PGA Amplifier Version 2 (PGAV2)

A low noise, wideband, high dynamic range preamplifier

Introduction

Version 2 of the PGA Amplifier uses a slightly different PCB layout to the previous PGA Amplifier. It has similar performance to version 1, but this board was originally designed with provision for a filter at the output, to tailor the frequency response for those situations where the full bandwidth of the amplifier was not required. To accommodate the filter the version 2 PCB is marginally longer than the previous version, but at the same width.

For those wishing to achieve the full bandwidth, the output filter can be omitted and the track breaks bridged with either zero Ω resistors or 1nF capacitors. The PGA Amp V2 is supplied with suitable 0Ω bridges. Simple low pass filter designs for 75MHz and 150MHz and for 70MHz and 144MHz band pass are shown below.

As in the previous version of the PGA Amplifier the usual supply voltage is 5V. A leaded dropper resistor is provided rather than the surface mount resistor used in version 1. This is able to dissipate more power where it is wished to use supply voltages in excess of 5v.

Provision is also made to supply the PGA Amp over the coaxial output, via L2 Decoupled by C6

PGA Amp V2 construction

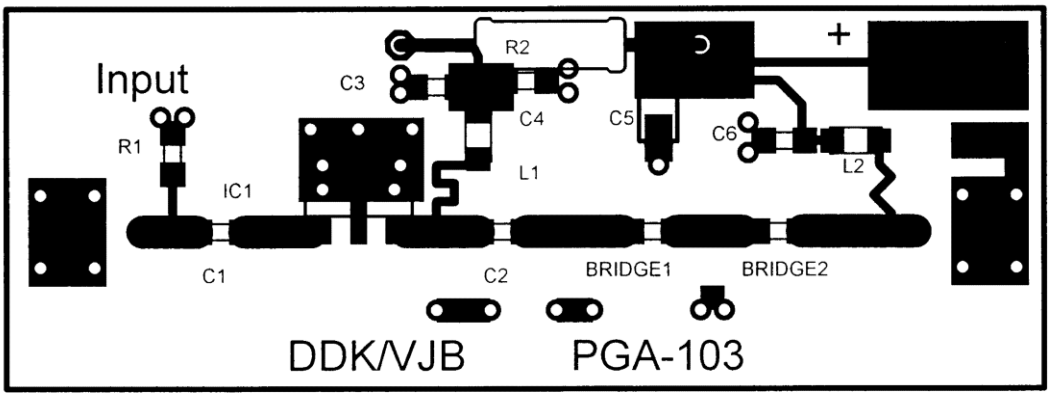

Fig 1 Layout of the PGA Amp V2

This is quite straightforward and consists of a number of surface mount (SMD) 0603 size capacitors and inductors. IC1 is the PGA103+ active device. IC1 should be positioned very carefully such that the input and output pins do no accidentally connect to the ground connection. If the output touches then L1 will burn up and if the input touches IC1 will be instantly destroyed!

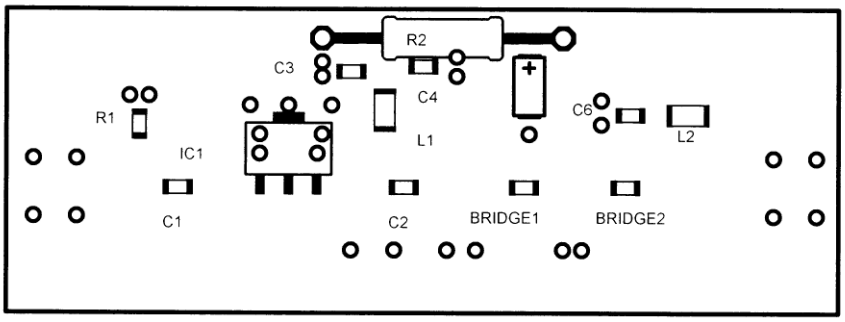

Figure 2 component layout

Table 1 shows the component values used in the PGA Amp V2

Component designation	**Value**	**Package**	**Marking**
R1	1MΩ	0603 SMD	green
R2	4.7Ω	1/4W carbon film leaded	Yellow/violet/gold
C1	1nF	0603 ceramic multi layer	blue
C2	1nF	0603 ceramic multi layer	blue
C3	1nF	0603 ceramic multi layer	blue
C4	100pF	0603 ceramic multi layer	yellow
C5	1µF	16 to 25V Tantalum, Case A	Black plastic
C6	1nF	0603 ceramic multi layer	blue
L1	220nH	0603 SMD Q>40	violet
L2	220nH	0603 SMD Q >40	violet
IC2	PGA103+	SOT89	x
Bridge 1	0Ω	0603 SMD	Black/black
Bridge 2	0Ω	0603 SMD	Black/black

Table 1 Component table for the PGA Amp V2

R1 is used to dissipate any static voltages that might develop on the antenna. It should not be used where lowest noise operation is required.

C5 is a 1µF Tantalum capacitor. Care must be taken to connect it the correct way round. The marked end is the positive end and should go to the junction with R2.

R2 is a 1/4W, 4.7Ω carbon film resistor. It is a leaded component and its leads should be formed to pass through the two holes in the PCB. If the board is to be mounted close to the housing then the resistor can be mounted on the top of the PCB rather than on the ground-plane side. The purpose of the resistor is to drop the supply down to 5v at the Drain (output) connection of IC1. The amplifier draws approximately 100mA at 5V.

If you use a 12V then you need to drop (12-5) = 7V across R2, giving a value of:

$$R = \frac{7}{0.1}$$

$$= 70\Omega$$

The nearest preferred value of 68Ω would be used.

Since a 5V supply requires no volts drop, a 0Ω resistor could be used. However, by including a 4.7Ω resistor you can check the current drawn by measuring the voltage drop across R2. This should be:

$$V = 4.7 * 0.1$$

$$V = 0.47\ volts$$

Obviously the resulting 4.3V is a bit below the recommended 5V but well within the operating range of the PGA103+. If the full 5v is required then increase the supply voltage to compensate or replace the 4.7Ω with a 0Ω bridging resistor.

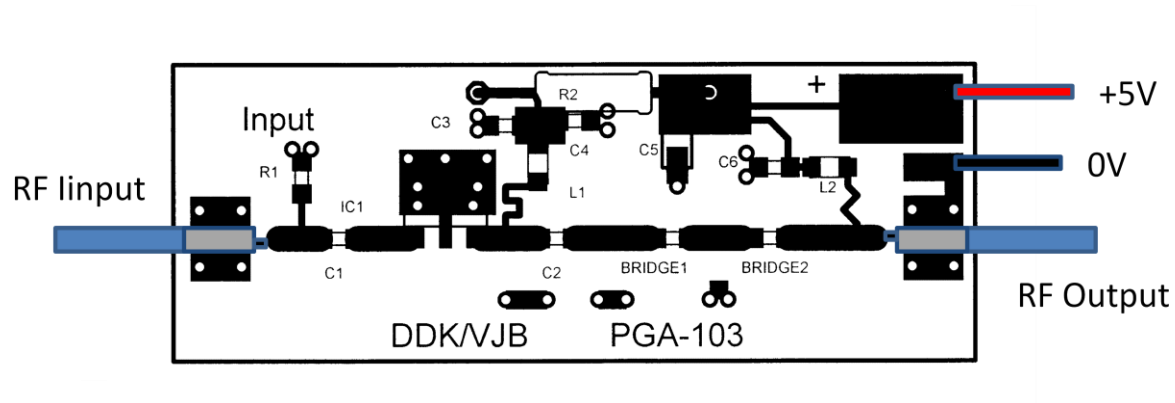

Fig 3 input and output RF and DC connections

The two 0Ω SMD bridging resistors are used purely to bridge the break in the output track.

In order to include a LPF at the output Bridge 1 is replaced by suitable inductor and an SMD capacitors are connected between the tracks and the adjacent ground connections as shown in figure 4.

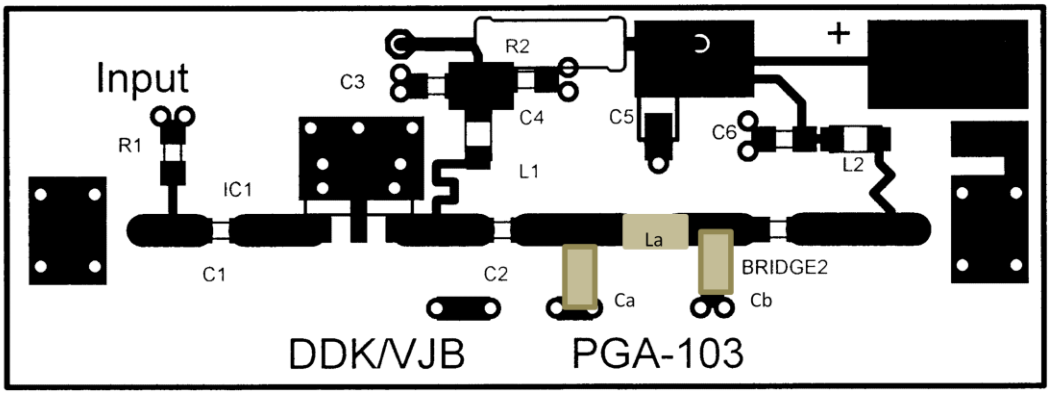

Fig 4 LPF component locations

Filter	
75MHz LPF	
La	100nH
Ca	82pF
Cb	82pF
150MHz LPF	
La	47nH
Ca	39pF
Cb	39pF
70MHz BPF	Loss <0.7dB
La	220nH / Q=50
Ca	12pF
Cb	12pF
C2	47pF
Bridge 2	47pF
144MHz BPF	Loss 2.3dB
La	180nH /Q=50
Ca	4.7pF
Cb	4.7pF
C2	8.2pF
Bridge 2	8.2pF

Table 2 Component values for various LP and BP filters. The 144MHz BPF is not optimised for loss

Document history

Version history	Date	Status
Draft 0.1	18/11/14	Initial document. Not reviewed
Draft 0.2	19/11/14	First revision

Kits

PGA Amp V2 (PGAV2) kits are available from the author. Each kit contains a PCB, PGA103+, all passive SMD parts for a broadband (no filter) amplifier together with the coax power feed components. Arlon as well as FR4 boards are available and unless specifically requested, either may be supplied at the authors discretion. Kits cost £13 each

Please ask about filter kits.