

The RF Line

NPN SILICON MICROWAVE POWER TRANSISTORS

... designed for Class B and C amplifier or oscillator applications in the 1.0 to 2.3 GHz frequency range.

- Guaranteed Performance @ 2 GHz, 28 Vdc
Output Power = 1.0 Watt
Minimum Gain = 9.0 dB
- 100% Tested for Load Mismatch at All Phase Angles With 10:1 VSWR
- Hermetically Sealed Industry Standard Package
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Compatible with Older 2001 Types
- Other Devices in the 2000 Series:
MRF2003 3 W
MRF2005 5 W
MRF2010 10 W

MAXIMUM RATINGS

| Rating | Symbol | Value | Unit |
|---|------------------|-------------|------------------|
| Collector-Emitter Voltage | V _{CEO} | 20 | Vdc |
| Collector-Base Voltage | V _{CBO} | 45 | Vdc |
| Emitter-Base Voltage | V _{EBO} | 4.0 | Vdc |
| Collector-Current — Continuous | I _C | 250 | mA _{dc} |
| Total Device Dissipation @ T _C = 25°C (1) Derate above 25°C | P _D | 7.0 40 | Watts mW/°C |
| Storage Temperature Range | T _{stg} | -65 to +200 | °C |

THERMAL CHARACTERISTICS

| Characteristic | Symbol | Max | Unit |
|--|------------------|-----|------|
| Thermal Resistance, Junction to Case (2) | R _{θJC} | 25 | °C/W |

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

MRF2001
MRF2001B

1.0 W 2 GHz

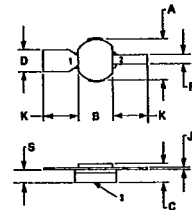
MICROWAVE POWER TRANSISTORS

NPN SILICON



MRF2001B

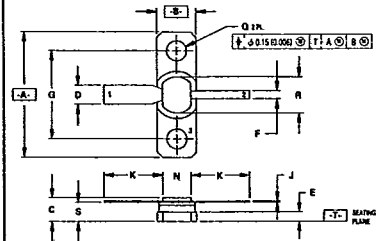
MRF2001



| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 5.72 | 5.97 | 0.225 | 0.236 |
| B | 4.44 | 4.70 | 0.175 | 0.186 |
| C | 2.29 | 2.74 | 0.090 | 0.108 |
| D | 2.92 | 3.18 | 0.115 | 0.125 |
| F | 1.14 | 1.40 | 0.045 | 0.055 |
| J | 0.08 | 0.15 | 0.003 | 0.006 |
| K | — | 0.52 | — | 0.375 |
| S | 1.52 | 1.78 | 0.060 | 0.070 |

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

CASE 328-02



- NOTES:
1. DIMENSIONS A-G AND TOLERANCES PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION—INCH.

| DIM | MILLIMETERS | | INCHES | |
|-----|-------------|-----------|--------|-------|
| | MIN | MAX | MIN | MAX |
| A | 20.20 | 20.57 | 0.795 | 0.810 |
| B | 6.32 | 6.47 | 0.245 | 0.256 |
| C | 3.69 | 4.31 | 0.145 | 0.170 |
| D | 2.93 | 3.17 | 0.115 | 0.125 |
| E | 1.40 | 1.77 | 0.055 | 0.070 |
| F | 1.15 | 1.29 | 0.045 | 0.055 |
| G | 14.22 BSC | 0.560 BSC | | |
| J | 0.08 | 0.15 | 0.003 | 0.006 |
| K | — | 0.52 | — | 0.375 |
| M | 4.45 | 4.69 | 0.175 | 0.186 |
| N | 3.95 | 4.42 | 0.150 | 0.175 |
| R | 5.72 | 5.97 | 0.225 | 0.236 |
| S | 2.93 | 3.50 | 0.115 | 0.140 |

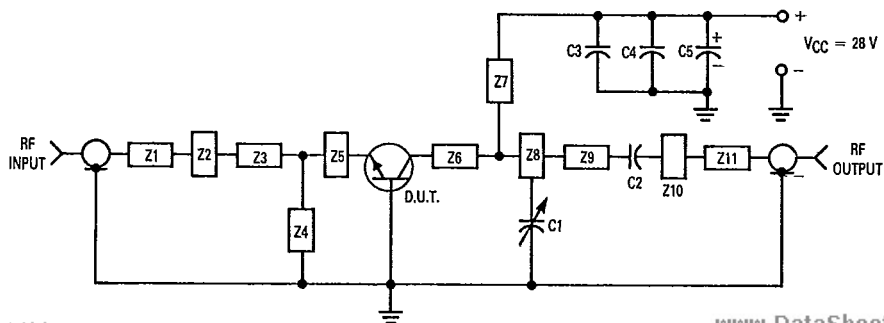
STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. BASE

CASE 328A-02

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

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---------------|--------------------------------|-----|-----|------|
| OFF CHARACTERISTICS | | | | | |
| Collector-Emitter Breakdown Voltage ($I_C = 5.0 \text{ mAdc}$, $I_E = 0$) | $V_{(BR)CEO}$ | 20 | — | — | Vdc |
| Collector-Emitter Breakdown Voltage ($I_C = 5.0 \text{ mAdc}$, $R_{BE} = 10 \Omega$) | $V_{(BR)CER}$ | 45 | — | — | Vdc |
| Collector-Base Breakdown Voltage ($I_C = 5.0 \text{ mAdc}$, $I_E = 0$) | $V_{(BR)CBO}$ | 45 | — | — | Vdc |
| Emitter-Base Breakdown Voltage ($I_E = 1.0 \text{ mAdc}$, $I_C = 0$) | $V_{(BR)EBO}$ | 4.0 | — | — | Vdc |
| Collector Cutoff Current ($V_{CB} = 28 \text{ Vdc}$, $I_E = 0$) | I_{CBO} | — | — | 0.5 | mAdc |
| ON CHARACTERISTICS | | | | | |
| DC Current Gain ($I_C = 100 \text{ mAdc}$, $V_{CE} = 5.0 \text{ Vdc}$) | h_{FE} | 10 | — | 100 | — |
| DYNAMIC CHARACTERISTICS | | | | | |
| Output Capacitance ($V_{CB} = 28 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$) | C_{ob} | — | 2.5 | 5.0 | pF |
| FUNCTIONAL TESTS | | | | | |
| Common-Base Amplifier Power Gain ($V_{CC} = 28 \text{ Vdc}$, $P_{out} = 1.0 \text{ W}$, $f = 2.0 \text{ GHz}$) | G_{PB} | 9.0 | 10 | — | dB |
| Collector Efficiency ($V_{CC} = 28 \text{ Vdc}$, $P_{out} = 1.0 \text{ W}$, $f = 2.0 \text{ GHz}$) | η | 30 | 35 | — | % |
| Load Mismatch ($V_{CC} = 28 \text{ Vdc}$, $P_{out} = 1.0 \text{ W}$, $f = 2.0 \text{ GHz}$, $VSWR = 10:1$ All Phase Angles) | ψ | No Degradation in Power Output | | | |

FIGURE 1. 2 GHz TEST CIRCUIT



Z1-Z11 — Microstrip
 C1 — 0.4-2.5 pF Johanson 7285
 C2, C3 — 56 pF Chip Capacitor
 C4 — 0.1 μF
 C5 — 10 μF 50 V Electrolytic
 Board Material — 0.062" Glass Teflon

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FIGURE 2 – OUTPUT POWER versus INPUT POWER
 (f = 1 GHz)

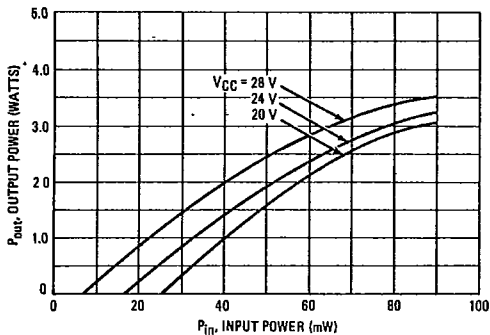


FIGURE 3 – OUTPUT POWER versus INPUT POWER
 (f = 2 GHz)

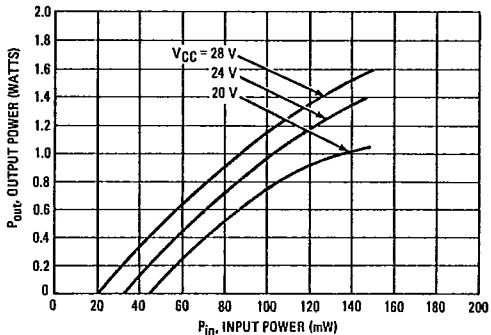


FIGURE 4 – OUTPUT POWER versus FREQUENCY

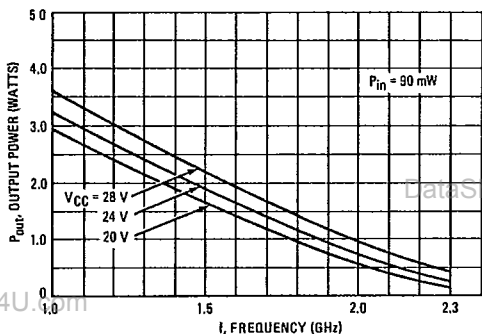


FIGURE 5 – POWER GAIN versus FREQUENCY

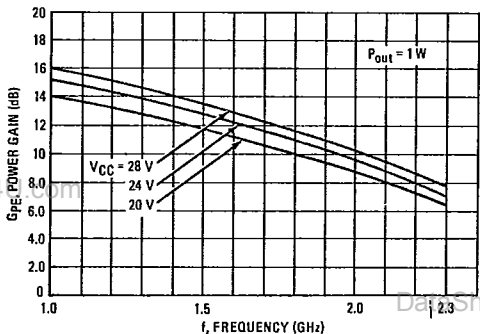
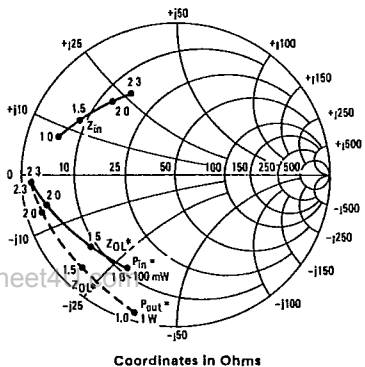


FIGURE 6 – SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE

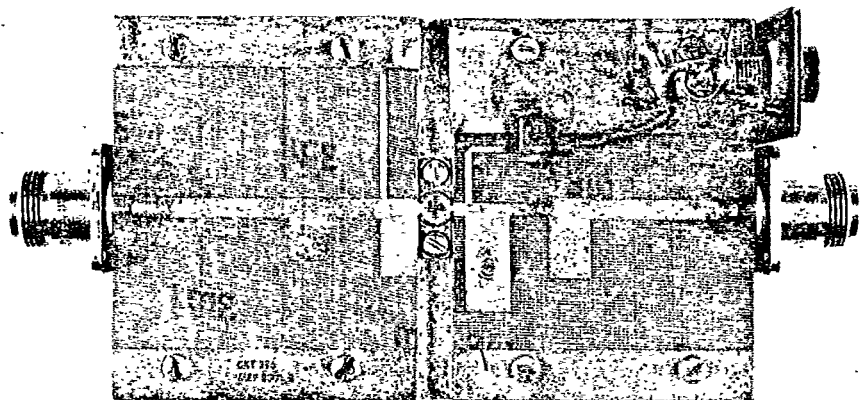


VCC = 28 V

| f GHz | Z _{in} Ohms | Z _{OL} * Ohms | P _{in} = 100 mW | Z _{OL} * Ohms | P _{out} = 1 W |
|----------|-------------------------|---------------------------|-----------------------------|---------------------------|---------------------------|
| 1.0 | 6.6 + j8.4 | 11 - j28.9 | | 4.9 - j37.4 | |
| 1.5 | 8.5 + j12.2 | 8.1 - j17.3 | | 4.6 - j20.0 | |
| 2.0 | 11.5 + j19.5 | 4.2 - j6.0 | | 3.5 - j7.0 | |
| 2.3 | 13.4 + j26.0 | 3.4 - j1.8 | | 3.4 - j1.8 | |

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

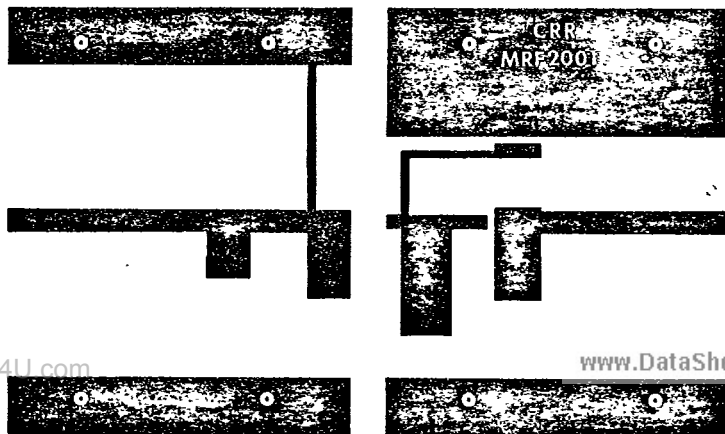
FIGURE 7 – 2 GHz TEST AMPLIFIER



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FIGURE 8 – PRINTED CIRCUIT BOARD LAYOUT – 2 GHz TEST CIRCUIT



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NOTE: The Printed Circuit Board shown is 75% of the original.