Low-Voltage Single SPDT Analog Switch

DESCRIPTION

The DG2714 is a single-pole/double-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, high speed (t_{ON}: 28 ns, t_{OFF}: 12 ns), low on-resistance ($r_{DS(on)}$: 0.85 Ω) and small physical size (SC70), the DG2714 is ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG2714 is built on Vishay Siliconix's low voltage submicron CMOS process. An epitaxial layer prevents latchup. Break-before -make is guaranteed for DG2714.

Each switch conducts equally well in both directions when on, and blocks up to the power supply level when off.

FEATURES

- Low Voltage Operation (1.6 V to 3.6 V)
- Low On-Resistance - $r_{DS(on)}$: 0.85 Ω Typ.
- Fast Switching - t_{ON}: 28 ns, t_{OFF}: 12 ns
- Low Leakage
- TTL/CMOS Compatible
- 6-Pin SC-70 Package

Pb-free Available

RoHS* COMPLIANT

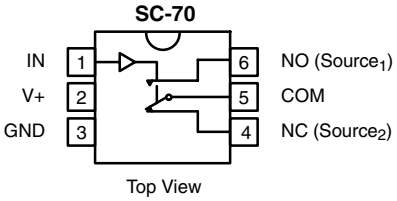
BENEFITS

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

APPLICATIONS

- Cellular Phones
- Communication Systems
- Portable Test Equipment
- Battery Operated Systems
- Sample and Hold Circuits

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



Top View

Device Marking: E8xx

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

ORDERING INFORMATION		
Temp Range	**Package**	**Part Number**
- 40 to 85 °C	SC70-6	DG2714DL-T1 DG2714DL-T1-E3

* Pb containing terminations are not RoHS compliant, exemptions may apply

ABSOLUTE MAXIMUM RATINGS

Parameter		Limit	Unit
Referenced V+ to GND		- 0.3 to + 4	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 SO70[c]	250	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 3.1 mW/°C above 70 °C.

SPECIFICATIONS (V+ = 1.8 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 1.8 V, ± 10 %, V_{IN} = 0.4 or 1.1 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/0.9 V I_{NO}, I_{NC} = 10 mA	Room Full[d]		1.8	3.0 4.5	Ω
r_{ON} Flatness[d]	r_{ON} Flatness	V+ = 1.8 V, V_{COM} = 0 to V+, I_{NO}, I_{NC} = 10 mA	Room			2	
r_{ON} Match[d]	Δr_{ON}		Room			0.06	
Switch Off Leakage Current[f]	$I_{NO(off)}$ $I_{NC(off)}$	V+ = 2.2 V V_{NO}, V_{NC} = 0.2 V/2.0 V, V_{COM} = 2.0 V/0.2 V	Room Full[d]	- 1 - 10		1 10	nA
	$I_{COM(off)}$		Room Full[d]	- 1 - 10		1 10	
Channel-On Leakage Current[f]	$I_{COM(on)}$	V+ = 2.2 V, V_{NO}, V_{NC} = V_{COM} = 0.2 V/2.0 V	Room Full[d]	- 1 - 10		1 10	
Digital Control							
Input High Voltage	V_{INH}		Full	1.1			V
Input Low Voltage	V_{INL}		Full			0.4	
Input Capacitance[d]	C_{in}		Full		3.5		pF
Input Current[f]	I_{INL} or I_{INH}	V_{IN} = 0 or V+	Full	- 1		1	µA
Dynamic Characteristics							
Turn-On Time[d]	t_{ON}	V_{NO} or V_{NC} = 1.5 V, R_L = 300 Ω, C_L = 35 pF Figures 1 and 2	Room Full[d]		55	75 89	ns
Turn-Off Time[d]	t_{OFF}		Room Full[d]		19	39 40	
Break-Before-Make Time[d]	t_d		Room	3			
Charge Injection[d]	Q_{INJ}	C_L = 1 nF, V_{GEN} = 0 V, R_{GEN} = 0 Ω, Figure 3	Room		13		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 64		dB
Crosstalk[d]	X_{TALK}		Room		- 64		
NO, NC Off Capacitance[d]	$C_{NO(off)}$ $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		32		pF
Channel-On Capacitance[d]	C_{ON}		Room		78		

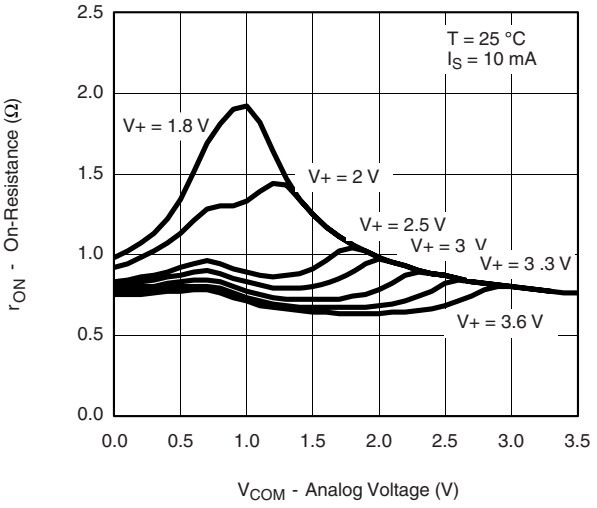
SPECIFICATIONS (V+ = 3.0 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3 V, ± 10 %, V_{IN} = 0.5 or 1.5 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} = 0.2 V/1.5 V I_{NO}, I_{NC} = 100 mA	Room Full		0.85	1.2 1.3	Ω
r_{ON} Flatness	r_{ON} Flatness	V+ = 2.7 V, V_{COM} = 0 to V+, I_{NO}, I_{NC} = 100 mA	Room			0.2	
r_{ON} MatchFlat	Δr_{ON}		Room			0.06	
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/10.3 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	V_{INH}		Full	1.5			V
Input Low Voltage	V_{INL}		Full			0.5	
Input Capacitance[d]	C_{in}		Full		3.3		pF
Input Current[f]	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 = 300 Ω, C_L = 35 pF Figures 1 and 2	Room Full		28	51 55	ns
Turn-Off Time	t_{OFF}		Room Full		12	33 34	
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		9		pC
Off-Isolation[d]	OIRR	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz	Room		- 64		dB
Crosstalk[d]	X_{TALK}		Room		- 64		
NO, NC Off Capacitance[d]	$C_{NO(off)}$ $C_{NC(off)}$	V_{IN} = 0 or V+, f = 1 MHz	Room		30		pF
Channel-On Capacitance[d]	C_{ON}		Room		77		
Power Supply							
Power Supply Range	V+			1.5		3.6	V
Power Supply Current	I+	V+ = 3.6 V, V_{IN} = 0 or V+			0.01	1.0	µA

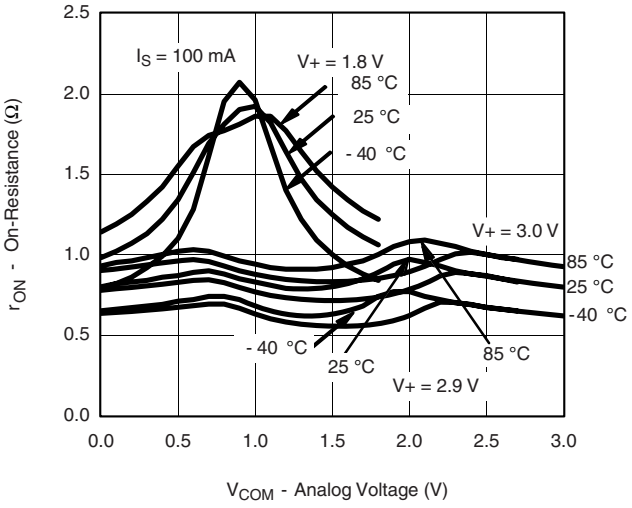
Notes:
a. Room = 25 °C, Full = as determined by the operating suffix.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Typical values are for design aid only, not guaranteed nor subject to production testing.
d. Guarantee by design, nor subjected to production test.
e. V_{IN} = input voltage to perform proper function.
f. Guaranteed by 3 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.

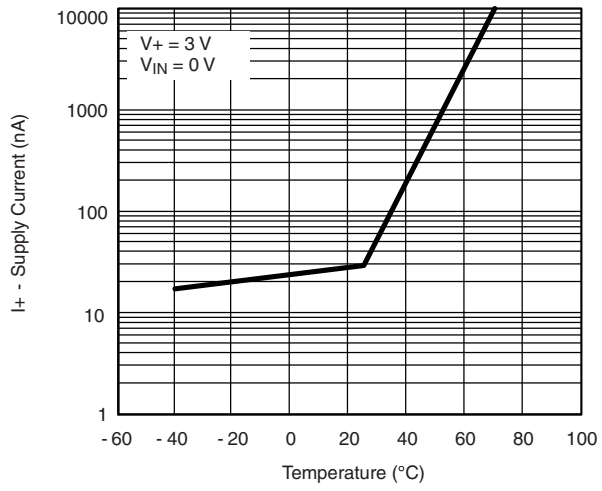
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



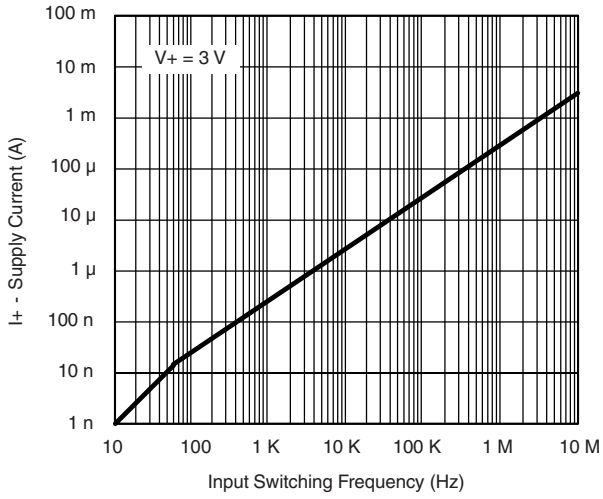
r_{ON} vs. V_{COM} and Single Supply Voltage



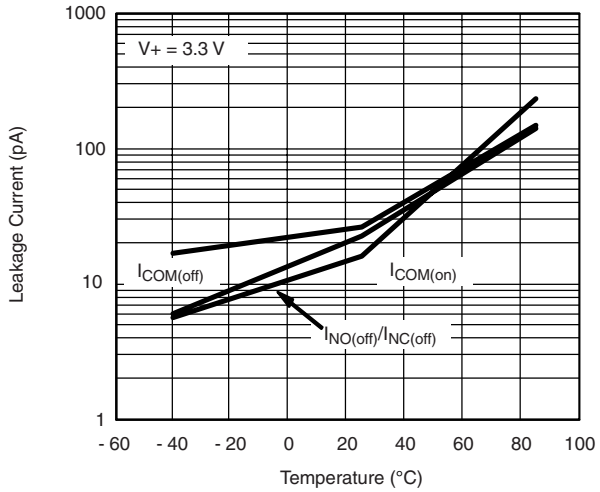
r_{ON} vs. Analog Voltage and Temperature



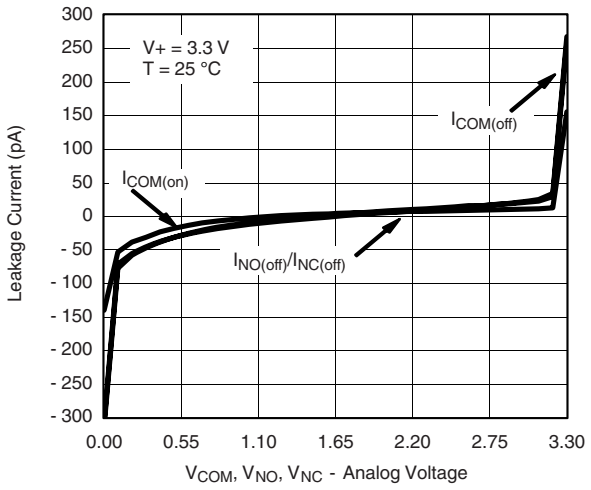
Supply Current vs. Temperature



Supply Current vs. Input Switching Frequency

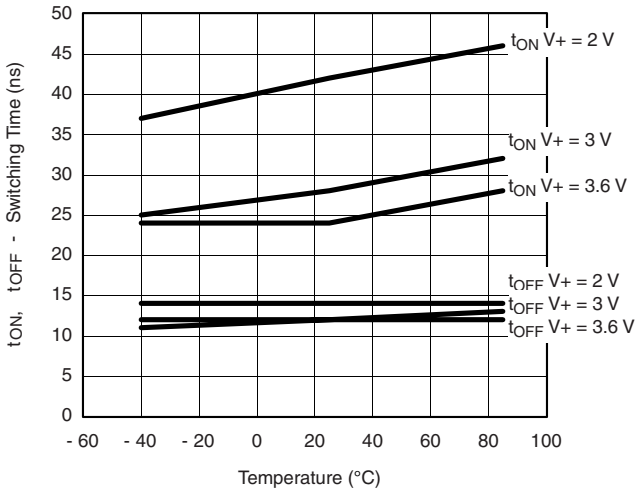


Leakage Current vs. Temperature

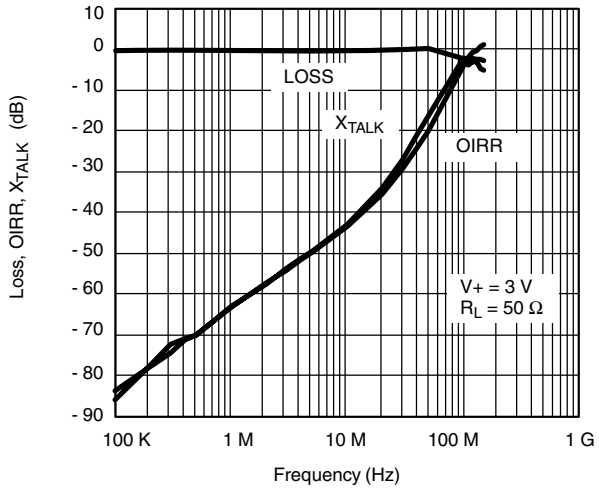


Leakage vs. Analog Voltage

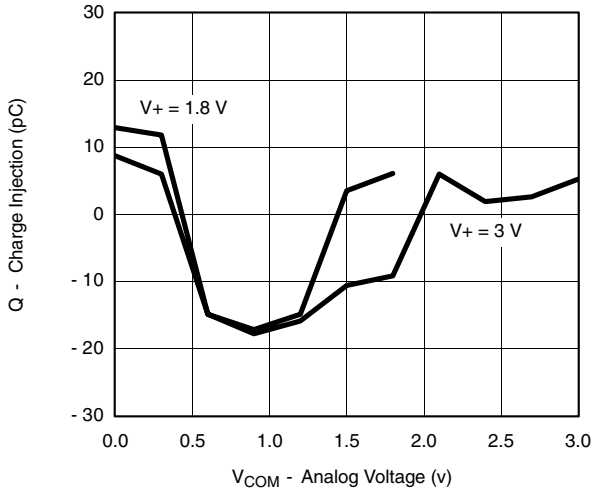
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted



Switching Time vs. Temperature and Supply Voltage

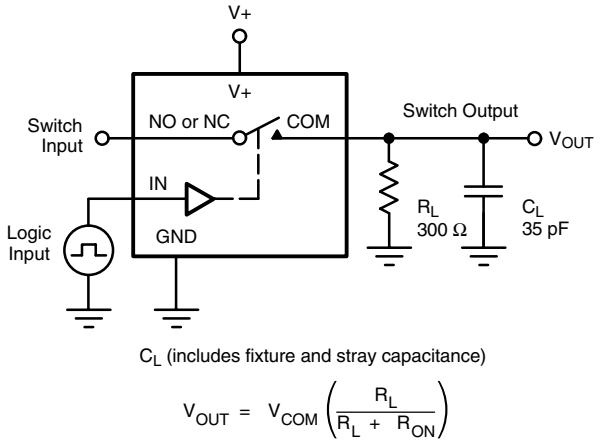


Insertion Loss, Off-Isolation Crosstalk vs. Frequency



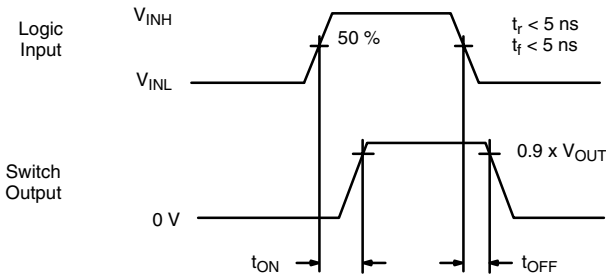
Charge Injection vs. Analog Voltage

TEST CIRCUITS



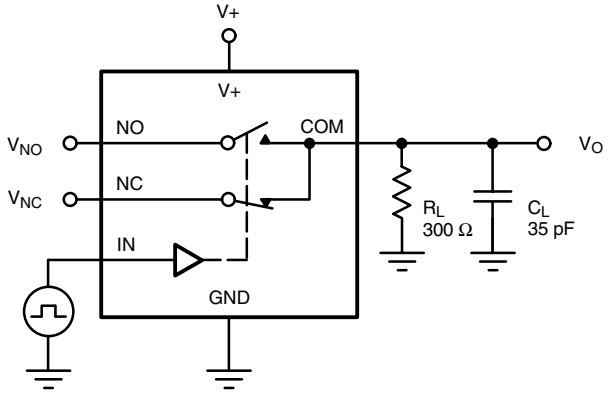
C_L (includes fixture and stray capacitance)

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



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

Figure 1. Switching Time



C_L (includes fixture and stray capacitance)

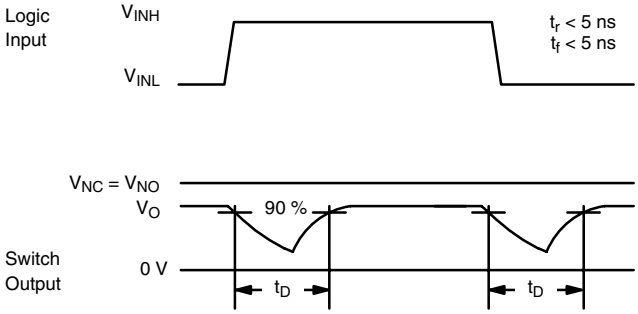
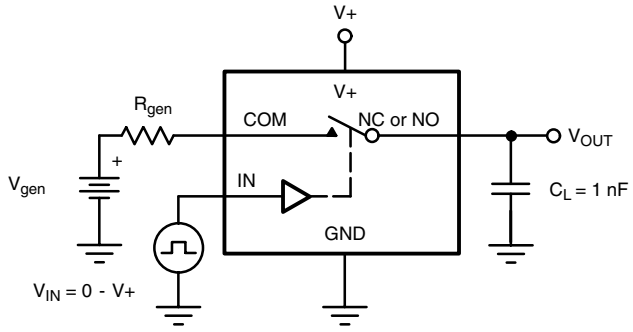
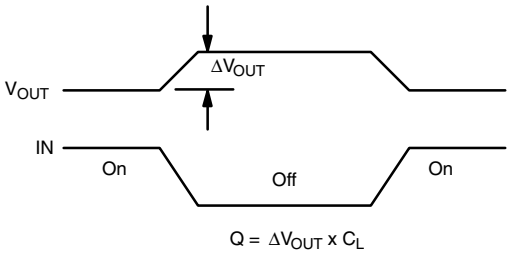


Figure 2. Break-Before-Make Interval





$Q = \Delta V_{OUT} \times C_L$

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

Figure 3. Charge Injection

TEST CIRCUITS

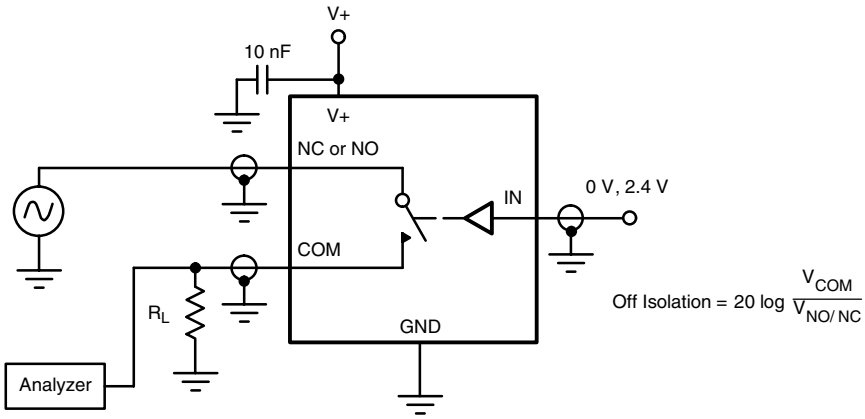


Figure 4. Off-Isolation

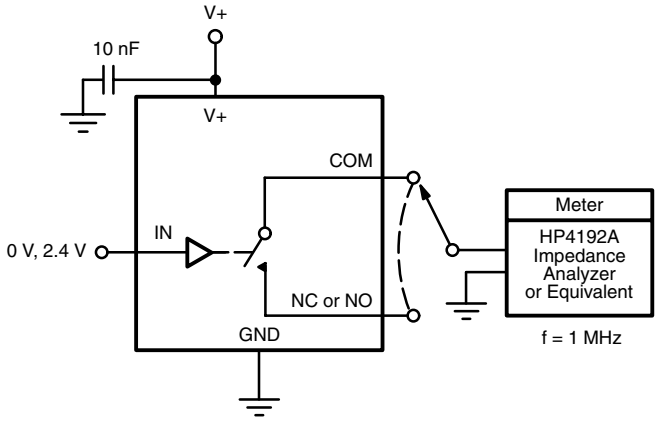


Figure 5. Channel Off/On Capacitance

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see http://www.vishay.com/ppg?72308.

Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, “Vishay”), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay’s terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.