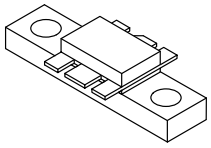
## The RF Line
# NPN Silicon RF Power Transistor

. . . 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°C (1)<br>Derate above 25°C | $P_D$ | 40<br>0.32 | Watts<br>W/°C |
| Storage Temperature Range | $T_{stg}$ | –65 to +150 | °C |

**THERMAL CHARACTERISTICS**

| Characteristic | Symbol | Max | Unit |
|---|---|---|---|
| Thermal Resistance, Junction to Case (2) | $R_{\theta JC}$ | 3.1 | °C/W |

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 25°C unless otherwise noted.)

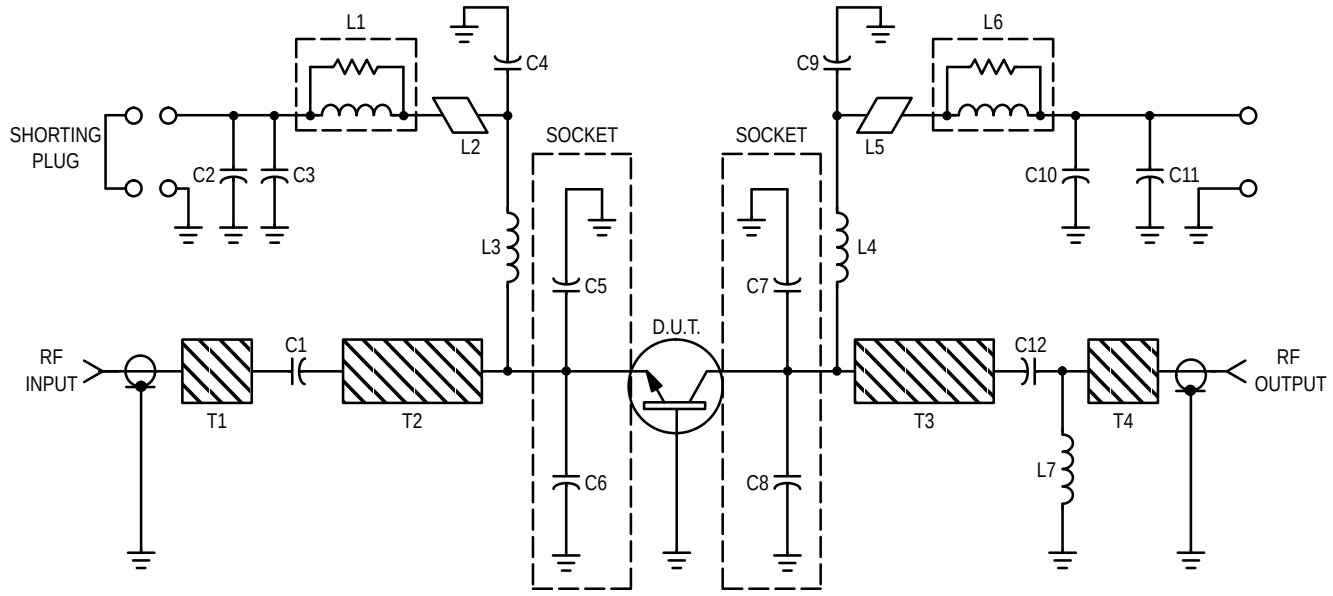
| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **OFF CHARACTERISTICS** | | | | | |
| Collector–Emitter Breakdown Voltage ($I_C$ = 50 mAdc, $I_B$ = 0) | $V_{(BR)CEO}$ | 16 | — | — | Vdc |
| Collector–Emitter Breakdown Voltage ($I_C$ = 50 mAdc, $V_{BE}$ = 0) | $V_{(BR)CES}$ | 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)
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°C unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|---|---|---|---|---|---|
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 1.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 10 | — | — | — |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 12.5 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{ob}$ | — | 24 | 35 | pF |
| **FUNCTIONAL TESTS** | | | | | |
| Common–Base Amplifier Power Gain ($P_{out}$ = 10 W, $V_{CC}$ = 12.5 Vdc, f = 870 MHz) | $G_{PE}$ | 6.0 | 7.0 | — | dB |
| Collector Efficiency ($P_{out}$ = 10 W, $V_{CC}$ = 12.5 Vdc, f = 870 MHz) | η | 50 | 55 | — | % |
| Load Mismatch Stress ($V_{CC}$ = 15.5 Vdc, $P_{in}$ = 3.0 W, (3) f = 870 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 μF, 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 Ω 1/2 W Resistor
L2, L5 — Ferrite Bead
L3, L4 — 4 Turn 20 AWG 0.2″ I.D.
T1, T4 — $Z_O$ = 50 Ω
T2 — $Z_O$ = 30 Ω $\ell$ = λ/4 @ 838 MHz
T3 — $Z_O$ = 13.5 Ω $\ell$ = λ/4 @ 838 MHz

L7 — 18 AWG Wire Loop

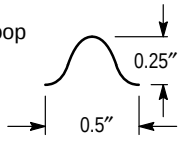



**Figure 1. 870 MHz Test Circuit**

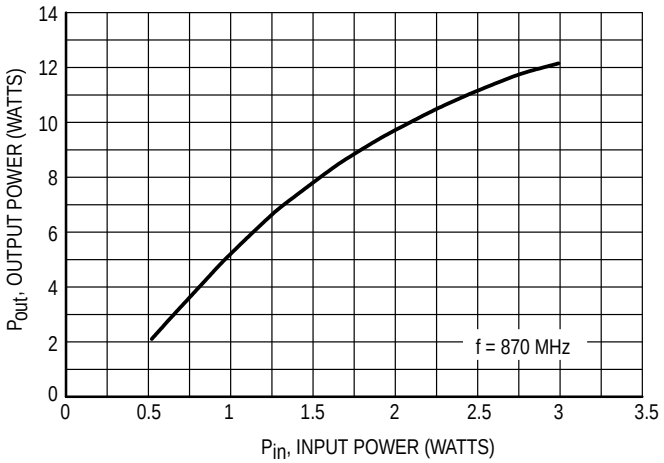



**Figure 2. Output Power versus Input Power**

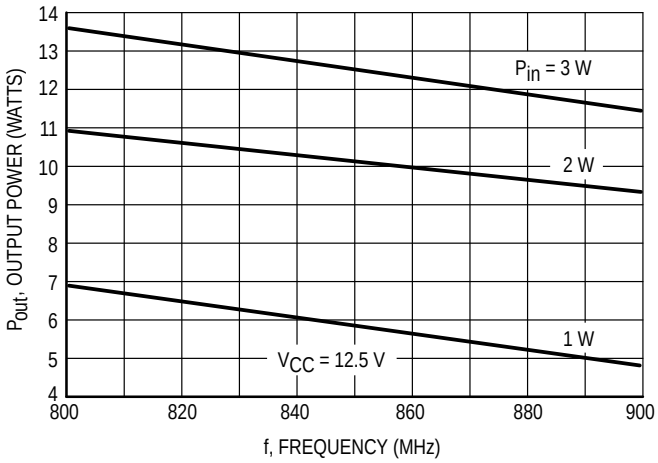



**Figure 3. Output Power versus Frequency**

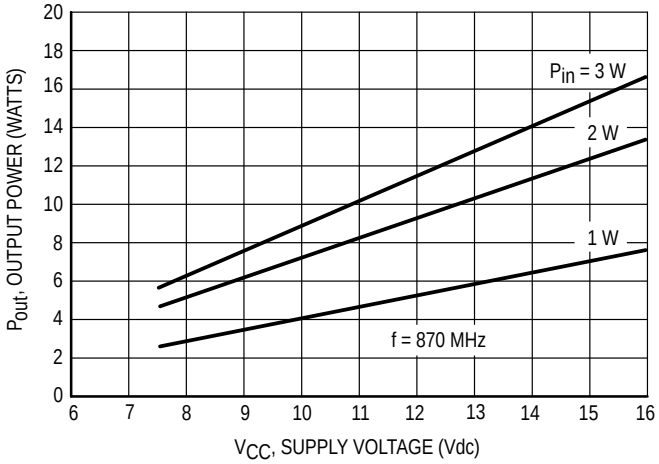
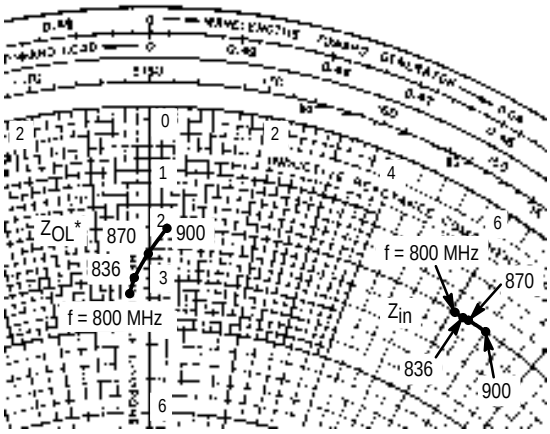



**Figure 4. Output Power versus Supply Voltage**



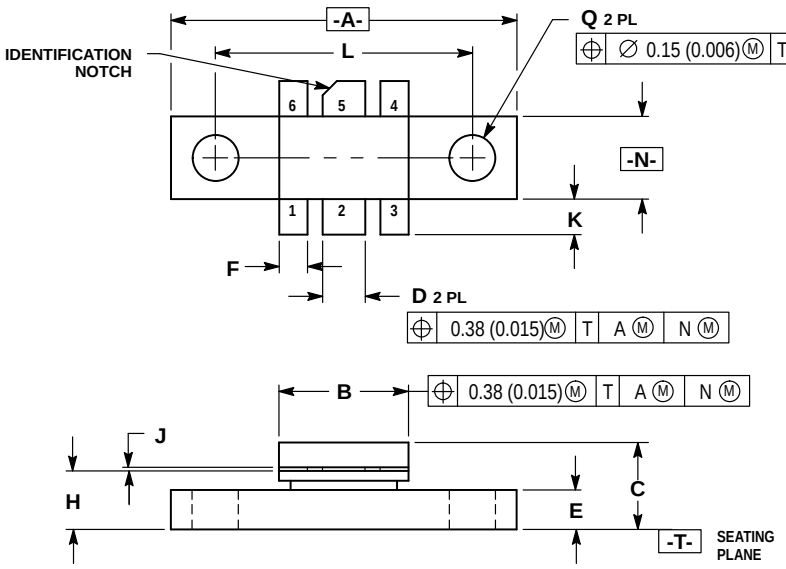

$P_{out}$ = 10 W, $V_{CC}$ = 12.5 Vdc

| f<br>MHz | $Z_{in}$<br>Ohms | $Z_{OL}$*<br>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**

## PACKAGE DIMENSIONS




NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.

| | INCHES | | MILLIMETER | |
|---|---|---|---|---|
| DIM | MIN | MAX | MIN | MAX |
| A | 0.965 | 0.985 | 24.52 | 25.01 |
| B | 0.355 | 0.375 | 9.02 | 9.52 |
| C | 0.230 | 0.260 | 5.85 | 6.60 |
| D | 0.115 | 0.125 | 2.93 | 3.17 |
| E | 0.102 | 0.114 | 2.59 | 2.90 |
| F | 0.075 | 0.085 | 1.91 | 2.15 |
| H | 0.160 | 0.170 | 4.07 | 4.31 |
| J | 0.004 | 0.006 | 0.11 | 0.15 |
| K | 0.090 | 0.110 | 2.29 | 2.79 |
| L | 0.725 BSC | | 18.42 BSC | |
| N | 0.225 | 0.241 | 5.72 | 6.12 |
| Q | 0.125 | 0.135 | 3.18 | 3.42 |

STYLE 1:
PIN 1. BASE (COMMON)
2. EMITTER (INPUT)
3. BASE (COMMON)
4. BASE (COMMON)
5. COLLECTOR (OUTPUT)
6. BASE (COMMON)

**CASE 319–07**
**ISSUE M**



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