

3 Ω , High Bandwidth, Dual SPDT Analog Switch

DESCRIPTION

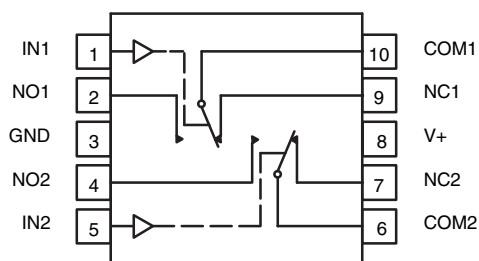
The DG2517/DG2518 are low-voltage dual single-pole/double-throw monolithic CMOS analog switches. Designed to operate from 1.8 V to 5.5 V power supply, the DG2517/DG2518 achieves a bandwidth of 157 MHz while providing low on-resistance (3 Ω), excellent on-resistance matching (0.2 Ω) and flatness (1 Ω) over the entire signal range.

The DG2517/DG2518 offers the advantage of high linearity that reduces signal distortion, making ideal for audio, video, and USB signal routing applications. Additionally, the DG2517/DG2518 are 1.6 V logic compatible within the full operation voltage range.

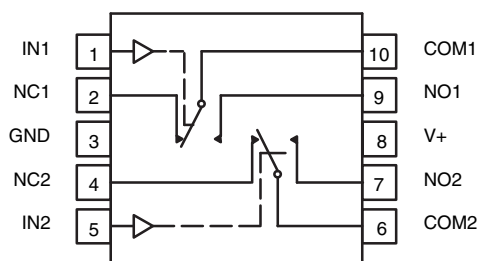
Built on Vishay Siliconix's proprietary sub-micron high-density process, the DG2517/DG2518 brings low power consumption at the same time as reduces PCB spacing with the MSOP10 and DFN10 packages.

As a committed partner to the community and the environment, Vishay Siliconix manufactures this product with the lead (Pb)-free device terminations. The DFN package has a nickel-palladium-gold device termination and is represented by the lead (Pb)-free "-E4" suffix. The MSOP package uses 100 % matte Tin device termination and is represented by the lead (Pb)-free "-E3" suffix. Both the matte Tin and nickel-palladium-gold device terminations meet all JEDEC standards for reflow and MSL ratings.

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION

DG2517


Top View

DG2518


Top View

FEATURES

- 1.8 to 5.5 V Single Supply Operation
- Low Ron: 3 Ω at 4.2 V
- 157 MHz, - 3 dB Bandwidth
- Low Off-Isolation, - 47 dB at 10 MHz
- + 1.6 V Logic Compatible


RoHS
COMPLIANT

BENEFITS

- High Linearity
- Low Power Consumption
- High Bandwidth
- Full Rail Signal Swing Range

APPLICATIONS

- USB/UART Signal Switching
- Audio/Video Switching
- Cellular Phone
- Media Players
- Modems
- Hard Drives
- PCMCIA

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 $^{\circ}$ C	MSOP-10	DG2517DQ-T1-E3
		DG2518DQ-T1-E3
	DFN-10	DG2517DN-T1-E4
		DG2518DN-T1-E4



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

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			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} = 1.5 V I _{NO/NC} = 10 mA	Room Full		3.2	4.5 5.0	Ω
r _{ON} Flatness	r _{ON} Flatness	V+ = 2.7 V, V _{COM} = 1.5, 2 V I _{NO/NC} = 10 mA	Room Full		1.0	1.4 1.6	
r _{ON} Match Between Channels	Δr _{ON}	V+ = 2.7 V, V _{COM} = 1.5 V I _{NO/NC} = 10 mA	Room Full		0.1	0.3 0.4	
Switch Off Leakage Current ^f	I _{NO(off)} , I _{NC(off)}	V+ = 3.6 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+ = 3.6 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		4		pF
Input Current	I _{INL} or I _{INH}		Full	1		1	μA
Dynamic Characteristics							
Turn-On Time	t _{ON}	V+ = 2.7 V, V _{NO} or V _{NC} = 1.5 V R _L = 300 Ω, C _L = 35 pF	Room Full		15	30 50	ns
Turn-Off Time	t _{OFF}		Room Full		10	25 35	
Break-Before-Make Time	t _d	V _{NO} or V _{NC} = 1.5 V, R _L = 300 Ω, C _L = 35 pF	Full	1			
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 1.5 V, R _{GEN} = 0 Ω	Room		1		pC
- 3 dB Bandwidth	BW	0 dBm, C _L = 5 pF, R _L = 50 Ω	Room		157		MHz
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room		- 67	dB
			f = 10 MHz	Room		- 47	
			f = 1 MHz	Room		- 67	
Crosstalk ^d	X _{TALK}	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room		- 67	dB
			f = 10 MHz	Room		- 47	
			f = 10 MHz	Room		- 47	
N _O , N _C Off Capacitance ^d	C _{NO(off)}	V _{IN} = 0 or V+, f = 1 MHz	Room		8		pF
	C _{NC(off)}		Room		8		
Channel-On Capacitance ^d	C _{NO(on)}		Room		35		
	C _{NC(on)}		Room		35		
Power Supply							
Power Supply Current	I+	V _{IN} = 0 or V+	Full		0.01	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.
- f. Guaranteed by 5 V leakage testing, not production tested.



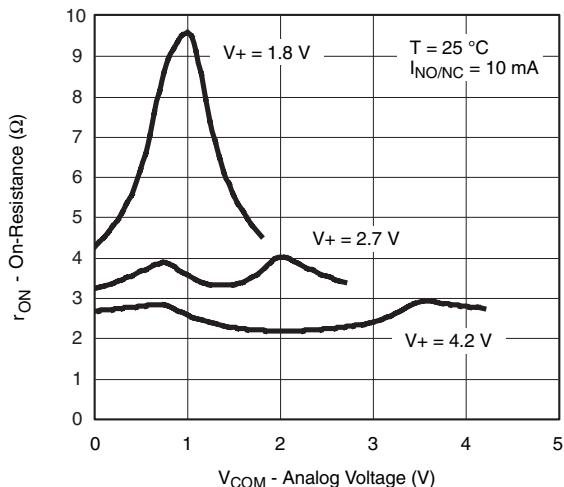
SPECIFICATIONS (V+ = 5 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 5 V, ± 10 %, VIN = 0.8 or 2.0 V ^e	Temp ^a	Limits - 40 to 85 °C			Unit
				Min ^b	Typ ^c	Max ^b	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} , V _{COM}		Full	0		V+	V
On-Resistance	r _{ON}	V+ = 4.2 V, V _{COM} = 3.5 V, I _{NO/NC} = 10 mA	Room Full		3	4.0 4.3	Ω
r _{ON} Flatness	r _{ON} Flatness	V+ = 4.2 V, V _{COM} = 1, 2, 3.5 V I _{NO/NC} = 10 mA	Room Full		1.1	1.4 1.6	
r _{ON} Match Between Channels	Δr _{ON}	V+ = 4.2 V, V _{COM} = 3.5 V, I _{NO/NC} = 10 mA	Room Full		0.1	0.3 0.4	
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 _{COM} = V _{NO} , V _{NC} = 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		4		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 V or V+	Full	1		1	μA
Dynamic Characteristics							
Turn-On Time	t _{ON}	V+ = 4.2 V, V _{NO} or V _{NC} = 3 V R _L = 300 Ω, C _L = 35 pF	Room Full		12	25 45	ns
Turn-Off Time	t _{OFF}		Room Full		8	20 30	
Break-Before-Make Time	t _d	V _{NO} or V _{NC} = 3 V, R _L = 300 Ω, C _L = 35 pF	Full	1			
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 2.5 V, R _{GEN} = 0 Ω	Room		2		pC
- 3 dB Bandwidth	BW	0 dBm, C _L = 5 pF, R _L = 50 Ω	Room		157		MHz
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room		- 67	dB
			f = 10 MHz	Room		- 47	
Crosstalk ^d	X _{TALK}	R _L = 50 Ω, C _L = 5 pF	f = 1 MHz	Room		- 67	
			f = 10 MHz	Room		- 47	
Source-Off Capacitance ^d	C _{NO(off)}	V _{IN} = 0 or V+, f = 1 MHz	Room		8		pF
	C _{NC(off)}		Room		8		
Channel-On Capacitance ^d	C _{NO(on)}		Room		35		
	C _{NC(on)}		Room		35		
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:

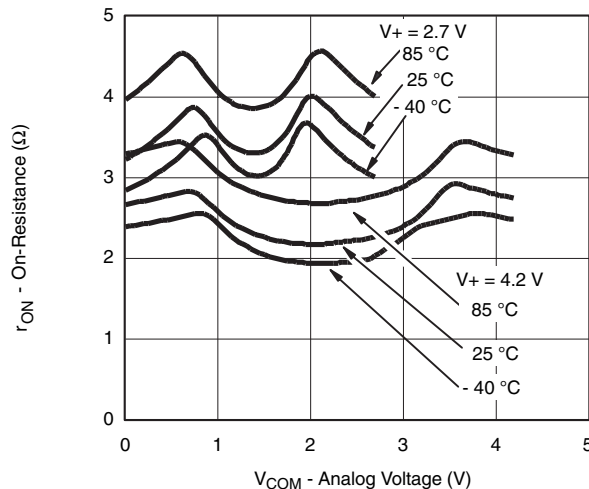
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- d. Guarantee by design, nor subjected to production test.
- e. V_{IN} = input voltage to perform proper function.
- f. Guaranteed by 5 V leakage testing, not production tested.

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.

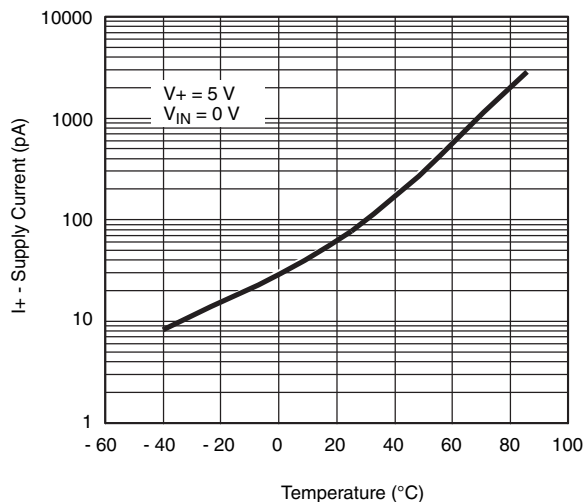
TYPICAL CHARACTERISTICS 25 °C, unless noted



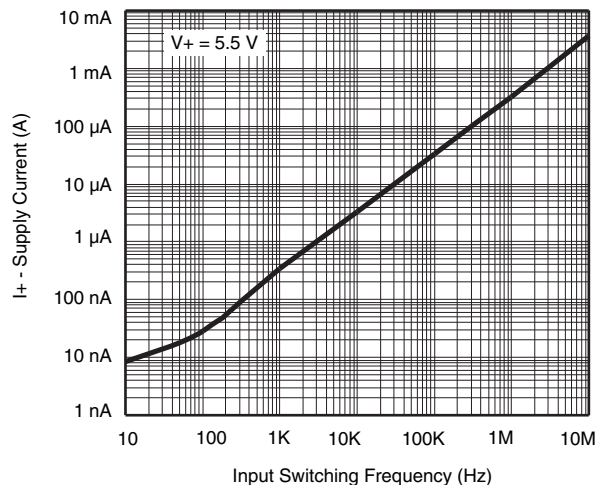
r_{ON} vs. V_{COM} and Supply Voltage



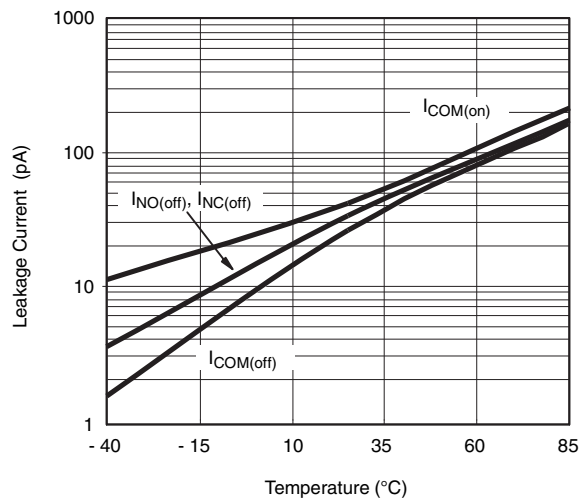
r_{ON} vs. Analog Voltage and Temperature



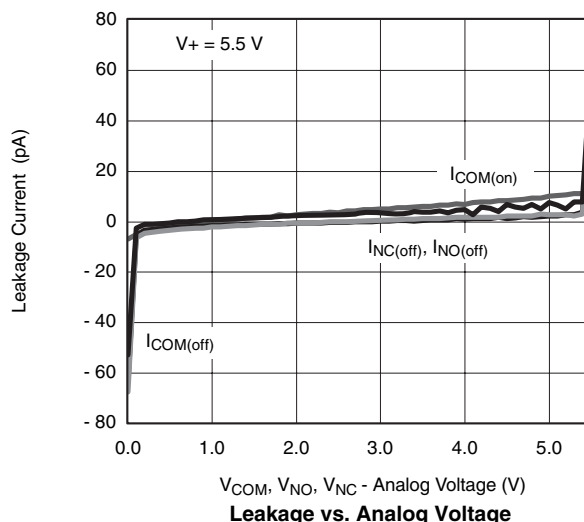
Supply Current vs. Temperature



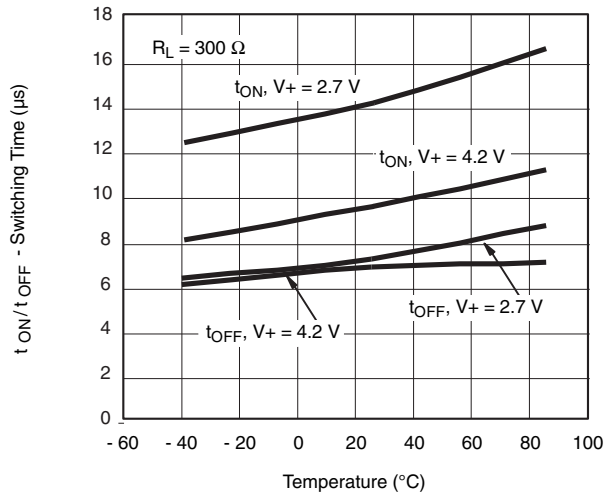
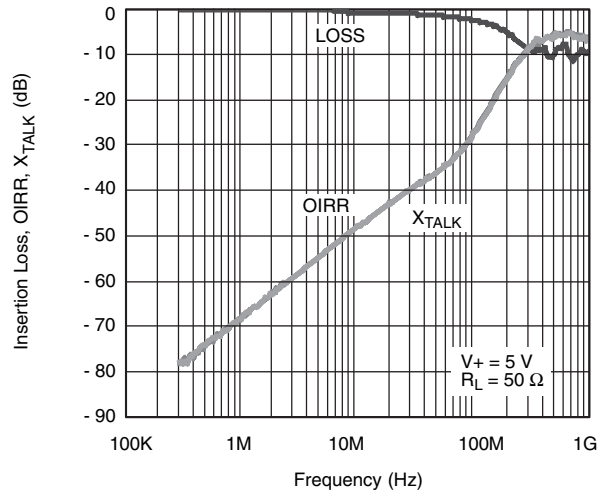
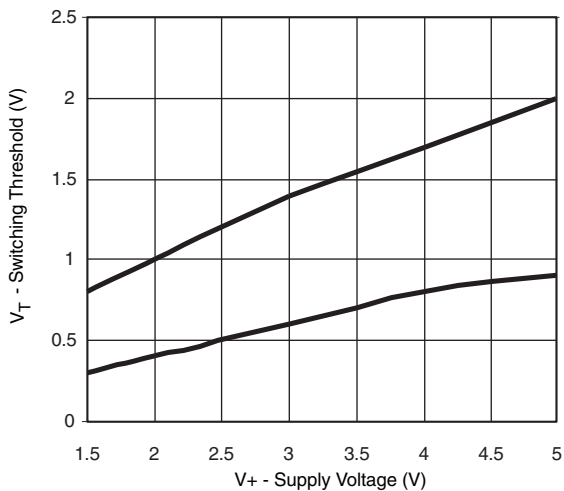
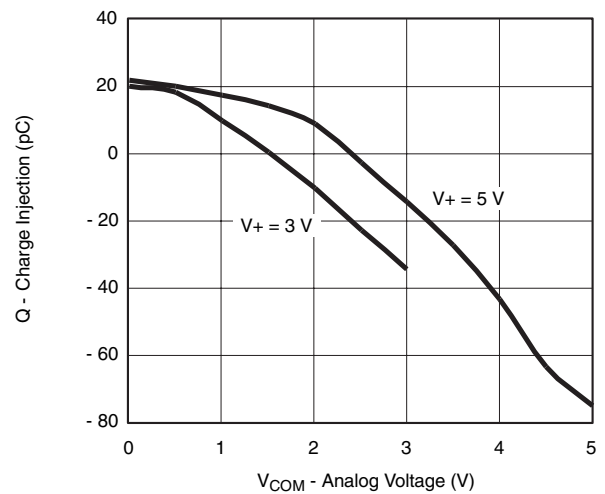
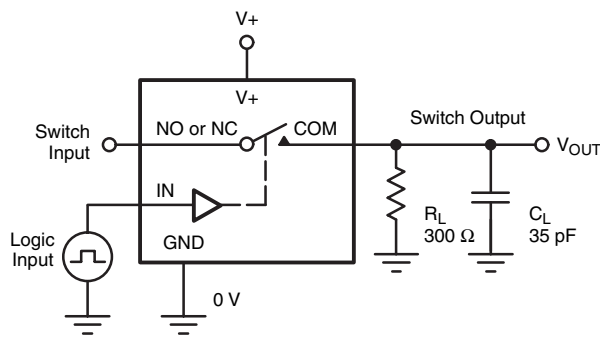
Supply Current vs. Input Switching Frequency



Leakage Current vs. Temperature



Leakage vs. Analog Voltage

TYPICAL CHARACTERISTICS 25 °C, unless noted

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)

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

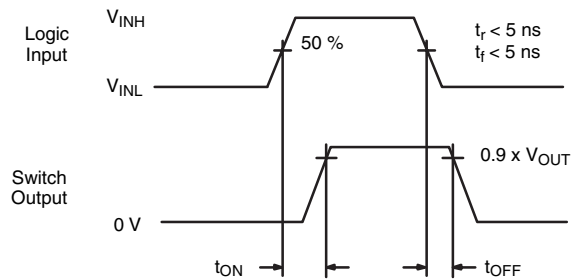

 Logic "1" = Switch On
 Logic input waveforms inverted for switches that have the opposite logic sense.

Figure 1. Switching Time

TEST CIRCUITS

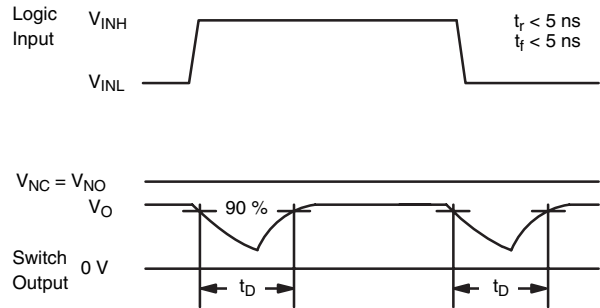
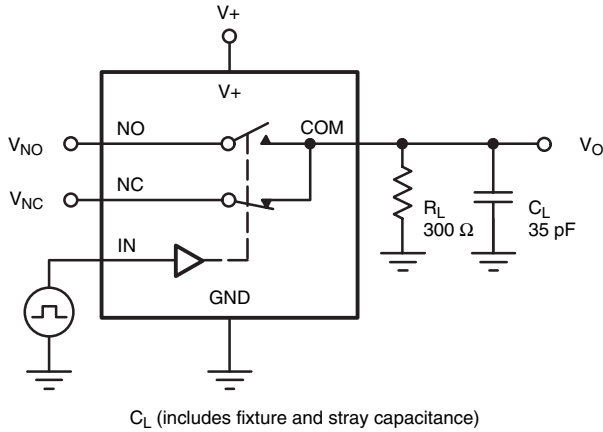
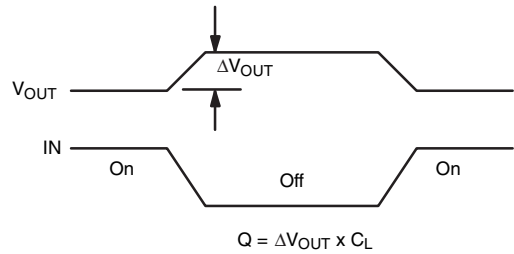
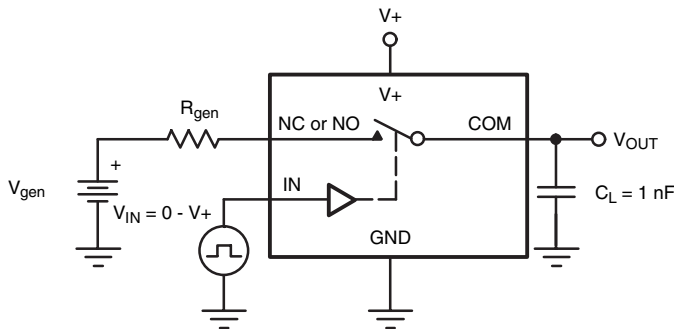


Figure 2. Break-Before-Make Interval



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

Figure 3. Charge Injection

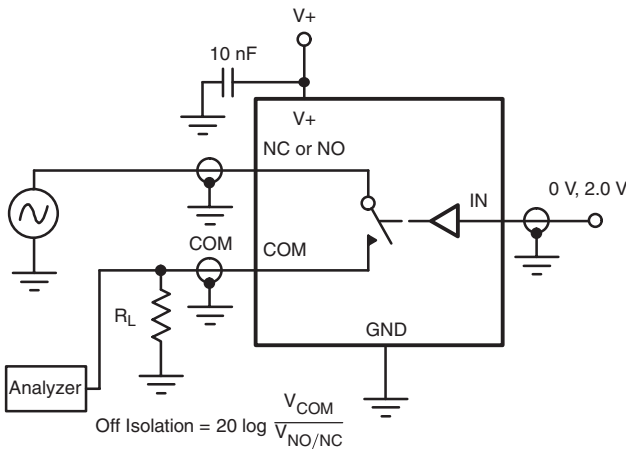


Figure 4. Off-Isolation

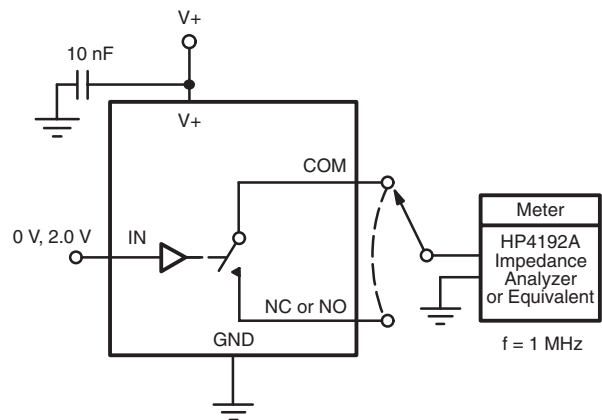


Figure 5. Channel Off/On Capacitance

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