Freescale Semiconductor
Technical Data

Document Number: MRF281
Rev. 6, 10/2008

RoHS

RF Power Field Effect Transistors

N-Channel Enhancement-Mode Lateral MOSFETs

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 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

Features

- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- S-Parameter Characterization at High Bias Levels
- RoHS Compliant
- In Tape and Reel. R1 Suffix = 500 Units per 12 mm, 7 inch Reel.

MRF281SR1
MRF281ZR1

1930-1990 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

Table 1. Maximum Ratings

Rating	Symbol	Value	Unit
Drain-Source Voltage	V_{DSS}	-0.5, +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	W W/°C
Storage Temperature Range	T_{stg}	- 65 to +150	°C
Case Operating Temperature	T_C	150	°C
Operating Junction Temperature	T_J	200	°C

Table 2. Thermal Characteristics

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

Table 3. 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.

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Table 3. Electrical Characteristics (T_C = 25°C unless otherwise noted) **(continued)**

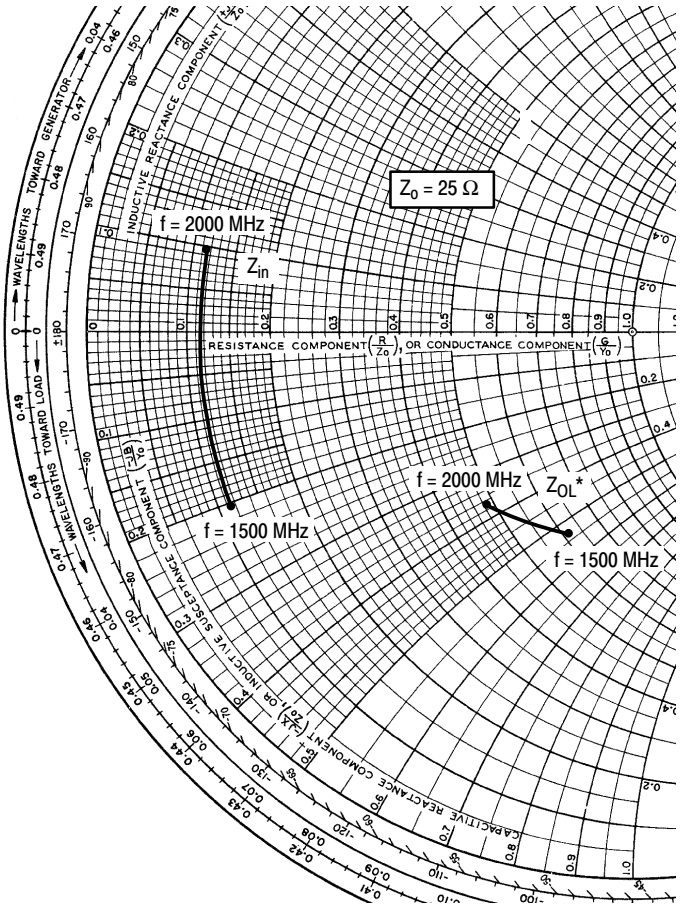
Characteristic	Symbol	Min	Typ	Max	Unit
On Characteristics					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 20 μAdc)	$V_{GS(th)}$	2.4	3.2	4	Vdc
Gate Quiescent Voltage (V_{DS} = 26 Vdc, I_D = 25 mAdc)	$V_{GS(q)}$	3	4.1	5	Vdc
Drain-Source On-Voltage (V_{GS} = 10 Vdc, I_D = 0.1 A)	$V_{DS(on)}$	0.18	0.24	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 Freescale Test Fixture)					
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

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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.

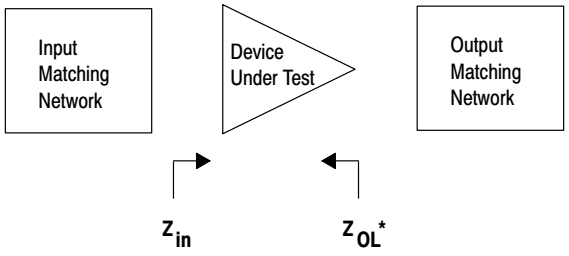


Figure 1. Series Equivalent Input and Output Impedance

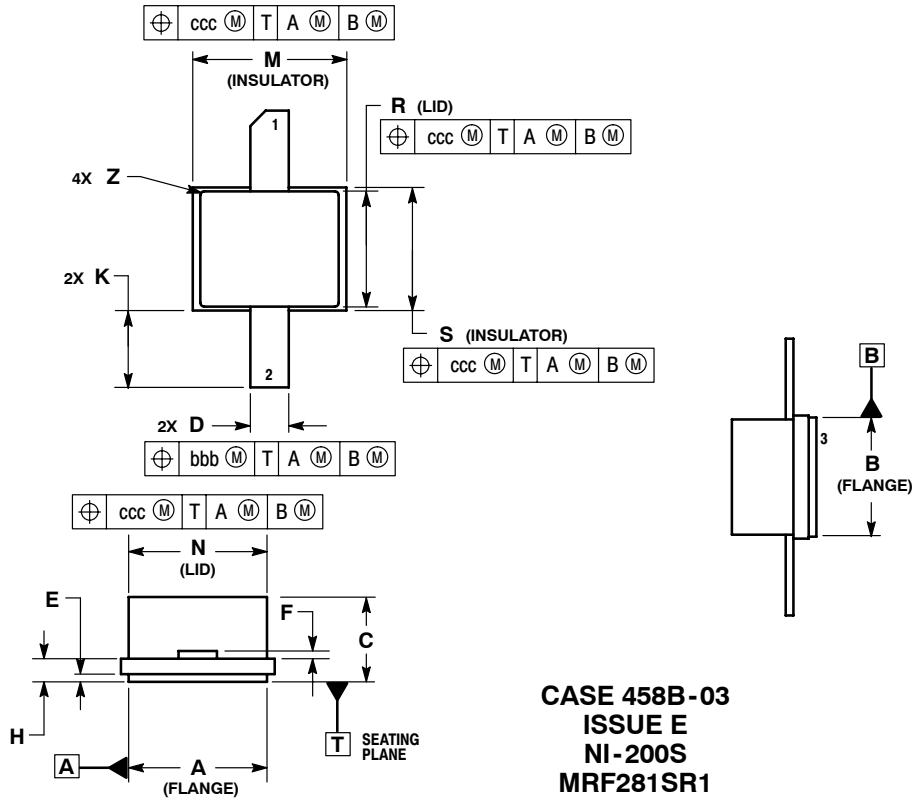
Table 4. Common Source S-Parameters at V_{DS} = 26 Vdc, I_D = 250 mAdc

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

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PACKAGE DIMENSIONS

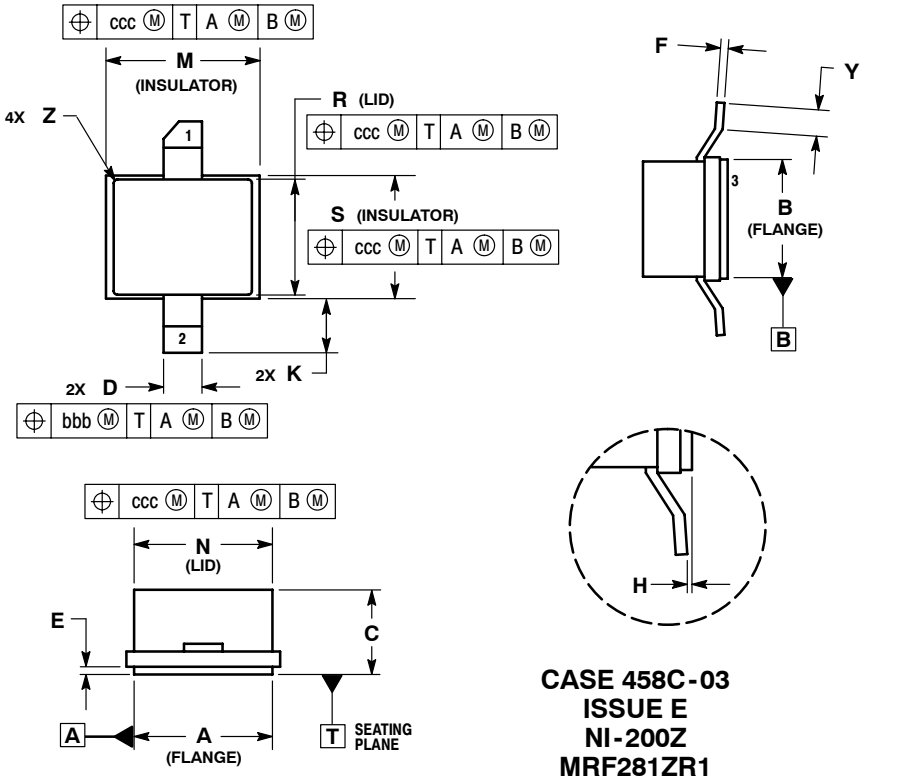


NOTES:
1. CONTROLLING DIMENSIONS: INCHES.
2. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M, 1994.
3. ALL DIMENSIONS ARE SYMMETRICAL ABOUT CENTERLINE UNLESS OTHERWISE NOTED.

	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 E
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 E
NI-200Z
MRF281ZR1

PRODUCT DOCUMENTATION

Refer to the following documents to aid your design process.

Engineering Bulletins

- EB212: Using Data Sheet Impedances for RF LDMOS Devices

REVISION HISTORY

The following table summarizes revisions to this document.

Revision	Date	Description
6	Oct. 2008	• Modified data sheet to reflect RF Test Reduction described in Product and Process Change Notification number, PCN13232, p. 1, 2, and Product Discontinuance Notification number, PCN13420, adding applicable overlay • Added Product Documentation and Revision History, p. 6

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