

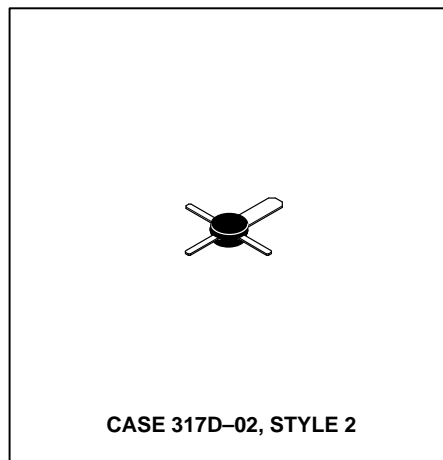
# The RF Line

## NPN Silicon

### RF Low Power Transistor



**1.5 W, 470 MHz  
RF LOW POWER  
TRANSISTOR  
NPN SILICON**



Designed primarily for wideband large signal predriver stages in the UHF frequency range.

- Specified @ 12.5 V, 470 MHz Characteristics @  $P_{out} = 1.5\text{ W}$   
Common Emitter Power Gain = 12.5 dB (Typ)  
Efficiency 60% (Typ)
- Cost Effective PowerMacro Package
- Electroless Tin Plated Leads for Improved Solderability
- 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	$I_C$	400	mAdc
Operating Junction Temperature	$T_J$	150	°C
Total Device Dissipation @ $T_C = 75^\circ\text{C}$ (1, 2) Derate above 75°C	$P_D$	3.0 40	Watts mW/°C
Storage Temperature Range	$T_{stg}$	-55 to +150	°C

#### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	25	°C/W

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

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

#### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C = 5.0\text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 5.0\text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 0.1\text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CE} = 15\text{ Vdc}$ , $V_{BE} = 0$ , $T_C = 25^\circ\text{C}$ )	$I_{CES}$	—	—	0.1	mAdc

#### ON CHARACTERISTICS

DC Current Gain ( $I_C = 100\text{ mAdc}$ , $V_{CE} = 5.0\text{ Vdc}$ )	$h_{FE}$	50	90	200	—
--	----------	----	----	-----	---

#### DYNAMIC CHARACTERISTICS

Output Capacitance ( $V_{CB} = 15\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ob}$	—	3.5	5.0	pF
---	----------	---	-----	-----	----

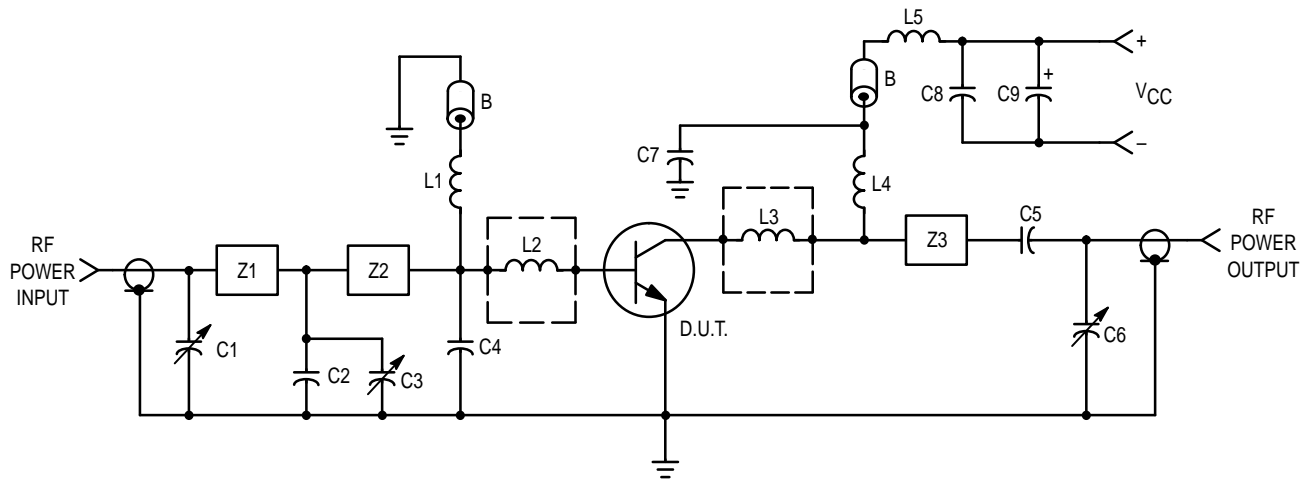
#### NOTES:

- $T_C$ , Case temperature measured on collector lead immediately adjacent to body of package.
- The MRF555 PowerMacro must be properly mounted for reliable operation. AN938, "Mounting Techniques in PowerMacro Transistor," discusses methods of mounting and heatsinking.

(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>FUNCTIONAL TESTS</b> ( $f = 470\text{ MHz}$ )					
Common-Emitter Power Gain ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{Out} = 1.5\text{ W}$ )	$G_{pe}$	11	12.5	—	dB
Collector Efficiency ( $V_{CC} = 12.5\text{ Vdc}$ , $P_{Out} = 1.5\text{ W}$ )	$\eta_c$	50	60	—	%
Load Mismatch Stress ( $V_{CC} = 15.5\text{ Vdc}$ , $P_{in} = 125\text{ mW}$ , $VSWR \geq 10:1$ all phase angles)	$\psi$	No Degradation in Output Power			



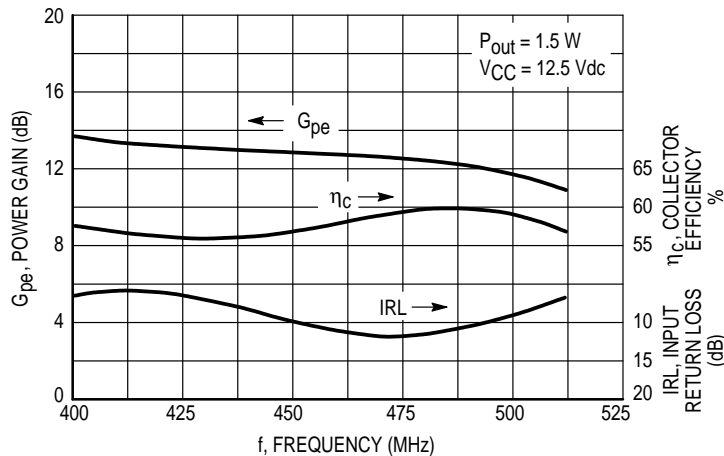
- \*C1, C3, C6 — 0.8–11 pF Johanson
- C2 — 15 pF Clamped Mica, Mini-Underwood
- C4 — 36 pF Clamped Mica, Mini-Underwood
- C5 — 470 pF Ceramic Chip Capacitor
- C7 — 91 pF Clamped Mica, Mini-Underwood
- C8 — 68 pF Clamped Mica, Mini-Underwood
- C9 — 1.0  $\mu\text{F}$ , 25 V Tantalum
- B — Bead, Ferroxcube 56–590–65/3B

\*Fixed tuned for broadband response

- L1 — 5 Turns #21 AWG, 5/32" I.D.
- L2, L3 — 60 x 125 x 250 Mils Copper Pad on 27 Mil Thick Alumina Substrate
- L4, L5 — 7 Turns #21 AWG 5/32" I.D.
- Z1 — 1.29" x 0.16" Microstrip
- Z2 — 0.70" x 0.16" Microstrip
- Z3 — 2.18" x 0.16" Microstrip

PCB — 1/16" Glass Teflon, 1 oz. cu. clad, double sided,  $\epsilon_r = 2.5$

**Figure 1. 400–512 MHz Broadband Circuit**



**Figure 2. Performance in Broadband Circuit**

f Frequency MHz	$Z_{in}$ Ohms		$Z_{OL}^*$ Ohms	
	$V_{CC} = 7.5\text{ V}$	$V_{CC} = 12.5\text{ V}$	$V_{CC} = 7.5\text{ V}$	$V_{CC} = 12.5\text{ V}$
	$P_{in} = 100\text{ mW}$	$P_{in} = 50\text{ mW}$	$P_{out} 400\text{ MHz} = 1.5\text{ W}$ $P_{out} 450\text{ MHz} = 1.35\text{ W}$ $P_{out} 512\text{ MHz} = 1.05\text{ W}$	$P_{out} 400\text{ MHz} = 1.9\text{ W}$ $P_{out} 450\text{ MHz} = 1.45\text{ W}$ $P_{out} 512\text{ MHz} = 0.9\text{ W}$
400	$2.9 - j2.7$	$1.9 - j3.1$	$18.0 - j13.4$	$12.2 - j19.7$
450	$2.2 - j0.8$	$2.6 - j4.0$	$21.6 - j9.9$	$20.2 - j18.6$
512	$3.5 - j1.2$	$2.6 - j2.6$	$20.1 - j1.0$	$23.4 - j23.0$

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

**Table 1.  $Z_{in}$  and  $Z_{OL}$  versus Collector Voltage, Input Power and Output Power**

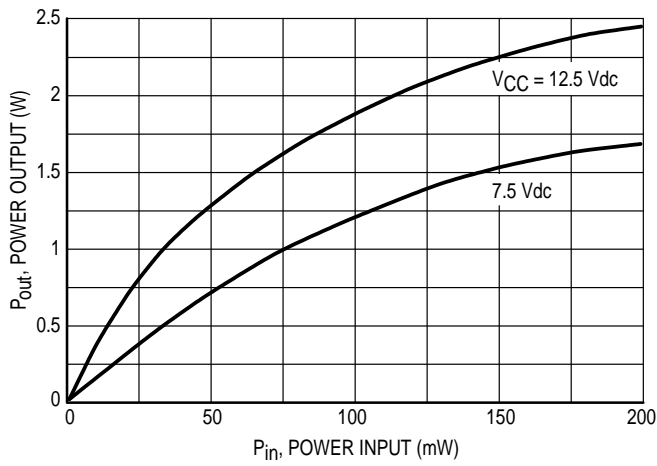


Figure 3. Power Output versus Power Input

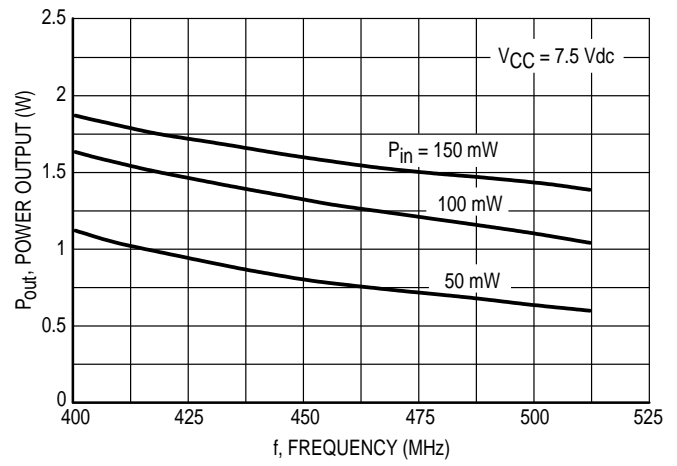


Figure 4. Power Output versus Frequency

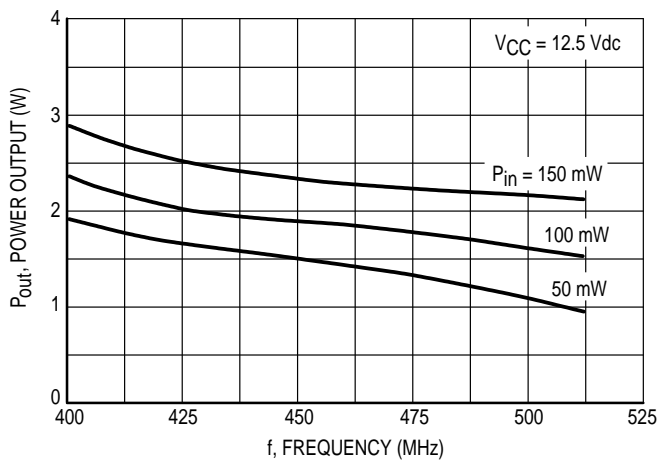


Figure 5. Power Output versus Frequency

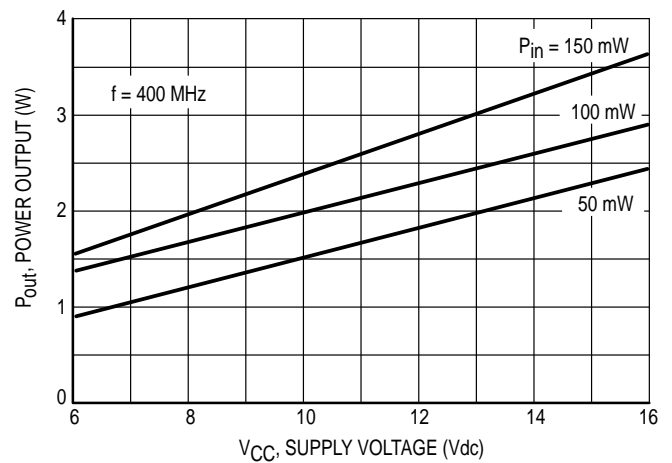


Figure 6. Power Output versus Supply Voltage

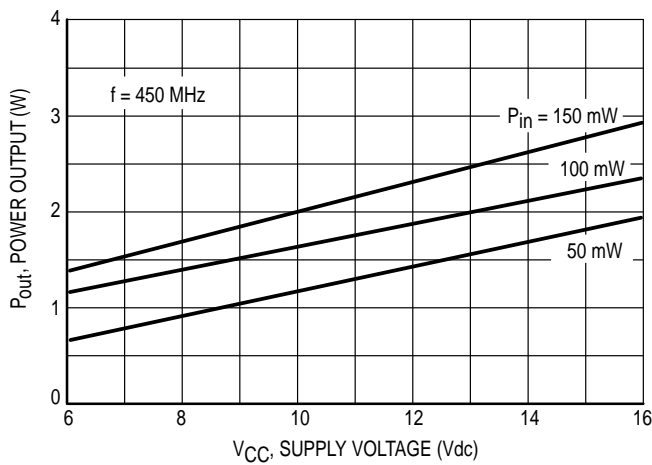


Figure 7. Power Output versus Supply Voltage

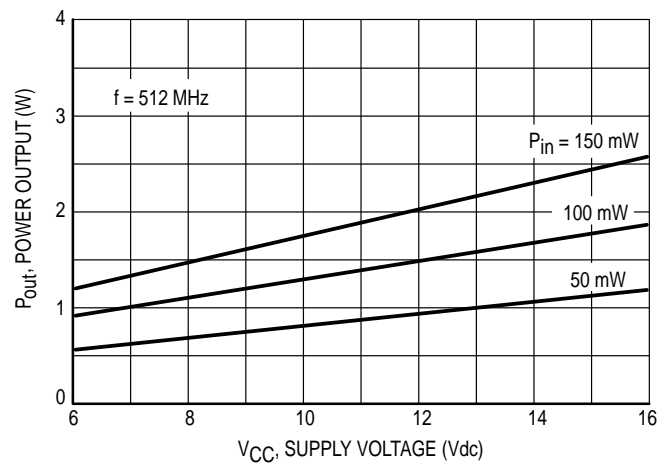
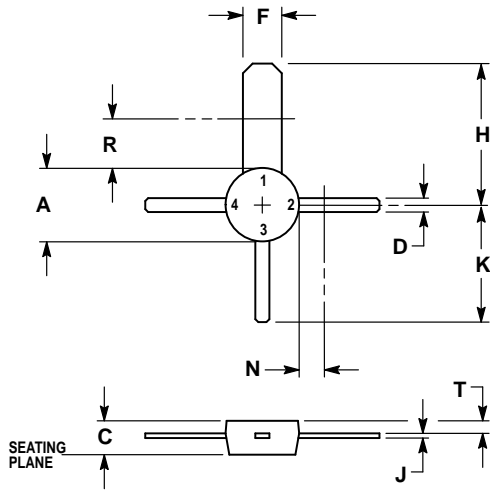


Figure 8. Power Output versus Supply Voltage

## PACKAGE DIMENSIONS




- NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  2. CONTROLLING DIMENSION: INCH.
  3. LEAD DIMENSIONS UNCONTROLLED WITHIN DIMENSION N AND R.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.175	0.205	4.45	5.20
C	0.075	0.100	1.91	2.54
D	0.033	0.039	0.84	0.99
F	0.097	0.104	2.46	2.64
H	0.348	0.383	8.84	9.72
J	0.008	0.012	0.24	0.30
K	0.285	0.320	7.24	8.12
N	—	0.065	—	1.65
R	—	0.128	—	3.25
T	0.025	0.040	0.64	1.01

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

**CASE 317D-02  
 ISSUE C**

Motorola reserves the right to make changes without further notice to any products herein. Motorola makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Motorola assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. "Typical" parameters can and do vary in different applications. All operating parameters, including "Typicals" must be validated for each customer application by customer's technical experts. Motorola does not convey any license under its patent rights nor the rights of others. Motorola products are not designed, intended, or authorized for use as components in systems intended for surgical implant into the body, or other applications intended to support or sustain life, or for any other application in which the failure of the Motorola product could create a situation where personal injury or death may occur. Should Buyer purchase or use Motorola products for any such unintended or unauthorized application, Buyer shall indemnify and hold Motorola and its officers, employees, subsidiaries, affiliates, and distributors harmless against all claims, costs, damages, and expenses, and reasonable attorney fees arising out of, directly or indirectly, any claim of personal injury or death associated with such unintended or unauthorized use, even if such claim alleges that Motorola was negligent regarding the design or manufacture of the part. Motorola and  are registered trademarks of Motorola, Inc. Motorola, Inc. is an Equal Opportunity/Affirmative Action Employer.

**How to reach us:**

**USA / EUROPE:** Motorola Literature Distribution;  
P.O. Box 20912; Phoenix, Arizona 85036. 1-800-441-2447

**JAPAN:** Nippon Motorola Ltd.; Tatsumi-SPD-JLDC, Toshikatsu Otsuki,  
6F Seibu-Butsuryu-Center, 3-14-2 Tatsumi Koto-Ku, Tokyo 135, Japan. 03-3521-8315

**MFAX:** RMFAX0@email.sps.mot.com - TOUCHTONE (602) 244-6609  
**INTERNET:** <http://Design-NET.com>

**HONG KONG:** Motorola Semiconductors H.K. Ltd.; 8B Tai Ping Industrial Park,  
51 Ting Kok Road, Tai Po, N.T., Hong Kong. 852-26629298



MRF555/D

