

## Features

- Low On-Resistance, (16–ohms typ)  
Minimizes Distortion and Error Voltages
- On-Resistance Match Between Channels, <2 ohms
- Guaranteed On-Resistance Flatness, <4 ohms
- Low Charge Injection, 3pC typ.
- Improved Leakage Over Temperature, <2.5nA at +85°C
- ESD Rating >2000V per Method 3015.7
- Single-Supply Operation (+3V to +15V)
- Bipolar-Supply Operation ( $\pm 3V$  to  $\pm 8V$ )
- Low Power Consumption, <1  $\mu A$
- TTL/CMOS Compatible

## Applications

- Instrumentation
- Battery Powered Systems
- Audio Switching
- $\pm 5V$  Data Acquisition Systems
- Sample-and-Hold Circuits
- Telecommunications Systems

## Description

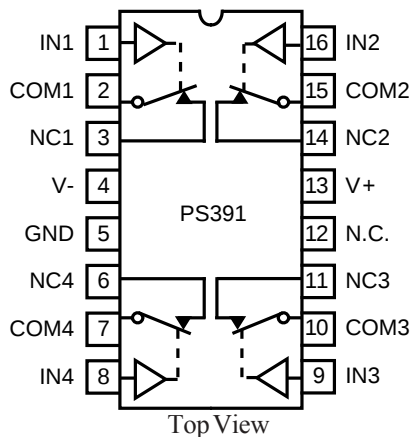
The PS391/PS392/PS393 are improved, quad, single-pole single-throw (SPST) analog switches designed to operate with  $\pm 3V$  to  $\pm 8V$  power supplies or a single 3V to 15V supply. The PS391 has four normally closed (NC) switches, the PS392 has four normally open (NO) switches. The PS393 has two NO and two NC switches. All three devices offer low leakage (<2pA typ) and fast switching speeds ( $t_{ON}$  <130ns). Power consumption is less than 1  $\mu A$ , ideal for battery-powered equipment.

With  $\pm 5V$  supplies, the PS391/PS392/PS393 guarantee <2ohm channel-to-channel matching, <30ohm on-resistance ( $R_{ON}$ ), and <4ohm  $R_{ON}$  flatness over the specified range.

These switches are fully specified for single +5V operation, with <2ohm  $R_{ON}$  match, <45ohm  $R_{ON}$ , and <4ohm flatness.

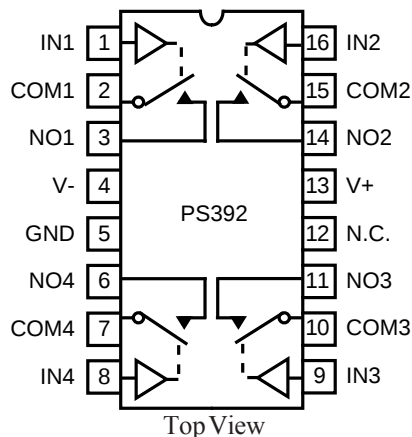
For operation below 5V, the PI5A391A/PI5A392A/PI5A393A are also recommended.

## Functional Diagrams, Pin Configurations, and Truth Tables



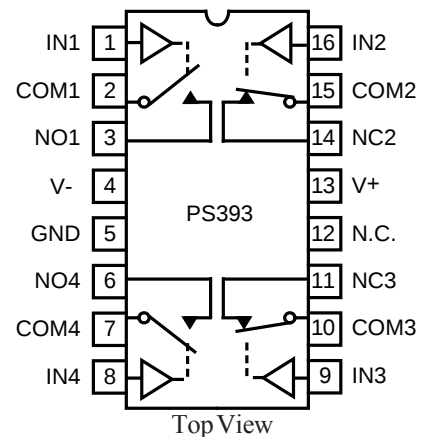
N.C. = No Connect.

| PS391 |        |
|-------|--------|
| Logic | Switch |
| 0     | ON     |
| 1     | OFF    |



Switches shown for logic "0" input

| PS392 |        |
|-------|--------|
| Logic | Switch |
| 0     | OFF    |
| 1     | ON     |



| PS393 |              |              |
|-------|--------------|--------------|
| Logic | Switches 1,4 | Switches 2,3 |
| 0     | OFF          | ON           |
| 1     | ON           | OFF          |

### Absolute Maximum Ratings

Voltages Referenced to V–

V+ ..... –0.3V to +17V

V<sub>IN</sub>, V<sub>COM</sub>, V<sub>NC</sub>, V<sub>NO</sub> (Note 1) ..... (V–)–2V to (V+)+2V  
or 30mA, whichever occurs first

Current (any terminal) ..... 30mA

Peak Current, COM, NO, NC  
(pulsed at 1ms, 10% duty cycle) ..... 100mA

ESD per Method 3015.7 ..... >2000V

### Thermal Information

Continuous Power Dissipation (T<sub>A</sub> = +70°C)

Plastic DIP (derate 10.5mW/°C above +70°C) ..... 800mW

SO and QSOP (derate 8.7mW/°C above +70°C) ..... 650mW

Storage Temperature ..... –65°C to +150°C

Lead Temperature (soldering, 10s) ..... +300°C

### Note

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 +12V Supply

(V+ = 12V ±10%, GND = 0V, V<sub>INH</sub> = 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+ = 12V, I <sub>COM</sub> = 2mA,<br>V <sub>NO</sub> = 10V         | 25         |                    | 16                 | 45                  | ohm   |
|                                                        |                                                    |                                                                    | Full       |                    |                    | 55                  |       |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                   | V+ = 12V, I <sub>COM</sub> = 2mA<br>V <sub>NO</sub> = 10V          | 25         |                    | 0.5                | 4                   |       |
|                                                        |                                                    |                                                                    | Full       |                    |                    | 6                   |       |
| On-Resistance<br>Flatness <sup>(5)</sup>               | R <sub>FLAT(ON)</sub>                              | V+ = 12V, I <sub>COM</sub> = 2mA,<br>V <sub>NO</sub> = 10V, 5V, 1V | 25         |                    | 2                  | 4                   | ohm   |
|                                                        |                                                    |                                                                    | Full       |                    |                    | 6                   |       |
| NO or NC Off<br>Leakage Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub><br>OR<br>I <sub>NC(OFF)</sub> | V+ = 12V, V <sub>COM</sub> = 0V,<br>V <sub>NO</sub> = 10V          | 25         | –1                 |                    | 1                   | nA    |
|                                                        |                                                    |                                                                    | Full       | –6                 |                    | 6                   |       |
| COM Off Leakage<br>Current <sup>(6)</sup>              | I <sub>COM(OFF)</sub>                              | V+ = 12V, V <sub>COM</sub> = 0V,<br>V <sub>NO</sub> = 10V          | 25         | –1                 |                    | 1                   |       |
|                                                        |                                                    |                                                                    | Full       | –6                 |                    | 6                   |       |
| COM On Leakage<br>Current <sup>(6)</sup>               | I <sub>COM(ON)</sub>                               | V+ = 12V, V <sub>COM</sub> = 10V,<br>V <sub>NO</sub> = 10V         | 25         | –2                 |                    | 2                   |       |
|                                                        |                                                    |                                                                    | Full       | –12                |                    | 12                  |       |

**Electrical Specifications - Single +12V Supply (continued)**

(V+ = 12V ± 10%, GND = 0V, V<sub>INH</sub> = 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 |
|---------------------------------------|-------------------------|--------------------------------------------------------------------------------|-----------|--------------------|--------------------|--------------------|-------|
| Logic Input                           |                         |                                                                                |           |                    |                    |                    |       |
| Input Current with Input Voltage High | I <sub>INH</sub>        | I <sub>N</sub> = 5V, all others = 0.8V                                         | Full      | −0.5               | 0.005              | 0.5                | μA    |
| Input Current with Input Voltage Low  | I <sub>INL</sub>        | I <sub>N</sub> = 0.8V, all others =5V                                          |           | −0.5               | 0.005              | 0.5                |       |
| Dynamic                               |                         |                                                                                |           |                    |                    |                    |       |
| Turn-On Time                          | t <sub>ON</sub>         | V <sub>COM</sub> = 10V, Figure 2                                               | 25        |                    | 51                 | 130                | ns    |
|                                       |                         |                                                                                | Full      |                    |                    | 175                |       |
| Turn-Off Time                         | t <sub>OFF</sub>        |                                                                                | 25        |                    | 17                 | 75                 |       |
|                                       |                         |                                                                                | Full      |                    |                    | 100                |       |
| On-Channel Bandwidth                  | BW                      | Signal = 0dbm<br>Figure 4, 50ohm in and out                                    | 25        |                    | 100                |                    | MHz   |
| Charge Injection <sup>(3)</sup>       | Q                       | C <sub>L</sub> =1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω,<br>Figure 3 |           |                    | 3                  | 10                 | pC    |
| Off Isolation                         | O <sub>IRR</sub>        | R <sub>L</sub> = 50ohm, C <sub>L</sub> = 5pF, f= 1 MHz, Figure 4               |           |                    | −58                |                    | dB    |
| Crosstalk <sup>(8)</sup>              | X <sub>TALK</sub>       | R <sub>L</sub> = 50ohm, C <sub>L</sub> = 5pF, f= 1 MHz, Figure 5               |           |                    | −86                |                    |       |
| NO Capacitance                        | C <sub>(OFF)</sub>      | f=1 MHz, Figure 6                                                              |           |                    | 12                 |                    | pF    |
| COM Off Capacitance                   | C <sub>COM(OFF-F)</sub> | f=1 MHz, Figure 6                                                              |           |                    | 12                 |                    |       |
| COM On Capacitance                    | C <sub>COM(ON)</sub>    | f=1MHz, Figure 7                                                               |           |                    | 25                 |                    |       |
|                                       |                         |                                                                                |           |                    |                    |                    |       |
| Positive Supply Current               | I+                      | V <sub>IN</sub> = 0V or V+, all channels on or off                             | Full      | −1                 | 0.001              | 1                  | μA    |
| Total Harmonic Distortion             | THD                     |                                                                                |           |                    | 0.03               |                    | %     |

**Notes:**

- The algebraic convention, where the most negative value is a minimum and the 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> = ΔR<sub>ON max</sub> - ΔR<sub>ON min</sub>
- 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>NO</sub>) ], V<sub>COM</sub> = Output, V<sub>NC</sub> / V<sub>NO</sub> = input to off switch
- Between any two switches.

**Electrical Specifications - Dual Supplies**

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

| Parameter                                              | Symbol                                          | Conditions                                                                                     | Temp°C | Min <sup>(2)</sup> | Typ <sup>(2)</sup> | Max <sup>(2)</sup> | Units |
|--------------------------------------------------------|-------------------------------------------------|------------------------------------------------------------------------------------------------|--------|--------------------|--------------------|--------------------|-------|
| Analog Switch                                          |                                                 |                                                                                                |        |                    |                    |                    |       |
| Analog Signal Range <sup>(3)</sup>                     | V <sub>ANALOG</sub>                             |                                                                                                | Full   | V−                 |                    | V+                 | V     |
| On-Resistance                                          | R <sub>ON</sub>                                 | V+ = 4.5V, V− = −4.5V,<br>I <sub>COM</sub> = −10mA, V <sub>NO</sub> or V <sub>NC</sub> = +3.5V | 25     |                    | 16                 | 30                 | ohm   |
|                                                        |                                                 |                                                                                                | Full   |                    |                    | 40                 |       |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                | V+ = 5.5V, V− = −5.5V,<br>V <sub>COM</sub> = −10mA, V <sub>NO</sub> or V <sub>NC</sub> = ±3.5V | 25     |                    | 0.2                | 2                  |       |
|                                                        |                                                 |                                                                                                | Full   |                    |                    | 4                  |       |
| On-Resistance Flatness <sup>(5)</sup>                  | R <sub>FLAT(ON)</sub>                           |                                                                                                | 25     |                    | 1                  | 4                  |       |
|                                                        |                                                 |                                                                                                | Full   |                    |                    | 6                  |       |
| NO or NC Off Leakage<br>Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub> or<br>I <sub>NO(OFF)</sub> | V+ = 5.5V, V− = −5.5V,<br>V <sub>COM</sub> = ±4.5V, V <sub>NO</sub> or V <sub>NC</sub> = ±4.5V | 25     | −0.1               | −0.001             | 0.1                | nA    |
|                                                        |                                                 |                                                                                                | Full   | −2.5               |                    | 2.5                |       |
| COM Off Leakage<br>Current <sup>(6)</sup>              | I <sub>COM(OFF)</sub>                           |                                                                                                | 25     | −0.1               | −0.001             | 0.1                |       |
|                                                        |                                                 |                                                                                                | Full   | −2.5               |                    | 2.5                |       |
| COM On Leakage<br>Current <sup>(6)</sup>               | I <sub>COM(ON)</sub>                            | V+ = 5.5V, V− = −5.5V,<br>V <sub>COM</sub> = ±4.5V, V <sub>NO</sub> or V <sub>NC</sub> = ±4.5V | 25     | −0.2               | 0.002              | 0.2                |       |
|                                                        |                                                 |                                                                                                | Full   | −5                 |                    | 5                  |       |

**Electrical Specifications - Dual Supplies** (continued)

(V+ = +5V ± 10%, V- = -5V ± 10%, GND = 0V, VINH = 2.4V, VINL = 0.8V)

| Parameter                             | Symbol                | Conditions                                                                        | Temp°C | Min <sup>(1)</sup> | Typ <sup>(2)</sup> | Max <sup>(1)</sup> | Units |
|---------------------------------------|-----------------------|-----------------------------------------------------------------------------------|--------|--------------------|--------------------|--------------------|-------|
| Logic Input                           |                       |                                                                                   |        |                    |                    |                    |       |
| Input Current with Input Voltage High | I <sub>INH</sub>      | I <sub>N</sub> = 2.4V,<br>all others = 0.8V                                       | Full   | −0.5               | 0.005              | 0.5                | μA    |
| Input Current with Input Voltage Low  | I <sub>INL</sub>      | I <sub>N</sub> = 0.8V,<br>all others = 2.4V                                       |        |                    |                    |                    |       |
| Dynamic                               |                       |                                                                                   |        |                    |                    |                    |       |
| Turn-On-Time                          | t <sub>ON</sub>       | V <sub>COM</sub> = ± 3V,<br>Figure 1                                              | 25     |                    | 51                 | 130                | ns    |
|                                       |                       |                                                                                   | Full   |                    |                    | 175                |       |
| Turn-Off-Time                         | t <sub>(OFF)</sub>    |                                                                                   | 25     |                    | 29                 | 75                 |       |
|                                       |                       |                                                                                   | Full   |                    |                    | 100                |       |
| Break-Before-Make Time Delay          | t <sub>D</sub>        | PS393 only, R <sub>L</sub> = 300ohm,<br>C <sub>L</sub> = 35pF, Figure 2           | Full   | 10                 | 20                 |                    |       |
| Charge Injection <sup>(3)</sup>       | Q                     | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0ohm, Figure 3 | 25     |                    | 3                  | 5                  | pC    |
| Off Isolation                         | O <sub>IRR</sub>      | R <sub>L</sub> = 50ohm, CL = 5pF,<br>f = 1MHz, Figure 4                           |        |                    | −65                |                    | dB    |
| Crosstalk                             | X <sub>TALK</sub>     | R <sub>L</sub> = 50ohm, CL = 5pF,<br>f = 1MHz, Figure 5                           |        |                    | −90                |                    |       |
| NC or NO Capacitance                  | C <sub>(OFF)</sub>    | f = 1MHz, Figure 6                                                                |        |                    | 12                 |                    | pF    |
| COM Off Capacitance                   | C <sub>COM(OFF)</sub> |                                                                                   |        |                    | 12                 |                    |       |
| COM On Capacitance                    | C <sub>COM(ON)</sub>  |                                                                                   |        |                    | 25                 |                    |       |
| Supply                                |                       |                                                                                   |        |                    |                    |                    |       |
| Positive Supply Range                 | V+, V−                |                                                                                   | Full   | ±3                 |                    | ±8                 | V     |
| Positive Supply Current               | I+                    | V+ = 5.5V, V− = −5.5V,<br>V <sub>IN</sub> = 0V or V+<br>All channels on or off    |        | −1                 |                    | 1                  | μA    |
| Negative Supply Current               | I−                    |                                                                                   |        |                    |                    |                    |       |

**Notes:**

- The algebraic convention, where the most negative value is a minimum and the 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 max</sub> - R<sub>ON min</sub>
- 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>NC</sub> or V<sub>NO</sub>) ], V<sub>COM</sub> = Output, V<sub>NC</sub>, V<sub>NO</sub> = input to off switch
- Between any two switches.

**Electrical Specifications - Single 5V Supply**

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

| Description                                            | Parameter                                       | Conditions                                                                        | Temp (°C) | Min <sup>(1)</sup> | Typ <sup>(2)</sup> | Max <sup>(1)</sup> | Units |
|--------------------------------------------------------|-------------------------------------------------|-----------------------------------------------------------------------------------|-----------|--------------------|--------------------|--------------------|-------|
| Analog Switch                                          |                                                 |                                                                                   |           |                    |                    |                    |       |
| Analog Switch Range <sup>(3)</sup>                     | V <sub>ANALOG</sub>                             |                                                                                   |           | 0                  |                    | V+                 | V     |
| On-Resistance                                          | R <sub>ON</sub>                                 | V+ = 4.5V, I <sub>COM</sub> = −10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 3.5V | 25        |                    | 23                 | 45                 | W     |
|                                                        |                                                 |                                                                                   | Full      |                    |                    | 60                 |       |
| On-Resistance Match<br>Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                | V+ = 5V, I <sub>COM</sub> = −1mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 3V      | 25        |                    | 0.3                | 2                  |       |
|                                                        |                                                 |                                                                                   | Full      |                    |                    | 4                  |       |
| On-Resistance<br>Flatness <sup>(3,5)</sup>             | R <sub>FLAT(ON)</sub>                           | V+ = 5V, I <sub>COM</sub> = −1mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1V, 4V  | 25        |                    | 1                  | 4                  |       |
|                                                        |                                                 |                                                                                   | Full      |                    |                    | 6                  |       |
| NO or NC Off Leakage<br>Current <sup>(9)</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        | −0.1               | 0.0004             | 0.1                | nA    |
|                                                        |                                                 |                                                                                   | Full      | −2.5               |                    | 2.5                |       |
| COM Off Leakage<br>Current <sup>(9)</sup>              | I <sub>COM(OFF)</sub>                           | V+ = 5.5V, V <sub>COM</sub> = 0V,<br>V <sub>NO</sub> or V <sub>NC</sub> = 4.5V    | 25        | −0.1               | 0.001              | 0.1                |       |
|                                                        |                                                 |                                                                                   | Full      | −2.5               |                    | 2.5                |       |
| COM On Leakage<br>Current <sup>(9)</sup>               | I <sub>COM(ON)</sub>                            | V+ = 5.5V, V <sub>COM</sub> = 4.5V                                                | 25        | −0.2               | 0.002              | 0.2                |       |
|                                                        |                                                 |                                                                                   | Full      | −5                 |                    | 5                  |       |
| Dynamic                                                |                                                 |                                                                                   |           |                    |                    |                    |       |
| Turn-On Time                                           | t <sub>ON</sub>                                 | V <sub>NO</sub> or V <sub>NC</sub> = 3V                                           | 25        |                    | 63                 | 170                | ns    |
|                                                        |                                                 |                                                                                   | Full      |                    |                    | 240                |       |
| Turn-Off Time                                          | t <sub>OFF</sub>                                |                                                                                   | 25        |                    | 34                 | 50                 |       |
|                                                        |                                                 |                                                                                   | Full      |                    |                    | 100                |       |
| Break-Before-Make<br>Time Delay <sup>(3)</sup>         | t <sub>D</sub>                                  | PS393 only, R <sub>L</sub> = 300ohm,<br>C <sub>L</sub> = 35pF                     | Full      | 10                 | 20                 |                    |       |
| Charge Injection <sup>(3)</sup>                        | Q                                               | C <sub>L</sub> = 1nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0V, Figure 4   | 25        |                    | 0                  | 5                  | pC    |
| Supply                                                 |                                                 |                                                                                   |           |                    |                    |                    |       |
| Positive Supply Current                                | I+                                              | V+ = 5.5V,<br>V <sub>IN</sub> = 0V or V+,<br>All channels on or off               | Full      | −1                 |                    | 1                  | mA    |
| Negative Supply Current                                | I−                                              |                                                                                   |           |                    |                    |                    |       |

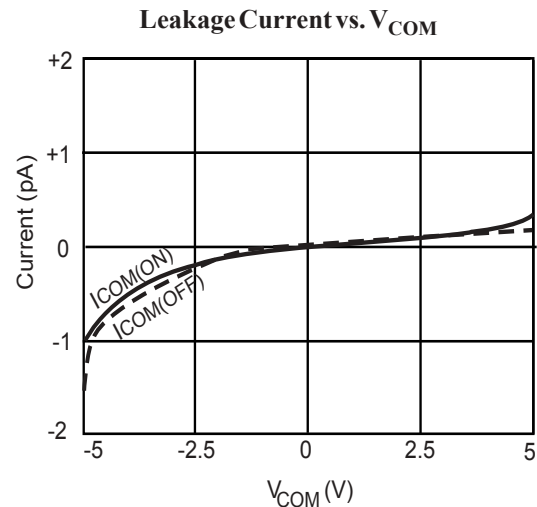
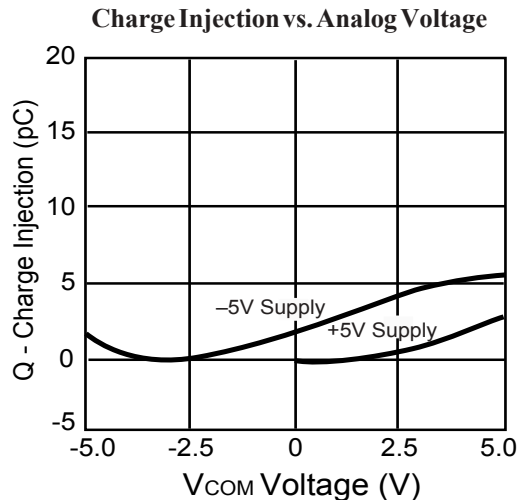
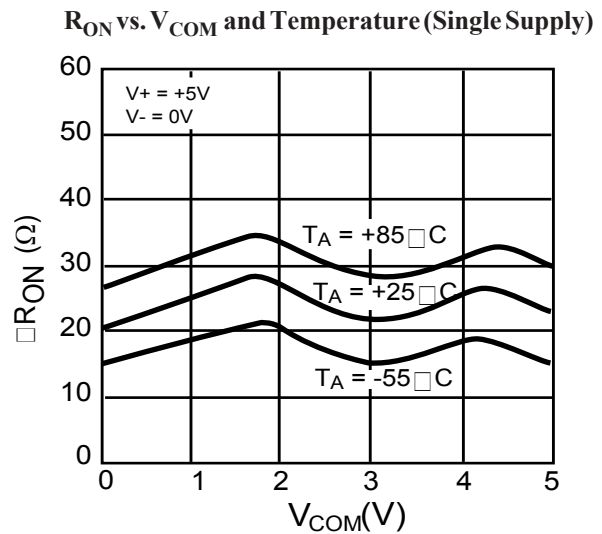
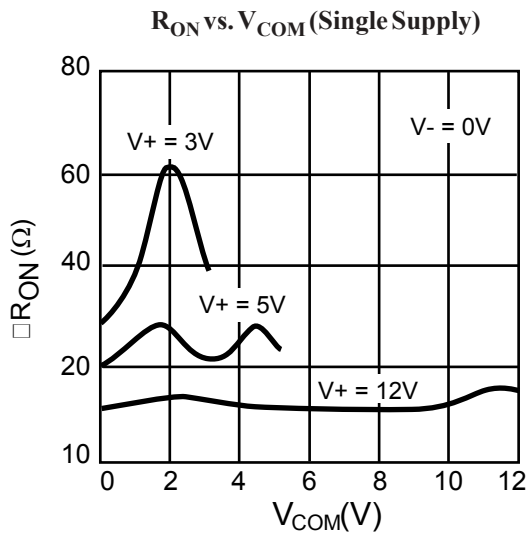
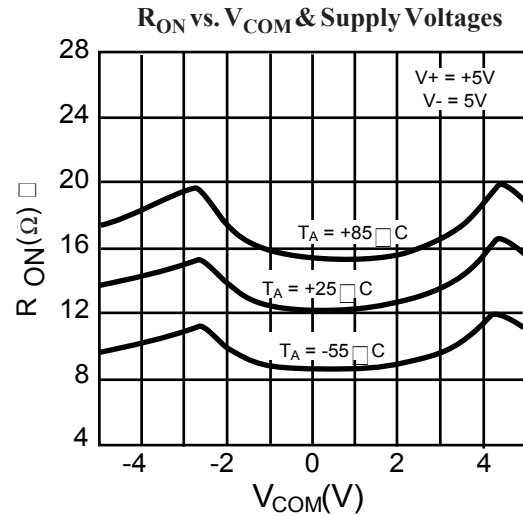
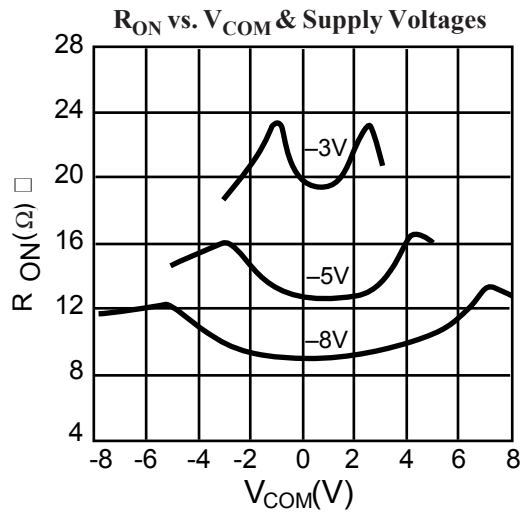
**Electrical Specifications - Single 3.3V Supply**

(V<sub>+</sub> = +3V to 3.6V, GND = 0V, V<sub>INH</sub> = 2.4V, V<sub>INL</sub> = 0.8V)

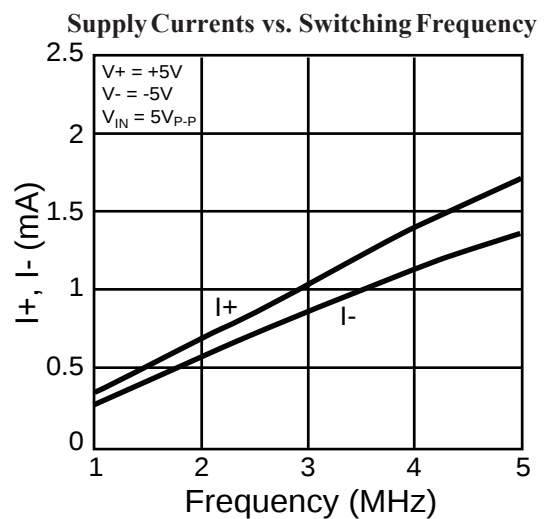
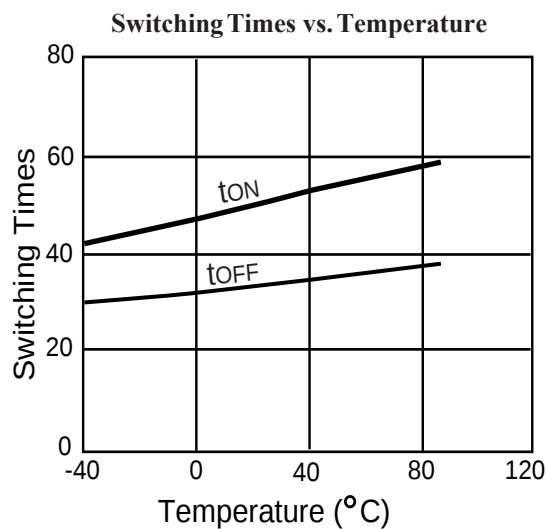
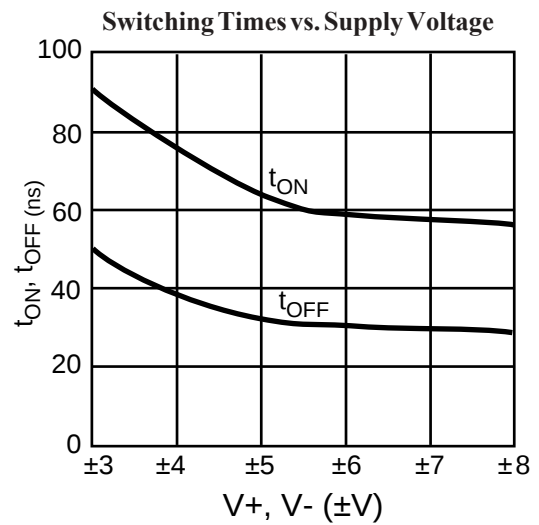
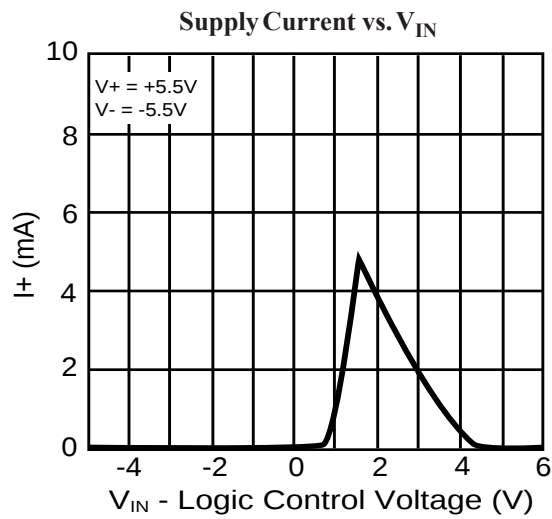
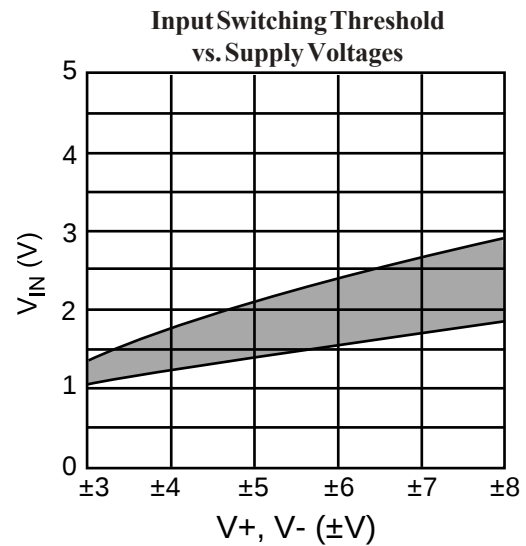
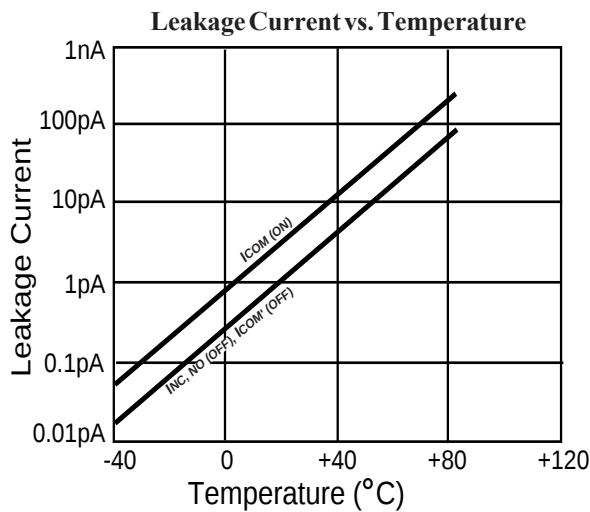
| Description                                 | Parameter           | Conditions                                                                     | Temp (°C) | Min <sup>(1)</sup> | Typ <sup>(2)</sup> | Max <sup>(1)</sup> | Units |
|---------------------------------------------|---------------------|--------------------------------------------------------------------------------|-----------|--------------------|--------------------|--------------------|-------|
| Analog Switch                               |                     |                                                                                |           |                    |                    |                    |       |
| Analog Switch Range <sup>(3)</sup>          | V <sub>ANALOG</sub> |                                                                                | Full      | 0                  |                    | V+                 | V     |
| Channel On-Resistance                       | R <sub>ON</sub>     | V+ =3V, I <sub>COM</sub> = −10mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = 1.5V | 25        |                    | 62                 | 175                | ohm   |
|                                             |                     |                                                                                | Full      |                    |                    | 275                |       |
| Dynamic                                     |                     |                                                                                |           |                    |                    |                    |       |
| Turn-On-Time <sup>(3)</sup>                 | t <sub>ON</sub>     | V <sub>NO</sub> or V <sub>NC</sub> = 1.5V                                      | 25        |                    | 97                 | 400                | ns    |
|                                             |                     |                                                                                | Full      |                    |                    | 500                |       |
| Turn-Off-Time <sup>(3)</sup>                | t <sub>(OFF)</sub>  |                                                                                | 25        |                    | 53                 | 125                |       |
|                                             |                     |                                                                                | Full      |                    |                    | 175                |       |
| Break-Before-Make Time Delay <sup>(3)</sup> | t <sub>D</sub>      | PS393 only, R <sub>L</sub> = 300ohm;<br>C <sub>L</sub> = 35pF                  | 25        | 20                 |                    |                    |       |
| Charge Injection <sup>(3)</sup>             | Q                   | C <sub>L</sub> = 1.0nF, V <sub>GEN</sub> = 0V,<br>R <sub>GEN</sub> = 0V        | Full      |                    | 1                  | 5                  | pC    |
| Supply                                      |                     |                                                                                |           |                    |                    |                    |       |
| Positive Supply Current                     | I+                  | V+ = 3.6V, V <sub>IN</sub> = 0V or<br>V+,<br>All channels on or off            | Full      | −1                 |                    | 1                  | μA    |
| Negative Supply Current                     | I−                  |                                                                                |           |                    |                    |                    |       |

**Notes:**

- The algebraic convention, where the most negative value is a minimum and the 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>NC</sub> or V<sub>NO</sub>) ], V<sub>COM</sub> = Output, V<sub>NC</sub>, V<sub>NO</sub> = input to off switch
- Between any two switches.
- Leakage testing at single supply is guaranteed by testing with dual supplies.

**Typical Operating Characteristics** ( $T_A = +25^\circ\text{C}$ , unless otherwise noted)


Typical Operating Characteristics (continued)



## Test Circuits/Timing Diagrams

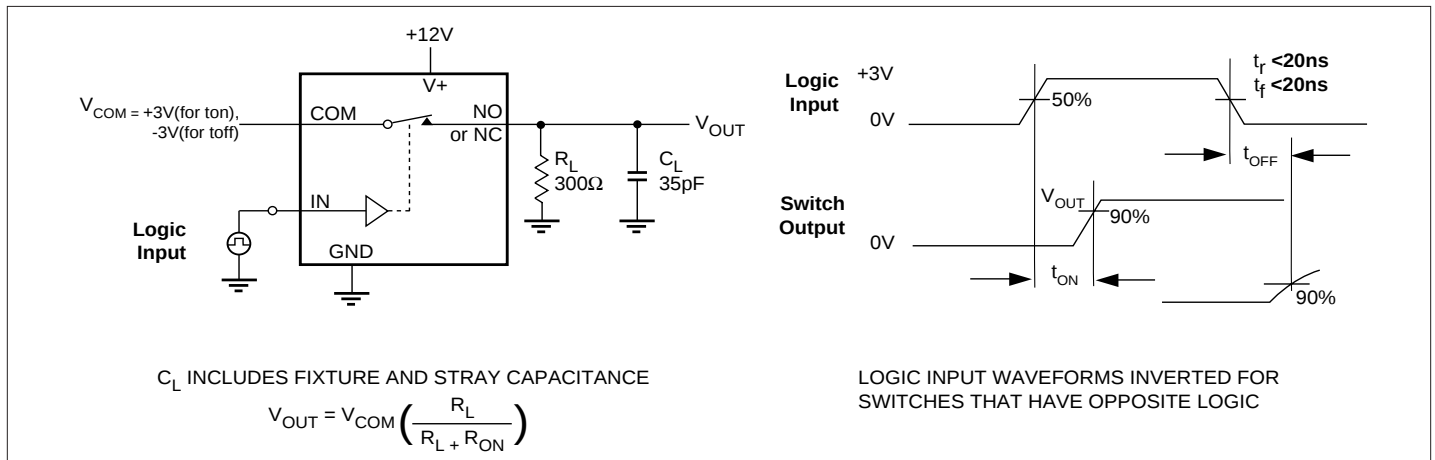


Figure 1. Switching Time

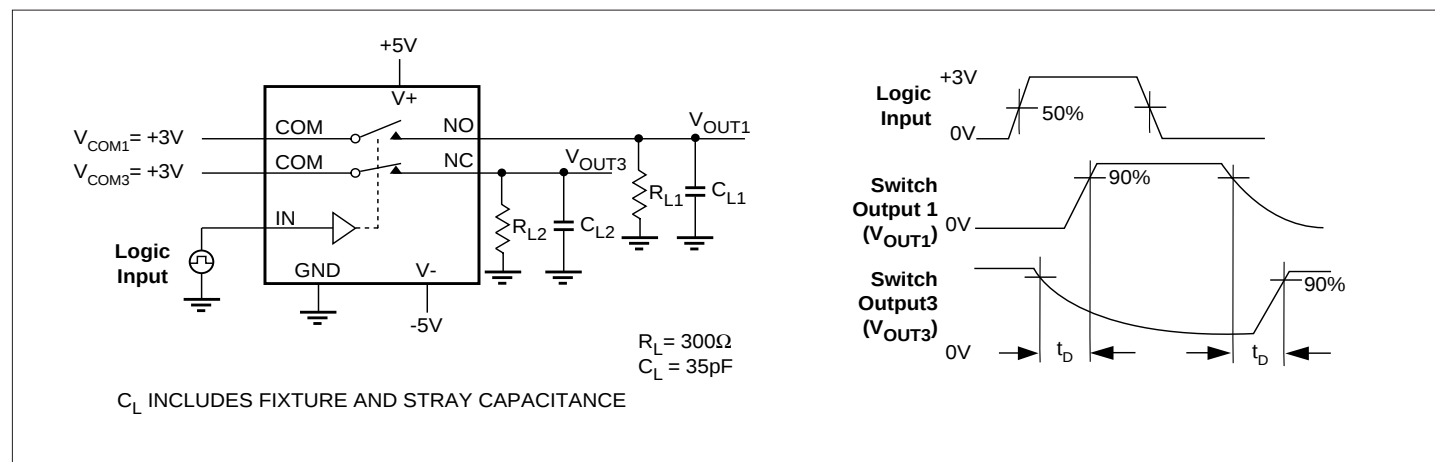


Figure 2. Break-Before-Make Interval (PS393 only)

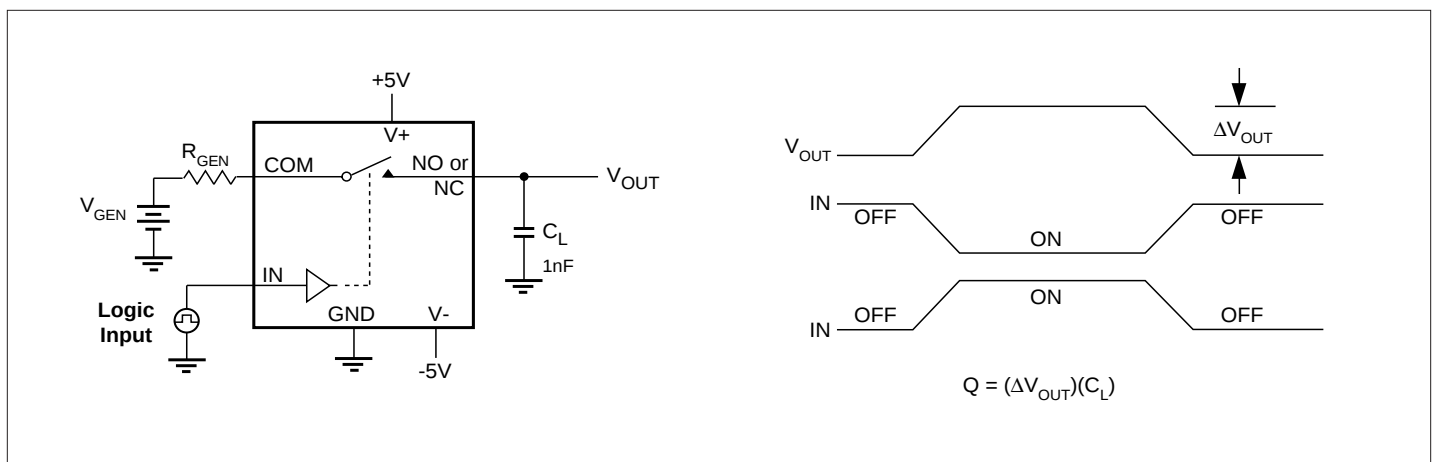


Figure 3. Charge Injection

## Test Circuits/Timing Diagrams (continued)

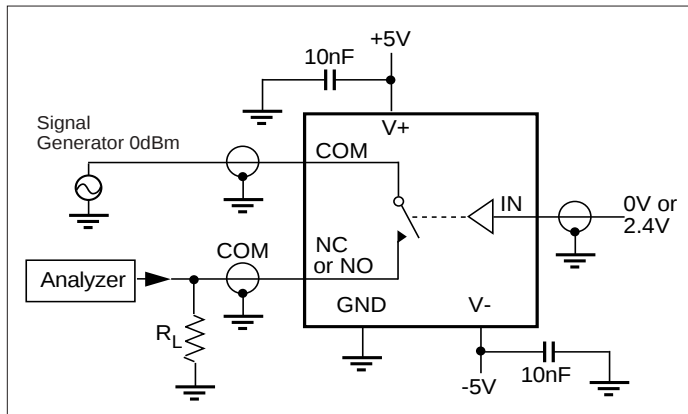


Figure 4. Off Isolation

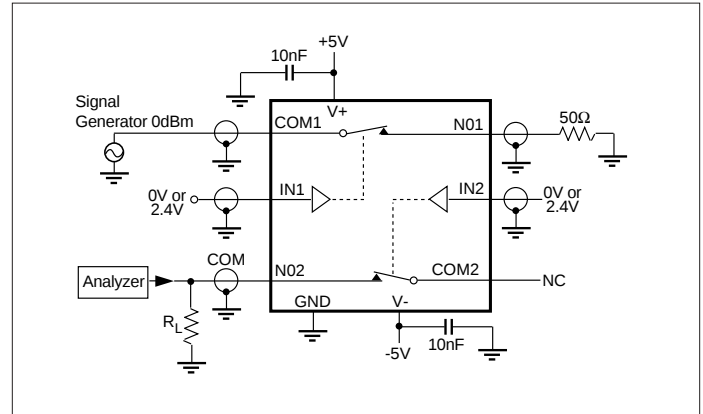


Figure 5. Crosstalk

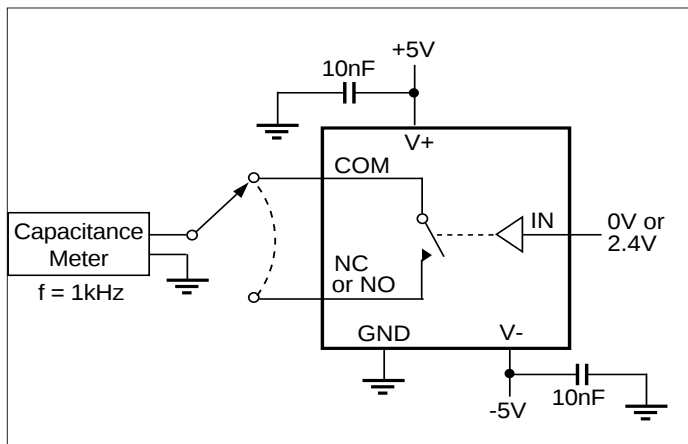


Figure 6. Channel-Off Capacitance

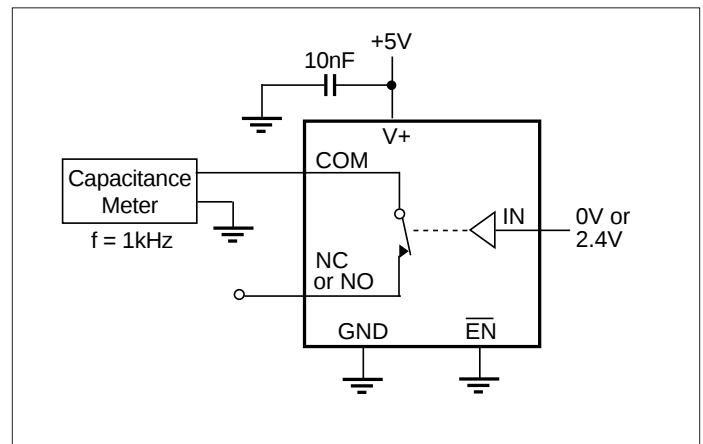


Figure 7. Channel-On Capacitance

## Applications

As illustrated in Figure 8, PS391 can be used to insert various capacitors (C1, C2) and set proper RC times for integration. The resistors R1 and R2 set initial gain. The  $R_{IN}$  resistor x C1 or C2 sets the RC time. The reset switch discharges the hold capacitor through  $R_{IN}$ .

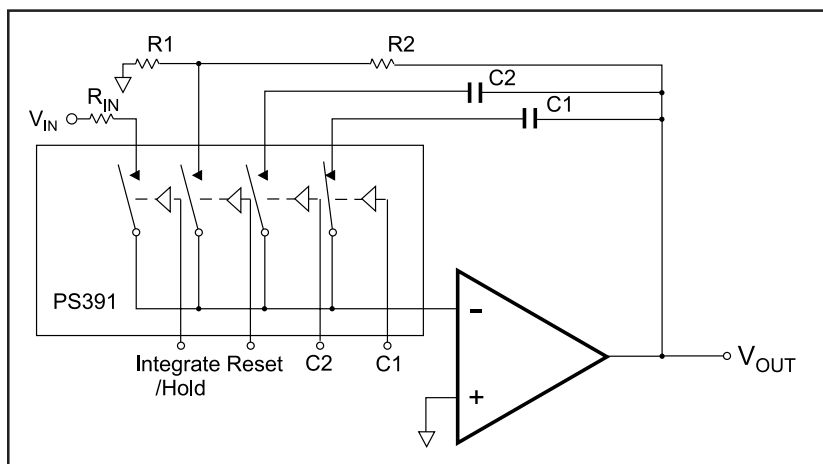
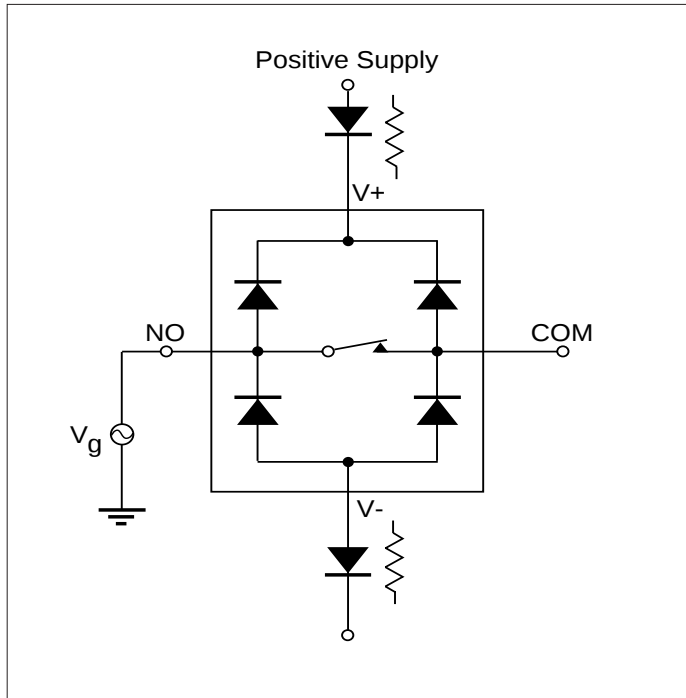


Figure 8. Programmable Integrator and Sample/Hold

### Overvoltage Protection

Proper power-supply sequencing is recommended for all CMOS devices. Do not exceed the absolute maximum ratings, because stresses beyond the listed ratings may cause permanent damage to the devices. Always sequence V+ on first, followed by V-, and then the logic inputs. If power-supply sequencing is not possible, add two small signal diodes or two current limiting resistors in series with the supply pins for overvoltage protection (Figure 9). Adding diodes reduces the analog signal range, but low switch resistance and low leakage characteristics are unaffected.



**Figure 9.** Overvoltage protection is accomplished using two external blocking diodes or two current limiting resistors.

### Ordering Information

| Part Number | Temperature Range | Package        |
|-------------|-------------------|----------------|
| PS391CPE    | 0°C to + 70°C     | 16 Ld PDIP     |
| PS391CSE    | 0°C to + 70°C     | 16 Narrow SOIC |
| PS391EPE    | -40°C to + 85°C   | 16 Ld PDIP     |
| PS391ESE    | -40°C to + 85°C   | 16 Narrow SOIC |
| PS391EEE    | -40°C to + 85°C   | 16 QSOP        |
| PS392CPE    | 0°C to + 70°C     | 16 Ld PDIP     |
| PS392CSE    | 0°C to + 70°C     | 16 Narrow SOIC |
| PS392EPE    | -40°C to + 85°C   | 16 Ld PDIP     |
| PS392ESE    | -40°C to + 85°C   | 16 Narrow SOIC |
| PS392EEE    | -40°C to + 85°C   | 16 QSOP        |
| PS393CPE    | 0°C to + 70°C     | 16 Ld PDIP     |
| PS393CSE    | 0°C to + 70°C     | 16 Narrow SOIC |
| PS393EPE    | -40°C to + 85°C   | 16 Ld PDIP     |
| PS393ESE    | -40°C to + 85°C   | 16 Narrow SOIC |
| PS393EEE    | -40°C to + 85°C   | 16 QSOP        |