

## MM54C86/MM74C86 Quad 2-Input EXCLUSIVE-OR Gate

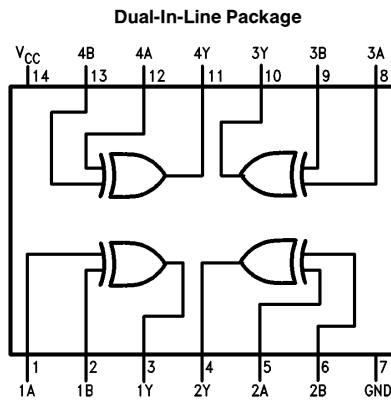
### General Description

Employing complementary MOS (CMOS) transistors to achieve wide power supply operating range, low power consumption and high noise margin these gates provide basic functions used in the implementation of digital integrated circuit systems. The N- and P-channel enhancement mode transistors provide a symmetrical circuit with output swing essentially equal to the supply voltage. No DC power other than that caused by leakage current is consumed during static condition. All inputs are protected from damage due to static discharge by diode clamps to  $V_{CC}$  and GND.

### Features

- Wide supply voltage range 3.0V to 15V
- Guaranteed noise margin 1.0V
- High noise immunity  $0.45 V_{CC}$  (typ.)
- Low power Fan out of 2 driving 74L
- TTL compatibility
- Low power consumption 10 nW/package (typ.)
- The MM54C86/MM74C86 follows the MM54LS86/MM74LS86 Pinout

### Connection Diagram



TL/F/5887-1

Order Number MM54C86 or MM74C86

### Truth Table

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | L      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

H = High Level    L = Low Level

## Absolute Maximum Ratings

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

|                             |                          |
|-----------------------------|--------------------------|
| Voltage at any Pin (Note 1) | -0.3V to $V_{CC} + 0.3V$ |
| Operating Temperature Range | -55°C to +125°C          |
| MM54C86                     | -40°C to +85°C           |
| MM74C86                     | -65°C to +150°C          |

|  |             |
|--|-------------|
| Power Dissipation ( $P_D$ )              | 700 mW      |
| Dual-In-Line Package                     | 500 mW      |
| Small Outline                            | 3.0V to 15V |
| Operating Range ( $V_{CC}$ )             | 18V         |
| Absolute Maximum ( $V_{CC}$ )            | 260°C       |
| Lead Temperature (Soldering, 10 seconds) |             |

## 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  | $V_{CC} = 5.0V$<br>$V_{CC} = 10V$                                   | 3.5<br>8.0 |        |            | V<br>V  |
| $V_{IN(0)}$         | Logical "0" Input Voltage  | $V_{CC} = 5.0V$<br>$V_{CC} = 10V$                                   |            |        | 1.5<br>2.0 | V<br>V  |
| $V_{OUT(1)}$        | Logical "1" Output Voltage | $V_{CC} = 5.0V, I_O = -10 \mu A$<br>$V_{CC} = 10V, I_O = -10 \mu A$ | 4.5<br>9.0 |        |            | V<br>V  |
| $V_{OUT(0)}$        | Logical "0" Output Voltage | $V_{CC} = 5.0V, I_O = +10 \mu A$<br>$V_{CC} = 10V, I_O = +10 \mu A$ |            |        | 0.5<br>1.0 | V<br>V  |
| $I_{IN(1)}$         | 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             | $V_{CC} = 15V$  |            | 0.01   | 15         | $\mu A$ |

### CMOS/LPTTL INTERFACE

|              |                            |   |                                  |  |            |        |
|--------------|----------------------------|---|----------------------------------|--|------------|--------|
| $V_{IN(1)}$  | 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, $V_{CC} = 4.5V, I_O = -360 \mu A$<br>74C, $V_{CC} = 4.75V, I_O = -360 \mu A$ | 2.4<br>2.4                       |  |            | V<br>V |
| $V_{OUT(0)}$ | Logical "0" Output Voltage | 54C, $V_{CC} = 4.5V, I_O = 360 \mu A$<br>74C, $V_{CC} = 4.75V, I_O = 360 \mu A$   |                                  |  | 0.4<br>0.4 | V<br>V |

### OUTPUT DRIVE (See 54/74C Family Characteristics Data Sheet) (Short Circuit Current)

|              |                                   |   |       |      |  |    |
|--------------|-----------------------------------|---|-------|------|--|----|
| $I_{SOURCE}$ | Output Source Current (P-Channel) | $V_{CC} = 5.0V, V_{OUT} = 0V$<br>$T_A = 25^\circ C$     | -1.75 | -3.3 |  | mA |
| $I_{SOURCE}$ | Output Source Current (P-Channel) | $V_{CC} = 10V, V_{OUT} = 0V$<br>$T_A = 25^\circ C$      | -8.0  | -15  |  | mA |
| $I_{SINK}$   | Output Sink Current (N-Channel)   | $V_{CC} = 5.0V, V_{OUT} = V_{CC}$<br>$T_A = 25^\circ C$ | 1.75  | 3.6  |  | mA |
| $I_{SINK}$   | Output Sink Current (N-Channel)   | $V_{CC} = 10V, V_{OUT} = V_{CC}$<br>$T_A = 25^\circ C$  | 8.0   | 16   |  | mA |

**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature 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\* (MM54C86/MM74C86) $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , unless otherwise specified

| Symbol   | Parameter                              | Conditions                                      | Min | Typ       | Max       | Units |
|----------|--|---|-----|-----------|-----------|-------|
| $t_{pd}$ | Propagation Time to Logical "1" or "0" | $V_{CC} = 5.0\text{V}$<br>$V_{CC} = 10\text{V}$ |     | 110<br>50 | 185<br>90 | ns    |
| $C_{iN}$ | Input Capacitance                      | Note 2  |     | 5.0       |           | pF    |
| $C_{pD}$ | Power Dissipation Capacitance          | (Note 3) Per Gate                               |     | 20        |           | pF    |

\*AC Parameters are guaranteed by DC correlated testing.

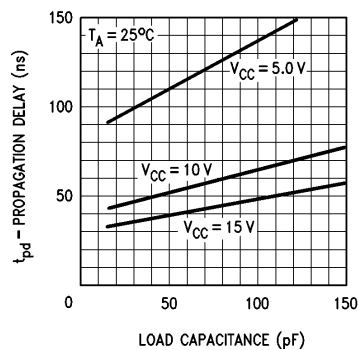
**Note 1:** "Absolute Maximum Ratings" are those values beyond which the safety of the device cannot be guaranteed. Except for "Operating Temperature Range" they are not meant to imply that the devices should be operated at these limits. The table of "Electrical Characteristics" provides conditions for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

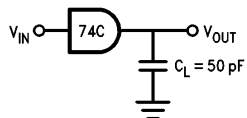
## Typical Performance Characteristics

Propagation Delay Time vs Load Capacitance  
MM54C86/MM74C86



TL/F/5887-2

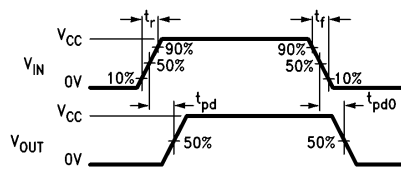
## AC Test Circuit



TL/F/5887-3

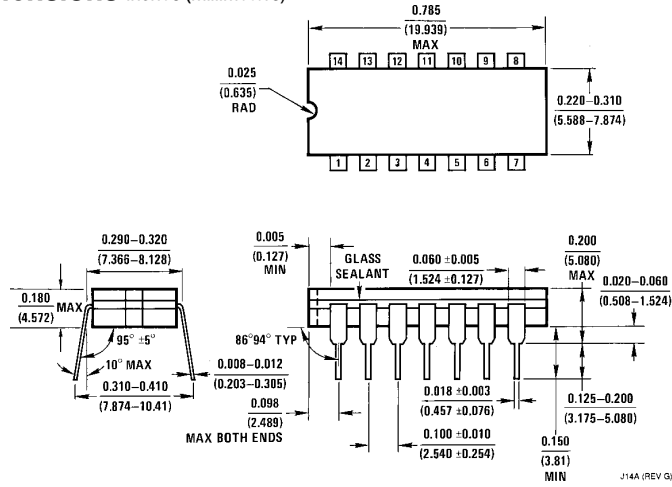
**Note:** Delays Measured with Input  $t_r$ ,  $t_f = 20\text{ ns}$

## Switching Time Waveforms

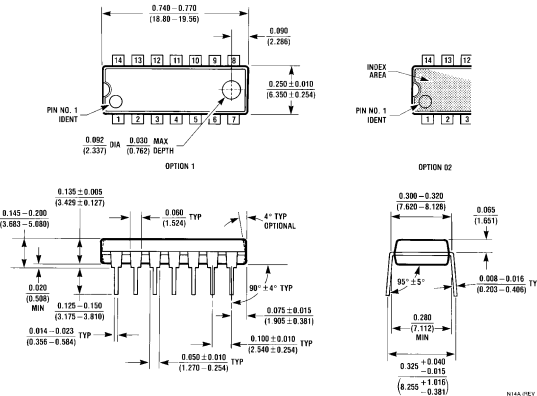


TL/F/5887-4

**Physical Dimensions** inches (millimeters)



**Ceramic Dual-In-Line Package (J)**  
**Order Number MM54C86J or MM74C86J**  
**NS Package Number J14A**



**Molded Dual-In-Line Package (N)**  
**Order Number MM54C86N or MM74C86N**  
**NS Package Number N14A**

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