

The RF Sub-Micron MOSFET Line  
**RF Power Field Effect Transistors**  
N-Channel Enhancement-Mode Lateral MOSFETs

**MRF281SR1**  
**MRF281ZR1**

Designed for digital and analog cellular PCN and PCS base station applications at frequencies from 1000 to 2500 MHz. Characterized for operation Class A and Class AB at 26 volts in commercial and industrial applications.

- Specified Two-Tone Performance @ 1930 and 2000 MHz, 26 Volts  
Output Power = 4 Watts PEP  
Power Gain = 11 dB  
Efficiency = 30%  
Intermodulation Distortion = -29 dBc
- Capable of Handling 10:1 VSWR, @ 26 Vdc, 2000 MHz, 4 Watts CW Output Power
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- S-Parameter Characterization at High Bias Levels
- Available in Tape and Reel. R1 Suffix = 500 Units per 12 mm, 7 inch Reel.
- LDMOS Models Available at <http://www.motorola.com/semiconductors/rf/models/>

2000 MHz, 4 W, 26 V  
LATERAL N-CHANNEL  
BROADBAND  
RF POWER MOSFETs



CASE 458B-02, STYLE 1  
(MRF281SR1)



CASE 458C-02, STYLE 1  
(MRF281ZR1)

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain-Source Voltage	V <sub>DSS</sub>	65	Vdc
Gate-Source Voltage	V <sub>GS</sub>	±20	Vdc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	P <sub>D</sub>	20 0.115	Watts W/°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	°C
Operating Junction Temperature	T <sub>J</sub>	200	°C

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	R <sub>θJC</sub>	5.74	°C/W

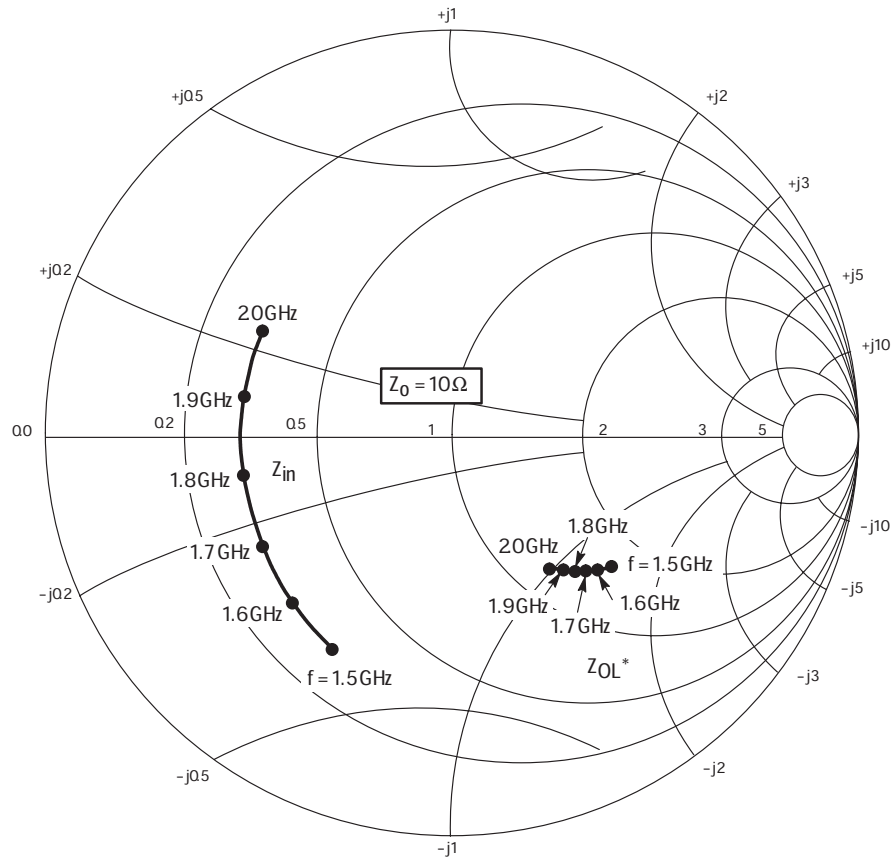
**ELECTRICAL CHARACTERISTICS** (T<sub>C</sub> = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Drain-Source Breakdown Voltage (V <sub>GS</sub> = 0, I <sub>D</sub> = 10 μA <sub>dc</sub> )	V <sub>(BR)DSS</sub>	65	74	—	Vdc
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 28 Vdc, V <sub>GS</sub> = 0)	I <sub>DSS</sub>	—	—	10	μA <sub>dc</sub>
Gate-Source Leakage Current (V <sub>GS</sub> = 20 Vdc, V <sub>DS</sub> = 0)	I <sub>GSS</sub>	—	—	1	μA <sub>dc</sub>

NOTE - **CAUTION** - MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

**ELECTRICAL CHARACTERISTICS continued** ( $T_C = 25^\circ\text{C}$  unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS</b>					
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 20\ \mu\text{Adc}$ )	$V_{GS(th)}$	2.4	3.2	4	Vdc
Gate Quiescent Voltage ( $V_{DS} = 26\text{ Vdc}$ , $I_D = 25\text{ mAdc}$ )	$V_{GS(q)}$	3	4.1	5	Vdc
Drain–Source On–Voltage ( $V_{GS} = 10\text{ Vdc}$ , $I_D = 0.1\text{ A}$ )	$V_{DS(on)}$	0.18	0.24	0.30	Vdc
<b>DYNAMIC CHARACTERISTICS</b>					
Input Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	—	5.5	—	pF
Output Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1.0\text{ MHz}$ )	$C_{oss}$	—	3.3	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 26\text{ Vdc}$ , $V_{GS} = 0$ , $f = 1.0\text{ MHz}$ )	$C_{rss}$	—	0.17	—	pF
<b>FUNCTIONAL TESTS</b> (In Motorola Test Fixture)					
Common–Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ , $f_2 = 2000.1\text{ MHz}$ )	$G_{ps}$	11	12.5	—	dB
Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ , $f_2 = 2000.1\text{ MHz}$ )	$\eta$	30	33	—	%
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ , $f_2 = 2000.1\text{ MHz}$ )	IRL	10	16	—	dB
Intermodulation Distortion ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ , $f_2 = 2000.1\text{ MHz}$ )	IMD	—	–31	–29	dBc
Common–Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ )	$G_{ps}$	11	12.5	—	dB
Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ )	$\eta$	30	—	—	%
Input Return Loss ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ )	IRL	10	16	—	dB
Intermodulation Distortion ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W PEP}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 1930.0\text{ MHz}$ , $f_2 = 1930.1\text{ MHz}$ )	IMD	—	–31	—	dBc
Common–Source Amplifier Power Gain ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W CW}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ )	$G_{ps}$	10.5	12	—	dB
Drain Efficiency ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W CW}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ )	$\eta$	40	44	—	%
Output Mismatch Stress ( $V_{DD} = 26\text{ Vdc}$ , $P_{out} = 4\text{ W CW}$ , $I_{DQ} = 25\text{ mA}$ , $f_1 = 2000.0\text{ MHz}$ , $V_{SWR} = 10:1$ , All Phase Angles at Frequency of Test)	$\Psi$	No Degradation In Output Power			



$V_{DD} = 26V, I_{DQ} = 25mA, P_{out} = 4W (PEP)$

f MHz	$Z_{in}$ $\Omega$	$Z_{OL}^*$ $\Omega$
1500	$3.15 - j5.3$	$15.5 - j13.6$
1600	$3.1 - j3.8$	$14.7 - j12.5$
1700	$3.1 - j2.3$	$14.0 - j11.7$
1800	$3.1 - j0.7$	$13.4 - j11.0$
1900	$3.1 + j0.9$	$12.8 - j10.1$
2000	$3.1 + j2.4$	$12.2 - j9.2$

$Z_{in}$  = Complex conjugate of source impedance.

$Z_{OL}^*$  = Complex conjugate of the optimum load impedance at given output power, voltage, IMD, bias current and frequency.

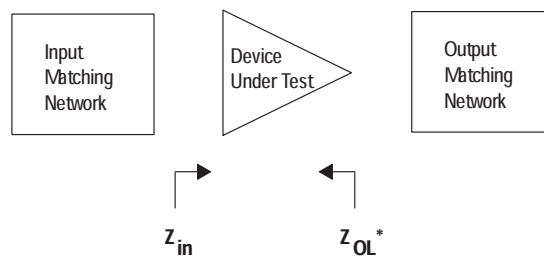


Figure 1. Series Equivalent Input and Output Impedance

Table 1. Common Source S-Parameters at  $V_{DS} = 26$  Vdc,  $I_D = 250$  mAdc

f GHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	φ	dB	φ	S <sub>12</sub>	φ	S <sub>22</sub>	φ
0.1	.982	-28	18.9	160	.008	73	.851	-13
0.2	.947	-52	17.0	143	.015	58	.811	-25
0.3	.912	-73	15.0	129	.019	45	.770	-33
0.4	.886	-90	12.9	117	.022	36	.741	-42
0.5	.859	-103	11.1	108	.022	28	.719	-47
0.6	.854	-114	9.69	100	.023	23	.718	-51
0.7	.841	-123	8.54	93	.022	18	.709	-56
0.8	.837	-131	7.57	87	.021	15	.714	-59
0.9	.838	-138	6.69	81	.019	12	.719	-62
1.0	.841	-143	6.01	76	.018	11	.728	-64
1.1	.840	-149	5.41	72	.015	12	.742	-66
1.2	.849	-153	4.91	68	.013	13	.745	-68
1.3	.848	-158	4.51	64	.012	18	.758	-69
1.4	.856	-162	4.12	60	.010	26	.769	-70
1.5	.858	-167	3.78	57	.009	36	.786	-70
1.6	.871	-170	3.50	54	.008	54	.797	-72
1.7	.868	-173	3.22	51	.009	69	.808	-71
1.8	.870	-176	3.00	49	.009	82	.823	-72
1.9	.872	-180	2.80	46	.011	95	.828	-72
2.0	.877	178	2.63	44	.013	104	.845	-72
2.1	.876	174	2.47	41	.015	109	.843	-72
2.2	.880	171	2.36	39	.018	111	.859	-71
2.3	.882	168	2.21	36	.021	114	.858	-72
2.4	.886	165	2.12	34	.024	114	.872	-70
2.5	.896	162	1.97	32	.027	115	.863	-70
2.6	.897	158	1.89	29	.029	117	.873	-69