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January 2014

# NC7SZ125 TinyLogic<sup>®</sup> UHS Buffer with Three-State Output

#### **Features**

- Ultra-High Speed: t<sub>PD</sub> 2.6 ns (Typical) into 50 pF at 5 V V<sub>CC</sub>
- High Output Drive: ±24 mA at 3 V V<sub>CC</sub>
- Broad V<sub>CC</sub> Operating Range: 1.65 V to 5.5 V
- Matches Performance of LCX Operated at 3.3 V V<sub>CC</sub>
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance Inputs Facilitate 5 V to 3 V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

#### **Description**

The NC7SZ125 is a single buffer with three-state output from Fairchild's Ultra-High Speed (UHS) of TinyLogic  $^{\otimes}$ . 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  $V_{\rm CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V range. The inputs and output are high impedance above ground when  $V_{\rm CC}$  is 0 V. Inputs tolerate voltages up to 6 V independent of  $V_{\rm CC}$  operating voltage. The output tolerates voltages above  $V_{\rm CC}$  when in the 3-STATE condition.

# **Ordering Information**

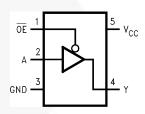
Part Number	Top Mark	Package	Packing Method
NC7SZ125M5X	7Z25	5-Lead SOT23, JEDEC MO-178 1.6 mm	3000 Units on Tape & Reel
NC7SZ125P5X	Z25	5-Lead SC70, EIAJ SC-88a, 1.25 mm Wide	3000 Units on Tape & Reel
NC7SZ125L6X	DD	6-Lead MicroPak™, 1.00 mm Wide	5000 Units on Tape & Reel
NC7SZ125FHX	DD	6-Lead, MicroPak2, 1x1 mm Body, .35mm Pitch	5000 Units on Tape & Reel

# **Connection Diagrams**



Figure 1. Logic Symbol

# **Pin Configurations**





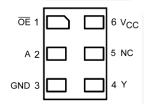


Figure 3. MicroPak™ (Top Through View)

## **Pin Definitions**

Pin # SC70 / SOT23	Pin # MicroPak	Name	Description
1	1	OE	Input
2	2	A	Input
3	3	GND	Ground
4	4	Υ	Output
5	6	V <sub>CC</sub>	Supply Voltage
\(\frac{1}{2}\)	5	NC	No Connect

# **Function Table**

In	puts	Output
/OE	In A	Out Y
L	L	r r
L	Н	Н
Н	X	Z

H = HIGH Logic Level

L = LOW Logic Level

X = HIGH or LOW Logic Level

Z = HIGH Impedance State

# **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	meter		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
	DC Input Diada Current	V <sub>IN</sub> < -0.5	5 V		-50	mA
I <sub>IK</sub>	DC Input Diode Current	$V_{IN} > 6.0$	V		+20	IIIA
	DC Output Diada Current	V <sub>OUT</sub> < -0	.5 V		-50	m A
I <sub>OK</sub>	DC Output Diode Current	$V_{OUT} > 6 \text{ V}, V_{CC} = \text{GND}$			+20	mA
I <sub>OUT</sub>	DC Output Current	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
$T_J$	Junction Temperature Under Bia	IS			+150	°C
$T_L$	Junction Lead Temperature (Sol	dering, 10 Second	s)		+260	°C
- /-		SOT-23			200	
Б	Device Discipation at 19590	SC70-5			150	\/
$P_D$	Power Dissipation at +85°C	MicroPak	<b>c-6</b>		130	mW
		MicroPak	MicroPak2-6		120	
ESD	Human Body Model, JESD22-A114				4000	.,
ESD	Charged Device Model, 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	
\/	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	
M	Output Voltage	Active State	0	V <sub>CC</sub>	V	
V <sub>OUT</sub>	Output Voltage	Three-State	0	5.5	V	
T <sub>A</sub>	Operating Temperature		-40	+85	°C	
		V <sub>CC</sub> at 1.8 V, 2.5 V ±0.2 V	0	20	K	
$t_r$ , $t_f$	Input Rise and Fall Times	V <sub>CC</sub> at 3.3 V ±0.3 V	0	10	ns/V	
		V <sub>CC</sub> at 5.0 V ±0.5 V	0	5		
		SOT-23		300		
0	The survey Designation	SC70-5		425	°C/W	
$\theta_{JA}$	Thermal Resistance	MicroPak-6		500		
		MicroPak2-6		560		

#### Note:

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

# **DC Electrical Characteristics**

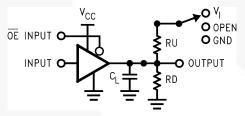
Symbol Baramatar		V <sub>CC</sub> Conditions	T <sub>A</sub> =+25°C			$T_A = -40 \text{ to } +85^{\circ}\text{C}$		Unito	
Symbol	ymbol Parameter	V <sub>cc</sub>	V <sub>CC</sub> Conditions		Тур.	Max.	Min.	Max.	Units
.,	HIGH Level	1.65 to 1.95		0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		.,
$V_{IH}$	Input Voltage	2.30 to 5.50		0.70V <sub>CC</sub>			0.70V <sub>CC</sub>		V
.,	LOW Level Input	1.65 to 1.95				0.25V <sub>CC</sub>		0.25V <sub>CC</sub>	.,
$V_{IL}$	Voltage	2.30 to 5.50				0.30V <sub>CC</sub>		0.30V <sub>CC</sub>	V
		1.65		1.55	1.65		1.55		
		1.80		1.70	1.80		1.70		
		2.30	$V_{IN}=V_{IH}$ , $I_{OH}=-100 \mu A$	2.20	2.30		2.20		V
		3.00		2.90	3.00		2.90		
\/	HIGH Level	4.50		4.40	4.50		4.40		
$V_{OH}$	Output Voltage	1.65	I <sub>OH</sub> =-4 mA	1.29	1.52		1.29		
		2.30	I <sub>OH</sub> =-8 mA	1.90	2.15	Á	1.90		
		3.00	I <sub>OH</sub> =-16 mA	2.40	2.80		2.40		
		3.00	I <sub>OH</sub> =-24 mA	2.30	2.68	leg-	2.30		
		4.50	I <sub>OH</sub> =-32 mA	3.80	4.20		3.80		
	1.65			0.00	0.10		0.00		
		1.80			0.00	0.10		0.10	
		2.30	V <sub>IN</sub> =V <sub>IL</sub> , I <sub>OL</sub> =100 μA		0.00	0.10		0.10	
	1/	3.00			0.00	0.10	W	0.10	
	LOW Level	4.50			0.00	0.10		0.10	.,
$V_{OL}$	Output Voltage	1.65	I <sub>OL</sub> =4 mA		0.80	0.24		0.24	V
		2.30	I <sub>OL</sub> =8 mA		0.10	0.30		0.30	
		3.00	I <sub>OL</sub> =16 mA		0.15	0.40		0.40	
		3.00	I <sub>OL</sub> =24 mA		0.22	0.55		0.55	
		4.50	I <sub>OL</sub> =32 mA		0.22	0.55		0.55	
I <sub>IN</sub>	Input Leakage Current	0 to 5.5	0 ≥ V <sub>IN</sub> ≥ 5.5 V			±1		±10	μΑ
l <sub>OZ</sub>	3-STATE Output Leakage	0 to 5.5	$V_{IN}=V_{IH} \text{ or } V_{IL}$ $0 \ge V_O \ge 5.5 \text{ V}$			±1	A	±10	μA
I <sub>OFF</sub>	Power Off Leakage Current	0	V <sub>IN</sub> or V <sub>OUT</sub> =5.5 V			1		10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> =5.5 V, GND		154	2		20	μA

## **AC Electrical Characteristics**

Compleal	Danamatan	Parameter V <sub>CC</sub> Conditions		T <sub>A</sub> =+25°C		T <sub>A</sub> =-40 to +85°C		Units	Ciaura	
Symbol Parameter		V <sub>cc</sub>	Conditions	Min.	Тур.	Max.	Min.	Max.	Units	Figure
		1.65		2.0	6.4	13.2	2.0	13.8		
		1.80	C <sub>L</sub> =15 pF,	2.0	5.3	11.0	2.0	11.5		
		2.50 ±0.20	$R_D=1 M\Omega$	8.0	3.4	7.5	0.8	8.0		
t <sub>PLH</sub> ,t <sub>PHL</sub>	Propagation Delay	3.30 ±0.30	S <sub>1</sub> =OPEN	0.5	2.5	5.2	0.5	5.5	ns	Figure 4
*FLN, *FNL	. ropaganon zonaj	5.00 ±0.50		0.5	2.1	4.5	0.5	4.8		Figure 6
		3.30 ±0.30	C <sub>L</sub> =50 pF,	1.5	3.2	5.7	1.5	6.0		
		5.00 ±0.50	$R_D=500 \Omega$ $S_1=OPEN$	0.8	2.6	5.0	0.8	5.3	1	
		1.65	$\begin{array}{c} \text{C}_{\text{L}}\text{=}50~\text{pF}, \\ \text{R}_{\text{D}}\text{=}500~\Omega \\ \text{RU}\text{=}500~\Omega \\ \text{S}_{\text{1}}\text{=}\text{GND for t}_{\text{PZH}} \\ \text{S}_{\text{1}}\text{=}\text{V}_{\text{IN}}\text{for t}_{\text{PZL}} \\ \text{V}_{\text{IN}}\text{=}2\text{•}\text{V}_{\text{CC}} \end{array}$	2.0	8.4	15.0	2.0	15.6		
		1.80		2.0	7.0	12.5	2.0	13.0		
$t_{PZL,}t_{PZH}$	Output Enable Time	2.50 ±0.20		1.5	4.6	8.5	1.5	9.0		
		3.30 ±0.30		1.5	3.5	6.2	1.5	6.5		
		5.00 ±0.50		0.8	2.8	5.5	0.8	5.8		Figure 4
		1.65	C <sub>L</sub> =50 pF,	2.0	6.5	13.2	2.0	14.5	ns	Figure 6
		1.80	$R_D=500 \Omega$	2.0	5.4	11.0	2.0	12.0		
$t_{PLZ,}t_{PHZ}$	Output Disable Time	2.50 ±0.20	RU=500 $\Omega$ S <sub>1</sub> =GND for t <sub>PHZ</sub>	1.5	3.5	8.0	1.5	8.5		
		3.30 ±0.30	$S_1 = V_{IN}$ for $t_{PLZ}$	1.0	2.8	5.7	1.0	6.0		
	37	5.00 ±0.50	O   - V		2.1	4.7	0.5	5.0		
C <sub>IN</sub>	Input Capacitance	0.00			4				pF	
C <sub>OUT</sub>	Output Capacitance	0.00			8					
0	Power Dissipation	3.30			17					F: 5
C <sub>PD</sub> Cap	Capacitance <sup>(2)</sup>	5.00			24				pF	Figure 5

#### Note:

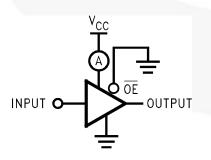
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output lading and operating at 50% duty cycle. C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression: I<sub>CCD</sub>=(C<sub>PD</sub>)(V<sub>CC</sub>)(f<sub>IN</sub>)+(I<sub>CC</sub>static).



#### Note:

3.  $C_L$  includes load and stray capacitance. Input PRR=1.0 MHz,  $t_W$ =500 ns.

Figure 4. AC Test Circuit



#### Note:

 Input=AC Waveform; t<sub>r</sub>=t<sub>f</sub>=1.8 ns; PRR=10 MHz; Duty Cycle=50%.

Figure 5. I<sub>CCD</sub> Test Circuit

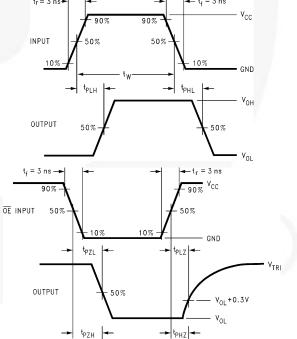


Figure 6. AC Waveforms

OUTPUT

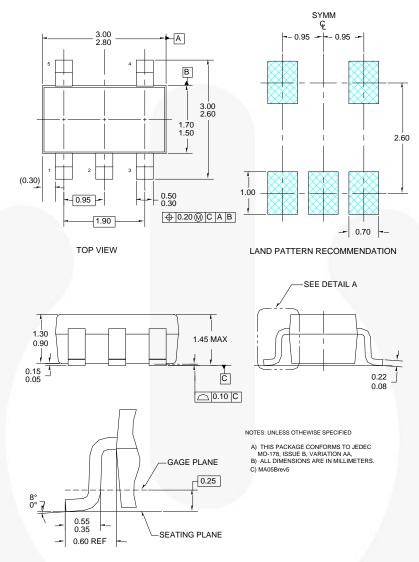


Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6 mm

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## **Tape and Reel Specifications**

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

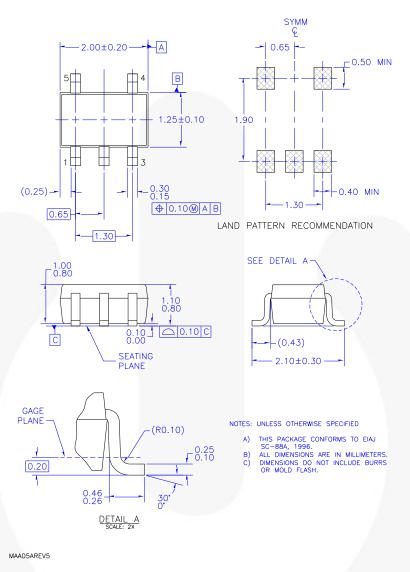


Figure 8. 5-Lead, SC70, EIAJ SC-88a, 1.25 mm Wide

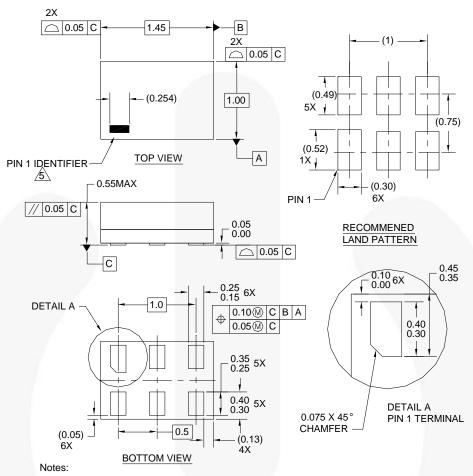
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Package Designator	Tape Section	<b>Cavity Number</b>	Cavity Status	Cover Type Status
	Leader (Start End)	125 (Typical)	Empty	Sealed
P5X	Carrier	3000	Filled	Sealed
	Trailer (Hub End)	75 (Typical)	Empty	Sealed



- 1. CONFORMS TO JEDEC STANDARD M0-252 VARIATION UAAD
- 2. DIMENSIONS ARE IN MILLIMETERS
- 3. DRAWING CONFORMS TO ASME Y14.5M-1994
- 4. FILENAME AND REVISION: MAC06AREV4
- 5. PIN ONE IDENTIFIER IS 2X LENGTH OF ANY

OTHER LINE IN THE MARK CODE LAYOUT.

Figure 9. 6-Lead, MicroPak™, 1.0 mm 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	

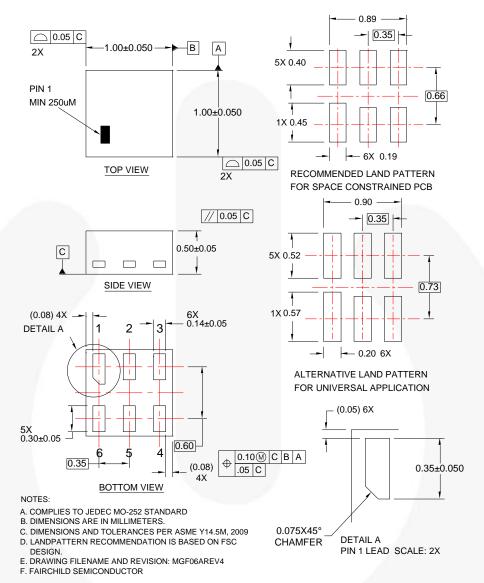


Figure 10. 6-Lead, MicroPak2, 1x1 mm Body, .35 mm Pitch

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Package Designator Tape Section		Cavity Number	<b>Cavity Status</b>	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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#### PRODUCT STATUS DEFINITIONS

#### Definition of Terms

Definition of Terms		
Datasheet Identification	Product Status	Definition
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Preliminary	First Production	Datasheet contains preliminary data; supplementary data will be published at a later date. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve design.
No Identification Needed	Full Production	Datasheet contains final specifications. Fairchild Semiconductor reserves the right to make changes at any time without notice to improve the design.
Obsolete	Not In Production	Datasheet contains specifications on a product that is discontinued by Fairchild Semiconductor.  The datasheet is for reference information only.

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