

# NLAS4717EP

## 4.5 $\Omega$ 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  $\Omega$  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  $\Omega$  @ 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  $\leq 6.0$  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:
  - ◆ Human Body Model (HBM) = 2500 V,
  - ◆ Machine Model (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.



ON Semiconductor®

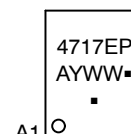
<http://onsemi.com>

### MARKING DIAGRAMS



A1

Microbump-10  
CASE 489AA



A = Assembly Location  
Y = Year  
W, WW = Work Week  
■ = Pb-Free Package  
(Note: Microdot may be in either location)



1

WQFN-10  
CASE 488AQ



AW = Specific Device Code  
M = Date Code  
■ = Pb-Free Device  
(Note: Microdot may be in either location)

### FUNCTION TABLE

| IN <sub>-</sub> | NO <sub>-</sub> | NC <sub>-</sub> |
|-----------------|-----------------|-----------------|
| 0               | OFF             | ON              |
| 1               | ON              | OFF             |

### ORDERING INFORMATION

| Device          | Package                   | Shipping†             |
|-----------------|---------------------------|-----------------------|
| NLAS4717EPFCT1G | Microbump-10<br>(Pb-Free) | 3000 /<br>Tape & Reel |
| NLAS4717EPMTR2G | WQFN-10<br>(Pb-Free)      | 3000 /<br>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.

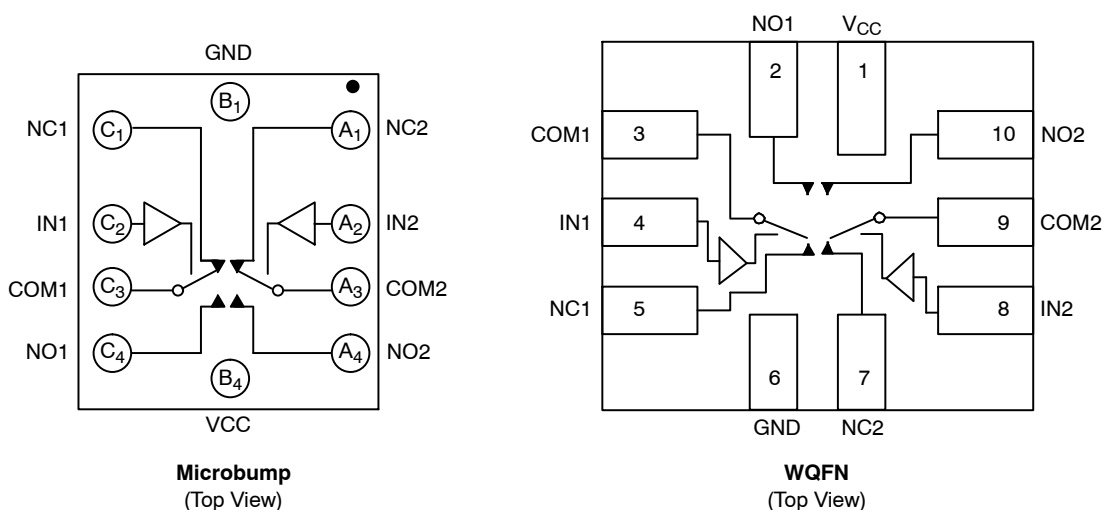


Figure 1. Device Circuit Diagrams and Pin Configurations

## MAXIMUM RATINGS

| Symbol          | Parameter                                                                                | Value                                          | Unit |
|-----------------|------------------------------------------------------------------------------------------|------------------------------------------------|------|
| V+              | DC Supply Voltage                                                                        | -0.5 to +7.0                                   | V    |
| V <sub>IS</sub> | Analog Input Voltage (V <sub>NO</sub> , V <sub>NC</sub> , or V <sub>COM</sub> ) (Note 1) | -0.5 ≤ V <sub>IS</sub> ≤ V <sub>CC</sub> + 0.5 | V    |
| V <sub>IN</sub> | Digital Select Input Voltage                                                             | -0.5 ≤ V <sub>I</sub> ≤ +7.0                   | V    |
| I <sub>IK</sub> | DC Current, Into or Out of Any Pin (Continuous)                                          | ±100                                           | mA   |
| I <sub>PK</sub> | Peak Current (10% Duty Cycle)                                                            | ±200                                           | 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.

1. Signal voltage on NC, NO, and COM exceeding V<sub>CC</sub> 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 <sub>IN</sub>                 | Digital Select Input Voltage                                                                          | GND    | 5.5             | V    |
| V <sub>IS</sub>                 | Analog Input Voltage (NC, NO, COM)                                                                    | GND    | V <sub>CC</sub> | V    |
| T <sub>A</sub>                  | Operating Temperature Range                                                                           | -40    | +85             | °C   |
| t <sub>r</sub> , t <sub>f</sub> | Input Rise or Fall Time, SELECT<br>V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V | 0<br>0 | 100<br>20       | ns/V |

**ANALOG SWITCH DC CHARACTERISTICS**

| Symbol          | Parameter                | Condition                                                               | V <sub>CC</sub> (V)                     | -40°C to +85°C                                         |                                                       | Unit |
|-----------------|--------------------------|-------------------------------------------------------------------------|-----------------------------------------|--------------------------------------------------------|-------------------------------------------------------|------|
|                 |                          |                                                                         |                                         | Min                                                    | Max                                                   |      |
| V <sub>IH</sub> | Input Logic High Voltage | V <sub>OUT</sub> = 0.1 V<br>I <sub>OUT</sub> ≤ 20 μA                    | 1.65 to 2.2<br>2.7 to 3.6<br>4.5 to 5.5 | V <sub>CC</sub> × 0.55<br>V <sub>CC</sub> × 0.5<br>2.0 | –<br>–<br>–                                           | V    |
| V <sub>IL</sub> | Input Logic Low Voltage  | V <sub>OUT</sub> = -V <sub>CC</sub> - 0.1 V<br>I <sub>OUT</sub> ≤ 20 μA | 1.65 to 2.2<br>2.7 to 3.6<br>4.5 to 5.5 | –<br>–<br>–                                            | V <sub>CC</sub> × 0.2<br>V <sub>CC</sub> × 0.2<br>0.8 | V    |
| I <sub>IN</sub> | Input Leakage Current    | V <sub>IN</sub> = V <sub>CC</sub> or GND                                | 5.5                                     | -100                                                   | +100                                                  | nA   |
| V <sub>CC</sub> | Power Supply Range       | All                                                                     | –                                       | 1.65                                                   | 5.5                                                   | V    |
| I <sub>CC</sub> | Supply Current           | V <sub>IN</sub> = V <sub>CC</sub> or GND<br>I <sub>OUT</sub> = 0 μA     | 1.8<br>3.3<br>5.5                       | –<br>–<br>–                                            | 1.0<br>1.0<br>1.0                                     | μA   |

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

| Symbol                                         | Parameter                                                 | Condition                                                                                | V <sub>CC</sub> (V) | -40°C to +85°C |      |      | Unit |
|------------------------------------------------|-----------------------------------------------------------|------------------------------------------------------------------------------------------|---------------------|----------------|------|------|------|
|                                                |                                                           |                                                                                          |                     | Min            | Typ  | Max  |      |
| R <sub>ON</sub>                                | ON Resistance<br>(Note 2)                                 | I <sub>COM</sub> = 10 mA<br>V <sub>IS</sub> = 0 to V <sub>CC</sub>                       | 3.0                 | –              | 3.2  | 4.5  | Ω    |
|                                                |                                                           |                                                                                          | 5.0                 | –              | 2.1  | 3.5  |      |
| ΔR <sub>ON</sub>                               | ON Resistance<br>Match Between Channels<br>(Note 2 and 3) | I <sub>COM</sub> = 10 mA<br>V <sub>IS</sub> = 0 to V <sub>CC</sub>                       | 3.0                 | –              | 0.1  | 0.4  | Ω    |
|                                                |                                                           |                                                                                          | 5.0                 | –              | 0.1  | 0.4  |      |
| R <sub>FLAT[ON]</sub>                          | ON Resistance<br>Flatness<br>(Note 4)                     | I <sub>COM</sub> = 10 mA<br>V <sub>IS</sub> = 0 to V <sub>CC</sub>                       | 3.0                 | –              | 1.12 | 1.5  | Ω    |
|                                                |                                                           |                                                                                          | 5.0                 | –              | 0.55 | 1.36 |      |
| I <sub>NO_[OFF]</sub><br>I <sub>NC_[OFF]</sub> | NO_, NC_<br>Off-Leakage Current<br>(Note 5)               | V <sub>COM</sub> = 0.3 V or 3.3 V<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.3 V or 3.3 V | 3.6                 | -1.0           | 0.01 | +1.0 | nA   |
|                                                |                                                           | V <sub>COM</sub> = 0 V or 5.0 V<br>V <sub>NO</sub> or V <sub>NC</sub> = 0 V or 5.0 V     | 5.5                 | -1.0           | 0.01 | +1.0 |      |
| I <sub>COM_[ON]</sub>                          | COM_<br>On-Leakage Current<br>(Note 5)                    | V <sub>COM</sub> = 0.3 V or 3.3 V<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.3 V or 3.3 V | 3.6                 | -2.0           | 0.01 | +2.0 | nA   |
|                                                |                                                           | V <sub>COM</sub> = 0 V or 5.0 V<br>V <sub>NO</sub> or V <sub>NC</sub> = 0 V or 5.0 V     | 5.5                 | -2.0           | 0.01 | +2.0 |      |

# ANALOG SWITCH AC CHARACTERISTICS

| Symbol            | Parameter                                   | Condition                                                                                                                                                                             | V <sub>CC</sub> (V) | -40°C to +85°C |      |     | Unit |
|-------------------|---------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|------|-----|------|
|                   |                                             |                                                                                                                                                                                       |                     | Min            | Typ  | Max |      |
| t <sub>ON</sub>   | Turn-On Time                                | V <sub>NC_</sub> , V <sub>NO_</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>IN[x]</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 1.8 to 5.5          | –              | –    | 30  | nS   |
| t <sub>OFF</sub>  | Turn-Off Time                               | V <sub>NC_</sub> , V <sub>NO_</sub> = V <sub>IH</sub> or V <sub>IL</sub><br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF<br>V <sub>IN[x]</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 1.8 to 5.5          | –              | –    | 40  | nS   |
| t <sub>BBM</sub>  | Break-Before-Make<br>Time Delay<br>(Note 5) | V <sub>NC_</sub> , V <sub>NO_</sub> = 1.5 V<br>R <sub>L</sub> = 300 Ω, C <sub>L</sub> = 35 pF                                                                                         | –                   | –              | 8.0  | –   | nS   |
| t <sub>SKEW</sub> | Skew<br>(Note 5)                            | R <sub>S</sub> = 39 Ω, C <sub>L</sub> = 50 pF                                                                                                                                         | –                   | –              | 0.15 | 2.0 | nS   |

2. R<sub>ON</sub> characterized for V<sub>CC</sub> range (1.65 V to 5.5 V).
3. ΔR<sub>ON</sub> = R<sub>ON</sub>(MAX) – R<sub>ON</sub>(MIN).
4. R<sub>FLAT[ON]</sub> = R<sub>ON</sub>(MAX) – R<sub>ON</sub>(MIN), measured over V<sub>CC</sub> range.
5. Guaranteed by design.

# ANALOG SWITCH APPLICATION CHARACTERISTICS

| Symbol                                         | Parameter                       | Condition                                                                                                                            | V <sub>CC</sub> (V) | -40°C to +85°C |            |     | Unit |
|------------------------------------------------|---------------------------------|--------------------------------------------------------------------------------------------------------------------------------------|---------------------|----------------|------------|-----|------|
|                                                |                                 |                                                                                                                                      |                     | Min            | Typ        | Max |      |
| Q                                              | Charge Injection                | V <sub>IN</sub> = V <sub>CC</sub> to GND<br>R <sub>In</sub> = 0 Ω, C <sub>L</sub> = 1.0 nF<br>Q = C <sub>L</sub> – ΔV <sub>OUT</sub> | 3.0<br>5.0          |                | 6.0<br>9.0 |     | pC   |
| VISO                                           | Off-Isolation                   | f = 10 MHz<br>V <sub>NO_</sub> , V <sub>NC_</sub> = 1.0 Vp-p<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5.0 pF                       | 1.65 to 5.5         |                | –50        |     | dB   |
|                                                |                                 | f = 1.0 MHz<br>V <sub>NO_</sub> , V <sub>NC_</sub> = 1.0 Vp-p<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5.0 pF                      |                     |                | –75        |     |      |
| VCT                                            | Cross-Talk                      | f = 10 MHz<br>V <sub>NO_</sub> , V <sub>NC_</sub> = 1.0 Vp-p<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5.0 pF                       | 1.65 to 5.5         |                | –80        |     | dB   |
|                                                |                                 | f = 1.0 MHz<br>V <sub>NO_</sub> , V <sub>NC_</sub> = 1.0 Vp-p<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5.0 pF                      |                     |                | –110       |     |      |
| BW                                             | On-Channel<br>–3.0 db Bandwidth | Signal = 0 dB<br>R <sub>L</sub> = 50 Ω, C <sub>L</sub> = 5.0 pF                                                                      | 1.8 to 5.0          |                | 90         |     | MHz  |
| THD                                            | Total Harmonic Distortion       | V <sub>COM</sub> = 2.0 Vp-p,<br>R <sub>L</sub> = 600 Ω, T <sub>A</sub> = 25°C                                                        | –                   |                | 0.02       |     | %    |
| C <sub>NO_[OFF]</sub><br>C <sub>NC_[OFF]</sub> | NO_, NC_<br>OFF-Capacitance     | F = 1.0 MHz                                                                                                                          | –                   |                | 15         |     | pF   |
| C <sub>NO_[ON]</sub><br>C <sub>NC_[ON]</sub>   | NO_, NC_<br>ON-Capacitance      | F = 1.0 MHz                                                                                                                          | –                   |                | 38         |     | pF   |

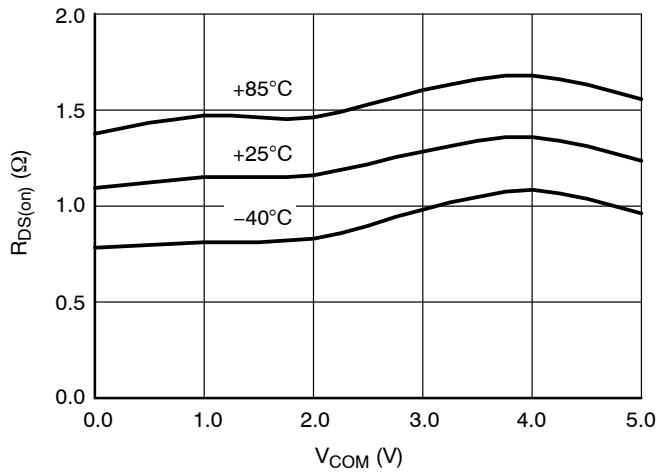


Figure 2.  $R_{DS(on)}$  @  $V_{CC} = 5.0$  V

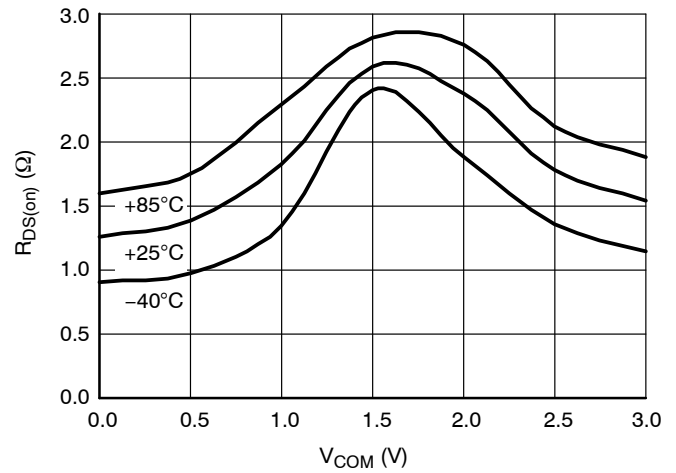


Figure 3.  $R_{DS(on)}$  @  $V_{CC} = 3.0$  V

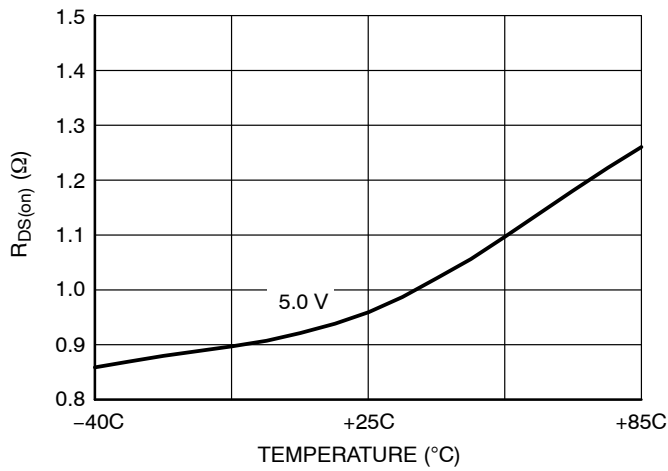


Figure 4.  $\Delta R_{DS(on)}$  @  $V_{CC} = 5.0$  V

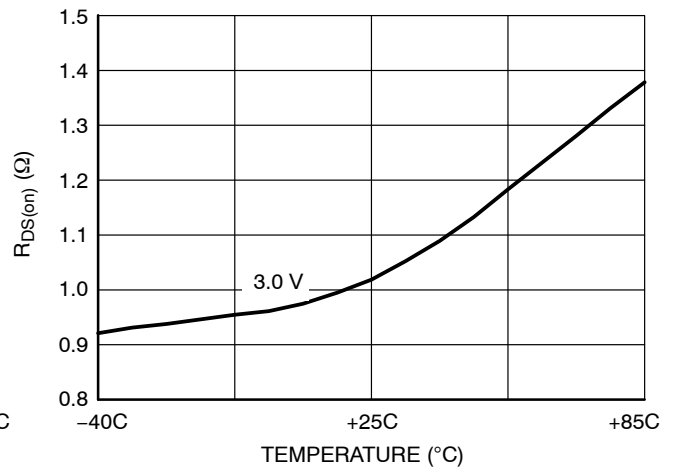


Figure 5.  $\Delta R_{DS(on)}$  @  $V_{CC} = 3.0$  V

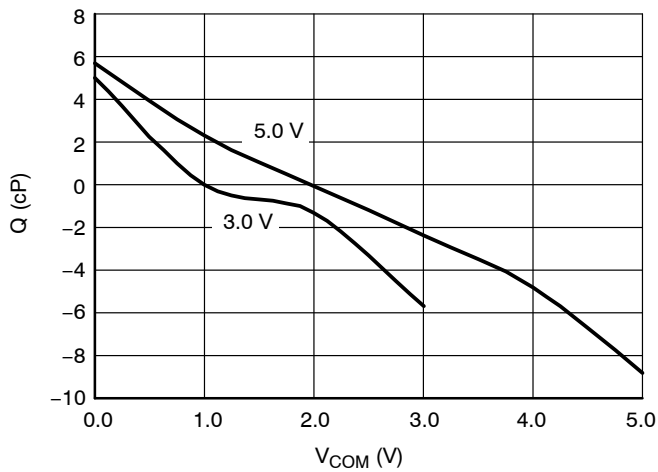


Figure 6. Charge Injection

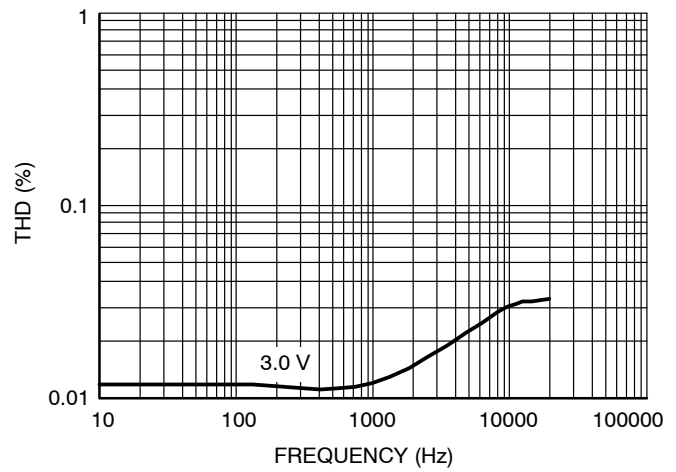


Figure 7. Total Harmonic Distortion

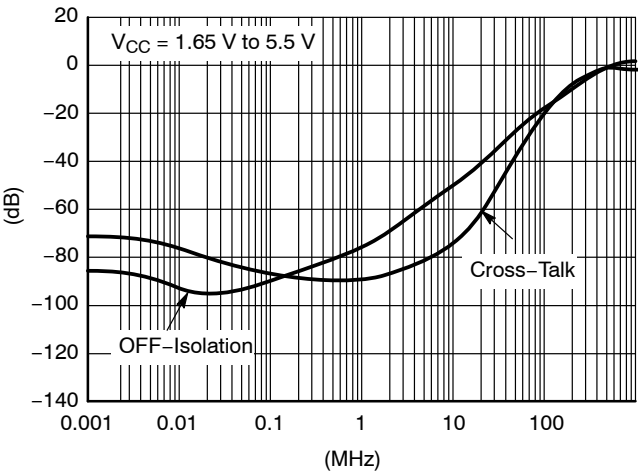


Figure 8. Frequency Response

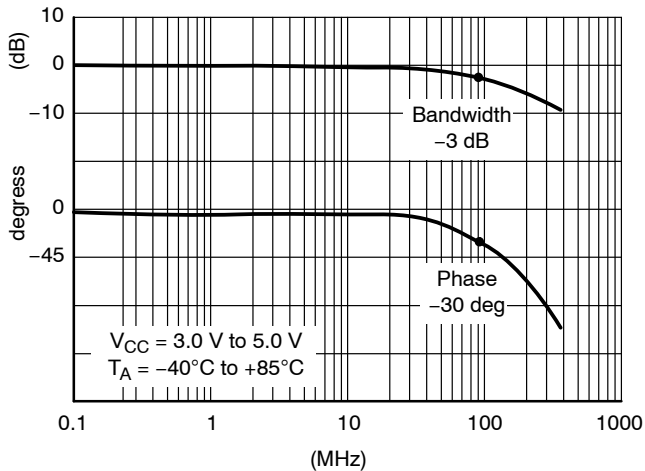


Figure 9. Bandwidth and Phase

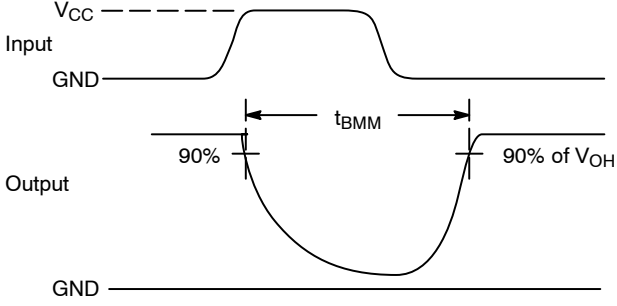
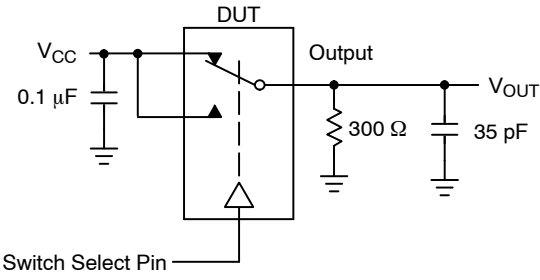


Figure 10.  $t_{BMM}$  (Time Break-Before-Make)

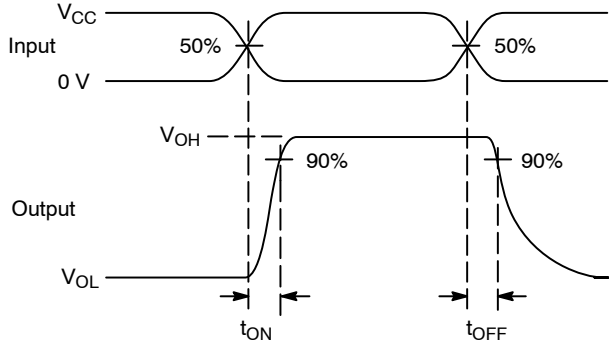
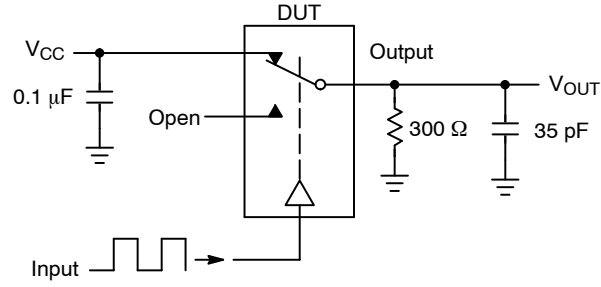


Figure 11.  $t_{ON}/t_{OFF}$

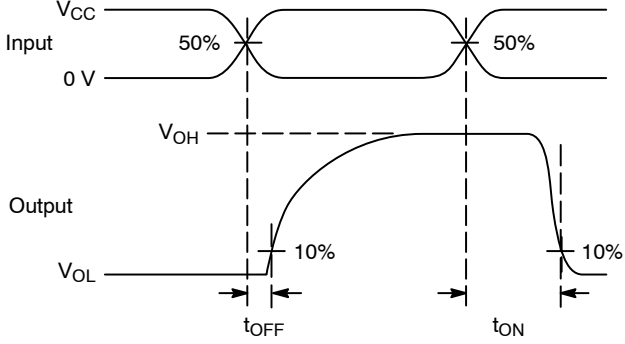
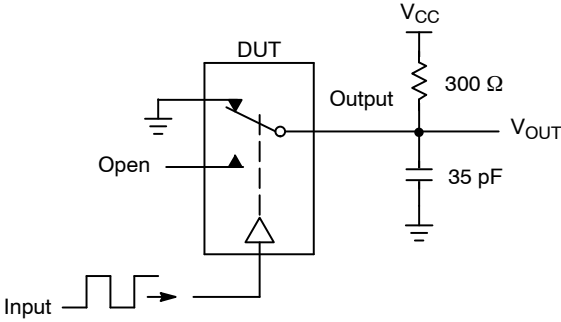
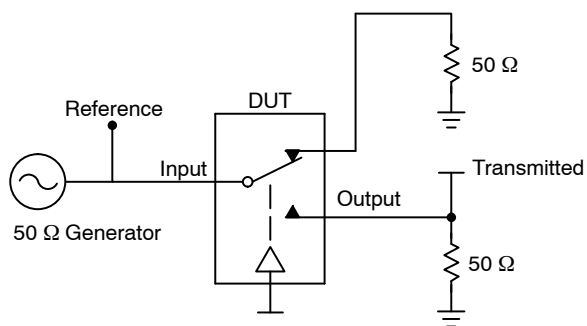


Figure 12.  $t_{ON}/t_{OFF}$



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.

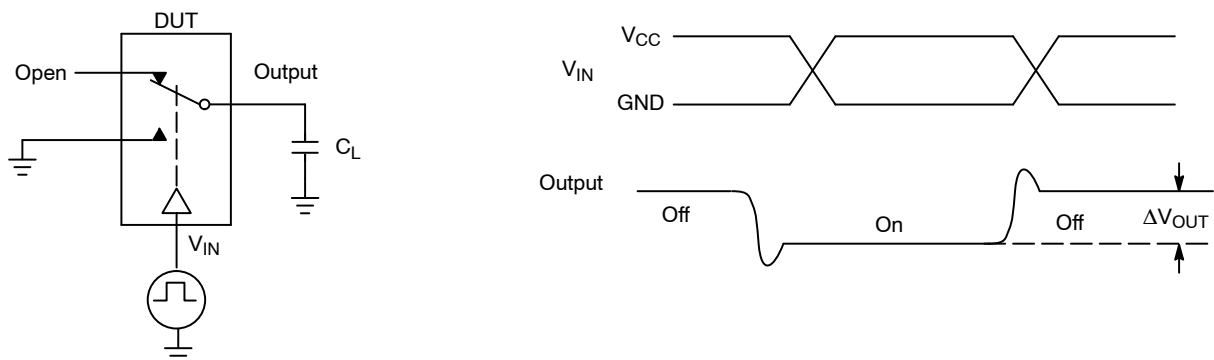
$$V_{ISO} = \text{Off Channel Isolation} = 20 \text{ Log} \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

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

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)/ $V_{ONL}$**

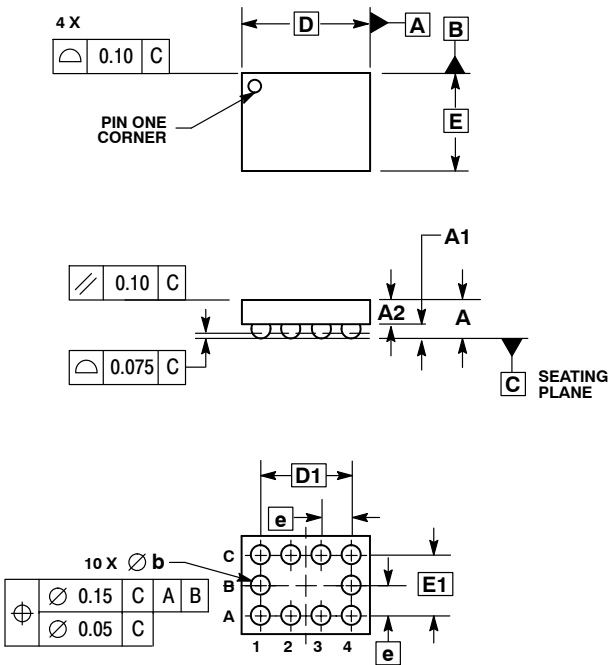


**Figure 14. Charge Injection: (Q)**

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   |       |





**Стандарт  
Электрон  
Связь**

Мы молодая и активно развивающаяся компания в области поставок электронных компонентов. Мы поставляем электронные компоненты отечественного и импортного производства напрямую от производителей и с крупнейших складов мира.

Благодаря сотрудничеству с мировыми поставщиками мы осуществляем комплексные и плановые поставки широчайшего спектра электронных компонентов.

Собственная эффективная логистика и склад в обеспечивает надежную поставку продукции в точно указанные сроки по всей России.

Мы осуществляем техническую поддержку нашим клиентам и предпродажную проверку качества продукции. На все поставляемые продукты мы предоставляем гарантию .

Осуществляем поставки продукции под контролем ВП МО РФ на предприятия военно-промышленного комплекса России , а также работаем в рамках 275 ФЗ с открытием отдельных счетов в уполномоченном банке. Система менеджмента качества компании соответствует требованиям ГОСТ ISO 9001.

Минимальные сроки поставки, гибкие цены, неограниченный ассортимент и индивидуальный подход к клиентам являются основой для выстраивания долгосрочного и эффективного сотрудничества с предприятиями радиоэлектронной промышленности, предприятиями ВПК и научно-исследовательскими институтами России.

С нами вы становитесь еще успешнее!

**Наши контакты:**

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Промышленная ул, дом № 19, литера Н,  
помещение 100-Н Офис 331