

## 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

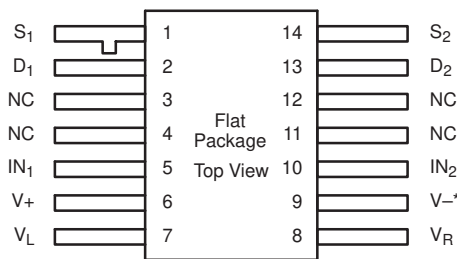
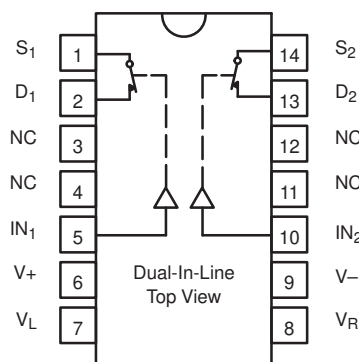
The DG180/181/182 are precision dual single-pole, single-throw (SPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

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

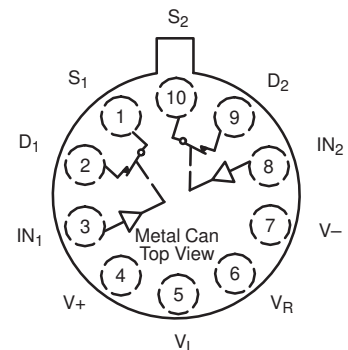
on-resistance include audio switching, video switching, and data acquisition.

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)

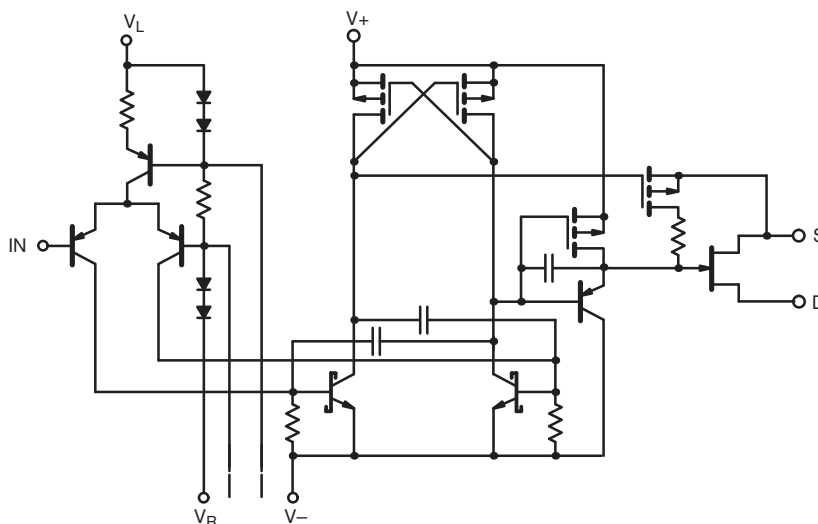


FIGURE 1.



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	$C_{S(off)}$	$f = 1\text{ MHz}$	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	$f = 1\text{ MHz}, R_L = 75\ \Omega$	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						pF	
Drain-Off Capacitance	$C_{D(off)}$									$V_S = -5\text{ V}, I_D = 0$
Channel-On Capacitance	$C_{D(on)}$									$V_D = -5\text{ V}, I_S = 0$
Off Isolation	OIRR	$f = 1\text{ MHz}, R_L = 75\text{ }\Omega$	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:

- 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.



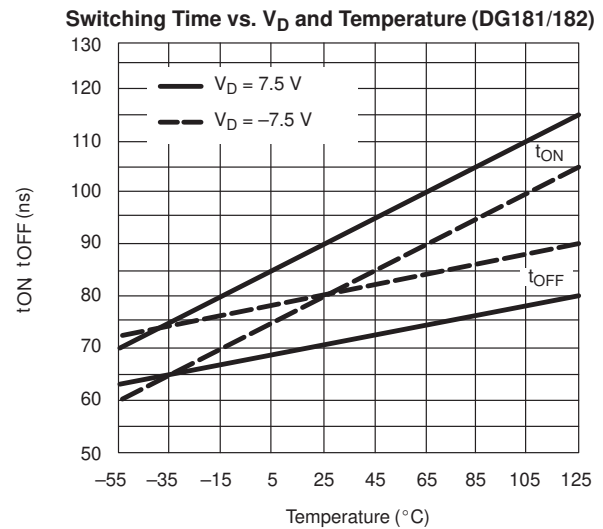
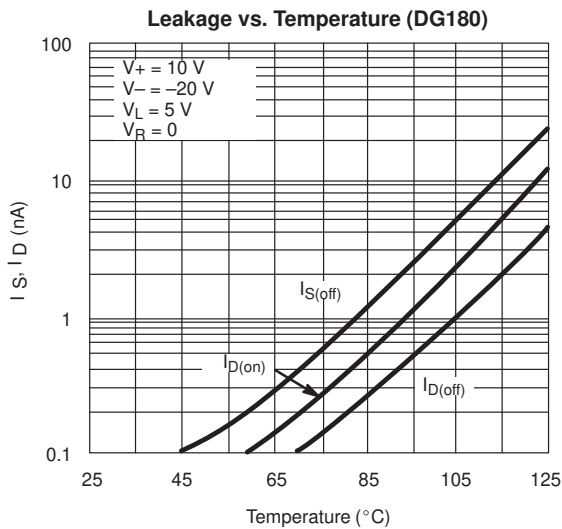
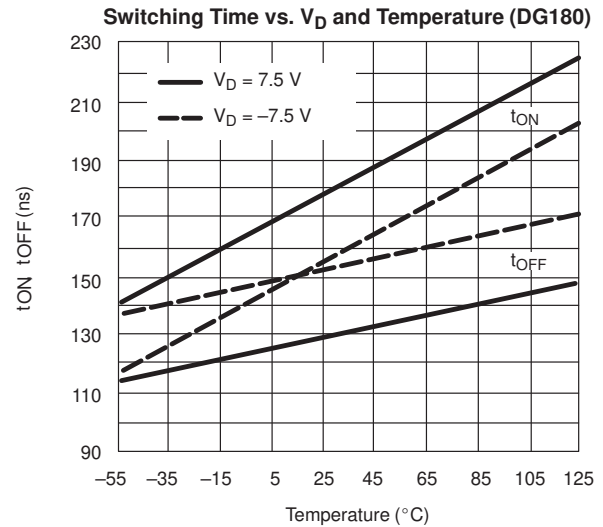
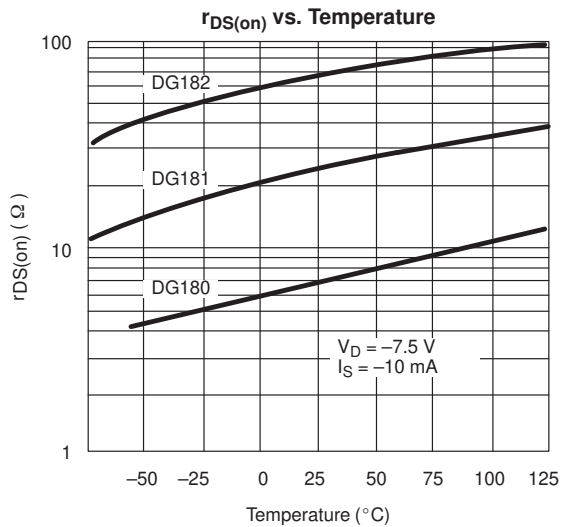
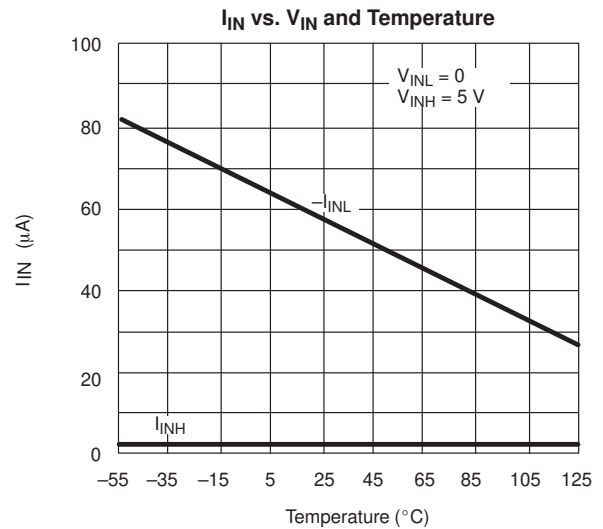
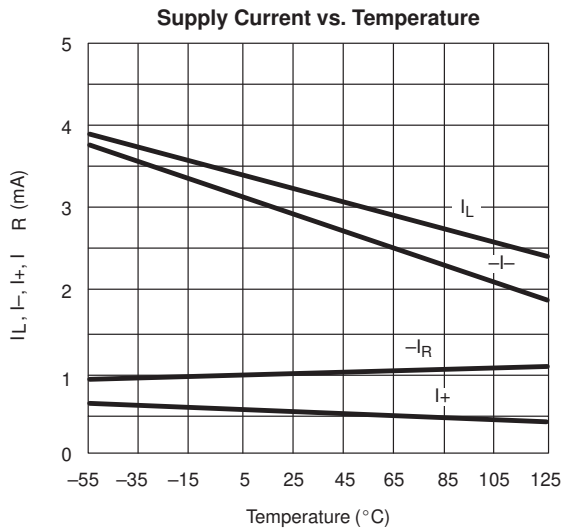
SPECIFICATIONS <sup>a</sup> FOR DG182									
Parameter	Symbol	Test Conditions Unless Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	Temp <sup>b</sup>	Typ <sup>c</sup>	A Suffix -55 to 125°C		B Suffix -25 to 85°C		Unit
					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:

- 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.

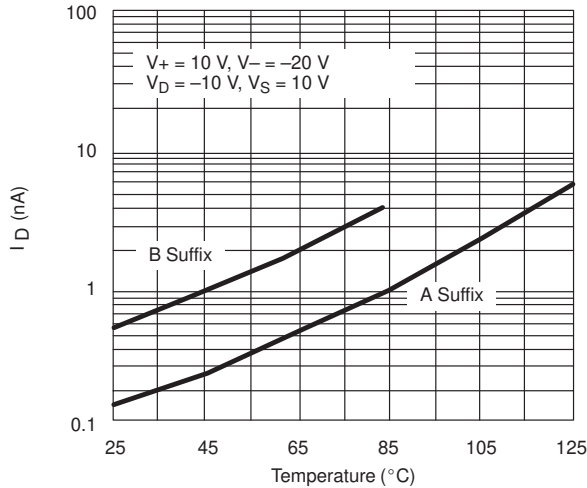


### TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

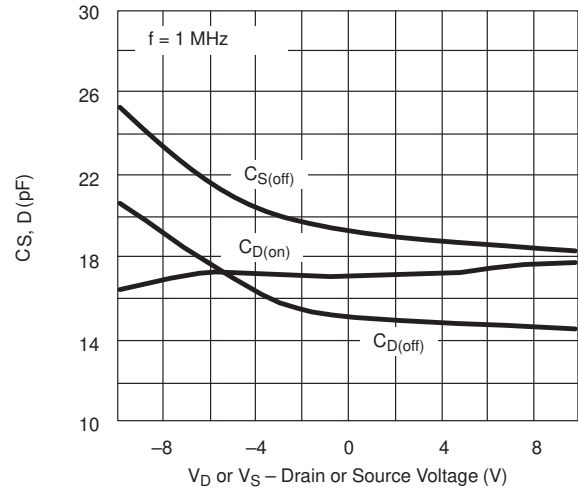


### TYPICAL CHARACTERISTICS (25°C UNLESS NOTED)

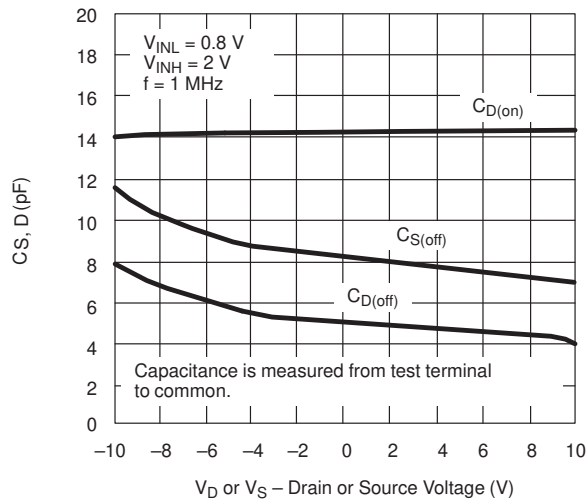
**$I_{D(off)}$  vs. Temperature (DG181/182)**



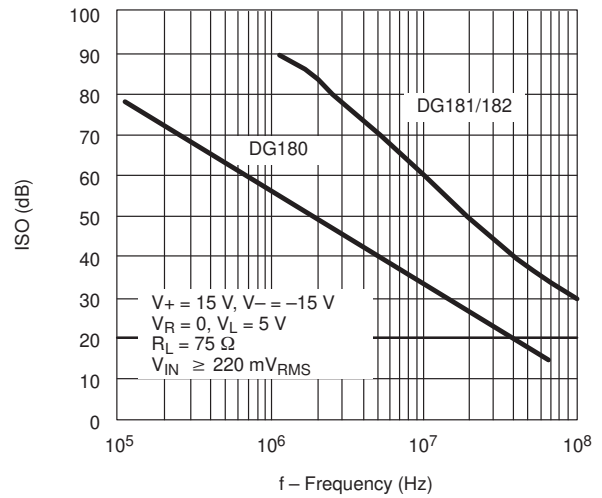
**Capacitance vs.  $V_D$  or  $V_S$  (DG180)**



**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.

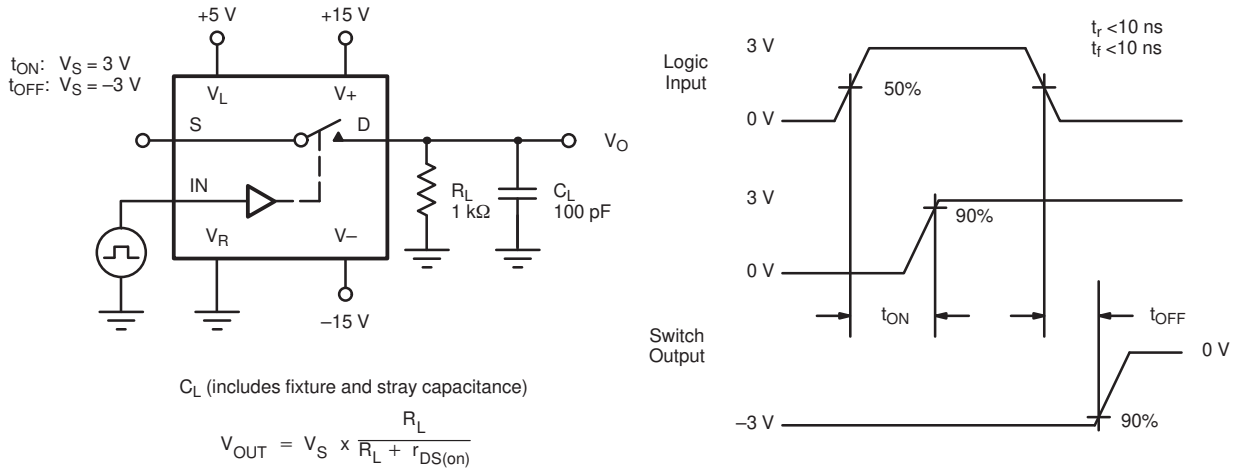


FIGURE 2. Switching Time

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:  
 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<sub>L</sub> = 5 V, V<sub>R</sub> = GND





## Disclaimer

All product specifications and data are subject to change without notice.

Vishay Intertechnology, Inc., its affiliates, agents, and employees, and all persons acting on its or their behalf (collectively, "Vishay"), disclaim any and all liability for any errors, inaccuracies or incompleteness contained herein or in any other disclosure relating to any product.

Vishay disclaims any and all liability arising out of the use or application of any product described herein or of any information provided herein to the maximum extent permitted by law. The product specifications do not expand or otherwise modify Vishay's terms and conditions of purchase, including but not limited to the warranty expressed therein, which apply to these products.

No license, express or implied, by estoppel or otherwise, to any intellectual property rights is granted by this document or by any conduct of Vishay.

The products shown herein are not designed for use in medical, life-saving, or life-sustaining applications unless otherwise expressly indicated. Customers using or selling Vishay products not expressly indicated for use in such applications do so entirely at their own risk and agree to fully indemnify Vishay for any damages arising or resulting from such use or sale. Please contact authorized Vishay personnel to obtain written terms and conditions regarding products designed for such applications.

Product names and markings noted herein may be trademarks of their respective owners.