

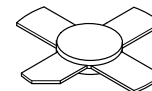
The RF MOSFET Line  
**Power Field Effect Transistor**  
N-Channel Enhancement-Mode MOSFET

Designed primarily for wideband large-signal output and driver from 30-500 MHz.

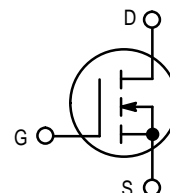
- Typical Performance at 400 MHz, 28 Vdc  
Output Power = 4.0 Watts  
Gain = 17 dB  
Efficiency = 50%
- Excellent Thermal Stability, Ideally Suited for Class A Operation
- Facilitates Manual Gain Control, ALC and Modulation Techniques
- 100% Tested for Load Mismatch at All Phase Angles with 30:1 VSWR
- Low  $C_{RSS}$  - 0.8 pF Typical at  $V_{DS} = 28$  Volts

**MRF160**

4.0 W, to 400 MHz  
MOSFET BROADBAND  
RF POWER FET



CASE 249-06, STYLE 3



**MAXIMUM RATINGS** ( $T_J = 25^\circ\text{C}$  unless otherwise noted)

Rating	Symbol	Value	Unit
Drain-Gate Voltage	$V_{DSS}$	65	Vdc
Drain-Gate Voltage ( $R_{GS} = 1.0 \text{ M}\Omega$ )	$V_{DGR}$	65	Vdc
Gate-Source Voltage	$V_{GS}$	$\pm 40$	Vdc
Drain Current-Continuous	$I_D$	1.0	ADC
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate Above $25^\circ\text{C}$	$P_D$	24 0.14	Watts W/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	- 65 to +150	$^\circ\text{C}$
Operating Junction Temperature	$T_J$	200	$^\circ\text{C}$

**THERMAL CHARACTERISTICS**

Thermal Resistance — Junction to Case	$R_{\theta JC}$	7.2	$^\circ\text{C/W}$
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NOTE: Handling and Packaging — MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

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

Characteristic	Symbol	Min	Typ	Max	Unit
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**OFF CHARACTERISTICS**

Drain–Source Breakdown Voltage ( $V_{DS} = 0\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $I_D = 5.0\text{ mA}$ )	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ V}$ )	$I_{DSS}$	—	—	0.8	mA
Gate–Source Leakage Current ( $V_{GS} = 40\text{ Vdc}$ , $V_{DS} = 0\text{ Vdc}$ )	$I_{GSS}$	—	—	1.0	$\mu\text{A}$

**ON CHARACTERISTICS**

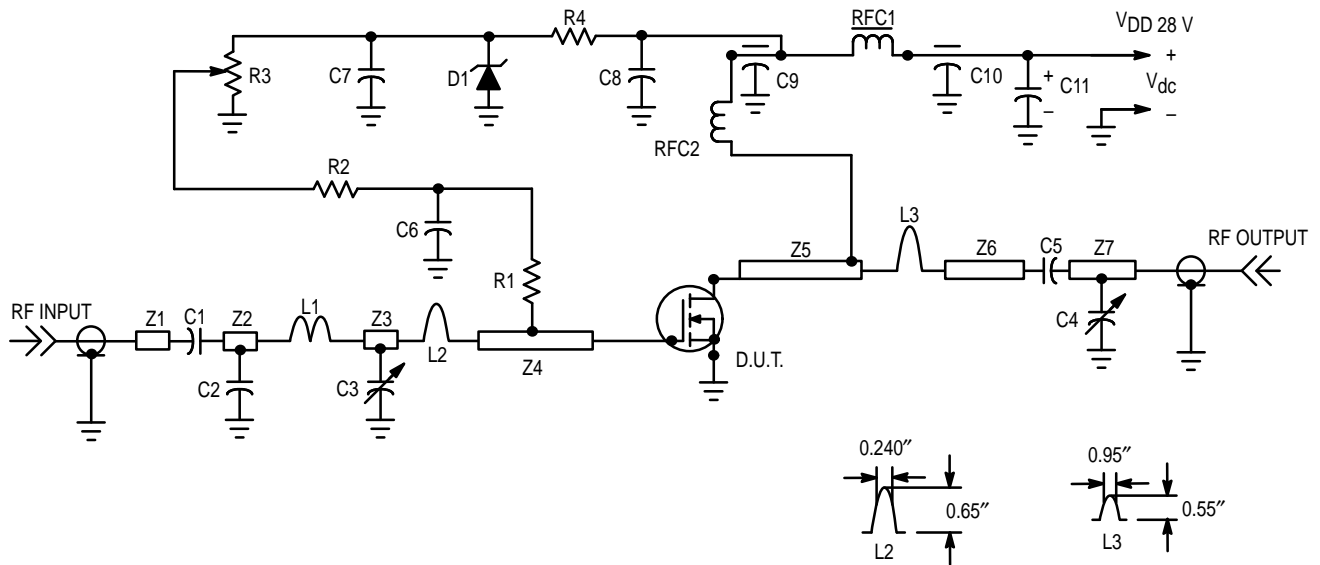
Gate Threshold Voltage ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 10\text{ mA}$ )	$V_{GS(th)}$	1.0	3.0	6.0	Vdc
Drain Source On–Voltage ( $V_{DS(on)}$ , $V_{GS} = 10\text{ Vdc}$ , $I_D = 500\text{ mA}$ )	$V_{DS(on)}$	—	3.8	—	Vdc
Forward Transconductance ( $V_{DS} = 10\text{ Vdc}$ , $I_D = 250\text{ mA}$ )	$g_{fs}$	110	160	—	mS

**DYNAMIC CHARACTERISTICS**

Input Capacitance ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ V}$ , $f = 1.0\text{ MHz}$ )	$C_{iss}$	—	6.0	—	pF
Output Capacitance ( $V_{DS} = 28\text{ V}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{oss}$	—	8.0	—	pF
Reverse Transfer Capacitance ( $V_{DS} = 28\text{ Vdc}$ , $V_{GS} = 0\text{ Vdc}$ , $f = 1.0\text{ MHz}$ )	$C_{rss}$	—	0.8	—	pF

**FUNCTIONAL CHARACTERISTICS**

Common Source Power Gain ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 4.0\text{ W}$ , $f = 400\text{ MHz}$ , $I_{DQ} = 50\text{ mA}$ )	$G_{ps}$	15	17	—	dB
Drain Efficiency ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 4.0\text{ W}$ , $f = 400\text{ MHz}$ , $I_{DQ} = 50\text{ mA}$ )	$\eta$	45	50	—	%
Electrical Ruggedness ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 4.0\text{ W}$ , $f = 400\text{ MHz}$ , $I_{DQ} = 50\text{ mA}$ ) Load VSWR = 30:1 at All Phase Angles at Frequency of Test	$\psi$	No Degradation in Output Power			
Series Equivalent Input Impedance ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 4.0\text{ W}$ , $f = 400\text{ MHz}$ , $I_{DQ} = 50\text{ mA}$ )	$Z_{in}$	—	$5.23-j\ 27.2$	—	Ohms
Series Equivalent Output Impedance ( $V_{DD} = 28\text{ Vdc}$ , $P_{out} = 4.0\text{ W}$ , $f = 400\text{ MHz}$ , $I_{DQ} = 50\text{ mA}$ )	$Z_{out}$	—	$14.7-j\ 31.2$	—	Ohms

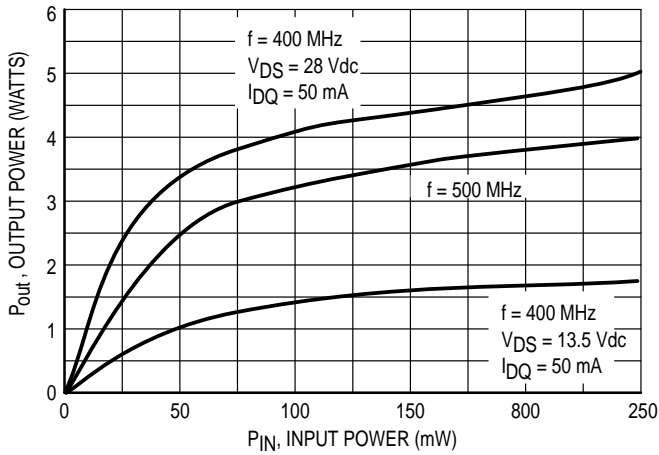


C1, C5	220 pF, Chip Capacitor	R3	10 k $\Omega$ , 10 Turns Bourns
C2	18 pF, ATC Chip Capacitor	R4	1.8 k $\Omega$ , 1/4 Watt
C3	2.0–20 pF, Johanson Trimmer Capacitor	RFC1	Ferroxcube VK200–19/4B
C4	2.0–10 pF, Johanson Trimmer Capacitor	RFC2	10 Turns, #20 AWG, Enameled Close Wound, 0.250" ID
C6, C7, C8	0.1 $\mu$ F	Z1	Microstrip Line 0.167" wide, 0.820" long
C9, C10	680 pF, Feed Through	Z2	Microstrip Line 0.240" wide, 0.240" long
C11	50 $\mu$ F, 50 V	Z3	Microstrip Line 0.240" wide, 0.240" long
L1	#20 AWG, 1 Turn 0.255" ID	Z4	Microstrip Line 0.230" wide, 0.590" long
L2	#20 AWG, Hairpin 1.3" long, bend into hairpin	Z5	Microstrip Line 0.230" wide, 0.580" long
L3	#20 AWG, Hairpin 1.1" long, bend into hairpin	Z6	Microstrip Line 0.167" wide, 0.620" long
R1	160 $\Omega$ , 1/2 Watt	Z7	Microstrip Line 0.167" wide, 0.800" long
R2	10 k $\Omega$ , 1/2 Watt		

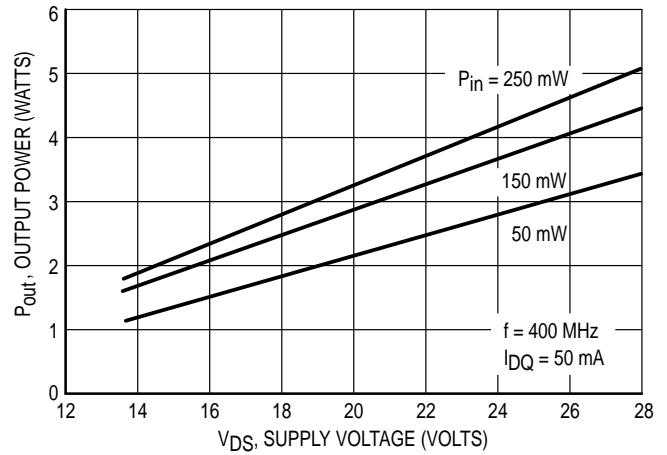
Board Material 0.060" Glass Teflon<sup>®</sup> 2 oz. Copper clad both sides  $\epsilon_r = 2.55$

**Figure 1. 400 MHz Test Circuit**

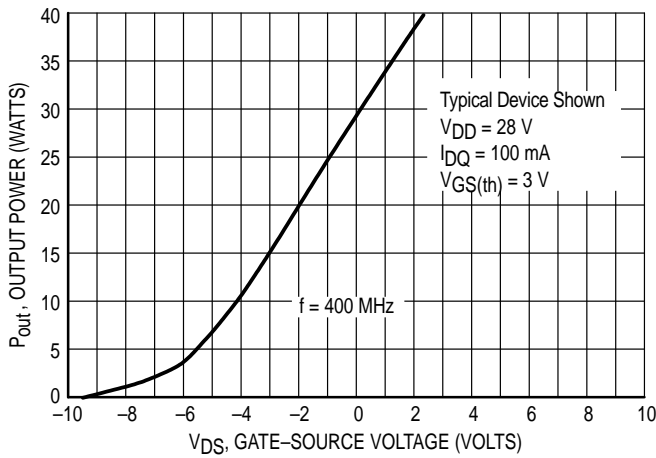
## Typical Characteristics



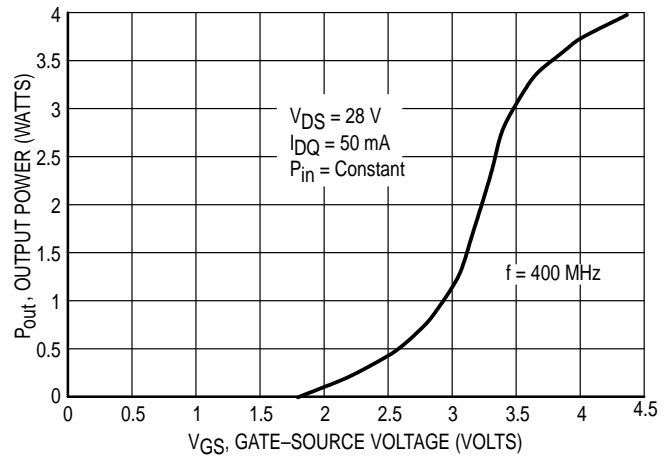
**Figure 2. Output Power versus Input Power**



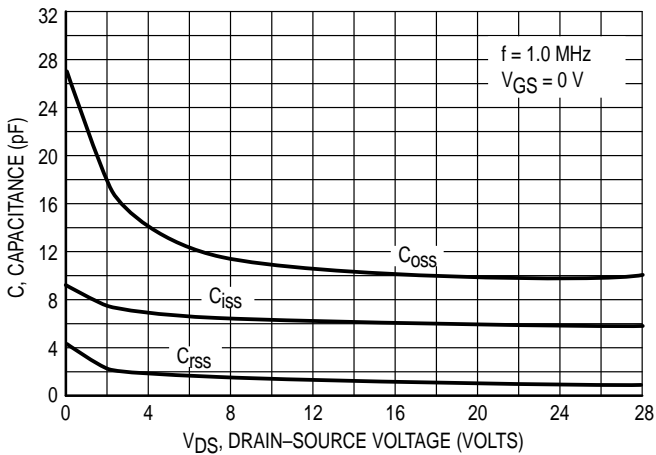
**Figure 3. Output Power versus Voltage**



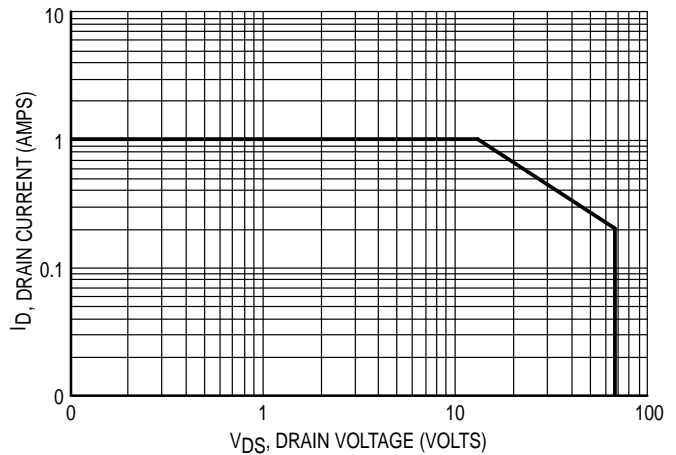
**Figure 4. Output Power versus Gate Voltage**



**Figure 5. Output Power versus Gate Voltage**



**Figure 6. Capacitance versus Drain-Source Voltage**



**Figure 7. DC Safe Operating Area**

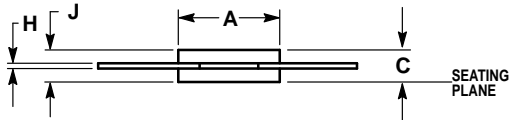
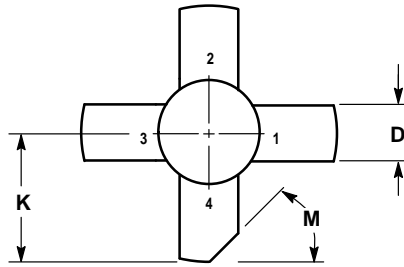
f (MHz)	S <sub>11</sub>		S <sub>21</sub>		S <sub>12</sub>		S <sub>22</sub>	
	S <sub>11</sub>	∠φ	S <sub>21</sub>	∠φ	S <sub>12</sub>	∠φ	S <sub>22</sub>	∠φ
10	0.96	-2.0	14.47	177	0.01	96	1.11	-5.0
30	0.99	-16	13.34	169	0.02	79	0.92	-11
50	0.97	-28	12.96	159	0.03	70	0.90	-22
75	0.94	-40	12.24	148	0.04	60	0.87	-35
100	0.90	-52	11.40	139	0.05	51	0.84	-45
120	0.87	-61	10.70	132	0.05	45	0.81	-53
150	0.83	-72	9.66	123	0.06	37	0.77	-63
170	0.81	-79	9.05	118	0.06	33	0.75	-69
200	0.78	-88	8.21	110	0.06	26	0.72	-77
220	0.77	-93	7.67	106	0.07	23	0.71	-81
250	0.75	-100	7.00	100	0.07	18	0.69	-87
300	0.72	-110	6.00	92	0.07	12	0.67	-96
350	0.71	-118	5.24	84	0.07	6.0	0.66	-103
390	0.71	-124	4.73	79	0.07	1.0	0.66	-108
400	0.70	-125	4.63	77	0.07	0	0.67	-109
410	0.70	-127	4.52	76	0.07	-1.0	0.66	-110
450	0.70	-131	4.10	71	0.07	-5.0	0.66	-114
470	0.70	-133	3.93	69	0.06	-6.0	0.67	-116
500	0.70	-137	3.68	65	0.06	-8.0	0.67	-118
600	0.71	-145	3.01	55	0.06	-14	0.69	-126
700	0.72	-153	2.51	46	0.05	-18	0.71	-132
800	0.73	-160	2.13	37	0.04	-21	0.73	-137
900	0.75	-166	1.83	30	0.03	-19	0.75	-142
1000	0.76	-171	1.60	23	0.03	-10	0.77	-146
1100	0.77	-177	1.40	16	0.02	3.0	0.79	-151
1200	0.78	177	1.25	10	0.02	18	0.80	-155
1300	0.79	172	1.11	4.0	0.03	29	0.82	-159
1400	0.81	166	1.00	-1.0	0.03	35	0.83	-163
1500	0.81	161	0.90	-6.0	0.03	48	0.85	-166

**Table 1. Common Source Scattering Parameters** ( $V_{DS} = 28$  Vdc,  $I_D = 200$  mA,  $50 \Omega$  System)

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
10	0.96	-4.0	16.09	176	0.01	85	1.08	-8.0
20	1.00	-15	14.82	171	0.02	82	0.88	-10
30	0.98	-23	14.64	164	0.03	73	0.89	-20
50	0.94	-39	13.76	152	0.04	63	0.86	-38
85	0.86	-61	11.81	134	0.06	47	0.79	-61
150	0.73	-91	8.63	112	0.08	27	0.70	-91
170	0.71	-97	7.90	107	0.09	23	0.68	-98
200	0.68	-106	6.97	101	0.09	17	0.67	-106
210	0.68	-109	6.68	99	0.09	15	0.66	-108
250	0.66	-117	5.75	92	0.09	10	0.65	-116
300	0.64	-126	4.85	84	0.09	4.0	0.64	-124
350	0.64	-133	4.18	78	0.09	-1.0	0.64	-129
390	0.64	-137	3.75	73	0.09	-5.0	0.65	-133
400	0.64	-138	3.66	71	0.09	-6.0	0.65	-134
410	0.64	-140	3.57	70	0.09	-7.0	0.65	-135
450	0.64	-143	3.23	66	0.08	-10	0.66	-138
470	0.65	-145	3.08	64	0.08	-11	0.66	-139
500	0.65	-147	2.88	61	0.08	-13	0.67	-141
550	0.66	-151	2.59	56	0.08	-16	0.67	-144
600	0.67	-154	2.35	52	0.07	-18	0.68	-146
700	0.69	-160	1.96	43	0.07	-22	0.71	-150
800	0.70	-166	1.67	35	0.06	-25	0.73	-154
900	0.72	-171	1.43	28	0.05	-24	0.75	-158
1000	0.74	-177	1.26	22	0.04	-21	0.77	-161
1100	0.74	178	1.11	16	0.04	-14	0.78	-164
1200	0.76	173	0.99	10	0.04	-6.0	0.80	-168
1300	0.78	168	0.88	5.0	0.04	2.0	0.81	-171
1400	0.79	163	0.80	0	0.03	8.0	0.83	-174
1500	0.80	158	0.72	-5.0	0.03	19	0.84	-177

**Table 2. Common Source Scattering Parameters (V<sub>DS</sub> = 12.5 Vdc, I<sub>D</sub> = 200 mA, 50 Ω System)**

## PACKAGE DIMENSIONS



**NOTES:**


1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. SEATING PLANE = GROUND AND IS CONNECTED TO PIN 1 AND 3.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.271	0.286	6.88	7.26
C	0.112	0.136	2.84	3.45
D	0.215	0.235	5.46	5.97
H	0.055	0.065	1.40	1.65
J	0.003	0.007	0.08	0.18
K	0.435	—	11.05	—
M	45° REF		45° REF	

**STYLE 3:**

- PIN 1. SOURCE
2. GATE
3. SOURCE
4. DRAIN

**CASE 249-06  
ISSUE H**

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MRF160/D





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