National Semiconductor

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

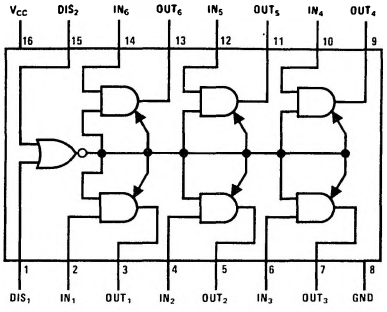
■ Wide supply voltage range	3.0 V to 15 V
■ Guaranteed noise margin	1.0 V
■ High noise immunity	0.45 V_{CC} (typ.)
■ TTL compatible	drive 1 TTL Load

Applications

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

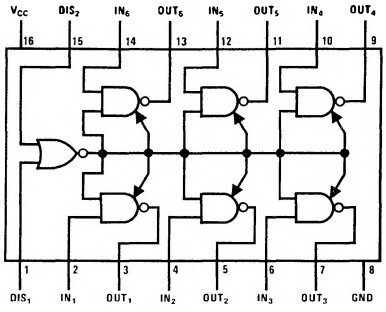
Connection Diagrams (Dual-In-Line and Flat Packages)

MM70C95/MM80C95



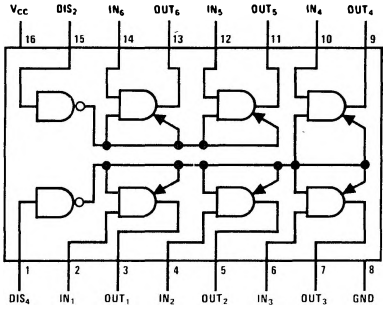
TOP VIEW

MM70C96/MM80C96



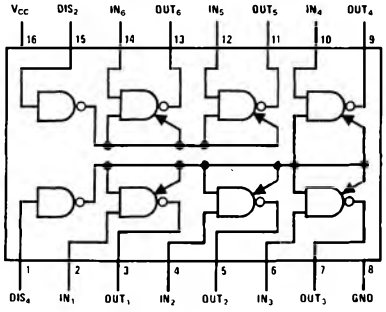
TOP VIEW

MM70C97/MM80C97



TOP VIEW

MM70C98/MM80C98



TOP VIEW

Absolute Maximum Ratings (Note 1)

Voltage at Any Pin	−0.3 V to V_{CC} + 0.3 V
Operating Temperature Range	
MM70CXX	−55°C to +125°C
MM80CXX	−40°C to +85°C
Storage Temperature Range	−65°C to +150°C
Package Dissipation	500 mW
Power Supply Voltage (V_{CC})	18 V
Lead Temperature (Soldering, 10 sec.)	300°C

DC Electrical Characteristics

Max./min. limits apply across temperature range, unless otherwise noted.

Parameter		Conditions	Min.	Typ.	Max.	Units
	CMOS to CMOS					
$V_{IN(1)}$	Logical "1" Input Voltage	V_{CC} = 5.0 V V_{CC} = 10 V	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	V_{CC} = 5.0 V V_{CC} = 10 V			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	V_{CC} = 5.0 V V_{CC} = 10 V	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	V_{CC} = 5.0 V, V_{CC} = 10 V			0.5 1.0	V V
$I_{IN(1)}$	Logical "1" Input Current	V_{CC} = 15 V		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current		−1.0	−0.005		μA
I_{OUT}	Output Current in High Impedance State	V_{CC} = 15 V, V_O = 15 V V_{CC} = 15 V, V_O = 0 V	−1.0	0.005 −0.005	1.0	μA μA
I_{CC}	Supply Current	V_{CC} = 15 V		0.01	15	μA
	TTL Interface					
$V_{IN(1)}$	Logical "1" Input Voltage	70C V_{CC} = 4.5 V 80C V_{CC} = 4.75 V	V_{CC} − 1.5 V_{CC} − 1.5			V V
$V_{IN(0)}$	Logical "0" Input Voltage	70C V_{CC} = 4.5 V 80C V_{CC} = 4.75 V			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	70C V_{CC} = 4.5 V, I_O = −1.6 mA 80C V_{CC} = 4.75 V, I_O = −1.6 mA	2.4 2.4			V V
$V_{OUT(O)}$	Logical "0" Output Voltage	70C V_{CC} = 4.5 V, I_O = 1.6 mA 80C V_{CC} = 4.75 V, I_O = 1.6 mA			0.4 0.4	V V
	Output Drive (Short Circuit Current)					
I_{SOURCE}	Output Source Current	V_{CC} = 5.0 V, $V_{IN(1)}$ = 5.0 V T_A = 25°C, V_{OUT} = 0 V	−4.35			mA
I_{SOURCE}	Output Source Current	V_{CC} = 10 V, $V_{IN(1)}$ = 10 V T_A = 25°C, V_{OUT} = 0 V	−20			mA
I_{SINK}	Output Sink Current	V_{CC} = 5.0 V, $V_{IN(0)}$ = 0 V T_A = 25°C, V_{OUT} = V_{CC}	4.35			mA
I_{SINK}	Output Sink Current	V_{CC} = 10 V, $V_{IN(0)}$ = 0 V T_A = 25°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 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.

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

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	$V_{CC} = 5.0V$		60	100	ns
	$V_{CC} = 10V$		25	40	ns
MM70C96/MM80C96, MM70C98/MM80C98	$V_{CC} = 5.0V$		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					
MM70C95/MM80C95, MM70C97/MM80C97	$V_{CC} = 5.0V$, $C_L = 150pF$		85	160	ns
	$V_{CC} = 10V$, $C_L = 150pF$		40	80	ns
MM70C96/MM80C96, MM70C98/MM80C98	$V_{CC} = 5.0V$, $C_L = 150pF$		95	210	ns
	$V_{CC} = 10V$, $C_L = 150pF$		45	110	ns
t_{1H}, t_{0H} Delay from Disable Input to High Impedance State, (from Logical "1" or Logical "0")	$R_L = 10k$, $C_L = 5.0pF$				
MM70C95/MM80C95	$V_{CC} = 5.0V$		80	135	ns
	$V_{CC} = 10V$		50	90	ns
MM70C96/MM80C96	$V_{CC} = 5.0V$		100	180	ns
	$V_{CC} = 10V$		70	125	ns
MM70C97/MM80C97	$V_{CC} = 5.0V$		70	125	ns
	$V_{CC} = 10V$		50	90	ns
MM70C98/MM80C98	$V_{CC} = 5.0V$		90	170	ns
	$V_{CC} = 10V$		70	125	
t_{H1}, t_{H0} Delay from Disable Input to Logical "1" Level (from High Impedance State)	$R_L = 10k$, $C_L = 50pF$				
MM70C95/MM80C95	$V_{CC} = 5.0V$		120	200	ns
	$V_{CC} = 10V$		50	90	ns
MM70C96/MM80C96	$V_{CC} = 5.0V$		130	225	ns
	$V_{CC} = 10V$		60	110	ns
MM70C97/MM80C97	$V_{CC} = 5.0V$		95	175	ns
	$V_{CC} = 10V$		40	80	ns
MM70C98/MM80C98	$V_{CC} = 5.0V$		120	200	ns
	$V_{CC} = 10V$		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

Truth Table

MM70C95/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

MM70C96/MM80C96

DISABLE DIS_1	INPUT DIS_2	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_4	INPUT DIS_2	INPUT	OUTPUT
0	0	0	0
0	0	1	1
X	1	X	H-z*
1	X	X	H-z**

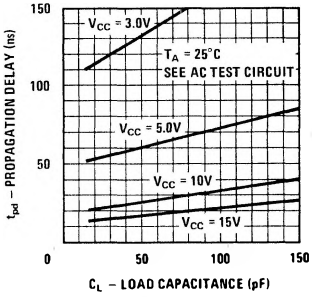
MM70C98/MM80C98

DISABLE DIS_4	INPUT DIS_2	INPUT	OUTPUT
0	0	0	1
0	0	1	0
X	1	X	H-z*
1	X	X	H-z**

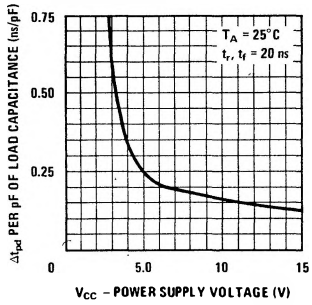
*Output 5-6 only
**Output 1-4 only
X = Irrelevant

Typical Performance Characteristics

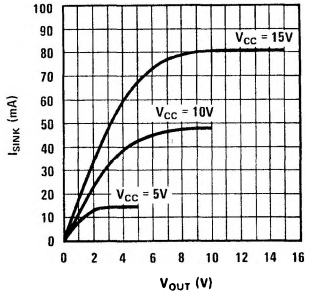
Propagation Delay vs Load Capacitance



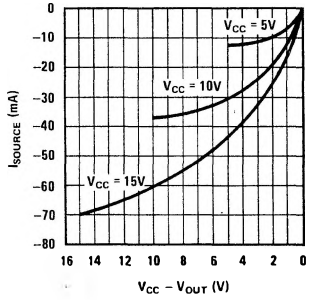
Δt_{pd}/pF vs Power Supply Voltage



N-Channel Output Drive @ 25°C

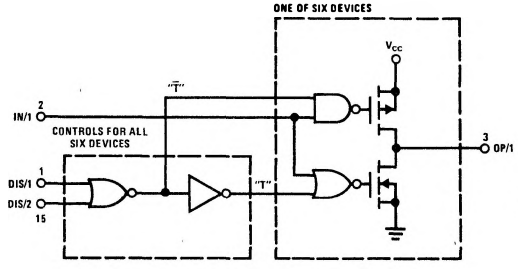


P-Channel Output Drive @ 25°C

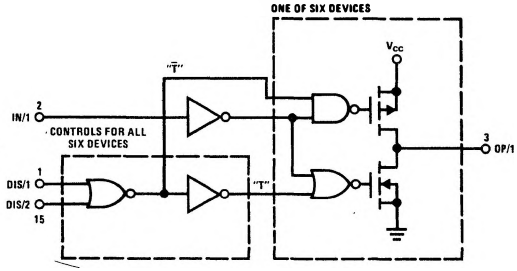


Schematic Diagram

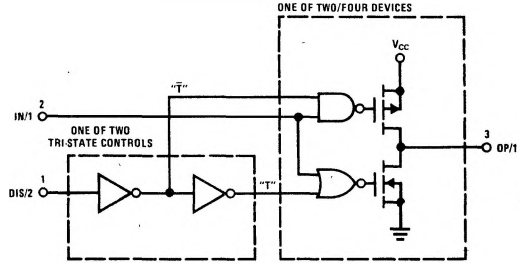
MM70C95/MM80C95 TRI-STATE



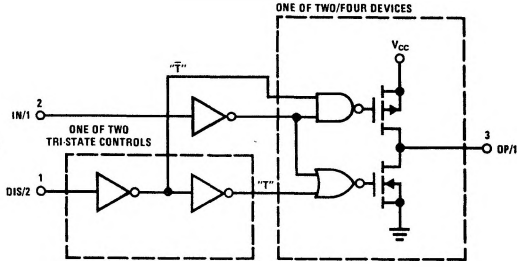
MM70C96/MM80C96 TRI-STATE



MM70C97/MM80C97 TRI-STATE

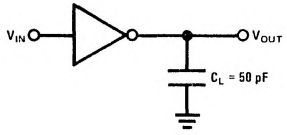


MM70C98/MM80C98 TRI-STATE

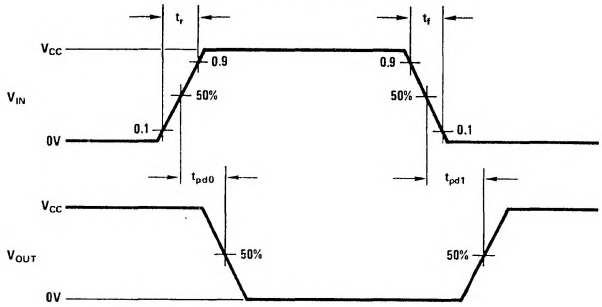


AC Test Circuit and Switching Time Waveforms

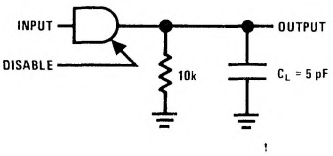
t_{pd0}, t_{pd1}



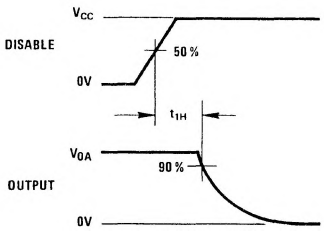
CMOS to CMOS



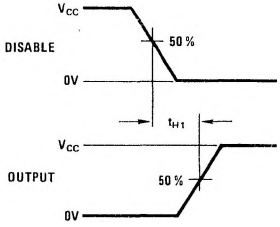
t_{1H} and t_{H1}



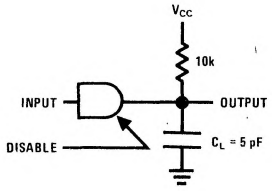
t_{1H}



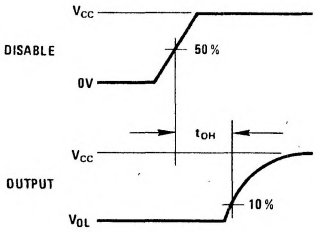
t_{H1}



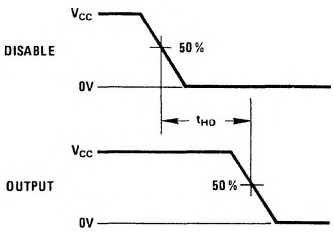
t_{0H} and t_{H0}



t_{0H}



t_{H0}



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