

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**

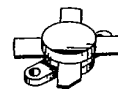
... designed primarily for applications as a high-power amplifier from 2.0 to 30 MHz, in single sideband mobile, marine and base station equipment where superior ruggedness is required.

- 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 @ $T_C = 25^\circ\text{C}$ (1) Derate above 25°C	P_D	250 1.43	Watts mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +150	$^\circ\text{C}$

THERMAL CHARACTERISTICS

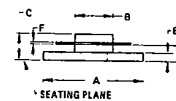
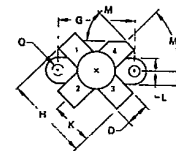
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	$R_{\theta JC}$	0.7	$^\circ\text{C}/\text{W}$

- (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	0.235
C	5.87	7.14	0.231	0.281
D	5.45	5.97	0.215	0.235
E	7.15	7.67	0.281	0.303
F	0.10	0.15	0.004	0.006
G	18.28	18.54	0.720	0.730
H	20.07	20.57	0.790	0.810
I	10.01	10.27	0.394	0.407
J	6.27	6.48	0.248	0.255
K	40°	50°	40°	50°
L	2.81	2.93	0.110	0.115
M	2.87	3.30	0.113	0.130

CASE 211-11

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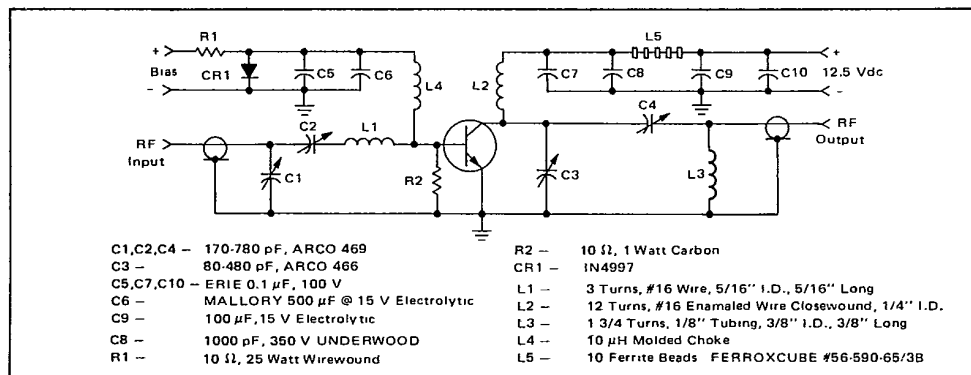
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ELECTRICAL CHARACTERISTICS ($T_C = 25^\circ\text{C}$ unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 100\text{ mA}$, $I_B = 0$)	$V_{(BR)CEO}$	18	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 50\text{ mA}$, $V_{BE} = 0$)	$V_{(BR)CES}$	36	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 10\text{ mA}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ($V_{CE} = 13.6\text{ Vdc}$, $V_{BE} = 0$)	I_{CES}	—	—	20	mA
ON CHARACTERISTICS					
DC Current Gain ($I_C = 5.0\text{ A}$, $V_{CE} = 5.0\text{ Vdc}$)	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

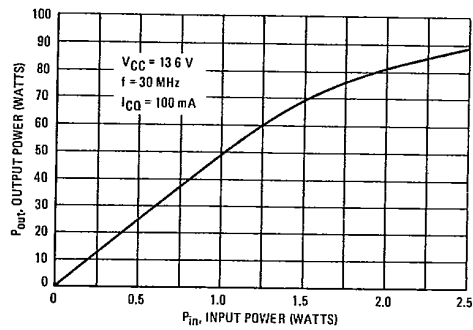


FIGURE 3 — POWER GAIN versus FREQUENCY

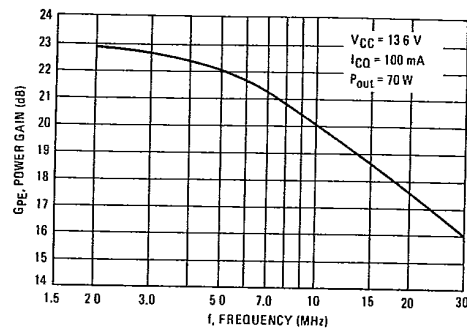


FIGURE 4 — OUTPUT POWER versus SUPPLY VOLTAGE

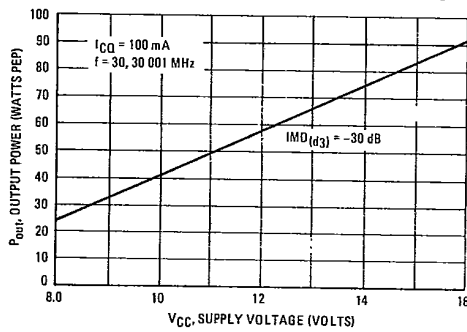


FIGURE 5 — INTERMODULATION DISTORTION versus OUTPUT POWER

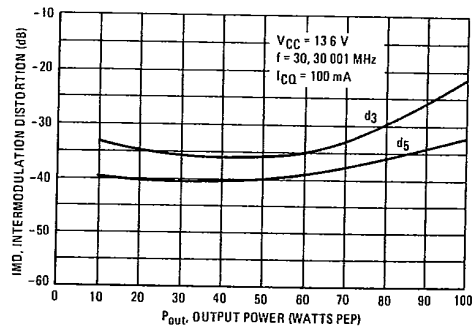


FIGURE 6 — OUTPUT CAPACITANCE versus FREQUENCY

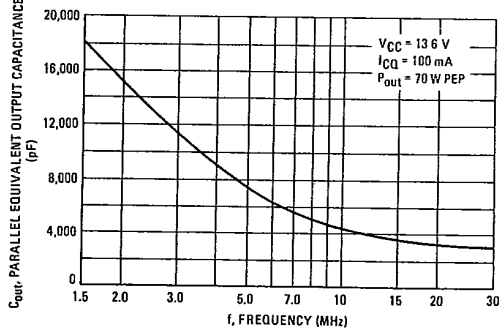
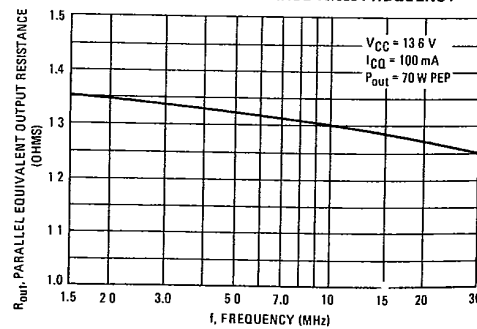


FIGURE 7 — OUTPUT RESISTANCE versus FREQUENCY



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FIGURE 8 -- SAFE OPERATING AREA

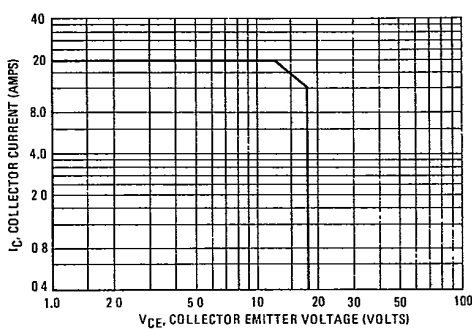
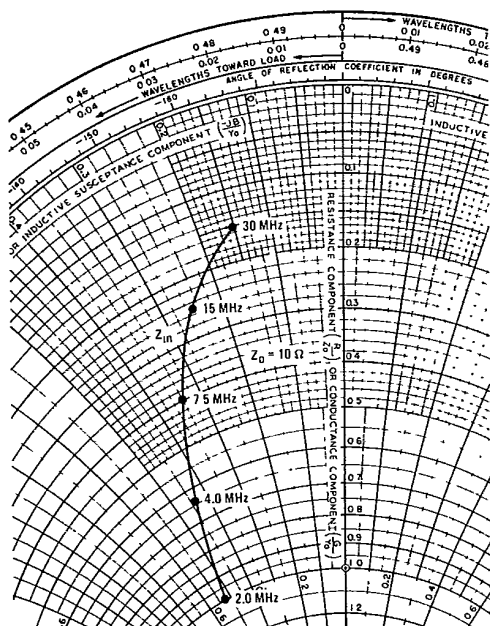


FIGURE 9 -- SERIES INPUT IMPEDANCE



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

f MHz	Z_{in} Ohms
30	$15 - j1.5$
15	$24 - j2.6$
7.5	$40 - j3.4$
4.0	$63 - j4.6$
2.0	$99 - j5.3$

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