# **DG201B, DG202B**



**Vishay Siliconix** 

# Improved Quad CMOS Analog Switches

#### DESCRIPTION

The DG201B, DG202B analog switches are highly improved versions of the industry-standard DG201A, DG202. These devices are fabricated in Vishay Siliconix' proprietary silicon gate CMOS process, resulting in lower on-resistance, lower leakage, higher speed, and lower power consumption.

These guad single-pole single-throw switches are designed for a wide variety of applications in telecommunications, instrumentation, process control, computer peripherals, etc. An improved charge injection compensation design minimizes switching transients. The DG201B and DG202B can handle up to ± 22 V input signals, and have an improved continuous current rating of 30 mA. An epitaxial layer prevents latchup.

All devices feature true bi-directional performance in the on condition, and will block signals to the supply voltages in the off condition.

The DG201B is a normally closed switch and the DG202B is a normally open switch. (see Truth Table.)

#### FEATURES

- ± 22 V supply voltage rating
- TTL and CMOS compatible logic
- Low on-resistance R<sub>DS(on)</sub>: 45 Ω
- Low leakage I<sub>D(on)</sub>: 20 pA
- Single supply operation possible
- Extended temperature range
- Fast switching ton: 120 ns
- Low glitching Q: 1 pC
- 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

#### BENEFITS

- · Wide analog signal range
- · Simple logic interface
- Higher accuracy
- Minimum transients
- Reduced power consumption
- Superior to DG201A, DG202
- Space savings (TSSOP)

#### APPLICATIONS

- Industrial instrumentation
- Test equipment
- Communications systems
- Disk drives
- Computer peripherals
- Portable instruments
- Sample-and-hold circuits

#### FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION





#### **TRUTH TABLE**

LOGIC	DG201B	DG202B
0	ON	OFF
1	OFF	ON

#### Note

- Logic "0" ≤ 0.8 V
- Logic "1" ≥ 2.4 V

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FREE



ORDERING INFORMATION					
TEMP. RANGE	PACKAGE	PART NUMBER			
	16-nin Plastic DIP	DG201BDJ-E3			
	10-pin Flastic DIF	DG202BDJ-E3			
-40 °C to +85 °C		DG201BDY-E3 DG201BDY-T1-E3			
	ro-pin narrow SOIC	DG202BDY-E3 DG202BDY-T1-E3			
	16 pin TSSOD	DG201BDQ-E3 DG201BDQ-T1-E3			
		DG202BDQ-E3 DG202BDQ-T1-E3			

ABSOLUTE MAXIMUM RATINGS							
PARAMETER	LIMIT	UNIT					
Voltages referenced, V+ to V-	44						
GND		25 V					
Digital inputs <sup>a</sup> , V <sub>S</sub> , V <sub>D</sub>	(V-) - 2 to (V+) + 2 or 30 mA, whichever occurs first						
Current (any terminal)		30	m (				
Peak current S or D (pulsed at 1 ms, 10 % duty cycle max.)		100	IIIA				
Storage temperature	(DJ, DY, DQ suffix)	-65 to +125	°C				
Bower dissinction (package) b	16-pin plastic DIP <sup>c</sup>	470	mW				
rower dissipation (package) ~	16-pin narrow SOIC and TSSOP <sup>d</sup>	640					

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 6.5 mW/°C above 75 °C

d. Derate 7.6 mW/°C above 75 °C

### SCHEMATIC DIAGRAM (typical channel)





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SPECIFICATIONS <sup>a</sup>							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS SPECIFIED	TEMP. <sup>b</sup>	TYP. ⁰	<b>D SUFFIX</b> -40 °C to +85 °C		UNIT
		V+ = 15 V, V- = -15 V V <sub>IN</sub> = 2.4 V, 0.8 V <sup>f</sup>			MIN. <sup>d</sup>	MAX. d	
Analog Switch							
Analog signal range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	-15	15	V
Drain-source	Brack		Room	45	-	85	
on-resistance	US(on)	$V_{D} = \pm 10 \text{ V}, \text{ I}_{S} = 1 \text{ mA}$	Full	-	-	100	Ω
R <sub>DS(on)</sub> match	$\Delta R_{DS(on)}$		Room	2	-	-	
Source off leakage current	I <sub>S(off)</sub>	$V_{S} = \pm 14 \text{ V}, V_{D} = \pm 14 \text{ V}$	Room Full	± 0.01	-0.5 -5	0.5 5	
Drain off leakage current	I <sub>D(off)</sub>	$V_D=\pm~14~V,~V_S=\pm~14~V$	Room Full	± 0.01	-0.5 -5	0.5 5	nA
Drain on leakage current	I <sub>D(on)</sub>	$V_{S} = V_{D} = \pm 14 V$	Room Full	± 0.02	-0.5 -10	0.5 10	
Digital Control							
Input voltage high	V <sub>INH</sub>		Full	-	2.4	-	V
Input voltage low	V <sub>INL</sub>		Full	-	-	0.8	v
Input current	$I_{\rm INH}$ or $I_{\rm INL}$	V <sub>INH</sub> or V <sub>INL</sub>	Full	-	-1	1	μA
Input capacitance	C <sub>IN</sub>		Room	5	-	-	pF
Dynamic Characteristics	6		1	1			
Turn-on time	t <sub>on</sub>	$V_{S} = 2 V$	Room	120	-	300	ns
Turn-off time	t <sub>off</sub>	see switching time test circuit	Room	65	-	200	
Charge injection	Q	$C_L$ = 1000 pF, $V_g$ = 0 V, $R_g$ = 0 $\Omega$	Room	1	-	-	рС
Source-off capacitance	C <sub>S(off)</sub>	$V_{e} = 0 V_{e} f = 1 MHz$	Room	5	-	-	
Drain-off capacitance	C <sub>D(off)</sub>		Room	5	-	-	pF
Channel on capacitance	C <sub>D(on)</sub>	$V_D = V_S = 0 V$ , f = 1 MHz	Room	16	-	-	
Off isolation	OIRR	$C_{\rm L} = 15  \rm pE, B_{\rm L} = 50  \Omega$	Room	90	-	-	
Channel-to-channel crosstalk	X <sub>TALK</sub>	$V_{\rm S} = 1 V_{\rm RMS}$ , f = 100 kHz	Room	95	-	-	dB
Power Supply			1	1	P		
Positive supply current	l+	V <sub>IN</sub> = 0 or 5 V	Room	-	-	50	- uA
			Full	-	-	100	
Negative supply current			Room	-	-1	-	P 1
			Full	-	-5	-	
Power supply range for continuous operation	V <sub>OP</sub>		Full	-	± 4.5	± 22	V





SPECIFICATIONS <sup>a</sup> (for Single Supply)							
PARAMETER	SYMBOL	TEST CONDITIONS UNLESS SPECIFIED	TEMP. <sup>b</sup>	TYP. °	<b>D SUFFIX</b> -40 °C to +85 °C		UNIT
		$V_{\rm H} = 12$ V, $V_{\rm -} = 0$ V V <sub>IN</sub> = 2.4 V, 0.8 V <sub>f</sub>			MIN. <sup>d</sup>	MAX. <sup>d</sup>	
Analog Switch							
Analog signal range <sup>e</sup>	V <sub>ANALOG</sub>		Full	-	0	12	V
Drain-source	D	$V_D = 3 V, 8 V, I_S = 1 mA$	Room	90	-	160	Ω
on-resistance	nDS(on)		Full	-	-	200	Ω
Dynamic Characteristics	;						
Turn-on time	t <sub>on</sub>	V <sub>S</sub> = 8 V	Room	120	-	300	20
Turn-off time	t <sub>off</sub>	see switching time test circuit	Room	60	-	200	115
Charge injection	Q	$C_L$ = 1 nF, $V_{gen}$ = 6 V, $R_{gen}$ = 0 $\Omega$	Room	4	-	-	рС
Power Supply							
Desitive supply summert	I+	- V <sub>IN</sub> = 0 or 5 V	Room	-	-	50	μA
r ositive supply current			Full	-	-	100	
Negative supply current	I-		Room	-	-1	-	
			Full	-	-5	-	
Power supply range for continuous operation	V <sub>OP</sub>		Full	-	+4.5	+25	V

#### 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<sub>DS(on)</sub> vs. V<sub>D</sub> and Power Supply Voltages



R<sub>DS(on)</sub> vs. V<sub>D</sub> and Single Power Supply Voltages



Leakage Currents vs. Analog Voltage



R<sub>DS(on)</sub> vs. V<sub>D</sub> and Temperature



Input Switching Threshold vs. Supply Voltage



Leakage Currents vs. Temperature

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



Switching Time vs. Single Supply Voltage







Switching Time vs. Power Supply Voltage







Supply Current vs. Switching Frequency

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### **TEST CIRCUITS**





Fig. 2 - Switching Time













 $\Delta V_O$  = measured voltage error due to charge injection The charge injection in coulombs is Q = C\_L x  $\Delta V_O$ 

Fig. 5 - Charge Injection

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### APPLICATIONS







Fig. 7 - Active Low Pass Filter with Digitally Selected Break Frequency

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### **APPLICATIONS**



Fig. 8 - A Precision Amplifier with Digitally Programable Input and Gains

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# DG201B, DG202B

Vishay Siliconix

Document Number: 61554

PRODUCT SUMMARY						
Part number	DG201B	DG201B	DG201B	DG202B	DG202B	DG202B
Status code	2	2	2	2	2	2
Configuration	SPST x 4, NC	SPST x 4, NC	SPST x 4, NC	SPST x 4, NO	SPST x 4, NO	SPST x 4, NO
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 ( $\Omega$ )	45	45	45	45	45	45
Charge injection (pC)	1	1	1	1	1	1
Source on capacitance (pF)	16	16	16	16	16	16
Source off capacitance (pF)	5	5	5	5	5	5
Leakage switch on typ. (nA)	0.02	0.02	0.02	0.02	0.02	0.02
Leakage switch off max. (nA)	0.5	0.5	0.5	0.5	0.5	0.5
-3 dB bandwidth (MHz)	-	-	-	-	-	-
Package	Plastic DIP-16	SO-16 (narrow) AS	TSSOP-16	Plastic DIP-16	SO-16 (narrow) AS	TSSOP-16
Functional circuit / applications	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)	120	120	120	120	120	120
Crosstalk and off isolation	-90	-90	-90	-90	-90	-90

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Revision: 01-Jan-2025