

### Features

- Low On-Resistance (17 $\Omega$  typ.) Minimizes Distortion and Error Voltages
- Low Glitching Reduces Step Errors in Sample-and-Holds
- Split-Supply Operation ( $\pm 3V$  to  $\pm 8V$ )
- Improved Second Sources for MAX320/MAX321/MAX322
- On-Resistance Matching Between Channels, 0.2 $\Omega$  typ.
- On-Resistance Flatness, <2 $\Omega$  typ.
- Low Off-Channel Leakage, <5nA @ +85°C
- TTL/CMOS Logic Compatible
- Fast Switching Speed,  $t_{ON}$  <150ns
- Guaranteed Break-Before-Make action (PS322) eliminates momentary crosstalk
- Rail-to-Rail Analog Signal Dynamic Range
- Low Power Consumption, <1.25mW
- MSOP Package Minimizes Board Area

### Applications

- Audio Switching and Routing
- Portable Instruments
- Data Acquisition Systems
- Sample-and-Holds
- Telecommunication Systems
- Battery-Powered Systems

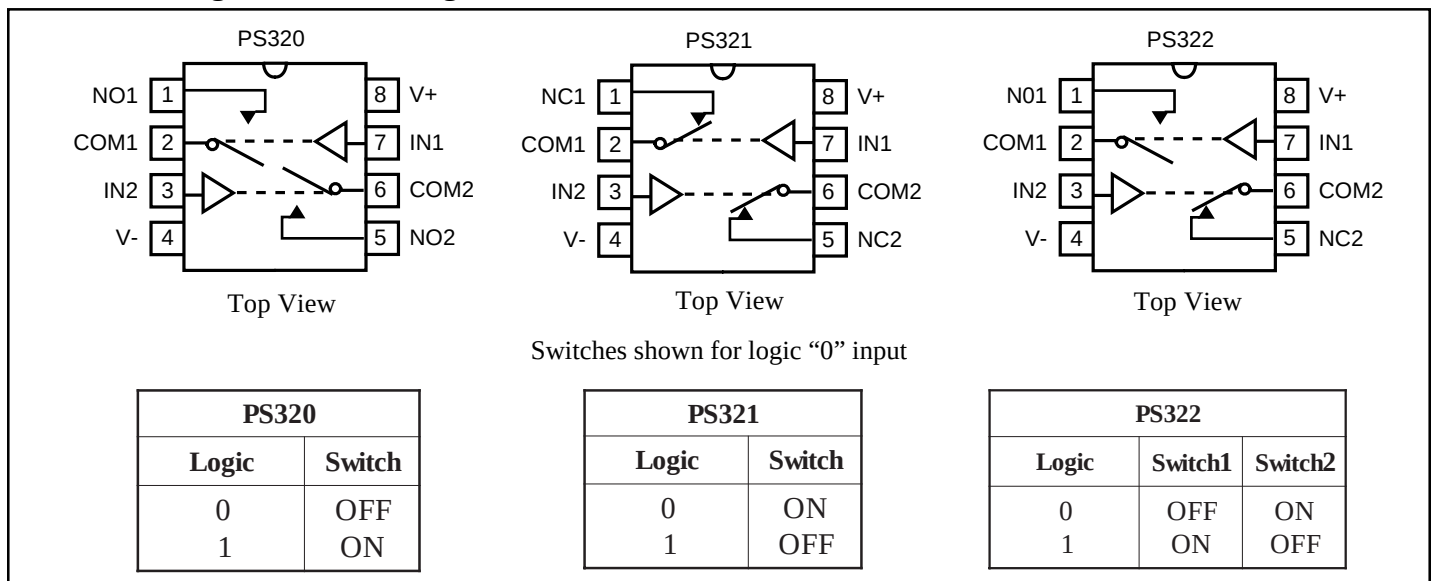
### Description

The PS320/PS321/PS322 are improved high-precision, medium voltage analog switches designed to operate with +3V to +8V power supplies. The PS320 is a dual, single-pole single-throw (SPST), normally open (NO) switch. The PS321 has the same pinout as the PS320 but it has two normally closed (NC) switches. The PS322 has one normally open (NO) and one normally closed (NC) switch per package. When on, each switch conducts current equally well in either direction. In the off state, each switch blocks voltages up to the power-supply rails.

With  $\pm 5V$  power supplies, the PS320/PS321/PS322 guarantee <35 $\Omega$  ON-resistance. ON-resistance matching between channels is within 2 $\Omega$ . ON-resistance flatness is less than 4 $\Omega$  over the specified range. All three devices guarantee low leakage currents (<100pA @ 25°C, <10nA @ +85°C) and fast switching speeds ( $t_{ON}$  <150ns). Break-before-make switching action protects against momentary crosstalk (PS322).

For single-supply operation the PS323/PS324/PS325 are recommended.

### Functional Diagrams, Pin Configurations, and Truth Tables



### Absolute Maximum Ratings

|                                                                                             |                                 |
|---------------------------------------------------------------------------------------------|---------------------------------|
| <b>Voltages Referenced to V–</b>                                                            |                                 |
| V+ .....                                                                                    | -0.3V to +17V                   |
| V <sub>IN</sub> , V <sub>COM</sub> , V <sub>NC</sub> , V <sub>NO</sub> <sup>(1)</sup> ..... | (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

|                                               |                 |
|-----------------------------------------------|-----------------|
| <b>Continuous Power Dissipation</b>           |                 |
| Plastic DIP (derate 6mW/°C above +70°C) ..... | 500mW           |
| Narrow SO (derate 6mW/°C above +70°C) .....   | 450mW           |
| MSOP (derate 4mW/°C above +70°C) .....        | 330mW           |
| 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 V– are clamped by internal diodes. Limit forward diode current to maximum current rating

#### 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 - Dual Supplies (V<sub>±</sub> = ±5V ±10%, V<sub>INH</sub> = 3.5V, V<sub>INL</sub> = 1V)

| Parameter                                              | Symbol                                          | Conditions                                                                                        | Temp. (°C) | Min. <sup>(2)</sup> | Typ. <sup>(1)</sup> | Max. <sup>(2)</sup> | Units |
|--------------------------------------------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------|------------|---------------------|---------------------|---------------------|-------|
| <b>Analog Switch</b>                                   |                                                 |                                                                                                   |            |                     |                     |                     |       |
| 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>V <sub>NO</sub> or V <sub>NC</sub> = ±3.5V<br>I <sub>COM</sub> = 1mA,   | 25         |                     | 16                  | 35                  | Ω     |
|                                                        |                                                 |                                                                                                   | Full       |                     |                     | 45                  |       |
| ON-Resistance Match<br>Between Channels <sup>(4)</sup> | ΔR <sub>ON</sub>                                | V+ = 5V, V– = –5V<br>V <sub>NO</sub> or V <sub>NC</sub> = ±3V,<br>I <sub>COM</sub> = 1mA,         | 25         |                     | 0.3                 | 2                   |       |
|                                                        |                                                 |                                                                                                   | Full       |                     |                     | 4                   |       |
| ON-Resistance Flatness <sup>(5)</sup>                  | R <sub>FLAT(ON)</sub>                           | V+ = 5V, V– = –5V,<br>I <sub>COM</sub> = 1mA,<br>V <sub>NO</sub> or V <sub>NC</sub> = ±3V         | 25         |                     | 1                   | 4                   |       |
|                                                        |                                                 |                                                                                                   | Full       |                     |                     | 6                   |       |
| NO or NC Off Leakage<br>Current <sup>(6)</sup>         | I <sub>NO(OFF)</sub> or<br>I <sub>NC(OFF)</sub> | V+ = 5.5V, V– = –5.5V,<br>V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> or V <sub>NC</sub> = ±4.5V | 25         | –0.1                | –0.01               | 0.1                 | nA    |
|                                                        |                                                 |                                                                                                   | Full       | –5                  |                     | 5                   |       |
| COM Off Leakage<br>Current <sup>(6)</sup>              | I <sub>COM(OFF)</sub>                           | V+ = 5.5V, V– = –5.5V<br>V <sub>COM</sub> = ±4.5V,<br>V <sub>NO</sub> or V <sub>NC</sub> = ±4.5V  | 25         | –0.1                | –0.01               | 0.1                 |       |
|                                                        |                                                 |                                                                                                   | Full       | –5                  |                     | 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<br>V <sub>NO</sub> or V <sub>NC</sub> = ±4.5V  | 25         | –0.2                | –0.04               | 0.2                 |       |
|                                                        |                                                 |                                                                                                   | Full       | –10                 |                     | 10                  |       |

continued next page

**Electrical Specifications - Dual Supplies ( $V_{\pm} = \pm 5V \pm 10\%$ ,  $V_{INH} = 3.5V$ ,  $V_{INL} = 1V$ ) continued**

| 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>      | V <sub>IN</sub> = 3.5V, all others = 0V                                       | Full       | − 0.5               | 0.005               | 0.5                 | mA    |
| Input Current with Input Voltage Low        | I <sub>INL</sub>      | V <sub>IN</sub> = 0V, all others = V+                                         |            | − 0.5               | 0.005               | 0.5                 |       |
| Logic High Input Voltage                    | V <sub>INH</sub>      | V+ = 5V ±10%, V− = − V+                                                       |            | 3.5                 |                     |                     | V     |
|                                             |                       | 3V < V+ < 8V, V− = − V+                                                       |            |                     | 0.6V+               |                     |       |
| Logic Low Input Voltage                     | V <sub>INL</sub>      | V+ = 5V ±10%, V− = − V+                                                       |            |                     |                     | 1                   |       |
|                                             |                       | 3V < V+ < 8V, V− = − V+                                                       |            |                     | 0.3V+               |                     |       |
| Dynamic                                     |                       |                                                                               |            |                     |                     |                     |       |
| Turn-On Time                                | t <sub>ON</sub>       | V <sub>COM</sub> = ±3V,<br>Figure 2                                           | 25         |                     | 65                  | 150                 | ns    |
|                                             |                       |                                                                               | Full       |                     |                     | 175                 |       |
| Turn-Off Time                               | t <sub>OFF</sub>      |                                                                               | 25         |                     | 35                  | 100                 |       |
|                                             |                       |                                                                               | Full       |                     |                     | 150                 |       |
| Break-Before-Make Time Delay <sup>(3)</sup> | t <sub>D</sub>        | PS322 only, R <sub>L</sub> = 300Ω, C <sub>L</sub> = 35pF, Figure 3            | 25         | 2                   | 5                   |                     | pC    |
| Charge Injection <sup>(3)</sup>             | Q                     | C <sub>L</sub> =1nF, V <sub>GEN</sub> = 0V, R <sub>GEN</sub> = 0Ω, Figure 4   |            |                     | 8                   | 12                  |       |
| Off Isolation <sup>(7)</sup>                | O <sub>IRR</sub>      | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 5                |            |                     | −72                 |                     | dB    |
| Crosstalk                                   | X <sub>TALK</sub>     | R <sub>L</sub> = 50Ω, C <sub>L</sub> = 5pF, f = 1MHz, Figure 6                |            |                     | −85                 |                     |       |
| NC or NO Off Capacitance                    | C <sub>(OFF)</sub>    | f = 1MHz, Figure 7                                                            |            |                     | 9                   |                     | pF    |
| COM Off Capacitance                         | C <sub>COM(OFF)</sub> | f = 1MHz, Figure 7                                                            |            |                     | 9                   |                     |       |
| COM On Capacitance                          | C <sub>COM(ON)</sub>  | f = 1MHz, Figure 8                                                            |            |                     | 22                  |                     |       |
| Supply                                      |                       |                                                                               |            |                     |                     |                     |       |
| Power-Supply Range                          | V+, V−                |                                                                               |            | ±2.7                |                     | ±8                  | V     |
| Positive Supply Current                     | I+                    | V+ = 5.5V, V- = − 5.5V, V <sub>IN</sub> = 0V or V+,<br>All channels on or off | 25         |                     | 80                  | 125                 | mA    |
|                                             |                       |                                                                               | Full       |                     |                     | 200                 |       |
| Negative Supply Current                     | I−                    |                                                                               | 25         | − 125               | − 80                |                     |       |
|                                             |                       |                                                                               | Full       | − 200               |                     |                     |       |

**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
- $\Delta R_{ON} = \Delta R_{ON} \text{ max.} - \Delta R_{ON} \text{ min.}$
- 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 =  $20 \log_{10} [ V_{COM} / (V_{NC} \text{ or } V_{NO}) ]$ .

## Test Circuits/Timing Diagrams

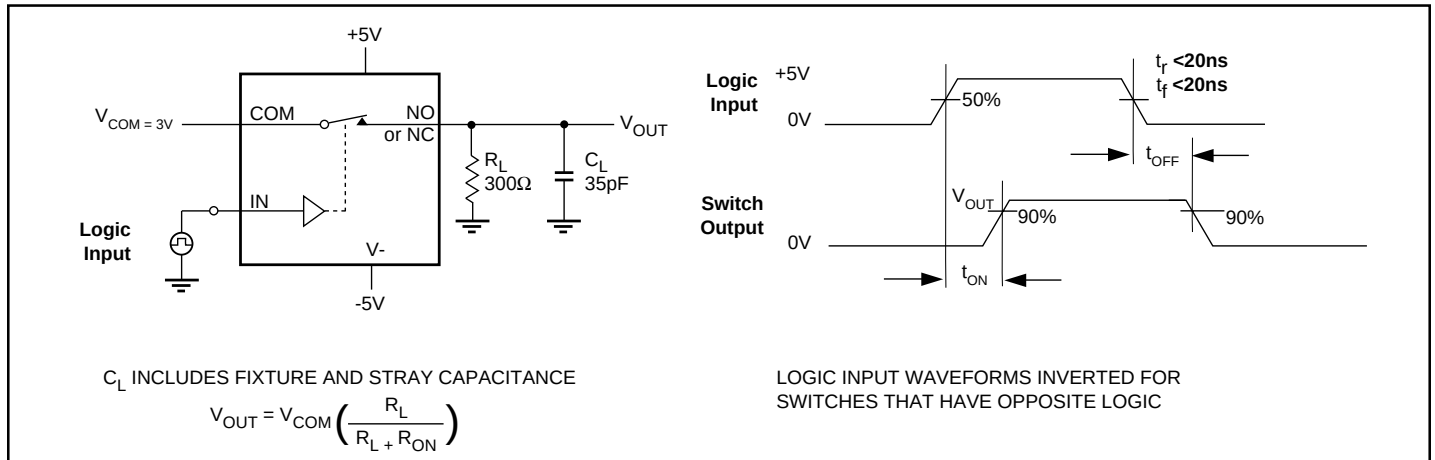


Figure 2. Switching Time

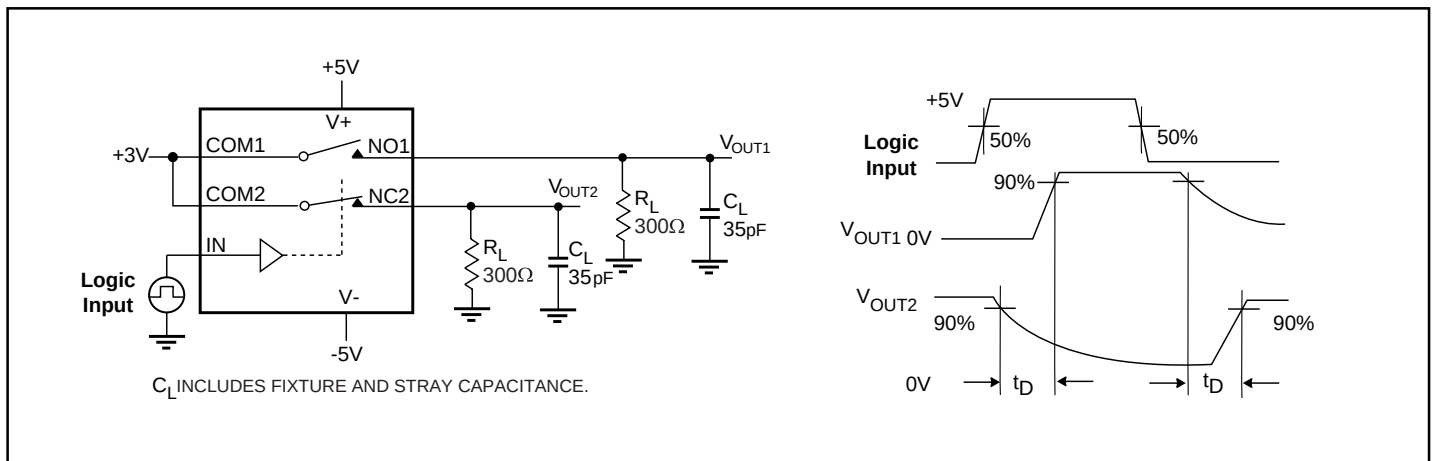


Figure 3. Break-Before-Make Interval (PS322 only)

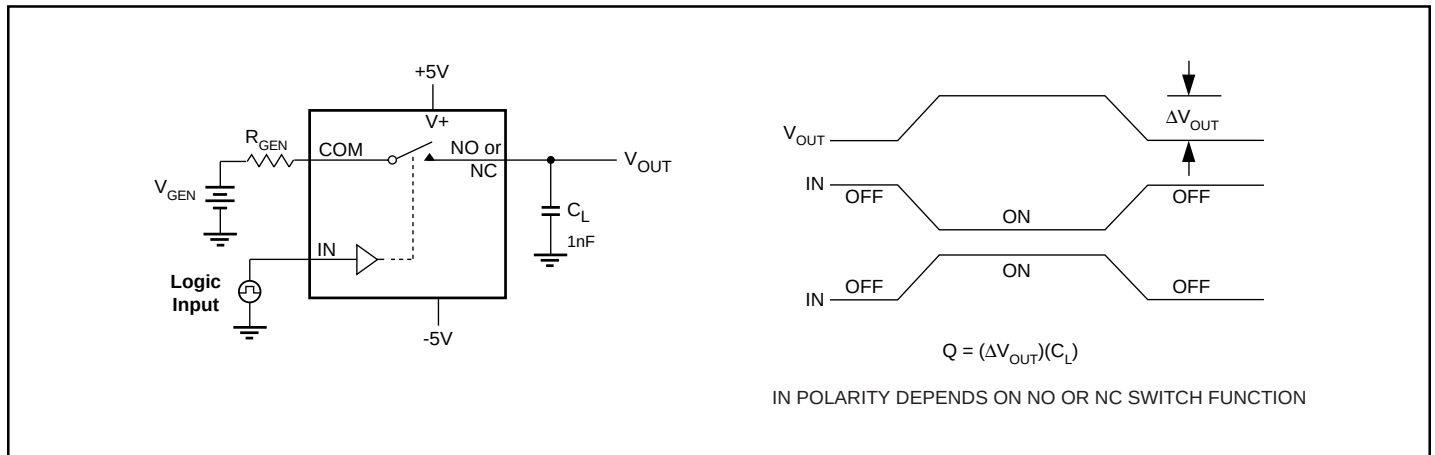


Figure 4. Charge Injection

### Test Circuits/Timing Diagrams (continued)

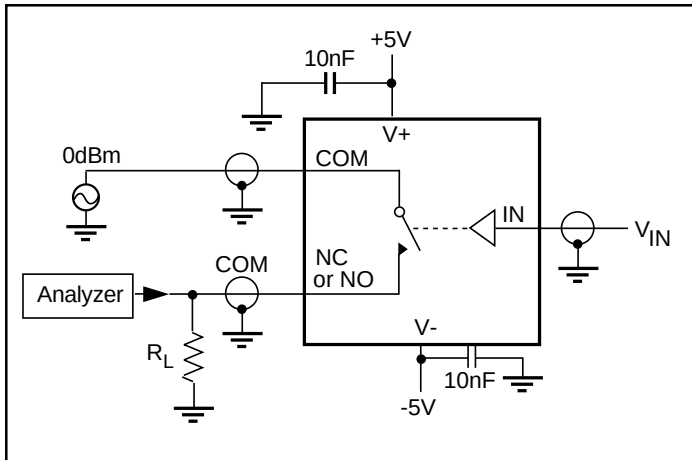


Figure 5. Off Isolation

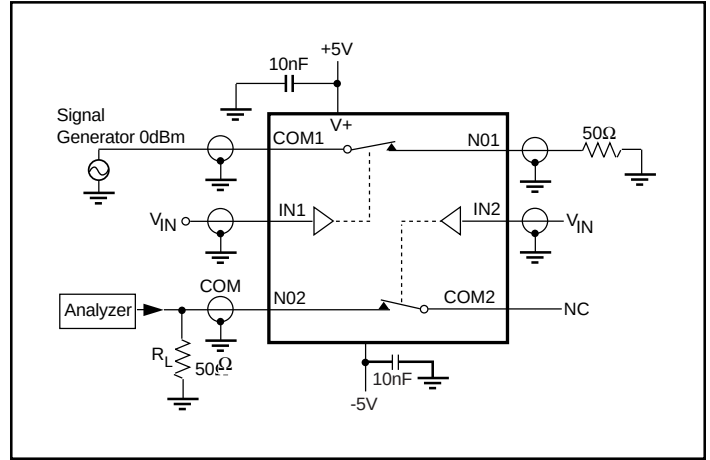


Figure 6. Crosstalk

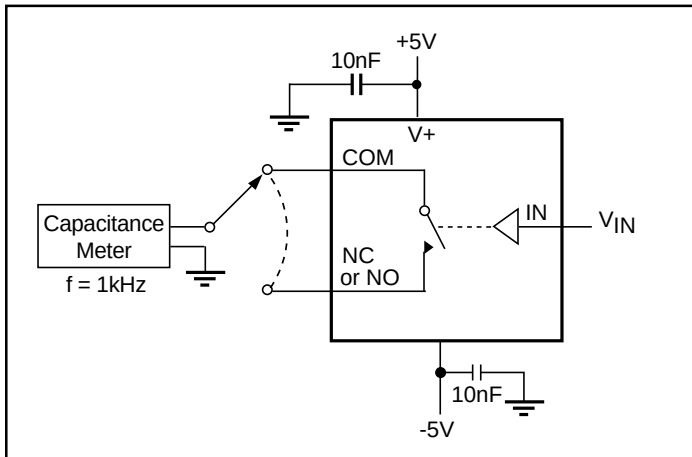


Figure 7. Channel-Off Capacitance

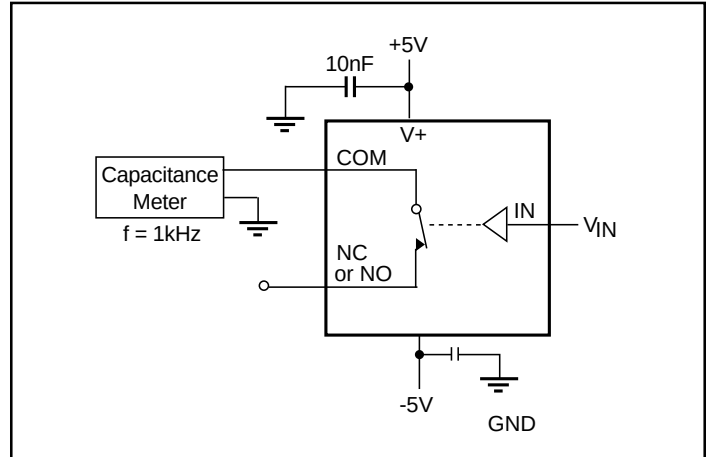


Figure 8. Channel-On Capacitance

### Ordering Information

| Part      | Temp. Range    | Package       |
|-----------|----------------|---------------|
| PS320CPA  | 0°C to +70°C   | 8 Plastic DIP |
| PS320CSA  |                | 8 Narrow SO   |
| PS320CUAX |                | 8 MSOP        |
| PS320EPA  | -40°C to +85°C | 8 Plastic DIP |
| PS320ESA  |                | 8 Narrow SO   |
| PS321CPA  | 0°C to +70°C   | 8 Plastic DIP |
| PS321CSA  |                | 8 Narrow SO   |
| PS321CUAX |                | 8 MSOP        |

| Part      | Temp. Range    | Package       |
|-----------|----------------|---------------|
| PS321EPA  | -40°C to +85°C | 8 Plastic DIP |
| PS321ESA  |                | 8 Narrow SO   |
| PS322CPA  | 0°C to +70°C   | 8 Plastic DIP |
| PS322CSA  |                | 8 Narrow SO   |
| PS322CUAX |                | 8 MSOP        |
| PS322EPA  | -40°C to +85°C | 8 Plastic DIP |
| PS322ESA  |                | 8 Narrow SO   |

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