



**< 0.4  $\Omega$  CMOS 1.8 V to 5.5 V,  
SPST Switches**

## ADG801/ADG802

### FEATURES

0.4  $\Omega$  Max ON Resistance @ 125°C  
0.08  $\Omega$  Max ON Resistance Flatness @ 125°C  
1.8 V to 5.5 V Single Supply  
Automotive Temperature Range -40°C to +125°C  
400 mA Current Carrying Capability  
Tiny 6-Lead SOT-23 and 8-Lead  $\mu$ SOIC Packages  
35 ns Switching Times  
Low Power Consumption  
TTL/CMOS-Compatible Inputs  
Pin Compatible with ADG701/ADG702

### APPLICATIONS

Power Routing  
Cellular Phones  
Modems  
PCMCIA Cards  
Hard Drives  
Data Acquisition Systems  
Communication Systems  
Relay Replacement  
Battery-Powered Systems

### GENERAL DESCRIPTION

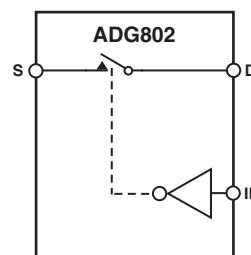
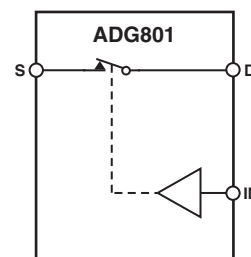
The ADG801/ADG802 are monolithic CMOS, SPST (Single Pole, Single Throw) switches with On Resistance of less than 0.4  $\Omega$ . These switches are designed on an advanced submicron process that provides extremely low On Resistance, high switching speed, and low leakage currents.

The low On Resistance of < 0.4  $\Omega$  means these parts are ideal for applications where low On Resistance switching is critical.

The ADG801 is a normally open (NO) switch, while the ADG802 is normally closed (NC). Each switch conducts equally well in both directions when On.

The ADG801 and ADG802 are available in 6-lead SOT-23 and 8-lead  $\mu$ SOIC packages.

### FUNCTIONAL BLOCK DIAGRAMS



SWITCHES SHOWN FOR A LOGIC "1" INPUT

### PRODUCT HIGHLIGHTS

1. Low On Resistance (0.25  $\Omega$  typical)
2. 1.8 V to 5.5 V single-supply operation
3. Tiny 6-lead SOT-23 and 8-lead  $\mu$ SOIC packages
4. 400 mA current carrying capability
5. Automotive temperature range -40°C to +125°C
6. Pin-compatible with ADG701 (ADG801)  
Pin-compatible with ADG702 (ADG802)

REV. 0

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# ADG801/ADG802—SPECIFICATIONS<sup>1</sup> ( $V_{DD} = 5\text{ V} \pm 10\%$ , $GND = 0\text{ V}$ . All specifications $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ , unless otherwise noted.)

| Parameter                                  | 25°C                     | $-40^{\circ}\text{C}$ to $+85^{\circ}\text{C}$ | $-40^{\circ}\text{C}$ to $+125^{\circ}\text{C}$ <sup>2</sup> | Unit                                   | Test Conditions/Comments                                                                                         |
|--------------------------------------------|--------------------------|------------------------------------------------|--------------------------------------------------------------|----------------------------------------|------------------------------------------------------------------------------------------------------------------|
| <b>ANALOG SWITCH</b>                       |                          |                                                |                                                              |                                        |                                                                                                                  |
| Analogue Signal Range                      |                          |                                                | 0 V to $V_{DD}$                                              | V                                      |                                                                                                                  |
| On Resistance ( $R_{ON}$ )                 | 0.25<br>0.3              | 0.35                                           | 0.4                                                          | $\Omega$ typ<br>$\Omega$ max           | $V_S = 0\text{ V}$ to $V_{DD}$ ; $I_S = 100\text{ mA}$ ;<br>Test Circuit 1                                       |
| On Resistance Flatness ( $R_{FLAT(ON)}$ )  | 0.05                     | 0.07                                           | 0.08                                                         | $\Omega$ typ<br>$\Omega$ max           | $V_S = 0\text{ V}$ to $V_{DD}$ ; $I_S = 100\text{ mA}$                                                           |
| <b>LEAKAGE CURRENTS</b>                    |                          |                                                |                                                              |                                        |                                                                                                                  |
| Source OFF Leakage $I_S$ (OFF)             | $\pm 0.01$<br>$\pm 0.25$ | $\pm 3$                                        | $\pm 30$                                                     | nA typ<br>nA max                       | $V_{DD} = 5.5\text{ V}$<br>$V_S = 4.5\text{ V}/1\text{ V}$ , $V_D = 1\text{ V}/4.5\text{ V}$ ;<br>Test Circuit 2 |
| Drain OFF Leakage $I_D$ (OFF)              | $\pm 0.01$<br>$\pm 0.25$ | $\pm 3$                                        | $\pm 30$                                                     | nA typ<br>nA max                       | $V_S = 4.5\text{ V}/1\text{ V}$ , $V_D = 1\text{ V}/4.5\text{ V}$ ;<br>Test Circuit 2                            |
| Channel ON Leakage $I_D$ , $I_S$ (ON)      | $\pm 0.01$<br>$\pm 0.25$ | $\pm 3$                                        | $\pm 30$                                                     | nA typ<br>nA max                       | $V_S = V_D = 1\text{ V}$ , or $4.5\text{ V}$ ;<br>Test Circuit 3                                                 |
| <b>DIGITAL INPUTS</b>                      |                          |                                                |                                                              |                                        |                                                                                                                  |
| Input High Voltage, $V_{INH}$              |                          |                                                | 2.0                                                          | V min                                  |                                                                                                                  |
| Input Low Voltage, $V_{INL}$               |                          |                                                | 0.8                                                          | V max                                  |                                                                                                                  |
| Input Current<br>$I_{INL}$ or $I_{INH}$    | 0.005                    |                                                | $\pm 0.1$                                                    | $\mu\text{A}$ typ<br>$\mu\text{A}$ max | $V_{IN} = V_{INL}$ or $V_{INH}$                                                                                  |
| $C_{IN}$ , Digital Input Capacitance       | 5                        |                                                |                                                              | pF typ                                 |                                                                                                                  |
| <b>DYNAMIC CHARACTERISTICS<sup>3</sup></b> |                          |                                                |                                                              |                                        |                                                                                                                  |
| $t_{ON}$                                   | 35<br>45                 | 50                                             | 55                                                           | ns typ<br>ns max                       | $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$<br>$V_S = 3\text{ V}$ ; Test Circuit 4                                 |
| $t_{OFF}$                                  | 9<br>15                  | 18                                             | 21                                                           | ns typ<br>ns max                       | $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$<br>$V_S = 3\text{ V}$ ; Test Circuit 4                                 |
| Charge Injection                           | 50                       |                                                |                                                              | pC typ                                 | $V_S = 2.5\text{ V}$ , $R_S = 0\ \Omega$ ; $C_L = 1\text{ nF}$ ;<br>Test Circuit 5                               |
| Off Isolation                              | -61                      |                                                |                                                              | dB typ                                 | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ; $f = 100\text{ kHz}$ ;<br>Test Circuit 6                              |
| Bandwidth -3 dB                            | 12                       |                                                |                                                              | MHz typ                                | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ; Test Circuit 7                                                        |
| $C_S$ (OFF)                                | 180                      |                                                |                                                              | pF typ                                 | $f = 1\text{ MHz}$                                                                                               |
| $C_D$ (OFF)                                | 180                      |                                                |                                                              | pF typ                                 | $f = 1\text{ MHz}$                                                                                               |
| $C_D$ , $C_S$ (ON)                         | 420                      |                                                |                                                              | pF typ                                 | $f = 1\text{ MHz}$                                                                                               |
| <b>POWER REQUIREMENTS</b>                  |                          |                                                |                                                              |                                        |                                                                                                                  |
| $I_{DD}$                                   | 0.001                    | 1.0                                            | 2.0                                                          | $\mu\text{A}$ typ<br>$\mu\text{A}$ max | $V_{DD} = 5.5\text{ V}$<br>Digital Inputs = 0 V or 5.5 V                                                         |

## NOTES

<sup>1</sup>Temperature range is as follows: Automotive Temperature Range:  $-40^{\circ}\text{C}$  to  $+125^{\circ}\text{C}$ .

<sup>2</sup>On Resistance parameters tested with  $I_S = 10\text{ mA}$ .

<sup>3</sup>Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

# SPECIFICATIONS<sup>1</sup>

( $V_{DD} = 2.7\text{ V to }3.6\text{ V}$ ,  $GND = 0\text{ V}$ . All specifications  $-40^{\circ}\text{C to }+125^{\circ}\text{C}$ , unless otherwise noted.)

| Parameter                                  | 25°C       | -40°C to +85°C | -40°C to +125°C <sup>2</sup> | Unit              | Test Conditions/Comments                                                                                         |
|--------------------------------------------|------------|----------------|------------------------------|-------------------|------------------------------------------------------------------------------------------------------------------|
| <b>ANALOG SWITCH</b>                       |            |                |                              |                   |                                                                                                                  |
| Analog Signal Range                        |            |                | 0 V to $V_{DD}$              | V                 |                                                                                                                  |
| On Resistance ( $R_{ON}$ )                 | 0.4        |                |                              | $\Omega$ typ      | $V_S = 0\text{ V to }V_{DD}$ , $I_S = 100\text{ mA}$ ;<br>Test Circuit 1                                         |
|                                            | 0.6        | 0.65           | 0.7                          | $\Omega$ max      |                                                                                                                  |
| On Resistance Flatness ( $R_{FLAT(ON)}$ )  | 0.1        | 0.1            | 0.1                          | $\Omega$ typ      | $V_S = 0\text{ V to }V_{DD}$ , $I_S = 100\text{ mA}$                                                             |
| <b>LEAKAGE CURRENTS</b>                    |            |                |                              |                   |                                                                                                                  |
| Source OFF Leakage $I_S$ (OFF)             | $\pm 0.01$ |                |                              | nA typ            | $V_{DD} = 3.6\text{ V}$<br>$V_S = 3.3\text{ V}/1\text{ V}$ , $V_D = 1\text{ V}/3.3\text{ V}$ ;<br>Test Circuit 2 |
|                                            | $\pm 0.25$ | $\pm 3$        | $\pm 30$                     | nA max            |                                                                                                                  |
| Drain OFF Leakage $I_D$ (OFF)              | $\pm 0.01$ |                |                              | nA typ            | $V_S = 3.3\text{ V}/1\text{ V}$ , $V_D = 1\text{ V}/3.3\text{ V}$ ;<br>Test Circuit 2                            |
|                                            | $\pm 0.25$ | $\pm 3$        | $\pm 30$                     | nA max            |                                                                                                                  |
| Channel On Leakage $I_D$ , $I_S$ (ON)      | $\pm 0.01$ |                |                              | nA typ            | $V_S = V_D = 1\text{ V}$ , or $3.3\text{ V}$ ;<br>Test Circuit 3                                                 |
|                                            | $\pm 0.25$ | $\pm 3$        | $\pm 30$                     | nA max            |                                                                                                                  |
| <b>DIGITAL INPUTS</b>                      |            |                |                              |                   |                                                                                                                  |
| Input High Voltage, $V_{INH}$              |            |                | 2.0                          | V min             |                                                                                                                  |
| Input Low Voltage, $V_{INL}$               |            |                | 0.8                          | V max             |                                                                                                                  |
| Input Current<br>$I_{INL}$ or $I_{INH}$    | 0.005      |                |                              | $\mu\text{A}$ typ | $V_{IN} = V_{INL}$ or $V_{INH}$                                                                                  |
|                                            |            |                | $\pm 0.1$                    | $\mu\text{A}$ max |                                                                                                                  |
| $C_{IN}$ , Digital Input Capacitance       | 5          |                |                              | pF typ            |                                                                                                                  |
| <b>DYNAMIC CHARACTERISTICS<sup>3</sup></b> |            |                |                              |                   |                                                                                                                  |
| $t_{ON}$                                   | 40         |                |                              | ns typ            | $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$<br>$V_S = 1.5\text{ V}$ ; Test Circuit 4                               |
|                                            | 55         | 60             | 65                           | ns max            |                                                                                                                  |
| $t_{OFF}$                                  | 9          |                |                              | ns typ            | $R_L = 50\ \Omega$ , $C_L = 35\text{ pF}$<br>$V_S = 1.5\text{ V}$ ; Test Circuit 4                               |
|                                            | 15         | 18             | 21                           | ns max            |                                                                                                                  |
| Charge Injection                           | 10         |                |                              | pC typ            | $V_S = 1.5\text{ V}$ , $R_S = 0\ \Omega$ , $C_L = 1\text{ nF}$ ;<br>Test Circuit 5                               |
| Off Isolation                              | -61        |                |                              | dB typ            | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 100\text{ kHz}$ ,<br>Test Circuit 6                              |
| Bandwidth -3 dB                            | 12         |                |                              | MHz typ           | $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ; Test Circuit 7                                                        |
| $C_S$ (OFF)                                | 180        |                |                              | pF typ            | $f = 1\text{ MHz}$                                                                                               |
| $C_D$ (OFF)                                | 180        |                |                              | pF typ            | $f = 1\text{ MHz}$                                                                                               |
| $C_D$ , $C_S$ (ON)                         | 420        |                |                              | pF typ            | $f = 1\text{ MHz}$                                                                                               |
| <b>POWER REQUIREMENTS</b>                  |            |                |                              |                   |                                                                                                                  |
| $I_{DD}$                                   | 0.001      |                |                              | $\mu\text{A}$ typ | $V_{DD} = 3.6\text{ V}$<br>Digital Inputs = 0 V or 3.6 V                                                         |
|                                            |            | 1.0            | 2.0                          | $\mu\text{A}$ max |                                                                                                                  |

## NOTES

<sup>1</sup>Temperature range is as follows: Automotive Temperature Range:  $-40^{\circ}\text{C to }+125^{\circ}\text{C}$ .<sup>2</sup>On Resistance parameters tested with  $I_S = 10\text{ mA}$ .<sup>3</sup>Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

# ADG801/ADG802

## ABSOLUTE MAXIMUM RATINGS<sup>1</sup>

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

|                                           |                                                                      |
|-------------------------------------------|----------------------------------------------------------------------|
| V <sub>DD</sub> to GND                    | –0.3 V to +7 V                                                       |
| Analog Inputs <sup>2</sup>                | –0.3 V to V <sub>DD</sub> +0.3 V<br>or 30 mA, Whichever Occurs First |
| Digital Inputs <sup>2</sup>               | –0.3 V to V <sub>DD</sub> +0.3 V<br>or 30 mA, Whichever Occurs First |
| Continuous Current, S or D                | 400 mA                                                               |
| Peak Current, S or D                      | 800 mA<br>(Pulsed at 1 ms, 10% Duty Cycle Max)                       |
| Operating Temperature Range Automotive    | –40°C to +125°C                                                      |
| Storage Temperature Range                 | –65°C to +150°C                                                      |
| Junction Temperature (T <sub>Jmax</sub> ) | 150°C                                                                |
| Package Power Dissipation                 | (T <sub>Jmax</sub> – T <sub>A</sub> )/θ <sub>JA</sub>                |
| μSOIC Package                             |                                                                      |
| θ <sub>JA</sub> Thermal Impedance         | 206°C/W                                                              |
| θ <sub>JC</sub> Thermal Impedance         | 44°C/W                                                               |
| SOT-23 Package (4-Layer Board)            |                                                                      |
| θ <sub>JA</sub> Thermal Impedance         | 119°C/W                                                              |
| Lead Temperature, Soldering (10 seconds)  | 300°C                                                                |
| IR Reflow, Peak Temperature (<20 seconds) | 235°C                                                                |

## NOTES

<sup>1</sup>Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those listed 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.

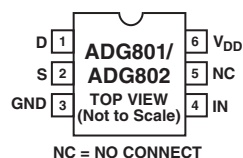
<sup>2</sup>Overvoltages at IN, S, or D will be clamped by internal diodes. Current should be limited to the maximum ratings given.

Table I. Truth Table

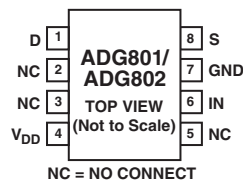
| ADG801 In | ADG802 In | Switch Condition |
|-----------|-----------|------------------|
| 0         | 1         | OFF              |
| 1         | 0         | ON               |

## PIN CONFIGURATIONS

### 6-Lead Plastic Surface-Mount (SOT-23) (RT-6)



### 8-Lead Small Outline μSOIC (RM-8)



## ORDERING GUIDE

| Model     | Temperature Range | Brand <sup>1</sup> | Package Descriptions           | Package Options   |
|-----------|-------------------|--------------------|--------------------------------|-------------------|
| ADG801BRT | –40°C to +125°C   | SLB                | SOT-23 (Plastic Surface-Mount) | RT-6 <sup>2</sup> |
| ADG801BRM | –40°C to +125°C   | SLB                | μSOIC (Small Outline)          | RM-8              |
| ADG802BRT | –40°C to +125°C   | SMB                | SOT-23 (Plastic Surface-Mount) | RT-6 <sup>2</sup> |
| ADG802BRM | –40°C to +125°C   | SMB                | μSOIC (Small Outline)          | RM-8              |

<sup>1</sup>Branding on SOT-23 and μSOIC packages is limited to three characters due to space constraints.

<sup>2</sup>Contact factory for availability.

## CAUTION

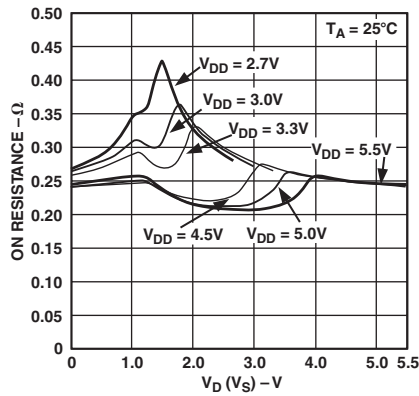
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADG801/ADG802 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high-energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



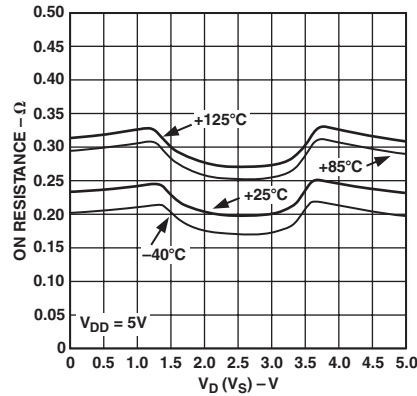
## TERMINOLOGY

|                     |                                                                                                                           |
|---------------------|---------------------------------------------------------------------------------------------------------------------------|
| $V_{DD}$            | Most Positive Power Supply Potential                                                                                      |
| $I_{DD}$            | Positive Supply Current                                                                                                   |
| GND                 | Ground (0 V) Reference                                                                                                    |
| S                   | Source Terminal. May be an input or output.                                                                               |
| D                   | Drain Terminal. May be an input or output.                                                                                |
| IN                  | Logic Control Input                                                                                                       |
| $V_D (V_S)$         | Analog Voltage on Terminals D and S                                                                                       |
| $R_{ON}$            | Ohmic Resistance Between D and S                                                                                          |
| $R_{FLAT(ON)}$      | The difference between the maximum and minimum value of On Resistance as measured over the specified analog signal range. |
| $I_S$ (OFF)         | Source Leakage Current with the Switch OFF                                                                                |
| $I_D$ (OFF)         | Drain Leakage Current with the Switch OFF                                                                                 |
| $I_D, I_S$ (ON)     | Channel Leakage Current with the Switch ON                                                                                |
| $V_{INL}$           | Maximum Input Voltage for Logic “0”                                                                                       |
| $V_{INH}$           | Minimum Input Voltage for Logic “1”                                                                                       |
| $I_{INL} (I_{INH})$ | Input Current of the Digital Input                                                                                        |
| $C_S$ (OFF)         | OFF Switch Source Capacitance. Measured with reference to ground.                                                         |
| $C_D$ (OFF)         | OFF Switch Drain Capacitance. Measured with reference to ground.                                                          |
| $C_D, C_S$ (ON)     | ON Switch Capacitance. Measured with reference to ground.                                                                 |
| $C_{IN}$            | Digital Input Capacitance                                                                                                 |
| $t_{ON}$            | Delay between applying the Digital Control Input and the Output Switching ON. See Test Circuit 4.                         |
| $t_{OFF}$           | Delay between applying the Digital Control Input and the Output Switching OFF.                                            |
| Charge Injection    | A measure of the glitch impulse transferred from the Digital Input to the Analog Output during switching.                 |
| Off Isolation       | A measure of unwanted signal coupling through an OFF switch.                                                              |
| Bandwidth           | The frequency at which the output is attenuated by 3 dBs.                                                                 |
| On Response         | The frequency response of the ON switch                                                                                   |
| Insertion Loss      | The loss due to the On Resistance of the switch                                                                           |

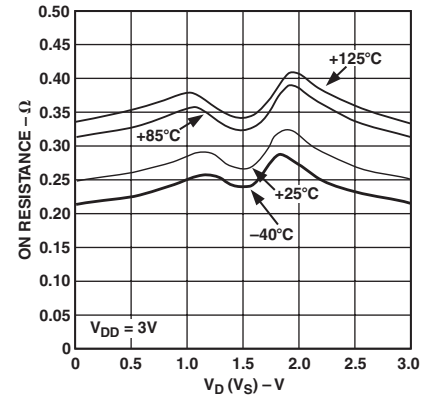
# ADG801/ADG802—Typical Performance Characteristics



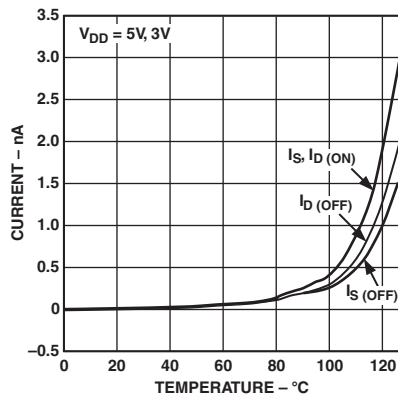
TPC 1. On Resistance vs.  $V_D (V_S)$



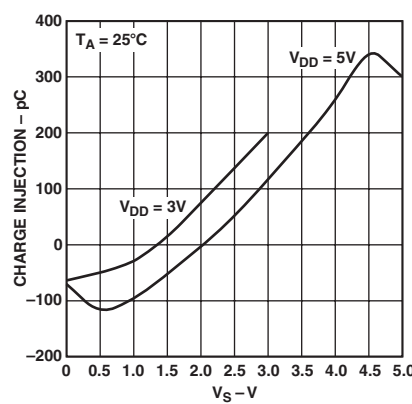
TPC 2. On Resistance vs.  $V_D (V_S)$  for Different Temperatures



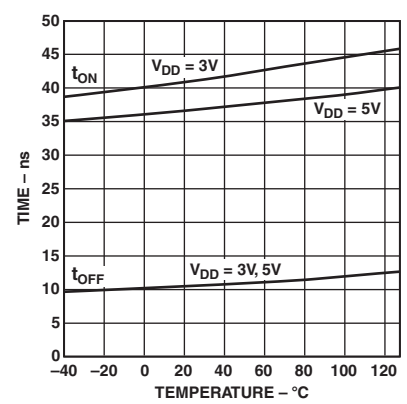
TPC 3. On Resistance vs.  $V_D (V_S)$  for Different Temperatures



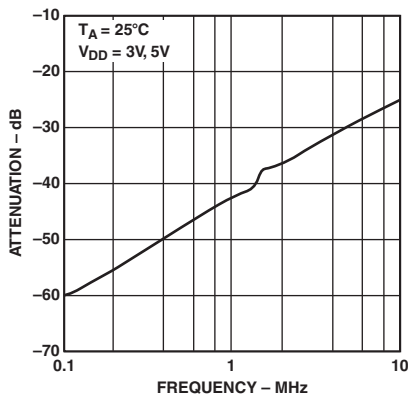
TPC 4. Leakage Currents vs. Temperature



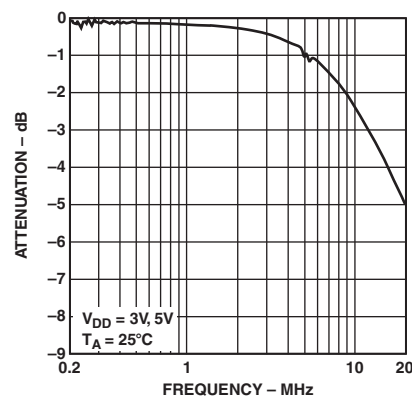
TPC 5. Charge Injection vs. Source Voltage



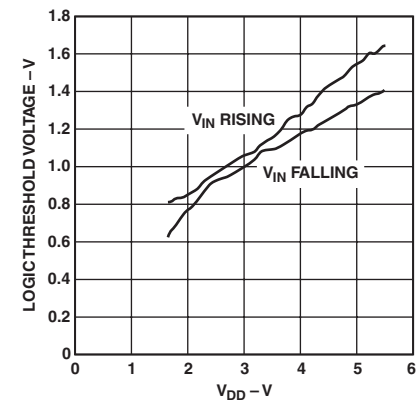
TPC 6.  $t_{ON}/t_{OFF}$  Times vs. Temperature



TPC 7. Off Isolation vs. Frequency

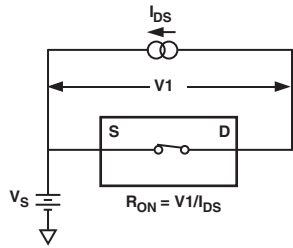


TPC 8. On Response vs. Frequency

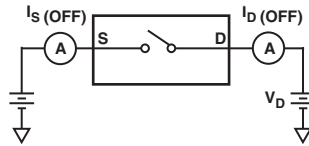


TPC 9. Logic Threshold Voltage vs. Supply Voltage

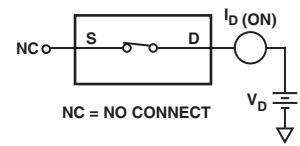
## Test Circuits



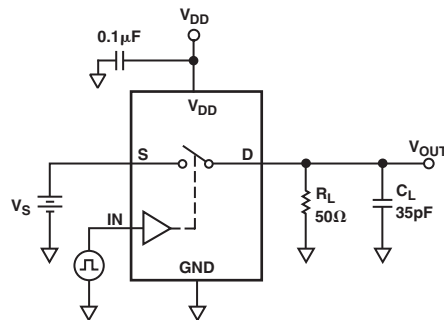
Test Circuit 1. On Resistance



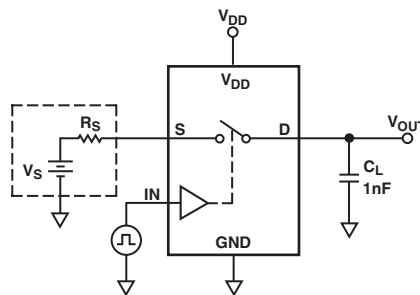
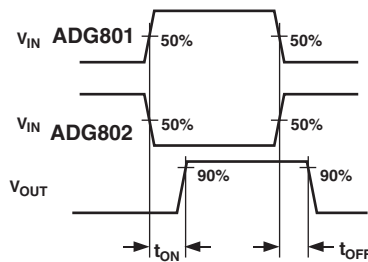
Test Circuit 2. Off Leakage



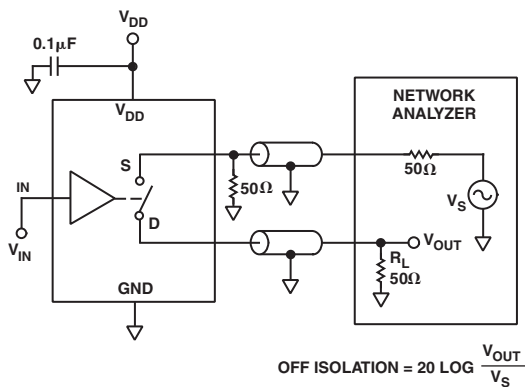
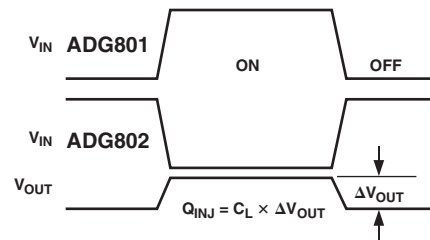
Test Circuit 3. On Leakage



Test Circuit 4. Switching Times

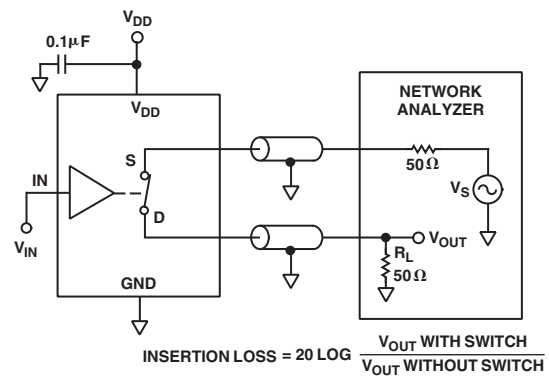


Test Circuit 5. Charge Injection



Test Circuit 6. Off Isolation

$$\text{OFF ISOLATION} = 20 \log \frac{V_{\text{OUT}}}{V_S}$$



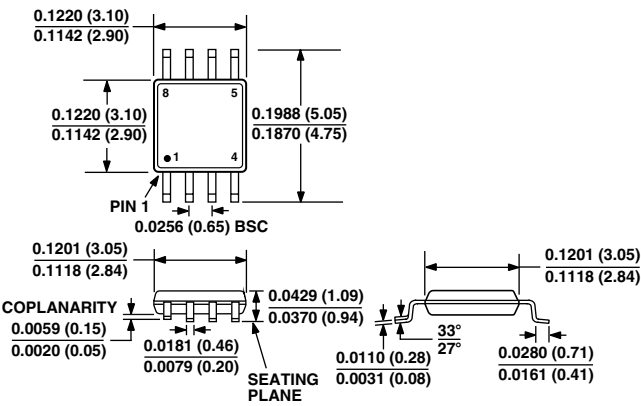
Test Circuit 7. Bandwidth

$$\text{INSERTION LOSS} = 20 \log \frac{V_{\text{OUT WITH SWITCH}}}{V_{\text{OUT WITHOUT SWITCH}}}$$

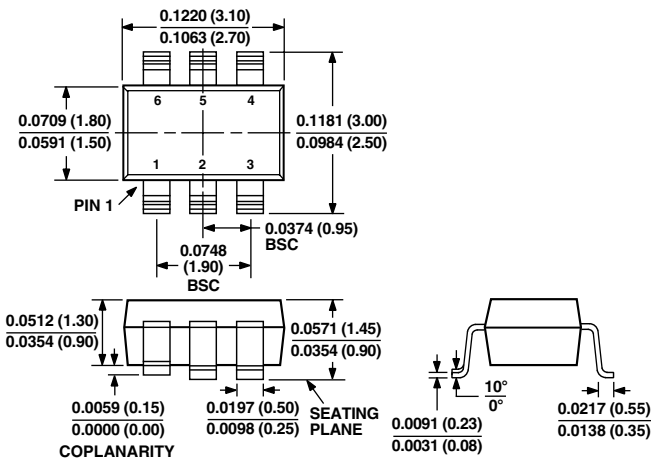
ADG801/ADG802

OUTLINE DIMENSIONS  
Dimensions shown in inches and (mm)

8-Lead  $\mu$ SOIC  
(RM-8)



6-Lead SOT-23  
(RT-6)



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