signetics

DUAL GATE D-MOS FET N-CHANNEL ENHANCEMENT

UHF AND GENERAL PURPOSE RF APPLICATIONS

SD300 SD301

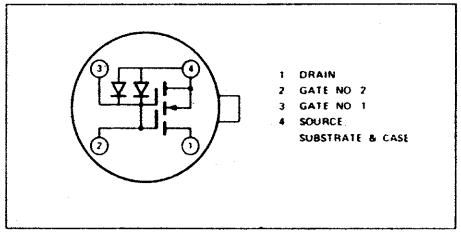
DESCRIPTION

The Signetics D-MOS SD300 and SD301 are dual gate silicon insulated field effect transistors of the N-channel enhancement mode type. They are fabricated by a new principle which gives superior high frequency performance up to 2 GHz. Special diodes are connected between the two gates and the case. These diodes bypass any voltage transients which lie outside the range of -0.3 volts to +25.0 volts. Thus, the gates are protected against damage in all normal handling and operating situations. The device attributes make them ideally suited for a variety of high frequency amplifier and mixer applications. The presence of two gates plus the incorporation of the drift region in the structure, has allowed us to reduce feedback capacity, C_{rss} to 0.02 pF typ. A wide AGC capability plus a significant reduction in cross modulation is now available because of the inherent linearity of the devices. The SD300 and SD301 are hermetically sealed in a modified 4 lead TO-72 package.

FEATURES

- LOWER CROSS-MODULATION AND WIDER DYNAMIC RANGE THAN BIPOLAR OR SINGLE GATE FETs.
- REVERSE AGC CAPABILITY.
- LINEAR MIXING CAPABILITY.
- DIODE PROTECTED GATES.
- HIGH FORWARD TRANSCONDUCTANCE g_{fs} = 10,000 μmhos (typ.).
- HIGH GAIN THROUGH UHF RANGE (13 dB typ. AT 1 GHz).
- LOW NOISE THROUGH UHF RANGE (6 dB typ. FOR SD301 AT 1 GHz).
- LOW INPUT CAPACITANCE (2.0 pF typ.).
- LOW FEEDBACK CAPACITANCE (0.02 pF typ.).
- LOW OUTPUT CAPACITANCE (0.6 pF typ. FOR SD301).
- ION IMPLANTED.
- POSITIVE BIAS ONLY.

PIN CONFIGURATION (Bottom View)

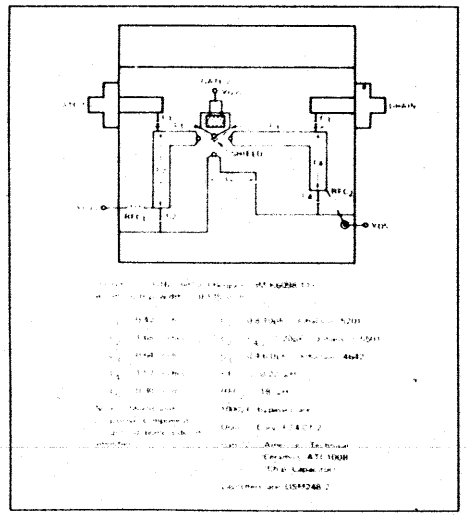


ABSOLUTE MAXIMUM RATING

(T_A = 25°C unless otherwise specified)

Drain-to-source voltage (V_{DS})	+25V (max)
Gate No. 1-to-source voltage (V_{G1S})	-0.3 to +15V dc
Gate No. 2-to-source voltage (V_{G2S})	-0.3 to +25V dc
Drain current (I_D)	50 mA (max)
Ambient temperature range (T_A)	
Storage	-65°C to +175°C
Operating	-65°C to +125°C
Transistor Dissipation (P_T)	
At 25°C case temperature	300mW
Temperature above 25°C	derate at 2.0mW/°C

TEST FIXTURE



ELECTRICAL CHARACTERISTICS SD300, SD301 at 25°C

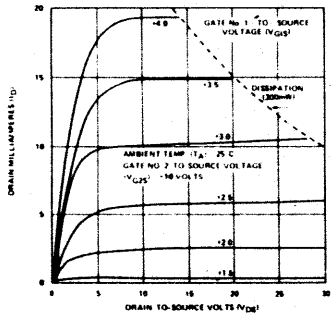
CHARACTERISTIC	SYMBOL	CONDITIONS		LIMITS MIN	LIMITS TYP	LIMITS MAX	UNITS
Drain to Source Breakdown	BV_{DS}	$V_{G1S} = V_{G2S} = 0V$, $I_D = 5\mu A$		+25	+30		volts
Gate 1 Leakage Current	I_{G1SS}	$V_{G1S} = +5V$, $V_{G2S} = V_D = 0V$			0.001	0.1	μA
Gate 2 Leakage Current	I_{G2SS}	$V_{G2S} = 10V$, $V_{G1S} = V_D = 0V$			0.001	0.1	μA
Drain to Source Leakage Current	$I_{D(off)}$	$V_{DS} = +15V$, $V_{G1S} = V_{G2S} = 0V$			0.001	1.0	μA
Zero Bias Drain Current	I_{DSS}						
Gate 1 Threshold Voltage	V_{T1}	$V_{DS} = V_{G1S} = V_{T1}$ $V_{G2S} = +10V$ $I_D = 1\mu A$		+0.1	+0.5	+2.0	volts
Gate 2 Threshold Voltage	V_{T2}	$V_{DS} = V_{G2S} = V_{T2}$ $V_{G1S} = +4V$ $I_D = 1\mu A$		+0.1	+0.5	+2.0	volts
Small Signal Short Circuit Capacitances Gate 2 A.C. Grounded Input	C_{iss}	$V_{DS} = +15V$, $V_{G1S} = +4V$, $V_{G2S} = +10V$, $I_D = 18mA$ $f = 1$ MHz			2.0	2.5	pF
Output	C_{oss}	$V_{DS} = +15V$ $V_{G2S} = +10V$ $f = 1$ MHz	SD300		1.0	1.2	pF
			SD301		0.6	0.8	
Reverse Transfer	C_{rss}	$V_{DS} = +15V$, $V_{G2S} = +10V$ $f = 1$ MHz			0.02		pF
Forward Transconductance	g_{fs}	$V_{DS} = +15V$, $V_{G1S} = +4V$ $V_{G2S} = +10V$, $I_D = 18mA$		8.0	10.0		mmhos
Power Gain *	G_{ps}	$V_{DS} = +15V$, $V_{G1S} = +4V$, $V_{G2S} = +10V$ $I_D = 18mA$	SD300	9.0	13.0		dB
			SD301	10.0	14.0		
Noise Figure *	NF	$f = 1$ GHz	SD300		8.0	9.0	dB
			SD301		6.0	7.0	
Power Gain	G_{ps}	$V_{DS} = +15V$, $V_{G1S} = +4V$, $V_{G2S} = +10V$, $I_D = 18mA$	SD300	22	24		dB
			SD301	22	25		
Noise Figure	NF	$f = 200$ MHz	SD300		3.0	4.0	dB
			SD301		2.0	3.0	
Interfering Signal Level at Gate for 1% Cross Modulation Distortion, Peak Voltage	E_{int}	$V_{DS} = V_{G2S} = +15V$ $I_D = 18mA$ Wanted Signal f = 500 MHz Interfering Signal f = 501 MHz			200		mV
Range of Automatic Gain Control	AGC (V_{G2S})	$V_{DS} = +15V$, V_{G1S} +4V $f = 500$ MHz			40		dB
Drain to Source on Resistance	$r_{DS(on)}$	$V_{G1S} = +5V$, $V_{G2S} = +10V$, $I_D = 0.1mA$			90	130	ohms

* Measured in Amplifier Text Fixture

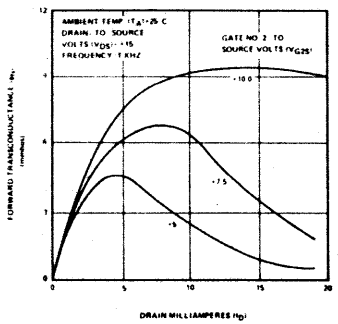
CHARACTERISTIC CURVES

PERFORMANCE CURVES

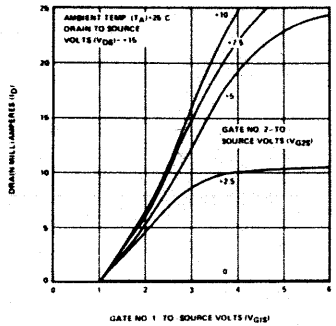
DRAIN CURRENT VERSUS DRAIN–TO–SOURCE VOLTAGE



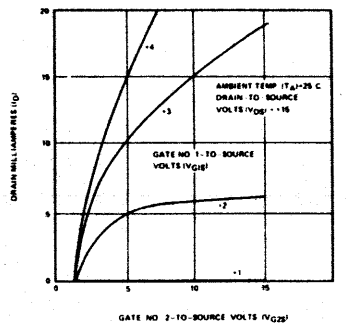
1 KHz FORWARD TRANSCONDUCTANCE VERSUS DRAIN CURRENT



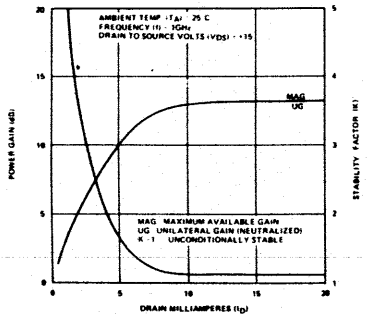
DRAIN CURRENT VERSUS GATE NO. 1–TO–SOURCE VOLTAGE



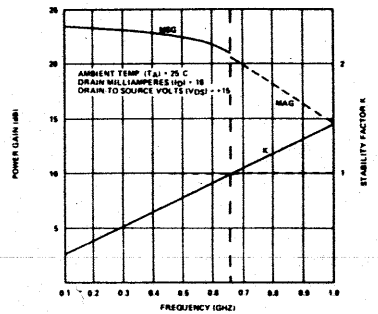
DRAIN CURRENT VERSUS GATE NO. 2–TO–SOURCE VOLTAGE



POWER GAIN VERSUS DRAIN CURRENT

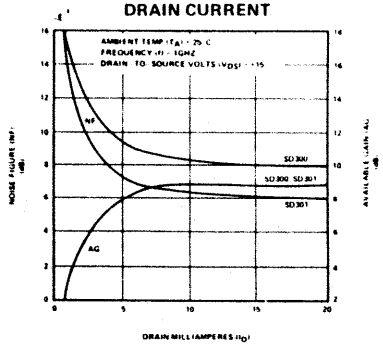


POWER GAIN VERSUS FREQUENCY



CHARACTERISTIC CURVES (Cont'd)

NOISE FIGURE AND AVAILABLE GAIN VERSUS DRAIN CURRENT



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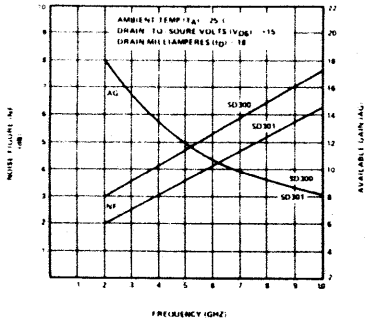
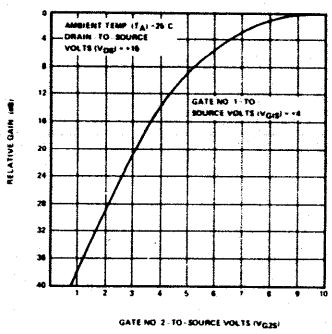
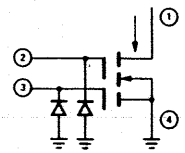


AUTOMATIC GAIN CONTROL RANGE AT 500 MHZ



DUAL GATE CASCODE BIAS SCHEME

SD 300/301



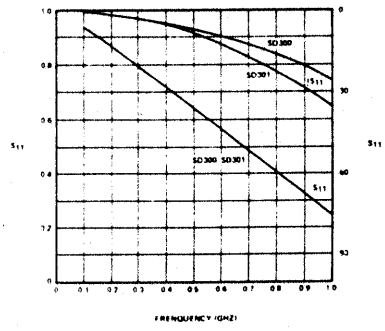
$+V_{DS}$ = 0 - +20 VOLTS
$+V_{G1S}$ = 0 - +4 VOLTS
$+V_{G2S}$ = 0 - +10 VOLTS
$+I_{DS}$ = 0 - +20mA

CHARACTERISTIC CURVES

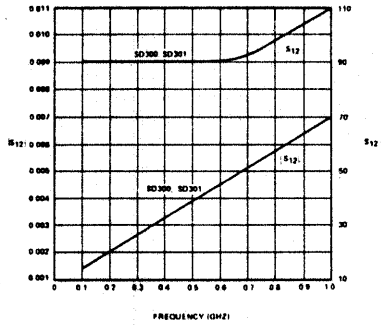
S PARAMETERS

AMBIENT TEMP. (T_A) = 25°C
DRAIN MILLIAMPERES (I_D) = 18
DRAIN–TO–SOURCE VOLTS (V_{DS}) = +15

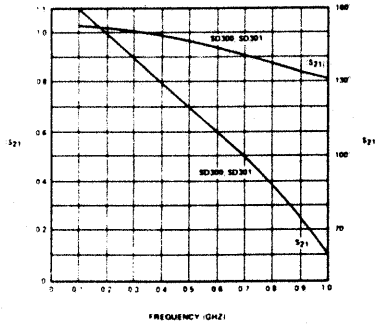
S_{11}



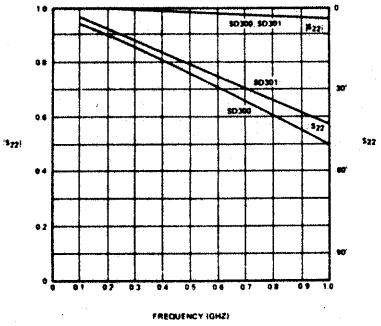
S_{12}



S_{21}



S_{22}



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