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19-3926; Rev 0; 3/91

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 under 120ns, a turn-off time under 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
Test Equipment
Communications Systems
PBX, PABX
Guidance and Control Systems
Heads-Up Displays
Military Radios

Features

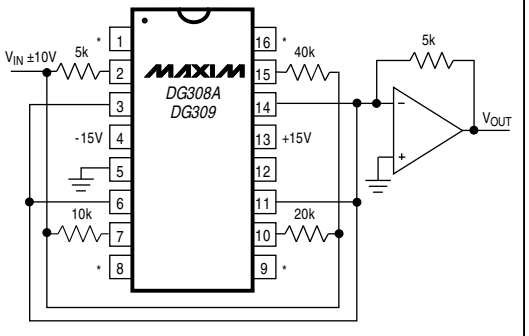
- **60Ω $r_{DS(ON)}$**
- **Single/Bipolar-Supply Operation**
- **CMOS Logic Compatible**
- **Monolithic, Low-Power CMOS Design**

Ordering Information

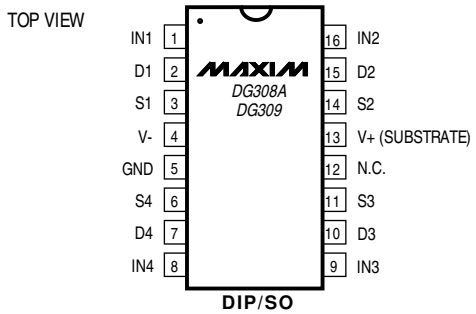
PART	TEMP. RANGE	PIN-PACKAGE
DG308ACJ	0°C to +70°C	16 Plastic DIP
DG308ACY	0°C to +70°C	16 Narrow SO
DG308ACK	0°C to +70°C	16 CERDIP
DG308AC/D	0°C to +70°C	Dice*
DG308ADJ	-40°C to +85°C	16 Plastic DIP
DG308ADY	-40°C to +85°C	16 Narrow SO
DG308ADK	-40°C to +85°C	16 CERDIP
DG308AAK	-55°C to +125°C	16 CERDIP**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

Typical Operating Circuit



Pin Configuration/Truth Table



TRUTH TABLE

LOGIC	DG308A	DG309
0	OFF	ON
1	ON	OFF

Quad, SPST Analog Switches

ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-
V+ .....+44V
GND .....+25V
Digital Inputs V_S, V_D.....(V- - 2V) to (V+ + 2V) or 20mA, whichever occurs first
Current into 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

Continuous Power Dissipation (T_A = +70°C) (Note 1)
Plastic DIP (derate 10.53mW/°C above +70°C).....842mW
Narrow SO (derate 8.70mW/°C above +70°C) 696mW
CERDIP (derate 10.00mW/°C above +70°C) 800mW
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 Range .....-65°C to +150°C
Lead Temperature (soldering, 10sec) .....+300°C

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, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.) (Note 2)

PARAMETER	SYMBOL	CONDITIONS		DG30_AK MIN	DG30_AK TYP	DG30_AK MAX	DG30_C/D MIN	DG30_C/D TYP	DG30_C/D MAX	UNITS
SWITCH										
Analog Signal Range	V_{ANALOG}		T_A = +25°C	-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 or -10V	T_A = +25°C, T_{MIN}		60	100		60	100	Ω
			T_A = T_{MAX}		95	150		80	125	
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	1	-5	0.1	5	nA
			T_A = T_{MAX}	-100		100	-100		100	
		V_{IN} = 3.5V (DG308A), V_{IN} = 11V (DG309), V_S = -14V, V_D = 14V	T_A = +25°C	-1	-0.1	1	-5	0.1	5	
			T_A = T_{MAX}	-100		100	-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	1	-5	0.1	5	nA
			T_A = T_{MAX}	-100		100	-100		100	
		V_{IN} = 3.5V (DG308A), V_{IN} = 11V (DG309), V_S = -14V, V_D = 14V	T_A = +25°C	-1	0.1	1	-5	0.1	5	
			T_A = T_{MAX}	-100		100	-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	2	-5	0.1	5	nA
			T_A = T_{MAX}	-200		200	-200		200	
		V_{IN} = 11V (DG308A), V_{IN} = 3.5V (DG309), V_S = V_D = -14V	T_A = +25°C	-2	0.1	2	-5	0.1	5	
			T_A = T_{MAX}	-200		200	-200		200	
INPUT										
Input Current with Input Voltage High	I_{INH}	V_{IN} = 15V	T_A = +25°C, T_{MAX}	-1	0.001	1	-1	0.001	1	µA
Input Current with Input Voltage Low	I_{INL}	V_{IN} = 0V	T_A = +25°C, T_{MAX}	-1	-0.001	1	-1	0.001	1	µA

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS		DG30_AK MIN	DG30_AK TYP	DG30_AK MAX	DG30_C/D MIN	DG30_C/D TYP	DG30_C/D MAX	UNITS
SUPPLY										
Positive Supply Current	I+	All channels on or off, V_{IN} = 0V or 15V	T_A = +25°C	-10	0.001	10	-100	0.001	100	µA
			$T_A = T_{MAX}$			100			100	
Negative Supply Current	I-	All channels on or off, V_{IN} = 0V or 15V	T_A = +25°C	-10	-0.001	10	-100	-0.001	100	µA
			$T_A = T_{MAX}$	-100			-100			
DYNAMIC										
Turn-On Time	t_{ON}	Figure 1			130	200		130	200	ns
Turn-Off Time	t_{OFF}	Figure 1			90	150		90	150	ns
Charge Injection	Q	C_L = 0.01µF, V_{GEN} = 0V, R_{GEN} = 0Ω			-10			-10		pC
Off Isolation (Note 3)	OIRR	V_{IN} = 0V (DG308A), V_{IN} = 15V (DG309), Z_L = 75Ω, V_S = $2V_{p-p}$, f = 500kHz			78			78		dB
Source-Off Capacitance	$C_{S(OFF)}$	V_{IN} = 0V (DG308A), V_{IN} = 15V (DG309), f = 140kHz, V_S = 0V			11			11		pF
Drain-Off Capacitance	$C_{D(OFF)}$	V_{IN} = 0V (DG308A), V_{IN} = 15V (DG309), f = 140kHz, V_S = 0V			8			8		pF
Channel-On Capacitance	$C_{D(ON)}$ + $C_{S(ON)}$	V_{IN} = 0V (DG308A), V_{IN} = 15V (DG309), V_D = V_S = 0V			27			27		pF

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

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 = 20log10 V_D/V_S, V_D = output, V_S = input to off switch.

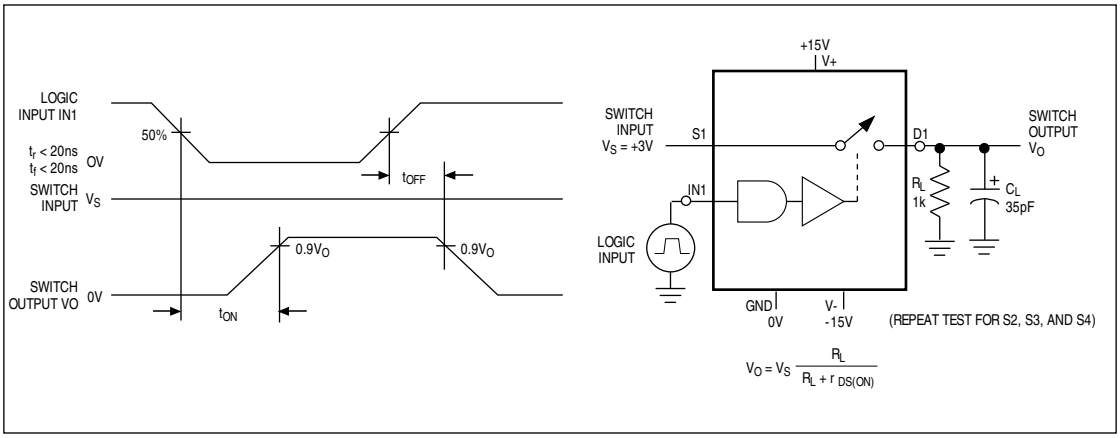


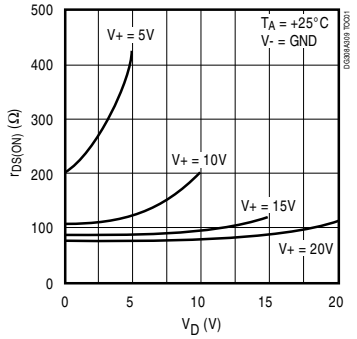
Figure 1. Switching-Time Test Circuit

Quad, SPST Analog Switches

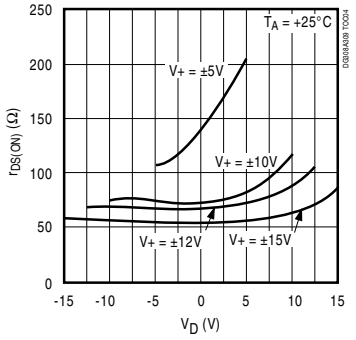
Typical Operating Characteristics

(T_A = +25°C, unless otherwise noted.)

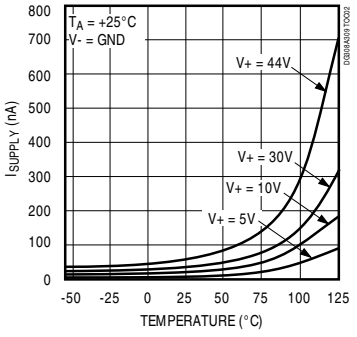
DRAIN-SOURCE ON-RESISTANCE vs. DRAIN VOLTAGE & POWER SUPPLIES



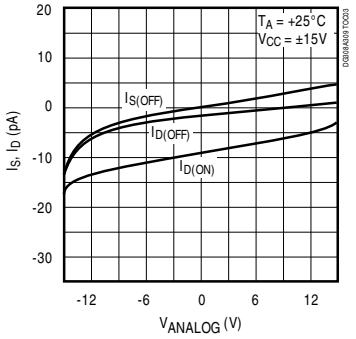
DRAIN-SOURCE ON-RESISTANCE vs. DRAIN VOLTAGE & POWER SUPPLIES



POWER-SUPPLY CURRENT AND VOLTAGE vs. TEMPERATURE



LEAKAGE CURRENTS vs. ANALOG VOLTAGE



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. Not internally connected.
13	V+	Positive Supply Voltage Input. Connected to substrate.

Applications Information

The DG308A/DG309 switch positive analog signals while using a single positive supply, allowing use in applications where only one supply is available. The disadvantages of using a single supply are slower switching speed and increased $r_{DS(ON)}$. The *Power-Supply Current and Voltage vs. Temperature* graph shows the typical curve for a single-supply design. 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.