

# MM54C240/MM74C240 Inverting MM54C244/MM74C244 Non-Inverting Octal Buffers and Line Drivers with TRI-STATE® Outputs

## General Description

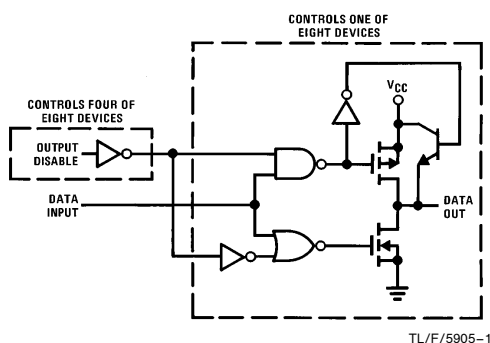
These octal buffers and line drivers are monolithic complementary MOS (CMOS) integrated circuits with TRI-STATE outputs. These outputs have been specially designed to drive highly capacitive loads such as bus-oriented systems. These devices have a fan out of 6 low power Schottky loads. A high logic level on the output disable control input G makes the outputs go into the high impedance state. For improved TTL input compatibility see MM74C941.

## Features

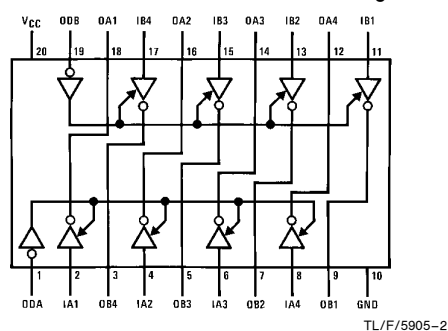
- Wide supply voltage range (3V to 15V)
- High noise immunity (0.45  $V_{CC}$  typ)
- Low power consumption
- High capacitive load drive capability
- TRI-STATE outputs
- Input protection
- TTL compatibility
- 20-pin dual-in-line package
- High speed 25 ns (typ.) @ 10V, 50 pF (MM74C244)

## Logic and Connection Diagrams

MM54C240/MM74C240



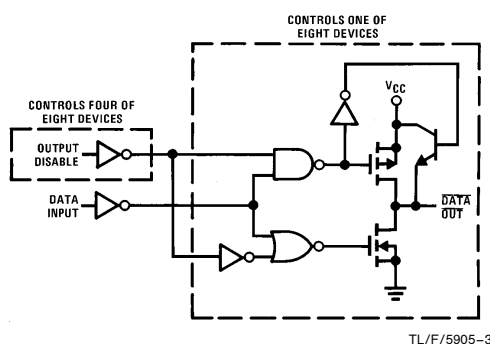
MM54C240/MM74C240 Dual-In-Line Package



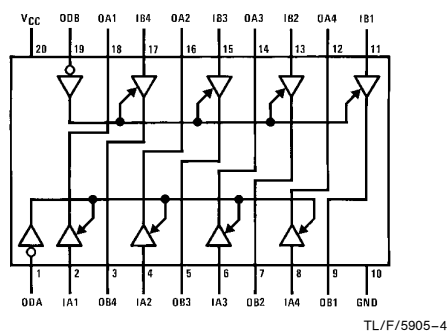
Top View

Order Number MM54C240 or MM74C240

MM54C244/MM74C244



MM54C244/MM74C244 Dual-In-Line Package



Top View

Order Number MM54C244 or MM74C244

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**Absolute Maximum Ratings** (Note 1)

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

|                             |                          |
|-----------------------------|--------------------------|
| Voltage at Any Pin          | −0.3V to $V_{CC} + 0.3V$ |
| Operating Temperature Range | −55°C to +125°C          |
| MM54C240, MM54C244          | −40°C to +85°C           |
| MM74C240, MM74C244          |                          |

|                                          |                 |
|------------------------------------------|-----------------|
| Storage Temperature Range                | −65°C to +150°C |
| Power Dissipation                        |                 |
| Dual-In-Line                             | 700 mW          |
| Small Outline                            | 500 mW          |
| Operating $V_{CC}$ Range                 | 3V to 15V       |
| Absolute Maximum $V_{CC}$                | 18V             |
| Lead Temperature (Soldering, 10 seconds) | 260°C           |

**DC Electrical Characteristics** Min/Max limits apply across temperature range, unless otherwise noted

| Symbol                                                                                      | Parameter                         | Conditions                                                                        | Min                              | Typ    | Max        | Units   |
|---------------------------------------------------------------------------------------------|-----------------------------------|-----------------------------------------------------------------------------------|----------------------------------|--------|------------|---------|
| <b>CMOS TO CMOS</b>                                                                         |                                   |                                                                                   |                                  |        |            |         |
| $V_{IN(1)}$                                                                                 | Logical “1” Input Voltage         | $V_{CC} = 5V$<br>$V_{CC} = 10V$                                                   | 3.5<br>8.0                       |        |            | V<br>V  |
| $V_{IN(0)}$                                                                                 | Logical “0” Input Voltage         | $V_{CC} = 5V$<br>$V_{CC} = 10V$                                                   |                                  |        | 1.5<br>2.0 | V<br>V  |
| $V_{OUT(1)}$                                                                                | Logical “1” Output Voltage        | $V_{CC} = 5V, I_O = -10 \mu A$<br>$V_{CC} = 10V, I_O = -10 \mu A$                 | 4.5<br>9.0                       |        |            | V<br>V  |
| $V_{OUT(0)}$                                                                                | Logical “0” Output Voltage        | $V_{CC} = 5V, I_O = 10 \mu A$<br>$V_{CC} = 10V, I_O = 10 \mu A$                   |                                  |        | 0.5<br>1.0 | V<br>V  |
| $I_{OZ}$                                                                                    | TRI-STATE Output Current          | $V_{CC} = 10V, OD = V_{IH}$                                                       |                                  |        | $\pm 10$   | $\mu A$ |
| $I_{IN(1)}$                                                                                 | Logical “1” Input Current         | $V_{CC} = 15V, V_{IN} = 15V$                                                      |                                  | 0.005  | 1.0        | $\mu A$ |
| $I_{IN(0)}$                                                                                 | Logical “0” Input Current         | $V_{CC} = 15V, V_{IN} = 0V$                                                       | −1.0                             | −0.005 |            | $\mu A$ |
| $I_{CC}$                                                                                    | Supply Current                    | $V_{CC} = 15V$                                                                    |                                  | 0.05   | 300        | $\mu A$ |
| <b>CMOS/LPTTL INTERFACE</b>                                                                 |                                   |                                                                                   |                                  |        |            |         |
| $V_{IN(1)}$                                                                                 | Logical “1” Input Voltage         | 54C, $V_{CC} = 4.5V$<br>74C, $V_{CC} = 4.75V$                                     | $V_{CC} - 1.5$<br>$V_{CC} - 1.5$ |        |            | V<br>V  |
| $V_{IN(0)}$                                                                                 | Logical “0” Input Voltage         | 54C, $V_{CC} = 4.5V$<br>74C, $V_{CC} = 4.75V$                                     |                                  |        | 0.8<br>0.8 | V<br>V  |
| $V_{OUT(1)}$                                                                                | Logical “1” Output Voltage        | 54C, $V_{CC} = 4.5V, I_O = -450 \mu A$<br>74C, $V_{CC} = 4.75V, I_O = -450 \mu A$ | $V_{CC} - 0.4$<br>$V_{CC} - 0.4$ |        |            | V<br>V  |
|                                                                                             |                                   | 54C, $V_{CC} = 4.5V, I_O = -2.2 mA$<br>74C, $V_{CC} = 4.75V, I_O = -2.2 mA$       | 2.4<br>2.4                       |        |            | V<br>V  |
| $V_{OUT(0)}$                                                                                | Logical “0” Output Voltage        | 54C, $V_{CC} = 4.5V, I_O = 2.2 mA$<br>74C, $V_{CC} = 4.75V, I_O = 2.2 mA$         |                                  |        | 0.4<br>0.4 | V<br>V  |
| <b>OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)</b> |                                   |                                                                                   |                                  |        |            |         |
| $I_{SOURCE}$                                                                                | Output Source Current (P-Channel) | $V_{CC} = 5V, V_{OUT} = 0V$<br>$T_A = 25^\circ C$                                 | −14                              | −30    |            | mA      |
|                                                                                             |                                   | $V_{CC} = 10V, V_{OUT} = 0V$<br>$T_A = 25^\circ C$                                | −36                              | −70    |            | mA      |
| $I_{SINK}$                                                                                  | Output Sink Current (N-Channel)   | $V_{CC} = 5V, V_{OUT} = V_{CC}$<br>$T_A = 25^\circ C$                             | 12                               | 20     |            | mA      |
|                                                                                             |                                   | $V_{CC} = 10V, V_{OUT} = V_{CC}$<br>$T_A = 25^\circ C$                            | 48                               | 70     |            | mA      |

**Note 1:** “Absolute Maximum Ratings” are those values beyond which the safety of the device cannot be guaranteed. Except for “Operating Range” they are not meant to imply that the devices should be operated at these limits. The table of “Electrical Characteristics” provides conditions for actual device operation.

## AC Electrical Characteristics\* $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , unless otherwise specified

| Symbol                              | Parameter                                                                                                 | Conditions                                                           | Min | Typ | Max | Units |
|-------------------------------------|-----------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------|-----|-----|-----|-------|
| $t_{PD(1)}$ , $t_{PD(0)}$           | Propagation Delay<br>(Data In to Out)<br>MM54C240/MM74C240                                                | $V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$                          |     | 60  | 90  | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$                         |     | 40  | 70  | ns    |
|                                     |                                                                                                           | $V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$                         |     | 80  | 110 | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$                        |     | 60  | 90  | ns    |
|                                     | MM54C244/MM74C244                                                                                         | $V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$                          |     | 45  | 70  | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$                         |     | 25  | 50  | ns    |
| $t_{1H}$ , $t_{0H}$                 | Propagation Delay Output<br>Disable to High Impedance<br>State (from a Logic Level)                       | $R_L = 1\text{k}$ , $C_L = 50\text{ pF}$                             |     | 45  | 80  | ns    |
|                                     |                                                                                                           | $V_{CC} = 5\text{V}$                                                 |     | 35  | 60  | ns    |
| $t_{H1}$ , $t_{H0}$                 | Propagation Delay Output<br>Disable to Logic Level<br>(from High Impedance State)                         | $R_L = 1\text{k}$ , $C_L = 50\text{ pF}$                             |     | 50  | 90  | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$                                                |     | 30  | 60  | ns    |
| $t_T(\text{HL})$ , $t_T(\text{LH})$ | Transition Time                                                                                           | $V_{CC} = 5\text{V}$ , $C_L = 50\text{ pF}$                          |     | 45  | 80  | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$ , $C_L = 50\text{ pF}$                         |     | 30  | 60  | ns    |
|                                     |                                                                                                           | $V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$                         |     | 75  | 140 | ns    |
|                                     |                                                                                                           | $V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$                        |     | 50  | 100 | ns    |
| $C_{PD}$                            | Power Dissipation<br>Capacitance<br>(Output Enabled per Buffer)<br>MM54C240/MM74C240<br>MM54C244/MM74C244 | (Note 3)                                                             |     |     |     |       |
|                                     |                                                                                                           |                                                                      |     | 100 |     | pF    |
|                                     | (Output Disabled per Buffer)<br>MM54C240/MM74C240<br>MM54C244/MM74C244                                    |                                                                      |     | 10  |     | pF    |
|                                     |                                                                                                           |                                                                      |     | 0   |     | pF    |
| $C_{IN}$                            | Input Capacitance<br>(Any Input)                                                                          | $V_{IN} = 0\text{V}$ , $f = 1\text{ MHz}$ , $T_A = 25^\circ\text{C}$ |     | 10  |     | pF    |
| $C_O$                               | Output Capacitance<br>(Output Disabled)                                                                   | $V_{IN} = 0\text{V}$ , $f = 1\text{ MHz}$ , $T_A = 25^\circ\text{C}$ |     | 10  |     | pF    |

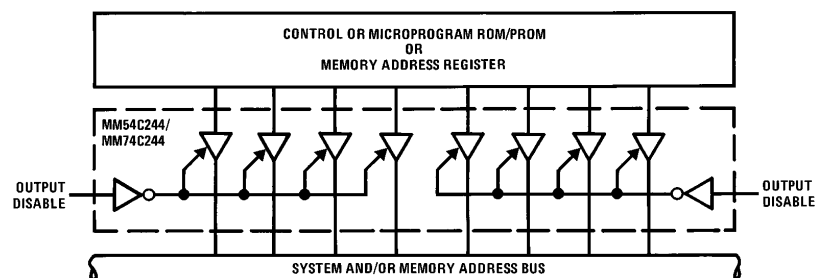
\*AC Parameters are guaranteed by DC correlated testing.

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

**Note 2:** Capacitance is guaranteed by periodic testing.

**Note 3:**  $C_{PD}$  determines the no load AC power consumption of any CMOS device. For complete explanation see 54C/74C Family Characteristics Application Note, AN-90.

## Typical Application



TL/F/5905-5

## Truth Tables

MM54C240/MM74C240

| ODA | IA | OA |
|-----|----|----|
| 1   | X  | Z  |
| 1   | X  | Z  |
| 0   | 0  | 1  |
| 0   | 1  | 0  |

| ODB | IB | OB |
|-----|----|----|
| 1   | X  | Z  |
| 1   | X  | Z  |
| 0   | 0  | 1  |
| 0   | 1  | 0  |

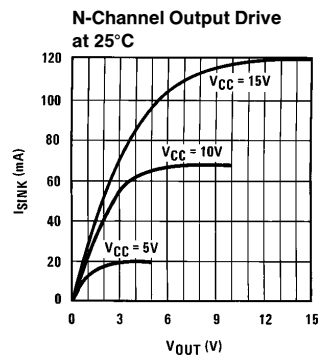
MM54C244/MM74C244

| ODA | IA | OA |
|-----|----|----|
| 1   | X  | Z  |
| 1   | X  | Z  |
| 0   | 0  | 0  |
| 0   | 1  | 1  |

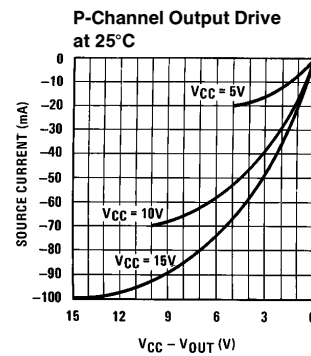
| ODB | IB | OB |
|-----|----|----|
| 1   | X  | Z  |
| 1   | X  | Z  |
| 0   | 0  | 0  |
| 0   | 1  | 1  |

1 = High  
0 = Low  
X = Don't Care  
Z = TRI-STATE

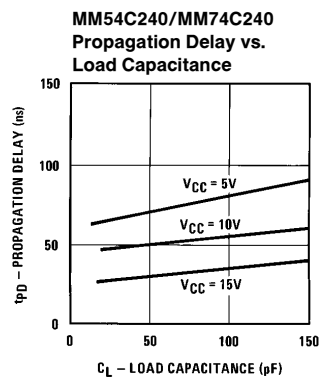
## Typical Performance Characteristics



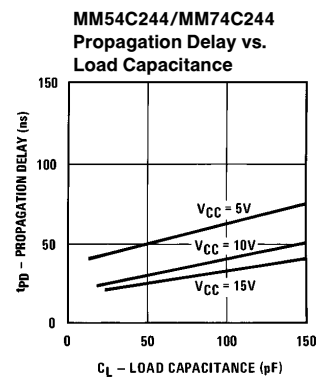
TL/F/5905-6



TL/F/5905-7



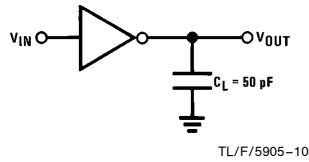
TL/F/5905-8



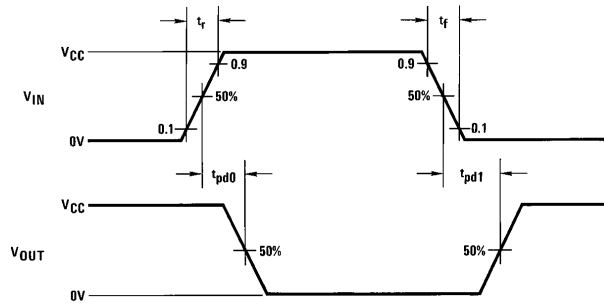
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## AC Test Circuits and Switching Time Waveforms

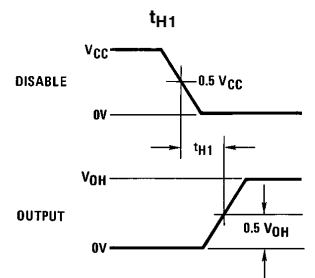
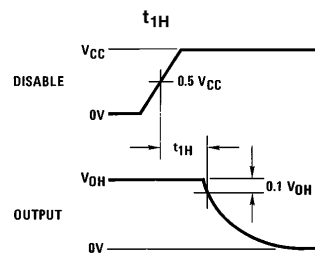
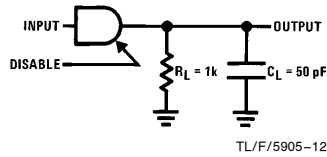
$t_{pd0}$ ,  $t_{pd1}$



CMOS to CMOS

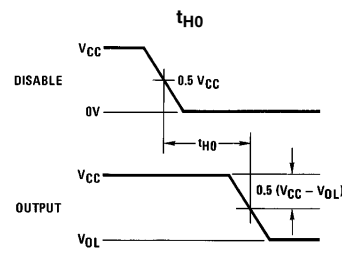
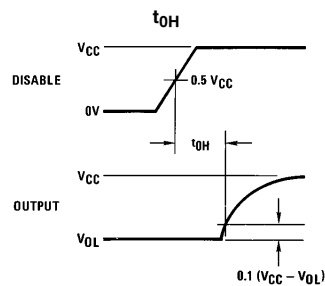
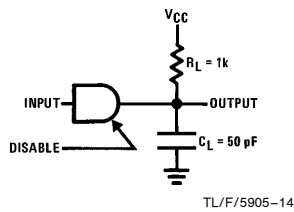


$t_{1H}$  and  $t_{H1}$



**Note:**  $V_{OH}$  is defined as the DC output high voltage when the device is loaded with a 1 k $\Omega$  resistor to ground.

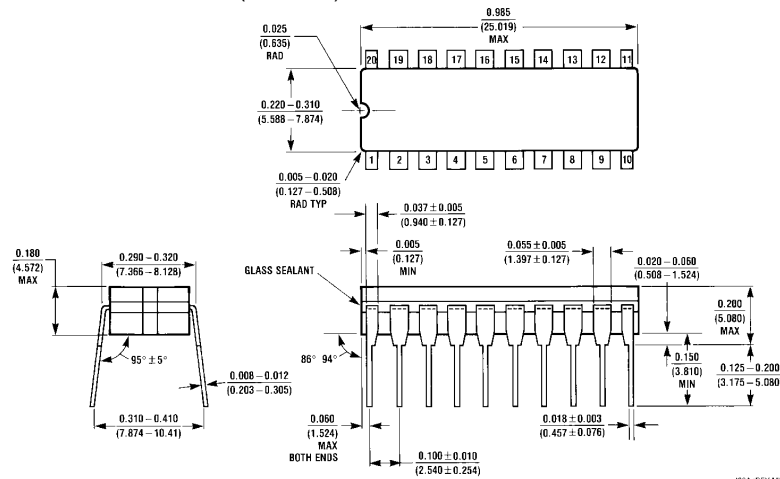
$t_{0H}$  and  $t_{H0}$



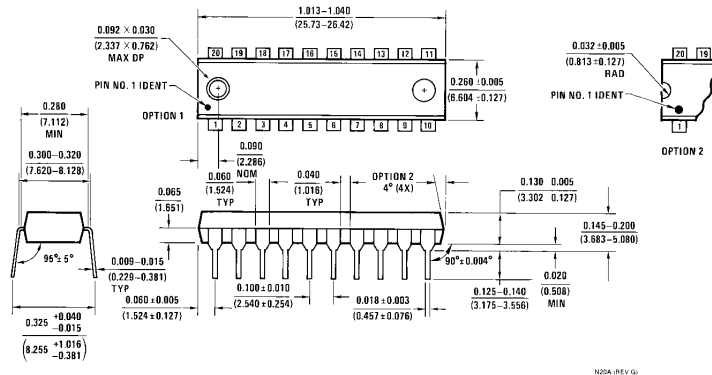
**Note:**  $V_{OL}$  is defined as the DC output low voltage when the device is loaded with a 1 k $\Omega$  resistor to  $V_{CC}$ .

**Note:** Delays measured with input  $t_r$ ,  $t_f \leq 20$  ns.

## Physical Dimensions inches (millimeters)



**Ceramic Dual-In-Line Package (J)**  
Order Number MM54C240J, MM54C244J, MM74C240J or MM74C244J  
See NS Package Number J20A



**Molded Dual-In-Line Package (N)**  
Order Number MM54C240N, MM54C244N, MM74C240N or MM74C244N  
See NS Package Number N20A

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