



Improved Quad CMOS Analog Switches

FEATURES

- $\pm 22\text{-V}$ Supply Voltage Rating
- TTL and CMOS Compatible Logic
- Low On-Resistance— $r_{DS(on)}$: $50\ \Omega$
- Low Leakage— $I_{D(on)}$: $20\ \text{pA}$
- Single Supply Operation Possible
- Extended Temperature Range
- Fast Switching— t_{ON} : $120\ \text{ns}$
- Low Charge Injection— Q : $1\ \text{pC}$

BENEFITS

- Wide Analog Signal Range
- Simple Logic Interface
- Higher Accuracy
- Minimum Transients
- Reduced Power Consumption
- Superior to DG211/212
- Space Savings (TSSOP)

APPLICATIONS

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

DESCRIPTION

The DG211B/212B analog switches are highly improved versions of the industry-standard DG211/212. 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.

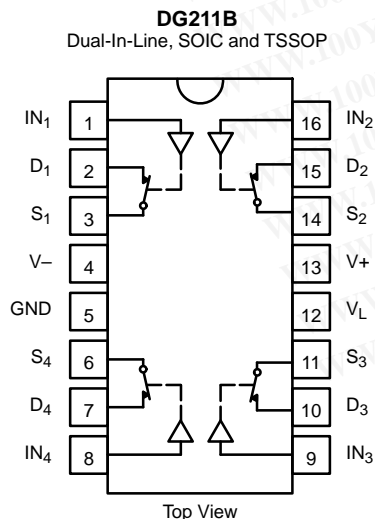
These quad single-pole single-throw switches are designed for a wide variety of applications in telecommunications, instrumentation, process control, computer peripherals, etc. An improved charge injection compensation design minimizes switching transients. The DG211B and DG212B can handle

up to $\pm 22\ \text{V}$, and have an improved continuous current rating of $30\ \text{mA}$. 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 DG211B is a normally closed switch and the DG212B is a normally open switch. (See Truth Table.)

FUNCTIONAL BLOCK DIAGRAM AND PIN CONFIGURATION



TRUTH TABLE		
Logic	DG211B	DG212B
0	ON	OFF
1	OFF	ON

Logic "0" $\leq 0.8\ \text{V}$
 Logic "1" $\geq 2.4\ \text{V}$

ORDERING INFORMATION		
Temp Range	Package	Part Number
-40 to 85°C	16-Pin Plastic DIP	DG211BDJ
		DG212BDJ
	16-Pin Narrow SOIC	DG211BDY
		DG212BDY
	16-Pin TSSOP	DG211BDQ
		DG212BDQ

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	-65 to 125°C

Power Dissipation (Package)^b

16-Pin Plastic DIP ^c	470 mW
16-Pin Narrow SOIC and TSSOP ^d	640 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

SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

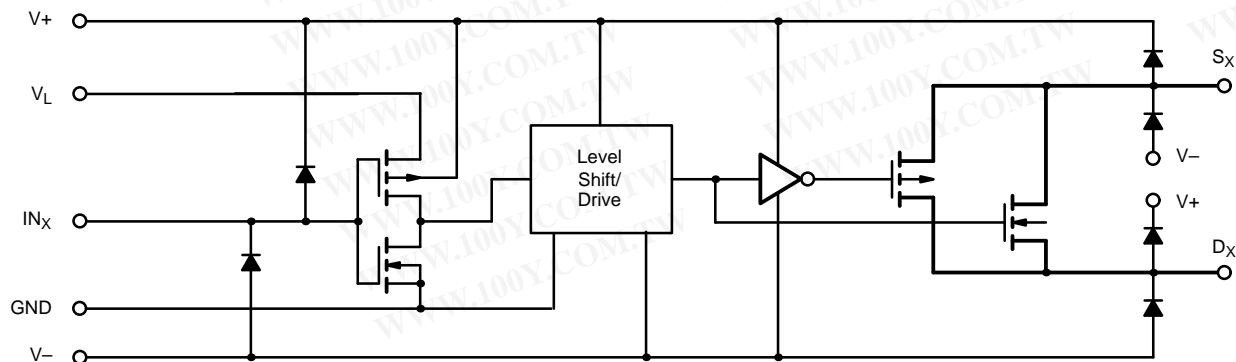


FIGURE 1.



SPECIFICATIONS								
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$, $V_- = -15\text{ V}$ $V_L = 5\text{ V}$, $V_{IN} = 2.4\text{ V}$, 0.8 V^e	Temp ^a	D Suffix -40 to 85°C			Unit	
				Min ^b	Typ ^c	Max ^b		
Analog Switch								
Analog Signal Range ^d	V_{ANALOG}		Full	-15		15	V	
Drain-Source On-Resistance	$r_{DS(on)}$	$V_D = \pm 10\text{ V}$, $I_S = 1\text{ mA}$	Room		45	85	Ω	
$r_{DS(on)}$ Match	$\Delta r_{DS(on)}$		Full			100		
Source Off Leakage Current	$I_{S(off)}$	$V_S = \pm 14\text{ V}$, $V_D = \mp 14\text{ V}$	Room	-0.5	± 0.01	0.5	nA	
Drain Off Leakage Current	$I_{D(off)}$	$V_D = \pm 14\text{ V}$, $V_S = \mp 14\text{ V}$	Full	-5		5		
Drain On Leakage Current	$I_{D(on)}$	$V_S = V_D = \pm 14\text{ V}$	Room	-0.5	± 0.02	0.5		
			Full	-10		10		
Digital Control								
Input Voltage High	V_{INH}		Full	2.4			V	
Input Voltage Low	V_{INL}		Full			0.8		
Input Current	I_{INH} or I_{INL}	V_{INH} or V_{INL}	Full	-1		1	μA	
Input Capacitance	C_{IN}		Room		5		pF	
Dynamic Characteristics								
Turn-On Time	t_{ON}	$V_S = 10\text{ V}$ See Figure 2	Room			300	ns	
Turn-Off Time	t_{OFF}		Room			200		
Charge Injection	Q	$C_L = 1000\text{ pF}$, $V_g = 0\text{ V}$, $R_g = 0\ \Omega$	Room		1		pC	
Source-Off Capacitance	$C_{S(off)}$	$V_S = 0\text{ V}$, $f = 1\text{ MHz}$	Room		5		pF	
Drain-Off Capacitance	$C_{D(off)}$		Room		5			
Channel On Capacitance	$C_{D(on)}$	$V_D = V_S = 0\text{ V}$, $f = 1\text{ MHz}$	Room		16			
Off Isolation	OIRR	$C_L = 15\text{ pF}$, $R_L = 50\ \Omega$ $V_S = 1\text{ V}_{RMS}$, $f = 100\text{ kHz}$	Room		90		dB	
Channel-to-Channel Crosstalk	X _{TALK}		Room		95			
Power Supply								
Positive Supply Current	I_+	$V_{IN} = 0\text{ or }5\text{ V}$	Room			10	μA	
Negative Supply Current	I_-		Full		-10			50
Logic Supply Current	I_L		Room					10
Power Supply Range for Continuous Operation	V_{OP}		Full	± 4.5		± 22	V	

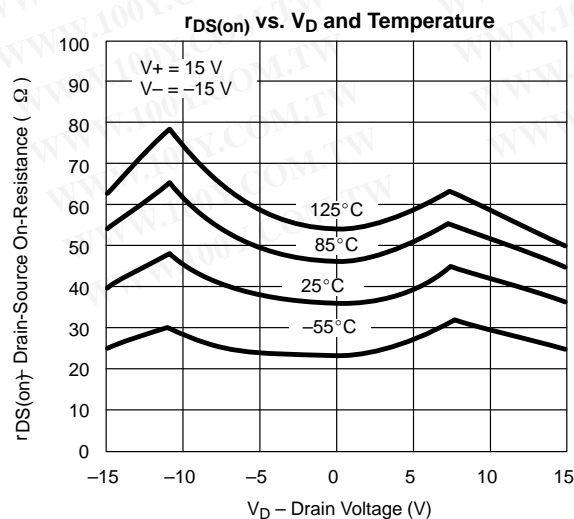
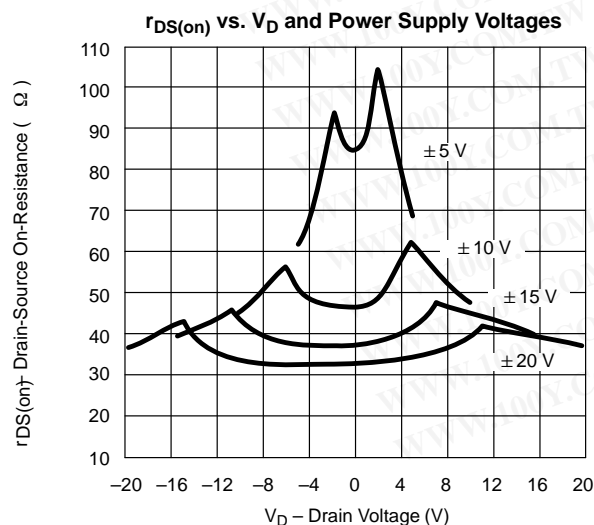


SPECIFICATIONS FOR SINGLE SUPPLY							
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 12\text{ V}, V_- = 0\text{ V}$ $V_L = 5\text{ V}, V_{IN} = 2.4\text{ V}, 0.8\text{ V}^e$	Temp ^a	D Suffix -40 to 85°C			Unit
				Min ^b	Typ ^c	Max ^b	
Analog Switch							
Analog Signal Range ^d	V_{ANALOG}		Full	0		12	V
Drain-Source On-Resistance	$r_{DS(on)}$	$V_D = 3\text{ V}, 8\text{ V}, I_S = 1\text{ mA}$	Room Full		90	160 200	Ω
Dynamic Characteristics							
Turn-On Time	t_{ON}	$V_S = 8\text{ V}$ See Figure 2	Room			300	ns
Turn-Off Time	t_{OFF}		Room			200	
Charge Injection	Q	$C_L = 1\text{ nF}, V_{gen} = 6\text{ V}, R_{gen} = 0\ \Omega$	Room		4		pC
Power Supply							
Positive Supply Current	I_+	$V_{IN} = 0\text{ or }5\text{ V}$	Room Full			10 50	μA
Negative Supply Current	I_-		Room Full	-10 -50			
Logic Supply Current	I_L		Room Full			10 50	
Power Supply Range for Continuous Operation	V_{OP}		Full	+4.5		+25	V

Notes:

- Room = 25°C, Full = as determined by the operating temperature suffix.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- Guaranteed by design, not subject to production test.
- V_{IN} = input voltage to perform proper function.

TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

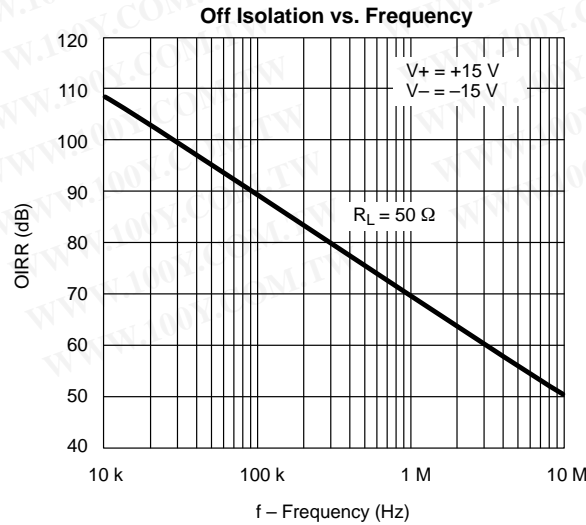
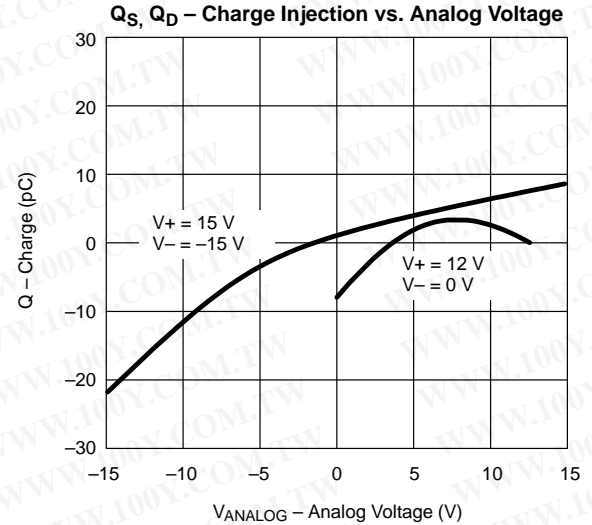
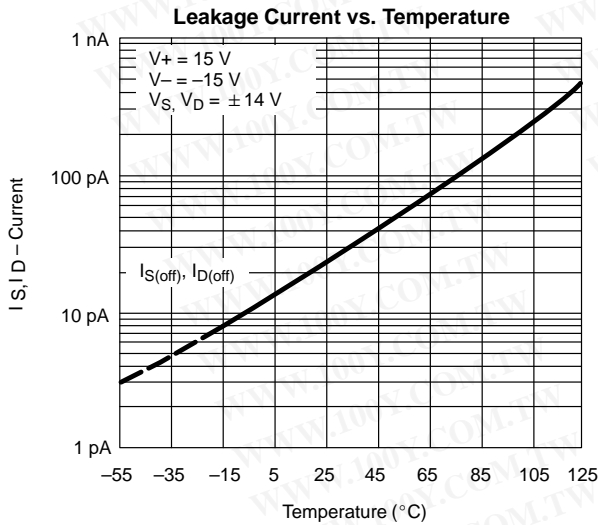
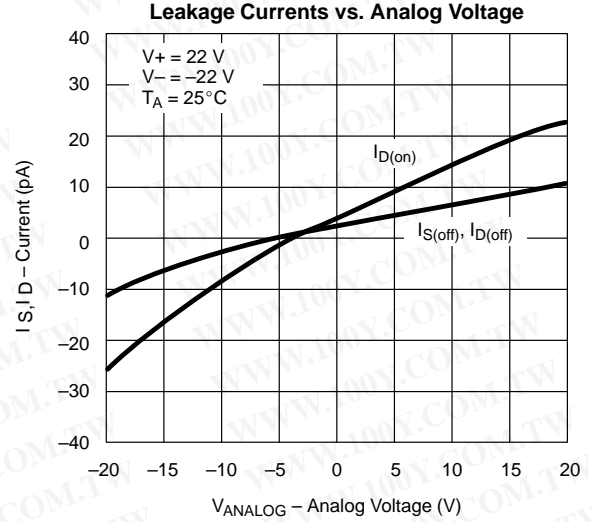
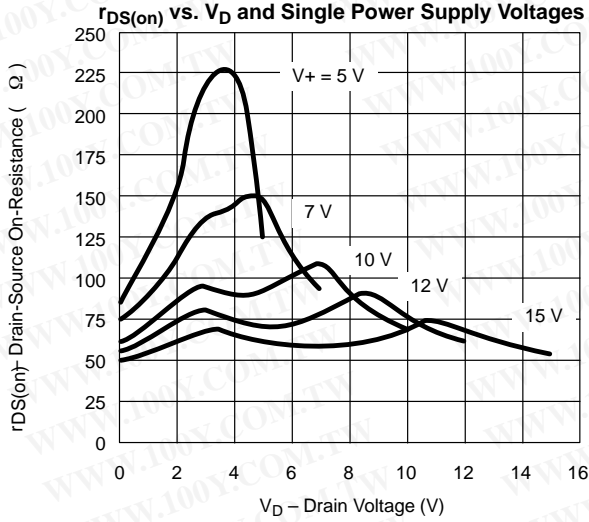




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DG211B/212B
Vishay Siliconix

TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



TEST CIRCUITS

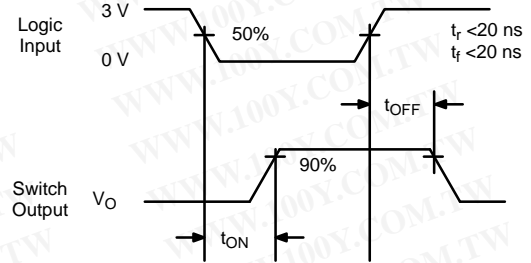
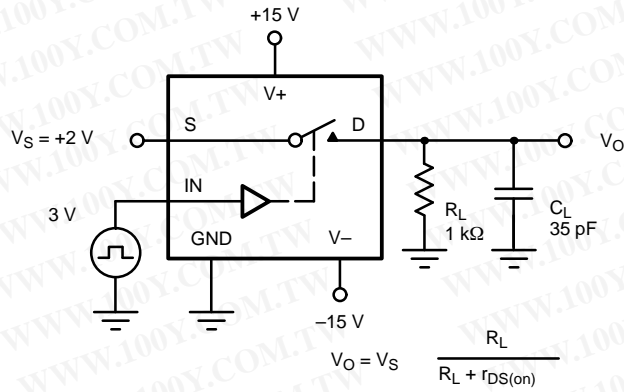


FIGURE 2. Switching Time

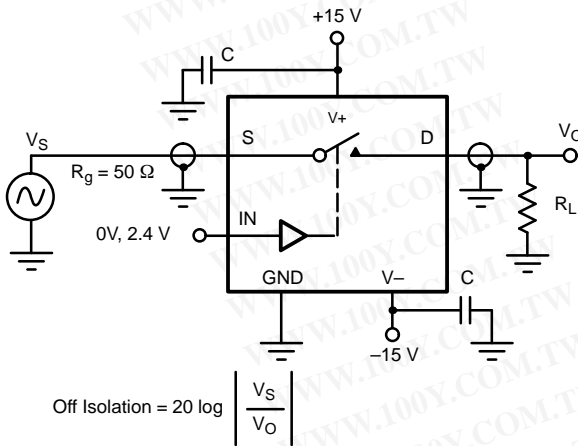


FIGURE 3. Off Isolation

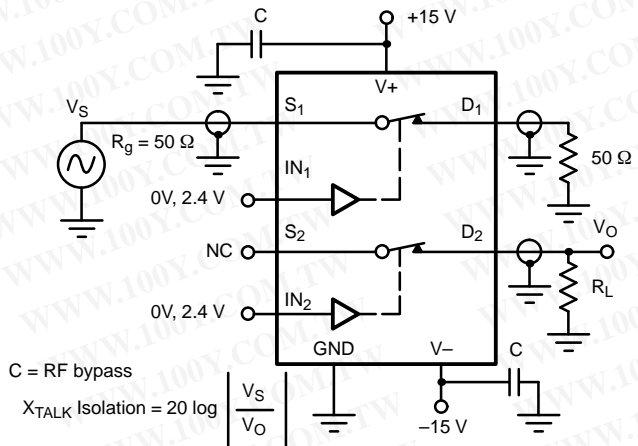
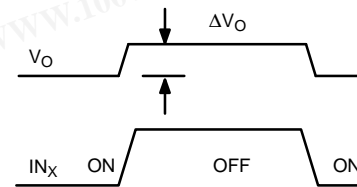
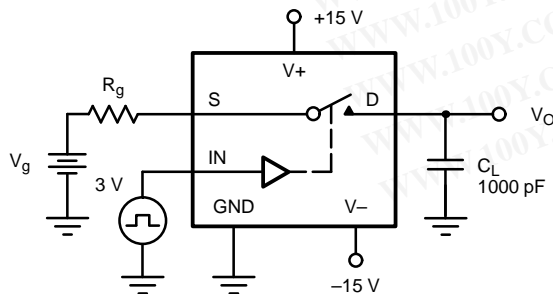


FIGURE 4. Channel-to-Channel Crosstalk



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

FIGURE 5. Charge Injection

APPLICATIONS

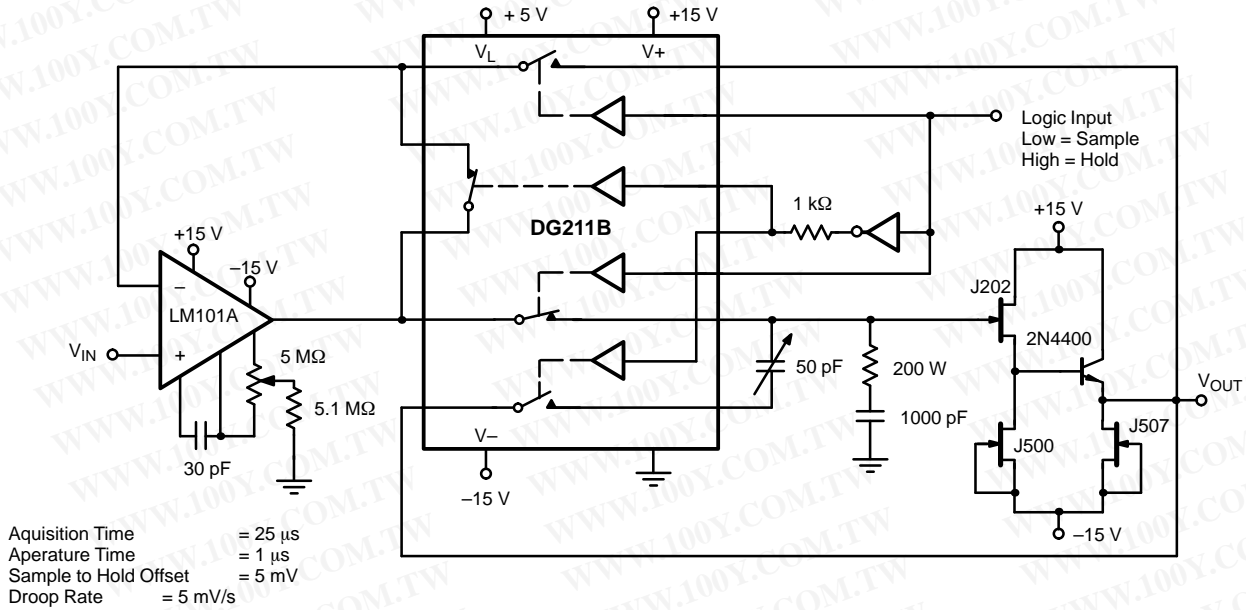
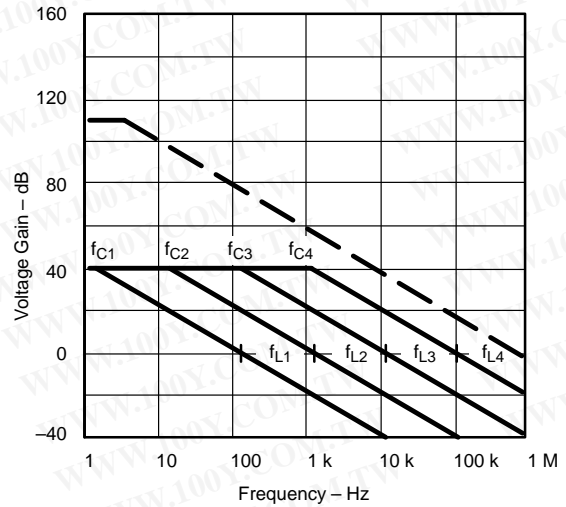
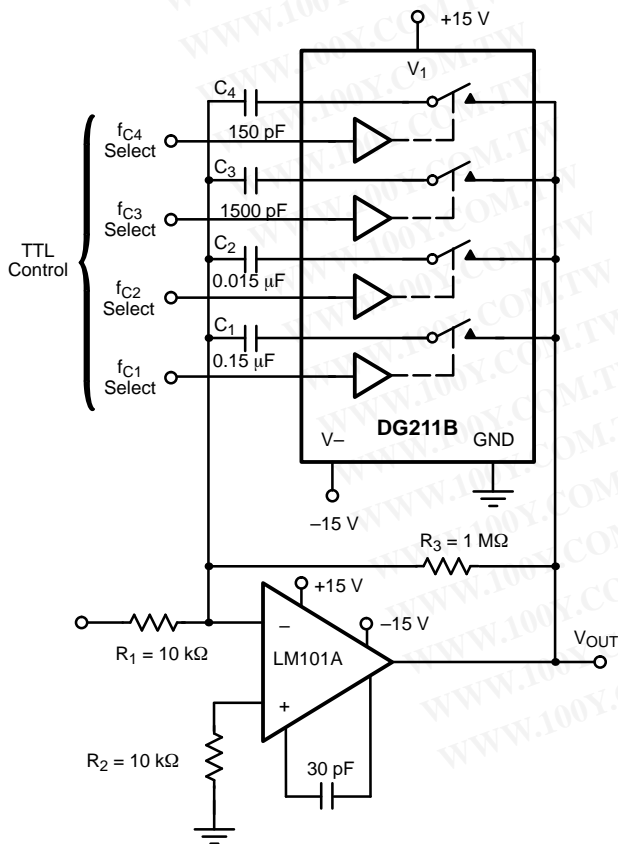


FIGURE 6. Sample-and-Hold



$$A_L \text{ (Voltage Gain Below Break Frequency)} = \frac{R_3}{R_1} = 100 \text{ (40 dB)}$$

$$f_C \text{ (Break Frequency)} = \frac{1}{2\pi R_3 C_X}$$

$$f_L \text{ (Unity Gain Frequency)} = \frac{1}{2\pi R_1 C_X}$$

$$\text{Max Attenuation} = \frac{\Gamma_{DS(on)}}{10 \text{ k}\Omega} \approx -47 \text{ dB}$$

FIGURE 7. Active Low Pass Filter with Digitally Selected Break Frequency

APPLICATIONS

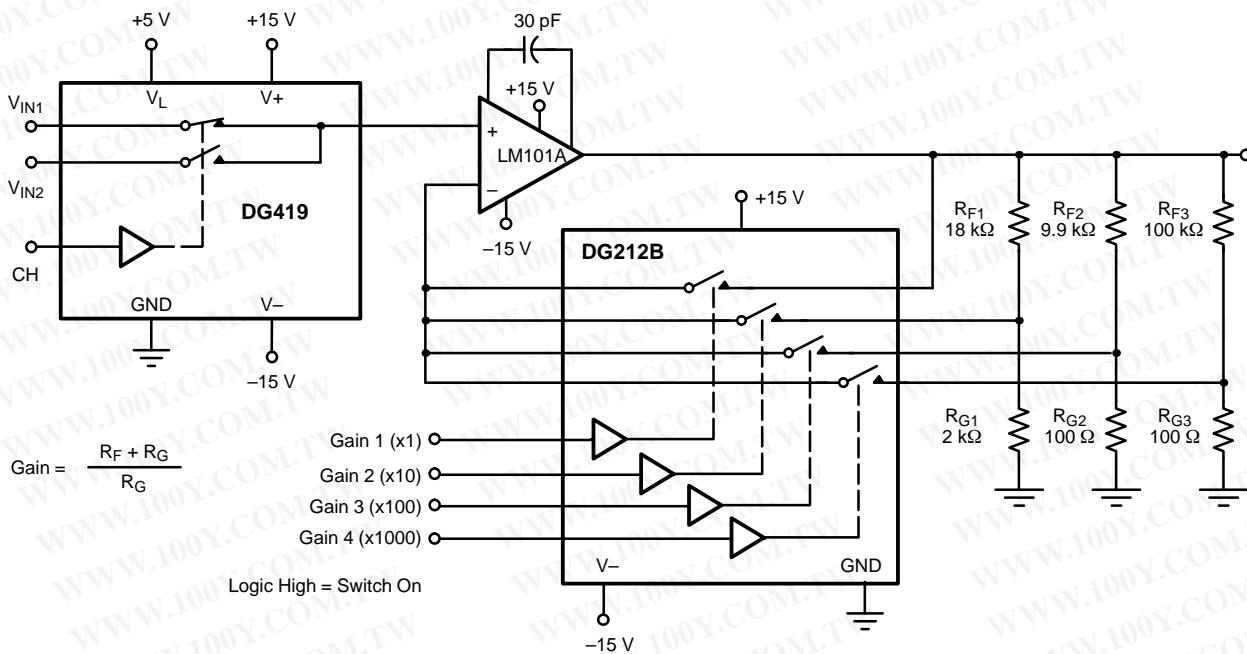


FIGURE 8. A Precision Amplifier with Digitally Programmable Input and Gains