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SEMICONDUCTOR TECHNICAL DATA

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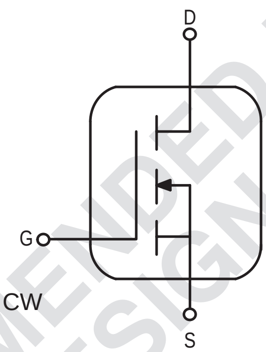
MRF184
MRF184S, R1

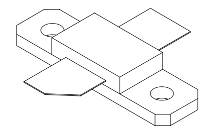
The RF MOSFET Line
RF POWER Field-Effect Transistors
N–Channel Enhancement–Mode Lateral MOSFETs

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

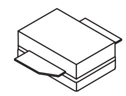
- Guaranteed Performance @ 945 MHz, 28 Volts
  Output Power = 60 Watts
  Power Gain = 11.5 dB
  Efficiency = 53%
- Characterized with Series Equivalent Large–Signal Impedance Parameters
- S–Parameter Characterization at High Bias Levels
- Excellent Thermal Stability
- 100% Tested for Load Mismatch Stress at all Phase Angles with 5:1 VSWR @ 28 Vdc, 945 MHz, 60 Watts CW
- MRF184S Available in Tape and Reel by Adding R1 Suffix to Part Number. MRF184SR1 = 500 Units per 24 mm, 13 inch Reel.
- LDMOS Models, Test Fixture, Reference Design and Circuit Board Artwork Available at: http://mot–sps.com/rf/designtds/



60 W, 1.0 GHz
LATERAL N–CHANNEL
BROADBAND
RF POWER MOSFETs



CASE 360B–03, STYLE 1
(MRF184)



CASE 360C–03, STYLE 1
(MRF184S)

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Drain–Source Voltage	V_{DSS}	65	Vdc
Gate–Source Voltage	V_{GS}	±20	Vdc
Drain Current — Continuous	I_D	7	Adc
Total Device Dissipation @ T_C = 70°C Derate above 70°C	P_D	118 0.9	Watts W/°C
Storage Temperature Range	T_{stg}	– 65 to +150	°C
Operating Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.1	°C/W

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Drain–Source Breakdown Voltage (V_{GS} = 0 V, I_D = 1 μAdc)	$V_{(BR)DSS}$	65	–	–	Vdc
Zero Gate Voltage Drain Current (V_{DS} = 28 V, V_{GS} = 0 V)	I_{DSS}	–	–	1	μAdc
Gate–Source Leakage Current (V_{GS} = 20 V, V_{DS} = 0 V)	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.

REV 7

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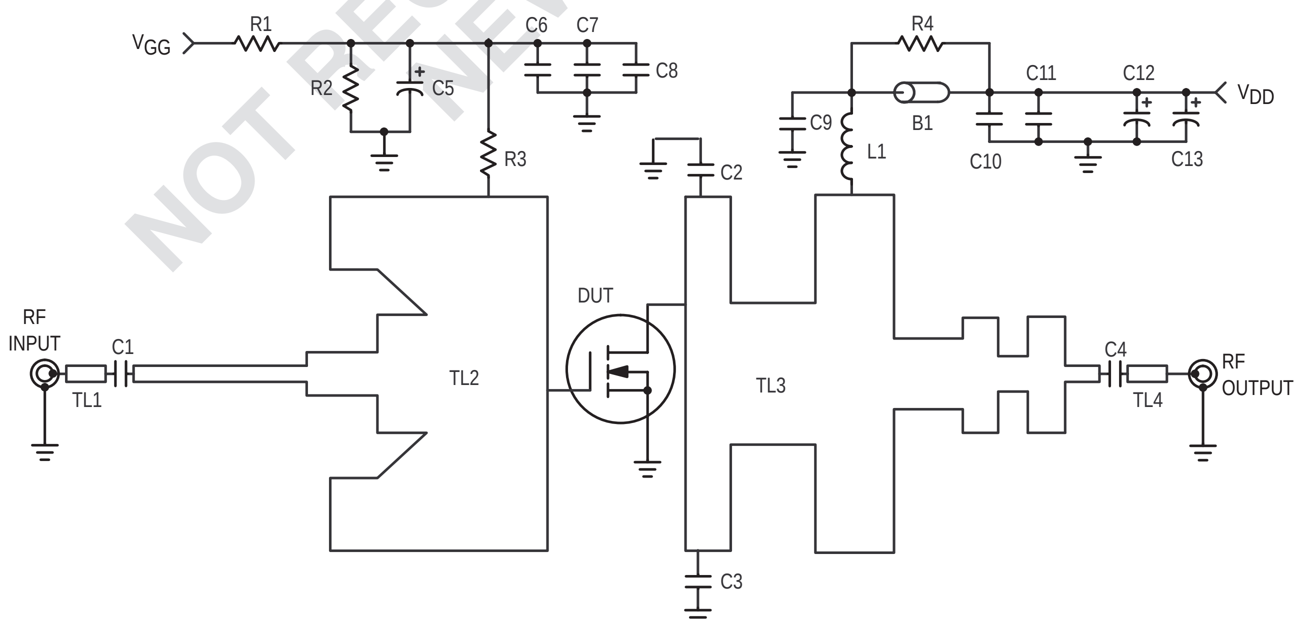
ELECTRICAL CHARACTERISTICS – continued (T_C = 25°C unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
Gate Threshold Voltage (V_{DS} = 10 V, I_D = 200 μA)	$V_{GS(th)}$	2	3	4	Vdc
Gate Quiescent Voltage (V_{DS} = 28 V, I_D = 100 mA)	$V_{GS(Q)}$	3	4	5	Vdc
Drain–Source On–Voltage (V_{GS} = 10 V, I_D = 3 A)	$V_{DS(on)}$	–	0.65	0.8	Vdc
Forward Transconductance (V_{DS} = 10 V, I_D = 3 A)	g_{fs}	2.2	2.6	–	s
DYNAMIC CHARACTERISTICS					
Input Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{iss}	–	83	–	pF
Output Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{oss}	–	44	–	pF
Reverse Transfer Capacitance (V_{DS} = 28 V, V_{GS} = 0 V, f = 1 MHz)	C_{rss}	–	4.3	–	pF
FUNCTIONAL CHARACTERISTICS					
Common Source Power Gain (V_{DD} = 28 V, P_{out} = 60 W, f = 945 MHz, I_{DQ} = 100 mA)	G_{ps}	11.5	13.5	–	dB
Drain Efficiency (V_{DD} = 28 V, P_{out} = 60 W, f = 945 MHz, I_{DQ} = 100 mA)	η	53	60	–	%
Load Mismatch (V_{DD} = 28 V, P_{out} = 60 W, I_{DQ} = 100 mA, f = 945 MHz, Load VSWR 5:1 at all Phase Angles)	ψ	No Degradation in Output Power			



B1	Short RF Bead Fair Rite–2743019447	L1	5 Turns, 20 AWG, IDIA 0.126″
C1	18 pF Chip Capacitor	R1	10 kΩ, 1/4 W Resistor
C2, C3, C6, C9	43 pF Chip Capacitor	R2	13 kΩ, 1/4 W Resistor
C4	100 pF Chip Capacitor	R3	1.0 kΩ, 1/4 W Chip Resistor
C5, C12	10 μF, 50 Vdc Electrolytic Capacitor	R4	4 x 39 Ω, 1/8 W Chip Resistor
C7, C10	1000 pF Chip Capacitor	TL1–TL4	Microstrip Line See Photomaster
C8, C11	0.1 μF, 50 Vdc Chip Capacitor	Ckt Board	1/32″ Glass Teflon, ε_r = 2.55
C13	250 μF, 50 Vdc Electrolytic Capacitor		ARLON–GX–0300–55–22

Figure 1. MRF184 Test Circuit Schematic

TYPICAL CHARACTERISTICS

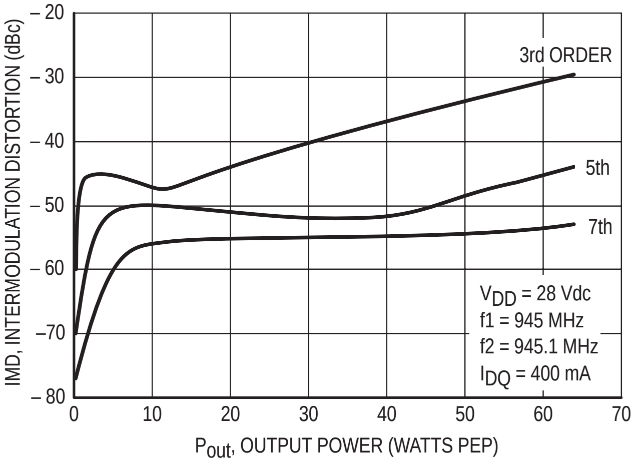


Figure 2. Intermodulation Distortion Products versus Output Power

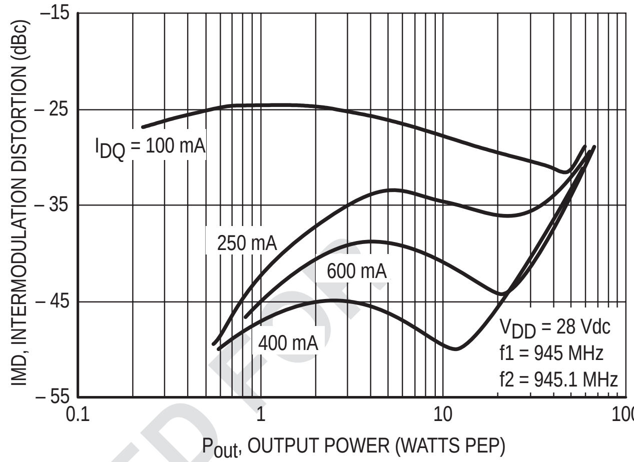


Figure 3. Intermodulation Distortion versus Output Power

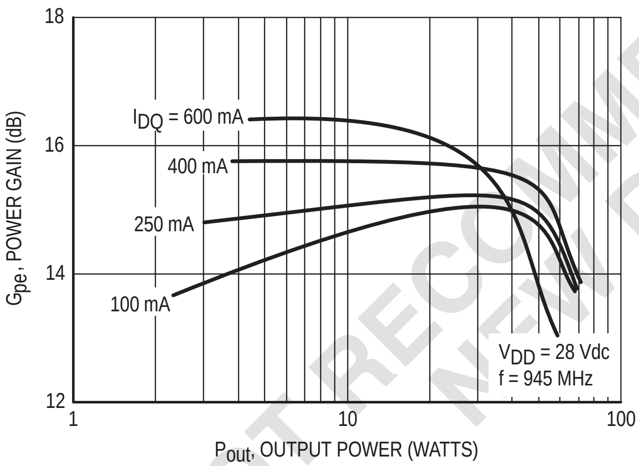


Figure 4. Power Gain versus Output Power

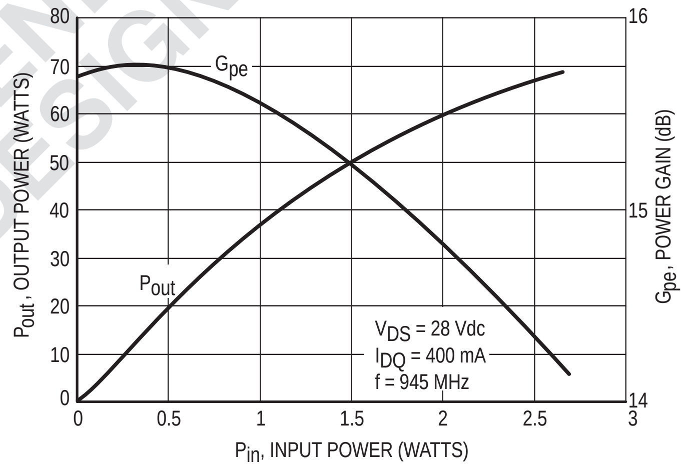


Figure 5. Output Power versus Input Power

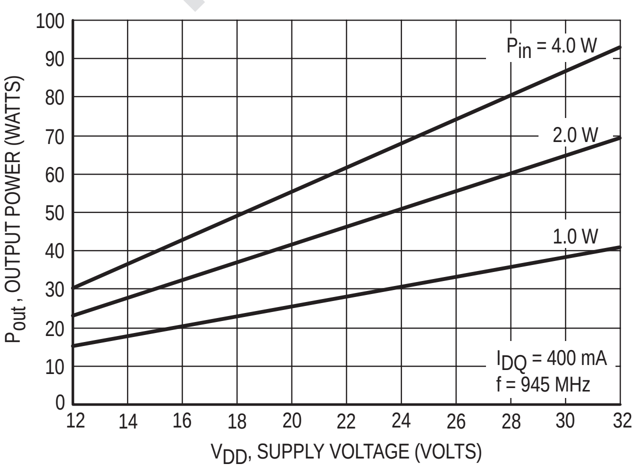


Figure 6. Output Power versus Supply Voltage

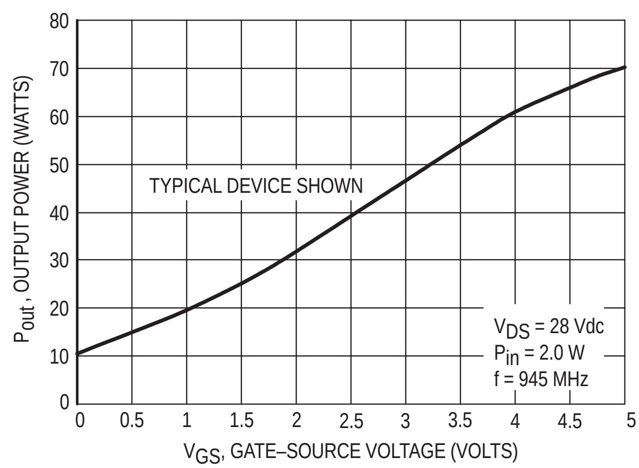


Figure 7. Output Power versus Gate Voltage

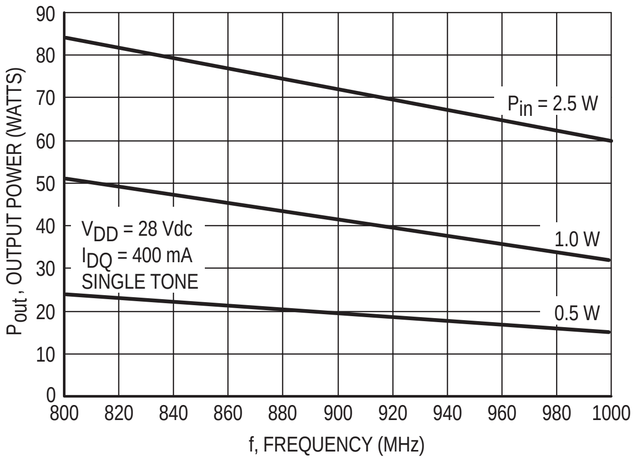


Figure 8. Output Power versus Frequency

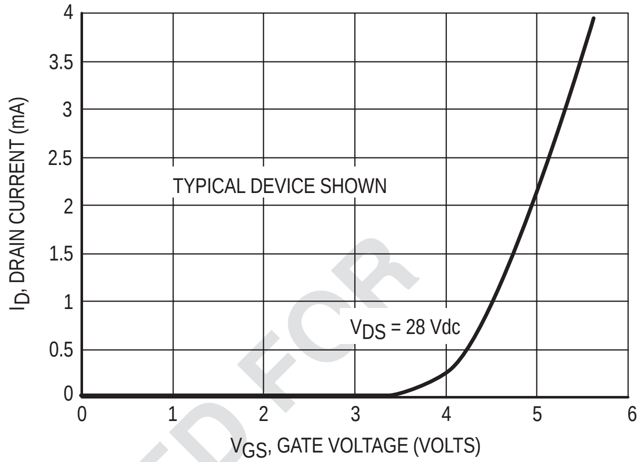


Figure 9. Drain Current versus Gate Voltage

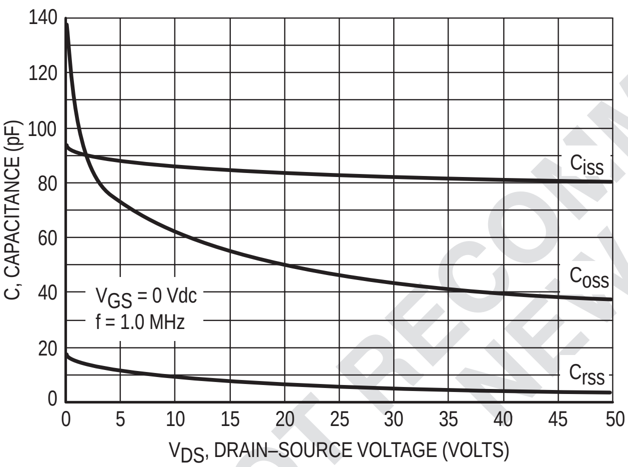


Figure 10. Capacitance versus Voltage

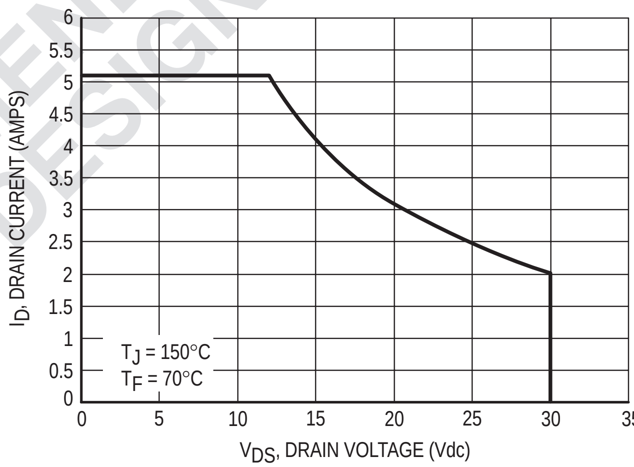


Figure 11. DC Safe Operating Area

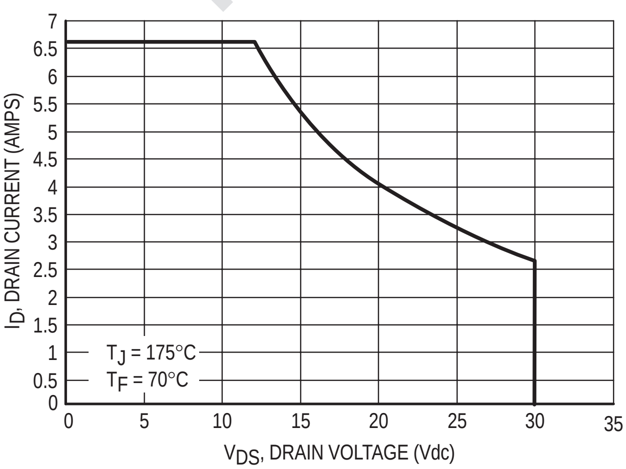


Figure 12. DC Safe Operating Area

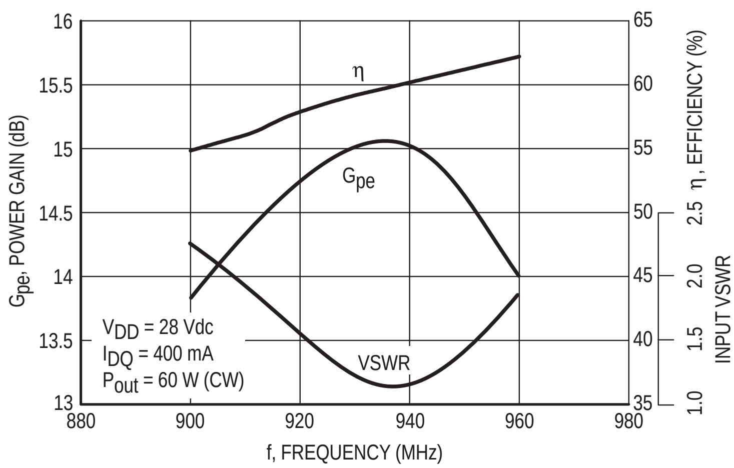


Figure 13. Performance in Broadband Circuit

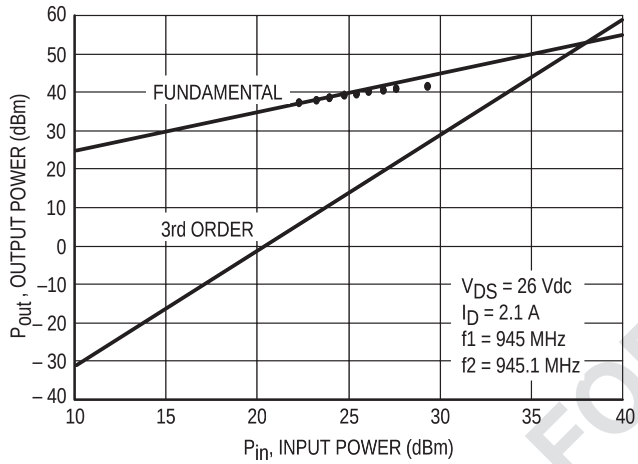


Figure 14. Class A Third Order Intercept Point

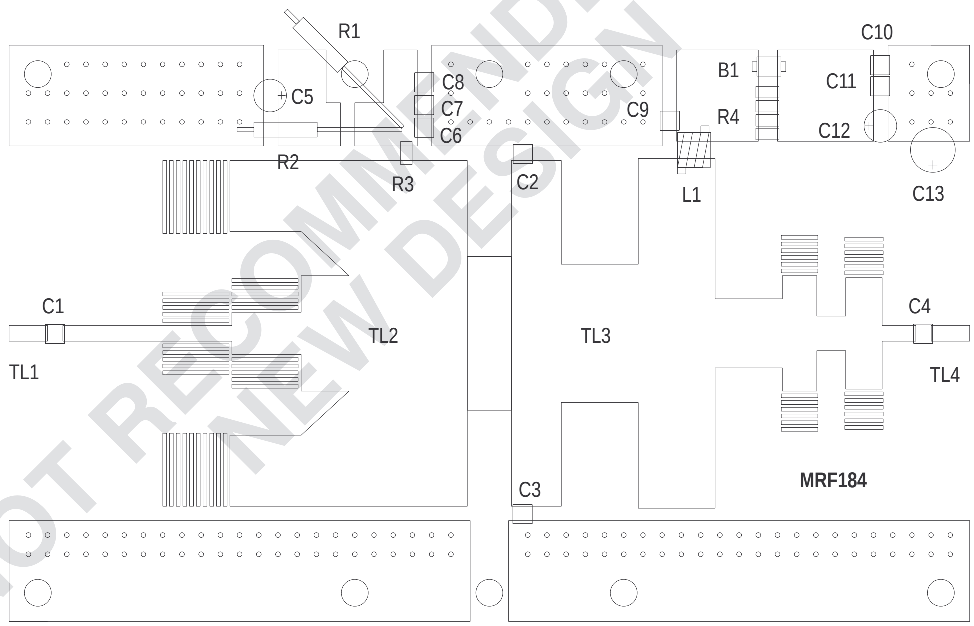
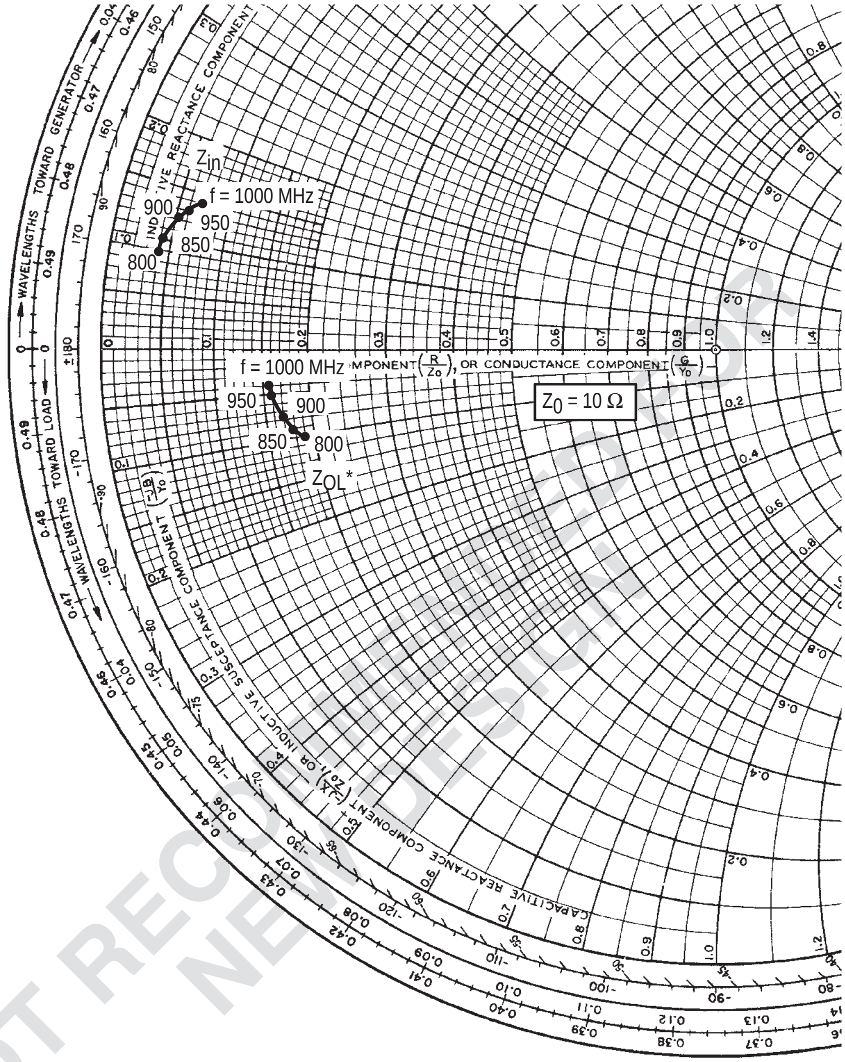


Figure 15. Component Parts Layout



V_{DD} = 28 Vdc, I_{DQ} = 100 mA, P_{out} = 60 W

f MHz	Z_{in} Ohms	Z_{OL}* Ohms
800	0.40 + j0.90	1.85 – j1.00
850	0.45 + j1.10	1.75 – j0.90
900	0.52 + j1.20	1.70 – j0.75
950	0.60 + j1.30	1.60 – j0.50
1000	0.70 + j1.38	1.57 – j0.40

Z_{in} = Conjugate of source impedance.

Z_{out} = Conjugate of the load impedance at given output power, voltage, frequency and efficiency.

Note: Z_{OL}* was chosen based on tradeoffs between gain, drain efficiency and device stability.

Figure 16. Series Equivalent Input and Output Impedance

Table 1. Common Source S–Parameters (V_{DS} = 13.5 V)

I_D = 2.0 A

f MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\|S_{11}\|$	ϕ	$\|S_{21}\|$	ϕ	$\|S_{12}\|$	ϕ	$\|S_{22}\|$	ϕ
20	0.916	179	10.88	80	0.014	–22	0.843	175
30	0.917	178	9.26	79	0.014	–25	0.847	174
40	0.918	177	8.10	78	0.015	–29	0.852	174
50	0.919	176	7.16	77	0.015	–33	0.853	174
100	0.919	175	4.57	75	0.015	–35	0.855	173
150	0.920	174	3.34	67	0.015	–38	0.865	173
200	0.921	173	2.60	62	0.014	–41	0.867	173
250	0.922	173	2.11	59	0.014	–45	0.877	173
300	0.928	172	1.77	55	0.014	–49	0.881	173
350	0.938	172	1.50	50	0.013	–55	0.887	173
400	0.941	171	1.28	47	0.013	–59	0.895	173
450	0.942	171	1.12	44	0.012	–62	0.896	173
500	0.943	171	1.00	41	0.012	–68	0.898	172
550	0.945	171	0.91	38	0.010	–75	0.899	172
600	0.947	171	0.80	35	0.010	–79	0.903	172
650	0.948	171	0.71	33	0.009	–85	0.905	172
700	0.955	170	0.65	30	0.008	–88	0.909	172
750	0.959	170	0.60	28	0.008	–95	0.919	172
800	0.962	169	0.55	25	0.007	–102	0.922	172
850	0.963	169	0.50	23	0.007	–111	0.923	171
900	0.964	169	0.45	21	0.007	–118	0.926	171
950	0.968	169	0.43	19	0.006	–125	0.929	171
1000	0.970	169	0.39	18	0.006	–129	0.933	171
1050	0.971	168	0.36	17	0.005	–134	0.935	171
1100	0.972	168	0.34	14	0.005	–142	0.936	170
1150	0.973	168	0.32	13	0.005	–149	0.938	170
1200	0.974	167	0.29	12	0.006	–156	0.940	169
1250	0.976	167	0.28	10	0.007	–162	0.943	169
1300	0.975	167	0.26	9	0.008	–173	0.945	168
1350	0.972	166	0.25	8	0.009	–178	0.946	167
1400	0.969	166	0.24	7	0.011	175	0.947	167
1450	0.965	165	0.22	6	0.012	172	0.948	167
1500	0.959	164	0.21	5	0.013	169	0.950	167

Table 2. Common Source S–Parameters (V_{DS} = 28 V)

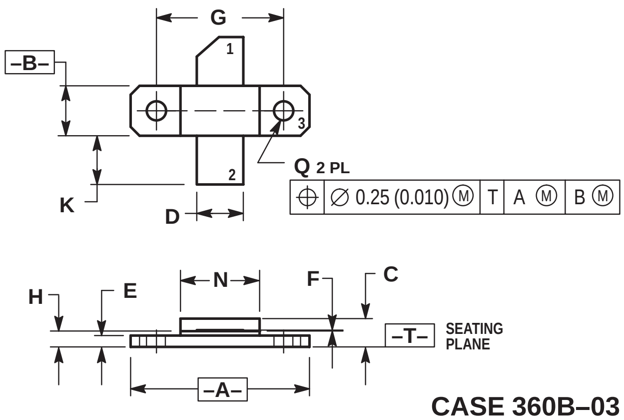
I_D = 2.0 A

f MHz	S_{11}		S_{21}		S_{12}		S_{22}	
	$\lvert S_{11} \rvert$	φ	$\lvert S_{21} \rvert$	φ	$\lvert S_{12} \rvert$	φ	$\lvert S_{22} \rvert$	φ
20	0.912	–170	16.01	84	0.016	–12	0.746	178
30	0.917	–173	13.73	82	0.015	–15	0.755	177
40	0.918	–174	12.02	80	0.014	–17	0.759	177
50	0.919	–176	10.62	78	0.013	–20	0.766	176
100	0.922	–178	6.76	71	0.012	–22	0.775	176
150	0.930	177	4.92	65	0.011	–25	0.791	176
200	0.931	176	3.82	60	0.010	–27	0.791	176
250	0.933	175	3.07	55	0.009	–29	0.793	176
300	0.941	174	2.53	51	0.009	–31	0.826	176
350	0.943	173	2.14	45	0.008	–35	0.834	176
400	0.945	172	1.83	41	0.008	–45	0.853	176
450	0.948	172	1.58	38	0.007	–52	0.858	176
500	0.950	172	1.39	35	0.007	–57	0.865	176
550	0.955	172	1.24	32	0.007	–61	0.876	176
600	0.960	172	1.10	29	0.006	–64	0.882	176
650	0.965	171	0.96	26	0.006	–68	0.888	175
700	0.967	171	0.89	24	0.006	–71	0.894	175
750	0.970	171	0.80	20	0.005	–73	0.904	175
800	0.973	170	0.73	18	0.005	–78	0.906	175
850	0.974	169	0.66	17	0.004	–83	0.908	174
900	0.975	169	0.61	13	0.004	–91	0.909	173
950	0.976	169	0.57	12	0.004	–94	0.915	173
1000	0.978	168	0.52	11	0.004	–96	0.916	173
1050	0.979	168	0.47	9	0.005	–102	0.919	172
1100	0.980	168	0.43	7	0.005	–115	0.924	172
1150	0.980	167	0.41	6	0.006	–119	0.931	171
1200	0.979	167	0.38	5	0.006	–125	0.934	170
1250	0.978	167	0.36	2	0.006	–139	0.935	170
1300	0.974	167	0.34	1	0.007	–148	0.936	170
1350	0.971	166	0.32	0	0.007	–156	0.937	169
1400	0.970	165	0.31	–1	0.007	–165	0.938	169
1450	0.969	165	0.30	–2	0.008	–171	0.939	169
1500	0.965	164	0.27	–3	0.008	–178	0.946	169

NOTES

NOTES

PACKAGE DIMENSIONS

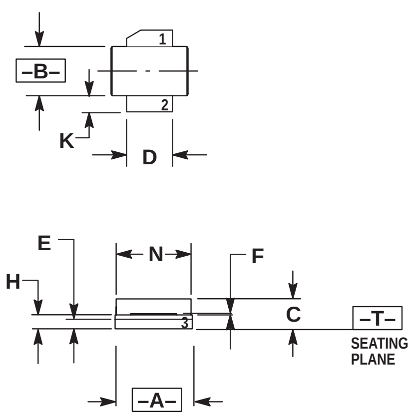


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION H IS MEASURED 0.030" AWAY FROM EDGE OF FLANGE.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.790	0.810	20.07	20.57
B	0.220	0.240	5.59	6.09
C	0.125	0.175	3.18	4.45
D	0.205	0.225	5.21	5.71
E	0.050	0.070	1.27	1.77
F	0.004	0.006	0.11	0.15
G	0.562 BSC		14.27 BSC	
H	0.077	0.087	1.96	2.21
K	0.215	0.255	5.47	6.47
N	0.350	0.370	8.89	9.39
Q	0.120	0.140	3.05	3.55

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

CASE 360B–03
ISSUE D
(MRF184)



NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	0.370	0.390	9.40	9.91
B	0.220	0.240	5.59	6.09
C	0.105	0.155	2.67	3.94
D	0.205	0.225	5.21	5.71
E	0.035	0.045	0.89	1.14
F	0.004	0.006	0.11	0.15
H	0.057	0.067	1.45	1.70
K	0.085	0.115	2.16	2.92
N	0.350	0.370	8.89	9.39

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

CASE 360C–03
ISSUE B
(MRF184S)

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