

FEATURES

- 6.5 Ω (maximum) on resistance**
- 0.8 Ω (maximum) on-resistance flatness**
- 2.7 V to 5.5 V single supply**
- $\pm 2.7\text{ V}$ to $\pm 5.5\text{ V}$ dual supply**
- Rail-to-rail operation**
- 8-lead SOT-23, 8-lead MSOP**
- Typical power consumption (<0.1 μW)**
- TTL-/CMOS-compatible inputs**

APPLICATIONS

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

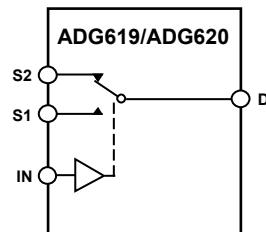
GENERAL DESCRIPTION

The ADG619/ADG620 are monolithic, CMOS single-pole double-throw (SPDT) switches. Each switch conducts equally well in both directions when the device is on.

The ADG619/ADG620 offer a low on resistance of 4 Ω , which is matched to within 0.7 Ω between channels. These switches also provide low power dissipation, yet result in high switching speeds. The ADG619 exhibits break-before-make switching action, thus preventing momentary shorting when switching channels. The ADG620 exhibits make-before-break action.

The ADG619/ADG620 are available in an 8-lead SOT-23 and an 8-lead MSOP.

FUNCTIONAL BLOCK DIAGRAM



NOTES
1. SWITCHES SHOWN FOR
A LOGIC 1 INPUT.

02617-001

Figure 1.

PRODUCT HIGHLIGHTS

1. Low on resistance (R_{ON}): 4 Ω typical.
2. Dual $\pm 2.7\text{ V}$ to $\pm 5.5\text{ V}$ or single 2.7 V to 5.5 V supplies.
3. Low power dissipation.
4. Fast t_{ON}/t_{OFF} .
5. Tiny, 8-lead SOT-23 and 8-lead MSOP.

Table 1. Truth Table for the ADG619/ADG620

IN	Switch S1	Switch S2
0	On	Off
1	Off	On

Rev. C

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1/06—Rev. A to Rev. B

Changes to R _{ON} Values in Table 2	2
Updated Outline Dimensions	13
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6/03—Rev. 0 to Rev. A.

Edits to Specifications	2
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SPECIFICATIONS

DUAL SUPPLY

$V_{DD} = +5 \text{ V} \pm 10\%$, $V_{SS} = -5 \text{ V} \pm 10\%$, GND = 0 V. All specifications -40°C to $+85^\circ\text{C}$, unless otherwise noted.

Table 2.

Parameter	B Version ¹		Unit	Test Conditions/Comments
	+25°C	-40°C to +85°C		
ANALOG SWITCH				
Analog Signal Range				
On Resistance (R_{ON})	4 6.5 0.7 1.1	V_{SS} to V_{DD} 8.5 Ω typ Ω max Ω typ Ω max	V Ω typ Ω max Ω typ Ω max	$V_{DD} = +4.5 \text{ V}$, $V_{SS} = -4.5 \text{ V}$ $V_S = \pm 4.5 \text{ V}$, $I_{DS} = -10 \text{ mA}$; see Figure 15
R_{ON} Match Between Channels (ΔR_{ON})	0.7 1.1	1.35		$V_S = \pm 4.5 \text{ V}$, $I_{DS} = -10 \text{ mA}$
On-Resistance Flatness ($R_{FLAT(ON)}$)	0.7 1.35	0.8 1.4	Ω typ Ω max	$V_S = \pm 3.3 \text{ V}$, $I_{DS} = -10 \text{ mA}$
LEAKAGE CURRENTS				
Source Off Leakage, I_S (Off)	± 0.01		nA typ	$V_{DD} = +5.5 \text{ V}$, $V_{SS} = -5.5 \text{ V}$
Channel On Leakage, I_D , I_S (On)	± 0.25 ± 0.01 ± 0.25	± 1	nA max nA typ nA max	$V_S = \pm 4.5 \text{ V}$, $V_D = \mp 4.5 \text{ V}$; see Figure 16
				$V_S = V_D = \pm 4.5 \text{ V}$; see Figure 17
DIGITAL INPUTS				
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	± 0.1	μA typ μA max	$V_{IN} = V_{INL}$ or V_{INH}
Digital Input Capacitance, C_{IN}	2		pF typ	
DYNAMIC CHARACTERISTICS ²				
ADG619				
t_{ON}	80 120	155	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
t_{OFF}	45 75	90	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
Break-Before-Make Time Delay, t_{BBM}	40	10	ns typ ns min	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_{S1} = V_{S2} = 3.3 \text{ V}$; see Figure 19
ADG620				
t_{ON}	40 65	85	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
t_{OFF}	200 330	400	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
Make-Before-Break Time Delay, t_{MBB}	160	10	ns typ ns min	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 0 \text{ V}$; see Figure 20
Charge Injection	110		pC typ	$V_S = 0 \text{ V}$, $R_S = 0 \Omega$, $C_L = 1 \text{ nF}$; see Figure 21
Off Isolation	-67		dB typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$, $f = 1 \text{ MHz}$; see Figure 22
Channel-to-Channel Crosstalk	-67		dB typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$, $f = 1 \text{ MHz}$; see Figure 23
Bandwidth -3 dB	190		MHz typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$; see Figure 24
C_S (Off)	25		pF typ	$f = 1 \text{ MHz}$
C_D , C_S (On)	95		pF typ	$f = 1 \text{ MHz}$

ADG619/ADG620

Parameter	B Version ¹		Unit	Test Conditions/Comments
	+25°C	-40°C to +85°C		
POWER REQUIREMENTS				
I _{DD}	0.001	1.0	µA typ µA max	V _{DD} = +5.5 V, V _{SS} = -5.5 V Digital inputs = 0 V or 5.5 V
I _{SS}	0.001	1.0	µA typ µA max	Digital inputs = 0 V or 5.5 V

¹ Temperature range for B version is -40°C to +85°C.

² Guaranteed by design, not subject to production test.

SINGLE SUPPLY

$V_{DD} = 5 \text{ V} \pm 10\%$, $V_{SS} = 0 \text{ V}$, GND = 0 V. All specifications -40°C to $+85^\circ\text{C}$, unless otherwise noted.

Table 3.

Parameter	B Version¹		Unit	Test Conditions/Comments
	+25°C	-40°C to +85°C		
ANALOG SWITCH				
Analog Signal Range		0 V to V_{DD}	V	$V_{DD} = 4.5 \text{ V}$, $V_{SS} = 0 \text{ V}$
On Resistance (R_{ON})	7 10	Ω typ Ω max	Ω typ Ω max	$V_S = 0 \text{ V}$ to 4.5 V , $I_{DS} = -10 \text{ mA}$; see Figure 15
R_{ON} Match Between Channels (ΔR_{ON})	0.8 1.1	12.5 1.3	Ω typ Ω max	$V_S = 0 \text{ V}$ to 4.5 V , $I_{DS} = -10 \text{ mA}$
On-Resistance Flatness ($R_{FLAT(ON)}$)	0.5	0.5 1.2	Ω typ Ω max	$V_S = 1.5 \text{ V}$ to 3.3 V , $I_{DS} = -10 \text{ mA}$
LEAKAGE CURRENTS				
Source Off Leakage, I_S (Off)	± 0.01 ± 0.25	± 1	nA typ nA max	$V_{DD} = 5.5 \text{ V}$ $V_S = 1 \text{ V}/4.5 \text{ V}$, $V_D = 4.5 \text{ V}/1 \text{ V}$; see Figure 16
Channel On Leakage, I_D , I_S (On)	± 0.01 ± 0.25	± 1	nA typ nA max	$V_S = V_D = 1 \text{ V}/4.5 \text{ V}$; see Figure 17
DIGITAL INPUTS				
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	± 0.1	μA typ μA max	$V_{IN} = V_{INL}$ or V_{INH}
Digital Input Capacitance, C_{IN}	2		pF typ	
DYNAMIC CHARACTERISTICS ²				
ADG619				
t_{ON}	120 220	280	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
t_{OFF}	50 75	110	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
Break-Before-Make Time Delay, t_{BBM}	70	10	ns typ ns min	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_{S1} = V_{S2} = 3.3 \text{ V}$; see Figure 19
ADG620				
t_{ON}	50 85	110	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
t_{OFF}	210 340	420	ns typ ns max	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 18
Make-Before-Break Time Delay, t_{MBB}	170	10	ns typ ns min	$R_L = 300 \Omega$, $C_L = 35 \text{ pF}$ $V_S = 3.3 \text{ V}$; see Figure 20
Charge Injection	6		pC typ	$V_S = 0 \text{ V}$, $R_S = 0 \Omega$, $C_L = 1 \text{ nF}$; see Figure 21
Off Isolation	-67		dB typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$, $f = 1 \text{ MHz}$; see Figure 22
Channel-to-Channel Crosstalk	-67		dB typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$, $f = 1 \text{ MHz}$; see Figure 23
Bandwidth -3 dB	190		MHz typ	$R_L = 50 \Omega$, $C_L = 5 \text{ pF}$; see Figure 24
C_S (OFF)	25		pF typ	$f = 1 \text{ MHz}$
C_D , C_S (ON)	95		pF typ	$f = 1 \text{ MHz}$
POWER REQUIREMENTS				
I_{DD}	0.001	1.0	μA typ μA max	$V_{DD} = 5.5 \text{ V}$ Digital inputs = 0 V or 5.5 V

¹ Temperature range for B version is -40°C to $+85^\circ\text{C}$.

² Guaranteed by design, not subject to production test.

ABSOLUTE MAXIMUM RATINGS

T_A = 25°C, unless otherwise noted.

Table 4.

Parameter	Rating
V _{DD} to V _{SS}	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 ¹	V _{SS} – 0.3 V to V _{DD} + 0.3 V
Digital Inputs ¹	-0.3 V to V _{DD} + 0.3 V or 30 mA (whichever occurs first)
Peak Current, S or D	100 mA (pulsed at 1 ms, 10% duty cycle maximum)
Continuous Current, S or D	50 mA
Operating Temperature Range Industrial (B Version)	-40°C to +85°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	150°C
MSOP	
θ _{JA} Thermal Impedance	206°C/W
θ _{JC} Thermal Impedance	44°C/W
SOT-23	
θ _{JA} Thermal Impedance	229.6°C/W
θ _{JC} Thermal Impedance	91.99°C/W
Lead Temperature, Soldering (10 sec)	300°C
IR Reflow, Peak Temperature	220°C

¹ Overvoltages at IN, S, or D are clamped by internal diodes. Current should be limited to the maximum ratings given.

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 indicated in the operational section 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 a 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 CONFIGURATIONS AND FUNCTION DESCRIPTIONS

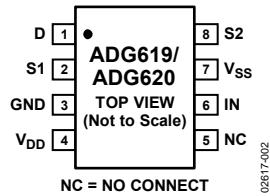


Figure 2. 8-Lead SOT-23
(RJ-8)

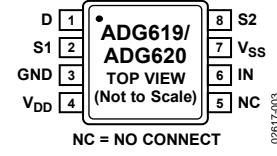


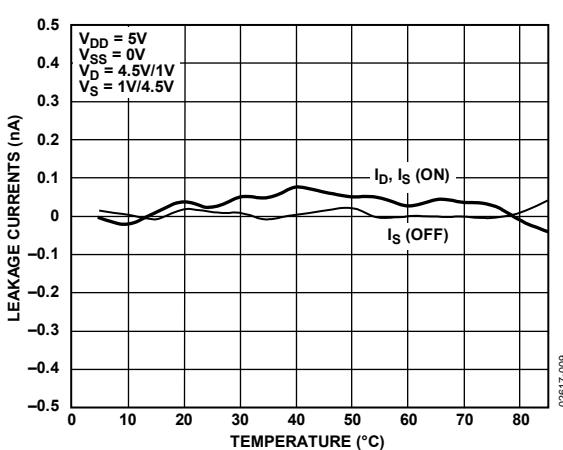
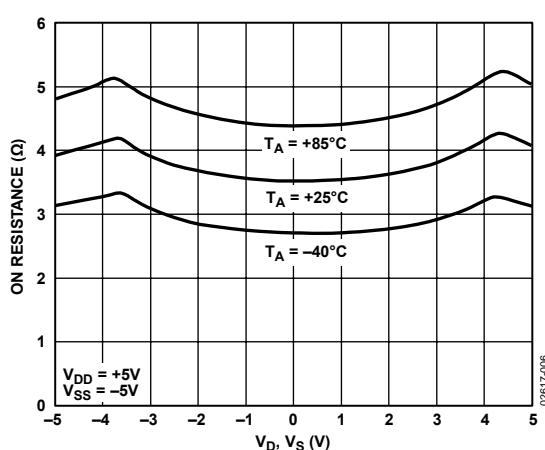
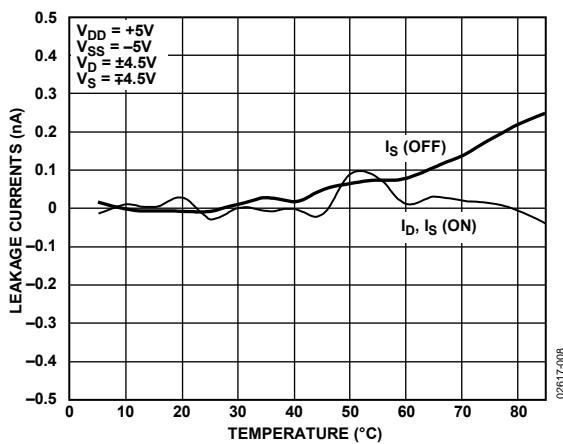
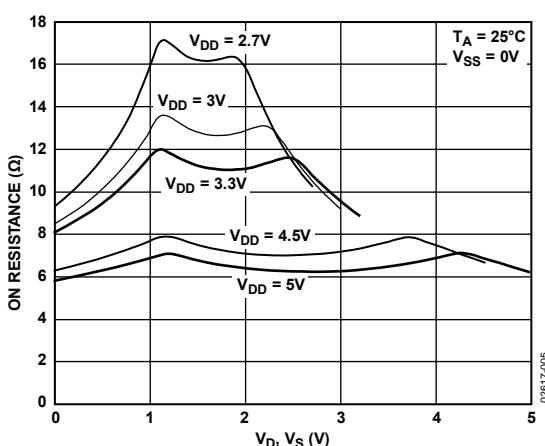
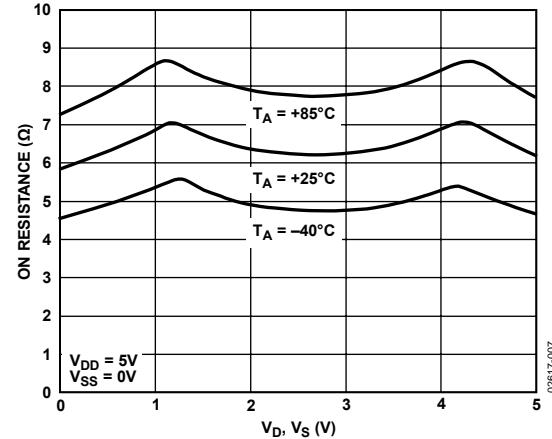
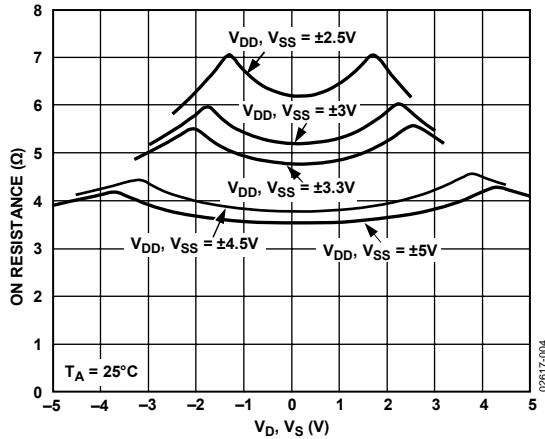
Figure 3. 8-Lead MSOP
(RM-8)

Table 5. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	D	Drain Terminal. Can be an input or output.
2	S1	Source Terminal. Can be an input or output.
3	GND	Ground (0 V) Reference.
4	V _{DD}	Most Positive Power Supply.
5	NC	No Connect. Not internally connected.
6	IN	Logic Control Input.
7	V _{SS}	Most Negative Power Supply. This pin is only used in dual-supply applications and should be tied to ground in single-supply applications.
8	S2	Source Terminal. Can be an input or output.

ADG619/ADG620

TYPICAL PERFORMANCE CHARACTERISTICS



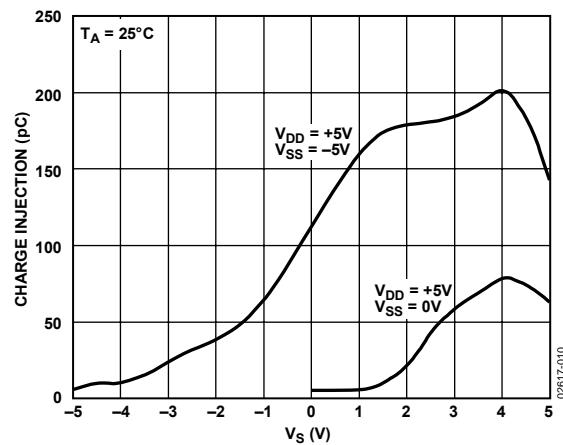


Figure 10. Charge Injection vs. Source Voltage

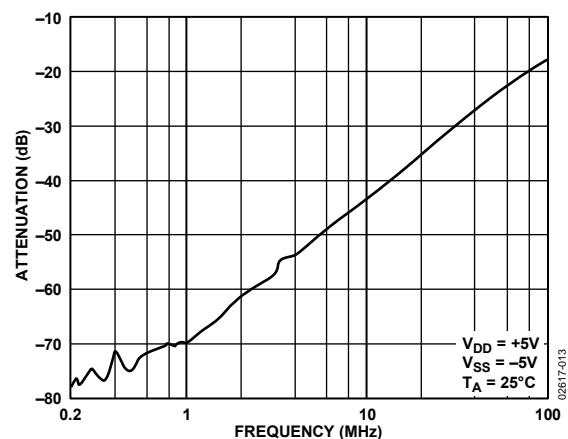


Figure 13. Crosstalk vs. Frequency

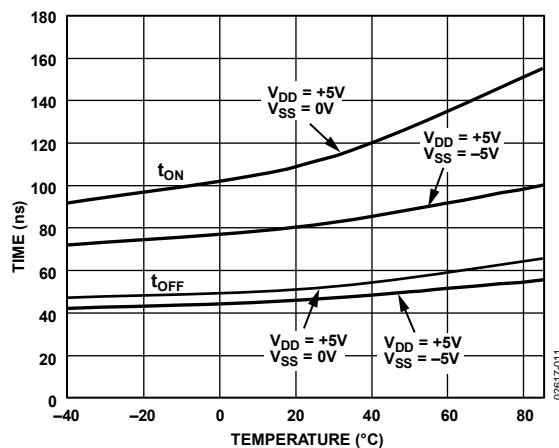


Figure 11. t_{on}/t_{off} Times vs. Temperatures

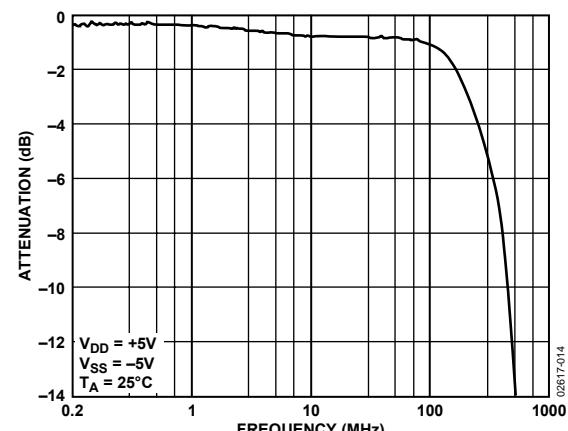


Figure 14. On Response vs. Frequency

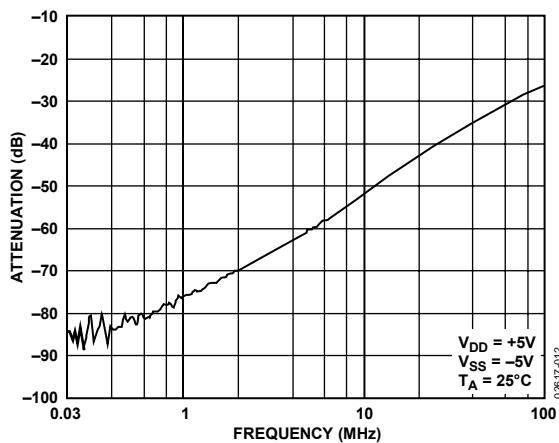


Figure 12. Off Isolation vs. Frequency

ADG619/ADG620

TERMINOLOGY

I_{DD}

Positive supply current.

I_{SS}

Negative supply current.

R_{ON}

Ohmic resistance between D and S terminals.

ΔR_{ON}

On resistance match between any two channels.

R_{FLAT (ON)}

Flatness is defined as 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, Is (On)}

Channel leakage current with the switch on.

V_{D, Vs}

Analog voltage on Terminal D and Terminal S.

V_{INL}

Maximum input voltage for Logic 0.

V_{INH}

Minimum input voltage for Logic 1.

I_{INL, INH}

Input current of the digital input.

C_{S (Off)}

Off switch source capacitance.

C_{D, Cs (On)}

On switch capacitance.

t_{ON}

Delay between applying the digital control input and the output switching on.

t_{OFF}

Delay between applying the digital control input and the output switching off.

t_{MBB}

On time is measured between the 80% points of both switches, when switching from one address state to another.

t_{BMM}

Off time or on time is measured between the 90% points of both switches, when switching from one address state to another.

Charge Injection

A measure of the glitch impulse transferred from the digital input to the analog output during switching.

Crosstalk

A measure of unwanted signal coupled through from one channel to another as a result of parasitic capacitance.

Off Isolation

A measure of unwanted signal coupling through an off switch.

Bandwidth

The frequency response of the on switch.

Insertion Loss

The loss due to the on resistance of the switch.

TEST CIRCUITS

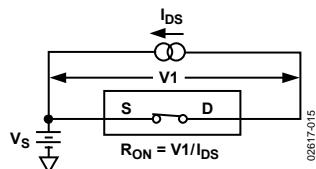


Figure 15. On Resistance

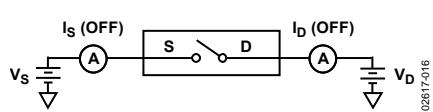


Figure 16. Off Leakage

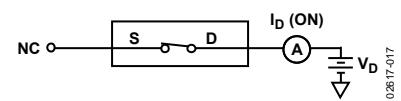


Figure 17. On Leakage

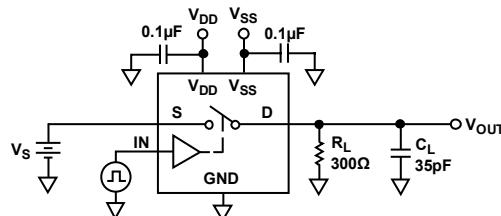


Figure 18. Switching Times

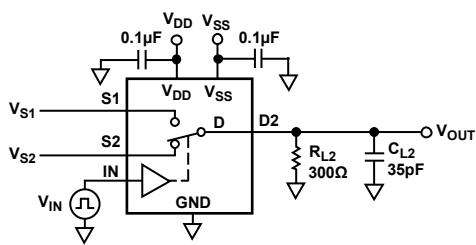
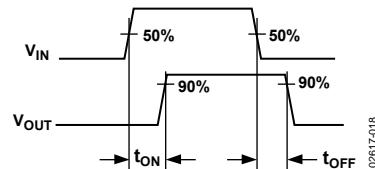
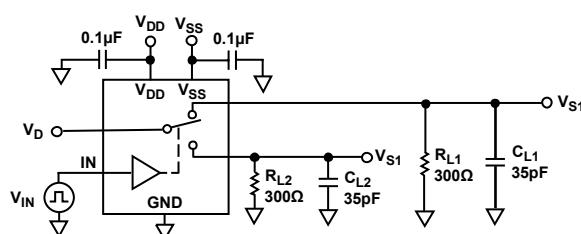
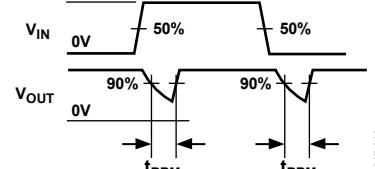
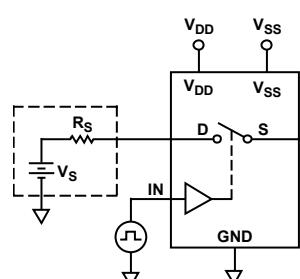
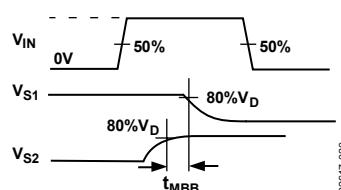
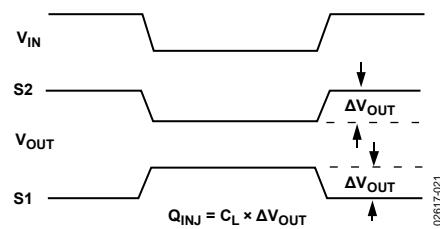
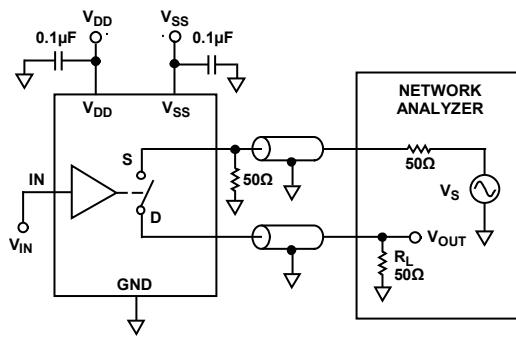
Figure 19. Break-Before-Make Time Delay, t_{BBM} (ADG619 Only)Figure 20. Make-Before-Break Time Delay, t_{MBB} (ADG620 Only)

Figure 21. Charge Injection



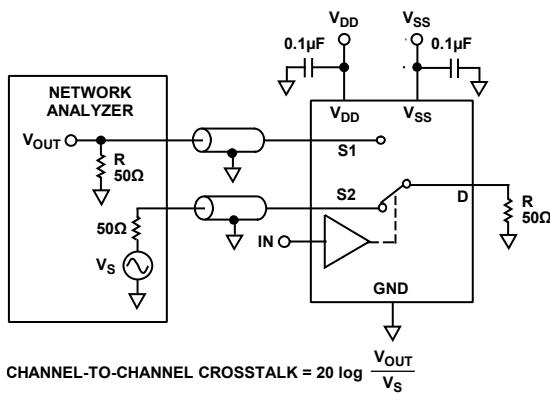
ADG619/ADG620



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

Figure 22. Off Isolation

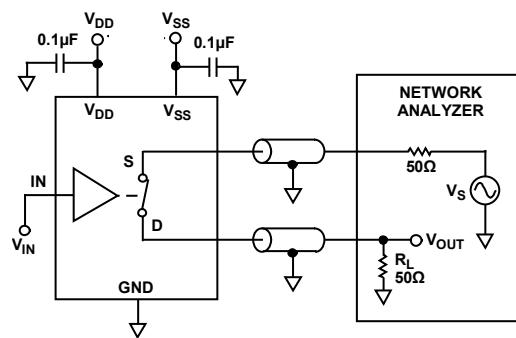
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$$\text{CHANNEL-TO-CHANNEL CROSSTALK} = 20 \log \frac{V_{OUT}}{V_S}$$

Figure 23. Channel-to-Channel Crosstalk

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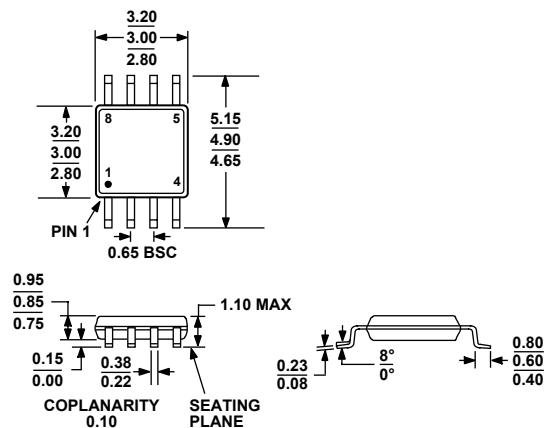


$$\text{INSERTION LOSS} = 20 \log \frac{V_{OUT \text{ WITH SWITCH}}}{V_{S \text{ WITHOUT SWITCH}}}$$

Figure 24. Bandwidth

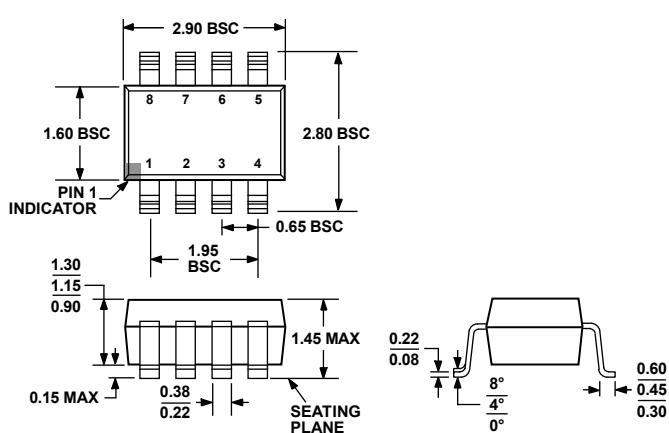
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OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-187-AA

*Figure 25. 8-Lead Mini Small Outline Package [MSOP]
(RM-8)*
Dimensions shown in millimeters



COMPLIANT TO JEDEC STANDARDS MO-178-BA

*Figure 26. 8-Lead Small Outline Transistor Package [SOT-23]
(RJ-8)*
Dimensions shown in millimeters

ADG619/ADG620

ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding ¹
ADG619BRM	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SVB
ADG619BRM-REEL	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SVB
ADG619BRM-REEL7	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SVB
ADG619BRMZ ²	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SCC
ADG619BRMZ-REEL ²	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SCC
ADG619BRMZ-REEL7 ²	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SCC
ADG619BRT-REEL	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SVB
ADG619BRT-REEL7	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SVB
ADG619BRT-500RL7	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SVB
ADG619BRTZ-REEL ²	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SCC
ADG619BRTZ-REEL7 ²	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SCC
ADG619BRTZ-500RL7 ²	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SCC
ADG620BRM	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SWB
ADG620BRM-REEL	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SWB
ADG620BRM-REEL7	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	SWB
ADG620BRMZ ²	−40°C to +85°C	8-Lead Mini Small Outline Package (MSOP)	RM-8	S21
ADG620BRT-REEL	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SWB
ADG620BRT-REEL7	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	SWB
ADG620BRTZ-REEL7 ²	−40°C to +85°C	8-Lead Small Outline Transistor Package (SOT-23)	RJ-8	S21

¹ Branding on SOT-23 and MSOP is limited to three characters due to space constraints.

² Z = RoHS Compliant Part.

NOTES

ADG619/ADG620

NOTES

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