

## High-Speed Drivers with Dual DPST JFET Switches

### Features

- Constant On-Resistance Over Entire Analog Range
- Low Leakage
- Low Crosstalk
- Break-Before-Make Switching
- Rad Hardness

### Benefits

- Low Distortion
- Eliminates Large Signal Errors
- High Precision
- Improved Channel Isolation
- Eliminates Inadvertent Shorting Between Channels
- Fault Protection

### Applications

- Audio Switching
- Precision Switching
- Video Switching
- Video Routing
- Sample/Hold
- Aerospace

### Description

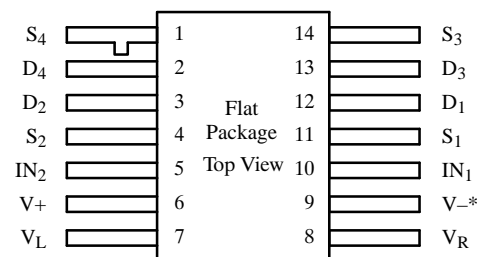
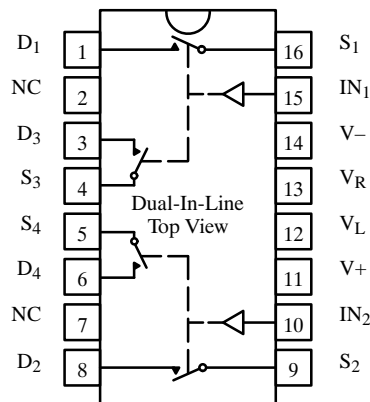
The DG183/184/185 are precision dual double-pole, single-throw (DPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

The major difference in the devices is the on-resistance (DG183—10  $\Omega$ , DG184—30  $\Omega$ , DG185—75  $\Omega$ ). Reduced errors are achieved through low leakage current ( $I_{D(on)} < 2$  nA). Applications which benefit from the flat

JFET on-resistance include audio switching, video switching, and data acquisition.

To achieve fast and accurate switch performance, each device comprises four n-channel JFET transistors and a TTL compatible bipolar driver. In the on state, each switch conducts current equally well in either direction. In the off condition, the switches will block up to 20 V peak-to-peak, with feedthrough of less than -60 dB at 10 MHz.

### Functional Block Diagram and Pin Configuration



Refer to JAN38510 Information, Military Section

\*Common to Substrate and Case

#### Ordering Information – DG183/184/185

Temp Range	Package	Part Number
-25 to 85°C	16-Pin Sidebraze	DG183BP
		DG184BP
-55 to 125°C	16-Pin Sidebraze	DG183AP/883
		DG184AP/883, JM38510/11103BEA
		DG185AP/883, JM38510/11104BEA
	14-Pin Flat Pack	JM38510/11103BXA
		JM38510/11104BXA

#### Truth Table

Logic	Switch
0	OFF
1	ON

Logic "0"  $\leq 0.8$  V  
 Logic "1"  $\geq 2.0$  V

Switches Shown for Logic "0" Input

# DG183/184/185

## Absolute Maximum Ratings

V <sub>+</sub> to V <sub>-</sub> .....	36 V	Current (S or D) DG184, DG185 .....	30 mA
V <sub>+</sub> to V <sub>D</sub> .....	33 V	Current (All Other Pins) .....	30 mA
V <sub>D</sub> to V <sub>-</sub> .....	33 V	Storage Temperature .....	-65 to 150°C
V <sub>D</sub> to V <sub>D</sub> .....	±22 V	Power Dissipation <sup>a</sup>	
V <sub>L</sub> to V <sub>-</sub> .....	36 V	16-Pin Sidebrazed <sup>b</sup> .....	900 mW
V <sub>L</sub> to V <sub>IN</sub> .....	8 V	14-Pin Flat Pack <sup>c</sup> .....	900 mW
V <sub>L</sub> to V <sub>R</sub> .....	8 V	Notes:	
V <sub>IN</sub> to V <sub>R</sub> .....	8 V	a. All leads welded or soldered to PC Board.	
V <sub>R</sub> to V <sub>-</sub> .....	27 V	b. Derate 12 mW/°C above 75°C	
V <sub>R</sub> to V <sub>IN</sub> .....	2 V	c. Derate 10 mW/°C above 75°C	
Current (S or D) DG183 .....	200 mA		

## Specifications<sup>a</sup> for DG183

Parameter	Symbol	Test Conditions Unless Otherwise Specified V <sub>+</sub> = 15 V, V <sub>-</sub> = -15 V, V <sub>L</sub> = 5 V V <sub>R</sub> = 0 V, V <sub>IN</sub> = 0.8 V or 2 V <sup>f</sup>	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					Min <sup>d</sup>	Max <sup>d</sup>	Min <sup>d</sup>	Max <sup>d</sup>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	V <sub>ANALOG</sub>		Full		-7.5	15	-7.5	15	V
Drain-Source On-Resistance	r <sub>DS(on)</sub>	I <sub>S</sub> = -10 mA, V <sub>D</sub> = -7.5 V	Room Full	7.5		10 20		15 25	Ω
Source Off Leakage Current	I <sub>S(off)</sub>	V <sub>S</sub> = ±10 V, V <sub>D</sub> = ∓10 V V <sub>+</sub> = 10 V, V <sub>-</sub> = -20 V	Room Hot	0.05		10 1000		15 300	nA
		V <sub>S</sub> = ±7.5 V, V <sub>D</sub> = ∓7.5 V	Room Hot	0.05		10 1000		15 300	
Drain Off Leakage Current	I <sub>D(off)</sub>	V <sub>S</sub> = ±10 V, V <sub>D</sub> = ∓10 V V <sub>+</sub> = 10 V, V <sub>-</sub> = -20 V	Room Hot	0.04		10 1000		15 300	
		V <sub>S</sub> = ±7.5 V, V <sub>D</sub> = ∓7.5 V	Room Hot	0.03		10 1000		15 300	
Channel On Leakage Current	I <sub>D(on)</sub>	V <sub>D</sub> = V <sub>S</sub> = ±7.5 V	Room Hot	-0.1	-2 -200		-10 -200		
Saturation Drain Current	I <sub>DSS</sub>	2 ms Pulse Duration	Room	300					mA
<b>Digital Input</b>									
Input Current with Input Voltage High	I <sub>INH</sub>	V <sub>IN</sub> = 5 V	Room Hot	<0.01		10 20		10 20	μA
Input Current with Input Voltage Low	I <sub>INL</sub>	V <sub>IN</sub> = 0 V	Full	-30	-250		-250		
<b>Dynamic Characteristics</b>									
Turn-On Time	t <sub>on</sub>	See Switching Time Test Circuit	Room	240		400		600	ns
Turn-Off Time	t <sub>off</sub>		Room	140		200		220	
Source-Off Capacitance	C <sub>S(off)</sub>	f = 1 MHz	Room	21					pF
Drain-Off Capacitance	C <sub>D(off)</sub>		V <sub>S</sub> = -5 V, I <sub>D</sub> = 0	Room	17				
Channel-On Capacitance	C <sub>D(on)</sub>		V <sub>D</sub> = -5 V, I <sub>S</sub> = 0	Room	17				
Off Isolation	OIRR	f = 1 MHz, R <sub>L</sub> = 75 Ω	Room	>55					dB
<b>Power Supplies</b>									
Positive Supply Current	I <sub>+</sub>	V <sub>IN</sub> = 0 V, or 5 V	Room	0.6		1.5		1.5	mA
Negative Supply Current	I <sub>-</sub>		Room	-2.7	-5		-5		
Logic Supply Current	I <sub>L</sub>		Room	3.1		4.5		4.5	
Reference Supply Current	I <sub>R</sub>		Room	-1	-2		-2		

## Specifications<sup>a</sup> for DG184

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ , $V_L = 5\text{ V}$ $V_R = 0\text{ V}$ , $V_{IN} = 0.8\text{ V}$ or $2\text{ V}^f$		Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
						Min <sup>d</sup>	Max <sup>d</sup>	Min <sup>d</sup>	Max <sup>d</sup>	
<b>Analog Switch</b>										
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$			Full		-7.5	15	-7.5	15	V
Drain-Source On-Resistance	$r_{DS(on)}$		$I_S = -10\text{ mA}$ , $V_D = -7.5\text{ V}$	Room Full	22		30 60		50 75	$\Omega$
Source Off Leakage Current	$I_{S(off)}$		$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$ $V_+ = 10\text{ V}$ , $V_- = -20\text{ V}$	Room Hot	0.06		1 100		5 100	nA
			$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	Room Hot	0.05		1 100		5 100	
Drain Off Leakage Current	$I_{D(off)}$		$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$ $V_+ = 10\text{ V}$ , $V_- = -20\text{ V}$	Room Hot	0.4		1 100		5 100	
			$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	Room Hot	0.3		1 100		5 100	
Channel On Leakage Current	$I_{D(on)}$		$V_D = V_S = \pm 7.5\text{ V}$	Room Hot	-0.02	-2 -200		-10 -200		
<b>Digital Input</b>										
Input Current with Input Voltage High	$I_{INH}$		$V_{IN} = 5\text{ V}$	Room Hot	<0.01		10 20		10 20	$\mu\text{A}$
Input Current with Input Voltage Low	$I_{INL}$		$V_{IN} = 0\text{ V}$	Full	-30	-250		-250		
<b>Dynamic Characteristics</b>										
Turn-On Time	$t_{on}$		See Switching Time Test Circuit	Room	85		150		180	ns
Turn-Off Time	$t_{off}$			Room	95		130		150	
Source-Off Capacitance	$C_{S(off)}$	$f = 1\text{ MHz}$	$V_S = -5\text{ V}$ , $I_D = 0$	Room	9					pF
Drain-Off Capacitance	$C_{D(off)}$		$V_D = -5\text{ V}$ , $I_S = 0$	Room	6					
Channel-On Capacitance	$C_{D(on)}$		$V_D = V_S = 0\text{ V}$	Room	14					
Off Isolation	OIRR		$f = 1\text{ MHz}$ , $R_L = 75\ \Omega$	Room	>50					dB
<b>Power Supplies</b>										
Positive Supply Current	$I_+$	$V_{IN} = 0\text{ V}$ , or $5\text{ V}$		Room	0.6		3		3	mA
Negative Supply Current	$I_-$			Room	-2.7	-5.5		-5.5		
Logic Supply Current	$I_L$			Room	3.1		4.5		4.5	
Reference Supply Current	$I_R$			Room	-1	-2		-2		

# DG183/184/185

## Specifications<sup>a</sup> for DG185

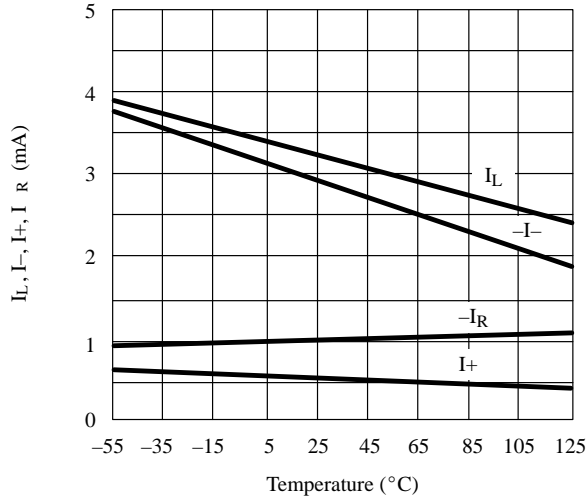
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ , $V_L = 5\text{ V}$ $V_R = 0\text{ V}$ , $V_{IN} = 0.8\text{ V}$ or $2\text{ V}^f$	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					Min <sup>d</sup>	Max <sup>d</sup>	Min <sup>d</sup>	Max <sup>d</sup>	
<b>Analog Switch</b>									
Analog Signal Range <sup>e</sup>	$V_{ANALOG}$		Full		-10	15	-10	15	V
Drain-Source On-Resistance	$r_{DS(on)}$	$I_S = -10\text{ mA}$ , $V_D = -7.5\text{ V}$	Room Full	35		75 150		100 150	$\Omega$
Source Off Leakage Current	$I_{S(off)}$	$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$ $V_+ = 10\text{ V}$ , $V_- = -20\text{ V}$	Room Hot	0.05		1 100		5 100	nA
		$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$	Room Hot	0.07		1 100		5 100	
Drain Off Leakage Current	$I_{D(off)}$	$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$ $V_+ = 10\text{ V}$ , $V_- = -20\text{ V}$	Room Hot	0.4		1 100		5 100	
		$V_S = \pm 10\text{ V}$ , $V_D = \mp 10\text{ V}$	Room Hot	0.3		1 100		5 100	
Channel On Leakage Current	$I_{D(on)}$	$V_D = V_S = \pm 10\text{ V}$	Room Hot	-0.03	-2 -200		-10 -200		
<b>Digital Input</b>									
Input Current with Input Voltage High	$I_{INH}$	$V_{IN} = 5\text{ V}$	Room Hot	<0.01		10 20		10 20	$\mu\text{A}$
Input Current with Input Voltage Low	$I_{INL}$	$V_{IN} = 0\text{ V}$	Full	-30	-250		-250		
<b>Dynamic Characteristics</b>									
Turn-On Time	$t_{on}$	See Switching Time Test Circuit	Room	120		250		300	ns
Turn-Off Time	$t_{off}$		Room	100		130		150	
Source-Off Capacitance	$C_{S(off)}$	f = 1 MHz	Room	9					pF
Drain-Off Capacitance	$C_{D(off)}$		$V_D = -5\text{ V}$ , $I_S = 0$	Room	6				
Channel-On Capacitance	$C_{D(on)}$		$V_D = V_S = 0\text{ V}$	Room	14				
Off Isolation	OIRR	f = 1 MHz, $R_L = 75\ \Omega$	Room	>50					dB
<b>Power Supplies</b>									
Positive Supply Current	$I_+$	$V_{IN} = 0\text{ V}$ , or $5\text{ V}$	Room	0.6		3		3	mA
Negative Supply Current	$I_-$		Room	-2.7	-5.5		-5.5		
Logic Supply Current	$I_L$		Room	3.1		4.5		4.5	
Reference Supply Current	$I_R$		Room	-1	-2		-2		

Notes:

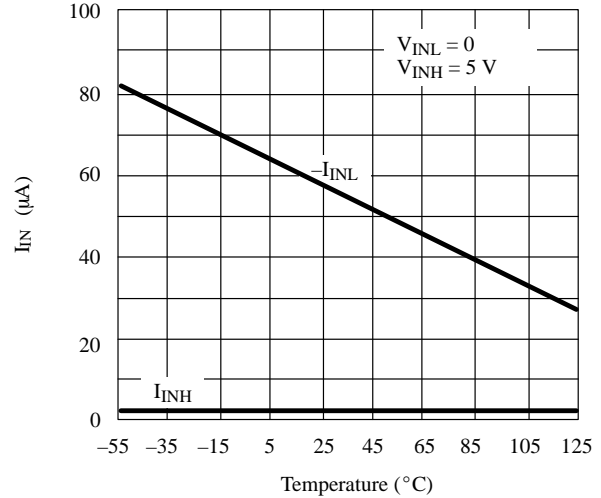
- Refer to PROCESS OPTION FLOWCHART (Section 5 of the 1994 Data Book or FaxBack number 7103).
- Room = 25°C, Full = as determined by the operating temperature suffix.
- Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- Guaranteed by design, not subject to production test.
- $V_{IN}$  = input voltage to perform proper function.

## Typical Characteristics

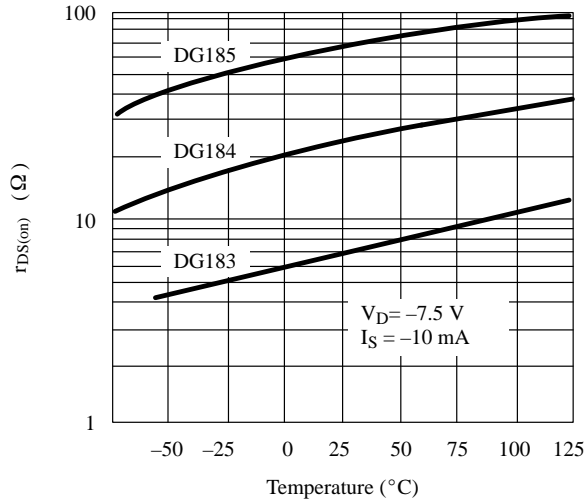
Supply Current vs. Temperature



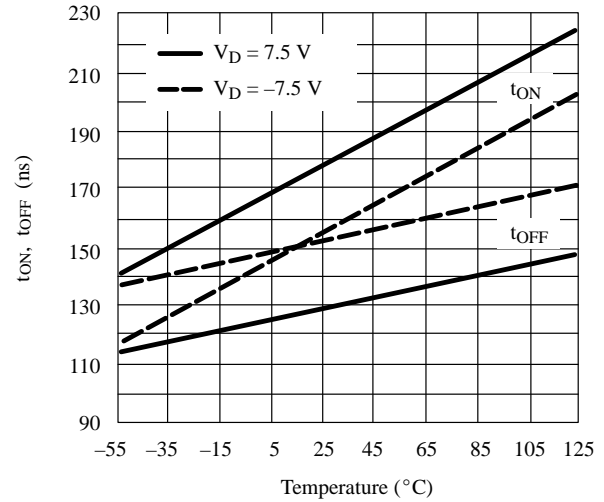
$I_{IN}$  vs.  $V_{IN}$  and Temperature



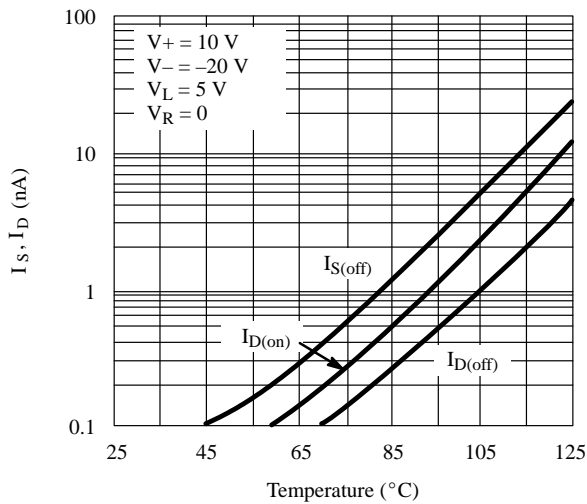
$r_{DS(on)}$  vs. Temperature



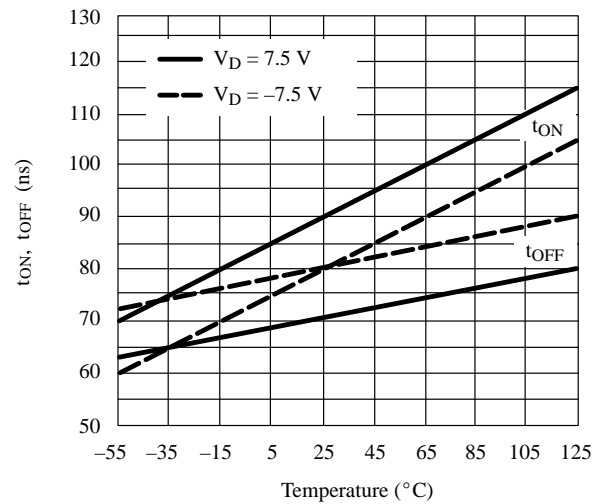
Switching Time vs.  $V_D$  and Temperature (DG183)



Leakage vs. Temperature (DG183)



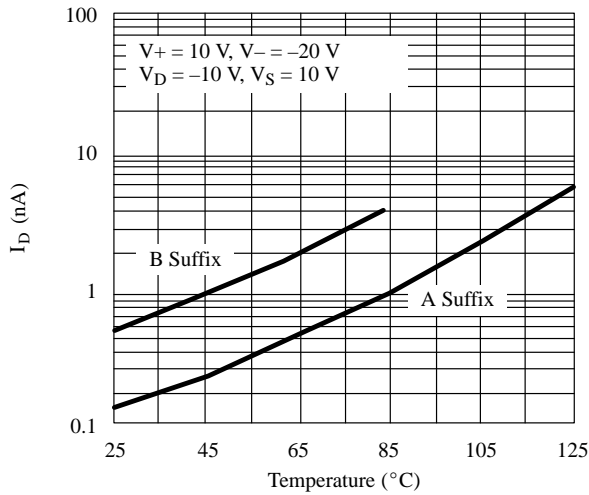
Switching Time vs.  $V_D$  and Temperature (DG184/185)



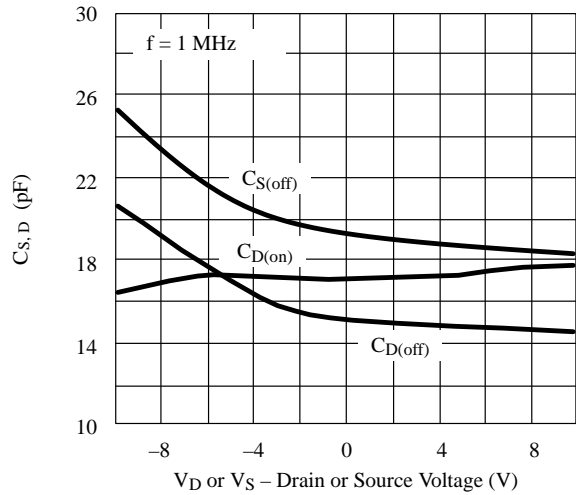
## DG183/184/185

### Typical Characteristics (Cont'd)

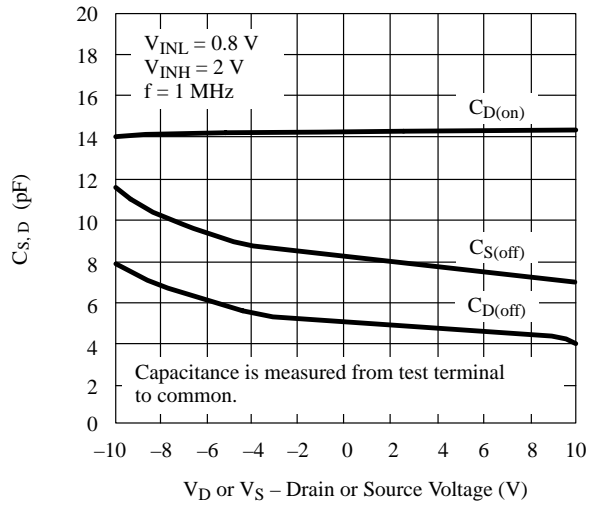
**$I_{D(off)}$  vs. Temperature (DG184/185)**



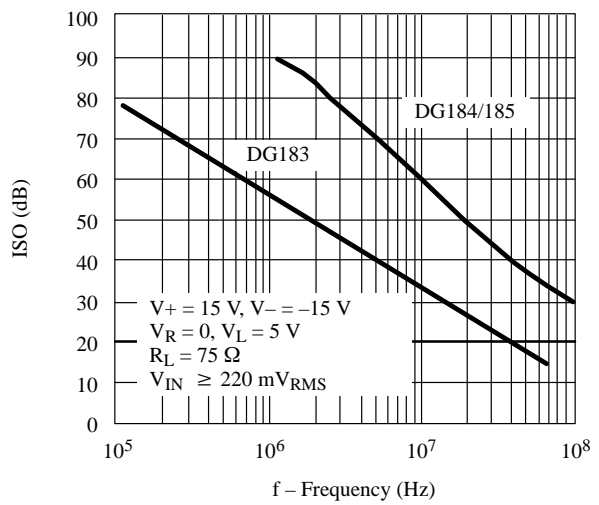
**Capacitance vs.  $V_D$  or  $V_S$  (DG183)**



**Capacitance vs.  $V_D$  or  $V_S$  (DG184/185)**



**Off Isolation vs. Frequency**



## Schematic Diagram (Typical Channel)

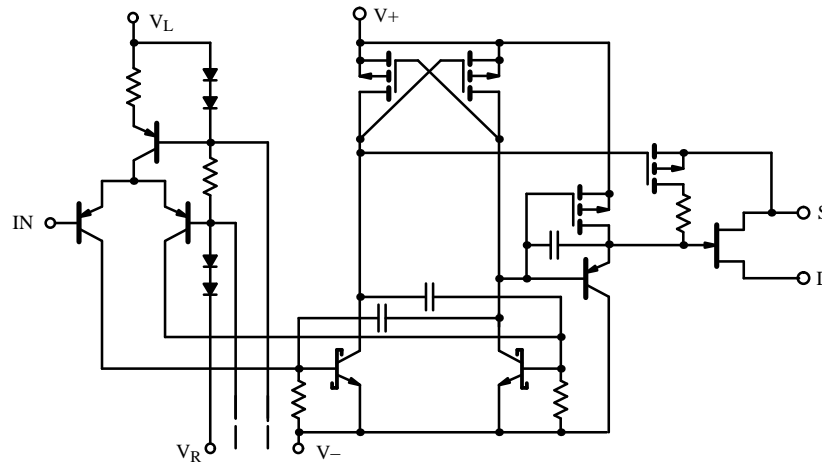
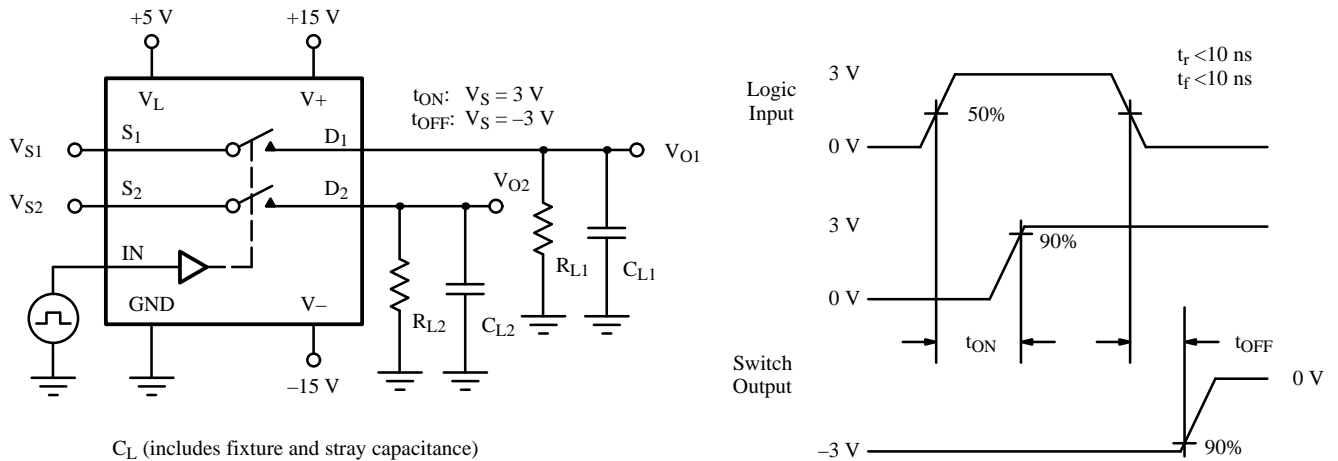


Figure 1.

## Test Circuits

Feedthrough due to charge injection may result in spikes at the leading and trailing edge of the output waveform.



$C_L$  (includes fixture and stray capacitance)

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

Figure 2. Switching Time

## Application Hints<sup>a</sup>

Switch	V+ Positive Supply Voltage (V)	V- Negative Supply Voltage (V)	V <sub>L</sub> Logic Supply Voltage (V)	V <sub>R</sub> Reference Supply Voltage (V)	V <sub>IN</sub> Logic Input Voltage V <sub>INH(min)</sub> /V <sub>INL(max)</sub> (V)	V <sub>S</sub> Analog Voltage Range (V)
DG183	15 <sup>b</sup>	-15	5	GND	2.0/0.8	-7.5 to 15
DG184	10	-20	5	GND	2.0/0.8	-12.5 to 10
	12	-12	5	GND	2.0/0.8	-4.5 to 12
DG185	15 <sup>b</sup>	-15	5	GND	2.0/0.8	-10 to 15
	10	-20	5	GND	2.0/0.8	-15 to 10
	12	-12	5	GND	2.0/0.8	-7 to 12

Notes:

- Application Hints are for DESIGN AID ONLY, not guaranteed and not subject to production testing.
- Electrical Parameter Chart based on V+ = 15 V, V<sub>L</sub> = 5 V, V<sub>R</sub> = GND.