DG139, DG142-DG146, DG161-DG164

High Reliability DUAL JFET Analog Switch

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.

FEATURES

- **Each Channel Complete – Interfaces With Most Integrated Logic**
- **Low OFF Power Dissipation, 1mW**
- **Switches Analog Signals Up to 20 Volts Peak-to-Peak**
- **Low $r_{DS(ON)}$, 10 Ohms Max on DG145 and DG146**

ORDERING INFORMATION

DG139 A K

- K — Package: 14-pin CERDIP (DG139,142,143,144,162,164)
  L — 14-pin Flat Package
  P — 14-pin Ceramic DIP (DG145,146,161,163)
- A — Temperature Range: Military (−55°C to +125°C)
- DG139 — Device Chip Type

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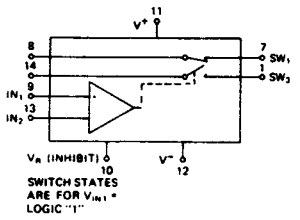
SPDT

DG143 ($r_{DS(ON)}$ = 80Ω)
DG144 ($r_{DS(ON)}$ = 30Ω)
DG146 ($r_{DS(ON)}$ = 10Ω)
DG161 ($r_{DS(ON)}$ = 15Ω)
DG162 ($r_{DS(ON)}$ = 50Ω)



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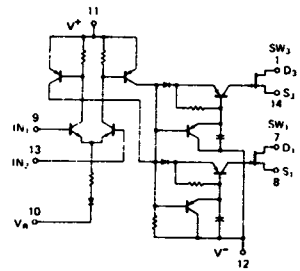

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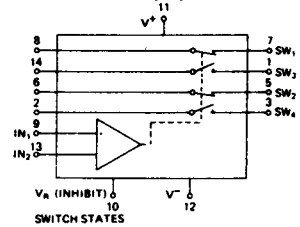
DPDT

DG139 ($r_{DS(ON)}$ = 30Ω)
DG142 ($r_{DS(ON)}$ = 80Ω)
DG145 ($r_{DS(ON)}$ = 10Ω)
DG163 ($r_{DS(ON)}$ = 15Ω)
DG164 ($r_{DS(ON)}$ = 50Ω)



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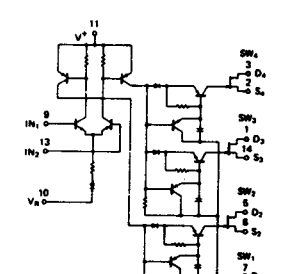

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Figure 1: Functional Diagrams (Outline Dwgs DD, FD-2, JD)

DG139, DG142-DG146, DG161-DG164

ABSOLUTE MAXIMUM RATINGS

$V^+ - V^-$ 36V
$V_S - V^-$ 30V
$V^+ - V_S$ 30V
$V_S - V_D$ ..... ±22V
$V_R - V^-$ 21V
$V^+ - V_R$ 17V
$V^+ - V_{IN1}$ or V_{IN2} 14V
$V_{IN1} - V_{IN2}$ ..... ±6V
$V_{IN1} - V_R$ ..... ±6V
$V_{IN2} - V_R$ ..... ±6V
Power Dissipation (Note) 750mW
Current (any terminal) 30mA
Storage Temperature ..... −65°C to +150°C
Operating Temperature ..... −55°C to +125°C
Lead Temperature (Soldering, 10sec) ..... 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 10mW/°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.*

ELECTRICAL CHARACTERISTICS

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)	Parameter	Type	Test Conditions	Absolute Max Limit −55°C	Absolute Max Limit 25°C	Absolute Max Limit 125°C	Units
INPUT							
$I_{IN1(ON)}$	Input Current	All Circuits	$V_{IN1} = 3.0V$	120	60	60	µA
$I_{IN2(ON)}$			$V_{IN2} = 2.0V$	120	60	60	µA
$I_{IN1(OFF)}$	Input Leakage Current		$V_{IN1} = 2.0V$	0.1	0.1	2	µA
$I_{IN2(OFF)}$			$V_{IN2} = 3.0V$	0.1	0.1	2	µA
SWITCH OUTPUT							
$r_{DS(ON)}$	Drain-Source On Resistance	DG142 DG143	$V_D = 10V$, $I_S = -10mA$ V_{IN} (See Note)	80	80	150	Ω
		DG139 DG144		30	30	60	Ω
		DG145 DG146	$V_D = 10V$, $I_S = -10mA$ V_{IN} (See Note)	10	10	20	Ω
		DG161 DG163	$V_D = 7.5V$, $I_S = -10mA$ V_{IN} (See Note)	15	15	30	Ω
		DG162 DG164		50	50	100	Ω
$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG139 DG142 DG143 DG144	$V_D = V_S = -10V$		2	100	nA
$I_{S(OFF)}$	Source Leakage Current		$V_S = 10V$, $V_D = -10V$		1	100	nA
$I_{D(OFF)}$	Drain Leakage Current		$V_D = 10V$, $V_S = -10V$		1	100	nA
$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG145 DG146	$V_D = V_S = -10V$		2	100	nA
$I_{S(OFF)}$	Source Leakage Current		$V_S = 10V$, $V_D = -10V$		10	1000	nA
$I_{D(OFF)}$	Drain Leakage Current		$V_D = 10V$, $V_S = -10V$		10	1000	nA
$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG161 DG163	$V_D = V_S = -7.5V$		2	500	nA
$I_{S(OFF)}$	Source Leakage Current		$V_S = 7.5V$, $V_D = -7.5V$		10	1000	nA
$I_{D(OFF)}$	Drain Leakage Current		$V_D = 7.5V$, $V_S = -7.5V$		10	1000	nA
$I_{D(ON)} + I_{S(ON)}$	Drive Leakage Current	DG162 DG164	$V_D = V_S = -7.5V$		2	500	nA
$I_{S(OFF)}$	Source Leakage Current		$V_S = 7.5V$, $V_D = -7.5V$		2	200	nA
$I_{D(OFF)}$	Drain Leakage Current		$V_D = 7.5V$, $V_S = -7.5V$		2	200	nA

NOTE: (OFF) and (ON) subscript notation refers to the conduction state of the FET switch for the given test. V_{IN} must be a step function with a minimum slew-rate of 1V/µs.

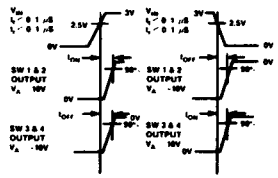
DG139, DG142–DG146, DG161–DG164

ELECTRICAL CHARACTERISTICS (Continued)

Symbol (Note)	Parameter	Type	Test Conditions	Absolute Max Limit			Units
				−55°C	25°C	125°C	
POWER SUPPLY							
$I_{1(ON)}$	Positive Power Supply Drain Current	All Circuits	$V_{IN1} = 3V$ or $V_{IN1} = 2V$		4.2		mA
$I_{2(ON)}$	Negative Power Supply Drain Current				−2.0		mA
$I_{R(ON)}$	Reference Power Supply Drain Current				−2.2		mA
$I_{1(OFF)}$	Positive Power Supply Leakage Current		$V_{IN1} = V_{IN2}, = 0.8V$		25		µA
$I_{2(OFF)}$	Negative Power Supply Leakage Current				−25		µA
$I_{R(OFF)}$	Reference Power Supply Leakage Current				−25		µA
SWITCHING							
t_{ON}	Turn-On Time	DG139, DG142 DG143, DG144 DG162, DG164	See Switching Times		0.8		µs
t_{OFF}	Turn-Off Time	DG139, DG142 DG143, DG144 DG162, DG164	See Switching Times		1.6		µs
t_{ON}	Turn-On Time	DG145, DG146 DG161, DG163	See Switching Times		1.0		µs
t_{OFF}	Turn-Off Time	DG145, DG146 DG161, DG163	See Switching Times		2.5		µs

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

DG139, 142, 143, 144, 145, 146



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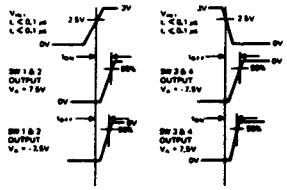
DG161, 162, 163, 164



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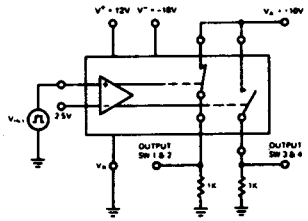

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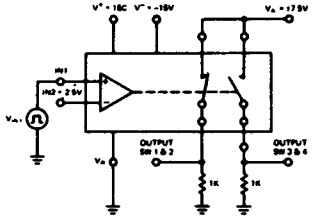
OFF MODEL



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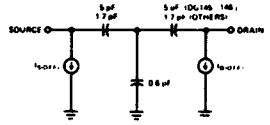
OFF MODEL



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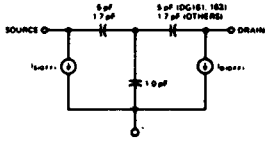
ON MODEL



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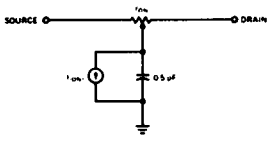
ON MODEL



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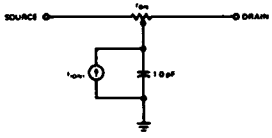

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Figure 2: Switching Times Test Circuits

DG139, DG142–DG146, DG161–DG164

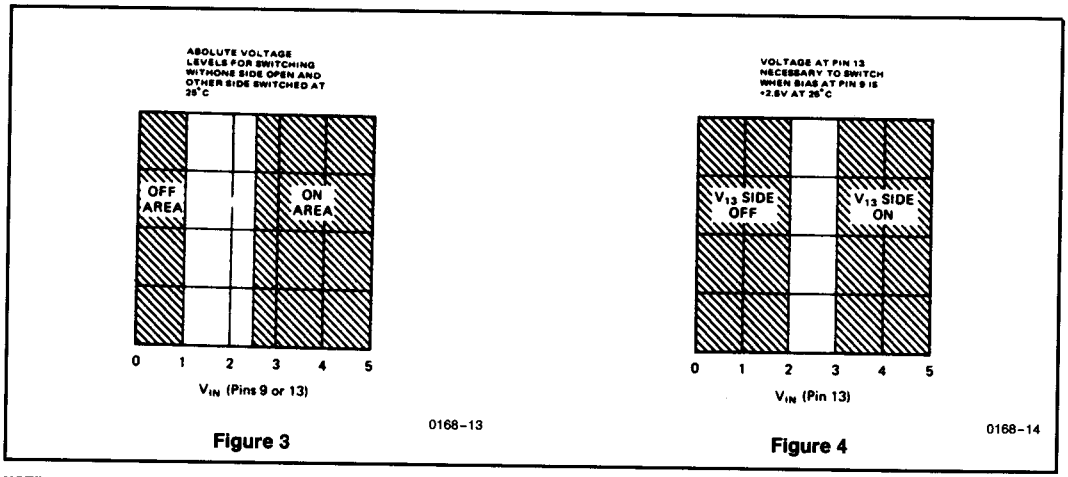


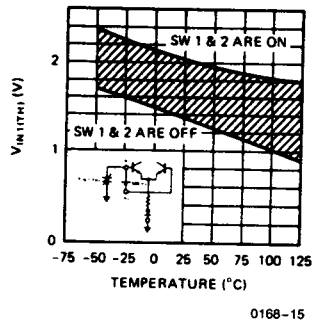
Figure 3 **Figure 4**

NOTE 1: 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.

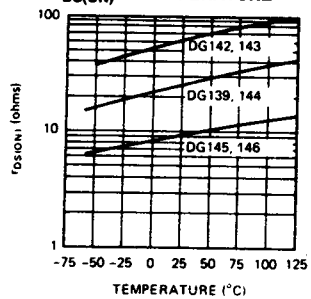
TYPICAL PERFORMANCE CHARACTERISTICS (per channel)

DG139, 142, 144, 145, 146

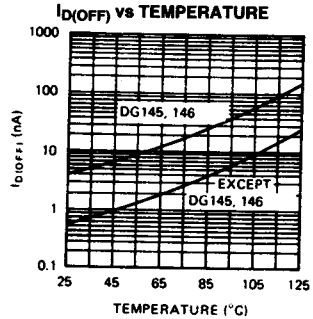
V_{IN1} THRESHOLD vs TEMPERATURE



$R_{DS(ON)}$ vs TEMPERATURE

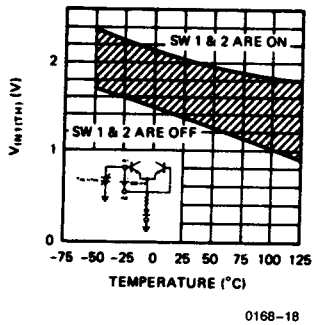


$I_{D(OFF)}$ vs TEMPERATURE

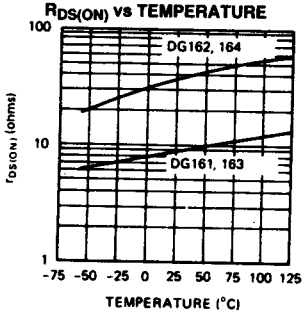


DG161, 162, 163, 164

V_{IN1} THRESHOLD vs TEMPERATURE



$R_{DS(ON)}$ vs TEMPERATURE



$I_{S(OFF)}$ vs TEMPERATURE