

NC7ST02 TinyLogic™ HST 2-Input NOR Gate

General Description

The NC7ST02 is a single 2-Input high performance CMOS NOR Gate, with TTL-compatible inputs. Advanced Silicon Gate CMOS fabrication assures high speed and low power circuit operation. ESD protection diodes inherently guard both inputs and output with respect to the V_{CC} and GND rails. High gain circuitry offers high noise immunity and reduced sensitivity to input edge rate. The TTL-compatible inputs facilitate TTL to NMOS/CMOS interfacing. Device

performance is similar to MM74HCT but with $\frac{1}{2}$ the output current drive of HC/HCT.

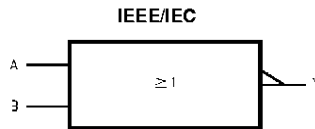
Features

- Space saving SOT23 or SC70 5-lead package
- High Speed; $t_{PD} < 7$ ns typ, $V_{CC} = 5V$, $C_L = 15$ pF
- Low Quiescent Power; $I_{CC} < 1$ μA typ, $V_{CC} = 5.5V$
- Balanced Output Drive: 2 mA I_{OL} , -2 mA I_{OH}
- TTL-compatible inputs

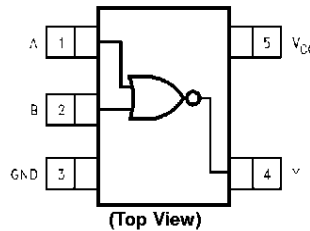
Ordering Code:

| Order Number | Package Number | Package Top Mark | Package Description | Supplied As |
|--------------|----------------|------------------|---------------------------------------|----------------------------|
| NC7ST02M5 | MA05B | 8S02 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 250 Units on Tape and Reel |
| NC7ST02M5X | MA05B | 8S02 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 3k Units on Tape and Reel |
| NC7ST02P5 | MAA05A | T02 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 250 Units on Tape and Reel |
| NC7ST02P5X | MAA05A | T02 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |

Logic Symbol



Connection Diagram



Pin Descriptions

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

Function Table

$$Y = \overline{A + B}$$

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

H = HIGH Logic Level
L = LOW Logic Level

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| Absolute Maximum Ratings (Note 1) | | Power Dissipation (P _D) @+85°C | |
|--------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| Supply Voltage (V _{CC}) | -0.5V to +7.0V | SOT23-5 | 200 mW |
| DC Input Diode Current (I _{IK}) | | SC70-5 | 150 mW |
| V _{IN} < -0.5V | -20 mA | Recommended Operating Conditions | |
| V _{IN} ≥ V _{CC} + 0.5V | +20 mA | Supply Voltage | 4.5V–5.5V |
| DC Input Voltage (V _{IN}) | -0.5V to V _{CC} +0.5V | Input Voltage (V _I) | 0V–V _{CC} |
| DC Output Diode Current (I _{OK}) | | Output Voltage (V _O) | 0V–V _{CC} |
| V _{OUT} < -0.5V | -20 mA | Operating Temperature (T _A) | -40°C to +85°C |
| V _{OUT} > V _{CC} + 0.5V | +20 mA | Input Rise and Fall Time (t _r , t _f) | V _{CC} = 5.0V |
| Output Voltage (V _{OUT}) | -0.5V to V _{CC} +0.5V | Thermal Resistance (θ _{JA}) | |
| DC Output Source or Sink Current (I _{OUT}) | ±12.5 mA | SOT23-5 | 300°C/W |
| DC V _{CC} or Ground Current per Supply Pin (I _{CC} or I _{GND}) | ±25 mA | SC70-5 | 425°C/W |
| Storage Temperature (T _{STG}) | -65°C to +150°C | Note 1: Absolute Maximum Ratings are those values beyond which damage to the device may occur. The databook 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 of circuits outside the databook specifications. | |
| Junction Temperature (T _J) | 150°C | | |
| Lead Temperature (T _L); (Soldering, 10 seconds) | 260°C | | |

DC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions |
|--------------------|---------------------------|---------------------|------------------------|------|------|---------------------------------|------|-------|---------------------------------------------------------------------------------------|
| | | | Min | Typ | Max | Min | Max | | |
| V _{IH} | HIGH Level Input Voltage | 4.5–5.5 | 2.0 | | | 2.0 | | V | |
| V _{IL} | LOW Level Input Voltage | 4.5–5.5 | | | 0.8 | | 0.8 | V | |
| V _{OH} | HIGH Level Output Voltage | 4.5 | 4.4 | 4.5 | | 4.4 | | V | I _{OH} = -20 μA, V _{IN} = V _{IL} , I _{OH} = -2 mA |
| | | 4.5 | 4.18 | 4.35 | | 4.13 | | V | |
| V _{OL} | LOW Level Output Voltage | 4.5 | | 0 | 0.1 | | 0.1 | V | I _{OL} = 20 μA, V _{IN} = V _{IH} , I _{OL} = 2 mA |
| | | 4.5 | | 0.10 | 0.26 | | 0.33 | V | |
| I _{IN} | Input Leakage Current | 5.5 | | | ±0.1 | | ±1.0 | μA | 0 ≤ V _{IN} ≤ 5.5V |
| I _{CC} | Quiescent Supply Current | 5.5 | | | 1.0 | | 10.0 | μA | V _{IN} = V _{CC} or GND |
| I _{CC(T)} | I _{CC} per Input | 5.5 | | | 2.0 | | 2.9 | mA | One Input V _{IN} = 0.5V or 2.4V, Other Input V _{CC} or GND |

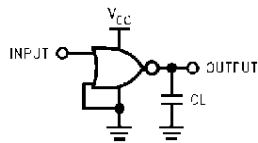
AC Electrical Characteristics

| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions | Fig. No. |
|--------------------------------------|-------------------------------|------------------------|------------------------|------|-----|---------------------------------|-----|-------|------------------------|----------------------|
| | | | Min | Typ | Max | Min | Max | | | |
| t _{PLH} t _{PHL} | Propagation Delay | 5.0 | | 3.5 | 12 | | | ns | C _L = 15 pF | Figure 1 Figure 3 |
| | | | | 6.3 | 17 | | | | | |
| | | | 4.5 | 6.1 | 16 | | 20 | | | |
| | | 5.5 | | 11.7 | 27 | | 31 | ns | C _L = 50 pF | |
| | | | | 4.2 | 14 | | 18 | | | |
| | | | | 11.4 | 26 | | 30 | | | |
| t _{TLH} t _{THL} | Output Transition Time | 5.0 | | 4 | 10 | | | ns | C _L = 15 pF | Figure 1 Figure 3 |
| | | | | 11 | 25 | | 31 | | | |
| | | | 4.5 | 10 | 21 | | 26 | | | |
| C _{IN} | Input Capacitance | Open | | 2 | 10 | | | pF | | |
| C _{PD} | Power Dissipation Capacitance | 5.0 | | 6 | | | | pF | (Note 2) | Figure 2 |

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

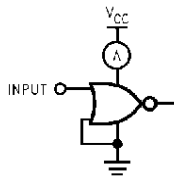
$$I_{CCD} = (C_{PD})(V_{CC})(f_{IN}) + (I_{CCstate})$$

AC Loading and Waveforms



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

FIGURE 1. AC Test Circuit



Input = AC Waveform, PRR = Variable, Duty Cycle = 50%

FIGURE 2. I_{CCD} Test Circuit

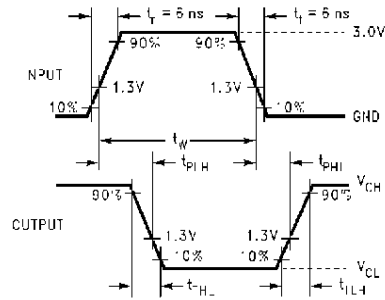


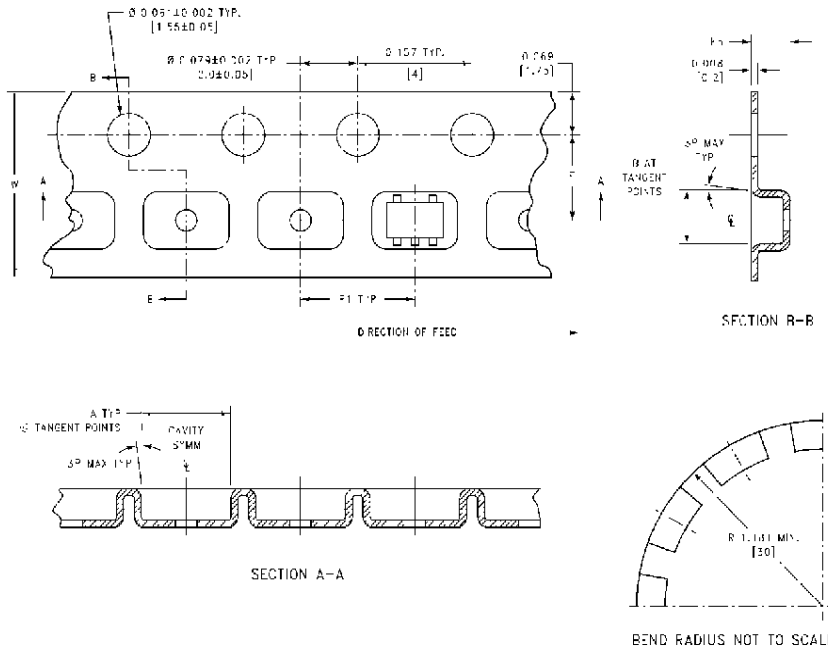
FIGURE 3. AC Waveforms

Tape and Reel Specification

TAPE FORMAT

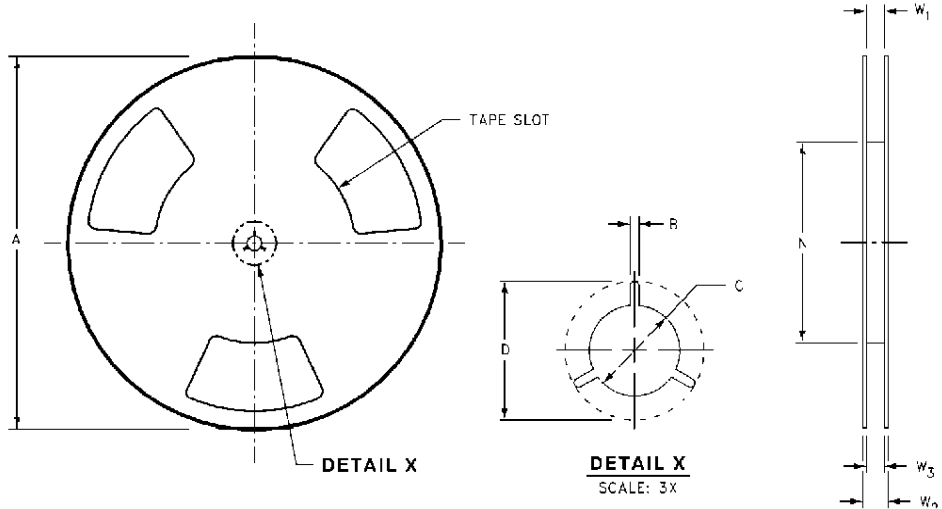
| Package Designator | Tape Section | Number Cavities | Cavity Status | Cover Tape Status |
|--------------------|--------------------|-----------------|---------------|-------------------|
| M5, P5 | Leader (Start End) | 125 (typ) | Empty | Sealed |
| | Carrier | 250 | Filled | Sealed |
| | Trailer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



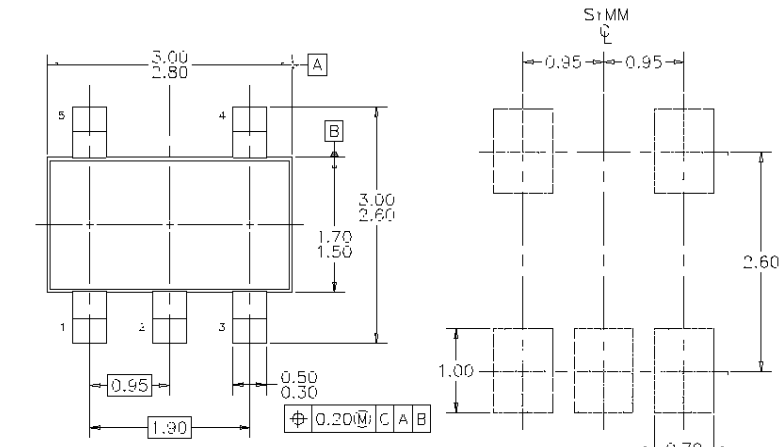
| Package | Tape Size | DIM A | DIM B | DIM F | DIM K ₀ | DIM P1 | DIM W |
|---------|-----------|-----------------|-----------------|-------------------------------|--------------------------------|--------------|----------------------------|
| SC70-5 | 8 mm | 0.093 (2.35) | 0.096 (2.45) | 0.138 ± 0.004 (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) |

REEL DIMENSIONS inches (millimeters)

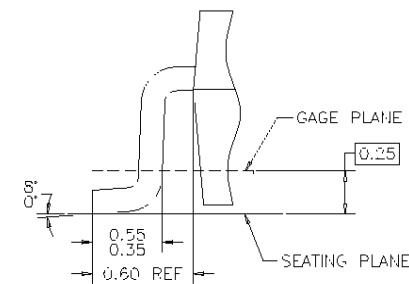
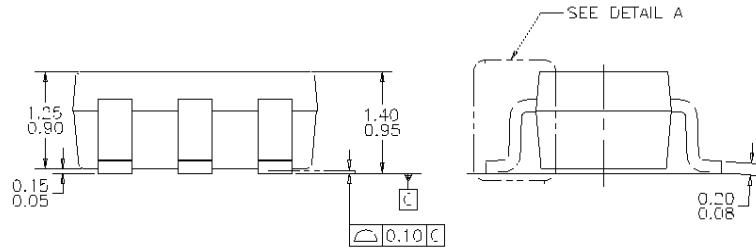


| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|-----------------------------------------------|------------------|------------------------------------------|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 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



LAND PATTERN RECOMMENDATION

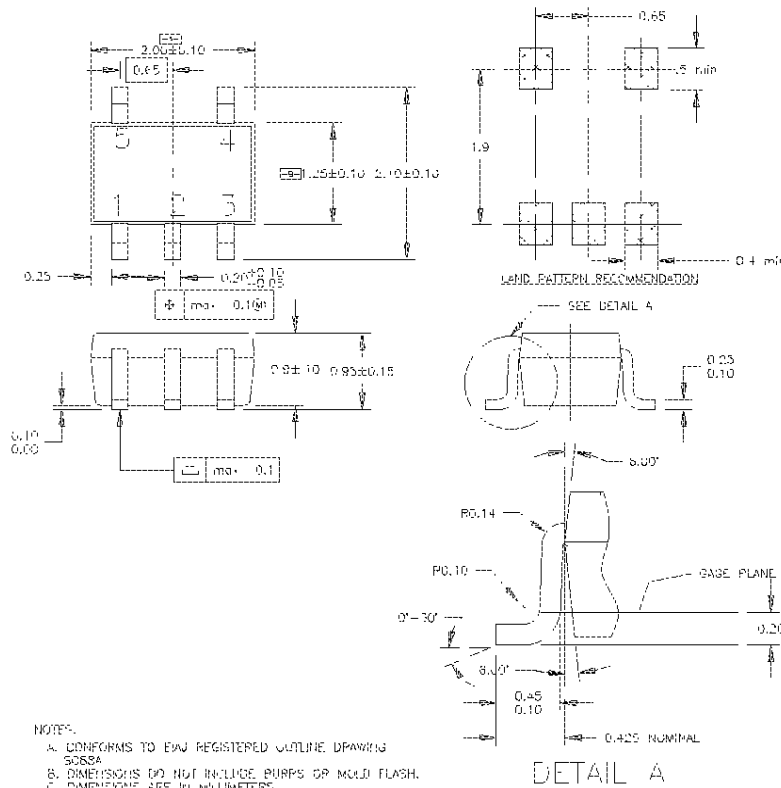


NOTES: UNLESS OTHERWISE SPECIFIED

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

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

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



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

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