



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.

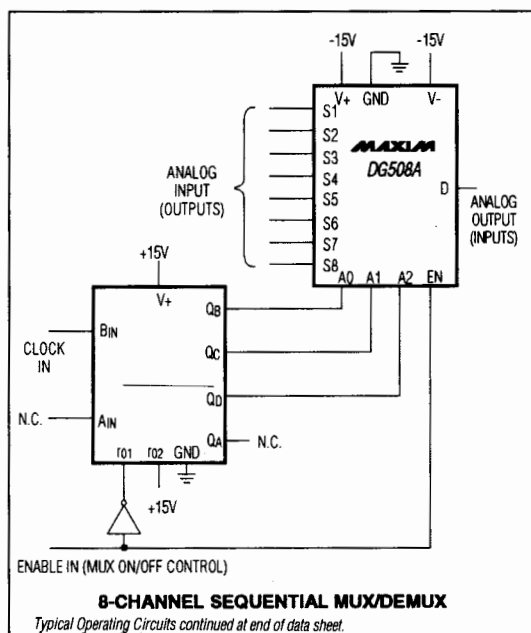
Both devices guarantee break-before-make switching. Maxim guarantees these muxes will not latch up if the power supplies are turned off with the input signals still present. Maxim also guarantees continuous operation when these devices are powered by supplies ranging from $\pm 4.5\text{V}$ to $\pm 18\text{V}$.

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 $\pm 4.5\text{V}$ to $\pm 18\text{V}$ Supplies
- ◆ Symmetrical, Bidirectional Operation
- ◆ Logic and Enable Inputs, TTL and CMOS Compatible
- ◆ Latchup-Proof Construction
- ◆ Monolithic, Low-Power CMOS Design

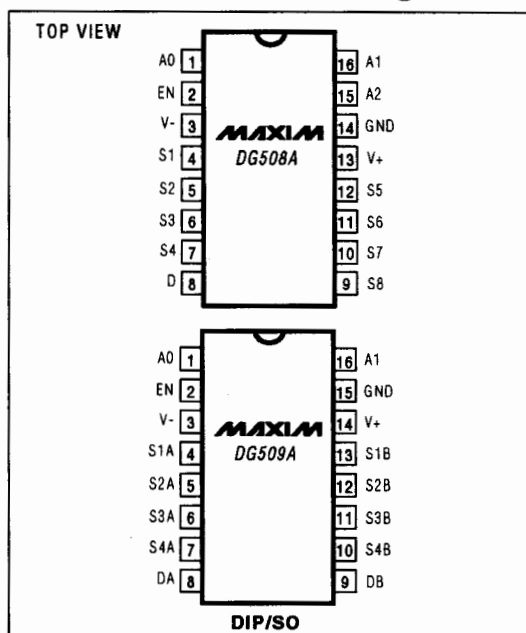
Ordering Information

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

MAXIM

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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 I_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													
Analog-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)}	Δr _{DS(ON)} = $\left(\frac{r_{DS(ON) \text{ max}} - r_{DS(ON) \text{ min}}}{r_{DS(ON)}}\right)$, -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	DG508A	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	DG508A	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			

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DG508A/DG509A

ELECTRICAL CHARACTERISTICS (continued)

(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	
LOGIC INPUT										
Logic Input Current, Input Voltage High	I _{AH}	V _A = 2.4V		-10	-0.002		-10	-0.002		μA
		V _A = 15V			0.006	10		0.006	10	
Logic Input Current, Input Voltage Low	I _{AL}	All V _A = 0V	V _{EN} = 2.4V	-10	-0.002		-10	-0.002		μA
			V _{EN} 0V	-10	-0.002		-10	-0.002		
DYNAMIC										
Multiplexer Switching Time	t _{transition}	Figure 1			0.6	1.0		0.6	1.0	μs
Break-Before-Make Interval	t _{open}	Figure 3			0.2			0.2		μs
Enable Turn-On Time	t _{on} (EN)	Figure 2			0.4	1.0		0.4	1.5	μs
Enable Turn-Off Time	t _{off} (EN)	Figure 2			0.2	0.7		0.2	1.0	μs
Off Isolation (Note 3)	OIRR	V _{EN} = 0V, R _L = 1kΩ, C _L = 15pF, V _S = 7V _{RMS} , f = 500kHz			68			68		dB
Source-Off Capacitance	C _{S(off)}	V _S = 0V, V _{EN} = 0V, f = 140kHz			5			5		pF
Drain-Off Capacitance	DG508A	C _{D(off)}	V _S = 0V, V _{EN} = 0V, f = 140kHz			25		25		pF
	DG509A					12		12		
SUPPLY										
Positive Supply Current	I ₊	V _{EN} = 2.4V, all V _A = 0V or 2.4V			0.02	0.2		0.02	0.2	mA
Negative Supply Current	I ₋	V _{EN} = 2.4V, all V _A = 0V or 2.4V			-0.1	-0.01		-0.1	-0.01	mA
Positive Supply Current in Standby	I ₊	V _{EN} = 0V, all V _A = 0V or 2.4V			0.02	0.2		0.02	0.2	mA
Negative Supply Current in Standby	I ₋	V _{EN} = 0V, all V _A = 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	VD = 10V, IS = -200μA				400				450		Ω
				VD = -10V, IS = -200μA				400				450		
Source-Off Leakage Current		IS(OFF)	VEN = 0V	VS = 10V, VD = -10V				50				50		nA
				VS = -10V, VD = 10V		-50				-50				
Drain-Off Leakage Current	DG508A	ID(OFF)	VEN = 0V	VD = 10V, VS = -10V				200				100		nA
	VD = -10V, VS = 10V			-200				-100						
	VD = 10V, VS = -10V					100				100				
	VD = -10V, VS = 10V			-100				-100						
Drain-On Leakage Current	DG508A	ID(ON) (Note 2)	Sequence each switch on, VAL = 0.8V, VAH = 2.4V	VS(all) = VD = 10V				200				100		nA
	VS(all) = VD = -10V			-200				-100						
	VS(all) = VD = 10V					100				100				
	VS(all) = VD = -10V			-100				-100						
LOGIC INPUT														
Logic Input Current, Input Voltage High		IAH	VA = 2.4V		-30				-30				μA	
			VA = 15V				30				30			
Logic Input Current, Input Voltage Low		IAL	All VA = 0V		VEN = 2.4V		-30		-30				μA	
					VEN 0V		-30		-30					

Note 2: ID(ON) is leakage from driver into "on" switch.

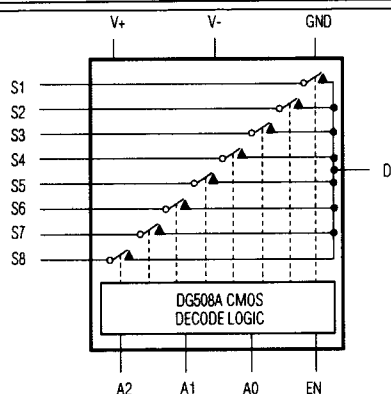
Note 3: Off isolation = $20 \log \frac{|V_S|}{|V_{DI}|}$

VS = input to "off" switch,
VD = output due to VS.

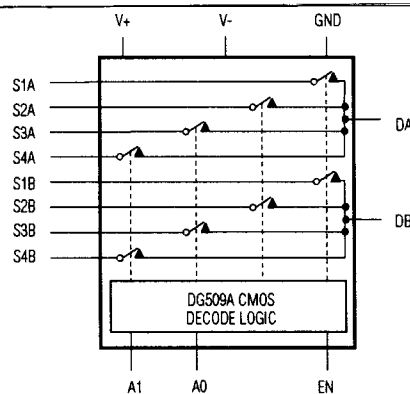
Note 4: Electrical characteristics (such as on resistance) will change when power supplies other than ±15V are used.

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



DG508A
8-CHANNEL SINGLE-ENDED MULTIPLEXER



DG509A
DIFFERENTIAL 4-CHANNEL MULTIPLEXER

Monolithic CMOS Analog Multiplexers

Test Circuits/Timing Diagrams

DG508A/DG509A

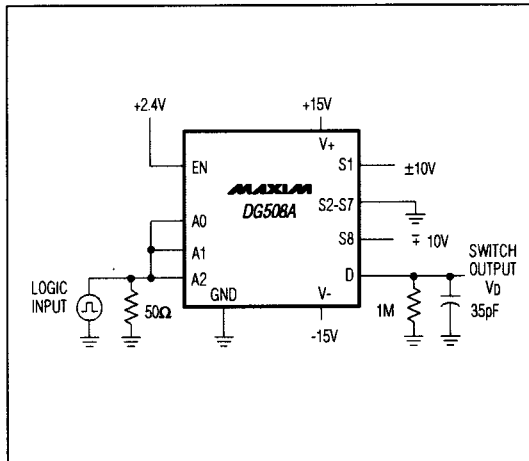


Figure 1a. Switching-Time Test Circuit

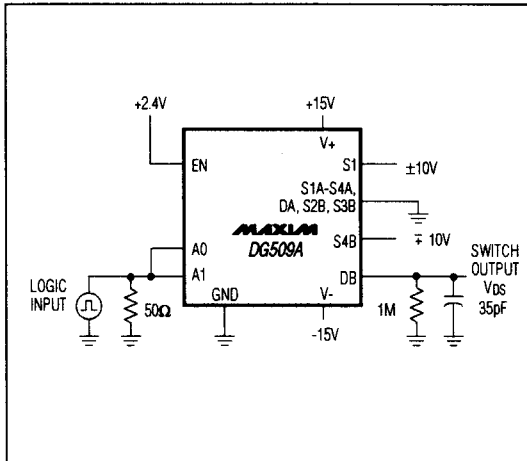


Figure 1b. Switching-Time Test Circuit

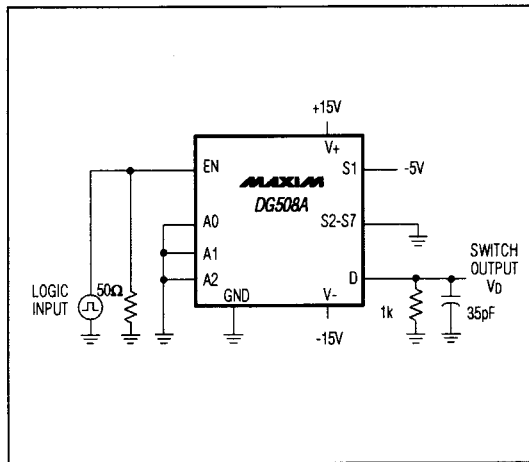


Figure 2a. DG509A Enable-Time Test Circuit

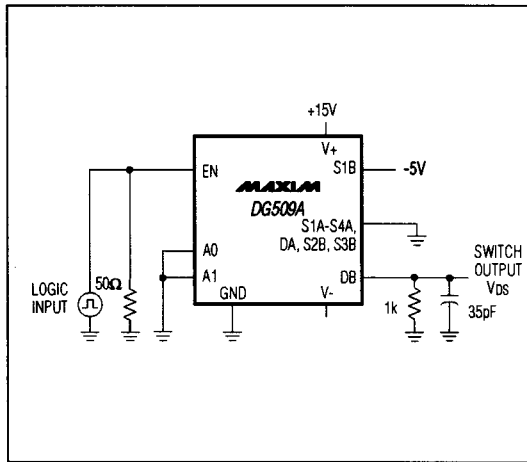


Figure 2b. DG509A Enable-Time Test Circuit

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Test Circuits/Timing Diagrams (continued)

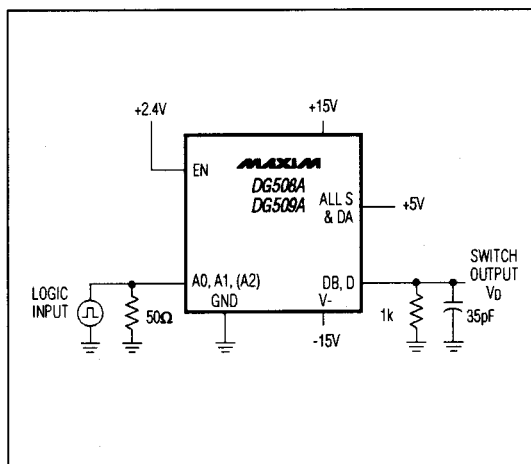


Figure 3. Break-Before-Make Test Circuit

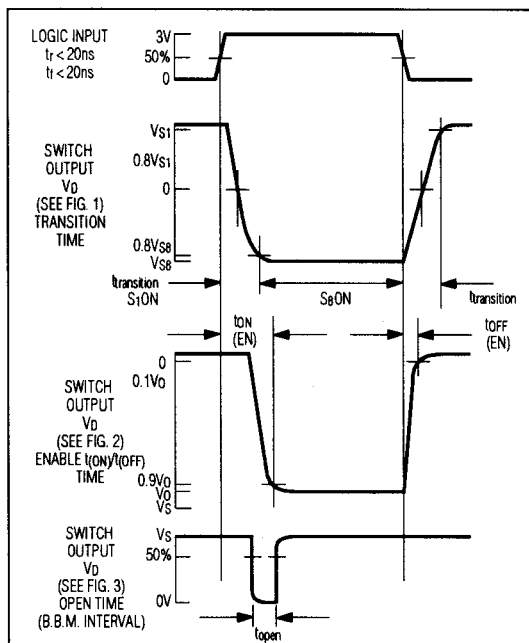


Figure 4. Timing Diagram for Figures 1, 2, and 3

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

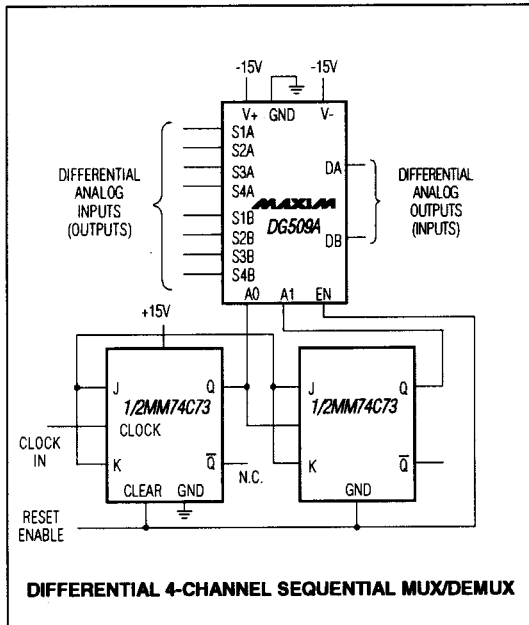
Table 1b. DG509A Truth Table

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

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Typical Operating Circuits (continued)



Ordering Information (continued)

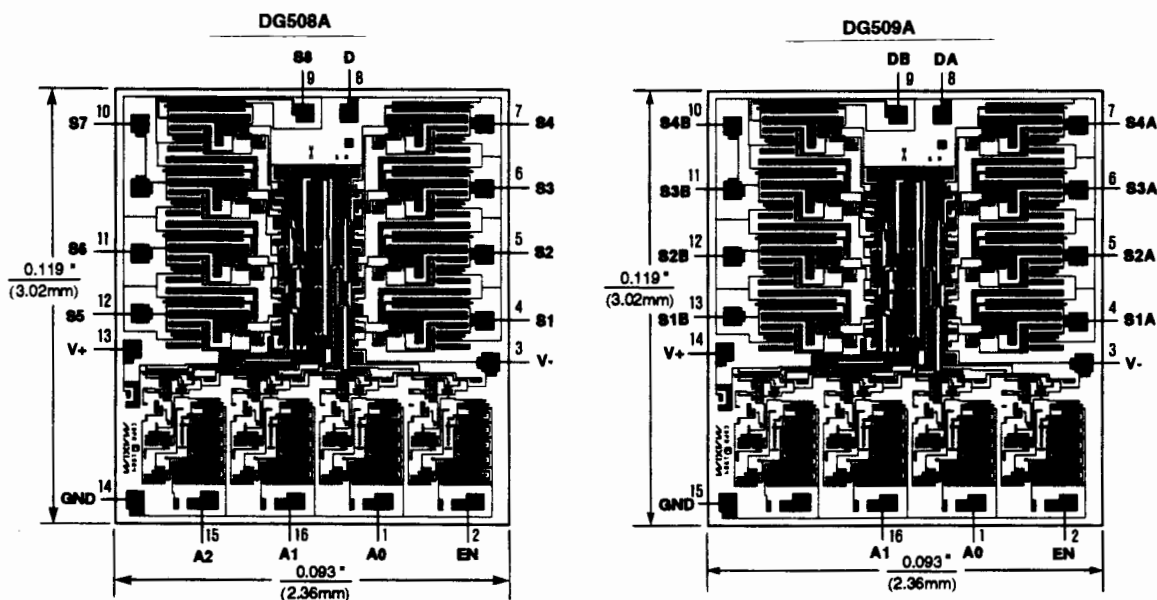
PART	TEMP. RANGE	PIN-PACKAGE
DG509ACJ	0°C to +70°C	16 Plastic DIP
DG509ACWE	0°C to +70°C	16 Wide SO
DG509AC/D	0°C to +70°C	Dice*
DG509ABK	-20°C to +85°C	16 Cerdip
DG509ADJ	-40°C to +85°C	16 Plastic DIP
DG509ADY	-40°C to +85°C	16 Narrow SO
DG509AEWE	-40°C to +85°C	16 Wide SO
DG509AAK	-55°C to +125°C	16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

*Contact factory for dice specifications.

DG508A/DG509A

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Chip Topographies



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