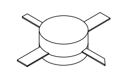
The RF Line
NPN Silicon
RF Power Transistor

MRF857S

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



CASE 305D–01, STYLE 1

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 = 0.3 Adc Characteristics
  Output Power = 2.1 Watts CW
  Minimum Power Gain = 12.5 dB
  Minimum ITO = + 43 dBm
  Typical Noise Figure = 5.25 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 = 0.3 Adc and Rated Output Power
- Will Withstand RF Input Overdrive of 0.4 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.

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	V_{CEO}	30	Vdc
Collector–Base Voltage	V_{CBO}	55	Vdc
Emitter–Base Voltage	V_{EBO}	4	Vdc
Total Device Dissipation @ T_C = 50°C Derate above 50°C	P_D	17 0.114	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 = 50°C)	$R_{\theta JC}$	8.4	°C/W

ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector–Emitter Breakdown Voltage (I_C = 20 mA, I_B = 0)	$V_{(BR)CEO}$	28	35	—	Vdc
Collector–Emitter Breakdown Voltage (I_C = 20 mA, V_{BE} = 0)	$V_{(BR)CES}$	55	85	—	Vdc
Collector–Base Breakdown Voltage (I_C = 20 mA, I_E = 0)	$V_{(BR)CBO}$	55	85	—	Vdc
Emitter–Base Breakdown Voltage (I_E = 1 mA, I_C = 0)	$V_{(BR)EBO}$	4	5	—	Vdc
Collector Cutoff Current (V_{CB} = 24 V, I_E = 0)	I_{CES}	—	—	1	mA

(continued)

ELECTRICAL CHARACTERISTICS — continued

Characteristic	Symbol	Min	Typ	Max	Unit
ON CHARACTERISTICS					
DC Current Gain (I_C = 0.1 A, V_{CE} = 5 V)	h_{FE}	30	60	120	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 24 V, f = 1 MHz)	C_{ob}	2.4	3.3	4.4	pF
FUNCTIONAL CHARACTERISTICS					
Common–Emitter Power Gain (V_{CE} = 24 V, I_C = 0.3 A, f = 840 – 900 MHz, Power Output = 2.1 W)	P_g	12.5	13.5	—	dB
Load Mismatch (P_o = 2.1 W) (V_{CE} = 24 V, I_C = 0.3 A, f = 840 MHz, Load VSWR = 30:1, All Phase Angles)	ψ	No Degradation in Output Power			
RF Input Overdrive (V_{CE} = 24 V, I_C = 0.3 A, f = 840 MHz) No degradation	$P_{in(over)}$	—	—	0.4	W
Third Order Intercept Point (V_{CE} = 24 V, I_C = 0.3 A) (f1 = 900 MHz, f2 = 900.1 MHz, Meas. @ IMD 3rd Order = –40 dBc)	ITO	+43	+44.5	—	dBm
Noise Figure (V_{CE} = 24 V, I_C = 0.3 A, f = 900 MHz)	NF	—	5.25	—	dB
Input Return Loss (V_{CE} = 24 V, I_C = 0.3 A, f = 840 – 900 MHz, Power Output = 2.1 W)	IRL	—	–15	–10	dB

Table 1. MRF857S Common Emitter S–Parameters

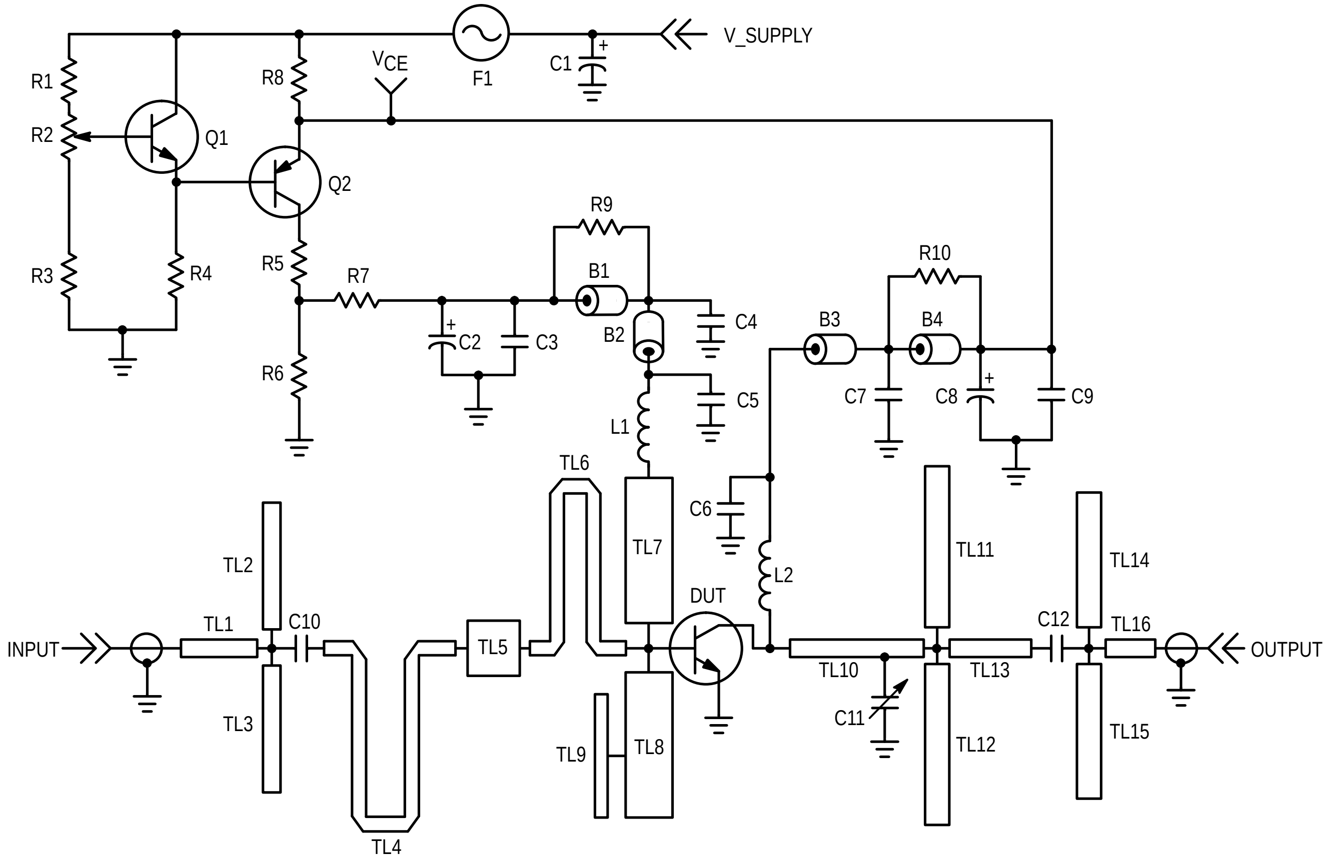
V_{CE} (V)	I_C (A)	f (MHz)	S_{11}		S_{21}		S_{12}		S_{22}	
			$\|S_{11}\|$	∠ϕ	$\|S_{21}\|$	∠ϕ	$\|S_{12}\|$	∠ϕ	$\|S_{22}\|$	∠ϕ
24	0.3	800	0.915	165	2.098	54	0.037	58	0.343	–157
		820	0.915	165	2.049	53	0.038	58	0.345	–157
		840	0.915	165	1.991	52	0.038	58	0.349	–157
		860	0.913	164	1.951	51	0.039	59	0.352	–158
		880	0.914	164	1.912	50	0.040	59	0.355	–158
		900	0.914	163	1.865	49	0.041	59	0.359	–158
		920	0.913	163	1.832	48	0.042	59	0.362	–158
		940	0.915	162	1.783	47	0.043	59	0.366	–159
		960	0.916	162	1.748	46	0.043	59	0.369	–159

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

f (MHz)	Z_{in} (Ohms)		Z_{OL}* (Ohms)	
840	1.5	4.4	18.4	–26.3
870	1.7	4.7	18.0	–26.1
900	1.5	4.8	14.9	–26.2

V_{CE} = 24 V, I_C = 0.3 A, P_o = 2.1 W

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



B1, B4	Long Ferrite Bead, Fair Rite (2743021447)	R1	330 Ω, 1/4 W
B2, B3	Short Ferrite Bead, Fair Rite (2743019447)	R2	500 Ω Potentiometer, 1/4 W
C1	250 μF, 50 Vdc Electrolytic Capacitor	R3	4.7K Ω, 1/4 W
C2, C8	10 μF, 50 Vdc Electrolytic Capacitor	R4	2 x 4.7K Ω, 1/4 W
C3, C9	0.1 μF, Chip Capacitor	R5	47 Ω, 2 W
C4, C7	1000 pF, Chip Capacitor	R6	75 Ω, 1/4 W
C5, C6	100 pF, Chip Capacitor	R7	4.7 Ω, 1/4 W
C10, C12	43 pF, 100 Mil Chip Capacitor	R8	10 Ω, 3 W
C11	0.8–8 pF, Johansen Gigatrim	R9, R10	4 x 39 Ω, 1/8 W Chip Resistors in Parallel
F1	1 A Micro–Fuse	TL1 – TL16	Microstrip Transmission Line
L1, L2	5 Turns, 20 AWG, 0.126″ ID, 46.2 nH	V_Supply	+27 Vdc ±0.5 V Due to Resistor Tolerance
Q1	MMBT2222ALT1, NPN Transistor	V_{CE}	+24 Vdc @ 0.3 A
Q2	BD136, PNP Transistor	Board	0.030″ Glass–Teflon® 2 oz. Cu, ε_r = 2.55

Figure 1. MRF857S Class A RF Test Fixture Schematic

TYPICAL CHARACTERISTICS

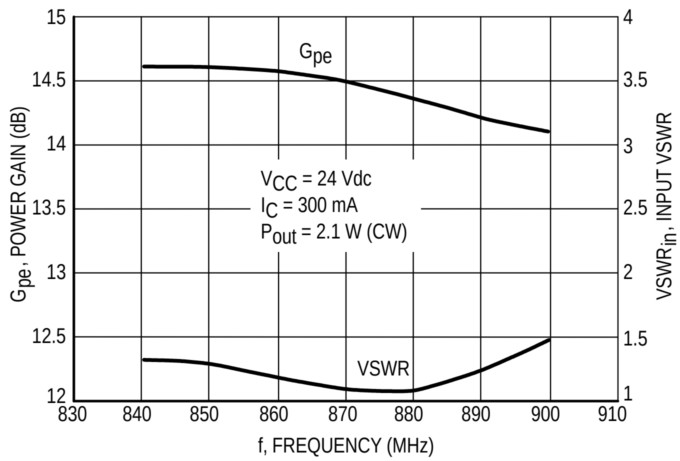


Figure 2. Performance of MRF857S in Broadband Circuit

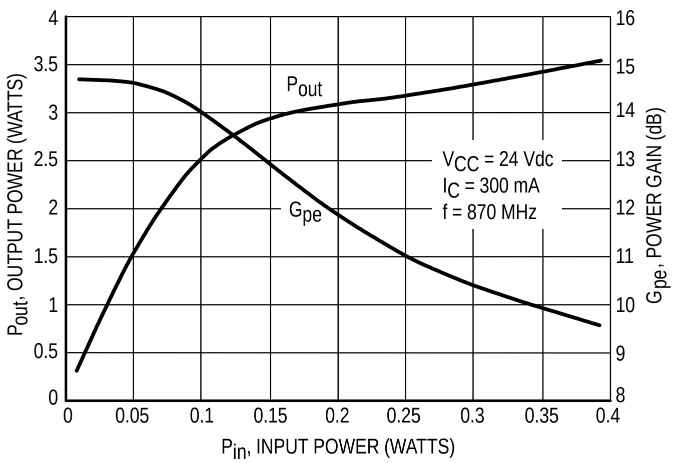


Figure 3. MRF857S Output Power & Power Gain versus Input Power

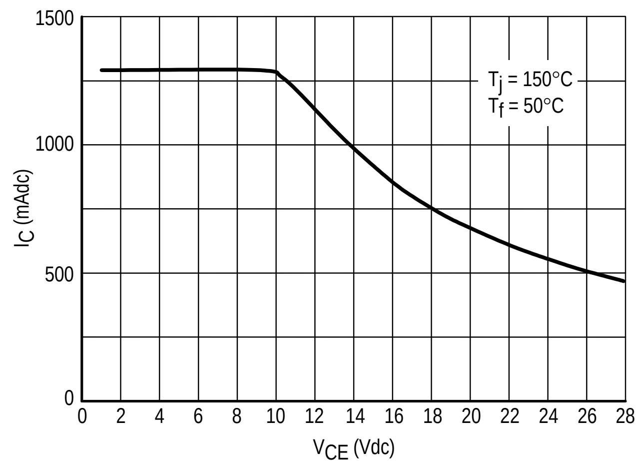


Figure 4. MRF857S DC SOA

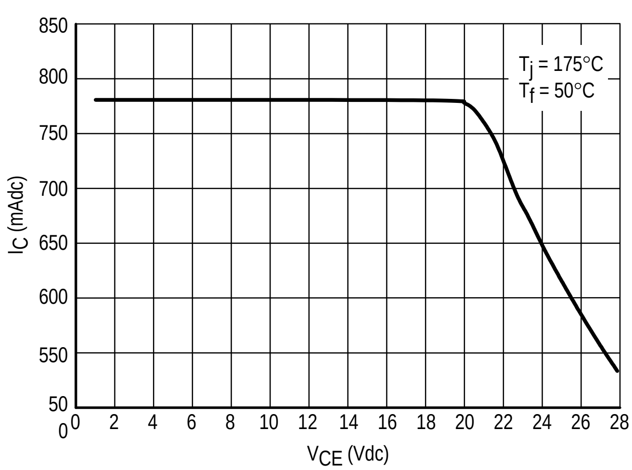


Figure 5. MRF857S DC SOA (This device is MTBF limited for $V_{CE} < 20$ Vdc.)

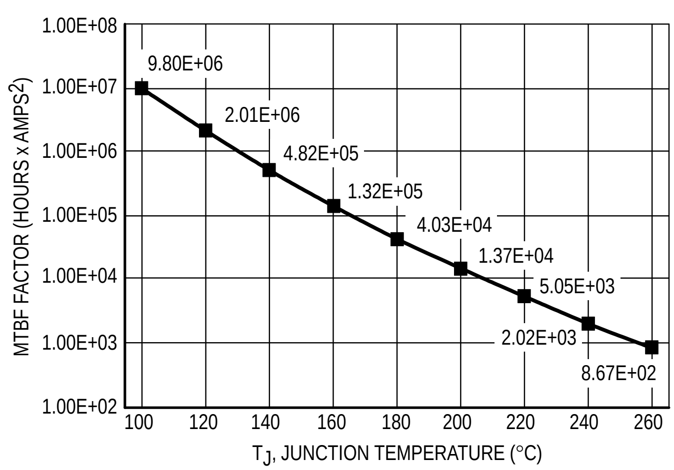


Figure 6. MRF857S MTBF Factor versus Junction Temperature

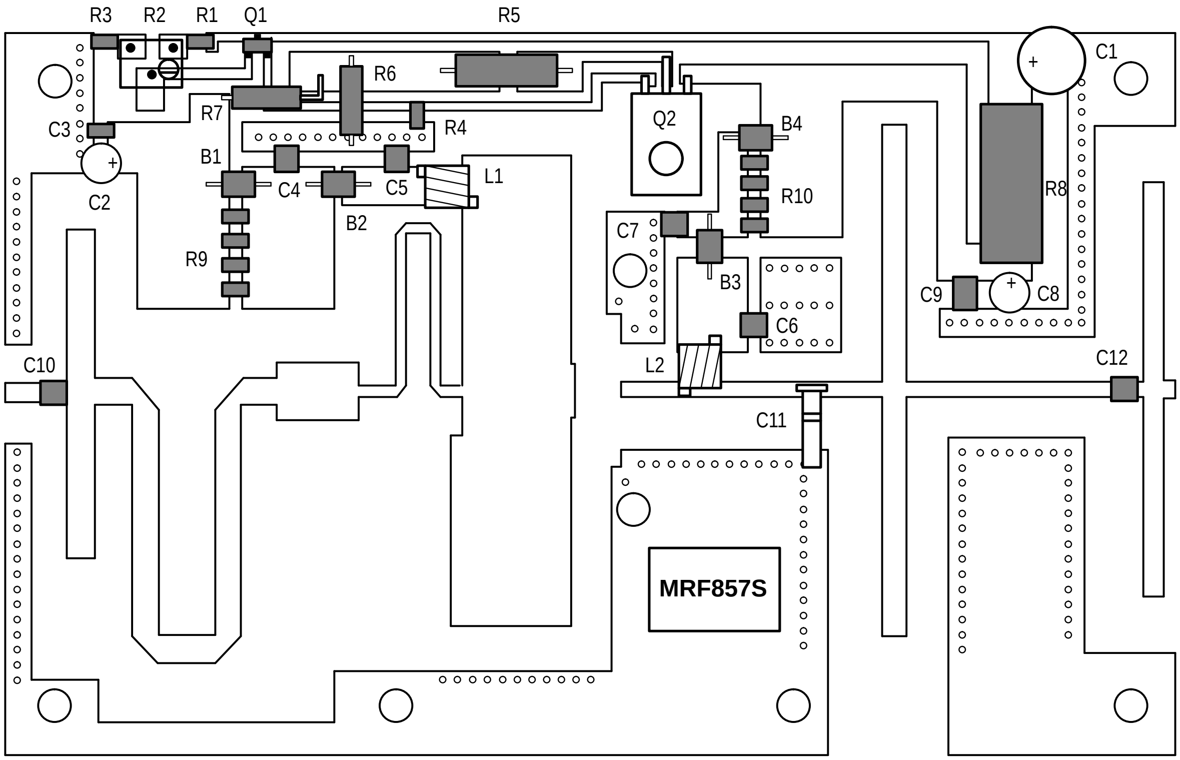
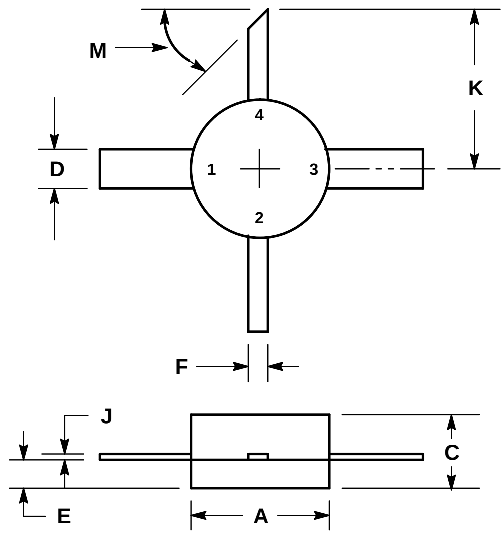


Figure 7. MRF857S Test Fixture Component Layout



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.200	0.220	5.08	5.59
C	0.095	0.130	2.41	3.30
D	0.055	0.065	1.40	1.65
E	0.040	0.050	1.02	1.27
F	0.025	0.035	0.64	0.89
J	0.003	0.007	0.08	0.18
K	0.235	0.265	5.97	6.73
M	45° NOM		45° NOM	

STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

CASE 305D–01
ISSUE O

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