

August 1997

## SPST 4-Channel Analog Switches

### Features

- Switches  $\pm 15V$  Analog Signals
- TTL Compatibility
- Logic Inputs Accept Negative Voltages
- $r_{ON} \dots \dots \dots \leq 175\Omega$

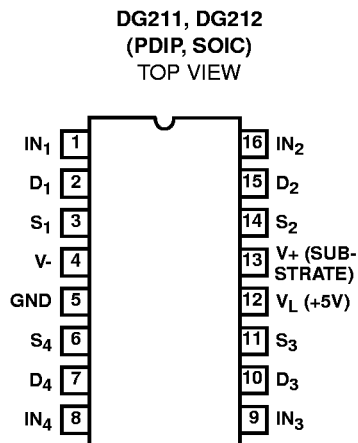
### Description

The DG211 and DG212 are low cost, CMOS monolithic, Quad SPST analog switches. These can be used in general purpose switching applications for communications, instrumentation, process control and computer peripheral equipment. Both devices provide true bidirectional performance in the ON condition and will block signals to 30V<sub>p-p</sub> in the OFF condition. The DG211 and DG212 differ only in that the digital control logic is inverted, as shown in the truth table.

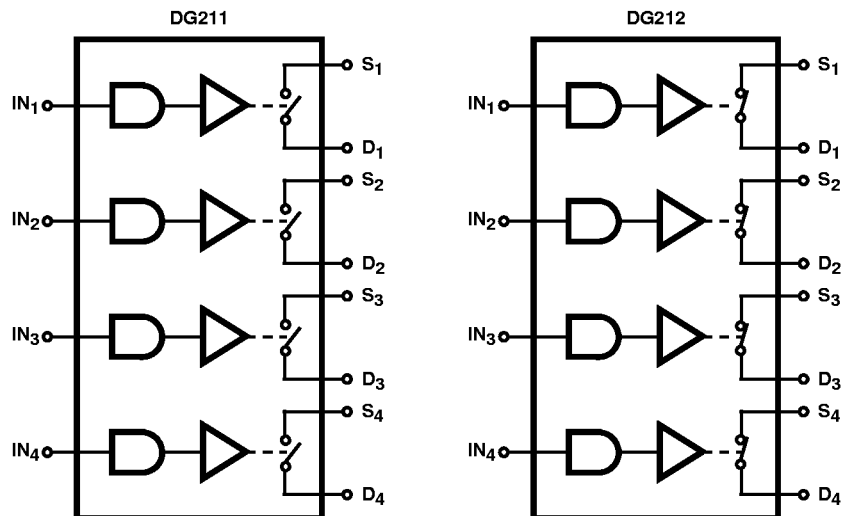
### Ordering Information

PART NUMBER	TEMP. RANGE (°C)	PACKAGE	PKG. NO.
DG211CJ	0 to 70	16 Ld PDIP	E16.3
DG212CJ	0 to 70	16 Ld PDIP	E16.3
DG211CY	0 to 70	16 Ld SOIC	M16.15
DG212CY	0 to 70	16 Ld SOIC	M16.15

### Pinout



### Functional Block Diagrams



- NOTES:
1. Four SPST switches per package.
  2. Switches shown for logic "1" input.

### TRUTH TABLE

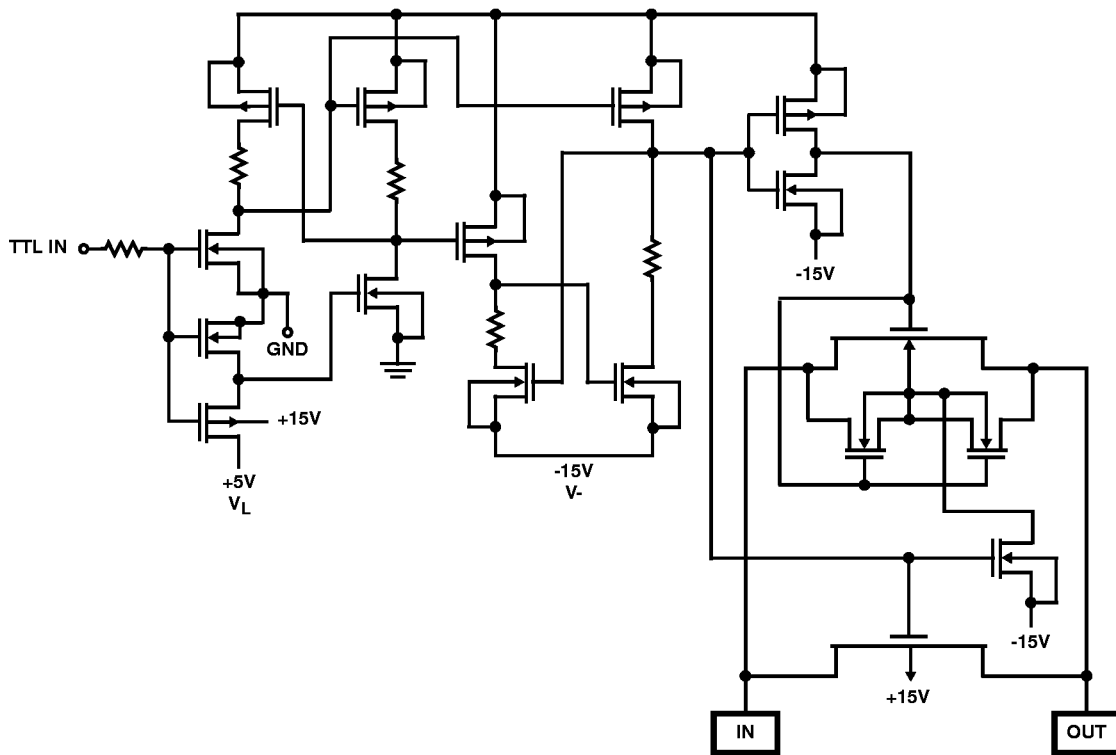
LOGIC	DG211	DG212
0	ON	OFF
1	OFF	ON

Logic "0"  $\leq 0.8V$ , Logic "1"  $\geq 2.4V$

DG211, DG212

Schematic Diagram

DG211 ( $1/4$  AS SHOWN)



# DG211, DG212

## Absolute Maximum Ratings

V+ to V-	44V
V <sub>IN</sub> to Ground	V-, V+
V <sub>L</sub> to Ground	-0.3V, 25V
V <sub>S</sub> or V <sub>D</sub> to V+	0, -36V
V <sub>S</sub> or V <sub>D</sub> to V-	0, 36V
V+ to Ground	25V
V- to Ground	-25V
Current, any Terminal Except S or D	30mA
Continuous Current, S or D	20mA
Peak Current, S or D (Pulsed at 1ms, 10% Duty Cycle Max)	70mA

## Thermal Information

Thermal Resistance (Typical, Note 1)	$\theta_{JA}$ (°C/W)
PDIP Package	100
SOIC Package	120
Maximum Junction Temperature	150°C
Maximum Storage Temperature Range	-65°C to 125°C
Maximum Lead Temperature (Soldering 10s)	300°C (SOIC - Lead Tips Only)

## Operating Conditions

Temperature Range . . . . . 0°C to 70°C

*CAUTION: Stresses above those listed in "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress only rating and operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.*

### NOTE:

1.  $\theta_{JA}$  is measured with the component mounted on an evaluation PC board in free air.

## Electrical Specifications $V_+ = +15V, V_- = -15V, V_L = +5V, GND, T_A = 25^\circ C$

PARAMETER	TEST CONDITIONS	(NOTE 1)	(NOTE 2)	MAX	UNITS	
		MIN	TYP			
<b>DYNAMIC CHARACTERISTICS</b>						
Turn-On Time, $t_{ON}$	See Figure 1 $V_S = 10V, R_L = 1k\Omega, C_L = 35pF$	-	460	-	ns	
Turn-Off Time, $t_{OFF1}$		-	360	-	ns	
$t_{OFF2}$		-	450	-	ns	
Source OFF Capacitance, $C_{S(OFF)}$	$V_S = 0V, V_{IN} = 5V, f = 1MHz$ (Note 2) $V_D = 0V, V_{IN} = 5V, f = 1MHz$ (Note 2) $V_D = V_S = 0V, V_{IN} = 0V, f = 1MHz$ (Note 2)	-	5	-	pF	
Drain OFF Capacitance, $C_{D(OFF)}$		-	5	-	pF	
Channel ON Capacitance, $C_{D + S(ON)}$		-	16	-	pF	
OFF Isolation, OIRR (Note 4)	$V_{IN} = 5V, R_L = 1k\Omega, C_L = 15pF, V_S = 1V_{RMS},$ $f = 100kHz$ (Note 2)	-	70	-	dB	
Crosstalk (Channel to Channel), CCRR		-	90	-	dB	
<b>INPUT</b>						
Input Current with Voltage High, $I_{INH}$	$V_{IN} = 2.4V$	-1.0	-0.0004	-	$\mu A$	
	$V_{IN} = 15V$	-	0.003	1.0	$\mu A$	
Input Current with Voltage Low, $I_{INL}$	$V_{IN} = 0V$	-1.0	-0.0004	-	$\mu A$	
<b>SWITCH</b>						
Analog Signal Range, $V_{ANALOG}$	$V_- = -15V, V_L = +5V$	-15	-	15	V	
Drain Source On Resistance, $r_{DS(ON)}$	$V_D = \pm 10V, V_{IN} = 2.4V$ (DG212) $I_S = 1mA, V_{IN} = 0.8V$ (DG211)	-	150	175	$\Omega$	
Source OFF Leakage Current, $I_{S(OFF)}$	$V_{IN} = 2.4V$ (DG211) $V_{IN} = 0.8V$ (DG212)	$V_S = 14V, V_D = -14V$	-	0.01	5.0	nA
		$V_S = -14V, V_D = 14V$	-5.0	-0.02	-	nA
Drain OFF Leakage Current, $I_{D(OFF)}$		$V_S = -14V, V_D = 14V$	-	0.01	5.0	nA
		$V_S = 14V, V_D = -14V$	-5.0	-0.02	-	nA

# DG211, DG212

## Electrical Specifications $V_+ = +15V, V_- = -15V, V_L = +5V, GND, T_A = 25^\circ C$ (Continued)

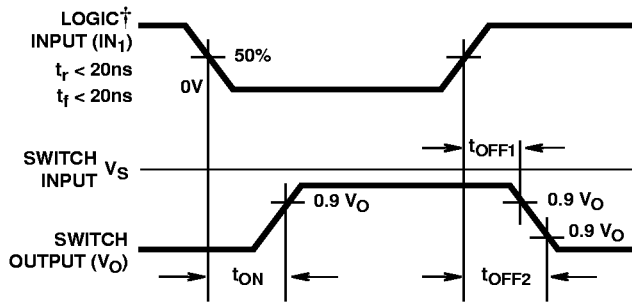
PARAMETER	TEST CONDITIONS	(NOTE 1)	(NOTE 2)	MAX	UNITS
		MIN	TYP		
Drain ON Leakage Current, $I_{D(ON)}$ (Note 3)	$V_S = V_D = -14V, V_{IN} = 0.8V$ (DG211) $V_{IN} = 2.4V$ (DG212)	-	0.1	5.0	nA
		-5.0	-0.15	-	nA
<b>POWER SUPPLY CHARACTERISTICS</b>					
Positive Supply Current, $I_+$	$V_{IN} = 0V$ and $2.4V$	-	0.1	10	$\mu A$
Negative Supply Current, $I_-$		-	0.1	10	$\mu A$
Logic Supply Current, $I_L$		-	0.1	10	$\mu A$

**NOTES:**

- The algebraic convention whereby the most negative value is a minimum, and the most positive is a maximum, is used in this data sheet.
- For design reference only, not 100% tested.
- $I_{D(ON)}$  is leakage from driver into ON switch.
- OFF Isolation =  $20 \log \frac{V_S}{V_D}$ ;  $V_S$  = Input to OFF switch,  $V_D$  = output.
- Switching times only sampled.

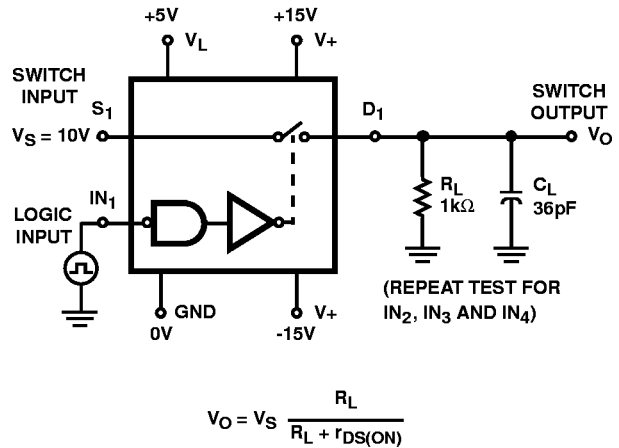
## Test Circuits and Waveforms

Switch output waveform shown for  $V_S =$  constant with logic input waveform as shown. Note the  $V_S$  may be + or - as per switching time test circuit.  $V_O$  is the steady state output with switch on. Feedthrough via gate capacitance may result in spikes at leading and trailing edge of output waveform.



† Logic shown for DG211. Invert for DG212.

**FIGURE 1. SWITCHING TIME TEST WAVEFORMS**



**FIGURE 2. SWITCHING TIME TEST CIRCUIT**

# DG211, DG212

## Die Characteristics

### DIE DIMENSIONS:

2159 $\mu$ m x 2235 $\mu$ m

### METALLIZATION:

Type: Al

Thickness: 10k $\text{\AA}$   $\pm$  1k $\text{\AA}$

### PASSIVATION:

Type: PSG/Nitride

PSG Thickness: 7k $\text{\AA}$   $\pm$  1.4k $\text{\AA}$

Nitride Thickness: 8k $\text{\AA}$   $\pm$  1.2k $\text{\AA}$

### WORST CASE CURRENT DENSITY:

9.1 x 10<sup>4</sup> A/cm<sup>2</sup>

## Metallization Mask Layout

DG211, DG212

