# MRF477

## The RF Line

40 W (PEP) — 30 MHz

RF POWER TRANSISTOR

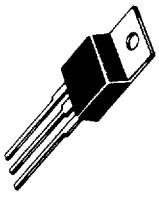
NPN SILICON

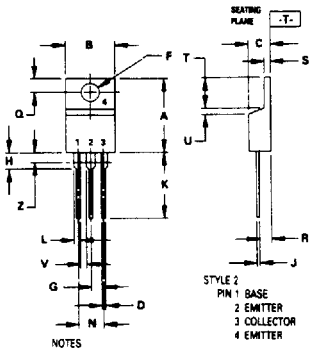
### NPN SILICON RF POWER TRANSISTOR

. . . designed primarily for application as a high-power linear amplifier from 1.5 to 30 MHz, in single sideband mobile, marine and base station equipment.

- Low-Cost, Common-Emitter TO-220AB Package
- Specified 12.5 Volt, 30 MHz Performance —
  Output Power = 40 W CW or PEP
  Power Gain = 15 dB Min
  Efficiency = 40% Min (PEP)
- Intermodulation Distortion @ 40 W (PEP) —
  IMD = −30 dB (Max)
- 30:1 VSWR Load Mismatch Capability at Rated Output Power and Supply Voltage








STYLE 2
PIN 1 BASE
2 EMITTER
3 COLLECTOR
4 EMITTER

NOTES
1 DIMENSIONING AND TOLERANCING PER ANSI Y14.5M 1982
2 CONTROLLING DIMENSION INCH
3 DIM Z DEFINES A ZONE WHERE ALL BODY AND LEAD IRREGULARITIES ARE ALLOWED

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 14.48 | 15.75 | 0.570 | 0.620 |
| B | 9.66 | 10.28 | 0.380 | 0.405 |
| C | 4.07 | 4.82 | 0.160 | 0.190 |
| D | 0.64 | 0.88 | 0.025 | 0.035 |
| F | 3.61 | 3.73 | 0.142 | 0.147 |
| G | 2.42 | 2.66 | 0.095 | 0.105 |
| H | 2.80 | 3.93 | 0.110 | 0.155 |
| J | 0.36 | 0.55 | 0.014 | 0.022 |
| K | 12.70 | 14.27 | 0.500 | 0.562 |
| L | 1.15 | 1.39 | 0.045 | 0.055 |
| N | 4.83 | 5.33 | 0.190 | 0.210 |
| Q | 2.54 | 3.04 | 0.100 | 0.120 |
| R | 2.04 | 2.79 | 0.080 | 0.110 |
| S | 1.15 | 1.39 | 0.045 | 0.055 |
| T | 5.97 | 6.47 | 0.235 | 0.255 |
| U | 0.00 | 1.27 | 0.000 | 0.050 |
| V | 1.15 | — | 0.045 | — |
| Z | — | 2.04 | — | 0.080 |

**CASE 221A-04**
TO-220AB

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector-Emitter Voltage | $V_{CEO}$ | 18 | Vdc |
| Collector Base Voltage | $V_{CBO}$ | 36 | Vdc |
| Emitter-Base Voltage | $V_{EBO}$ | 4.0 | Vdc |
| Collector Current — Continuous | $I_C$ | 5.0 | Adc |
| Withstand Current (t = 5.0 s) | — | 8.0 | Adc |
| Total Device Dissipat on @ $T_C$ = 25°C (1) Derate above 25°C | $P_D$ | 87.5 0.5 | Watts W/°C |
| Storage Temperature Range | $T_{stg}$ | −65 to +150 | °C |

### THERMAL CHARACTERISTICS

| Characteristics | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 2.0 | °C/W |

(1) This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.

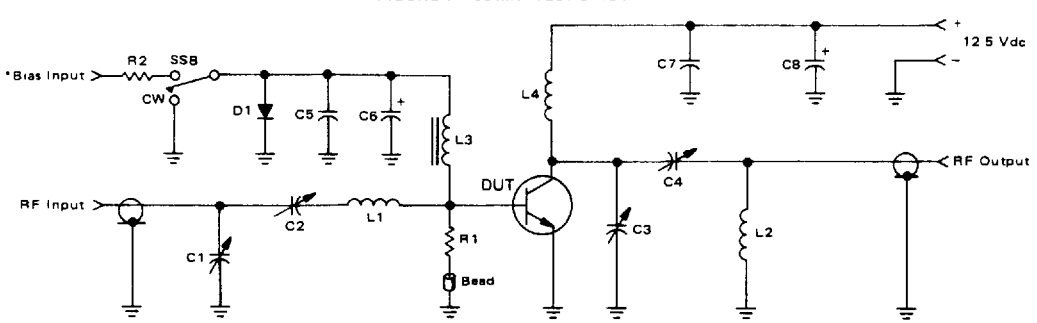
## ELECTRICAL CHARACTERISTICS ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector-Emitter Breakdown Voltage ($I_C$ = 100 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 18 | – | – | Vdc |
| Collector Base Breakdown Voltage ($I_C$ = 100 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 36 | – | – | Vdc |
| Emitter-Base Breakdown Voltage ($I_E$ = 5.0 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 4.0 | – | – | Vdc |
| Collector Cutoff Current ($V_{CE}$ = 12.5 Vdc, $V_{BE}$ = 0, $T_C$ = 25°C) | $I_{CES}$ | – | – | 10 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 2.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 20 | 70 | – | – |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 12.5 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{ob}$ | – | 175 | 250 | pF |
| **FUNCTIONAL TESTS** | | | | | |
| Common-Emitter Amplifier Power Gain ($V_{CC}$ = 12.5 Vdc, $P_{out}$ = 40 W (PEP), f1 = 30 MHz, f2 = 30.001 MHz, $I_{CQ}$ = 40 mAdc) | $G_{PE}$ | 15 | 17 | – | dB |
| Collector Efficiency ($V_{CC}$ = 12.5 Vdc, $P_{out}$ = 40 W (PEP), f1 = 30 MHz, f2 = 30.001 MHz, $I_{CQ}$ = 40 mAdc) | $\eta$ | 40 | 45 | – | % |
| Intermodulation Distortion (1) ($V_{CC}$ = 12.5 Vdc, $P_{out}$ = 40 W (PEP), f1 = 30 MHz, f2 = 30.001 MHz, $I_{CQ}$ = 40 mAdc) | IMD ($d_3$) | – | -35 | -30 | dB |

(1) To Proposed EIA Method of Measurement Reference Peak Envelope Power



FIGURE 1 – 30 MHz TEST CIRCUIT




C1, C2, C4 – Arco 469, 190-780 pF
C3 – Arco 429, 90-400 pF
C5, C7 – 0.001 μF Disk Ceramics
C6 – 500 μF 3.0 Vdc Electrolytic
C8 – 100 μF 16 Vdc Electrolytic

R1 – 10 Ω 1.0 Watt Resistor
R2 – 5 Ω 5.0 Watt Resistor

L1 – 4 Turns #16 AWG 1/3" ID, 1/3" Long
L2 – 3 Turns #16 AWG 1/3" ID, 1/2" Long
L3 – 10 μH Molded Choke
L4 – 12 Turns #18 AWG 1/4" ID

Bead – Ferroxcube #56 590-65/38

D1 – 1N4719

*Adjust Bias (Base) Voltage for $I_{CQ}$ = 40 mA with no RF applied.

FIGURE 2 – OUTPUT POWER versus INPUT POWER

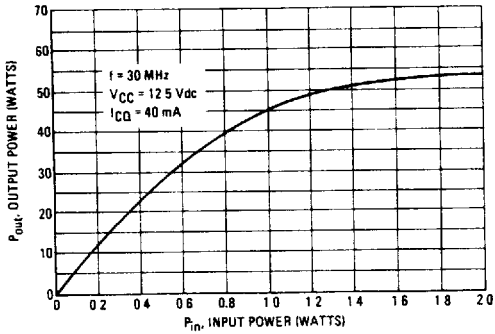



FIGURE 3 – OUTPUT POWER versus SUPPLY VOLTAGE

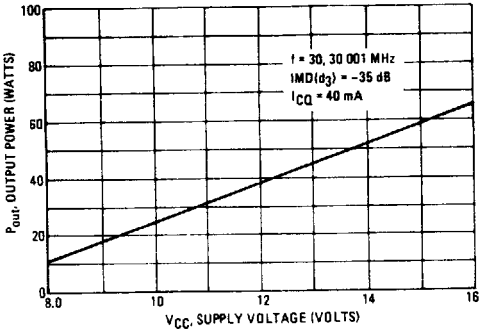



FIGURE 4 – POWER GAIN versus FREQUENCY

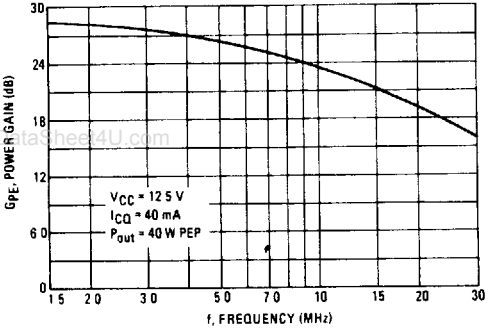



FIGURE 5 – INTERMODULATION DISTORTION versus OUTPUT POWER

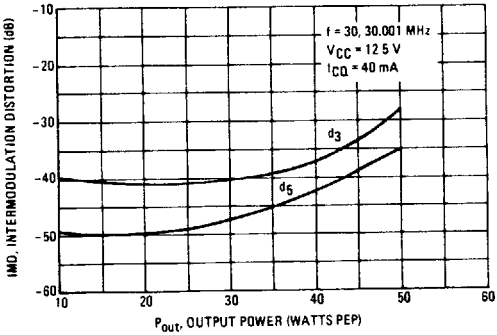



FIGURE 6 – SAFE OPERATING AREA

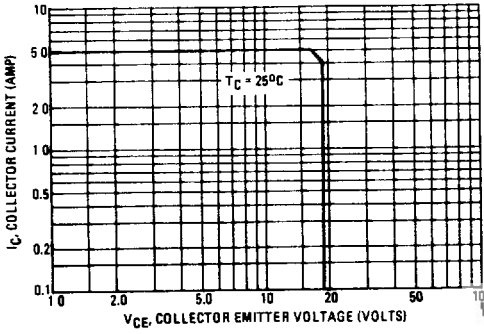


FIGURE 7 – SERIES EQUIVALENT INPUT IMPEDANCE

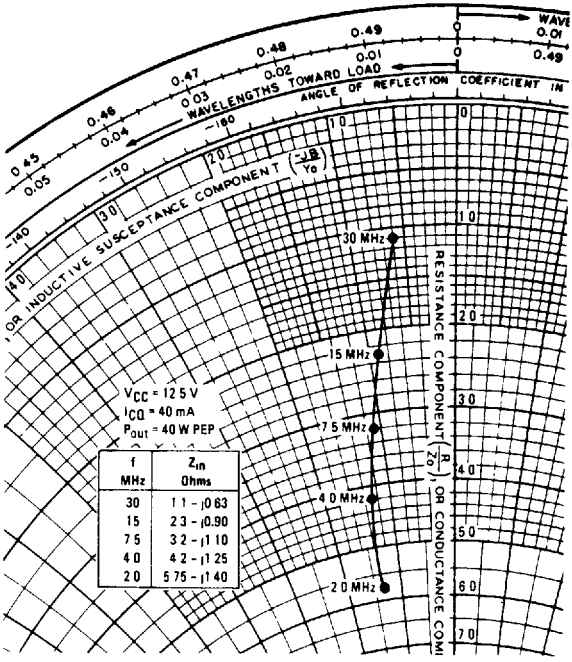





FIGURE 8 – OUTPUT CAPACITANCE versus FREQUENCY

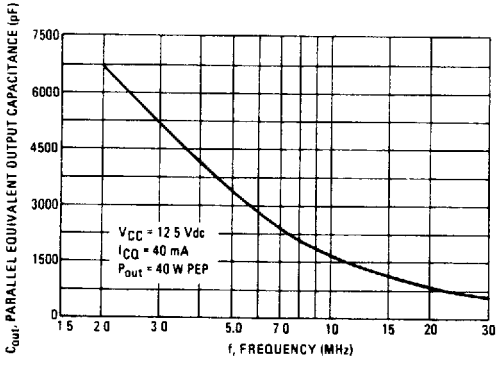



FIGURE 9 – OUTPUT RESISTANCE versus FREQUENCY