MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MRF1090MA
MRF1090MB
MRF1090MC

2

The RF Line

MICROWAVE PULSE POWER TRANSISTORS

. . . designed for Class B and C *common base* amplifier applications in short pulse TACAN, IFF, and DME transmitters.

- Guaranteed Performance @ 1090 MHz, 50 Vdc
  Output power = 90 Watts Peak
  Minimum Gain = 8.4 dB
- 100% Tested for Load Mismatch at All Phase Angles with 10:1 VSWR
- Industry Standard Package
- Nitride Passivated
- Gold Metallized for Long Life and Resistance to Metal Migration
- Compatible with Other 1090M and 1075M Types
- Internal Input Matching for Broadband Operation

90 W PEAK, 960-1215 MHz

MICROWAVE POWER TRANSISTORS

NPN SILICON

MAXIMUM RATINGS

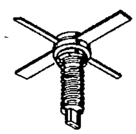
Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CBO}	70	Vdc
Emitter-Base Voltage	V_{EBO}	4.0	Vdc
Collector-Current — Peak (1)	I_C	6.0	Adc
Peak Device Dissipation @ T_C = 25°C (1)(2) Derate above 25°C	P_D	290 1.66	Watts W/°C
Storage Temperature Range	T_{stg}	-65 to +150	°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (3)	$R_{\theta JC}$	0.6	°C/W

(1) Pulse Width = 10 μs, Duty Cycle = 1%.
(2) These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as RF short pulse amplifiers.
(3) Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques.

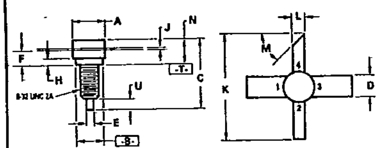
MRF1090MA
CASE 332-04



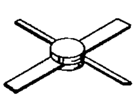
NOTES.
1. DIM -B- IS DATUM.
2. POSITIONAL TOLERANCE FOR LEADS.
   ⌖ | 0.76 (0.030) Ⓜ | T | B Ⓜ
3. -T- IS SEATING PLANE.
4. DIMENSION K APPLIES TWO PLACES.
5. DIMENSIONING AND TOLERANCING PER ANSI Y 14.5, 1973.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	6.86	7.62	0.270	0.300
B	6.10	6.60	0.240	0.260
C	16.26	16.76	0.640	0.660
D	4.95	5.21	0.195	0.205
E	1.40	1.65	0.055	0.065
F	2.67	4.32	0.105	0.170
H	1.40	1.65	0.055	0.065
J	0.08	0.18	0.003	0.007
K	15.24	—	0.600	—
L	2.41	2.67	0.095	0.105
M	45° Nom		45° Nom	
N	4.57	6.22	0.180	0.245
U	2.92	3.68	0.115	0.145

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

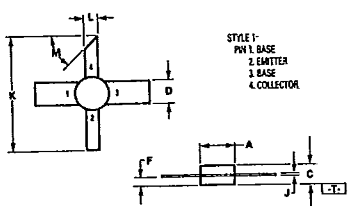


MRF1090MB
CASE 332A-01



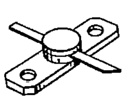
NOTES
1. DIM -A- IS DATUM.
2. POSITIONAL TOLERANCE FOR LEADS.
   ⌖ | 0.76 (0.030) Ⓜ | T | A Ⓜ
3. -T- IS SEATING PLANE.
4. DIM K APPLIES 2 PLACES
5. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	6.85	7.34	0.270	0.290
C	3.30	3.81	0.130	0.150
D	4.95	5.21	0.195	0.205
F	1.40	1.78	0.055	0.070
J	0.08	0.18	0.003	0.007
K	15.24	—	0.600	—
L	2.41	2.67	0.095	0.105
M	45° NOM		45° NOM	

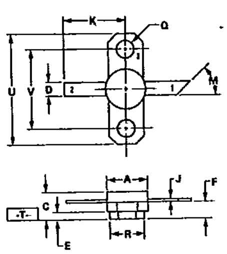


STYLE 1:
PIN 1. BASE
2. EMITTER
3. BASE
4. COLLECTOR

MRF1090MC
CASE 361A-01



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



NOTES.
1. DIMENSIONS R AND U ARE DATUMS AND T IS A DATUM SURFACE AND SEATING PLANE.
2. POSITIONAL TOLERANCE FOR MOUNTING HOLES
   ⌖ | ⌀ 0.38 (0.015) Ⓜ | T | U Ⓜ | R Ⓜ
3. DIMENSIONING AND TOLERANCING PER ANSI Y14.5, 1973.

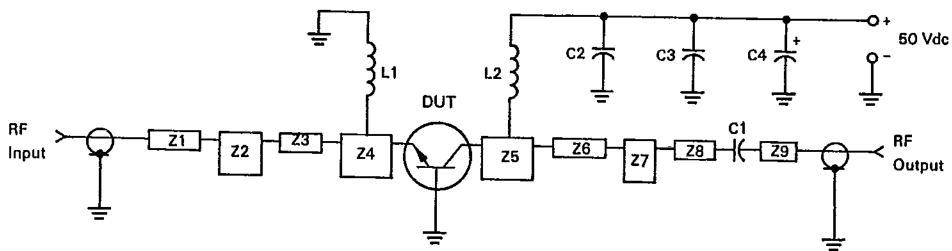
DIM	MILLIMETERS MIN	MILLIMETERS MAX	INCHES MIN	INCHES MAX
A	7.06	7.26	0.278	0.286
C	4.44	5.20	0.175	0.205
D	2.36	2.71	0.093	0.107
E	1.39	1.77	0.055	0.070
F	2.66	3.42	0.105	0.135
J	0.10	0.15	0.004	0.006
K	11.04	—	0.435	—
M	45° NOM		45° NOM	
Q	3.04	3.42	0.120	0.135
R	6.09	6.60	0.240	0.260
U	20.06	20.57	0.790	0.810
V	14.27 BSC		0.562 BSC	

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage (I_C = 25 mAdc, V_{BE} = 0)	$V_{(BR)CES}$	70	—	—	Vdc
Collector-Base Breakdown Voltage (I_C = 25 mAdc, I_E = 0)	$V_{(BR)CBO}$	70	—	—	Vdc
Emitter-Base Breakdown Voltage (I_E = 5.0 mAdc, I_C = 0)	$V_{(BR)EBO}$	4.0	—	—	Vdc
Collector Cutoff Current (V_{CB} = 50 Vdc, I_E = 0)	I_{CBO}	—	—	5.0	mAdc
ON CHARACTERISTICS					
DC Current Gain* (I_C = 2.5 Adc, V_{CE} = 5.0 Vdc)	h_{FE}	10	30	—	—
DYNAMIC CHARACTERISTICS					
Output Capacitance (V_{CB} = 50 Vdc, I_E = 0, f = 1.0 MHz)	C_{ob}	—	12	16	pF
FUNCTIONAL TESTS (Pulse Width = 10 μs, Duty Cycle = 1.0%)					
Common-Base Amplifier Power Gain (V_{CC} = 50 Vdc, P_{out} = 90 W pk, f = 1090 MHz)	G_{PB}	8.4	10.8	—	dB
Collector Efficiency (V_{CC} = 50 Vdc, P_{out} = 90 W pk, f = 1090 MHz)	η	35	40	—	%
Load Mismatch (V_{CC} = 50 Vdc, P_{out} = 90 W pk, f = 1090 MHz) VSWR = 10:1 All Phase Angles)	ψ	No Degradation in Power Output			

* 80 μs Pulse on Tektronix 576 or equivalent.

FIGURE 1 — 1090 MHz TEST CIRCUIT



C1, C2 — 220 pF Chip Capacitor, 100-mil ATC
C3 — 0.1 μF
C4 — 47 μF, 75 V
L1, L2 — 3 Turns, #18 AWG, 1/8" ID
Z1-Z9 — Distributed Microstrip Elements — See Figure 9
Board Material — 0.031" Thick Glass Teflon, ϵ_r = 2.5

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FIGURE 2 — OUTPUT POWER versus INPUT POWER

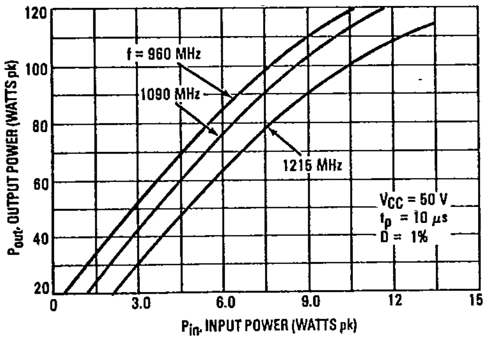


FIGURE 3 — OUTPUT POWER versus FREQUENCY

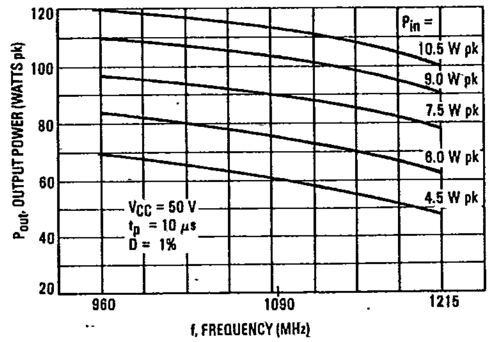


FIGURE 4 — OUTPUT POWER versus SUPPLY VOLTAGE

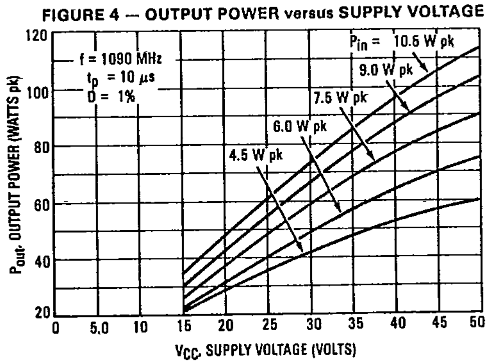


FIGURE 5 — POWER GAIN versus FREQUENCY

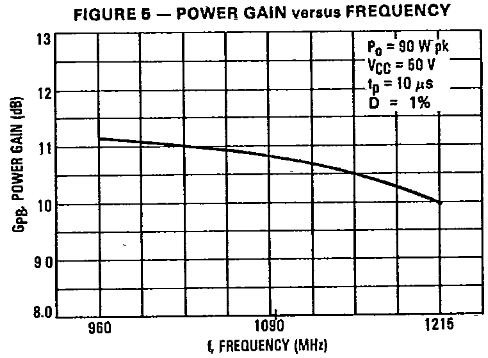
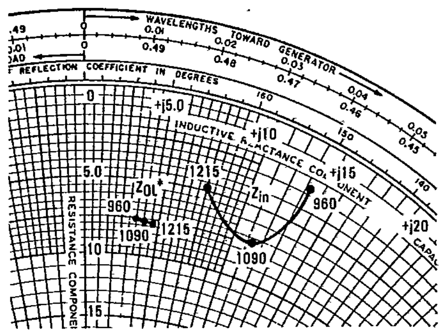


FIGURE 6 — SERIES EQUIVALENT INPUT/OUTPUT IMPEDANCE



Coordinates in Ohms

P_{out} 90 W pk V_{CC} = 50 V
t_p = 10 μs D = 1%

f MHz	Z_{in} Ohms	Z_{OL}* Ohms
960	2.8 + j13.2	7.6 + j3.5
1090	7.4 + j11.4	7.6 + j4.0
1215	4.7 + j7.5	7.7 + j4.5

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

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FIGURE 7 — 1090 MHz TEST AMPLIFIER

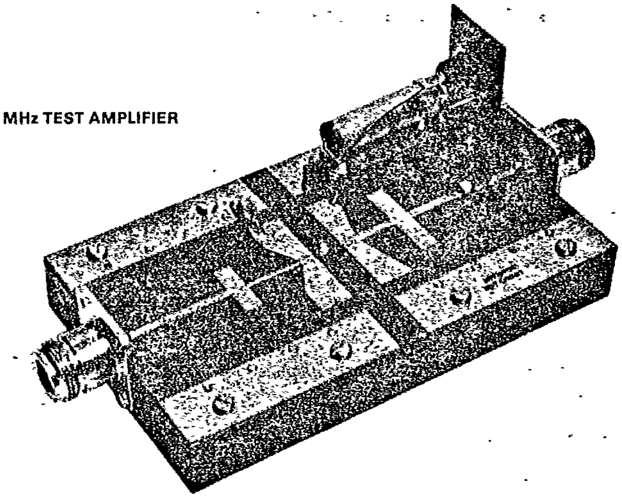


FIGURE 8 — TYPICAL PULSE PERFORMANCE

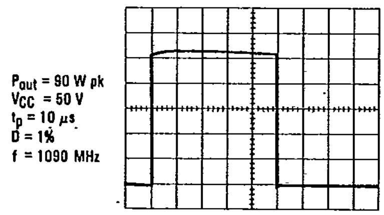
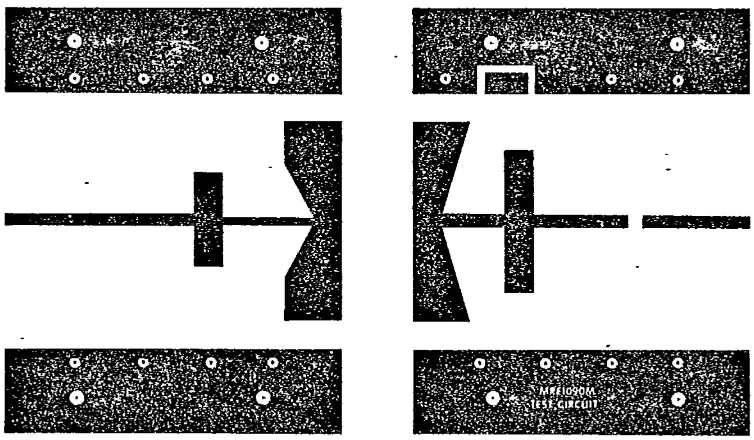


FIGURE 9 — PRINTED CIRCUIT BOARD LAYOUT — 1090 MHz TEST CIRCUIT



⊙ Soldered Eyelet
⊙ 4-40 Screw Placement
NOTE: The Printed Circuit Board shown is 75% of the original.