

High-Speed Drivers and 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

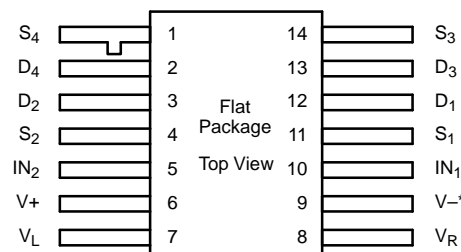
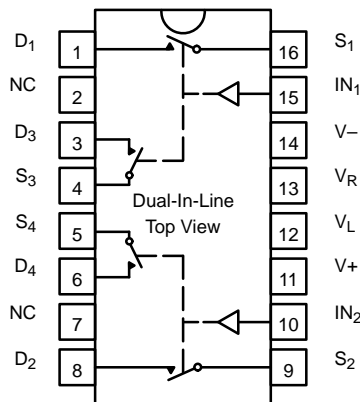
The DG183/184/185 are precision dual double-pole, single-throw (DPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

The major difference in the devices is the on-resistance (DG183—10 Ω , DG184—30 Ω , DG185—75 Ω). 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

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+ to V-	36 V	Current (S or D) DG184, DG185	30 mA
V+ to V _D	33 V	Current (All Other Pins)	30 mA
V _D to V-	33 V	Storage Temperature	-65 to 150°C
V _D to V _D	±22 V	Power Dissipation ^a	
V _L to V-	36 V	16-Pin Sidebrazed ^b	900 mW
V _L to V _{IN}	8 V	14-Pin Flat Pack ^c	900 mW
V _L to V _R	8 V		
V _{IN} to V _R	8 V		
V _R to V-	27 V		
V _R to V _{IN}	2 V		
Current (S or D) DG183	200 mA	Notes:	

- a. All leads welded or soldered to PC Board.
- b. Derate 12 mW/°C above 75°C
- c. Derate 10 mW/°C above 75°C

SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

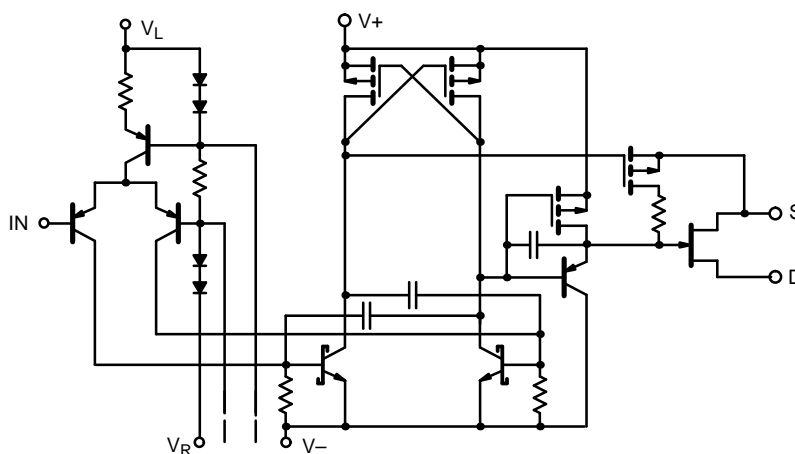


FIGURE 1.



SPECIFICATIONS ^a FOR DG183									
Parameter	Symbol	Test Conditions Unless 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 V^f	Temp ^b	Typ ^c	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	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	Ω
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
Digital Input									
Input Current with Input Voltage High	I_{INH}	$V_{IN} = 5\text{ V}$	Room Hot	<0.01		10 20		10 20	μA
Input Current with Input Voltage Low	I_{INL}	$V_{IN} = 0\text{ V}$	Full	-30	-250		-250		
Dynamic Characteristics									
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	Room	21					pF
Drain-Off Capacitance	$C_{D(off)}$		$V_S = -5\text{ V}, I_D = 0$	Room	17				
Channel-On Capacitance	$C_{D(on)}$		$V_D = -5\text{ V}, I_S = 0$	Room	17				
Off Isolation	OIRR	f = 1 MHz, $R_L = 75\ \Omega$	Room	>55					dB
Power Supplies									
Positive Supply Current	I_+	$V_{IN} = 0\text{ V}, \text{ or } 5\text{ V}$	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:

- a. Refer to PROCESS OPTION FLOWCHART.
- b. Room = 25°C, Full = as determined by the operating temperature suffix.
- c. Typical values are for DESIGN AID ONLY, not guaranteed nor subject to production testing.
- d. The algebraic convention whereby the most negative value is a minimum and the most positive a maximum, is used in this data sheet.
- e. Guaranteed by design, not subject to production test.
- f. V_{IN} = input voltage to perform proper function.



SPECIFICATIONS ^a FOR DG184									
Parameter	Symbol	Test Conditions Unless 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 V^f	Temp ^b	Typ ^c	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	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	Ω
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		
Digital Input									
Input Current with Input Voltage High	I_{INH}	$V_{IN} = 5\text{ V}$	Room Hot	<0.01		10 20		10 20	μA
Input Current with Input Voltage Low	I_{INL}	$V_{IN} = 0\text{ V}$	Full	-30	-250		-250		
Dynamic Characteristics									
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	$C_{S(off)}$	$f = 1\text{ MHz}$	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	$f = 1\text{ MHz}, R_L = 75\ \Omega$	Room	>50					dB
Power Supplies									
Positive Supply Current	I_+	$V_{IN} = 0\text{ V}, \text{ or } 5\text{ V}$	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.
- Room = 25°C, Full = as determined by the operating temperature suffix.
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- V_{IN} = input voltage to perform proper function.



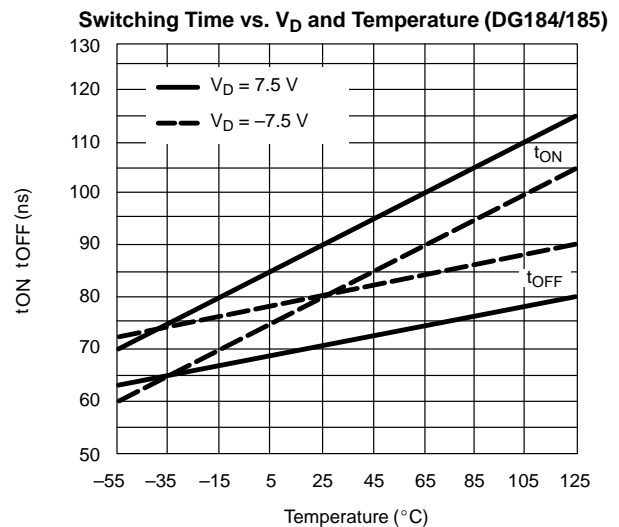
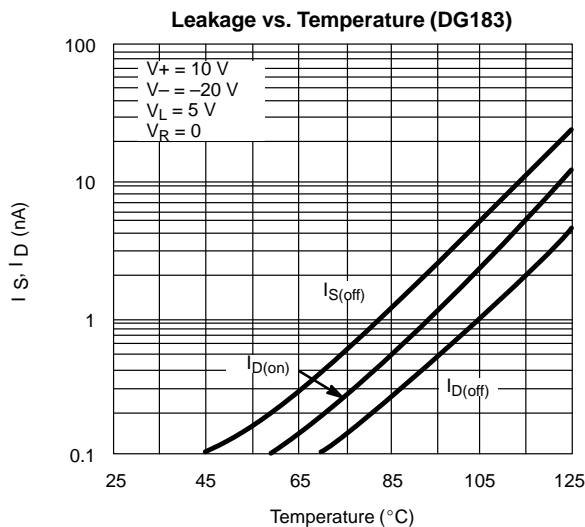
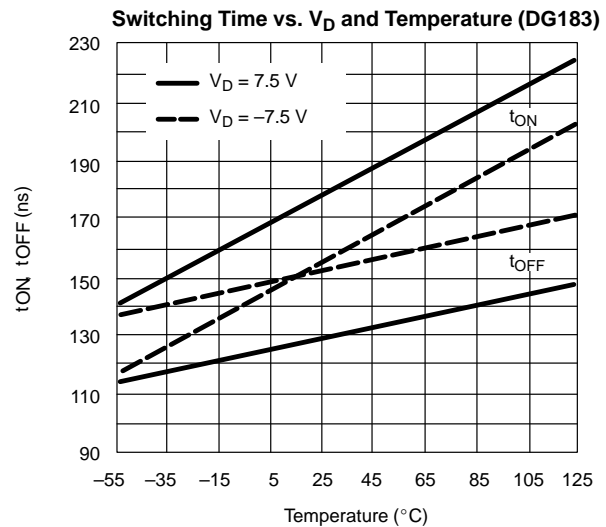
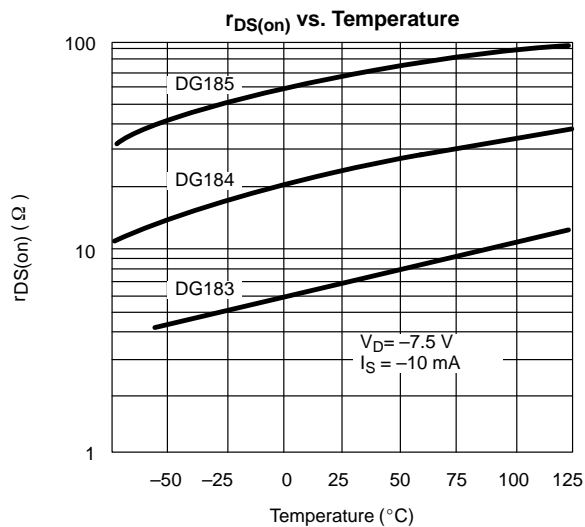
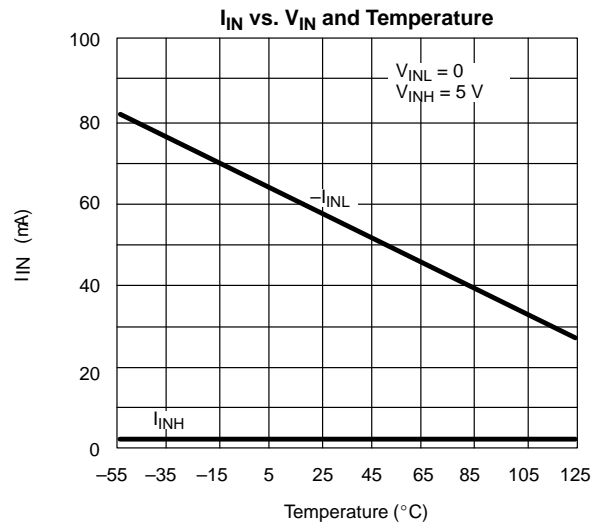
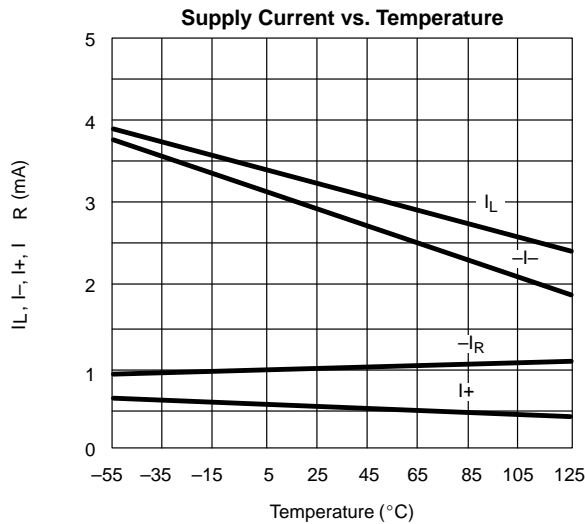
SPECIFICATIONS ^a FOR DG185									
Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 0.8\text{ V}$ or 2 V^f	Temp ^b	Typ ^c	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					Min ^d	Max ^d	Min ^d	Max ^d	
Analog Switch									
Analog Signal Range ^e	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	Ω
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		
Digital Input									
Input Current with Input Voltage High	I_{INH}	$V_{IN} = 5\text{ V}$	Room Hot	<0.01		10 20		10 20	μA
Input Current with Input Voltage Low	I_{INL}	$V_{IN} = 0\text{ V}$	Full	-30	-250		-250		
Dynamic Characteristics									
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
Power Supplies									
Positive Supply Current	I_+	$V_{IN} = 0\text{ V}, \text{ or } 5\text{ V}$	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:

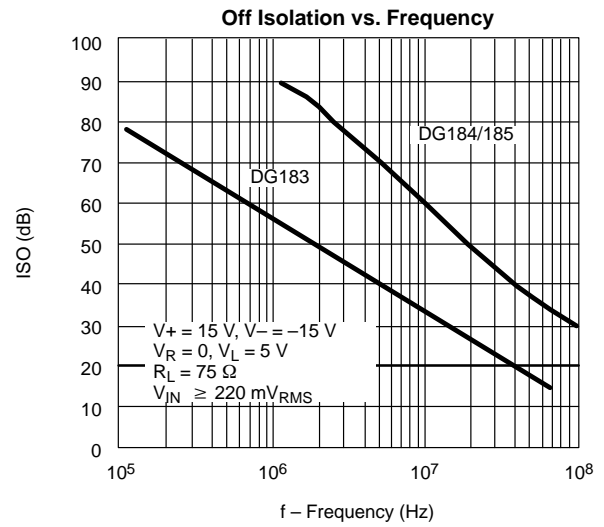
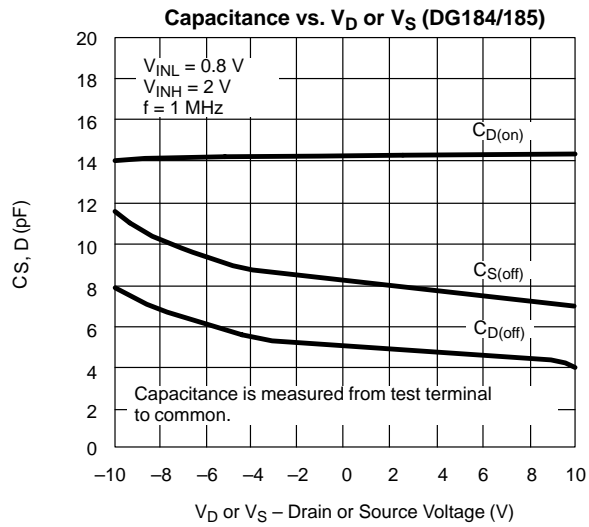
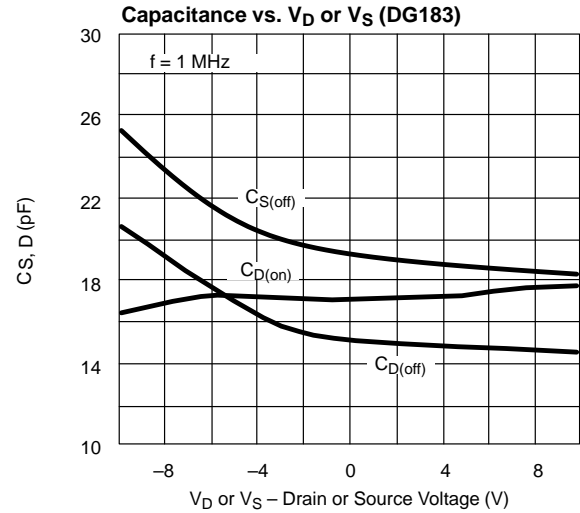
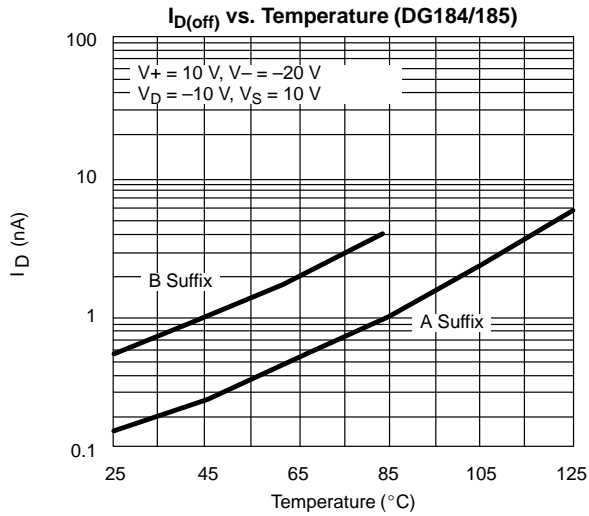
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- f. V_{IN} = input voltage to perform proper function.



TYPICAL CHARACTERISTICS (25 °C UNLESS NOTED)



TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)



TEST CIRCUITS

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

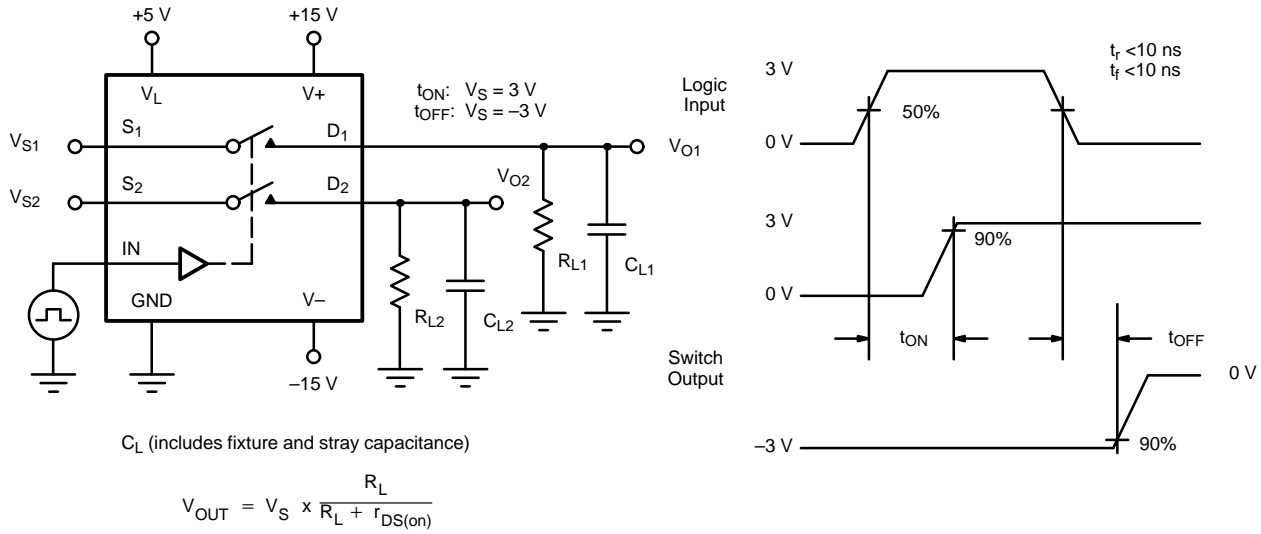


FIGURE 2. Switching Time

APPLICATION HINTS ^a						
Switch	V+ Positive Supply Voltage (V)	V- Negative Supply Voltage (V)	V _L Logic Supply Voltage (V)	V _R Reference Supply Voltage (V)	V _{IN} Logic Input Voltage V _{INH(min)} /V _{INL(max)} (V)	V _S Analog Voltage Range (V)
DG183 DG184	15 ^b	-15	5	GND	2.0/0.8	-7.5 to 15
	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 ^b	-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:

- a. Application Hints are for DESIGN AID ONLY, not guaranteed and not subject to production testing.
- b. Electrical Parameter Chart based on V+ = 15 V, V_L = 5 V, V_R = GND.



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