

# The RF Line

## NPN Silicon

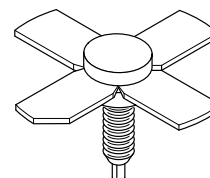
### RF Power Transistors

Designed for 12.5 Vdc UHF large-signal, amplifier applications in industrial and commercial FM equipment operating to 512 MHz.

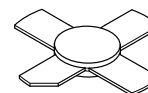
- Guaranteed 12.5 Volt, 512 MHz Characteristics
  - Output Power = 5.0 Watts
  - Minimum Gain = 10 dB
  - Efficiency = 65% (Typ)
- Typical Performance at 512 MHz, 12.5 V, 5.0 W Output = 6.0 dB
- Series Equivalent Large-Signal Characterization
- Gold Metallized, Emitter Ballasted for Long Life and Reliability
- Capable of 30:1 VSWR Load Mismatch at 15.5 V Supply Voltage
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.

**MRF652**  
**MRF652S**

**5.0 W, 512 MHz**  
**RF POWER**  
**TRANSISTORS**  
**NPN SILICON**



**CASE 244-04, STYLE 1**  
**MRF652**



**CASE 249-06, STYLE 1**  
**MRF652S**

#### MAXIMUM RATINGS

| Rating   | Symbol    | Value       | Unit                          |
|--|-----------|-------------|-------------------------------|
| Collector-Emitter Voltage  | $V_{CEO}$ | 16          | Vdc                           |
| Collector-Base Voltage   | $V_{CBO}$ | 36          | Vdc                           |
| Emitter-Base Voltage   | $V_{EBO}$ | 4.0         | Vdc                           |
| Collector Current — Continuous   | $I_C$     | 2.0         | Adc                           |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$     | 25<br>143   | Watts<br>mW/ $^\circ\text{C}$ |
| Storage Temperature Range  | $T_{stg}$ | -65 to +150 | $^\circ\text{C}$              |
| Operating Junction Temperature   | $T_J$     | 200         | $^\circ\text{C}$              |

#### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max | Unit               |
|--------------------------------------|-----------------|-----|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 7.0 | $^\circ\text{C/W}$ |

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

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

#### OFF CHARACTERISTICS

|   |               |     |   |     |      |
|---|---------------|-----|---|-----|------|
| Collector-Emitter Breakdown Voltage<br>( $I_C = 25 \text{ mAdc}$ , $I_B = 0$ )    | $V_{(BR)CEO}$ | 16  | — | —   | Vdc  |
| Collector-Emitter Breakdown Voltage<br>( $I_C = 25 \text{ mAdc}$ , $V_{BE} = 0$ ) | $V_{(BR)CES}$ | 36  | — | —   | Vdc  |
| Collector-Base Breakdown Voltage<br>( $I_C = 25 \text{ mAdc}$ , $I_E = 0$ )       | $V_{(BR)CBO}$ | 36  | — | —   | 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>( $V_{CE} = 15 \text{ Vdc}$ , $V_{BE} = 0$ )          | $I_{CES}$     | —   | — | 1.0 | mAdc |

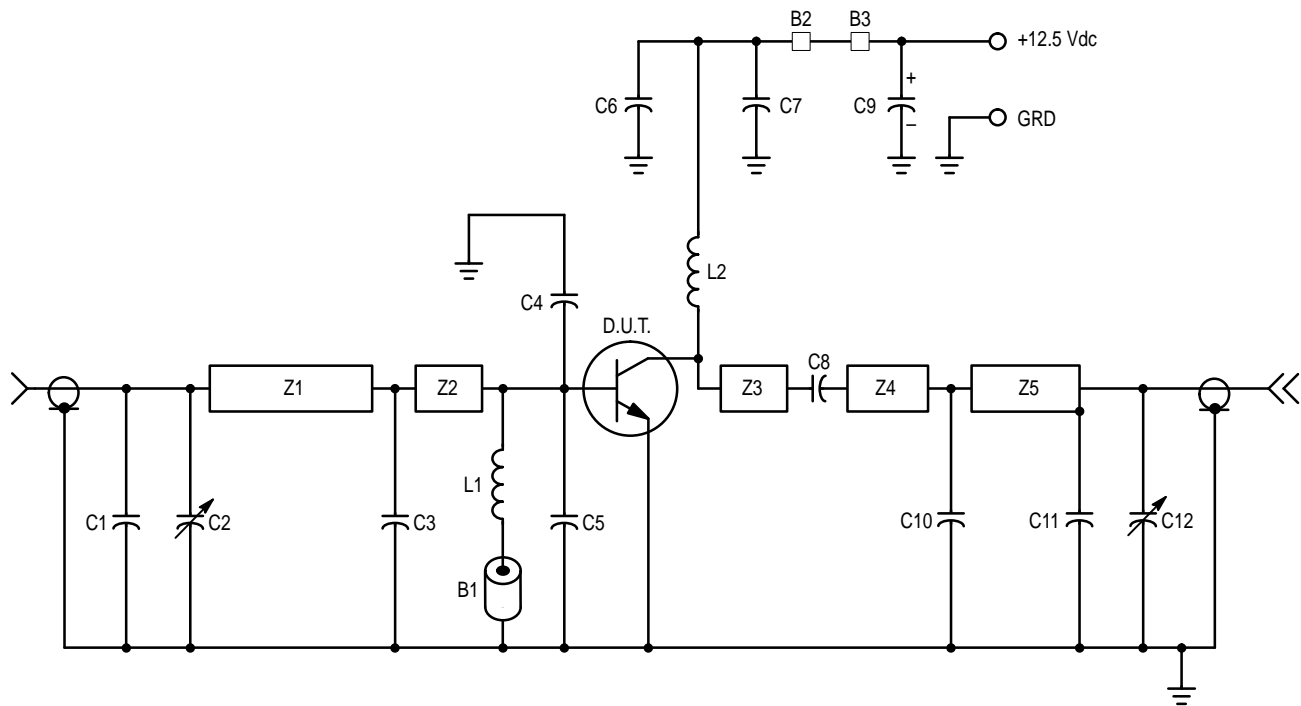
#### ON CHARACTERISTICS

|  |          |    |   |     |   |
|--|----------|----|---|-----|---|
| DC Current Gain<br>( $I_C = 200 \text{ mAdc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) | $h_{FE}$ | 10 | — | 150 | — |
|--|----------|----|---|-----|---|

(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 ( $V_{CB} = 15\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )  | $C_{ob}$                                     | —        | 9.5                            | 15        | pF     |    |
| <b>FUNCTIONAL TESTS</b>   |  |          |                                |           |        |    |
| Common-Emitter Amplifier Power Gain<br>( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 5.0\text{ W}$ )  | $f = 512\text{ MHz}$<br>$f = 870\text{ MHz}$ | $G_{pe}$ | 10<br>—                        | 11<br>6.0 | —<br>— | dB |
| Collector Efficiency<br>( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 5.0\text{ W}$ , $f = 512\text{ MHz}$ )                                  |  | $\eta$   | 60                             | 65        | —      | %  |
| Load Mismatch<br>( $V_{CC} = 15.5\text{ Vdc}$ , $P_{in} = 500\text{ mW}$ , $f = 512\text{ MHz}$ ,<br>$VSWR = 30:1$ , At All Phase Angles) |  | $\psi$   | No Degradation in Output Power |           |        |    |



- |  |   |
|--|---|
| B1, B2, B3 — Ferrite Bead              | C8 — 68 pF Mini-Underwood Mica            |
| C1 — 7.0 pF Unelco Mica                | C9 — 1.0 $\mu\text{F}$ Electrolytic 25 V  |
| C2 — 1.0–6.0 pF Johanson Variable 5201 | C10, C11 — 5.0 pF Unelco Mica             |
| C3 — 15 pF Unelco Mica                 | C12 — 1.0–10 pF Johanson Variable 5501    |
| C4 — 43 pF Mini-Underwood Mica         | L1, L2 — 6 Turns, 20 AWG Wire 0.125" ID   |
| C5 — 56 pF Mini-Underwood Mica         | Z1, Z2 — 25 Ohm $\mu\text{Stripline}$     |
| C6 — 1000 pF Unelco Mica               | Z3, Z4, Z5 — 50 Ohm $\mu\text{Stripline}$ |
| C7 — 0.1 $\mu\text{F}$ Ceramic         | Board — 0.032" Glass-Teflon               |

**Figure 1. 440–512 MHz Broadband Test Circuit**

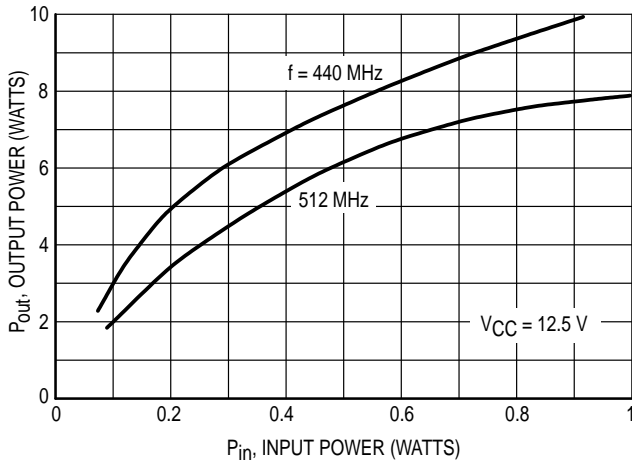


Figure 2. Output Power versus Input Power

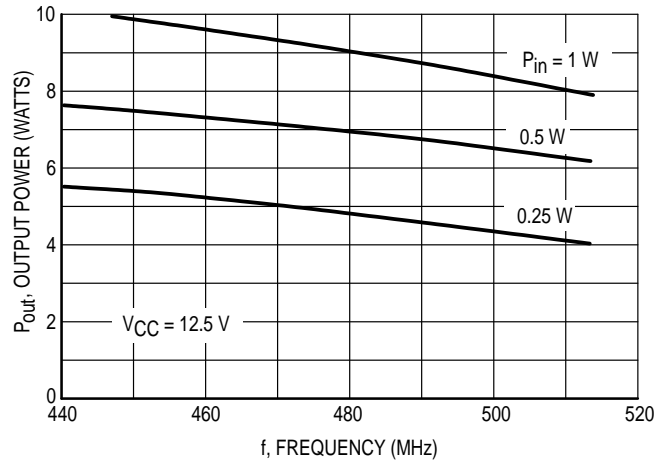


Figure 3. Output Power versus Frequency

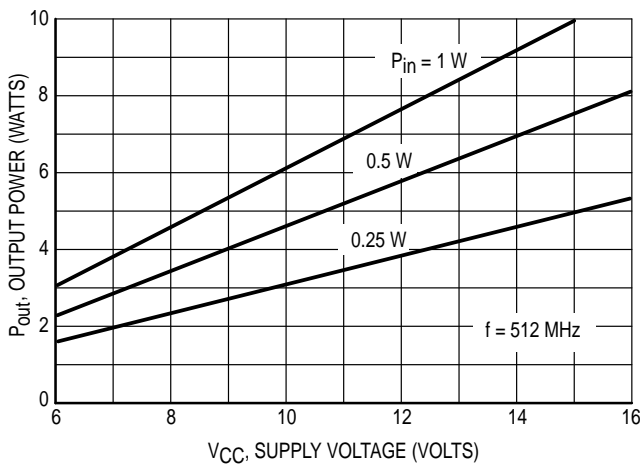


Figure 4. Output Power versus Supply Voltage

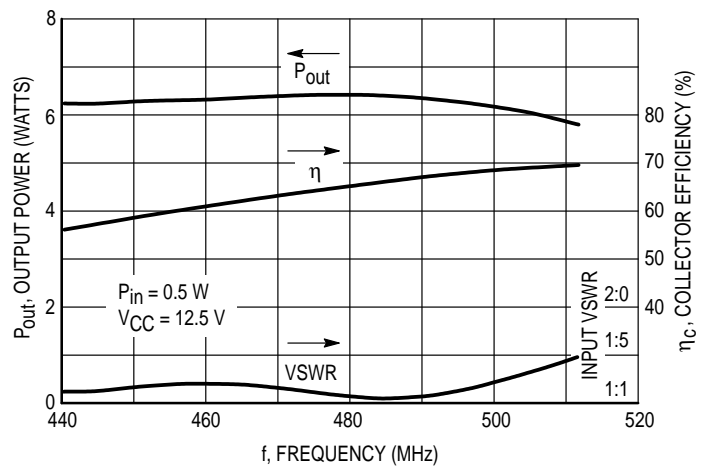
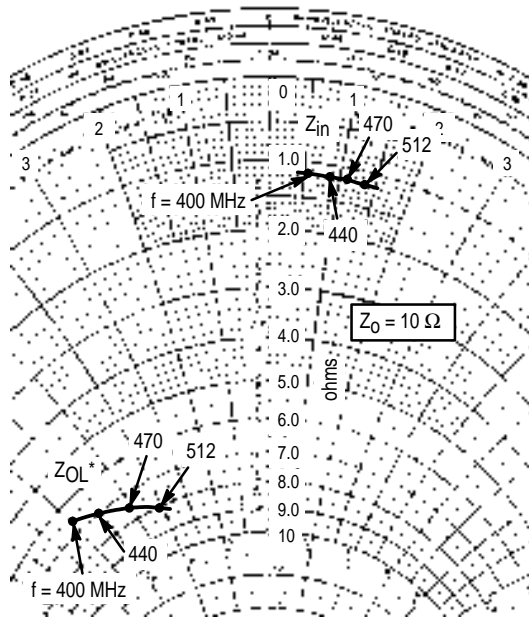


Figure 5. Typical Broadband Circuit Performance



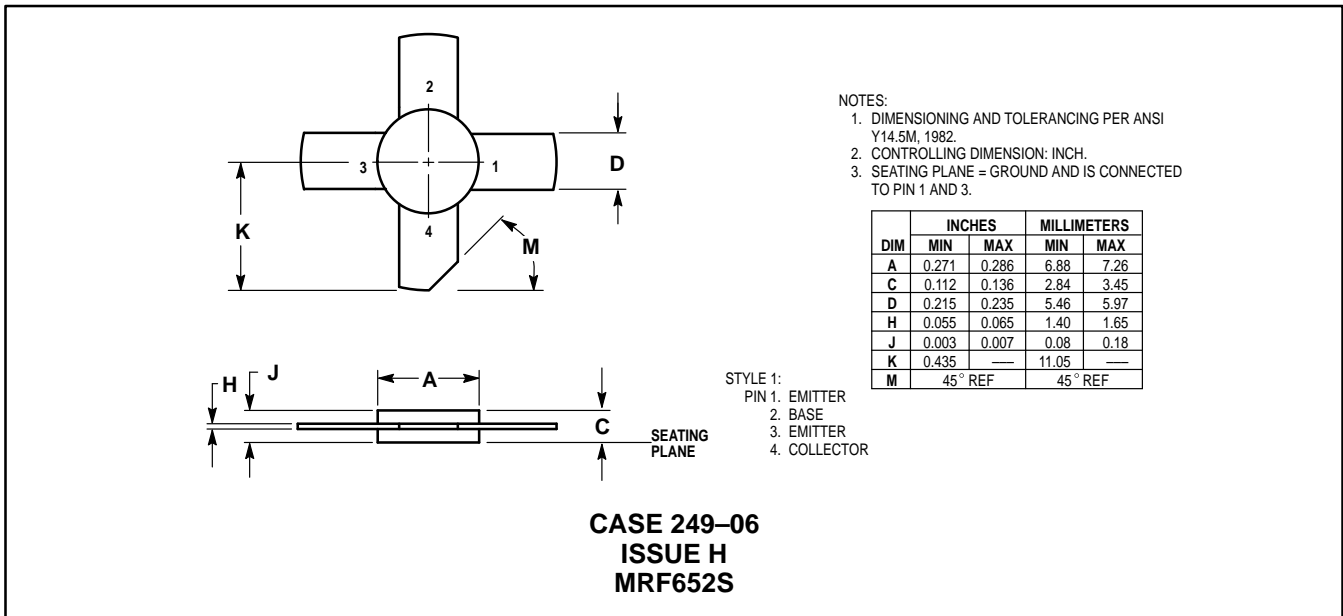
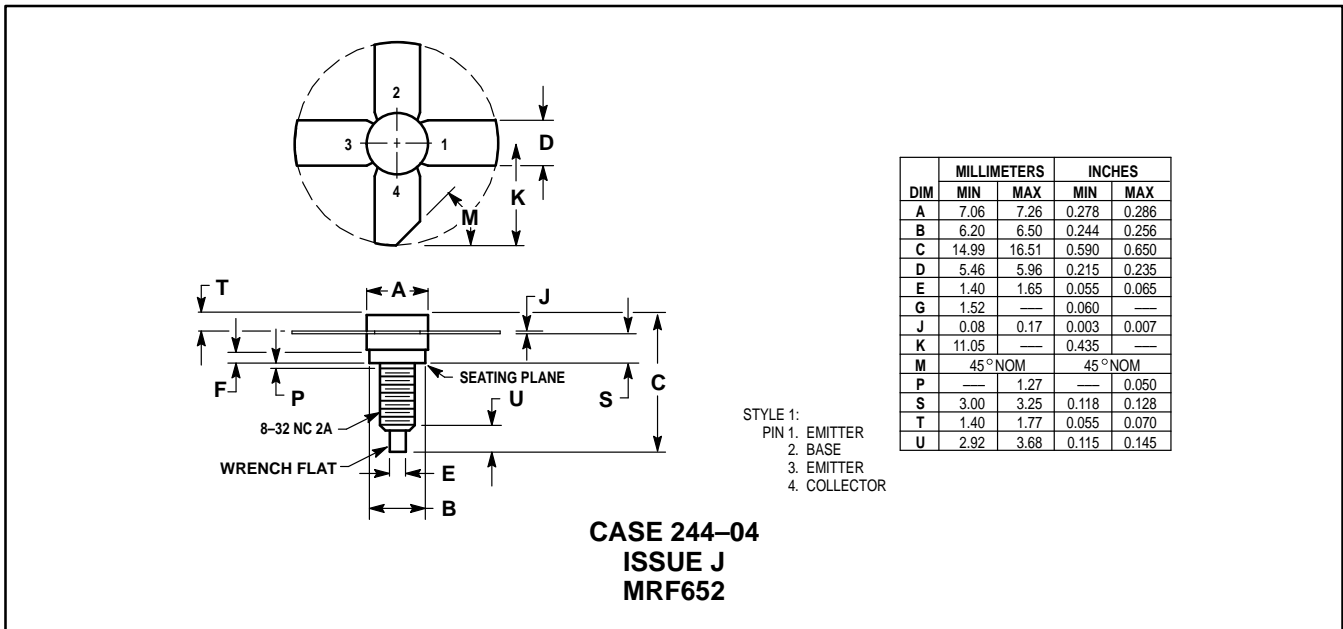
$V_{CC} = 12.5 \text{ Vdc}$   
 $P_{out} = 5.0 \text{ W}$

| f<br>MHz | $Z_{in}$<br>Ohms | $Z_{OL}^*$<br>Ohms |
|----------|------------------|--------------------|
| 400      | $1.18 + j0.54$   | $6.7 - j6.9$       |
| 440      | $1.19 + j0.88$   | $7.05 - j6.1$      |
| 470      | $1.19 + j1.11$   | $7.6 - j5.1$       |
| 512      | $1.19 + j1.35$   | $8.1 - j4.1$       |

$Z_{OL}^*$  = 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

## PACKAGE DIMENSIONS



- NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.  
2. CONTROLLING DIMENSION: INCH.  
3. SEATING PLANE = GROUND AND IS CONNECTED TO PIN 1 AND 3.

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