

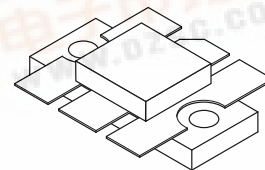
## The RF Line NPN Silicon RF Power Transistor

Designed primarily for wideband large-signal output and driver amplifier stages in the 400 to 512 MHz frequency range.

- Specified 28 Volt, 470 MHz Characteristics
  - Output Power = 80 Watts
  - Minimum Gain = 7.3 dB
  - Efficiency = 50% (Min)
- Built-In Matching Network for Broadband Operation
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Gold Metallization System for High Reliability Applications

**MRF338**

**80 W, 400 to 512 MHz  
 CONTROLLED "Q"  
 BROADBAND RF POWER  
 TRANSISTOR  
 NPN SILICON**



CASE 333-04, STYLE 1

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	30	Vdc
Collector-Base Voltage	$V_{CBO}$	60	Vdc
Emitter-Base Voltage	$V_{EBO}$	4	Vdc
Collector Current — Continuous — Peak	$I_C$	9 12	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1) Derate above $25^\circ\text{C}$	$P_D$	250 1.43	Watts $W/^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	-65 to +150	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	$R_{\theta JC}$	0.7	$^\circ\text{C/W}$

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

Characteristic	Symbol	Min	Typ	Max	Unit
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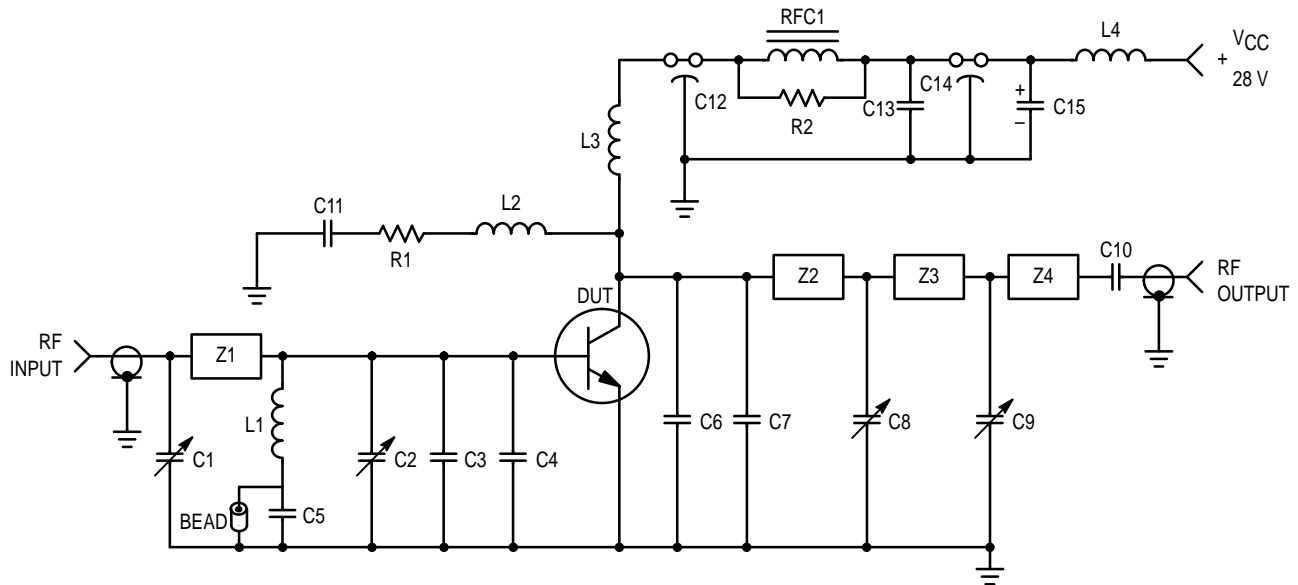
### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage ( $I_C = 80 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	30	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 80 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	60	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 8 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4	—	—	Vdc

- (1) This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.  
 (2) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Base Breakdown Voltage ( $I_C = 80\text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	60	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 30\text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	—	5	mAdc
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 4\text{ Adc}$ , $V_{CE} = 5\text{ Vdc}$ )	$h_{FE}$	20	—	80	—
<b>DYNAMIC CHARACTERISTICS</b>					
Output Capacitance ( $V_{CB} = 28\text{ Vdc}$ , $I_E = 0$ , $f = 1\text{ MHz}$ )	$C_{ob}$	—	95	125	pF
<b>FUNCTIONAL TESTS</b> (Figure 1)					
Common–Emitter Amplifier Power Gain ( $V_{CC} = 28\text{ Vdc}$ , $P_{out} = 80\text{ W}$ , $f = 470\text{ MHz}$ )	$G_{PE}$	7.3	8.8	—	dB
Collector Efficiency ( $V_{CC} = 28\text{ Vdc}$ , $P_{out} = 80\text{ W}$ , $f = 470\text{ MHz}$ )	$\eta$	50	60	—	%
Load Mismatch ( $V_{CC} = 28\text{ Vdc}$ , $P_{out} = 80\text{ W}$ , $f = 470\text{ MHz}$ , $VSWR = 30:1$ , All Phase Angles at Frequency of Test)	$\psi$	No Degradation in Output Power			



Bead	Ferroxcube #56–590–65/3B	L3	3 Turns #18 AWG, 0.185" ID, Close Wound
C1, C2, C8, C9	0.8–20 pF, Johanson (JMC 5501)	L4	4 Turns #18 AWG, 0.185" ID, Close Wound
C3, C4, C6, C7	25 pF, 100 V, Underwood	RFC1	Ferroxcube VK200 19/4B
C5, C10	100 pF, 100 V, Underwood	R1, R2	10 $\Omega$ , 2.0 Watt Carbon
C11, C13	0.1 $\mu\text{F}$ , Erie Redcap	Z1	0.190" W x 2.5" L, Microstrip Lin
C12, C14	680 pF, Feedthru	Z2	0.190" W x 0.289" L, Microstrip Line
C15	1.0 $\mu\text{F}$ , Tantalum	Z3	0.190" W x 0.55" L, Microstrip Line
L1	0.15 $\mu\text{H}$ , Molded Choke	Z4	0.190" W x 0.325" L, Microstrip Line
L2	5 Turns #20 AWG, 0.185" ID, Close Wound	Board	Glass Teflon, $t = 0.062"$ , $\epsilon_r = 2.56$

**Figure 1. 470 MHz Test Circuit**

## TYPICAL CHARACTERISTICS

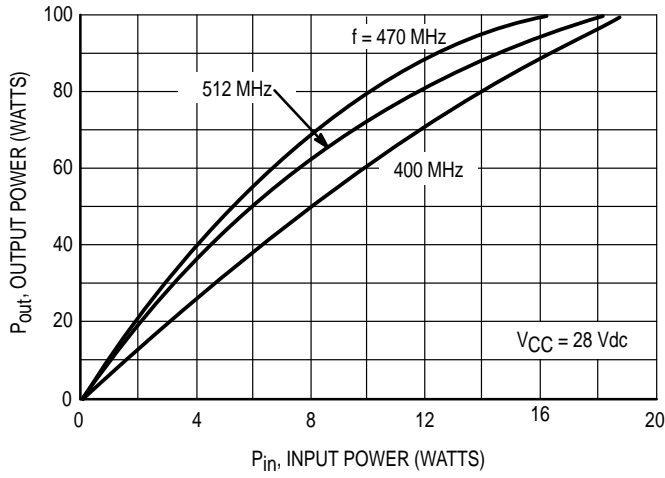


Figure 2. Output Power versus Input Power

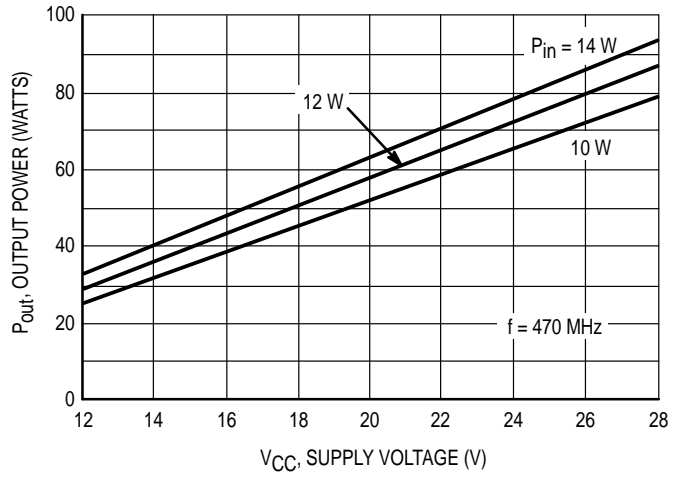


Figure 3. Output Power versus Supply Voltage

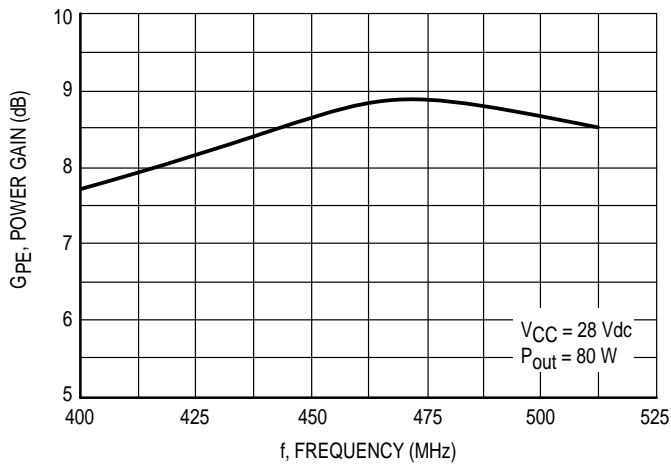


Figure 4. Power Gain versus Frequency

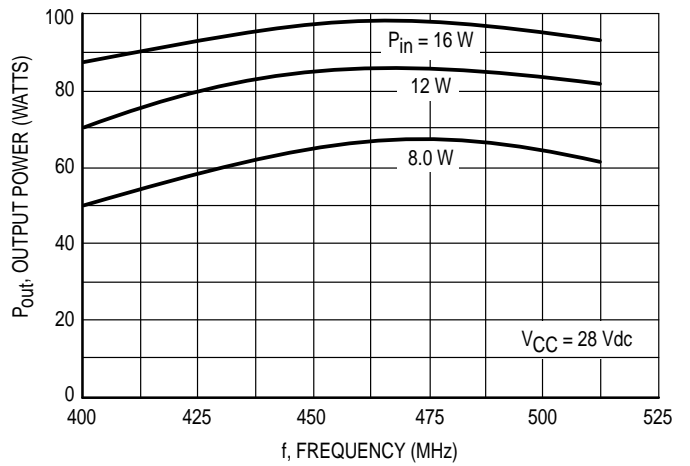
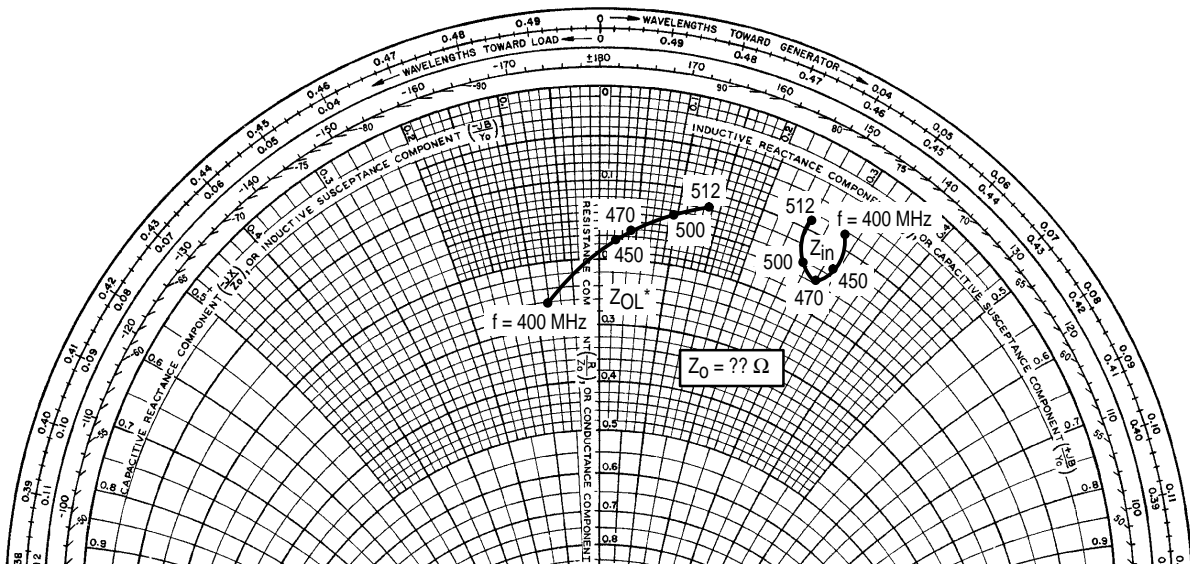


Figure 5. Output Power versus Frequency

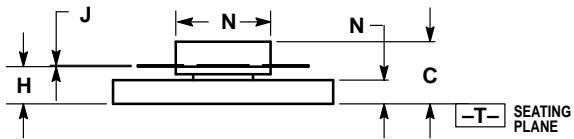
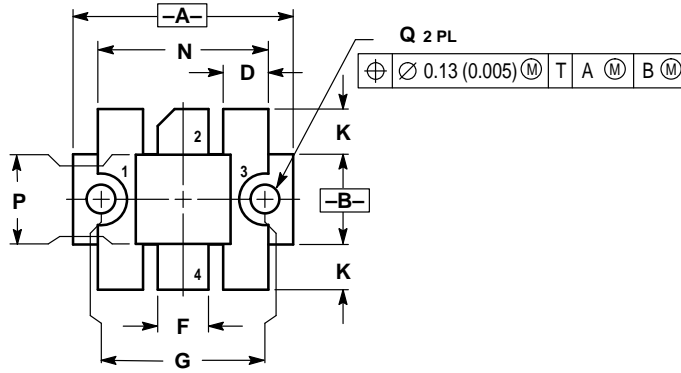


$V_{CC} = 28 \text{ V}, P_{out} = 80 \text{ W}$		
f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ Ohms
512	$0.91 + j2.61$	$1.19 + j1.34$
500	$1.47 + j2.71$	$1.33 + j0.96$
470	$1.53 + j2.98$	$1.60 + j0.45$
450	$1.27 + j3.09$	$1.70 + j0.25$
400	$0.86 + j3.01$	$2.58 - j0.79$

$Z_{OL}^*$  = 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.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.965	0.985	24.51	25.02
B	0.390	0.410	9.91	10.41
C	0.250	0.290	6.73	7.36
D	0.190	0.210	4.83	5.33
E	0.095	0.115	2.42	2.92
F	0.215	0.235	5.47	5.96
G	0.725 BSC		18.42 BSC	
H	0.155	0.175	3.94	4.44
J	0.004	0.006	0.10	0.15
K	0.195	0.205	4.95	5.21
L	0.740	0.770	18.80	19.55
N	0.415	0.425	10.54	10.80
P	0.390	0.400	9.91	10.16
Q	0.120	0.135	3.05	3.42

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

**CASE 333-04  
 ISSUE E**

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