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 with 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.

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

CASE 458B–03, STYLE 1
(NI–200S)
(MRF281SR1)

CASE 458C–03, STYLE 1
(NI–200Z)
(MRF281ZR1)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	65	Vdc
Gate–Source Voltage	V_{GS}	±20	Vdc
Total Device Dissipation @ T_C = 25°C Derate above 25°C	P_D	20 0.115	Watts W/°C
Storage Temperature Range	T_{stg}	–65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	5.74	°C/W

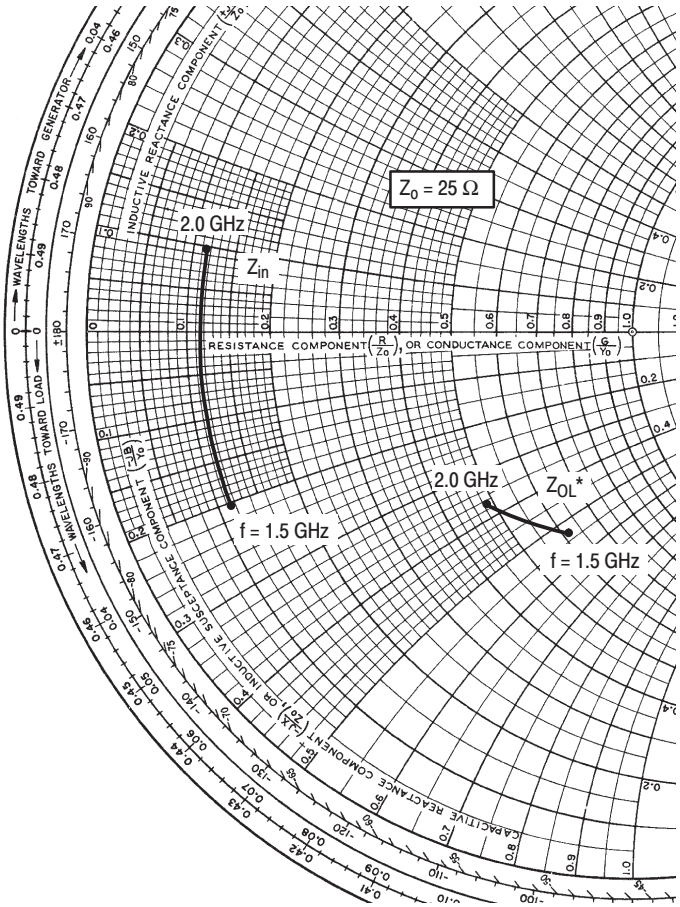
ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{GS} = 0, I_D = 10 μAdc)	$V_{(BR)DSS}$	65	74	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0)	I_{DSS}	—	—	10	μAdc
Gate–Source Leakage Current (V_{GS} = 20 Vdc, V_{DS} = 0)	I_{GSS}	—	—	1	μAdc

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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 20 μAdc)	$V_{GS(th)}$	2.4	3.2	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 25 mAdc)	$V_{GS(q)}$	3	4.1	5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 Vdc, I_D = 0.1 A)	$V_{DS(on)}$	0.18	0.24	0.30	Vdc
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{iss}	—	5.5	—	pF
Output Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{oss}	—	3.3	—	pF
Reverse Transfer Capacitance (V_{DS} = 26 Vdc, V_{GS} = 0, f = 1.0 MHz)	C_{rss}	—	0.17	—	pF
FUNCTIONAL TESTS (In Motorola Test Fixture)					
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	G_{ps}	11	12.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	η	30	33	—	%
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	IRL	—	–16	–10	dB
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 2000.0 MHz, f2 = 2000.1 MHz)	IMD	—	–31	–29	dBc
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	G_{ps}	11	12.5	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 4 W, I_{DQ} = 25 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	η	30	—	—	%
Input Return Loss (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IRL	—	–16	–10	dB
Intermodulation Distortion (V_{DD} = 26 Vdc, P_{out} = 4 W PEP, I_{DQ} = 25 mA, f1 = 1930.0 MHz, f2 = 1930.1 MHz)	IMD	—	–31	—	dBc
Common–Source Amplifier Power Gain (V_{DD} = 26 Vdc, P_{out} = 4 W CW, I_{DQ} = 25 mA, f1 = 2000.0 MHz)	G_{ps}	10.5	12	—	dB
Drain Efficiency (V_{DD} = 26 Vdc, P_{out} = 4 W CW, I_{DQ} = 25 mA, f1 = 2000.0 MHz)	η	40	44	—	%
Output Mismatch Stress (V_{DD} = 26 Vdc, P_{out} = 4 W CW, I_{DQ} = 25 mA, f1 = 2000.0 MHz, VSWR = 10:1, All Phase Angles at Frequency of Test)	Ψ	No Degradation In Output Power			



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

f MHz	Z_{in} Ω	Z_{OL}^* Ω
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.

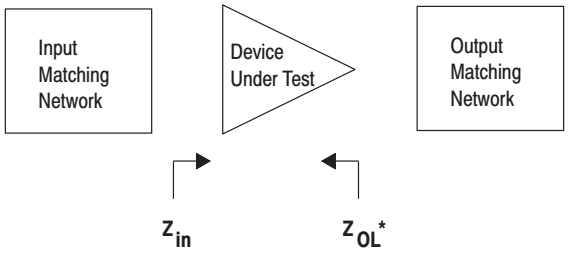


Figure 1. Series Equivalent Input and Output Impedance

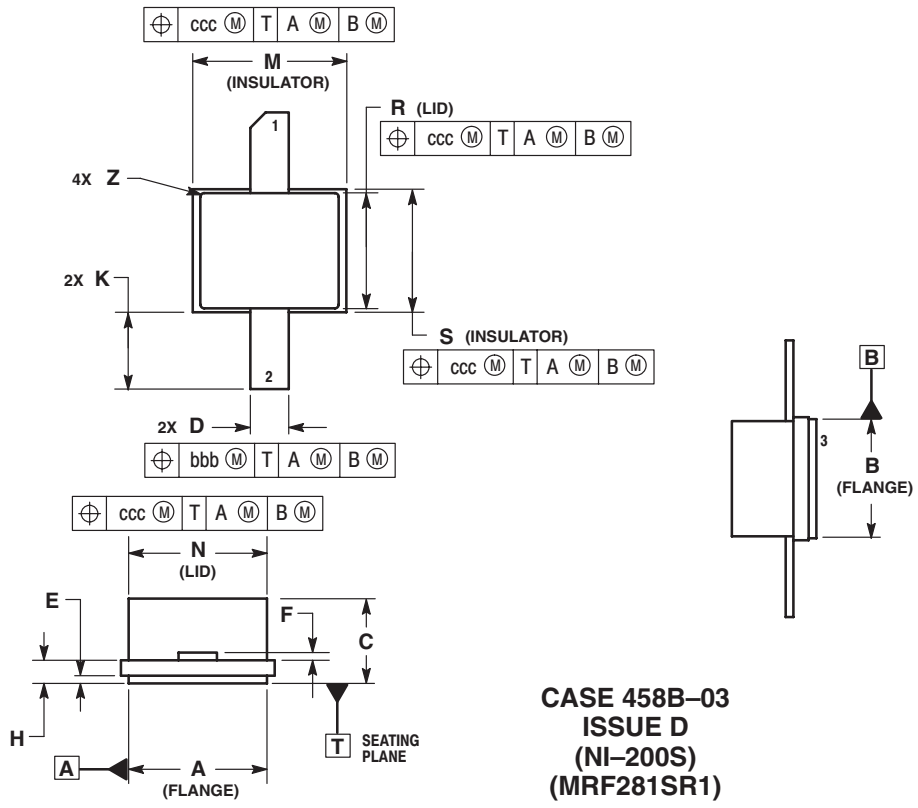
Table 1. Common Source S–Parameters at V_{DS} = 26 Vdc, I_D = 250 mAdc

f GHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	$\angle\phi$	dB	$\angle\phi$	$\|S_{12}\|$	$\angle\phi$	$\|S_{22}\|$	$\angle\phi$
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

NOTES

NOTES

PACKAGE DIMENSIONS

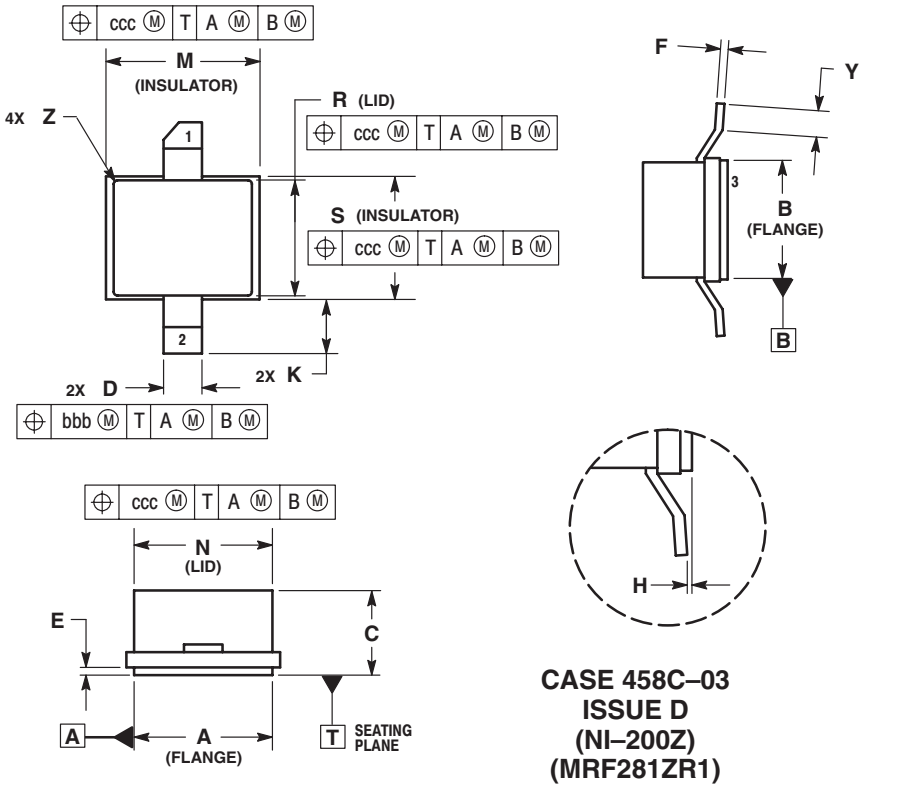


NOTES:
1. CONTROLLING DIMENSIONS: INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. ALL DIMENSIONS ARE SYMMETRICAL ABOUT CENTERLINE UNLESS OTHERWISE NOTED.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.180	0.190	4.572	4.83
B	0.140	0.150	3.556	3.81
C	0.082	0.116	2.083	2.946
D	0.047	0.053	1.194	1.346
E	0.004	0.010	0.102	0.254
F	0.004	0.006	0.102	0.152
H	0.025	0.031	0.635	0.787
K	0.060	0.110	1.524	2.794
M	0.197	0.203	5.004	5.156
N	0.177	0.183	4.496	4.648
R	0.147	0.153	3.734	3.886
S	0.157	0.163	3.988	4.14
Z	---	0.020	---	0.508
bbb	0.010 REF		0.254 REF	
ccc	0.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

CASE 458B–03
ISSUE D
(NI–200S)
(MRF281SR1)



NOTES:
1. CONTROLLING DIMENSIONS: INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. DIMENSION H (PACKAGE COPLANARITY): THE BOTTOM OF LEADS AND REFERENCE PLANE T MUST BE COPLANAR WITHIN DIMENSION H.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.180	0.190	4.572	4.830
B	0.140	0.150	3.556	3.810
C	0.082	0.116	2.083	2.946
D	0.047	0.053	1.194	1.346
E	0.004	0.010	0.102	0.254
F	0.004	0.006	0.102	0.152
H	0.000	0.004	0.000	0.102
K	0.050	0.090	1.270	2.286
M	0.197	0.203	5.004	5.156
N	0.177	0.183	4.496	4.648
R	0.147	0.153	3.734	3.886
S	0.157	0.163	3.988	4.140
Y	0.020	0.040	0.508	1.016
Z	---	R .020	---	R .508
bbb	.010 REF		0.254 REF	
ccc	.015 REF		0.381 REF	

STYLE 1:
PIN 1. DRAIN
2. GATE
3. SOURCE

CASE 458C–03
ISSUE D
(NI–200Z)
(MRF281ZR1)

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