



# NLU1GT04

## Single Inverter, TTL Level LSTTL-Compatible Inputs

The NLU1GT04 MiniGate™ is an advanced CMOS high-speed inverting buffer in ultra-small footprint.

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

The NLU1GT04 input and output structures provide protection when voltages up to 7 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:  $I_{CC} = 1 \mu\text{A (Max) at } T_A = 25^\circ\text{C}$
- TTL-Compatible Input:  $V_{IL} = 0.8 \text{ V}$ ;  $V_{IH} = 2.0 \text{ V}$
- CMOS-Compatible Output:  
 $V_{OH} > 0.8 V_{CC}$ ;  $V_{OL} < 0.1 V_{CC}$  @ Load
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Ultra-Small Packages
- These Devices are Pb-Free, Halogen Free/BFR Free and are RoHS Compliant

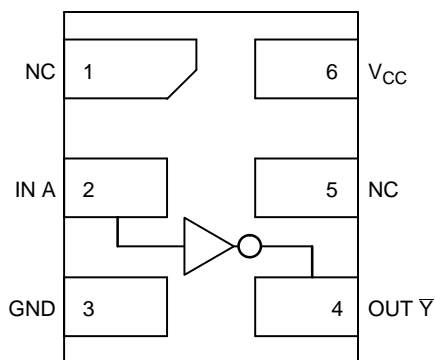


Figure 1. Pinout (Top View)

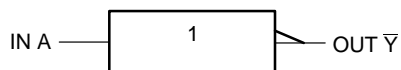


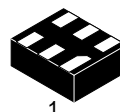
Figure 2. Logic Symbol



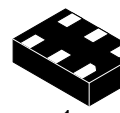
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### MARKING DIAGRAMS



UDFN6  
MU SUFFIX  
CASE 517AA



UDFN6  
MU SUFFIX  
CASE 517AQ



N or P = Device Marking  
M = Date Code

### PIN ASSIGNMENT

1	NC
2	IN A
3	GND
4	OUT $\bar{Y}$
5	NC
6	$V_{CC}$

### 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.

# NLU1GT04

## 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	
$V_{ESD}$	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 $V_{CC} = 3.3 V \pm 0.3 V$ $V_{CC} = 5.0 V \pm 0.5 V$	0 0	100 20	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.

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## 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>IH</sub>	Low-Level Input Voltage		1.8	1.2			1.2		1.2		V
			3.0	1.4			1.4		1.4		
			4.5 to 5.5	2.0			2.0		2.0		
V <sub>IL</sub>	Low-Level Input Voltage		1.8			0.3		0.3		0.3	V
			3.0			0.53		0.53		0.53	
			4.5 to 5.5			0.8		0.8		0.8	
V <sub>OH</sub>	High-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -50 μA	3.0	2.9	3.0		2.9		2.9		V
			4.5	4.4	4.5		4.4		4.4		
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OH</sub> = -2 mA I <sub>OH</sub> = -4 mA I <sub>OH</sub> = -8 mA	1.8	1.40			1.38		1.37		
			3.0	2.58			2.48		2.34		
			4.5	3.94			3.80		3.66		
V <sub>OL</sub>	Low-Level Output Voltage	V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 50 μA	3.0		0	0.1		0.1		0.1	V
			4.5		0	0.1		0.1		0.1	
		V <sub>IN</sub> = V <sub>IH</sub> or V <sub>IL</sub> I <sub>OL</sub> = 2 mA I <sub>OL</sub> = 4 mA I <sub>OL</sub> = 8 mA	1.8				0.36		0.44		
			3.0					0.44		0.52	
			4.5					0.44		0.52	
I <sub>IN</sub>	Input Leakage Current	0 ≤ V <sub>IN</sub> ≤ 5.5 V	0 to 5.5			±0.1		±1.0		±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	5.5			1.0		20		40	μA
I <sub>CC(T)</sub>	Quiescent Supply Current	V <sub>IN</sub> = 3.4 V	5.5			1.35		1.50		1.65	mA
I <sub>OPD</sub>	Output Leakage Current	V <sub>OUT</sub> = 5.5 V	0.0			0.5		5.0		10	μA

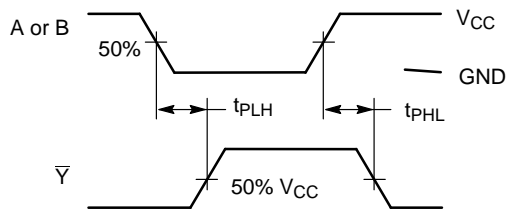
Product parametric performance is indicated in the Electrical Characteristics for the listed test conditions, unless otherwise noted. Product performance may not be indicated by the Electrical Characteristics if operated under different conditions.

## AC ELECTRICAL CHARACTERISTICS (Input t<sub>r</sub> = t<sub>f</sub> = 3.0 ns)

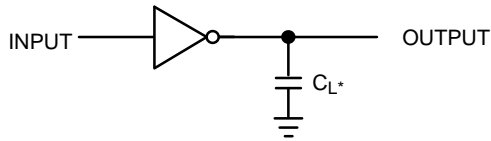
Symbol	Parameter	V <sub>CC</sub> (V)	Test Condition	T <sub>A</sub> = 25 °C			T <sub>A</sub> = +85°C		T <sub>A</sub> = -55°C to +125°C		Unit
				Min	Typ	Max	Min	Max	Min	Max	
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay, Input A to Output $\bar{Y}$	3.0 to 3.6	C <sub>L</sub> = 15 pF		5.0	10.0		11.0		13.0	ns
			C <sub>L</sub> = 50 pF		6.2	13.5		15.0		17.5	
		4.5 to 5.5	C <sub>L</sub> = 15 pF		3.8	6.7		7.5		8.5	
			C <sub>L</sub> = 50 pF		4.2	7.7		8.5		9.5	
C <sub>IN</sub>	Input Capacitance				5	10		10		10.0	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	5.0			10						pF

6. C<sub>PD</sub> 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<sub>CC(OPR)</sub> = C<sub>PD</sub> • V<sub>CC</sub> • f<sub>in</sub> + I<sub>CC</sub>. C<sub>PD</sub> is used to determine the no-load dynamic power consumption: P<sub>D</sub> = C<sub>PD</sub> • V<sub>CC</sub><sup>2</sup> • f<sub>in</sub> + I<sub>CC</sub> • V<sub>CC</sub>.

# NLU1GT04



**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†
NLU1GT04MUTCG	UDFN6 (Pb-Free)	3000 / Tape & Reel
NLU1GT04AMUTCG	UDFN6 (Pb-Free)	3000 / Tape & Reel

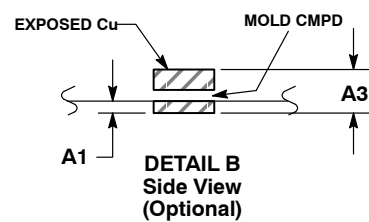
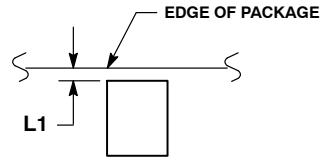
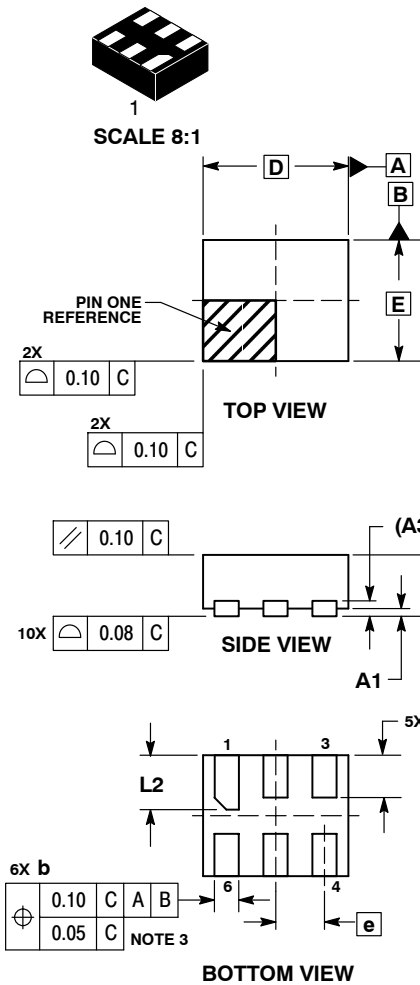
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.

# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



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

DATE 03 SEP 2010



- 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

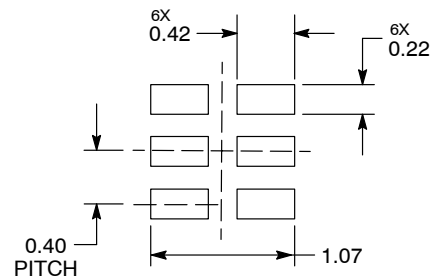
### GENERIC MARKING DIAGRAM\*



X = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

### 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.

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<b>DESCRIPTION:</b>	<b>6 PIN UDFN, 1.2X1.0, 0.4P</b>	<b>PAGE 1 OF 1</b>

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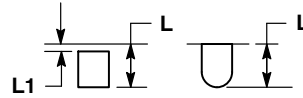
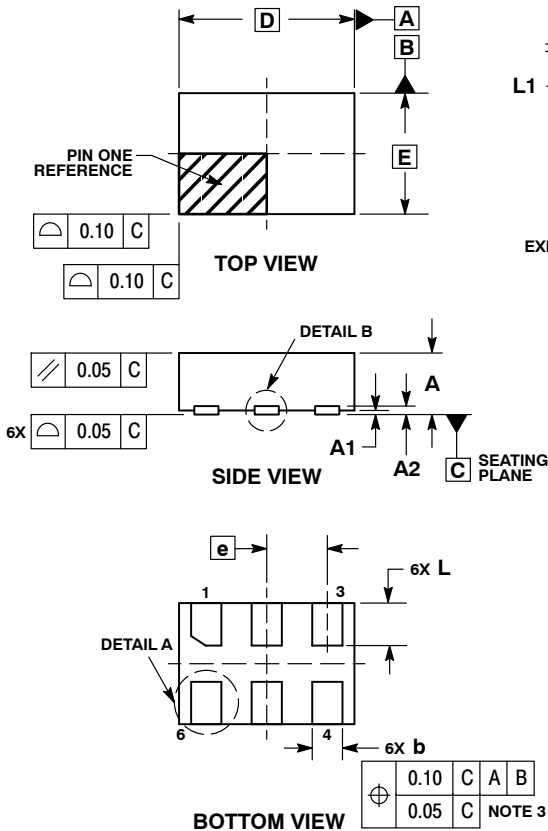
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



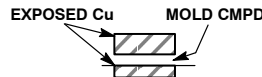
SCALE 4:1

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

DATE 15 MAY 2008



**DETAIL A**  
OPTIONAL  
CONSTRUCTIONS



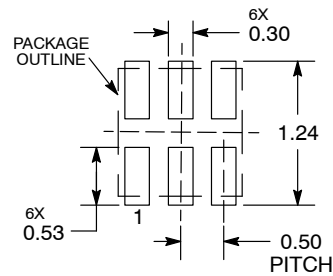
**DETAIL B**  
OPTIONAL  
CONSTRUCTIONS

**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.

**GENERIC  
MARKING DIAGRAM\***



X = Specific Device Code  
M = Date Code

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

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