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The RF MOSFET Line

Power Field Effect Transistor

N–Channel Enhancement–Mode MOSFET

MRF160

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

4.0 W, to 400 MHz
MOSFET BROADBAND
RF POWER FET

CASE 249–06, STYLE 3

MAXIMUM RATINGS (T_J = 25°C unless otherwise noted)

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

THERMAL CHARACTERISTICS

Thermal Resistance — Junction to Case	$R_{\theta JC}$	7.2	°C/W

NOTE: Handling and Packaging — 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°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{DS} = 0 Vdc, V_{GS} = 0 Vdc, I_D = 5.0 mA)	$V_{(BR)DSS}$	65	—	—	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 Vdc, V_{GS} = 0 V)	I_{DSS}	—	—	0.8	mA
Gate–Source Leakage Current (V_{GS} = 40 Vdc, V_{DS} = 0 Vdc)	I_{GSS}	—	—	1.0	μA
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 Vdc, I_D = 10 mA)	$V_{GS(th)}$	1.0	3.0	6.0	Vdc
Drain Source On–Voltage ($V_{DS\ (on)}$, V_{GS} = 10 Vdc, I_D = 500 mA)	$V_{DS(on)}$	—	3.8	—	Vdc
Forward Transconductance (V_{DS} = 10 Vdc, I_D = 250 mA)	g_{fs}	110	160	—	mS
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0 V, f = 1.0 MHz)	C_{iss}	—	6.0	—	pF
Output Capacitance (V_{DS} = 28 V, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{oss}	—	8.0	—	pF
Reverse Transfer Capacitance (V_{DS} = 28 Vdc, V_{GS} = 0 Vdc, f = 1.0 MHz)	C_{rss}	—	0.8	—	pF
FUNCTIONAL CHARACTERISTICS					
Common Source Power Gain (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 400 MHz, I_{DQ} = 50 mA)	G_{ps}	15	17	—	dB
Drain Efficiency (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 400 MHz, I_{DQ} = 50 mA)	η	45	50	—	%
Electrical Ruggedness (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 400 MHz, I_{DQ} = 50 mA) Load VSWR = 30:1 at All Phase Angles at Frequency of Test	ψ	No Degradation in Output Power			
Series Equivalent Input Impedance (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 400 MHz, I_{DQ} = 50 mA)	Z_{in}	—	5.23–j 27.2	—	Ohms
Series Equivalent Output Impedance (V_{DD} = 28 Vdc, P_{out} = 4.0 W, f = 400 MHz, I_{DQ} = 50 mA)	Z_{out}	—	14.7–j 31.2	—	Ohms

C1, C5	220 pF, Chip Capacitor	R3	10 kΩ, 10 Turns Bourns
C2	18 pF, ATC Chip Capacitor	R4	1.8 kΩ, 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 μF		
C9, C10	680 pF, Feed Through	Z1	Microstrip Line 0.167″ wide, 0.820″ long
C11	50 μF, 50 V	Z2	Microstrip Line 0.240″ wide, 0.240″ long
L1	#20 AWG, 1 Turn 0.255″ ID	Z3	Microstrip Line 0.240″ wide, 0.240″ long
L2	#20 AWG, Hairpin 1.3″ long, bend into hairpin	Z4	Microstrip Line 0.230″ wide, 0.590″ long
L3	#20 AWG, Hairpin 1.1″ long, bend into hairpin	Z5	Microstrip Line 0.230″ wide, 0.580″ long
R1	160 Ω, 1/2 Watt	Z6	Microstrip Line 0.167″ wide, 0.620″ long
R2	10 kΩ, 1/2 Watt	Z7	Microstrip Line 0.167″ wide, 0.800″ long

Board Material 0.060″ Glass Teflon® 2 oz. Copper clad both sides ε_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	S_{11}		S_{21}		S_{12}		S_{22}	
(MHz)	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠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 Ω System)

f	S_{11}		S_{21}		S_{12}		S_{22}	
(MHz)	$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠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_{DS} = 12.5 Vdc, I_D = 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.

	INCHES		MILLIMETERS	
DIM	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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