INTERSIL

DG139, DG142 — DG146, DG161 — DG164
Drivers with Differentially Driven N.O. and N.C. FET Switches

FEATURES

- Each channel complete-interfaces with most integrated logic
- Low OFF power dissipation, 1 mW
- Switches analog signals up to 20 volts peak-to-peak
- Low $r_{DS(ON)}$, 10 ohms max on DG145 and DG146

GENERAL DESCRIPTION

Each package contains a monolithic driver with differential input and 2 or 4 discrete FET switches. The driver may be treated as a special purpose differential amplifier which controls the conduction state of the FET switches. The differential output of the driver sets the switches in opposition, one pair open and the other pair closed. All switches may be opened by applying a positive control signal to the V_R terminal.

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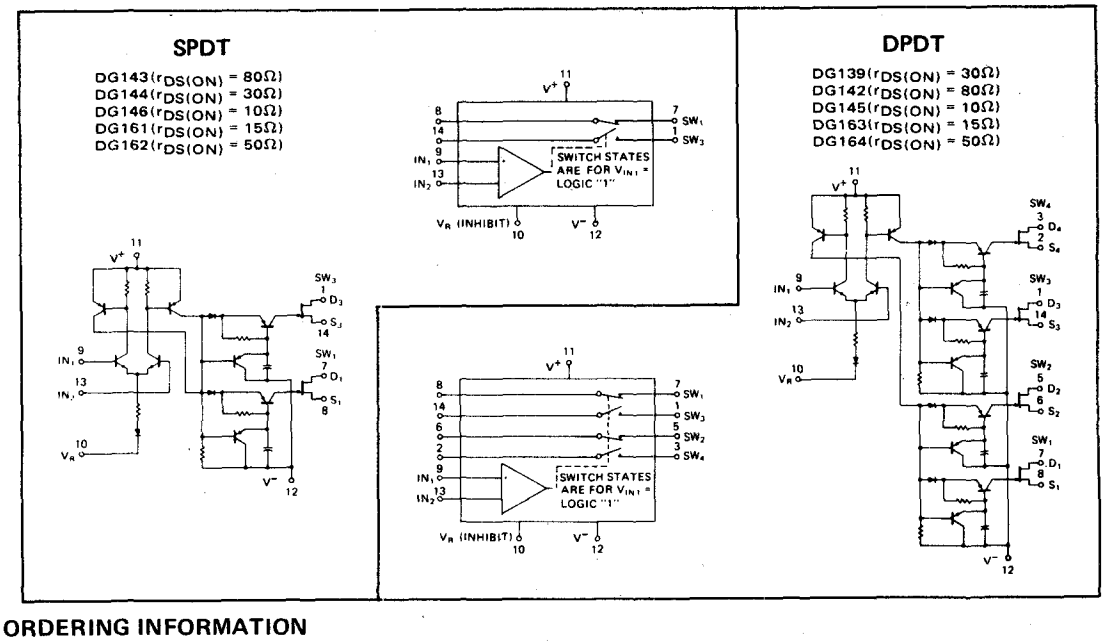
SCHEMATIC AND LOGIC DIAGRAMS (Outline Dwgs DD, FD-2, JD)



ORDERING INFORMATION

DG139 A K

- Package
  - K — 14-pin CERDIP
  - L — 14-pin Flat Pack
  - P — 14-pin Ceramic DIP (Special Order Only)
- Temperature Range
  - A — Military −55°C to +125°C
  - B — Industrial −20°C to +85°C
- Device Type

ABSOLUTE MAXIMUM RATINGS

$V^+ - V^-$ 36V
$V_S - V^-$ 30V
$V^+ - V_S$ 30V
$V_S - V_D$ ..... ±22V
$V_R - V^-$ 21V
Power Dissipation (Note) ..... 750 mW
Current (any terminal) ..... 30 mA

$V^+ - V_R$ 17V
$V^+ - V_{IN1}$ or V_{IN2} . 14V
$V_{IN1} - V_{IN2}$ ..... ±6V
$V_{IN1} - V_R$ ..... ±6V
$V_{IN2} - V_R$ ..... ±6V

Storage Temperature ..... -65 to +150°C
Operating Temperature ..... -55 to +125°C
Lead Temperature (soldering, 10 sec) ..... 300°C

NOTE: Dissipation rating assumes device is mounted with all leads welded or soldered to printed circuit board in ambient temperature below 70°C. For higher temperature, derate at rate of 10 mW/°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

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Applied voltages for all tests: DG139, DG142, DG143, DG144, DG145, DG146 (V^+ = 12V, V^- = -18V, V_R = 0, V_{IN2} = 2.5V) and DG161, DG162, DG163, DG164 (V^+ = 15V, V^- = -15V, V_R = 0, V_{IN2} = 2.5V). Input test condition that guarantees FET switch ON or OFF as specified is used for output specifications.

	SYMBOL (NOTE)	CHARACTERISTIC	TYPE	ABSOLUTE MAX. LIMIT -55°	25°	125°	UNITS	TEST CONDITIONS
INPUT	$V_{IN(ON)}$	Input Voltage—On	All Circuits	2.9 min	2.5 min	2.0 min	Volts	At Pin 9 and 13 See Figure 1 and 2, Pg. 4
	$V_{IN(OFF)}$	Input Voltage—Off		1.4	1.0	0.6	Volts	At Pin 9 and 13 See Figure 1 and 2, Pg. 4
	$\lvert V_9 - V_{13}\rvert$	Differential Voltage		0.5 min	0.5 min	0.5 min	Volts	See Note 1, Pg. 4
	$I_{IN1(ON)}$	Input Current		120	60	60	µA	V_{IN1} 3.0V
	$I_{IN2(ON)}$			120	60	60	µA	V_{IN2} 2.0V
	$I_{IN1(OFF)}$	Input Leakage Current		0.1	0.1	2	µA	V_{IN1} 2.0V
	$I_{IN2(OFF)}$			0.1	0.1	2	µA	V_{IN2} 3.0V
SWITCH OUTPUT	$r_{DS(ON)}$	Drain-Source On Resistance	DG142 DG143	80	80	150	Ω	V_D = 10V, I_S = -1mA
			DG139 DG144	30	30	60	Ω	
			DG145 DG146	10	10	20	Ω	V_D = 10V, I_S = -1mA
			DG161 DG163	15	15	30	Ω	V_D 7.5V, I_S 1 mA
			DG162 DG164	50	50	100	Ω	
	$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG139 DG142 DG143 DG144		2	100	nA	V_D V_S -10V
	$I_{S(OFF)}$	Source Leakage Current			1	100	nA	V_S 10V, V_D -10V
	$I_{D(OFF)}$	Drain Leakage Current			1	100	nA	V_D 10V, V_S -10V
	$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG145 DG146		2	100	nA	V_D V_S -10V
	$I_{S(OFF)}$	Source Leakage Current			10	1000	nA	V_S 10V, V_D -10V
	$I_{D(OFF)}$	Drain Leakage Current			10	1000	nA	V_D 10V, V_S -10V
	$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG161 DG163		2	500	nA	V_D V_S -7.5V
	$I_{S(OFF)}$	Source Leakage Current			10	1000	nA	V_S 7.5V, V_D -7.5V
	$I_{D(OFF)}$	Drain Leakage Current			10	1000	nA	V_D 7.5V, V_S -7.5V
	$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG162 DG164		2	500	nA	V_D V_S -7.5V
	$I_{S(OFF)}$	Source Leakage Current			2	200	nA	V_S 7.5V, V_D -7.5V
	$I_{D(OFF)}$	Drain Leakage Current			2	200	nA	V_D 7.5V, V_S -7.5V
POWER SUPPLY	$I_{1(ON)}$	Positive Power Supply Drain Current	All Circuits		4.0		mA	V_{IN1} 3V or V_{IN1} 2V
	$I_{2(ON)}$	Negative Power Supply Drain Current			-2.0		mA	
	$I_{R(ON)}$	Reference Power Supply Drain Current			-2.0		mA	
	$I_{1(OFF)}$	Positive Power Supply Leakage Current			25		µA	V_{IN1} V_{IN2} 0.8V
	$I_{2(OFF)}$	Negative Power Supply Leakage Current			-25		µA	
	$I_{R(OFF)}$	Reference Power Supply Leakage Current			-25		µA	

NOTE: (OFF) and (ON) subscript notation refers to the conduction state of the FET switch for the given test.

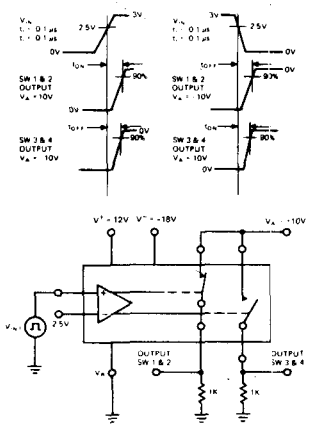
ELECTRICAL CHARACTERISTICS PER CHANNEL (cont.)

	SYMBOL (NOTE)	CHARACTERISTIC	TYPE	ABSOLUTE MAX. LIMIT -55°C	25°	125°	UNITS	TEST CONDITIONS
SWITCHING	t_{ON}	Turn-On Time	DG139, DG142 DG143, DG144 DG162, DG164		0.8		µs	See Below
			DG139, DG142 DG143, DG144 DG162, DG164		0.4	0.7	µs	
	t_{OFF}	Turn-Off Time	DG139, DG142 DG143, DG144 DG162, DG164		1.6		µs	See Below
			DG139, DG142 DG143, DG144 DG162, DG164		0.8	1.2	µs	
	t_{ON}	Turn-On Time	DG145, DG146 DG161, DG163		1.0		µs	See Below
			DG145, DG146 DG161, DG163		0.5	0.8	µs	
	t_{OFF}	Turn-Off Time	DG145, DG146 DG161, DG163		2.5		µs	See Below
			DG145, DG146 DG161, DG163		1.25	1.8	µs	
POWER	P_{ON}	ON Driver Power	All Circuits		175		mW	Both Inputs V_{IN} = 2.5V
	P_{OFF}	OFF Driver Power			1		mW	Both Inputs V_{IN} = 1.0V

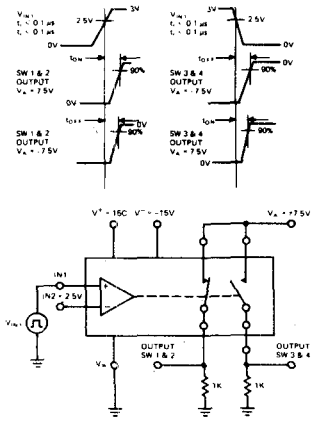
NOTE: (OFF) and (ON) subscript notation refers to the conduction state of the FET switch for the given test.

SWITCHING TIMES (25°C)

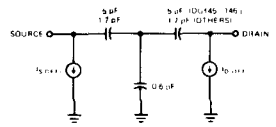
DG139, 142, 143, 144, 145, 146



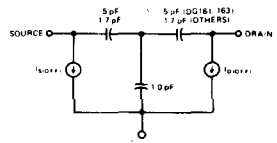
DG161, 162, 163, 164



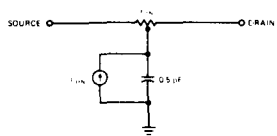
OFF MODEL



OFF MODEL



ON MODEL



ON MODEL

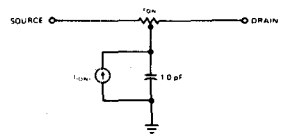


FIGURE 1

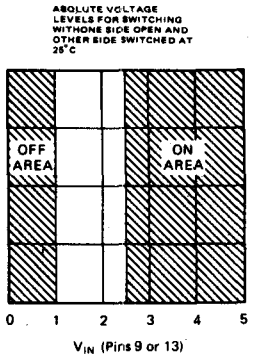
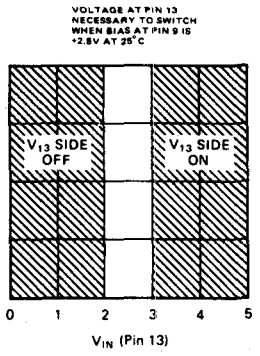


FIGURE 2



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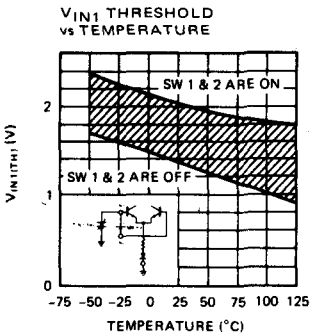
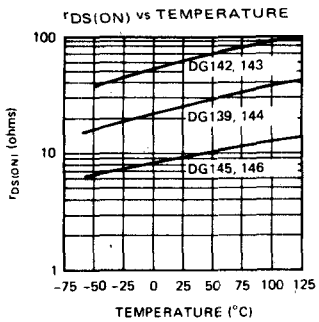
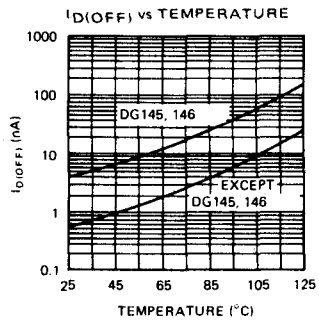
NOTE1: An example of Absolute Minimum Differential Voltage, $|V_9 - V_{13}|$, is when V_9 = 3V and V_{13} = 2.5V, the V_9 side of the switch is ON and the V_{13} side of the switch is OFF at 25°C. Conversely, when V_9 = 2V and V_{13} = 2.5V, the V_9 side of the switch is OFF and the V_{13} side of the switch is ON at 25°C.

TYPICAL CHARACTERISTICS (per channel)

DG139, 142, 144, 145, 146







DG161, 162, 163, 164