

DG133/134/141

Dual SPST JFET Analog Switches

FEATURES

- Low Standby Power ($< 1 \mu\text{W}$)
- Bipolar Drivers
- Constant $r_{DS(ON)}$ Over Signal Range
- High Off Isolation ($> 60 \text{ dB @ } 1 \text{ MHz}$)

BENEFITS

- Minimizes Standby Power Requirement
- Better Radiation Tolerance
- Less Signal Distortion
- Higher Frequency Switching

APPLICATIONS

- Portable and Battery Powered Systems
- Switching in Satellite Applications
- Low Distortion Circuits
- High Frequency Switching Circuits

DESCRIPTION

The DG133, DG134, and DG141 are dual precision single-pole, single-throw analog switches for use in process control, communication, and instrumentation applications. This series is ideally suited for applications requiring a constant ON resistance over the entire analog range.

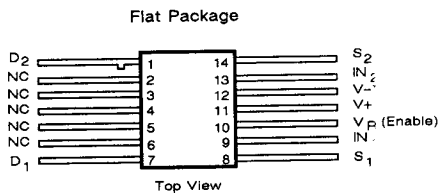
ON resistance of the DG134 is $< 80 \Omega$, the DG133 is $< 30 \Omega$, and the DG141 is $< 10 \Omega$, and ON shunt leakage for all three is $< 2 \text{ nA}$. With both drivers in the "switch OFF" state, total power consumption is $750 \mu\text{W}$. Because JFET and bipolar processing is used, all three devices are relatively radiation tolerant.

The DG133, DG134, and DG141 each contain two junction-type field-effect transistors (JFETs) de-

signed to function as two single-pole, single-throw electronic switches. Level-shifting drivers enable low-level inputs (0.8 to 2.5 V) to control the ON-OFF state of each switch. With a positive logic "0" at the driver input the switches will be OFF. With a positive logic "1" at the input the switches will be ON. In the ON state each switch will conduct current in either direction, and in the OFF state each switch will block voltages up to 20 V peak-to-peak.

Packaging for this series include a 14-pin side braze and flatpack options. Performance grades include both a military, A suffix (-55 to 125°C) and industrial, B suffix (-25 to 85°C) temperature range. The flatpack option is only available in the military grade.

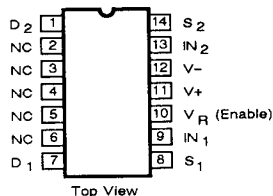
PIN CONFIGURATION



Order Numbers:
DG133AL/883, DG134AL/883
DG141AL/883

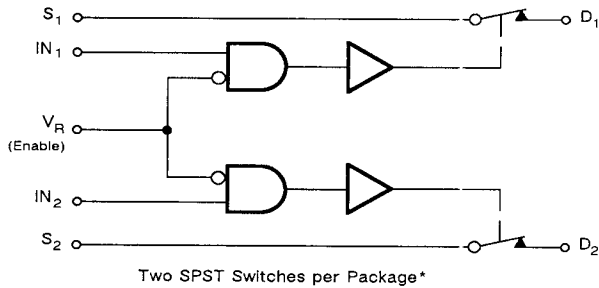
* Common to Substrate and Base of Package

Dual-In-Line Package



Order Numbers:
Side Braze: DG133AP, DG133BP
DG134AP, DG134BP
DG141AP, DG141BP

FUNCTIONAL BLOCK DIAGRAM



Truth Table

Logic	Switch
0	OFF
1	ON

Logic "0" ≤ 0.8 V
Logic "1" ≥ 2.5 V

*Switches Shown for Logic "1" Input

ABSOLUTE MAXIMUM RATINGS

V+ to V-	33 V
V+ to VD	33 V
VD or VS to V-	33 V
VD to VS	± 22 V
V+ to VR	25 V
VR to V-	25 V
VIN to V-	30 V
V+ to VIN	25 V
VIN to VR	± 3 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*

Flat Package**	750 mW
14-Pin DIP***	825 mW

* All leads welded or soldered to PC board.

** Derate 10 mW/°C above 75°C.

*** Derate 11 mW/°C above 75°C.

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ELECTRICAL CHARACTERISTICS ^a						DG133			
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V+ = 12 V V- = -18 V VR = 0	LIMITS						UNIT
			1=25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH									
Analog Signal Range ^c	VANALOG		1,2,3		-10	10	-8	8	V
Drain-Source ON Resistance	rDS(ON)	IS = -10 mA VIN = 2.5 V	VD = 10 V	1,3 2	20	30 60			Ω
			VD = 8 V	1,3 2	30		50 75		
Source OFF Leakage Current	IS(OFF)	VIN = 0.8 V	VS = 10 V VD = -10 V	1 2	0.03	1 100			nA
			VS = 8 V VD = -8 V	1 2			5 100		

Not Recommended for New Designs

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ELECTRICAL CHARACTERISTICS ^a										DG133
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: $V_+ = 12\text{ V}$ $V_- = -18\text{ V}$ $V_R = 0\text{ V}$	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			
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b		
SWITCH (Cont'd)										
Drain OFF Leakage Current	$I_{D(OFF)}$	$V_{IN} = 0.8\text{ V}$	$V_D = 10\text{ V}$ $V_S = -10\text{ V}$	1 2	0.02		1 100			nA
			$V_D = 8\text{ V}$ $V_S = -8\text{ V}$	1 2	0.1			5 100		
Channel ON Leakage Current	$I_{D(ON)} + I_{S(ON)}$	$V_{IN} = 2.5\text{ V}$	$V_D = V_S = -10\text{ V}$	1 2	-0.03	-2 -100				nA
			$V_D = V_S = -8\text{ V}$	1 2	-0.08			-5 -100		
INPUT										
Input Current with Input Voltage HIGH	I_{INH}	$V_{IN} = 2.5\text{ V}$		1,2 3			60 120		100 150	μA
Input Current with Input Voltage LOW	I_{INL}	$V_{IN} = 0.8\text{ V}$		1,3 2			0.1 2		4 4	
DYNAMIC										
Turn-ON Time	t_{ON}	See Switching Time Test Circuit ^e		1			0.6		1	μs
Turn-OFF Time	t_{OFF}			1			1.6		2	
Drain-OFF Capacitance	$C_{D(OFF)}$	$f = 1\text{ MHz}$	$V_D = 0\text{ V}$ $I_S = 0$	1	2.4					pF
Source-OFF Capacitance	$C_{S(OFF)}$		$V_S = 0\text{ V}$ $I_D = 0$	1	2.4					
Channel-ON Capacitance	$C_{D(ON)} + C_{S(ON)}$		$V_D = V_S = 0$	1	2.8					
OFF Isolation	OIRR	$R_L = 75\ \Omega$, $f = 1\text{ MHz}$		1	>60					dB
SUPPLY										
Positive Supply Current	I_+	One Channel ON $V_{IN} = 2.5\text{ V}$		1	2.1		3		3.3	mA
Negative Supply Current	I_-			1	-1.2	-1.8		-2		
Reference Supply Current	I_R			1	-1	-1.4		-1.5		

ELECTRICAL CHARACTERISTICS ^a								DG133	
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: $V_+ = 12\text{ V}$ $V_- = -18\text{ V}$ $V_R = 0\text{ V}$	LIMITS						UNIT
			1=25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SUPPLY (Cont'd)									
Positive Supply Current	I_+	All Channels OFF Botn $V_{IN} = 0\text{ V}$	1	0.1		25		25	μA
Negative Supply Current	I_-		1	-0.5	-25		-25		
Reference Supply Current	I_R		1	-0.5	-25		-25		

ELECTRICAL CHARACTERISTICS ^a								DG134	
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: $V_+ = 12\text{ V}$ $V_- = -18\text{ V}$ $V_R = 0\text{ V}$	LIMITS						UNIT
			1=25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH									
Analog Signal Range ^c	V_{ANALOG}		1,2,3		-10	10	-8	8	V
Drain-Source ON Resistance	$r_{DS(ON)}$	$I_S = -10\text{ mA}$ $V_{IN} = 2.5\text{ V}$	$V_D = 10\text{ V}$	1,3 2	30		80 150		Ω
			$V_D = 8\text{ V}$	1,3 2	35			100 150	
Source OFF Leakage Current	$I_{S(OFF)}$	$V_{IN} = 0.8\text{ V}$	$V_S = 10\text{ V}$ $V_D = -10\text{ V}$	1 2	0.01		1 100		nA
			$V_S = 8\text{ V}$ $V_D = -8\text{ V}$	1 2	0.05				
Drain OFF Leakage Current	$I_{D(OFF)}$	$V_{IN} = 0.8\text{ V}$	$V_D = 10\text{ V}$ $V_S = -10\text{ V}$	1 2	0.005		1 100		
			$V_D = 8\text{ V}$ $V_S = -8\text{ V}$	1 2	0.025				
Channel ON Leakage Current	$I_{D(ON)} + I_{S(ON)}$	$V_{IN} = 2.5\text{ V}$	$V_D = V_S = -10\text{ V}$	1 2	-0.02	-2 -100			
			$V_D = V_S = -8\text{ V}$	1 2	-0.05			-5 -100	

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Not Recommended for New Designs

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ELECTRICAL CHARACTERISTICS ^a										DG134	
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: $V_+ = 12\text{ V}$ $V_- = -18\text{ V}$ $V_R = 0\text{ V}$	LIMITS						UNIT		
			1=25°C		A SUFFIX		B SUFFIX				
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b			
INPUT											
Input Current with Input Voltage HIGH	I_{INH}	$V_{IN} = 2.5\text{ V}$	1,2 3			60 120		100 150		μA	
Input Current with Input Voltage LOW	I_{INL}	$V_{IN} = 0.8\text{ V}$	1,3 2			0.1 2		4 4			
DYNAMIC											
Turn-ON Time	t_{ON}	See Switching Time Test Circuit ^e	1			0.6		1		μs	
Turn-OFF Time	t_{OFF}		1			1.6		2			
Drain-OFF Capacitance	$C_{D(OFF)}$	$f = 1\text{ MHz}$	1	2.4						pF	
Source-OFF Capacitance	$C_{S(OFF)}$										$V_D = 0\text{ V}$ $I_S = 0$
Channel-ON Capacitance	$C_{D(ON)} + C_{S(ON)}$										$V_S = 0\text{ V}$ $I_D = 0$
Channel-ON Capacitance	$C_{D(ON)} + C_{S(ON)}$	$V_D = V_S = 0$	1	2.8							
OFF Isolation	OIRR	$R_L = 75\ \Omega, f = 1\text{ MHz}$	1	>60						dB	
SUPPLY											
Positive Supply Current	I_+	One Channel ON $V_{IN} = 2.5\text{ V}$	1	2.1			3		3.3	mA	
Negative Supply Current	I_-		1	-1.2	-1.8			-2			
Reference Supply Current	I_R		1	-1	-1.4			-1.5			
Positive Supply Current	I_+	All Channels OFF Both $V_{IN} = 0\text{ V}$	1	0.1			25		25	μA	
Negative Supply Current	I_-		1	-0.5	-25			-25			
Reference Supply Current	I_R		1	-0.5	-25			-25			

ELECTRICAL CHARACTERISTICS ^a										DG141
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V ₊ = 12 V V ₋ = -18 V V _R = 0 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		
				TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	
SWITCH										
Analog Signal Range ^c	V _{ANALOG}			1,2,3		-10	10	-8	8	V
Drain-Source ON Resistance	r _{DS(ON)}	I _S = -10 mA, V _{IN} = 2.5 V	V _D = 10 V	1,3 2	6.3		10 20			Ω
			V _D = 8 V	1,3 2	9.5			15 25		
Source OFF Leakage Current	I _{S(OFF)}	V _{IN} = 0.8 V	V _S = 10 V V _D = -10 V	1 2	0.04		10 1000			nA
			V _S = 8 V V _D = -8 V	1 2	0.06			15 300		
Drain OFF Leakage Current	I _{D(OFF)}	V _{IN} = 0.8 V	V _D = 10 V V _S = -10 V	1 2			10 1000			nA
			V _D = 8 V V _S = -8 V	1 2				15 300		
Channel ON Leakage Current	I _{D(ON)} + I _{S(ON)}	V _{IN} = 2.5 V	V _D = V _S = -10 V	1 2	-0.4	-2 -100				nA
			V _D = V _S = -8 V	1 2	-1.0			-5 -100		
INPUT										
Input Current with Input Voltage HIGH	I _{INH}	V _{IN} = 2.5 V		1,2 3			60 120		100 150	μA
Input Current with Input Voltage LOW	I _{INL}	V _{IN} = 0.8 V		1,3 2			0.1 2		4 4	
DYNAMIC										
Turn-ON Time	t _{ON}	See Switching Time Test Circuit ^e		1			1		1.5	μs
Turn-OFF Time	t _{OFF}			1	1.15		2.5		2.5	
Drain-OFF Capacitance	C _{D(OFF)}	f = 1 MHz	V _D = 0 V I _S = 0	1	3					pF
Source-OFF Capacitance	C _{S(OFF)}		V _S = 0 V I _D = 0	1	3					
Channel-ON Capacitance	C _{D(ON)} + C _{S(ON)}		V _D = V _S = 0	1	2.8					
OFF Isolation	OIRR	R _L = 75 Ω, f = 1 MHz		1	>50					dB

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Not Recommended for New Designs

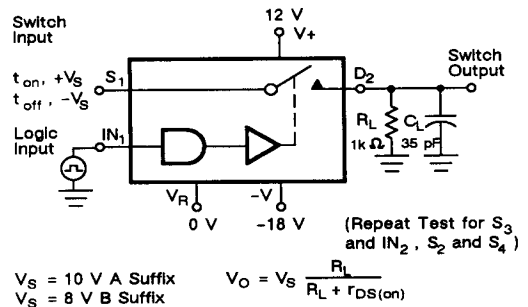
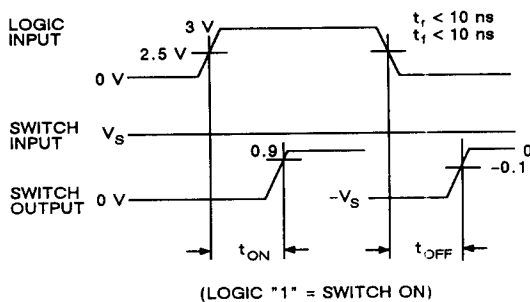
ELECTRICAL CHARACTERISTICS ^a							DG141		
PARAMETER	SYMBOL	Test Conditions Unless Otherwise Specified: V ₊ = 12 V V ₋ = -18 V V _R = 0 V	LIMITS						
			1=25°C		A SUFFIX -55 to 125°C		B SUFFIX -25 to 85°C		
			TEMP	TYP ^d	MIN ^b	MAX ^b	MIN ^b	MAX ^b	UNIT
SUPPLY									
Positive Supply Current	I ₊	One Channel ON V _{IN} = 2.5 V	1	2.1		3		3.3	mA
Negative Supply Current	I ₋		1	-1.2	-1.8		-2		
Reference Supply Current	I _R		1	-1	-1.4		-1.5		
Positive Supply Current	I ₊	All Channels OFF Both V _{IN} = 0 V	1	0.1		25		25	μA
Negative Supply Current	I ₋		1	-0.5	-25		-25		
Reference Supply Current	I _R		1	-0.5	-25		-25		

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.
- e. V_{IN} must be a step function with a minimum rise and fall time of 1 V/μs.

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.



APPLICATION HINTS

V+ Positive Supply Voltage (V)	V- Negative Supply Voltage (V)	V _R Reference Voltage (V)	V _{IN} Logic Input Voltage V _{INH} Min/ V _{INL} Max (V)	V _S or V _D Analog Voltage Range (V)
12	-18	0	2.5/0.8	-10 to 10
15	-15	0	2.5/0.8	-5 to 13
10	-10	0	2.5/0.8	0 to 8

Not Recommended for New Designs