

# NLAS2750

## Low Voltage Dual SPDT Analog Switch with Negative Swing Audio Capability

The NLAS2750 is a dual SPDT low on-resistance analog switch. It can operate from a single 1.8 V to 5.0 V power supply. It is a bi-directional switch that can switch a negative voltage swing audio signal without requiring a coupling capacitor. With a single power supply, the audio signal can swing over the range from -2.5 V to  $V_{CC}$ .

### Features

- Capable to Switch Negative Swing Audio Signals Without Requiring a DC Blocking Capacitor
- Low On-resistance ( $R_{ON}$ )
- Low Voltage Digital Control Logic:  
( $V_{INH} = 1.4\text{ V}$  @  $V_{CC} = 2.7\text{ V}$  to  $4.3\text{ V}$ )
- Low Power Consumption ( $I_{CC} \leq 250\text{ nA}$ )
- Space Saving 1.4 mm x 1.8 mm Package UQFN Package
- This is a Pb-Free Device

### Typical Applications

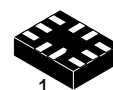
- Cellular Phones
- Portable Media Players



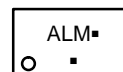
ON Semiconductor®

[www.onsemi.com](http://www.onsemi.com)

### MARKING DIAGRAM

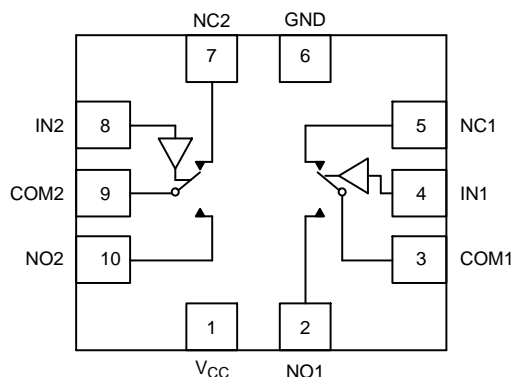


UQFN10  
CASE 488AT



AL = Specific Device Code  
M = Date Code/Assembly Location  
▪ = Pb-Free Device

(Note: Microdot may be in either location)



### FUNCTION TABLE

| IN1 (Pin 4) | IN2 (Pin 8) | Function   |
|-------------|-------------|------------|
| 0           | X           | COM1 = NC1 |
| 1           | X           | COM1 = NO1 |
| X           | 0           | COM2 = NC2 |
| X           | 1           | COM2 = NO2 |

### ORDERING INFORMATION

See detailed ordering and shipping information on page 7 of this data sheet.

# NLAS2750

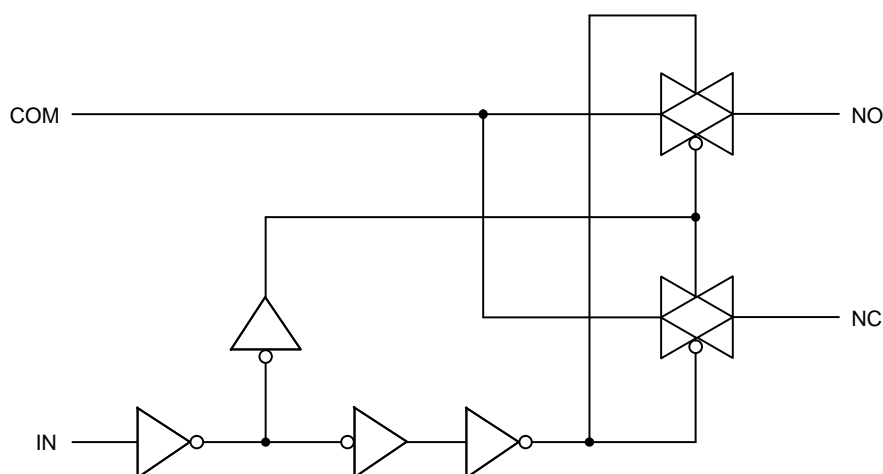


Figure 1. Logic Equivalent Circuit

## MAXIMUM RATINGS

| Symbol    | Parameter  | Value  | Unit         |
|-----------|--|--|--------------|
| $V_{CC}$  | Positive DC Supply Voltage                           | -0.3 to +6.5   | V            |
| $V_{IS}$  | Analog Input Voltage (COM, NO, NC) (Notes 1 and 2)   | Min. $V_{IS} = V_{CC} - 6.5$ V or<br>-2.5 V (whichever is greater)<br>Max. $V_{IS} = V_{CC} + 0.3$ V | V            |
| $V_{IN}$  | Digital (IN1, IN2)                                   | -0.3 to +6.5   | V            |
| $I_{CC}$  | Current (GND, $V_{CC}$ )                             | 50   | mA           |
| $I_{IS}$  | Continuous Switch Current (COM, NO, NC) (Note 1)     | $\pm 250$  | mA           |
| $I_{ISP}$ | Peak Switch Current (Pulsed at 1 ms, 10% Duty Cycle) | $\pm 500$  | mA           |
| $T_{STG}$ | Storage Temperature                                  | -65 to +150  | $^{\circ}$ C |
| $P_D$     | Power Dissipation                                    | 200  | mW           |
| $V_{ESD}$ | ESD (Human Body Model)<br>All pins<br>I/O to GND     | 6<br>8   | kV           |
| $I_{LU}$  | Latch-up (per JESD78)                                | 300  | 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. Signals on COM, NO, NC, exceeding  $V_{CC}$  will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
2. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum is used in this data sheet.

## RECOMMENDED OPERATING CONDITIONS

| Symbol     | Parameter   | Min  | Max      | Unit         |
|------------|---|------|----------|--------------|
| $V_{CC}$   | Power Supply Range  | 1.8  | 5.5      | V            |
| $V_{IN}$   | Digital Select Input Voltage Overvoltage Tolerance (OVT) (IN1, IN2)           | GND  | 5.5      | V            |
| $V_{IS}$   | Analog Input Voltage (NC, NO, COM) (Note 3)                                   | -2.5 | $V_{CC}$ | V            |
| $T_A$      | Operating Temperature Range   | -40  | +85      | $^{\circ}$ C |
| $t_r, t_f$ | Input Rise or Fall Time (IN1, IN2)<br>$V_{CC} < 2.7$ V<br>$V_{CC} \geq 2.7$ V |      | 20<br>10 | ns/V         |

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.

3. The voltage across the switch should be  $\leq 5.5$  V.

# NLAS2750

## ELECTRICAL CHARACTERISTICS ( $V_{CC} = 2.7\text{ V}, \pm 10\%$ ) (Note 4)

| Symbol | Parameter | Test Conditions | Guaranteed Maximum Limit |     |     | Unit |
|--------|-----------|-----------------|--------------------------|-----|-----|------|
|        |           |                 | -40°C to 85°C            |     |     |      |
|        |           |                 | Min                      | Typ | Max |      |

### ANALOG SWITCH

|                   |                                   |   |      |      |           |          |
|-------------------|-----------------------------------|---|------|------|-----------|----------|
| $V_{IS}$          | Analog Signal Range (Note 5)      |   | -2.5 |      | $V_{CC}$  | V        |
| $R_{DS(on)}$      | On-Resistance                     | $V_{CC} = 2.7\text{ V},$<br>$V_{IS} = (V_{CC} - 4.5\text{ V}), -1\text{ V}, 0\text{ V}$<br>$1\text{ V}, 2\text{ V}, V_{CC}$<br>$I_{IS} = 100\text{ mA}$ |      | 0.6  | 1.3       | $\Omega$ |
| $\Delta R_{ON}$   | On-Resistance Match               |   |      | 0.1  |           | $\Omega$ |
| $R_{ON}$ Flatness | On-Resistance Resistance Flatness |   |      | 0.37 |           | $\Omega$ |
| $I_{NO/NC(off)}$  | Switch Off Leakage Current        | $V_{CC} = 2.7\text{ V},$<br>$V_{NC/NO} = -2.5\text{ V}$ or $2.5\text{ V},$<br>$V_{COM} = 2.5\text{ V}$ or $-2.5\text{ V}$                               |      | 50   |           | nA       |
| $I_{COM(off)}$    |                                   |   |      |      | $\pm 250$ | nA       |
| $I_{COM(on)}$     | Channel On Leakage Current        |   |      | 50   | $\pm 250$ | nA       |

### DIGITAL CONTROL

|                        |                    |  |            |   |         |               |
|------------------------|--------------------|--|------------|---|---------|---------------|
| $V_{INH}$              | Input Voltage High | $V_{CC} = 5\text{ V}$<br>$V_{CC} = 2.7\text{ V}$ to $4.3\text{ V}$ | 1.6<br>1.4 |   |         | V             |
| $V_{INL}$              | Input Voltage Low  | $V_{CC} = 2.7\text{ V}$ to $5\text{ V}$                            |            |   | 0.6     | V             |
| $C_{IN}$               | Input Capacitance  |  |            | 5 |         | pF            |
| $I_{INL}$ or $I_{INH}$ | Input Current      | $V_{IN} = 0$ or $V_{CC}$   |            |   | $\pm 1$ | $\mu\text{A}$ |

### POWER CONSUMPTION

|          |                                  |   |  |    |           |    |
|----------|----------------------------------|---|--|----|-----------|----|
| $I_{CC}$ | Maximum Quiescent Supply Current | $V_{CC} = 2.7\text{ V}$ to $4.3\text{ V}$ |  | 50 | $\pm 250$ | nA |
|----------|----------------------------------|---|--|----|-----------|----|

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.

4. Typical values are measured at 25°C and are for design aid only, not guaranteed nor subject to production testing.

5. Guaranteed by design, not subject to production testing.

## DYNAMIC CHARACTERISTICS ( $V_{CC} = 2.7\text{ V}, \pm 10\%$ ) (Note 4)

| Symbol              | Parameter                              | Test Conditions   | Guaranteed Maximum Limit |      |     | Unit |
|---------------------|--|---|--------------------------|------|-----|------|
|                     |  |   | -40°C to 85°C            |      |     |      |
|                     |  |   | Min                      | Typ  | Max |      |
| $t_{BBM}$           | Break-Before-Make Time (Notes 6 and 7) | $V_{CC} = 2.7\text{ V}, V_{IS} = 1.5\text{ V},$<br>$R_L = 50\ \Omega, C_L = 35\text{ pF}$ | 1000                     | 1250 |     | ns   |
| $t_{ON(EN)}$        | Enable Turn-On Time (Notes 6 and 7)    |   |                          | 80   | 150 | ns   |
| $t_{OFF(EN)}$       | Enable Turn-Off Time (Notes 6 and 7)   |   |                          | 110  | 130 | ns   |
| $Q_{INJ}$           | Charge Injection (Note 6)              | $C_L = 1\text{ nF}, R_{GEN} = 0\ \Omega,$<br>$V_{GEN} = 0\text{ V}$                       |                          | 60   |     | pC   |
| OIRR                | Off-Isolation (Note 6)                 | $V_{CC} = 2.7\text{ V}, R_L = 50\ \Omega,$<br>$C_L = 5\text{ pF}, f = 300\text{ kHz}$     |                          | -58  |     | dB   |
| $X_{TALK}$          | Crosstalk (Notes 6 and 8)              |   |                          | -61  |     | dB   |
| BW                  | Bandwidth (Note 6)                     | $V_{CC} = 2.7\text{ V}, R_L = 50\ \Omega, -3\text{ dB}$                                   |                          | 44   |     | MHz  |
| $C_{NC/NO(off)}$    | Channel-Off Capacitance (Note 6)       | $V_{CC} = 2.7\text{ V}, f = 1\text{ MHz}$   |                          | 25   |     | pF   |
| $C_{COM/NC/NO(on)}$ | Channel-On Capacitance (Note 6)        |   |                          | 75   |     | pF   |

6. Guaranteed by design, not subject to production testing.

7.  $V_{IS}$  = input voltage to perform proper function.

8. Crosstalk Measured between channels.

# NLAS2750

## TYPICAL CHARACTERISTICS

(25°C, unless otherwise specified)

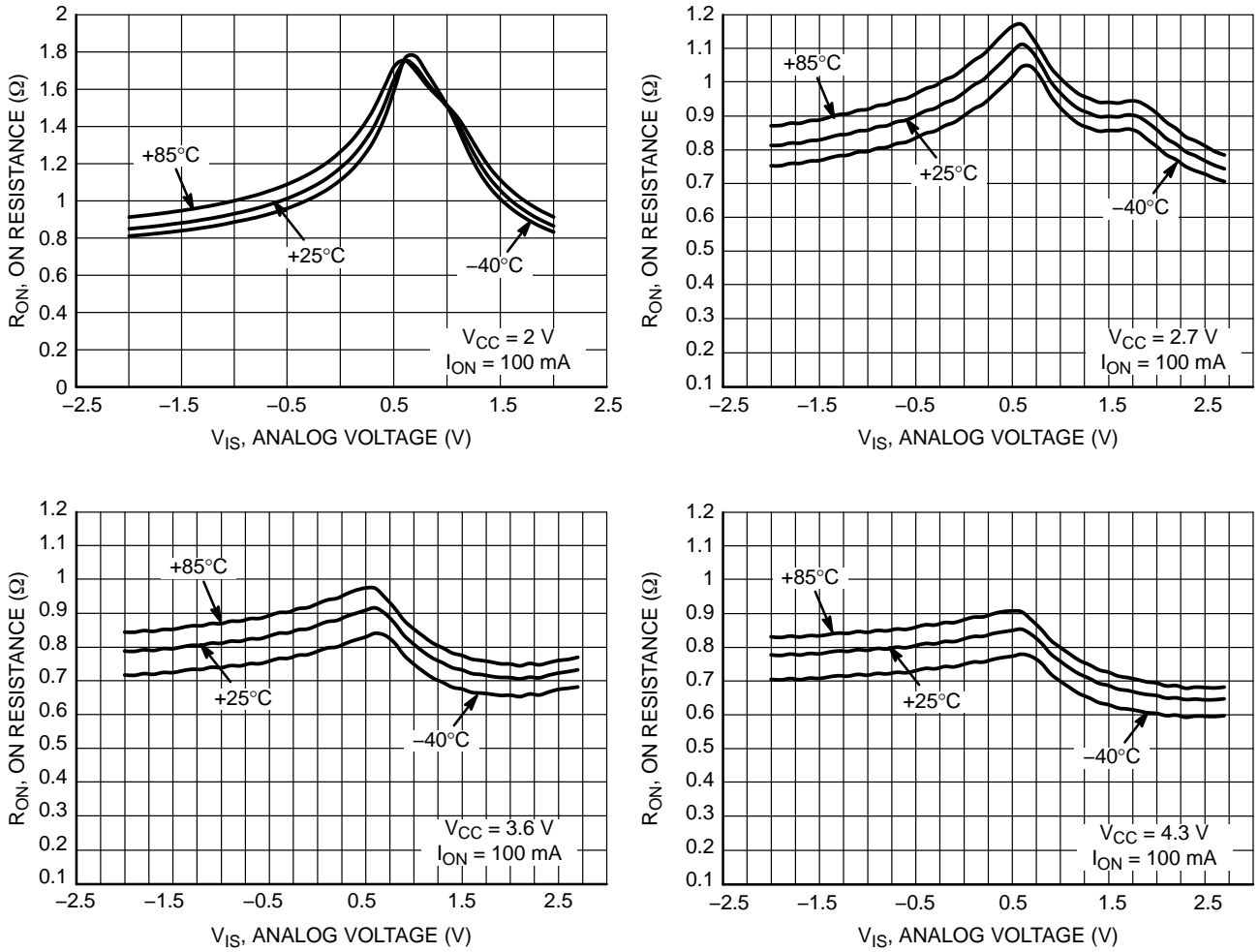
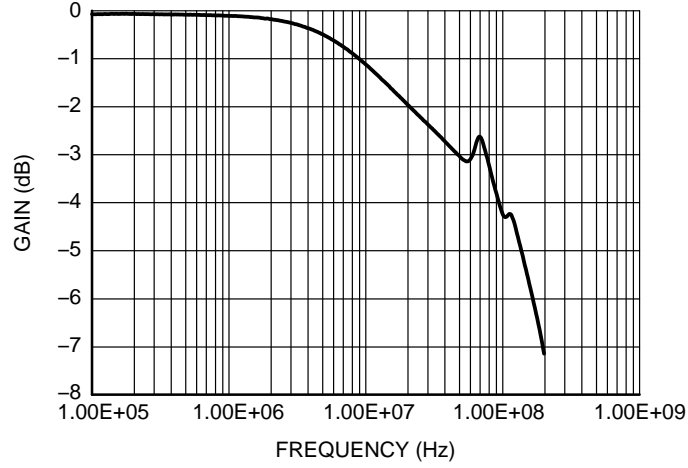


Figure 2. On Resistance ( $R_{ON}$ ) vs. Analog Input Voltage ( $V_{IS}$ )

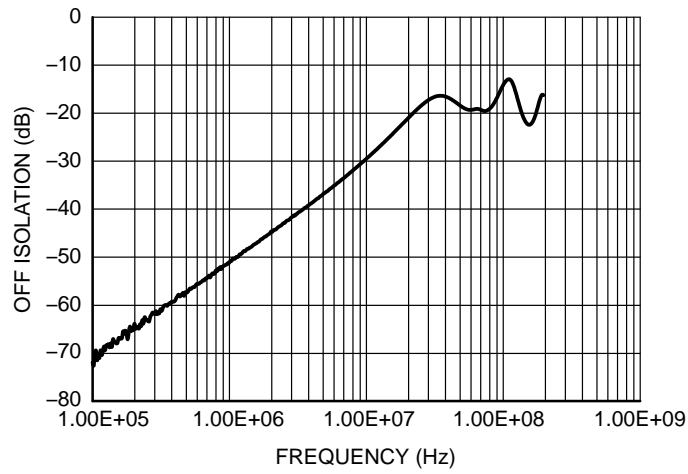
# NLAS2750

## TYPICAL CHARACTERISTICS

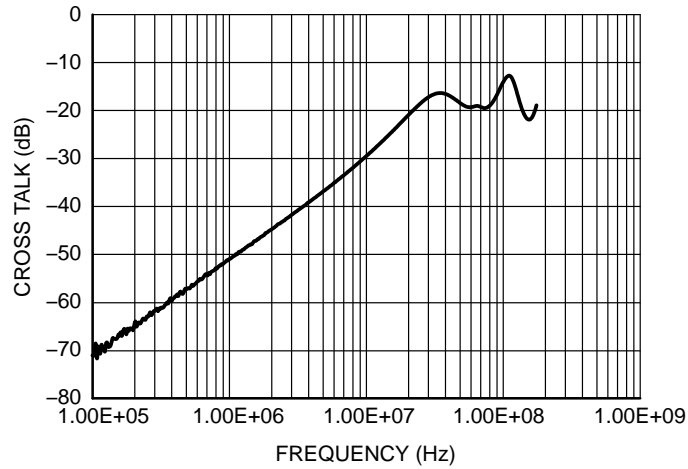
(25°C, unless otherwise specified)



**Figure 3. Bandwidth Measurement – Gain vs. Frequency**



**Figure 4. Off Isolation Measurement**



**Figure 5. Cross Talk Measurement**

# NLAS2750

## TEST CIRCUITS

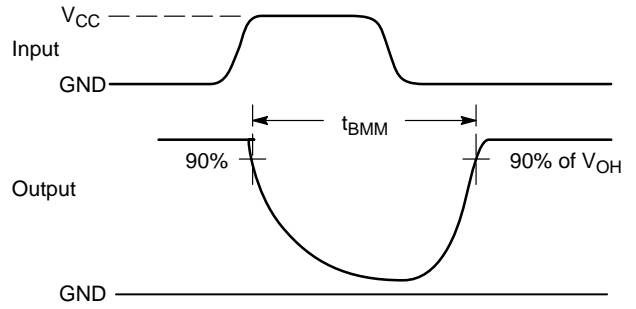
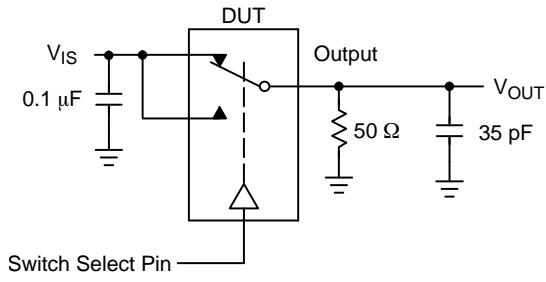


Figure 6.  $t_{BMM}$  (Time Break-Before-Make)

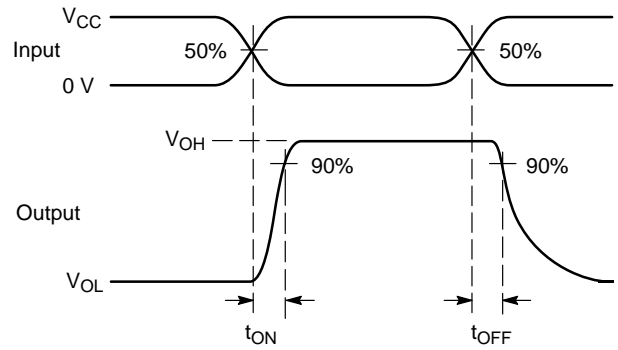
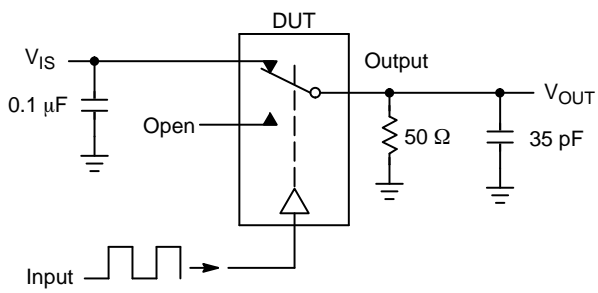


Figure 7.  $t_{ON}/t_{OFF}$

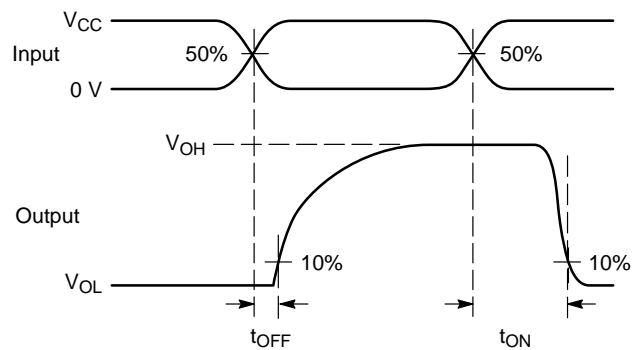
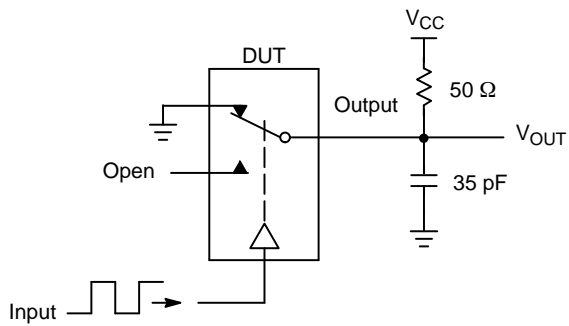
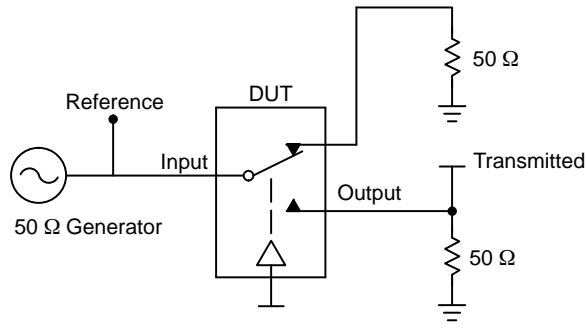


Figure 8.  $t_{ON}/t_{OFF}$

# NLAS2750



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.

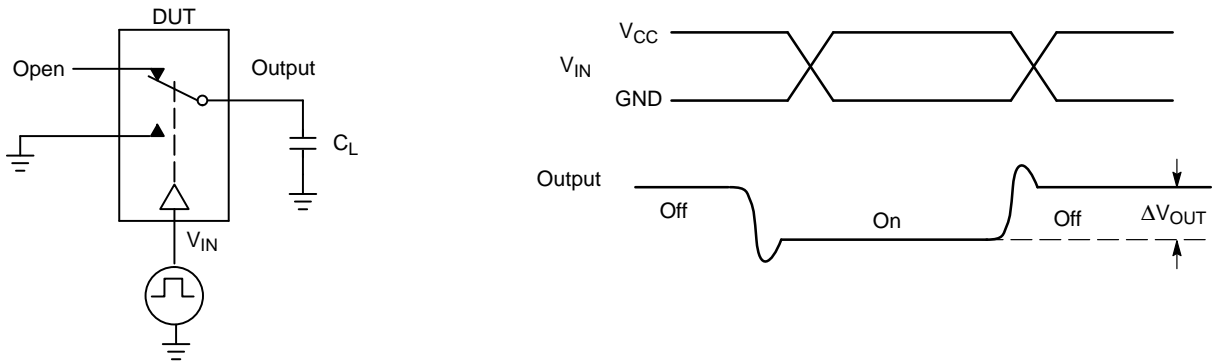
$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

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

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



**Figure 10. Charge Injection: (Q)**

## ORDERING INFORMATION

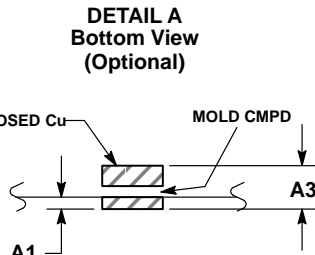
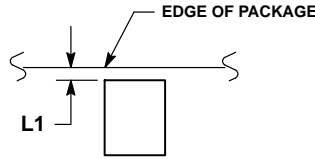
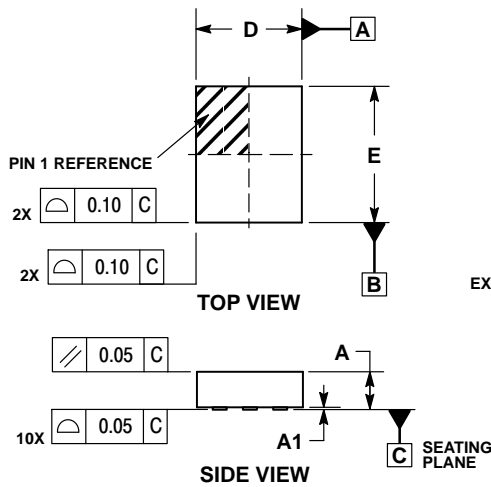
| Device        | Package             | Shipping†          |
|---------------|---------------------|--------------------|
| NLAS2750MUTAG | UQFN10<br>(Pb-Free) | 3000 / Tape & Reel |

†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.

# NLAS2750

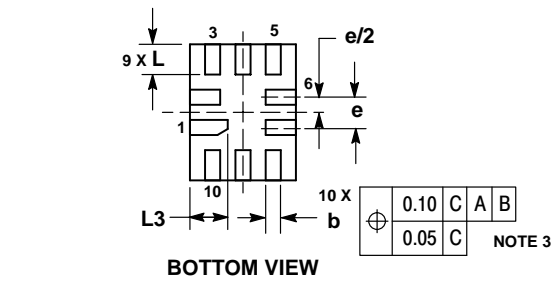
## PACKAGE DIMENSIONS

### UQFN10 1.4x1.8, 0.4P CASE 488AT ISSUE A

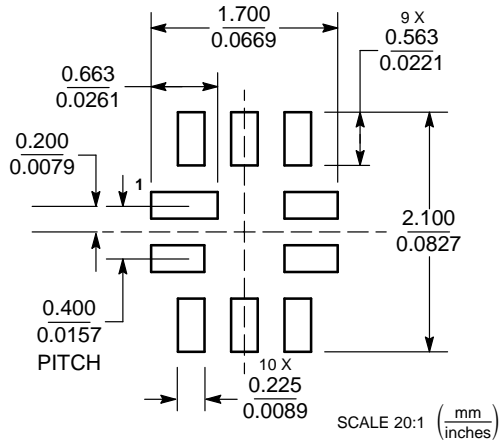


- NOTES:
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
  2. CONTROLLING DIMENSION: MILLIMETERS
  3. DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
  4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

| MILLIMETERS |       |      |
|-------------|-------|------|
| DIM         | MIN   | MAX  |
| A           | 0.45  | 0.60 |
| A1          | 0.00  | 0.05 |
| A3          | 0.127 | REF  |
| b           | 0.15  | 0.25 |
| D           | 1.40  | BSC  |
| E           | 1.80  | BSC  |
| e           | 0.40  | BSC  |
| L           | 0.30  | 0.50 |
| L1          | 0.00  | 0.15 |
| L3          | 0.40  | 0.60 |



### MOUNTING 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.

ON Semiconductor and are registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of SCILLC's product/patent coverage may be accessed at [www.onsemi.com/site/pdf/Patent-Marking.pdf](http://www.onsemi.com/site/pdf/Patent-Marking.pdf). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

### PUBLICATION ORDERING INFORMATION

**LITERATURE FULFILLMENT:**  
Literature Distribution Center for ON Semiconductor  
P.O. Box 5163, Denver, Colorado 80217 USA  
Phone: 303-675-2175 or 800-344-3860 Toll Free USA/Canada  
Fax: 303-675-2176 or 800-344-3867 Toll Free USA/Canada  
Email: [orderlit@onsemi.com](mailto:orderlit@onsemi.com)

**N. American Technical Support:** 800-282-9855 Toll Free  
USA/Canada  
**Europe, Middle East and Africa Technical Support:**  
Phone: 421 33 790 2910  
**Japan Customer Focus Center**  
Phone: 81-3-5817-1050

**ON Semiconductor Website:** [www.onsemi.com](http://www.onsemi.com)  
**Order Literature:** <http://www.onsemi.com/orderlit>  
For additional information, please contact your local Sales Representative