

# TinyLogic UHS Dual 2-Input Exclusive-OR Gate

## NC7WZ86

### Description

The NC7WZ86 is a dual 2-Input Exclusive-OR Gate from ON Semiconductor'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 very broad  $V_{CC}$  operating range. The device is specified to operate over the 1.65 V to 5.5 V  $V_{CC}$  range. The inputs and output are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating voltage.

### Features

- Space Saving US8 Surface Mount Package
- MicroPak™ Pb-Free Leadless Package
- Ultra High Speed:  $t_{PD}$  2.9 ns Typ. into 50 pF at 5 V  $V_{CC}$
- High Output Drive:  $\pm 24$  mA at 3 V  $V_{CC}$
- Broad  $V_{CC}$  Operating Range: 1.65 V to 5.5 V
- Matches the Performance of LCX when Operated at 3.3 V  $V_{CC}$
- Power Down High Impedance Inputs / Output
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

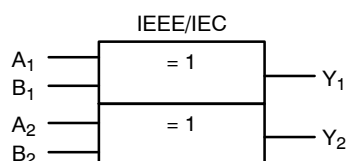


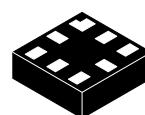
Figure 1. Logic Symbol



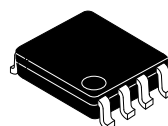
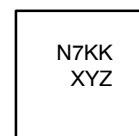
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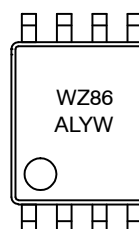
### MARKING DIAGRAMS



UQFN8  
1.6X1.6, 0.5P  
CASE 523AY



US8  
CASE 846AN



N7, WZ86 = Specific Device Code  
KK = 2-Digit Lot Run Traceability Code  
XY = 2-Digit Date Code Format  
Z = Assembly Plant Code  
A = Assembly Site  
L = Wafer Lot Number  
YW = Assembly Start Week

### ORDERING INFORMATION

See detailed ordering, marking and shipping information in the package dimensions section on page 6 of this data sheet.

## Connection Diagrams

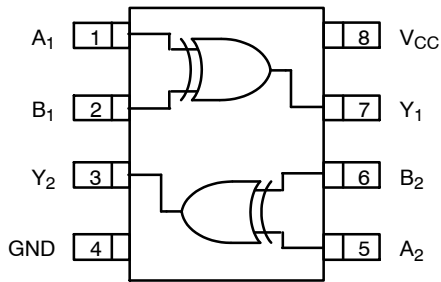


Figure 2. Connection Diagram  
(Top View)

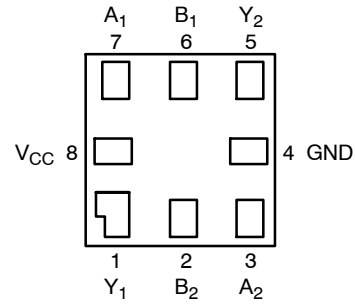
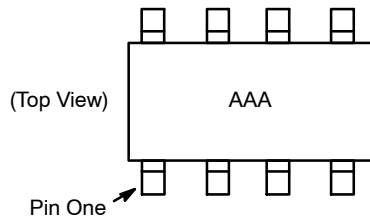


Figure 4. Pad Assignments for MicroPak  
(Top Thru View)



AAA represents Product Code Top Mark – see ordering code

NOTE: Orientation of Top Mark determines Pin One location.  
Read the top product code mark left to right, Pin One is the lower left pin (see diagram).

Figure 3. Pin One Orientation Diagram

## PIN DESCRIPTIONS

Pin Names	Description
A <sub>n</sub> , B <sub>n</sub>	Input
Y <sub>n</sub>	Output

## FUNCTION TABLE (Y = A ⊕ B)

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

H = HIGH Logic Level  
L = LOW Logic Level

**ABSOLUTE MAXIMUM RATINGS**

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage		-0.5	6.5	V
V <sub>IN</sub>	DC Input Voltage		-0.5	6.5	V
V <sub>OUT</sub>	DC Output Voltage		-0.5	6.5	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>IN</sub> < 0 V	-	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < 0 V	-	-50	mA
I <sub>OUT</sub>	DC Output Current		-	±50	mA
I <sub>CC</sub> / I <sub>GND</sub>	DC V <sub>CC</sub> / GND Current		-	±100	mA
T <sub>STG</sub>	Storage Temperature		-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 in Still Air		-	500	mW
			-	539	

Stresses exceeding those listed in the Maximum Ratings table may damage the device. If any of these limits are exceeded, device functionality should not be assumed, damage may occur and reliability may be affected.

**RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter		Min	Max	Unit
V <sub>CC</sub>	Supply Voltage Operating		1.65	5.5	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 Time	V <sub>CC</sub> = 1.8 V ±0.15 V, 2.5 V ±0.2 V	0	20	ns/V
		V <sub>CC</sub> = 3.3 V ±0.3 V	0	10	
		V <sub>CC</sub> = 5.0 V ±0.5 V	0	5	
θ <sub>JA</sub>	Thermal Resistance		-	250	°C/W
			-	232	

Functional operation above the stresses listed in the Recommended Operating Ranges is not implied. Extended exposure to stresses beyond the Recommended Operating Ranges limits may affect device reliability.

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

## DC ELECTRICAL CHARACTERISTICS

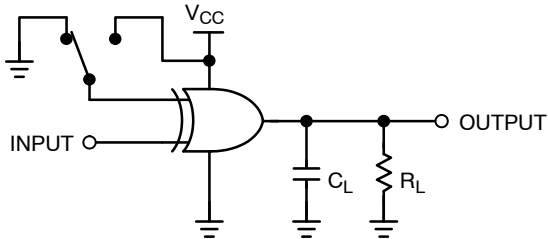
Symbol	Parameter	Conditions		V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
					Min	Typ	Max	Min	Max	
V <sub>IH</sub>	HIGH Level Input Voltage			1.65 to 1.95	0.65 V <sub>CC</sub>	–	–	0.65 V <sub>CC</sub>	–	V
				2.3 to 5.5	0.7 V <sub>CC</sub>	–	–	0.7 V <sub>CC</sub>	–	
V <sub>IL</sub>	LOW Level Input Voltage			1.65 to 1.95	–	–	0.35 V <sub>CC</sub>	–	0.35 V <sub>CC</sub>	V
				2.3 to 5.5	–	–	0.3 V <sub>CC</sub>	–	0.3 V <sub>CC</sub>	
V <sub>OH</sub>	HIGH Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> , V <sub>IL</sub>	I <sub>OH</sub> = -100 µA	1.65	1.55	1.65	–	1.55	–	V
				2.3	2.2	2.3	–	2.2	–	
				3.0	2.9	3.0	–	2.9	–	
				4.5	4.4	4.5	–	4.4	–	
			I <sub>OH</sub> = -4 mA	1.65	1.29	1.52	–	1.29	–	
			I <sub>OH</sub> = -8 mA	2.3	1.9	2.15	–	1.9	–	
			I <sub>OH</sub> = -16 mA	3.0	2.4	2.80	–	2.4	–	
			I <sub>OH</sub> = -24 mA	3.0	2.3	2.68	–	2.3	–	
			I <sub>OH</sub> = -32 mA	4.5	3.8	4.20	–	3.8	–	
V <sub>OL</sub>	LOW Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	I <sub>OL</sub> = 100 µA	1.65	–	0.0	0.1	–	0.1	V
				2.3	–	0.0	0.1	–	0.1	
				3.0	–	0.0	0.1	–	0.1	
				4.5	–	0.0	0.1	–	0.1	
			I <sub>OL</sub> = 4 mA	1.65	–	0.08	0.24	–	0.24	
			I <sub>OL</sub> = 8 mA	2.3	–	0.10	0.3	–	0.3	
			I <sub>OL</sub> = 16 mA	3.0	–	0.15	0.4	–	0.4	
			I <sub>OL</sub> = 24 mA	3.0	–	0.22	0.55	–	0.55	
			I <sub>OL</sub> = 32 mA	4.5	–	0.22	0.55	–	0.55	
I <sub>IN</sub>	Input Leakage Current	V <sub>IN</sub> = 5.5 V, GND		1.65 to 5.5	–	–	±0.1	–	±1	µA
I <sub>OFF</sub>	Power Off Leakage Current	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V		0.0	–	–	1	–	10	µA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IN</sub> = 5.5 V, GND		1.65 to 5.5	–	–	1	–	10	µA

# AC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C			T <sub>A</sub> = -40 to +85°C		Unit
				Min	Typ	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay (Figure 5, 7)	C <sub>L</sub> = 15 pF, R <sub>L</sub> = 1 MΩ	1.8 ±0.15	–	6.7	12.5	–	13.0	ns
			2.5 ±0.2	–	4.1	7.0	–	7.5	
			3.3 ±0.3	–	3.0	4.8	–	5.2	
			5.0 ±0.5	–	2.2	3.5	–	3.8	
		C <sub>L</sub> = 50 pF, R <sub>L</sub> = 500 Ω	3.3 ±0.3	–	3.8	5.4	–	5.9	
			5.0 ±0.5	–	2.9	4.2	–	4.6	
C <sub>IN</sub>	Input Capacitance		0	–	2.5	–	–	–	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Figure 6)	(Note 2)	3.3	–	15	–	–	–	pF
			5.0	–	19	–	–	–	

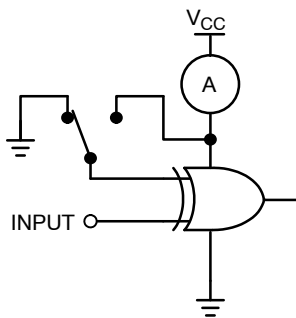
2. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (see Figure 6) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by 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 5. AC Test Circuit



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

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

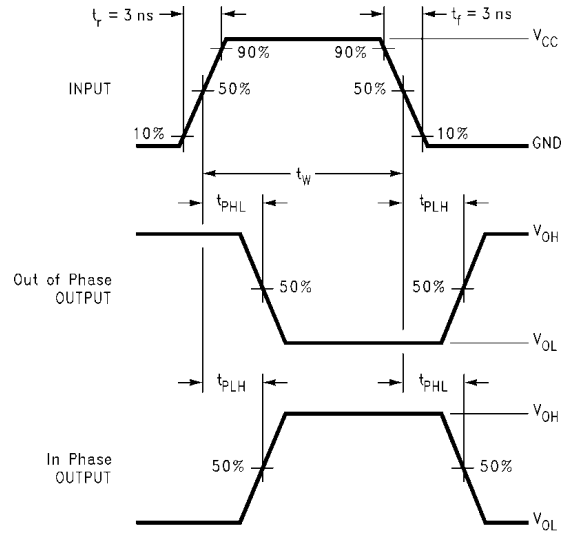


Figure 7. AC Waveforms

## NC7WZ86

### ORDERING INFORMATION

Order Number	Top Mark	Package	Shipping†
NC7WZ86K8X	WZ86	8-Lead US8, JEDEC MO-187, Variation CA 3.1 mm Wide	3000 / Tape & Reel
NC7WZ86L8X	N7	8-Lead MicroPak, 1.6 mm Wide (Pb-Free)	5000 / Tape & Reel

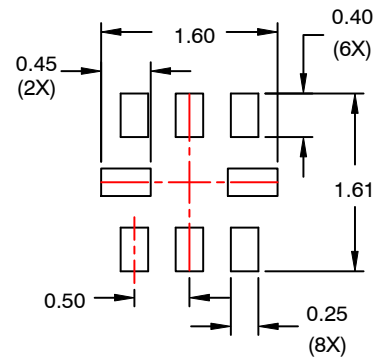
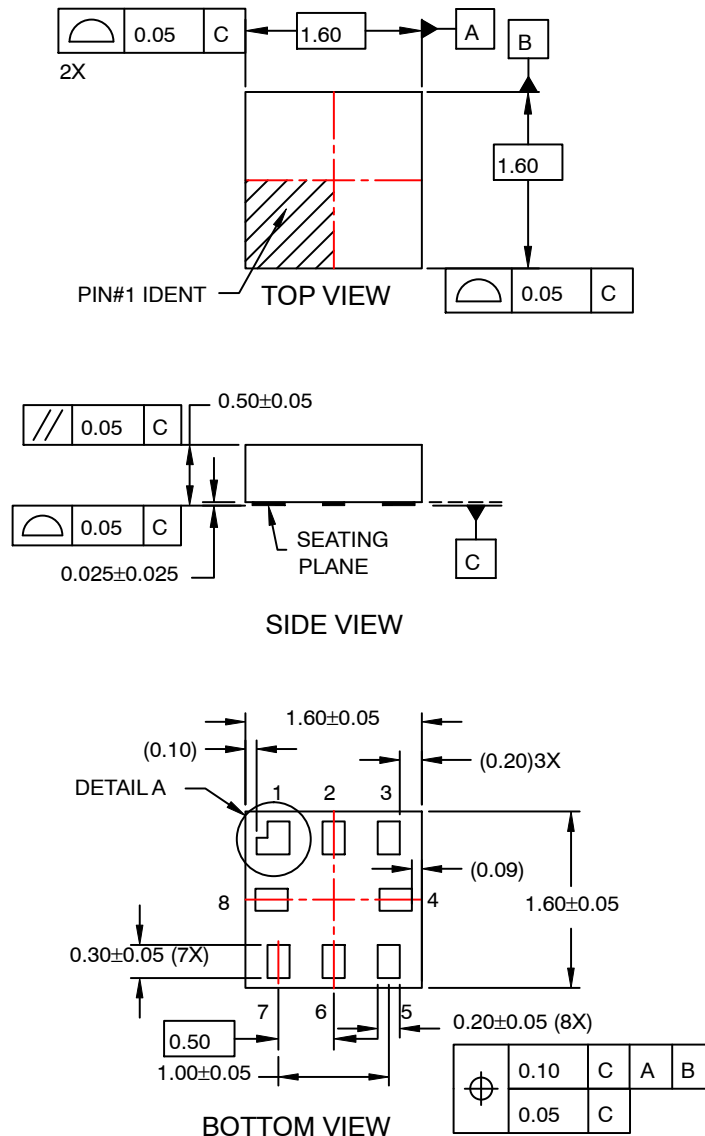
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

3. Pb-Free package per JEDEC J-STD-020B.

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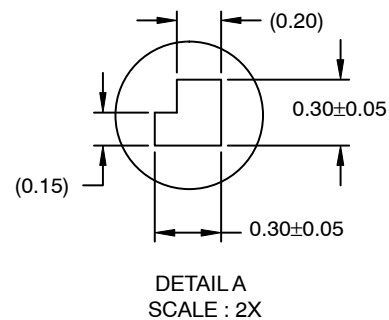
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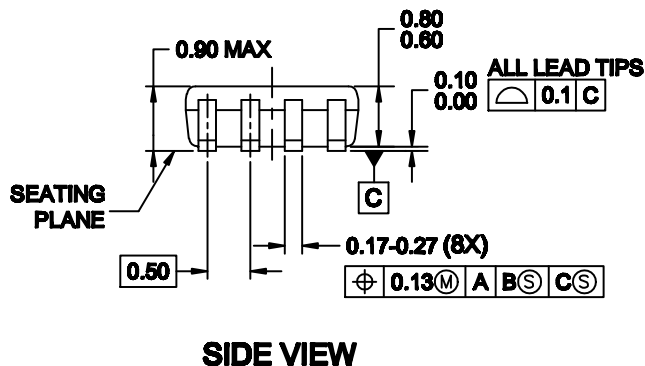
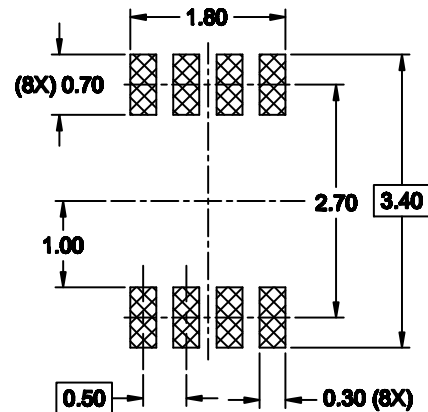
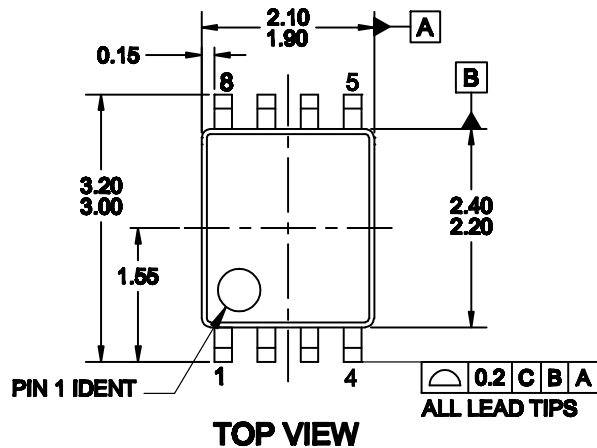


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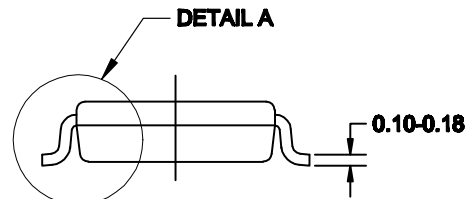
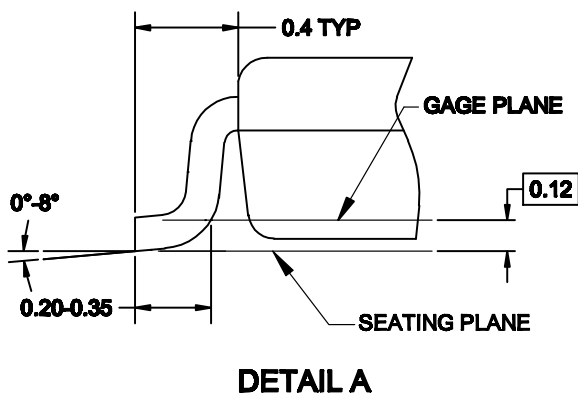
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