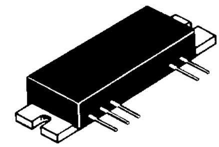
MOTOROLA
SEMICONDUCTOR
TECHNICAL DATA

MHW820-1
MHW820-2
MHW820-3

The RF Line

18/20 W — 806–950 MHz

RF POWER AMPLIFIERS



UHF POWER AMPLIFIERS

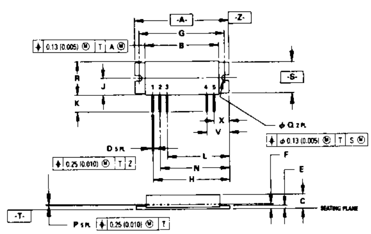
. . . designed for 12.5 volt UHF power amplifier applications in industrial and commercial FM equipment operating from 806 to 950 MHz.

- MHW820-1 806–870 MHz
  MHW820-2 806–890 MHz
  MHW820-3 870–950 MHz
- Specified 12.5 Volt, UHF Characteristics
  Output Power = 20 Watts (MHW820-1,2)
  = 18 Watts (MHW820-3)
  Minimum Gain = 19 dB (MHW820-1,2)
  = 17.1 dB (MHW820-3)
  Harmonics = −58 dBc Max
- 50 Ω Input/Output Impedances
- Guaranteed Stability and Ruggedness
- Features Three Common-Emitter Gain Stages
- Thin-Film Hybrid Construction Gives Consistent Performance and Reliability
- Gold-Metallized and Silicon Nitride-Passivated Transistor Chips
- Controllable, Stable Performance Over More Than 30 dB Range in Output Power

5

MAXIMUM RATINGS (Flange Temperature = 25°C)

Rating	Symbol	Value	Unit
DC Supply Voltages	V_{s1}, V_{s2}, V_{s3}	16	Vdc
RF Input Power ($P_{out} \leq$ 25 W)	P_{in}	400	mW
RF Output Power ($P_{in} \leq$400 mW)	P_{out}	25	W
Storage Temperature Range	T_{stg}	-30 to +100	°C
Operating Case Temperature Range	T_C	-40 to +100	°C



STYLE 1:
PIN 1. RF INPUT
2. +DC
3. +DC
4. +DC
5. RF OUTPUT

NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION F TO CENTER OF LEADS.

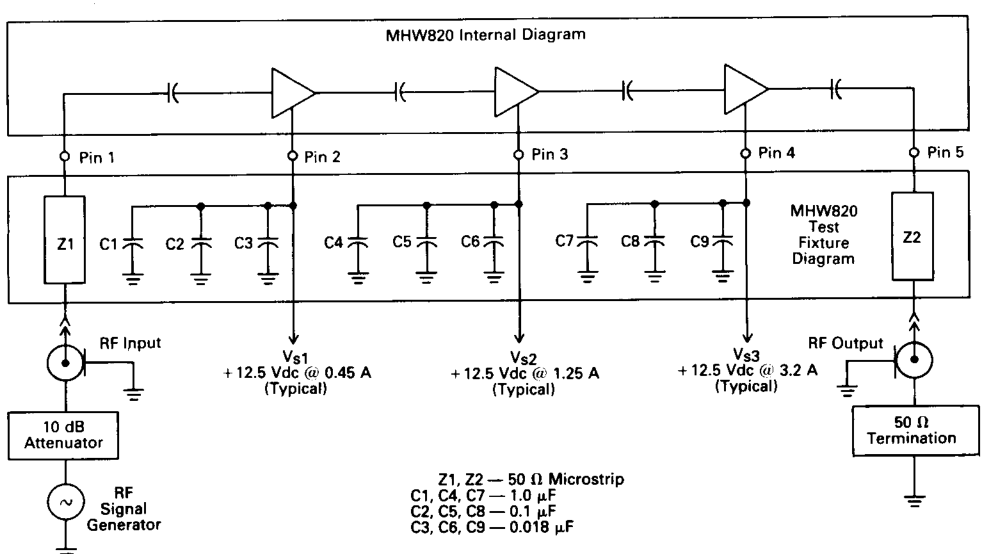
	MILLIMETERS		INCHES	
DIM	MIN	MAX	MIN	MAX
A	55.63	56.13	2.190	2.210
B	35.44	35.94	1.395	1.415
C	8.89	9.55	0.350	0.376
D	0.46	0.55	0.018	0.022
E	3.05	3.42	0.120	0.135
F	4.06 BSC		0.160 BSC	
G	48.26 BSC		1.900 BSC	
H	40.64 BSC		1.600 BSC	
J	8.77	9.77	0.345	0.385
K	5.72	—	0.225	—
L	35.56 BSC		1.400 BSC	
N	38.10 BSC		1.500 BSC	
P	0.21	0.30	0.008	0.012
Q	3.81	4.06	0.150	0.160
R	17.53	19.55	0.690	0.770
S	15.12	15.49	0.595	0.610
V	17.78 BSC		0.700 BSC	
X	12.70 BSC		0.500 BSC	

CASE 301G-03

ELECTRICAL CHARACTERISTICS (Flange Temperature = 25°C, 50 Ω system, and $V_{S1} = V_{S2} = 12.5$ V unless otherwise noted)

Characteristic		Symbol	Min	Typ	Max	Unit
Frequency Range	MHW820-1 MHW820-2 MHW820-3	BW	806 806 870	— — —	870 890 950	MHz
Input Power (P_{out} = 20 W) (P_{out} = 18 W)	MHW820-1, 2 MHW820-3	P_{in}	— —	200 300	250 350	mW
Power Gain (P_{out} = 20 W) (P_{out} = 18 W)	MHW820-1, 2 MHW820-3	G_p	19 17.1	20 17.8	— —	dB
Efficiency (P_{out} = 20 W) (P_{out} = 18 W)	MHW820-1, 2 MHW820-3	η	28 26	32 30	—	%
Harmonic Output (P_{out} Reference = Rated P_{out})		—	—	—	−58	dBc
Input VSWR (P_{out} = Rated P_{out}, 50 Ω Reference)		—	—	—	2:1	—
Power Degradation (−30 to +80°C) (Reference P_{out} = Rated P_{out} @ T_C = 25°C)		—	—	1.2	1.7	dB
Load Mismatch Stress ($V_{S1} = V_{S2} = V_{S3}$ = 16 Vdc, P_{out} = 25 W, VSWR = 30:1, all phase angles)		—	No degradation in Power Output			
Stability (P_{in} = 0 to 250 mW, [MHW820-1, 2] or 350 mW [MHW820-3] consistent with max, P_{out} = 25 W, V_{S1} = V_{S2} = V_{S3} = 10 to 16 Vdc, Load VSWR = 4:1)		All non-harmonic related spurious outputs ≥ 70 dB below the desired output signal level				
Quiescent Current (I_{S1} with no RF drive applied)		$I_{S1(q)}$	—	—	125	mA

FIGURE 1 — 806-950 MHz TEST SYSTEM DIAGRAM



5

TYPICAL PERFORMANCE CURVES
(MHW820-1, 2)

FIGURE 2 — INPUT POWER, EFFICIENCY AND VSWR versus FREQUENCY

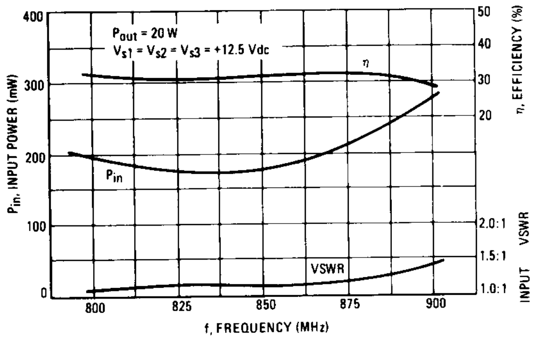


FIGURE 3 — OUTPUT POWER versus INPUT POWER

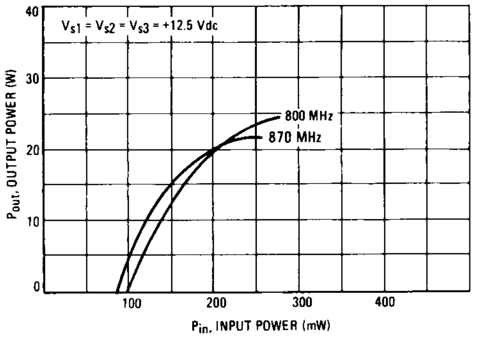


FIGURE 4 — OUTPUT POWER versus SUPPLY VOLTAGE

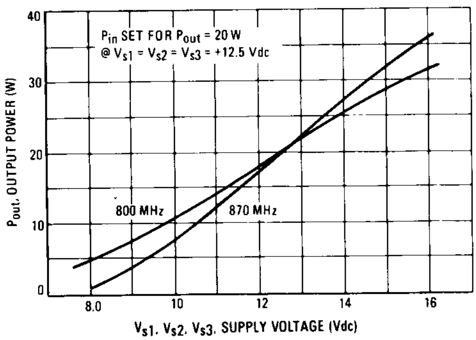


FIGURE 5 — EFFICIENCY versus SUPPLY VOLTAGE

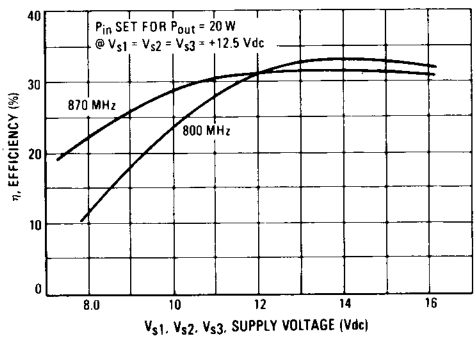


FIGURE 6 — OUTPUT POWER versus SUPPLY VOLTAGE TO FIRST STAGE (V_{s1})

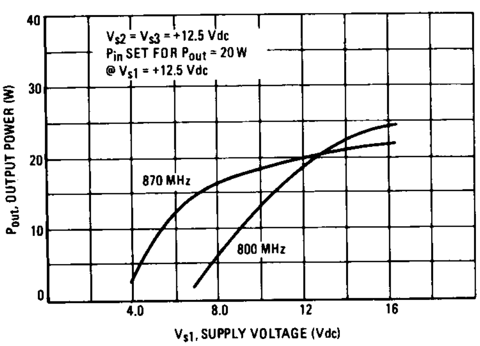
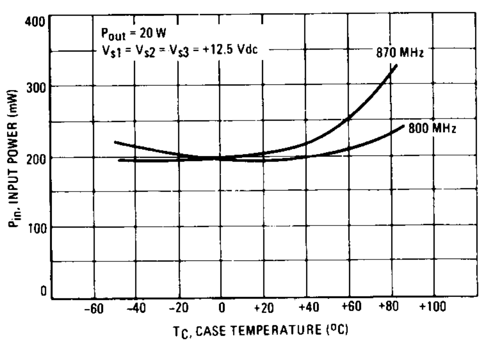


FIGURE 7 — INPUT POWER versus CASE TEMPERATURE



TYPICAL PERFORMANCE CURVES (MHW820-3)

FIGURE 8 — INPUT POWER, EFFICIENCY AND VSWR versus FREQUENCY

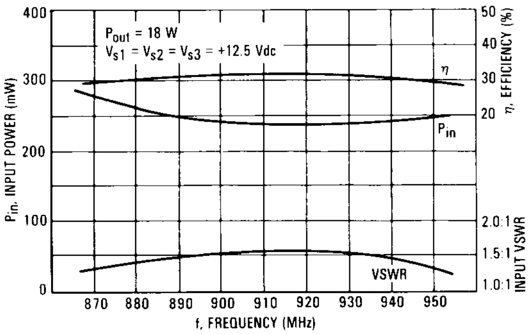


FIGURE 9 — OUTPUT POWER versus INPUT POWER

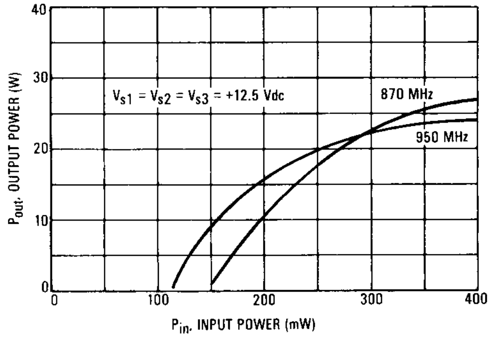


FIGURE 10 — OUTPUT POWER versus SUPPLY VOLTAGE

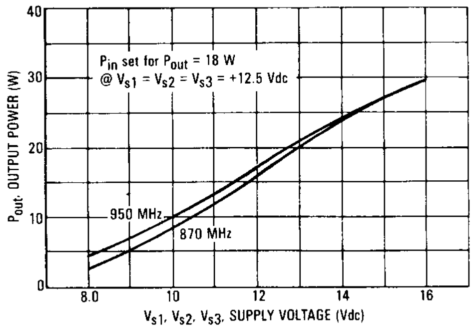
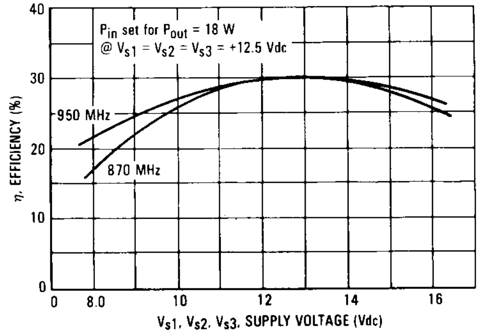


FIGURE 11 — EFFICIENCY versus SUPPLY VOLTAGE



5

APPLICATIONS INFORMATION

Nominal Operation

All electrical specifications are based on the following nominal conditions: (P_{out} = Rated, $V_{s1} = V_{s2} = V_{s3} = 12.5$ Vdc). This module is designed to have excess gain margin with ruggedness, but operation outside the limits of the published specifications is not recommended unless prior communications regarding the intended use has been made with a factory representative.

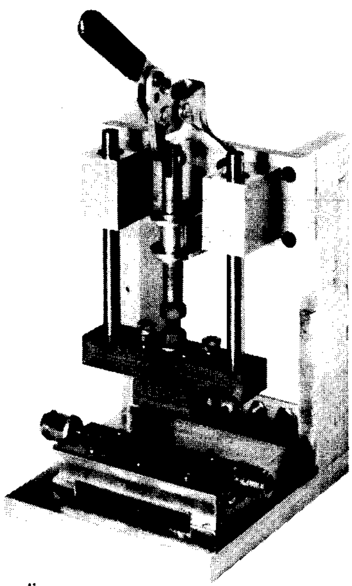
Gain Control

This module is designed for wide range P_{out} level control. The recommended method of power output control, as shown in Figure 3 and 9, is to fix V_{s1}, V_{s2}, and V_{s3} at 12.5 Vdc and vary the input RF drive level at Pin 1.

A second method of output control is to adjust the supply voltage (V_{s1} independently or V_{s1}, V_{s2}, and V_{s3} simultaneously). However, if any of these voltages fall out of the range from 10 to 16 volts module stability cannot be guaranteed. Typical ranges of power output control using this method are shown in Figures 4, 6, and 10.

In all applications, the module output power should be limited to 25 watts.

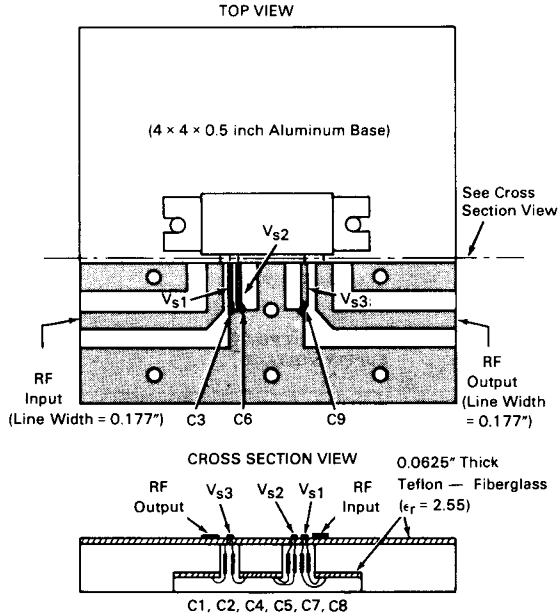
FIGURE 12 — TEST FIXTURE ASSEMBLY



Decoupling

Due to the high gain of each of the two stages and the module size limitation, external decoupling networks require careful consideration. Pins 2, 3 and 4 are internally bypassed with 0.018 μF chip capacitors which are effective for frequencies from 5 MHz through 950 MHz. For bypassing frequencies below 5 MHz, networks equivalent to that shown in the test fixture schematic are recommended. Inadequate decoupling will result in spurious outputs at specific operating frequencies and phase angles of input and output VSWR.

FIGURE 13 — TEST FIXTURE CONSTRUCTION



Bring capacitor leads through fiberglass board and solder to V_{s1}, V_{s2}, and V_{s3} lines as close to module as possible.
To insure optimum heat transfer from 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.

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_{s1}, V_{s2} and V_{s3} equal to 16 volts output, VSWR 30:1 and output power equal to 25 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 0.002 inch to prevent fracturing of ceramic substrate material. For more information on module mounting, see EB-107.