

FEATURES

50ns max Switching Time Over Full Temperature Range

Low R_{ON} (30Ω typ)

Single Supply Specifications for +10.8V to +16.5V Operation

Extended Plastic Temperature Range (-40°C to +85°C)

Break-Before-Make Switching

Low Leakage (100pA typ)

44V Supply max Rating

Available in 16-Lead DIP/SOIC and 20-Lead LCCC/PLCC Packages

ADG201HS (K, B, T) Replaces HI-201HS

ADG201HS (J, A, S) Replaces DG271

GENERAL DESCRIPTION

The ADG201HS is a monolithic CMOS device comprising four independently selectable SPST switches. It is designed on an enhanced LC²MOS process which gives very fast switching speeds and low R_{ON}.

The switches also feature break-before-make switching action for use in multiplexer applications and low charge injection for minimum transients on the output when switching the digital inputs.

ORDERING GUIDE

| Model ¹ | Temperature Range | Package Option ² |
|-------------------------|-------------------|-----------------------------|
| ADG201HSJN | -40°C to +85°C | N-16 |
| ADG201HSKN | -40°C to +85°C | N-16 |
| ADG201HSKR | -40°C to +85°C | R-16 |
| ADG201HSAQ | -40°C to +85°C | Q-16 |
| ADG201HSBQ | -40°C to +85°C | Q-16 |
| ADG201HSJP | -40°C to +85°C | P-20A |
| ADG201HSKP | -40°C to +85°C | P-20A |
| ADG201HSSQ | -55°C to +125°C | Q-16 |
| ADG201HSTQ ³ | -55°C to +125°C | Q-16 |
| ADG201HSTE ³ | -55°C to +125°C | E-20A |

NOTES

¹To order MIL-STD-883, Class B processed parts, add /883B to T grade part numbers. See the Analog Devices Military Products Databook (1994) for military data sheet.

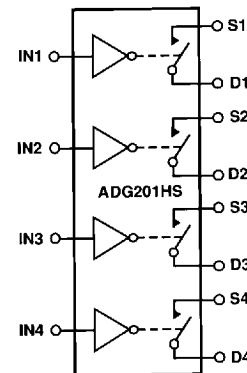
²E = Leadless Ceramic Chip Carrier; N = Narrow Plastic DIP; P = Plastic Leaded Chip Carrier; Q = Cerdip; R = 0.15" Small Outline IC (SOIC).

³Standard Military Drawing (SMD) approved by DESC. SMD numbers are

5962-86716012X (ADG201HSTE/883B)

5962-8671601EX (ADG201HSTQ/883B)

FUNCTIONAL BLOCK DIAGRAM



PRODUCT HIGHLIGHTS

1. 50ns max t_{ON} and t_{OFF}:

The ADG201HS top grades (K, B, T) have guaranteed 50ns max turn-on and turn-off times over the full operating temperature range. The lower grades (J,A,S) have guaranteed 75ns switching times over the full operating temperature range.

2. Single Supply Specifications:

The ADG201HS is fully specified for applications which require a single positive power supply in the +10.8V to +16.5V range.

3. Low Leakage:

Leakage currents in the range of 100pA 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.

| IN | Switch Condition |
|----|------------------|
| 0 | ON |
| 1 | OFF |

Truth Table

REV. B

Information furnished by Analog Devices is believed to be accurate and reliable. However, no responsibility is assumed by Analog Devices for its use, nor for any infringements of patents or other rights of third parties which may result from its use. No license is granted by implication or otherwise under any patent or patent rights of Analog Devices.

ADG201HS—SPECIFICATIONS

DUAL SUPPLY ($V_{DD} = +13.5V$ to $+16.5V$, $= -13.5V$ to $-16.5V$, $GND = 0V$,
 $V_{IN} = 3V$ [Logic High Level] or $0.8V$ [Logic Low Level] unless otherwise noted)

| Parameter | Version | +25°C | $T_{min} - T_{max}^1$ | Units | Comments |
|--|------------|----------|-----------------------|--------------|--|
| ANALOG SWITCH | | | | | |
| Analog Signal Range | All | V_{SS} | V_{SS} | V min | |
| | All | V_{DD} | V_{DD} | V max | |
| R_{ON} | All | 30 | – | Ω typ | – $10V \leq V_S \leq +10V$, $I_{DS} = 1mA$; Test Circuit 1 |
| | All | 50 | 75 | Ω max | |
| R_{ON} Drift | All | 0.5 | – | %/°C typ | – $10V \leq V_S \leq +10V$, $I_{DS} = 1mA$ |
| R_{ON} Match | All | 3 | – | % typ | – $10V \leq V_S \leq +10V$, $I_{DS} = 1mA$ |
| I_S (OFF), Off Input Leakage ² | All | 0.1 | – | nA typ | $V_D = \pm 14V$; $V_S = \mp 14V$; Test Circuit 2 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| I_D (OFF), Off Output Leakage ² | All | 0.1 | – | nA typ | $V_D = \pm 14V$; $V_S = \mp 14V$; Test Circuit 2 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| I_D (ON), On Channel Leakage ² | All | 0.1 | – | nA typ | $V_D = V_S = \pm 14V$; Test Circuit 3 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| DIGITAL CONTROL | | | | | |
| V_{INH} , Input High Voltage | All | 2.4 | 2.4 | V min | |
| V_{INL} , Input Low Voltage | All | 0.8 | 0.8 | V max | |
| I_{INL} or I_{INH} | All | 1 | 1 | μA max | |
| C_{IN} | All | 8 | 8 | pF max | |
| DYNAMIC CHARACTERISTICS | | | | | |
| t_{ON} | K, B, T | 50 | 50 | ns max | Test Circuit 4 |
| | J, A, S | 75 | 75 | ns max | |
| t_{OFF1} | K, B, T | 50 | 50 | ns max | Test Circuit 4 |
| | J, A, S | 75 | 75 | ns max | |
| t_{OFF2} | All | 150 | – | ns typ | Test Circuit 4 |
| t_{OPEN} | All | 5 | 5 | ns typ | $t_{ON} - t_{OFF1}$; Test Circuit 4 |
| Output Settling Time to 0.1% | All | 180 | – | ns typ | $V_{IN} = 3V$ to $0V$; Test Circuit 4 |
| OFF Isolation | All | 72 | – | dB typ | $V_S = 3V$ rms, $f = 100kHz$, $R_L = 1k\Omega$; $C_L = 10pF$; Test Circuit 5 |
| Channel-to-Channel Crosstalk | All | 86 | – | dB typ | $V_S = 3V$ rms, $f = 100kHz$, $R_L = 1k\Omega$; $C_L = 10pF$; Test Circuit 6 |
| Q_{INJ} , Charge Injection | All | 10 | – | pC typ | $R_S = 0\Omega$, $V_S = 0V$; Test Circuit 7 |
| C_S (OFF) | All | 10 | – | pF typ | |
| C_D (OFF) | All | 10 | – | pF typ | |
| C_D , C_S (ON) | All | 30 | – | pF typ | |
| C_{DS} (OFF) | All | 0.5 | – | pF typ | |
| POWER SUPPLY | | | | | |
| I_{DD} | All | 10 | 10 | mA max | |
| I_{SS} | All | 6 | 6 | mA max | |
| Power Dissipation | All | 240 | 240 | mW max | $V_{DD} = +15V$, $V_{SS} = -15V$ |

NOTES

¹Temperature ranges are as follows: ADG201HSJ, K; –40°C to +85°C
 ADG201HSA, B; –40°C to +85°C
 ADG201HSS, T; –55°C to +125°C

²Leakage specifications apply with a V_D (V_S) of $\pm 14V$ or with a V_D (V_S) of 0.5V within the supply voltages (V_{DD} , V_{SS}), whichever is the minimum.
 Specifications subject to change without notice.

SINGLE SUPPLY ($V_{DD} = +10.8V$ to $+16.5V$, $V_{SS} = GND = 0V$, $V_{IN} = 3V$ [Logic High Level] or $0.8V$ [Logic Low Level] unless otherwise noted)

| Parameter | Version | +25°C | $T_{min} - T_{max}$ | Units | Comments |
|--|------------|----------|---------------------|--------------|--|
| ANALOG SWITCH | | | | | |
| Analog Signal Range | All | V_{SS} | V_{SS} | V min | |
| | All | V_{DD} | V_{DD} | V max | |
| R_{ON} | All | 65 | – | Ω typ | $0V \leq V_S \leq +10V$, $I_{DS} = 1mA$; Test Circuit 1 |
| | All | 90 | 120 | Ω max | |
| R_{ON} Drift | All | 0.5 | – | %/°C typ | $0V \leq V_S \leq +10V$, $I_{DS} = 1mA$ |
| R_{ON} Match | All | 3 | – | % typ | $0V \leq V_S \leq +10V$, $I_{DS} = 1mA$ |
| I_S (OFF), Off Input Leakage ¹ | All | 0.1 | – | nA typ | $V_D = +10V/+0.5V$; $V_S = +0.5V/+10V$; Test Circuit 2 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| I_D (OFF), Off Output Leakage ¹ | All | 0.1 | – | nA typ | $V_D = +10V/+0.5V$; $V_S = +0.5V/+10V$; Test Circuit 2 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| I_D (ON), On Channel Leakage ¹ | All | 0.1 | – | nA typ | $V_D = V_S = +10V/+0.5V$; Test Circuit 3 |
| | J, K, A, B | 1 | 20 | nA max | |
| | S, T | 1 | 60 | nA max | |
| DIGITAL CONTROL | | | | | |
| V_{INH} , Input High Voltage | All | 2.4 | 2.4 | V min | |
| V_{INL} , Input Low Voltage | All | 0.8 | 0.8 | V max | |
| I_{INL} or I_{INH} | All | 1 | 1 | μA max | |
| C_{IN} | All | 8 | 8 | pF max | |
| DYNAMIC CHARACTERISTICS | | | | | |
| t_{ON} | K, B, T | 50 | 70 | ns max | Test Circuit 4 |
| | J, A, S | 75 | 90 | ns max | |
| t_{OFF1} | K, B, T | 50 | 70 | ns max | Test Circuit 4 |
| | J, A, S | 75 | 90 | ns max | |
| t_{OFF2} | All | 150 | – | ns typ | Test Circuit 4 |
| t_{OPEN} | All | 5 | 5 | ns typ | $t_{ON} - t_{OFF1}$; Test Circuit 4 |
| Output Settling Time to 0.1% | All | 180 | – | ns typ | $V_{IN} = 3V$ to $0V$; Test Circuit 4 |
| OFF Isolation | All | 72 | – | dB typ | $V_S = 3V$ rms, $f = 100kHz$, $R_L = 1k\Omega$; $C_L = 10pF$; Test Circuit 5 |
| Channel-to-Channel Crosstalk | All | 86 | – | dB typ | $V_S = 3V$ rms, $f = 100kHz$, $R_L = 1k\Omega$; $C_L = 10pF$; Test Circuit 6 |
| Q_{INJ} , Charge Injection | All | 10 | – | pC typ | $R_S = 0\Omega$, $V_S = 0V$; Test Circuit 7 |
| C_S (OFF) | All | 10 | – | pF typ | |
| C_D (OFF) | All | 10 | – | pF typ | |
| C_D , C_S (ON) | All | 30 | – | pF typ | |
| C_{DS} (OFF) | All | 0.5 | – | pF typ | |
| POWER SUPPLY | | | | | |
| I_{DD} | All | 10 | 10 | mA max | |
| Power Dissipation | All | 150 | 150 | mW max | $V_{DD} = +15V$ |

NOTE

¹The leakage specifications degrade marginally (typically 1nA at 25°C) with $V_D(V_S) = V_{SS}$.

Specifications subject to change without notice.

ADG201HS

ABSOLUTE MAXIMUM RATINGS*

(T_A = 25°C unless otherwise noted)

| | |
|--|--|
| V _{DD} to V _{SS} | 44V |
| V _{DD} to GND | -0.3V, 25V |
| V _{SS} to GND ¹ | +0.3V, -25V |
| Analog Inputs ² | |
| Voltage at S, D | V _{SS} - 2V to V _{DD} + 2V or 20mA, Whichever Occurs First |
| Continuous Current, S or D | 20mA |
| Pulsed Current S or D | 20mA |
| I _{ms} Duration, 10% Duty Cycle | 70mA |
| Digital Inputs ² | |
| Voltage at IN | V _{SS} - 4V to V _{DD} + 4V or 20mA, Whichever Occurs First |

Power Dissipation (Any Package)

| | |
|----------------------------------|--------|
| Up to +75°C | 470mW |
| Derates above +75°C by | 6mW/°C |

Operating Temperature

| | |
|--|-----------------|
| Commerical (J, K Version) | -40°C to +85°C |
| Industrial (A, B Version) | -40°C to +85°C |
| Extended (S, T Version) | -55°C to +125°C |
| Storage Temperature Range | -65°C to +150°C |
| Lead Temperature (Soldering 10sec) | +300°C |

NOTES

¹If V_{SS} is open circuited with V_{DD} and GND applied, the V_{SS} pin will be pulled positive, exceeding the Absolute Maximum Ratings. If this possibility exists, a Schottky diode from V_{SS} to GND (cathode end to GND) ensures that the Absolute Maximum Ratings will be observed.

²Overtoltage at IN, S or D, will be clamped by diodes. Current should be limited to the maximum rating above.

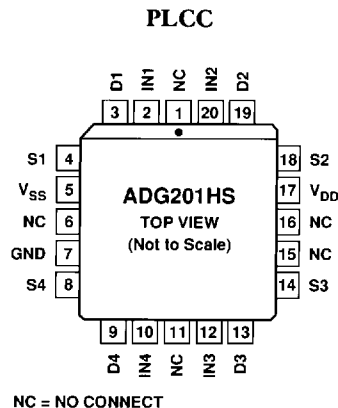
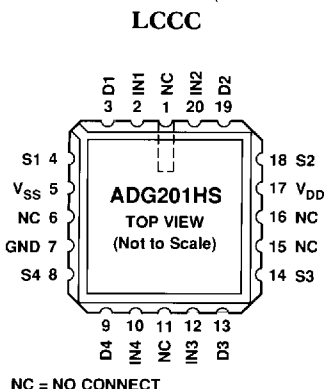
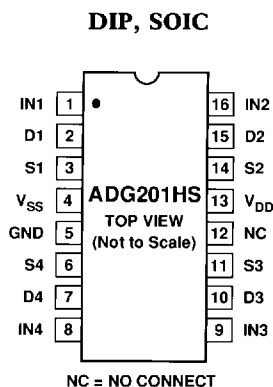
*COMMENT: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied.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

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 inserted.

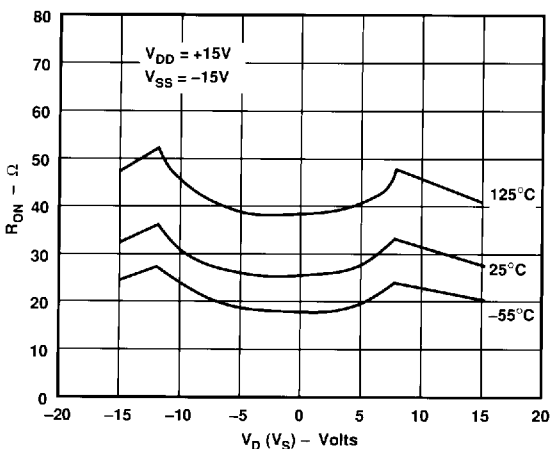


PIN CONFIGURATIONS

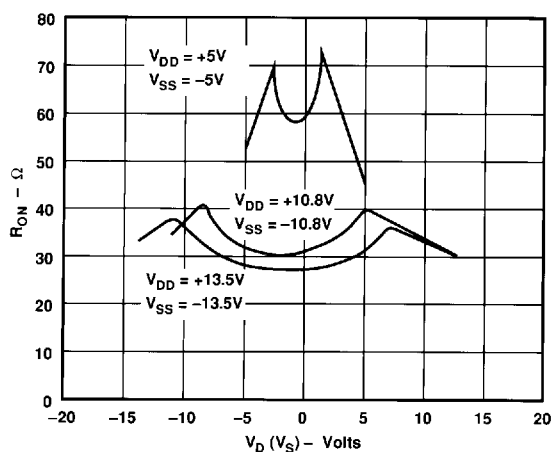


Typical Performance Characteristics—ADG201HS

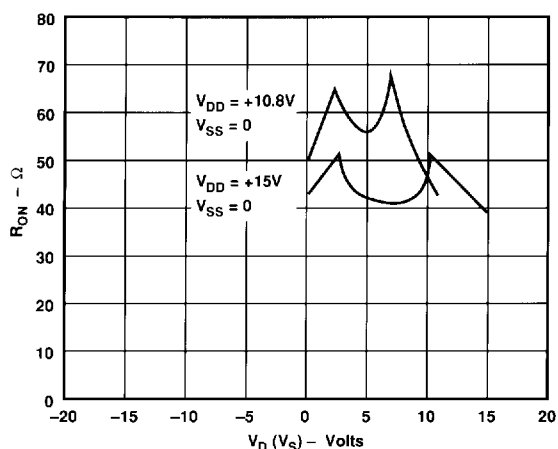
The switches are guaranteed functional with reduced single or dual supplies down to 4.5V.



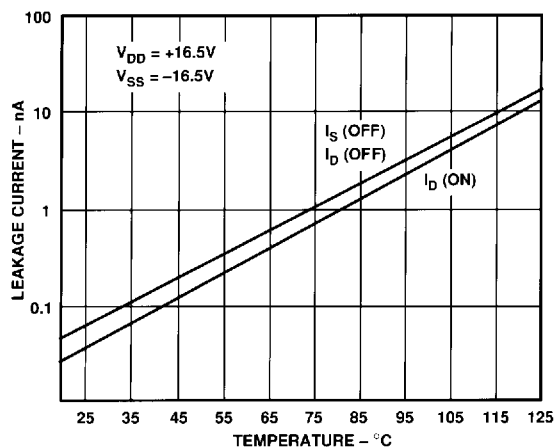
R_{ON} as a Function of V_D (V_S): Dual Supply Voltage



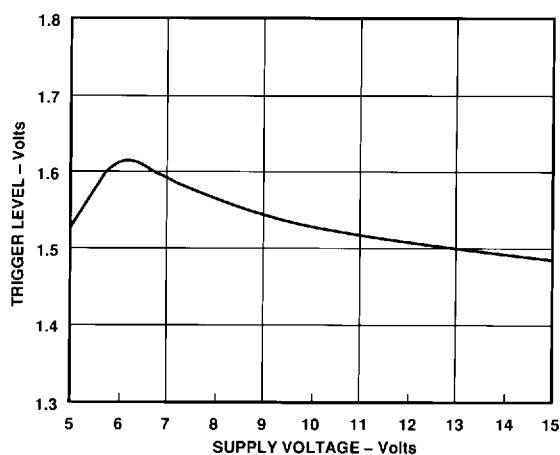
R_{ON} as a Function of V_D (V_S): Dual Supply Voltage, $T_A = +25^\circ\text{C}$



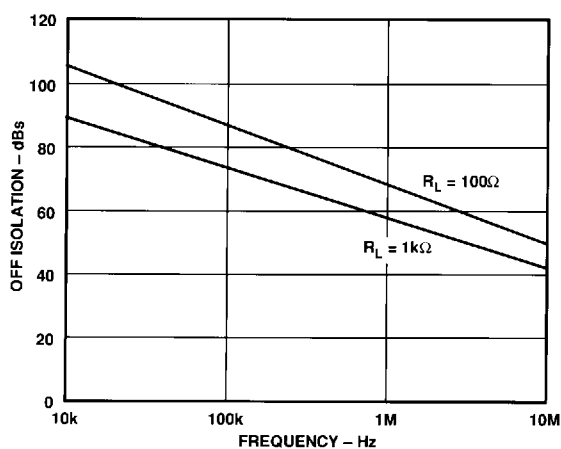
R_{ON} as a Function of V_D (V_S): Single Supply Voltage, $T_A = +25^\circ\text{C}$



Leakage Current as a Function of Temperature Dual Supply Voltage. (Note: Leakage Currents Reduce as the Supply Voltages Reduce)

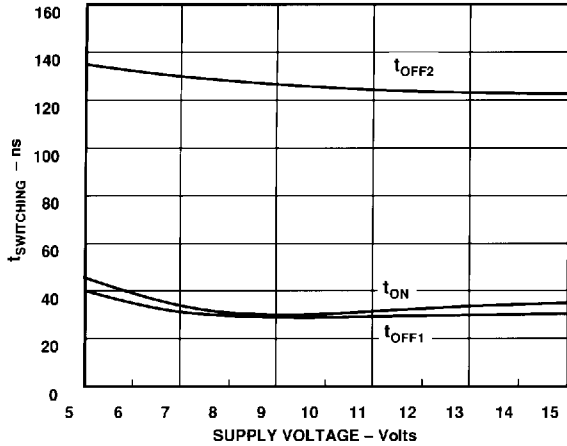


Trigger Levels vs. Power Supply Voltage, Dual or Single Supply, $T_A = +25^\circ\text{C}$

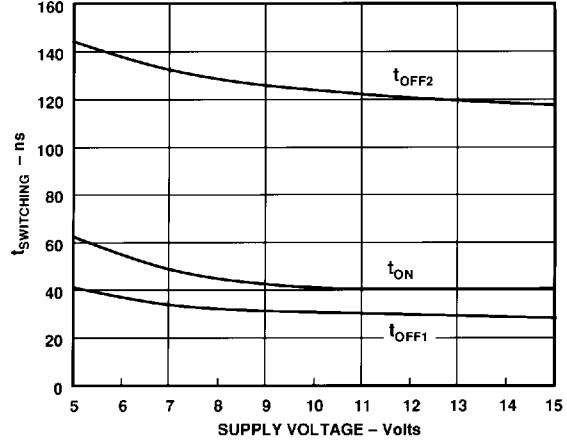


Off Isolation vs. Signal Frequency; Dual or Single 15V Supplies, $T_A = +25^\circ\text{C}$

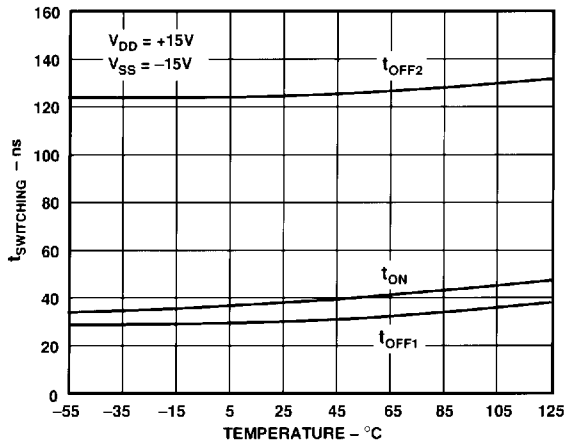
ADG201HS—Typical Performance Characteristics (Continued)



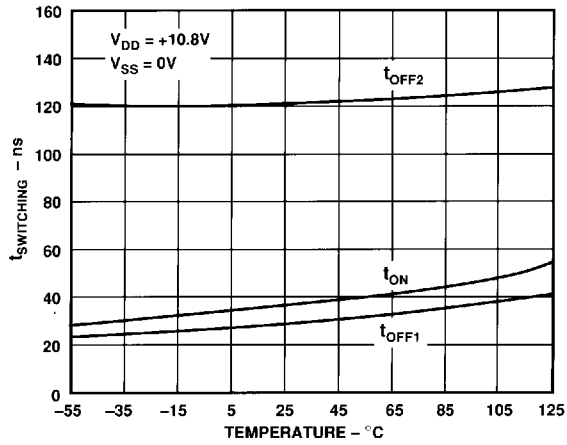
Switching Time vs. Supply Voltage (Dual Supply):
 $T_A = +25^\circ\text{C}$. (Note: See Test Circuit 4.
 For $V_{DD} < 10\text{V}$, $V_S = V_{DD}$)



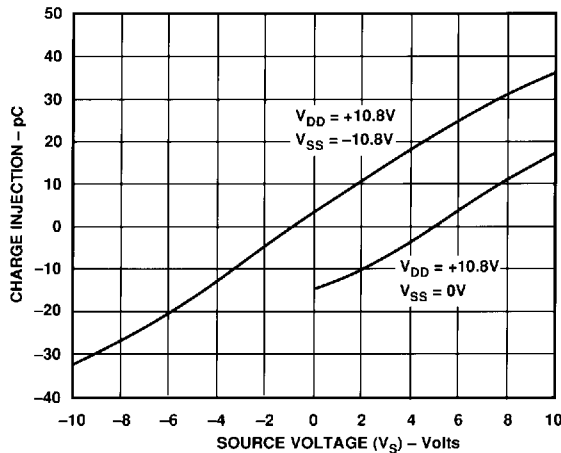
Switching Time vs. Supply Voltage (Single Supply):
 $T_A = +25^\circ\text{C}$. (Note: See Test Circuit 4.
 For $V_{DD} < 10\text{V}$, $V_S = V_{DD}$)



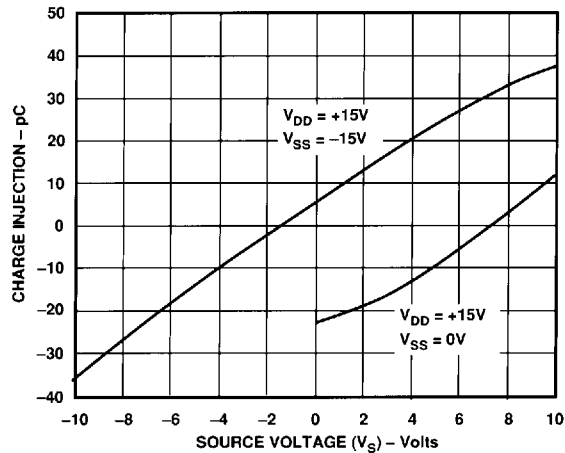
Switching Time vs. Temperature: Dual Supply Voltage



Switching Time vs. Temperature: Single Supply Voltage



Charge Injection vs. Source Voltage (V_S) for Dual and Single 10.8V Supplies: $T_A = +25^\circ\text{C}$

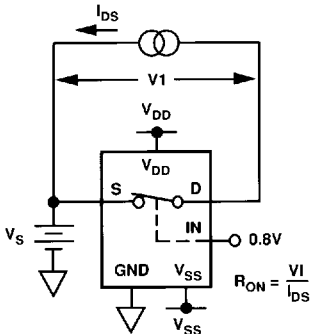


Charge Injection vs. Source Voltage (V_S) for Dual and Single 15V Supplies: $T_A = +25^\circ\text{C}$

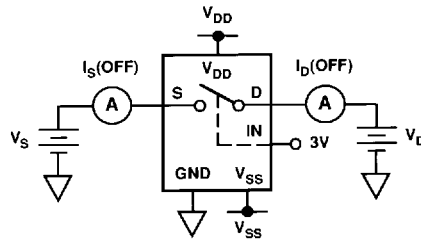
Test Circuits—ADG201HS

Note: All digital input signal rise and fall times measured from 10% to 90% of 3V. $t_R = t_F = 5\text{ns}$. Decoupling capacitors ($0.01\mu\text{F}$ min) from V_{DD} and V_{SS} to GND are recommended to achieve specified performance.

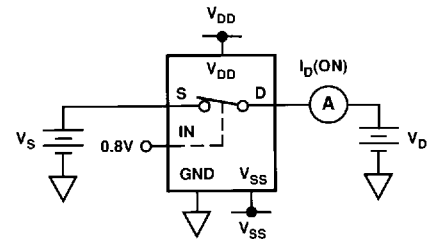
TEST CIRCUIT 1
 R_{ON}



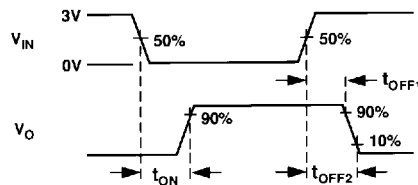
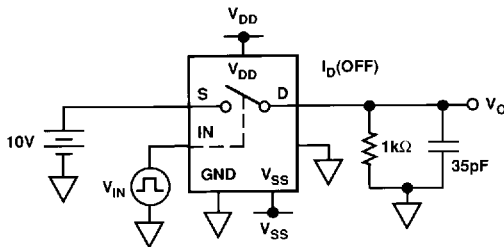
TEST CIRCUIT 2
 $I_S(\text{OFF}), I_D(\text{OFF})$



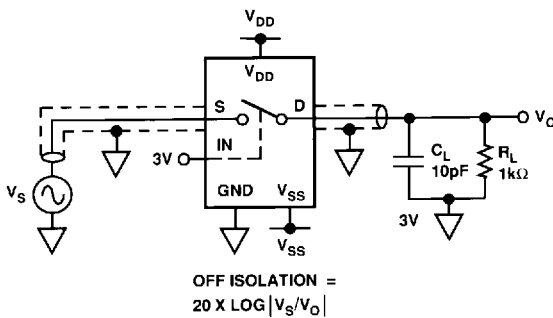
TEST CIRCUIT 3
 $I_D(\text{ON})$



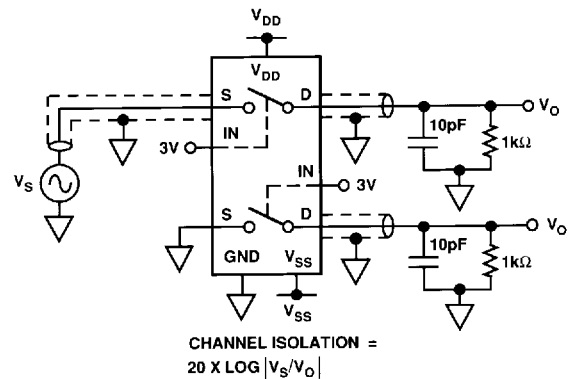
TEST CIRCUIT 4
 $t_{ON}, t_{OFF}, t_{OPEN}$, SETTLING TIME



TEST CIRCUIT 5
OFF ISOLATION



TEST CIRCUIT 6
CHANNEL-TO-CHANNEL CROSSTALK



TEST CIRCUIT 7
CHARGE INJECTION

