

# NLAS3157

## Product Preview

# Low Voltage SPDT Mux / Demux Analog Switch

The NLAS3157 Mux / Demux Analog Switch is an advanced high-speed single-pole double-throw (SPDT) CMOS switch. It can be used as an analog switch or as a low-delay bus switch. Break-before-make switching prevents both switches being enabled simultaneously. This eliminates signal disruption during switching. The control input, S, is independent of supply voltage line switch in an ultra-small footprint.

### Features

- High Speed:  $t_{PD} = 0.25$  ns (Max) @  $V_{CC} = 4.5$  V
- $R_{ON}$ : 7.5 pF Typ @  $V_{CC} = 4.2$  V
- $C_{ON}$ : 7.5 pF Typ @  $V_{CC} = 3.3$  V
- $V_{CC}$  Range: 1.65 V to 4.5 V
- Ultra-Small 1 x 1 mm Package
- This Device is Pb-Free, Halogen Free/BFR Free and RoHS Compliant

### Typical Applications

- Mobile Phones, PDAs, Camera

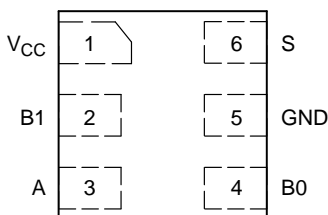


Figure 1. ULLGA6 (Top View)

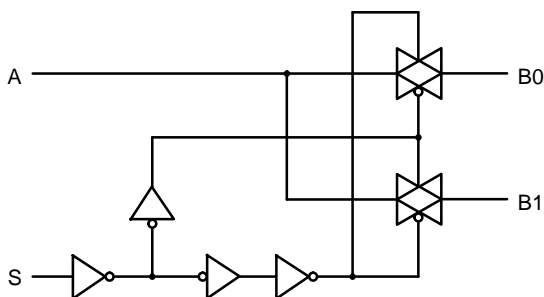


Figure 2. Logic Diagram

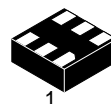
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### MARKING DIAGRAMS



ULLGA6  
1.0 x 1.0  
CASE 613AD



Y = Specific Device Code  
M = Date Code

### FUNCTION TABLE

Input S	Function
L	A = B0
H	A = B1

### ORDERING INFORMATION

See detailed ordering and shipping information on page 5 of this data sheet.

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**Table 1. MAXIMUM RATINGS**

Symbol	Parameter	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +5.5	V
V <sub>IN</sub>	Control Input Voltage (S Pin)	-0.5 to +5.5	V
V <sub>I/O</sub>	Switch Input / Output Voltage (A, BO, B1 Pins)	-0.5 to +5.5	V
I <sub>IK</sub>	Control DC Input Diode Current (S Pin) <span style="float: right;">V<sub>IN</sub> &lt; GND</span>	-50	mA
I <sub>OK</sub>	Switch I/O Port DC Diode Current (A, BO, B1 Pins) <span style="float: right;">V<sub>I/O</sub> &lt; GND or V<sub>I/O</sub> &gt; V<sub>CC</sub></span>	±50	mA
I <sub>O</sub>	On-State Switch Current	±128	mA
	Continuous Current Through V <sub>CC</sub> or GND	±150	mA
I <sub>CC</sub>	DC Supply Current per Supply Pin	±150	mA
I <sub>GND</sub>	DC Ground Current per Ground Pin	±150	mA
T <sub>STG</sub>	Storage Temperature Range	-65 to +150	°C
T <sub>L</sub>	Lead Temperature, 1 mm from Case for 10 Seconds	260	°C
T <sub>J</sub>	Junction Temperature Under Bias	150	°C
θ <sub>JA</sub>	Thermal Resistance (Note 1)	TBD	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 85°C (Note 1)	TBD	mW
MSL	Moisture Sensitivity	Level 1	
F <sub>R</sub>	Flammability Rating <span style="float: right;">Oxygen Index: 28 to 34</span>	UL 94 V-0 @ 0.125 in	
V <sub>ESD</sub>	ESD Withstand Voltage <span style="float: right;">Human Body Mode (Note 2) Machine Mode (Note 3) Charged Device Mode (Note 4)</span>	>2000 >200 N/A	V
I <sub>LATCHUP</sub>	Latchup Performance Above V <sub>CC</sub> and Below GND at 85°C (Note 5)	±100	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

**Table 2. RECOMMENDED OPERATING CONDITIONS**

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage	1.65	4.5	V
V <sub>I</sub>	Control Input Voltage (S Pin)	0	4.5	V
V <sub>I/O</sub>	Switch Input / Output Voltage (A, BO, B1 Pins)	0	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Free-Air Temperature	-40	+85	°C
Δt / ΔV	Input Transition Rise or Fall Rate <span style="float: right;">Control Input Switch I/O</span>	0	5	ns/V
		0	10	

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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**Table 3. DC ELECTRICAL CHARACTERISTICS** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V)

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
				Min	Typ	Max	
V <sub>IH</sub>	Control Input, HIGH Voltage		2.7	1.25			V
			3.3				
			4.2				
V <sub>IL</sub>	Control Input, LOW Voltage		2.7			0.4	V
			3.3				
			4.2				
I <sub>IN</sub>	Control Input, Leakage Current	0 ≤ V <sub>IS</sub> ≤ V <sub>CC</sub>	1.65 – 4.5			±1.0	μA
I <sub>CC</sub>	Quiescent Supply Current	V <sub>IS</sub> = V <sub>CC</sub> or GND; I <sub>D</sub> = 0 A	1.65 – 4.5			1.0	μA
I <sub>NC (OFF)</sub> I <sub>NO (OFF)</sub>	NC or NO Leakage Current	V <sub>IS</sub> = 1.65 V to 4.5 V	4.5		10		nA
I <sub>COM (ON)</sub>	COM ON Leakage Current	V <sub>IS</sub> = 1.65 V to 4.5 V	4.5		10		nA

**ON RESISTANCE** (Typical: T = 25°C)

R <sub>ON</sub>	On-Resistance	I <sub>ON</sub> = 8 mA V <sub>IS</sub> = 0 V to V <sub>CC</sub>	2.7 3.3 4.2		9.3 8.7 7.5		Ω
R <sub>FLAT</sub>	On-Resistance Flatness	I <sub>ON</sub> = 8 mA V <sub>IS</sub> = 0 V to V <sub>CC</sub>	2.7 3.3 4.2		3.6 3.3 2.9		Ω
ΔR <sub>ON</sub>	Delta On-Resistance	I <sub>ON</sub> = 8 mA V <sub>IS</sub> = 0 V to V <sub>CC</sub>	2.7 3.3 4.2		0.8 0.7 0.5		Ω

**Table 4. AC ELECTRICAL CHARACTERISTICS**

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
				Min	Typ	Max	

**TIMING/FREQUENCY** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 35 pF, f = 1 MHz)

t <sub>PD</sub>	Propagation Delay, A to Bn or Bn to A	(See Figures 3 and 4)	1.65 – 4.5			0.25	ns
t <sub>ON</sub>	Turn-ON Time	(See Figures 6 and 7)	1.65 – 4.5		13.0	30.0	ns
t <sub>OFF</sub>	Turn-OFF Time	(See Figures 6 and 7)	1.65 – 4.5		12.0	25.0	ns
T <sub>BBM</sub>	Break-Before-Make Time	(See Figure 5)	1.65 – 4.5	2.0			ns
BW	-3 dB Bandwidth	C <sub>L</sub> = 5 pF	1.65 – 4.5		1000		MHz

**ISOLATION** (Typical: T = 25°C, V<sub>CC</sub> = 3.3 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF)

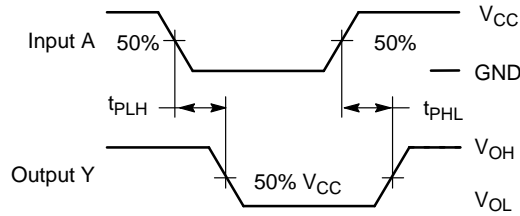
O <sub>IRR</sub>	OFF-Isolation	f = 240 MHz (See Figure 9)	1.65 – 4.5		-21		dB
X <sub>TALK</sub>	Non-Adjacent Channel Crosstalk	f = 240 MHz	1.65 – 4.5		-21		dB

**Table 4. AC ELECTRICAL CHARACTERISTICS**

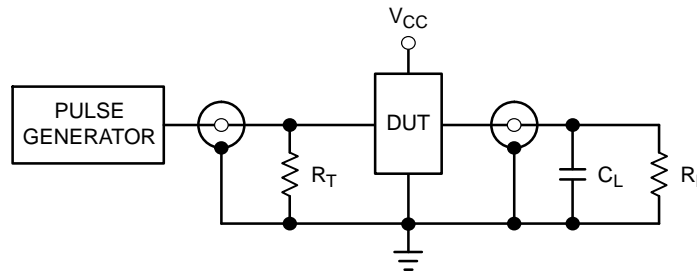
**CAPACITANCE (Typical: T = 25°C)**

C <sub>IN</sub>	Control Pin Input Capacitance	V <sub>CC</sub> = 0 V, f = 1 MHz	1.5	pF
		V <sub>CC</sub> = 0 V, f = 10 MHz	1.0	
C <sub>ON</sub>	ON Capacitance	V <sub>CC</sub> = 3.3 V; OE = 0 V, S = 0 V or 3.3 V, f = 1 MHz	7.5	
		V <sub>CC</sub> = 3.3 V; OE = 0 V, S = 0 V or 3.3 V, f = 10 MHz	6.5	
C <sub>OFF</sub>	OFF Capacitance	V <sub>CC</sub> = V <sub>IS</sub> = 3.3 V; OE = 0 V, S = 3.3 V or 0 V, f = 1 MHz	3.8	
		V <sub>CC</sub> = V <sub>IS</sub> = 3.3 V; OE = 0 V, S = 3.3 V or 0 V, f = 10 MHz	2.0	

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.

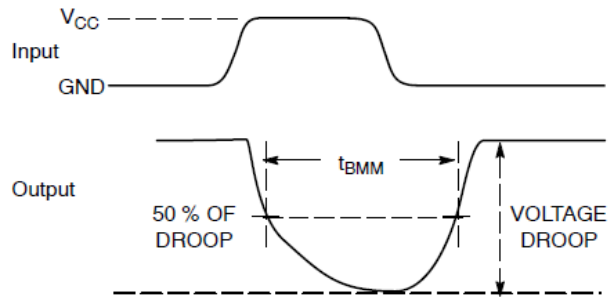
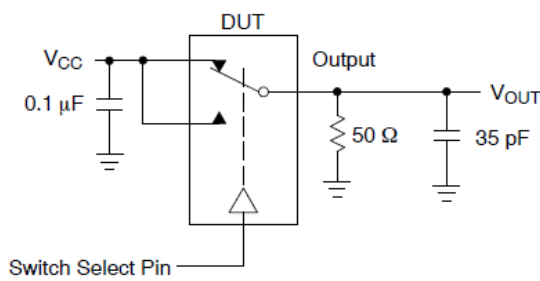


**Figure 3. Propagation Delay Waveforms**



R<sub>T</sub> = Z<sub>OUT</sub> of pulse generator (typically 50 Ω)

**Figure 4. Propagation Delay Test Circuit**



**Figure 5. t<sub>BMM</sub> (Time Break–Before–Make)**

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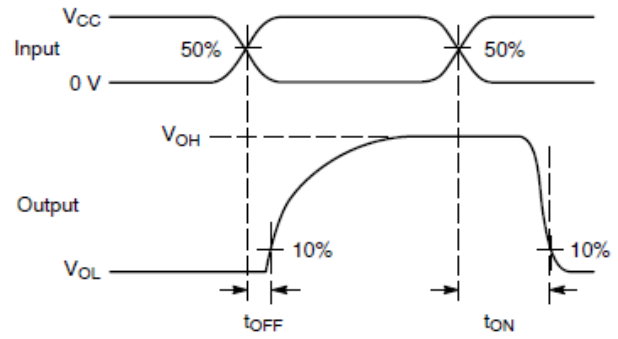
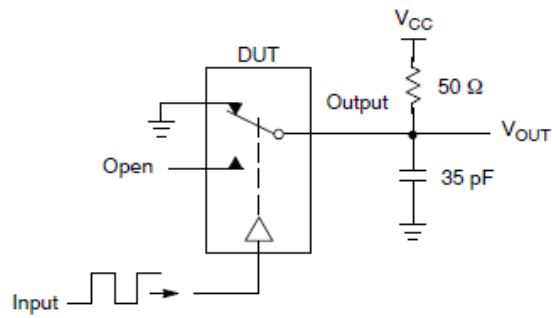


Figure 6.  $t_{ON} / t_{OFF}$

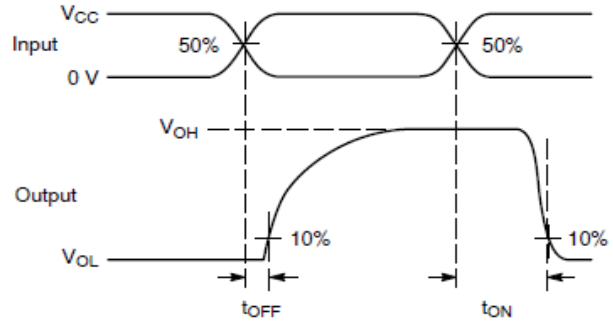
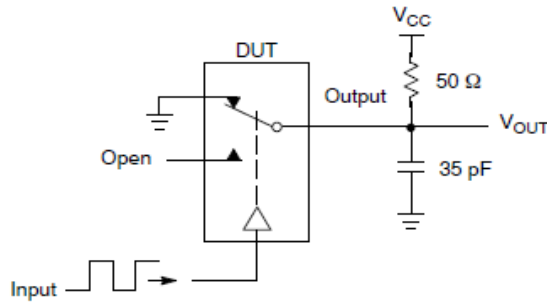
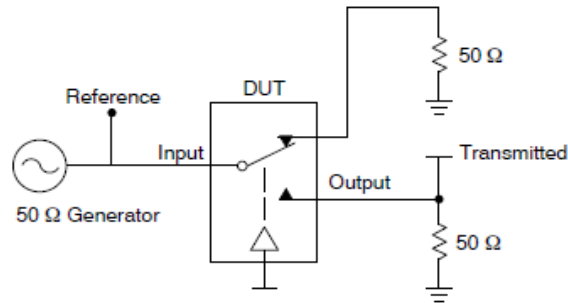


Figure 7.  $t_{ON} / t_{OFF}$



Channel switch control/s test socket is normalized. Off isolation is measured across an off channel. On loss is the bandwidth of an On switch.  $V_{ISO}$ , Bandwidth and  $V_{ONL}$  are independent of the input signal direction.

$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

$$V_{ONL} = \text{On Channel Loss} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz}$$

Bandwidth (BW) = the frequency 3 dB below  $V_{ONL}$

$V_{CT}$  = Use  $V_{ISO}$  setup and test to all other switch analog input/outputs terminated with 50  $\Omega$

Figure 8. Off Channel Isolation / On Channel Loss (BW)/Crosstalk (On Channel to Off Channel) /  $V_{ONL}$

## ORDERING INFORMATION

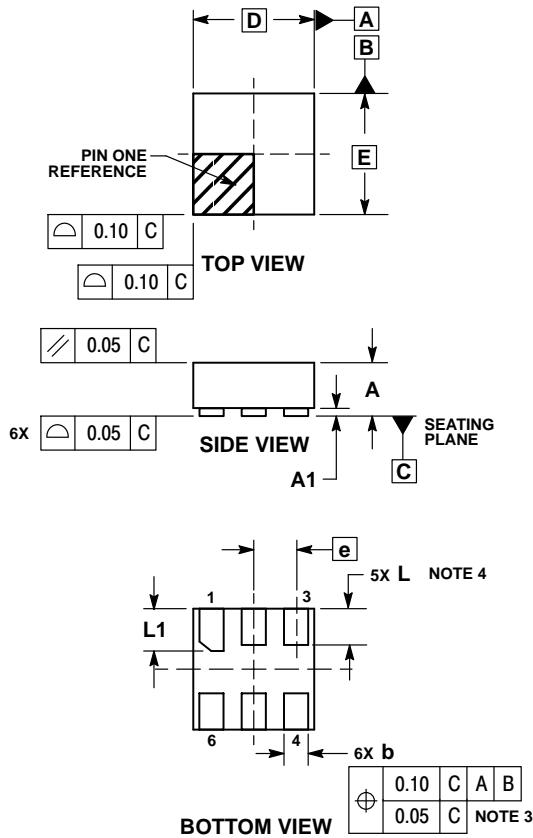
Device	Package	Shipping <sup>†</sup>
NLAS3157MX3TCG	ULLGA6 – 1.0 x 1.0, 0.35P (Pb-Free)	3000 / Tape & Reel

<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.

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## PACKAGE DIMENSIONS

### ULLGA6 1.0x1.0, 0.35P CASE 613AD ISSUE A

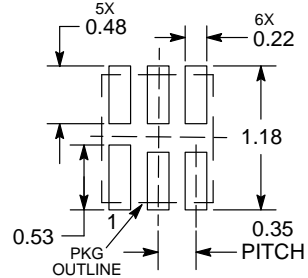


**NOTES:**

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
A	—	0.40
A1	0.00	0.05
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

### MOUNTING FOOTPRINT SOLDERMASK DEFINED\*



\*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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