

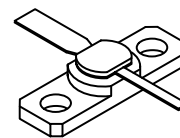
## The RF Line Microwave Power Transistors

... designed primarily for large-signal output and driver amplifier stages in the 1.5 to 3.0 GHz frequency range.

- Designed for Class B or C, Common Base Linear Power Amplifiers
- Specified 28 Volt, 3.0 GHz Characteristics:
  - Output Power — 1.0 to 5.0 Watts
  - Power Gain — 5.0 to 7.0 dB Min
  - Collector Efficiency — 30% Min
- Gold Metallization for Improved Reliability
- Diffused Ballast Resistors
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.

**MRW3001**  
**MRW3003**  
**MRW3005**

**5.0–7.0 dB**  
**1.5–3.0 GHz**  
**1.0–5.0 WATTS**  
**MICROWAVE**  
**POWER TRANSISTORS**



CASE 328A-03, STYLE 1  
(GP-13)  
MRW3001, 3003, 3005

### MAXIMUM RATINGS

| Rating                         | Symbol    | 3001        | 3003 | 3005 | Unit |
|--------------------------------|-----------|-------------|------|------|------|
| Collector–Base Voltage         | $V_{CBO}$ | 45          |      |      | Vdc  |
| Emitter–Base Voltage           | $V_{EBO}$ | 3.5         |      |      | Vdc  |
| Operating Junction Temperature | $T_J$     | 200         |      |      | °C   |
| Storage Temperature Range      | $T_{stg}$ | –65 to +200 |      |      | °C   |

### THERMAL CHARACTERISTICS

| Characteristic                           | Symbol          | Max |    |     | Unit |
|------------------------------------------|-----------------|-----|----|-----|------|
| Thermal Resistance, RF, Junction to Case | $R_{\theta JC}$ | 35  | 17 | 8.5 | °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<br>( $I_C = 10\text{ mA}$ , $V_{BE} = 0$ )<br>( $I_C = 30\text{ mA}$ , $V_{BE} = 0$ )<br>( $I_C = 50\text{ mA}$ , $V_{BE} = 0$ ) | MRW3001<br>MRW3003<br>MRW3005 | $V_{(BR)CES}$ | 50<br>50<br>50 | —<br>—<br>— | —<br>—<br>—         | Vdc  |
| Collector–Base Breakdown Voltage<br>( $I_C = 1.0\text{ mA}$ , $I_E = 0$ )<br>( $I_C = 3.0\text{ mA}$ , $I_E = 0$ )<br>( $I_C = 5.0\text{ mA}$ , $I_E = 0$ )          | MRW3001<br>MRW3003<br>MRW3005 | $V_{(BR)CBO}$ | 45<br>45<br>45 | —<br>—<br>— | —<br>—<br>—         | Vdc  |
| Emitter–Base Breakdown Voltage<br>( $I_E = 1.0\text{ mA}$ , $I_C = 0$ )                                                                                              |                               | $V_{(BR)EBO}$ | 3.5            | —           | —                   | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 28\text{ V}$ , $I_E = 0$ )                                                                                                   | MRW3001<br>MRW3003<br>MRW3005 | $I_{CBO}$     | —<br>—<br>—    | —<br>—<br>— | 0.5<br>0.75<br>1.25 | mAdc |

### ON CHARACTERISTICS

|                                                                                                                                                                                      |                               |          |                |             |                   |   |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|----------------|-------------|-------------------|---|
| DC Current Gain<br>( $I_C = 100\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )<br>( $I_C = 300\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ )<br>( $I_C = 500\text{ mA}$ , $V_{CE} = 5.0\text{ V}$ ) | MRW3001<br>MRW3003<br>MRW3005 | $h_{FE}$ | 10<br>10<br>10 | —<br>—<br>— | 120<br>120<br>120 | — |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|----------------|-------------|-------------------|---|

(continued)

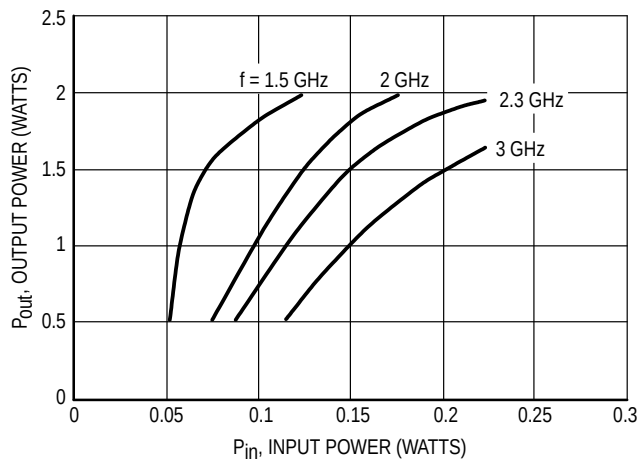
# **ELECTRICAL CHARACTERISTICS — continued** ( $T_C = 25^\circ\text{C}$ unless otherwise noted.)

| Characteristic                                                                      |                               | Symbol   | Min | Typ               | Max              | Unit |
|-------------------------------------------------------------------------------------|-------------------------------|----------|-----|-------------------|------------------|------|
| <b>DYNAMIC CHARACTERISTICS</b>                                                      |                               |          |     |                   |                  |      |
| Output Capacitance<br>( $V_{CB} = 28\text{ V}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ ) | MRW3001<br>MRW3003<br>MRW3005 | $C_{ob}$ | —   | 3.5<br>5.7<br>8.4 | 4.0<br>7.0<br>10 | pF   |

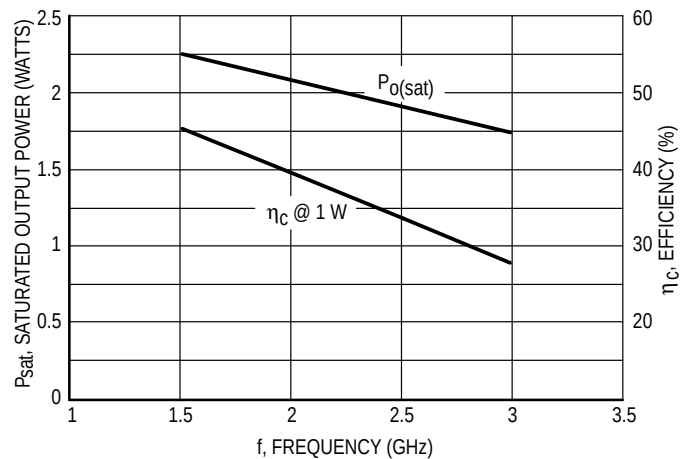
## **FUNCTIONAL TESTS**

|                                                                                                                                                                                                                                                                                  |                               |          |                                |             |             |    |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------|----------|--------------------------------|-------------|-------------|----|
| Common-Base Amplifier Power Gain<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 1.0\text{ W}$ , $f = 3.0\text{ GHz}$ )<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 3.0\text{ W}$ , $f = 3.0\text{ GHz}$ )<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 5.0\text{ W}$ , $f = 3.0\text{ GHz}$ ) | MRW3001<br>MRW3003<br>MRW3005 | $G_{PB}$ | 7.0<br>6.0<br>5.0              | —<br>—<br>— | —<br>—<br>— | dB |
| Collector Efficiency<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 1.0\text{ W}$ , $f = 3.0\text{ GHz}$ )<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 3.0\text{ W}$ , $f = 3.0\text{ GHz}$ )<br>( $V_{CE} = 28\text{ V}$ , $P_{out} = 5.0\text{ W}$ , $f = 3.0\text{ GHz}$ )             | MRW3001<br>MRW3003<br>MRW3005 | $\eta_c$ | 30<br>30<br>30                 | —<br>—<br>— | —<br>—<br>— | %  |
| Load Mismatch<br>( $V_{CE} = 28\text{ V}$ , $f = 3.0\text{ GHz}$ , Load VSWR = $\infty:1$ , All Phase Angles)<br>$P_{out} = 1.0\text{ W}$<br>$P_{out} = 3.0\text{ W}$<br>$P_{out} = 5.0\text{ W}$                                                                                | MRW3001<br>MRW3003<br>MRW3005 | $\psi$   | No Degradation in Output Power |             |             |    |

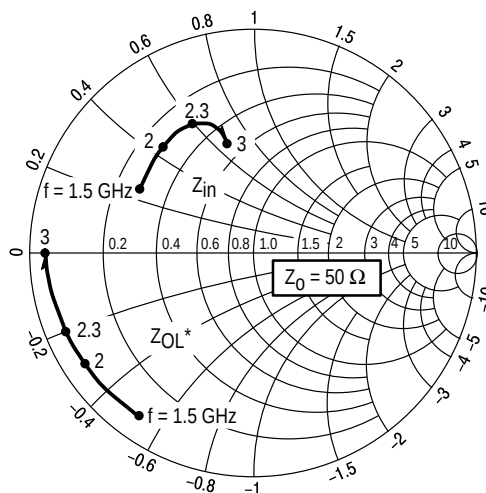
## **MRW3001** **TYPICAL CHARACTERISTICS**



**Figure 1. Output Power versus Input Power**



**Figure 2.  $P_{sat}$  and  $\eta$  versus Frequency**



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

# MRW3003 TYPICAL CHARACTERISTICS

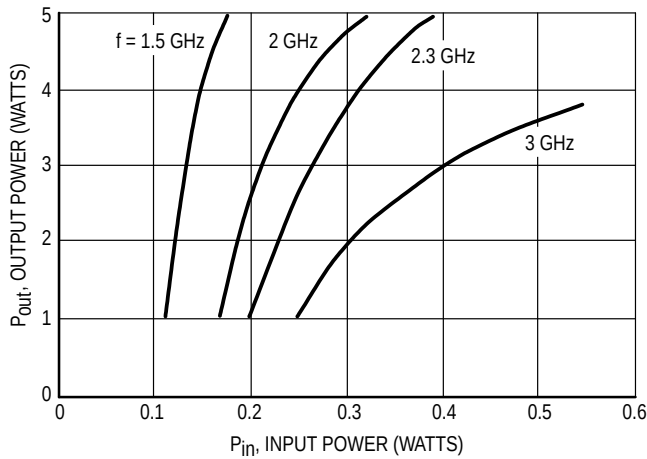


Figure 4. Output Power versus Input Power

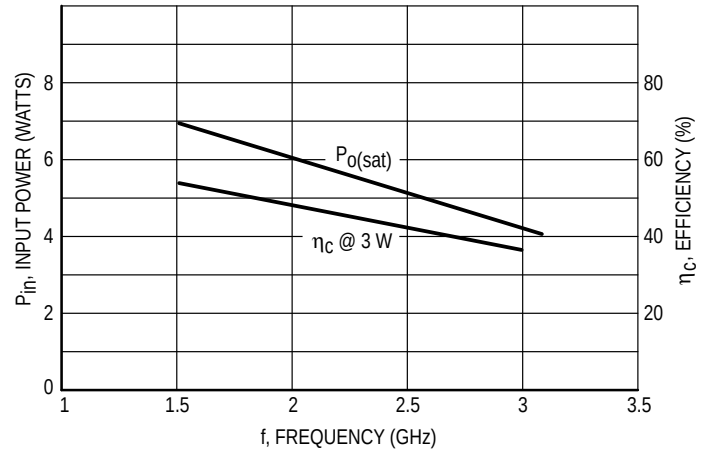


Figure 5.  $P_{sat}$  and  $\eta$  versus Frequency

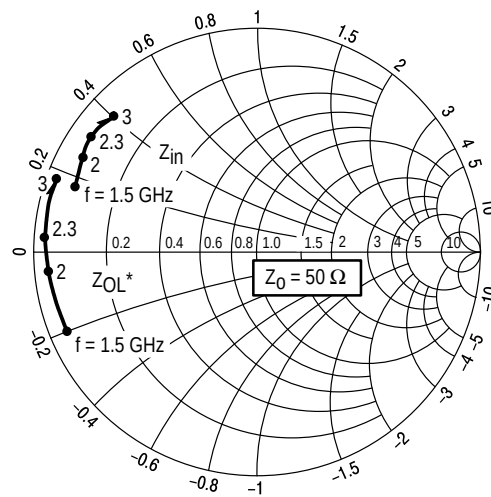


Figure 6. Series Equivalent Input/Output Impedance

## MRW3005 TYPICAL CHARACTERISTICS

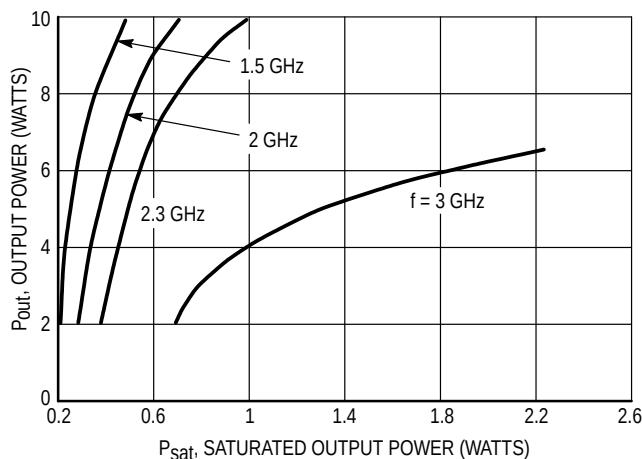


Figure 7. Output Power versus Input Power

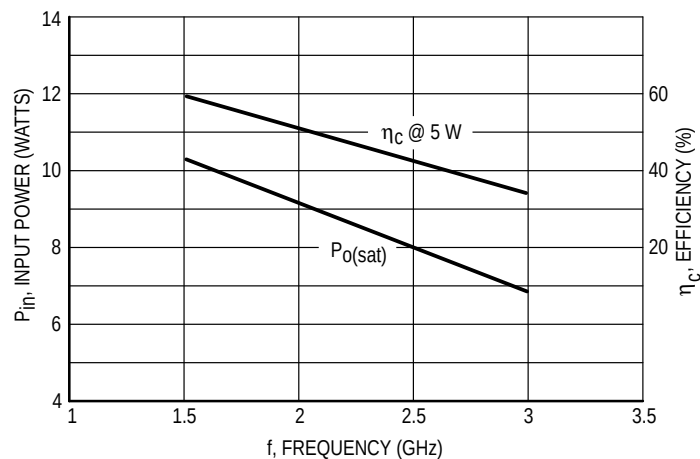


Figure 8.  $P_{sat}$  and  $\eta$  versus Frequency

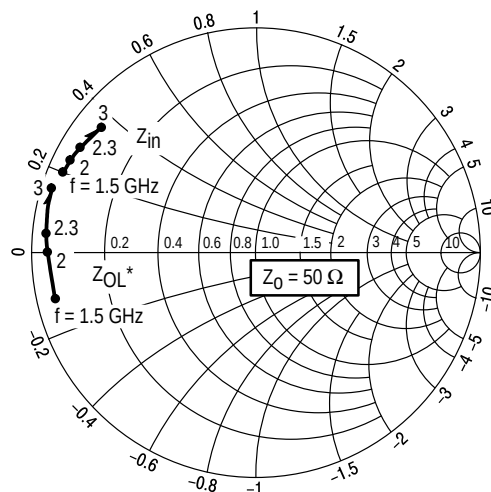


Figure 9. Series Equivalent Input/Output Impedance

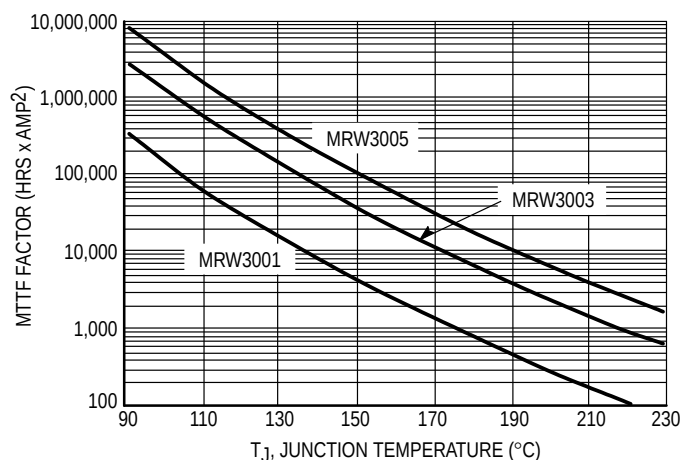


Figure 10. MTF Factor versus Junction Temperature

### MTF Factor (Normalized to 1.0 ampere<sup>2</sup> Continuous Duty)

The graph shown displays MTF in hours x ampere<sup>2</sup> emitter current for each of the 3.0 GHz devices. Life tests at elevated temperatures have correlated to better than  $\pm 10\%$  to the theoretical prediction for metal failure. **CAUTION** — A calculation is required to obtain actual metal life. Sample MTF calculations based on operating conditions are shown below.

Junction Temperature — °C

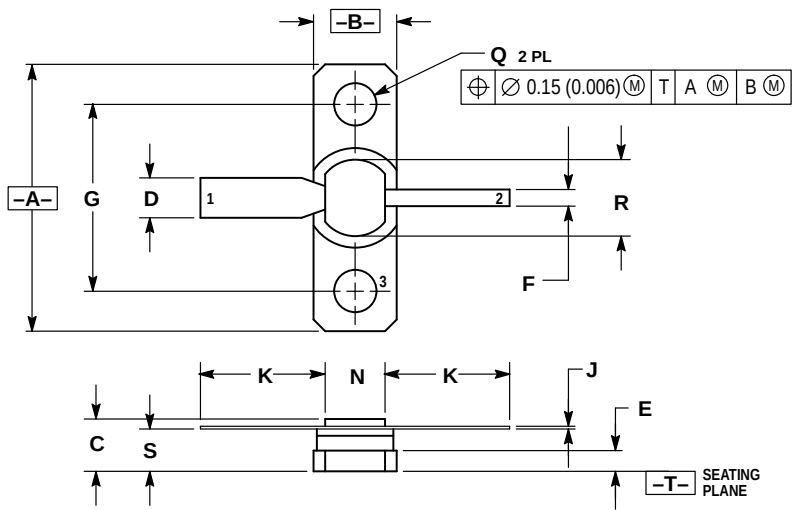
To calculate metal lifetime under any set of conditions, obtain actual data or estimate from typical performance curves. Solve for  $T_J$  (°C):

$$(1) T_J = \theta_{JF} \left( \frac{P_{out} \times 100}{\eta_c \%} + P_{in} - P_{out} \right) + T_{FLANGE}$$

Enter graph of MTF factor versus  $T_J$ . Obtain MTF factor. Calculate metal life by:

$$(2) \text{Metal Life in Hours} = \frac{\text{MTF Factor}}{I_C^2 \text{ (Amps)}}$$

PACKAGE DIMENSIONS



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

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 0.795     | 0.805 | 20.20       | 20.45 |
| B   | 0.245     | 0.255 | 6.23        | 6.47  |
| C   | 0.145     | 0.170 | 3.69        | 4.31  |
| D   | 0.115     | 0.125 | 2.93        | 3.17  |
| E   | 0.055     | 0.065 | 1.40        | 1.65  |
| F   | 0.045     | 0.055 | 1.15        | 1.39  |
| G   | 0.562 BSC |       | 14.27 BSC   |       |
| J   | 0.003     | 0.006 | 0.08        | 0.15  |
| K   | 0.260     | 0.375 | 6.60        | 9.52  |
| N   | 0.175     | 0.185 | 4.45        | 4.69  |
| Q   | 0.120     | 0.135 | 3.05        | 3.42  |
| R   | 0.225     | 0.235 | 5.72        | 5.97  |
| S   | 0.120     | 0.130 | 3.05        | 3.30  |

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

CASE 328A-03  
ISSUE D

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MRW3001/D

