

MGA-83-A Evaluation Circuit Board

Application Note

**Applies to MGA-83563
RFIC Medium Power
Amplifier**

Description

The MGA-83-A is a printed circuit board that allows you to test and evaluate the performance of the MGA-83563 GaAs RFIC amplifier for your specific application.

The MGA-83563 MMIC amplifier is a two-stage, medium power device designed for use as a driver or output stage within the 500 MHz to 6 GHz frequency range. The MGA-83563 operates with a +3-volt power supply and delivers a saturated output power of +22 dBm (158 mW). For detailed design information covering the use of the MGA-83563, refer to the Application Note included as part of the MGA-83563 data sheet. (Request HP publication 5966-1730E, *+22 dBm P_{sat} 3V Power Amplifier for 0.5-6 GHz Applications*.)

The MGA-83-A PCB has provision for impedance matching to cover a wide range of frequencies. Design solutions for 900 MHz, 1.9 GHz, and 2.5 GHz have been verified using the MGA-83-A circuit board. The MGA-83-A circuit board is normally fabricated on 0.031-inch thick FR-4 ($\epsilon_r = 4.65$) dielectric material. (Some earlier boards may be received with GETEK[®]1 G200D, $\epsilon_r = 4.2$, laminate.

1 General Electric Co.

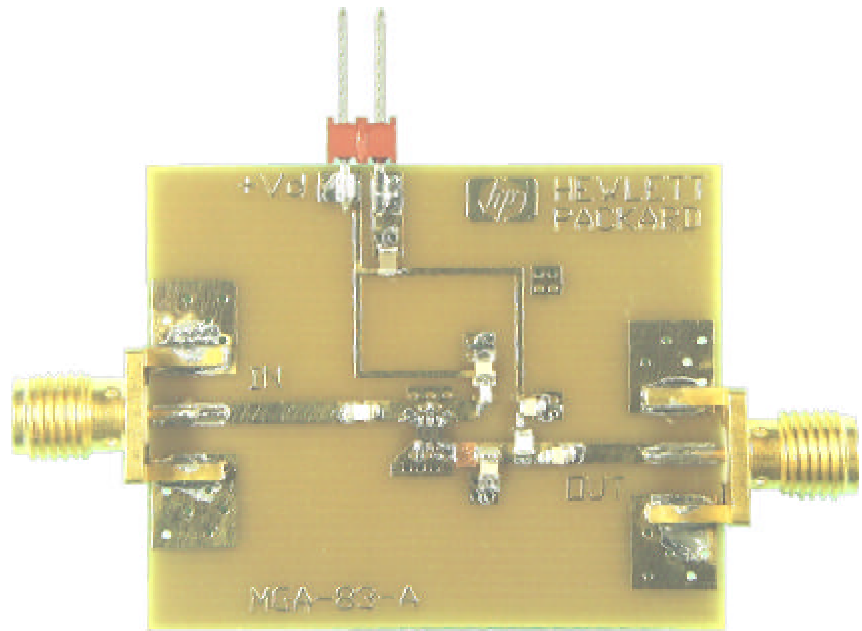


Figure 1. Photograph of MGA-83-A Evaluation Circuit.

Although the MGA-83563 RFIC amplifier operates to 6 GHz, this circuit board is generally not recommended for use beyond approximately 4 GHz. For higher frequency applications, such as the 5.8 GHz license-free band, a dielectric material such as PTFE/glass is recommended to achieve peak performance.

General Assembly Information

The amplifier and related components are assembled onto

the printed circuit board as shown in the photograph in Figure 1 and in the assembly drawing in Figure 2. The MGA-83-A circuit board is designed to use edge-mounting SMA connectors such as Johnson Components, Inc., Model 142-0701-881. These connectors are designed to slip over the edge of 0.031-inch thick circuit boards and obviate the need to mount PCBs on a metal base plate for testing. The center conductors of the connectors are soldered to the input and output microstrip lines.

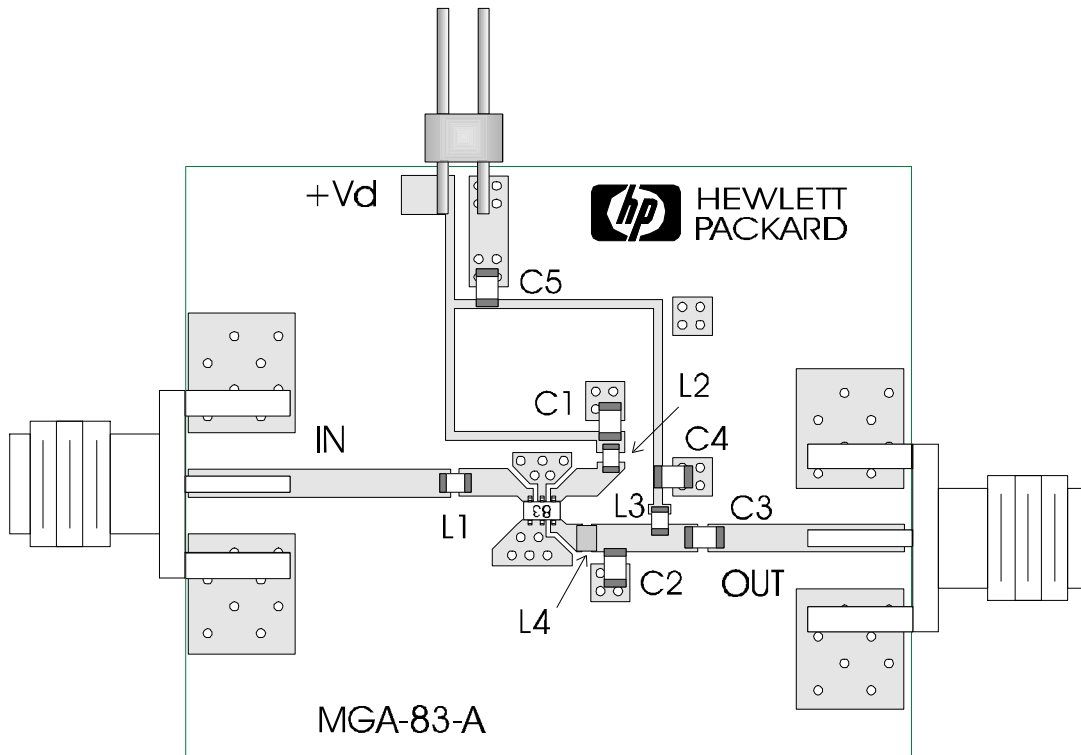


Figure 2. Assembled Evaluation Circuit.

The ground pins are soldered to the ground plane on the backside of the board and to the ground pads on the topside.

The + V_d and its adjacent ground pad is designed to fit a 2-pin, 0.100" centerline single row header of the type popularly used in computing equipment (Molex, Inc. P/N 22-10-

2021 or equivalent). This type of PCB-to-wire connector provides a convenient means of making connection to the power supply with either a mating connector or clip leads.

Low-cost chip inductors and capacitors of only average quality may be used since the input and output of the MGA-83563 is already

partially matched internal to the device.

A schematic diagram of the circuit is shown in Figure 3 with component values for 900 MHz, 1.9 GHz, and 2.5 GHz listed in Table 1. A ground pad is provided near the V_d connection to attach capacitor C5 for additional bypassing of the bias line.

(nH, pF)	Frequency		
	900 MHz	1.9 GHz	2.5 GHz
L1	5.6	2.2	2.7
L2	12	2.7	1.5
L3	82	33	22
L4	Not used (short circuit)		
C2	3.6	1.2	0.9
C1, C3, C4	150	82	62
C5	1000		

Table 1. Component Values for MGA-83-A Circuit Board.

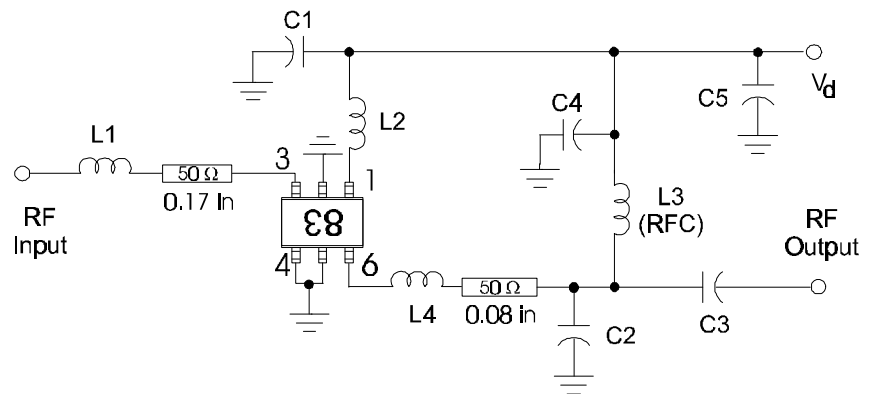


Figure 3. Schematic Diagram of MGA-83563 Amplifier Circuit.

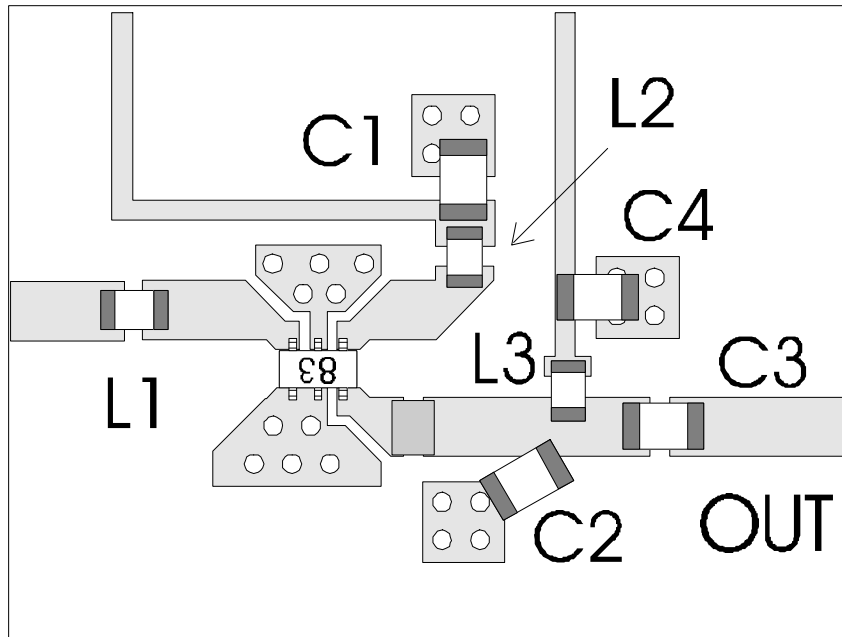


Figure 4. Location of C2 for 900 MHz.

Notes Specific to 900 MHz

Referring to Figure 4, the best performance at 900 MHz was obtained with the position of the output matching capacitor C2 located the furthest distance from the output of the MGA-83563 that the ground pad would allow. The shunt capacitor was placed diagonally from the edge of the ground pad to the output line as indicated in Figure 4

Notes Specific to 5.8 GHz

Although the MGA-83-A evaluation circuit is best suited for frequencies lower than 4 GHz, the board can be used for preliminary evaluation of 5.8 GHz applications. For frequencies greater than 4 GHz, inductor L2 is not used. Instead, package Pin 1 is bypassed directly to ground with C1 as shown in Figure 5 .

Operation

The MGA-83563 amplifier is a voltage-biased device. To operate, it is only necessary to apply 3 volts

to the + V_d connection. Typical current drain is 142 mA when operated in the saturated mode. Some final tuning of the circuit may be needed depending on the particular components used in the assembly. The output power should

be optimized first, followed by the input match.

The output matching circuit is adjusted by applying +4 dBm to the input of the amplifier and varying the value of the shunt

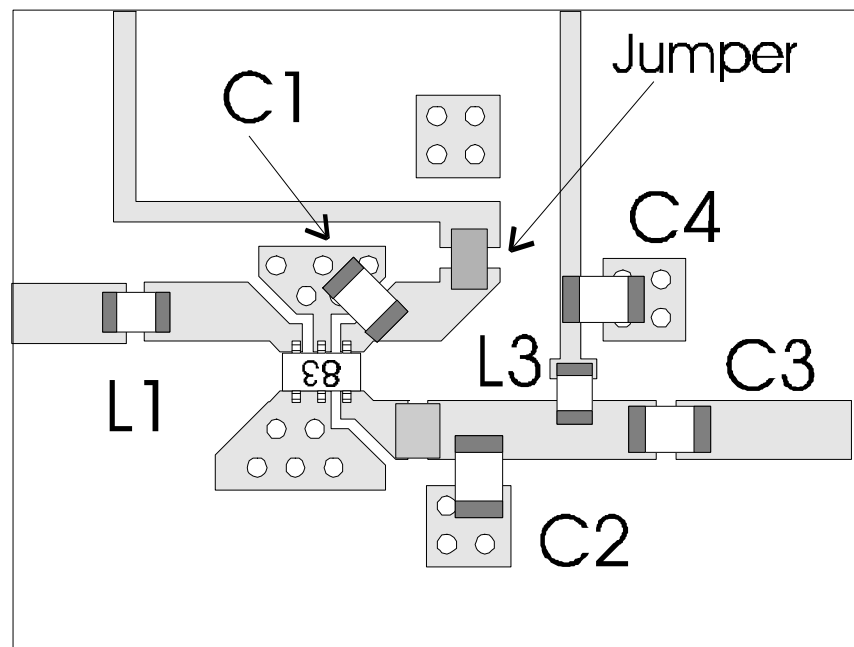


Figure 5. Location of bypass capacitor C1 for 5.8 GHz.

capacitor (C2) and the distance the capacitor is located along the output line from the MGA-83563. The output power of the amplifier is monitored with a power meter. An ammeter is used to observe device current (I_d) as an indication of amplifier efficiency. The optimum output match occurs at the point of maximum P_{Sat} and minimum I_d . The frequency range for the interstage inductor L2 is fairly broad and L2 will not normally need to be adjusted.

A Final Note on Performance

Actual performance of RFICs mounted on the MGA-83-A demonstration board may not exactly match the data sheet for the MGA-83563. The board material, passive components, and connectors all introduce losses and parasitics that may degrade device performance, especially at higher frequencies. Some variation in measured results is also to be expected as a result of the normal manufacturing distribution of products.

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