19-0482; Rev 4; 6/12

MAXIM

Monolithic CMOS Analog Multiplexers

General Description

Maxim's DG506A/DG507A are monolithic CMOS analog multiplexers. The DG506A is a single 16-channel (1 of 16) multiplexer and the DG507A is a differential 8-channel (2 of 16) multiplexer.

Both devices feature break-before-make switching. Maxim guarantees that these multiplexers will not latch-up if the power supplies are turned off with the input signals still present as long as absolute maximum ratings are not violated. The multiplexers operate over a wide range of power supplies from ±4.5V to ±18V.

Compared to the original manufacturer's devices, Maxim's DG506A/DG507A consume significantly less power, making them ideal for portable equipment.

Maxim's DG506A/DG507A meet or exceed the specifications of, and are drop-in replacements for Intersil's IH6116 and IH6216, Siliconix's DG506A and DG507A, and Harris' HI506 and HI507.

Applications

Control Systems

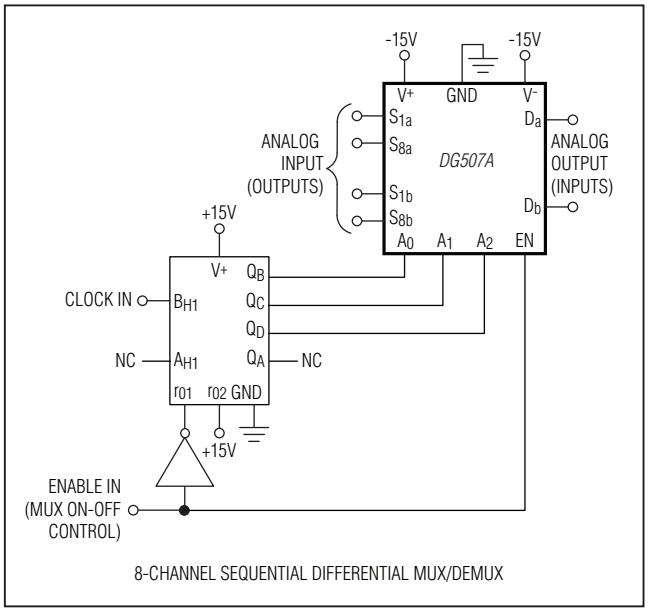
Data Logging Systems

Aircraft Heads Up Displays

Data Acquisition Systems

Signal Routing

Typical Operating Circuit



8-CHANNEL SEQUENTIAL DIFFERENTIAL MUX/DEMUX

Features

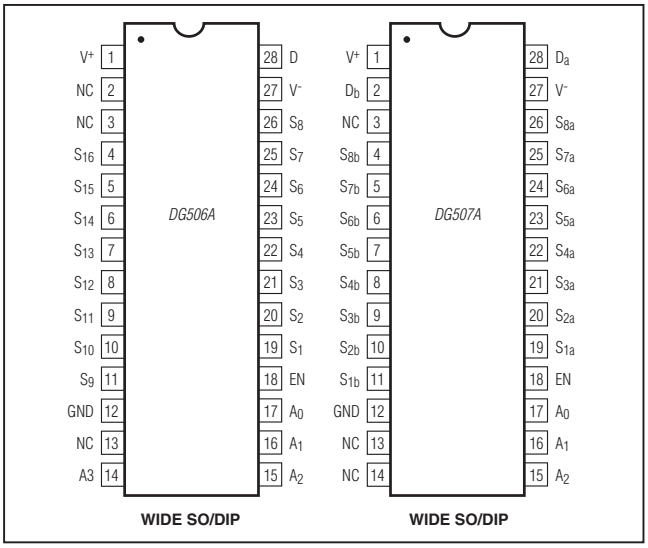
- ♦ **Improved 2nd Source**
- ♦ **Pin Compatible with Harris, Siliconix, Intersil**
- ♦ **Operable with ±4.5V to ±18V Supplies**
- ♦ **Symmetrical, Bidirectional Operation**
- ♦ **Logic and Enable Inputs, TTL and CMOS Compatible**
- ♦ **Latch-Up Proof Construction**
- ♦ **Monolithic, Low-Power CMOS Design**

Ordering Information

PART†	TEMP RANGE	PIN-PACKAGE
DG506AAK	-55°C to +125°C	28 CERDIP
DG506ABK	-25°C to +85°C	28 CERDIP
DG506AC/D	0°C to +70°C	Dice
DG506ACJ	0°C to +70°C	28 Plastic Dip
DG506ACK	0°C to +70°C	28 CERDIP
DG506ACWI	0°C to +70°C	28 Wide SO
DG506AMWI/PR	-55°C to +125°C	28 Wide SO
DG506AAZ/833B	-55°C to +125°C	28 LCC
DG507AAK	-55°C to +125°C	28 CERDIP
DG507ABK	-25°C to +85°C	28 CERDIP
DG507AC/D	0°C to +70°C	Dice
DG507ACJ	0°C to +70°C	28 Plastic DIP
DG507ACK	0°C to +70°C	28 CERDIP
DG507ACWI	0°C to +70°C	28 Wide SO

†Devices are available in a lead(Pb)-free/RoHS-compliant package, specify lead-free by adding "+" to the part number when ordering.

Pin Configurations



Pin Configurations continued in middle of data sheet.

Monolithic CMOS Analog Multiplexers

ABSOLUTE MAXIMUM RATINGS

(Voltages referenced to V-.)

V+ 44V
GND 25V
Digital Inputs V_S, 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)*
28-Pin Ceramic DIP (derate 16.7mW/°C above +70°C) . 1333mW
28-Pin Plastic DIP (derate 14.3mW/°C above +70°C) .. 1143mW
28-Pin Wide SO (derate 12.5mW/°C above +70°C) . 1000mW
28-Pin LCC (derate 10.2mW/°C above +70°C) 816.3mW
Operating Temperature Range (A Suffix) ..... -55°C to +125°C
(B Suffix) ..... -25°C to +85°C
(C Suffix) ..... 0°C to +70°
Storage Temperature (A and B Suffix) ..... -65°C to +150°C
(C Suffix) ..... -65°C to +125°C
Lead Temperature (soldering, 10s) ..... +300°C
Soldering Temperature (reflow)
Lead (Pb)-free packages ..... +260°C
Packages containing lead (Pb) ..... +240°C

**All leads soldered or welded to PCB.*

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 indicated.)

PARAMETER	SYMBOL	CONDITIONS		DG506AA DG507AA			DG506AB/C DG507AB/C			UNITS
				MIN (Note 2)	TYP (Note 3)	MAX	MIN (Note 2)	TYP (Note 3)	MAX	
SWITCH										
Analog Signal Range	V_{ANALOG}			-15		+15	-15		+15	V
Drain-to-Source On-Resistance	$R_{DS(ON)}$	Sequence each switch on, V_{AL} = 0.8V, V_{AH} = 2.4V, V_{EN} = 2.4V	V_D = 10V, I_S = -200µA		270	400		270	450	Ω
			V_D = -10V, I_S = -200µA		230	400		230	450	
Greatest Change in Drain-Source On-Resistance Between Channels	$R_{DS(ON)}$	$\Delta R_{DS(ON)} = \left(\frac{R_{DS(ON)MAX} - R_{DS(ON)MIN}}{R_{DS(ON)AVE}}\right)$ -10V ≤ V_S ≤ +10V			6			6		%
Source Off-Leakage Current	$I_{S(OFF)}$	V_{EN} = 0.8V, V_{AL} = 0.8V	V_S = 10V, V_D = -10V	-1	0.002	+1	-5	0.002	+5	nA
			V_S = -10V, V_D = 10V	-1	-0.005	+1	-5	-0.005	+5	
Drain Off-Leakage Current	$I_{D(OFF)}$	DG506A, V_{EN} = 0.8V, V_{AL} = 0.8V	V_D = 10V, V_S = -10V	-10	0.02	+10	-20	0.02	+20	nA
			V_D = -10V, V_S = 10V	-10	-0.03	+10	-20	-0.03	+20	
		DG507A, V_{EN} = 0.8V, V_{AL} = 0.8V	V_D = 10V, V_S = -10V	-5	0.007	+5	-10	0.007	+10	
			V_D = -10V, V_S = 10V	-5	-0.015	+5	-10	-0.015	+10	

ELECTRICAL CHARACTERISTICS (continued)

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

PARAMETER	SYMBOL	CONDITIONS		DG506AA DG507AA			DG506AB/C DG507AB/C			UNITS
				MIN (Note 2)	TYP (Note 3)	MAX	MIN (Note 2)	TYP (Note 3)	MAX	
Channel On-Leakage Current	$I_{D(ON)}$ (Note 4)	DG506A, sequence each switch on, $V_{AL} = 0.8V$, $V_{AH} = 2.4V$, $V_{EN} = 2.4V$	$V_{S(all)} = V_D = 10V$	-10	0.03	+10	-20	0.03	+20	nA
			$V_{S(all)} = V_D = -10V$	-10	-0.06	+10	-20	-0.06	+20	
		DG507A, sequence each switch on, $V_{AL} = 0.8V$, $V_{AH} = 2.4V$, $V_{EN} = 2.4V$	$V_{S(all)} = V_D = 10V$	-5	0.015	+5	-10	0.015	+10	
			$V_{S(all)} = V_D = -10V$	-5	-0.03	+5	-10	-0.03	+10	
INPUT										
Address 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	
Address 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										
Switching Time of Multiplexer	$t_{transition}$	Figure 1			0.6	1		0.06		µs
Break-Before-Make Interval	t_{OPEN}	Figure 3			0.2			0.2		µs
Enable Turn-On Time	$t_{ON(EN)}$	Figure 2			1			1		µs
Enable Turn-Off Time	$t_{OFF(EN)}$	Figure 2			0.4			0.4		µs
Off-Isolation (Note 5)	OIRR	$V_{EN} = 0V$, $R_L = 1k\Omega$, $C_L = 15pF$, $V_S = 7V_{RMS}$, f = 500kHz			68			68		dB
Source Off-Capacitance	$C_{S(OFF)}$	$V_{EN} = 0V$, f = 140kHz, $V_S = 0V$			6			6		pF
Drain Off-Capacitance	$C_{D(OFF)}$	$V_{EN} = 0V$, f = 140kHz	DG506A, $V_D = 0V$		45			45		pF
			DG507A, $V_D = 0V$		23			23		
SUPPLY										
Positive Supply Current	I^+	$V_{EN} = 0$ or 5V, all $V_A = 0V$			0.13	0.25		0.13	0.3	mA
Negative Supply Current	I^-	$V_{EN} = 0$ or 5V, all $V_A = 0V$		-0.15	-0.07		-0.25	-0.07		

ELECTRICAL CHARACTERISTICS (Overtemperature)

(V+ = 15V, V- = -15V, V_{GND} = 0V, T_A = overtemperature range, unless otherwise noted.)

PARAMETER	SYMBOL	CONDITIONS		DG506AA DG507AA			DG506AB/C DG507AB/C			UNITS
				MIN (Note 2)	TYP (Note 3)	MAX	MIN (Note 2)	TYP (Note 3)	MAX	
SWITCH										
Analog Signal Range	V_{ANALOG}			-15		+15	-15		+15	V
Drain-to-Source On-Resistance	$R_{DS(ON)}$	Sequence each switch on, V_{AL} = 0.8V, V_{AH} = 2.4V, V_{EN} = 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} = 0.8V, V_{AL} = 0.8V	V_S = 10V, V_D = -10V	-50		+50	-50		+50	nA
			V_S = -10V, V_D = 10V	-50		+50	-50		+50	
Drain Off-Leakage Current	$I_{D(OFF)}$	DG506A, V_{EN} = 0.8V, V_{AL} = 0.8V	V_D = 10V, V_S = -10V	-300		+300	-300		+300	nA
			V_D = -10V, V_S = 10V	-300		+300	-300		+300	
		DG507A, V_{EN} = 0.8V, V_{AL} = 0.8V	V_D = 10V, V_S = -10V	-200		+200	-200		+200	
			V_D = -10V, V_S = 10V	-200		+200	-200		+200	
Channel On-Leakage Current	$I_{D(ON)}$ (Note 4)	DG506A, sequence each switch on, V_{AL} = 0.8V, V_{AN} = 2.4V, V_{EN} = 2.4V	$V_{S(all)}$ = V_D = 10V	-300		+300	-300		+300	nA
			$V_{S(all)}$ = V_D = -10V	-300		+300	-300		+300	
		DG507A, sequence each switch on, V_{AL} = 0.8V, V_{AN} = 2.4V, V_{EN} = 2.4V	$V_{S(all)}$ = V_D = 10V	-200		+200	-200		+200	
			$V_{S(all)}$ = V_D = -10V	-200		+200	-200		+200	
INPUT										
Address Input Current, Input-Voltage High	I_{AH}	V_A = 2.4V		-30			-30			µA
		V_A = 15V				30			30	
Address Input Current, Input-Voltage Low	I_{AL}	All V_A = 0V	V_{EN} = 2.4V	-30			-30			µA
			V_{EN} = 0V			30			30	

ELECTRICAL CHARACTERISTICS (Overtemperature) (continued)

(V+ = 15V, V- = -15V, V_{GND} = 0V, T_A = over temperature range, unless otherwise noted.)

Note 1: Signals on S_X, D_X, or IN_X exceeding V+ or V- will be clamped by internal diodes. Limit forward diode current to maximum current ratings.
Note 2: The algebraic convention whereby the most negative value is a minimum, and the most positive value is a maximum, is used in this data sheet.
Note 3: Typical values are for design aid only, not guaranteed nor subject to production testing.
Note 4: $I_{D(ON)}$ is leakage from driver into on switch.
Note 5: Off-isolation = 20log x V_O/V_S, V_S = input to off switch, V_D = output due to V_S.

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

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

Note: *Logic "0" = $V_{AL} \leq 0.8V$, Logic "1" = $V_{AH} \geq 2.4V$, "0" = Don't Care.*

Switching Time Test Circuits

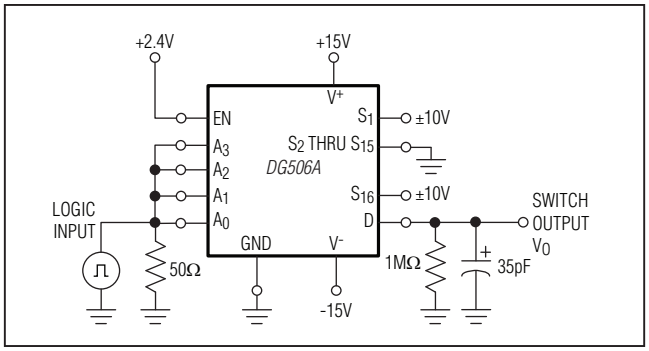


Figure 1a. Transition Switching Time

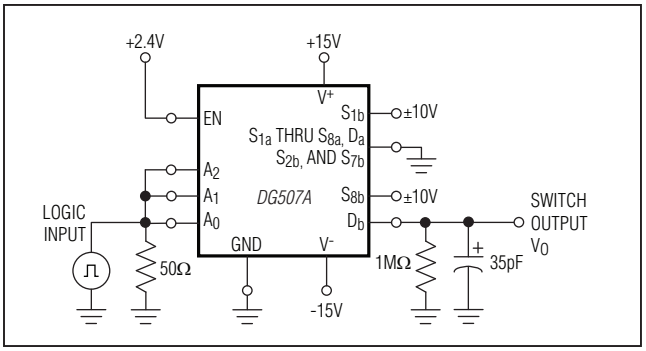


Figure 1b. Transition Switching Time

Monolithic CMOS Analog Multiplexers

Switching Time Test Circuits (continued)

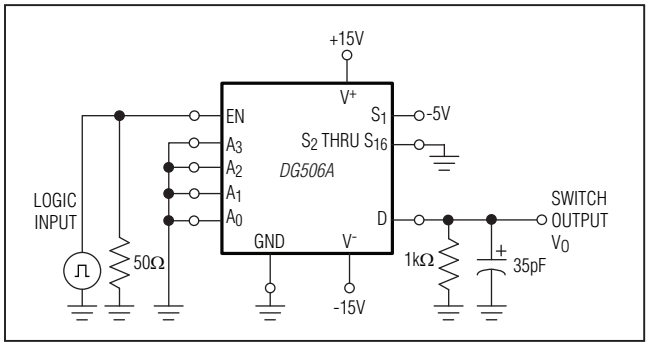


Figure 2a. Enable Switching Time

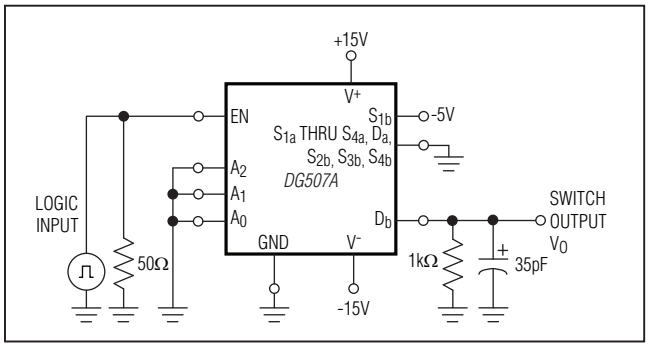


Figure 2b. Enable Switching Time

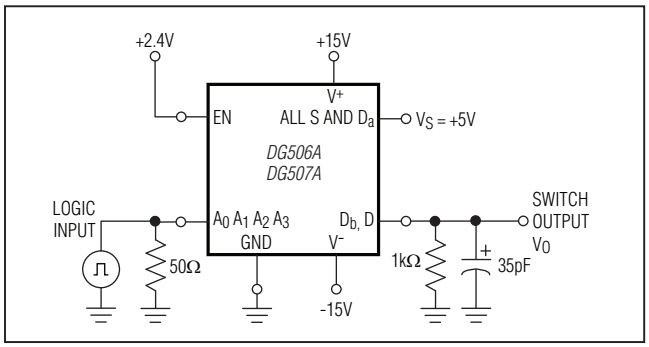


Figure 3. Break-Before-Make

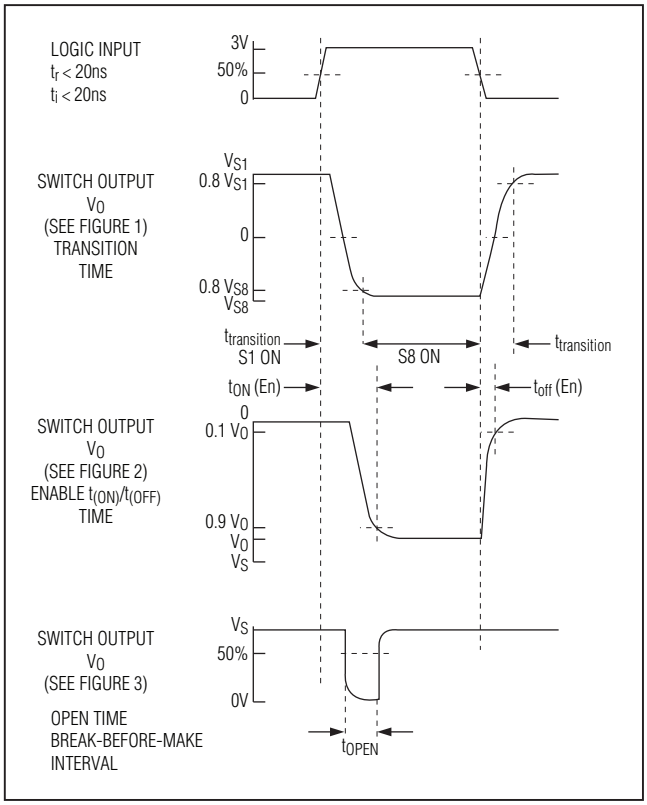
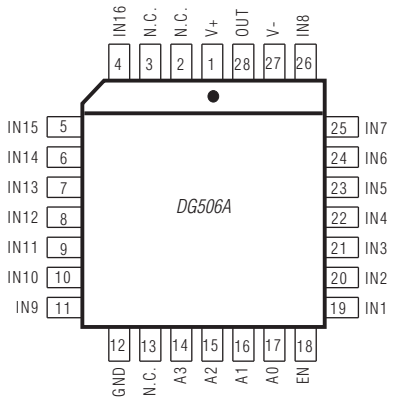


Figure 4. Timing Diagrams for Figures 1, 2, and 3

Pin Configurations (continued)



LCC

N.C. = NO INTERNAL CONNECTION

Pin Description

PIN		NAME	FUNCTION
DG506A DIP / SO	DG507A DIP / SO		
1	1	V+	Positive Supply Voltage Input
2, 3	3	N.C.	No Connection. Internally not connected.
—	2	D_b	Analog Output Bidirectional Channel b
4	—	S_{16}	Analog Output Bidirectional Channel 16
—	4	S_{8b}	Analog Output Bidirectional Channel 8b
5	—	S_{15}	Analog Output Bidirectional Channel 15
—	5	S_{7b}	Analog Output Bidirectional Channel 7b
6	—	S_{14}	Analog Output Bidirectional Channel 14
—	6	S_{6b}	Analog Output Bidirectional Channel 6b
7	—	S_{13}	Analog Output Bidirectional Channel 13
—	7	S_{5b}	Analog Output Bidirectional Channel 5b
8	—	S_{12}	Analog Output Bidirectional Channel 12
—	8	S_{4b}	Analog Output Bidirectional Channel 4b
9	—	S_{11}	Analog Output Bidirectional Channel 11
—	9	S_{3b}	Analog Output Bidirectional Channel 3b
10	—	S_{10}	Analog Output Bidirectional Channel 10
—	10	S_{2b}	Analog Output Bidirectional Channel 2b
11	—	S_9	Analog Output Bidirectional Channel 9
—	11	S_{1b}	Analog Output Bidirectional Channel 1b
12	12	GND	Ground

Monolithic CMOS Analog Multiplexers

Pin Description (continued)

PIN		NAME	FUNCTION
DG506A DIP / SO	DG507A DIP / SO		
13	13, 14	N.C.	No Connection. Not internally connected.
14	—	A3	Address Input A3
15	15	A2	Address Input A2
16	16	A1	Address Input A1
17	17	A0	Address Input A0
18	18	EN	Enable Input
19	—	S_1	Analog Output Bidirectional Channel 1
—	19	S_{1A}	Analog Output Bidirectional Channel 1a
20	—	S_2	Analog Output Bidirectional Channel 2
—	20	S_{2A}	Analog Output Bidirectional Channel 2a
21	—	S_3	Analog Output Bidirectional Channel 3
—	21	S_{3A}	Analog Output Bidirectional Channel 3a
22	—	S_4	Analog Output Bidirectional Channel 4
—	22	S_{4A}	Analog Output Bidirectional Channel 5
23	—	S_5	Analog Output Bidirectional Channel 5a
—	23	S_{5a}	Analog Output Bidirectional Channel 6
24	—	S_6	Analog Output Bidirectional Channel 6a
—	24	S_{6a}	Analog Output Bidirectional Channel 7
25	—	S_7	Analog Output Bidirectional Channel 7a
—	25	S_{7a}	Analog Output Bidirectional Channel 8
26	—	S_8	Analog Output Bidirectional Channel 8a
—	26	S_{8a}	Analog Output Bidirectional Channel
27	27	V-	Negative Supply Voltage Input
28	—	D	Analog Output Bidirectional
—	28	Da	Analog Output Bidirectional Channel a

Pin Description (continued)

PIN DG506A LCC	NAME	FUNCTION
1	V+	Positive Supply Voltage Input
2, 3	N.C.	NoConnection. Internally not connected.
4	IN_{16}	Analog Input Bidirectional Channel 16
5	IN_{15}	Analog Input Bidirectional Channel 15
6	IN_{14}	Analog Input Bidirectional Channel 14
7	IN_{13}	Analog Input Bidirectional Channel 13
8	IN_{12}	Analog Input Bidirectional Channel 12
9	IN_{11}	Analog Input Bidirectional Channel 11
10	IN_{10}	Analog Input Bidirectional Channel 10
11	IN_9	Analog Input Bidirectional Channel 9
12	GND	Ground
13	N.C.	No Connection. Not internally connected.
14	A3	Address Input A3
15	A2	Address Input A2
16	A1	Address Input A1
17	A0	Address Input A0
18	EN	Enable Input
19	IN_1	Analog Input Bidirectional Channel 1
20	IN_2	Analog Input Bidirectional Channel 2
21	IN_3	Analog Input Bidirectional Channel 3
22	IN_4	Analog Input Bidirectional Channel 4
23	IN_5	Analog Input Bidirectional Channel 5
24	IN_6	Analog Input Bidirectional Channel 6
25	IN_7	Analog Input Bidirectional Channel 7
26	IN_8	Analog Input Bidirectional Channel 8
27	V-	Negative Supply Voltage Input
28	OUT	Analog Output Bidirectional

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 number, but the drawing pertains to the package regardless of RoHS status.

PACKAGE TYPE	PACKAGE CODE	OUTLINE NO.	LAND PATTERN NO.
28 CERDIP	J28-2	**21-0046**	—
28 Plastic DIP	P28-2	**21-0044**	—
28 Wide SO	W28-5	**21-0042**	**90-0109**
28 Wide SO	W28-5	**21-0047**	**90-0178**
28 LCC	L28-2	**21-4497**	**90-0178**

Monolithic CMOS Analog Multiplexers

Revision History

REVISION NUMBER	REVISION DATE	DESCRIPTION	PAGES CHANGED
0	8/92	Initial release	—
1	1/99	Updated to Word format.	1–7
2	5/09	Added ruggedized plastic part.	1–4, 7
3	2/10	• Added lead temperature to the *Absolute Maximum Ratings*. • Changed the derate rate of all packages to above 70°C in the *Absolute Maximum Ratings*.	2
4	6/12	Added DG506AAZ/883B; added the Pin Descriptions for DG506A DIP/SO, DG507A DIP/SO, DG506A LCC; added LCC Pin Configuration for the DG506A	1, 2, 7, 9