# MRF10502

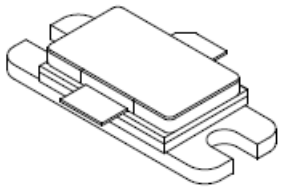
## Microwave Pulse Power Silicon NPN Transistor
## 500W (peak), 1025–1150MHz

Rev. V1

Designed for 1025–1150 MHz pulse common base amplifier applications such as TCAS, TACAN and Mode–S transmitters.

- Guaranteed performance @ 1090 MHz
  Output power = 500 W peak
  Gain = 8.5 dB min, 9.0 dB (typ.)
- 100% tested for load mismatch at all phase angles with 10:1 VSWR
- Hermetically sealed industry package
- Silicon nitride passivated
- Gold metalized, emitter ballasted for long life and resistance to metal migration
- Internal input and output matching
- Characterized with 10μs, 1% duty cycle pulses

**Product Image**



**CASE 355J–02, STYLE 1**

### MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|---|---|---|
| Collector–Emitter Voltage | $V_{CES}$ | 65 | Vdc |
| Collector–Base Voltage | $V_{CBO}$ | 65 | Vdc |
| Emitter–Base Voltage | $V_{EBO}$ | 3.5 | Vdc |
| Collector Current — Peak (1) | $I_C$ | 29 | Adc |
| Total Device Dissipation @ $T_C$ = 25°C (1), (2)<br>Derate above 25°C | $P_D$ | 1460<br>8.3 | Watts<br>W/°C |
| Storage Temperature Range | $T_{stg}$ | –65 to +200 | °C |
| Junction Temperature | $T_J$ | 200 | °C |

### THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case (3) | $R_{\theta JC}$ | 0.12 | °C/W |

NOTES:
1. Under pulse RF operating conditions.
2. These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as pulsed RF amplifiers.
3. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques. (Worst case $\theta_{JC}$ value measured @ 32 μs, 2%.)

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C$ = 60 mAdc, $V_{BE}$ = 0) | $V_{(BR)CES}$ | 65 | — | — | Vdc |
| Collector–Base Breakdown Voltage ($I_C$ = 60 mAdc, $I_E$ = 0) | $V_{(BR)CBO}$ | 65 | — | — | Vdc |
| Emitter–Base Breakdown Voltage ($I_E$ = 10 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 3.5 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 36 Vdc, $I_E$ = 0) | $I_{CBO}$ | — | — | 25 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 5.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 20 | — | — | — |
| **FUNCTIONAL TESTS** | | | | | |
| Common–Base Amplifier Power Gain ($V_{CC}$ = 50 Vdc, $P_{out}$ = 500 W Peak, f = 1090 MHz) | $G_{PB}$ | 8.5 | 9.0 | — | dB |
| Collector Efficiency ($V_{CC}$ = 50 Vdc, $P_{out}$ = 500 W Peak, f = 1090 MHz) | η | 40 | 45 | — | % |
| Load Mismatch ($V_{CC}$ = 50 Vdc, $P_{out}$ = 500 W Peak, f = 1090 MHz, VSWR = 10:1 All Phase Angles) | ψ | No Degradation in Output Power | | | |

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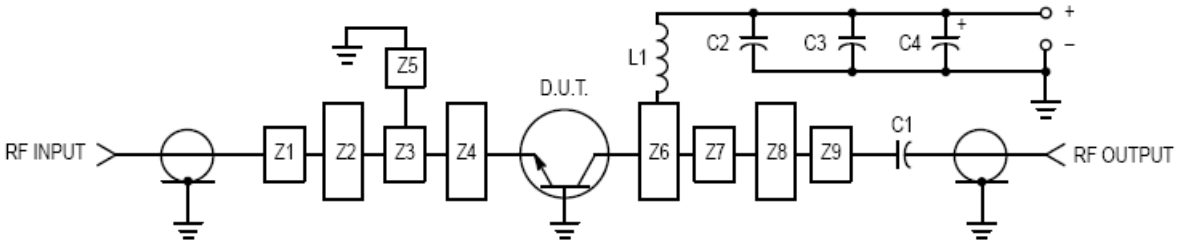


C1 — 82 pF 100 Mil Chip Capacitor
C2 — 39 pF 100 Mil Chip Capacitor
C3 — 0.1 µF
C4 — 100 µF, 100 Vdc, Electrolytic
L1 — 3 Turns #18 AWG, 1/8″ ID, 0.18 Long

Z1–Z9 — Microstrip, See Details
Board Material — Teflon, Glass Laminate
Dielectric Thickness = 0.030″
$\varepsilon_r$ = 2.55, 2 Oz. Copper

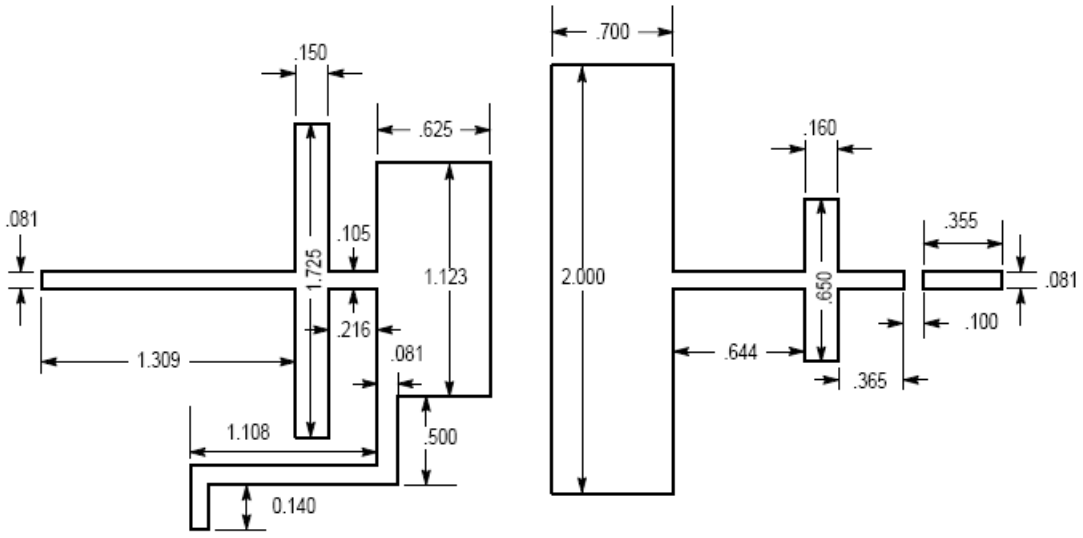


**Figure 1. Test Circuit**

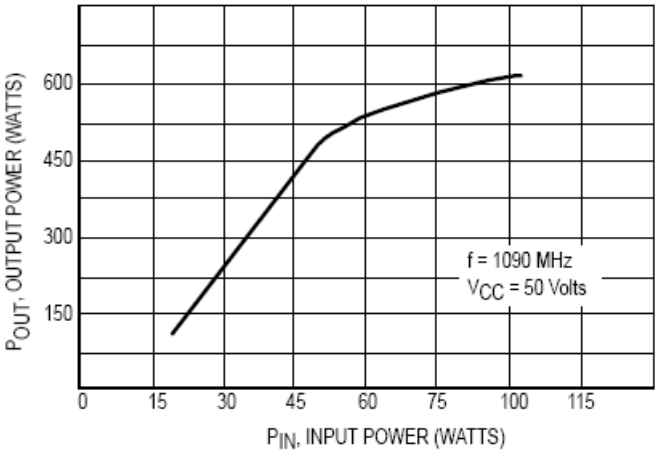


**Figure 2. Output Power versus Input Power**

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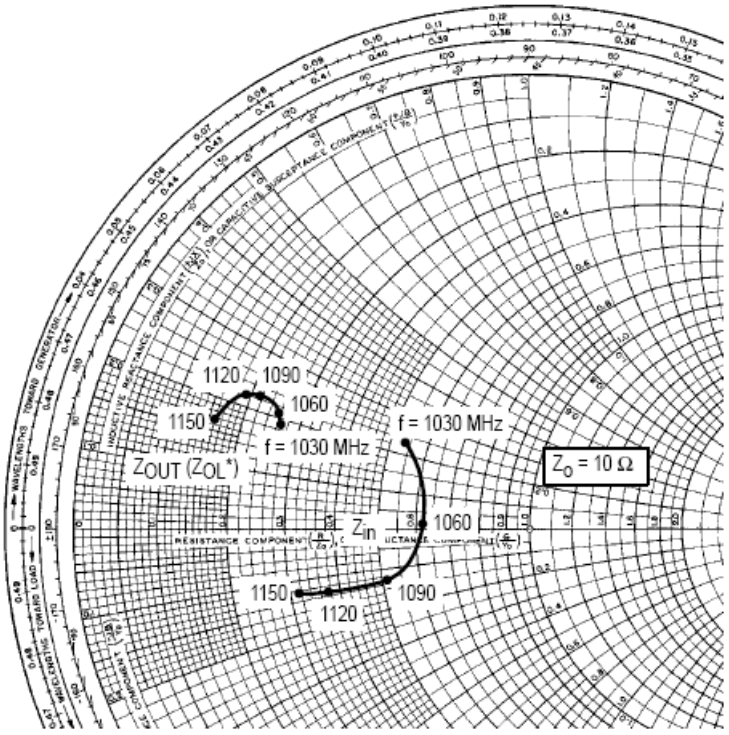


$P_{OUT}$ = 500 W Pk  $V_{CC}$ = 50 V

| f MHz | $Z_{in}$ OHMS | $Z_{OL}^*$ ($Z_{OUT}$) OHMS |
|---|---|---|
| 1030 | 5.3 + j2.25 | 2.6 + j1.89 |
| 1060 | 6.2 + j0.2 | 2.56 + j2.0 |
| 1090 | 5.2 – j1.4 | 2.12 + j2.2 |
| 1120 | 3.7 – j1.35 | 1.9 + j2.15 |
| 1150 | 3.15 – j1.3 | 1.6 + j1.62 |

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

**Figure 3. Series Equivalent Input/Output Impedances**

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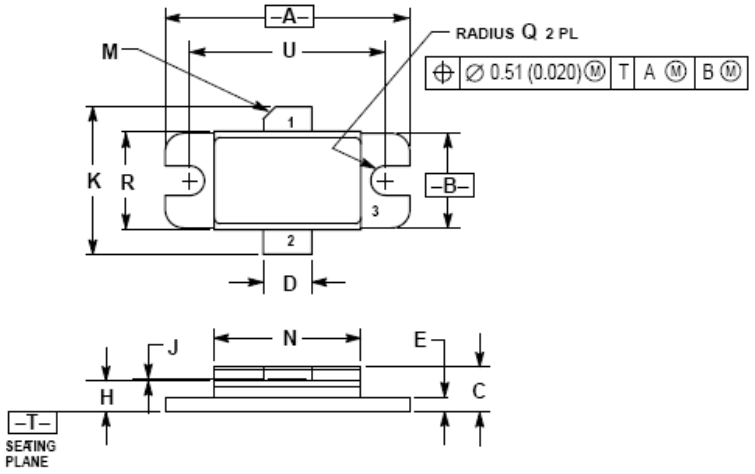
### PACKAGE DIMENSIONS




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

| | INCHES | | MILLIMETERS | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.990 | 1.010 | 25.15 | 25.65 |
| B | 0.375 | 0.395 | 9.53 | 10.03 |
| C | 0.145 | 0.175 | 3.68 | 4.45 |
| D | 0.195 | 0.205 | 4.95 | 5.21 |
| E | 0.055 | 0.065 | 1.40 | 1.65 |
| H | 0.117 | 0.133 | 2.97 | 3.38 |
| J | 0.003 | 0.006 | 0.08 | 0.15 |
| K | 0.580 | 0.620 | 14.73 | 15.75 |
| M | 45° REF | | 45° REF | |
| N | 0.590 | 0.610 | 14.99 | 15.49 |
| Q | 0.055 | 0.065 | 1.40 | 1.65 |
| R | 0.395 | 0.405 | 10.03 | 10.29 |
| U | 0.800 BSC | | 20.32 BSC | |

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

CASE 355J–02
ISSUE A