

# MC1400UB

## Dual 3-Input "NOR" Gate Plus Inverter

The MC1400UB dual 3-input NOR gate plus inverter is constructed with MOS P-channel and N-channel enhancement mode devices in a single monolithic structure. These complementary MOS logic gates find primary use where low power dissipation and/or high noise immunity is desired.

- Diode Protection on All Inputs
- Supply Voltage Range = 3.0 Vdc to 18 Vdc
- Logic Swing Independent of Fanout
- Pin-for-Pin Replacement for CD4000UB

### MAXIMUM RATINGS\* (Voltages Referenced to V<sub>SS</sub>)

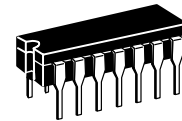
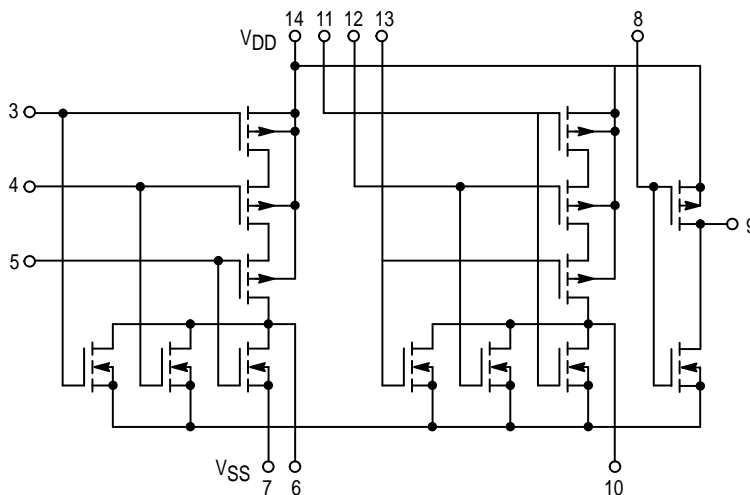
| Symbol                             | Parameter  | Value                          | Unit |
|------------------------------------|--|--------------------------------|------|
| V <sub>DD</sub>                    | DC Supply Voltage                                  | - 0.5 to + 18.0                | V    |
| V <sub>in</sub> , V <sub>out</sub> | Input or Output Voltage (DC or Transient)          | - 0.5 to V <sub>DD</sub> + 0.5 | V    |
| I <sub>in</sub> , I <sub>out</sub> | Input or Output Current (DC or Transient), per Pin | ± 10                           | mA   |
| P <sub>D</sub>                     | Power Dissipation, per Package†                    | 500                            | mW   |
| T <sub>stg</sub>                   | Storage Temperature                                | - 65 to + 150                  | °C   |
| T <sub>L</sub>                     | Lead Temperature (8-Second Soldering)              | 260                            | °C   |

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

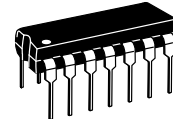
† Temperature Derating:

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 SCHEMATIC



**L SUFFIX**  
CERAMIC  
CASE 632



**P SUFFIX**  
PLASTIC  
CASE 646

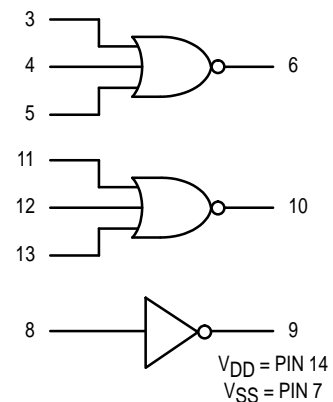


**D SUFFIX**  
SOIC  
CASE 751A

### ORDERING INFORMATION

MC14XXXUBCP Plastic  
MC14XXXUBCL Ceramic  
MC14XXXUBD SOIC  
T<sub>A</sub> = - 55° to 125°C for all packages.

### LOGIC DIAGRAM



### PIN ASSIGNMENT

|                   |   |    |                   |
|-------------------|---|----|-------------------|
| NC                | 1 | 14 | V <sub>DD</sub>   |
| NC                | 2 | 13 | IN 3 <sub>B</sub> |
| IN 1 <sub>A</sub> | 3 | 12 | IN 2 <sub>B</sub> |
| IN 2 <sub>A</sub> | 4 | 11 | IN 1 <sub>B</sub> |
| IN 3 <sub>A</sub> | 5 | 10 | OUT <sub>B</sub>  |
| OUT <sub>A</sub>  | 6 | 9  | OUT <sub>C</sub>  |
| V <sub>SS</sub>   | 7 | 8  | IN 1 <sub>C</sub> |

NC = NO CONNECTION

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

| Characteristic  | Symbol  | V <sub>DD</sub><br>Vdc | - 55°C   |       | 25°C  |           |       | + 125°C |       | Unit |   |
|---|---|------------------------|--|-------|-------|-----------|-------|---------|-------|------|---|
|   |   |                        | Min  | Max   | Min   | Typ #     | Max   | Min     | Max   |      |   |
| Output Voltage<br>V <sub>in</sub> = V <sub>DD</sub> or 0  | "0" Level<br>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<br>V <sub>in</sub> = 0 or V <sub>DD</sub>   | V <sub>OH</sub>        | 5.0  | 4.95  | —     | 4.95      | 5.0   | —       | 4.95  |      | — |
|   |   |                        | 10   | 9.95  | —     | 9.95      | 10    | —       | 9.95  |      | — |
|   |   |                        | 15   | 14.95 | —     | 14.95     | 15    | —       | 14.95 |      | — |
| Input Voltage<br>(V <sub>O</sub> = 4.5 Vdc)<br>(V <sub>O</sub> = 9.0 Vdc)<br>(V <sub>O</sub> = 13.5 Vdc)  | "0" Level<br>V <sub>IL</sub>  | 5.0                    | —  | 1.0   | —     | 2.25      | 1.0   | —       | 1.0   | Vdc  |   |
|   |   | 10                     | —  | 2.0   | —     | 4.50      | 2.0   | —       | 2.0   |      |   |
|   |   | 15                     | —  | 2.5   | —     | 6.75      | 2.5   | —       | 2.5   |      |   |
|   | "1" Level<br>(V <sub>O</sub> = 0.5 Vdc)<br>(V <sub>O</sub> = 1.0 Vdc)<br>(V <sub>O</sub> = 1.5 Vdc) | V <sub>IH</sub>        | 5.0  | 4.0   | —     | 4.0       | 2.75  | —       | 4.0   |      | — |
|   |   |                        | 10   | 8.0   | —     | 8.0       | 5.50  | —       | 8.0   |      | — |
|   |   |                        | 15   | 12.5  | —     | 12.5      | 8.25  | —       | 12.5  |      | — |
| Output Drive Current<br>(V <sub>OH</sub> = 2.5 Vdc)<br>(V <sub>OH</sub> = 4.6 Vdc)<br>(V <sub>OH</sub> = 9.5 Vdc)<br>(V <sub>OH</sub> = 13.5 Vdc) | Source<br>I <sub>OH</sub>   | 5.0                    | - 1.2  | —     | - 1.0 | - 1.7     | —     | - 0.7   | —     | mAdc |   |
|   |   | 5.0                    | - 0.25   | —     | - 0.2 | - 0.36    | —     | - 0.14  | —     |      |   |
|   |   | 10                     | - 0.62   | —     | - 0.5 | - 0.9     | —     | - 0.35  | —     |      |   |
|   | Sink<br>I <sub>OL</sub>   | 5.0                    | 5.0  | 0.64  | —     | 0.51      | 0.88  | —       | 0.36  |      | — |
|   |   |                        | 10   | 1.6   | —     | 1.3       | 2.25  | —       | 0.9   |      | — |
|   |   |                        | 15   | 4.2   | —     | 3.4       | 8.8   | —       | 2.4   |      | — |
| Input Current   | I <sub>in</sub>   | 15                     | —  | ± 0.1 | —     | ± 0.00001 | ± 0.1 | —       | ± 1.0 | μAdc |   |
| Input Capacitance<br>(V <sub>in</sub> = 0)  | C <sub>in</sub>   | —                      | —  | —     | —     | 5.0       | 7.5   | —       | —     | pF   |   |
| Quiescent Current<br>(Per Package)  | I <sub>DD</sub>   | 5.0                    | —  | 0.25  | —     | 0.0005    | 0.25  | —       | 7.5   | μAdc |   |
|   |   | 10                     | —  | 0.5   | —     | 0.0010    | 0.5   | —       | 15    |      |   |
|   |   | 15                     | —  | 1.0   | —     | 0.0015    | 1.0   | —       | 30    |      |   |
| Total Supply Current**†<br>(Dynamic plus Quiescent,<br>Per Gate, C <sub>L</sub> = 50 pF)  | I <sub>T</sub>  | 5.0                    | I <sub>T</sub> = (0.3 μA/kHz) f + I <sub>DD</sub> /N |       |       |           |       |         |       | μAdc |   |
|   |   | 10                     | I <sub>T</sub> = (0.6 μA/kHz) f + I <sub>DD</sub> /N |       |       |           |       |         |       |      |   |
|   |   | 15                     | I <sub>T</sub> = (0.8 μA/kHz) f + I <sub>DD</sub> /N |       |       |           |       |         |       |      |   |

#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 μH (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 = 0.001 x the number of exercised gates per package.

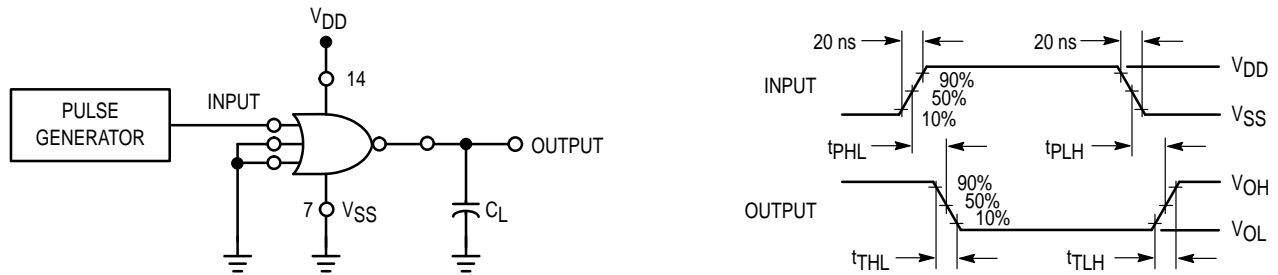
**This device contains protection circuitry to guard against damage due to high static voltages or electric fields. However, precautions must be taken to avoid applications of any voltage higher than maximum rated voltages to this high-impedance circuit. For proper operation, V<sub>in</sub> and V<sub>out</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.**

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

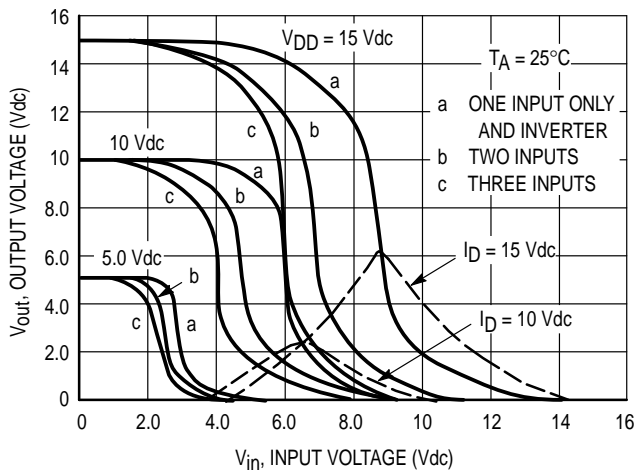
| Characteristic   | Symbol                  | V <sub>DD</sub><br>Vdc | Min         | Typ #           | Max               | Unit |
|--|-------------------------|------------------------|-------------|-----------------|-------------------|------|
| Output Rise Time<br>$t_{TLH} = (3.0 \text{ ns/pF}) C_L + 30 \text{ ns}$<br>$t_{TLH} = (1.5 \text{ ns/pF}) C_L + 15 \text{ ns}$<br>$t_{TLH} = (1.1 \text{ ns/pF}) C_L + 10 \text{ ns}$                                    | $t_{TLH}$               | 5.0<br>10<br>15        | —<br>—<br>— | 180<br>90<br>65 | 360<br>180<br>130 | ns   |
| Output Fall Time<br>$t_{THL} = (1.5 \text{ ns/pF}) C_L + 25 \text{ ns}$<br>$t_{THL} = (0.75 \text{ ns/pF}) C_L + 12.5 \text{ ns}$<br>$t_{THL} = (0.55 \text{ ns/pF}) C_L + 9.5 \text{ ns}$                               | $t_{THL}$               | 5.0<br>10<br>15        | —<br>—<br>— | 100<br>50<br>40 | 200<br>100<br>80  | ns   |
| Propagation Delay Time<br>$t_{PLH}, t_{PHL} = (1.7 \text{ ns/pF}) C_L + 30 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.66 \text{ ns/pF}) C_L + 22 \text{ ns}$<br>$t_{PLH}, t_{PHL} = (0.50 \text{ ns/pF}) C_L + 15 \text{ ns}$ | $t_{PLH},$<br>$t_{PHL}$ | 5.0<br>10<br>15        | —<br>—<br>— | 115<br>55<br>40 | 230<br>110<br>80  | ns   |

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

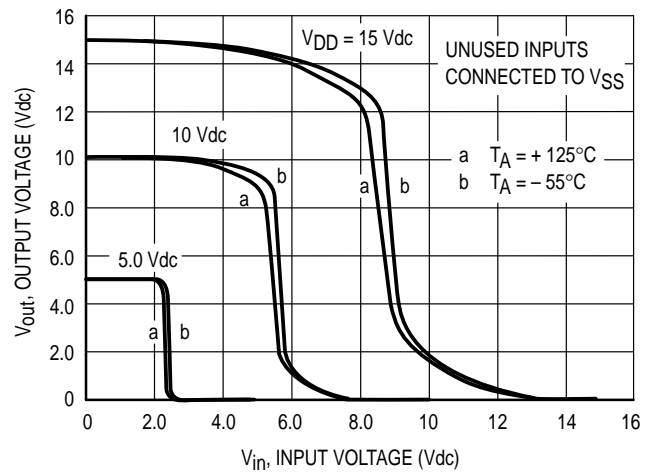
#Data labelled "Typ" is not to be used for design purposes but is intended as an indication of the IC's potential performance.



**Figure 1. Switching Time Test Circuit and Waveforms**



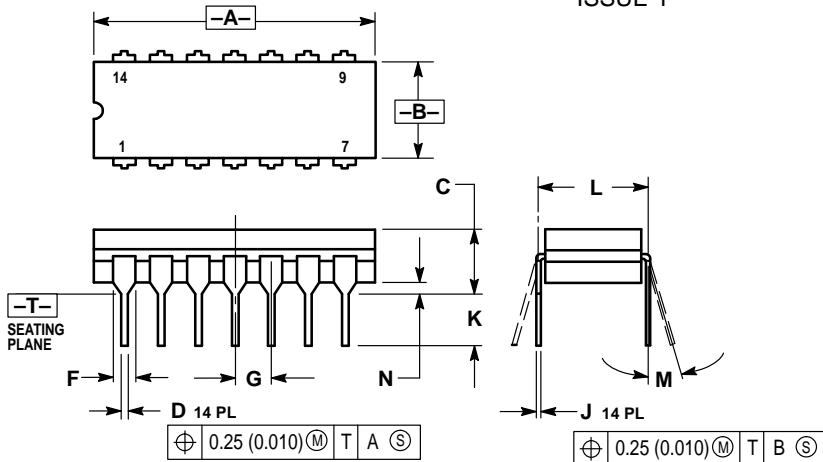
**Figure 2. Typical Voltage and Current Transfer Characteristics**



**Figure 3. Typical Voltage Transfer Characteristics versus Temperature**

## OUTLINE DIMENSIONS

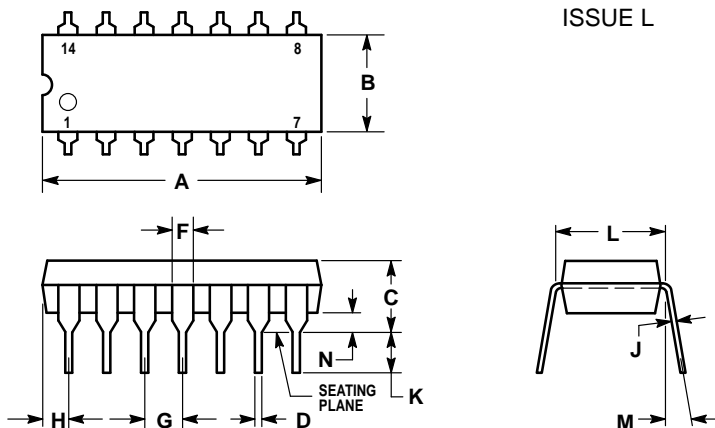
### L SUFFIX CERAMIC DIP PACKAGE CASE 632-08 ISSUE Y



- 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       | 19.94 |
| B   | 0.245     | 0.280 | 6.23        | 7.11  |
| C   | 0.155     | 0.200 | 3.94        | 5.08  |
| D   | 0.015     | 0.020 | 0.39        | 0.50  |
| F   | 0.055     | 0.065 | 1.40        | 1.65  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| J   | 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°         |       |
| N   | 0.020     | 0.040 | 0.51        | 1.01  |

### P SUFFIX PLASTIC DIP PACKAGE CASE 646-06 ISSUE L

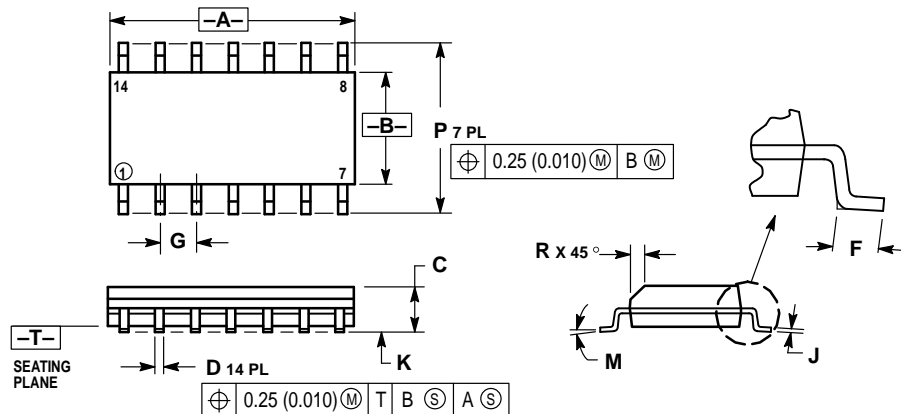


- NOTES:
1. LEADS WITHIN 0.13 (0.005) RADIUS OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  2. DIMENSION L TO CENTER OF LEADS WHEN FORMED PARALLEL.
  3. DIMENSION B DOES NOT INCLUDE MOLD FLASH.
  4. ROUNDED CORNERS OPTIONAL.

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.715     | 0.770 | 18.16       | 19.56 |
| B   | 0.240     | 0.260 | 6.10        | 6.60  |
| C   | 0.145     | 0.185 | 3.69        | 4.69  |
| D   | 0.015     | 0.021 | 0.38        | 0.53  |
| F   | 0.040     | 0.070 | 1.02        | 1.78  |
| G   | 0.100 BSC |       | 2.54 BSC    |       |
| H   | 0.052     | 0.095 | 1.32        | 2.41  |
| J   | 0.008     | 0.015 | 0.20        | 0.38  |
| K   | 0.115     | 0.135 | 2.92        | 3.43  |
| L   | 0.300 BSC |       | 7.62 BSC    |       |
| M   | 0°        |       | 10°         |       |
| N   | 0.015     | 0.039 | 0.39        | 1.01  |

## OUTLINE DIMENSIONS

### D SUFFIX PLASTIC SOIC PACKAGE CASE 751A-03 ISSUE F



**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 0.127 (0.005) TOTAL IN EXCESS OF THE D DIMENSION AT MAXIMUM MATERIAL CONDITION.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 8.55        | 8.75 | 0.337     | 0.344 |
| B   | 3.80        | 4.00 | 0.150     | 0.157 |
| C   | 1.35        | 1.75 | 0.054     | 0.068 |
| D   | 0.35        | 0.49 | 0.014     | 0.019 |
| F   | 0.40        | 1.25 | 0.016     | 0.049 |
| G   | 1.27 BSC    |      | 0.050 BSC |       |
| J   | 0.19        | 0.25 | 0.008     | 0.009 |
| K   | 0.10        | 0.25 | 0.004     | 0.009 |
| M   | 0°          | 7°   | 0°        | 7°    |
| P   | 5.80        | 6.20 | 0.228     | 0.244 |
| R   | 0.25        | 0.50 | 0.010     | 0.019 |

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MC14000UB/D

