



# Quad Monolithic SPST CMOS Analog Switches

## DESCRIPTION

Featuring low on-resistance (60 Ω) and fast switching (130 ns), the DG308A is supplied in the “normally open” configuration while DG309 is supplied “normally closed”. Input thresholds are high voltage CMOS compatible.

Designed with the Vishay Siliconix PLUS-40 CMOS process to combine low power dissipation with a high breakdown voltage rating of 44 V, each switch conducts equally well in both directions when on, and blocks up to the supply voltage when off. An epitaxial layer prevents latch up.

The DG308B, DG309B upgrades are recommended for new designs.

## BENEFITS

- Full rail-to-rail analog signal range
- Low signal error
- Wide dynamic range
- Single or dual supply capability
- Static protected logic inputs
- Space savings (TSSOP)

## FEATURES

- ± 15 V analog input range
- Low on-resistance -  $R_{DS(on)}$ : 60 Ω
- Fast switching -  $t_{on}$ : 130 ns
- Low power dissipation: 30 nW
- CMOS logic compatible
- Material categorization: for definitions of compliance please see [www.vishay.com/doc?99912](http://www.vishay.com/doc?99912)



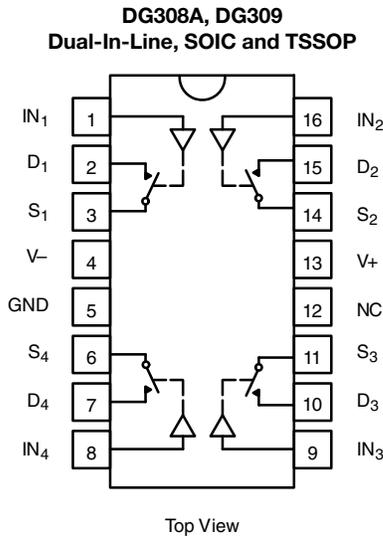
### Note

\* 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

## APPLICATIONS

- Portable and battery powered instrumentation
- Communication systems
- Computer peripherals
- High-speed multiplexing

## FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



For SPST switches per package

TRUTH TABLE		
LOGIC	DG308A	DG309
0	Off	On
1	On	Off

### Note

- Logic “0” ≤ 3.5 V
- Logic “1” ≥ 11 V

ORDERING INFORMATION		
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +85 °C	16-pin narrow SOIC	DG308ADY-E3
		DG308ADY-T1-E3
	16-pin TSSOP	DG309DY-E3
		DG309DY-T1-E3
	16-pin plastic DIP	DG308ADQ-E3
		DG308ADQ-T1-E3
		DG309DQ-E3
		DG309DQ-T1-E3
		DG308ACJ-E3
		DG309CJ-E3

ABSOLUTE MAXIMUM RATINGS (T <sub>A</sub> = 25 °C, unless otherwise noted)			
PARAMETER		LIMIT	UNIT
Voltages referenced, V <sub>+</sub> to V <sub>-</sub>		44	V
GND		25	
Digital inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>		(V <sub>-</sub> ) - 2 to (V <sub>+</sub> ) + 2 or 20 mA, whichever occurs first	
Current (any terminal), except S or D		30	mA
Peak current, S or D (pulsed at 1 ms, 10 % duty cycle max.)		100	
Continuous current	S or D	20	
	(Pulsed at 1 ms, 10 % duty cycle max.)	70	
Storage temperature	(AK suffix)	-65 to +150	°C
	(CJ, DY, and DQ suffix)	-65 to +125	
Power dissipation (package) <sup>b</sup>	16 pin plastic DIP <sup>c</sup>	470	mW
	16 pin narrow SOIC and TSSOP <sup>d</sup>	600	

**Notes**

- Signals on SX, DX, or INX exceeding V<sub>+</sub> or V<sub>-</sub> will be clamped by internal diodes. Limit forward diode current to maximum current ratings
- All leads welded or soldered to PC board
- Derate 12 mW/°C above 75 °C
- Derate 7.6 mW/°C above 25 °C

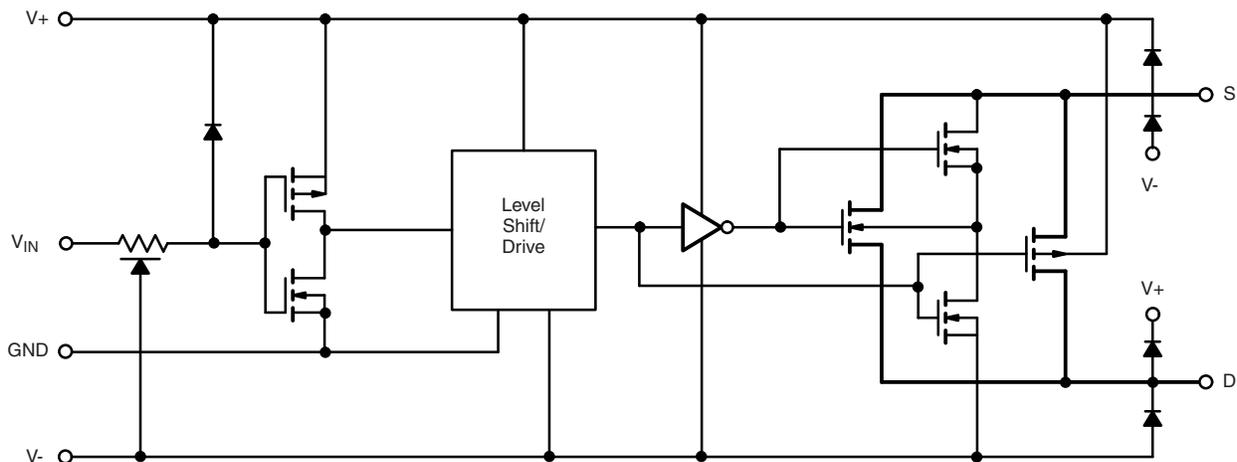
**SCHEMATIC DIAGRAM** (typical channel)


Fig. 1



SPECIFICATIONS									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS SPECIFIED $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ $V_{IN} = 3.5\text{ V}$ or $11\text{ V}$ <sup>f</sup>	TEMP. <sup>b</sup>	TYP. <sup>c</sup>	A SUFFIX -40 °C to +85 °C		C, D SUFFIX -40 °C to +85 °C		UNIT
					MIN. <sup>d</sup>	MAX. <sup>d</sup>	MIN. <sup>d</sup>	MAX. <sup>d</sup>	
<b>Analog Switch</b>									
Analog signal range <sup>e</sup>	$V_{ANALOG}$		Full	-	-15	15	-15	15	V
Drain-source on-resistance	$R_{DS(on)}$	$V_D = \pm 10\text{ V}$ , $I_S = 1\text{ mA}$	Room	60	-	100	-	100	$\Omega$
			Full	-	-	150	-	125	
Source off leakage current	$I_{S(off)}$	$V_S = \pm 14\text{ V}$ , $V_D = \pm 14\text{ V}$	Room	$\pm 0.1$	-1	1	-5	5	nA
			Full	$\pm 0.1$	100	100	-100	100	
Drain off leakage current	$I_{D(off)}$	$V_D = \pm 14\text{ V}$ , $V_S = \pm 14\text{ V}$	Room	$\pm 0.1$	-1	1	-5	5	
			Full	$\pm 0.1$	100	100	-100	100	
Drain on leakage current	$I_{D(on)}$	$V_S = V_D = \pm 14\text{ V}$	Room	$\pm 0.1$	-1	1	-5	5	
			Full	$\pm 0.1$	100	100	-200	200	
<b>Digital Control</b>									
Input voltage high	$V_{INH}$		Full	0.001	-	1	-	1	V
Input voltage low	$V_{INL}$		Full	-0.001	-1	-	-1	-	
Input capacitance	$C_{IN}$		Room	8	-	-	-	-	pF
<b>Dynamic Characteristics</b>									
Turn-on time	$t_{ON}$	See Fig. 9	Room	130	-	200	-	200	ns
Turn-off time	$t_{OFF}$		Room	90	-	150	-	150	
Charge injection	Q	$C_L = 0.01\ \mu\text{F}$ , $V_{gen} = 0\text{ V}$ , $R_{gen} = 0\ \Omega$	Room	-10	-	-	-	-	pC
Source-off capacitance	$C_{S(off)}$	$V_S, V_D = 0\text{ V}$ , $f = 140\text{ kHz}$	Room	11	-	-	-	-	pF
Drain-off capacitance	$C_{D(off)}$		Room	8	-	-	-	-	
Channel-on capacitance	$C_{D(on)}$		Room	27	-	-	-	-	
Off isolation	$O_{IRR}$	$R_L = 75\ \Omega$ , $V_S = 2\text{ V}_{p-p}$ , $f = 500\text{ kHz}$	Room	78	-	-	-	-	dB
<b>Power Supply</b>									
Positive supply current	I+	All channels on or off $V_{IN} = 0\text{ V}$ or $15\text{ V}$	Room	0.001	-	10	-	10	$\mu\text{A}$
			Full	-	-	100	-	100	
Negative supply current	I-		Room	-0.001	-10	-	-100	-	
			Full	-	-100	-	-	-	

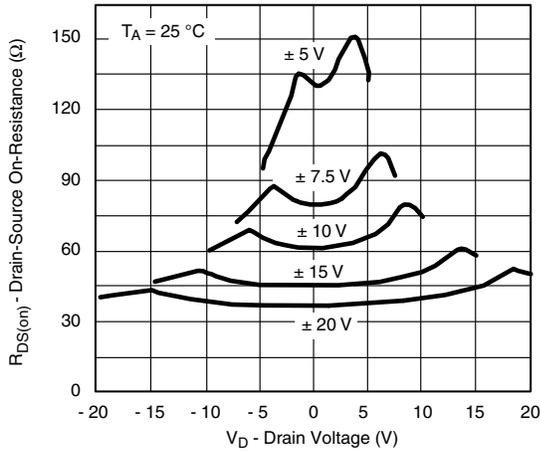
**Notes**

- 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

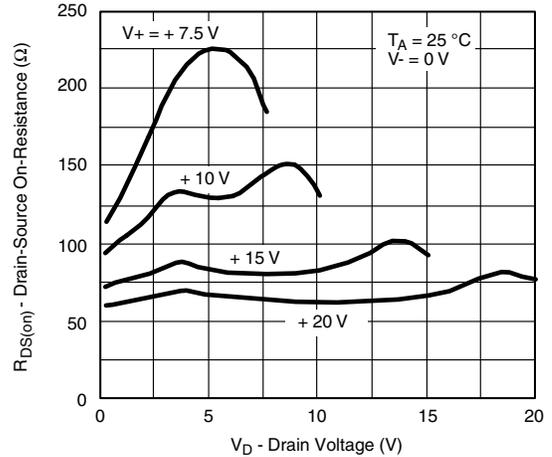
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



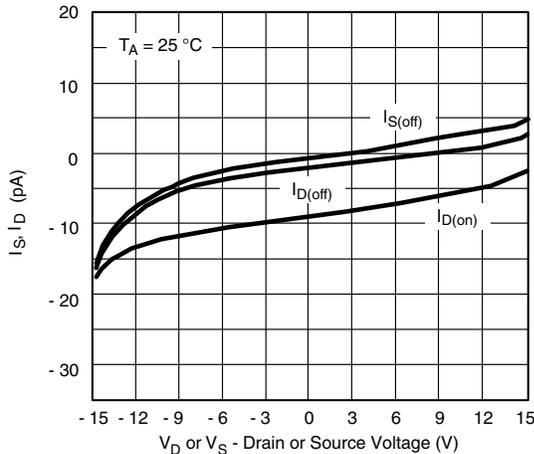
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



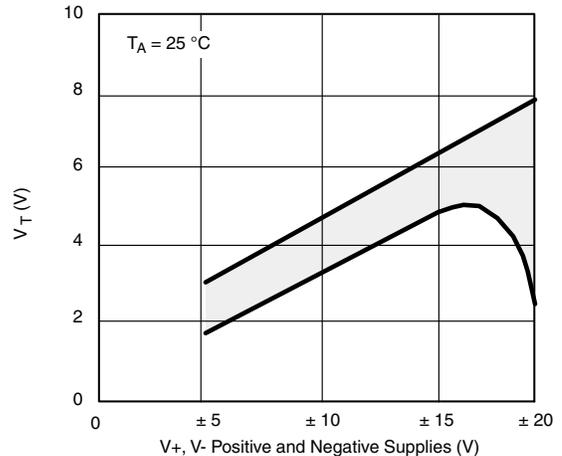
$R_{DS(on)}$  vs.  $V_D$  and Power Supply



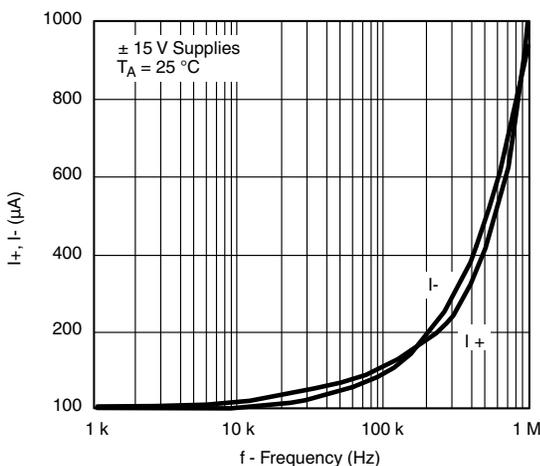
$R_{DS(on)}$  vs.  $V_D$  and Power Supply Voltage



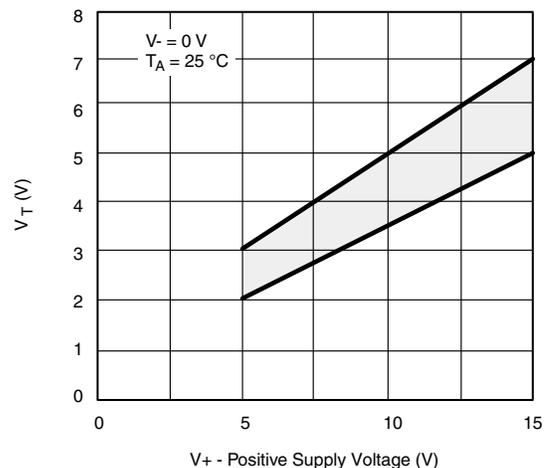
Leakage Currents vs. Analog Voltage



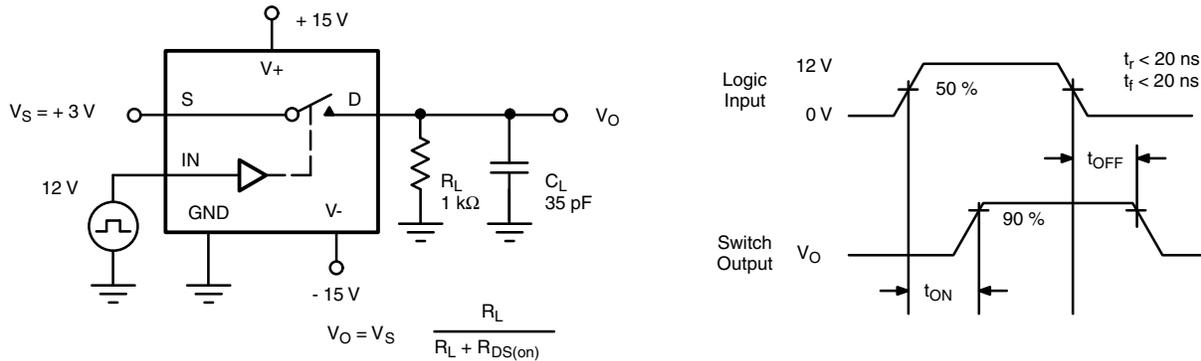
Input Switching Threshold vs.  $V_+$  and  $V_-$  Supply Voltages



Supply Currents vs. Switching Frequency (All Inputs Active)



Input Switching Threshold vs. Positive Supply Voltage

**TEST CIRCUITS**

**Fig. 2 - Switching Time**
**APPLICATIONS**
**Single Supply Operation**

The DG308A and DG309 will switch positive analog signals while using a single positive supply. This will allow use in many applications where only one supply is available. The trade-offs or performance given up while using single supplies are:

1) increased  $R_{DS(on)}$  and 2) slower switching speed. As stated in the absolute maximum ratings section of the datasheet, the analog voltage should not go above or below the supply voltages which in single supply operation are  $V_+$  and 0 V.



<b>PRODUCT SUMMARY</b>						
Part number	DG308A	DG308A	DG308A	DG309	DG309	DG309
Status code	2	2	2	2	2	2
Configuration	SPST x 4, NO	SPST x 4, NO	SPST x 4, NO	SPST x 4, NC	SPST x 4, NC	SPST x 4, NC
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)	22	22	22	22	22	22
On-resistance ( $\Omega$ )	60	60	60	60	60	60
Charge injection (pC)	-10	-10	-10	-10	-10	-10
Source on capacitance (pF)	-	-	-	-	-	-
Source off capacitance (pF)	11	11	11	11	11	11
Leakage switch on typ. (nA)	0.1	0.1	0.1	0.1	0.1	0.1
Leakage switch off max. (nA)	5	5	5	5	5	5
-3 dB bandwidth (MHz)	-	-	-	-	-	-
Package	TSSOP-16	SO-16 (narrow) AS	Plastic DIP-16	TSSOP-16	SO-16 (narrow) AS	Plastic DIP-16
Functional circuit / applications	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)	200	200	200	200	200	200
Crosstalk and off isolation	-78	-78	-78	-78	-78	-78

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