



## Low-Voltage Dual SPST Analog Switch

### FEATURES

- Wide Operation Voltage (+2.7 to +12 V)
- Low Charge Injection -  $Q_{INJ}$ : 1 pC
- Low Power Consumption
- TTL/CMOS Logic Compatible Over The Full Operating Voltage range
- Available in MSOP-8 and SOT23-8

### BENEFITS

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

### APPLICATIONS

- Battery Operated Systems
- Portable Test Equipment
- Sample and Hold Circuits
- Cellular Phones
- Communication Systems
- Military Radio
- PBX, PABX Guidance and Control Systems

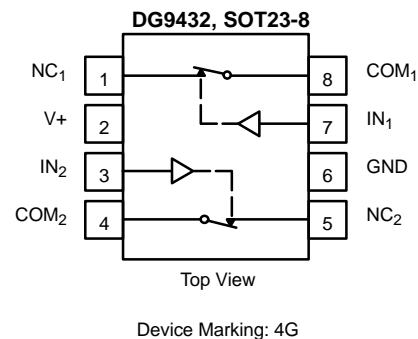
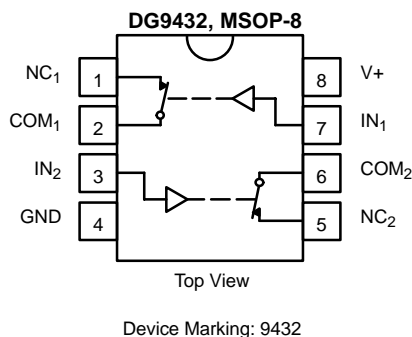
### DESCRIPTION

The DG9432/9433/9434 is a dual single-pole/single-throw monolithic CMOS analog switch designed for high performance switching of analog signals. Combining low power, high speed ( $t_{ON}$ : 25 ns,  $t_{OFF}$ : 20 ns), the DG9432/9433/9434 is ideal for portable and battery powered applications requiring high performance and efficient use of board space.

The DG9432/9433/9434 is built on Vishay Siliconix's low voltage BCD-15 process. An epitaxial layer prevents latchup. Break-before -make is guaranteed for DG9432/9433/9434.

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

### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION—DG9432

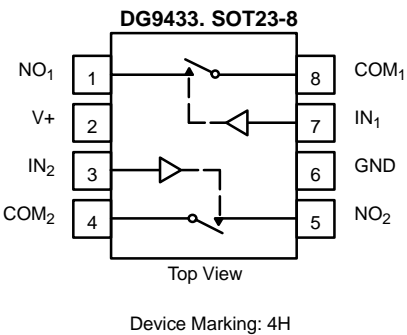
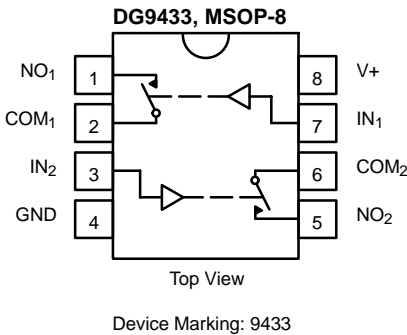


**TRUTH TABLE DG9432**

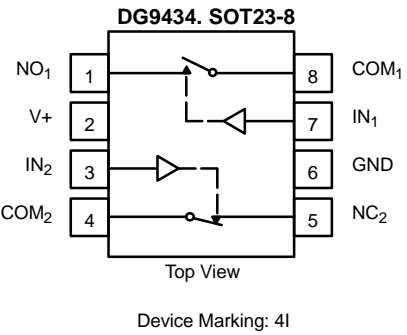
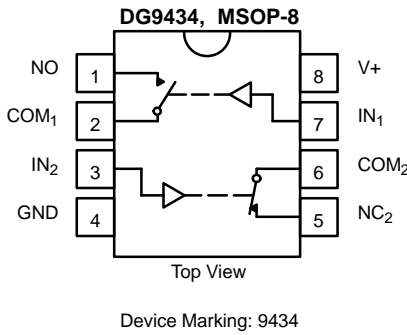
Logic	Switch
0	On
1	Off



FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION—DG9433/DG9434



TRUTH TABLE DG9433	
Logic	Switch
0	Off
1	On



TRUTH TABLE DG9434		
Logic	Switch-1	Switch-2
0	Off	On
1	On	Off

ORDERING INFORMATION		
Temp Range	Package	Part Number
-40 to 85°C	MSOP-8	DG9432DQ
		DG9433DQ
		DG9434DQ
	SOT23-8	DG9432DS
		DG9433DS
		DG9434DS



## ABSOLUTE MAXIMUM RATINGS

Reference to GND

V+ ..... -0.3 to +13.5 V

IN, COM, NC, NO<sup>a</sup> ..... -0.3 to (V+ + 0.3 V)

Continuous Current (Any terminal) ..... ±10 mA

Peak Current ..... ±20 mA

(Pulsed at 1ms, 10% duty cycle)

Storage Temperature (D Suffix) ..... -65 to 150°C

Power Dissipation (Packages)<sup>b</sup>MSOP-8<sup>c</sup> ..... 320 mWSOT23-8<sup>c</sup> ..... 515 mW

Notes:

a. Signals on S<sub>X</sub>, D<sub>X</sub>, or IN<sub>X</sub> 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 6.5 mW/°C above 75°C

## SPECIFICATIONS (V+ = 3 V)

Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 3.3 V, ± 10%, V <sub>IN</sub> = 0.4 or 1.8 V <sup>e</sup>	Temp <sup>a</sup>	Limits -40 to 85°C			Unit
				Min <sup>c</sup>	Typ <sup>b</sup>	Max <sup>c</sup>	
Switch On Resistance							
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	V -		V+	V
Drain-Source On-Resistance	r <sub>(on)</sub>	V+ = 2.7 V, I <sub>COM</sub> = 1 mA,V <sub>COM</sub> = 1.5 V	Room Full		81	100 120	Ω
r <sub>(on)</sub> Match <sup>d</sup>	Δr <sub>(on)</sub>		Room		0.4	3.0	
Digital Control							
Input, High Voltage	V <sub>INH</sub>	V+ Ranges 2.7 to 5 V	Full	1.8			V
Input, Low Voltage	V <sub>INL</sub>		Full			0.4	
Input Current	I <sub>INH</sub>			-1		1	μA
Dynamic Characteristics							
Break-Before-Make <sup>d,g</sup>	t <sub>OPEN</sub>	V+ = 3 V, R <sub>L</sub> = 300 Ω V <sub>NO</sub> = V <sub>NC</sub> = 1.5 V C <sub>L</sub> = 35 pF, V <sub>IN</sub> = 0 V, 3 V	Room Full	1			ns
Turn-OnTime <sup>d</sup>	t <sub>ON</sub>		Room Full		60	80 100	
Turn-OffTime <sup>d</sup>	t <sub>OFF</sub>		Room Full		14	25 35	
Charge Injection <sup>d</sup>	Q	C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>g</sub> = 0 V	Room		0.16		pC
Off-Isolation <sup>d</sup>	OIRR	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 1 MHz	Room		77		dB
		C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 10 MHz	Room		55		
Crosstalk <sup>d</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz, V+ = 2.5 V	Room		98		
Source Off Capacitance <sup>d</sup>	C <sub>NC/NO(off)</sub>	f = 1 MHz, V <sub>NC/NO</sub> = 0 V	Room		7.5		pF
Drain Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>	f = 1 MHz, V <sub>COM</sub> = 0 V	Room		7.8		
Drain On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>		Room		22		
Supply Current	I <sub>+</sub>	V+ = 3.3 V, V <sub>IN</sub> = 0 or V+	Room	-1		-1	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, not subjected to production test.

e. V<sub>IN</sub> = input voltage to perform proper function.

f. Guaranteed by 12-V leakage testing, not production tested.

g. Applies for DG9434 only.

SPECIFICATIONS (V+ = 5 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V+ = 5 V, ± 10%, VIN = 0.4 or 1.8 V <sup>e</sup>	Temp <sup>a</sup>	Limits -40 to 85°C			Unit
				Min <sup>c</sup>	Typ <sup>b</sup>	Max <sup>c</sup>	
Switch On Resistance							
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	V <sub>-</sub>		V <sub>+</sub>	V
Drain-Source On-Resistance	r <sub>(on)</sub>	V <sub>+</sub> = 4.5 V, I <sub>COM</sub> = 1 mA, V <sub>COM</sub> = 2.5 or 3.5 V	Room Full		39	60 70	Ω
r <sub>DS(on)</sub> Match	Δr <sub>(on)</sub>	V <sub>+</sub> = 4.5 V, I <sub>COM</sub> = 1 mA, V <sub>COM</sub> = 3.5 V	Room		0.3	3.0	
Switch Off Leakage Current <sup>f</sup>	I <sub>NC/NO(off)</sub>	V <sub>+</sub> = 5 V, V <sub>COM</sub> = 0.5 V, 4.5 V V <sub>NC/NO</sub> = 4.5 V, 0.5 V	Room Full	-1 -10	0.3	1 10	nA
	I <sub>COM(off)</sub>		Room Full	-1 -10	0.3	1 10	
Channel On Leakage Current <sup>f</sup>	I <sub>COM(on)</sub>		Room Full	-1 10	0.3	1 10	
Digital Control							
Input, High Voltage	V <sub>INH</sub>	V+ Ranges 2.7 to 5 V	Full	1.8			V
Input, Low Voltage	V <sub>INL</sub>		Full			0.4	
Input Current	I <sub>INH</sub>			-1		1	μA
Dynamic Characteristics							
Break-Before-Make <sup>d,g</sup>	t <sub>OPEN</sub>	V <sub>+</sub> = 5 V, R <sub>L</sub> = 300 Ω V <sub>NO</sub> = V <sub>NC</sub> = 3 V C <sub>L</sub> = 35 pF, V <sub>IN</sub> = 0 V, 5 V	Room Full	1			ns
Turn-On Time	t <sub>ON</sub>		Room Full		33	60 70	
Turn-Off Time	t <sub>OFF</sub>		Room Full		10	20 30	
Charge Injection <sup>d</sup>	Q	C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>g</sub> = 0 V	Room		0.56		pC
Off-Isolation <sup>d</sup>	OIRR	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 1 MHz	Room		76		dB
		C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 10 MHz, V <sub>+</sub> = 5 V	Room		54		
Crosstalk <sup>d</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz, V <sub>+</sub> = 5 V	Room		96		
Source Off Capacitance <sup>d</sup>	C <sub>NC/NO(off)</sub>	f = 1 MHz, V <sub>NO/NC</sub> = 0 V	Room		7.5		pF
Drain Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>	f = 1 MHz, V <sub>COM</sub> = 0 V	Room		7.8		
Drain On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>		Room		22		
Supply Current	I <sub>+</sub>	V <sub>+</sub> = 5.5 V, V <sub>IN</sub> = 0 or V <sub>+</sub>	Room	-1		-1	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, not subjected to production test.
- V<sub>IN</sub> = input voltage to perform proper function.
- Guaranteed by 12-V leakage testing, not production tested.
- Applies to DG9434 only.

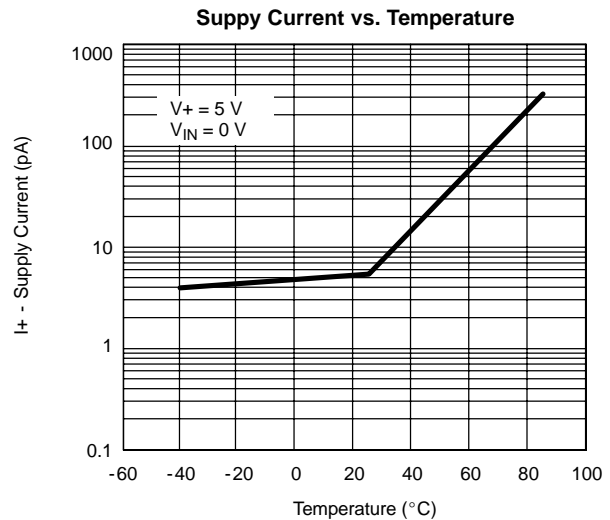
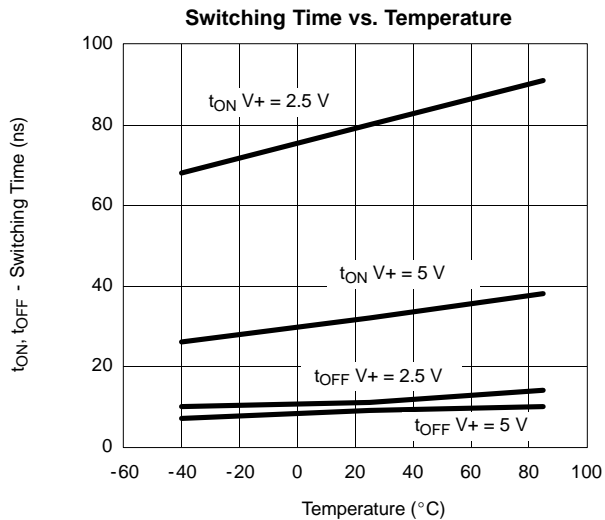
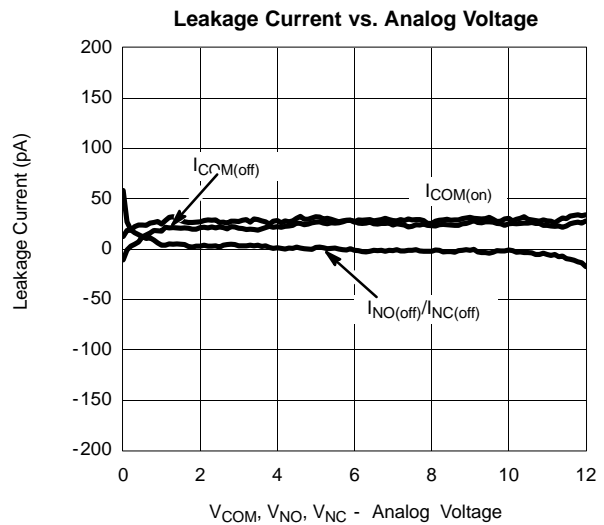
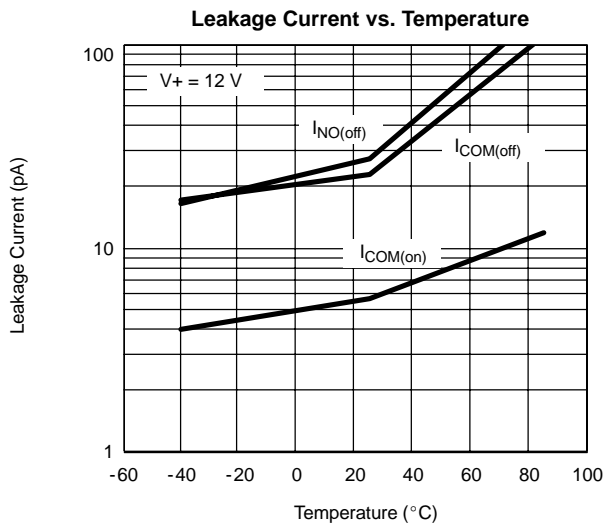
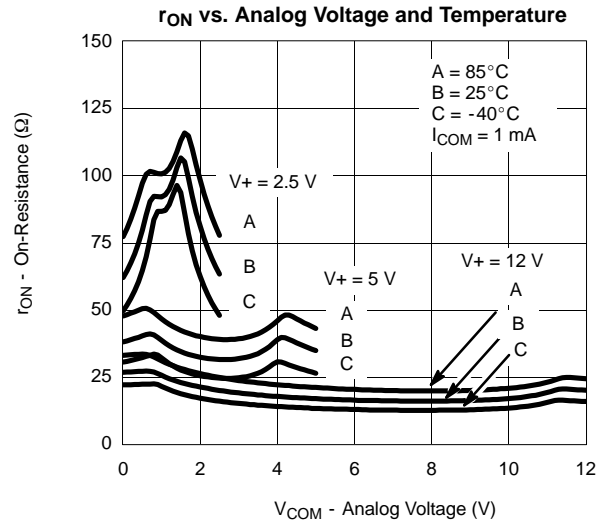
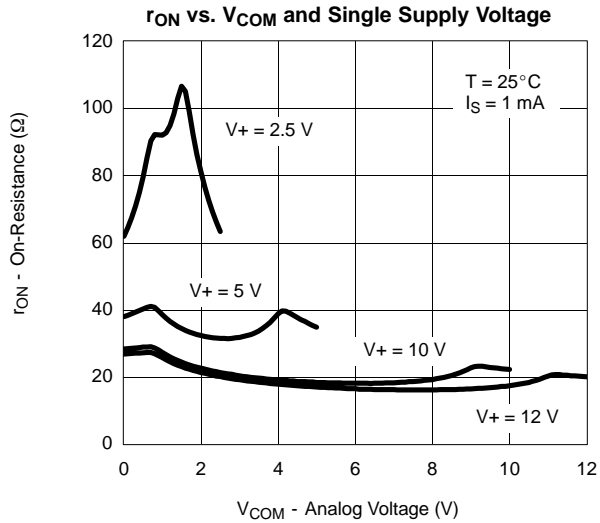


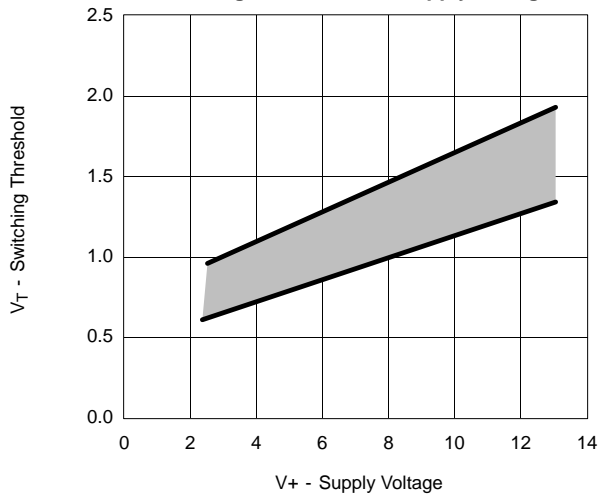
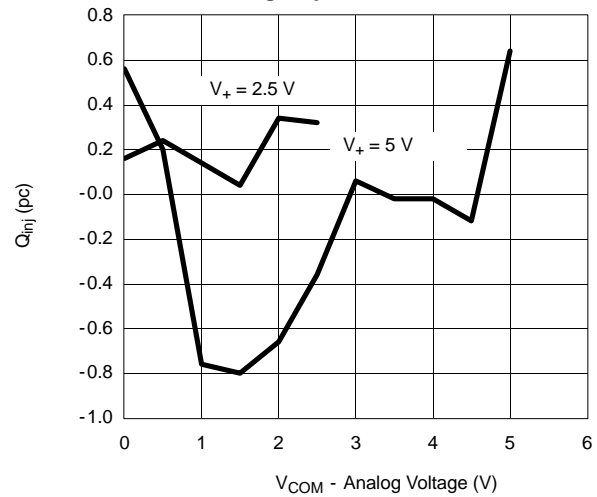
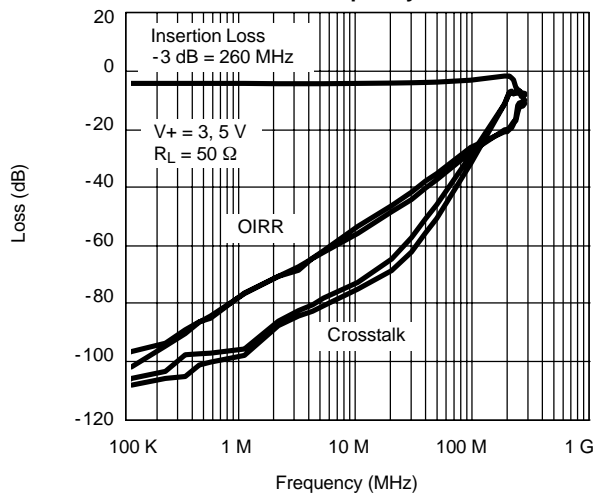
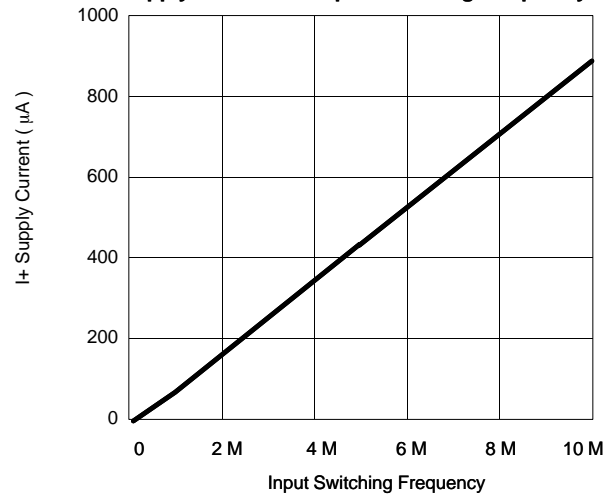
SPECIFICATIONS (V+ = 12 V)							
Parameter	Symbol	Test Conditions Otherwise Unless Specified V <sub>+</sub> = 12 V, ± 10%, V <sub>IN</sub> = 0.8 or 2.4 V <sup>e</sup>	Temp <sup>a</sup>	Limits -40 to 85°C			Unit
				Min <sup>c</sup>	Typ <sup>b</sup>	Max <sup>c</sup>	
Switch On Resistance							
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full	V <sub>-</sub>		V <sub>+</sub>	V
Drain-Source On-Resistance	r <sub>(on)</sub>	V <sub>+</sub> = 10.8 V, I <sub>COM</sub> = 1 mA, V <sub>COM</sub> = 9 V	Room Full		19	30 40	Ω
r <sub>DS(on)</sub> Match	Δr <sub>(on)</sub>	V <sub>+</sub> = 10.8 V, I <sub>COM</sub> = 1 mA, V <sub>COM</sub> = 9 V	Room		0.3	3.0	
Switch Off Leakage Current <sup>a</sup>	I <sub>NC/NO(off)</sub>	V <sub>+</sub> = 12 V, V <sub>S</sub> = 1/11 V, V <sub>COM</sub> = 11/1 V	Room Full	-1 -10	0.3	1 10	nA
	I <sub>COM(off)</sub>		Room Full	-1 -10	0.3	1 10	
Channel On Leakage Current <sup>a</sup>	I <sub>COM(on)</sub>		Room Full	-1 10	0.3	1 10	
Digital Control							
Input, High Voltage	V <sub>INH</sub>	V+ = 12 V	Full			2.4	V
Input, Low Voltage	V <sub>INL</sub>		Full	0.8			
Input Current	I <sub>INH</sub>			-1		1	μA
Dynamic Characteristics							
Break-Before-Make <sup>d,g</sup>	t <sub>OPEN</sub>	V <sub>+</sub> = 12 V, R <sub>L</sub> = 300 Ω V <sub>NO</sub> = V <sub>NC</sub> = 8 V C <sub>L</sub> = 35 pF, V <sub>IN</sub> = 0 V, 12 V	Room Full	1			ns
Turn-OnTime	t <sub>ON</sub>		Room Full		21	35 40	
Turn-OffTime	t <sub>OFF</sub>		Room Full		6	18 25	
Charge Injection <sup>d</sup>	Q	C <sub>L</sub> = 1 nF, R <sub>GEN</sub> = 0 Ω, V <sub>g</sub> = 0 V, V <sub>+</sub> = 5 V	Room		0.36		pC
Off-Isolation <sup>d</sup>	OIRR	C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 1 MHz	Room		75		dB
		C <sub>L</sub> = 5 pF, R <sub>L</sub> = 50 Ω, f = 10 MHz	Room		53		
Crosstalk <sup>d</sup>	X <sub>TALK</sub>	R <sub>L</sub> = 50 Ω, f = 1 MHz, V <sub>+</sub> = 5 V	Room		96		
Source Off Capacitance <sup>d</sup>	C <sub>NC/NO(off)</sub>	f = 1 MHz, V <sub>NC/NO</sub> = 0 V	Room		7.5		pF
Drain Off Capacitance <sup>d</sup>	C <sub>COM(off)</sub>	f = 1 MHz, V <sub>COM</sub> = 0 V	Room		7.8		
Drain On Capacitance <sup>d</sup>	C <sub>COM(on)</sub>		Room		22		
Supply Current	I <sub>+</sub>	V <sub>+</sub> = 12 V, V <sub>IN</sub> = 0 or V+	Room	-1		-1	μA

## Notes:

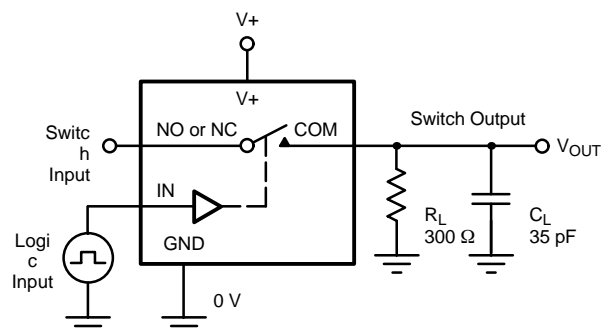
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- Applies for DG9434 only.

**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**



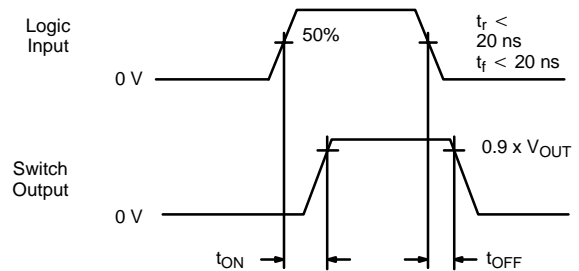
**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)****Switching Threshold vs. Supply Voltage****Charge Injection at Source****Insertion Loss, Off Isolation and Crosstalk vs. Frequency****Supply Current vs. Input Switching Frequency**

TEST CIRCUITS



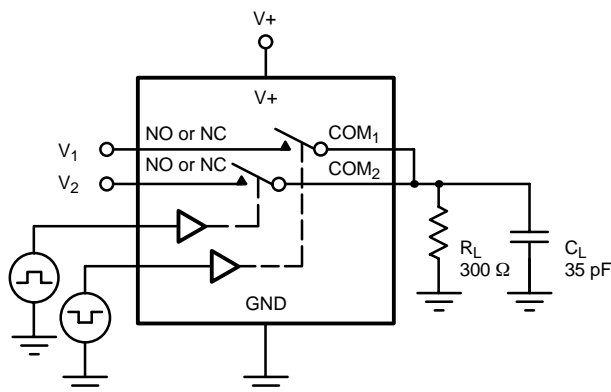
$C_L$  (includes fixture and stray capacitance)

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



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)

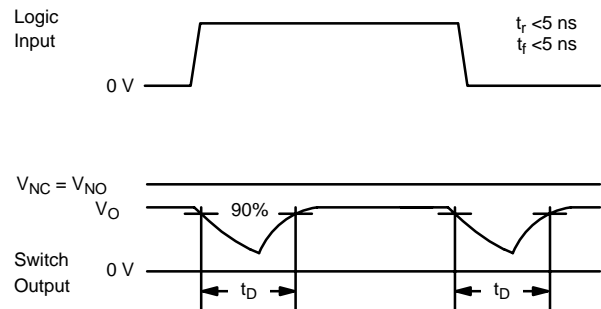
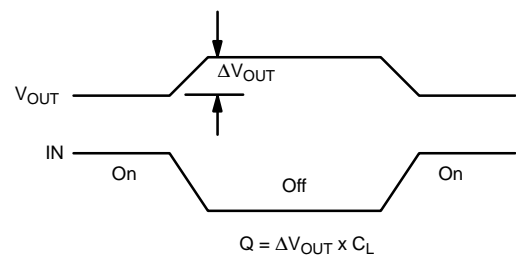
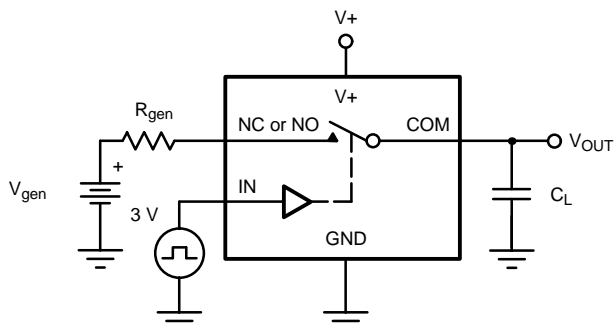


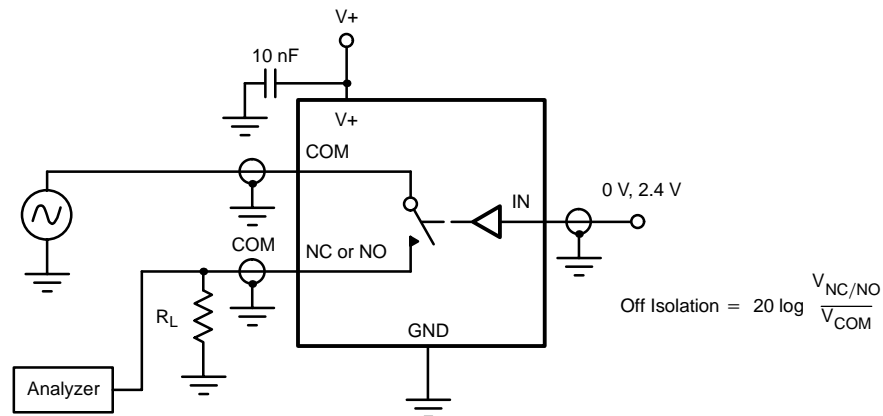
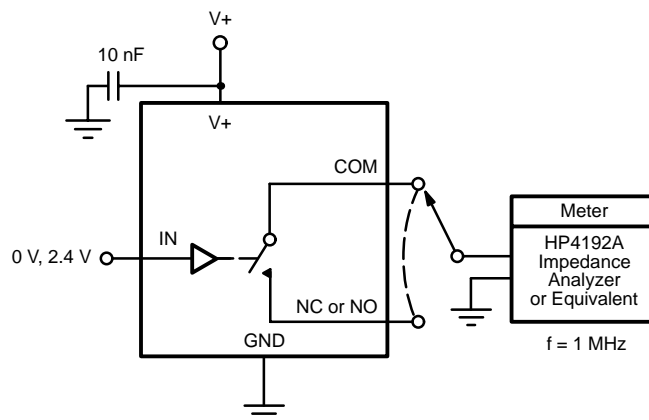
FIGURE 2. Break-Before-Make Interval



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



### Notice

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