SD210/211/212/213/214/215-DE

D-MOS FET SWITCH N-CHANNEL ENHANCEMENT

DESCRIPTION

The Signetics D-MOS SD210, 211, 212, 213, 214 and 215 are silicon, insulated gate, field effect transistors of the N-channel enhancement mode type. They are fabricated by the Signetics double-diffused process which gives high switching speed and low capacitance. A zener diode is connected between the gate and substrate of the SD211, 213 and 215. The diode bypasses any voltage transients which lie outside the range of -0.3V to +30V. Thus, the gate is protected against damage in all normal handling and operating situations. A drain-to-source breakdown of typically 35V makes the SD210 and 211 ideally suited for ±10V switch driver applications. Other characteristics allow them to be used as ±5V switches. The SD214 and 215 are designed to switch signals up to ±10V and the SD212 and 213 are designed to switch signals up to ±5V.

All the devices feature low gate node capacitance, extremely low drain node capacitance and very low feedback capacitance. Low "ON" resistance and hermetically sealed 4-lead TO-72 packages are also featured.

FEATURES

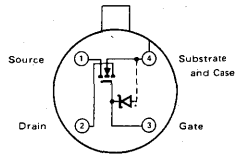
- **Low feedback capacitance: 0.30pF**
- **Low drain node capacitance: 1.3pF**
- **Low gate node capacitance: 2.4pF**
- **Low feedthrough and feedback transients**
- **Ion-implanted for greater reliability**
- **Excellent isolation from input to output: -120dB**
- **35V drain-to-source voltage for SD210/211**
- **Military qualifications pending**

APPLICATIONS

- **Switch driver**
- **Analog switch**
- **Multiplexers**
- **Digital switch**
- **Sample and hold**
- **Choppers**
- **A-TO-D converters**
- **D-TO-A converters**

PIN CONFIGURATION (Top View)

DE PACKAGE



*Diode protection on SD 211/213/215 only.

ORDER PART NO.
SD210DE, SD211DE, SD212DE,
SD213DE, SD214DE, SD215DE

ABSOLUTE MAXIMUM RATINGS (all devices)

PARAMETER	RATING	UNIT
Drain current (I_D)	50	mA
Ambient temperature range		
Storage	-65 to +175	°C
Operating	-55 to +125	°C
Transistor dissipation (P_T)		
At 25°C case temperature (Derate linearly to +125°C case temperature at the rate of 8.0mW/°C.)	1.2	W
At 25°C free-air temperature (Derate linearly to +125°C free-air temperature at the rate of 2.0mW/°C.)	300	mW

ABSOLUTE MAXIMUM RATINGS T_A = 25°C unless otherwise specified.*

PARAMETER		SD210	SD211	SD212	SD213	SD214	SD215	UNIT
V_{DS}	Drain-to-source	+30	+30	+10	+10	+20	+20	Vdc
V_{SD}	Source-to-drain*	+10	+10	+10	+10	+20	+20	Vdc
V_{DB}	Drain-to-substrate	+30	+30	+15	+15	+25	+25	Vdc
V_{SB}	Source-to-substrate	+15	+15	+15	+15	+25	+25	Vdc
V_{GS}	Gate-to-source	±40	-15 +25	±40	-15 +25	±40	-25 +30	Vdc
V_{GB}	Gate-to-substrate	±40	-0.3 +25	±40	-0.3 +25	±40	-0.3 +30	Vdc
V_{GD}	Gate-to-drain	±40	-30 +25	±40	-15 +25	±40	-25 +30	Vdc

*NOTE

Refer to test conditions specified in Electrical Characteristics Table.

DC ELECTRICAL CHARACTERISTICS

T_A = 25°C unless otherwise specified.

PARAMETER		TEST CONDITIONS	SD210			SD211			SD212			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Breakdown voltage												
BV_{DS}	Drain-to-source	$V_{GS} = V_{BS} = 0V$, $I_D = 10\mu A$	30	35		30	35					V
		$V_{GS} = V_{BS} = -5V$, $I_S = 10nA$	10	25		10	25		10	25		V
BV_{SD}	Source-to-drain	$V_{GD} = V_{BD} = -5V$ $I_D = 10nA$	10			10			10			V
BV_{DB}	Drain-to-substrate	$V_{GB} = 0V$, source OPEN $I_D = 10nA$	15			15			15			V
BV_{SB}	Source-to-substrate	$V_{GB} = 0V$, drain OPEN $I_S = 10\mu A$	15			15			15			V
Leakage current												
$I_{DS(OFF)}$	Drain-to-source	$V_{GS} = V_{BS} = -5V$ $V_{DS} = +10V$		1	10		1	10		1	10	nA
$I_{SD(OFF)}$	Source-to-drain	$V_{GD} = V_{BD} = -5V$ $V_{SD} = +10V$		1	10		1	10		1	10	nA
I_{GBS}	Gate	$V_{DB} = V_{SB} = 0V$ $V_{GB} = \pm 40V$			0.1						0.1	nA
		$V_{GB} = +25V$						10				μA
V_T	Threshold voltage	$V_{DS} = V_{GS} = V_T$, $I_S = 1\mu A$ $V_{SB} = 0V$	0.5	1.0	2.0	0.5	1.0	2.0	0.1	1.0	2.0	V
$r_{DS(ON)}$	Drain-to-source resistance	$I_D = 1.0mA$, $V_{SB} = 0$ $V_{GS} = +5V$		50	70		50	70		50	70	Ω
		$V_{GS} = +10V$		30	45		30	45		30	45	Ω
		$V_{GS} = +15V$		23			23			23		Ω
		$V_{GS} = +20V$		19			19			19		Ω
		$V_{GS} = +25V$		17						17		Ω

DC ELECTRICAL CHARACTERISTICS (Cont'd) T_A = 25 °C unless otherwise specified.

PARAMETER		TEST CONDITIONS	SD213			SD214			SD215			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
Breakdown voltage												
BV_{DS}	Drain-to-source	V_{GS} = V_{BS} = -5V, I_S = 10nA	10	25		20	25		20	25		V
BV_{SD}	Source-to-drain	V_{GD} = V_{BD} = -5V I_D = 10nA	10			20			20			V
BV_{DB}	Drain-to-substrate	V_{GB} = 0V, source OPEN I_D = 10nA	15			25			25			V
BV_{SB}	Source-to-substrate	V_{GB} = 0V, drain OPEN I_S = 10μA	15			25			25			V
Leakage current												
$I_{DS}(OFF)$	Drain-to-source	V_{GS} = V_{BS} = -5V										
		V_{DS} = +10V		1	10							nA
		V_{DS} = +20V					1	10		1	10	nA
$I_{SD}(OFF)$	Source-to-drain	V_{GD} = V_{BD} = -5V										
		V_{SD} = +10V		1	10							nA
		V_{SD} = +20V					1	10		1	10	nA
I_{GBS}	Gate	V_{DB} = V_{SB} = 0V										
		V_{GB} = ±40V						0.1				nA
		V_{GB} = +25V			10							μA
		V_{GB} = +30V									10	μA
V_T	Threshold voltage	V_{DS} = V_{GS} = V_T, I_S = 1μA V_{SB} = 0V	0.1	1.0	2.0	0.1	1.0	2.0	0.1	1.0	2.0	V
$r_{DS}(ON)$	Drain-to-source resistance	I_D = 1.0mA, V_{SB} = 0										
		V_{GS} = +5V		50	70		50	70		50	70	Ω
		V_{GS} = +10V		30	45		30	45		30	45	Ω
		V_{GS} = +15V		23			23			23		Ω
		V_{GS} = +20V		19			19			19		Ω
		V_{GS} = +25V					17			17		Ω

AC ELECTRICAL CHARACTERISTICS T_A = 25 °C unless otherwise specified.

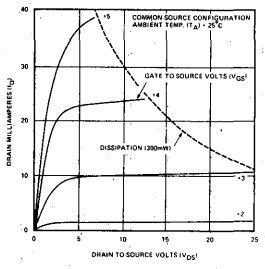
PARAMETER		TEST CONDITIONS	SD210			SD211			SD212			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
gfs	Forward transconductance	V_{DS} = 10V, V_{SB} = 0V I_D = 20mA, f = 1kHz	10	15		10	15		10	15		mmhos
Small Signal Capacitances (See capacitance model)		V_{DS} = 10V, f = 1MHz V_{GS} = V_{BS} = -15V										
$C_{(GS+GD+GB)}$	Gate node			2.4	3.5		2.4	3.5		2.4	3.5	pF
$C_{(GD+DB)}$	Drain node			1.3	1.5		1.3	1.5		1.3	1.5	pF
$C_{(GS+SB)}$	Source node			3.5	4.0		3.5	4.0		3.5	4.0	pF
C_{DG}	Reverse transfer			0.3	0.5		0.3	0.5		0.3	0.5	pF

AC ELECTRICAL CHARACTERISTICS (Cont'd) T_A = 25 °C unless otherwise specified.

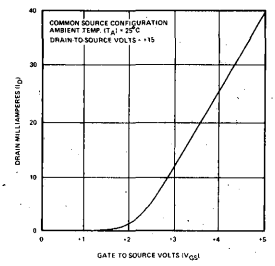
PARAMETER		TEST CONDITIONS	SD213			SD214			SD215			UNIT
			Min	Typ	Max	Min	Typ	Max	Min	Typ	Max	
gfs	Forward transconductance	V_{DS} = 10V, V_{SB} = 0V I_D = 20mA, f = 1kHz	10	15		10	15		10	15		mmhos
Small Signal Capacitances (See capacitance model)		V_{DS} = 10V, f = 1MHz V_{GS} = V_{BS} = -15V										
$C_{(GS+GD+GB)}$	Gate node			2.4	3.5		2.4	3.5		2.4	3.5	pF
$C_{(GD+DB)}$	Drain node			1.3	1.5		1.3	1.5		1.3	1.5	pF
$C_{(GS+SB)}$	Source node			3.5	4.0		3.5	4.0		3.5	4.0	pF
C_{DG}	Reverse transfer			0.3	0.5		0.3	0.5		0.3	0.5	pF

TYPICAL PERFORMANCE CHARACTERISTICS

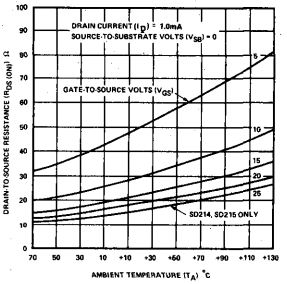
DRAIN CURRENT vs DRAIN-TO-SOURCE VOLTAGE



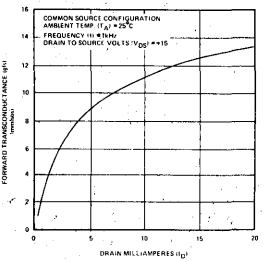
DRAIN CURRENT vs GATE-TO-SOURCE VOLTAGE



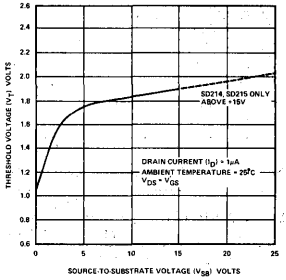
DRAIN-TO-SOURCE RESISTANCE vs TEMPERATURE



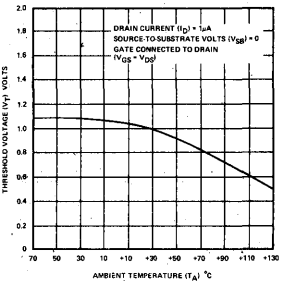
1kHz FORWARD TRANSCONDUCTANCE vs DRAIN CURRENT



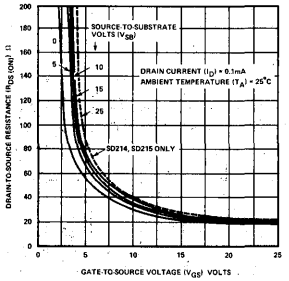
THRESHOLD VOLTAGE vs SOURCE-TO-SUBSTRATE VOLTAGE



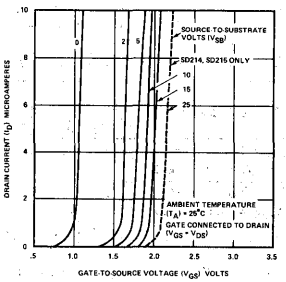
THRESHOLD VOLTAGE vs TEMPERATURE



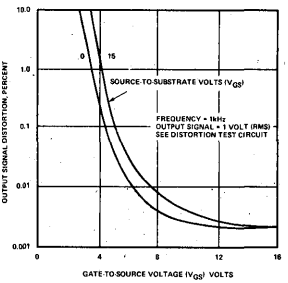
DRAIN-TO-SOURCE RESISTANCE vs GATE-TO-SOURCE VOLTAGE



DRAIN CURRENT vs GATE-TO-SOURCE VOLTAGE

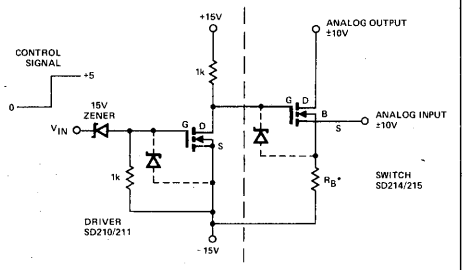


DISTORTION vs GATE-TO-SOURCE VOLTAGE



TYPICAL APPLICATION

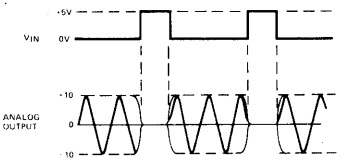
D-MOS DRIVER/SWITCH



RB*Optional current limiting resistor

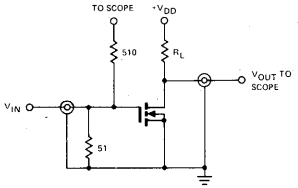
NOTE
*All resistors standard and are measured in ohms.

TYPICAL SWITCHING WAVEFORM



TEST CIRCUITS

SWITCHING

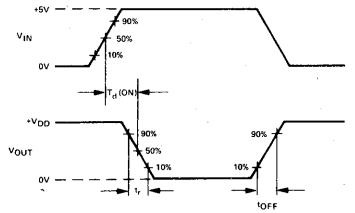


Input pulse: t_d, t_r < 1ns,
Pulse width = 100ns,
Rep rate = 1MHz

SAMPLING SCOPE

t_r < 360ps
R_{IN} = 1MΩ
C_{IN} = 2.0pF

TYPICAL SWITCHING WAVEFORM

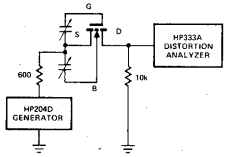


SWITCHING CHARACTERISTICS

		t_d(ON) (ns)		t_r(ns)		t_{OFF}(ns)	
V_{DD}	R_L	Typ	Max	Typ	Max	Typ	Max
5	680	0.6	1.0	0.7	1.0	9.0	*
10	680	0.7		0.8		9.0	*
15	1k	0.9		1.0		14.0	*

*t_{OFF} is dependent on R_L and C_L and does not depend on the device characteristics.

DISTORTION



NOTE: All resistors standard and are measured in ohms.

CAPACITANCE MODEL