

# NLAS4717

## Analog Switch, High Bandwidth, Dual SPDT

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  $4.5\ \Omega$  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:

- ♦ Micro10: 3.0 x 5.0 mm
- ♦ Flip-Chip-10: 2.0 x 1.5 mm

### Features

- Low  $R_{DS(on)}$ :  $4.5\ \Omega$  @ 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  $\leq 6.0\ \text{pC}$
- Low Standby Current –  $I_{CC} = 1.0\ \text{nA}$  (Max) @  $T_A = 25^\circ\text{C}$
- OVT\* on Pins 4 and 8 (CTRL Logic Pins)
- Pb-Free Packages are Available

### Typical Applications

- Cell Phones
- PDAs
- MP3s
- Digital Still Cameras

### Important Information

- ESD Protection:  
HBM = 2000 V, MM = 200 V
- Latchup Max Rating: 200 mA (Per JEDEC EIA/JESD78)
- Pin-to-Pin Compatible with MAX4717

### \*OVT

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



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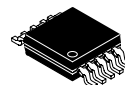
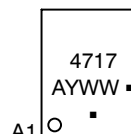
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### MARKING DIAGRAMS

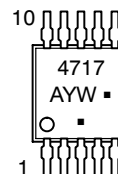


A1

FLIP-CHIP-10  
CASE 489AA



Micro10  
CASE 846B



A = Assembly Location  
Y = Year  
W, WW = Work Week  
▪ = Pb-Free Package

### FUNCTION TABLE

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

### ORDERING INFORMATION

| Device        | Package                | Shipping†          |
|---------------|------------------------|--------------------|
| NLAS4717FCT1  | Flip-Chip-10           | 3000 / Tape & Reel |
| NLAS4717FCT1G | Flip-Chip-10 (Pb-Free) | 3000 / Tape & Reel |
| NLAS4717MR2   | Micro10                | 4000 / Tape & Reel |
| NLAS4717MR2G  | 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.

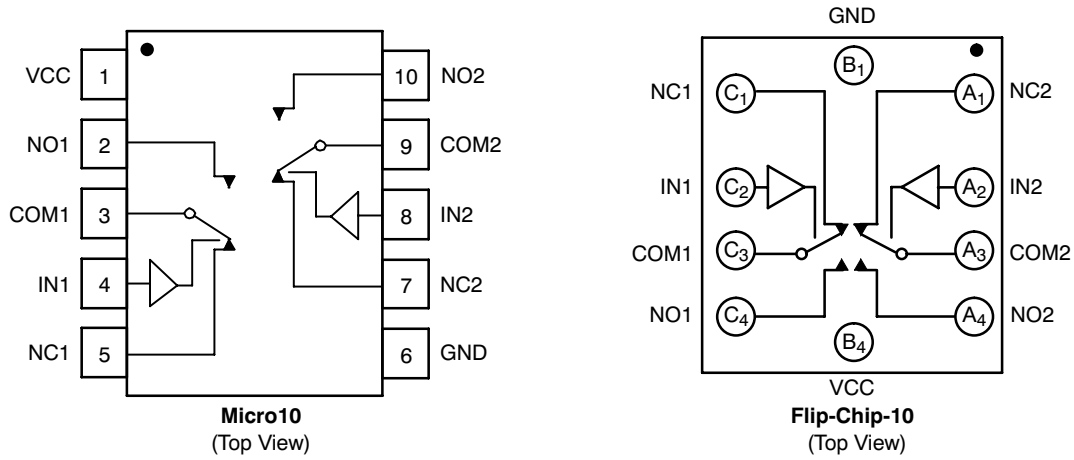


Figure 1. Device Circuit Diagrams and Pin Configurations

#### MAXIMUM RATINGS

| Symbol          | Parameter                                                                                | Value                                           | Unit |
|-----------------|------------------------------------------------------------------------------------------|-------------------------------------------------|------|
| V+              | Positive 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    | V <sub>CC</sub> = 3.3 V ± 0.3 V<br>V <sub>CC</sub> = 5.0 V ± 0.5 V |                 | ns/V |
|                                 |                                    | 0                                                                  | 100             |      |
|                                 |                                    | 0                                                                  | 20              |      |

#### 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                                | 5.0                                     | -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>5.0                       | -<br>-<br>-                                            | 1.0<br>1.0<br>1.0                                     | μA   |
| V <sub>IS</sub> | Analog Signal Range      | Key parameter                                                           | -                                       | 0                                                      | V <sub>CC</sub>                                       | V    |

**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)                                 | V <sub>CC</sub> = 3.0 V<br>I <sub>COM</sub> = 10 mA<br>V <sub>NO</sub> or V <sub>NC</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 3.0                 | -               |      | 4.5  | Ω    |
|                                                |                                                           | V <sub>CC</sub> = 5.0 V<br>I <sub>COM</sub> = 10 mA<br>V <sub>NO</sub> or V <sub>NC</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 5.0                 | -               |      | 3.5  |      |
| ΔR <sub>ON</sub>                               | ON Resistance<br>Match Between Channels<br>(Note 2 and 3) | V <sub>CC</sub> = 3.6 V<br>I <sub>COM</sub> = 10 mA<br>V <sub>NO</sub> or V <sub>NC</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 3.6                 | -               | 0.1  | 0.4  | Ω    |
|                                                |                                                           | V <sub>CC</sub> = 5.5 V<br>I <sub>COM</sub> = 10 mA<br>V <sub>NO</sub> or V <sub>NC</sub> = V <sub>IH</sub> or V <sub>IL</sub> | 5.5                 |                 |      |      |      |
| 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                 | -               |      | 1.5  | Ω    |
|                                                |                                                           | I <sub>COM</sub> = 10 mA<br>V <sub>IS</sub> = 0 to V <sub>CC</sub>                                                             | 5.5                 | -               |      | 1.36 |      |
| I <sub>NO_[OFF]</sub><br>I <sub>NC_[OFF]</sub> | NO_, NC_<br>Off-Leakage Current<br>(Note 5)               | V <sub>CC</sub> = 3.6 V<br>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>CC</sub> = 5.5 V<br>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>CC</sub> = 3.6 V<br>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>CC</sub> = 5.5 V<br>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          |                 | 40         |     | 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 = 10 MHz                                                                                                                           | -                   |                 | 30         |     | pF   |
| C <sub>NO_[ON]</sub><br>C <sub>NC_[ON]</sub>   | NO_, NC_<br>ON-Capacitance      | F = 10 MHz                                                                                                                           | -                   |                 | 110        |     | pF   |

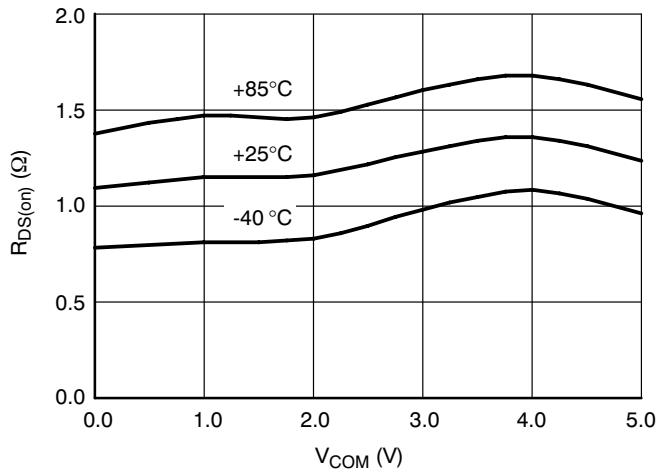


Figure 2. Low  $R_{DS(on)}$  @  $V_{CC} = 5.0$  V

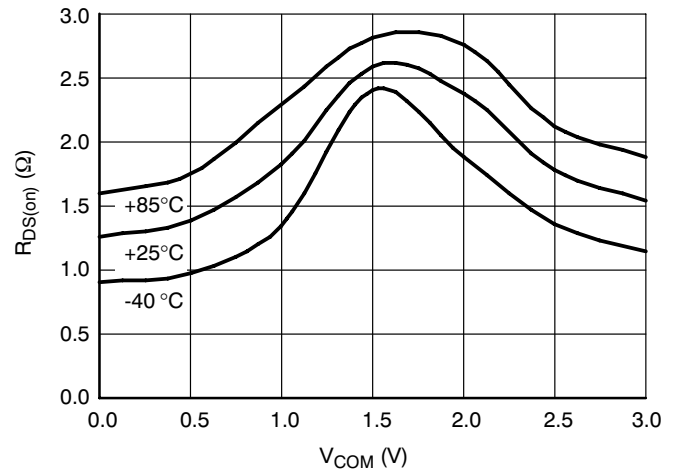


Figure 3. Low  $R_{DS(on)}$  @  $V_{CC} = 3.0$  V

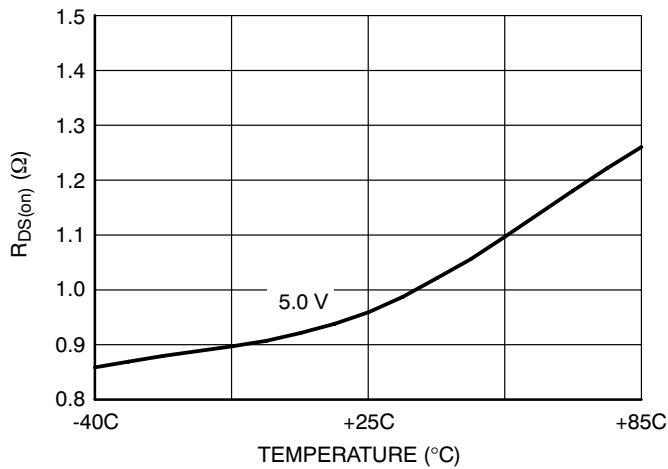


Figure 4. Delta  $R_{DS(on)}$  @  $V_{CC} = 5.0$  V

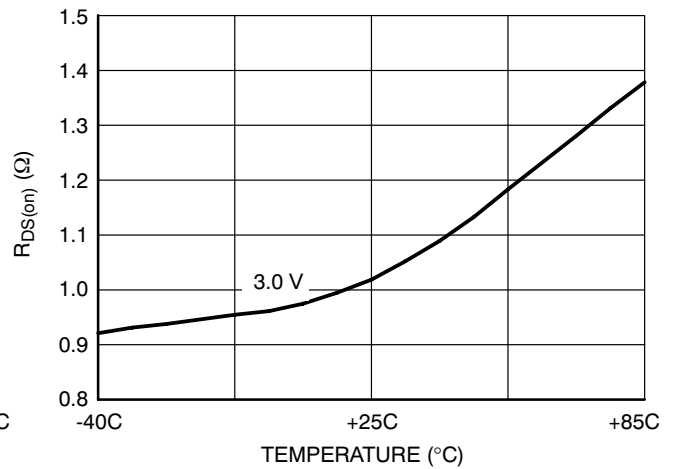


Figure 5. Delta  $R_{DS(on)}$  @  $V_{CC} = 3.0$  V

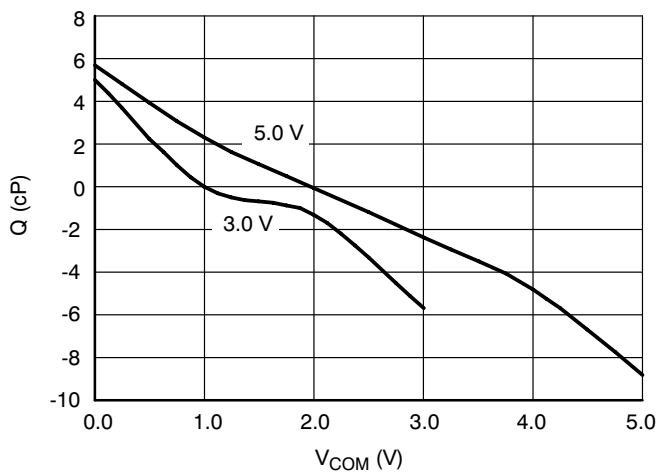


Figure 6. Charge Injection

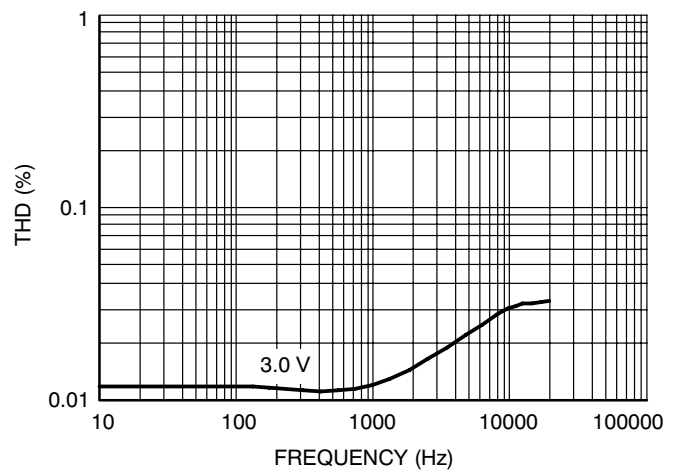


Figure 7. Total Harmonic Distortion

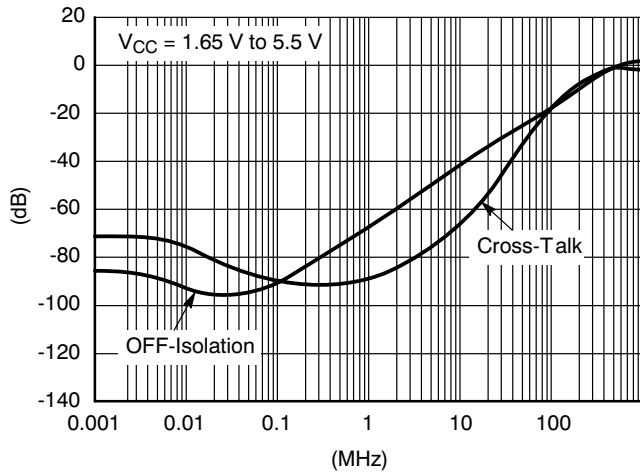


Figure 8. Frequency Response

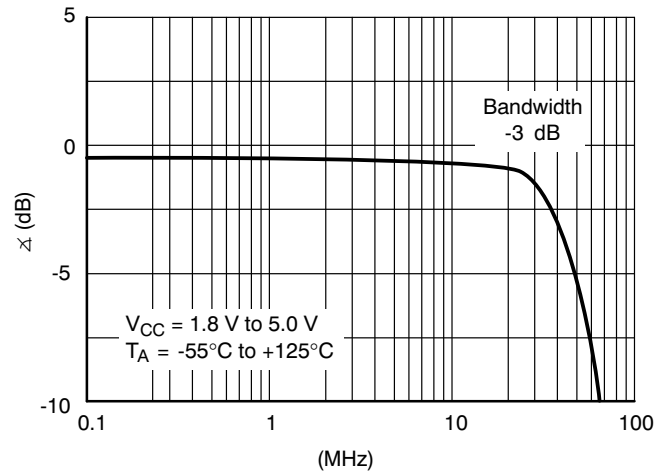


Figure 9. Bandwidth and Phase

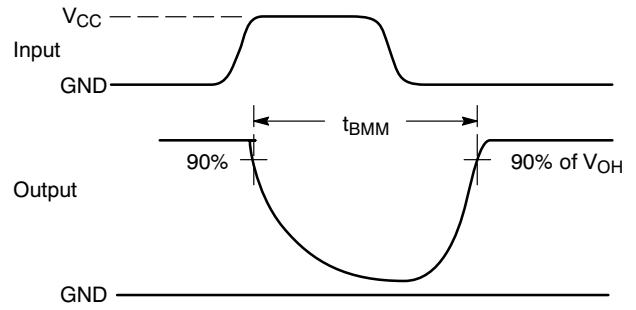
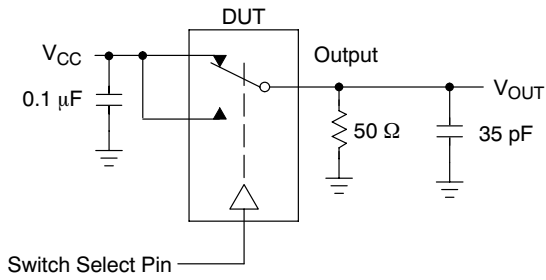


Figure 10.  $t_{BMM}$  (Time Break-Before-Make)

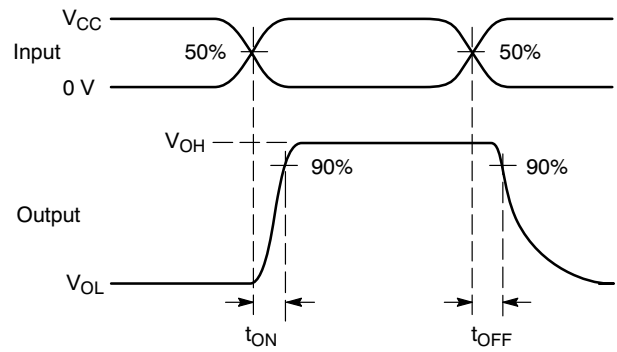
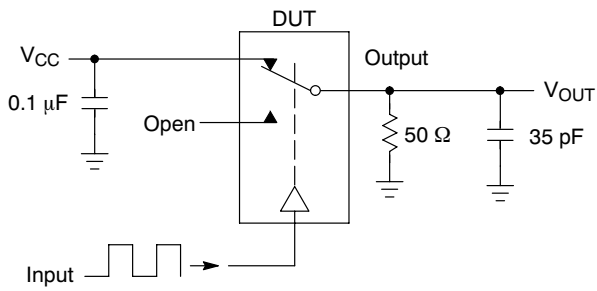


Figure 11.  $t_{ON}/t_{OFF}$

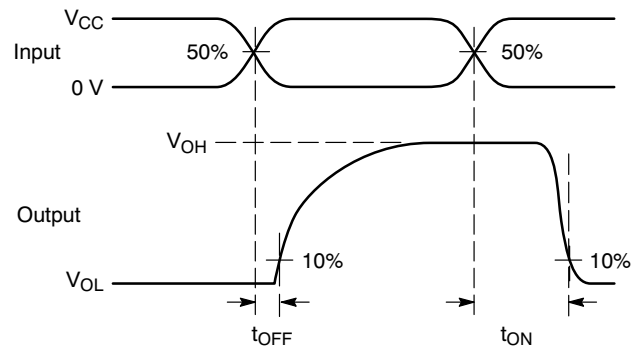
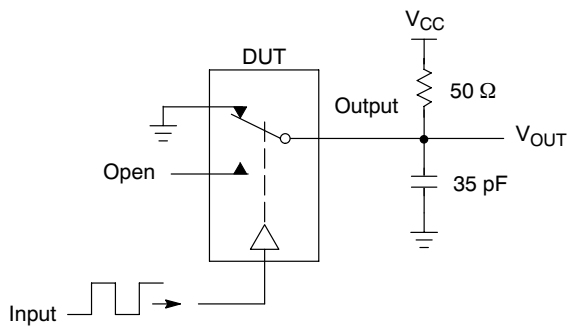
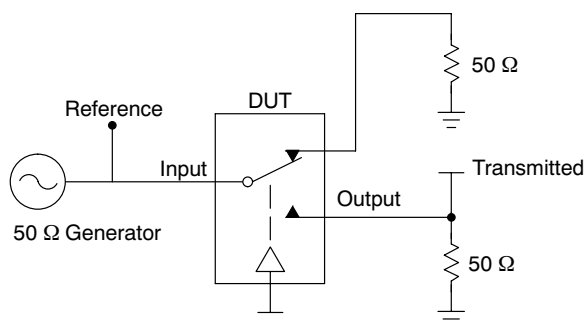


Figure 12.  $t_{ON}/t_{OFF}$



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.

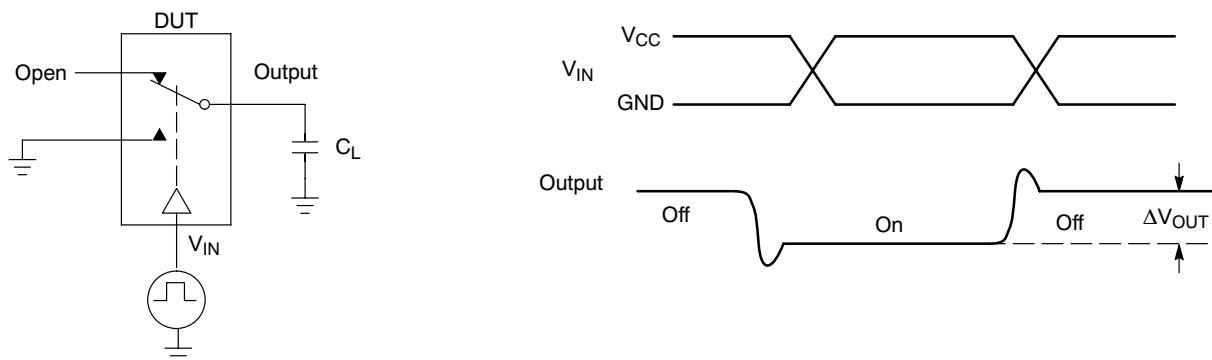
$$V_{ISO} = \text{Off Channel Isolation} = 20 \log \left( \frac{V_{OUT}}{V_{IN}} \right) \text{ for } V_{IN} \text{ at } 100 \text{ kHz}$$

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

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)**



# MECHANICAL CASE OUTLINE

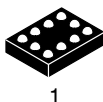
## PACKAGE DIMENSIONS

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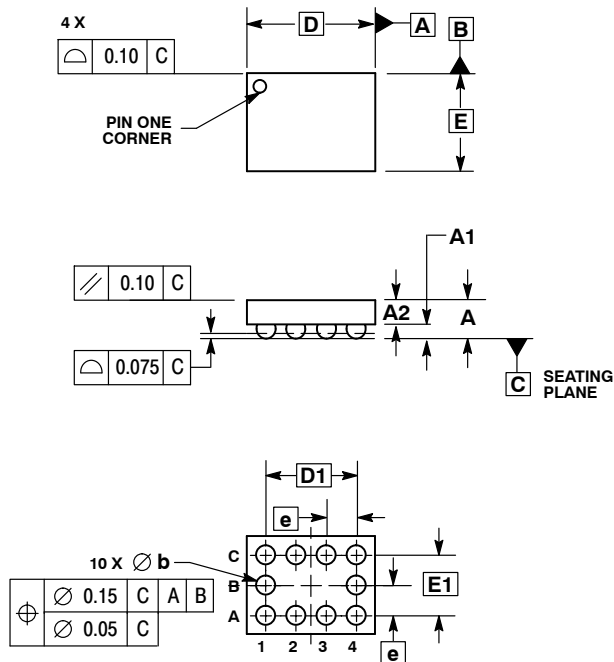


### 10 PIN FLIP-CHIP CASE 489AA-01 ISSUE A

DATE 04 MAY 2004



SCALE 4:1

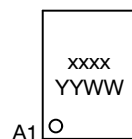


#### NOTES:

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   |       |

#### GENERIC MARKING DIAGRAM\*



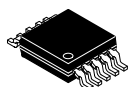
xxxx = Specific Device Code  
YY = Year  
WW = Work Week

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present.

|                  |                  |                                                                                                                                                                                  |
|------------------|------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| DOCUMENT NUMBER: | 98AON12946D      | Electronic versions are uncontrolled except when accessed directly from the Document Repository. Printed versions are uncontrolled except when stamped "CONTROLLED COPY" in red. |
| DESCRIPTION:     | 10 PIN FLIP-CHIP | PAGE 1 OF 1                                                                                                                                                                      |

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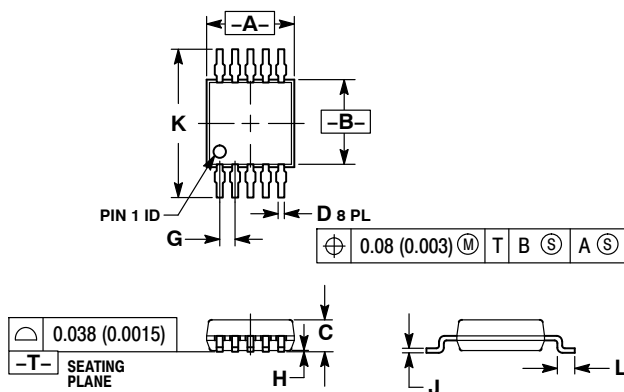
# MECHANICAL CASE OUTLINE PACKAGE DIMENSIONS



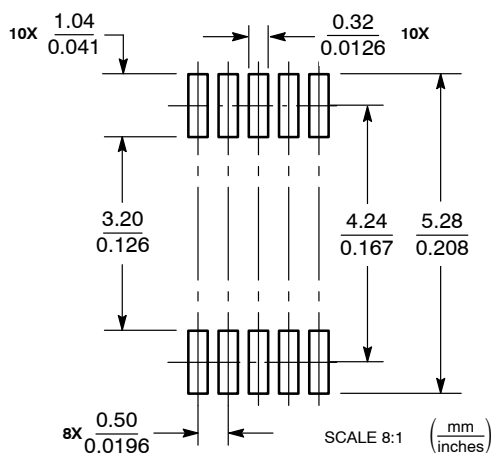
SCALE 2:1

**Micro10**  
CASE 846B-03  
ISSUE D

DATE 07 DEC 2004



## SOLDERING FOOTPRINT



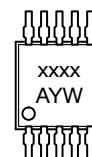
**Micro10**

## 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 |

## GENERIC MARKING DIAGRAM\*



- xxxx = Device Code
- A = Assembly Location
- Y = Year
- W = Work Week
- = Pb-Free Package

\*This information is generic. Please refer to device data sheet for actual part marking. Pb-Free indicator, "G" or microdot "▪", may or may not be present. Some products may not follow the Generic Marking.

|                         |                    |                                                                                                                                                                                  |
|-------------------------|--------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
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| <b>DESCRIPTION:</b>     | <b>Micro10</b>     | <b>PAGE 1 OF 1</b>                                                                                                                                                               |

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