

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

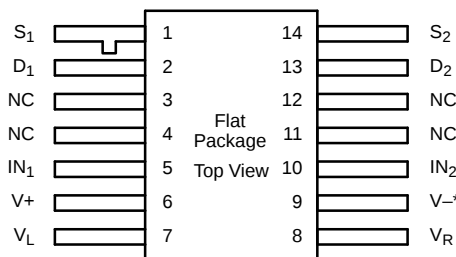
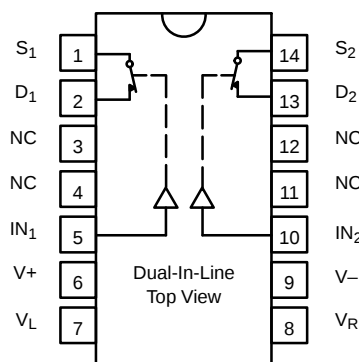
The DG180/181/182 are precision dual single-pole, single-throw (SPST) analog switches designed to provide accurate switching of video and audio signals. This series is ideally suited for applications requiring a constant on-resistance over the entire analog range.

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

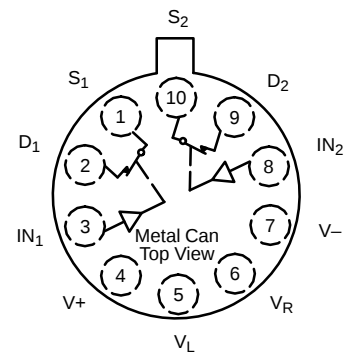
on-resistance include audio switching, video switching, and data acquisition.

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



*Common to Substrate and Case

TRUTH TABLE	
Logic	Switch
0	ON
1	OFF

Logic "0" ≤ 0.8 V
Logic "1" ≥ 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, 5962-87673011A
		DG181AA/883, JM38510/11101B1A
		DG182AA/883, JM38510/11102B1A
	14-Pin Sidebrazed	DG180AP/883, 5962-87673011CA
		DG181AP/883, JM38510/11101BCA
		DG182AP/883, JM38510/11102BCA
	14-Pin Flat Pack	5962-87673011XA
		JM38510/11101BXA
		JM38510/11102BXA

ABSOLUTE MAXIMUM RATINGS

V_+ to V_-	36 V
V_+ to V_D	33 V
V_D to V_-	33 V
V_D to V_D	± 22 V
V_L to V_-	36 V
V_L to V_{IN}	8 V
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) DG180	200 mA

Current (S or D) DG181, DG182	30 mA
Current (All Other Pins)	30 mA
Storage Temperature	-65 to 150°C
Power Dissipation ^a	
10-Pin Metal Can ^b	450 mW
14-Pin Sidebrazed ^c	825 mW
14-Pin Flat Pack ^d	900 mW

Notes:

- All leads welded or soldered to PC Board.
- Derate 6 mW/°C above 75°C
- Derate 11 mW/°C above 75°C
- Derate 10 mW/°C above 75°C

SCHEMATIC DIAGRAM (TYPICAL CHANNEL)

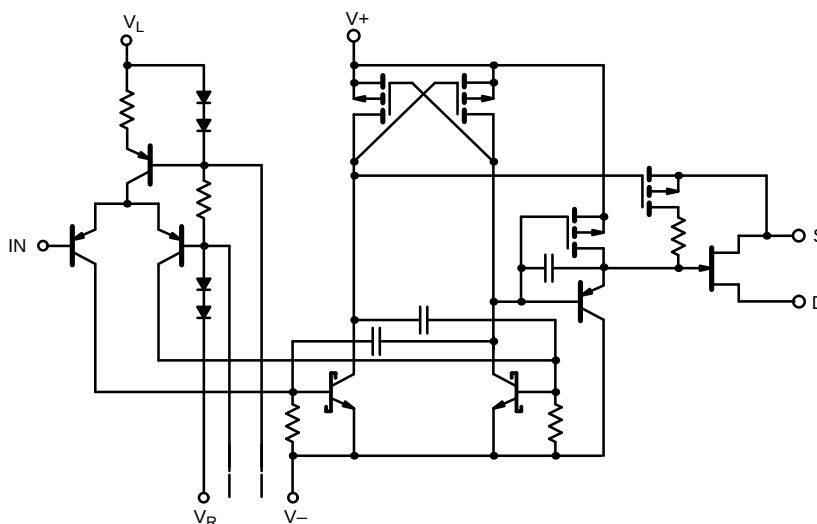


FIGURE 1.

**SPECIFICATIONS^a FOR DG180**

Parameter	Symbol	Test Conditions Unless Specified V+ = 15 V, V− = −15 V, VL = 5 V VR = 0 V, VIN = 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	V _S = −5 V, I _D = 0	Room	21					pF
Drain-Off Capacitance	C _{D(off)}		V _D = −5 V, I _S = 0	Room	17					
Channel-On Capacitance	C _{D(on)}		V _D = V _S = 0 V	Room	17					
Off Isolation	OIRR	f = 1 MHz, R _L = 75 Ω		Room	>55					dB
Power Supplies										
Positive Supply Current	I+	V _{IN} = 0 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		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^a 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 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	18		30 60		50 75	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		1 100		5 100	nA	
		V _S = ±7.5 V, V _D = ∓7.5 V	Room Hot	0.07		1 100		5 100		
Drain Off Leakage Current	I _{D(off)}	V _S = ±10 V, V _D = ∓10 V V ₊ = 10 V, V _– = –20 V	Room Hot	0.5		1 100		5 100		
		V _S = ±7.5 V, V _D = ∓7.5 V	Room Hot	0.6		1 100		5 100		
Channel On Leakage Current	I _{D(on)}	V _D = V _S = ±7.5 V	Room Hot	–0.02	–2 –200		–10 –200			
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	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)}		Room	6						
Channel-On Capacitance	C _{D(on)}		Room	14						
Off Isolation	OIRR	f = 1 MHz, R _L = 75 Ω	Room	>50					dB	
Power Supplies										
Positive Supply Current	I ₊	V _{IN} = 0 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.



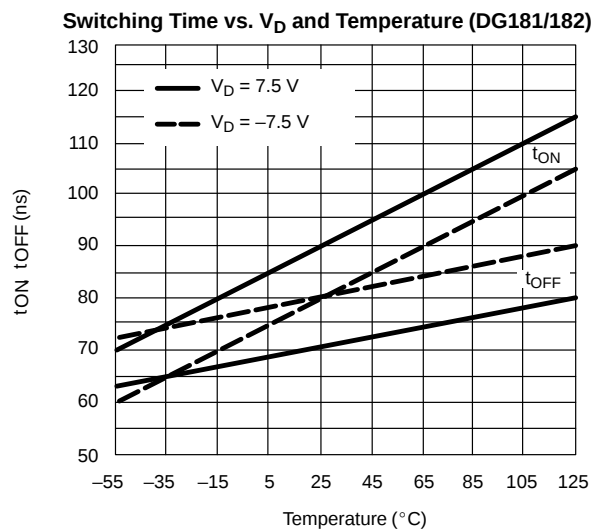
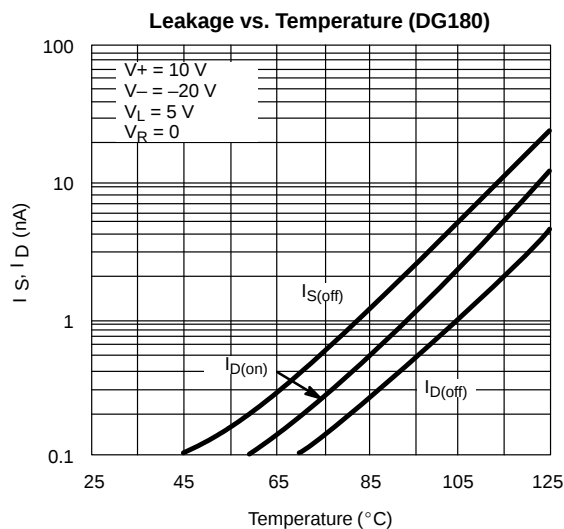
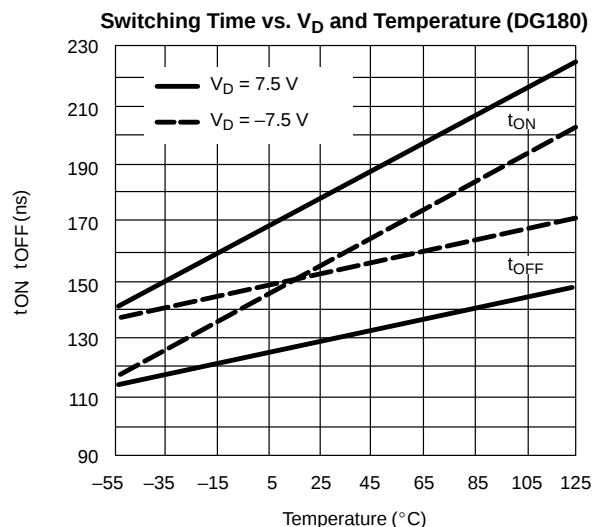
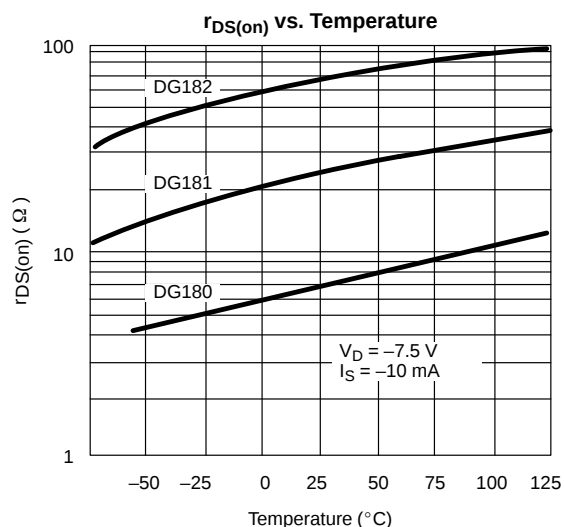
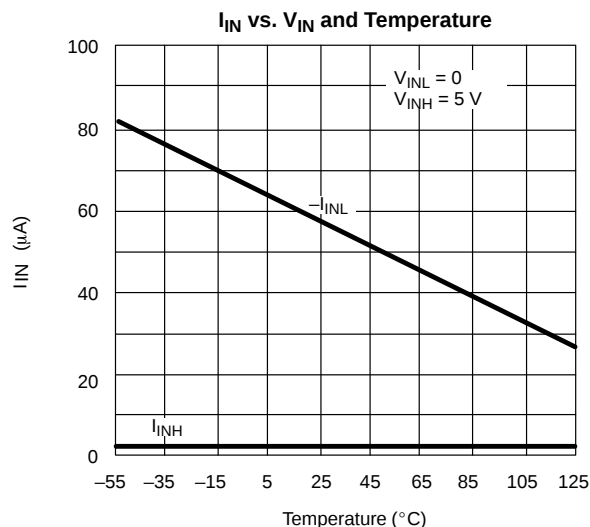
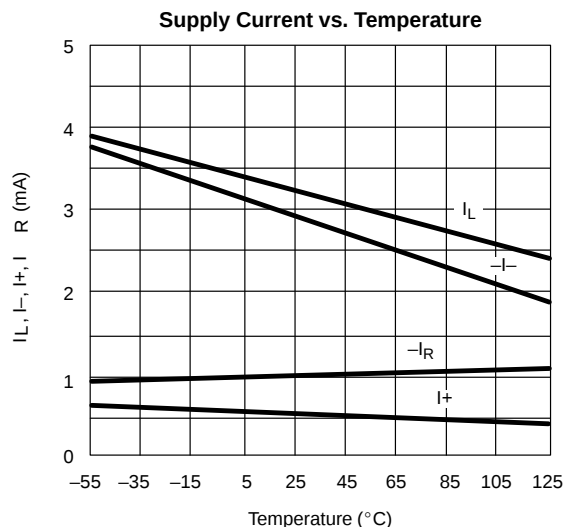
SPECIFICATIONS^a FOR DG182

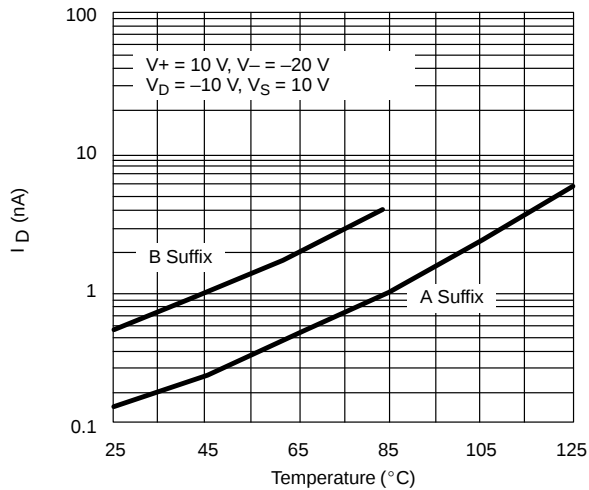
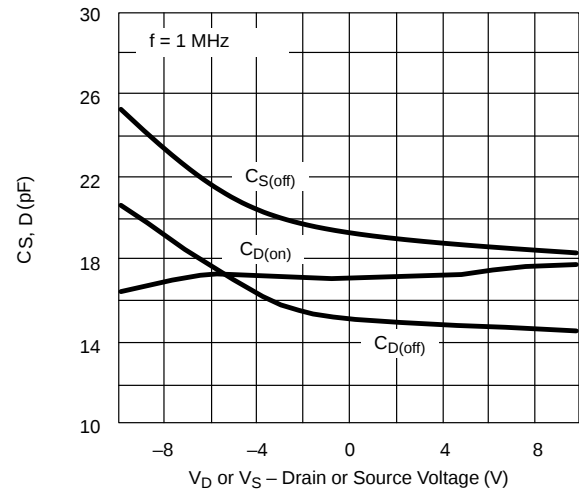
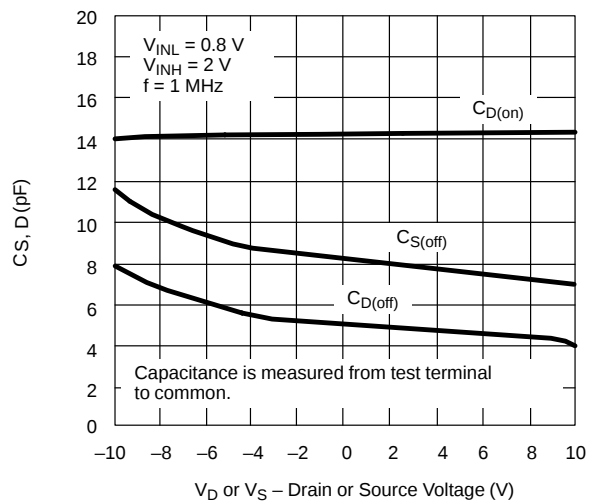
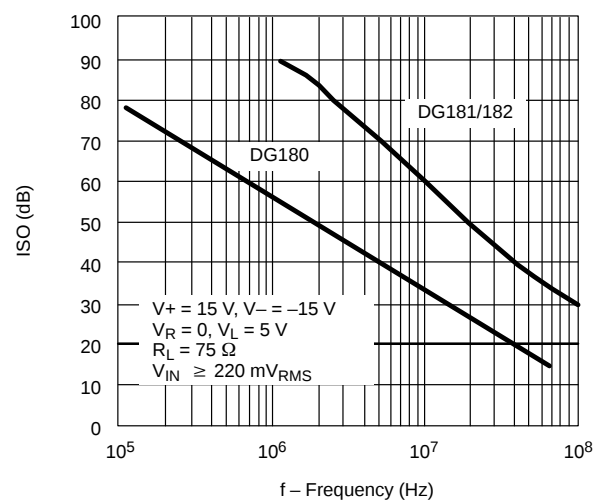
Parameter	Symbol	Test Conditions Unless Specified V+ = 15 V, V− = −15 V, VL = 5 V VR = 0 V, VIN = 2 V, 0.8 V ^f	Temp ^b	Typ ^c	A Suffix −55 to 125°C		B Suffix −25 to 85°C		Unit	
					Min ^d	Max ^d	Min ^d	Max ^d		
Analog Switch										
Analog Signal Range ^e	VANALOG		Full			−10	15	−10	15	V
Drain-Source On-Resistance	rDS(on)	IS = −10 mA, VD = −7.5 V	Room Full	35			75 150		100 150	Ω
Source Off Leakage Current	IS(off)	VS = ±10 V, VD = ∓10 V V+ = 10 V, V− = −20 V	Room Hot	0.05			1 100		5 100	nA
		VS = ±10 V, VD = ∓10 V	Room Hot	0.07			1 100		5 100	
Drain Off Leakage Current	ID(off)	VS = ±10 V, VD = ∓10 V V+ = 10 V, V− = −20 V	Room Hot	0.4			1 100		5 100	
		VS = ±10 V, VD = ∓10 V	Room Hot	0.5			1 100		5 100	
Channel On Leakage Current	ID(on)	VD = VS = ±10 V	Room Hot	−0.02	−2 −200			−10 −200		
Digital Input										
Input Current with Input Voltage High	IINH	VIN = 5 V	Room Hot	<0.01			10 20		10 20	μA
Input Current with Input Voltage Low	IINL	VIN = 0 V	Full	−30	−250			−250		
Dynamic Characteristics										
Turn-On Time	ton	See Switching Time Test Circuit		Room	120		250		300	ns
Turn-Off Time	toff			Room	100		130		150	
Source-Off Capacitance	CS(off)	f = 1 MHz	VS = −5 V, ID = 0	Room	9					pF
Drain-Off Capacitance	CD(off)		VD = −5 V, IS = 0	Room	6					
Channel-On Capacitance	CD(on)		VD = VS = 0 V	Room	14					
Off Isolation	OIRR	f = 1 MHz, RL = 75 Ω	Room	>50						dB
Power Supplies										
Positive Supply Current	I+	VIN = 0 V, or 5 V		Room	0.6		1.5		1.5	mA
Negative Supply Current	I−			Room	−2.7	−5		−5		
Logic Supply Current	IL			Room	3.1		4.5		4.5	
Reference Supply Current	IR			Room	−1	−2		−2		

Notes:

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- 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.

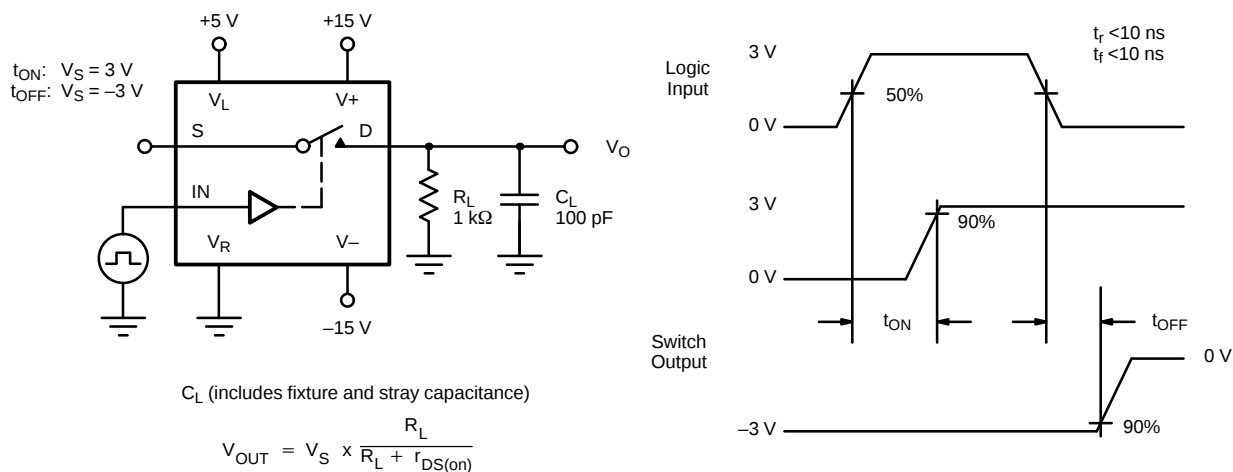


FIGURE 2. Switching Time

APPLICATION HINTS^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)
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:

a. Application Hints are for DESIGN AID ONLY, not guaranteed and not subject to production testing.

b. Electrical Parameter Chart based on $V_+ = 15\text{ V}$, $V_I = 5\text{ V}$, $V_R = \text{GND}$