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 ns (Typ) @ V_{CC} = 5.0 V
- Low Power Dissipation: I_{CC} = 1 µA (Max) at T_A = 25°C
- TTL−Compatible Input: V_{IL} = 0.8 V; V_{IH} = 2.0 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
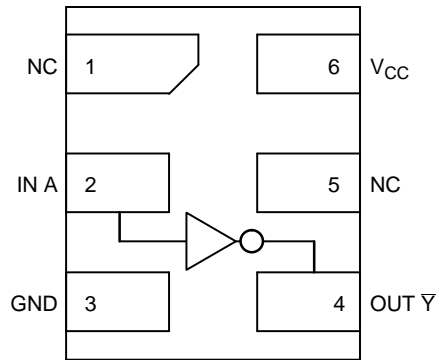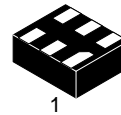- These Devices are Pb−Free, Halogen Free/BFR Free and are RoHS Compliant

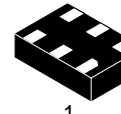## ON Semiconductor®

MARKING DIAGRAMS

UDFN6
MU SUFFIX
CASE 517AA

zM

UDFN6
MU SUFFIX
CASE 517AQ

PM

N or P = Device Marking
M = Date Code

PIN ASSIGNMENT

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

FUNCTION TABLE

A	$\overline{Y}$
L	H
H	L

Figure 1. Pinout (Top View)

Figure 2. Logic Symbol

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 ± 0.3 V V_{CC} = 5.0 V ± 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.

DC ELECTRICAL CHARACTERISTICS

Symbol	Parameter	Conditions	V_{CC} (V)	T_A = 25 °C Min	Typ	Max	T_A = +85°C Min	Max	T_A = −55°C to +125°C Min	Max	Unit
V_{IH}	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_{IL}	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_{OH}	High–Level Output Voltage	V_{IN} = V_{IH} or V_{IL} I_{OH} = −50 μA	3.0 4.5	2.9 4.4	3.0 4.5		2.9 4.4		2.9 4.4		V
		V_{IN} = V_{IH} or V_{IL} I_{OH} = −2 mA I_{OH} = −4 mA I_{OH} = −8 mA	1.8 3.0 4.5	1.40 2.58 3.94			1.38 2.48 3.80		1.37 2.34 3.66		
V_{OL}	Low–Level Output Voltage	V_{IN} = V_{IH} or V_{IL} I_{OL} = 50 μA	3.0 4.5		0 0	0.1 0.1		0.1 0.1		0.1 0.1	V
		V_{IN} = V_{IH} or V_{IL} I_{OL} = 2 mA I_{OL} = 4 mA I_{OL} = 8 mA	1.8 3.0 4.5			0.36 0.36 0.36		0.44 0.44 0.44		0.52 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
I_{CCT}	Quiescent Supply Current	V_{IN} = 3.4 V	5.5			1.35		1.50		1.65	mA
I_{OPD}	Output Leakage Current	V_{OUT} = 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_r = t_f = 3.0 ns)

Symbol	Parameter	V_{CC} (V)	Test Condition	T_A = 25 °C Min	Typ	Max	T_A = +85°C Min	Max	T_A = −55°C to +125°C Min	Max	Unit
t_{PLH}, t_{PHL}	Propagation Delay, Input A to Output $\overline{Y}$	3.0 to 3.6	C_L = 15 pF		5.0	10.0		11.0		13.0	ns
			C_L = 50 pF		6.2	13.5		15.0		17.5	
		4.5 to 5.5	C_L = 15 pF		3.8	6.7		7.5		8.5	
			C_L = 50 pF		4.2	7.7		8.5		9.5	
C_{IN}	Input Capacitance				5	10		10		10.0	pF
C_{PD}	Power Dissipation Capacitance (Note 6)	5.0			10						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: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.
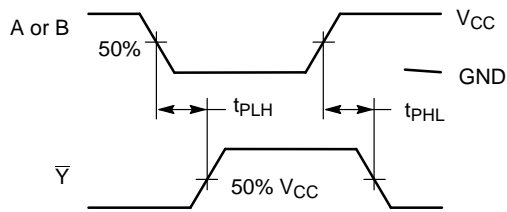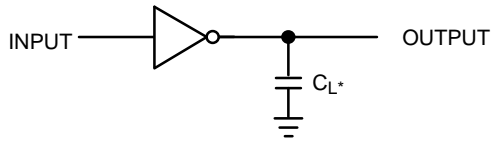
NLU1GT04

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.

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MECHANICAL CASE OUTLINE
PACKAGE DIMENSIONS

onsemi

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

DATE 03 SEP 2010
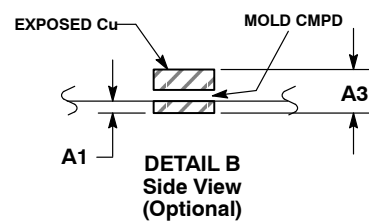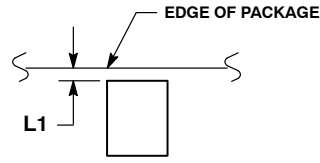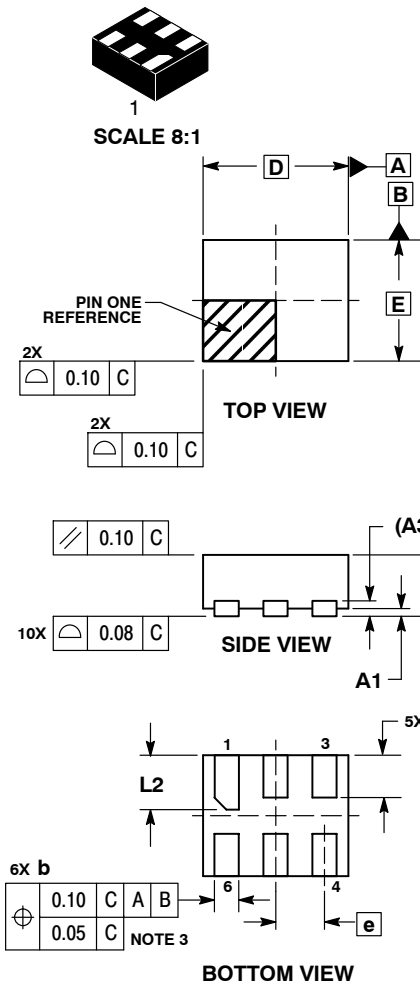
SCALE 8:1

1

TOP VIEW

D

A
B

E

PIN ONE
REFERENCE

2X
△ | 0.10 | C

2X
△ | 0.10 | C

EDGE OF PACKAGE

L1

DETAIL A
Bottom View
(Optional)

EXPOSED Cu   MOLD CMPD

A3

A1

DETAIL B
Side View
(Optional)

// | 0.10 | C

(A3)

A

10X
△ | 0.08 | C

SIDE VIEW

A1

SEATING
PLANE

C

5X **L**

1   3

L2

6X **b**
⊕ | 0.10 | C | A | B
| 0.05 | C | NOTE 3

6   4

e

BOTTOM VIEW

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.

| DIM | MILLIMETERS | |
	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 M
●

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*
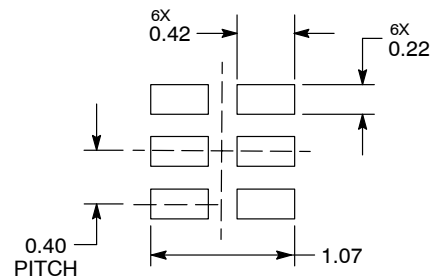
6X
0.42

6X
0.22

0.40
PITCH

1.07

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.

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

DATE 15 MAY 2008

SCALE 4:1

TOP VIEW

PIN ONE
REFERENCE

| ⌒ | 0.10 | C |
| ⌒ | 0.10 | C |

SIDE VIEW

| ⟋ | 0.05 | C |
| 6X ⌒ | 0.05 | C |

DETAIL B

A
A1
A2
SEATING PLANE

BOTTOM VIEW

DETAIL A

6X L
6X b

| ⊕ | 0.10 | C | A | B |
| | 0.05 | C | NOTE 3 |
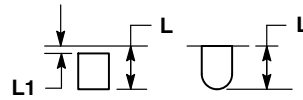
DETAIL A
OPTIONAL
CONSTRUCTIONS

L
L
L1
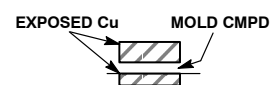
DETAIL B
OPTIONAL
CONSTRUCTIONS

EXPOSED Cu   MOLD CMPD

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
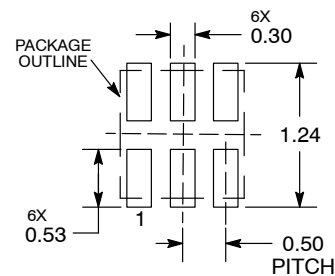
PACKAGE
OUTLINE

6X
0.30

1.24

6X
0.53

1

0.50
PITCH

DIMENSIONS: MILLIMETERS

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

**GENERIC
MARKING DIAGRAM***

XM

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.

DOCUMENT NUMBER:	98AON30313E		
DESCRIPTION:	**UDFN6, 1.45x1.0, 0.5P**		**PAGE 1 OF 1**

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:
Technical Library: www.onsemi.com/design/resources/technical–documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support
For additional information, please contact your local Sales Representative at
www.onsemi.com/support/sales

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