

NC7SZ00 TinyLogic™ UHS 2-Input NAND Gate

General Description

The NC7SZ00 is a single 2-Input NAND Gate from Fairchild's Ultra High Speed Series of TinyLogic™. The device is fabricated with advanced CMOS technology to achieve ultra high speed with high output drive while maintaining low static power dissipation over a broad V_{CC} operating range. The device is specified to operate over the 1.8V to 5.5V V_{CC} operating range. The inputs and output are high impedance when V_{CC} is 0V. Inputs tolerate voltages up to 6V independent of V_{CC} operating voltage.

Features

- Space saving SOT23 or SC70 5-lead surface mount package
- Ultra High Speed; T_{PD} 2.4 ns typ into 50 pF at 5V V_{CC}
- High Output Drive; ± 24 mA at 3V V_{CC}
- Broad V_{CC} Operating Range; 1.8V–5.5V
- Matches the performance of LCX when operated at 3.3V V_{CC}
- Power down high impedance inputs/output
- Overvoltage tolerant inputs facilitate 5V to 3V translation
- Patented noise/EMI reduction circuitry implemented

Ordering Code:

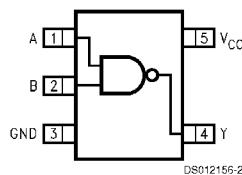
| Product Code | Package | Package Drawing | Package Top Mark | Supplied As |
|--------------|---------|-----------------|------------------|----------------------------|
| NC7SZ00M5 | SOT23-5 | MA05B | 7Z00 | 250 Units on Tape and Reel |
| NC7SZ00M5X | SOT23-5 | MA05B | 7Z00 | 3k Units on Tape and Reel |
| NC7SZ00P5 | SC70-5 | MAA05A | Z00 | 250 Units on Tape and Reel |
| NC7SZ00P5X | SC70-5 | MAA05A | Z00 | 3k Units on Tape and Reel |

Logic Symbol



Connection Diagram

Pin Assignment for 5-lead Packages



(Top View)

Pin Descriptions

| Pin Names | Description |
|-----------|-------------|
| A, B | Inputs |
| Y | Output |

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

Absolute Maximum Ratings (Note 1)

| | |
|---|-----------------|
| Supply Voltage (V_{CC}) | -0.5V to +6V |
| DC Input Voltage (V_{IN}) | -0.5V to +6V |
| DC Output Voltage (V_{OUT}) | -0.5V to +6V |
| DC Input Diode Current (I_{IK}) | |
| @ $V_{IN} < -0.5V$ | -50 mA |
| @ $V_{IN} > 6V$ | +20 mA |
| DC Output Diode Current (I_{OK}) | |
| @ $V_{OUT} < -0.5V$ | -50 mA |
| @ $V_{OUT} > 6V, V_{CC} = GND$ | +20 mA |
| DC Output Current (I_{OUT}) | ± 50 mA |
| DC V_{CC}/GND Current (I_{CC}/I_{GND}) | ± 50 mA |
| Storage Temperature (T_{STG}) | -65°C to +150°C |
| Junction Temperature under Bias (T_J) | 150°C |
| Junction Lead Temperature (T_L); (Soldering, 10 seconds) | 260°C |
| Power Dissipation (P_D) @ +85°C | |
| SOT23-5 | 200 mW |
| SC70-5 | 150 mW |
| ESD Tolerance (Human Body Model) | |
| MIL-STD-883D Method 3015.7 | 1000V |
| DC Latchup Tolerance (JEDEC Method 17) | |

| | |
|-------------------------------|---------|
| Negative Source Current (NIT) | -500 mA |
| Positive Source Voltage (PVT) | +8V |

Recommended Operating Conditions

| | |
|--|-------------------|
| Supply Voltage Operating (V_{CC}) | 1.8V to 5.5V |
| Supply Voltage Data Retention (V_{CC}) | 1.5V to 5.5V |
| Input Voltage (V_{IN}) | 0V to 5.5V |
| Output Voltage (V_{OUT}) | 0V to V_{CC} |
| Operating Temperature (T_A) | -40°C to +85°C |
| Input Rise and Fall Time (t_r, t_f) | |
| V_{CC} @ 1.8V, 2.5V $\pm 0.2V$ | 0 ns/V to 20 ns/V |
| V_{CC} @ 3.3V $\pm 0.3V$ | 0 ns/V to 10 ns/V |
| V_{CC} @ 5.0V $\pm 0.5V$ | 0 ns/V to 5 ns/V |
| Thermal Resistance (θ_{JA}) | |
| SOT23-5 | 300°C/W |
| SC70-5 | 425°C/W |

Note 1: Absolute maximum ratings are DC values beyond which the device may be damaged or have its useful life impaired. The datasheet specifications should be met, without exception, to ensure that the system design is reliable over its power supply, temperature, and output/input loading variables. Fairchild does not recommend operation outside datasheet specifications.

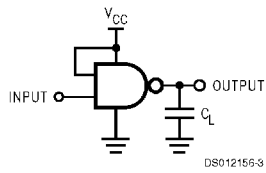
DC Electrical Characteristics

| Symbol | Parameter | V_{CC} (V) | NC7SZ00 | | | NC7SZ00 | | Units | Conditions | | | |
|-----------|---------------------------|-----------------|--------------------------------|--------------------------------|------|--------------------------------|-----|---------------|------------------------------|-----------------------------|----------------------------|--------------------------|
| | | | $T_A = +25^\circ\text{C}$ | | | $T_A =$ | | | | | | |
| | | | Min | Typ | Max | -40°C to +85°C | | | | | | |
| Min | Max | Min | Max | Min | Max | | | | | | | |
| V_{IH} | High Level Input Voltage | 1.8 2.3-5.5 | 0.75 V_{CC} 0.70 V_{CC} | | | 0.75 V_{CC} 0.70 V_{CC} | | V | | | | |
| V_{IL} | Low Level Input Voltage | 1.8 2.3-5.5 | | 0.25 V_{CC} 0.30 V_{CC} | | 0.25 V_{CC} 0.30 V_{CC} | | V | | | | |
| V_{OH} | High Level Output Voltage | 1.8 | 1.7 | 1.8 | | 1.7 | | V | $V_{IN} = V_{IL}$ | $I_{OH} = -100 \mu\text{A}$ | | |
| | | 2.3 | 2.2 | 2.3 | | 2.2 | | | | | | |
| | | 3.0 | 2.9 | 3.0 | | 2.9 | | | | | | |
| | | 4.5 | 4.4 | 4.5 | | 4.4 | | | | | | |
| | | | 2.3 | 1.9 | 2.15 | | 1.9 | | V | | $I_{OH} = -8 \text{ mA}$ | |
| | | | 3.0 | 2.4 | 2.80 | | 2.4 | | | | $I_{OH} = -16 \text{ mA}$ | |
| | | | 3.0 | 2.3 | 2.68 | | 2.3 | | | | $I_{OH} = -24 \text{ mA}$ | |
| | | | 4.5 | 3.8 | 4.20 | | 3.8 | | | | $I_{OH} = -32 \text{ mA}$ | |
| V_{OL} | Low Level Output Voltage | 1.8 | | 0.0 | 0.1 | | 0.1 | | V | $V_{IN} = V_{IH}$ | $I_{OL} = 100 \mu\text{A}$ | |
| | | 2.3 | | 0.0 | 0.1 | | 0.1 | | | | | |
| | | 3.0 | | 0.0 | 0.1 | | 0.1 | | | | | |
| | | 4.5 | | 0.0 | 0.1 | | 0.1 | | | | | |
| | | | 2.3 | | 0.10 | 0.3 | | 0.3 | | V | | $I_{OL} = 8 \text{ mA}$ |
| | | | 3.0 | | 0.15 | 0.4 | | 0.4 | | | | $I_{OL} = 16 \text{ mA}$ |
| | | | 3.0 | | 0.22 | 0.55 | | 0.55 | | | | $I_{OL} = 24 \text{ mA}$ |
| | | | 4.5 | | 0.22 | 0.55 | | 0.55 | | | | $I_{OL} = 32 \text{ mA}$ |
| I_{IN} | Input Leakage Current | 0-5.5 | | ± 1 | | ± 10 | | μA | $V_{IN} = 5.5V, GND$ | | | |
| I_{OFF} | Power Off Leakage Current | 0.0 | | 1 | | 10 | | μA | V_{IN} or $V_{OUT} = 5.5V$ | | | |
| I_{CC} | Quiescent Supply Current | 1.8-5.5 | | 2.0 | | 20 | | μA | $V_{IN} = 5.5V, GND$ | | | |

AC Electrical Characteristics

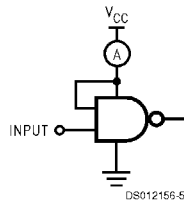
| Symbol | Parameter | V _{CC} (V) | NC7SZ00 | | | NC7SZ00 | | Units | Conditions | Fig. No. |
|--|-------------------------------|------------------------|-------------------------|-----|-----|--------------------------------------|------|-------|---|--------------|
| | | | T _A = +25° C | | | T _A = -40° C to +85° C | | | | |
| | | | Min | Typ | Max | Min | Max | | | |
| t _{PLH} , t _{PHL} | Propagation Delay | 1.8 | 2.0 | 4.5 | 9.5 | 2.0 | 10.0 | ns | C _L = 15 pF, R _L = 1 MΩ | Figures 1, 3 |
| | | 2.5 ± 0.2 | 0.8 | 3.0 | 6.5 | 0.8 | 7.0 | | | |
| | | 3.3 ± 0.3 | 0.5 | 2.4 | 4.5 | 0.5 | 4.7 | | | |
| | | 5.0 ± 0.5 | 0.5 | 2.0 | 3.9 | 0.5 | 4.1 | | | |
| t _{PLH} , t _{PHL} | Propagation Delay | 3.3 ± 0.3 | 1.5 | 2.9 | 5.0 | 1.5 | 5.2 | ns | C _L = 50 pF, R _L = 500Ω | Figures 1, 3 |
| | | 5.0 ± 0.5 | 0.8 | 2.4 | 4.3 | 0.8 | 4.5 | | | |
| C _{IN} | Input Capacitance | 0 | 4 | | | | | pF | | |
| C _{PD} | Power Dissipation Capacitance | 3.3 | 24 | | | | | pF | (Note 2) | Figure 2 |
| | | 5.0 | 30 | | | | | | | |

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



C_L includes load and stray capacitance
Input PRR = 1.0 MHz; t_w = 500 ns

FIGURE 1. AC Test Circuit



Input = AC Waveform; t_r = t_f = 1.8 ns;
PRR = 10 MHz; Duty Cycle = 50%

FIGURE 2. I_{CCD} Test Circuit

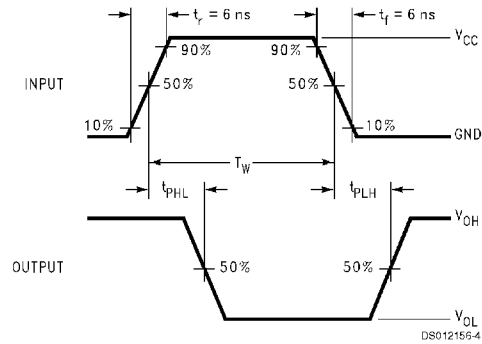
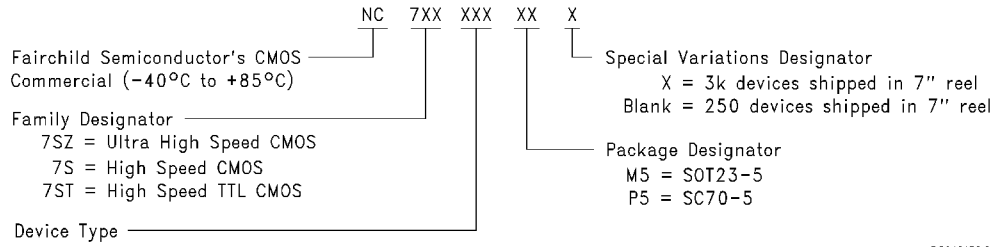


FIGURE 3. AC Waveforms

Ordering Information

The device number is used to form part of a simplified purchasing code where the package type and temperature range are defined as follows:



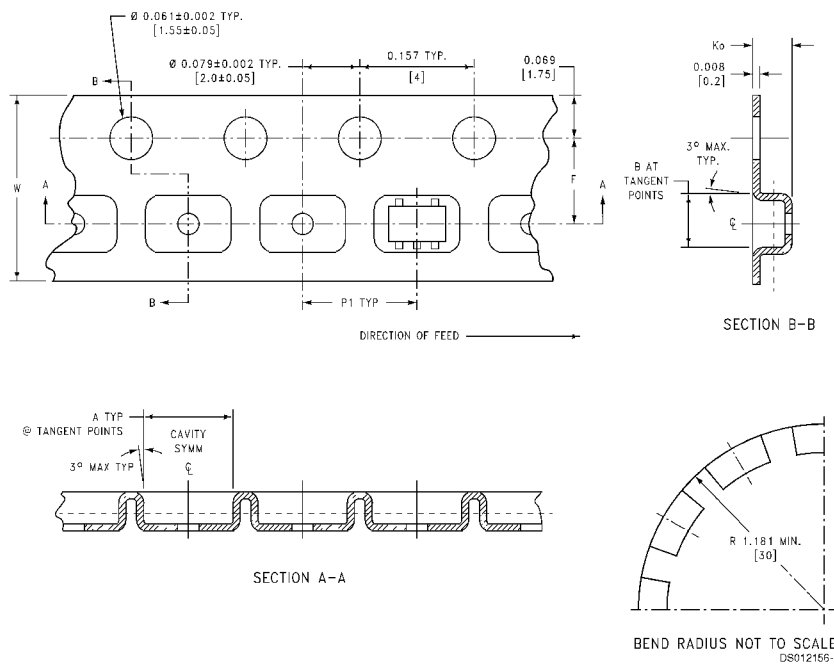
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Tape and Reel Specification

Tape Format

| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| M5, P5 | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 250 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |
| M5X, P5X | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 3000 | Filled | Sealed |
| | Trailer (Hub End) | 75 (typ) | Empty | Sealed |

TAPE DIMENSIONS inches (millimeters)

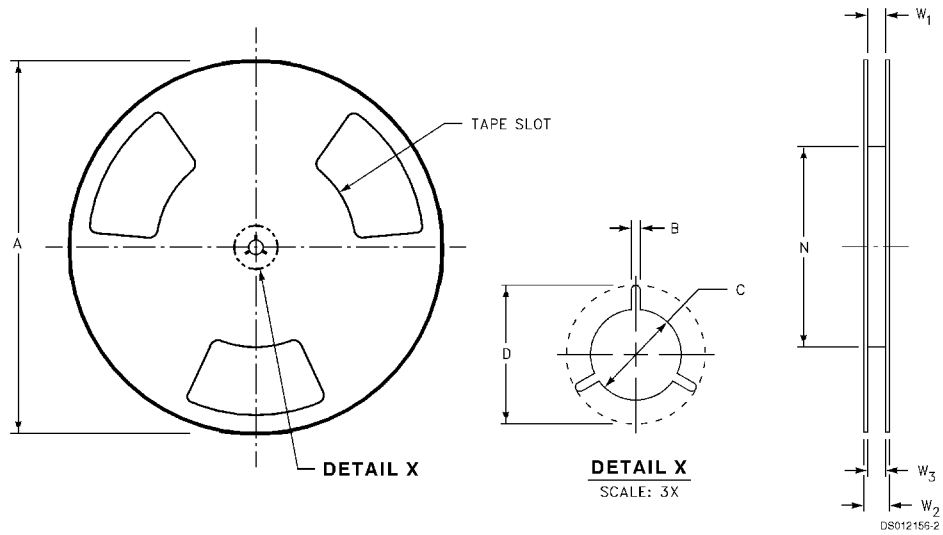


| Pkg | Tape Size | DIM A | DIM B | DIM F | DIM K_0 | DIM P1 | DIM W |
|---------|-----------|-----------------|-----------------|-----------------------------------|------------------------------------|--------------|--------------------------------|
| SC70-5 | 8 mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (3.5 ± 0.10) | 0.053 ± 0.004 (1.35 ± 0.10) | 0.157 (4) | 0.315 ± 0.004 (8 ± 0.1) |
| SOT23-5 | 8 mm | 0.130 (3.3) | 0.130 (3.3) | 0.138 ± 0.002 (3.5 ± 0.05) | 0.055 ± 0.004 (1.4 ± 0.11) | 0.157 (4) | 0.315 ± 0.012 (8 ± 0.3) |

Tape and Reel Specification

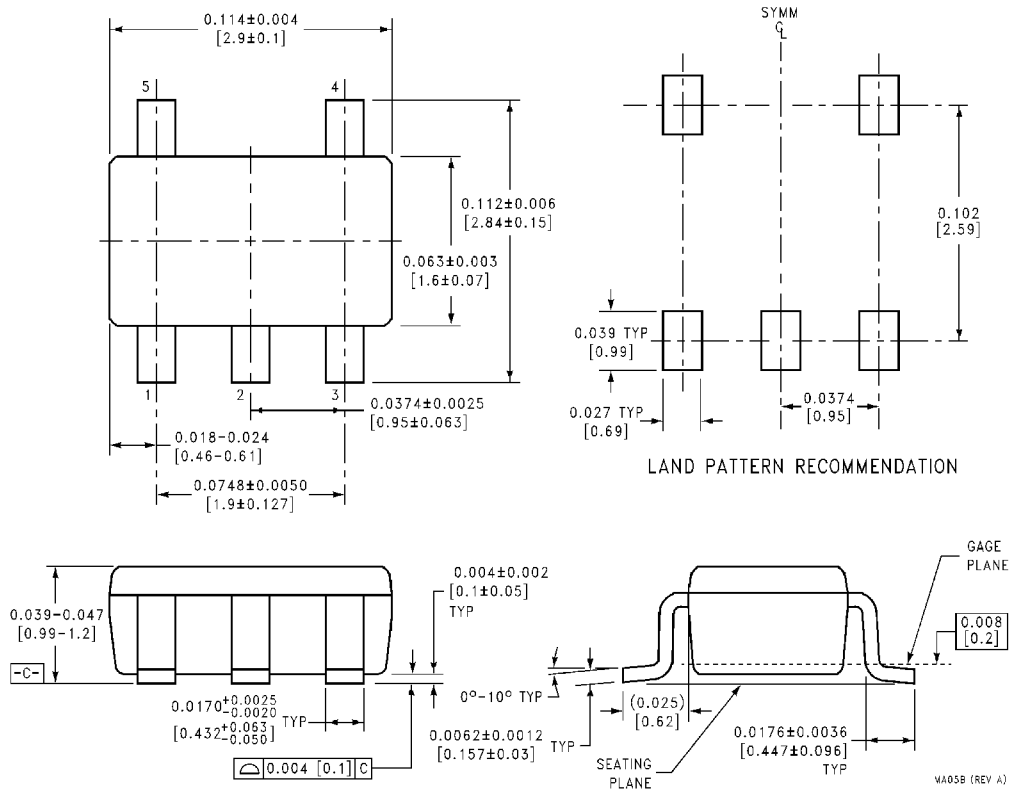
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REEL DIMENSIONS inches (millimeters)



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

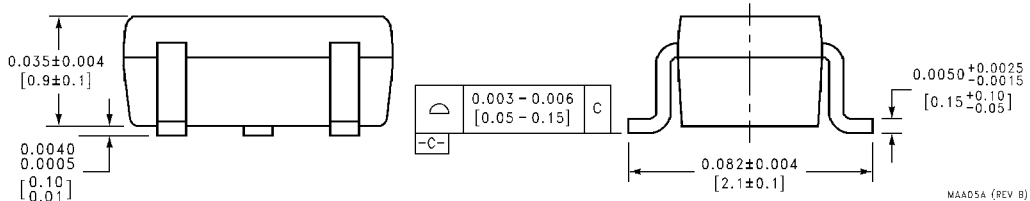
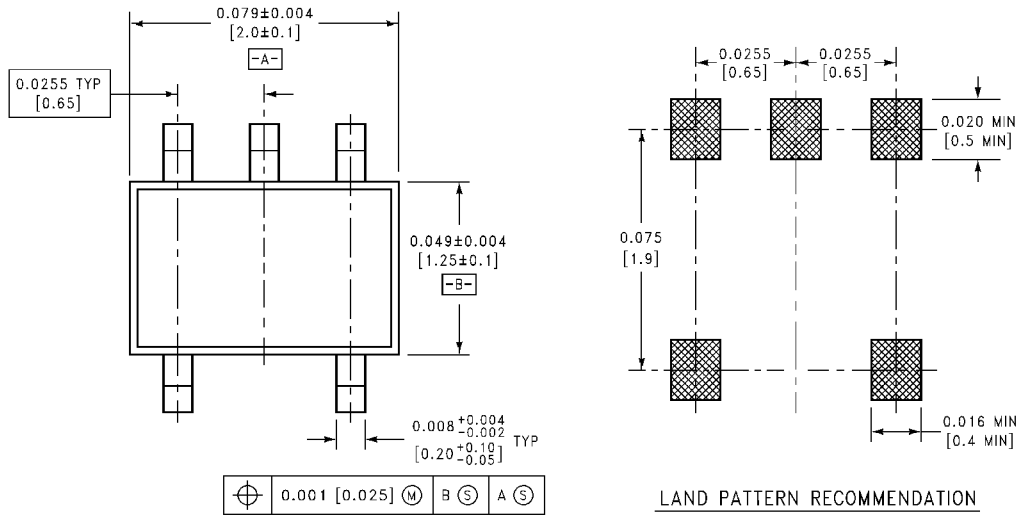
Physical Dimensions inches (millimeters) unless otherwise noted



**5-Lead Molded SOT23, Enhanced Thermal
Package Number MA05B**

MA05B (REV A)

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



5-Lead Molded SC70, Enhanced Thermal Package Number MAA05A

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