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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

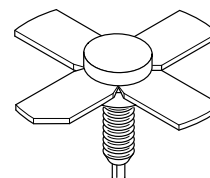
## ON CHARACTERISTICS

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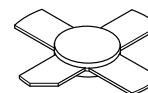
(continued)

**MRF652**  
**MRF652S**

5.0 W, 512 MHz  
RF POWER  
TRANSISTORS  
NPN SILICON



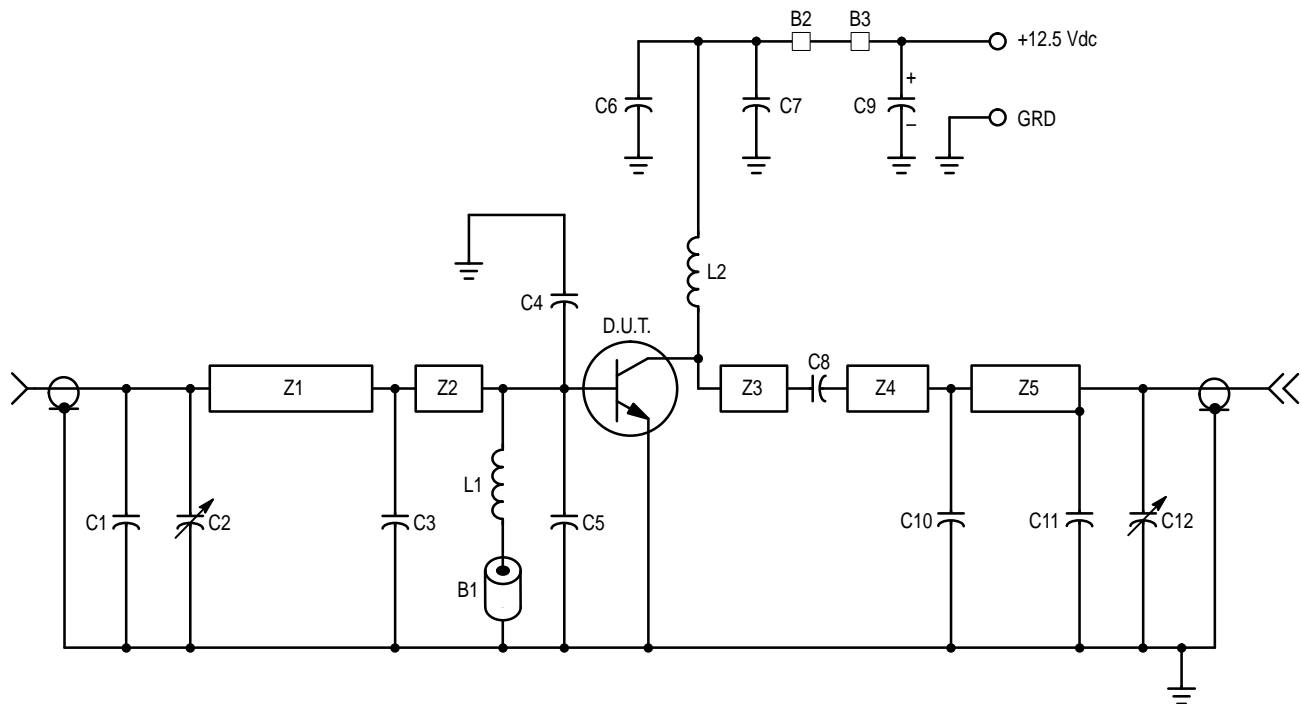
CASE 244-04, STYLE 1  
MRF652



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  
 C1 — 7.0 pF Unelco Mica  
 C2 — 1.0–6.0 pF Johanson Variable 5201  
 C3 — 15 pF Unelco Mica  
 C4 — 43 pF Mini-Underwood Mica  
 C5 — 56 pF Mini-Underwood Mica  
 C6 — 1000 pF Unelco Mica  
 C7 — 0.1  $\mu\text{F}$  Ceramic

C8 — 68 pF Mini-Underwood Mica  
 C9 — 1.0  $\mu\text{F}$  Electrolytic 25 V  
 C10, C11 — 5.0 pF Unelco Mica  
 C12 — 1.0–10 pF Johanson Variable 5501  
 L1, L2 — 6 Turns, 20 AWG Wire 0.125" ID  
 Z1, Z2 — 25 Ohm  $\mu\text{Stripline}$   
 Z3, Z4, Z5 — 50 Ohm  $\mu\text{Stripline}$   
 Board — 0.032" Glass-Teflon

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

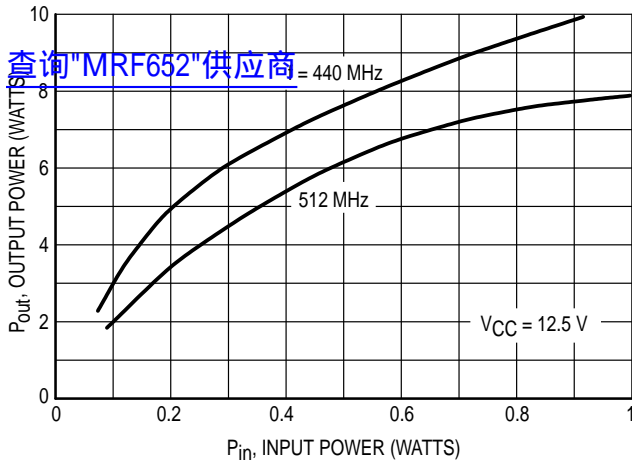


Figure 2. Output Power versus Input Power

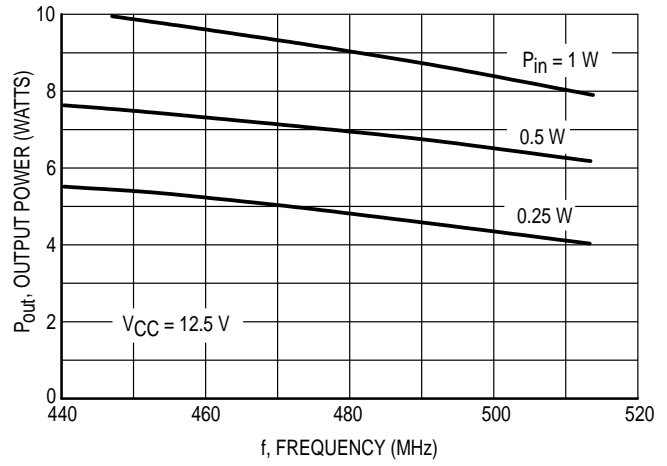


Figure 3. Output Power versus Frequency

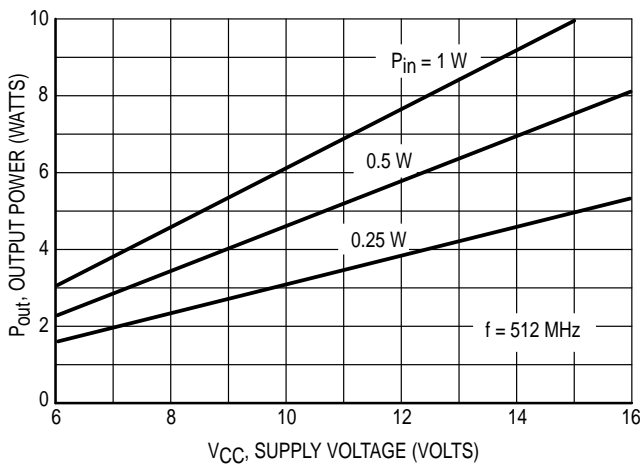


Figure 4. Output Power versus Supply Voltage

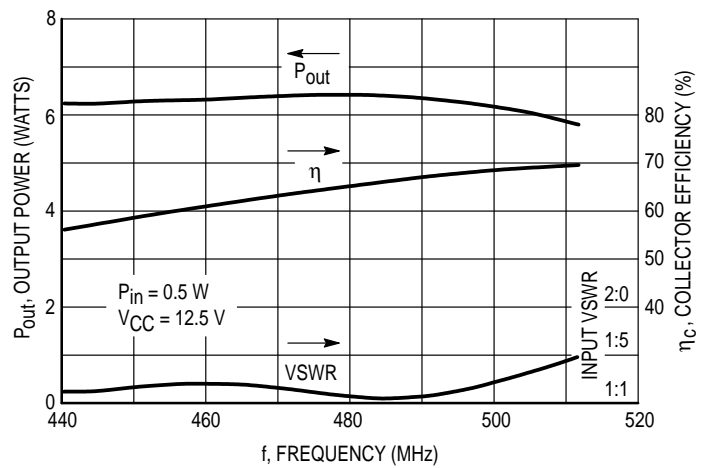
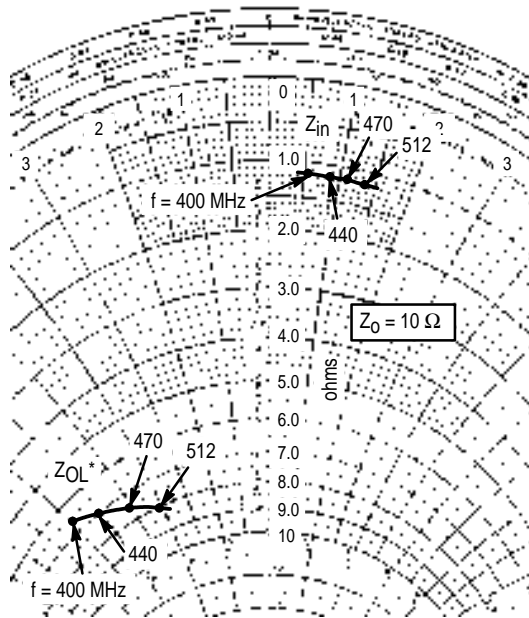


Figure 5. Typical Broadband Circuit Performance



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

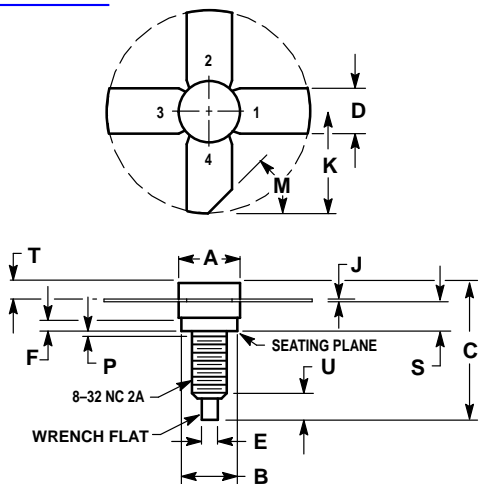
f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ Ohms
400	$1.18 + j0.54$	$6.7 - j6.9$
440	$1.19 + j0.88$	$7.05 - j6.1$
470	$1.19 + j1.11$	$7.6 - j5.1$
512	$1.19 + j1.35$	$8.1 - j4.1$

$Z_{OL}^*$  = 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

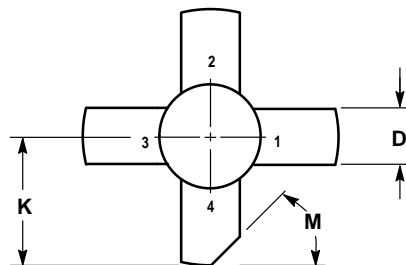
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DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	7.06	7.26	0.278	0.286
B	6.20	6.50	0.244	0.256
C	14.99	16.51	0.590	0.650
D	5.46	5.96	0.215	0.235
E	1.40	1.65	0.055	0.065
G	1.52	—	0.060	—
J	0.08	0.17	0.003	0.007
K	11.05	—	0.435	—
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
S	3.00	3.25	0.118	0.128
T	1.40	1.77	0.055	0.070
U	2.92	3.68	0.115	0.145

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

**CASE 244-04  
 ISSUE J  
 MRF652**



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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.271	0.286	6.88	7.26
C	0.112	0.136	2.84	3.45
D	0.215	0.235	5.46	5.97
H	0.055	0.065	1.40	1.65
J	0.003	0.007	0.08	0.18
K	0.435	—	11.05	—
M	45° REF		45° REF	

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

**CASE 249-06  
 ISSUE H  
 MRF652S**

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