

NLAS4717EP

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:

Micro10: 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 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: $I_{CC} = 1.0$ nA (Max) @ $T_A = 25^\circ\text{C}$
- *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.



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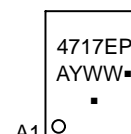
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MARKING DIAGRAMS

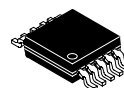


A1

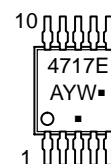
Microbump-10
CASE 489AA



A1



Micro10
CASE 846B



A = Assembly Location
Y = Year
W, WW = Work Week
▪ = Pb-Free Package
(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 |
| NLAS4717EPMR2G | Micro10 (Pb-Free) | 4000 / 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.

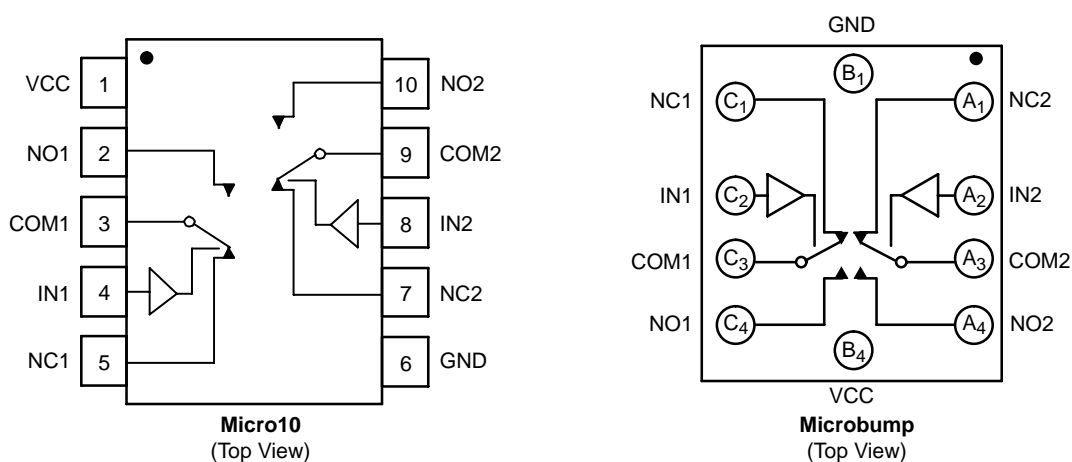


Figure 1. Device Circuit Diagrams and Pin Configurations

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 ≤ 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 VCC 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} (V) | –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} × 0.5 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} × 0.2 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 |
| I _{CC} | Supply Current | V _{IN} = V _{CC} or GND I _{OUT} = 0 μA | 1.8 3.3 5.5 | – – – | 1.0 1.0 1.0 | μA |

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

| Symbol | Parameter | Condition | V _{CC} (V) | –40°C to +85°C | | | Unit |
|--|---|--|---------------------|----------------|------|------|------|
| | | | | Min | Typ | Max | |
| R _{ON} | ON Resistance (Note 2) | I _{COM} = 10 mA V _{IS} = 0 to V _{CC} | 3.0 | – | 3.2 | 4.5 | Ω |
| | | | 5.0 | – | 2.1 | 3.5 | |
| ΔR _{ON} | ON Resistance Match Between Channels (Note 2 and 3) | I _{COM} = 10 mA V _{IS} = 0 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 mA V _{IS} = 0 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 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 _{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 5) | 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 _{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} (V) | -40°C to +85°C | | | Unit |
|-------------------|---|---|---------------------|----------------|------|-----|------|
| | | | | Min | Typ | Max | |
| t _{ON} | Turn-On Time | V _{NC_} , V _{NO_} = V _{IH} or V _{IL} R _L = 300 Ω, C _L = 35 pF V _{IN[x]} = V _{IH} or V _{IL} | 1.8 to 5.5 | – | – | 30 | nS |
| t _{OFF} | Turn-Off Time | V _{NC_} , V _{NO_} = V _{IH} or V _{IL} R _L = 300 Ω, C _L = 35 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 V R _L = 300 Ω, C _L = 35 pF | – | – | 8.0 | – | nS |
| t _{SKEW} | Skew (Note 5) | R _S = 39 Ω, C _L = 50 pF | – | – | 0.15 | 2.0 | nS |

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

ANALOG SWITCH APPLICATION CHARACTERISTICS

| Symbol | Parameter | Condition | V _{CC} (V) | -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 | 1.65 to 5.5 | | –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 | 1.65 to 5.5 | | –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 | 1.8 to 5.0 | | 90 | | 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 | – | | 15 | | pF |
| C _{NO_[ON]} C _{NC_[ON]} | NO_, NC_ ON-Capacitance | F = 1.0 MHz | – | | 38 | | pF |

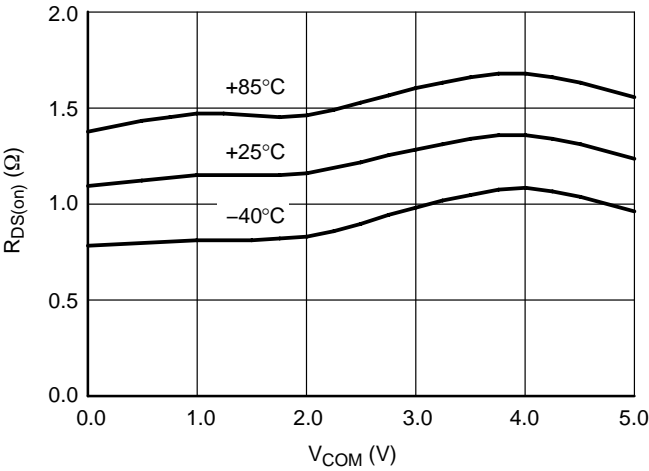


Figure 2. $R_{DS(on)}$ @ $V_{CC} = 5.0$ V

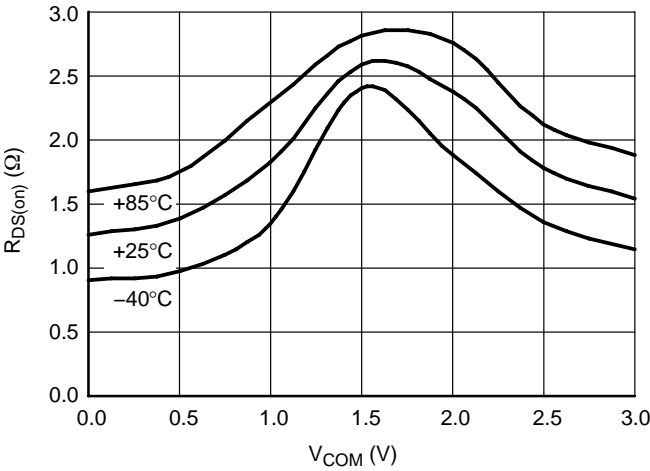


Figure 3. $R_{DS(on)}$ @ $V_{CC} = 3.0$ V

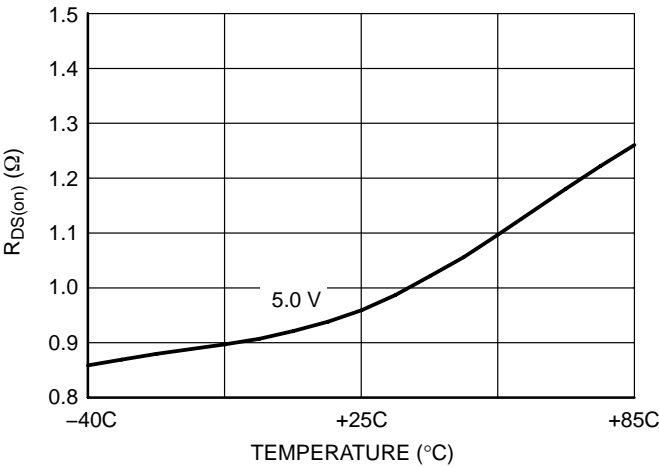


Figure 4. $\Delta R_{DS(on)}$ @ $V_{CC} = 5.0$ V

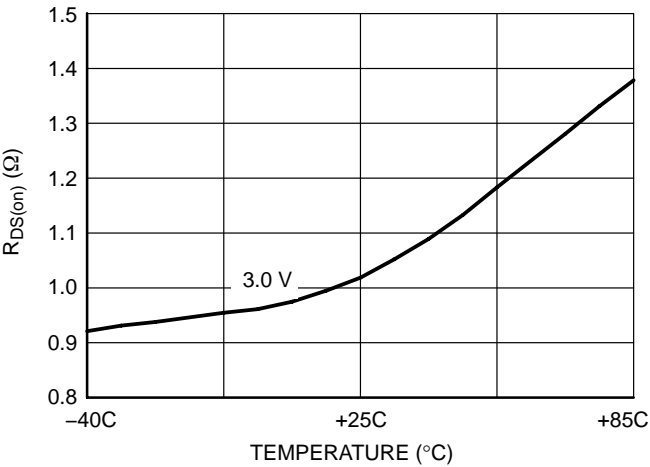


Figure 5. $\Delta R_{DS(on)}$ @ $V_{CC} = 3.0$ V

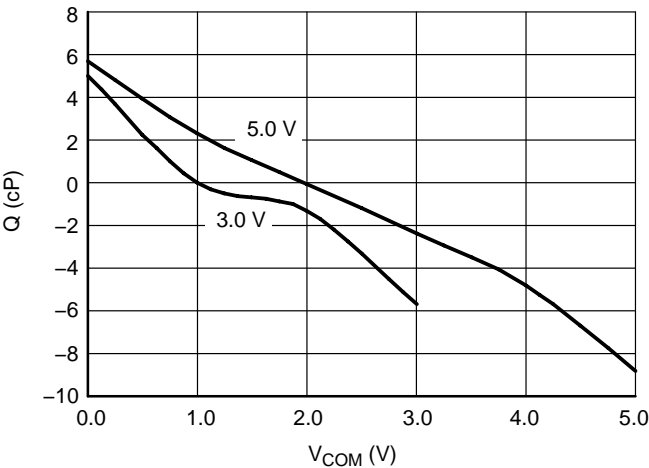


Figure 6. Charge Injection

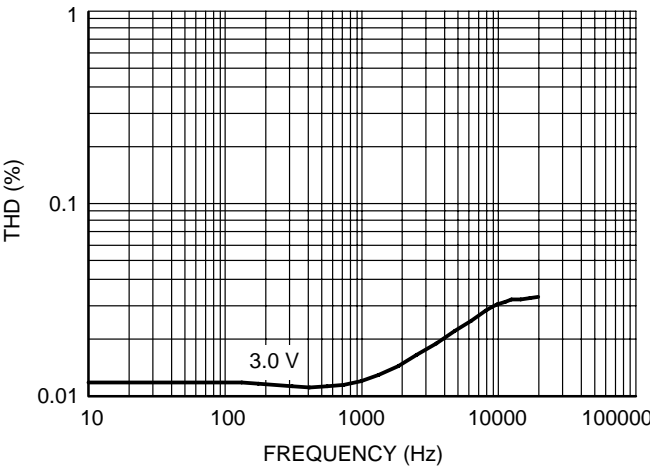


Figure 7. Total Harmonic Distortion

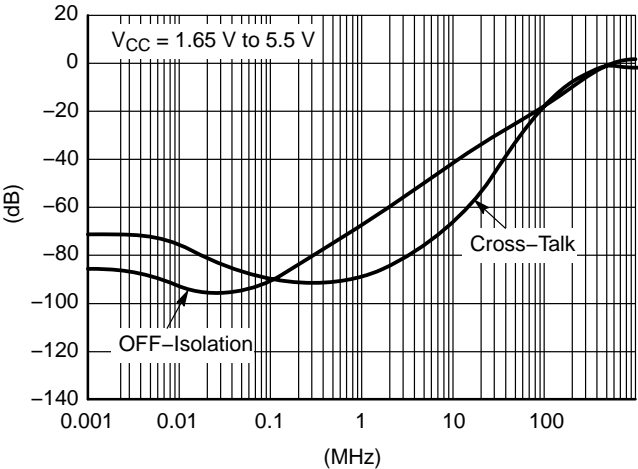


Figure 8. Frequency Response

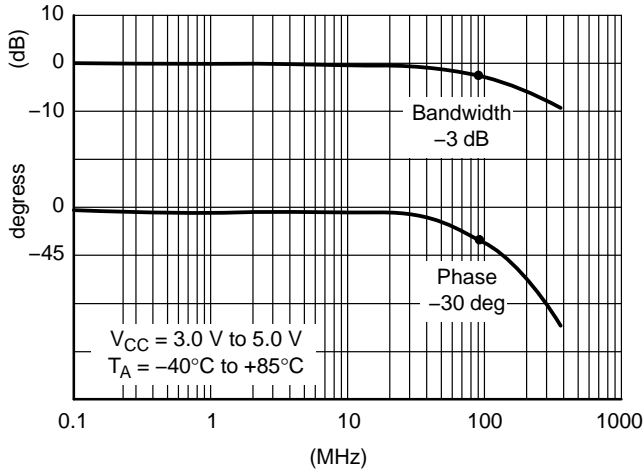


Figure 9. Bandwidth and Phase

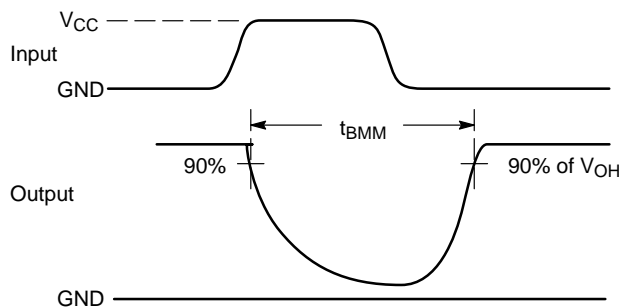
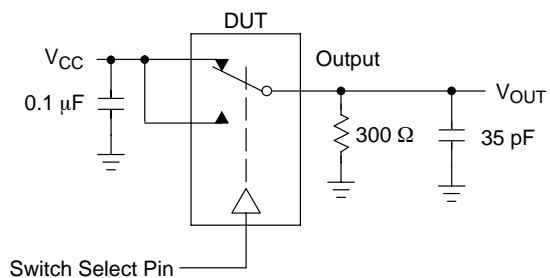


Figure 10. t_{BMM} (Time Break-Before-Make)

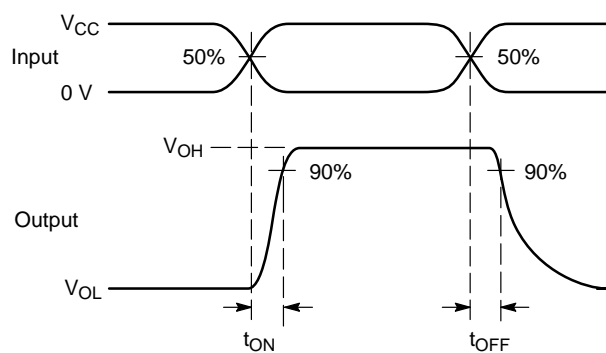
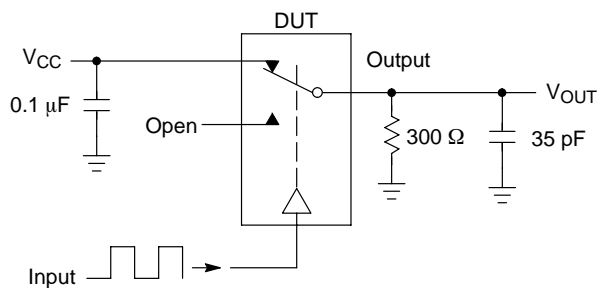


Figure 11. t_{ON}/t_{OFF}

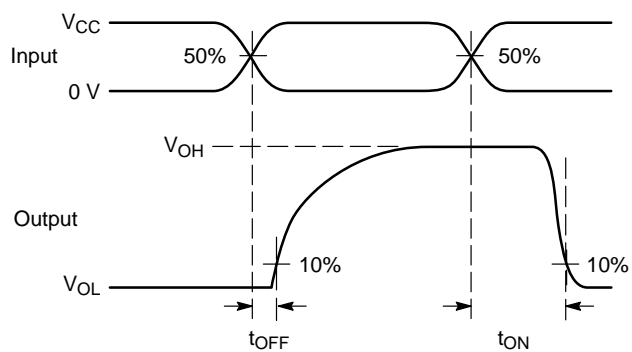
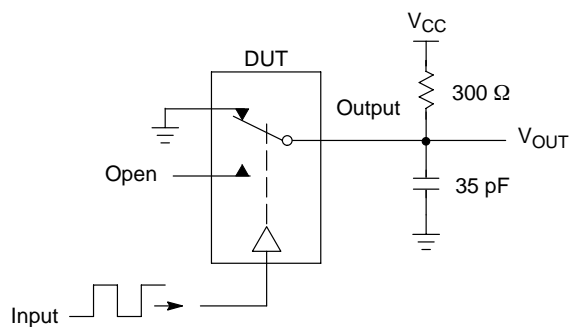
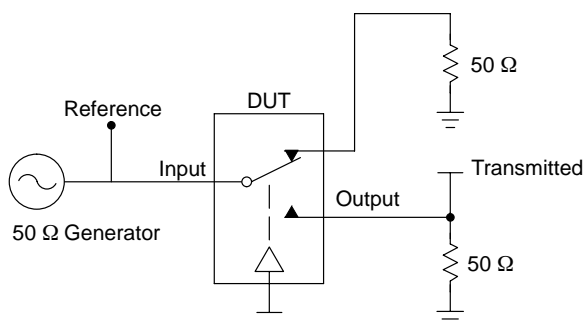


Figure 12. t_{ON}/t_{OFF}



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

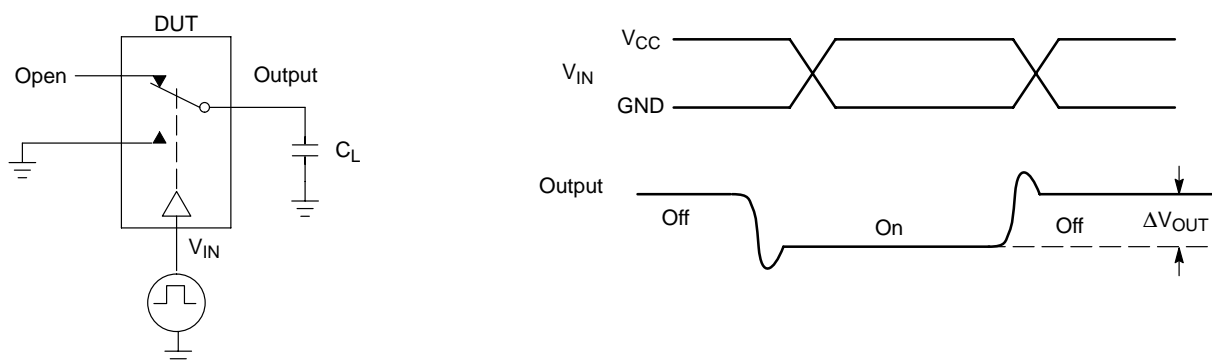
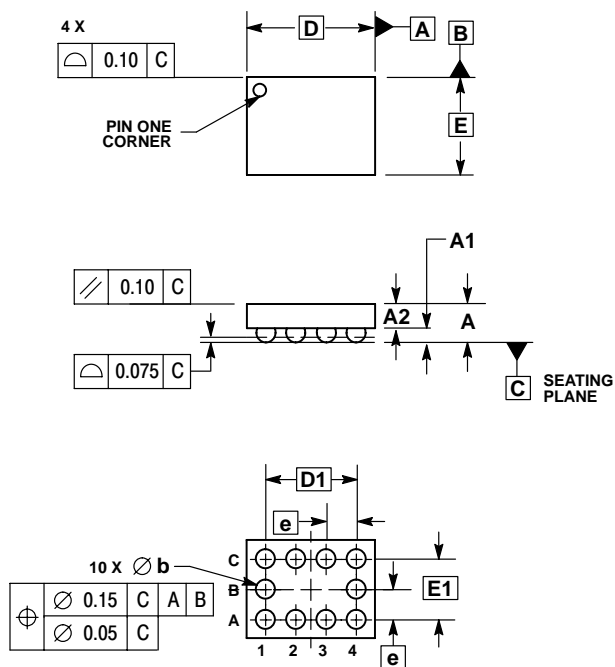


Figure 14. Charge Injection: (Q)

NLAS4717EP

PACKAGE DIMENSIONS

Microbump-10
CASE 489AA-01
ISSUE A



NOTES:

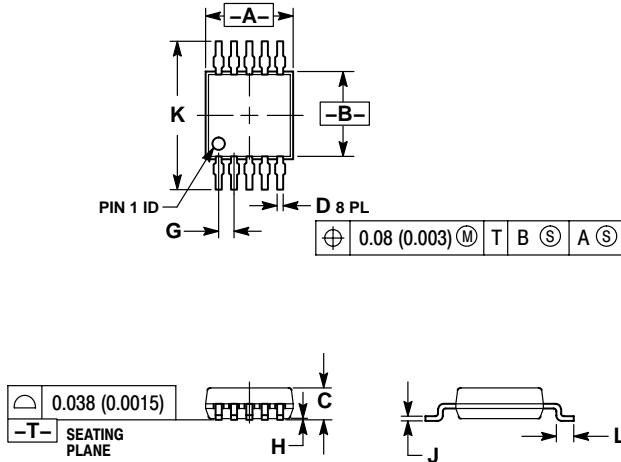
1. DIMENSIONING AND TOLERANCING PER ASME Y14.5M, 1994.
2. CONTROLLING DIMENSION: MILLIMETERS.
3. COPLANARITY APPLIES TO SPHERICAL CROWNS OF SOLDER BALLS.

| 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 | |

NLAS4717EP

PACKAGE DIMENSIONS

Micro10
CASE 846B-03
ISSUE D

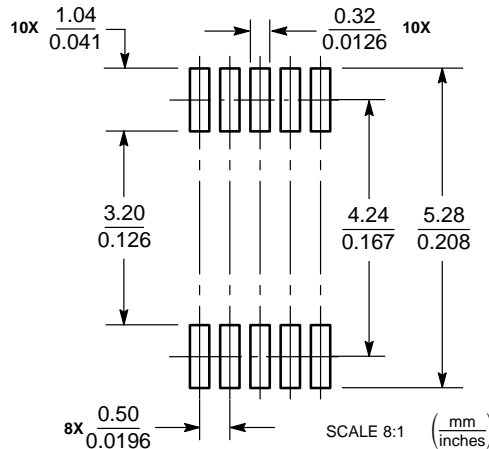


NOTES:

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 |

SOLDERING 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.

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