

## Quad Monolithic SPST CMOS Analog Switches

### DESCRIPTION

Featuring low on-resistance ( $60\ \Omega$ ) 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.

### FEATURES

- $\pm 15\text{ V}$  analog input range
- Low on-resistance:  $60\ \Omega$
- Fast switching: 130 ns
- Low power dissipation: 30 nW
- CMOS logic compatible



**RoHS\***  
COMPLIANT

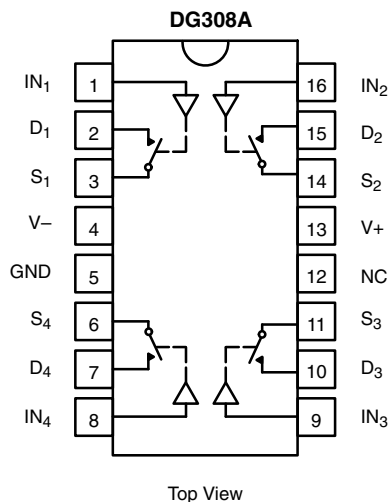
### BENEFITS

- 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)

### 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

Logic “0”  $\leq 3.5\text{ V}$

Logic “1”  $\geq 11\text{ V}$

\* Pb containing terminations are not RoHS compliant, exemptions may apply



ORDERING INFORMATION		
Temp. Range	Package	Part Number
0 °C to 70 °C	16-Pin Plastic DIP	DG308ACJ DG308ACJ-E3
		DG309CJ DG309CJ-E3
- 40 °C to 85 °C	16-Pin Narrow SOIC	DG308ADY DG308ADY-E3 DG308ADY-T1 DG308ADY-T1-E3
		DG309DY DG309DY-E3 DG309DY-T1 DG309DY-T1-E3
		DG308ADQ DG308ADQ-E3 DG308ADQ-T1 DG308ADQ-T1-E3
	16-Pin TSSOP	DG309DQ DG309DQ-E3 DG309DQ-T1 DG309DQ-T1-E3

ABSOLUTE MAXIMUM RATINGS			
Parameter	Limit	Unit	
Voltages Referenced V+ to V-	44	V	
GND	25		
Digital Inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>	(V-) - 2 to (V+) + 2 or 20 mA, whichever occurs first		
Current, Any Terminal Except S or D	30	mA	
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 <sup>b</sup>	16-Pin Plastic DIP <sup>c</sup>	470	mW
	16-Pin Narrow SOIC and TSSOP <sup>e</sup>	600	
	16-Pin CerDIP <sup>d</sup>	900	

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 12 mW/°C above 75 °C.
- d. Derate 6.5 mW/°C above 25 °C.
- e. Derate 7.6 mW/°C above 75 °C.

**SCHEMATIC DIAGRAM** (Typical Channel)


Figure 1.

SPECIFICATIONS <sup>a</sup>									
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 -55 °C to 125 °C		C, D Suffix		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 Full	60		100 150		100 125	$\Omega$
Source Off Leakage Current	$I_{S(off)}$	$V_S = \pm 14\text{ V}$ , $V_D = \pm 14\text{ V}$	Room Full	$\pm 0.1$	-1 100	1 100	-5 -100	5 100	nA
Drain Off Leakage Current	$I_{D(off)}$	$V_D = \pm 14\text{ V}$ , $V_S = \pm 14\text{ V}$	Room Full	$\pm 0.1$	-1 100	1 100	-5 -100	5 100	
Drain On Leakage Current	$I_{D(on)}$	$V_D = V_S = \pm 14\text{ V}$	Room Full	$\pm 0.1$	-1 100	1 100	-5 -200	5 200	
<b>Digital Control</b>									
Input Current with Input Voltage High	$I_{INH}$	$V_{IN} = 15\text{ V}$	Full	0.001		1		1	$\mu\text{A}$
Input Current with Input Voltage Low	$I_{INL}$	$V_{IN} = 0\text{ V}$	Full	-0.001	-1		-1		
Input Capacitance	$C_{IN}$		Room	8					pF
<b>Dynamic Characteristics</b>									
Turn-On Time	$t_{ON}$	see figure 2	Room	130		200		200	ns
Turn-Off Time	$t_{OFF}$		Room	90		150		150	
Charge Injection	Q	$C_L = 0.01\ \mu\text{F}$ , $R_{gen} = 0\ \Omega$ , $V_{gen} = 0\text{ V}$ ,	Room	-10					pC
Source-Off Capacitance	$C_{S(off)}$	$f = 140\text{ kHz}$ , $V_S$ , $V_D = 0\text{ V}$	Room	11					pF
Drain-Off Capacitance	$C_{D(off)}$		Room	8					
Channel-On Capacitance	$C_{D(on)}$		Room	27					
Off-Isolation <sup>f</sup>	OIRR	$R_L = 75\ \Omega$ , $V_S = 2\text{ V}_{p-p}$ , $f = 500\text{ kHz}$	Room	78					dB



## SPECIFICATIONS<sup>a</sup>

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 -55 °C to 125 °C		C, D Suffix		Unit
					Min. <sup>d</sup>	Max. <sup>d</sup>	Min. <sup>d</sup>	Max. <sup>d</sup>	
<b>Power Supplies</b>									
Positive Supply Current	I+	all channels on or off $V_{IN} = 0\text{ V}$ or $15\text{ V}$	Room Full	0.001		10	10	100	$\mu\text{A}$
Negative Supply Current	I-		Room Full	-0.001	-10 -100		-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 data sheet.

e. Guaranteed by design, not subject to production test.

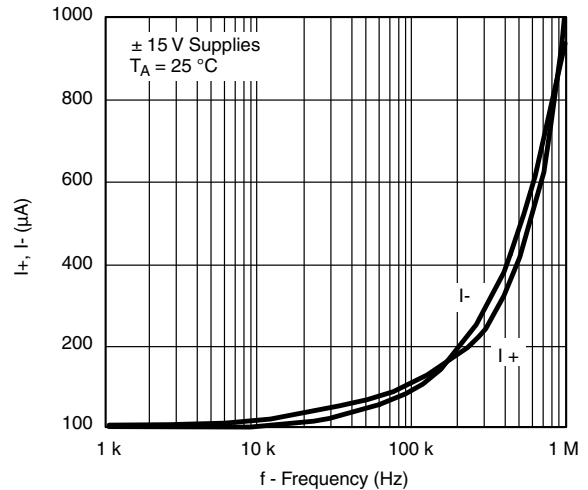
f.  $V_{IN}$  = input voltage to perform proper function.

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)



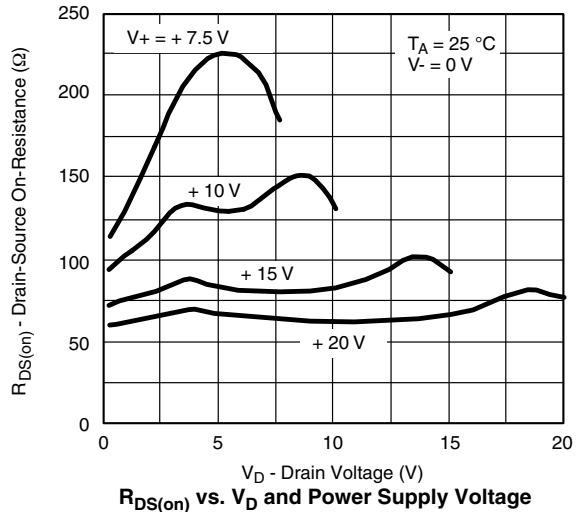
$R_{DS(on)}$  vs.  $V_D$  and Power Supply



Supply Currents vs. Switching Frequency (All Inputs Active)



Leakage Currents vs. Analog Voltage



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

**TYPICAL CHARACTERISTICS** (25 °C, unless otherwise noted)



**Figure 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 data sheet, the analog voltage should not go above or below the supply voltages which in single supply operation are V+ and 0 V.

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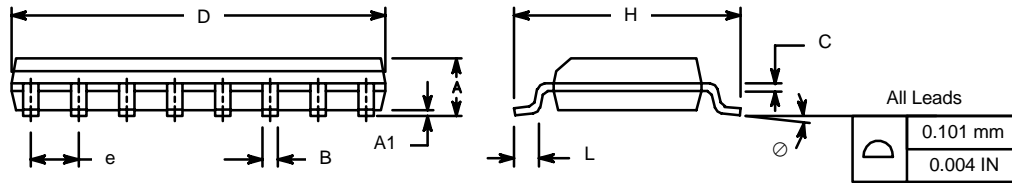


**SOIC (NARROW): 16-LEAD**  
JEDEC Part Number: MS-012

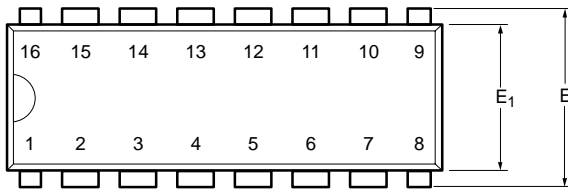


Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
A	1.35	1.75	0.053	0.069
A <sub>1</sub>	0.10	0.20	0.004	0.008
B	0.38	0.51	0.015	0.020
C	0.18	0.23	0.007	0.009
D	9.80	10.00	0.385	0.393
E	3.80	4.00	0.149	0.157
e	1.27 BSC		0.050 BSC	
H	5.80	6.20	0.228	0.244
L	0.50	0.93	0.020	0.037
∅	0°	8°	0°	8°

ECN: S-03946—Rev. F, 09-Jul-01  
DWG: 5300



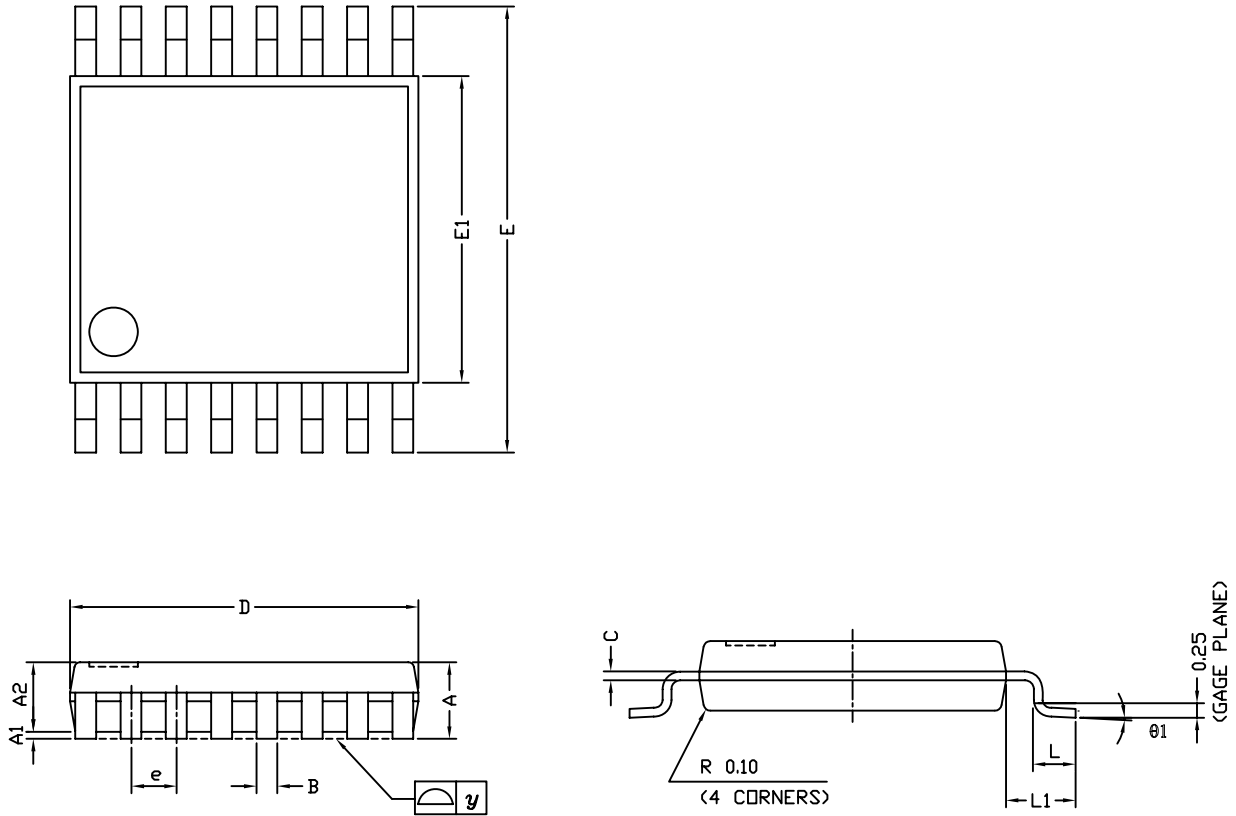
### PDIP: 16-LEAD



Dim	MILLIMETERS		INCHES	
	Min	Max	Min	Max
<b>A</b>	3.81	5.08	0.150	0.200
<b>A<sub>1</sub></b>	0.38	1.27	0.015	0.050
<b>B</b>	0.38	0.51	0.015	0.020
<b>B<sub>1</sub></b>	0.89	1.65	0.035	0.065
<b>C</b>	0.20	0.30	0.008	0.012
<b>D</b>	18.93	21.33	0.745	0.840
<b>E</b>	7.62	8.26	0.300	0.325
<b>E<sub>1</sub></b>	5.59	7.11	0.220	0.280
<b>e<sub>1</sub></b>	2.29	2.79	0.090	0.110
<b>e<sub>A</sub></b>	7.37	7.87	0.290	0.310
<b>L</b>	2.79	3.81	0.110	0.150
<b>Q<sub>1</sub></b>	1.27	2.03	0.050	0.080
<b>S</b>	0.38	1.52	.015	0.060

ECN: S-03946—Rev. D, 09-Jul-01  
DWG: 5482

## TSSOP: 16-LEAD



Symbols	DIMENSIONS IN MILLIMETERS		
	Min	Nom	Max
A	-	1.10	1.20
A1	0.05	0.10	0.15
A2	-	1.00	1.05
B	0.22	0.28	0.38
C	-	0.127	-
D	4.90	5.00	5.10
E	6.10	6.40	6.70
E1	4.30	4.40	4.50
e	-	0.65	-
L	0.50	0.60	0.70
L1	0.90	1.00	1.10
y	-	-	0.10
θ1	0°	3°	6°

ECN: S-61920-Rev. D, 23-Oct-06  
 DWG: 5624





## RECOMMENDED MINIMUM PAD FOR TSSOP-16



Recommended Minimum Pads  
Dimensions in inches (mm)

## RECOMMENDED MINIMUM PADS FOR SO-16



Recommended Minimum Pads  
Dimensions in Inches/(mm)

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