

## 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

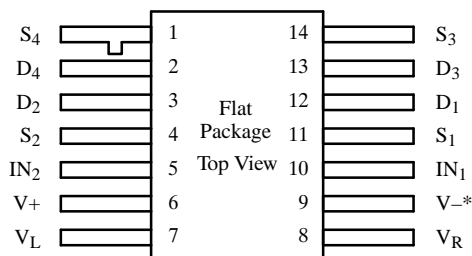
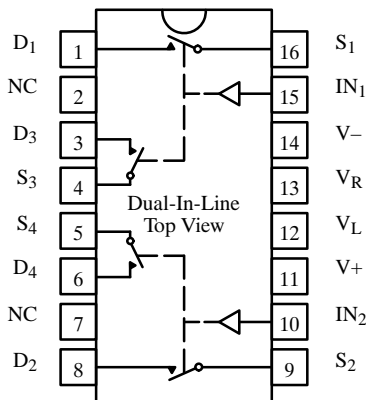
The DG183/184/185 are precision dual double-pole, single-throw (DPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

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

Truth Table

Logic	Switch
0	OFF
1	ON

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

Updates to this data sheet may be obtained via facsimile by calling Siliconix FaxBack, 1-408-970-5600. Please request FaxBack document #70032.

## Ordering Information

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

## 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		
V <sub>IN</sub> to V <sub>R</sub> .....	8 V	Notes:	
V <sub>R</sub> to V <sub>-</sub> .....	27 V	a. All leads welded or soldered to PC Board.	
V <sub>R</sub> to V <sub>IN</sub> .....	2 V	b. Derate 12 mW/°C above 75°C	
Current (S or D) DG183 .....	200 mA	c. Derate 10 mW/°C above 75°C	

## Schematic Diagram (Typical Channel)

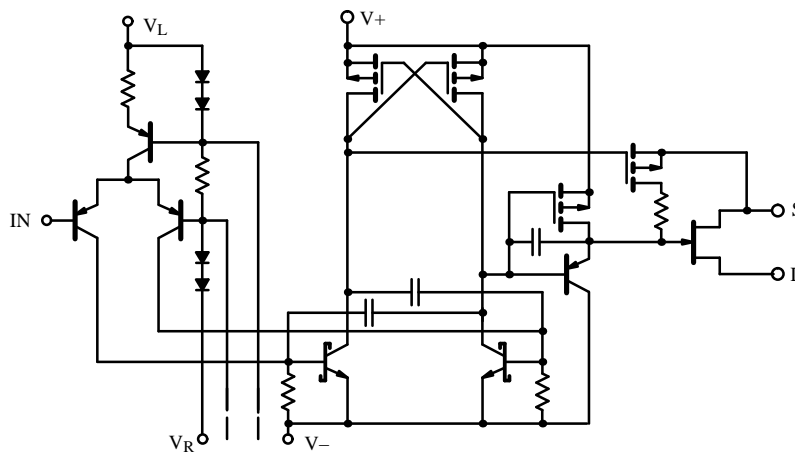


Figure 1.

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

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	7.5		10 20		15 25	$\Omega$
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		10 1000		15 300	nA
			$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	Room Hot	0.05		10 1000		15 300	
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	0.04		10 1000		15 300	
			$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	Room Hot	0.03		10 1000		15 300	
Channel On Leakage Current	$I_{D(on)}$		$V_D = V_S = \pm 7.5\text{ V}$	Room Hot	-0.1	-2 -200		-10 -200		
Saturation Drain Current	$I_{DSS}$		2 ms Pulse Duration	Room	300					mA
<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	240		400		600	ns
Turn-Off Time	$t_{off}$			Room	140		200		220	
Source-Off Capacitance	$C_{S(off)}$	f = 1 MHz	$V_S = -5\text{ V}$ , $I_D = 0$	Room	21					pF
Drain-Off Capacitance	$C_{D(off)}$		$V_D = -5\text{ V}$ , $I_S = 0$	Room	17					
Channel-On Capacitance	$C_{D(on)}$		$V_D = V_S = 0\text{ V}$	Room	17					
Off Isolation	OIRR		f = 1 MHz, $R_L = 75\ \Omega$	Room	>55					dB
<b>Power Supplies</b>										
Positive Supply Current	$I_+$	$V_{IN} = 0\text{ V}$ , or $5\text{ V}$		Room	0.6		1.5		1.5	mA
Negative Supply Current	$I_-$			Room	-2.7	-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 .
- 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.

## 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 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:

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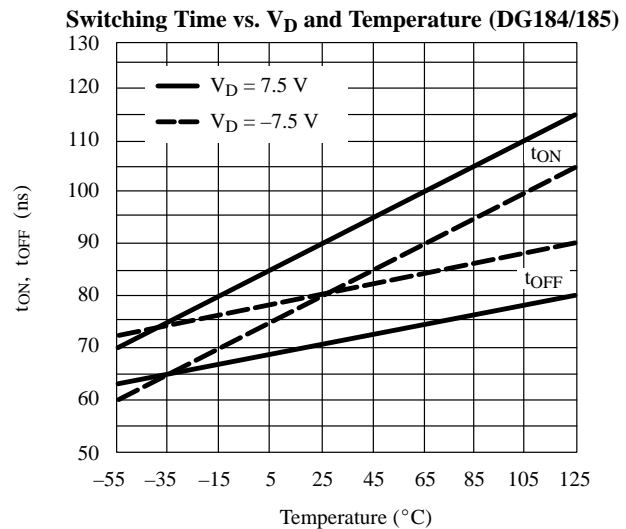
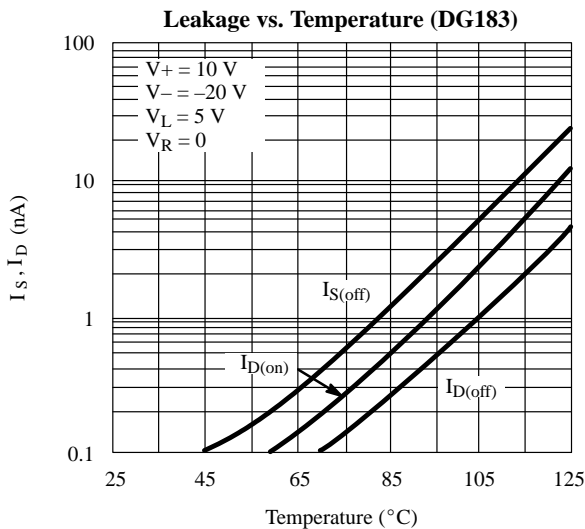
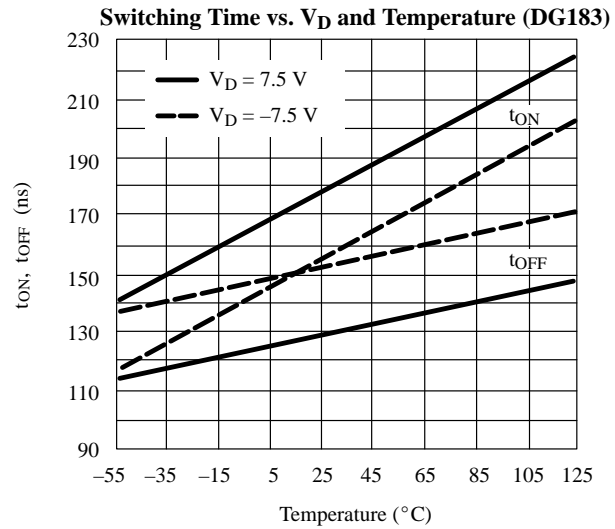
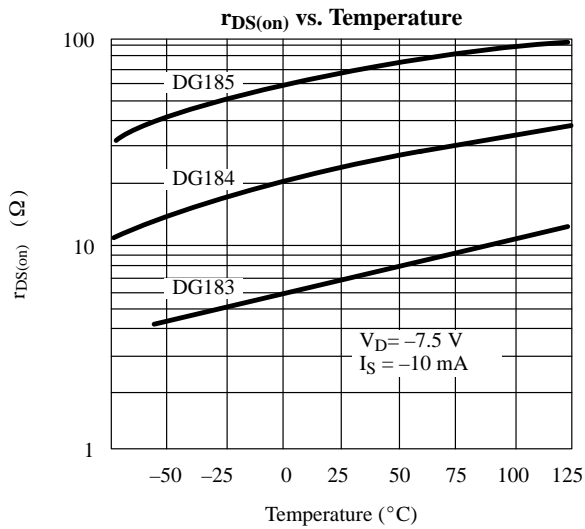
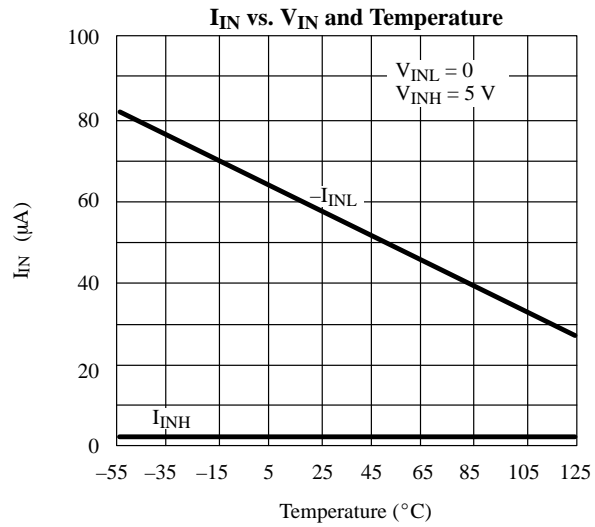
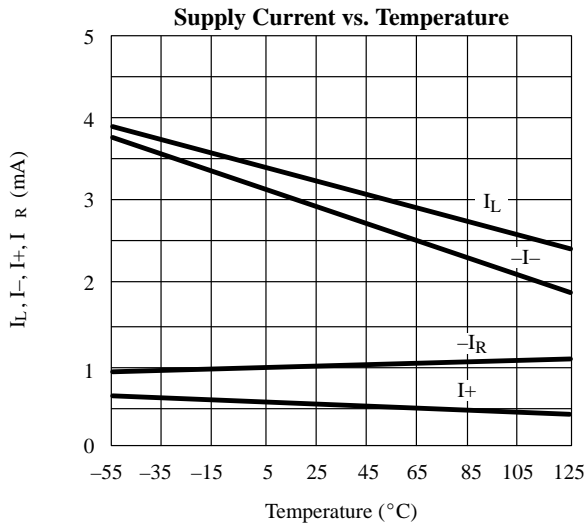
## Specifications<sup>a</sup> for DG185

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	$C_{D(off)}$		$V_S = -5\text{ V}$ , $I_D = 0$	Room	6				
Channel-On Capacitance	$C_{D(on)}$		$V_D = -5\text{ V}$ , $I_S = 0$	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		

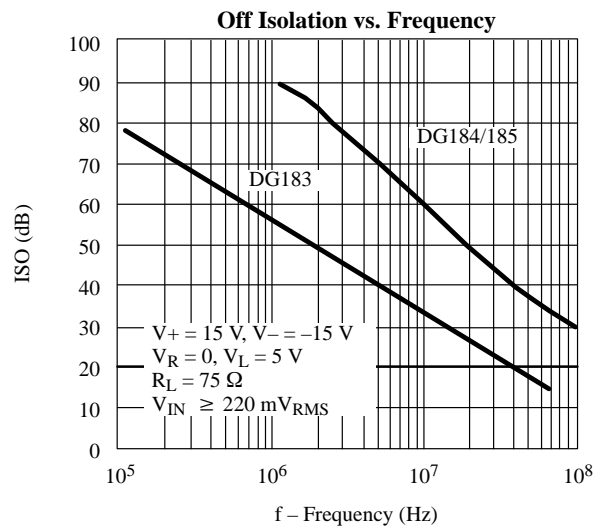
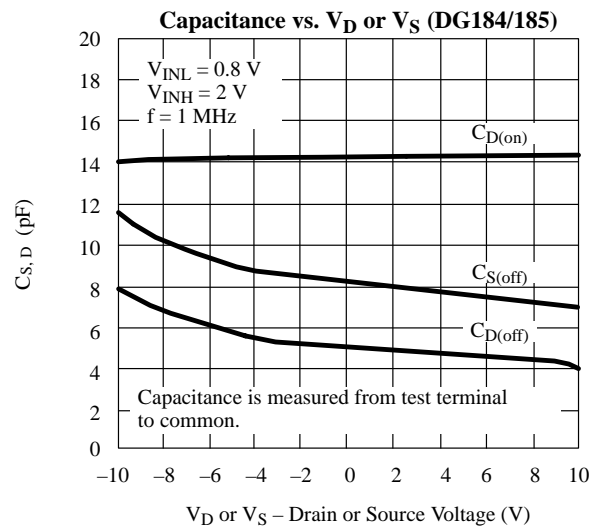
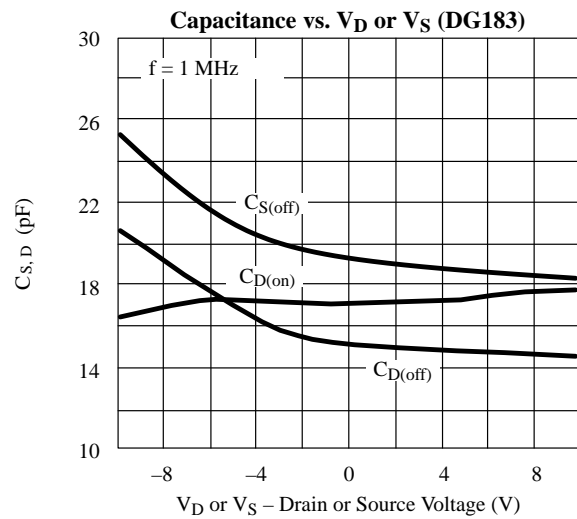
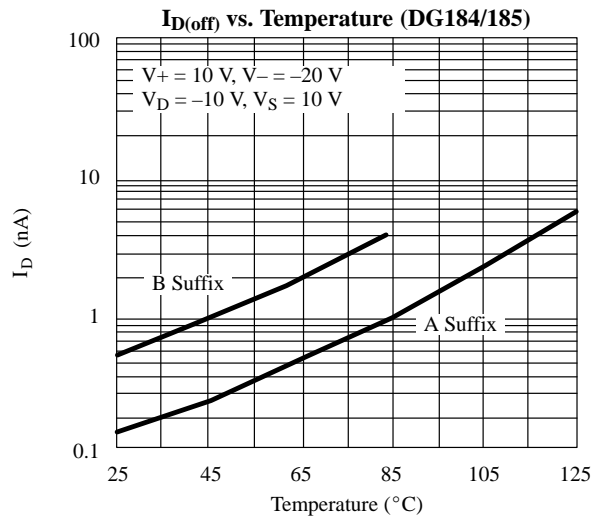
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## Typical Characteristics

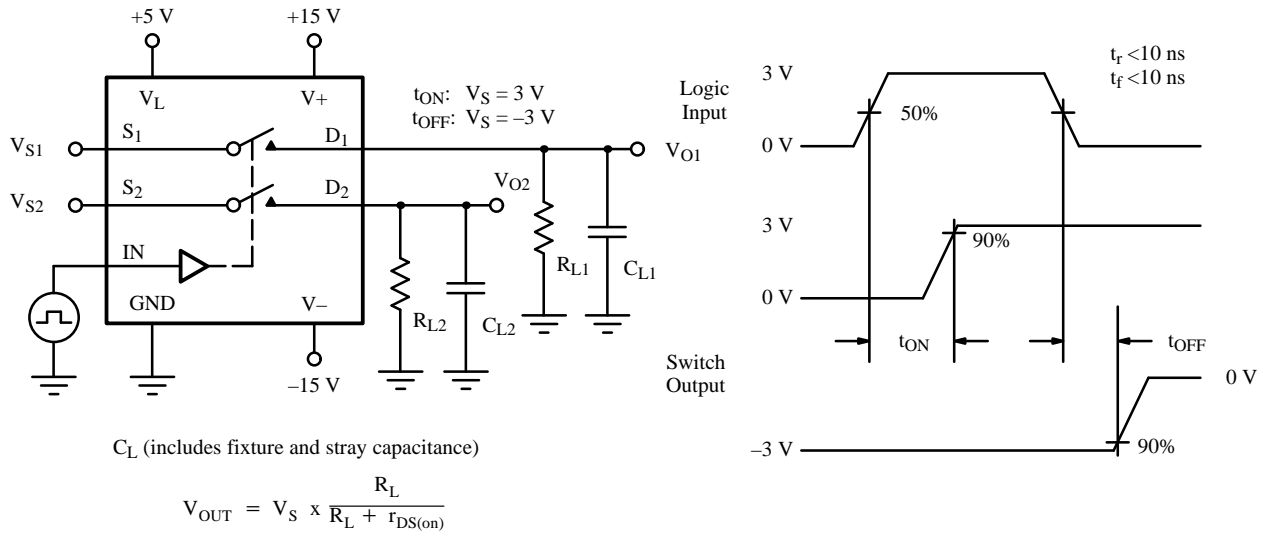


## Typical Characteristics (Cont'd)



## Test Circuits

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



**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.