# **Dual Buffer**

The NLX2G16 MiniGate<sup>™</sup> is an advanced high-speed CMOS dual non-inverting buffer in ultra-small footprint.

The NLX2G16 input and output structures provide protection when voltages up to 7.0 V are applied, regardless of the supply voltage.

#### **Features**

- High Speed:  $t_{PD} = 1.8 \text{ ns (Typ)} @ V_{CC} = 5.0 \text{ V}$
- Designed for 1.65 V to 5.5 V V<sub>CC</sub> Operation
- Low Power Dissipation:  $I_{CC} = 1 \mu A$  (Max) at  $T_A = 25^{\circ}C$
- 24 mA Balanced Output Source and Sink Capability
- Balanced Propagation Delays
- Overvoltage Tolerant (OVT) Input and Output Pins
- Ultra-Small Packages
- These are Pb-Free Devices

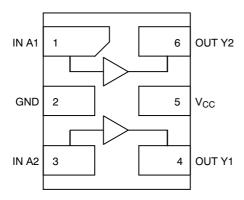


Figure 1. Pinout (Top View)

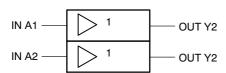


Figure 2. Logic Symbol



# ON Semiconductor®

http://onsemi.com

#### MARKING DIAGRAMS



ULLGA6 1.0 x 1.0 CASE 613AD





ULLGA6 1.2 x 1.0 CASE 613AE





ULLGA6 1.45 x 1.0 CASE 613AF



J = Device MarkingM = Date Code

#### **PIN ASSIGNMENT**

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

#### **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	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>OUT</sub> < GND	-50	mA
Ι <sub>Ο</sub>	DC Output Source/Sink Current	±50	mA	
I <sub>CC</sub>	DC Supply Current Per Supply Pin		±100	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±100	mA	
T <sub>STG</sub>	Storage Temperature Range		-65 to +150	°C
TL	Lead Temperature, 1 mm from Case for 10 Second	onds	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 Gi	±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/JESD22-A114-A.

- 3. Tested to EIA/UESD22-A115-A.
- 4. Tested to JESD22-C101-A.
- 5. 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	V
V <sub>OUT</sub>	Output Voltage	0	5.5	V
T <sub>A</sub>	Operating Free-Air Temperature	-55	+125	°C
Δt/ΔV	Input Transition Rise or Fall Rate $\begin{array}{c} V_{CC} = 1.8 \ V \pm 0.18 \\ V_{CC} = 2.5 \ V \pm 0.2 \ V \\ V_{CC} = 3.3 \ V \pm 0.3 \ V \\ V_{CC} = 5.0 \ V \pm 0.5 \ V \end{array}$	0 0 0 0	20 20 10 5	ns/V

# DC ELECTRICAL CHARACTERISTICS

			V <sub>CC</sub> T <sub>A</sub> = 25 °C		<b>T</b> <sub>A</sub> = +	+85°C		55°C to 5°C			
Symbol	Parameter	Conditions	(V)	Min	Тур	Max	Min	Max	Min	Max	Unit
V <sub>IH</sub>	Low-Level Input Voltage		1.65-1.95	0.75 x V <sub>CC</sub>			0.75 x V <sub>CC</sub>		0.75 x V <sub>CC</sub>		V
	voitage		2.3 to 5.5	0.70 x V <sub>CC</sub>			0.70 x V <sub>CC</sub>		0.70 x V <sub>CC</sub>		
V <sub>IL</sub>	Low-Level Input Voltage		1.65-1.95			0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>		0.25 x V <sub>CC</sub>	V
	voltage		2.3 - 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	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OH} = -100 \mu A$	1.65 - 5.5	V <sub>CC</sub> - 0.1	V <sub>CC</sub>		V <sub>CC</sub> - 0.1		V <sub>CC</sub> - 0.1		V
	Voltage	$\begin{aligned} &V_{\text{IN}} = V_{\text{IH}} \text{ or } V_{\text{IL}} \\ &I_{\text{OH}} = -4 \text{ mA} \\ &I_{\text{OH}} = -8 \text{ mA} \\ &I_{\text{OH}} = -16 \text{ mA} \\ &I_{\text{OH}} = -24 \text{ mA} \\ &I_{\text{OH}} = -32 \text{ mA} \end{aligned}$	1.65 2.3 3.0 3.0 4.5	1.29 1.9 2.4 2.3 3.8	1.52 2.15 2.8 2.68 4.2		1.29 1.9 2.4 2.3 3.8		1.29 1.9 2.4 2.3 3.8		
V <sub>OL</sub>	Low-Level Output Voltage	$V_{IN} = V_{IH} \text{ or } V_{IL}$ $I_{OL} = 100 \mu A$	1.65 - 5.5			0.1		0.1		0.1	٧
	voltage	$\begin{aligned} &V_{\text{IN}} = V_{\text{IH}} \text{ or } V_{\text{IL}} \\ &I_{\text{OH}} = 4 \text{ mA} \\ &I_{\text{OH}} = 8 \text{ mA} \\ &I_{\text{OH}} = 16 \text{ mA} \\ &I_{\text{OH}} = 24 \text{ mA} \\ &I_{\text{OH}} = 32 \text{ mA} \end{aligned}$	1.65 2.3 3.0 3.0 4.5		0.08 0.1 0.15 0.22 0.22	0.24 0.3 0.4 0.55 0.55		0.24 0.3 0.4 0.55 0.55		0.24 0.3 0.4 0.55 0.55	
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	μА
I <sub>OFF</sub>	Power-Off Output Leakage Current	V <sub>IN</sub> or V <sub>OUT</sub> = 5.5 V	0			1.0		10		10	μΑ
I <sub>CC</sub>	Quiescent Supply Current	$0 \le V_{IN} \le V_{CC}$	5.5			1.0		10		10	μА

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

		V <sub>cc</sub>	Test	т	A = 25 °(	С	T <sub>A</sub> = - to +1		
Symbol	Parameter	(V)	Condition	Min	Тур	Max	Min	Max	Unit
t <sub>PLH</sub> , t <sub>PHL</sub>	Propagation Delay Input A to Output	1.65-1.95	$R_L = 1 M\Omega$ , $C_L = 15 pF$	1.8	8.0	9.6	1.8	10.2	ns
		2.3-2.7	$R_L = 1 M\Omega$ , $C_L = 15 pF$	1.0	3.0	5.2	1.0	5.8	
		3.0-3.6	$R_L = 1 M\Omega$ , $C_L = 15 pF$	0.8	2.3	3.6	0.8	4.0	
			$R_L = 500 \Omega$ , $C_L = 50 pF$	1.2	3.0	4.6	1.2	5.1	
		4.5-5.5	$R_L = 1 M\Omega$ , $C_L = 15 pF$	0.5	1.8	2.9	0.5	3.2	
			$R_L = 500 \Omega$ , $C_L = 50 pF$	0.8	2.4	3.8	0.8	4.2	
C <sub>IN</sub>	Input Capacitance	5.5	V <sub>IN</sub> = 0 V or V <sub>CC</sub>		7.0				pF
C <sub>PD</sub>	Power Dissipation Capacitance (Note 6)	3.3 5.5	10 MHz V <sub>IN</sub> = 0 V or V <sub>CC</sub>		9 11				pF

<sup>6.</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<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>.

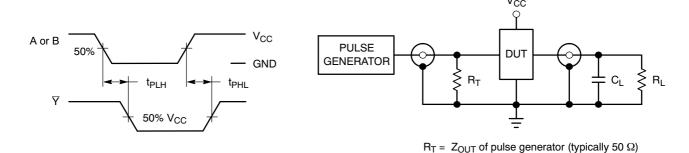


Figure 3. Switching Waveforms

Figure 4. Test Circuit

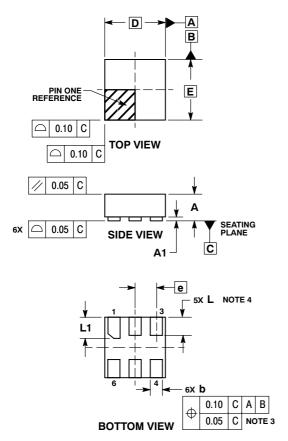
## **ORDERING INFORMATION**

Device	Package	Shipping <sup>†</sup>
NLX2G16AMX1TCG	ULLGA6, 1.45 x 1.0, 0.5P (Pb-Free)	3000 / Tape & Reel
NLX2G16BMX1TCG	ULLGA6, 1.2 x 1.0, 0.4P (Pb-Free)	3000 / Tape & Reel
NLX2G16CMX1TCG	ULLGA6, 1.0 x 1.0, 0.35P (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

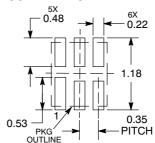
ULLGA6 1.0x1.0, 0.35P CASE 613AD-01 **ISSUE A** 



- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS.
  3. DIMENSION & 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. PACKAGE IS ALLOWED.

_	MILLIMETERS					
DIM	MIN	MAX				
Α	-	0.40				
A1	0.00	0.05				
b	0.12	0.22				
D	1.00	BSC				
E	1.00 BSC					
е	0.35 BSC					
L	0.25	0.35				
L1	0.30	0.40				

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

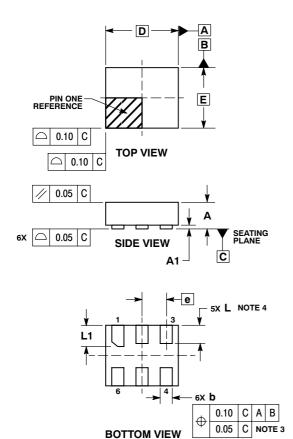


DIMENSIONS: MILLIMETERS

\*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

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



#### NOTES:

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

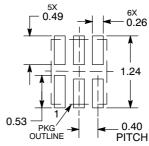
  2. CONTROLLING DIMENSION: MILLIMETERS.

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

  4. A MAXIMUM OF 0.05 PULL BACK OF THE PLATED TERMINAL FROM THE EDGE OF THE PACKAGE IS ALLOWED.

	<b>MILLIMETERS</b>						
DIM	MIN	MAX					
Α		0.40					
A1	0.00	0.05					
b	0.15	0.25					
D	1.20	BSC					
E	1.00 BSC						
е	0.40 BSC						
L	0.25	0.35					
L1	0.35	0.45					

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

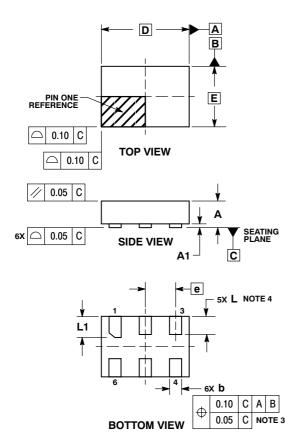


DIMENSIONS: MILLIMETERS

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#### PACKAGE DIMENSIONS

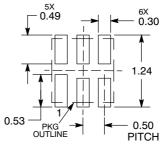
#### ULLGA6 1.45x1.0, 0.5P CASE 613AF-01 **ISSUE A**



- NOTES:
  1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  CONTROLLING DIMENSION: MILLIMETERS.
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	MILLIMETERS				
DIM	MIN	MAX			
Α	-	0.40			
A1	0.00	0.05			
b	0.15	0.25			
D	1.45 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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