

# 9XXX Series

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*011065*  
*011054*  
*010126*  
**9002 • 9003 • 9004**  
*010116*  
*011580*  
**9007 • 9012**  
*010566*  
**9016 • 9017**

## NAND GATES/HEX INVERTERS

**DESCRIPTION** — The 9002, 9003, 9004, 9007, and 9012 are active LOW level output AND gates commonly known as NAND gates. The 9016 and 9017 are hex inverters with input and output characteristics identical to a NAND gate.

**ORDERING CODE:** See Section 9

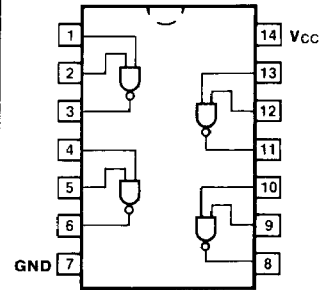
| PKGS               | PIN OUT | COMMERCIAL GRADE   | MILITARY GRADE   | PKG TYPE |
|--------------------|---------|--|--|----------|
|                    |         | V <sub>CC</sub> = +5.0 V ±5%,<br>T <sub>A</sub> = 0°C to +75°C | V <sub>CC</sub> = +5.0 V ±10%,<br>T <sub>A</sub> = -55°C to +125°C |          |
| Ceramic<br>DIP (D) | A       | 9002DC, 9012DC   | 9002DM, 9012DM   | 6A       |
|                    | B       | 9003DC   | 9003DM   |          |
|                    | C       | 9004DC   | 9004DM   |          |
|                    | D       | 9007DC   | 9007DM   |          |
|                    | E       | 9016DC, 9017DC   | 9016DM, 9017DM   |          |
| Flatpak<br>(F)     | A       | 9002FC, 9012FC   | 9002FM, 9012FM   | 3I       |
|                    | B       | 9003FC   | 9003FM   |          |
|                    | C       | 9004FC   | 9004FM   |          |
|                    | D       | 9007FC   | 9007FM   |          |
|                    | E       | 9016FC, 9017FC   | 9016FM, 9017FM   |          |

**INPUT LOADING/FAN-OUT:** See Section 3 for U.L. definitions

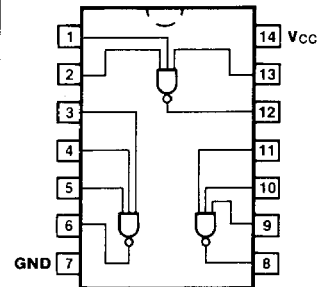
| PINS    | 9XXX (U.L.)<br>HIGH/LOW |
|---------|-------------------------|
| Inputs  | 1.5/1.0                 |
| Outputs | 30*/8.8                 |

\*9012 and 9017 have open-collector outputs

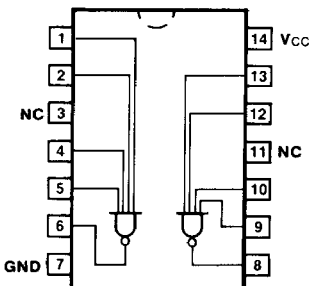
### CONNECTION DIAGRAMS PINOUT A



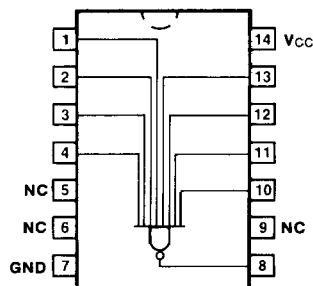
### PINOUT B



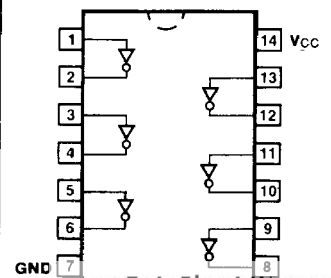
### PINOUT C



### PINOUT D



### PINOUT E



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| DC AND AC CHARACTERISTICS OVER COMMERCIAL TEMPERATURE RANGE: $V_{CC} = +5.0\text{ V} \pm 5\%$ |   |  |            |     |        |     |       |     |               |   |
|---|---|--|------------|-----|--------|-----|-------|-----|---------------|---|
| SYMBOL  | PARAMETER                               |  | 0°C        |     | 25°C   |     | 75°C  |     | UNITS         | CONDITIONS  |
|   |   |  | Min        | Max | Min    | Max | Min   | Max |               |   |
| $V_{IH}$  | Input HIGH Voltage                      |  | 1.9        |     | 1.8    |     | 1.6   |     | V             | Guaranteed Input HIGH Threshold   |
| $V_{IL}$  | Input LOW Voltage                       |  | 0.85       |     | 0.85   |     | 0.85  |     | V             | Guaranteed Input LOW Threshold  |
| $V_{OH}$  | Output HIGH Voltage (except 9012, 9017) |  | 2.4        |     | 2.4    |     | 2.4   |     | V             | $V_{CC} = 4.75\text{ V}$ ,<br>$I_{OH} = -1.2\text{ mA}$ ,<br>Inputs at $V_{IL}$     |
| $V_{OL}$  | Output LOW Voltage                      |  | 0.45       |     | 0.45   |     | 0.45  |     | V             | $V_{CC} = 5.25\text{ V}$ ,<br>$I_{OL} = 16\text{ mA}$ ,<br>$V_{IN} = 5.25\text{ V}$ |
|   |   |  | 0.45       |     | 0.45   |     | 0.45  |     |               | $V_{CC} = 4.75\text{ V}$ ,<br>$I_{OL} = 14.1\text{ mA}$ ,<br>Inputs at $V_{IH}$     |
| $I_{IH}$  | Input HIGH Current                      |  |            |     | 60     |     | 60    |     | $\mu\text{A}$ | $V_{CC} = 5.25\text{ V}$ ,<br>$V_{IN} = 4.5\text{ V}$<br>Gnd on Other Inputs        |
| $I_{IL}$  | Input LOW Current                       |  | -1.6       |     | -1.6   |     | -1.6  |     | mA            | $V_{CC} = 5.25\text{ V}$<br>$V_{IN} = 0.45\text{ V}$ ,<br>5.25 V on Other Inputs    |
|   |   |  | -1.41      |     | -1.41  |     | -1.41 |     |               | $V_{CC} = 4.75\text{ V}$<br>$V_{IN} = 0.45\text{ V}$ ,<br>5.25 V on Other Inputs    |
| $I_{OH}$  | Output HIGH Current<br>9012, 9017       |  |            |     | 250    |     | 250   |     | $\mu\text{A}$ | $V_{CC} = 4.75\text{ V}$ ,<br>$V_{IN} = V_{IL}$ ,<br>$V_{OUT} = 5.5\text{ V}$       |
| $I_{CC}$  | Power Supply Current, each gate         |  | ON.        |     | 6.1    |     | 6.1   |     | mA            | $V_{IN} = \text{Open}$<br>$V_{IN} = \text{Gnd}$                                     |
|   |   |  | OFF        |     | 1.7    |     | 1.7   |     |               |   |
| $t_{PLH}$   | Propagation Delay<br>Input to Output    |  |            |     | 3.0 13 |     |       |     | ns            | $C_L = 15\text{ pF}$ , Fig. 3-4   |
|   |   |  | 9012, 9017 |     | 3.0 45 |     |       |     |               | $R_L = 4.0\text{ k}\Omega$<br>$C_L = 15\text{ pF}$ , Fig. 3-4                       |
| $t_{PHL}$   | Propagation Delay<br>Input to Output    |  |            |     | 3.0 15 |     |       |     | ns            | $C_L = 15\text{ pF}$ , Fig. 3-4   |
|   |   |  | 9012, 9017 |     | 3.0 15 |     |       |     |               | $R_L = 400\ \Omega$<br>$C_L = 15\text{ pF}$ , Fig. 3-4                              |

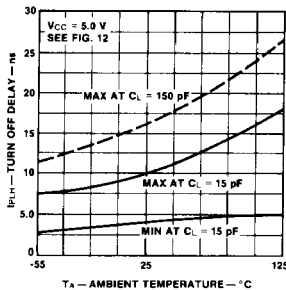
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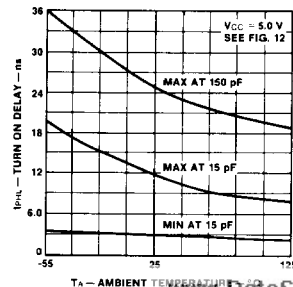
**DC AND AC CHARACTERISTICS OVER MILITARY TEMPERATURE RANGE:  $V_{CC} = +5.0\text{ V} \pm 10\%$**

| SYMBOL    | PARAMETER                               | -55°C      |       | 25°C |       | 125°C |       | UNITS         | CONDITIONS  |
|-----------|---|------------|-------|------|-------|-------|-------|---------------|---|
|           |   | Min        | Max   | Min  | Max   | Min   | Max   |               |   |
| $V_{IH}$  | Input HIGH Voltage                      | 2.0        |       | 1.7  |       | 1.4   |       | V             | Guaranteed Input HIGH Threshold   |
| $V_{IL}$  | Input LOW Voltage                       |            | 0.8   |      | 0.9   |       | 0.8   | V             | Guaranteed Input LOW Threshold  |
| $V_{OH}$  | Output HIGH Voltage (except 9012, 9017) | 2.4        |       | 2.4  |       | 2.4   |       | V             | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OH} = -1.32\text{ mA}$ ,<br>Inputs at $V_{IL}$     |
| $V_{OL}$  | Output LOW Voltage                      |            | 0.4   |      | 0.4   |       | 0.4   | V             | $V_{CC} = 5.5\text{ V}$ ,<br>$I_{OL} = 17.6\text{ mA}$ ,<br>$V_{IN} = 5.5\text{ V}$ |
|           |   |            | 0.4   |      | 0.4   |       | 0.4   |               | $V_{CC} = 4.5\text{ V}$ ,<br>$I_{OL} = 13.6\text{ mA}$ ,<br>Inputs at $V_{IH}$      |
| $I_{IH}$  | Input HIGH Current                      |            |       | 60   |       | 60    |       | $\mu\text{A}$ | $V_{CC} = 5.5\text{ V}$ ,<br>$V_{IN} = 4.5\text{ V}$<br>Gnd on Other Inputs         |
| $I_{IL}$  | Input LOW Current                       |            | -1.6  |      | -1.6  |       | -1.6  | mA            | $V_{CC} = 5.5\text{ V}$<br>$V_{IN} = 0.4\text{ V}$<br>5.5 V on Other Inputs         |
|           |   |            | -1.24 |      | -1.24 |       | -1.24 |               | $V_{CC} = 4.5\text{ V}$<br>$V_{IN} = 0.4\text{ V}$<br>5.5 V on Other Inputs         |
| $I_{OH}$  | Output HIGH Current<br>9012, 9017       |            |       | 250  |       | 250   |       | $\mu\text{A}$ | $V_{CC} = 4.5$ , $V_{IN} = V_{IL}$<br>$V_{OUT} = 5.5\text{ V}$                      |
| $I_{CC}$  | Power Supply Current, each gate         | ON         | 5.5   | 5.5  | 5.5   | 5.5   |       | mA            | $V_{IN} = \text{Open}$  |
|           |   | OFF        | 1.6   | 1.6  | 1.6   | 1.6   |       |               | $V_{IN} = \text{Gnd}$   |
| $t_{PLH}$ | Propagation Delay<br>Input to Output    | 9012, 9017 |       | 3.0  | 10    |       |       | ns            | $C_L = 15\text{ pF}$ , Fig. 3-4   |
|           |   |            |       | 3.0  | 45    |       |       |               | $R_L = 4.0\text{ k}\Omega$<br>$C_L = 15\text{ pF}$ , Fig. 3-4                       |
| $t_{PHL}$ | Propagation Delay<br>Input to Output    | 9012,9017  |       | 3.0  | 12    |       |       | ns            | $C_L = 15\text{ pF}$ , Fig. 3-4   |
|           |   |            |       | 3.0  | 15    |       |       |               | $R_L = 400\ \Omega$<br>$C_L = 15\text{ pF}$ , Fig. 3-4                              |

**WORST CASE TURN OFF DELAY  
VERSUS  
AMBIENT TEMPERATURE**



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VERSUS  
AMBIENT TEMPERATURE**



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