

# NLAS2066

## 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  $R_{DS(ON)}$  15  $\Omega$  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 LVTTTL/CMOS Levels
- Ultra-Low Charge Injection  $\leq 4.8$  pC at 3.0 V
- Low Standby Power –  $I_{CC} = 1.0$  nA (max) @  $T_A = 25^\circ\text{C}$
- CMOS Level Compatibility
- OVT\* (Pins 1, 3, 5, and 7) as much as +7.0 V in any Input, Regardless of Operating Voltage, Allows a Short from USB Line without Damage to the Device

### Typical Applications

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

### Important Information

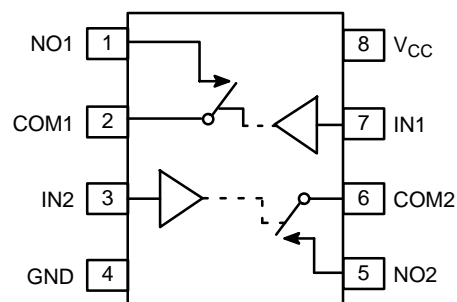
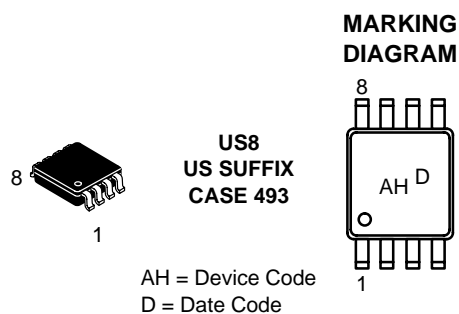
- ESD Protection: MM >200 V, HBM >2000 V
- Latch-Up Max Rating: 200 mA

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



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### PIN ASSIGNMENT

Pin	Function	OVT
1	NO1	Yes
2	COM1	–
3	IN2	Yes
4	GND	–
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
H	On

### ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 9 of this data sheet.

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## MAXIMUM RATINGS

Symbol	Rating	Value	Unit
V <sub>CC</sub>	DC Supply Voltage	-0.5 to +7.0	V
V <sub>I</sub>	DC Input Voltage	-0.5 to +7.0 -0.5 to V <sub>CC</sub>	V
V <sub>O</sub>	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
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
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)	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)	> 2000 > 200 N/A V

Maximum Ratings are those values beyond which damage to the device may occur. Exposure to these conditions or conditions beyond those indicated may adversely affect device reliability. Functional operation under absolute maximum rated conditions is not implied. Functional operation should be restricted to the Recommended Operating Conditions.

1. Measured with minimum pad spacing on an FR4 board, using 10 mm-by-1 inch, 2-ounce copper trace with no air flow
2. Tested to EIA/JESD22-A114-A
3. Tested to EIA/JESD22-A115-A
4. Tested to JESD22-C101-A

## RECOMMENDED OPERATING CONDITIONS

Symbol	Characteristics	Min	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	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)	0 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

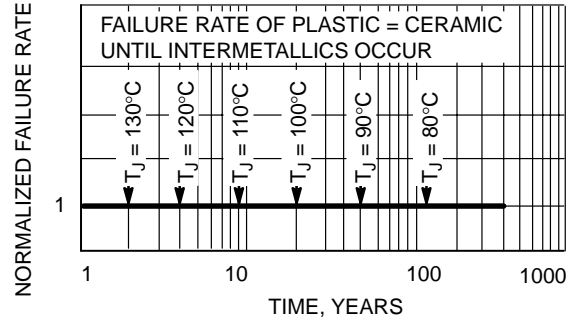


Figure 1. Failure Rate vs. Time Junction Temperature

**DC CHARACTERISTICS – Digital Section** (Voltages Referenced to GND)

Symbol	Parameter	Condition	V <sub>CC</sub>	Guaranteed Max Limit			Unit
				25°C	-40 to 85°C	-55 to <125°C	
V <sub>IH</sub>	Minimum High-Level Input Voltage, Enable Inputs		2.3 ± 10%	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	V
			2.7 ± 10%	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	
			3.0 ± 10%	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	
			4.5 ± 10%	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	V <sub>CC</sub> × 0.60	
V <sub>IL</sub>	Maximum Low-Level Input Voltage, Enable Inputs		2.3 ± 10%	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	V
			2.7 ± 10%	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	
			3.0 ± 10%	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	
			4.5 ± 10%	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	V <sub>CC</sub> × 0.25	
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	±0.1	±1.0	±1.0	µA
I <sub>CC</sub>	Maximum Quiescent Supply Current (per package)	Enable and V <sub>IS</sub> = V <sub>CC</sub> or GND	5.5	1.0	1.0	2.0	µA

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## DC ELECTRICAL CHARACTERISTICS – Analog Section

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

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

Symbol	Parameter	Test Conditions	V <sub>CC</sub> (V)	Guaranteed Max Limit									Unit
				25°C			-40 to 85°C			-55 to <125°C			
				Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
t <sub>ON</sub>	Turn-On Time	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF (Figures 7, 14 and 15)	2.3		8	9			10			10	ns
			2.7		4	5			7			7	
			3.0		3	4			6			6	
			4.5		2	3			5			5	
t <sub>OFF</sub>	Turn-Off Time	R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF (Figures 7, 14 and 15)	2.3		8	10			11			11	ns
			2.7		6	8			9			9	
			3.0		5	7			8			8	
			4.5		4	6			7			7	

		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			

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### 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	102	MHz
			2.7	175	
			3.0	180	
			4.5	186	
V <sub>ONL</sub>	Maximum Feed-Through On Loss	V <sub>IS</sub> = 0 dBm @ 10 kHz (Figure 8 and 9)	2.3	-2.2	dB
			2.7	-0.9	
			3.0	-0.8	
			4.5	-0.4	
V <sub>ISO</sub>	Off-Channel Isolation	f = 100 kHz V <sub>IS</sub> = 1.0 V RMS (Figure 10 and 11)	2.3	-73	dB
			2.7	-74	
			3.0	-74	
			4.5	-75	
Q	Charge Injection Enable Input to Common I/O	V <sub>IS</sub> = V <sub>CC</sub> to GND, F <sub>IS</sub> = 20 kHz (Figure 12)	3.0	4.8	pC
			5.5	7.4	
THD	Total Harmonic Distortion TDH + Noise	F <sub>IS</sub> = 10 Hz to 100 kHz, R <sub>L</sub> = R <sub>gen</sub> = 600 Ω, C <sub>L</sub> = 50 pF (Figure 13)	3.0	0.19	%
			5.5	0.06	

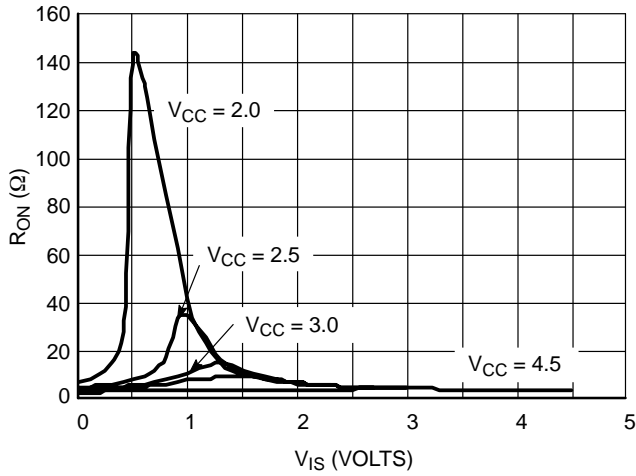


Figure 2.  $R_{ON}$  vs.  $V_{COM}$  and  $V_{CC}$  (@25°C)

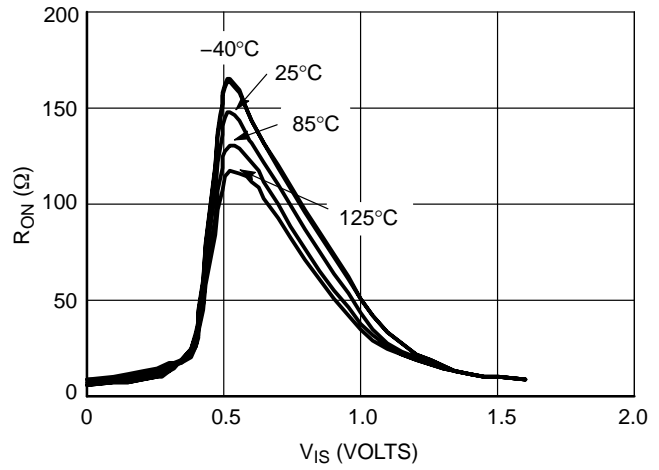


Figure 3.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC} = 2.0$  V

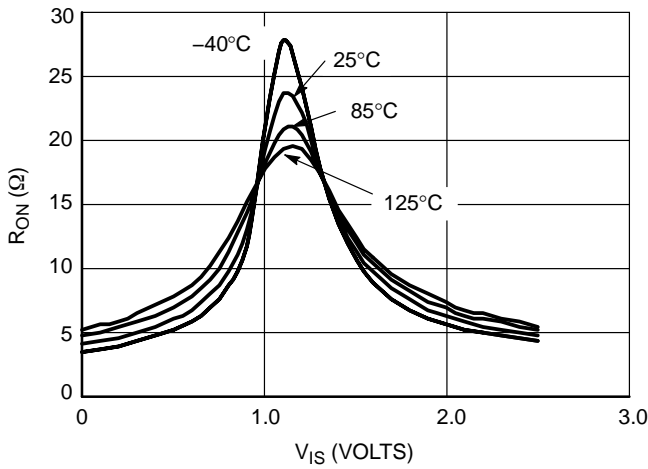


Figure 4.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC} = 2.5$  V

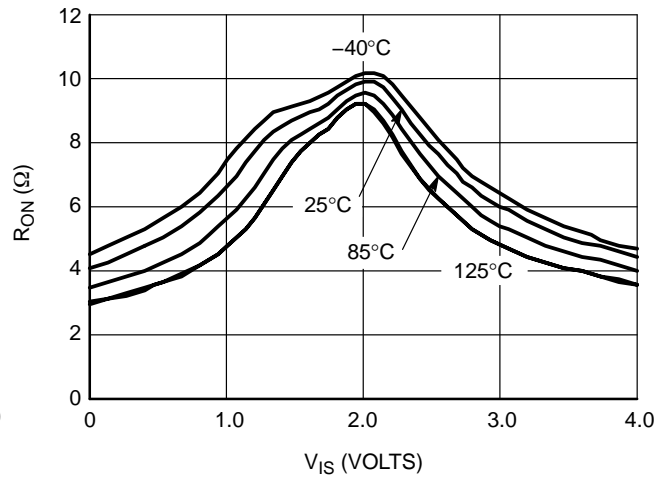


Figure 5.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC} = 3.0$  V

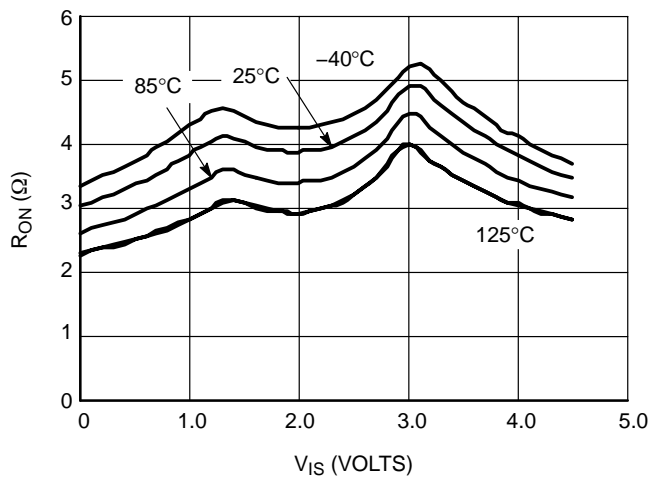


Figure 6.  $R_{ON}$  vs.  $V_{COM}$  and Temperature,  $V_{CC} = 4.5$  V

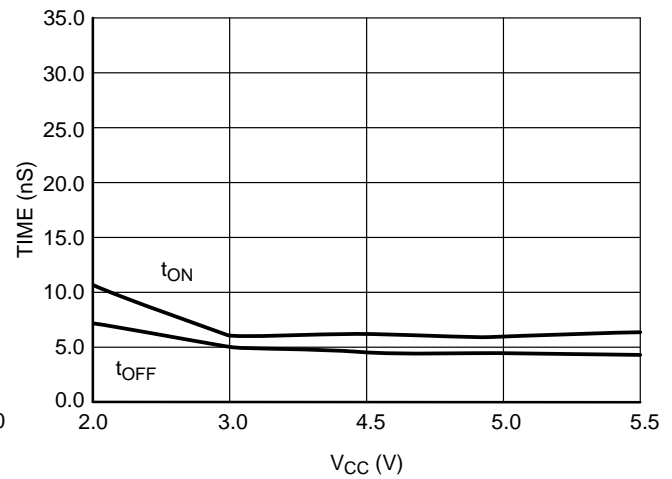


Figure 7. Switching Time vs. Supply Voltage,  $T = 25^\circ\text{C}$

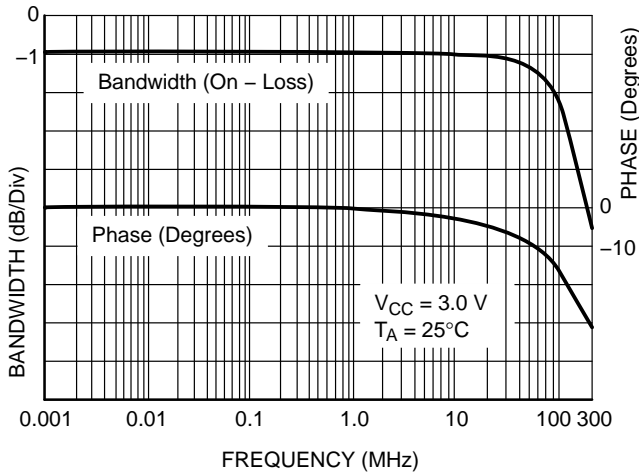


Figure 8. ON Channel Bandwidth and Phase Shift Over Frequency

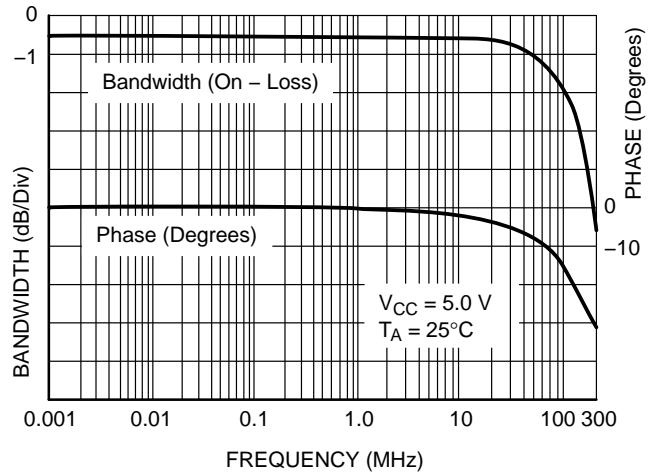


Figure 9. ON Channel Bandwidth and Phase Shift Over Frequency

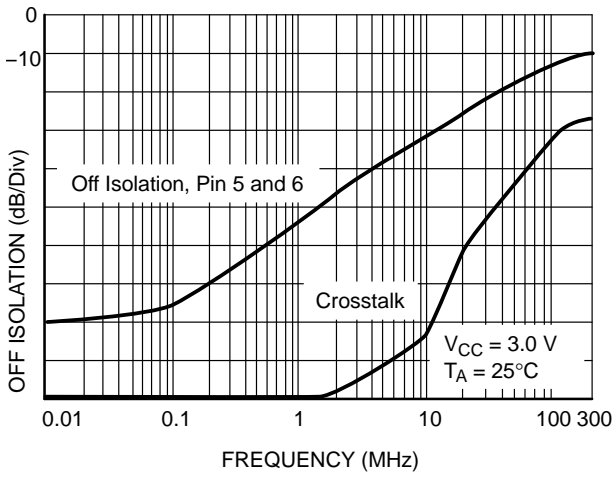


Figure 10. Off Isolation and Crosstalk

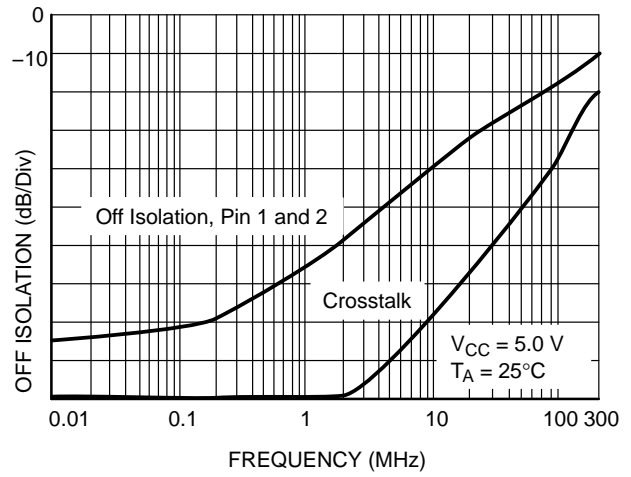


Figure 11. Off Isolation and Crosstalk

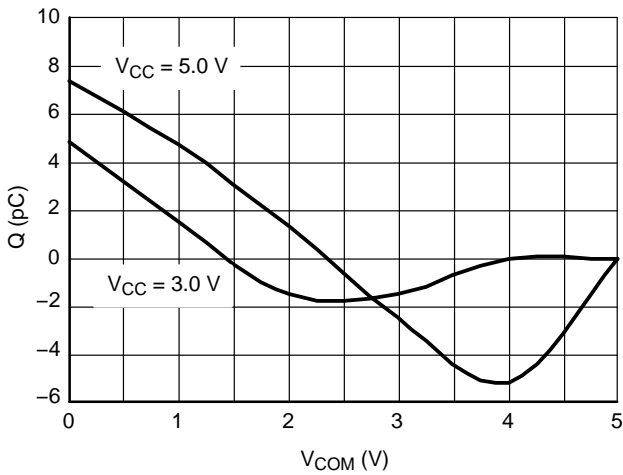


Figure 12. Charge Injection vs.  $V_{COM}$

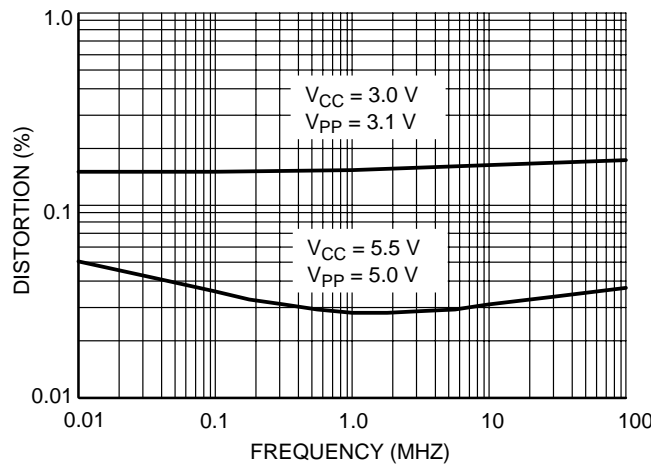


Figure 13. THD vs. Frequency

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## TIMING INFORMATION

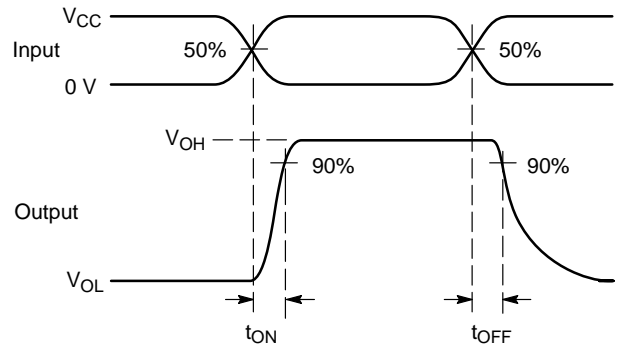
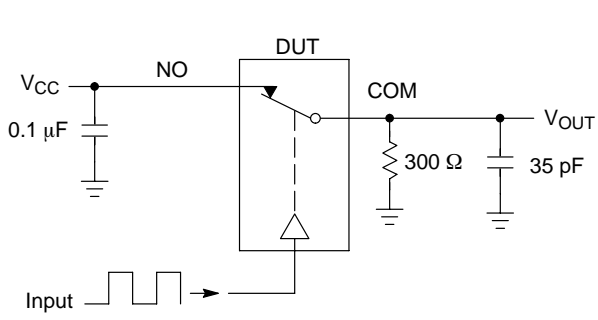


Figure 14.  $t_{ON}/t_{OFF}$

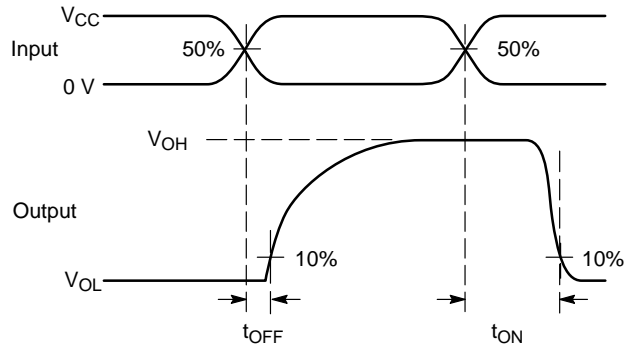
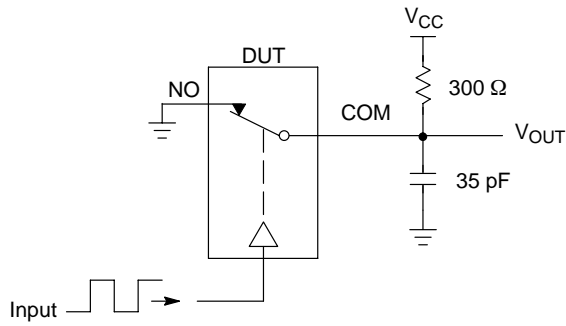


Figure 15.  $t_{ON}/t_{OFF}$

$V_{CC}$	VMI
2.0 V	1.0 V
3.0 V	1.5 V
4.5 V	1.5 V



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## DEVICE ORDERING INFORMATION

Device Order Number	Device Nomenclature				Package Type	Tape and Reel Size
	Circuit Indicator	Technology	Device Function	Package Suffix		
NLAS2066US	NL	AS	2066	US	US8	178 mm (7") 3000 Unit

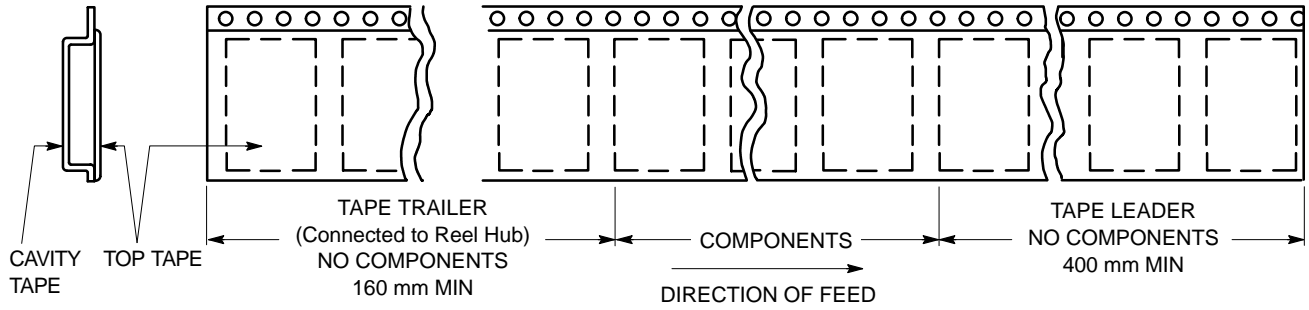


Figure 16. Tape Ends for Finished Goods

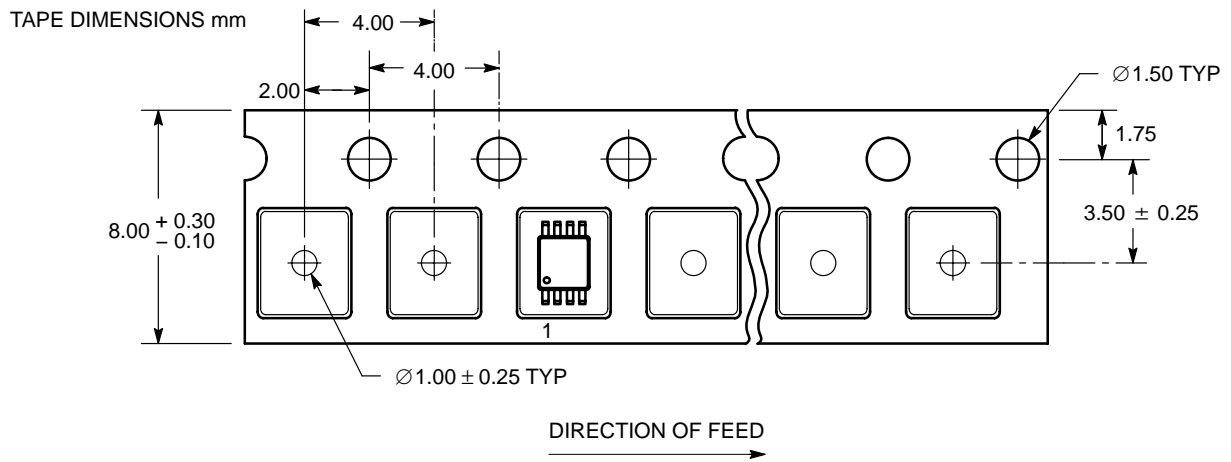


Figure 17. US8 Reel Configuration/Orientation

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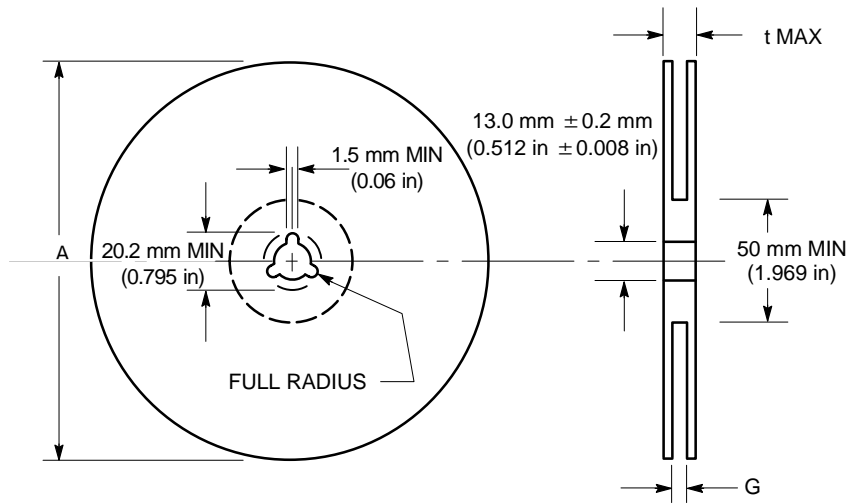


Figure 18. Reel Dimensions

## REEL DIMENSIONS

Tape Size	T and R Suffix	A Max	G	t Max
8 mm	US	178 mm (7 in)	8.4 mm, + 1.5 mm, -0.0 (0.33 in + 0.059 in, -0.00)	14.4 mm (0.56 in)

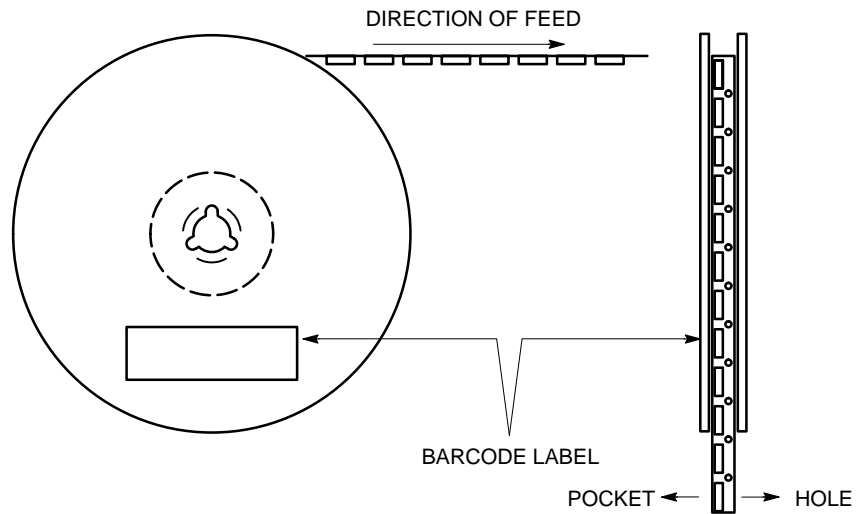
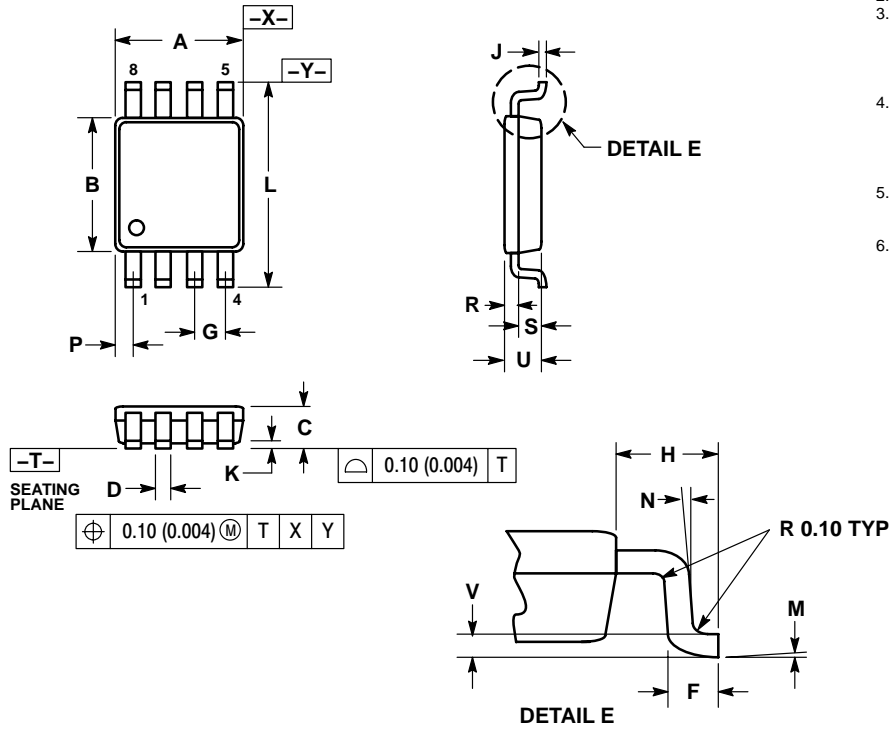


Figure 19. Reel Winding Direction

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## PACKAGE DIMENSIONS

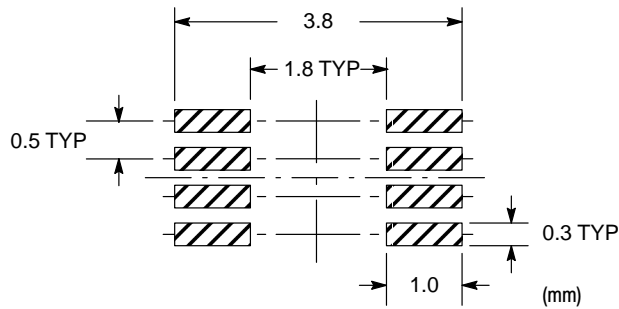
US8  
US SUFFIX  
CASE 493-02  
ISSUE A




**NOTES:**

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. 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.
4. DIMENSION "B" DOES NOT INCLUDE INTER-LEAD FLASH OR PROTRUSION. INTER-LEAD FLASH AND PROTRUSION SHALL NOT EXCEED 0.140 (0.0055") PER SIDE.
5. LEAD FINISH IS SOLDER PLATING WITH THICKNESS OF 0.0076-0.0203 MM. (300-800 ").
6. ALL TOLERANCE UNLESS OTHERWISE SPECIFIED  $\pm 0.0508$  (0.0002 ").

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	1.90	2.10	0.075	0.083
B	2.20	2.40	0.087	0.094
C	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	
H	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°
P	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
V	0.12 BSC		0.005 BSC	



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