

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

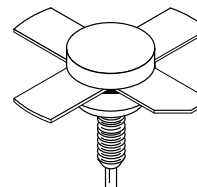
MRF1946
MRF1946A

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°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

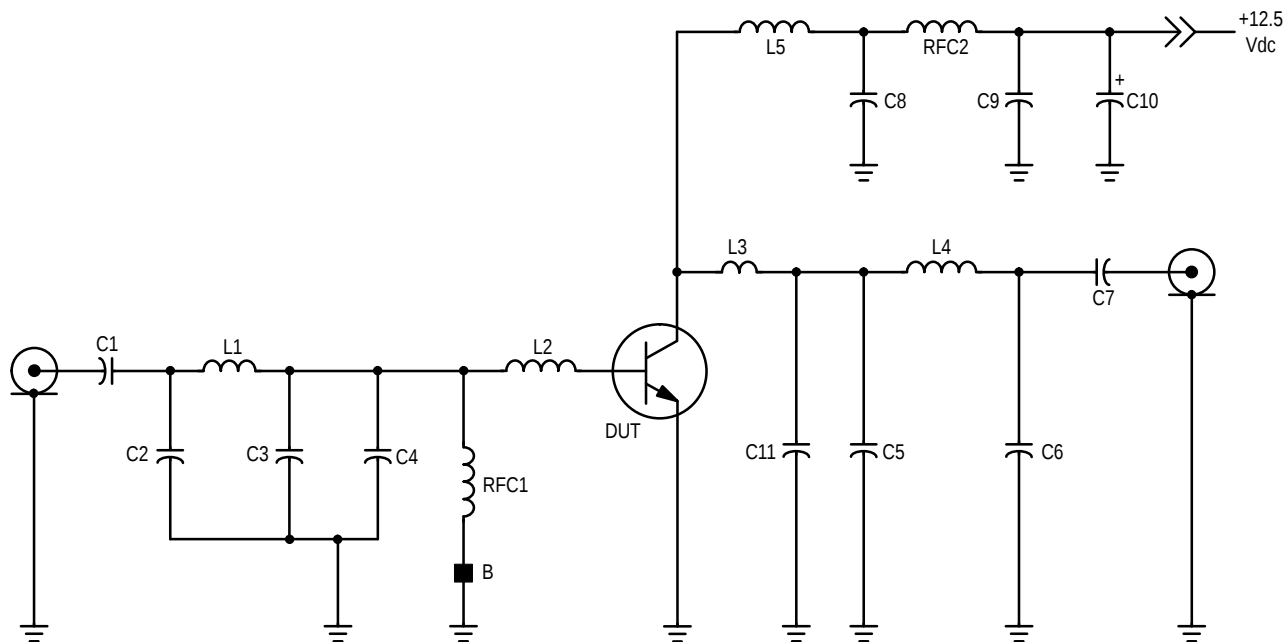
ON CHARACTERISTICS

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°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Output Capacitance (V _{CB} = 15 Vdc, I _E = 0, f = 1.0 MHz)	C _{ob}	—	75	100	pF
FUNCTIONAL TESTS					
Common–Emitter Amplifier Power Gain (V _{CC} = 12.5 Vdc, P _{out} = 30 W, f = 175 MHz)	G _{pe}	10	11	—	dB
Collector Efficiency (V _{CC} = 12.5 Vdc, P _{out} = 30 W, f = 175 MHz)	η	60	70	—	%
Load Mismatch (V _{CC} = 15.5 Vdc, P _{in} = 2.0 dB Overdrive, Load VSWR = 30:1)	ψ	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 μ F Ceramic Capacitor
C10 — 10 μ 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 μ 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

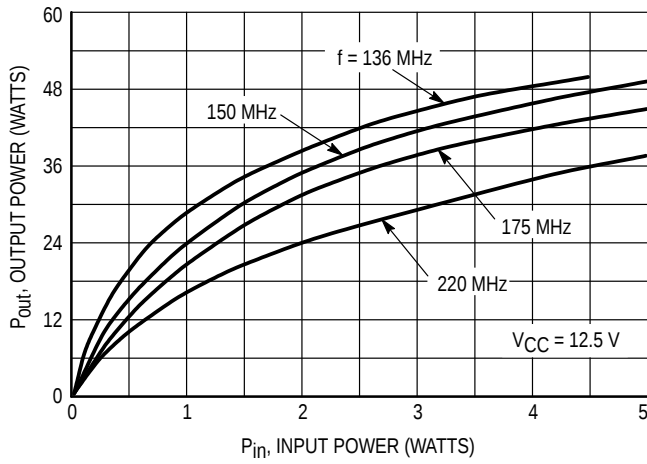


Figure 2. Output Power versus Input Power

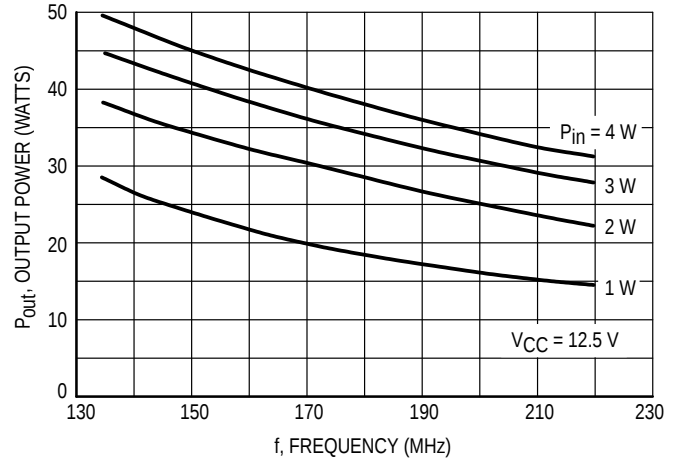


Figure 3. Output Power versus Frequency

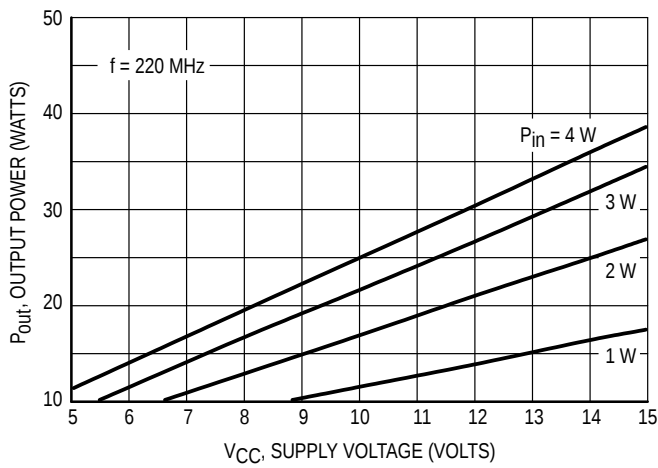


Figure 4. Output Power versus Supply Voltage

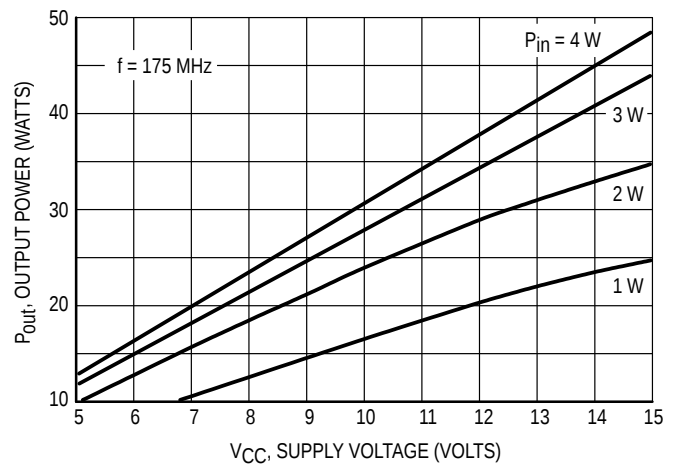


Figure 5. Output Power versus Supply Voltage

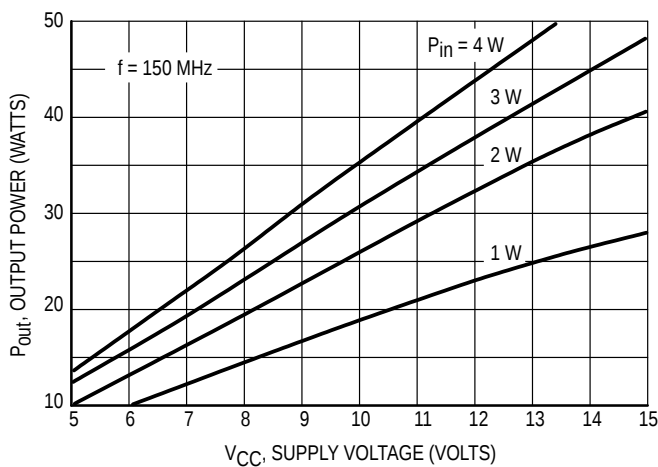


Figure 6. Output Power versus Supply Voltage

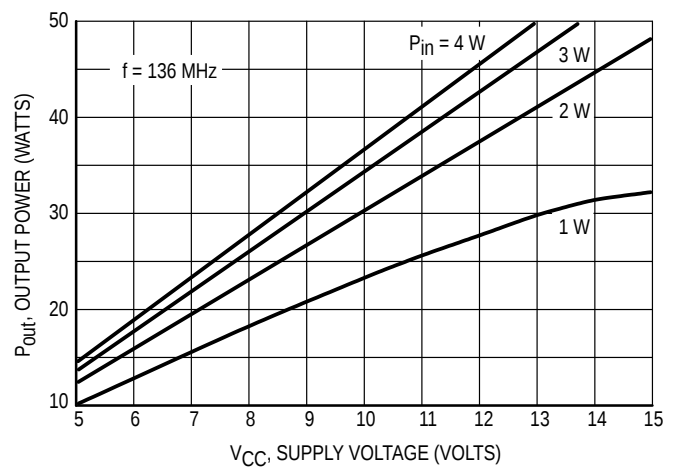


Figure 7. Output Power versus Supply Voltage

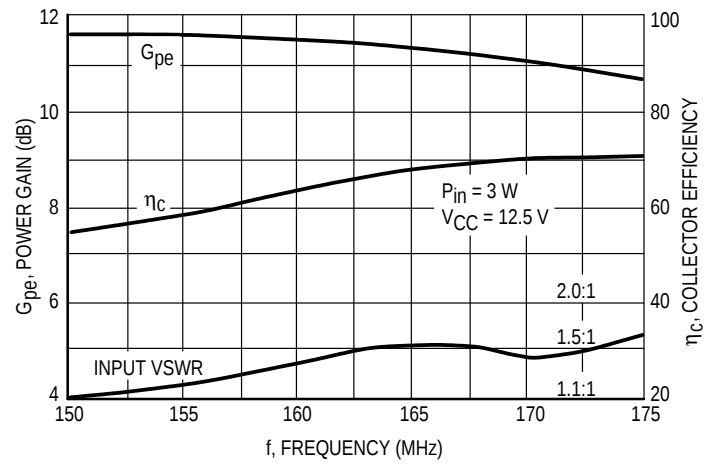
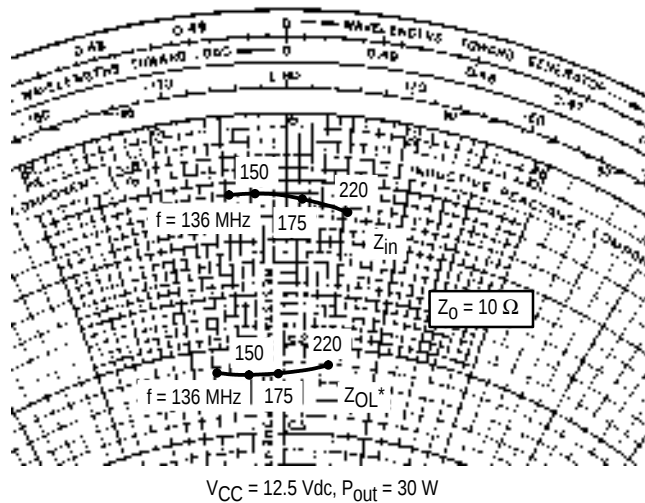


Figure 8. Typical Performance in a Broadband Circuit

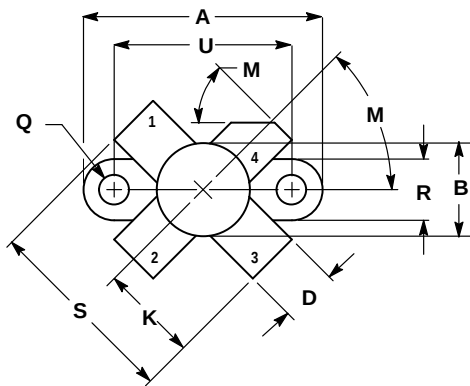


f MHz	Z _{in} Ohms	Z _{OL} * Ohms
136	0.60 – j0.48	2.22 – j0.74
150	0.63 – j0.26	2.30 – j0.40
175	0.62 + j0.13	2.35 – j0.04
220	0.73 + j0.57	2.20 + j0.43

Z_{OL}* = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.

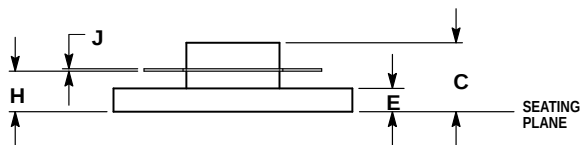
Figure 9. Series Equivalent Input and Output Impedance

PACKAGE DIMENSIONS



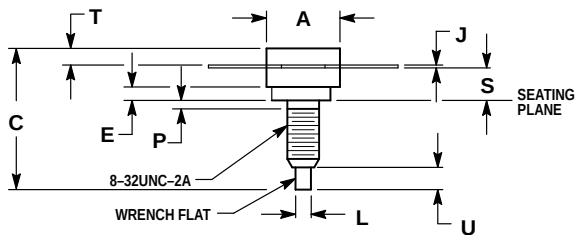
- NOTES:
 1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
 2. CONTROLLING DIMENSION: INCH.

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



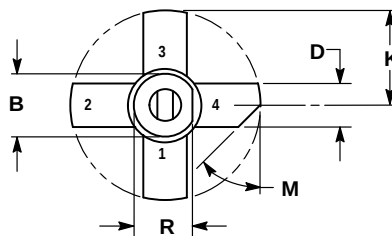
- STYLE 1:
 PIN 1. EMITTER
 2. BASE
 3. EMITTER
 4. COLLECTOR

**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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MOTOROLA



MRF1946/D

