

## NC7SU04 TinyLogic™ HS Unbuffered Inverter

### General Description

The NC7SU04 is a single special purpose CMOS Inverter. The inverter circuit is designed with a single unbuffered stage to facilitate use in crystal oscillator applications. It is not intended for use in logic inversion applications.

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.

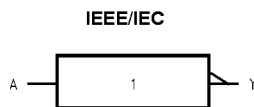
### Features

- Space saving SOT23 or SC70 5-lead package
- Unbuffered for crystal oscillator applications
- 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

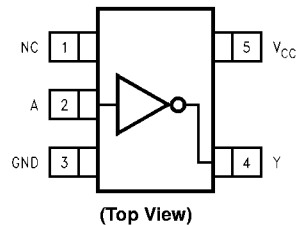
### Ordering Code:

Order Number	Package Number	Package Top Mark	Package Description	Supplied As
NC7SU04M5	MA05B	7SU4	5-Lead SOT23, JEDEC MO-178, 1.6mm	250 Units on Tape and Reel
NC7SU04M5X	MA05B	7SU4	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SU04P5	MAA05A	SU4	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	250 Units on Tape and Reel
NC7SU04P5X	MAA05A	SU4	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	
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 ( $\theta_{JA}$ )	
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 ( $I_{OUT}$ )	$\pm 12.5$ mA		
DC $V_{CC}$ or Ground Current			
per Output Pin ( $I_{CC}$ or $I_{GND}$ )	$\pm 25$ 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		

**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 databook specifications.

**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	1.70			1.70		V			
		3.0	2.45			2.45					
		4.5	3.60			3.60					
		6.0	4.80			4.80					
$V_{IL}$	LOW Level Input Voltage	2.0			0.30		0.30	V			
		3.0			0.50		0.50				
		4.5			0.90		0.90				
		6.0			1.20		1.20				
$V_{OH}$	HIGH Level Output Voltage	2.0	1.80	2.0		1.80		V	$I_{OH} = -20 \mu A$ $V_{IN} = V_{IL}$		
		3.0	2.5	3.0		2.50					
		4.5	4.00	4.5		4.00					
		6.0	5.50	5.9		5.50					
				3.0	2.68	2.82		2.63		V	$V_{IN} = GND$ $I_{OH} = -1.3$ mA $I_{OH} = -2$ mA $I_{OH} = -2.6$ mA
				4.5	4.18	4.33		4.13			
				6.0	5.68	5.76		5.63			
$V_{OL}$	LOW Level Output Voltage	2.0		0.00	0.20		0.20	V	$I_{OL} = 20 \mu A$ $V_{IN} = V_{IH}$		
		3.0		0.00	0.50		0.50				
		4.5		0.01	0.50		0.50				
		6.0		0.04	0.50		0.50				
				3.0		0.11	0.26		0.33	V	$V_{IN} = V_{CC}$ $I_{OL} = 1.3$ mA $I_{OL} = 2$ mA $I_{OL} = 2.6$ mA
				4.5		0.12	0.26		0.33		
				6.0		0.15	0.26		0.33		
$I_{IN}$	Input Leakage Current	6.0			$\pm 0.1$		$\pm 1.0$	$\mu A$	$V_{IN} = V_{CC}, GND$		
$I_{CC}$	Quiescent Supply Current	6.0			1.0		10.0	$\mu A$	$V_{IN} = V_{CC}, GND$		

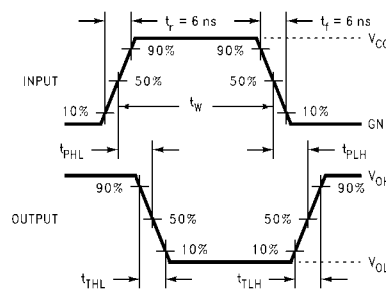
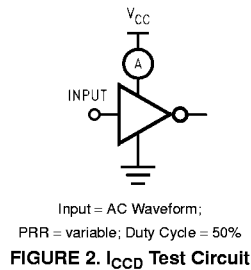
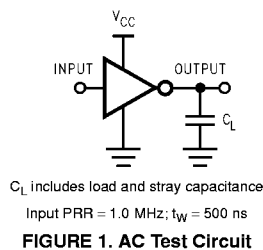
## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units	Conditions	Fig. No.
			Min	Typ	Max	Min	Max			
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay	5.0		3	15			ns	C <sub>L</sub> = 15 pF	Figure 1
		2.0		17	100		125		C <sub>L</sub> = 50 pF	Figure 3
		3.0		9	27		35	ns		
		4.5		7	20		25			
		6.0		6.5	17		21			
t <sub>TLH</sub> , t <sub>THL</sub>	Output Transition Time	5.0		4	10			ns	C <sub>L</sub> = 15 pF	Figure 1
		2.0		25	125		155		C <sub>L</sub> = 50 pF	Figure 3
		3.0		16	35		45	ns		
		4.5		12	25		31			
		6.0		10	21		26			
C <sub>IN</sub>	Input Capacitance	Open		2	10		10	pF		
C <sub>PD</sub>	Power Dissipation Capacitance	5.0		4				pF	(Note 2)	Figure 2

**Note 2:** 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:

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

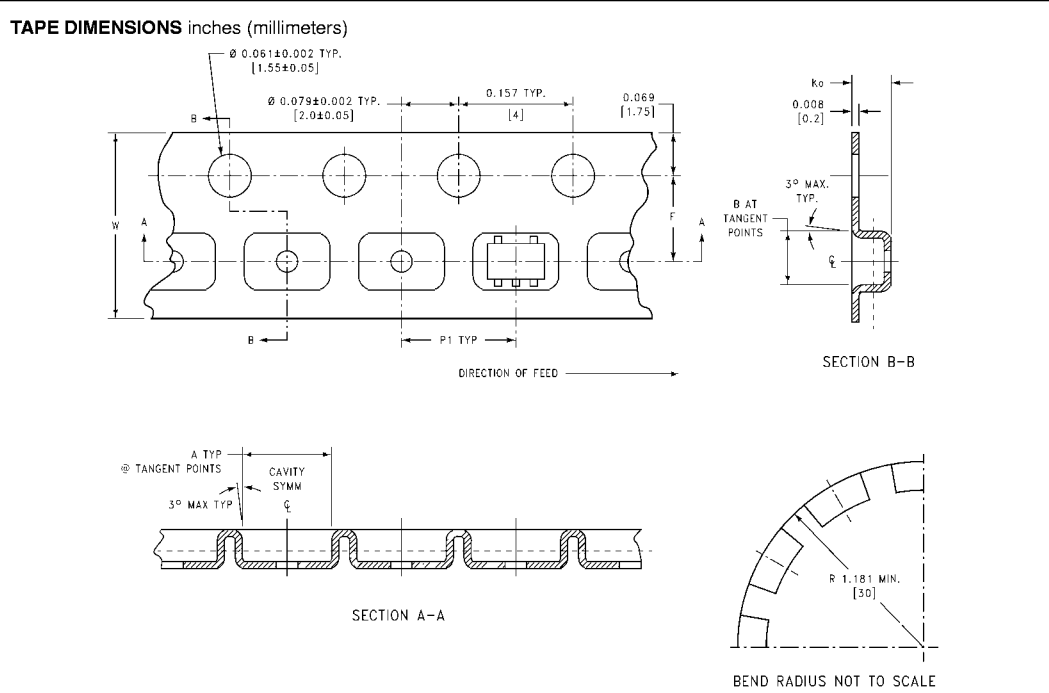
## AC Loading and Waveforms



### Tape and Reel Specification

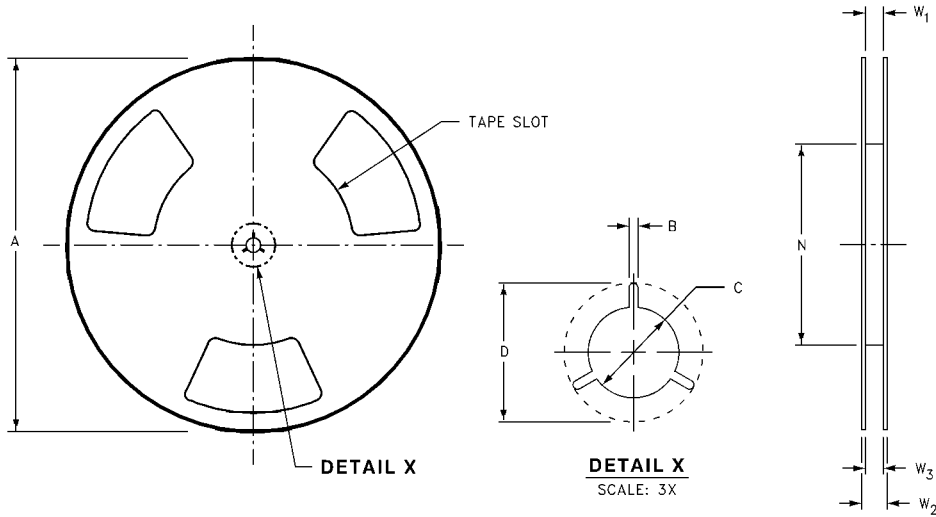
**TAPE FORMAT**

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



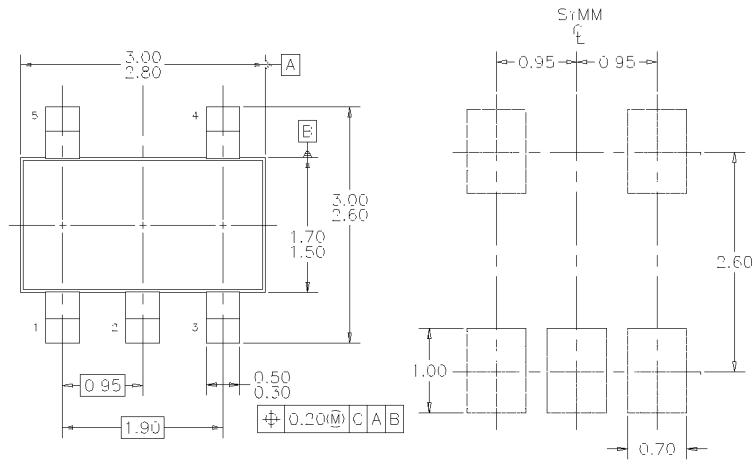
Package	Tape Size	DIM A	DIM B	DIM F	DIM K <sub>o</sub>	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315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

**REEL DIMENSIONS** inches (millimeters)

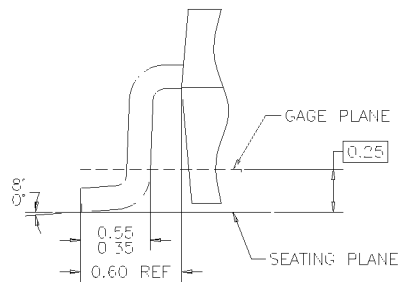
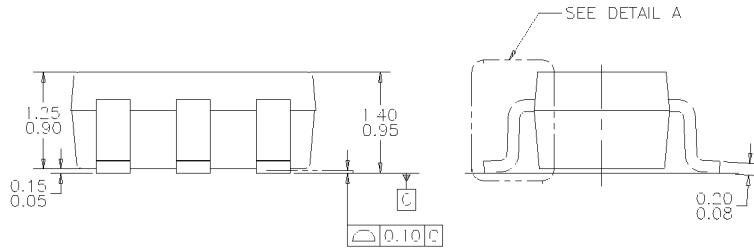


Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)	0.567 (14.40)	W1 + 0.078/-0.039 (W1 + 2.00/-1.00)

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



LAND PATTERN RECOMMENDATION

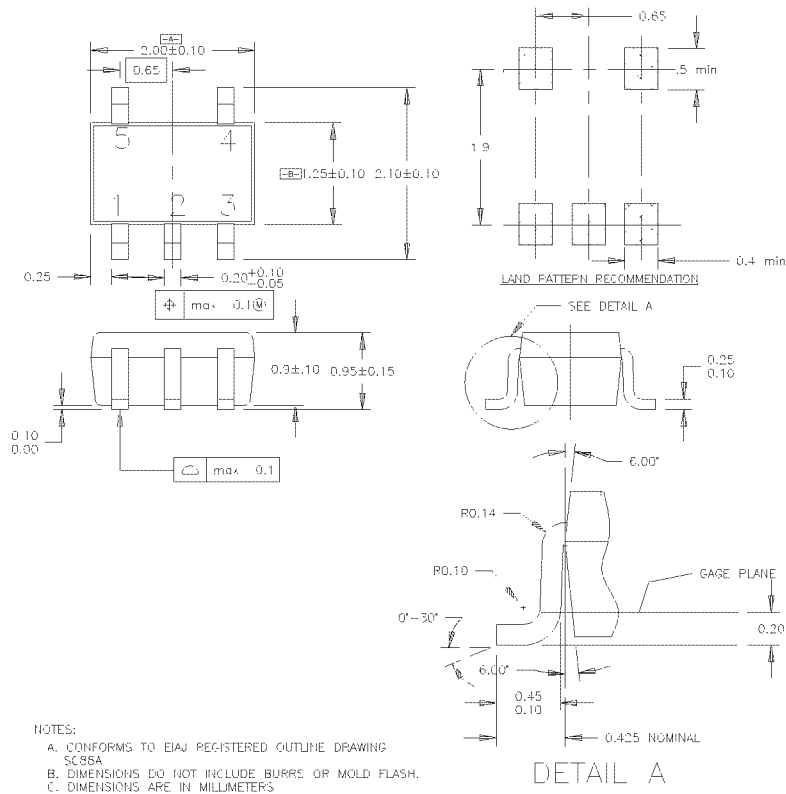


NOTES: UNLESS OTHERWISE SPECIFIED

- 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)



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

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

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