

## The RF Line NPN Silicon Power Transistors

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

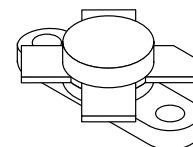
- High Common Emitter Power Gain
- Specified 12.5 V, 175 MHz Performance
  - Output Power = 30 Watts
  - Power Gain = 10 dB
  - Efficiency = 60%
- Diffused Emitter Resistor Ballasting
- Characterized to 220 MHz
- Load Mismatch at High Line and Overdrive Conditions

**MRF1946**  
**MRF1946A**

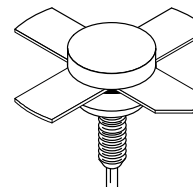
**30 W, 136–220 MHz**  
**RF POWER**  
**TRANSISTORS**  
**NPN SILICON**

### 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	$^\circ\text{C}/\text{W}$

### 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

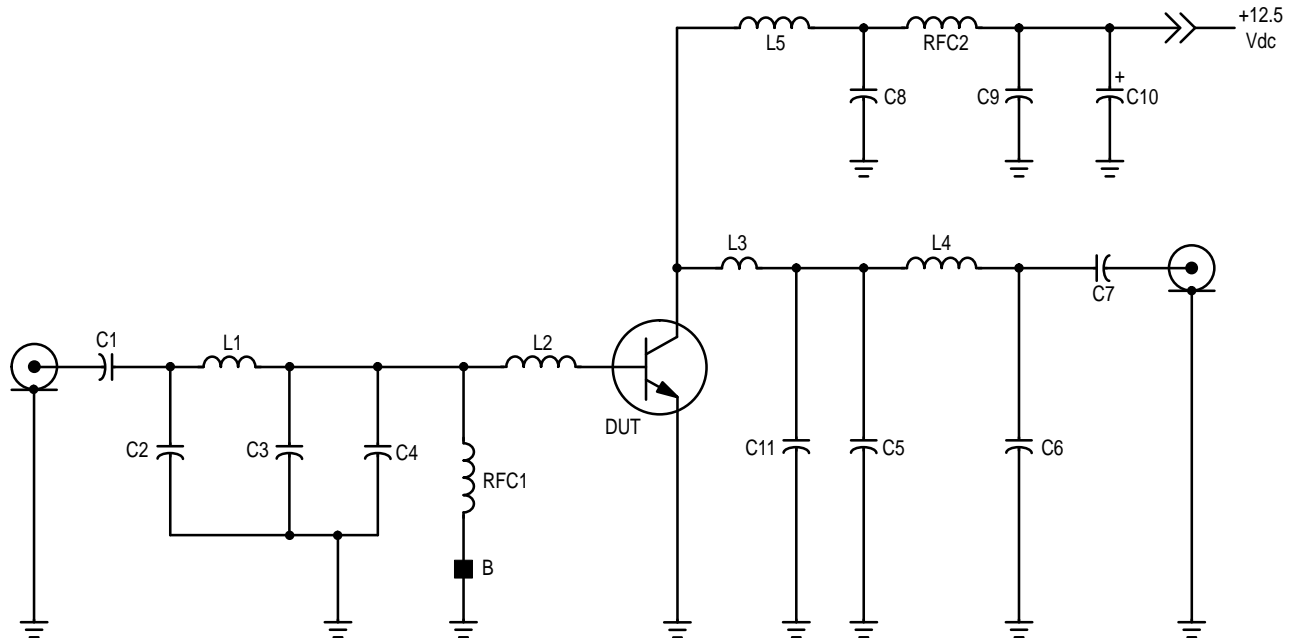
### ON CHARACTERISTICS

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**

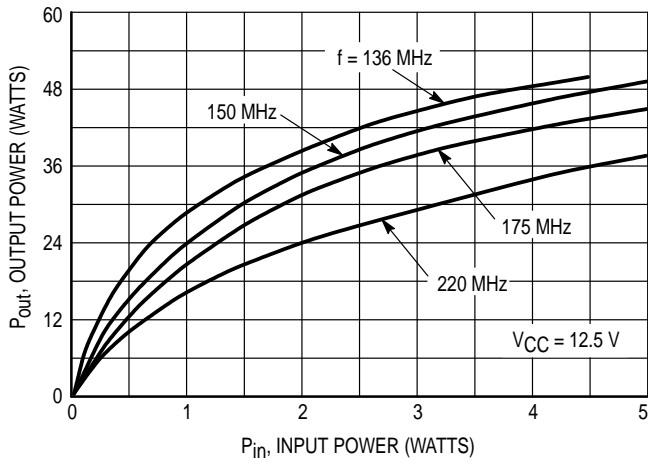


Figure 2. Output Power versus Input Power

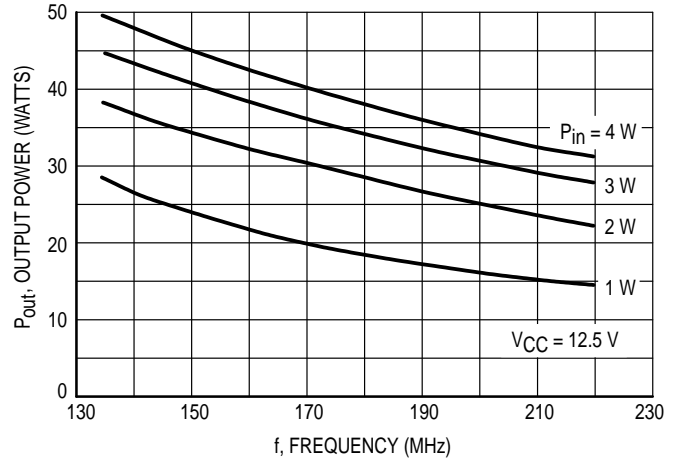


Figure 3. Output Power versus Frequency

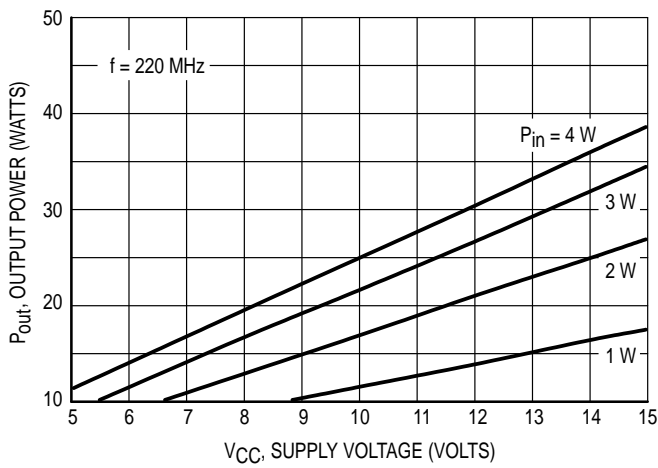


Figure 4. Output Power versus Supply Voltage

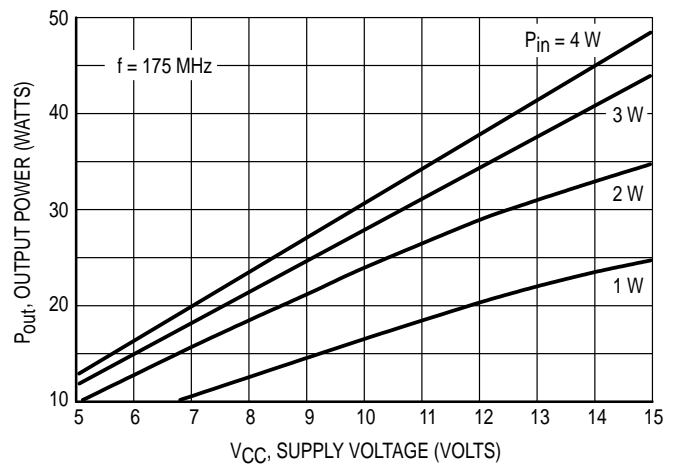


Figure 5. Output Power versus Supply Voltage

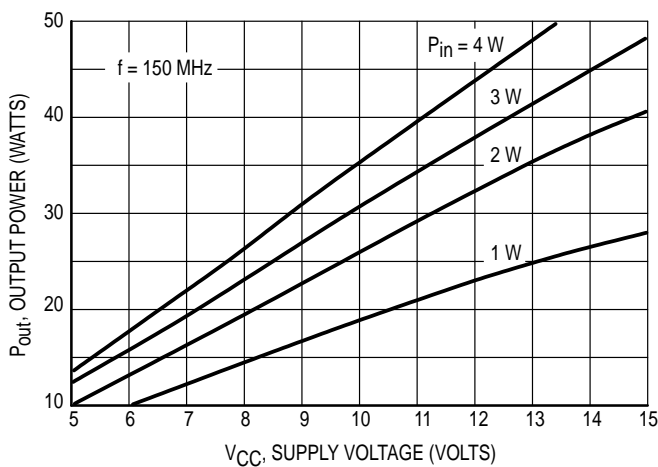


Figure 6. Output Power versus Supply Voltage

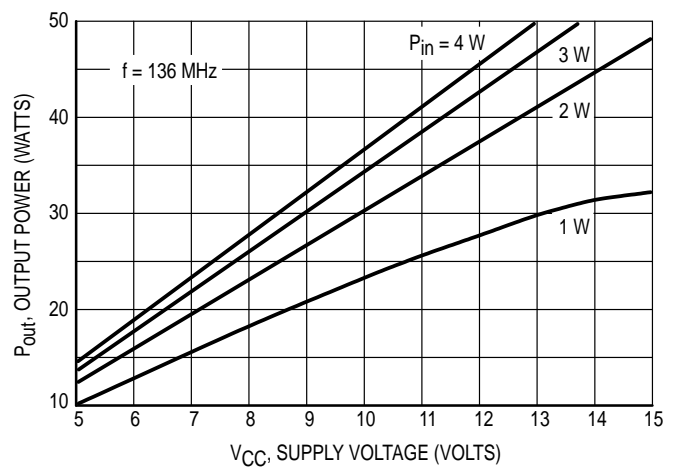


Figure 7. Output Power versus Supply Voltage

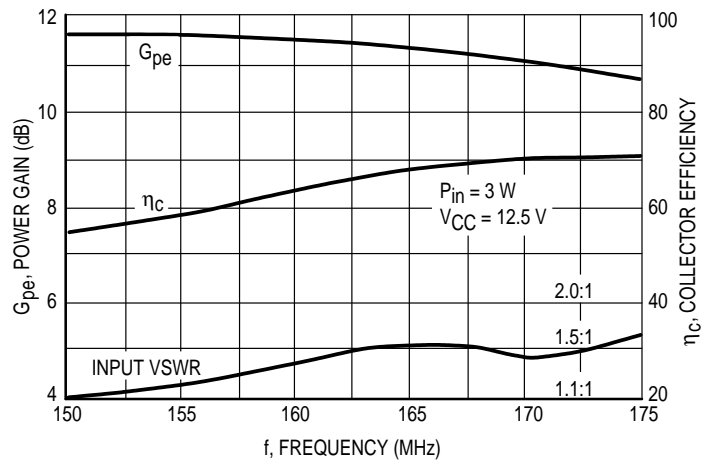
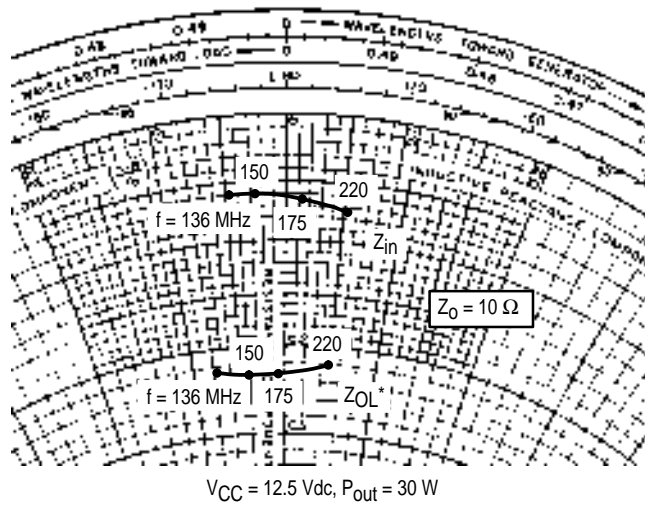


Figure 8. Typical Performance in a Broadband Circuit



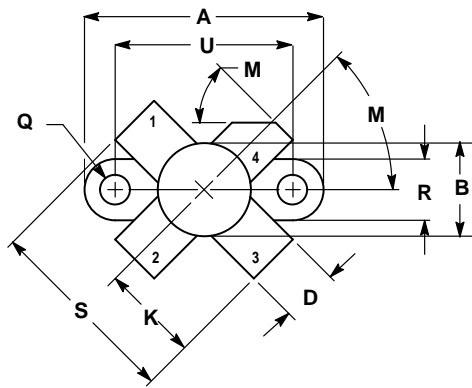
$V_{CC} = 12.5 \text{ Vdc}, P_{out} = 30 \text{ W}$

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

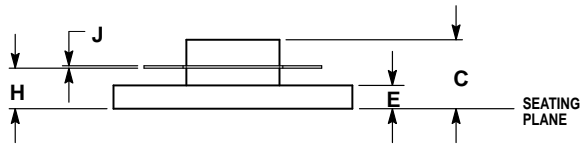
Figure 9. Series Equivalent Input and Output Impedance

## PACKAGE DIMENSIONS



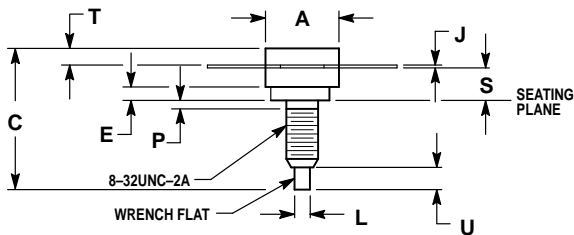
- NOTES:  
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
 2. CONTROLLING DIMENSION: INCH.

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



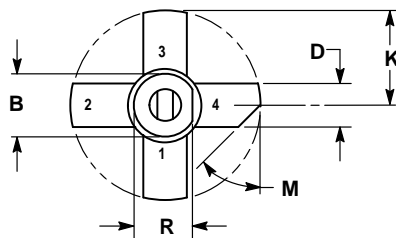
- STYLE 1:  
 PIN 1. EMITTER  
 2. BASE  
 3. EMITTER  
 4. COLLECTOR

**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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