

# NLAS3899B

## 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  $\Omega$  (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  $\Omega$  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

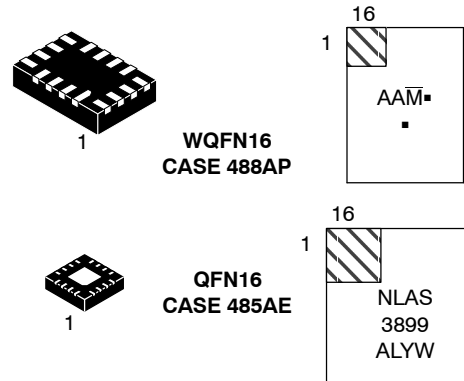
- ESD Protection:  
Human Body Model (HBM) 1000 V – All Pins  
5000 V – I/O to GND
- Continuous Current Rating Through each Switch  $\pm 300$  mA
- Conforms to: JEDEC MO-220, Issue H, Variation VEED-6
- Package:
  - ◆ 1.8 x 2.6 x 0.75 mm WQFN16 Pb-Free
  - ◆ 3.0 x 3.0 x 0.9 mm QFN16 Pb-Free



**ON Semiconductor®**

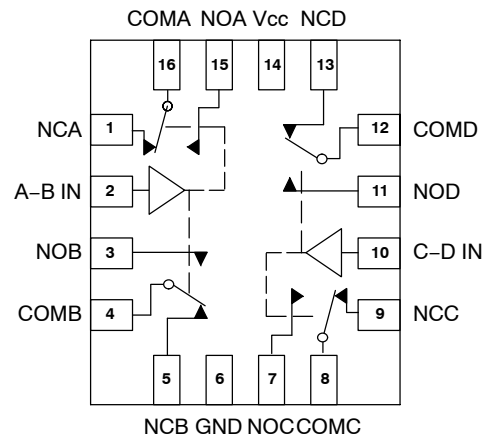
<http://onsemi.com>

### MARKING DIAGRAMS



XX = Specific Device Code  
 A = Assembly Location  
 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.

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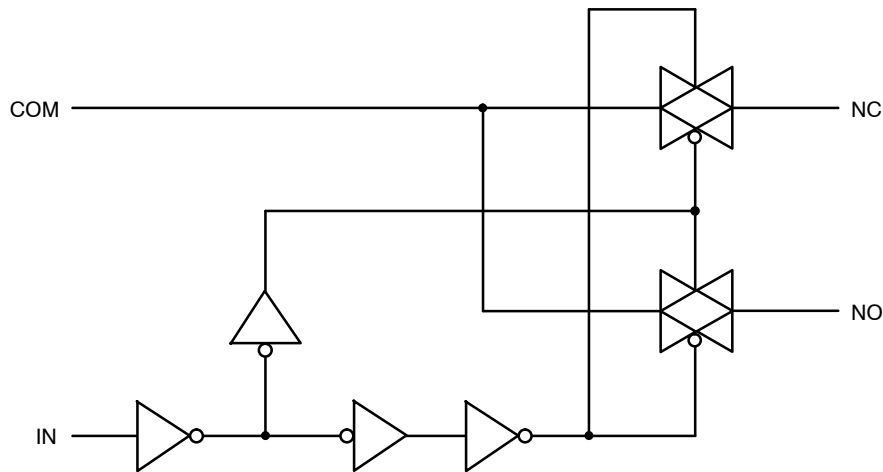


Figure 1. Input Equivalent Circuit

## 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 <sub>CC</sub>	Positive Supply Voltage

## TRUTH TABLE

IN	NO	NC
H	ON	OFF*
L	OFF*	ON

\*High impedance.

## OPERATING CONDITIONS

### MAXIMUM RATINGS

Symbol	Pins	Parameter	Value	Condition	Unit
V <sub>CC</sub>	V <sub>CC</sub>	Positive DC Supply Voltage	-0.5 to +5.5		V
V <sub>IS</sub>	NO <sub>x</sub> , NC <sub>x</sub> , or COM <sub>x</sub>	Analog Signal Voltage	-0.5 to V <sub>CC</sub> + 0.5		V
V <sub>IN</sub>	A-B IN, C-D IN	Control Input Voltage	-0.5 to 5.5		V
I <sub>IS_CON</sub>	NO <sub>x</sub> , NC <sub>x</sub> , or COM <sub>x</sub>	Analog Signal Continuous Current	±300	Closed Switch	mA
I <sub>IS_PK</sub>	NO <sub>x</sub> , NC <sub>x</sub> , or COM <sub>x</sub>	Analog Signal Peak Current	±500	10% Duty Cycle	mA
I <sub>IN</sub>	A-B IN, C-D IN	Control Input Current	±20		mA
T <sub>STG</sub>		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.

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## 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	$V_{CC} = 1.6\text{ V} - 2.7\text{ V}$	ns/V
			10	$V_{CC} = 3.0\text{ V} - 4.5\text{ V}$	

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

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## DC Electrical Characteristics

Typical: T = 25°C; V<sub>CC</sub> = 3.0 V

### CONTROL INPUT (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
V <sub>IH</sub>	A-B IN, C-D IN	Control Input High		3.0 4.3	1.3 1.6			V
V <sub>IL</sub>	A-B IN, C-D IN	Control Input Low		3.0 4.3			0.5 0.6	V
I <sub>IN</sub>	A-B IN, C-D IN	Control Input Leakage	0 ≤ V <sub>IN</sub> ≤ V <sub>CC</sub>	4.3		±0.1	±1.0	μA

### SUPPLY CURRENT AND LEAKAGE (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
I <sub>NO/NC</sub> (OFF)	NCx, NOx	OFF State Leakage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NC/NO</sub> = 0.3 V V <sub>COM</sub> = 4.0 V	4.3		±10	±300	nA
I <sub>COM</sub> (ON)	COMx	ON State Leakage	V <sub>IN</sub> = V <sub>IL</sub> or V <sub>IH</sub> V <sub>NO</sub> = 0.3 V or 4.0 V with V <sub>NC</sub> floating or V <sub>NC</sub> = 0.3 V or 4.0 V with V <sub>NO</sub> floating V <sub>COM</sub> = 0.3 V or 4.0 V	4.3		±10	±300	nA
I <sub>CC</sub>	V <sub>CC</sub>	Quiescent Supply	V <sub>IN</sub> and V <sub>IS</sub> = V <sub>CC</sub> or GND I <sub>D</sub> = 0 A	1.65 – 4.3		±1.0	±2.0	μA
I <sub>OFF</sub>	A-B IN, C-D IN	Power Off Leakage	V <sub>IN</sub> = 4.3 V or GND	0		±0.5	±2.0	μA

### ON RESISTANCE (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
R <sub>ON</sub>	NOx, NCx COMx	ON Resistance	I <sub>ON</sub> = -100 mA V <sub>IS</sub> = 0 to V <sub>CC</sub>	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 <sub>FLAT</sub>	NOx, NCx COMx	R <sub>ON</sub> Flatness	I <sub>ON</sub> = -100 mA V <sub>IS</sub> = 0 to V <sub>CC</sub>	3.0 4.3		0.8 1.1		Ω
ΔR <sub>ON</sub>	NOx, NCx COMx	R <sub>ON</sub> Matching	I <sub>ON</sub> = -100 mA V <sub>IS</sub> = 0 to V <sub>CC</sub>	3.0 4.3		0.8 0.7		Ω

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## AC ELECTRICAL CHARACTERISTICS

**TIMING/FREQUENCY** (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 35 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
t <sub>ON</sub>	IN to NCx or NOx	Turn On Time		2.3 – 4.3		30	40	ns
t <sub>OFF</sub>	IN to NCx or NOx	Turn Off Time		2.3 – 4.53		20	30	ns
t <sub>BBM</sub>	IN to NCx or NOx	Break Before Make		3.0	2	15		ns
BW		-3dB Bandwidth	C <sub>L</sub> = 5 pF	1.65 – 4.3		280		MHz

**ISOLATION AND THD** (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
Q		Charge Injection	V <sub>IN</sub> = V <sub>CC</sub> to GND R <sub>IS</sub> = 0 Ω, C <sub>L</sub> = 1.0 nF Q = C <sub>L</sub> - ΔV <sub>OUT</sub>	1.65 – 4.3		111		pC
THD		Total Harmonic Distortion	F <sub>IS</sub> = 20 Hz to 20 kHz R <sub>L</sub> = R <sub>gen</sub> = 600 Ω, C <sub>L</sub> = 1.0 pF V <sub>IS</sub> = 1.0 V <sub>PP</sub>	3.0		0.007		%
V <sub>ONL</sub>		Maximum Feed-through On Loss	V <sub>IN</sub> = 0 dBm @ 100 kHz to 50 MHz V <sub>IN</sub> centered between V <sub>CC</sub> & GND	1.65 – 4.3		-0.06		dB
O <sub>IRR</sub>	NOx	Off Isolation	V <sub>IN</sub> = 0 V <sub>NO</sub> or V <sub>NC</sub> (pk-pk) = 1.0 V	1.65 – 4.3		-67		dB
Xtalk	COMx to COMy	Non-Adjacent Channel	V <sub>NO</sub> or V <sub>NC</sub> (pk-pk) = 1.0 V	1.65 – 4.3		-100		dB

**CAPACITANCE** (Typical: T = 25°C; V<sub>CC</sub> = 3.0 V, R<sub>L</sub> = 50 Ω, C<sub>L</sub> = 5 pF, f = 1 MHz)

Symbol	Pins	Parameter	Test Conditions	V <sub>CC</sub> (V)	-40°C to +85°C			Unit
					Min	Typ	Max	
C <sub>IN</sub>	A-B IN, C-D IN	Control Input		0 V		5.0		pF
C <sub>ON</sub>	NCx to COMx	Through Switch	V <sub>IN</sub> = 0V	3.0 V		20		pF
C <sub>OFF</sub>	NCx NOx	Unselected Port	V <sub>IS</sub> = 3.0V, V <sub>IN</sub> = 3.0V	3.0 V		10		pF

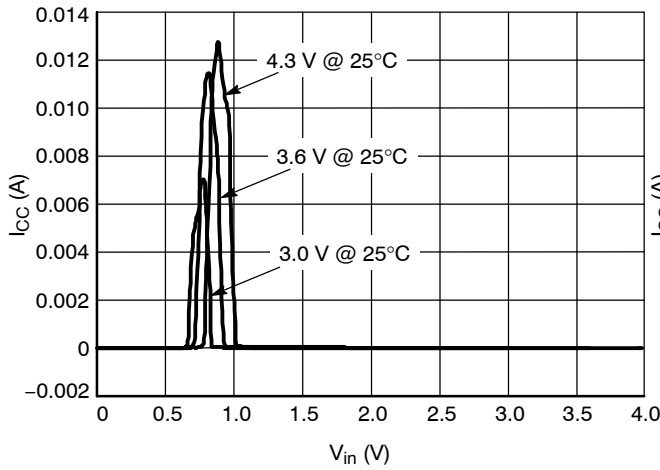


Figure 2.  $I_{CC}$  vs.  $V_{in}$

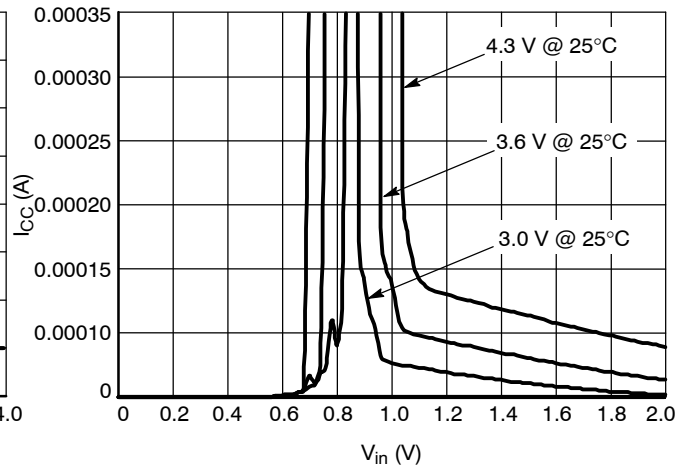


Figure 3. (Expanded View)  $I_{CC}$  vs.  $V_{in}$

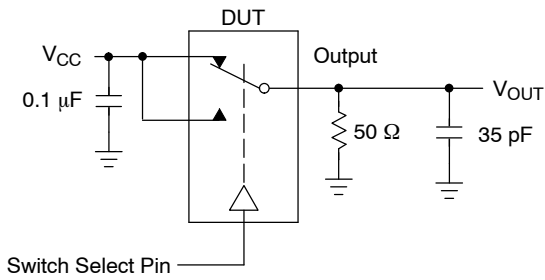


Figure 4.  $t_{BMM}$  (Time Break-Before-Make)

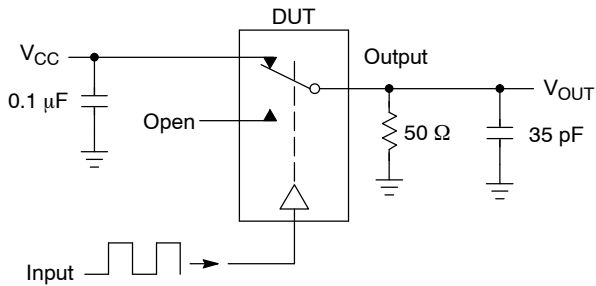
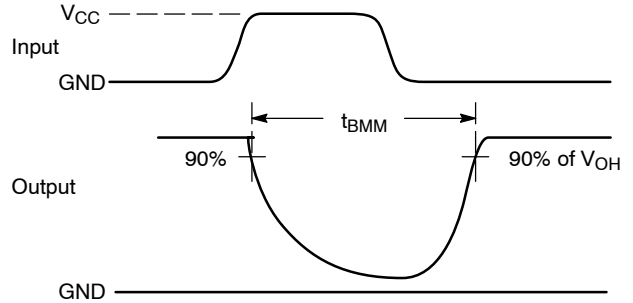


Figure 5.  $t_{ON}/t_{OFF}$

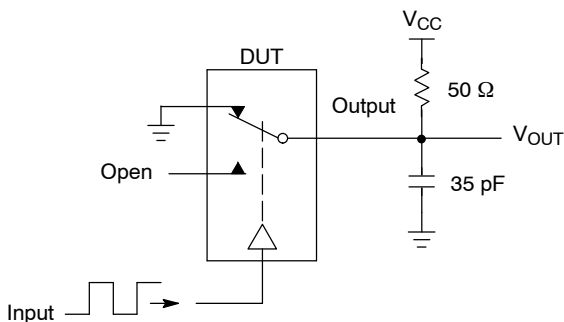
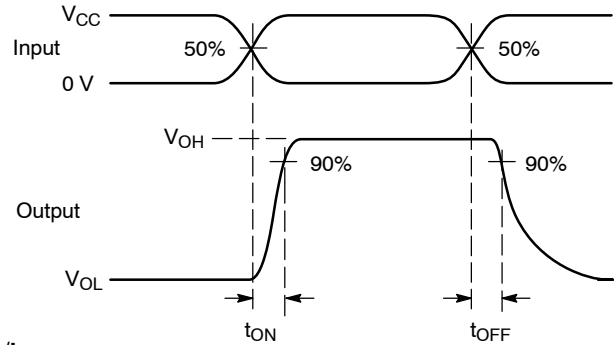
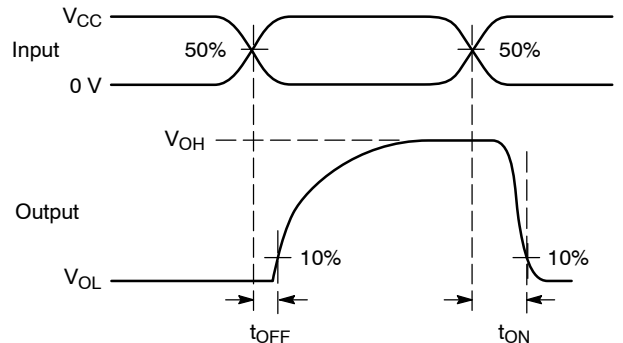
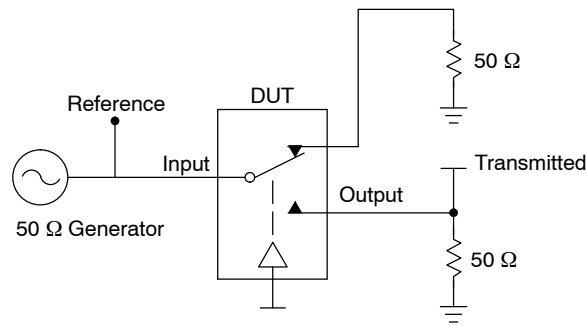


Figure 6.  $t_{ON}/t_{OFF}$



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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.

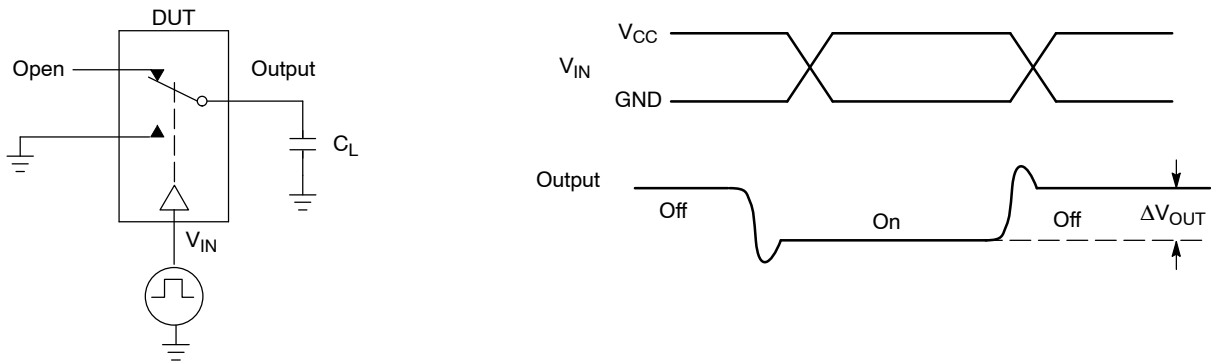
$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

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

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  $\Omega$

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



**Figure 8. Charge Injection: (Q)**

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## DEVICE ORDERING INFORMATION

Device Order Number	Package Type	Tape & Reel Size†
NLAS3899BMNTBG	WQFN16 (Pb-Free)	3000 / Tape & Reel
NLAS3899BMNTWG	QFN16 (Pb-Free)	3000 / Tape & Reel
NLAS3899BMNTXG	QFN16 (Pb-Free)	3000 / Tape & Reel

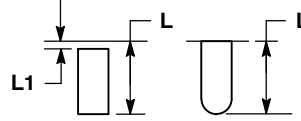
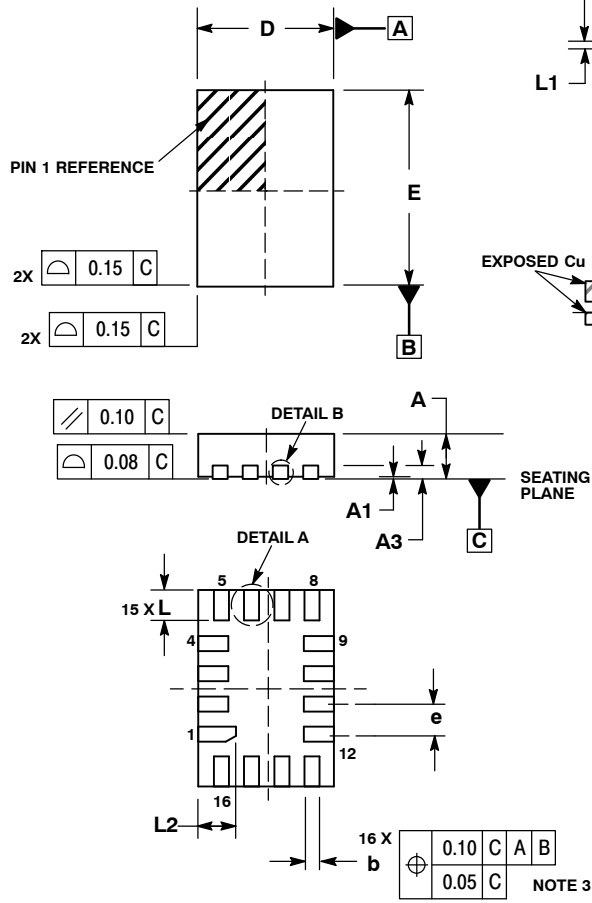
†For information on tape and reel specifications, including part orientation and tape sizes, please refer to our Tape and Reel Packaging Specifications Brochure, BRD8011/D.



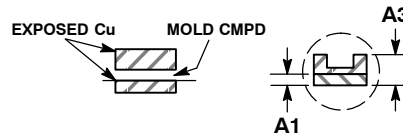
# NLAS3899B

## PACKAGE DIMENSIONS

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



DETAIL A  
ALTERNATE TERMINAL  
CONSTRUCTIONS



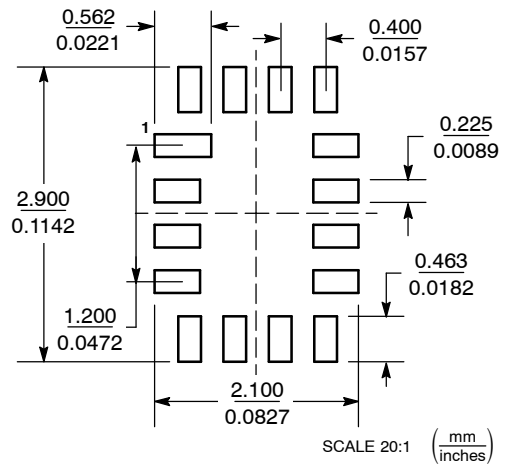
DETAIL B  
ALTERNATE  
CONSTRUCTIONS

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

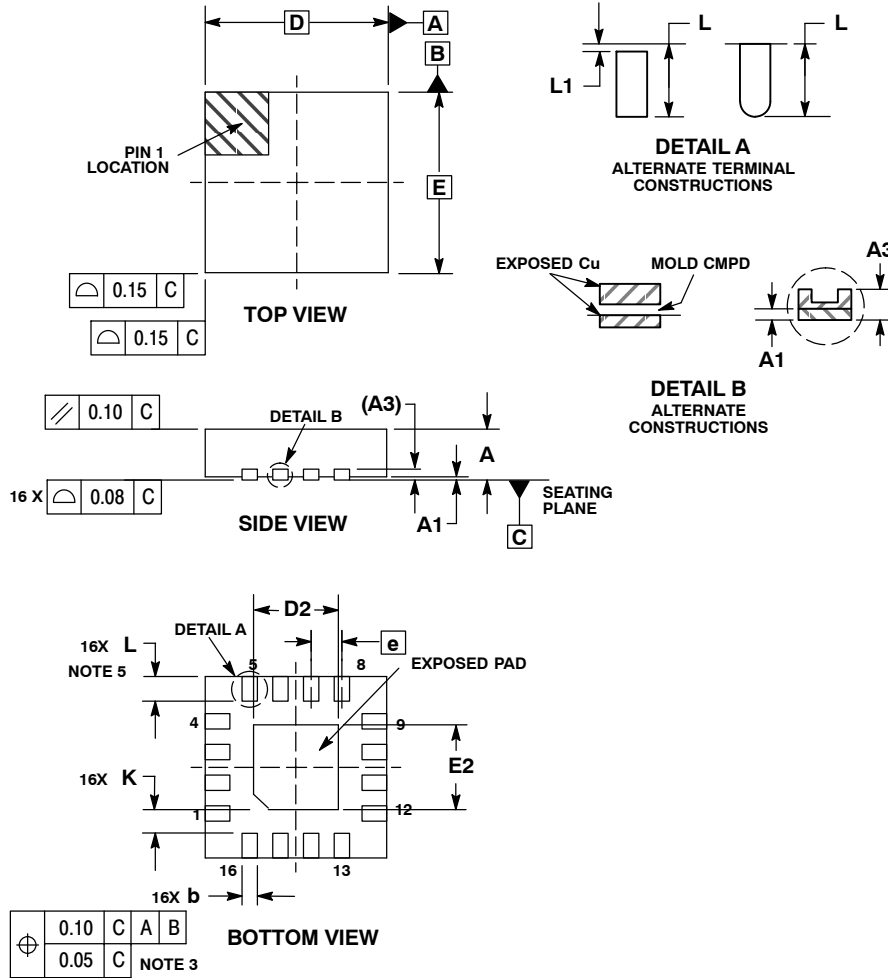


\*For additional information on our Pb-Free strategy and soldering details, please download the ON Semiconductor Soldering and Mounting Techniques Reference Manual, SOLDERRM/D.

# NLAS3899B

## PACKAGE DIMENSIONS

QFN16 3x3, 0.5 P  
CASE 485AE  
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.
5. OUTLINE MEETS JEDEC DIMENSIONS PER MO-220, VARIATION VEED-6.

DIM	MILLIMETERS		
	MIN	NOM	MAX
A	0.80	0.90	1.00
A1	0.00	0.03	0.05
A3	0.20 REF		
b	0.18	0.25	0.30
D	3.00 BSC		
D2	1.25	1.40	1.55
E	3.00 BSC		
E2	1.25	1.40	1.55
e	0.50 BSC		
K	0.20	---	---
L	0.30	0.40	0.50
L1	0.00	---	0.15

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