

19-0028; Rev 2; 2/96



Monolithic CMOS Analog Multiplexers

General Description

Maxim's DG508A and DG509A are monolithic CMOS analog multiplexers (muxes): the DG508A is a single 8-channel (1-of-8) mux, and the DG509 is a differential 4-channel (2-of-8) mux.

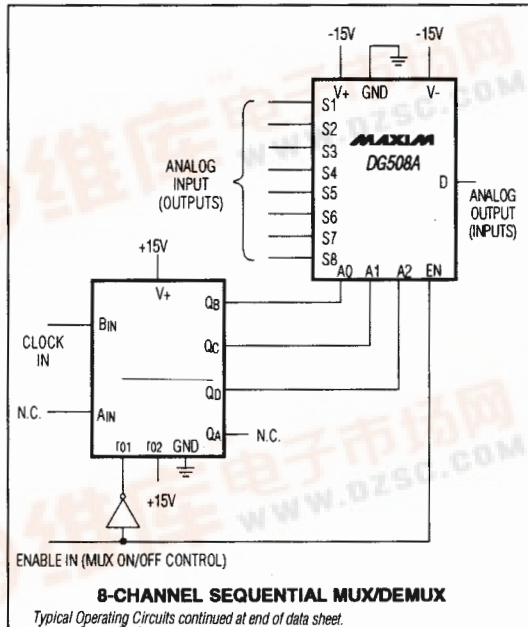
Both devices guarantee break-before-make switching. Maxim guarantees these muxes will not latch up if the power supplies are turned off with the input signals still present. Maxim also guarantees continuous operation when these devices are powered by supplies ranging from $\pm 4.5V$ to $\pm 18V$.

The DG508A/DG509A are plug-in upgrades for the industry-standard DG508A/DG509A, respectively. Maxim's parts have lower on resistance, faster enable switching times, and significantly lower leakage currents. The DG508A/DG509A also consume significantly lower power, making them ideal for portable equipment.

Applications

- Control Systems
- Data Logging Systems
- Aircraft Heads-Up Displays
- Data-Acquisition Systems
- Signal Routing

Typical Operating Circuits



Features

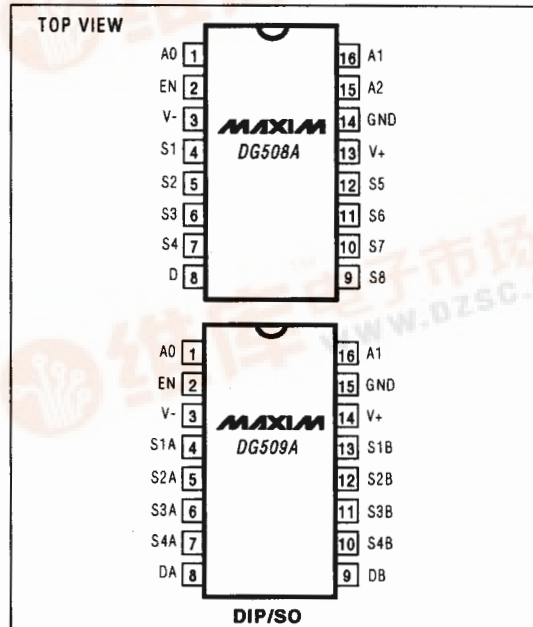
- ◆ Improved Second Source
- ◆ Operate from $\pm 4.5V$ to $\pm 18V$ Supplies
- ◆ Symmetrical, Bidirectional Operation
- ◆ Logic and Enable Inputs, TTL and CMOS Compatible
- ◆ Latchup-Proof Construction
- ◆ Monolithic, Low-Power CMOS Design

Ordering Information

PART	TEMP. RANGE	PIN-PACKAGE
DG508ACJ	0°C to +70°C	16 Plastic DIP
DG508ACWE	0°C to +70°C	16 Wide SO
DG508AC/D	0°C to +70°C	Dice*
DG508ABK	-20°C to +85°C	16 CERDIP
DG508ADJ	-40°C to +85°C	16 Plastic DIP
DG508ADY	-40°C to +85°C	16 Narrow SO
DG508AEWE	-40°C to +85°C	16 Wide SO
DG508AAK	-55°C to +125°C	16 CERDIP

Ordering Information continued at end of data sheet.
*Contact factory for dice specifications.

Pin Configurations



DG508A/DG509A



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ABSOLUTE MAXIMUM RATINGS

Voltage Referenced to V-

V+	+44V
GND	+25V
Digital Inputs, V _S and V _D (Note 1)	-2V to (V+ + 2V) or 20mA, whichever occurs first

Current (any terminal, except S or D)	.....	30mA
Continuous Current, S or D	.....	20mA
Peak Current, S or D (pulsed at 1ms, 10% duty cycle max)	..	40mA
Continuous Power Dissipation (T _A = +70°C)		
Plastic DIP (derate 10.53mW/°C above +70°C)	.....	842mW
Narrow SO (derate 8.70mW/°C above +70°C)	.....	696mW
Wide SO (derate 9.52mW/°C above +70°C)	.....	762mW
CERDIP (derate 10.00mW/°C above +70°C)	.....	800mW

Operating Temperature Ranges:

DG50_ACJ/CWE	.....	0°C to +70°C
DG50_ABK	.....	-20°C to +85°C
DG50_ADJ/DY/EWE	.....	-40°C to +85°C
DG50_AAK	.....	-55°C to +125°C
Storage Temperature Range	.....	-65°C to +150°C
Lead Temperature (soldering, 10sec)	.....	+300°C

Note 1: Signals on S_n, D_n, or IN_n exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.

Stresses beyond those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only, and functional operation of the device at these or any other conditions beyond those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum ratings conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

(V+ = 15V, V- = -15V, GND = 0V, T_A = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	DG508AA DG509AA			DG508AD/E/B/C DG509AD/E/B/C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
SWITCH									
Analogue-Signal Range	V _{ANALOG}		-15	15	-15	15		V	
Drain-Source On Resistance (Note 4)	r _{DS(ON)}	Sequence each switch on, V _{AL} = 0.8V, V _{AH} = 2.4V	V _D = 10V, I _S = -200µA		170	300	170	350	Ω
			V _D = -10V, I _S = -200µA		130	300	130	350	
Greatest Change in Drain-Source On Resistance Between Channels	Δr _{DS(ON)}	$\Delta r_{DS(ON)} = \left(\frac{r_{DS(ON) \max} - r_{DS(ON) \min}}{r_{DS(ON)}} \right)$ -10V ≤ V _S ≤ 10V	6			6			%
Source-Off Leakage Current	I _{S(OFF)}	V _{EN} = 0V	V _S = 10V, V _D = -10V		0.002	0.5	0.002	1	nA
			V _S = -10V, V _D = 10V		-0.5	-0.005	-1	-0.005	
Drain-Off Leakage Current	I _{D(OFF)}	V _{EN} = 0V	V _D = 10V, V _S = -10V		0.01	2	0.01	5	nA
			V _D = -10V, V _S = 10V		-2	-0.015	-5	-0.015	
			V _D = 10V, V _S = -10V		0.005	2	0.005	5	
			V _D = -10V, V _S = 10V		-2	-0.008	-5	-0.008	
Drain-On Leakage Current	I _{D(ON)} (Note 2)	Sequence each switch on, V _{AL} = 0.8V, V _{AH} = 2.4V	V _{S(all)} = V _D = 10V		0.015	2	0.015	5	nA
			V _{S(all)} = V _D = -10V		2	-0.03	-5	-0.03	
			V _{S(all)} = V _D = 10V		0.007	2	0.007	5	
			V _{S(all)} = V _D = -10V		-2	-0.015	-5	-0.015	

Monolithic CMOS Analog Multiplexers

DG508A/DG509A

ELECTRICAL CHARACTERISTICS (continued)

(V+ = 15V, V- = -15V, GND = 0V, TA = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	DG508AA DG509AA			DG508AD/E/B/C DG509AD/E/B/C			UNITS
			MIN	TYP	MAX	MIN	TYP	MAX	
LOGIC INPUT									
Logic Input Current, Input Voltage High	IAH	VA = 2.4V	-10	-0.002		-10	-0.002		μA
		VA = 15V		0.006	10		0.006	10	
Logic Input Current, Input Voltage Low	IAL	All VA = 0V	VEN = 2.4V	-10	-0.002		-10	-0.002	μA
			VEN = 0V	-10	-0.002		-10	-0.002	
DYNAMIC									
Multiplexer Switching Time	ttransition	Figure 1		0.6	1.0		0.6	1.0	μs
Break-Before-Make Interval	topen	Figure 3		0.2			0.2		μs
Enable Turn-On Time	ton(EN)	Figure 2		0.4	1.0		0.4	1.5	μs
Enable Turn-Off Time	toff(EN)	Figure 2		0.2	0.7		0.2	1.0	μs
Off Isolation (Note 3)	OIRR	VEN = 0V, RL = 1kΩ, CL = 15pF, VS = 7VRMS, f = 500kHz		68			68		dB
Source-Off Capacitance	CS(off)	VS = 0V, VEN = 0V, f = 140kHz		5			5		pF
Drain-Off Capacitance	DG508A	VS = 0V, VEN = 0V, f = 140kHz		25			25		pF
	DG509A			12			12		
SUPPLY									
Positive Supply Current	I+	VEN = 2.4V, all VA = 0V or 2.4V		0.02	0.2		0.02	0.2	mA
Negative Supply Current	I-	VEN = 2.4V, all VA = 0V or 2.4V	-0.1	-0.01		-0.1	-0.01		mA
Positive Supply Current in Standby	I+	VEN = 0V, all VA = 0V or 2.4V		0.02	0.2		0.02	0.2	mA
Negative Supply Current in Standby	I-	VEN = 0V, all VA = 0V or 2.4V	-0.1	-0.01		-0.1	-0.01		mA
Power-Supply Range for Continuous Operation (Notes 4, 5)	V-, V+		±4.5		±18.0	±4.5		±18.0	V

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ELECTRICAL CHARACTERISTICS (continued)

(V+ = 15V, GND = 0V, TA = TMIN to TMAX, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS	DG508AA DG509AA			DG508AD/E/B/C DG509AD/E/B/C			UNITS	
			MIN	TYP	MAX	MIN	TYP	MAX		
SWITCH										
Analog-Signal Range	VANALOG		-15	15		-15	15		V	
Drain-Source On Resistance	rDS(ON)	Sequence each switch on, VAL = 0.8V, VAH = 2.4V	V _D = 10V, I _S = -200μA		400		450		Ω	
			V _D = -10V, I _S = -200μA		400		450			
Source-Off Leakage Current	I _{S(OFF)}	V _{EN} = 0V	V _S = 10V, V _D = -10V			50		50	nA	
			V _S = -10V, V _D = 10V	-50		-50				
Drain-Off Leakage Current	DG508A DG509A	I _{D(OFF)}	V _{EN} = 0V	V _D = 10V, V _S = -10V		200		100	nA	
				V _D = -10V, V _S = 10V	-200		-100			
				V _D = 10V, V _S = -10V		100		100		
				V _D = -10V, V _S = 10V	-100		-100			
Drain-On Leakage Current	DG508A DG509A	I _{D(ON)} (Note 2)	Sequence each switch on, VAL = 0.8V, VAH = 2.4V	V _{S(all)} = V _D = 10V		200		100	nA	
				V _{S(all)} = V _D = -10V	-200		-100			
				V _{S(all)} = V _D = 10V		100		100		
				V _{S(all)} = V _D = -10V	-100		-100			
LOGIC INPUT										
Logic Input Current, Input Voltage High	I _{AH}	V _A = 2.4V		-30		-30		μA		
		V _A = 15V			30		30			
Logic Input Current, Input Voltage Low	I _{AL}	All V _A = 0V	V _{EN} = 2.4V	-30		-30		μA		
			V _{EN} = 0V	-30		-30				

Note 2: I_{D(ON)} is leakage from driver into "on" switch.

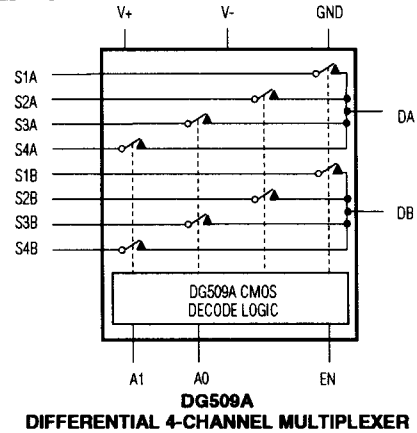
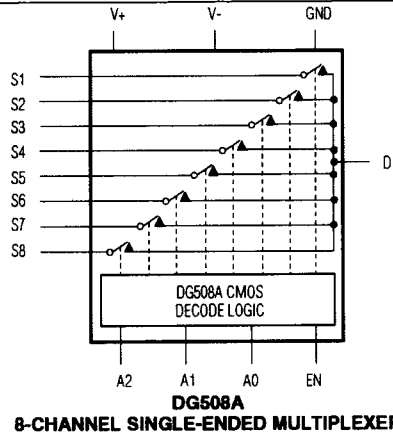
Note 3: Off isolation = $20 \log \frac{|V_S|}{|V_D|}$,

V_S = input to "off" switch,
V_D = output due to V_S.

Note 4: Electrical characteristics (such as on resistance) will change when power supplies other than ±15V are used.

Note 5: For designs requiring single 5V or dual ±5V operation, refer to Maxim's improved MAX338 and MAX339. Minimum operating voltage for DG508ADY and DG509ADY is ±9V.

Functional Diagrams



Monolithic CMOS Analog Multiplexers

Test Circuits/Timing Diagrams

DG508A/DG509A

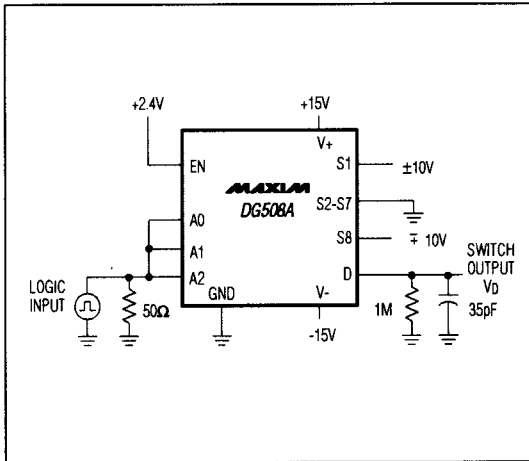


Figure 1a. Switching-Time Test Circuit

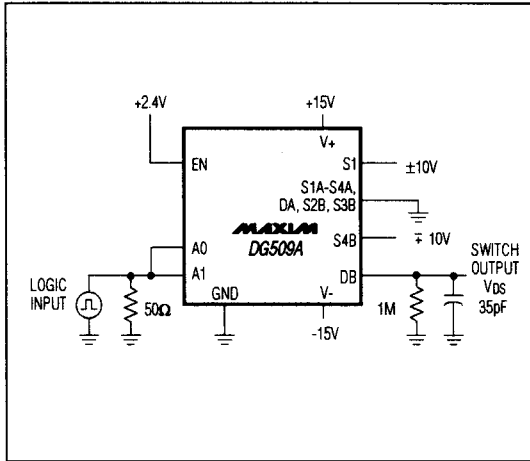


Figure 1b. Switching-Time Test Circuit

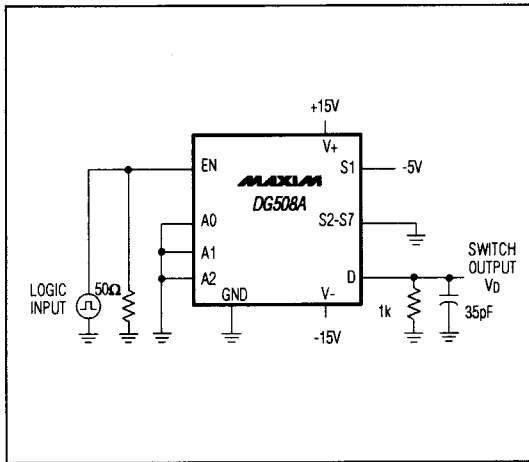


Figure 2a. DG509A Enable-Time Test Circuit

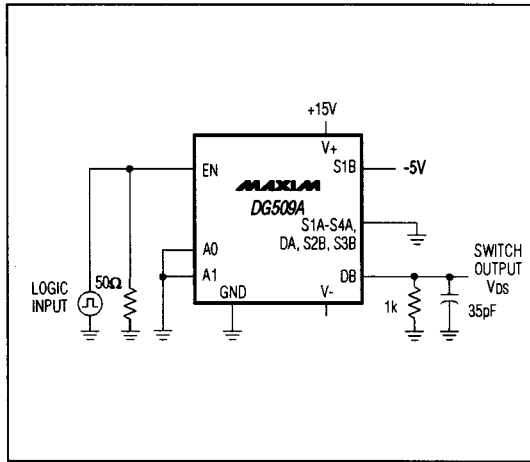


Figure 2b. DG509A Enable-Time Test Circuit

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Test Circuits/Timing Diagrams (continued)

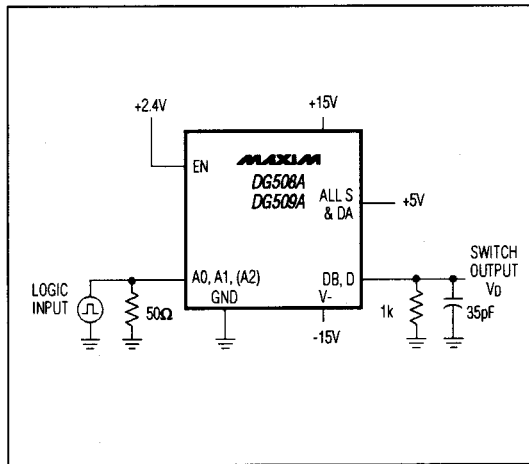


Figure 3. Break-Before-Make Test Circuit

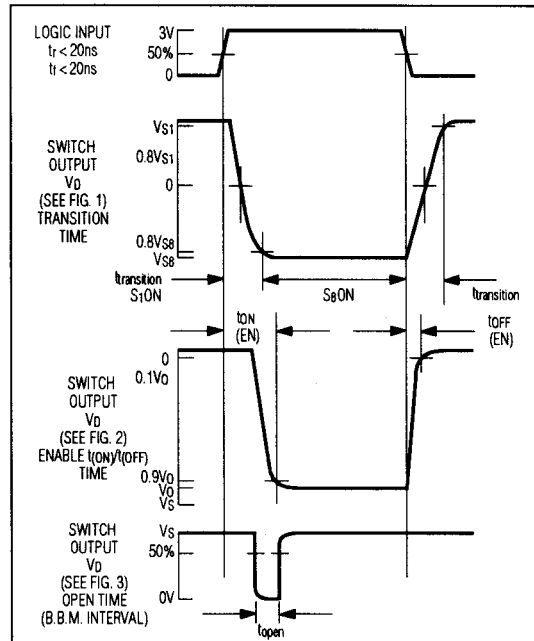


Figure 4. Timing Diagram for Figures 1, 2, and 3

Table 1a. DG508A Truth Table

A2	A1	A0	EN	ON SWITCH
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

X = Don't Care

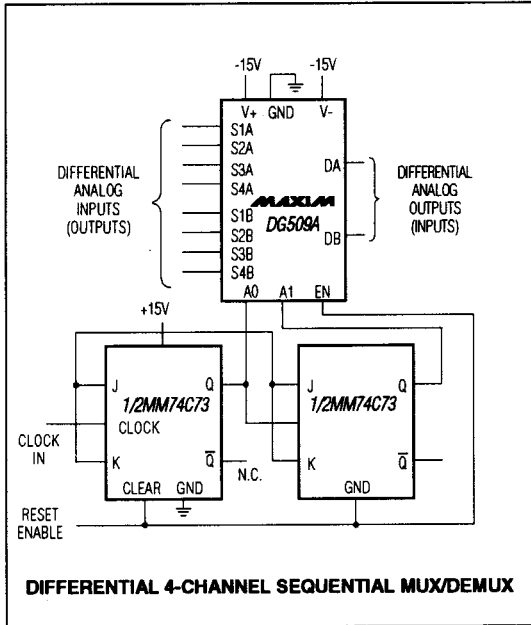
Table 1b. DG509A Truth Table

A1	A0	EN	ON SWITCH
X	X	0	NONE
0	0	1	1
0	1	1	2
1	0	1	3
1	1	1	4

X = Don't Care

Monolithic CMOS Analog Multiplexers

Typical Operating Circuits (continued)



Ordering Information (continued)

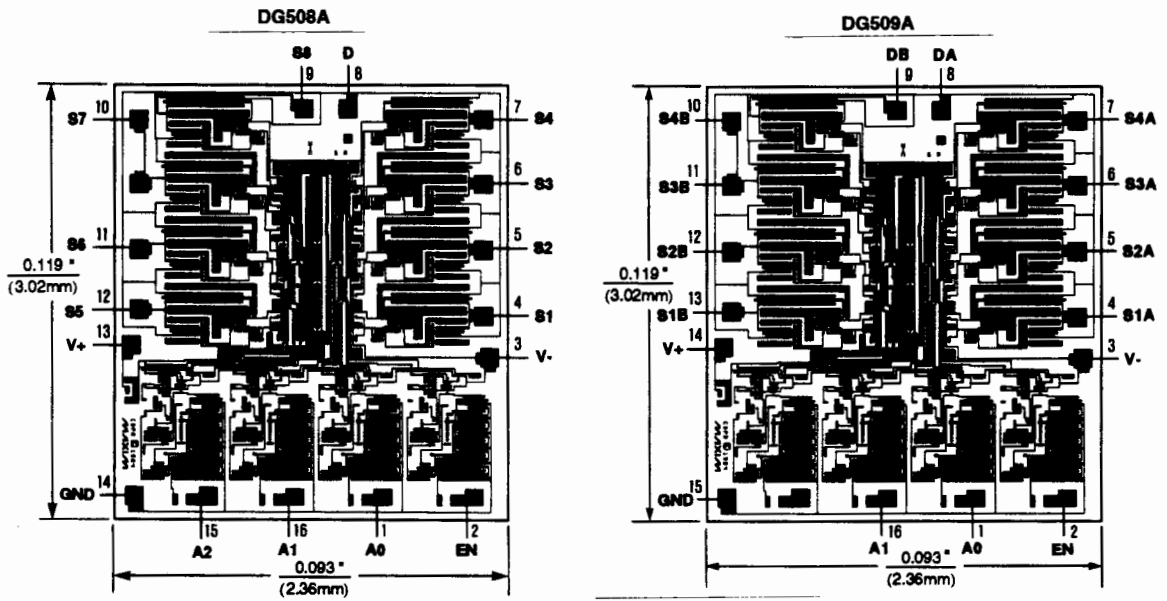
PART	TEMP. RANGE	PIN-PACKAGE
DG509ACJ	0°C to +70°C	16 Plastic DIP
DG509ACWE	0°C to +70°C	16 Wide SO
DG509AC/D	0°C to +70°C	Dice*
DG509ABK	-20°C to +85°C	16 CERDIP
DG509ADJ	-40°C to +85°C	16 Plastic DIP
DG509ADY	-40°C to +85°C	16 Narrow SO
DG509AEWE	-40°C to +85°C	16 Wide SO
DG509AAK	-55°C to +125°C	16 CERDIP

*Contact factory for dice specifications.

DG508A/DG509A

Monolithic CMOS Analog Multiplexers

Chip Topographies



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