

# The RF Line

## NPN Silicon

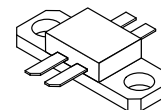
### RF Power Transistor

**MRF897R**

Designed for 24 Volt UHF large-signal, common emitter, class-AB linear amplifier applications in industrial and commercial FM/AM equipment operating in the range 800-970 MHz.

- Specified 24 Volt, 900 MHz Characteristics
  - Output Power = 30 Watts
  - Minimum Gain = 10.5 dB @ 900 MHz, class-AB
  - Minimum Efficiency = 30% @ 900 MHz, 30 Watts (PEP)
  - Maximum Intermodulation Distortion -30 dBc @ 30 Watts (PEP)
- Characterized with Series Equivalent Large-Signal Parameters from 800 to 960 MHz
- Silicon Nitride Passivated
- 100% Tested for Load Mismatch Stress at all Phase Angles with 5:1 VSWR @ 26 Vdc, and Rated Output Power
- Gold Metalized, Emitter Ballasted for Long Life and Resistance to Metal-Migration
- Circuit Board Photomaster Available by Ordering Document MRF897RPHT/D from Motorola Literature Distribution.

**30 W, 900 MHz**  
**RF POWER**  
**TRANSISTOR**  
**NPN SILICON**



CASE 395B-01, STYLE 1

#### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	$V_{CEO}$	30	Vdc
Collector-Emitter Voltage	$V_{CES}$	60	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 $25^\circ\text{C}$	$P_D$	105 0.60	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	$R_{\theta JC}$	1.67	$^\circ\text{C}/\text{W}$

#### 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 ( $I_C = 50 \text{ mAdc}$ , $I_B = 0$ )	$V_{(BR)CEO}$	30	33	—	Vdc
Collector-Emitter Breakdown Voltage ( $I_C = 50 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	60	80	—	Vdc
Emitter-Base Breakdown Voltage ( $I_E = 5 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	4.0	4.7	—	Vdc
Collector Cutoff Current ( $V_{CE} = 30 \text{ Vdc}$ , $V_{BE} = 0$ , $T_C = 25^\circ\text{C}$ )	$I_{CES}$	—	—	10.0	mAdc

#### ON CHARACTERISTICS

DC Current Gain ( $I_{CE} = 1.0 \text{ Adc}$ , $V_{CE} = 5 \text{ Vdc}$ )	$h_{FE}$	30	80	120	—
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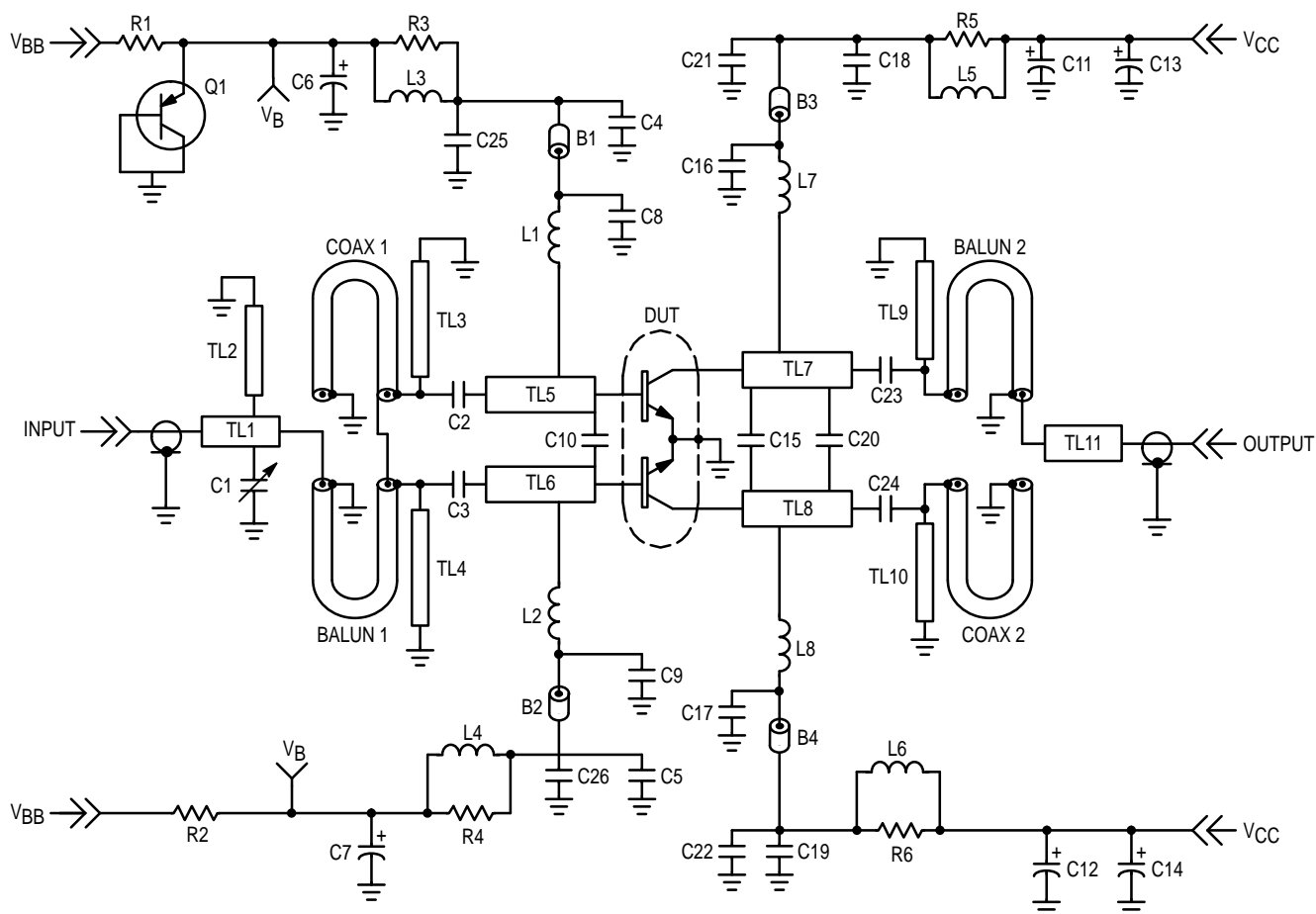
#### DYNAMIC CHARACTERISTICS

Output Capacitance ( $V_{CB} = 24 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ )	$C_{ob}$	14	21	28	pF
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(continued)

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

Characteristic	Symbol	Min	Typ	Max	Unit
<b>FUNCTIONAL CHARACTERISTICS</b>					
Common-Emitter Amplifier Power Gain ( $V_{CC} = 24\text{ Vdc}$ , $P_{out} = 30\text{ Watts (PEP)}$ , $I_{CQ} = 125\text{ mA}$ , $f_1 = 900\text{ MHz}$ , $f_2 = 900.1\text{ MHz}$ )	$G_{pe}$	10.5	12.0	—	dB
Collector Efficiency ( $V_{CC} = 24\text{ Vdc}$ , $P_{out} = 30\text{ Watts (PEP)}$ , $I_{CQ} = 125\text{ mA}$ , $f_1 = 900\text{ MHz}$ , $f_2 = 900.1\text{ MHz}$ )	$\eta$	30	38	—	%
Intermodulation Distortion ( $V_{CC} = 24\text{ Vdc}$ , $P_{out} = 30\text{ Watts (PEP)}$ , $I_{CQ} = 125\text{ mA}$ , $f_1 = 900\text{ MHz}$ , $f_2 = 900.1\text{ MHz}$ )	IMD	—	-37	-30	dBc
Output Mismatch Stress ( $V_{CC} = 26\text{ Vdc}$ , $P_{out} = 30\text{ Watts (PEP)}$ , $I_{CQ} = 125\text{ mA}$ , $f_1 = 900\text{ MHz}$ , $f_2 = 900.1\text{ MHz}$ , Load VSWR = 5:1 (all phase angles))	$\psi$	No Degradation in Output Power			



B1, B2, B3, B4 — Short Ferrite Bead, Fair Rite #2743019447  
 C1 — 0.8–8.0 pF Var Capacitor, Johansen Gigatrim  
 C2, C3, C23, C24 — 43 pF, 100 mil, ATC Chip Capacitor  
 C4, C5, C21, C22 — 1000 pF, 100 mil, ATC Chip Capacitor  
 C6, C7, C11, C12 — 10  $\mu\text{F}$ , Electrolytic Capacitor, Panasonic  
 C8, C9, C16, C17 — 100 pF, 100 mil, ATC Chip Capacitor  
 C10 — 9.1 pF, 50 mil, ATC Chip Capacitor  
 C13 — 250  $\mu\text{F}$  Electrolytic Capacitor, Mallory  
 C14, C18, C19, C25 — 0.1  $\mu\text{F}$ , Chip Capacitor, Kemet  
 C15 — 1.1 pF, 50 mil, ATC Chip Capacitor  
 C20 — 6.8 pF, 100 mil, ATC Chip Capacitor  
 L1, L2, L3, L4, L5, L6, L7, L8 — 5 Turns 20 AWG,  
 IDIA 0.126" Choke, Taylor Spring 46 nH

N1, N2 — Type N Flange Mount, Omni Spectra 3052–1648–10  
 Q1 — Bias Transistor BD136 PNP  
 R1, R12 — 27 Ohm, 2.0 W  
 R3, R4, R5, R6 — 4.0 x 39 Ohm, 1/8 W, Chips Resistors in  
 Parallel, Rohm 390–J  
 SB1 — 0.15" x 0.3" x 0.03" Cu  
 TL1–TL11 — Microstrip Line, See Photomaster  
 Balun1, Balun2, Coax 1, Coax 2 — 2.20" 50 Ohm, 0.086" o.d.  
 semi-rigid coax, Micro Coax  
 UT–85–M17  
 Circuit Board — 1/32" Glass Teflon, Arlon GX–0300–55–22,  
 $\epsilon_r = 2.55$

**Figure 1. 840–900 MHz Test Circuit Schematic**

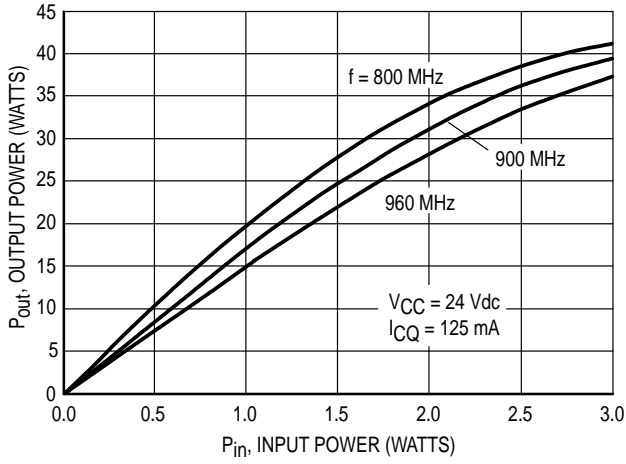


Figure 2. Output Power versus Input Power

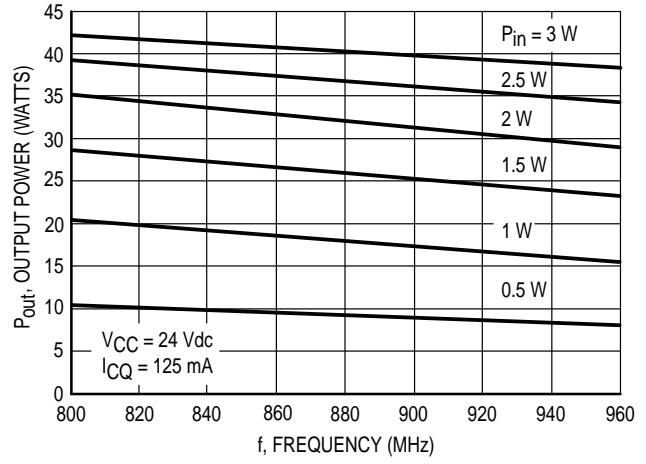


Figure 3. Output Power versus Frequency

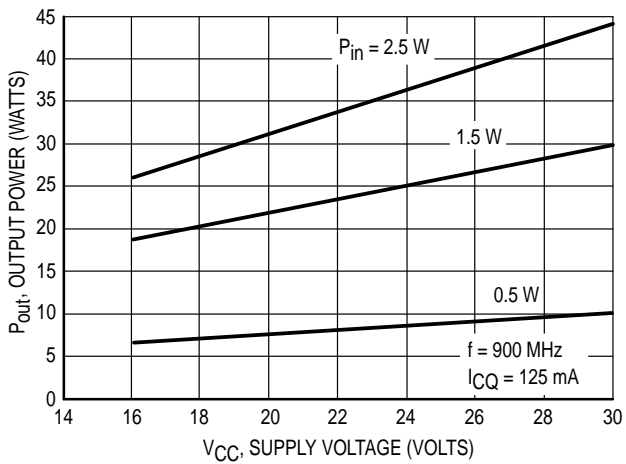


Figure 4. Output Power versus Supply Voltage

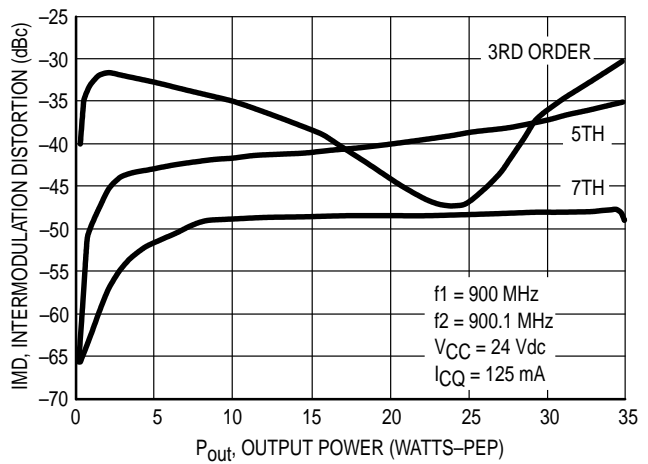


Figure 5. Intermodulation versus Output Power

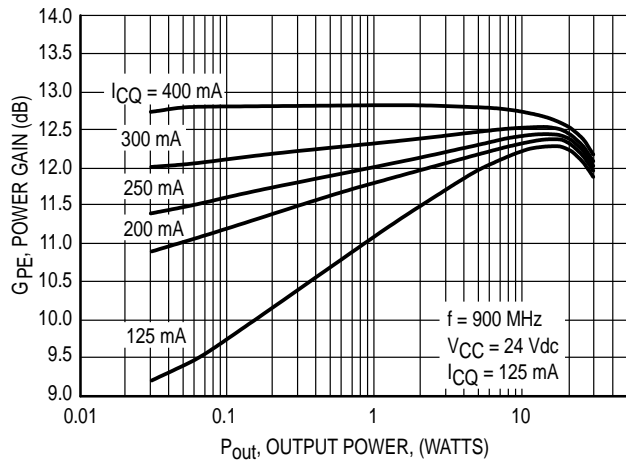


Figure 6. Power Gain versus Output Power

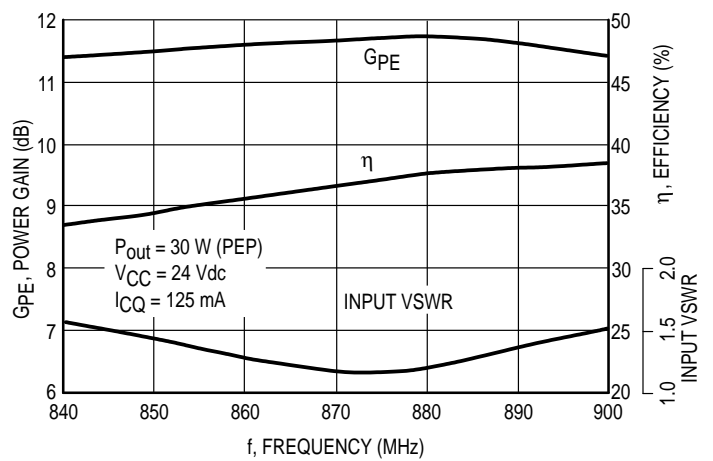
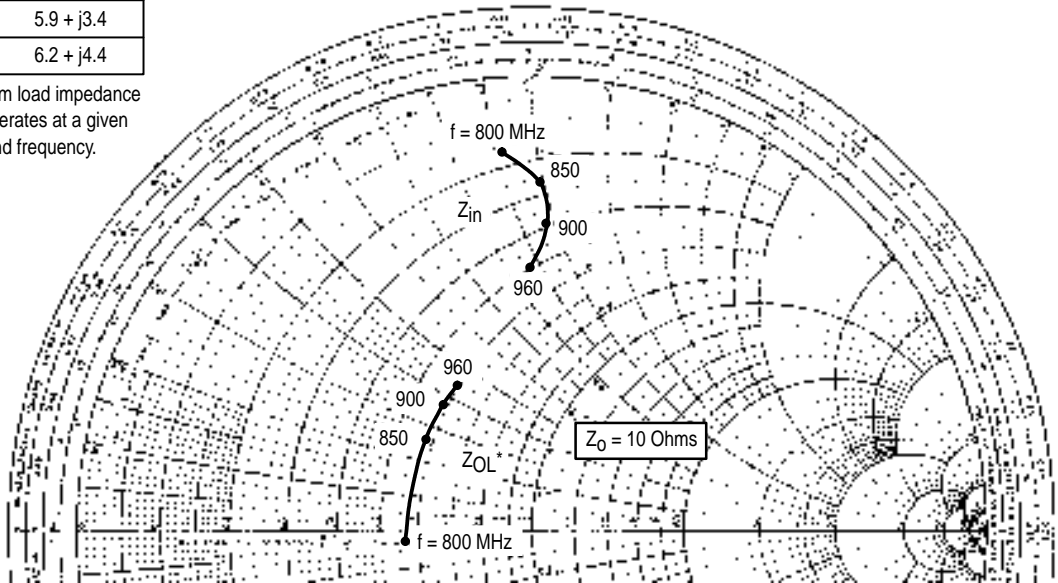


Figure 7. Broadband Test Fixture Performance

$P_{out} = 30 \text{ W (PEP)}$ ,  $V_{CC} = 24 \text{ V}$

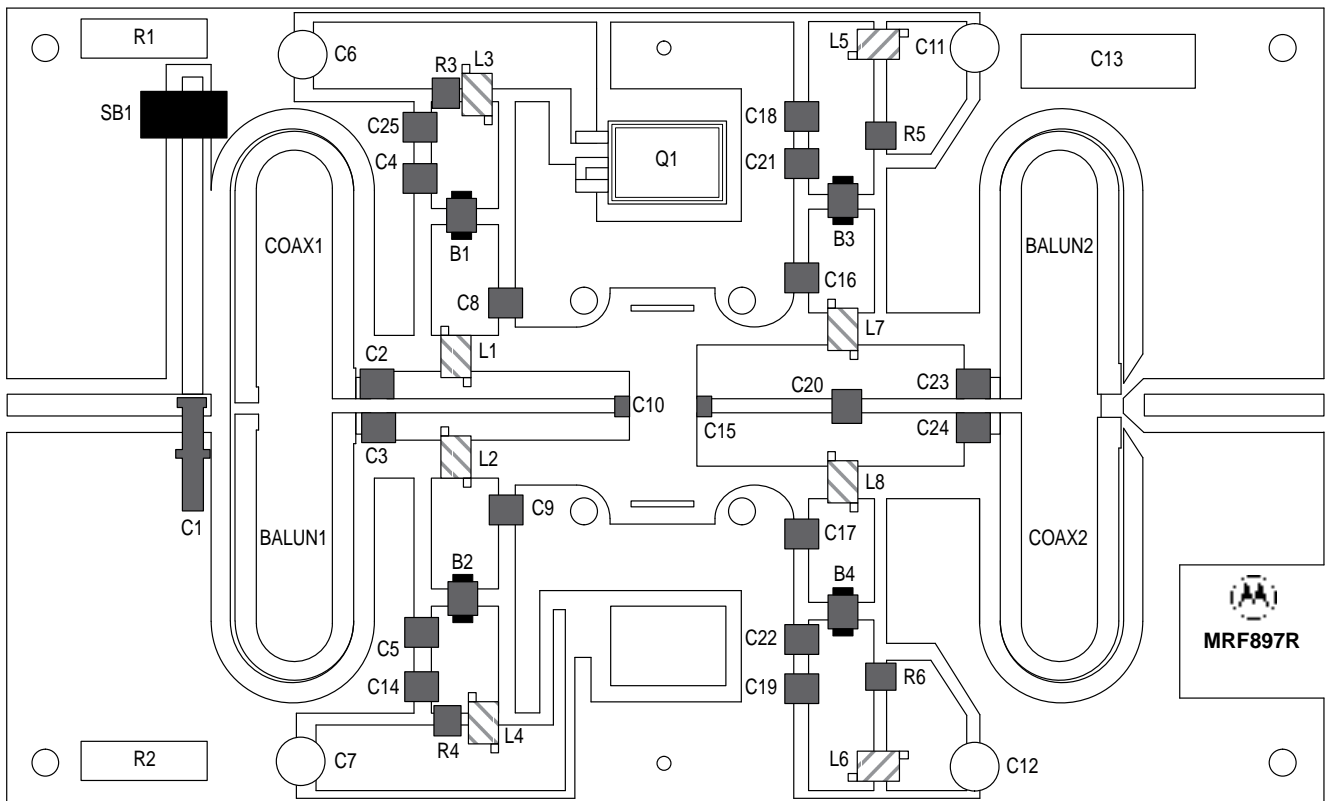
f MHz	$Z_{in}$ Ohms	$Z_{OL}^*$ Ohms
800	$1.7 + j9.2$	$5.9 - j0.4$
850	$2.6 + j10$	$5.7 + j2.6$
900	$4 + j9.9$	$5.9 + j3.4$
950	$5 + j8.8$	$6.2 + j4.4$

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




NOTE:  $Z_{in}$  &  $Z_{OL}^*$  are given from base-to-base and collector-to-collector respectively.

**Figure 8. Series Equivalent Input/Output Impedances**



**Figure 9. 840–900 MHz Test Circuit Component Layout**



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