

NLAS4783

Triple SPDT 1.0 Ω R_{ON} Switch

The NLAS4783 is a triple independent ultra-low R_{ON} SPDT analog switch with ENABLE. This device is designed for low operating voltage, high current switching of speaker output for cell phone applications. It can switch a balanced stereo output. The NLAS4783 can handle a balanced microphone/speaker/ring-tone generator in a monophone mode. The device contains a break-before-make feature.

Features

- Single Supply Operation
1.65 to 3.6 V V_{CC}
- Tiny 3 x 3 mm 16-Pin QFN Package
Meets JEDEC MO-220 Specifications
- Low Static Power
- OVT on Logic Address and Enable Inputs
- This is a Pb-Free Device*

Typical Applications

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

Important Information

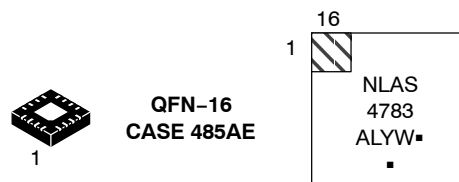
- ESD Protection:
Human Body Model (HBM) > 8000 V
Machine Model (MM) > 400 V
- Ringtone-Chip/Amplifier Switching
- Continuous Current Rating Through each Switch ± 300 mA
- Conforms to: JEDEC MO-220, Issue H, Variation VEED-6
- Pin-for-Pin Compatible with MAX4783



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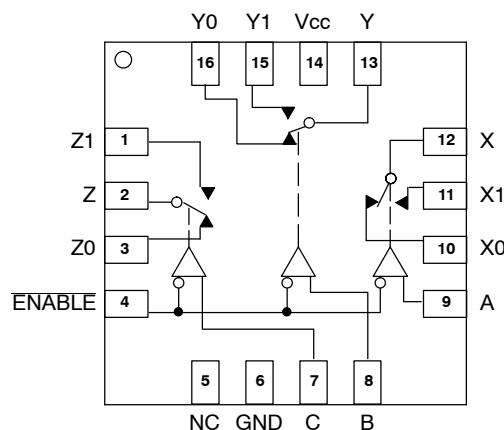
<http://onsemi.com>

MARKING DIAGRAM



A = Assembly Location
L = Wafer Lot
Y = Year
W = Work Week
▪ = Pb-Free Package
(Note: Microdot may be in either location)

PIN CONNECTIONS



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.

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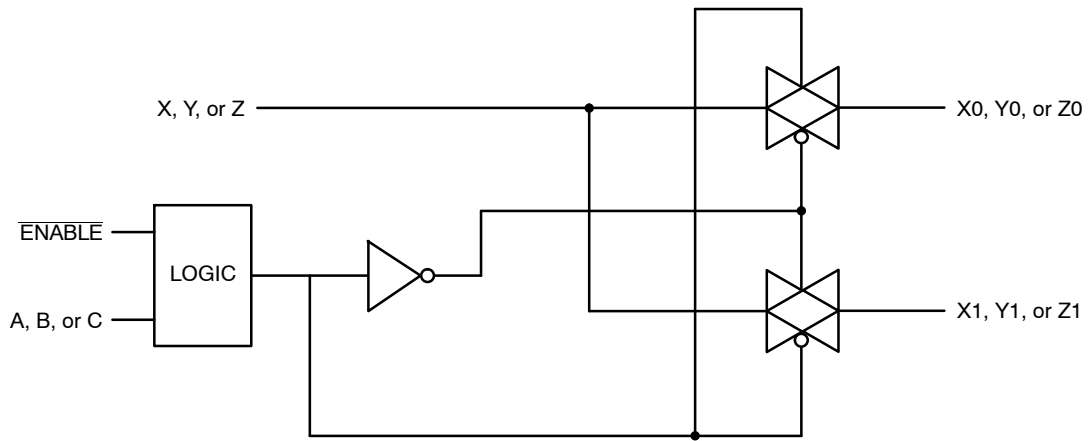


Figure 1. Input Equivalent Circuit

PIN FUNCTION DESCRIPTION

QFN PIN #	Symbol	Description
15	Y1	Analog Switch Y Normally Open Input
16	Y0	Analog Switch Y Normally Closed Input
1	Z1	Analog Switch Z Normally Open Input
2	Z	Analog Switch Z Output
3	Z0	Analog Switch Z Normally Closed Input
4	ENABLE	Digital Enable Input. Normally connect to GND. Drive to logic high to set all switches off.
5	NC	No Connection. Not internally connected.
6	GND	Ground
7	C	Digital Address C Input
8	B	Digital Address B Input
9	A	Digital Address A Input
10	X0	Analog Switch X Normally Closed Input
11	X1	Analog Switch X Normally Open Input
12	X	Analog Switch X Output
13	Y	Analog Switch Y Output
14	V _{CC}	Positive Analog and Digital Supply Voltage Input

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TRUTH TABLE/SWITCH PROGRAMMING

Enable Input	Select Input			
	C	B	A	
H	X	X	X	All Switches Open
L	L	L	L	X-X0 Y-Y0 Z-Z0
L	L	L	H	X-X1 Y-Y0 Z-Z0
L	L	H	L	X-X0 Y-Y1 Z-Z0
L	L	H	H	X-X1 Y-Y1 Z-Z0
L	H	L	L	X-X0 Y-Y0 Z-Z1
L	H	L	H	X-X1 Y-Y0 Z-Z1
L	H	H	L	X-X0 Y-Y1 Z-Z1
L	H	H	H	X-X1 Y-Y1 Z-Z1

1. Input and output pins are identical and interchangeable. Both pins can be considered input or output. Bidirectional signal pass.

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DC CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

Symbol	Parameter	Condition	V _{CC}	Guaranteed Limit		Unit
				-40°C to 25°C	< 85°C	
V _{IH}	Minimum High-Level Input Voltage, Select Inputs		1.65	1.0	1.0	V
			2.7	1.4	1.4	
			3.6	1.8	1.8	
V _{IL}	Maximum Low-Level Input Voltage, Select Inputs		1.65	0.4	0.4	V
			2.7	0.5	0.5	
			3.6	0.6	0.6	
I _{IN}	Maximum Input Leakage Current, Select Inputs	V _{IN} = 3.6 V 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 3)	Select and V _{IS} = V _{CC} or GND	1.65 to 3.6	± 1.0	± 2.0	μA

DC ELECTRICAL CHARACTERISTICS – Analog Section

Symbol	Parameter	Condition	V _{CC}	Guaranteed Maximum Limit				Unit
				-40°C to 25°C		< 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	2.7 – 3.6		1.0		1.2	Ω
R _{FLAT}	NC/NO On-Resistance Flatness (Notes 3, 5)	I _{COM} = 100 mA V _{IS} = 0 to V _{CC}	2.7 – 3.6		0.2		0.2	Ω
ΔR _{ON}	On-Resistance Match Between Channels (Notes 3 and 4)	V _{IS} = 1.3 V; I _{COM} = 100 mA	2.7 – 3.6		0.4		0.6	Ω
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	-5.0	5.0	-10	10	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. ΔR_{ON} = R_{ON(MAX)} – R_{ON(MIN)} between NC1 and NC2 or between NO1 and NO2.

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

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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
					-40°C to 25°C			< 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 – 3.6	1.5			25		27	ns
t_{OFF}	Turn-Off Time	$R_L = 50 \Omega$, $C_L = 35$ pF (Figures 3 and 4)	2.3 – 3.6	1.5			15		20	ns
t_{BBM}	Minimum Break-Before-Make Time	$V_{IS} = 3.0$ $R_L = 300 \Omega$, $C_L = 35$ pF (Figure 2)	3.0	1.5	2.0	8.0				ns

		Typical @ 25, $V_{CC} = 3.6$ V		
C_{IN}	Control Pin Input Capacitance	2.5		pF
C_{SN}	SN Port Capacitance	75		pF
C_D	D Port Capacitance When Switch is Enabled	240		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 -3dB Bandwidth or Minimum Frequency Response	V_{IN} centered between V_{CC} and GND (Figure 5)	1.65 – 3.6	17		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	-0.10		dB
V_{ISO}	Off-Channel Isolation	$f = 100$ kHz; $V_{IS} = 1$ V RMS; $C_L = 5$ nF V_{IN} centered between V_{CC} and GND (Figure 5) (Note 6)	1.65 – 3.6	-62		dB
Q	Charge Injection Select Input to Common I/O	$V_{IN} = V_{CC}$ to GND, $R_{IS} = 0 \Omega$, $C_L = 1$ nF $Q = C_L \times \Delta V_{OUT}$ (Figure 6)	1.65 – 3.6	50		pC
THD	Total Harmonic Distortion THD + Noise	$F_{IS} = 20$ Hz to 20 kHz, $R_L = R_{gen} = 600 \Omega$, $C_L = 50$ pF $V_{IS} = 2$ V RMS	3.0	0.015		%
VCT	Channel-to-Channel Crosstalk	$f = 100$ kHz; $V_{IS} = 1$ V RMS, $C_L = 5$ pF, $R_L = 50 \Omega$ V_{IN} centered between V_{CC} and GND (Figure 5)	1.65 – 3.6	-62		dB

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

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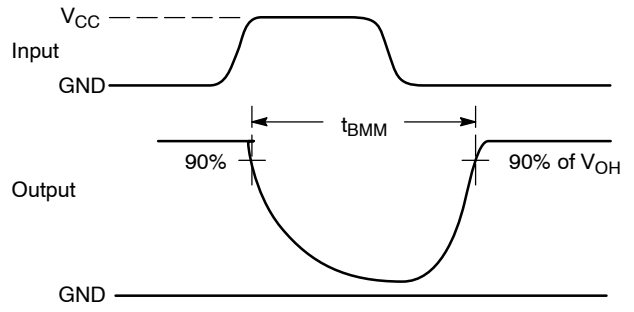
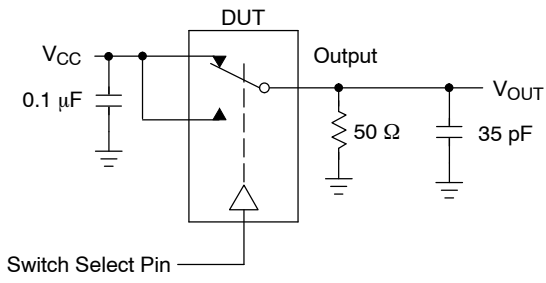


Figure 2. t_{BMM} (Time Break-Before-Make)

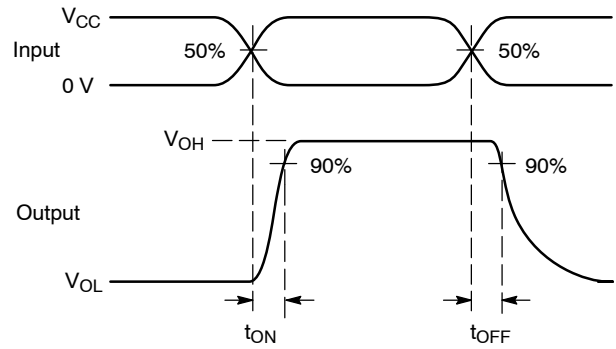
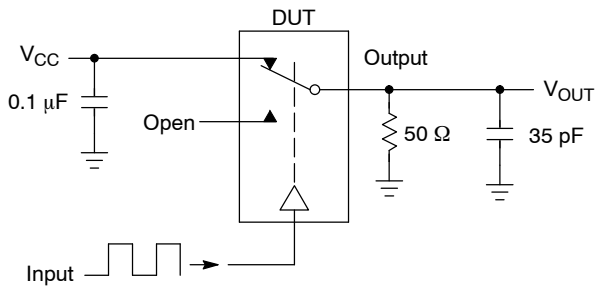


Figure 3. t_{ON}/t_{OFF}

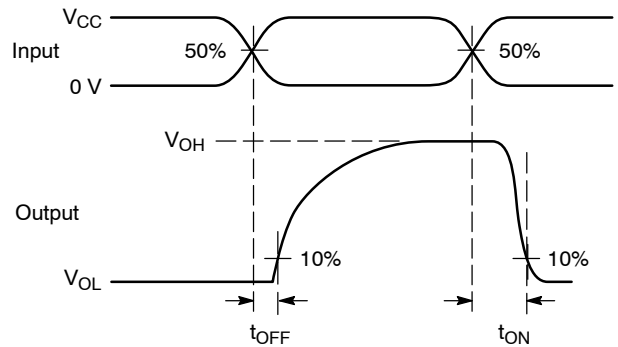
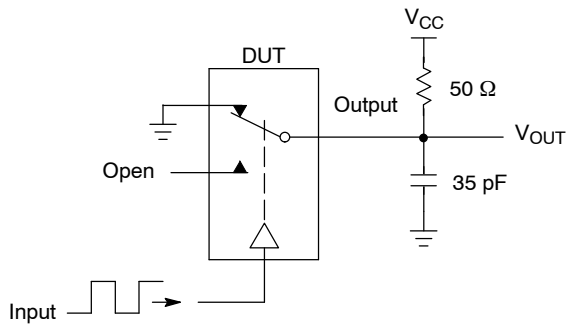
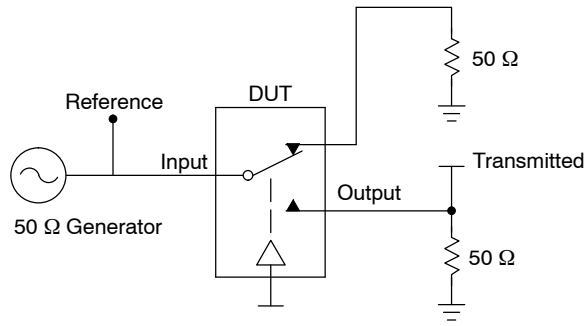


Figure 4. t_{ON}/t_{OFF}

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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}

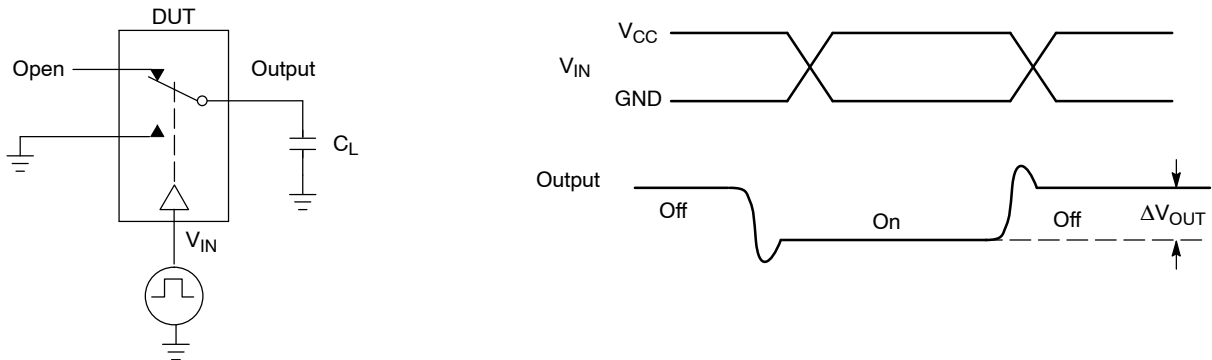


Figure 6. Charge Injection: (Q)

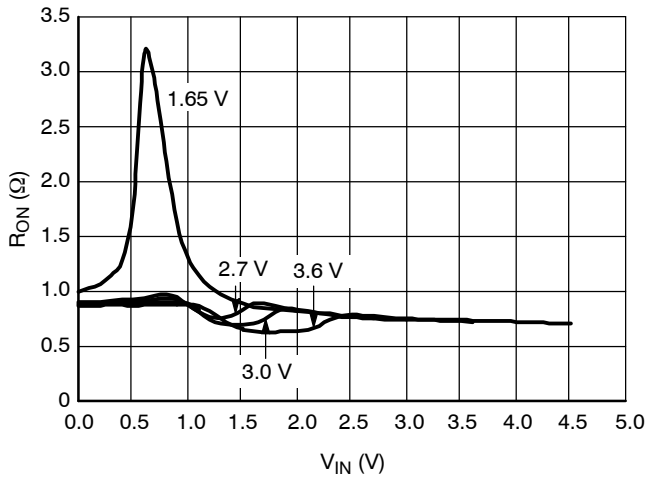


Figure 7. On-Resistance vs. Input Voltage

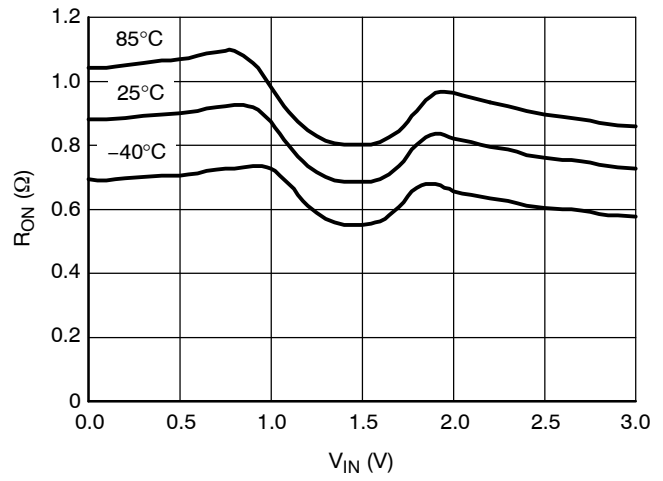


Figure 8. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 3.0$ V

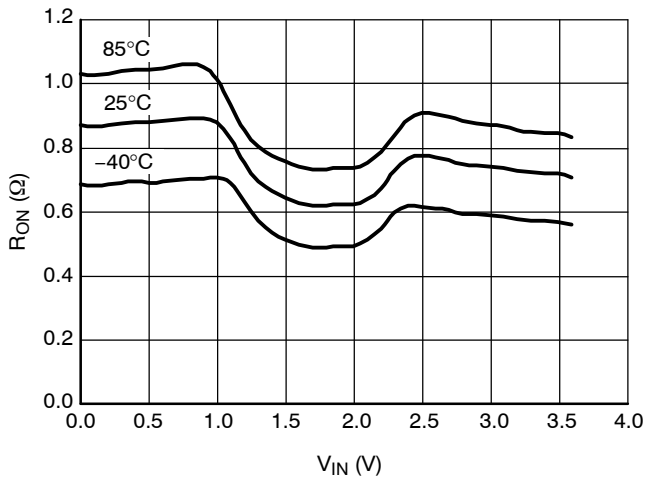


Figure 9. R_{ON} vs. V_{IN} vs. Temperature @ $V_{CC} = 3.6$ V

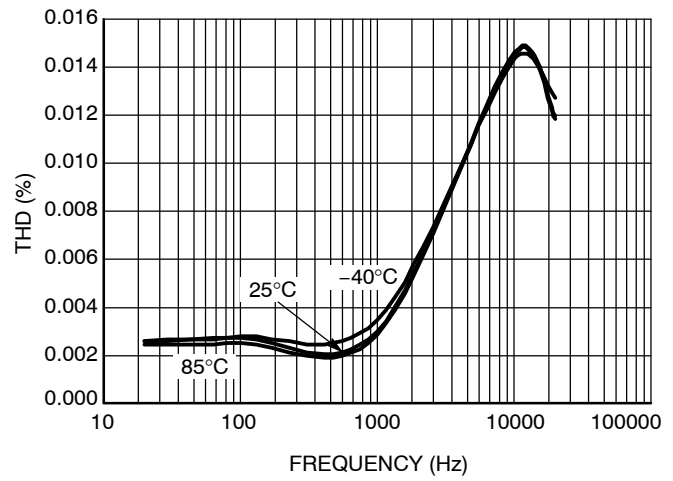


Figure 10. Total Harmonic Distortion vs. Frequency

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ORDERING INFORMATION

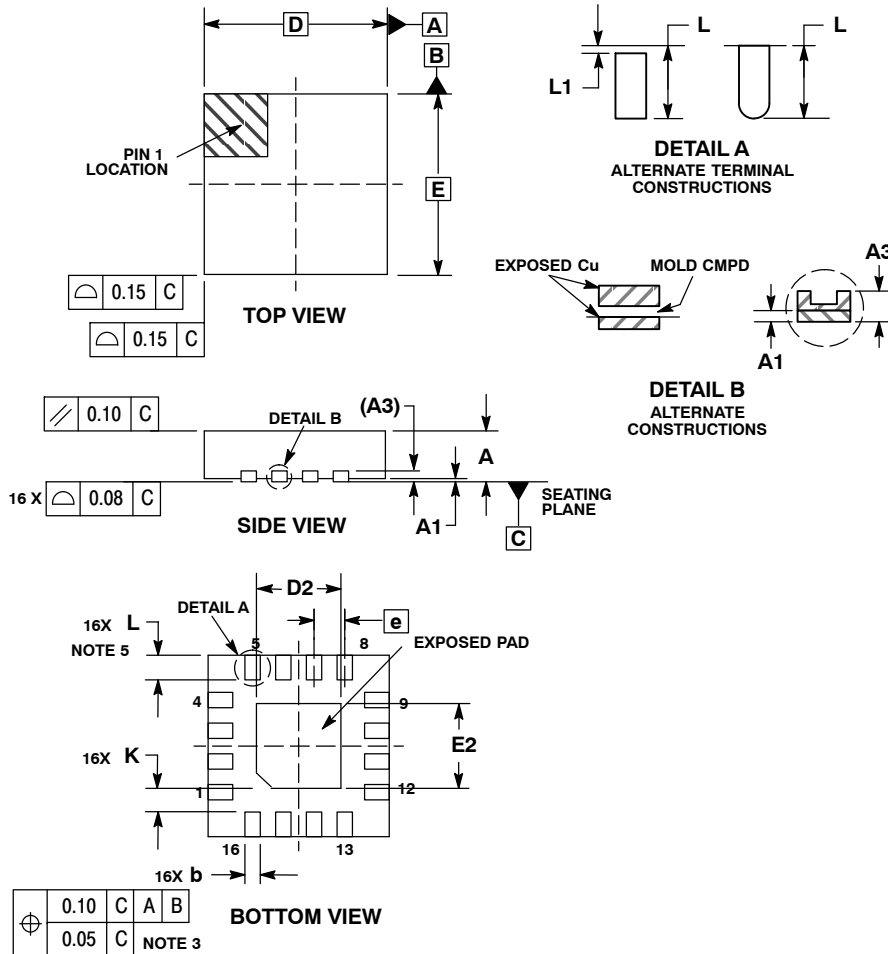
Device Order Number	Device Nomenclature				Package Type	Tape & Reel Size [†]
	Circuit Indicator	Technology	Device Function	Tape & Reel Suffix		
NLAS4783MN1R2G	NL	AS	4783	R2	QFN (Pb-Free)	3000 Tape & Reel

[†]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.

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PACKAGE DIMENSIONS

QFN16 3x3, 0.5P
CASE 485AE-01
ISSUE A



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.
- 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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