

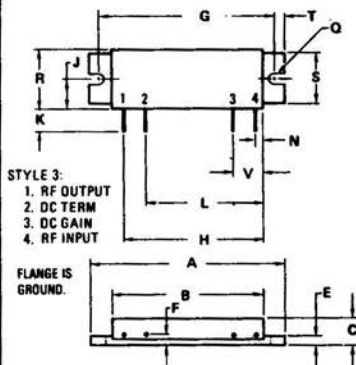
**MOTOROLA****MHW613A****The RF Line****VHF POWER AMPLIFIER MODULE**

... designed for 12.5 volt VHF power amplifier applications in industrial and commercial FM equipment operating to 174 MHz

- Frequency Range — 150 to 174 MHz
- Specified 12.5 Volt, VHF Characteristics
  - Output Power = 30 Watts
  - Minimum Gain = 20 dB
  - Harmonics = -30 dB
- 50  $\Omega$  Input/Output Impedances
- Guaranteed Stability and Ruggedness
- Gain Control Pin for Manual or Automatic Output Level Control
- Thin-Film Hybrid Construction Gives Consistent Performance and Reliability
- Replacement for MHW603

**30 W — 150-174 MHz****RF POWER AMPLIFIER MODULE****MAXIMUM RATINGS** (Flange Temperature = 25°C)

Rating	Symbol	Value	Unit
DC Supply Voltages	$V_s, V_{sc}$	16	Vdc
RF Input Power	$P_{in}$	500	mW
RF Output Power ( $V_s = V_{sc} = 12.5$ V)	$P_{out}$	40	W
Storage Temperature Range	$T_{stg}$	-65 to +125	°C
Operating Case Temperature Range	$T_C$	-30 to +100	°C



NOTE:  
1. MOUNTING SLOTS WITHIN .13 (0.005) DIA. OF TRUE POSITION AT SEATING PLANE AT MAXIMUM MATERIAL CONDITION.

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		2.406 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	40.26	41.02	1.585	1.615
N	2.16	2.92	0.085	0.115
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
V	9.78	10.54	0.385	0.415

CASE 297-03

# MHW613A

## ELECTRICAL CHARACTERISTICS (Flange Temperature = 25°C, 50 Ω system, and $V_S = V_{SC} = 12.5$ V unless otherwise noted)

Characteristic	Symbol	Min	Typ	Max	Unit
Frequency Range	BW	150	—	174	MHz
Input Power ( $P_{OUT} = 30$ W)	$P_{in}$	—	—	300	mW
Power Gain ( $P_{OUT} = 30$ W)	$G_p$	20	—	—	dB
Efficiency ( $P_{OUT} = 30$ W)	$\eta$	40	—	—	%
Harmonic Output ( $P_{OUT} = 30$ W Reference)	—	—	—	-30	dB
Input Impedance ( $P_{in} = 300$ mW, 50 Ω Reference, $V_{sc}$ set for $P_{OUT} = 30$ W)	$Z_{in}$	—	—	2:1	VSWR
Power Degradation (-30 to +80°C) ( $P_{in} = 300$ mW, $V_{sc}$ set for $P_{OUT} = 30$ W @ $T_C = 25$ °C)	—	—	—	0.7	dB
Load Mismatch Stress ( $V_S = V_{sc} = 15.5$ Vdc, $P_{OUT} = 40$ W, VSWR = 30:1, all phase angles)	—	No degradation in Power Output			
Stability 1. ( $P_{in} = 100$ to $400$ mW, $V_S = V_{sc} = 9.5$ to $15.5$ V, $P_{OUT} \leq 40$ W, Load VSWR = 3:1) 2. ( $V_S = 12.5$ V, $V_{sc} = 0$ to $12.5$ V, $P_{in} = 300$ mW, Load VSWR = 3:1)	All spurious outputs $\geq 70$ dB below the desired output signal level				

FIGURE 1 – TEST CIRCUIT

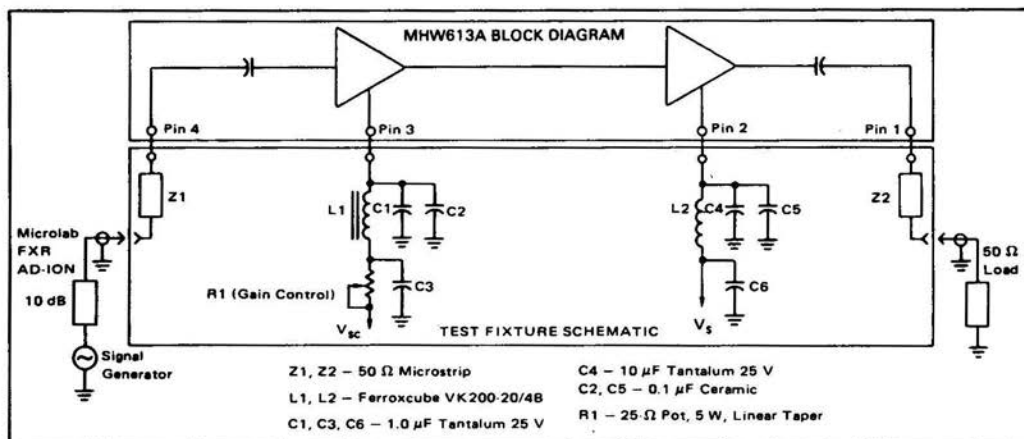


FIGURE 2 – INPUT POWER, EFFICIENCY AND VSWR versus FREQUENCY

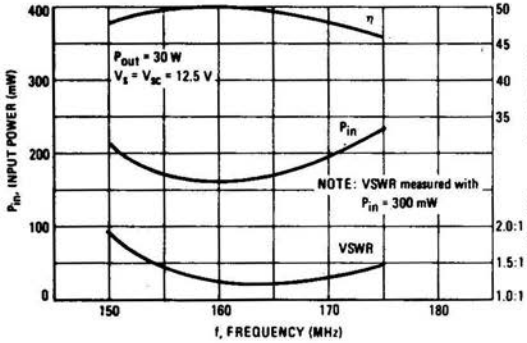


FIGURE 3 – OUTPUT POWER versus INPUT POWER

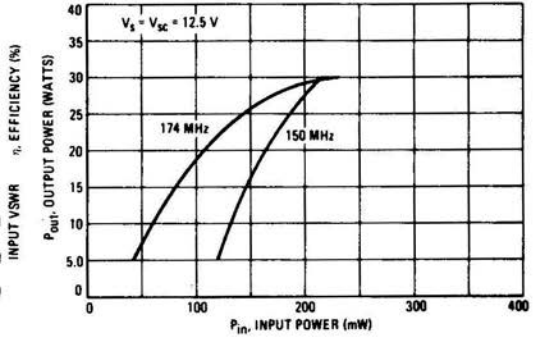


FIGURE 4 – OUTPUT POWER versus VOLTAGE

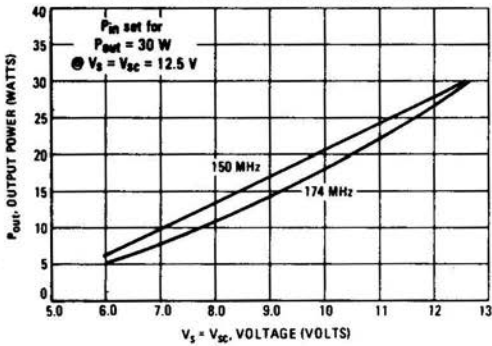


FIGURE 5 – GAIN CONTROL CURRENT versus CONTROL VOLTAGE

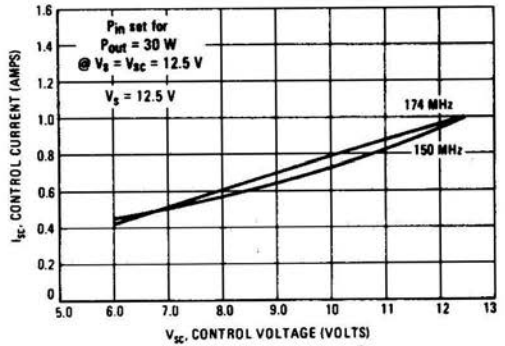


FIGURE 6 – OUTPUT POWER versus GAIN CONTROL VOLTAGE

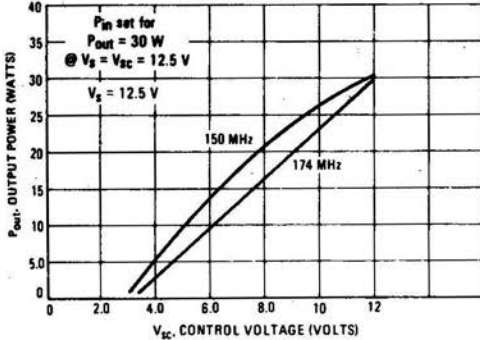
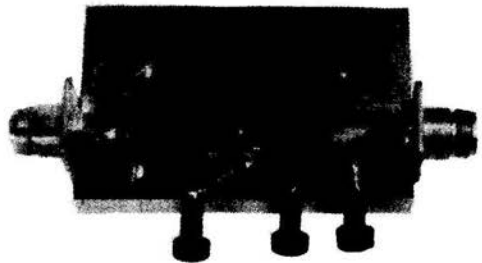


FIGURE 8 – TEST CIRCUIT ASSEMBLY



## APPLICATIONS INFORMATION

### Nominal Operation

All electrical specifications are based on the following nominal conditions: ( $P_{in} = 300$  mW,  $V_s = 12.5$  V,  $V_{sc}$  adjusted for 30 W  $P_{out}$ ). These modules are designed to have excess gain margin with ruggedness, but operation outside the limits of published specifications is not recommended unless prior communications regarding intended use has been made with a factory representative.

### Gain Control

In general, the module output power should be limited to 35 watts. The preferred method of power output control is to fix both  $V_{sc}$  and  $V_s$  at 12.5 volts and to vary the input RF drive level at Pin 4. 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 a 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.

### Operation at $P_{out} \leq 1.0$ Watt

Marine VHF radio applications usually require the transmitter RF output power be reduced to less than one watt during in-harbor operation. This may be achieved with the MHW613 by removing the dc voltage from the module output stage, i.e.,  $V_s$  (Pin 2) = 0, and leaving Pin 2

open circuit. With  $V_s = 0$ ,  $V_{sc}$  (Pin 3) = 12.5 V and the RF power input = 300 mW, the module RF output power  $P_{out}$  is typically in the range  $0.3 \text{ W} \leq P_{out} \leq 1.0 \text{ W}$ .

The above technique of operating the module at low RF output power is preferred over methods utilizing low RF input power and/or low supply voltage which tends to have gain stability problems and potential generation of spurious outputs.

### Decoupling

Due to the high gain of each of the two stages and the module size limitation, external decoupling networks require careful consideration. Both Pins 2 and 3 are internally bypassed with a  $0.018 \mu\text{F}$  chip capacitor effective for frequencies of 5 MHz through 174 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 specific operating frequencies and phase angles of input and output VSWR less than 4:1.

### 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 to 15.5 volts output, VSWR 30:1 and output power equal to 40 watts.

FIGURE 7 - VHF POWER MODULE TEST FIXTURE PRINTED CIRCUIT BOARD

