MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF390

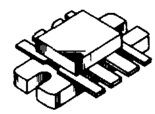
The RF Line

NPN Silicon Push-Pull RF Power Transistor

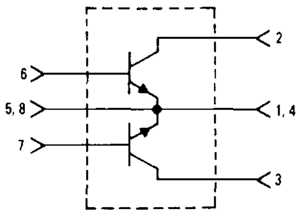
. . . designed primarily for wideband large-signal output and driver amplifier stages in the 30–500 MHz frequency range.

- Specified 28 Volt, 400 MHz Characteristics —
  Output Power = 60 Watts
  Typical Gain = 9.5 dB
  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

60 WATTS, 30–500 MHz CONTROLLED "Q" BROADBAND PUSH-PULL RF POWER TRANSISTOR NPN SILICON



CASE 744A-01, STYLE 1



The MRF390 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_{CEO}	30	Vdc
Collector-Base Voltage	V_{CBO}	60	Vdc
Emitter-Base Voltage	V_{EBO}	4	Vdc
Collector Current — Continuous	I_C	7	Adc
Total Device Dissipation @ T_C = 25°C (1) Derate above 25°C	P_D	140 0.80	Watts W/°C
Storage Temperature Range	T_{stg}	−65 to +150	°C
Junction Temperature	T_J	200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	1.25	°C/W

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

ELECTRICAL CHARACTERISTICS (T_C = 25°C unless otherwise noted.)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (NOTE 1)					
Collector-Emitter Breakdown Voltage (I_C = 30 mAdc, I_B = 0)	$V_{(BR)CEO}$	30	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 30 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	60	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 3 mAdc, I_C = 0)	$V_{(BR)EBO}$	4	—	—	Vdc
Collector Cutoff Current (V_{CB} = 30 Vdc, I_E = 0)	I_{CBO}	—	—	3	mAdc
ON CHARACTERISTICS (NOTE 1)					
DC Current Gain (I_C = 1 Adc, V_{CE} = 5 Vdc)	h_{FE}	20	—	100	—
DYNAMIC CHARACTERISTICS (NOTE 1)					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1 MHz)	C_{ob}	—	37	50	pF
FUNCTIONAL TEST (NOTE 2 — See Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 60 W, f = 400 MHz)	G_{pe}	7.5	9.5	—	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 60 W, f = 400 MHz)	η	50	55	—	%
Load Mismatch (V_{CC} = 28 Vdc, P_{out} = 60 W, f = 400 MHz VSWR = 30:1, all phase angles)	ψ	No Degradation in Output Power			

NOTES:
1. Each transistor chip measured separately.
2. Both transistor chips operating in push-pull amplifier.

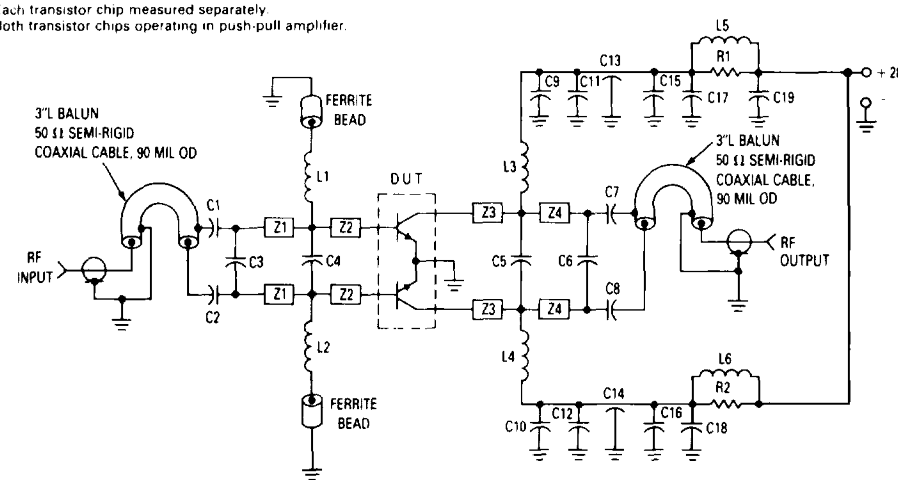


Figure 1. 400 MHz Test Circuit

C1, C2 — 240 pF, 100 Mil Chip
C3 — 12 pF, 100 Mil Chip
C5 — 20 pF, 100 Mil Chip
C4, C6 — 18 pF, 100 Mil Chip
C7, C8 — 270 pF, 100 Mil Chip
C9, C10, C11, C12 — 470 pF, 100 Mil Chip
C13, C14 — 680 pF Feedthru Capacitor
C15, C16, C19 — 0.1 μF Disc Ceramic
C17, C18 — 1 μF, 50 V Tantalum Capacitor
R1, R2 — 910 kΩ, 2 W Carbon Res.

L1, L2 — 10 μH RF Choke With Ferrite Bead
L3, L4 — 5 Turns #20 AWG, 1/4" ID
L5, L6 — 15 Turns #18 AWG Enameled, 0.35" ID Closewound Around R1, R2 Respectively
Z1 — Microstrip Line 850 Mils L x 130 Mils W
Z2, Z3 — Microstrip Line 250 Mils L x 130 Mils W
Z4 — Microstrip Line 830 Mils L x 130 Mils W
Board Material — 0.0625" Teflon Fiberglass ϵ_r = 2.5 ± 0.05, 1 oz. cu. clad, Double Sided

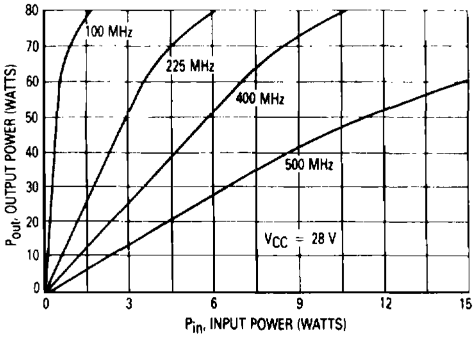


Figure 2. Output Power versus Input Power/Frequency

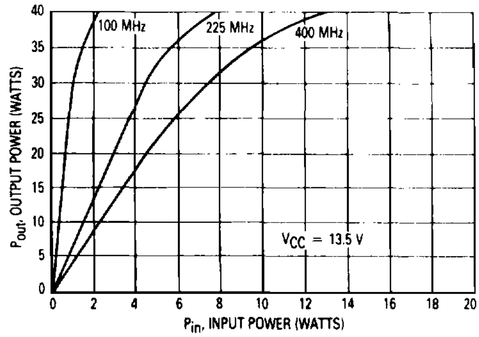


Figure 3. Output Power versus Input Power/Frequency

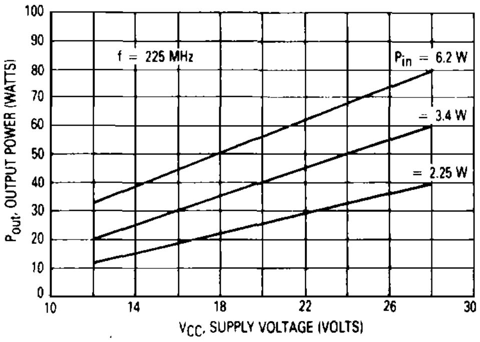


Figure 4. Output Power versus Supply Voltage — 225 MHz

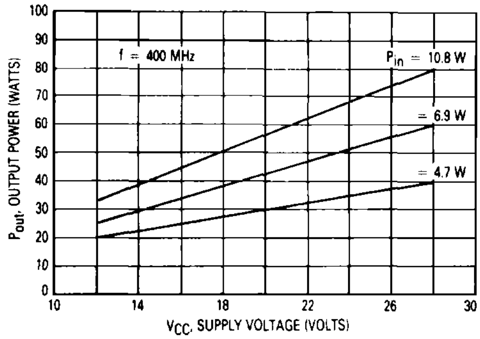
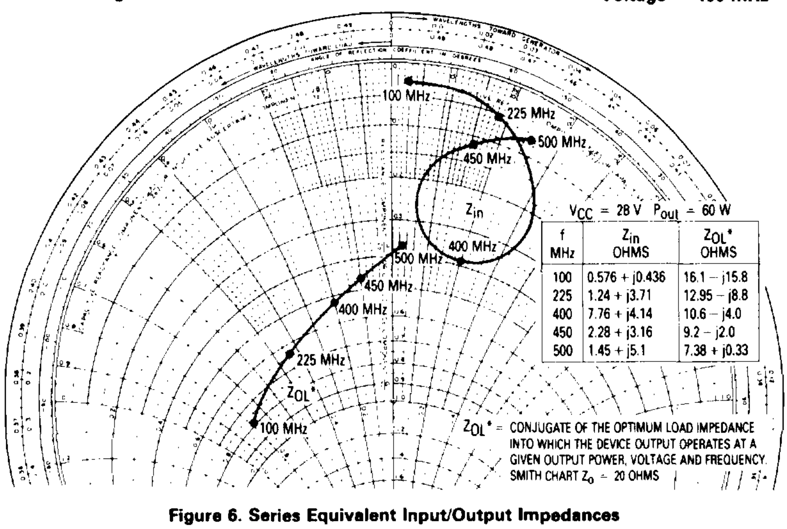
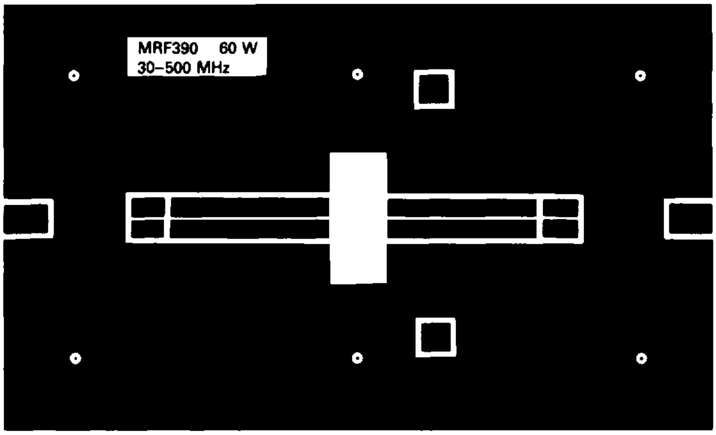


Figure 5. Output Power versus Supply Voltage — 400 MHz



f MHz	Z_{in} OHMS	Z_{OL}* OHMS
100	0.576 + j0.436	16.1 – j15.8
225	1.24 + j3.71	12.95 – j8.8
400	7.76 + j4.14	10.6 – j4.0
450	2.28 + j3.16	9.2 – j2.0
500	1.45 + j5.1	7.38 + j0.33

Figure 6. Series Equivalent Input/Output Impedances



NOTE: The Printed Circuit Board shown is 75% of the original.

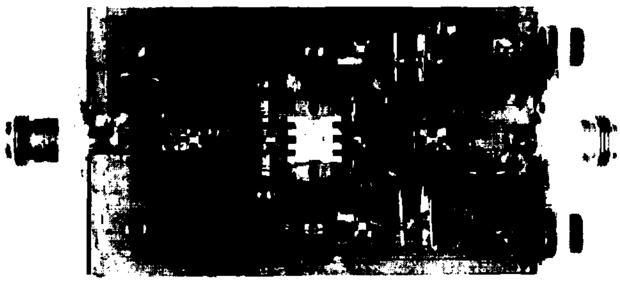


Figure 7. 400 MHz Test Circuit and Photomaster