

# NL37WZ16

## Triple Buffer

The NL37WZ16 is a high performance buffer with inputs operating from a 1.65 to 5.5 V supply.

The NL37WZ16 can be used as a line receiver which will receive slow input signals.

### Features

- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- Over Voltage Tolerant Inputs and Outputs
- LVTTL Compatible – Interface Capability with 5 V TTL Logic with  $V_{CC} = 3$  V
- LVC MOS Compatible
- 24 mA Balanced Output Sink and Source Capability
- Near Zero Static Supply Current Substantially Reduces System Power Requirements
- Current Drive Capability is 24 mA at the Outputs
- Chip Complexity: FET = 94
- NLV Prefix for Automotive and Other Applications Requiring Unique Site and Control Change Requirements; AEC-Q100 Qualified and PPAP Capable
- These Devices are Pb-Free and are RoHS Compliant

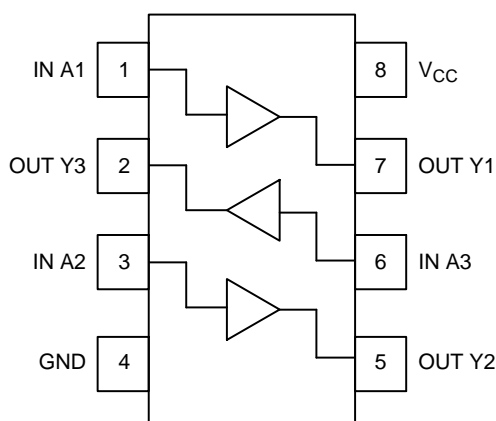


Figure 1. Pinout (Top View)

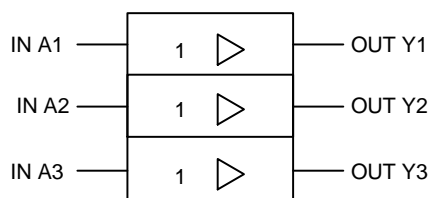


Figure 2. Logic Symbol



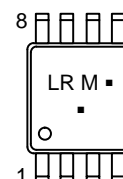
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**US8  
US SUFFIX  
CASE 493**

### MARKING DIAGRAM



LR = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

### PIN ASSIGNMENT

| Pin | Function |
|-----|----------|
| 1   | IN A1    |
| 2   | OUT Y3   |
| 3   | IN A2    |
| 4   | GND      |
| 5   | OUT Y2   |
| 6   | IN A3    |
| 7   | OUT Y1   |
| 8   | $V_{CC}$ |

### FUNCTION TABLE

| A Input | Y Output |
|---------|----------|
| L       | L        |
| H       | H        |

### ORDERING INFORMATION

| Device       | Package          | Shipping†        |
|--------------|------------------|------------------|
| NL37WZ16USG  | US8<br>(Pb-Free) | 3000/Tape & Reel |
| NLV37WZ16USG | US8<br>(Pb-Free) | 3000/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.

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## MAXIMUM RATINGS

| Symbol           | Parameter   | Value                        | Units |
|------------------|---|------------------------------|-------|
| V <sub>CC</sub>  | DC Supply Voltage   | -0.5 to +7.0                 | V     |
| V <sub>I</sub>   | DC Input Voltage  | -0.5 ≤ V <sub>I</sub> ≤ +7.0 | V     |
| V <sub>O</sub>   | DC Output Voltage<br>Output in Z or LOW State (Note 1)  | -0.5 ≤ V <sub>O</sub> ≤ +7.0 | V     |
| I <sub>IK</sub>  | DC Input Diode Current<br>V <sub>I</sub> < GND  | -50                          | mA    |
| I <sub>OK</sub>  | DC Output Diode Current<br>V <sub>O</sub> < GND   | -50                          | mA    |
| I <sub>O</sub>   | DC Output Sink Current  | ±50                          | mA    |
| I <sub>CC</sub>  | DC Supply Current per Supply Pin  | ±100                         | mA    |
| I <sub>GND</sub> | DC Ground Current per Ground Pin  | ±100                         | mA    |
| T <sub>STG</sub> | Storage Temperature Range   | -65 to +150                  | °C    |
| T <sub>L</sub>   | Lead Temperature, 1 mm from Case for 10 Seconds   | 260                          | °C    |
| T <sub>J</sub>   | Junction Temperature under Bias   | +150                         | °C    |
| θ <sub>JA</sub>  | Thermal Resistance (Note 2)   | 333                          | °C/W  |
| P <sub>D</sub>   | Power Dissipation in Still Air at 85°C  | 200                          | mW    |
| MSL              | Moisture Sensitivity  | Level 1                      |       |
| F <sub>R</sub>   | Flammability Rating<br>Oxygen Index: 28 to 34   | UL 94 V-0 @ 0.125 in         |       |
| V <sub>ESD</sub> | ESD Withstand Voltage<br>Human Body Model (Note 3)<br>Machine Model (Note 4)<br>Charged Device Model (Note 5) | > 2000<br>> 200<br>N/A       | V     |

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. I<sub>O</sub> absolute maximum rating must be observed.
2. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow.
3. Tested to EIA/JESD22-A114-A.
4. Tested to EIA/JESD22-A115-A.
5. Tested to JESD22-C101-A.

## RECOMMENDED OPERATING CONDITIONS

| Symbol          | Parameter  | Min         | Max           | Units |
|-----------------|--|-------------|---------------|-------|
| V <sub>CC</sub> | Supply Voltage<br>Operating<br>Data Retention Only   | 1.65<br>1.5 | 5.5<br>5.5    | V     |
| V <sub>I</sub>  | Input Voltage (Note 6)   | 0           | 5.5           | V     |
| V <sub>O</sub>  | Output Voltage (HIGH or LOW State)   | 0           | 5.5           | V     |
| T <sub>A</sub>  | Operating Free-Air Temperature   | -40         | +85           | °C    |
| Δt/ΔV           | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 2.5 V ±0.2 V<br>V <sub>CC</sub> = 3.0 V ±0.3 V<br>V <sub>CC</sub> = 5.0 V ±0.5 V | 0<br>0<br>0 | 20<br>10<br>5 | ns/V  |

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.

6. Unused inputs may not be left open. All inputs must be tied to a high-logic voltage level or a low-logic input voltage level.

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## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter   | Condition  | V <sub>CC</sub><br>(V)     | T <sub>A</sub> = 25°C                       |                 |   | -40°C ≤ T <sub>A</sub> ≤ 85°C               |   | Units |
|------------------|---|--|----------------------------|---|-----------------|---|---|---|-------|
|                  |   |  |                            | Min   | Typ             | Max   | Min   | Max   |       |
| V <sub>IH</sub>  | High-Level Input Voltage  |  | 1.65 to 1.95<br>2.3 to 5.5 | 0.75 V <sub>CC</sub><br>0.7 V <sub>CC</sub> |                 |   | 0.75 V <sub>CC</sub><br>0.7 V <sub>CC</sub> |   | V     |
| V <sub>IL</sub>  | Low-Level Input Voltage   |  | 1.65 to 1.95<br>2.3 to 5.5 |   |                 | 0.25 V <sub>CC</sub><br>0.3 V <sub>CC</sub> |   | 0.25 V <sub>CC</sub><br>0.3 V <sub>CC</sub> | V     |
| V <sub>OH</sub>  | High-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> | I <sub>OH</sub> = -100 μA                              | 1.65 to 5.5                | V <sub>CC</sub> - 0.1                       | V <sub>CC</sub> |   | V <sub>CC</sub> - 0.1                       |   | V     |
|                  |   | I <sub>OH</sub> = -4 mA                                | 1.65                       | 1.4   | 1.50            |   | 1.55  |   |       |
|                  |   | I <sub>OH</sub> = -8 mA                                | 2.3                        | 1.9   | 2.1             |   | 1.9   |   |       |
|                  |   | I <sub>OH</sub> = -12 mA                               | 2.7                        | 2.2   | 2.4             |   | 2.2   |   |       |
|                  |   | I <sub>OH</sub> = -16 mA                               | 3.0                        | 2.4   | 2.7             |   | 2.4   |   |       |
|                  |   | I <sub>OH</sub> = -24 mA                               | 3.0                        | 2.3   | 2.5             |   | 2.3   |   |       |
|                  |   | I <sub>OH</sub> = -32 mA                               | 4.5                        | 3.8   | 4.0             |   | 3.8   |   |       |
| V <sub>OL</sub>  | Low-Level Output Voltage<br>V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub>  | I <sub>OL</sub> = 100 μA                               | 1.65 to 5.5                |   |                 | 0.1   |   | 0.1   | V     |
|                  |   | I <sub>OL</sub> = 4 mA                                 | 1.65                       |   |                 | 0.24  |   | 0.24  |       |
|                  |   | I <sub>OL</sub> = 8 mA                                 | 2.3                        |   | 0.20            | 0.3   |   | 0.3   |       |
|                  |   | I <sub>OL</sub> = 12 mA                                | 2.7                        |   | 0.22            | 0.4   |   | 0.4   |       |
|                  |   | I <sub>OL</sub> = 16 mA                                | 3.0                        |   | 0.28            | 0.4   |   | 0.4   |       |
|                  |   | I <sub>OL</sub> = 24 mA                                | 3.0                        |   | 0.38            | 0.55  |   | 0.55  |       |
|                  |   | I <sub>OL</sub> = 32 mA                                | 4.5                        |   | 0.42            | 0.55  |   | 0.55  |       |
| I <sub>IN</sub>  | Input Leakage Current   | V <sub>IN</sub> = 5.5 V or GND                         | 0 to 5.5                   |   |                 | ±0.1  |   | ±1.0  | μA    |
| I <sub>OFF</sub> | Power Off Leakage Current   | V <sub>IN</sub> = 5.5 V or<br>V <sub>OUT</sub> = 5.5 V | 0                          |   |                 | 1   |   | 10  | μA    |
| I <sub>CC</sub>  | Quiescent Supply Current  | V <sub>IN</sub> = 5.5 V or GND                         | 5.5                        |   |                 | 1   |   | 10  | μA    |

Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS t<sub>R</sub> = t<sub>F</sub> = 2.5 ns; C<sub>L</sub> = 50 pF; R<sub>L</sub> = 500 Ω

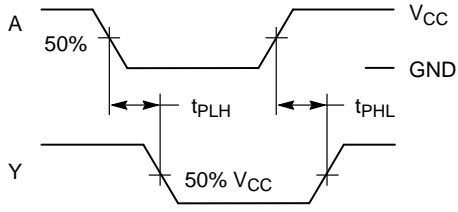
| Symbol                               | Parameter                             | Condition   | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |            |            | -40°C ≤ T <sub>A</sub> ≤ 85°C |            | Units |
|--------------------------------------|---------------------------------------|---|---------------------|-----------------------|------------|------------|-------------------------------|------------|-------|
|                                      |                                       |   |                     | Min                   | Typ        | Max        | Min                           | Max        |       |
| t <sub>PLH</sub><br>t <sub>PHL</sub> | Propagation Delay<br>(Figure 3 and 4) | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 1.8 ± 0.15          | 1.8                   | 6.0        | 7.9        | 1.8                           | 8.8        | ns    |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF   | 2.5 ± 0.2           | 1.0                   | 3.0        | 5.2        | 1.0                           | 5.8        |       |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF | 3.3 ± 0.3           | 0.8<br>1.2            | 2.3<br>3.0 | 3.6<br>4.6 | 0.8<br>1.2                    | 4.0<br>5.1 |       |
|                                      |                                       | R <sub>L</sub> = 1 MΩ, C <sub>L</sub> = 15 pF<br>R <sub>L</sub> = 500 Ω, C <sub>L</sub> = 50 pF | 5.0 ± 0.5           | 0.5<br>0.8            | 1.8<br>2.4 | 2.9<br>3.8 | 0.5<br>0.8                    | 3.2<br>4.2 |       |

## CAPACITIVE CHARACTERISTICS

| Symbol          | Parameter                              | Condition  | Typical | Units |
|-----------------|--|--|---------|-------|
| C <sub>IN</sub> | Input Capacitance                      | V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub>   | 7.0     | pF    |
| C <sub>PD</sub> | Power Dissipation Capacitance (Note 7) | 10 MHz, V <sub>CC</sub> = 3.3 V, V <sub>I</sub> = 0 V or V <sub>CC</sub><br>10 MHz, V <sub>CC</sub> = 5.5 V, V <sub>I</sub> = 0 V or V <sub>CC</sub> | 9<br>11 | pF    |

7. C<sub>PD</sub> is defined as the value of the internal equivalent capacitance which is calculated from the operating current consumption without load. Average operating current can be obtained by the equation: I<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption; P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

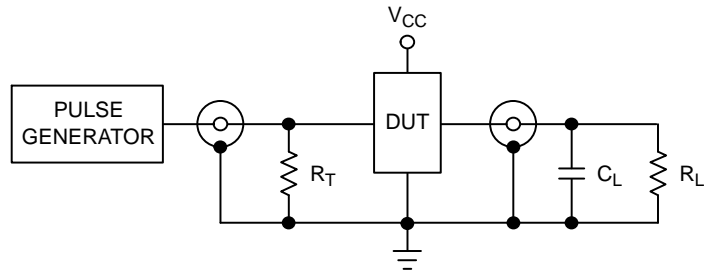
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### PROPAGATION DELAYS

$t_R = t_F = 2.5 \text{ ns}$ , 10% to 90%;  $f = 1 \text{ MHz}$ ;  $t_W = 500 \text{ ns}$

**Figure 3. Switching Waveforms**



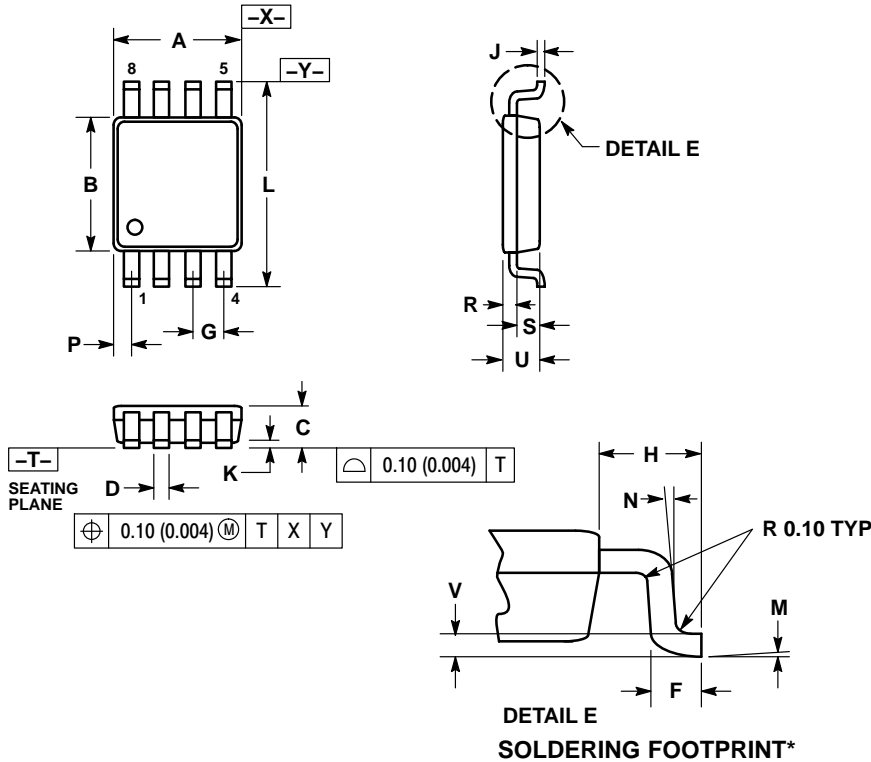
$R_T = Z_{OUT}$  of pulse generator (typically  $50 \Omega$ )

**Figure 4. Test Circuit**

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## PACKAGE DIMENSIONS

### US8 CASE 493-02 ISSUE B



#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH, PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM (300-800 Å).
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002").

| DIM | MILLIMETERS |      | INCHES    |       |
|-----|-------------|------|-----------|-------|
|     | MIN         | MAX  | MIN       | MAX   |
| A   | 1.90        | 2.10 | 0.075     | 0.083 |
| B   | 2.20        | 2.40 | 0.087     | 0.094 |
| C   | 0.60        | 0.90 | 0.024     | 0.035 |
| D   | 0.17        | 0.25 | 0.007     | 0.010 |
| F   | 0.20        | 0.35 | 0.008     | 0.014 |
| G   | 0.50 BSC    |      | 0.020 BSC |       |
| H   | 0.40 REF    |      | 0.016 REF |       |
| J   | 0.10        | 0.18 | 0.004     | 0.007 |
| K   | 0.00        | 0.10 | 0.000     | 0.004 |
| L   | 3.00        | 3.20 | 0.118     | 0.126 |
| M   | 0°          | 6°   | 0°        | 6°    |
| N   | 5°          | 10°  | 5°        | 10°   |
| P   | 0.23        | 0.34 | 0.010     | 0.013 |
| R   | 0.23        | 0.33 | 0.009     | 0.013 |
| S   | 0.37        | 0.47 | 0.015     | 0.019 |
| U   | 0.60        | 0.80 | 0.024     | 0.031 |
| V   | 0.12 BSC    |      | 0.005 BSC |       |

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

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