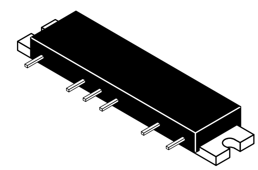
The RF Line
UHF Power Amplifiers

MHW914
MHW915

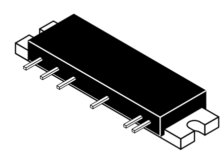
**14 W
890 to 915 MHz
RF POWER
AMPLIFIERS**

. . . designed specifically for the Pan European digital 8.0 watt, GSM mobile radio. The MHW914 and MHW915 are capable of wide power range control, operate from a 12.5 volt supply and require only 1 mW (MHW914) or 100 mW (MHW915) of RF input power.

- Specified 12.5 Volt Characteristics:
  RF Input Power — 1.0 mW (0 dBm) MHW914 or 100 mW (20 dBm) MHW915
  RF Output Power — 14 W
  Minimum Gain — 41.5 dB (MHW914) or 21.5 dB (MHW915)
  Harmonics — –30 dBc Max @ 2.0 f_o
- New Biasing and Control Techniques Providing Dynamic Range and Control Circuit Bandwidth Ideal for GSM
- Low Control Current
- 50 Ohm Input/Output Impedances
- Guaranteed Stability and Ruggedness
- Circuit board photomaster available upon request by contacting RF Tactical Marketing in Phoenix, AZ.



**CASE 301R–01, STYLE 1
(MHW914)**



**CASE 301T–02, STYLE 1
(MHW915)**

MAXIMUM RATINGS (Flange Temperature = 25°C)

Rating	Symbol	MHW914	MHW915	Unit
DC Supply Voltage	V_{s1}	8.5	15.6	Vdc
DC Supply Voltage	V_b	8.5	5.25	Vdc
DC Supply Voltage	$V_{s2,3}$	15.6	15.6	Vdc
DC Control Voltage	V_{cont}	4.0	—	Vdc
RF Input Power	P_{in}	3.0	400	mW
RF Output Power	P_{out}	15		W
Operating Case Temperature Range Storage Temperature Range	T_C T_{stg}	–30 to +100		°C

ELECTRICAL CHARACTERISTICS MHW914 — V_{s2} = V_{s3} = 12.5 Vdc; V_{s1} = V_b = 8.0 Vdc; MHW915 — V_{s1} = V_{s2} = V_{s3} = 12.5 Vdc; V_b = 5.0 Vdc (T_C = 25°C, 50 ohm system, unless otherwise noted)

Characteristic		Symbol	Min	Max	Unit
Frequency Range		BW	890	915	MHz
Power Gain (P_{out} = 14 W)	MHW914 (1) MHW915 (2)	G_P	41.5 21.5	— —	dB
Control Current (P_{out} = 14 W; P_{in} = 1.0 mW)	MHW914 only (1)	I_{cont}	—	1.0	mA
Supply Current (P_{out} = 14 W; P_{in} = 1.0 mW)	MHW914 only (1)	$I_{s1} + I_b$	—	220	mA
Leakage Current (P_{in} = 0 mW; $V_{cont.}$ = V_{s1} = V_b = 0 Vdc; V_{s2} = V_{s3} = 15.6 V for MHW914 • V_{s1} = V_{s2} = V_{s3} = 15.6 V; V_b = 0 Vdc; P_{in} = 0 mW for MHW915		I_L	—	1.0	mA
Efficiency (P_{out} = 14 W, P_{in} = 1.0 mW) MHW914 (1) (P_{out} = 14 W) MHW915 (2)		η	35 35	— —	%
Input VSWR (P_{out} = 14 W, P_{in} = 1.0 mW) MHW914 (1) (P_{out} = 14 W) MHW915 (2)		$VSWR_{in}$	— —	2.0:1 2.0:1	—
Harmonics (P_{out} = 14 W, P_{in} = 1.0 mW) MHW914 (1) (P_{out} = 14 W) MHW915 (2)	2.0 f_o 3.0 f_o to 5.0 f_o 2.0 f_o 3.0 f_o to 5.0 f_o	—	— — — —	–30 –40 –30 –35	dBc

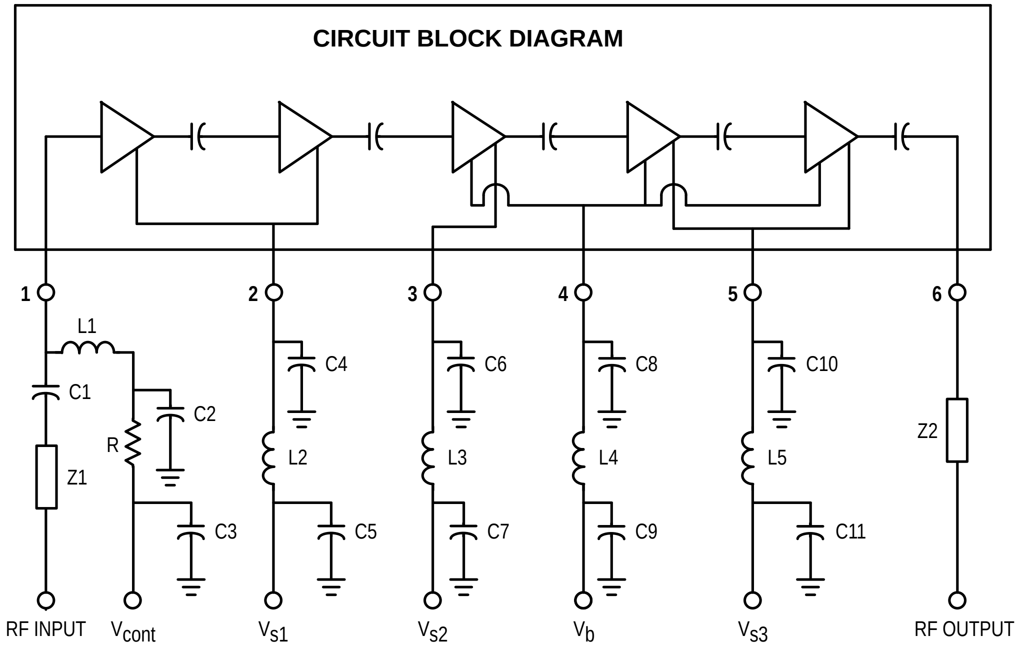
NOTES:
1. Adjust V_{cont} for specified P_{out}; duty cycle = 12.5%, period = 4.6 ms
2. Adjust P_{in} for specified P_{out}; duty cycle = 12.5%, period = 4.6 ms

REV 6

ELECTRICAL CHARACTERISTICS — continued MHW914 — V_{S2} = V_{S3} = 12.5 Vdc; V_{S1} = V_b = 8.0 Vdc;
MHW915 — V_{S1} = V_{S2} = V_{S3} = 12.5 Vdc; V_b = 5.0 Vdc (T_C = 25°C, 50 ohm system, unless otherwise noted)

Characteristic	Symbol	Min	Max	Unit
Noise Power (In 30 kHz Bandwidth, 20 MHz above f_o) (P_{out} = 0.03 to 14 W, V_{S2} = V_{S3} = 10.8 to 15.6 Vdc, P_{in} = 1.0 mW) MHW914 (1) (P_{out} = 0.03 to 14 W, V_{S1} = V_{S2} = V_{S3} = 10.8 to 15.6 Vdc) MHW915 (2)	—	 — —	 –70 –70	dBm
3.0 dB V_{cont} Bandwidth (P_{in} = 1.0 mW, P_{out} = 0.03 to 14 W) MHW914 only	—	1.0	—	MHz
Output Power Reduced Voltage (P_{in} = 1.0 mW; V_{S2} = V_{S3} = 10.8 Vdc) MHW914 (P_{in} = 100 mW; V_{S1} = V_{S2} = V_{S3} = 10.8 Vdc) MHW915	P_{OUT2}	10	—	W
Linearity — % AM in Output (P_{out} = 0.02 to 14 W; 135 kHz, 1% AM on Input) MHW915 only (2)	—	—	6.0	%
Load Mismatch Stress (V_{S2} = V_{S3} = 15.6 Vdc, P_{in} = 3.0 mW, P_{out} = 15 W) MHW914 (1) (V_{S1} = V_{S2} = V_{S3} = 15.6 Vdc, P_{out} = 15 W) MHW915 (2) (Load VSWR = 10:1, All Phase Angles at Frequency of Test)	ψ	No degradation in output power before and after test		
Stability (V_{S2} = V_{S3} = 10.8 to 15.6 Vdc; P_{in} = 0.5 to 3.0 mW; P_{out} = 0 mW to 14 W) MHW914 (1) (V_{S1} = V_{S2} = V_{S3} = 10.8 to 15.6 Vdc, P_{out} = 0.03 to 14 W) MHW915 (2) (Load VSWR = 6:1, Source VSWR = 3:1, All Phase Angles at Frequency of Test)	—	All spurious outputs more than 60 dB below desired signal		

NOTES:
1. Adjust V_{cont} for specified P_{out}; duty cycle = 12.5%, period = 4.6 ms
2. Adjust P_{in} for specified P_{out}; duty cycle = 12.5%, period = 4.6 ms



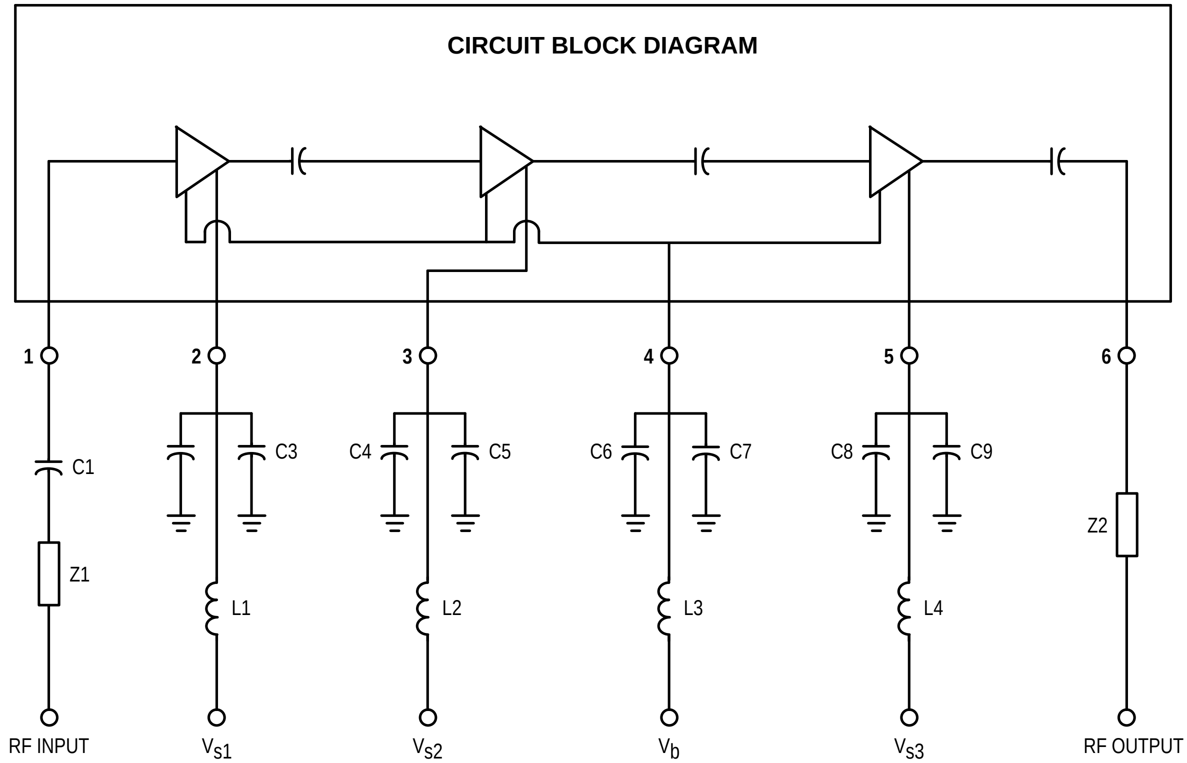
PIN DESIGNATIONS:

Pin 1 — RF Input Power @ 0 dBm and Control Voltage @ 0–3.0 Vdc
Pin 2 — First and Second Stage Collector Supply Voltage @ 8.0 Vdc
Pin 3 — Third Stage Collector Voltage @ 12.5 Vdc
Pin 4 — Trickle Bias Voltage @ 8.0 Vdc
Pin 5 — Fourth and Fifth Stage Collector Supply Voltage @ 12.5 Vdc
Pin 6 — RF Output Power @ 14 W

ELEMENT VALUES:

C1=C4=C6=C8=C10 = 0.018 µF
C2=0.1 µF
C3=C5=C7=C9=C11 = 1.0 µF
L1–L4 = 0.29 µH
L5 = 0.2 µH
R = 20 Ohms
Z1, Z2 = 50 Ohm Microstrip

Figure 1. Test Circuit Diagram — MHW914



PIN DESIGNATIONS:

Pin 1 — RF Input Power @ 20 dBm Max Adjust for Output Power
Pin 2 — First Stage Collector Voltage @ 12.5 Vdc
Pin 3 — Second Stage Collector Voltage @ 12.5 Vdc
Pin 4 — Trickle Bias Voltage @ 5.0 Vdc
Pin 5 — Third Stage Collector Supply @ 12.5 Vdc
Pin 6 — RF Output Power @ 14 W Nominal

ELEMENT VALUES:

C1=C2=C4=C6=C8 = 0.018 µF
C3=C5=C7=C9 = 2.2 µF
L1 – L3 = 0.29 µH
L4 = 0.2 µH
Z1, Z2 = 50 Ohm Microstrip

Figure 2. Test Circuit Diagram — MHW915

TYPICAL CHARACTERISTICS
(MHW914)

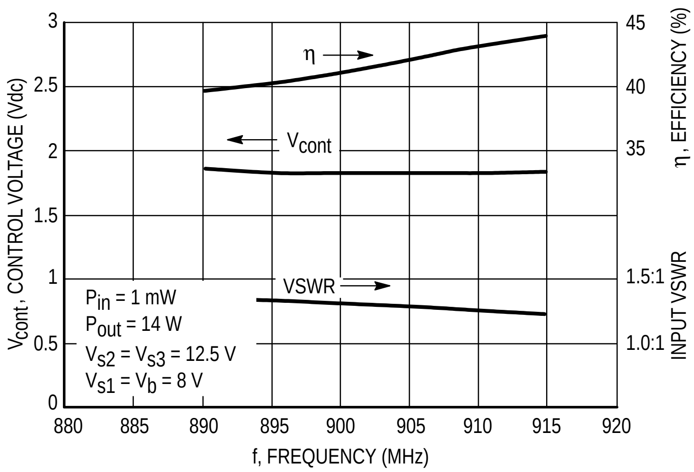


Figure 3. Control Voltage, Efficiency and Input VSWR versus Frequency

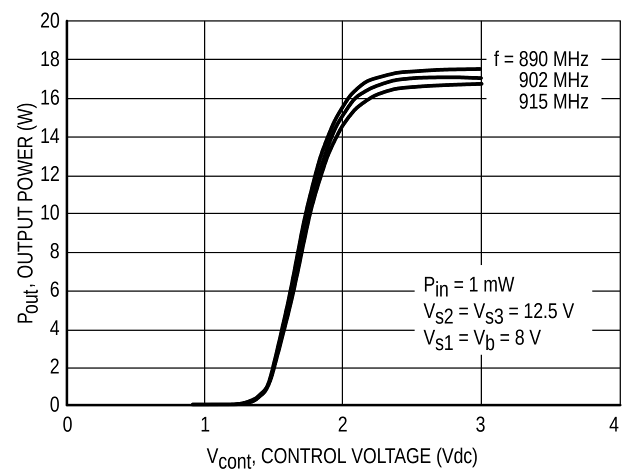


Figure 4. Output Power versus Control Voltage

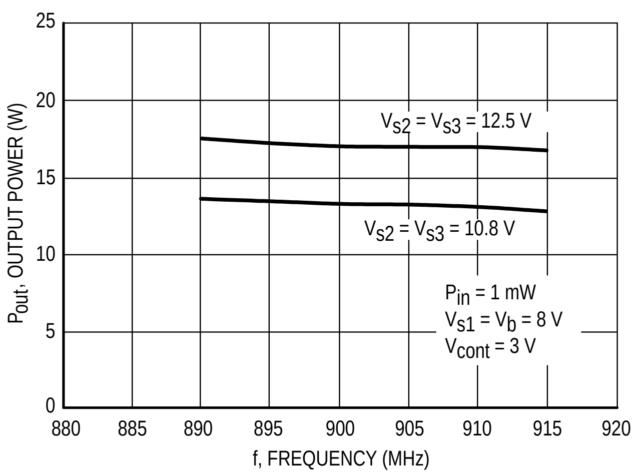


Figure 5. Output Power versus Frequency

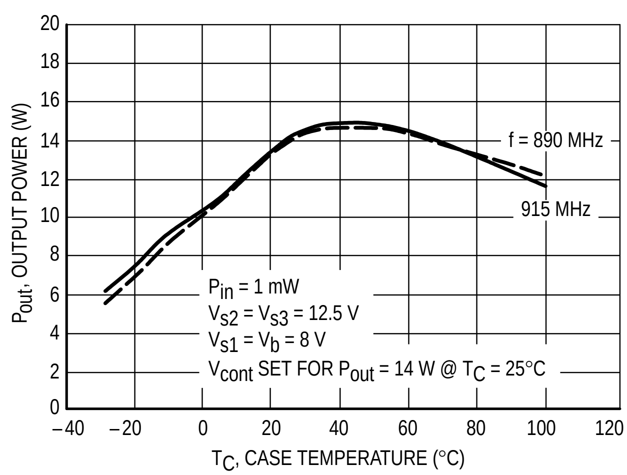


Figure 6. Output Power versus Case Temperature

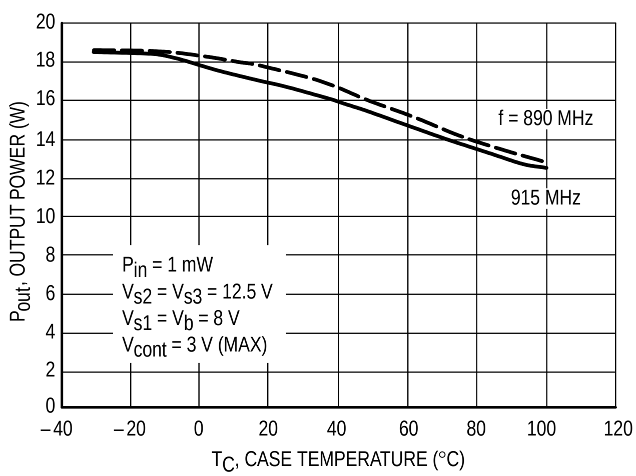


Figure 7. Output Power versus Case Temperature at Maximum Control Voltage

TYPICAL CHARACTERISTICS
(MHW915)

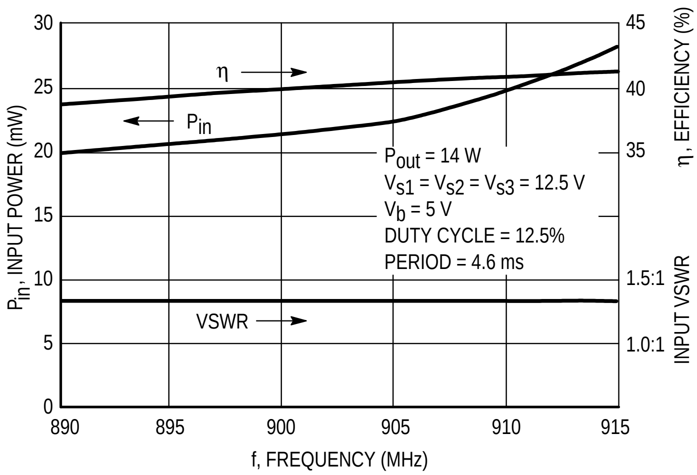


Figure 8. Input Power, Efficiency and Input VSWR versus Frequency

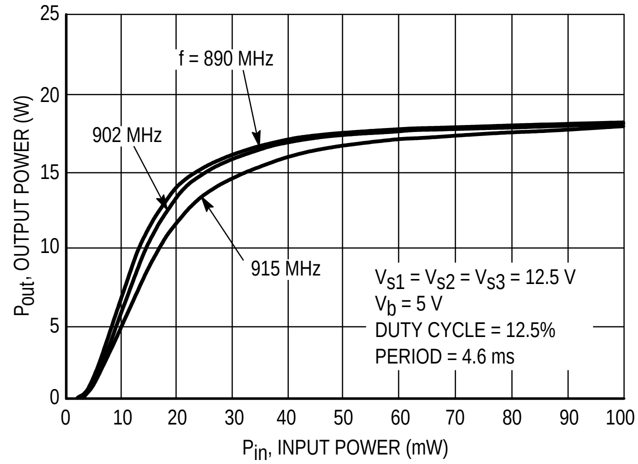


Figure 9. Output Power versus Input Power

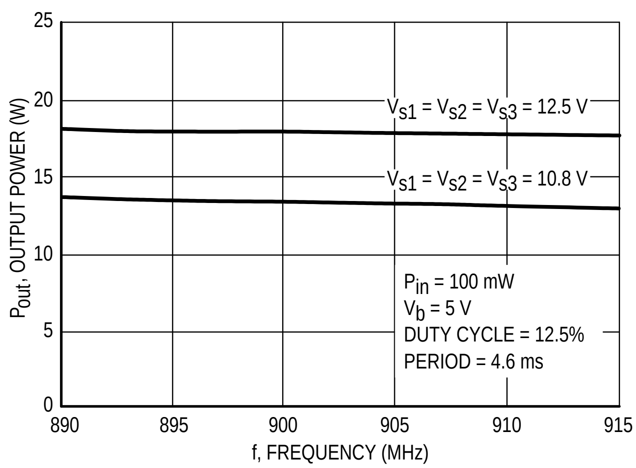


Figure 10. Output Power versus Frequency

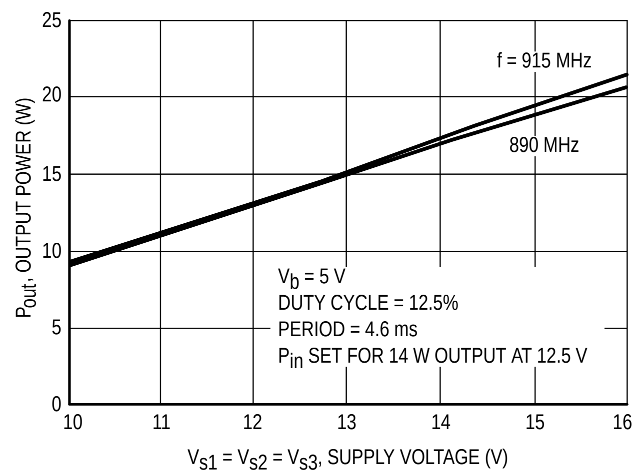


Figure 11. Output Power versus Supply Voltage

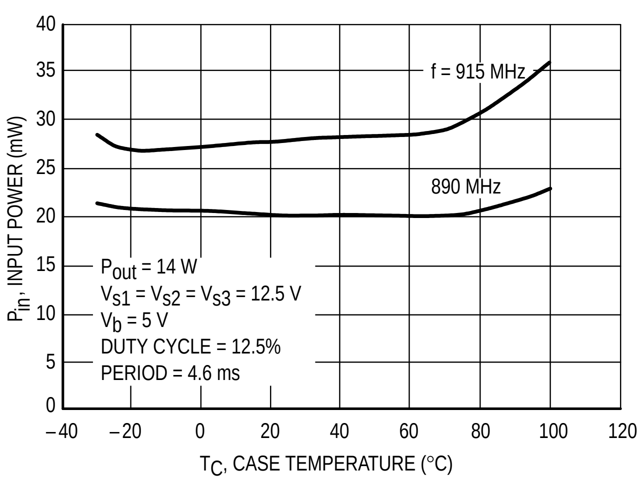


Figure 12. Input Power versus Case Temperature for P_{out} = 14 W

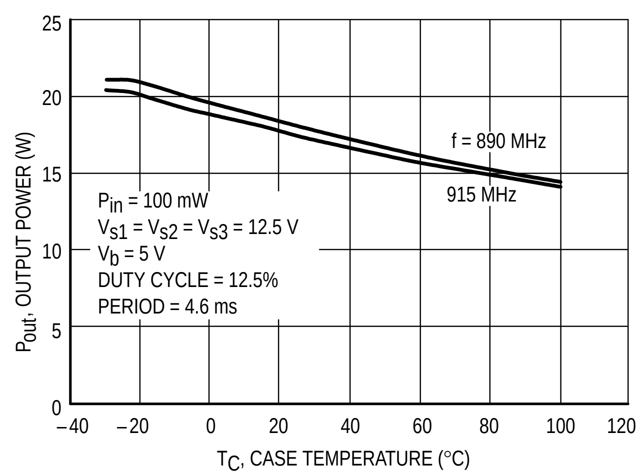


Figure 13. Output Power versus Case Temperature for Maximum Input Power

APPLICATIONS INFORMATION

NOMINAL OPERATION

For the MHW914, all electrical specifications are based on the nominal conditions of $V_b = V_{S1} = 8.0$ Vdc (Pins 2, 4), and $V_{S2} = V_{S3} = 12.5$ Vdc (Pins 3, 5). For the MHW915 the nominal conditions are $V_{S1} = V_{S2} = V_{S3} = 12.5$ Vdc (Pins 2, 3, 5) and $V_b = 5.0$ Vdc (Pin 4). With these conditions, maximum current density on any device is 1.5×10^5 A/cm^2 and maximum die temperature is 165°C. While the modules are designed to have excess gain margin with ruggedness, operation of these units outside the published specifications is not recommended unless prior communications regarding intended use have been made with the factory representative.

GAIN CONTROL

The module output power should be limited to specified value. The preferred method of power control for the MHW914 is to fix $V_b = V_{S1} = 8.0$ Vdc, $V_{S2} = V_{S3} = 12.5$ Vdc, P_{in} (Pin 1) at 1.0 mW, and vary V_{cont} (Pin 1) voltage. The preferred method for the MHW915 is to fix all voltages at nominal and vary P_{out} (Pin 6) by changing P_{in} (Pin 1) from 0 to 100 mW.

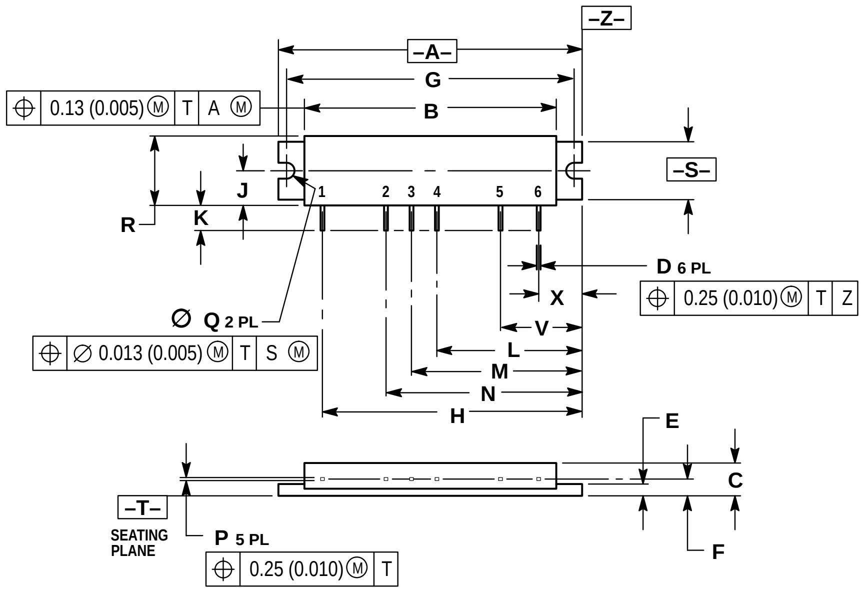
DECOUPLING

Due to the high gain of the five stages and the module size limitation, external decoupling networks require careful consideration, Pins 2, 3, 4 and 5 are internally bypassed with a 0.018 µF chip capacitor which is effective for frequencies from 5.0 MHz through 940 MHz. For bypassing frequencies below 5.0 MHz, networks equivalent to that shown in Figure 1 and Figure 2 are recommended. Inadequate decoupling will result in spurious outputs at certain operating frequencies and certain phase angles of input and output VSWR.

LOAD MISMATCH

During final test each module is load mismatch tested in a fixture having the identical decoupling networks described in Figures 1 and 2 for the MHW914 and MHW915 respectively. Electrical conditions are $V_b = V_{S1} = 8.0$ V (Pins 2, 4) and $V_{S2} = V_{S3} = 15.6$ Vdc (Pins 3, 5) for the MHW914 and $V_{S1} = V_{S2} = V_{S3} = 15.6$ Vdc (Pins 2, 3, 5) and $V_b = 5.0$ Vdc (Pin 4) for the MHW915. $P_{out} = 15$ W, $P_{in} = 3.0$ mW, load VSWR equals 10:1 at all phase angles for both modules.

PACKAGE DIMENSIONS

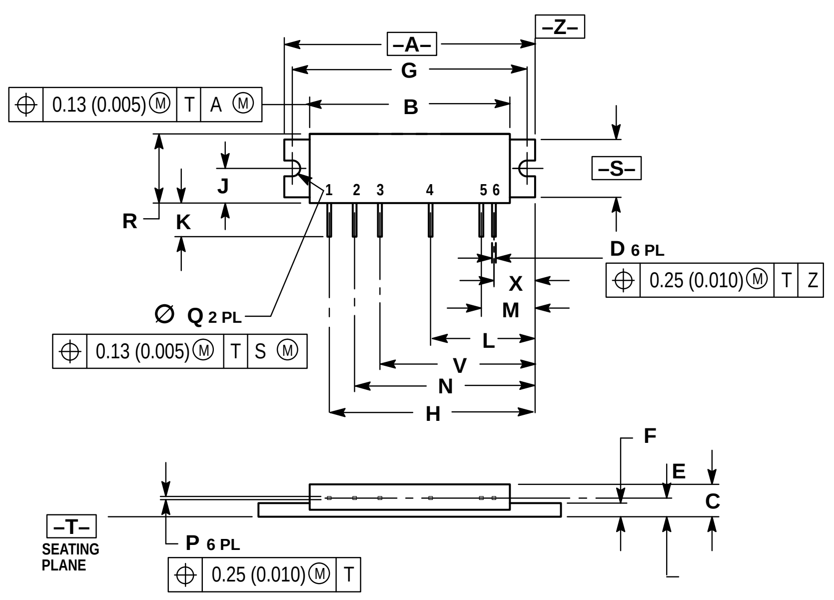


NOTES:
1. DIMENSIONING AND TOLERANCING PER ANSI Y14.5M, 1982.
2. CONTROLLING DIMENSION: INCH.
3. DIMENSION F TO CENTER OF LEADS.

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	2.380	2.395	60.46	60.83
B	1.970	1.990	50.04	50.54
C	0.250	0.265	6.35	6.73
D	0.018	0.022	0.46	0.55
E	0.085	0.100	2.16	2.54
F	0.132 BSC		3.35 BSC	
G	2.260 BSC		57.40 BSC	
H	2.042 BSC		51.87 BSC	
J	0.267	0.278	6.78	7.06
K	0.177	0.217	4.49	5.51
L	1.142 BSC		29.01 BSC	
M	1.342 BSC		34.09 BSC	
N	1.542 BSC		39.17 BSC	
P	0.008	0.012	0.21	0.30
Q	0.120	0.130	3.05	3.30
R	0.535	0.555	13.59	14.09
S	0.445	0.465	11.31	11.81
V	0.642 BSC		16.31 BSC	
X	0.342 BSC		8.69 BSC	

STYLE 1:
PIN 1. RF INPUT/VCONT
2. VS1
3. VS2
4. Vb
5. VS3
6. RF OUTPUT

CASE 301R–01
ISSUE O
MHW914



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

	INCHES		MILLIMETERS	
DIM	MIN	MAX	MIN	MAX
A	1.970	1.990	50.04	50.55
B	1.570	1.590	39.88	4.039
C	0.245	0.265	6.23	6.73
D	0.018	0.022	0.46	0.56
E	0.100	0.115	2.54	2.92
F	0.147 BSC		3.73 BSC	
G	1.860 BSC		47.24 BSC	
H	1.626 BSC		41.28 BSC	
J	0.267	0.278	6.78	7.06
K	0.177	0.217	4.50	5.51
L	0.825 BSC		20.96 BSC	
M	0.425 BSC		10.80 BSC	
N	1.425 BSC		36.20 BSC	
P	0.008	0.012	0.20	0.30
Q	0.120	0.130	3.05	3.30
R	0.535	0.555	13.59	14.10
S	0.445	0.465	11.30	11.81
V	1.225 BSC		31.12 BSC	
X	0.325 BSC		8.26 BSC	

STYLE 1:
PIN 1. RF INPUT
2. DC TERMINAL, Vs1
3. DC TERMINAL, Vs2
4. DC TERMINAL, Vb
5. DC TERMINAL, Vs3
6. RF OUTPUT

CASE 301T–02
ISSUE B
MHW915

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