

0.4-Ω Low-Voltage Dual SPDT Analog Switch

DESCRIPTION

The DG2531/DG2532 is a sub 1-Ω (0.4 Ω at 2.7 V) dual SPDT analog switches designed for low voltage applications.

The DG2531/DG2532 has on-resistance matching (less than 0.05 Ω at 2.7 V) and flatness (less than 0.2 Ω at 2.7 V) that are guaranteed over the entire voltage range. Additionally, low logic thresholds makes the DG2531/DG2532 an ideal interface to low voltage DSP control signals.

The DG2531/DG2532 has fast switching speed (on/off time at 40 and 35 ns) with break-before-make guaranteed. In the On condition, all switching elements conduct equally in both directions. Off-isolation and crosstalk is - 69 dB at 100 kHz.

The DG2531/DG2532 is built on Vishay Siliconix's high-density low voltage CMOS process. An epitaxial layer is built in to prevent latchup. The DG2531/DG2532 contains the additional benefit of 2000 V ESD protection.

Packaged in space saving MSOP-10, the DG2531/DG2532 is a high performance, low r_{ON} switches for battery powered applications.

FEATURES

- Low Voltage Operation (1.8 V to 5.5 V)
- Low On-Resistance - r_{ON} : 0.4 Ω at 2.7 V
- - 69 dB OIRR at 2.7 V, 100 kHz
- MSOP-10 Package
- ESD Protection > 2000 V

BENEFITS

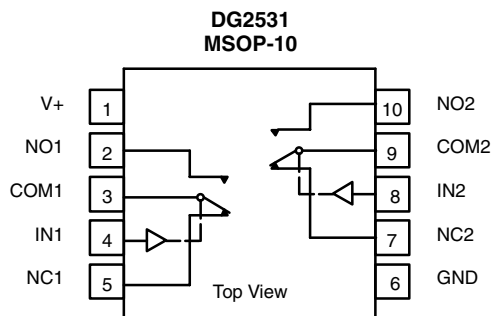
- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- 1.6 V Logic Compatible
- High Bandwidth

APPLICATIONS

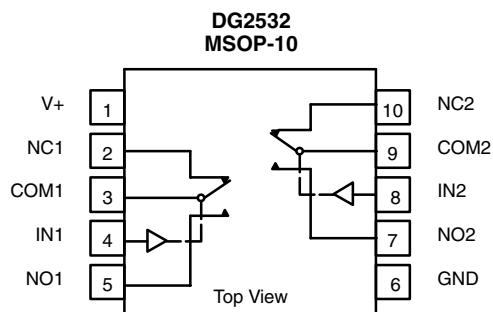
- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Battery Operated Systems
- Relay Replacement


RoHS
COMPLIANT

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



| TRUTH TABLE | | |
|-------------|-------------|-------------|
| Logic | NC1 and NC2 | NO1 and NO2 |
| 0 | ON | OFF |
| 1 | OFF | ON |



| ORDERING INFORMATION | | |
|----------------------|---------|----------------------------------|
| Temp Range | Package | Part Number |
| - 40 to 85 °C | MSOP-10 | DG2531DQ-T1-E3 DG2532DQ-T1-E3 |

| ABSOLUTE MAXIMUM RATINGS | | | |
|--|----------------------|---------------------|------|
| Parameter | | Limit | Unit |
| Reference V+ to GND | | - 0.3 to + 6 | V |
| IN, COM, NC, NO ^a | | - 0.3 to (V+ + 0.3) | |
| Continuous Current (NO, NC, COM) | | ± 300 | mA |
| Peak Current (Pulsed at 1 ms, 10 % duty cycle) | | ± 500 | |
| Storage Temperature | (D Suffix) | - 65 to 150 | °C |
| PESD per Method 3015.7 | | > 2 | kV |
| Power Dissipation (Packages) ^b | MSOP-10 ^c | 320 | mW |

Notes:

- a. Signals on NC, NO, or COM or IN exceeding V+ will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
- b. All leads welded or soldered to PC Board.
- c. Derate 4.0 mW/°C above 70 °C.

| SPECIFICATIONS (V+ = 3 V) | | | | | | | |
|--|---|--|-------------------|-------------------------|------------------|------------------|------|
| Parameter | Symbol | Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, V _{IN} = 0.5 V or 1.4 V ^e | Temp ^a | Limits - 40 to 85 °C | | | Unit |
| | | | | Min ^b | Typ ^c | Max ^b | |
| Analog Switch | | | | | | | |
| Analog Signal Range ^d | V _{NO} , V _{NC} , V _{COM} | | Full | 0 | | V+ | V |
| On-Resistance | r _{ON} | V+ = 2.7 V, V _{COM} = 0.6 V/1.5 V I _{NO} , I _{NC} = 100 mA | Room Full | | 0.4 | 0.6 0.7 | Ω |
| r _{ON} Flatness ^d | r _{ON} Flatness | | Room | | 0.12 | 0.2 | |
| On-Resistance Match Between Channels ^d | Δr _{DS(on)} | | Room | | | 0.05 | |
| Switch Off Leakage Current | I _{NO(off)} I _{NC(off)} | V+ = 3.3 V, V _{NO} , V _{NC} = 0.3 V/3 V, V _{COM} = 3 V/0.3 V | Room Full | - 1 - 10 | | 1 10 | nA |
| | I _{COM(off)} | | Room Full | - 1 - 10 | | 1 10 | |
| Channel-On Leakage Current | I _{COM(on)} | V+ = 3.3 V, V _{NO} , V _{NC} = V _{COM} = 0.3 V/3 V | Room Full | - 1 - 10 | | 1 10 | |
| Digital Control | | | | | | | |
| Input High Voltage ^d | V _{INH} | | Full | 1.4 | | | V |
| Input Low Voltage | V _{INL} | | Full | | | 0.5 | |
| Input Capacitance | C _{in} | | Full | | 7 | | pF |
| Input Current | I _{INL} or I _{INH} | V _{IN} = 0 or V+ | Full | 1 | | 1 | μA |



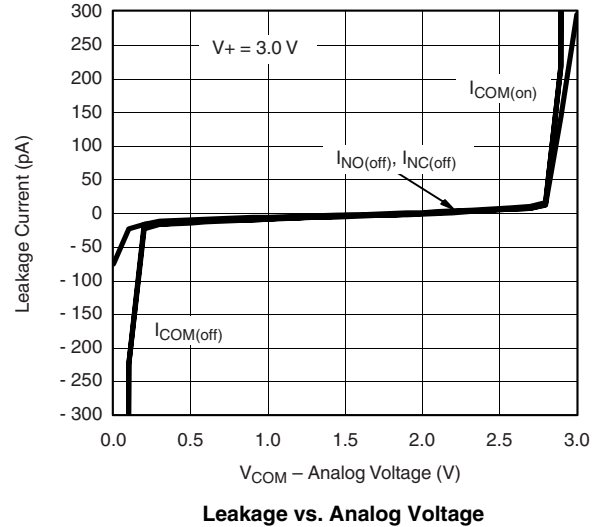
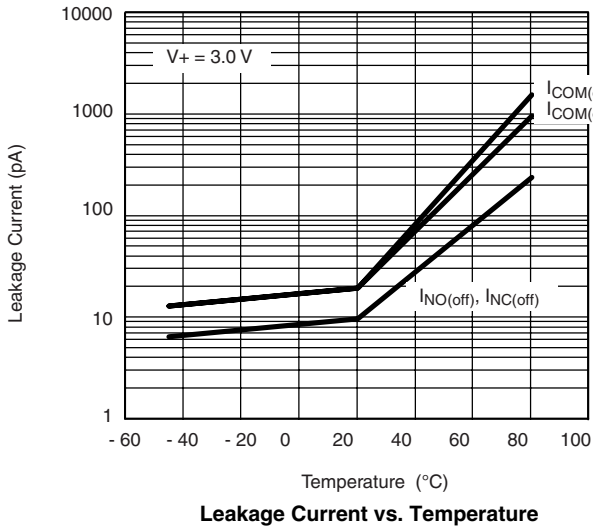
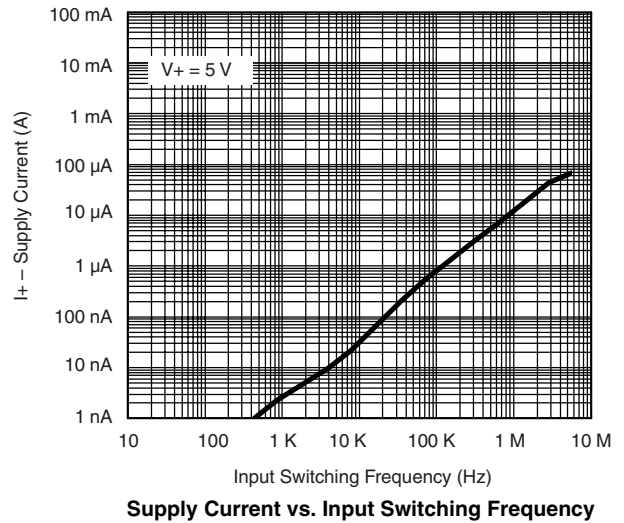
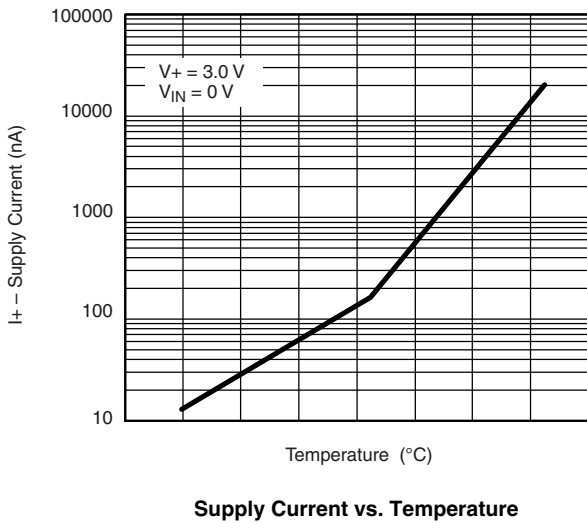
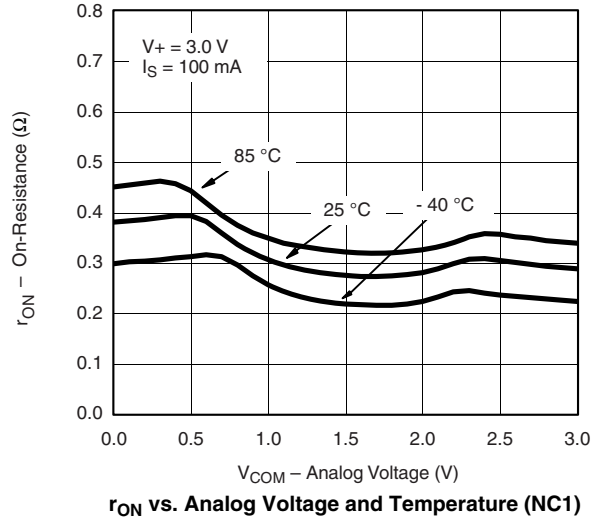
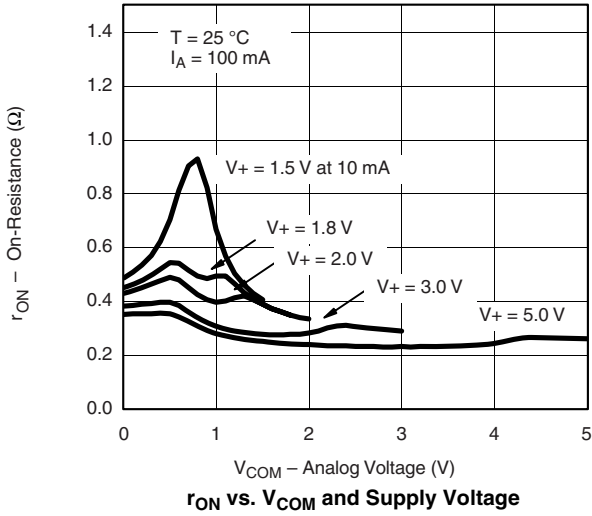
| SPECIFICATIONS (V ₊ = 3 V) | | | | | | | |
|--|--|--|-------------------|-------------------------|------------------|------------------|------|
| Parameter | Symbol | Test Conditions Otherwise Unless Specified V ₊ = 3 V, ± 10 %, V _{IN} = 0.5 V or 1.4 V ^e | Temp ^a | Limits - 40 to 85 °C | | | Unit |
| | | | | Min ^b | Typ ^c | Max ^b | |
| Dynamic Characteristics | | | | | | | |
| Turn-On Time | t _{ON} | V _{NO} or V _{NC} = 2.0 V, R _L = 50 Ω, C _L = 35 pF | Room Full | | 40 | 70 77 | ns |
| Turn-Off Time | t _{OFF} | | Room Full | | 35 | 65 72 | |
| Break-Before-Make Time | t _d | | Room | 1 | 4 | | |
| Charge Injection ^d | Q _{INJ} | C _L = 1 nF, V _{GEN} = 1.5 V, R _{GEN} = 0 Ω | Room | | 54 | | pC |
| Off-Isolation ^d | OIRR | R _L = 50 Ω, C _L = 5 pF, f = 100 kHz | Room | | - 69 | | dB |
| Crosstalk ^d | X _{TALK} | | Room | | - 69 | | |
| N _O , N _C Off Capacitance ^d | C _{NO(off)} C _{NC(off)} | V _{IN} = 0 or V ₊ , f = 1 MHz | Room | | 143 | | pF |
| Channel-On Capacitance ^d | C _{NO(on)} C _{NC(on)} | | Room | | 403 | | |
| Power Supply | | | | | | | |
| Power Supply Range | V ₊ | | | 1.8 | | 5.5 | V |
| Power Supply Current | I ₊ | V _{IN} = 0 or V ₊ | Full | | | 1.0 | μA |

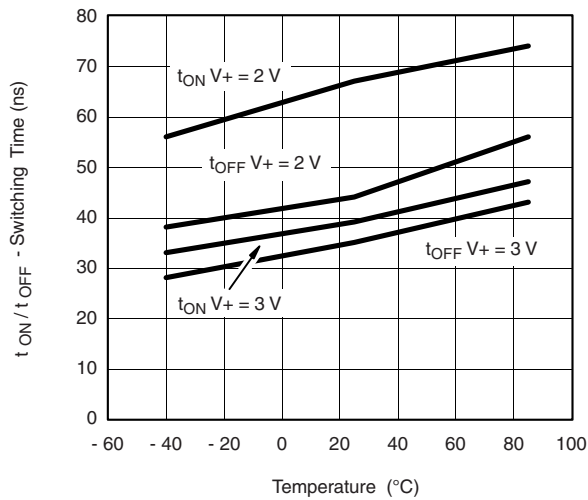
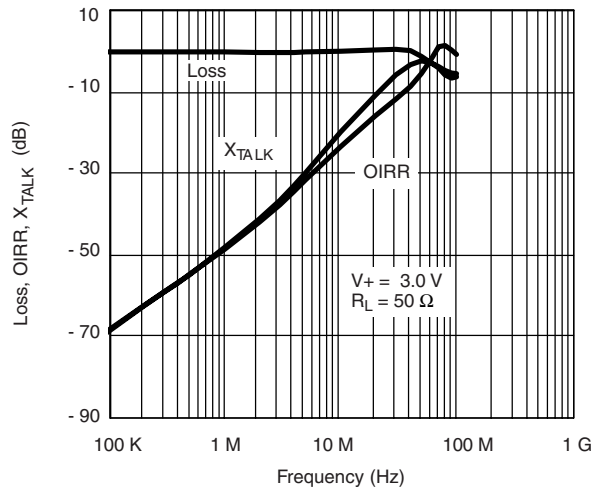
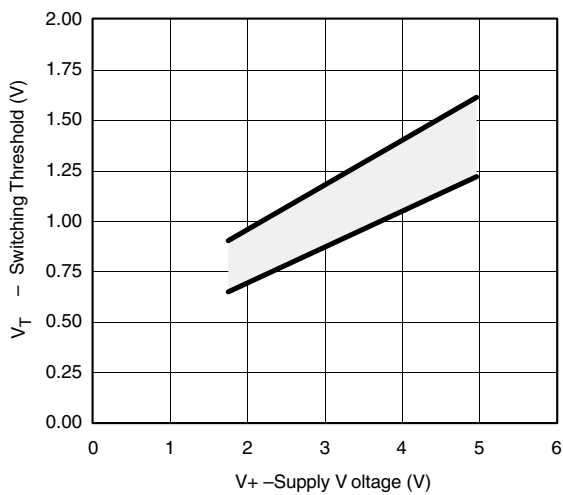
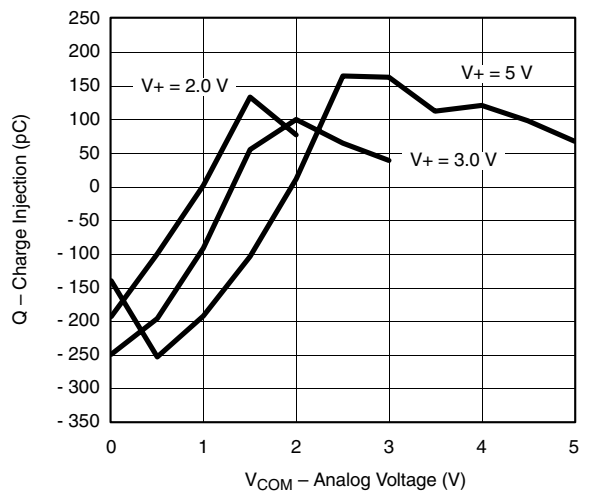
Notes:

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

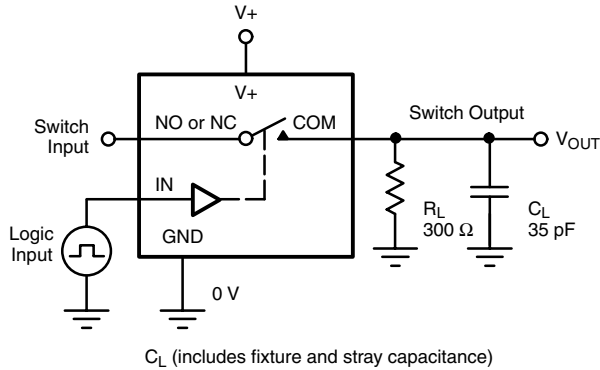
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted

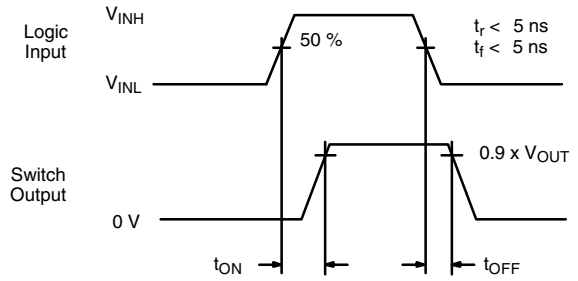


TYPICAL CHARACTERISTICS $T_A = 25\text{ }^\circ\text{C}$, unless otherwise noted

Switching Time vs. Temperature

Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

Switching Threshold vs. Supply Voltage

Charge Injection vs. Analog Voltage

TEST CIRCUITS



$$V_{OUT} = V_{COM} \left(\frac{R_L}{R_L + R_{ON}} \right)$$



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

Figure 1. Switching Time

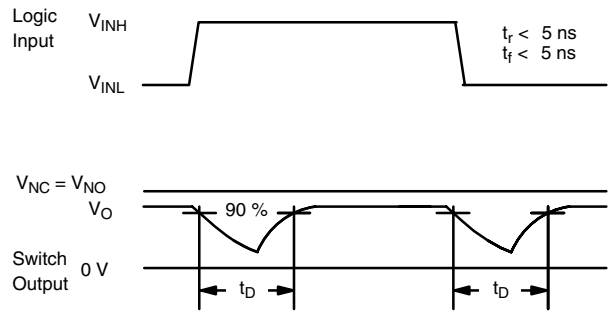
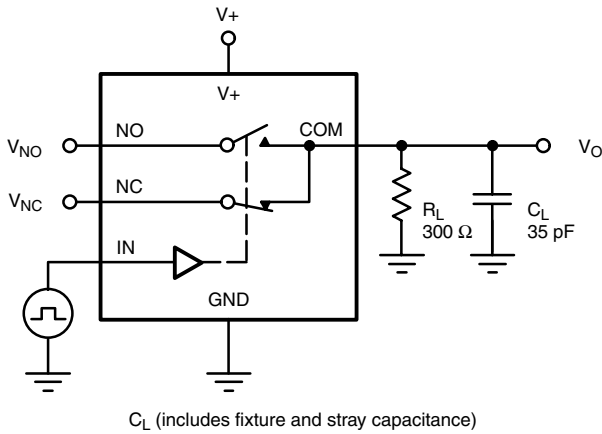
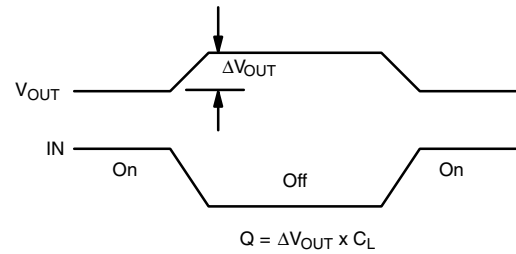
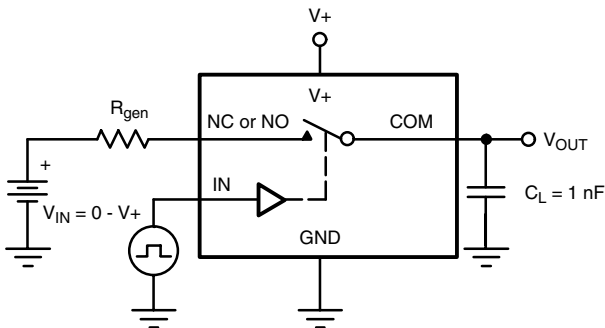


Figure 2. Break-Before-Make Interval



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

Figure 3. Charge Injection

TEST CIRCUITS

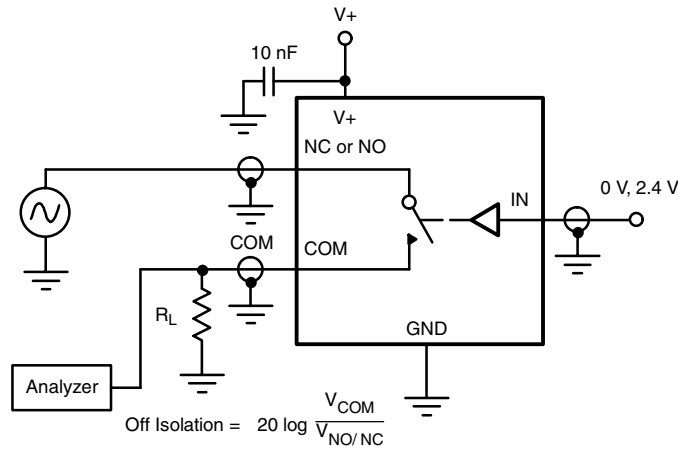


Figure 4. Off-Isolation

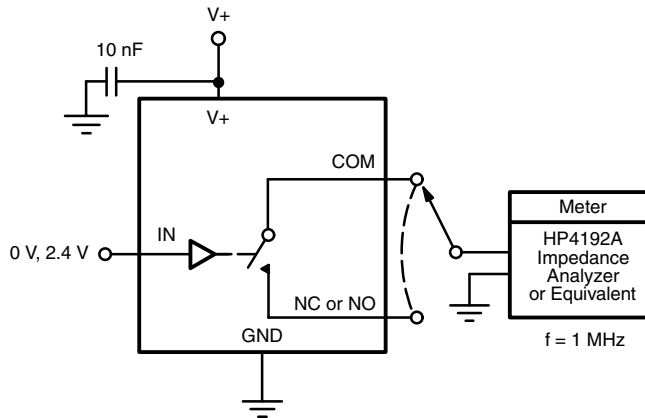


Figure 5. Channel Off/On Capacitance

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