

## High-Speed Drivers with Dual SPST JFET Switches

### FEATURES

- Constant On-Resistance Over Entire Analog Range
- Low Leakage
- Low Crosstalk
- Rad Hardness

### BENEFITS

- Low Distortion
- Eliminates Large Signal Errors
- High Precision
- High Bandwidth Capability
- Fault Protection

### APPLICATIONS

- Audio Switching
- Video Switching
- Sample/Hold
- Guidance and Control Systems
- Aerospace

### DESCRIPTION

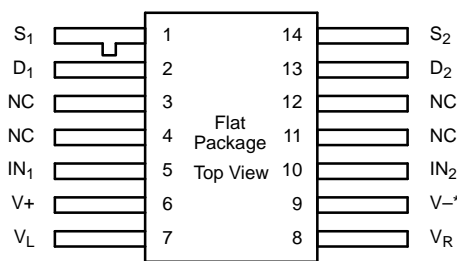
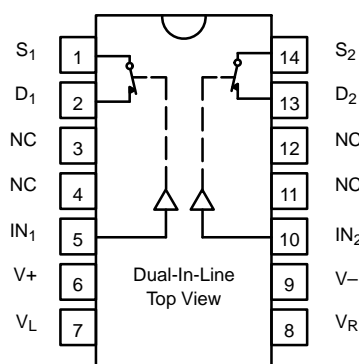
The DG180/181/182 are precision dual single-pole, single-throw (SPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

The major difference in the devices is the on-resistance (DG180—10  $\Omega$ , DG181—30  $\Omega$ , DG182—75  $\Omega$ ). Reduced errors are achieved through low leakage current ( $I_{D(on)}$  < 2 nA). Applications which benefit from the flat JFET

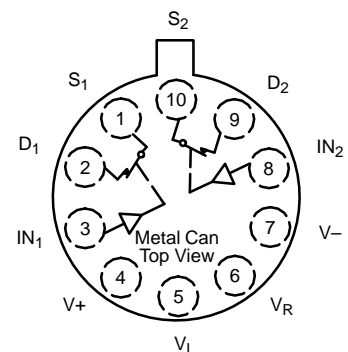
on-resistance include audio switching, video switching, and data acquisition.

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	ON
1	OFF

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

ORDERING INFORMATION		
Temp Range	Package	Part Number
-25 to 85°C	10-Pin Metal Can	DG181BA
	14-Pin Sidebrazed	DG180BP
-55 to 125°C	10-Pin Metal Can	DG180AA/883, 5962-8767301IA
		DG181AA/883, JM38510/11101BIA
		DG182AA/883, JM38510/11102BIA
	14-Pin Sidebrazed	DG180AP/883, 5962-8767301CA
		DG181AP/883, JM38510/11101BCA
		DG182AP/883, JM38510/11102BCA
	14-Pin Flat Pack	5962-8767301XA
		JM38510/11101BXA
		JM38510/11102BXA

### ABSOLUTE MAXIMUM RATINGS

$V_+$ to $V_-$ .....	36 V	Current (S or D) DG181, DG182 .....	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 $V_D$ .....	$\pm 22$ V	Power Dissipation <sup>a</sup>	
$V_L$ to $V_-$ .....	36 V	10-Pin Metal Can <sup>b</sup> .....	450 mW
$V_L$ to $V_{IN}$ .....	8 V	14-Pin Sidebrazed <sup>c</sup> .....	825 mW
$V_L$ to $V_R$ .....	8 V	14-Pin Flat Pack <sup>d</sup> .....	900 mW
$V_{IN}$ to $V_R$ .....	8 V	Notes:	
$V_R$ to $V_-$ .....	27 V	a. All leads welded or soldered to PC Board.	
$V_R$ to $V_{IN}$ .....	2 V	b. Derate 6 mW/°C above 75°C	
Current (S or D) DG180 .....	200 mA	c. Derate 11 mW/°C above 75°C	
		d. Derate 10 mW/°C above 75°C	

### SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

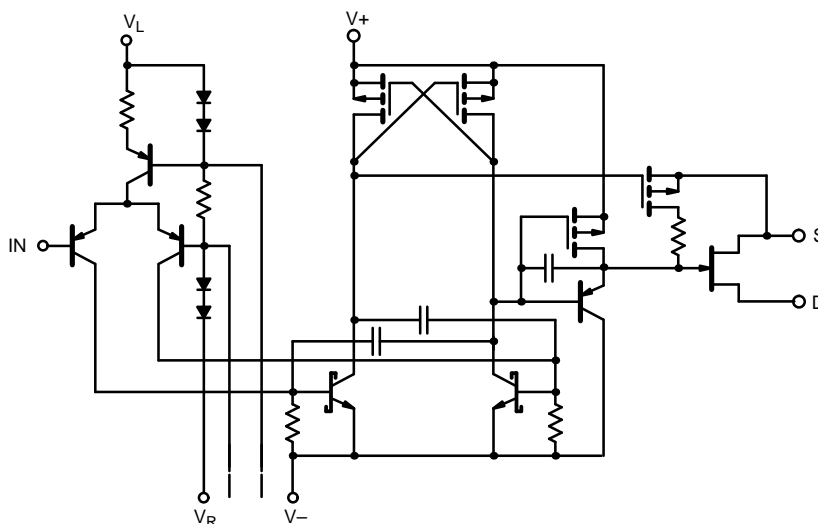


FIGURE 1.



SPECIFICATIONS <sup>a</sup> FOR DG180									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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		250	
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
<b>Power Supplies</b>									
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		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 <sup>a</sup> FOR DG181									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}$ , $V_- = -15\text{ V}$ , $V_L = 5\text{ V}$ $V_R = 0\text{ V}$ , $V_{IN} = 2\text{ V}$ , $0.8\text{ V}^f$	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	18		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	0.05		1 100		5 100	nA
		$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	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	0.5		1 100		5 100	
		$V_S = \pm 7.5\text{ V}$ , $V_D = \mp 7.5\text{ V}$	Room Hot	0.6		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	$C_{D(off)}$		$V_S = -5\text{ V}$ , $I_D = 0$	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 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:

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



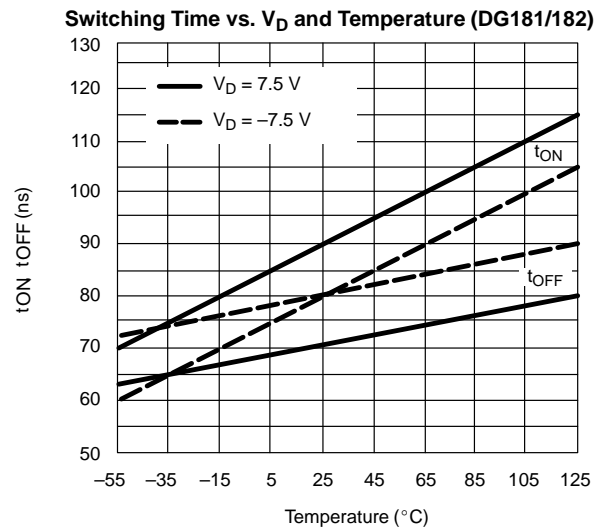
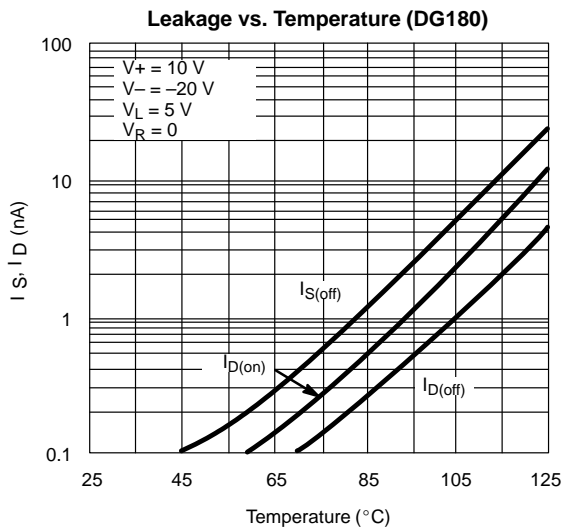
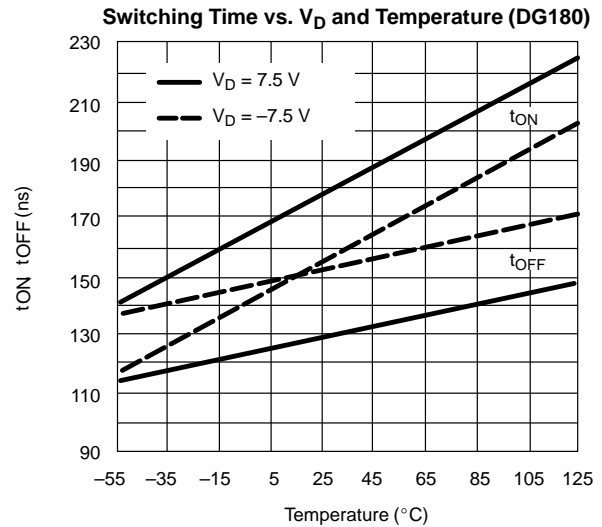
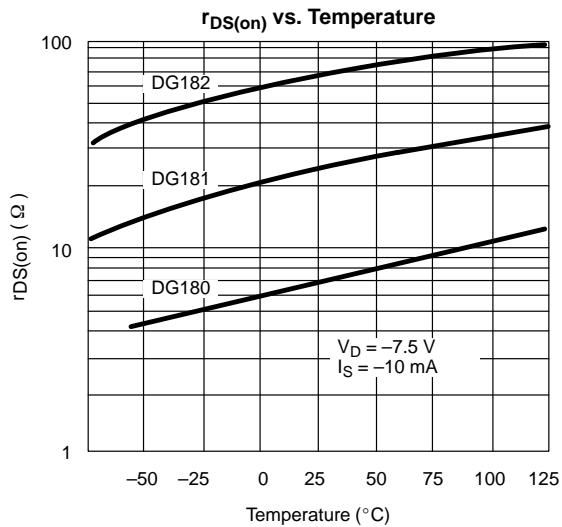
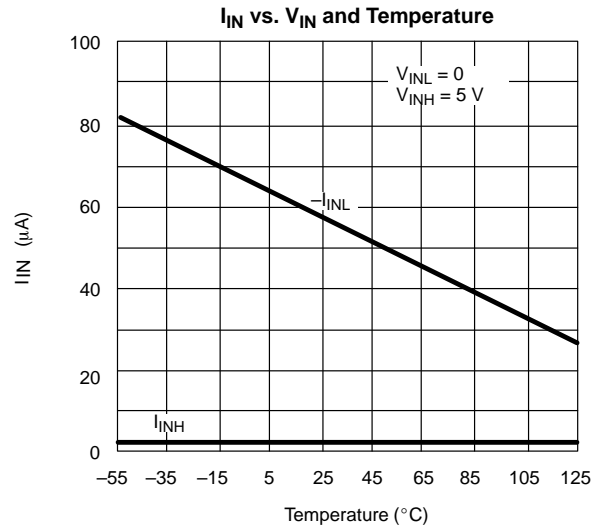
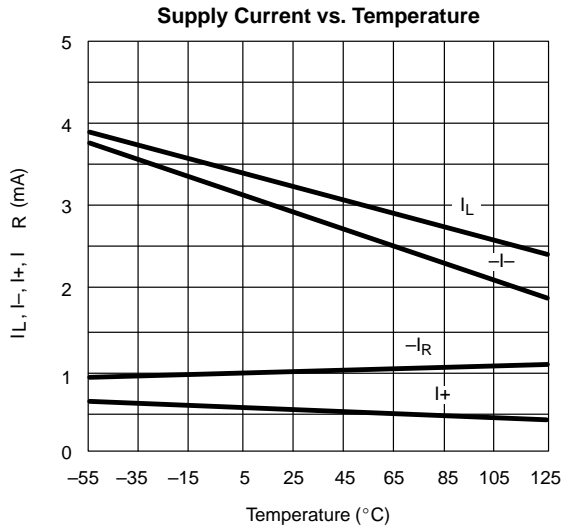
SPECIFICATIONS <sup>a</sup> FOR DG182									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					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	0.5		1 100		5 100	
Channel On Leakage Current	$I_{D(on)}$	$V_D = V_S = \pm 10\text{ V}$	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	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	$I_+$	$V_{IN} = 0\text{ V}, \text{ or } 5\text{ V}$	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:

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- b. Room = 25°C, Full = as determined by the operating temperature suffix.
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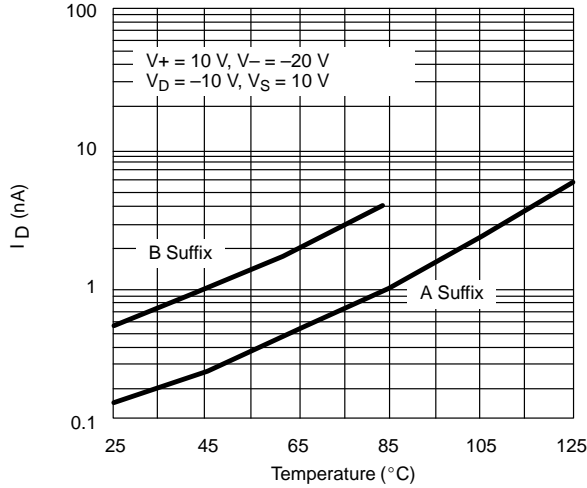


**TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)**

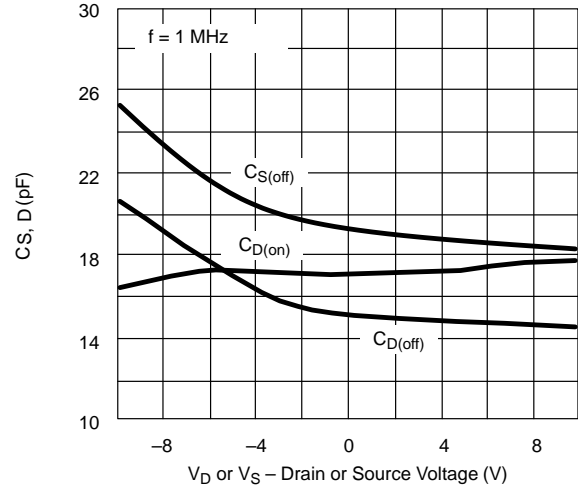


### TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

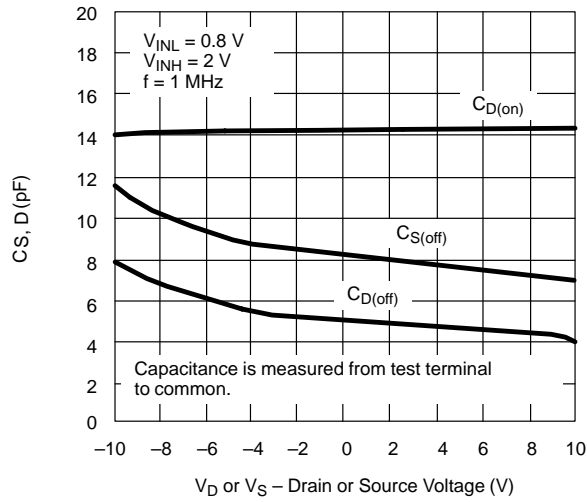
**$I_{D(off)}$  vs. Temperature (DG181/182)**



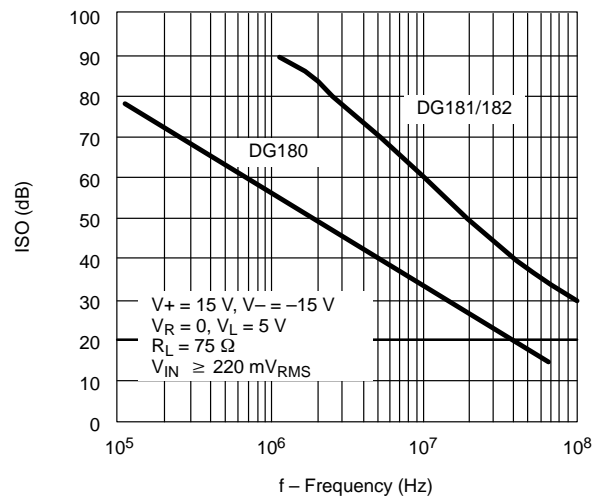
**Capacitance vs.  $V_D$  or  $V_S$  (DG180)**



**Capacitance vs.  $V_D$  or  $V_S$  (DG181/182)**



**Off Isolation vs. Frequency**



### TEST CIRCUITS

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

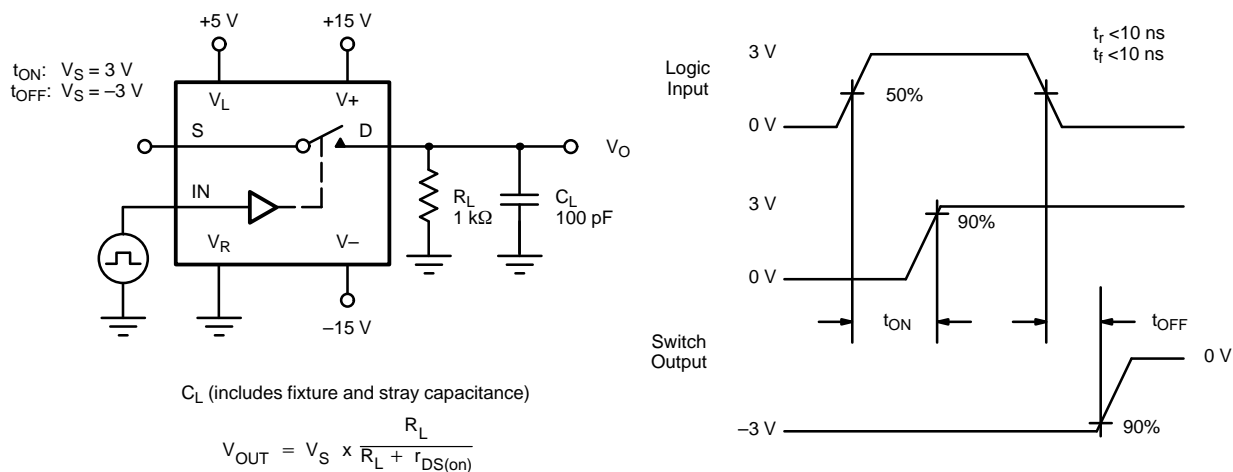


FIGURE 2. Switching Time

### 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)
DG180 DG181	15 <sup>b</sup>	-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
DG182	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





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