

# The RF Line

## NPN Silicon

## RF Power Transistors

Designed for 24 volt UHF large-signal, common-emitter amplifier applications in industrial and commercial FM equipment operating in the range of 804–960 MHz.

- Specified 24 Volt, 900 MHz Characteristics
  - Output Power = 2.0 Watts
  - Power Gain = 9.0 dB Min
  - Efficiency = 55% Min
- Series Equivalent Large-Signal Characterization
- Capable of 30:1 VSWR Load Mismatch at Rated Output Power and Supply Voltage
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Silicon Nitride Passivated
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.

### MAXIMUM RATINGS

| Rating   | Symbol    | Value       | Unit                          |
|--|-----------|-------------|-------------------------------|
| Collector–Emitter Voltage  | $V_{CEO}$ | 30          | Vdc                           |
| Collector–Base Voltage   | $V_{CBO}$ | 55          | Vdc                           |
| Emitter–Base Voltage   | $V_{EBO}$ | 4.0         | Vdc                           |
| Collector Current — Continuous   | $I_C$     | 0.5         | Adc                           |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1)<br>Derate above $25^\circ\text{C}$ | $P_D$     | 7.0<br>40   | Watts<br>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

|  |               |     |   |     |      |
|--|---------------|-----|---|-----|------|
| Emitter–Base Breakdown Voltage<br>( $I_C = 5.0 \text{ mAdc}$ , $I_B = 0$ )         | $V_{(BR)CEO}$ | 30  | — | —   | Vdc  |
| Collector–Emitter Breakdown Voltage<br>( $I_C = 5.0 \text{ mAdc}$ , $V_{BE} = 0$ ) | $V_{(BR)CES}$ | 55  | — | —   | Vdc  |
| Emitter–Base Breakdown Voltage<br>( $I_E = 5.0 \text{ mAdc}$ , $I_C = 0$ )         | $V_{(BR)EBO}$ | 4.0 | — | —   | Vdc  |
| Collector Cutoff Current<br>( $V_{CB} = 30 \text{ Vdc}$ , $I_E = 0$ )              | $I_{CBO}$     | —   | — | 0.5 | mAdc |

### ON CHARACTERISTICS

|  |          |    |   |     |   |
|--|----------|----|---|-----|---|
| DC Current Gain<br>( $I_C = 100 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) | $h_{FE}$ | 10 | — | 100 | — |
|--|----------|----|---|-----|---|

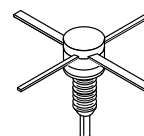
#### NOTES:

- This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.
- Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

(continued)

**MRF890**

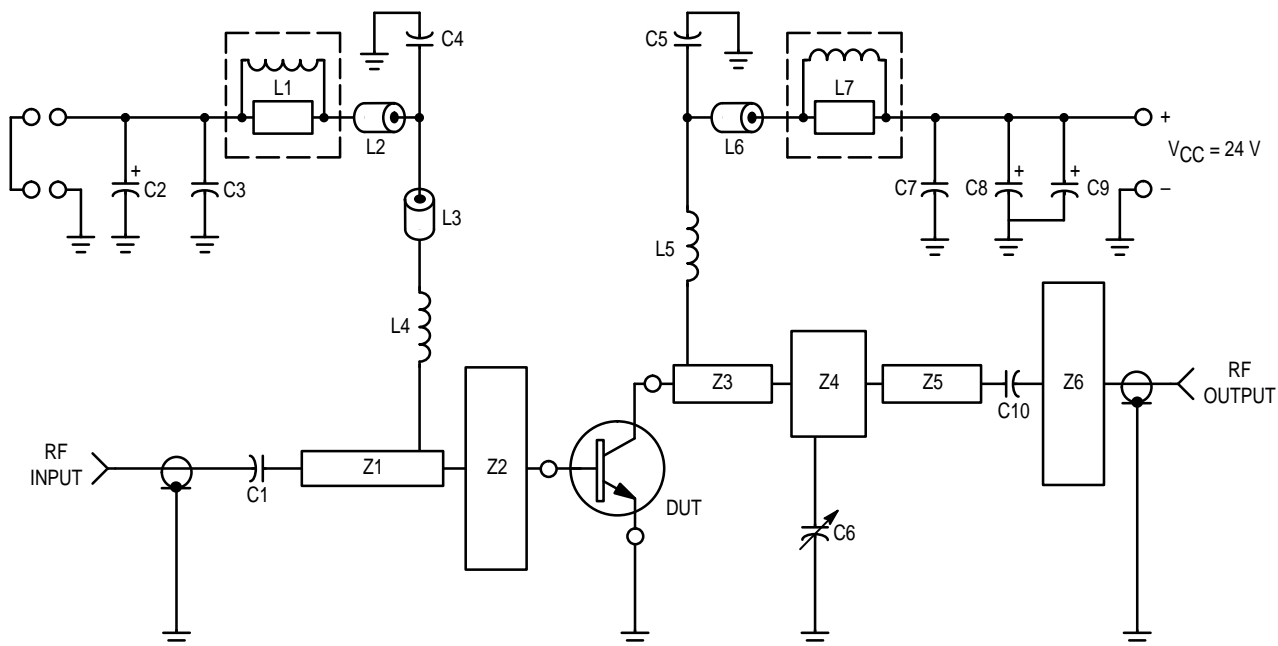
**2.0 W, 900 MHz  
RF POWER  
TRANSISTORS  
NPN SILICON**



**CASE 305–01, STYLE 1**

# **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>( $V_{CB} = 30\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )                                 | $C_{ob}$ | —   | 2.0 | —   | pF   |
| <b>FUNCTIONAL TESTS</b>   |          |     |     |     |      |
| Common-Emitter Amplifier Power Gain<br>( $P_{out} = 2.0\text{ W}$ , $V_{CC} = 24\text{ Vdc}$ , $f = 900\text{ MHz}$ ) | $G_{PE}$ | 8.5 | 9.0 | —   | dB   |
| Collector Efficiency<br>( $P_{out} = 2.0\text{ W}$ , $V_{CC} = 24\text{ Vdc}$ , $f = 900\text{ MHz}$ )                | $\eta$   | 55  | 60  | —   | %    |



C1, C4, C5 — 91 pF Mini Underwood Mica  
 C2, C8 — 1.0  $\mu\text{F}$  Electrolytic  
 C3, C7 — 250 pF Unelco  
 C6 — Johanson 0.5–4.0 pF Giga-Trim  
 C9 — 10  $\mu\text{F}$ , 50 V, Electrolytic  
 C10 — 39 pF Mini Underwood  
 L1, L7 — 10 Turns Around 10  $\Omega$  1/2 W Resistor  
 L2, L3, L6 — Ferrite Bead  
 L4, L5 — 5 Turns 20 AWG 0.1" ID  
 Z1, Z2, Z3, Z4, Z5, Z6 — Distributed Microstrip Elements (see photomask)  
 Board Material — Glass Teflon  $\epsilon_r = 2.55$   $t = 0.031"$

**Figure 1. 850–900 MHz Test Circuit**

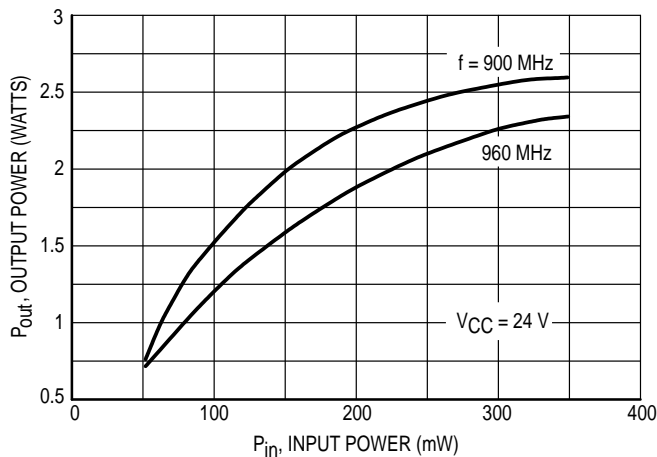


Figure 2. Output Power versus Input Power

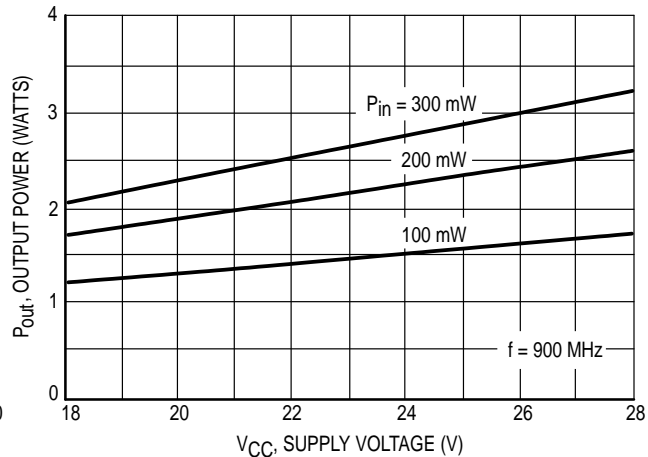


Figure 3. Output Power versus Supply Voltage

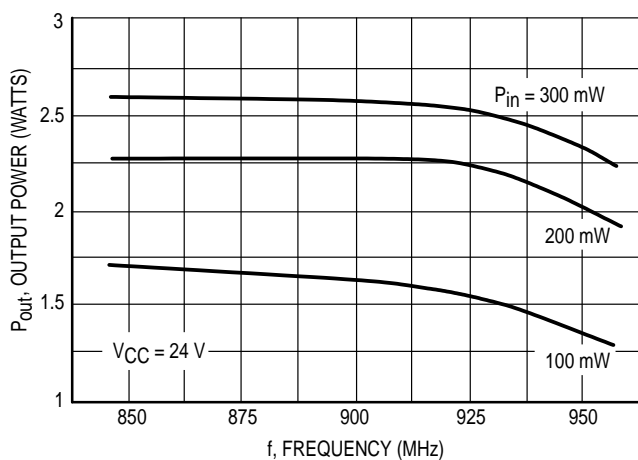


Figure 4. Output Power versus Frequency

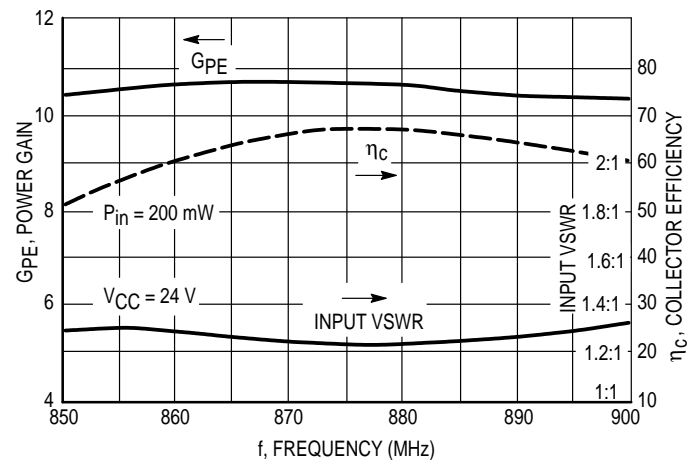


Figure 5. Typical Performance in Broadband Circuit

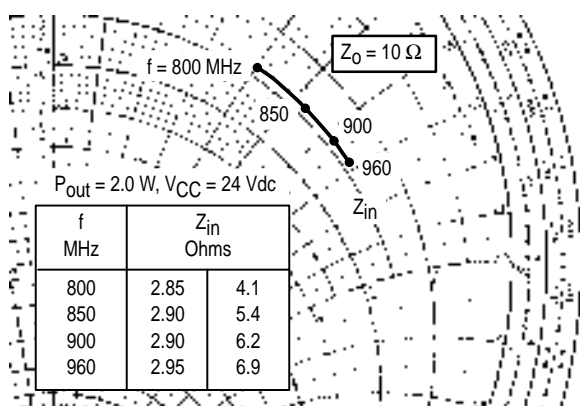
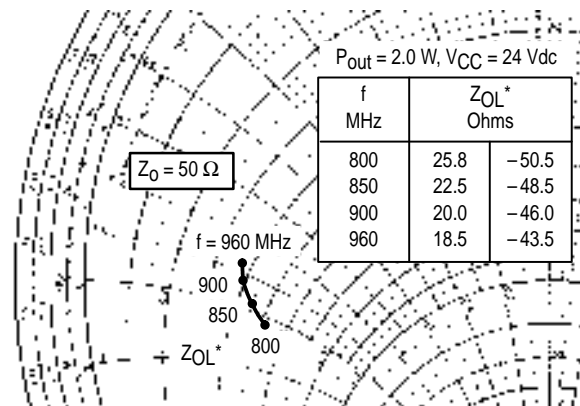


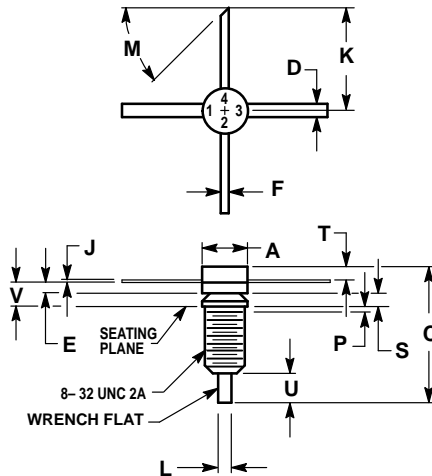
Figure 6. Series Equivalent Input Impedance



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

Figure 7. Series Equivalent Output Impedance


## PACKAGE DIMENSIONS



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

| DIM | INCHES  |       | MILLIMETERS |       |
|-----|---------|-------|-------------|-------|
|     | MIN     | MAX   | MIN         | MAX   |
| A   | 0.200   | 0.220 | 5.08        | 5.59  |
| C   | 0.550   | 0.640 | 13.97       | 16.26 |
| D   | 0.055   | 0.065 | 1.40        | 1.65  |
| E   | 0.040   | 0.050 | 1.02        | 1.27  |
| F   | 0.025   | 0.035 | 0.64        | 0.89  |
| J   | 0.003   | 0.007 | 0.08        | 0.18  |
| K   | 0.435   | —     | 11.05       | —     |
| L   | 0.055   | 0.065 | 1.40        | 1.65  |
| M   | 45° NOM |       | 45° NOM     |       |
| P   | —       | 0.050 | —           | 1.27  |
| S   | 0.055   | 0.065 | 1.40        | 1.65  |
| T   | 0.055   | 0.070 | 1.40        | 1.78  |
| U   | 0.110   | 0.150 | 2.79        | 3.81  |
| V   | 0.095   | 0.115 | 2.41        | 2.92  |

### CASE 305-01 ISSUE O

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