



Precision Monolithic Quad SPST CMOS Analog Switches

DESCRIPTION

The DG417B, DG418B, DG419B monolithic CMOS analog switches were designed to provide high performance switching of analog signals. Combining low power, low leakages, high speed, low on-resistance and small physical size, the DG417B series is ideally suited for portable and battery powered industrial and military applications requiring high performance and efficient use of board space. To achieve high-voltage ratings and superior switching performance, the DG417B series is built on Vishay Siliconix's high voltage silicon gate (HVSG) process. Break-before-make is guaranteed for the DG419B, which is an SPDT configuration. An epitaxial layer prevents latchup. Each switch conducts equally well in both directions when on, and blocks up to the power supply level when off. The DG417B and DG418B respond to opposite control logic levels as shown in the Truth Table.

BENEFITS

- Widest dynamic range
- Low signal errors and distortion
- Break-before-make switching action
- Simple interfacing
- Reduced board space
- Improved reliability

FEATURES

- ± 15 V analog signal range
- On-resistance - $R_{DS(on)}$: 15 Ω
- Fast switching action - t_{on} : 110 ns
- TTL and CMOS compatible
- MSOP-8 and SOIC-8 package

Note

* This datasheet provides information about parts that are RoHS-compliant and / or parts that are non RoHS-compliant. For example, parts with lead (Pb) terminations are not RoHS-compliant. Please see the information / tables in this datasheet for details

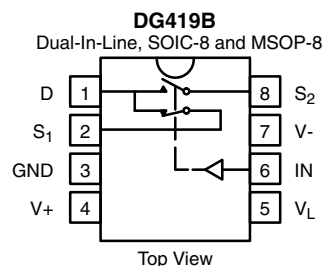
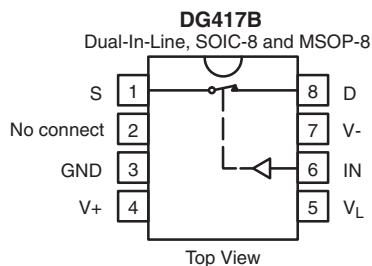


RoHS*
Available

APPLICATIONS

- Precision test equipment
- Precision instrumentation
- Battery powered systems
- Sample-and-hold circuits
- Military radios
- Guidance and control systems
- Hard disk drivers

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE		
LOGIC	DG417B	DG418B
0	On	Off
1	Off	On

Note

- Logic "0" ≤ 0.8 V
- Logic "1" ≥ 2.4 V

TRUTH TABLE (DG419B)		
LOGIC	SW ₁	SW ₂
0	On	Off
1	Off	On

Note

- Logic "0" ≤ 0.8 V
- Logic "1" ≥ 2.4 V

**ORDERING INFORMATION**

TEMP. RANGE	PACKAGE	PART NUMBER
DG417B, DG418B		
-40 °C to +85 °C	8-pin narrow SOIC	DG417BDY-E3 DG417BDY-T1-E3
		DG418BDY-E3 DG418BDY-T1-E3
	8-pin MSOP	DG417BDQ-T1-E3
		DG418BDQ-T1-E3
DG419B		
-40 °C to +85 °C	8-pin narrow SOIC	DG419BDY-E3 DG419BDY-T1-E3
	8-pin MSOP	DG419BDQ-T1-E3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ °C}$, unless otherwise noted)

PARAMETER	LIMIT	UNIT
V-	-20	V
V+	20	
GND	25	
V_L	(GND - 0.3) to (V+) + 0.3	
Digital inputs ^a , V_S , V_D	(V-) - 2 to (V+) + 2 or 30 mA, whichever occurs first	
Current (any terminal) continuous	30	mA
Current (S or D) pulsed at 1 ms, 10 % duty cycle	100	
Storage temperature	-65 to +150	°C
Power dissipation (package) ^b	8-pin narrow SOIC ^d	400
	8-pin MSOP ^e	400
	8-pin CerDIP ^e	600

Notes

- a. Signals on S_X , D_X , or IN_X exceeding V_+ or 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 5.3 mW/°C above 75 °C
- d. Derate 4 mW/°C above 70 °C
- e. Derate 8 mW/°C above 75 °C

SCHEMATIC DIAGRAM (Typical Channel)

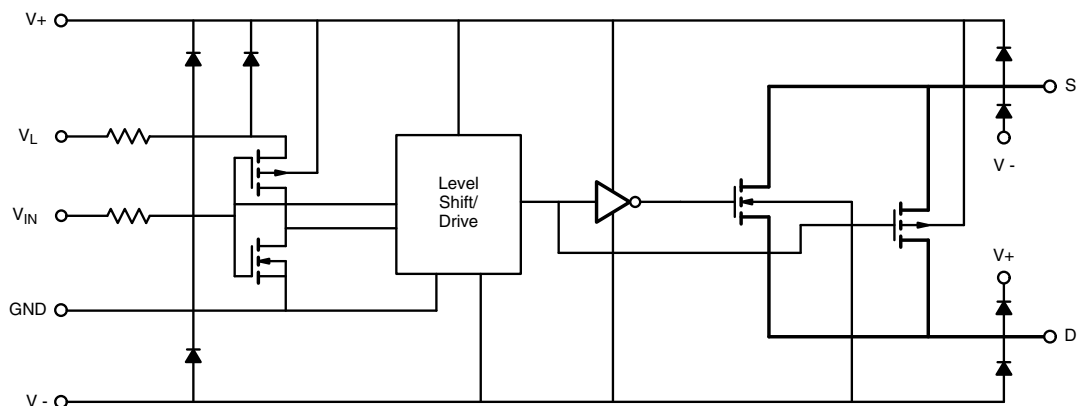


Fig. 1

**SPECIFICATIONS ^a**

PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V ₊ = 15 V, V ₋ = -15 V, V _L = 5 V, V _{IN} = 2.4 V, 0.8 V ^f		TEMP. ^b	TYP. ^c	A SUFFIX -55 °C to +125 °C		D SUFFIX -40 °C to +85 °C		UNIT	
						MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d		
Analog Switch											
Analog signal range ^e	V _{ANALOG}			Full	-	-15	15	-15	15	V	
Drain-source on-resistance	R _{DS(on)}	I _S = -10 mA, V _D = ± 12.5 V, V ₊ = 13.5 V, V ₋ = -13.5 V		Room	15	-	25	-	25	Ω	
				Full	-	-	34	-	29		
Switch off leakage current	I _{S(off)}	V ₊ = 16.5, V ₋ = -16.5 V V _D = ± 15.5 V, V _S = ± 15.5 V		Room	-0.1	-0.25	0.25	-0.25	0.25	nA	
				Full	-	-20	20	-5	5		
	I _{D(off)}			DG417B	Room	-0.1	-0.25	0.25	-0.25		0.25
				DG418B	Full	-	-20	20	-5		5
				DG419B	Room	-0.1	-0.75	0.75	-0.75		0.75
				DG419B	Full	-	-60	60	-12		12
Channel on leakage current	I _{D(on)}	V ₊ = 16.5 V, V ₋ = -16.5 V V _S = V _D = ± 15.5 V	DG417B	Room	-0.4	-0.4	0.4	-0.4	0.4		
			DG418B	Full	-	-40	40	-10	10		
			DG419B	Room	-0.4	-0.75	0.75	-0.75	0.75		
			DG419B	Full	-	-60	60	-12	12		
Digital Control											
Input current V _{IN} low	I _{IL}			Full	-	-0.5	0.5	-0.5	0.5	μA	
Input current V _{IN} high	I _{IH}			Full	-	-0.5	0.5	-0.5	0.5		
Dynamic Characteristics											
Turn-on time	t _{on}	R _L = 300 Ω, C _L = 35 pF, V _S = ± 10 V, see Switching Time Test Circuit		DG417B	Room	62	-	89	-	89	ns
				DG418B	Full	-	-	106	-	99	
Turn-off time	t _{off}			DG417B	Room	53	-	80	-	80	
				DG418B	Full	-	-	88	-	86	
Transition time	t _{TRANS}	R _L = 300 Ω, C _L = 35 pF, V _{S1} = ± 10 V, V _{S2} = ± 10 V	DG419B	Room	60	-	87	-	87		
			DG419B	Full	-	-	96	-	93		
Break-before-make time delay	t _D	R _L = 300 W, C _L = 35 pF, V _{S1} = V _{S2} = ± 10 V	DG419B	Room	16	3	-	3	-	pC	
Charge injection	Q	C _L = 10 nF, V _{gen} = 0 V, R _{gen} = 0 Ω		Room	38	-	-	-	-		
Off isolation ^e	OIRR	R _L = 50 Ω, C _L = 5 pF, f = 1 MHz		Room	-82	-	-	-	-	dB	
Channel-to-channel crosstalk ^e	X _{TALK}		DG419B	Room	-88	-	-	-	-		
Source off capacitance ^e	C _{S(off)}	f = 1 MHz, V _S = 0 V		Room	12					pF	
Drain off capacitance ^e	C _{D(off)}			DG417B DG418B	Room	12					
Channel on capacitance ^e	C _{D(on)}	f = 1 MHz, V _S = 0 V	DG417B DG418B	Room	50						
			DG419B	Room	57						
Power Supplies											
Positive supply current	I ₊	V ₊ = 16.5 V, V ₋ = -16.5 V, V _{IN} = 0 V or 5 V		Room	0.001	-	1	-	1	μA	
				Full	-	-	5	-	5		
Negative supply current	I ₋			Room	-0.001	-1	-	-1	-		
				Full	-	-5	-	-5	-		
Logic supply current	I _L			Room	0.001	-	1	-	1		
				Full	-	-	5	-	5		
Ground current	I _{GND}			Room	-0.001	-1	-	-1	-		
				Full	-	-5	-	-5	-		



SPECIFICATIONS ^a										
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS OTHERWISE SPECIFIED V ₊ = 12 V, V ₋ = 0 V, V _L = 5 V, V _{IN} = 2.4 V, 0.8 V ^f		TEMP. ^b	TYP. ^c	A SUFFIX -55 °C to +125 °C		D SUFFIX -40 °C to +85 °C		UNIT
						MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d	
Analog Switch										
Analog signal range ^e	V _{ANALOG}			Full	-	0	12	0	12	V
Drain-source on-resistance	R _{DS(on)}	I _S = -10 mA, V _D = 3.8 V, V ₊ = 10.8 V		Room	26	-	35	-	35	Ω
				Full	-	-	52	-	45	
Dynamic Characteristics										
Turn-on time	t _{on}	R _L = 300 Ω, C _L = 35 pF, V _S = 8 V, see Switching Time Test Circuit		Room	100	-	125	-	125	ns
				Full	-	-	155	-	143	
Turn-off time	t _{off}			Room	38	-	66	-	66	
				Full	-	-	73	-	69	
Break-before-make time delay	t _D	R _L = 300 Ω, C _L = 35 pF	DG419B	Room	62	25	-	25	-	
Transition time	t _{TRANS}	R _L = 300 Ω, C _L = 35 pF, V _{S1} = 0 V, 8 V, V _{S2} = 8 V, 0 V		Room	95	-	119	-	119	
				Full	-	-	153	-	141	
Charge injection	Q	C _L = 10 nF, V _{gen} = 0 V, R _{gen} = 0 Ω		Room	18	-	-	-	-	pC
Power Supplies										
Positive supply current	I ₊	V ₊ = 13.2 V, V _L = 5.25 V, V _{IN} = 0 V or 5 V		Room	0.001	-	1	-	1	μA
				Full	-	-	5	-	5	
Negative supply current	I ₋			Room	-0.001	-1	-	-1	-	
				Full	-	-5	-	-5	-	
Logic supply current	I _L			Room	0.001	-	1	-	1	
				Full	-	-	5	-	5	
Ground current	I _{GND}			Room	-0.001	-1	-	-1	-	
				Full	-	-5	-	-5	-	

Notes

a. Refer to PROCESS OPTION FLOWCHART

b. Room = 25 °C, full = as determined by the operating temperature suffix

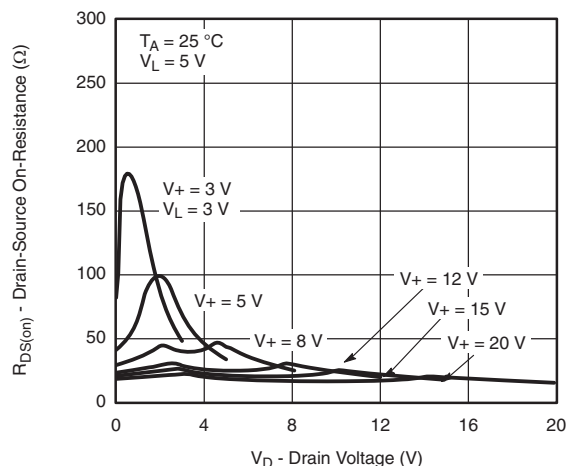
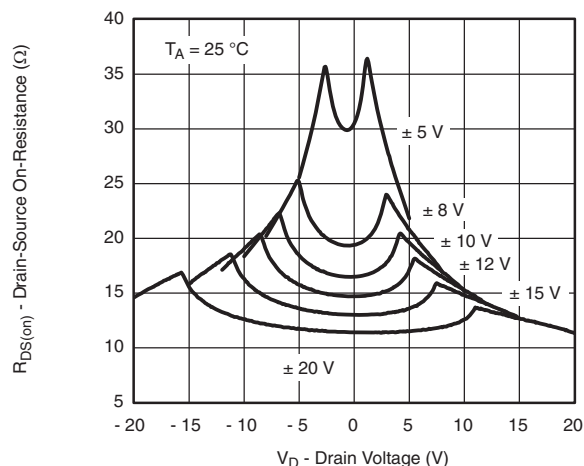
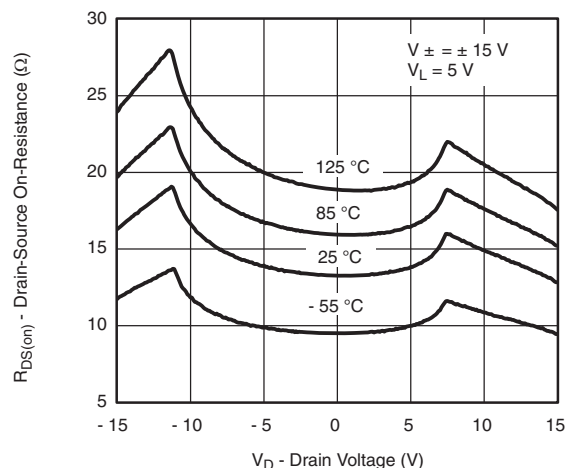
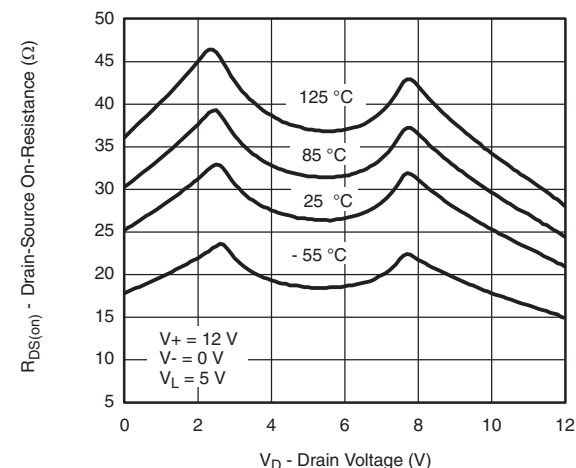
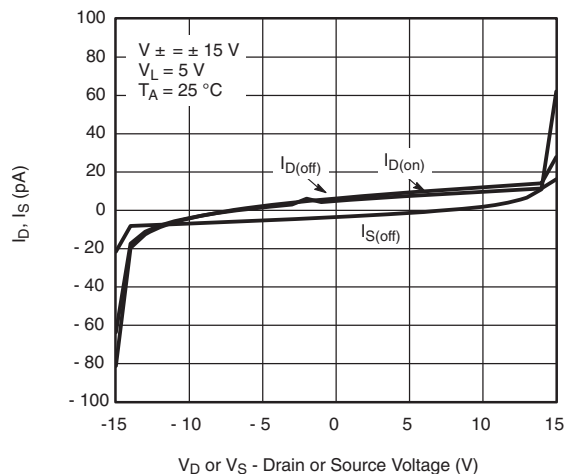
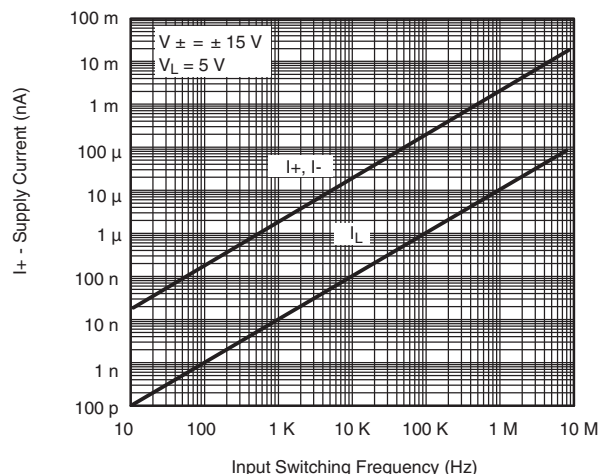
c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing

d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this datasheet

e. Guaranteed by design, not subject to production test

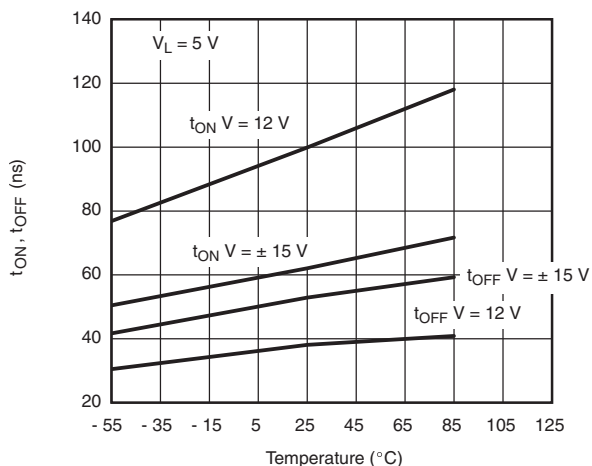
f. V_{IN} = input voltage to perform proper function

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.

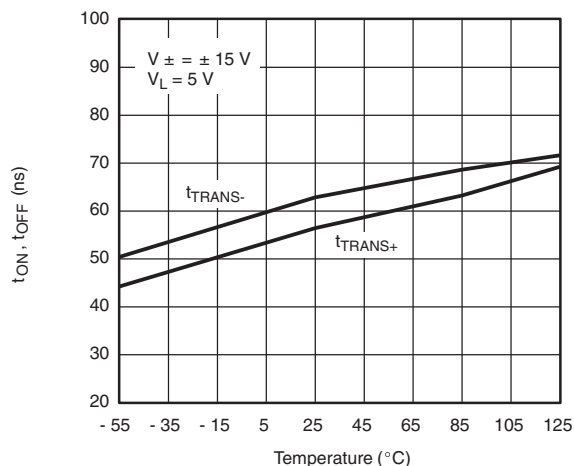
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)

On-Resistance vs. V_D and Unipolar Power

On-Resistance vs. V_D and Dual Supply Voltage

On-Resistance vs. V_D and Temperature

On-Resistance vs. V_D and Temperature

Leakage vs. Analog Voltage

Supply Current vs. Input Switching Frequency



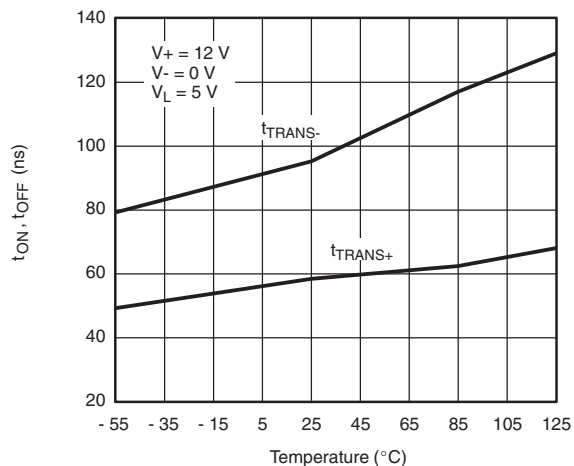
TYPICAL CHARACTERISTICS ($T_A = 25^\circ\text{C}$, unless otherwise noted)



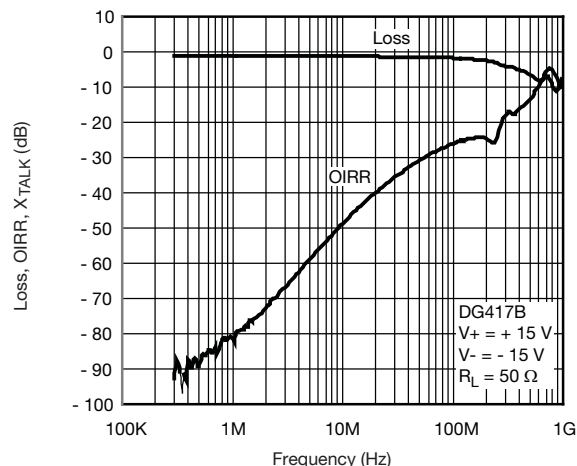
Switching Time vs. Temperature



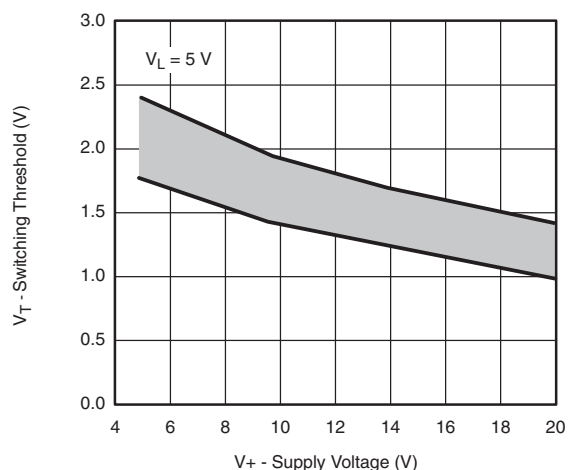
Transition Time vs. Temperature



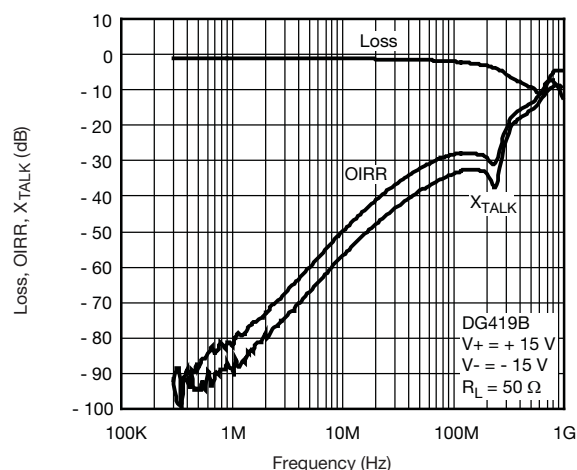
Transition Time vs. Temperature



Insertion Loss, Off-Isolation Crosstalk vs. Frequency



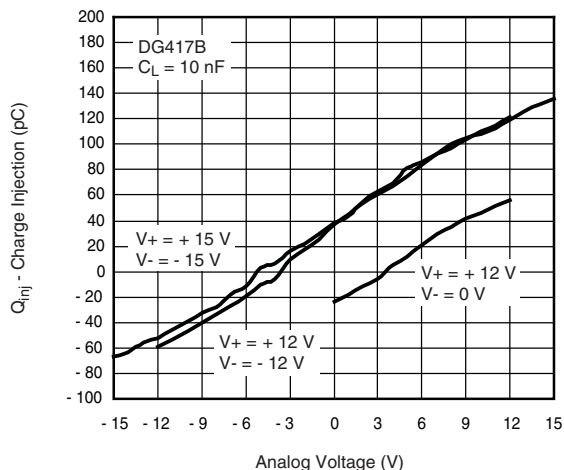
Switching Threshold vs. Supply Voltage



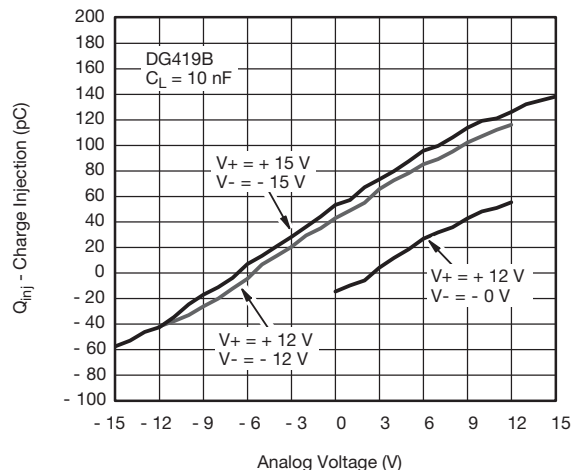
Insertion Loss, Off-Isolation Crosstalk vs. Frequency



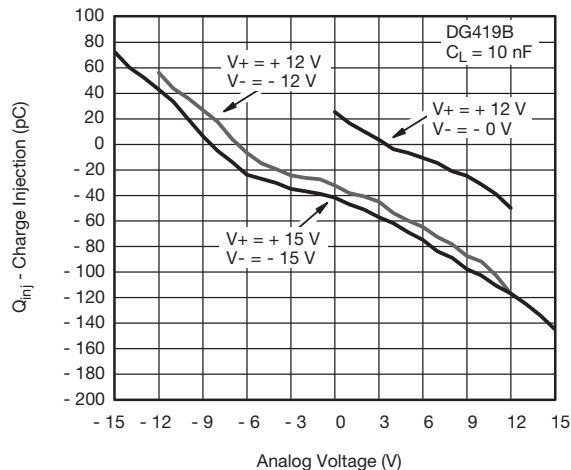
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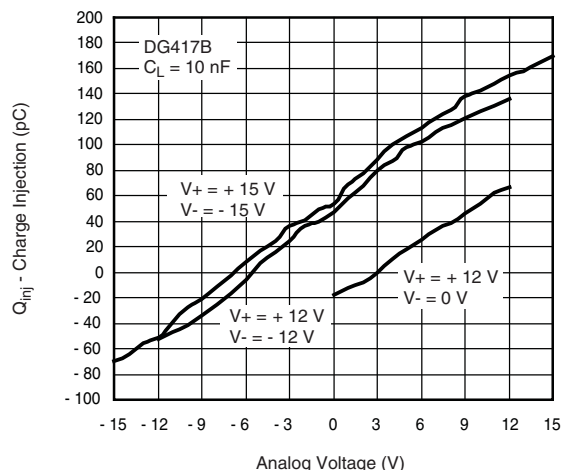
Charge Injection vs. Analog Voltage (measured at drain pin)



Charge Injection vs. Analog Voltage (measured at source pin)



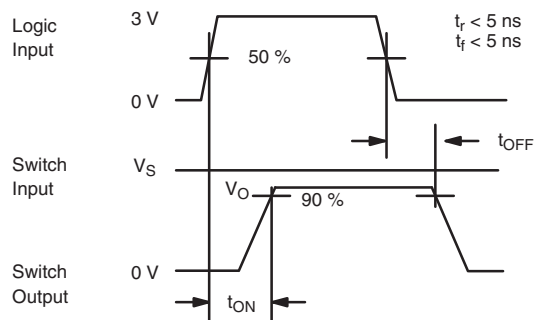
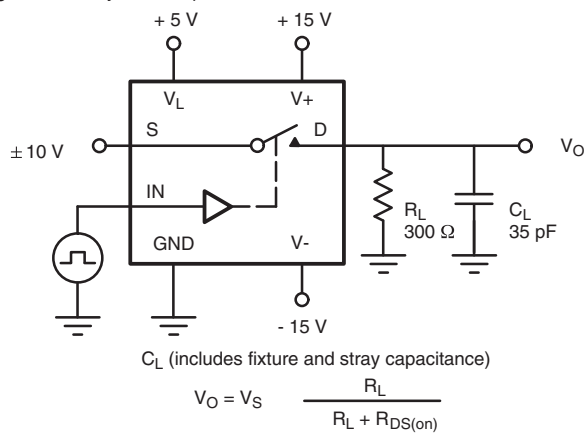
Charge Injection vs. Analog Voltage (measured at drain pin)



Charge Injection vs. Analog Voltage (measured at source pin)

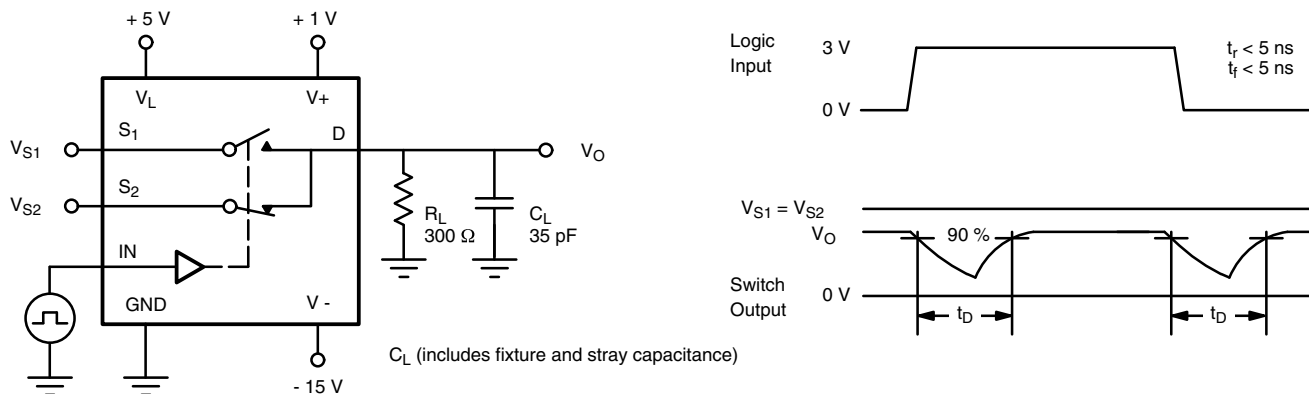
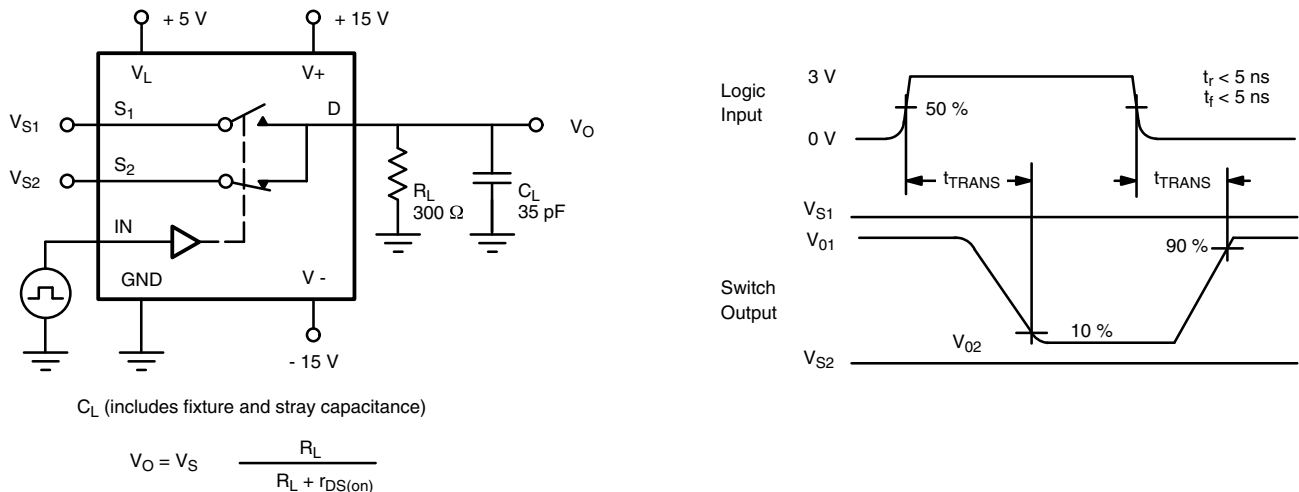
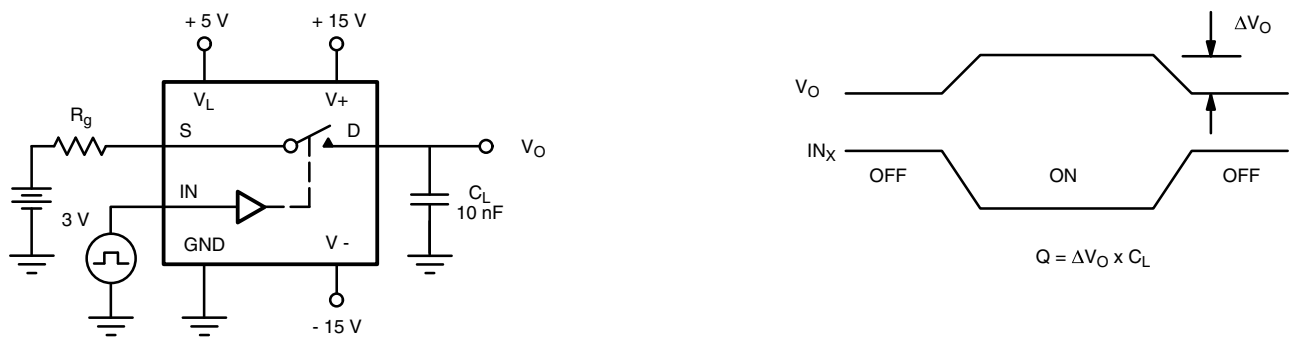
TEST CIRCUITS

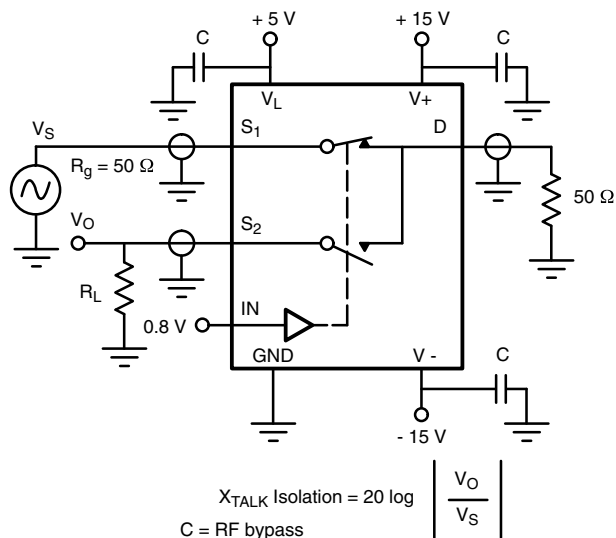
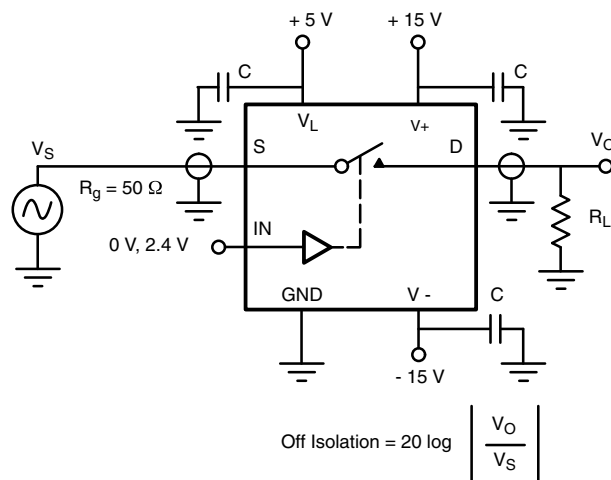
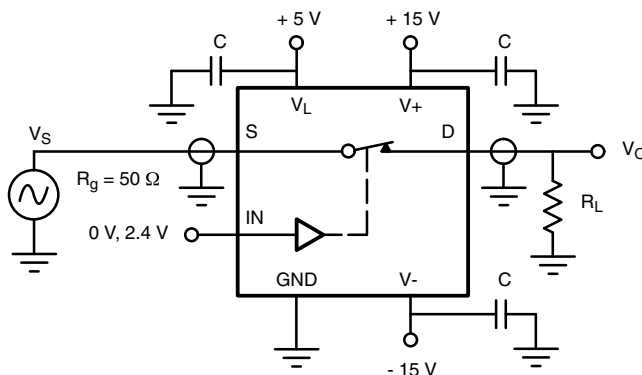
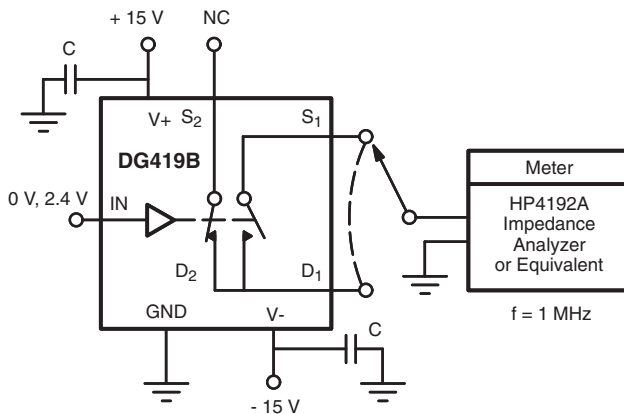
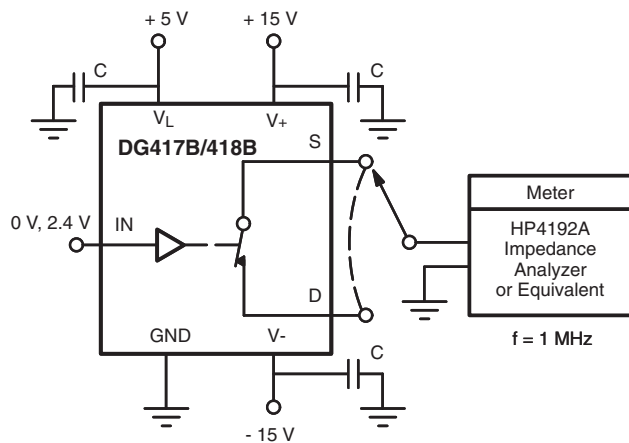
V_O is the steady state output with the switch on.



Note: Logic input waveform is inverted for switches that have the opposite logic sense.

Fig. 2 - Switching Time (DG417B/DG418B)

TEST CIRCUITS

Fig. 3 - Break-Before-Make (DG419B)

Fig. 4 - Transition Time (DG419B)

Fig. 5 - Charge Injection

TEST CIRCUITS

Fig. 6 - Crosstalk

Fig. 7 - Off isolation

Fig. 8 - Insertion Loss

Fig. 9 - Source/Drain Capacitances



PRODUCT SUMMARY						
Part number	DG417B	DG417B	DG418B	DG418B	DG419B	DG419B
Status code	2	2	2	2	2	2
Configuration	SPST x 1, NC	SPST x 1, NC	SPST x 1, NO	SPST x 1, NO	SPDT x 1	SPDT x 1
Single supply min. (V)	5	5	5	5	5	5
Single supply max. (V)	36	36	36	36	36	36
Dual supply min. (V)	5	5	5	5	5	5
Dual supply max. (V)	20	20	20	20	20	20
On-resistance (Ω)	15	15	15	15	15	15
Charge injection (pC)	38	38	38	38	38	38
Source on capacitance (pF)	50	50	50	50	57	57
Source off capacitance (pF)	12	12	12	12	12	12
Leakage switch on typ. (nA)	0.4	0.4	0.4	0.4	0.4	0.4
Leakage switch off max. (nA)	0.25	0.25	0.25	0.25	0.75	0.75
-3 dB bandwidth (MHz)	-	-	-	-	-	-
Package	SO-8 (narrow) AS	MSOP-8	SO-8 (narrow) AS	MSOP-8	SO-8 (narrow) AS	MSOP-8
Functional circuit / applications	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare
Interface	Parallel	Parallel	Parallel	Parallel	Parallel	Parallel
Single supply operation	Yes	Yes	Yes	Yes	Yes	Yes
Dual supply operation	Yes	Yes	Yes	Yes	Yes	Yes
Turn on time max. (ns)	89	89	89	89	89	89
Crosstalk and off isolation	-88	-88	-88	-88	-88	-88

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 www.vishay.com/ppg?61566.



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