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# NLX1G97

## Configurable Multifunction Gate

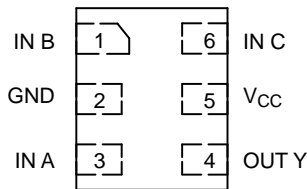
The NLX1G97 MiniGate™ is an advanced high-speed CMOS multifunction gate. The device allows the user to choose logic functions MUX, AND, OR, NAND, NOR, INVERT and BUFFER. The device has Schmitt-trigger inputs, thereby enhancing noise immunity.

The NLX1G97 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

### Features

- High Speed:  $t_{PD} = 3.3 \text{ ns (Typ) @ } V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation:  $I_{CC} = 1 \mu\text{A (Maximum) at } T_A = 25^\circ\text{C}$
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Packages
- These are Pb-Free Devices

### PIN ASSIGNMENTS



(Top View)



**ON Semiconductor®**

[www.onsemi.com](http://www.onsemi.com)

### MARKING DIAGRAMS



UDFN6  
1.0 x 1.0  
CASE 517BX



1



UDFN6  
1.2 x 1.0  
CASE 517AA



1



UDFN6  
1.45 x 1.0  
CASE 517AQ



1

F = Specific Device Code  
M = Date Code

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 7 of this data sheet.

# NLX1G97

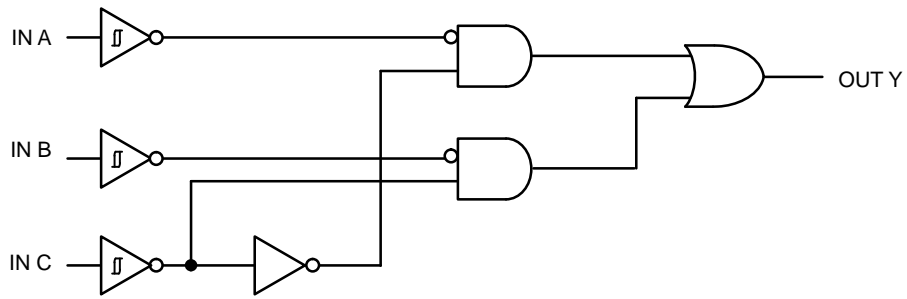


Figure 1. Function Diagram

## PIN ASSIGNMENT

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

## FUNCTION TABLE\*

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

\*To select a logic function, please refer to "Logic Configurations section".

LOGIC CONFIGURATIONS

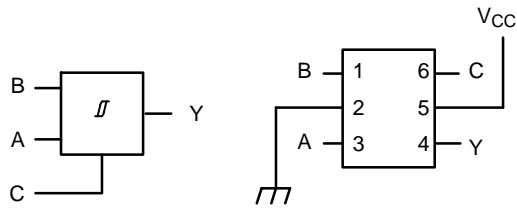


Figure 2. 2-Input MUX

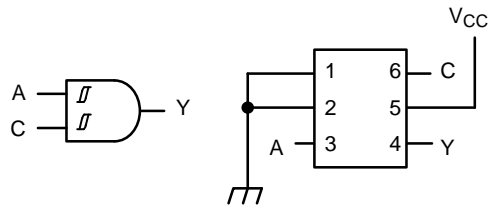


Figure 3. 2-Input AND (When B = "L")

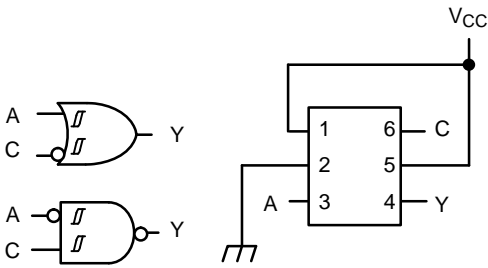


Figure 4. 2-Input OR with Input C Inverted (When B = "H")

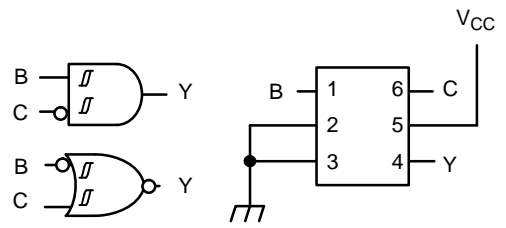


Figure 5. 2-Input AND with Input C Inverted (When A = "L")

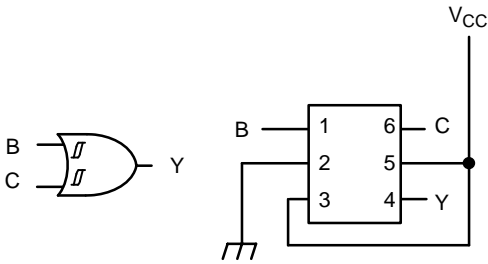


Figure 6. 2-Input OR (When A = "H")

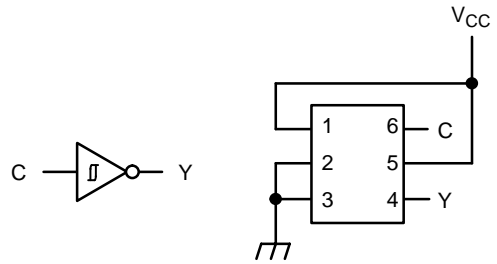


Figure 7. Inverter (When A = "L" and B = "H")

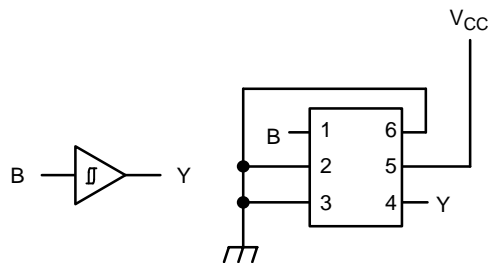


Figure 8. Buffer (When A = C = "L")

# NLX1G97

## MAXIMUM RATINGS

| Symbol        | Parameter   | Value                | Unit |
|---------------|---|----------------------|------|
| $V_{CC}$      | DC Supply Voltage   | -0.5 to +7.0         | V    |
| $V_{IN}$      | DC Input Voltage  | -0.5 to +7.0         | V    |
| $V_{OUT}$     | DC Output Voltage   | -0.5 to +7.0         | V    |
| $I_{IK}$      | DC Input Diode Current<br>$V_{IN} < GND$  | -50                  | mA   |
| $I_{OK}$      | DC Output Diode Current<br>$V_{OUT} < GND$  | -50                  | mA   |
| $I_O$         | DC Output Source/Sink Current   | $\pm 50$             | mA   |
| $I_{CC}$      | DC Supply Current Per Supply Pin  | $\pm 100$            | mA   |
| $I_{GND}$     | DC Ground Current per Ground Pin  | $\pm 100$            | mA   |
| $T_{STG}$     | Storage Temperature Range   | -65 to +150          | °C   |
| $T_L$         | Lead Temperature, 1 mm from Case for 10 Seconds   | 260                  | °C   |
| $T_J$         | Junction Temperature Under Bias   | 150                  | °C   |
| MSL           | Moisture Sensitivity  | Level 1              |      |
| $F_R$         | Flammability Rating Oxygen Index: 28 to 34  | UL 94 V-0 @ 0.125 in |      |
| $V_{ESD}$     | 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    |
| $I_{LATCHUP}$ | Latchup Performance Above $V_{CC}$ and Below GND at 125°C (Note 5)  | $\pm 500$            | mA   |

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. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2 ounce copper trace 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 |
|---------------------|--|-------------|----------------------------------|------|
| $V_{CC}$            | Positive DC Supply Voltage   | 1.65        | 5.5                              | V    |
| $V_{IN}$            | Digital Input Voltage  | 0           | 5.5                              | V    |
| $V_{OUT}$           | Output Voltage   | 0           | 5.5                              | V    |
| $T_A$               | Operating Free-Air Temperature   | -55         | +125                             | °C   |
| $\Delta t/\Delta V$ | Input Transition Rise or Fall Rate<br>$V_{CC} = 2.5 V \pm 0.2 V$<br>$V_{CC} = 3.3 V \pm 0.3 V$<br>$V_{CC} = 5.0 V \pm 0.5 V$ | 0<br>0<br>0 | No Limit<br>No Limit<br>No Limit | 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.

# NLX1G97

## DC ELECTRICAL CHARACTERISTICS

| Symbol          | Parameter                         | Conditions   | V <sub>CC</sub> (V) | T <sub>A</sub> = 25°C |     |      | T <sub>A</sub> ≤ +85°C |      | T <sub>A</sub> = -55°C to +125°C |      | Unit |
|-----------------|-----------------------------------|--|---------------------|-----------------------|-----|------|------------------------|------|----------------------------------|------|------|
|                 |                                   |  |                     | Min                   | Typ | Max  | Min                    | Max  | Min                              | Max  |      |
| V <sub>T+</sub> | Positive Threshold Voltage        |  | 1.65                | 0.79                  |     | 1.16 |                        | 1.16 |                                  | 1.16 | V    |
|                 |                                   |  | 2.3                 | 1.11                  |     | 1.56 |                        | 1.56 |                                  | 1.56 |      |
|                 |                                   |  | 3.0                 | 1.5                   |     | 1.87 |                        | 1.87 |                                  | 1.87 |      |
|                 |                                   |  | 4.5                 | 2.16                  |     | 2.74 |                        | 2.74 |                                  | 2.74 |      |
|                 |                                   |  | 5.5                 | 2.61                  |     | 3.33 |                        | 3.33 |                                  | 3.33 |      |
| V <sub>T-</sub> | Negative Threshold Voltage        |  | 1.65                | 0.35                  |     | 0.62 | 0.35                   |      | 0.35                             |      | V    |
|                 |                                   |  | 2.3                 | 0.58                  |     | 0.87 | 0.58                   |      | 0.58                             |      |      |
|                 |                                   |  | 3.0                 | 0.84                  |     | 1.19 | 0.84                   |      | 0.84                             |      |      |
|                 |                                   |  | 4.5                 | 1.41                  |     | 1.9  | 1.41                   |      | 1.41                             |      |      |
|                 |                                   |  | 5.5                 | 1.78                  |     | 2.29 | 1.78                   |      | 1.78                             |      |      |
| V <sub>H</sub>  | Hysteresis Voltage                |  | 1.65                | 0.30                  |     | 0.62 | 0.30                   | 0.62 | 0.30                             | 0.62 | V    |
|                 |                                   |  | 2.3                 | 0.40                  |     | 0.8  | 0.40                   | 0.8  | 0.40                             | 0.8  |      |
|                 |                                   |  | 3.0                 | 0.53                  |     | 0.87 | 0.53                   | 0.87 | 0.53                             | 0.87 |      |
|                 |                                   |  | 4.5                 | 0.71                  |     | 1.04 | 0.71                   | 1.04 | 0.71                             | 1.04 |      |
|                 |                                   |  | 5.5                 | 0.8                   |     | 1.2  | 0.8                    | 1.2  | 0.8                              | 1.2  |      |
| V <sub>OH</sub> | Minimum High-Level Output Voltage | V <sub>IN</sub> = V <sub>T-MIN</sub> or V <sub>T+MAX</sub><br>I <sub>OH</sub> = -50 μA | 1.65 – 5.5          | V <sub>CC</sub> – 0.1 |     |      | V <sub>CC</sub> – 0.1  |      | V <sub>CC</sub> – 0.1            |      | V    |
|                 |                                   | V <sub>IN</sub> = V <sub>T-MIN</sub> or V <sub>T+MAX</sub>                             |                     |                       |     |      |                        |      |                                  |      |      |
|                 |                                   | I <sub>OH</sub> = -4 mA  | 1.65                | 1.2                   |     |      | 1.2                    |      | 1.2                              |      |      |
|                 |                                   | I <sub>OH</sub> = -8 mA  | 2.3                 | 1.9                   |     |      | 1.9                    |      | 1.9                              |      |      |
|                 |                                   | I <sub>OH</sub> = -16 mA   | 3.0                 | 2.4                   |     |      | 2.4                    |      | 2.4                              |      |      |
|                 |                                   | I <sub>OH</sub> = -24 mA   | 3.0                 | 2.3                   |     |      | 2.3                    |      | 2.3                              |      |      |
|                 |                                   | I <sub>OH</sub> = -32 mA   | 4.5                 | 3.8                   |     |      | 3.8                    |      | 3.8                              |      |      |
| V <sub>OL</sub> | Maximum Low-Level Output Voltage  | V <sub>IN</sub> = V <sub>T-MIN</sub> or V <sub>T+MAX</sub><br>I <sub>OL</sub> = 50 μA  | 1.65 – 5.5          |                       |     | 0.1  |                        | 0.1  |                                  | 0.1  | V    |
|                 |                                   | V <sub>IN</sub> = V <sub>T-MIN</sub> or V <sub>T+MAX</sub>                             |                     |                       |     |      |                        |      |                                  |      |      |
|                 |                                   | I <sub>OL</sub> = 4 mA   | 1.65                |                       |     | 0.45 |                        | 0.45 |                                  | 0.45 |      |
|                 |                                   | I <sub>OL</sub> = 8 mA   | 2.3                 |                       |     | 0.3  |                        | 0.3  |                                  | 0.3  |      |
|                 |                                   | I <sub>OL</sub> = 16 mA  | 3.0                 |                       |     | 0.4  |                        | 0.4  |                                  | 0.4  |      |
|                 |                                   | I <sub>OL</sub> = 24 mA  | 3.0                 |                       |     | 0.55 |                        | 0.55 |                                  | 0.55 |      |
|                 |                                   | I <sub>OL</sub> = 32 mA  | 4.5                 |                       |     | 0.55 |                        | 0.55 |                                  | 0.55 |      |
| I <sub>IN</sub> | Input Leakage Current             | 0 ≤ V <sub>IN</sub> ≤ 5.5 V  | 0 to 5.5            |                       |     | ±0.1 |                        | ±1.0 |                                  | μA   |      |
| I <sub>CC</sub> | Quiescent Supply Current          | V <sub>IN</sub> = V <sub>CC</sub> or GND   | 5.5                 |                       |     | 1.0  |                        | 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.

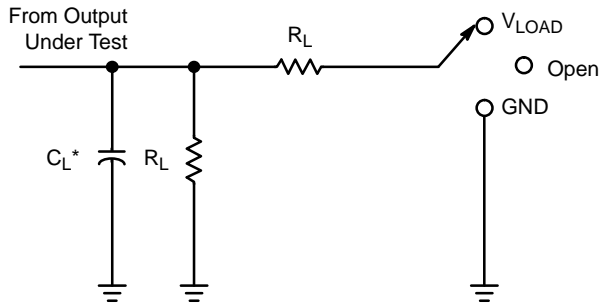
# NLX1G97

## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

| Symbol                   | Parameter   | $V_{CC}$ (V) | Test Condition | $T_A = 25^\circ\text{C}$ |     |      | $T_A \leq +85^\circ\text{C}$ |      | $T_A = -55^\circ\text{C}$<br>to $+125^\circ\text{C}$ |      | Unit |
|--------------------------|---|--------------|----------------|--------------------------|-----|------|------------------------------|------|--|------|------|
|                          |   |              |                | Min                      | Typ | Max  | Min                          | Max  | Min  | Max  |      |
| $t_{PLH}$ ,<br>$t_{PHL}$ | Propagation Delay,<br>Any Input to Output<br>Y (See Test Circuit) | 1.65 – 1.95  |                | 3.2                      | 8.6 | 14.4 | 3.2                          | 14.4 | 3.2  | 14.4 | ns   |
|                          |   |              |                | 2.0                      | 5.1 | 8.3  | 2.0                          | 8.3  | 2.0  | 8.3  |      |
|                          |   |              |                | 1.5                      | 3.9 | 6.3  | 1.5                          | 6.3  | 1.5  | 6.3  |      |
|                          |   |              |                | 1.1                      | 3.3 | 5.1  | 1.1                          | 5.1  | 1.1  | 5.1  |      |
| $C_{IN}$                 | Input Capacitance   |              |                | 3.5                      |     |      |                              |      |  | pF   |      |
| $C_{PD}$                 | Power Dissipation<br>Capacitance<br>(Note 6)                      | 5.0          | $f = 10$ MHz   |                          | 22  |      |                              |      |  | pF   |      |

6.  $C_{PD}$  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:  $P_D = C_{PD} \cdot V_{CC}^2 \cdot f_{in} + I_{CC} \cdot V_{CC}$ .

## TEST CIRCUIT AND VOLTAGE WAVEFORMS



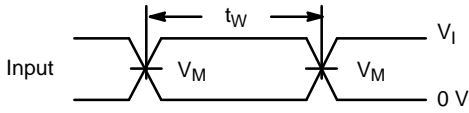
| Test              | S1         |
|-------------------|------------|
| $t_{PLH}/t_{PHL}$ | Open       |
| $t_{PLZ}/t_{PZL}$ | $V_{LOAD}$ |
| $t_{PHZ}/t_{PZH}$ | GND        |

\* $C_L$  includes probes and jig capacitance.

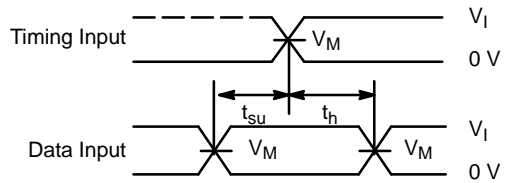
Figure 9. Load Circuit

| $V_{CC}$                         | Inputs   |               | $V_M$      | $V_{LOAD}$        | $C_L$ | $R_L$        | $V_A$  |
|----------------------------------|----------|---------------|------------|-------------------|-------|--------------|--------|
|                                  | $V_I$    | $t_r/t_f$     |            |                   |       |              |        |
| $1.8\text{ V} \pm 0.15\text{ V}$ | $V_{CC}$ | $\leq 2$ ns   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k $\Omega$ | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$  | $V_{CC}$ | $\leq 2$ ns   | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 $\Omega$ | 0.15 V |
| $3.3\text{ V} \pm 0.3\text{ V}$  | 3 V      | $\leq 2.5$ ns | 1.5 V      | 6 V               | 50 pF | 500 $\Omega$ | 0.3 V  |
| $5.5\text{ V} \pm 0.5\text{ V}$  | $V_{CC}$ | $\leq 2.5$ ns | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 $\Omega$ | 0.3 V  |

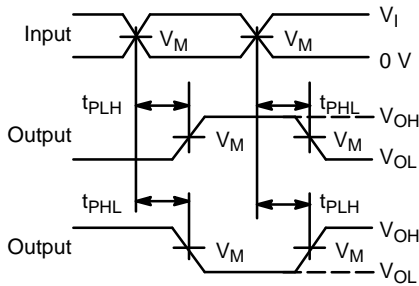
# NLX1G97



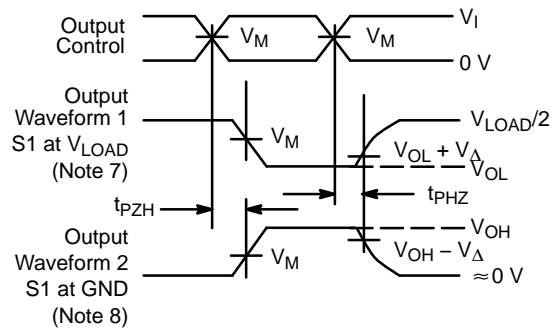
**Figure 10. Voltage Waveforms Pulse Duration**



**Figure 11. Voltage Waveforms Setup and Hold Times**



**Figure 12. Voltage Waveforms Propagation Delay Times Inverting and Noninverting Outputs**



**Figure 13. Voltage Waveforms Enable and Disable Times Low- and High-Level Enabling**

7. Waveform 1 is for an output with internal conditions such that the output is low, except when disabled by the output control.
8. Waveform 2 is for an output with internal conditions such that the output is high, except when disabled by the output control
9. All input pulses are supplied by generators having the following characteristics:  $PRR \leq 10 \text{ MHz}$ ,  $Z_O = 50 \Omega$ .
10. The outputs are measured one at a time, with one transition per measurement.
11. All parameters are waveforms are not applicable to all devices.

## ORDERING INFORMATION

| Device                            | Package                              | Shipping†          |
|-----------------------------------|--------------------------------------|--------------------|
| NLX1G97MUTCG                      | UDFN6, 1.2 x 1.0, 0.4P<br>(Pb-Free)  | 3000 / Tape & Reel |
| NLX1G97AMUTCG<br>(In Development) | UDFN6, 1.45 x 1.0, 0.5P<br>(Pb-Free) | 3000 / Tape & Reel |
| NLX1G97CMUTCG<br>(In Development) | UDFN6, 1.0 x 1.0, 0.35P<br>(Pb-Free) | 3000 / Tape & Reel |

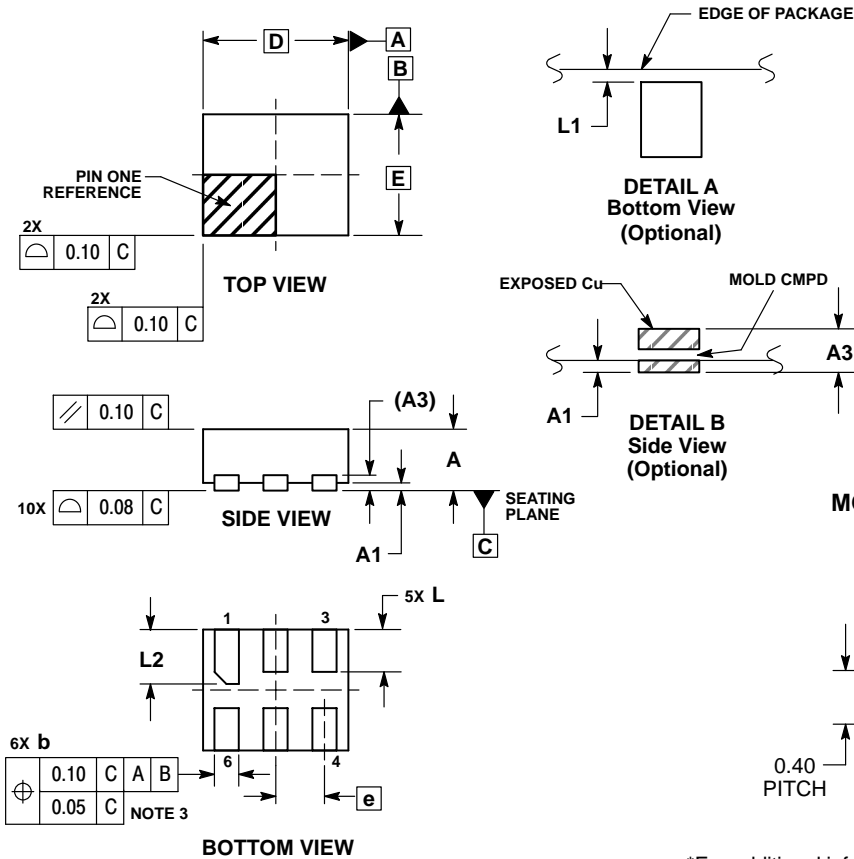
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



# NLX1G97

## PACKAGE DIMENSIONS

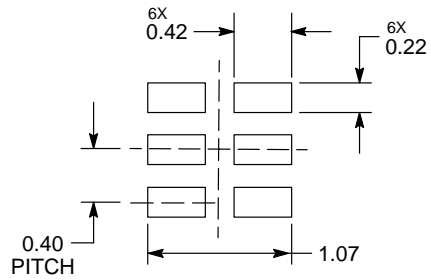
UDFN6, 1.2x1.0, 0.4P  
CASE 517AA-01  
ISSUE D



- 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.

| MILLIMETERS |       |      |
|-------------|-------|------|
| DIM         | MIN   | MAX  |
| A           | 0.45  | 0.55 |
| A1          | 0.00  | 0.05 |
| A3          | 0.127 | REF  |
| b           | 0.15  | 0.25 |
| D           | 1.20  | BSC  |
| E           | 1.00  | BSC  |
| e           | 0.40  | BSC  |
| L           | 0.30  | 0.40 |
| L1          | 0.00  | 0.15 |
| L2          | 0.40  | 0.50 |

### MOUNTING FOOTPRINT\*



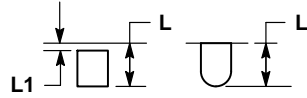
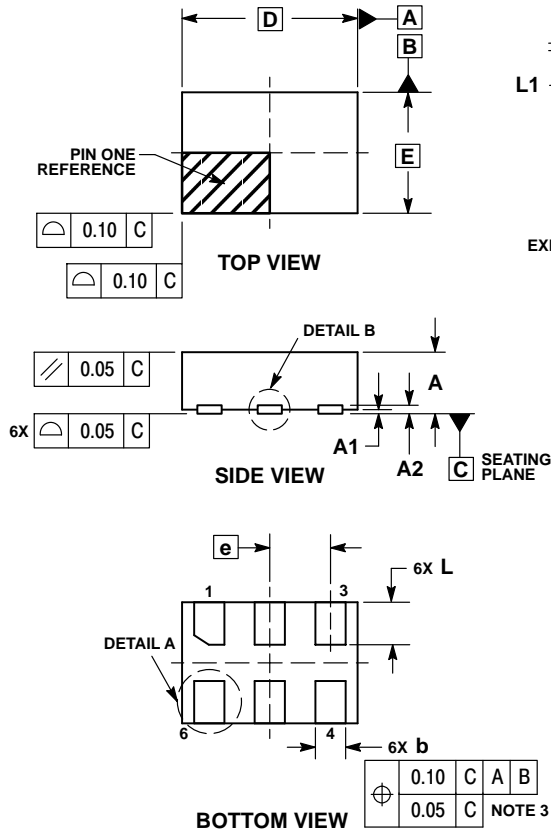
DIMENSIONS: MILLIMETERS

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

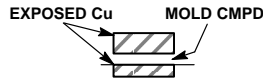
# NLX1G97

## PACKAGE DIMENSIONS

UDFN6 1.45x1.0, 0.5P  
CASE 517AQ  
ISSUE O



**DETAIL A**  
OPTIONAL  
CONSTRUCTIONS



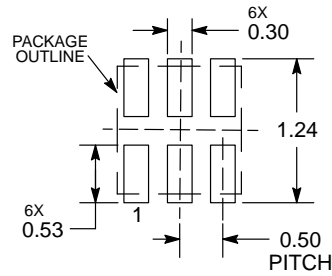
**DETAIL B**  
OPTIONAL  
CONSTRUCTIONS

**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 0.15 AND 0.30 mm FROM THE TERMINAL TIP.

| DIM | MILLIMETERS |      |
|-----|-------------|------|
|     | MIN         | MAX  |
| A   | 0.45        | 0.55 |
| A1  | 0.00        | 0.05 |
| A2  | 0.07 REF    |      |
| b   | 0.20        | 0.30 |
| D   | 1.45 BSC    |      |
| E   | 1.00 BSC    |      |
| e   | 0.50 BSC    |      |
| L   | 0.30        | 0.40 |
| L1  | ---         | 0.15 |

### MOUNTING FOOTPRINT



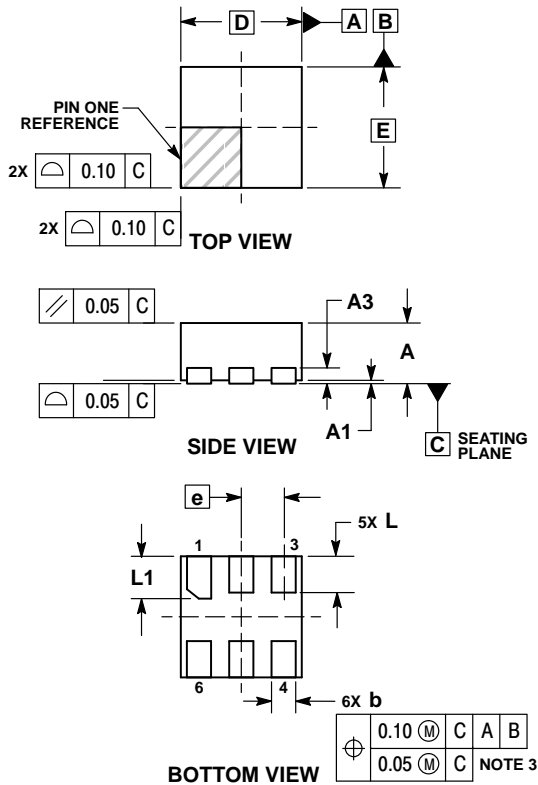
DIMENSIONS: MILLIMETERS

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

# NLX1G97

## PACKAGE DIMENSIONS

UDFN6 1.0x1.0, 0.35P  
CASE 517BX  
ISSUE O

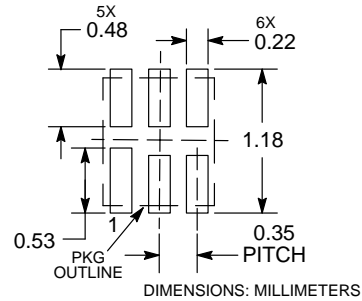


**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

| MILLIMETERS |          |      |
|-------------|----------|------|
| DIM         | MIN      | MAX  |
| A           | 0.45     | 0.55 |
| A1          | 0.00     | 0.05 |
| A3          | 0.13 REF |      |
| b           | 0.12     | 0.22 |
| D           | 1.00 BSC |      |
| E           | 1.00 BSC |      |
| e           | 0.35 BSC |      |
| L           | 0.25     | 0.35 |
| L1          | 0.30     | 0.40 |

**RECOMMENDED 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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