MOTOROLA Semiconductors

BOX 20912 • PHOENIX, ARIZONA 85036

MRF233

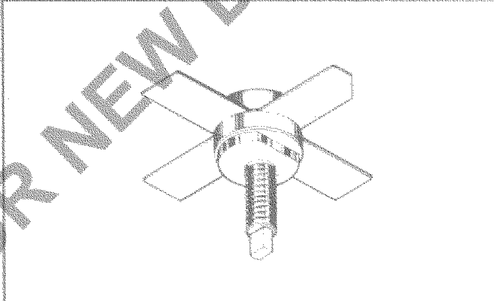
The RF Line

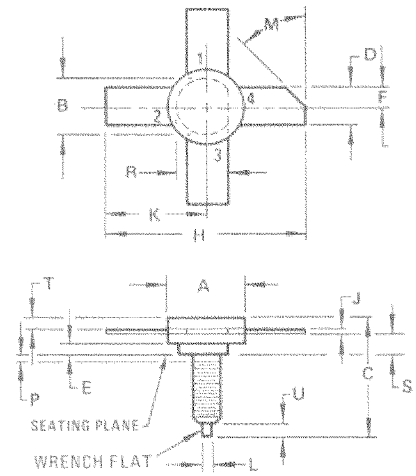
15 W – 90 MHz
RF POWER TRANSISTOR
NPN SILICON

NPN SILICON RF POWER TRANSISTORS

. . . designed for 12.5 Volt, mid-band large-signal amplifier applications in industrial and commercial FM equipment operating in the 40 to 100 MHz range.

- Specified 12.5 Volt, 90 MHz Characteristics –
  Output Power = 15 Watts
  Minimum Gain = 10 dB
  Efficiency = 55%
- 100% Tested for Load Mismatch at all Phase Angles with 30:1 VSWR
- Characterized with Series Equivalent Large-Signal Impedance Parameters
- Characterized with Parallel Equivalent Large-Signal Impedance Parameters





STYLE 1:
PIN 1. EMITTER
2. BASE
3. EMITTER
4. COLLECTOR

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	9.40	9.78	0.370	0.385
B	8.13	8.38	0.320	0.330
C	18.03	19.05	0.710	0.750
D	5.59	5.84	0.220	0.230
E	1.78	2.03	0.070	0.080
F	2.79	2.92	0.110	0.115
H	26.42	28.70	1.040	1.130
J	0.10	0.15	0.004	0.006
K	13.21	14.35	0.520	0.565
L	1.40	1.65	0.055	0.065
M	45° NOM		45° NOM	
P	—	1.27	—	0.050
R	7.59	7.80	0.299	0.307
S	4.01	4.52	0.158	0.178
T	2.16	2.41	0.085	0.095
U	2.54	3.30	0.100	0.130

NOTE:
CASE 145A-01 USE 8-32NC2A STUD

CASE 145A-01

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	3.5	Adc
Total Device Dissipation @ $T_C = 25^\circ C$ (1)	P_D	50	Watts
Derate Above 25°C	—	285	mW/°C
Storage Temperature Range	T_{stg}	-65 to +200	°C
Stud Torque (2)	—	6.5	In-lb

THERMAL CHARACTERISTICS

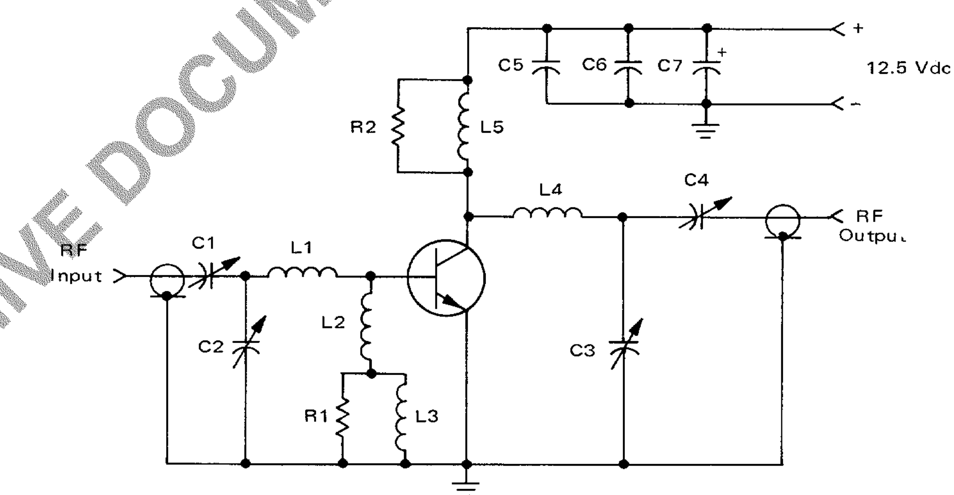
Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case	$R_{\theta JC}$	3.5	°C/W

(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as Class C RF amplifiers.
(2) For Repeated Assembly use 5 In. Lb.

ELECTRICAL CHARACTERISTICS ($T_C = 25^oC$ unless otherwise noted).

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 100 mAdc, I_B = 0)	BV_{CEO}	18	—	—	Vdc
Collector-Emitter Breakdown Voltage (I_C = 50 mAdc, V_{BE} = 0)	BV_{CES}	36	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 5.0 mAdc, I_C = 0)	BV_{EBO}	4.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 15 Vdc, I_E = 0)	I_{CBO}	—	—	1.0	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 1.0 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	5.0	—	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 12.5 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	—	100	120	pF
FUNCTIONAL TESTS (Figure 1)					
Common-Emitter Amplifier Power Gain (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz)	G_{PE}	10	—	—	dB
Collector Efficiency (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz)	η	55	—	—	%
Load Mismatch (V_{CC} = 12.5 Vdc, P_{out} = 15 W, f = 90 MHz, $T_C \leqslant 25^oC$)	—	VSWR > 30:1 Through All Phase Angles in a 3 Second Interval After Which Devices Will Meet G_{PE} Test Limits			

FIGURE 1 — 90 MHz TEST CIRCUIT SCHEMATIC



C1,C3 9.0-180 pF, ARCO 463
C2,C4 25-280 pF ARCO 464
C5 1000 pF UNELCO
C6 0.01 μF ERIE Disc Ceramic
C7 1.0 μF, 35 Vdc TANTALUM
L1 2 Turns, #18 AWG, 3/8" I.D., 1/4" Long
L2 0.22 μH, 9230-04 MILLER Molded Choke
L3 2.2 μH, 9230-200 MILLER Molded Choke
L4 2 Turns, #18 AWG, 3/8" I.D., 3/8" Long
L5 10 Turns, #16 AWG, Wound On R2.
R1 15 Ohm, 1/2 W, 10% Carbon
R2 68 Ohm, 1 Watt, 10% Carbon
Input/Output Connectors — Type BNC

FIGURE 2 – OUTPUT POWER versus INPUT POWER

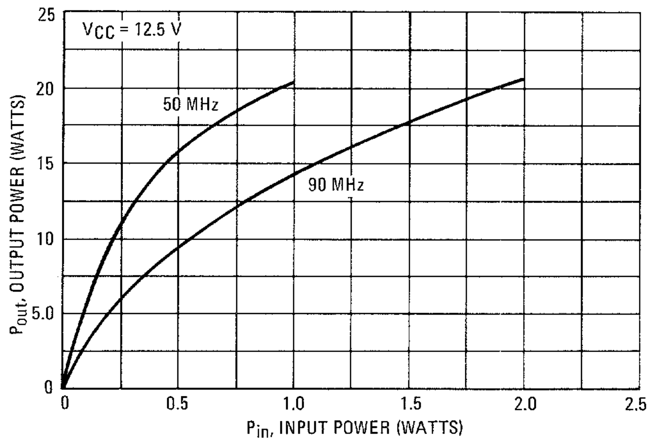


FIGURE 3 – OUTPUT POWER versus FREQUENCY

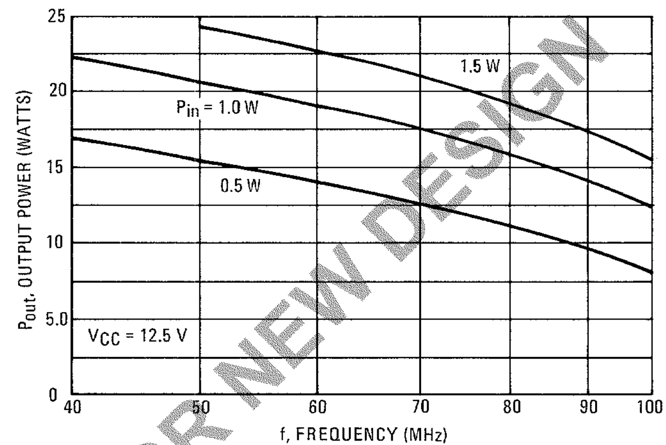


FIGURE 4 – OUTPUT POWER versus SUPPLY VOLTAGE

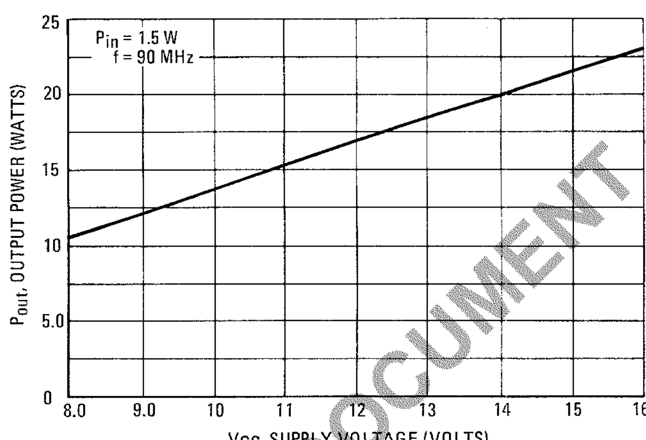
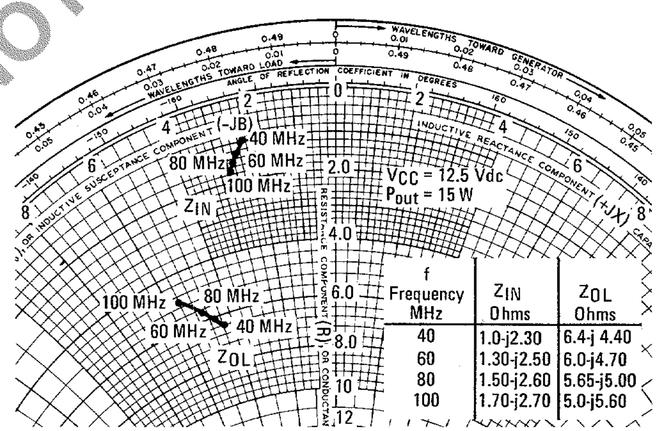


FIGURE 5 – SERIES EQUIVALENT IMPEDANCE



f Frequency MHz	Z_{IN} Ohms	Z_{OL} Ohms
40	1.0-j2.30	6.4-j 4.40
60	1.30-j2.50	6.0-j4.70
80	1.50-j2.60	5.65-j5.00
100	1.70-j2.70	5.0-j5.60

FIGURE 6 — PARALLEL EQUIVALENT INPUT RESISTANCE versus FREQUENCY

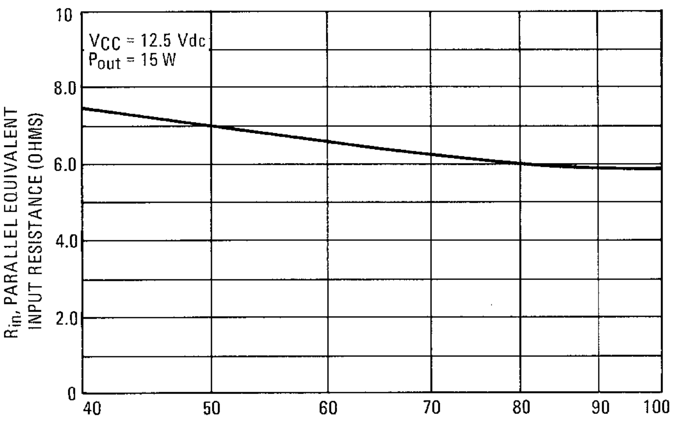


FIGURE 7 — PARALLEL EQUIVALENT INPUT CAPACITANCE versus FREQUENCY

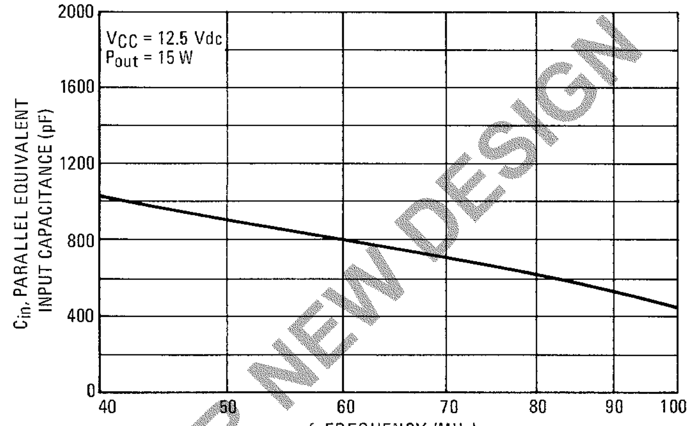


FIGURE 8 — PARALLEL EQUIVALENT OUTPUT RESISTANCE versus FREQUENCY

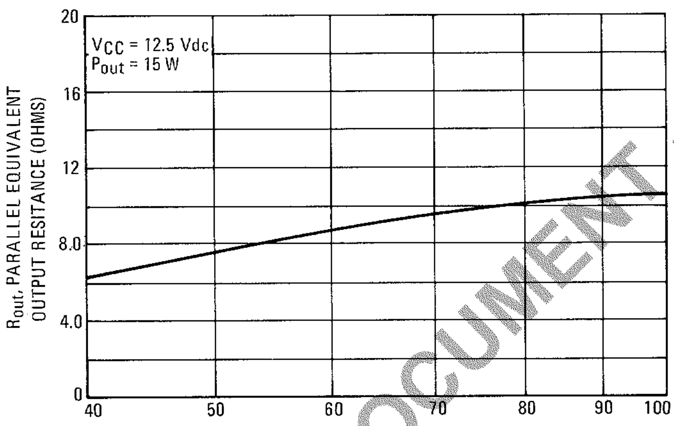
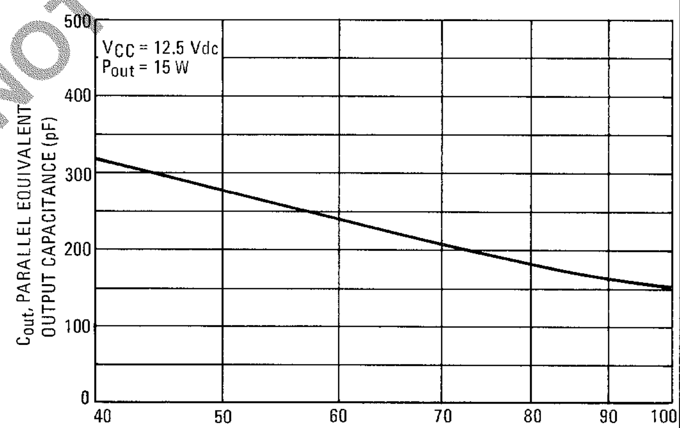


FIGURE 9 — PARALLEL EQUIVALENT OUTPUT CAPACITANCE versus FREQUENCY



MOTOROLA Semiconductor Products Inc.

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