

# MOTOROLA SEMICONDUCTOR TECHNICAL DATA

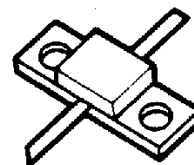
## The RF Line UHF Power Transistors

... designed primarily for wideband, large-signal output and driver amplifier stages in the 600 to 1000 MHz frequency range.

- Designed for Class C, Common Base Power Amplifiers
- Specified 28 Volt, 1000 MHz Characteristics:
  - Output Power — 3 to 40 Watts
  - Power Gain — 7 to 7.8 dB Min, Common Base
  - Collector Efficiency — 50 to 55%
- Built-In Matching Network for Broadband Operation
- Gold Metallization for Improved Reliability
- Diffused Ballast Resistors

### MRA0610 Series

7 to 7.8 dB  
600-1000 MHz  
3 TO 40 WATTS  
BROADBAND  
UHF POWER  
TRANSISTORS



CASE 394-01, STYLE 1  
(MRA .25)

### MAXIMUM RATINGS

Rating	Symbol	-3	-9	-18A	-40A	Unit
Collector-Base Voltage	V <sub>CES</sub>	50				V <sub>dc</sub>
Emitter-Base Voltage	V <sub>EBO</sub>	3.5				V <sub>dc</sub>
Collector Current — Continuous	I <sub>C</sub>	0.5	1.5	2.5	5	A <sub>dc</sub>
Operating Junction Temperature	T <sub>J</sub>	200				°C
Storage Temperature Range	T <sub>stg</sub>	-65 to +150				°C

### THERMAL CHARACTERISTICS

Characteristic	Symbol	Max				Unit
Thermal Resistance, RF, Junction to Case	R <sub>θJC</sub>	15	6	4	2.5	°C/W

### ELECTRICAL CHARACTERISTICS

Characteristic	Symbol	Min	Typ	Max	Unit
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### OFF CHARACTERISTICS

Collector-Emitter Breakdown Voltage (I <sub>C</sub> = 20 mA, V <sub>BE</sub> = 0)	MRA0610-3	V <sub>(BR)CES</sub>	50	—	—	V <sub>dc</sub>
(I <sub>C</sub> = 60 mA, V <sub>BE</sub> = 0)	-9		50	—	—	
(I <sub>C</sub> = 100 mA, V <sub>BE</sub> = 0)	-18A		50	—	—	
(I <sub>C</sub> = 200 mA, V <sub>BE</sub> = 0)	-40A		50	—	—	
Emitter-Base Breakdown Voltage (I <sub>E</sub> = 0.25 mA, I <sub>C</sub> = 0)	MRA0610-3	V <sub>(BR)EBO</sub>	3.5	—	—	V <sub>dc</sub>
(I <sub>E</sub> = 0.75 mA, I <sub>C</sub> = 0)	-9		3.5	—	—	
(I <sub>E</sub> = 1.25 mA, I <sub>C</sub> = 0)	-18A		3.5	—	—	
(I <sub>E</sub> = 2.5 mA, I <sub>C</sub> = 0)	-40A		3.5	—	—	
Collector Cutoff Current (V <sub>CB</sub> = 28 V, I <sub>E</sub> = 0)	MRA0610-3	I <sub>CBO</sub>	—	—	0.5	mA <sub>dc</sub>
	-9		—	—	1.5	
	-18A		—	—	2.5	
	-40A		—	—	5	

(continued)

Characteristic	Symbol	Min	Typ	Max	Unit			
<b>ON CHARACTERISTICS</b>								
DC Current Gain ( $I_C = 0.1 \text{ A}, V_{CE} = 5 \text{ V}$ )	MRA0610-3	hFE	10	—	100			
( $I_C = 0.3 \text{ A}, V_{CE} = 5 \text{ V}$ )						-9	100	
( $I_C = 0.5 \text{ A}, V_{CE} = 5 \text{ V}$ )						-18A	100	
( $I_C = 1 \text{ A}, V_{CE} = 5 \text{ V}$ )						-40A	100	
<b>DYNAMIC CHARACTERISTICS</b>								
Output Capacitance ( $V_{CB} = 28 \text{ V}, I_E = 0, f = 1 \text{ MHz}$ )	MRA0610-3	Cob	—	—	4.5	pF		
	-9		—	—	10			
	-18A		—	—	14			
	-40A		—	—	28			
<b>FUNCTIONAL TESTS</b>								
Common-Base Amplifier Power Gain ( $V_{CE} = 28 \text{ V}, P_{out} = 3 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )	MRAL0610-3	GPB	7.8	—	—	dB		
( $V_{CE} = 28 \text{ V}, P_{out} = 9 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-9	7.8
( $V_{CE} = 28 \text{ V}, P_{out} = 18 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-18A	7.8
( $V_{CE} = 28 \text{ V}, P_{out} = 40 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-40A	7
Collector Efficiency ( $V_{CE} = 28 \text{ V}, P_{out} = 3 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )	MRA0610-3	$\eta_c$	50	—	—	%		
( $V_{CE} = 28 \text{ V}, P_{out} = 9 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-9	55
( $V_{CE} = 28 \text{ V}, P_{out} = 18 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-18A	50
( $V_{CE} = 28 \text{ V}, P_{out} = 40 \text{ W}, f = 0.6 \text{ \& 1 GHz}$ )							-40A	50

**TYPICAL CHARACTERISTICS**  
**MRA0610-3 — 3 WATTS BROADBAND**

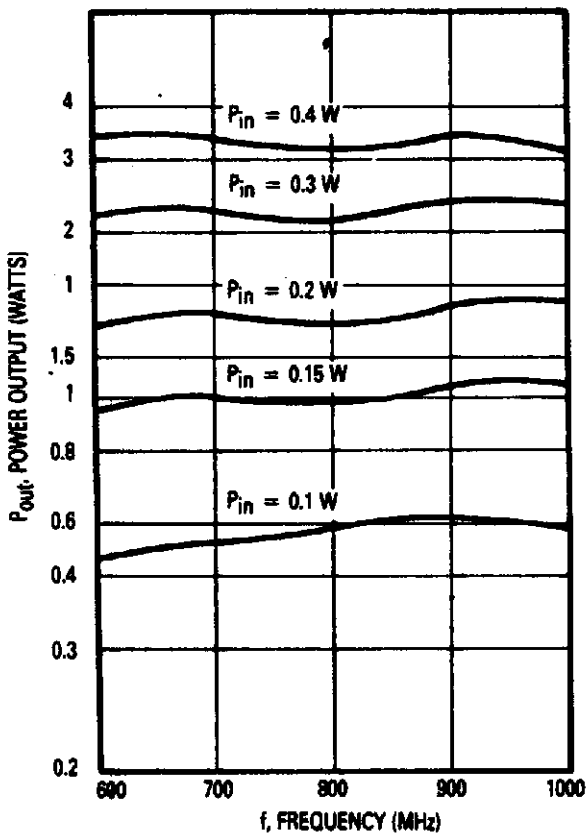


Figure 1. Power Output versus Frequency

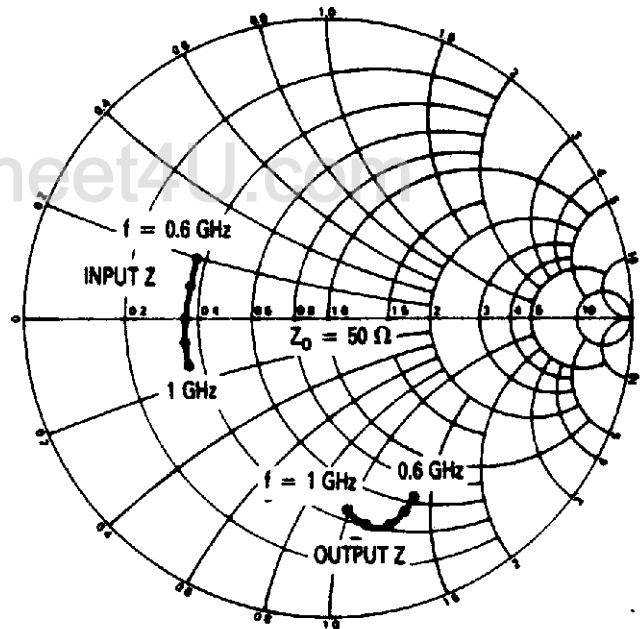


Figure 2. Series Equivalent Input/Output Impedance  
 $V_{CC} = 28 \text{ V}$

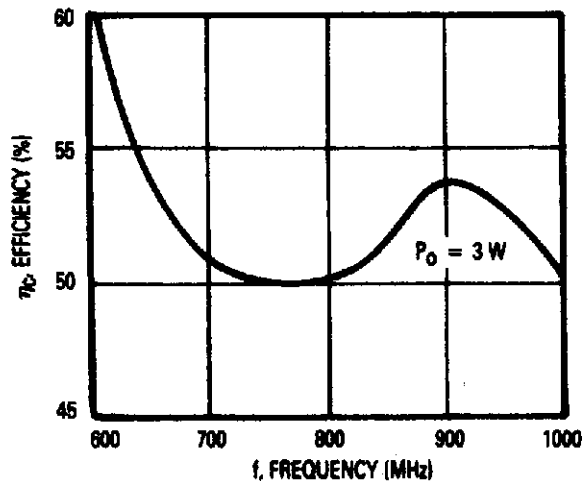


Figure 3. Efficiency versus Frequency

## TYPICAL CHARACTERISTICS

### MRA0610-9 — 9 WATTS BROADBAND

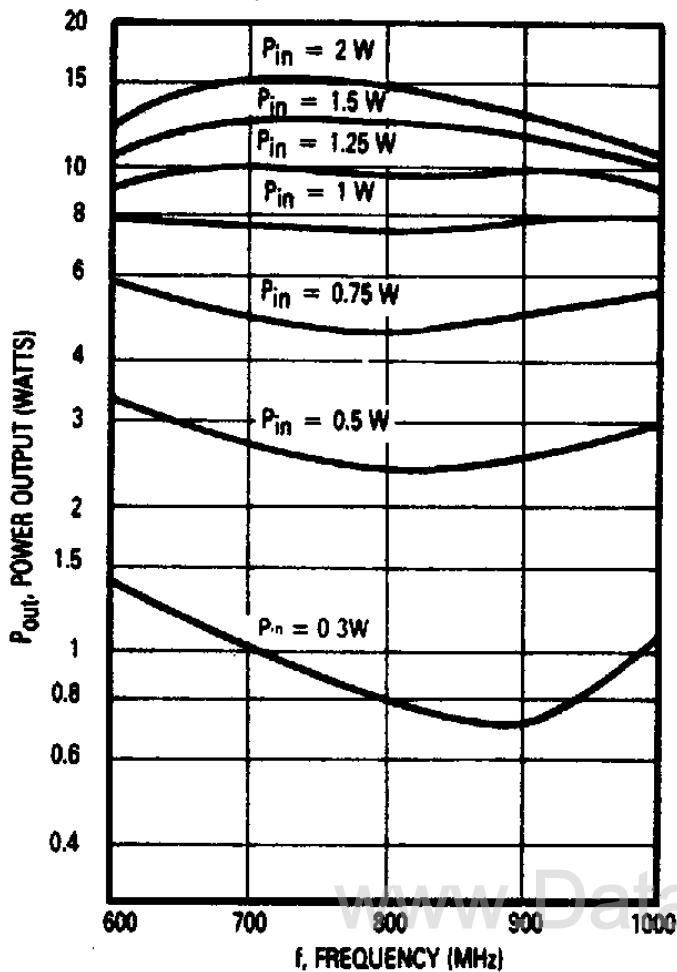


Figure 4. Power Output versus Frequency

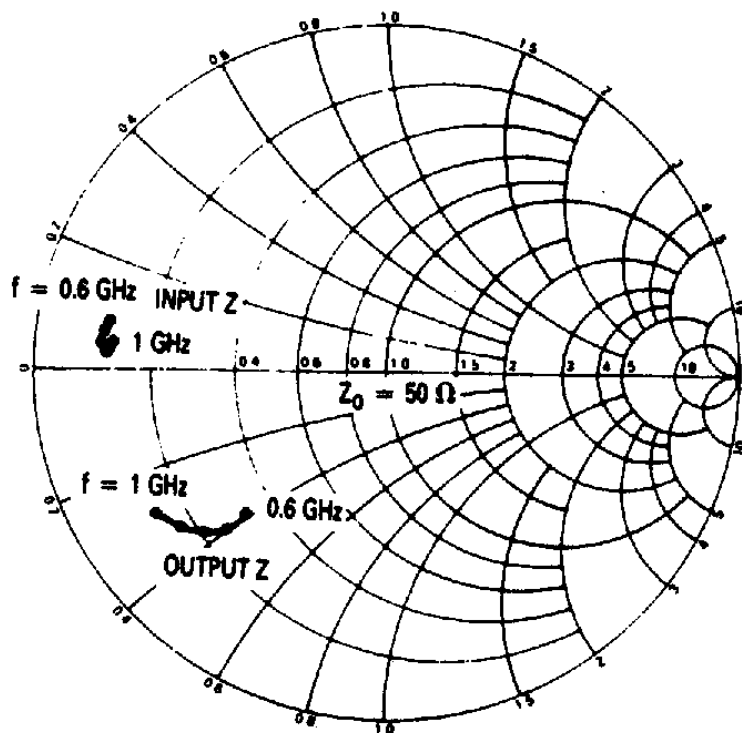


Figure 5. Series Equivalent Input/Output Impedance  
 $V_{CC} = 28\text{ V}$

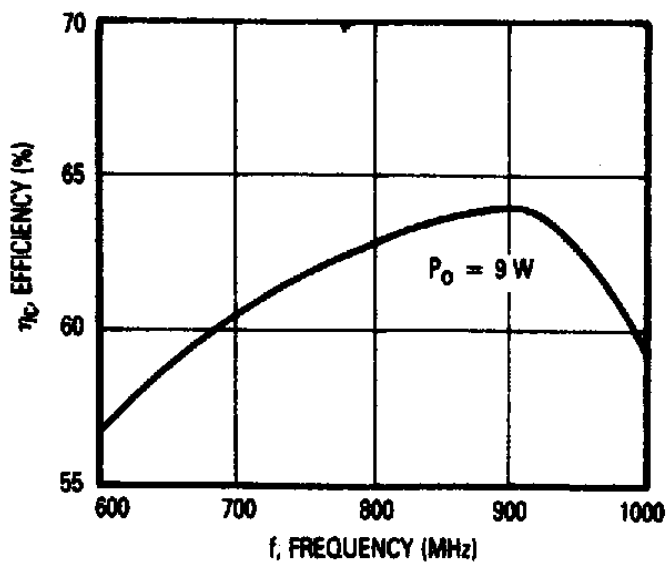


Figure 6. Efficiency versus Frequency

# MRA0610 Series

## TYPICAL CHARACTERISTICS

### MRA0610-18A — 18 WATTS BROADBAND

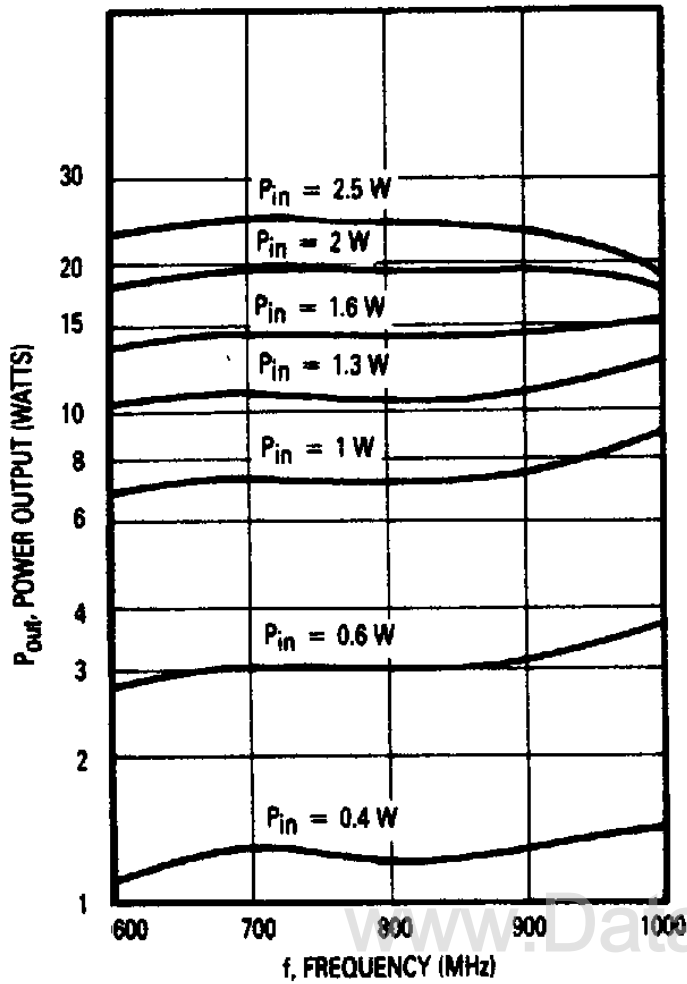


Figure 7. Power Output versus Frequency

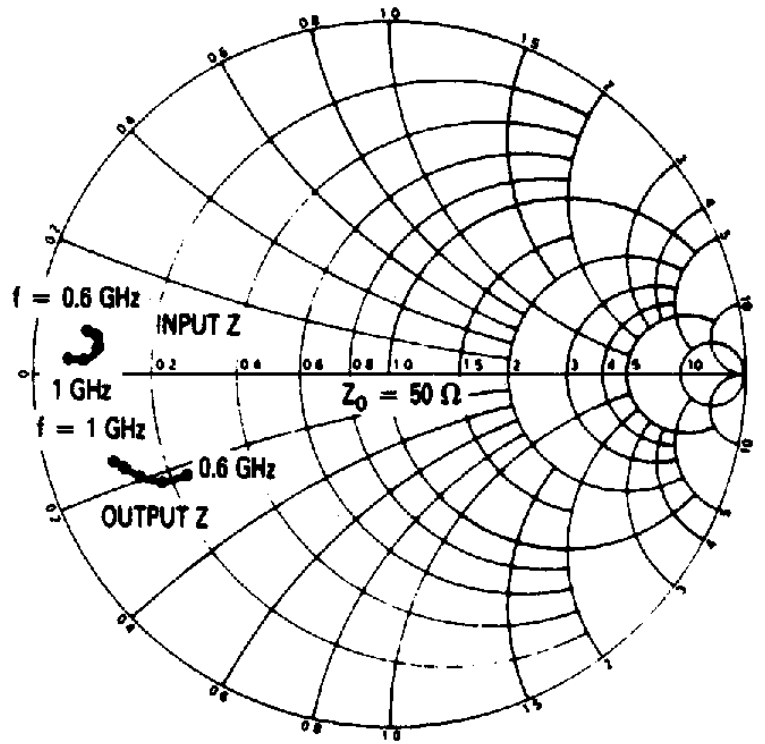


Figure 8. Series Equivalent Input/Output Impedance  
 $V_{CC} = 28 V$

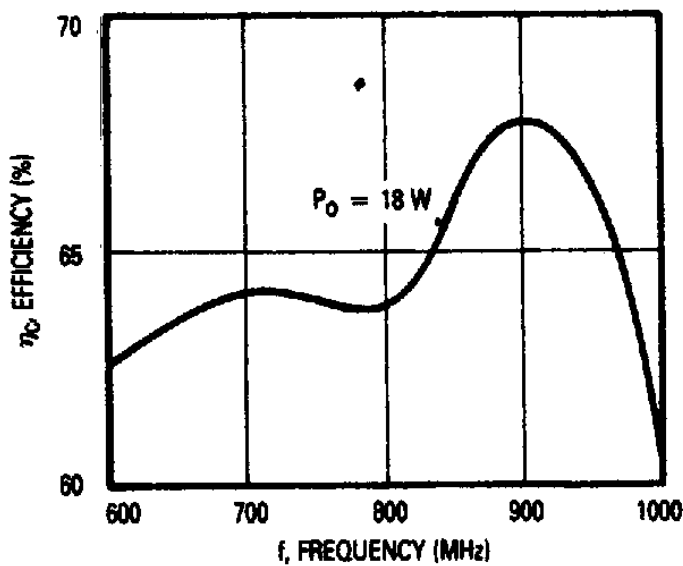


Figure 9. Efficiency versus Frequency

TYPICAL CHARACTERISTICS

MRA0610-40A — 40 WATTS BROADBAND

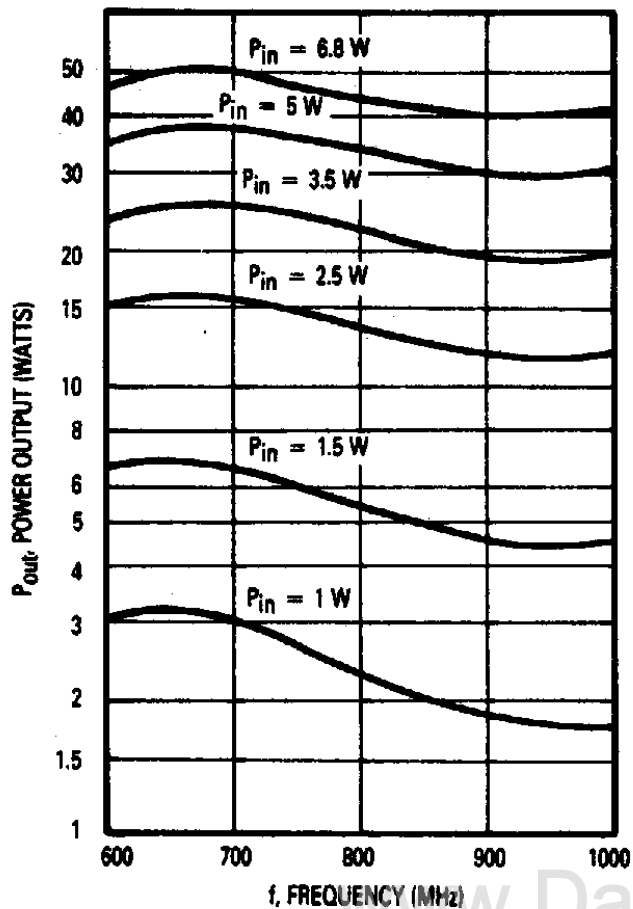


Figure 10. Power Output versus Frequency

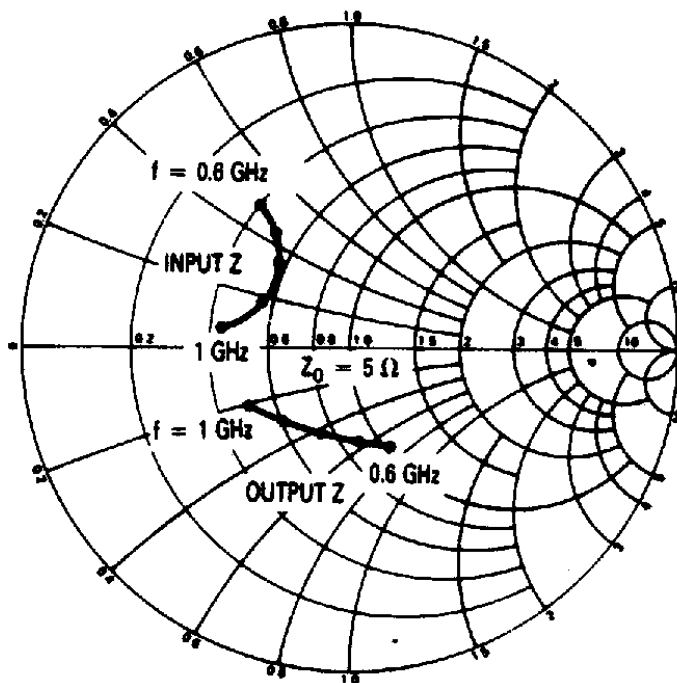


Figure 11. Series Equivalent Input/Output Impedance  
VCC = 28 V

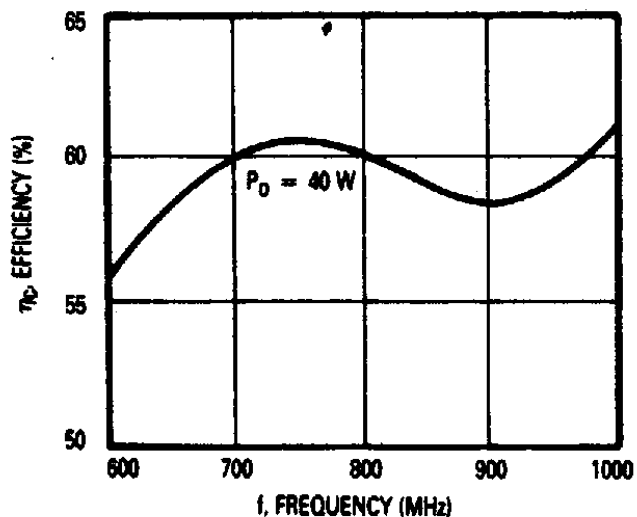


Figure 12. Efficiency versus Frequency

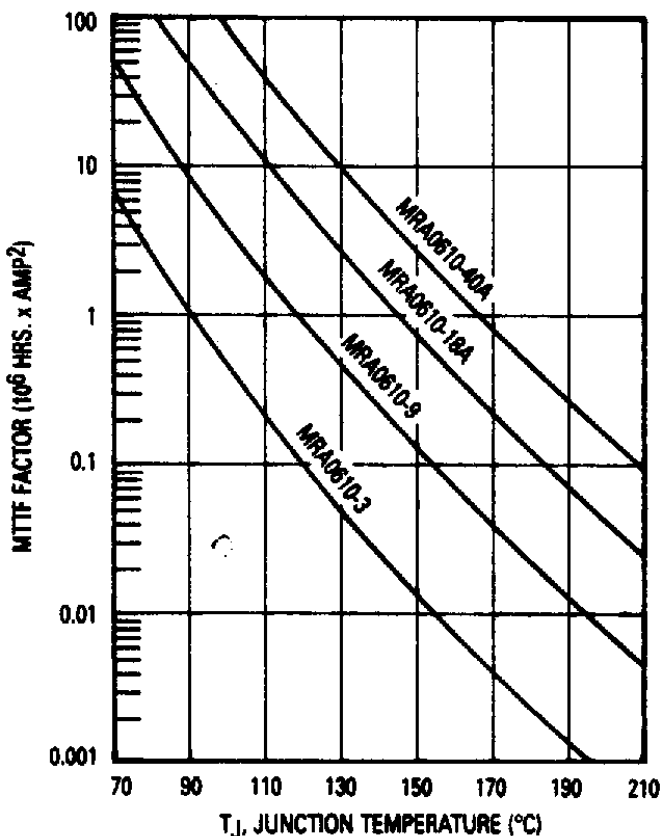
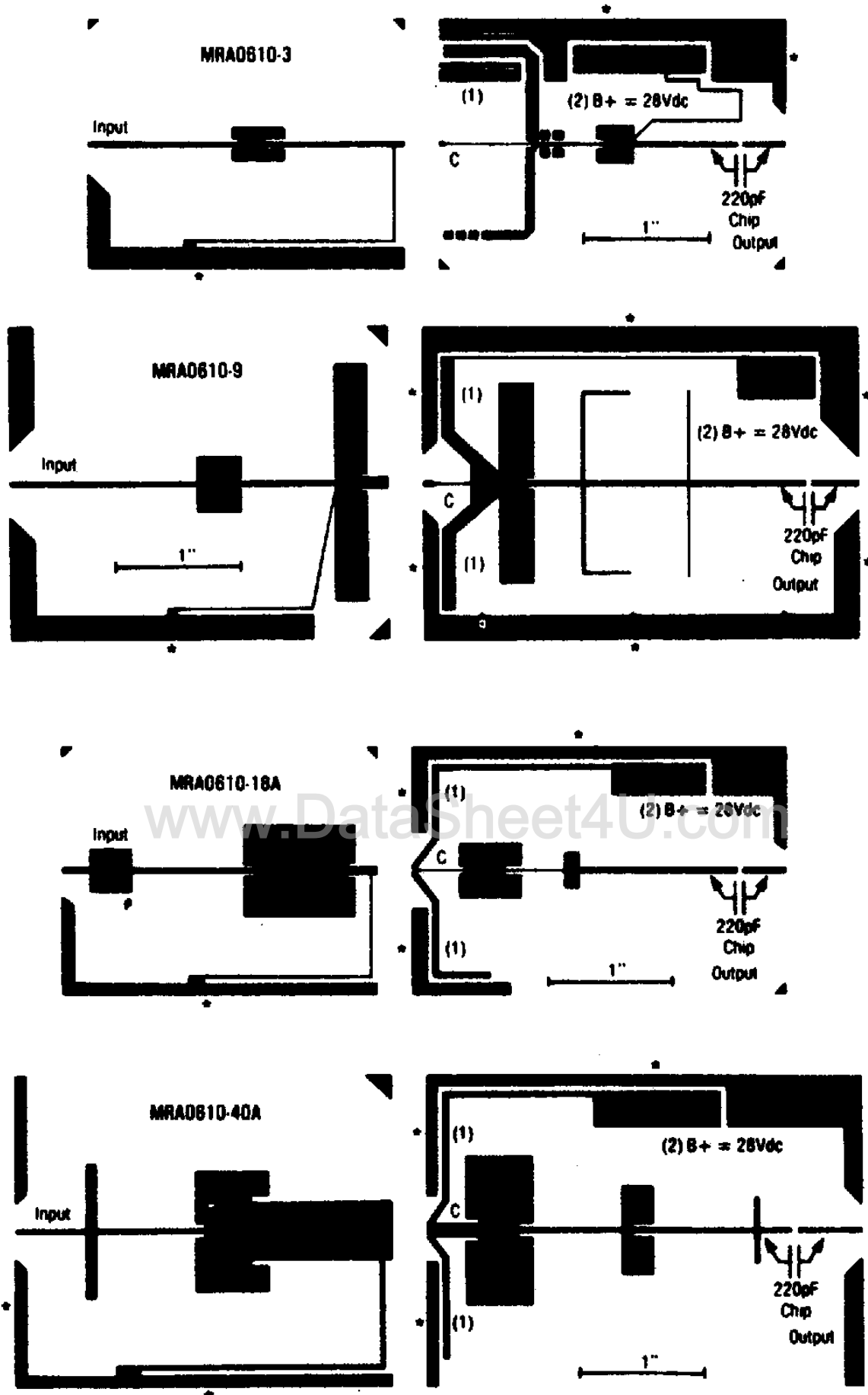


Figure 13. MTTF Factor versus Junction Temperature

Note: Divide by  $I_C^2$  to obtain metal lifetime in hours



\*Foil wrap or plate around to ground plane. Board material 0.020 inch glass teflon  $\epsilon_r = 2.55$ .  
 (1) Bypass capacitor to ground for shunt inductor (220pF chip).  
 (2) Use B+ bypass of 0.01 and 1 $\mu$ F capacitors at this point.

**Figure 14. Test Circuit Boards for MRA0610 Series**

(Not to Scale)