

6367254 MOTOROLA SC (XSTRS/R F)

89D 78971 D

T-33-15

**MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA**

MRF412

The RF Line

NPN SILICON RF POWER TRANSISTOR

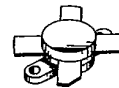
... designed primarily for applications as a high-power amplifier from 2.0 to 30 MHz, in single sideband mobile, marine and base station equipment where superior ruggedness is required.

- Specified 13.6 V, 30 MHz Characteristics —
Output Power = 70 W PEP or CW
Minimum Gain = 13 dB
Efficiency = 40%
Intermodulation Distortion $d_3 = -33$ dB Typ
- Guaranteed Ruggedness @ 3.0 dB Overdrive and 15.5 V Supply

70 W (PEP) — 30 MHz

**RF POWER
TRANSISTOR**

NPN SILICON



MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	18	Vdc
Collector-Base Voltage	V _{CBO}	36	Vdc
Emitter-Base Voltage	V _{EBO}	4.0	Vdc
Collector-Current — Continuous	I _C	20	Adc
Total Device Dissipation @ T _C = 25°C (1) Derate above 25°C	P _D	250 1.43	Watts mW/°C
Storage Temperature Range	T _{stg}	-65 to +150	°C

THERMAL CHARACTERISTICS

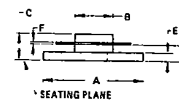
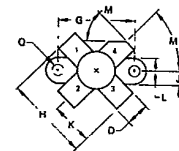
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	R _{θJC}	0.7	°C/W

- (1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as RF amplifiers.
- (2) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

MATCHING PROCEDURE

In the push-pull circuit configuration it is preferred that the transistors are used as matched pairs to obtain optimum performance.

The matching procedure used by Motorola consists of measuring h_{FE} at the data sheet conditions and color coding the device to predetermined h_{FE} ranges within the normal h_{FE} limits. A color dot is added to the marking on top of the cap. Any two devices with the same color dot can be paired together to form a matched set of units.



STYLE 1
PIN 1 EMITTER
2 BASE
3 EMITTER
4 COLLECTOR

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	24.38	25.15	0.960	0.990
B	5.40	5.93	0.213	0.233
C	5.87	7.14	0.231	0.281
D	5.48	5.97	0.215	0.235
E	7.15	7.67	0.281	0.303
F	2.15	2.15	0.084	0.084
G	18.28	18.54	0.719	0.730
H	20.07	20.57	0.790	0.810
K	10.23	10.23	0.403	0.403
L	6.27	6.48	0.248	0.255
M	40°	40°	40°	40°
N	4.81	4.93	0.189	0.193
D	2.87	3.30	0.113	0.130

CASE 211-11

6367254 MOTOROLA SC (XSTRS/R F)

89D 78972 DT-33-15

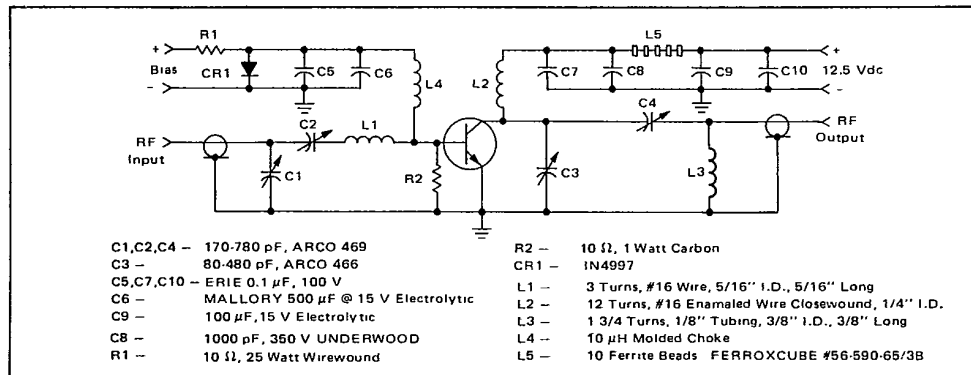
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ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 100 \text{ mAdc}$, $I_B = 0$)	$V_{(BR)CEO}$	18	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 50 \text{ mAdc}$, $V_{BE} = 0$)	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10 \text{ mAdc}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ($V_{CE} = 13.6 \text{ Vdc}$, $V_{BE} = 0$)	I_{CES}	—	—	20	mAdc
ON CHARACTERISTICS					
DC Current Gain ($I_C = 5.0 \text{ Adc}$, $V_{CE} = 5.0 \text{ Vdc}$)	h_{FE}	10	—	150	—
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 15 \text{ Vdc}$, $I_E = 0$, $f = 1.0 \text{ MHz}$)	C_{ob}	—	—	450	pF
FUNCTIONAL TESTS (SSB)					
Common-Emitter Amplifier Power Gain ($V_{CC} = 13.6 \text{ Vdc}$, $P_{out} = 70 \text{ W (PEP)}$, $f_1 = 30 \text{ MHz}$, $f_2 = 30.001 \text{ MHz}$, $I_{CQ} = 100 \text{ mA}$)	G_{PE}	13	16	—	dB
Collector Efficiency ($V_{CC} = 13.6 \text{ Vdc}$, $P_{out} = 70 \text{ W (PEP)}$, $f_1 = 30 \text{ MHz}$, $f_2 = 30.001 \text{ MHz}$, $I_{CQ} = 100 \text{ mA}$)	η	40	—	—	%
Intermodulation Distortion (1) (PEP) ($V_{CC} = 13.6 \text{ Vdc}$, $P_{out} = 70 \text{ W (PEP)}$, $f_1 = 30 \text{ MHz}$, $f_2 = 30.001 \text{ MHz}$, $I_{CQ} = 100 \text{ mA}$)	$IMD(d_3)$	—	-33	-28	dB
Load Mismatch ($V_{CC} = 15.5 \text{ Vdc}$, $P_{in} = 7.0 \text{ W (CW)}$, $f = 30 \text{ MHz}$, $V_{SWR} = 30:1$ All Angles)	ψ	No Degradation in Output Power			

(1) To MIL-STD-1311 Version A, Test Method 2204B, Two Tone, Reference Each Tone.

FIGURE 1 — 30-MHz TEST CIRCUIT



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FIGURE 2 — OUTPUT POWER versus INPUT POWER

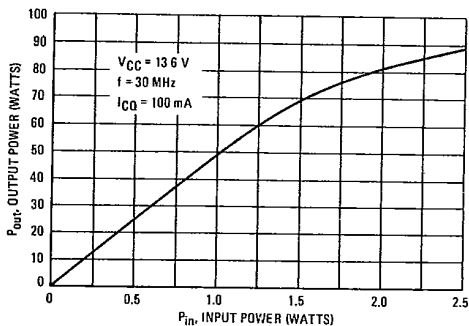


FIGURE 3 — POWER GAIN versus FREQUENCY

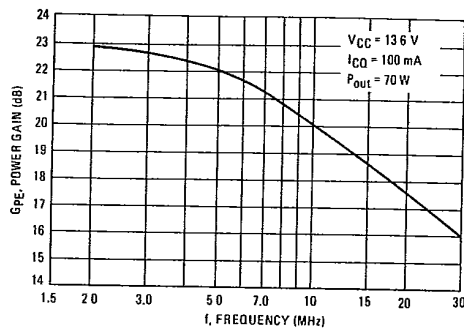


FIGURE 4 — OUTPUT POWER versus SUPPLY VOLTAGE

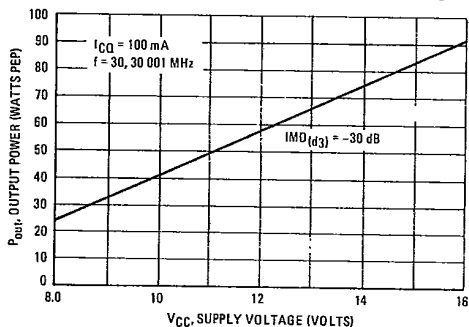


FIGURE 5 — INTERMODULATION DISTORTION versus OUTPUT POWER

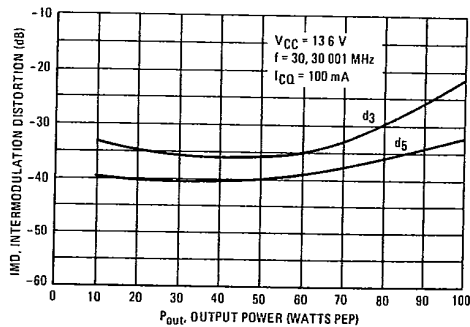


FIGURE 6 — OUTPUT CAPACITANCE versus FREQUENCY

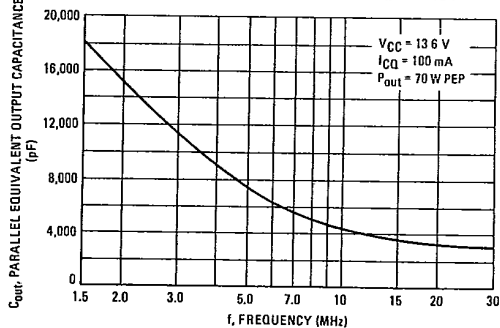
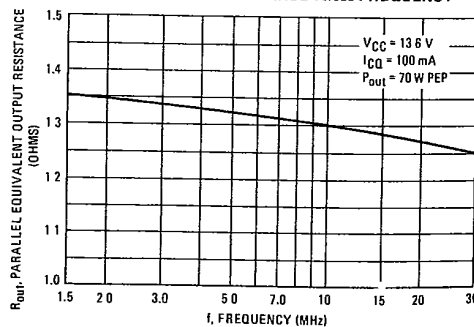


FIGURE 7 — OUTPUT RESISTANCE versus FREQUENCY



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FIGURE 8 -- SAFE OPERATING AREA

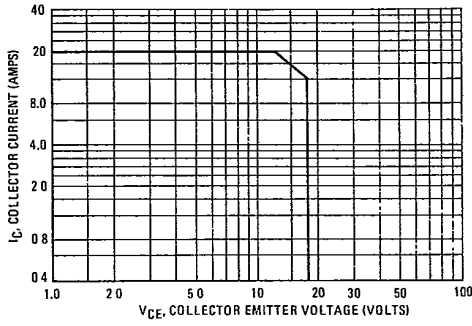
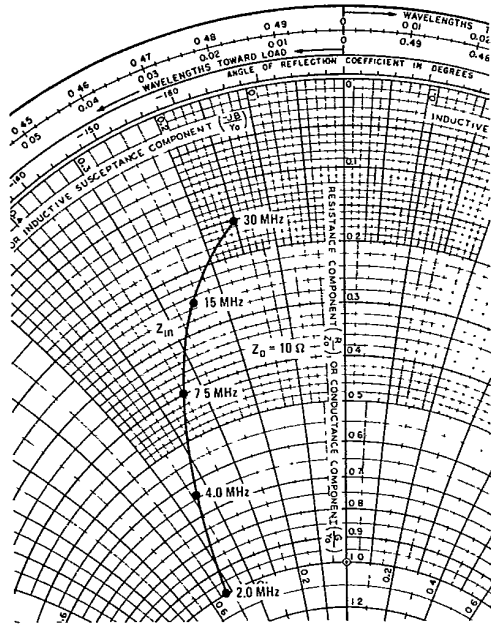


FIGURE 9 -- SERIES INPUT IMPEDANCE



$V_{CC} = 13.6 \text{ V}$
 $I_{CQ} = 100 \text{ mA}$
 $P_{out} = 70 \text{ W PEP}$

f MHz	Z _{in} Ohms
30	1.5 - j1.5
15	2.4 - j2.6
7.5	4.0 - j3.4
4.0	6.3 - j4.6
2.0	9.9 - j5.3

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