

# NLX1G125

## Non-Inverting 3-State Buffer

The NLX1G125 is an advanced high-speed 2-input CMOS non-inverting 3-state buffer in ultra-small footprint.

The NLX1G125 input structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

### Features

- High Speed:  $t_{PD} = 2.7 \text{ ns}$  (Typ) @  $V_{CC} = 5.0 \text{ V}$
- Designed for 1.65 V to 5.5 V  $V_{CC}$  Operation
- Low Power Dissipation:  $I_{CC} = 1 \mu\text{A}$  (Max) at  $T_A = 25^\circ\text{C}$
- 24 mA Balanced Output Source and Sink Capability
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input Pins
- Ultra-Small Packages
- These are Pb-Free Devices

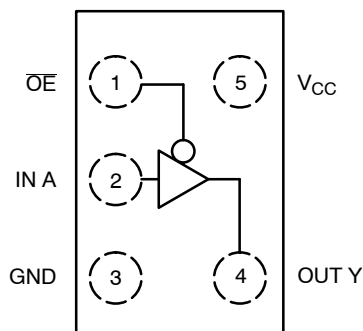


Figure 1. Pinout (Top View)

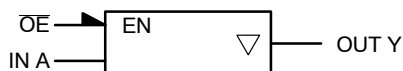


Figure 2. Logic Symbol



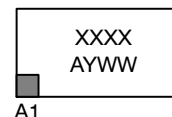
**ON Semiconductor®**

<http://onsemi.com>

### MARKING DIAGRAM



**5 PIN FLIP-CHIP  
CASE 499BG**



XXXX = Specific Device Code  
A = Assembly Location  
Y = Year  
WW = Work Week

### PIN ASSIGNMENT

|   | PIN ASSIGNMENT  |
|---|-----------------|
| 1 | OE              |
| 2 | IN A            |
| 3 | GND             |
| 4 | OUT Y           |
| 5 | V <sub>CC</sub> |

### FUNCTION TABLE

| A Input | OE Input | Y Output |
|---------|----------|----------|
| L       | L        | L        |
| H       | L        | H        |
| X       | H        | Z        |

X = Don't Care

### ORDERING INFORMATION

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

# NLX1G125

## MAXIMUM RATINGS

| Symbol               | Parameter                                                                                                     | Value                  | Unit |
|----------------------|---------------------------------------------------------------------------------------------------------------|------------------------|------|
| V <sub>CC</sub>      | DC Supply Voltage                                                                                             | -0.5 to +7.0           | V    |
| V <sub>IN</sub>      | DC Input Voltage                                                                                              | -0.5 to +7.0           | V    |
| V <sub>OUT</sub>     | DC Output Voltage                                                                                             | -0.5 to +7.0           | V    |
| I <sub>IK</sub>      | DC Input Diode Current<br>V <sub>IN</sub> < GND                                                               | -50                    | mA   |
| I <sub>OK</sub>      | DC Output Diode Current<br>V <sub>OUT</sub> < GND                                                             | -50                    | mA   |
| I <sub>OUT</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                                                               | TBD                    | °C   |
| T <sub>J</sub>       | Junction Temperature Under Bias                                                                               | TBD                    | °C   |
| θ <sub>JA</sub>      | Thermal Resistance (Note 1)                                                                                   | TBD                    | °C/W |
| P <sub>D</sub>       | Power Dissipation in Still Air at 85°C                                                                        | TBD                    | 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 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 200<br>N/A | V    |
| I <sub>LATCHUP</sub> | Latchup Performance Above V <sub>CC</sub> and Below GND at 125 °C (Note 5)                                    | ±500                   | mA   |

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.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace with no air flow.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.
5. Tested to EIA / JESD78.

## RECOMMENDED OPERATING CONDITIONS

| Symbol           | Parameter                                                                                                                                                                       | Min              | Max                   | Unit |
|------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|-----------------------|------|
| V <sub>CC</sub>  | Positive DC Supply Voltage<br>Operating<br>Data Retention Only                                                                                                                  | 1.65<br>1.5      | 5.5<br>5.5            | V    |
| V <sub>IN</sub>  | Digital Input Voltage (Note 6)                                                                                                                                                  | 0                | 5.5                   | V    |
| V <sub>OUT</sub> | Output Voltage                                                                                                                                                                  | 0                | 5.5                   | V    |
| T <sub>A</sub>   | Operating Free-Air Temperature                                                                                                                                                  | -55              | +125                  | °C   |
| Δt/ΔV            | Input Transition Rise or Fall Rate<br>V <sub>CC</sub> = 1.8 V ± 0.15 V<br>V <sub>CC</sub> = 2.5 V ± 0.2 V<br>V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>0<br>0<br>0 | 20<br>20<br>10<br>5.0 | ns/V |

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

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## DC ELECTRICAL CHARACTERISTICS

| Symbol           | Parameter                        | Conditions                                                                          | V <sub>CC</sub><br>(V) | T <sub>A</sub> = 25 °C |                 |                        | T <sub>A</sub> = -55°C to +125°C |                        | Unit |
|------------------|----------------------------------|-------------------------------------------------------------------------------------|------------------------|------------------------|-----------------|------------------------|----------------------------------|------------------------|------|
|                  |                                  |                                                                                     |                        | Min                    | Typ             | Max                    | Min                              | Max                    |      |
| V <sub>IH</sub>  | Low-Level Input Voltage          |                                                                                     | 1.65                   | 0.75 x V <sub>CC</sub> |                 |                        | 0.75 x V <sub>CC</sub>           |                        | V    |
|                  |                                  |                                                                                     | 2.3 to 5.5             | 0.70 x V <sub>CC</sub> |                 |                        | 0.70 x V <sub>CC</sub>           |                        |      |
| V <sub>IL</sub>  | Low-Level Input Voltage          |                                                                                     | 1.65                   |                        |                 | 0.25 x V <sub>CC</sub> |                                  | 0.25 x V <sub>CC</sub> | V    |
|                  |                                  |                                                                                     | 2.3 – 5.5              |                        |                 | 0.30 x V <sub>CC</sub> |                                  | 0.30 x 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><br>I <sub>OH</sub> = -100 µA   | 1.65 – 5.5             | V <sub>CC</sub> -0.1   | V <sub>CC</sub> |                        | V <sub>CC</sub> -0.1             |                        | V    |
|                  |                                  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>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> = -12 mA                                                            | 2.7                    | 2.2                    | 2.4             |                        | 2.2                              |                        |      |
|                  |                                  | I <sub>OH</sub> = -16 mA                                                            | 3.0                    | 2.4                    | 2.8             |                        | 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                    | 4.2             |                        | 3.8                              |                        |      |
| V <sub>OL</sub>  | Low-Level Output Voltage         | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OL</sub> = 100 µA    | 1.65 – 5.5             |                        |                 | 0.1                    |                                  | 0.1                    | V    |
|                  |                                  | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>I <sub>OH</sub> = 4 mA      | 1.65                   |                        | 0.08            | 0.24                   |                                  | 0.24                   |      |
|                  |                                  | I <sub>OH</sub> = 8 mA                                                              | 2.3                    |                        | 0.1             | 0.3                    |                                  | 0.3                    |      |
|                  |                                  | I <sub>OH</sub> = 12 mA                                                             | 2.7                    |                        | 0.12            | 0.4                    |                                  | 0.4                    |      |
|                  |                                  | I <sub>OH</sub> = 16 mA                                                             | 3.0                    |                        | 0.15            | 0.4                    |                                  | 0.4                    |      |
|                  |                                  | I <sub>OH</sub> = 24 mA                                                             | 3.0                    |                        | 0.22            | 0.55                   |                                  | 0.55                   |      |
|                  |                                  | I <sub>OH</sub> = 32 mA                                                             | 4.5                    |                        | 0.22            | 0.55                   |                                  | 0.55                   |      |
| I <sub>IN</sub>  | Input Leakage Current            | 0 ≤ V <sub>IN</sub> ≤ 5.5V                                                          | 0 to 5.5               |                        |                 | ±0.1                   |                                  | ±1.0                   | µA   |
| I <sub>OZ</sub>  | 3-State Output Leakage Current   | V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>0 ≤ V <sub>OUT</sub> ≤ 5.5V | 0                      |                        |                 | ±0.5                   |                                  | ±5.0                   | µA   |
| I <sub>OFF</sub> | Power-Off Output Leakage Current | V <sub>IN</sub> = 5.5 V                                                             | 0                      |                        |                 | 1.0                    |                                  | 10                     | µA   |
| I <sub>CC</sub>  | Quiescent Supply Current         | 0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>                                               | 5.5                    |                        |                 | 1.0                    |                                  | 10                     | µA   |

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 2.5$ ns)

| Symbol                   | Parameter                                                              | $V_{CC}$<br>(V) | Test<br>Condition                                                 | $T_A = 25\text{ }^{\circ}\text{C}$ |     |     | $T_A = -55^{\circ}\text{C to } +125^{\circ}\text{C}$ |      | Unit |
|--------------------------|------------------------------------------------------------------------|-----------------|-------------------------------------------------------------------|------------------------------------|-----|-----|------------------------------------------------------|------|------|
|                          |                                                                        |                 |                                                                   | Min                                | Typ | Max | Min                                                  | Max  |      |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Propagation Delay,<br>Input to Output<br>(Figures 3 and 4,<br>Table 1) | 1.65–1.95       | $R_L = 1\text{ M}\Omega$ , $C_L = 15\text{ pF}$                   | 2.0                                | 6.0 | 10  | 2.0                                                  | 10.5 | ns   |
|                          |                                                                        | 2.3–2.7         | $R_L = 1\text{ M}\Omega$ , $C_L = 15\text{ pF}$                   | 1.0                                | 3.4 | 7.5 | 1.0                                                  | 8.0  |      |
|                          |                                                                        | 3.0–3.6         | $R_L = 1\text{ M}\Omega$ , $C_L = 15\text{ pF}$                   | 0.8                                | 2.5 | 5.2 | 0.8                                                  | 5.5  |      |
|                          |                                                                        |                 | $R_L = 500\text{ }\Omega$ , $C_L = 50\text{ pF}$                  | 1.2                                | 3.1 | 5.7 | 1.2                                                  | 6.0  |      |
|                          |                                                                        | 4.5–5.5         | $R_L = 1\text{ M}\Omega$ , $C_L = 15\text{ pF}$                   | 0.5                                | 1.8 | 4.5 | 0.5                                                  | 4.8  |      |
|                          |                                                                        |                 | $R_L = 500\text{ }\Omega$ , $C_L = 50\text{ pF}$                  | 0.8                                | 2.3 | 5.0 | 0.8                                                  | 5.3  |      |
| $t_{PZH}$ ,<br>$t_{PZL}$ | Output Enable Time<br>(Figures 5, 6 and 7,<br>Table 1)                 | 1.65–1.95       | $R_L = 250\text{ }\Omega$ , $C_L = 50\text{ pF}$                  | 2.0                                | 7.6 | 9.5 | 2.0                                                  | 10   | ns   |
|                          |                                                                        | 2.3–2.7         |                                                                   | 1.8                                |     | 8.5 | 1.8                                                  | 9.0  |      |
|                          |                                                                        | 3.0–3.6         |                                                                   | 1.2                                |     | 6.2 | 1.2                                                  | 6.5  |      |
|                          |                                                                        | 4.5–5.5         |                                                                   | 0.8                                |     | 5.5 | 0.8                                                  | 5.8  |      |
| $t_{PHZ}$ ,<br>$t_{PLZ}$ | Output Disable Time<br>(Figures 5, 6 and 7,<br>Table 1)                | 1.65–1.95       | $R_L = R_1 = 5\text{--}0\text{ }\Omega$ ,<br>$C_L = 50\text{ pF}$ | 2.0                                | 8.0 | 10  | 2.0                                                  | 10.5 | ns   |
|                          |                                                                        | 2.3–2.7         |                                                                   | 1.5                                |     | 8.0 | 1.5                                                  | 8.5  |      |
|                          |                                                                        | 3.0–3.6         |                                                                   | 0.8                                |     | 5.7 | 0.8                                                  | 6.0  |      |
|                          |                                                                        | 4.5–5.5         |                                                                   | 0.3                                |     | 4.7 | 0.3                                                  | 5.0  |      |
| $C_{IN}$                 | Input Capacitance                                                      | 5.5             | $V_{IN} = 0\text{ V or } V_{CC}$                                  |                                    | 2.5 |     |                                                      |      | pF   |
| $C_{OUT}$                | Output Capacitance                                                     | 5.5             | $V_{IN} = 0\text{ V or } V_{CC}$                                  |                                    | 2.5 |     |                                                      |      | pF   |
| $C_{PD}$                 | Power Dissipation<br>Capacitance (Note 7)                              | 3.3             | 10 MHz                                                            |                                    | 9.0 |     |                                                      |      | pF   |
|                          |                                                                        | 5.5             | $V_{IN} = 0\text{ V or } V_{CC}$                                  |                                    | 11  |     |                                                      |      |      |

7.  $C_{PD}$  is defined as the value of the internal equivalent capacitance which is calculated from the dynamic operating current consumption without load. Average operating current can be obtained by the equation  $I_{CC(OPR)} = C_{PD} \cdot V_{CC} \cdot f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption:  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

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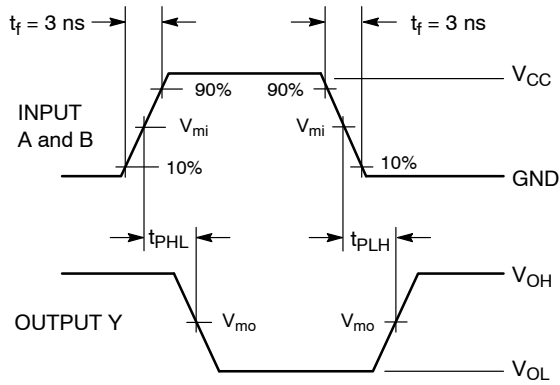
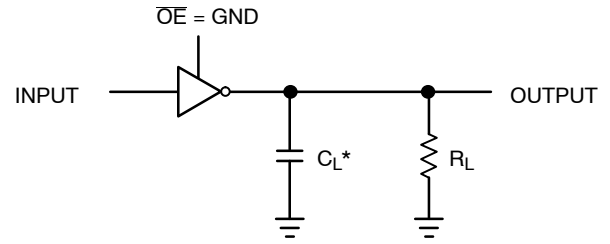
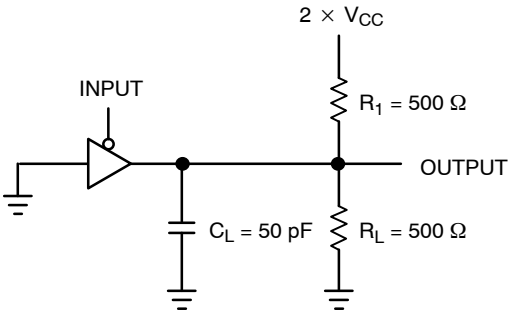


Figure 3. Switching Waveform



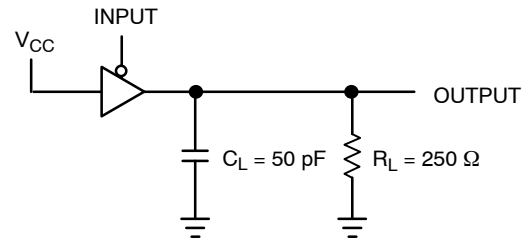
\*Includes all probe and jig capacitance.  
A 1 MHz square input wave is recommended for propagation delay tests.

Figure 4.  $T_{PLH}$  or  $T_{PHL}$



A 1 MHz square input wave is recommended for propagation delay tests.

Figure 5.  $T_{PZL}$  or  $T_{PL}$



A 1 MHz square input wave is recommended for propagation delay tests.

Figure 6.  $T_{PZH}$  or  $T_{PHZ}$

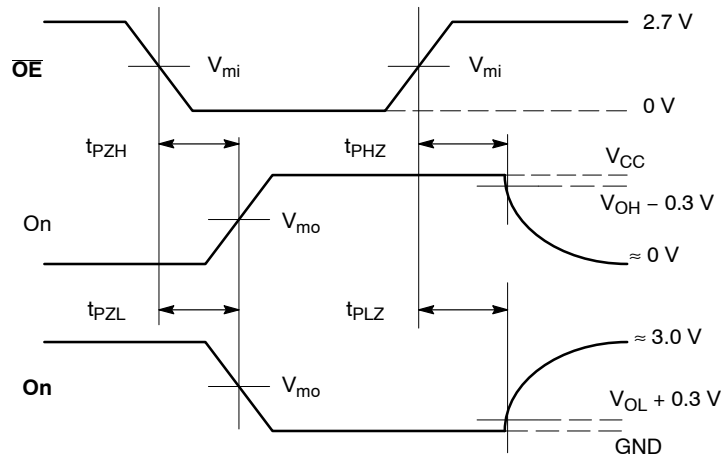


Figure 7. AC Output Enable and Disable Waveform

Table 1. OUTPUT ENABLE AND DISABLE TIMES

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

| Symbol   | $V_{CC}$                          |                 |                                   |
|----------|-----------------------------------|-----------------|-----------------------------------|
|          | $3.3 \text{ V} \pm 0.3 \text{ V}$ | $2.7 \text{ V}$ | $2.5 \text{ V} \pm 0.2 \text{ V}$ |
| $V_{mi}$ | 1.5 V                             | 1.5 V           | $V_{CC}/2$                        |
| $V_{mo}$ | 1.5 V                             | 1.5 V           | $V_{CC}/2$                        |

## NLX1G125

### DEVICE ORDERING INFORMATION

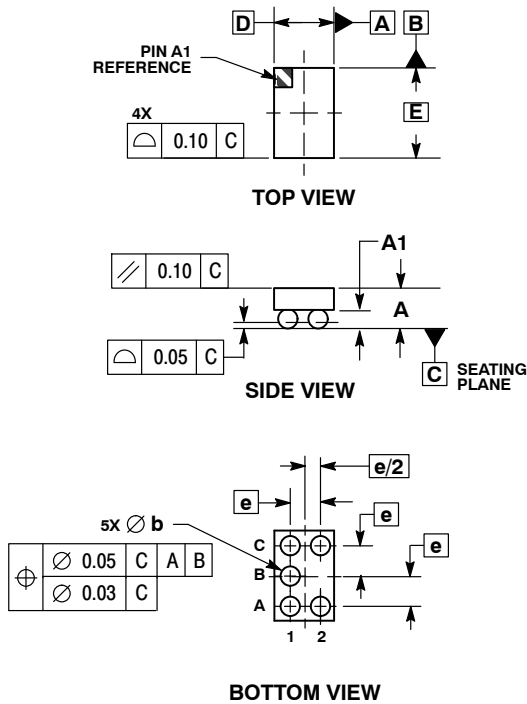
| Device        | Package                  | Shipping†          |
|---------------|--------------------------|--------------------|
| NLX1G125FCT1G | Flip-Chip 5<br>(Pb-Free) | 3000 / Tape & Reel |

†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.

# NLX1G125

## PACKAGE DIMENSIONS

### 5 PIN FLIP-CHIP CASE 499BG-01 ISSUE O

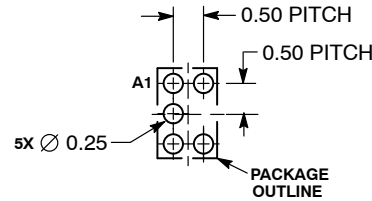


#### NOTES:

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.44     | 0.50 |
| A1          | 0.15     | 0.19 |
| b           | 0.21     | 0.25 |
| D           | 0.90 BSC |      |
| E           | 1.40 BSC |      |
| e           | 0.50 BSC |      |

#### SOLDERING FOOTPRINT\*



\*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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