

### ADG211A/ADG212A

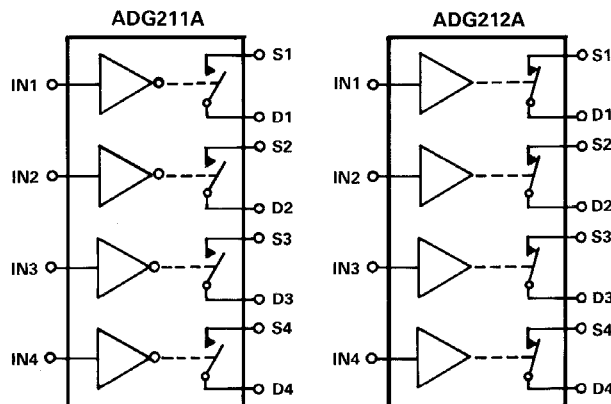
#### FEATURES

**44V Supply Maximum Rating**  
**±15V Analog Signal Range**  
**Low  $R_{ON}$  (115Ω max)**  
**Low Leakage (0.5nA typ)**  
**Break Before Make Switching**  
**Single Supply Operation Possible**  
**Extended Plastic Temperature Range**  
 (−40°C to +85°C)  
**TTL/CMOS Compatible**  
**Available in 16-Lead DIP/SOIC and**  
**20-Lead PLCC Packages**  
**Superior Second Source:**  
**ADG211A Replaces DG211**  
**ADG212A Replaces DG212**

#### GENERAL DESCRIPTION

The ADG211A and ADG212A are monolithic CMOS devices comprising four independently selectable switches. They are designed on an enhanced LC<sup>2</sup>MOS process which gives an increased signal handling capability of ±15V. These switches also feature high switching speeds and low  $R_{ON}$ .

The ADG211A and ADG212A consist of four SPST switches. They differ only in that the digital control logic is inverted. In multiplexer applications, all switches exhibit break-before-make switching action when driven simultaneously. Inherent in the design is low charge injection for minimum transients when switching the digital inputs.



SWITCHES SHOWN FOR A LOGIC "1" INPUT

#### PRODUCT HIGHLIGHTS

- Extended Signal Range:**  
These switches are fabricated on an enhanced LC<sup>2</sup>MOS process, resulting in high breakdown and an increased analog signal range of ±15V.
- Single Supply Operation:**  
For applications where the analog signal is unipolar (0V to 15V), the switches can be operated from a single +15V supply.
- Low Leakage:**  
Leakage currents in the range of 500pA make these switches suitable for high precision circuits. The added feature of Break before Make allows for multiple outputs to be tied together for multiplexer applications while keeping leakage errors to a minimum.

| ADG211A<br>IN | ADG212A<br>IN | SWITCH<br>CONDITION |
|---------------|---------------|---------------------|
| 0             | 1             | ON                  |
| 1             | 0             | OFF                 |

Table I. Truth Table

#### REV. B

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# ADG211A/ADG212A—SPECIFICATIONS ( $V_{DD} = +15V$ , $V_{SS} = -15V$ , $V_L = 5V$ , unless otherwise noted.)

|                                                      | ADG211AKN<br>ADG212AKN |                  |          |                                                                                     |
|------------------------------------------------------|------------------------|------------------|----------|-------------------------------------------------------------------------------------|
| Parameter                                            | 25°C                   | − 40°C to + 85°C | Units    | Test Conditions                                                                     |
| ANALOG SWITCH                                        |                        |                  |          |                                                                                     |
| Analog Signal Range                                  | ± 15                   | ± 15             | Volts    | − 10V ≤ V <sub>S</sub> ≤ + 10V, I <sub>DS</sub> = 1mA,<br>Test Circuit 1            |
| R <sub>ON</sub>                                      | 115                    | 175              | Ωmax     |                                                                                     |
| R <sub>ON</sub> vs. V <sub>D</sub> (V <sub>S</sub> ) | 20                     |                  | % typ    |                                                                                     |
| R <sub>ON</sub> Drift                                | 0.5                    |                  | %/°C typ |                                                                                     |
| R <sub>ON</sub> Match                                | 5                      |                  | % typ    | V <sub>S</sub> = 0V, I <sub>DS</sub> = 1mA                                          |
| I <sub>S</sub> (OFF)                                 | 0.5                    |                  | nA typ   | V <sub>D</sub> = ± 14V; V <sub>S</sub> = ∓ 14V; Test Circuit 2                      |
| OFF Input Leakage                                    | 5                      | 100              | nA max   |                                                                                     |
| I <sub>D</sub> (OFF)                                 | 0.5                    |                  | nA typ   | V <sub>D</sub> = ± 14V; V <sub>S</sub> = ∓ 14V; Test Circuit 2                      |
| OFF Output Leakage                                   | 5                      | 100              | nA max   |                                                                                     |
| I <sub>D</sub> (ON)                                  | 0.5                    |                  | nA typ   | V <sub>D</sub> = V <sub>S</sub> = ± 14V; Test Circuit 3                             |
| ON Channel Leakage                                   | 5                      | 200              | nA max   |                                                                                     |
| DIGITAL CONTROL                                      |                        |                  |          |                                                                                     |
| V <sub>INH</sub> , Input High Voltage                |                        | 2.4              | V min    | TTL Compatibility is Independent of V <sub>L</sub>                                  |
| V <sub>INL</sub> , Input Low Voltage                 |                        | 0.8              | V max    |                                                                                     |
| I <sub>INL</sub> or I <sub>INH</sub>                 |                        | 1                | μA max   |                                                                                     |
| C <sub>IN</sub> , Digital Input Capacitance          | 5                      |                  | pF typ   |                                                                                     |
| DYNAMIC CHARACTERISTICS                              |                        |                  |          |                                                                                     |
| t <sub>OPEN</sub> <sup>1</sup>                       | 30                     |                  | ns typ   | Test Circuit 4                                                                      |
| t <sub>ON</sub> <sup>1</sup>                         | 600                    |                  | ns max   | Test Circuit 5                                                                      |
| t <sub>OFF</sub> <sup>1</sup>                        | 450                    |                  | ns max   | Test Circuit 5                                                                      |
| OFF Isolation                                        | 80                     |                  | dB typ   | V <sub>S</sub> = 10V(p-p); f = 100kHz<br>R <sub>L</sub> = 75Ω; Test Circuit 6       |
| Channel-to-Channel Crosstalk                         | 80                     |                  | dB typ   | Test Circuit 7                                                                      |
| C <sub>S</sub> (OFF)                                 | 5                      |                  | pF typ   | R <sub>S</sub> = 0Ω; C <sub>L</sub> = 1000pF; V <sub>S</sub> = 0V<br>Test Circuit 8 |
| C <sub>D</sub> (OFF)                                 | 5                      |                  | pF typ   |                                                                                     |
| C <sub>S</sub> , C <sub>D</sub> (ON)                 | 16                     |                  | pF typ   |                                                                                     |
| Q <sub>INJ</sub> , Charge Injection                  | 20                     |                  | pC typ   |                                                                                     |
|                                                      |                        |                  |          |                                                                                     |
| POWER SUPPLY                                         |                        |                  |          |                                                                                     |
| I <sub>DD</sub>                                      | 0.6                    |                  | mA typ   | Digital Inputs = V <sub>INL</sub> or V <sub>INH</sub>                               |
| I <sub>DD</sub>                                      | 1                      |                  | mA max   |                                                                                     |
| I <sub>SS</sub>                                      | 0.1                    |                  | mA typ   |                                                                                     |
| I <sub>SS</sub>                                      | 0.2                    |                  | mA max   |                                                                                     |
| I <sub>L</sub>                                       | 0.9                    |                  | mA max   |                                                                                     |

## NOTE

<sup>1</sup>Sample tested at 25°C to ensure compliance.

Specifications subject to change without notice.

## ABSOLUTE MAXIMUM RATINGS\*

(T<sub>A</sub> = 25°C unless otherwise stated)

|                                    |                                                  |
|------------------------------------|--------------------------------------------------|
| V <sub>DD</sub> to V <sub>SS</sub> | 44V                                              |
| V <sub>DD</sub> to GND             | 25V                                              |
| V <sub>SS</sub> to GND             | -25V                                             |
| V <sub>L</sub> to GND              | -0.3V, 25V                                       |
| Analog Inputs <sup>1</sup>         |                                                  |
| Voltage at S, D                    | V <sub>SS</sub> - 0.3V to V <sub>DD</sub> + 0.3V |
| Continuous Current, S or D         | 30mA                                             |
| Pulsed Current S or D              |                                                  |
| 1ms Duration, 10% Duty Cycle       | 70mA                                             |

## Digital Inputs<sup>1</sup>

Voltage at IN . . . . . V<sub>SS</sub> - 2V to V<sub>DD</sub> + 2V or 20mA, Whichever Occurs First

## Power Dissipation (Any Package)

Up to +75°C . . . . . 470mW

Derates above +75°C by . . . . . 6mW/°C

Operating Temperature . . . . . -40°C to +85°C

Storage Temperature Range . . . . . -65°C to +150°C

Lead Temperature (Soldering 10sec) . . . . . +300°C

## NOTE

<sup>1</sup>Overvoltage at IN, S or D will be clamped by diodes. Current should be limited to the Maximum Rating above.

\*COMMENT: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Only one Absolute Maximum Rating may be applied at any one time.

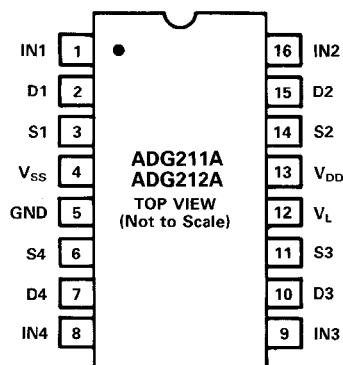
## CAUTION

ESD (electrostatic discharge) sensitive device. The digital control inputs are diode protected; however, permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. The protective foam should be discharged to the destination socket before devices are removed.

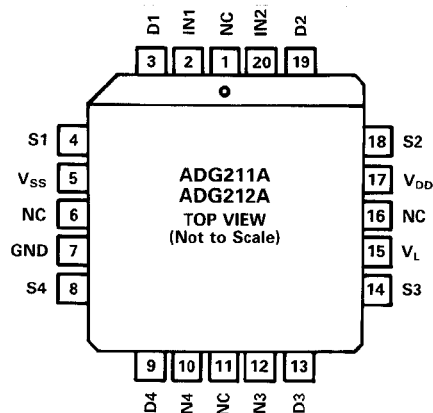


## PIN CONFIGURATIONS

### DIP, SOIC



### PLCC



NC = NO CONNECT

## ORDERING GUIDE

| Model     | Temperature Range | Package Option* |
|-----------|-------------------|-----------------|
| ADG211AKN | -40°C to +85°C    | N-16            |
| ADG211AKR | -40°C to +85°C    | R-16A           |
| ADG211AKP | -40°C to +85°C    | P-20A           |
| ADG212AKN | -40°C to +85°C    | N-16            |
| ADG212AKR | -40°C to +85°C    | R-16A           |
| ADG212AKP | -40°C to +85°C    | P-20A           |

\*N = Plastic DIP; R = 0.15" Small Outline IC (SOIC);  
P = Plastic Leaded Chip Carrier (PLCC).

# ADG211A/ADG212A—Typical Performance Characteristics

The switches can comfortably operate anywhere in the 10V to 15V single or dual supply range, with only a slight degradation in performance. The following graphs show the relevant performance curves. The test circuits and test conditions are given in a following section, "Test Circuits."

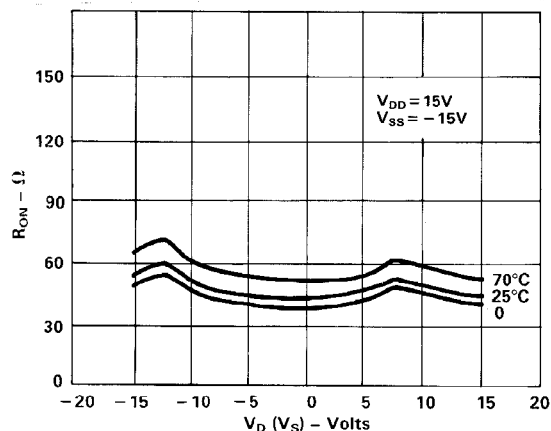


Figure 1.  $R_{ON}$  as a Function of  $V_D (V_S)$ : Dual  $\pm 15$  Supplies

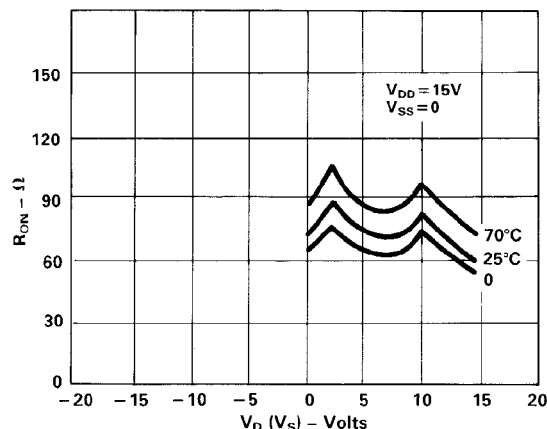


Figure 2.  $R_{ON}$  as a Function of  $V_D (V_S)$ : Single +15V Supply

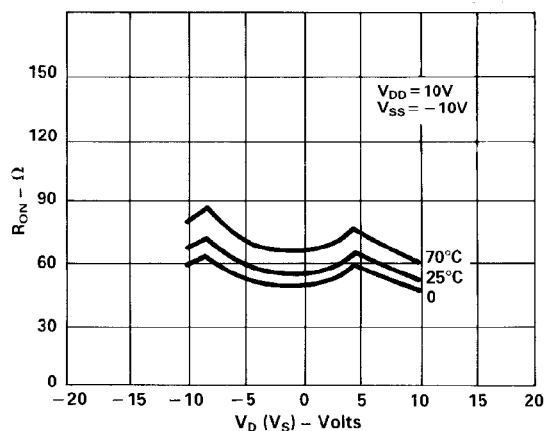


Figure 3.  $R_{ON}$  as a Function of  $V_D (V_S)$ : Dual  $\pm 10$ V Supplies

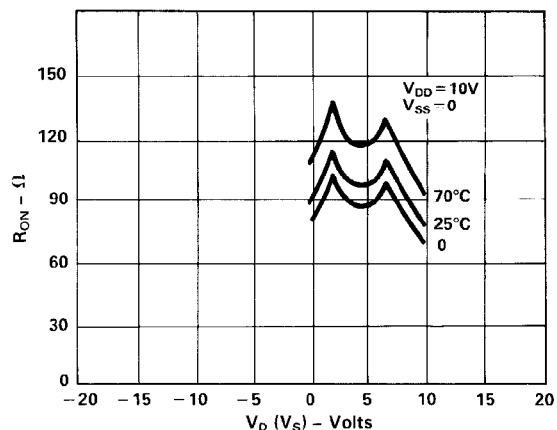


Figure 4.  $R_{ON}$  as a Function of  $V_D (V_S)$ : Single +10V Supply

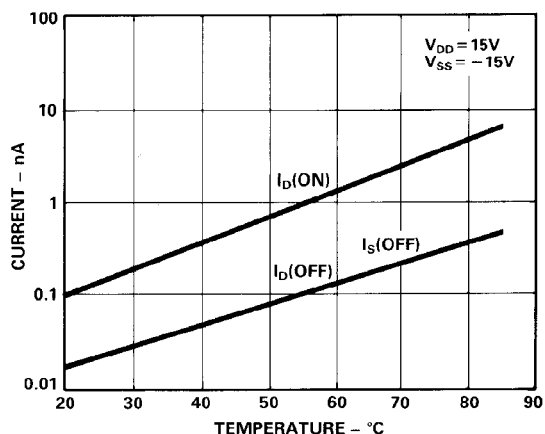


Figure 5. Leakage Current as a Function of Temperature (Note: Leakage Current Reduces as the Supply Voltages Reduce)

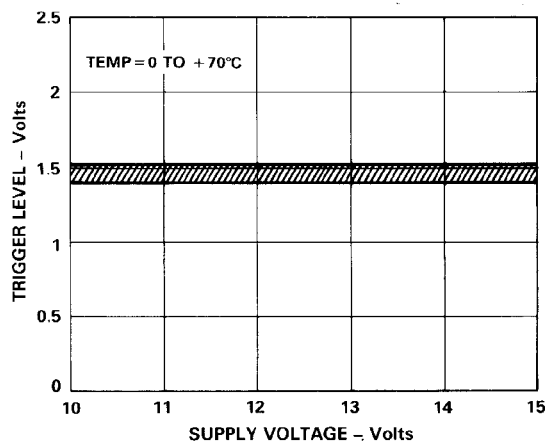


Figure 6. Trigger Levels vs. Power Supply Voltage, Dual or Single Supply Voltage

# Typical Performance Characteristics—ADG211A/ADG212A

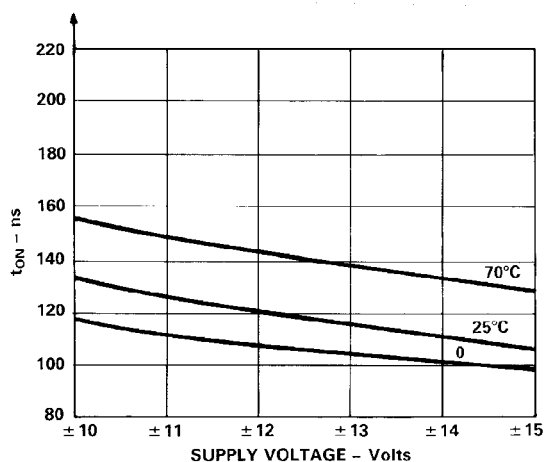


Figure 7.  $t_{ON}$  vs. Supply Voltage, (Dual Supply)

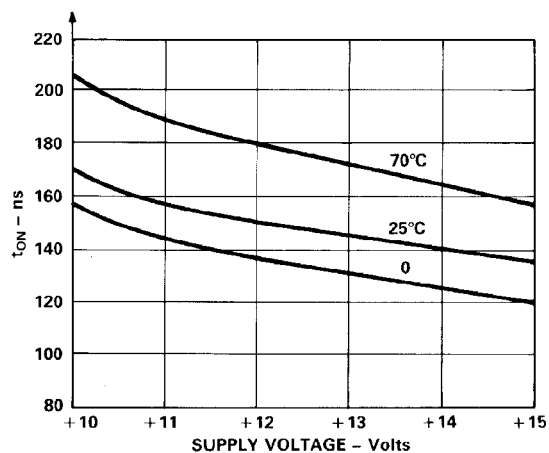


Figure 8.  $t_{ON}$  vs. Supply Voltage, (Single Supply)

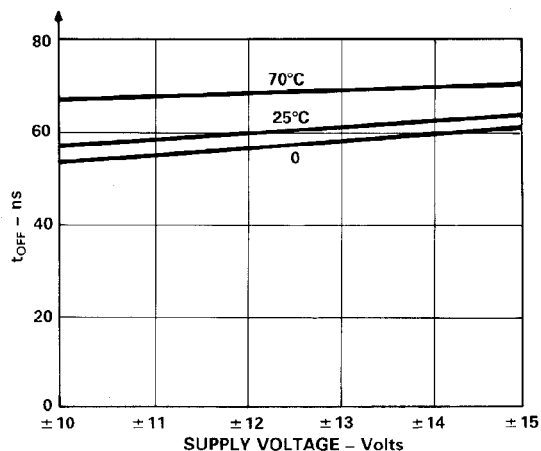


Figure 9.  $t_{OFF}$  vs. Supply Voltage, (Dual Supply)

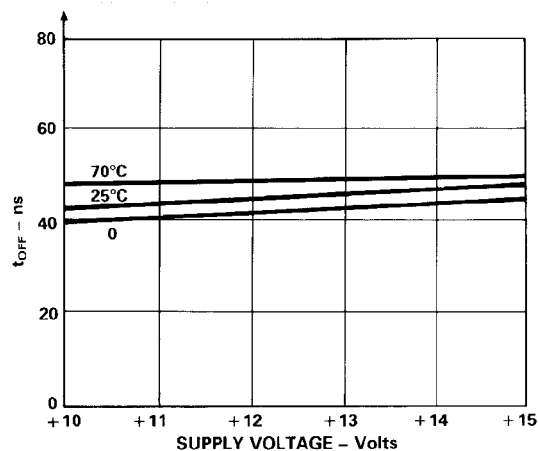


Figure 10.  $t_{OFF}$  vs. Supply Voltage, (Single Supply)

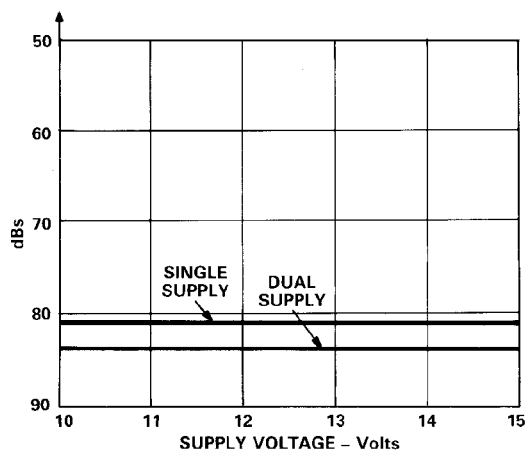


Figure 11. Off Isolation and Channel-to-Channel Crosstalk vs. Supply Voltage

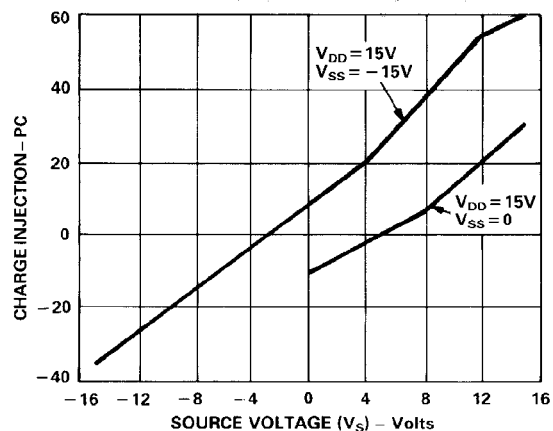


Figure 12. Charge Injection vs. Source Voltage ( $V_S$ ) for Dual and Single 15V Supplies

# ADG211A/ADG212A—Typical Performance Characteristics

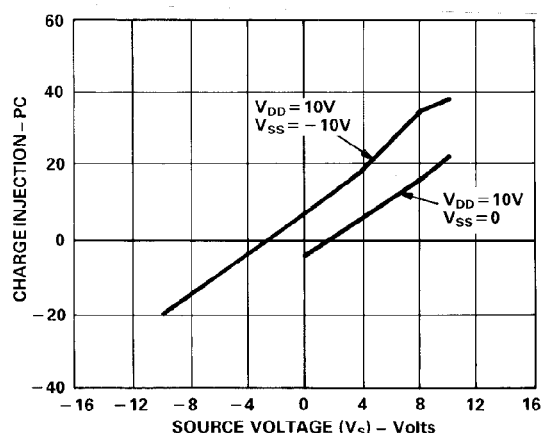


Figure 13. Charge Injection vs. Source Voltage for Dual and Single 10V Supplies

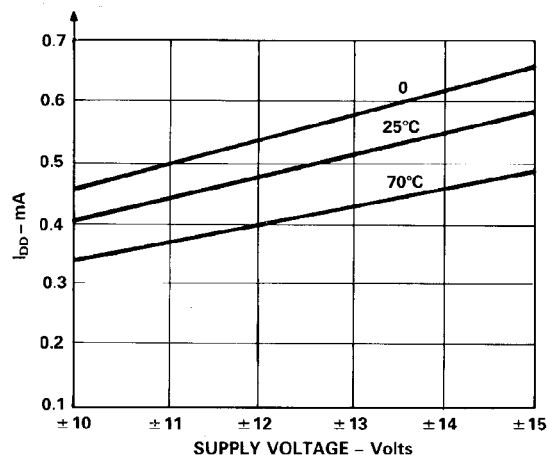


Figure 14.  $I_{DD}$  vs. Supply Voltage, (Dual Supply)

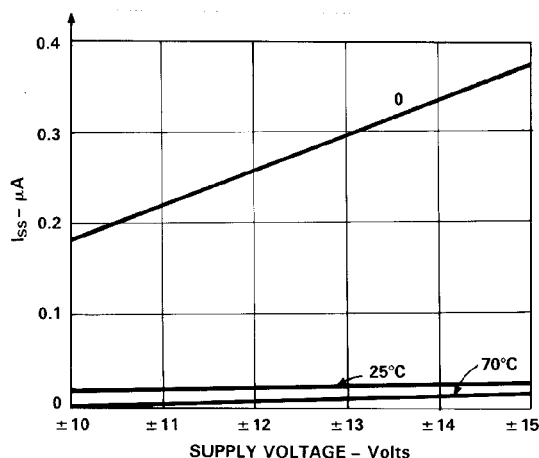


Figure 15.  $I_{SS}$  vs. Supply Voltage, (Dual Supply)

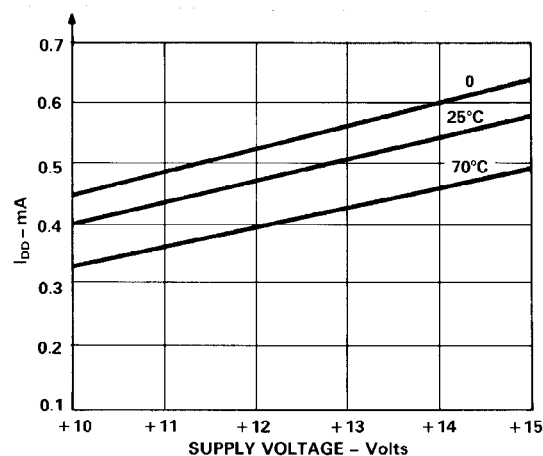


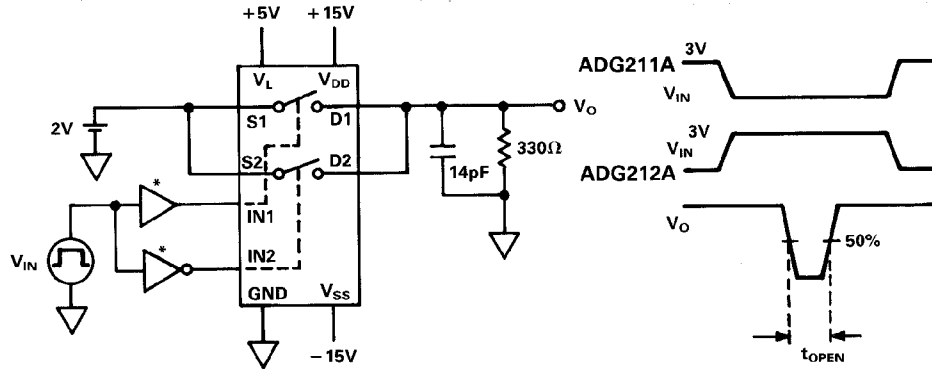
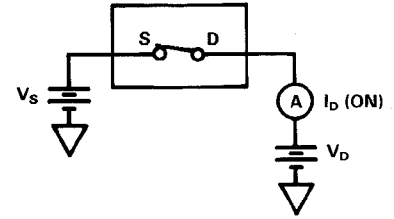
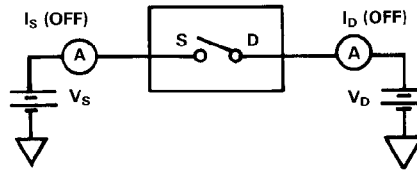
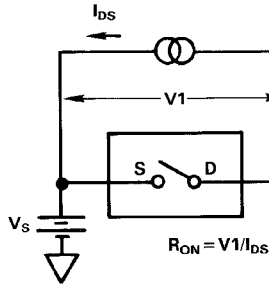
Figure 16.  $I_{DD}$  vs. Supply Voltage, (Single Supply)

## TERMINOLOGY

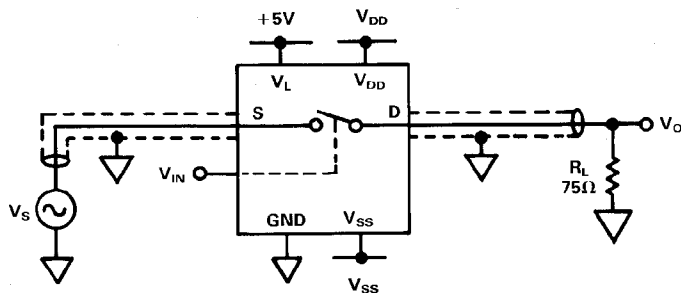
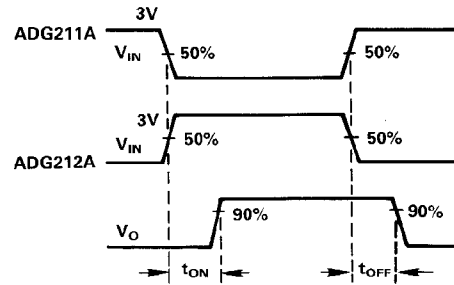
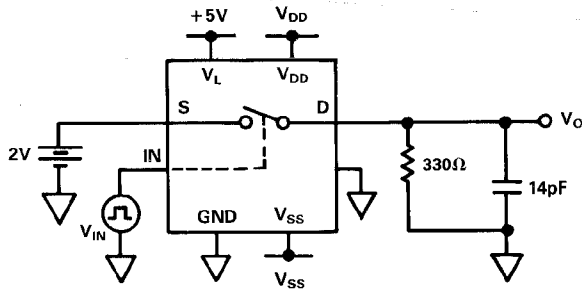
|                 |                                                                                          |
|-----------------|------------------------------------------------------------------------------------------|
| $R_{ON}$        | Ohmic resistance between terminals OUT and S                                             |
| $R_{ON}$ Match  | Difference between the $R_{ON}$ of any two channels                                      |
| $I_S$ (OFF)     | Source terminal leakage current when the switch is off                                   |
| $I_D$ (OFF)     | Drain terminal leakage current when the switch is off                                    |
| $I_D$ (ON)      | Leakage current that flows from the closed switch into the body                          |
| $V_D$ ( $V_S$ ) | Analog voltage on terminal D, S                                                          |
| $C_S$ (OFF)     | Switch input capacitance "OFF" condition                                                 |
| $C_D$ (OFF)     | Switch output capacitance "OFF" condition                                                |
| $C_{IN}$        | Digital input capacitance                                                                |
| $C_D, C_S$ (ON) | Input or output capacitance when the switch is on                                        |
| $t_{ON}$        | Delay time between the 50% and 90% points of the digital input and switch "ON" condition |

|                         |                                                                                                                                                 |
|-------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------|
| $t_{OFF}$               | Delay time between the 50% and 90% points of the digital input and switch "OFF" condition                                                       |
| $t_{OPEN}$              | "OFF" time measured between 50% points of both switches, which are connected as a multiplexer, when switching from one address state to another |
| $V_{INL}$               | Maximum Input Voltage for a Logic Low                                                                                                           |
| $V_{INH}$               | Minimum Input Voltage for a Logic High                                                                                                          |
| $I_{INL}$ ( $I_{INH}$ ) | Input current of the digital input                                                                                                              |
| $V_{DD}$                | Most positive voltage supply                                                                                                                    |
| $V_{SS}$                | Most negative voltage supply                                                                                                                    |
| $V_L$                   | Logic supply voltage                                                                                                                            |
| $I_{DD}$                | Positive supply current                                                                                                                         |
| $I_{SS}$                | Negative supply current                                                                                                                         |

# Test Circuits—ADG211A/ADG212A



\*BOTH THE BUFFER AND INVERTER SHOULD HAVE THE SAME PROPAGATION DELAY.



ADG211A  $V_{IN}=5V$   
ADG212A  $V_{IN}=0V$

OFFISOLATION =  
 $20 \times \log |V_S/V_O|$

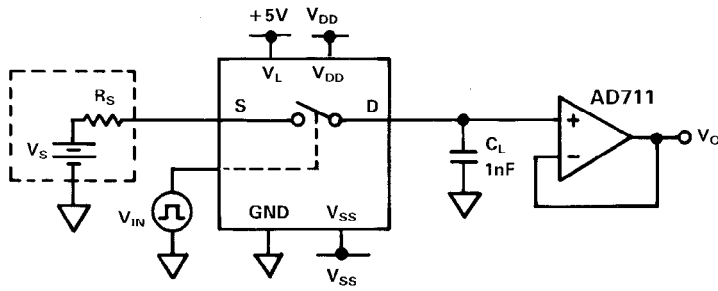
ADG211A  $V_{IN}=0V$   
ADG212A  $V_{IN}=5V$

CHANNEL-TO-CHANNEL  
CROSSTALK =  $20 \times \log |V_S/V_O|$

Test Circuit 6. Off Isolation

Test Circuit 7. Channel-to-Channel Crosstalk

# ADG211A/ADG212A

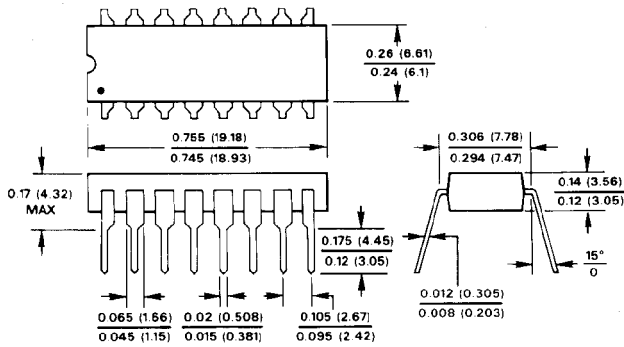


Test Circuit 8. Charge Injection

## OUTLINE DIMENSIONS

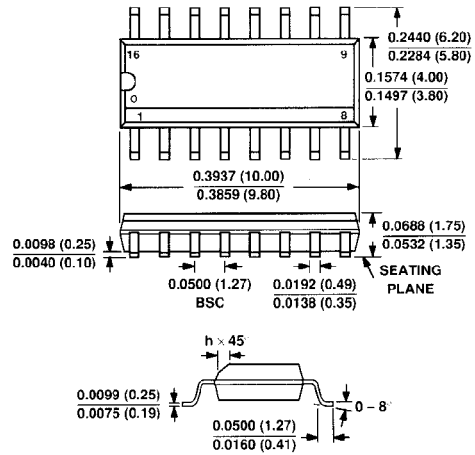
Dimensions shown in inches and (mm).

### 16-Pin Plastic (N-16)



LEAD NO. 1 IDENTIFIED BY DOT OR NOTCH  
LEADS ARE SOLDER OR TIN-PLATED KOVAR OR ALLOY 42

### 16-Lead Narrow Body SOIC (R-16A)



### 20-Terminal Plastic Leaded Chip Carrier (P-20A)

