



High-Bandwidth, Low Voltage, Dual SPDT Analog Switches

FEATURES

- Single Supply (1.8 V to 5.5 V)
- Low On-Resistance - r_{ON} : 2.4 Ω
- Crosstalk and Off Isolation: -81 dB @ 1 MHz
- MSOP-10 Package

BENEFITS

- Reduced Power Consumption
- High Accuracy
- Reduce Board Space
- Low-Voltage Logic Compatible
- High Bandwidth

APPLICATIONS

- Cellular Phones
- Speaker Headset Switching
- Audio and Video Signal Routing
- PCMCIA Cards
- Low-Voltage Data Acquisition
- ATE

DESCRIPTION

The DG2016/DG2026 are monolithic CMOS dual single-pole/double-throw (SPDT) analog switches. They are specifically designed for low-voltage, high bandwidth applications.

The DG2016/DG2026's on-resistance (3 Ω @ 2.7 V), matching and flatness are guaranteed over the entire analog voltage range. Wide dynamic performance is achieved with better than -80 dB for both cross-talk and off-isolation at 1 MHz.

Both SPDT's operate with independent control logic, conduct equally well in both directions and block signals up to the

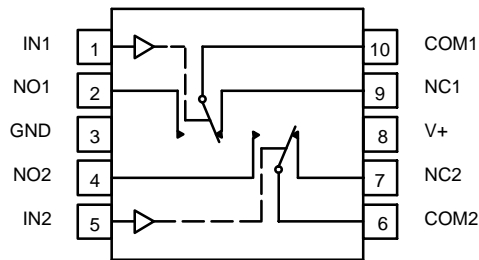
power supply level when off. Break-before-make is guaranteed.

With fast switching speeds, low on-resistance, high bandwidth, and low charge injection, the DG2016/DG2026 are ideally suited for audio and video switching with high linearity.

Built on Vishay Siliconix's low voltage CMOS technology, the DG2016/DG2026 contain an epitaxial layer which prevents latch-up.

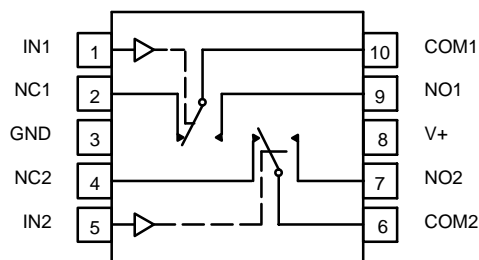
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2016DQ—MSOP-10



Top View

DG2026DQ—MSOP-10



Top View

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	DG2016DQ
		DG2026DQ



ABSOLUTE MAXIMUM RATINGS

Reference to GND

V+	.....	-0.3 to +6 V
IN, COM, NC, NO ^a	.....	-0.3 to (V+ + 0.3 V)
Continuous Current (Any terminal)	.....	± 50 mA
Peak Current (Pulsed at 1 ms, 10% duty cycle)	.....	± 200 mA
Storage Temperature (D Suffix)	.....	-65 to 150°C

Power Dissipation (Packages)^b

MSOP-10 ^c	320 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 4.0 mW/°C above 70°C

SPECIFICATIONS (V+ = 3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10%, V _{IN} = 0.4 or 2.0 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} = 0.2 V/1.5 V I _{NO} , I _{NC} = 10 mA	Room Full		3.0	4.8 5.3	Ω
r _{ON} Flatness	r _{ON} Flatness	V+ = 2.7 V V _{COM} = 0 to V+, I _{NO} , I _{NC} = 10 mA	Room			1.6	
r _{ON} Match Between Channels	Δr _{ON}		Room			0.2	
Switch Off Leakage Current ^f	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 ^f	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	1.6			V
Input Low Voltage	V _{INL}		Full			0.4	
Input Capacitance	C _{in}		Full		5		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V+	Full	1		1	μA
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		28	53 59	ns
Turn-Off Time	t _{OFF}		Room Full		13	38 38	
Break-Before-Make Time	t _d	V _{NO} or V _{NC} = 2.0 V, R _L = 50 Ω, C _L = 35 pF	Full	1			
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 0 V, R _{GEN} = 0 Ω	Room		38		pC
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF, f = 1 MHz	Room		-78		dB
Crosstalk ^d	X _{TALK}		Room		-82		
NO, NC Off Capacitance ^d	C _{NO(off)}	V _{IN} = 0 or V+, f = 1 MHz	Room		15		pF
	C _{NC(off)}		Room		15		
Channel-On Capacitance ^d	C _{NO(on)}		Room		49		
	C _{NC(on)}		Room		45		
Power Supply							
Power Supply Current	I+	V _{IN} = 0 or V+	Full		0.01	1.0	μA

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.



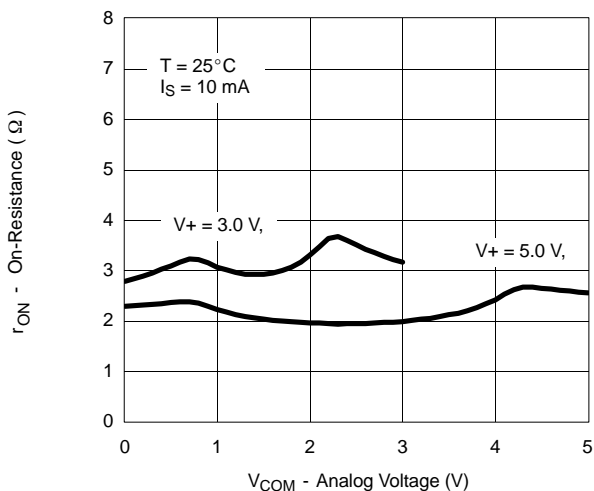
SPECIFICATIONS (V+ = 5 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 5 V, ±10%, VIN = 0.8 or 2.4 V ^e	Temp ^a	Limits -40 to 85°C			Unit
				Min ^b	Typ ^c	Max ^b	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} , V _{COM}		Full	0		V+	V
On-Resistance	r _{ON}	V+ = 4.5 V, V _{COM} = 3 V, I _{NO} , I _{NC} = 10 mA	Room Full		2.4	4.0 4.3	Ω
r _{ON} Flatness	r _{ON} Flatness	V+ = 4.5 V, V _{COM} = 0 to V+, I _{NO} , I _{NC} = 10 mA	Room			1.2	
r _{ON} Match Between Channels	Δr _{ON}		Room				
Switch Off Leakage Current	I _{NO(off)} , I _{NC(off)}	V+ = 5.5 V V _{NO} , V _{NC} = 1 V/4.5 V, V _{COM} = 4.5 V/1 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+ = 5.5 V, V _{NO} , V _{NC} = V _{COM} = 1 V/4.5 V	Room Full	-1 -10		1 10	
Digital Control							
Input High Voltage ^d	V _{INH}		Full	2.0			V
Input Low Voltage	V _{INL}		Full			0.8	
Input Capacitance	C _{in}		Full		5		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V+	Full	1		1	μA
Dynamic Characteristics							
Turn-On Time	t _{ON}	V _{NO} or V _{NC} = 3 V, R _L = 50 Ω, C _L = 35 pF	Room Full		23	48 52	ns
Turn-Off Time	t _{OFF}		Room Full		8	33 35	
Break-Before-Make Time	t _d	V _{NO} or V _{NC} = 3 V, R _L = 50 Ω, C _L = 35 pF	Full	1			
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 0 V, R _{GEN} = 0 Ω	Room		79		pC
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF, f = 1 MHz	Room		-81		dB
Crosstalk ^d	X _{TALK}		Room		-82		
Source-Off Capacitance ^d	C _{NO(off)}	V _{IN} = 0 or V+, f = 1 MHz	Room		14		pF
	C _{NC(off)}		Room		14		
Channel-On Capacitance ^d	C _{NO(on)}		Room		48		
	C _{NC(on)}		Room		44		
Power Supply							
Power Supply Range	V+			1.8		5.5	V
Power Supply Current	I+	V _{IN} = 0 or V+	Full		0.01	1.0	μA

Notes:

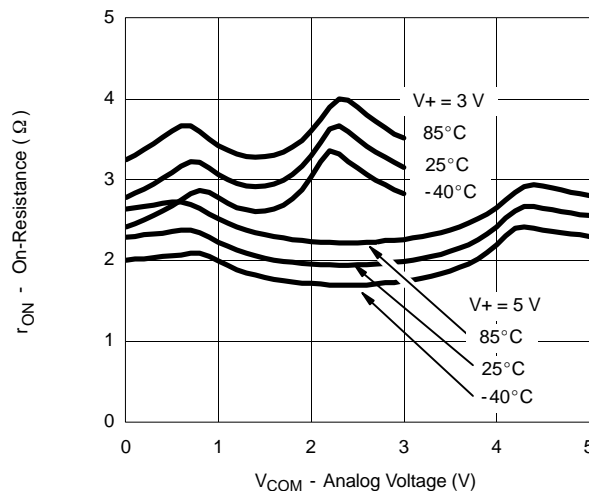
- Room = 25°C, Full = as determined by the operating suffix.
- Typical values are for design aid only, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guarantee by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

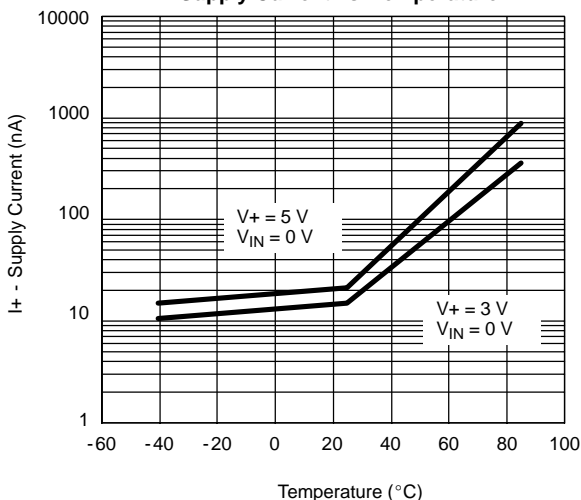
r_{ON} vs. V_{COM} and Supply Voltage



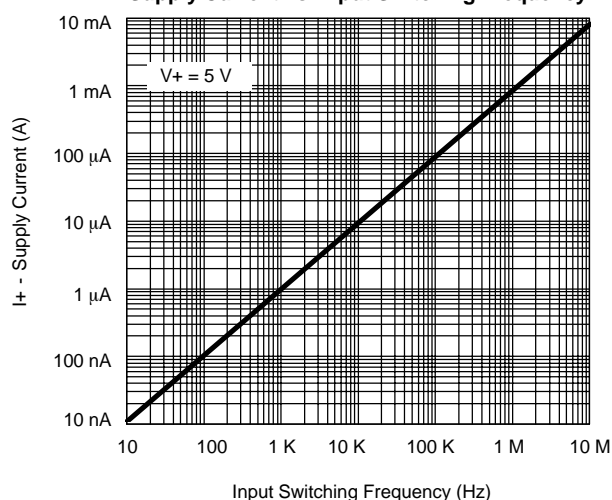
r_{ON} vs. Analog Voltage and Temperature



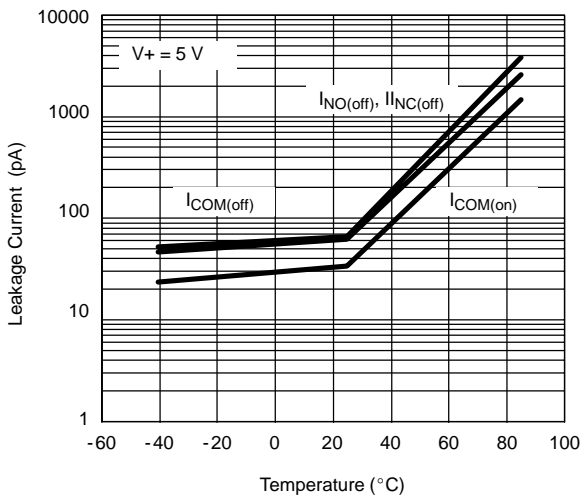
Supply Current vs. Temperature



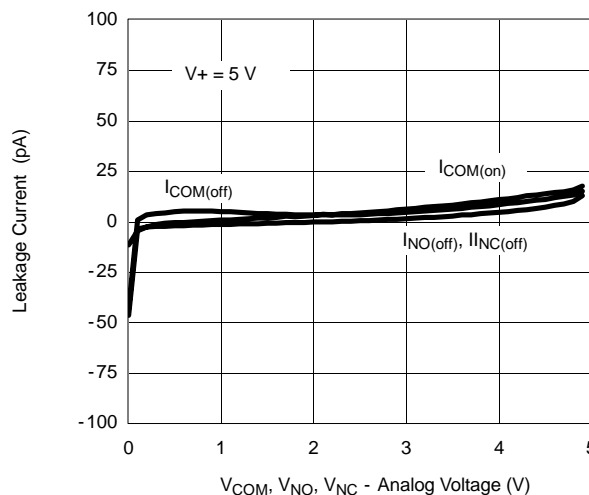
Supply Current vs. Input Switching Frequency



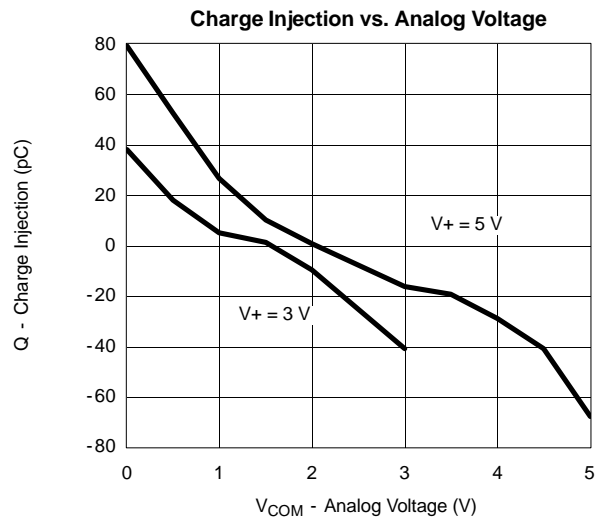
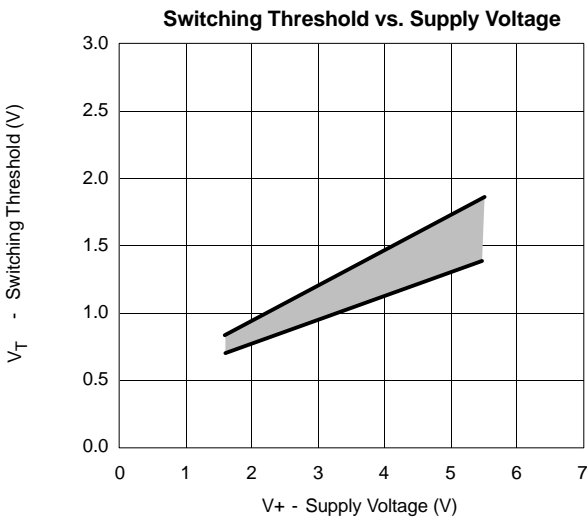
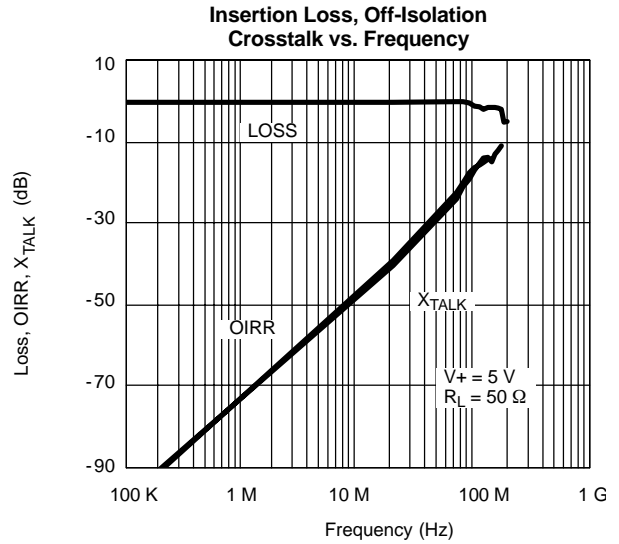
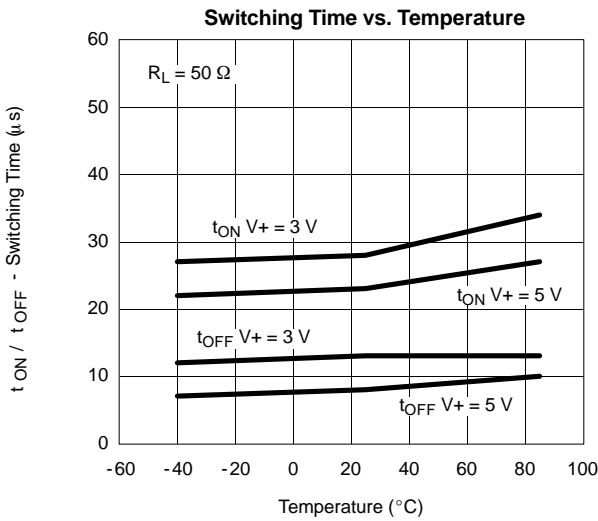
Leakage Current vs. Temperature



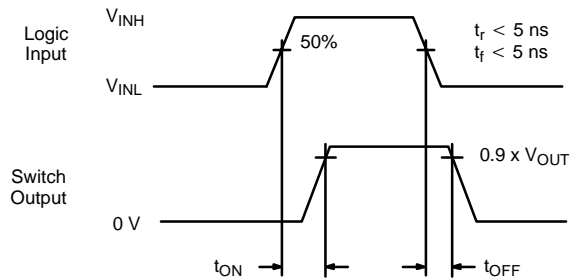
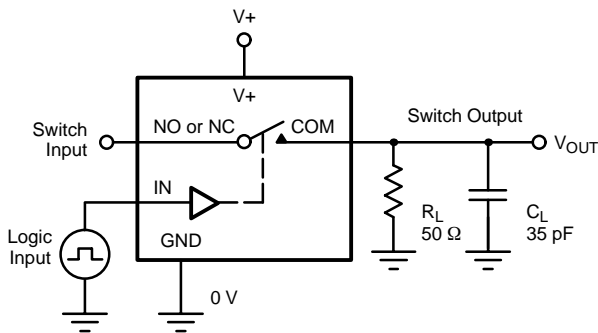
Leakage vs. Analog Voltage



TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)



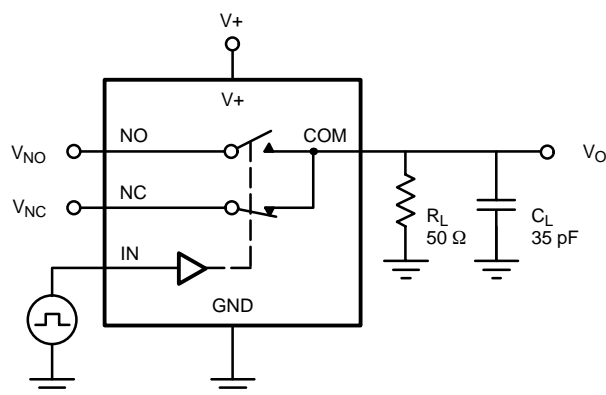
TEST CIRCUITS



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

FIGURE 1. Switching Time

TEST CIRCUITS



C_L (includes fixture and stray capacitance)

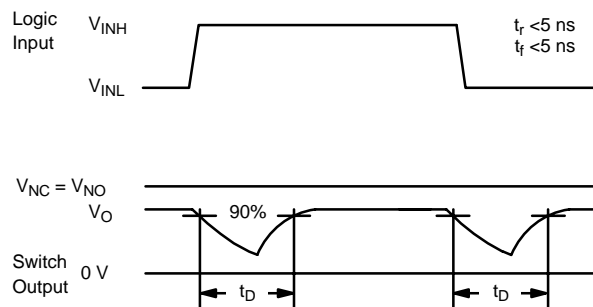
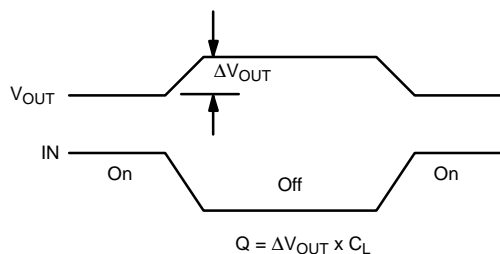
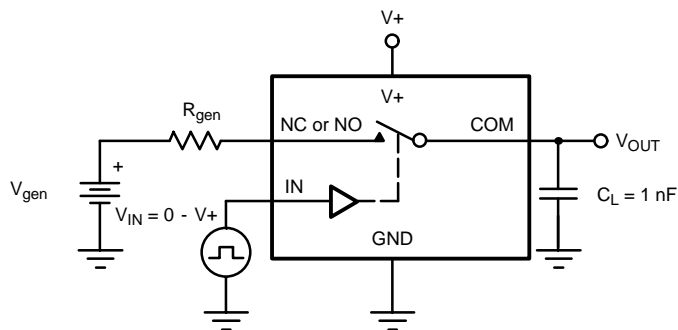


FIGURE 5. Break-Before-Make Interval



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

FIGURE 2. Charge Injection

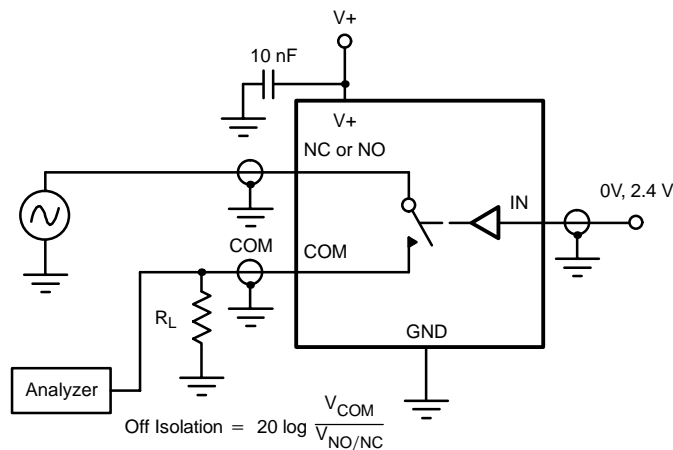


FIGURE 3. Off-Isolation

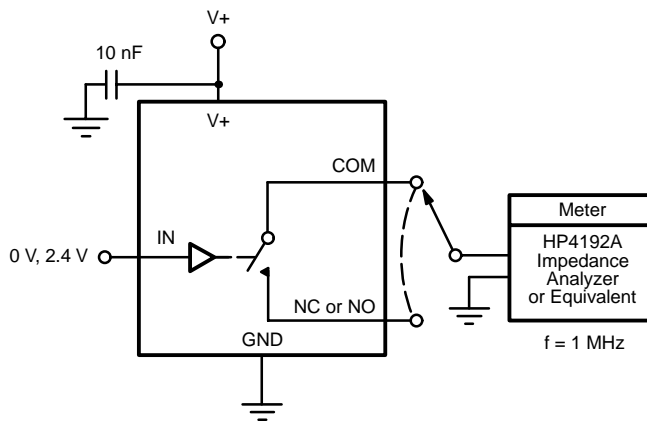


FIGURE 4. Channel Off/On Capacitance