0.35-Ω Low-Voltage Dual SPDT Analog Switch

DESCRIPTION

The DG2535/DG2536 is a sub 1 Ω (0.35 Ω at 2.7 V) dual SPDT analog switches designed for low voltage applications.

The DG2535/DG2536 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 make the DG2535/DG2536 an ideal interface to low voltage DSP control signals.

The DG2535/DG2536 has fast switching speed 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 DG2535/DG2536 is built on Vishay Siliconix's high-density low voltage CMOS process. An eptiaxial layer is built in to prevent latchup. The DG2535/DG2536 contains the additional benefit of 2,000 V ESD protection.

In space saving MSOP-10 and DFN-10 lead (Pb)-free packages, the DG2535/DG2536 are high performance, low r_{ON} switches for battery powered applications. No lead (Pb) is used in the manufacturing process either inside the device/ package or on the external terminations. As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. For analog switching products manufactured in DFN packages, the lead (Pb)-free "-E3/E4" suffix is being used as a designator. Lead (Pb)-free DFN products purchased at any time will have either a nickel-palladium-gold device termination or a 100 % matte tin device termination. The different lead (Pb)-free materials are interchangeable and meet all JEDEC standards for reflow and MSL rating.

FEATURES

- Low Voltage Operation
- Low On-Resistance - r_{ON}: 0.35 Ω at 2.7 V
- - 69 dB OIRR at 2.7 V, 100 kHz
- MSOP-10 and DFN-10 Packages
- ESD Protection > 2000 V
- Latch-Up Current > 300 mA (JESD 78)

Pb-free

RoHS COMPLIANT

BENEFITS

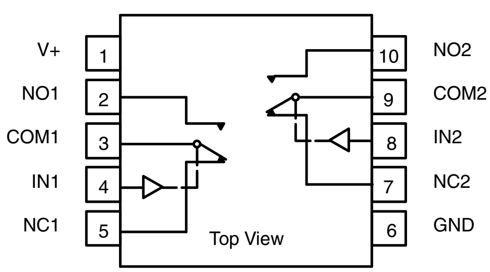
- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- 1.8 V Logic Compatible
- High Bandwidth

APPLICATIONS

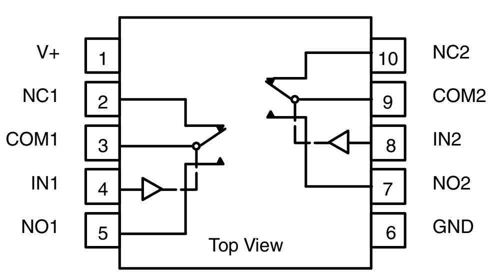
- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Battery Operated Systems
- Relay Replacement

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2535



DG2536



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	DG2535DQ-T1-E3 DG2536DQ-T1-E3
	DFN-10	DG2535DN-T1-E4 DG2536DN-T1-E4

ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
Referenced 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
ESD per Method 3015.7		> 2	kV
Power Dissipation (Packages)[b]	MSOP-10[c]	320	mW
	DFN-10[d]	1191	

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
d. Derate 14.9 mW/°C above 70 °C.

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.

SPECIFICATIONS (V+ = 3 V)

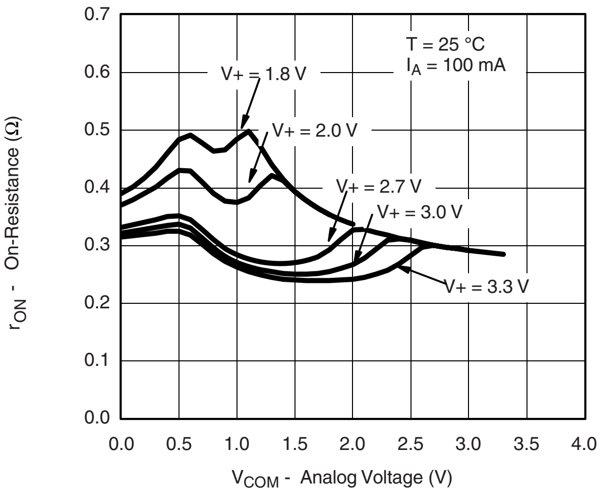
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, V_{IN} = 0.5 or 1.4 V[e]	Temp[a]	Limits -40 to 85 °C Min[b]	Typ[c]	Max[b]	Unit
Analog Switch							
Analog Signal Range[d]	V_{NO}, V_{NC} V_{COM}		Full	0		V+	V
On-Resistance	r_{ON}	V+ = 2.7 V, V_{COM} = 0.6 V/1.5 V, I_{NO}, I_{NC} = 100 mA	Room Full		0.35	0.5 0.6	Ω
r_{ON} Flatness[d]	r_{ON} Flatness		Room		0.09	0.2	
On-Resistance Match Between Channels[d]	$\Delta r_{DS(on)}$		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		10		pF
Input Current	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	1		1	µA

SPECIFICATIONS (V+ = 3 V)

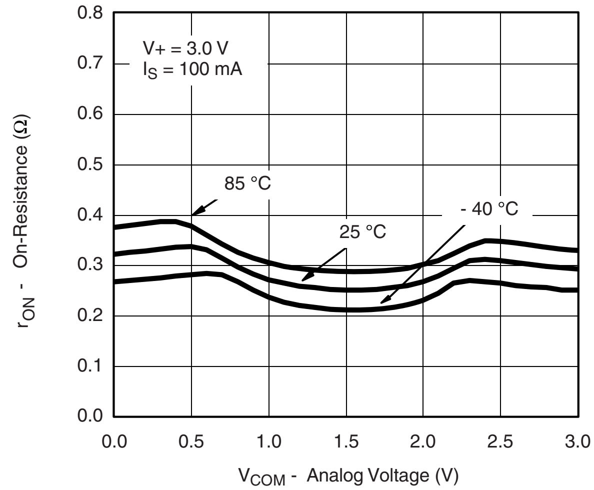
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, V_{IN} = 0.4 or 2.0 V[e]	Temp[a]	Limits - 40 to 85 °C Min[b]	Typ[c]	Max[b]	Unit
Dynamic Characteristics							
Turn-On Time	t_{ON}	V_{NO} or V_{NC} = 2.0 V, R_L = 50 Ω, C_L = 35 pF	Room Full		52	82 90	ns
Turn-Off Time	t_{OFF}		Room Full		43	73 78	
Break-Before-Make Time	t_d		Full	1	6		
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 1.5 V, R_{GEN} = 0 Ω	Room		21		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]	$C_{NO(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		145		pF
	$C_{NC(off)}$		Room		145		
Channel-On Capacitance[d]	$C_{NO(on)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		406		
	$C_{NC(on}$		Room		406		
Power Supply							
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.

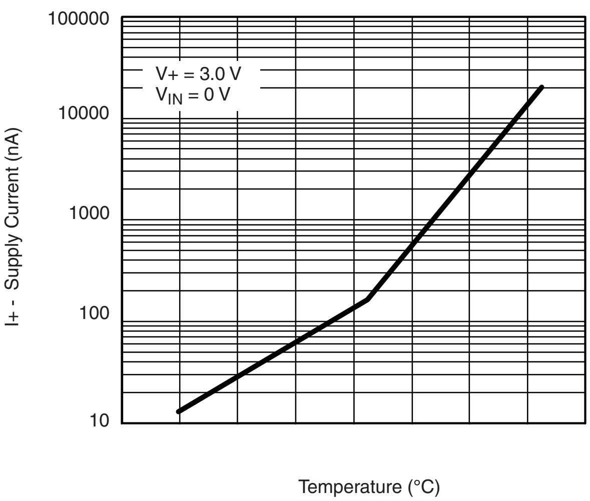
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



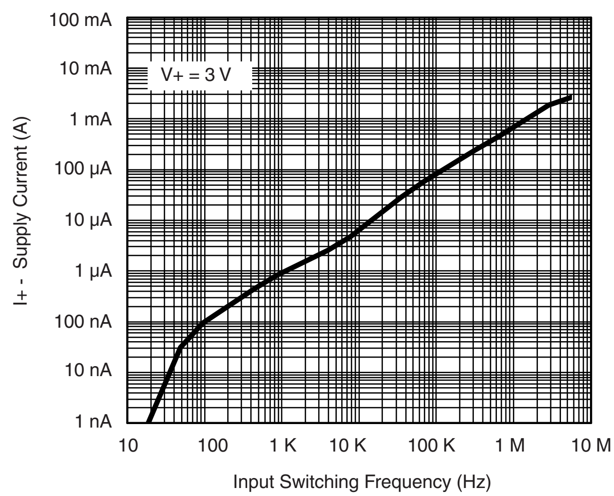
r_{ON} vs. V_{COM} and Supply Voltage



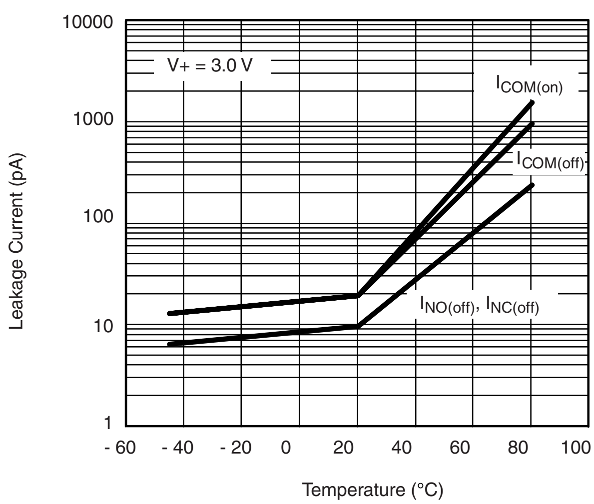
r_{ON} vs. Analog Voltage and Temperature (NC1)



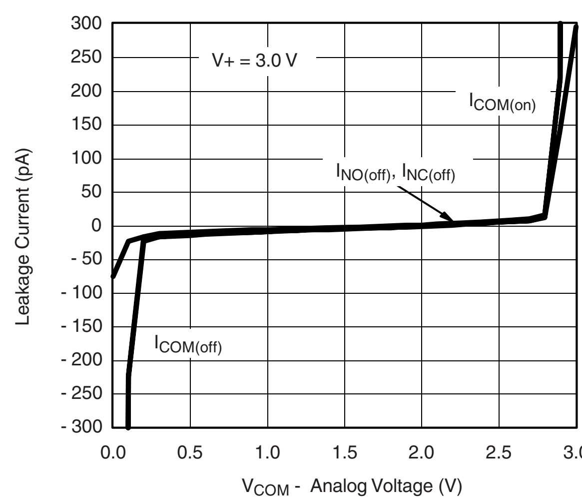
Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency

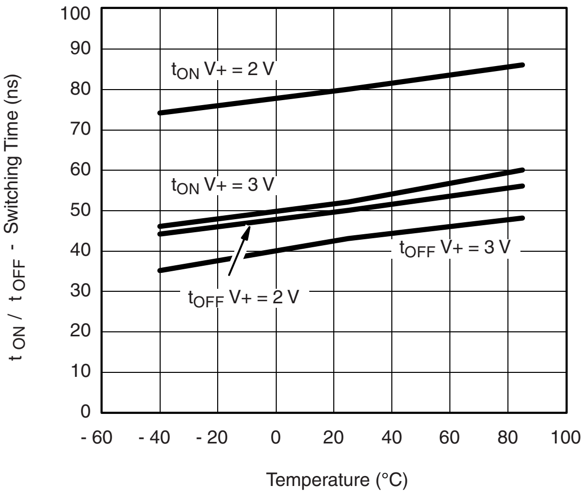


Leakage Current vs. Temperature

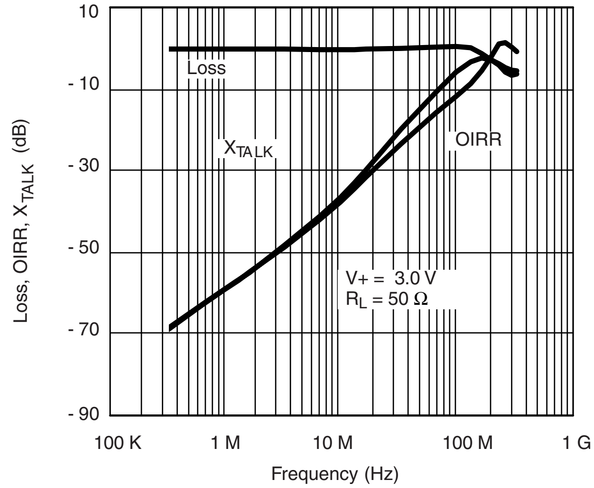


Leakage vs. Analog Voltage

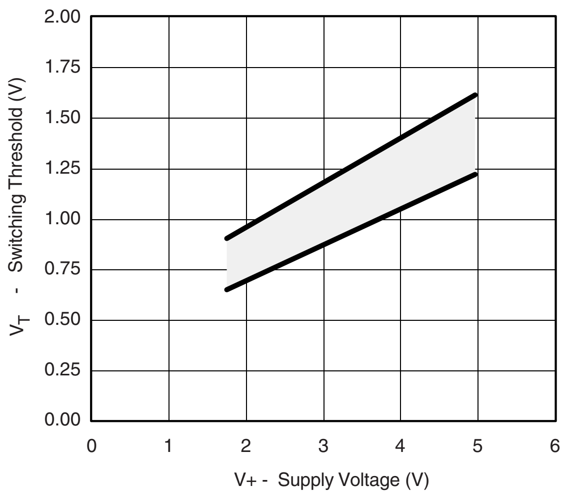
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



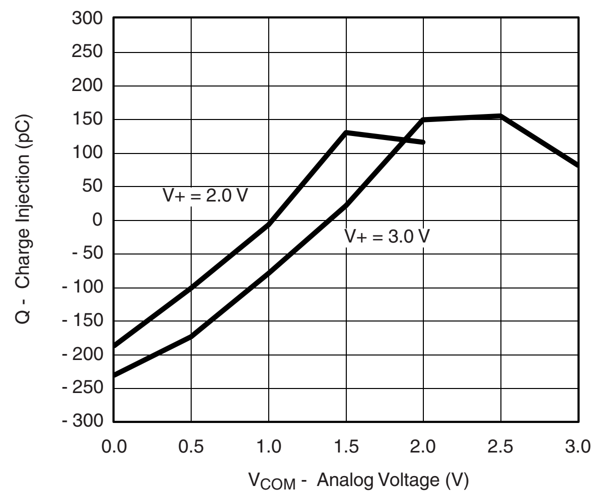
Switching Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency

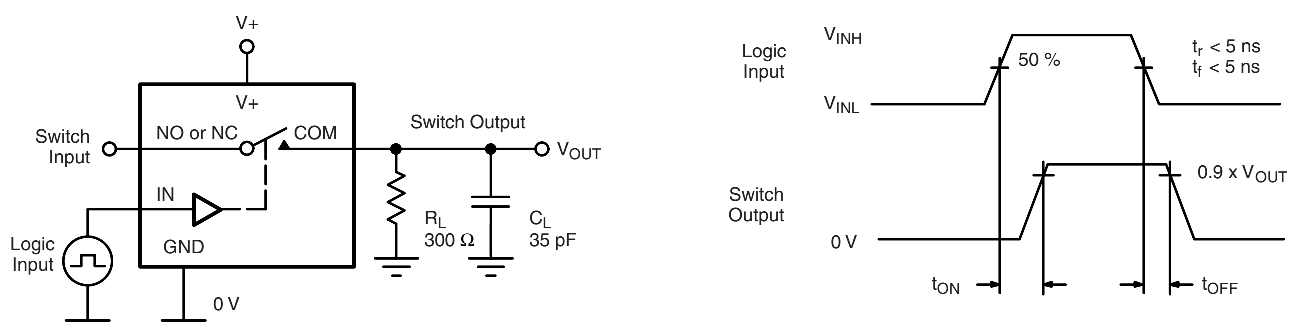


Switching Threshold vs. Supply Voltage



Charge Injection vs. Analog Voltage

TEST CIRCUITS



C_L (includes fixture and stray capacitance)

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

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

Figure 1. Switching Time

TEST CIRCUITS

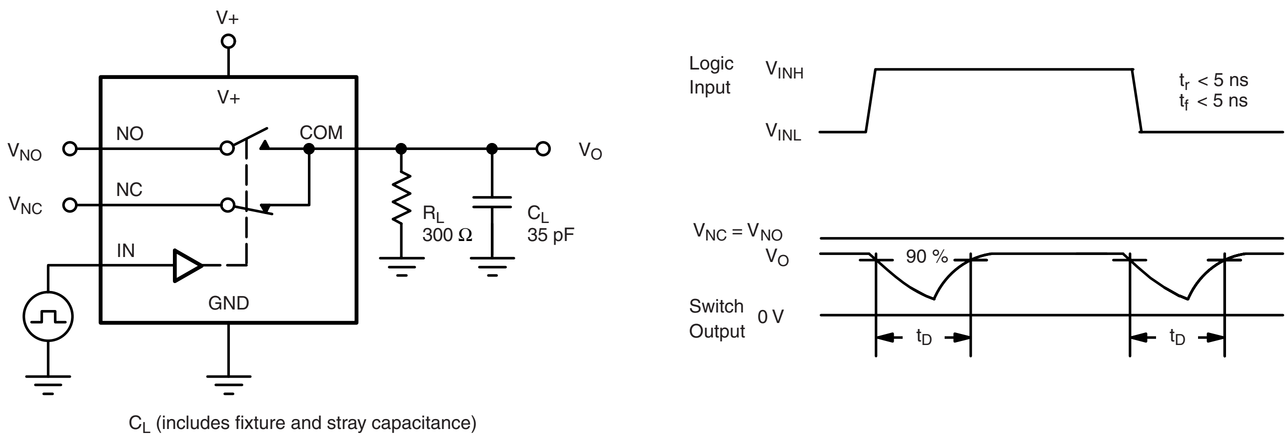


Figure 2. Break-Before-Make Interval

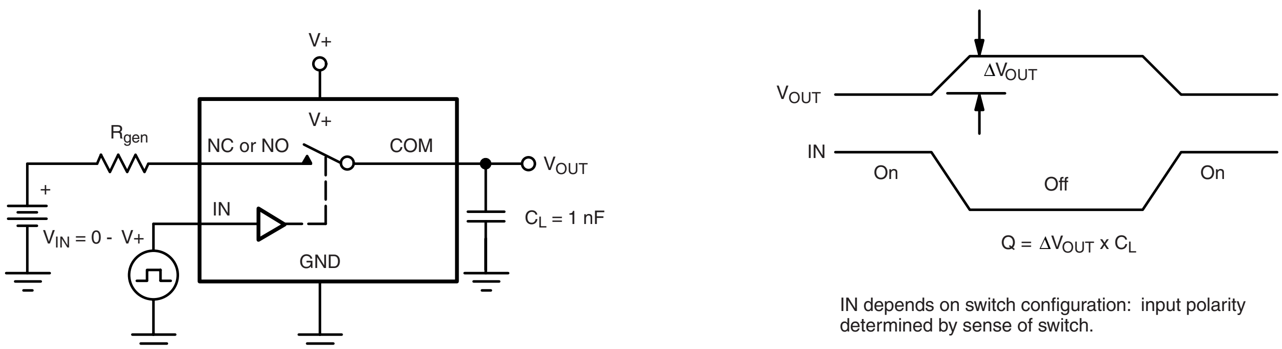


Figure 3. Charge Injection

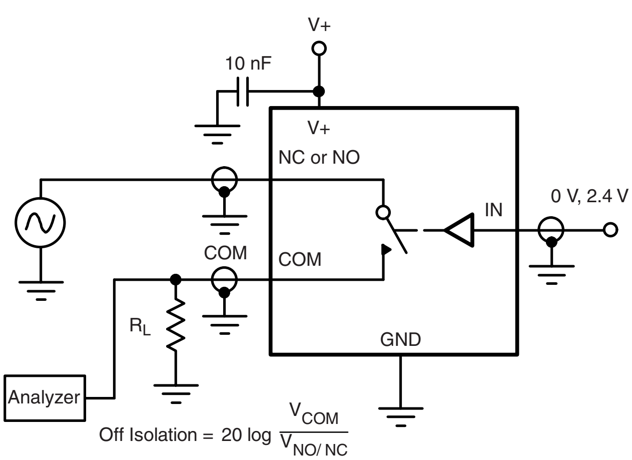


Figure 4. Off-Isolation

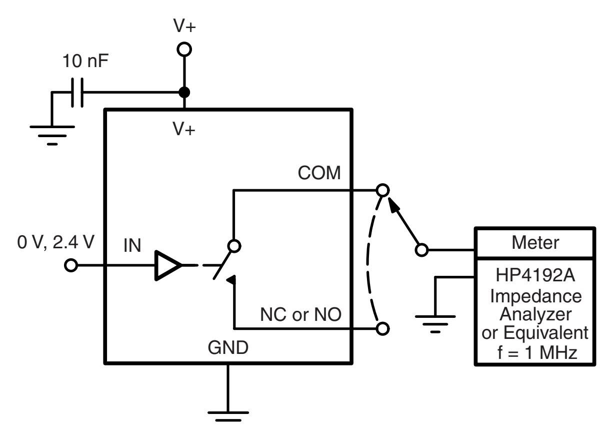


Figure 5. Channel Off/On Capacitance

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