

The RF Line Microwave Pulse Power Transistors

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

- Guaranteed Performance @ 1090 MHz, 35 Vdc
Output Power = 4.0 Watts Peak
Minimum Gain = 10 dB
- 100% Tested for Load Mismatch at All Phase Angles with 10:1 VSWR
- Industry Standard Package
- Nitride Passivated
- Gold Metallized, Emitter Ballasted 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.

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|--|-----------|-------------|-------------------------------|
| Collector-Emitter Voltage | V_{CEO} | 20 | Vdc |
| Collector-Base Voltage | V_{CBO} | 50 | Vdc |
| Emitter-Base Voltage | V_{EBO} | 3.5 | Vdc |
| Collector Current — Continuous | I_C | 250 | mAdc |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1) Derate above 25°C | P_D | 7.0 40 | Watts mW/ $^\circ\text{C}$ |
| Storage Temperature Range | T_{stg} | -65 to +150 | $^\circ\text{C}$ |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case (2) | $R_{\theta JC}$ | 25 | $^\circ\text{C/W}$ |

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

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

OFF CHARACTERISTICS

| | | | | | |
|---|---------------|-----|---|-----|------|
| Collector-Emitter Breakdown Voltage ($I_C = 5.0$ mAdc, $I_B = 0$) | $V_{(BR)CEO}$ | 20 | — | — | Vdc |
| Collector-Emitter Breakdown Voltage ($I_C = 5.0$ mAdc, $V_{BE} = 0$) | $V_{(BR)CES}$ | 50 | — | — | Vdc |
| Collector-Base Breakdown Voltage ($I_C = 5.0$ mAdc, $I_E = 0$) | $V_{(BR)CBO}$ | 50 | — | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E = 1.0$ mAdc, $I_C = 0$) | $V_{(BR)EBO}$ | 3.5 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB} = 35$ Vdc, $I_E = 0$) | I_{CBO} | — | — | 0.5 | mAdc |

ON CHARACTERISTICS

| | | | | | |
|---|----------|----|---|-----|---|
| DC Current Gain ($I_C = 75$ mAdc, $V_{CE} = 5.0$ Vdc) | h_{FE} | 10 | — | 100 | — |
|---|----------|----|---|-----|---|

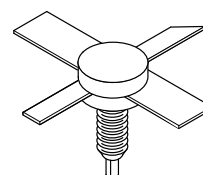
NOTES:

(continued)

1. These devices are designed for RF operation. The total device dissipation rating applies only when the device is operated as RF amplifiers.
2. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

MRF1004MA

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



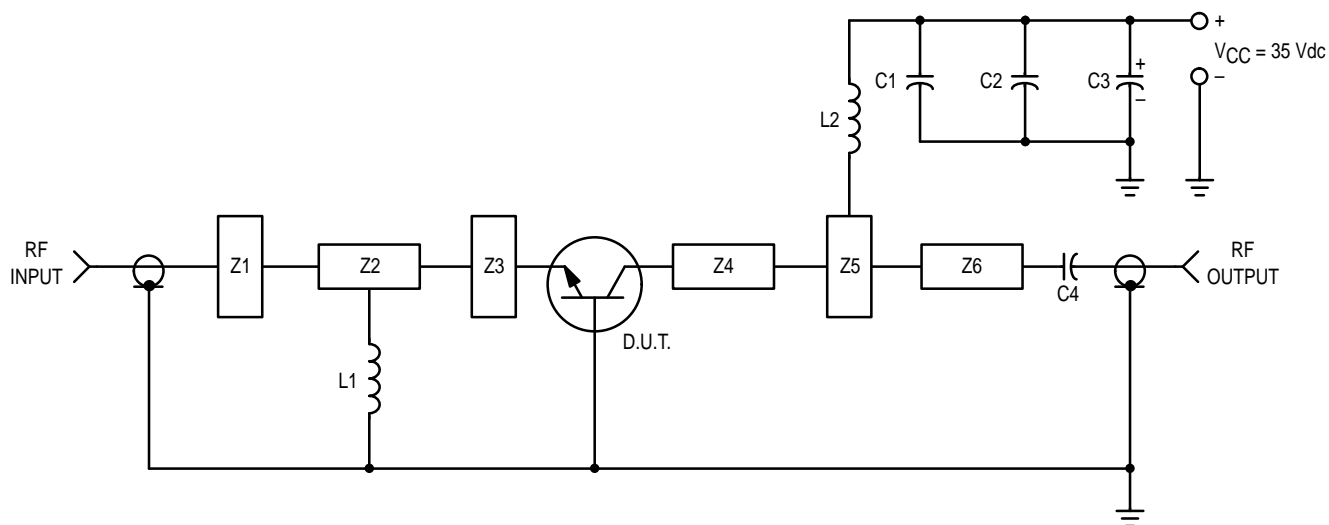
CASE 332-04, STYLE 1

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|----------|-----|-----|-----|------|
| DYNAMIC CHARACTERISTICS | | | | | |
| Output Capacitance ($V_{CB} = 35\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$) | C_{ob} | — | 3.3 | 5.0 | pF |

FUNCTIONAL TESTS (Pulse Width = $10\text{ }\mu\text{s}$, Duty Cycle = 1.0%)

| | | | | | |
|--|----------|--------------------------------|----|---|----|
| Common–Base Amplifier Power Gain ($V_{CC} = 35\text{ Vdc}$, $P_{out} = 4.0\text{ W pk}$, $f = 1090\text{ MHz}$) | G_{PB} | 10 | 11 | — | dB |
| Collector Efficiency ($V_{CC} = 35\text{ Vdc}$, $P_{out} = 4.0\text{ W pk}$, $f = 1090\text{ MHz}$) | η | 40 | 45 | — | dB |
| Load Mismatch ($V_{CC} = 35\text{ Vdc}$, $P_{out} = 4.0\text{ W pk}$, $f = 1090\text{ MHz}$, $VSWR = 10:1$ All Phase Angles) | ψ | No Degradation in Power Output | | | |



$C1$ — $0.1\text{ }\mu\text{F}$
 $C2, C4$ — 220 pF Chip Capacitor
 $C3$ — $20\text{ }\mu\text{F}$, 50 V Electrolytic
 $L1, L2$ — 3 Turns #18 AWG, $1/8''$ ID
 $Z1$ – $Z6$ Distributed Microstrip Elements, See Photomaster
 Board Material — $0.031''$ Thick Glass Teflon

Figure 1. 1090 MHz Test Circuit

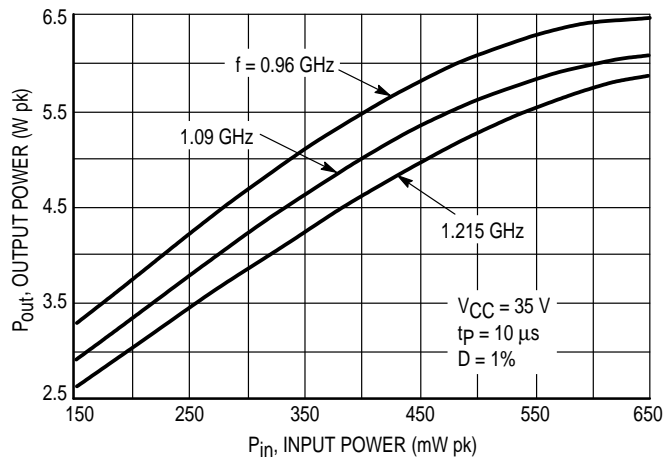


Figure 2. Output Power versus Input Power

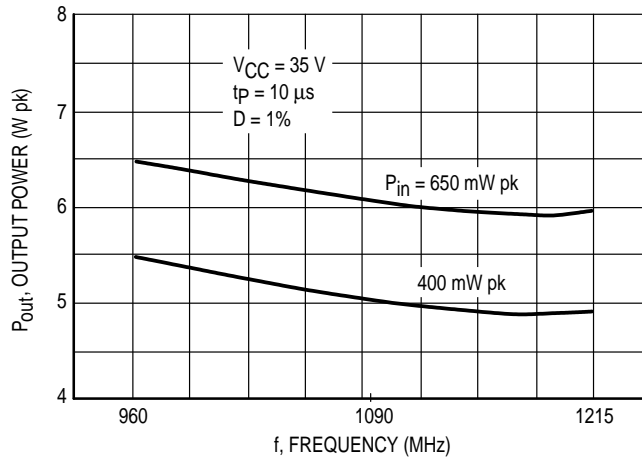


Figure 3. Output Power versus Frequency

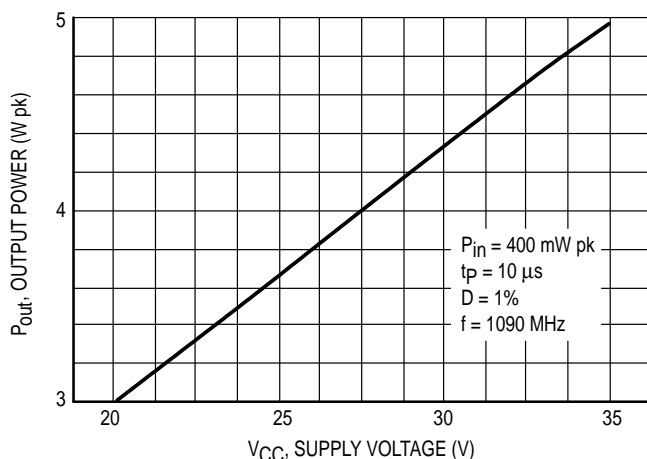


Figure 4. Output Power versus Supply Voltage

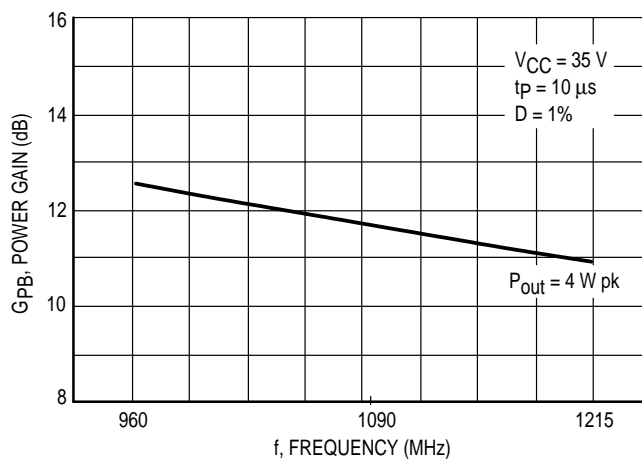
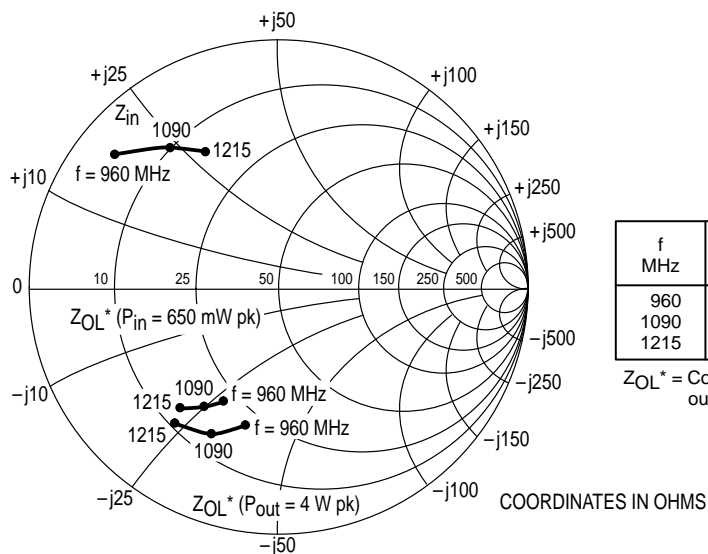


Figure 5. Power Gain versus Frequency



| f MHz | Z _{in} Ohms | Z _{OL} * (P _{in} = 400 mW pk) Ohms | Z _{OL} * (P _{out} = 4.0 W pk) Ohms |
|----------|-------------------------|---|---|
| 960 | 5.0 + j17.5 | 23.5 - j26 | 22.5 - j36 |
| 1090 | 10 + j23 | 18.5 - j25 | 15 - j32.5 |
| 1215 | 16 + j29.5 | 15.5 - j23.5 | 11 - j23 |

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

$P_{out} = 4 \text{ W pk}$
 $V_{CC} = 35 \text{ V}$
 $t_p = 1 \text{ ms}$
 $D = 10\%$
 $f = 1090 \text{ MHz}$

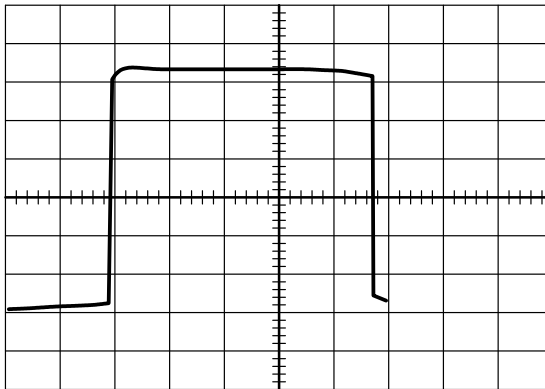
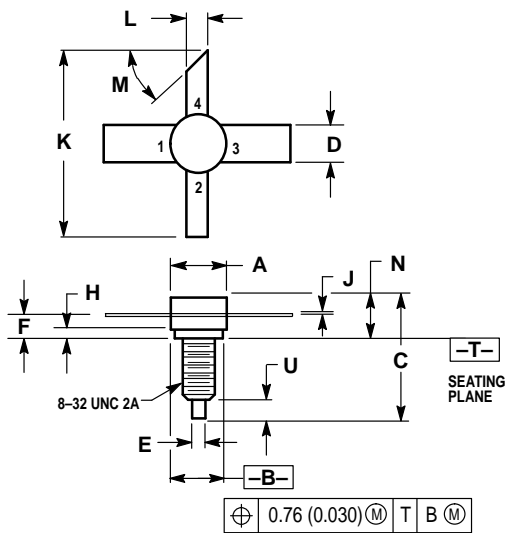


Figure 7. Typical Long Pulse Performance

PACKAGE DIMENSIONS




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

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-------|--------|-------|
| | 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
MRF1004MA

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