

## The RF Line NPN Silicon RF Power Transistor

... designed primarily for wideband large-signal driver and predriver amplifier stages in 200–500 MHz frequency range.

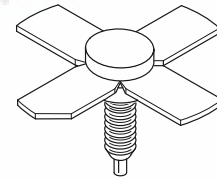
- Guaranteed Performance at 400 MHz, 28 Vdc
  - Output Power = 10 Watts
  - Power Gain = 12 dB Min
  - Efficiency = 50% Min
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability
- Computer-Controlled Wirebonding Gives Consistent Input Impedance

**MRF321**

**10 W, 400 MHz  
RF POWER  
TRANSISTOR  
NPN SILICON**

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	33	Vdc
Collector-Base Voltage	$V_{CBO}$	60	Vdc
Emitter-Base Voltage	$V_{EBO}$	4.0	Vdc
Collector Current — Continuous — Peak	$I_C$	1.1 1.5	Adc
Total Device Dissipation @ $T_A = 25^\circ\text{C}$ (1) Derate above $25^\circ\text{C}$	$P_D$	27 160	Watts mW/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$



CASE 244-04, STYLE 1

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	6.4	$^\circ\text{C}/\text{W}$

### 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 ( $I_C = 20$ mAdc, $I_B = 0$ )	$V_{(BR)CEO}$	33	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 20$ mAdc, $V_{BE} = 0$ )	$V_{(BR)CES}$	60	—	—	Vdc
Collector-Base Breakdown Voltage ( $I_C = 20$ mAdc, $I_E = 0$ )	$V_{(BR)CBO}$	60	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 2.0$ mAdc, $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 30$ Vdc, $I_E = 0$ )	$I_{CBO}$	—	—	1.0	mAdc

### ON CHARACTERISTICS

DC Current Gain ( $I_C = 500$ mA, $V_{CE} = 5.0$ Vdc)	$h_{FE}$	20	—	80	—
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NOTE:

1. This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.

(continued)



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

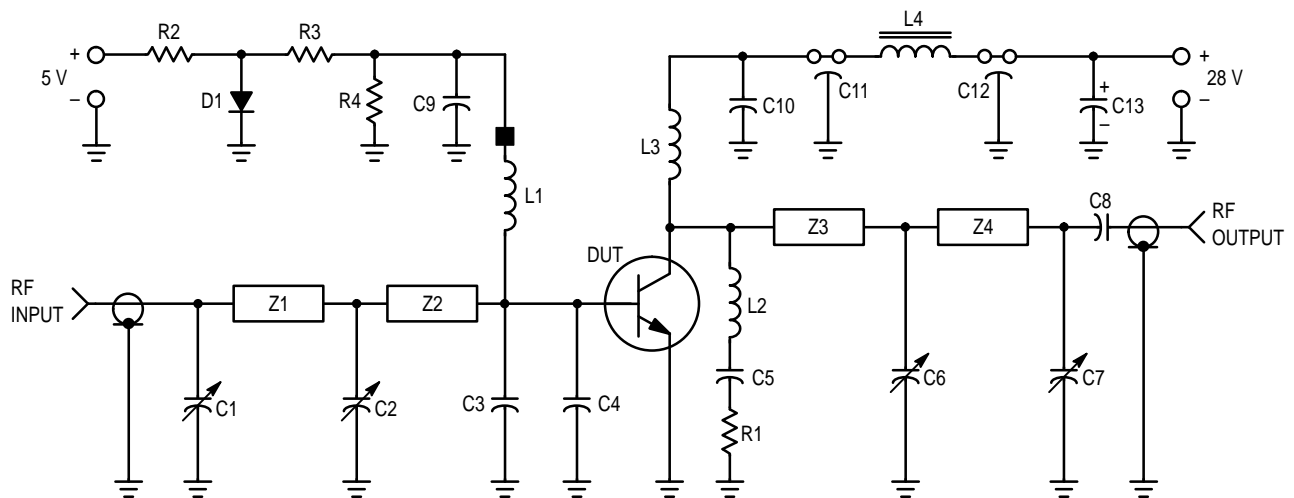
Characteristic	Symbol	Min	Typ	Max	Unit
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**DYNAMIC CHARACTERISTICS**

Output Capacitance ( $V_{CB} = 28\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ob}$	—	10	12	pF
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**FUNCTIONAL TESTS** (Figure 1)

Common-Emitter Amplifier Power Gain ( $V_{CC} = 28\text{ Vdc}$ , $P_{Out} = 10\text{ W}$ , $f = 400\text{ MHz}$ )	$G_{PE}$	12	13	—	dB
Collector Efficiency ( $V_{CC} = 28\text{ Vdc}$ , $P_{Out} = 10\text{ W}$ , $f = 400\text{ MHz}$ )	$\eta$	50	60	—	%
Load Mismatch ( $V_{CC} = 28\text{ Vdc}$ , $P_{Out} = 10\text{ W}$ , $f = 400\text{ MHz}$ , $V_{SWR} = 30:1$ all phase angles)	$\psi$	No Degradation in Output Power			



C1, C2, C3 — 1.0–20 pF Johanson Trimmer (JMC 5501)  
 C3, C4 — 47 pF ATC Chip Capacitor  
 C5, C10 — 0.1  $\mu\text{F}$  Erie Redcap  
 C7 — 0.5–10 pF Johanson Trimmer (JMC 5201)  
 C8 — 0.018  $\mu\text{F}$  Vitramon Chip Capacitor  
 C9 — 200 pF UNELCO Capacitor  
 C11, C12 — 680 pF Feedthru  
 C13 — 1.0  $\mu\text{F}$ , 50 Volt Tantalum Capacitor  
 D1 — 1N4001  
 L1 — 0.33  $\mu\text{H}$  Molded Choke with Ferrocube Bead  
 (Ferrocube 56–590–65/4B) on Ground End of Coil  
 L2 — 4 Turns #20 Enamel, 1/8" ID

L3 — 6 Turns #20 Enamel, 1/4" ID  
 L4 — Ferrocube VK200–19/4B  
 R1 — 5.1  $\Omega$ , 1/4 Watt  
 R2 — 120  $\Omega$ , 1.0 Watt  
 R3 — 20  $\Omega$ , 1/2 Watt  
 R4 — 47  $\Omega$ , 1/2 Watt  
 Z1 — Microstrip 0.1" W x 1.35" L  
 Z2 — Microstrip 0.1" W x 0.55" L  
 Z3 — Microstrip 0.1" W x 0.8" L  
 Z4 — Microstrip 0.1" W x 1.75" L  
 Board — Glass Teflon,  $\epsilon_R = 2.56$ ,  $t = 0.062$ "  
 Input/Output Connectors — Type N

**Figure 1. 400 MHz Test Circuit Schematic**

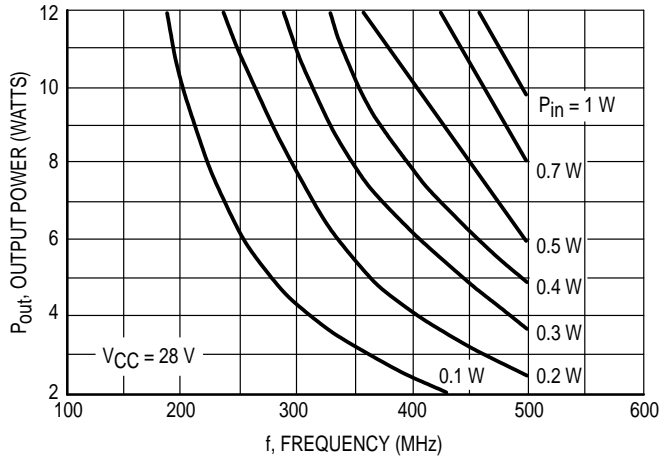


Figure 2. Output Power versus Frequency

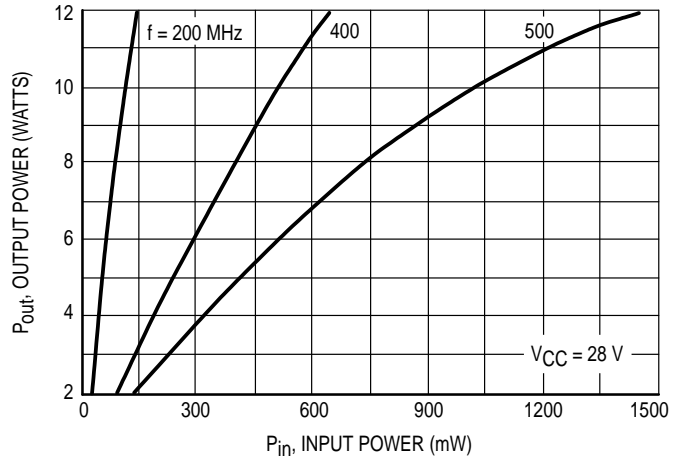


Figure 3. Output Power versus Input Power

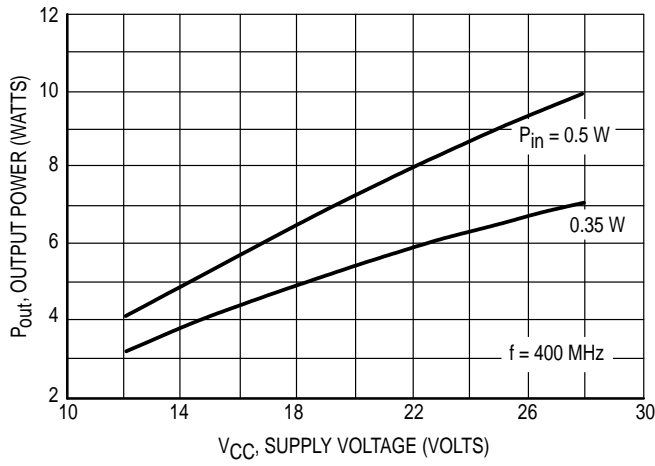


Figure 4. Output Power versus Supply Voltage

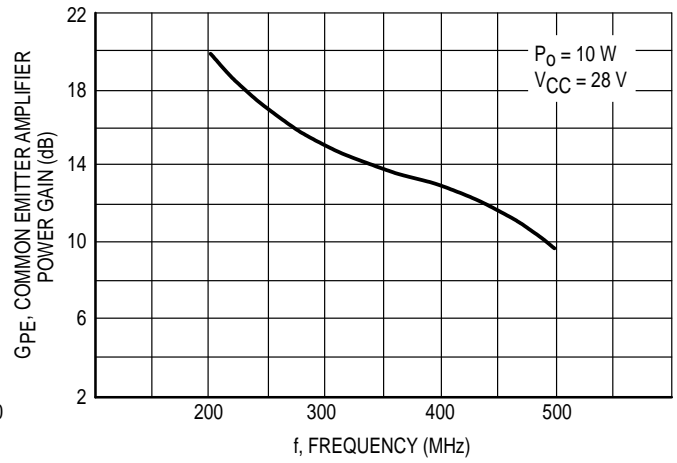
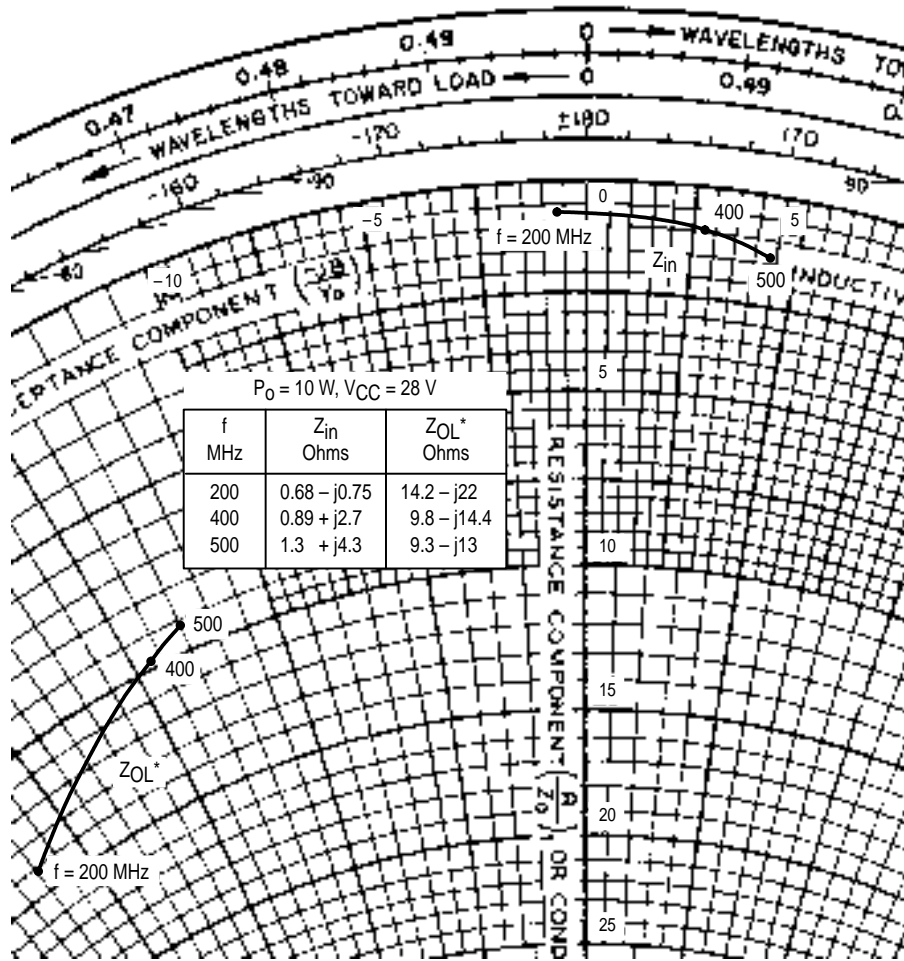


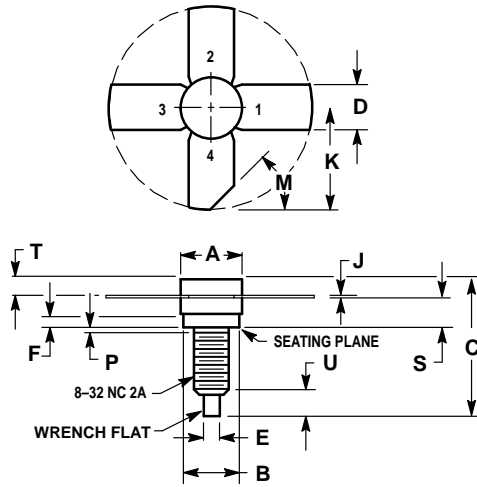
Figure 5. Power Gain versus Frequency



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

**Figure 6. Series Equivalent Impedance**


## PACKAGE DIMENSIONS



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**

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