

ON Semiconductor

Is Now



To learn more about onsemi™, please visit our website at
www.onsemi.com

onsemi and **onsemi** and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi** product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner. Other names and brands may be claimed as the property of others.

NLX1G97

Configurable Multifunction Gate

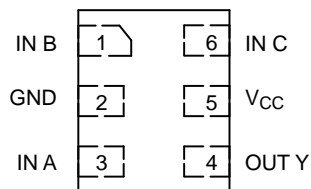
The NLX1G97 MiniGate™ is an advanced high-speed CMOS multifunction gate. The device allows the user to choose logic functions MUX, AND, OR, NAND, NOR, INVERT and BUFFER. The device has Schmitt-trigger inputs, thereby enhancing noise immunity.

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

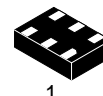
MARKING DIAGRAMS



UDFN6
1.0 x 1.0
CASE 517BX



UDFN6
1.2 x 1.0
CASE 517AA



UDFN6
1.45 x 1.0
CASE 517AQ



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

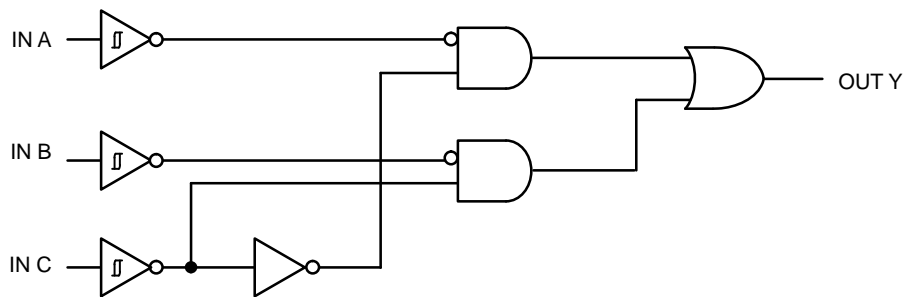


Figure 1. Function Diagram

PIN ASSIGNMENT

| | |
|---|-----------------|
| 1 | IN B |
| 2 | GND |
| 3 | IN A |
| 4 | OUT Y |
| 5 | V _{CC} |
| 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

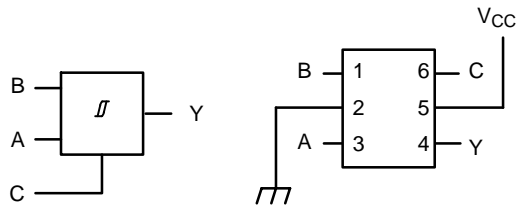


Figure 2. 2-Input MUX

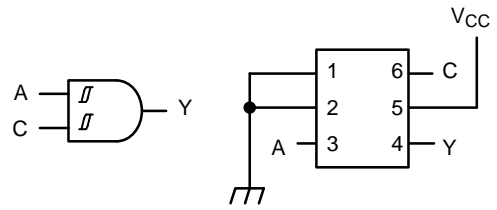


Figure 3. 2-Input AND (When B = "L")

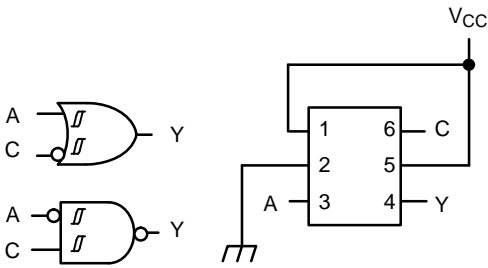


Figure 4. 2-Input OR with Input C Inverted (When B = "H")

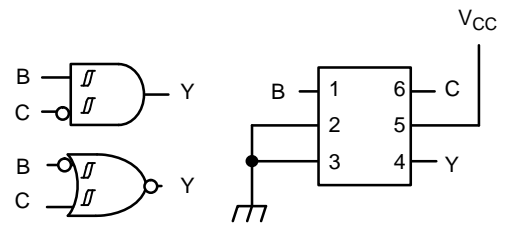


Figure 5. 2-Input AND with Input C Inverted (When A = "L")

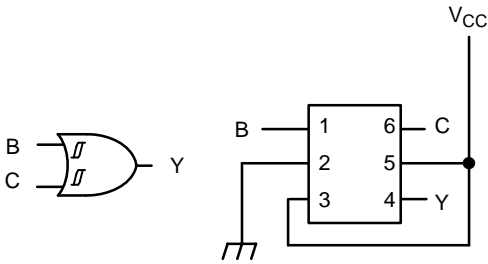


Figure 6. 2-Input OR (When A = "H")

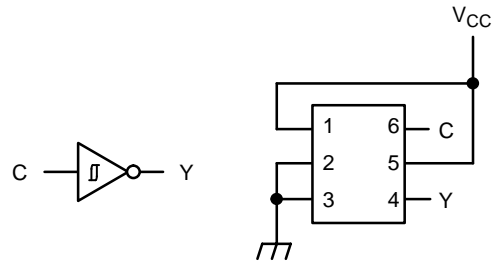


Figure 7. Inverter (When A = "L" and B = "H")

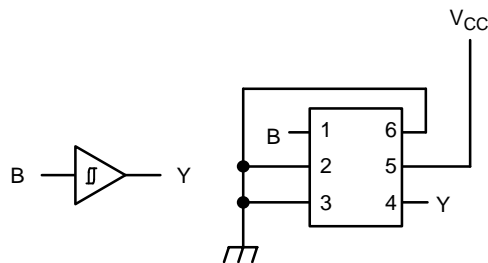


Figure 8. Buffer (When A = C = "L")

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 $V_{IN} < GND$ | -50 | mA |
| I_{OK} | DC Output Diode Current $V_{OUT} < GND$ | -50 | mA |
| I_O | DC Output Source/Sink Current | ± 50 | mA |
| I_{CC} | DC Supply Current Per Supply Pin | ± 100 | mA |
| I_{GND} | DC Ground Current per Ground Pin | ± 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 Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4) | >2000 >200 N/A | V |
| $I_{LATCHUP}$ | Latchup Performance Above V_{CC} and Below GND at 125°C (Note 5) | ± 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 $V_{CC} = 2.5 \text{ V} \pm 0.2 \text{ V}$ $V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$ | 0 0 0 | No Limit No Limit 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 _{CC} (V) | T _A = 25°C | | | T _A ≤ +85°C | | T _A = -55°C to +125°C | | Unit |
|-----------------|-----------------------------------|--|------------------------|-----------------------|-----|------|------------------------|------|----------------------------------|------|------|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| V _{T+} | 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 _{T-} | 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 _H | 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 _{OH} | Minimum High-Level Output Voltage | V _{IN} = V _{T-MIN} or V _{T+MAX} I _{OH} = -50 μA | 1.65 – 5.5 | V _{CC} – 0.1 | | | V _{CC} – 0.1 | | V _{CC} – 0.1 | | V |
| | | V _{IN} = V _{T-MIN} or V _{T+MAX} | | | | | | | | | |
| | | I _{OH} = -4 mA | 1.65 | 1.2 | | | 1.2 | | 1.2 | | |
| | | I _{OH} = -8 mA | 2.3 | 1.9 | | | 1.9 | | 1.9 | | |
| | | I _{OH} = -16 mA | 3.0 | 2.4 | | | 2.4 | | 2.4 | | |
| | | I _{OH} = -24 mA | 3.0 | 2.3 | | | 2.3 | | 2.3 | | |
| | | I _{OH} = -32 mA | 4.5 | 3.8 | | | 3.8 | | 3.8 | | |
| V _{OL} | Maximum Low-Level Output Voltage | V _{IN} = V _{T-MIN} or V _{T+MAX} I _{OL} = 50 μA | 1.65 – 5.5 | | | 0.1 | | 0.1 | | 0.1 | V |
| | | V _{IN} = V _{T-MIN} or V _{T+MAX} | | | | | | | | | |
| | | I _{OL} = 4 mA | 1.65 | | | 0.45 | | 0.45 | | 0.45 | |
| | | I _{OL} = 8 mA | 2.3 | | | 0.3 | | 0.3 | | 0.3 | |
| | | I _{OL} = 16 mA | 3.0 | | | 0.4 | | 0.4 | | 0.4 | |
| | | I _{OL} = 24 mA | 3.0 | | | 0.55 | | 0.55 | | 0.55 | |
| | | I _{OL} = 32 mA | 4.5 | | | 0.55 | | 0.55 | | 0.55 | |
| I _{IN} | Input Leakage Current | 0 ≤ V _{IN} ≤ 5.5 V | 0 to 5.5 | | | ±0.1 | | ±1.0 | | ±1.0 | μA |
| I _{CC} | Quiescent Supply Current | V _{IN} = V _{CC} or GND | 5.5 | | | 1.0 | | 10 | | 10 | μA |

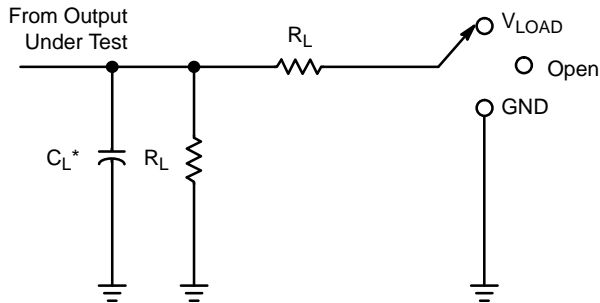
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

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

| Symbol | Parameter | V_{CC} (V) | Test Condition | $T_A = 25^\circ\text{C}$ | | | $T_A \leq +85^\circ\text{C}$ | | $T_A = -55^\circ\text{C}$ to $+125^\circ\text{C}$ | | Unit |
|--------------------------|---|--------------|----------------|--------------------------|-----|------|------------------------------|------|--|------|------|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| t_{PLH} , t_{PHL} | Propagation Delay, Any Input to Output Y (See Test Circuit) | 1.65 – 1.95 | | 3.2 | 8.6 | 14.4 | 3.2 | 14.4 | 3.2 | 14.4 | ns |
| | | 2.3 – 2.7 | | 2.0 | 5.1 | 8.3 | 2.0 | 8.3 | 2.0 | 8.3 | |
| | | 3.0 – 3.6 | | 1.5 | 3.9 | 6.3 | 1.5 | 6.3 | 1.5 | 6.3 | |
| | | 4.5 – 5.5 | | 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 Capacitance (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} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 1 k Ω | 0.15 V |
| $2.5\text{ V} \pm 0.2\text{ V}$ | V_{CC} | $\leq 2\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 30 pF | 500 Ω | 0.15 V |
| $3.3\text{ V} \pm 0.3\text{ V}$ | 3 V | $\leq 2.5\text{ ns}$ | 1.5 V | 6 V | 50 pF | 500 Ω | 0.3 V |
| $5.5\text{ V} \pm 0.5\text{ V}$ | V_{CC} | $\leq 2.5\text{ ns}$ | $V_{CC}/2$ | $2 \times V_{CC}$ | 50 pF | 500 Ω | 0.3 V |

NLX1G97

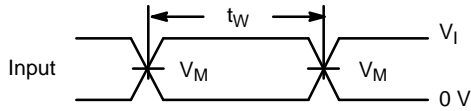


Figure 10. Voltage Waveforms Pulse Duration

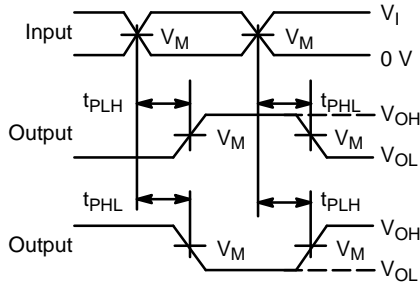


Figure 12. Voltage Waveforms Propagation Delay Times Inverting and Noninverting Outputs

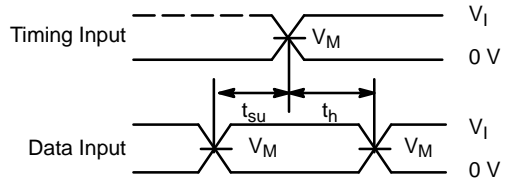


Figure 11. Voltage Waveforms Setup and Hold Times

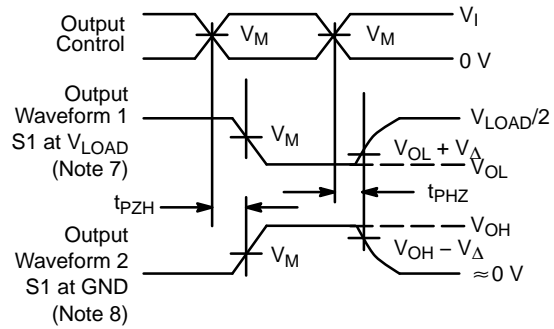


Figure 13. Voltage Waveforms Enable and Disable Times Low- and High-Level Enabling

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

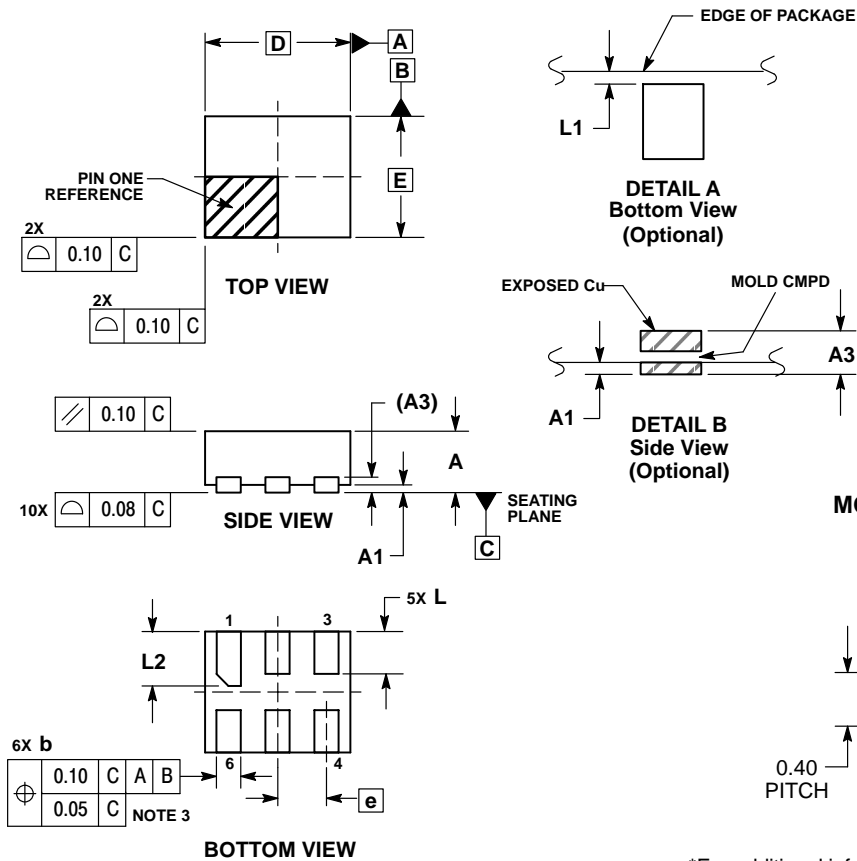
| Device | Package | Shipping† |
|-----------------------------------|--------------------------------------|--------------------|
| NLX1G97MUTCG | UDFN6, 1.2 x 1.0, 0.4P (Pb-Free) | 3000 / Tape & Reel |
| NLX1G97AMUTCG (In Development) | UDFN6, 1.45 x 1.0, 0.5P (Pb-Free) | 3000 / Tape & Reel |
| NLX1G97CMUTCG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

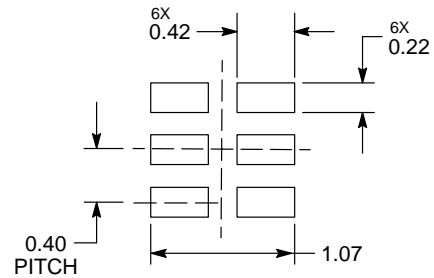


NOTES:

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*



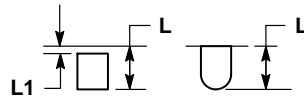
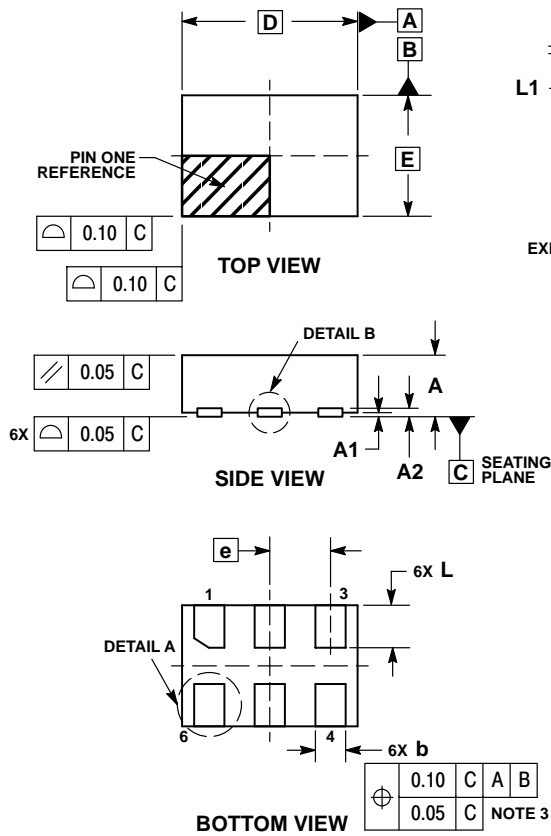
DIMENSIONS: MILLIMETERS

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

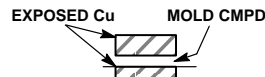
NLX1G97

PACKAGE DIMENSIONS

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



DETAIL A
OPTIONAL
CONSTRUCTIONS



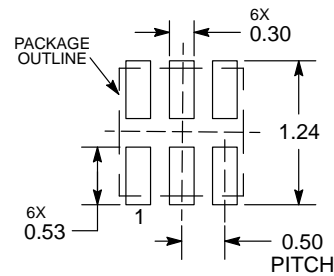
DETAIL B
OPTIONAL
CONSTRUCTIONS

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.

| MILLIMETERS | | |
|-------------|------|------|
| DIM | 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.

