# NLAS324

# Dual SPST Analog Switch, Low Voltage, Single Supply

The NLAS324 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 μ CMOS process, improves the $R_{ON}$ resistance considerably compared to older higher voltage technologies.

### Features

- On Resistance is 20 Ω Typical at 5.0 V
- Matching is < Ω Between Sections
- 2 − 6 V Operating Range
- Ultra Low < 5 pC Charge Injection
- Ultra Low Leakage < 1 nA at 5.0 V, 25°C
- Wide Bandwidth > 200 MHz, −3 dB
- 2000 V ESD (HBM)
- Ron Flatness ± 6 Ω at 5.0 V
- US8 Package
- Negative Enable
- Switches are Independent
- Pb−Free Package is Available

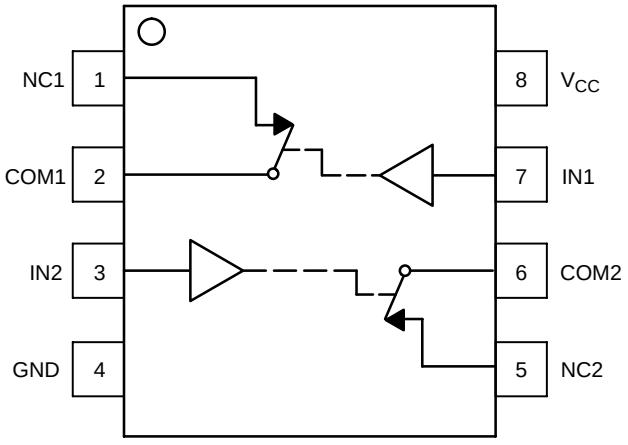


**Figure 1. Pinout**

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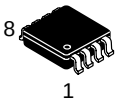
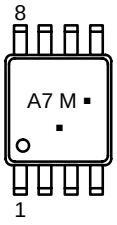
**http://onsemi.com**

**MARKING DIAGRAM**




**US8**
**US SUFFIX**
**CASE 493**




A7 = 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 | NC1 |
| 2 | COM1 |
| 3 | IN2 |
| 4 | GND |
| 5 | NC2 |
| 6 | COM2 |
| 7 | IN1 |
| 8 | $V_{CC}$ |

**FUNCTION TABLE**

| On/Off Enable Input | State of Analog Switch |
|---|---|
| L | On |
| H | Off |

**ORDERING INFORMATION**

| Device | Package | Shipping† |
|---|---|---|
| NLAS324US | US8 | 3,000 / Tape & Reel |
| NLAS324USG | US8 (Pb−Free) | 3,000 / Tape & Reel |

†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.

## MAXIMUM RATINGS

| Symbol | Parameter | | Value | Unit |
|---|---|---|---|---|
| $V_{CC}$ | DC Supply Voltage | | −0.5 to +7.0 | V |
| $V_I$ | DC Input Voltage | | −0.5 to +7.0 | V |
| $V_O$ | DC Output Voltage | | −0.5 to +7.0 | V |
| $I_{IK}$ | DC Input Diode Current | $V_I$ < GND | −50 | mA |
| $I_{OK}$ | DC Output Diode Current | $V_O$ < GND | −50 | mA |
| $I_O$ | DC Output Sink Current | | ±50 | mA |
| $I_{CC}$ | DC Supply Current per Supply Pin | | ±100 | mA |
| $I_{GND}$ | DC Ground Current per Ground Pin | | ±100 | mA |
| $T_{STG}$ | Storage Temperature Range | | −65 to +150 | °C |
| $T_L$ | Lead Temperature, 1 mm from Case for 10 Seconds | | 260 | °C |
| $T_J$ | Junction Temperature under Bias | | +150 | °C |
| $\theta_{JA}$ | Thermal Resistance (Note 1) | | 250 | °C/W |
| $P_D$ | Power Dissipation in Still Air at 85°C | | 250 | mW |
| MSL | Moisture Sensitivity | | Level 1 | |
| $F_R$ | Flammability Rating Oxygen Index: 28 to 34 | | UL 94 V−0 @ 0.125 in | |
| $V_{ESD}$ | ESD Withstand Voltage | Human Body Model (Note 2)<br>Machine Model (Note 3)<br>Charged Device Model (Note 4) | > 2000<br>> 150<br>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 | Characteristics | | Min | Max | Unit |
|---|---|---|---|---|---|
| $V_{CC}$ | Positive DC Supply Voltage | | 2.0 | 5.5 | V |
| $V_{IN}$ | Digital Input Voltage (Enable) | | GND | 5.5 | V |
| $V_{IO}$ | Static or Dynamic Voltage Across an Off Switch | | GND | $V_{CC}$ | V |
| $V_{IS}$ | Analog Input Voltage (NO, COM) | | GND | $V_{CC}$ | V |
| $T_A$ | Operating Temperature Range, All Package Types | | −55 | +125 | °C |
| $t_r$, $t_f$ | Input Rise or Fall Time, (Enable Input) | $V_{cc}$ = 3.3 V ± 0.3 V<br>$V_{cc}$ = 5.0 V ± 0.5 V | 0<br>0 | 100<br>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 |

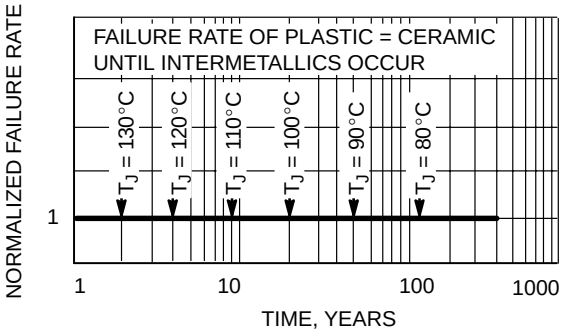



**Figure 2. Failure Rate vs. Time Junction Temperature**

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

| Symbol | Parameter | Condition | $V_{CC}$ | Guaranteed Max Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | −55 to 25°C | <85°C | <125°C | |
| $V_{IH}$ | Minimum High−Level Input Voltage, Enable Inputs | | 2.0<br>3.0<br>4.5<br>5.5 | 1.5<br>2.1<br>3.15<br>3.85 | 1.5<br>2.1<br>3.15<br>3.85 | 1.5<br>2.1<br>3.15<br>3.85 | V |
| $V_{IL}$ | Maximum Low−Level Input Voltage, Enable Inputs | | 2.0<br>3.0<br>4.5<br>5.5 | 0.5<br>0.9<br>1.35<br>1.65 | 0.5<br>0.9<br>1.35<br>1.65 | 0.5<br>0.9<br>1.35<br>1.65 | V |
| $I_{IN}$ | Maximum Input Leakage Current, Enable Inputs | $V_{IN}$ = 5.5 V or GND | 0 V to 5.5 V | ±0.1 | ±1.0 | ±1.0 | μA |
| $I_{CC}$ | Maximum Quiescent Supply Current (per package) | Enable and $V_{IS}$ = $V_{CC}$ or GND | 5.5 | 1.0 | 1.0 | 2.0 | μA |

**DC ELECTRICAL CHARACTERISTICS − Analog Section**

| Symbol | Parameter | Condition | $V_{CC}$ | Guaranteed Max Limit | | | Unit |
|---|---|---|---|---|---|---|---|
| | | | | −55 to 25°C | <85°C | <125°C | |
| $R_{ON}$ | Maximum ON Resistance (Figures 8 − 12) | $V_{IN}$ = $V_{IH}$<br>$V_{IS}$ = $V_{CC}$ to GND<br>$I_{Is}$I = ≤10.0mA | 3.0<br>4.5<br>5.5 | 45<br>30<br>25 | 50<br>35<br>30 | 55<br>40<br>35 | Ω |
| $R_{FLAT(ON)}$ | ON Resistance Flatness | $V_{IN}$ = $V_{IH}$<br>$I_{Is}$I = ≤10.0mA<br>$V_{IS}$ = 1V, 2V, 3.5V | 4.5 | 4 | 4 | 5 | Ω |
| $I_{NO(OFF)}$ | Off Leakage Current, Pin 2 (Figure 3) | $V_{IN}$ = $V_{IL}$<br>$V_{NO}$ = 1.0 V, $V_{COM}$ = 4.5 V or<br>$V_{COM}$ = 1.0 V and $V_{NO}$ 4.5 V | 5.5 | 1 | 10 | 100 | nA |
| $I_{COM(OFF)}$ | Off Leakage Current, Pin 1 (Figure 3) | $V_{IN}$ = $V_{IL}$<br>$V_{NO}$ = 4.5 V or 1.0 V<br>$V_{COM}$ = 1.0 V or 4.5 V | 5.5 | 1 | 10 | 100 | nA |

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

| Symbol | Parameter | Test Conditions | $V_{CC}$ (V) | Guaranteed Max Limit | | | | | | | | | Unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | −55 to 25°C | | | <85°C | | | <125°C | | | |
| | | | | Min | Typ | Max | Min | Typ | Max | Min | Typ | Max | |
| $t_{ON}$ | Turn−On Time | $R_L$ = 300 Ω, $C_L$ = 35 pF (Figures 4, 5, and 13) | 2.03.04.55.5 | | 7.0<br>5.0<br>4.5<br>4.5 | 14<br>10<br>9<br>9 | | | 16<br>12<br>11<br>11 | | | 16<br>12<br>11<br>11 | ns |
| $t_{OFF}$ | Turn−Off Time | $R_L$ = 300 Ω, $C_L$ = 35 pF (Figures 4, 5, and 13) | 2.03.04.5<br>5.5 | | 11.0<br>7.0<br>5.0<br>5.0 | 22<br>14<br>10<br>10 | | | 24<br>16<br>12<br>12 | | | 24<br>16<br>12<br>12 | ns |

| | | Typical @ 25, $V_{CC}$ = 5.0 V | |
|---|---|---|---|
| $C_{IN}$ | Maximum Input Capacitance, Select Input | 8 | pF |
| $C_{NO\ or}$ $C_{NC}$ | Analog I/O (switch off) | 10 | |
| $C_{COM(OFF)}$ | Common I/O (switch off) | 10 | |
| $C_{COM(ON)}$ | Feedthrough (switch on) | 20 | |

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

| Symbol | Parameter | Condition | $V_{CC}$ V | Limit 25°C | Unit |
|---|---|---|---|---|---|
| BW | Maximum On−Channel −3dB Bandwidth or Minimum Frequency Response | $V_{IS}$ = 0 dBm<br>$V_{IS}$ centered between $V_{CC}$ and GND<br>(Figures 6 and 14) | 3.0<br>4.5<br>5.5 | 190<br>200<br>220 | MHz |
| $V_{ONL}$ | Maximum Feedthrough On Loss | $V_{IS}$ = 0 dBm @ 10 kHz<br>$V_{IS}$ centered between $V_{CC}$ and GND (Figure 6) | 3.0<br>4.5<br>5.5 | −2<br>−2<br>−2 | dB |
| $V_{ISO}$ | Off−Channel Isolation | f = 100 kHz; $V_{IS}$ = 1 V RMS<br>$V_{IS}$ centered between $V_{CC}$ and GND<br>(Figures 6 and 15) | 3.0<br>4.5<br>5.5 | −93 | dB |
| Q | Charge Injection<br>Enable Input to Common I/O | $V_{IS}$ = $V_{CC}$ to GND, $F_{IS}$ = 20 kHz<br>$t_r = t_f$ = 3 ns<br>$R_{IS}$ = 0 Ω, $C_L$ = 1000 pF<br>Q = $C_L$ * $\Delta V_{OUT}$ (Figures 7 and 16) | 3.0<br>5.5 | 1.5<br>3.0 | pC |
| THD | Total Harmonic Distortion<br>THD + Noise | $F_{IS}$ = 20 Hz to 1 MHz, $R_L$ = Rgen = 600 Ω, $C_L$ = 50 pF<br>$V_{IS}$ = 3.0 $V_{PP}$ sine wave<br>$V_{IS}$ = 5.0 $V_{PP}$ sine wave (Figure 17) | 3.3<br>5.5 | 0.3<br>0.15 | % |

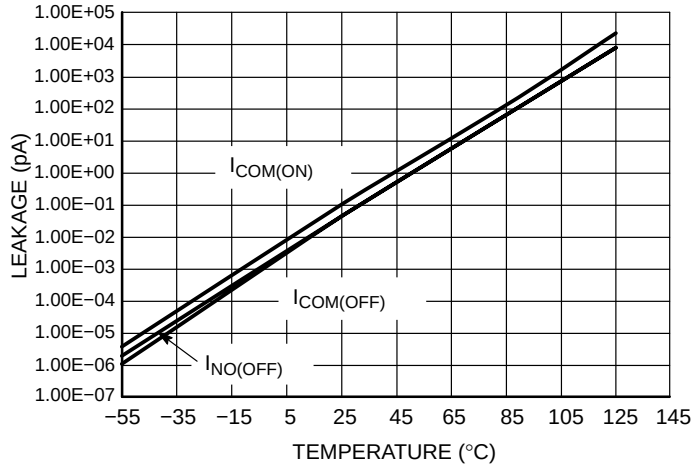



**Figure 3. Switch Leakage vs. Temperature**

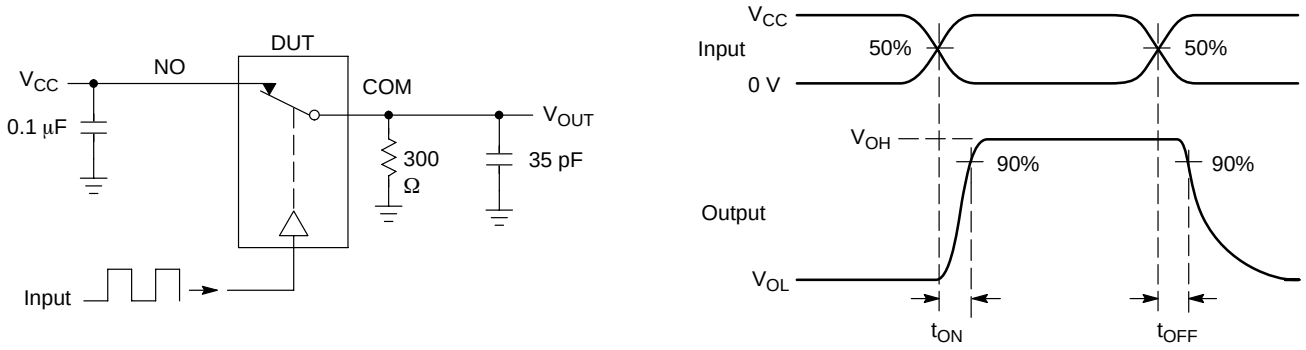



**Figure 4. $t_{ON}/t_{OFF}$**

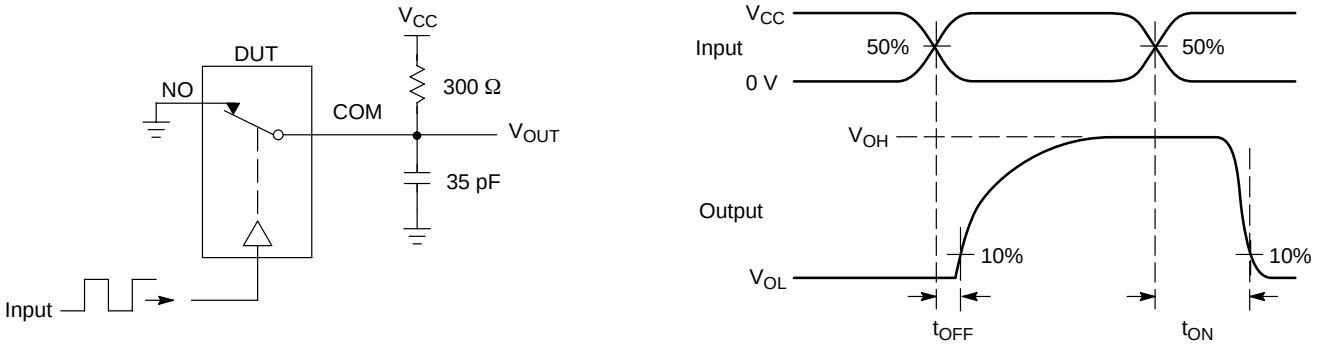
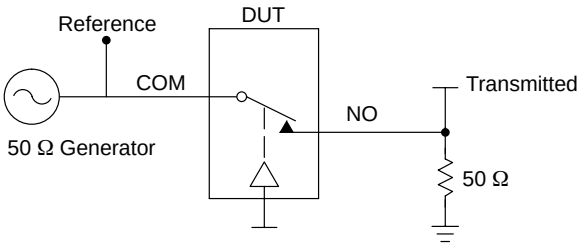



**Figure 5. $t_{ON}/t_{OFF}$**




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.

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

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

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

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

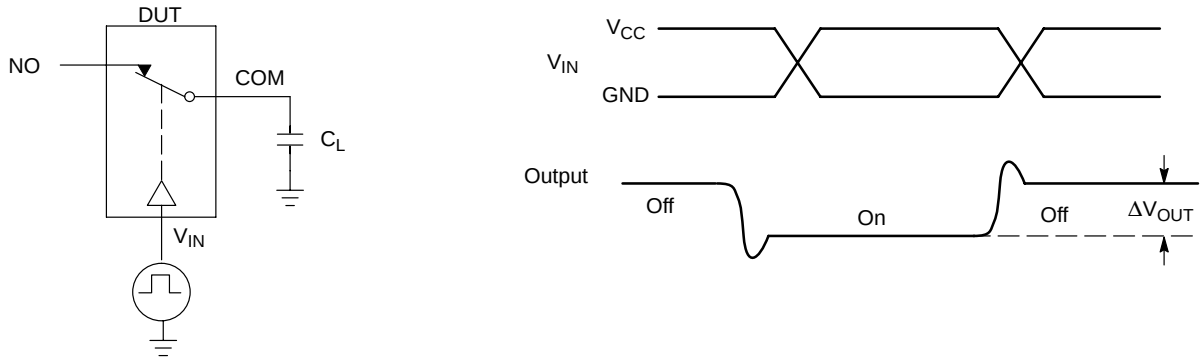



**Figure 7. Charge Injection: (Q)**

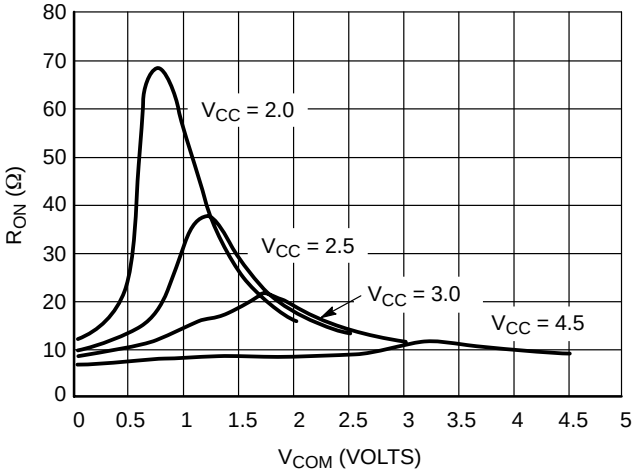



**Figure 8. $R_{ON}$ vs. $V_{COM}$ and $V_{CC}$ (@25°C)**

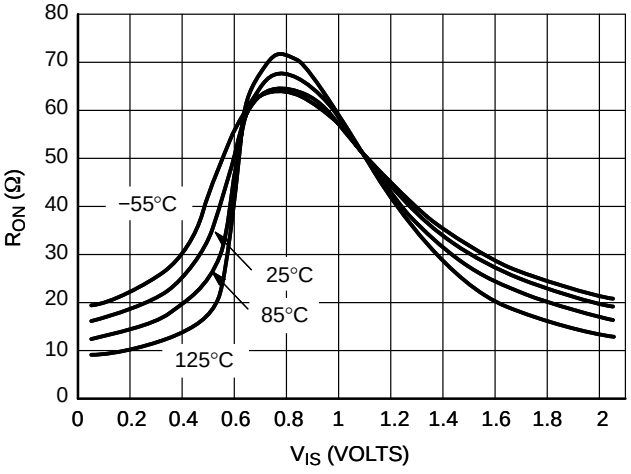



**Figure 9. $R_{ON}$ vs. $V_{COM}$ and Temperature, $V_{CC}$ = 2.0 V**

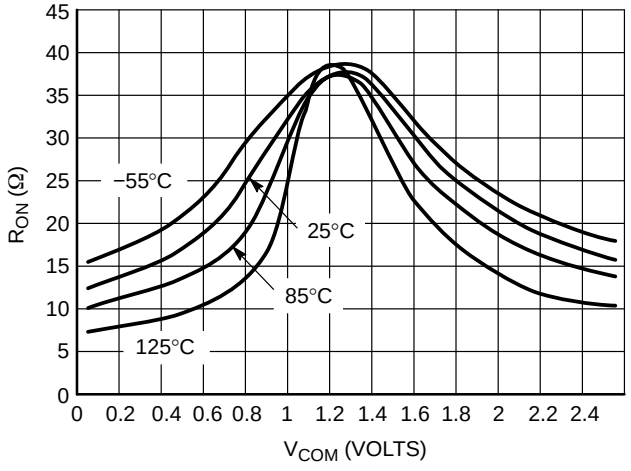



**Figure 10. $R_{ON}$ vs. $V_{COM}$ and Temperature, $V_{CC}$ = 2.5 V**

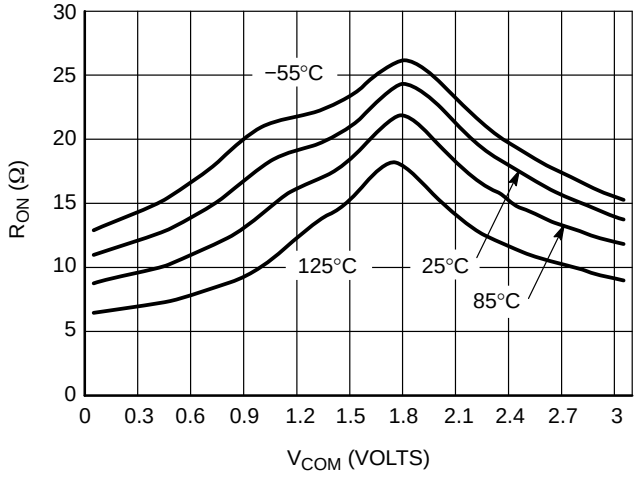



**Figure 11. $R_{ON}$ vs. $V_{COM}$ and Temperature, $V_{CC}$ = 3.0 V**

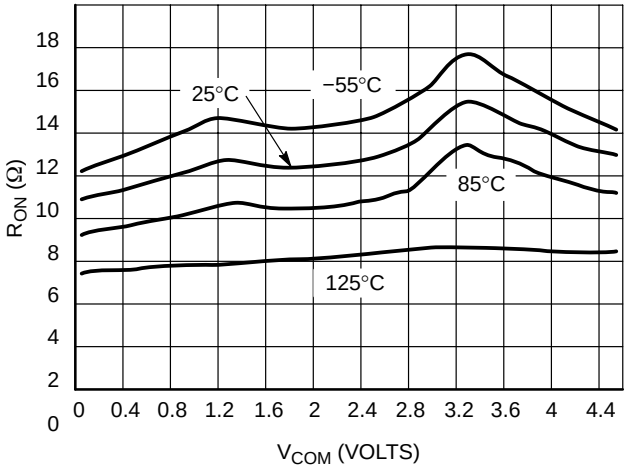



**Figure 12. $R_{ON}$ vs. $V_{COM}$ and Temperature, $V_{CC}$ = 4.5 V**

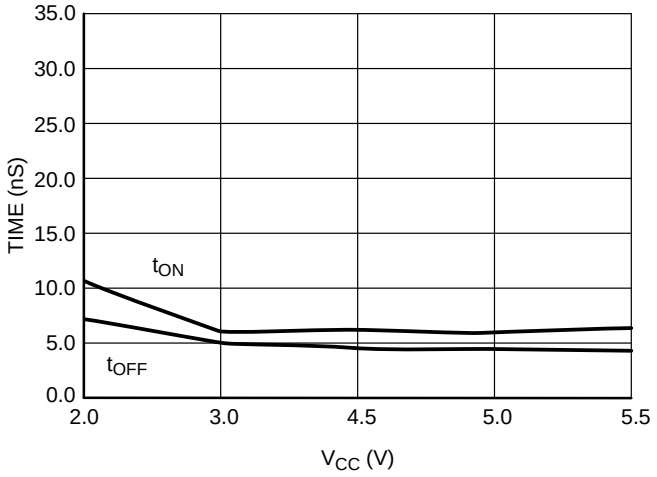



**Figure 13. Switching Time vs. Supply Voltage, T = 25°C**

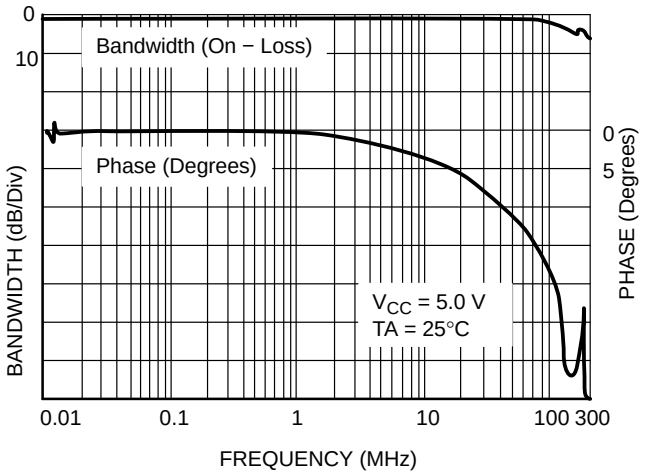



**Figure 14. ON Channel Bandwidth and Phase Shift Over Frequency**

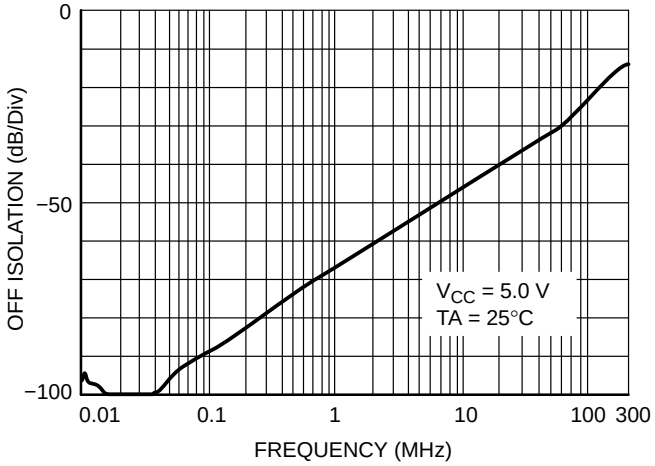



**Figure 15. Off Channel Isolation**

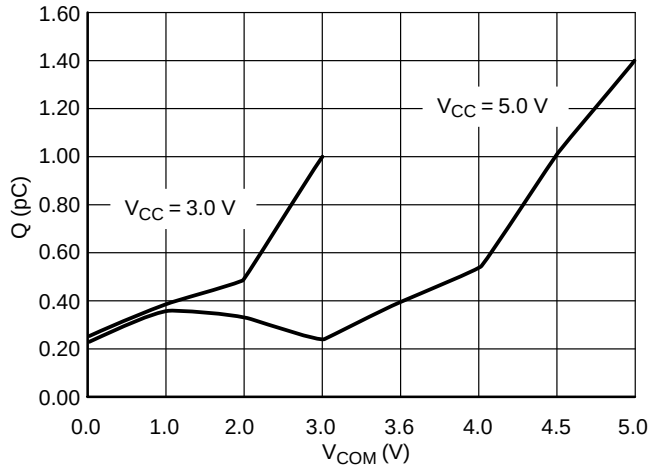



**Figure 16. Charge Injection vs. $V_{COM}$**

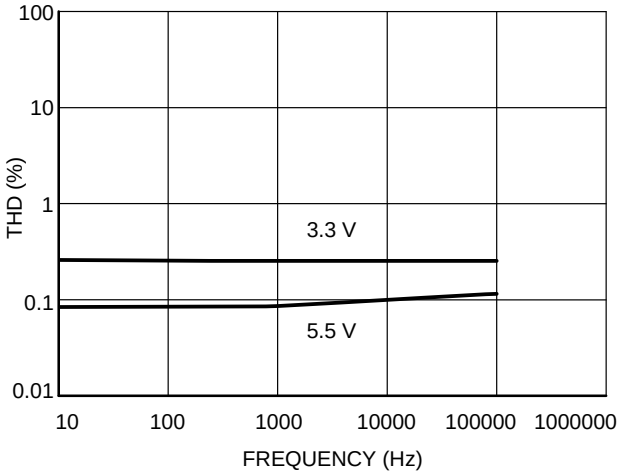



**Figure 17. THD vs. Frequency**

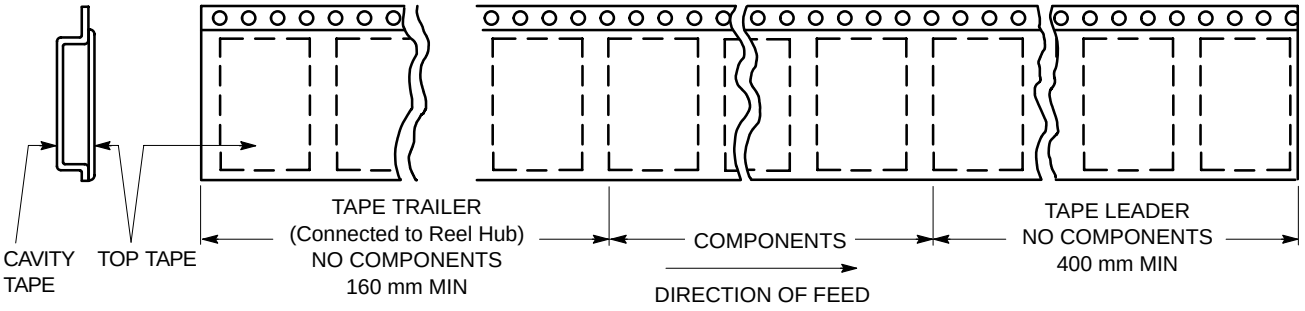



**Figure 18. Tape Ends for Finished Goods**

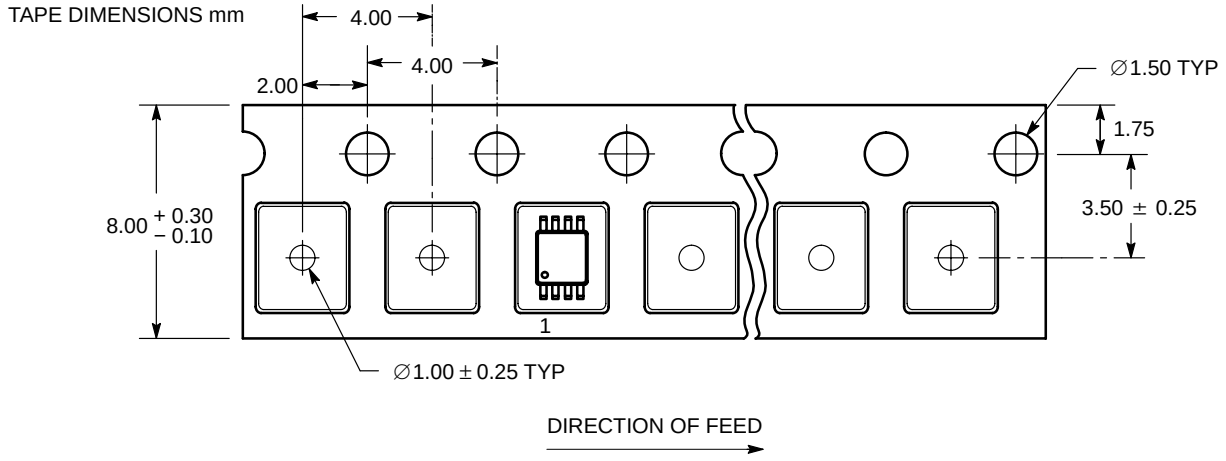



**Figure 19. US8 Reel Configuration/Orientation**

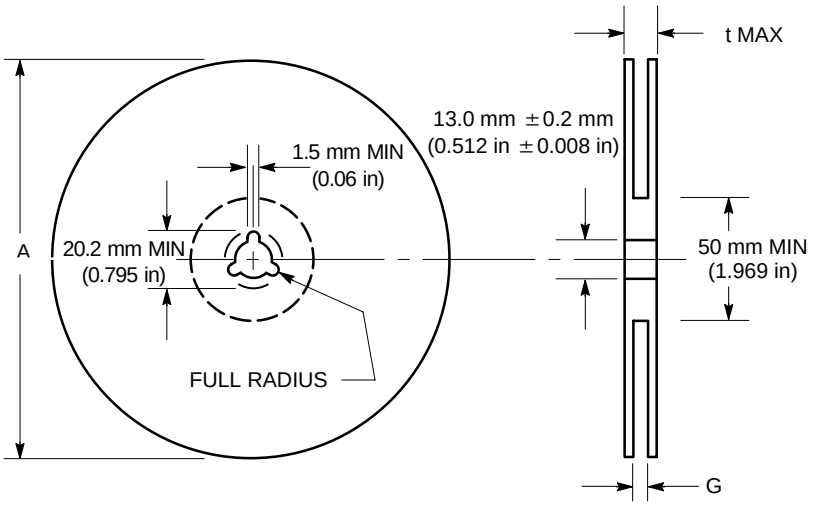



**Figure 20. Reel Dimensions**

**REEL DIMENSIONS**

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

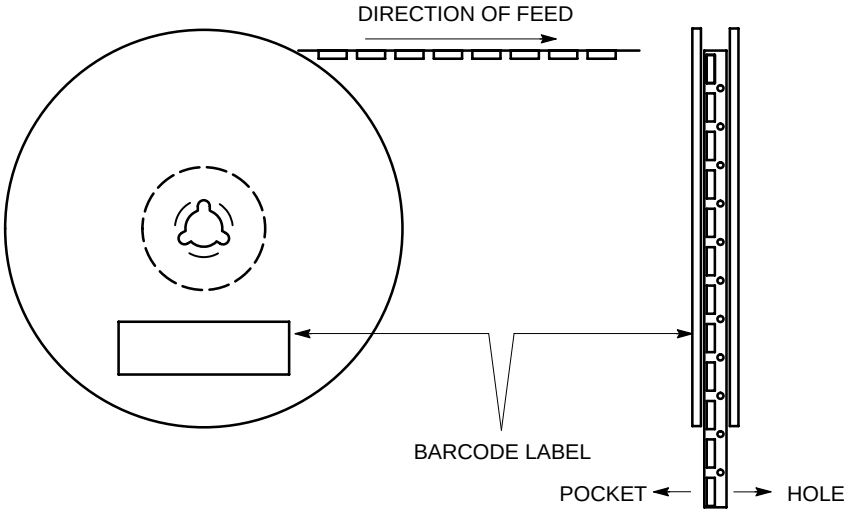
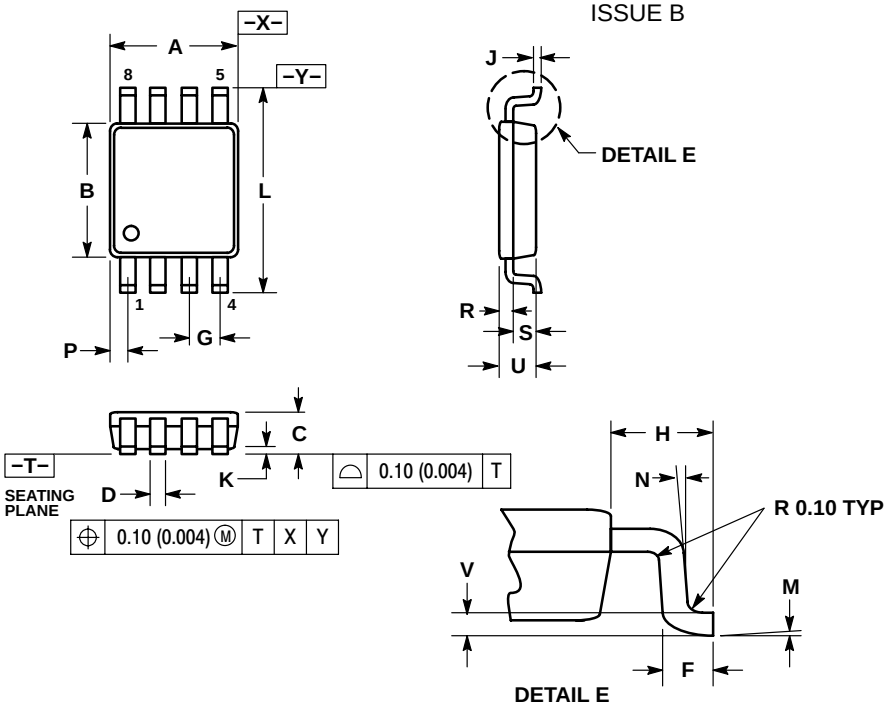



**Figure 21. Reel Winding Direction**

## PACKAGE DIMENSIONS

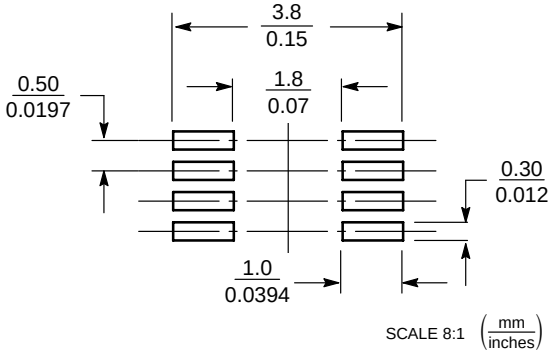
**US8**
**US SUFFIX**
CASE 493−02
ISSUE B




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 E3XCEED 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 “).

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | 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.



### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT**:
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