

DG180-191

High-Speed Driver With JFET Switch

GENERAL DESCRIPTION

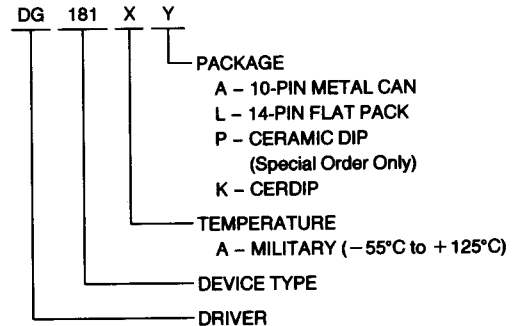
The DG180 thru DG191 series of analog gates consist of 2 or 4 N-channel junction-type field-effect transistors (JFET) designed to function as electronic switches. Level-shifting drivers enable low-level inputs (0.8 to 2V) to control the ON-OFF state of each switch. The driver is designed to provide a turn-off speed which is faster than turn-on speed, so that break-before-make action is achieved when switching from one channel to another. In the ON state, each switch conducts current equally well in both directions. In the OFF condition, the switches will block voltages up to 20V peak-to-peak. Switch-OFF input-output isolation is 50dB at 10MHz, due to the low output impedance of the FET-gate driving circuit.

ORDERING INFORMATION

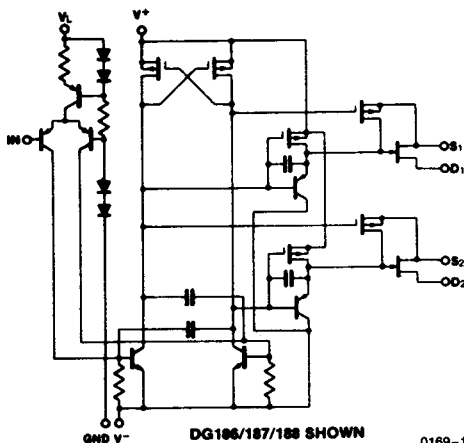
Part Number	Type	$r_{DS(on)}$ (Max)
DG180	Dual SPST	10
DG181	Dual SPST	30
DG182	Dual SPST	75
DG183	Dual DPST	10
DG184	Dual DPST	30
DG185	Dual DPST	75
DG186	SPDT	10
DG187	SPDT	30
DG188	SPDT	75
DG189	Dual SPDT	10
DG190	Dual SPDT	30
DG191	Dual SPDT	75

FEATURES

- Constant ON-Resistance for Signals to $\pm 10V$ (DG182, 185, 188, 191), to $\pm 7.5V$ (All Devices)
- $\pm 15V$ Power Supplies
- $< 2nA$ Leakage From Signal Channel in Both ON and OFF States
- TTL, DTL, RTL Direct Drive Compatibility
- $t_{on}, t_{off} < 150ns$, Break-Before-Make Action
- Cross-talk and Open Switch Isolation $> 50dB$ at 10MHz (75 Ω Load)
- JAN 38510 Approved



ONE AND TWO CHANNEL SPDT AND SPST CIRCUIT CONFIGURATION



TWO CHANNEL DPST CIRCUIT CONFIGURATION

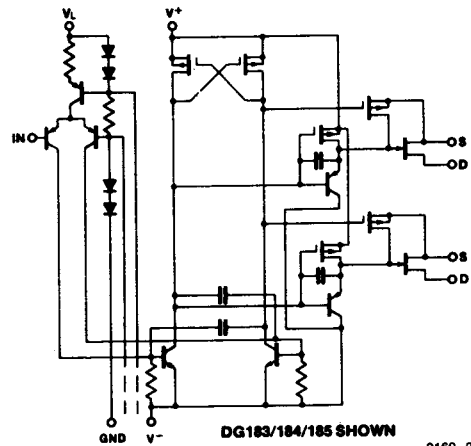


Figure 1: Functional Diagram (Typical Channel)

DG180-191

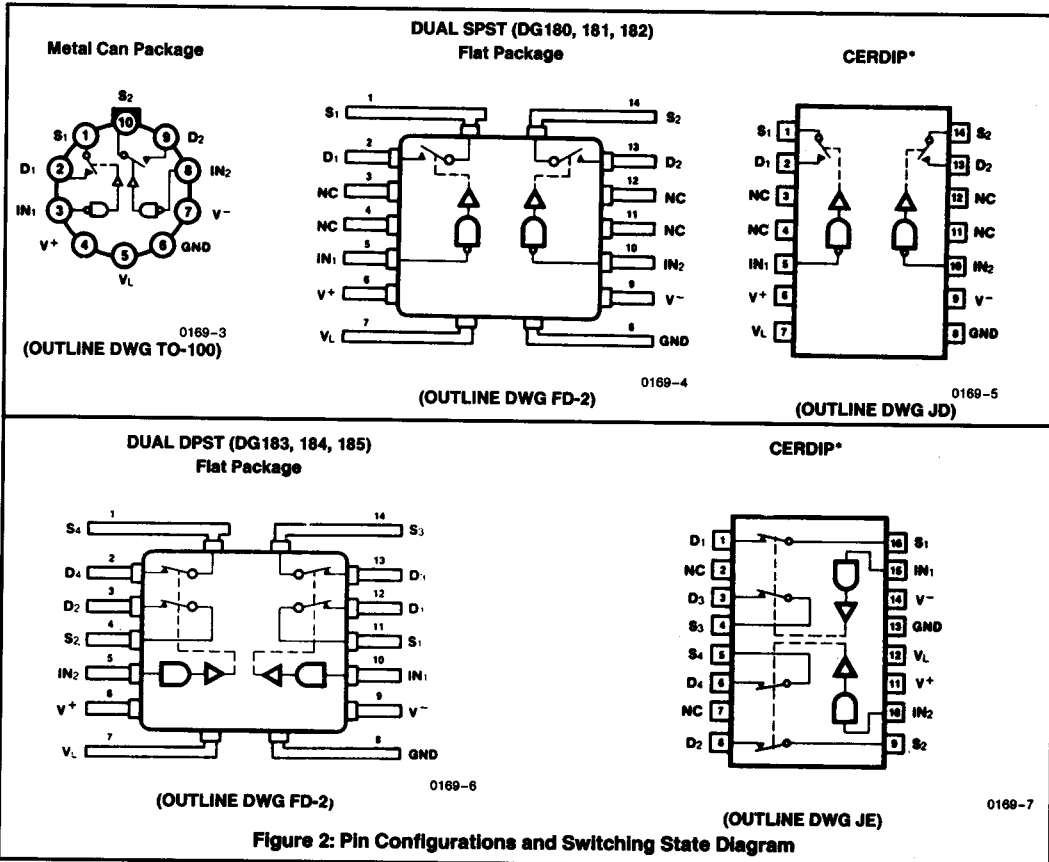
ABSOLUTE MAXIMUM RATINGS

$V^+ - V^-$	36V
$V^+ - V_D$	33V
$V_D - V^-$	33V
$V_D - V_S$	$\pm 22V$
$V_L - V^-$	36V
$V_L - V_{IN}$	8V
$V_L - GND$	8V
$V_{IN} - GND$	8V

$GND - V^-$	27V
$GND - V_{IN}$	20V
Current (S or D)	See Note 3 200mA
Storage Temperature	-65°C to +150°C
Operating Temperature	-55°C to +125°C
Power Dissipation*	450 (TW), 750 (FLAT), 825 (DIP)mW
Lead Temperature (Soldering, 10sec)	300°C

*Device mounted with all leads welded or soldered to PC board. Derate 6mW/°C (TW); 10mW/°C (FLAT); 11mW/°C (DIP) above 75°C.

NOTE: Stresses above those listed under "Absolute Maximum Ratings" may cause permanent damage to the device. These are stress ratings only and functional operation of the device at these or any other conditions above those indicated in the operational sections of the specifications is not implied. Exposure to absolute maximum rating conditions for extended periods may affect device reliability.



DG180-191

2

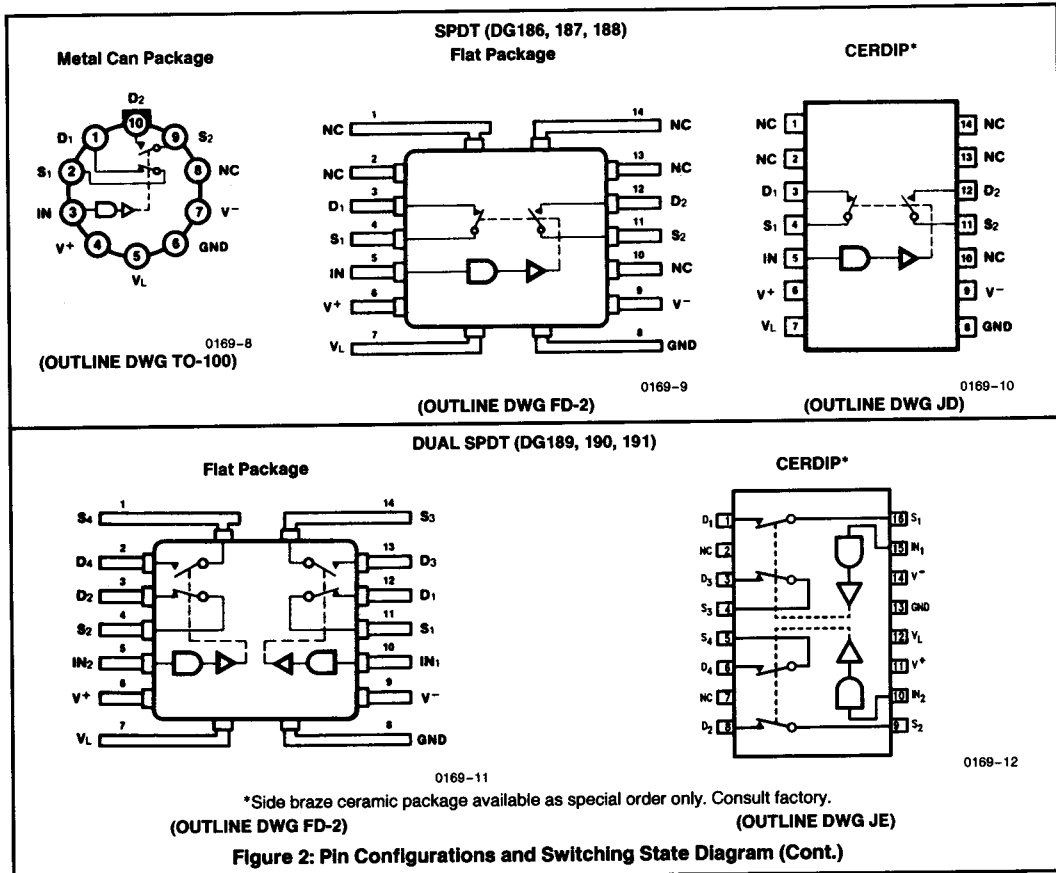


Figure 2: Pin Configurations and Switching State Diagram (Cont.)

ELECTRICAL CHARACTERISTICS

($V^+ = +15V$, $V^- = -15V$, $V_L = 5V$, Unless Noted)

Parameter	Device No.	Test Conditions (Note 1)	A Series			Units
			-55°C	+25°C	+125°C	
SWITCH						
$I_{S(off)}$	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)	$V_S = 10V, V_D = -10V, V^+ = 10V$ $V^- = -20V, V_{IN} = \text{"OFF"}$		± 1 $\pm(10)$	100 (1000)	nA
	DG181, 184, 187, 190 (DG180, 183, 186, 189)	$V_S = 7.5V, V_D = -7.5V$ $V_{IN} = \text{"OFF"}$		± 1 $\pm(10)$	100 (1000)	nA
	DG182, 185, 188, 191	$V_S = 10V, V_D = -10V$ $V_{IN} = \text{"OFF"}$		± 1	100	nA
$I_{D(off)}$	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)	$V_S = 10V, V_D = -10V, V^+ = 10V$ $V^- = -20V, V_{IN} = \text{"OFF"}$		± 1 $\pm(10)$	100 (1000)	nA
	DG181, 184, 187, 190 (DG180, 183, 186, 189)	$V_S = 7.5V, V_D = -7.5V$ $V_{IN} = \text{"OFF"}$		± 1 $\pm(10)$	100 (1000)	nA
	DG182, 185, 188, 191	$V_S = 10V, V_D = -10V$ $V_{IN} = \text{"OFF"}$		± 1	100	nA

DG180-191**ELECTRICAL CHARACTERISTICS** ($V^+ = +15V$, $V^- = -15V$, $V_L = 5V$, Unless Noted) (Continued)

Parameter	Device No.	Test Conditions (Note 1)	A Series			Units
			-55°C	+25°C	+125°C	
SWITCH (Continued)						
$I_{D(on)} + I_{S(on)}$	DG180, 181, 183, 184 186, 187, 189, 190	$V_D = V_S = -7.5V$, $V_{IN} = \text{"ON"}$		± 2	-200	nA
	DG182, 185, 188, 191	$V_D = V_S = -10V$, $V_{IN} = \text{"ON"}$		± 2	-200	nA
INPUT						
I_{INL}	ALL	$V_{IN} = 0V$	-250	-250	-250	μA
I_{INH}	ALL	$V_{IN} = 5V$		10	20	μA
DYNAMIC						
t_{on}	10 Ω Switches	See switching time test circuit		300		ns
	30 Ω Switches			150		
	75 Ω Switches			250		
t_{off}	10 Ω Switches			250		
	30 Ω and 75 Ω Switches			130		
$C_{S(off)}$	DG181, 182, 184, 185, 187, 188, 190, 191 (DG180, 183, 186, 189)	$V_S = -5V$, $I_D = 0$, $f = 1MHz$	9 typical (21 typical)			pF
$C_{D(off)}$		$V_D = +5V$, $I_S = 0$, $f = 1MHz$	6 typical (17 typical)			
$C_{D(on)} + C_{S(on)}$		$V_D = V_S = 0$, $f = 1MHz$	14 typical (17 typical)			
OFF Isolation			$R_L = 75\Omega$, $C_L = 3pF$	Typically > 50dB at 10MHz (See Note 2)		
SUPPLY						
I^+	DG180, 181, 182, 189 190, 191	$V_{IN} = 5V$		1.5		mA
	DG183, 184, 185			0.1		
	DG186, 187, 188			0.8		
I^-	DG180, 181, 182, 189 190, 191			-5.0		
	DG183, 184, 185			-4.0		
	DG186, 187, 188			-3.0		
I_L	DG180, 181, 182, 183 184, 185, 189, 190, 191		4.5			
	DG186, 187, 188		3.2			
I_{GND}	ALL		-2.0			
I^+	DG180, 181, 182, 189 190, 191	$V_{IN} = 0V$		1.5		mA
	DG183, 184, 185			3.0		
	DG186, 187, 188			0.8		
I^-	DG180, 181, 182, 189 190, 191			-5.0		
	DG183, 184, 185			-5.5		
	DG186, 187, 188			-3.0		
I_L	DG180, 181, 182, 183 184, 185, 189, 190, 191			4.5		
	DG186, 187, 188			3.2		
I_{GND}	ALL			-2.0		

NOTES 1. See Switching State Diagrams for V_{IN} "ON" and V_{IN} "OFF" Test Conditions.

2. Off Isolation typically > 55dB at 1MHz for DG180, 183, 186, 189.

3. Saturation Drain Current for DG180, 183, 186, 189 only, typically 300mA (2ms Pulse Duration). Maximum Current on all other devices (any terminal) 30mA.

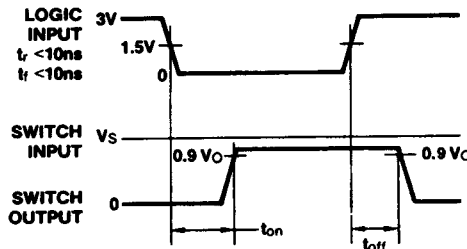
DG180-191

ELECTRICAL CHARACTERISTICS (Continued) MAXIMUM RESISTANCES ($r_{DS(ON)}$ MAX)

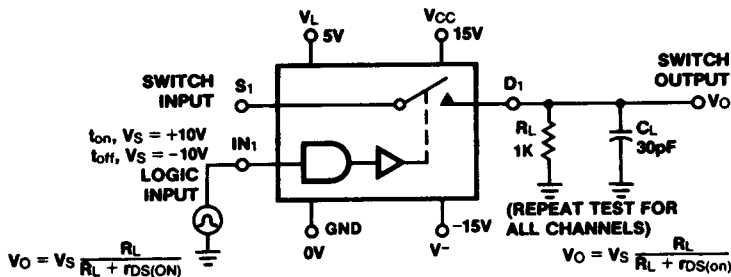
Device Number	Conditions (Note 1) $V^+ = 15V$, $V^- = -15V$, $V_L = 5V$		Military Temperature			Units $V_L = 5V$
			-55°C	+25°C	+125°C	
DG180	$V_D = -7.5V$	$I_S = -10mA$ $V_{IN} = "ON"$	10	10	20	Ω
DG181	$V_D = -7.5V$		30	30	60	Ω
DG182	$V_D = -10V$		75	75	100	Ω
DG183	$V_D = -7.5V$		10	10	20	Ω
DG184	$V_D = -7.5V$		30	30	60	Ω
DG185	$V_D = -10V$		75	75	150	Ω
DG186	$V_D = -7.5V$		10	10	20	Ω
DG187	$V_D = -7.5V$		30	30	60	Ω
DG188	$V_D = -10V$		75	75	150	Ω
DG189	$V_D = -7.5V$		10	10	20	Ω
DG190	$V_D = -7.5V$		30	30	60	Ω
DG191	$V_D = -10V$		75	75	150	Ω

APPLICATION HINT (for design only): Normally the minimum signal handling capability of the DG180 through DG191 family is 20V peak-to-peak for the 75 Ω switches and 15V peak-to-peak for the 10 Ω and 30 Ω (refer I_D and I_S tests above). For other Analog Signals, the following guidelines can be used: proper switch turn-off requires that $V^- \leq V_{ANALOG(peak)} - V_p$ where $V_p = 7.5V$ for the 10 Ω AND 30 Ω switches and $V_p = 5.0V$ for 75 Ω switches e.g., -10V minimum (-peak) analog signal and a 75 Ω switch ($V_p = 5V$), requires that $V^- \leq -10V - 5V = -15V$.

Logic Input for "OFF" to "ON" Condition (DG180/181/182 Shown)



0169-13



0169-14

Figure 3: Switching Time Test Circuits

Switch output waveform shown for $V_S = \text{constant}$ with logic input waveform as shown. Note that V_S may be + or - as per switching time test circuit. V_O is the steady state output with switch on. Feedthrough via gate capacitance may result in spikes at leading and trailing edge of output waveform.

DG180-191**DUAL SPST – DG180/181/182****TEST CONDITIONS**

DG180/181/182	
V_{IN} "ON" = 0.8V	All Channels
V_{IN} "OFF" = 2.0V	All Channels

SWITCH STATES ARE
FOR LOGIC "1" INPUT = 2.0V

SPDT – DG186/187/188**TEST CONDITIONS**

DG186/187/188	
V_{IN} "ON" = 2.0V	Channel 1
V_{IN} "ON" = 0.8V	Channel 2
V_{IN} "OFF" = 2.0V	Channel 2
V_{IN} "OFF" = 0.8V	Channel 1

SWITCH STATES ARE
FOR LOGIC "1" INPUT = 2.0V

DUAL DPST – DG183/184/185**TEST CONDITIONS**

DG183/184/185	
V_{IN} "ON" = 2.0V	All Channels
V_{IN} "OFF" = 0.8V	All Channels

SWITCH STATES ARE
FOR LOGIC "1" INPUT = 2.0V

DUAL SPDT – DG189/190/191**TEST CONDITIONS**

DG189/190/191	
V_{IN} "ON" = 2.0V	Channels 1 & 2
V_{IN} "ON" = 0.8V	Channels 3 & 4
V_{IN} "OFF" = 2.0V	Channels 3 & 4
V_{IN} "OFF" = 0.8V	Channels 1 & 2

SWITCH STATES ARE
FOR LOGIC "1" INPUT = 2.0V