

**FEATURES**

- 1.8 V to 5.5 V single supply**
- 4  $\Omega$  (max) on resistance**
- 0.75  $\Omega$  (typ) on resistance flatness**
- 3 dB bandwidth > 200 MHz**
- Rail-to-rail operation**
- 6-lead SOT-23 package**
- Fast switching times:**
  - $t_{ON} = 12$  ns
  - $t_{OFF} = 6$  ns
- Typical power consumption: (< 0.01  $\mu$ W)**
- TTL/CMOS compatible**
- Military temperature range: -55°C to +125°C**

**APPLICATIONS**

- Battery-powered systems**
- Communication systems**
- Sample-and-hold systems**
- Audio signal routing**
- Video switching**
- Mechanical reed relay replacement**

**GENERAL DESCRIPTION**

The ADG719-EP is a monolithic CMOS SPDT switch. This switch is designed on a submicron process that provides low power dissipation yet gives high switching speed, low on resistance, and low leakage currents.

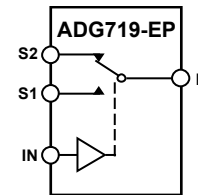
The ADG719-EP can operate from a single-supply range of 1.8 V to 5.5 V, making it ideal for use in battery-powered instruments and with the new generation of DACs and ADCs from Analog Devices, Inc.

Each switch of the ADG719-EP conducts equally well in both directions when on. The ADG719-EP exhibits break-before-make switching action.

Because of the advanced submicron process, -3 dB bandwidths of greater than 200 MHz can be achieved.

The ADG719-EP is available in a 6-lead SOT-23 package.

Full details about this enhanced product are available in the [ADG719](#) data sheet, which should be consulted in conjunction with this data sheet.

**FUNCTIONAL BLOCK DIAGRAM**


NOTES  
1. SWITCHES SHOWN FOR A LOGIC 1 INPUT.

08842-001

Figure 1.

**PRODUCT HIGHLIGHTS**

1. Supports defense and aerospace applications (AQEC standard).
2. Military temperature range: -55°C to +125°C.
3. Controlled manufacturing baseline.
4. One assembly and test site.
5. One fabrication site.
6. Enhanced product change notification.
7. Qualification data available on request.

**Rev. 0**

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## REVISION HISTORY

4/10—Revision 0: Initial Version

## SPECIFICATIONS

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

**Table 1.**

Parameter	+25°C	−55°C to +125°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>				
Analog Signal Range		0 V to $V_{DD}$	V	
On Resistance ( $R_{ON}$ )	2.5 4		$\Omega$ typ $\Omega$ max	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$ ; see Figure 13
On Resistance Match Between Channels ( $\Delta R_{ON}$ )	0.1	7	$\Omega$ typ	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$
On Resistance Flatness ( $R_{FLAT(ON)}$ )	0.75	0.4	$\Omega$ max	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$
		1.5	$\Omega$ typ $\Omega$ max	
<b>LEAKAGE CURRENTS <math>I_S</math> (Off)</b>				
Source Off Leakage	$\pm 0.01$		nA typ	$V_{DD} = 5.5\text{ V}$ $V_S = 4.5\text{ V/1 V}$ , $V_D = 1\text{ V/4.5 V}$ ; see Figure 14
Channel On Leakage $I_D$ , $I_S$ (On)	$\pm 0.25$	1	nA max	$V_S = V_D = 1\text{ V or }V_S = V_D = 4.5\text{ V}$ ; see Figure 15
	$\pm 0.01$ $\pm 0.25$	5	nA typ nA max	
<b>DIGITAL INPUTS</b>				
Input High Voltage, $V_{INH}$		2.4	V min	$V_{IN} = V_{INL}$ or $V_{INH}$
Input Low Voltage, $V_{INL}$		0.8	V max	
Input Current				
$I_{INL}$ or $I_{INH}$	0.005	$\pm 0.1$	$\mu\text{A}$ typ $\mu\text{A}$ max	
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>				
$t_{ON}$	7		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ $V_S = 3\text{ V}$ ; see Figure 16
		12	ns max	
$t_{OFF}$	3		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ $V_S = 3\text{ V}$ ; see Figure 16
		6	ns max	
Break-Before-Make Time Delay, $t_D$	8		ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ , $V_{S1} = V_{S2} = 3\text{ V}$ ; see Figure 17
		1	ns min	
Off Isolation	−67 −87		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 10\text{ MHz}$ $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ ; see Figure 18
			dB typ	
Channel-to-Channel Crosstalk	−62 −82		dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 10\text{ MHz}$ $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ ; see Figure 19
			dB typ	
Bandwidth −3 dB	200		MHz typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ; see Figure 20
$C_S$ (Off)	7		pF typ	
$C_D$ , $C_S$ (On)	27		pF typ	
<b>POWER REQUIREMENTS</b>				
$I_{DD}$	0.001		$\mu\text{A}$ typ	$V_{DD} = 5.5\text{ V}$ Digital inputs = 0 V or 5.5 V
		1.0	$\mu\text{A}$ max	

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

# ADG719-EP

$V_{DD} = 3\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ .

**Table 2.**

Parameter	+25°C	-55°C to +125°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>				
Analog Signal Range		0 V to $V_{DD}$	V	
On Resistance ( $R_{ON}$ )	6	12	$\Omega$ typ $\Omega$ max	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$ ; see Figure 13
On Resistance Match Between Channels ( $\Delta R_{ON}$ )	0.1	0.4	$\Omega$ typ $\Omega$ max	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$
On Resistance Flatness ( $R_{FLAT(ON)}$ )		2.5	$\Omega$ typ	$V_S = 0\text{ V to }V_{DD}$ , $I_S = -10\text{ mA}$
<b>LEAKAGE CURRENTS</b>				
Source Off Leakage $I_S$ (Off)	$\pm 0.01$		nA typ	$V_{DD} = 3.3\text{ V}$ $V_S = 3\text{ V}/1\text{ V}$ , $V_D = 1\text{ V}/3\text{ V}$ ; see Figure 14
Channel On Leakage $I_D$ , $I_S$ (On)	$\pm 0.25$	1	nA max	
	$\pm 0.01$		nA typ	$V_S = V_D = 1\text{ V}$ or $V_S = V_D = 3\text{ V}$ ; see Figure 15
	$\pm 0.25$	5	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 $I_{INL}$ or $I_{INH}$	0.005	$\pm 0.1$	$\mu\text{A}$ typ $\mu\text{A}$ max	$V_{IN} = V_{INL}$ or $V_{INH}$
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>				
$t_{ON}$	10	15	ns typ ns max	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ $V_S = 2\text{ V}$ ; see Figure 16
$t_{OFF}$	4	8	ns typ ns max	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ $V_S = 2\text{ V}$ ; see Figure 16
Break-Before-Make Time Delay, $t_D$	8	1	ns typ ns min	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ $V_{S1} = V_{S2} = 2\text{ V}$ ; see Figure 17
Off Isolation	-67 -87		dB typ dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 10\text{ MHz}$ $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ ; see Figure 18
Channel-to-Channel Crosstalk	-62 -82		dB typ dB typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 10\text{ MHz}$ $R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ , $f = 1\text{ MHz}$ ; see Figure 19
Bandwidth -3 dB	200		MHz typ	$R_L = 50\ \Omega$ , $C_L = 5\text{ pF}$ ; see Figure 20
$C_S$ (Off)	7		pF typ	
$C_D$ , $C_S$ (On)	27		pF typ	
<b>POWER REQUIREMENTS</b>				
$I_{DD}$	0.001 1.0		$\mu\text{A}$ typ $\mu\text{A}$ max	$V_{DD} = 3.3\text{ V}$ Digital inputs = 0 V or 3.3 V

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

## ABSOLUTE MAXIMUM RATINGS

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

**Table 3.**

Parameter	Rating
$V_{DD}$ to GND	$-0.3\text{ V to }+7\text{ V}$
Analog, Digital Inputs <sup>1</sup>	$-0.3\text{ V to }V_{DD} + 0.3\text{ V}$ or 30 mA, whichever occurs first
Peak Current, S or D	100 mA (Pulsed at 1 ms, 10% duty cycle max)
Continuous Current, S or D	30 mA
Operating Temperature Range	$-55^\circ\text{C to }+125^\circ\text{C}$
Storage Temperature Range	$-65^\circ\text{C to }+150^\circ\text{C}$
Junction Temperature	$150^\circ\text{C}$
SOT-23 Package	
$\theta_{JA}$ Thermal Impedance <sup>2</sup>	$186.45^\circ\text{C/W}$
Lead Soldering	
Reflow, Peak Temperature	$260(+0/-5)^\circ\text{C}$
Time at Peak Temperature	20 sec to 40 sec
ESD	1 kV

<sup>1</sup>Overvoltages at IN, S, or D will be clamped by internal diodes. Current should be limited to the maximum ratings given

<sup>2</sup>Measured on a 4-layer board.

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 maximum rating may 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.

# ADG719-EP

## PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

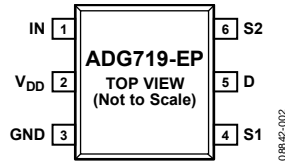


Figure 2. 6-Lead SOT-23 Pin Configuration

Table 4. Pin description

Pin No.	Mnemonic	Description
1	IN	Digital Switch Control Pin.
2	VDD	Most Positive Power Supply Pin.
3	GND	Ground (0 V) Reference Pin.
4	S1	Source Terminal. Can be used as an input or output.
5	D	Drain Terminal. Can be used as an input or output.
6	S2	Source Terminal. Can be used as an input or output.

Table 5. Truth Table

ADG719-EP IN	Switch S1	Switch S2
0	On	Off
1	Off	On

# TYPICAL PERFORMANCE CHARACTERISTICS

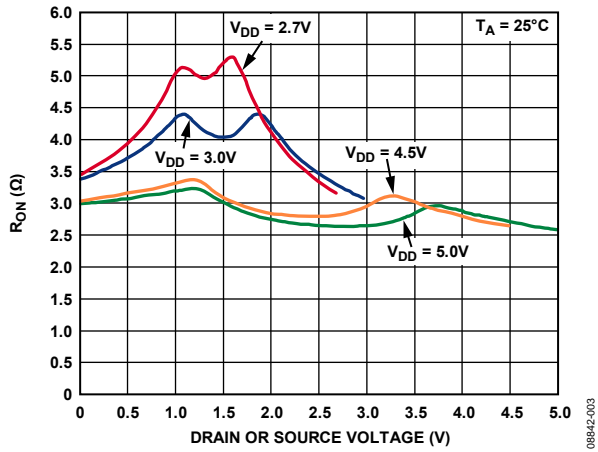


Figure 3. On Resistance vs.  $V_D$  ( $V_S$ ), Single Supplies

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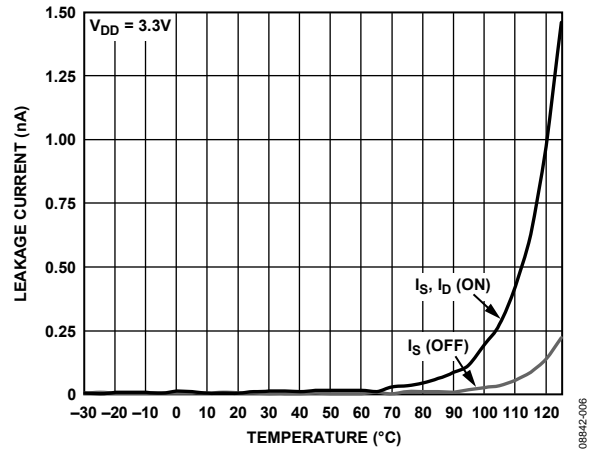


Figure 6. Leakage Currents vs. Temperature

08942-006

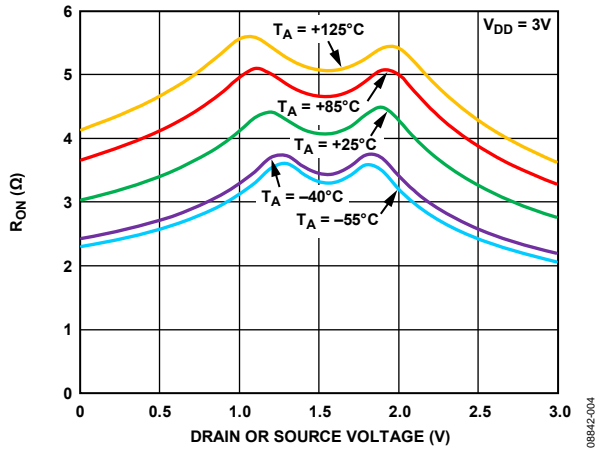


Figure 4. On Resistance vs.  $V_D$  ( $V_S$ ) for Different Temperatures,  $V_{DD} = 3V$

08942-004

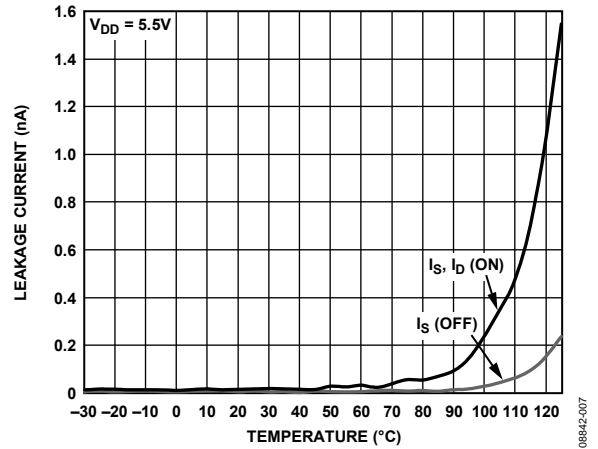


Figure 7. Leakage Currents vs. Temperature

08942-007

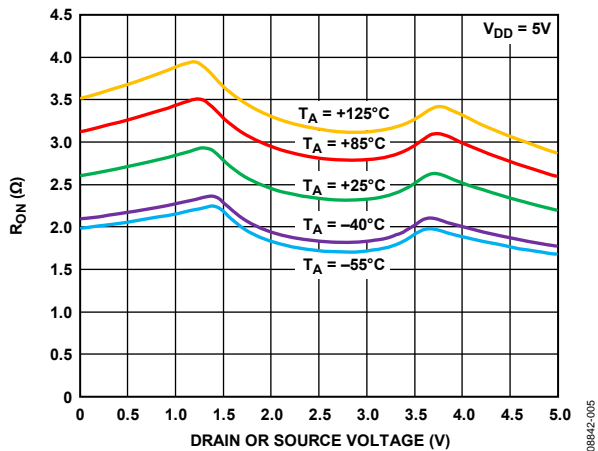


Figure 5. On Resistance vs.  $V_D$  ( $V_S$ ) for Different Temperatures,  $V_{DD} = 5V$

08942-005

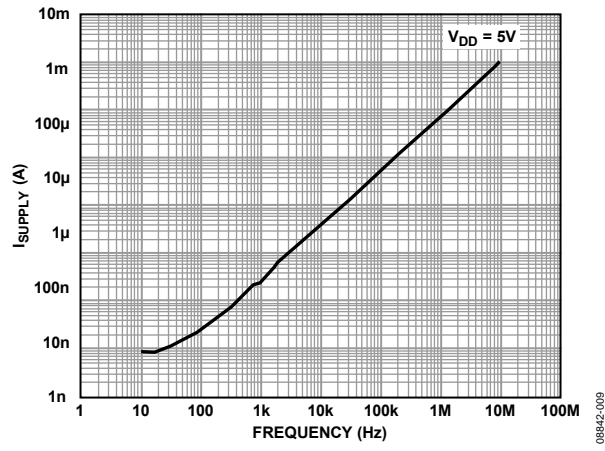


Figure 8. Supply Current vs. Input Switching Frequency

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# ADG719-EP

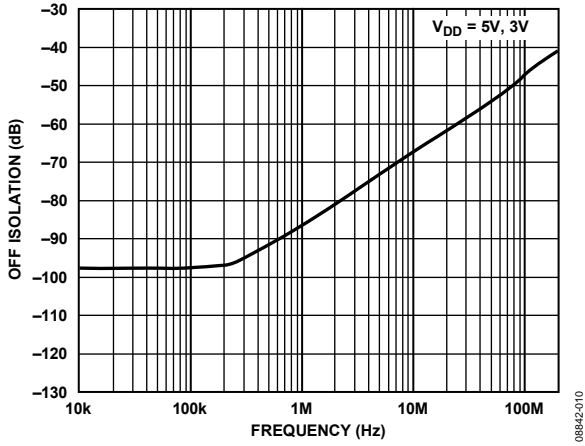


Figure 9. Off Isolation vs. Frequency

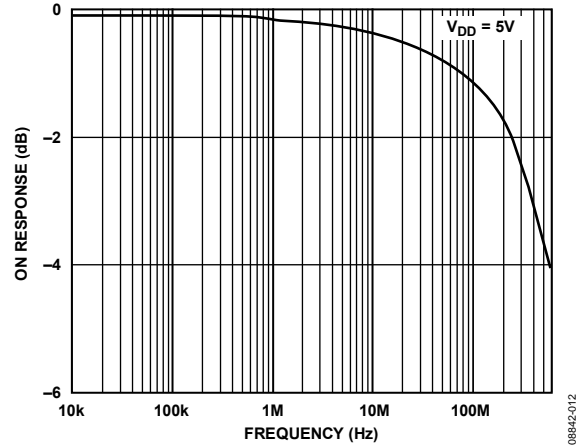


Figure 11. On Response vs. Frequency

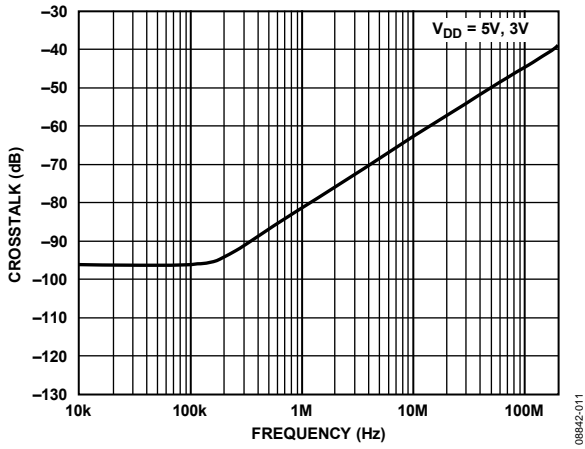


Figure 10. Crosstalk vs. Frequency

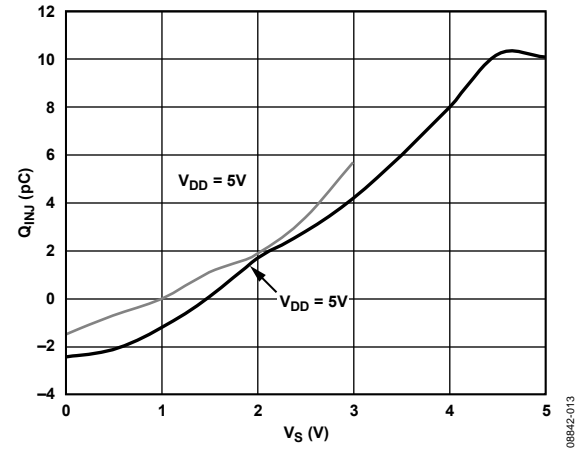


Figure 12. Charge Injection vs. Source Voltage



# TEST CIRCUITS

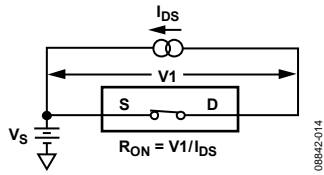


Figure 13. On Resistance

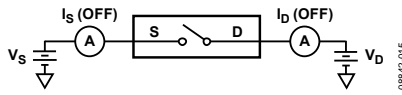


Figure 14. Off Leakage

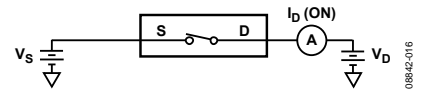


Figure 15. On Leakage

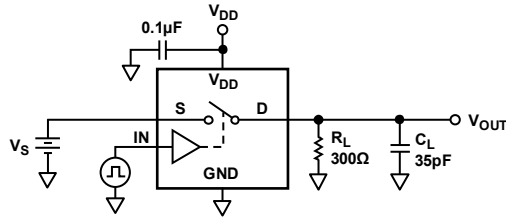


Figure 16. Switching Times

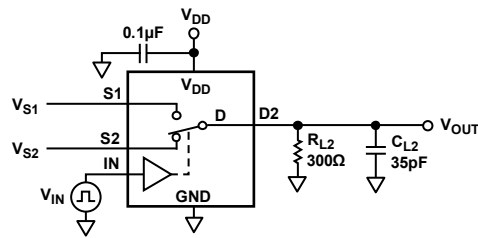


Figure 17. Break-Before-Make Time Delay,  $t_D$

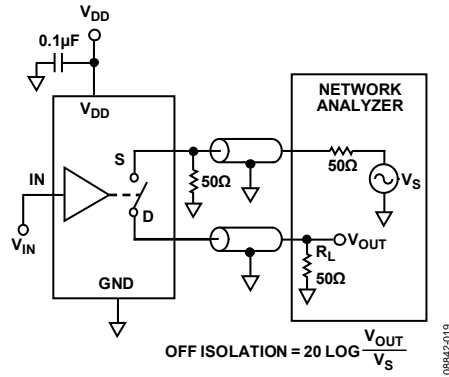


Figure 18. Off Isolation

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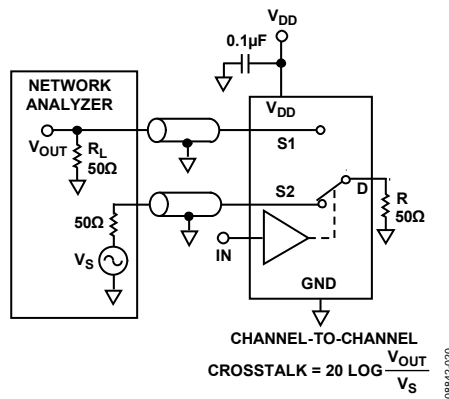


Figure 19. Channel-to-Channel Crosstalk

08842-020

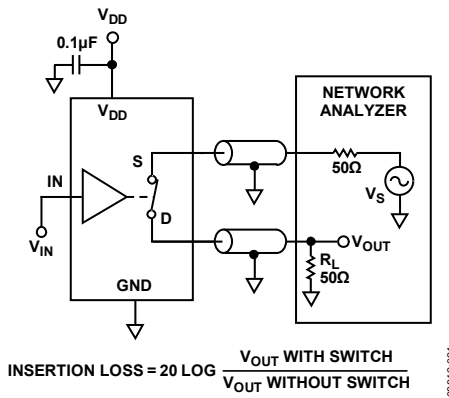
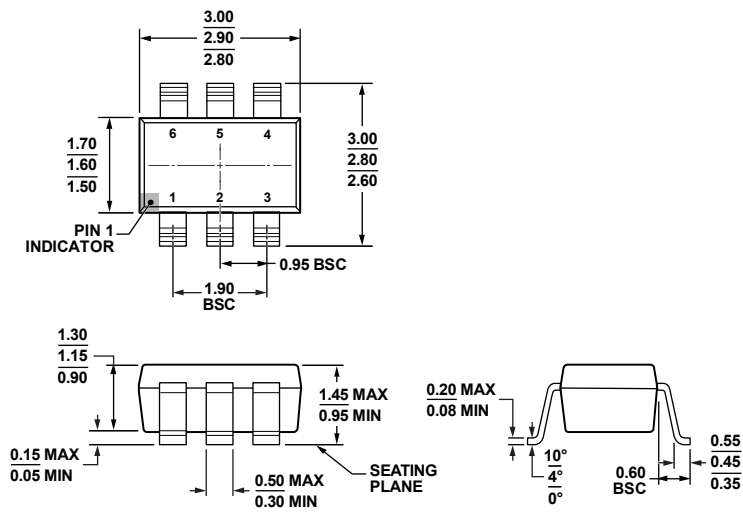


Figure 20. Bandwidth

08842-021

# OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-178-AB  
 Figure 21. 6-Lead Small Outline Transistor Package [SOT-23]  
 (RJ-6)  
 Dimensions shown in millimeters

121609-A

## ORDERING GUIDE

Model <sup>1</sup>	Temperature Range	Package Description	Package Option	Branding
ADG719SRJZ-EP-RL7	-55°C to +125°C	6-Lead SOT-23	RJ-6	S3T

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

**ADG719-EP**

**NOTES**

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