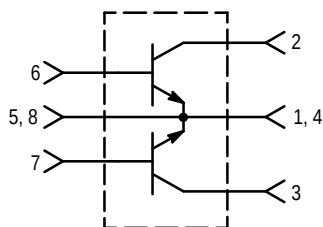


## The RF Line NPN Silicon Push-Pull RF Power Transistor

... 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

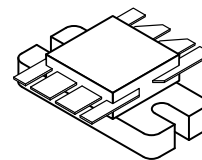


The MRF393 is two transistors in a single package with separate base and collector leads and emitters common. This arrangement provides the designer with a space saving device capable of operation in a push-pull configuration.

### PUSH-PULL TRANSISTORS

**MRF393**

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



CASE 744A-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                                                                       | $V_{EBO}$ | 4.0         | Vdc                          |
| Collector Current — Continuous                                                             | $I_C$     | 16          | Adc                          |
| Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1)<br>Derate above $25^\circ\text{C}$ | $P_D$     | 270<br>1.54 | Watts<br>W/ $^\circ\text{C}$ |
| Storage Temperature Range                                                                  | $T_{stg}$ | -65 to +150 | $^\circ\text{C}$             |
| Junction Temperature                                                                       | $T_J$     | 200         | $^\circ\text{C}$             |

### THERMAL CHARACTERISTICS

| Characteristic                       | Symbol          | Max  | Unit               |
|--------------------------------------|-----------------|------|--------------------|
| Thermal Resistance, Junction to Case | $R_{\theta JC}$ | 0.65 | $^\circ\text{C/W}$ |

#### NOTE:

- 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.

**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)**

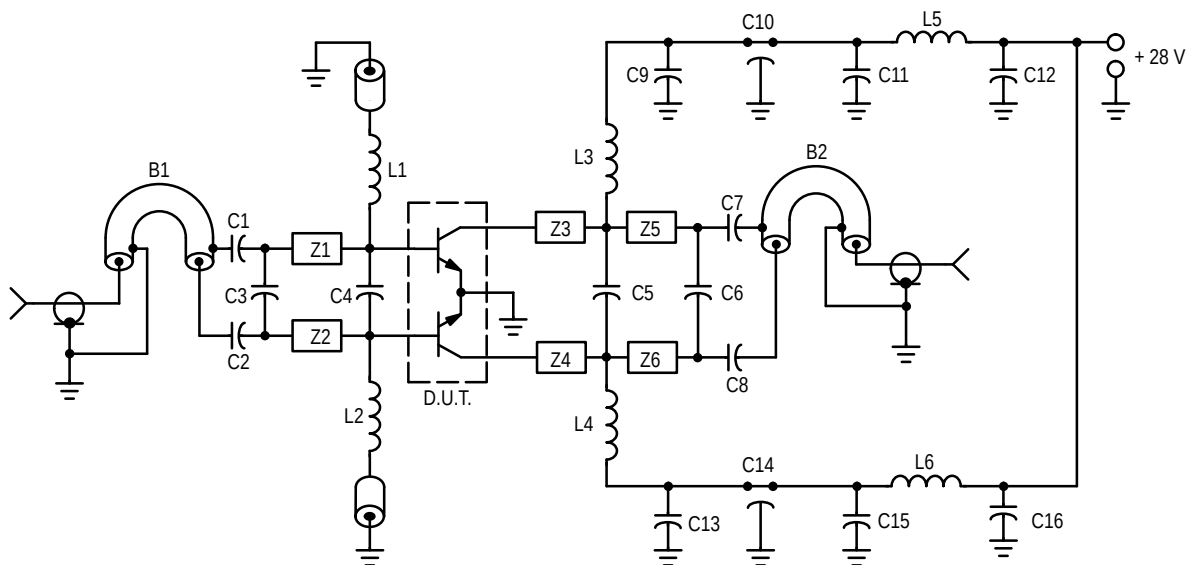
|                                                                                    |          |    |    |    |    |
|------------------------------------------------------------------------------------|----------|----|----|----|----|
| Output Capacitance ( $V_{CB} = 28\text{ Vdc}$ , $I_E = 0$ , $f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

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## CLASS C

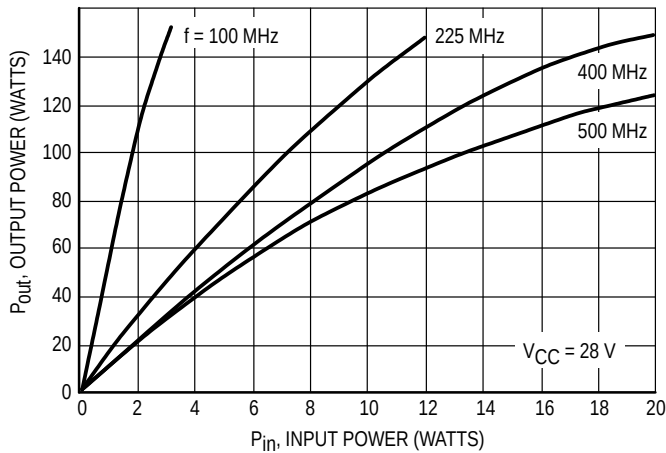


Figure 2. Output Power versus Input Power

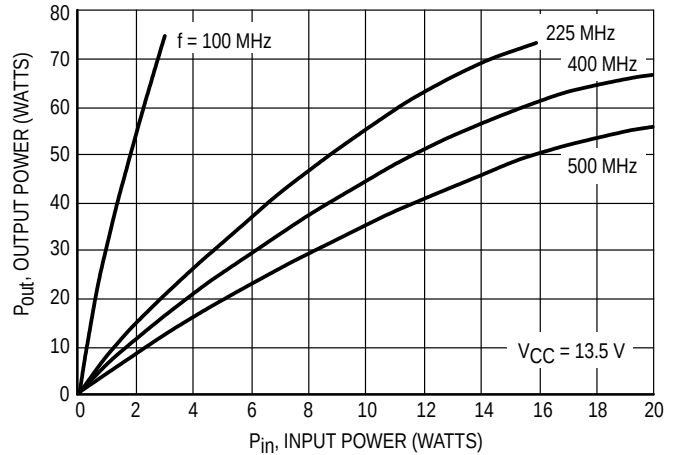


Figure 3. Output Power versus Input Power

## CLASS C

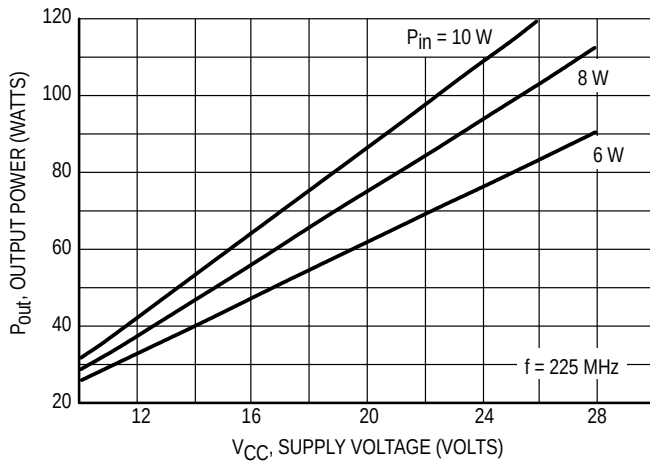


Figure 4. Output Power versus Supply Voltage

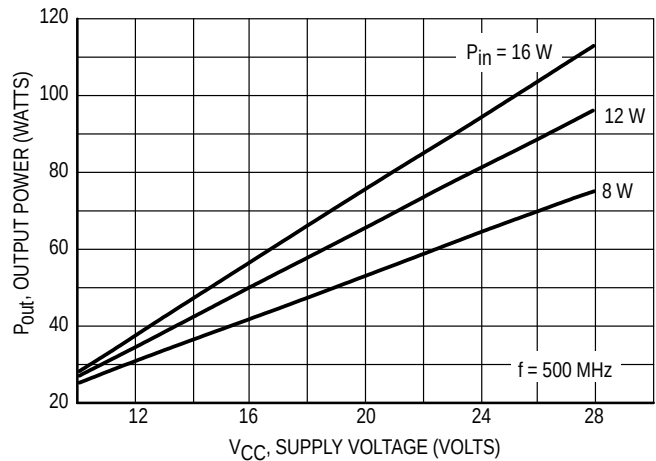
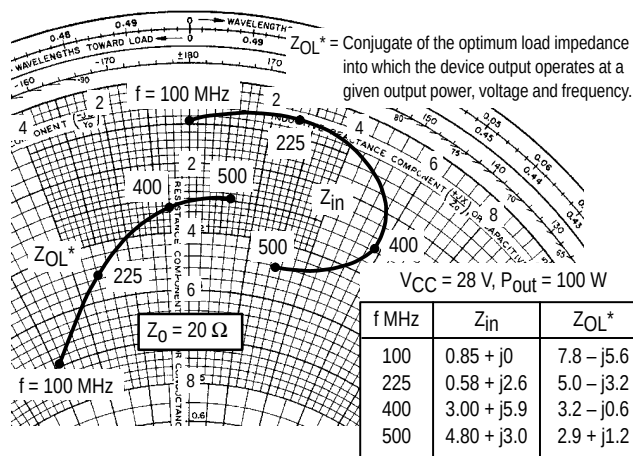


Figure 5. Output Power versus Supply Voltage



NOTE: Z<sub>in</sub> & Z<sub>OL</sub>\* are given from base-to-base and collector-to-collector respectively.

Figure 6. Series Equivalent Input/Output Impedance

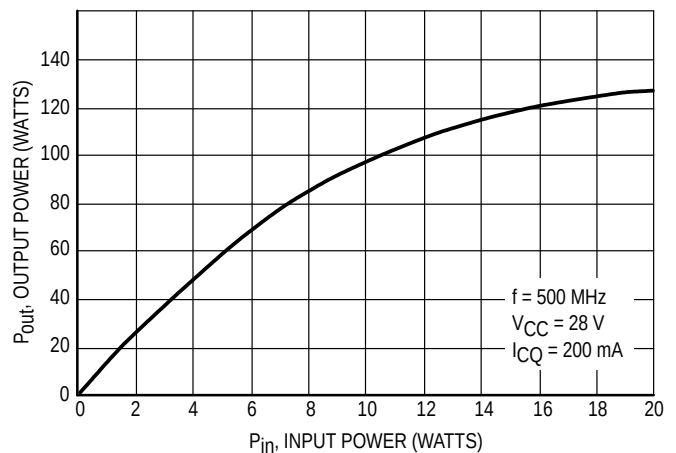
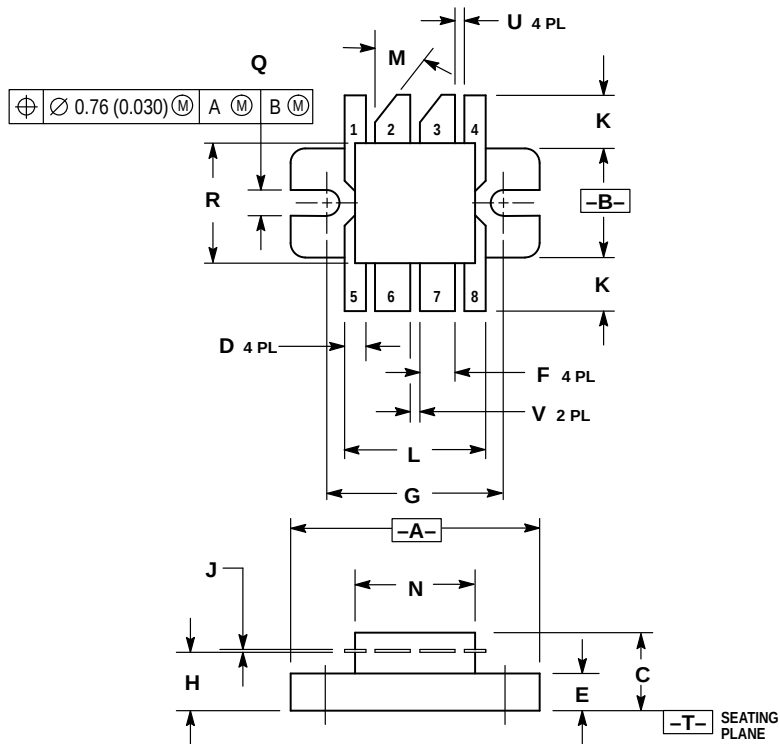


Figure 7. Class AB Output Power versus Input Power

## PACKAGE DIMENSIONS



NOTES:  
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.

| DIM | MILLIMETERS |       | INCHES |       |
|-----|-------------|-------|--------|-------|
|     | MIN         | MAX   | MIN    | MAX   |
| A   | 22.60       | 23.11 | 0.890  | 0.910 |
| B   | 9.52        | 10.03 | 0.375  | 0.395 |
| C   | 6.65        | 7.16  | 0.262  | 0.282 |
| D   | 1.60        | 1.95  | 0.063  | 0.077 |
| E   | 2.94        | 3.40  | 0.116  | 0.134 |
| F   | 2.87        | 3.22  | 0.113  | 0.127 |
| G   | 16.51       | BSC   | 0.650  | BSC   |
| H   | 4.01        | 4.36  | 0.158  | 0.172 |
| J   | 0.07        | 0.15  | 0.003  | 0.006 |
| K   | 4.34        | 4.90  | 0.171  | 0.193 |
| L   | 12.45       | 12.95 | 0.490  | 0.510 |
| M   | 45°         | NOM   | 45°    | NOM   |
| N   | 1.051       | 11.02 | 0.414  | 0.434 |
| Q   | 3.04        | 3.35  | 0.120  | 0.132 |
| R   | 9.90        | 10.41 | 0.390  | 0.410 |
| U   | 1.02        | 1.27  | 0.040  | 0.050 |
| V   | 0.64        | 0.89  | 0.025  | 0.035 |

STYLE 1:  
PIN 1: EMITTER (COMMON)  
2: COLLECTOR  
3: COLLECTOR  
4: EMITTER (COMMON)  
5: EMITTER (COMMON)  
6: BASE  
7: BASE  
8: EMITTER (COMMON)

CASE 744A-01  
ISSUE C

Specifications subject to change without notice.

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