MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

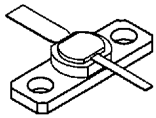
MRW2001
MRW2003
MRW2005
MRW2010

The RF Line
Microwave Power Transistors

. . . designed primarily for large-signal output and driver amplifier stages in the 1.0 to 2.3 GHz frequency range.

- Designed for Class B or C, Common Base Power Amplifiers
- Specified 28 Volt, 2.0 GHz Characteristics:
  Output Power — 1.0 to 20 Watts
  Power Gain — 5.2 to 9.0 dB, Min
  Collector Efficiency — 40%, Min
- Gold Metallization for Improved Reliability
- Diffused Ballast Resistors

5.2–9.0 dB
1.0–2.3 GHz
1.0–20 WATTS
MICROWAVE
POWER TRANSISTORS



CASE 328A, STYLE 1
(GP-13)

2

MAXIMUM RATINGS

Rating	Symbol	Value	Unit
Collector-Base Voltage	V_{CES}	50	Vdc
Emitter-Base Voltage	V_{EBO}	3.5	Vdc
Collector Current — Continuous	I_C		Adc
MRW2001		0.25	
MRW2003		0.5	
MRW2005		1.0	
MRW2010		2.0	
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	$R_{\theta JC}$		°C/W
MRW2001		25	
MRW2003		15	
MRW2005		8.5	
MRW2010		6.0	

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

Characteristic	Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS					
Collector-Emitter Breakdown Voltage	$V_{(BR)CES}$				Vdc
(I_C = 10 mA, V_{BE} = 0) MRW2001		50	—	—	
(I_C = 20 mA, V_{BE} = 0) MRW2003		50	—	—	
(I_C = 40 mA, V_{BE} = 0) MRW2005		50	—	—	
(I_C = 80 mA, V_{BE} = 0) MRW2010		50	—	—	

(continued)

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

Characteristic		Symbol	Min	Typ	Max	Unit
OFF CHARACTERISTICS (continued)						
Emitter-Base Breakdown Voltage		$V_{(BR)EBO}$				Vdc
(I_E = 0.2 mA, I_C = 0)	MRW2001		3.5	—	—	
(I_E = 0.25 mA, I_C = 0)	MRW2003		3.5	—	—	
(I_E = 0.5 mA, I_C = 0)	MRW2005		3.5	—	—	
(I_E = 1.0 mA, I_C = 0)	MRW2010		3.5	—	—	
Collector Cutoff Current	MRW2001	I_{CBO}	—	—	0.5	mAdc
(V_{CB} = 28 V, I_E = 0)	MRW2003		—	—	0.5	
	MRW2005		—	—	0.5	
	MRW2010		—	—	0.5	
ON CHARACTERISTICS						
DC Current Gain		h_{FE}				—
(I_C = 100 mA, V_{CE} = 5.0 V)	MRW2001		10	—	120	
(I_C = 100 mA, V_{CE} = 5.0 V)	MRW2003		10	—	100	
(I_C = 200 mA, V_{CE} = 5.0 V)	MRW2005		10	—	100	
(I_C = 400 mA, V_{CE} = 5.0 V)	MRW2010		10	—	100	
DYNAMIC CHARACTERISTICS						
Output Capacitance	MRW2001	C_{ob}	—	—	4.0	pF
(V_{CB} = 28 V, I_E = 0, f = 1.0 MHz)	MRW2003		—	—	5.0	
	MRW2005		—	—	7.0	
	MRW2010		—	—	12	
FUNCTIONAL TESTS						
Common-Base Amplifier Power Gain		G_{PB}				dB
(V_{CE} = 28 V, P_{out} = 1.0 W, f = 2.0 GHz)	MRW2001		9.0	—	—	
(V_{CE} = 28 V, P_{out} = 10 W, f = 2.0 GHz)	MRW2010		7.0	—	—	
Common-Base Amplifier Power Gain		G_{PB}				dB
(V_{CE} = 28 V, P_{out} = 3.0 W, f = 2.0 GHz)	MRW2003		8.0	—	—	
(V_{CE} = 28 V, P_{out} = 5.0 W, f = 2.0 GHz)	MRW2005		8.0	—	—	
Collector Efficiency		η	40	—	—	%
(V_{CE} = 28 V, P_{out} = 1.0 W, f = 2.0 GHz)	MRW2001					
(V_{CE} = 28 V, P_{out} = 3.0 W, f = 2.0 GHz)	MRW2003					
(V_{CE} = 28 V, P_{out} = 5.0 W, f = 2.0 GHz)	MRW2005					
(V_{CE} = 28 V, P_{out} = 10 W, f = 2.0 GHz)	MRW2010					
Load Mismatch		ψ	No Degradation in Output Power			
(V_{CE} = 28 V, f = 2.0 GHz, Load VSWR = ∞:1, All Phase Angles)						
P_{out} = 1.0 W	MRW2001					
P_{out} = 3.0 W	MRW2003					
P_{out} = 5.0 W	MRW2005					
P_{out} = 10 W	MRW2010					
Saturated Output Power						W
(V_{CE} = 28 V, f = 2.3 GHz)	MRW2001	P_{sat1}	—	1.0	—	
(V_{CE} = 28 V, f = 1.5 GHz)		P_{sat2}	—	1.2	—	
(V_{CE} = 28 V, f = 1.0 GHz)		P_{sat3}	—	1.3	—	
(V_{CE} = 28 V, f = 2.3 GHz)	MRW2003		—	3.0	—	
(V_{CE} = 28 V, f = 1.5 GHz)			—	3.7	—	
(V_{CE} = 28 V, f = 1.0 GHz)			—	4.0	—	
(V_{CE} = 28 V, f = 2.3 GHz)	MRW2005		—	5.0	—	
(V_{CE} = 28 V, f = 1.5 GHz)			—	6.5	—	
(V_{CE} = 28 V, f = 1.0 GHz)			—	7.5	—	
(V_{CE} = 28 V, f = 2.3 GHz)	MRW2010		—	10	—	
(V_{CE} = 28 V, f = 1.5 GHz)			—	13	—	
(V_{CE} = 28 V, f = 1.0 GHz)			—	15	—	

TYPICAL CHARACTERISTICS

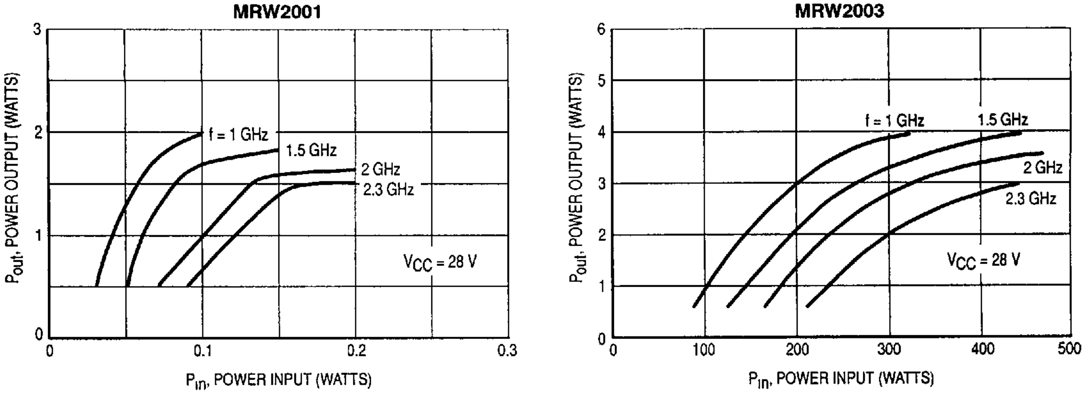


Figure 1. Output Power versus Input Power

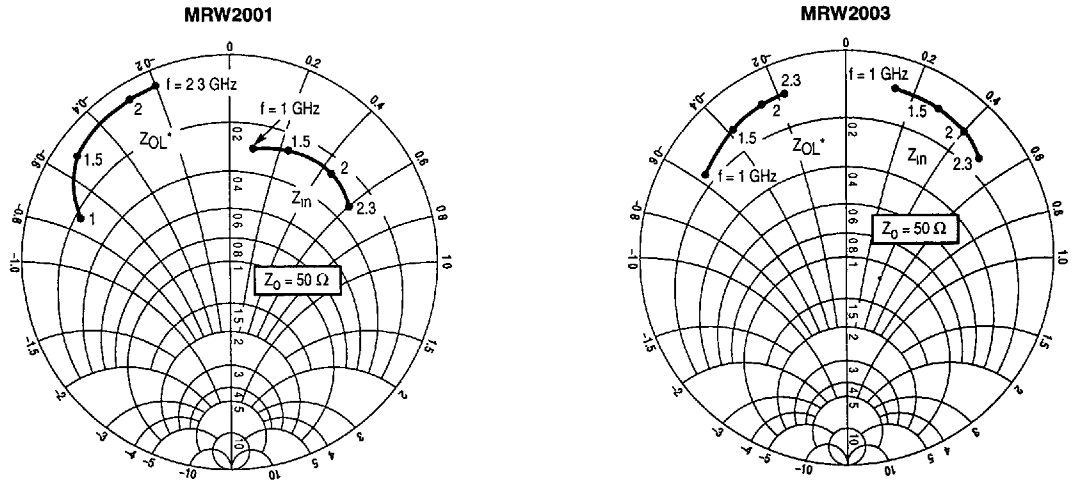


Figure 2. Series Equivalent Input/Output Impedance
V_{CC} = 28 V

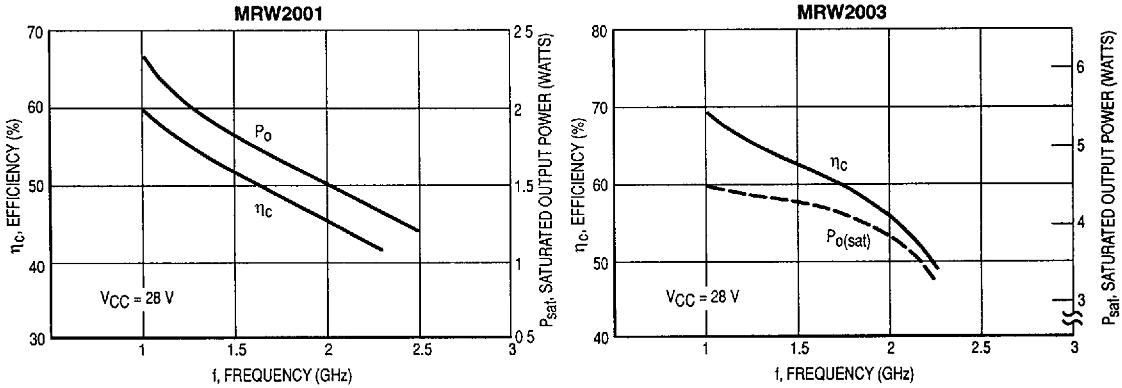


Figure 3. Power Output and Efficiency versus Frequency

TYPICAL CHARACTERISTICS

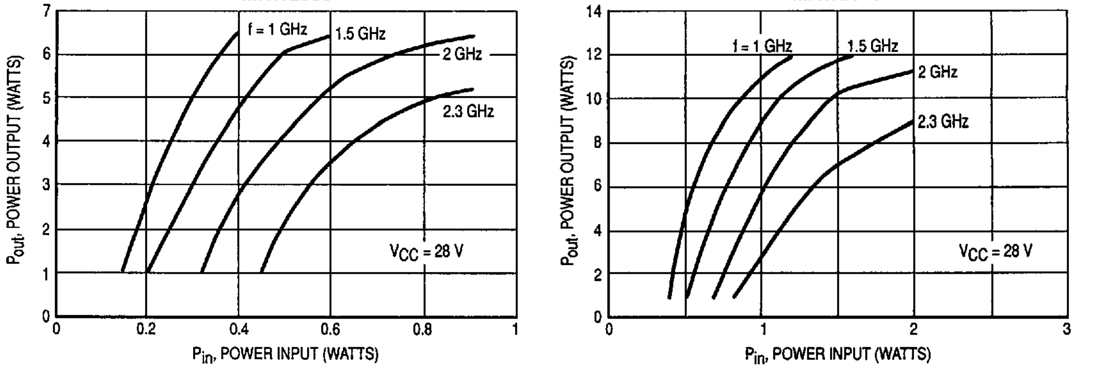


Figure 4. Output Power versus Input Power

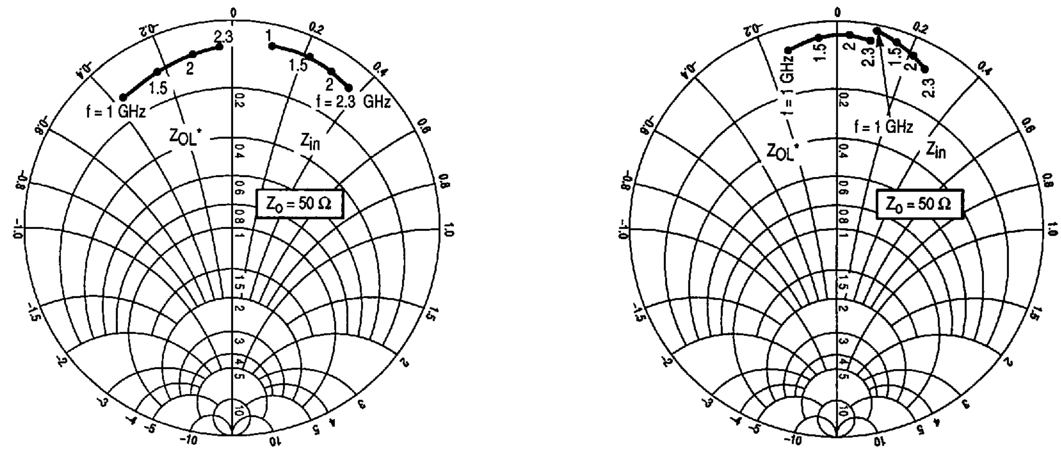


Figure 5. Series Equivalent Input/Output Impedance
V_{CC} = 28 V

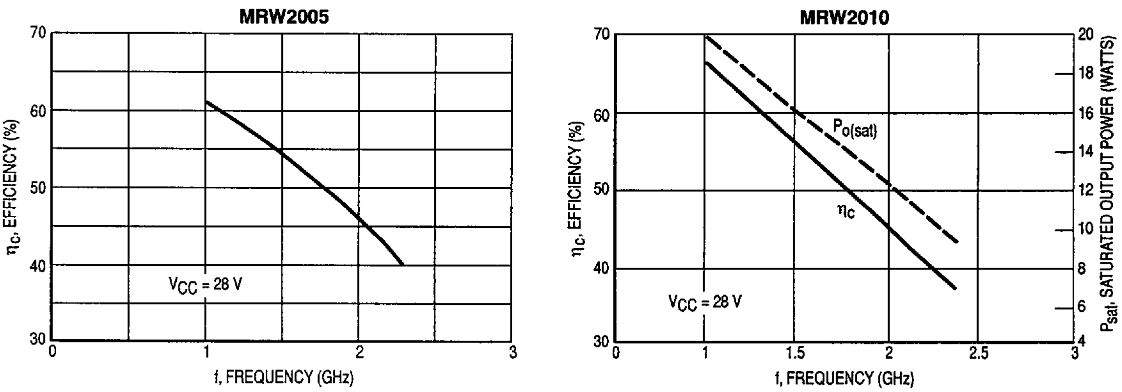


Figure 6. Power Output and Efficiency versus Frequency

The graph shown below displays MTTF in hours x ampere^2 emitter current for each of the "Super 2.0 GHz" devices. Life tests at elevated temperatures have correlated to better than ±10% to the theoretical prediction for metal failure. Sample MTTF calculations based on operating conditions are included on the graph.

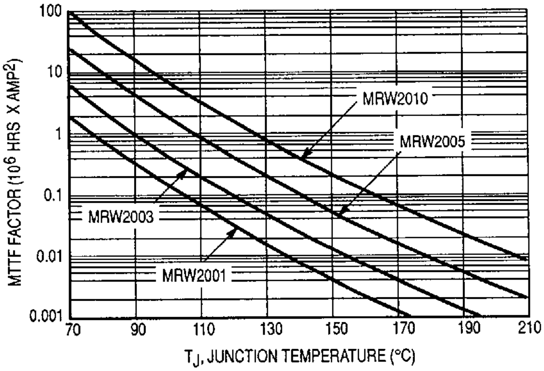


Figure 7. MTTF Factor

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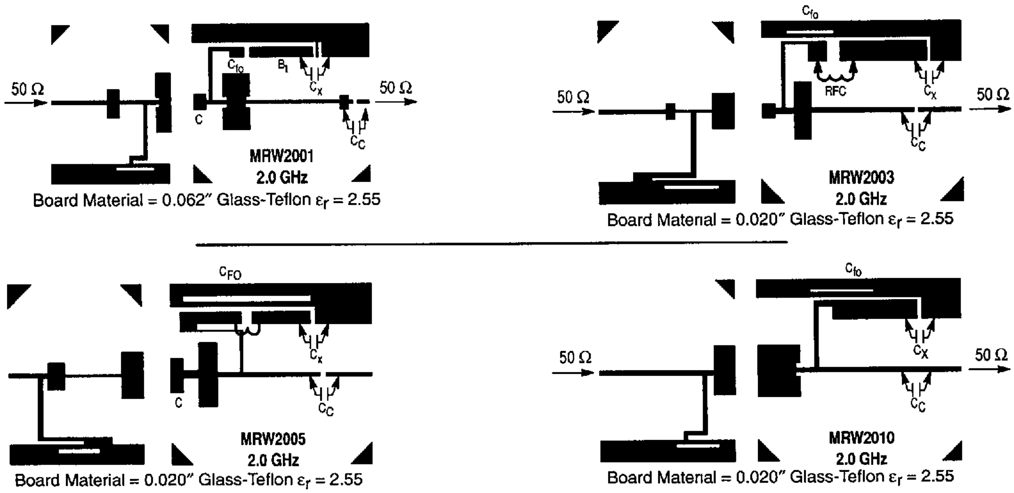

Figure 8. PC Board Layouts