

**SOTINY™ Low Resistance, Low-Voltage  
Single-Supply SPDT Switch**
**Features**

- Low On-Resistance: 10-ohm max.
- $R_{ON}$  Matching: 2-ohm max.
- $R_{ON}$  Flatness: 3.5-ohm max.
- Low 0.5nA Input Leakage at 25 °C
- 2V to 6V Single-Supply Operation
- Fast Switching Time
  - 15ns  $t_{ON}$
  - 7ns  $t_{OFF}$
- Break-Before-Make Switching Guaranteed
- 5pC max Charge Injection
- 225MHz Channel Bandwidth
- 76dB Off-Isolation at 1MHz
- TTL/CMOS Logic Compatible
- Low Power Consumption: 5 $\mu$ W
- Improved Direct Replacement for MAX4599
- Packaging (Pb-free & Green available):
  - 6-pin Small Compact SC70 (C)
  - 6-pin SOT-23 (T)

**Applications**

- Communication Circuits
- Cellular Phones
- Audio and Video Signal Routing
- Portable Battery-Operated Equipment
- Data Acquisition Systems
- Computer Peripherals
- Telecommunications
- Relay Replacement
- Wireless Terminals and Peripherals

**Truth Tables**

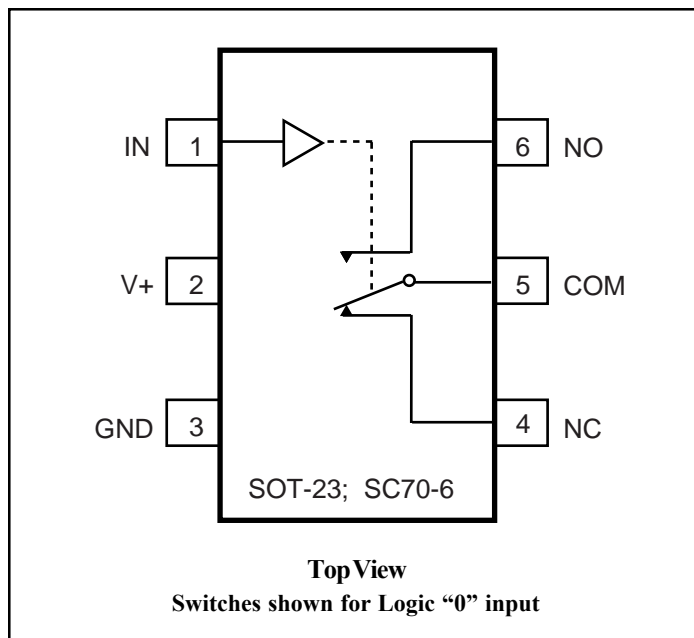
|       | PI5A4599A |     |
|-------|-----------|-----|
| Logic | NC        | NO  |
| 0     | ON        | OFF |
| 1     | OFF       | ON  |

**Description**

The PI5A4599A is an improved, direct replacement for the MAX4599 single-pole, double-throw (SPDT) analog switch. Improved specifications include a low maximum ON resistance of 10-ohm and fast switching times ( $t_{ON} = 15\text{ns max.}$ ,  $t_{OFF} = 7\text{ns max.}$ ) with 5V supply operation. With a 2.5V supply, resistance is a low 400-ohm max.

Specifications are given for 2.5V, 3.3V and 5V power supply operation. Operating voltage range is 2.0V to 6.0V.

To minimize PC board area use, the PI5A4599A is available in a compact 6-pin SC70 package. Operating temperature range is  $-40^{\circ}\text{C}$  to  $85^{\circ}\text{C}$ .

**Functional Diagram, Pin Configuration**




### Absolute Maximum Ratings

Voltages Referenced to GND  
 V+ ..... -0.5V to +7V  
 V<sub>IN</sub>, V<sub>COM</sub>, V<sub>NC</sub>, V<sub>NO</sub> (Note 1) ..... -0.5V to V<sub>CC</sub>+2V  
 or 30mA, whichever occurs first  
 Current (any terminal) ..... ±30mA  
 Peak Current, COM, NO, NC  
 (Pulsed at 1ms, 10% duty cycle) ..... ±30mA

### Thermal Information

Continuous Power Dissipation  
 SC70-6 (derate 3.1mW/°C above +70°C) ..... 245mW  
 Storage Temperature ..... -65°C to +150°C  
 Lead Temperature (soldering, 10s) ..... +300°C

**Note:**

1. Signals on NC, NO, COM, or IN exceeding V+ or GND are clamped by internal diodes. Limit forward diode current to 30mA.

**Caution:** Stresses beyond those listed under “Absolute Maximum Ratings” may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions beyond those indicated in the operational sections of this specification is not implied.

### Electrical Specifications - Single +5V Supply

(V+ = +5V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter   | Symbol  | Conditions   | Temp.(°C) | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units |
|---|---|--|-----------|---------------------|---------------------|---------------------|-------|
| <b>Analog Switch</b>                                |   |  |           |                     |                     |                     |       |
| Analog Signal Range <sup>(3)</sup>                  | V <sub>ANALOG</sub>                             |  | Full      | 0                   |                     | V+                  | V     |
| On Resistance                                       | R <sub>ON</sub>                                 | V+ = 4.5V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = +2.5V         | 25        |                     | 7                   | 8                   | ohm   |
| On-Resistance Match Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                |  | Full      |                     |                     | 10                  |       |
| On-Resistance Flatness <sup>(5)</sup>               | R <sub>FLAT(ON)</sub>                           | V+ = 5V,<br>I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1V, 2.5V, 4V | 25        |                     | 0.1                 | 0.5                 |       |
|   |   |  | Full      |                     |                     | 1                   |       |
| NO or NC Off Leakage Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub> or<br>I <sub>NC(OFF)</sub> | V+ = 5.5V, V <sub>COM</sub> = 0V,<br>V <sub>NO</sub> or V <sub>NC</sub> = 4.5V             | 25        | -0.5                | 0.18                | 0.5                 | nA    |
|   |   |  | Full      |                     |                     | 5                   |       |
| COM Off Leakage Current <sup>(6)</sup>              | I <sub>COM(OFF)</sub>                           | V+ = 5.5V,<br>V <sub>COM</sub> = + 4.5V, V <sub>NO</sub> or<br>V <sub>NC</sub> = ± 0V      | 25        | -1.0                | 0.20                | 1.0                 |       |
|   |   |  | Full      |                     |                     | 10                  |       |
| COM On Leakage Current <sup>(6)</sup>               | I <sub>COM(ON)</sub>                            | V+ = 5.5V, V <sub>COM</sub> = +4.5V<br>V <sub>NO</sub> or V <sub>NC</sub> = +4.5V          | 25        | -1.0                | 0.20                | 1.0                 |       |
|   |   |  | Full      |                     |                     | 10                  |       |

**Electrical Specifications - Single +5V Supply (continued)**

(V+ = +5V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter                       | Symbol                | Conditions  | Temp(°C)   | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units |    |
|---------------------------------|-----------------------|---|--|---------------------|---------------------|---------------------|-------|----|
| <b>Logic Input</b>              |                       |   |  |                     |                     |                     |       |    |
| Input High Voltage              | V <sub>IH</sub>       | Guaranteed logic High Level   | Full   | 2                   |                     |                     | V     |    |
| Input Low Voltage               | V <sub>IL</sub>       | Guaranteed logic Low Level  |  |                     |                     | 0.8                 |       |    |
| Input Current with Voltage High | I <sub>INH</sub>      | V <sub>IN</sub> = 2.4V, all others = 0.8V                             |  | -1                  | 0.005               | 1                   | μA    |    |
| Input Current with Voltage Low  | I <sub>INL</sub>      | V <sub>IN</sub> = 0.8V, all others = 2.4V                             |  | -1                  | 0.005               | 1                   |       |    |
| <b>Dynamic</b>                  |                       |   |  |                     |                     |                     |       |    |
| Turn-On Time                    | t <sub>ON</sub>       | V <sub>CC</sub> = 5V, Figure 1  | 25   |                     | 7                   | 15                  | ns    |    |
|                                 |                       |   | Full   |                     |                     | 20                  |       |    |
| Turn-Off Time                   | t <sub>OFF</sub>      |   | 25   |                     | 1                   | 7                   |       |    |
|                                 |                       |   | Full   |                     |                     | 10                  |       |    |
| Break-Before-Make               | t <sub>BBM</sub>      | Figure 3  | 25   |                     |                     | 10                  |       |    |
|                                 |                       |   | Full   | 5                   |                     |                     |       |    |
| Charge Injection <sup>(3)</sup> | Q                     |   | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0 ohm, Figure 2 | 25                  |                     | 1.5                 | 5     | pC |
| Off Isolation                   | OIRR                  |   | R <sub>L</sub> = 50 ohms, C <sub>L</sub> = 5pF,<br>f = 1MHz, Figure 4              |                     |                     | 80                  |       | dB |
| Crosstalk <sup>(8)</sup>        | X <sub>TALK</sub>     | R <sub>L</sub> = 50 ohms, C <sub>L</sub> = 5pF,<br>f = 1MHz, Figure 5 |  |                     | 80                  |                     |       |    |
| NC or NO Capacitance            | C <sub>(OFF)</sub>    | f = 1MHz, Figure 6  |  |                     | 5.0                 |                     | pF    |    |
| COM Off Capacitance             | C <sub>COM(OFF)</sub> |   |  |                     | 5.0                 |                     |       |    |
| COM On Capacitance              | C <sub>COM(ON)</sub>  |   | f = 1MHz, Figure 7   |                     |                     | 13                  |       |    |
| -3dB Bandwidth                  | BW                    | R <sub>L</sub> = 50 ohms, Figure 8                                    | Full   |                     | 300                 |                     | MHz   |    |
| <b>Supply</b>                   |                       |   |  |                     |                     |                     |       |    |
| Power-Supply Range              | V+                    | V <sub>CC</sub> = 5.5V, V <sub>IN</sub> = 0V or V+                    | Full   | 2                   |                     | 6                   | V     |    |
| Positive Supply Current         | I+                    |   |  |                     |                     | 1                   | μA    |    |

**Notes:**

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
5. Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
7. Off Isolation = 20log<sub>10</sub> [ V<sub>COM</sub> / (V<sub>NO</sub> or V<sub>NC</sub>) ]. See Figure 3.
8. Between any two switches. See Figure 4.

**Electrical Specifications - Single +3.3V Supply**

 (V+ = +3.3V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter  | Symbol                | Conditions  | Temp.(°C) | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units |  |
|--|-----------------------|---|-----------|---------------------|---------------------|---------------------|-------|--|
| <b>Analog Switch</b>                                   |                       |   |           |                     |                     |                     |       |  |
| Analog Signal Range <sup>(3)</sup>                     | V <sub>ANALOG</sub>   |   |           | 0                   |                     | V+                  | V     |  |
| On-Resistance  | R <sub>ON</sub>       | V+ = 3V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1.5V         | 25        |                     | 12                  | 14.0                | Ω     |  |
|  |                       |   | Full      |                     |                     | 17                  |       |  |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> |                       | V+ = 3.3V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V | 25        |                     | 0.2                 | 0.5                 |       |  |
|  |                       |   | Full      |                     |                     | 1                   |       |  |
| On-Resistance<br>Flatness <sup>(3,5)</sup>             | R <sub>FLAT(ON)</sub> | V+ = 3.3V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V | 25        |                     | 0.5                 | 4                   |       |  |
|  |                       |   | Full      |                     |                     | 5                   |       |  |
| <b>Dynamic</b>   |                       |   |           |                     |                     |                     |       |  |
| Turn-On Time   | t <sub>ON</sub>       | V+ = 3.3V, V <sub>NO</sub><br>or V <sub>NC</sub> = 1.5V, Figure 1                       | 25        |                     | 15                  | 25                  | ns    |  |
|  |                       |   | Full      |                     |                     | 40                  |       |  |
| Turn-Off Time  | t <sub>OFF</sub>      |   | 25        |                     | 1.5                 | 12                  |       |  |
|  |                       |   | Full      |                     |                     | 20                  |       |  |
| Break-Before-Make                                      | t <sub>BBM</sub>      |   | Figure 3  | 25                  |                     | 10                  |       |  |
|  |                       |   |           | Full                | 5                   |                     |       |  |
| Charge Injection <sup>(3)</sup>                        | Q                     | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0V, Figure 2         | 25        |                     | 1.3                 | 5                   | pC    |  |
| <b>Supply</b>  |                       |   |           |                     |                     |                     |       |  |
| Positive Supply Current                                | I+                    | V+ = 3.6V, V <sub>IN</sub> = 0V or V+<br>All Channels on or off                         | Full      |                     |                     | 1                   | μA    |  |
| <b>Logic Input</b>                                     |                       |   |           |                     |                     |                     |       |  |
| Input High Voltage                                     | V <sub>IH</sub>       | Guaranteed logic high level   | Full      | 2                   |                     |                     | V     |  |
| Input Low Voltage                                      | V <sub>IL</sub>       | Guaranteed logic low level  | Full      |                     |                     | 0.8                 |       |  |
| Input High Current                                     | I <sub>INH</sub>      | V <sub>IN</sub> = 2.4V, all others = 0.8V   | Full      | -1                  |                     | 1                   | μA    |  |
| Input Low Current                                      | I <sub>INL</sub>      | V <sub>IN</sub> = 0.8V, all others = 2.4V   | Full      | -1                  |                     | 1                   |       |  |

**Notes:**

- The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
- Guaranteed by design.
- ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
- Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.
- Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
- Off Isolation = 20log<sub>10</sub> [ V<sub>COM</sub> / (V<sub>NO</sub> or V<sub>NC</sub>) ]. See Figure 4.
- Between any two switches. See Figure 5.

**Electrical Specifications - Single +2.5V Supply**

(V+ = +2.5V ± 10%, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

| Parameter  | Symbol                | Conditions  | Temp.(°C) | Min. <sup>(1)</sup> | Typ. <sup>(2)</sup> | Max. <sup>(1)</sup> | Units |
|--|-----------------------|---|-----------|---------------------|---------------------|---------------------|-------|
| <b>Analog Switch</b>                                   |                       |   |           |                     |                     |                     |       |
| Analog Signal Range <sup>(3)</sup>                     | V <sub>ANALOG</sub>   |   |           | 0                   |                     | V+                  | V     |
| On-Resistance  | R <sub>ON</sub>       | V+ = 2.5V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1.5V       | 25        |                     | 20                  | 22                  | Ω     |
|  |                       |   | Full      |                     |                     | 26                  |       |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>      | V+ = 2.5V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V | 25        |                     | 0.3                 | 0.5                 |       |
|  |                       |   | Full      |                     |                     | 1                   |       |
| On-Resistance<br>Flatness <sup>(3,5)</sup>             | R <sub>FLAT(ON)</sub> | V+ = 2.5V, I <sub>COM</sub> = -30mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 0.8V, 2.5V | 25        |                     | 0.5                 | 5                   |       |
|  |                       |   | Full      |                     |                     | 6                   |       |
| <b>Dynamic</b>   |                       |   |           |                     |                     |                     |       |
| Turn-On Time   | t <sub>ON</sub>       | V+ = 2.5V, V <sub>NO</sub><br>or V <sub>NC</sub> = 1.5V, Figure 1                       | 25        |                     | 20                  | 30                  | ns    |
|  |                       |   | Full      |                     | -                   | 45                  |       |
| Turn-Off Time  | t <sub>OFF</sub>      | V+ = 2.5V, V <sub>NO</sub><br>or V <sub>NC</sub> = 1.5V, Figure 1                       | 25        |                     |                     | 20                  |       |
|  |                       |   | Full      |                     | -                   | 30                  |       |
| Break-Before-Make                                      | t <sub>BBM</sub>      | Figure 3  | 25        |                     | 10                  |                     |       |
|  |                       |   | Full      | 5                   |                     |                     |       |
| Charge Injection <sup>(3)</sup>                        | Q                     | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0V, Figure 2         | 25        |                     | 0.9                 | 5                   | pC    |
| <b>Supply</b>  |                       |   |           |                     |                     |                     |       |
| Positive Supply Current                                | I+                    | V+ = 2.5V, V <sub>IN</sub> = 0V or V+<br>All Channels on or off                         | Full      |                     |                     | 1                   | μA    |
| <b>Logic Input</b>                                     |                       |   |           |                     |                     |                     |       |
| Input High Voltage                                     | V <sub>IH</sub>       | Guaranteed logic high level   | Full      | 2                   |                     |                     | V     |
| Input Low Voltage                                      | V <sub>IL</sub>       | Guaranteed logic low level  | Full      |                     |                     | 0.8                 |       |
| Input High Current                                     | I <sub>INH</sub>      | V <sub>IN</sub> = 2.4V, all others = 0.8V   | Full      | -1                  |                     | 1                   | μA    |
| Input Low Current                                      | I <sub>INL</sub>      | V <sub>IN</sub> = 0.8V, all others = 2.4V   | Full      | -1                  |                     | 1                   |       |

**Notes:**

1. The algebraic convention, where most negative value is a minimum and most positive is a maximum, is used in this data sheet.
2. Typical values are for DESIGN AID ONLY, not guaranteed or subject to production testing.
3. Guaranteed by design.
4. ΔR<sub>ON</sub> = R<sub>ON</sub> max. - R<sub>ON</sub> min.
5. Flatness is defined as the difference between the maximum and minimum value of On-resistance measured.
6. Leakage parameters are 100% tested at maximum rated hot temperature and guaranteed by correlation at +25°C.
7. Off Isolation = 20log<sub>10</sub> [ V<sub>COM</sub> / (V<sub>NO</sub> or V<sub>NC</sub>) ]. See Figure 4.
8. Between any two switches. See Figure 5.

Test Circuits/Timing Diagrams

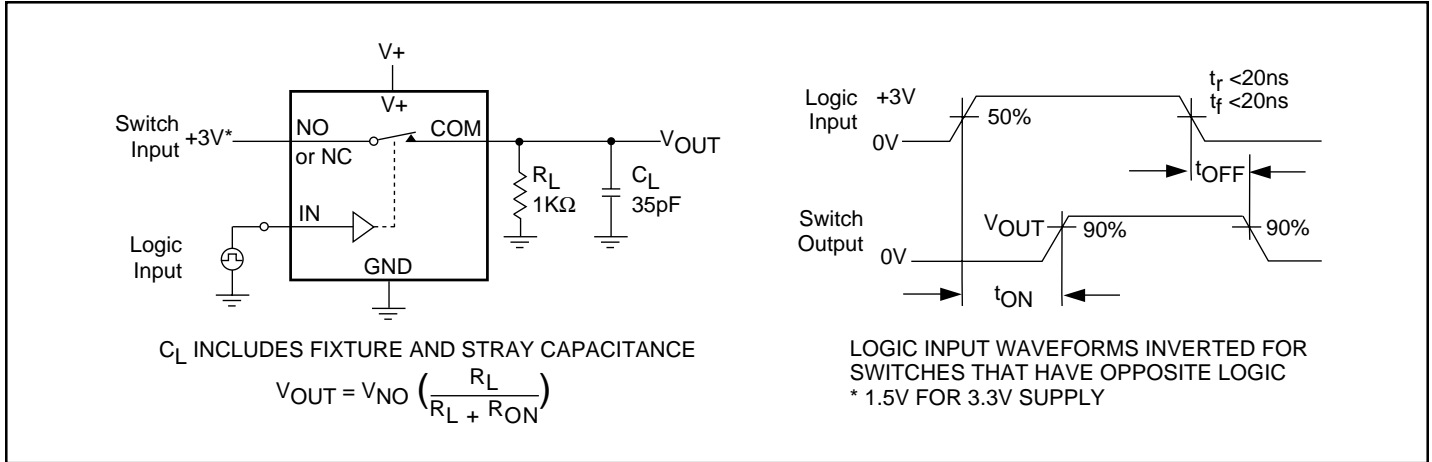


Figure 1. Switching Time

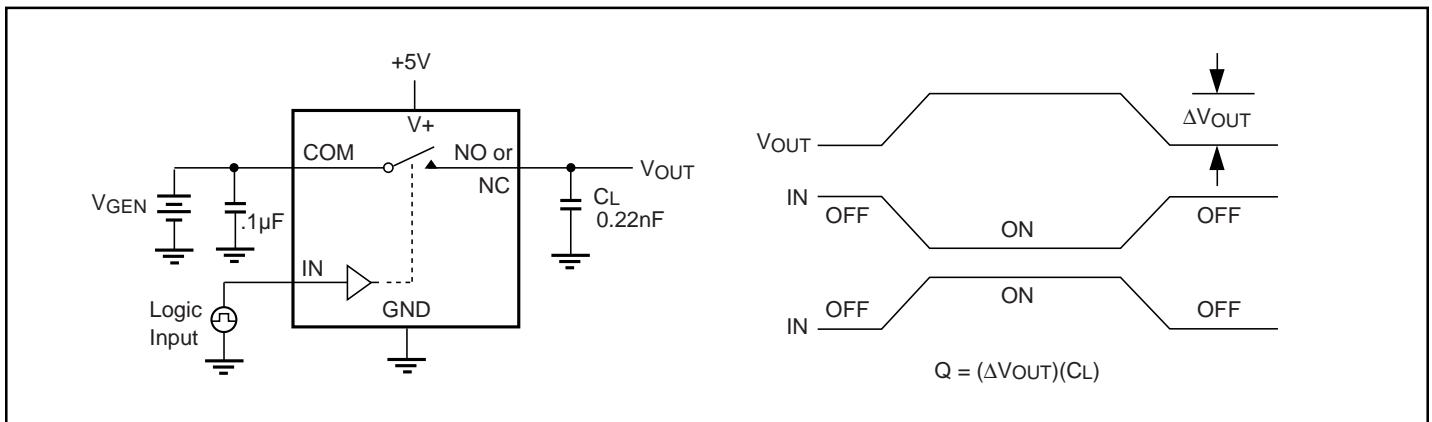


Figure 2. Charge Injection

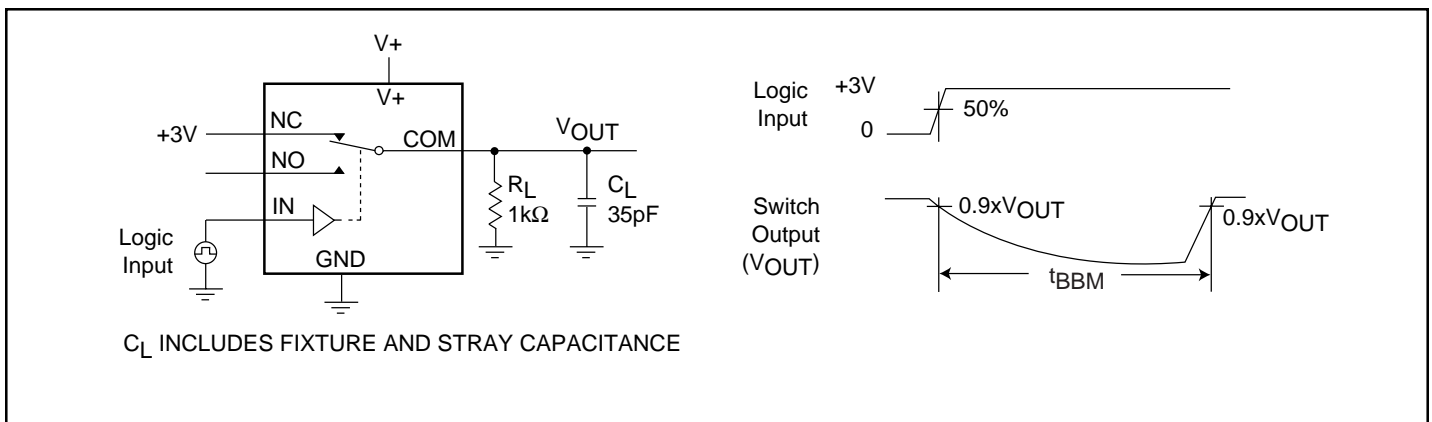
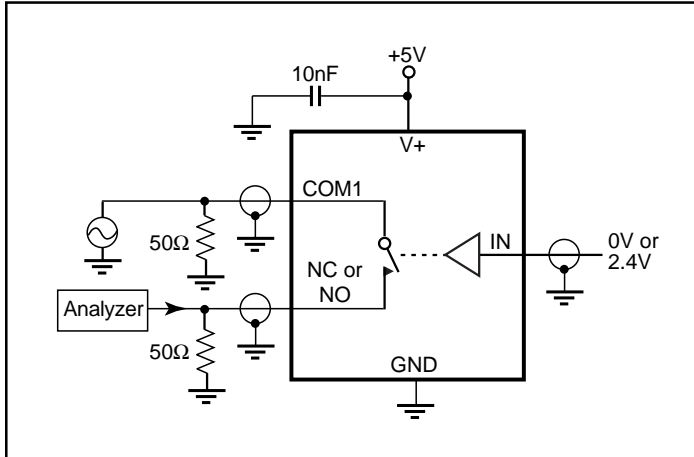
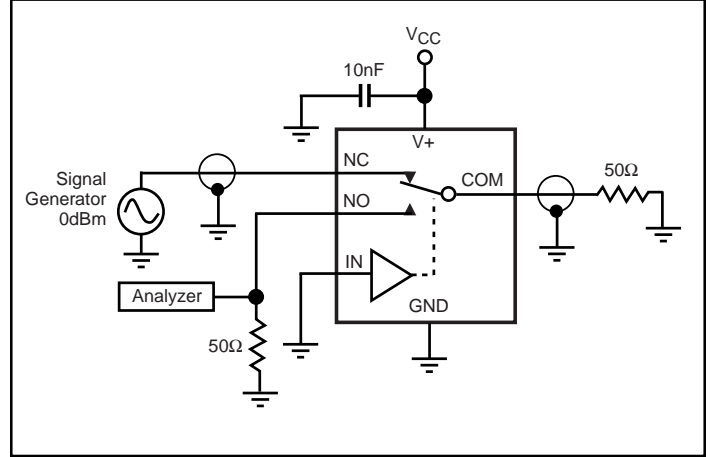


Figure 3. Break-Before-Make Interval

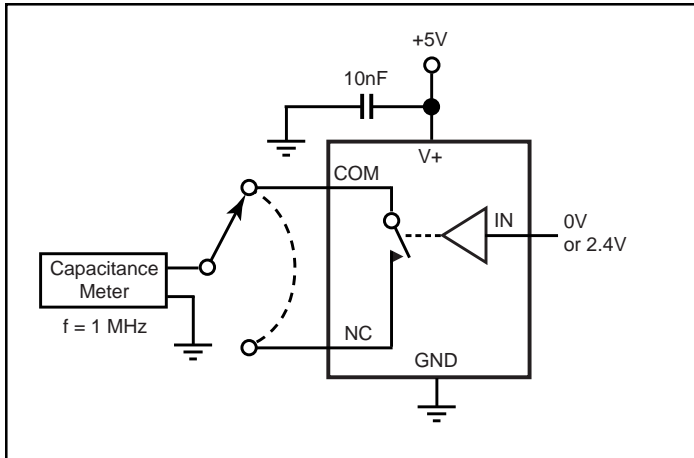
**Test Circuits/Timing Diagrams (continued)**



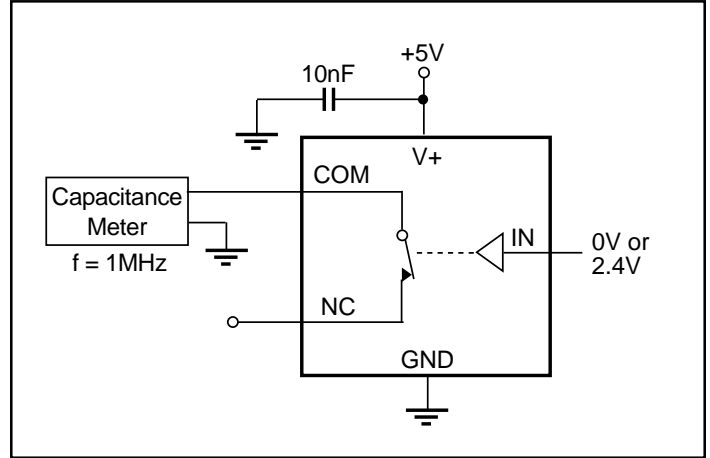
**Figure 4. Off Isolation/On-Channel Bandwidth**



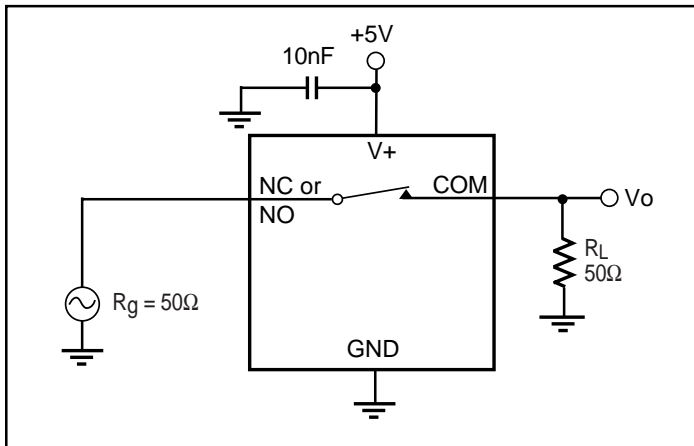
**Figure 5. Crosstalk**



**Figure 6. Channel-Off Capacitance**

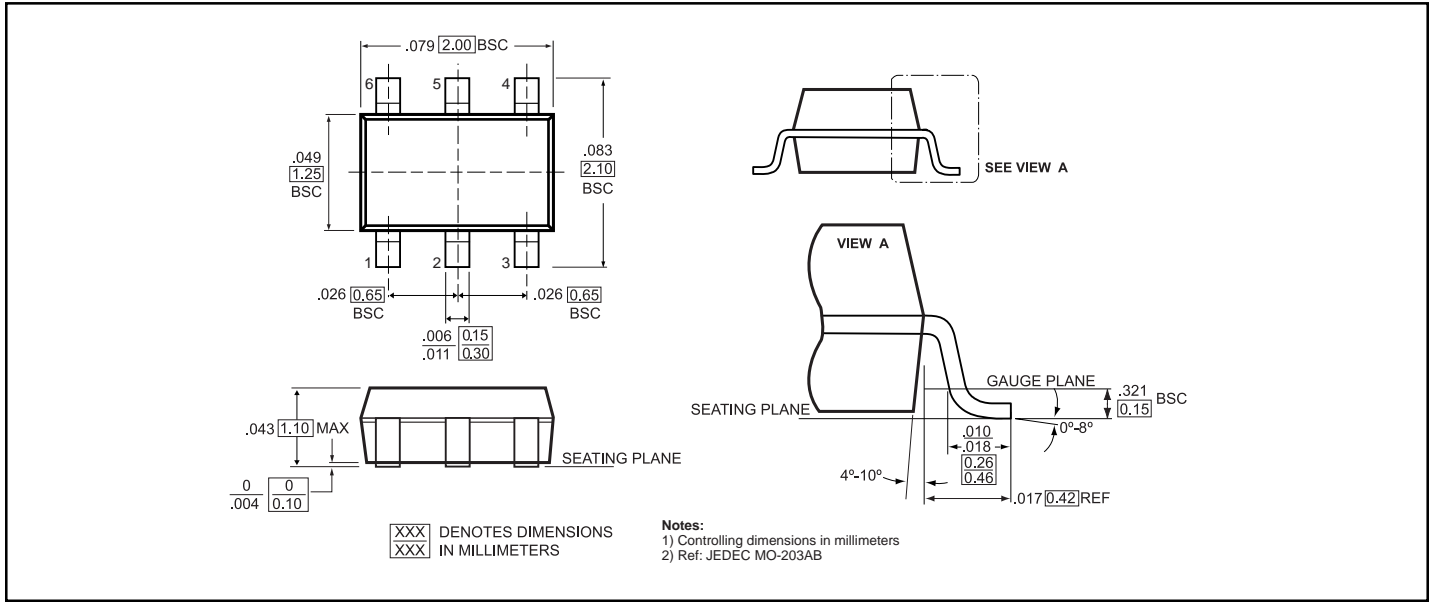


**Figure 7. Channel-On Capacitance**

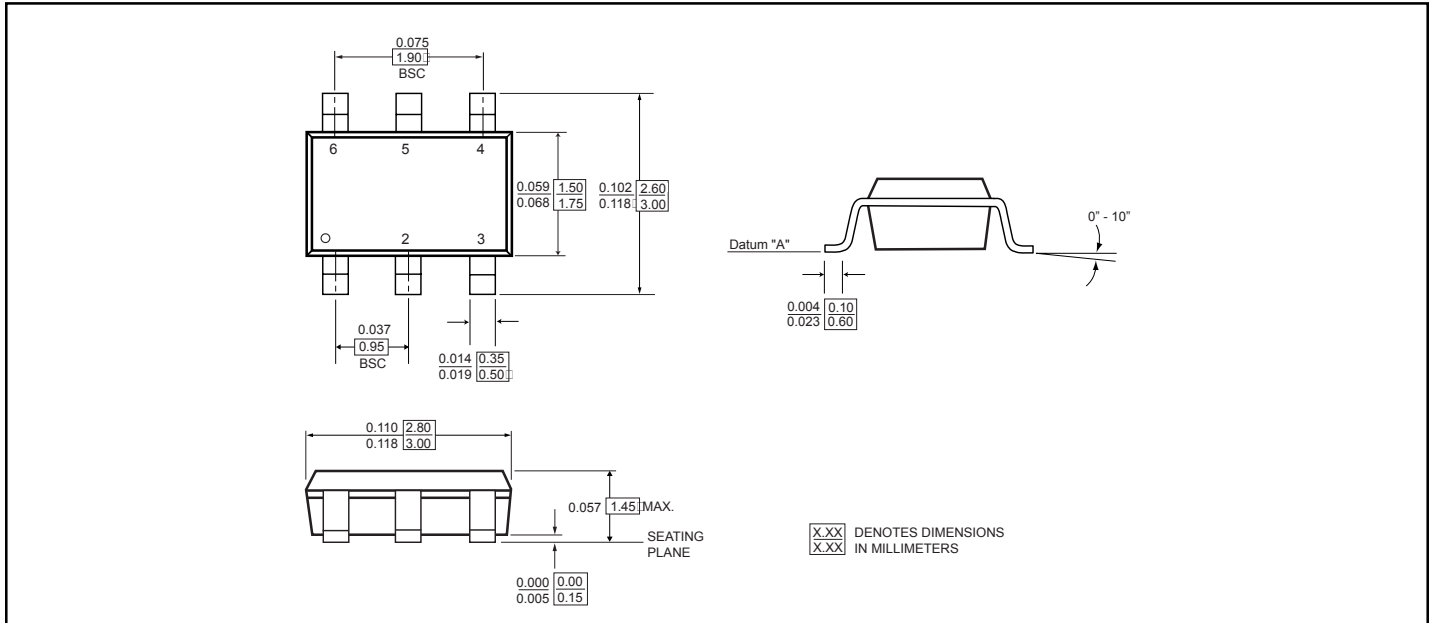


**Figure 8. Bandwidth**

**Packaging Mechanical: 6-Pin SC70 (C)**



**Packaging Mechanical: 6-Pin SOT-23 (T)**







**Ordering Code**

| Ordering Code | Package Code | Package Description           | Top Marking |
|---------------|--------------|-------------------------------|-------------|
| PI5A4599ACX   | C            | 6-pin SC70                    | ZN          |
| PI5A4599ACEX  | C            | Pb-free & Green, 6-pin SC70   | $\bar{Z}N$  |
| PI5A4599ATX   | T            | 6-pin SOT-23                  | ZN          |
| PI5A4599ATEX  | T            | Pb-free & Green, 6-pin SOT-23 | $\bar{Z}N$  |

**Notes:**

1. Thermal Characteristics can be found on the world wide web at: [www.pericom.com/packaging/](http://www.pericom.com/packaging/)
2. X = Tape and reel