

9XXX Series

9002 • 9003 • 9004  
9007 • 9012  
9016 • 9017

NAND GATES/HEX INVERTERS

**DESCRIPTION** — The 9002, 9003, 9004, 9007, and 9012 are active LOW level output AND gates commonly know 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

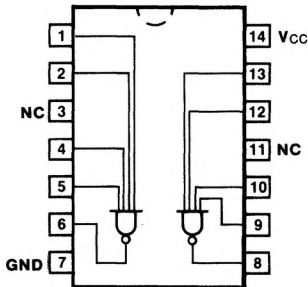
| PKGS               | PIN OUT | COMMERCIAL GRADE                                               | MILITARY GRADE                                                     | PKG TYPE |
|--------------------|---------|----------------------------------------------------------------|--------------------------------------------------------------------|----------|
|                    |         | 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

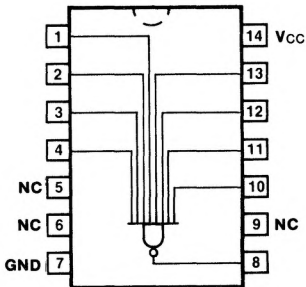
| PINS    | 9XXX (U.L.)<br>HIGH/LOW |
|---------|-------------------------|
| Inputs  | 1.5/1.0                 |
| Outputs | 30*/8.8                 |

\*9012 and 9017 have open-collector outputs

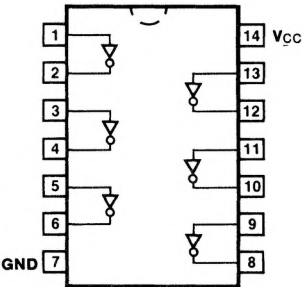
PINOUT C



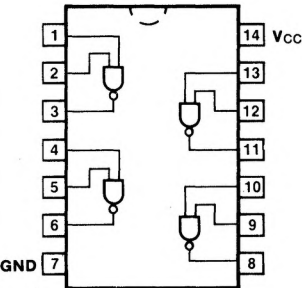
PINOUT D



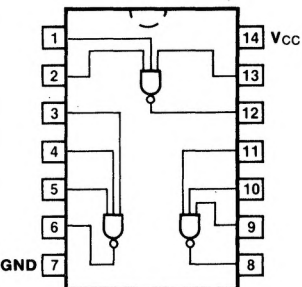
PINOUT E



CONNECTION DIAGRAMS  
PINOUT A



PINOUT B



# 9XXX Series

## DC AND AC CHARACTERISTICS OVER COMMERCIAL TEMPERATURE RANGE: $V_{CC} = +5.0\text{ V} \pm 5\%$

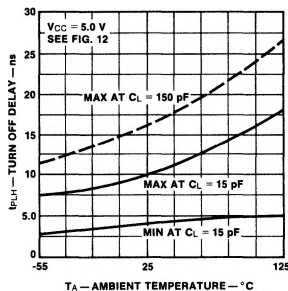
| SYMBOL           | PARAMETER                               |            | 0°C   |     | 25°C  |     | 75°C  |     | UNITS | CONDITIONS                                                                             |                        |
|------------------|-----------------------------------------|------------|-------|-----|-------|-----|-------|-----|-------|----------------------------------------------------------------------------------------|------------------------|
|                  |                                         |            | Min   | Max | Min   | Max | Min   | Max |       |                                                                                        |                        |
| V <sub>IH</sub>  | Input HIGH Voltage                      |            | 1.9   |     | 1.8   |     | 1.6   |     | V     | Guaranteed Input HIGH Threshold                                                        |                        |
| V <sub>IL</sub>  | Input LOW Voltage                       |            | 0.85  |     | 0.85  |     | 0.85  |     | V     | Guaranteed Input LOW Threshold                                                         |                        |
| V <sub>OH</sub>  | Output HIGH Voltage (except 9012, 9017) |            | 2.4   |     | 2.4   |     | 2.4   |     | V     | V <sub>CC</sub> = 4.75 V, I <sub>OH</sub> = -1.2 mA, Inputs at V <sub>IL</sub>         |                        |
| V <sub>OL</sub>  | Output LOW Voltage                      |            | 0.45  |     | 0.45  |     | 0.45  |     | V     | V <sub>CC</sub> = 5.25 V, I <sub>OL</sub> = 16 mA, V <sub>IN</sub> = 5.25 V            |                        |
|                  |                                         |            | 0.45  |     | 0.45  |     | 0.45  |     |       | V <sub>CC</sub> = 4.75 V, I <sub>OL</sub> = 14.1 mA, Inputs at V <sub>IH</sub>         |                        |
| i <sub>IH</sub>  | Input HIGH Current                      |            |       |     | 60    |     | 60    |     | μA    | V <sub>CC</sub> = 5.25 V, V <sub>IN</sub> = 4.5 V<br>Gnd on Other Inputs               |                        |
| I <sub>IL</sub>  | Input LOW Current                       |            | -1.6  |     | -1.6  |     | -1.6  |     | mA    | V <sub>CC</sub> = 5.25 V<br>V <sub>IN</sub> = 0.45 V, 5.25 V on Other Inputs           |                        |
|                  |                                         |            | -1.41 |     | -1.41 |     | -1.41 |     |       | V <sub>CC</sub> = 4.75 V<br>V <sub>IN</sub> = 0.45 V, 5.25 V on Other Inputs           |                        |
| I <sub>OH</sub>  | Output HIGH Current 9012, 9017          |            |       |     | 250   |     | 250   |     | μA    | V <sub>CC</sub> = 4.75 V, V <sub>IN</sub> = V <sub>IL</sub> , V <sub>OUT</sub> = 5.5 V |                        |
| I <sub>CC</sub>  | Power Supply Current, each gate         |            | ON    | 6.1 |       | 6.1 |       | 6.1 |       | mA                                                                                     | V <sub>IN</sub> = Open |
|                  |                                         |            | OFF   | 1.7 |       | 1.7 |       | 1.7 |       |                                                                                        | V <sub>IN</sub> = Gnd  |
| t <sub>PLH</sub> | Propagation Delay Input to Output       |            |       |     | 3.0   | 13  |       |     | ns    | C <sub>L</sub> = 15 pF, Fig. 3-4                                                       |                        |
|                  |                                         | 9012, 9017 |       |     | 3.0   | 45  |       |     |       | R <sub>L</sub> = 4.0 kΩ<br>C <sub>L</sub> = 15 pF, Fig. 3-4                            |                        |
| t <sub>PHL</sub> | Propagation Delay Input to Output       |            |       |     | 3.0   | 15  |       |     | ns    | C <sub>L</sub> = 15 pF, Fig. 3-4                                                       |                        |
|                  |                                         | 9012, 9017 |       |     | 3.0   | 15  |       |     |       | R <sub>L</sub> = 400 Ω<br>C <sub>L</sub> = 15 pF, Fig. 3-4                             |                        |

9XXX Series

DC AND AC CHARACTERISITICS OVER MILITARY TEMPERATURE RANGE: VCC = +5.0 V ±10%

| SYMBOL           | PARAMETER                                  | -55°C |       | 25°C |       | 125°C |       | UNITS | CONDITIONS                                                                                      |
|------------------|--------------------------------------------|-------|-------|------|-------|-------|-------|-------|-------------------------------------------------------------------------------------------------|
|                  |                                            | Min   | Max   | Min  | Max   | Min   | Max   |       |                                                                                                 |
| V <sub>IH</sub>  | Input HIGH Voltage                         | 2.0   |       | 1.7  |       | 1.4   |       | V     | Guaranteed Input HIGH Threshold                                                                 |
| V <sub>IL</sub>  | Input LOW Voltage                          |       | 0.8   |      | 0.9   |       | 0.8   | V     | Guaranteed Input LOW Threshold                                                                  |
| V <sub>OH</sub>  | Output HIGH Voltage<br>(except 9012, 9017) | 2.4   |       | 2.4  |       | 2.4   |       | V     | V <sub>CC</sub> = 4.5 V,<br>I <sub>OH</sub> = -1.32 mA,<br>Inputs at V <sub>IL</sub>            |
| V <sub>OL</sub>  | Output LOW Voltage                         |       | 0.4   |      | 0.4   |       | 0.4   | V     | V <sub>CC</sub> = 5.5 V,<br>I <sub>OL</sub> = 17.6 mA,<br>V <sub>IN</sub> = 5.5 V               |
|                  |                                            |       | 0.4   |      | 0.4   |       | 0.4   |       | V <sub>CC</sub> = 4.5 V,<br>I <sub>OL</sub> = 13.6 mA,<br>Inputs at V <sub>IH</sub>             |
| I <sub>IH</sub>  | Input HIGH Current                         |       |       | 60   |       | 60    |       | μA    | V <sub>CC</sub> = 5.5 V,<br>V <sub>IN</sub> = 4.5 V<br>Gnd on Other Inputs                      |
| I <sub>IL</sub>  | Input LOW Current                          |       | -1.6  |      | -1.6  |       | -1.6  | mA    | V <sub>CC</sub> = 5.5 V<br>V <sub>IN</sub> = 0.4 V<br>5.5 V on Other Inputs                     |
|                  |                                            |       | -1.24 |      | -1.24 |       | -1.24 |       | V <sub>CC</sub> = 4.5 V<br>V <sub>IN</sub> = 0.4 V<br>5.5 V on Other Inputs                     |
| I <sub>OH</sub>  | Output HIGH Current<br>9012, 9017          |       |       | 250  |       | 250   |       | μA    | V <sub>CC</sub> = 4.5, V <sub>IN</sub> = V <sub>IL</sub><br>V <sub>OUT</sub> = 5.5 V            |
| I <sub>CC</sub>  | Power Supply<br>Current, each gate         | ON    |       | 5.5  | 5.5   | 5.5   |       | mA    | V <sub>IN</sub> = Open                                                                          |
|                  |                                            | OFF   |       | 1.6  | 1.6   | 1.6   |       |       | V <sub>IN</sub> = Gnd                                                                           |
| t <sub>PLH</sub> | Propagation Delay<br>Input to Output       |       |       | 3.0  | 10    |       |       | ns    | C <sub>L</sub> = 15 pF, Fig. 3-4<br>R <sub>L</sub> = 4.0 kΩ<br>C <sub>L</sub> = 15 pF, Fig. 3-4 |
|                  |                                            |       |       | 3.0  | 45    |       |       |       |                                                                                                 |
| t <sub>PHL</sub> | Propagation Delay<br>Input to Output       |       |       | 3.0  | 12    |       |       | ns    | C <sub>L</sub> = 15 pF, Fig. 3-4<br>R <sub>L</sub> = 400 Ω                                      |
|                  |                                            |       |       | 3.0  | 15    |       |       |       | C <sub>L</sub> = 15 pF, Fig. 3-4                                                                |

WORST CASE TURN OFF DELAY  
VERSUS  
AMBIENT TEMPERATURE



WORST CASE TURN ON DELAY  
VERSUS  
AMBIENT TEMPERATURE

