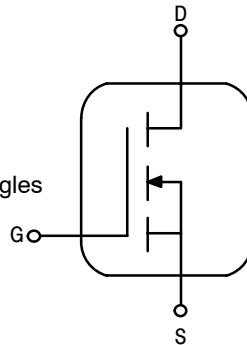




The RF MOSFET Line  
**RF Power**  
**Field Effect Transistors**  
N-Channel Enhancement-Mode Lateral  
MOSFETs

Designed for broadband commercial and industrial applications with frequencies to 1.0 GHz. The high gain and broadband performance of these devices make them ideal for large-signal, common source amplifier applications in 28 volt base station equipment.

- Guaranteed Performance at 945 MHz, 28 Volts  
Output Power — 45 Watts PEP  
Power Gain — 11.5 dB  
Efficiency — 33%  
IMD — - 28 dBc
- Excellent Thermal Stability
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- S-Parameter Characterization at High Bias Levels
- 100% Tested for Load Mismatch Stress at all Phase Angles with 5:1 VSWR @ 28 Vdc, 945 MHz, 45 Watts CW
- In Tape and Reel. R1 Suffix = 500 Units per 32 mm, 13 inch Reel.



**MRF183R1**  
**MRF183LSR1**

**1.0 GHz, 45 W, 28 V**  
**LATERAL N-CHANNEL**  
**BROADBAND**  
**RF POWER MOSFETs**

**CASE 360B-05, STYLE 1**  
**NI-360**  
**MRF183R1**

**CASE 360C-05, STYLE 1**  
**NI-360S**  
**MRF183LSR1**

**MAXIMUM RATINGS**

Rating	Symbol	Value	Unit
Drain-Source Voltage	$V_{DSS}$	65	Vdc
Drain-Gate Voltage (RGS = 1 Meg Ohm)	$V_{DGR}$	65	Vdc
Gate-Source Voltage	$V_{GS}$	$\pm 20$	Vdc
Drain Current - Continuous	$I_D$	5	Adc
Total Device Dissipation @ $T_C = 70^\circ\text{C}$ Derate above $70^\circ\text{C}$	$P_D$	86 0.67	W W/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 65 to +200	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.5	$^\circ\text{C}/\text{W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

**OFF CHARACTERISTICS**

Drain-Source Breakdown Voltage ( $V_{GS} = 0 \text{ Vdc}, I_D = 50 \mu\text{Adc}$ )	$BV_{DSS}$	65	-	-	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 28 \text{ Vdc}, V_{GS} = 0 \text{ Vdc}$ )	$I_{DSS}$	-	-	1	$\mu\text{Adc}$
Gate-Source Leakage Current ( $V_{GS} = 20 \text{ Vdc}, V_{DS} = 0 \text{ Vdc}$ )	$I_{GSS}$	-	-	1	$\mu\text{Adc}$

**ON CHARACTERISTICS**

Gate Quiescent Voltage ( $V_{DS} = 28 \text{ Vdc}, I_D = 250 \text{ mAdc}$ )	$V_{GS(Q)}$	3	-	5	Vdc
Drain-Source On-Voltage ( $V_{GS} = 10 \text{ V}, I_D = 3 \text{ A}$ )	$V_{DS(on)}$	-	0.7	-	Vdc
Forward Transconductance ( $V_{DS} = 10 \text{ Vdc}, I_D = 5 \text{ Adc}$ )	$g_{fs}$	-	2	-	S

**DYNAMIC CHARACTERISTICS**

Input Capacitance ( $V_{DS} = 28 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$ )	$C_{iss}$	-	82	-	pF
Output Capacitance ( $V_{DS} = 28 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$ )	$C_{oss}$	-	38	-	pF
Reverse Transfer Capacitance ( $V_{DS} = 28 \text{ V}, V_{GS} = 0, f = 1 \text{ MHz}$ )	$C_{rss}$	-	4.5	-	pF

**FUNCTIONAL TESTS** (In Motorola Test Fixture, 50 ohm system)

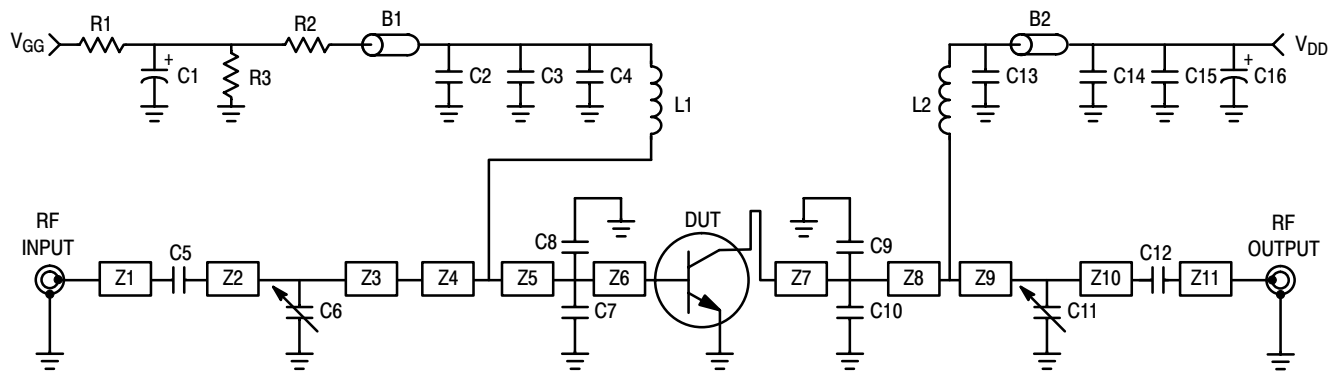
( $V_{DD} = 28 \text{ Vdc}, P_{out} = 45 \text{ Watts PEP}, f_1 = 945.0, f_2 = 945.1 \text{ MHz}, I_{DQ} = 250 \text{ mA}$ )

Two-Tone Common Source Amplifier Power Gain	$G_{ps}$	11.5	13.5	-	dB
Two-Tone Drain Efficiency	$\eta$	33	38	-	%
3rd Order Intermodulation Distortion	IMD	-	-32	-28	dBc
Input Return Loss	IRL	9	14	-	dB

( $V_{DD} = 28 \text{ Vdc}, P_{out} = 45 \text{ Watts PEP}, f_1 = 930.0, f_2 = 930.1 \text{ MHz}, \text{ and } f_1 = 960.0, f_2 = 960.1 \text{ MHz}, I_{DQ} = 250 \text{ mA}$ )

Two-Tone Common Source Amplifier Power Gain	$G_{ps}$	-	13	-	dB
Two-Tone Drain Efficiency	$\eta$	-	35	-	%
3rd Order Intermodulation Distortion	IMD	-	-32	-	dBc
Input Return Loss	IRL	-	12	-	dB
Output Mismatch Stress ( $V_{DD} = 28 \text{ Vdc}, P_{out} = 45 \text{ Watts CW}, I_{DQ} = 250 \text{ mA}, f = 945 \text{ MHz}, \text{VSWR } 5:1 \text{ at All Phase Angles}$ )	$\Psi$	No Degradation in Output Power Before and After Test			

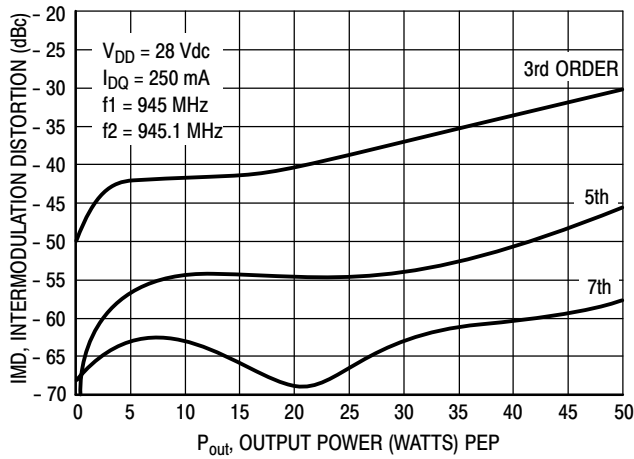
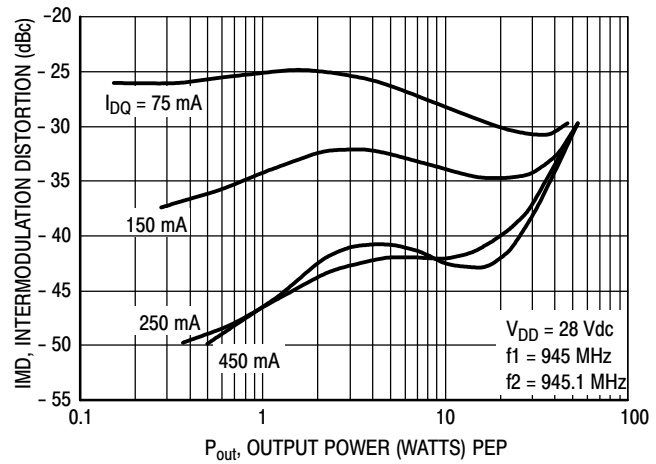
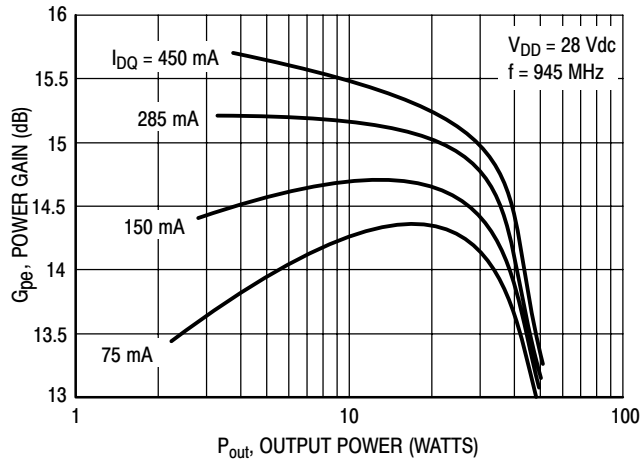
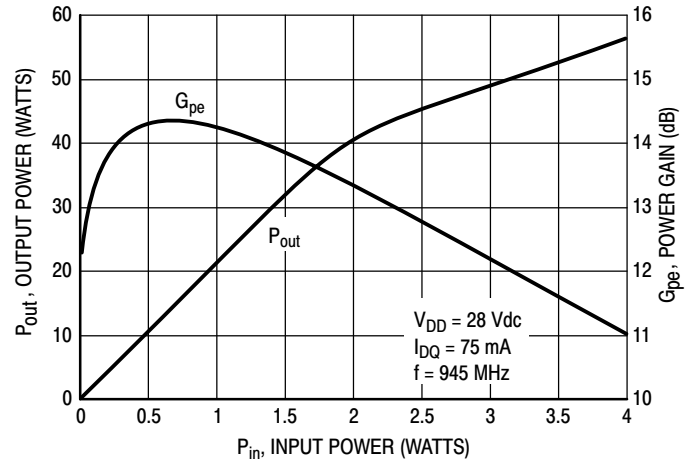
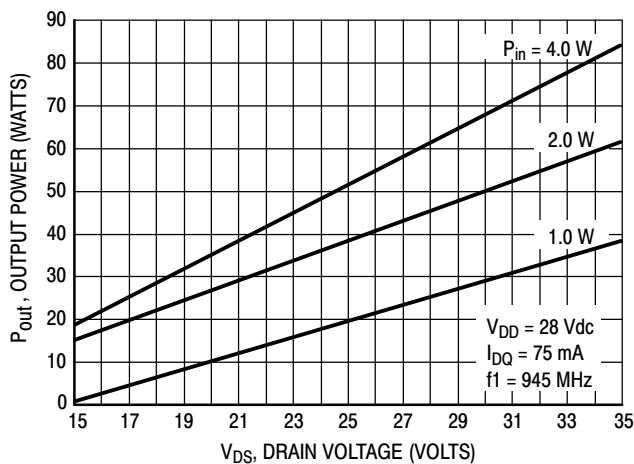
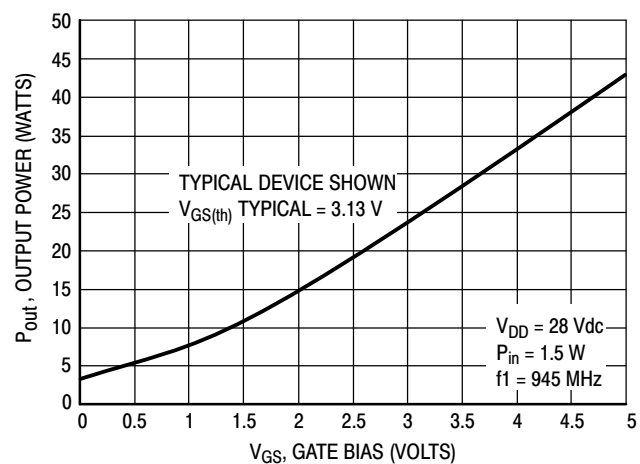
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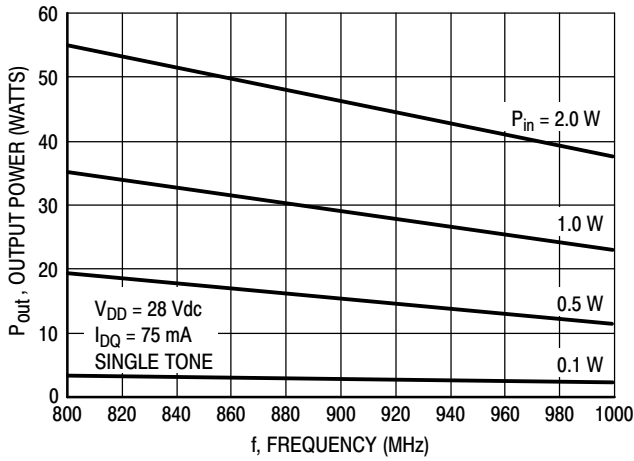
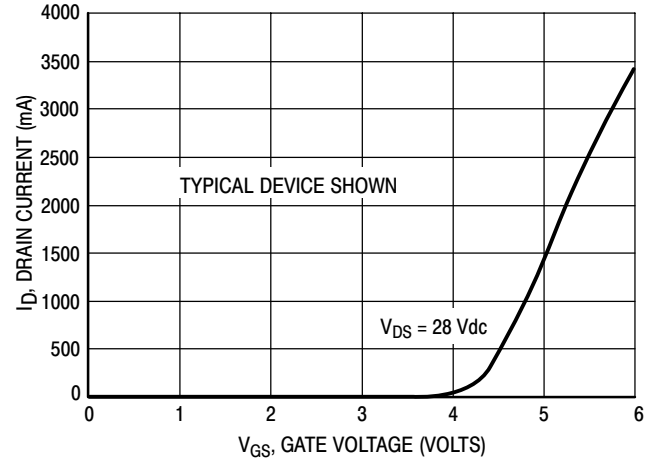
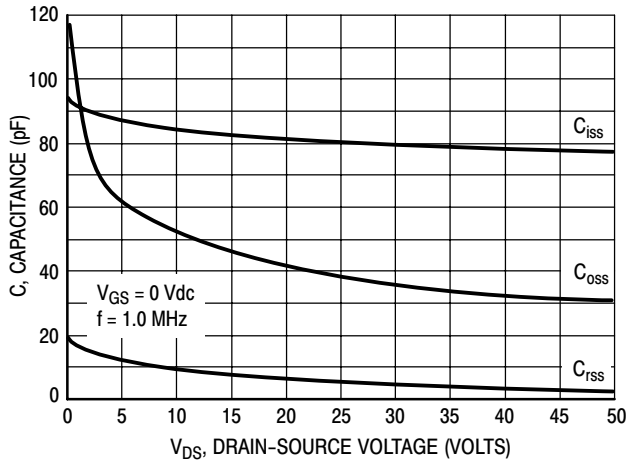
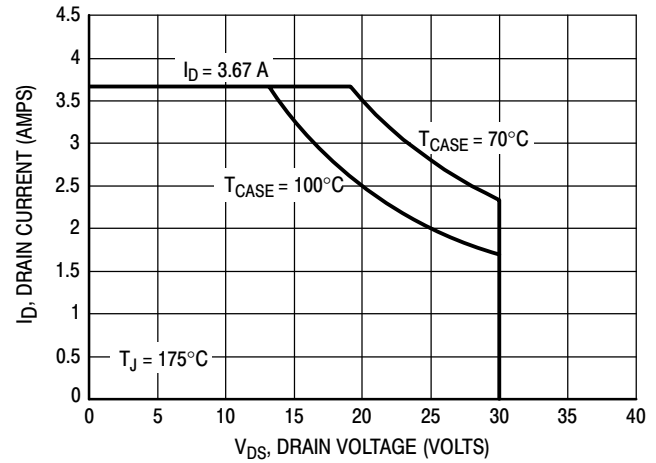
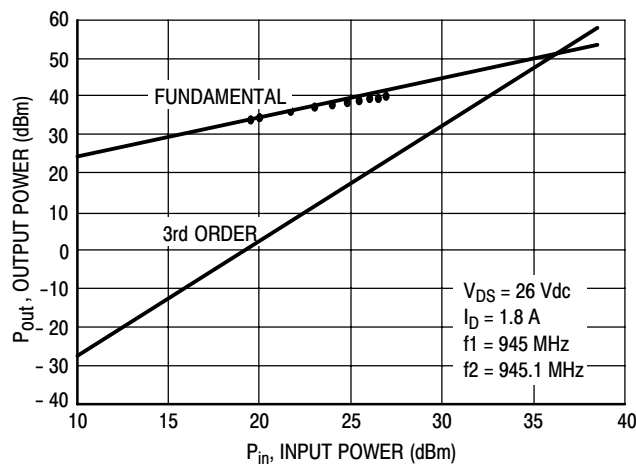


B1	Short Ferrite Bead	R3	4.7 MΩ, 1/4 W Carbon
B2	Long Ferrite Bead	Z1	T-Line, 0.200" x 0.080"
C1	10 μF, 50 V Electrolytic Capacitor	Z2	T-Line, 0.570" x 0.120"
C2, C14	0.1 μF Chip Capacitor	Z3	T-Line, 0.610" x 0.320"
C3	1000 pF Chip Capacitor	Z4	T-Line, 0.160" x 0.320" x 0.620"
C4, C13	47 pF Chip Capacitor		Tapered Line
C5, C12	47 pF Chip Capacitor	Z5	T-Line, 0.650" x 0.620"
C6, C11	0.8-8.0 pF Trim Capacitor	Z6	T-Line, 0.020" x 0.620"
C7, C8	10 pF Chip Capacitor	Z7	T-Line, 0.270" x 0.320"
C9, C10	10 pF Chip Capacitor	Z8	T-Line, 0.130" x 0.320"
C15	100 pF Chip Capacitor	Z9	T-Line, 0.370" x 0.080"
C16	250 μF, 50 V Electrolytic Capacitor	Z10	T-Line, 1.050" x 0.080"
L1, L2	5 Turns, 24 AWG, ID 0.059"	Z11	T-Line, 0.290" x 0.080"
R1	120 Ω, 1/4 W Carbon	Board	0.030" Glass Teflon, ε <sub>r</sub> = 2.55
R2	18 kΩ, 1/4 W Carbon		ARLON-GX-0300-55-22

Figure 1. MRF183LSR1 Two Tone Test Circuit Schematic

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**TYPICAL CHARACTERISTICS**

**Figure 2. Intermodulation Distortion Products versus Output Power**

**Figure 3. Intermodulation Distortion versus Output Power**

**Figure 4. Power Gain versus Output Power**

**Figure 5. Output Power versus Input Power**

**Figure 6. Output Power versus Drain Bias Supply Voltage**

**Figure 7. Output Power versus Gate Bias Supply Voltage**

**TYPICAL CHARACTERISTICS**

**Figure 8. Output Power versus Frequency**

**Figure 9. Drain Current versus Gate Voltage**

**Figure 10. Capacitance versus Voltage**

**Figure 11. Class A Safe Operating Region**

**Figure 12. Class A Third Order Intercept Point**

### TYPICAL CHARACTERISTICS

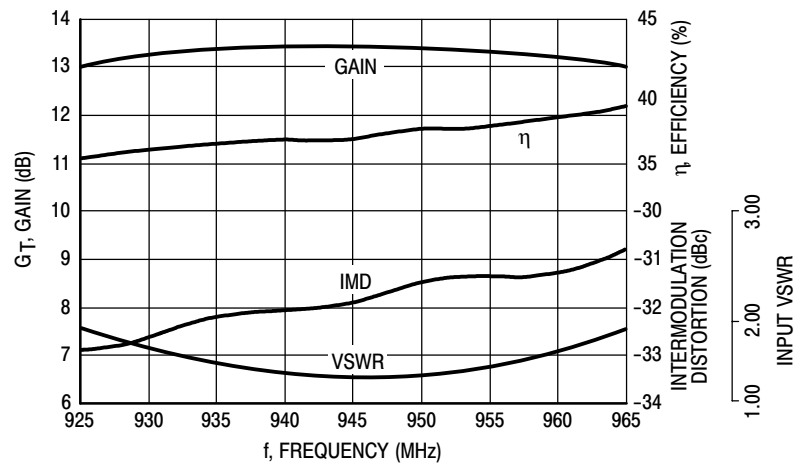


Figure 13. Broadband Power Performance of MRF183LSR1

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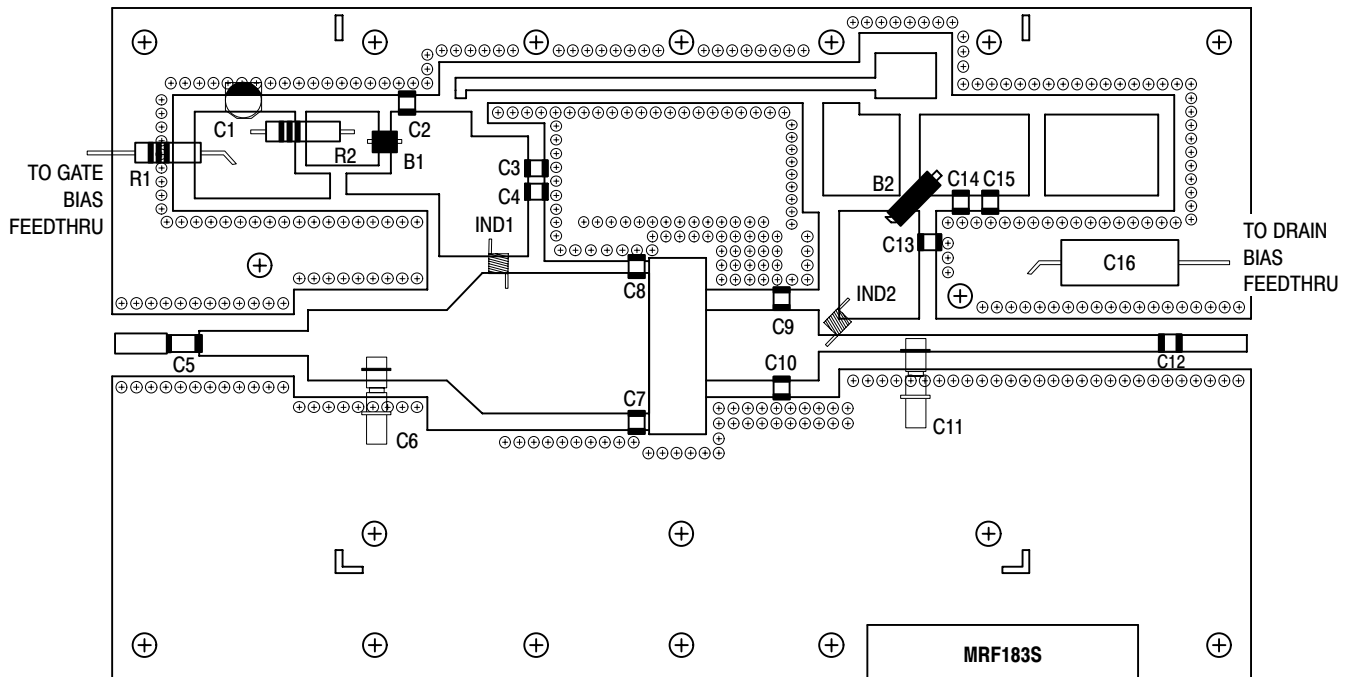
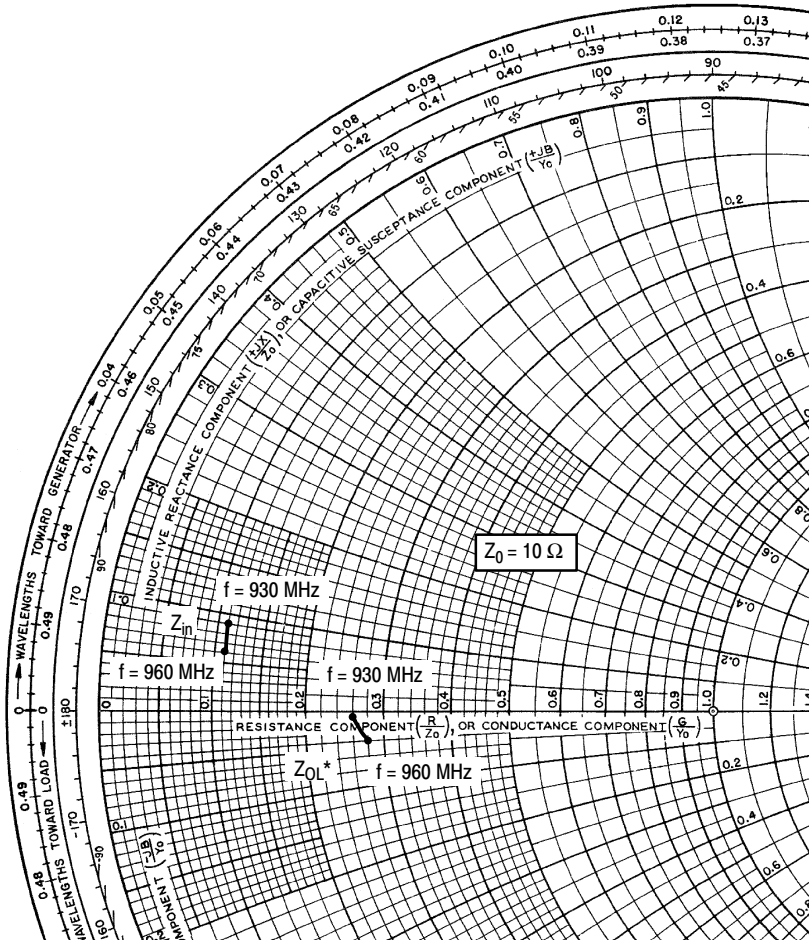


Figure 14. MRF183LSR1 Two Tone Test Circuit Component Parts Layout



$V_{DD} = 28 \text{ V}$ ,  $I_{DQ} = 250 \text{ mA}$ ,  $P_{out} = 45 \text{ W PEP}$

f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ Ohms
930	$1.10 + j0.93$	$2.60 - j0.13$
945	$1.10 + j0.78$	$2.70 - j0.28$
960	$1.10 + j0.60$	$2.80 - j0.42$

$Z_{in}$  = Conjugate of source impedance.

$Z_{OL}^*$  = Conjugate of the load impedance at a given output power, voltage, and current conditions.

Note:  $Z_{OL}^*$  was chosen based on tradeoffs between gain, output power, drain efficiency and intermodulation distortion.

**Figure 15. Series Equivalent Input and Output Impedance**

Table 1. Typical Common Source S-Parameters ( $V_{DS} = 13.5\text{ V}$ )

$I_D = 1.5\text{ A}$

f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
20	0.954	-157	29.58	100	0.017	11	0.778	-161
30	0.941	-164	19.73	96	0.017	8	0.796	-168
40	0.922	-168	14.84	93	0.017	4	0.804	-170
50	0.907	-171	11.94	91	0.017	3	0.808	-172
60	0.903	-172	9.75	89	0.017	2	0.812	-173
70	0.899	-173	8.34	88	0.017	0	0.814	-174
80	0.898	-174	7.29	86	0.017	-1	0.816	-175
90	0.896	-175	6.49	85	0.017	-2	0.816	-175
100	0.897	-175	5.83	84	0.017	-2	0.817	-175
150	0.895	-177	3.82	79	0.017	-6	0.822	-176
200	0.898	-178	2.84	74	0.016	-9	0.828	-176
250	0.902	-178	2.24	70	0.016	-11	0.835	-176
300	0.908	-179	1.84	66	0.015	-14	0.842	-176
350	0.905	-179	1.55	62	0.015	-16	0.850	-176
400	0.913	-180	1.32	58	0.014	-18	0.861	-176
450	0.920	180	1.15	54	0.014	-18	0.865	-176
500	0.924	179	1.01	51	0.013	-20	0.874	-177
550	0.922	179	0.89	47	0.013	-21	0.881	-177
600	0.931	178	0.80	44	0.012	-21	0.889	-177
650	0.935	178	0.72	41	0.011	-20	0.895	-177
700	0.935	177	0.64	38	0.011	-17	0.901	-178
750	0.937	177	0.59	37	0.012	-18	0.905	-178
800	0.940	176	0.54	33	0.012	-20	0.913	-178
850	0.943	176	0.50	30	0.012	-29	0.919	-179
900	0.945	175	0.46	28	0.010	-33	0.924	-179
950	0.947	174	0.43	26	0.009	-34	0.930	-180
1000	0.947	174	0.40	24	0.008	-29	0.935	180
1050	0.947	173	0.37	21	0.007	-24	0.939	179
1100	0.952	172	0.35	19	0.007	-19	0.944	179
1150	0.949	172	0.32	17	0.007	-17	0.948	178
1200	0.946	171	0.30	14	0.006	-16	0.948	177
1250	0.954	170	0.28	12	0.006	-13	0.953	177
1300	0.952	170	0.27	9	0.006	-12	0.950	176
1350	0.949	169	0.26	9	0.006	-10	0.951	176
1400	0.948	168	0.23	8	0.005	-7	0.953	175
1450	0.948	168	0.22	6	0.004	4	0.948	174
1500	0.940	167	0.21	4	0.004	19	0.944	174

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Table 2. Typical Common Source S-Parameters ( $V_{DS} = 28\text{ V}$ )

$I_D = 1.5\text{ A}$

f MHz	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
20	0.968	-132	45.79	113	0.014	24	0.579	-145
30	0.953	-145	31.75	106	0.015	17	0.623	-157
40	0.921	-154	24.33	99	0.015	12	0.648	-161
50	0.904	-159	19.68	95	0.015	7	0.661	-164
60	0.898	-163	16.11	92	0.015	5	0.670	-166
70	0.890	-165	13.79	90	0.015	2	0.677	-167
80	0.886	-167	12.06	87	0.015	1	0.681	-168
90	0.886	-168	10.71	86	0.015	-1	0.684	-169
100	0.887	-169	9.61	84	0.015	-3	0.688	-169
150	0.886	-172	6.26	76	0.015	-9	0.706	-170
200	0.890	-174	4.59	69	0.014	-13	0.724	-170
250	0.898	-175	3.57	64	0.014	-17	0.744	-169
300	0.906	-176	2.88	59	0.013	-19	0.764	-169
350	0.908	-177	2.37	54	0.012	-23	0.785	-169
400	0.915	-178	2.00	49	0.011	-24	0.807	-170
450	0.924	-178	1.71	45	0.010	-25	0.821	-170
500	0.930	-179	1.48	41	0.010	-26	0.838	-171
550	0.928	-180	1.28	37	0.009	-26	0.851	-171
600	0.937	180	1.13	33	0.008	-25	0.865	-172
650	0.944	179	1.00	30	0.007	-22	0.878	-172
700	0.943	178	0.88	27	0.008	-14	0.888	-173
750	0.946	178	0.81	25	0.008	-15	0.895	-173
800	0.949	177	0.73	22	0.009	-17	0.906	-174
850	0.954	177	0.67	20	0.009	-28	0.912	-175
900	0.953	175	0.61	18	0.007	-34	0.919	-175
950	0.957	175	0.56	15	0.005	-32	0.927	-176
1000	0.957	174	0.51	13	0.004	-22	0.934	-177
1050	0.957	174	0.48	10	0.004	-11	0.939	-178
1100	0.962	173	0.45	8	0.004	-2	0.945	-178
1150	0.959	172	0.41	7	0.004	3	0.950	-179
1200	0.955	171	0.39	4	0.004	9	0.950	-180
1250	0.962	170	0.36	2	0.004	13	0.955	180
1300	0.959	170	0.33	0	0.004	17	0.953	179
1350	0.956	169	0.31	-1	0.004	25	0.954	178
1400	0.954	168	0.29	-4	0.004	32	0.957	177
1450	0.955	168	0.28	-6	0.004	46	0.952	177
1500	0.948	167	0.26	-7	0.004	56	0.948	176

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# NOTES

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PACKAGE DIMENSIONS

**2X  $\varnothing$  Q**  
 $\oplus \varnothing$  aaa (M) T A (M) B (M)

**B**  
**B** (FLANGE)

**G**

**1**

**2**

**2X K**

**2X D**  
 $\oplus$  bbb (M) T A (M) B (M)

**E**

**N** (LID)  
 $\oplus$  ccc (M) T A (M) B (M)

**C**

**T** SEATING PLANE

**M** (INSULATOR)  
 $\oplus$  bbb (M) T A (M) B (M)

**A**

**R** (LID)  
 $\oplus$  ccc (M) T A (M) B (M)

**H**

**F**

**S** (INSULATOR)  
 $\oplus$  aaa (M) T A (M) B (M)

**NOTES:**  
 1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.795	0.805	20.19	20.45
B	0.225	0.235	5.72	5.97
C	0.125	0.175	3.18	4.45
D	0.210	0.220	5.33	5.59
E	0.055	0.065	1.40	1.65
F	0.004	0.006	0.10	0.15
G	0.562 BSC		14.28 BSC	
H	0.077	0.087	1.96	2.21
K	0.220	0.250	5.59	6.35
M	0.355	0.365	9.02	9.27
N	0.357	0.363	9.07	9.22
Q	0.125	0.135	3.18	3.43
R	0.227	0.233	5.77	5.92
S	0.225	0.235	5.72	5.97
aaa	0.005 REF		0.13 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

**CASE 360B-05  
 ISSUE F  
 NI-360  
 MRF183R1**

**A**

**A** (FLANGE)

**B**

**B** (FLANGE)

**2X D**

**2X K**

$\oplus$  bbb (M) T A (M) B (M)

**E**

**N** (LID)  
 $\oplus$  ccc (M) T A (M) B (M)

**C**

**T** SEATING PLANE

**M** (INSULATOR)  
 $\oplus$  bbb (M) T A (M) B (M)

**PIN 3**

**R** (LID)  
 $\oplus$  ccc (M) T A (M) B (M)

**H**

**F**

**S** (INSULATOR)  
 $\oplus$  aaa (M) T A (M) B (M)

**NOTES:**  
 1. INTERPRET DIMENSIONS AND TOLERANCES PER ASME Y14.5M-1994.  
 2. CONTROLLING DIMENSION: INCH.  
 3. DIMENSION H IS MEASURED 0.030 (0.762) AWAY FROM PACKAGE BODY.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.375	0.385	9.53	9.78
B	0.225	0.235	5.72	5.97
C	0.105	0.155	2.67	3.94
D	0.210	0.220	5.33	5.59
E	0.035	0.045	0.89	1.14
F	0.004	0.006	0.10	0.15
H	0.057	0.067	1.45	1.70
K	0.085	0.115	2.16	2.92
M	0.355	0.365	9.02	9.27
N	0.357	0.363	9.07	9.22
R	0.227	0.23	5.77	5.92
S	0.225	0.235	5.72	5.97
aaa	0.005 REF		0.13 REF	
bbb	0.010 REF		0.25 REF	
ccc	0.015 REF		0.38 REF	

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

**CASE 360C-05  
 ISSUE D  
 NI-360S  
 MRF183LSR1**

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