MOTOROLA SEMICONDUCTOR TECHNICAL DATA

MHW710-1 MHW710-2 MHW710-3

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 = 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	Pin	250	mW
RF Output Power (@ V _S = V _{SC} = 12.5 V)	Pout	15	W
Operating Case Temperature Range	TC	-30 to +100	°C
Storage Temperature Range	T _{stg}	-40 to +100	°C

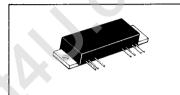
ELECTRICAL CHARACTERISTICS

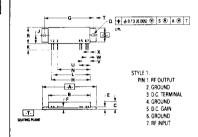
(Ve and Vec set at 12.5 Vdc, $T_{\Delta} = 25^{\circ}$ C, 50 Ω system unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
Frequency Range MHW710-1 MHW710-2 MHW710-3		_	400 440 470	440 470 512	MHz
Input Power (Pout = 13 W)		Pin	ı	150	mW
Power Gain	Gp	19.4	_	dB	
Efficiency (Pout = 13 W)		η	35	_	%
Harmonics (Pout = 13 W, Reference)		_	_	- 40	dB
Input Impedance (Pout = 13 W, 50 Ω Reference)		z _{in}	_	2:1	VSWR
Power Degradation ($P_{out} = 13 \text{ W}$ Reference) $\{T_C = 0^{\circ}C \text{ to } 60^{\circ}C\}$ $\{T_C = -30^{\circ}C \text{ to } 80^{\circ}C\}$	_		0.3 0.7	dB	
Load Mismatch (VSWR = ∞ , V _S = 15.5 Vdc, P _C	_{ut} = 16.5 W)	_	No degradation in P _{out}		
Stability 1. ($P_{in}=50$ to 200 mW, Load M 50 Ω reference, $V_{S}=V_{SC}=8$ 2. ($V_{S}=12.5$ Vdc, V_{SC} adjusted to 15 W, $P_{in}=150$ mW, Load = 4:1, 50 Ω reference, note V_{SC}	0 to 15.5 Vdc) for P _{out} = 5.0 Mismatch	_	All spurious outputs more than 70 dB below desired signal		

13 W 400-512 MHz

RF POWER AMPLIFIERS





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

DIM	MILLIMETERS		INCHES	
	MIN	MAX	MIN	MAX
Α	67.06	67.56	2.640 1	2.660
В	51.82	52.95	2.040	2.085
С	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	
Н	47.88	48.64	1.885	1.915
J	10.16	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
Q	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
Ü	12.32	13.08	0.485	0.515
٧	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

MHW710-1, MHW710-2, MHW710-3

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/cm² 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 fingeright, 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.

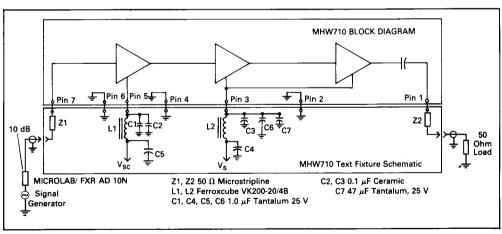


FIGURE 1 — UHF POWER AMPLIFIER TEST SETUP

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

MHW710-1, MHW710-2, MHW710-3

TYPICAL PERFORMANCE CURVES (MHW710-2)

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

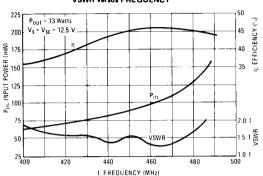


FIGURE 3 - OUTPUT POWER versus INPUT POWER

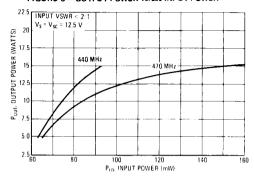


FIGURE 4 - OUTPUT POWER versus VOLTAGE

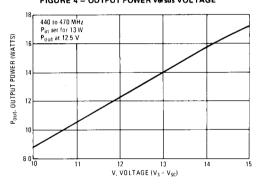


FIGURE 5 - OUTPUT POWER versus GAIN CONTROL VOLTAGE

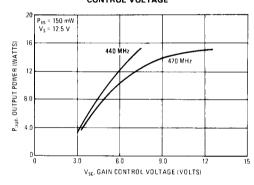
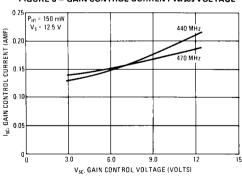


FIGURE 6 - GAIN CONTROL CURRENT versus VOLTAGE



MHW710-1, MHW710-2, MHW710-3

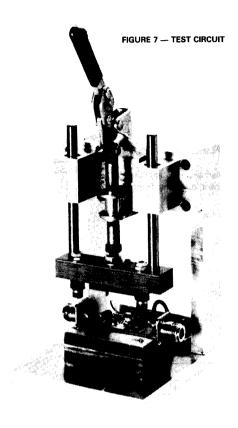


FIGURE 8 — UHF POWER AMPLIFIER TEST FIXTURE PRINTED CIRCUIT BOARD

