# NLX2G14

# Dual Schmitt-Trigger Inverter

The NLX2G14 MiniGate™ is an advanced high−speed CMOS dual Schmitt−trigger inverter in ultra−small footprint.

The NLX2G14 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

The NLX2G14 can be used to enhance noise immunity or to square up slowly changing waveforms.

### Features

- Designed for 1.65 V to 5.5 V $V_{CC}$ Operation
- Low Power Dissipation: $I_{CC}$ = 1 μA (Max) at $T_A$ = 25°C
- 24 Balanced Output Source and Sink Capability
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra−Small Packages
- These are Pb−Free Devices

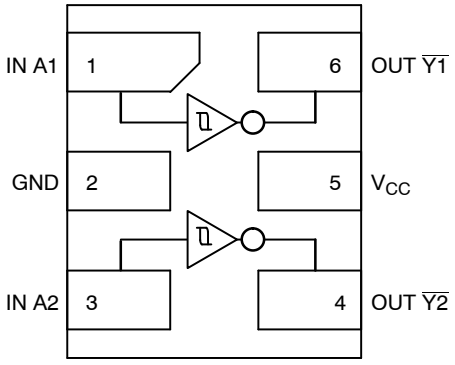



**Figure 1. Pinout** (Top View)

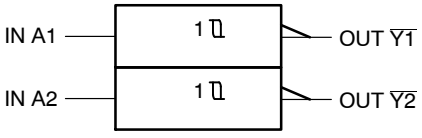



**Figure 2. Logic Symbol**

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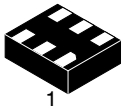
**http://onsemi.com**

**MARKING DIAGRAMS**



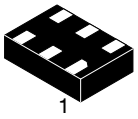
**ULLGA6**
**1.0 x 1.0**
**CASE 613AD**



**ULLGA6**
**1.2 x 1.0**
**CASE 613AE**



**ULLGA6**
**1.45 x 1.0**
**CASE 613AF**




T = Device Marking*
M = Date Code
* Rotated 90° clockwise

**PIN ASSIGNMENT**

| | |
|---|---|
| 1 | IN A1 |
| 2 | GND |
| 3 | IN A2 |
| 4 | OUT $\overline{Y2}$ |
| 5 | $V_{CC}$ |
| 6 | OUT $\overline{Y1}$ |

**FUNCTION TABLE**

| **A** | **$\overline{Y}$** |
|---|---|
| L | H |
| H | L |

**ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 5 of this data sheet.

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## 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 | |
| $I_{LATCHUP}$ | Latchup Performance Above $V_{CC}$ 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 no air flow.
2. Tested to EIA/JESD22−A114−A.
3. Tested to EIA/UESD22−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 | $V_{CC}$ = 3.3 V ± 0.3 V<br>$V_{CC}$ = 5.0 V ± 0.5 V | 0<br>0 | No Limit<br>No Limit | ns/V |

**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<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5 | 0.6<br>1.0<br>1.2<br>1.3<br>1.9<br>2.2 | 1.0<br>1.5<br>1.7<br>1.9<br>2.7<br>3.3 | 1.4<br>1.8<br>2.0<br>2.2<br>3.1<br>3.6 | 0.6<br>1.0<br>1.2<br>1.3<br>1.9<br>2.2 | 1.4<br>1.8<br>2.0<br>2.2<br>3.1<br>3.6 | 0.6<br>1.0<br>1.2<br>1.3<br>1.9<br>2.2 | 1.4<br>1.8<br>2.0<br>2.2<br>3.1<br>3.6 | V |
| $V_{T-}$ | Negative Threshold Voltage | | 1.65<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5 | 0.2<br>0.4<br>0.5<br>0.6<br>1.0<br>1.2 | 0.5<br>0.75<br>0.87<br>1.0<br>1.5<br>1.9 | 0.8<br>1.15<br>1.4<br>1.5<br>2.0<br>2.3 | 0.2<br>0.4<br>0.5<br>0.6<br>1.0<br>1.2 | 0.8<br>1.15<br>1.4<br>1.5<br>2.0<br>2.3 | 0.2<br>0.4<br>0.5<br>0.6<br>1.0<br>1.2 | 0.8<br>1.15<br>1.4<br>1.5<br>2.0<br>2.3 | V |
| $V_H$ | Hysteresis Voltage | | 1.65<br>2.3<br>2.7<br>3.0<br>4.5<br>5.5 | 0.1<br>0.25<br>0.3<br>0.4<br>0.6<br>0.7 | 0.48<br>0.75<br>0.83<br>0.93<br>1.2<br>1.4 | 0.9<br>1.1<br>1.15<br>1.2<br>1.5<br>1.7 | 0.1<br>0.25<br>0.3<br>0.4<br>0.6<br>0.7 | 0.9<br>1.1<br>1.15<br>1.2<br>1.5<br>1.7 | 0.1<br>0.25<br>0.3<br>0.4<br>0.6<br>0.7 | 0.9<br>1.1<br>1.15<br>1.2<br>1.5<br>1.7 | V |
| $V_{OH}$ | Minimum High−Level Output Voltage | $V_{IN} \le V_{T-MIN}$<br>$I_{OH}$ = −100 μA | 1.65−5.5 | $V_{CC}$ − 0.1 | $V_{CC}$ | | $V_{CC}$ − 0.1 | | $V_{CC}$ − 0.1 | | V |
| | | $V_{IN} \le V_{T-MIN}$<br>$I_{OH}$ = −4 mA<br>$I_{OH}$ = −8 mA<br>$I_{OH}$ = −12 mA<br>$I_{OH}$ = −16 mA<br>$I_{OH}$ = −24 mA<br>$I_{OH}$ = −32 mA | <br>1.65<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 | <br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | <br>1.52<br>2.1<br>2.4<br>2.7<br>2.5<br>4.0 | | <br>1.29<br>1.9<br>2.2<br>2.4<br>2.3<br>3.8 | | <br>1.29<br>1.8<br>2.1<br>2.3<br>2.2<br>3.7 | | |
| $V_{OL}$ | Maximum Low−Level Output Voltage | $V_{IN} \ge V_{T+MAX}$<br>$I_{OL}$ = 100 μA | 1.65−5.5 | | 0 | 0.1 | | 0.1 | | 0.1 | V |
| | | $V_{IN} \ge V_{T+MAX}$<br>$I_{OH}$ = −4 mA<br>$I_{OH}$ = −8 mA<br>$I_{OH}$ = −12 mA<br>$I_{OH}$ = −16 mA<br>$I_{OH}$ = −24 mA<br>$I_{OH}$ = −32 mA | <br>1.65<br>2.3<br>2.7<br>3.0<br>3.0<br>4.5 | <br><br><br><br><br><br> | <br>0.08<br>0.2<br>0.22<br>0.28<br>0.38<br>0.42 | <br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | <br><br><br><br><br><br> | <br>0.24<br>0.3<br>0.4<br>0.4<br>0.55<br>0.55 | <br><br><br><br><br><br> | <br>0.24<br>0.4<br>0.5<br>0.5<br>0.55<br>0.65 | |
| $I_{IN}$ | Input Leakage Current | 0 ≤ $V_{IN}$ ≤ 5.5 V | 0 to 5.5 | | | ±0.1 | | ±1.0 | | ±1.0 | μA |
| $I_{OFF}$ | Power−Off Output Leakage Current | $V_{OUT}$ = 5.5 V | 0 | | | 1.0 | | 10 | | 10 | μA |
| $I_{CC}$ | Quiescent Supply Current | 0 ≤ $V_{IN}$ ≤ $V_{CC}$ | 5.5 | | | 1.0 | | 10 | | 10 | μA |

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

| Symbol | Parameter | $V_{CC}$ (V) | Test Condition | $T_A$ = 25 °C | | | $T_A$ = +85°C | | $T_A$ = −55°C to +125°C | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Min | Typ | Max | Min | Max | Min | Max | |
| $t_{PLH}$, $t_{PHL}$ | Propagation Delay, Input A to Output $\overline{Y}$ | 2.3–2.7 | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 1.8 | 4.3 | 7.4 | 1.8 | 8.1 | 1.8 | 9.1 | ns |
| | | 3.0–3.6 | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 1.5 | 3.3 | 5.0 | 1.5 | 5.5 | 1.5 | 6.5 | |
| | | | $R_L$ = 500 Ω, $C_L$ = 50 pF | 1.8 | 4.0 | 6.0 | 1.8 | 6.6 | 1.8 | 7.6 | |
| | | 4.5–5.5 | $R_L$ = 1 MΩ, $C_L$ = 15 pF | 1.0 | 2.7 | 4.1 | 1.0 | 4.5 | 1.0 | 5.5 | |
| | | | $R_L$ = 500 Ω, $C_L$ = 50 pF | 1.2 | 3.2 | 4.9 | 1.2 | 5.4 | 1.2 | 6.4 | |
| $C_{IN}$ | Input Capacitance | 5.5 | $V_{IN}$ = 0 V or $V_{CC}$ | | 2.5 | | | | | | pF |
| $C_{PD}$ | Power Dissipation Capacitance (Note 6) | 3.3<br>5.5 | 10 MHz<br>$V_{IN}$ = 0 V or $V_{CC}$ | | 11<br>12.5 | | | | | | 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 $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. $C_{PD}$ is used to determine the no−load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

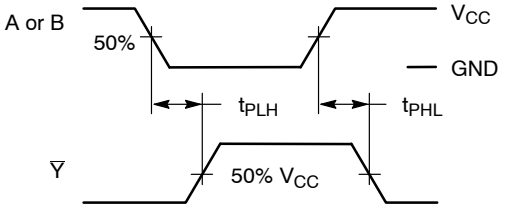
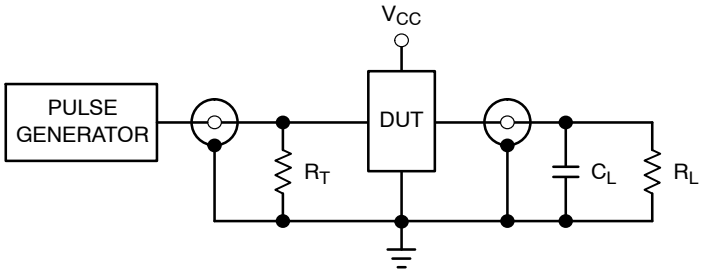



**Figure 3. Switching Waveforms**




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

**Figure 4. Test Circuit**

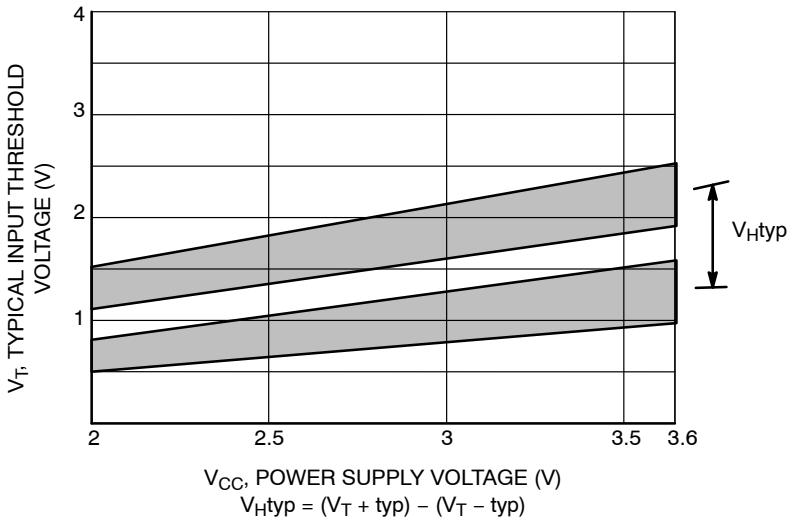
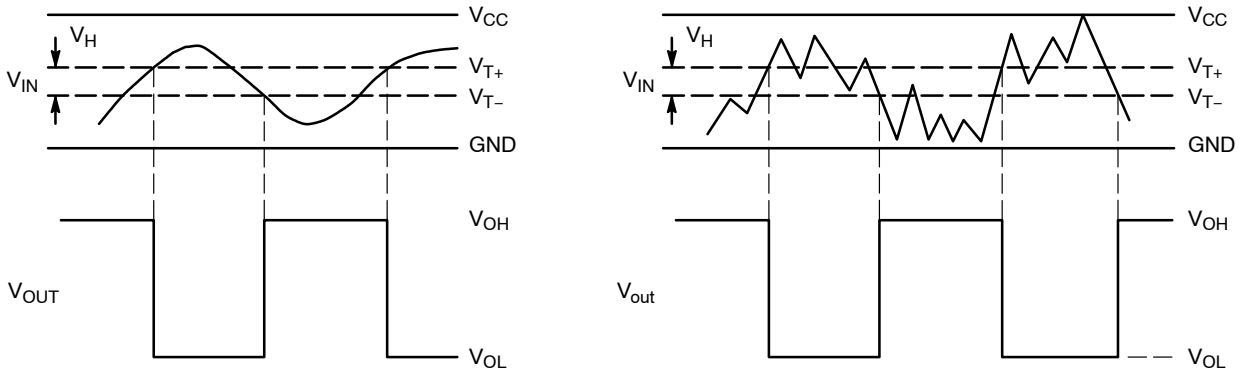



**Figure 5. Typical Input Threshold, $V_{T+}$, $V_{T-}$ versus Power Supply Voltage**




(a) A Schmitt−Trigger Squares Up Inputs With Slow Rise and Fall Times

(b) A Schmitt−Trigger Offers Maximum Noise Immunity

**Figure 6. Typical Schmitt−Trigger Applications**

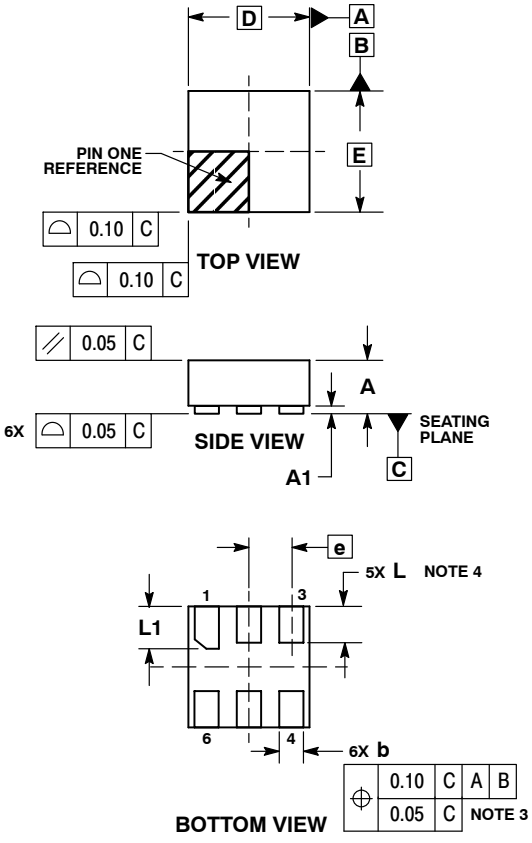
## ORDERING INFORMATION

| Device | Package | Shipping† |
|---|---|---|
| NLX2G14AMX1TCG | ULLGA6, 1.45 x 1.0, 0.5P (Pb−Free) | 3000 / Tape & Reel |
| NLX2G14BMX1TCG | ULLGA6, 1.2 x 1.0, 0.4P (Pb−Free) | 3000 / Tape & Reel |
| NLX2G14CMX1TCG | ULLGA6, 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.

## PACKAGE DIMENSIONS

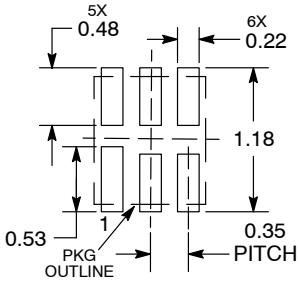
**ULLGA6 1.0x1.0, 0.35P**
CASE 613AD−01
ISSUE A




NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. DIMENSION b 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 PACKAGE IS ALLOWED.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | −−− | 0.40 |
| A1 | 0.00 | 0.05 |
| 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 |

### MOUNTING FOOTPRINT SOLDERMASK DEFINED*

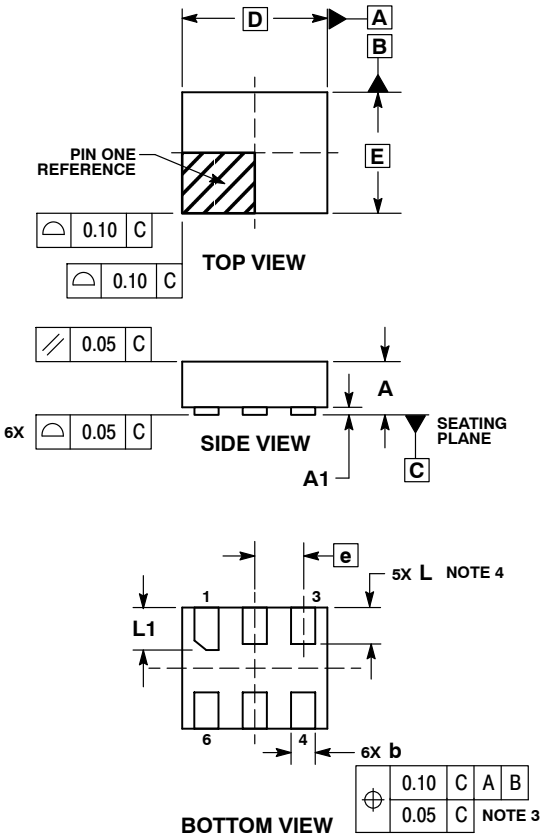



DIMENSIONS: MILLIMETERS

*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

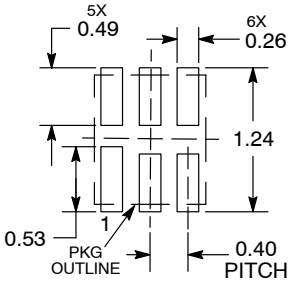
**ULLGA6 1.2x1.0, 0.4P**
CASE 613AE−01
ISSUE A




NOTES:
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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.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | ---- | 0.40 |
| A1 | 0.00 | 0.05 |
| b | 0.15 | 0.25 |
| D | 1.20 BSC | |
| E | 1.00 BSC | |
| e | 0.40 BSC | |
| L | 0.25 | 0.35 |
| L1 | 0.35 | 0.45 |

**MOUNTING FOOTPRINT SOLDERMASK DEFINED***

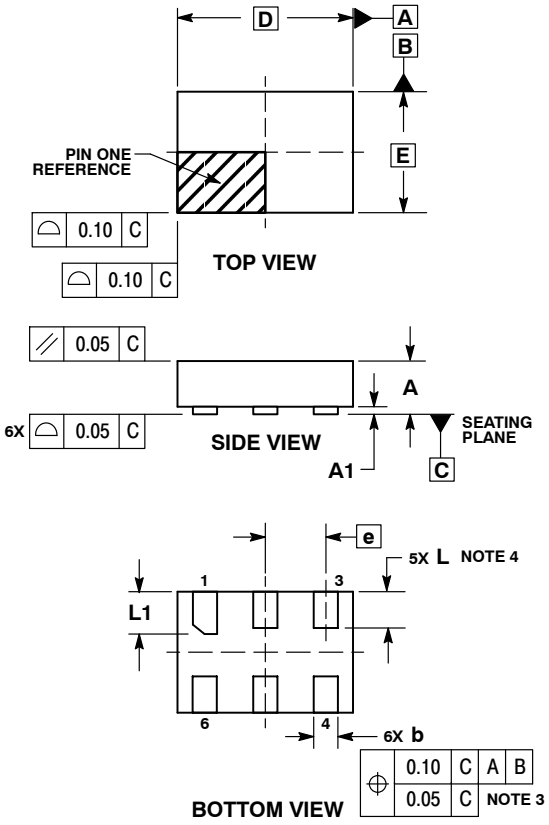



DIMENSIONS: MILLIMETERS

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## PACKAGE DIMENSIONS

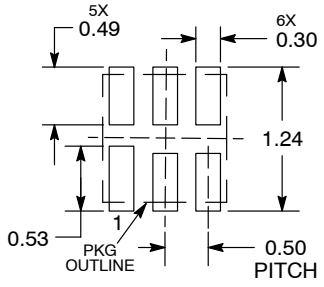
**ULLGA6 1.45x1.0, 0.5P**
CASE 613AF−01
ISSUE A




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.
4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

| | MILLIMETERS | |
|---|---|---|
| DIM | MIN | MAX |
| A | −−− | 0.40 |
| A1 | 0.00 | 0.05 |
| b | 0.15 | 0.25 |
| D | 1.45 BSC | |
| E | 1.00 BSC | |
| e | 0.50 BSC | |
| L | 0.25 | 0.35 |
| L1 | 0.30 | 0.40 |

**MOUNTING FOOTPRINT SOLDERMASK DEFINED***




DIMENSIONS: MILLIMETERS

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**NLX2G14/D**