



CMOS Latched 4/8 Channel Analog Multiplexers

ADG528A/ADG529A

FEATURES

44V Supply Maximum Rating
 V_{SS} to V_{DD} Analog Signal Range
Single/Dual Supply Specifications
Wide Supply Ranges (10.8V to 16.5V)
Microprocessor Compatible (100ns $\overline{WR}$ Pulse)
Extended Plastic Temperature Range
(-40°C to +85°C)
Low Leakage (20pA typ)
Low Power Dissipation (28mW max)
Available in 16-Lead DIP and
20-Lead LCCC/PLCC Packages
Superior Alternative to:
DG528
DG529

GENERAL DESCRIPTION

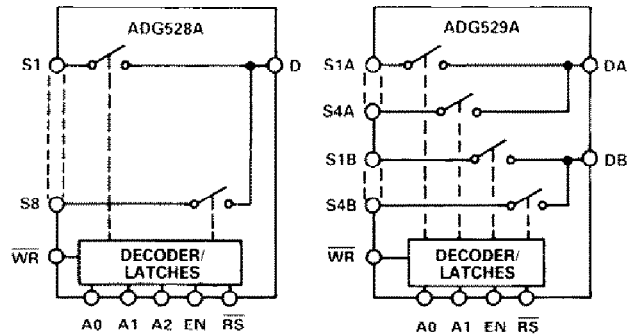
The ADG528A and ADG529A are CMOS monolithic analog multiplexers with 8 channels and dual 4 channels respectively. On-chip latches facilitate microprocessor interfacing. The ADG528A switches one of 8 inputs to a common output depending on the state of three binary addresses and an enable input. The ADG529A switches one of 4 differential inputs to a common differential output depending on the state of two binary addresses and an enable input. Both devices have TTL and 5V CMOS logic compatible digital inputs.

The ADG528A and ADG529A are designed on an enhanced LC^2MOS process which gives an increased signal capability of V_{SS} to V_{DD} and enables operation over a wide range of supply voltages. The devices can comfortably operate anywhere in the 10.8V to 16.5V single or dual supply range. These multiplexers also feature high switching speeds and low R_{ON} .

PRODUCT HIGHLIGHTS

1. **Single/Dual Supply Specifications with a Wide Tolerance:**
The devices are specified in the 10.8V to 16.5V range for both single and dual supplies.
2. **Easily Interfaced:**
The ADG528A and ADG529A can be easily interfaced with microprocessors. The $\overline{WR}$ signal latches the state of the address control lines and the enable line. The $\overline{RS}$ signal clears both the address and enable data in the latches resulting in no output (all switches off). $\overline{RS}$ can be tied to the microprocessor reset pin.

FUNCTIONAL BLOCK DIAGRAMS



3. **Extended Signal Range:**
The enhanced LC^2MOS processing results in a high breakdown and an increased analog signal range of V_{SS} to V_{DD} .
4. **Break-Before-Make Switching:**
Switches are guaranteed break-before-make so that input signals are protected against momentary shorting.
5. **Low Leakage:**
Leakage currents in the range of 20pA make these multiplexers suitable for high precision circuits.

ORDERING GUIDE

Model ¹	Temperature Range	Package Option ²
ADG528AKN	-40°C to +85°C	N-28
ADG528AKP	-40°C to +85°C	P-20A
ADG528ABQ	-40°C to +85°C	Q-18
ADG528ATQ ³	-55°C to +125°C	Q-18
ADG528ATE ³	-55°C to +125°C	E-20A
ADG529AKN	-40°C to +85°C	N-18
ADG529AKP	-40°C to +85°C	P-20A
ADG529ABQ	-40°C to +85°C	Q-18
ADG529ATQ ³	-55°C to +125°C	Q-18
ADG529ATE ³	-55°C to +125°C	E-20A

NOTES

¹To order MIL-STD-883, Class B processed parts, add /883B to part number. See Analog Devices Military Products Databook (1990) for military data sheet.

²E = Leadless Ceramic Chip Carrier (LCCC); N = Plastic DIP; P = Plastic Leaded Chip Carrier (PLCC); Q = Cerdip.

REV. A

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Telex: 924491 Cable: ANALOG NORWOODMASS

ADG528A/ADG529A—SPECIFICATIONS

Dual Supply ($V_{DD} = +10.8V$ to $+16.5V$, $V_{SS} = -10.8V$ to $-16.5V$ unless otherwise noted.)

	ADG528A ADG529A K Version		ADG528A ADG529A B Version		ADG528A ADG529A T Version			
Parameter	- 40°C to + 25°C + 85°C		- 40°C to + 25°C + 85°C		- 55°C to + 25°C + 125°C		Units	Comments
ANALOG SWITCH								
Analog Signal Range	V _{SS} V _{DD}	V _{SS} V _{DD}	V _{SS} V _{DD}	V _{SS} V _{DD}	V _{SS} V _{DD}	V _{SS} V _{DD}	V min V max	
R _{ON}	280 450 300	600 400	280 450 300	600 400	280 450 300	600 400	Ω typ Ω max Ω max	- 10V ≤ V _S ≤ + 10V, I _{DS} = 1mA; Test Circuit 1 V _{DD} = 15V(± 10%), V _{SS} = - 15V(± 10%) V _{DD} = 15V(± 5%), V _{SS} = - 15V(± 5%)
R _{ON} Drift	0.6		0.6		0.6		%/°C typ	- 10V ≤ V _S ≤ + 10V, I _{DS} = 1mA
R _{ON} Match	5		5		5		% typ	- 10V ≤ V _S ≤ + 10V, I _{DS} = 1mA
I _S (OFF), Off Input Leakage	0.02 1	50	0.02 1	50	0.02 1	50	nA typ nA max	V1 = ± 10V, V2 = ∓ 10V; Test Circuit 2
I _D (OFF), Off Output Leakage	0.04 1	100	0.04 1	100	0.04 1	100	nA typ nA max	V1 = ± 10V, V2 = ∓ 10V; Test Circuit 3
ADG528A	1	50	1	50	1	50	nA max	
I _D (ON), On Channel Leakage	0.04 1	100	0.04 1	100	0.04 1	100	nA typ nA max	V1 = ± 10V, V2 = ∓ 10V; Test Circuit 4
ADG528A	1	100	1	100	1	100	nA max	
ADG529A	1	50	1	50	1	50	nA max	
I _{DIFF} , Differential Off Output Leakage (ADG529A only)		25		25		25	nA max	V1 = ± 10V, V2 = ∓ 10V; Test Circuit 5
DIGITAL CONTROL								
V _{INH} , Input High Voltage		2.4		2.4		2.4	V min	
V _{INL} , Input Low Voltage		0.8		0.8		0.8	V max	
I _{INL} or I _{INH}		1		1		1	μA max	V _{IN} = 0 to V _{DD}
C _{IN} Digital Input Capacitance	8		8		8		pF max	
DYNAMIC CHARACTERISTICS¹								
t _{TRANSITION}	200 300	400	200 300	400	200 300	400	ns typ ns max	V1 = ± 10V, V2 = ∓ 10V; Test Circuit 6
t _{OPEN}	50 25	10	50 25	10	50 25	10	ns typ ns min	Test Circuit 7
t _{ON} (EN, $\overline{WR}$)	200 300	400	200 300	400	200 300	400	ns typ ns max	Test Circuits 8 and 9
t _{OFF} (EN, $\overline{RS}$)	200 300	400	200 300	400	200 300	400	ns typ ns max	Test Circuits 8 and 10
t _W Write Pulse Width	100	120	100	120	100	130	ns min	See Figure 1
t _S Address, Enable Setup Time		100		100		100	ns min	See Figure 1
t _H Address, Enable Hold Time		10		10		10	ns min	See Figure 1
t _{RS} Reset Pulse Width		100		100		100	ns min	See Figure 2
OFF Isolation	68 50		68 50		68 50		dB typ dB min	V _{EN} = 0.8V, R _L = 1kΩ, C _L = 15pF, V _S = 7V rms, f = 100kHz
C _S (OFF)	5		5		5		pF typ	V _{EN} = 0.8V
C _D (OFF)								
ADG528A	22		22		22		pF typ	V _{EN} = 0.8V
ADG529A	11		11		11		pF typ	
Q _{INJ} , Charge Injection	4		4		4		pC typ	R _S = 0Ω, V _S = 0V; Test Circuit 11
POWER SUPPLY								
I _{DD}	0.6	1.5	0.6	1.5	0.6	1.5	mA typ mA max	V _{IN} = V _{INL} or V _{INH}
I _{SS}	20	0.2	20	0.2	20	0.2	μA typ mA max	V _{IN} = V _{INL} or V _{INH}
Power Dissipation	10		10		10		mW typ mW max	
		28		28		28		

NOTE

¹Sample tested at +25°C to ensure compliance.

Specifications subject to change without notice.

Single Supply ($V_{DD} = +10.8V$ to $+16.5V$, $V_{SS} = GND = 0V$ unless otherwise noted.)

	ADG528A ADG529A K Version		ADG528A ADG529A B Version		ADG528A ADG529A T Version			
Parameter	+25°C	-40°C to +85°C	+25°C	-40°C to +85°C	+25°C	-55°C to +125°C	Units	Comments
ANALOG SWITCH								
Analog Signal Range	GND	GND	GND	GND	GND	GND	V min V max	GND ≤ V _S ≤ +10V, I _{DS} = 0.5mA; Test Circuit 1
R _{ON}	V _{DD}	V _{DD}	V _{DD}	V _{DD}	V _{DD}	V _{DD}	Ω typ	
	500	500	500	500	500	500	Ω max	
R _{ON} Drift	700	1000	700	1000	700	1000	%/°C typ	GND ≤ V _S ≤ +10V, I _{DS} = 0.5mA GND ≤ V _S ≤ +10V, I _{DS} = 0.5mA
R _{ON} Match	0.6		0.6		0.6		% typ	
I _S (OFF), Off Input Leakage	5		5		5		nA typ	V ₁ = +10V/GND, V ₂ = GND/+10V Test Circuit 2
	0.02		0.02		0.02		nA max	
I _D (OFF), Off Output Leakage	1	50	1	50	1	50	nA typ	V ₁ = +10V/GND, V ₂ = GND/+10V Test Circuit 3
ADG528A	0.04		0.04		0.04		nA max	
ADG529A	1	100	1	100	1	100	nA max	
I _D (ON), On Channel Leakage	1	50	1	50	1	50	nA max	V ₁ = +10V/GND, V ₂ = GND/+10V Test Circuit 4
ADG528A	0.04		0.04		0.04		nA typ	
ADG529A	1	100	1	100	1	100	nA max	
I _{DIFF} , Differential Off Output Leakage (ADG529A only)	1	50	1	50	1	50	nA max	V ₁ = +10V/GND, V ₂ = GND/+10V Test Circuit 5.
		25		25		25	nA max	
DIGITAL CONTROL								
V _{INH} , Input High Voltage		2.4		2.4		2.4	V min	V _{IN} = 0 to V _{DD}
V _{INL} , Input Low Voltage		0.8		0.8		0.8	V max	
I _{INL} or I _{INH}		1		1		1	μA max	
C _{IN} Digital Input Capacitance	8		8		8		pF max	
DYNAMIC CHARACTERISTICS ¹								
t _{TRANSITION}	300		300		300		ns typ	V ₁ = +10V/GND, V ₂ = GND/+10V; Test Circuit 6
	450	600	450	600	450	600	ns max	
t _{OPEN}	50		50		50		ns typ	Test Circuit 7
	25	10	25	10	25	10	ns min	
t _{ON} (EN, $\overline{WR}$)	250		250		250		ns typ	Test Circuits 8 and 9
	450	600	450	600	450	600	ns max	
t _{OFF} (EN, $\overline{RS}$)	250		250		250		ns typ	Test Circuits 8 and 10
	450	600	450	600	450	600	ns max	
t _w Write Pulse Width	100	120	100	120	100	130	ns min	See Figure 1
t _S Address, Enable Setup Time		100		100		100	ns min	See Figure 1
t _H Address, Enable Hold Time		10		10		10	ns min	See Figure 1
t _{RS} Reset Pulse Width		100		100		100	ns min	See Figure 2
OFF Isolation	68		68		68		dB typ	V _{EN} = 0.8V, R _L = 1kΩ, C _L = 15pF, V _S = 3.5V rms, f = 100kHz
	50		50		50		dB min	
C _S (OFF)	5		5		5		pF typ	V _{EN} = 0.8V
C _D (OFF)								
ADG528A	22		22		22		pF typ	V _{EN} = 0.8V
ADG529A	11		11		11		pF typ	
Q _{INJ} , Charge Injection	4		4		4		pC typ	R _S = 0Ω, V _S = 0V; Test Circuit 11
POWER SUPPLY								
I _{DD}	0.6		0.6		0.6		mA typ	V _{IN} = V _{INL} or V _{INH}
		1.5		1.5		1.5	mA max	
Power Dissipation	11		11		11		mW typ	
		25		25		25	mW max	

NOTE

¹Sample tested at +25°C to ensure compliance.

Specifications subject to change without notice.

ADG528A/ADG529A

ABSOLUTE MAXIMUM RATINGS*

(T_A = +25°C unless otherwise noted)

V _{DD} to V _{SS}	44V
V _{DD} to GND	25V
V _{SS} to GND	-25V
Analog Inputs ¹	
Voltage at S, D	V _{SS} - 2V to V _{DD} + 2V or 20mA, Whichever Occurs First
Continuous Current, S or D	20mA
Pulsed Current S or D	
1ms Duration, 10% Duty Cycle	40mA

Digital Inputs¹

Voltage at A, EN, $\overline{\text{WR}}$, $\overline{\text{RS}}$ V_{SS} - 4V to V_{DD} + 4V or 20mA, Whichever Occurs First

Power Dissipation (Any Package)

Up to +75°C 470mW
Derates above +75°C by 6mW/°C

Operating Temperature

Commercial (K Version) -40°C to +85°C
Industrial (B Version) -40°C to +85°C
Extended (T Version) -55°C to +125°C

Storage Temperature Range

Lead Temperature (Soldering, 10sec) +300°C

NOTE

¹Overvoltage at A, EN, $\overline{\text{WR}}$, $\overline{\text{RS}}$, S or D will be clamped by diodes. Current should be limited to the maximum rating above.

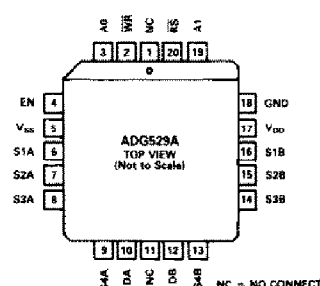
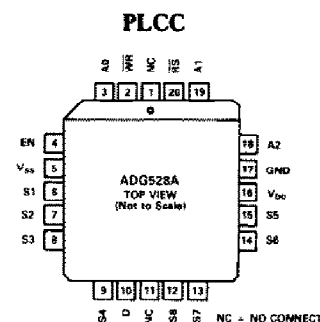
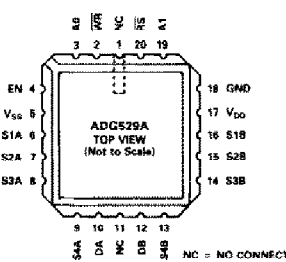
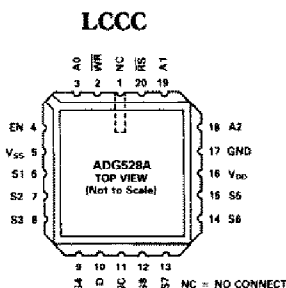
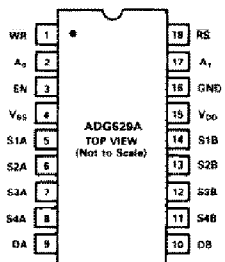
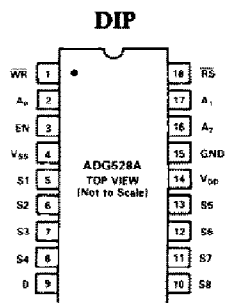
*COMMENT: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. This is a stress rating only and functional operation of the device at these or any other conditions above those indicated in the operational sections of this specification is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.

CAUTION

ESD (electrostatic discharge) sensitive device. The digital control inputs are diode protected; however, permanent damage may occur on unconnected devices subject to high energy electrostatic fields. Unused devices must be stored in conductive foam or shunts. The protective foam should be discharged to the destination socket before devices are removed.



PIN CONFIGURATIONS



TRUTH TABLES

A2	A1	A0	EN	WR	RS	ON SWITCH PAIR
X	X	X	X	$\overline{f}$	1	Retains Previous Switch Condition
X	X	X	X	X	0	NONE (Address and Enable Latches Cleared)
X	X	X	0	0	1	NONE
0	0	0	1	0	1	1
0	0	1	1	0	1	2
0	1	0	1	0	1	3
0	1	1	1	0	1	4
1	0	0	1	0	1	5
1	0	1	1	0	1	6
1	1	0	1	0	1	7
1	1	1	1	0	1	8

X = Don't Care **ADG528A**

A1	A0	EN	WR	RS	ON SWITCH PAIR
X	X	X	$\overline{f}$	1	Retains Previous Switch Condition
X	X	X	X	0	NONE (Address and Enable Latches Cleared)
X	X	0	0	1	NONE
0	0	1	0	1	1
0	1	1	0	1	2
1	0	1	0	1	3
1	1	1	0	1	4

X = Don't Care **ADG529A**

TIMING DIAGRAMS

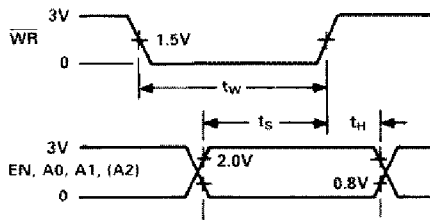


Figure 1

Figure 1 shows the timing sequence for latching the switch address and enable inputs. The latches are level sensitive; therefore, while $\overline{WR}$ is held low, the latches are transparent and the switches respond to the address and enable inputs. This input data is latched on the rising edge of $\overline{WR}$.

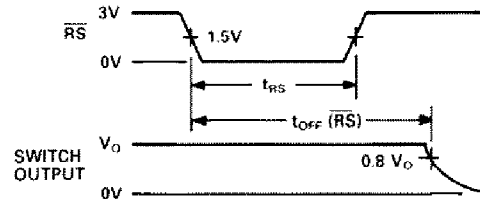


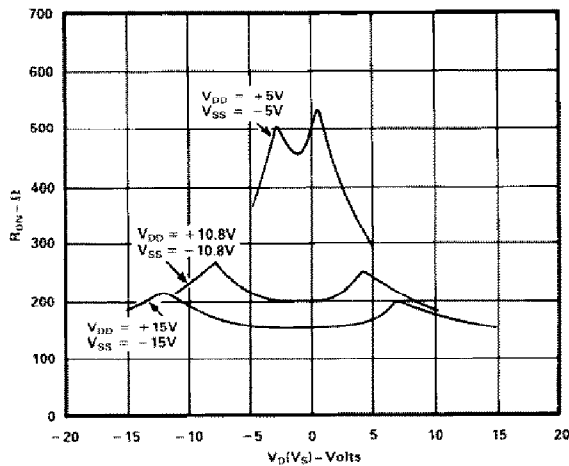
Figure 2

Figure 2 shows the Reset Pulse Width, t_{RS} , and Reset Turn-off Time, $t_{OFF} (RS)$.

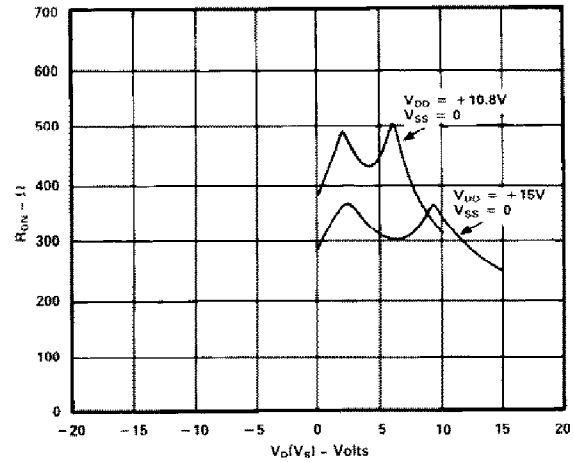
Note: All digital input signals rise and fall times measured from 10% to 90% of 3V. $t_R = t_F = 20\text{ns}$.

Typical Performance Characteristics

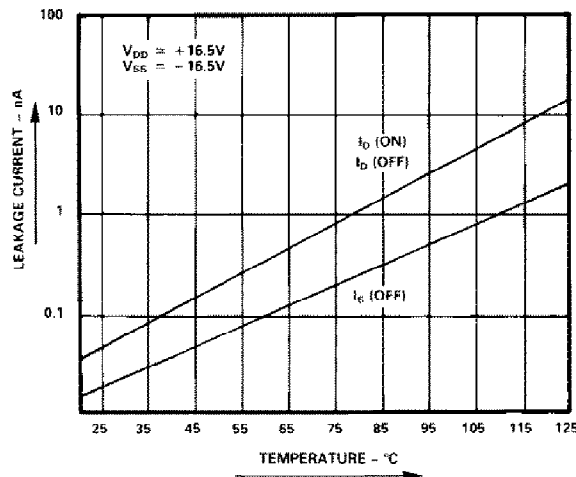
The multiplexers are guaranteed functional with reduced single or dual supplies down to 4.5V.



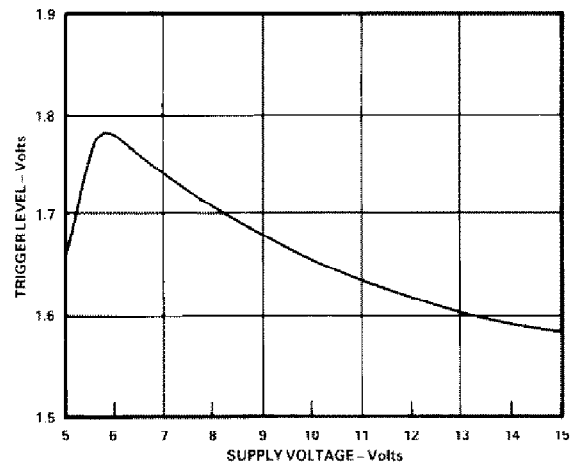
R_{ON} as a Function of $V_D(V_S)$: Dual Supply Voltage, $T_A = +25^\circ\text{C}$



R_{ON} as a Function of $V_D(V_S)$: Single Supply Voltage, $T_A = +25^\circ\text{C}$

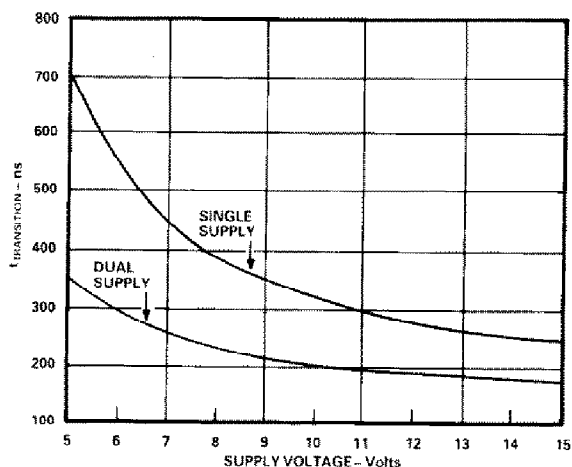


Leakage Current as a Function of Temperature
(Note: Leakage Currents Reduce as the Supply Voltages Reduce)

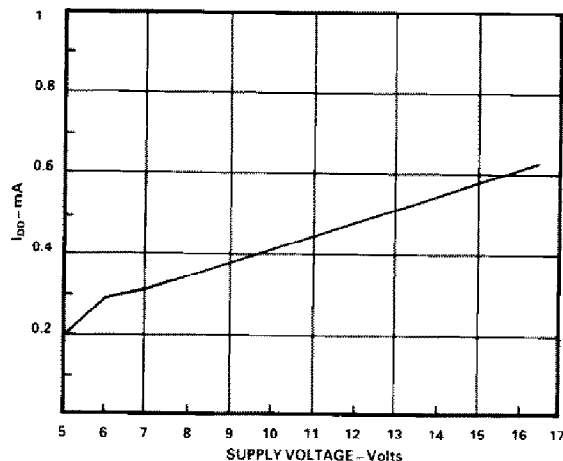


Trigger Levels vs. Power Supply Voltage, Dual or Single Supply, $T_A = +25^\circ\text{C}$

ADG528A/ADG529A



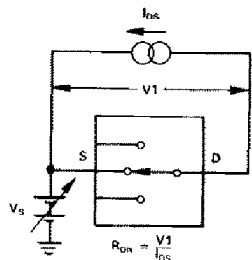
$t_{\text{TRANSITION}}$ vs. Supply Voltage: Dual and Single Supplies,
 $T_A = +25^\circ\text{C}$
 (Note: For V_{DD} and $|V_{SS}| < 10\text{V}$; $V1 = V_{DD}/V_{SS}$,
 $V2 = V_{SS}/V_{DD}$. See Test Circuit 6)



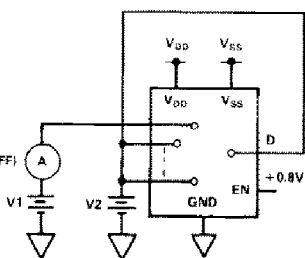
I_{DD} vs. Supply Voltage: Dual or Single Supply, $T_A = +25^\circ\text{C}$

Test Circuits

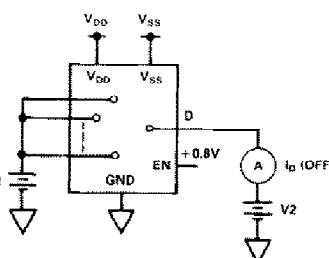
TEST CIRCUIT 1
 R_{ON}



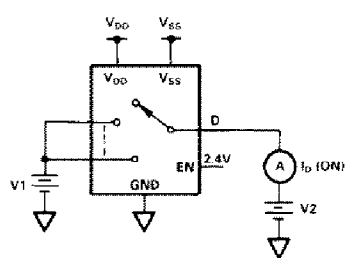
TEST CIRCUIT 2
 I_S (OFF)



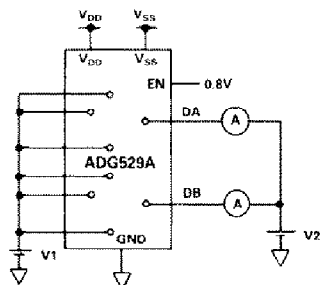
TEST CIRCUIT 3
 I_D (OFF)



TEST CIRCUIT 4
 I_D (ON)

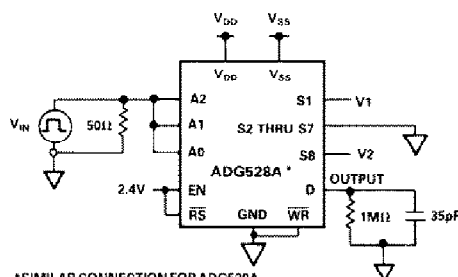
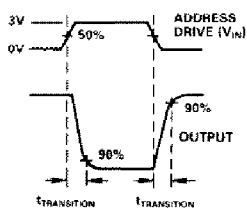


TEST CIRCUIT 5
 I_{DIFF}



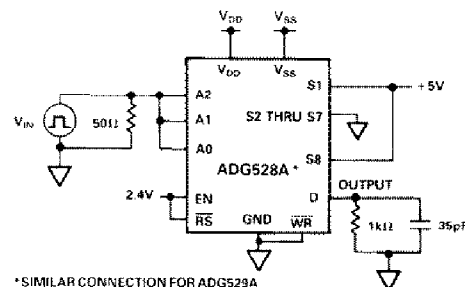
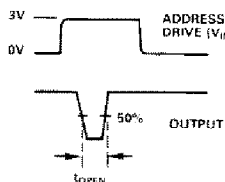
$$I_{DIFF} = I_{DA}(\text{OFF}) - I_{DB}(\text{OFF})$$

TEST CIRCUIT 6
 SWITCHING TIME OF MULTIPLEXER, $t_{\text{TRANSITION}}$



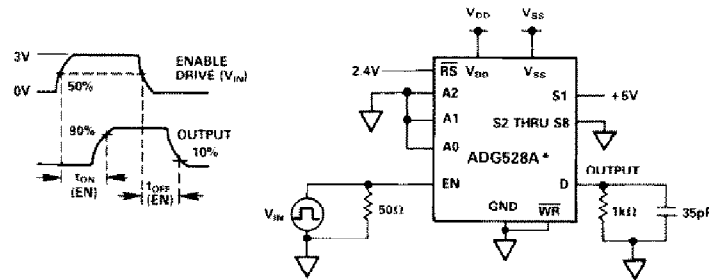
*SIMILAR CONNECTION FOR ADG529A

TEST CIRCUIT 7
 BREAK-BEFORE-MAKE DELAY, t_{OPEN}



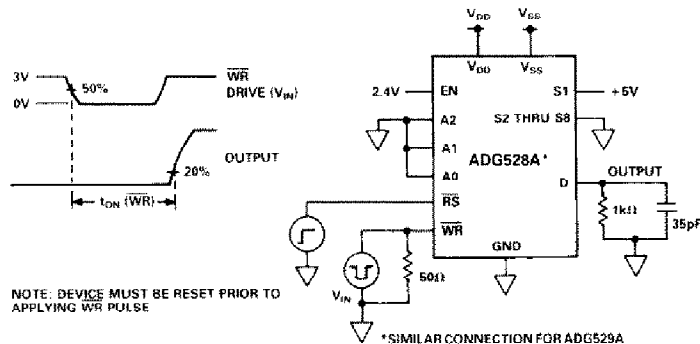
*SIMILAR CONNECTION FOR ADG529A

TEST CIRCUIT 8 ENABLE DELAY, $t_{ON}(EN)$, $t_{OFF}(EN)$



*SIMILAR CONNECTION FOR ADG529A

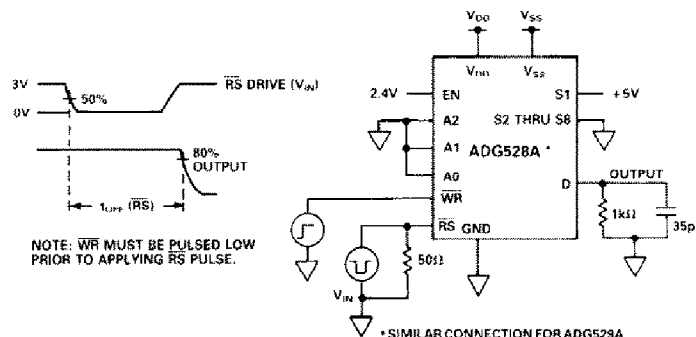
TEST CIRCUIT 9 WRITE TURN-ON TIME, $t_{ON}(WR)$



NOTE: DEVICE MUST BE RESET PRIOR TO APPLYING WR PULSE

*SIMILAR CONNECTION FOR ADG529A

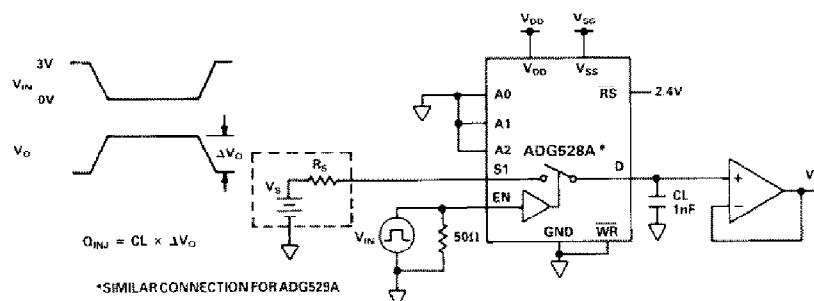
TEST CIRCUIT 10 RESET TURN-OFF TIME, $t_{OFF}(RS)$



NOTE: WR MUST BE PULSED LOW PRIOR TO APPLYING RS PULSE.

*SIMILAR CONNECTION FOR ADG529A

TEST CIRCUIT 11 CHARGE INJECTION



$$Q_{INJ} = CL \times \Delta V_0$$

*SIMILAR CONNECTION FOR ADG529A

ADG528A/ADG529A

TERMINOLOGY

R_{ON}	Ohmic resistance between terminals D and S
R_{ON} Match	Difference between the R_{ON} of any two channels
R_{ON} Drift	Change in R_{ON} versus temperature
I_S (OFF)	Source terminal leakage current when the switch is off
I_D (OFF)	Drain terminal leakage current when the switch is off
I_D (ON)	Leakage current that flows from the closed switch into the body
V_S (V_D)	Analog voltage on terminal S or D
C_S (OFF)	Channel input capacitance for "OFF" condition
C_D (OFF)	Channel output capacitance for "OFF" condition
C_{IN}	Digital input capacitance
t_{ON} (EN)	Delay time between the 50% and 90% points of the digital input and switch "ON" condition

t_{OFF} (EN)	Delay time between the 50% and 10% points of the digital input and switch "OFF" condition
$t_{TRANSITION}$	Delay time between the 50% and 90% points of the digital inputs and switch "ON" condition when switching from one address state to another
t_{OPEN}	"OFF" time measured between 50% points of both switches when switching from one address state to another
V_{INL}	Maximum input voltage for Logic "0"
V_{INH}	Minimum input voltage for Logic "1"
I_{INL} (I_{INH})	Input current of the digital input
V_{DD}	Most positive voltage supply
V_{SS}	Most negative voltage supply
I_{DD}	Positive supply current
I_{SS}	Negative supply current

MECHANICAL INFORMATION

OUTLINE DIMENSIONS

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