

### 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 <sub>DS(on)</sub> (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 $\Omega$  Load)
- JAN 38510 Approved

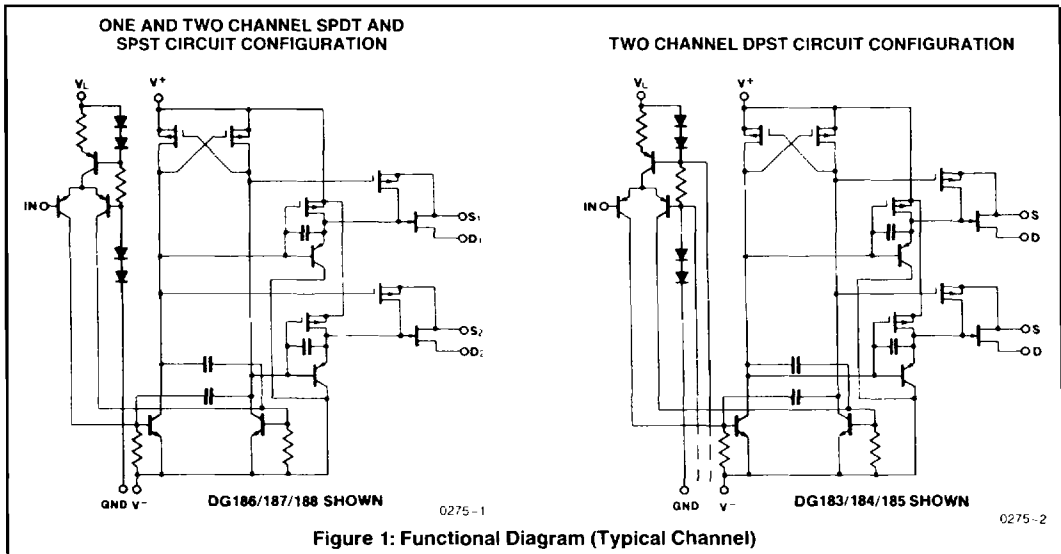
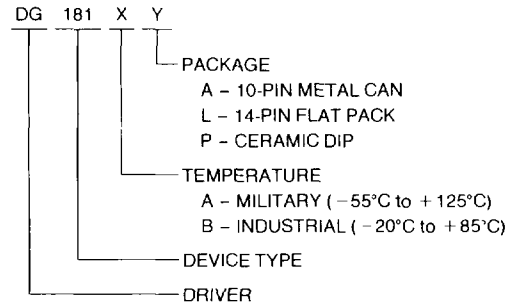


Figure 1: Functional Diagram (Typical Channel)

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NOTE: All typical values have been characterized but are not tested.

**ABSOLUTE MAXIMUM RATINGS**

V+ - V-	36V	GND - V-	27V
V+ - VD	33V	GND - VIN	20V
VD - V-	33V	Current (S or D) See Note 3	200mA
VD - VS	±22V	Storage Temperature	-65°C to +150°C
VL - V-	36V	Operating Temperature	-55°C to +125°C
VL - VIN	8V	Power Dissipation*	450 (TW), 750 (FLAT), 825 (DIP)mW
VL - GND	8V	Lead Temperature (Soldering, 10sec)	300°C
VIN - GND	8V		

\*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.

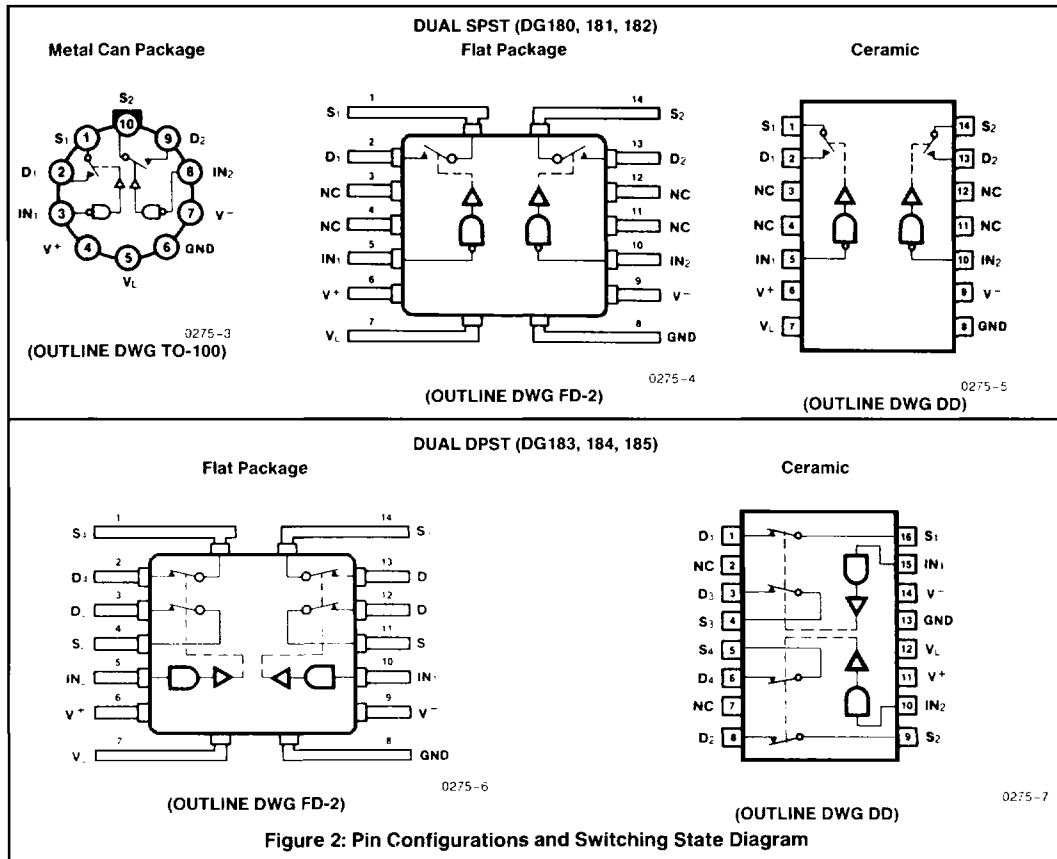
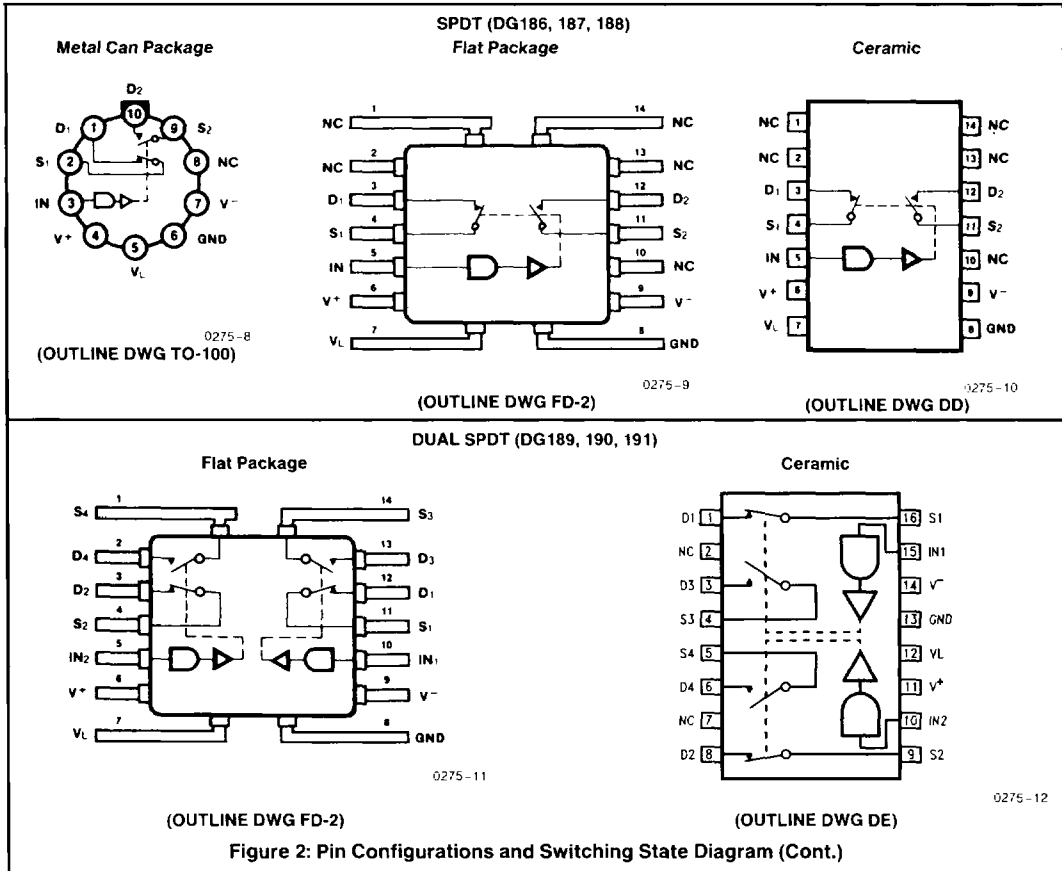


Figure 2: Pin Configurations and Switching State Diagram



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**ELECTRICAL CHARACTERISTICS** (V<sup>+</sup> = +15V, V<sup>-</sup> = -15V, V<sub>L</sub> = 5V, Unless Noted)

Parameter	Device No.	Test Conditions (Note 1)	A Series			B Series			Units
			-55°C	+25°C	+125°C	-20°C	+25°C	+85°C	
<b>SWITCH</b>									
I <sub>S(off)</sub>	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)	V <sub>S</sub> = 10V, V <sub>D</sub> = -10V, V <sup>+</sup> = 10V V <sup>-</sup> = -20V, V <sub>IN</sub> = "OFF"		± 1	100		± 5	100	nA
	DG181, 184, 187, 190 (DG180, 183, 186, 189)	V <sub>S</sub> = 7.5V, V <sub>D</sub> = -7.5V V <sub>IN</sub> = "OFF"		± 1 ± (10)	100 (1000)		± 5 (15)	100 (300)	nA
	DG182, 185, 188, 191	V <sub>S</sub> = 10V, V <sub>D</sub> = -10V V <sub>IN</sub> = "OFF"		± 1	100		± 5	100	nA
I <sub>D(off)</sub>	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)	V <sub>S</sub> = 10V, V <sub>D</sub> = -10V, V <sup>+</sup> = 10V V <sup>-</sup> = -20V, V <sub>IN</sub> = "OFF"		± 1	100		± 5	100	nA
	DG181, 184, 187, 190 (DG180, 183, 186, 189)	V <sub>S</sub> = 7.5V, V <sub>D</sub> = -7.5V V <sub>IN</sub> = "OFF"		± 1 ± (10)	100 (1000)		± 5 (15)	100 (300)	nA
	DG182, 185, 188, 191	V <sub>S</sub> = 10V, V <sub>D</sub> = -10V V <sub>IN</sub> = "OFF"		± 1	100		± 5	100	nA

NOTE: All typical values have been characterized but are not tested

## ELECTRICAL CHARACTERISTICS (V<sup>+</sup> = +15V, V<sup>-</sup> = -15V, V<sub>L</sub> = 5V, Unless Noted) (Continued)

Parameter	Device No.	Test Conditions (Note 1)	A Series			B Series			Units	
			-55°C	+25°C	+125°C	-20°C	+25°C	+85°C		
<b>SWITCH</b> (Continued)										
I <sub>D(on)</sub> + I <sub>S(on)</sub>	DG180, 181, 183, 184 186, 187, 189, 190	V <sub>D</sub> = V <sub>S</sub> = -7.5V, V <sub>IN</sub> = "ON"		+2	-200		-10	-200	nA	
	DG182, 185, 188, 191	V <sub>D</sub> = V <sub>S</sub> = -10V, V <sub>IN</sub> = "ON"		+2	-200		-10	-200	nA	
<b>INPUT</b>										
I <sub>INL</sub>	ALL	V <sub>IN</sub> = 0V	-250	-250	-250	-250	-250	-250	μA	
I <sub>INH</sub>	ALL	V <sub>IN</sub> = 5V		10	20		10	20	μA	
<b>DYNAMIC</b>										
t <sub>on</sub>	10Ω Switches	See switching time test circuit		300			350		ns	
	30Ω Switches			150			180			
	75Ω Switches			250			300			
t <sub>off</sub>	10Ω Switches			250			300			
	30Ω and 75Ω Switches			130			150			
C <sub>S(off)</sub>	DG181, 182, 184, 185, 187, 188, 190, 191	V <sub>S</sub> = -5V, I <sub>D</sub> = 0, f = 1MHz	9 typical (21 typical)						pF	
C <sub>D(off)</sub>	(DG180, 183, 186, 189)	V <sub>D</sub> = +5V, I <sub>S</sub> = 0, f = 1MHz	6 typical (17 typical)							
C <sub>D(on)</sub> + C <sub>S(on)</sub>		V <sub>D</sub> = V <sub>S</sub> = 0, f = 1MHz	14 typical (17 typical)							
OFF Isolation		R <sub>L</sub> = 75Ω, C <sub>L</sub> = 3pF	Typically > 50dB at 10MHz (See Note 2)							
<b>SUPPLY</b>										
I <sup>+</sup>	DG180, 181, 182, 189 190, 191	V <sub>IN</sub> = 5V		1.5			1.5		mA	
	DG183, 184, 185			0.1			0.1			
	DG186, 187, 188			0.8			0.8			
I <sup>-</sup>	DG180, 181, 182, 189 190, 191			-5.0			-5.0			
	DG183, 184, 185			-4.0			-4.0			
	DG186, 187, 188			-3.0			-3.0			
I <sub>L</sub>	DG180, 181, 182, 183 184, 185, 189, 190, 191				4.5			4.5		
	DG186, 187, 188				3.2			3.2		
I <sub>GND</sub>	ALL				-2.0			-2.0		
I <sup>+</sup>	DG180, 181, 182, 189 190, 191		V <sub>IN</sub> = 0V		1.5			1.5		
	DG183, 184, 185				3.0			3.0		
	DG186, 187, 188				0.8			0.8		
I <sup>-</sup>	DG180, 181, 182, 189 190, 191				-5.0			-5.0		
	DG183, 184, 185				-5.5			-5.5		
	DG186, 187, 188				-3.0			-3.0		
I <sub>L</sub>	DG180, 181, 182, 183 184, 185, 189, 190, 191				4.5			4.5		
	DG186, 187, 188				3.2			3.2		
I <sub>GND</sub>	ALL				-2.0			-2.0		

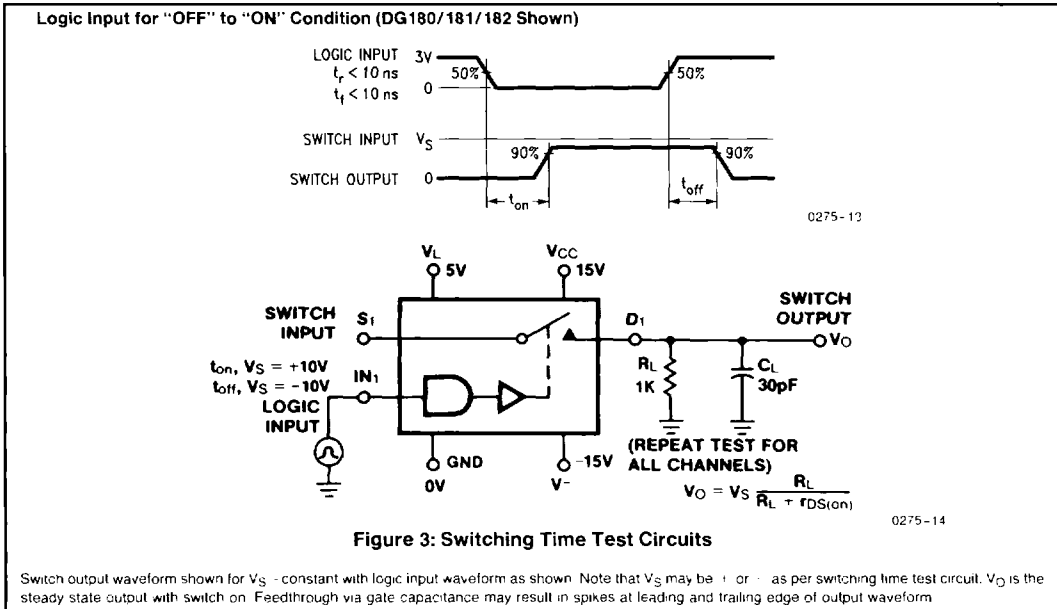
- NOTES**
- See Switching State Diagrams for V<sub>IN</sub> "ON" and V<sub>IN</sub> "OFF" Test Conditions
  - Off Isolation typically > 55dB at 1MHz for DG180, 183, 186, 189.
  - Saturation Drain Current for DG180, 183, 186, 189 only typically 300mA (2ms Pulse Duration) Maximum Current on all other devices (any terminal) 30mA

NOTE: All typical values have been characterized but are not tested

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

Device Number	Conditions (Note 1) $V^+ = 15V, V^- = -15V, V_L = 5V$		Military Temperature			Industrial Temperature			Units
			-55°C	+25°C	+125°C	-20°C	+25°C	+85°C	
DG180	$V_D = -7.5V$	$I_S = -10mA$ $V_{IN} = \text{"ON"}$	10	10	20	15	15	25	$\Omega$
DG181	$V_D = -7.5V$		30	30	60	50	50	75	$\Omega$
DG182	$V_D = -10V$		75	75	100	100	100	150	$\Omega$
DG183	$V_D = -7.5V$		10	10	20	15	15	25	$\Omega$
DG184	$V_D = -7.5V$		30	30	60	50	50	75	$\Omega$
DG185	$V_D = -10V$		75	75	150	100	100	150	$\Omega$
DG186	$V_D = -7.5V$		10	10	20	15	15	25	$\Omega$
DG187	$V_D = -7.5V$		30	30	60	50	50	75	$\Omega$
DG188	$V_D = -10V$		75	75	150	100	100	150	$\Omega$
DG189	$V_D = -7.5V$		10	10	20	15	15	25	$\Omega$
DG190	$V_D = -7.5V$		30	30	60	50	50	75	$\Omega$
DG191	$V_D = -10V$		75	75	150	100	100	150	$\Omega$

**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 $\Omega$  switches and 15V peak-to-peak for the 10 $\Omega$  and 30 $\Omega$  (refer  $I_D$  and  $I_S$  tests above). For other Analog Signals, the following guidelines can be used: proper switch turn-off requires that  $V_{-} \leq V_{ANALOG(peak)} - V_D$  where  $V_D = 7.5V$  for the 10 $\Omega$  AND 30 $\Omega$  switches and  $V_D = 5.0V$  for 75 $\Omega$  switches e.g., -10V minimum (-peak) analog signal and a 75 $\Omega$  switch ( $V_p = 5V$ ), requires that  $V_{-} \leq -10V - 5V = -15V$ .



NOTE: All typical values have been characterized but are not tested.

## 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