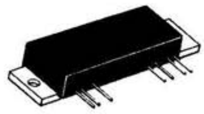
MHW710-1
MHW710-2
MHW710-3

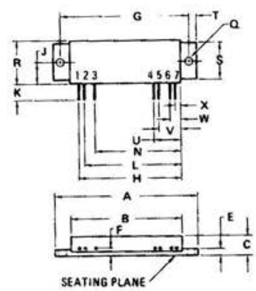
MOTOROLA

The RF Line

13 W 400–512 MHz

RF POWER AMPLIFIER MODULE





NOTE:
1. MOUNTING HOLES WITHIN 0.13 mm (0.005) DIA OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.

STYLE 1:
PIN 1. RF OUTPUT
2. GROUND
3. D.C. TERMINAL
4. GROUND
5. D.C. GAIN
6. GROUND
7. RF INPUT

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
A	67.06	67.56	2.640	2.660
B	51.82	52.96	2.040	2.085
C	8.51	9.14	0.335	0.360
E	2.54	2.92	0.100	0.115
F	2.67	2.92	0.105	0.115
G	61.09 BSC		2.405 BSC	
H	47.88	48.64	1.885	1.915
J	10.16	11.18	0.400	0.440
K	5.84	7.62	0.230	0.300
L	45.34	46.10	1.785	1.815
N	40.26	41.02	1.585	1.615
Q	3.45	3.71	0.136	0.146
R	20.32	20.83	0.800	0.820
S	17.02	17.53	0.670	0.690
T	2.98	3.24	0.1175	0.1275
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 700-03

UHF POWER AMPLIFIER MODULE

. . . 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 = 13 Watts
  Minimum Gain = 19.4 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

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}	15	W
Operating Case Temperature Range	T_C	−30 to +100	°C
Storage Temperature Range	T_{stg}	−30 to +100	°C

ELECTRICAL CHARACTERISTICS
(V_s and V_{sc} set at 12.5 Vdc, T_A = 25°C, 50 Ω system unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Frequency Range MHW710-1 MHW710-2 MHW710-3	—	400 440 470	440 470 512	MHz
Input Power (P_{out} = 13 W)	P_{in}	—	150	mW
Power Gain	G_p	19.4	—	dB
Efficiency (P_{out} = 13 W)	η	35	—	%
Harmonics (P_{out} = 13 W, Reference)	—	—	−40	dB
Input Impedance (P_{out} = 13 W, 50 Ω Reference)	Z_{in}	—	2:1	VSWR
Power Degradation (P_{out} = 13 W, T_C = 25°C, Reference) (T_C = 0°C to 60°C) (T_C = −30°C to 80°C)	—	 — —	 0.3 0.7	dB
Load Mismatch (VSWR = ∞, V_s = 15.5 Vdc, P_{out} = 16.5 W)	—	No degradation in P_{out}		
Stability 1. (P_{in} = 50 to 200 mW, Load Mismatch = 4:1, 50 Ω reference, $V_s = V_{sc}$ = 8.0 to 15.5 Vdc) 2. (V_s = 12.5 Vdc, V_{sc} adjusted for P_{out} = 5.0 to 15 W, P_{in} = 150 mW, Load Mismatch = 4:1, 50 Ω reference, note $V_{sc} \leq V_s$)	—	All spurious outputs more than 70 dB below desired signal		

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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 13 watts. With these conditions, maximum current density on any device is 1.5×10^5 A/cm^2 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 µF 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.

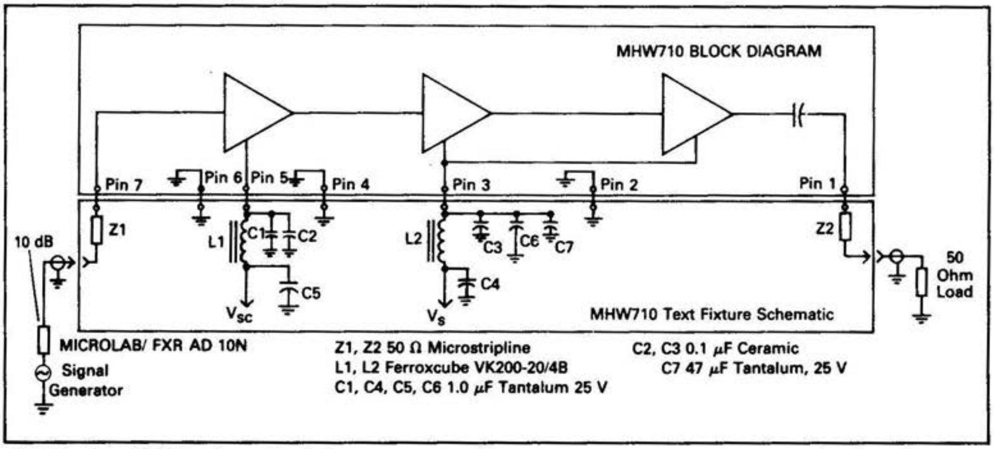
Load Pull

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 16.5 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 1 — UHF POWER MODULE TEST SETUP



NOTE: No Internal D.C. blocking on input pin.

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TYPICAL PERFORMANCE CURVES
(MHW710-2)

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

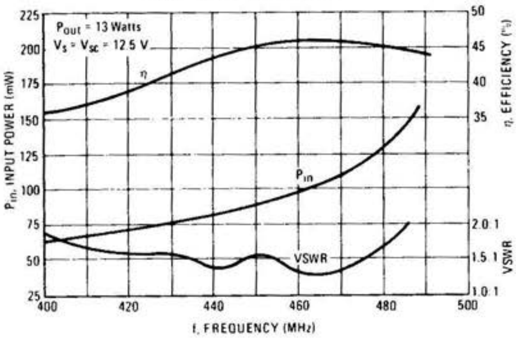

FIGURE 3 – OUTPUT POWER versus INPUT POWER

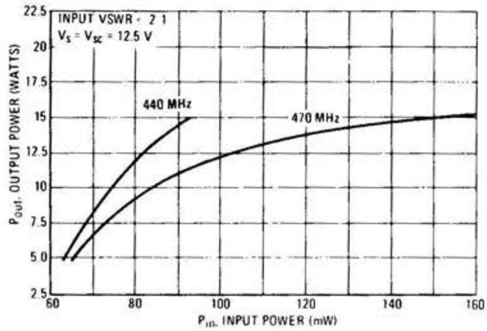

FIGURE 4 – OUTPUT POWER versus VOLTAGE

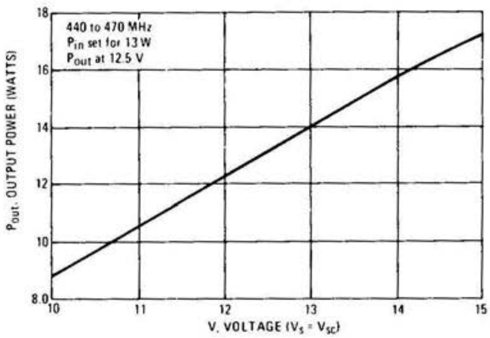

FIGURE 5 – OUTPUT POWER versus GAIN CONTROL VOLTAGE

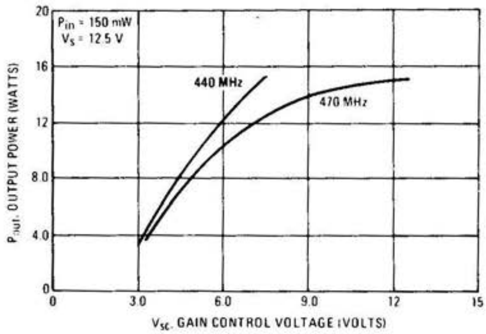

FIGURE 6 – GAIN CONTROL CURRENT versus VOLTAGE

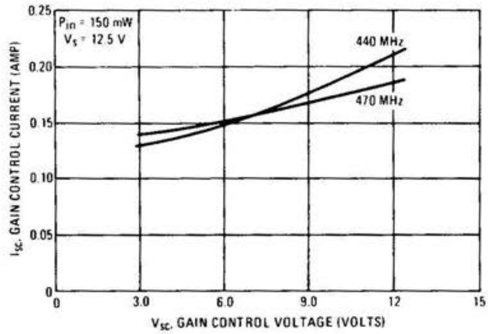

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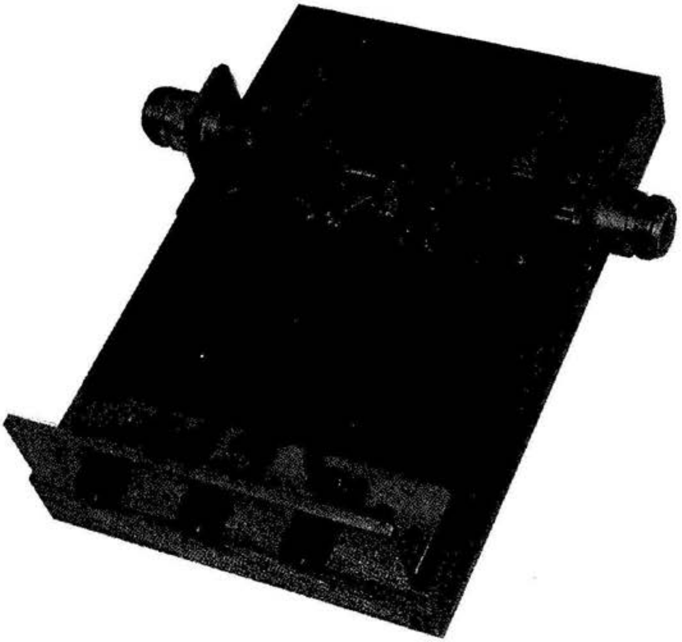
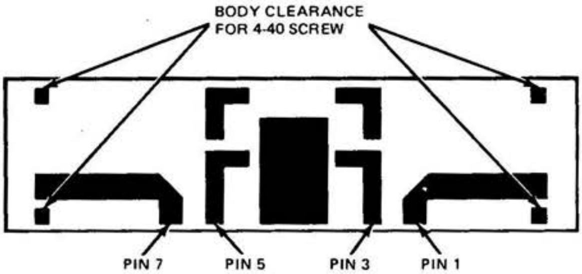
FIGURE 7 – TEST CIRCUIT





Teflon Glass Board
t = 0.062"
ϵ_R = 2.56

NOTE:
Mount board and module on 1/2" thick aluminum block for heat sinking and electrical ground. Pins 2, 4 and 6 are not directly connected to ground in this test fixture. Ground is provided through module heat sink.