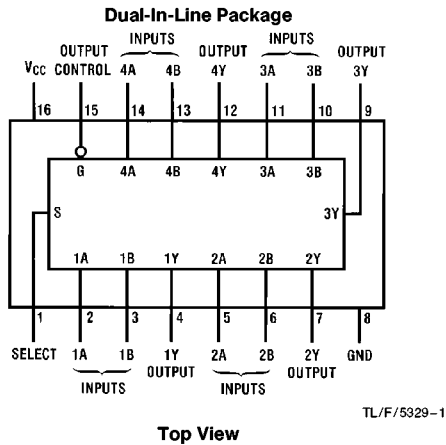
This QUAD 2-TO-1 line data selector/multiplexer utilizes advanced silicon-gate CMOS technology. Along with the high noise immunity and low power dissipation of standard CMOS integrated circuits, it possesses the ability to drive up to 15 LS-TTL loads. The large output drive capability coupled with the TRI-STATE feature make this device ideal for interfacing with bus lines in a bus organized system. When the OUTPUT CONTROL input line is taken high, the outputs of all four multiplexers are sent into a high impedance state. When the OUTPUT CONTROL line is low, the SELECT input chooses whether the A or B input is used.

The 54HC/74HC logic family is speed, function, and pin-out 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: 12 ns
- Wide power supply range: 2V–6V
- Low quiescent current: 80  $\mu$ A maximum (74HC Series)
- TRI-STATE outputs for connection to system buses.

## Connection and Logic Diagrams



## Truth Table

Output Control	Inputs		Output Y
	Select	A	
H	X	X	X
L	L	L	L
L	L	H	H
L	H	X	L
L	H	X	H

H = high level, L = low level, X = irrelevant, Z = high impedance, (off)

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## 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 ( $I_{OUT}$ )	$\pm 35$ mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	$\pm 70$ 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 Temp. ( $T_L$ ) (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	1.5	V		
			4.5V		3.15	3.15	3.15	3.15	V		
			6.0V		4.2	4.2	4.2	4.2	V		
$V_{IL}$	Maximum Low Level Input Voltage**		2.0V		0.5	0.5	0.5	0.5	V		
			4.5V		1.35	1.35	1.35	1.35	V		
			6.0V		1.8	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	1.9	V		
			4.5V	4.5	4.4	4.4	4.4	4.4	V		
			6.0V	6.0	5.9	5.9	5.9	5.9	V		
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 6.0$ mA $ I_{OUT}  \leq 7.8$ mA	4.5V	4.2	3.98	3.84	3.7	3.7	V		
			6.0V	5.7	5.48	5.34	5.2	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	0.1	V		
			4.5V	0	0.1	0.1	0.1	0.1	V		
			6.0V	0	0.1	0.1	0.1	0.1	V		
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 6.0$ mA $ I_{OUT}  \leq 7.8$ mA	4.5V	0.2	0.26	0.33	0.4	0.4	V		
			6.0V	0.2	0.26	0.33	0.4	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	$V_{OUT} = V_{CC}$ or GND $OC = V_{IH}$	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 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 ( $I_{IN}$ ,  $I_{OZ}$ , and  $I_{CC}$ ) 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**  $V_{CC}=5V, T_A=25^{\circ}C, t_r=t_f=6\text{ ns}$ 

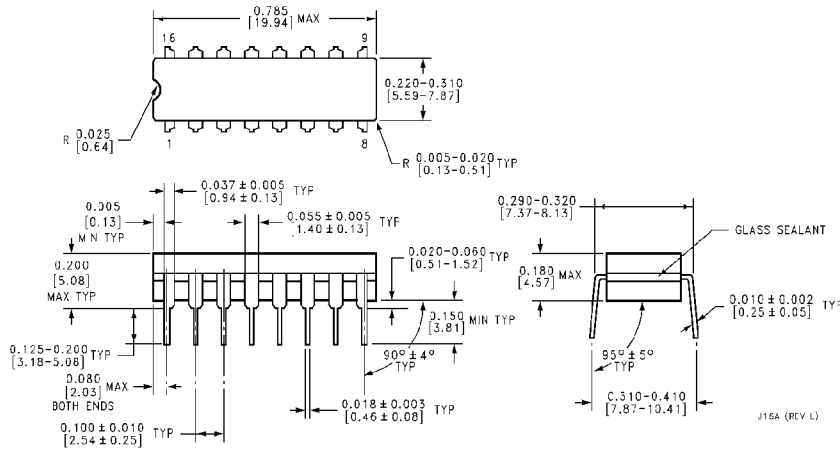
Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select to any Y Output	$C_L=45\text{ pF}$	12	18	ns
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, A or B to any Y Output	$C_L=50\text{ pF}$	13	21	ns
$t_{PZH}, t_{PZL}$	Maximum Output Enable Time, any Y Output to a Logic Level	$R_L=1\text{ k}\Omega$ $C_L=45\text{ pF}$	17	28	ns
$t_{PHZ}, t_{PLZ}$	Maximum Output Disable Time, any Y Output to a High Impedance State	$R_L=1\text{ k}\Omega$ $C_L=5\text{ pF}$	15	25	ns

**AC Electrical Characteristics**  $V_{CC}=2.0V\text{ to }6.0V, C_L=50\text{ pF}, t_r=t_f=6\text{ ns}$  (unless otherwise specified)

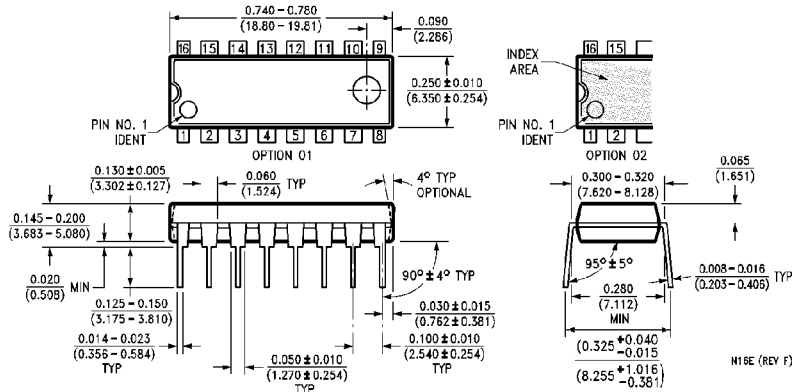
Symbol	Parameter	Conditions	$V_{CC}$	$T_A=25^{\circ}C$		74HC	54HC	Units
						$T_A=-40\text{ to }85^{\circ}C$	$T_A=-55\text{ to }125^{\circ}C$	
				Typ	Guaranteed Limits			
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, Select to any Y Output	$C_L=50\text{ pF}$	2.0V	50	100	125	150	ns
			2.0V	70	150	189	224	ns
		$C_L=150\text{ pF}$	4.5V	10	20	25	30	ns
			4.5V	15	30	38	45	ns
$t_{PHL}, t_{PLH}$	Maximum Propagation Delay, A or B to any Y Output	$C_L=50\text{ pF}$	6.0V	9	17	21	25	ns
			6.0V	13	26	32	38	ns
		$C_L=150\text{ pF}$	4.5V	10	20	29	30	ns
			4.5V	15	30	38	45	ns
$t_{PZH}, t_{PZL}$	Maximum Output Enable Time, any Y Output to a Logic Level	$R_L=1\text{ k}\Omega$	2.0V	75	150	189	224	ns
			2.0V	100	200	252	298	ns
		$C_L=50\text{ pF}$	4.5V	15	30	38	45	ns
			4.5V	20	40	50	60	ns
$t_{PHZ}, t_{PLZ}$	Maximum Output Disable Time, any Y Output to a High Impedance State	$R_L=1\text{ k}\Omega$	6.0V	13	26	32	38	ns
			6.0V	17	34	43	51	ns
		$C_L=50\text{ pF}$	2.0V	75	150	189	224	ns
			4.5V	15	30	38	45	ns
$t_{THL}, t_{TLH}$	Maximum Output Rise and Fall Time	$C_L=50\text{ pF}$	6.0V	10	10	13	15	ns
			4.5V	12	15	15	18	ns
			2.0V	60	75	90	90	ns
$C_{PD}$	Power Dissipation Capacitance (Note 5)	(per mux) Enable Disabled		30 8				pF pF
$C_{IN}$	Maximum Input Capacitance			5	10	10	10	pF
$C_{OUT}$	Maximum Output Capacitance			10	20	20	20	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,  $I_S=C_{PD} V_{CC} f + I_{CC}$ .

**Physical Dimensions** inches (millimeters)



**Order Number MM54HC257J or MM74HC257J  
NS Package J16A**



**Order Number MM74HC257N  
NS Package N16E**

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