

MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF2001
MRF2001B

The RF Line

NPN SILICON MICROWAVE POWER TRANSISTORS

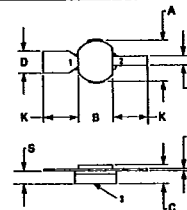
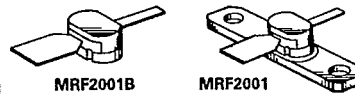
... designed for Class B and C amplifier or oscillator applications in the 1.0 to 2.3 GHz frequency range.

- Guaranteed Performance @ 2 GHz, 28 Vdc
Output Power = 1.0 Watt
Minimum Gain = 9.0 dB
- 100% Tested for Load Mismatch at All Phase Angles
With 10:1 VSWR
- Hermetically Sealed Industry Standard Package
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Compatible with Older 2001 Types
- Other Devices in the 2000 Series:
MRF2003 3 W
MRF2005 5 W
MRF2010 10 W

1.0 W 2 GHz

MICROWAVE POWER TRANSISTORS

NPN SILICON



DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	5.72	5.97	0.225	0.235
B	4.44	4.70	0.175	0.185
C	2.29	2.74	0.090	0.108
D	2.92	3.18	0.115	0.125
F	1.14	1.40	0.045	0.055
J	0.08	0.15	0.003	0.006
K	—	0.52	—	0.020
S	1.52	1.78	0.060	0.070

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

CASE 328-02

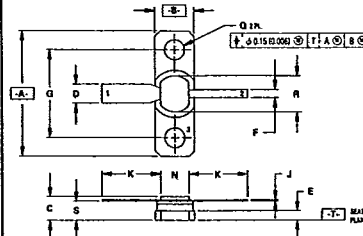
MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Emitter Voltage	V _{CEO}	20	Vdc
Collector-Base Voltage	V _{CBO}	45	Vdc
Emitter-Base Voltage	V _{EBO}	4.0	Vdc
Collector-Current — Continuous	I _C	250	mA _{dc}
Total Device Dissipation @ T _C = 25°C (1) Derate above 25°C	P _D	7.0 40	Watts mW/°C
Storage Temperature Range	T _{stg}	-65 to +200	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	R _{θJC}	25	°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.



NOTES:
1. DIMENSION J AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION—INCH

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.20	20.57	0.795	0.810
B	6.23	6.47	0.245	0.255
C	3.69	4.31	0.145	0.170
D	2.92	3.17	0.115	0.125
E	1.40	1.77	0.055	0.070
F	1.15	1.39	0.045	0.055
G	14.22 BSC	—	0.560 BSC	—
J	0.08	0.15	0.003	0.006
K	—	0.52	—	0.020
M	4.45	4.69	0.175	0.185
O	3.05	3.42	0.120	0.135
R	5.72	5.97	0.225	0.235
S	2.92	3.55	0.115	0.140

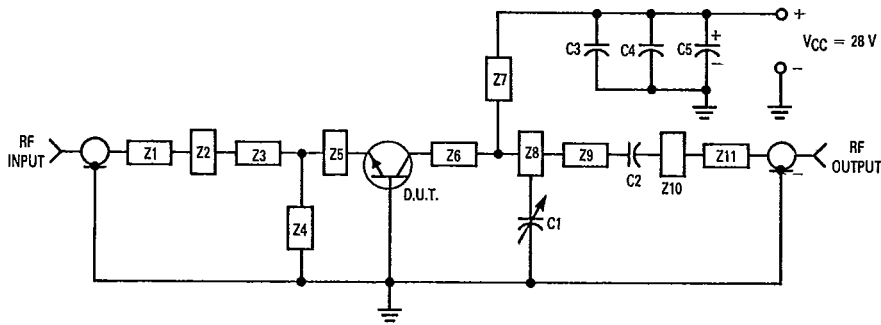
STYLE 1:
PIN 1. EMITTER
2. COLLECTOR
3. BASE

CASE 328A-02

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I _C = 5.0 mA _{dc} , I _B = 0)	V _{(BR)CEO}	20	—	—	V _{dc}
Collector-Emitter Breakdown Voltage (I _C = 5.0 mA _{dc} , R _{BE} = 10 Ω)	V _{(BR)CER}	45	—	—	V _{dc}
Collector-Base Breakdown Voltage (I _C = 5.0 mA _{dc} , I _E = 0)	V _{(BR)CBO}	45	—	—	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 1.0 mA _{dc} , I _C = 0)	V _{(BR)EBO}	4.0	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 28 V _{dc} , I _E = 0)	I _{CBO}	—	—	0.5	mA _{dc}
ON CHARACTERISTICS					
DC Current Gain (I _C = 100 mA _{dc} , V _{CE} = 5.0 V _{dc})	h _{FE}	10	—	100	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V _{CB} = 28 V _{dc} , I _E = 0, f = 1.0 MHz)	C _{ob}	—	2.5	5.0	pF
FUNCTIONAL TESTS					
Common-Base Amplifier Power Gain (V _{CC} = 28 V _{dc} , P _{out} = 1.0 W, f = 2.0 GHz)	G _{PB}	9.0	10	—	dB
Collector Efficiency (V _{CC} = 28 V _{dc} , P _{out} = 1.0 W, f = 2.0 GHz)	η	30	35	—	%
Load Mismatch (V _{CC} = 28 V _{dc} , P _{out} = 1.0 W, f = 2.0 GHz, VSWR = 10:1 All Phase Angles)	ψ	No Degradation in Power Output			

FIGURE 1. 2 GHz TEST CIRCUIT



- Z1-Z11 — Microstrip
- C1 — 0.4-2.5 pF Johanson 7285
- C2, C3 — 56 pF Chip Capacitor
- C4 — 0.1 μF
- C5 — 10 μF 50 V Electrolytic
- Board Material — 0.062" Glass Teflon

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FIGURE 2 – OUTPUT POWER versus INPUT POWER
(f = 1 GHz)

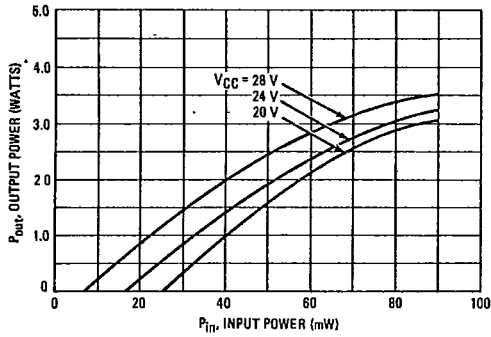


FIGURE 3 – OUTPUT POWER versus INPUT POWER
(f = 2 GHz)

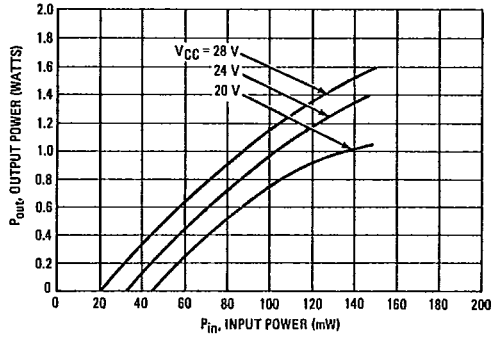


FIGURE 4 – OUTPUT POWER versus FREQUENCY

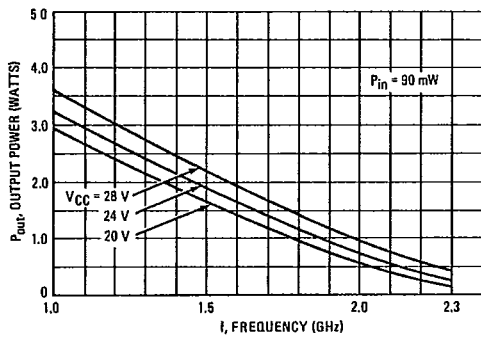


FIGURE 5 – POWER GAIN versus FREQUENCY

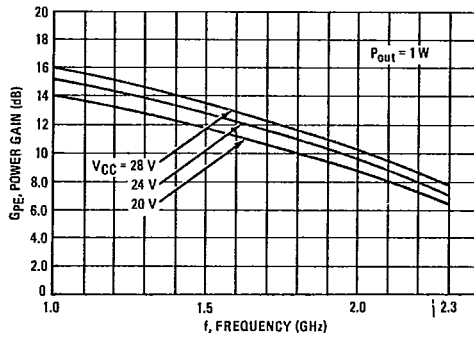
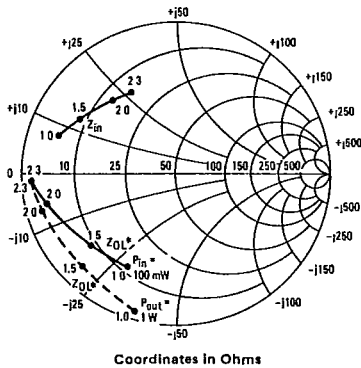


FIGURE 6 – SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE



V_{CC} = 28 V

f GHz	Z _{in} Ohms	Z _{OL} * Ohms	P _{in} = 100 mW	Z _{OL} * Ohms	P _{out} = 1 W
1.0	6.6 + j8.4	11 - j28.9		4.9 - j37.4	
1.5	8.5 + j12.2	8.1 - j17.3		4.6 - j21.0	
2.0	11.5 + j19.5	4.2 - j6.0		3.5 - j7.0	
2.3	13.4 + j26.0	3.4 - j1.8		3.4 - j1.8	

*Z_{OL} = Conjugate of the optimum load impedance into which the device output operates at a given output power, voltage and frequency.

MRF2001, MRF2001B

MOTOROLA SC XSTRS/R F

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FIGURE 7 - 2 GHz TEST AMPLIFIER

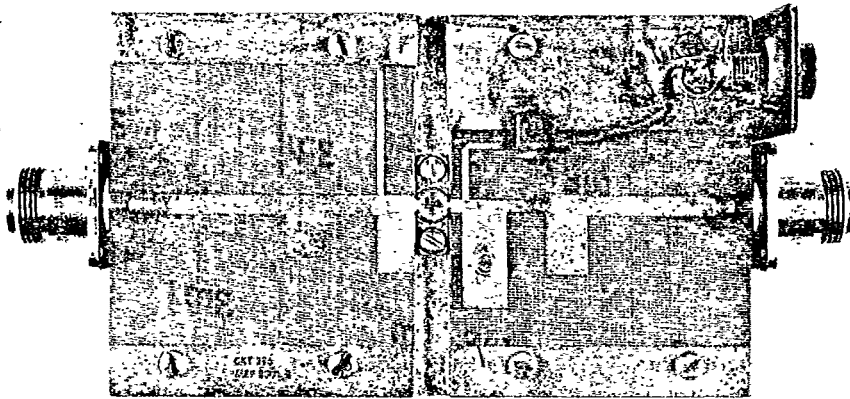
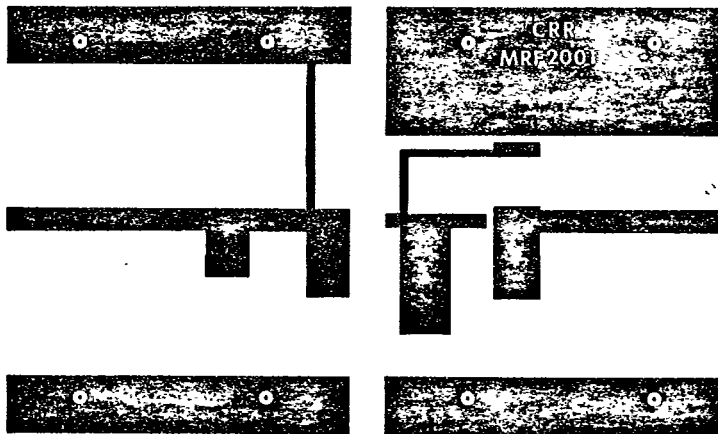


FIGURE 8 - PRINTED CIRCUIT BOARD LAYOUT - 2 GHz TEST CIRCUIT



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