

# The RF Line

## NPN Silicon

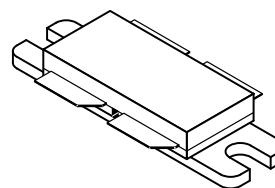
### RF Power Transistor

Designed for 26 Volt UHF large-signal, common emitter, Class AB linear amplifier applications in industrial and commercial FM/AM equipment operating in the range 800–960 MHz.

- Specified 26 Volt, 900 MHz Characteristics
  - Output Power = 150 Watts (PEP)
  - Minimum Gain = 8.0 dB @ 900 MHz, Class AB
  - Minimum Efficiency = 35% @ 900 MHz, 150 Watts (PEP)
  - Maximum Intermodulation Distortion –28 dBc @ 150 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 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.

**MRF899**

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



CASE 375A-01, STYLE 1

#### MAXIMUM RATINGS

| Rating                                                                                 | Symbol    | Value       | Unit                         |
|----------------------------------------------------------------------------------------|-----------|-------------|------------------------------|
| Collector–Emitter Voltage                                                              | $V_{CEO}$ | 28          | Vdc                          |
| Collector–Emitter Voltage                                                              | $V_{CES}$ | 60          | Vdc                          |
| Emitter–Base Voltage                                                                   | $V_{EBO}$ | 4.0         | Vdc                          |
| Collector–Current — Continuous                                                         | $I_C$     | 25          | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$<br>Derate above $25^\circ\text{C}$ | $P_D$     | 230<br>1.33 | Watts<br>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 | $R_{\theta JC}$ | 0.75 | $^\circ\text{C/W}$ |

#### ELECTRICAL CHARACTERISTICS ( $T_C = 25^\circ\text{C}$ unless otherwise noted.)

| Characteristic | Symbol | Min | Typ | Max | Unit |
|----------------|--------|-----|-----|-----|------|
|----------------|--------|-----|-----|-----|------|

#### OFF CHARACTERISTICS

|                                                                               |               |     |     |    |      |
|-------------------------------------------------------------------------------|---------------|-----|-----|----|------|
| Collector–Emitter Breakdown Voltage ( $I_C = 100\text{ mAdc}$ , $I_B = 0$ )   | $V_{(BR)CEO}$ | 28  | 37  | —  | Vdc  |
| Collector–Emitter Breakdown Voltage ( $I_C = 50\text{ mAdc}$ , $V_{BE} = 0$ ) | $V_{(BR)CES}$ | 60  | 85  | —  | Vdc  |
| Emitter–Base Breakdown Voltage ( $I_E = 10\text{ mAdc}$ , $I_C = 0$ )         | $V_{(BR)EBO}$ | 4.0 | 4.9 | —  | Vdc  |
| Collector Cutoff Current ( $V_{CE} = 30\text{ Vdc}$ , $V_{BE} = 0$ )          | $I_{CES}$     | —   | —   | 10 | mAdc |

#### ON CHARACTERISTICS

|                                                                           |          |    |    |     |   |
|---------------------------------------------------------------------------|----------|----|----|-----|---|
| DC Current Gain ( $I_{CE} = 1.0\text{ Adc}$ , $V_{CE} = 5.0\text{ Vdc}$ ) | $h_{FE}$ | 30 | 75 | 120 | — |
|---------------------------------------------------------------------------|----------|----|----|-----|---|

#### DYNAMIC CHARACTERISTICS

|                                                                                        |          |   |    |   |    |
|----------------------------------------------------------------------------------------|----------|---|----|---|----|
| Output Capacitance ( $V_{CB} = 26\text{ Vdc}$ , $I_E = 0$ , $f = 1.0\text{ MHz}$ ) (1) | $C_{ob}$ | — | 75 | — | pF |
|----------------------------------------------------------------------------------------|----------|---|----|---|----|

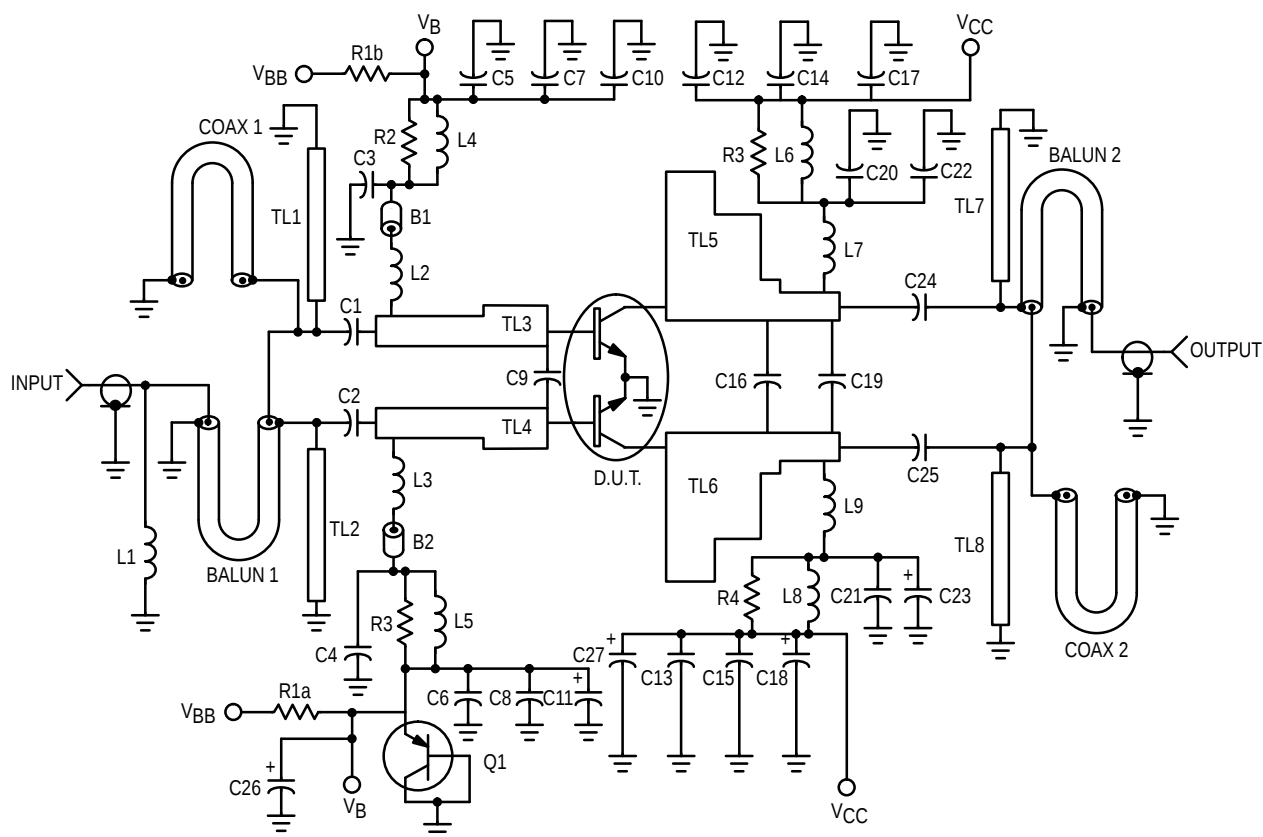
(1) For information only. This part is collector matched.

(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<br>$V_{CC} = 26\text{ Vdc}$ , $P_{out} = 150\text{ Watts (PEP)}$ , $I_{CQ} = 300\text{ mA}$ , $f_1 = 900\text{ MHz}$ ,<br>$f_2 = 900.1\text{ MHz}$                      | $G_{pe}$ | 8.0                                                  | 9.0 | —   | dB   |
| Collector Efficiency<br>$V_{CC} = 26\text{ Vdc}$ , $P_{out} = 150\text{ Watts (PEP)}$ , $I_{CQ} = 300\text{ mA}$ , $f_1 = 900\text{ MHz}$ ,<br>$f_2 = 900.1\text{ MHz}$                                     | $\eta$   | 30                                                   | 40  | —   | %    |
| 3rd Order Intermodulation Distortion<br>$V_{CC} = 26\text{ Vdc}$ , $P_{out} = 150\text{ Watts (PEP)}$ , $I_{CQ} = 300\text{ mA}$ , $f_1 = 900\text{ MHz}$ ,<br>$f_2 = 900.1\text{ MHz}$                     | IMD      | —                                                    | -32 | -28 | dBc  |
| Output Mismatch Stress<br>$V_{CC} = 26\text{ Vdc}$ , $P_{out} = 150\text{ Watts (PEP)}$ , $I_{CQ} = 300\text{ mA}$ , $f_1 = 900\text{ MHz}$ ,<br>$f_2 = 900.1\text{ MHz}$ , $VSWR = 5:1$ (all phase angles) | $\psi$   | No Degradation in Output Power Before and After Test |     |     |      |



B1, B2 — Ferrite Bead, Ferroxcube #56-590-65-3B  
 C1, C2, C24, C25 — 43 pF, B Case, ATC Chip Capacitor  
 C3, C4, C20, C21 — 100 pF, B Case, ATC Chip Capacitor  
 C5, C6, C12, C13 — 1000 pF, B Case, ATC Chip Capacitor  
 C7, C8, C14, C15 — 1800 pF, AVX Chip Capacitor  
 C9 — 9.1 pF, A Case, ATC Chip Capacitor  
 C10, C11, C17, C18, C22, C23 — 10  $\mu\text{F}$ , Electrolytic Capacitor  
 Panasonic  
 C16 — 3.9 pF, B Case, ATC Chip Capacitor  
 C19 — 0.8 pF, B Case, ATC Chip Capacitor  
 C26 — 200  $\mu\text{F}$ , Electrolytic Capacitor Mallory Sprague  
 C27 — 500  $\mu\text{F}$  Electrolytic Capacitor

L1 — 5 Turns 24 AWG IDIA 0.059" Choke, 19.8 nH  
 L2, L3, L7, L9 — 4 Turns 20 AWG IDIA 0.163" Choke  
 L4, L5, L6, L8 — 12 Turns 22 AWG IDIA 0.140" Choke  
 N1, N2 — Type N Flange Mount, Omni Spectra  
 Q1 — Bias Transistor BD136 PNP  
 R2, R3, R4, R5 — 4.0 x 39 Ohm 1/8 W Chips in Parallel  
 R1a, R1b — 56 Ohm 1.0 W  
 TL1–TL8 — See Photomaster  
 Balun1, Balun2, Coax 1, Coax 2 — 2.20" 50 Ohm 0.088" o.d.  
 Semi-rigid Coax, Micro Coax  
 Board — 1/32" Glass Teflon,  $\epsilon_r = 2.55$ " Arlon (GX-0300-55-22)

**Figure 1. 900 MHz Power Gain Test Circuit**

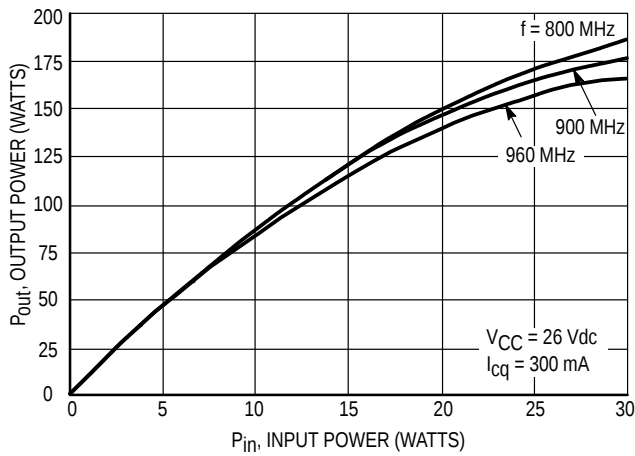


Figure 2. Output Power versus Input Power

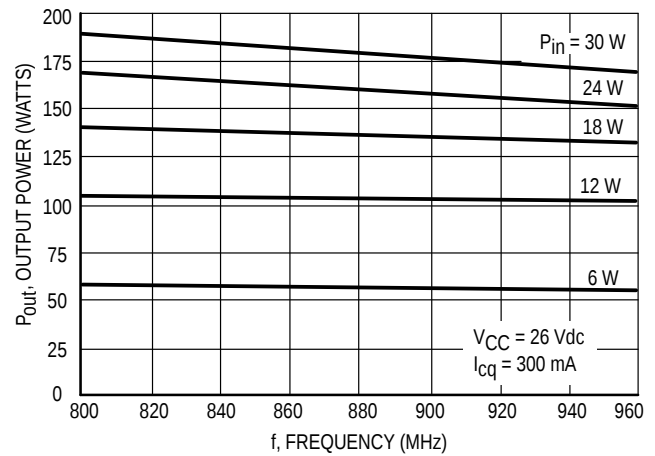


Figure 3. Output Power versus Frequency

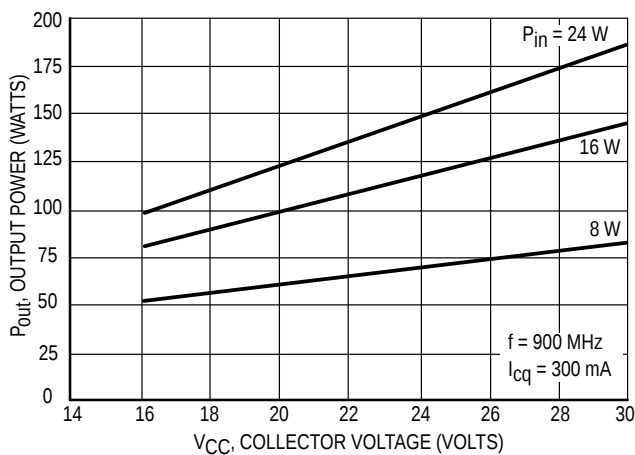


Figure 4. Output Power versus Supply Voltage

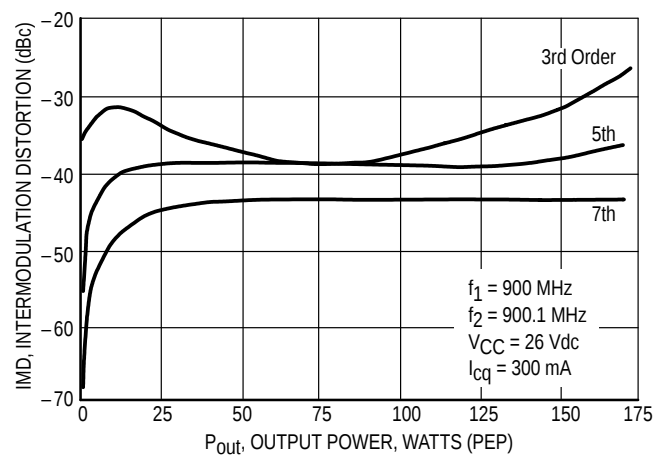


Figure 5. Intermodulation versus Output Power

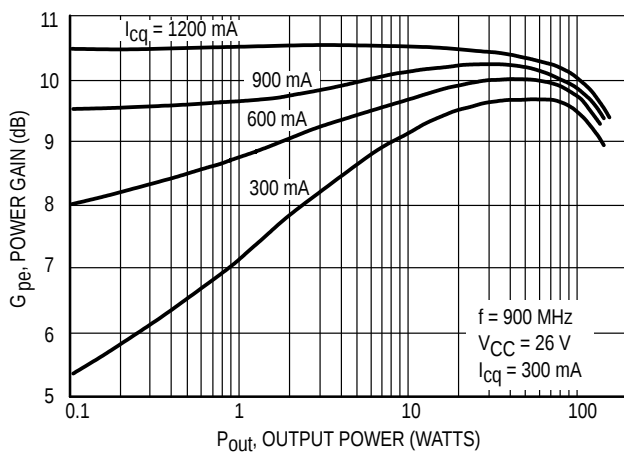


Figure 6. Power Gain versus Output Power

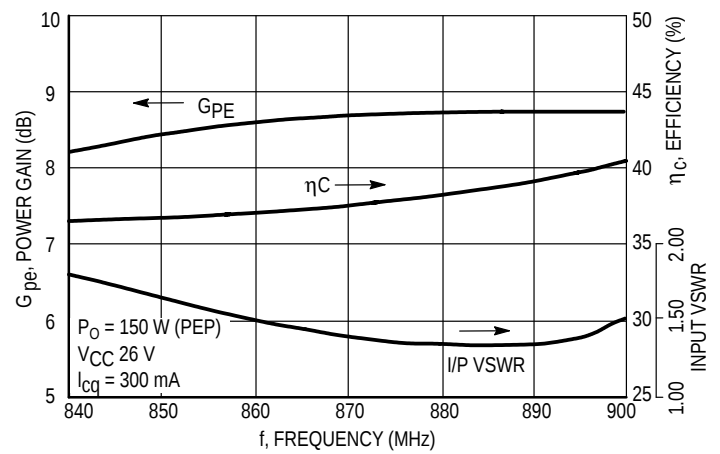
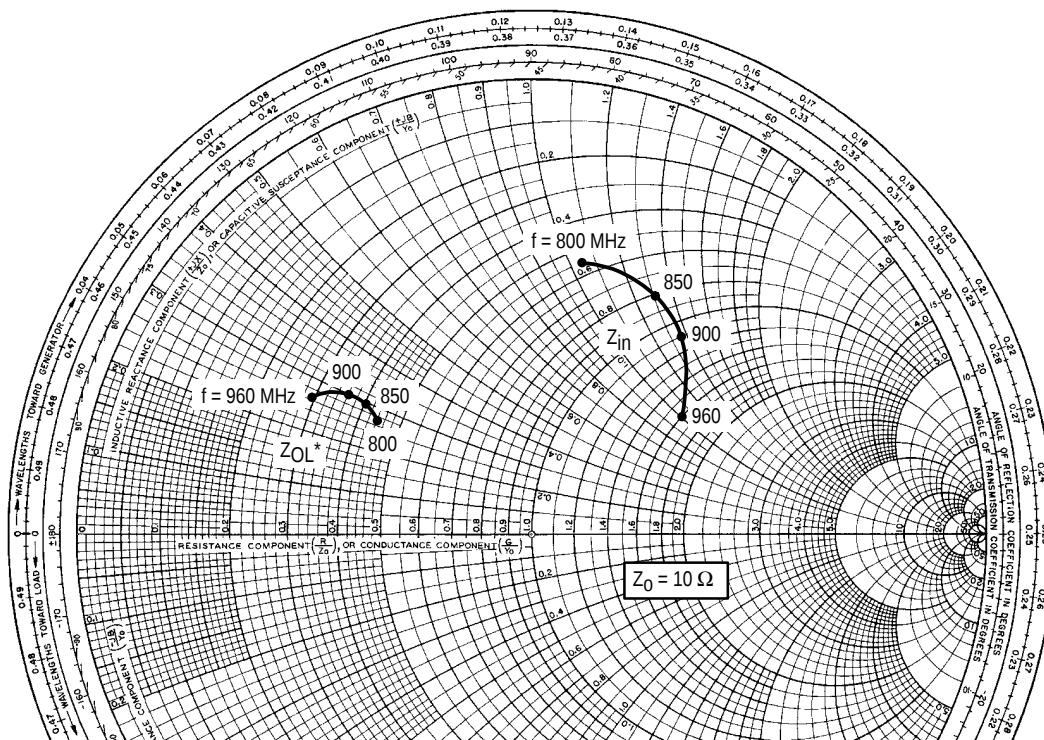


Figure 7. Broadband Test Fixture Performance



| f<br>MHz | $Z_{in}$<br>Ohms | $Z_{OL}^*$<br>Ohms |
|----------|------------------|--------------------|
| 800      | $5.51 + j10.6$   | $4.52 + j2.64$     |
| 850      | $8.17 + j13.2$   | $4.21 + j2.98$     |
| 900      | $11.2 + j13.8$   | $3.68 + j2.97$     |
| 960      | $16.8 + j10.1$   | $2.98 + j2.71$     |

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

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

**Figure 8. Input and Output Impedances**  
with Circuit Tuned for Maximum Gain @  $P_O = 150 \text{ W (PEP)}$ ,  $V_{CC} = 26 \text{ V}$

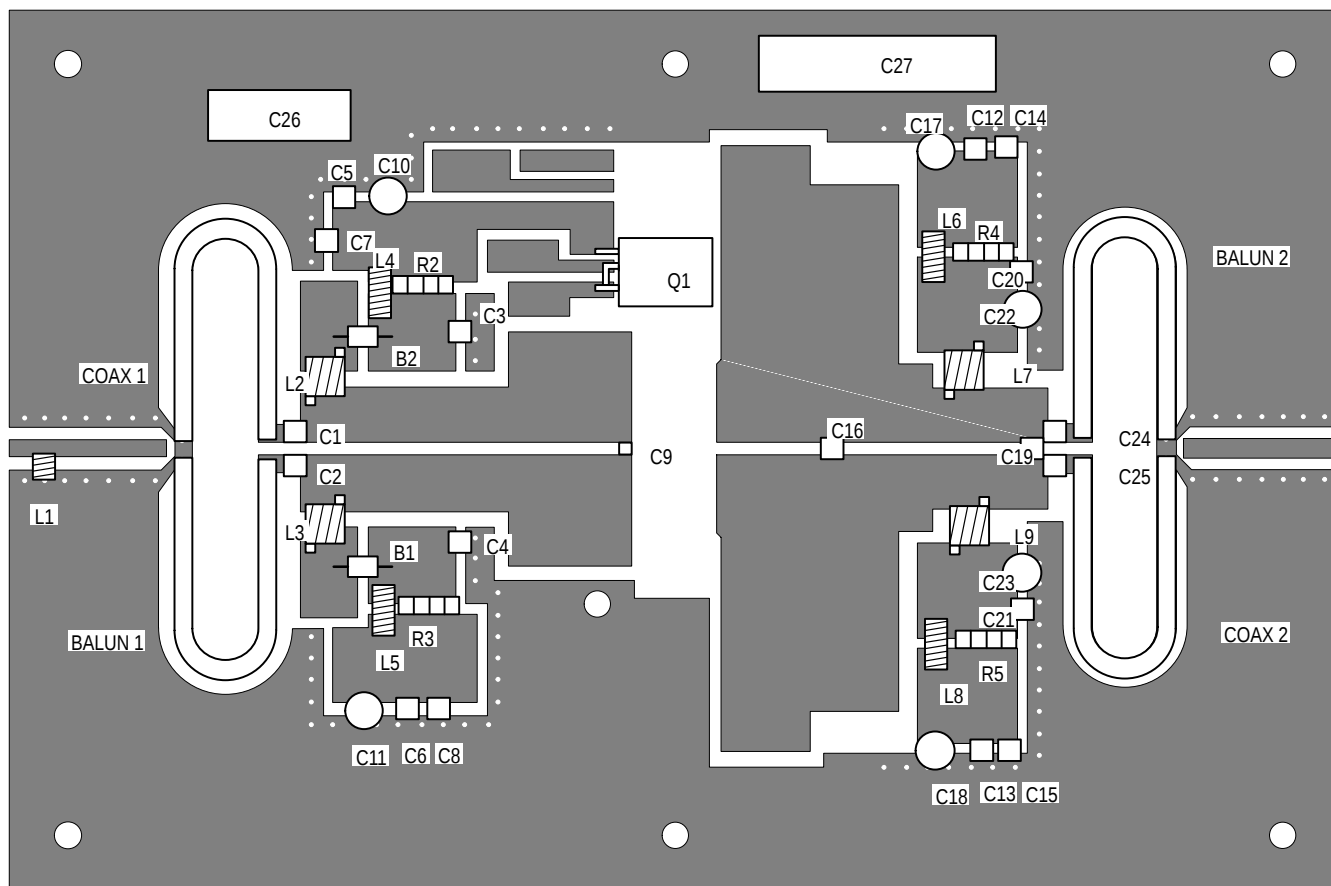
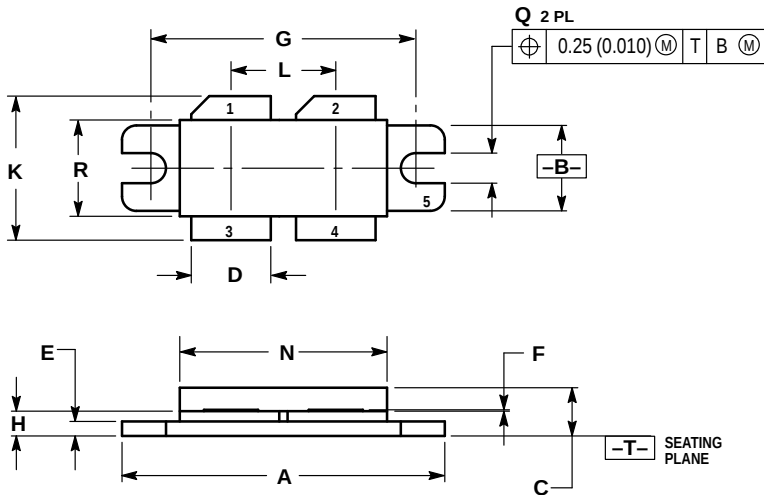


Figure 9. MRF899 Test Fixture Component Layout

## PACKAGE DIMENSIONS



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

| DIM | INCHES    |       | MILLIMETERS |       |
|-----|-----------|-------|-------------|-------|
|     | MIN       | MAX   | MIN         | MAX   |
| A   | 1.330     | 1.350 | 33.79       | 34.29 |
| B   | 0.375     | 0.395 | 9.52        | 10.03 |
| C   | 0.180     | 0.205 | 4.57        | 5.21  |
| D   | 0.320     | 0.340 | 8.13        | 8.64  |
| E   | 0.060     | 0.070 | 1.52        | 1.77  |
| F   | 0.004     | 0.006 | 0.11        | 0.15  |
| G   | 1.100 BSC |       | 27.94 BSC   |       |
| H   | 0.082     | 0.097 | 2.08        | 2.46  |
| K   | 0.580     | 0.620 | 14.73       | 15.75 |
| L   | 0.435 BSC |       | 11.05 BSC   |       |
| N   | 0.845     | 0.875 | 21.46       | 22.23 |
| Q   | 0.118     | 0.130 | 3.00        | 3.30  |
| R   | 0.390     | 0.410 | 9.91        | 10.41 |

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

**CASE 375A-01  
 ISSUE O**

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