

Monolithic 4-Channel PMOS Analog Switch

FEATURES

- TTL, CMOS Direct Interface
- Voltage Limiting Diodes Protect PMOS Gates
- Four Independent Switches
- Chip Select Pin (V_L)
- Make-Before-Break Switching

BENEFITS

- Easy Interface
- Reduces External Protection Components
- Easily Expandable
- Will Not Leave Op Amp Input Floating

APPLICATIONS

- Programmable Gain Amplifiers
- Sample/Hold
- Solid-State Logic Trees

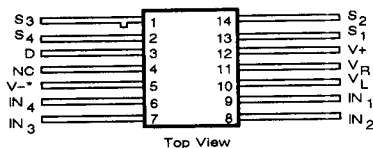
DESCRIPTION

The DG172 is a 4-channel single-pole, single-throw analog switch designed for low level logic controlled analog switching in instrumentation, process control, and communications. Featuring Make-Before-Break action, DG172 can be used inside closed loop systems to select one of four inputs for multiplexing/demultiplexing of analog signals or for gain bandwidth control (by switching passive elements) without opening the loop. The reference pin (V_R) is normally connected to ground to allow TTL level inputs (0.8 V to 2.0 V) to control the

ON-OFF condition of each switch. The DG172 is a bi-directional MOS switch rated to handle 20 V peak-to-peak analog signals at up to 30 mA continuous current. Each switch will block 20 V peak-to-peak signals when OFF. Package options are the 14-pin ceramic and plastic DIP and flatpack. The former is characterized for operation over the standard industrial, B suffix (-25 to 85°C) and military, A suffix (-55 to 125°C) temperature ranges, while the latter is specified for the military range only.

PIN CONFIGURATION

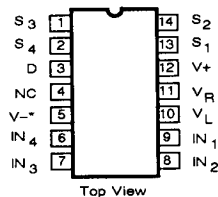
Flat Package



Order Number:
DG172AL/883

* Common to Substrate and Base of Package

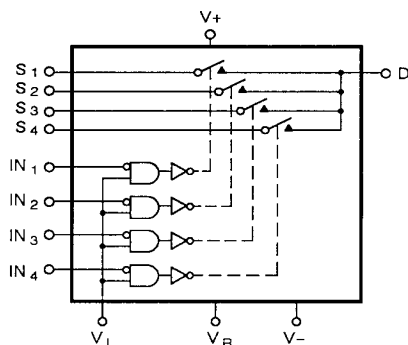
Dual-In-Line Package



Order Numbers:

Side Braze: DG172AP, DG172BP
Plastic: DG172CJ

FUNCTIONAL BLOCK DIAGRAM AND TRUTH TABLE



Truth Table	
LOGIC	SWITCH
0	ON
1	OFF

Logic "0" ≤ 0.8 V
Logic "1" ≥ 2.0 V

*Switches Shown for Logic "1" Input

One 4-Channel Switch per Package*

ABSOLUTE MAXIMUM RATINGS

V_+ to V_-	36 V
V_+ to V_D	25 V
V_+ to V_S	25 V
V_S to V_-	36 V
V_D to V_-	36 V
V_S to V_D	25 V
V_L to V_-	30 V
V_L to V_{IN}	± 6 V
V_L to V_R	± 6 V
V_{IN} to V_R	± 6 V
Current (Any Terminal)	20 mA

Storage Temperature (A & B Suffix)	-65 to 150°C
(C Suffix)	-65 to 125°C
Operating Temperature (A Suffix)	-55 to 125°C
(B Suffix)	-25 to 85°C
(C Suffix)	0 to 70°C

Power Dissipation (Package) *

Flat Package**	750 mW
14-Pin Ceramic DIP***	825 mW
14-Pin Plastic DIP****	470 mW

* All leads welded or soldered to PC board.

** Derate 10 mW/°C above 75°C.

*** Derate 11 mW/°C above 75°C.

**** Derate 6.3 mW/°C above 75°C.

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ELECTRICAL CHARACTERISTICS ^a

PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V ₊ = 10 V V ₋ = -20 V V _R = 0 V V _L = 5 V	LIMITS								UNIT	
			1=25°C 2=125,85°C 3=-55,-25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		C SUFFIX 0 to 70°C			
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	MIN ^b	MAX ^b		
			SWITCH									
Analog Signal Range ^c	V _{ANALOG}		1,2,3		-10	10	-10	10	-10	10	V	
Drain-Source ON Resistance	r _{DS(ON)}	I _S = -1 mA V _{IN} = 0.8 V	V _D = 10 V	1,3 2	100		150 250		150 250		200	Ω
			V _D = 0 V	1,3 2	130		200 350		225 300		300	
			V _D = -10 V	1,3 2	300		450 600		500 600		600	

Not Recommended for New Designs

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ELECTRICAL CHARACTERISTICS ^a											
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			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH (Cont'd)											
Source OFF Leakage Current	I _{S(OFF)}	V _S = -10 V, V _D = 10 V V _{IN} = 2 V	1 2	-0.03	-1 -1000		-5 -100		-10		nA
Drain OFF Leakage Current	I _{D(OFF)}	V _D = -10 V, V _S = 10 V V _{IN} = 2 V	1 2	-0.12	-4 -4000		-10 -300		-10		
Channel ON Leakage Current	I _{D(ON)} + I _{S(ON)}	V _D =V _S = 10 V V _{IN} = 0.8 V	1 2			4 4000		10 300		10	
INPUT											
Input Current with Input Voltage HIGH	I _{INH}	V _{IN} = 5 V	1,3 2			0.1 10		1 10		1	μA
Input Current with Input Voltage LOW	I _{INL}	V _{IN} = 0 V	1,3 2		-0.5 -0.5		-1 -1		-1		mA
DYNAMIC											
Turn-ON Time	t _{ON}	See Switching Time Test Circuit	1			0.3		0.5			μs
Turn-OFF Time	t _{OFF}		1			0.75		1.0			
Source OFF ^c Capacitance	C _{S(OFF)}	V _S = 0 V, I _L = 0 f = 1 MHz	1	5							pF
Drain OFF ^c Capacitance	C _{D(OFF)}	V _D = 0 V, I _S = 0 f = 1 MHz	1	18							
Channel ON ^c Capacitance	C _{D(ON)} + C _{S(ON)}	V _D =V _S = 0 V, V _{ITJ} = 0 V f = 140 kHz	1	28							
Off Isolation ^c		R _L = 100 Ω, C _L = 3 pF f = 5 MHz	1	>50							dB
SUPPLY											
Positive Supply Current	I ₊	One Channel ON V _{IN} = 0 V	1	1.3		3		3		3	mA
Negative Supply Current	I ₋		1	-2.0	-5.1		-5.1		-5.1		
Logic Supply Current	I _L		1	2.5		5.7		5.7		5.7	
		One Channel ON V _{IN} = 0 V I _R = 0	1	0.8		2.1		2.1		2.1	
Reference Supply Current	I _R	One Channel ON V _{IN} = 0 V	1	-1.5	-3.6		-3.6		-3.6		

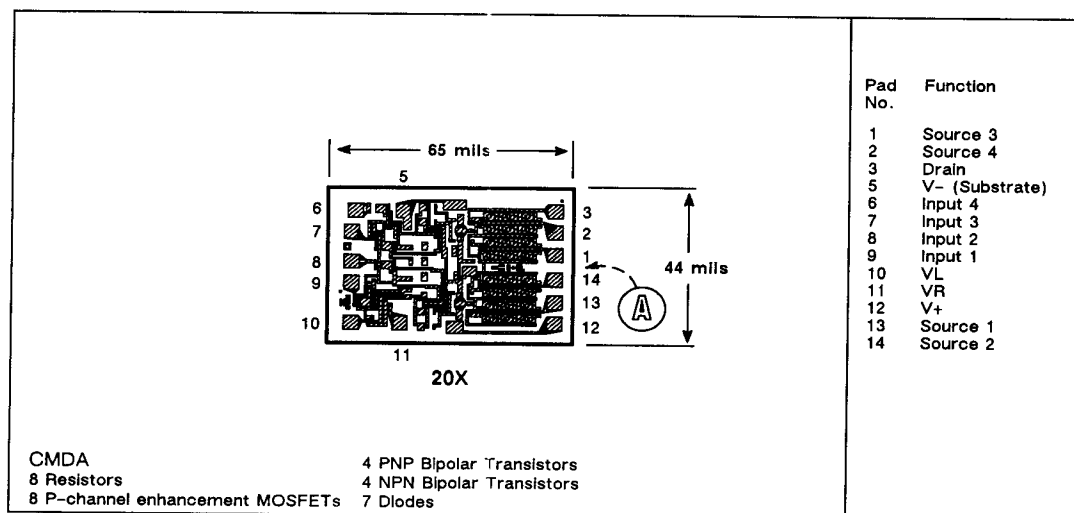
ELECTRICAL CHARACTERISTICS ^a											
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V ₊ = 10 V V ₋ = -20 V V _R = 0 V V _L = 5 V	LIMITS								UNIT
			1=25°C 2=125,85°C 3=-55,-25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		C SUFFIX 0 to 70°C		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SUPPLY											
Positive Supply Current	I ₊	All Channels OFF V _{IN} = 5 V	1	0.1		10		10		10	μA
Negative Supply Current	I ₋		1	-0.01	-20		-20		-20		
Logic Supply Current	I _L	All Channels OFF V _{IN} = 5 V I _R = 0	1	2.0		4.5		4.5		4.5	mA
			1	0.1		10		10		10	μA
Reference Supply Current	I _R	All Channels OFF V _{IN} = 5 V	1	2.0	-4.5		-4.5		-4.5		mA

NOTES:

- a. Refer to PROCESS OPTION FLOWCHART for additional information.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Guaranteed by design, not subject to production test.
d. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.

DIE TOPOGRAPHY

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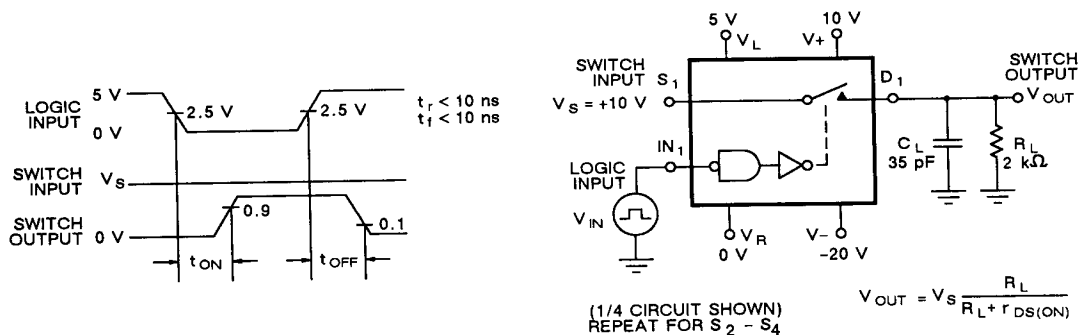


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SWITCHING TIME TEST CIRCUIT

Switch output waveform shown for $V_S = \text{constant}$ with logic input waveform as shown. Note that V_S may be + or - as per switching time test circuit. V_O is the steady state output with switch ON. Feedthrough via gate capacitance may result in spikes at leading and trailing edge of output waveform.



APPLICATION HINTS*

V+ Positive Supply Voltage (V)	V- Negative Supply Voltage (V)	VR Reference Pin Connection	VL Logic Supply Voltage (V)	VIN Logic Input Voltage VINH Min/ VINL Max (V)	VS Analog Signal Range (V)
10**	-20	GND	5	2.0/0.8	-10 to 10
10**	-20	OPEN	5	4.6/0.5	-10 to 10
15	-15	GND	5	2.0/0.8	-5 to 15
20	-10	GND	5	2.0/0.8	0 to 20
5	-15	GND	5	2.0/0.8	-5 to 5
5	-25	GND	5	2.0/0.8	-15 to 5

* Application Hints are for DESIGN AID ONLY, not guaranteed and not subject to production testing.

** Electrical Characteristics are based on $V_+ = +10\text{ V}$, $V_- = -20\text{ V}$ only.