

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.

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

- $\pm 15\text{ V}$ analog input range
- Low on-resistance - $R_{DS(on)}$: $60\ \Omega$
- 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

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

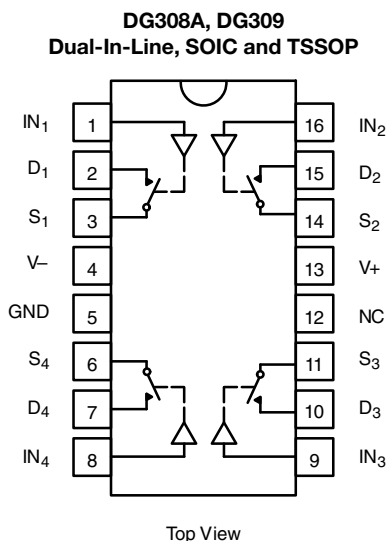


RoHS*
Available

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” $\leq 3.5\text{ V}$
Logic “1” $\geq 11\text{ V}$

**ORDERING INFORMATION**

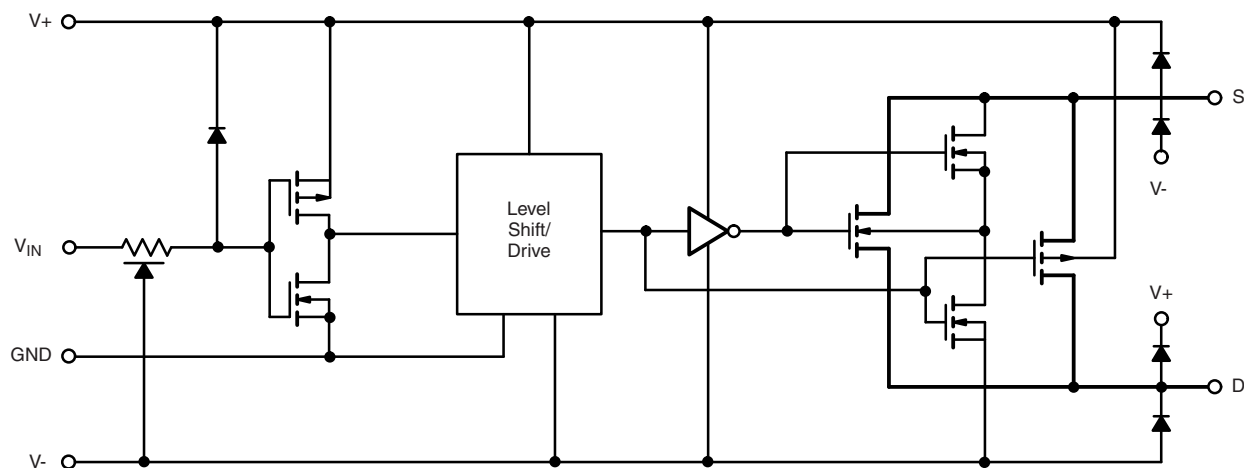
TEMP. RANGE	PACKAGE	PART NUMBER
-40 °C to +85 °C	16-pin narrow SOIC	DG308ADY-E3 DG308ADY-T1-E3
		DG309DY-E3 DG309DY-T1-E3
	16-pin TSSOP	DG308ADQ-E3 DG308ADQ-T1-E3
		DG309DQ-E3 DG309DQ-T1-E3
	16-pin plastic DIP	DG308ACJ-E3
		DG309CJ-E3

ABSOLUTE MAXIMUM RATINGS ($T_A = 25\text{ }^{\circ}\text{C}$, unless otherwise noted)

PARAMETER	LIMIT	UNIT
Voltages referenced, V_+ to V_-	44	V
GND	25	
Digital inputs ^a , V_S , V_D	(V_-) - 2 to (V_+) + 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	
	(Pulsed at 1 ms, 10 % duty cycle max.)	20
Storage temperature	(AK suffix)	-65 to +150
	(CJ, DY, and DQ suffix)	-65 to +125
Power dissipation (package) ^b	16 pin plastic DIP ^c	470
	16 pin narrow SOIC and TSSOP ^d	600

Notes

- a. Signals on SX, DX, or INX 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/ $^{\circ}\text{C}$ above 75 $^{\circ}\text{C}$
- d. Derate 7.6 mW/ $^{\circ}\text{C}$ above 25 $^{\circ}\text{C}$

SCHEMATIC DIAGRAM (typical channel)**Fig. 1**



SPECIFICATIONS									
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS SPECIFIED V ₊ = 15 V, V ₋ = -15 V V _{IN} = 3.5 V or 11 V ^f	TEMP. ^b	TYP. ^c	A SUFFIX -40 °C to +85 °C		C, D SUFFIX -40 °C to +85 °C		UNIT
					MIN. ^d	MAX. ^d	MIN. ^d	MAX. ^d	
Analog Switch									
Analog signal range ^e	V _{ANALOG}		Full	-	-15	15	-15	15	V
Drain-source on-resistance	R _{DS(on)}	V _D = ± 10 V, I _S = 1 mA	Room	60	-	100	-	100	Ω
			Full	-	-	150	-	125	
Source off leakage current	I _{S(off)}	V _S = ± 14 V, V _D = ± 14 V	Room	± 0.1	-1	1	-5	5	nA
			Full	± 0.1	100	100	-100	100	
Drain off leakage current	I _{D(off)}	V _D = ± 14 V, V _S = ± 14 V	Room	± 0.1	-1	1	-5	5	
			Full	± 0.1	100	100	-100	100	
Drain on leakage current	I _{D(on)}	V _S = V _D = ± 14 V	Room	± 0.1	-1	1	-5	5	
			Full	± 0.1	100	100	-200	200	
Digital Control									
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
Dynamic Characteristics									
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 μF, V _{gen} = 0 V, R _{gen} = 0 Ω	Room	-10	-	-	-	-	pC
Source-off capacitance	C _{S(off)}	V _S , V _D = 0 V, f = 140 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 Ω, V _S = 2 V _{p-p} , f = 500 kHz	Room	78	-	-	-	-	dB
Power Supply									
Positive supply current	I ₊	All channels on or off V _{IN} = 0 V or 15 V	Room	0.001	-	10	-	10	μA
			Full	-	-	100	-	100	
Negative supply current	I ₋		Room	-0.001	-10	-	-100	-	
			Full	-	-100	-	-	-	

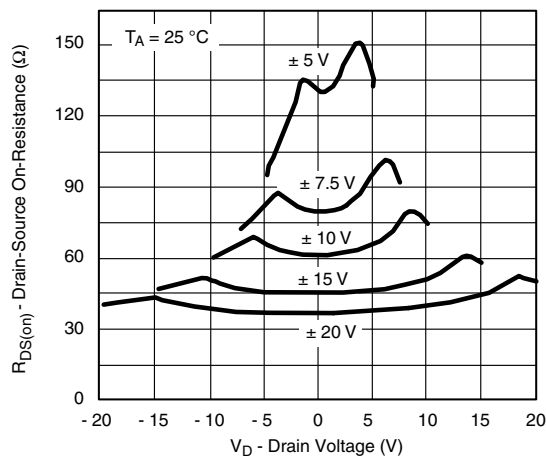
Notes

- 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

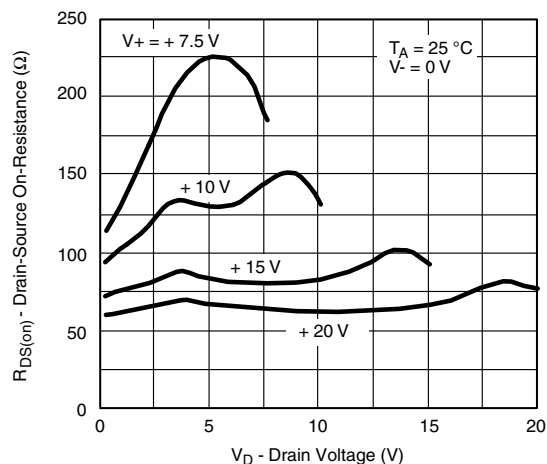
Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure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



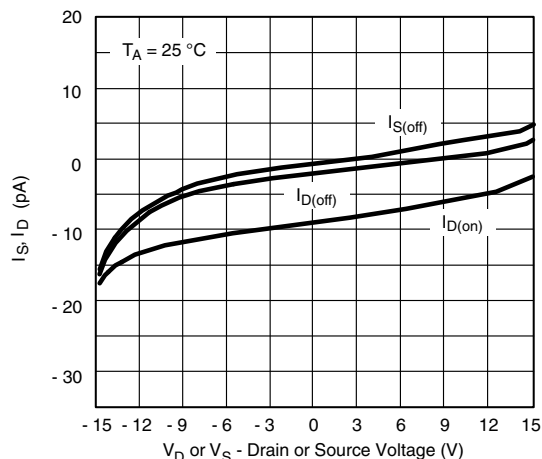
TYPICAL CHARACTERISTICS (25 °C, unless otherwise noted)



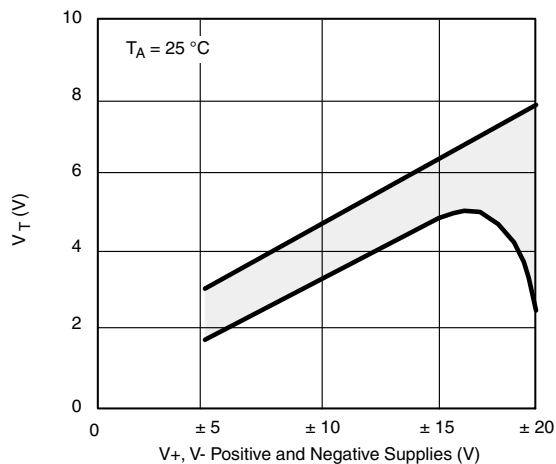
$R_{DS(on)}$ vs. V_D and Power Supply



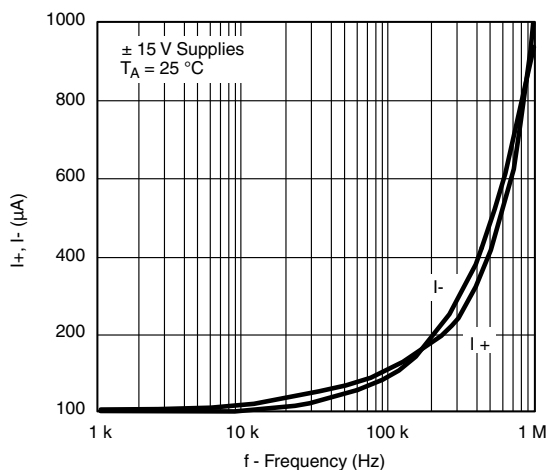
$R_{DS(on)}$ vs. V_D and Power Supply Voltage



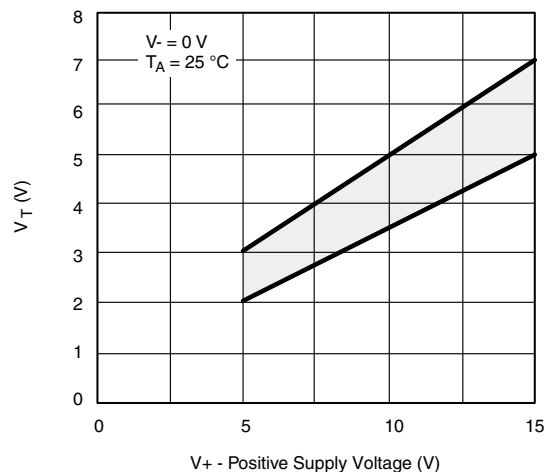
Leakage Currents vs. Analog Voltage



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

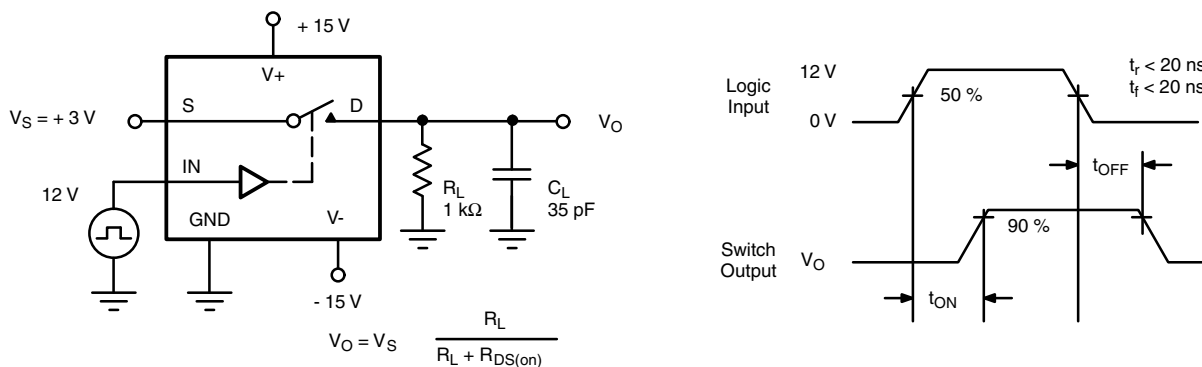


Fig. 2 - Switching Time

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.



PRODUCT SUMMARY						
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 (Ω)	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	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	Multi purpose, instrumentation, medical and healthcare	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

Vishay Siliconix maintains worldwide manufacturing capability. Products may be manufactured at one of several qualified locations. Reliability data for Silicon Technology and Package Reliability represent a composite of all qualified locations. For related documents such as package/tape drawings, part marking, and reliability data, see www.vishay.com/ppg?61560.



Disclaimer

ALL PRODUCT, PRODUCT SPECIFICATIONS AND DATA ARE SUBJECT TO CHANGE WITHOUT NOTICE TO IMPROVE RELIABILITY, FUNCTION OR DESIGN OR OTHERWISE.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained in any datasheet or in any other disclosure relating to any product.

Vishay makes no warranty, representation or guarantee regarding the suitability of the products for any particular purpose or the continuing production of any product. To the maximum extent permitted by applicable law, Vishay disclaims (i) any and all liability arising out of the application or use of any product, (ii) any and all liability, including without limitation special, consequential or incidental damages, and (iii) any and all implied warranties, including warranties of fitness for particular purpose, non-infringement and merchantability.

Statements regarding the suitability of products for certain types of applications are based on Vishay's knowledge of typical requirements that are often placed on Vishay products in generic applications. Such statements are not binding statements about the suitability of products for a particular application. It is the customer's responsibility to validate that a particular product with the properties described in the product specification is suitable for use in a particular application. Parameters provided in datasheets and / or specifications may vary in different applications and performance may vary over time. All operating parameters, including typical parameters, must be validated for each customer application by the customer's technical experts. Product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein.

Hyperlinks included in this datasheet may direct users to third-party websites. These links are provided as a convenience and for informational purposes only. Inclusion of these hyperlinks does not constitute an endorsement or an approval by Vishay of any of the products, services or opinions of the corporation, organization or individual associated with the third-party website. Vishay disclaims any and all liability and bears no responsibility for the accuracy, legality or content of the third-party website or for that of subsequent links.

Vishay products are not designed for use in life-saving or life-sustaining applications or any application in which the failure of the Vishay product could result in personal injury or death unless specifically qualified in writing by Vishay. Customers using or selling Vishay products not expressly indicated for use in such applications do so at their own risk. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay. Product names and markings noted herein may be trademarks of their respective owners.