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## NC7S00 TinyLogic® HS 2-Input NAND Gate

### General Description

The NC7S00 is a single 2-Input high performance CMOS NAND Gate. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation over a broad  $V_{CC}$  range. ESD protection diodes inherently guard both inputs and output with respect to the  $V_{CC}$  and GND rails. Three stages of gain between inputs and output assures high noise immunity and reduced sensitivity to input edge rate.

### Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- High speed:  $t_{PD}$  3.5 ns typ
- Low Quiescent Power:  $I_{CC} < 1 \mu A$
- Balanced Output Drive: 2 mA  $I_{OL}$ , -2 mA  $I_{OH}$
- Broad  $V_{CC}$  Operating Range: 2V-6V
- Balanced Propagation Delays
- Specified for 3V operation

### Ordering Code:

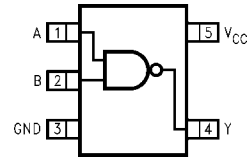
| Order Number | Package Number | Product Code Top Mark | Package Description                   | Supplied As               |
|--------------|----------------|-----------------------|---------------------------------------|---------------------------|
| NC7S00M5X    | MA05B          | 7S00                  | 5-Lead SOT23, JEDEC MO-178, 1.6mm     | 3k Units on Tape and Reel |
| NC7S00P5X    | MAA05A         | S00                   | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7S00L6X    | MAC06A         | A3                    | 6-Lead MicroPak, 1.0mm Wide           | 5k Units on Tape and Reel |

### Logic Symbol



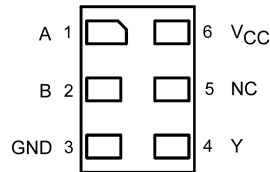
### Connection Diagrams

#### Pin Assignments for SC70 and SOT23



(Top View)

#### Pad Assignments for MicroPak



(Top Thru View)

### Pin Descriptions

| Pin Names | Description |
|-----------|-------------|
| A, B      | Input       |
| Y         | Output      |
| NC        | No Connect  |

### Function Table

$$Y = \overline{AB}$$

| Inputs |   | Output |
|--------|---|--------|
| A      | B | Y      |
| L      | L | H      |
| L      | H | H      |
| H      | L | H      |
| H      | H | L      |

H = HIGH Logic Level

L = LOW Logic Level

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**Absolute Maximum Ratings**(Note 1)

|  |                                 |
|--|---------------------------------|
| Supply Voltage (V <sub>CC</sub> )  | -0.5V to +7.0V                  |
| DC Input Diode Current (I <sub>IK</sub> )  |                                 |
| @ V <sub>IN</sub> ≤ -0.5V  | -20 mA                          |
| @ V <sub>IN</sub> ≥ V <sub>CC</sub> + 0.5V   | +20 mA                          |
| DC Input Voltage (V <sub>IN</sub> )  | -0.5V to V <sub>CC</sub> + 0.5V |
| DC Output Diode Current (I <sub>OK</sub> )   |                                 |
| @ V <sub>OUT</sub> < -0.5V   | -20 mA                          |
| @ V <sub>OUT</sub> > V <sub>CC</sub> + 0.5V  | +20 mA                          |
| DC Output Voltage (V <sub>OUT</sub> )  | -0.5V to V <sub>CC</sub> + 0.5V |
| DC Output Source or Sink Current (I <sub>OUT</sub> )                                       | ±12.5 mA                        |
| DC V <sub>CC</sub> or Ground Current per Output Pin (I <sub>CC</sub> or I <sub>GND</sub> ) | ±25 mA                          |
| Storage Temperature (T <sub>STG</sub> )  | -65°C to +150°C                 |
| Junction Temperature (T <sub>J</sub> )   | 150°C                           |
| Lead Temperature (T <sub>L</sub> ); (Soldering, 10 seconds)                                | 260°C                           |
| Power Dissipation (P <sub>D</sub> ) @ +85°C  |                                 |
| SOT23-5  | 200 mW                          |
| SC70-5   | 150 mW                          |

**Recommended Operating Conditions** (Note 2)

|   |                    |
|---|--------------------|
| Supply Voltage (V <sub>CC</sub> )                           | 2.0V-6.0V          |
| Input Voltage (V <sub>IN</sub> )                            | 0V-V <sub>CC</sub> |
| Output Voltage (V <sub>OUT</sub> )                          | 0V-V <sub>CC</sub> |
| Operating Temperature (T <sub>A</sub> )                     | -40°C to +85°C     |
| Input Rise and Fall Time (t <sub>r</sub> , t <sub>f</sub> ) |                    |
| V <sub>CC</sub> @ 2.0V                                      | 0-1000 ns          |
| V <sub>CC</sub> @ 3.0V                                      | 0-750 ns           |
| V <sub>CC</sub> @ 4.5V                                      | 0-500 ns           |
| V <sub>CC</sub> @ 6.0V                                      | 0-400 ns           |
| Thermal Resistance (θ <sub>JA</sub> )                       |                    |
| SOT23-5   | 300°C/W            |
| SC70-5  | 425°C/W            |

**Note 1:** Absolute maximum ratings are those values beyond which damage to the device may occur. The databook specifications should be met, with-out exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation of circuits outside the databook specifications.

**Note 2:** Unused inputs must be held HIGH or LOW. They may not float.

**DC Electrical Characteristics**

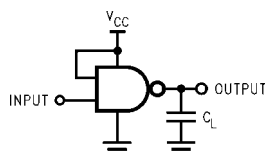
| Symbol          | Parameter                 | V <sub>CC</sub> (V) | T <sub>A</sub> = +25°C |                     |      | T <sub>A</sub> = -40°C to +85°C |      | Units | Conditions  |  |
|-----------------|---------------------------|---------------------|------------------------|---------------------|------|---------------------------------|------|-------|---|--|
|                 |                           |                     | Min                    | Typ                 | Max  | Min                             | Max  |       |   |  |
| V <sub>IH</sub> | HIGH Level Input Voltage  | 2.0                 | 1.50                   |                     |      | 1.50                            |      | V     |   |  |
|                 |                           | 3.0 - 6.0           | 0.7 V <sub>CC</sub>    |                     |      | 0.7 V <sub>CC</sub>             |      |       |   |  |
| V <sub>IL</sub> | LOW Level Input Voltage   | 2.0                 |                        | 0.50                |      | 0.50                            |      | V     |   |  |
|                 |                           | 3.0 - 6.0           |                        | 0.3 V <sub>CC</sub> |      | 0.3 V <sub>CC</sub>             |      |       |   |  |
| V <sub>OH</sub> | HIGH Level Output Voltage | 2.0                 | 1.90                   | 2.0                 |      | 1.90                            |      | V     | I <sub>OH</sub> = -20 μA<br>V <sub>IN</sub> = V <sub>IL</sub> |  |
|                 |                           | 3.0                 | 2.90                   | 3.0                 |      | 2.90                            |      |       |   |  |
|                 |                           | 4.5                 | 4.40                   | 4.5                 |      | 4.40                            |      |       |   |  |
|                 |                           | 6.0                 | 5.90                   | 6.0                 |      | 5.90                            |      |       |   |  |
|                 |                           |                     | 3.0                    | 2.68                | 2.85 |                                 | 2.63 |       | V   | V <sub>IN</sub> = V <sub>IL</sub><br>I <sub>OH</sub> = -1.3 mA<br>I <sub>OH</sub> = -2 mA<br>I <sub>OH</sub> = -2.6 mA |
|                 |                           |                     | 4.5                    | 4.18                | 4.35 |                                 | 4.13 |       |   |  |
|                 |                           |                     | 6.0                    | 5.68                | 5.85 |                                 | 5.63 |       |   |  |
|                 |                           |                     |                        |                     |      |                                 |      |       |   |  |
| V <sub>OL</sub> | LOW Level Output Voltage  | 2.0                 |                        | 0.0                 | 0.10 |                                 | 0.10 | V     | I <sub>OL</sub> = 20 μA<br>V <sub>IN</sub> = V <sub>IH</sub>  |  |
|                 |                           | 3.0                 |                        | 0.0                 | 0.10 |                                 | 0.10 |       |   |  |
|                 |                           | 4.5                 |                        | 0.0                 | 0.10 |                                 | 0.10 |       |   |  |
|                 |                           | 6.0                 |                        | 0.0                 | 0.10 |                                 | 0.10 |       |   |  |
|                 |                           |                     | 3.0                    |                     | 0.1  | 0.26                            |      | 0.33  | V   | V <sub>IN</sub> = V <sub>IH</sub><br>I <sub>OL</sub> = 1.3 mA<br>I <sub>OL</sub> = 2 mA<br>I <sub>OL</sub> = 2.6 mA    |
|                 |                           |                     | 4.5                    |                     | 0.1  | 0.26                            |      | 0.33  |   |  |
|                 |                           |                     | 6.0                    |                     | 0.1  | 0.26                            |      | 0.33  |   |  |
|                 |                           |                     |                        |                     |      |                                 |      |       |   |  |
| I <sub>IN</sub> | Input Leakage Current     | 6.0                 |                        | ±0.1                |      | ±1.0                            |      | μA    | V <sub>IN</sub> = V <sub>CC</sub> , GND                       |  |
| I <sub>CC</sub> | Quiescent Supply Current  | 6.0                 |                        | 1.0                 |      | 10.0                            |      | μA    | V <sub>IN</sub> = V <sub>CC</sub> , GND                       |  |

## AC Electrical Characteristics

| Symbol                                 | Parameter                     | V <sub>CC</sub><br>(V) | T <sub>A</sub> = +25°C |      |     | T <sub>A</sub> = -40°C to +85°C |     | Units | Conditions             | Figure Number |
|--|-------------------------------|------------------------|------------------------|------|-----|---------------------------------|-----|-------|------------------------|---------------|
|  |                               |                        | Min                    | Typ  | Max | Min                             | Max |       |                        |               |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay             | 5.0                    |                        | 3.5  | 15  |                                 |     | ns    | C <sub>L</sub> = 15 pF | Figures 1, 3  |
|  |                               | 2.0                    |                        | 19   | 100 |                                 | 125 |       | C <sub>L</sub> = 50 pF |               |
|  |                               | 3.0                    |                        | 10.5 | 27  |                                 | 35  | ns    |                        |               |
|  |                               | 4.5                    |                        | 7.5  | 20  |                                 | 25  |       |                        |               |
|  |                               | 6.0                    |                        | 6.5  | 17  |                                 | 21  |       |                        |               |
| t <sub>TLH</sub> ,<br>t <sub>THL</sub> | Output Transition Time        | 5.0                    |                        | 3.0  | 10  |                                 |     | ns    | C <sub>L</sub> = 15 pF | Figures 1, 3  |
|  |                               | 2.0                    |                        | 25   | 125 |                                 | 155 | ns    | C <sub>L</sub> = 50 pF |               |
|  |                               | 3.0                    |                        | 16   | 35  |                                 | 45  |       |                        |               |
|  |                               | 4.5                    |                        | 11   | 25  |                                 | 31  |       |                        |               |
|  |                               | 6.0                    |                        | 9    | 21  |                                 | 26  |       |                        |               |
| C <sub>IN</sub>                        | Input Capacitance             | Open                   |                        | 2    | 10  |                                 |     | pF    |                        |               |
| C <sub>PD</sub>                        | Power Dissipation Capacitance | 5.0                    |                        | 6    |     |                                 |     | pF    | (Note 3)               | Figure 2      |

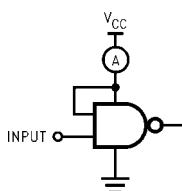
**Note 3:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2.) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
 $I_{CCD} = (C_{PD}) (V_{CC}) (f_{IN}) + (I_{CCstatic})$ .

## AC Loading and Waveforms



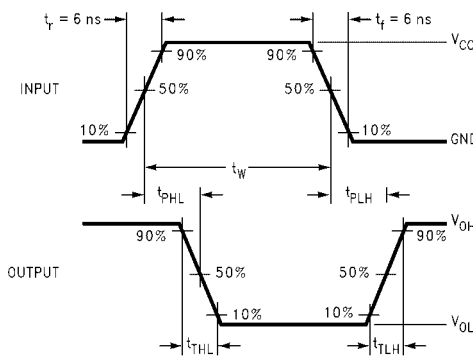
C<sub>L</sub> includes load and stray capacitance  
 Input PRR = 1.0 MHz, t<sub>w</sub> = 500 ns

**FIGURE 1. AC Test Circuit**



Input = AC Waveform;  
 PRR = variable; Duty Cycle = 50%

**FIGURE 2. I<sub>CCD</sub> Test Circuit**



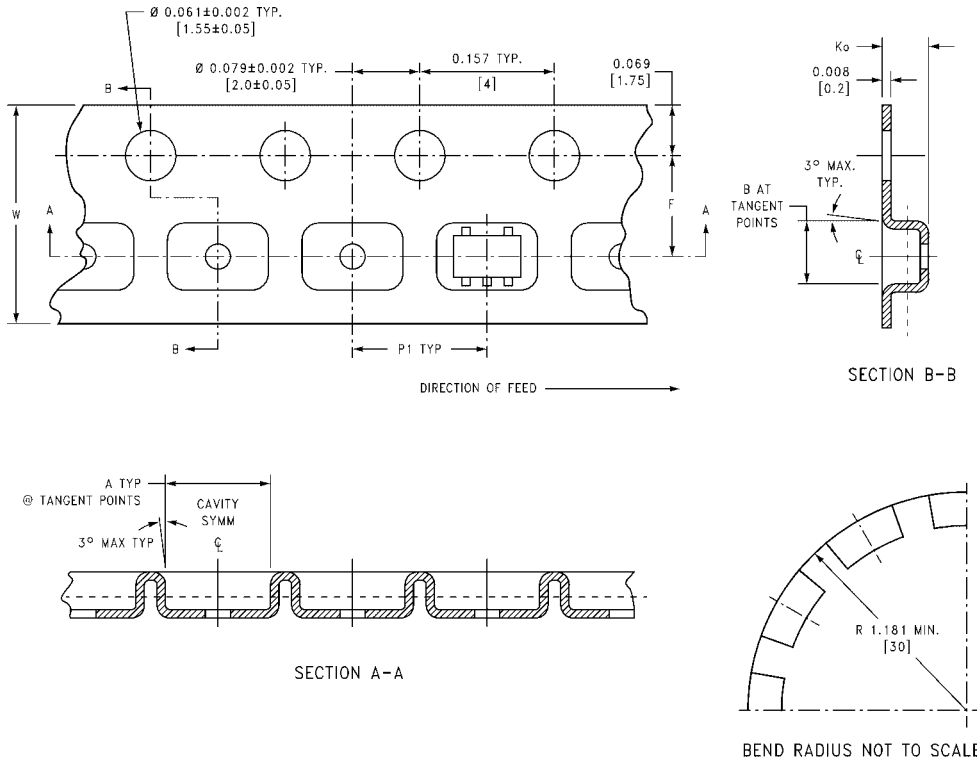
**FIGURE 3. AC Waveforms**

## Tape and Reel Specification

### TAPE FORMAT for SC70 and SOT23

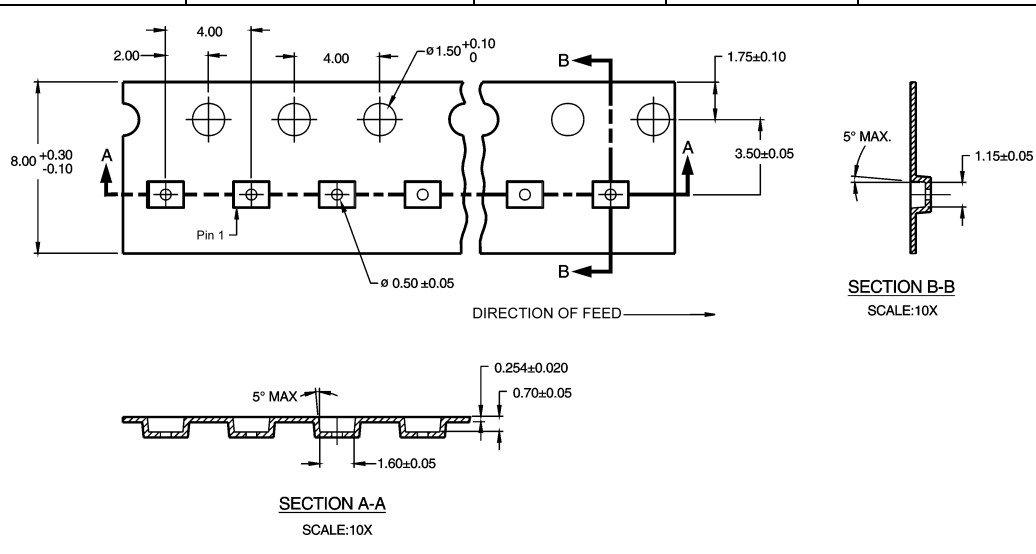
| Package Designator | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| M5X, P5X           | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|                    | Carrier            | 3000            | Filled        | Sealed            |
|                    | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |

### TAPE DIMENSIONS inches (millimeters)

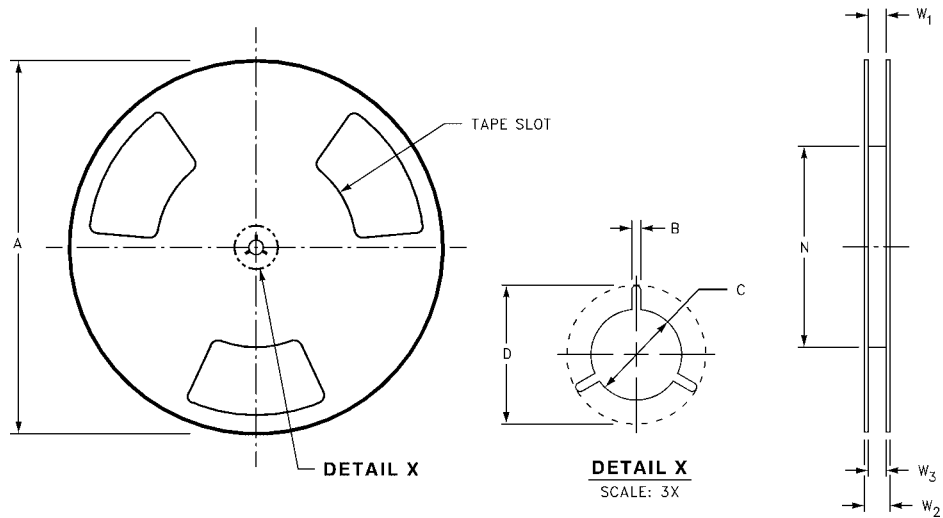


| Package | Tape Size | DIM A           | DIM B           | DIM F                       | DIM K <sub>o</sub>           | DIM P1       | DIM W                    |
|---------|-----------|-----------------|-----------------|-----------------------------|------------------------------|--------------|--------------------------|
| SC70-5  | 8 mm      | 0.093<br>(2.35) | 0.096<br>(2.45) | 0.138 ±0.004<br>(3.5 ±0.10) | 0.053 ±0.004<br>(1.35 ±0.10) | 0.157<br>(4) | 0.315 ±0.004<br>(8 ±0.1) |
| SOT23-5 | 8 mm      | 0.130<br>(3.3)  | 0.130<br>(3.3)  | 0.138 ±0.002<br>(3.5 ±0.05) | 0.055 ±0.004<br>(1.4 ±0.11)  | 0.157<br>(4) | 0.315 ±0.012<br>(8 ±0.3) |

| Tape and Reel Specification (Continued) |                    |                 |               |                   |
|---|--------------------|-----------------|---------------|-------------------|
| TAPE FORMAT for MicroPak                |                    |                 |               |                   |
| Package Designator                      | Tape Section       | Number Cavities | Cavity Status | Cover Tape Status |
| L6X                                     | Leader (Start End) | 125 (typ)       | Empty         | Sealed            |
|   | Carrier            | 5000            | Filled        | Sealed            |
|   | Trailer (Hub End)  | 75 (typ)        | Empty         | Sealed            |



**REEL DIMENSIONS** inches (millimeters)

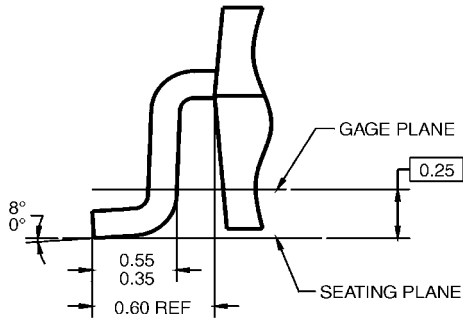
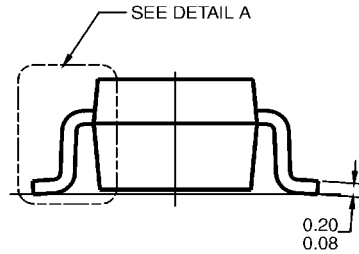
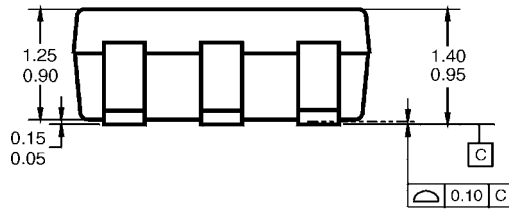


| Tape Size | A              | B               | C                | D                | N                | W1  | W2               | W3                                   |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--------------------------------------|
| 8 mm      | 7.0<br>(177.8) | 0.059<br>(1.50) | 0.512<br>(13.00) | 0.795<br>(20.20) | 2.165<br>(55.00) | 0.331 +0.059/-0.000<br>(8.40 +1.50/-0.00) | 0.567<br>(14.40) | W1 +0.078/-0.039<br>(W1 +2.00/-1.00) |

**Physical Dimensions** inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION



DETAIL A

NOTES: UNLESS OTHERWISE SPECIFIED

- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
- B) ALL DIMENSIONS ARE IN MILLIMETERS.

MA05BRevC

5-Lead SOT23, JEDEC MO-178, 1.6mm  
Package Number MA05B

**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



NOTES:

- A. CONFORMS TO EIAJ REGISTERED OUTLINE DRAWING SC88A.
- B. DIMENSIONS DO NOT INCLUDE BURRS OR MOLD FLASH.
- C. DIMENSIONS ARE IN MILLIMETERS.

MAA05ARevC

**5-Lead SC70, EIAJ SC-88a, 1.25mm Wide  
Package Number MAA05A**



**Physical Dimensions** inches (millimeters) unless otherwise noted (Continued)



**Notes:**

1. JEDEC PACKAGE REGISTRATION IS ANTICIPATED
2. DIMENSIONS ARE IN MILLIMETERS
3. DRAWING CONFORMS TO ASME Y14.5M-1994

MAC06ARevB

**6-Lead MicroPak, 1.0mm Wide  
Package Number MAC06A**

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