# MRF846

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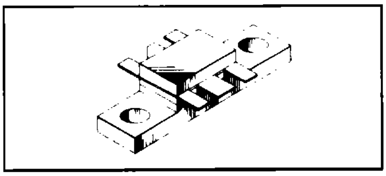
## The RF Line

40 W-870 MHz

RF POWER
TRANSISTOR

NPN SILICON



### 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 = 40 Watts
  Minimum Gain = 4.3 dB
  Efficiency = 50%
- Series Equivalent Large-Signal Characterization
- Internally Matched Input for Broadband Operation
- Tested for Load Mismatch Stress at All Phase Angles with 10:1 VSWR @ High Line and RF Overdrive
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Silicon Nitride Passivated

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

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

| DIM | MILLIMETERS MIN | MILLIMETERS MAX | INCHES MIN | INCHES MAX |
|---|---|---|---|---|
| A | 24.52 | 25.01 | 0.965 | 0.985 |
| B | 9.02 | 9.52 | 0.355 | 0.375 |
| C | 5.85 | 6.60 | 0.230 | 0.260 |
| D | 2.93 | 3.17 | 0.115 | 0.125 |
| E | 2.70 | 2.94 | 0.106 | 0.116 |
| F | 1.91 | 2.15 | 0.075 | 0.085 |
| H | 4.07 | 4.31 | 0.160 | 0.170 |
| J | 0.11 | 0.15 | 0.004 | 0.006 |
| K | 2.29 | 2.79 | 0.090 | 0.110 |
| L | 18.42 BSC | | 0.725 BSC | |
| N | 5.72 | 6.12 | 0.225 | 0.241 |
| Q | 3.18 | 3.42 | 0.125 | 0.135 |

CASE 319-06

### 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 | $I_C$ | 14.0 | Adc |
| Total Device Dissipation @ $T_C = 25°C$ (1)<br>Derate Above 25°C | $P_D$ | 150<br>0.86 | 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) | $R_{\theta JC}$ | 1.17 | °C/W |

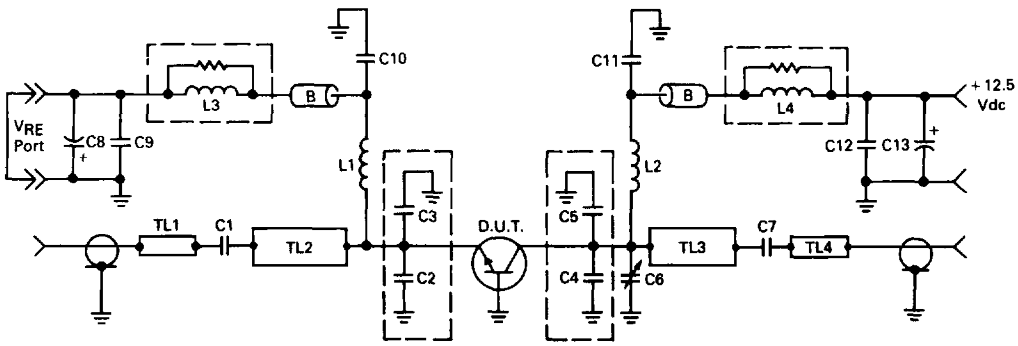
(1) This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF amplifier.
(2) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

**ELECTRICAL CHARACTERISTICS** ($T_C$ = 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 ($I_E$ = 10 mAdc, $I_C$ = 0) | $V_{(BR)EBO}$ | 4.0 | – | – | Vdc |
| Collector Cutoff Current ($V_{CB}$ = 15 Vdc, $I_E$ = 0) | $I_{CBO}$ | – | – | 10 | mAdc |
| **ON CHARACTERISTICS** | | | | | |
| DC Current Gain ($I_C$ = 2.0 Adc, $V_{CE}$ = 5.0 Vdc) | $h_{FE}$ | 10 | 50 | – | – |
| **DYNAMIC CHARACTERISTICS** | | | | | |
| Output Capacitance ($V_{CB}$ = 12.5 Vdc, $I_E$ = 0, f = 1.0 MHz) | $C_{ob}$ | – | 85 | 120 | pF |
| **FUNCTIONAL TEST** | | | | | |
| Common-Base Amplifier Power Gain ($P_{out}$ = 40 W, $V_{CC}$ = 12.5 Vdc, f = 870 MHz) | $G_{PB}$ | 4.3 | 5.2 | – | dB |
| Collector Efficiency ($P_{out}$ = 40 W, $V_{CC}$ = 12.5 Vdc, f = 870 MHz) | $\eta$ | 50 | 55 | – | % |
| Load Mismatch Stress ($V_{CC}$ = 15.5 Vdc, $P_{in}$ = 15 W, f = 870 MHz, VSWR = 10:1, all phase angles) | – | No Degradation in Output Power | | | |

*$P_{in}$ = 125% of the typical input power requirement for 40 W output power @ 12.5 Vdc.

**FIGURE 1 — 870 MHz TEST CIRCUIT SCHEMATIC**




C1 — 43 pF, 100 Mil Chip Capacitor
C2 — 12 pF Mini-Unelco
C3 — 15 pF Mini-Unelco
C4 — 21 pF Mini-Unelco
C5 — 18 pF Mini-Unelco
C6 — 0.8–8.0 pF Johanson Gigatrim
C7 — 47 pF, 100 Mil Chip Capacitor
C8 — 10 μF, 25 WV
C9, C12 — 1000 pF Unelco J101
C10, C11 — 91 pF Mini-Unelco
C13 — 25 μF, 25 WV

L1, L2 — 4 Turns #18 Enameled; 200 Mil ID
L3, L4 — 15 Turns #24 Enameled Over 12 ohm Carbon Resistor
B — Ferrite Bead; Ferroxcube 56-590-65-3B
TL1, TL4 — Micro Strip; 50 Ω
TL2 — Micro Strip; $Z_o$ = 34 Ω, λ/4 @ 838 MHz
TL3 — Micro Strip; $Z_o$ = 30 Ω, λ/4 @ 838 MHz
Board — 0.032" Glass Teflon
2 oz. Cu CLAD, $\epsilon_r$ = 2.55

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FIGURE 2 – OUTPUT POWER versus INPUT POWER

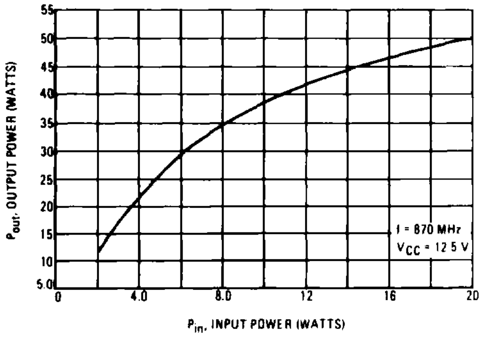



FIGURE 3 – OUTPUT POWER versus FREQUENCY

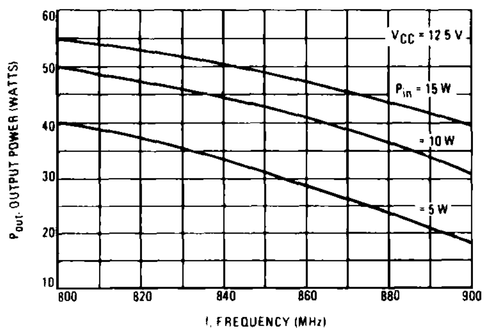



FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

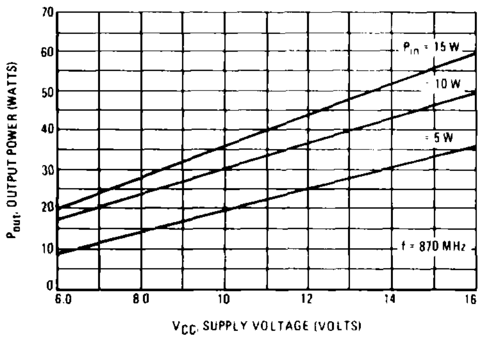



FIGURE 5 — 870 MHz TEST CIRCUIT

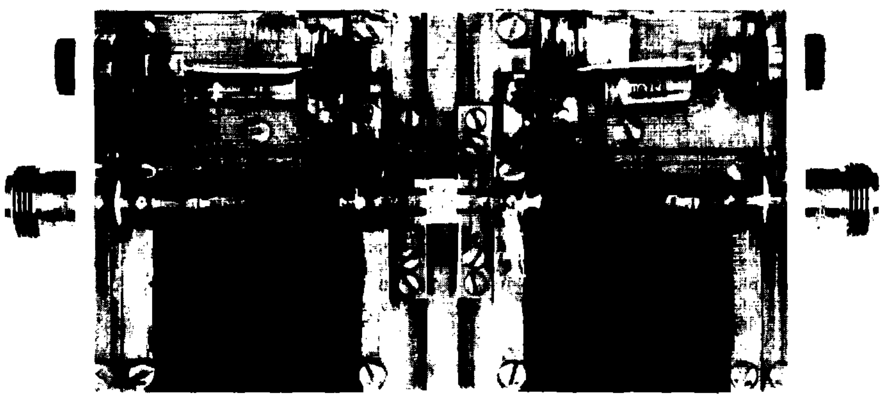
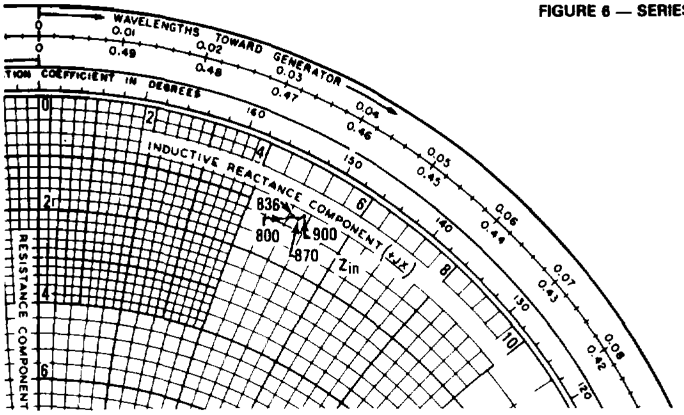


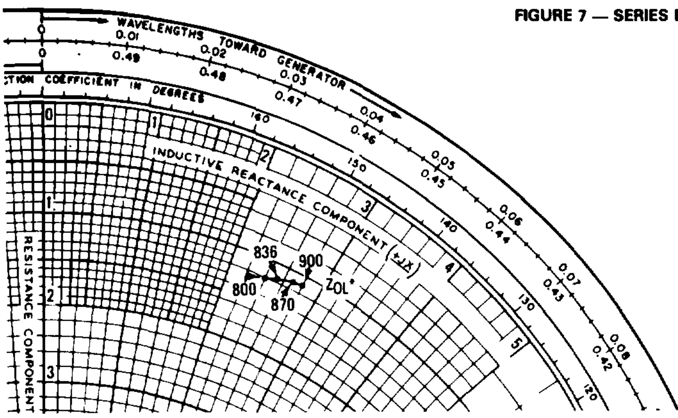
FIGURE 6 — SERIES EQUIVALENT INPUT IMPEDANCES




$V_{CC}$ = 12.5 Vdc, $P_{in}$ = 12 W

| f MHz | $Z_{in}$ Ohms |
|---|---|
| 800 | 1.1 + j4.8 |
| 836 | 1.0 + j4.9 |
| 870 | 1.0 + j5.0 |
| 900 | 0.9 + j5.1 |

FIGURE 7 — SERIES EQUIVALENT OUTPUT IMPEDANCES




$V_{CC}$ = 12.5 Vdc, $P_{out}$ = 40 W

| f MHz | $Z_{OL}$* Ohms |
|---|---|
| 800 | 1.2 + j2.4 |
| 836 | 1.15 + j2.5 |
| 870 | 1.1 + j2.7 |
| 900 | 1.1 + j2.8 |

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