NLU2G04

Dual Inverter

The NLU2G04 MiniGate™ is an advanced high−speed CMOS dual inverter in ultra−small footprint.

The NLU2G04 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

Features

- High Speed: $t_{PD} = 3.5$ ns (Typ) @ $V_{CC} = 5.0$ V
- Low Power Dissipation: $I_{CC} = 1$ μA (Max) at $T_A = 25°C$
- Power Down Protection Provided on inputs
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
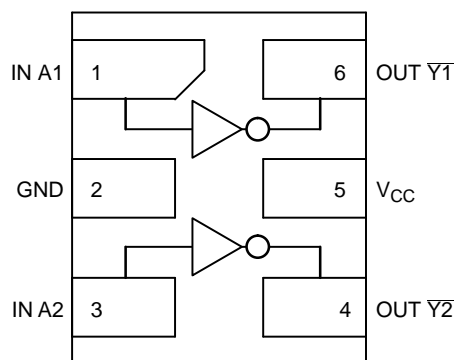- Ultra−Small Packages
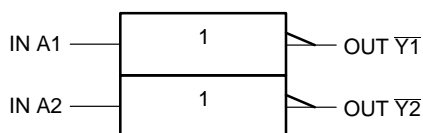- These are Pb−Free Devices

Figure 1. Pinout (Top View)

Figure 2. Logic Symbol

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

ON Semiconductor®

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

H = Device Marking
M = Date Code
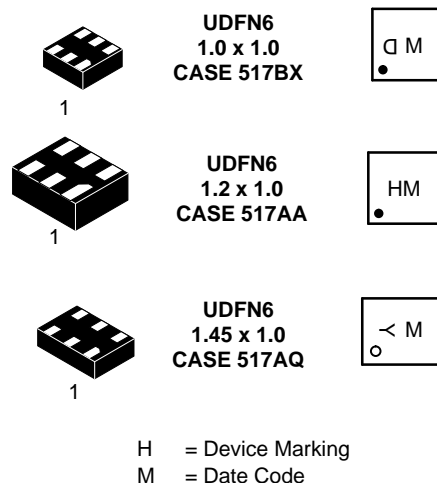
ORDERING INFORMATION

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

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 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 / 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

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	0.75 x V_{CC}			0.75 x V_{CC}				V
			2.3 to 5.5	0.70 x V_{CC}			0.70 x V_{CC}				
V_{IL}	Low–Level Input Voltage		1.65			0.25 x V_{CC}		0.25 x V_{CC}		0.25 x V_{CC}	V
			2.3 to 5.5			0.30 x V_{CC}		0.30 x V_{CC}		0.30 x V_{CC}	
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
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		10		40	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			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 $\overline{Y}$	3.0 to 3.6	C_L = 15 pF		4.5	7.1		8.5		10.0	ns
			C_L = 50 pF		6.4	10.6		12.0		14.5	
		4.5 to 5.5	C_L = 15 pF		3.5	5.5		6.5		8.0	
			C_L = 50 pF		4.5	7.5		8.5		10.0	
C_{IN}	Input Capacitance				4	10		10		10.0	pF
C_{PD}	Power Dissipation Capacitance (Note 3)	5.0			8.0						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 $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$. C_{PD} is used to determine the no–load dynamic power consumption: $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$.

NLU2G04
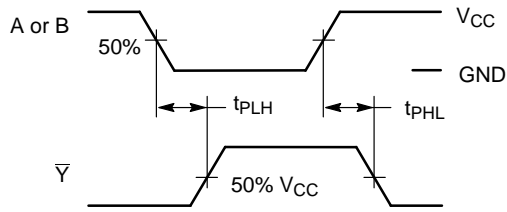
Figure 3. Switching Waveforms
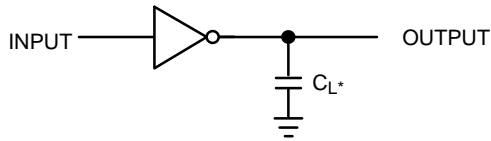
*Includes all probe and jig capacitance.
A 1–MHz square input wave is recommended for propagation delay tests.

Figure 4. Test Circuit

ORDERING INFORMATION

Device	Package	Shipping†
NLU2G04MUTCG	UDFN6, 1.2 x 1.0, 0.4P (Pb−Free)	3000 / Tape & Reel
NLU2G04AMUTCG	UDFN6, 1.45 x 1.0, 0.5P (Pb−Free)	3000 / Tape & Reel
NLU2G04CMUTCG	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.

UDFN6, 1.2x1.0, 0.4P
CASE 517AA–01
ISSUE D

DATE 03 SEP 2010
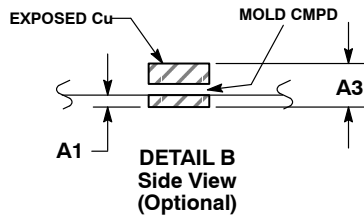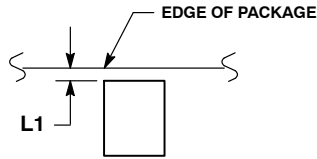
SCALE 8:1

1

EDGE OF PACKAGE

L1

DETAIL A
Bottom View
(Optional)

D

A
B

PIN ONE REFERENCE

E

2X
△ 0.10 C

2X
△ 0.10 C

TOP VIEW

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

6   4

6X b
⊕ 0.10 C A B
  0.05 C   NOTE 3

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*
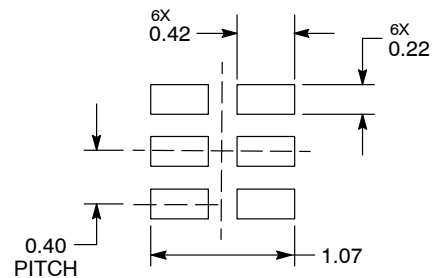
6X
0.42

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.

DOCUMENT NUMBER:	98AON22068D	Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red.	
DESCRIPTION:	6 PIN UDFN, 1.2X1.0, 0.4P		PAGE 1 OF 1

SCALE 4:1

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

DATE 15 MAY 2008

TOP VIEW

□ | 0.10 | C
□ | 0.10 | C

PIN ONE REFERENCE

SIDE VIEW

∥ | 0.05 | C
6X □ | 0.05 | C

BOTTOM VIEW

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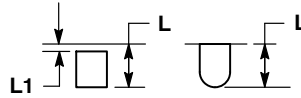
DETAIL A
OPTIONAL CONSTRUCTIONS
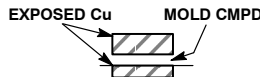
DETAIL B
OPTIONAL CONSTRUCTIONS

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
6X 0.53
1.24
1
0.50 PITCH

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*

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.
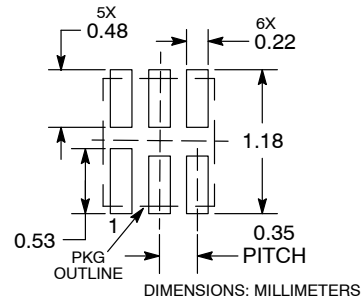
UDFN6, 1x1, 0.35P
CASE 517BX
ISSUE O

SCALE 4:1

DATE 18 MAY 2011

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 0.20 MM FROM TERMINAL TIP.
4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

DIM	MILLIMETERS	
	MIN	MAX
A	0.45	0.55
A1	0.00	0.05
A3	0.13 REF	
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

PIN ONE REFERENCE

2X 0.10 C

2X 0.10 C   **TOP VIEW**

0.05 C

A3

A

0.05 C

A1   C SEATING PLANE

SIDE VIEW

e

5X L

L1

1   3

6   4

6X b

0.10 (M) C A B
0.05 (M) C   NOTE 3

BOTTOM VIEW

RECOMMENDED SOLDERING FOOTPRINT*

5X 0.48

6X 0.22

1.18

0.53

1

0.35 PITCH

PKG OUTLINE

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 M

1
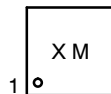
X = Specific Device Code
M = Date Code

*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. Some products may not follow the Generic Marking.

DOCUMENT NUMBER:	98AON56787E	
DESCRIPTION:	UDFN6, 1x1, 0.35P	PAGE 1 OF 1