

**MC14502B**

**Strobed Hex Inverter/Buffer**

The MC14502B is a strobed hex buffer/inverter with 3-state outputs, an inhibit control, and guaranteed TTL drive over the temperature range. The 3-state output simplifies design by allowing a common bus.

- Separate Output Disable Control
- 3-State Output
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Capable of Driving 4LSTTL Loads Over the Rated Temperature Range

**MAXIMUM RATINGS\*** (Voltages Referenced to  $V_{SS}$ )

Symbol	Parameter	Value	Unit
$V_{DD}$	DC Supply Voltage	- 0.5 to + 18.0	V
$V_{in}, V_{out}$	Input or Output Voltage (DC or Transient)	- 0.5 to $V_{DD} + 0.5$	V
$I_{in}$	Input Current (DC or Transient), per Pin	$\pm 10$	mA
$I_{out}$	Output Current (DC or Transient), per Pin	+ 30	mA
$P_D$	Power Dissipation, per Package†	500	mW
$T_{stg}$	Storage Temperature	- 65 to + 150	°C
$T_L$	Lead Temperature (8-Second Soldering)	260	°C

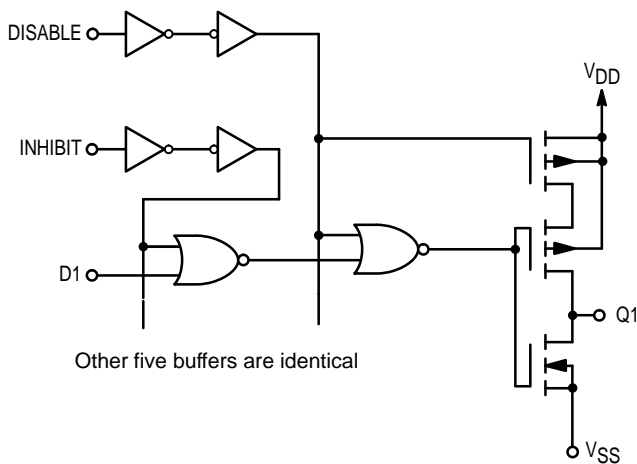
\* Maximum Ratings are those values beyond which damage to the device may occur.

† Temperature Derating:

Plastic "P and D/DW" Packages: - 7.0 mW/°C From 65°C To 125°C

Ceramic "L" Packages: - 12 mW/°C From 100°C To 125°C

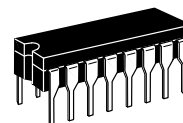
**CIRCUIT DIAGRAM**



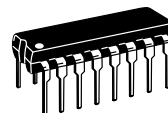
**TRUTH TABLE**

$D_n$	Inhibit	Disable	$Q_n$
0	0	0	1
1	0	0	0
X	1	0	0
X	X	1	High Impedance

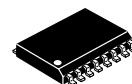
X = Don't Care



**L SUFFIX**  
CERAMIC  
CASE 620



**P SUFFIX**  
PLASTIC  
CASE 648



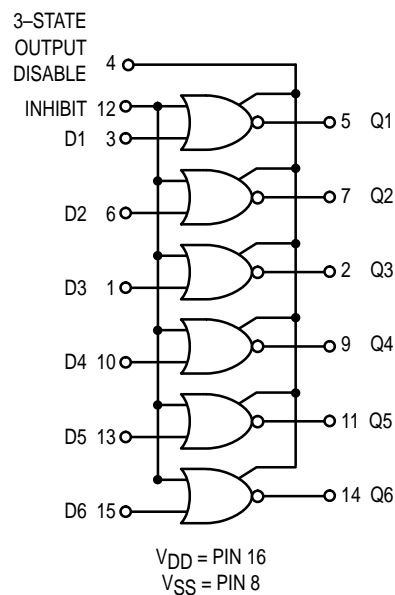
**DW SUFFIX**  
SOIC  
CASE 751G

**ORDERING INFORMATION**

MC14XXXBCP Plastic  
MC14XXXBCL Ceramic  
MC14XXXBDW SOIC

$T_A = - 55^\circ$  to  $125^\circ\text{C}$  for all packages.

**LOGIC DIAGRAM**



**ELECTRICAL CHARACTERISTICS** (Voltages Referenced to V<sub>SS</sub>)

Characteristic	Symbol	V <sub>DD</sub> Vdc	- 55°C		25°C			125°C		Unit		
			Min	Max	Min	Typ #	Max	Min	Max			
Output Voltage V <sub>in</sub> = V <sub>DD</sub> or 0	"0" Level V <sub>OL</sub>	5.0	—	0.05	—	0	0.05	—	0.05	Vdc		
		10	—	0.05	—	0	0.05	—	0.05			
		15	—	0.05	—	0	0.05	—	0.05			
	"1" Level V <sub>in</sub> = 0 or V <sub>DD</sub>	V <sub>OH</sub>	5.0	4.95	—	4.95	5.0	—	4.95		—	Vdc
			10	9.95	—	9.95	10	—	9.95		—	
			15	14.95	—	14.95	15	—	14.95		—	
Input Voltage "0" Level (V <sub>O</sub> = 4.5 or 0.5 Vdc) (V <sub>O</sub> = 9.0 or 1.0 Vdc) (V <sub>O</sub> = 13.5 or 1.5 Vdc)	V <sub>IL</sub>	5.0	—	1.5	—	2.25	1.5	—	1.5	Vdc		
		10	—	3.0	—	4.50	3.0	—	3.0			
		15	—	4.0	—	6.75	4.0	—	4.0			
	"1" Level (V <sub>O</sub> = 0.5 or 4.5 Vdc) (V <sub>O</sub> = 1.0 or 9.0 Vdc) (V <sub>O</sub> = 1.5 or 13.5 Vdc)	V <sub>IH</sub>	5.0	3.5	—	3.5	2.75	—	3.5		—	Vdc
			10	7.0	—	7.0	5.50	—	7.0		—	
			15	11	—	11	8.25	—	11		—	
Output Drive Current Source (V <sub>OH</sub> = 2.5 Vdc) (V <sub>OH</sub> = 4.6 Vdc) (V <sub>OH</sub> = 9.5 Vdc) (V <sub>OH</sub> = 13.5 Vdc)	I <sub>OH</sub>	5.0	- 3.0	—	- 2.4	- 4.2	—	- 1.7	—	mAdc		
		5.0	- 0.64	—	- 0.51	- 0.88	—	- 0.36	—			
		10	- 1.6	—	- 1.3	- 2.25	—	- 0.9	—			
	Sink (V <sub>OL</sub> = 0.4 Vdc) (V <sub>OL</sub> = 0.5 Vdc) (V <sub>OL</sub> = 1.5 Vdc)	I <sub>OL</sub>	5.0	3.5	—	2.8	6.6	—	2.0		—	mAdc
			10	7.8	—	6.3	17	—	4.4		—	
			15	29	—	24	66	—	16		—	
Input Current	I <sub>in</sub>	15	—	± 0.1	—	± 0.00001	± 0.1	—	± 1.0	µAdc		
Input Capacitance (V <sub>in</sub> = 0)	C <sub>in</sub>	—	—	—	—	5.0	7.5	—	—	pF		
Quiescent Current (Per Package)	I <sub>DD</sub>	5.0	—	1.0	—	0.002	1.0	—	30	µAdc		
		10	—	2.0	—	0.004	2.0	—	60			
		15	—	4.0	—	0.006	4.0	—	120			
Total Supply Current**† (Dynamic plus Quiescent, Per Package) (C <sub>L</sub> = 50 pF on all outputs, all buffers switching)	I <sub>T</sub>	5.0	I <sub>T</sub> = (2.7 µA/kHz) f + I <sub>DD</sub>							µAdc		
		10	I <sub>T</sub> = (5.3 µA/kHz) f + I <sub>DD</sub>									
		15	I <sub>T</sub> = (8.0 µA/kHz) f + I <sub>DD</sub>									
Three-State Leakage Current	I <sub>TL</sub>	15	—	± 0.1	—	± 0.0001	± 0.1	—	± 3.0	µAdc		

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.

\*\*The formulas given are for the typical characteristics only at 25°C.

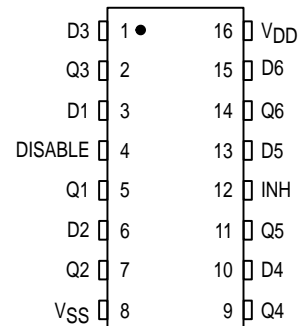
†To calculate total supply current at loads other than 50 pF:

$$I_T(C_L) = I_T(50 \text{ pF}) + (C_L - 50) Vfk$$

where: I<sub>T</sub> is in µA (per package), C<sub>L</sub> in pF, V = (V<sub>DD</sub> - V<sub>SS</sub>) in volts, f in kHz is input frequency, and k = 0.006.

This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>in</sub> and V<sub>out</sub> should be constrained to the range V<sub>SS</sub> ≤ (V<sub>in</sub> or V<sub>out</sub>) ≤ V<sub>DD</sub>. Unused inputs must always be tied to an appropriate logic voltage level (e.g., either V<sub>SS</sub> or V<sub>DD</sub>). Unused outputs must be left open.

**PIN ASSIGNMENT**

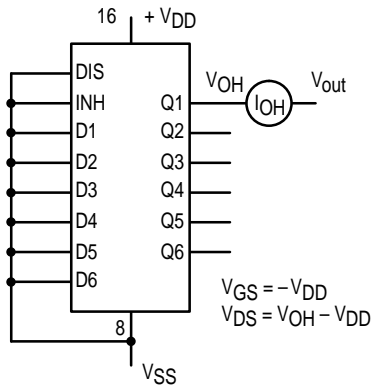


**SWITCHING CHARACTERISTICS\*** ( $C_L = 50 \text{ pF}$ ,  $T_A = 25^\circ\text{C}$ )

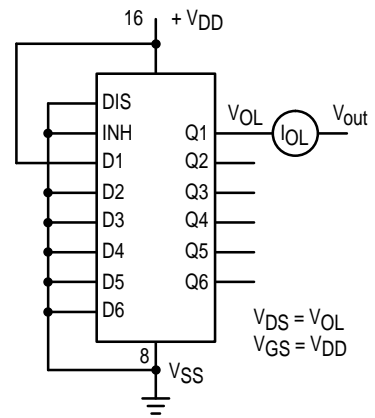
Characteristic	Symbol	$V_{DD}$	All Types			Unit
			Min	Typ #	Max	
Output Rise Time	$t_{TLH}$	5.0	—	100	200	ns
		10	—	50	100	
		15	—	40	80	
Output Fall Time	$t_{THL}$	5.0	—	40	80	ns
		10	—	20	40	
		15	—	15	30	
Propagation Delay Time Data to Q	$t_{PHL}$	5.0	—	135	270	ns
		10	—	55	110	
		15	—	40	80	
Propagation Delay Time, Inhibit to Q	$t_{PHL}$	5.0	—	335	670	ns
		10	—	145	290	
		15	—	95	190	
Propagation Delay Time Data to Q, Inhibit to Q	$t_{PLH}$	5.0	—	295	590	ns
		10	—	130	260	
		15	—	95	190	
3-State Propagation Delay, Output "1" to High Impedance	$t_{PHZ}$	5.0	—	65	130	ns
		10	—	30	60	
		15	—	25	50	
3-State Propagation Delay, High Impedance to "1" Level	$t_{PZH}$	5.0	—	260	520	ns
		10	—	105	210	
		15	—	80	160	
3-State Propagation Delay, Output "0" to High Impedance	$t_{PLZ}$	5.0	—	150	300	ns
		10	—	70	140	
		15	—	55	110	
3-State Propagation Delay, High Impedance to "0" Level	$t_{PZL}$	5.0	—	160	320	ns
		10	—	65	130	
		15	—	50	100	

\* The formulas given are for the typical characteristics only at  $25^\circ\text{C}$ .

#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



**Figure 1. Typical Output Source Current Test Circuit ( $I_{OH}$ )**



**Figure 2. Typical Output Sink Current Test Circuit ( $I_{OL}$ )**

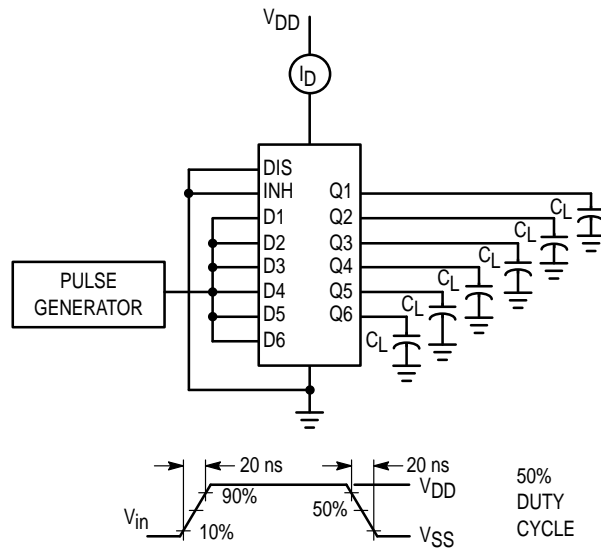
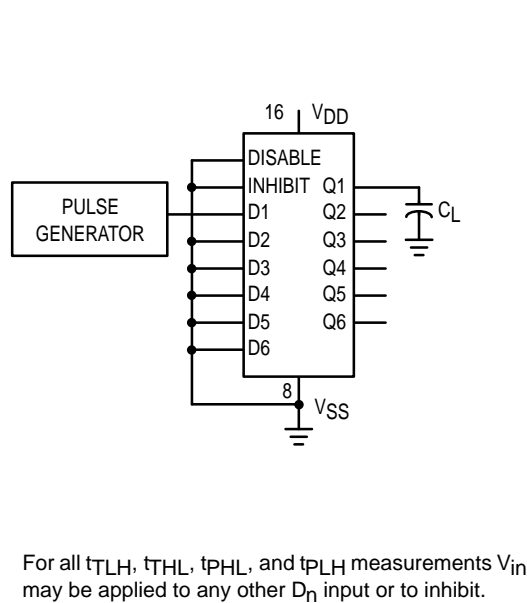


Figure 3. Power Dissipation Test Circuit and Waveform



For all  $t_{TLH}$ ,  $t_{THL}$ ,  $t_{PHL}$ , and  $t_{PLH}$  measurements  $V_{in}$  may be applied to any other  $D_n$  input or to inhibit.

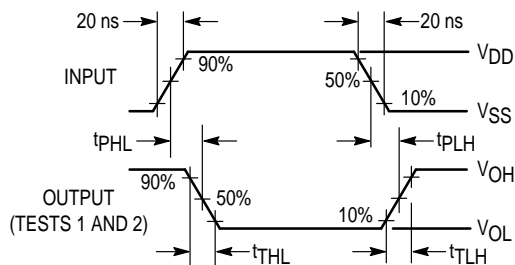


Figure 4. AC Test Circuit and Waveforms ( $t_{TLH}$ ,  $t_{THL}$ ,  $t_{PLH}$ , and  $t_{PHL}$ )

Switch Positions for 3-State Test

Test	S1	S2	S3	S4
$t_{PHZ}$	Open	Closed	Closed	Open
$t_{PLZ}$	Closed	Open	Open	Closed
$t_{PZL}$	Closed	Open	Open	Closed
$t_{PZH}$	Open	Closed	Closed	Open

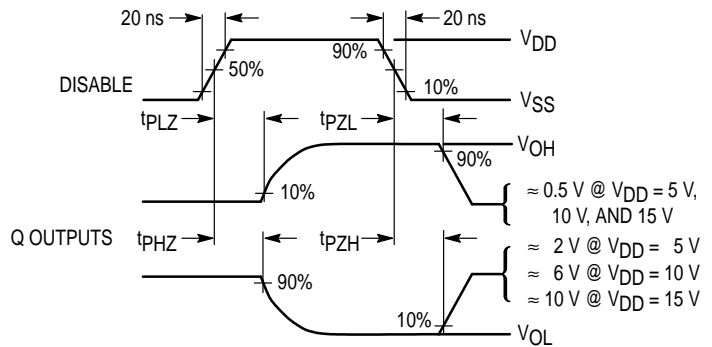
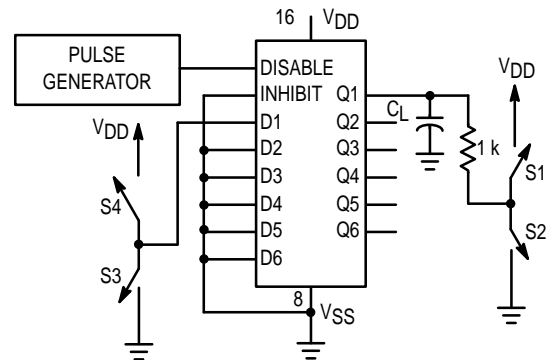
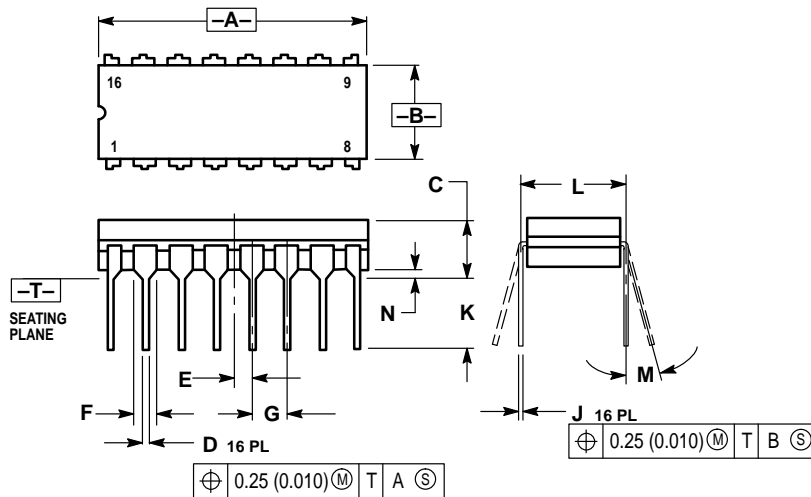


Figure 5. 3-State AC Test Circuit and Waveforms ( $t_{PHZ}$ ,  $t_{PLZ}$ ,  $t_{PZH}$ ,  $t_{PZL}$ )

## OUTLINE DIMENSIONS

### L SUFFIX CERAMIC DIP PACKAGE CASE 620-10 ISSUE V

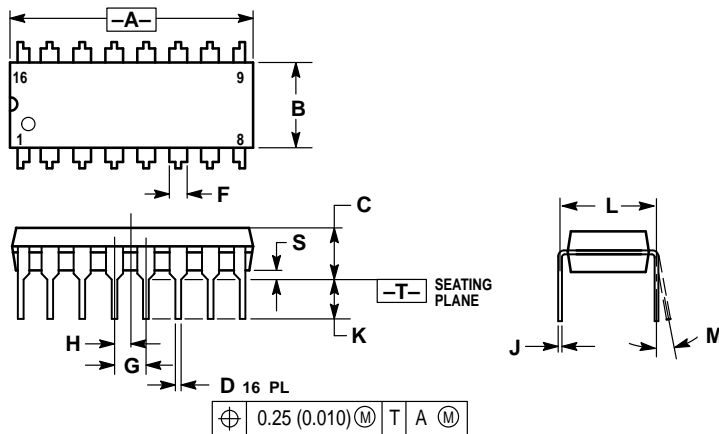


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEAD WHEN FORMED PARALLEL.
4. DIMENSION F MAY NARROW TO 0.76 (0.030) WHERE THE LEAD ENTERS THE CERAMIC BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.750	0.785	19.05	19.93
B	0.240	0.295	6.10	7.49
C	—	0.200	—	5.08
D	0.015	0.020	0.39	0.50
E	0.050 BSC		1.27 BSC	
F	0.055	0.065	1.40	1.65
G	0.100 BSC		2.54 BSC	
H	0.008	0.015	0.21	0.38
K	0.125	0.170	3.18	4.31
L	0.300 BSC		7.62 BSC	
M	0°	15°	0°	15°
N	0.020	0.040	0.51	1.01

### P SUFFIX PLASTIC DIP PACKAGE CASE 648-08 ISSUE R



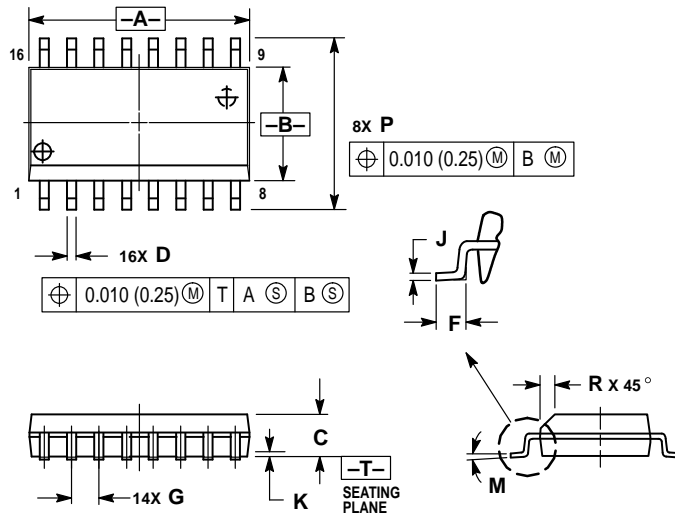
**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
4. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
5. ROUNDED CORNERS OPTIONAL.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.740	0.770	18.80	19.55
B	0.250	0.270	6.35	6.85
C	0.145	0.175	3.69	4.44
D	0.015	0.021	0.39	0.53
F	0.040	0.70	1.02	1.77
G	0.100 BSC		2.54 BSC	
H	0.050 BSC		1.27 BSC	
J	0.008	0.015	0.21	0.38
K	0.110	0.130	2.80	3.30
L	0.295	0.305	7.50	7.74
M	0°	10°	0°	10°
S	0.020	0.040	0.51	1.01

## OUTLINE DIMENSIONS

### DW SUFFIX PLASTIC SOIC PACKAGE CASE 751G-02 ISSUE A



**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSIONS A AND B DO NOT INCLUDE MOLD PROTRUSION.
4. MAXIMUM MOLD PROTRUSION 0.15 (0.006) PER SIDE.
5. DIMENSION D DOES NOT INCLUDE DAMBAR PROTRUSION. ALLOWABLE DAMBAR PROTRUSION SHALL BE 0.13 (0.005) TOTAL IN EXCESS OF D DIMENSION AT MAXIMUM MATERIAL CONDITION.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	10.15	10.45	0.400	0.411
B	7.40	7.60	0.292	0.299
C	2.35	2.65	0.093	0.104
D	0.35	0.49	0.014	0.019
F	0.50	0.90	0.020	0.035
G	1.27 BSC		0.050 BSC	
J	0.25	0.32	0.010	0.012
K	0.10	0.25	0.004	0.009
M	0°	7°	0°	7°
P	10.05	10.55	0.395	0.415
R	0.25	0.75	0.010	0.029

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MC14502B/D

