NLAS4783B

Triple SPDT 1.0 Ω R_{ON} Switch

The NLAS4783B is a triple independent 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 NLAS4783B 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 4.5 V V_{CC}
  - Function Directly from LiON Battery
- 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

*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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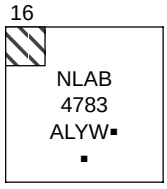
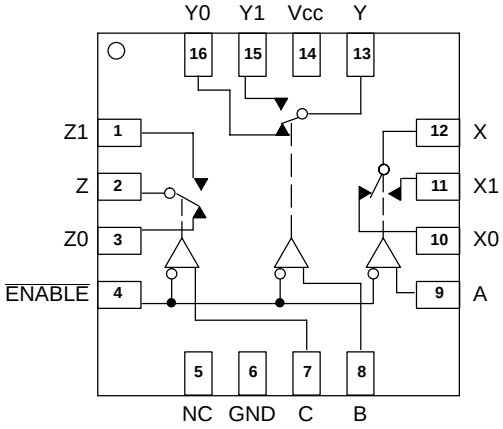
MARKING DIAGRAM

QFN−16
CASE 485AE



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 9 of this data sheet.

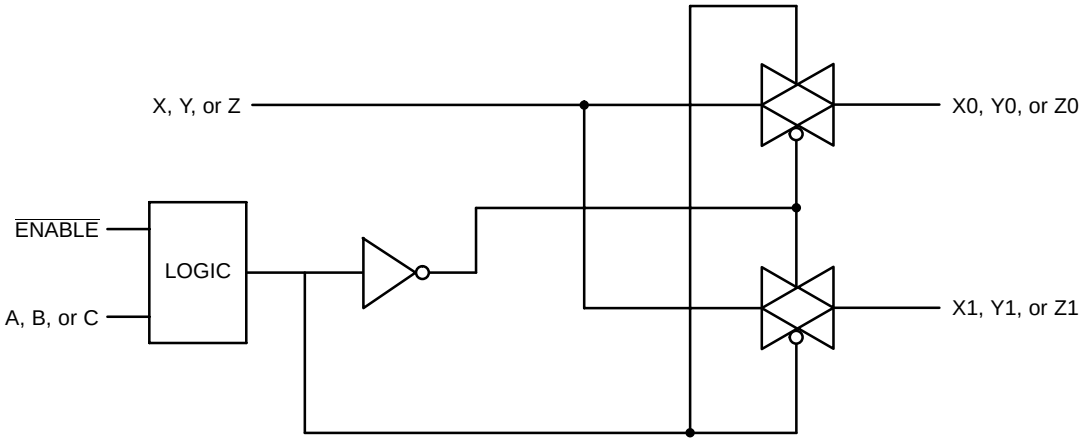


Figure 1. Input Equivalent Circuit

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	$\overline{\text{ENABLE}}$	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

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.

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 to V_{CC}	V
V_{IN}	Digital Select Input Voltage	−0.5 to +5.5	V
I_{anl1}	Continuous DC Current from COM to NC/NO	±300	mA
$I_{anl-pk\ 1}$	Peak Current from COM to NC/NO, 10 Duty Cycles (Note 2)	±500	mA
I_{clmp}	Continuous DC Current into COM/NC/NO 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.

2. Defined as 10% ON, 90% off duty cycle.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V_{CC}	Positive DC Supply Voltage		1.65	4.5	V
V_{IS}	Analog Input Voltage (V_{NO}, V_{NC}, or V_{COM})		−	V_{CC}	V
V_{IN}	Digital Select Input Voltage		−	V_{CC}	V
T_A	Operating Temperature Range		−40	85	°C
t_r, t_f	Input Rise or Fall Time, SELECT	V_{CC} = 1.6−2.7 V V_{CC} = 3.0−4.5 V	− −	20 10	ns/V

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 2.7 3.6 4.3	1.0 1.4 1.8 2.2	1.0 1.4 1.8 2.2	V
V_{IL}	Maximum Low−Level Input Voltage, Select Inputs		1.65 2.7 3.6 4.3	0.4 0.5 0.6 0.8	0.4 0.5 0.6 0.8	V
I_{IN}	Maximum Input Leakage Current, Select Inputs	V_{IN} = 4.5 V 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 3)	Select and V_{IS} = V_{CC} or GND	1.65 to 4.5	± 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)	$V_{IN} \le V_{IL}$ or $V_{IN} \ge V_{IH}$ V_{IS} = GND to V_{CC} $\lvert I_{IN} \rvert \le$ 100 mA	2.7 − 4.3		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 − 4.3		0.2		0.2	Ω
ΔR_{ON}	On−Resistance Match Between Channels (Notes 3 and 4)	V_{IS} = 0.5 V_{CC}; I_{COM} = 100 mA	2.7 − 4.3		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} = 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. $\Delta R_{ON} = R_{ON(MAX)} - R_{ON(MIN)}$ 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.

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 Ω, C_L = 35 pF (Figures 3 and 4)	2.3 − 4.5	1.5			25		27	ns
t_{OFF}	Turn−Off Time	R_L = 50 Ω, C_L = 35 pF (Figures 3 and 4)	2.3 − 4.5	1.5			15		20	ns
t_{BBM}	Minimum Break−Before−Make Time	V_{IS} = 3.0 R_L = 300 Ω, C_L = 35 pF (Figure 2)	3.0	1.5	2.0	8.0				ns

		Typical @ 25, V_{CC} = 4.5 V	
C_{IN}	Control Pin Input Capacitance	5.0	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 − 4.5	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 − 4.5	−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 − 4.5	−62	dB
Q	Charge Injection Select Input to Common I/O	V_{IN} = $V_{CC\ to}$ GND, R_{IS} = 0 Ω, C_L = 1 nF Q = C_L x ΔV_{OUT} (Figure 6)	1.65 − 4.5	50	pC
THD	Total Harmonic Distortion THD + Noise	F_{IS} = 20 Hz to 20 kHz, R_L = R_{gen} = 600 Ω, C_L = 50 pF V_{IS} = 2 V RMS	4.5	0.008	%
VCT	Channel−to−Channel Crosstalk	f = 100 kHz; V_{IS} = 1 V RMS, C_L = 5 pF, R_L = 50 Ω V_{IN} centered between V_{CC} and GND (Figure 5)	1.65 − 4.5	−62	dB

6. Off−Channel Isolation = 20log10 (Vcom/Vno), Vcom = output, Vno = input to off switch.

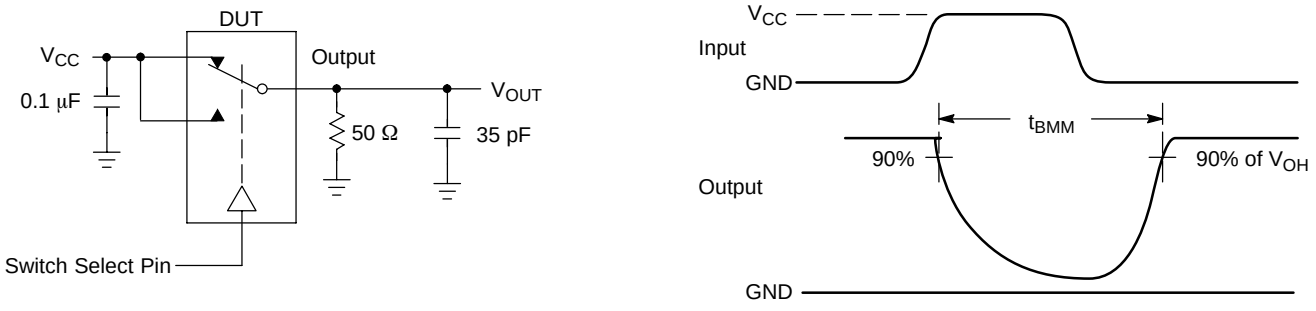


Figure 2. t_{BBM} (Time Break−Before−Make)

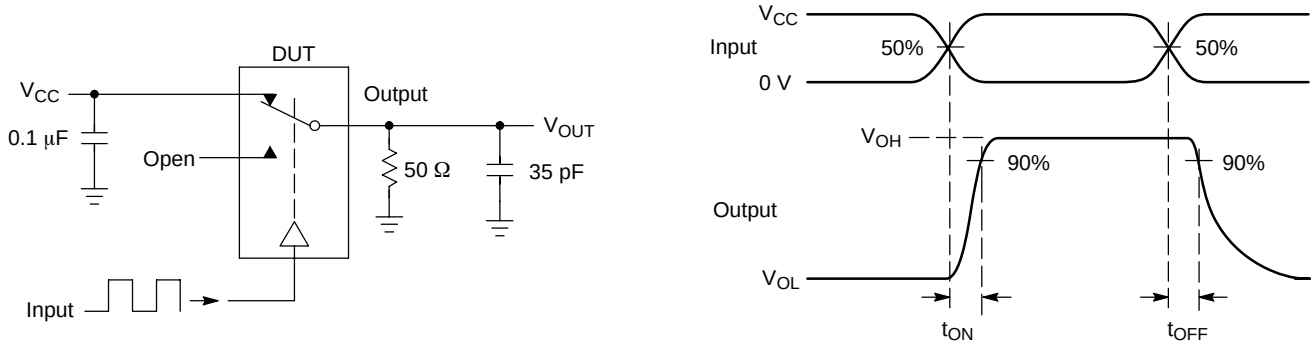


Figure 3. t_{ON}/t_{OFF}

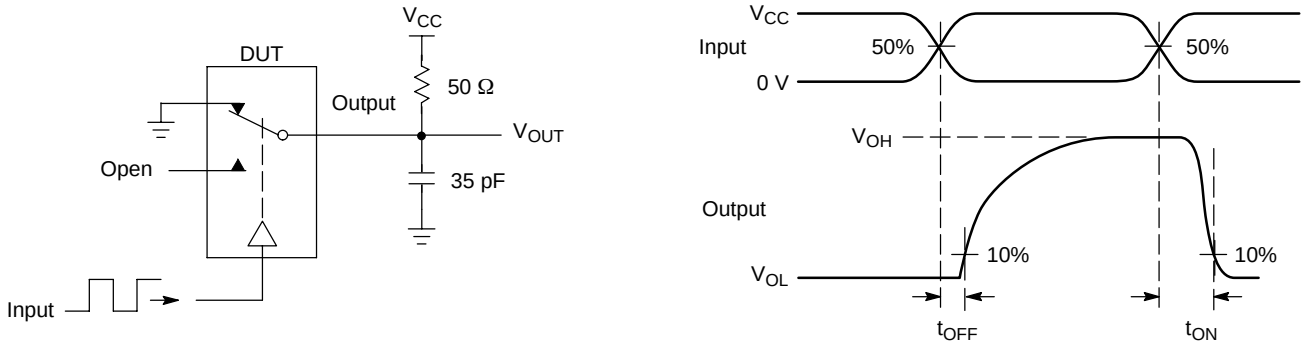
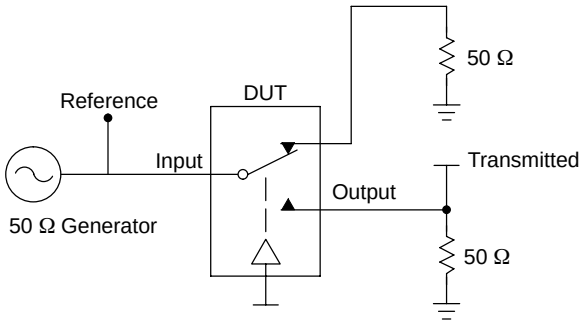


Figure 4. t_{ON}/t_{OFF}



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

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

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

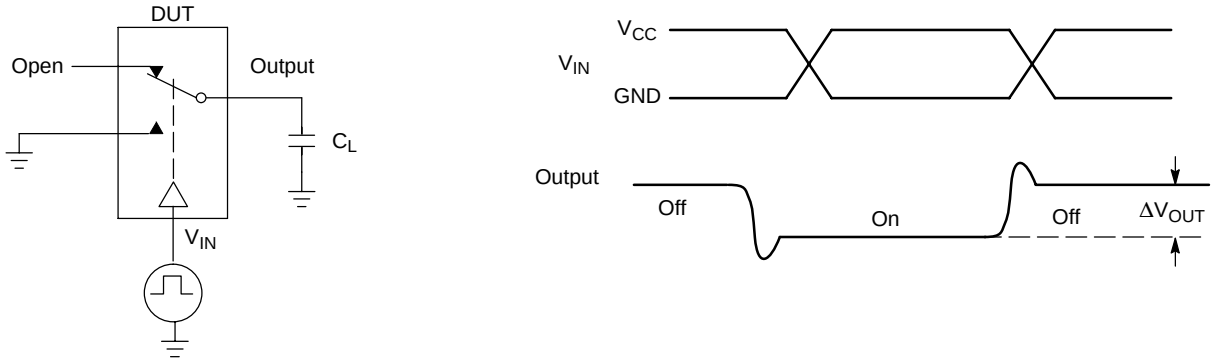


Figure 6. Charge Injection: (Q)

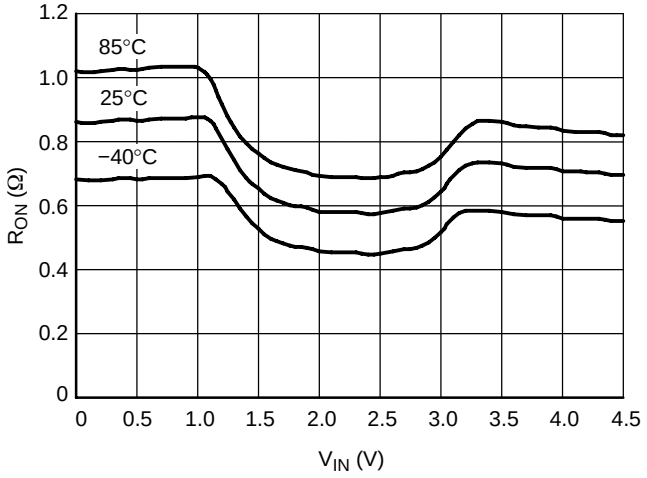


Figure 7. On−Resistance vs. Input Voltage @ V_{CC} = 4.3 V

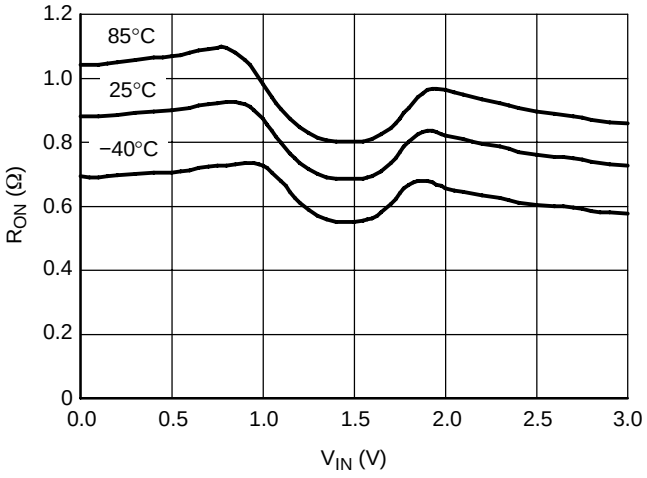


Figure 8. R_{ON} vs. V_{IN} vs. Temperature @ V_{CC} = 3.0 V

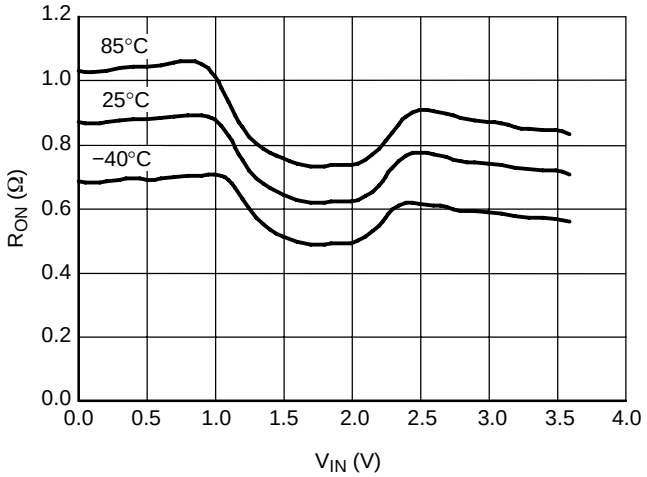


Figure 9. R_{ON} vs. V_{IN} vs. Temperature @ V_{CC} = 3.6 V

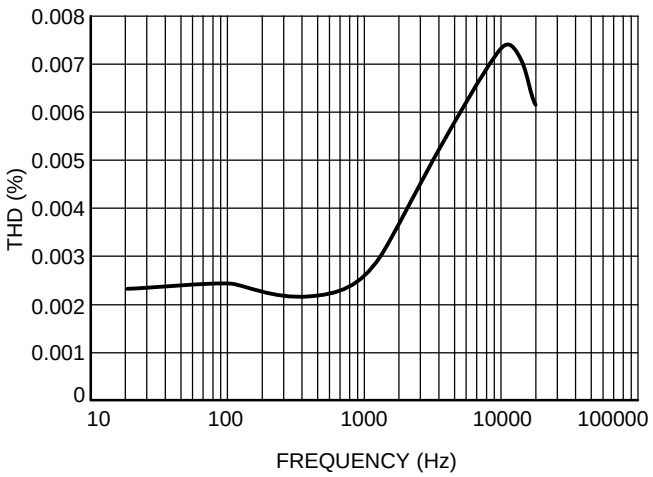


Figure 10. Total Harmonic Distortion vs. Frequency

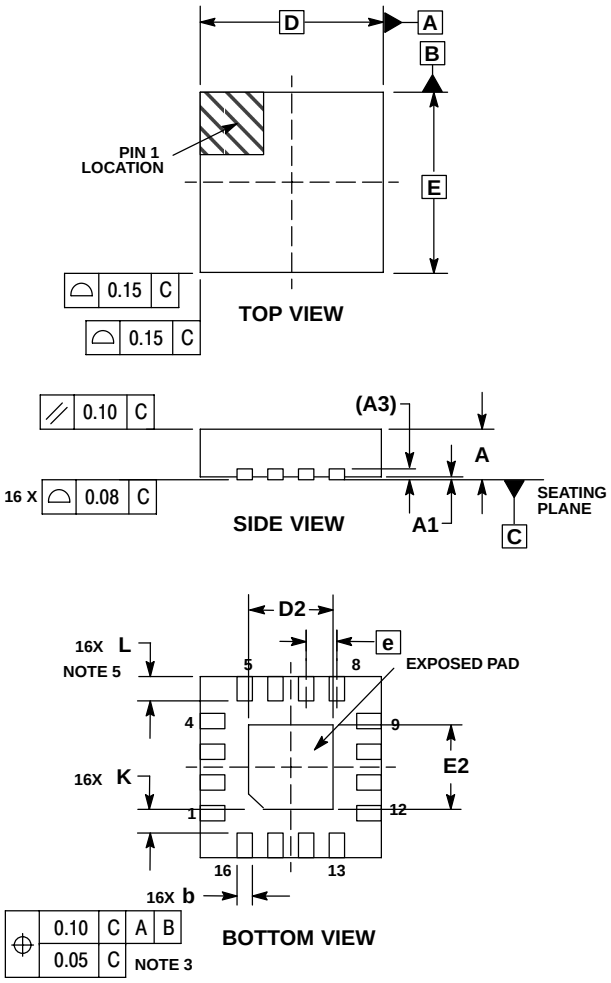
ORDERING INFORMATION

Device Order Number	Device Nomenclature					Package Type	Tape & Reel Size†
	Circuit Indicator	Technology	Device Function	Package Suffix	Tape & Reel Suffix		
NLAS4783BMN1R2G	NL	AS	4783B	MN1	R2G	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.

PACKAGE DIMENSIONS

QFN−16 (3 x 3 x 0.85 mm)
CASE 485AE−01
ISSUE O



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.

	MILLIMETERS		
DIM	MIN	NOM	MAX
A	0.800	0.900	1.000
A1	0.000	0.025	0.050
A3		0.200 REF	
b	0.180	0.250	0.300
D		3.00 BSC	
D2	1.250	1.40	1.550
E		3.00 BSC	
E2	1.250	1.40	1.550
e		0.500 BSC	
K	0.200	−−−	−−−
L	0.300	0.400	0.500

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:
Literature Distribution Center for ON Semiconductor
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Phone: 480−829−7710 or 800−344−3860 Toll Free USA/Canada
Fax: 480−829−7709 or 800−344−3867 Toll Free USA/Canada
Email: orderlit@onsemi.com

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Phone: 81−3−5773−3850

ON Semiconductor Website: http://onsemi.com

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