

## The RF Line

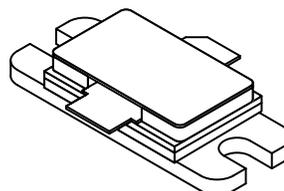
# Microwave Pulse Power Transistors

... designed for 1025–1150 MHz pulse common base amplifier applications such as TCAS, TACAN and Mode-S transmitters.

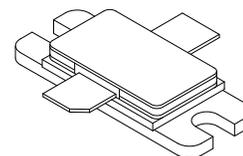
- Guaranteed Performance @ 1090 MHz  
Output Power = 500 Watts Peak  
Gain = 8.5 dB Min, 9.0 dB (Typ)
- 100% Tested for Load Mismatch at All Phase Angles with 10:1 VSWR
- Hermetically Sealed Industry Package
- Silicon Nitride Passivated
- Gold Metallized, Emitter Ballasted for Long Life and Resistance to Metal Migration
- Internal Input and Output Matching
- Characterized with 10  $\mu$ s, 1% Duty Cycle Pulses

**MRF10500**  
**MRF10501**

**500 W (PEAK)**  
**1025–1150 MHz**  
**MICROWAVE POWER**  
**TRANSISTORS**  
**NPN SILICON**



**CASE 355D-02, STYLE 1**  
**MRF10500**



**CASE 355H-01, STYLE 1**  
**MRF10501**

### MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector–Emitter Voltage	$V_{CES}$	65	Vdc
Collector–Base Voltage	$V_{CBO}$	65	Vdc
Emitter–Base Voltage	$V_{EBO}$	3.5	Vdc
Collector Current — Peak (1)	$I_C$	29	Adc
Total Device Dissipation @ $T_C = 25^\circ\text{C}$ (1), (2) Derate above $25^\circ\text{C}$	$P_D$	1460 8.3	Watts W/ $^\circ\text{C}$
Storage Temperature Range	$T_{stg}$	–65 to +200	$^\circ\text{C}$
Junction Temperature	$T_J$	200	$^\circ\text{C}$

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max	Unit
Thermal Resistance, Junction to Case (3)	$R_{\theta JC}$	0.12	$^\circ\text{C}/\text{W}$

#### NOTES:

1. Under pulse RF operating conditions.
2. These devices are designed for RF operation. The total device dissipation rating applies only when the devices are operated as pulsed RF amplifiers.
3. Thermal Resistance is determined under specified RF operating conditions by infrared measurement techniques. (Worst case  $\theta_{JC}$  value measured @ 32  $\mu$ s, 2%.)

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

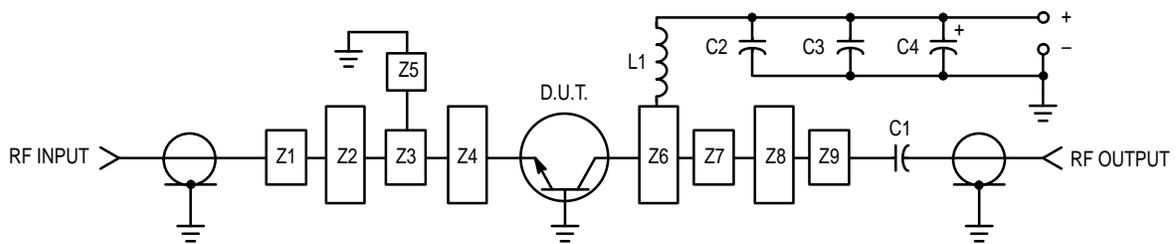
Characteristic	Symbol	Min	Typ	Max	Unit
<b>OFF CHARACTERISTICS</b>					
Collector–Emitter Breakdown Voltage ( $I_C = 60 \text{ mAdc}$ , $V_{BE} = 0$ )	$V_{(BR)CES}$	65	—	—	Vdc
Collector–Base Breakdown Voltage ( $I_C = 60 \text{ mAdc}$ , $I_E = 0$ )	$V_{(BR)CBO}$	65	—	—	Vdc
Emitter–Base Breakdown Voltage ( $I_E = 10 \text{ mAdc}$ , $I_C = 0$ )	$V_{(BR)EBO}$	3.5	—	—	Vdc
Collector Cutoff Current ( $V_{CB} = 36 \text{ Vdc}$ , $I_E = 0$ )	$I_{CBO}$	—	—	25	mAdc

**ON CHARACTERISTICS**

DC Current Gain ( $I_C = 5.0 \text{ Adc}$ , $V_{CE} = 5.0 \text{ Vdc}$ )	$h_{FE}$	20	—	—	—
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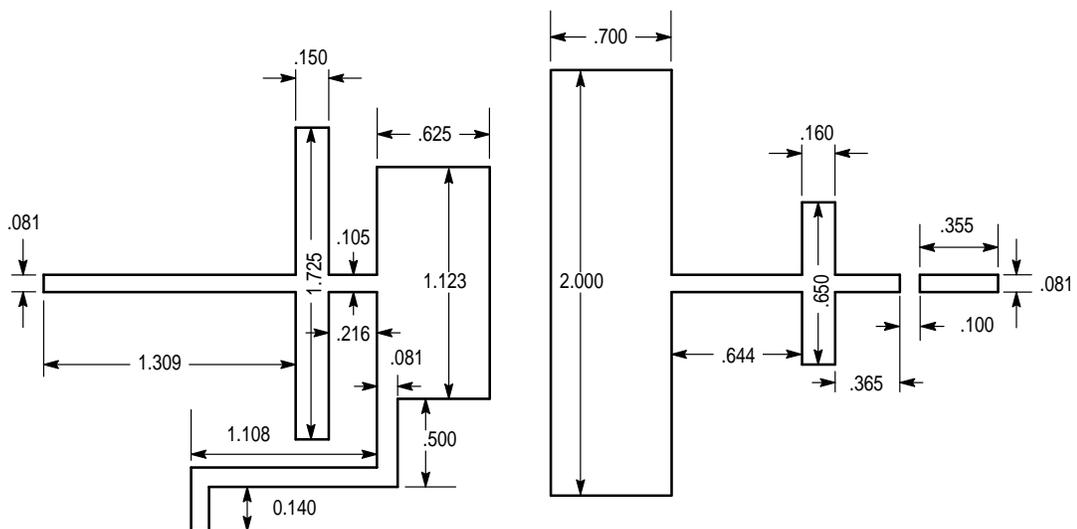
**FUNCTIONAL TESTS**

Common–Base Amplifier Power Gain ( $V_{CC} = 50 \text{ Vdc}$ , $P_{Out} = 500 \text{ W Peak}$ , $f = 1090 \text{ MHz}$ )	$G_{PB}$	8.5	9.0	—	dB
Collector Efficiency ( $V_{CC} = 50 \text{ Vdc}$ , $P_{Out} = 500 \text{ W Peak}$ , $f = 1090 \text{ MHz}$ )	$\eta$	40	45	—	%
Load Mismatch ( $V_{CC} = 50 \text{ Vdc}$ , $P_{Out} = 500 \text{ W Peak}$ , $f = 1090 \text{ MHz}$ , $VSWR = 10:1$ All Phase Angles)	$\psi$	No Degradation in Output Power			

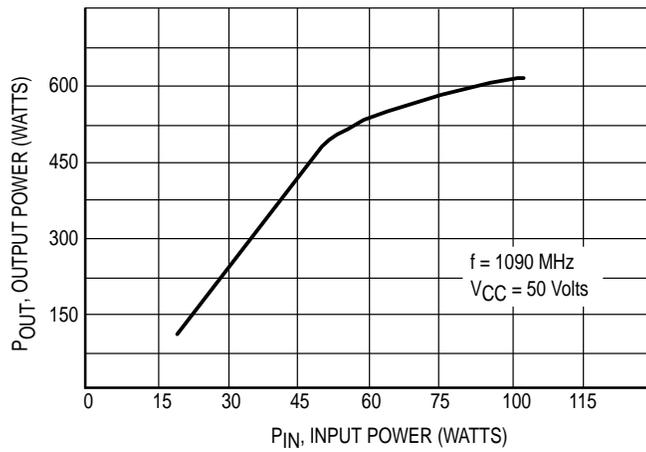


- C1 — 82 pF 100 Mil Chip Capacitor
- C2 — 39 pF 100 Mil Chip Capacitor
- C3 — 0.1  $\mu\text{F}$
- C4 — 100  $\mu\text{F}$ , 100 Vdc, Electrolytic
- L1 — 3 Turns #18 AWG, 1/8" ID, 0.18 Long

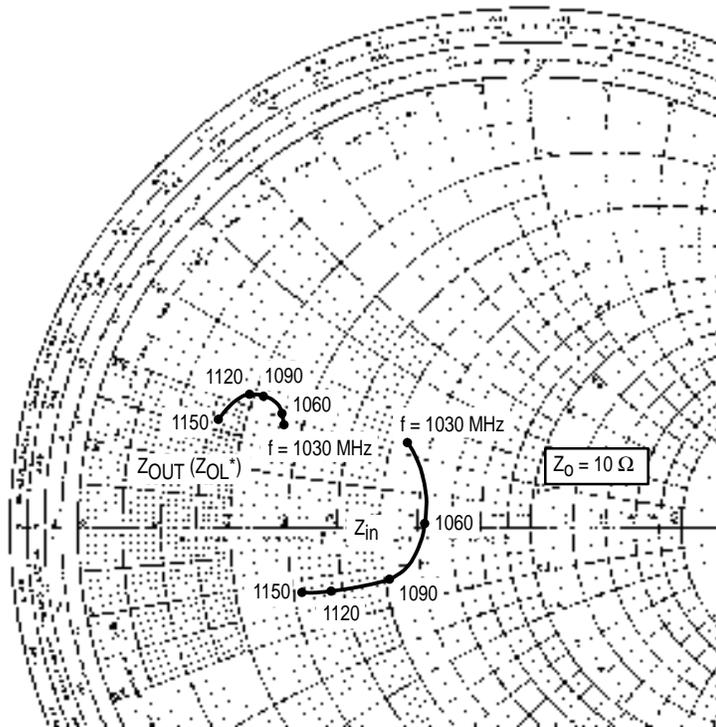
- Z1–Z9 — Microstrip, See Details
- Board Material — Teflon, Glass Laminate
- Dielectric Thickness = 0.030"
- $\epsilon_r = 2.55$ , 2 Oz. Copper



**Figure 1. Test Circuit**



**Figure 2. Output Power versus Input Power**



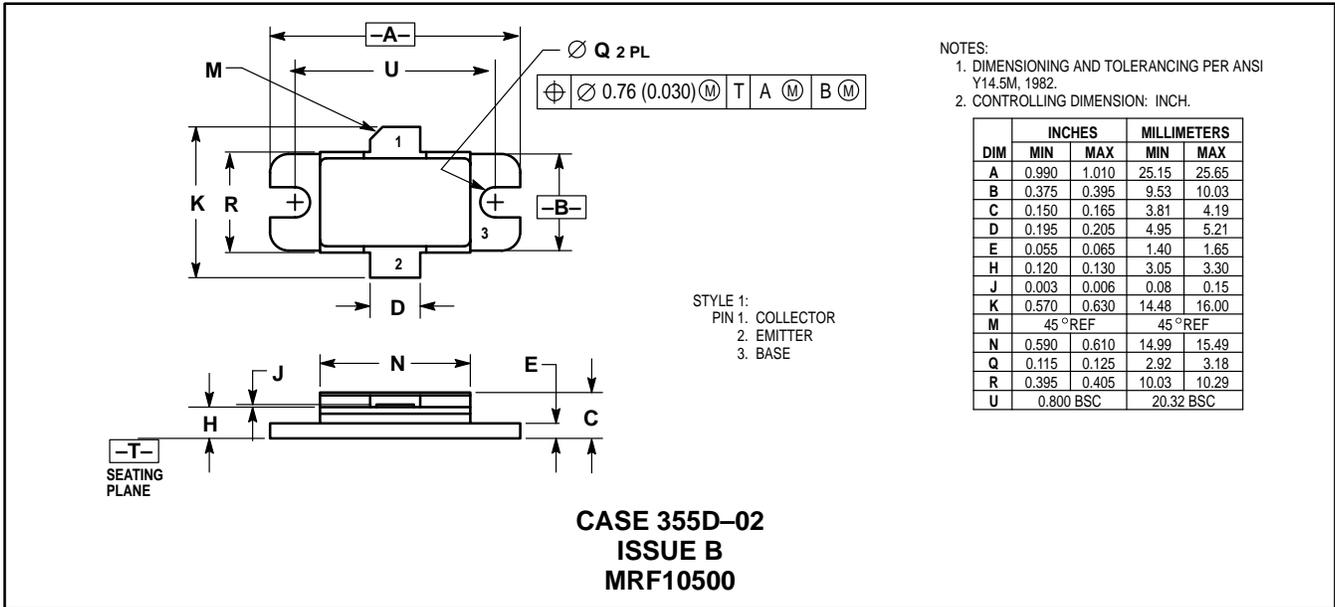
$P_{OUT} = 500 \text{ W Pk}$   $V_{CC} = 50 \text{ V}$

f MHz	$Z_{in}$ OHMS	$Z_{OL}^*$ ( $Z_{OUT}$ ) OHMS
1030	$5.3 + j2.25$	$2.6 + j1.89$
1060	$6.2 + j0.2$	$2.56 + j2.0$
1090	$5.2 - j1.4$	$2.12 + j2.2$
1120	$3.7 - j1.35$	$1.9 + j2.15$
1150	$3.15 - j1.3$	$1.6 + j1.62$

$Z_{OL}^*$  is the conjugate of the optimum load impedance into which the device operates at a given output power voltage and frequency.

**Figure 3. Series Equivalent Input/Output Impedances**

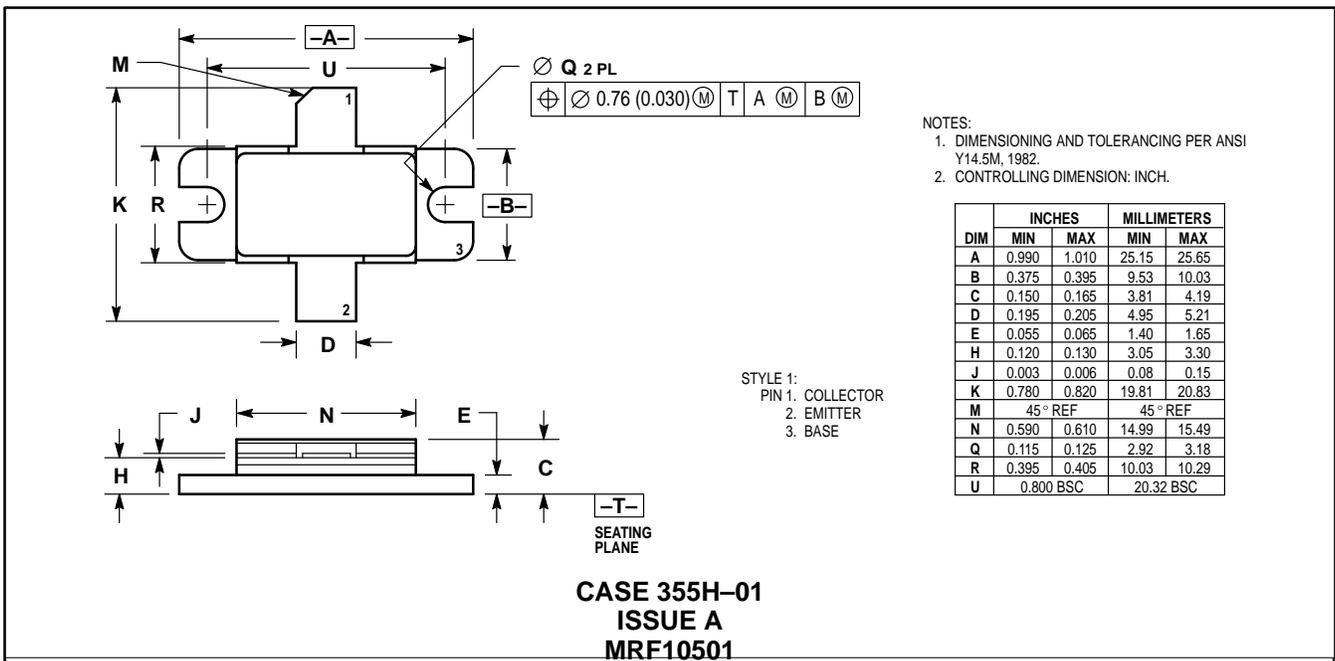
## PACKAGE DIMENSIONS



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

DIM	INCHES		MILLIMETERS	
	MIN	MAX	MIN	MAX
A	0.990	1.010	25.15	25.65
B	0.375	0.395	9.53	10.03
C	0.150	0.165	3.81	4.19
D	0.195	0.205	4.95	5.21
E	0.055	0.065	1.40	1.65
H	0.120	0.130	3.05	3.30
J	0.003	0.006	0.08	0.15
K	0.570	0.630	14.48	16.00
M	45° REF		45° REF	
N	0.590	0.610	14.99	15.49
Q	0.115	0.125	2.92	3.18
R	0.395	0.405	10.03	10.29
U	0.800 BSC		20.32 BSC	

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



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	MIN	MAX	MIN	MAX
A	0.990	1.010	25.15	25.65
B	0.375	0.395	9.53	10.03
C	0.150	0.165	3.81	4.19
D	0.195	0.205	4.95	5.21
E	0.055	0.065	1.40	1.65
H	0.120	0.130	3.05	3.30
J	0.003	0.006	0.08	0.15
K	0.780	0.820	19.81	20.83
M	45° REF		45° REF	
N	0.590	0.610	14.99	15.49
Q	0.115	0.125	2.92	3.18
R	0.395	0.405	10.03	10.29
U	0.800 BSC		20.32 BSC	

- STYLE 1:  
 PIN 1. COLLECTOR  
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MRF10500/D

