

# TinyLogic UHS Dual Buffer with 3-STATE Outputs

## NC7WZ241

### Description

The NC7WZ241 is a Dual Non-Inverting Buffer with 3-STATE outputs. The output enable circuitry is organized as active LOW for one buffer and active HIGH for the other buffer, thus facilitating transceiver operation.

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:  $t_{PD}$  2.6 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
- Patented Noise / EMI Reduction Circuitry Implemented
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

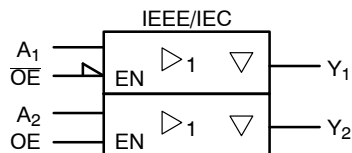


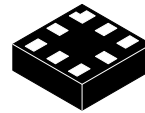
Figure 1. Logic Symbol



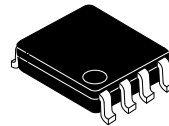
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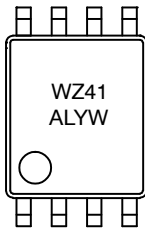
### MARKING DIAGRAMS



UQFN8  
1.6X1.6, 0.5P  
CASE 523AY



US8  
CASE 846AN



T7, WZ41 = 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

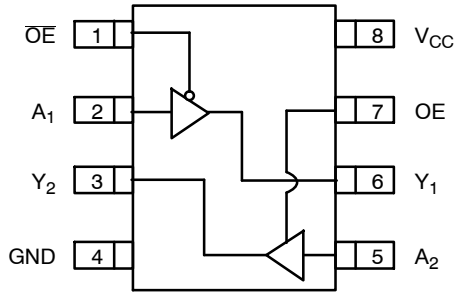


Figure 2. Pin Assignments for USB (Top View)

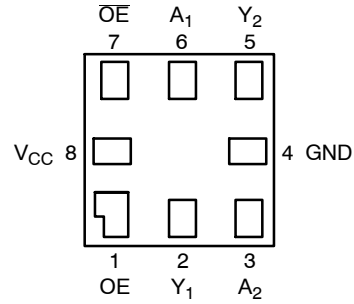
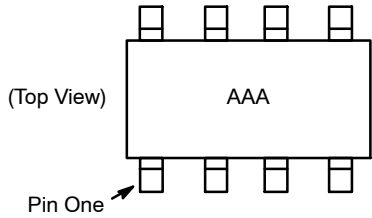


Figure 4. Pad Assignments for MicroPak (Top Thru View)



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

FUNCTION TABLE

Inputs		Output	
$\overline{OE}$ or OE	$A_n$	$Y_1$	$Y_2$
L	L	L	Z
L	H	H	Z
H	L	Z	L
H	H	Z	H

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> / GND Current		-	±100	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 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	-		
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	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		-
					3.0	2.4	2.80	-	2.4		-
				I <sub>OH</sub> = -24 mA	3.0	2.3	2.68	-	2.3		-
					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		
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>	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
					3.0	-	0.15	0.4	-		0.4
				I <sub>OL</sub> = 24 mA	3.0	-	0.22	0.55	-		0.55
					4.5	-	0.22	0.55	-		0.55

## 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.

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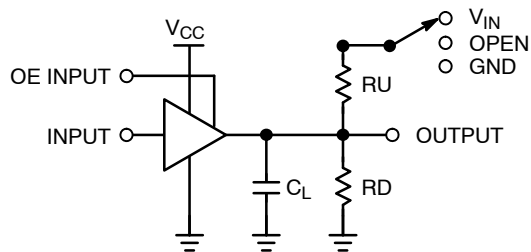
## AC ELECTRICAL CHARACTERISTICS

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 RD = 1 MΩ S <sub>1</sub> = 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, RD = 500 Ω S <sub>1</sub> = 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, RD = 500 Ω S <sub>1</sub> = 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 RD,RU = 500 Ω S <sub>1</sub> = GND for t <sub>PZH</sub> S <sub>1</sub> = 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	
			5.0 ±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 RD,RU = 500 Ω S <sub>1</sub> = GND for t <sub>PHZ</sub> S <sub>1</sub> = V <sub>I</sub> for t <sub>PLZ</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 (Note 5) (Figure 6)	OE = GND OE = V <sub>CC</sub>	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>|.

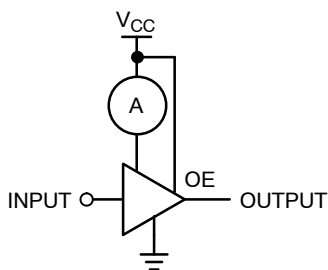
5. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is derived from dynamic operating current consumption (I<sub>CCD</sub>) at no output loading and operating at 50% duty cycle. (see Figure 6) C<sub>PD</sub> is related to I<sub>CCD</sub> dynamic operating current by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

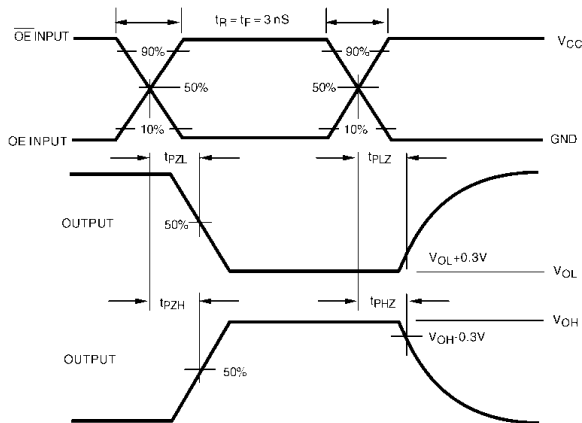
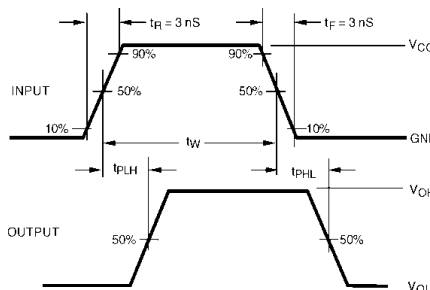


Figure 7. AC Waveforms

ORDERING INFORMATION

Order Number	Top Mark	Package	Shipping†
NC7WZ241K8X	WZ41	8-Lead US8, JEDEC MO-187, Variation CA 3.1 mm Wide	3000 / Tape & Reel
NC7WZ241L8X	T7	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.

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



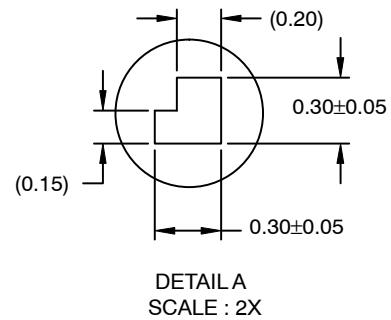
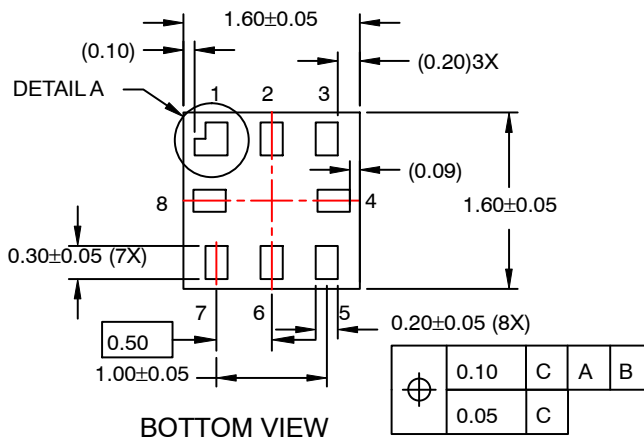
**UQFN8 1.6X1.6, 0.5P**  
CASE 523AY  
ISSUE O

DATE 31 AUG 2016



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