

NLAS3799, NLAS3799L

Analog Switch, Dual DPDT, Ultra-Low R_{ON}

The NLAS3799 is an ultra-low R_{ON} DPDT and a 0.5Ω R_{ON} DPDT analog switch. This device is designed for low operating voltage, high current switching of speaker output and earpiece for cellphone applications. It can switch a balanced stereo output. The NLAS3799 can handle a balanced microphone/speaker/ring-tone generator in a monophone mode. The device contains a break-before-make (BBM) feature.

Features

- Single Supply Operation
1.65 to 3.6 V V_{CC}
- Maximum Breakdown Voltage: 4.6 V
- Low Static Power
- NLAS3799 Interfaces with 2.8 V Chipset
NLAS3799L Interfaces with 1.8 V Chipset
- These are Pb-Free Devices*

Typical Applications

- Cell Phone Speaker/Microphone Switching
- Ringtone-Chip/Amplifier Switching
- Four Unbalanced (Single-Ended) Switches
- Stereo Balanced (Push-Pull) Switching

Important Information

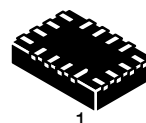
- ESD Protection:
Human Body Model (HBM) > 8000 V
Machine Model (MM) > 400 V
- Continuous Current Rating Through each Switch ± 300 mA
- Conforms to: JEDEC MO-220, Issue H, Variation VEED-6
- Package: 1.8 x 2.6 x 0.75 mm WQFN-16 Pb-Free



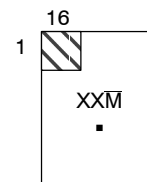
ON Semiconductor®

<http://onsemi.com>

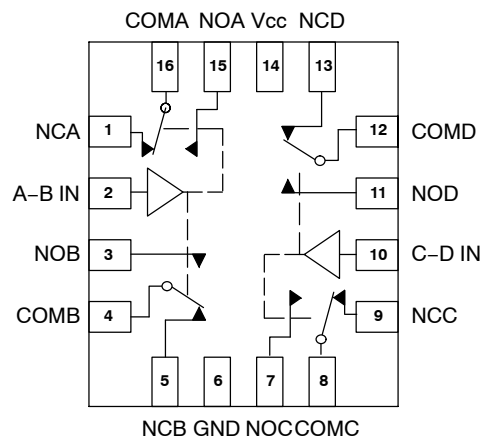
MARKING DIAGRAMS



**WQFN-16
CASE 488AP**



- XX = Specific Device Code
AR = NLAS3799
AT = NLAS3799L
- \overline{M} = Date Code/Assembly Location
- = Pb-Free Package



ORDERING INFORMATION

See detailed ordering and shipping information in the package dimensions section on page 10 of this data sheet.

*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

NLAS3799, NLAS3799L

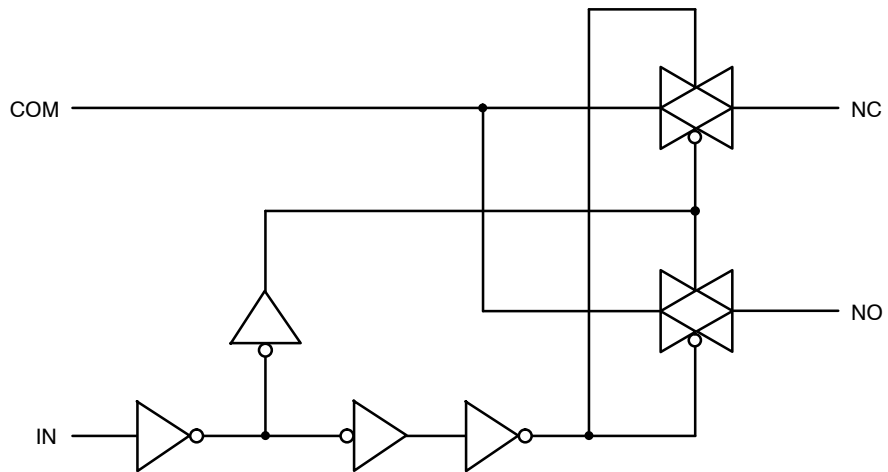


Figure 1. Input Equivalent Circuit

PIN DESCRIPTION

| QFN PIN # | Symbol | Name and Function |
|---------------------------|-----------------|-------------------------|
| 1, 3, 5, 7, 9, 11, 13, 15 | NO A-D, NC A-D | Independent Channels |
| 2, 10 | A-B IN, C-D IN | Controls |
| 4, 8, 12, 16 | COM A-D | Common Channels |
| 6 | GND | Ground (V) |
| 14 | V _{CC} | Positive Supply Voltage |

TRUTH TABLE

| IN | NO | NC |
|----|------|------|
| H | ON | OFF* |
| L | OFF* | ON |

*High impedance.

NLAS3799, NLAS3799L

MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------|--|--------------------------------------|------|
| V_{CC} | Positive DC Supply Voltage | -0.5 to +4.6 | V |
| V_{IS} | Analog Input Voltage (V_{NO} , V_{NC} , or V_{COM}) | $-0.5 \leq V_{IS} \leq V_{CC} + 0.5$ | V |
| V_{IN} | Digital Select Input Voltage | $-0.5 \leq V_{IN} \leq +V_{CC}$ | V |
| I_{anI1} | Continuous DC Current from COM to NC/NO | ± 300 | mA |
| $I_{anI-pk1}$ | Peak Current from COM to NC/NO, 10 Duty Cycle (Note 1) | ± 500 | mA |
| I_{clmp} | Continuous DC Current into COM/NO/NC with Respect to V_{CC} or GND | ± 100 | mA |
| T_S | Storage Temperature | -65 to +150 | °C |

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. Defined as 10% ON, 90% OFF Duty Cycle.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Parameter | Min | Max | Unit |
|------------|------------------------------------|------|--|------|
| V_{CC} | DC Supply Voltage | 1.65 | 3.6 | V |
| V_{IN} | Digital Select Input Voltage | GND | V_{CC} | V |
| V_{IS} | Analog Input Voltage (NC, NO, COM) | GND | V_{CC} | V |
| T_A | Operating Temperature Range | -40 | +85 | °C |
| t_r, t_f | Input Rise or Fall Time, IN | | 20 10 | ns/V |
| | | | $V_{CC} = 1.6\text{ V} - 2.7\text{ V}$ $V_{CC} = 3.0\text{ V} - 3.6\text{ V}$ | |

NLAS3799, NLAS3799L

NLAS3799 DC CHARACTERISTICS – DIGITAL SECTION (Voltages Referenced to GND)

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Limit | | Unit |
|------------------|---|---|-----------------|------------------|----------------|------|
| | | | | 25°C | -40°C to +85°C | |
| V _{IH} | Minimum High-Level Input Voltage, Select Inputs | | 3.0 | 1.4 | 1.4 | V |
| | | | 3.6 | 1.7 | 1.7 | |
| V _{IL} | Maximum Low-Level Input Voltage, Select Inputs | | 3.0 | 0.5 | 0.5 | V |
| | | | 3.6 | 0.5 | 0.5 | |
| I _{IN} | Maximum Input Leakage Current, Select Inputs | V _{IN} = V _{CC} or GND | 3.6 | ±0.1 | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 3.6 V or GND | 0 | ±0.5 | ±2.0 | μA |
| I _{CC} | Maximum Quiescent Supply Current (Note 2) | Select and V _{IS} = V _{CC} or GND | 1.65 to 3.6 | ±1.0 | ±2.0 | μA |

2. Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

NLAS3799 DC ELECTRICAL CHARACTERISTICS – ANALOG SECTION

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Maximum Limit | | | | Unit |
|--|--|--|-----------------|--------------------------|------|----------------|------|------|
| | | | | 25°C | | -40°C to +85°C | | |
| | | | | Min | Max | Min | Max | |
| R _{ON} | NC/NO On-Resistance (Note 3) | V _{IN} = V _{IL} or V _{IN} = V _{IH} V _{IS} = GND to V _{CC} I _{IN} = 100 mA | 3.0 | | 0.5 | | 0.5 | Ω |
| | | | 3.6 | | 0.4 | | 0.4 | |
| R _{FLAT} | NC/NO On-Resistance Flatness (Notes 3 and 4) | I _{COM} = 100 mA V _{IS} = 0 to V _{CC} | 3.0 | | 0.15 | | 0.15 | Ω |
| | | | 3.6 | | 0.15 | | 0.15 | |
| ΔR _{ON} | On-Resistance Match Between Channels (Notes 3 and 5) | V _{IS} = 1.5 V; I _{COM} = 100 mA V _{IS} = 1.8 V; I _{COM} = 100 mA | 3.0 | | 0.05 | | 0.05 | Ω |
| | | | 3.6 | | 0.05 | | 0.05 | |
| I _{NC(OFF)} I _{NO(OFF)} | NC or NO Off Leakage Current (Note 3) | V _{IN} = V _{IL} or V _{IH} V _{NO} or V _{NC} = 0.3 V V _{COM} = 3.3 V | 3.6 | -10 | 10 | -100 | 100 | nA |
| I _{COM(ON)} | COM ON Leakage Current (Note 3) | V _{IN} = V _{IL} or V _{IH} V _{NO} 0.3 V or 3.3 V with V _{NC} floating or V _{NC} 0.3 V or 3.3 V with V _{NO} floating V _{COM} = 0.3 V or 3.3 V | 3.6 | -10 | 10 | -100 | 100 | nA |

3. Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

4. Flatness is defined as the difference between the maximum and minimum value of On-resistance as measured over the specified analog signal ranges.

5. ΔR_{ON} = R_{ON(MAX)} – R_{ON(MIN)} between nS2 or nS1.

NLAS3799, NLAS3799L

NLAS3799L DC CHARACTERISTICS – DIGITAL SECTION (Voltages Referenced to GND)

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Limit | | Unit |
|------------------|---|---|-----------------|------------------|--------------|------|
| | | | | 25°C | -40 to +85°C | |
| V _{IH} | Minimum High-Level Input Voltage, Select Inputs | | 3.0 | 1.2 | 1.2 | V |
| | | | 3.6 | 1.3 | 1.3 | |
| V _{IL} | Maximum Low-Level Input Voltage, Select Inputs | | 3.0 | 0.5 | 0.5 | V |
| | | | 3.6 | 0.5 | 0.5 | |
| I _{IN} | Maximum Input Leakage Current, Select Inputs | V _{IN} = V _{CC} or GND | 3.6 | ±0.1 | ±1.0 | µA |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 3.6 V or GND | 0 | ±0.5 | ±2.0 | µA |
| I _{CC} | Maximum Quiescent Supply Current (Note 6) | Select and V _{IS} = V _{CC} or GND | 1.65 to 3.6 | ±10 | ±20 | µA |

6. Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

NLAS3799L DC ELECTRICAL CHARACTERISTICS – ANALOG SECTION

| Symbol | Parameter | Condition | V _{CC} | Guaranteed Maximum Limit | | | | Unit |
|--|--|--|-----------------|--------------------------|--------------|----------------|--------------|------|
| | | | | 25°C | | -40°C to +85°C | | |
| | | | | Min | Max | Min | Max | |
| R _{ON} | NC/NO On-Resistance (Note 7) | V _{IN} = V _{IL} or V _{IN} = V _{IH} V _{IS} = GND to V _{CC} I _{IN} = 100 mA | 3.0 | | 0.5 | | 0.5 | Ω |
| | | | 3.6 | | 0.5 | | 0.5 | |
| R _{FLAT} | NC/NO On-Resistance Flatness (Notes 7 and 8) | I _{COM} = 100 mA V _{IS} = 0 to V _{CC} | 3.0 3.6 | | 0.15 0.15 | | 0.15 0.15 | Ω |
| ΔR _{ON} | On-Resistance Match Between Channels (Notes 7 and 9) | V _{IS} = 1.5 V; I _{COM} = 100 mA V _{IS} = 1.8 V; I _{COM} = 100 mA | 3.0 | | 0.05 | | 0.05 | Ω |
| | | | 3.6 | | 0.05 | | 0.05 | |
| I _{NC(OFF)} I _{NO(OFF)} | NC or NO Off Leakage Current (Note 7) | V _{IN} = V _{IL} or V _{IH} V _{NO} or V _{NC} = 0.3 V V _{COM} = 3.3 V | 3.6 | -10 | 10 | -100 | 100 | nA |
| I _{COM(ON)} | COM ON Leakage Current (Note 7) | V _{IN} = V _{IL} or V _{IH} V _{NO} 0.3 V or 3.3 V with V _{NC} floating or V _{NC} 0.3 V or 3.3 V with V _{NO} floating V _{COM} = 0.3 V or 3.3 V | 3.6 | -10 | 10 | -100 | 100 | nA |

7. Guaranteed by design. Resistance measurements do not include test circuit or package resistance.

8. Flatness is defined as the difference between the maximum and minimum value of On-resistance as measured over the specified analog signal ranges.

9. ΔR_{ON} = R_{ON(MAX)} - R_{ON(MIN)} between NC1 and NC2 or between NO1 and NO2.

NLAS3799, NLAS3799L

NLAS3799/NLAS3799L 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 |
|------------------|--------------------------------|--|------------------------|------------------------|--------------------------|------|-----|----------------|-----|------|
| | | | | | 25°C | | | -40°C to +85°C | | |
| | | | | | Min | Typ* | Max | Min | Max | |
| t _{ON} | Turn-On Time | R _L = 50 Ω, C _L = 35 pF (Figures 3 and 4) | 2.3 – 3.6 | 1.5 | | | 50 | | 60 | ns |
| t _{OFF} | Turn-Off Time | R _L = 50 Ω, C _L = 35 pF (Figures 3 and 4) | 2.3 – 3.6 | 1.5 | | | 30 | | 40 | ns |
| t _{BBM} | Minimum Break-Before-Make Time | V _{IS} = 3.0 R _L = 50 Ω, C _L = 35 pF (Figure 2) | 3.0 | 1.5 | 2 | 15 | | | | ns |

| | | Typical @ 25, V _{CC} = 3.6 V | Unit |
|-----------------|---|---------------------------------------|------|
| C _{IN} | Control Pin Input Capacitance | 3.0 | pF |
| C _{SN} | SN Port Capacitance | 72 | pF |
| C _D | D Port Capacitance When Switch is Enabled | 220 | pF |

*Typical Characteristics are at 25°C.

ADDITIONAL APPLICATION CHARACTERISTICS (Voltages Referenced to GND Unless Noted)

| Symbol | Parameter | Condition | V _{CC} (V) | 25°C | Unit |
|------------------|---|---|------------------------|---------|------|
| | | | | Typical | |
| BW | Maximum On-Channel -3 dB Bandwidth or Minimum Frequency Response (Figure 9) | V _{IN} centered between V _{CC} and GND (Figure 5) | 1.65 – 3.6 | 19 | MHz |
| V _{ONL} | Maximum Feed-through On Loss | V _{IN} = 0 dBm @ 100 kHz to 50 MHz V _{IN} centered between V _{CC} and GND (Figure 5) | 1.65 – 3.6 | -0.06 | dB |
| V _{ISO} | Off-Channel Isolation | f = 100 kHz; V _{IS} = 1 V RMS; C _L = 5.0 pF V _{IN} centered between V _{CC} and GND (Figure 5) | 1.65 – 3.6 | -69 | dB |
| Q | Charge Injection Select Input to Common I/O (Figure 8) | V _{IN} = V _{CC} to GND, R _{IS} = 0 Ω, C _L = 1.0 nF Q = C _L × ΔV _{OUT} (Figure 6) | 1.65 – 3.6 | 42 | pC |
| THD | Total Harmonic Distortion THD + Noise (Figure 7) | F _{IS} = 20 Hz to 20 kHz, R _L = R _{gen} = 600 Ω, C _L = 50 pF V _{IS} = 2 V _{PP} | 3.0 | 0.11 | % |
| VCT | Channel-to-Channel Crosstalk (Figure 10) | f = 100 kHz; V _{IS} = 1.0 V RMS, C _L = 5.0 pF, R _L = 50 Ω V _{IN} centered between V _{CC} and GND (Figure 5) | 1.65 – 3.6 | -90 | dB |

10. Off-Channel Isolation = 20log₁₀ (V_{COM}/V_{NO}), V_{COM} = output, V_{NO} = input to off switch.

NLAS3799, NLAS3799L

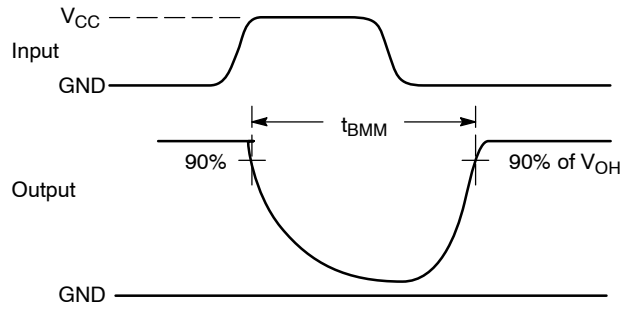
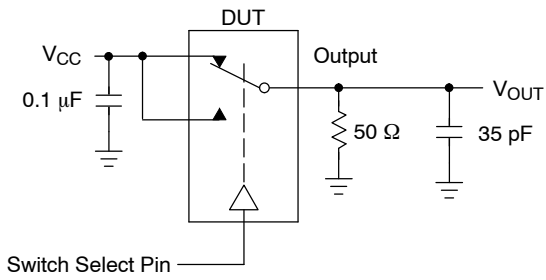


Figure 2. t_{BMM} (Time Break-Before-Make)

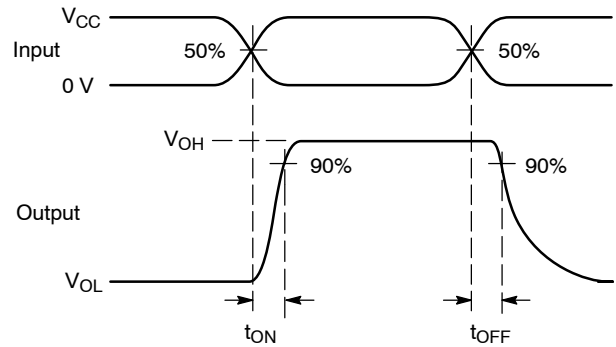
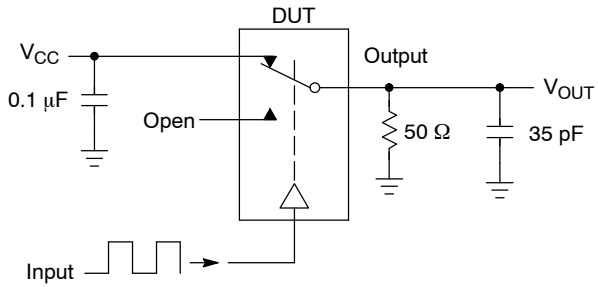


Figure 3. t_{ON}/t_{OFF}

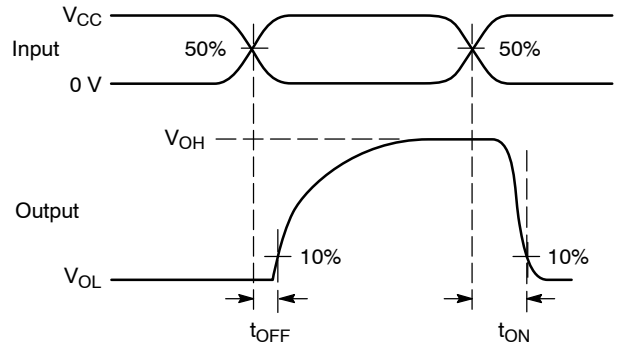
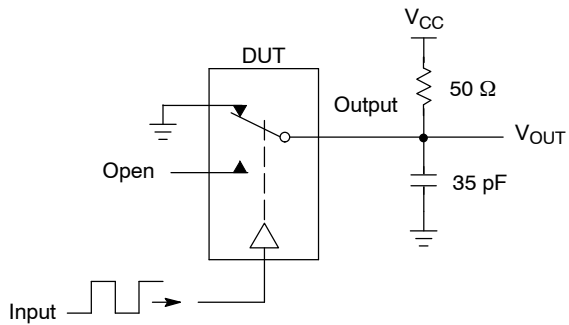


Figure 4. t_{ON}/t_{OFF}

NLAS3799, NLAS3799L



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 Ω

Figure 5. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ V_{ONL}

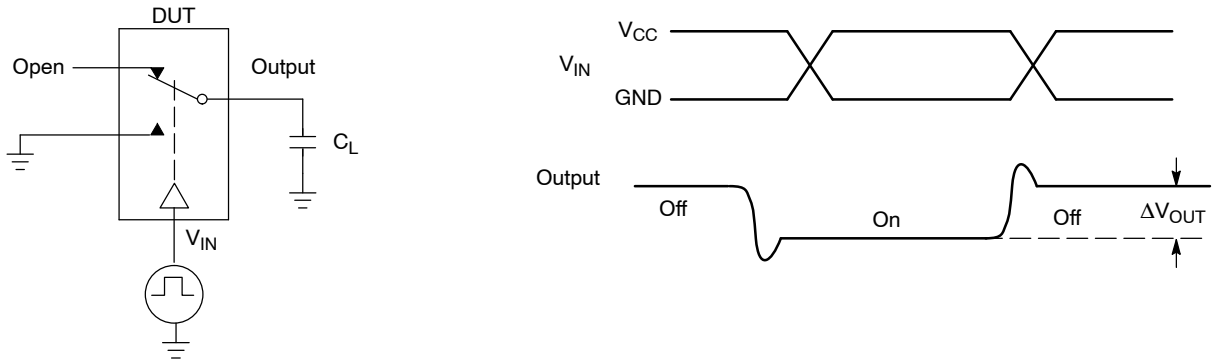


Figure 6. Charge Injection: (Q)

NLAS3799, NLAS3799L

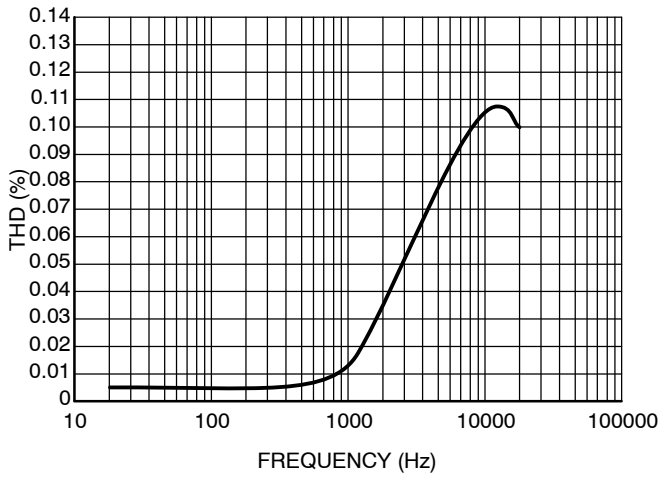


Figure 7. Total Harmonic Distortion vs. Frequency

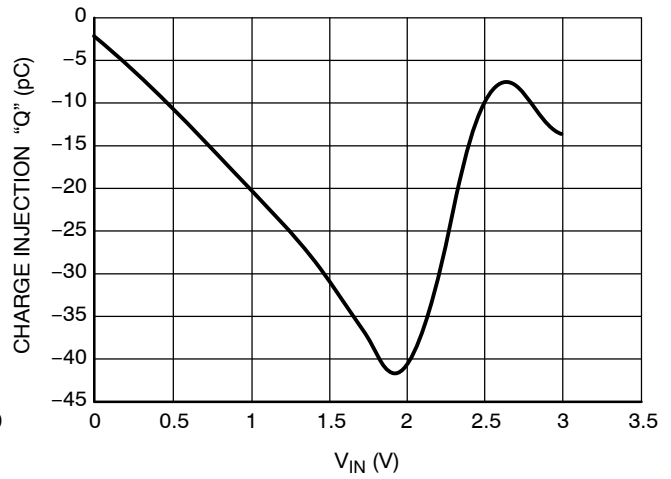


Figure 8. Charge Injection @ $V_{CC} = 3.0\text{ V}$

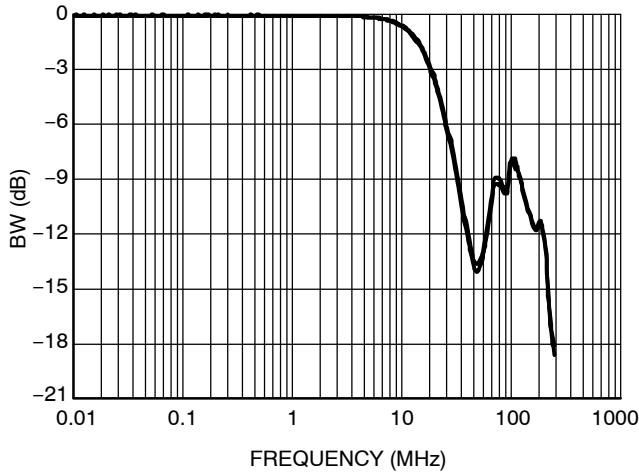


Figure 9. Bandwidth vs. Frequency

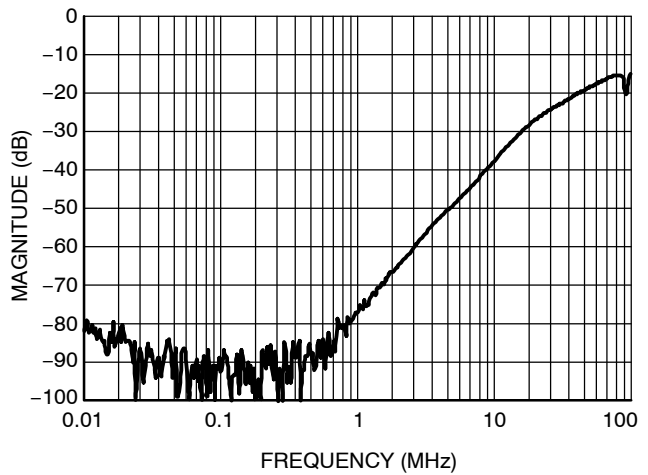


Figure 10. Cross-Talk vs. Frequency

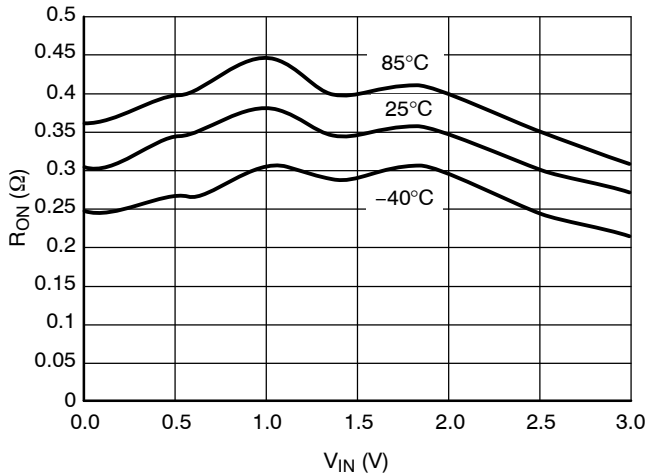


Figure 11. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 3.0\text{ V}$

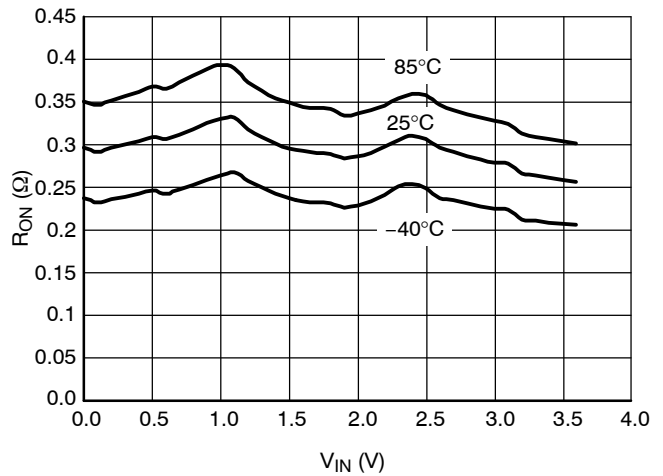


Figure 12. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 3.6\text{ V}$

NLAS3799, NLAS3799L

DEVICE ORDERING INFORMATION

| Device Order Number | Device Nomenclature | | | | | Package Type | Tape & Reel Size [†] |
|---------------------|---------------------|------------|-----------------|----------------|--------------------|----------------|-------------------------------|
| | Circuit Indicator | Technology | Device Function | Package Suffix | Tape & Reel Suffix | | |
| NLAS3799MNR2G | NL | AS | 3799 | MN | R2 | WQFN (Pb-Free) | 3000 / Tape & Reel |
| NLAS3799LMNR2G | NL | AS | 3799L | MN | R2 | WQFN (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.

MECHANICAL CASE OUTLINE

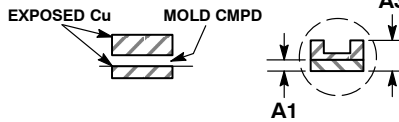
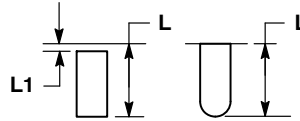
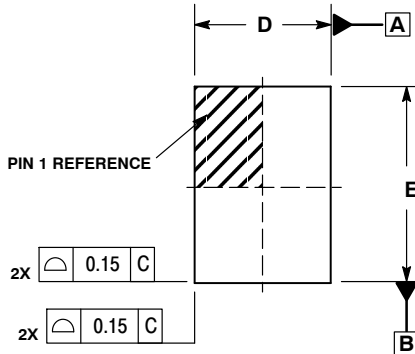
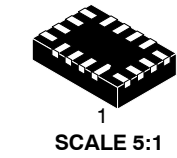
PACKAGE DIMENSIONS

ON Semiconductor®



WQFN16, 1.8x2.6, 0.4P CASE 488AP-01 ISSUE B

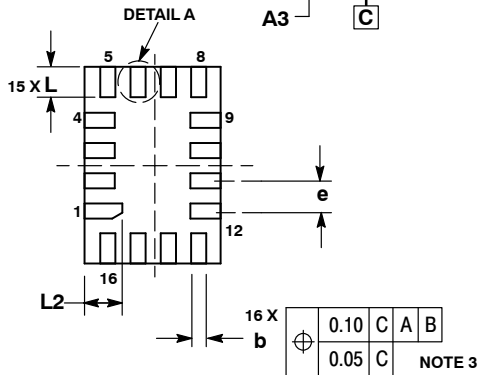
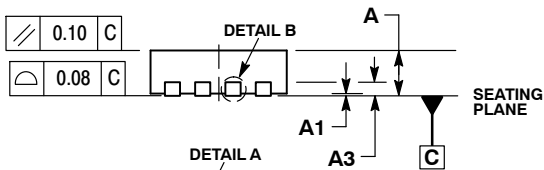
DATE 25 JUN 2008



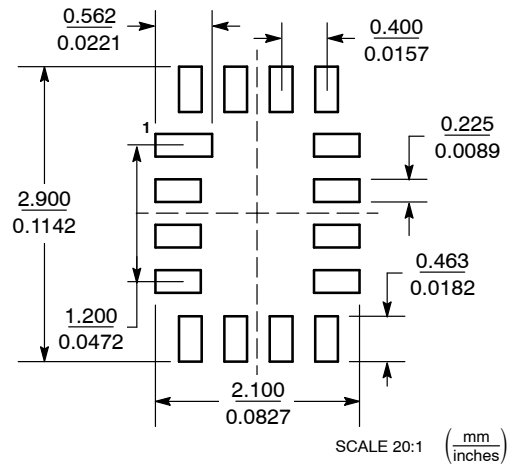
NOTES:

- DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
- CONTROLLING DIMENSION: MILLIMETERS
- DIMENSION b APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM FROM TERMINAL.
- COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
- EXPOSED PADS CONNECTED TO DIE FLAG. USED AS TEST CONTACTS.

| DIM | MILLIMETERS | |
|-----|-------------|-------|
| | MIN | MAX |
| A | 0.70 | 0.80 |
| A1 | 0.00 | 0.050 |
| A3 | 0.20 REF | |
| b | 0.15 | 0.25 |
| D | 1.80 BSC | |
| E | 2.60 BSC | |
| e | 0.40 BSC | |
| L | 0.30 | 0.50 |
| L1 | 0.00 | 0.15 |
| L2 | 0.40 | 0.60 |



MOUNTING FOOTPRINT



| | | |
|-------------------------|--------------------------------|--|
| DOCUMENT NUMBER: | 98AON20790D | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION: | WQFN16, 1.8 X 2.6, 0.4P | PAGE 1 OF 1 |

ON Semiconductor and are trademarks of Semiconductor Components Industries, LLC dba ON Semiconductor or its subsidiaries in the United States and/or other countries. ON Semiconductor reserves the right to make changes without further notice to any products herein. ON Semiconductor makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does ON Semiconductor 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. ON Semiconductor does not convey any license under its patent rights nor the rights of others.

onsemi, **Onsemi**, and other names, marks, and brands are registered and/or common law trademarks of Semiconductor Components Industries, LLC dba "**onsemi**" or its affiliates and/or subsidiaries in the United States and/or other countries. **onsemi** owns the rights to a number of patents, trademarks, copyrights, trade secrets, and other intellectual property. A listing of **onsemi**'s product/patent coverage may be accessed at www.onsemi.com/site/pdf/Patent-Marking.pdf. **onsemi** reserves the right to make changes at any time to any products or information herein, without notice. The information herein is provided "as-is" and **onsemi** makes no warranty, representation or guarantee regarding the accuracy of the information, product features, availability, functionality, or suitability of its products for any particular purpose, nor does **onsemi** 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. Buyer is responsible for its products and applications using **onsemi** products, including compliance with all laws, regulations and safety requirements or standards, regardless of any support or applications information provided by **onsemi**. "Typical" parameters which may be provided in **onsemi** 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. **onsemi** does not convey any license under any of its intellectual property rights nor the rights of others. **onsemi** products are not designed, intended, or authorized for use as a critical component in life support systems or any FDA Class 3 medical devices or medical devices with a same or similar classification in a foreign jurisdiction or any devices intended for implantation in the human body. Should Buyer purchase or use **onsemi** products for any such unintended or unauthorized application, Buyer shall indemnify and hold **onsemi** 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 **onsemi** was negligent regarding the design or manufacture of the part. **onsemi** is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

ADDITIONAL INFORMATION

TECHNICAL PUBLICATIONS:

Technical Library: www.onsemi.com/design/resources/technical-documentation
onsemi Website: www.onsemi.com

ONLINE SUPPORT: www.onsemi.com/support

For additional information, please contact your local Sales Representative at www.onsemi.com/support/sales