

NLU2GU04

Dual Unbuffered Inverter

The NLU2GU04 MiniGate™ is an advanced high-speed CMOS dual unbuffered inverter in ultra-small footprint.

This device is well suited for use in oscillator, pulse-shaping and high input impedance amplifier applications. For digital applications, the NLU2GU04 is recommended.

The NLU2GU04 input and output structures provide protection when voltages up to 7 V are applied, regardless of the supply voltage.

Features

- High Speed: $t_{PD} = 2.5 \text{ ns (Typ) @ } V_{CC} = 5.0 \text{ V}$
- Low Power Dissipation: $I_{CC} = 1 \mu\text{A (Max) at } T_A = 25^\circ\text{C}$
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Packages
- These are Pb-Free Devices

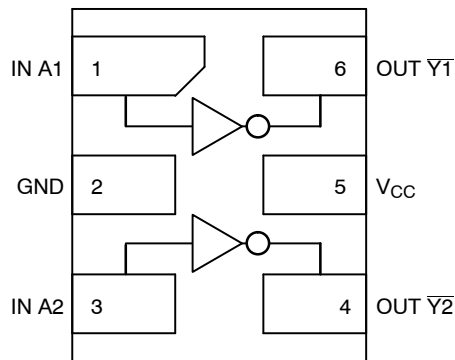


Figure 1. Pinout (Top View)

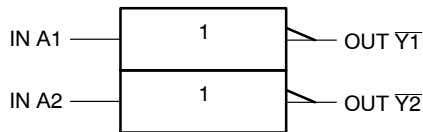


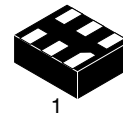
Figure 2. Logic Symbol



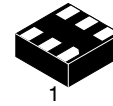
ON Semiconductor®

<http://onsemi.com>

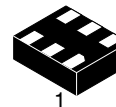
MARKING DIAGRAMS



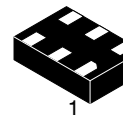
UDFN6
MU SUFFIX
CASE 517AA



ULLGA6
1.0 x 1.0
CASE 613AD



ULLGA6
1.2 x 1.0
CASE 613AE



ULLGA6
1.45 x 1.0
CASE 613AF



Z or 3 = Device Marking
M = Date Code

PIN ASSIGNMENT

| | |
|---|----------------|
| 1 | IN A1 |
| 2 | GND |
| 3 | IN A2 |
| 4 | OUT $\bar{Y}2$ |
| 5 | V_{CC} |
| 6 | OUT $\bar{Y}1$ |

FUNCTION TABLE

| A | \bar{Y} |
|---|-----------|
| L | H |
| H | L |

ORDERING INFORMATION

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

NLU2GU04

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 | -20 | mA |
| I _{OK} | DC Output Diode Current V _{OUT} < GND | ±20 | mA |
| I _O | DC Output Source/Sink Current | ±12.5 | mA |
| I _{CC} | DC Supply Current Per Supply Pin | ±25 | mA |
| I _{GND} | DC Ground Current per Ground Pin | ±25 | 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 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.

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 / 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 |
| Δt/ΔV | Input Transition Rise or Fall Rate V _{CC} = 3.3 V ± 0.3 V V _{CC} = 5.0 V ± 0.5 V | 0 0 | 100 20 | ns/V |

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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 _{IH} | Low-Level Input Voltage | | 1.65 2.3 to 5.5 | 0.85 x V _{CC} 0.80 x V _{CC} | | | 0.85 x V _{CC} 0.80 x V _{CC} | | | | V |
| V _{IL} | Low-Level Input Voltage | | 1.65 2.3 to 5.5 | | | 0.15 x V _{CC} 0.20 x V _{CC} | | 0.15 x V _{CC} 0.20 x V _{CC} | | 0.15 x V _{CC} 0.20 x V _{CC} | V |
| V _{OH} | High-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OH} = -50 μA | 2.0 3.0 4.5 | 1.9 2.9 4.4 | 2.0 3.0 4.5 | | 1.9 2.9 4.4 | | 1.9 2.9 4.4 | | V |
| | | V _{IN} = V _{IH} or V _{IL} I _{OH} = -4 mA I _{OH} = -8 mA | 3.0 4.5 | 2.58 3.94 | | | 2.48 3.80 | | 2.34 3.66 | | |
| V _{OL} | Low-Level Output Voltage | V _{IN} = V _{IH} or V _{IL} I _{OL} = 50 μA | 2.0 3.0 4.5 | | 0 0 0 | 0.1 0.1 0.1 | | 0.1 0.1 0.1 | | 0.1 0.1 0.1 | V |
| | | V _{IN} = V _{IH} or V _{IL} I _{OL} = 4 mA I _{OL} = 8 mA | 3.0 4.5 | | | 0.36 0.36 | | 0.44 0.44 | | 0.52 0.52 | |
| 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 | 0 ≤ V _{IN} ≤ V _{CC} | 5.5 | | | 1.0 | | 20 | | 40 | 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 Y | 3.0 to 3.6 | C _L = 15 pF | | 3.5 | 8.9 | | 10.5 | | 12 | ns |
| | | | C _L = 50 pF | | 4.8 | 11.4 | | 13 | | 15.5 | |
| | | 4.5 to 5.5 | C _L = 15 pF | | 2.5 | 5.5 | | 6.5 | | 8.0 | |
| | | | C _L = 50 pF | | 3.8 | 7.0 | | 8.0 | | 9.5 | |
| C _{IN} | Input Capacitance | | | | 4 | 10 | | 10 | | 10 | pF |
| C _{PD} | Power Dissipation Capacitance (Note 3) | 5.0 | | | 22 | | | | | | 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} • V_{CC} • f_{in} + I_{CC}. C_{PD} is used to determine the no-load dynamic power consumption: P_D = C_{PD} • V_{CC}² • f_{in} + I_{CC} • V_{CC}.

NLU2GU04

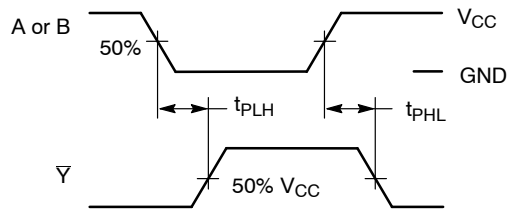
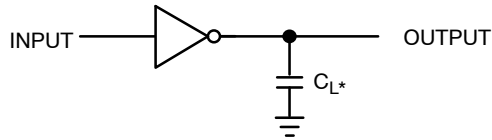


Figure 3. Switching Waveforms



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

Figure 4. Test Circuit

ORDERING INFORMATION

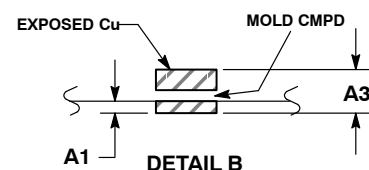
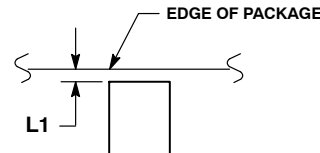
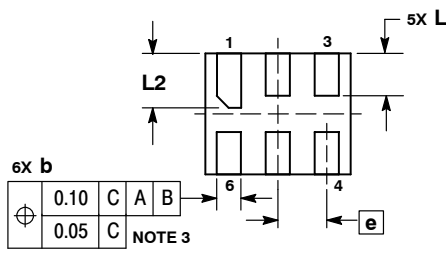
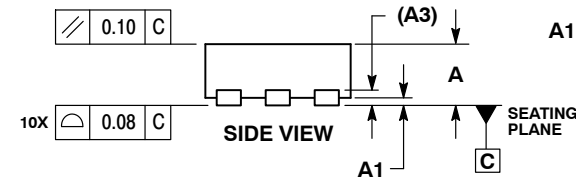
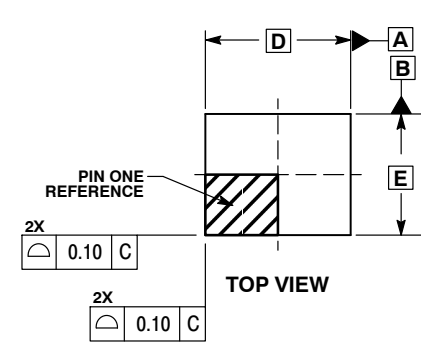
| Device | Package | Shipping [†] |
|-----------------|---------------------------------------|-----------------------|
| NLU2GU04MUTCG | UDFN6 (Pb-Free) | 3000 / Tape & Reel |
| NLU2GU04AMX1TCG | ULLGA6, 1.45 x 1.0, 0.5P (Pb-Free) | 3000 / Tape & Reel |
| NLU2GU04BMX1TCG | ULLGA6, 1.2 x 1.0, 0.4P (Pb-Free) | 3000 / Tape & Reel |
| NLU2GU04CMX1TCG | 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.

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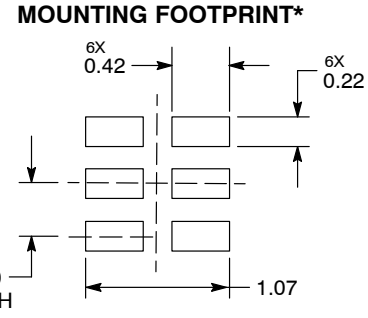
PACKAGE DIMENSIONS

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



- 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 |



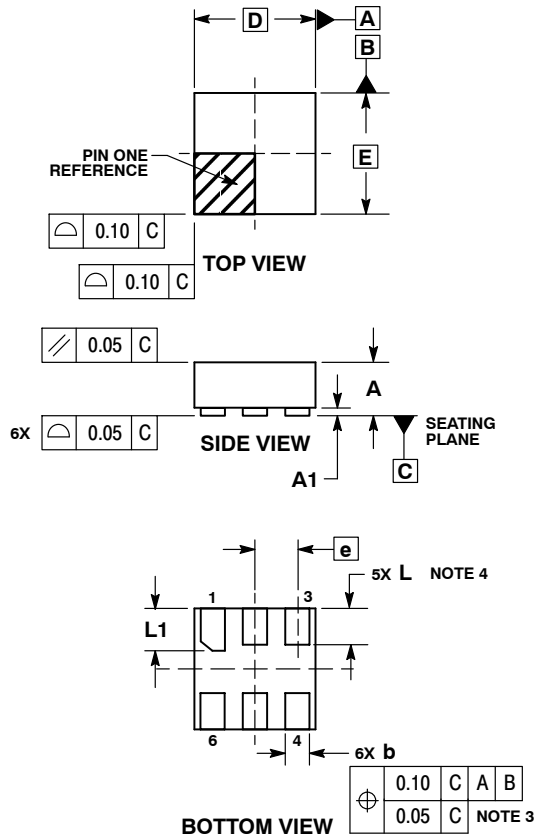
DIMENSIONS: MILLIMETERS

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

NLU2GU04

PACKAGE DIMENSIONS

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

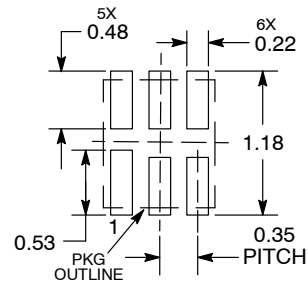


NOTES:

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*



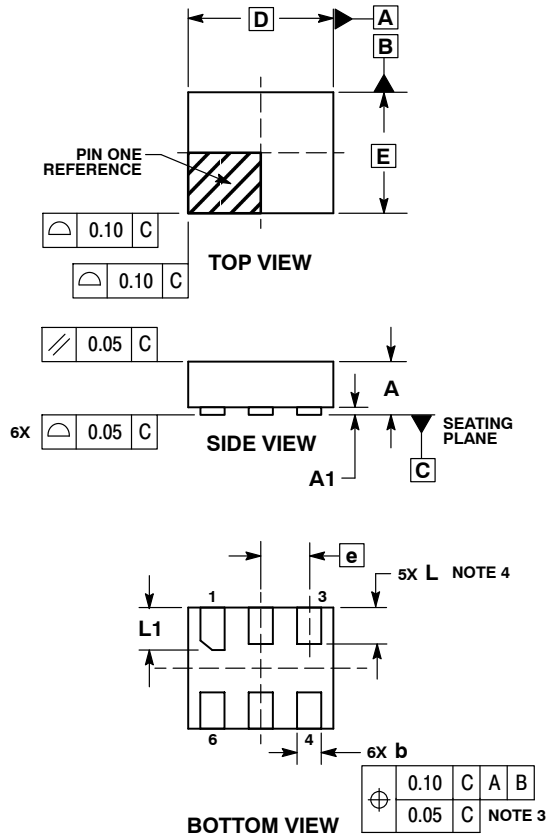
DIMENSIONS: MILLIMETERS

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PACKAGE DIMENSIONS

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

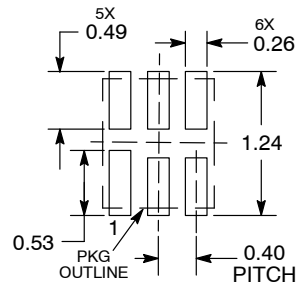


NOTES:

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| 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 SOLDEMASK DEFINED*



DIMENSIONS: MILLIMETERS

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