

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

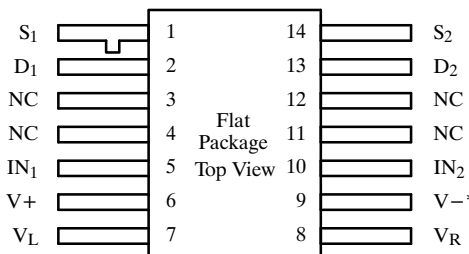
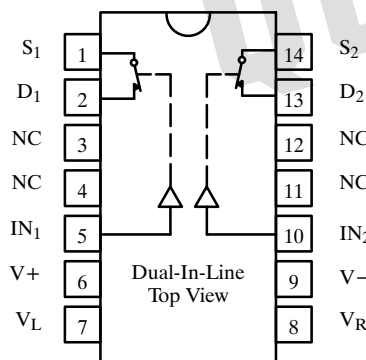
The DG180/181/182 are precision dual single-pole, single-throw (SPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

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

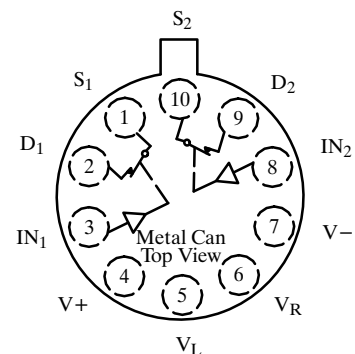
which benefit from the flat JFET on-resistance include audio switching, video switching, and data acquisition.

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



Ordering Information – DG180/181/182

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

*Common to Substrate and Case

Truth Table

Logic	Switch
0	ON
1	OFF

Logic "0" ≤ 0.8 V
Logic "1" ≥ 2.0 V

Switches Shown for Logic "0" Input

DG180/181/182

Absolute Maximum Ratings

V+ to V-	36 V	Current (All Other Pins)	30 mA
V+ to V _D	33 V	Storage Temperature	-65 to 150°C
V _D to V-	33 V	Power Dissipation ^a	
V _D to V _D	±22 V	10-Pin Metal Can ^b	450 mW
V _L to V-	36 V	14-Pin Sidebrazed ^c	825 mW
V _L to V _{IN}	8 V	14-Pin Flat Pack ^d	900 mW
V _L to V _R	8 V		
V _{IN} to V _R	8 V		
V _R to V-	27 V	Notes	
V _R to V _{IN}	2 V	a. All leads welded or soldered to PC Board.	
Current (S or D) DG180	200 mA	b. Derate 6 mW/°C above 75°C	
Current (S or D) DG181, DG182	30 mA	c. Derate 11 mW/°C above 75°C	
		d. Derate 10 mW/°C above 75°C	

Specifications^a for DG180

Parameter	Symbol	Test Conditions Unless Otherwise Specified V+ = 15 V, V- = -15 V, V _L = 5 V V _R = 0 V, V _{IN} = 2 V, 0.8 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 mA, V _D = -7.5 V	Room Full	7.5		10 20		15 25	Ω	
Source Off Leakage Current	I _{S(off)}	V _S = ±10 V, V _D = ∓10 V V+ = 10 V, V- = -20 V	Room Hot	0.05		10 1000		15 300	nA	
		V _S = ±7.5 V, V _D = ∓7.5 V	Room Hot	0.05		10 1000		15 300		
Drain Off Leakage Current	I _{D(off)}	V _S = ±10 V, V _D = ∓10 V V+ = 10 V, V- = -20 V	Room Hot	0.04		10 1000		15 300		
		V _S = ±7.5 V, V _D = ∓7.5 V	Room Hot	0.03		10 1000		15 300		
Channel On Leakage Current	I _{D(on)}	V _D = V _S = ±7.5 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 V	Room Hot	<0.01		10 20		10 20	μA	
Input Current with Input Voltage Low	I _{INL}	V _{IN} = 0 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		250		
Source-Off Capacitance	C _{S(off)}	f = 1 MHz	Room	21					pF	
Drain-Off Capacitance	C _{D(off)}									V _S = -5 V, I _S = 0
Channel-On Capacitance	C _{D(on)}									V _D = V _S = 0 V
Off Isolation	OIRR	f = 1 MHz, R _L = 75 Ω	Room	>55					dB	

Specifications^a for DG180

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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	
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		4.5		4.5	
Reference Supply Current	I _R		Room	-1	-2		-2		

Specifications^a for DG181

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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	18		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	0.05		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		
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 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 Ω	Room	>50					dB

DG180/181/182

Specifications^a for DG181

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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	
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		

Specifications^a for DG182

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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	0.5		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		
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	$C_{S(off)}$	$f = 1\text{ MHz}$	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

Specifications^a for DG182

Parameter	Symbol	Test Conditions Unless Otherwise Specified $V_+ = 15\text{ V}, V_- = -15\text{ V}, V_L = 5\text{ V}$ $V_R = 0\text{ V}, V_{IN} = 2\text{ V}, 0.8\text{ V}^f$	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	
Power Supplies									
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 (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.

Schematic Diagram (Typical Channel)

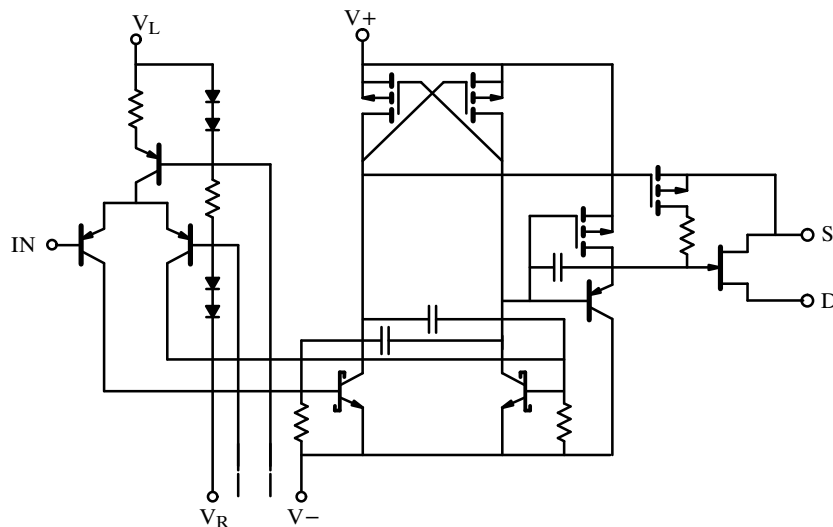


Figure 1.

DG180/181/182

Test Circuits

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

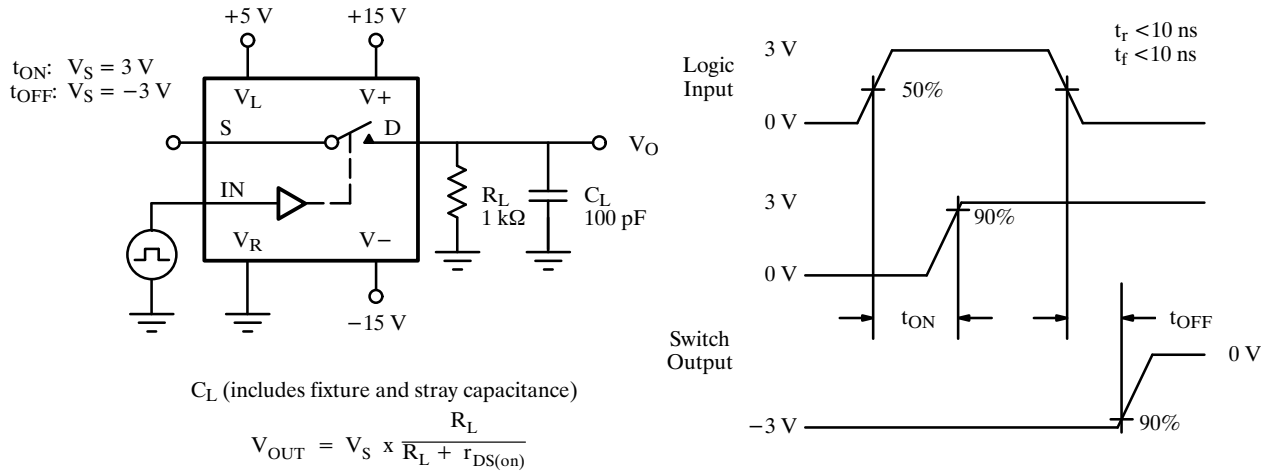


Figure 2. Switching Time

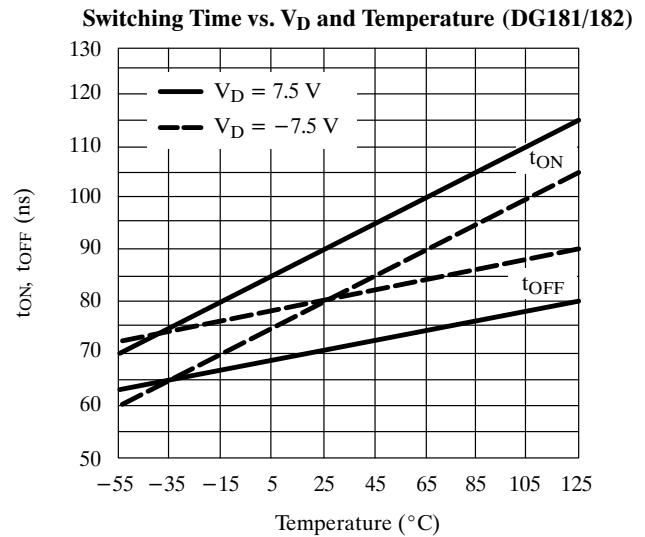
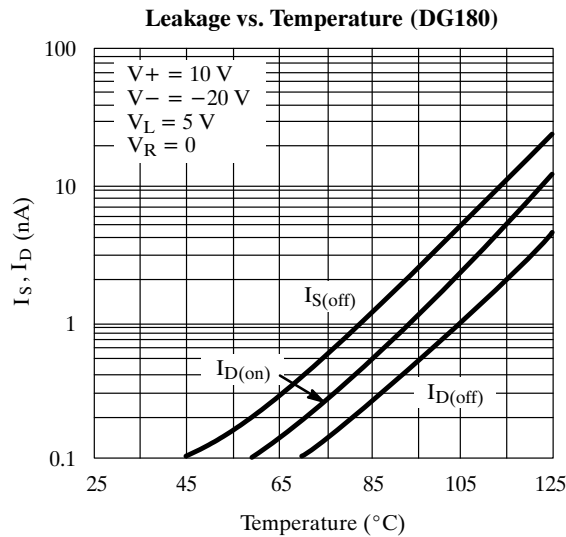
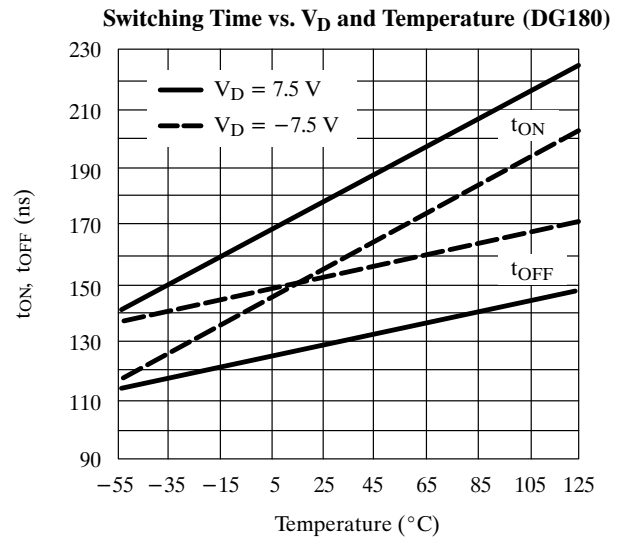
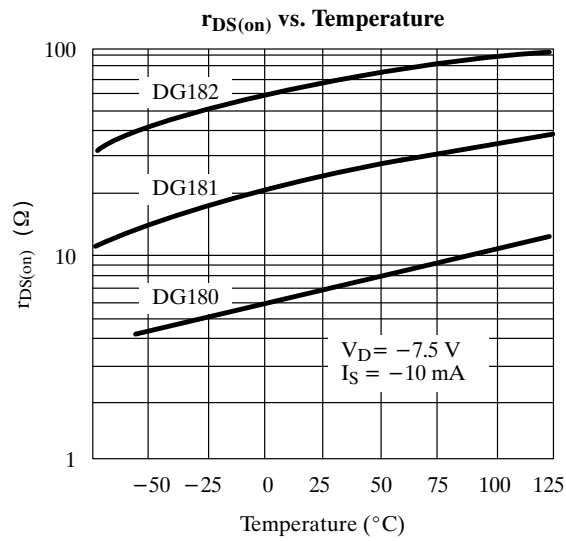
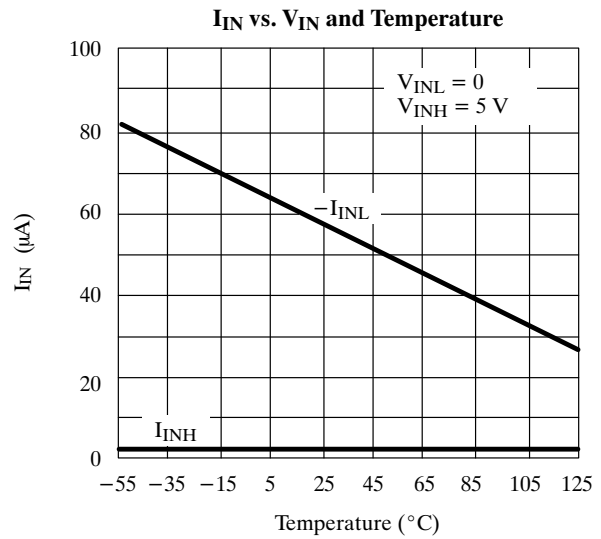
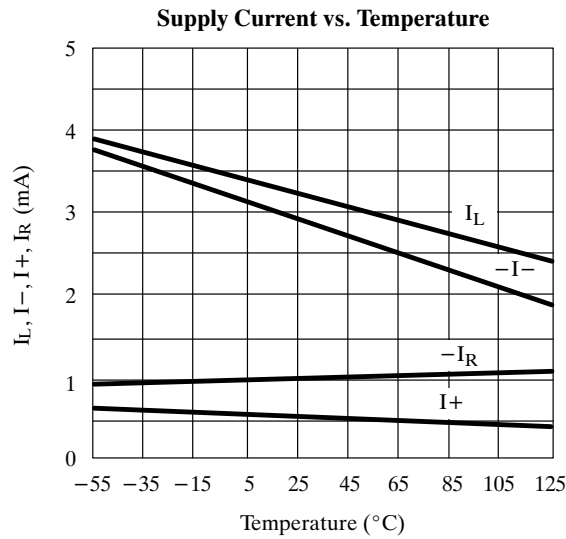
Application Hints^a

Switch	V+ Positive Supply Voltage (V)	V- Negative Sup- ply Voltage (V)	VL Logic Supply Voltage (V)	VR Reference Supply Voltage (V)	VIN Logic Input Voltage VINH(min)/ VINL(max) (V)	VS Analog Voltage Range (V)
DG180 DG181	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
DG182	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

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

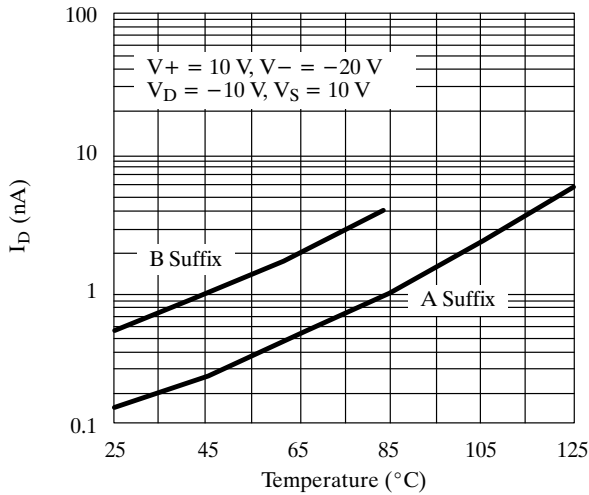
Typical Characteristics



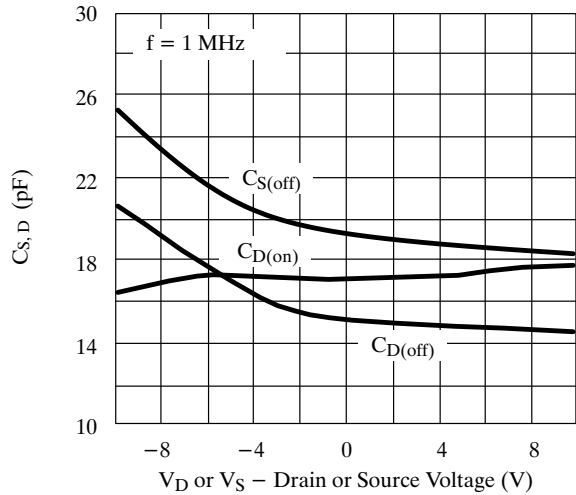
DG180/181/182

Typical Characteristics (Cont'd)

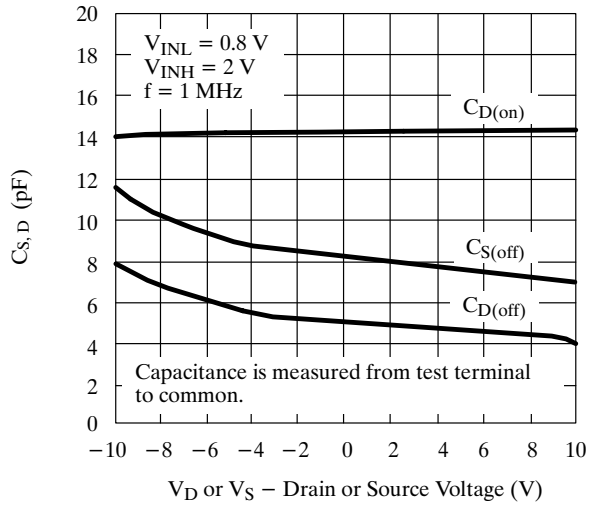
$I_{D(off)}$ vs. Temperature (DG181/182)



Capacitance vs. V_D or V_S (DG180)



Capacitance vs. V_D or V_S (DG181/182)



Off Isolation vs. Frequency

