

# NB3N2304NZ

## 3.3V 1:4 Clock Fanout Buffer

### Description

The NB3N2304NZ is a low skew 1-to 4 clock fanout buffer, designed for high speed clock distribution such as in PCI-X applications. The NB3N2304NZ guarantees low output-to-output skew. Optimal design, layout and processing minimizes skew within a device and from device-to-device.

The Output Enable (OE) pin forces the outputs LOW when LOW.

### Features

- Input/Output Clock Frequency up to 140 MHz
- Low Skew Outputs (100 ps)
- Output Enable
- Operating Range:  $V_{DD} = 3.0\text{ V to }3.6\text{ V}$
- Ideal for PCI-X and networking clocks
- Packaged in 8-pin TSSOP, 4.4 mm x 3 mm
- Industrial Temperature Range
- These are Pb-Free Devices\*



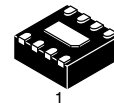
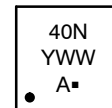
**ON Semiconductor®**

<http://onsemi.com>

### MARKING DIAGRAM\*



**TSSOP-8  
DT SUFFIX  
CASE 948S**

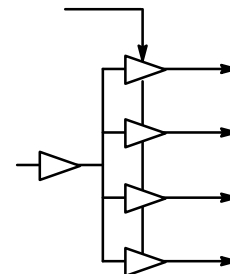


**DFN8  
MN SUFFIX  
CASE 506AA**



A = Assembly Location  
Y = Year  
WW = Work Week  
M̄ = Date Code  
▪ = Pb-Free Package

\*For additional marking information, refer to Application Note AND8002/D.



**Figure 1. Simplified Logic Diagram**

\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

# NB3N2304NZ

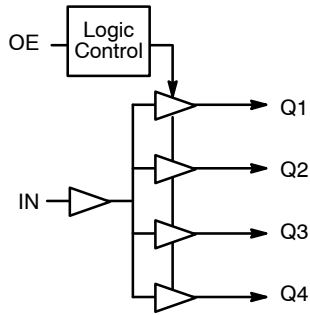


Figure 2. Block Diagram

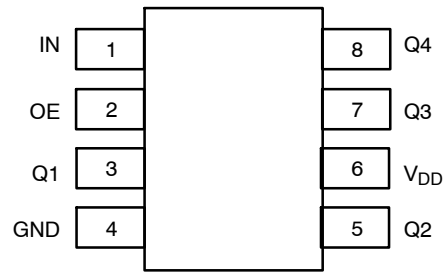


Figure 3. NB3N2304NZ Package Pinout (Top View)

Table 1. PIN DESCRIPTION

| Pin # | Pin Name        | Type                    | Description  |
|-------|-----------------|-------------------------|--|
| 1     | IN              | LVC MOS/LVTTL Input     | Clock Input  |
| 2     | OE              | LVC MOS/LVTTL Input     | Output Enable for the clock outputs. Outputs are enabled when forced HIGH. Outputs are forced to logic LOW when OE is forced LOW.  |
| 3     | Q1              | LVC MOS/LVTTL Output    | Clock Output 1   |
| 4     | GND             | Power                   | Negative Supply Voltage; Connect to Ground, 0 V  |
| 5     | Q2              | (LV)CMOS/(LV)TTL Input  | Clock Output 2   |
| 6     | V <sub>DD</sub> | Power                   | Positive Supply Voltage (3.0 V to 3.6 V)   |
| 7     | Q3              | (LV)CMOS/(LV)TTL Output | Clock Output 3   |
| 8     | Q4              | (LV)CMOS/(LV)TTL Input  | Clock Output 4   |
| -     | EP              | Thermal Exposed Pad     | (DFN8 only) Thermal exposed pad must be connected to a sufficient thermal conduit. Electrically connect to the most negative supply (GND) or leave unconnected, floating open. |

Table 2. OE, OUTPUT ENABLE FUNCTION TABLE

| Inputs |    | Outputs |
|--------|----|---------|
| IN     | OE |         |
| L      | L  | L       |
| H      | L  | L       |
| L      | H  | L       |
| H      | H  | H       |

# NB3N2304NZ

**Table 3. ATTRIBUTES**

| Characteristics   | Value                |
|---|----------------------|
| ESD Protection<br>Human Body Model<br>Machine Model                               | > 2kV<br>> 200 V     |
| Moisture Sensitivity, Indefinite Time Out of Drypack (Note 1)<br>TSSOP-8<br>DFN-8 | Level 3<br>Level 1   |
| Flammability Rating<br>Oxygen Index: 28 to 34                                     | UL 94 V-O @ 0.125 in |
| Transistor Count  | 480 Devices          |
| Meets or exceeds JEDEC Spec EIA/JESD78 IC Latchup Test                            |                      |

1. For additional information, see Application Note AND8003/D.

**Table 4. MAXIMUM RATINGS**

| Symbol           | Parameter                                | Condition 1                              | Condition 2                          | Rating  | Unit |
|------------------|--|--|--------------------------------------|---|------|
| V <sub>DD</sub>  | Positive Power Supply                    | GND = 0 V                                |                                      | V <sub>DD</sub> + 0.5V                                | V    |
| V <sub>I</sub>   | Input Voltage                            |  |                                      | GND - 0.5 ≤<br>V <sub>I</sub> ≤ V <sub>DD</sub> + 0.5 | V    |
| T <sub>A</sub>   | Operating Temperature Range, Industrial  |  |                                      | ≥ -40 to ≤ +85  | °C   |
| T <sub>stg</sub> | Storage Temperature Range                |  |                                      | -65 to +150   | °C   |
| θ <sub>JA</sub>  | Thermal Resistance (Junction-to-Ambient) | 0 lfpm<br>500 lfpm<br>0 lfpm<br>500 lfpm | TSSOP-8<br>TSSOP-8<br>DFN-8<br>DFN-8 | 143<br>103<br>129<br>84                               | °C/W |
| T <sub>SOL</sub> | Wave Solder<br>Pb-Free                   | (Note 2)                                 |                                      | 265   | °C   |
| θ <sub>JC</sub>  | Thermal Resistance (Junction-to-Case)    | (Note 2)                                 | DFN8                                 | 35 to 40  | °C/W |

Stresses exceeding Maximum Ratings may damage the device. Maximum Ratings are stress ratings only. Functional operation above the Recommended Operating Conditions is not implied. Extended exposure to stresses above the Recommended Operating Conditions may affect device reliability.

2. JEDEC standard multilayer board – 2S2P (2 signal, 2 power)

# NB3N2304NZ

**Table 5. DC CHARACTERISTICS**  $V_{DD} = 3.0\text{ V to }3.6\text{ V}$ ,  $GND = 0\text{ V}$ ,  $T_A = -40^\circ\text{C to }+85^\circ\text{C}$

| Symbol   | Characteristic  | Min        | Typ | Max         | Unit          |
|----------|---|------------|-----|-------------|---------------|
| $I_{DD}$ | Power Supply Current @ 66.66 MHz, Unloaded Outputs                              |            | 12  | 25          | mA            |
| $V_{OH}$ | Output HIGH Voltage<br>– $I_{OH} = -24\text{ mA}$<br>– $I_{OH} = -12\text{ mA}$ | 2.0<br>2.4 |     |             | V             |
| $V_{OL}$ | Output LOW Voltage<br>– $I_{OL} = 24\text{ mA}$<br>– $I_{OL} = 12\text{ mA}$    |            |     | 0.8<br>0.55 | V             |
| $V_{IH}$ | Input HIGH Voltage, IN and OE (Note 3)  | 2.0        |     |             | V             |
| $V_{IL}$ | Input LOW Voltage, IN and OE (Note 3)   |            |     | 0.8         | V             |
| $I_{IH}$ | Input HIGH Current, $V_{IN} = V_{DD}$   | -50        |     | 50          | $\mu\text{A}$ |
| $I_{IL}$ | Input LOW Current, $V_{IN} = 0\text{ V}$  | -100       |     | 100         | $\mu\text{A}$ |
| CIN      | Input Capacitance, IN, OE   |            | 5   | 7           | pF            |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

3. IN input has a threshold voltage of  $V_{DD}/2$ .

**Table 6. AC CHARACTERISTICS**  $V_{DD} = 3.0\text{ V to }3.6\text{ V}$ ,  $GND = 0\text{ V}$ ,  $T_A = -40^\circ\text{C to }+85^\circ\text{C}$  (Note 4) (Figure 4)

| Symbol       | Characteristic  | Min  | Typ | Max | Unit |
|--------------|---|------|-----|-----|------|
| $f_{in}$     | Input Clock Frequency   | DC   |     | 140 | MHz  |
| $t_{DCskew}$ | Duty Cycle Skew = $t_2 \div t_1$ (Figure 4) Measured at 1.5 V | 40   | 50  | 60  | %    |
| tr/tf        | Output Rise and Fall Times; 0.8 V to 2.0 V                    |      | 0.9 | 1.5 | ns   |
| $t_{pd}$     | Propagation Delay, IN-to-Qn (Note 5)                          | 2.5  | 3.5 | 5   | ns   |
| $t_{skew}$   | Output-to-Output Skew; (Note 5)                               |      |     | 100 | ps   |
| $t_{pu}$     | Powerup Time for $V_{DD}$ to Reach Minimum Specified Voltage  | 0.05 |     | 50  | ms   |

NOTE: Device will meet the specifications after thermal equilibrium has been established when mounted in a test socket or printed circuit board with maintained transverse airflow greater than 500 lfm. Electrical parameters are guaranteed only over the declared operating temperature range. Functional operation of the device exceeding these conditions is not implied. Device specification limit values are applied individually under normal operating conditions and not valid simultaneously.

4. All outputs loaded equally with  $C_L = 25\text{ pF}$  to GND. Duty cycle out = duty in. A  $0.01\text{ }\mu\text{F}$  decoupling capacitor should be connected between  $V_{DD}$  and GND.

5. Measured on rising edges at  $V_{DD} \div 2$ ; all outputs with equal loading.

# NB3N2304NZ

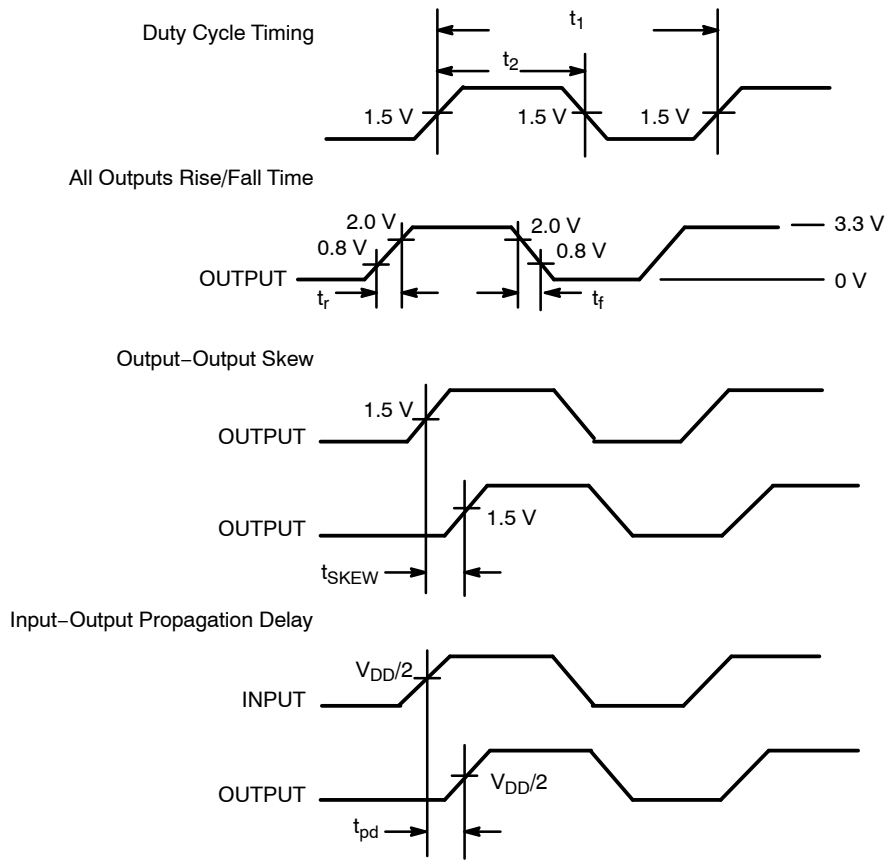


Figure 4. Switching Waveforms

## ORDERING INFORMATION

| Device           | Package              | Shipping <sup>†</sup> |
|------------------|----------------------|-----------------------|
| NB3N2304NZDTG    | TSSOP-8<br>(Pb-Free) | 100 Units / Rail      |
| NB3N2304NZDTR2G  | TSSOP-8<br>(Pb-Free) | 2500 / Tape & Reel    |
| NB3N2304NZMNR4G* | DFN8<br>(Pb-Free)    | 1000 / Tape & Reel    |

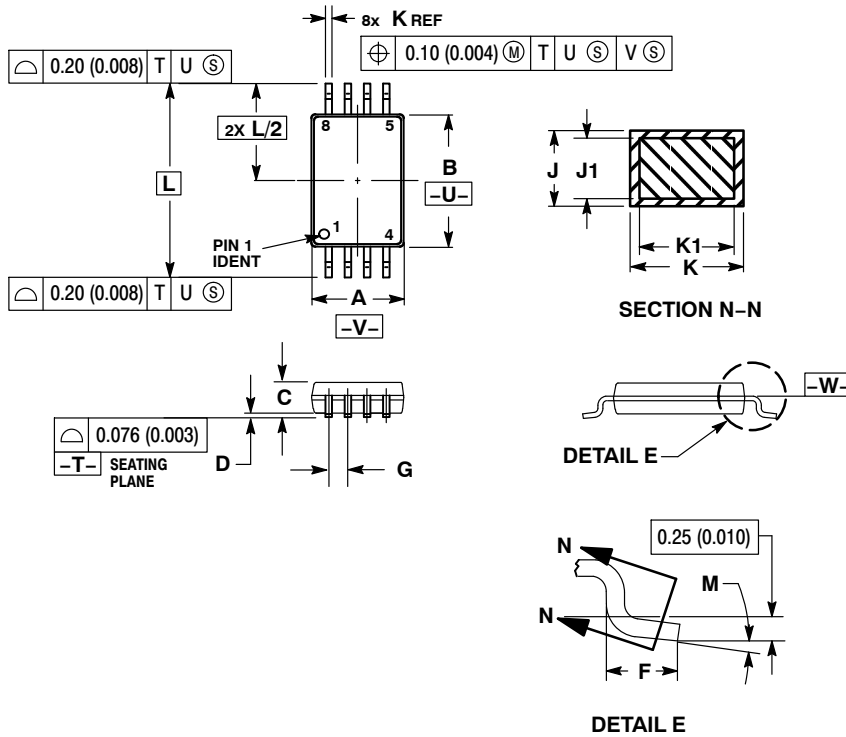
<sup>†</sup>For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

\*Contact a sales representative.

# NB3N2304NZ

## PACKAGE DIMENSIONS

TSSOP-8  
CASE 948S-01  
ISSUE C



### NOTES:

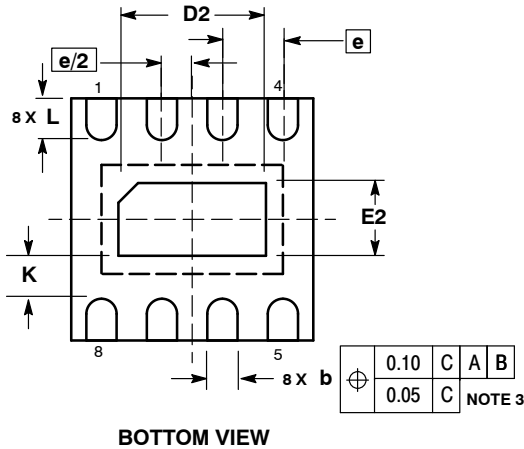
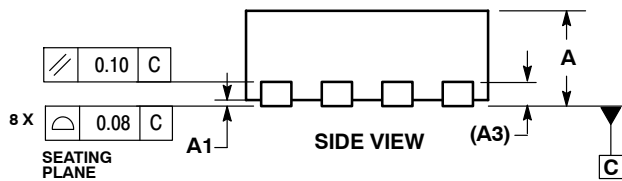
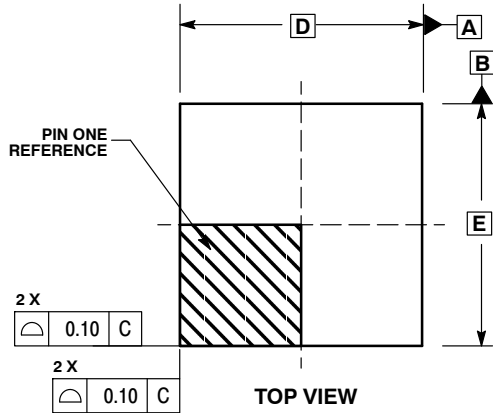
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION A DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION B DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. TERMINAL NUMBERS ARE SHOWN FOR REFERENCE ONLY.
6. DIMENSION A AND B ARE TO BE DETERMINED AT DATUM PLANE -W-.

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 2.90        | 3.10 | 0.114     | 0.122 |
| B   | 4.30        | 4.50 | 0.169     | 0.177 |
| C   | ---         | 1.10 | ---       | 0.043 |
| D   | 0.05        | 0.15 | 0.002     | 0.006 |
| F   | 0.50        | 0.70 | 0.020     | 0.028 |
| G   | 0.65 BSC    |      | 0.026 BSC |       |
| J   | 0.09        | 0.20 | 0.004     | 0.008 |
| J1  | 0.09        | 0.16 | 0.004     | 0.006 |
| K   | 0.19        | 0.30 | 0.007     | 0.012 |
| K1  | 0.19        | 0.25 | 0.007     | 0.010 |
| L   | 6.40 BSC    |      | 0.252 BSC |       |
| M   | 0°          | 8°   | 0°        | 8°    |

# NB3N2304NZ

## PACKAGE DIMENSIONS

DFN8  
CASE 506AA-01  
ISSUE D



NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994 .
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.80        | 1.00 |
| A1  | 0.00        | 0.05 |
| A3  | 0.20 REF    |      |
| b   | 0.20        | 0.30 |
| D   | 2.00 BSC    |      |
| D2  | 1.10        | 1.30 |
| E   | 2.00 BSC    |      |
| E2  | 0.70        | 0.90 |
| e   | 0.50 BSC    |      |
| K   | 0.20        | ---  |
| L   | 0.25        | 0.35 |

**ON Semiconductor** and **ON** are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
**Phone:** 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
**Fax:** 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
**Email:** orderlit@onsemi.com

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5773-3850

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative