

# TinyLogic UHS Dual Inverting Buffer with 3-STATE Outputs

## NC7WZ240

### Description

The NC7WZ240 is a Dual Inverting Buffer with independent active LOW enables for the 3-STATE outputs. The Ultra High Speed device is fabricated with advanced CMOS technology to achieve superior switching performance 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 1.65 V to 5.5 V  $V_{CC}$  operating range. The inputs and outputs are high impedance when  $V_{CC}$  is 0 V. Inputs tolerate voltages up to 5.5 V independent of  $V_{CC}$  operating range. Outputs tolerate voltages above  $V_{CC}$  when in the 3-STATE condition.

### Features

- Space Saving US8 Surface Mount Package
- MicroPak™ Pb-Free Leadless Package
- Ultra High Speed:  $t_{PD} = 2.3$  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 / Outputs
- Overvoltage Tolerant Inputs Facilitate 5 V to 3 V Translation
- Outputs are Overvoltage Tolerant in 3-STATE Mode
- Proprietary Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

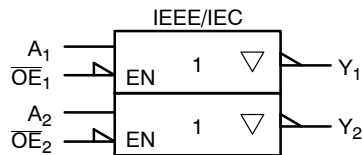


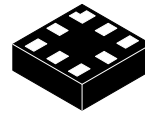
Figure 1. Logic Symbol



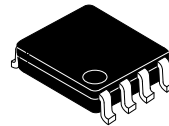
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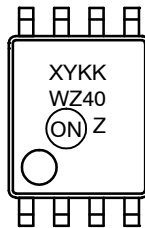
### MARKING DIAGRAMS



UQFN8  
1.6X1.6, 0.5P  
CASE 523AY



US8  
CASE 846AN



U7, WZ40 = Specific Device Code  
KK = 2-Digit Lot Run Traceability Code  
XY = 2-Digit Date Code Format  
Z = Assembly Plant Code

### ORDERING INFORMATION

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

Connection Diagrams

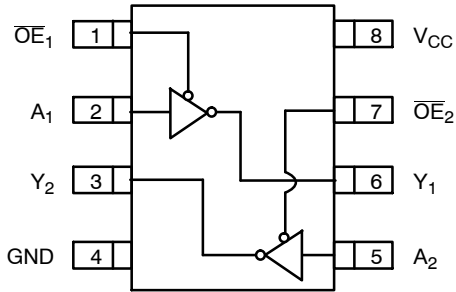


Figure 2. Pin Assignments for US8 (Top View)

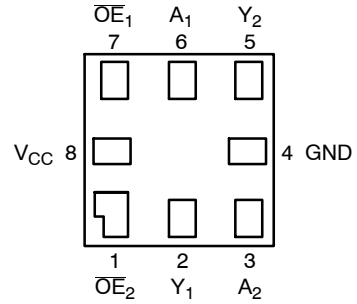
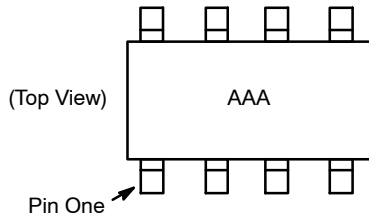


Figure 4. Pad Assignments for MicroPak (Top Thru View)



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
$\overline{OE}_n$	Enable Inputs for 3-STATE Outputs
$A_n$	Inputs
$Y_n$	3-STATE Outputs

FUNCTION TABLE

Inputs		Output
$\overline{OE}$	$A_n$	$Y_n$
L	L	H
L	H	L
H	L	Z
H	H	Z

H = HIGH Logic Level  
 L = LOW Logic Level  
 Z = 3-STATE

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## 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 (Note 1)		-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 Source / Sink Current		-	±50	mA
I <sub>CC</sub> / I <sub>GND</sub>	DC V <sub>CC</sub> / Ground Current		-	±50	mA
T <sub>STG</sub>	Storage Temperature Range		-65	+150	°C
T <sub>J</sub>	Junction Lead 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	US8	-	500	mW
		MicroPak-8	-	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.

1. The input and output negative voltage ratings may be exceeded if the input and output diode current ratings are observed.

## 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	Active State	0	V <sub>CC</sub>	V
		3-STATE	0	5.5	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	US8	-	250	°C/W
		MicroPak-8	-	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.

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

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## 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> or 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	0.10	-	0.10	V
				2.3	-	0.0	0.10	-	0.10	
				3.0	-	0.0	0.10	-	0.10	
				4.5	-	0.0	0.10	-	0.10	
			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>OZ</sub>	3-STATE Output Leakage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> 0 ≤ V <sub>OUT</sub> ≤ 5.5 V	1.65 to 5.5	-	-	±0.5	-	±5	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	

## NOISE CHARACTERISTICS

Symbol	Parameter	Conditions	V <sub>CC</sub> (V)	T <sub>A</sub> = +25°C		Unit
				Typ	Max	
V <sub>OLP</sub> (Note 3)	Quiet Output Maximum Dynamic V <sub>OL</sub>	C <sub>L</sub> = 50 pF	5.0	-	1.0	V
V <sub>OLV</sub> (Note 3)	Quiet Output Minimum Dynamic V <sub>OL</sub>	C <sub>L</sub> = 50 pF	5.0	-	1.0	V
V <sub>OHV</sub> (Note 3)	Quiet Output Minimum Dynamic V <sub>OH</sub>	C <sub>L</sub> = 50 pF	5.0	-	4.0	V
V <sub>IHD</sub> (Note 3)	Minimum HIGH Level Dynamic Input Voltage	C <sub>L</sub> = 50 pF	5.0	-	3.5	V
V <sub>ILD</sub> (Note 3)	Maximum LOW Level Dynamic Input Voltage	C <sub>L</sub> = 50 pF	5.0	-	1.5	V

3. Parameter guaranteed by design.

# NC7WZ240

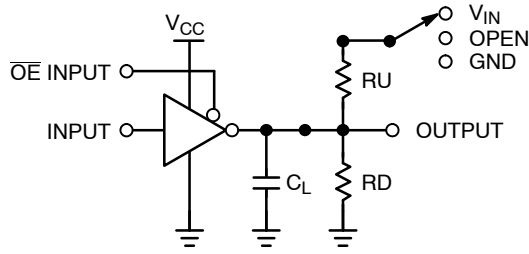
## AC ELECTRICAL CHARACTERISTICS

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 A <sub>n</sub> to Y <sub>n</sub> (Figure 5, 7)	C <sub>L</sub> = 15 pF R <sub>D</sub> = 1 MΩ S1 = Open	1.8 ±0.15	-	-	12.0	-	13.0	ns
			2.5 ±0.2	-	-	7.5	-	8.0	
			3.3 ±0.3	-	-	5.2	-	5.5	
			5.0 ±0.5	-	-	4.5	-	4.8	
		C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω S1 = Open	3.3 ±0.3	-	-	5.7	-	6.0	
			5.0 ±0.5	-	-	5.0	-	5.3	
t <sub>OSLH</sub> , t <sub>OSSL</sub>	Output to Output Skew (Note 4) (Figure 5, 7)	C <sub>L</sub> = 50 pF, R <sub>D</sub> = 500 Ω S1 = Open	3.3 ±0.3	-	-	1.0	-	1.0	ns
			5.0 ±0.5	-	-	0.8	-	0.8	
t <sub>PZL</sub> , t <sub>PZH</sub>	Output Enable Time (Figure 5, 7)	C <sub>L</sub> = 50 pF R <sub>D</sub> , R <sub>U</sub> = 500 Ω S1 = GND for t <sub>PZH</sub> S1 = V <sub>I</sub> for t <sub>PZL</sub> V <sub>I</sub> = 2 x V <sub>CC</sub>	1.8 ±0.15	-	-	14.0	-	15.0	ns
			2.5 ±0.2	-	-	8.5	-	9.0	
			3.3 ±0.3	-	-	6.2	-	6.5	
			5.5 ±0.5	-	-	5.5	-	5.8	
t <sub>PLZ</sub> , t <sub>PHZ</sub>	Output Disable Time (Figure 5, 7)	C <sub>L</sub> = 50 pF R <sub>D</sub> , R <sub>U</sub> = 500 Ω S1 = GND for t <sub>PZH</sub> S1 = V <sub>I</sub> for t <sub>PZL</sub> V <sub>I</sub> = 2 x V <sub>CC</sub>	1.8 ±0.15	-	-	12.0	-	13.0	ns
			2.5 ±0.2	-	-	8.0	-	8.5	
			3.3 ±0.3	-	-	5.7	-	6.0	
			5.0 ±0.5	-	-	4.7	-	5.0	
C <sub>IN</sub>	Input Capacitance		0	-	2.5	-	-	-	pF
C <sub>OUT</sub>	Output Capacitance		5.0	-	4	-	-	-	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Figure 6)	(Note 5)	3.3	-	10	-	-	-	pF
			5.0	-	12	-	-	-	

4. Parameter guaranteed by design. t<sub>OSLH</sub> = |t<sub>PLHmax</sub> - t<sub>PLHmin</sub>|; t<sub>OSSL</sub> = |t<sub>PHLmax</sub> - t<sub>PHLmin</sub>|.

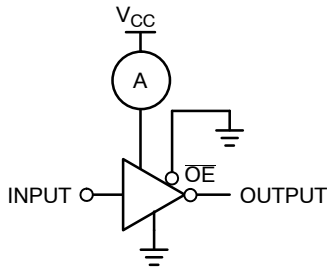
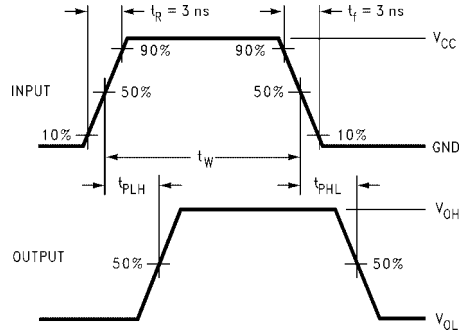
5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (see Figure 6) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by the expression:  
I<sub>CCD</sub> = (C<sub>PD</sub>) (V<sub>CC</sub>) (f<sub>IN</sub>) + (I<sub>CCstatic</sub>).

AC Loading and Waveforms



$C_L$  includes load and stray capacitance  
 Input PRR = 1.0 MHz;  $t_W = 500$  ns

Figure 5. AC Test Circuit



Input = AC Waveform;  $t_r = t_f = 1.8$  ns;  
 PRR = 10 MHz; Duty Cycle = 50%.

Figure 6.  $I_{CCD}$  Test Circuit

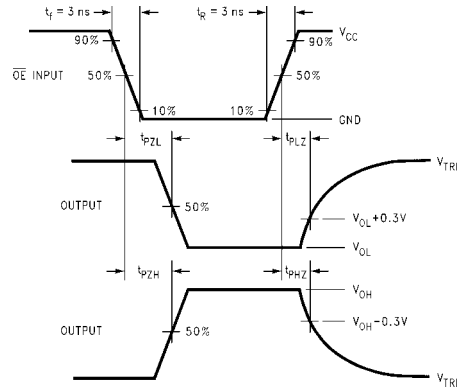


Figure 7. AC Waveforms

ORDERING INFORMATION

Order Number	Top Mark	Package	Shipping <sup>†</sup>
NC7WZ240K8X	WZ40	8-Lead US8, JEDEC MO-187, Variation CA 3.1 mm Wide	3000 / Tape & Reel
NC7WZ240L8X	U7	8-Lead MicroPak, 1.6 mm Wide (Pb-Free)	5000 / Tape & Reel

<sup>†</sup>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.

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

**UQFN8 1.6X1.6, 0.5P**  
CASE 523AY  
ISSUE O

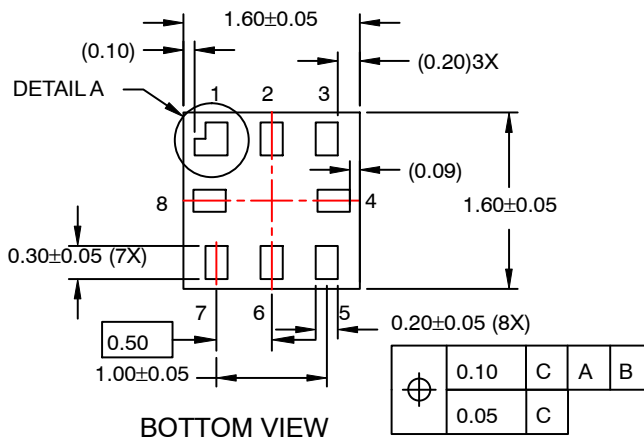
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**SIDE VIEW**



**BOTTOM VIEW**

**NOTES:**

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