

# Dual SPST Analog Switch, Low Voltage, Single Supply

The NLAS325 is a dual SPST (Single Pole, Single Throw) switch, similar to 1/2 a standard 4066. The device permits the independent selection of 2 analog/digital signals. Available in the Ultra-Small 8 package.

The use of advanced 0.6  $\mu$  CMOS process, improves the  $R_{ON}$  resistance considerably compared to older higher voltage technologies.

## Features

- On Resistance is 20  $\Omega$  Typical at 5.0 V
- Matching is < 1.0  $\Omega$  Between Sections
- 2.0–6.0 V Operating Range
- Ultra Low < 5.0 pC Charge Injection
- Ultra Low Leakage < 1.0 nA at 5.0 V, 25°C
- Wide Bandwidth > 200 MHz, –3.0 dB
- 2000 V ESD (HBM)
- $R_{ON}$  Flatness  $\pm 6.0 \Omega$  at 5.0 V
- US8 Package
- Independent Enables; One Positive, One Negative
- Pb-Free Package is Available

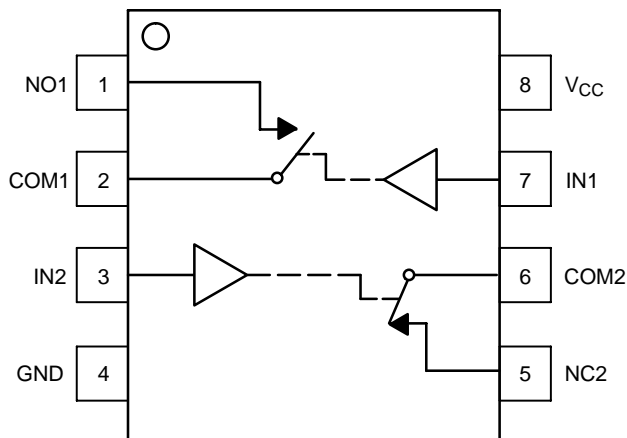


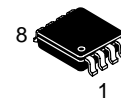
Figure 1. Pinout



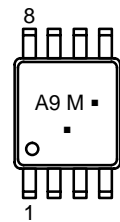
ON Semiconductor®

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## MARKING DIAGRAM



US8  
US SUFFIX  
CASE 493



A9 = Device Code  
M = Date Code\*  
▪ = Pb-Free Package

(Note: Microdot may be in either location)

\*Date Code orientation may vary depending upon manufacturing location.

## PIN ASSIGNMENT

1	NO1
2	COM1
3	IN2
4	GND
5	NC2
6	COM2
7	IN1
8	V <sub>CC</sub>

## FUNCTION TABLE

On/Off Enable Input	Analog Switch 1	Analog Switch 2
L	Off	On
H	On	Off

## ORDERING INFORMATION

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

# NLAS325

## MAXIMUM RATINGS

Symbol	Parameter	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	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, 1.0 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

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.
2. Tested to EIA/JESD22-A114-A.
3. Tested to EIA/JESD22-A115-A.
4. Tested to JESD22-C101-A.

## RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter	Min	Max	Unit
V <sub>CC</sub>	DC Supply Voltage	2.0	5.5	V
V <sub>IN</sub>	Digital Select Input Voltage	GND	5.5	V
V <sub>IS</sub>	Analog Input Voltage (NC, NO, COM)	GND	V <sub>CC</sub>	V
T <sub>A</sub>	Operating Temperature Range	-55	+125	°C
t <sub>r</sub> , t <sub>f</sub>	Input Rise or Fall Time, SELECT V <sub>CC</sub> = 3.3 V ± 0.3 V V <sub>CC</sub> = 5.0 V ± 0.5 V	0	100 20	ns/V

## DEVICE JUNCTION TEMPERATURE VERSUS 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

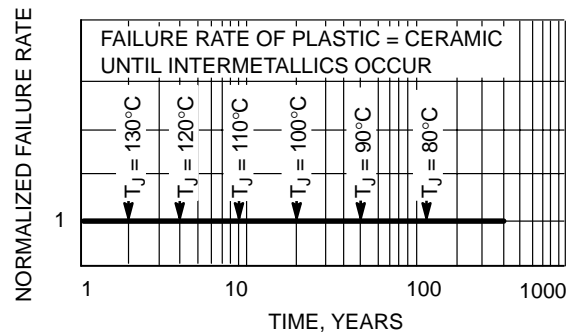


Figure 2. Failure Rate vs. Time Junction Temperature

# NLAS325

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

Symbol	Parameter	Condition	V <sub>CC</sub>	Guaranteed Limit			Unit
				–55°C to 25°C	<85°C	<125°C	
V <sub>IH</sub>	Minimum High-Level Input Voltage, Select Inputs		2.0	1.5	1.5	1.5	V
			2.5	1.9	1.9	1.9	
			3.0	2.1	2.1	2.1	
			4.5	3.15	3.15	3.15	
			5.5	3.85	3.85	3.85	
V <sub>IL</sub>	Maximum Low-Level Input Voltage, Select Inputs		2.0	0.5	0.5	0.5	V
			2.5	0.6	0.6	0.6	
			3.0	0.9	0.9	0.9	
			4.5	1.35	1.35	1.35	
			5.5	1.65	1.65	1.65	
I <sub>IN</sub>	Maximum Input Leakage Current, Select Inputs	V <sub>IN</sub> = 5.5 V or GND	0 V to 5.5 V	±0.2	±2.0	±2.0	μA
I <sub>CC</sub>	Maximum Quiescent Supply Current	Select and V <sub>IS</sub> = V <sub>CC</sub> or GND	5.5	4.0	4.0	8.0	μA

## DC ELECTRICAL CHARACTERISTICS – Analog Section

Symbol	Parameter	Condition	V <sub>CC</sub>	Guaranteed Limit			Unit
				–55°C to 25°C	<85°C	<125°C	
R <sub>ON</sub>	Maximum “ON” Resistance (Figures 16 – 22)	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>IS</sub> = GND to V <sub>CC</sub>  I <sub>IN</sub>   ≤ 10 mA	2.5	85	95	105	Ω
			3.0	45	50	55	
			4.5	30	35	40	
			5.5	25	30	35	
R <sub>FLAT(ON)</sub>	ON Resistance Flatness (Figures 16 – 22)	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub>  I <sub>IN</sub>   ≤ 10 mA V <sub>IS</sub> = 1.0 V, 2.0 V, 3.5 V	4.5	4.0	4.0	5.0	Ω
I <sub>NC(OFF)</sub> I <sub>NO(OFF)</sub>	NO or NC Off Leakage Current (Figure 8)	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NO</sub> or V <sub>NC</sub> = 1.0 V <sub>COM</sub> 4.5 V	5.5	1.0	10	100	nA
I <sub>COM(ON)</sub>	COM ON Leakage Current (Figure 8)	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NO</sub> 1.0 V or 4.5 V with V <sub>NC</sub> floating or V <sub>NO</sub> 1.0 V or 4.5 V with V <sub>NO</sub> floating V <sub>COM</sub> = 1.0 V or 4.5 V	5.5	1.0	10	100	nA

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## AC ELECTRICAL CHARACTERISTICS (Input $t_r = t_f = 3.0$ ns)

Symbol	Parameter	Test Conditions	$V_{CC}$ (V)	$V_{IS}$ (V)	Guaranteed Maximum Limit						Unit	
					-55°C to 25°C			< 85°C		< 125°C		
					Min	Typ*	Max	Min	Max	Min		Max
$t_{ON}$	Turn-On Time (Figures 11 and 12)	$R_L = 300 \Omega$ , $C_L = 35$ pF (Figures 4 and 5)	2.5	2.0	5.0	23	35	5.0	38	5.0	41	ns
			3.0	2.0	5.0	16	24	5.0	27	5.0	30	
			4.5	3.0	2.0	11	16	2.0	19	2.0	22	
			5.5	3.0	2.0	9.0	14	2.0	17	2.0	20	
$t_{OFF}$	Turn-Off Time (Figures 11 and 12)	$R_L = 300 \Omega$ , $C_L = 35$ pF (Figures 4 and 5)	2.5	2.0	1.0	7.0	12	1.0	15	1.0	18	ns
			3.0	2.0	1.0	5.0	10	1.0	13	1.0	16	
			4.5	3.0	1.0	4.0	6.0	1.0	9.0	1.0	12	
			5.5	3.0	1.0	3.0	5.0	1.0	8.0	1.0	11	
$t_{BBM}$	Minimum Break-Before-Make Time	$V_{IS} = 3.0$ V (Figure 3) $R_L = 300 \Omega$ , $C_L = 35$ pF	2.5	2.0	1.0	12		1.0		1.0		ns
			3.0	2.0	1.0	11		1.0		1.0		
			4.5	3.0	1.0	6.0		1.0		1.0		
			5.5	3.0	1.0	5.0		1.0		1.0		

\*Typical Characteristics are at 25°C.

Symbol	Parameter	Typical @ 25, $V_{CC} = 5.0$ V		Unit
		Value	Value	
$C_{IN}$	Maximum Input Capacitance, Select Input	8.0		pF
$C_{NO}$ or $C_{NC}$	Analog I/O (switch off)	10		
$C_{COM}$	Common I/O (switch off)	10		
$C_{(ON)}$	Feedthrough (switch on)	20		

## ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

Symbol	Parameter	Condition	$V_{CC}$ (V)	Typical	Unit
				25°C	
BW	Maximum On-Channel -3.0 dB Bandwidth or Minimum Frequency Response (Figure 10)	$V_{IN} = 0$ dBm $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6)	3.0	145	MHz
			4.5	170	
			5.5	175	
$V_{ONL}$	Maximum Feedthrough On Loss	$V_{IN} = 0$ dBm @ 100 kHz to 50 MHz $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6)	3.0	-2.0	dB
			4.5	-2.0	
			5.5	-2.0	
$V_{ISO}$	Off-Channel Isolation (Figure 9)	$f = 100$ kHz; $V_{IS} = 1.0$ V RMS $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6)	3.0	-93	dB
			4.5	-93	
			5.5	-93	
Q	Charge Injection Select Input to Common I/O (Figure 14)	$V_{IN} = V_{CC}$ to GND, $F_{IS} = 20$ kHz $t_r = t_f = 3.0$ ns $R_{IS} = 0 \Omega$ , $C_L = 1000$ pF $Q = C_L * \Delta V_{OUT}$ (Figure 7)	3.0	1.5	pC
			5.5	3.0	
THD	Total Harmonic Distortion THD + Noise (Figure 13)	$F_{IS} = 20$ Hz to 100 kHz, $R_L = R_{gen} = 600 \Omega$ , $C_L = 50$ pF $V_{IS} = 5.0$ V <sub>PP</sub> sine wave	5.5	0.1	%
VCT	Channel-to-Channel Crosstalk	$f = 100$ kHz; $V_{IS} = 1.0$ V RMS $V_{IN}$ centered between $V_{CC}$ and GND (Figure 6)	5.5	-90	dB
			3.0	-90	

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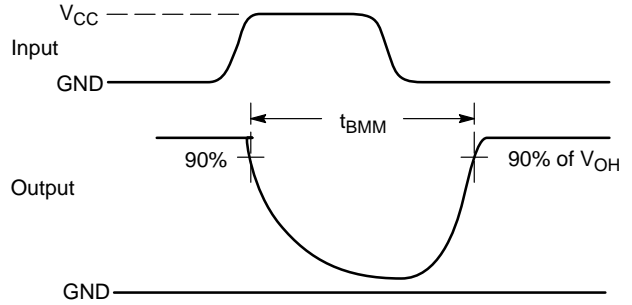
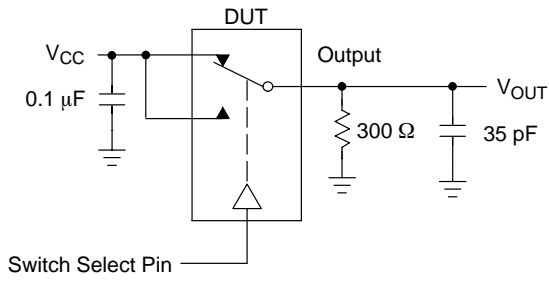


Figure 3.  $t_{\text{BMM}}$  (Time Break-Before-Make)

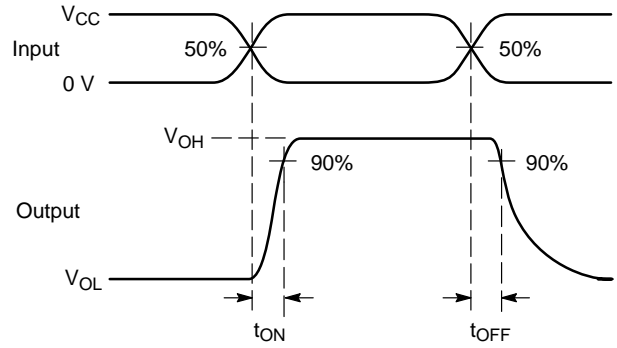
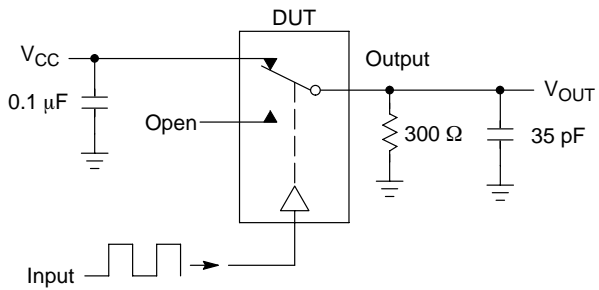


Figure 4.  $t_{\text{ON}}/t_{\text{OFF}}$

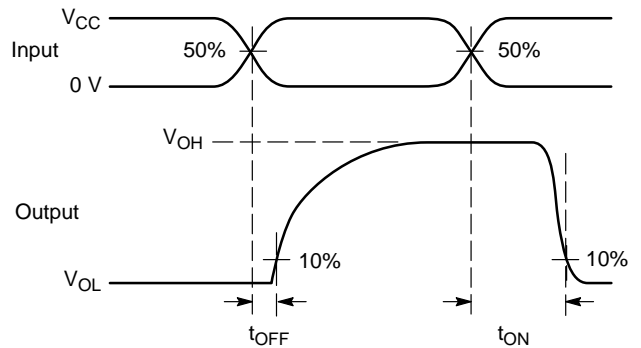
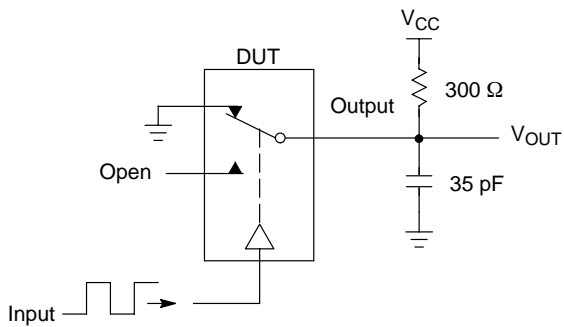
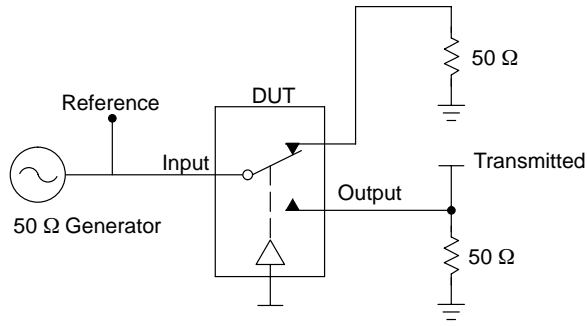


Figure 5.  $t_{\text{ON}}/t_{\text{OFF}}$

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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.

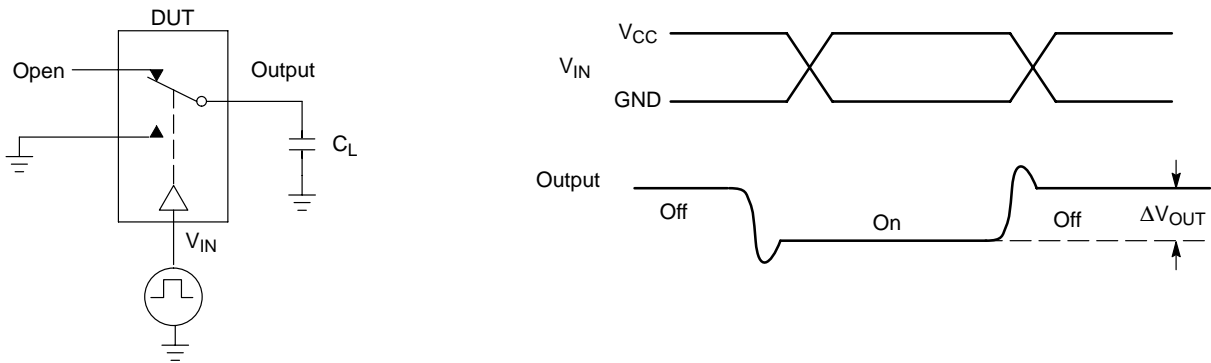
$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ or } V_{IN} \text{ at } 100 \text{ kHz}$$

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

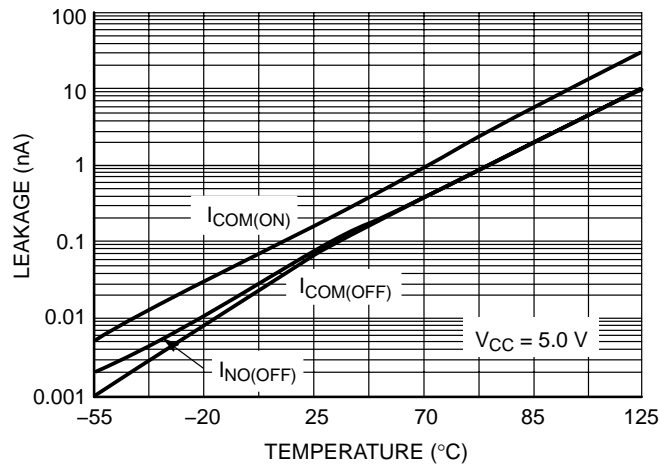
Bandwidth (BW) = the frequency 3.0 dB below  $V_{ONL}$

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

**Figure 6. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ $V_{ONL}$**



**Figure 7. Charge Injection: (Q)**



**Figure 8. Switch Leakage vs. Temperature**

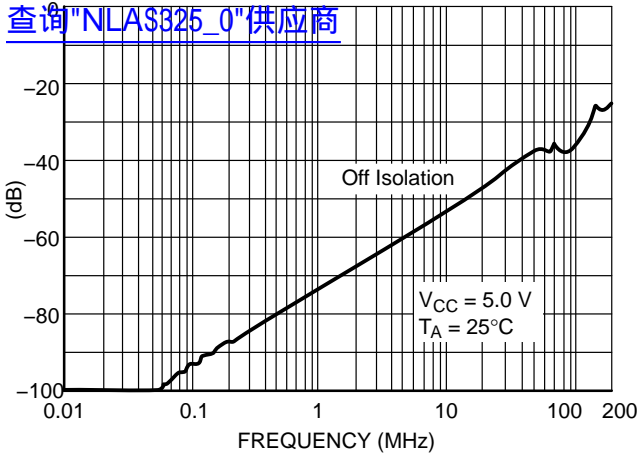


Figure 9. Off-Channel Isolation

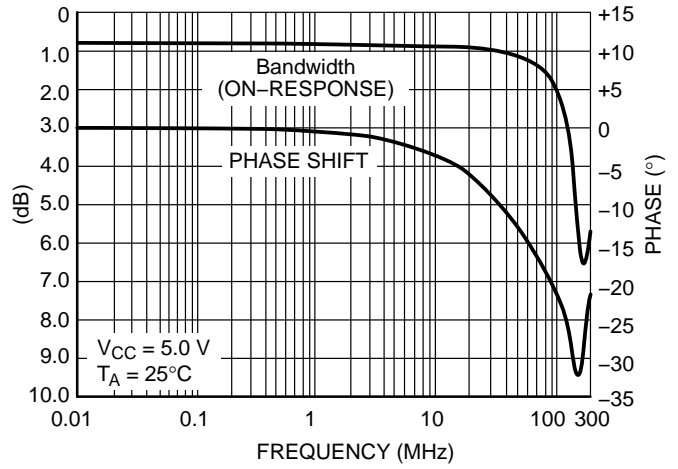


Figure 10. Typical Bandwidth and Phase Shift

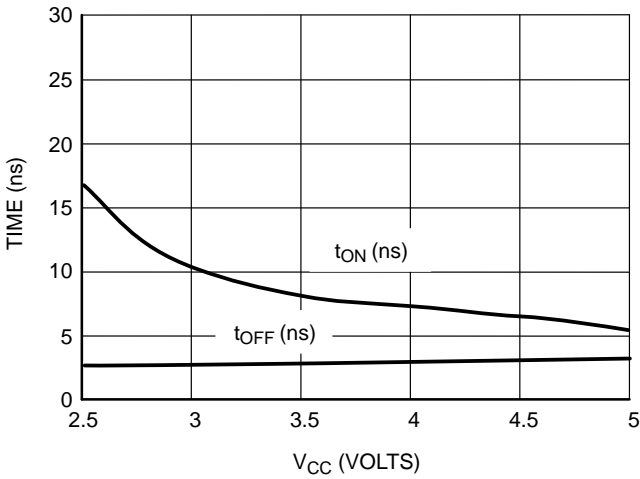


Figure 11.  $t_{ON}$  and  $t_{OFF}$  vs.  $V_{CC}$  at 25°C

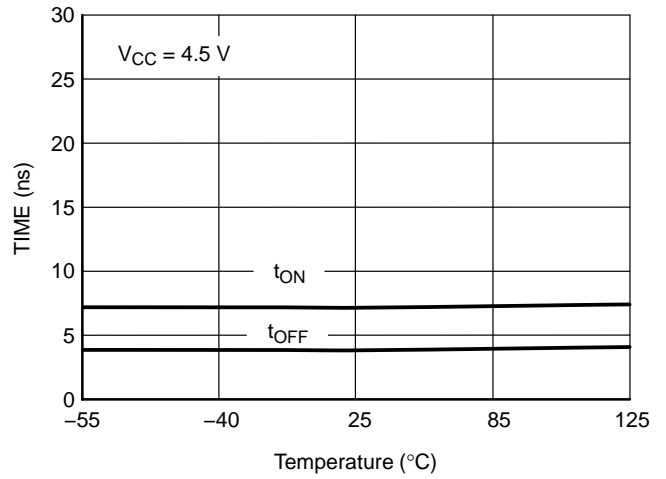


Figure 12.  $t_{ON}$  and  $t_{OFF}$  vs. Temp

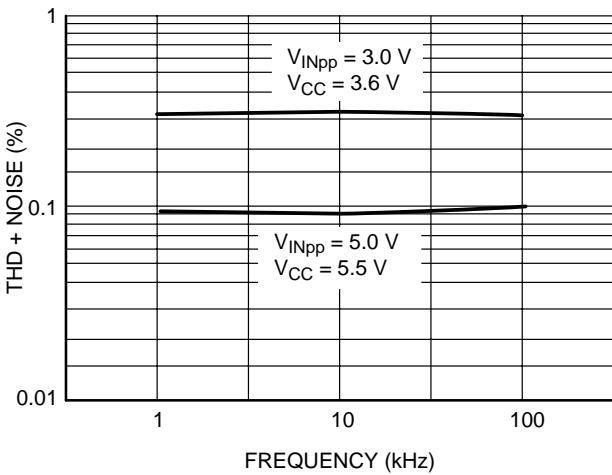


Figure 13. Total Harmonic Distortion Plus Noise vs. Frequency

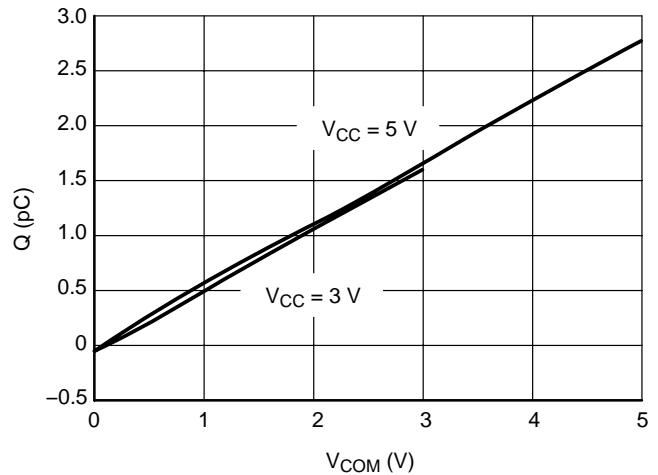


Figure 14. Charge Injection vs. COM Voltage

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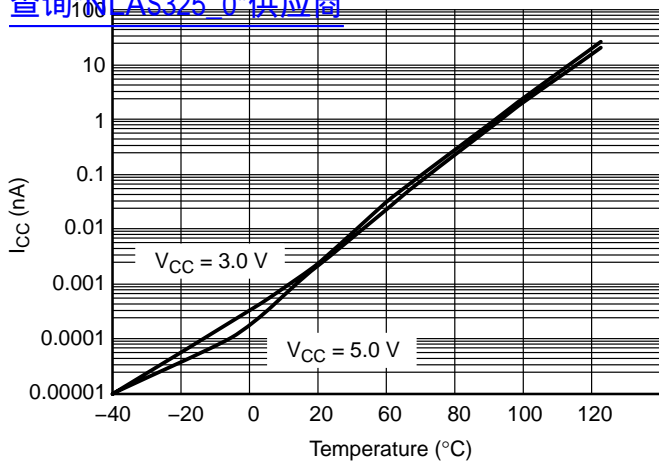


Figure 15.  $I_{CC}$  vs. Temp,  $V_{CC} = 3.0$  V and 5.0 V

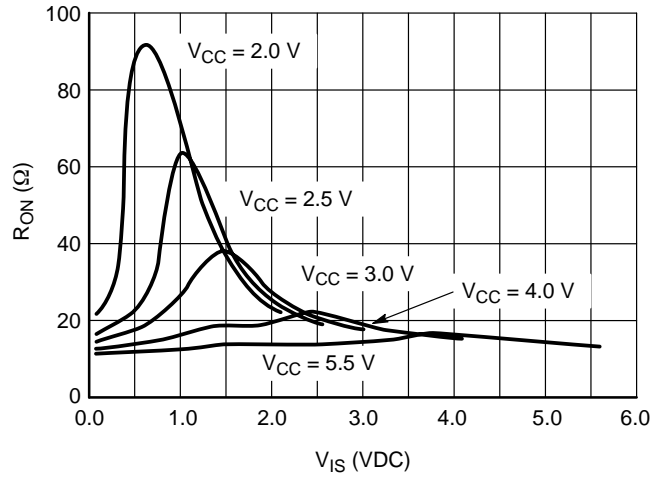


Figure 16.  $R_{ON}$  vs.  $V_{CC}$ , Temp = 25°C

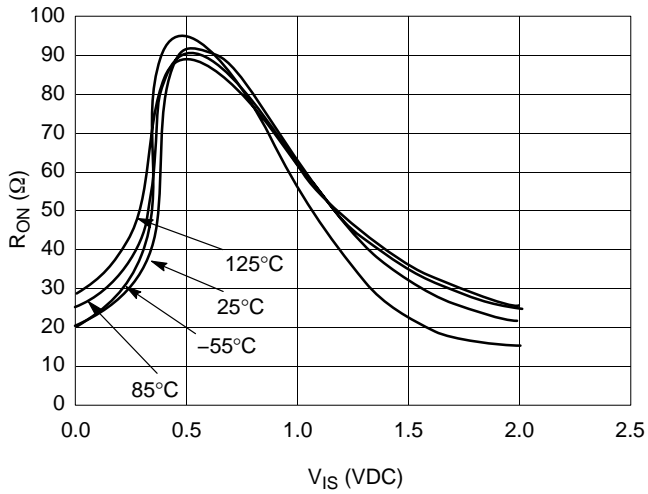


Figure 17.  $R_{ON}$  vs. Temp,  $V_{CC} = 2.0$  V

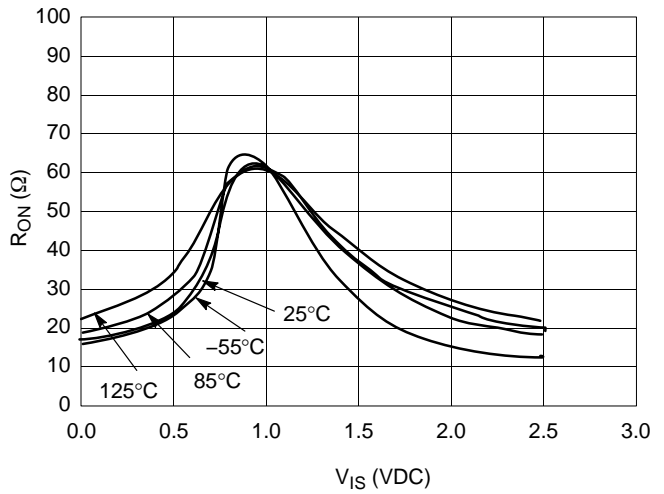


Figure 18.  $R_{ON}$  vs. Temp,  $V_{CC} = 2.5$  V

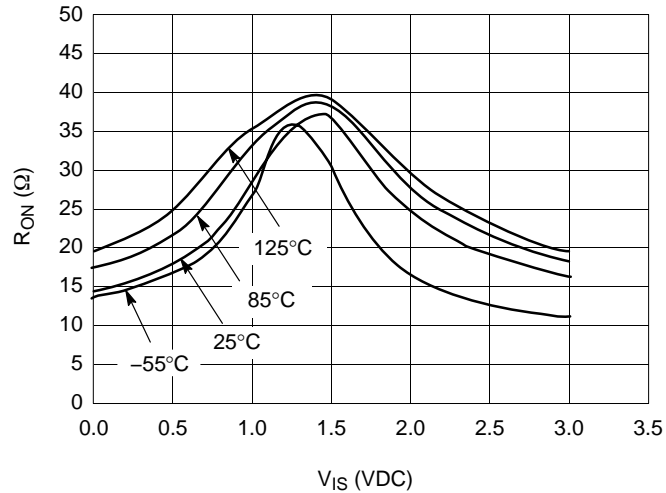


Figure 19.  $R_{ON}$  vs. Temp,  $V_{CC} = 3.0$  V

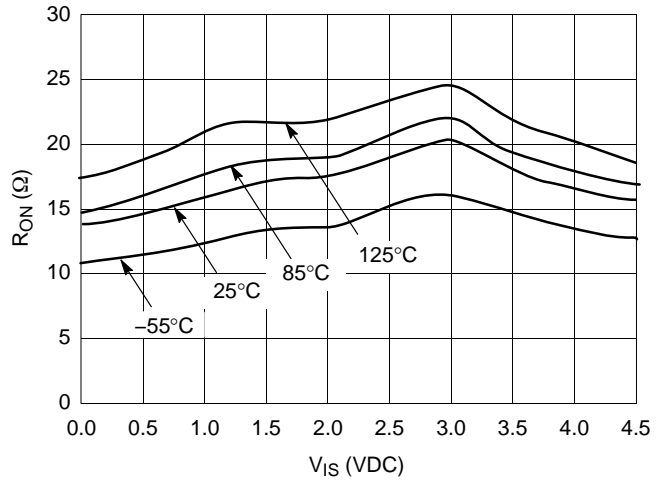


Figure 20.  $R_{ON}$  vs. Temp,  $V_{CC} = 4.5$  V



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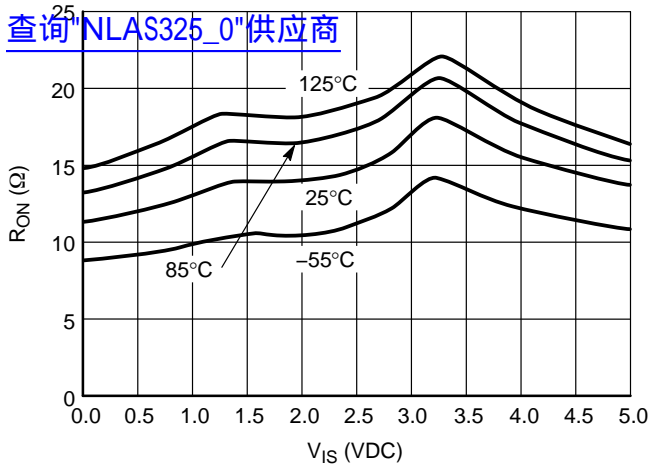


Figure 21.  $R_{ON}$  vs. Temp,  $V_{CC} = 5.0$  V

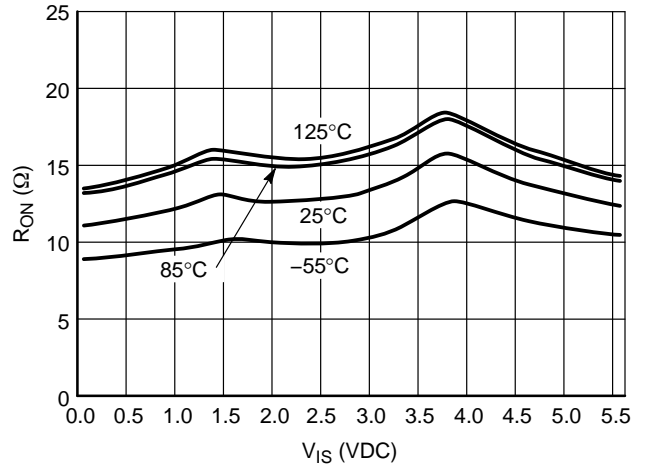


Figure 22.  $R_{ON}$  vs. Temp,  $V_{CC} = 5.5$  V

## ORDERING INFORMATION

Device Order Number	Device Nomenclature				Package Type	Tape and Reel Size†
	Circuit Indicator	Technology	Device Function	Package Suffix		
NLAS325US	NL	AS	325	US	US8	178 mm (7") 3000 Unit
NLAS325USG	NL	AS	325	USG	US8 (Pb-Free)	178 mm (7") 3000 Unit

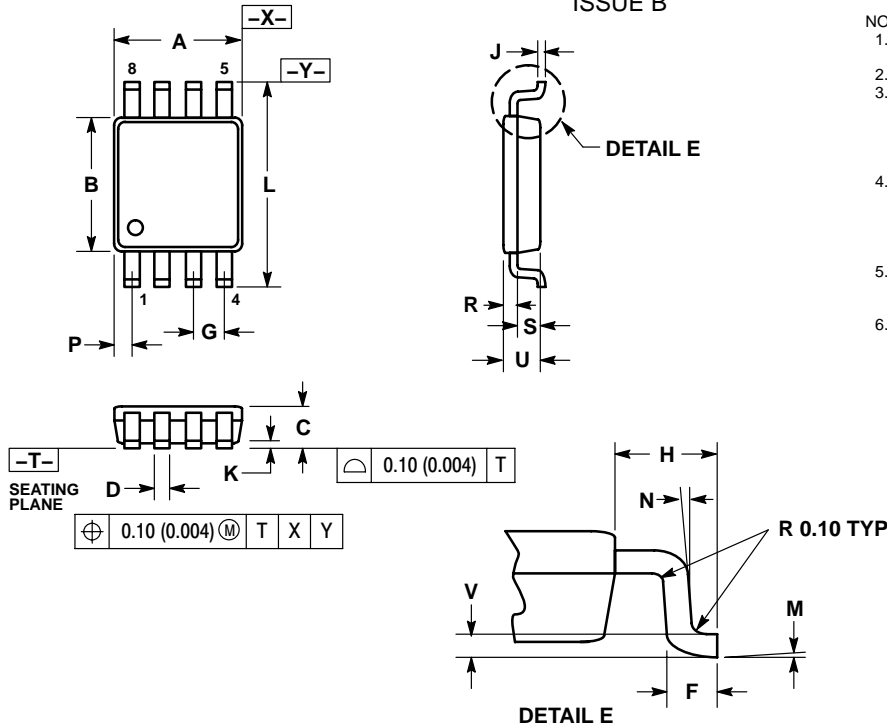
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specification Brochure, BRD8011/D.

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## PACKAGE DIMENSIONS

US8  
US SUFFIX  
CASE 493-02  
ISSUE B

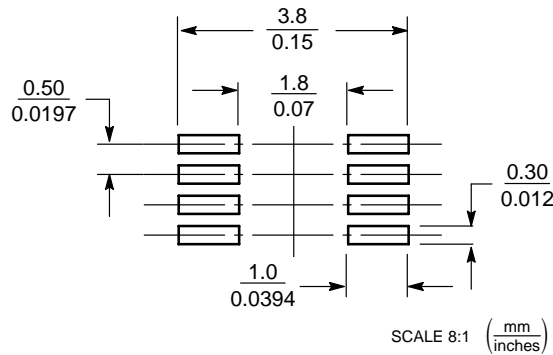


### NOTES:

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 ±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	

### 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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