# The RF MOSFET Line 30W, to 400MHz, 28V

Designed for wideband large signal output and drive stages up to 400 MHz range.

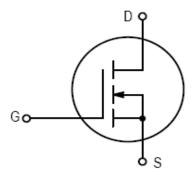
- N-Channel enhancement mode
- Guaranteed 28 V, 150 MHz performance Output power = 30 W Minimum gain = 13 dB Efficiency — 60% (Typical)
- Small- and large-signal characterization
- Typical performance at 400 MHz, 28 Vdc, 30 W output = 7.7 dB gain
- 100% tested for load mismatch at all phase angles with 30:1 VSWR
- Low noise figure 1.5 dB (typ.) at 1.0 A, 150 MHz
- Excellent thermal stability, ideally suited for Class A operation
- Facilitates manual gain control, ALC and modulation techniques



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# CASE 211-07, STYLE 2

Product Image



### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain-Source Voltage	VDSS	65	Vdc
Drain–Gate Voltage (R <sub>GS</sub> = 1.0 MΩ)	VDGR	65	Vdc
Gate-Source Voltage	V <sub>GS</sub>	±40	Vdc
Drain Current — Continuous	ID	2.5	Adc
Total Device Dissipation @ T <sub>C</sub> = 25°C Derate above 25°C	PD	55 0.314	Watts W/°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150	ů
Operating Junction Temperature	TJ	200	°C

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	R <sub>ØJC</sub>	3.2	°C/W

NOTE – <u>CAUTION</u> – MOS devices are susceptible to damage from electrostatic charge. Reasonable precautions in handling and packaging MOS devices should be observed.

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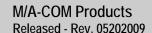
Characteristic	Symbol	Min	Тур	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V <sub>GS</sub> = 0, I <sub>D</sub> = 10 mA)	V(BR)DSS	65	_	_	Vdc
Zero Gate Voltage Drain Current (V <sub>DS</sub> = 28 V, V <sub>GS</sub> = 0)	I <sub>DSS</sub>	_	-	4.0	mAdc
Gate-Source Leakage Current (V <sub>GS</sub> = 20 V, V <sub>DS</sub> = 0)	I <sub>GSS</sub>	_	-	1.0	μAdc
ON CHARACTERISTICS			•		•
Gate Threshold Voltage (V <sub>DS</sub> = 10 V, I <sub>D</sub> = 25 mA)	V <sub>GS(th)</sub>	1.0	3.0	6.0	Vdc
Forward Transconductance (V <sub>DS</sub> = 10 V, I <sub>D</sub> = 500 mA)	g <sub>fs</sub>	500	750	_	mmhos
DYNAMIC CHARACTERISTICS			•		•
Input Capacitance (V <sub>DS</sub> = 28 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	Ciss	_	48	_	pF
Output Capacitance (V <sub>DS</sub> = 28 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	Coss	_	54	_	pF
Reverse Transfer Capacitance (V <sub>DS</sub> = 28 V, V <sub>GS</sub> = 0, f = 1.0 MHz)	C <sub>rss</sub>	_	11	_	pF
FUNCTIONAL CHARACTERISTICS					
Noise Figure (V <sub>DS</sub> = 28 Vdc, I <sub>D</sub> = 1.0 A, f = 150 MHz)	NF	—	1.5	—	dB
Common Source Power Gain           (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 30 W,         f = 150 MHz (Figure 1)           I <sub>DQ</sub> = 25 mA)         f = 400 MHz (Figure 14)	G <sub>ps</sub>	13 —	16 7.7		dB
Drain Efficiency (Figure 1) (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 30 W, f = 150 MHz, I <sub>DQ</sub> = 25 mA)	η	50	60	_	%
Electrical Ruggedness (Figure 1) (V <sub>DD</sub> = 28 Vdc, P <sub>out</sub> = 30 W, f = 150 MHz, I <sub>DQ</sub> = 25 mA, VSWR 30:1 at All Phase Angles)	Ψ	No Degradation in Output Power			

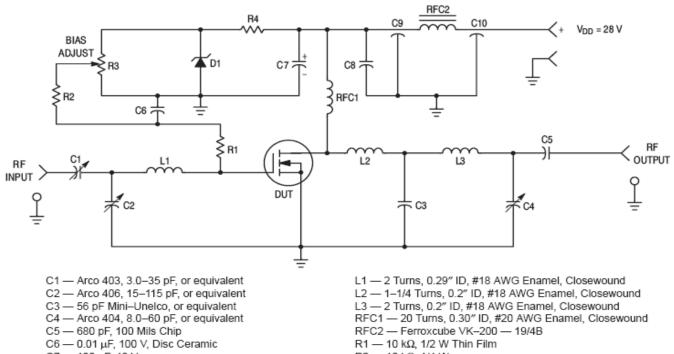
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- C7 100 µF, 40 V
- C8 0.1 µF, 50 V, Disc Ceramic
- C9, C10 680 pF Feedthru
- D1 1N5925A Motorola Zener

R2 - 10 kΩ, 1/4 W R3 - 10 Turns, 10 kΩ R4 - 1.8 kΩ, 1/2 W Board - G10, 62 Mils



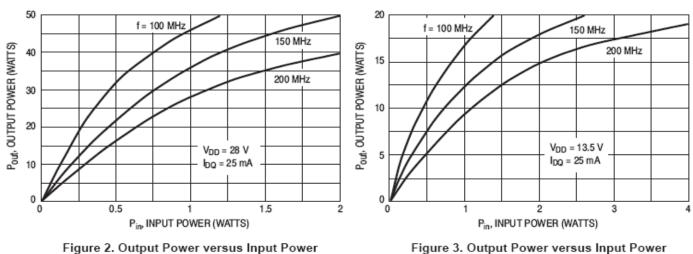


Figure 3. Output Power versus Input Power

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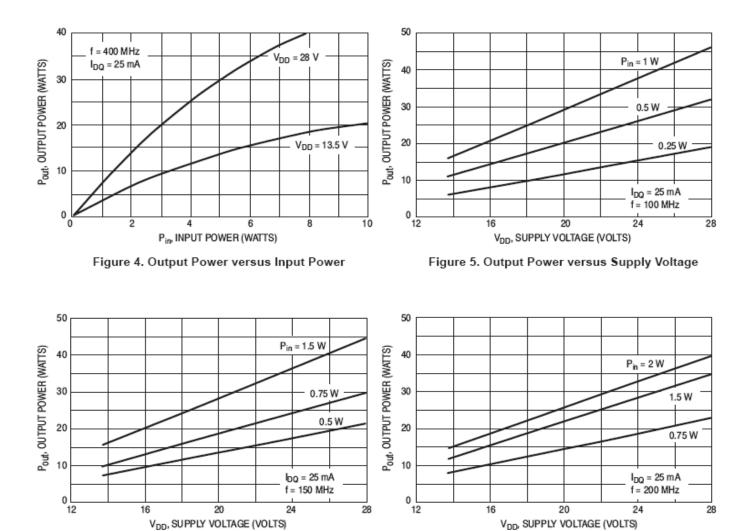


Figure 6. Output Power versus Supply Voltage

Figure 7. Output Power versus Supply Voltage

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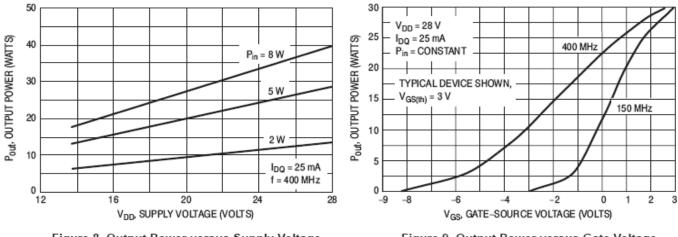
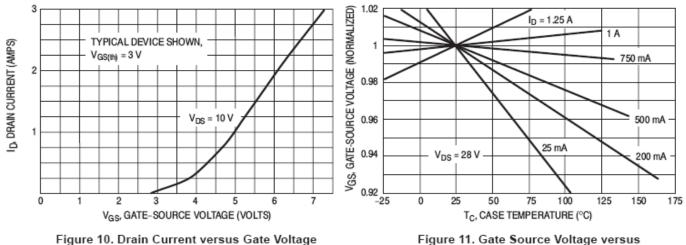


Figure 8. Output Power versus Supply Voltage

Figure 9. Output Power versus Gate Voltage



(Transfer Characteristics)

jure 11. Gate Source Voltage versi Case Temperature

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180 T<sub>C</sub> = 25°C 5 V<sub>GS</sub> = 0 V 160 DRAIN CURRENT (AMPS) f = 1 MHz 140 C, CAPACITANCE (pF) 2 120 Coss 1 100 80 Ciss 0.5 60 C<sub>rss</sub> ò 40 20 0 L 0 0.1 4 8 12 16 20 24 28 2 5 10 20 60 100 VDS, DRAIN-SOURCE VOLTAGE (VOLTS) VDS, DRAIN-SOURCE VOLTAGE (VOLTS) Figure 12. Capacitance versus Figure 13. DC Safe Operating Area Drain-Source Voltage RFC2 R4 C10 C11 V<sub>DD</sub> = 28 V BIAS C12 C13 ADJUST 🛣 D1 R3 ÷ RFC1 C9 R2 ≶ RF R1 Z4 Z5 Z6 OUTPUT RF Z1 Z2 Z3 INPUT Ċ5 DUT C7 C3 C4C6 7 C2 C. ÷ C1, C2, C3, C4 - 0-20 pF Johanson, or equivalent R4 — 1.8 kΩ, 1/2 W C5, C8 - 270 pF, 100 Mil Chip Z1 - 2.9" x 0.166" Microstrip C6, C7 - 24 pF Mini-Unelco, or equivalent Z2, Z4 - 0.35" x 0.166" Microstrip C9 - 0.01 µF, 100 V, Disc Ceramic Z3 - 0.40" x 0.166" Microstrip C10 - 100 µF, 40 V Z5 - 1.05" x 0.166" Microstrip C11 - 0.1 µF, 50 V, Disc Ceramic Z6 - 1.9" x 0.166" Microstrip RFC1 - 6 Turns, 0.300" ID, #20 AWG Enamel, Closewound C12, C13 - 680 pF Feedthru D1 — 1N5925A Motorola Zener RFC2 — Ferroxcube VK-200 — 19/4B R1, R2 - 10 kΩ, 1/4 W Board — Glass Teflon, 62 Mils

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Figure 14. 400 MHz Test Circuit

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R3 - 10 Turns, 10 kΩ

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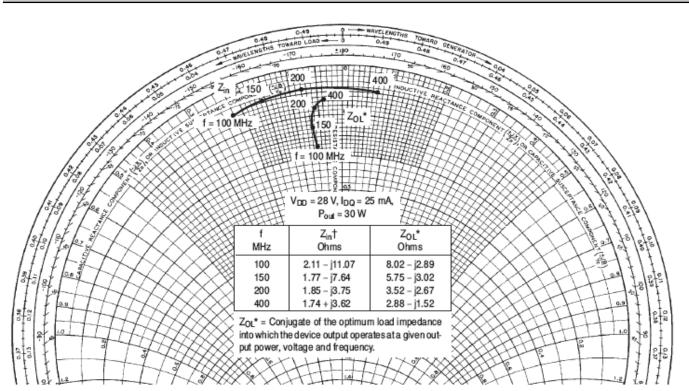


Figure 15. Large-Signal Series Equivalent Input and Output Impedance, Zin, ZOL\*

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(MHz)         (By1) $2 + 0$ (By2) $2 - 4$ 2.0         0.977         -32         59.48         163         0.011         67         0.661         -36           5.0         0.919         -70         48.67         163         0.024         444         0.662         -78           10         0.852         -109         33.50         122         0.032         29         0.747         -117           20         0.814         -153         13.11         99         0.038         14         0.774         -157           40         0.811         -169         9.88         95         0.038         11         0.777         -168           50         0.812         -164         5.708         86         0.038         11         0.787         -176           60         0.816         -170         5.003         84         0.038         11         0.787         -177           100         0.817         -171         4.570         81         0.039         13         0.788         -173           110         0.817         -173         3.420         79         0.039         13         0.788	f	S <sub>11</sub>		\$ <sub>21</sub>		\$ <sub>12</sub>		\$ <sub>22</sub>	
5.0 $0.919$ $-70$ $48.67$ $142$ $0.024$ $44$ $0.692$ $-78$ $10$ $0.852$ $-109$ $33.60$ $122$ $0.032$ $29$ $0.747$ $-117$ $20$ $0.814$ $-153$ $13.11$ $99$ $0.038$ $14$ $0.747$ $-162$ $40$ $0.811$ $-159$ $9.88$ $95$ $0.038$ $11$ $0.777$ $-162$ $50$ $0.812$ $-164$ $7.98$ $92$ $0.038$ $11$ $0.787$ $-162$ $60$ $0.813$ $-166$ $6.66$ $89$ $0.038$ $11$ $0.787$ $-170$ $90$ $0.817$ $-171$ $4.500$ $83$ $0.038$ $11$ $0.787$ $-172$ $110$ $0.818$ $-173$ $3.420$ $79$ $0.39$ $13$ $0.788$ $-173$ $120$ $0.821$ $-173$ $3.420$ $79$ $0.39$ $14$		S <sub>11</sub>	∠¢	S <sub>21</sub>	∠¢	S <sub>12</sub>	∠¢	S <sub>22</sub>	∠¢
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$\begin{array}{c c c c c c c c c c c c c c c c c c c $	100	0.817	-172	4.170	81	0.039	13	0.787	-172
$\begin{array}{c ccccccccccccccccccccccccccccccccccc$	110	0.818	-173	3.670	80	0.039	13	0.788	-172
140 $0.822$ $-174$ $2.980$ $78$ $0.039$ $13$ $0.788$ $-173$ 150 $0.823$ $-175$ $2.826$ $77$ $0.039$ $14$ $0.788$ $-173$ 160 $0.824$ $-175$ $2.650$ $76$ $0.039$ $14$ $0.790$ $-174$ 170 $0.825$ $-176$ $2.438$ $75$ $0.039$ $14$ $0.792$ $-174$ 180 $0.827$ $-176$ $2.325$ $73$ $0.039$ $16$ $0.796$ $-174$ 190 $0.829$ $-177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $-174$ 200 $0.831$ $-177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $-174$ 225 $0.836$ $-178$ $1.621$ $66$ $0.039$ $23$ $0.822$ $-174$ 250 $0.846$ $-178$ $1.462$ $64$ $0.039$ $23$ $0.822$ $-174$ 275 $0.853$ $-179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $-174$ 300 $0.853$ $-179$ $1.99$ $56$ $0.040$ $27$ $0.828$ $-174$ 350 $0.857$ $+179$ $1.048$ $54$ $0.042$ $32$ $0.842$ $-174$ 400 $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ 450 $0.881$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ 450 $0.881$ $+178$ $0.876$ <	120	0.820	-173	3.420	79	0.039	13	0.788	-173
150 $0.823$ $175$ $2.826$ $77$ $0.039$ $14$ $0.788$ $173$ $160$ $0.824$ $175$ $2.650$ $76$ $0.039$ $14$ $0.790$ $174$ $170$ $0.825$ $176$ $2.438$ $75$ $0.039$ $14$ $0.792$ $174$ $180$ $0.827$ $176$ $2.325$ $73$ $0.039$ $16$ $0.796$ $174$ $190$ $0.829$ $177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $174$ $200$ $0.831$ $177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $174$ $225$ $0.836$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.621$ $66$ $0.039$ $23$ $0.822$ $174$ $300$ $0.853$ $179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $174$ $350$ $0.856$ $179$ $1.99$ $56$ $0.400$ $27$ $0.828$ $174$ $350$ $0.857$ $+.179$ $1.048$ $56$ $0.040$ $30$ $0.842$ $174$ $450$ $0.881$ $+.178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $174$ $450$ $0.881$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$	130	0.821	-173	3.170	79	0.039	13	0.788	-173
150 $0.823$ $175$ $2.826$ $77$ $0.039$ $14$ $0.788$ $173$ $160$ $0.824$ $175$ $2.650$ $76$ $0.039$ $14$ $0.790$ $174$ $170$ $0.825$ $176$ $2.438$ $75$ $0.039$ $14$ $0.792$ $174$ $180$ $0.827$ $176$ $2.325$ $73$ $0.039$ $16$ $0.796$ $174$ $190$ $0.829$ $177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $174$ $200$ $0.831$ $177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $174$ $225$ $0.836$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.621$ $66$ $0.039$ $23$ $0.822$ $174$ $300$ $0.853$ $179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $174$ $350$ $0.856$ $179$ $1.99$ $56$ $0.400$ $27$ $0.828$ $174$ $350$ $0.857$ $+.179$ $1.048$ $56$ $0.040$ $30$ $0.842$ $174$ $450$ $0.881$ $+.178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $174$ $450$ $0.881$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$	140	0.822	-174	2.980	78	0.039	13	0.788	-173
160 $0.824$ $175$ $2.650$ $76$ $0.039$ $14$ $0.790$ $174$ $170$ $0.825$ $176$ $2.438$ $75$ $0.039$ $14$ $0.792$ $174$ $180$ $0.827$ $176$ $2.325$ $73$ $0.039$ $15$ $0.793$ $174$ $190$ $0.829$ $177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $174$ $200$ $0.831$ $177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $174$ $225$ $0.836$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.621$ $66$ $0.039$ $23$ $0.822$ $174$ $275$ $0.853$ $179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $174$ $300$ $0.853$ $179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $174$ $350$ $0.857$ $+.179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $174$ $400$ $0.865$ $+.178$ $0.927$ $51$ $0.043$ $35$ $0.866$ $174$ $450$ $0.881$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$ $450$ $0.886$ $+.177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $174$ $550$ $0.886$ $+.177$ $0.694$ $411$ $0.055$ $45$ $0.898$ $174$ <t< td=""><td>150</td><td>0.823</td><td>-175</td><td>2.826</td><td>77</td><td>0.039</td><td>14</td><td></td><td>-173</td></t<>	150	0.823	-175	2.826	77	0.039	14		-173
180 $0.827$ $-176$ $2.325$ $73$ $0.039$ $15$ $0.793$ $-174$ 190 $0.829$ $-177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $-174$ 200 $0.831$ $-177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $-174$ 225 $0.836$ $-178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $-174$ 250 $0.846$ $-178$ $1.621$ $66$ $0.039$ $21$ $0.816$ $-174$ 275 $0.853$ $-179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $-174$ 300 $0.853$ $-179$ $1.319$ $61$ $0.040$ $25$ $0.833$ $-174$ 325 $0.856$ $-179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $-174$ 350 $0.857$ $+179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $-174$ $400$ $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ $400$ $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ $450$ $0.881$ $+178$ $0.810$ $46$ $0.045$ $37$ $0.866$ $-174$ $450$ $0.881$ $+178$ $0.810$ $46$ $0.046$ $43$ $0.875$ $-174$ $450$ $0.886$ $+177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $-174$ $455$ $0.888$ $+176$	160	0.824		2.650	76	0.039	14	0.790	
190 $0.829$ $-177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $-174$ 200 $0.831$ $-177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $-174$ 225 $0.836$ $-178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $-174$ 250 $0.846$ $-178$ $1.621$ $66$ $0.039$ $21$ $0.816$ $-174$ 275 $0.853$ $-179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $-174$ 300 $0.853$ $-179$ $1.319$ $61$ $0.040$ $25$ $0.833$ $-174$ 325 $0.856$ $-179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $-174$ 350 $0.857$ $+179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $-174$ 400 $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ 425 $0.875$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.866$ $-174$ 450 $0.881$ $+178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $-174$ 450 $0.881$ $+178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $-174$ 450 $0.887$ $+177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $-174$ 450 $0.881$ $+176$ $0.677$ $39$ $0.052$ $43$ $0.890$ $-174$ 550 $0.896$ $+176$ $0.625$	170	0.825		2.438	75	0.039	14		
190 $0.829$ $-177$ $2.175$ $72$ $0.039$ $16$ $0.796$ $-174$ 200 $0.831$ $-177$ $2.084$ $71$ $0.039$ $16$ $0.799$ $-174$ 225 $0.836$ $-178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $-174$ 250 $0.846$ $-178$ $1.621$ $66$ $0.039$ $21$ $0.816$ $-174$ 275 $0.853$ $-179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $-174$ 300 $0.853$ $-179$ $1.319$ $61$ $0.040$ $25$ $0.833$ $-174$ 325 $0.856$ $-179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $-174$ 350 $0.857$ $+179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $-174$ 400 $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ 425 $0.875$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.866$ $-174$ 450 $0.881$ $+178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $-174$ 450 $0.881$ $+178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $-174$ 450 $0.887$ $+177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $-174$ 450 $0.881$ $+176$ $0.677$ $39$ $0.052$ $43$ $0.890$ $-174$ 550 $0.896$ $+176$ $0.625$	180	0.827	-176	2.325	73	0.039	15	0.793	-174
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	190	0.829	-177		72	0.039	16		-174
225 $0.836$ $178$ $1.824$ $69$ $0.039$ $18$ $0.805$ $174$ $250$ $0.846$ $178$ $1.621$ $66$ $0.039$ $21$ $0.816$ $174$ $275$ $0.853$ $179$ $1.462$ $64$ $0.039$ $23$ $0.822$ $174$ $300$ $0.853$ $179$ $1.319$ $61$ $0.040$ $25$ $0.833$ $174$ $325$ $0.856$ $179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $174$ $350$ $0.857$ $+.179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $174$ $375$ $0.861$ $+.179$ $1.014$ $54$ $0.042$ $32$ $0.849$ $174$ $400$ $0.865$ $+.178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $174$ $425$ $0.875$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$ $425$ $0.881$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$ $450$ $0.881$ $+.178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $174$ $450$ $0.881$ $+.178$ $0.876$ $49$ $0.046$ $43$ $0.875$ $174$ $550$ $0.886$ $+.177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $174$ $550$ $0.896$ $+.176$ $0.625$ $36$ $0.055$ $45$ $0.988$ $174$ <td< td=""><td>200</td><td>0.831</td><td></td><td></td><td>71</td><td>0.039</td><td>16</td><td>0.799</td><td>-174</td></td<>	200	0.831			71	0.039	16	0.799	-174
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	225	0.836			69	0.039	18	0.805	-174
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	250				66	0.039	21	0.816	
300         0.853         -179         1.319         61         0.040         25         0.833         -174           325         0.856         -179         1.194         59         0.040         27         0.828         -174           350         0.857         +179         1.089         56         0.040         30         0.842         -174           375         0.861         +179         1.014         54         0.042         32         0.849         -174           400         0.865         +178         0.927         51         0.043         35         0.856         -174           425         0.875         +178         0.927         51         0.043         35         0.866         -174           450         0.881         +178         0.876         49         0.045         37         0.866         -174           450         0.881         +178         0.810         46         0.046         40         0.870         -174           475         0.886         +177         0.755         44         0.046         43         0.875         -174           500         0.887         +177         0.694	275	0.853			64	0.039	23		
325 $0.856$ $-179$ $1.194$ $59$ $0.040$ $27$ $0.828$ $-174$ $350$ $0.857$ $+179$ $1.089$ $56$ $0.040$ $30$ $0.842$ $-174$ $375$ $0.861$ $+179$ $1.014$ $54$ $0.042$ $32$ $0.849$ $-174$ $400$ $0.865$ $+178$ $0.927$ $51$ $0.043$ $35$ $0.856$ $-174$ $425$ $0.875$ $+178$ $0.876$ $49$ $0.045$ $37$ $0.866$ $-174$ $450$ $0.881$ $+178$ $0.810$ $46$ $0.046$ $40$ $0.870$ $-174$ $450$ $0.881$ $+178$ $0.810$ $46$ $0.046$ $43$ $0.875$ $-174$ $450$ $0.881$ $+177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $-174$ $475$ $0.886$ $+177$ $0.755$ $44$ $0.046$ $43$ $0.875$ $-174$ $500$ $0.887$ $+177$ $0.694$ $41$ $0.051$ $43$ $0.888$ $-174$ $555$ $0.888$ $+176$ $0.677$ $39$ $0.052$ $43$ $0.890$ $-174$ $555$ $0.896$ $+176$ $0.625$ $36$ $0.055$ $45$ $0.913$ $-174$ $555$ $0.907$ $+175$ $0.603$ $34$ $0.058$ $45$ $0.913$ $-174$ $600$ $0.910$ $+175$ $0.585$ $32$ $0.061$ $45$ $0.945$ $-174$ $650$ $0.920$ <	300	0.853	-179	1.319	61	0.040			
$\begin{array}{c c c c c c c c c c c c c c c c c c c $	325	0.856	-179	1.194	59	0.040		0.828	-174
4000.865+1780.927510.043350.856-1744250.875+1780.876490.045370.866-1744500.881+1780.810460.046400.870-1744750.886+1770.755440.046430.875-1745000.887+1770.694410.051430.888-1745250.888+1760.677390.052430.890-1745500.896+1760.625360.055450.898-1745500.896+1760.625360.058450.913-1745500.907+1750.603340.058450.913-1746000.910+1750.585320.061450.918-1746500.920+1740.563300.065450.945-1746750.938+1730.533260.074470.974-1747000.943+1700.491220.079460.953-1777500.940+1700.475220.084480.943-177	350	0.857		1.089	56	0.040	30	0.842	-174
4000.865+1780.927510.043350.856-1744250.875+1780.876490.045370.866-1744500.881+1780.810460.046400.870-1744750.886+1770.755440.046430.875-1745000.887+1770.694410.051430.888-1745250.888+1760.677390.052430.890-1745500.896+1760.625360.055450.898-1745500.896+1760.625360.058450.913-1745500.907+1750.603340.058450.913-1746000.910+1750.585320.061450.918-1746500.920+1740.563300.065450.945-1746750.938+1730.533260.074470.974-1747000.943+1700.491220.079460.953-1777500.940+1700.475220.084480.943-177	375	0.861	+179	1.014	54	0.042	32	0.849	-174
4250.875+1780.876490.045370.866-1744500.881+1780.810460.046400.870-1744750.886+1770.755440.046430.875-1745000.887+1770.694410.051430.888-1745250.888+1760.677390.052430.890-1745500.896+1760.625360.055450.898-1745750.907+1750.603340.058450.913-1746000.910+1750.585320.061450.918-1746250.910+1740.563300.065450.945-1746500.920+1740.543280.069460.952-1746750.938+1730.533260.074470.974-1747000.943+1710.515240.078470.958-1767250.934+1700.491220.079460.953-1777500.940+1700.475220.084480.943-177	400	0.865		0.927	51	0.043	35	0.856	-174
4500.881+1780.810460.046400.870-1744750.886+1770.755440.046430.875-1745000.887+1770.694410.051430.888-1745250.888+1760.677390.052430.890-1745500.896+1760.625360.055450.898-1745750.907+1750.603340.058450.913-1746000.910+1750.585320.061450.918-1746250.910+1740.563300.065450.945-1746500.920+1740.543280.069460.952-1746750.938+1730.533260.074470.974-1747000.943+1710.515240.078470.958-1767250.934+1700.491220.079460.953-1777500.940+1700.475220.084480.943-177	425		+178	0.876	49	0.045	37	0.866	-174
4750.886+1770.755440.046430.875-1745000.887+1770.694410.051430.888-1745250.888+1760.677390.052430.890-1745500.896+1760.625360.055450.898-1745750.907+1750.603340.058450.913-1746000.910+1750.585320.061450.918-1746250.910+1740.563300.065450.945-1746500.920+1740.543280.069460.952-1746750.938+1730.533260.074470.974-1747000.943+1700.491220.079460.953-1777500.940+1700.475220.084480.943-177	450	0.881		0.810	46	0.046	40	0.870	
525         0.888         +176         0.677         39         0.052         43         0.890         -174           550         0.896         +176         0.625         36         0.055         45         0.898         -174           575         0.907         +175         0.603         34         0.058         45         0.913         -174           600         0.910         +175         0.585         32         0.061         45         0.918         -174           625         0.910         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.978         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491	475	0.886	+177	0.755	44	0.046	43	0.875	-174
550         0.896         +176         0.625         36         0.055         45         0.898         -174           575         0.907         +175         0.603         34         0.058         45         0.913         -174           600         0.910         +175         0.585         32         0.061         45         0.918         -174           625         0.910         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	500	0.887	+177	0.694	41	0.051	43	0.888	-174
575         0.907         +175         0.603         34         0.058         45         0.913         -174           600         0.910         +175         0.585         32         0.061         45         0.918         -174           625         0.910         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	525	0.888	+176	0.677	39	0.052	43	0.890	-174
600         0.910         +175         0.585         32         0.061         45         0.918         -174           625         0.910         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	550	0.896	+176	0.625	36	0.055	45	0.898	-174
600         0.910         +175         0.585         32         0.061         45         0.918         -174           625         0.910         +174         0.563         30         0.065         45         0.945         -174           650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	575	0.907	+175	0.603	34	0.058	45	0.913	-174
650         0.920         +174         0.543         28         0.069         46         0.952         -174           675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177									
675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	625	0.910	+174	0.563	30	0.065	45	0.945	-174
675         0.938         +173         0.533         26         0.074         47         0.974         -174           700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177									
700         0.943         +171         0.515         24         0.078         47         0.958         -176           725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177									-174
725         0.934         +170         0.491         22         0.079         46         0.953         -177           750         0.940         +170         0.475         22         0.084         48         0.943         -177	700					0.078			-176
750 0.940 +170 0.475 22 0.084 48 0.943 -177									
	750	0.940		0.475	22	0.084	48	0.943	-177
(75   0.953   +169   0.477   21   0.090   48   0.957   -177	775	0.953	+169	0.477	21	0.090	48	0.957	-177
800 0.959 +168 0.467 17 0.093 48 0.957 -179						0.093			-179

Table 1. Common Source Scattering Parameters

50 Ω System

 $V_{DS} = 28 \text{ V}, I_D = 0.75 \text{ A}$ 

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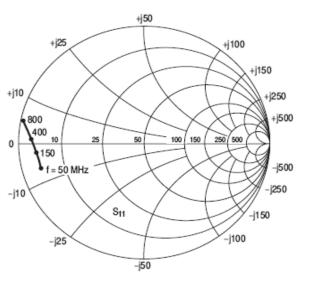
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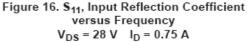


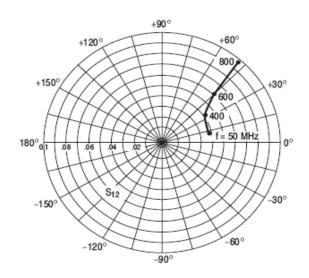
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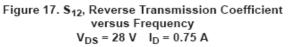
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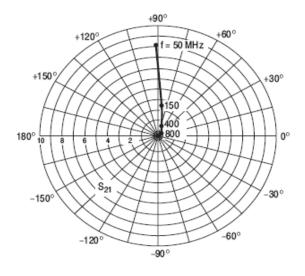


Figure 18.  $S_{21}$ , Forward Transmission Coefficient versus Frequency  $V_{DS} = 28 \text{ V}$  I<sub>D</sub> = 0.75 A

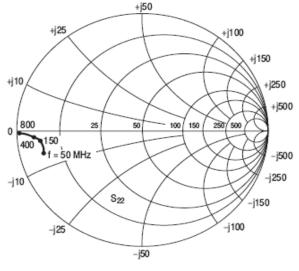


Figure 19.  $S_{22}$ , Output Reflection Coefficient versus Frequency  $V_{DS} = 28 \text{ V}$  I<sub>D</sub> = 0.75 A

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### **RF POWER MOSFET CONSIDERATIONS**

### **DESIGN CONSIDERATIONS**

The MRF137 is a RF power N–Channel enhancementmode field–effect transistor (FET) designed especially for VHF power amplifier applications. M/A-COM RF MOS FETs feature a vertical structure with a planar design, thus avoiding the processing difficulties associated with V– groove vertical power FETs.

M/A-COM Application Note AN211A, FETs in Theory and-Practice, is suggested reading for those not familiar with the construction and characteristics of FETs.

The major advantages of RF power FETs include high gain, low noise, simple bias systems, relative immunity from thermal runaway, and the ability to withstand severely mismatched loads without suffering damage. Power output can be varied over a wide range with a low power dc control signal, thus facilitating manual gain control, ALC and modulation.

### DC BIAS

The MRF137 is an enhancement mode FET and, therefore, does not conduct when drain voltage is applied. Drain current flows when a positive voltage is applied to the gate. See Figure 10 for a typical plot of drain current versus gate voltage. RF power FETs require forward bias for optimum performance.

The value of quiescent drain current (IDQ) is not critical formany applications. The MRF137 was characterized at IDQ = 25 mA, which is the suggested minimum value of IDQ. For special applications such as linear amplification, IDQ may have to be selected to optimize the critical parameters.

The gate is a dc open circuit and draws no current. Therefore, the gate bias circuit may generally be just a simple resistive divider network. Some special applications may require a more elaborate bias system. **GAIN CONTROL** 

Power output of the MRF137 may be controlled from its rated value down to zero (negative gain) by varying the dc gate voltage. This feature facilitates the design of manual gain control, AGC/ALC and modulation systems. (See Figure 9.)

### **AMPLIFIER DESIGN**

Impedance matching networks similar to those used with bipolar VHF transistors are suitable for MRF137. See M/A-COM Application Note AN721, Impedance Matching Networks Applied to RF Power Transistors. The higher input impedance of RF MOS FETs helps ease the task of broadband network design. Both small signal scattering parameters and large signal impedances are provided. While the s-parameters will not produce an exact design solution for high power operation, they do yield a good first approximation. This is an additional advantage of RF MOS power FETs.

RF power FETs are triode devices and, therefore, not unilateral. This, coupled with the very high gain of the MRF137, yields a device capable of self oscillation. Stability may be achieved by techniques such as drain loading, input shunt resistive loading, or output to input feedback. Two port parameter stability analysis with the MRF137 sparameters provides a useful tool for selection of loading or feedback circuitry to assure stable operation. See M/A-COM Application Note AN215A for a discussion of two port network theory and stability.

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The RF MOSFET Line

30W, to 400MHz, 28V



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4X .225" [5.72] DRAIN X 45.00° ±1.00° SOURCE .800"±.015" [20.32±0.38] SOURCE × ø.380" [ø9.65] GATE .975" [24.77] .725" [18.42] 2X Ø.120" [Ø3.05] 2X R.125" [R3.18] ø.375" [9.53] .272"±.010" [6.91±0.25] 4X .005"±.001" [0.13±0.03] .100" [2.54] .172"±.010" [4.37±0.25]

Unless otherwise noted, tolerances are inches  $\pm .005$ " [millimeters  $\pm 0.13$ mm]

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