

MRF2001M

The RF Line

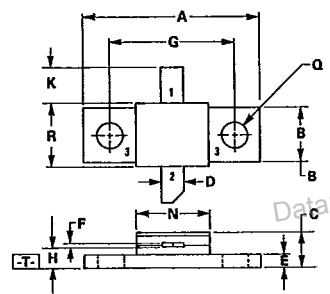
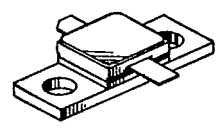
NPN SILICON MICROWAVE POWER TRANSISTOR

... designed for Class B and C *common base* broadband amplifier applications in the 1.7 to 2.3 GHz frequency range.

- Internal Input Matching for Broadband Operation
- Guaranteed Performance @ 2 GHz, 24 Vdc
 Output power = 1.0 Watt
 Minimum Gain = 8.5 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
- Silicon Nitride Passivation
- Characterized for Operation from 20 V to 28 V Supply Voltages

1.0 W 2 GHz
MICROWAVE POWER TRANSISTOR

NPN SILICON



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

- NOTES:
1. DIMENSIONS [A] AND [B] ARE DATUMS.
 2. POSITIONAL TOLERANCE FOR MOUNTING HOLES:
 ± 0.13 (0.005) (M) T A (M) B (M)
 3. [T] IS SEATING PLANE.
 4. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973

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 @ $T_C = 25^\circ\text{C}$ (1) Derate above 25°C	P_D	7.0 40	Watts mW/ $^\circ\text{C}$
Storage Temperature Range	T_{stg}	-65 to +200	$^\circ\text{C}$

THERMAL CHARACTERISTICS

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

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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	20.07	20.57	0.790	0.810
B	6.48	6.73	0.255	0.265
C	3.68	4.06	0.145	0.160
D	2.29	2.79	0.090	0.110
E	1.42	1.73	0.056	0.068
F	0.05	0.15	0.002	0.006
G	14 27 BSC		0.560 BSC	
H	2.29	2.79	0.090	0.110
K	3.43	4.19	0.135	0.165
N	7.87	8.38	0.310	0.330
O	8.65	8.90	0.340	0.350
R	7.24	7.49	0.285	0.295

CASE 337-02

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage ($I_C = 5.0\text{ mA dc}$, $I_B = 0$)	$V_{(BR)CEO}$	20	—	—	Vdc
Collector-Emitter Breakdown Voltage ($I_C = 5.0\text{ mA dc}$, $V_{BE} = 0$)	$V_{(BR)CES}$	45	—	—	Vdc
Collector-Base Breakdown Voltage ($I_C = 5.0\text{ mA dc}$, $I_E = 0$)	$V_{(BR)CBO}$	45	—	—	Vdc
Emitter-Base Breakdown Voltage ($I_E = 1.0\text{ mA dc}$, $I_C = 0$)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current ($V_{CB} = 28\text{ Vdc}$, $I_E = 0$)	I_{CBO}	—	—	0.5	mA dc

ON CHARACTERISTICS

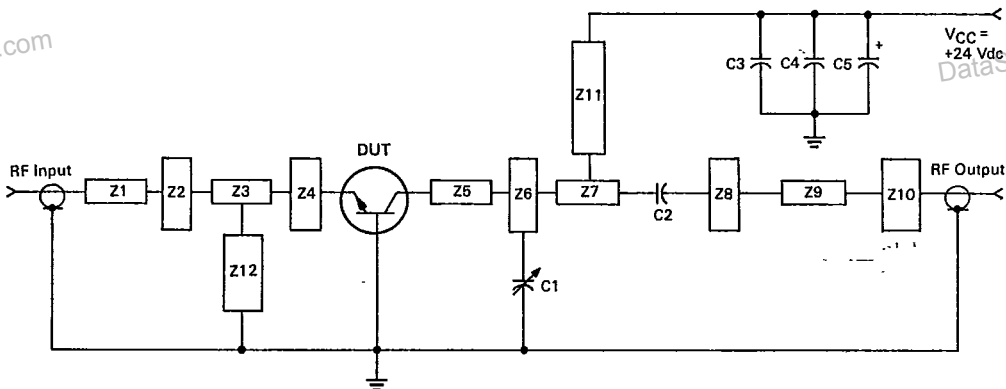
DC Current Gain ($I_C = 100\text{ mA dc}$, $V_{CE} = 5.0\text{ Vdc}$)	h_{FE}	10	—	100	—
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DYNAMIC CHARACTERISTICS

Output Capacitance ($V_{CB} = 24\text{ Vdc}$, $I_E = 0$, $f = 1.0\text{ MHz}$)	C_{ob}	—	4.0	6.0	pF
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FUNCTIONAL TESTS

Common-Base Amplifier Power Gain ($V_{CC} = 24\text{ Vdc}$, $P_{out} = 1.0\text{ W}$, $f = 2.0\text{ GHz}$)	G_{PB}	8.5	9.5	—	dB
Collector Efficiency ($V_{CC} = 24\text{ Vdc}$, $P_{out} = 1.0\text{ W}$, $f = 2.0\text{ GHz}$)	η	35	40	—	
Load Mismatch ($V_{CC} = 24\text{ Vdc}$, $P_{out} = 1.0\text{ W}$, $f = 2.0\text{ GHz}$) VSWR = 10:1 All Phase Angles)	ψ	No Degradation in Power Output			

FIGURE 1 — 2.0 GHz TEST CIRCUIT

Z1-Z12 — Microstrip, See Photomaster
 C1 — 0.6-4.5 pF Johanson 7271
 C2, C3 — 56 pF Chip Capacitor
 C4 — 0.1 μF
 C5 — 10 μF , 35 V
 Board Material — 0.0312" Teflon Fiberglass
 $\epsilon_r = 2.5 \pm 0.05$

FIGURE 2 — OUTPUT POWER versus INPUT POWER
($f = 1.7$ GHz)

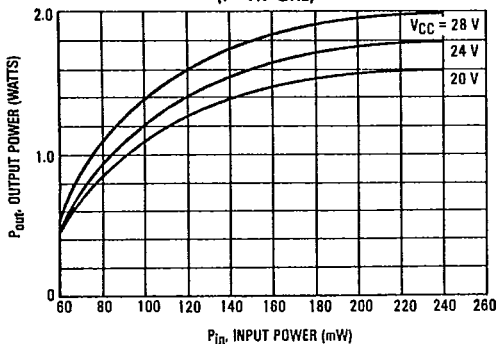


FIGURE 3 — OUTPUT POWER versus INPUT POWER
($f = 2.0$ GHz)

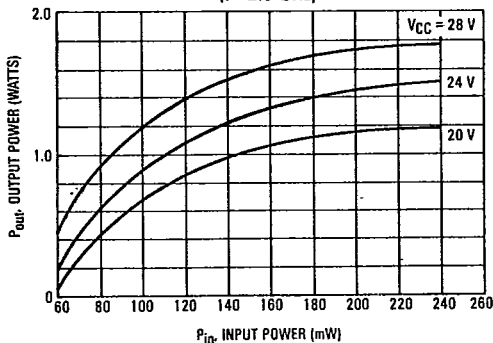


FIGURE 4 — OUTPUT POWER versus INPUT POWER
($f = 2.3$ GHz)

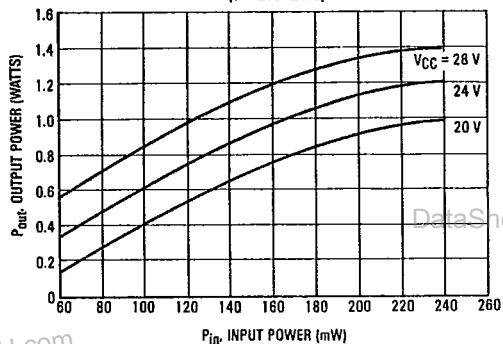


FIGURE 5 — POWER GAIN versus FREQUENCY

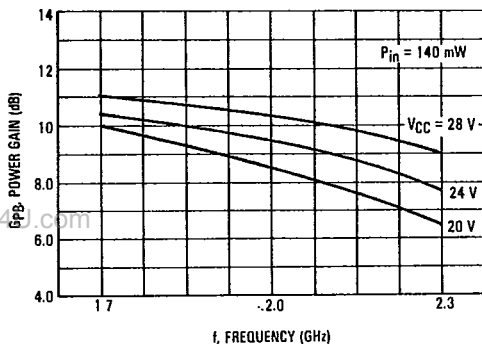
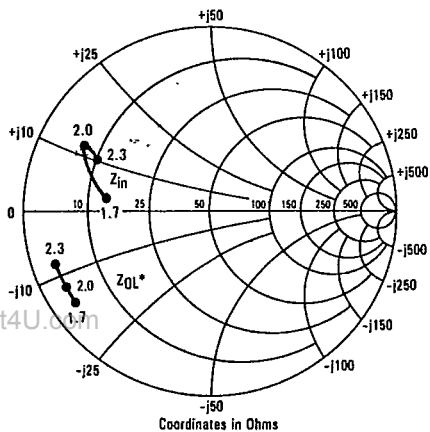


FIGURE 6 — SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE



$V_{CC} = 24$ V, $P_{in} = 140$ mW

f GHz	Z_{in} Ohms	Z_{OL}^* Ohms
1.7	15.5 + j 3.0	4.5 - j15.0
2.0	7.5 + j11.0	4.0 - j12.0
2.3	10.0 + j10.0	3.0 - j 7.0

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

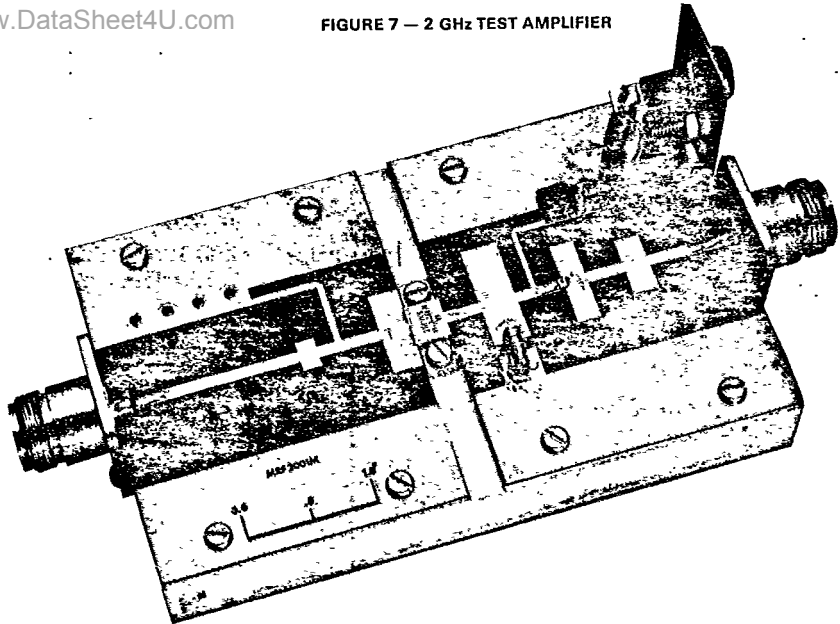
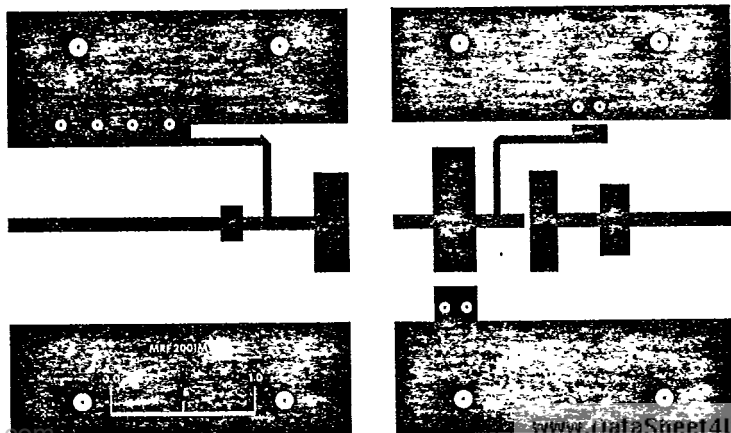


FIGURE 8 — PRINTED CIRCUIT BOARD LAYOUT — 2.0 GHz TEST CIRCUIT



⊙ Denotes Eyelet

⊙ 4-40 Screw Placement

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