

**MHW709-1**  
**MHW709-2**  
**MHW709-3**

**The RF Line**

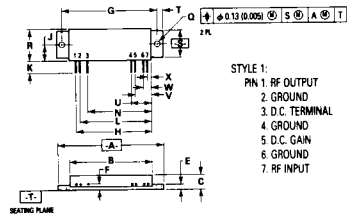
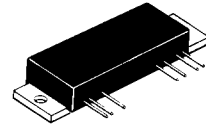
**UHF POWER AMPLIFIERS**

... designed for 12.5 volt UHF power amplifier applications in industrial and commercial FM equipment operating from 400 to 512 MHz.

- Specified 12.5 Volt, UHF Characteristics —
  - Output Power = 7.5 Watts
  - Minimum Gain = 18.8 dB
  - Harmonics = 40 dB
- 50 Ω Input/Output Impedance
- Guaranteed Stability and Ruggedness
- Gain Control Pin for Manual or Automatic Output Level Control
- Thin-Film Hybrid Construction Gives Consistent Performance and Reliability

7.5 W — 400-512 MHz

**RF POWER AMPLIFIERS**



- NOTES:
1. MOUNTING HOLES WITHIN 0.13MM (0.005) DIA OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.
  2. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
  3. CONTROLLING DIMENSION: INCH.

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	67.06	67.56	2.640	2.660
B	51.82	52.95	2.040	2.085
C	8.51	9.14	0.335	0.360
E	2.54	2.92	0.100	0.115
F	2.16	2.62	0.085	0.115
G	61.09 BSC	2.405 BSC		
H	47.88	48.94	1.885	1.915
J	10.15	11.18	0.400	0.440
K	5.85	7.62	0.230	0.300
L	45.34	46.10	1.785	1.815
N	40.26	41.02	1.585	1.615
O	3.46	3.70	0.136	0.146
R	20.32	20.82	0.800	0.820
S	17.02	17.52	0.670	0.690
U	12.32	13.08	0.485	0.515
V	9.78	10.54	0.385	0.415
W	4.70	5.46	0.185	0.215
X	2.16	2.92	0.085	0.115

CASE 700-04

**MAXIMUM RATINGS** (Flange Temperature = 25°C)

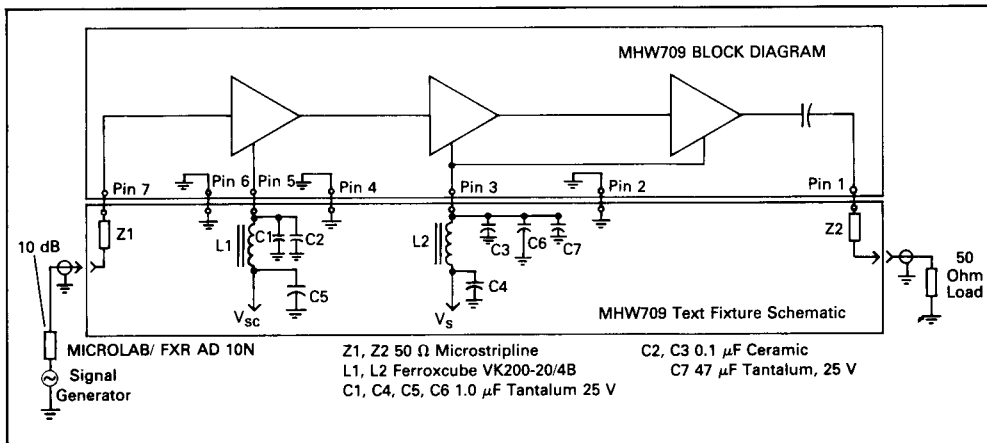
Rating	Symbol	Value	Unit
DC Supply Voltages	$V_S, V_{SC}$	15.5	Vdc
RF Input Power	$P_{in}$	250	mW
RF Output Power(@ $V_S = V_{SC} = 12.5$ V)	$P_{out}$	10	W
Operating Case Temperature Range	$T_C$	-30 to +100	°C
Storage Temperature Range	$T_{stg}$	-40 to +100	°C

# MHW709-1, MHW709-2, MHW709-3

## ELECTRICAL CHARACTERISTICS ( $V_S$ and $V_{SC}$ set at 12.5 Vdc, $T_A = 25^\circ\text{C}$ , 50 $\Omega$ system unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Frequency Range MHW709-1 MHW709-2 MHW709-3	—	400 440 470	440 470 512	MHz
Input Power ( $P_{Out} = 7.5\text{ W}$ )	$P_{in}$	—	100	mW
Power Gain	$G_p$	18.8	—	dB
Efficiency ( $P_{Out} = 7.5\text{ W}$ )	$\eta$	35	—	%
Harmonics ( $P_{Out} = 7.5\text{ W}$ , Reference)	—	—	-40	dB
Input Impedance ( $P_{Out} = 7.5\text{ W}$ , 50 $\Omega$ Reference)	$Z_{in}$	—	2:1	VSWR
Power Degradation ( $P_{Out} = 7.5\text{ W}$ , $T_C = 25^\circ\text{C}$ , Reference) ( $T_C = 0^\circ\text{C}$ to $60^\circ\text{C}$ ) ( $T_C = -30^\circ\text{C}$ to $80^\circ\text{C}$ )	—	— —	0.3 0.7	dB
Load Mismatch (VSWR = $\infty$ , $V_S = V_{SC} = 15.5\text{ Vdc}$ , $P_{Out} = 10\text{ W}$ )	—	No degradation in $P_{Out}$		
Stability 1. ( $P_{in} = 30$ to $150\text{ mW}$ , Load Mismatch = 2:1, 50 $\Omega$ Reference, $V_S = V_{SC} = 3.0$ to $15.5\text{ Vdc}$ ) 2. ( $V_S = 12.5\text{ Vdc}$ , $V_{SC}$ adjusted for $P_{Out} = 5.0$ to $10\text{ W}$ , $P_{in} = 100\text{ mW}$ , Load Mismatch = 4:1, 50 $\Omega$ Reference, note $V_{SC} \leq V_S$ )	—	All spurious outputs more than 70 dB below desired signal		
Standby Current ( $P_{in} = 0$ )	$I_{sc(q)}$	—	10	mA

FIGURE 1 — UHF POWER AMPLIFIER TEST SETUP



TYPICAL PERFORMANCE CURVES

(MHW709-2)

FIGURE 2 – INPUT POWER, EFFICIENCY, AND VSWR versus FREQUENCY

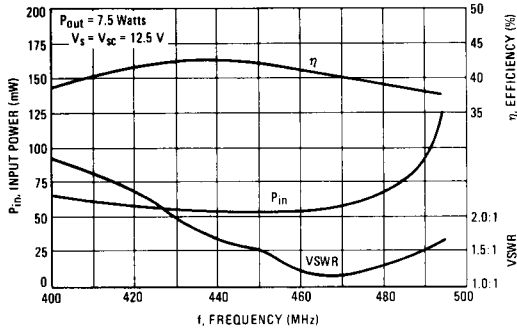


FIGURE 3 – OUTPUT POWER versus INPUT POWER

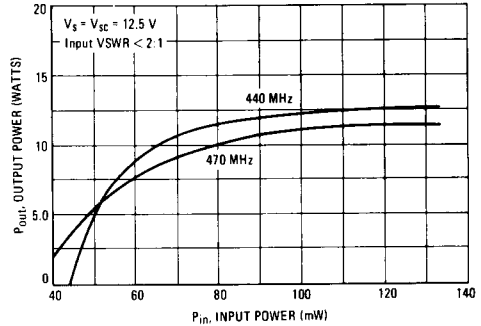


FIGURE 4 – OUTPUT POWER versus VOLTAGE

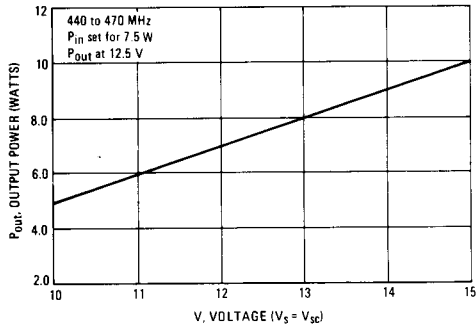


FIGURE 5 – OUTPUT POWER versus GAIN CONTROL VOLTAGE

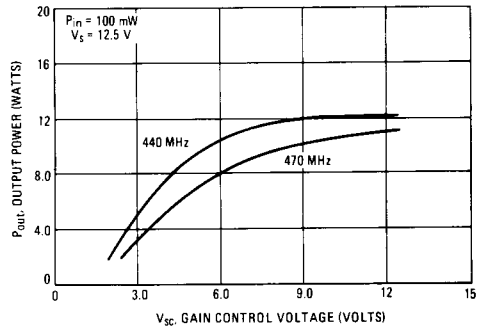


FIGURE 6 – GAIN CONTROL CURRENT versus VOLTAGE

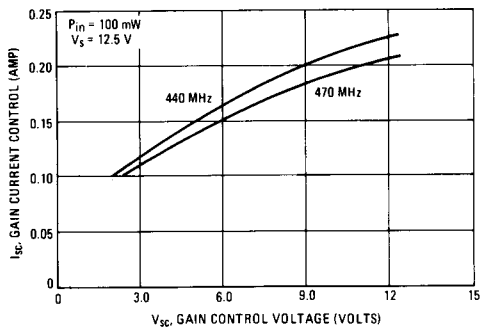
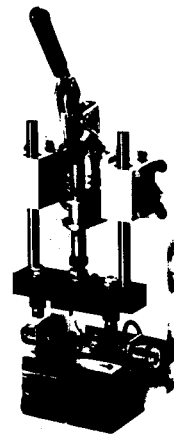


FIGURE 7 – TEST CIRCUIT



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## APPLICATIONS INFORMATION

**Nominal Operation**

All electrical specifications are based on the nominal conditions of  $V_{SC}$  (Pin 5) and  $V_S$  (Pin 3) equal to 12.5 Vdc and with output power equaling 7.5 watts. With these conditions, maximum current density on any device is  $1.5 \times 10^5$  A/cm<sup>2</sup> and maximum die temperature with 100° base plate temperature is 165°. While the modules are designed to have excess gain margin with ruggedness, operation of these units outside the limits of published specifications is not recommended unless prior communications regarding intended use has been made with the factory representative.

**Gain Control**

The intent of these gain control methods is to set the nominal  $P_{out}$ . Do not use them for wide range gain control.

In general, the module output power should be limited to 10 watts. The preferred method of power output control is to fix both  $V_{SC}$  and  $V_S$  at 12.5 Vdc and vary the input RF drive level at Pin 7. The next method is to control  $V_{SC}$  through a stiff voltage source.

A third method of power output control is to control  $V_{SC}$  through a current source or voltage source with series resistance. This mode of control creates a region of negative slope on the power gain profile curve and aggravates output power slump with temperature.

**Decoupling**

Due to the high gain of the three stages and the module size limitation, external decoupling network requires careful consideration. Both Pins 3 and 5 are internally bypassed with a 0.018  $\mu$ F chip capacitor effective for frequencies from 5 through 512 MHz. For bypassing frequencies below 5 MHz, networks equivalent to that shown in the test figure schematic are recommended. Inadequate decoupling will result in spurious outputs at certain operating frequencies and certain phase angles of input and output VSWR less than 3:1.

**Load Pull**

During final test, each module is "load pull" tested in a fixture having the identical decoupling network described in Figure 1. Electrical conditions are  $V_S$  and  $V_{SC}$  equal 15.5 V output, VSWR infinite, output power equal to 10 watts.

**Mounting Considerations**

To insure optimum heat transfer from the flange to heatsink, use standard 6-32 mounting screws and an adequate quantity of silicon thermal compound (e.g., Dow Corning 340). With both mounting screws finger tight, alternately torque down the screws to 4-6 inch pounds. The heatsink mounting surface directly beneath the module flange should be flat to within 0.005 inch to prevent fracturing of ceramic substrate material. For more information on module mounting, see EB-107.

FIGURE 8 — UHF POWER AMPLIFIER TEST FIXTURE  
PRINTED CIRCUIT BOARD

