

## 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.

### 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 @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	25 143	Watts 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
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C = 25\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 25\text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 25\text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 5.0\text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CE} = 15\text{ Vdc}$ , $V_{BE} = 0$ )	$I_{CES}$	—	—	1.0	mAdc

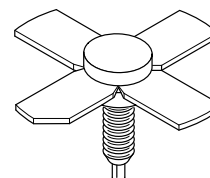
### ON CHARACTERISTICS

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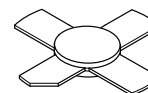
(continued)

**MRF652**  
**MRF652S**

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



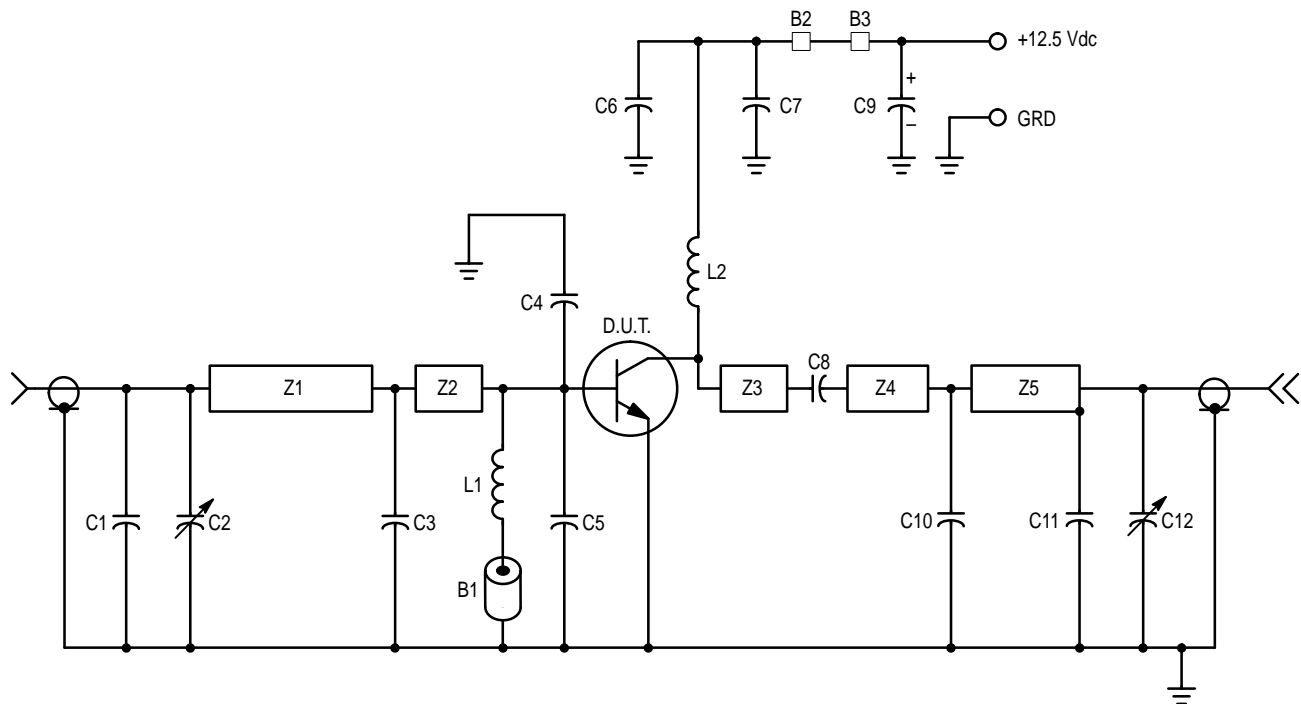
**CASE 244-04, STYLE 1**  
**MRF652**



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

**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 ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 5.0\text{ W}$ )	$f = 512\text{ MHz}$ $f = 870\text{ MHz}$	$G_{pe}$	10 —	11 6.0	— —	dB
Collector Efficiency ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{out} = 5.0\text{ W}$ , $f = 512\text{ MHz}$ )		$\eta$	60	65	—	%
Load Mismatch ( $V_{CC} = 15.5\text{ Vdc}$ , $P_{in} = 500\text{ mW}$ , $f = 512\text{ MHz}$ , $VSWR = 30:1$ , 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**

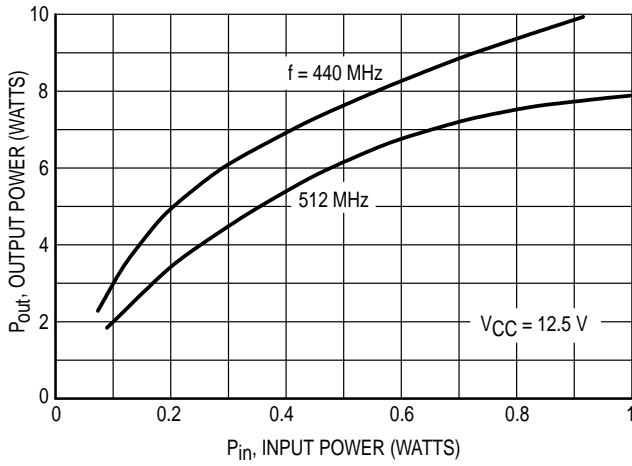


Figure 2. Output Power versus Input Power

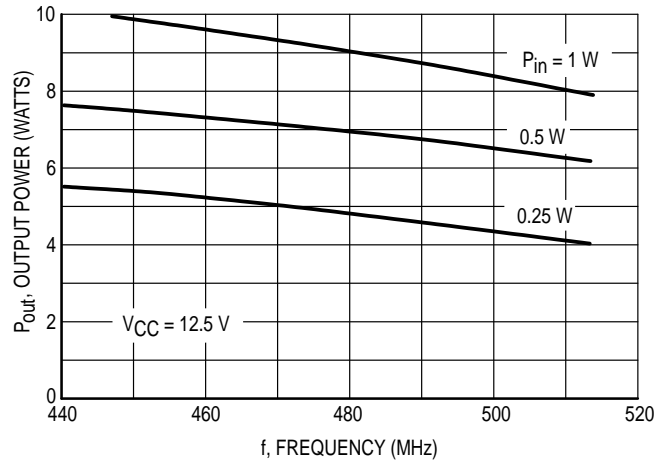


Figure 3. Output Power versus Frequency

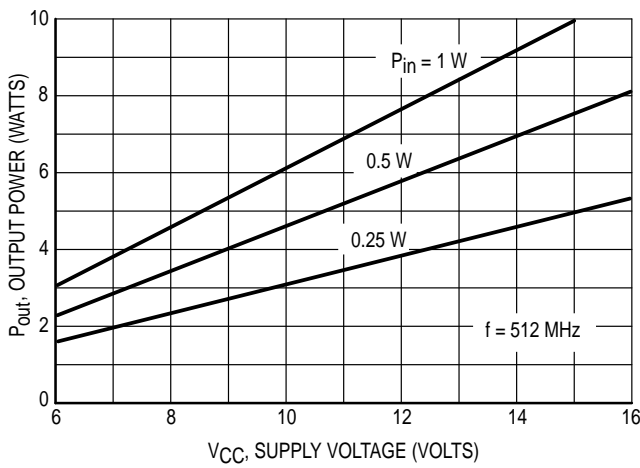


Figure 4. Output Power versus Supply Voltage

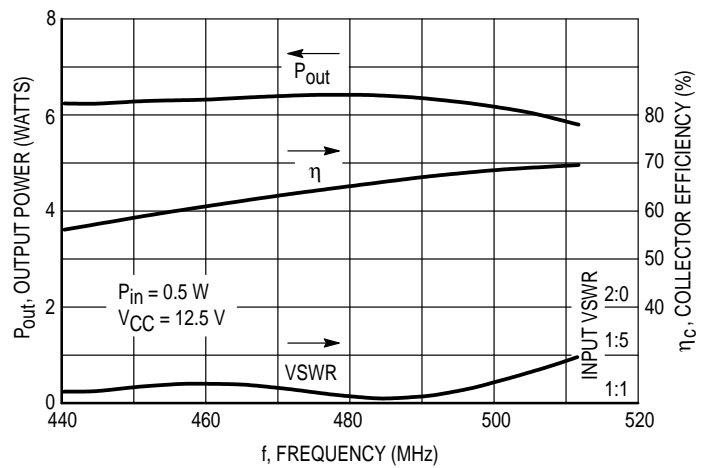
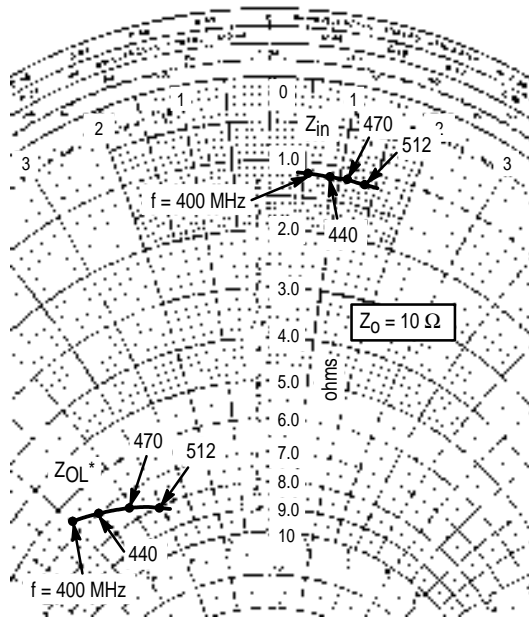


Figure 5. Typical Broadband Circuit Performance



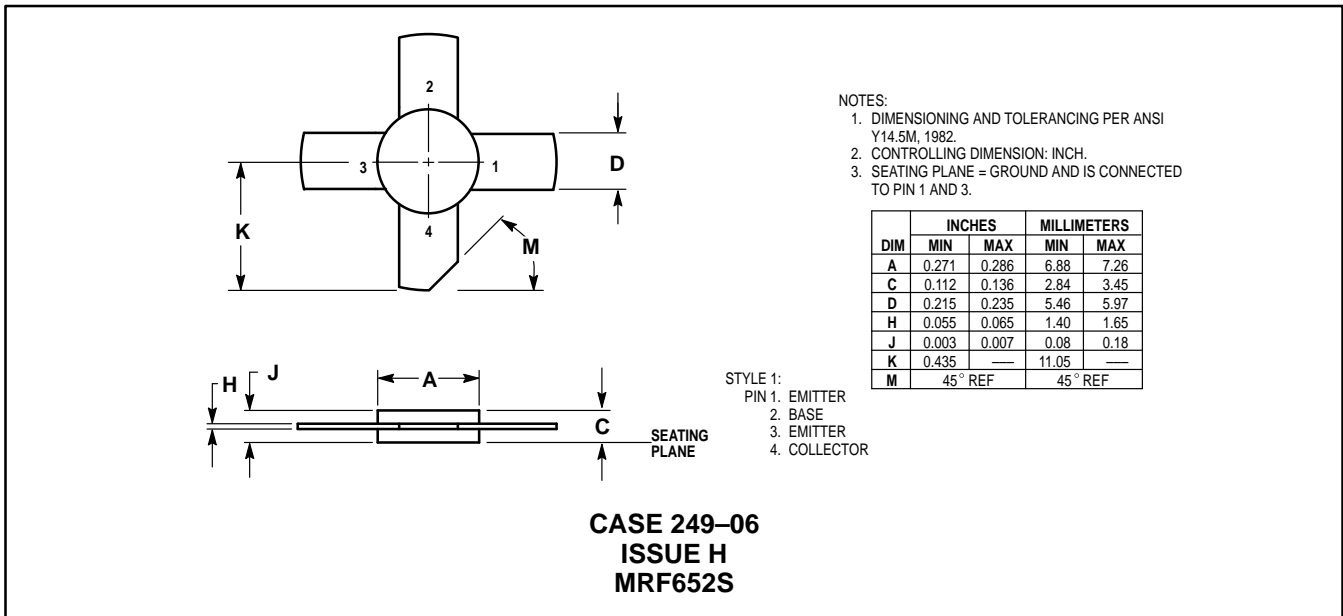
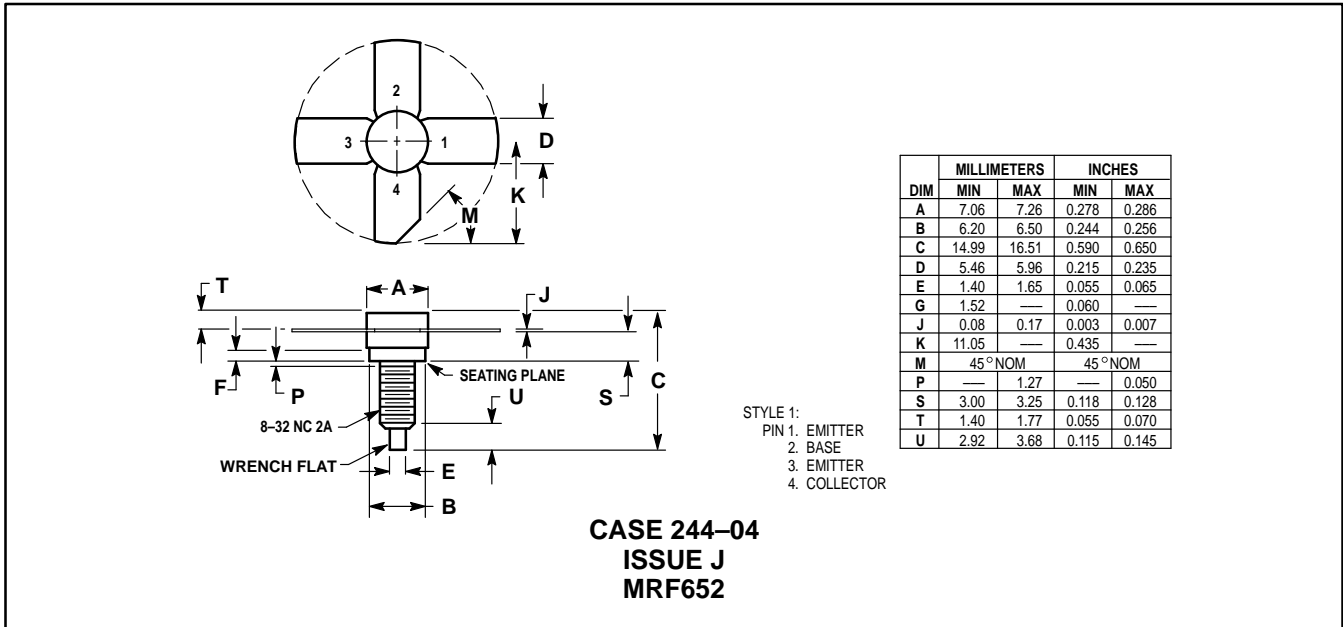
$V_{CC} = 12.5 \text{ Vdc}$   
 $P_{out} = 5.0 \text{ W}$

f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ 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



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