# **Triple Non-Inverting Buffer**

The NLU3G16 MiniGate™ is an advanced high-speed CMOS triple non-inverting buffer in ultra-small footprint.

The NLU3G16 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

#### **Features**

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

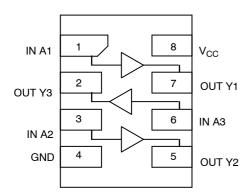


Figure 1. Pinout (Top View)

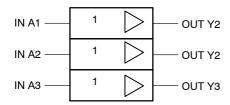


Figure 2. Logic Symbol

#### **PIN ASSIGNMENT**

1	IN A1
2	OUT Y3
3	IN A2
4	GND
5	OUT Y2
6	IN A3
7	OUT Y1
8	V <sub>CC</sub>



# ON Semiconductor®

http://onsemi.com

### MARKING DIAGRAMS



UDFN8 1.8 x 1.2 CASE 517AJ





ULLGA8 1.45 x 1.0 CASE 613AA





ULLGA8 1.6 x 1.0 CASE 613AB





ULLGA8 1.95 x 1.0 CASE 613AC





UDFN8 1.45x1, 0.35P CASE 517BZ





UDFN8 1.6x1, 0.4P CASE 517BY





UDFN8 1.95x1, 0.5P CASE 517CA



UY, R or LR = Specific Device Code

M = Date Code

■ = Pb-Free Package

#### **FUNCTION TABLE**

Α	Υ
L	L
H	H

#### **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 <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>IN</sub>	DC Input Voltage	-0.5 to +7.0	V
V <sub>OUT</sub>	DC Output Voltage	-0.5 to +7.0	V
I <sub>IK</sub>	DC Input Diode Current V <sub>IN</sub> < GND	-20	mA
I <sub>OK</sub>	DC Output Diode Current V <sub>OUT</sub> < GND	±20	mA
Ιο	DC Output Source/Sink Current	±12.5	mA
I <sub>CC</sub>	DC Supply Current Per Supply Pin	±25	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±25	mA
T <sub>STG</sub>	Storage Temperature Range	−65 to +150	°C
$T_L$	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
TJ	Junction Temperature Under Bias	150	°C
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	
I <sub>LATCHUP</sub>	Latchup Performance Above V <sub>CC</sub> 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 <sub>CC</sub>	Positive DC Supply Voltage	1.65	5.5	V
V <sub>IN</sub>	Digital Input Voltage	0	5.5	٧
V <sub>OUT</sub>	Output Voltage	0	5.5	٧
T <sub>A</sub>	Operating Free-Air Temperature		+125	°C
Δt/ΔV	Input Transition Rise or Fall Rate $ \begin{array}{c} V_{CC} = 3.3 \ V \pm 0.3 \ V \\ V_{CC} = 5.0 \ V \pm 0.5 \ V \end{array} $	0 0	100 20	ns/V

# DC ELECTRICAL CHARACTERISTICS

			v <sub>cc</sub>	T	<sub>A</sub> = 25 °	С	<b>T</b> <sub>A</sub> = -	+85°C		55°C to 25°C	
Symbol	Parameter	Conditions	(V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V <sub>IH</sub>	Low-Level Input Voltage		1.65	0.75 x V <sub>CC</sub>			0.75 x V <sub>CC</sub>				V
			2.3 to 5.5	0.70 x V <sub>CC</sub>			0.70 x V <sub>CC</sub>				
$V_{IL}$	Low-Level Input Voltage		1.65			0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	٧
			2.3 to 5.5			0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>		0.30 x V <sub>CC</sub>	
V <sub>OH</sub>	High-Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -50  \mu\text{A}$	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 <sub>OL</sub>	Low-Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 50 \mu A$	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 <sub>IN</sub>	Input Leakage Current	$0 \le V_{IN} \le 5.5 V$	0 to 5.5			±0.1		±1.0		±1.0	μΑ
Icc	Quiescent Supply Current	$0 \le V_{IN} \le V_{CC}$	5.5			1.0		10		40	μΑ

# AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0 \text{ ns}$ )

		V <sub>CC</sub>	Test	T,	<sub>Δ</sub> = 25 °	С	<b>T</b> <sub>A</sub> = 4	⊦85°C	T <sub>A</sub> = -5 +12		
Symbol	Parameter	(V)	Condition	Min	Тур	Max	Min	Max	Min	Max	Unit
t <sub>PLH</sub> ,	Propagation Delay,	3.0 to	C <sub>L</sub> = 15 pF		4.5	7.1		8.5		10	ns
t <sub>PHL</sub>	Input A to Output ₹	3.6	C <sub>L</sub> = 50 pF		6.4	10.6		12		14.5	
		4.5 to	C <sub>L</sub> = 15 pF		3.5	5.5		6.5		8.0	
		5.5	C <sub>L</sub> = 50 pF		4.5	7.5		8.5		10	
C <sub>IN</sub>	Input Capacitance				4.0	10		10		10	pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 3)	5.0			8.0						pF

<sup>3.</sup> 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  $I_{CC(OPR)} = C_{PD} \bullet V_{CC} \bullet f_{in} + I_{CC}$ . C<sub>PD</sub> is used to determine the no–load dynamic power consumption:  $P_D = C_{PD} \bullet V_{CC}^2 \bullet f_{in} + I_{CC} \bullet V_{CC}$ .

# **SWITCHING WAVEFORMS**

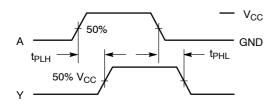
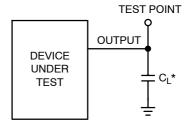


Figure 3. Switching Waveforms



\*Includes all probe and jig capacitance

Figure 4. Test Circuit

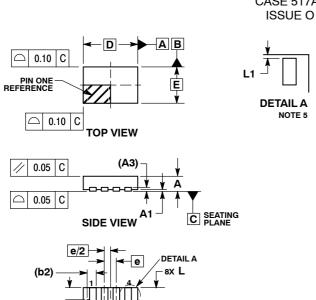
# **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NLU3G16MUTAG	UDFN8 (Pb-Free)	3000 / Tape & Reel
NLU3G16AMX1TCG	ULLGA8, 1.95 x 1.0, 0.5P (Pb-Free)	3000 / Tape & Reel
NLU3G16BMX1TCG	ULLGA8, 1.6 x 1.0, 0.4P (Pb-Free)	3000 / Tape & Reel
NLU3G16CMX1TCG	ULLGA8, 1.45 x 1.0, 0.35P (Pb-Free)	3000 / Tape & Reel
NLU3G16DMUTCG	UDFN8, 1.95 x 1 (Pb-Free)	3000 / Tape & Reel
NLU3G16EMUTCG	UDFN8, 1.6 x 1 (Pb-Free)	3000 / Tape & Reel
NLU3G16FMUTCG	UDFN8, 1.45 x 1 (Pb-Free)	3000 / Tape & Reel

<sup>†</sup>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**

# UDFN8 1.8x1.2, 0.4P CASE 517AJ



0.10 M C A B

0.05 M C NOTE 3

Ф

(L2)

**BOTTOM VIEW** 

- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

  2. CONTROLLING DIMENSION: MILLIMETERS.

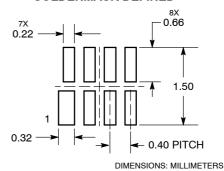
  3. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.30 mm FROM TERMINAL TIP.

  4. MOLD FLASH ALLOWED ON TERMINALS ALONG EDGE OF PACKAGE, FLASH MAY NOT EXCEED 0.03 ONTO BOTTOM SURFACE OF TERMINALS.

  5. DETAIL A SHOWS OPTIONAL CONSTRUCTION FOR TERMINALS.

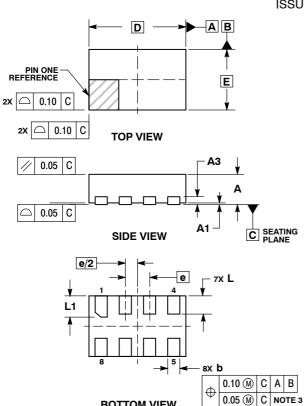
	MILLIMETERS				
DIM	MIN	MAX			
Α	0.45	0.55			
A1	0.00	0.05			
А3	0.127	REF			
b	0.15	0.25			
b2	0.30	REF			
D	1.80 BSC				
Е	1.20	BSC			
е	0.40	BSC			
L	0.45	0.55			
L1	0.00	0.03			
L2	0.40 REF				

# MOUNTING FOOTPRINT SOLDERMASK DEFINED



#### PACKAGE DIMENSIONS

### UDFN8, 1.6x1, 0.4P CASE 517BY ISSUE O



**BOTTOM VIEW** 

- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

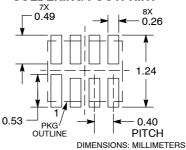
  2. CONTROLLING DIMENSION: MILLIMETERS.

  3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.15 AND 0.20 MM FROM TERMINAL TIP.

  4. PACKAGE DIMENSIONS EXCLUSIVE OF BURRS AND MOLD FLASH.

	MILLIMETERS					
DIM	MIN	MAX				
Α	0.45	0.55				
A1	0.00	0.05				
A3	0.13 REF					
b	0.15	0.25				
D	1.60	BSC				
E	1.00	BSC				
е	0.40	BSC				
L	0.25	0.35				
L1	0.30	0.40				

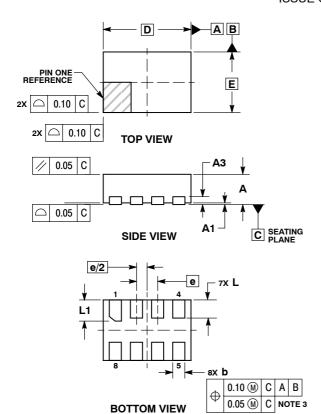
#### **RECOMMENDED SOLDERING FOOTPRINT\***



\*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

### UDFN8, 1.45x1, 0.35P CASE 517BZ ISSUE O



#### NOTES:

- NOTES:

  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

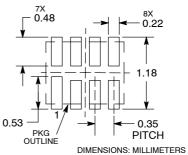
  2. CONTROLLING DIMENSION: MILLIMETERS.

  3. DIMENSION 6 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.

	MILLIMETERS				
DIM	MIN	MAX			
Α	0.45	0.55			
A1	0.00	0.05			
А3	0.13 REF				
b	0.15	0.25			
D	1.45	BSC			
Е	1.00	BSC			
е	0.35	BSC			
Ĺ	0.25	0.35			
L1	0.30	0.40			

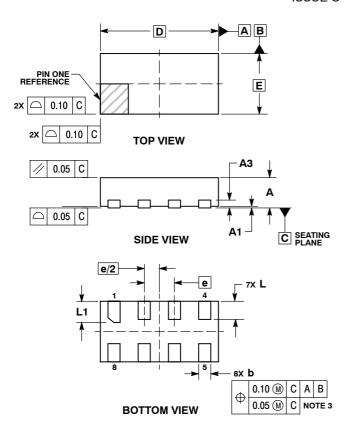
#### **RECOMMENDED SOLDERING FOOTPRINT\***



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#### PACKAGE DIMENSIONS

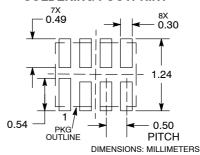
UDFN8, 1.95x1, 0.5P CASE 517CA ISSUE O



- 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.

	MILLIMETERS				
DIM	MIN	MAX			
Α	0.45	0.55			
A1	0.00	0.05			
А3	0.13 REF				
b	0.15	0.25			
D	1.95	BSC			
Е	1.00 BSC				
е	0.50 BSC				
L	0.25	0.35			
L1	0.30	0.40			

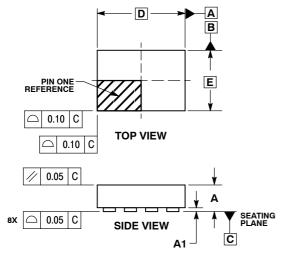
#### **RECOMMENDED SOLDERING FOOTPRINT\***

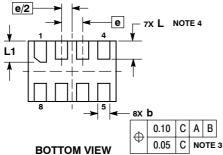


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

#### PACKAGE DIMENSIONS

#### ULLGA8 1.45x1.0, 0.35P CASE 613AA ISSUE A





- NOTES:
  1. DIMENSIONING AND TOLERANCING PER
- ASME Y14.5M, 1994.

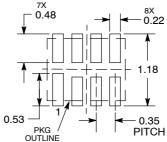
  2. CONTROLLING DIMENSION: MILLIMETERS.

  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			
Α		0.40			
A1	0.00	0.05			
b	0.15	0.25			
D	1.45	BSC			
E	1.00 BSC				
е	0.35 BSC				
L	0.25	0.35			
L1	0.30	0.40			

#### **MOUNTING FOOTPRINT SOLDERMASK DEFINED\***

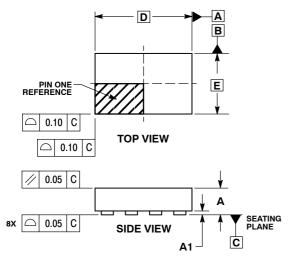


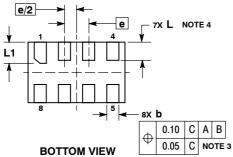
DIMENSIONS: MILLIMETERS

<sup>\*</sup>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

### ULLGA8 1.6x1.0, 0.4P CASE 613AB **ISSUE A**



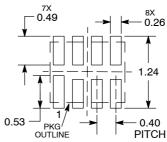


#### NOTES:

- DIMENSIONING AND TOLERANCING PER
- DIMENSIONING AND TOLERANGING FER
  ASME Y14.5M, 1994.
  CONTROLLING DIMENSION: MILLIMETERS.
  DIMENSION 6 APPLIES TO PLATED TERMINAL
  AND IS MEASURED BETWEEN 0.15 AND
- 0.30 mm FROM THE TERMINAL TIP.
  A MAXIMUM OF 0.05 PULL BACK OF THE
  PLATED TERMINAL FROM THE EDGE OF THE
  PACKAGE IS ALLOWED.

	MILLIMETERS	
DIM	MIN	MAX
Α		0.40
A1	0.00	0.05
b	0.15	0.25
D	1.60 BSC	
E	1.00 BSC	
е	0.40 BSC	
L	0.25	0.35
L1	0.30	0.40

#### **MOUNTING FOOTPRINT SOLDERMASK DEFINED\***

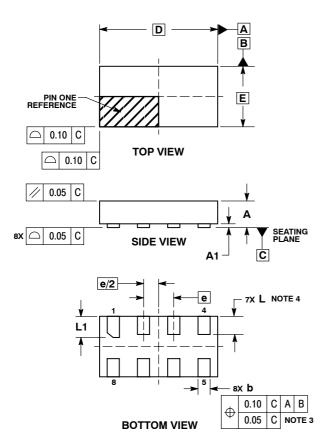


DIMENSIONS: MILLIMETERS

<sup>\*</sup>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

#### ULLGA8 1.95x1.0, 0.5P CASE 613AC ISSUE A



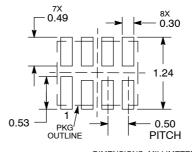
#### NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- 2. CONTROLLING DIMENSION: MILLIMETERS.
- 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
Α		0.40
A1	0.00	0.05
b	0.15	0.25
D	1.95 BSC	
Е	1.00 BSC	
е	0.50 BSC	
L	0.25	0.35
L1	0.30	0.40

#### MOUNTING FOOTPRINT SOLDERMASK DEFINED\*



DIMENSIONS: MILLIMETERS

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