4.5 Ω High Bandwidth, Dual SPDT Analog Switch

The NLAS4717EP is an advanced CMOS analog switch fabricated in sub–micron silicon gate CMOS technology. The device is a dual independent Single Pole Double Throw (SPDT) switch featuring low $R_{DS(on)}$ of 4.5 Ω at 3.0 V.

The device also features guaranteed Break–Before–Make (BBM) switching, assuring the switches never short the driver.

The NLAS4717EP is available in two small size packages:

Microbump: 2.0 x 1.5 mm WQFN-10: 1.4 x 1.8 mm

Features

- Low R_{DS(on)}: 4.5 Ω @ 3.0 V
- Matching Between the Switches $\pm 0.5 \Omega$
- Wide Voltage Range: 1.8 V to 5.5 V
- High Bandwidth > 90 MHz
- 1.65 V to 5.5 V Operating Range
- Low Threshold Voltages on Pins 4 and 8 (CTRL Pins)
- Ultra-Low Charge Injection ≤ 6.0 pC
- Low Standby Current: $I_{CC} = 1.0 \text{ nA (Max)} @ T_A = 25^{\circ}C$
- *OVT on Pins 4 and 8 (CTRL Logic Pins)
- These are Pb-Free Devices

Typical Applications

- Cell Phones
- PDAs
- MP3s
- Digital Still Cameras
- USB 2.0 Full Speed (USB1.1) 12 Mbps Compliant

Important Information

• ESD Protection:

HBM = 2500 V, MM = 200 V

- Latchup Max Rating: 200 mA (Per JEDEC EIA/JESD78)
- Pin-to-Pin Compatible with MAX4717

*OVT

• Overvoltage Tolerant (OVT) specific pins operate higher than normal supply voltages, with no damage to the devices or to signal integrity.

1



ON Semiconductor®

http://onsemi.com

MARKING DIAGRAMS



Microbump-10 CASE 489AA



A = Assembly Location

Y = Year W, WW = Work Week

= Pb-Free Package

(Note: Microdot may be in either location)





AW = Specific Device Code

M = Date Code■ Pb-Free Device

(Note: Microdot may be in either location)

FUNCTION TABLE

IN_	NO_	NC_
0	OFF	ON
1	ON	OFF

ORDERING INFORMATION

Device	Package	Shipping [†]
NLAS4717EPFCT1G	Microbump-10 (Pb-Free)	3000 / Tape & Reel
NLAS4717EPMTR2G	WQFN-10 (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.

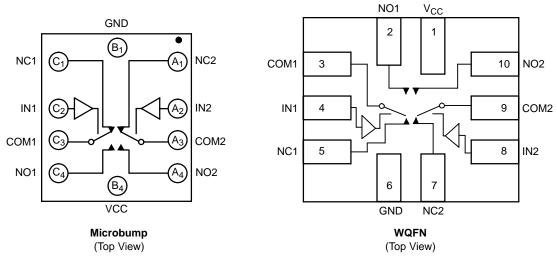


Figure 1. Device Circuit Diagrams and Pin Configurations

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V+	DC Supply Voltage	-0.5 to +7.0	V
V _{IS}	Analog Input Voltage (V _{NO} , V _{NC} , or V _{COM}) (Note 1)	$-0.5 \le V_{IS} \le V_{CC} + 0.5$	V
V _{IN}	Digital Select Input Voltage	$-0.5 \le V_{ } \le +7.0$	V
I _{IK}	DC Current, Into or Out of Any Pin (Continuous)	± 100	mA
I _{PK}	Peak Current (10% Duty Cycle)	±200	mA

Maximum ratings are those values beyond which device damage can occur. Maximum ratings applied to the device are individual stress limit values (not normal operating conditions) and are not valid simultaneously. If these limits are exceeded, device functional operation is not implied, damage may occur and reliability may be affected.

RECOMMENDED OPERATING CONDITIONS

Symbol	Parameter		Min	Max	Unit
V+	DC Supply Voltage		1.8	5.5	V
V _{IN}	Digital Select Input Voltage		GND	5.5	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, SELECT $V_{CC} = V_{CC} = V_{CC$	3.3 V ± 0.3 V 5.0 V ± 0.5 V	0	100 20	ns/V

^{1.} Signal voltage on NC, NO, and COM exceeding VCC or GND are clamped by the internal diodes. Limit forward diode current to maximum current rating.

ANALOG SWITCH DC CHARACTERISTICS

				-40°C to +85°C		
Symbol	Parameter	Condition	V _{CC} (V)	Min	Max	Unit
V _{IH}	Input Logic High Voltage	V _{OUT} = 0.1 V I _{OUT} ≤ 20 μA	1.65 to 2.2 2.7 to 3.6 4.5 to 5.5	V _{CC} x 0.55 V _{CC} x 0.5 2.0	- - -	V
V _{IL}	Input Logic Low Voltage	$V_{OUT} = -V_{CC} - 0.1 \text{ V}$ $I_{OUT} \le 20 \mu\text{A}$	1.65 to 2.2 2.7 to 3.6 4.5 to 5.5	- - -	V _{CC} x 0.2 V _{CC} x 0.2 0.8	V
I _{IN}	Input Leakage Current	$V_{IN} = V_{CC}$ or GND	5.5	-100	+100	nA
V _{CC}	Power Supply Range	All	-	1.65	5.5	V
Icc	Supply Current	$V_{IN} = V_{CC}$ or GND $I_{OUT} = 0 \mu A$	1.8 3.3 5.5	- - -	1.0 1.0 1.0	μΑ

ANALOG SWITCH CHARACTERISTICS – Digital Section (Voltages Referenced to GND)

				-	-40°C to +85°	С	
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Unit
R _{ON}	ON Resistance (Note 2)	$I_{COM} = 10 \text{ mA}$ $V_{IS} = 0 \text{ to } V_{CC}$	3.0	_	3.2	4.5	Ω
			5.0	-	2.1	3.5	1
ΔR _{ON}	ON Resistance Match Between Channels (Note 2 and 3)	$I_{COM} = 10 \text{ mA}$ $V_{IS} = 0 \text{ to } V_{CC}$	3.0	-	0.1	0.4	Ω
			5.0	-	0.1	0.4	
R _{FLAT[ON]}	ON Resistance Flatness (Note 4)	$I_{COM} = 10 \text{ mA}$ $V_{IS} = 0 \text{ to } V_{CC}$	3.0	-	1.12	1.5	Ω
			5.0	-	0.55	1.36	
I _{NO_[OFF]} I _{NC_[OFF]}	NO_, NC_ Off-Leakage Current (Note 5)	$V_{COM} = 0.3 \text{ V or } 3.3 \text{ V}$ $V_{NO} \text{ or } V_{NC} = 0.3 \text{ V or } 3.3 \text{ V}$	3.6	-1.0	0.01	+1.0	nA
		$V_{COM} = 0 \text{ V or } 5.0 \text{ V}$ $V_{NO} \text{ or } V_{NC} = 0 \text{ V or } 5.0 \text{ V}$	5.5	-1.0	0.01	+1.0	
I _{COM} [ON]	COM_ On-Leakage Current (Note 5)	$V_{COM} = 0.3 \text{ V or } 3.3 \text{ V}$ $V_{NO} \text{ or } V_{NC} = 0.3 \text{ V or } 3.3 \text{ V}$	3.6	-2.0	0.01	+2.0	nA
		$V_{COM} = 0 \text{ V or } 5.0 \text{ V}$ $V_{NO} \text{ or } V_{NC} = 0 \text{ V or } 5.0 \text{ V}$	5.5	-2.0	0.01	+2.0	

ANALOG SWITCH AC CHARACTERISTICS

				_	40°C to +85°	С	
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Unit
t _{ON}	Turn-On Time	V_{NC} , $V_{NO} = V_{IH}$ or V_{IL} $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_{IN[X]} = V_{IH}$ or V_{IL}	1.8 to 5.5	-	-	30	nS
tOFF	Turn-Off Time	V_{NC} , $V_{NO} = V_{IH}$ or V_{IL} $R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_{IN[X]} = V_{IH}$ or V_{IL}	1.8 to 5.5	-	-	40	nS
t _{BBM}	Break-Before-Make Time Delay (Note 5)	$V_{NC_{-}}, V_{NO_{-}} = 1.5 \text{ V}$ $R_{L} = 300 \Omega, C_{L} = 35 \text{ pF}$	-	-	8.0	-	nS
t _{SKEW}	Skew (Note 5)	$R_S = 39 \Omega, C_L = 50 pF$	_	_	0.15	2.0	nS

- R_{ON} characterized for V_{CC} range (1.65 V to 5.5 V).
 ΔR_{ON} = R_{ON}(MAX) R_{ON}(MIN).
 R_{FLAT[ON]} = R_{ON}(MAX) R_{ON}(MIN), measured over V_{CC} range.
 Guaranteed by design.

ANALOG SWITCH APPLICATION CHARACTERISTICS

				-	-40°C to +85°	C	
Symbol	Parameter	Condition	V _{CC} (V)	Min	Тур	Max	Unit
Q	Charge Injection	$V_{IN} = V_{CC}$ to GND $R_{In} = 0 \Omega$, $C_L = 1.0 \text{ nF}$ $Q = C_L - \Delta V_{OUT}$	3.0 5.0		6.0 9.0		рС
VISO	Off-Isolation	f = 10 MHz $V_{NO_}, V_{NC_} = 1.0 \text{ Vp-p}$ $R_L = 50 \Omega, C_L = 5.0 \text{ pF}$ f = 1.0 MHz	1.65 to 5.5		-70 -110		dB
		$V_{NO_}$, $V_{NC_} = 1.0 \text{ Vp-p}$ $R_L = 50 \Omega$, $C_L = 5.0 \text{ pF}$					
VCT	Cross-Talk	$f = 10 \text{ MHz}$ $V_{NO_}, V_{NC_} = 1.0 \text{ Vp-p}$ $R_L = 50 \Omega, C_L = 5.0 \text{ pF}$	1.65 to 5.5		-35		dB
		$f = 1.0 \text{ MHz} \\ V_{NO_}, V_{NC_} = 1.0 \text{ Vp-p} \\ R_L = 50 \ \Omega, C_L = 5.0 \text{ pF} \\ \end{cases}$			-53		
BW	On-Channel -3.0 db Bandwidth	Signal = 0 dB $R_L = 50 \Omega$, $C_L = 5.0 pF$	1.8 to 5.0		90		MHz
THD	Total Harmonic Distortion	$V_{COM} = 2.0 \text{ Vp-p},$ RL = 600 Ω , T _A = 25°C	-		0.02		%
C _{NO_[OFF]}	NO_, NC_ OFF-Capacitance	F = 1.0 MHz	_		15		pF
C _{NO_[ON]}	NO_, NC_ ON-Capacitance	F = 1.0 MHz	_		38		pF

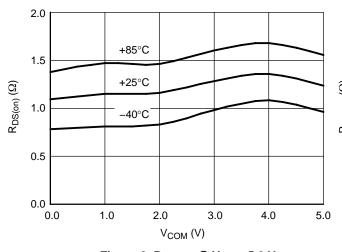


Figure 2. R_{DS(on)} @ V_{CC} = 5.0 V

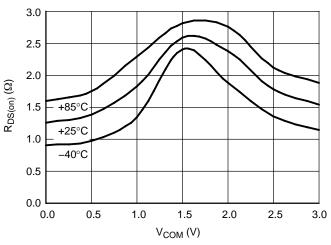


Figure 3. R_{DS(on)} @ V_{CC} = 3.0 V

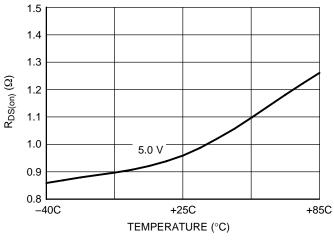


Figure 4. Delta $R_{DS(on)} @ V_{CC} = 5.0 V$

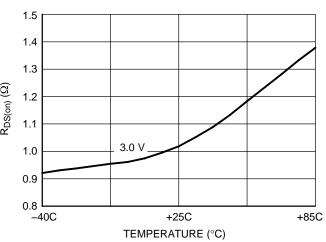


Figure 5. Delta R_{DS(on)} @ V_{CC} = 3.0 V

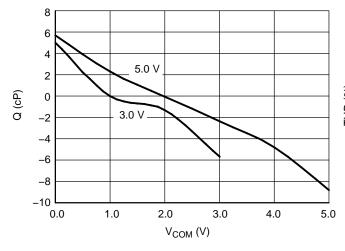


Figure 6. Charge Injection

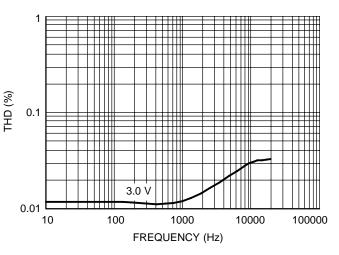
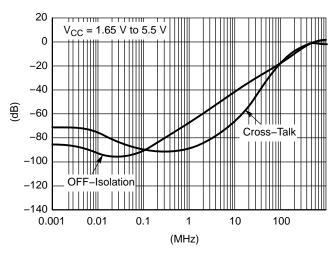


Figure 7. Total Harmonic Distortion



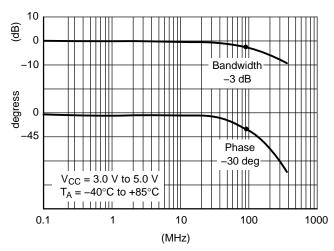
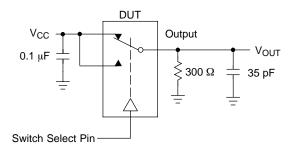


Figure 8. Frequency Response

Figure 9. Bandwidth and Phase



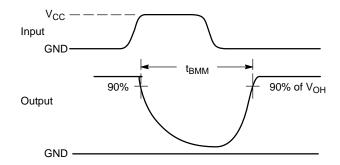
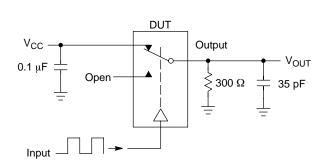


Figure 10. t_{BBM} (Time Break-Before-Make)



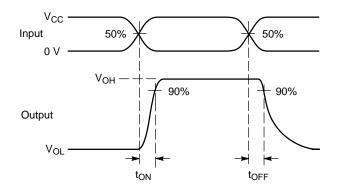
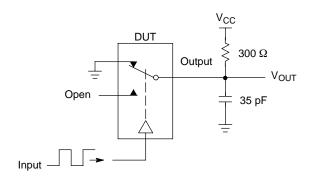


Figure 11. t_{ON}/t_{OFF}



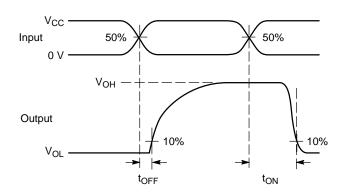
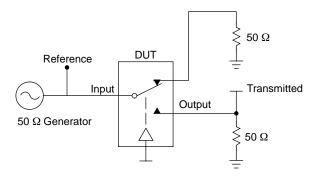


Figure 12. t_{ON}/t_{OFF}



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.

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

Bandwidth (BW) = the frequency 3.0 dB below V_{ONL}

 V_{CT} = Use V_{ISO} setup and test to all other switch analog input/outputs terminated with 50 Ω

Figure 13. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/V_{ONL}

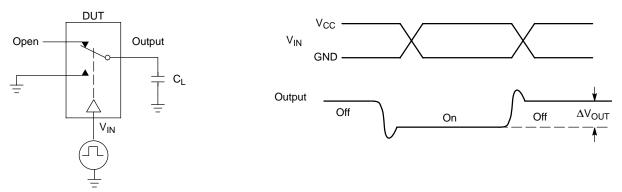
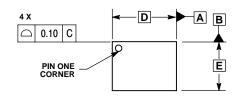
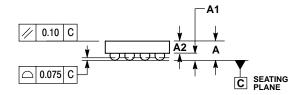


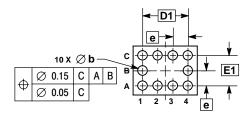
Figure 14. Charge Injection: (Q)

PACKAGE DIMENSIONS

Microbump-10 CASE 489AA-01 **ISSUE A**





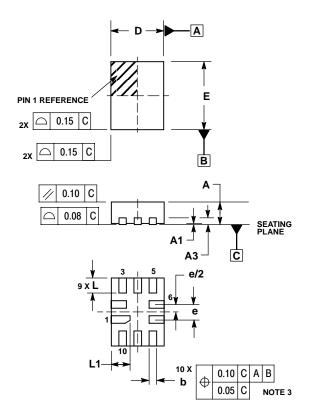


- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
 2. CONTROLLING DIMENSION: MILLIMETERS.
 3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

	MILLIMETERS					
DIM	MIN	MAX				
Α	-	0.650				
A1	0.210	0.270				
A2	0.280	0.380				
D	1.965	BSC				
E	1.465	BSC				
b	0.250	0.350				
е	0.500 BSC					
D1	1.500 BSC					
E1	1.000	BSC				

PACKAGE DIMENSIONS

WQFN10, 1.4x1.8x0.4PCASE 488AQ-01 ISSUE B

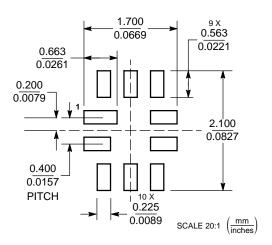


NOTES:

- 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 PAD
- COPLANARITY APPLIES TO THE EXPOSED PAD AS WELL AS THE TERMINALS.
 EXPOSED PADS CONNECTED TO DIE FLAG.
- 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 REF				
b	0.15	0.25			
D	1.40	BSC			
E	1.80	BSC			
е	0.40 BSC				
L	0.30	0.50			
L1	0.40	0.60			

MOUNTING FOOTPRINT



ON Semiconductor and the registered trademarks of Semiconductor Components Industries, LLC (SCILLC). SCILLC reserves the right to make changes without further notice to any products herein. SCILLC makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does SCILLC assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation special, consequential or incidental damages. "Typical" parameters which may be provided in SCILLC data sheets and/or specifications can and do vary in different applications and actual performance may vary over time. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. SCILLC does not convey any license under its patent rights nor the rights of others. SCILLC products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the SCILLC product could create a situation where personal injury or death may occur. Should Buyer purchase or use SCILLC products for any such unintended or unauthorized application, Buyer shall indemnify and hold SCILLC and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that SCILLC was negligent regarding the design or manufacture of the part. SCILLC is an Equal Opportunity/Affirmative Action Employer. This literature is subject to all applicable copyright laws and is not for resale in any manner.

PUBLICATION ORDERING INFORMATION

LITERATURE FULFILLMENT:

Literature Distribution Center for ON Semiconductor
P.O. Box 61312, Phoenix, Arizona 85082–1312 USA
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

N. American Technical Support: 800–282–9855 Toll Free USA/Canada

Japan: ON Semiconductor, Japan Customer Focus Center 2–9–1 Kamimeguro, Meguro–ku, Tokyo, Japan 153–0051 Phone: 81–3–5773–3850

ON Semiconductor Website: http://onsemi.com

Order Literature: http://www.onsemi.com/litorder

For additional information, please contact your local Sales Representative.