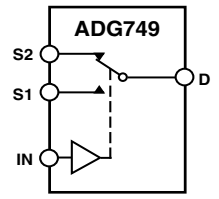
CMOS 1.8 V to 5.5 V, 2.5 Ω 2:1 MUX/SPDT Switch in SC70 Package

ADG749

FEATURES
1.8 V to 5.5 V Single Supply
5 Ω (Max) On Resistance
0.75 Ω (Typ) On Resistance Flatness
Automotive Temperature Range: –40°C to +125°C
–3 dB Bandwidth > 200 MHz
Rail-to-Rail Operation
6-Lead SC70 Package
Fast Switching Times:
t_{ON} = 12 ns
t_{OFF} = 6 ns
Typical Power Consumption (< 0.01 μW)
TTL/CMOS Compatible

APPLICATIONS
Battery-Powered Systems
Communication Systems
Sample-and-Hold Systems
Audio Signal Routing
Video Switching
Mechanical Reed Relay Replacement

FUNCTIONAL BLOCK DIAGRAM



*SWITCHES SHOWN FOR A LOGIC "1" INPUT

GENERAL DESCRIPTION

The ADG749 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 ADG749 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.

Each switch of the ADG749 conducts equally well in both directions when on. The ADG749 exhibits break-before-make switching action.

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

The ADG749 is available in a 6-lead SC70 package.

PRODUCT HIGHLIGHTS

1. 1.8 V to 5.5 V Single-Supply Operation. The ADG749 offers high performance, including low on resistance and fast switching times, and is fully specified and guaranteed with 3 V and 5 V supply rails.
2. Very Low R_{ON} (5 Ω Max at 5 V and 10 Ω Max at 3 V). At 1.8 V operation, R_{ON} is typically 40 Ω over the temperature range.
3. Automotive Temperature Range: –40°C to 125°C.
4. On Resistance Flatness ($R_{FLAT(ON)}$) (0.75 Ω typ).
5. –3 dB Bandwidth > 200 MHz.
6. Low Power Dissipation. CMOS construction ensures low power dissipation.
7. Fast t_{ON}/t_{OFF}.
8. Tiny 6-lead SC70 package.

REV. A

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ADG749–SPECIFICATIONS[1] (V_{DD} = 5 V ± 10%, GND = 0 V.)

Parameter	25°C	B Version –40°C to +85°C	–40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V_{DD}	V	
On Resistance (R_{ON})	2.5			Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA;
	5	6	7	Ω max	Test Circuit 1
On Resistance Match Between Channels (ΔR_{ON})		0.1		Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA
		0.8	0.8	Ω max	
On Resistance Flatness ($R_{FLAT(ON)}$)	0.75			Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA
		1.2	1.5	Ω max	
LEAKAGE CURRENTS[2]					V_{DD} = 5.5 V
Source Off Leakage I_S (Off)	±0.01			nA typ	V_S = 4.5 V/1 V, V_D = 1 V/4.5 V;
	±0.25	±0.35	1	nA max	Test Circuit 2
Channel On Leakage I_D, I_S (On)	±0.01			nA typ	V_S = V_D = 1 V or V_S = V_D = 4.5 V;
	±0.25	±0.35	5	nA max	Test Circuit 3
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			µA typ	V_{IN} = V_{INL} or V_{INH}
			±0.1	µA max	
DYNAMIC CHARACTERISTICS[2]					
t_{ON}	7			ns typ	R_L = 300 Ω, C_L = 35 pF
			12	ns max	V_S = 3 V; Test Circuit 4
t_{OFF}	3			ns typ	R_L = 300 Ω, C_L = 35 pF
			6	ns max	V_S = 3 V; Test Circuit 4
Break-Before-Make Time Delay, t_D	8			ns typ	R_L = 300 Ω, C_L = 35 pF,
			1	ns min	V_{S1} = V_{S2} = 3 V; Test Circuit 5
Off Isolation	–67			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz
	–87			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; Test Circuit 6
Channel-to-Channel Crosstalk	–62			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz
	–82			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; Test Circuit 7
Bandwidth –3 dB	200			MHz typ	R_L = 50 Ω, C_L = 5 pF; Test Circuit 8
C_S (OFF)	7			pF typ	
C_D, C_S (ON)	27			pF typ	
POWER REQUIREMENTS					V_{DD} = 5.5 V Digital Inputs = 0 V or 5.5 V
I_{DD}	0.001			µA typ	
			1.0	µA max	

NOTES
[1]Temperature range is as follows: B Version: –40°C to +125°C.
[2]Guaranteed by design, not subject to production test.
Specifications subject to change without notice.

SPECIFICATIONS[1] (V_{DD} = 3 V ± 10%, GND = 0 V.)

Parameter	B Version 25°C	–40°C to +85°C	–40°C to +125°C	Unit	Test Conditions/Comments
ANALOG SWITCH					
Analog Signal Range			0 V to V_{DD}	V	
On Resistance (R_{ON})	6	7		Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA;
		10	12	Ω max	Test Circuit 1
On Resistance Match Between Channels (ΔR_{ON})		0.1		Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA
		0.8	0.8	Ω max	
On Resistance Flatness ($R_{FLAT(ON)}$)		2.5		Ω typ	V_S = 0 V to V_{DD}, I_S = –10 mA
LEAKAGE CURRENTS[2]					V_{DD} = 3.3 V
Source Off Leakage I_S (Off)	±0.01			nA typ	V_S = 3 V/1 V, V_D = 1 V/3 V;
	±0.25	±0.35	1	nA max	Test Circuit 2
Channel On Leakage I_D, I_S (On)	±0.01			nA typ	V_S = V_D = 1 V or V_S = V_D = 3 V;
	±0.25	±0.35	5	nA max	Test Circuit 3
DIGITAL INPUTS					
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			µA typ	V_{IN} = V_{INL} or V_{INH}
			±0.1	µA max	
DYNAMIC CHARACTERISTICS[2]					
t_{ON}	10			ns typ	R_L = 300 Ω, C_L = 35 pF
			15	ns max	V_S = 2 V; Test Circuit 4
t_{OFF}	4			ns typ	R_L = 300 Ω, C_L = 35 pF
			8	ns max	V_S = 2 V; Test Circuit 4
Break-Before-Make Time Delay, t_D	8			ns typ	R_L = 300 Ω, C_L = 35 pF
			1	ns min	V_{S1} = V_{S2} = 2 V; Test Circuit 5
Off Isolation	–67			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz
	–87			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; Test Circuit 6
Channel-to-Channel Crosstalk	–62			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 10 MHz
	–82			dB typ	R_L = 50 Ω, C_L = 5 pF, f = 1 MHz; Test Circuit 7
Bandwidth –3 dB	200			MHz typ	R_L = 50 Ω, C_L = 5 pF; Test Circuit 8
C_S (Off)	7			pF typ	
C_D, C_S (On)	27			pF typ	
POWER REQUIREMENTS					V_{DD} = 3.3 V Digital Inputs = 0 V or 3.3 V
I_{DD}	0.001			µA typ	
			1.0	µA max	

NOTES

[1]Temperature range is as follows: B Version: –40°C to +125°C.

[2]Guaranteed by design, not subject to production test.

Specifications subject to change without notice.

ABSOLUTE MAXIMUM RATINGS[1]

(T_A = 25°C, unless otherwise noted)

V_{DD} to GND ..... –0.3 V to +7 V
Analog, Digital Inputs[2] ..... –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 Max)
Continuous Current, S or D ..... 30 mA
Operating Temperature Range
  Industrial (B Version) ..... –40°C to +125°C
Storage Temperature Range ..... –65°C to +150°C
Junction Temperature ..... 150°C
SC70 Package, Power Dissipation ..... 315 mW
  θ_{JA} Thermal Impedance ..... 332°C/W
  θ_{JC} Thermal Impedance ..... 120°C/W
Lead Temperature, Soldering
  Vapor Phase (60 sec) ..... 215°C
  Infrared (15 sec) ..... 220°C
ESD ..... 1.5 kV

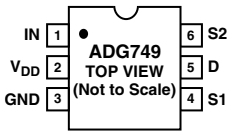
[1]Stresses above those listed under Absolute Maximum Ratings may cause permanent damage to the device. This is a stress rating only; functional operation of the device at these or any other conditions above those listed in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability. Only one absolute maximum rating may be applied at any one time.

[2]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

ADG749 IN	Switch S1	Switch S2
0	ON	OFF
1	OFF	ON

PIN CONFIGURATION



TERMINOLOGY

V_{DD}	Most Positive Power Supply Potential
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
R_{ON}	Ohmic Resistance between D and S
ΔR_{ON}	On Resistance Match between any Two Channels i.e., R_{ON} max – R_{ON} min
$R_{FLAT(ON)}$	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, I_S (On)	Channel Leakage Current with the Switch On
V_D (V_S)	Analog Voltage on Terminals D and S
C_S (Off)	Off Switch Source Capacitance
C_D, C_S (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_D	Off time or on time measured between the 90% points of both switches, when switching from one address state to another.
Crosstalk	A measure of unwanted signal that is 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 at which the output is attenuated by –3 dBs.
On Response	The Frequency Response of the On Switch
Insertion Loss	Loss due to On Resistance of the Switch

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ORDERING GUIDE

Model	Temperature Range	Package Description	Package Option	Branding Information*
ADG749BKS	–40°C to +125°C	SC70 (6-Lead Plastic Surface Mount)	KS-6	SHB

*Branding on this package is limited to three characters due to space constraints.

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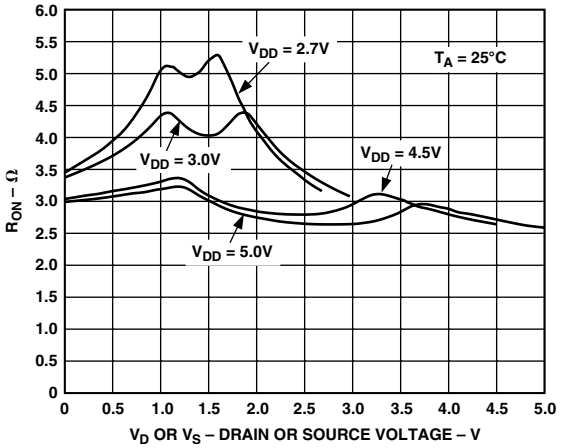
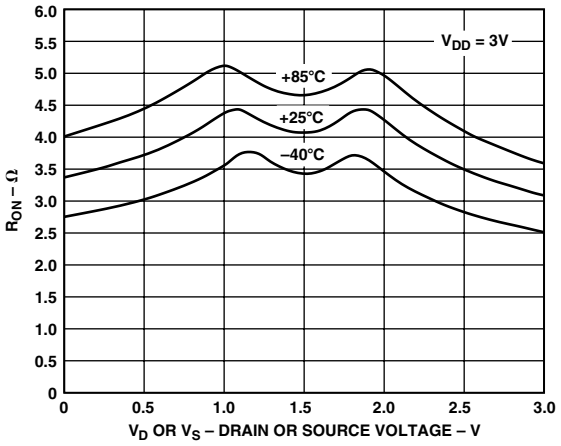
CAUTION

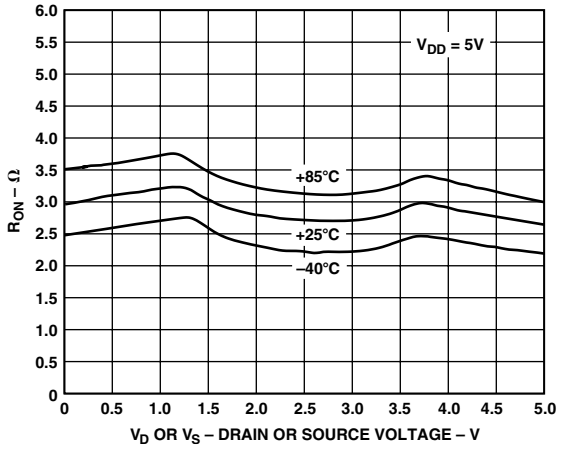
ESD (electrostatic discharge) sensitive device. Electrostatic charges as high as 4000 V readily accumulate on the human body and test equipment and can discharge without detection. Although the ADG749 features proprietary ESD protection circuitry, permanent damage may occur on devices subjected to high energy electrostatic discharges. Therefore, proper ESD precautions are recommended to avoid performance degradation or loss of functionality.



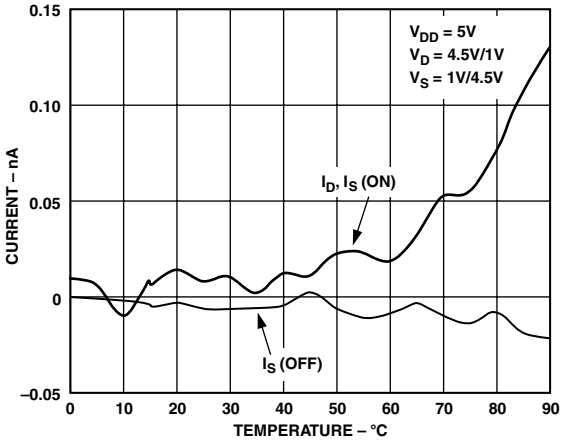
TPC 1. On Resistance vs. V_D (V_S) Single Supplies



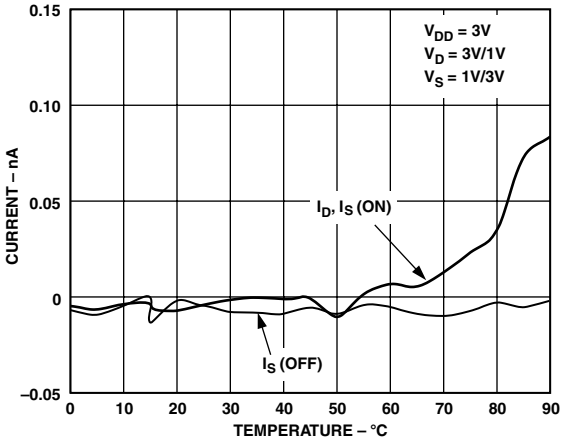
TPC 2. On Resistance vs. V_D (V_S) for Different Temperatures V_{DD} = 3 V



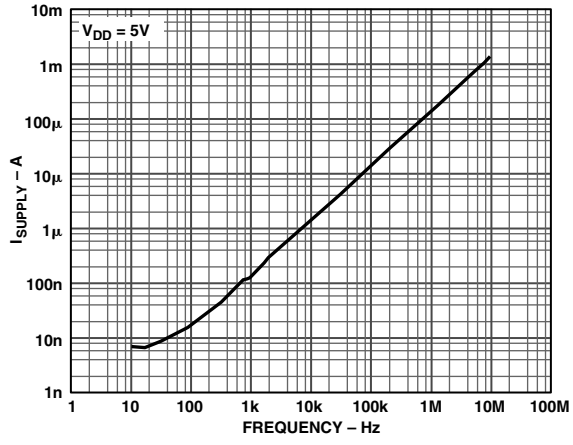
TPC 3. On Resistance vs. V_D (V_S) for Different Temperatures, V_{DD} = 5 V



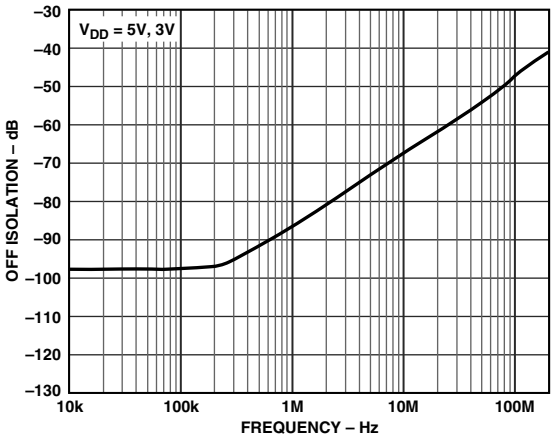
TPC 4. Leakage Currents vs. Temperature



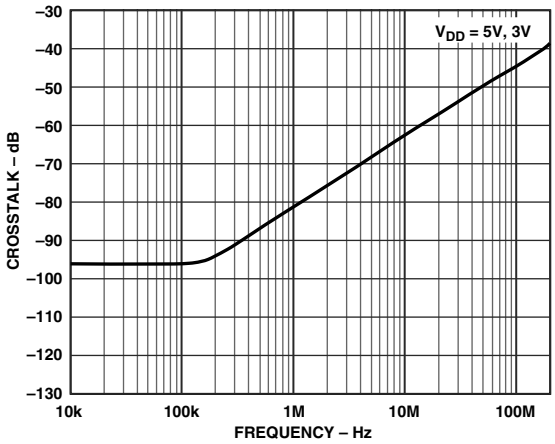
TPC 5. Leakage Currents vs. Temperature



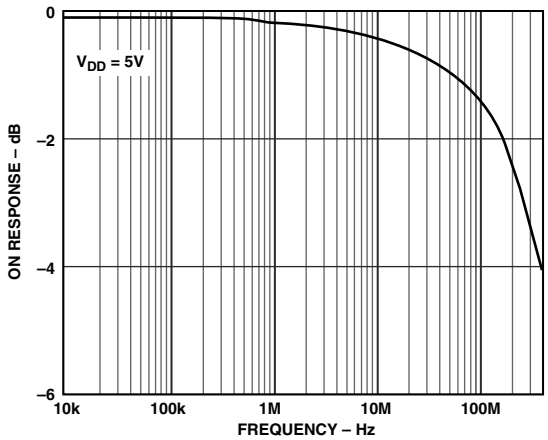
TPC 6. Supply Current vs. Input Switching Frequency



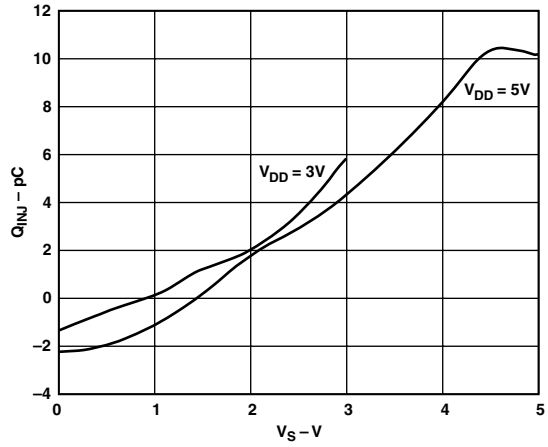
TPC 7. Off Isolation vs. Frequency



TPC 8. Crosstalk vs. Frequency



TPC 9. On Response vs. Frequency



TPC 10. Charge Injection vs. Source Voltage

Revision History

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