

# The RF Line

## NPN Silicon

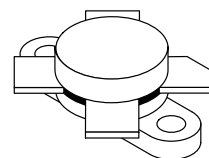
### RF Power Transistor

Designed primarily for high-voltage applications as a high-power linear amplifier from 2.0 to 30 MHz. Ideal for marine and base station equipment.

- Specified 50 Volt, 30 MHz Characteristics
  - Output Power = 250 W
  - Minimum Gain = 12 dB
  - Efficiency = 45%
- Intermodulation Distortion @ 250 W (PEP) —
  - IMD = -30 dB (Max)
- 100% Tested for Load Mismatch at all Phase Angles with 3:1 VSWR

**MRF448**

**250 W, 30 MHz  
RF POWER  
TRANSISTOR  
NPN SILICON**



**CASE 211-11, STYLE 1**

#### MAXIMUM RATINGS

| Rating                                                                                     | Symbol    | Value       | Unit                         |
|--------------------------------------------------------------------------------------------|-----------|-------------|------------------------------|
| Collector-Emitter Voltage                                                                  | $V_{CEO}$ | 50          | Vdc                          |
| Collector-Base Voltage                                                                     | $V_{CBO}$ | 100         | Vdc                          |
| Emitter-Base Voltage                                                                       | $V_{EBO}$ | 4.0         | Vdc                          |
| Collector Current — Continuous                                                             | $I_C$     | 16          | Adc                          |
| Withstand Current — 10 s                                                                   | —         | 20          | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1)<br>Derate above $25^\circ\text{C}$ | $P_D$     | 290<br>1.67 | Watts<br>W/ $^\circ\text{C}$ |
| Storage Temperature Range                                                                  | $T_{stg}$ | -65 to +150 | $^\circ\text{C}$             |

#### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max | Unit               |
|--------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.6 | $^\circ\text{C/W}$ |

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

#### OFF CHARACTERISTICS

|                                                                        |               |     |   |   |     |
|------------------------------------------------------------------------|---------------|-----|---|---|-----|
| Collector-Emitter Breakdown Voltage ( $I_C = 200$ mAdc, $I_B = 0$ )    | $V_{(BR)CEO}$ | 50  | — | — | Vdc |
| Collector-Emitter Breakdown Voltage ( $I_C = 100$ mAdc, $V_{BE} = 0$ ) | $V_{(BR)CES}$ | 100 | — | — | Vdc |
| Collector-Base Breakdown Voltage ( $I_C = 100$ mAdc, $I_E = 0$ )       | $V_{(BR)CBO}$ | 100 | — | — | Vdc |
| Emitter-Base Breakdown Voltage ( $I_E = 10$ mAdc, $I_C = 0$ )          | $V_{(BR)EBO}$ | 4.0 | — | — | Vdc |

NOTE:

- $P_D$  is a measurement reflecting short term maximum condition. See SOAR curve for operating conditions.

(continued)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

## **ON CHARACTERISTICS**

|                                                                            |          |    |    |   |   |
|----------------------------------------------------------------------------|----------|----|----|---|---|
| DC Current Gain<br>( $I_C = 5.0 \text{ Adc}$ , $V_{CE} = 10 \text{ Vdc}$ ) | $h_{FE}$ | 10 | 30 | — | — |
|----------------------------------------------------------------------------|----------|----|----|---|---|

## **DYNAMIC CHARACTERISTICS**

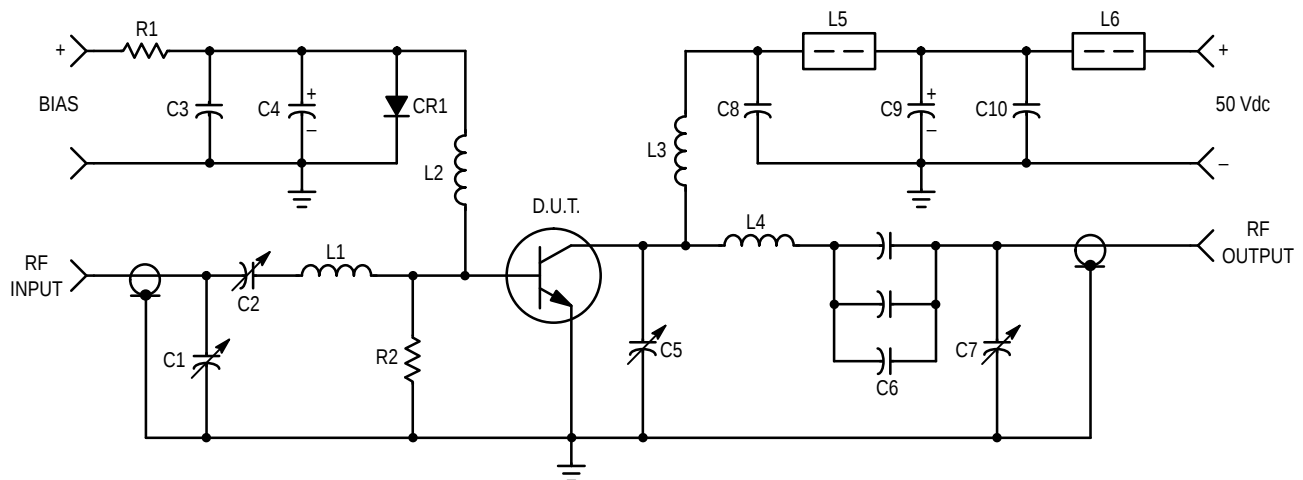
|                                                                                         |          |   |     |     |    |
|-----------------------------------------------------------------------------------------|----------|---|-----|-----|----|
| Output Capacitance<br>( $V_{CB} = 50 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ ) | $C_{ob}$ | — | 350 | 450 | pF |
|-----------------------------------------------------------------------------------------|----------|---|-----|-----|----|

## **FUNCTIONAL TESTS**

|                                                                                                                                                        |          |                                |          |     |                   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------|----------|--------------------------------|----------|-----|-------------------|
| Common-Emitter Amplifier Power Gain<br>( $V_{CC} = 50 \text{ Vdc}$ , $P_{out} = 250 \text{ W CW}$ , $f = 30 \text{ MHz}$ , $I_{CQ} = 250 \text{ mA}$ ) | $G_{PE}$ | 12                             | 14       | —   | dB                |
| Collector Efficiency<br>( $V_{CC} = 50 \text{ Vdc}$ , $P_{out} = 250 \text{ W}$ , $f = 30 \text{ MHz}$ , $I_{CQ} = 250 \text{ mA}$ )                   | $\eta$   | —                              | 45<br>65 | —   | % (PEP)<br>% (CW) |
| Intermodulation Distortion (2)<br>( $V_{CE} = 50 \text{ Vdc}$ , $P_{out} = 250 \text{ W (PEP)}$ , $I_{CQ} = 250 \text{ mA}$ , $f = 30 \text{ MHz}$ )   | IMD      | —                              | –33      | –30 | dB                |
| Electrical Ruggedness<br>( $V_{CC} = 50 \text{ Vdc}$ , $P_{out} = 250 \text{ W CW}$ , $f = 30 \text{ MHz}$ ,<br>VSWR 3:1 at all Phase Angles)          | $\psi$   | No Degradation in Output Power |          |     |                   |

### NOTE:

- To Mil-Std-1311 Version A, Test Method 2204, Two Tone, Reference each Tone.



C1, C2, C5, C7 — 170–780 pF, Arco 469  
C3, C8, C9 — 0.1  $\mu\text{F}$ , 100 V Erie  
C4 — 500  $\mu\text{F}$  @ 6.0 V  
C6 — 360 pF, 3 x 120 pF 3.0 kV in parallel  
C10 — 10  $\mu\text{F}$ , 100 V  
R1 — 10  $\Omega$ , 10 Watt  
R2 — 10  $\Omega$ , 1.0 Watt

CR1 — 1N4997 or equivalent  
L1 — 3 Turns, #16 Wire, 0.4" I.D., 0.3" Long  
L2 — 0.8  $\mu\text{H}$ , Ohmite Z-235 or equivalent  
L3 — 12 Turns, #16 Enameled Wire Closewound 0.25" I.D.  
L4 — 4 Turns, 1/8" Copper Tubing, 0.6" I.D., 1.0" Long  
L5, L6 — 2.0  $\mu\text{H}$ , Fair-Rite 2643021801 Ferrite bead each or equivalent

**Figure 1. 30 MHz Test Circuit Schematic**

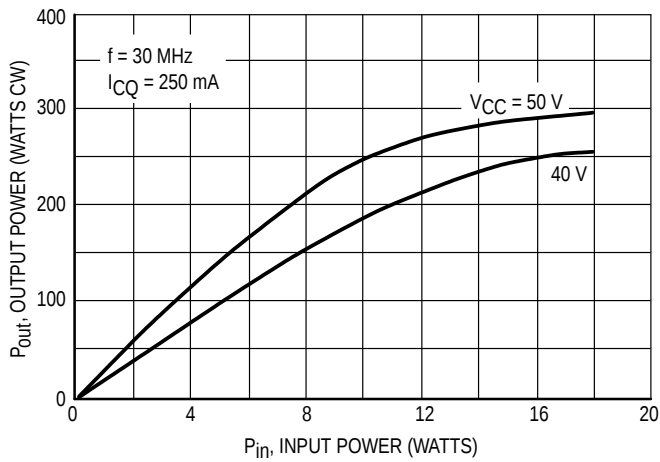


Figure 2. Output Power versus Input Power

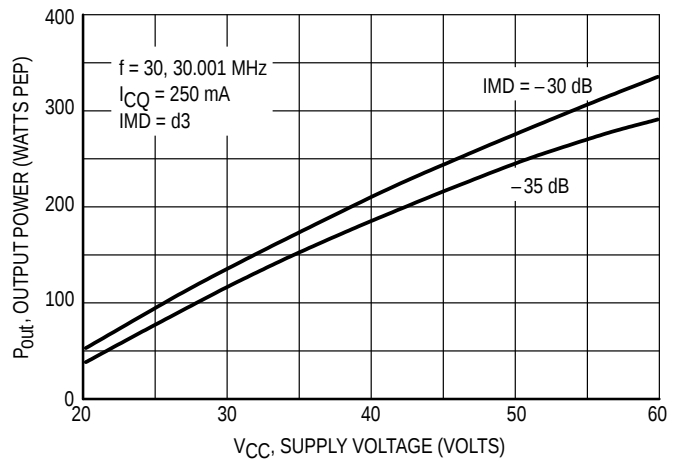


Figure 3. Output Power versus Supply Voltage

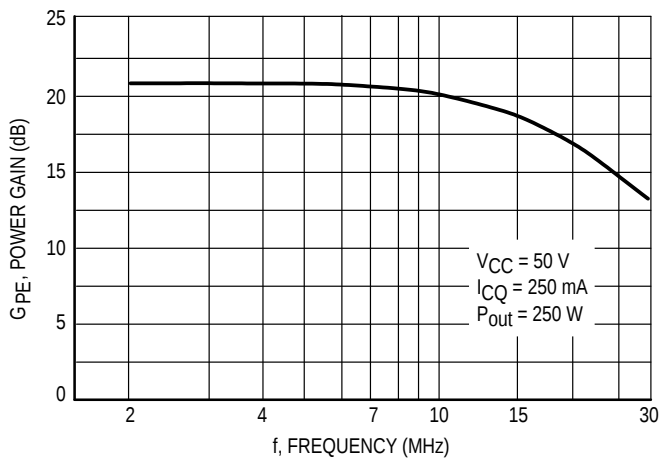


Figure 4. Power Gain versus Frequency

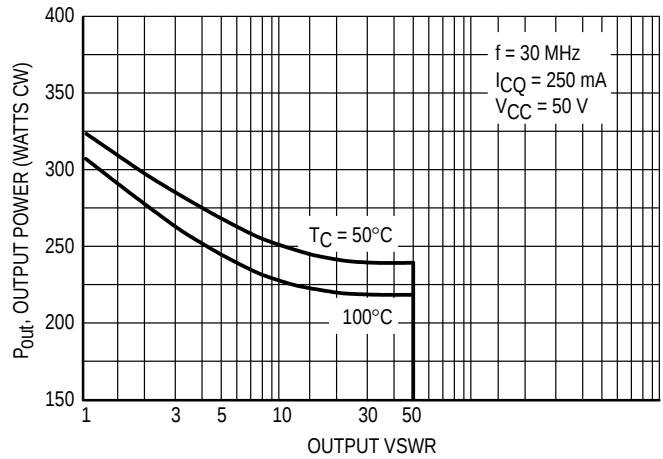


Figure 5. RF SOAR (Class AB)  
Pout versus Output VSWR

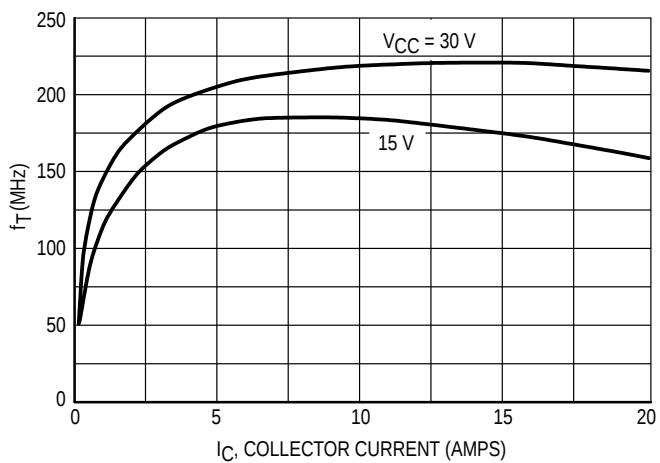


Figure 6.  $f_T$  versus Collector Current

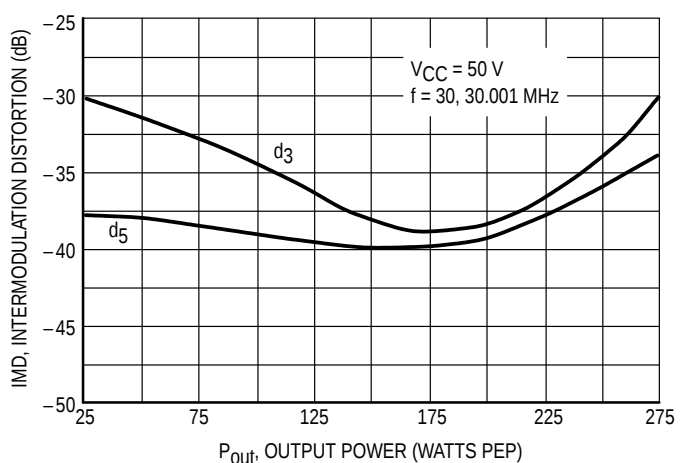
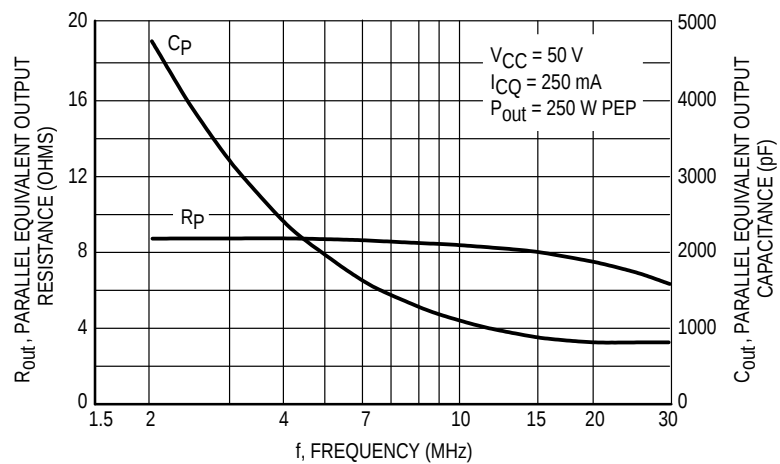
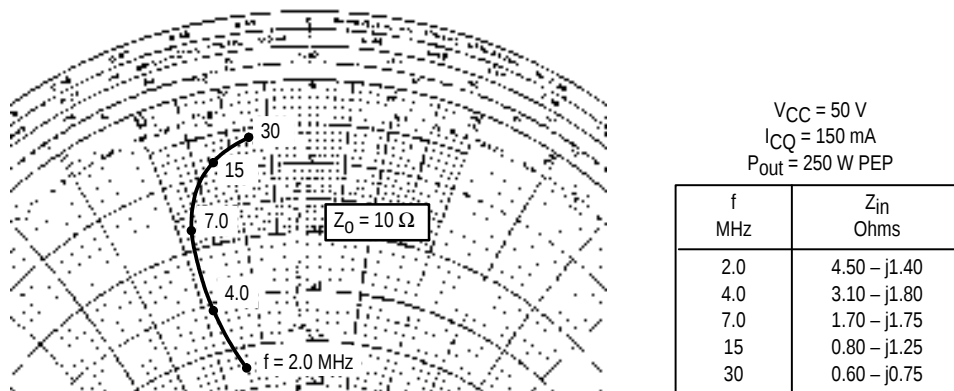


Figure 7. IMD versus Pout

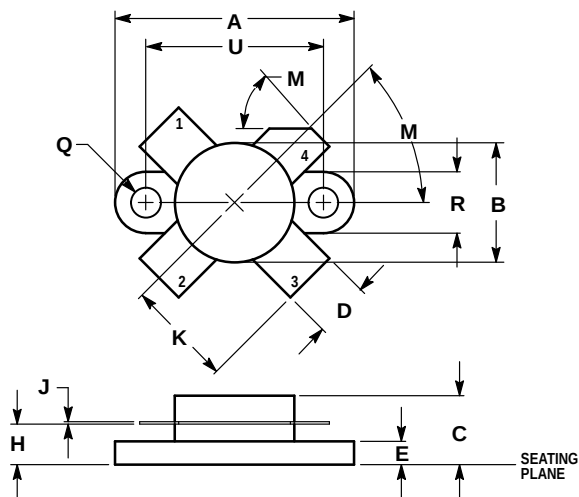


**Figure 8. Output Resistance and Capacitance versus Frequency**



**Figure 9. Series Equivalent 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   | 0.465  | 0.510 | 11.82       | 12.95 |
| C   | 0.229  | 0.275 | 5.82        | 6.98  |
| D   | 0.216  | 0.235 | 5.49        | 5.96  |
| E   | 0.084  | 0.110 | 2.14        | 2.79  |
| H   | 0.144  | 0.178 | 3.66        | 4.52  |
| J   | 0.003  | 0.007 | 0.08        | 0.17  |
| K   | 0.435  | —     | 11.05       | —     |
| M   | 45°NOM |       | 45°NOM      |       |
| Q   | 0.115  | 0.130 | 2.93        | 3.30  |
| R   | 0.246  | 0.255 | 6.25        | 6.47  |
| U   | 0.720  | 0.730 | 18.29       | 18.54 |

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

CASE 211-11  
ISSUE N

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