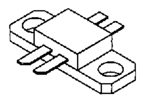
The RF Line
NPN Silicon RF Power Transistor

MRF860

Designed for 24 Volt UHF large–signal, common emitter, class A linear amplifier applications in industrial and commercial equipment operating in the range of 800–960 MHz.

- Specified for V_{CE} = 24 Vdc, I_C = 1.9 Adc Characteristics
  Output Power = 13.7 Watts CW
  Minimum Power Gain = 11 dB
  Minimum ITO = +51.5 dBm
  Typical Noise Figure = 6.5 dB
- Characterized with Small–Signal S–Parameters and Series Equivalent Large–Signal Parameters from 800–960 MHz
- Silicon Nitride Passivated
- 100% Tested for Load Mismatch Stress at All Phase Angles with 30:1 VSWR @ 24 Vdc, I_C = 1.9 Adc and Rated Output Power
- Will Withstand RF Input Overdrive of 3.25 W CW
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.

**CLASS A
800–960 MHz
13.7 W (CW), 24 V
NPN SILICON
RF POWER TRANSISTOR**



CASE 395B–01, STYLE 1

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	30	Vdc
Collector–Base Voltage	V_{CBO}	60	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Total Device Dissipation @ T_C = 60°C Derate above 60°C	P_D	71 0.51	Watts W/°C
Operating Junction Temperature	T_J	200	°C
Storage Temperature Range	T_{stg}	–65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance (T_J = 150°C, T_C = 60°C)	$R_{\theta JC}$	1.9	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (1)					
Collector–Emitter Breakdown Voltage (I_C = 50 mA, I_B = 0)	$V_{(BR)CEO}$	28	33	—	Vdc
Collector–Emitter Breakdown Voltage (I_C = 50 mA, V_{BE} = 0)	$V_{(BR)CES}$	60	80	—	Vdc
Collector–Base Breakdown Voltage (I_C = 50 mA, I_E = 0)	$V_{(BR)CBO}$	60	80	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 5 mA, I_C = 0)	$V_{(BR)EBO}$	4	4.7	—	Vdc
Collector Cutoff Current (V_{CB} = 24 V, I_E = 0)	I_{CES}	—	—	10	mA

(1) All DC tests are per side.

(continued)

REV 2

ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS (1)					
DC Current Gain (I_C = 1 A, V_{CE} = 5 V)	h_{FE}	30	80	120	—
DYNAMIC CHARACTERISTICS (1)					
Output Capacitance (V_{CB} = 24 V, f = 1 MHz)	C_{ob}	14	21	28	pF
FUNCTIONAL CHARACTERISTICS (2)					
Common–Emitter Power Gain (V_{CE} = 24 V, I_C = 1.9 A, f = 900 MHz, Power Output = 13.7 W)	P_g	11	12.5	—	dB
Load Mismatch (V_{CE} = 24 V, I_C = 1.9 A, f = 900 MHz, Power Output = 13.7 W, Load VSWR = 30:1, All Phase Angles)	ψ	No Degradation in Output Power			
RF Input Overdrive (V_{CE} = 24 V, I_C = 1.9 A, f = 900 MHz) No degradation	$P_{in(over)}$	—	—	3.25	W
Third Order Intercept Point (V_{CE} = 24 V, I_C = 1.9 A, f1 = 900 MHz, f2 = 900.1 MHz, Meas. @ IMD 3rd Order = −40 dBc)	ITO	+51.5	+52.5	—	dBm
Noise Figure (V_{CE} = 24 V, I_C = 1.9 A, f = 900 MHz)	NF	—	6.5	—	dB
Input Return Loss (V_{CE} = 24 V, I_C = 1.9 A, f = 900 MHz, Power Output = 13.7 W)	IRL	—	—	−10	dB

(1) All DC tests are per side.
(2) Operating bias point I_C is the total for both halves.

Table 1. MRF860 Common Emitter S–Parameters (Per Side)

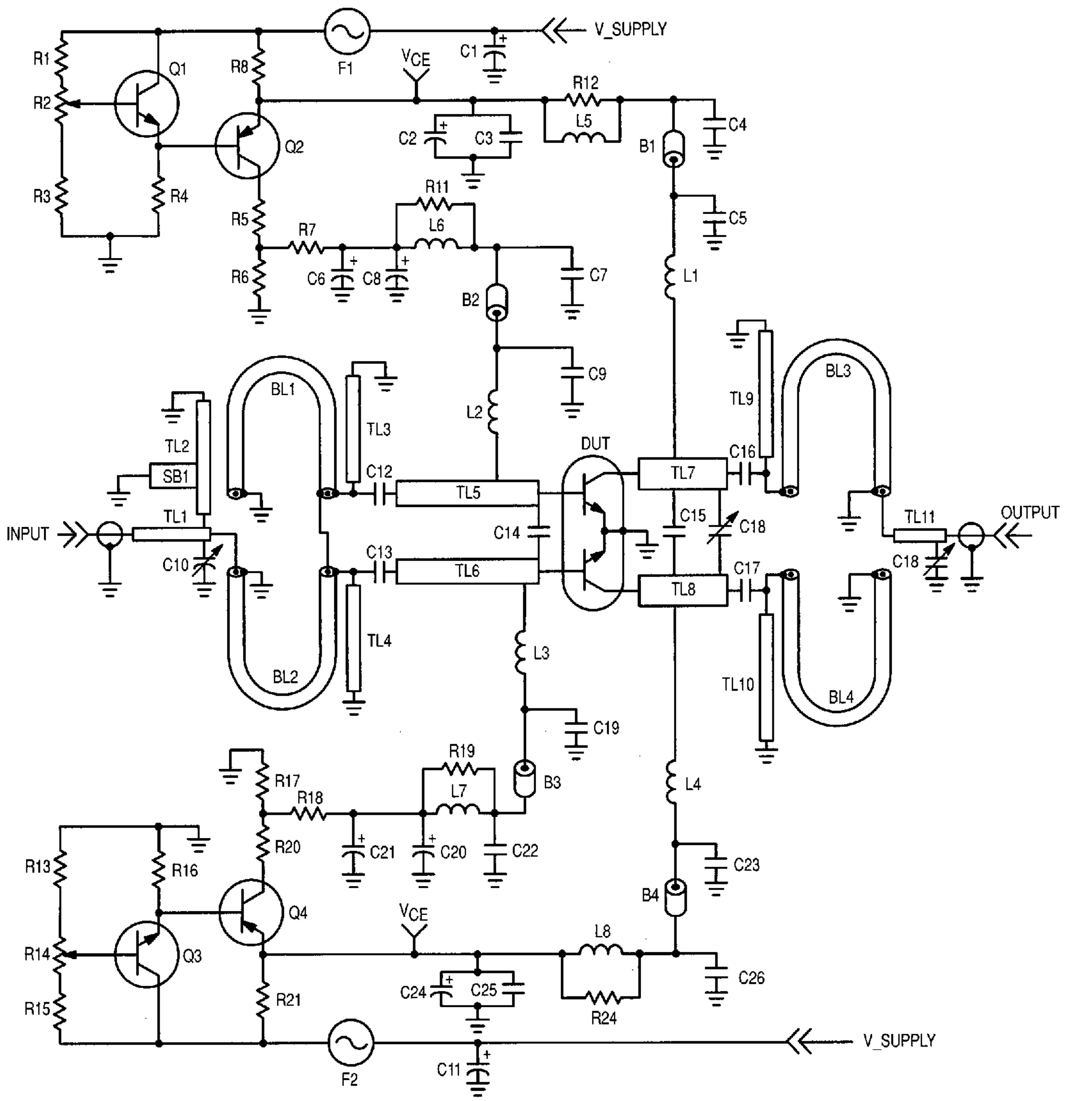
V_{CE} (V)	I_C (A)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	∠ φ	$\|S_{21}\|$	∠ φ	$\|S_{12}\|$	∠ φ	$\|S_{22}\|$	∠ φ
24	0.95	800	0.964	171	0.829	45	0.012	15	0.781	174
		820	0.963	170	0.831	43	0.012	15	0.779	174
		840	0.963	170	0.839	42	0.013	13	0.779	173
		860	0.959	169	0.844	40	0.013	13	0.778	173
		880	0.957	169	0.856	38	0.014	12	0.779	173
		900	0.952	169	0.870	36	0.014	11	0.778	173
		920	0.951	168	0.884	34	0.015	9	0.778	173
		940	0.944	168	0.897	32	0.015	8	0.774	173
		960	0.941	168	0.917	30	0.016	7	0.774	173

Table 2. Z_{in} and Z_{OL}* versus Frequency

f (MHz)	Z_{in} (Ohms)		Z_{OL}* (Ohms)	
840	1.6	9	3.6	−2.1
870	1.4	9.7	4.4	−2.3
900	1.7	9.9	4.9	−2.3

V_{CE} = 24 V, I_C = 1.9 A, P_o = 13.7 W

Notes: Z_{in} is a balanced base–to–base measurement.
Z_{OL}* = Conjugate of optimum load impedance, collector to collector, into which the device operates at a given output power, bias current, voltage and frequency.



B1, B2, B3, B4	Short Ferrite Bead, Fair Rite (2743019447)	R1, R15	470 Ω, 1/4 W
BL1–BL4	2.20″ 50 Ω 0.085″ OD Semi–Rigid Coax	R2, R14	500 Ω Potentiometer, 1/4 W
C1, C11	470 µF, 50 Vdc Electrolytic Capacitor	R3, R13	4.7K Ω, 1/4 W
C6, C21	220 µF, 50 Vdc Electrolytic Capacitor	R4, R16	2 x 4.7K Ω, 1/4 W
C2, C8, C20, C24	10 µF, 50 Vdc Electrolytic Capacitor	R5, R20	47 Ω, 2 W
C3, C7, C22, C25	0.1 µF, Chip Capacitor	R6, R17	75 Ω, 1/4 W
C4, C26	1000 pF, Chip Capacitor	R7, R18	4.7 Ω, 1/4 W
C5, C9, C19, C23	100 pF, Chip Capacitor	R8, R21	4 Ω, 10 W
C10, C18	0.8–8.0 pF, Johanson Gigatrim	R11, R12, R19, R24	4 x 39 Ω, 1/8 W Chip Resistors in Parallel
C12, C13, C16, C17	43 pF, 100 Mil Chip Capacitor	SB1	Copper 0.500″ x 0.200″ x 0.050″
C14	13 pF, 50 Mil Chip Capacitor	TL1, TL11	50 Ω, Microstrip Transmission Line
C15	7.5 pF, 100 Mil Chip Capacitor	TL2–TL10	Microstrip Transmission Line
F1, F2	3 A Micro–Fuse	V_Supply	+27.8 Vdc ±0.5 Vdc Due to Resistor Tolerance
L1–L8	5 Turns 18 AWG 0.142″ ID (47.5 nH)		
Q1, Q3	MMBT2222ALT1, NPN Transistor	V_{CE}	+24 Vdc @ 0.95 A
Q2, Q4	BD136, PNP Transistor	Board	0.030″ Glass–Teflon® 2 oz. Cu, $\varepsilon_r = 2.55$

Figure 1. MRF860 Class A RF Test Fixture Schematic

TYPICAL CHARACTERISTICS

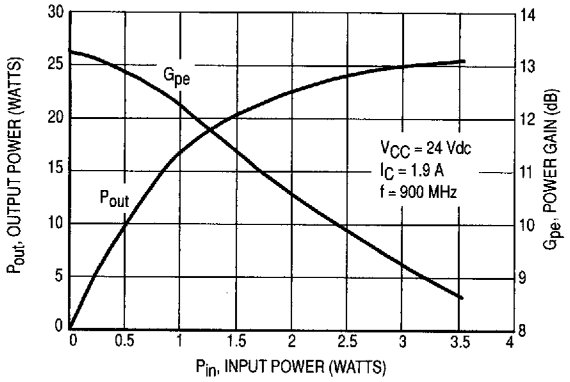


Figure 2. Output Power & Power Gain versus Input Power

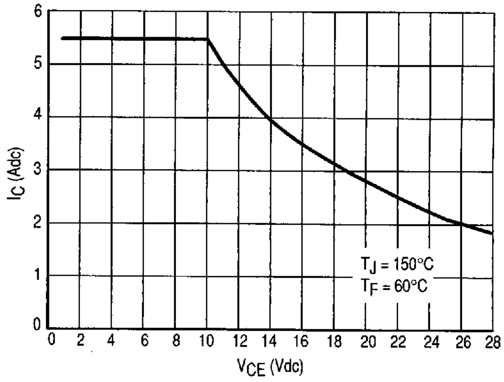


Figure 3. DC SOA (Total I_C for both halves operating.)

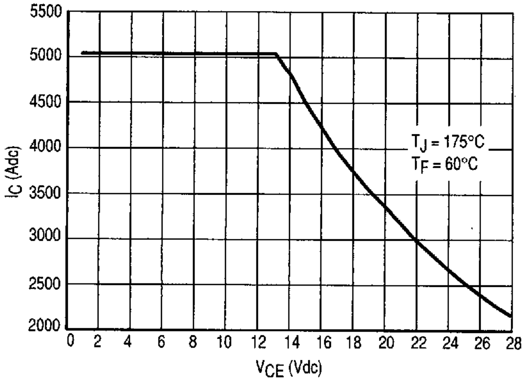


Figure 4. DC SOA (This device is MTBF limited for $V_{CE} < 14$ Vdc; total I_C for both halves operating.)

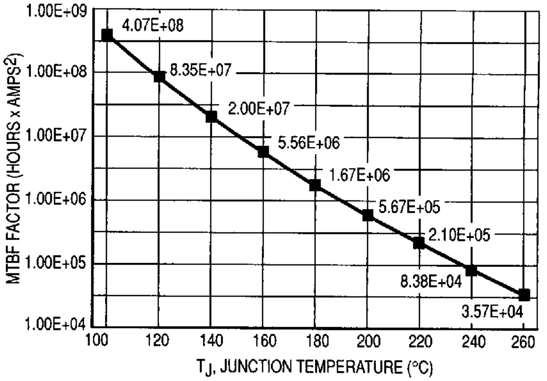


Figure 5. MTBF Factor versus Junction Temperature

6367254 0106987 233

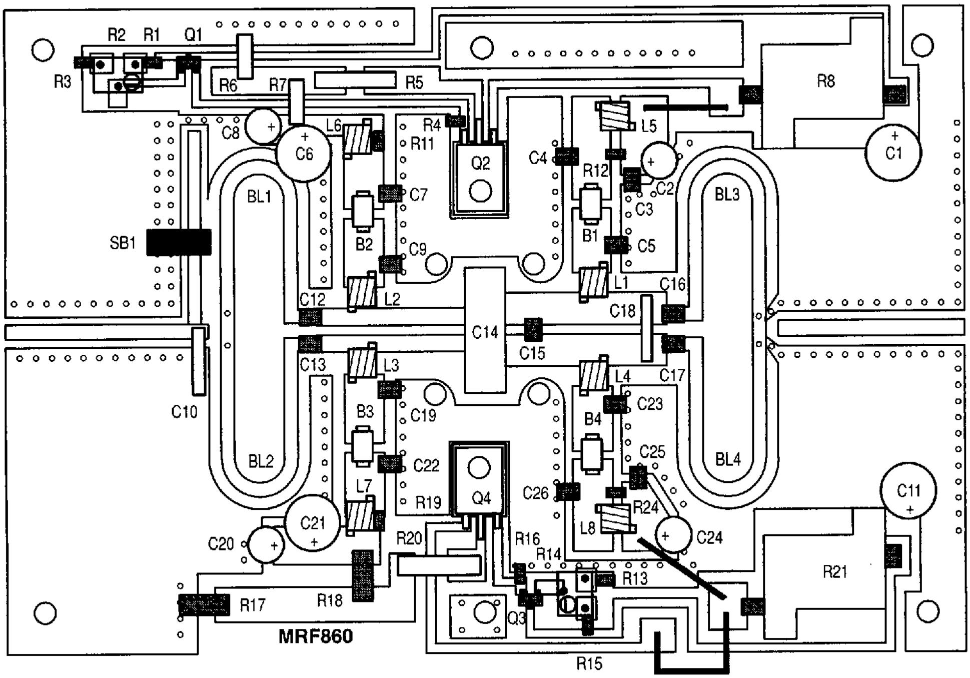


Figure 6. MRF860 Test Fixture Component Layout