

# The RF Line

## NPN Silicon

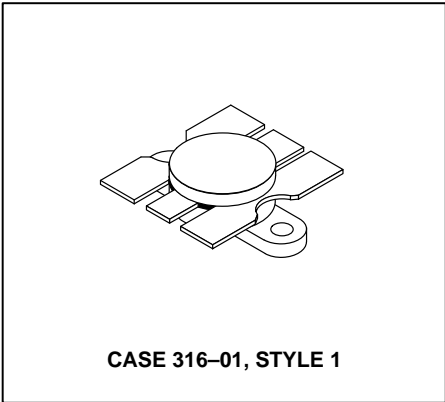
### RF Power Transistor

... designed for 12.5 Volt UHF large-signal amplifier applications in industrial and commercial FM equipment operating to 512 MHz.

- Specified 12.5 Volt, 470 MHz Characteristics —
  - Output Power = 25 Watts
  - Minimum Gain = 6.2 dB
  - Efficiency = 60%
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Built-In Matching Network for Broadband Operation
- Tested for Load Mismatch Stress at all Phase Angles with 20:1 VSWR @ 16-Volt High Line and 50% Overdrive
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.



**25 W, 470 MHz  
CONTROLLED Q  
RF POWER  
TRANSISTOR  
NPN SILICON**



#### 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	$I_C$	4.0	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ Derate above $25^\circ\text{C}$	$P_D$	103 0.59	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	$R_{\theta JC}$	1.7	$^\circ\text{C}/\text{W}$

#### 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 ( $I_C = 20 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 20 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 5.0 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CE} = 15 \text{ Vdc}$ , $V_{BE} = 0$ , $T_C = 25^\circ\text{C}$ )	$I_{CES}$	—	—	5.0	mAdc

(continued)

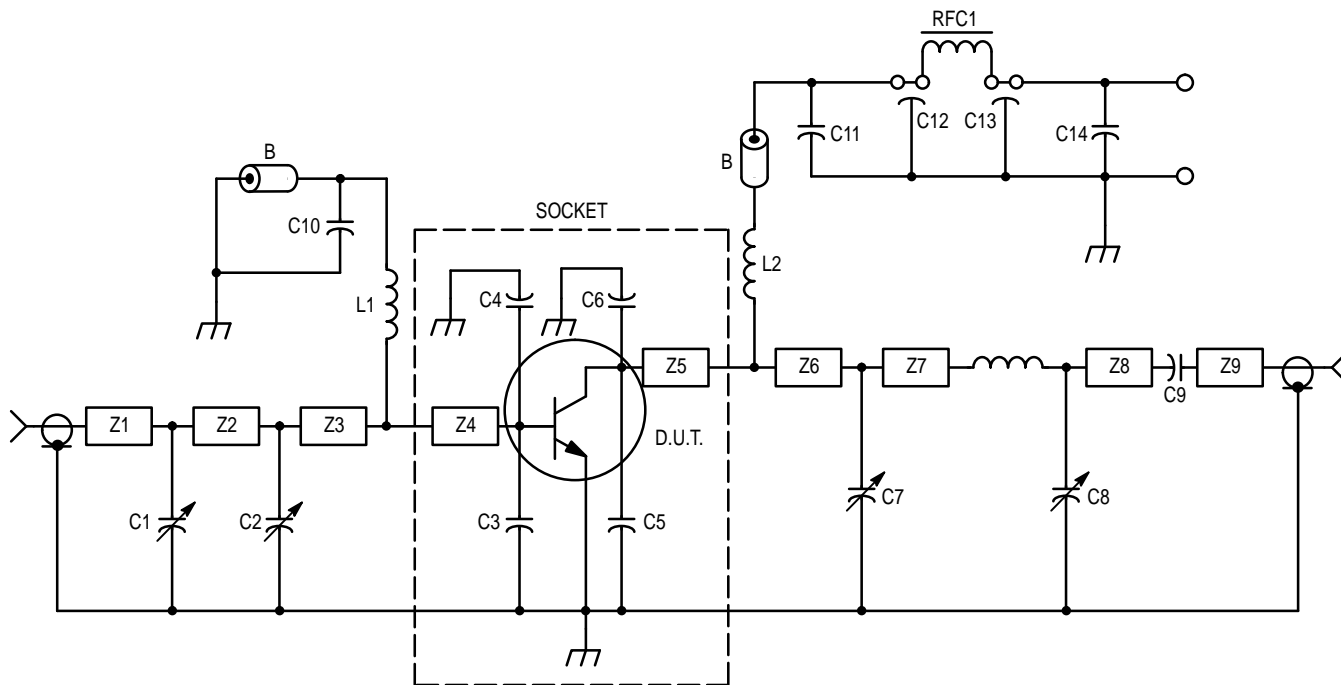
**ELECTRICAL CHARACTERISTICS — continued** ( $T_C = 25^\circ\text{C}$  unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
<b>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 4.0 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE}$	40	70	100	—
<b>DYNAMIC CHARACTERISTICS</b>					
Output Capacitance ( $V_{CB} = 12.5 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ob}$	—	60	85	pF
<b>FUNCTIONAL TESTS</b>					
Common-Emitter Amplifier Power Gain ( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 25 \text{ W}$ , $I_C (\text{MAX}) = 3.6 \text{ Adc}$ , $f = 470 \text{ MHz}$ )	$G_{pe}$	6.2	7.0	—	dB
Input Power ( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 25 \text{ W}$ , $f = 470 \text{ MHz}$ )	$P_{in}$	—	5.0	6.0	Watts
Collector Efficiency ( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 25 \text{ W}$ , $I_C (\text{MAX}) = 3.6 \text{ Adc}$ , $f = 470 \text{ MHz}$ )	$\eta$	55	60	—	%
Output Mismatch Stress ( $V_{CC} = 16 \text{ Vdc}$ , $P_{in} = \text{Note 1}$ , $f = 470 \text{ MHz}$ , $V_{SWR} = 20:1$ , All Phase Angles)	$\psi^*$	No Degradation in Output Power			
Series Equivalent Input Impedance ( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 25 \text{ W}$ , $f = 470 \text{ MHz}$ )	$Z_{in}$	—	$1.2 + j3.3$	—	Ohms
Series Equivalent Output Impedance ( $V_{CC} = 12.5 \text{ Vdc}$ , $P_{out} = 25 \text{ W}$ , $f = 470 \text{ MHz}$ )	$Z_{OL}$	—	$1.9 + j2.1$	—	Ohms

**NOTE:**

1.  $P_{in} = 150\%$  of Drive Requirement for 25 W Output at 12.5 Vdc.

\*  $\psi$  = Mismatch stress factor — the electrical criterion established to verify the device resistance to load mismatch failure. The mismatch stress test is accomplished in the standard test fixture (Figure 1) terminated in a 20:1 minimum load mismatch at all phase angles.



C1, C2, C7, C8 — 1.0–20 pF Johanson Variable  
 C3 — 27 pF 100 mil ATC  
 C4 — 30 pF 100 mil ATC  
 C5, C6 — 33 pF 100 mil ATC  
 C9 — 250 pF 100 mil ATC  
 C10 — 100 pF UNELCO  
 C11, C14 — 1.0  $\mu\text{F}$  35 V TANTALUM

C12, C13 — 680 pF Feedthrough  
 L1 — 5" #22 AWG 0.100" ID  
 L2 — 5" #20 AWG 0.187" ID  
 RFC1 — Ferroxcube VK200–20–4B  
 B — Ferroxcube Bead 56–590–65–3B  
 Z1 — 0.25" x 0.20" Microstrip  
 Z2 — 1.63" x 0.20" Microstrip

Z3 — 0.20" x 0.20" Microstrip  
 Z4, Z5 — 1/2" #18 AWG bent in a "V" shape 1/8" Wide  
 Z6 — 0.20" x 0.20" Microstrip  
 Z7 — 0.70" x 0.20" Microstrip  
 Z8 — 0.33" x 0.20" Microstrip  
 Z9 — 0.50" x 0.20" Microstrip  
 Board — 62.5 mil Glass Teflon,  $\epsilon_r = 2.55$

**Figure 1. Test Circuit Schematic**

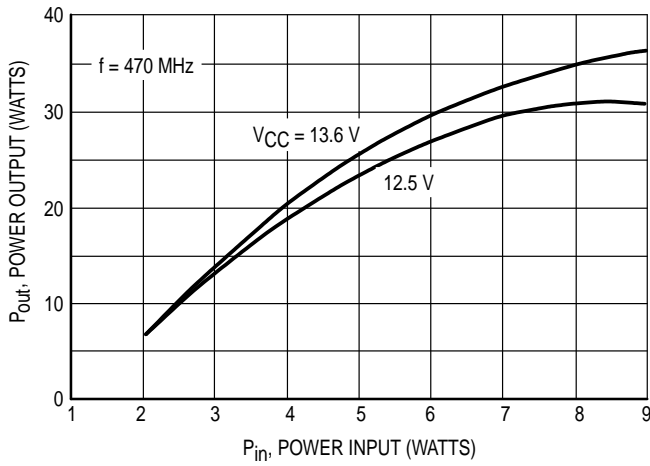


Figure 2. Power Output versus Power Input

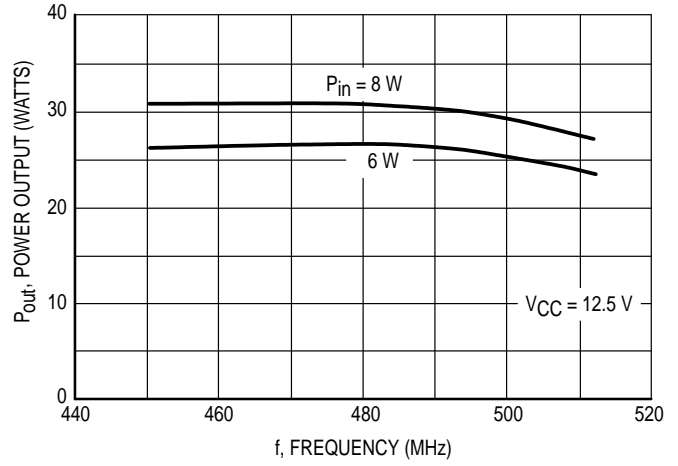


Figure 3. Power Output versus Frequency

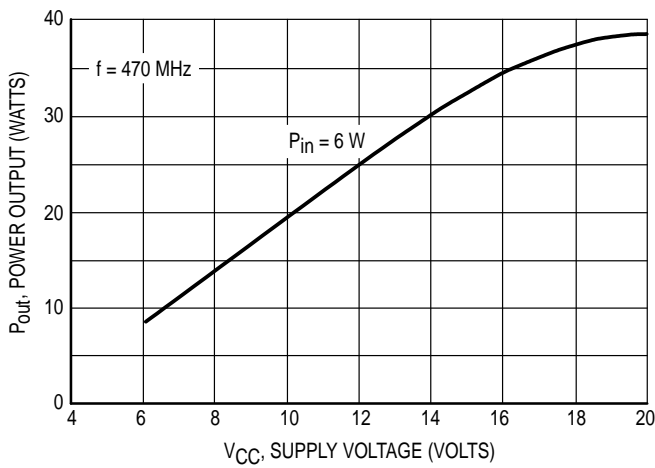


Figure 4. Power Output versus Supply Voltage

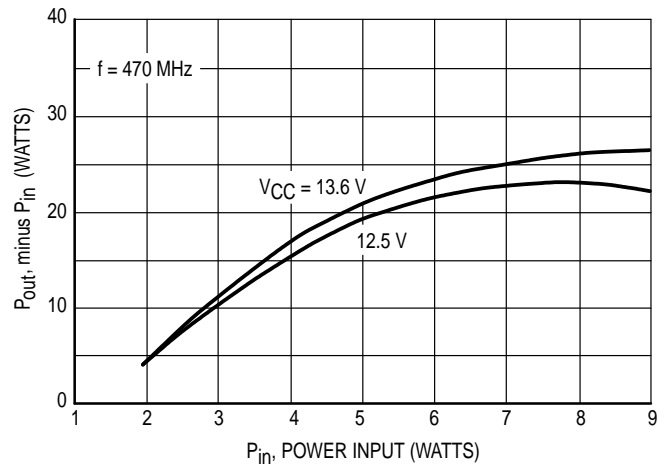


Figure 5. Power Saturation Profile

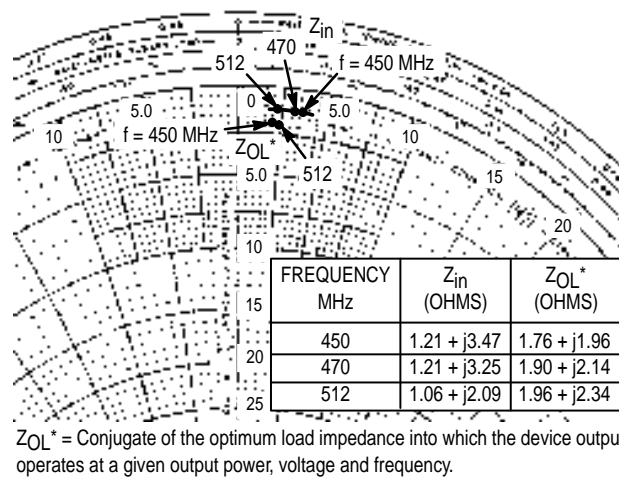
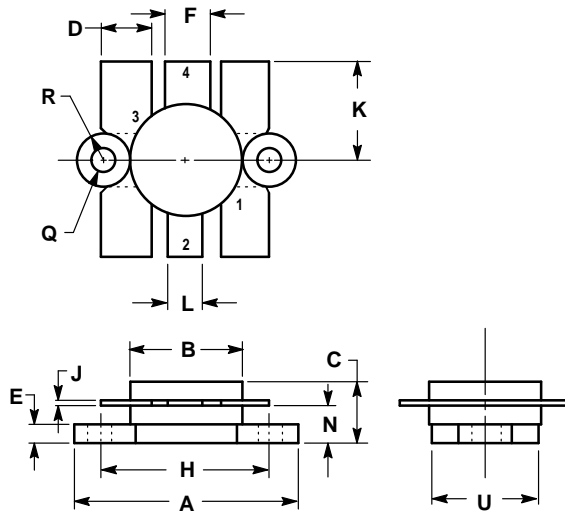


Figure 6. Series Equivalent Input-Output Impedance

## PACKAGE DIMENSIONS



**NOTES:**

1. FLANGE IS ISOLATED IN ALL STYLES.

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	24.38	25.14	0.960	0.990
B	12.45	12.95	0.490	0.510
C	5.97	7.62	0.235	0.300
D	5.33	5.58	0.210	0.220
E	2.16	3.04	0.085	0.120
F	5.08	5.33	0.200	0.210
H	18.29	18.54	0.720	0.730
J	0.10	0.15	0.004	0.006
K	10.29	11.17	0.405	0.440
L	3.81	4.06	0.150	0.160
N	3.81	4.31	0.150	0.170
Q	2.92	3.30	0.115	0.130
R	3.05	3.30	0.120	0.130
U	11.94	12.57	0.470	0.495

**STYLE 1:**

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

### CASE 316-01 ISSUE D

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