

September 2009

# NC7SZ05 TinyLogic<sup>®</sup> UHS Inverter, Open Drain Output

## **Features**

- Ultra-High Speed: t<sub>PD</sub> 1.9ns (Typical) into 50pF at 5V V<sub>CC</sub>
- Open Drain Output for OR Tied Applications
- High Output Drive: +24mA at 3V V<sub>CC</sub>
- Broad V<sub>CC</sub> Operating Range: 1.65V to 5.5V
- Matches Performance of LCX Operated at 3.3V V<sub>CC</sub>
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5V to 3V Translation
- Proprietary Noise/EMI Reduction Circuitry Implemented
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

#### Description

The NC7SZ05 is a single inverter with open drain output stage from Fairchild's Ultra-High Speed series of TinyLogic®. 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 broad  $V_{\rm CC}$  operating range. The device is specified to operate over the 1.65V to 5.5V  $V_{\rm CC}$  operating range. The inputs and output are high-impedance when  $V_{\rm CC}$  is 0V. Inputs tolerate voltages up to 6V, independent of  $V_{\rm CC}$  operating voltage. The open drain output stage tolerates voltages up to 6V, independent of  $V_{\rm CC}$  when in the high-impedance state.

## **Ordering Information**

Part Number	Top Mark	<b>©</b> Eco Status	Package	Packing Method
NC7SZ05M5X	7Z05	RoHS	5-Lead SOT23, JEDEC MO-178 1.6mm	3000 Units on Tape & Reel
NC7SZ05P5X	Z05	RoHS	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3000 Units on Tape & Reel
NC7SZ05L6X	C6	RoHS	6-Lead MicroPak™, 1.00mm Wide	5000 Units on Tape & Reel
NC7SZ05FHX	C6	Green	6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch	5000 Units on Tape & Reel

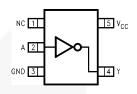
For Fairchild's definition of Eco Status, please visit: <a href="http://www.fairchildsemi.com/company/green/rohs-green.html">http://www.fairchildsemi.com/company/green/rohs-green.html</a>.

# **Connection Diagrams**



Figure 1. Logic Symbol

# **Pin Configurations**



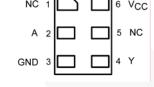


Figure 2. SC70 and SOT23 (Top View)

Figure 3. MicroPak (Top Through View)

## **Pin Definitions**

Pin # SC70 / SOT23	Pin # MicroPak	Name	Description
1	1,5	NC	No Connect
2	2	A	Input
3	3	GND	Ground
4	4	Υ	Output
5	6	V <sub>CC</sub> Supply Voltage	

## **Function Table**

Y = /A

Inputs	Output
Α	Y
L	*H
Н	L

H = HIGH Logic Level

L = LOW Logic Level

\*H = High Impedance Output State, Open Drain

## **Absolute Maximum Ratings**

Stresses exceeding the absolute maximum ratings may damage the device. The device may not function or be operable above the recommended operating conditions and stressing the parts to these levels is not recommended. In addition, extended exposure to stresses above the recommended operating conditions may affect device reliability. The absolute maximum ratings are stress ratings only.

Symbol	Para	ameter	Min.	Max.	Unit	
V <sub>CC</sub>	Supply Voltage		-0.5	6.0	V	
V <sub>IN</sub>	DC Input Voltage		-0.5	6.0	V	
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.0	V	
1	DC Input Diada Current	V <sub>IN</sub> < -0.5V		-50	m /	
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> > 6.0V		+20	- mA	
	DC Output Diada Cumant	V <sub>OUT</sub> < -0.5V		-50	A	
l <sub>ok</sub>	DC Output Diode Current	$V_{OUT} > 6V, V_{CC} = GND$		+20	mA	
l <sub>out</sub>	DC Output Current			±50	mA	
I <sub>CC</sub> or I <sub>GND</sub>	DC V <sub>CC</sub> or Ground Current			±50	mA	
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C	
TJ	Junction Temperature Under B	ias		+150	°C	
TL	Junction Lead Temperature (S	oldering, 10 Seconds)		+260	°C	
		SOT-23		200		
<b>D</b>	Davida Diagination at 10500	SC70-5		150	\/	
$P_D$	Power Dissipation at +85°C	MicroPak-6	1	130	mW	
		MicroPak2-6		120		
FCD	Human Body Model, JEDEC:JESD22-A114			4000	V	
ESD	Charge Device Model, JEDEC:	JESD22-C101		2000	V	

# **Recommended Operating Conditions**

The Recommended Operating Conditions table defines the conditions for actual device operation. Recommended operating conditions are specified to ensure optimal performance to the datasheet specifications. Fairchild does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit	
V	Supply Voltage Operating		1.65	5.50	V	
V <sub>CC</sub>	Supply Voltage Data Retention		1.50	5.50	7 v	
V <sub>IN</sub>	Input Voltage		0	5.5	V	
V <sub>OUT</sub>	Output Voltage		0	5.5	V	
T <sub>A</sub>	Operating Temperature		-40	+85	°C	
		V <sub>CC</sub> at 1.8V, 2.5V ± 0.2V	0	20	$\prec$	
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall TimeS	V <sub>CC</sub> at 3.3V ± 0.3V	0	10	ns/V	
		V <sub>CC</sub> at 5.0V ± 0.5V	0	5		
		SOT-23		300		
0	Thormal Desigtance	SC70-5		425	°C/\/	
$\theta_{JA}$	Thermal Resistance	MicroPak-6		500	°C/W	
		MicroPak2-6		560		

#### Note:

1. Unused inputs must be held HIGH or LOW. They may not float.

## **DC Electrical Characteristics**

	O-maked Bereins		V 0 150	Т,	T <sub>A</sub> =+25°C			T <sub>A</sub> =-40 to +85°C		
Symbol	Parameter	V <sub>CC</sub>	Conditions	Min.	Тур.	Max.	Min.	Max.	Units	
V	HIGH Level Input	1.65 to 1.95		0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		V	
V <sub>IH</sub>	Voltage	2.30 to 5.50		0.70V <sub>CC</sub>			0.70V <sub>CC</sub>		V	
VIL	LOW Level Input	1.65 to 1.95				0.25V <sub>CC</sub>		0.25V <sub>CC</sub>	V	
V IL	Voltage	2.30 to 5.50				0.30V <sub>CC</sub>		0.30V <sub>CC</sub>	V	
I <sub>LKG</sub>	HIGH Level Output Leakage Current	1.65 to 5.50	V <sub>IN</sub> =V <sub>IL</sub> , V <sub>OUT</sub> =V <sub>CC</sub> or GND			±5		±10	μΑ	
		1.65			0.00	0.10		0.10		
		1.80			0.00	0.10		0.10		
		2.30	V <sub>IN</sub> =V <sub>IH</sub> , I <sub>OL</sub> =100		0.00	0.10		0.10		
		3.00			0.00	0.10		0.10		
V <sub>OL</sub>	LOW Level	4.50			0.00	0.10		0.10	V	
VOL	Output Voltage	1.65	I <sub>OL</sub> =4mA		0.80	0.24		0.24	V	
_/		2.30	I <sub>OL</sub> =8mA		0.10	0.30		0.30		
		3.00	I <sub>OL</sub> =16mA		0.15	0.40		0.40		
		3.00	I <sub>OL</sub> =24mA		0.22	0.55		0.55		
		4.50	I <sub>OL</sub> =32mA		0.22	0.55		0.55		
I <sub>IN</sub>	Input Leakage Current	0 to 5.5	$0 \le V_{IN} \le 5.5V$			±1		±10	μΑ	
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> =5.5V			1		10	μΑ	
Icc	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> =5.5V, GND			2		20	μΑ	

#### **AC Electrical Characteristics**

Symbol	Parameter	V	Conditions	T,	<sub>4</sub> =+25°(	;	T <sub>A</sub> =-40 1	to +85°C	Units	Figure
Symbol	Parameter	V <sub>cc</sub>	Conditions	Min.	Тур.	Max.	Min.	Max.	Ullits	rigure
		1.65		1.5	5.5	12.9	1.5	13.4		
		1.80	C <sub>L</sub> =50pF,	1.5	4.6	10.5	1.5	11.0		
t <sub>PZL</sub>		2.50 ± 0.20	RU=500 $\Omega$ , RD-500 $\Omega$ ,	0.8	3.0	7.0	0.8	7.5		
		$3.30 \pm 0.30$	V <sub>IN</sub> =2•V <sub>CC</sub>	0.8	2.4	5.0	0.8	5.2		Figure 4 Figure 5
	Branagation Dalay	$5.00 \pm 0.50$		0.5	1.9	4.3	0.5	4.5		
	Propagation Delay	1.65	C <sub>L</sub> =50pF, RU=500Ω, RD-500Ω, V <sub>IN</sub> =2•V <sub>CC</sub>	1.5	5.0	12.9	1.5	13.4	ns	
		1.80		1.5	4.1	10.5	1.5	11.0		
t <sub>PLZ</sub>		2.50 ± 0.20		0.8	2.5	7.0	0.8	7.5		
		$3.30 \pm 0.30$		0.8	2.1	5.0	0.8	5.2		
		$5.00 \pm 0.50$		0.5	1.2	4.3	0.5	4.5		
C <sub>IN</sub>	Input Capacitance	0.00			4.0				pF	
C <sub>OUT</sub>	Output Capacitance	0.00		·	6.0				pF	
C	C <sub>PD</sub> Power Dissipation Capacitance <sup>(2)</sup>	3.30			3.6				nE.	Figure 6
OPD		5.00			6.5				pF	Figure 6

#### 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 lading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub>=(C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>)+(I<sub>CC</sub>static).

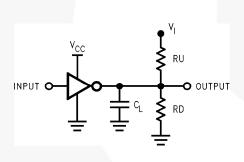


Figure 4. AC Test Circuit

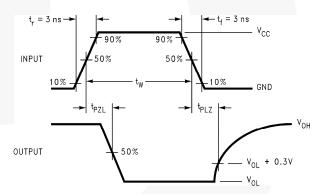
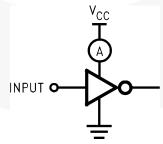


Figure 5. AC Waveforms



#### Note:

Input=AC Waveform; tr=tf=1.8ns; PRR=10MHz; Duty Cycle =50%.

Figure 6. Test Circuit

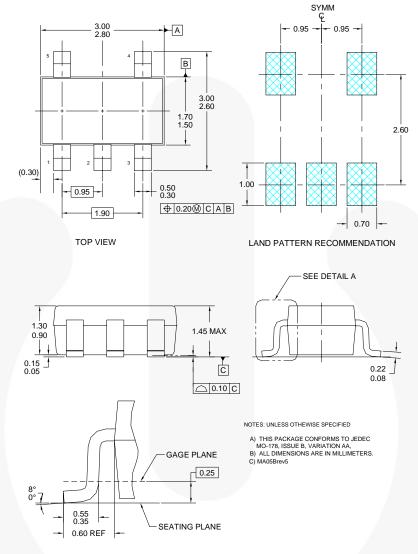


Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6mm

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Please visit Fairchild Semiconductor's online packaging area for the most recent tape and reel specifications: http://www.fairchildsemi.com/packaging/SOT23-5L\_tr.pdf.

Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status	
	Leader (Start End)	125 (Typical)	Empty	Sealed	
M5X	Carrier	3000	Filled	Sealed	
	Trailer (Hub End)	75 (Typical)	Empty	Sealed	

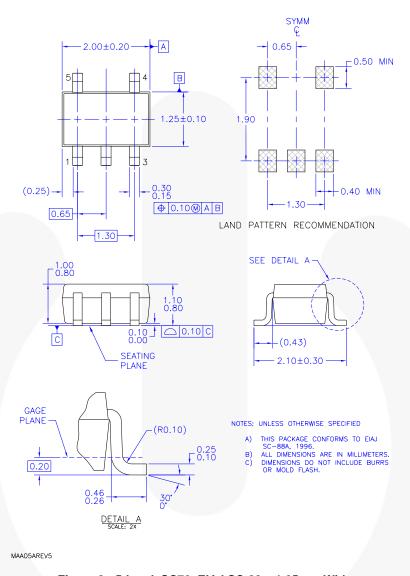


Figure 8. 5-Lead, SC70, EIAJ SC-88a, 1.25mm Wide

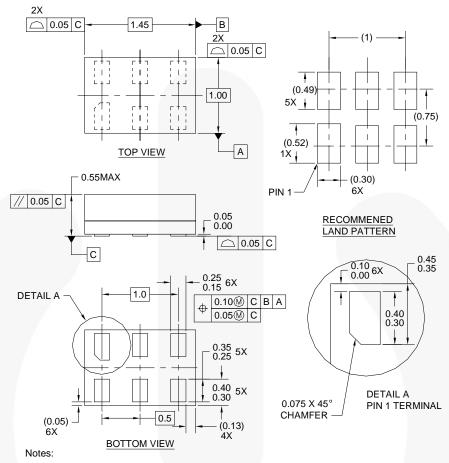
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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status	
	Leader (Start End)	125 (Typical)	Empty	Sealed	
P5X	Carrier	3000	Filled	Sealed	
	Trailer (Hub End)	75 (Typical)	Empty	Sealed	



- 1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
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Figure 9. 6-Lead, MicroPak™, 1.0mm Wide

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Package Designator	Tape Section	Cavity Number	Cavity Status	Cover Type Status	
	Leader (Start End)	125 (Typical)	Empty	Sealed	
L6X	Carrier	5000	Filled	Sealed	
	Trailer (Hub End)	75 (Typical)	Empty	Sealed	

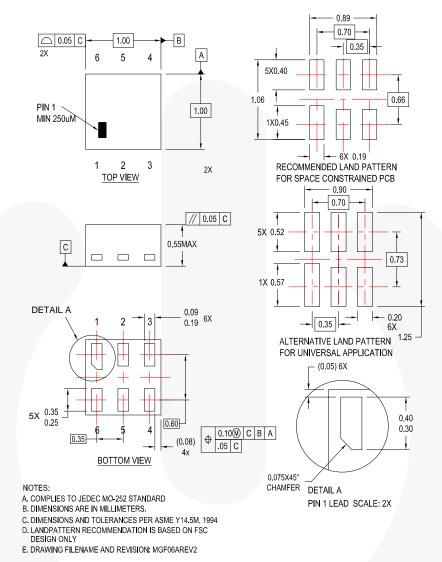


Figure 10.6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch

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Package Designator	Tape Section	pe Section Cavity Number		Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
FHX	Carrier	5000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed





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