

MAXIM

QUAD SPST Analog Switches

General Description

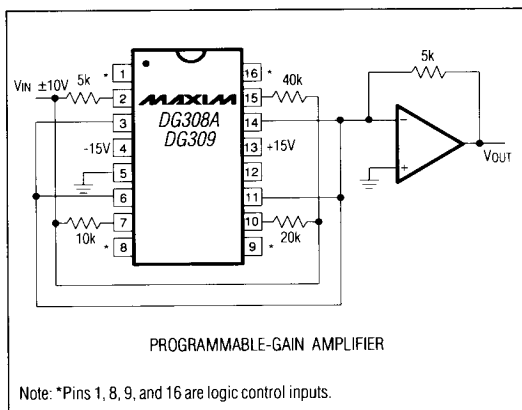
The DG308A/DG309 are quad single-pole-single-throw (SPST) analog switches. The DG308A is normally open (SPST, NO), while the DG309 is normally closed (SPST, NC). Both parts feature fast switching speeds and low on resistance over the analog range. Other features include a turn-on time less than 120ns, a turn-off time less than 90ns, and a channel on resistance of 60Ω. CMOS inputs provide reduced input loading and very low leakage currents.

Both parts feature a 44V maximum breakdown voltage rating that allows 30V peak-to-peak switch-off blocking capacity. The DG308A/DG309 can be used with split supplies (±5V to ±20V) or a single positive supply (+5V to +30V) while retaining CMOS logic compatible inputs.

Applications

Sample-and-Hold Circuits
Winchester Disk Drives
Test Equipment
Communications Systems
PBX, PABX
Guidance and Control Systems
Heads-Up Displays
Military Radios

Typical Operating Circuit



Features

- ◆ $r_{DS(ON)}$ 60Ω Typ
- ◆ Single- or Bipolar-Supply Operation
- ◆ CMOS Logic Compatible
- ◆ Monolithic, Low-Power CMOS Design

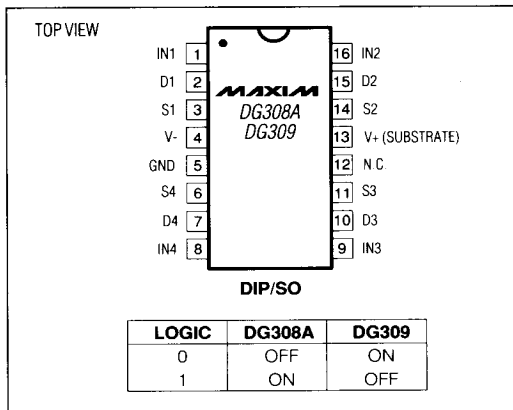
Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
DG308ACJ	0°C to +70°C	16 Plastic DIP
DG308ACY	0°C to +70°C	16 Narrow SO
DG308ACK	0°C to +70°C	16 CERDIP
DG308AC/D	0°C to +70°C	Dice*
DG308ADJ	-40°C to +85°C	16 Plastic DIP
DG308ADY	-40°C to +85°C	16 Narrow SO
DG308ADK	-40°C to +85°C	16 CERDIP
DG308AAK	-55°C to +125°C	16 CERDIP**
DG309CJ	0°C to +70°C	16 Plastic DIP
DG309CY	0°C to +70°C	16 Narrow SO
DG309CK	0°C to +70°C	16 CERDIP
DG309C/D	0°C to +70°C	Dice*
DG309DJ	-40°C to +85°C	16 Plastic DIP
DG309DY	-40°C to +85°C	16 Narrow SO
DG309DK	-40°C to +85°C	16 CERDIP
DG309AK	-55°C to +125°C	16 CERDIP**

* Contact factory for dice specifications.

** Contact factory for availability and processing to MIL-STD-883.

Pin Configuration



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DG308A/DG309

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ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-	
V+	+44V
GND	+25V
Digital Inputs Vs, Vd	V- -2V to V+ +2V or 20mA, whichever comes first.
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

Power Dissipation (TA = +70°C) (Note 1)

16-Pin CERDIP (derate 10mW/°C above +70°C)	900mW
16-Pin Plastic DIP (derate 7.5mW/°C above +70°C)	470mW
16-Pin Narrow SO (derate 10mW/°C above +70°C)	400mW
Operating Temperature Ranges:	
DG308AC _ /DG309C _	0°C to +70°C
DG308AD _ /DG309D _	-40°C to +85°C
DG308AAK/DG309AK	-55°C to +125°C
Storage Temperature	-65°C to +150°C

Note 1: All leads are soldered or welded to PC board.

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.

ELECTRICAL CHARACTERISTICS

(V+ = 15V, V- = -15V, TA = TMIN to TMAX, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	DG30 _ AK			DG30 _ C/D			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
SWITCH									
Analog Signal Range	V _{ANALOG}		T _A = +25°C		-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 or -10V	T _A = +25°C, T _{MIN}		60		100		Ω
			T _A = T _{MAX}		95		150		
Source-Off Leakage Current	I _{S(OFF)}	V _{IN} = + 3.5V (DG308A), V _{IN} = +11V (DG309) V _S = +14V, V _D = -14V	T _A = +25°C		-1		0.1		nA
			T _A = T _{MAX}		-100		100		
		V _{IN} = +3.5V (DG308A), V _{IN} = +11V (DG309) V _S = -14V, V _D = +14V	T _A = +25°C		-1		-0.1		
			T _A = T _{MAX}		-100		100		
Drain-Off Leakage Current	I _{D(OFF)}	V _{IN} = + 3.5V (DG308A), V _{IN} = +11V (DG309) V _S = +14V, V _D = -14V	T _A = +25°C		-1		0.1		nA
			T _A = T _{MAX}		-100		100		
		V _{IN} = +3.5V (DG308A), V _{IN} = +11V (DG309) V _S = -14V, V _D = +14V	T _A = +25°C		-1		0.1		
			T _A = T _{MAX}		-100		100		
Drain-On Leakage Current	I _{D(ON)}	V _{IN} = +11V (DG308A), V _{IN} = +3.5V (DG309) V _S = V _D = +14V	T _A = +25°C		-2		0.1		nA
			T _A = T _{MAX}		-200		200		
		V _{IN} = +11V (DG308A), V _{IN} = +3.5V (DG309) V _S = V _D = -14V	T _A = +25°C		-2		0.1		
			T _A = T _{MAX}		-200		200		
INPUT									
Input Current with Input Voltage High	I _{INH}	V _{IN} = +15V	T _A = +25°C, T _{MAX}		-1		0.001		μA
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0V	T _A = +25°C, T _{MAX}		-1		-0.001		μA

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DG308A/DG309

ELECTRICAL CHARACTERISTICS (continued)

($V_+ = 15V$, $V_- = -15V$, $T_A = T_{MIN}$ to T_{MAX} , unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS	DG30 _ AK			DG30 _ C/D			UNITS	
			MIN	TYP	MAX	MIN	TYP	MAX		
SUPPLY										
Positive Supply Current	I+	All channels on or off, VIN = 0V or +15V	TA = +25°C	-10	0.001	10	-100	0.001	100	μA
			TA = TMAX	100			100			
Negative Supply Current	I-	All channels on or off, VIN = 0V or +15V	TA = +25°C	-10	-0.001	10	-100	-0.001	100	μA
			TA = TMAX	-100			-100			
DYNAMIC										
Turn-On Time	tON	Figure 1		130	200		130	200	ns	
Turn-Off Time	tOFF	Figure 1		90	150		90	150	ns	
Charge Injection	Q	CL = 0.01μF, VGEN = 0V, RGEN = 0Ω		-10			-10		pC	
Off Isolation (Note 3)	OIRR	VIN = 0V (DG308A), VIN = +15V (DG309) ZL = 75Ω, VS = 2Vp-p, f = 500kHz		78			78		dB	
Source-Off Capacitance	CS(OFF)	VIN = 0V (DG308A), VIN = +15V (DG309) f = 140kHz, VS = 0V		11			11		pF	
Drain-Off Capacitance	CD(OFF)	VIN = 0V (DG308A), VIN = +15V (DG309) f = 140kHz, VS = 0V		8			8		pF	
Channel-On Capacitance	CD(ON) + CS(ON)	VIN = 0V (DG308A), VIN = +15V (DG309) VD = VS = 0V		27			27		pF	

Note 2: The algebraic convention where the most negative value is a minimum and the most positive value a maximum is used in this data sheet.

Note 3: Off Isolation = $20 \log_{10} V_D/V_S$, V_D = output, V_S = input to off switch.

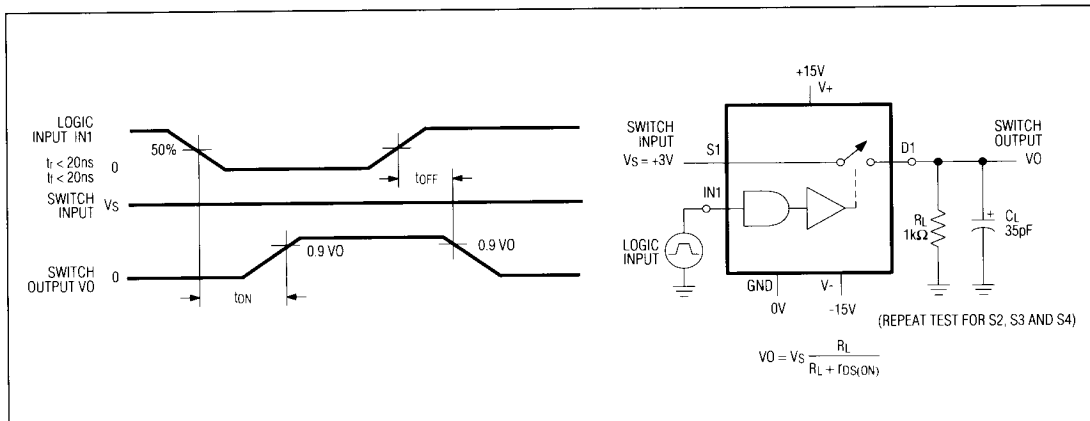


Figure 1. Switching-Time Test Circuit

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Pin Description

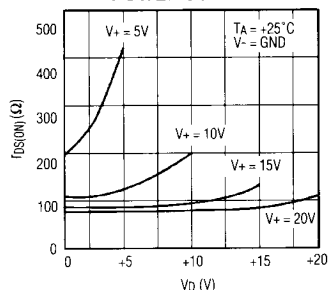
PIN	NAME	FUNCTION
1, 8, 9, 16	IN1-IN4	Logic Control Inputs
2, 7, 10, 15	D1-D4	Drain Output
3, 6, 11, 14	S1-S4	Source Input
4	V-	Negative Supply Voltage Input
5	GND	Ground
12	N.C.	No Connect
13	V+	Positive Supply Voltage Input – connected to substrate.

Application Tips

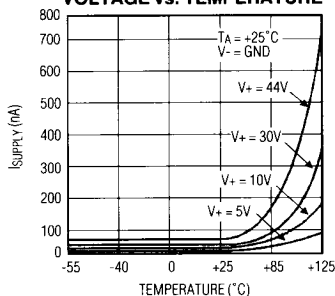
The DG308A/DG309 switch positive analog signals while using a single positive supply, allowing use in applications where only one supply is available. The trade-offs or performance given up when using single supplies are slower switching speed and increased $r_{DS(ON)}$. The *Power-Supply Current and Voltage vs. Temperature* graph shows the typical curve for single-supply designs. As stated in the Absolute Maximum Ratings, the analog voltage should not go above or below the supply voltages, which are V+ and 0V in single-supply operation.

Typical Operating Characteristics

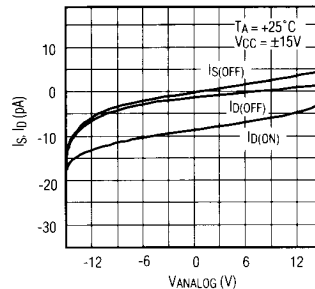
DRAIN-SOURCE ON RESISTANCE vs. DRAIN VOLTAGE AND POWER SUPPLIES



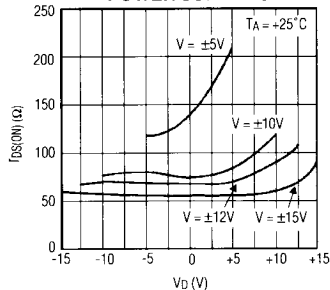
POWER-SUPPLY CURRENT AND VOLTAGE vs. TEMPERATURE



LEAKAGE CURRENTS vs. ANALOG VOLTAGE



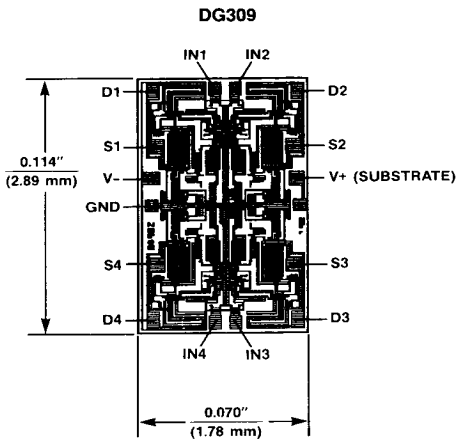
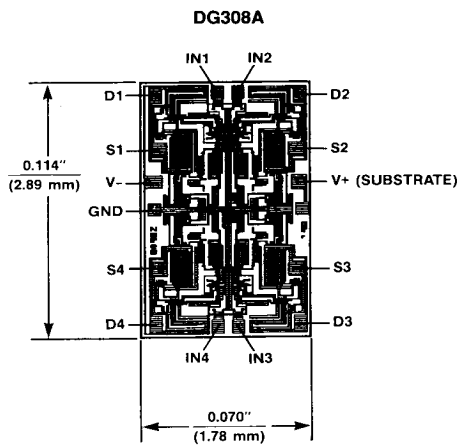
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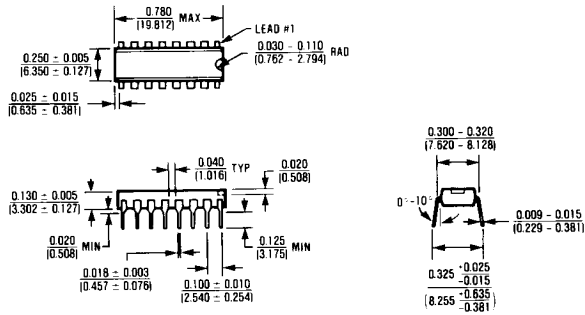
Chip Topographies

DG308A/DG309



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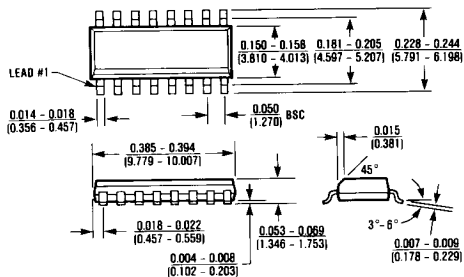
Package Information



16 Lead Plastic DIP

$$\theta_{JA} = 135^{\circ}\text{C/W}$$

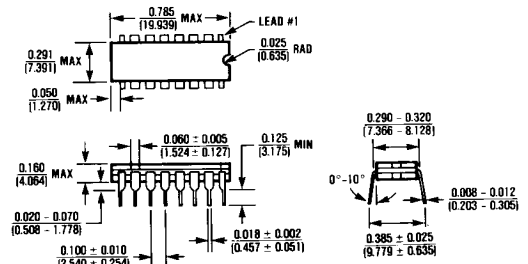
$$\theta_{JC} = 65^{\circ}\text{C/W}$$



16 Lead Narrow Small Outline

$$\theta_{JA} = 110^{\circ}\text{C/W}$$

$$\theta_{JC} = 60^{\circ}\text{C/W}$$



16 Lead Cerdip

$$\theta_{JA} = 100^{\circ}\text{C/W}$$

$$\theta_{JC} = 50^{\circ}\text{C/W}$$

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