



## Low-Voltage, Low $r_{ON}$ , Dual DPDT Analog Switch

### FEATURES

- Low Voltage Operation (2.7 V to 3.3 V)
- Low On-Resistance -  $r_{ON}$ : 0.85  $\Omega$
- 3 dB Loss @ 100 MHz
- Fast Switching:  $t_{ON}$  = 40 ns  
 $t_{OFF}$  = 35 ns
- QFN-16 Package

### BENEFITS

- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- TTL/1.8-V Logic Compatible
- High Bandwidth

### APPLICATIONS

- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Battery Operated Systems

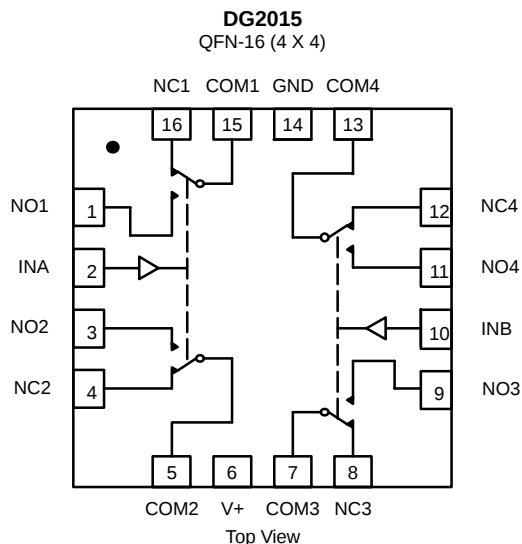
### DESCRIPTION

The DG2015 is a dual double-pole/double-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, high speed, low on-resistance and small physical size, the DG2015 is ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2015 is built on Vishay Siliconix's low voltage J12 process. An epitaxial layer prevents latchup. Break-before-make is guaranteed.

The switch conducts equally well in both directions when on, and blocks up to the power supply level when off.

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



#### TRUTH TABLE

| Logic | NC1, 2, 3 and 4 | NO1, 2, 3 and 4 |
|-------|-----------------|-----------------|
| 0     | ON              | OFF             |
| 1     | OFF             | ON              |

#### ORDERING INFORMATION

| Temp Range  | Package               | Part Number |
|-------------|-----------------------|-------------|
| -40 to 85°C | 16-Pin QFN (4 x 4 mm) | DG2015DN    |

## ABSOLUTE MAXIMUM RATINGS

Reference to GND

|                                               |       |                      |
|-----------------------------------------------|-------|----------------------|
| V+                                            | ..... | -0.3 to +6 V         |
| IN, COM, NC, NO <sup>a</sup>                  | ..... | -0.3 to (V+ + 0.3 V) |
| Current (Any terminal except NO, NC or COM)   | ..... | 30 mA                |
| Continuous Current (NO, NC, or COM)           | ..... | ±150 mA              |
| Peak Current                                  | ..... | ±200 mA              |
| (Pulsed at 1 ms, 10% duty cycle)              |       |                      |
| Storage Temperature (D Suffix)                | ..... | -65 to 150°C         |
| Package Solder Reflow Conditions <sup>d</sup> | ..... |                      |
| 16-Pin QFN (4 x 4 mm)                         | ..... | 240°C                |

Power Dissipation (Packages)<sup>b</sup>

|                     |       |         |
|---------------------|-------|---------|
| QFN-16 <sup>c</sup> | ..... | 1880 mW |
|---------------------|-------|---------|

Notes:

- Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- All leads welded or soldered to PC Board.
- Derate 23.5 mW/°C above 70°C
- Manual soldering with iron is not recommended for leadless components. The QFN is a leadless package. The end of the lead terminal is exposed copper (not plated) as a result of the singulation process in manufacturing. A solder fillet at the exposed copper lip cannot be guaranteed and is not required to ensure adequate bottom side solder interconnection.

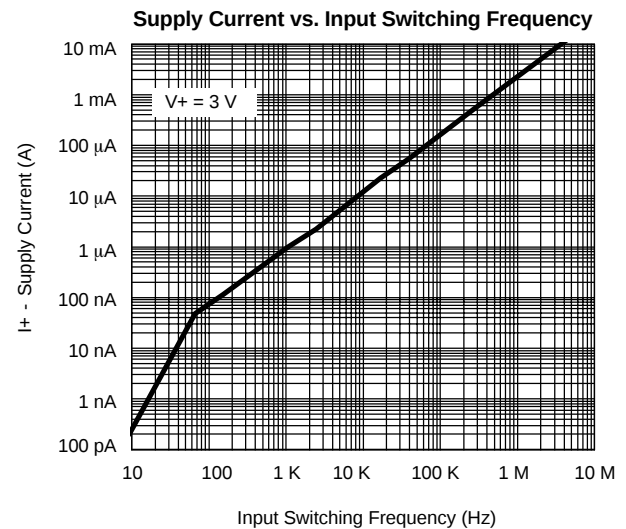
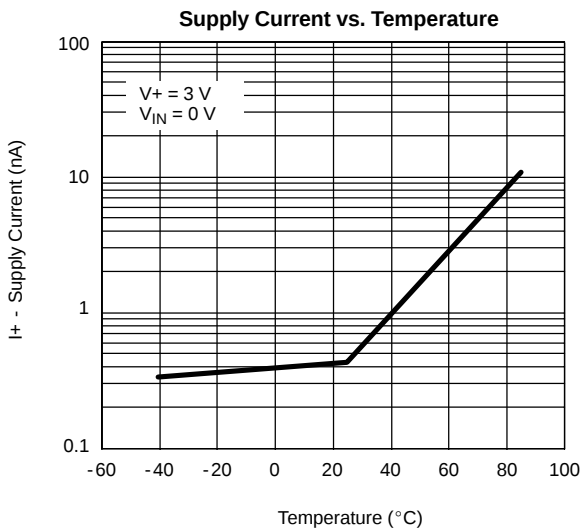
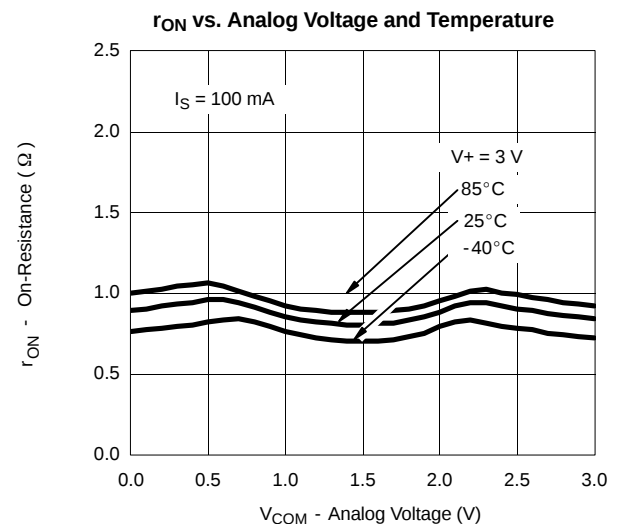
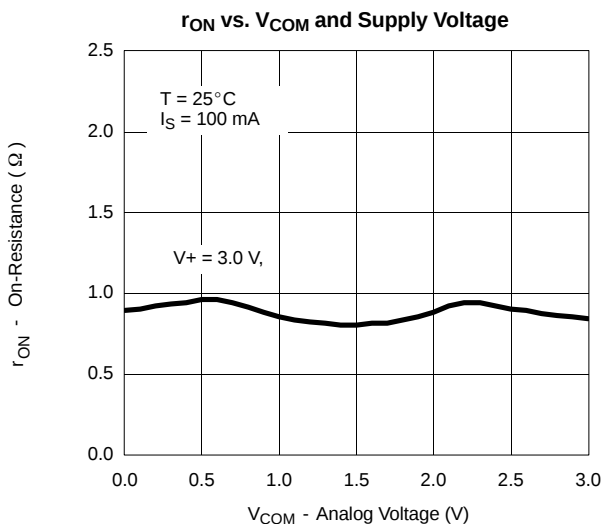
| SPECIFICATIONS (V+ = 3 V)           |                       |                                                                                                  |                   |                       |                  |                  |      |
|-------------------------------------|-----------------------|--------------------------------------------------------------------------------------------------|-------------------|-----------------------|------------------|------------------|------|
| Parameter                           | Symbol                | Test Conditions<br>Otherwise Unless Specified<br>V+ = 3 V, ±10%, VIN = 0.4 or 2.0 V <sup>e</sup> | Temp <sup>a</sup> | Limits<br>-40 to 85°C |                  |                  | Unit |
|                                     |                       |                                                                                                  |                   | Min <sup>b</sup>      | Typ <sup>c</sup> | Max <sup>b</sup> |      |
| Analog Switch                       |                       |                                                                                                  |                   |                       |                  |                  |      |
| Analog Signal Range <sup>d</sup>    | VNO, VNC,<br>VCOM     |                                                                                                  | Full              | 0                     |                  | V+               | V    |
| On-Resistance                       | rON                   | V+ = 2.7 V, VCOM = 0.2 V/1.5 V, INO, INC = 100 mA                                                | Room<br>Full      |                       | 0.85             | 1.6<br>1.7       | Ω    |
| rON Flatness                        | rON<br>Flatness       | V+ = 2.7 V<br>VCOM = 0 to V+, INO, INC = 100 mA                                                  | Room              |                       | 0.16             |                  |      |
| rON Match                           | ΔrON                  |                                                                                                  | Room              |                       | 0.15             |                  |      |
| Switch Off Leakage Current          | INO(off),<br>INC(off) | V+ = 3.3 V, VNO, VNC = 1 V/3 V<br>VCOM = 3 V/1 V                                                 | Room<br>Full      | -1<br>-10             |                  | 1<br>10          | nA   |
|                                     | ICOM(off)             |                                                                                                  | Room<br>Full      | -1<br>-10             |                  | 1<br>10          |      |
| Channel-On Leakage Current          | ICOM(on)              | V+ = 3.3 V, VNO, VNC = VCOM = 1 V/3 V                                                            | Room<br>Full      | -1<br>-10             |                  | 1<br>10          |      |
| Digital Control                     |                       |                                                                                                  |                   |                       |                  |                  |      |
| Input High Voltage                  | VINH                  |                                                                                                  | Full              | 2                     |                  |                  | V    |
| Input Low Voltage                   | VINL                  |                                                                                                  | Full              |                       |                  | 0.4              |      |
| Input Capacitance                   | Cin                   |                                                                                                  | Full              |                       | 4                |                  | pF   |
| Input Current                       | IINL or IINH          | VIN = 0 or V+                                                                                    | Full              | -1                    |                  | 1                | μA   |
| Dynamic Characteristics             |                       |                                                                                                  |                   |                       |                  |                  |      |
| Turn-On Time                        | tON                   | VNO or VNC = 2.0 V, RL = 300 Ω, CL = 35 pF                                                       | Room<br>Full      |                       | 40               | 65<br>67         | ns   |
| Turn-Off Time                       | tOFF                  |                                                                                                  | Room<br>Full      |                       | 35               | 60<br>62         |      |
| Break-Before-Make Time              | t <sub>d</sub>        |                                                                                                  | Full              | 1                     | 3                |                  |      |
| Charge Injection <sup>d</sup>       | QINJ                  | CL = 1 nF, VGEN = 0 V, RGEN = 0 Ω                                                                | Room              |                       | 7                |                  | pC   |
| Off-Isolation <sup>d</sup>          | OIRR                  | RL = 50 Ω, CL = 5 pF, f = 1 MHz                                                                  | Room              |                       | -67              |                  | dB   |
| Crosstalk <sup>d</sup>              | XTALK                 |                                                                                                  | Room              |                       | -70              |                  |      |
| NO, NC Off Capacitance <sup>d</sup> | CNO(off)              | VIN = 0 or V+, f = 1 MHz                                                                         | Room              |                       | 63               |                  | pF   |
|                                     | CNC(off)              |                                                                                                  | Room              |                       | 67               |                  |      |
| Channel-On Capacitance <sup>d</sup> | CNO(on)               |                                                                                                  | Room              |                       | 200              |                  |      |
|                                     | CNC(on)               |                                                                                                  | Room              |                       | 196              |                  |      |

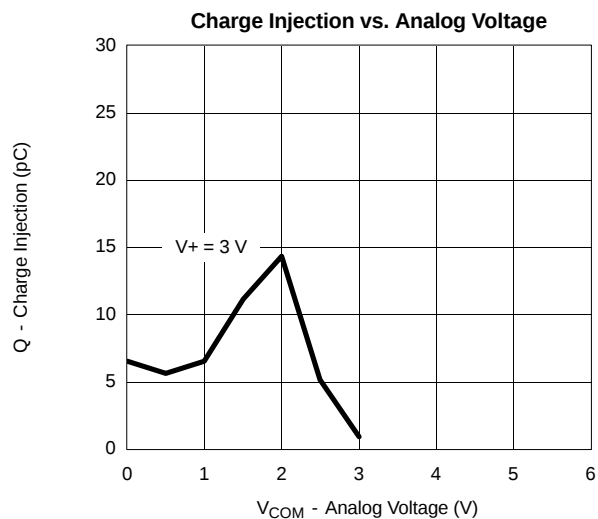
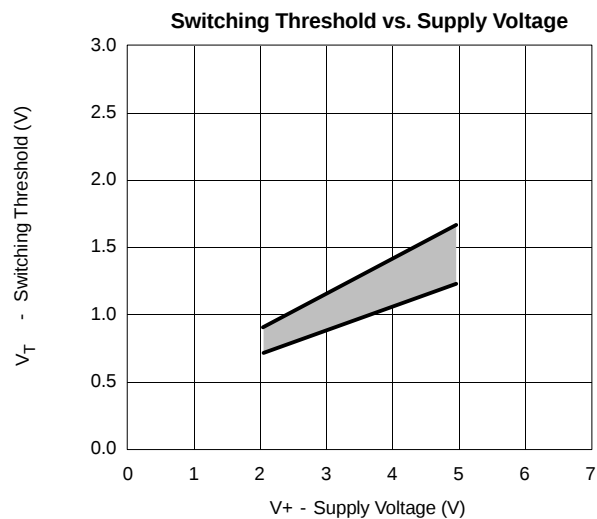
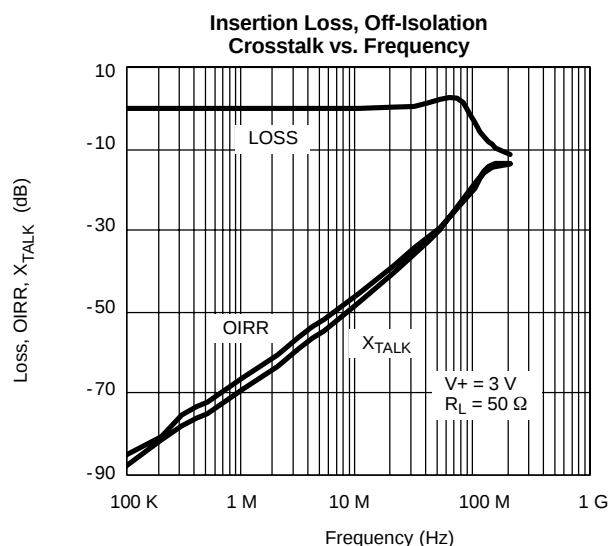
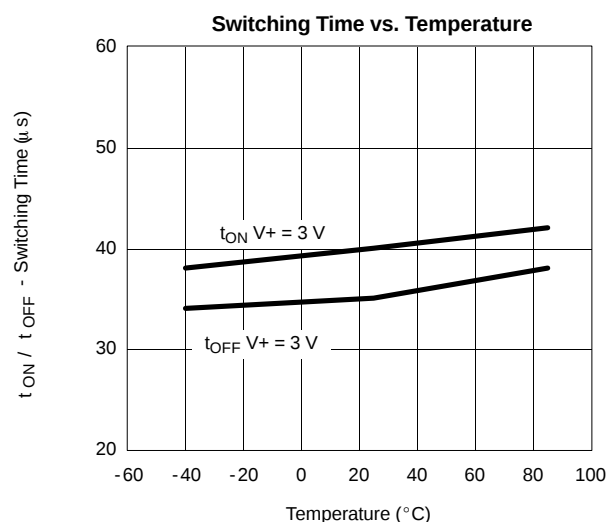
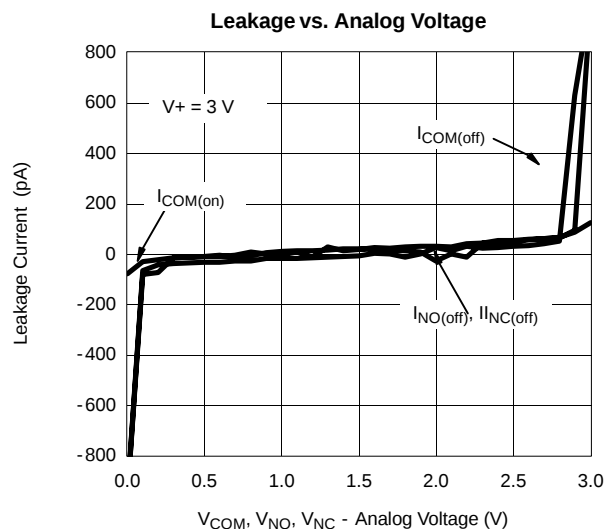
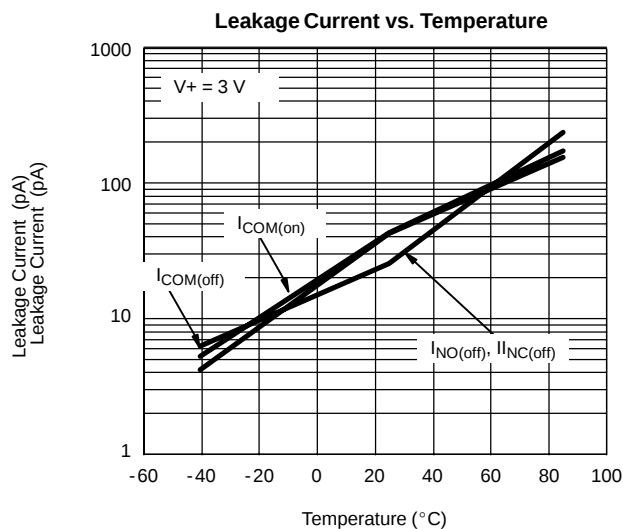
**SPECIFICATIONS (V+ = 3 V)**

| Parameter            | Symbol | Test Conditions<br>Otherwise Unless Specified<br><br>V+ = 3 V, ± 10%, VIN = 0.4 or 2.0 V <sup>e</sup> | Temp <sup>a</sup> | Limits<br>-40 to 85°C |                  |                  | Unit |
|----------------------|--------|-------------------------------------------------------------------------------------------------------|-------------------|-----------------------|------------------|------------------|------|
|                      |        |                                                                                                       |                   | Min <sup>b</sup>      | Typ <sup>c</sup> | Max <sup>b</sup> |      |
| Power Supply         |        |                                                                                                       |                   |                       |                  |                  |      |
| Power Supply Range   | V+     |                                                                                                       |                   | 2.7                   |                  | 3.3              | V    |
| Power Supply Current | I+     | VIN = 0 or V+                                                                                         | Full              |                       |                  | 1.0              | μA   |
| Power Consumption    | PC     |                                                                                                       | Full              |                       |                  | 3.3              | μW   |

## Notes:

- Room = 25°C, Full = as determined by the operating suffix.
- Typical values are for design aid only, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guarantee by design, nor subjected to production test.
- $V_{IN}$  = input voltage to perform proper function.
- Guaranteed by 5-V leakage testing, not production tested.

**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**


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TEST CIRCUITS

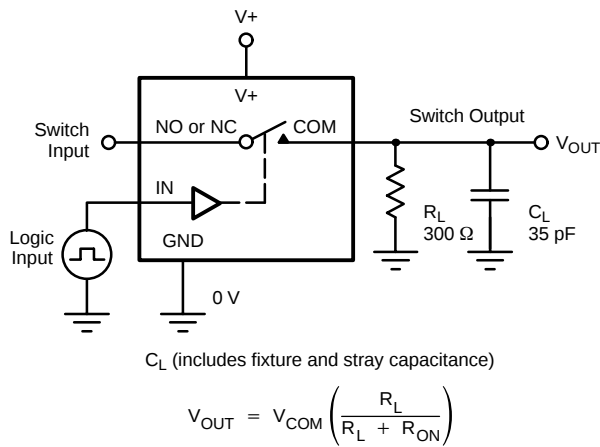
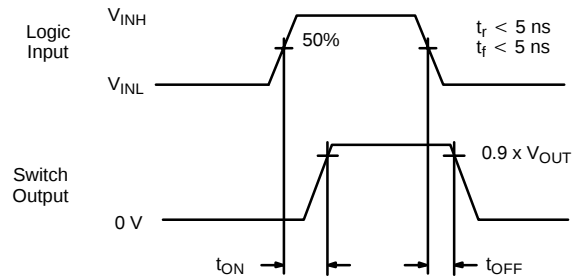


Figure 1. Switching Time



Logic "1" = Switch On  
Logic input waveforms inverted for switches that have the opposite logic sense.

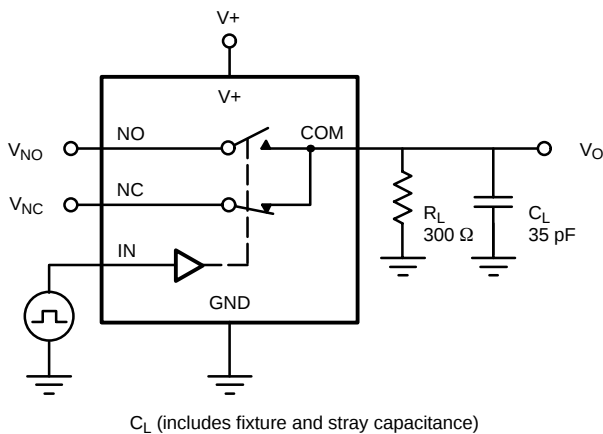


Figure 2. Break-Before-Make Interval

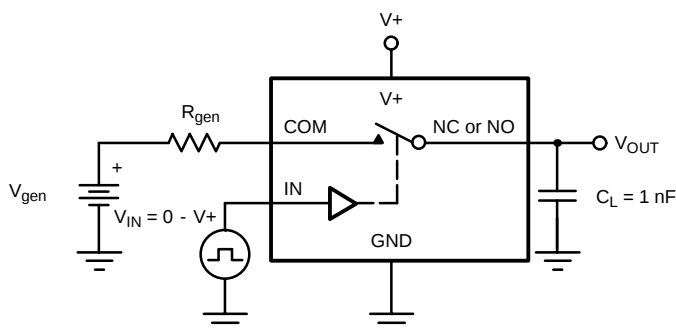
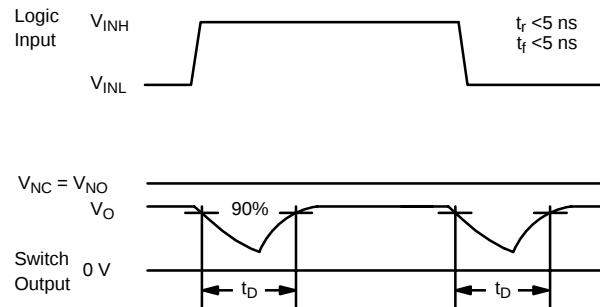
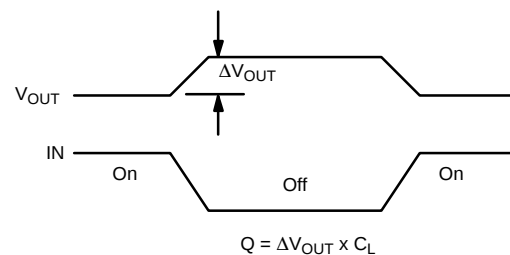
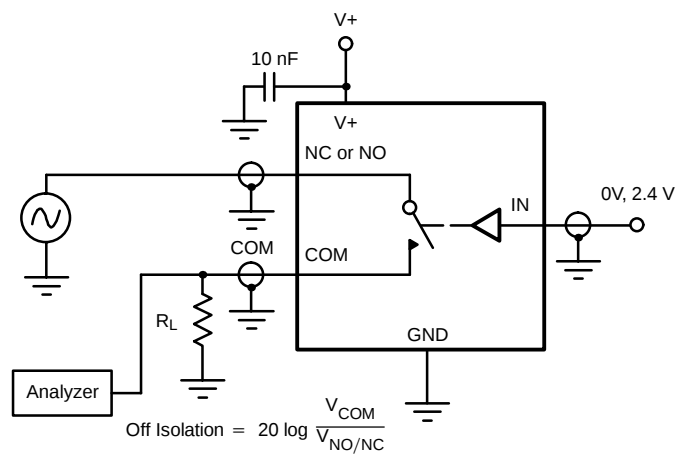
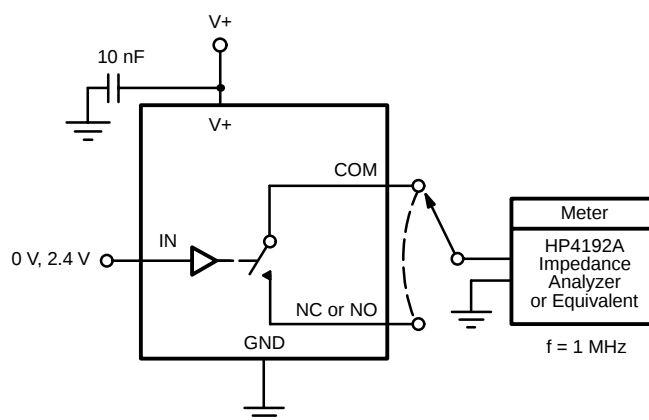


Figure 3. Charge Injection



IN depends on switch configuration: input polarity determined by sense of switch.

**TEST CIRCUITS**

**Figure 4.** Off-Isolation

**Figure 5.** Channel Off/On Capacitance