Objective: Build Magnetometer

Step 1: Start with an objective. I always believe you start at the top, so you keep a focus on what you are trying to do.

Step 2:Break the objective down to handlable tasks

First Break Down

1. Hardware
2. Software
3. implementation

Second Break Down

Start with the hardware part of the objective and break it down into components.

1. Filter module
2. Coils
3. Amplifier module
4. A/D Card
5. Cable and interconnection

1. Filter module

To build the filter module we first need to understand the schematic. The schematic acts like a set of instructions. It gives you a list of parts and instructions on how to connect them.

Skills you will need:
1. Ability to read a schematic (See Filter module schematic)
2. Ability to read the part pin-outs
3. Ability to use a multimeter
4. Understanding of components

What makes this schematic more difficult to read is that some of the parts are interconnected on modules. You will need to compare the schematics of the individual modules with the overall schematic.

After you study this, you will find that you are interconnecting 4 different parts.

1. Post amplifier module (Quantity of 2)
2. Filter Module (Quantity of 4)
3. 10k Resistor (optional) (Quantity of 2)
4. 9-volt Battery (Quantity of 2)

At this point you could simply build the filter module from the schematic. Even if a student can build the filter module from the schematic it doesn't mean that he understands the components. If you don't have any idea how the components function then debugging the module after it is together can be very difficult.

Let's take one final step of testing the electrical parts of the filter module before using them.

Let's look at the **Post Amplifier Module Schematic and Test Circuit, *Post Amplifier pin-out***.

Get the components shown in the schematic and place them on the module as shown on the pinout. Make sure you understand the physical difference between the post amplifier module and the filter module, and make sure the module is in the correct orientation when you place on the components, especially the terminal blocks.

Once you have placed all the parts on the module, take a copy of the ***Post Amplifier Module Schematic*** and ohm out some or all of the connection. Ohming out just a few of the connections verifies that you have the right module in the correct orientation.

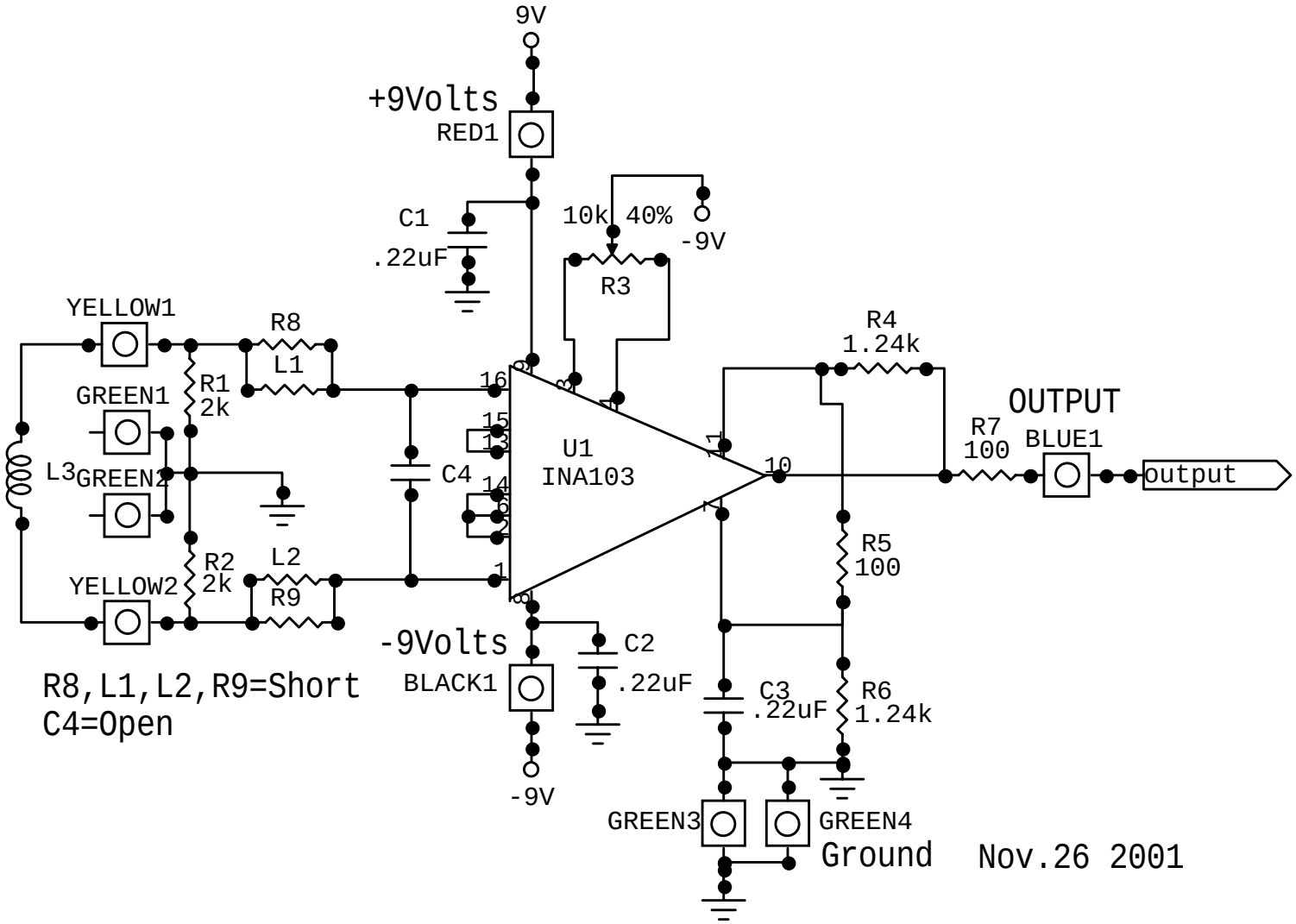
Once you have an assembled module place it on the springboard and connect it as shown in the ***Test Circuit Post Amplifier.***

The post amplifier multiplies the input voltage by the gain to get the output voltage. The gain is determined by R2/R1 10k/5k= 2 . So in an Ideal world, if the input voltage is 4.5 Volts the output voltage would be 9 Volts. Because the operational amplifier is powered by 9 volts, it can't reach this limit. If you had 1.5 Volts on the input you would get close to 3 Volts on the output.

Appendix

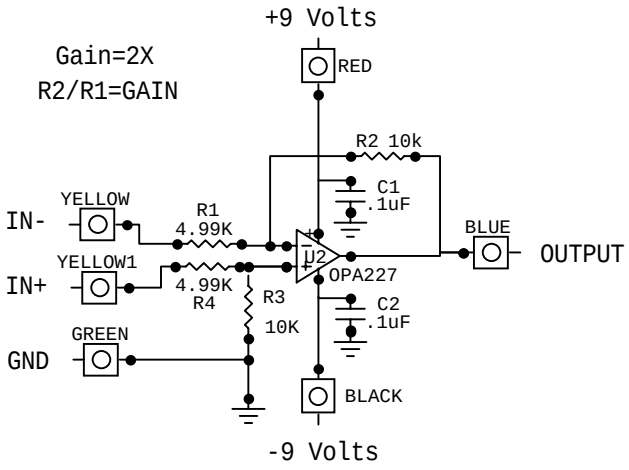
Amplifier Module Schematic

AMPLIFIER MODULE SCHEMATIC



Post Amplifier Module Schematic and Test Circuit

POST AMPLIFIER MODULE SCHEMATIC

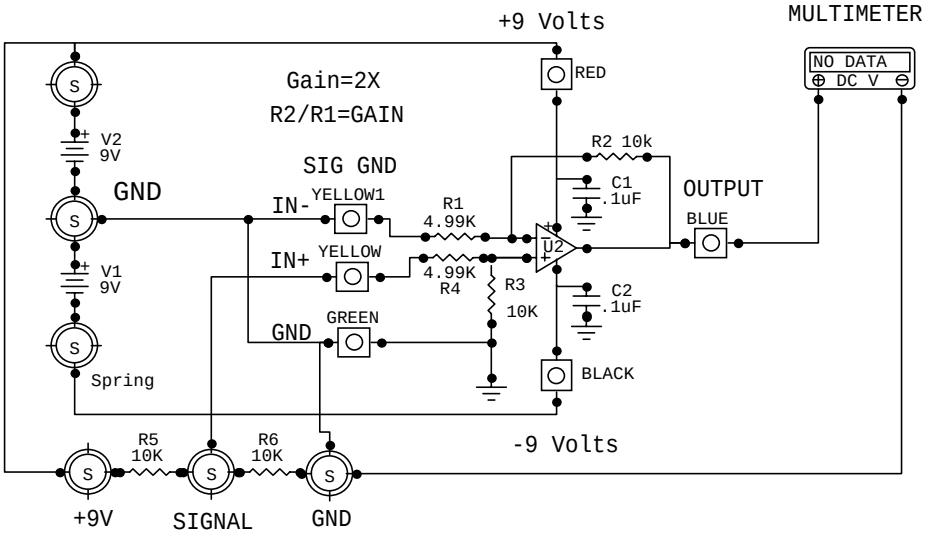


NOV 20,2001

TEST CIRCUIT FOR POST AMPLIFIER

(Using Snap Springboard)

OPA227 POST AMP

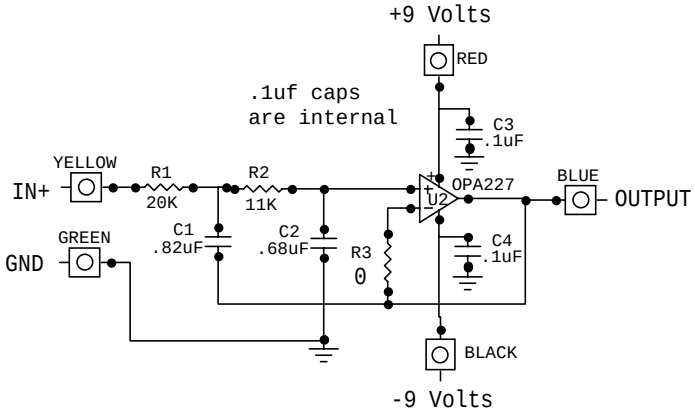


NOTE: THE OUTPUT VOLTAGE SHOULD BE TWO TIMES THE INPUT VOLTAGE

NOV 20,2001

Filter Module Schematic and Test Circuit

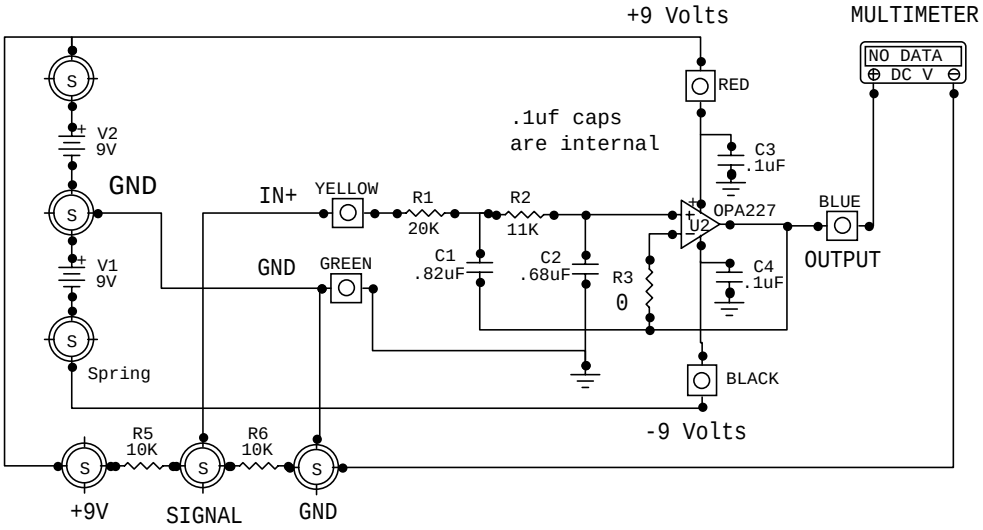
FILTER MODULE SCHEMATIC



NOV 20,2001

TEST CIRCUIT FOR FILTER MODULE

(Using Snap Springboard)

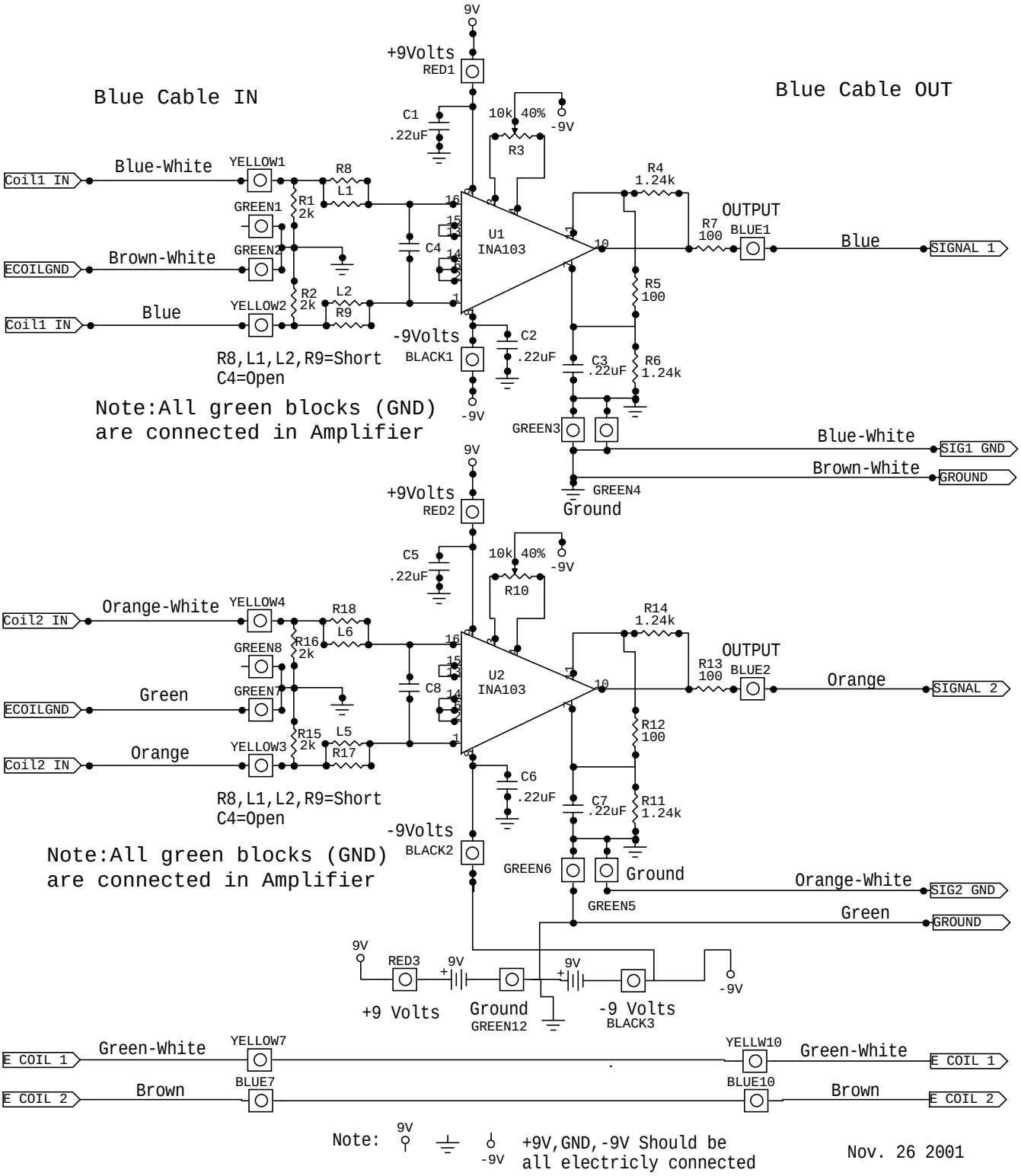


NOTE: THE OUTPUT VOLTAGE SHOULD EQUAL
THE INPUT VOLTAGE

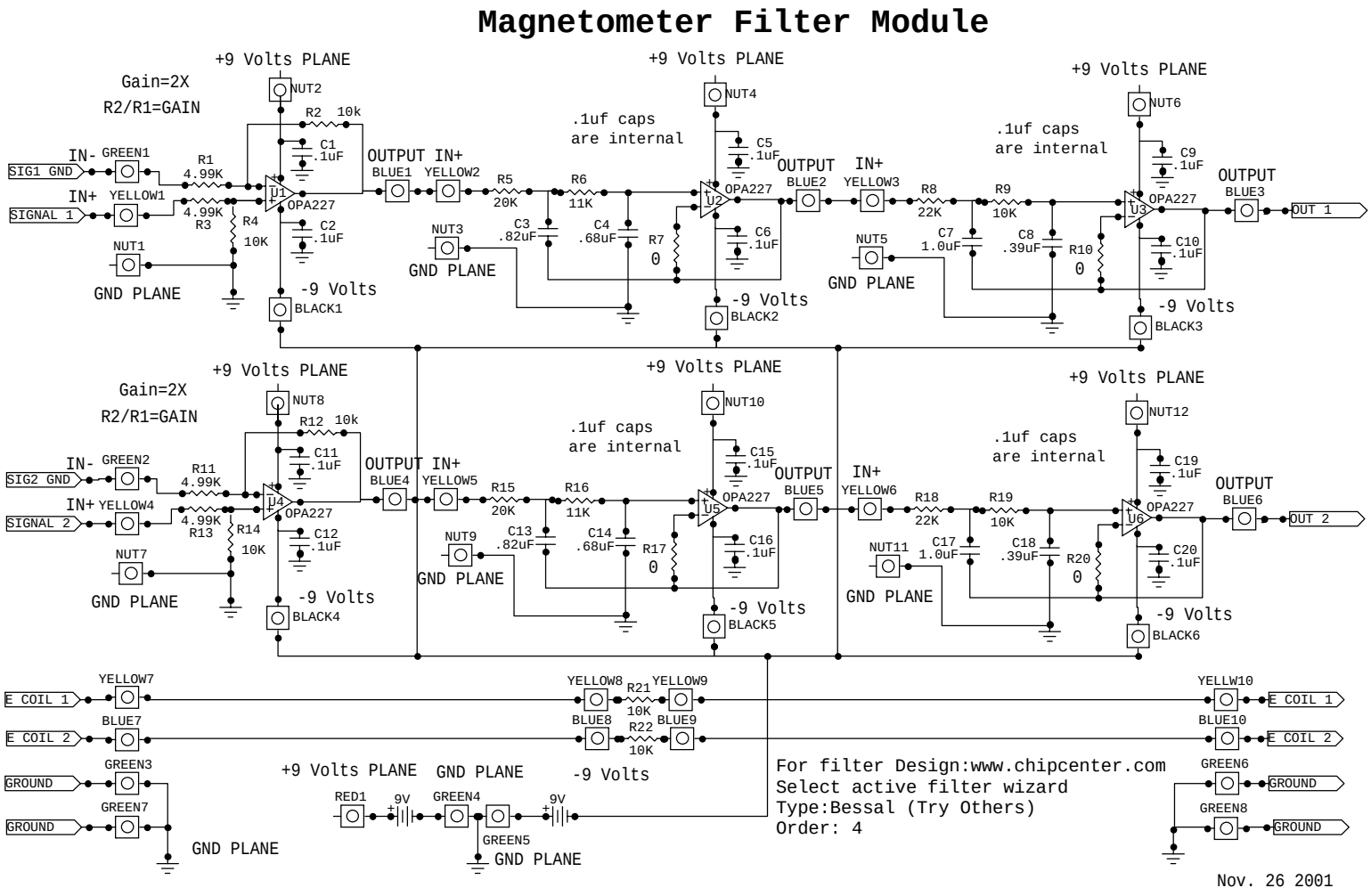
NOV 20,2001

Magnetometer Amplifier Module

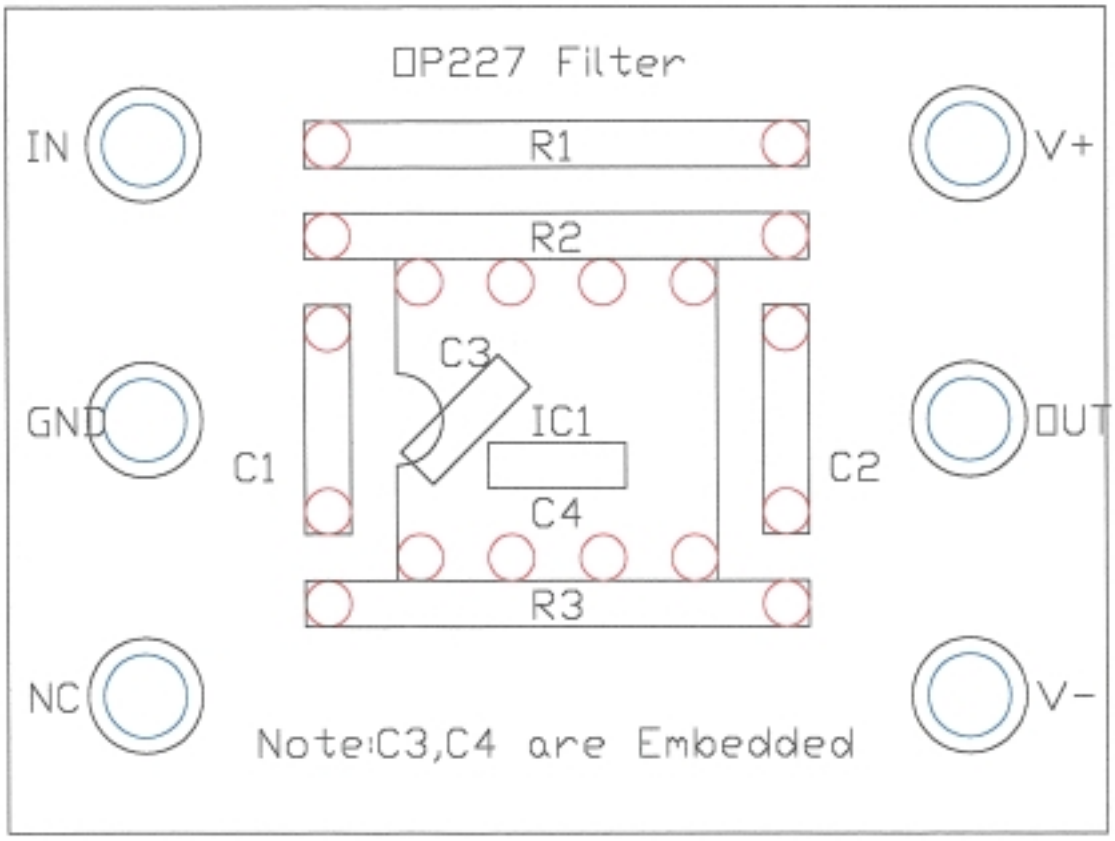
Magnetometer Amplifier Module



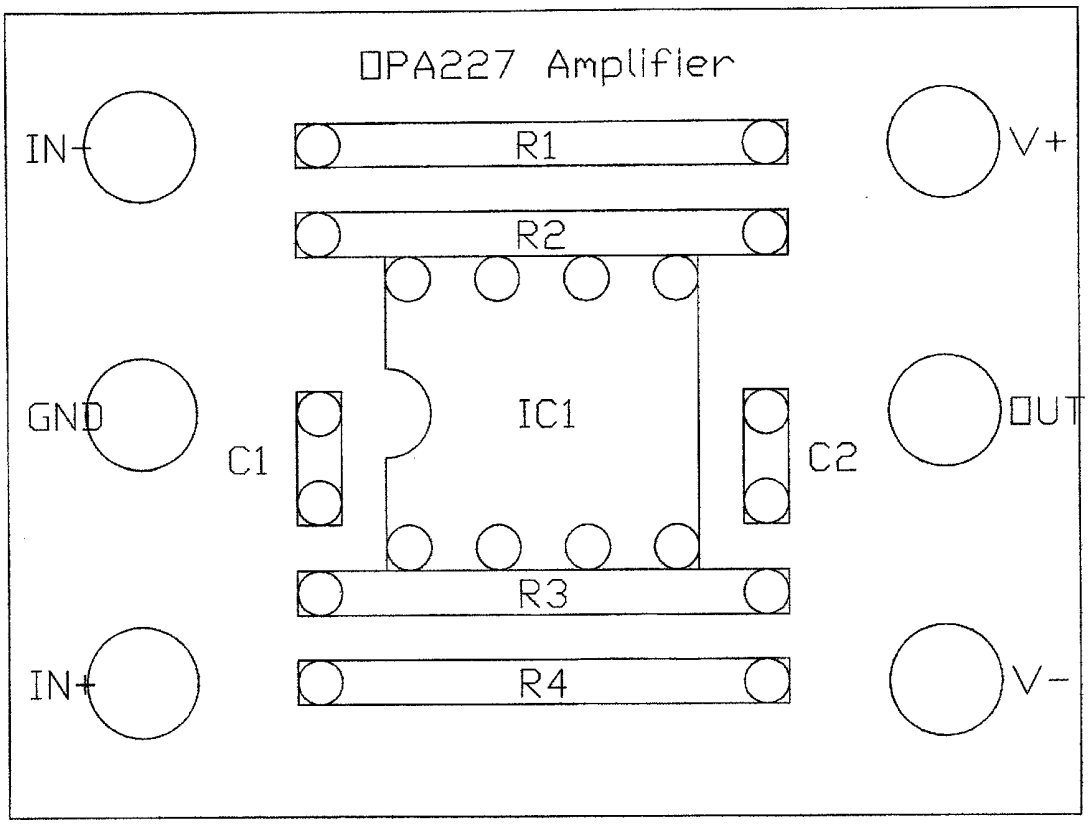
Magnetometer Filter Module



Filter Pin-out



Post Amplifier Pin-out



Amplifier Pin-out