# Non-Inverting 3-State Buffer, TTL Level

# LSTTL-Compatible Inputs

The NLU1GT125 MiniGate<sup>™</sup> is an advanced CMOS high-speed non-inverting buffer in ultra-small footprint.

The NLU1GT125 requires the 3-state control input  $\overline{OE}$  to be set High to place the output in the high impedance state.

The device input is compatible with TTL-type input thresholds and the output has a full 5.0 V CMOS level output swing.

The NLU1GT125 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

#### Features

- High Speed:  $t_{PD} = 3.8 \text{ ns} (Typ) @ V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 1 \ \mu A$  (Max) at  $T_A = 25^{\circ}C$
- TTL-Compatible Input:  $V_{IL} = 0.8 \text{ V}; V_{IH} = 2.0 \text{ V}$
- CMOS-Compatible Output: V<sub>OH</sub> > 0.8 V<sub>CC</sub>; V<sub>OL</sub> < 0.1 V<sub>CC</sub> @ Load
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Ultra-Small Packages
- These are Pb-Free Devices

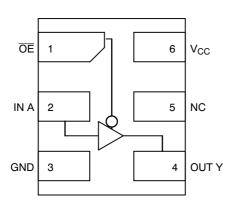


Figure 1. Pinout (Top View)

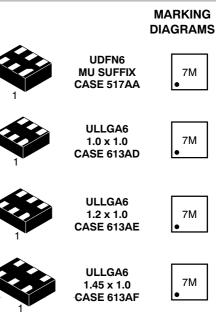


Figure 2. Logic Symbol



# **ON Semiconductor®**

http://onsemi.com



7 = Device Marking M = Date Code

#### **PIN ASSIGNMENT**

| 1 | ŌĒ              |
|---|-----------------|
| 2 | IN A            |
| 3 | GND             |
| 4 | OUT Y           |
| 5 | NC              |
| 6 | V <sub>CC</sub> |

#### **FUNCTION TABLE**

| Inp | out | Output |
|-----|-----|--------|
| Α   | ŌĒ  | Y      |
| L   | L   | L      |
| Н   | L   | н      |
| х   | Н   | Z      |

#### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 4 of this data sheet.

### 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                                | V <sub>IN</sub> < GND  | -20                  | mA   |
| I <sub>OK</sub>      | DC Output Diode Current                               | V <sub>OUT</sub> < GND | ±20                  | mA   |
| Ι <sub>Ο</sub>       | DC Output Source/Sink Current                         |                        | ±12.5                | mA   |
| I <sub>CC</sub>      | DC Supply Current Per Supply Pin                      |                        | ±25                  | mA   |
| I <sub>GND</sub>     | DC Ground Current per Ground Pin                      |                        | ±25                  | mA   |
| T <sub>STG</sub>     | Storage Temperature Range                             |                        | -65 to +150          | °C   |
| ΤL                   | Lead Temperature, 1 mm from Case for 10 Seconds       |                        | 260                  | °C   |
| Τ <sub>J</sub>       | Junction Temperature Under Bias                       |                        | 150                  | °C   |
| MSL                  | Moisture Sensitivity                                  | Level 1                |                      |      |
| F <sub>R</sub>       | Flammability Rating Oxyge                             | n Index: 28 to 34      | UL 94 V-0 @ 0.125 in |      |
| I <sub>LATCHUP</sub> | Latchup Performance Above $V_{CC}$ and Below GND at 1 | 25°C (Note 2)          | ±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.
 Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace no air flow.
 Tested to EIA / JESD78.

### **RECOMMENDED OPERATING CONDITIONS**

| Symbol              | Parameter  | Min | Max    | Unit      |      |
|---------------------|--|-----|--------|-----------|------|
| V <sub>CC</sub>     | Positive DC Supply Voltage                                       |     | 1.65   | 5.5       | V    |
| V <sub>IN</sub>     | Digital Input Voltage  |     | 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   |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate V <sub>C</sub> V <sub>C</sub> |     | 0<br>0 | 100<br>20 | ns/V |

### DC ELECTRICAL CHARACTERISTICS

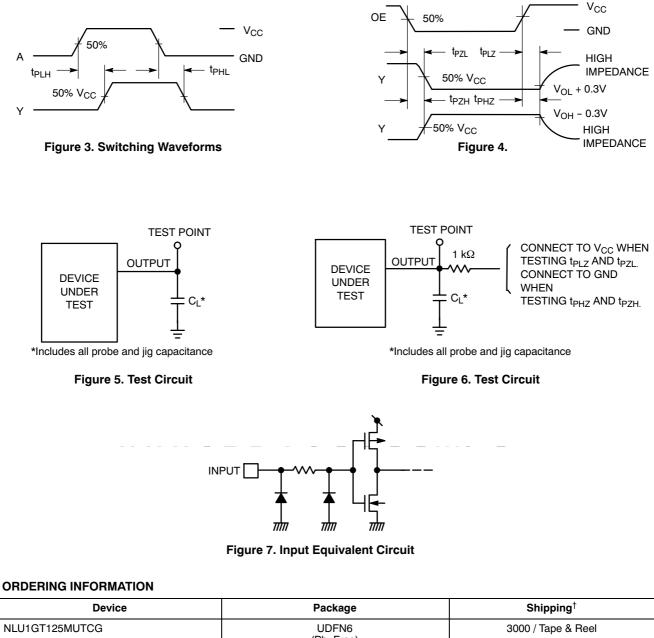
|                  |                              |  | T <sub>A</sub>      |              |            | T <sub>A</sub> = 25 °C |              | T <sub>A</sub> = 25 °C T, | <sub>A</sub> = 25 °C T <sub>A</sub> = +8 |              | T <sub>A</sub> = −55°C<br>+85°C to +125°C |  |  |  |
|------------------|------------------------------|--|---------------------|--------------|------------|------------------------|--------------|---------------------------|--|--------------|---|--|--|--|
| Symbol           | Parameter                    | Conditions   | V <sub>CC</sub> (V) | Min          | Тур        | Max                    | Min          | Max                       | Min                                      | Max          | Unit                                      |  |  |  |
| V <sub>IH</sub>  | Low-Level Input<br>Voltage   |  | 3.0<br>4.5 to 5.5   | 1.4<br>2.0   |            |                        | 1.4<br>2.0   |                           | 1.4<br>2.0                               |              | V   |  |  |  |
| VIL              | Low-Level Input<br>Voltage   |  | 3.0<br>4.5 to 5.5   |              |            | 0.53<br>0.8            |              | 0.53<br>0.8               |  | 0.53<br>0.8  | V   |  |  |  |
| V <sub>OH</sub>  | High-Level Output<br>Voltage | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$I_{OH} = -50 \ \mu A$   | 3.0<br>4.5          | 2.9<br>4.4   | 3.0<br>4.5 |                        | 2.9<br>4.4   |                           | 2.9<br>4.4                               |              | V   |  |  |  |
|                  |                              | $\label{eq:VIN} \begin{array}{l} V_{IN} = V_{IH} \mbox{ or } V_{IL} \\ I_{OH} = -4 \mbox{ mA} \\ I_{OH} = -8 \mbox{ mA} \end{array}$ | 3.0<br>4.5          | 2.58<br>3.94 |            |                        | 2.48<br>3.80 |                           | 2.34<br>3.66                             |              |   |  |  |  |
| V <sub>OL</sub>  | Low-Level Output<br>Voltage  | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$I_{OL} = 50 \ \mu\text{A}$  | 3.0<br>4.5          |              | 0<br>0     | 0.1<br>0.1             |              | 0.1<br>0.1                |  | 0.1<br>0.1   | V   |  |  |  |
|                  |                              | $V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 4 \text{ mA}$ $I_{OL} = 8 \text{ mA}$   | 3.0<br>4.5          |              |            | 0.36<br>0.36           |              | 0.44<br>0.44              |  | 0.52<br>0.52 |   |  |  |  |
| I <sub>IN</sub>  | Input Leakage<br>Current     | $0 \le V_{IN} \le 5.5 V$   | 0 to 5.5            |              |            | ±0.1                   |              | ±1.0                      |  | ±1.0         | μA  |  |  |  |
| I <sub>CC</sub>  | Quiescent Supply<br>Current  | $0 \le V_{IN} \le V_{CC}$  | 5.5                 |              |            | 1.0                    |              | 20                        |  | 40           | μΑ  |  |  |  |
| ICCT             | Quiescent Supply<br>Current  | V <sub>IN</sub> = 3.4 V<br>Other Input: V <sub>CC</sub><br>or GND  | 5.5                 |              |            | 1.35                   |              | 1.50                      |  | 1.65         | mA  |  |  |  |
| I <sub>OPD</sub> | Output Leakage<br>Current    | V <sub>OUT</sub> = 5.5 V   | 0.0                 |              |            | 0.5                    |              | 5.0                       |  | 10           | μA  |  |  |  |
| I <sub>OZ</sub>  | 3-State Leakage<br>Current   | $V_{IN} = V_{IH} \text{ or } V_{IL}$<br>$V_{OUT} = V_{CC} \text{ or}$<br>GND   | 0.0                 |              | _          | ±0.25                  |              | ±2.5                      |  | ±2.5         | μA  |  |  |  |

#### AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

|  |   | v <sub>cc</sub> | Test   | т   | _ <sub>A</sub> = 25 ° | °C          | T <sub>A</sub> = | +85°C        |     | -55°C<br>25°C |      |
|--|---|-----------------|--|-----|-----------------------|-------------|------------------|--------------|-----|---------------|------|
| Symbol                                 | Parameter   | (V)             | Condition  | Min | Тур                   | Max         | Min              | Мах          | Min | Мах           | Unit |
| t <sub>PLH</sub> ,<br>t <sub>PHL</sub> | Propagation Delay, A to <b>Y</b><br>(Figures 3 and 5)             | 3.0 to 3.6      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 5.6<br>8.1            | 8.0<br>11.5 | 1.0<br>1.0       | 9.5<br>13.0  |     | 12.0<br>16.0  | ns   |
|  |   | 4.5 to 5.5      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 3.8<br>5.3            | 5.5<br>7.5  | 1.0<br>1.0       | 6.5<br>8.5   |     | 8.5<br>10.5   |      |
| t <sub>PZL</sub> ,<br>t <sub>PZH</sub> | Output Enable Time, $\overline{OE}$ to Y (Figures 4 and 6)        | 3.0 to 3.6      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 5.4<br>7.9            | 8.0<br>11.5 | 1.0<br>1.0       | 9.5<br>13.0  |     | 11.5<br>15.0  | ns   |
|  |   | 4.5 to 5.5      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 3.6<br>5.1            | 5.1<br>7.1  | 1.0<br>1.0       | 6.0<br>8.0   |     | 7.5<br>9.5    |      |
| t <sub>PLZ</sub> ,<br>t <sub>PHZ</sub> | Output Disable Time, $\overline{OE}$ to Y (Figures 4 and 6)       | 3.0 to 3.6      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 6.5<br>8.0            | 9.7<br>13.2 | 1.0<br>1.0       | 11.5<br>15.0 |     | 14.5<br>18.5  | ns   |
|  |   | 4.5 to 5.5      | C <sub>L</sub> = 15 pF<br>C <sub>L</sub> = 50 pF |     | 4.8<br>7.0            | 6.8<br>8.8  | 1.0<br>1.0       | 8.0<br>10.0  |     | 10.0<br>12.0  |      |
| C <sub>IN</sub>                        | Input Capacitance   |                 |  |     | 4                     | 10          |                  | 10           |     | 10.0          | pF   |
| C <sub>OUT</sub>                       | 3-State Output Capacitance<br>(Output in High Impedance<br>State) |                 |  |     | 6                     |             |                  |              |     |               | pF   |
| C <sub>PD</sub>                        | Power Dissipation<br>Capacitance (Note 3)                         | 5.0             |  |     | 14                    |             |                  |              |     |               | pF   |

3.  $C_{PD}$  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  $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$ .  $C_{PD}$  is used to determine the no-load dynamic power consumption:  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .

### SWITCHING WAVEFORMS

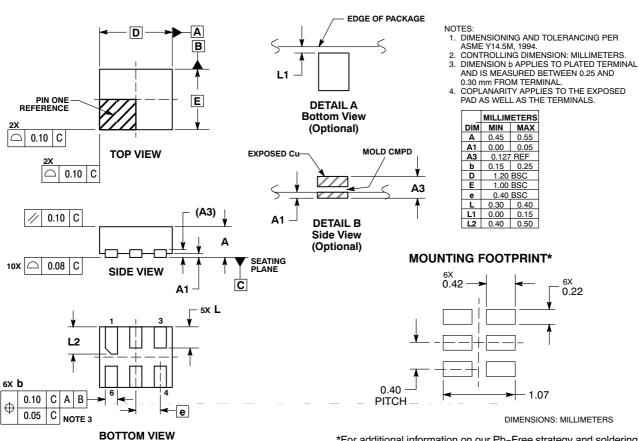


| NLU1GT125MUTCG   | UDFN6<br>(Pb-Free)                    | 3000 / Tape & Reel |
|------------------|---------------------------------------|--------------------|
| NLU1GT125AMX1TCG | ULLGA6, 1.45 x 1.0, 0.5P<br>(Pb-Free) | 3000 / Tape & Reel |
| NLU1GT125BMX1TCG | ULLGA6, 1.2 x 1.0, 0.4P<br>(Pb-Free)  | 3000 / Tape & Reel |
| NLU1GT125CMX1TCG | ULLGA6, 1.0 x 1.0, 0.35P<br>(Pb-Free) | 3000 / 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.

#### PACKAGE DIMENSIONS

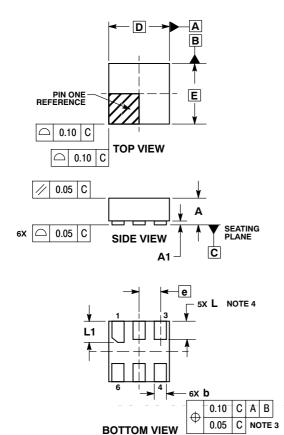
UDFN6, 1.2x1.0, 0.4P CASE 517AA-01 ISSUE C



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

#### PACKAGE DIMENSIONS

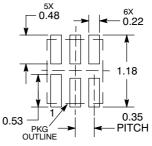
ULLGA6 1.0x1.0, 0.35P CASE 613AD-01 ISSUE A



- NOTES: 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. 2. CONTROLLING DIMENSION: MILLIMETERS. 3. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP. 4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| PACKAGE IS ALLOWE |           |             |  |  |  |  |  |
|-------------------|-----------|-------------|--|--|--|--|--|
|                   | MILLIM    | MILLIMETERS |  |  |  |  |  |
| DIM               | MIN MAX   |             |  |  |  |  |  |
| Α                 |           | 0.40        |  |  |  |  |  |
| A1                | 0.00      | 0.05        |  |  |  |  |  |
| b                 | 0.12      | 0.22        |  |  |  |  |  |
| D                 | 1.00      | BSC         |  |  |  |  |  |
| Е                 | 1.00      | BSC         |  |  |  |  |  |
| е                 | 0.35      | BSC         |  |  |  |  |  |
| L                 | 0.25 0.35 |             |  |  |  |  |  |
| L1                | 0.30      | 0.40        |  |  |  |  |  |

**MOUNTING FOOTPRINT** SOLDERMASK DEFINED\*

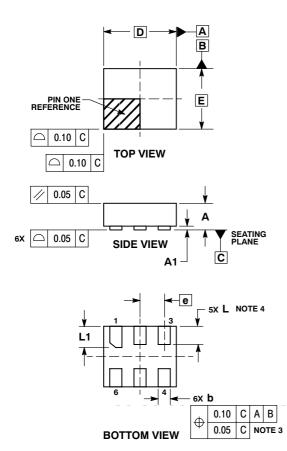


DIMENSIONS: MILLIMETERS

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

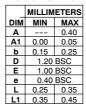
### PACKAGE DIMENSIONS

ULLGA6 1.2x1.0, 0.4P CASE 613AE-01 ISSUE A

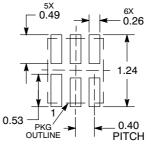


NOTES:

- 1.
- DIES: DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994. CONTROLLING DIMENSION: MILLIMETERS. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 2. З.
- 0.30 mm FROM THE TERMINAL TIP. A MAXIMUM OF 0.05 PULL BACK OF THE 4. PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.



#### **MOUNTING FOOTPRINT** SOLDERMASK DEFINED\*

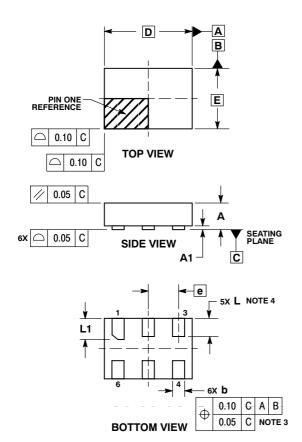


DIMENSIONS: MILLIMETERS

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

#### PACKAGE DIMENSIONS

ULLGA6 1.45x1.0, 0.5P CASE 613AF-01 ISSUE A

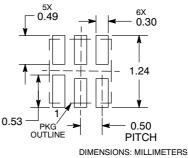


NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
   CONTROLLING DIMENSION: MILLIMETERS.
- CONTROLLING DIMENSION: MILLIMETERS.
  DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM THE TERMINAL TIP.
- A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

|     | MILLIMETERS |      |  |  |  |  |
|-----|-------------|------|--|--|--|--|
| DIM | MIN         | MAX  |  |  |  |  |
| Α   |             | 0.40 |  |  |  |  |
| A1  | 0.00        | 0.05 |  |  |  |  |
| b   | 0.15        | 0.25 |  |  |  |  |
| D   | 1.45        | BSC  |  |  |  |  |
| Е   | 1.00        | BSC  |  |  |  |  |
| е   | 0.50        | BSC  |  |  |  |  |
| L   | 0.25        | 0.35 |  |  |  |  |
| L1  | 0.30        | 0.40 |  |  |  |  |

MOUNTING FOOTPRINT SOLDERMASK DEFINED\*



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

MiniGate is a trademark of Semiconductor Components Industries, LLC (SCILLC).

ON Semiconductor and 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 application in which the BSCILLC 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, 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 payes 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

Order Literature: http://www.onsemi.com/orderlit

For additional information, please contact your local Sales Representative

NLU1GT125/D