

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.

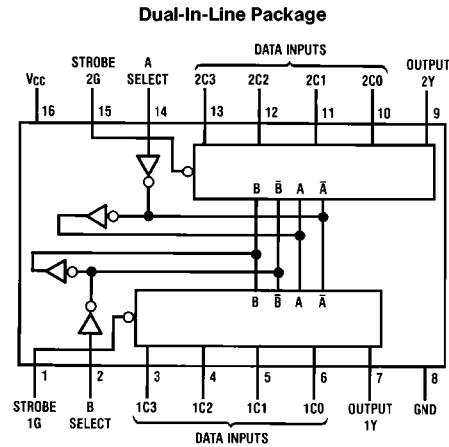
The 54HC/74HC logic family is functionally and pinout compatible with the standard 54LS/74LS logic family. All inputs

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 μ A maximum (74HC Series)
- Low input current: 1 μ A maximum
- Fanout of 10 LS-TTL loads

Connection Diagram



TL/F/5107-1

Top View

Order Number MM54HC153 or MM74HC153

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.

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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}) | ± 20 mA |
| DC Output Current, per pin (I_{OUT}) | ± 25 mA |
| DC V_{CC} or GND Current, per pin (I_{CC}) | ± 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 | | ± 0.1 | ± 1.0 | ± 1.0 | μA | |
| I_{CC} | Maximum Quiescent Supply Current | $V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$ | 6.0V | | 8.0 | 80 | 160 | μA | |

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

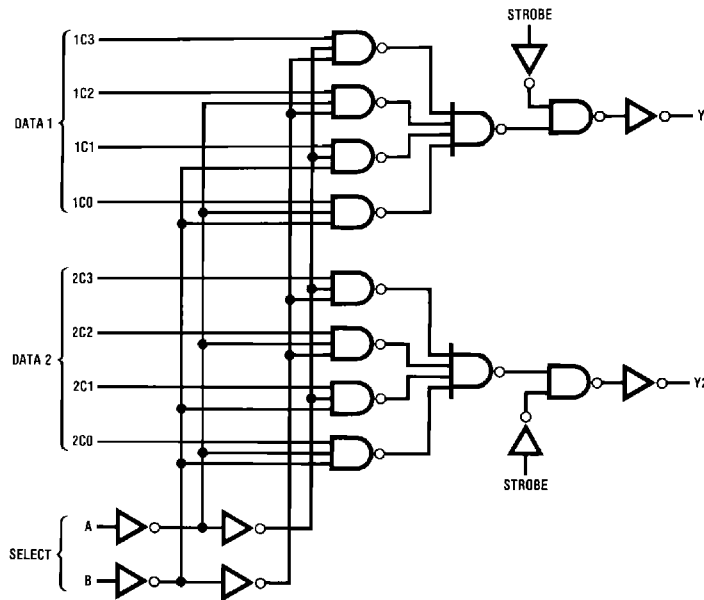
| Symbol | Parameter | Conditions | Typ | Guaranteed Limit | Units |
|-----------------------|---|------------|-----|------------------|-------|
| t_{PHL} , t_{PLH} | Maximum Propagation Delay, Select A or B to Y | | 26 | 30 | ns |
| t_{PHL} , t_{PLH} | Maximum Propagation Delay, any Data to Y | | 20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

AC Electrical Characteristics $C_L = 50$ pF, $t_r = t_f = 6$ ns (unless otherwise specified)

| 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 | | | |
| 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 | | 90 | | | | pF |
| | | | | 25 | | | | pF |

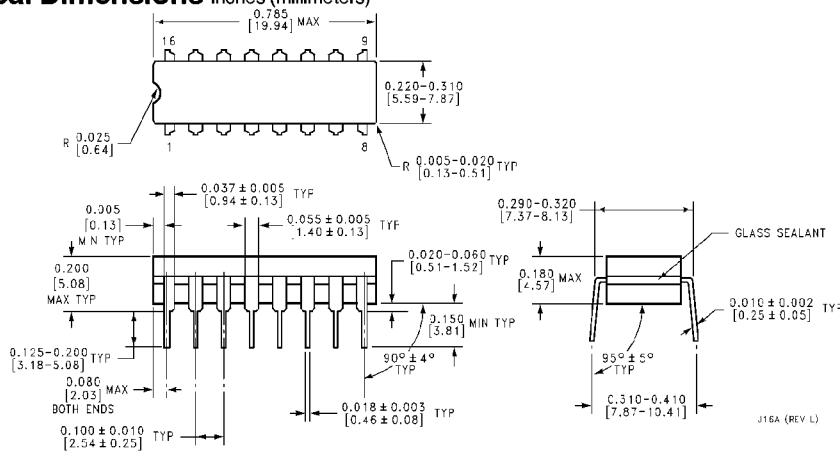
Note 5: C_{PD} determines the no load dynamic power consumption, $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$, and the no load dynamic current consumption, $I_S = C_{PD} V_{CC} f + I_{CC}$.

Logic Diagram

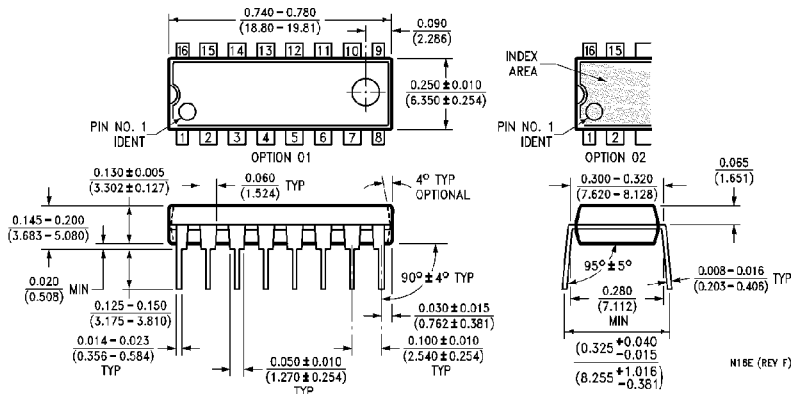


TL/F/5107-2

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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