

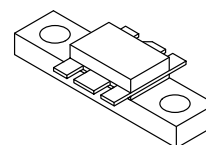
# The RF Line

## NPN Silicon

## RF Power Transistor

... designed for 12.5 volt UHF large-signal, common-base amplifier applications in industrial and commercial FM equipment operating in the range of 806–960 MHz.

- Specified 12.5 Volt, 870 MHz Characteristics
  - Output Power = 10 Watts
  - Power Gain = 6.0 dB Min
  - Efficiency = 50% Min
- Series Equivalent Large-Signal Characterization
- Internally Matched Input for Broadband Operation
- Tested for Load Mismatch Stress at All Phase Angles with 20:1 VSWR @ 15.5 Volt Supply and 50% RF Overdrive
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Silicon Nitride Passivated

**MRF840**
**10 W, 870 MHz**  
**RF POWER**  
**TRANSISTOR**  
**NPN SILICON**

**CASE 319-07, STYLE 1**
**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	$I_C$	3.8	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1) Derate above $25^\circ\text{C}$	$P_D$	40 0.32	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)	$R_{\theta JC}$	3.1	$^\circ\text{C/W}$

**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 ( $I_C = 50$ mAdc, $I_B = 0$ )	$V_{(BR)CEO}$	16	—	—	Vdc
Collector–Emitter Breakdown Voltage ( $I_C = 50$ mAdc, $V_{BE} = 0$ )	$V_{(BR)CES}$	36	—	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 5.0$ mAdc, $I_C = 0$ )	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 15$ Vdc, $I_E = 0$ )	$I_{CBO}$	—	—	2.0	mAdc

**NOTES:**

(continued)

- This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.
- 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>ON CHARACTERISTICS</b>					
DC Current Gain ( $I_C = 1.0\text{ A dc}$ , $V_{CE} = 5.0\text{ V dc}$ )	$h_{FE}$	10	—	—	—

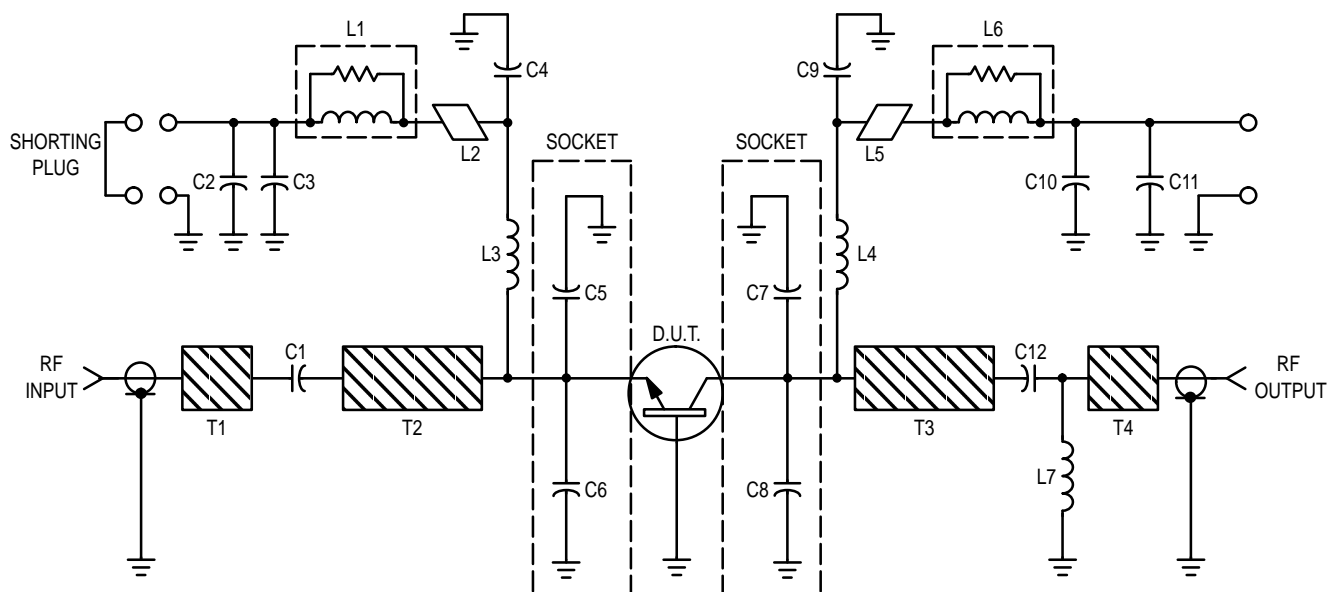
**DYNAMIC CHARACTERISTICS**

Output Capacitance ( $V_{CB} = 12.5\text{ V dc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ )	$C_{ob}$	—	24	35	pF
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**FUNCTIONAL TESTS**

Common-Base Amplifier Power Gain ( $P_{out} = 10\text{ W}$ , $V_{CC} = 12.5\text{ V dc}$ , $f = 870\text{ MHz}$ )	$G_{PE}$	6.0	7.0	—	dB
Collector Efficiency ( $P_{out} = 10\text{ W}$ , $V_{CC} = 12.5\text{ V dc}$ , $f = 870\text{ MHz}$ )	$\eta$	50	55	—	%
Load Mismatch Stress ( $V_{CC} = 15.5\text{ V dc}$ , $P_{in} = 3.0\text{ W}$ , (3) $f = 870\text{ MHz}$ , $VSWR = 20:1$ , all phase angles)	—	No Degradation in Output Power			

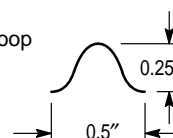
NOTE:

3.  $P_{in}$  = 150% of the typical input power requirement for 10 W output power @ 12.5 Vdc.

C1, C12 — 50 pF, 100 Mil Chip Capacitor  
 C2, C11 — 15  $\mu\text{F}$ , 20 V Tantalum  
 C3, C10 — 1000 pF, 350 V UNELCO  
 C4, C9 — 91 pF Mini-Underwood  
 C5 — 15 pF  
 C6 — 15 pF  
 C7 — 15 pF  
 C8 — 15 pF

L1, L6 — 11 Turns 20 AWG Around 10  $\Omega$  1/2 W Resistor  
 L2, L5 — Ferrite Bead  
 L3, L4 — 4 Turn 20 AWG 0.2" I.D.  
 T1, T4 —  $Z_0 = 50\ \Omega$   
 T2 —  $Z_0 = 30\ \Omega$   $\ell = \lambda/4$  @ 838 MHz  
 T3 —  $Z_0 = 13.5\ \Omega$   $\ell = \lambda/4$  @ 838 MHz

L7 — 18 AWG Wire Loop

**Figure 1. 870 MHz Test Circuit**

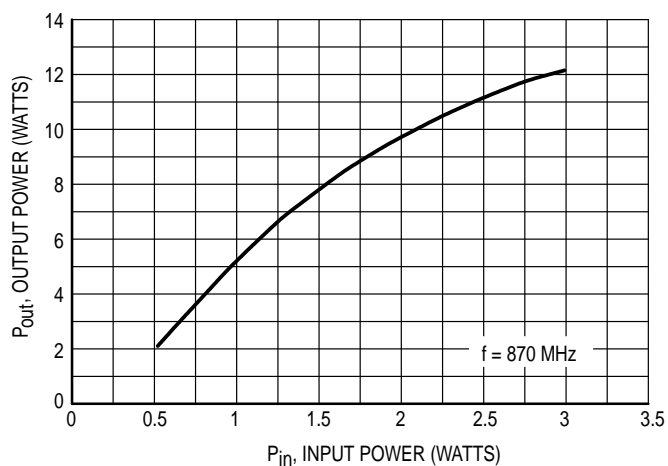


Figure 2. Output Power versus Input Power

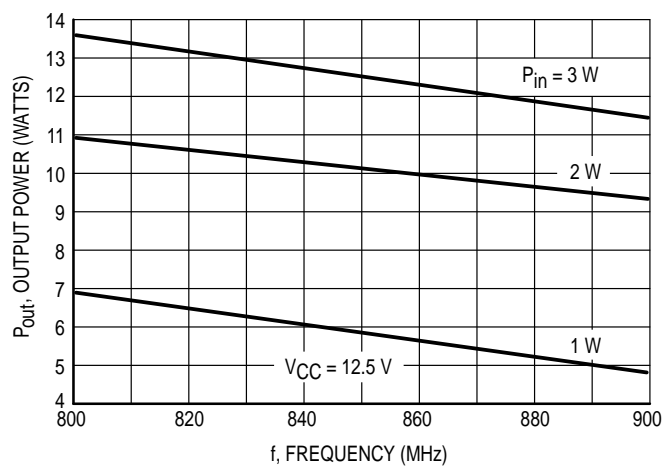


Figure 3. Output Power versus Frequency

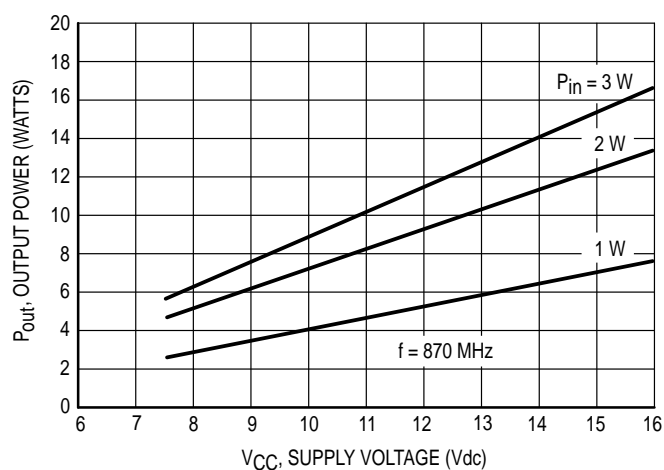
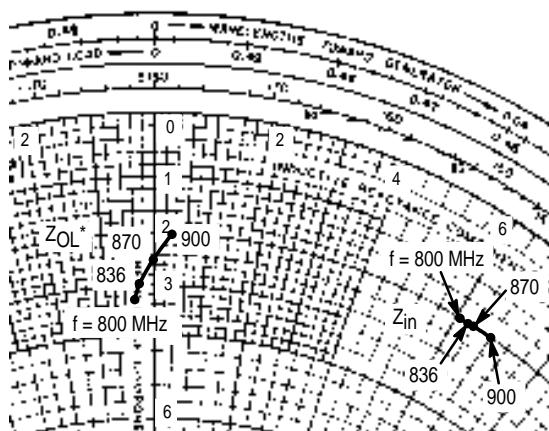


Figure 4. Output Power versus Supply Voltage



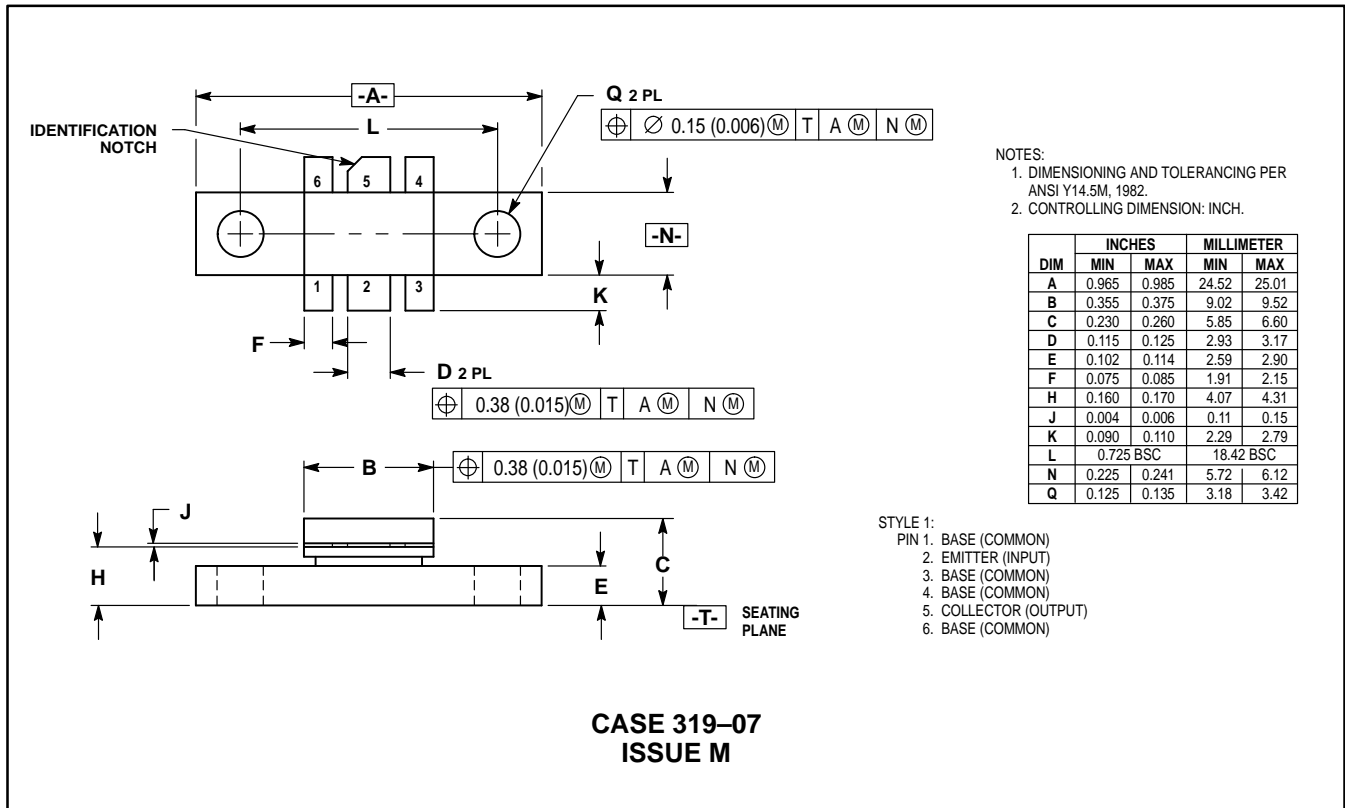
$P_{out} = 10 \text{ W}$ ,  $V_{CC} = 12.5 \text{ Vdc}$


f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ Ohms
800	$2.0 + j6.1$	$3.3 - j0.4$
836	$2.0 + j6.2$	$3.0 - j0.3$
870	$2.0 + j6.4$	$2.5 + j0.0$
900	$2.0 + j6.8$	$2.0 + j0.3$

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

Figure 5. Series Equivalent Input/Output Impedance

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