

# NC7SZU04

## TinyLogic™ UHS Unbuffered Inverter

### General Description

The NC7SZU04 is a single unbuffered inverter from Fairchild's Ultra High Speed Series of TinyLogic™. The special purpose unbuffered circuit design is primarily intended for crystal oscillator or analog applications. 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 very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.8V to 5.5V  $V_{CC}$  range.

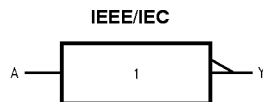
### Features

- Space saving SOT23 or SC70 5-lead package
- Unbuffered for crystal oscillator and analog applications
- Balanced Output Drive;  $\pm 16$  mA at 4.5V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range; 1.8V–5.5V
- Low Quiescent Power;  
 $I_{CC} < 2 \mu A$ ,  $V_{CC} = 5.5V$ ,  $T_A = 25^\circ C$

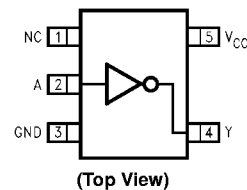
### Ordering Code:

Order Number	Package Number	Package Top Mark	Package Description	Supplied As
NC7SZU04M5	MA05B	7ZU4	5-Lead SOT23, JEDEC MO-178, 1.6mm	250 Units on Tape and Reel
NC7SZU04M5X	MA05B	7ZU4	5-Lead SOT23, JEDEC MO-178, 1.6mm	3k Units on Tape and Reel
NC7SZU04P5	MAA05A	ZU4	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	250 Units on Tape and Reel
NC7SZU04P5X	MAA05A	ZU4	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

TinyLogic™ is a trademark of Fairchild Semiconductor Corporation.

Absolute Maximum Ratings (Note 1)		Power Dissipation (P <sub>D</sub> ) @ +85°C	
Supply Voltage (V <sub>CC</sub> )	-0.5V to +6V	SOT23-5	200 mW
DC Input Voltage (V <sub>IN</sub> )	-0.5V to +6V	SC70-5	150 mW
DC Output Voltage (V <sub>OUT</sub> )	-0.5V to +6V	<b>Recommended Operating Conditions</b>	
DC Input Diode Current (I <sub>IK</sub> )		Supply Voltage Operating (V <sub>CC</sub> )	1.8V to 5.5V
@ V <sub>IN</sub> < -0.5V	-50 mA	Supply Voltage Data Retention (V <sub>CC</sub> )	1.5V to 5.5V
@ V <sub>IN</sub> > V <sub>CC</sub> + 0.5V	+20 mA	Input Voltage (V <sub>IN</sub> )	0V to 5.5V
DC Output Diode Current (I <sub>OK</sub> )		Output Voltage (V <sub>OUT</sub> )	0V to V <sub>CC</sub>
@ V <sub>OUT</sub> < -0.5V	-50 mA	Operating Temperature (T <sub>A</sub> )	-40°C to +85°C
@ V <sub>OUT</sub> > 0.5V, V <sub>CC</sub> = GND	+50 mA	Thermal Resistance (θ <sub>JA</sub> )	
DC Output Current (I <sub>OUT</sub> )	±50 mA	SOT23-5	300°C/W
DC V <sub>CC</sub> /GND Current (I <sub>CC</sub> /I <sub>GND</sub> )	±100 mA	SC70-5	425°C/W
Storage Temperature (T <sub>STG</sub> )	-65°C to +150°C	<b>Note 1:</b> 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.	
Junction Temperature under Bias (T <sub>J</sub> )	150°C		
Junction Lead Temperature (T <sub>L</sub> ); (Soldering, 10 seconds)	260°C		

### DC Electrical Characteristics

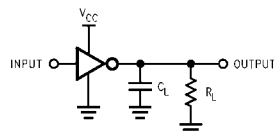
Symbol	Parameter	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40°C to +85°C		Units	Conditions
			Min	Typ	Max	Min	Max		
V <sub>IH</sub>	HIGH Level Input Voltage	1.8-2.7 3.0-5.5	0.85 V <sub>CC</sub> 0.8 V <sub>CC</sub>			0.85 V <sub>CC</sub> 0.8 V <sub>CC</sub>		V	
V <sub>IL</sub>	LOW Level Input Voltage	1.8-2.7 3.0-5.5	0.15 V <sub>CC</sub> 0.2 V <sub>CC</sub>			0.15 V <sub>CC</sub> 0.2 V <sub>CC</sub>		V	
V <sub>OH</sub>	HIGH Level Output Voltage	1.8	1.6	1.8	1.6		V	V <sub>IN</sub> = V <sub>IL</sub> I <sub>OH</sub> = -100 μA	
		2.3	2.1	2.3	2.1				
		3.0	2.7	3.0	2.7				
		4.5	4.0	4.4	4.0				
	2.3	1.9	2.14	1.9		V	V <sub>IN</sub> = GND I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -8 mA I <sub>OH</sub> = -12 mA I <sub>OH</sub> = -16 mA		
	3.0	2.4	2.75	2.4					
3.0	2.3	2.61	2.3						
4.5	3.8	4.13	3.8						
V <sub>OL</sub>	LOW Level Output Voltage	1.8	0.0			0.2		V	V <sub>IN</sub> = V <sub>IH</sub> I <sub>OL</sub> = 100 μA
		2.3	0.0			0.2			
		3.0	0.0			0.3			
		4.5	0.0			0.5			
	2.3	0.10			0.3		V	V <sub>IN</sub> = V <sub>CC</sub> I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 mA I <sub>OL</sub> = 12 mA I <sub>OL</sub> = 16 mA	
	3.0	0.17			0.4				
3.0	0.25			0.55					
4.5	0.26			0.55					
I <sub>IN</sub>	Input Leakage Current	0-5.5	±1			±10		μA	V <sub>IN</sub> = 5.5V, GND
I <sub>CC</sub>	Quiescent Supply Current	1.8-5.5	2.0			20		μA	V <sub>IN</sub> = 5.5V, GND
I <sub>CCPEAK</sub>	Peak Supply Current in Analog Operation	1.8	2					mA	V <sub>OUT</sub> = Open V <sub>IN</sub> = Adjust for Peak I <sub>CC</sub> Current
		2.5	4						
		3.3	10						
		5.0	30						

## 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>	Propagation Delay	1.8	1.0		8.5	1.0	9.0	ns	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	Figure 1
t <sub>PHL</sub>		2.5 ± 0.2	0.8		6.2	0.8	6.5			Figure 3
		3.3 ± 0.3	0.5		4.5	0.5	4.8			
		5.0 ± 0.5	0.5		3.9	0.5	4.1			
t <sub>PLH</sub>	Propagation Delay	3.3 ± 0.3	1.0		6.0	1.0	6.5	ns	C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500Ω	Figure 1
t <sub>PHL</sub>		5.0 ± 0.5	0.8		5.0	0.8	5.5			Figure 3
C <sub>IN</sub>	Input Capacitance	0		4.5				pF		
C <sub>PD</sub>	Power Dissipation	3.3		6.3				pF	(Note 2)	Figure 2
	Capacitance	5.0		9.5						

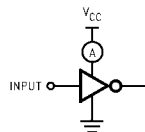
**Note 2:** C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (See Figure 2.) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating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

## AC Loading and Waveforms



C<sub>L</sub> includes load and stray capacitance  
 Input PRR = 1.0 MHz; t<sub>W</sub> = 500 ns

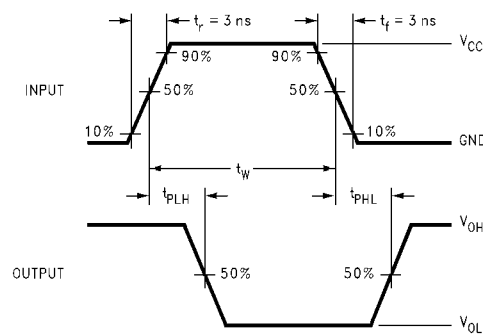
**FIGURE 1. AC Test Circuit**



**Application Note:** When operating the NC7SZU04's unbuffered output stage in its linear range, as in oscillator applications, care must be taken to observe maximum power rating for the device and package. The high drive nature of the design of the output stage will result in substantial simultaneous conduction currents when the stage is in the linear region. See the I<sub>CCPEAK</sub> specification in the DC Electrical Characteristics table.

Input = AC Waveform; t<sub>r</sub> = t<sub>f</sub> = 1.8 ns;  
 PRR = variable; Duty Cycle = 50%

**FIGURE 2. I<sub>CCD</sub> Test Circuit**



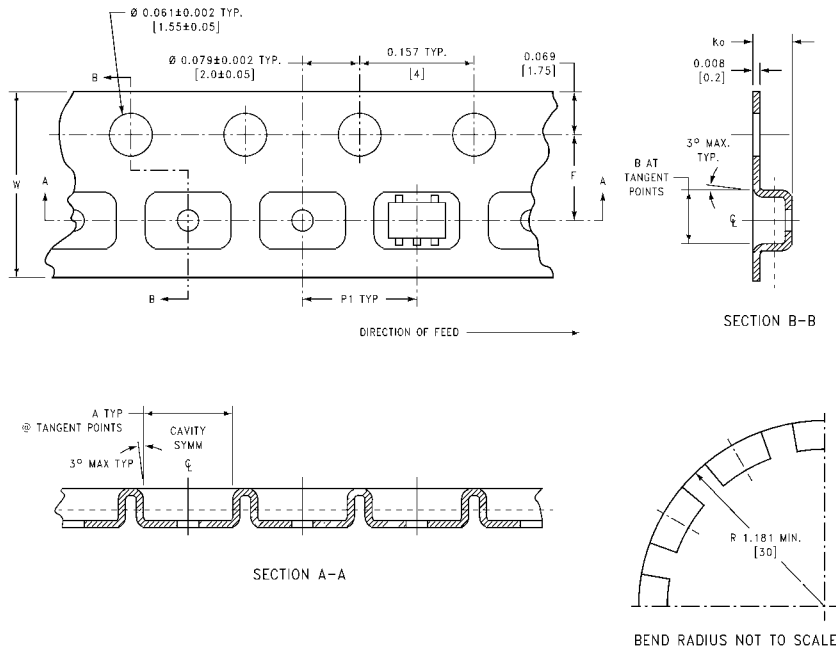
**FIGURE 3. AC Waveforms**

## Tape and Reel Specification

### TAPE FORMAT

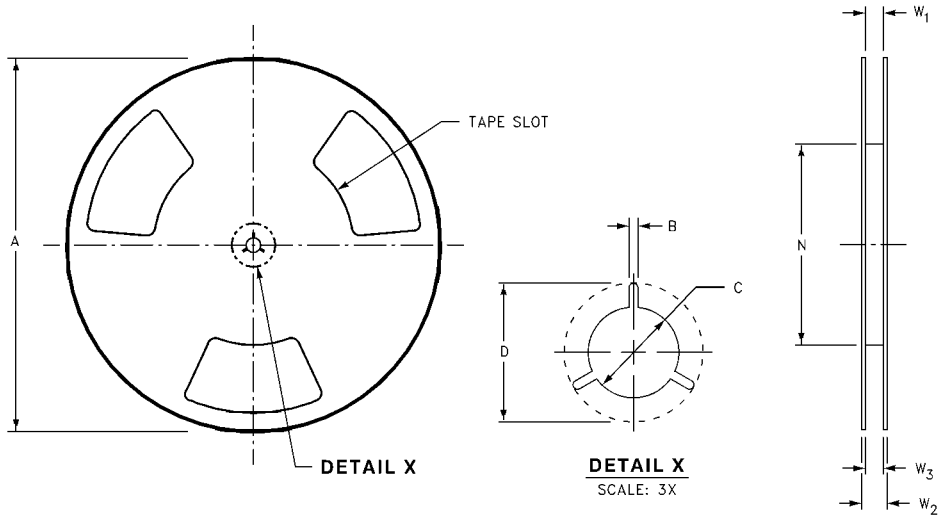
Package Designator	Tape Section	Number Cavities	Cavity Status	Cover Tape Status
M5, P5	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	250	Filled	Sealed
	Trailer (Hub End)	75 (typ)	Empty	Sealed
M5X, P5X	Leader (Start End)	125 (typ)	Empty	Sealed
	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (typ)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

### TAPE DIMENSIONS inches (millimeters)



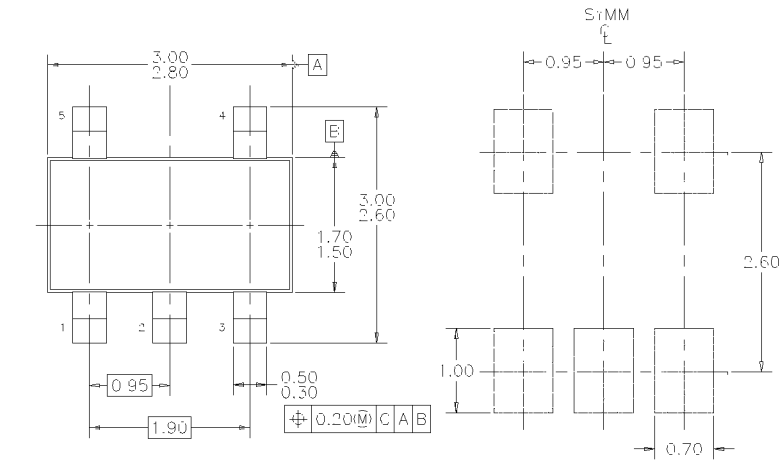
Package	Tape Size	DIM A	DIM B	DIM F	DIM K <sub>o</sub>	DIM P1	DIM W
SC70-5	8 mm	0.093 (2.35)	0.096 (2.45)	0.138 ± 0.004 (3.5 ± 0.10)	0.053 ± 0.004 (1.35 ± 0.10)	0.157 (4)	0.315 ± 0.004 (8 ± 0.1)
SOT23-5	8 mm	0.130 (3.3)	0.130 (3.3)	0.138 ± 0.002 (3.5 ± 0.05)	0.055 ± 0.004 (1.4 ± 0.11)	0.157 (4)	0.315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

REEL DIMENSIONS inches (millimeters)

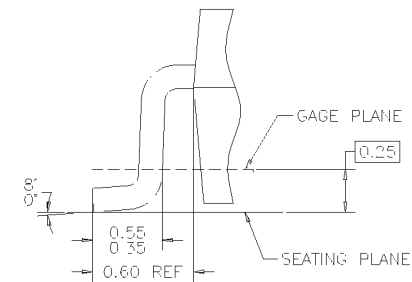
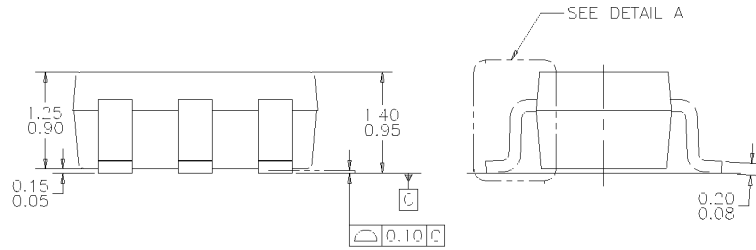


Tape Size	A	B	C	D	N	W1	W2	W3
8 mm	7.0 (177.8)	0.059 (1.50)	0.512 (13.00)	0.795 (20.20)	2.165 (55.00)	0.331 + 0.059/-0.000 (8.40 + 1.50/-0.00)	0.567 (14.40)	W1 + 0.078/-0.039 (W1 + 2.00/-1.00)

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



LAND PATTERN RECOMMENDATION

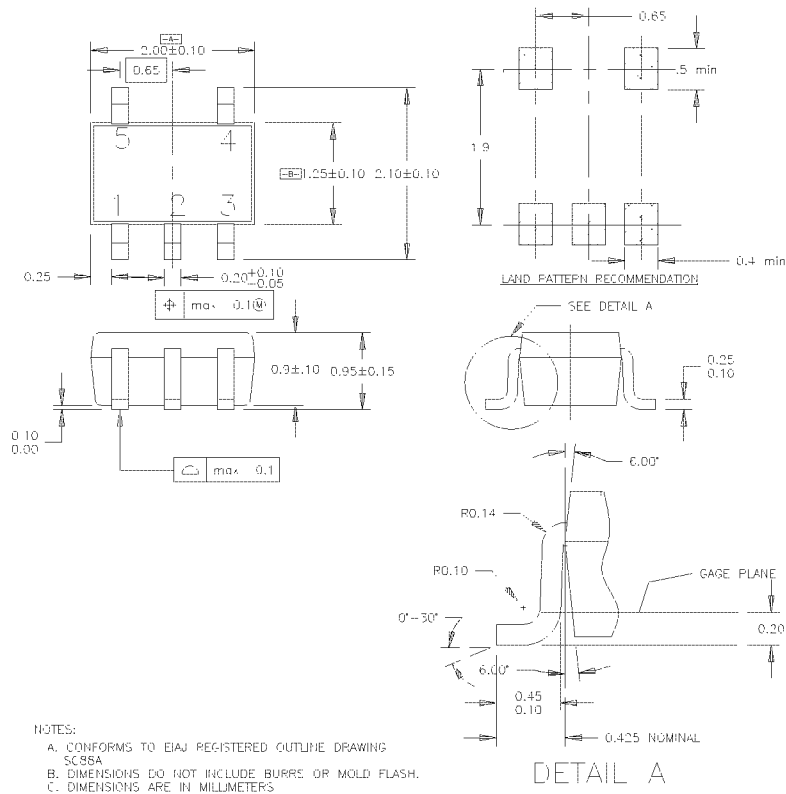


NOTES: UNLESS OTHERWISE SPECIFIED

- 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)



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

**LIFE SUPPORT POLICY**

FAIRCHILD'S PRODUCTS ARE NOT AUTHORIZED FOR USE AS CRITICAL COMPONENTS IN LIFE SUPPORT DEVICES OR SYSTEMS WITHOUT THE EXPRESS WRITTEN APPROVAL OF THE PRESIDENT OF FAIRCHILD SEMICONDUCTOR CORPORATION. As used herein:

1. Life support devices or systems are devices or systems which, (a) are intended for surgical implant into the body, or (b) support or sustain life, and (c) whose failure to perform when properly used in accordance with instructions for use provided in the labeling, can be reasonably expected to result in a significant injury to the user.
2. A critical component in any component of a life support device or system whose failure to perform can be reasonably expected to cause the failure of the life support device or system, or to affect its safety or effectiveness.

[www.fairchildsemi.com](http://www.fairchildsemi.com)