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NC7S14 TinyLogic® HS Inverter with Schmitt Trigger Input

General Description

The NC7S14 is a single high performance CMOS Inverter with Schmitt Trigger input. The circuit design provides hysteresis between the positive-going and negative going input thresholds thereby improving noise margins.

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.

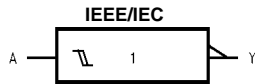
Features

- Space saving SOT23 or SC70 5-lead package
- Ultra small MicroPak™ leadless package
- Schmitt input hysteresis: > 1V typ
- High speed: t_{PD} 4.5 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 | Package Top Mark | Package Description | Supplied As |
|--------------|----------------|------------------|---------------------------------------|---------------------------|
| NC7S14M5X | MA05B | 7S14 | 5-Lead SOT23, JEDEC MO-178, 1.6mm | 3k Units on Tape and Reel |
| NC7S14P5X | MAA05A | S14 | 5-Lead SC70, EIAJ SC-88a, 1.25mm Wide | 3k Units on Tape and Reel |
| NC7S14L6X | MAC06A | UU | 6-Lead MicroPak, 1.0mm Wide | 5k Units on Tape and Reel |

Logic Symbol



Pin Descriptions

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

Function Table

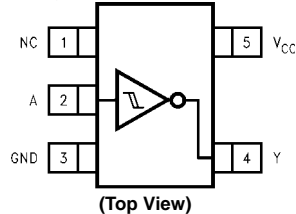
$$Y = \bar{A}$$

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

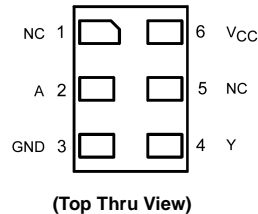
H = HIGH Logic Level
L = LOW Logic Level

Connection Diagrams

Pin Assignments for SC70 and SOT23



Pad Assignments for MicroPak



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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 $V_{CC} + 0.5V$ | Thermal Resistance (θ_{JA}) | |
| DC Output Diode Current (I_{OK}) | | SOT23-5 | 300°C/W |
| @ $V_{OUT} < -0.5V$ | -20 mA | SC70-5 | 425°C/W |
| @ $V_{OUT} > V_{CC} + 0.5V$ | +20 mA | | |
| DC Output Voltage (V_{OUT}) | -0.5V to $V_{CC} + 0.5V$ | | |
| DC Output Source or Sink Current (I_{OUT}) | ± 12.5 mA | | |
| DC V_{CC} or Ground Current per Output Pin (I_{CC} or I_{GND}) | ± 25 mA | | |
| Storage Temperature (T_{STG}) | -65°C to +150°C | | |
| Junction Temperature (T_J) | 150°C | | |
| Lead Temperature (T_L) (Soldering, 10 seconds) | 260°C | | |
| Power Dissipation (P_D) @ +85°C | | | |
| SOT23-5 | 200 mW | | |
| SC70-5 | 150 mW | | |

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.

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

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_P | Positive Threshold Voltage | 2.0 | 1.0 | 1.29 | 1.5 | 1.0 | 1.6 | V | |
| | | 3.0 | 1.5 | 1.90 | 2.2 | 1.5 | 2.2 | | |
| | | 4.5 | 2.3 | 2.73 | 3.15 | 2.3 | 3.15 | | |
| | | 6.0 | 3.0 | 3.56 | 4.2 | 3.0 | 4.2 | | |
| V_N | Negative Threshold Voltage | 2.0 | 0.3 | 0.70 | 0.9 | 0.3 | 0.9 | V | |
| | | 3.0 | 0.6 | 1.05 | 1.35 | 0.6 | 1.35 | | |
| | | 4.5 | 1.13 | 1.66 | 2.0 | 1.13 | 2.0 | | |
| | | 6.0 | 1.5 | 2.24 | 2.6 | 1.5 | 2.6 | | |
| V_H | Hysteresis Voltage | 2.0 | 0.3 | 0.59 | 1.0 | 0.3 | 1.0 | V | |
| | | 3.0 | 0.4 | 0.85 | 1.3 | 0.4 | 1.3 | | |
| | | 4.5 | 0.6 | 1.08 | 1.4 | 0.6 | 1.4 | | |
| | | 6.0 | 0.8 | 1.31 | 1.7 | 0.8 | 1.7 | | |
| 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 | 2.87 | | 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 | 4.37 | | 4.13 | | | |
| | | 6.0 | 5.68 | 5.86 | | 5.63 | | | |
| | | | | | | | | | |
| V_{OL} | LOW Level Output Voltage | 2.0 | | 0.0 | 0.10 | | 0.10 | V | $I_{OH} = 20 \mu A$ $V_{IN} = V_{IH}$ |
| | | 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 | | |
| | | | | | | | | | |

DC Electrical Characteristics (Continued)

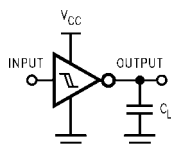
| Symbol | Parameter | V _{CC} (V) | T _A = +25°C | | | T _A = -40°C to +85°C | | Units | Conditions |
|-----------------|--------------------------|------------------------|------------------------|-----|------|---------------------------------|-----|-------|---|
| | | | Min | Typ | Max | Min | Max | | |
| I _{IN} | Input Leakage Current | 6.0 | | | ±0.1 | | | μA | V _{IN} = V _{CC} , GND |
| I _{CC} | Quiescent Supply Current | 6.0 | | | 1.0 | | | 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 | Figure Number | |
|------------------|-------------------------------|------------------------|------------------------|-----|-----|---------------------------------|-----|-------|------------------------|---------------|----------|
| | | | Min | Typ | Max | Min | Max | | | | |
| t _{PLH} | Propagation Delay | 5.0 | | 4.5 | 21 | | | ns | C _L = 15 pF | Figures 1, 3 | |
| t _{PHL} | | 2.0 | | 20 | 100 | | 125 | ns | C _L = 50 pF | | |
| | | 3.0 | | 12 | 27 | | 35 | | | | |
| | | 4.5 | | 8.5 | 20 | | 25 | | | | |
| | | 6.0 | | 7.5 | 17 | | 21 | | | | |
| t _{TLH} | Output Transition Time | 5.0 | | 3 | 8 | | | ns | C _L = 15 pF | Figures 1, 3 | |
| t _{THL} | | 2.0 | | 25 | 125 | | 145 | ns | C _L = 50 pF | | |
| | | 3.0 | | 16 | 35 | | 45 | | | | |
| | | 4.5 | | 11 | 25 | | 30 | | | | |
| | | 6.0 | | 9 | 21 | | 24 | | | | |
| C _{IN} | Input Capacitance | Open | | 2 | 10 | | | 10 | pF | | |
| C _{PD} | Power Dissipation Capacitance | 5.0 | | 7 | | | | | pF | (Note 3) | Figure 2 |

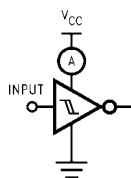
Note 3: C_{PD} is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I_{CCD}) at no output loading and operating at 50% duty cycle. (See Figure 2.) C_{PD} is related to I_{CCD} dynamic operating current by the expression:
 $I_{CCD}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

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

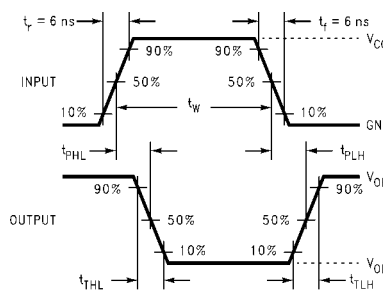


FIGURE 3. AC Waveforms

Tape and Reel Specification

TAPE FORMAT 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 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 (Continued)

TAPE FORMAT for MircoPak

| 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 |

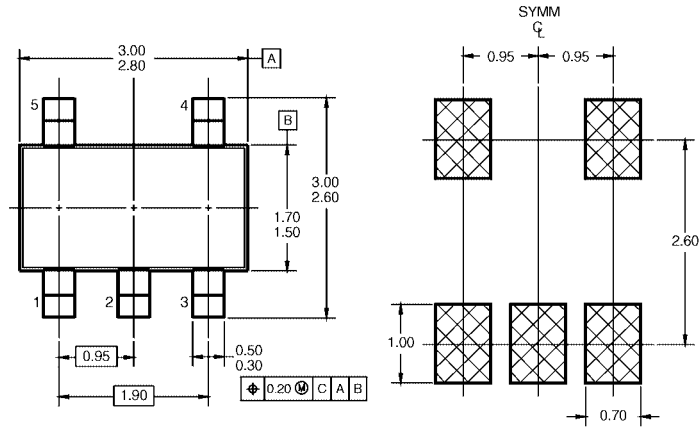


REEL DIMENSIONS inches (millimeters)

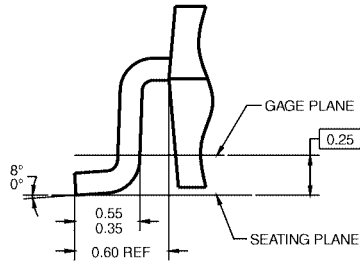
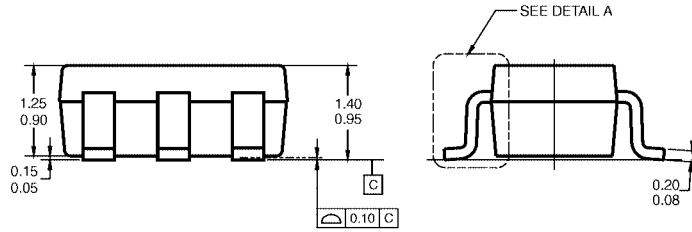


| Tape Size | A | B | C | D | N | W1 | W2 | W3 |
|-----------|----------------|-----------------|------------------|------------------|------------------|---|------------------|--------------------------------------|
| 8 mm | 7.0 (177.8) | 0.059 (1.50) | 0.512 (13.00) | 0.795 (20.20) | 2.165 (55.00) | 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



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)



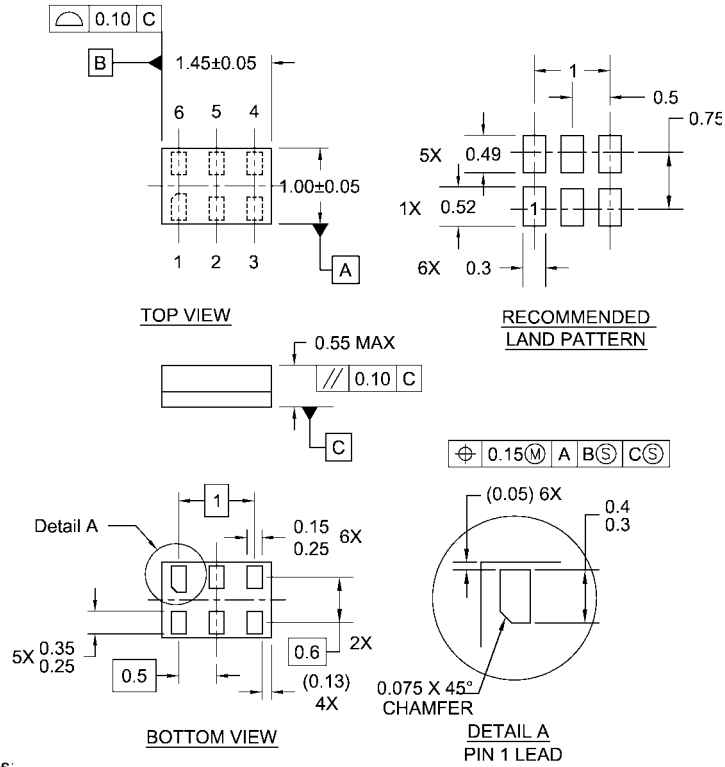
NOTES:

- 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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