

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 DG509A is a differential 4-channel (2-of-8) mux.

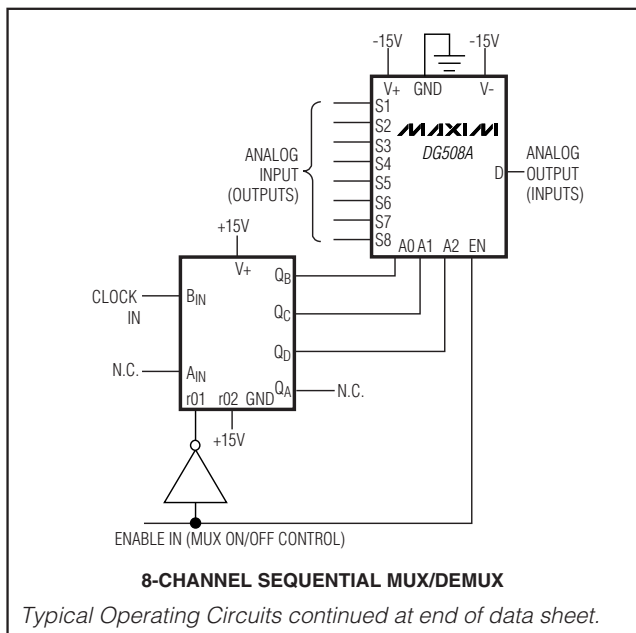
Both devices guarantee break-before-make switching. Maxim guarantees these muxes will not latch up if the power supplies are turned off with the input signals still present. Maxim also guarantees continuous operation when these devices are powered by supplies ranging from $\pm 4.5\text{V}$ to $\pm 18\text{V}$.

The DG508A/DG509A are plug-in upgrades for the industry-standard DG508A/DG509A, respectively. Maxim's parts have 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
DG508AMY/PR	-55°C to +125°C	16 Narrow SO
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
DG509AMY/PR	-55°C to +125°C	16 Narrow SO

Devices are available in a lead(Pb)-free/RoHS-compliant package (except CERDIP). Specify lead-free by adding a plus (+) to the part number when ordering.

*Contact factory for dice specifications.

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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 D20mA

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/CWE0°C to +70°C

DG50_ABK-20°C to +85°C

DG50_ADJ/DY/EWE.....-40°C to +85°C

DG50_AAK/MY-55°C to +125°C

Storage Temperature Range-65°C to +150°C

Lead Temperature (soldering, 10s)+300°C

Soldering Temperature (reflow)

PDIP, Wide SO, Narrow SO, CERDIP containing lead(Pb) ..+240°C

PDIP, Wide SO, Narrow SO lead(Pb)-free+260°C

Note 1: Signals on S₋ or D₋ exceeding V+ or V- are 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 rating conditions for extended periods may affect device reliability.

ELECTRICAL CHARACTERISTICS

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

PARAMETER		SYMBOL	CONDITIONS		DG508AA/M DG509AA/M			DG508AD/E/B/C DG509AD/E/B/C			UNITS
					MIN	TYP	MAX	MIN	TYP	MAX	
SWITCH											
Analog Signal		V _{ANALOG}			-15	+15		-15	+15		V
Drain-Source On-Resistance		R _{DS(ON)}	Sequence each switch on, V _{A_L} = 0.8V, V _{A_H} = 2.4V (Note 4)	V _D = 10V, I _S = -200μA	170	400		170	450		Ω
				V _D = -10V, I _S = 200μA	130	400		130	450		
Greatest Change in Drain-Source On-Resistance Between Channels		ΔR _{DS(ON)}	$\Delta R_{DS(ON)} = \left(\frac{R_{DS(ON) \text{ max}} - R_{DS(ON) \text{ min}}}{R_{DS(ON)}} \right)$ -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)}	Sequence each switch on, V _{A_L} = 0.8V V _{A_H} = 2.4V (Note 2)	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, VGND = 0V, TA = +25°C, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		DG508AA/M DG509AA/M			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	-		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	-		10	-0.002		μA
			V _{EN} = 0V	-10	-		-10	-0.002		
DYNAMIC										
Multiplexer Switching	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	OIRR	V _{EN} = 0V, R _L = 1kΩ, C _L = 15pF, V _S = 7V _{RMS} f = 500kHz (Note 3)			68			68		dB
Source Off-Capacitance	C _{S(OFF)}	V _S = 0V, V _{EN} = 0V, f = 140kHz			5			5		pF
Drain Off- Capacitanc	IDG508A	C _{D(OFF)}	V _S = 0V, V _{EN} = 0V, f = 140kHz		25			25		pF
	DGS09A				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	V ₋ , V ₊	(Notes 4, 5)		±4.5		±18.0	±4.5		±18.0	V

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ELECTRICAL CHARACTERISTICS

(V₊ = 15V, V_{GND} = 0V, T_A = T_{MIN} to T_{MAX}, unless otherwise noted.)

PARAMETER		SYMBOL	CONDITIONS		DG508AA/M DG509AA/M			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		R _{DS(ON)}	Sequence each switch on, V _{A_L} = 0.8V, V _{A_H} = 2.4V	V _D = 10V, I _S = -200μA		500		550	Ω		
				V _D = -10V, I _S = 200μA		500		550			
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	I _{D(OFF)}	V _{EN} = 0V	V _D = 10V, V _S = -10V		+200		+100	nA		
	V _D = -10V, V _S = -10V			-200		-200					
	V _D = 10V, V _S = -10V				+200		+100				
	V _D = -10V, V _S = -10V			-100		-100					
Drain On-Leakage Current	DG508A	I _{D(ON)}	Sequence each switch on, V _{A_L} = 0.8V, V _{A_H} = 2.4V (Note 2)	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) 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/MY and DG509ADY/MY is ±9V.

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Pin Configurations



Pin Descriptions

PIN		NAME	FUNCTION
DG508A	DG509A		
DIP/SO	DIP/SO		
1, 15, 16	—	A0, A2, A1	Address Input
—	1, 16	A0, A1	Address Input
2	2	EN	Enable
3	3	V-	Negative-Supply Voltage Input
4–7	—	S1–S4	Analog Inputs, Bidirectional
—	4–7	S1A–S4A	Analog Inputs, Bidirectional
8	—	D	Analog Outputs, Bidirectional
—	8, 9	DA, DB	Analog Outputs, Bidirectional
9–12	—	S8–S5	Analog Inputs, Bidirectional
—	10–13	S4B–S1B	Analog Inputs, Bidirectional
13	14	V+	Positive-Supply Voltage Input
14	15	GND	Ground

Functional Diagrams



DG508A/DG509A

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Figure 1a. Switching-Time Test Circuit



Figure 1b. Switching-Time Test Circuit



Figure 2a. DG508A Enable-Time Test Circuit



Figure 2b. DG509A Enable-Time Test Circuit

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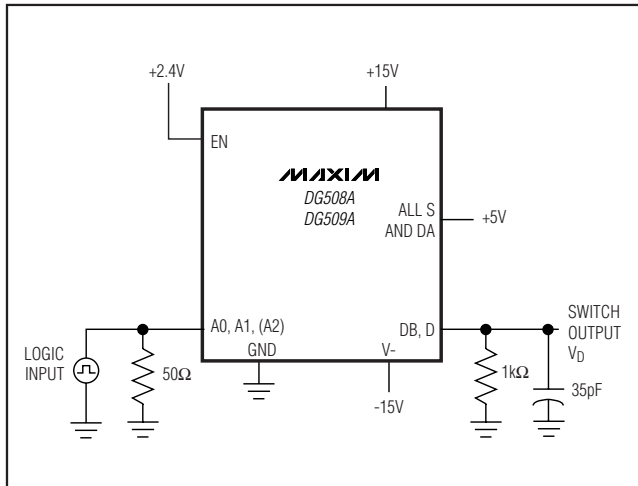


Figure 3. Break-Before-Make Test Circuit

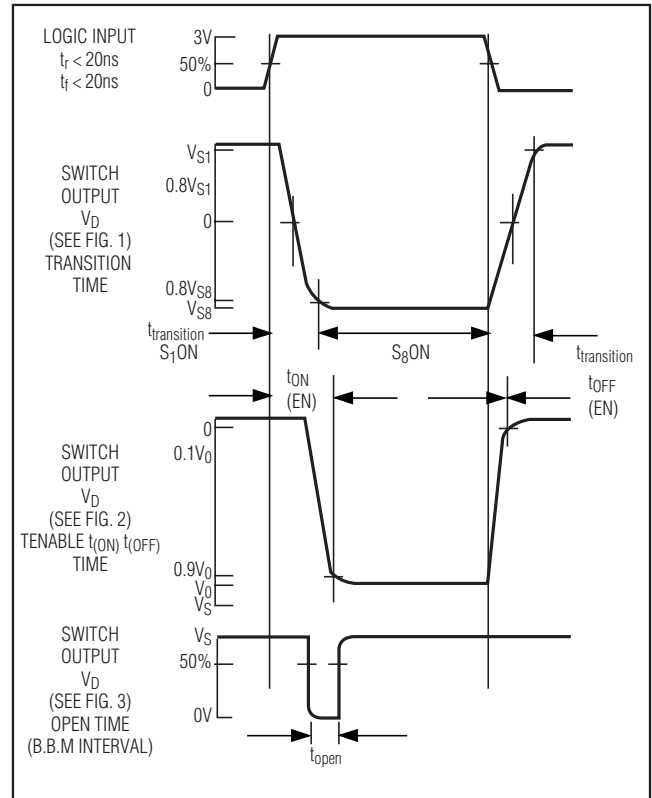


Figure 4. Timing Diagram for Figures 1, 2, and 3

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)



Package Information

For the latest package outline information and land patterns, go to www.maxim-ic.com/packages. Note that a "+", "#", or "-" in the package code indicates RoHS status only. Package drawings may show a different suffix character, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	DOCUMENT NO.
16 Plastic DIP	P16-1	21-0043
16 Wide SO	W16-2	21-0042
16 Narrow SO	S16-5	21-0041
16 Cerdip	J16-3	21-0045

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Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
4	5/10	Updated the "Drain-Source On-Resistance" parameter for both the $T_A = +25^{\circ}\text{C}$ and $T_A = T_{\text{MIN}}$ to T_{MAX} conditions.	2, 4
		Deleted the QFN package from the <i>Ordering Information</i> , <i>Absolute Maximum Ratings</i> , <i>Pin Configurations</i> , <i>Pin Descriptions</i> , and <i>Package Information</i> sections.	1, 2, 5, 8
		Added the DG508AMY/PR and DG509AMY/PR parts to the <i>Ordering Information</i> table.	1

DG508A/DG509A

Maxim cannot assume responsibility for use of any circuitry other than circuitry entirely embodied in a Maxim product. No circuit patent licenses are implied. Maxim reserves the right to change the circuitry and specifications without notice at any time.

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