

**FEATURES**

**5.5  $\Omega$  (maximum) on resistance**  
**0.9  $\Omega$  (typical) on resistance flatness**  
**2.7 V to 5.5 V single supply**  
 **$\pm 2.7$  V to  $\pm 5.5$  V dual supply**  
**Rail-to-rail operation**  
**10-lead MSOP package**  
**Typical power consumption: <0.01  $\mu$ W**  
**TTL-/CMOS-compatible inputs**

**APPLICATIONS**

**Automatic test equipment**  
**Power routing**  
**Communication systems**  
**Data acquisition systems**  
**Sample-and-hold systems**  
**Avionics**  
**Relay replacements**  
**Battery-powered systems**

**GENERAL DESCRIPTION**

The [ADG621](#) is a monolithic, CMOS, single-pole, single-throw (SPST) switch. The [ADG621](#) conducts equally well in both directions when on. The [ADG621](#) contains two independent switches. The [ADG621](#) is a normally open switch.

The [ADG621](#) offers low on resistance of 4  $\Omega$ , which is matched to within 0.25  $\Omega$  between channels. The [ADG621](#) also provides low power dissipation yet offers high switching speeds.

All digital inputs have 0.8 V to 2.4 V logic thresholds, ensuring TTL/CMOS compatibility when using single +5 V or dual  $\pm 5$  V supplies. The [ADG621](#) is available in a 10-lead MSOP package.

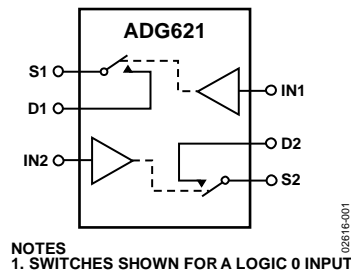
**FUNCTIONAL BLOCK DIAGRAM**


Figure 1.

**PRODUCT HIGHLIGHTS**

1. Low on resistance,  $R_{ON}$  (4  $\Omega$  typical).
2. Dual  $\pm 2.7$  V to  $\pm 5.5$  V or single +2.7 V to +5.5 V.
3. Low power dissipation; CMOS construction ensures low power dissipation.
4. Tiny 10-lead MSOP package.

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## REVISION HISTORY

### 5/2017—Rev. B to Rev. C

Deleted ADG622 and ADG623 .....	Universal
Changes to Features Section and General Description Section....	1
Deleted Figure 2 and Figure 3; Renumbered Sequentially.....	1
Deleted Break-Before-Make Time Delay Parameter, Table 1.....	3
Deleted Note 1, Table 1; Renumbered Sequentially.....	3
Added Note 2, Table 1.....	3
Deleted Break-Before-Make Time Delay Parameter, Table 2 .....	4
Deleted Note 1, Table 2; Renumbered Sequentially.....	4
Added Note 2, Table 2.....	4
Added Note 1, Table 3; Renumbered Sequentially.....	5
Changes to Table 3.....	5
Deleted Table 5; Renumbered Sequentially.....	5
Moved Table 5 .....	6
Changes to Figure 2, Table 4, and Table 5 .....	6
Changes to Figure 11, Figure 12, and Figure 13 .....	8
Changes to Figure 14, Figure 15, Figure 16, Figure 17, and Figure 18 .....	9
Changes to Figure 19 and Figure 21.....	10
Deleted Figure 20.....	10

Moved Terminology Section.....	11
Changes to Terminology Section .....	11
Changes to Ordering Guide .....	12

### 11/2009—Rev. A to Rev. B

Changes to Table 5.....	5
Changes to Ordering Guide .....	12

### 6/2007—Rev. 0 to Rev. A

Change to On Resistance Flatness, $R_{\text{FLAT(ON)}}$ Specification (Table 1) .....	3
Change to On Resistance Flatness, $R_{\text{FLAT(ON)}}$ Specification (Table 2) .....	4
Added Table 6 .....	6
Changes to Terminology Section .....	7
Changes to Figure 13.....	9
Updated Outline Dimensions.....	12
Changes to Ordering Guide .....	12

### 11/2001—Revision 0: Initial Version

## SPECIFICATIONS

### DUAL SUPPLY

$V_{DD} = 5\text{ V} \pm 10\%$ ,  $V_{SS} = -5\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ , unless otherwise noted.

Table 1.

Parameter	+25°C	-40°C to +85°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>				
Analog Signal Range		$V_{SS}$ to $V_{DD}$	V	$V_{DD} = +4.5\text{ V}$ , $V_{SS} = -4.5\text{ V}$
On Resistance, $R_{ON}$	4		$\Omega$ typ	$V_S = \pm 4.5\text{ V}$ , $I_S = -10\text{ mA}$ , see Figure 14
	5.5	7	$\Omega$ max	
On Resistance Match Between Channels, $\Delta R_{ON}$	0.25		$\Omega$ typ	$V_S = \pm 4.5\text{ V}$ , $I_S = -10\text{ mA}$
	0.35	0.4	$\Omega$ max	
On Resistance Flatness, $R_{FLAT(ON)}$	0.9	0.9	$\Omega$ typ	$V_S = \pm 3.3\text{ V}$ , $I_S = -10\text{ mA}$
		1.5	$\Omega$ max	
<b>LEAKAGE CURRENTS</b>				
Source Off Leakage, $I_S$ (Off)	$\pm 0.01$		nA typ	$V_{DD} = +5.5\text{ V}$ , $V_{SS} = -5.5\text{ V}$
	$\pm 0.25$	$\pm 1$	nA max	$V_S = \pm 4.5\text{ V}$ , $V_D = \mp 4.5\text{ V}$ , see Figure 15
Drain Off Leakage, $I_D$ (Off)	$\pm 0.01$		nA typ	$V_S = \pm 4.5\text{ V}$ , $V_D = \mp 4.5\text{ V}$ , see Figure 15
	$\pm 0.25$	$\pm 1$	nA max	
Channel On Leakage, $I_D$ , $I_S$ (On)	$\pm 0.01$		nA typ	$V_S = V_D = \pm 4.5\text{ V}$ , see Figure 16
	$\pm 0.25$	$\pm 1$	nA max	
<b>DIGITAL INPUTS</b>				
Input High Voltage, $V_{INH}$		2.4	V min	
Input Low Voltage, $V_{INL}$		0.8	V max	
Input Current, $I_{INL}$ or $I_{INH}$	0.005		$\mu\text{A}$ typ	$V_{IN} = V_{INL}$ or $V_{INH}$
		$\pm 0.1$	$\mu\text{A}$ max	
Digital Input Capacitance, $C_{IN}$	2		pF typ	
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>				
$t_{ON}$	75		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_S = 3.3\text{ V}$ , see Figure 17
	120	155	ns max	
$t_{OFF}$	45		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_S = 3.3\text{ V}$ , see Figure 17
	70	85	ns max	
Charge Injection, $Q_{INJ}$	110		pC typ	$V_S = 0\text{ V}$ , $R_S = 0\ \Omega$ , $C_L = 1\text{ nF}$ , see Figure 18
Off Isolation	-65		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ , see Figure 19
Channel to Channel Crosstalk	-90		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ , see Figure 20
-3 dB Bandwidth	230		MHz typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , see Figure 21
$C_S$ (Off)	20		pF typ	$f = 1\text{ MHz}$
$C_D$ (Off)	20		pF typ	$f = 1\text{ MHz}$
$C_D$ , $C_S$ (On)	70		pF typ	$f = 1\text{ MHz}$
<b>POWER REQUIREMENTS<sup>2</sup></b>				
$I_{DD}$	0.001		$\mu\text{A}$ typ	$V_{DD} = 5.5\text{ V}$ , $V_{SS} = -5.5\text{ V}$
		1.0	$\mu\text{A}$ max	Digital inputs = 0V or 5.5V
$I_{SS}$	0.001		$\mu\text{A}$ typ	Digital inputs = 0V or 5.5V
		1.0	$\mu\text{A}$ max	

<sup>1</sup> Guaranteed by design; not subject to production test.

<sup>2</sup> The device is fully specified at  $\pm 5\text{ V}$  dual supply and at  $+5\text{ V}$  single supply only. It is possible to operate the ADG621 with unbalanced supplies or at other voltage supplies ( $\pm 2.7\text{ V}$  to  $\pm 5.5\text{ V}$  dual supply, and  $+2.7\text{ V}$  to  $+5.5\text{ V}$  single supply); however, the switch characteristics change. These changes include, but are not limited to, analog signal range, on resistance, leakage,  $V_{INL}$ ,  $V_{INH}$ , and switching times. The optimal power-up sequence for the device is ground,  $V_{DD}$ ,  $V_{SS}$ , and then the digital inputs, before applying the analog input signal.

**SINGLE SUPPLY**

$V_{DD} = 5\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ ,  $GND = 0\text{ V}$ , unless otherwise noted.

**Table 2.**

Parameter	+25°C	-40°C to +85°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>				
Analog Signal Range		0 to $V_{DD}$	V	$V_{DD} = 4.5\text{ V}$ , $V_{SS} = 0\text{ V}$
On Resistance, $R_{ON}$	7		$\Omega$ typ	$V_S = 0\text{ V to } 4.5\text{ V}$ , $I_S = -10\text{ mA}$ , see Figure 14
	10	12.5	$\Omega$ max	
On Resistance Match Between Channels, $\Delta R_{ON}$	0.5		$\Omega$ typ	$V_S = 0\text{ V to } 4.5\text{ V}$ , $I_S = -10\text{ mA}$
	0.75	1	$\Omega$ max	
On Resistance Flatness, $R_{FLAT(ON)}$	0.5	0.5	$\Omega$ typ	$V_S = 1.5\text{ V to } 3.3\text{ V}$ , $I_S = -10\text{ mA}$
		1.2	$\Omega$ max	
<b>LEAKAGE CURRENTS</b>				
Source Off Leakage $I_S$ (Off)	$\pm 0.01$		nA typ	$V_{DD} = 5.5\text{ V}$
	$\pm 0.25$	$\pm 1$	nA max	$V_S = 1\text{ V}/4.5\text{ V}$ , $V_D = 4.5\text{ V}/1\text{ V}$ , see Figure 15
Drain Off Leakage $I_D$ (Off)	$\pm 0.01$		nA typ	$V_S = 1\text{ V}/4.5\text{ V}$ , $V_D = 4.5\text{ V}/1\text{ V}$ , see Figure 15
	$\pm 0.25$	$\pm 1$	nA max	
Channel On Leakage, $I_D$ , $I_S$ (On)	$\pm 0.01$		nA typ	$V_S = V_D = 1\text{ V}/4.5\text{ V}$ , see Figure 16
	$\pm 0.25$	$\pm 1$	nA max	
<b>DIGITAL INPUTS</b>				
Input High Voltage, $V_{INH}$		2.4	V min	
Input Low Voltage, $V_{INL}$		0.8	V max	
Input Current, $I_{INL}$ or $I_{INH}$	0.005		$\mu\text{A}$ typ	$V_{IN} = V_{INL}$ or $V_{INH}$
		$\pm 0.1$	$\mu\text{A}$ max	
Digital Input Capacitance, $C_{IN}$	2		pF typ	
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>				
$t_{ON}$	120		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_S = 3.3\text{ V}$ , see Figure 17
	210	260	ns max	
$t_{OFF}$	50		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_S = 3.3\text{ V}$ , see Figure 17
	75	100	ns max	
Charge Injection, $Q_{INJ}$	6		pC typ	$V_S = 0\text{ V}$ ; $R_S = 0\ \Omega$ , $C_L = 1\text{ nF}$ , see Figure 18
Off Isolation	-65		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ , see Figure 19
Channel-to-Channel Crosstalk	-90		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ , see Figure 20
-3 dB Bandwidth	230		MHz typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , see Figure 21
$C_S$ (Off)	20		pF typ	$f = 1\text{ MHz}$
$C_D$ (Off)	20		pF typ	$f = 1\text{ MHz}$
$C_D$ , $C_S$ (On)	70		pF typ	$f = 1\text{ MHz}$
<b>POWER REQUIREMENTS<sup>2</sup></b>				
$I_{DD}$	0.001		$\mu\text{A}$ typ	$V_{DD} = 5.5\text{ V}$
		1.0	$\mu\text{A}$ max	Digital Inputs = 0V or 5.5V

<sup>1</sup> Guaranteed by design; not subject to production test.

<sup>2</sup> The device is fully specified at  $\pm 5\text{ V}$  dual supply and at  $+5\text{ V}$  single supply only. It is possible to operate the ADG621 with unbalanced supplies or at other voltage supplies ( $\pm 2.7\text{ V}$  to  $\pm 5.5\text{ V}$  dual supply, and  $+2.7\text{ V}$  to  $+5.5\text{ V}$  single supply); however, the switch characteristics change. These changes include, but are not limited to, analog signal range, on resistance, leakage,  $V_{INL}$ ,  $V_{INH}$ , and switching times. The optimal power-up sequence for the device is ground,  $V_{DD}$ ,  $V_{SS}$ , and then the digital inputs, before applying the analog input signal.

## ABSOLUTE MAXIMUM RATINGS

$T_A = 25^\circ\text{C}$ , unless otherwise noted.

Table 3.

Parameter	Rating
$V_{DD}$ to $V_{SS}$ <sup>1</sup>	13 V
$V_{DD}$ to GND	-0.3 V to +6.5 V
$V_{SS}$ to GND	+0.3 V to -6.5 V
Analog Inputs <sup>2</sup>	$V_{SS} - 0.3\text{ V}$ to $V_{DD} + 0.3\text{ V}$
Digital Inputs <sup>2</sup>	-0.3 V to $V_{DD} + 0.3\text{ V}$ or 30 mA, whichever occurs first
Peak Current, Sx or Dx	100 mA (pulsed at 1 ms, 10% duty cycle maximum)
Continuous Current, S or D	50 mA
Operating Temperature Range Industrial	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	150°C
MSOP Package	
$\theta_{JA}$ Thermal Impedance	206°C/W
$\theta_{JC}$ Thermal Impedance	44°C/W
Lead Soldering	
Lead Temperature, Soldering (10 sec)	300°C
Infrared (IR) Reflow, Peak Temperature	220°C
Pb-Free Soldering	
Reflow, Peak Temperature	260 (+0/-5)°C
Time at Peak Temperature	20 sec to 40 sec

<sup>1</sup> The device is fully specified at  $\pm 5\text{ V}$  dual supply and at +5 V single supply only. It is possible to operate the ADG621 with unbalanced supplies or at other voltage supplies ( $\pm 2.7\text{ V}$  to  $\pm 5.5\text{ V}$ , and  $2.7\text{ V}$  to  $5.5\text{ V}$ ); however, the switch characteristics change. These changes include, but are not limited to, analog signal range, on resistance, leakage,  $V_{INL}$ ,  $V_{INH}$ , and switching times. The optimal power-up sequence for the device is ground,  $V_{DD}$ ,  $V_{SS}$ , and then the digital inputs, before applying the analog input signal.

<sup>2</sup> Overvoltages at INx, S, or D must be clamped by internal diodes. Limit currents to the maximum ratings given.

Stresses at or above those listed under Absolute Maximum Ratings may cause permanent damage to the product. This is a stress rating only; functional operation of the product at these or any other conditions above those indicated in the operational section of this specification is not implied. Operation beyond the maximum operating conditions for extended periods may affect product reliability.

Only one absolute maximum rating can be applied at any one time.

### ESD CAUTION



**ESD (electrostatic discharge) sensitive device.** Charged devices and circuit boards can discharge without detection. Although this product features patented or proprietary protection circuitry, damage may occur on devices subjected to high energy ESD. Therefore, proper ESD precautions should be taken to avoid performance degradation or loss of functionality.

## PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

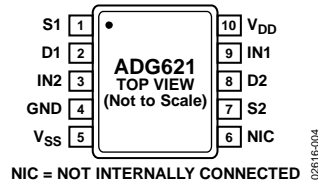


Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1, 7	S1, S2	Source Terminals. S1 and S2 can be inputs or outputs.
2, 8	D1, D2	Drain Terminals. D1 and D2 can be inputs or outputs.
3, 9	IN2, IN1	Control Inputs.
4	GND	Ground (0 V) Reference.
5	V <sub>SS</sub>	Most Negative Power Supply in a Dual-Supply Application. In single-supply applications, tie this pin to ground at the device.
6	NIC	Not Internally Connected.
10	V <sub>DD</sub>	Most Positive Power Supply Potential.

Table 5. Truth Table

IN <sub>x</sub>	Switch S <sub>x</sub> Condition
0	Off
1	On

### TYPICAL PERFORMANCE CHARACTERISTICS

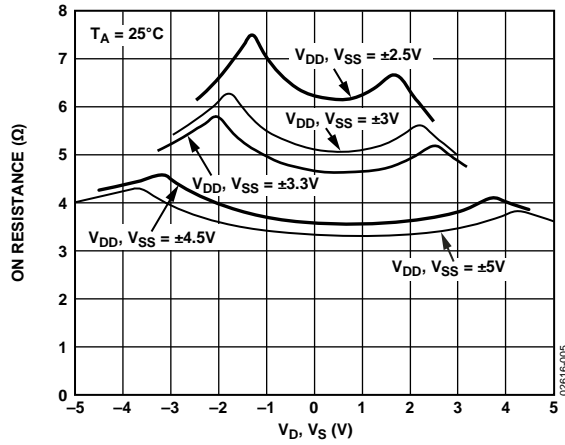


Figure 3. On Resistance vs.  $V_D, V_S$  (Dual Supply)

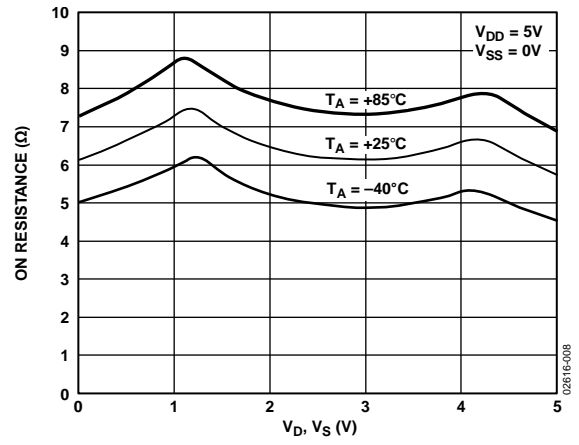


Figure 6. On Resistance vs.  $V_D, V_S$  for Different Temperature (Single Supply)

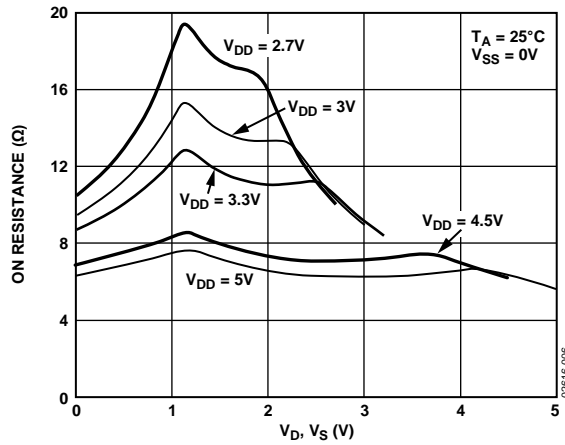


Figure 4. On Resistance vs.  $V_D, V_S$  (Single Supply)

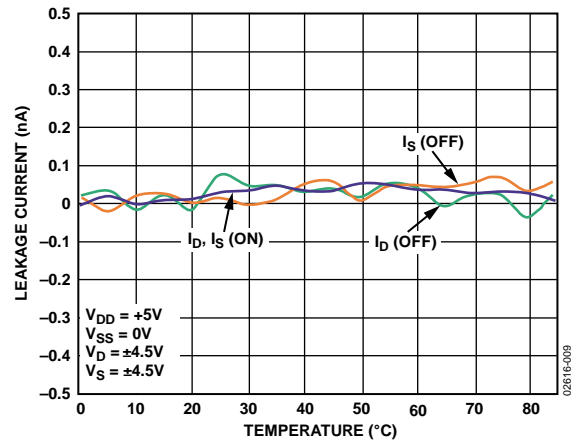


Figure 7. Leakage Current vs. Temperature (Dual Supply)

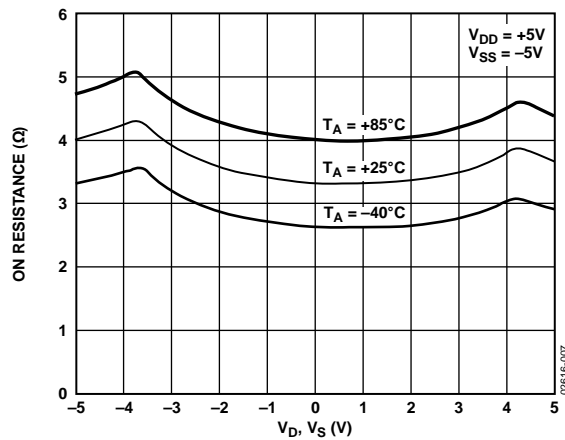


Figure 5. On Resistance vs.  $V_D, V_S$  for Different Temperatures (Dual Supply)

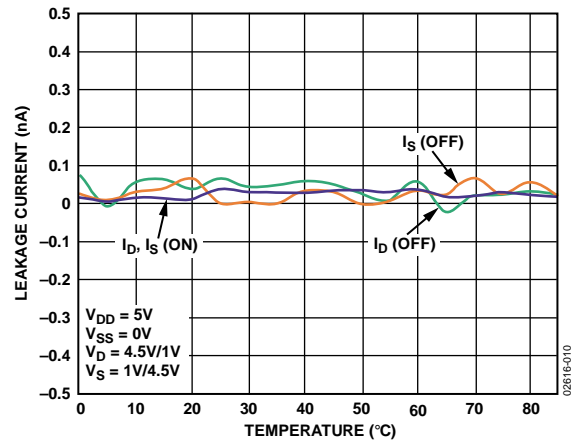


Figure 8. Leakage Current vs. Temperature (Single Supply)

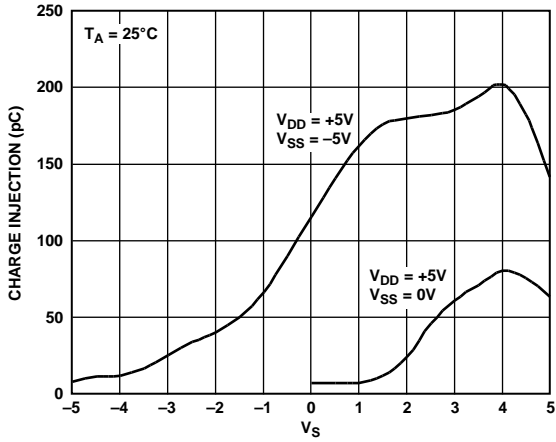


Figure 9. Charge Injection vs. Source Voltage ( $V_s$ )

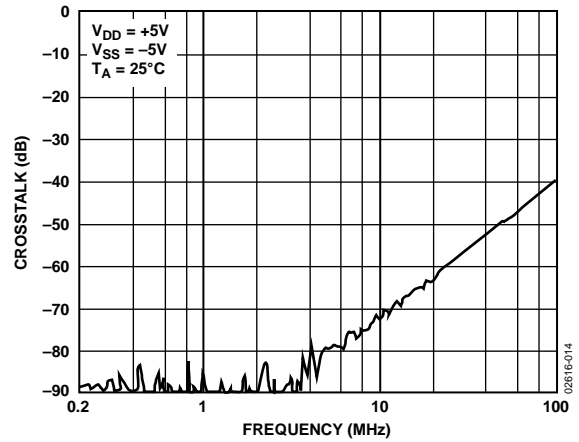


Figure 12. Crosstalk vs. Frequency

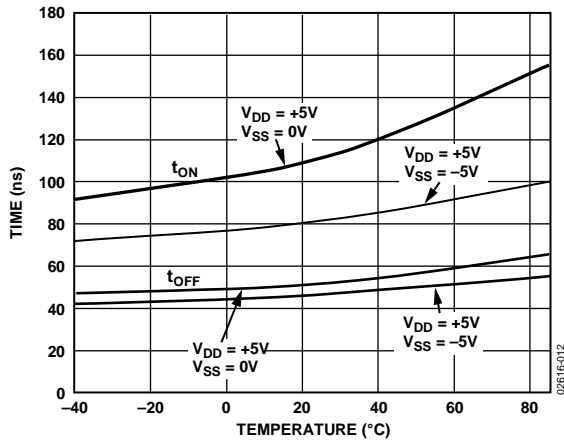


Figure 10.  $t_{ON}/t_{OFF}$  Times vs. Temperature

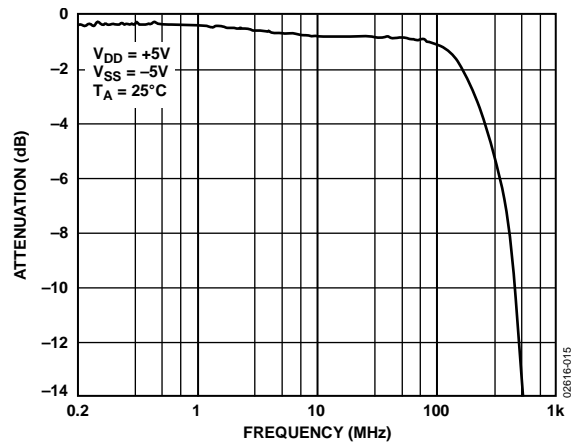


Figure 13. Bandwidth vs. Frequency

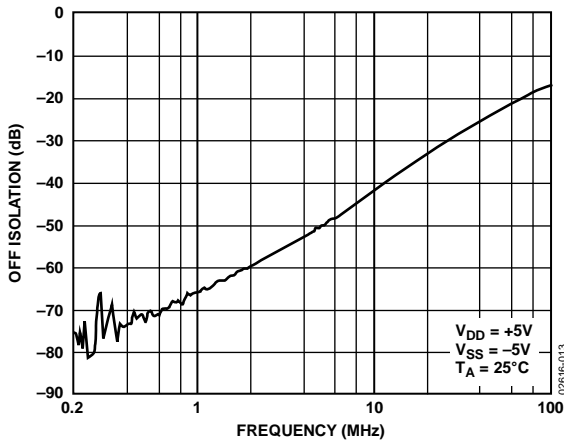


Figure 11. Off Isolation vs. Frequency



TEST CIRCUITS

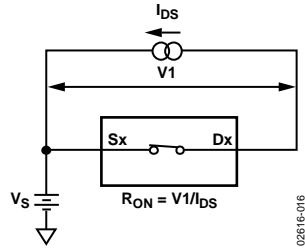


Figure 14. On Resistance

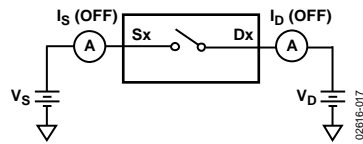


Figure 15. Off Leakage

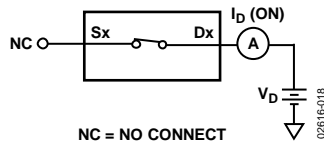


Figure 16. On Leakage

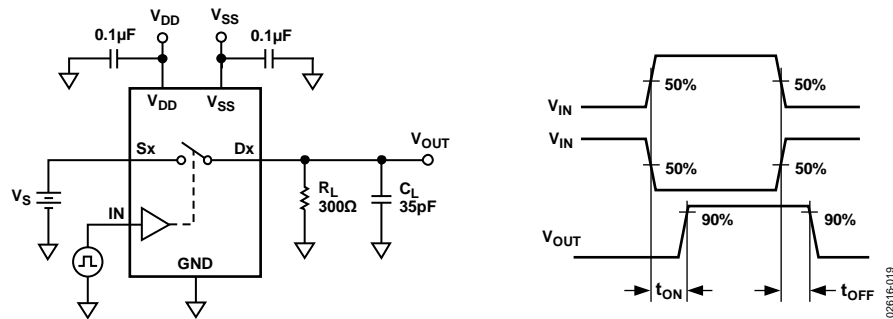


Figure 17. Switching Times ( $t_{ON}$ ,  $t_{OFF}$ )

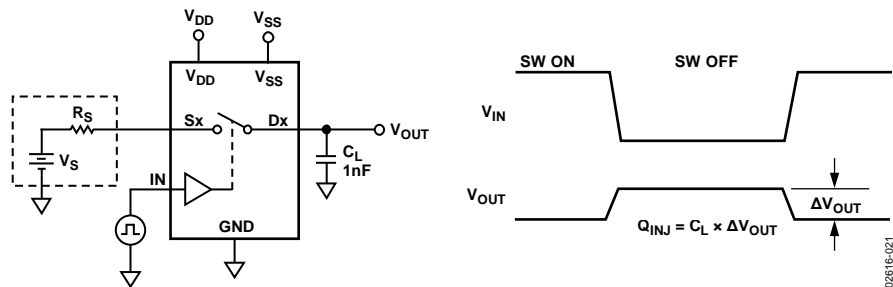


Figure 18. Charge Injection

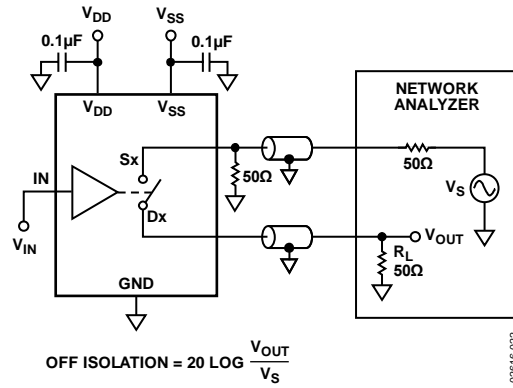


Figure 19. Off Isolation

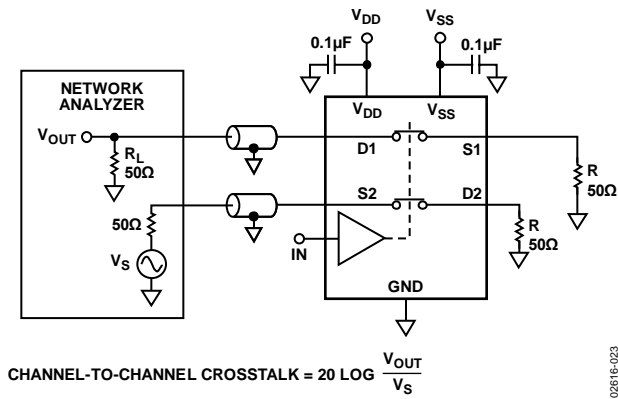


Figure 20. Channel to Channel Crosstalk

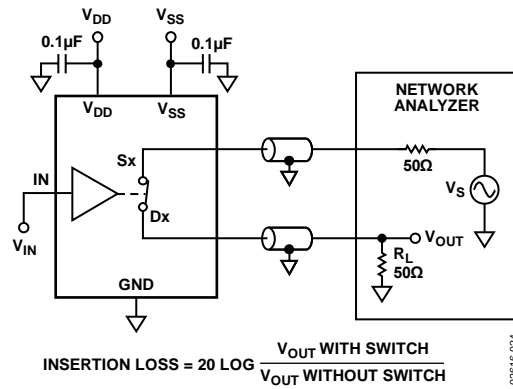


Figure 21. Bandwidth

## TERMINOLOGY

### $I_{DD}$

$I_{DD}$  is the positive supply current.

### $I_{SS}$

$I_{SS}$  is the negative supply current.

### $V_D$ ( $V_S$ )

$V_D$  and  $V_S$  are the analog voltages on Terminal D and Terminal S, respectively.

### $R_{ON}$

$R_{ON}$  is the ohmic resistance between Terminal D and Terminal S.

### $R_{FLAT(ON)}$

On resistance flatness is defined as the difference between the maximum and minimum value of on resistance as measured over the specified analog signal range.

### $\Delta R_{ON}$

$\Delta R_{ON}$  is the on resistance match between any two channels.

### $I_S$ (Off)

$I_S$  (Off) is the source leakage current with the switch off.

### $I_D$ (Off)

$I_D$  (Off) is the drain leakage current with the switch off.

### $I_D$ , $I_S$ (On)

$I_D$  (On) and  $I_S$  (On) are the channel leakage currents with the switch on.

### $V_{INL}$

$V_{INL}$  is the maximum input voltage for Logic 0.

### $V_{INH}$

$V_{INH}$  is the minimum input voltage for Logic 1.

### $I_{INL}$ ( $I_{INH}$ )

$I_{INL}$  and  $I_{INH}$  are the input currents of the digital input.

### $C_S$ (Off)

$C_S$  (Off) is the off switch source capacitance, measured with reference to ground.

### $C_D$ (Off)

$C_D$  (Off) is the off switch drain capacitance, measured with reference to ground.

### $C_D$ , $C_S$ (On)

$C_D$  (On) and  $C_S$  (On) are the on switch capacitances, measured with reference to ground.

### $C_{IN}$

$C_{IN}$  is the digital input capacitance.

### $t_{ON}$

$t_{ON}$  is the delay time between the 50% and the 90% points of the digital input and switch on condition.

### $t_{OFF}$

$t_{OFF}$  is the delay time between the 50% and the 90% points of the digital input and switch off condition.

### Charge Injection

Charge injection,  $Q_{INJ}$ , is a measure of the glitch impulse transferred from the digital input to the analog output during on and off switching.

### Off Isolation

Off isolation is a measure of an unwanted signal coupling through an off switch.

### Crosstalk

Crosstalk is a measure of an unwanted signal that is coupled through from one channel to another as a result of parasitic capacitance.

### -3 dB Bandwidth

-3 dB bandwidth is the frequency at which the output is attenuated by -3 dB.

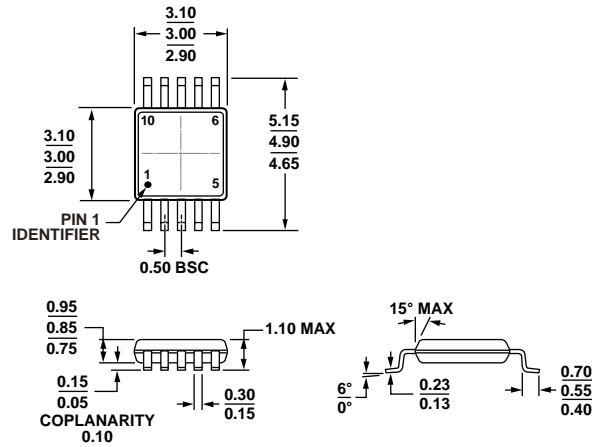
### On Response

On response is the frequency response of the on switch.

### Insertion Loss

Insertion loss is the attenuation between the input and output ports of the switch when the switch is in the on condition and is due to the on resistance of the switch.

OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-187-BA

Figure 22. 10-Lead Mini Small Outline Package [MSOP] (RM-10)

Dimensions shown in millimeters

081709-A

ORDERING GUIDE

Model <sup>1</sup>	Temperature Range	Package Description	Package Option	Branding <sup>2</sup>
ADG621BRMZ	-40°C to +85°C	10-Lead Mini Small Outline Package [MSOP]	RM-10	SXB#
ADG621BRMZ-REEL	-40°C to +85°C	10-Lead Mini Small Outline Package [MSOP]	RM-10	SXB#

<sup>1</sup> Z = RoHS Compliant Part.

<sup>2</sup> # denotes RoHS compliant product; may be top or bottom marked.

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