



# THE DATASHEET OF NC7SZ00M5





ON Semiconductor®

# NC7SZ00 TinyLogic® UHS Two-Input NAND Gate

## Features

- Ultra-High Speed:  $t_{PD}$  2.4ns (Typical) into 50pF at 5V  $V_{CC}$
- High Output Drive:  $\pm 24mA$  at 3V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65V to 5.5V
- Matches Performance of LCX Operated at 3.3V  $V_{CC}$
- Power Down High-Impedance Inputs/Outputs
- Over-Voltage Tolerance inputs facilitate 5V to 3V Translation
- Proprietary Noise/EMI Reduction Circuitry
- Ultra-Small MicroPak™ Packages
- Space-Saving SOT23 and SC70 Packages

## Description

The NC7SZ00 is a single two-input NAND gate from ON Semiconductor's Ultra-High Speed (UHS) 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  $V_{CC}$  operating range. The device is specified to operate over the 1.65V to 5.5V  $V_{CC}$  operating range. The inputs and output are high impedance when  $V_{CC}$  is 0V. Inputs tolerate voltages up to 6V, independent of  $V_{CC}$  operating voltage.

## Ordering Information

Part Number	Top Mark	Package	Packing Method
NC7SZ00M5X	7Z00	5-Lead SOT23, JEDEC MO-178 1.6mm	3000 Units on Tape & Reel
NC7SZ00P5X	Z00	5-Lead SC70, EIAJ SC-88a, 1.25mm Wide	3000 Units on Tape & Reel
NC7SZ00L6X	YY	6-Lead MicroPak™, 1.00mm Wide	5000 Units on Tape & Reel
NC7SZ00FHX	YY	6-Lead, MicroPak2™, 1x1mm Body, .35mm Pitch	5000 Units on Tape & Reel

## Connection Diagrams

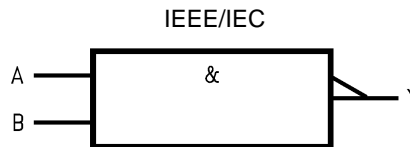


Figure 1. Logic Symbol

## Pin Configurations

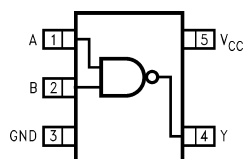


Figure 2. SC70 and SOT23 (Top View)

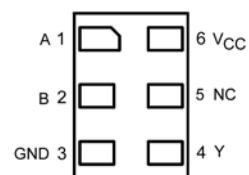


Figure 3. MicroPak™ (Top Through View)

## Pin Definitions

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

## Function Table

Inputs		Output
A	B	Y
L	L	H
L	H	H
H	L	H
H	H	L

H = HIGH Logic Level

L = LOW Logic Level

## 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	Parameter	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	
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < -0.5V		-50	mA
		V <sub>IN</sub> > 6.0V		+20	
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < -0.5V		-50	mA
		V <sub>OUT</sub> > 6V, V <sub>CC</sub> =GND		+20	
I <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	

T <sub>J</sub>	Junction Temperature Under Bias		+150	°C
T <sub>L</sub>	Junction Lead Temperature (Soldering, 10 Seconds)		+260	°C
P <sub>D</sub>	Power Dissipation at +85°C	SOT-23	200	mW
		SC70-5	150	
		MicroPak™-6	130	
		MicroPak2™-6	120	
ESD	Human Body Model, JEDEC:JESD22-A114		4000	V
	Charge Device Model, JEDEC:JESD22-C101		2000	

### 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. ON Semiconductor does not recommend exceeding them or designing to Absolute Maximum Ratings.

Symbol	Parameter	Conditions	Min.	Max.	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.50	V
	Supply Voltage Data Retention		1.5	5.5	
V <sub>IN</sub>	Input Voltage		0	5.5	V
V <sub>OUT</sub>	Output Voltage		0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature		-40	+85	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise and Fall Times	V <sub>CC</sub> at 1.8V, 2.5V ±0.2V	0	20	ns/V
		V <sub>CC</sub> at 3.3V ± 0.3V	0	10	
		V <sub>CC</sub> at 5.0V ± 0.5V	0	5	
θ <sub>JA</sub>	Thermal Resistance	SOT-23		300	°C/W
		SC70-5		435	
		MicroPak™-6		500	
		MicroPak2™-6		560	

**Note:**

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

### DC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =25°C			T <sub>A</sub> =-40 to +85°C		Units
				Min.	Typ.	Max.	Min.	Max.	
V <sub>IH</sub>	HIGH Level Input Voltage	1.65 to 1.95		0.75V <sub>CC</sub>			0.75V <sub>CC</sub>		V
		2.30 to 5.50		0.70V <sub>CC</sub>			0.70V <sub>CC</sub>		
V <sub>IL</sub>	LOW Level Input Voltage	1.65 to 1.95				0.25V <sub>CC</sub>		0.25V <sub>CC</sub>	V
		2.30 to 5.50				0.30V <sub>CC</sub>		0.30V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IL</sub> I <sub>OH</sub> =-100μA	1.55	1.65		1.55		V
		1.80		1.70	1.80		1.70		
		2.30		2.20	2.30		2.20		
		3.00		2.90	3.00		2.90		
		4.50		4.40	4.50		4.40		
		1.65	I <sub>OH</sub> =-4mA	1.29	1.52		1.29		
		2.30	I <sub>OH</sub> =-8mA	1.90	2.15		1.90		
		3.00	I <sub>OH</sub> =-16mA	2.40	2.80		2.40		
		3.00	I <sub>OH</sub> =-24mA	2.30	2.68		2.30		
		4.50	I <sub>OH</sub> =-32mA	3.80	4.20		3.80		
V <sub>OL</sub>	LOW Level Output Voltage	1.65	V <sub>IN</sub> =V <sub>IH</sub> I <sub>OL</sub> =100μA		0.00	0.10		0.08	V
		2.30			0.00	0.10		0.10	
		3.00			0.00	0.10		0.10	
		3.00			0.00	0.10		0.10	
		4.50			0.00	0.10		0.10	
		1.65	I <sub>OL</sub> =4mA		0.80	0.24		0.24	
		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	V <sub>IN</sub> =5.5V, GND			±1		±10	μA
I <sub>OFF</sub>	Power Off	0	V <sub>IN</sub> or V <sub>OUT</sub> =5.5V			1		10	μA
I <sub>CC</sub>	Quiescent Supply Current	1.65 to 5.50	V <sub>IN</sub> =5.5V, GND			2		20	μA

## AC Electrical Characteristics

Symbol	Parameter	V <sub>CC</sub>	Conditions	T <sub>A</sub> =25°C			T <sub>A</sub> =-40 to +85°C		Units	Figure
				Min.	Typ.	Max.	Min.	Max.		
t <sub>PHL</sub> , t <sub>PLH</sub>	Propagation Delay	1.65	C <sub>L</sub> =15pF, R <sub>L</sub> =1MΩ	2.0	5.4	11.4	2.0	12.0	ns	Figure 4 Figure 5
		1.80		2.0	4.5	9.5	2.0	10.0		
		2.50 ± 0.20		0.8	3.0	6.5	0.8	7.0		
		3.30 ± 0.30		0.5	2.4	4.5	0.5	4.7		
		5.00 ± 0.50		0.5	2.0	3.9	0.5	4.1		
		3.30 ± 0.30	C <sub>L</sub> =50pF, R <sub>L</sub> =500Ω	1.5	2.9	5.0	1.5	5.2		
		5.00 ± 0.50		0.8	2.4	4.3	0.8	4.5		
C <sub>IN</sub>	Input Capacitance	0.00			4			pF		
C <sub>PD</sub>	Power Dissipation Capacitance <sup>(2)</sup>	3.30			24			pF	Figure 6	
		5.00			30					

**Note:**

- C<sub>PD</sub> is defined as the value of the internal equivalent capacitance 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).

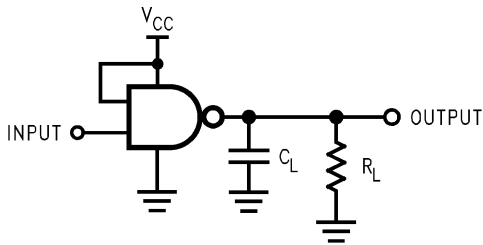


Figure 4. AC Test Circuit

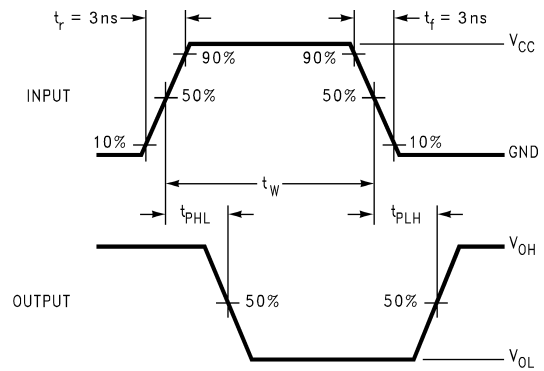
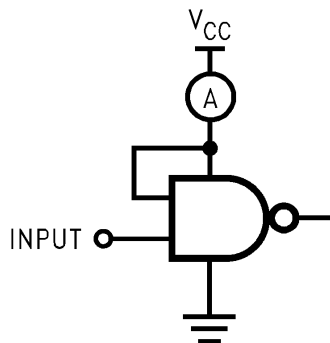


Figure 5. AC Waveforms

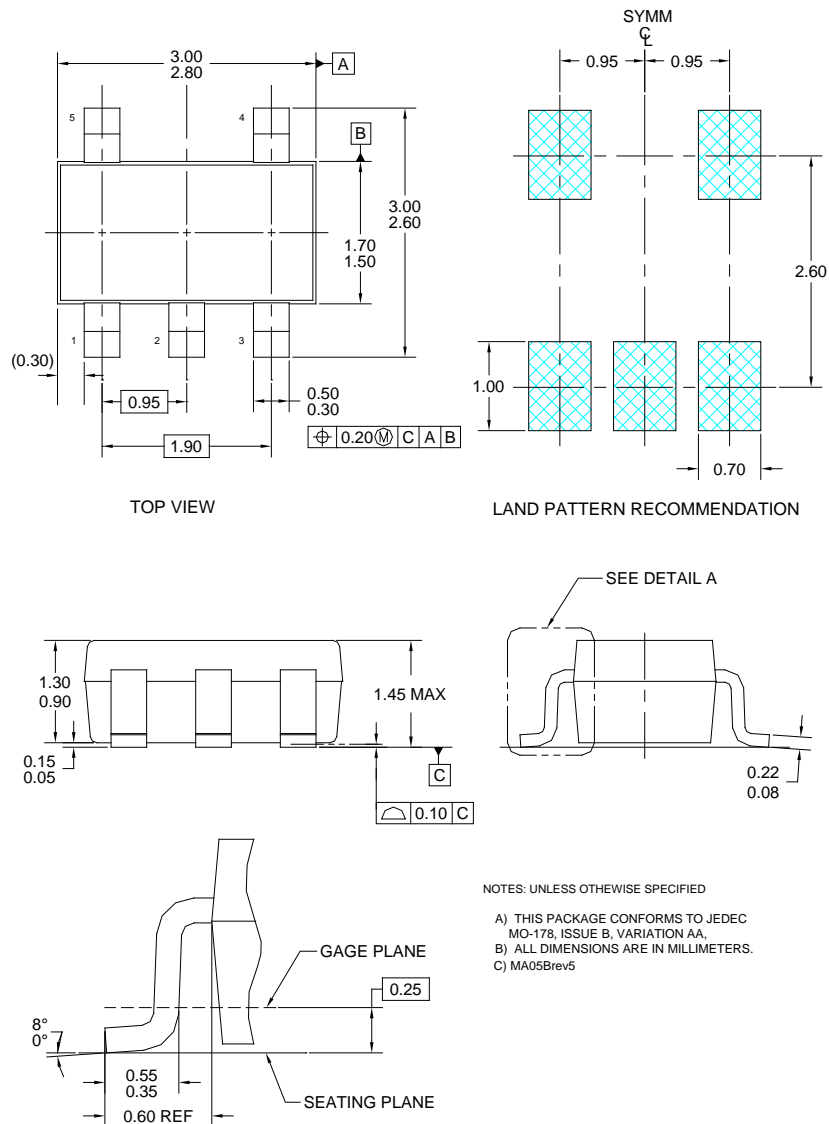


**Note:**

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

Figure 6. I<sub>CCD</sub> Test Circuit

## Physical Dimensions



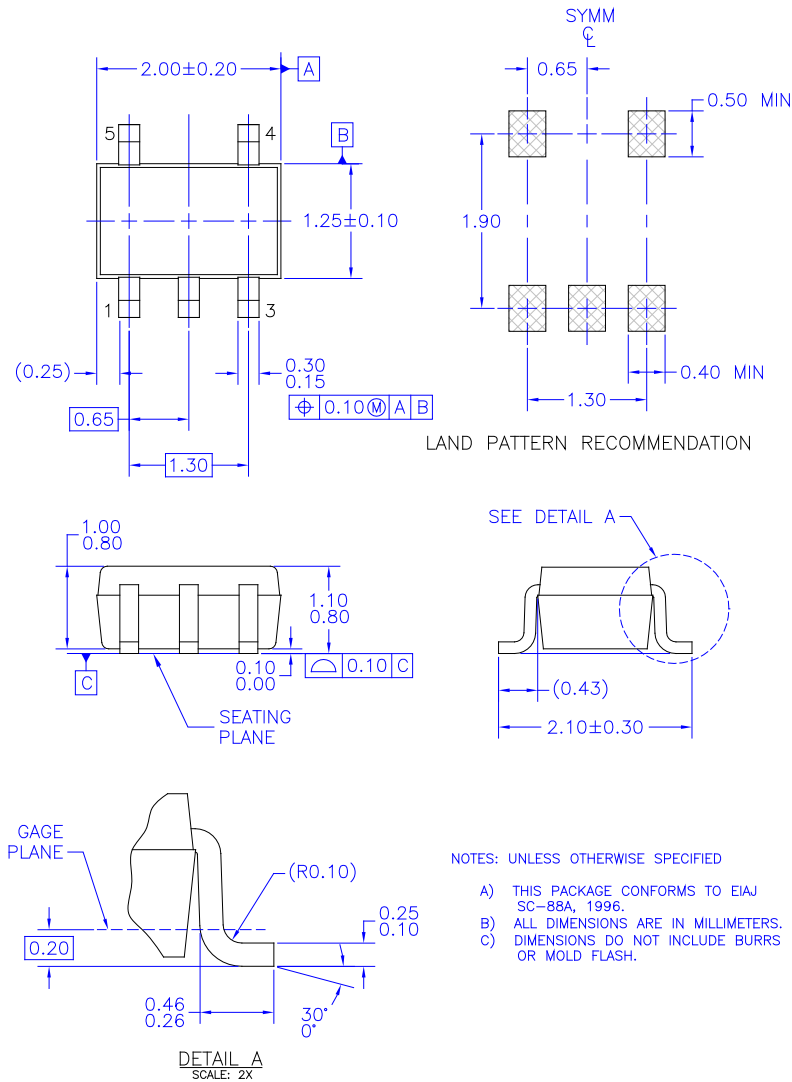
**Figure 7. 5-Lead SOT23, JEDEC MO-178 1.6mm**

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## Tape and Reel Specifications

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

## Physical Dimensions



MAA05AREV5

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

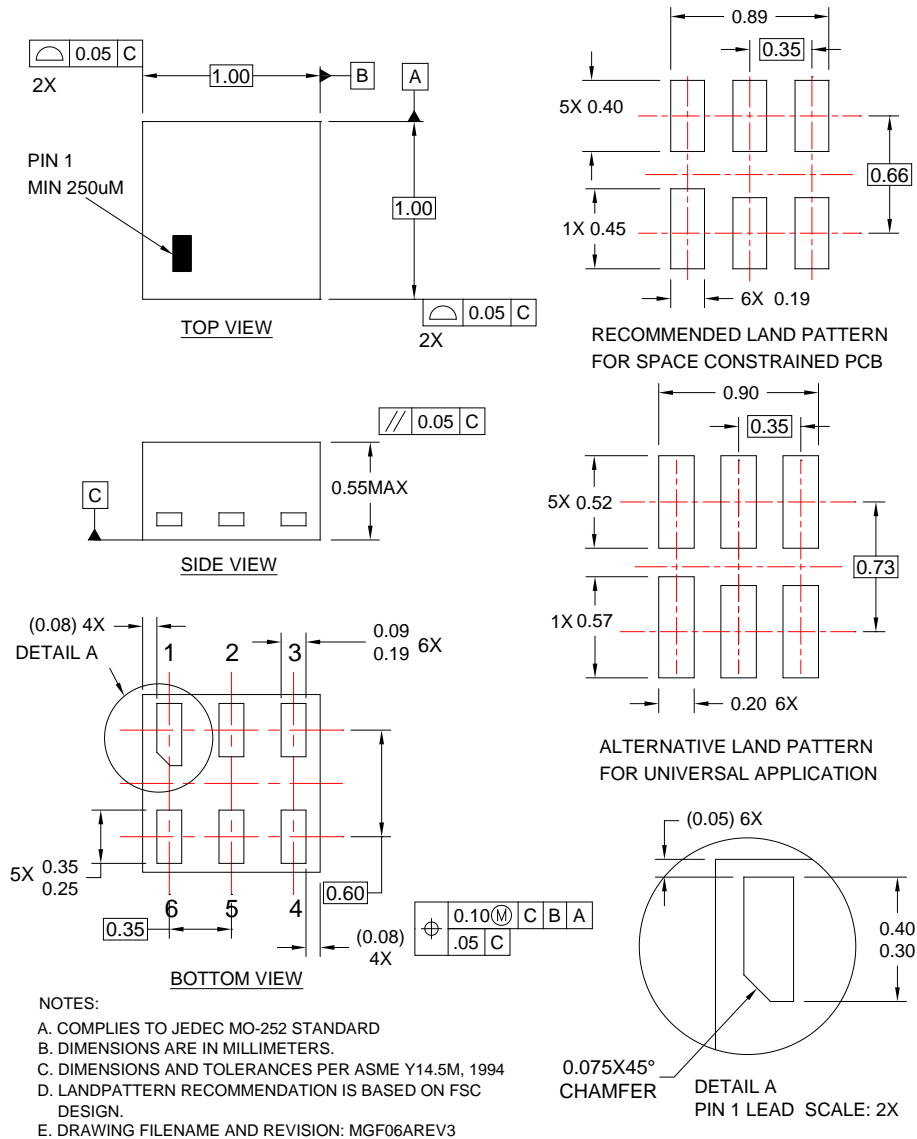
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## Tape and Reel Specifications

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



## Physical Dimensions



**Figure 10. 6-Lead, MicroPak2, 1x1mm Body, .35mm Pitch**

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## Tape and Reel Specifications

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

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