# Ultra-Small Dual Single Pole, Single Throw Analog Switch with Over Voltage Tolerance

The NLAS2066 is a Dual SPST (Single Pole, Single Throw) Analog Switch high performance version of the popular NLAS323. Packaged in the ultra-small US8 package. It is designed as a general analog/digital switch and can also be used to isolate USB ports.

### **Features**

- Same Pinout as the Popular NLAS323
- Excellent Performance Maximum RDS<sub>ON</sub> 15 Ω at 3.0 V
- Matching Between the Switches  $\pm 1.5 \Omega$  at 3.0 V
- 1.65 V to 5.5 V Operating Range
- Lower Threshold Voltages for LVTTL/CMOS Levels
- Ultra-Low Charge Injection ≤ 4.8 pC at 3.0 V
- Low Standby Power  $I_{CC} = 1.0 \text{ nA (max)} @ T_A = 25^{\circ}C$
- CMOS Level Compatibility
- OVT\* (Pins 1, 3, 5, and 7) These Pins may be Subjected to 0 to +7.0 V, Regardless of Operating Voltage
- Allows a Short from USB Line without Damage to the Device
- This is a Pb-Free Device\*

## **Typical Applications**

- USB Isolation
- Cell Phones
- PDAs
- MP3s Digital Still Cameras

### **Important Information**

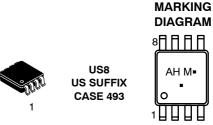
• ESD Protection: Human Body Model; > 1500 V Machine Model; > 200 V

• Latch-Up Maximum Rating: 200 mA



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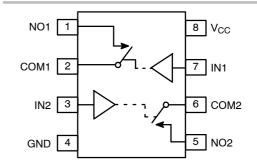


AH = Specific Device Code

M = Date Code

= Pb-Free Package

(Note: Microdot may be in either location)



#### **PIN ASSIGNMENT**

Pin	Function	OVT
1	NO1	Yes
2	COM1	ı
3	IN2	Yes
4	GND	i
5	NO2	Yes
6	COM2	-
7	IN1	Yes
8	V <sub>CC</sub>	-

### **FUNCTION TABLE**

On/Off Enable Input	State of Analog Switch
L	Off
Н	On

### **ORDERING INFORMATION**

See detailed ordering and shipping information in the package dimensions section on page 8 of this data sheet.

<sup>\*</sup>Over Voltage Tolerance (OVT) enables pins to function outside (higher) of their operating voltages, with no damage to the devices or to signal integrity.

<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.

### **MAXIMUM RATINGS**

Symbol	Rating		Value	Unit
V <sub>CC</sub>	DC Supply Voltage		-0.5  to  +7.0	V
VI	DC Input Voltage	Pins 1, 3, 5, 7 Pins 2, 6	$-0.5 \text{ to } +7.0 \\ -0.5 \text{ to V}_{CC}$	V
Vo	DC Output Voltage		-0.5  to  +7.0	V
I <sub>IK</sub>	DC Input Diode Current	V <sub>I</sub> < GND	-50	mA
I <sub>OK</sub>	DC Output Diode Current	V <sub>O</sub> < GND	-50	mA
I <sub>O</sub>	DC Output Sink Current		±50	mA
Icc	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 S	econds	260	°C
TJ	Junction Temperature under Bias		+150	°C
$\theta_{JA}$	Thermal Resistance (Note 1)		250	°C/W
P <sub>D</sub>	Power Dissipation in Still Air at 85°C		250	mW
MSL	Moisture Sensitivity		Level 1	_
F <sub>R</sub>	Flammability Rating	Oxygen Index: 28 to 34	UL 94 V-0 @ 0.125 in	-
V <sub>ESD</sub>	ESD Withstand Voltage	Human Body Model (Note 2) Machine Model (Note 3) Charged Device Model (Note 4)	> 1500 > 200 N/A	V

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 with no air flow
- Tested to EIA/JESD22-A114-A
   Tested to EIA/JESD22-A115-A
- 4. Tested to JESD22-C101-A

## **RECOMMENDED OPERATING CONDITIONS**

Symbol	Characteristics			Max	Unit
V <sub>CC</sub>	Positive DC Supply Voltage		1.65	5.5	V
V <sub>IN</sub>	Digital Input Voltage (Enable)	GND	5.5	V	
V <sub>IO</sub>	Static or Dynamic Voltage Across an Off Switch		GND	V <sub>CC</sub>	V
V <sub>IS</sub>	Analog Input Voltage	NO COM	GND GND	V <sub>CC</sub> 5.5	V
T <sub>A</sub>	Operating Temperature Range, All Package Types		-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Time (Enable Input)	$V_{CC} = 3.3 \text{ V} \pm 0.3 \text{ V}$ $V_{CC} = 5.0 \text{ V} \pm 0.5 \text{ V}$	0	100 20	ns/V

# DEVICE JUNCTION TEMPERATURE VS. TIME TO 0.1% BOND FAILURES

Junction Temperature °C	Time, Hours	Time, Years
80	1,032,200	117.8
90	419,300	47.9
100	178,700	20.4
110	79,600	9.4
120	37,000	4.2
130	17,800	2.0
140	8,900	1.0

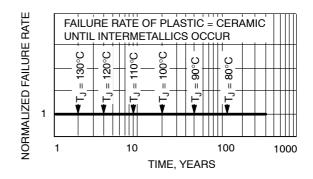


Figure 1. Failure Rate vs. Time Junction Temperature

# DC CHARACTERISTICS - Digital Section (Voltages Referenced to GND)

				Guaranteed Max Limit			
Symbol	Parameter	Condition	V <sub>CC</sub>	25°C	-40 to 85°C	−55 to <125°C	Unit
V <sub>IH</sub>	Minimum High- Level Input Voltage, Enable Inputs		2.3 ± 10% 2.7 ± 10% 3.0 ± 10% 5.0 ± 10%	V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55	V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55	V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55 V <sub>CC</sub> x 0.55	V
V <sub>IL</sub>	Maximum Low- Level Input Voltage, Enable Inputs		2.3 ± 10% 2.7 ± 10% 3.0 ± 10% 5.0 ± 10%	V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30	V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30	V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30 V <sub>CC</sub> x 0.30	V
I <sub>IN</sub>	Maximum Input Leakage Current, Enable Inputs	V <sub>IN</sub> = 5.5 V or GND	0 V to 5.5 V	<u>+</u> 0.1	<u>+</u> 1.0	<u>+</u> 1.0	μΑ
I <sub>CC</sub>	Maximum Quies- cent Supply Current (per package)	Enable and V <sub>IS</sub> = V <sub>CC</sub> or GND	5.5	1.0	1.0	2.0	μΑ

# DC ELECTRICAL CHARACTERISTICS - Analog Section

				G	nit		
Symbol	Parameter	Condition	v <sub>cc</sub>	25°C	-40 to 85°C	−55 to <125°C	Unit
R <sub>ON</sub>	Maximum On	$V_{IN} = V_{IH}$ $I_s = 8 \text{ mA}$	2.3	50	54	54	Ω
	Resistance	$V_{IS} = V_{CC}$ to GND $I_s = 8$ mA	2.7	20	24	24	
		I <sub>s</sub> = 24 mA	3.0	15	19	19	
		I <sub>s</sub> = 32 mA	4.5	7	11	11	
		(Figures 2 and 3)					
R <sub>FLAT(ON)</sub>	On Resistance	$V_{IN} = V_{IH}$ $I_s = 8 \text{ mA}$	2.3	60	60	60	Ω
	Flatness	$V_{IS} = 0 \text{ to } V_{CC}$ $I_{S} = 8 \text{ mA}$	2.7	24	24	24	
		I <sub>s</sub> = 24 mA	3.0	13.5	13.5	13.5	
		$I_s = 32 \text{ mA}$	4.5	3.0	3.0	3.0	
		(Figure 5)					
$\Delta$ R <sub>ON</sub>	On Resistance	V <sub>IS</sub> = 1.4 V	2.3	1.3	1.3	1.3	Ω
	Match Between	V <sub>IS</sub> = 1.6 V	2.7	1.4	1.4	1.4	
	Channels	V <sub>IS</sub> = 1.8 V	3.0	1.5	1.5	1.5	
		$V_{IS} = 2.7 \text{ V}$	4.5	2.0	2.0	2.0	
		(Figures 4, 5 and 6)					
I <sub>NO(OFF)</sub>	Off Leakage Current	$V_{IN} = V_{IL}$	5.5	1.0	10	100	nA
, ,		$V_{NO} = 1.0 \text{ V}, V_{COM} = 4.5 \text{ V}$					
		or					
		$V_{COM} = 1.0 \text{ V} \text{ and } V_{NO} 4.5 \text{ V}$					
I <sub>COM(OFF)</sub>	Off Leakage Current	$V_{IN} = V_{IL}$	5.5	1.0	10	100	nA
		V <sub>NO</sub> = 4.5 V or 1.0 V					
		V <sub>COM</sub> = 1.0 V or 4.5 V					

# AC ELECTRICAL CHARACTERISTICS (Input $t_{\text{r}} = t_{\text{f}} = 3.0 \text{ ns}$ )

			Guaranteed Max Limit										
			V <sub>CC</sub>		25°C		-4	0 to 8	5°C	-55	to <12	25°C	
Symbol	Parameter	Condition	(V)	Min	Тур	Max	Min	Тур	Max	Min	Тур	Max	Unit
t <sub>ON</sub>	Turn-On Time	$R_L$ = 300 $\Omega$ , $C_L$ = 35 pF (Figures 7, 14 and 15)	2.3 2.7 3.0 4.5		8 4 3 2	9 5 4 3			10 7 6 5			10 7 6 5	ns
t <sub>OFF</sub>	Turn-Off Time	$R_L = 300 \Omega$ , $C_L = 35 pF$ (Figures 7, 14 and 15)	2.3 2.7 3.0 4.5		8 6 5 4	10 8 7 6			11 9 8 7			11 9 8 7	ns

		Typical @ 25°C, V <sub>CC</sub> = 5.0 V	Unit
C <sub>IN</sub>	Maximum Input Capacitance, Select Input	3.0	pF
C <sub>NO</sub> or C <sub>NC</sub>	Analog I/O (Switch Off)	10	
C <sub>COM(OFF)</sub>	Common I/O (Switch Off)	10	
C <sub>COM(ON)</sub>	Feedthrough (Switch Off)	10	

# ADDITIONAL APPLICATIONS CHARACTERISTICS (Voltage Reference to GND Unless Noted)

Symbol	Parameter	Condition	V <sub>CC</sub> (V)	Typical 25°C	Unit
BW	Maximum On-Channel -3.0 dB Bandwidth or Minimum Frequency Response	V <sub>IS</sub> = 0 dBm (Figure 8 and 9)	2.3 2.7	102 175	MHz
		(Figure 5 and 5)	3.0 4.5	180 186	
V <sub>ONL</sub>	Maximum Feed-Through On Loss	V <sub>IS</sub> = 0 dBm @ 10 kHz (Figure 8 and 9)	2.3 2.7 3.0 4.5	-2.2 -0.9 -0.8 -0.4	dB
V <sub>ISO</sub>	Off-Channel Isolation	f = 100 kHz V <sub>IS</sub> = 1.0 V RMS (Figure 10 and 11)	2.3 2.7 3.0 4.5	-73 -74 -74 -75	dB
Q	Charge Injection Enable Input to Common I/O	$V_{IS} = V_{CC}$ to GND, $F_{IS} = 20$ kHz (Figure 12)	3.0 5.5	4.8 7.4	рС
THD	Total Harmonic Distortion TDH + Noise	$F_{IS}$ = 10 Hz to 100 kHz, $R_L$ = Rgen = 600 $\Omega$ , $C_L$ = 50 pF (Figure 13)	3.0 5.5	0.19 0.06	%

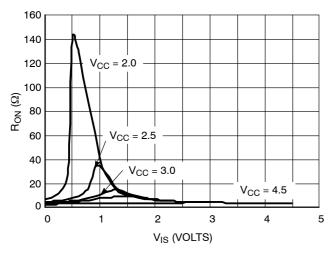


Figure 2. R<sub>ON</sub> vs. V<sub>COM</sub> and V<sub>CC</sub> (@25°C)

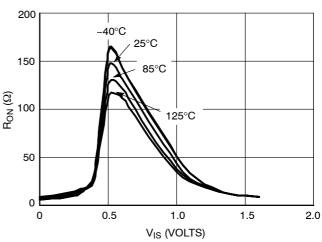


Figure 3.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC}$  = 2.0 V

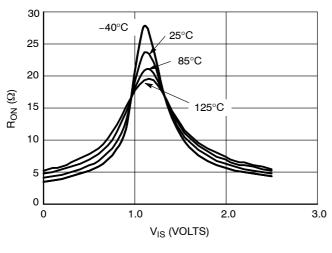


Figure 4.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC}$  = 2.5 V

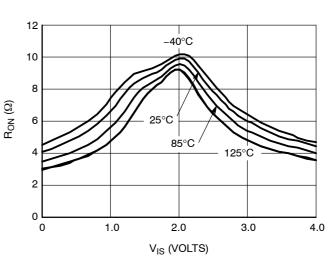


Figure 5.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC}$  = 3.0 V

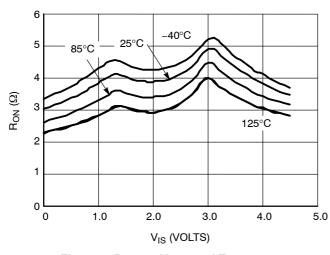


Figure 6.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC}$  = 4.5 V

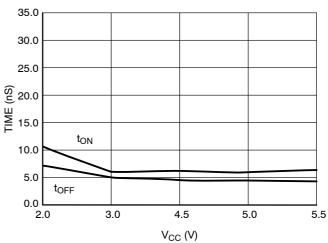
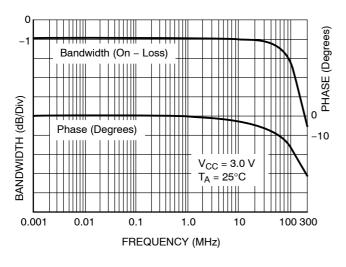


Figure 7. Switching Time vs. Supply Voltage,  $T = 25^{\circ}C$ 



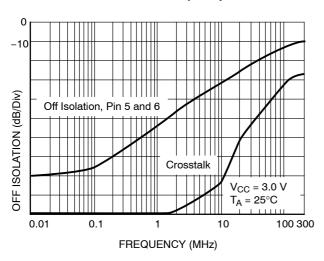
0
-1
Bandwidth (On – Loss)
Phase (Degrees)
-10
V<sub>CC</sub> = 5.0 V
T<sub>A</sub> = 25°C

0.001
0.01
0.1
1.0
10
100 300

FREQUENCY (MHz)

Figure 8. ON Channel Bandwidth and Phase Shift Over Frequency

Figure 9. ON Channel Bandwidth and Phase Shift Over Frequency



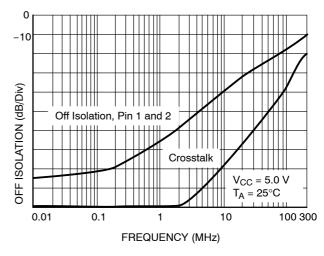
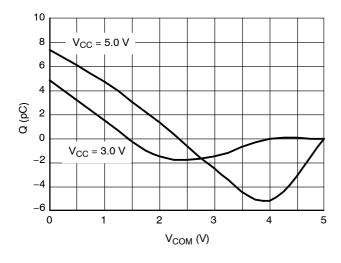


Figure 10. Off Isolation and Crosstalk

Figure 11. Off Isolation and Crosstalk



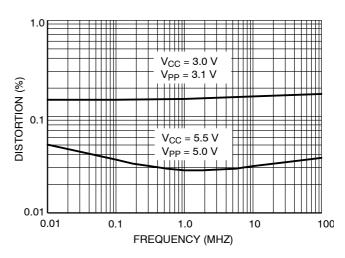


Figure 12. Charge Injection vs. V<sub>COM</sub>

Figure 13. THD vs. Frequency

# **TIMING INFORMATION**

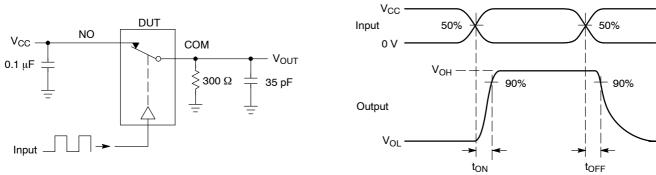


Figure 14. t<sub>ON</sub>/t<sub>OFF</sub>

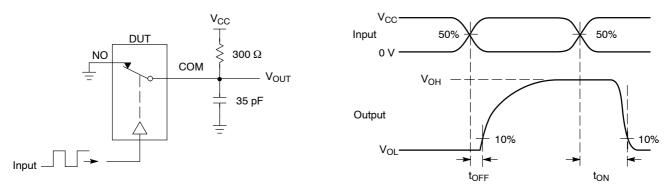


Figure 15. t<sub>ON</sub>/t<sub>OFF</sub>

V <sub>CC</sub>	VMI
2.0 V	1.0 V
3.0 V	1.5 V
4.5 V	1.5 V

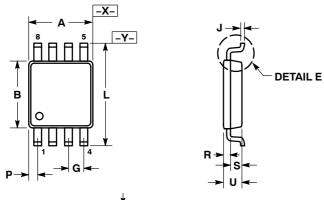
## **DEVICE ORDERING INFORMATION**

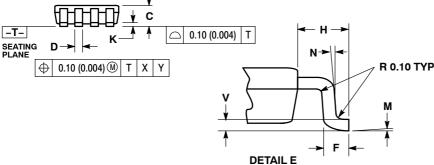
		Device Non	nenclature			
Device	Circuit Indicator	Technology	Device Function	Package Suffix	Package Type	Shipping <sup>†</sup>
NLAS2066USG	NL	AS	2066	US	US8 (Pb-Free)	3,000 / Tape & Reel
NLAS2066UST3G	NL	AS	2066	UST3	US8 (Pb-Free)	10,000 / Tape & Reel

<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

### US8 **US SUFFIX** CASE 493-02 **ISSUE B**



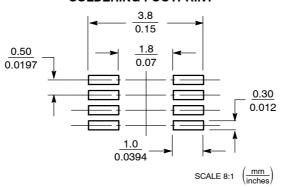


#### NOTES:

- DIMENSIONING AND TOLERANCING PER
- DIMENSIONING AND TOLEHANGING PER ANSI Y14-5M, 1982. CONTROLLING DIMENSION: MILLIMETERS. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSION OR GATE BURR. MOLD FLASH. PROTRUSION AND GATE BURR SHALL NOT EXCEED 0.140 MM (0.0055") PER SIDE. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION.
- INTER-LEAD FLASH AND PROTRUSION SHALL NOT E3XCEED 0.140 (0.0055") PER
- 5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM.
- (300-800 °). ALL TOLERANCE UNLESS OTHERWISE SPECIFIED ±0.0508 (0.0002 ").

	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
Α	1.90	2.10	0.075	0.083
В	2.20	2.40	0.087	0.094
С	0.60	0.90	0.024	0.035
D	0.17	0.25	0.007	0.010
F	0.20	0.35	0.008	0.014
G	0.50 BSC		0.020 BSC	
Н	0.40 REF		0.016 REF	
J	0.10	0.18	0.004	0.007
K	0.00	0.10	0.000	0.004
L	3.00	3.20	0.118	0.126
M	0 °	6 °	0 °	6 °
N	5°	10 °	5 °	10 °
Р	0.23	0.34	0.010	0.013
R	0.23	0.33	0.009	0.013
S	0.37	0.47	0.015	0.019
U	0.60	0.80	0.024	0.031
٧	0.12 BSC		0.005 BSC	

### **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.

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