

NLAS4717

4.5 Ω High Bandwidth, Dual SPDT Analog Switch

The NLAS4717 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 two 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 NLAS4717 is available in two small size packages:

Micro-10: 3.0 x 5.0 mm

Microbump: 2.0 x 1.5 mm

Features

- Low $R_{DS(on)}$: 4.5 Ω @ 3.0 V
- Matching Between the Switches $\pm 0.5 \Omega$
- Wide Low Voltage Range: 1.8 V to 5.5 V
- High Bandwidth > 40 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 – $I_{CC} = 1.0$ nA (Max) @ $T_A = 25^\circ\text{C}$
- OVT* on Pins 4 and 8 (CTRL Pins)

Typical Applications

- Cell Phones
- PDAs
- MP3s
- Digital Still Cameras
- USB 1.1, Full Bandwidth Switching – 12 Mbps

Important Information

- ESD Protection:
MM = 200 V, HBM = 2000 V, CDM = 1500 V
- Latch-Up Max Rating: 200 Ma (Per JEDEC EIA/JESD78)
- Pin-to-Pin Compatible with MAX4717

*OVT

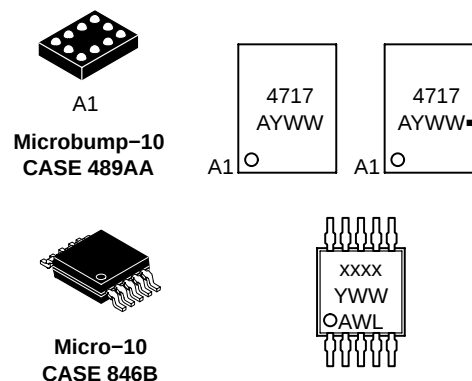
- Over-Voltage Tolerance (OVT) specific pins to function higher than normal operating voltages, with no damage to the devices or to signal integrity.



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MARKING DIAGRAMS



xxxxx = Device Code
A = Assembly Location
WL = Wafer Lot
Y = Year
WW = Work Week
▪ = Pb-Free Package

FUNCTION TABLE

IN_	NO_	NC_
0	OFF	ON
1	ON	OFF

ORDERING INFORMATION

Device	Package	Shipping [†]
NLAS4717FCT1	Microbump-10	3000 / Tape & Reel
NLAS4717MR2	Micro-10	4000 / Tape & Reel
NLAS4717FCT1G	Microbump-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.

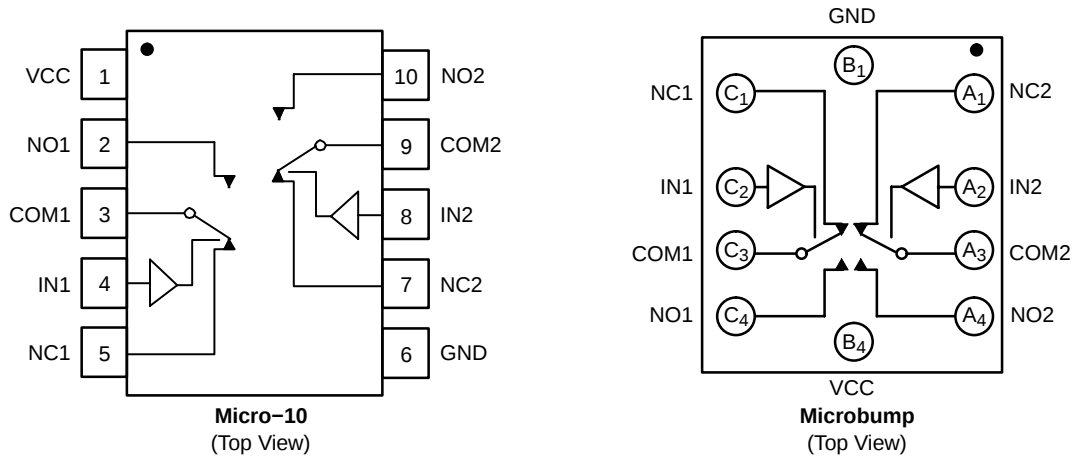


Figure 1. Device Circuit Diagrams and Pin Configurations

MAXIMUM RATINGS

Symbol	Parameter	Value	Unit
V+	Positive 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 ≤ V _{IS} ≤ V _{CC} + 0.5	V
V _{IN}	Digital Select Input Voltage	-0.5 ≤ V _I ≤ +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.

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

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} = 3.3 V ± 0.3 V V _{CC} = 5.0 V ± 0.5 V		ns/V
		0	100	
		0	20	

ANALOG SWITCH DC CHARACTERISTICS

Symbol	Parameter	Condition	V _{CC}	-40°C to +85°C		Unit
				Min	Max	
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} × 0.55 V _{CC} × 0.45 2.0	- - -	V
V _{IL}	Input Logic Low Voltage	V _{OUT} = -V _{CC} - 0.1 V I _{OUT} ≤ 20 μA	1.65 to 2.2 2.7 to 3.6 4.5 to 5.5	- - -	V _{CC} × 0.2 V _{CC} × 0.25 0.8	V
I _{IN}	Input Leakage Current	V _{IN} - V _{CC} or GND	5.0	-100	+100	nA
V _{CC}	Power Supply Range	All	-	1.65	5.5	V
I _{CC}	Supply Current	V _{IN} = V _{CC} or GND I _{OUT} = 0 μA	1.8 3.3 5.0	- - -	1.0 1.0 1.0	μA
V _{IS}	Analog Signal Range	Key parameter	-	0	V _{CC}	V

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

Symbol	Parameter	Condition	V _{CC}	–40°C to +85°C			Unit
				Min	Typ	Max	
R _{ON}	ON Resistance (Note 1)	V _{CC} = 3.0 V I _{COM} = 10 mA V _{NO} or V _{NC} = V _{IH} or V _{IL}	3.0	–		4.5	Ω
		V _{CC} = 5.0 V I _{COM} = 10 mA V _{NO} or V _{NC} = V _{IH} or V _{IL}	5.0	–		3.5	
ΔR _{ON}	ON Resistance Match Between Channels (Note 1 and 2)	V _{CC} = 3.6 V I _{COM} = 10 mA V _{NO} or V _{NC} = V _{IH} or V _{IL}	3.6	–	0.1	0.4	Ω
		V _{CC} = 5.5 V I _{COM} = 10 mA V _{NO} or V _{NC} = V _{IH} or V _{IL}	5.5				
R _{FLAT[ON]}	ON Resistance Flatness (Note 3)	I _{COM} = 10 mA V _{IS} = 0 to V _{CC}	3.0	1.16		1.5	Ω
		I _{COM} = 10 mA V _{IS} = 0 to V _{CC}	5.5	0.87		1.36	
I _{NO_[OFF]} I _{NC_[OFF]}	NO_, NC_ Off-Leakage Current (Note 4)	V _{CC} = 3.6 V V _{COM} = 0.3 V or 3.3 V V _{NO} or V _{NC} = 0.3 V or 3.3 V	3.6	–1.0	0.01	+1.0	nA
		V _{CC} = 5.5 V V _{COM} = 0 V or 5.0 V V _{NO} or V _{NC} = 0 V or 5.0 V	5.5	–1.0	0.01	+1.0	
I _{COM_[ON]}	COM_ On-Leakage Current (Note 4)	V _{CC} = 3.6 V V _{COM} = 0.3 V or 3.3 V V _{NO} or V _{NC} = 0.3 V or 3.3 V	3.6	–2.0	0.01	+2.0	nA
		V _{CC} = 5.5 V V _{COM} = 0 V or 5.0 V V _{NO} or V _{NC} = 0 V or 5.0 V	5.5	–2.0	0.01	+2.0	

ANALOG SWITCH AC CHARACTERISTICS

Symbol	Parameter	Condition	V _{CC}	–40°C to +85°C			Unit
				Min	Typ	Max	
t _{ON}	Turn-On Time	V _{NC_} , V _{NO_} = V _{IH} or V _{IL}	1.8	15	16	17	nS
		R _L = 300 Ω, C _L = 35 pF	2.7 to 3.6	13	15	15	
		V _{IN[x]} = V _{IH} or V _{IL}	4.5 to 5.5	12	12	13	
t _{OFF}	Turn-Off Time	V _{NC_} , V _{NO_} = V _{IH} or V _{IL}	18	16	17	19	nS
		R _L = 300 Ω, C _L = 35 pF	2.7 to 3.6	18	19	20	
		V _{IN[x]} = V _{IH} or V _{IL}	4.5 to 5.5	13	14	15	
t _{BBM}	Break-Before-Make Time Delay (Note 4)	V _{NC_} , V _{NO_} = 1.5 V R _L = 300 Ω, C _L = 35 pF	–	–	8.0	–	nS
t _{SKEW}	Skew (Note 4)	R _S = 39 Ω, C _L = 50 pF	–	–	0.15	2.0	nS

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

ANALOG SWITCH APPLICATION CHARACTERISTICS

Symbol	Parameter	Condition	V _{CC}	-40°C to +85°C			Unit
				Min	Typ	Max	
Q	Charge Injection	V _{IN} = V _{CC} to GND R _{IN} = 0 Ω, C _L = 1.0 nF Q = C _L - ΔV _{OUT}	3.0 5.0		6.0 9.0		pC
VISO	Off-Isolation	f = 10 MHz V _{NO_} , V _{NC_} = 1.0 Vp-p R _L = 50 Ω, C _L = 5.0 pF	-		70		dB
		f = 1.0 MHz V _{NO_} , V _{NC_} = 1.0 Vp-p R _L = 50 Ω, C _L = 5.0 pF			110		
VCT	Cross-Talk	f = 10 MHz V _{NO_} , V _{NC_} = 1.0 Vp-p R _L = 50 Ω, C _L = 5.0 pF	-		-35		dB
		f = 1.0 MHz V _{NO_} , V _{NC_} = 1.0 Vp-p R _L = 50 Ω, C _L = 5.0 pF			-53		
BW	On-Channel -3.0 db Bandwidth	Signal = 0 dB R _L = 50 Ω, C _L = 5.0 pF	-	39.48	40	44.52	MHz
THD	Total Harmonic Distortion	V _{COM} = 2.0 Vp-p, R _L = 600 Ω, T _A = 25°C	-		0.02		%
C _{NO_[OFF]} C _{NC_[OFF]}	NO_, NC_ Off-Capacitance	F = 1.0 MHz	-		9.0		pF

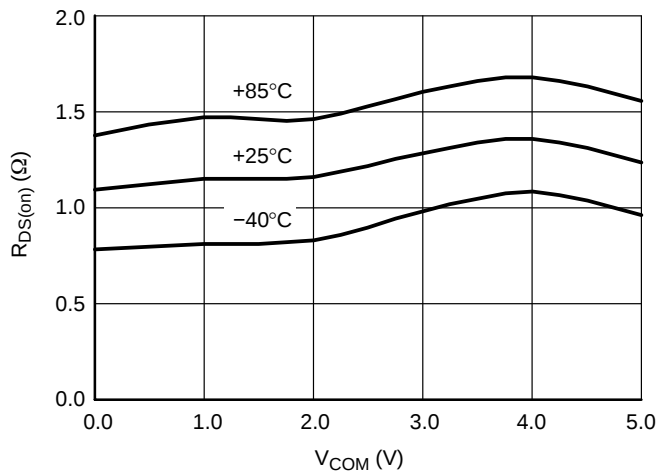


Figure 2. Low $R_{DS(on)}$ @ $V_{CC} = 5.0$ V

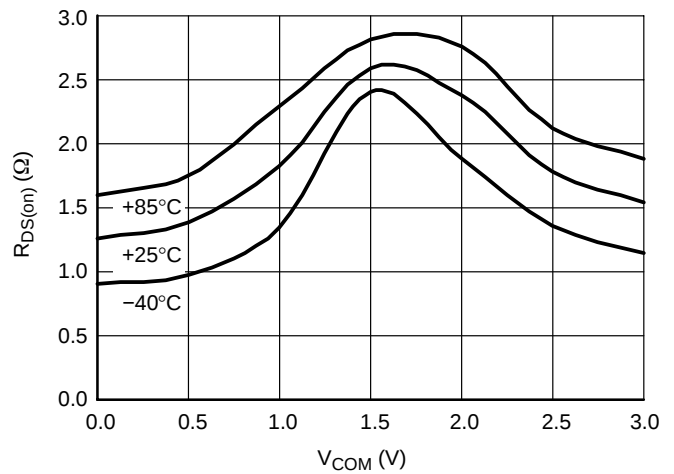


Figure 3. Low $R_{DS(on)}$ @ $V_{CC} = 3.0$ V

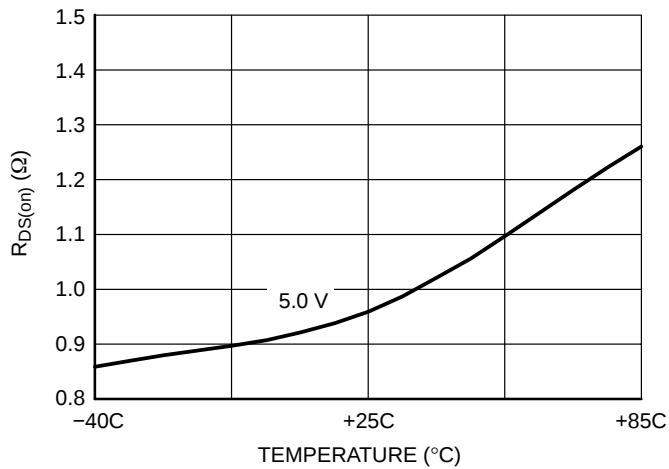


Figure 4. Delta $R_{DS(on)}$ @ $V_{CC} = 5.0$ V

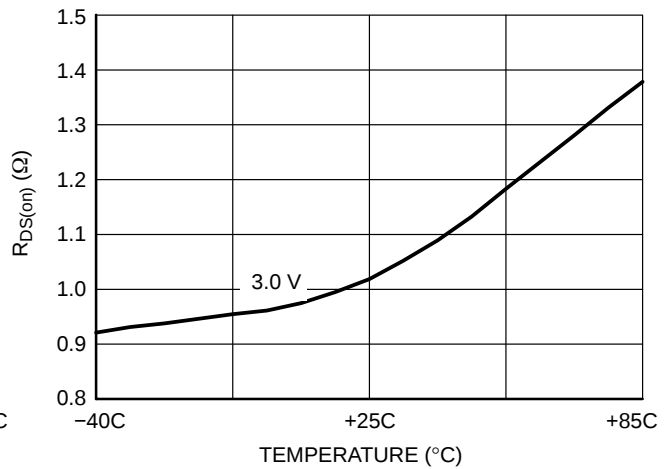


Figure 5. Delta $R_{DS(on)}$ @ $V_{CC} = 3.0$ V

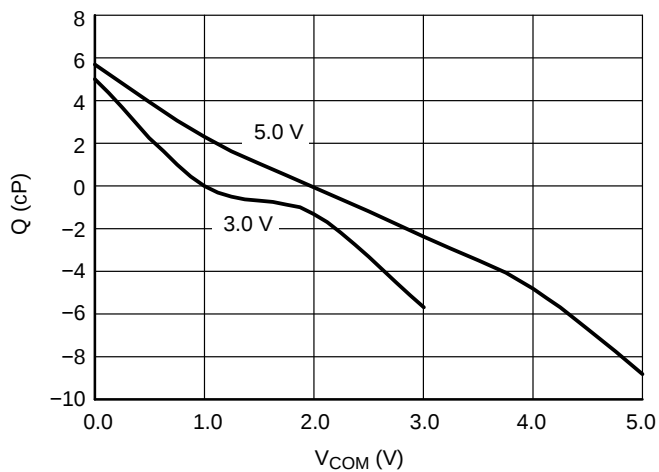


Figure 6. Charge Injection

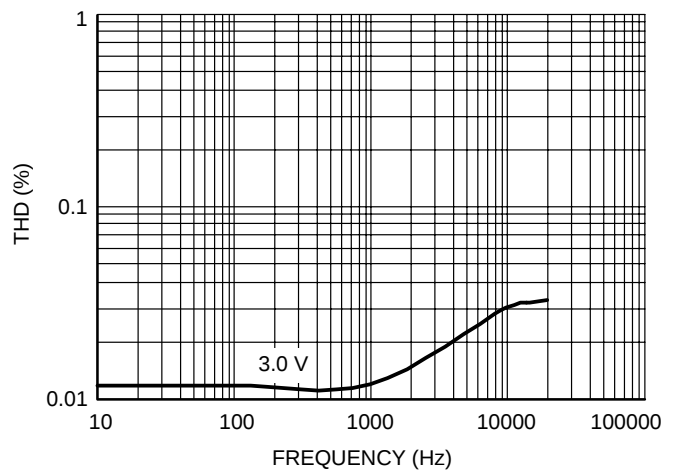


Figure 7. Total Harmonic Distortion

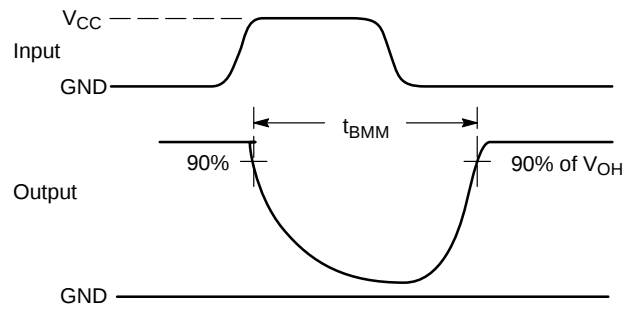
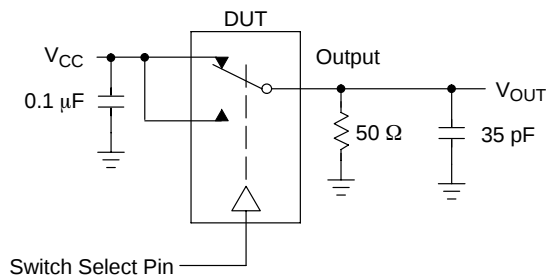


Figure 8. t_{BMM} (Time Break-Before-Make)

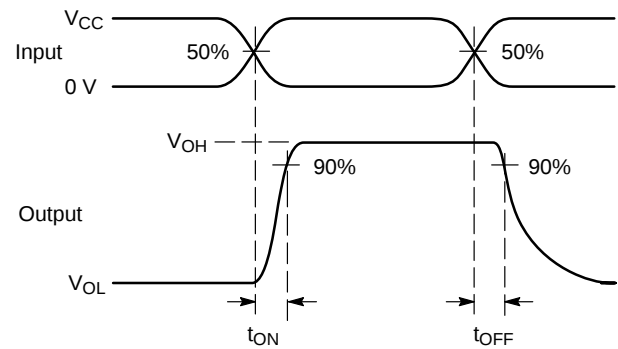
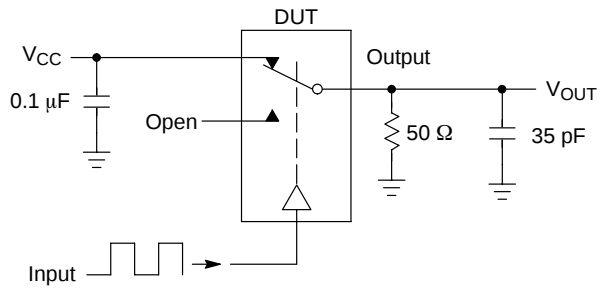


Figure 9. t_{ON}/t_{OFF}

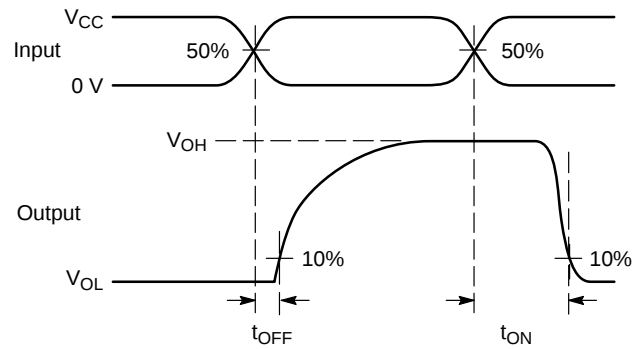
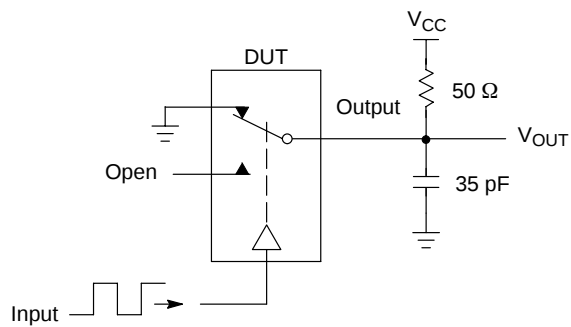
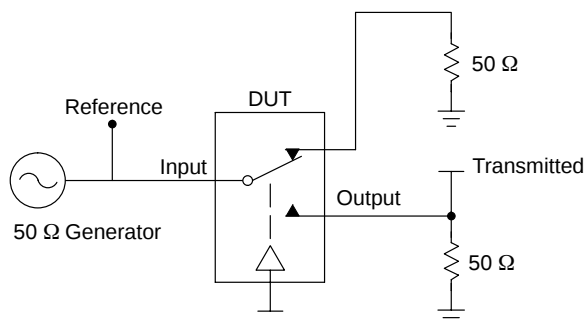


Figure 10. t_{ON}/t_{OFF}



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.

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

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

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

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

Figure 11. Off Channel Isolation/On Channel Loss (BW)/Crosstalk (On Channel to Off Channel)/ V_{ONL}

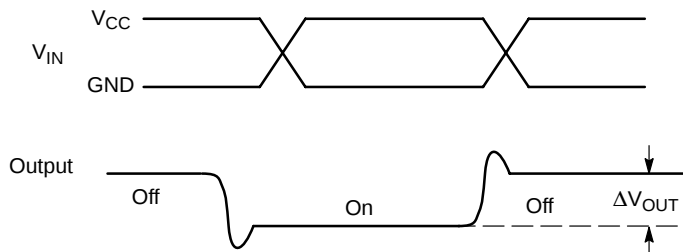
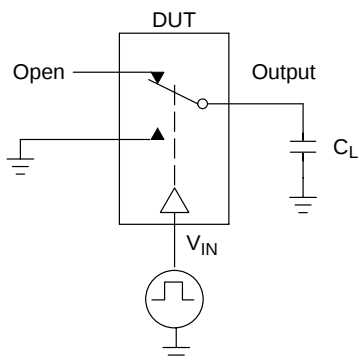


Figure 12. Charge Injection: (Q)

NLAS4717

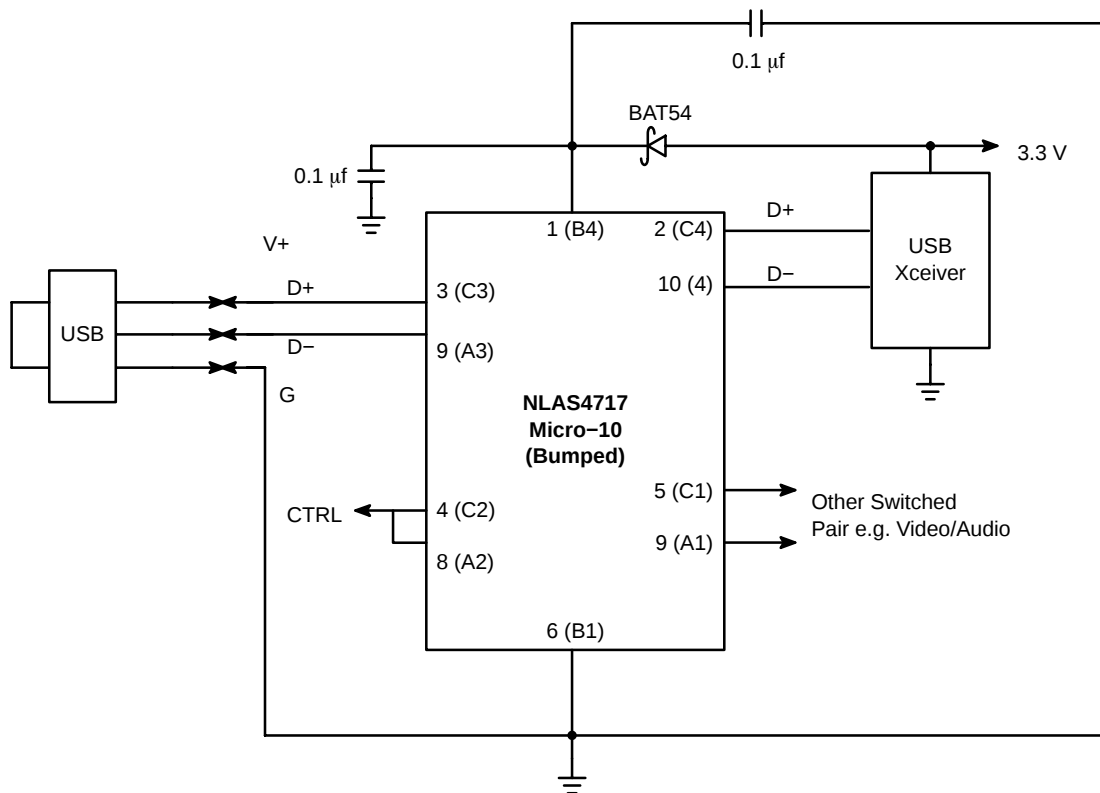
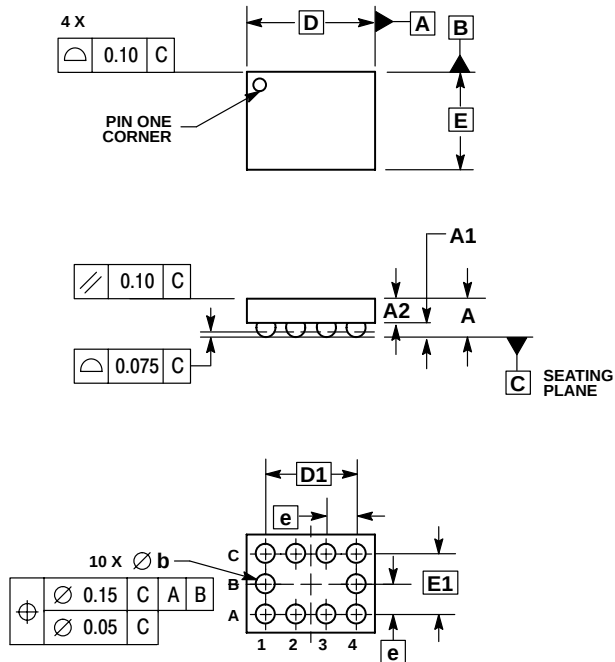


Figure 13. Application Diagram
NLAS4717 USB 1.1 Switch

NLAS4717

PACKAGE DIMENSIONS

Microbump-10
CASE 489AA-01
ISSUE A



NOTES:

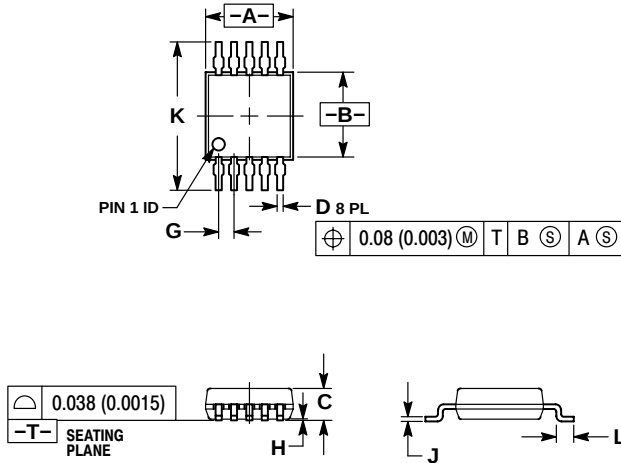
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

DIM	MILLIMETERS	
	MIN	MAX
A	---	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
e	0.500 BSC	
D1	1.500 BSC	
E1	1.000 BSC	

NLAS4717

PACKAGE DIMENSIONS

Micro-10 CASE 846B-03 ISSUE C



NOTES:

1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: MILLIMETER.
3. DIMENSION "A" DOES NOT INCLUDE MOLD FLASH, PROTRUSIONS OR GATE BURRS. MOLD FLASH, PROTRUSIONS OR GATE BURRS SHALL NOT EXCEED 0.15 (0.006) PER SIDE.
4. DIMENSION "B" DOES NOT INCLUDE INTERLEAD FLASH OR PROTRUSION. INTERLEAD FLASH OR PROTRUSION SHALL NOT EXCEED 0.25 (0.010) PER SIDE.
5. 846B-01 OBSOLETE. NEW STANDARD 846B-02

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	2.90	3.10	0.114	0.122
B	2.90	3.10	0.114	0.122
C	0.95	1.10	0.037	0.043
D	0.20	0.30	0.008	0.012
G	0.50 BSC		0.020 BSC	
H	0.05	0.15	0.002	0.006
J	0.10	0.21	0.004	0.008
K	4.75	5.05	0.187	0.199
L	0.40	0.70	0.016	0.028

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