

NLAS3799B, NLAS3799BL

Dual DPDT Ultra-Low R_{ON} Switch

The NLAS3799B is an ultra-low R_{ON} dual DPDT and a 0.5Ω R_{ON} 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 NLAS3799B 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 4.5 V V_{CC}
Function Directly from LiON Battery
- Maximum Breakdown Voltage: 5.5 V
- Low Static Power
- NLAS3799B Interfaces with 2.8 V Chipset
NLAS3799BL 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

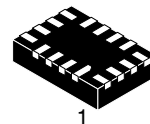
- ESD Protection:
Human Body Model (HBM) > 8000 V
Machine Model (MM) > 400 V
- Continuous Current Rating Through each Switch ± 300 mA
- Conforms to: JEDEC MO-220, Issue H, Variation VEED-6
- Package:
 - ◆ 1.8 x 2.6 x 0.75 mm WQFN-16 Pb-Free
 - ◆ 1.8 x 2.6 x 0.55 mm UQFN-16 Pb-Free



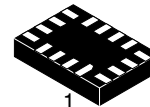
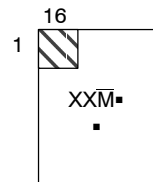
ON Semiconductor®

<http://onsemi.com>

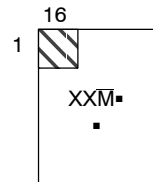
MARKING DIAGRAMS



**WQFN-16
CASE 488AP**

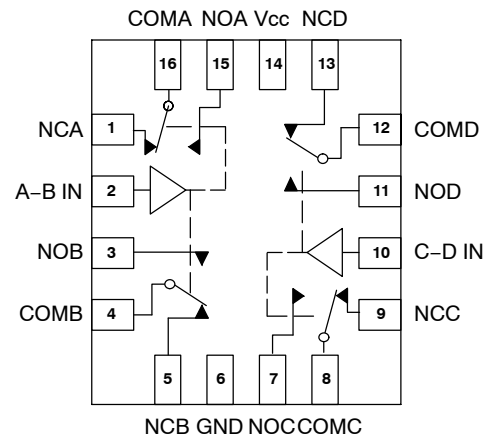


**UQFN-16
CASE 488AU**



XX = Specific Device Code
AK = NLAS3799BMNR2G
AL = NLAS3799BLMNR2G
AX = NLAS3799BMUR2G
 \bar{M} = Date Code/Assembly Location
▪ = Pb-Free Package

(Note: Microdot may be in either location)



ORDERING INFORMATION

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

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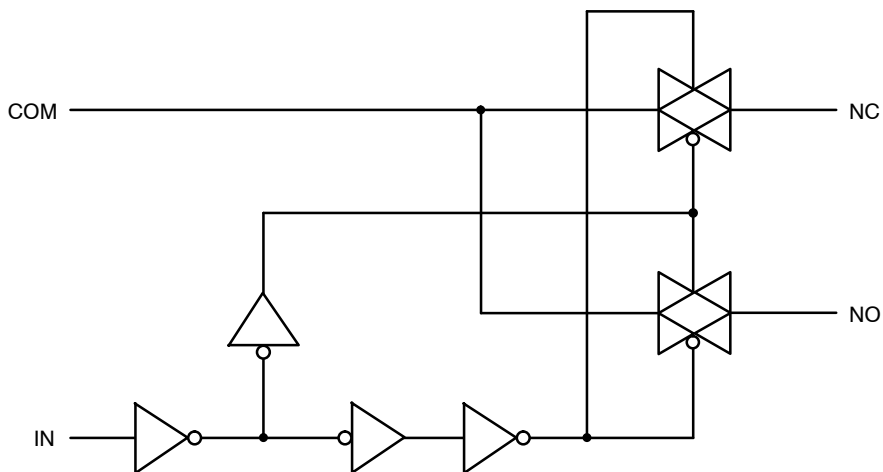


Figure 1. Input Equivalent Circuit

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.

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MAXIMUM RATINGS

| Symbol | Parameter | Value | Unit |
|---------------|--|--------------------------------------|------|
| V_{CC} | Positive DC Supply Voltage | -0.5 to +5.5 | 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 |

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 | 4.5 | 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 |
| | | | $V_{CC} = 1.6\text{ V} - 2.7\text{ V}$ $V_{CC} = 3.0\text{ V} - 4.5\text{ V}$ | |

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NLAS3799B 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 |
| | | | 4.3 | 2.0 | 2.0 | |
| V _{IL} | Maximum Low-Level Input Voltage, Select Inputs | | 3.0 | 0.5 | 0.5 | V |
| | | | 4.3 | 0.8 | 0.8 | |
| I _{IN} | Maximum Input Leakage Current, Select Inputs | V _{IN} = V _{CC} or GND | 4.3 | ±0.1 | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 4.5 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 4.5 | ±1.0 | ±2.0 | μA |

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

NLAS3799B 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 | | 0.6 | Ω |
| | | | 4.3 | | 0.4 | | 0.5 | |
| 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 |
| | | | 4.3 | | 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} = 2.2 V; I _{COM} = 100 mA | 3.0 | | 0.05 | | 0.05 | Ω |
| | | | 4.3 | | 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} = 4.0 V | 4.3 | -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 4.0 V with V _{NC} floating or V _{NC} 0.3 V or 4.0 V with V _{NO} floating V _{COM} = 0.3 V or 4.0 V | 4.3 | -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 NCn or NOn.

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NLAS3799BL 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 | 1.3 | 1.3 | V |
| | | | 4.3 | 1.6 | 1.6 | |
| V _{IL} | Maximum Low-Level Input Voltage, Select Inputs | | 3.0 | 0.5 | 0.5 | V |
| | | | 4.3 | 0.6 | 0.6 | |
| I _{IN} | Maximum Input Leakage Current, Select Inputs | V _{IN} = V _{CC} or GND | 4.3 | ±0.1 | ±1.0 | μA |
| I _{OFF} | Power Off Leakage Current | V _{IN} = 4.5 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 4.3 | ±40 | ±45 | μA |

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

NLAS3799BL 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 | | 0.6 | Ω |
| | | | 4.3 | | 0.4 | | 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 | | 0.15 | | 0.15 | Ω |
| | | | 4.3 | | 0.15 | | 0.15 | |
| ΔR _{ON} | On-Resistance Match Between Channels (Notes 7 and 9) | V _{IS} = 1.5 V; I _{COM} = 100 mA V _{IS} = 2.2 V; I _{COM} = 100 mA | 3.0 | | 0.05 | | 0.05 | Ω |
| | | | 4.3 | | 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} = 4.0 V | 4.3 | -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 4.0 V with V _{NC} floating or V _{NC} 0.3 V or 4.0 V with V _{NO} floating V _{COM} = 0.3 V or 4.0 V | 4.3 | -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.

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NLAS3799B/NLAS3799BL 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 | $R_L = 50 \Omega$, $C_L = 35$ pF (Figures 3 and 4) | 2.3 – 4.3 | 1.5 | | | 50 | | 60 | ns |
| t_{OFF} | Turn-Off Time | $R_L = 50 \Omega$, $C_L = 35$ pF (Figures 3 and 4) | 2.3 – 4.3 | 1.5 | | | 30 | | 40 | ns |
| t_{BBM} | Minimum Break-Before-Make Time | $V_{IS} = 3.0$ $R_L = 50 \Omega$, $C_L = 35$ 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 – 4.5 | 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 – 4.5 | -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 – 4.5 | -69 | dB |
| Q | Charge Injection Select Input to Common I/O (Figure 8) | $V_{IN} = V_{CC}$ to GND, $R_{IS} = 0 \Omega$, $C_L = 1.0$ nF $Q = C_L \times \Delta V_{OUT}$ (Figure 6) | 1.65 – 4.5 | 51 | pC |
| THD | Total Harmonic Distortion THD + Noise (Figure 7) | $F_{IS} = 20$ Hz to 20 kHz, $R_L = R_{gen} = 600 \Omega$, $C_L = 50$ pF $V_{IS} = 2$ V _{PP} | 4.3 | 0.042 | % |
| VCT | Channel-to-Channel Crosstalk (Figure 10) | $f = 100$ kHz; $V_{IS} = 1.0$ V RMS, $C_L = 5.0$ pF, $R_L = 50 \Omega$ V_{IN} centered between V_{CC} and GND (Figure 5) | 1.65 – 4.5 | -90 | dB |

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

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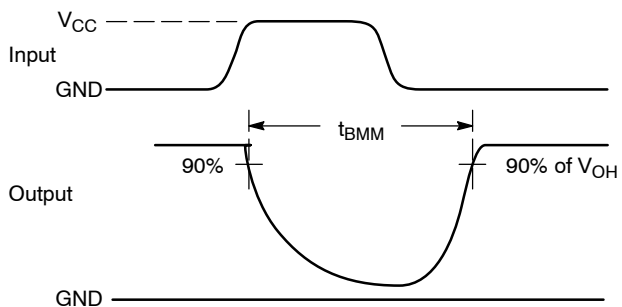
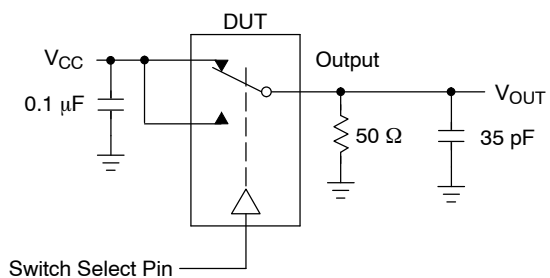


Figure 2. t_{BMM} (Time Break-Before-Make)

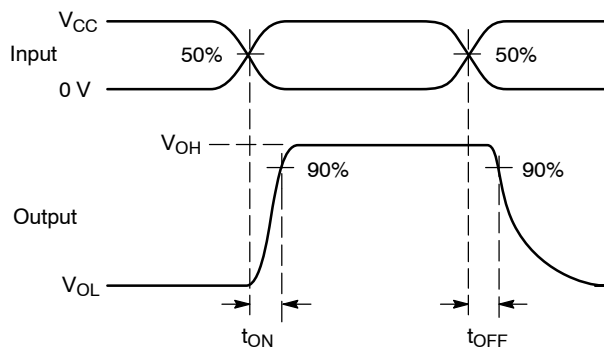
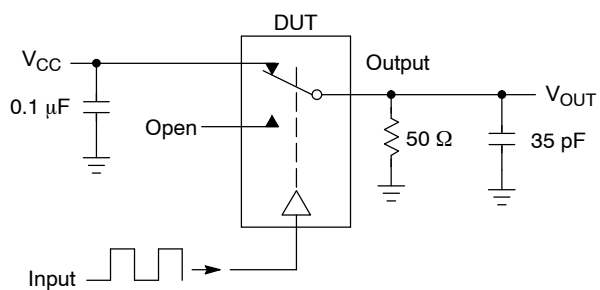


Figure 3. t_{ON}/t_{OFF}

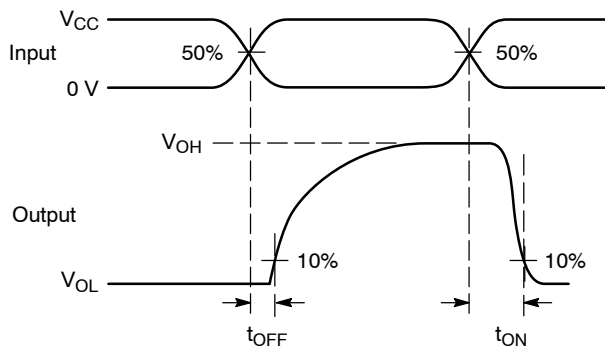
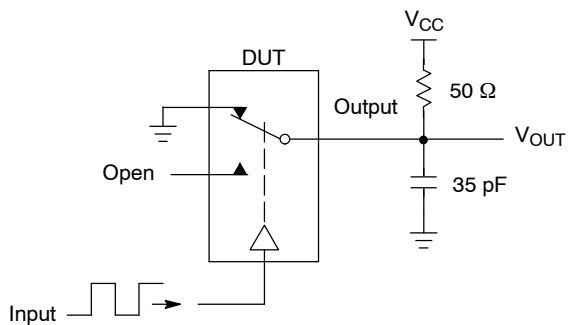
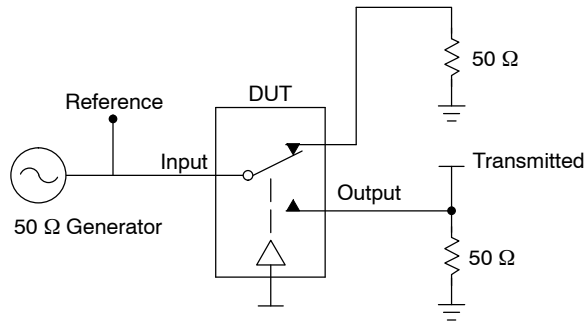


Figure 4. t_{ON}/t_{OFF}

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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.

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

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

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}

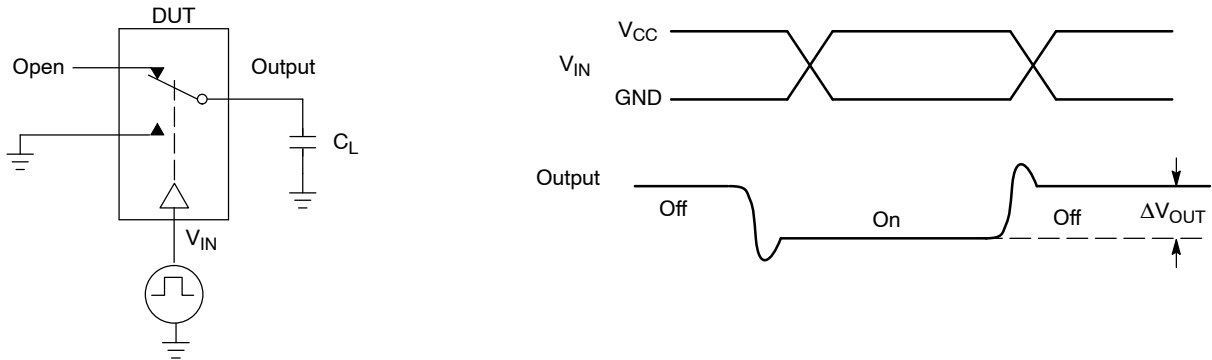


Figure 6. Charge Injection: (Q)

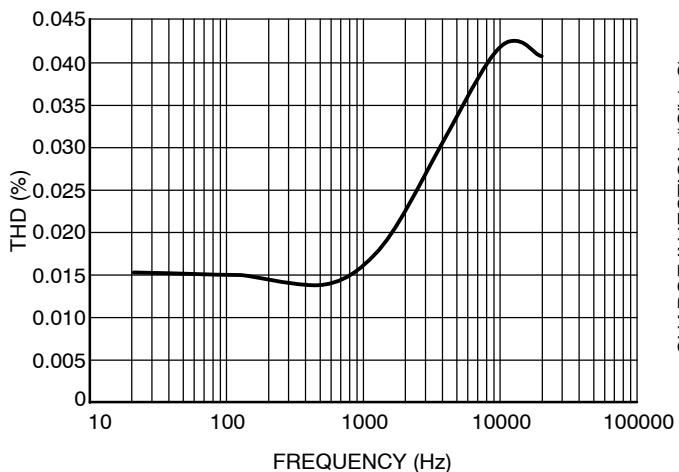


Figure 7. Total Harmonic Distortion vs. Frequency

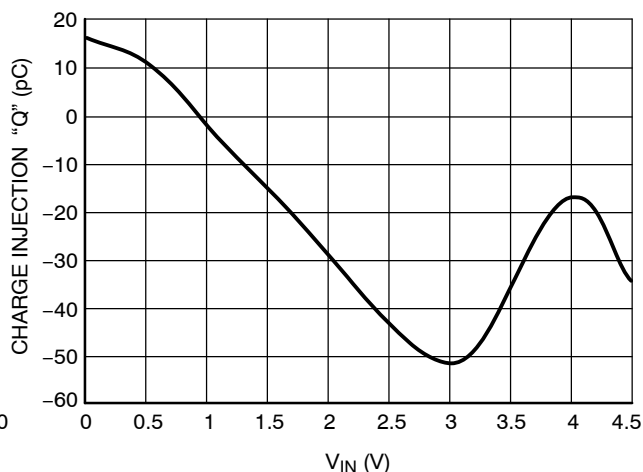


Figure 8. Charge Injection @ $0\text{ V} < V_{CC} < 4.5\text{ V}$

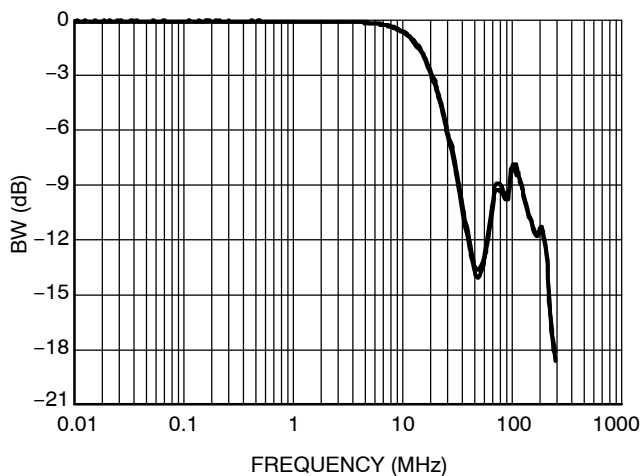


Figure 9. Bandwidth vs. Frequency

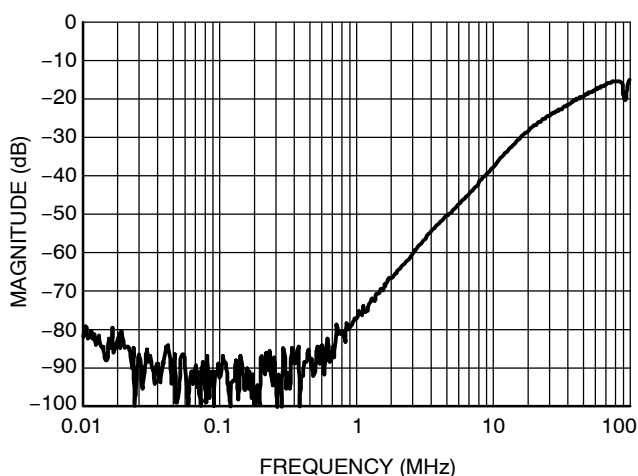


Figure 10. Cross-Talk vs. Frequency

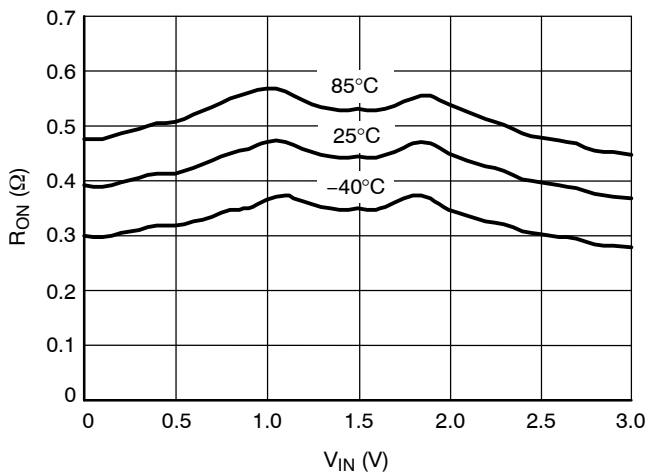


Figure 11. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 3.0\text{ V}$

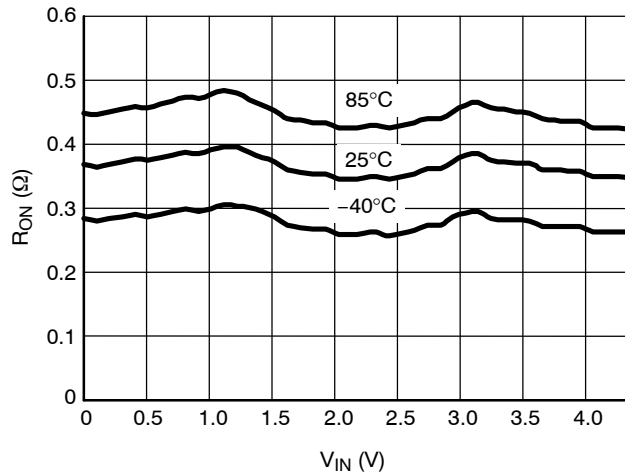


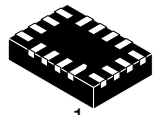
Figure 12. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 4.3\text{ V}$

NLAS3799B, NLAS3799BL

DEVICE ORDERING INFORMATION

| Device Order Number | Package Type | Tape & Reel Size† |
|---------------------|----------------------|--------------------|
| NLAS3799BMNR2G | WQFN-16 (Pb-Free) | 3000 / Tape & Reel |
| NLAS3799BLMNR2G | WQFN-16 (Pb-Free) | 3000 / Tape & Reel |
| NLAS3799BMUR2G | UQFN-16 (Pb-Free) | 3000 / Tape & Reel |

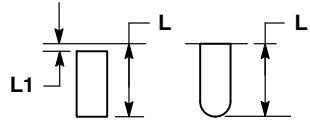
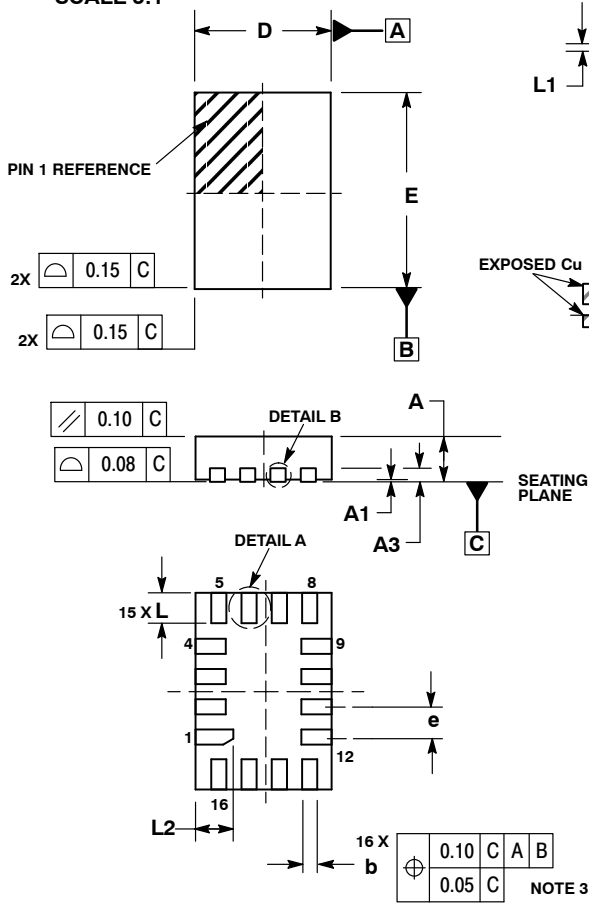
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



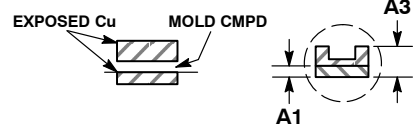
SCALE 5:1

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

DATE 25 JUN 2008



DETAIL A
ALTERNATE TERMINAL
CONSTRUCTIONS



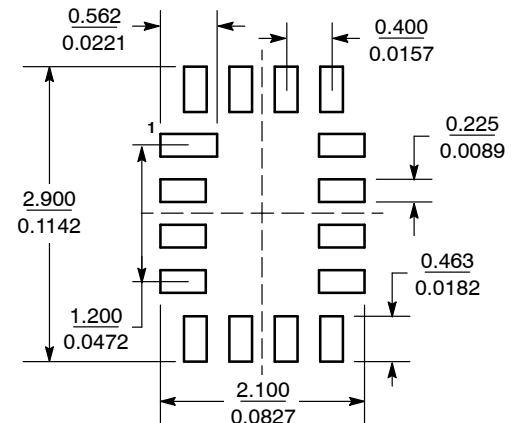
DETAIL B
ALTERNATE
CONSTRUCTIONS

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.
5. 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



SCALE 20:1 (mm/inches)

| | | |
|-------------------------|--------------------------------|--|
| 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 |

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MECHANICAL CASE OUTLINE

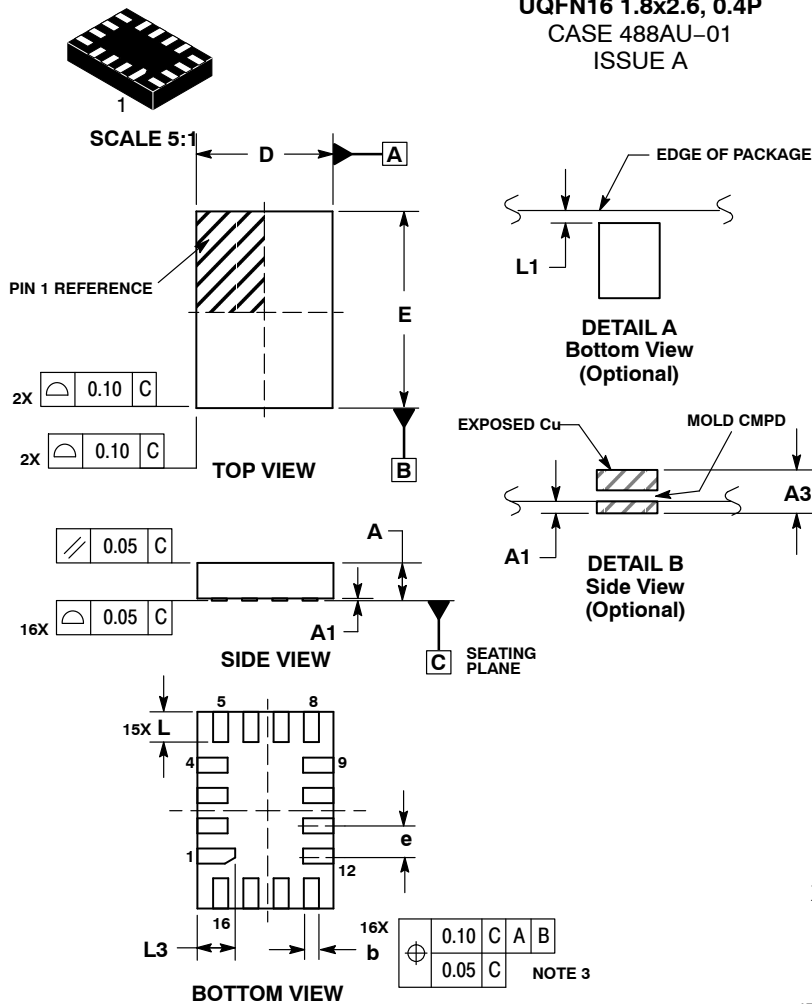
PACKAGE DIMENSIONS

ON Semiconductor®



UQFN16 1.8x2.6, 0.4P CASE 488AU-01 ISSUE A

DATE 01 AUG 2007

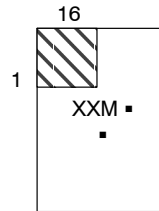


NOTES:

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.

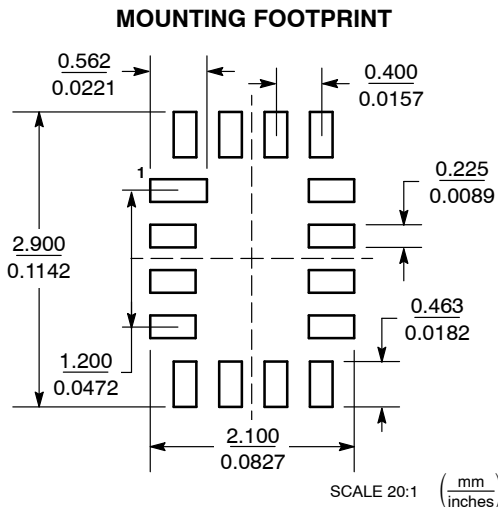
| MILLIMETERS | | |
|-------------|-----------|------|
| DIM | MIN | MAX |
| A | 0.45 | 0.60 |
| A1 | 0.00 | 0.05 |
| A3 | 0.127 REF | |
| b | 0.15 | 0.25 |
| D | 1.80 BSC | |
| E | 2.60 BSC | |
| e | 0.40 BSC | |
| L | 0.30 | 0.50 |
| L1 | 0.00 | 0.15 |
| L3 | 0.40 | 0.60 |

GENERIC MARKING DIAGRAM*



- XX = Specific Device Code
 - M = Date Code/Assembly Location
 - = Pb-Free Package
- (Note: Microdot may be in either location)

*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G", may or not be present.



| | | |
|-------------------------|-------------------------------------|--|
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| DESCRIPTION: | 16 PIN UQFN, 1.8 X 2.6, 0.4P | PAGE 1 OF 1 |

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