National Semiconductor

February 1988

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

General Description

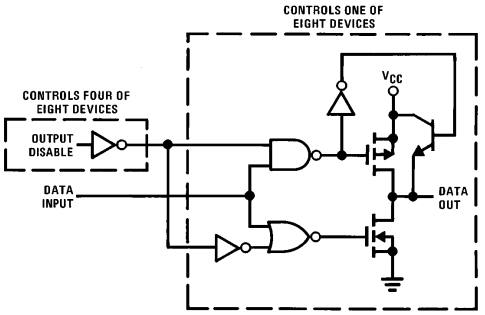
These octal buffers and line drivers are monolithic complementary MOS (CMOS) integrated circuits with TRI-STATE outputs. These outputs have been specially designed to drive highly capacitive loads such as bus-oriented systems. These devices have a fan out of 6 low power Schottky loads. A high logic level 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



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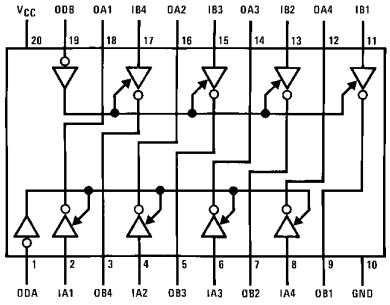
MM54C240/MM74C240 Dual-In-Line Package



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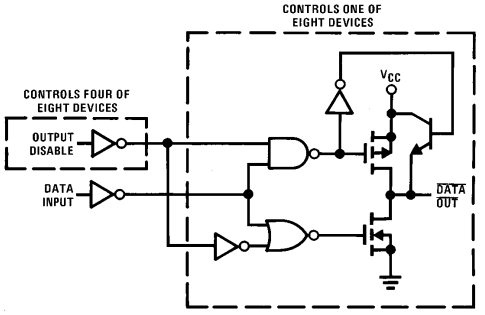
Top View

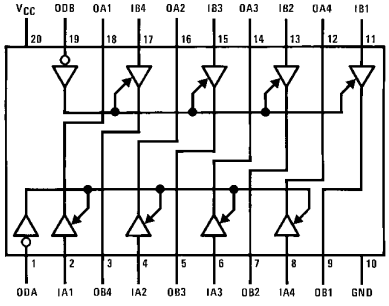
Order Number MM54C240 or MM74C240

MM54C244/MM74C244



TL/F/5905–3

MM54C244/MM74C244 Dual-In-Line Package



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Top View

Order Number MM54C244 or MM74C244

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RRD-B30M105/Printed in U. S. A.

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

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	
MM54C240, MM54C244	$-55°C$ to $+125°C$
MM74C240, MM74C244	$-40°C$ to $+85°C$
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
CMOS TO CMOS						
$V_{IN(1)}$	Logical "1" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$	3.5 8.0			V V
$V_{IN(0)}$	Logical "0" Input Voltage	$V_{CC} = 5V$ $V_{CC} = 10V$			1.5 2.0	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	$V_{CC} = 5V$, $I_O = -10\ \mu A$ $V_{CC} = 10V$, $I_O = -10\ \mu A$	4.5 9.0			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	$V_{CC} = 5V$, $I_O = 10\ \mu A$ $V_{CC} = 10V$, $I_O = 10\ \mu A$			0.5 1.0	V V
I_{OZ}	TRI-STATE Output Current	$V_{CC} = 10V$, OD = V_{IH}			± 10	μA
$I_{IN(1)}$	Logical "1" Input Current	$V_{CC} = 15V$, $V_{IN} = 15V$		0.005	1.0	μA
$I_{IN(0)}$	Logical "0" Input Current	$V_{CC} = 15V$, $V_{IN} = 0V$	-1.0	-0.005		μA
I_{CC}	Supply Current	$V_{CC} = 15V$		0.05	300	μA
CMOS/LPTTL INTERFACE						
$V_{IN(1)}$	Logical "1" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$	$V_{CC} - 1.5$ $V_{CC} - 1.5$			V V
$V_{IN(0)}$	Logical "0" Input Voltage	54C, $V_{CC} = 4.5V$ 74C, $V_{CC} = 4.75V$			0.8 0.8	V V
$V_{OUT(1)}$	Logical "1" Output Voltage	54C, $V_{CC} = 4.5V$, $I_O = -450\ \mu A$ 74C, $V_{CC} = 4.75V$, $I_O = -450\ \mu A$	$V_{CC} - 0.4$ $V_{CC} - 0.4$			V V
		54C, $V_{CC} = 4.5V$, $I_O = -2.2$ mA 74C, $V_{CC} = 4.75V$, $I_O = -2.2$ mA	2.4 2.4			V V
$V_{OUT(0)}$	Logical "0" Output Voltage	54C, $V_{CC} = 4.5V$, $I_O = 2.2$ mA 74C, $V_{CC} = 4.75V$, $I_O = 2.2$ mA			0.4 0.4	V V
OUTPUT DRIVE (See 54C/74C Family Characteristics Data Sheet) (Short Circuit Current)						
I_{SOURCE}	Output Source Current (P-Channel)	$V_{CC} = 5V$, $V_{OUT} = 0V$ $T_A = 25°C$	-14	-30		mA
		$V_{CC} = 10V$, $V_{OUT} = 0V$ $T_A = 25°C$	-36	-70		mA
I_{SINK}	Output Sink Current (N-Channel)	$V_{CC} = 5V$, $V_{OUT} = V_{CC}$ $T_A = 25°C$	12	20		mA
		$V_{CC} = 10V$, $V_{OUT} = V_{CC}$ $T_A = 25°C$	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* $T_A = 25°C$, $C_L = 50$ pF, unless otherwise specified

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

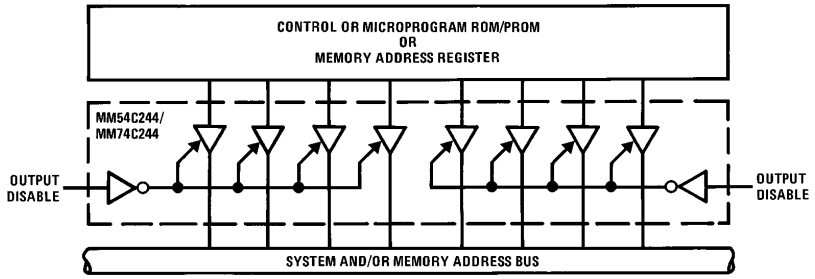
*AC Parameters are guaranteed by DC correlated testing.

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



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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

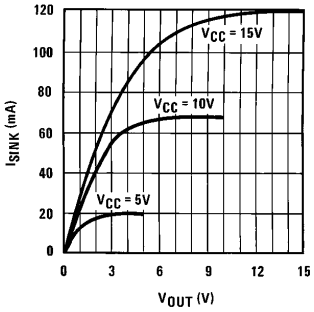
ODA	IA	OA
1	X	Z
1	X	Z
0	0	0
0	1	1

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

N-Channel Output Drive at 25°C



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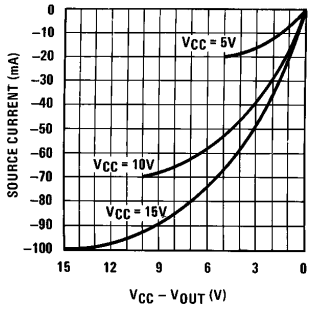
P-Channel Output Drive at 25°C



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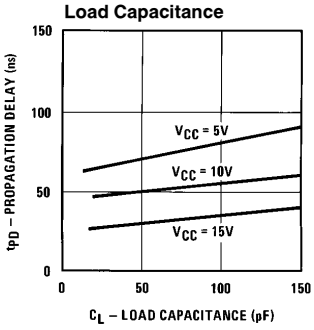
MM54C240/MM74C240 Propagation Delay vs. Load Capacitance



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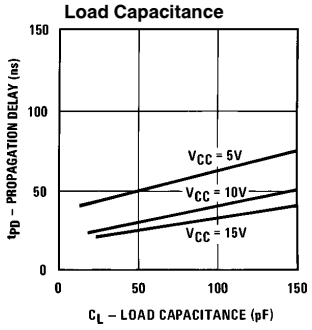
MM54C244/MM74C244 Propagation Delay vs. Load Capacitance



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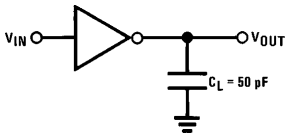
AC Test Circuits and Switching Time Waveforms

t_{pd0}, t_{pd1}



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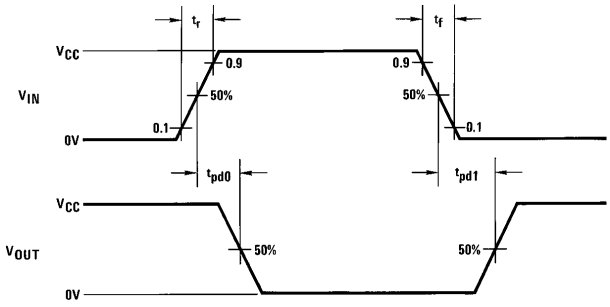
CMOS to CMOS



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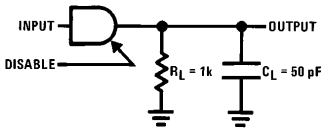
t_{1H} and t_{H1}



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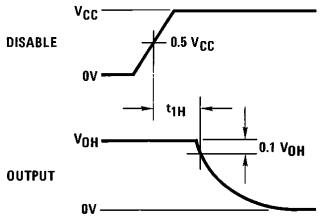
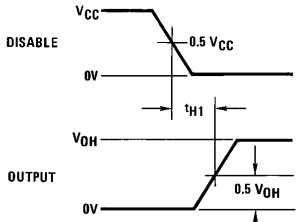
t_{1H}



t_{H1}



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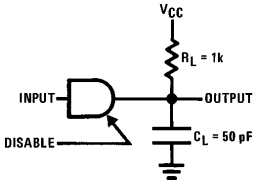
Note: V_{OH} is defined as the DC output high voltage when the device is loaded with a 1 kΩ resistor to ground.

t_{0H} and t_{H0}



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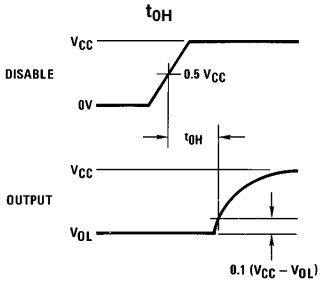
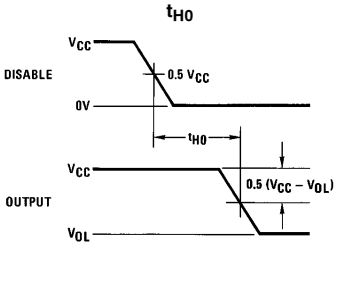
t_{0H}



t_{H0}



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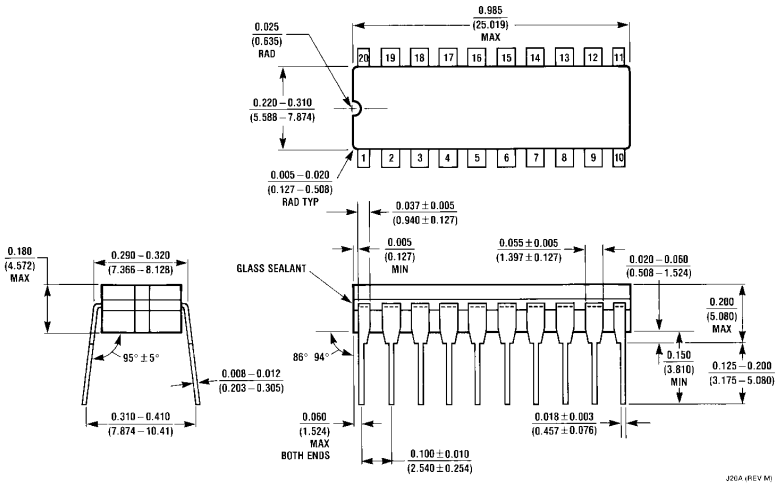
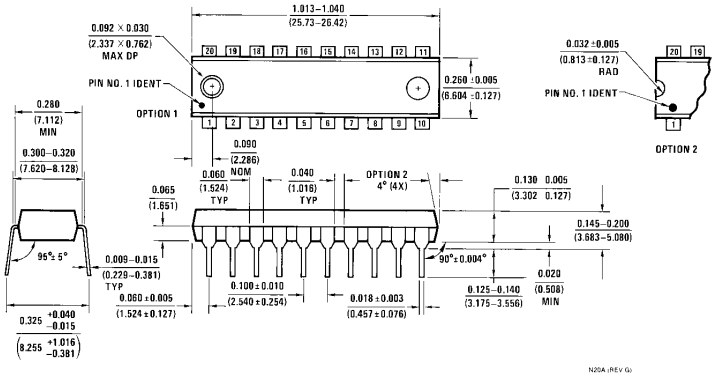
Note: V_{OL} is defined as the DC output low voltage when the device is loaded with a 1 kΩ resistor to V_{CC}.

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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2. A critical component is any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

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