

## MM54HC244/MM74HC244 Octal TRI-STATE® Buffer

### General Description

These TRI-STATE buffers utilize advanced silicon-gate CMOS technology and are general purpose high speed non-inverting buffers. They possess high drive current outputs which enable high speed operation even when driving large bus capacitances. These circuits achieve speeds comparable to low power Schottky devices, while retaining the advantage of CMOS circuitry, i.e., high noise immunity, and low power consumption. All three devices have a fanout of 15 LS-TTL equivalent inputs.

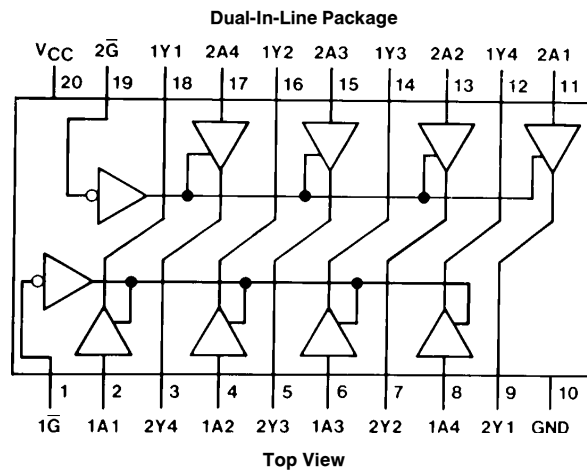
The MM54HC244/MM74HC244 is a non-inverting buffer and has two active low enables (1G and 2G). Each enable independently controls 4 buffers. This device does not have Schmitt trigger inputs.

All inputs are protected from damage due to static discharge by diodes to  $V_{CC}$  and ground.

### Features

- Typical propagation delay: 14 ns
- TRI-STATE outputs for connection to system buses
- Wide power supply range: 2–6V
- Low quiescent supply current: 80  $\mu$ A (74 Series)
- Output current: 6 mA

### Connection Diagram



### Truth Table

'HC244

1G	1A	1Y	2G	2A	2Y
L	L	L	L	L	L
L	H	H	L	H	H
H	L	Z	H	L	Z
H	H	Z	H	H	Z

H = high level, L = low level, Z = high impedance

## Absolute Maximum Ratings (Notes 1 & 2)

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

Supply Voltage ( $V_{CC}$ )	-0.5 to +7.0V
DC Input Voltage ( $V_{IN}$ )	-1.5 to $V_{CC} + 1.5V$
DC Output Voltage ( $V_{OUT}$ )	-0.5 to $V_{CC} + 0.5V$
Clamp Diode Current ( $I_{IK}, I_{OK}$ )	$\pm 20$ mA
DC Output Current, per pin ( $I_{OUT}$ )	$\pm 35$ mA
DC $V_{CC}$ or GND Current, per pin ( $I_{CC}$ )	$\pm 70$ mA
Storage Temperature Range ( $T_{STG}$ )	-65°C to +150°C
Power Dissipation ( $P_D$ ) (Note 3)	600 mW
S.O. Package only	500 mW
Lead Temperature ( $T_L$ ) (Soldering 10 seconds)	260°C

## Operating Conditions

	Min	Max	Units
Supply Voltage ( $V_{CC}$ )	2	6	V
DC Input or Output Voltage ( $V_{IN}, V_{OUT}$ )	0	$V_{CC}$	V
Operating Temp. Range ( $T_A$ )			
MM74HC	-40	+85	°C
MM54HC	-55	+125	°C
Input Rise or Fall Times ( $t_r, t_f$ )			
$V_{CC} = 2.0V$		1000	ns
$V_{CC} = 4.5V$		500	ns
$V_{CC} = 6.0V$		400	ns

## DC Electrical Characteristics (Note 4)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A = 25^\circ C$		74HC $T_A = -40$ to $85^\circ C$		54HC $T_A = -55$ to $125^\circ C$		Units
				Typ		Guaranteed Limits		Guaranteed Limits		
				$V_{IH}$	Minimum High Level Input Voltage		2.0V 4.5V 6.0V	1.5 3.15 4.2	1.5 3.15 4.2	
$V_{IL}$	Maximum Low Level Input Voltage**		2.0V 4.5V 6.0V	0.5 1.35 1.8	0.5 1.35 1.8	0.5 1.35 1.8	V V V			
$V_{OH}$	Minimum High Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	2.0	1.9	1.9	1.9	V		
			4.5V 6.0V	4.5 6.0	4.4 5.9	4.4 5.9	4.4 5.9	V V		
		$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 6.0$ mA $ I_{OUT}  \leq 7.8$ mA	4.5V	4.2	3.98	3.84	3.7	V		
			6.0V	5.7	5.48	5.34	5.2	V		
$V_{OL}$	Maximum Low Level Output Voltage	$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 20 \mu A$	2.0V	0	0.1	0.1	0.1	V		
			4.5V 6.0V	0 0	0.1 0.1	0.1 0.1	0.1 0.1	V V		
			$V_{IN} = V_{IH}$ or $V_{IL}$ $ I_{OUT}  \leq 6.0$ mA $ I_{OUT}  \leq 7.8$ mA	4.5V	0.2	0.26	0.33	0.4	V	
		6.0V		0.2	0.26	0.33	0.4	V		
$I_{IN}$	Maximum Input Current	$V_{IN} = V_{CC}$ or GND	6.0V		$\pm 0.1$	$\pm 1.0$	$\pm 1.0$	$\mu A$		
$I_{OZ}$	Maximum TRI-STATE Output Leakage Current	$V_{IN} = V_{IH}$ , or $V_{IL}$ $V_{OUT} = V_{CC}$ or GND $\bar{G} = V_{IH}$	6.0V		$\pm 0.5$	$\pm 5$	$\pm 10$	$\mu A$		
$I_{CC}$	Maximum Quiescent Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	6.0V		8.0	80	160	$\mu A$		

**Note 1:** Absolute Maximum Ratings are those values beyond which damage to the device may occur.

**Note 2:** Unless otherwise specified all voltages are referenced to ground.

**Note 3:** Power Dissipation temperature derating — plastic "N" package: -12 mW/°C from 65°C to 85°C; ceramic "J" package: -12 mW/°C from 100°C to 125°C.

**Note 4:** For a power supply of 5V  $\pm 10\%$  the worst case output voltages ( $V_{OH}$ , and  $V_{OL}$ ) occur for HC at 4.5V. Thus the 4.5V values should be used when designing with this supply. Worst case  $V_{IH}$  and  $V_{IL}$  occur at  $V_{CC} = 5.5V$  and 4.5V respectively. (The  $V_{IH}$  value at 5.5V is 3.85V.) The worst case leakage current ( $I_{IN}$ ,  $I_{CC}$ , and  $I_{OZ}$ ) occur for CMOS at the higher voltage and so the 6.0V values should be used.

\*\*  $V_{IL}$  limits are currently tested at 20% of  $V_{CC}$ . The above  $V_{IL}$  specification (30% of  $V_{CC}$ ) will be implemented no later than Q1, CY'89.

### AC Electrical Characteristics MM54HC244/MM74HC244

$V_{CC} = 5V$ ,  $T_A = 25^\circ C$ ,  $t_r = t_f = 6$  ns

Symbol	Parameter	Conditions	Typ	Guaranteed Limit	Units
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay	$C_L = 45$ pF	14	20	ns
$t_{PZH}$ , $t_{PZL}$	Maximum Enable Delay to Active Output	$R_L = 1$ k $\Omega$ $C_L = 45$ pF	17	28	ns
$t_{PHZ}$ , $t_{PLZ}$	Maximum Disable Delay from Active Output	$R_L = 1$ k $\Omega$ $C_L = 5$ pF	15	25	ns

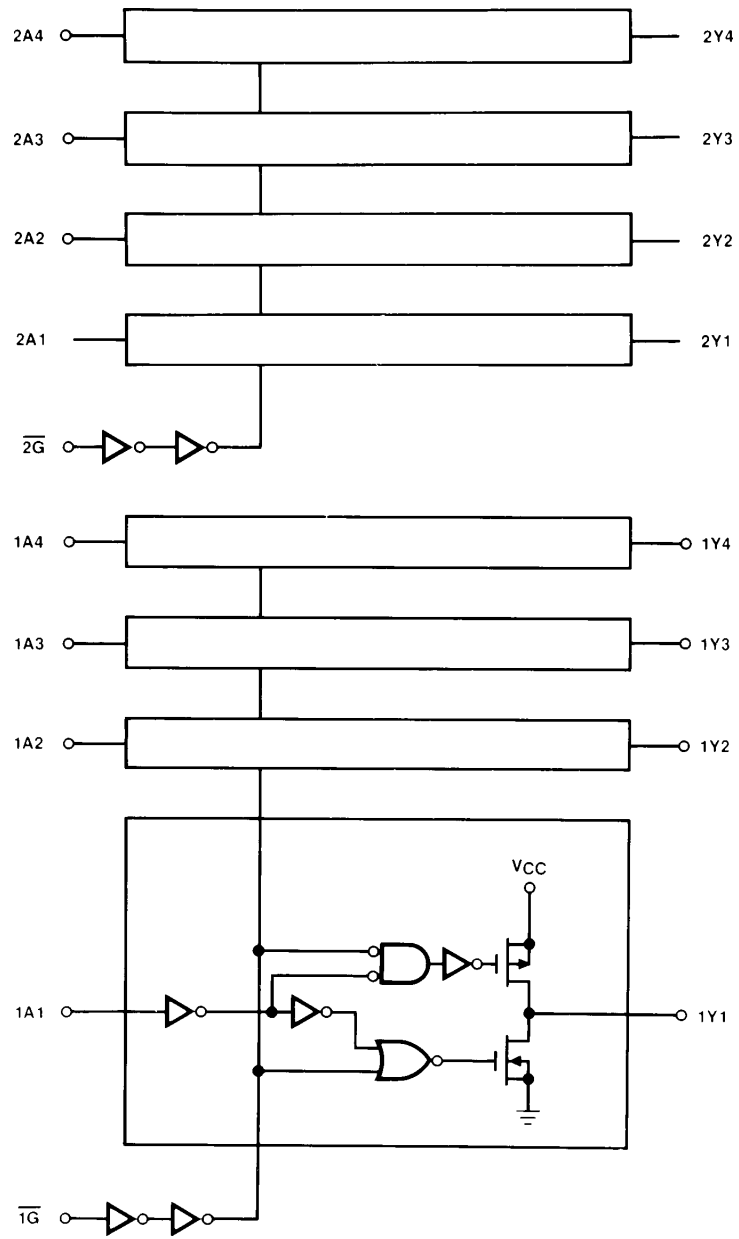
### AC Electrical Characteristics $V_{CC} = 2.0V-6.0V$ , $C_L = 50$ pF, $t_r = t_f = 6$ ns (unless otherwise specified)

Symbol	Parameter	Conditions	$V_{CC}$	$T_A = 25^\circ C$		74HC	54HC	Units
						$T_A = -40$ to $85^\circ C$	$T_A = -55$ to $125^\circ C$	
				Typ	Guaranteed Limits			
$t_{PHL}$ , $t_{PLH}$	Maximum Propagation Delay	$C_L = 50$ pF $C_L = 150$ pF	2.0V	58	115	145	171	ns
			2.0V	83	165	208	246	ns
		4.5V 4.5V	4.5V	14	23	29	34	ns
			4.5V	17	33	42	49	ns
$t_{PZH}$ , $t_{PZL}$	Maximum Output Enable Time	$R_L = 1$ k $\Omega$ $C_L = 50$ pF $C_L = 150$ pF	2.0V	75	150	189	224	ns
			2.0V	100	200	252	298	ns
		4.5V 4.5V	4.5V	15	30	38	45	ns
			4.5V	30	40	50	60	ns
$t_{PHZ}$ , $t_{PLZ}$	Maximum Output Disable Time	$R_L = 1$ k $\Omega$ $C_L = 50$ pF $C_L = 150$ pF	2.0V	75	150	189	224	ns
			4.5V	15	30	38	45	ns
		6.0V 6.0V	6.0V	13	26	32	38	ns
			6.0V	17	34	43	51	ns
$t_{TLH}$ , $t_{THL}$	Maximum Output Rise and Fall Time		2.0V		60	75	90	ns
			4.5V		12	15	18	ns
			6.0V		10	13	15	ns
$C_{PD}$	Power Dissipation Capacitance (Note 5)	(per buffer) $\bar{G} = V_{IH}$ $\bar{G} = V_{IL}$		12 50				pF pF
$C_{IN}$	Maximum Input Capacitance			5	10	10	10	pF
$C_{OUT}$	Maximum Output Capacitance			10	20	20	20	pF

**Note 5:**  $C_{PD}$  determines the no load dynamic power consumption,  $P_D = C_{PD} V_{CC}^2 f + I_{CC} V_{CC}$ , and the no load dynamic current consumption,  $I_S = C_{PD} V_{CC} f + I_{CC}$ .

# Logic Diagram

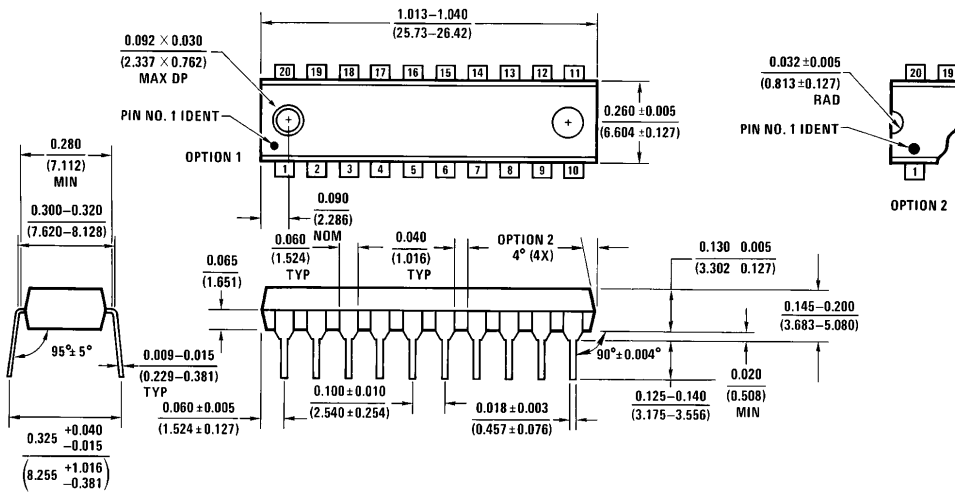
'HC244



TL/F/5327-2



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



**Dual-In-Line Package  
Order Number MM74HC244N  
NS Package N20A**

N20A (REV G)

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