

CMOS Analog Switches

FEATURES

- $\pm 15\text{-V}$ Input Range
- Fast Switching— t_{ON} : 110 ns
- Low $r_{DS(on)}$: 30 Ω
- Single Supply Operation
- CMOS Logic Levels
- Micropower: 30 nW

BENEFITS

- Full Rail-to-Rail Analog Signal Range
- Low Signal Error
- Wide Dynamic Range
- Low Power Dissipation

APPLICATIONS

- Low Level Switching Circuits
- Programmable Gain Amplifiers
- Portable and Battery Powered Systems

DESCRIPTION

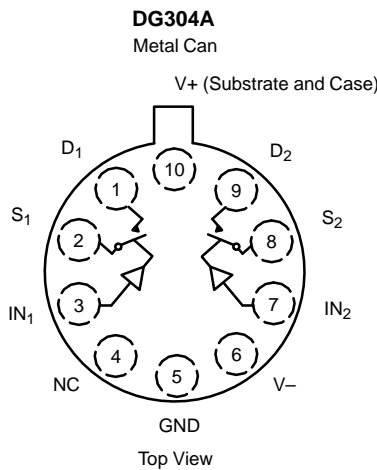
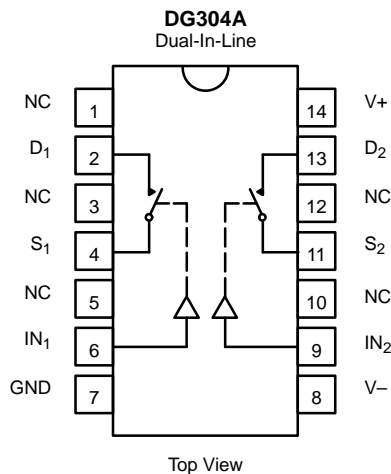
The DG304A through DG307A series of monolithic CMOS switches were designed for applications in communications, instrumentation and process control. This series is well suited for applications requiring fast switching and nearly flat on-resistance over the entire analog range.

applications, without sacrificing switching speed. Break-before-make switching action is guaranteed, and an epitaxial layer prevents latchup. Single supply operation (for positive switch voltages) is allowed by connecting the V^- rail to 0 V.

Designed on the Vishay Siliconix PLUS-40 CMOS process to achieve low power consumption and excellent on/off switch performance, these switches are ideal for battery powered

Each switch conducts equally well in both directions when on, and blocks up to the supply voltage when off. These switches are CMOS input compatible.

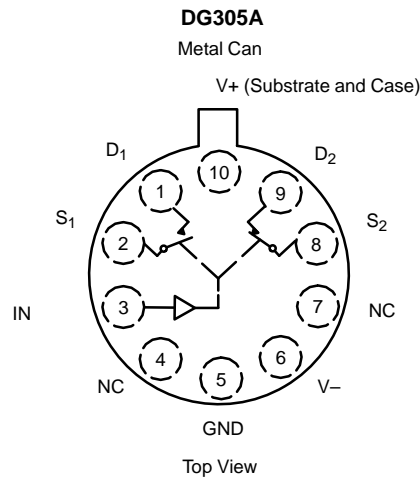
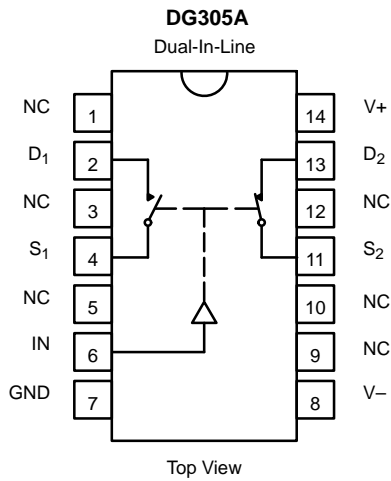
FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE	
Logic	Switch
0	OFF
1	ON

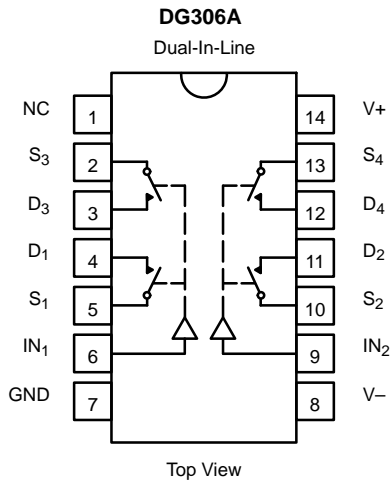
Logic "0" $\leq 3.5\text{ V}$
 Logic "1" $\geq 11\text{ V}$

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



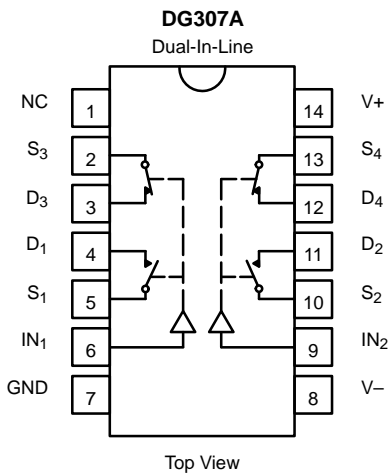
TRUTH TABLE		
Logic	SW ₁	SW ₂
0	OFF	ON
1	ON	OFF

Logic "0" ≤ 3.5 V
Logic "1" ≥ 11 V



TRUTH TABLE	
Logic	Switch
0	OFF
1	ON

Logic "0" ≤ 3.5 V
Logic "1" ≥ 11 V



Four SPST Switches per Package

TRUTH TABLE		
Logic	SW ₁ , SW ₂	SW ₃ , SW ₄
0	OFF	ON
1	ON	OFF

Logic "0" ≤ 3.5 V
Logic "1" ≥ 11 V



ORDERING INFORMATION		
Temp Range	Package	Part Number
DG304A		
-0 to 70°C	14-Pin Plastic DIP	DG304ACJ
-55 to 125°C	14-Pin CerDIP	DG304AAK/883
		JM38510/11605BCA
	10-Pin Can	JM38510/11605BIA
	14-Pin Sidebrazed	JM38510/11605BCC
DG305A		
-55 to 125°C	14-Pin CerDIP	JM38510/11605BCA
	10-Pin Can	JM38510/11606BIC
	14-Pin Sidebrazed	JM38510/11606BCA
DG306A		
-0 to 70°C	14-Pin Plastic DIP	DG306ACJ
-55 to 125°C	14-Pin CerDIP	DG306AAK/883
		JM38510/11607BCA
	14-Pin Sidebrazed	JM38510/11607BCC
DG307A		
0 to 70°C	14-Pin Plastic DIP	DG307ACJ
-25 to 85°C	14-Pin CerDIP	DG307ABK
-55 to 125°C		DG307AAK
		DG307AAK/883
		JM38510/11608BCA
		JM38510/11608BCC
	14-Pin Sidebrazed	JM38510/11608BCC

ABSOLUTE MAXIMUM RATINGS

Voltages Referenced to V-

V+ 44 V

GND 25 V

Digital Inputs^a, V_S, V_D (V-) -2 V to (V+) +2V or 30 mA, whichever occurs first

Current, Any Terminal 30 mA

Continuous Current, S or D (Pulsed at 1 ms, 10% duty cycle max) 100 mA

Storage Temperature (AAA, AAK, ABK Suffix) -65 to 150°C (ACJ Suffix) -65 to 125°C

Power Dissipation^b

14-Pin Plastic DIP^c 470 mW

14-Pin CerDIP^d 825 mW

10-Pin Metal Can^e 450 mW

- Notes:
- a. Signals on S_X, D_X, or I_{NX} 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 11 mW/°C above 75°C
 - d. Derate 6.5 mW/°C above 25°C
 - e. Derate 6 mW/°C above 75°C



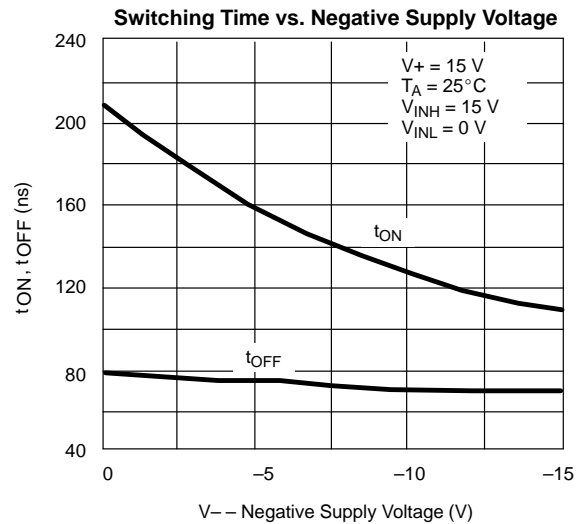
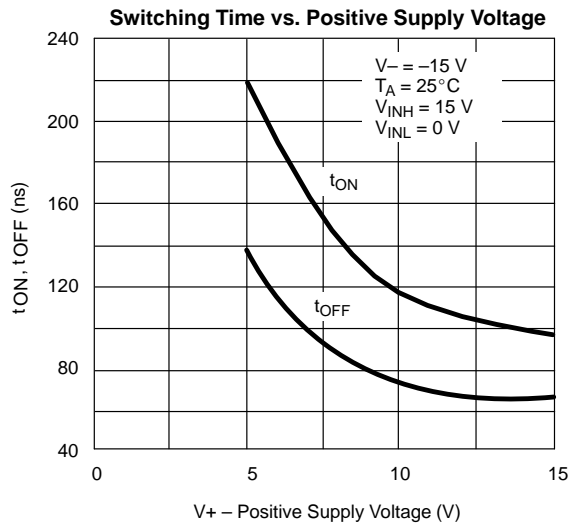
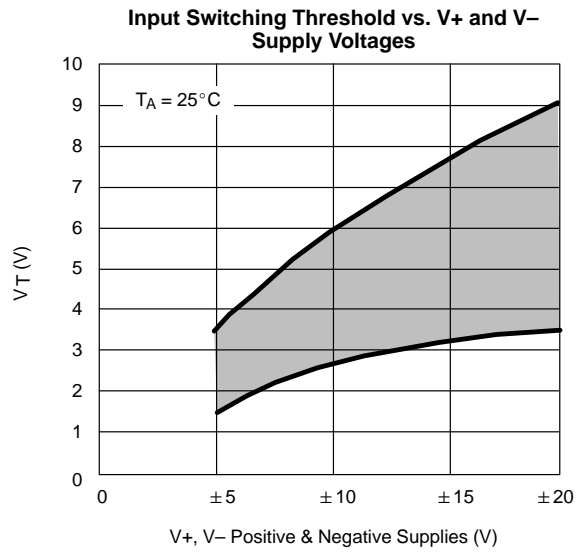
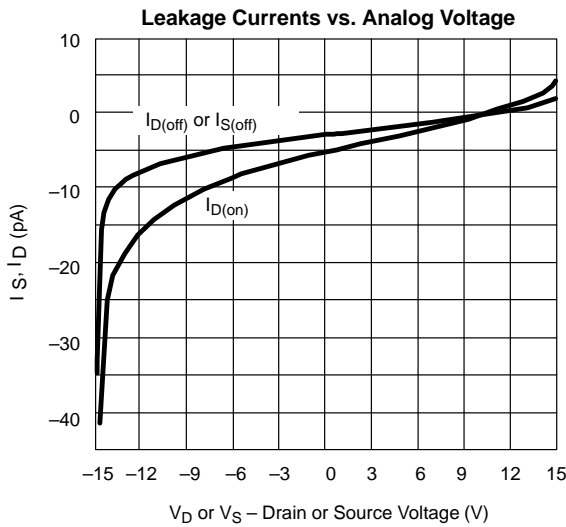
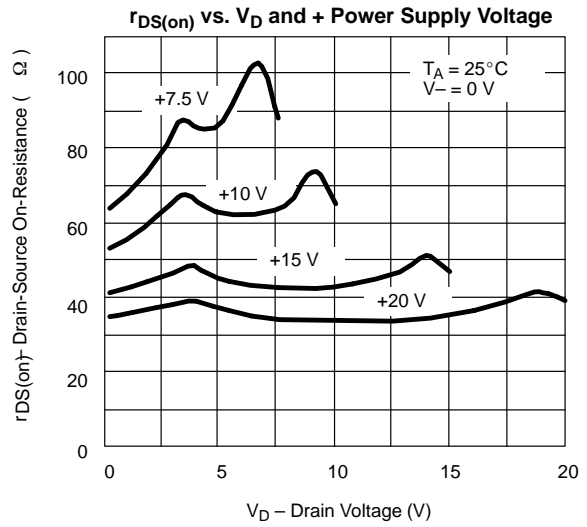
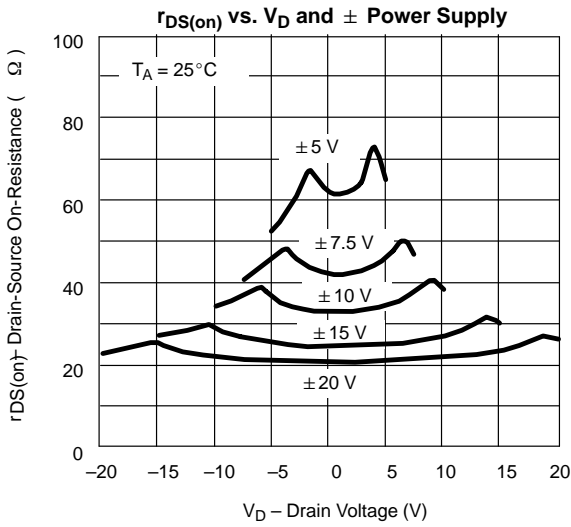
SPECIFICATIONS ^a									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_{IN} = 3.5\text{ V}$ or 11 V ^f	Temp ^b	Typ ^c	A Suffix -55 to 125°C		B, C Suffix -25 to 85°C 0 to 70°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	V_{ANALOG}		Full		-15	15	-15	15	V
Drain-Source On-Resistance	$r_{DS(on)}$	$V_D = \pm 10\text{ V}$, $I_S = 10\text{ mA}$	Room Full	30		50 75		50 75	Ω
Source Off Leakage Current	$I_{S(off)}$	$V_S = \pm 14\text{ V}$ $V_D = \mp 14\text{ V}$	Room Full	± 0.1	-1 -100	1 100	-5 -100	5 100	nA
Drain Off Leakage Current	$I_{D(off)}$	$V_S = \pm 14\text{ V}$ $V_D = \mp 14\text{ V}$	Room Full	± 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	± 0.1	-2 -200	2 200	-5 -200	5 200	
Digital Control									
Input Current with Input Voltage High	I_{INH}	$V_{IN} = 5\text{ V}$	Room Full	-0.001	-1 -1		-1		μA
		$V_{IN} = 15\text{ V}$	Room Full	0.001		1 1		1	
Input Current with Input Voltage Low	I_{INL}	$V_{IN} = 0\text{ V}$	Room Full	-0.001	-1 -1		-1		
Dynamic Characteristics									
Turn-On Time	t_{ON}	See Figure 2	Room	110		250			ns
Turn-Off Time	t_{OFF}		Room	70		150			
Break-Before-Make Time	t_{OPEN}	DG305A/307A ONLY See Figure 3	Room	50					
Charge Injection	Q	$C_L = 1\text{ nF}$, $R_{gen} = 0$ $V_{gen} = 0\text{ V}$, See Figure 4	Room	30					pC
Source-Off Capacitance	$C_{S(off)}$	$f = 1\text{ MHz}$, $V_S = 0\text{ V}$ V_S , $V_D = 0\text{ V}$	Room	14					pF
Drain-Off Capacitance	$C_{D(off)}$		Room	14					
Channel-On Capacitance	$C_{D(on)}$		Room	40					
Input Capacitance	C_{IN}	$f = 1\text{ MHz}$	$V_{IN} = 0\text{ V}$	Room	6				
			$V_{IN} = 15\text{ V}$	Room	7				
Off-Isolation	OIRR	$V_{IN} = 0\text{ V}$, $R_L = 1\text{ k}\Omega$	Room	62					dB
Crosstalk (Channel-to-Channel)	X_{TALK}	$V_S = 1\text{ V}_{rms}$, $f = 500\text{ kHz}$	Room	74					
Power Supplies									
Positive Supply Current	I_+	$V_{IN} = 15\text{ V}$ or 0 V (All Inputs)	Room Full	0.001		10 100		100	μA
Negative Supply Current	I_-		Room Full	-0.001	-10 -100		-100		

Notes:

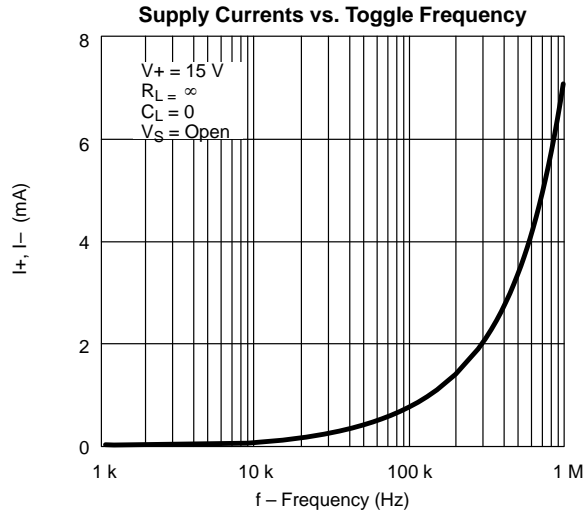
- a. Refer to PROCESS OPTION FLOWCHART.
- b. Room = 25°C, Full = as determined by the operating temperature suffix.
- c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- d. The algebraic convention whereby the most negative value is a minimum and the most positive 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.



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

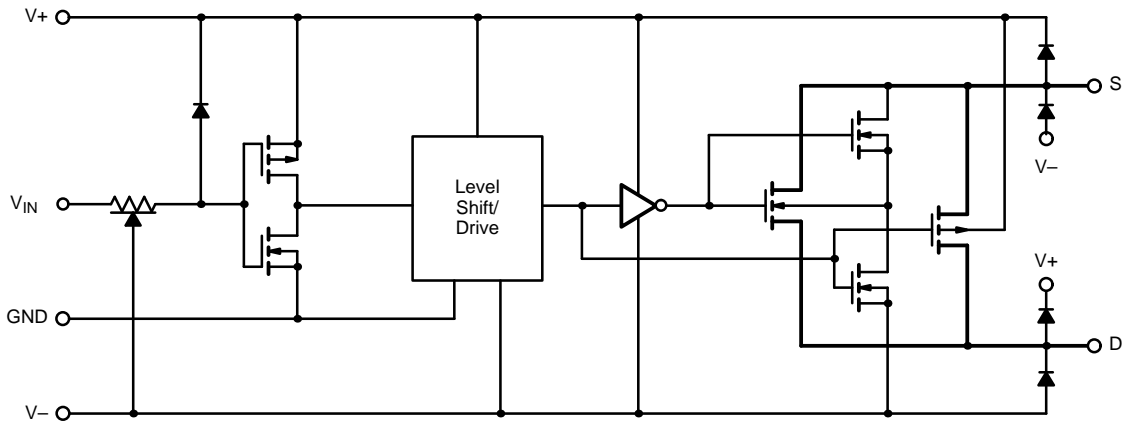


FIGURE 1.

TEST CIRCUITS

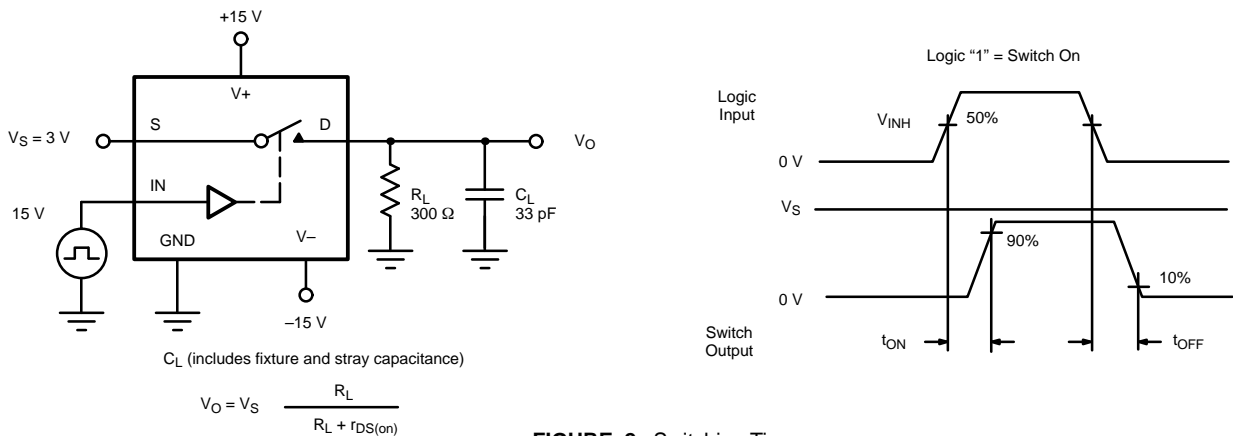
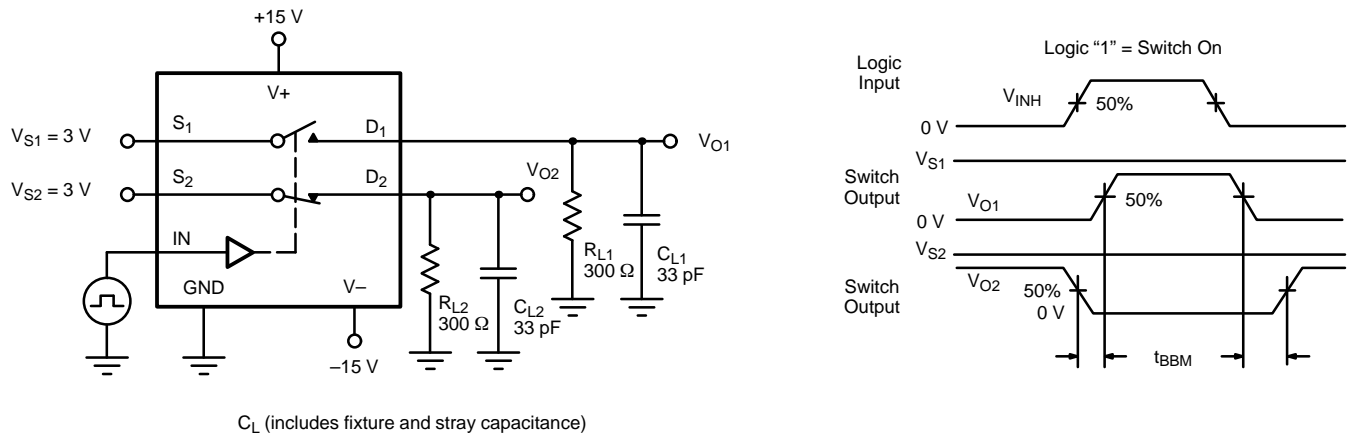
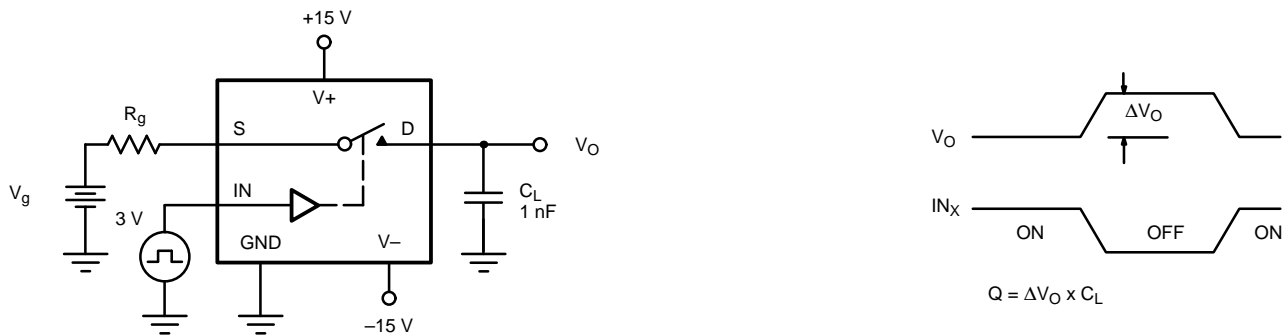


FIGURE 2. Switching Time

TEST CIRCUITS

FIGURE 3. Break-Before-Make SPDT (DG305A, DG307A)

FIGURE 4. Charge Injection

APPLICATION HINTS^a				
V+ Positive Supply Voltage (V)	V- Negative Supply Voltage (V)	GND Voltage (V)	V_{IN} Logic Input Voltage $V_{INH(min)}/V_{INL(max)}$ (V)	V_S or V_D Analog Voltage Range (V)
15	-15	0	11/3.5	-15 to 15
20	-20	0	11/3.5	-20 to 20
15	0	0	11/3.5	0 to 15

Notes:

a. Application Hints are for DESIGN AID ONLY, not guaranteed and not subject to production testing.

APPLICATIONS

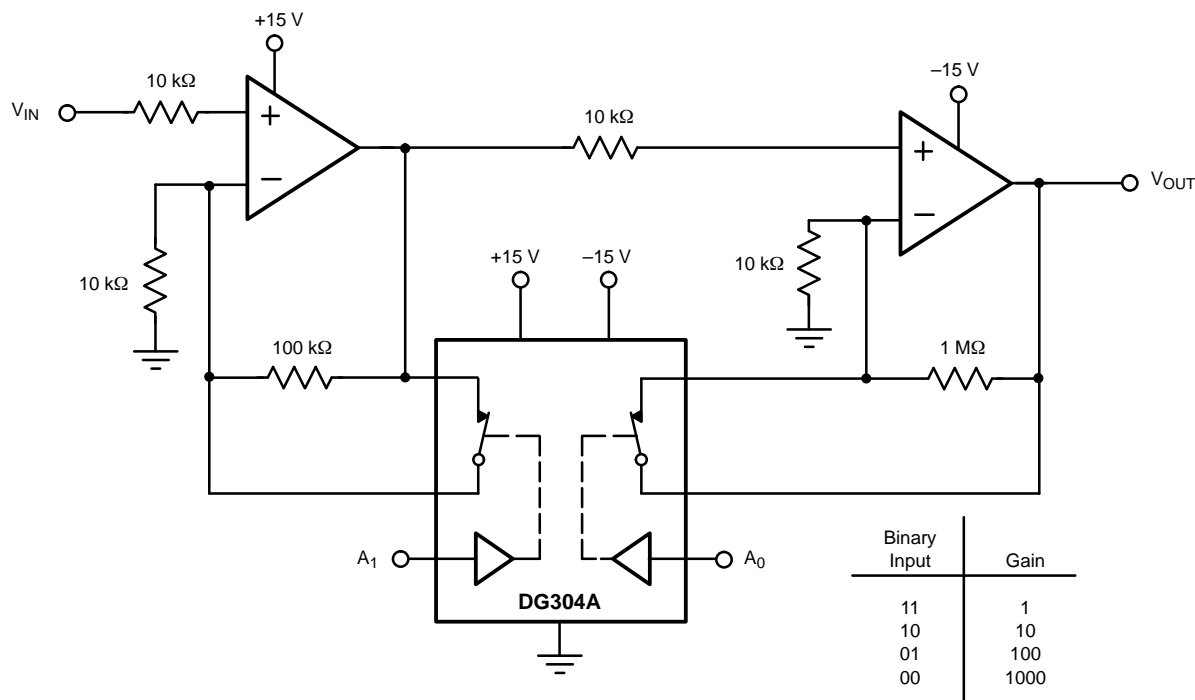


FIGURE 5. Low Power Binary to 10^n Gain Low Frequency Amplifier

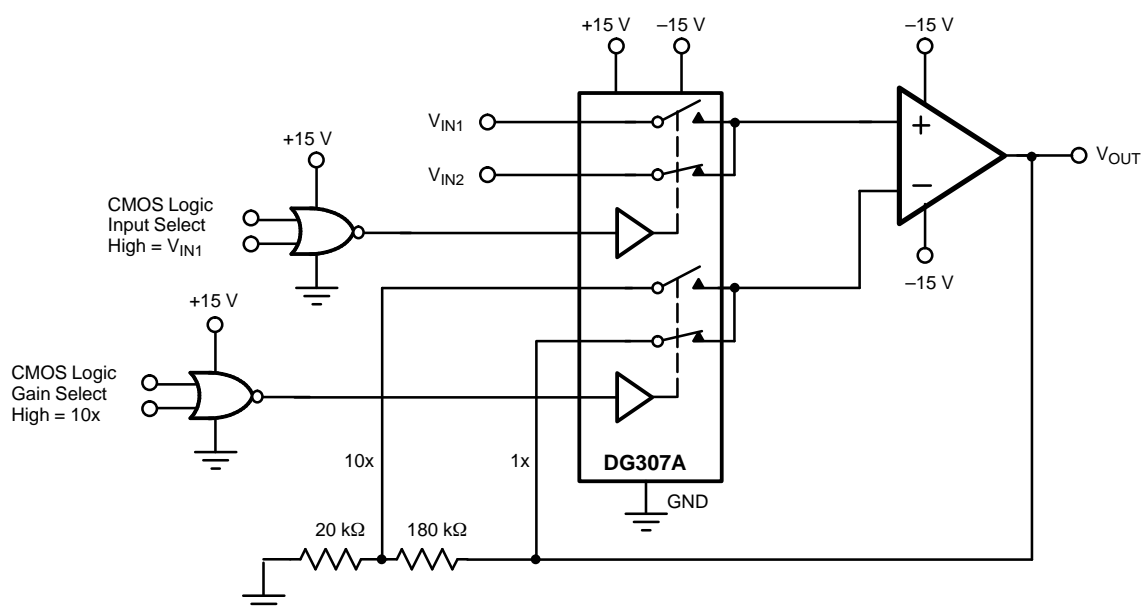


FIGURE 6. Low Power Non-Inverting Amplifier with Digitally Selectable Inputs and Gain



Disclaimer

All product specifications and data are subject to change without notice.

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 herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

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.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.