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.

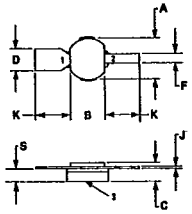
- Guaranteed Performance @ 2 GHz, 28 Vdc
  Output Power = 1.0 Watt
  Minimum Gain = 9.0 dB
- 100% Tested for Load Mismatch at All Phase Angles With 10:1 VSWR
- Hermetically Sealed Industry Standard Package
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Compatible 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

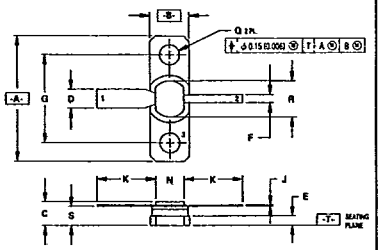
MRF2001B MRF2001



DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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	—	9.52	—	0.375
S	1.52	1.78	0.060	0.070

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

CASE 328-02



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

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES 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	2.93	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	—	9.52	—	0.375
N	4.45	4.69	0.175	0.185
Q	3.05	3.42	0.120	0.135
R	5.72	5.97	0.225	0.235
S	2.93	3.55	0.115	0.140

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

CASE 328A-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	mAdc
Total Device Dissipation @ $T_C = 25^oC$ (1) Derate above 25^oC	P_D	7.0 40	Watts $mW/^oC$
Storage Temperature Range	T_{stg}	−65 to +200	^oC

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (2)	$R_{\theta JC}$	25	$^oC/W$

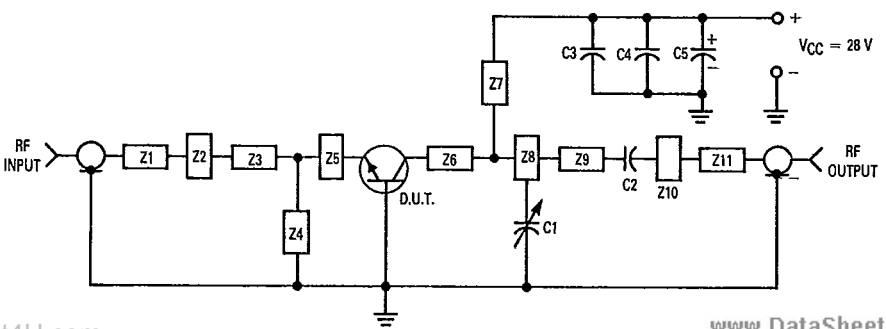
(1) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as RF amplifiers.

(2) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

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 mAdc, I_B = 0)	$V_{(BR)CEO}$	20	–	–	Vdc
Collector-Emitter Breakdown Voltage (I_C = 5.0 mAdc, R_{BE} = 10 Ω)	$V_{(BR)CER}$	45	–	–	Vdc
Collector-Base Breakdown Voltage (I_C = 5.0 mAdc, I_E = 0)	$V_{(BR)CBO}$	45	–	–	Vdc
Emitter-Base Breakdown Voltage (I_E = 1.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	–	–	Vdc
Collector Cutoff Current (V_{CB} = 28 Vdc, I_E = 0)	I_{CBO}	–	–	0.5	mAdc
ON CHARACTERISTICS					
DC Current Gain (I_C = 100 mAdc, V_{CE} = 5.0 Vdc)	h_{FE}	10	–	100	–
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 28 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	–	2.5	5.0	pF
FUNCTIONAL TESTS					
Common-Base Amplifier Power Gain (V_{CC} = 28 Vdc, P_{out} = 1.0 W, f = 2.0 GHz)	G_{PB}	9.0	10	–	dB
Collector Efficiency (V_{CC} = 28 Vdc, P_{out} = 1.0 W, f = 2.0 GHz)	η	30	35	–	%
Load Mismatch (V_{CC} = 28 Vdc, 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

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

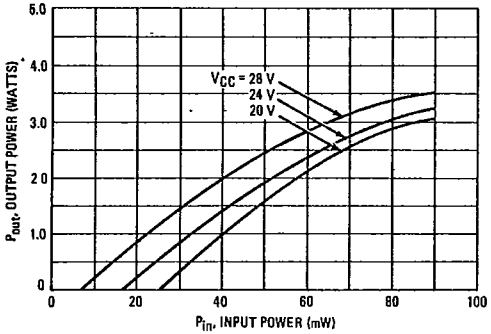


FIGURE 3 – OUTPUT POWER versus INPUT POWER
(f = 2 GHz)

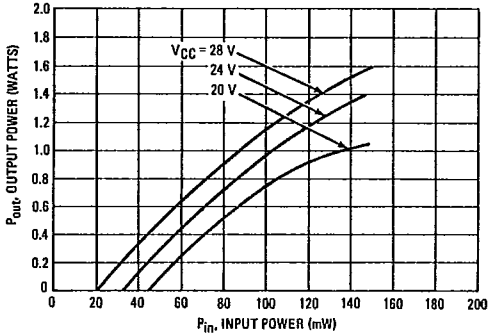


FIGURE 4 – OUTPUT POWER versus FREQUENCY

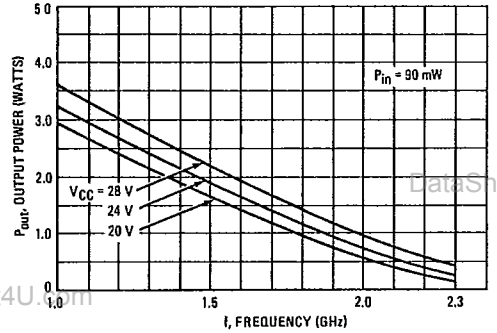


FIGURE 5 – POWER GAIN versus FREQUENCY

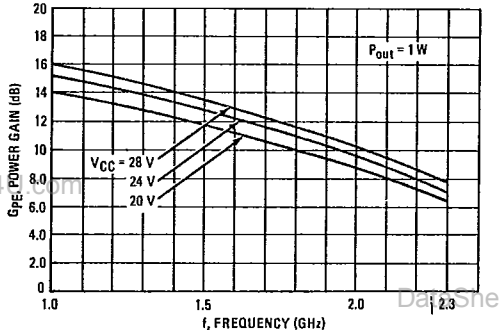
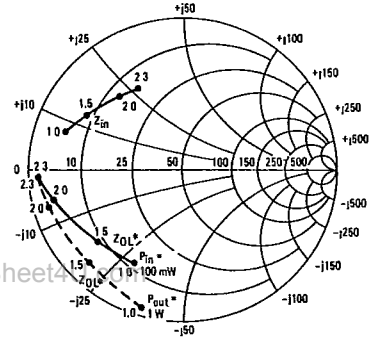


FIGURE 6 – SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE



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.

FIGURE 7 – 2 GHz TEST AMPLIFIER

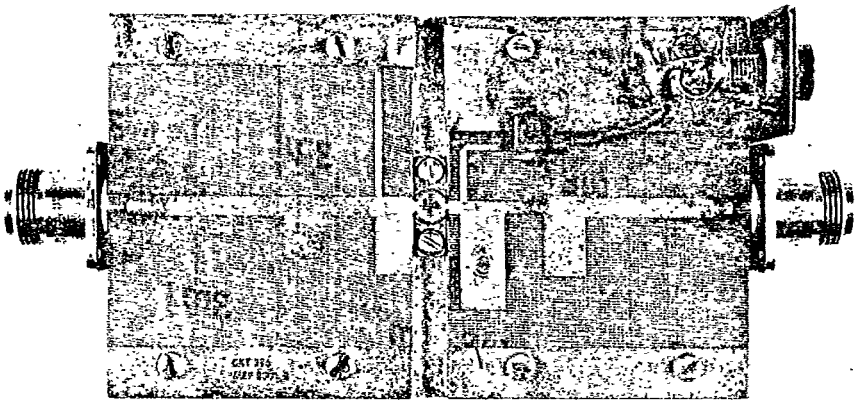
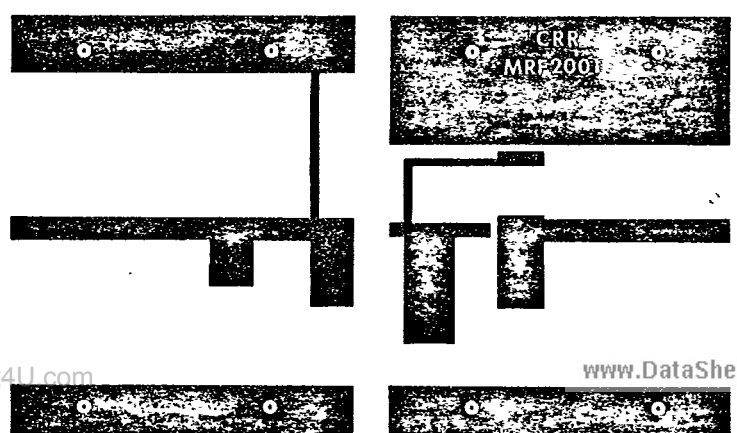


FIGURE 8 – PRINTED CIRCUIT BOARD LAYOUT – 2 GHz TEST CIRCUIT



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