

NC7S04 TinyLogic™ HS Inverter

General Description

The NC7S04 is a single high performance CMOS Inverter. 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 input and output with respect to the V_{CC} and GND rails. Three stages of gain between input and output assures high noise immunity and reduced sensitivity to input edge rate.

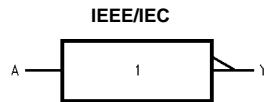
Features

- Space saving SOT23 or SC70 5-lead package
- High Speed: $t_{PD} = 3$ 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

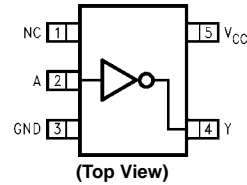
Ordering Code:

| Order Number | Package Number | Product Code Top Mark | Package Description | Supplied As |
|--------------|----------------|-----------------------|---------------------------------------|----------------------------|
| NC7S04M5 | MA05B | 7S04 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 250 Units On Tape and Reel |
| NC7S04M5X | MA05B | 7S04 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 3k Units on Tape and Reel |
| NC7S04P5 | MAA05A | S04 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 250 Units On Tape and Reel |
| NC7S04P5X | MAA05A | S04 | 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 | Input |
| Y | Output |
| NC | No Connect |

Function Table

$Y = \bar{A}$

| Input | Output |
|-------|--------|
| A | Y |
| L | H |
| H | L |

H = HIGH Logic Level
L = LOW Logic Level

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| Absolute Maximum Ratings (Note 1) | | Recommended Operating Conditions (Note 2) | |
|--|--------------------------|--|----------------|
| Supply Voltage (V_{CC}) | -0.5V to +7.0V | Supply Voltage (V_{CC}) | 2.0V to 6.0V |
| DC Input Diode Current (I_{IK}) | | Input Voltage (V_{IN}) | 0V to V_{CC} |
| @ $V_{IN} \leq -0.5V$ | -20 mA | Output Voltage (V_{OUT}) | 0V to V_{CC} |
| @ $V_{IN} \geq V_{CC} + 0.5V$ | +20 mA | Operating Temperature (T_A) | -40°C to +85°C |
| DC Input Voltage (V_{IN}) | -0.5V to $V_{CC} + 0.5V$ | Input Rise and Fall Time (t_r, t_f) | |
| DC Output Diode Current (I_{OK}) | | $V_{CC} @ 2.0V$ | 0 to 1000 ns |
| @ $V_{OUT} \leq -0.5V$ | -20 mA | $V_{CC} @ 3.0V$ | 0 to 750 ns |
| @ $V_{OUT} \geq V_{CC} + 0.5V$ | +20 mA | $V_{CC} @ 4.5V$ | 0 to 500 ns |
| DC Output Voltage (V_{OUT}) | -0.5V to $V_{CC} + 0.5V$ | $V_{CC} @ 6.0V$ | 0 to 400 ns |
| DC Output Source or Sink Current (I_{OUT}) | ± 12.5 mA | Thermal Resistance (θ_{JA}) | |
| DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND}) | ± 25 mA | SOT23-5 | 300°C/W |
| Storage Temperature (T_{STG}) | -65°C to +150°C | SC70-5 | 425°C/W |
| Junction Temperature (T_J) | 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. | |
| Lead Temperature (T_L) (Soldering, 10 seconds) | 260°C | Note 2: Unused inputs must be held HIGH or LOW. They may not float. | |
| Power Dissipation (P_D) @ +85°C | | | |
| SOT23-5 | 200 mW | | |
| SC70-5 | 150 mW | | |

DC Electrical Characteristics

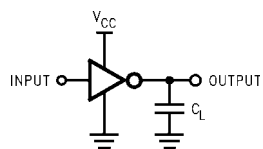
| Symbol | Parameter | V_{CC} (V) | $T_A = +25^\circ C$ | | | $T_A = -40^\circ C$ to $+85^\circ C$ | | Units | Conditions | |
|----------|---------------------------|--------------|---------------------|-----------|--------------|--------------------------------------|--------------|------------------------|---|---|
| | | | Min | Typ | Max | Min | Max | | | |
| V_{IH} | HIGH Level Input Voltage | 2.0 | 1.50 | | | 1.50 | | V | | |
| | | 3.0-6.0 | 0.7 V_{CC} | | | 0.7 V_{CC} | | | | |
| V_{IL} | LOW Level Input Voltage | 2.0 | | | 0.50 | | 0.50 | V | | |
| | | 3.0-6.0 | | | 0.3 V_{CC} | | 0.3 V_{CC} | | | |
| V_{OH} | HIGH Level Output Voltage | 2.0 | 1.90 | 2.0 | | 1.90 | | V | $I_{OH} = -20 \mu A$ $V_{IN} = V_{IL}$ | |
| | | 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 | $V_{IN} = V_{IL}$ $I_{OH} = -1.3$ mA $I_{OH} = -2$ mA $I_{OH} = -2.6$ mA |
| | | | 4.5 | 4.18 | 4.35 | | 4.13 | | | |
| | | | 6.0 | 5.68 | 5.85 | | 5.63 | | | |
| | | | | | | | | | | |
| V_{OL} | LOW Level Output Voltage | 2.0 | | 0.0 | 0.10 | | 0.10 | V | $I_{OL} = 20 \mu A$ $V_{IN} = V_{IH}$ | |
| | | 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 | $V_{IN} = V_{IH}$ $I_{OL} = 1.3$ mA $I_{OL} = 2$ mA $I_{OL} = 2.6$ mA |
| | | | 4.5 | | 0.1 | 0.26 | | 0.33 | | |
| | | | 6.0 | | 0.1 | 0.26 | | 0.33 | | |
| | | | | | | | | | | |
| I_{IN} | Input Leakage Current | 6.0 | | ± 0.1 | | ± 1.0 | μA | $V_{IN} = V_{CC}, GND$ | | |
| I_{CC} | Quiescent Supply Current | 6.0 | | 1.0 | | 10.0 | μA | $V_{IN} = V_{CC}, GND$ | | |

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 | 15 | | | ns | C _L = 15 pF | Figures 1, 3 |
| | | 2.0 | | 18 | 100 | | 125 | | C _L = 50 pF | |
| | | 3.0 | | 10 | 27 | | 35 | ns | | |
| | | 4.5 | | 7 | 20 | | 25 | | | |
| | | 6.0 | | 6 | 17 | | 21 | | | |
| t _{TLH} , t _{THL} | Output Transition Time | 5.0 | | 3 | 10 | | | ns | C _L = 15 pF | Figures 1, 3 |
| | | 2.0 | | 25 | 125 | | 155 | | C _L = 50 pF | |
| | | 3.0 | | 16 | 35 | | 45 | ns | | |
| | | 4.5 | | 11 | 25 | | 31 | | | |
| | | 6.0 | | 9 | 21 | | 26 | | | |
| C _{IN} | Input Capacitance | Open | | 2 | 10 | | 10 | pF | | |
| C _{PD} | Power Dissipation Capacitance | 5.0 | | 6 | | | | pF | (Note 3) | Figure 2 |

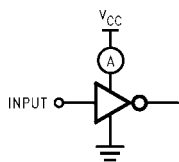
Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:
 $I_{CCD}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

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 Waveforms;
 PRR = Variable; Duty Cycle = 50%

FIGURE 2. I_{CCD} Test Circuit

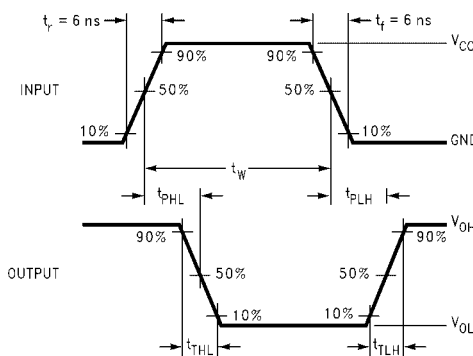


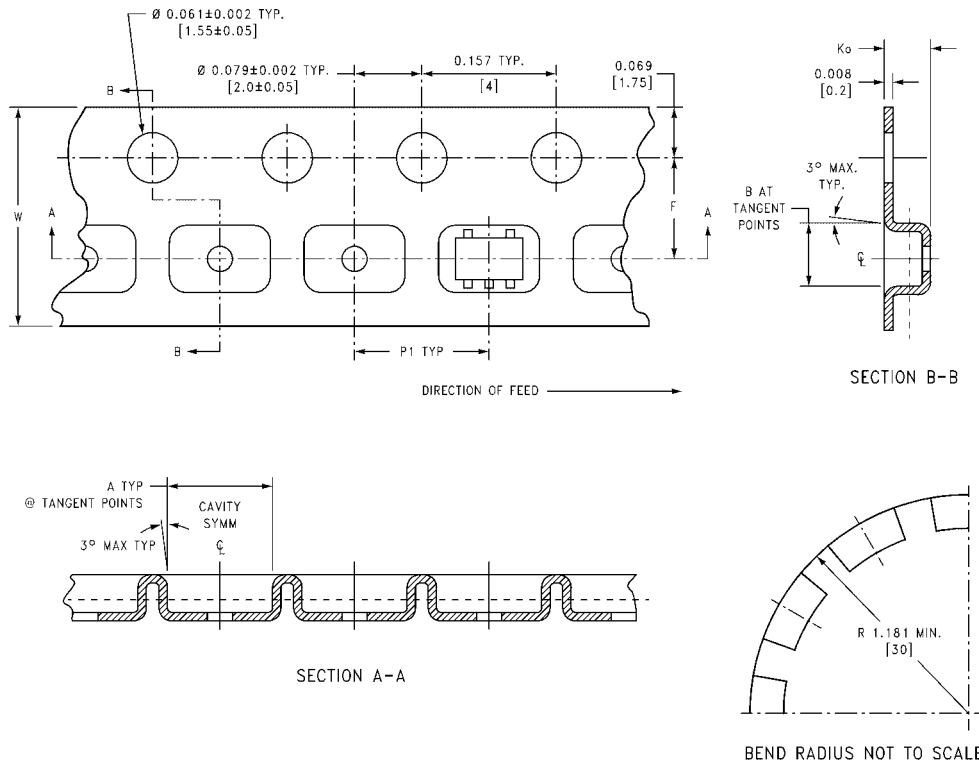
FIGURE 3. AC Waveforms

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 |

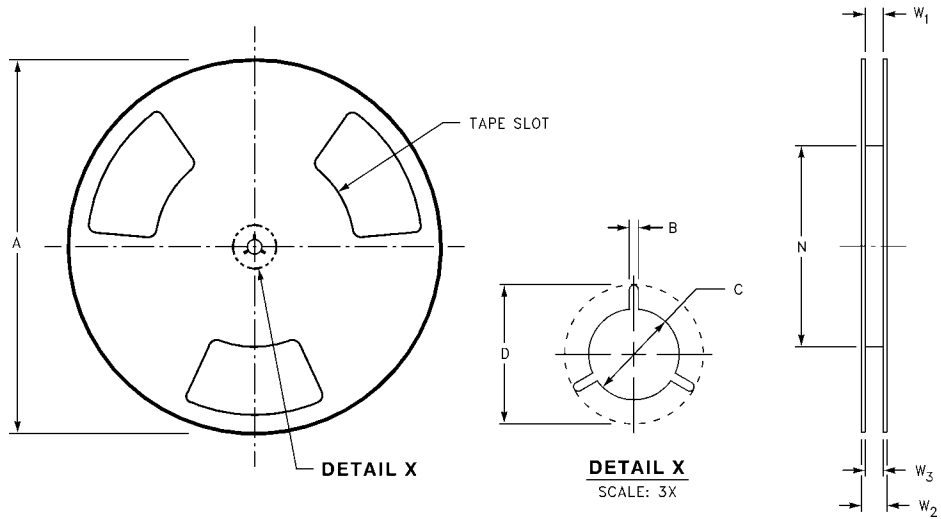
TAPE DIMENSIONS inches (millimeters)



| Package | Tape Size | DIM A | DIM B | DIM F | DIM K _o | 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 (Continued)

REEL DIMENSIONS inches (millimeters)

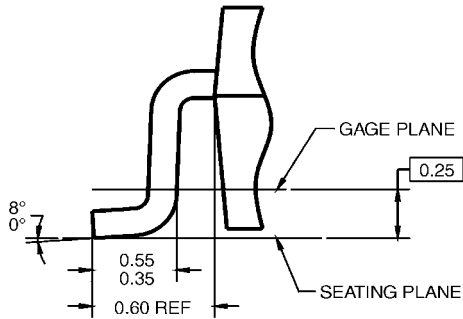


| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)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

Physical Dimensions inches (millimeters) unless otherwise noted



LAND PATTERN RECOMMENDATION

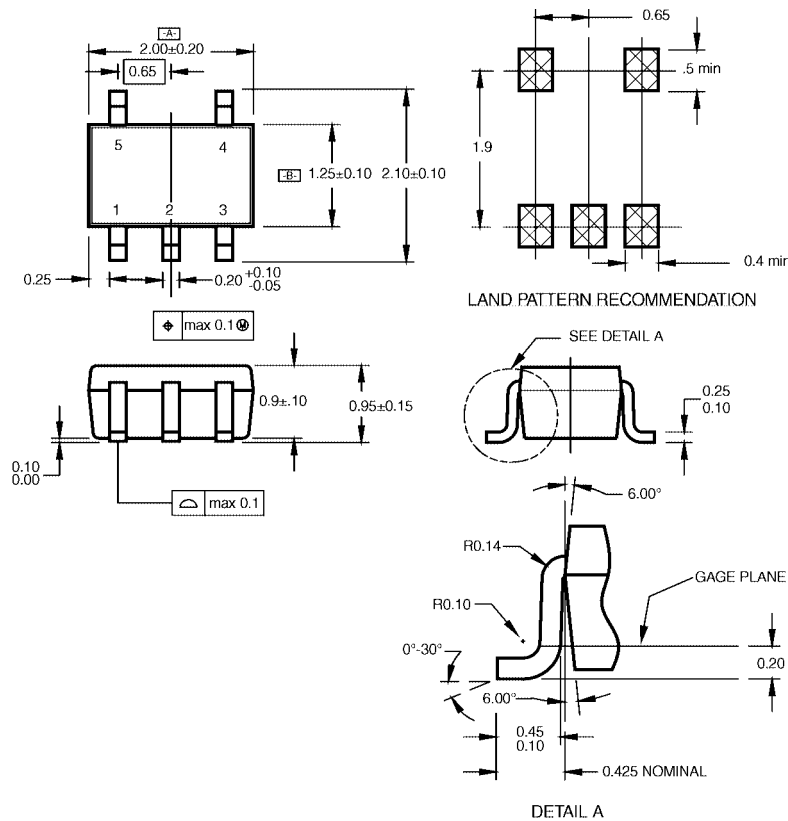


- NOTES: UNLESS OTHERWISE SPECIFIED
- A) THIS PACKAGE CONFORMS TO JEDEC MO-178, ISSUE B, VARIATION AA, DATED JANUARY 1999.
 - B) ALL DIMENSIONS ARE IN MILLIMETERS.

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**

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