FAIRCHILD SEMICONDUCTOR™

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# MM80C95 • MM80C97 • MM80C98
# 3-STATE Hex Buffers • 3-STATE Hex Inverters

## General Description

The MM80C95, MM80C97 and MM80C98 gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. The MM80C95 and the MM80C97 convert CMOS or TTL outputs to 3-STATE outputs with no logic inversion, the MM80C98 provides the logical opposite of the input signal. The MM80C95 has common 3-STATE controls for all six devices. The MM80C97 and the MM80C98 have two 3-STATE controls; one for two devices and one for the other four devices. 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.)
- TTL compatible: Drive 1 TTL Load

## Applications

- Bus drivers: Typical propagation delay into 150 pF load is 40 ns

## Ordering Code:

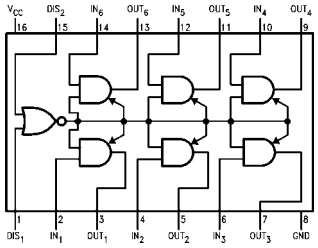
| Order Number | Package Number | Package Description |
|---|---|---|
| MM80C95N | N16E | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |
| MM80C97M | M16A | 16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150" Narrow |
| MM80C97N | N16E | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |
| MM80C98N | N16E | 16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide |

Devices also available in Tape and Reel. Specify by appending the suffix letter "X" to the ordering code.

## Connection Diagrams

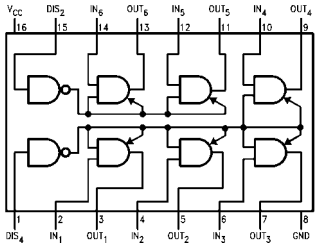
**Pin Assignments for DIP**

**MM80C95**



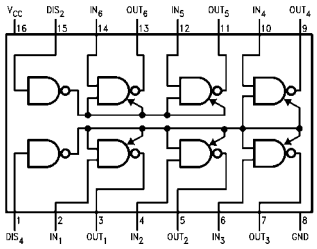

**Top View**

**MM80C97**




**Top View**

**MM80C98**




**Top View**

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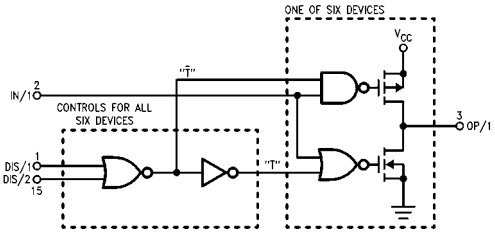
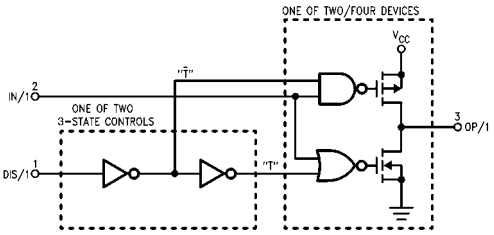
## Schematic Diagrams

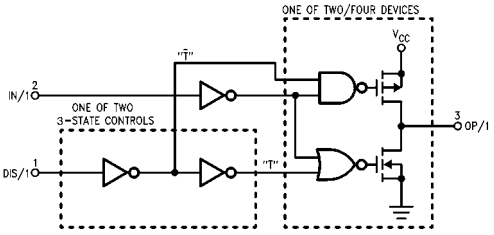
**MM80C95 3-STATE**




**MM80C97 3-STATE**




**MM80C98 3-STATE**




## Truth Tables

**MM80C95**

| Disable $DIS_1$ | Input $DIS_2$ | Input | Output |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| 0 | 1 | X | H-z |
| 1 | 0 | X | H-z |
| 1 | 1 | X | H-z |

**MM80C97**

| Disable $DIS_4$ | Input $DIS_2$ | Input | Output |
|---|---|---|---|
| 0 | 0 | 0 | 0 |
| 0 | 0 | 1 | 1 |
| X | 1 | X | H-z (Note 1) |
| 1 | X | X | H-z (Note 2) |

**MM80C98**

| Disable $DIS_4$ | Input $DIS_2$ | Input | Output |
|---|---|---|---|
| 0 | 0 | 0 | 1 |
| 0 | 0 | 1 | 0 |
| X | 1 | X | H-z (Note 1) |
| 1 | X | X | H-z (Note 2) |

X = Irrelevant

**Note 1:** Output 5–6 only

**Note 2:** Output 1–4 only

## Absolute Maximum Ratings (Note 3)

| | |
|---|---|
| Voltage at Any Pin | −0.3V to $V_{CC}$ + 0.3V |
| Operating Temperature Range | −40°C to +85°C |
| Storage Temperature Range | −65°C to +150°C |
| Power Dissipation ($P_D$) | |
| Dual-In-Line | 700 mW |
| Small Outline | 500 mW |
| Power Supply Voltage ($V_{CC}$) | 18V |
| Lead Temperature | |
| (Soldering, 10 seconds) | 260°C |

**Note 3:** "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 device should be operated at these limits. The table of "Electrical Characteristics" provides conditions for actual device operation.

## DC Electrical Characteristics

Min/Max limits apply across temperature range unless otherwise noted

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| **CMOS TO CMOS** | | | | | | |
| $V_{IN(1)}$ | Logical "1" Input Voltage | $V_{CC}$ = 5V | 3.5 | | | V |
| | | $V_{CC}$ = 10V | 8.0 | | | V |
| $V_{IN(0)}$ | Logical "0" Input Voltage | $V_{CC}$ = 5V | | | 1.5 | V |
| | | $V_{CC}$ = 10V | | | 2.0 | V |
| $V_{OUT(1)}$ | Logical "1" Output Voltage | $V_{CC}$ = 5V | 4.5 | | | V |
| | | $V_{CC}$ = 10V | 9.0 | | | V |
| $V_{OUT(0)}$ | Logical "0" Output Voltage | $V_{CC}$ = 5V | | | 0.5 | V |
| | | $V_{CC}$ = 10V | | | 1.0 | V |
| $I_{IN(1)}$ | Logical "1" Input Current | $V_{CC}$ = 15V | | 0.005 | 1.0 | µA |
| $I_{IN(0)}$ | Logical "0" Input Current | | −1.0 | −0.005 | | µA |
| $I_{OZ}$ | Output Current in High | $V_{CC}$ = 15V, $V_O$ = 15V | | 0.005 | 1.0 | µA |
| | Impedance State | $V_{CC}$ = 15V, $V_O$ = 0V | −1.0 | −0.005 | | µA |
| $I_{CC}$ | Supply Current | $V_{CC}$ = 15V | | 0.01 | 15 | µA |
| **TTL INTERFACE** | | | | | | |
| $V_{IN(1)}$ | Logical "1" Input Voltage | $V_{CC}$ = 4.75V | $V_{CC}$ − 1.5 | | | V |
| $V_{IN(0)}$ | Logical "0" Input Voltage | $V_{CC}$ = 4.75V | | | 0.8 | V |
| $V_{OUT(1)}$ | Logical "1" Output Voltage | $V_{CC}$ = 4.75V, | 2.4 | | | V |
| | | $I_O$ = −1.6 mA | | | | |
| $V_{OUT(0)}$ | Logical "0" Output Voltage | $V_{CC}$ = 4.75V, | | | 0.4 | V |
| | | $I_O$ = 1.6 mA | | | | |
| **OUTPUT DRIVE (Short Circuit Current)** | | | | | | |
| $I_{SOURCE}$ | Output Source Current | $V_{CC}$ = 5V, $V_{IN(1)}$ = 5V | −4.35 | | | mA |
| | | $T_A$ = 25°C, $V_{OUT}$ = 0V | | | | |
| $I_{SOURCE}$ | Output Source Current | $V_{CC}$ = 10V, $V_{IN(1)}$ = 10V | −20 | | | mA |
| | | $T_A$ = 25°C, $V_{OUT}$ = 0V | | | | |
| $I_{SINK}$ | Output Sink Current | $V_{CC}$ = 5V, $V_{IN(0)}$ = 0V | 4.35 | | | mA |
| | | $T_A$ = 25°C, $V_{OUT}$ = $V_{CC}$ | | | | |
| $I_{SINK}$ | Output Sink Current | $V_{CC}$ = 10V, $V_{IN(0)}$ = 0V | 20 | | | mA |
| | | $T_A$ = 25°C, $V_{OUT}$ = $V_{CC}$ | | | | |

## AC Electrical Characteristics (Note 4)

$T_A = 25°C$, $C_L = 50$ pF, unless otherwise noted.

| Symbol | Parameter | Conditions | Min | Typ | Max | Units |
|---|---|---|---|---|---|---|
| $t_{pd0}$, $t_{pd1}$ | Propagation Delay Time to a Logical "0" or Logical "1" from Data Input to Output | | | | | |
| | MM80C95, MM80C97 | $V_{CC} = 5V$ | | 60 | 100 | ns |
| | | $V_{CC} = 10V$ | | 25 | 40 | ns |
| | MM80C98 | $V_{CC} = 5V$ | | 70 | 150 | ns |
| | | $V_{CC} = 10V$ | | 35 | 75 | ns |
| $t_{pd0}$, $t_{pd1}$ | Propagation Delay Time to a Logical "0" or Logical "1" from Data Input to Output | | | | | |
| | MM80C95, MM80C97 | $V_{CC} = 5V$, $C_L = 150$ pF | | 85 | 160 | ns |
| | | $V_{CC} = 10V$, $C_L = 150$ pF | | 40 | 80 | ns |
| | MM80C98 | $V_{CC} = 5V$, $C_L = 150$ pF | | 95 | 210 | ns |
| | | $V_{CC} = 10V$, $C_L = 150$ pF | | 45 | 110 | ns |
| $t_{1H}$, $t_{0H}$ | Delay from Disable Input to High Impedance State, (from Logical "1" or Logical "0") | $R_L = 10k$, $C_L = 5$ pF | | | | |
| | MM80C95 | $V_{CC} = 5V$ | | 80 | 135 | ns |
| | | $V_{CC} = 10V$ | | 50 | 90 | ns |
| | MM80C97 | $V_{CC} = 5V$ | | 70 | 125 | ns |
| | | $V_{CC} = 10V$ | | 50 | 90 | ns |
| | MM80C98 | $V_{CC} = 5V$ | | 90 | 170 | ns |
| | | $V_{CC} = 10V$ | | 70 | 125 | ns |
| $t_{H1}$, $t_{H0}$ | Delay from Disable Input to Logical "1" Level (from High Impedance State) | $R_L = 10k$, $C_L = 50$ pF | | | | |
| | MM80C95 | $V_{CC} = 5V$ | | 120 | 200 | ns |
| | | $V_{CC} = 10V$ | | 50 | 90 | ns |
| | MM80C96 | $V_{CC} = 5V$ | | 130 | 225 | ns |
| | | $V_{CC} = 10V$ | | 60 | 110 | ns |
| | MM80C98 | $V_{CC} = 5V$ | | 120 | 200 | ns |
| | | $V_{CC} = 10V$ | | 50 | 90 | ns |
| $C_{IN}$ | Input Capacitance | Any Input (Note 5) | | 5.0 | | pF |
| $C_{OUT}$ | Output Capacitance 3-STATE | Any Output (Note 5) | | 11 | | pF |
| $C_{PD}$ | Power Dissipation Capacitance | (Note 6) | | 60 | | pF |

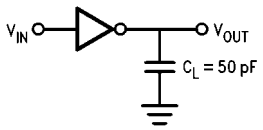
**Note 4:** AC Parameters are guaranteed by DC correlated testing.

**Note 5:** Capacitance is guaranteed by periodic testing.

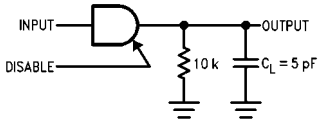
**Note 6:** $C_{PD}$ determines the no load AC power consumption of any CMOS device. For complete explanation see Family Characteristics application note AN-90.

## AC Test Circuits and Switching Time Waveforms

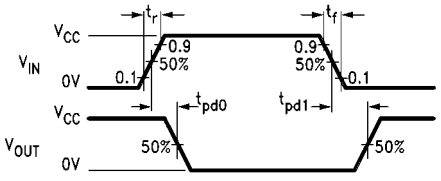
**$t_{pd0}$, $t_{pd1}$**



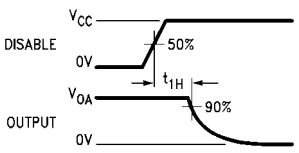

**$t_{1H}$ and $t_{H1}$**




**CMOS to CMOS**

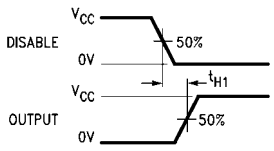



**$t_{1H}$**

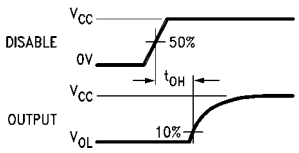


## AC Test Circuits and Switching Time Waveforms (Continued)

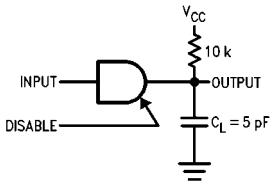
**$t_{H1}$**



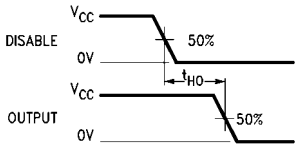

**$t_{0H}$**




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



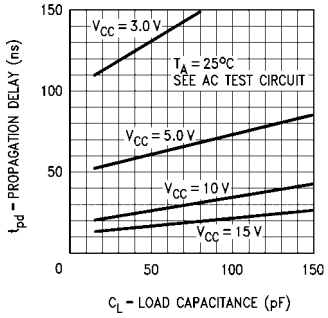

**$t_{H0}$**



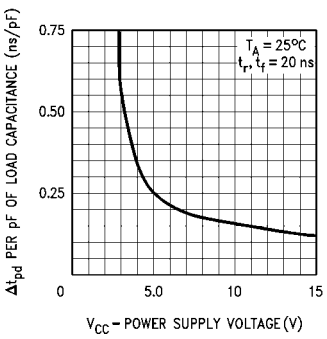

**Note:** Delays measured with input $t_r$, $t_f \leq 20$ ns.

## Typical Performance Characteristics

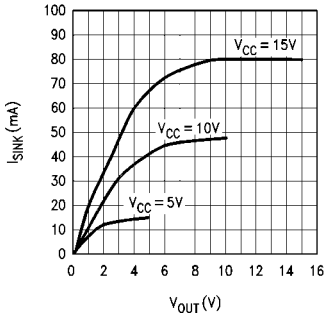
**Propagation Delay vs Load Capacitance**



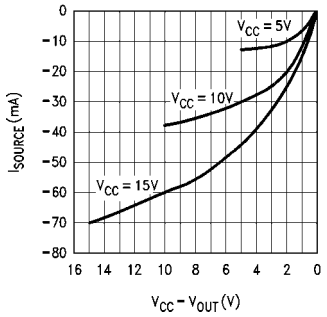

**$\Delta t_{pd}$/pF vs Power Supply Voltage**



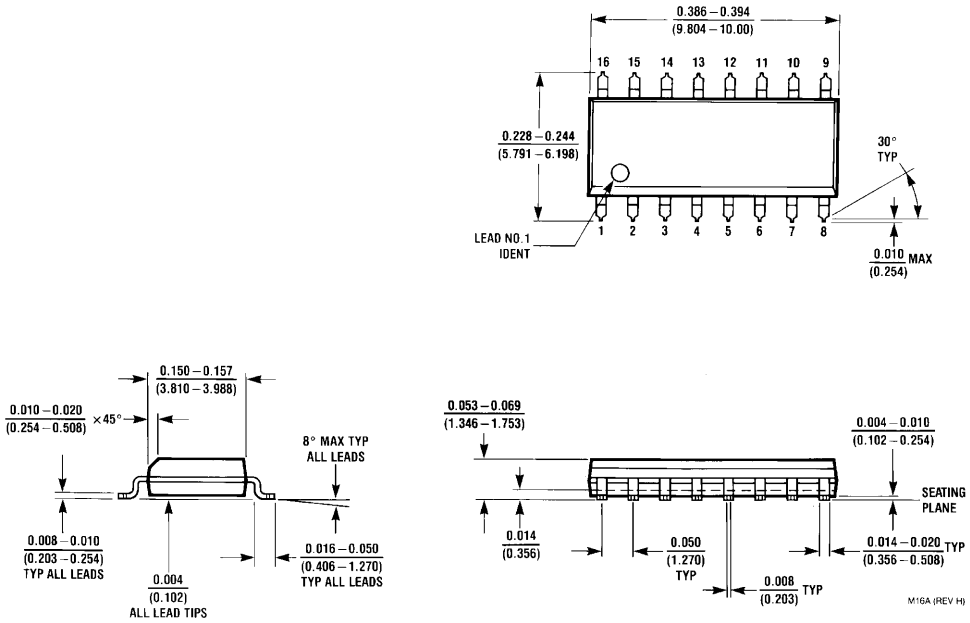

**N-Channel Output Drive at 25°C**




**P-Channel Output Drive at 25°C**

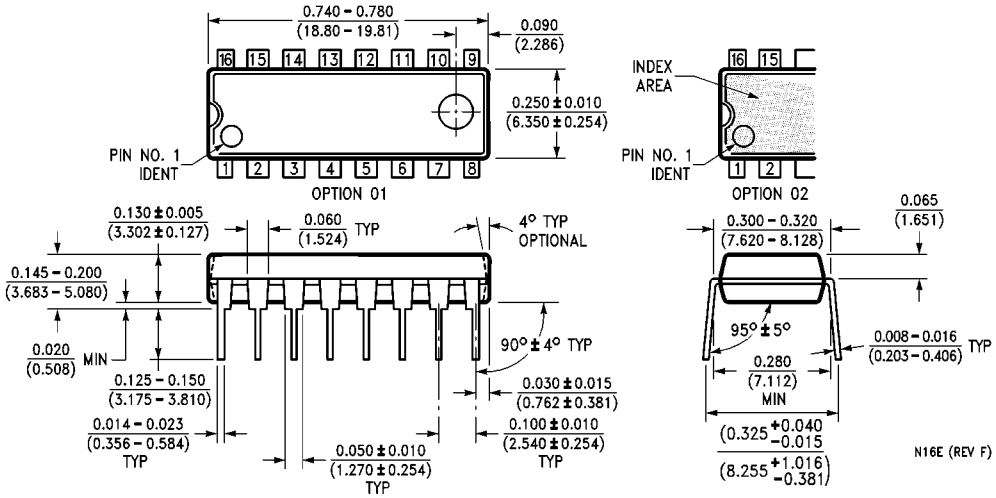


## Physical Dimensions inches (millimeters) unless otherwise noted




**16-Lead Small Outline Integrated Circuit (SOIC), JEDEC MS-012, 0.150” Narrow**
**Package Number M16A**

## Physical Dimensions inches (millimeters) unless otherwise noted (Continued)




**16-Lead Plastic Dual-In-Line Package (PDIP), JEDEC MS-001, 0.300" Wide**
**Package Number N16E**

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