

The RF Line
Microwave Power Transistors

... designed primarily for large-signal output and driver amplifier stages in the 1.5 to 3 GHz frequency range.

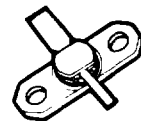
- Designed for Class B or C, Common Base Linear Power Amplifiers
- Specified 28 Volt, 3 GHz Characteristics:
 - Output Power — 1 to 5 Watts
 - Power Gain — 5 to 7 dB Min
 - Collector Efficiency — 30% Min
- Hermetic Package Suitable for Military/Space Applications
- Gold Metallization for Improved Reliability
- Diffused Ballast Resistors
- Formerly Named TRW3000 Series

MRW3000
Series

5 TO 7 dB
1.5-3 GHz
1 TO 5 WATTS
MICROWAVE
POWER
TRANSISTORS



CASE 328E-01, STYLE 1
(GP-13F)
MRW3001F, 3003F, 3005F



CASE 328F-01, STYLE 2
(GP-13)
MRW3001, 3003, 3005

MAXIMUM RATINGS

Rating	Symbol	3001,F	3003,F	3005,F	Unit
Collector-Base Voltage	V _{CBO}	45			V _{dc}
Emitter-Base Voltage	V _{EBO}	3.5			V _{dc}
Operating Junction Temperature	T _J	200			°C
Storage Temperature Range	T _{stg}	- 65 to + 200			°C

THERMAL CHARACTERISTICS

Characteristic	Symbol	Max			Unit
Thermal Resistance, RF, Junction to Case	R _{θJC}	35	17	8.5	°C/W

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

Characteristic	Symbol	Min	Typ	Max	Unit
----------------	--------	-----	-----	-----	------

OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage (I _C = 10 mA, V _{BE} = 0) (I _C = 30 mA, V _{BE} = 0) (I _C = 50 mA, V _{BE} = 0)	MRW3001,F 3003,F 3005,F	V _{(BR)CES}	50 50 50	— — —	— — —	V _{dc}
Collector-Base Breakdown Voltage (I _C = 1 mA, I _E = 0) (I _C = 3 mA, I _E = 0) (I _C = 5 mA, I _E = 0)	MRW3001,F 3003,F 3005,F	V _{(BR)CBO}	45 45 45	— — —	— — —	V _{dc}
Emitter-Base Breakdown Voltage (I _E = 1 mA, I _C = 0)		V _{(BR)EBO}	3.5	—	—	V _{dc}
Collector Cutoff Current (V _{CB} = 28 V, I _E = 0)	MRW3001,F 3003,F 3005,F	I _{CBO}	— — —	— — —	0.5 0.75 1.25	mAdc

ON CHARACTERISTICS

DC Current Gain (I _C = 100 mA, V _{CE} = 5 V) (I _C = 300 mA, V _{CE} = 5 V) (I _C = 500 mA, V _{CE} = 5 V)	MRW3001,F 3003,F 3005,F	h _{FE}	10 10 10	— — —	120 120 120	—
---	-------------------------------	-----------------	----------------	-------------	-------------------	---

(continued)

MRW3000 Series

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

Characteristic	Symbol	Min	Typ	Max	Unit
DYNAMIC CHARACTERISTICS					
Output Capacitance ($V_{CB} = 28\text{ V}$, $I_E = 0$, $f = 1\text{ MHz}$)	MRW3001,F	—	3.5	4	μF
	3003,F	—	5.7	7	
	3005,F	—	8.4	10	
FUNCTIONAL TESTS					
Common-Base Amplifier Power Gain ($V_{CE} = 28\text{ V}$, $P_{out} = 1\text{ W}$, $f = 3\text{ GHz}$) ($V_{CE} = 28\text{ V}$, $P_{out} = 3\text{ W}$, $f = 3\text{ GHz}$) ($V_{CE} = 28\text{ V}$, $P_{out} = 5\text{ W}$, $f = 3\text{ GHz}$)	MRW3001,F	G _{pb}	7	—	dB
	3003,F		6	—	
	3005,F		5	—	
Collector Efficiency ($V_{CE} = 28\text{ V}$, $P_{out} = 1\text{ W}$, $f = 3\text{ GHz}$) ($V_{CE} = 28\text{ V}$, $P_{out} = 3\text{ W}$, $f = 3\text{ GHz}$) ($V_{CE} = 28\text{ V}$, $P_{out} = 5\text{ W}$, $f = 3\text{ GHz}$)	MRW3001,F	η_c	30	—	%
	3003,F		30	—	
	3005,F		30	—	
Load Mismatch ($V_{CE} = 28\text{ V}$, $P_{out} = 1\text{ W}$, $f = 3\text{ GHz}$, $P_{out} = 3\text{ W}$, $P_{out} = 5\text{ W}$, Load VSWR = $\infty:1$, All Phase Angles)	MRW3001,F 3003,F 3005,F	ψ	No Degradation in Output Power		

2

MRW3001,F TYPICAL CHARACTERISTICS

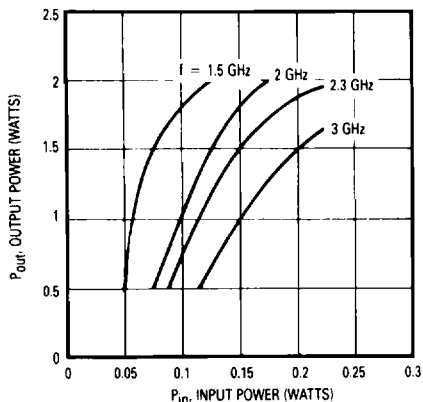


Figure 1. Output Power versus Input Power

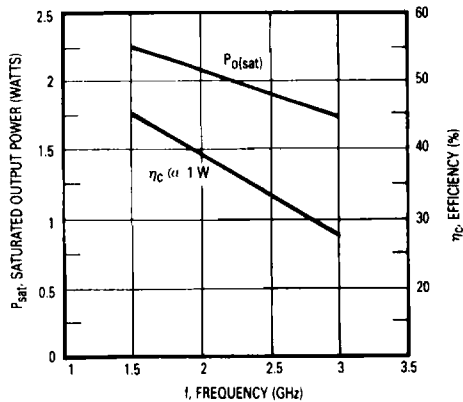


Figure 2. P_{sat} and η versus Frequency

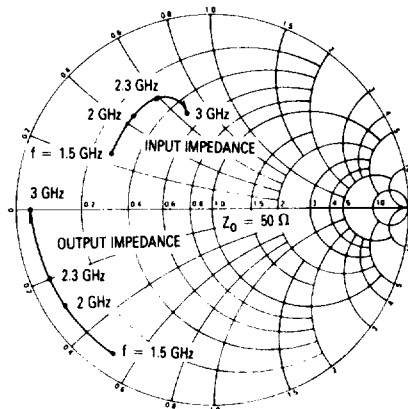
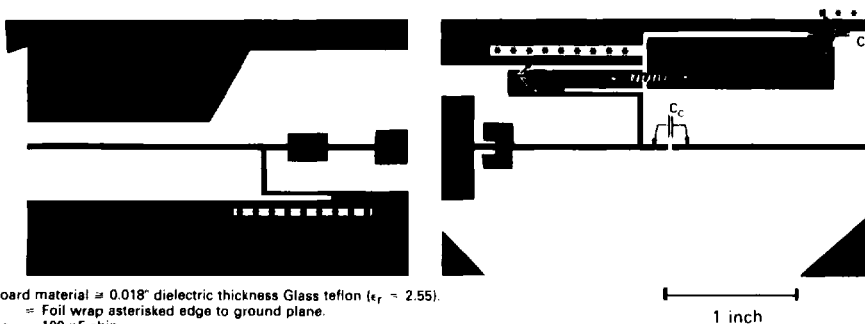


Figure 3. Series Equivalent Input/Output Impedance

MRW3000 Series



Board material = 0.018" dielectric thickness Glass teflon ($\epsilon_r = 2.55$).
 * = Foil wrap asterisked edge to ground plane.
 C_c = 100 pF chip.
 C_cX = 100 pF chip capacitor and 10 μ F electrolytic.
 C_cC = 100 pF chip capacitor. The capacitor position can be tuned.
 RFC = 8 turns #28 AWG, 0.010 dia.

Figure 4. MRW3001 PC Board Layout, $f = 3$ GHz
 (Not to Scale)

MRW3003,F TYPICAL CHARACTERISTICS

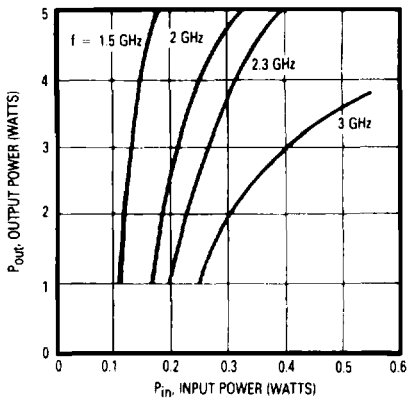


Figure 5. Output Power versus Input Power

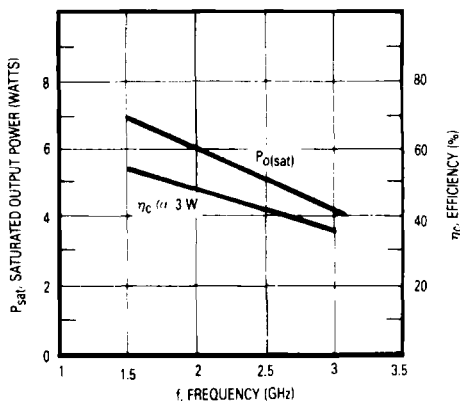


Figure 6. P_{sat} and η versus Frequency

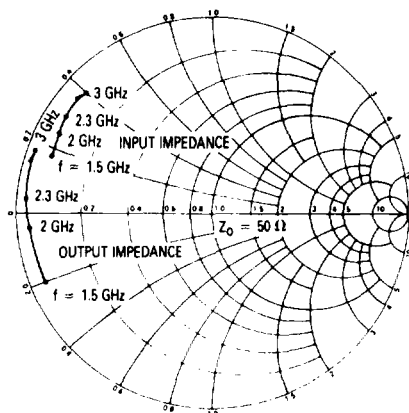
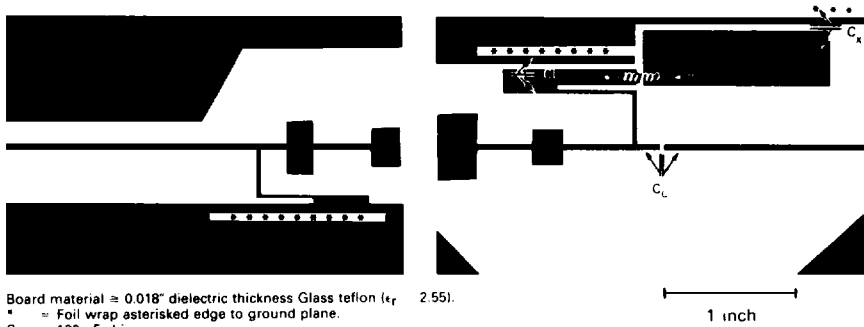


Figure 7. Series Equivalent Input/Output Impedance

MRW3000 Series



Board material = 0.018" dielectric thickness Glass teflon ($\epsilon_r = 2.55$).
 * = Foil wrap asterisked edge to ground plane.
 C_c = 100 pF chip.
 C_x = 100 pF chip capacitor and 10 μ F electrolytic.
 C_f = 100 pF chip capacitor. The capacitor position can be tuned.
 R_{FC} = 8 turns #28 AWG, 0.010 dia.

Figure 8. MRW3003 PC Board Layout, $f = 3$ GHz
 (Not to Scale)

2

MRW3005.F TYPICAL CHARACTERISTICS

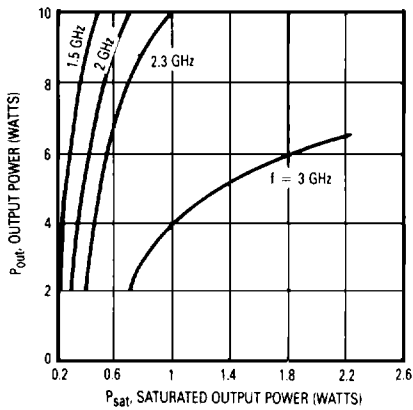


Figure 9. Output Power versus Input Power

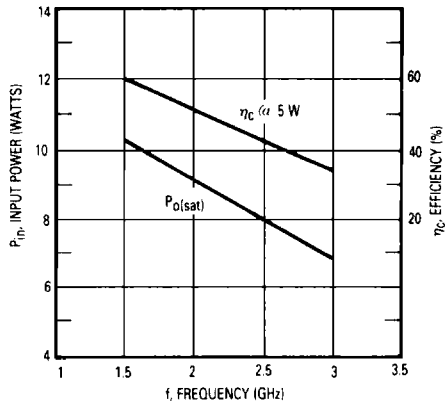


Figure 10. P_{sat} and η versus Frequency

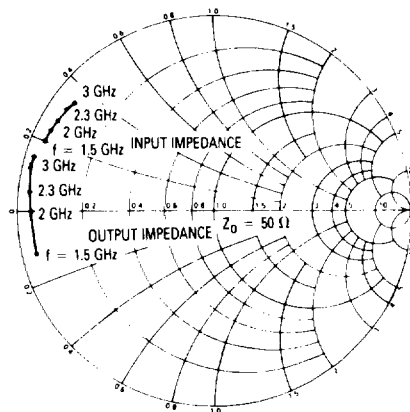
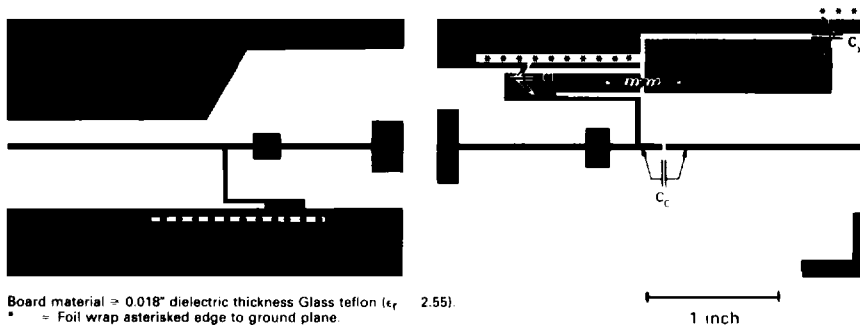


Figure 11. Series Equivalent Input/Output Impedance

MRW3000 Series

2



Board material ≥ 0.018 " dielectric thickness Glass teflon ($\epsilon_r = 2.55$)
 * = Foil wrap asterisked edge to ground plane.
 C_C = 100 pF chip
 C_X = 100 pF chip capacitor and 10 μ F electrolytic.
 C_L = 100 pF chip capacitor. The capacitor position can be tuned.
 R_{FC} = 8 turns #28 AWG, 0.010 dia.

Figure 12. MRW3005 PC Board Layout, $f = 3$ GHz
 (Not to Scale)

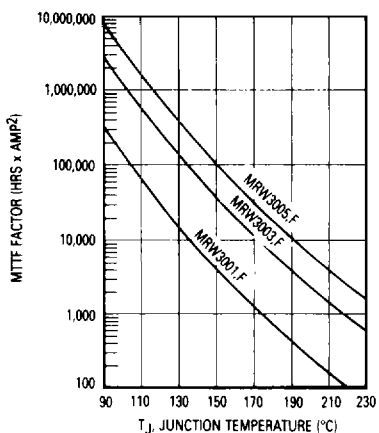


Figure 13. MTTF Factor versus Junction Temperature

MTTF Factor

(Normalized to 1 ampere² Continuous Duty)

The graph shown displays MTTF in hours x ampere² emitter current for each of the 3 GHz devices. Life tests at elevated temperatures have correlated to better than $\pm 10\%$ to the theoretical prediction for metal failure. **CAUTION** — A calculation is required to obtain actual metal life. Sample MTTF calculations based on operating conditions are shown below.

Junction Temperature — °C

To calculate metal lifetime under any set of conditions, obtain actual data or estimate from typical performance curves. Solve for T_J (°C):

$$(1) T_J = \theta_{JF} \left(\frac{P_{out} \times 100}{\eta_c \%} + P_{in} - P_{out} \right) + T_{FLANGE}$$

Enter graph of MTF factor versus T_J . Obtain MTF factor. Calculate metal life by:

$$(2) \text{Metal Life in Hours} = \frac{\text{MTF Factor}}{I_C^2 \text{ (Amps)}}$$