Dual DPDT Low R_{ON}, Low Capacitance Switch

The NLAS3899B is a dual DPDT analog switch designed for low power audio and dual SIM card applications. The low R_{ON} of 3.0 Ω (typical) is ideal for routing audio signals to or from a moderately high impedance load. In addition, the low C_{ON} of 20 pF (typical) gives the NLAS3899B a high bandwidth of 280 MHz, perfect for dual SIM card applications.

Features

- Single Supply Operation
 1.65 to 4.3 V V_{CC}
 Function Directly from Li–Ion Battery
- Low ON Resistance (3.0 Ω Typical Across V_{CC})
- Low C_{ON} (20 pF Typical)
- Bandwidth 280 MHz
- Maximum Breakdown Voltage: 5.5 V
- Low Static Power
- Interfaces with 1.8 V Chipset
- These are Pb-Free Devices

Typical Applications

- Cell Phone Speaker/Microphone Switching
- Ringtone-Chip/Amplifier Switching
- Dual SIM Card Data Switching
- Four Unbalanced (Single-Ended) Switches

Important Information

• ESD Protection:

Human Body Model (HBM) 1000 V – All Pins 5000 V – I/O to GND

- 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 WQFN16 Pb-Free
 - ◆ 3.0 x 3.0 x 0.9 mm QFN16 Pb-Free



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MARKING DIAGRAMS



WQFN16 CASE 488AP





QFN16 CASE 485AE

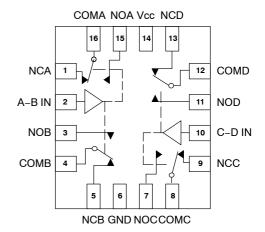


XX = Specific Device CodeA = Assembly Location

 \overline{M} = Date Code/Assembly Location

L = Wafer Lot
Y = Year
W = Work Week
= 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 8 of this data sheet.

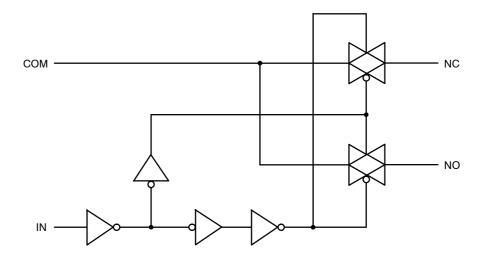


Figure 1. Input Equivalent Circuit

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 |
|----|------|------|
| Н | ON | OFF* |
| L | OFF* | ON |

^{*}High impedance.

OPERATING CONDITIONS

MAXIMUM RATINGS

| Symbol | Pins | Parameter | Value | Condition | Unit |
|---------------------|----------------------|----------------------------------|-------------------------------|----------------|------|
| V _{CC} | V _{CC} | Positive DC Supply Voltage | -0.5 to +5.5 | | V |
| V _{IS} | NOx, NCx, or COMx | Analog Signal Voltage | -0.5 to V _{CC} + 0.5 | | V |
| V _{IN} | A-B IN, C-D IN | Control Input Voltage | -0.5 to 5.5 | | V |
| I _{IS_CON} | NOx, NCx, or COMx | Analog Signal Continuous Current | ±300 | Closed Switch | mA |
| I _{IS_PK} | NOx, NCx, or COMx | Analog Signal Peak Current | ±500 | 10% Duty Cycle | mA |
| I _{IN} | A-B IN, C-D IN | Control Input Current | ±20 | | mA |
| T _{STG} | | Storage Temperature Range | -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.

RECOMMENDED OPERATING CONDITIONS

| Symbol | Pins | Parameter | Value | Condition | Unit |
|---------------------------------|----------------------|-----------------------------|------------------------|---------------------------------|------|
| V _{CC} | V _{CC} | Positive DC Supply Voltage | 1.65 to 4.3 | | V |
| V _{IS} | NOx, NCx, or COMx | Analog Signal Voltage | GND to V _{CC} | | V |
| V _{IN} | A-B IN, C-D IN | Control Input Voltage | GND to 4.3 | | V |
| T _A | | Operating Temperature Range | -40 to +85 | | °C |
| t _r , t _f | | Input Rise or Fall Time | 20 | V _{CC} = 1.6 V – 2.7 V | ns/V |
| | | | 10 | V _{CC} = 3.0 V - 4.5 V | |

Minimum and maximum values are guaranteed through test or design across the **Recommended Operating Conditions**, where applicable. Typical values are listed for guidance only and are based on the particular conditions listed for each section, where applicable. These conditions are valid for all values found in the characteristics tables unless otherwise specified in the test conditions.

ESD PROTECTION

| Pins | Description | Minimum Voltage |
|------------|------------------|-----------------|
| All Pins | Human Body Model | 1 kV |
| I/O to GND | Human Body Model | 5 kV |

DC Electrical Characteristics

Typical: T = 25 $^{\circ}$ C; V_{CC} = 3.0 V

CONTROL INPUT (Typical: T = 25° C; $V_{CC} = 3.0 \text{ V}$)

| | | | | V _{CC} | -40°C to +85°C | | | |
|-----------------|-------------------|-----------------------|---------------------------|-----------------|----------------|------|------------|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| V _{IH} | A-B IN, C-D IN | Control Input High | | 3.0 4.3 | 1.3 1.6 | | | V |
| V _{IL} | A-B IN, C-D IN | Control Input Low | | 3.0 4.3 | | | 0.5 0.6 | V |
| I _{IN} | A-B IN, C-D IN | Control Input Leakage | $0 \le V_{IN} \le V_{CC}$ | 4.3 | | ±0.1 | ±1.0 | μΑ |

SUPPLY CURRENT AND LEAKAGE (Typical: $T = 25^{\circ}C$; $V_{CC} = 3.0 \text{ V}$)

| | | | | V _{CC} | -4 | 0°C to +85 | s°C | |
|--------------------------|-------------------|-------------------|--|-----------------|-----|------------|------|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| I _{NO/NC} (OFF) | NCx, NOx | OFF State Leakage | $V_{IN} = V_{IL} \text{ or } V_{IH} \\ V_{NC/NO} = 0.3 \text{ V} \\ V_{COM} = 4.0 \text{ V}$ | 4.3 | | ±10 | ±300 | nA |
| I _{COM} (ON) | COMx | ON State Leakage | $\begin{aligned} &V_{IN} = V_{IL} \text{ or } V_{IH} \\ &V_{NO} = 0.3 \text{ V or } 4.0 \text{ V with} \\ &V_{NC} \text{ floating or} \\ &V_{NC} = 0.3 \text{ V or } 4.0 \text{ V with} \\ &V_{NO} \text{ floating} \\ &V_{COM} = 0.3 \text{ V or } 4.0 \text{ V} \end{aligned}$ | 4.3 | | ±10 | ±300 | nA |
| Icc | V _{CC} | Quiescent Supply | V_{IN} and $V_{IS} = V_{CC}$ or GND $I_D = 0$ A | 1.65 – 4.3 | | ±1.0 | ±2.0 | μΑ |
| l _{OFF} | A-B IN, C-D IN | Power Off Leakage | V _{IN} = 4.3 V or GND | 0 | | ±0.5 | ±2.0 | μΑ |

ON RESISTANCE (Typical: T = 25° C; V_{CC} = 3.0 V)

| | | | | V _{cc} | -40°C to +85°C | | | |
|-------------------|------------------|--------------------------|---|--------------------------|----------------|--------------------------|--------------------------|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| R _{ON} | NOx, NCx COMx | ON Resistance | $I_{ON} = -100 \text{ mA}$ $V_{IS} = 0 \text{ to } V_{CC}$ | 2.5 3.0 3.6 4.3 | | 3.0 2.6 2.5 2.2 | 4.0 3.0 3.0 2.5 | Ω |
| R _{FLAT} | NOx, NCx COMx | R _{ON} Flatness | I _{ON} = -100 mA V _{IS} = 0 to V _{CC} | 3.0 4.3 | | 0.8 1.1 | | Ω |
| ΔR_{ON} | NOx, NCx COMx | R _{ON} Matching | $I_{ON} = -100 \text{ mA}$ $V_{IS} = 0 \text{ to } V_{CC}$ | 3.0 4.3 | | 0.8 0.7 | | Ω |

AC ELECTRICAL CHARACTERISTICS

TIMING/FREQUENCY (Typical: T = 25°C; V_{CC} = 3.0 V, R_L = 50 Ω , C_L = 35 pF, f = 1 MHz)

| | | | | V _{CC} | -40 | | | |
|------------------|---------------------|-------------------|-----------------------|-----------------|-----|-----|-----|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| t _{ON} | IN to NCx or NOx | Turn On Time | | 2.3 – 4.3 | | 30 | 40 | ns |
| t _{OFF} | IN to NCx or NOx | Turn Off Time | | 2.3 – 4.53 | | 20 | 30 | ns |
| t _{BBM} | IN to NCx or NOx | Break Before Make | | 3.0 | 2 | 15 | | ns |
| BW | | -3dB Bandwidth | C _L = 5 pF | 1.65 – 4.3 | | 280 | | MHz |

ISOLATION AND THD (Typical: T = 25°C; V_{CC} = 3.0 V, RL = 50 Ω , CL = 5 pF, f = 1 MHz)

| | | | | V _{CC} | -40 | 0°C to +85 | °C | |
|------------------|-----------------|----------------------------------|---|-----------------|-----|------------|-----|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| Q | | Charge Injection | $\begin{aligned} &V_{IN} = V_{CC} \text{ to GND} \\ &R_{IS} = 0 \ \Omega, \ C_L = 1.0 \ nF \\ &Q = C_L - \Delta V_{OUT} \end{aligned}$ | 1.65 – 4.3 | | 111 | | pC |
| THD | | Total Harmonic Distortion | $\begin{aligned} F_{ S} &= 20 \text{ Hz to } 20 \text{ kHz} \\ R_L &= R_{gen} = 600 \ \Omega, \\ C_L &= 1.0 \text{ pF} \\ V_{ S} &= 1.0 \text{ V}_{PP} \end{aligned}$ | 3.0 | | 0.007 | | % |
| V _{ONL} | | Maximum Feed- through On Loss | V_{IN} = 0 dBm @ 100 kHz to 50 MHz V_{IN} centered between V_{CC} & GND | 1.65 – 4.3 | | -0.06 | | dB |
| O _{IRR} | NOx | Off Isolation | $V_{IN} = 0$ V_{NO} or V_{NC} (pk-pk) = 1.0 V | 1.65 – 4.3 | | -67 | | dB |
| Xtalk | COMx to COMy | Non-Adjacent Chan- nel | V_{NO} or V_{NC} (pk-pk) = 1.0 V | 1.65 – 4.3 | | -100 | | dB |

CAPACITANCE (Typical: T = 25°C; V_{CC} = 3.0 V, R_L = 50 Ω , C_L = 5 pF, f = 1 MHz)

| | | | | v_{cc} | -40°C to +85°C | | | |
|------------------|-------------------|-----------------|--------------------------------|----------|----------------|-----|-----|------|
| Symbol | Pins | Parameter | Test Conditions | (V) | Min | Тур | Max | Unit |
| C _{IN} | A-B IN, C-D IN | Control Input | | 0 V | | 5.0 | | pF |
| C _{ON} | NCx to COMx | Through Switch | V _{IN} = 0V | 3.0 V | | 20 | | pF |
| C _{OFF} | NCx NOx | Unselected Port | $V_{IS} = 3.0V, V_{IN} = 3.0V$ | 3.0 V | | 10 | | pF |

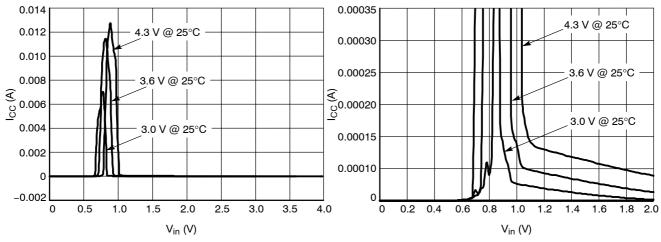
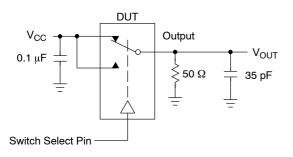


Figure 2. I_{CC} vs. V_{in}

Figure 3. (Expanded View) I_{CC} vs. V_{in}



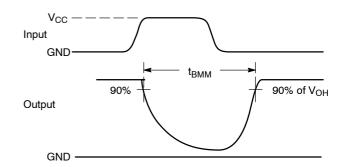
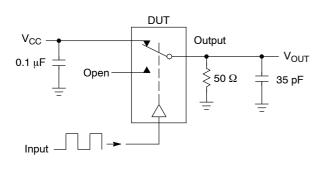


Figure 4. t_{BBM} (Time Break-Before-Make)



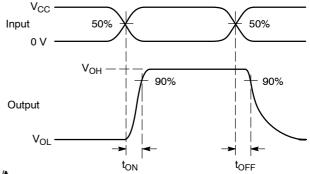
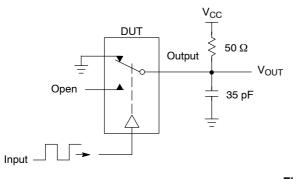


Figure 5. t_{ON}/t_{OFF}



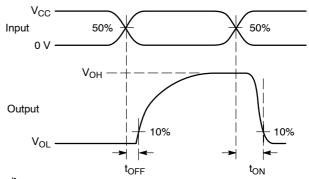
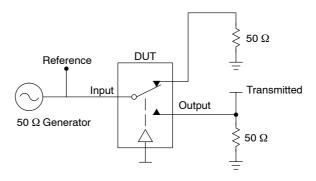


Figure 6. t_{ON}/t_{OFF}



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. $V_{\rm ISO}$, Bandwidth and $V_{\rm ONL}$ are independent of the input signal direction.

$$\begin{split} &V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log } \left(\frac{V_{OUT}}{V_{IN}}\right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz} \\ &V_{ONL} = \text{On Channel Loss} = 20 \text{ Log } \left(\frac{V_{OUT}}{V_{IN}}\right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz to } 50 \text{ MHz} \end{split}$$

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

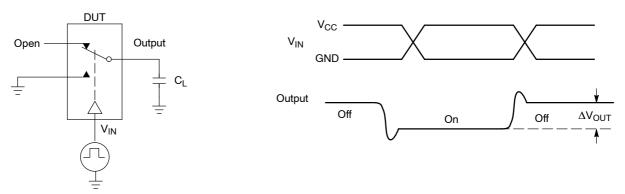


Figure 8. Charge Injection: (Q)

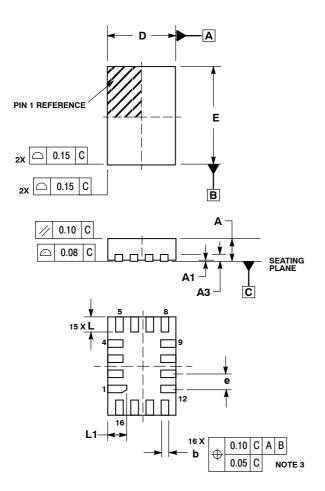
DEVICE ORDERING INFORMATION

| Device Order Number | Package Type | Tape & Reel Size [†] |
|---------------------|---------------------|-------------------------------|
| NLAS3899BMNTBG | WQFN16 (Pb-Free) | 3000 / Tape & Reel |
| NLAS3899BMNTXG | QFN16 (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.

PACKAGE DIMENSIONS

WQFN16 (1.8x2.6x0.4P) CASE 488AP-01 **ISSUE A**



NOTES:

- NOTES:

 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.

 2. CONTROLLING DIMENSION: MILLIMETERS

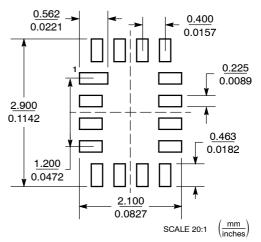
 3. DIMENSION & APPLIES TO PLATED TERMINAL AND IS MEASURED BETWEEN 0.25 AND 0.30 MM
- FROM TERMINAL.

 4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.

 5. EXPOSED PADS CONNECTED TO DIE FLAG. USED AS TEST CONTACTS.

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

MOUNTING FOOTPRINT

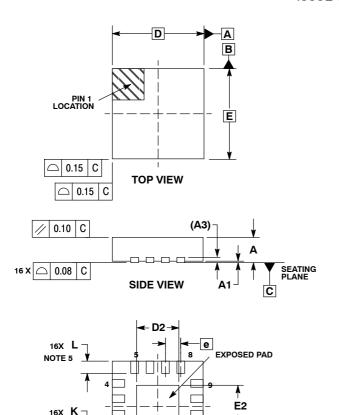


*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

PACKAGE DIMENSIONS

QFN16 3*3*0.85 MM, 0.5 P

CASE 485AE-01 ISSUE O



NOTES:

- DIMENSIONING AND TOLERANCING PER
 ASME V14 5M 1994
- ASME Y14.5M, 1994. 2. CONTROLLING DIMENSION: MILLIMETERS.
- DIMENSION 6 APPLIES TO PLATED
 TERMINAL AND IS MEASURED BETWEEN
 0.25 AND 0.30 MM FROM TERMINAL.
 COPLANARITY APPLIES TO THE EXPOSED
- 4. COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.5. OUTLINE MEETS JEDEC DIMENSIONS PER
- OUTLINE MEETS JEDEC DIMENSIONS PER MO-220, VARIATION VEED-6.

| | MILLIMETERS | | |
|-----|-------------|-------|-------|
| DIM | MIN | NOM | MAX |
| Α | 0.800 | 0.900 | 1.000 |
| A1 | 0.000 | 0.025 | 0.050 |
| А3 | 0.200 REF | | |
| b | 0.180 | 0.250 | 0.300 |
| D | 3.00 BSC | | |
| D2 | 1.250 | 1.40 | 1.550 |
| Е | 3.00 BSC | | |
| E2 | 1.250 | 1.40 | 1.550 |
| е | 0.500 BSC | | |
| K | 0.200 | | |
| L | 0.300 | 0.400 | 0.500 |

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BOTTOM VIEW

A B

0.10 C

0.05 C NOTE 3

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