



Improved Quad CMOS Analog Switches

FEATURES

- $\pm 22\text{-V}$ Supply Voltage Rating
- CMOS Compatible Logic
- Low On-Resistance— $r_{DS(on)}$: $45\ \Omega$
- Low Leakage— $I_{D(on)}$: $20\ \text{pA}$
- Single Supply Operation Possible
- Extended Temperature Range
- Fast Switching— t_{ON} : $< 200\ \text{ns}$
- Low Glitching— Q : $1\ \text{pC}$

BENEFITS

- Wide Analog Signal Range
- Simple Logic Interface
- Higher Accuracy
- Minimum Transients
- Reduced Power Consumption
- Superior to DG308A/309
- Space Savings (TSSOP)

APPLICATIONS

- Industrial Instrumentation
- Test Equipment
- Communications Systems
- Disk Drives
- Computer Peripherals
- Portable Instruments
- Sample-and-Hold Circuits

DESCRIPTION

The DG308B/309B analog switches are highly improved versions of the industry-standard DG308A/309. 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.

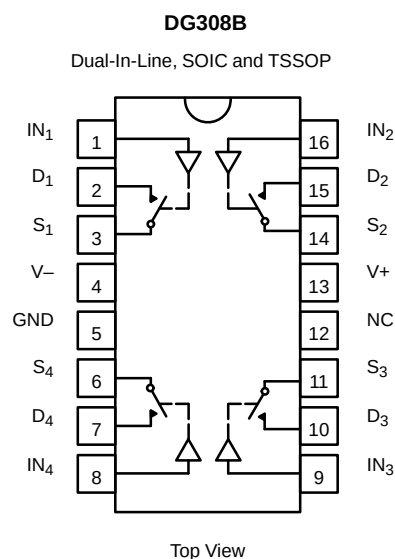
These quad single-pole single-throw switches are designed for a wide variety of applications in telecommunications, instrumentation, process control, computer peripherals, etc. An improved charge injection compensation design minimizes

switching transients. The DG308B and DG309B can handle up to $\pm 22\text{-V}$ input signals. An epitaxial layer prevents latchup.

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

The DG308B is a normally open switch and the DG309B is a normally closed switch. (See Truth Table.)

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE		
Logic	DG308B	DG309B
0	OFF	ON
1	ON	OFF

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

ORDERING INFORMATION		
Temp Range	Package	Part Number
-40 to 85°C	16-Pin Plastic DIP	DG308BDJ
		DG309BDJ
	16-Pin Narrow SOIC	DG308BDY
		DG309BDY
	16-Pin TSSOP	DG308BDQ
		DG309BDQ
-55 to 125°C	16-Pin CerDIP	DG308BAK
		DG308BAK/883
		DG309BAK
		DG309BAK/883

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+) +2 V
or 30 mA, whichever occurs first

Current, Any Terminal 30 mA

Peak Current, S or D

(Pulsed at 1 ms, 10% duty cycle max) 100 mA

Storage Temperature (AK, Suffix) –65 to 150°C

(DJ, DY, DQ Suffix) –65 to 125°C

Power Dissipation (Package)^b16-Pin Plastic DIP^c 470 mW16-Pin Narrow SOIC and TSSOP^d 640 mW16-Pin CerDIP^e 900 mW

Notes:

a. Signals on S_X, D_X, or IN_X 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

e. Derate 12 mW/°C above 75°C

SPECIFICATIONS^a

Parameter	Symbol	Test Conditions Unless Specified V ₊ = 15 V, V _– = –15 V V _{IN} = 11 V, 3.5 V ^f	Temp ^b	Typ ^c	A Suffix –55 to 125°C		D Suffix –40 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 Full	45		85 100		85 100	Ω
r _{DS(on)} Match	Δr _{DS(on)}		Room	2					%
Source Off Leakage Current	I _{S(off)}	V _S = ±14 V, V _D = ∓14 V	Room Full	± 0.01	–0.5 –20	0.5 20	–0.5 –5	0.5 5	nA
Drain Off Leakage Current	I _{D(off)}	V _D = ±14 V, V _S = ∓14 V	Room Full	± 0.01	–0.5 –20	0.5 20	–0.5 –5	0.5 5	
Drain On Leakage Current	I _{D(on)}	V _S = V _D = ±14 V	Room Full	± 0.02	–0.5 –40	0.5 40	–0.5 –10	0.5 10	
Digital Control									
Input Voltage High	V _{INH}		Full		11		11		V
Input Voltage Low	V _{INL}		Full			3.5		3.5	
Input Current	I _{INH} or I _{INL}	V _{INH} or V _{INL}	Full		–1	1	–1	1	μA
Input Capacitance	C _{IN}		Room	5					pF
Dynamic Characteristics									
Turn-On Time	t _{ON}	V _S = 3 V, See Figure 2	Room			200		200	ns
Turn-Off Time	t _{OFF}		Room			150		150	
Charge Injection	Q	C _L = 1000 pF, V _g = 0 V, R _g = 0 Ω	Room	1					pC
Source-Off Capacitance	C _{S(off)}	V _S = 0 V, f = 1 MHz	Room	5					pF
Drain-Off Capacitance	C _{D(off)}		Room	5					
Channel On Capacitance	C _{D(on)}	V _D = V _S = 0 V, f = 1 MHz	Room	16					
Off Isolation	OIRR	C _L = 15 pF, R _L = 50 Ω V _S = 1 V _{RMS} , f = 100 kHz	Room	90					dB
Channel-to-Channel Crosstalk	X _{TALK}		Room	95					

**SPECIFICATIONS^a**

Parameter	Symbol	Test Conditions Unless Specified V+ = 15 V, V– = –15 V VIN = 11 V, 3.5 V ^f	Temp ^b	Typ ^c	A Suffix –55 to 125°C		D Suffix –40 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Power Supply									
Positive Supply Current	I+	VIN = 0 or 15 V	Room Full			1 5		1 5	μA
Negative Supply Current	I–		Room Full		–1 –5		–1 –5		
Power Supply Range for Continuous Operation	VOP		Full		± 4	± 22	± 4	± 22	V

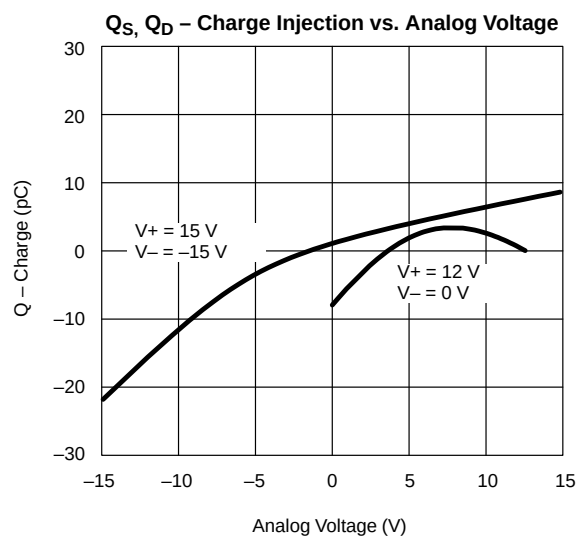
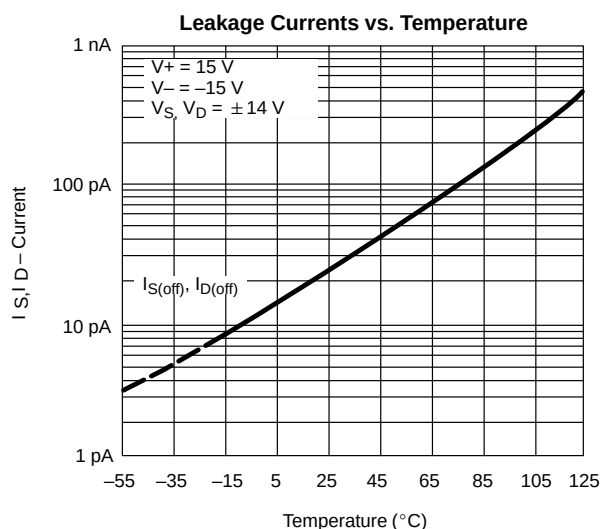
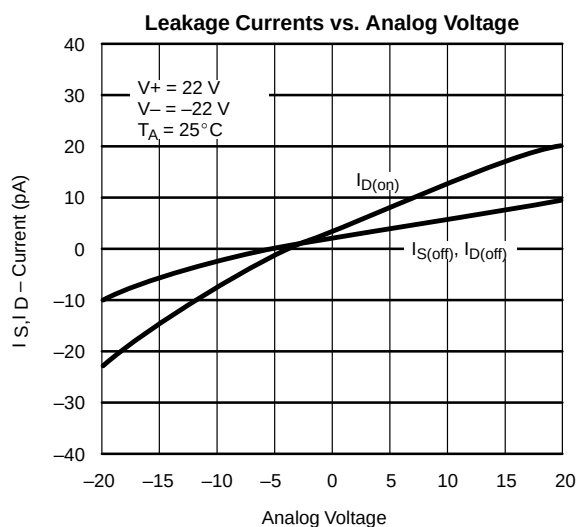
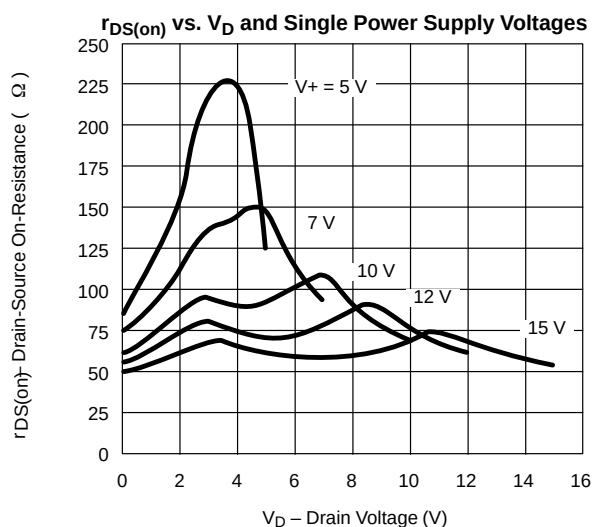
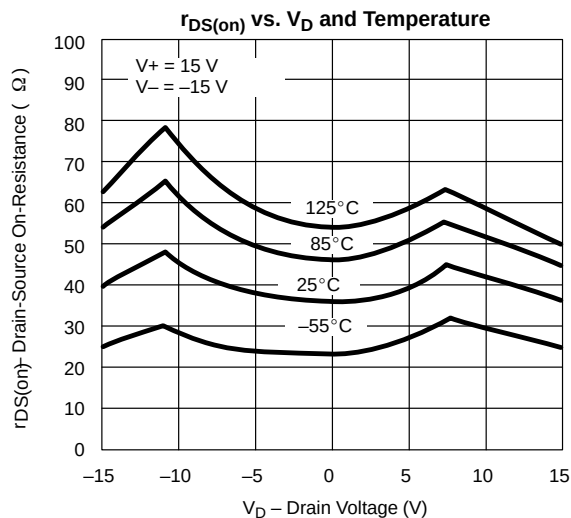
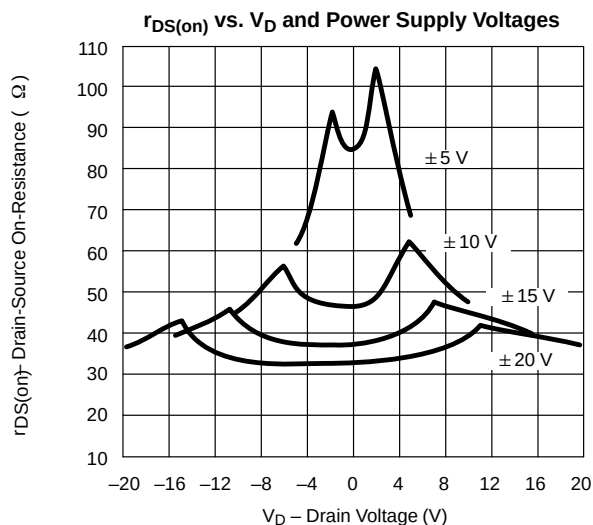
SPECIFICATIONS^a FOR SINGLE SUPPLY

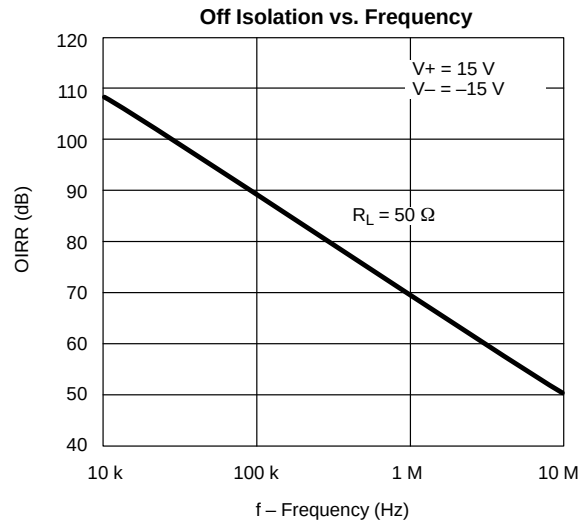
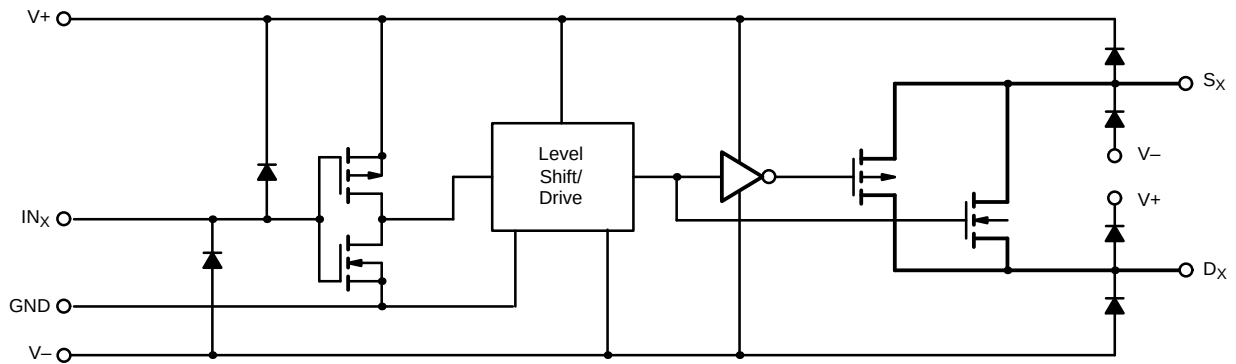
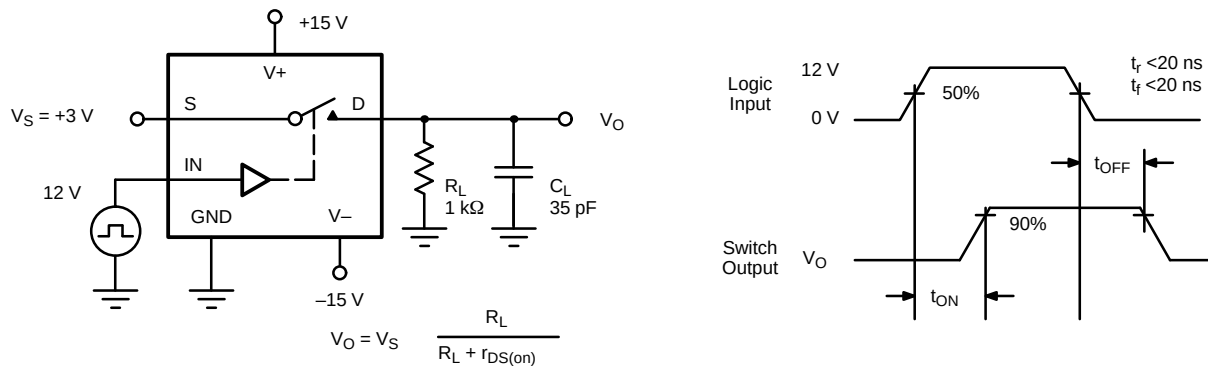
Parameter	Symbol	Test Conditions Unless Specified V ₊ = 12 V, V _– = 0 V V _{IN} = 11 V, 3.5 V ^f	Temp ^b	Typ ^c	A Suffix –55 to 125°C		D Suffix –40 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	V _{ANALOG}		Full		0	12	0	12	V
Drain-Source On-Resistance	r _{DS(on)}	V _D = 3 V, 8 V, I _S = 1 mA	Room Full	90		160 200		160 200	Ω
Dynamic Characteristics									
Turn-On Time	t _{ON}	V _S = 8 V, See Figure 2	Room			300		300	ns
Turn-Off Time	t _{OFF}		Room			200		200	
Charge Injection	Q	C _L = 1 nF, V _{gen} = 6 V, R _{gen} = 0 Ω	Room	4					pC
Power Supply									
Positive Supply Current	I ₊	V _{IN} = 0 or 12 V	Room Full			1 5		1 5	μA
Negative Supply Current	I _–		Room Full		–1 –5		–1 –5		
Power Supply Range for Continuous Operation	V _{OP}		Full		4	44	4	44	V

Notes:

- Refer to PROCESS OPTION FLOWCHART.
- Room = 25°C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guaranteed by design, not subject to production test.
- 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

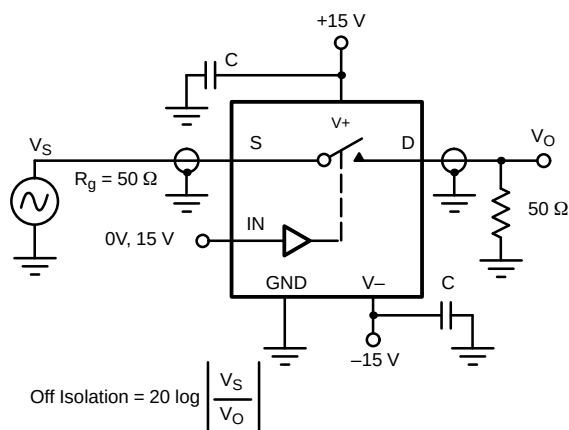


FIGURE 3. Off Isolation

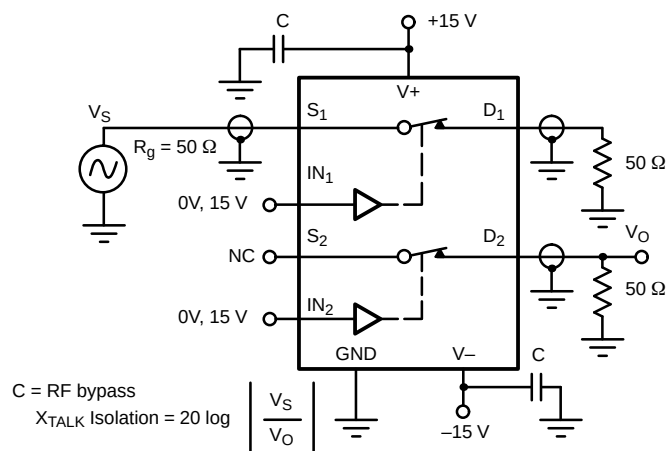


FIGURE 4. Channel-to-Channel Crosstalk

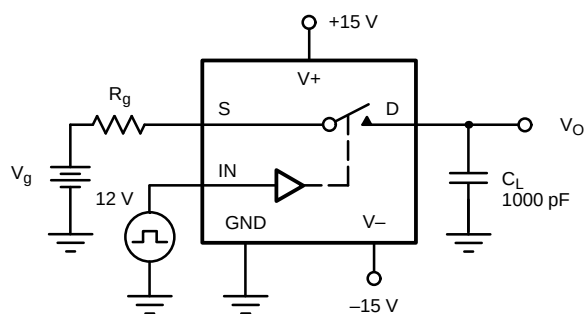
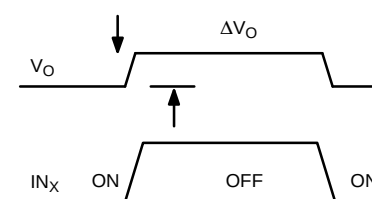


FIGURE 5. Charge Injection



ΔV_O = measured voltage error due to charge injection
The charge injection in coulombs is $Q = C_L \times \Delta V_O$

APPLICATIONS

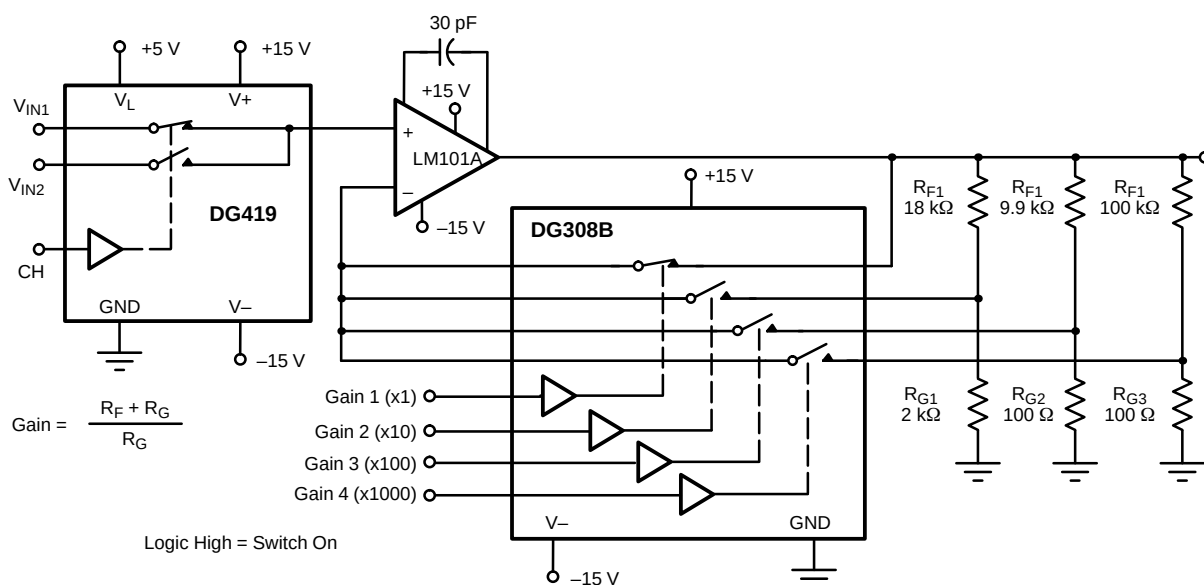
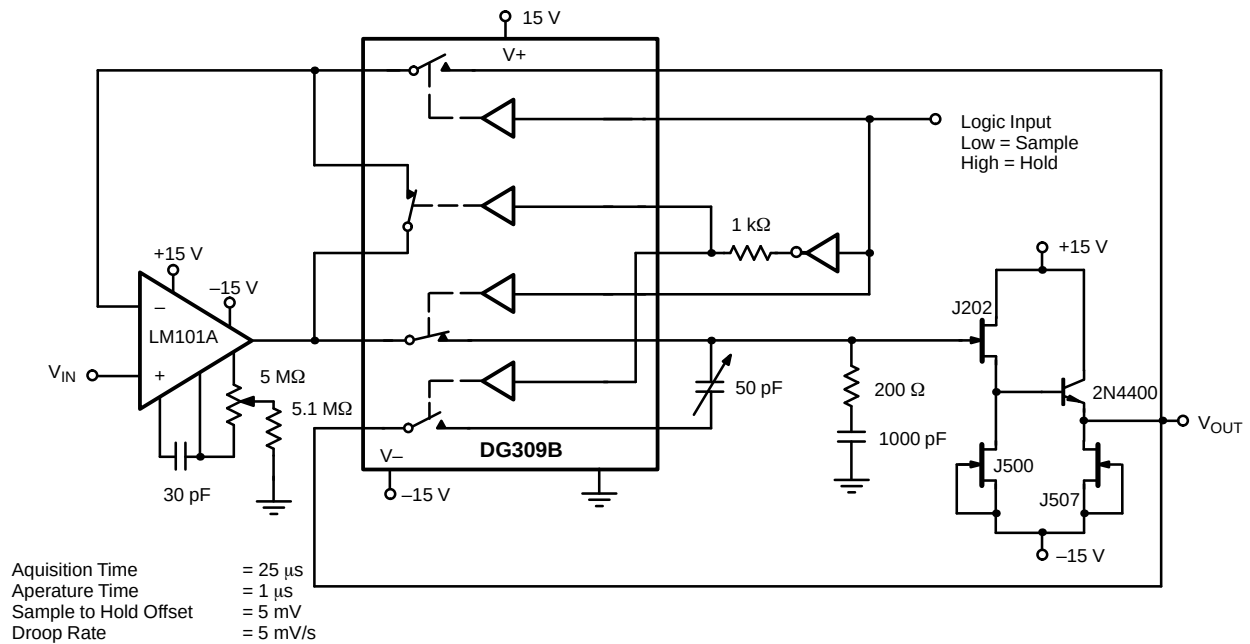
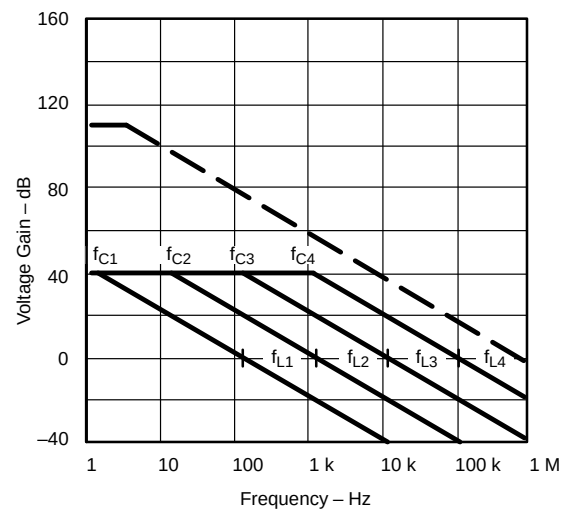
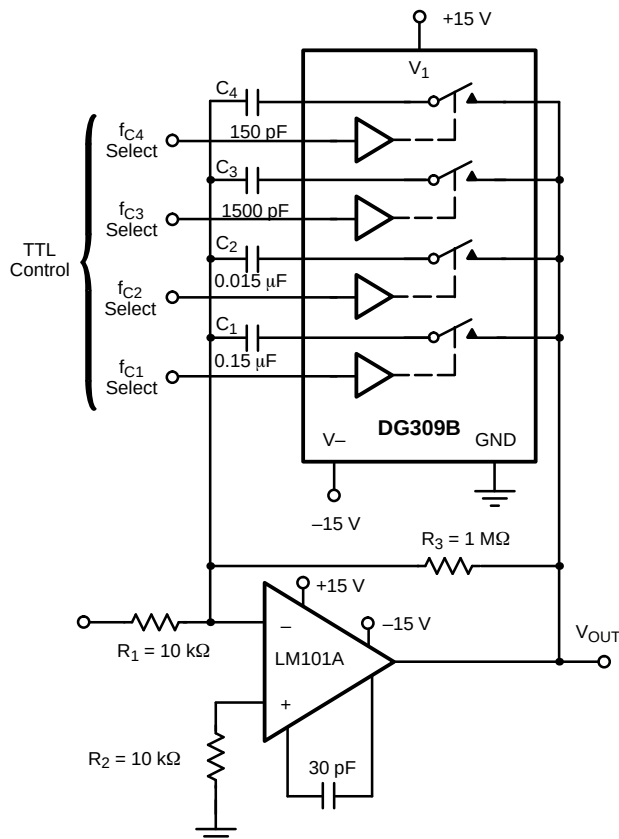


FIGURE 6. A Precision Amplifier with Digitally Programmable Inputs and Gains

APPLICATIONS

FIGURE 7. Sample-and-Hold


$$\begin{aligned}
 A_L \text{ (Voltage Gain Below Break Frequency)} &= \frac{R_3}{R_1} = 100 \text{ (40 dB)} \\
 f_C \text{ (Break Frequency)} &= \frac{1}{2\pi R_3 C_X} \\
 f_L \text{ (Unity Gain Frequency)} &= \frac{1}{2\pi R_1 C_X} \\
 \text{Max Attenuation} &= \frac{f_{DS(on)}}{10 \text{ k}\Omega} \approx -40 \text{ dB}
 \end{aligned}$$

FIGURE 8. Active Low Pass Filter with Digitally Selected Break Frequency