

**FEATURES**

**44 V supply maximum ratings**  
**V<sub>SS</sub> to V<sub>DD</sub> analog signal range**  
**Low on resistance: <35 Ω**  
**Ultralow power dissipation: <35 μW**  
**Fast transition time: 145 ns maximum**  
**Break-before-make switching action**  
**Plug-in replacement for DG419**  
**Supports defense and aerospace applications**  
**(AQEC standard)**  
**Military temperature range: -55°C to +125°C**  
**Controlled manufacturing baseline**  
**One assembly/test site**  
**One fabrication site**  
**Enhanced product change notification**  
**Qualification data available on request**

**APPLICATIONS**

**Precision test equipment**  
**Precision instrumentation**  
**Battery-powered systems**  
**Sample-and-hold systems**

**GENERAL DESCRIPTION**

The ADG419-EP is a monolithic CMOS SPDT switch. This switch is fabricated on an enhanced LC<sup>2</sup>MOS process that provides low power dissipation yet gives high switching speed, low on resistance, and low leakage current.

The on resistance profile of the ADG419-EP is very flat over the full analog input range, ensuring excellent linearity and low distortion. The part also exhibits high switching speed and high signal bandwidth. CMOS construction ensures ultralow power dissipation, making the part ideally suited for portable and battery-powered instruments.

Each switch of the ADG419-EP conducts equally well in both directions when on and has an input signal range that extends to the supplies. In the off condition, signal levels up to the supplies are blocked. The ADG419-EP exhibits break-before-make switching action.

Full details about this enhanced product are available in the [ADG419](#) data sheet, which should be consulted in conjunction with this data sheet.

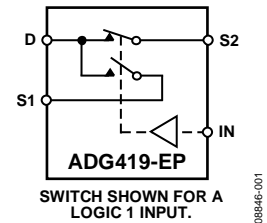
**FUNCTIONAL BLOCK DIAGRAM**

Figure 1.

**PRODUCT HIGHLIGHTS**

1. **Extended Signal Range.**  
The ADG419-EP is fabricated on an enhanced LC<sup>2</sup>MOS process, giving an increased signal range that extends to the supply rails.
2. **Ultralow Power Dissipation.**
3. **Low R<sub>ON</sub>.**
4. **Single-Supply Operation.**  
For applications where the analog signal is unipolar, the ADG419-EP can be operated from a single rail power supply. The part is fully specified with a single 12 V power supply and remains functional with single supplies as low as 5 V.

**Rev. 0**

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## REVISION HISTORY

7/10—Revision 0: Initial Version

## SPECIFICATIONS

### DUAL SUPPLY

$V_{DD} = 15\text{ V} \pm 10\%$ ,  $V_{SS} = -15\text{ V} \pm 10\%$ ,  $V_L = 5\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ , unless otherwise noted.

Table 1.

Parameter	+25°C	-40°C to +85°C	-55°C to +125°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>					
Analog Signal Range				V	
$R_{ON}$	25 35	45	45	$\Omega$ typ $\Omega$ max	$V_D = \pm 12.5\text{ V}$ , $I_S = -10\text{ mA}$ ; see Figure 9 $V_{DD} = +13.5\text{ V}$ , $V_{SS} = -13.5\text{ V}$ ; see Figure 9
<b>LEAKAGE CURRENT</b>					
Source Off Leakage, $I_S$ (Off)	$\pm 0.1$ $\pm 0.25$	$\pm 5$	$\pm 15$	nA typ nA max	$V_{DD} = +16.5\text{ V}$ , $V_{SS} = -16.5\text{ V}$ $V_D = \pm 15.5\text{ V}$ , $V_S = \mp 15.5\text{ V}$ ; see Figure 10
Drain Off Leakage, $I_D$ (Off)	$\pm 0.1$ $\pm 0.75$	$\pm 5$	$\pm 30$	nA typ nA max	$V_D = \pm 15.5\text{ V}$ , $V_S = \mp 15.5\text{ V}$ ; see Figure 10
Channel On Leakage, $I_D$ , $I_S$ (On)	$\pm 0.4$ $\pm 0.75$	$\pm 5$	$\pm 30$	nA typ nA max	$V_S = V_D = \pm 15.5\text{ V}$ ; see Figure 11
<b>DIGITAL INPUTS</b>					
Input High Voltage, $V_{INH}$		2.4	2.4	V min	
Input Low Voltage, $V_{INL}$		0.8	0.8	V max	
Input Current, $I_{INL}$ or $I_{INH}$		$\pm 0.005$ $\pm 0.5$	$\pm 0.005$ $\pm 0.5$	$\mu\text{A}$ typ $\mu\text{A}$ max	$V_{IN} = V_{INL}$ or $V_{INH}$
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>					
$t_{TRANSITION}$	145	200	200	ns max	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_{S1} = \pm 10\text{ V}$ , $V_{S2} = \mp 10\text{ V}$ ; see Figure 12
Break-Before-Make Time Delay, $t_D$	30			ns typ	$R_L = 300\ \Omega$ , $C_L = 35\text{ pF}$ ; $V_{S1} = V_{S2} = \pm 10\text{ V}$ ; see Figure 13
Off Isolation	5 80			ns min dB typ	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ; see Figure 14
Channel-to-Channel Crosstalk	90			dB typ	$R_L = 50\ \Omega$ , $f = 1\text{ MHz}$ ; see Figure 15
$C_S$ (Off)	6			pF typ	$f = 1\text{ MHz}$
$C_D$ , $C_S$ (On)	55			pF typ	$f = 1\text{ MHz}$
<b>POWER REQUIREMENTS</b>					
$I_{DD}$	0.0001 1	2.5	2.5	$\mu\text{A}$ typ $\mu\text{A}$ max	$V_{DD} = +16.5\text{ V}$ , $V_{SS} = -16.5\text{ V}$ $V_{IN} = 0\text{ V}$ or $5\text{ V}$
$I_{SS}$	0.0001 1	2.5	2.5	$\mu\text{A}$ typ $\mu\text{A}$ max	
$I_L$	0.0001 1	2.5	2.5	$\mu\text{A}$ typ $\mu\text{A}$ max	$V_L = 5.5\text{ V}$

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

# ADG419-EP

## SINGLE SUPPLY

$V_{DD} = 12\text{ V} \pm 10\%$ ,  $V_{SS} = 0\text{ V}$ ,  $V_L = 5\text{ V} \pm 10\%$ ,  $GND = 0\text{ V}$ , unless otherwise noted.

Table 2.

Parameter	+25°C	-40°C to +85°C	-55°C to +125°C	Unit	Test Conditions/Comments
<b>ANALOG SWITCH</b>					
Analogue Signal Range			0 to $V_{DD}$	V	
$R_{ON}$	40	60	70	$\Omega$ typ $\Omega$ max	$V_D = 3\text{ V}, 8.5\text{ V}, I_S = -10\text{ mA}$ ; see Figure 9 $V_{DD} = 10.8\text{ V}$ ; see Figure 9
<b>LEAKAGE CURRENT</b>					
Source Off Leakage, $I_S$ (Off)	$\pm 0.1$			nA typ nA max	$V_{DD} = 13.2\text{ V}$ $V_D = 12.2\text{ V}/1\text{ V}, V_S = 1\text{ V}/12.2\text{ V}$ ; see Figure 10
Drain Off Leakage, $I_D$ (Off)	$\pm 0.1$	$\pm 5$	$\pm 15$	nA typ nA max	$V_D = 12.2\text{ V}/1\text{ V}, V_S = 1\text{ V}/12.2\text{ V}$ ; see Figure 10
Channel On Leakage, $I_D, I_S$ (On)	$\pm 0.75$ $\pm 0.4$ $\pm 0.75$	$\pm 5$	$\pm 30$	nA typ nA max	$V_S = V_D = 12.2\text{ V}/1\text{ V}$ ; see Figure 11
<b>DIGITAL INPUTS</b>					
Input High Voltage, $V_{INH}$		2.4	2.4	V min	
Input Low Voltage, $V_{INL}$		0.8	0.8	V max	
Input Current, $I_{INL}$ or $I_{INH}$		$\pm 0.005$ $\pm 0.5$	$\pm 0.005$ $\pm 0.5$	$\mu\text{A}$ typ $\mu\text{A}$ max	$V_{IN} = V_{INL}$ or $V_{INH}$
<b>DYNAMIC CHARACTERISTICS<sup>1</sup></b>					
$t_{TRANSITION}$	170	250	250	ns max	$R_L = 300\ \Omega, C_L = 35\text{ pF}; V_{S1} = 0\text{ V}/8\text{ V}, V_{S2} = 8\text{ V}/0\text{ V}$ ; see Figure 12
Break-Before-Make Time Delay, $t_D$	60			ns typ	$R_L = 300\ \Omega, C_L = 35\text{ pF}; V_{S1} = V_{S2} = 8\text{ V}$ ; see Figure 13
Off Isolation	80			dB typ	$R_L = 50\ \Omega, f = 1\text{ MHz}$ ; see Figure 14
Channel-to-Channel Crosstalk	70			dB typ	$R_L = 50\ \Omega, f = 1\text{ MHz}$ ; see Figure 15
$C_S$ (Off)	13			pF typ	$f = 1\text{ MHz}$
$C_D, C_S$ (On)	65			pF typ	$f = 1\text{ MHz}$
<b>POWER REQUIREMENTS</b>					
$I_{DD}$	0.0001			$\mu\text{A}$ typ	$V_{DD} = 13.2\text{ V}$ $V_{IN} = 0\text{ V}$ or $5\text{ V}$
	1	2.5	2.5	$\mu\text{A}$ max	
$I_L$	0.0001			$\mu\text{A}$ typ	$V_L = 5.5\text{ V}$
	1	2.5	2.5	$\mu\text{A}$ max	

<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 $V_{SS}$	44 V
$V_{DD}$ to GND	-0.3 V to +25 V
$V_{SS}$ to GND	+0.3 V to -25 V
$V_L$ to GND	-0.3 V to $V_{DD} + 0.3$ V
Analog, Digital Inputs <sup>1</sup>	$V_{SS} - 2$ V to $V_{DD} + 2$ V or 30 mA, whichever occurs first
Continuous Current, Sx or D	30 mA
Peak Current, Sx or D (Pulsed at 1 ms, 10% Duty Cycle Maximum)	100 mA
Operating Temperature Range	-55°C to +125°C
Storage Temperature Range	-65°C to +150°C
Junction Temperature	150°C
Power Dissipation (MSOP)	315 mW
Thermal Impedance, $\theta_{JA}$	205°C/W
Lead Temperature, Soldering	As per JEDEC J-STD-020

<sup>1</sup> Overvoltages at IN, Sx, or D are clamped by internal diodes. Limit current 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 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.

# ADG419-EP

## PIN CONFIGURATION AND FUNCTION DESCRIPTIONS

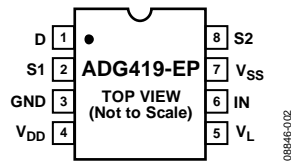


Figure 2. Pin Configuration

Table 4. Pin Function Descriptions

Pin No.	Mnemonic	Description
1	D	Drain Terminal. Can be an input or an output.
2	S1	Source Terminal. Can be an input or an output.
3	GND	Ground Reference (0 V).
4	V <sub>DD</sub>	Most Positive Power Supply Potential.
5	V <sub>L</sub>	Logic Power Supply (5 V).
6	IN	Logic Control Input.
7	V <sub>SS</sub>	Most Negative Power Supply Potential in Dual-Supply Applications. In single-supply applications, this pin can be connected to GND.
8	S2	Source Terminal. Can be an input or an output.

Table 5. Truth Table

Logic	Switch 1	Switch 2
0	On	Off
1	Off	On

# TYPICAL PERFORMANCE CHARACTERISTICS

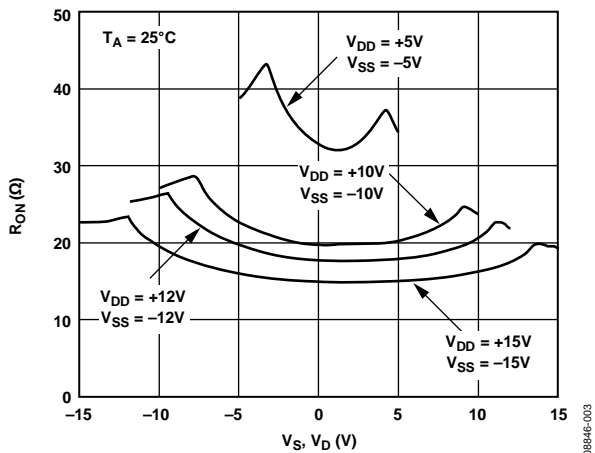


Figure 3.  $R_{ON}$  as a Function of  $V_D$  ( $V_S$ ), Dual-Supply Voltage

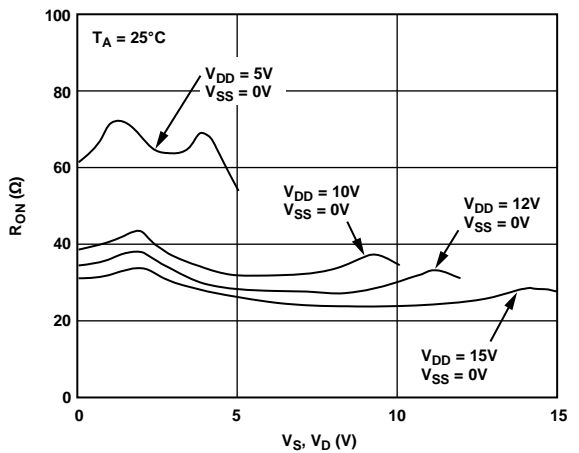


Figure 6.  $R_{ON}$  as a Function of  $V_D$  ( $V_S$ ), Single-Supply Voltage

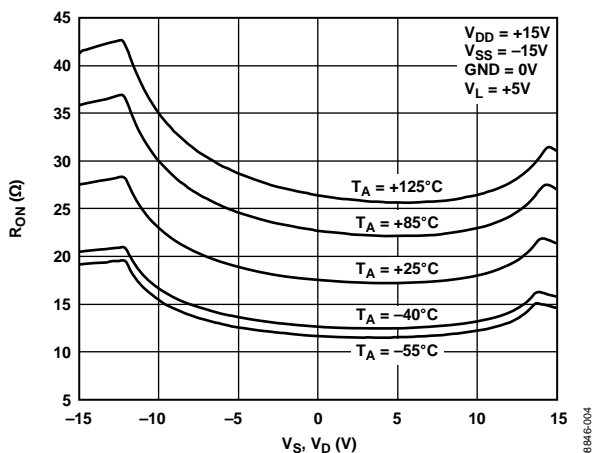


Figure 4.  $R_{ON}$  as a Function of  $V_D$  ( $V_S$ ) for Different Temperatures, Dual-Supply Voltage

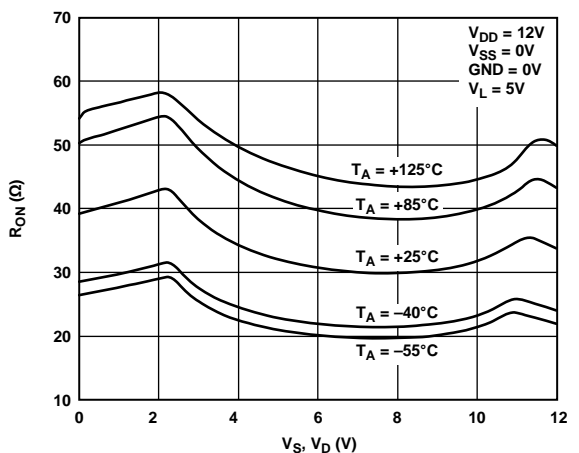


Figure 7.  $R_{ON}$  as a Function of  $V_D$  ( $V_S$ ) for Different Temperatures, Single-Supply Voltage

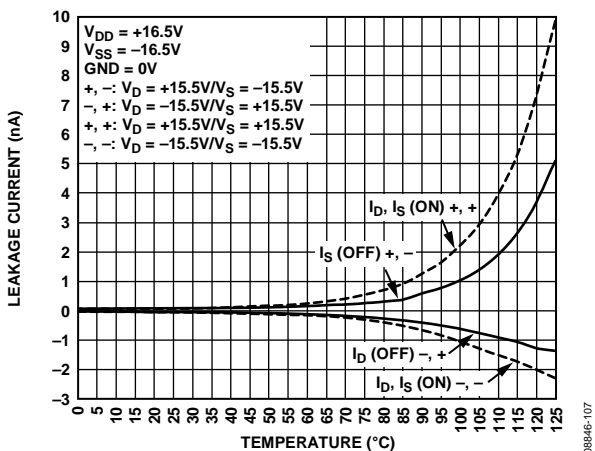


Figure 5. Leakage Current vs. Temperature, Dual-Supply Voltage

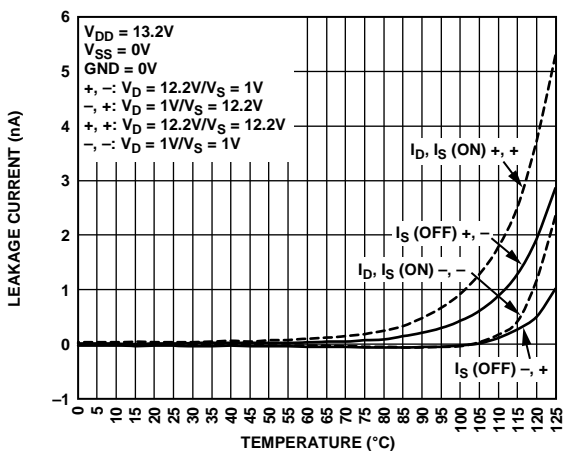


Figure 8. Leakage Current vs. Temperature, Single-Supply Voltage

## TEST CIRCUITS

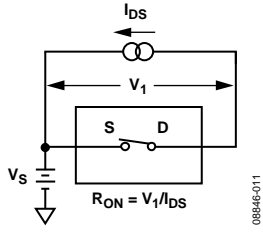


Figure 9. On Resistance

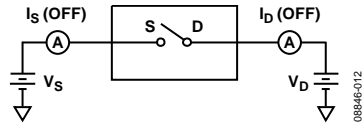


Figure 10. Off Leakage

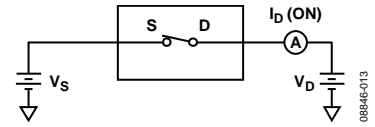


Figure 11. On Leakage

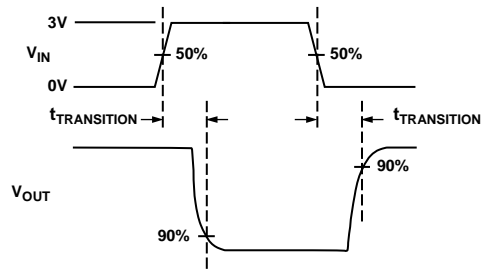
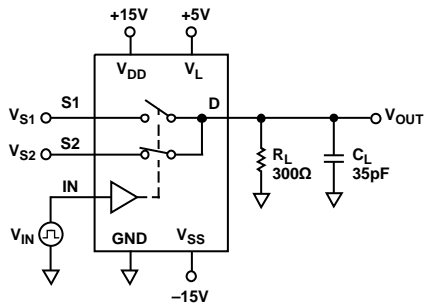


Figure 12. Transition Time,  $t_{\text{TRANSITION}}$

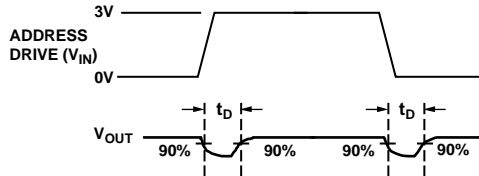
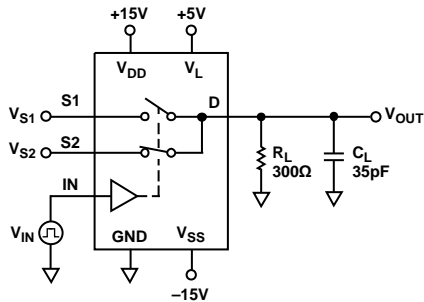
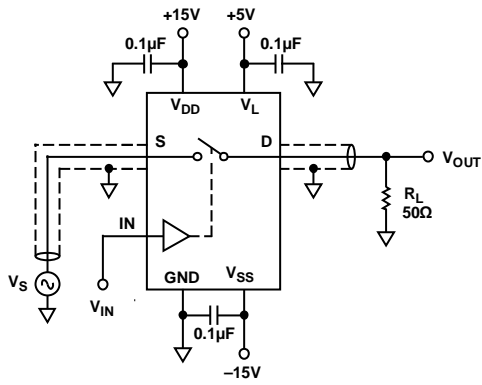


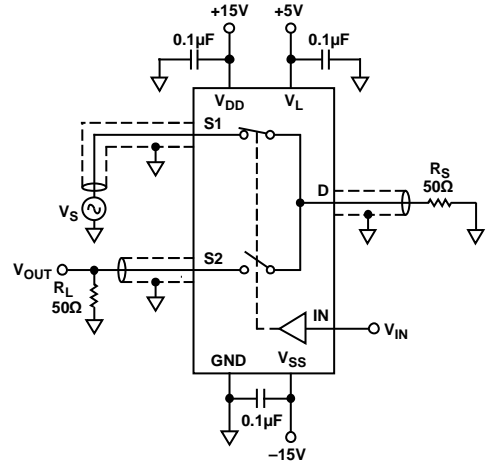
Figure 13. Break-Before-Make Time Delay,  $t_D$





08846-016

Figure 14. Off Isolation



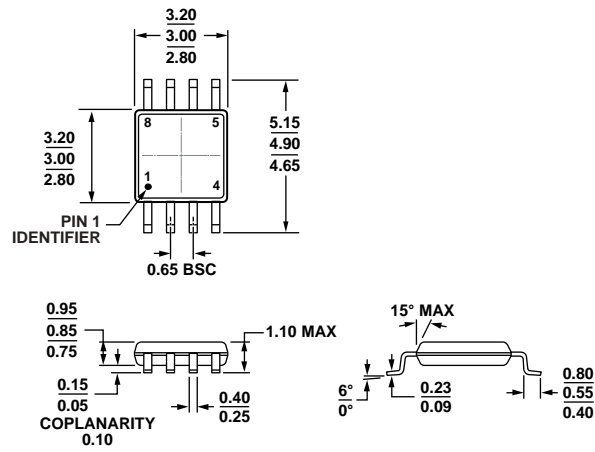
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CHANNEL-TO-CHANNEL CROSSTALK =  $20 \times \log |V_S/V_{OUT}|$

Figure 15. Crosstalk

# ADG419-EP

## OUTLINE DIMENSIONS



COMPLIANT TO JEDEC STANDARDS MO-187-AA

Figure 16. 8-Lead Mini Small Outline Package [MSOP] (RM-8)

Dimensions shown in millimeters

1000705-B

## ORDERING GUIDE

Model <sup>1</sup>	Temperature Range	Package Description	Package Option	Branding
ADG419SRMZ-EP-RL7	-55°C to +125°C	8-Lead Mini Small Outline Package [MSOP]	RM-8	S3U

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

**NOTES**

**ADG419-EP**

**NOTES**