DG123
5-Channel SPST PMOS Analog Switch

Siliconix incorporated

FEATURES

- Low Level Logic Control
- Make-Before-Break Switching Action
- Very Low Standby Power Requirements

BENEFITS

- Reduces External Components Required
- Reduces Switching Errors

APPLICATIONS

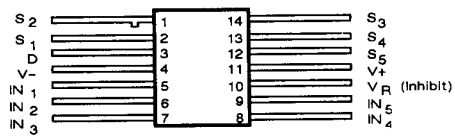
- Feedback Switching for Op Amps
- Commutation Systems
- Portable and Remote Operation

DESCRIPTION

The DG123 is a 5-channel single-pole, single-throw analog switch designed for low level logic controlled analog switching in instrumentation, process control, and communications systems. Featuring make-before-break action, the DG123 can be used inside closed loop systems to select one of five 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 a low-level input (0.4 V to 1.3 V) to control the ON-OFF condition of each switch. The standby or OFF state power consumption is less than 0.5 mW. The DG123 is a bi-directional MOS switch, rated to handle ±10 V 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 DIP and flatpack. The former is characterized for operation over the standard industrial, B suffix and military, A suffix temperature ranges, while the latter is specified for the military range only.

PIN CONFIGURATION

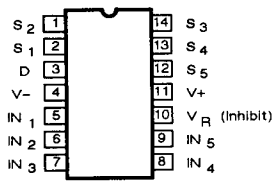
Flat Package



Top View

Order Number: DG123AL/883

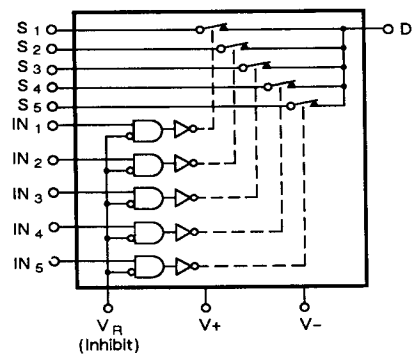
Dual-In-Line Package



Top View

Order Numbers: DG123AP or DG123BP

FUNCTIONAL BLOCK DIAGRAM



One 5-Channel Switch per Package*

Truth Table

LOGIC	SWITCH
0	OFF
1	ON

Logic "0" ≤ 0.4 V
Logic "1" ≥ 1.3 V

* Switches Shown for Logic "1" Input

Not Recommended for New Designs

ABSOLUTE MAXIMUM RATINGS

V+ to V–	36 V
V_D to V–	36 V
V_S to V–	36 V
V_D to V_S	25 V
V_S to V_D	25 V
V_R to V–	30 V
V_{IN} to V–	30 V
V_R to V_{IN}	6 V
V_{IN} to V_R	2 V

Current (Any Terminal)	30 mA
Storage Temperature	-65 to 150°C
Operating Temperature (A Suffix)	-55 to 125°C
(B Suffix)	-25 to 85°C

Power Dissipation (Package)*
Flat Package** ..... 750 mW
14-Pin DIP*** ..... 825 mW

* All leads soldered or welded to PC board.
** Derate 10 mW/°C above 75°C.
*** Derate 11 mW/°C above 75°C.

ELECTRICAL CHARACTERISTICS [a]

PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V_+ = 10 V, V- = -20 V, V_R = 0 V		LIMITS 1=25°C 2=125,85°C 3=-55,-25°C TEMP	TYP [d]	A SUFFIX -55 to 125°C MIN [b]	A SUFFIX -55 to 125°C MAX [b]	B SUFFIX -25 to 85°C MIN [b]	B SUFFIX -25 to 85°C MAX [b]	UNIT
SWITCH										
Analog Signal Range [c]	V_{ANALOG}			1,2,3		-10	10	-10	10	V
Drain-Source ON Resistance	$r_{DS(ON)}$	I_S = -1 mA, I_{IN} = 1 mA	V_D = 10 V	1,3 2	70		100 125		125 150	Ω
			V_D = 0	1,3 2	100		200 250		225 300	
			V_D = -10 V	1,3 2	270		450 600		500 600	
Source OFF Leakage Current	$I_{S(OFF)}$	V_S = -10 V, V_D = 10 V, V_{IN} = 0.4V		1 2		-1 -1000		-5 -100		nA
Drain OFF Leakage Current	$I_{D(OFF)}$	V_D = -10 V, V_S = 10 V, V_{IN} = 0.4V		1 2		-1 -4000		-10 -300		
Channel ON Leakage Current	$I_{D(ON)}$ + $I_{S(ON)}$	V_D = V_S = 10 V, I_{IN} = 1 mA		1 2			4 4000		10 300	
INPUT										
Input Voltage HIGH	V_{INH}	I_{IN} = 1 mA		1 2 3			1 .8 1.3		1 1.0 1.3	V
Input Current with Input Voltage LOW	I_{INL}	V_{IN} = 0.4 V		1,3 2			1 100		5 100	µA
DYNAMIC										
Turn-ON Time	t_{ON}	See Switching Time Test Circuit (C_L = 35 pF, R_L = 2 kΩ)		1			0.3		0.5	µs
Turn-OFF Time	t_{OFF}			1			2		2	

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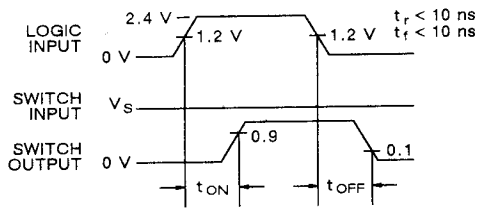
ELECTRICAL CHARACTERISTICS [a]

PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V+ = 10 V, V− = −20 V, V_R = 0 V	1=25°C, 2=125,85°C, 3=−55,−25°C		LIMITS A SUFFIX −55 to 125°C		LIMITS B SUFFIX −25 to 85°C		UNIT
			TEMP	TYP [d]	MIN [b]	MAX [b]	MIN [b]	MAX [b]	
DYNAMIC (Cont'd)									
Source-OFF Capacitance	$C_{S(OFF)}$	V_S = 0 V, I_D = 0, f = 1 MHz	1	5					pF
Drain-OFF Capacitance	$C_{D(OFF)}$	V_D = 0 V, I_S = 0, f = 1 MHz	1	18					pF
Off Isolation		R_L = 100 Ω, C_L = 3 pF, f = 5 MHz	1	>50					dB
SUPPLY									
Positive Supply Current	I+	One Channel ON, I_{IN} = 1 mA	1			3		3	mA
Negative Supply Current	I−		1		−6		−6		
Reference Supply Current	I_R		1		−0.5		−0.5		
Positive Supply Current	I+	All Channels OFF, V_{IN} = 0.4 V	1			15		25	µA
Negative Supply Current	I−		1		−20		−40		
Reference Supply Current	I_R		1		−10		−20		

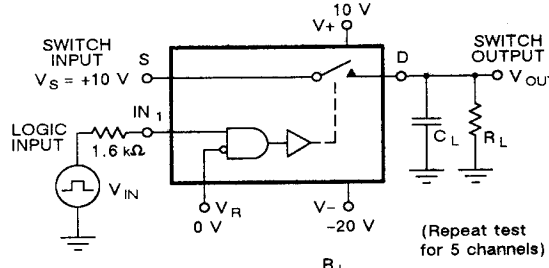
NOTES:
a. Refer to PROCESS OPTION FLOWCHART for additional information.
b. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
c. Guaranteed by design, not subject to production test.
d. Typical values are for DESIGN AID ONLY,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

SWITCHING TIME TEST CIRCUIT

Switch output waveform shown for V_S = 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.



(LOGIC "1" = SWITCH ON)



(Repeat test for 5 channels)

$$V_{OUT} = V_S \frac{R_L}{R_L + r_{DS(ON)}}$$

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