

# MM70C95/MM80C95, MM70C97/MM80C97 TRI-STATE® Hex Buffers MM70C96/MM80C96, MM70C98/MM80C98 TRI-STATE Hex Inverters

## General Description

These gates are monolithic complementary MOS (CMOS) integrated circuits constructed with N- and P-channel enhancement mode transistors. The MM70C95/MM80C95 and the MM70C97/MM80C97 convert CMOS or TTL outputs to TRI-STATE outputs with no logic inversion, the MM70C96/MM80C96 and the MM70C98/MM80C98 provide the logical opposite of the input signal. The MM70C95/MM80C95 and the MM70C96/MM80C96 have common TRI-STATE controls for all six devices. The MM70C97/MM80C97 and the MM70C98/MM80C98 have two TRI-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.

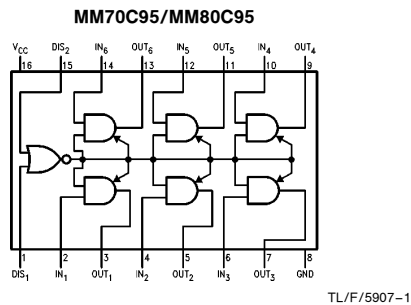
## Features

- 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

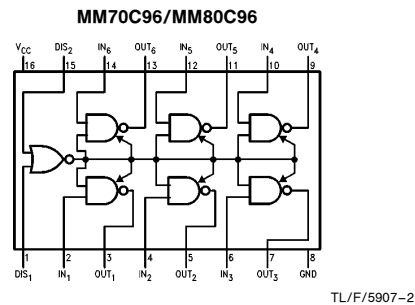
- Bus drivers Typical propagation delay into 150 pF load is 40 ns

## Connection Diagrams (Dual-In-Line Packages)



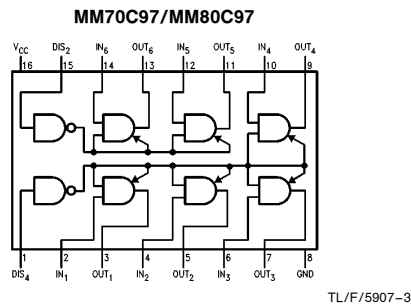
Top View

Order Number MM70C95 or MM80C95



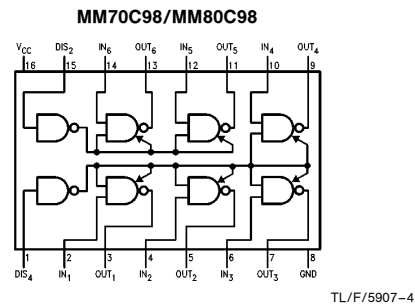
Top View

Order Number MM70C96 or MM80C96



Top View

Order Number MM70C97 or MM80C97



Top View

Order Number MM70C98 or MM80C98

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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
MM70CXX	-40°C to +85°C
MM80CXX	

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

## 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	$V_{CC} = 5V$	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	$\mu A$
$I_{IN(0)}$	Logical "0" Input Current		-1.0	-0.005		$\mu A$
$I_{OZ}$	Output Current in High Impedance State	$V_{CC} = 15V, V_O = 15V$		0.005	1.0	$\mu A$
		$V_{CC} = 15V, V_O = 0V$	-1.0	-0.005		$\mu A$
$I_{CC}$	Supply Current	$V_{CC} = 15V$		0.01	15	$\mu A$

## TTL INTERFACE

$V_{IN(1)}$	Logical "1" Input Voltage	70C $V_{CC} = 4.5V$	$V_{CC} - 1.5$			V
		80C $V_{CC} = 4.75V$	$V_{CC} - 1.5$			V
$V_{IN(0)}$	Logical "0" Input Voltage	70C $V_{CC} = 4.5V$			0.8	V
		80C $V_{CC} = 4.75V$			0.8	V
$V_{OUT(1)}$	Logical "1" Output Voltage	70C $V_{CC} = 4.5V, I_O = -1.6 mA$	2.4			V
		80C $V_{CC} = 4.75V, I_O = -1.6 mA$	2.4			V
$V_{OUT(0)}$	Logical "0" Output Voltage	70C $V_{CC} = 4.5V, I_O = 1.6 mA$			0.4	V
		80C $V_{CC} = 4.75V, I_O = 1.6 mA$			0.4	V

## OUTPUT DRIVE (Short Circuit Current)

$I_{SOURCE}$	Output Source Current	$V_{CC} = 5V, V_{IN(1)} = 5V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-4.35			mA
$I_{SOURCE}$	Output Source Current	$V_{CC} = 10V, V_{IN(1)} = 10V$ $T_A = 25^\circ C, V_{OUT} = 0V$	-20			mA
$I_{SINK}$	Output Sink Current	$V_{CC} = 5V, V_{IN(0)} = 0V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	4.35			mA
$I_{SINK}$	Output Sink Current	$V_{CC} = 10V, V_{IN(0)} = 0V$ $T_A = 25^\circ C, V_{OUT} = V_{CC}$	20			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 device 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.

## AC Electrical Characteristics\* $T_A = 25^\circ\text{C}$ , $C_L = 50\text{ pF}$ , 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 MM70C95/MM80C95, MM70C97/MM80C97	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		60	100	ns
				25	40	ns
	MM70C96/MM80C96, MM70C98/MM80C98	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		70	150	ns
				35	75	ns
$t_{pd0}$ , $t_{pd1}$	Propagation Delay Time to a Logical "0" or Logical "1" from Data Input to Output MM70C95/MM80C95, MM70C97/MM80C97	$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$ $V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		85	160	ns
				40	80	ns
	MM70C96/MM80C96, MM70C98/MM80C98	$V_{CC} = 5\text{V}$ , $C_L = 150\text{ pF}$ $V_{CC} = 10\text{V}$ , $C_L = 150\text{ pF}$		95	210	ns
				45	110	ns
$t_{1H}$ , $t_{0H}$	Delay from Disable Input to High Impedance State, (from Logical "1" or Logical "0") MM70C95/MM80C95	$R_L = 10\text{k}$ , $C_L = 5\text{ pF}$ $V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		80	135	ns
				50	90	ns
	MM70C96/MM80C96	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		100	180	ns
				70	125	ns
	MM70C97/MM80C97	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		70	125	ns
				50	90	ns
	MM70C98/MM80C98	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		90	170	ns
				70	125	ns
$t_{H1}$ , $t_{H0}$	Delay from Disable Input to Logical "1" Level (from High Impedance State) MM70C95/MM80C95	$R_L = 10\text{k}$ , $C_L = 50\text{ pF}$ $V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		120	200	ns
				50	90	ns
	MM70C96/MM80C96	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		130	225	ns
				60	110	ns
	MM70C97/MM80C97	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		95	175	ns
				40	80	ns
	MM70C98/MM80C98	$V_{CC} = 5\text{V}$ $V_{CC} = 10\text{V}$		120	200	ns
				50	90	ns
$C_{IN}$	Input Capacitance	Any Input (Note 2)		5.0		pF
$C_{OUT}$	Output Capacitance TRI-STATE	Any Output (Note 2)		11		pF
$C_{PD}$	Power Dissipation Capacitance	(Note 3)		60		pF

\*AC Parameters are guaranteed by DC correlated testing.

## Truth Tables

MM70C95/MM80C95

Disable DIS <sub>1</sub>	Input DIS <sub>2</sub>	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

MM70C96/MM80C96

Disable DIS <sub>1</sub>	Input DIS <sub>2</sub>	Input	Output
0	0	0	1
0	0	1	0
0	1	X	H-z
1	0	X	H-z
1	1	X	H-z

MM70C97/MM80C97

Disable DIS <sub>4</sub>	Input DIS <sub>2</sub>	Input	Output
0	0	0	0
0	0	1	1
X	1	X	H-z*
1	X	X	H-z**

MM70C98/MM80C98

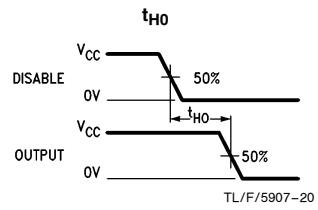
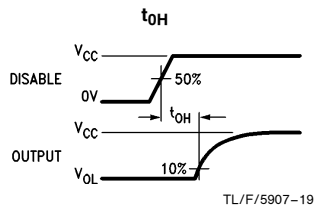
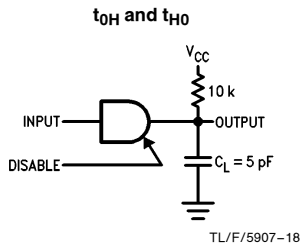
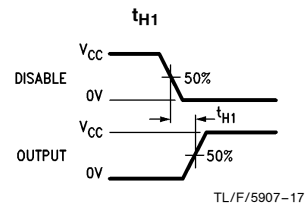
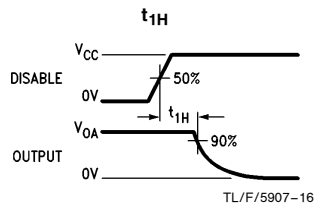
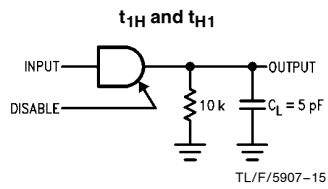
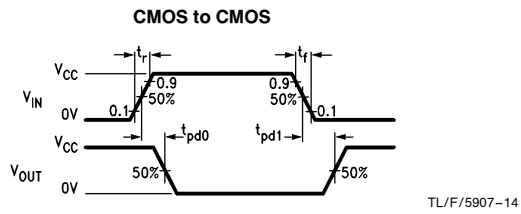
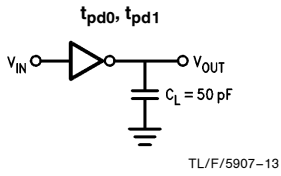
Disable DIS <sub>4</sub>	Input DIS <sub>2</sub>	Input	Output
0	0	0	1
0	0	1	0
X	1	X	H-z*
1	X	X	H-z**

\*Output 5-6 only

\*\*Output 1-4 only

X = Irrelevant

## AC Test Circuits and Switching Time Waveforms

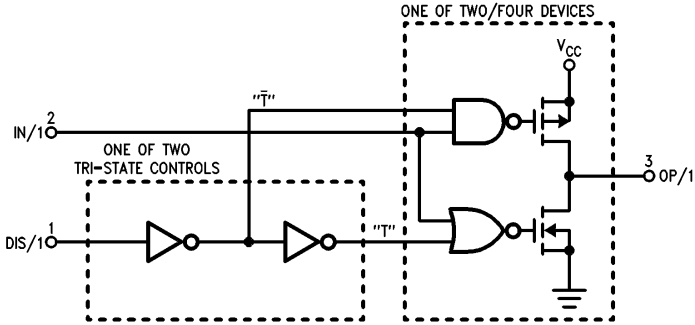


**Note:** Delays measured with input  $t_r, t_f \leq 20$  ns.



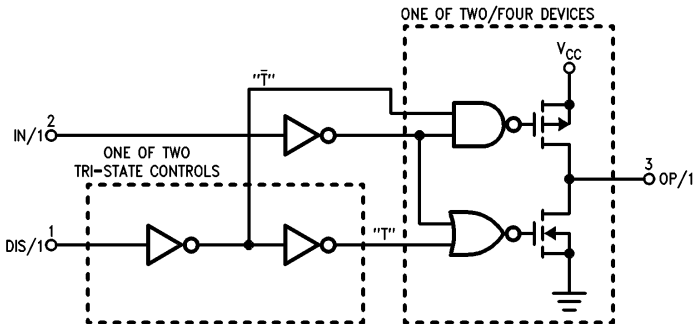
**Schematic Diagrams** (Continued)

**MM70C97/MM80C97 TRI-STATE**



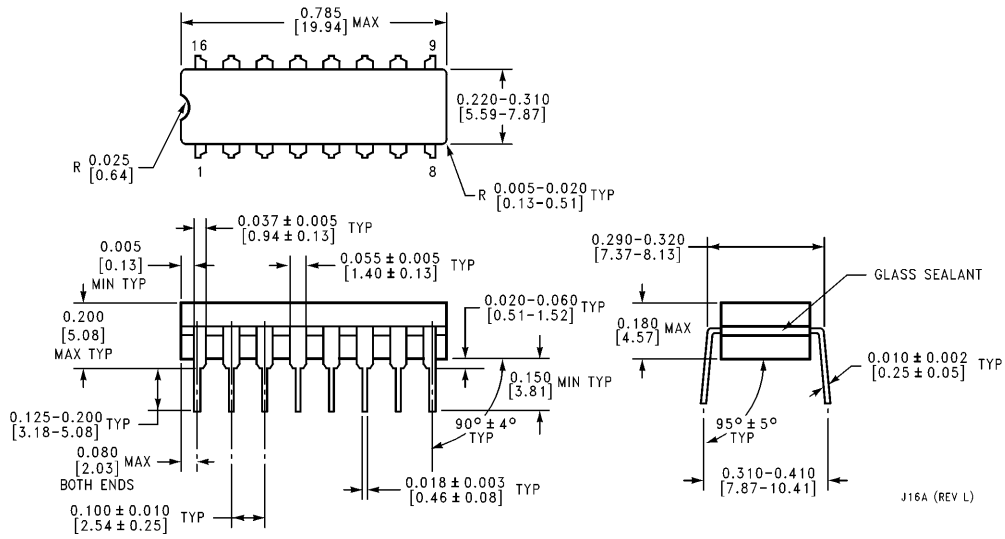
TL/F/5907-11

**MM70C98/MM80C98 TRI-STATE**



TL/F/5907-12

**Physical Dimensions** inches (millimeters)

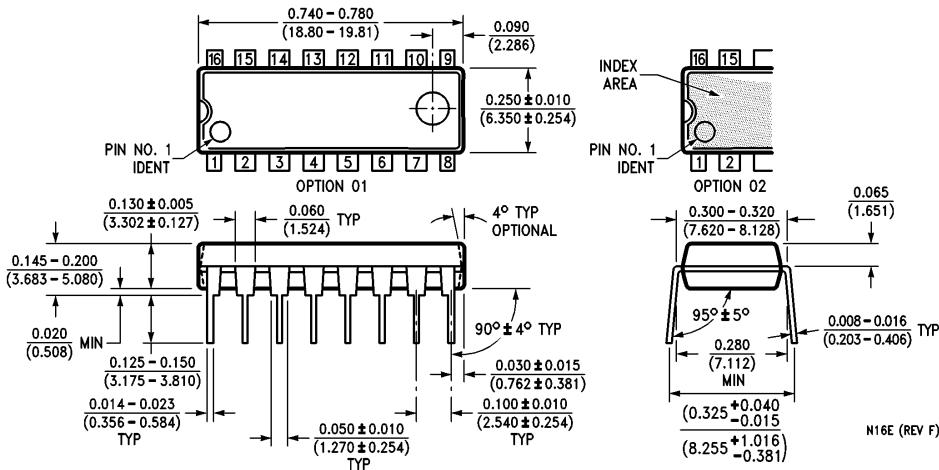


**Ceramic Dual-In-Line Package (J)**  
**Order Number MM70C95J, MM70C96J, MM70C97J, MM70C98J,**  
**MM80C95J, MM80C96J, MM80C97J or MM80C98J**  
**NS Package Number J16A**

J16A (REV L)

**MM70C95/MM80C95, MM70C97/MM80C97 TRI-STATE Hex Buffers  
MM70C96/MM80C96, MM70C98/MM80C98 TRI-STATE Hex Inverters**

**Physical Dimensions** inches (millimeters) (Continued)



**Molded Dual-In-Line Package (N)**  
**Order Number MM70C95N, MM70C96N, MM70C97N, MM70C98N,**  
**MM80C95N, MM80C96N, MM80C97N or MM80C98N**  
**NS Package Number N16E**

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