

ADG506A/ADG507A

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)
Extended Plastic Temperature Range
 (–40°C to +85°C)
Low Power Dissipation (28mW max)
Low Leakage (20pA typ)
Available in 28-Lead DIP, SOIC, PLCC and LCCC Packages
Superior Alternative to:
DG506A, HI-506
DG507A, HI-507

GENERAL DESCRIPTION

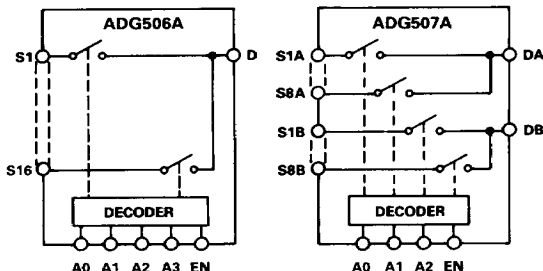
The ADG506A and ADG507A are CMOS monolithic analog multiplexers with 16 channels and dual 8 channels respectively. The ADG506A switches one of 16 inputs to a common output depending on the state of four binary addresses and an enable input. The ADG507A switches one of 8 differential inputs to a common differential output depending on the state of three binary addresses and an enable input. Both devices have TTL and 5V CMOS logic compatible digital inputs.

The ADG506A and ADG507A are designed on an enhanced LC^2 MOS 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

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

FUNCTIONAL BLOCK DIAGRAMS



ORDERING INFORMATION

Model ¹	Temperature Range	Package Option ²
ADG506AKN	–40°C to +85°C	N-28
ADG506AKR	–40°C to +85°C	R-28
ADG506AKP	–40°C to +85°C	P-28A
ADG506ABQ	–40°C to +85°C	Q-28
ADG506ATQ	–55°C to +125°C	Q-28
ADG506ATE	–55°C to +125°C	E-28A
ADG507AKN	–40°C to +85°C	N-28
ADG507AKR	–40°C to +85°C	R-28
ADG507AKP	–40°C to +85°C	P-28A
ADG507ABQ	–40°C to +85°C	Q-28
ADG507ATQ	–55°C to +125°C	Q-28
ADG507ATE	–55°C to +125°C	E-28A

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.

²N = Plastic DIP; R = 0.3" Small Outline IC (SOIC); P = Plastic Leaded Chip Carrier (PLCC); Q = Cerdip; E = Leadless Ceramic Chip Carrier (LCCC). For outline information see Package Information section.

ADG506A/ADG507A — SPECIFICATIONS

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

	ADG506A ADG507A K Version		ADG506A ADG507A B Version		ADG506A ADG507A T Version			
	-40°C to		-40°C to		-55°C to			
Parameter	+25°C	+85°C	+25°C	+85°C	+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	V _{SS} 600 400	280 450 300	V _{SS} 600 400	280 450 300	V _{SS} 600 400	Ω typ Ω max Ω max	-10V ≤ V _S ≤ +10V, I _{DS} = 1mA; Test Circuit 1
R _{ON} Drift	0.6		0.6		0.6		%/°C typ	V _{DD} = 15V(±10%), V _{SS} = -15V(±10%)
R _{ON} Match	5		5		5		% typ	V _{DD} = 15V(±5%), V _{SS} = -15V(±5%)
I _S (OFF), Off Input Leakage	0.02 1	50	0.02 1	50	0.02 1	50	nA typ nA max	-10V ≤ V _S ≤ +10V, I _{DS} = 1mA -10V ≤ V _S ≤ +10V, I _{DS} = 1mA V1 = ±10V, V2 = ∓10V; Test Circuit 2
I _D (OFF), Off Output Leakage	0.04 1	200	0.04 1	200	0.04 1	200	nA typ nA max	V1 = ±10V, V2 = ∓10V; Test Circuit 3
ADG506A	1	100	1	100	1	100	nA max	
ADG507A	1	100	1	100	1	100	nA max	
I _D (ON), On Channel Leakage	0.04 1	200	0.04 1	200	0.04 1	200	nA typ nA max	V1 = ±10V, V2 = ∓10V; Test Circuit 4
ADG506A	1	100	1	100	1	100	nA max	
ADG507A	1	100	1	100	1	100	nA max	
I _{DIFF} , Differential Off Output Leakage (ADG507A 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 CHARACTERISTICS								
t _{TRANSITION} ¹	200 300	400	200 300	400	200 300	400	ns typ ns max	V1 = ±10V, V2 = ∓10V; Test Circuit 6
t _{OPEN} ¹	50 25	10	50 25	10	50 25	10	ns typ ns min	Test Circuit 7
t _{ON} (EN) ¹	200 300	400	200 300	400	200 300	400	ns typ ns max	Test Circuit 8
t _{OFF} (EN) ¹	200 300	400	200 300	400	200 300	400	ns typ ns max	Test Circuit 8
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)								
ADG506A	44		44		44		pF typ	V _{EN} = 0.8V
ADG507A	22		22		22		pF typ	
Q _{INJ} , Charge Injection	4		4		4		pC typ	R _S = 0Ω, V _S = 0V; Test Circuit 9
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 specified)

	ADG506A ADG507A K Version		ADG506A ADG507A B Version		ADG506A ADG507A 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								
Analogue Signal Range	V _{SS}	V _{SS} V _{DD}	V _{SS}	V _{SS} V _{DD}	V _{SS}	V _{SS} V _{DD}	V _{min} V _{max}	0V ≤ V _S ≤ +10V, I _{DS} = 0.5mA; Test Circuit 1
R _{ON}	500	500 1000	500	500 1000	500	500 1000	Ω typ Ω max	
R _{ON} Drift	0.6		0.6		0.6		%/°C typ	0V ≤ V _S ≤ +10V, I _{DS} = 0.5mA
R _{ON} Match	5		5		5		% typ	0V ≤ V _S ≤ +10V, I _{DS} = 0.5mA
I _S (OFF), Off Input Leakage	0.02		0.02		0.02		nA typ	V ₁ = +10V/0V, V ₂ = 0V/+10V;
	1	50	1	50	1	50	nA max	Test Circuit 2
I _D (OFF), Off Output Leakage	0.04		0.04		0.04		nA typ	V ₁ = +10V/0V, V ₂ = 0V/+10V;
ADG506A	1	200	1	200	1	200	nA max	Test Circuit 3
ADG507A	1	100	1	100	1	100	nA max	
I _D (ON), On Channel Leakage	0.04		0.04		0.04		nA typ	V ₁ = +10V/0V, V ₂ = 0V/+10V;
ADG506A	1	200	1	200	1	200	nA max	Test Circuit 4
ADG507A	1	100	1	100	1	100	nA max	
I _{DIFF} , Differential Off Output Leakage (ADG507A only)		25		25		25	nA max	V ₁ = +10V/0V, V ₂ = 0V/+10V; Test Circuit 5.
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								
t _{TRANSITION} ¹	300		300		300		ns typ	V ₁ = +10V/0V, V ₂ = 0V/+10V; Test Circuit 6
	450	600	450	600	450	600	ns max	
t _{OPEN} ¹	50		50		50		ns typ	Test Circuit 7
	25	10	25	10	25	10	ns min	
t _{ON} (EN) ¹	250		250		250		ns typ	Test Circuit 8
	450	600	450	600	450	600	ns max	
t _{OFF} (EN) ¹	250		250		250		ns typ	Test Circuit 8
	450	600	450	600	450	600	ns max	
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)								
ADG506A	44		44		44		pF typ	V _{EN} = 0.8V
ADG507A	22		22		22		pF typ	
Q _{INJ} , Charge Injection	4		4		4		pC typ	R _S = 0Ω, V _S = 0V; Test Circuit 9
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	10		10		10		mW typ	
		25		25		25	mW max	

NOTE

¹Sample tested at 25°C to ensure compliance.

Specifications subject to change without notice.

TRUTH TABLES

A3	A2	A1	A0	EN	ON SWITCH
X	X	X	X	0	NONE
0	0	0	0	1	1
0	0	0	1	1	2
0	0	1	0	1	3
0	0	1	1	1	4
0	1	0	0	1	5
0	1	0	1	1	6
0	1	1	0	1	7
0	1	1	1	1	8
1	0	0	0	1	9
1	0	0	1	1	10
1	0	1	0	1	11
1	0	1	1	1	12
1	1	0	0	1	13
1	1	0	1	1	14
1	1	1	0	1	15
1	1	1	1	1	16

ADG506A

A2	A1	A0	EN	ON SWITCH PAIR
X	X	X	0	NONE
0	0	0	1	1
0	0	1	1	2
0	1	0	1	3
0	1	1	1	4
1	0	0	1	5
1	0	1	1	6
1	1	0	1	7
1	1	1	1	8

ADG507A

X = Don't Care

ADG506A/ADG507A

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	V _{SS} -4V to V _{DD} +4V or 20mA, Whichever Occurs First
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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	-65°C to +150°C
Lead Temperature (Soldering, 10secs)	+300°C

NOTE

¹Overtolerance at A, EN, 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.

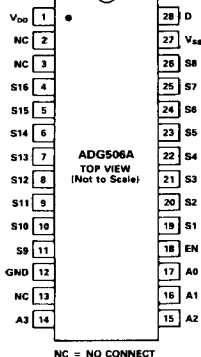
CAUTION

ESD (Electro-Static-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.

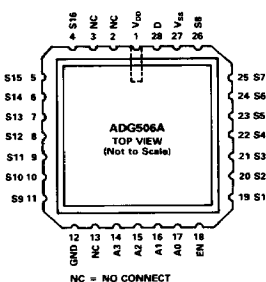


PIN CONFIGURATIONS

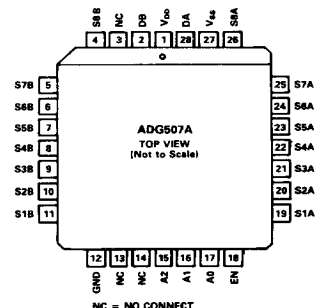
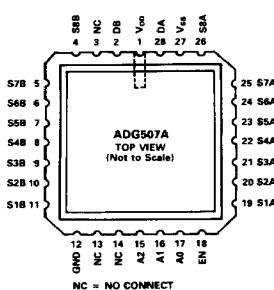
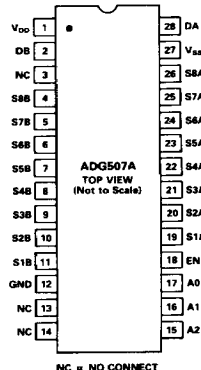
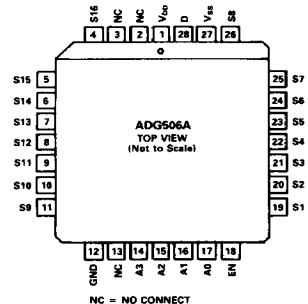
DIP, SOIC



LCCC

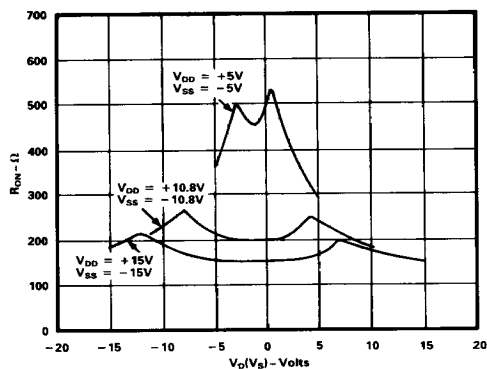


PLCC

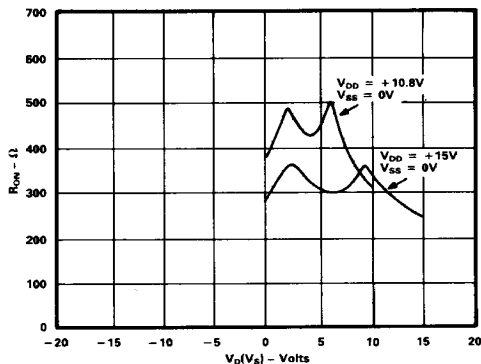


Typical Performance Characteristics—ADG506A/ADG507A

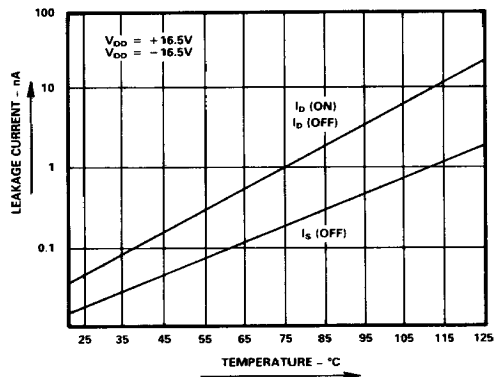
The multiplexers are guaranteed functional with reduced single or dual supplies down to 4.5V.



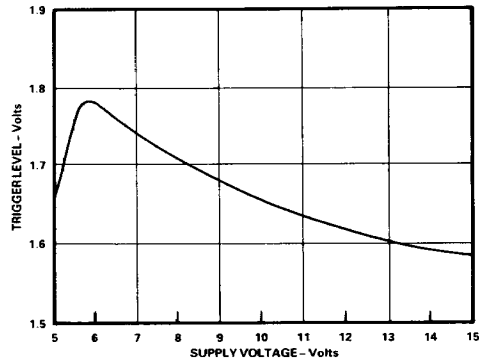
R_{ON} as a Function of $V_D(V_S)$: Dual Supply Voltage, $T_A = +25^\circ\text{C}$



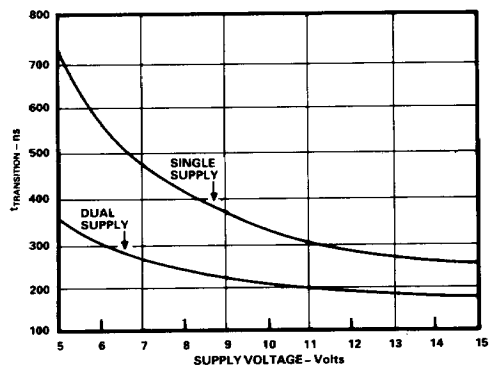
R_{ON} as a Function of $V_D(V_S)$: Single Supply Voltage, $T_A = +25^\circ\text{C}$



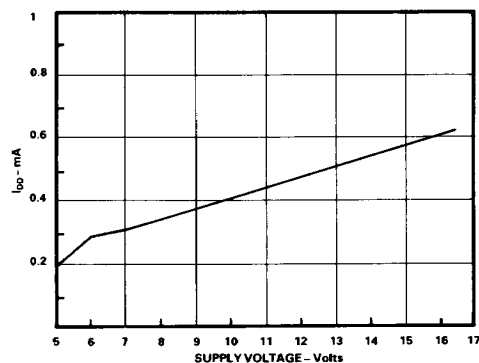
Leakage Current as a Function of Temperature
(Note: Leakage Currents Reduce as the Supply Voltages Reduce)



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



$t_{TRANSITION}$ vs. Supply Voltage: Dual and Single Supplies, $T_A = +25^\circ\text{C}$
(Note: For V_{DD} and $|V_{SS}| < 10\text{V}$; $V_1 = V_{DD}/V_{SS}$, $V_2 = V_{SS}/V_{DD}$. See Test Circuit 6)



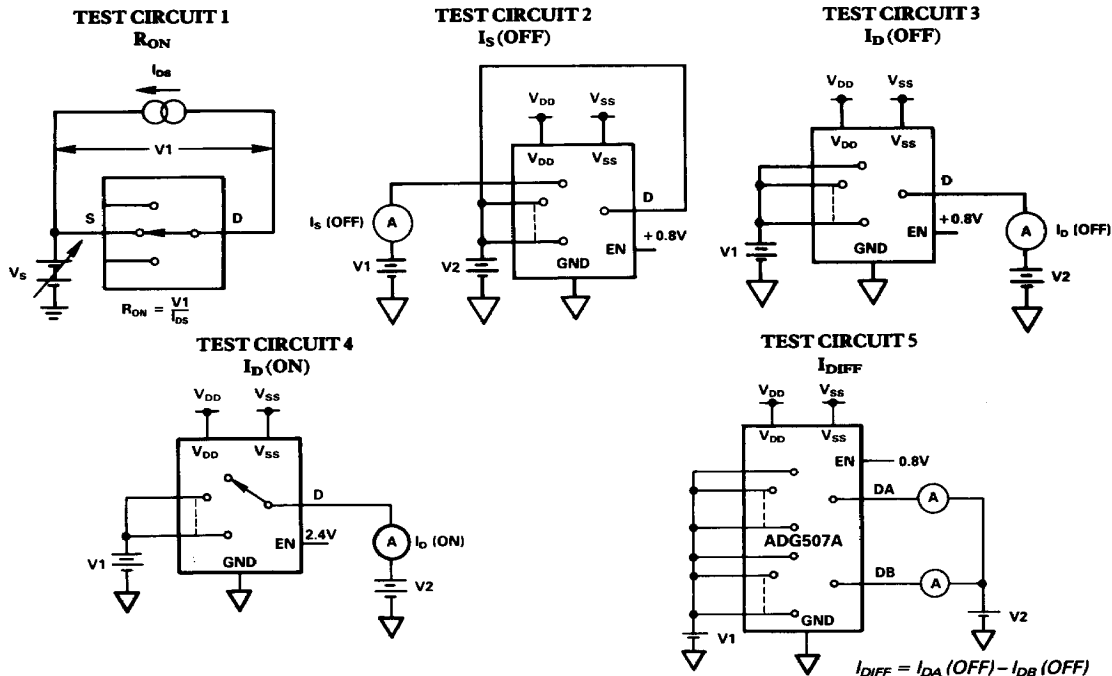
I_{DD} vs. Supply Voltage: Dual or Single Supply, $T_A = +25^\circ\text{C}$

REV. A

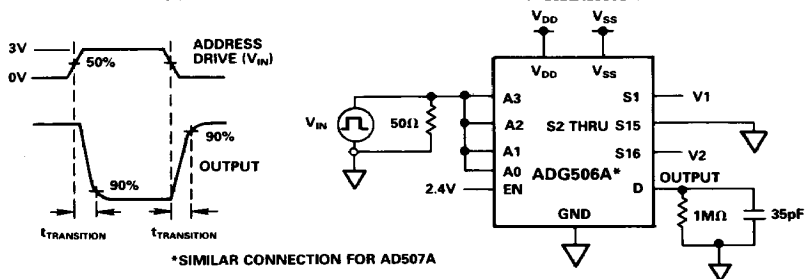
CMOS SWITCHES & MULTIPLEXERS 5-83

ADG506A/ADG507A — Test Circuits

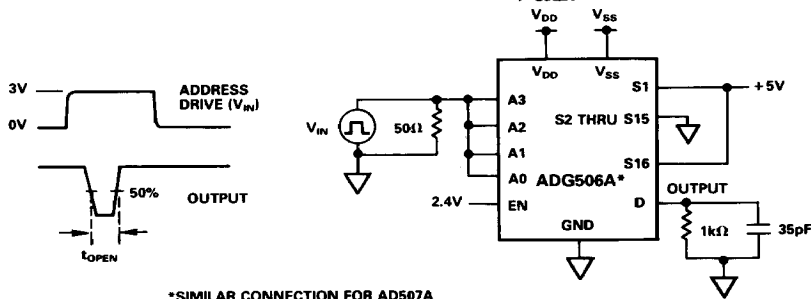
Note: All Digital Input Signal Rise and Fall Times Measured from 10% to 90% of 3V. $t_R = t_F = 20\text{ns}$.



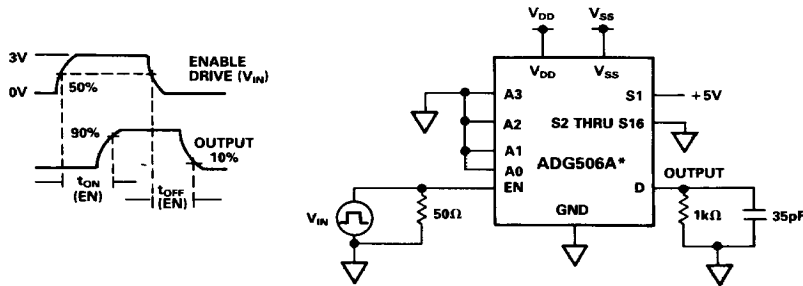
TEST CIRCUIT 6
SWITCHING TIME OF MULTIPLEXER, $t_{TRANSITION}$



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

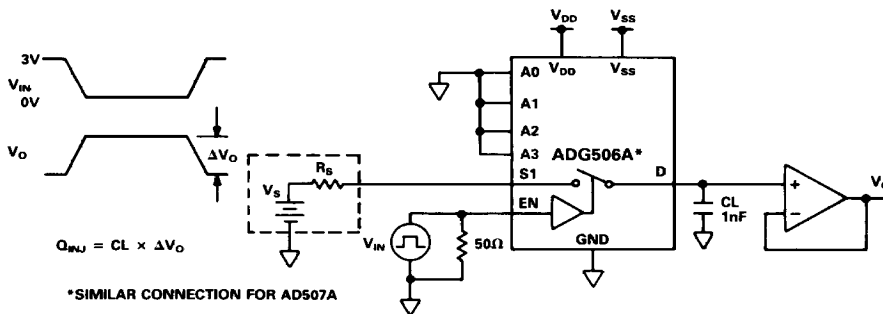


TEST CIRCUIT 8 ENABLE DELAY, $t_{ON}(EN)$, $t_{OFF}(EN)$



*SIMILAR CONNECTION FOR AD507A

TEST CIRCUIT 9 CHARGE INJECTION

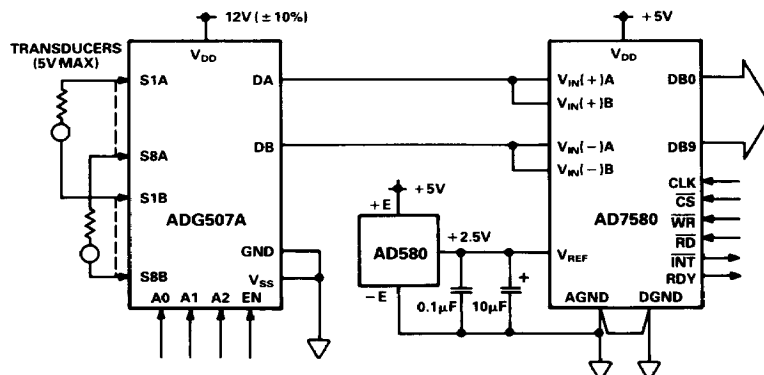


*SIMILAR CONNECTION FOR AD507A

SINGLE SUPPLY AUTOMOTIVE APPLICATION

The excellent performance of the multiplexers under single supply conditions makes the ADG506A/ADG507A suitable in applications, such as automotive and disc drives, where only positive power supply voltages are normally available. The following application circuit shows the ADG507A connected as an 8-channel differential multiplexer in an automotive, data acquisition application circuit.

The AD7580 is a 10-bit successive approximation ADC which has an on-chip sample-and-hold amplifier and provides a conversion result in 20μs. The ADC has a differential analog inputs and is configured in the application circuit for a span of 2.5V over a common-mode range 0 to +5V. Wider common-mode ranges can be accommodated. See the AD7579/AD7580 data sheet for more details. The complete system operates from +12V (±10%) and +5V supplies. The analog input signals to the ADG507A contain information such as temperature, pressure, speed etc.



ADG507A in a Single Supply Automotive Data Acquisition Application.

ADG506A/ADG507A

TERMINOLOGY

R_{ON}	Ohmic resistance between terminals D and S	$t_{OFF} (EN)$	Delay time between the 50% and 10% points of the digital input and switch "OFF" condition
$R_{ON} \text{ Match}$	Difference between the R_{ON} of any two channels	$t_{TRANSITION}$	Delay time between the 50% and 90% points of the digital inputs and switch "ON" condition when switching from one address state to another
$R_{ON} \text{ Drift}$	Change in R_{ON} versus temperature	t_{OPEN}	"OFF" time measured between 50% points of both switches when switching from one address state to another
$I_S (OFF)$	Source terminal leakage current when the switch is off	V_{INL}	Maximum input voltage for Logic "0"
$I_D (OFF)$	Drain terminal leakage current when the switch is off	V_{INH}	Minimum input voltage for Logic "1"
$I_D (ON)$	Leakage current that flows from the closed switch into the body	$I_{ENL} (I_{INH})$	Input current of the digital input
$V_S (V_D)$	Analog voltage on terminal S or D	V_{DD}	Most positive voltage supply
$C_S (OFF)$	Channel input capacitance for "OFF" condition	V_{SS}	Most negative voltage supply
$C_D (OFF)$	Channel output capacitance for "OFF" condition	I_{DD}	Positive supply current
C_{IN}	Digital input capacitance	I_{SS}	Negative supply current
$t_{ON} (EN)$	Delay time between the 50% and 90% points of the digital input and switch "ON" condition		