



DG180-191

High-Speed Driver With Junction FET Switches

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)

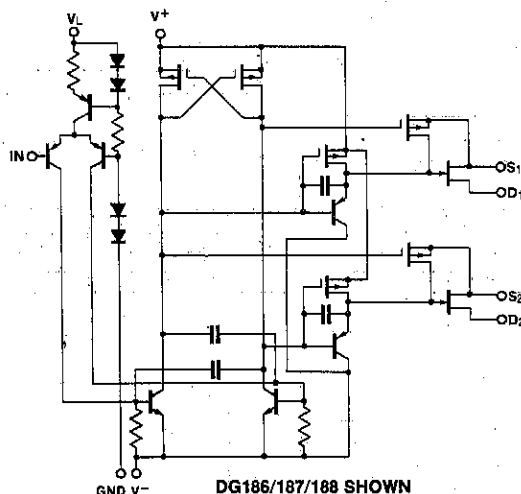
GENERAL DESCRIPTION

The DG180 thru DG191 series of analog gates consists of 2 or 4 N-channel junction-type field-effect transistors (J-FET) 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 feedthrough is $> 50dB$ down at 10MHz, because of the low output impedance of the FET-gate driving circuit.

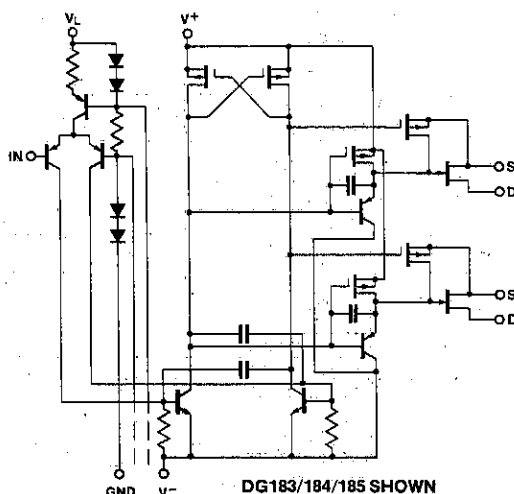
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SCHEMATIC DIAGRAM (Typical Channel)

ONE AND TWO CHANNEL SPDT AND SPST CIRCUIT CONFIGURATION

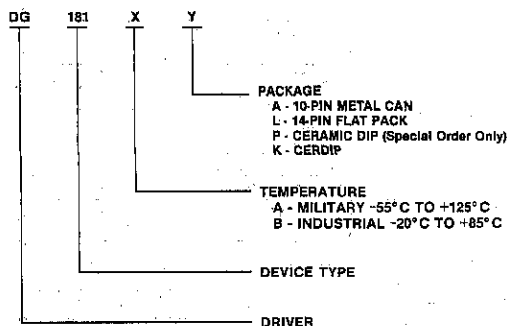


TWO CHANNEL DPST CIRCUIT CONFIGURATION



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



DG180-191



MAXIMUM RATINGS

V ⁺ -V ⁻	36V	V _L -V _{IN}	8V
V ⁺ -V _D	33V	V _L -GND	8V
V _D -V _S	33V	V _{IN} -GND	8V
V _D -V _S	±22V	GND-V _{IN}	27V
V _L -V _{IN}	36V	GND-V _{IN}	20V

Lead Temperature (Soldering, 10 sec) 300 °C

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.

ELECTRICAL CHARACTERISTICS (V⁺ = +15V, V⁻ = -15V, V_L = 5V, Unless Noted)

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

	PARAMETER	DEVICE	A SERIES			B SERIES			UNITS	TEST CONDITIONS (Note 1)	
			-55°C	+25°C	+125°C	-20°C	+25°C	+85°C			
SWITCH	I _{S(off)}	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)		1 (10)	100 (1000)		5 (15)	100 (300)	nA	V _S = 10V, V _D = -10V, V ⁺ = 10V V ⁻ = -20V, V _{IN} = "OFF"	
		DG181, 184, 187, 190 (DG180, 183, 186, 189)		1 (10)	100 (1000)		5 (15)	100 (300)	nA	V _S = 7.5V, V _D = -7.5V V _{IN} = "OFF"	
		DG182, 185, 188, 191		1	100		5	100	nA	V _S = 10V, V _D = -10V V _{IN} = "OFF"	
	I _{D(off)}	DG181, 182, 184, 185 187, 188, 190, 191 (DG180, 183, 186, 189)		1 (10)	100 (1000)		5 (15)	100 (300)	nA	V _S = 10V, V _D = -10V, V ⁺ = 10V V ⁻ = -20V, V _{IN} = "OFF"	
		DG181, 184, 187, 190 (DG180, 183, 186, 189)		1 (10)	100 (1000)		5 (15)	100 (300)	nA	V _S = 7.5V, V _D = -7.5V V _{IN} = "OFF"	
		DG182, 185, 188, 191		1	100		5	100	nA	V _S = 10V, V _D = -10V V _{IN} = "OFF"	
	I _{D(on)} + I _{S(on)}	DG180, 181, 183, 184 186, 187, 189, 190		-2	-200		-10	-200	nA	V _D = V _S = -7.5V, V _{IN} = "ON"	
		DG182, 185, 188, 191		-2	-200		-10	-200	nA	V _D = V _S = -10V, V _{IN} = "ON"	
	I _N	I _{NL}	ALL	-250	-250	-250	-250	-250	-250	μA	V _{IN} = 0V
		I _{NH}	ALL		10	20		10	20	μA	V _{IN} = 5V
DYNAMIC	t _{on}	10Ω Switches		300			350		ns	See switching time test circuit	
		30Ω Switches		150			180				
	t _{off}	75Ω Switches		250			300				
		10Ω Switches		250			300				
	30Ω and 75Ω Switches			130			150				
	C _{S(off)}	DG181, 182, 184, 185, 187, 188, 190, 191 (DG180, 183, 186, 189)	9 typical (21 typical) 6 typical (17 typical) 14 typical (17 typical) Typically >50dB at 10MHz (See Note 2)						pF		V _S = -5V, I _D = 0, f = 1MHz
	C _{D(off)}							V _D = +5V, I _S = 0, f = 1MHz			
SUPPLY	I ⁺	DG180, 181, 182, 189 190, 191		1.5			1.5		mA	V _{IN} = 5V	
		DG183, 184, 185		0.1			0.1				
		DG186, 187, 188		0.8			0.8				
	I ⁻	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 _L	DG180, 181, 182, 183, 184, 185, 189, 190, 191		4.5			4.5				
		DG186, 187, 188		3.2			3.2				
	I _{GND}	ALL		-2.0			-2.0				
	I ⁺	DG180, 181, 182, 189, 190, 191		1.5			1.5		mA	V _{IN} = 0V	
		DG183, 184, 185		3.0			3.0				
		DG186, 187, 188		0.8			0.8				
	I ⁻	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 _L	DG180, 181, 182, 183, 184, 185, 189, 190, 191		4.5			4.5				
		DG186, 187, 188		3.2			3.2				
I _{GND}	ALL		-2.0			-2.0					

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

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

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

ELECTRICAL CHARACTERISTICS (CONT'D)

MAXIMUM RESISTANCES ($r_{DS(ON)}$ MAX)

DEVICE NUMBER	MILITARY TEMPERATURE			INDUSTRIAL TEMPERATURE			UNITS	CONDITIONS (Note 1)	
	-55°C	+25°C	+125°C	-20°C	+25°C	+85°C		$V^+ = 15V, V^- = -15V, V_L = 5V$	
DG180	10	10	20	15	15	25	Ω	$V_D = -7.5V$	$I_S = -10mA$ $V_{IN} = "ON"$
DG181	30	30	60	50	50	75	Ω	$V_D = -7.5V$	
DG182	75	75	100	100	100	150	Ω	$V_D = -10V$	
DG183	10	10	20	15	15	25	Ω	$V_D = -7.5V$	
DG184	30	30	60	50	50	75	Ω	$V_D = -7.5V$	
DG185	75	75	150	100	100	150	Ω	$V_D = -10V$	
DG186	10	10	20	15	15	25	Ω	$V_D = -7.5V$	
DG187	30	30	60	50	50	75	Ω	$V_D = -7.5V$	
DG188	75	75	150	100	100	150	Ω	$V_D = -10V$	
DG189	10	10	20	15	15	25	Ω	$V_D = -7.5V$	
DG190	30	30	60	50	50	50	Ω	$V_D = -7.5V$	
DG191	75	75	150	100	100	150	Ω	$V_D = -10V$	

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 switches (refer I_D and I_S tests above). For other Analog Signals, the following guidelines can be used: proper switch turn-off requires that $V^- \approx V_{ANALOG(peak)} - V_p$ 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 $V^- \leq -10V - 5V = -15V$.

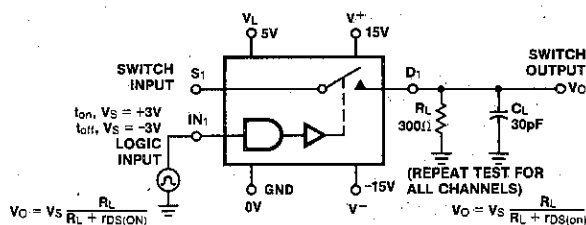
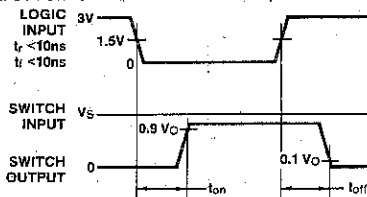
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SWITCHING TIME TEST CIRCUIT

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.

LOGIC INPUT FOR "OFF" TO "ON" CONDITION (DG180/181/182 SHOWN)



DUAL SPST DG180/181/182

DUAL DPST DG183/184/185

SPDT DG186/187/188

DUAL SPDT DG189/190/191

TEST CONDITIONS

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

TEST CONDITIONS

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

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

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

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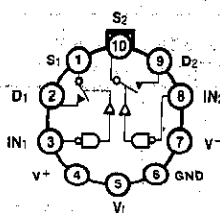
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PIN CONFIGURATIONS AND SWITCHING STATE DIAGRAM (See previous page for logic input)

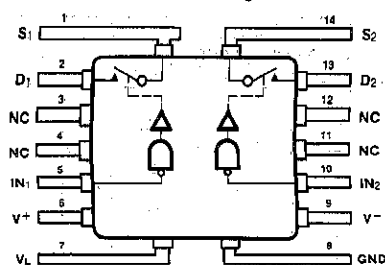
DUAL SPST (DG180, 181, 182)

Metal Can Package



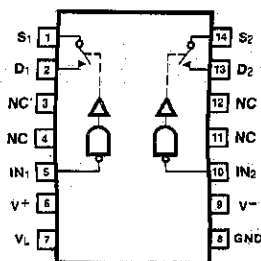
(OUTLINE DWG TO-100)

Flat Package



(OUTLINE DWG FD-2)

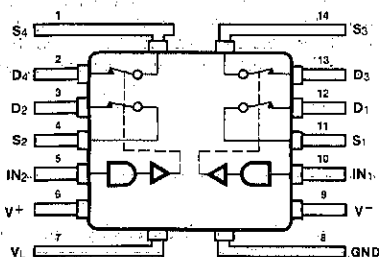
CERDIP*



(OUTLINE DWG JD)

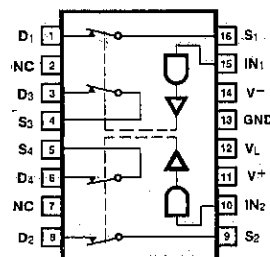
DUAL DPST (DG183, 184, 185)

Flat Package



(OUTLINE DWG FD-2)

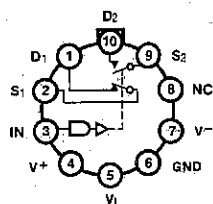
CERDIP*



(OUTLINE DWG JE)

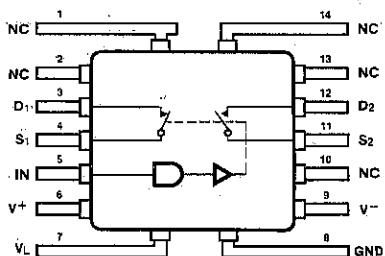
SPDT (DG186, 187, 188)

Metal Can Package



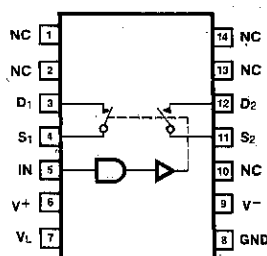
(OUTLINE DWG TO-100)

Flat Package



(OUTLINE DWG FD-2)

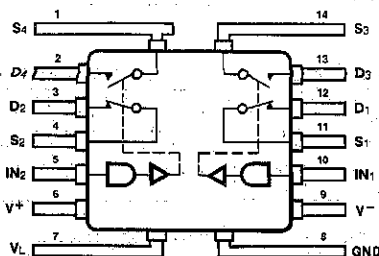
CERDIP*



(OUTLINE DWG JD)

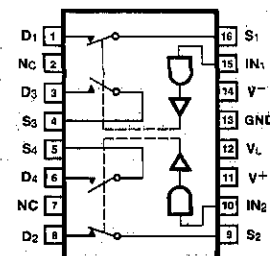
DUAL SPDT (DG189, 190, 191)

Flat Package



(OUTLINE DWG FD-2)

CERDIP*



(OUTLINE DWG JE)

*Side braze ceramic package available as special order only. Consult factory.