## The RF Line

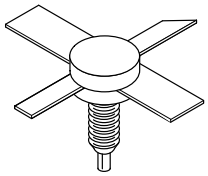
# Microwave Pulse Power Transistors

# MRF1090MA
# MRF1090MB

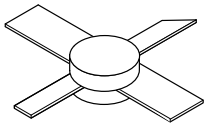
**90 W PEAK, 960 – 1215 MHz**
**MICROWAVE POWER**
**TRANSISTORS**
**NPN SILICON**

Designed for Class B and C common base amplifier applications in short pulse TACAN, IFF, and DME transmitters.

- Guaranteed Performance @ 1090 MHz, 50 Vdc
  Output Power = 90 Watts Peak
  Minimum Gain = 8.4 dB
- 100% Tested for Load Mismatch at All Phase Angles with 10:1 VSWR
- Industry Standard Package
- Nitride Passivated
- Gold Metallized for Long Life and Resistance to Metal Migration
- Internal Input Matching for Broadband Operation
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.



**CASE 332–04, STYLE 1**
**(MRF1090MA)**



**CASE 332A–03, STYLE 1**
**(MRF1090MB)**

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector–Base Voltage | $V_{CBO}$ | 70 | Vdc |
| Emitter–Base Voltage | $V_{EBO}$ | 4.0 | Vdc |
| Collector–Current — Peak (1) | $I_C$ | 6.0 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C (1) (2)<br>Derate above 25°C | $P_D$ | 290<br>1.66 | Watts<br>W/°C |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case (3) | $R_{\theta JC}$ | 0.6 | °C/W |

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

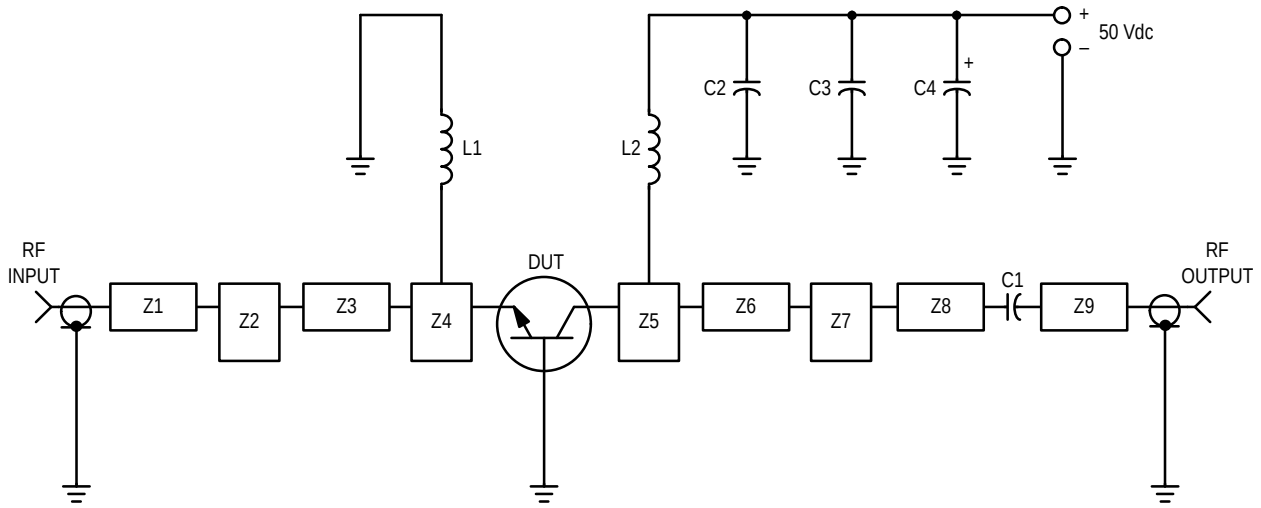
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C$ = 25 mAdc, $V_{BE}$ = 0) | $V_{(BR)CES}$ | 70 | — | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C$ = 25 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 70 | — | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E$ = 5.0 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 4.0 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 50 Vdc, $I_E$ = 0) | $I_{CBO}$ | — | — | 5.0 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain (4) ($I_C$ = 2.5 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 10 | 30 | — | — |

NOTES: (continued)

1. Pulse Width = 10 μs, Duty Cycle = 1%.
2. These devices are designed for RF operation. The total device dissipation rating applies only when the device is operated as RF amplifiers.
3. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.
4. 80 μs Pulse on Tektronix 576 or equivalent.

**ELECTRICAL CHARACTERISTICS — continued** ($T_C$ = 25°C unless otherwise noted)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 50 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{ob}$ | — | 12 | 16 | pF |
| **FUNCTIONAL TESTS** (Pulse Width = 10 μs, Duty Cycle = 1.0%) | | | | | |
| Common–Base Amplifier Power Gain ($V_{CC}$ = 50 Vdc, $P_{out}$ = 90 W pk, f = 1090 MHz) | $G_{PB}$ | 8.4 | 10.8 | — | dB |
| Collector Efficiency ($V_{CC}$ = 50 Vdc, $P_{out}$ = 90 W pk, f = 1090 MHz) | η | 35 | 40 | — | % |
| Load Mismatch ($V_{CC}$ = 50 Vdc, $P_{out}$ = 90 W pk, f = 1090 MHz, VSWR = 10:1 All Phase Angles) | ψ | No Degradation in Power Output | | | |




C1, C2 — 220 pF Chip Capacitor, 100–mil ATC
C3 — 0.1 μF
C4 — 47 μF/75 V
L1, L2 — 3 Turns #18 AWG, 1/8″ ID
Z1–Z9 — Distributed Microstrip Elements, See Photomaster
Board Material — 0.031″ Thick Glass Teflon, $\varepsilon_r$ = 2.5

**Figure 1. 1090 MHz Test Circuit**

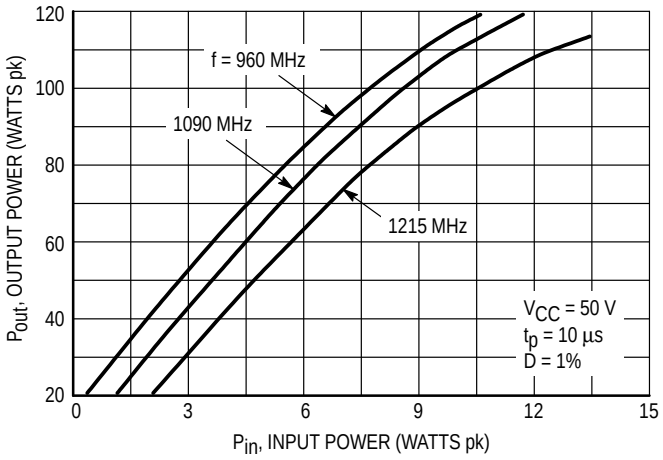



**Figure 2. Output Power versus Input Power**

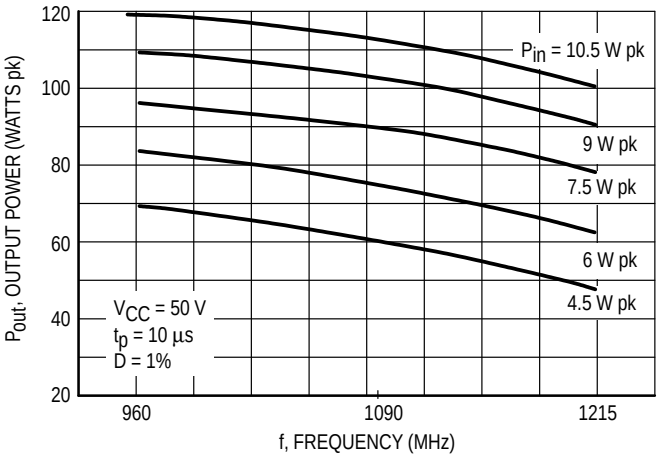



**Figure 3. Output Power versus Frequency**

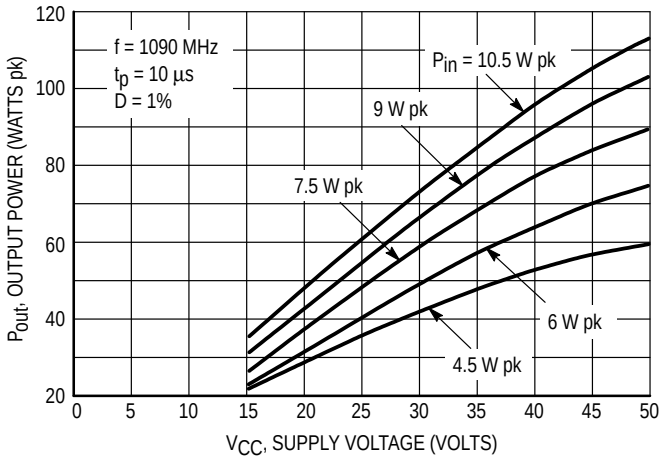



**Figure 4. Output Power versus Supply Voltage**

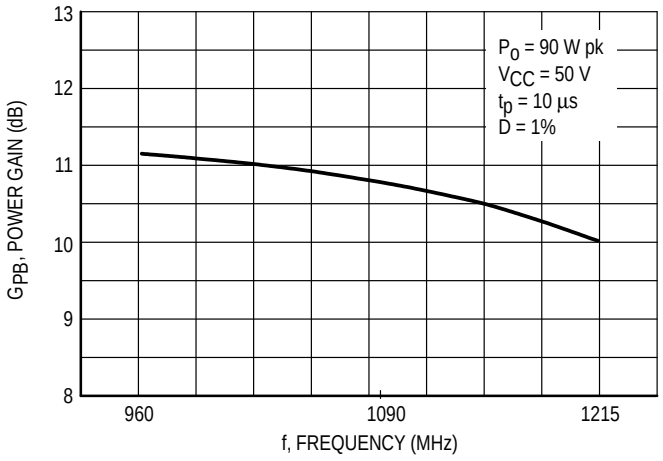
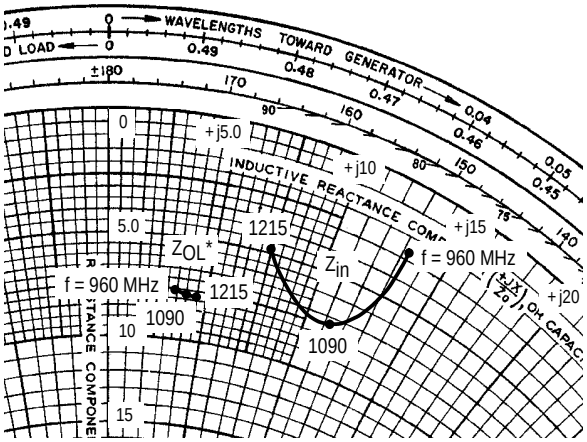



**Figure 5. Power Gain versus Frequency**




Coordinates in Ohms

$P_{out}$ = 90 W pk $V_{CC}$ = 50 V
$t_p$ = 10 µs D = 1%

| f MHz | $Z_{in}$ Ohms | $Z_{OL}$* Ohms |
|---|---|---|
| 960 | 2.8 + j13.2 | 7.6 + j3.5 |
| 1090 | 7.4 + j11.4 | 7.6 + j4.0 |
| 1215 | 4.7 + j7.5 | 7.7 + j4.5 |

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

**Figure 6. Series Equivalent Input/Output Impedance**

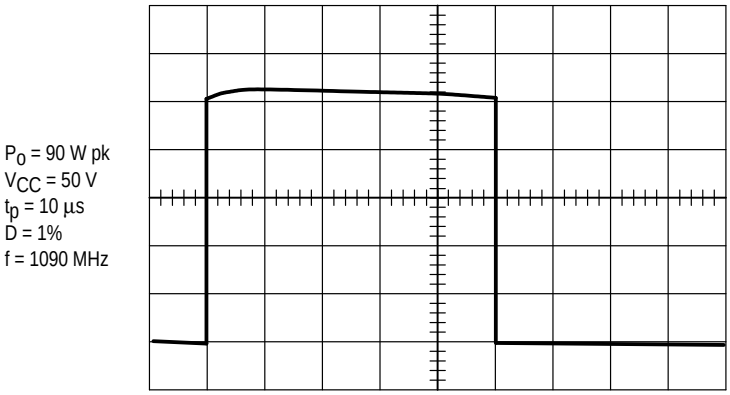
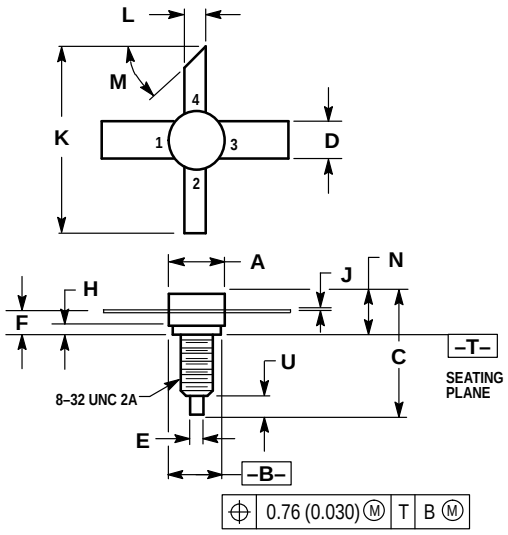



**Figure 7. Typical Pulse Performance**

## PACKAGE DIMENSIONS

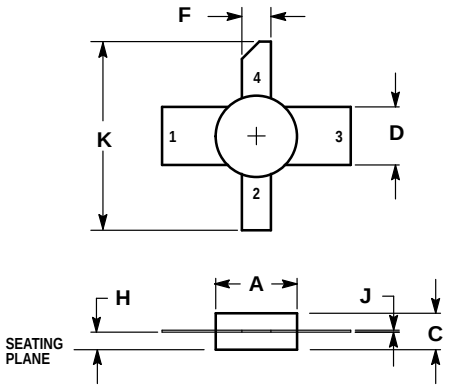



NOTES:
1. DIMENSION K APPLIES TWO PLACES.
2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1973.

| | MILLIMETERS | | INCHES | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 6.86 | 7.62 | 0.270 | 0.300 |
| B | 6.10 | 6.60 | 0.240 | 0.260 |
| C | 16.26 | 16.76 | 0.640 | 0.660 |
| D | 4.95 | 5.21 | 0.195 | 0.205 |
| E | 1.40 | 1.65 | 0.055 | 0.065 |
| F | 2.67 | 4.32 | 0.105 | 0.170 |
| H | 1.40 | 1.65 | 0.055 | 0.065 |
| J | 0.08 | 0.18 | 0.003 | 0.007 |
| K | 15.24 | — | 0.600 | — |
| L | 2.41 | 2.67 | 0.095 | 0.105 |
| M | 45 °NOM | | 45 °NOM | |
| N | 4.97 | 6.22 | 0.180 | 0.245 |
| U | 2.92 | 3.68 | 0.115 | 0.145 |

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

**CASE 332–04**
**ISSUE D**
**(MRF1090MA)**




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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.270 | 0.290 | 6.86 | 7.36 |
| C | 0.115 | 0.135 | 2.93 | 3.42 |
| D | 0.195 | 0.205 | 4.96 | 5.20 |
| F | 0.095 | 0.105 | 2.42 | 2.66 |
| H | 0.050 | 0.070 | 1.27 | 1.77 |
| J | 0.003 | 0.007 | 0.08 | 0.17 |
| K | 0.600 | — | 15.24 | — |

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

**CASE 332A–03**
**ISSUE D**
**(MRF1090MB)**

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