Low-Voltage, 0.45-Ω, SPDT Analog Switch

DESCRIPTION

The DG2717 is a low voltage, low on resistance, single- pole/ double-throw (SPDT) monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low-power, high speed, low on-resistance, and small package size, the DG2717 is ideal for portable and battery power applications.

The DG2717 has an operation range from 1.6 V to 4.3 V single supply, and is low voltage logic compatible within this range, allowing the easy interface with low voltage DSP or MCU control logic. These traits make it ideal for one cell Li-ion battery direct power.

The switch conducts signals within power rails equally well in both directions when on, and blocks up to the power supply level when off. Break-before-make is guaranteed.

The DG2717 is built on Vishay Siliconix's sub micron CMOS low voltage process.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with lead (Pb)-free device terminations. For analog switching products manufactured in SC89 package, the lead (Pb)-free "E3" suffix is being used as a designator. It has a Tin device termination that meets all JEDEC standards for reflow and MSL rating.

FEATURES

- Low Voltage Operation (1.6 V to 4.3 V)
- Low On-Resistance - $r_{DS(on)}$: 0.45 Ω Typ.
- Fast Switching - t_{ON}: 22 ns, t_{OFF}: 8 ns
- Low Leakage
- TTL/CMOS Compatible
- SC-89 (1.6 mm x 1.6 mm) Package

Pb-free
RoHS COMPLIANT

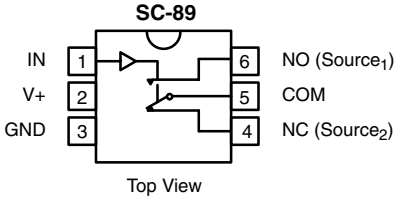
BENEFITS

- Reduced Power Consumption
- Simple Logic Interface
- High Accuracy
- Reduce Board Space

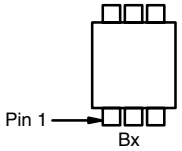
APPLICATIONS

- Cellular Phones
- PMP/MP3
- Audio and Video Signal Routing
- Power Switch
- Reed Relay Replacement

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



Top View



Device Marking: Bx
x = Date/Lot Traceability Code

TRUTH TABLE		
Logic	**NC**	**NO**
0	ON	OFF
1	OFF	ON

ORDERING INFORMATION		
Temp Range	**Package**	**Part Number**
- 40 to 85 °C	SC89-6	DG2717DX-T1-E3

ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
Reference V+ to GND		- 0.3 to + 5.0	V
IN, COM, NC, NO[a]		- 0.3 to (V+ + 0.3)	
Continuous Current (NO, NC and COM Pins)		± 200	mA
Peak Current (Pulsed at 1 ms, 10 % duty cycle)		± 300	
Storage Temperature (D Suffix)		- 65 to 150	°C
Power Dissipation (Packages)[b]	6-Pin SC89	172	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 2.15 mW/°C above 70 °C.

SPECIFICATIONS (V+ = 1.8 V)

Parameter	Symbol	Test Condition Otherwise Unless Specified V+ = 1.8 V, ± 10 %, V_{IN} = 0.4 or 1.0 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+ = 1.8 V, V_{COM} = 0.2 V, $I_{NO/NC}$ = 100 mA	Room Full		1.0	2.0 2.1	Ω
Digital Control							
Input High Voltage	V_{INH}		Full	1.0			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance[d]	C_{in}		Full		7		pF
Input Current[f]	I_{INL} or I_{INH}	V_{IN} = 0 V or V+	Full	- 1		1	µA
Dynamic Characteristics							
Turn-On Time[d]	t_{ON}	V_{NO} or V_{NC} = 1.5 V, R_L = 50 Ω, C_L = 35 pF Figures 1 and 2	Room Full[d]		54	74 81	ns
Turn-Off Time[d]	t_{OFF}		Room Full[d]		14	34 35	
Break-Before-Make Time[d]	t_d		Room	8			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, Figure 3	Room		26		pC
Off-Isolation[d]	O_{IRR}	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 54		dB
Crosstalk[d]	X_{TALK}		Room		- 60		
NO, NC Off Capacitance[d]	$C_{NO(off)}$, $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		80		pF
Channel-On Capacitance[d]	C_{ON}		Room		180		

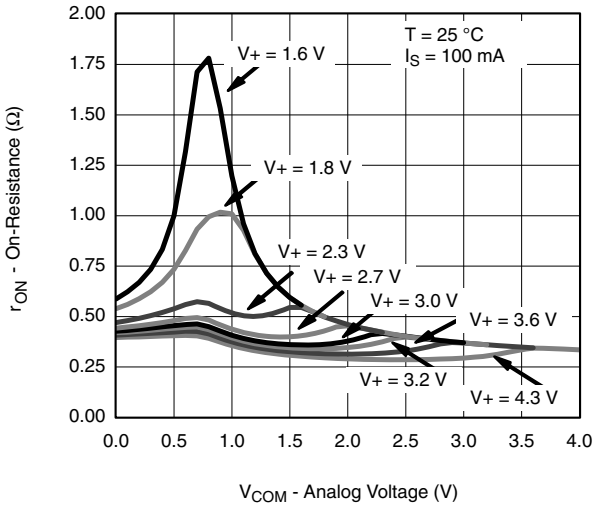
SPECIFICATIONS (V+ = 3.0 V)

Parameter	Symbol	Test Condition Otherwise Unless Specified V+ = 2.7 V to 3.6 V, 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} = 1.5 V, I_{NO}, I_{NC} = 100 mA	Room Full		0.5	0.7 0.8	Ω
		V+ = 3.6 V, V_{COM} = 0.5 V, 2.0 V, I_{NO}, I_{NC} = 100 mA	Room Full		0.45	0.65 0.75	
r_{ON} Flatness[d]	r_{ON} Flatness	V+ = 2.7 V, V_{COM} = 0.6 V, 2.1 V, I_{NO}, I_{NC} = 100 mA	Room			0.2	
r_{ON} Match[d]	Δr_{ON}	V+ = 2.7 V, V_{COM} = 1.5 V, I_{NO}, I_{NC} = 100 mA	Room			0.6	
Switch Off Leakage Current	$I_{NO(off)}$, $I_{NC(off)}$	V+ = 4.3 V, V_{NO}, V_{NC} = 0.3 V / 4 V, V_{COM} = 4 V / 0.3 V	Room Full	- 10 - 100		10 100	nA
	$I_{COM(off)}$		Room Full	- 10 - 100		10 100	
Channel-On Leakage Current	$I_{COM(on)}$	V+ = 4.3 V, V_{NO}, V_{NC} = V_{COM} = 0.3 V / 4 V	Room Full	- 10 - 100		10 100	
Digital Control							
Input High Voltage	V_{INH}		Full	1.4			V
Input Low Voltage	V_{INL}		Full			0.5	
Input Capacitance[d]	C_{in}		Full		7		pF
Input Current[f]	I_{INL} or I_{INH}	V_{IN} = 0 V or V+	Full	- 1		1	µA
Dynamic Characteristics							
Turn-On Time	t_{ON}	V+ = 3.0 V, V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF, Figure 1 and 2	Room Full		22	44 48	ns
Turn-Off Time	t_{OFF}		Room Full		8	29 30	
Break-Before-Make Time	t_d		Room	1			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, Figure 3	Room		28		pC
Off-Isolation[d]	O_{IRR}	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 54		dB
Crosstalk[d]	X_{TALK}		Room		- 57		
NO, NC Off Capacitance[d]	$C_{NO(off)}$, $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		76		pF
Channel-On Capacitance[d]	C_{ON}		Room		178		
Power Supply							
Power Supply Range	V+			1.6		4.3	V
Power Supply Current	I+	V+ = 3.6 V, V_{IN} = 0 or V+			0.01	1.0	µA

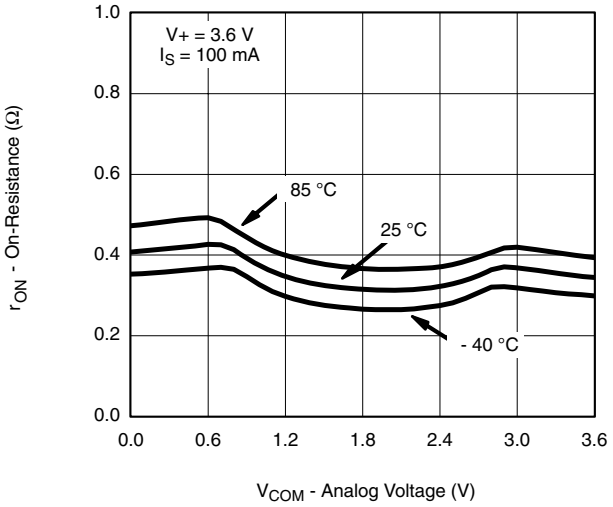
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee 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.

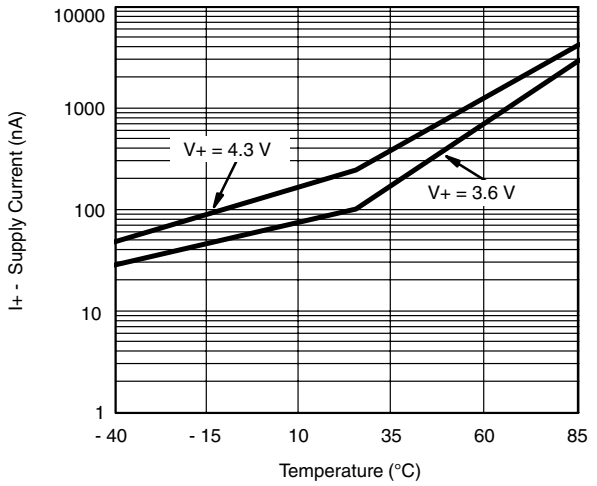
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



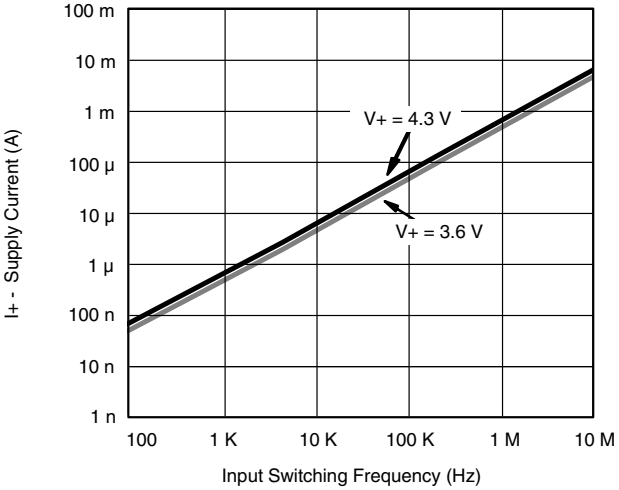
r_{ON} vs. V_{COM} and Single Supply Voltage



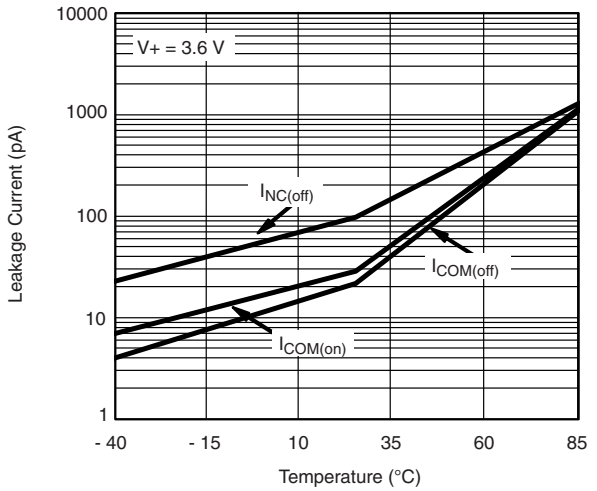
r_{ON} vs. Analog Voltage and Temperature



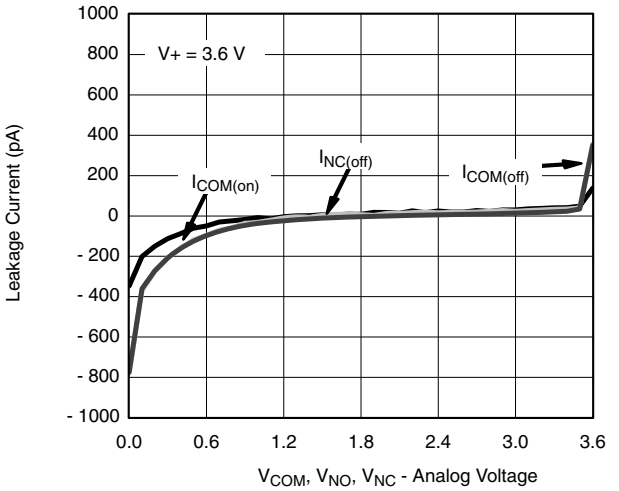
Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency

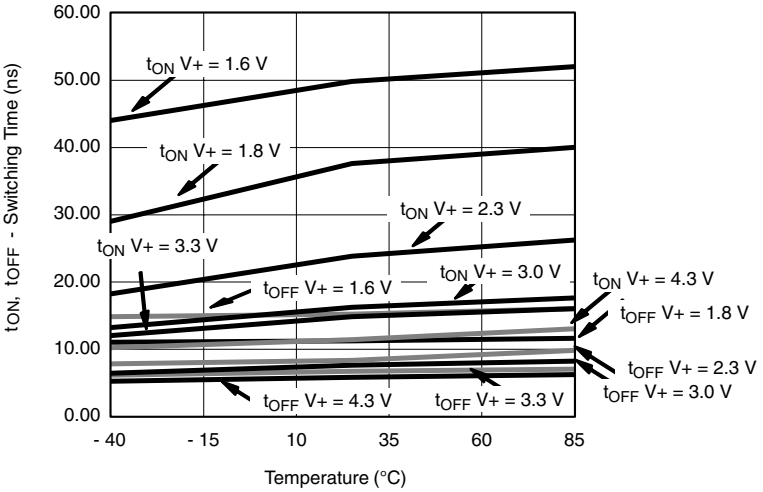


Leakage Current vs. Temperature

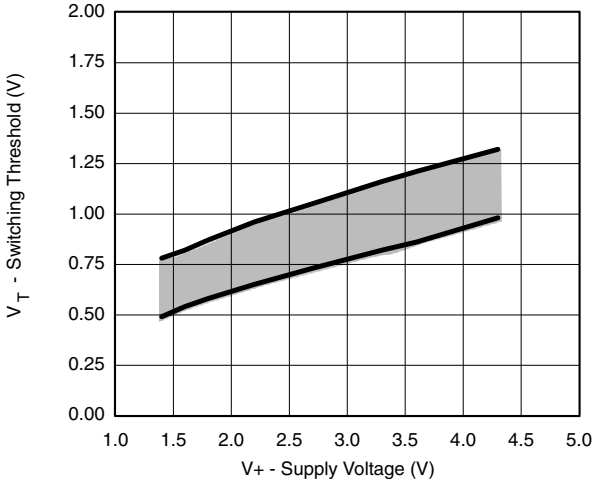


Leakage vs. Analog Voltage

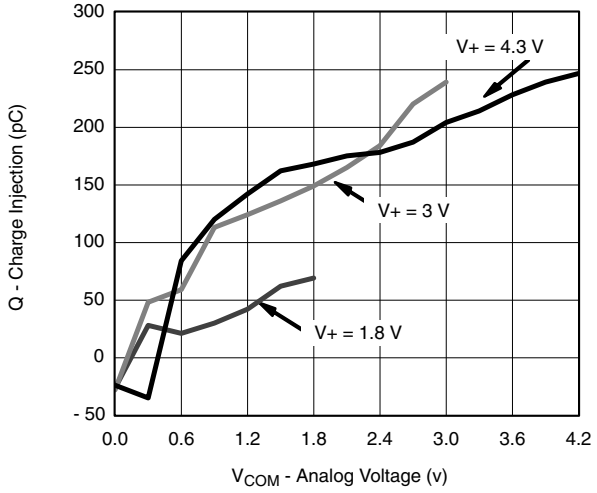
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



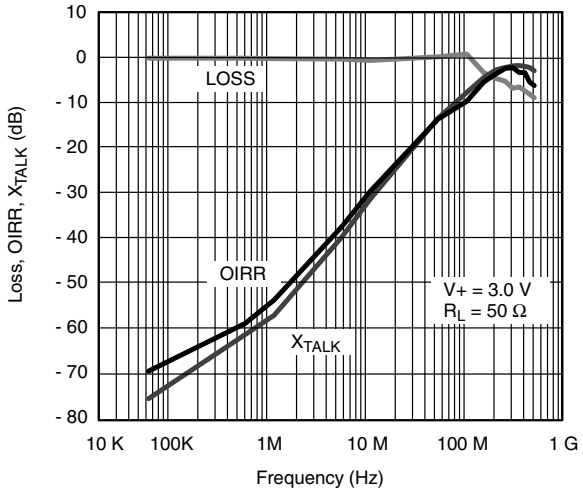
Switching Time vs. Temperature



Switching Threshold vs. Supply Voltage

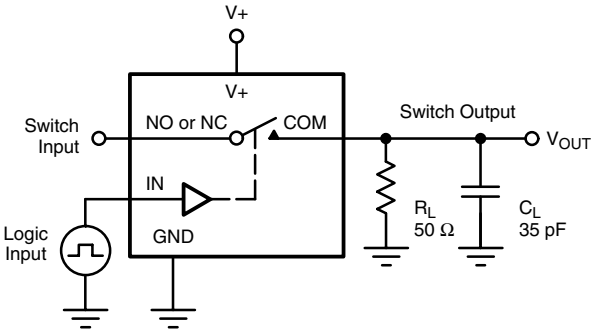


Charge Injection vs. Analog Voltage



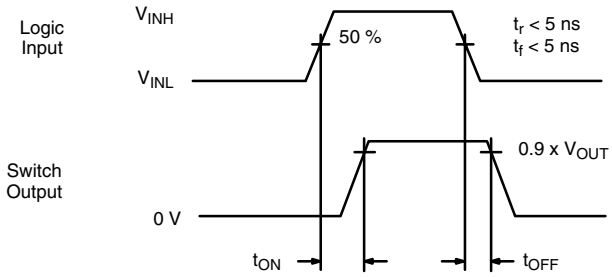
Insertion Loss, Off-Isolation, Crosstalk vs. Frequency

TEST CIRCUITS



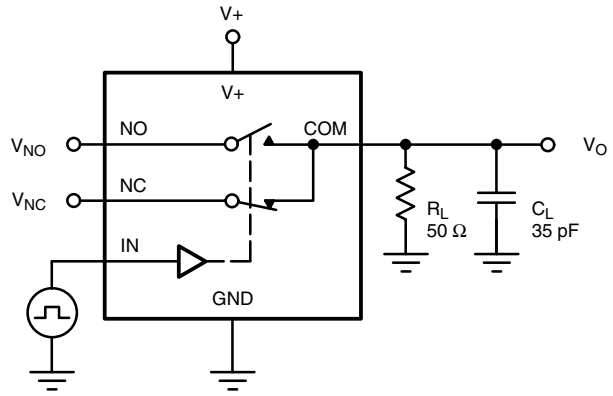
C_L (includes fixture and stray capacitance)

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



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

Figure 1. Switching Time



C_L (includes fixture and stray capacitance)

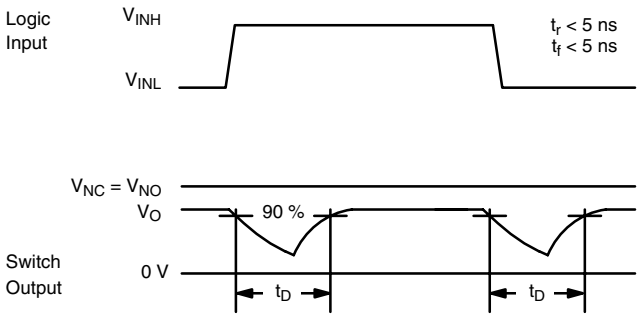
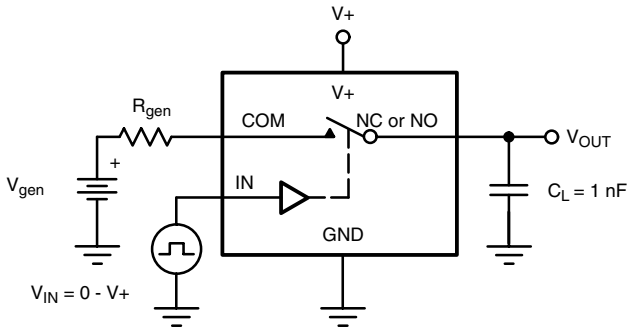
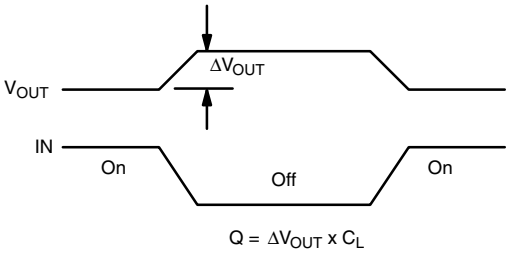


Figure 2. Break-Before-Make Interval





Q = ΔV_{OUT} x C_L

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

Figure 3. Charge Injection

TEST CIRCUITS

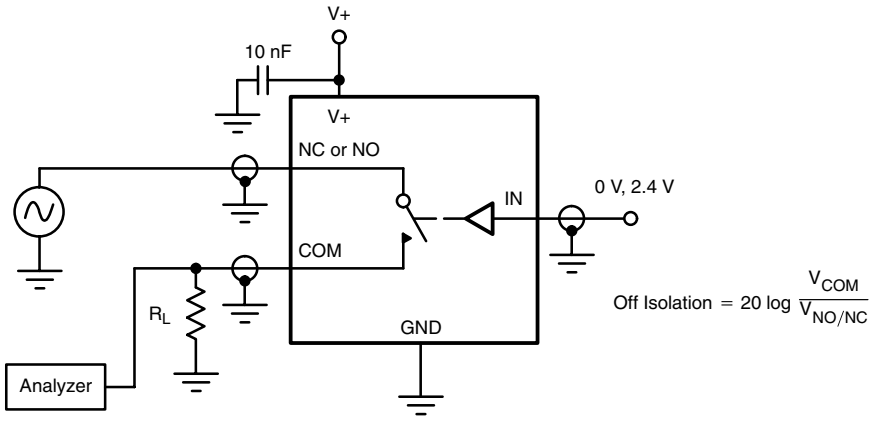


Figure 4. Off-Isolation

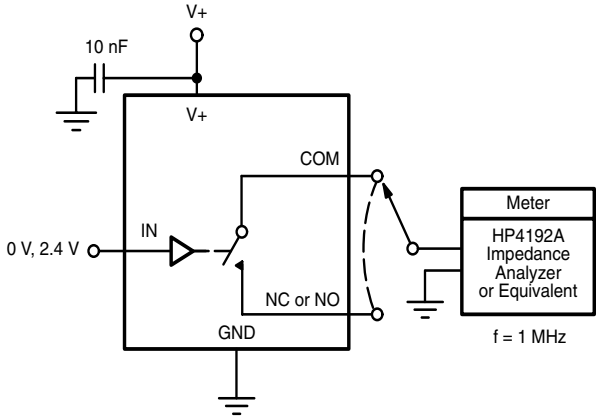


Figure 5. Channel Off/On Capacitance

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