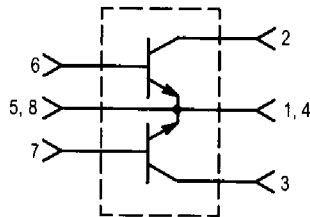


## The RF Line NPN Silicon Push-Pull RF Power Transistor

... designed primarily for wideband large-signal output and driver amplifier stages in the 30 to 500 MHz frequency range.

- Specified 28 Volt, 500 MHz Characteristics —  
Output Power = 100 W  
Typical Gain = 9.5 dB (Class AB); 8.5 dB (Class C)  
Efficiency = 55% (Typ)
- Built-In Input Impedance Matching Networks for Broadband Operation
- Push-Pull Configuration Reduces Even Numbered Harmonics
- Gold Metallization System for High Reliability
- 100% Tested for Load Mismatch



The MRF3993 is two transistors in a single package with separate base and collector leads and emitters common. This arrangement provides the designer with a space saving device capable of operation in a push-pull configuration.

### PUSH-PULL TRANSISTORS

#### MAXIMUM RATINGS

| Rating  | Symbol           | Value       | Unit          |
|---|------------------|-------------|---------------|
| Collector-Emitter Voltage   | V <sub>CEO</sub> | 30          | Vdc           |
| Collector-Base Voltage  | V <sub>CB0</sub> | 60          | Vdc           |
| Emitter-Base Voltage  | V <sub>EBO</sub> | 4.0         | Vdc           |
| Collector Current — Continuous  | I <sub>C</sub>   | 16          | Adc           |
| Total Device Dissipation @ T <sub>C</sub> = 25°C (1)<br>Derate above 25°C | P <sub>D</sub>   | 270<br>1.54 | Watts<br>W/°C |
| Storage Temperature Range   | T <sub>stg</sub> | -65 to +150 | °C            |
| Junction Temperature  | T <sub>J</sub>   | 200         | °C            |

#### THERMAL CHARACTERISTICS

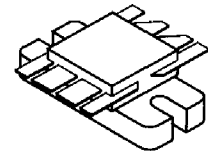
| Characteristic                       | Symbol           | Max  | Unit |
|--------------------------------------|------------------|------|------|
| Thermal Resistance, Junction to Case | R <sub>θJC</sub> | 0.65 | °C/W |

NOTE:

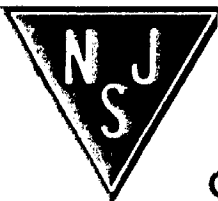
1. This device is designed for RF operation. The total device dissipation rating applies only when the device is operated as an RF push-pull amplifier.

**MRF393**

100 W, 30 to 500 MHz  
CONTROLLED "Q"  
BROADBAND PUSH-PULL  
RF POWER TRANSISTOR  
NPN SILICON



CASE 744A-01



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

| Characteristic   | Symbol        | Min | Typ | Max | Unit |
|--|---------------|-----|-----|-----|------|
| <b>OFF CHARACTERISTICS (1)</b>   |               |     |     |     |      |
| Collector-Emitter Breakdown Voltage ( $I_C = 50 \text{ mAdc}$ , $I_B = 0$ )    | $V_{(BR)CEO}$ | 30  | —   | —   | Vdc  |
| Collector-Emitter Breakdown Voltage ( $I_C = 50 \text{ mAdc}$ , $V_{BE} = 0$ ) | $V_{(BR)CES}$ | 60  | —   | —   | Vdc  |
| Emitter-Base Breakdown Voltage ( $I_E = 5.0 \text{ mAdc}$ , $I_C = 0$ )        | $V_{(BR)EBO}$ | 4.0 | —   | —   | Vdc  |
| Collector Cutoff Current ( $V_{CB} = 30 \text{ Vdc}$ , $I_E = 0$ )             | $I_{CBO}$     | —   | —   | 5.0 | mAdc |

**ON CHARACTERISTICS (1)**

|  |          |    |   |     |   |
|--|----------|----|---|-----|---|
| DC Current Gain ( $I_C = 1.0 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ ) | $h_{FE}$ | 20 | — | 100 | — |
|--|----------|----|---|-----|---|

**DYNAMIC CHARACTERISTICS (1)**

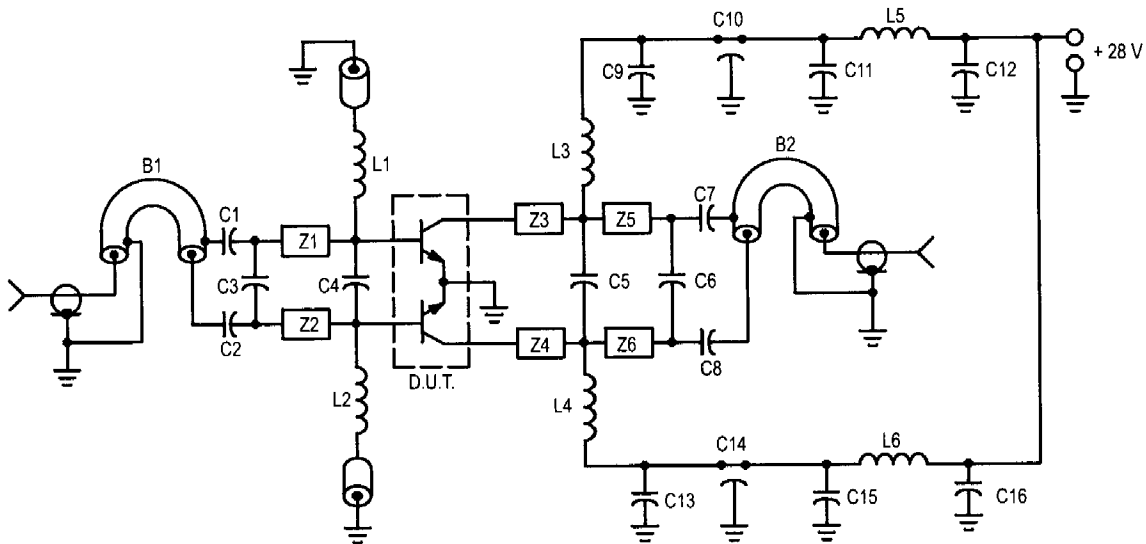
|  |          |    |    |    |    |
|--|----------|----|----|----|----|
| Output Capacitance ( $V_{CB} = 28 \text{ Vdc}$ , $I_E = 0$ , $f = 1.0 \text{ MHz}$ ) | $C_{ob}$ | 40 | 75 | 95 | pF |
|--|----------|----|----|----|----|

**FUNCTIONAL TESTS (2) — See Figure 1**

|   |          |                                |     |   |    |
|---|----------|--------------------------------|-----|---|----|
| Common-Emitter Amplifier Power Gain<br>( $V_{CC} = 28 \text{ Vdc}$ , $P_{out} = 100 \text{ W}$ , $f = 500 \text{ MHz}$ )                | $G_{pe}$ | 7.5                            | 8.5 | — | dB |
| Collector Efficiency<br>( $V_{CC} = 28 \text{ Vdc}$ , $P_{out} = 100 \text{ W}$ , $f = 500 \text{ MHz}$ )                               | $\eta$   | 50                             | 55  | — | %  |
| Load Mismatch<br>( $V_{CC} = 28 \text{ Vdc}$ , $P_{out} = 100 \text{ W}$ , $f = 500 \text{ MHz}$ ,<br>$VSWR = 30:1$ , all phase angles) | $\psi$   | No Degradation in Output Power |     |   |    |

**NOTES:**

- Each transistor chip measured separately.
- Both transistor chips operating in push-pull amplifier.



C1, C2, C7, C8 — 240 pF 100 mil Chip Cap  
 C3 — 15 pF 100 mil Chip Cap  
 C4 — 24 pF 100 mil Chip Cap  
 C5 — 33 pF 100 mil Chip Cap  
 C6 — 12 pF 100 mil Chip Cap  
 C9, C13 — 1000 pF 100 mil Chip Cap  
 C10, C14 — 680 pF Feedthru Cap  
 C11, C15 — 0.1  $\mu\text{F}$  Ceramic Disc Cap  
 C12, C16 — 50  $\mu\text{F}$  50 V

L1, L2 — 0.15  $\mu\text{H}$  Molded Choke with Ferrite Bead  
 L3, L4 — 2-1/2 Turns #20 AWG 0.200" ID  
 L5, L6 — 3-1/2 Turns #18 AWG 0.200" ID  
 B1, B2 — Balun 50  $\Omega$  Semi Rigid Coax, 86 mil OD, 4" Long  
 Z1, Z2 — 850 mil Long x 125 mil W. Microstrip  
 Z3, Z4 — 200 mil Long x 125 mil W. Microstrip  
 Z5, Z6 — 800 mil Long x 125 mil W. Microstrip  
 Board Material — 0.0325" Teflon-Fiberglass,  $\epsilon_r = 2.56$ ,  
 1 oz. Copper Clad both sides.

**Figure 1. 500 MHz Test Fixture**