

Low-Voltage Single-Supply, SPDT Analog Switch in SC-70

DESCRIPTION

The DG4599 is a cost effective upgrade to other types of 4599 low-voltage, single-pole/double-throw analog switches available in the industry today.

Combining low power, high speed, low on-resistance and small physical size, the DG4599 is ideal for portable and battery powered applications.

The DG4599 is built on Vishay Siliconix's low voltage CMOS process. An epitaxial layer prevents latchup. Break-before-make is guaranteed for DG4599.

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

FEATURES

- 6-Pin SC-70 Package
- 60 Ω Max. (26 Typ.) On-Resistance
- 2 Ω Typ. R_{ON} Flatness
- Fast Switching: $t_{ON} = 30$ ns (Max.)
 $t_{OFF} = 25$ ns (Max.)
- 2.25 V to 5.5 V Single Supply Operation
- Break-Before-Make Switching
- TTL/CMOS-Logic Compatible



RoHS*
COMPLIANT

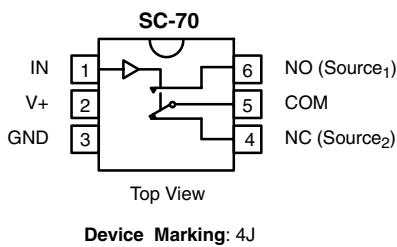
BENEFITS

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

APPLICATIONS

- Battery-Operated Equipment
- Audio and Video Signal Routing
- Cellular Phones
- Low-Voltage Data-Acquisition Systems
- Sample-and-Hold Circuits
- Communications Systems

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE

Logic	NC	NO
0	ON	OFF
1	OFF	ON

Logic "0" \leq 0.8 V

Logic "1" \geq 2.4 V

ORDERING INFORMATION

Temp Range	Package	Part Number
- 40 to 85 °C	SC70-6	DG4599DL-T1 DG4599DL-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 + 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 125	°C
Power Dissipation (Packages) ^b	250	mW
6-Pin SO70 ^c		

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 6.5 mW/°C above 25 °C.

SPECIFICATIONS (V+ = 5 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 5 V, ± 10 %, V _{IN} = 0.8 or 2.4 V ^e	Temp ^a	Limits			Unit
				Min ^b	Typ ^c	Max ^b	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} V _{COM}		Full	0		V+	V
Drain-Source On-Resistance	r _{DS(on)}	V+ = 4.5 V, V _D = 3 V, I _S = 10 mA	Room Full		7 10	60 65	Ω
r _{DS(on)} Flatness ^d	r _{DS(on)} Flatness	V+ = 2.5 V	Room		2		
Switch Off Leakage Current	I _{S(off)}	V+ = 5.5 V V _S = 1 V/4.5 V, V _D = 4.5 V/1 V	Room Full	- 1.0 - 4.0		1.0 4.0	nA
	I _{D(off)}		Room Full	- 1.0 - 4.0		1.0 4.0	
Channel-On Leakage Current	I _{D(on)}	V+ = 5.5 V, V _S = V _D = 1 V/4.5 V	Room Full	- 1.0 - 3.0		1.0 4.5	
Digital Control							
Input High Voltage	V _{INH}		Full	2.4			V
Input Low Voltage	V _{INL}		Full			0.8	
Input Capacitance	C _{in}		Full		3		pF
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V+	Full	- 1		1	μA
Dynamic Characteristics							
Turn-On Time ^d	t _{ON}	V _D or V _S = 3 V, R _L = 300 Ω, C _L = 35 pF Figures 1 and 2	Room Full		9	30 40	ns
Turn-Off Time ^d	t _{OFF}		Room Full		5	25 30	
Break-Before-Make Time ^d	t _d		Room	1	4		
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _S = 0 V V _{GEN} = 0 V, R _{GEN} = 0 Ω, Figure 3	Room		5	10	pC
Off-Isolation ^d	OIRR	R _L = 50 Ω, C _L = 5 pF, f = 1 MHz	Room		- 73		dB
Crosstalk ^d	X _{TALK}		Room		- 70		
Source-Off Capacitance ^d	C _{S(off)}	V _{IN} = 0 or V+, f = 1 MHz	Room		7		pF
Channel-On Capacitance ^d	C _{D(on)}		Room		20		
Drain-to-Source Capacitance ^d	C _{DS(off)}		Room		20		
Power Supply							
Power Supply Range	V+			4.5		5.5	V
Power Supply Current	I+	V _{IN} = 0 or V+			0.01	1.0	μA
Power Consumption	P _C					5.5	μW

SPECIFICATIONS (V₊ = 3 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified		Temp^a	Limits		Unit
		V ₊ = 3 V, ± 10 %, V _{IN} = 0.4 or 2.0 V ^e			Min ^b	Typ ^c	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} V _{COM}		Full	0		V ₊	V
Drain-Source On-Resistance ^d	r _{DS(on)}	V ₊ = 2.7 V, V _D = 1.5 V, I _S = 10 mA	Room Full	15 19	95 105		Ω
r _{DS(on)} Flatness ^d	r _{DS(on)} Flatness	V _S = 0 to V ₊ , I _S = 10 mA	Room		7.5		
Digital Control							
Input High Voltage	V _{INH}		Full	2			V
Input Low Voltage	V _{INL}		Full			0.8	
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V ₊	Full	-1		1	μA
Dynamic Characteristics							
Turn-On Time ^d	t _{ON}	V _D or V _S = 2.0 V, R _L = 300 Ω, C _L = 35 pF Figures 1 and 2	Room Full		12	45 55	ns
Turn-Off Time ^d	t _{OFF}		Room Full		6	35 40	
Break-Before-Make Time ^d	t _d		Room	1	7		
Charge Injection ^d	Q _{INJ}	C _L = 1 nF, V _{GEN} = 0 V, V _S = 0 V R _{GEN} = 0 Ω, Figure 3	Room		5	10	pC
Power Supply							
Power Supply Range	V ₊			2.7		3.3	V
Power Supply Current	I ₊	V _{IN} = 0 or V ₊			0.01	1.0	μA
Power Consumption	P _C					3.3	μW

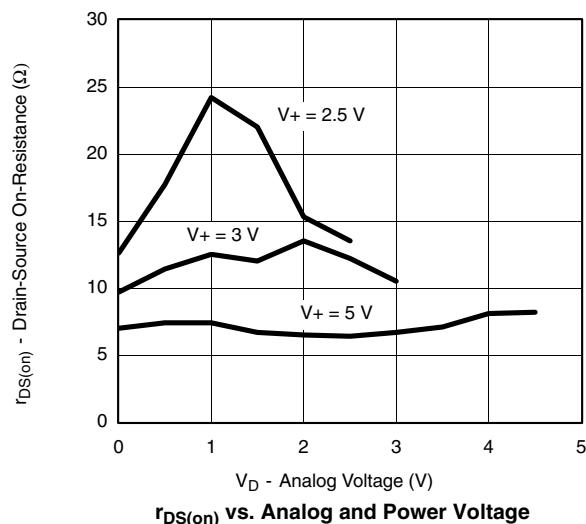
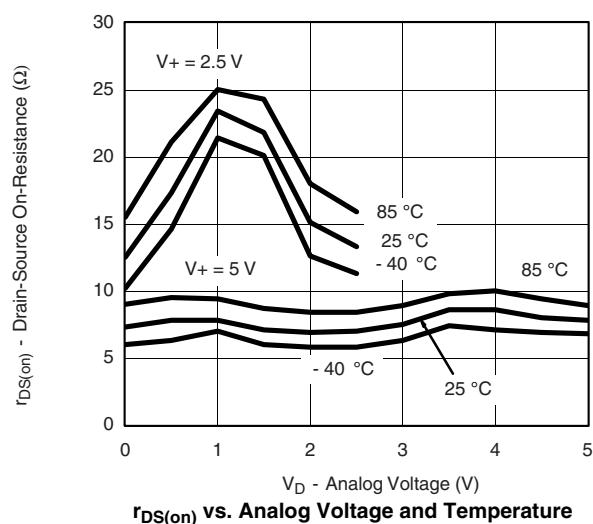
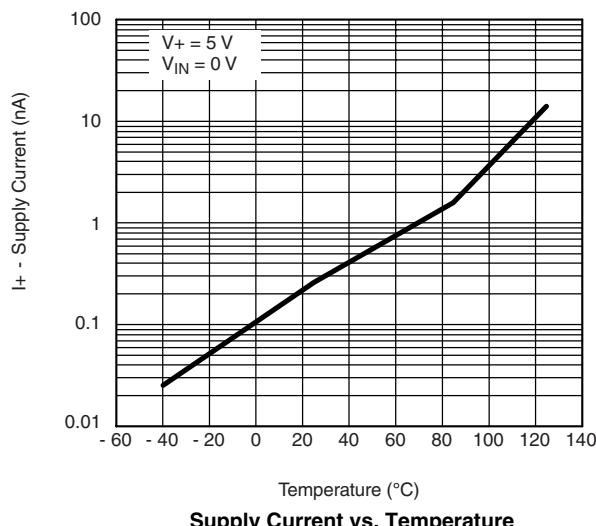
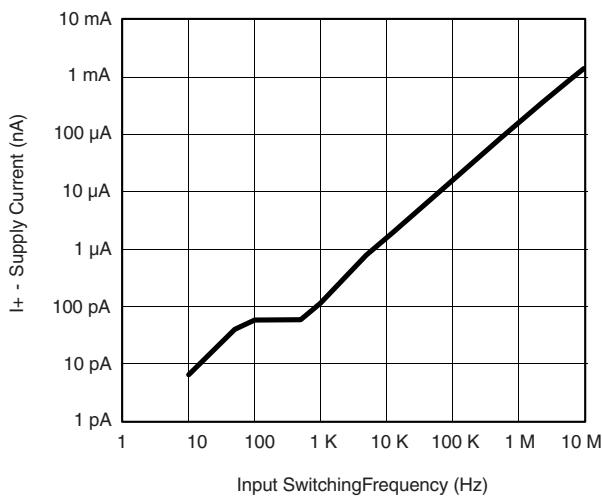
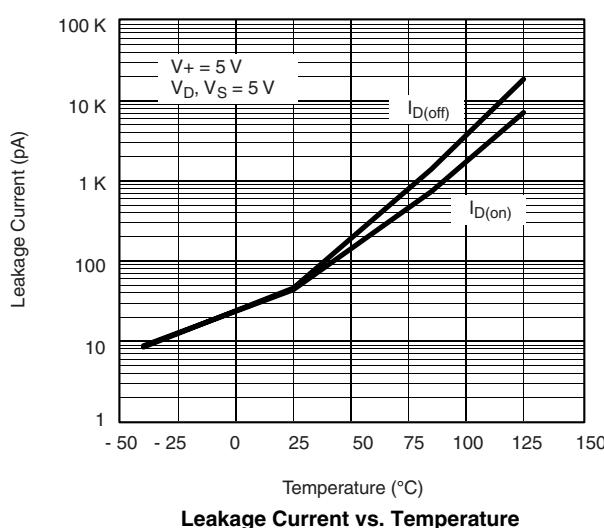
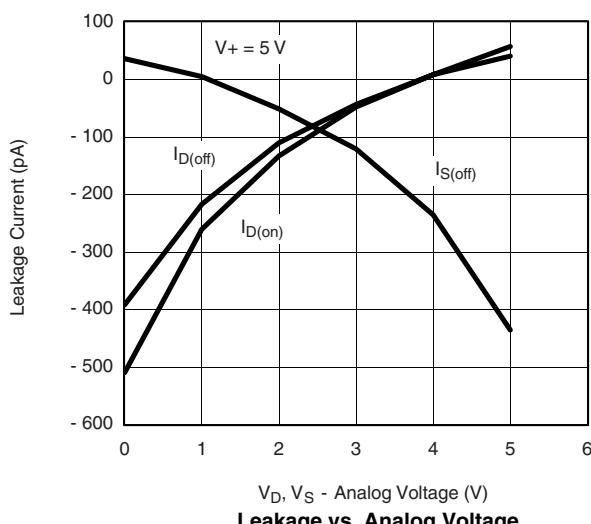
SPECIFICATIONS (V₊ = 2.5 V)

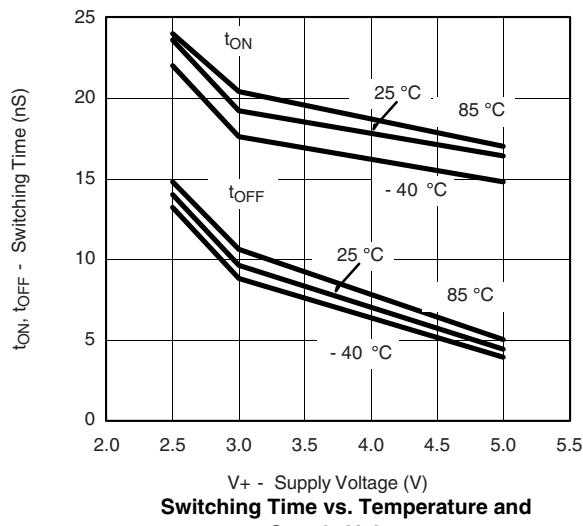
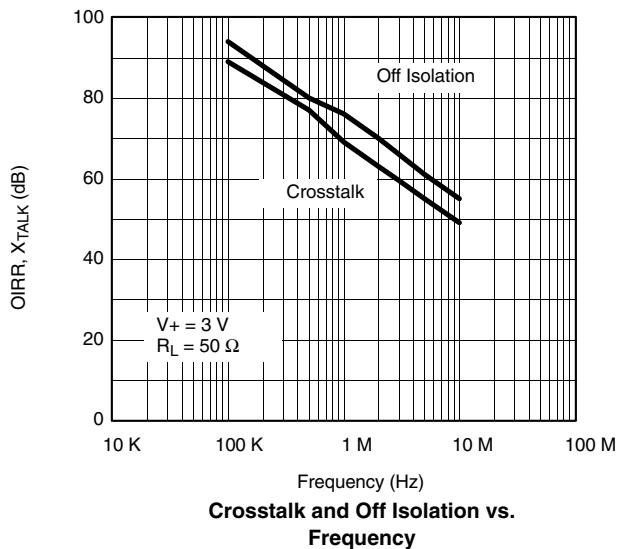
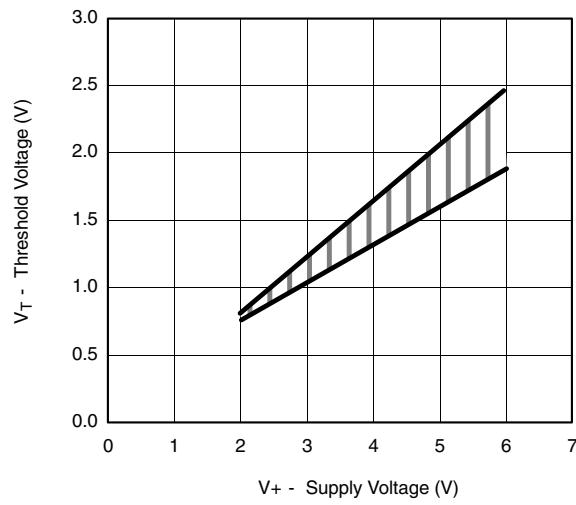
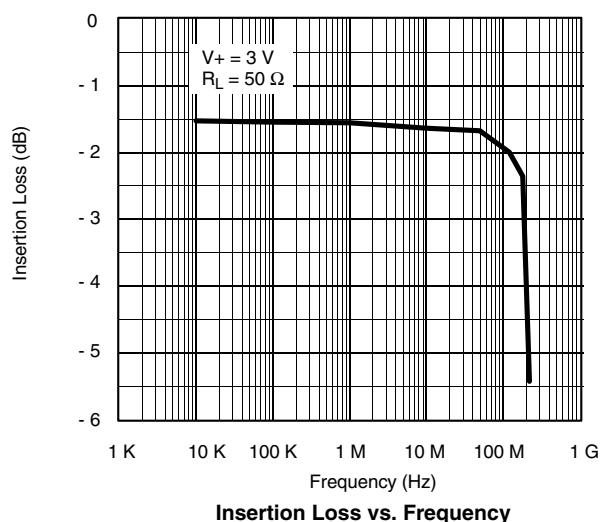
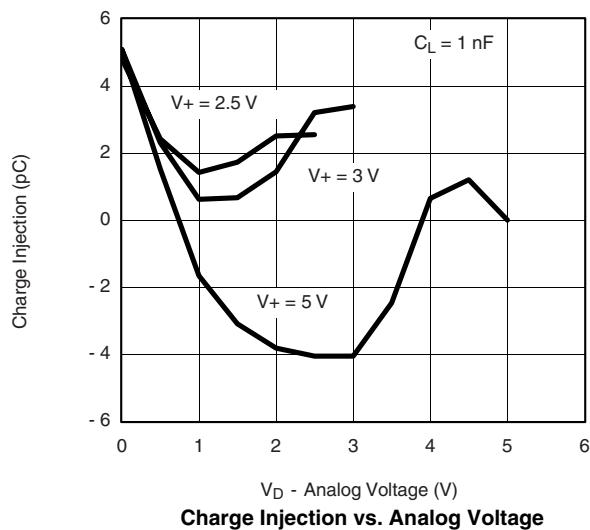
Parameter	Symbol	Test Conditions Otherwise Unless Specified V ₊ = 2.5 V, ± 10 %, V _{IN} = 0.4 or 2.0 V ^e	Temp ^a	Limits			Unit
				Min ^b	Typ ^c	Max ^b	
Analog Switch							
Analog Signal Range ^d	V _{NO} , V _{NC} V _{COM}		Full	0		V ₊	V
Drain-Source On-Resistance	r _{DS(on)}	V ₊ = 2.25 V, V _D = 1.0 V, I _S = 10 mA	Room Full ^d	26 29	110 120		Ω
r _{DS(on)} Flatness ^d	r _{DS(on)} Flatness	V ₊ = 2.5 V	Room		10		
Digital Control							
Input High Voltage	V _{INH}		Full	2			V
Input Low Voltage	V _{INL}		Full			0.4	
Input Current	I _{INL} or I _{INH}	V _{IN} = 0 or V ₊	Full	- 1		1	μA
Dynamic Characteristics							
Turn-On Time	t _{ON}	V _D or V _S = 1.5 V, R _L = 300 Ω, C _L = 35 pF Figures 1 and 2	Room Full ^d		16	50 60	ns
Turn-Off Time	t _{OFF}		Room Full ^d		7	35 45	
Break-Before-Make Time	t _d		Room	1	12		
Power Supply							
Power Supply Range	V ₊			2.25		2.75	V
Power Supply Current ^d	I ₊	V _{IN} = 0 or V ₊			0.01	1.0	μA
Power Consumption	P _C					2.75	μW

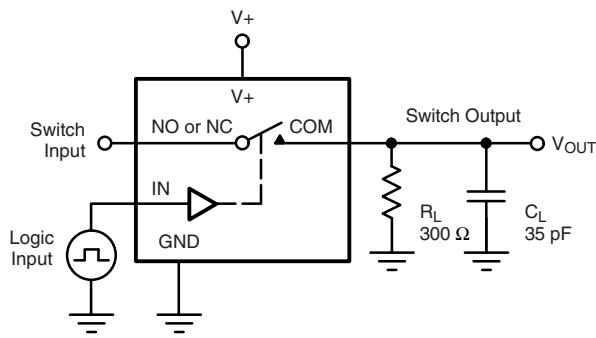
Notes:

- 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 5 V leakage testing, not production tested.

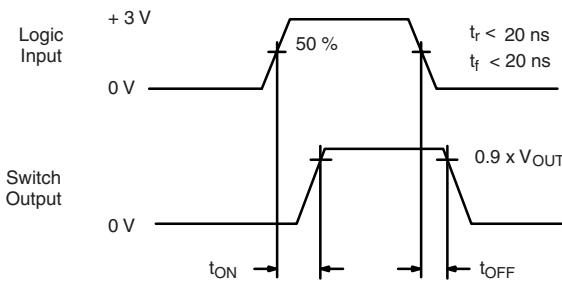
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

 $r_{DS(on)}$ vs. Analog and Power Voltage

 $r_{DS(on)}$ vs. Analog Voltage and Temperature

Supply Current vs. Temperature

Supply Current vs. Input Switching Frequency

Leakage Current vs. Temperature

Leakage vs. Analog Voltage

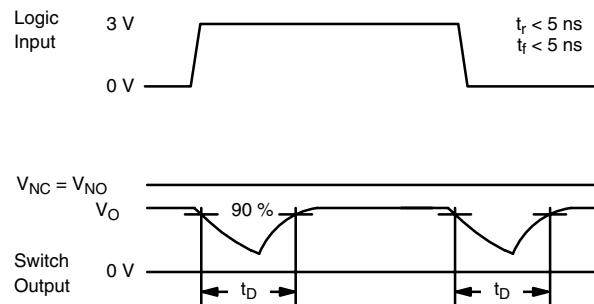
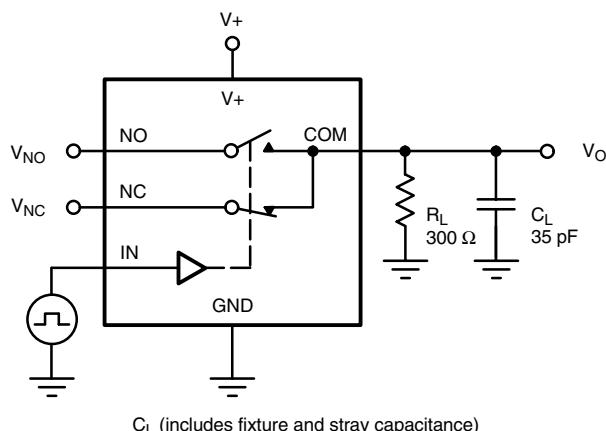
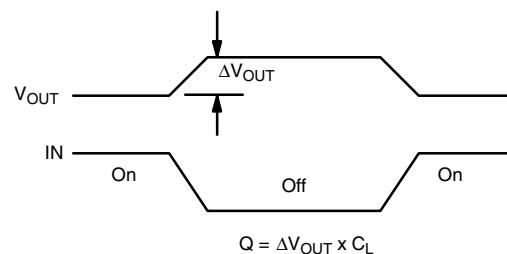
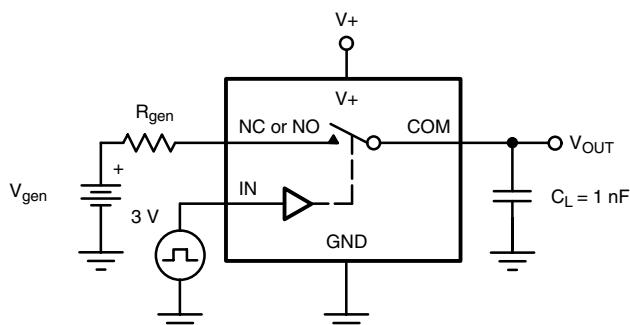
TYPICAL CHARACTERISTICS 25 °C, unless otherwise noted

Switching Time vs. Temperature and Supply Voltage

Crosstalk and Off Isolation vs. Frequency

Input Switching Threshold vs. Supply Voltage

Insertion Loss vs. Frequency

Charge Injection vs. Analog Voltage

TEST CIRCUITS


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



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

Figure 1. Switching Time

Figure 2. Break-Before-Make Interval


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

Figure 3. Charge Injection

TEST CIRCUITS

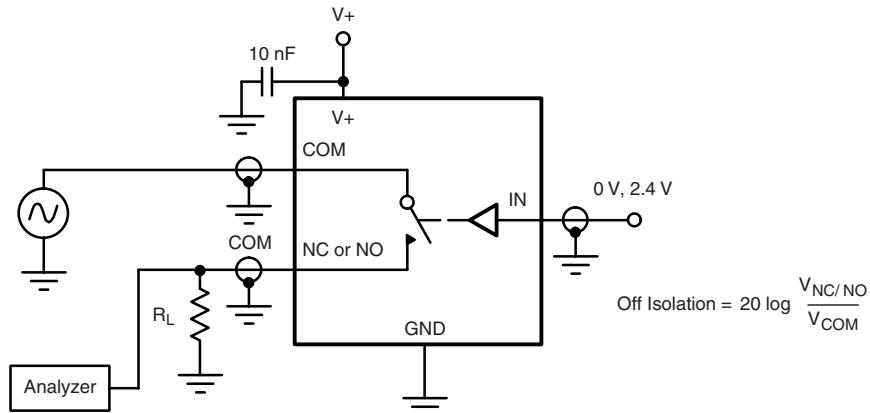


Figure 4. Off-isolation

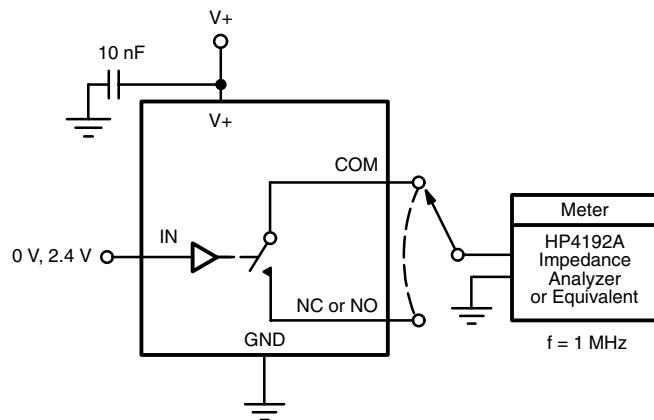


Figure 5. Channel Off/On Capacitance

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?72218>.

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.