

## Quad Monolithic SPST CMOS Analog Switches

December 1993

### Features

- Low Power Consumption
- CMOS Compatible
- $\pm 15V$  Analog Signal Range
- Single or Dual Supply Capability
- Alternate Source

### Ordering Information

PART NUMBER	TEMP. RANGE	PACKAGE
DG308AAK	-55°C to +125°C	16 Lead Ceramic DIP
DG308ABK	-25°C to +85°C	16 Lead Ceramic DIP
DG308ACK	0°C to +70°C	16 Lead Ceramic DIP
DG308ACJ	0°C to +70°C	16 Lead Plastic DIP
DG308ACY	0°C to +70°C	16 Lead SOIC (W)
DG308AAK/883B	-55°C to +125°C	16 Lead Ceramic DIP
DG309AK	-55°C to +125°C	16 Lead Ceramic DIP
DG309BK	-25°C to +85°C	16 Lead Ceramic DIP
DG309CK	0°C to +70°C	16 Lead Ceramic DIP
DG309CJ	0°C to +70°C	16 Lead Plastic DIP
DG309CY	0°C to +70°C	16 Lead SOIC (W)
DG309AK/883B	-55°C to +125°C	16 Lead Ceramic DIP

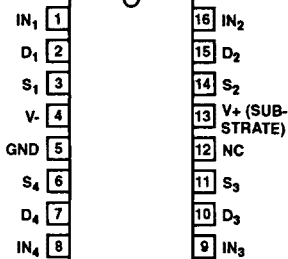
### Description

The DG308A and DG309 quad monolithic SPST CMOS switches are latch proof and are designed to block signals up to 30V peak-to-peak when OFF. Featuring low ON resistance, low power consumption, and rail-to-rail analog signal range, these switches are ideally suited for high speed switching applications in communications, instrumentation and process control. The DG308A "normally-closed" and DG309 "normally-open" switches have single and dual supply capability. The input thresholds are CMOS compatible.

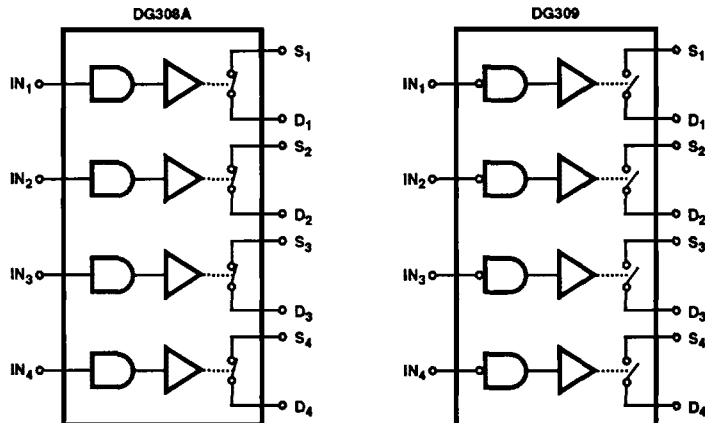
The DG308A and DG309 switches are available over commercial, industrial, and military temperature ranges.

### Pinout

DG308A, DG309  
(CDIP, PDIP, SOIC)  
TOP VIEW



### Functional Diagrams



#### NOTES:

1. Four SPST switches per package.
2. Switches shown for logic "1" input

#### TRUTH TABLE

LOGIC	DG308A	DG309
0	OFF	ON
1	ON	OFF

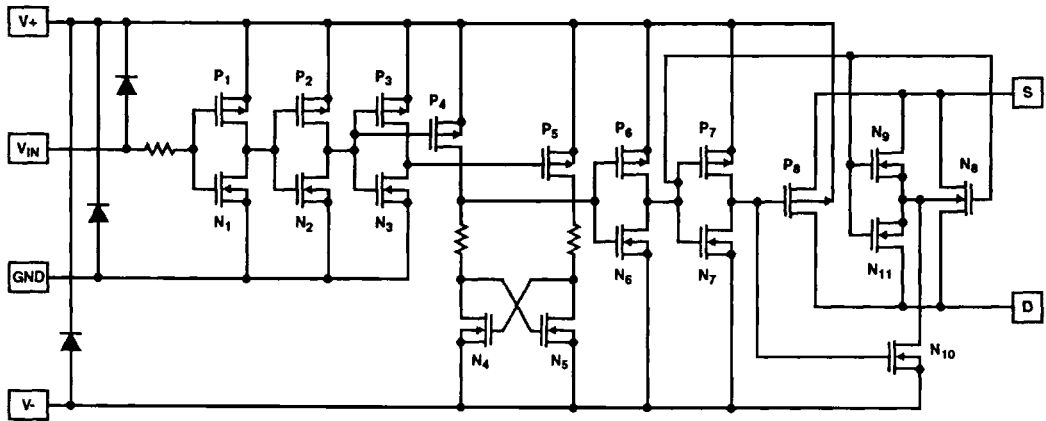
Logic "0"  $\leq 3.5V$ , Logic "1"  $\geq 11V$

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SWITCHES

Typical Schematic Diagram (One Channel)

DG308A



# Specifications DG308A, DG309

## Absolute Maximum Ratings

V+ to V-	44V
V- to Ground	-25V
V <sub>IN</sub> to Ground (Note 1)	(V- -2V), (V+ +2V)
V <sub>S</sub> or V <sub>D</sub> to V+ (Note 1)	+2, (V- -2V)
V <sub>S</sub> or V <sub>D</sub> to V- (Note 1)	-2, (V+ +2V)
Current, any Terminal Except S or D	.30mA
Continuous Current, S or D	.20mA
Peak Current, S or D (Pulsed at 1ms, 10% Duty Cycle Max)	.70mA
Lead Temperature (Soldering 10s)	+300°C
Storage Temperature Range	
C Suffix	-65°C to +125°C
A & B Suffix	-65°C to +150°C

## Thermal Information

Thermal Resistance	$\theta_{JA}$	$\theta_{JC}$
Ceramic DIP Package	80°C/W	24°C/W
Plastic DIP Package	100°C/W	-
SOIC DIP Package	100°C/W	-
Junction Temperature		
Plastic DIP Package		+150°C
Ceramic DIP Package		+175°C
Operating Temperature Range		
*A* Suffix		-55°C to +125°C
*B* Suffix		-25°C to +85°C
*C* Suffix		0°C to +70°C

CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.

## Electrical Specifications V+ = 15V, V- = -15V, GND = 0V, T<sub>A</sub> = +25°C

PARAMETERS	TEST CONDITIONS	DG308AA/DG309A			DG308AB/C, DG309B/C			UNITS	
		MIN	(NOTE 2) TYP	MAX	MIN	(NOTE 2) TYP	MAX		
<b>DYNAMIC CHARACTERISTICS</b>									
Turn-On Time, t <sub>ON</sub>	See Figure 1	-	130	200	-	130	200	ns	
Turn-Off Time, t <sub>OFF</sub>	See Figure 1	-	90	150	-	90	150	ns	
Charge Injection, Q	C <sub>L</sub> = 1μF, R <sub>S</sub> = 0, V <sub>S</sub> = 0V	-	-10	-	-	-10	-	pC	
Source OFF Capacitance, C <sub>S(OFF)</sub>	f = 140kHz V <sub>S</sub> = 0V V <sub>IN</sub> = 0V (DG308A) V <sub>IN</sub> = 15V (DG309)	-	11	-	-	11	-	pF	
Drain OFF Capacitance, C <sub>D(OFF)</sub>	V <sub>D</sub> = 0V V <sub>IN</sub> = 0V (DG308A) V <sub>IN</sub> = 15V (DG309)	-	8	-	-	8	-	pF	
Channel ON Capacitance, C <sub>D(ON)</sub> + C <sub>S(ON)</sub>	V <sub>S</sub> = V <sub>D</sub> = 0V V <sub>IN</sub> = 15V (DG308A) V <sub>IN</sub> = 0V (DG309)	-	27	-	-	27	-	pF	
OFF Isolation, OIRR	V <sub>IN</sub> = 0V (DG308A) V <sub>IN</sub> = 15V (DG309), R <sub>L</sub> = 75Ω, V <sub>S</sub> = 2V <sub>P-P</sub> , f = 500kHz (Note 4)	-	78	-	-	78	-	dB	
<b>INPUT</b>									
Input Current with Voltage High, I <sub>INH</sub>	V <sub>IN</sub> = 15V	-	0.001	1	-	0.001	1	μA	
Input Current with Voltage Low, I <sub>INL</sub>	V <sub>IN</sub> = 0V	-1.0	-0.001	-	-1.0	-0.001	-	μA	
<b>SWITCH</b>									
Analog Signal Range, V <sub>ANALOG</sub>		-15	-	15	-15	-	15	V	
Drain Source ON Resistance, R <sub>DS(ON)</sub>	V <sub>IN</sub> = 11V (DG308A) V <sub>IN</sub> = 3.5V (DG309)	I <sub>S</sub> = -1mA, V <sub>D</sub> = +10V	-	60	100	-	60	100	Ω
		I <sub>S</sub> = 1mA, V <sub>D</sub> = -10V	-	60	100	-	60	100	Ω
Drain ON Leakage Current, I <sub>D(ON)</sub>	V <sub>D</sub> = V <sub>S</sub> = 14V V <sub>D</sub> = V <sub>S</sub> = -14V	-	0.1	1	-	0.1	5	nA	
		-2	-0.1	-	-5	-0.1	-	nA	
Source OFF Leakage Current, I <sub>S(OFF)</sub>	V <sub>IN</sub> = 3.5V (DG308A) V <sub>IN</sub> = 11V (DG309)	V <sub>S</sub> = 14V, V <sub>D</sub> = -14V	-	0.1	1	-	0.1	5	nA
		V <sub>S</sub> = -14V, V <sub>D</sub> = 14V	-1	-0.1	-	-5	-0.1	-	nA
Drain OFF Leakage Current, I <sub>D(OFF)</sub>	V <sub>S</sub> = -14V, V <sub>D</sub> = 14V V <sub>S</sub> = 14V, V <sub>D</sub> = -14V	-	0.1	1	-	0.1	5	nA	
		-1	-0.1	-	-5	-0.1	-	nA	
<b>POWER SUPPLY CHARACTERISTICS</b>									
Positive Supply Current, I <sub>+</sub>	All Channels ON or OFF	-	0.001	10	-	0.001	100	μA	
Negative Supply Current, I <sub>-</sub>	V <sub>IN</sub> = 0V or 15V	-10	-0.001	-	-100	-0.001	-	μA	

# Specifications DG308A, DG309

## Electrical Specifications

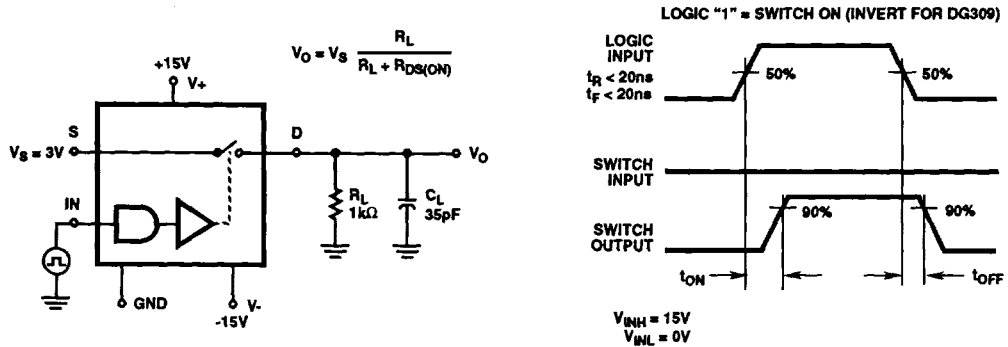
$V_+ = 15V$ ,  $V_- = -15V$ ,  $GND = 0V$ ,  $T_A =$  Over Operating Temperature Range

PARAMETERS	TEST CONDITIONS	DG308AA/DG309A			DG308AB/C, DG309B/C			UNITS	
		MIN	(NOTE 2) TYP	MAX	MIN	(NOTE 2) TYP	MAX		
<b>INPUT</b>									
Input Current with Voltage High, $I_{INH}$	$V_{IN} = 15V$	-	-	1	-	-	1	$\mu A$	
Input Current with Voltage Low, $I_{INL}$	$V_{IN} = 0V$	-1	-	-	-1	-	-	$\mu A$	
<b>SWITCH</b>									
Analog Signal Range, $V_{ANALOG}$		-15	-	15	-15	-	15	V	
Drain Source ON Resistance, $R_{DS(ON)}$	$V_{IN} = 11V$ (DG308A) $V_{IN} = 3.5V$ (DG309)	$I_S = -1mA, V_D = 10V$	-	-	150	-	-	125	$\Omega$
		$I_S = 1mA, V_D = -10V$	-	-	150	-	-	125	$\Omega$
Drain ON Leakage Current, $I_{D(ON)}$	$V_{IN} = 11V$ (DG308A) $V_{IN} = 3.5V$ (DG309)	$V_D = V_S = 14V$	-	-	100	-	-	200	nA
		$V_D = V_S = -14V$	-200	-	-	-200	-	-	nA
Source OFF Leakage Current, $I_{S(OFF)}$	$V_{IN} = 3.5V$ (DG308A) $V_{IN} = 11V$ (DG309)	$V_S = 14V, V_D = -14V$	-	-	100	-	-	100	nA
		$V_S = -14V, V_D = 14V$	-100	-	-	-100	-	-	nA
Drain OFF Leakage Current, $I_{D(OFF)}$	$V_{IN} = 3.5V$ (DG308A) $V_{IN} = 11V$ (DG309)	$V_S = -14V, V_D = 14V$	-	-	100	-	-	100	nA
		$V_S = 14V, V_D = -14V$	-100	-	-	-100	-	-	nA
<b>POWER SUPPLY CHARACTERISTICS</b>									
Positive Supply Current, $I_+$	$V_{IN} = 0V$ or $15V$	-	-	100	-	-	100	$\mu A$	
Negative Supply Current, $I_-$		-100	-	-	-100	-	-	$\mu A$	

**NOTES:**

1. Signals on  $V_S$ ,  $V_D$ , or  $V_{IN}$  exceeding  $V_+$  or  $V_-$  will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
2. Typical values are for design aid only, not guaranteed and not subject to production testing.
3. The algebraic convention whereby the most negative value is a minimum, and the most positive is a maximum, is used in this data sheet.
4. OFF isolation =  $20 \log V_D/V_S$ , where  $V_S$  = input to OFF switch, and  $V_D$  = output.

## Test Circuits



**FIGURE 1.  $t_{ON}$  AND  $t_{OFF}$  SWITCHING TEST**

# DG308A, DG309

## Die Characteristics

**DIE DIMENSIONS:**  
2058 $\mu$ m x 2109 $\mu$ m

**METALLIZATION:**  
Type: Al  
Thickness: 10k $\text{\AA}$   $\pm$  1k $\text{\AA}$

**GLASSIVATION:**  
Type: PSG Over Nitride  
PSG Thickness: 7k $\text{\AA}$   $\pm$  1.4k $\text{\AA}$   
Nitride Thickness: 8k $\text{\AA}$   $\pm$  1.2k $\text{\AA}$

**WORST CASE CURRENT DENSITY:**  
9.1 x 10<sup>4</sup> A/cm<sup>2</sup>

## Metallization Mask Layout

