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The RF Line

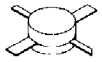
# NPN Silicon RF Power Transistor

# MRF857S

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

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.



CASE 305D–01,

**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<br>Derate above 50°C | $P_D$ | 17<br>0.114 | Watts<br>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)

NJ Semi-Conductors reserves the right to change test conditions, parameter limits and package dimensions without notice. Information furnished by NJ Semi-Conductors is believed to be both accurate and reliable at the time of going to press. However, NJ Semi-Conductors assumes no responsibility for any errors or omissions discovered in its use. NJ Semi-Conductors encourages customers to verify that datasheets are current before placing orders.

Quality Semi-Conductors

**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.