

# The RF Line

## NPN Silicon

## Power Transistors

... designed for 12.5 volt large-signal power amplifiers in commercial and industrial equipment.

- High Common Emitter Power Gain
- Specified 12.5 V, 175 MHz Performance
  - Output Power = 30 Watts
  - Power Gain = 10 dB
  - Efficiency = 60%
- Diffused Emitter Resistor Ballasting
- Characterized to 220 MHz
- Load Mismatch at High Line and Overdrive Conditions

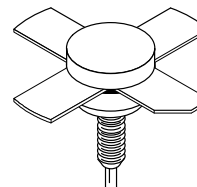
**MRF1946**  
**MRF1946A**

**30 W, 136–220 MHz**  
**RF POWER**  
**TRANSISTORS**  
**NPN SILICON**

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CEO}$	16	Vdc
Collector–Base Voltage	$V_{CBO}$	36	Vdc
Emitter–Base Voltage	$V_{EBO}$	4.0	Vdc
Collector Current — Continuous	$I_C$	8.0	Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	100 0.57	Watts W/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	–65 to +150	$^\circ\text{C}$
Junction Temperature	$T_J$	200	$^\circ\text{C}$

**CASE 211–07, STYLE 1**  
**MRF1946**



**CASE 145A–09, STYLE 1**  
**MRF1946A**

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.75	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector–Emitter Breakdown Voltage ( $I_C = 25 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector–Emitter Breakdown Voltage ( $I_C = 25 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 5.0 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CE} = 15 \text{ Vdc}$ , $V_{BE} = 0$ , $T_C = 25^\circ\text{C}$ )	$I_{CES}$	—	—	5.0	mAdc

### ON CHARACTERISTICS

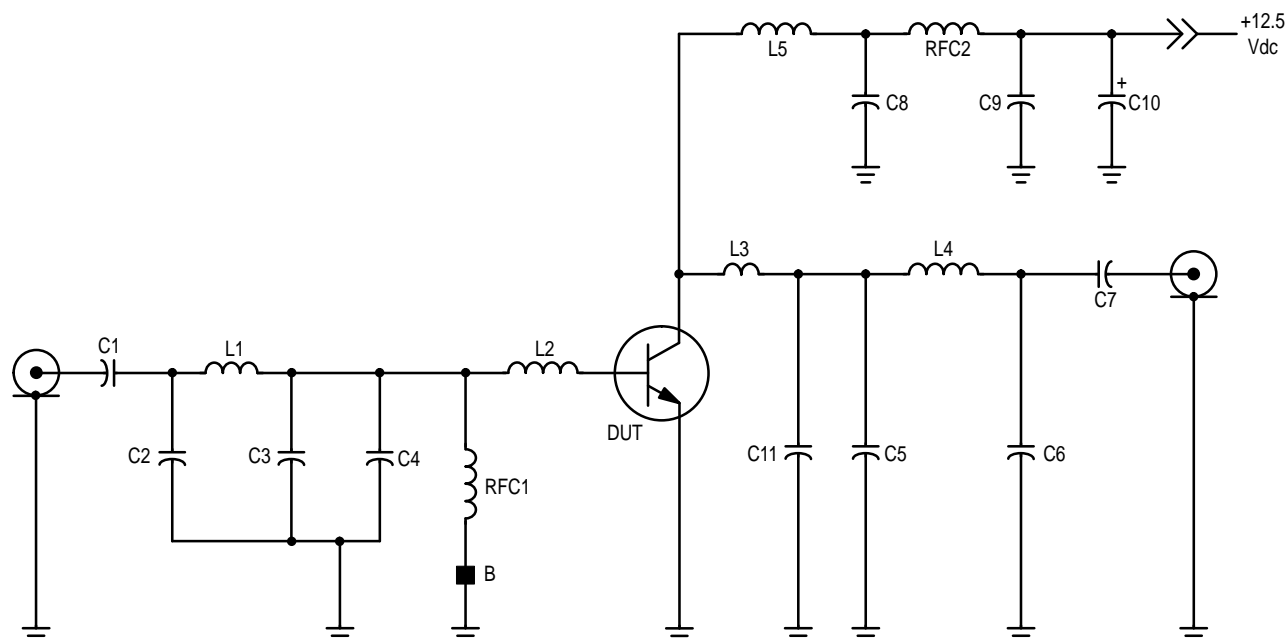
DC Current Gain ( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE}$	40	75	150	—
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(continued)



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

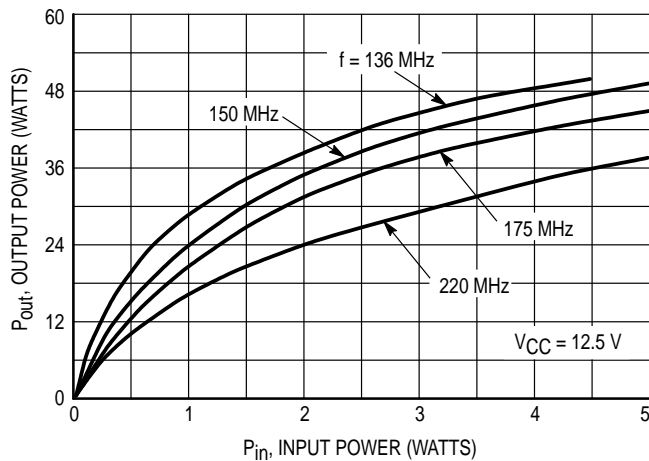
Characteristic	Symbol	Min	Typ	Max	Unit
<b>DYNAMIC CHARACTERISTICS</b>					
Output Capacitance ( $V_{CB} = 15\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ob}$	—	75	100	pF
<b>FUNCTIONAL TESTS</b>					
Common-Emitter Amplifier Power Gain ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 30\text{ W}$ , $f = 175\text{ MHz}$ )	$G_{pe}$	10	11	—	dB
Collector Efficiency ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 30\text{ W}$ , $f = 175\text{ MHz}$ )	$\eta$	60	70	—	%
Load Mismatch ( $V_{CC} = 15.5\text{ Vdc}$ , $P_{in} = 2.0\text{ dB Overdrive}$ , Load VSWR = 30:1)	$\psi$	No Degradation in Power Output			



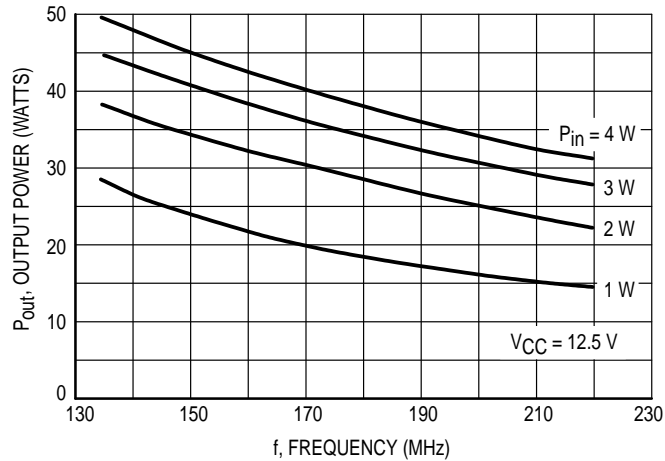
C1 — 56 pF Mini-Unelco, 3HS0006-56  
 C2 — 47 pF Mini-Unelco, 3HS0006-47  
 C3, C4 — 180 pF Chip Cap, ATC 100B181JC500  
 C5 — 150 pF Unelco, J101-150  
 C6 — 39 pF Mini-Unelco, 3HS0006-39  
 C7, C8 — 1000 pF Chip Cap, ATC 100B102JC50  
 C9 — 0.1  $\mu\text{F}$  Ceramic Capacitor  
 C10 — 10  $\mu\text{F}$ , 25 V Electrolytic Capacitor  
 C11 — 56 pF Mini-Unelco, 3HS0006-56

L1 — 2 Turns #18 AWG, 0.125" ID  
 L2, L3 — Circuit Board and Mounting Pad Inductance  
 L4 — 3 Turns #18 AWG, 0.125" ID  
 L5 — 6 Turns #16 Enameled, 0.250" ID  
 RFC1 — 0.15  $\mu\text{H}$  Molded Choke w/Ferrite Bead  
 RFC2 — Ferrite Choke, Fair Rite VK200-4B  
 Board Material — 1/32, Glass Teflon, 1 oz. Cu Plating  
 Bead — Ferroxcube

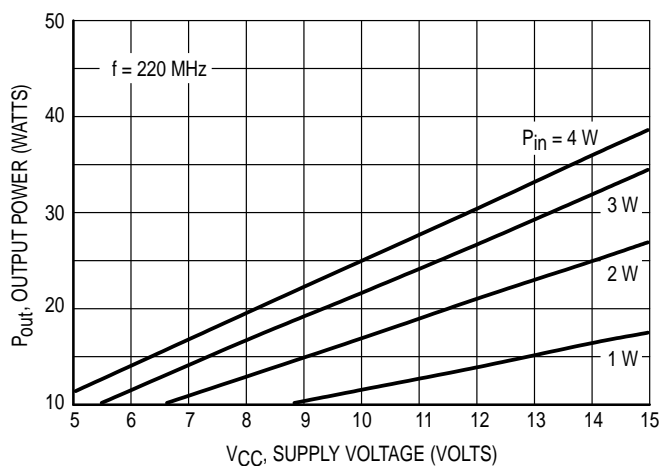
**Figure 1. Broadband Test Circuit Schematic**



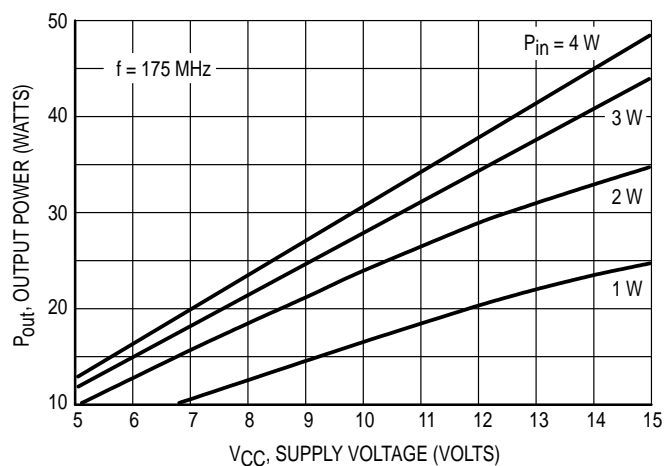
**Figure 2. Output Power versus Input Power**



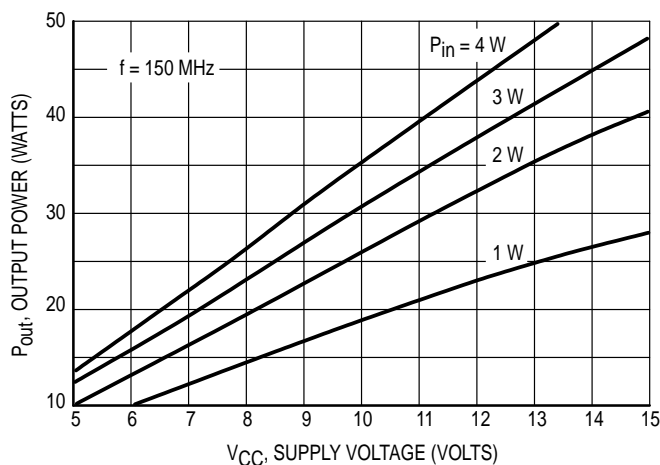
**Figure 3. Output Power versus Frequency**



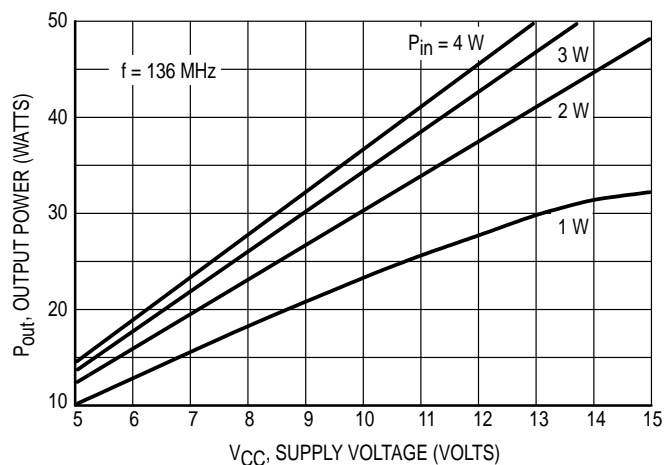
**Figure 4. Output Power versus Supply Voltage**



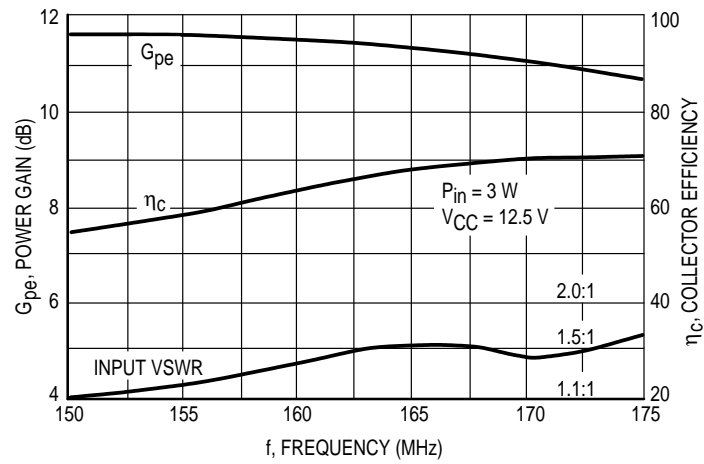
**Figure 5. Output Power versus Supply Voltage**



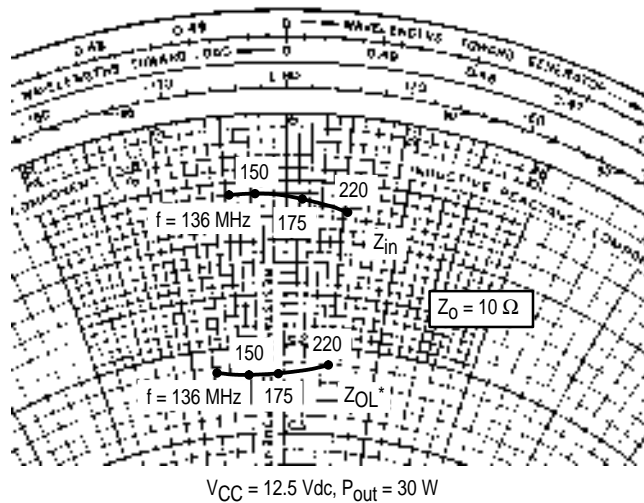
**Figure 6. Output Power versus Supply Voltage**



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



**Figure 8. Typical Performance in a Broadband Circuit**

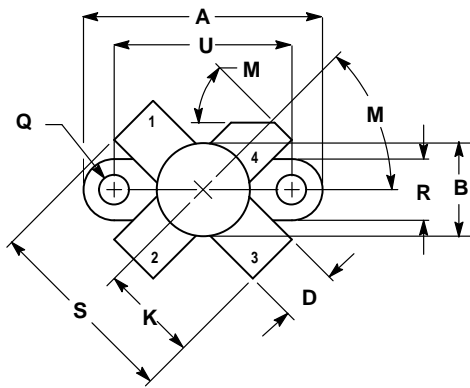


f MHz	Z <sub>in</sub> Ohms	Z <sub>OL</sub> * Ohms
136	0.60 - j0.48	2.22 - j0.74
150	0.63 - j0.26	2.30 - j0.40
175	0.62 + j0.13	2.35 - j0.04
220	0.73 + j0.57	2.20 + j0.43

Z<sub>OL</sub>\* = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.

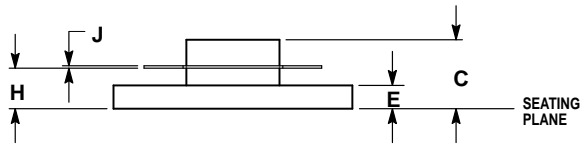
**Figure 9. Series Equivalent Input and Output Impedance**

## PACKAGE DIMENSIONS



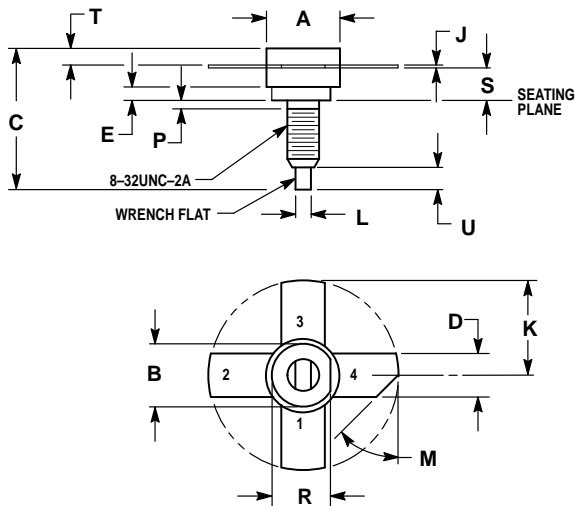
- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.960	0.990	24.39	25.14
B	0.370	0.390	9.40	9.90
C	0.229	0.281	5.82	7.13
D	0.215	0.235	5.47	5.96
E	0.085	0.105	2.16	2.66
H	0.150	0.108	3.81	4.57
J	0.004	0.006	0.11	0.15
K	0.395	0.405	10.04	10.28
M	40°	50°	40°	50°
Q	0.113	0.130	2.88	3.30
R	0.245	0.255	6.23	6.47
S	0.790	0.810	20.07	20.57
U	0.720	0.730	18.29	18.54



- STYLE 1:  
 PIN 1. EMITTER  
 2. BASE  
 3. EMITTER  
 4. COLLECTOR

**CASE 211-07  
 ISSUE N  
 MRF1946**




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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.370	0.385	9.40	9.78
B	0.320	0.330	8.13	8.38
C	0.670	0.790	17.02	20.07
D	0.215	0.235	5.46	5.97
E	0.070	—	1.78	—
J	0.003	0.007	0.08	0.18
K	0.490	—	12.45	—
L	0.055	0.070	1.40	1.78
M	45°NOM	—	45°NOM	—
P	—	0.050	—	1.27
R	0.299	0.307	7.59	7.80
S	0.158	0.178	4.01	4.52
T	0.083	0.100	2.11	2.54
U	0.098	0.132	2.49	3.35

- STYLE 1:  
 PIN 1. EMITTER  
 2. BASE  
 3. EMITTER  
 4. COLLECTOR

**CASE 145A-09  
 ISSUE M  
 MRF1946A**

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**MRF1946/D**



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