

First Watt model F4

Operation and Service Manual

Introduction

Anyone paying attention is aware that First Watt makes unusual amplifiers with the emphasis on performance at low power levels.

Here's another one.

The F4 is Class A impedance converting amplifier, having no voltage gain or feedback. Its input impedance is 48,000 ohms, and its output impedance is about 0.2 ohms. It is suitable for driving a high sensitivity loudspeaker with the output voltage of a preamp or other line-level audio source. It is also useful with a less sensitive loudspeaker in a bi-amped configuration where it takes input from the output of a conventional amplifier.

As a stereo amplifier with single-ended inputs and outputs, it will deliver up to 25 watts into 8 ohms with a damping factor of 40. It will do 50 watts into 4 ohms, and as a mono-block amplifier with parallel inputs and outputs, it will do 100 watts into 2 ohms.

As a mono-block amplifier with balanced inputs and outputs the power output rating is 100 watts into 8 ohms at 0.5%, and the damping factor is 20.

At ordinary listening levels the amplifier operates Class A, and the distortion is 2nd harmonic in character, rising or declining in linear proportion to the output power. The amplifier has a direct coupled input and output, with a -0.5 dB rolloff around .1 Hz and 200 KHz, and it does a clean square wave at 100 KHz.

The combination of a simple Class A circuit operated without feedback and the excellent objective performance gives us a superb sounding amplifier. The low distortion, bandwidth extension, and high damping results in midrange clarity, treble detail, and control on the bottom end.

While these are available from most good solid state amplifiers, the F4 also brings depth, imaging, midrange warmth and top end sweetness.

Overall, it is one of the best sounding amplifiers, and if you can live with unity voltage gain in your amplifier, it is possibly your best choice.

The amplifier is designed for fairly unusual applications:

1) You can drive it directly with a line source such as a preamp.

Using this amplifier presupposes that you have a preamplifier or other source with adequate voltage and/or loudspeakers sufficiently sensitive to be able to work with the voltage and gain you have.

You would think offhand that this might be a real problem, but it is my experience that this is often not the case.

First, you will find that the more sensitive drivers deliver good volume levels at quite low wattage. My Lowther DX55's (93 dB/watt) mounted in Alerion enclosures adequately fill my 11,000 cubic foot listening room with about 5 volts (the equivalent of a 4 watt amplifier). I can achieve good levels with headroom to spare with my phono stage or DAC feeding an X1 preamp, which has a maximum of 14 dB gain.

If I lived in an apartment, I could get complaints from my neighbors.

Thanks to the dutiful efforts of John Atkinson at Stereophile, I have been able to examine the maximum gain and output voltage of the tube and solid state preamps he has measured over the last 20 years or so (www.stereophile.com).

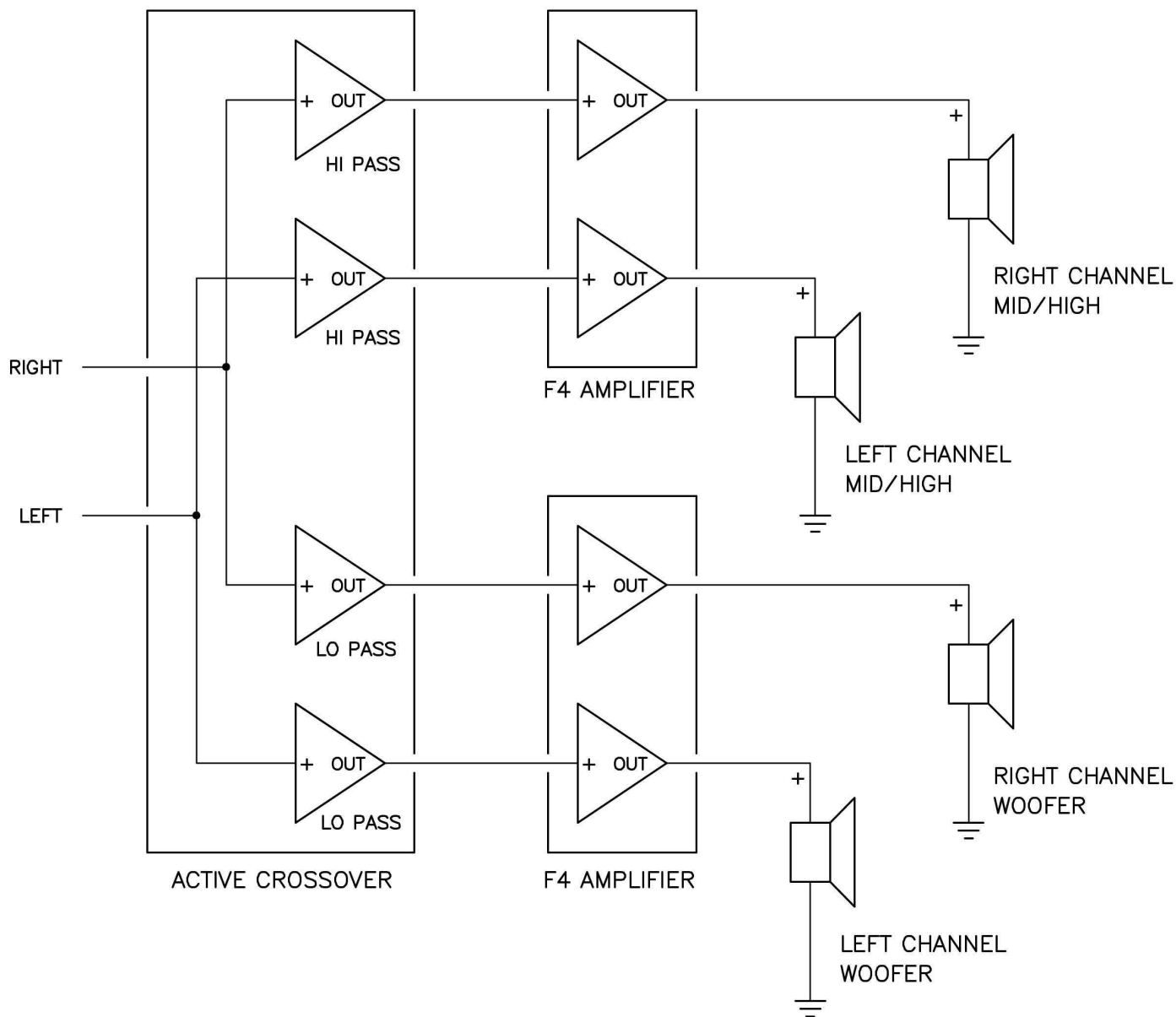
Virtually all active line stages achieve adequate gain and voltage swing to drive the above combination. Basically you need a linestage with about 12+ dB gain and 10+ volt maximum output.

This includes tube products from VTL, Hovland, ARC, Cary, McIntosh, CJ, EAR, MF, BAT, Lamm, and Rogue. It includes solid state preamps from Pass Labs, Krell, McIntosh, Levinson, Halcro, Naim, Boulder, Ayre, Bryston, Threshold, McCormack, Linn, Sutherland, and on and on.

If your loudspeaker is less efficient, then you need more gain from your source and/or more gain and voltage swing from your linestage. As you go in sensitivity below 87 dB, you will want to consider 100 watt balanced mono-block use, with a preamp capable of swinging 14 volts per balanced output and having a gain of 20+ dB.

As your loudspeaker increases in sensitivity, you need less gain and voltage swing.

You can also use active crossover networks to drive multiple F4's as shown below. A number of crossovers on the market incorporate voltage gain and high voltage swing (a prime candidate being the Pass Labs XVR1, which can swing the full voltage capability of the F4).



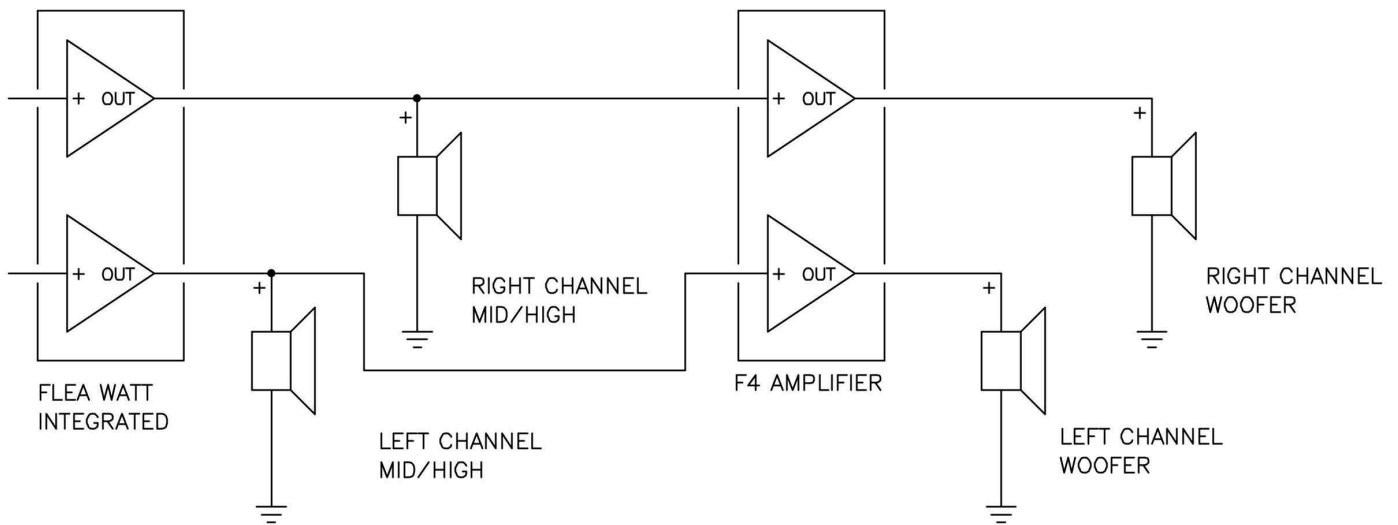
F4 BI-AMPING WITH ACTIVE CROSSOVER NETWORKS

2) You can use it with a low wattage integrated or tube amplifier in a “biamped” system

There are a number of popular tube integrated amplifiers on the market, the so-called “Flea Watt” amplifiers which don’t have much juice, but offer a warm “tubey” sound which is much prized. These amplifiers are good candidates for operation with an F4 in a setup where the loudspeakers have two separate sets of input terminals, one for the woofer and one for the midrange/tweeter.

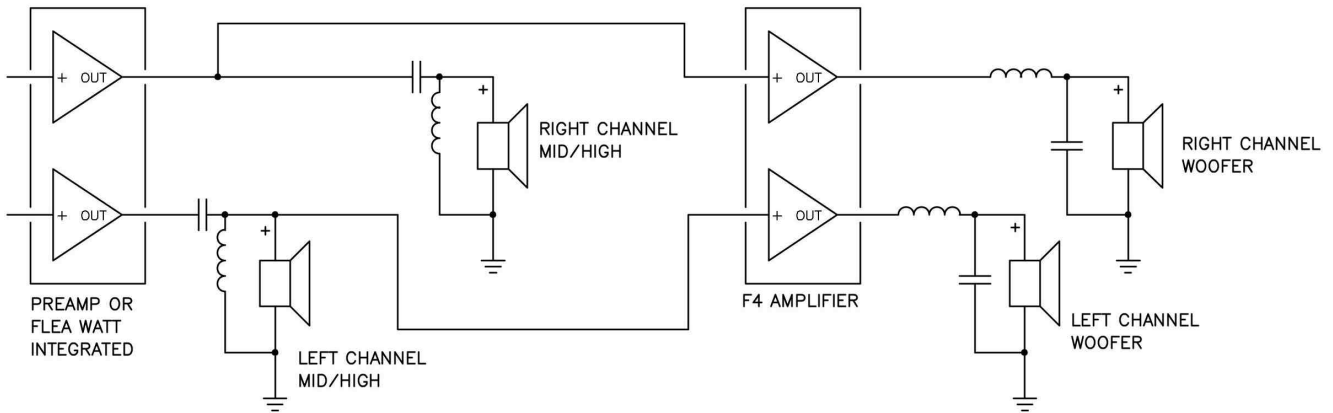
In such a system the F4 is used to drive the bottom end, where it offers superior damping and higher current, and the flea watt amplifier drives the mid and top end, unburdened by the effort of driving the woofer but preserving the character of the tube amp.

It is particularly convenient that the F4 is close to unity gain, which provides close level matching between the bottom and top. (In the diagram below, it is assumed that crossover networks are incorporated into the woofer and mid/high end speakers)



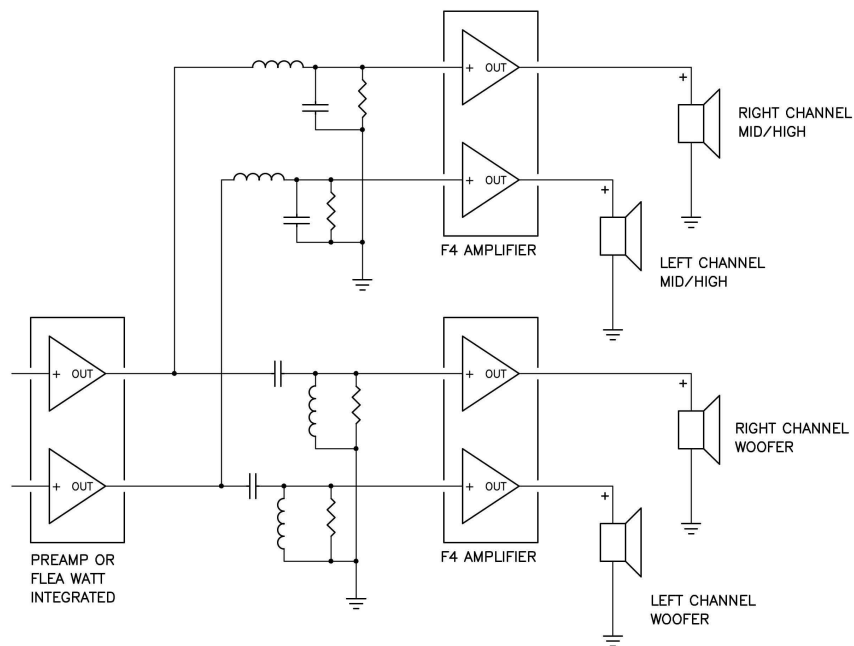
F4 BI-AMPING WITH FLEA WATT INTEGRATED AMPS

You can take advantage of the same arrangement if you have drivers and you want to make your own custom passive crossovers:



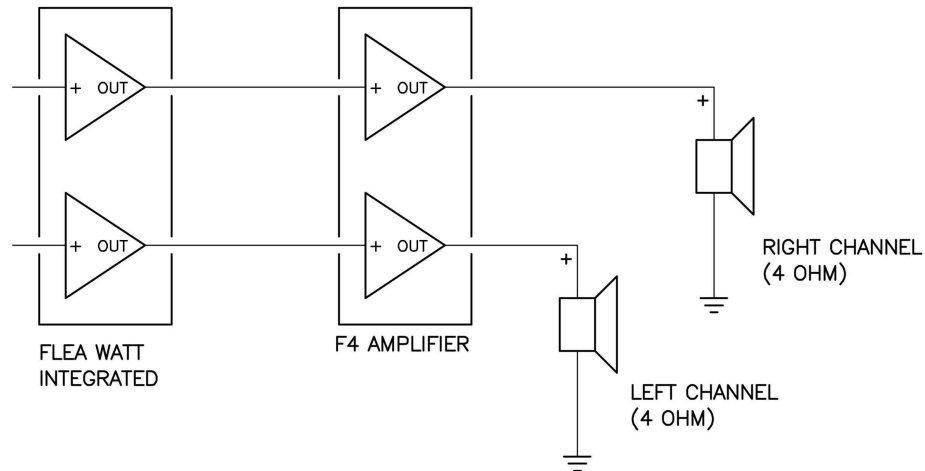
F4 BI-AMPING WITH FLEA WATT INTEGRATED AMPS AND PASSIVE CROSSOVER NETWORKS

An alternative arrangement results when you create your own passive crossover networks using resistors as loads and feeding the results to F4 channels. The networks behave more ideally driving resistors than the complex impedance of loudspeakers, and the resistor values can be set over a wide range of impedances.. The loudspeaker drivers themselves benefit from the direct connection to the low output impedance of the amplifiers.



F4 ALTERNATIVE BI-AMPING WITH FLEA WATT INTEGRATED AMPS AND PASSIVE CROSSOVER NETWORKS

3) You can use it with a low wattage integrated or tube amplifier in a stand-alone system for higher output current



F4 BOOSTING FLEA WATT INTEGRATED AMPS

There will be occasions where the loudspeaker load is too low for optimal performance from a flea watt, and in this case you can consider F4's for the purpose of getting as much as 100 watts into 2 ohms per mono-block. In this arrangement you can also load the flea watt amp (not shown here) with a resistive or other load which elicits the best performance from it.

Setup

The initial setup of the amplifier is very straight-forward. Place the amplifier in a well-ventilated location, as it draws about 160 watts during operation and requires as much opportunity to cool itself as possible. You should be able to put your hands on the heat sink during operation. If you can't do this for 5 seconds or so, they need more ventilation.

On the front panel there are two blue LED lights, one for each channel (or each half of a mono-block), indicating power to the channel. On the rear panel you will find a pair of RCA inputs, and XLR balanced input, speaker outputs, a fuse holder, an AC power receptacle, and on/off switch.

The label will indicate a serial number and also what AC line voltage the amplifier is set for. If the voltage is 120 VAC, then the fuse value will be a 3AG slow blow fuse rated at 2.5 amps. If the voltage is 240 VAC, then the fuse will be rated at

1.25 amps. Do not substitute a larger value fuse. Contact First Watt if you have any questions.

The amplifier can be run in three configurations. There is one way to use the amplifier in stereo. There are two ways you can run the amplifier as a mono-block, either by paralleling the inputs and outputs for more current and less distortion, or by driving the two channels from a balanced source.

I'm assuming that you know how to attach the speaker cables to the 5 way output connectors provided. Please make all the connections with the amplifier power switch in the OFF position.

Stereo Operation

For two channel operation, input signal is connected to the RCA inputs, ignoring the XLR input. (Unlike some other designs from First Watt or Pass Labs, there are no jumpers on the unused XLR inputs.) The output connections to the loudspeakers are made through the gold plated brass 5 way connectors. The red (top) connection is positive and the black (bottom) is negative. In this amplifier the black banded output connectors are connected directly to signal ground.

Mono Balanced Operation

In mono balanced operation, you can achieve up to 100 watts output into an 8 ohm load. The amplifier is driven by a balanced source, either through the two RCA inputs or the balanced XLR connector. The left channel (as seen from the front) is presumed to have the positive phase, so the positive input appears either on the left channel RCA or Pin 2 of the XLR connector. The right channel gets the negative phase input on its RCA or on Pin 3 of the XLR connector.

Pin 1 of the XLR connector is ground

Pin 2 is positive.

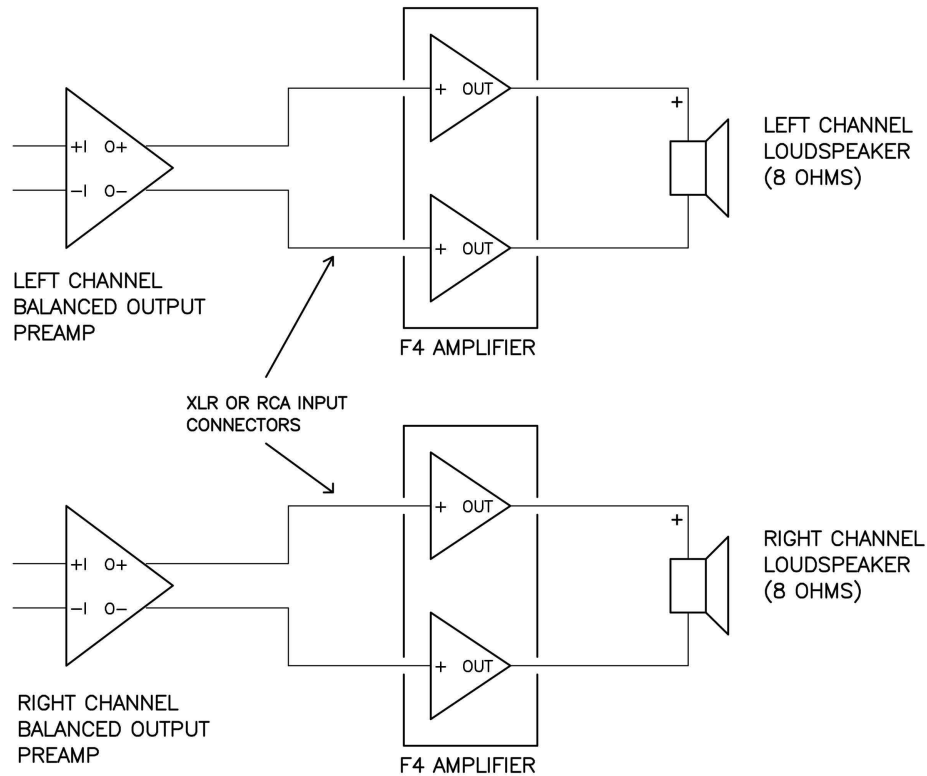
Pin 3 is negative.

If you look carefully at the connector you will see tiny labels next to the pin holes.

No jumpers or shorting plugs are necessary.

The output to the speakers occurs through the top red banded brass connectors on the two output 5 way binding posts. The left channel (as seen from the front) has the positive output, and the right channel has the negative. The bottom black

banded connectors are signal ground, and are not used. The positive speaker lead goes to the left red band, and the negative speaker lead goes to the right red band.



F4 BALANCED MONO CONNECTIONS

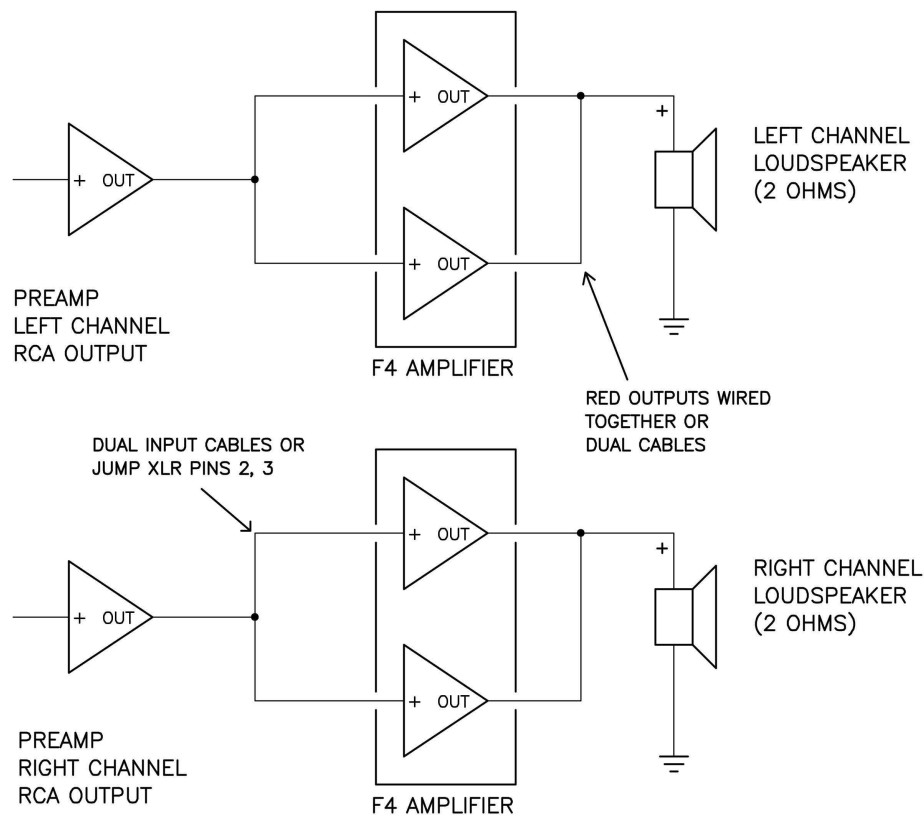
Mono Parallel Operation

In mono parallel operation, you can achieve up to 100 watts output into a 2 ohm load. The amplifier is driven by a single-ended source, through the two RCA inputs in parallel. The easiest way to do this is through a male RCA cable going into one of the RCA inputs with a jumper between pins 2 and 3 of the XLR input connector, which parallels the two inputs. This jumper is supplied with the amplifier.

If you look carefully at the connector you will see tiny labels next to the pin holes.

For parallel operation of the two channels as one, you must connect the outputs left positive to right positive either at the connectors themselves or by “bi-wiring” the loudspeaker with two sets of cables. Remember that the positive outputs have a red band.

The black banded output connectors are already connected together to ground, so you can make this connection externally or not as you please.



F4 PARALLEL MONO CONNECTIONS

With everything connected up and the source equipment powered up first, you can proceed to turn on the power switch to the amplifier. Turn-on and turn-off thumps and noise are small in this amplifier, and should not present any hazard to delicate drivers.

At this point you should be able to listen to music. This amplifier has less gain than most, but at 15 watts rating, it should not need it. If you need to turn the gain up on your preamp, then do so. If you can't get enough gain, then you are probably using either the wrong speaker or the wrong amplifier. Talk to your dealer if this is the case.

The power supply of the amplifier is isolated from the chassis and AC earth ground by a thermistor which connects the circuit ground to the chassis and earth ground. This helps to prevent ground loops, but the thermistor stands by to

conduct AC line voltage to ground until the fuse blows in case of transformer or other such failure.

The input impedance is 48 Kohms, and the input capacitance is very low, so you should find it easy to drive with tube equipment if you like. The amplifier is largely indifferent to the source impedance of your preamp, so a high source impedance is not a problem.

The amplifier requires about 1 hour of operation to reach normal operating temperature, and this warm-up time is appropriate for the most critical listening, but is not otherwise an issue. The amplifier's final adjustments were made after an hour, and the performance difference between 5 minutes and 60 minutes is significant.

I do not personally see a reason to run the amplifier all the time, but you can do that if you want to. The power supply capacitors are likely to last about 15 years or so, and while they will slowly dry out just sitting there, they will have a shorter life span with the amplifier running constantly. Also, at 160 watts it makes economic sense to shut the amplifier off if you aren't planning on using it for the rest of the day.

Again, the heat sinks on this amplifier run fairly hot, and you want to make sure that they get adequate ventilation. They will run at around 25 degrees C. above the ambient temperature, which puts them around 50 degrees in the average listening room. At this temperature you should be able to put your hand on them for about 5 to 10 seconds or so.

Now the following is for your protection –

Do not defeat the AC line Earth ground connection on the amplifier power cord. It provides an extra barrier to prevent potential shock hazard.

Do not replace the fuse with a type other than specified.

Do not operate the amplifier outside in the weather, or in and around water or anything resembling water. If you spill a drink in the amplifier or if your dog/cat/child urinates on it, turn it off immediately, unplug it, and do not operate it until cleaned by a qualified technician.

If something gets loose or rattles around inside or smells funny, or if you can't touch the heat sinks for 5 seconds or so, then turn it off, unplug it from the wall, and contact First Watt.

There are no user serviceable parts inside. Do not open the amplifier, and if you do anyway, don't operate it with the cover off. There are hazardous voltages inside. If you need to change the operating AC voltage, contact First Watt.

If you have a problem, contact First Watt. We are much happier helping you solve problems so that we can be certain that it's done properly. If you are far away and don't want to ship the product for repair, we will assist your technician with information and parts.

Contact: www.Firstwatt.com nelson@passlabs.com

Summary of the nominal specifications:

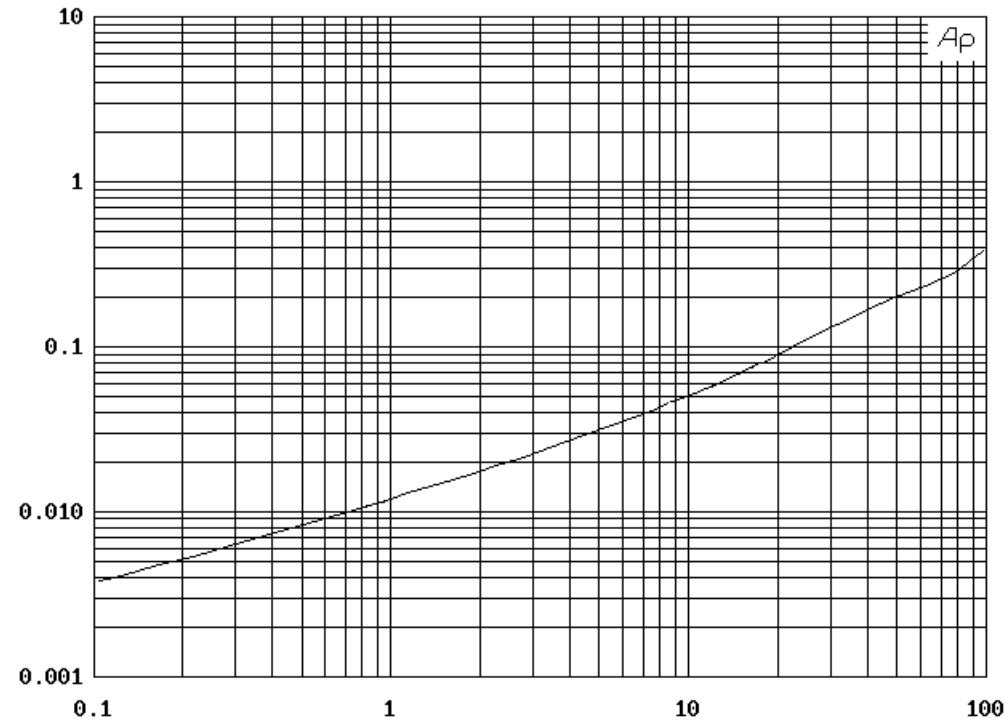
Measured at 120 V AC with a 600 ohm source and an 8 ohm load:

Distortion @ 1 watt	.02% @ 1 KHz
Input Impedance	48 Kohm (single-ended stereo) 96 Kohm (balanced mono)
Damping Factor	40 (single-ended stereo) 20 (balanced mono)
Output power stereo 8 ohms	25 watts @ 0.5% THD, 1KHz
Output power mono 8 ohms	100 watts @ 0.5% THD, 1KHz
Voltage Gain	-0.5 dB
Maximum unclipped output	+/-20 Volts (SE) +/-40 Volts (Balanced Mono)
Maximum output current	5 amps
Frequency response	- .5 dB @ 0.1 Hz, 200 KHz
Noise	60 uV unweighted, 20-20 KHz
Power consumption	160 watts
Fuse	3AG slow blow type, 2.5 Amp for 120VAC 1.25 Amp for 240 VAC

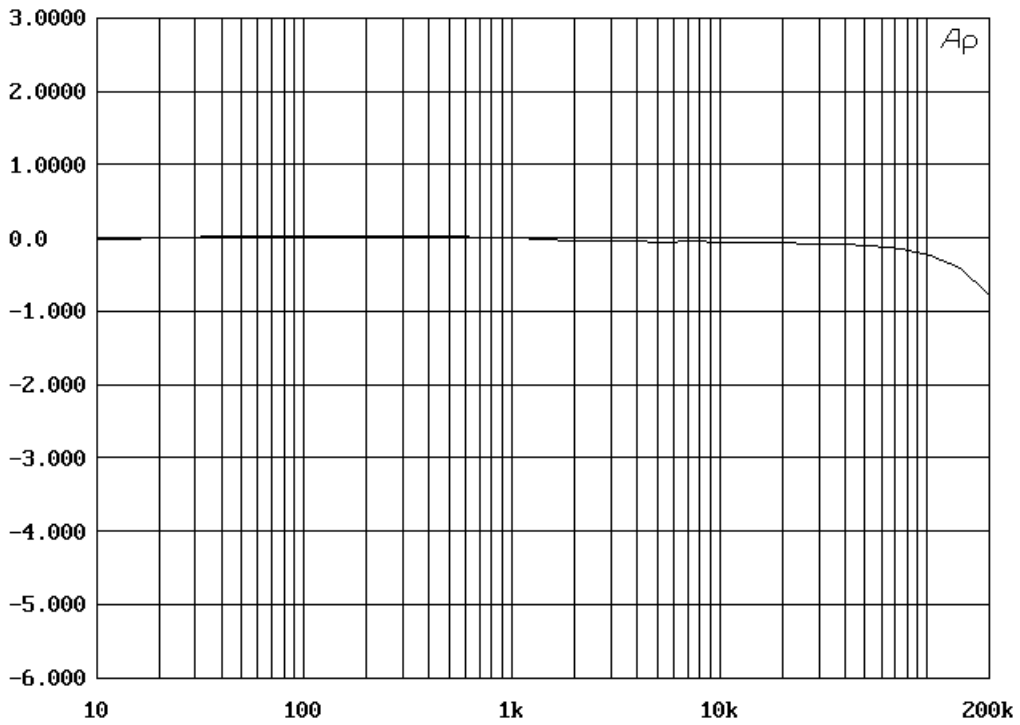
Warranty: Parts and labor for 3 years, not covering shipping costs or consequential damages.

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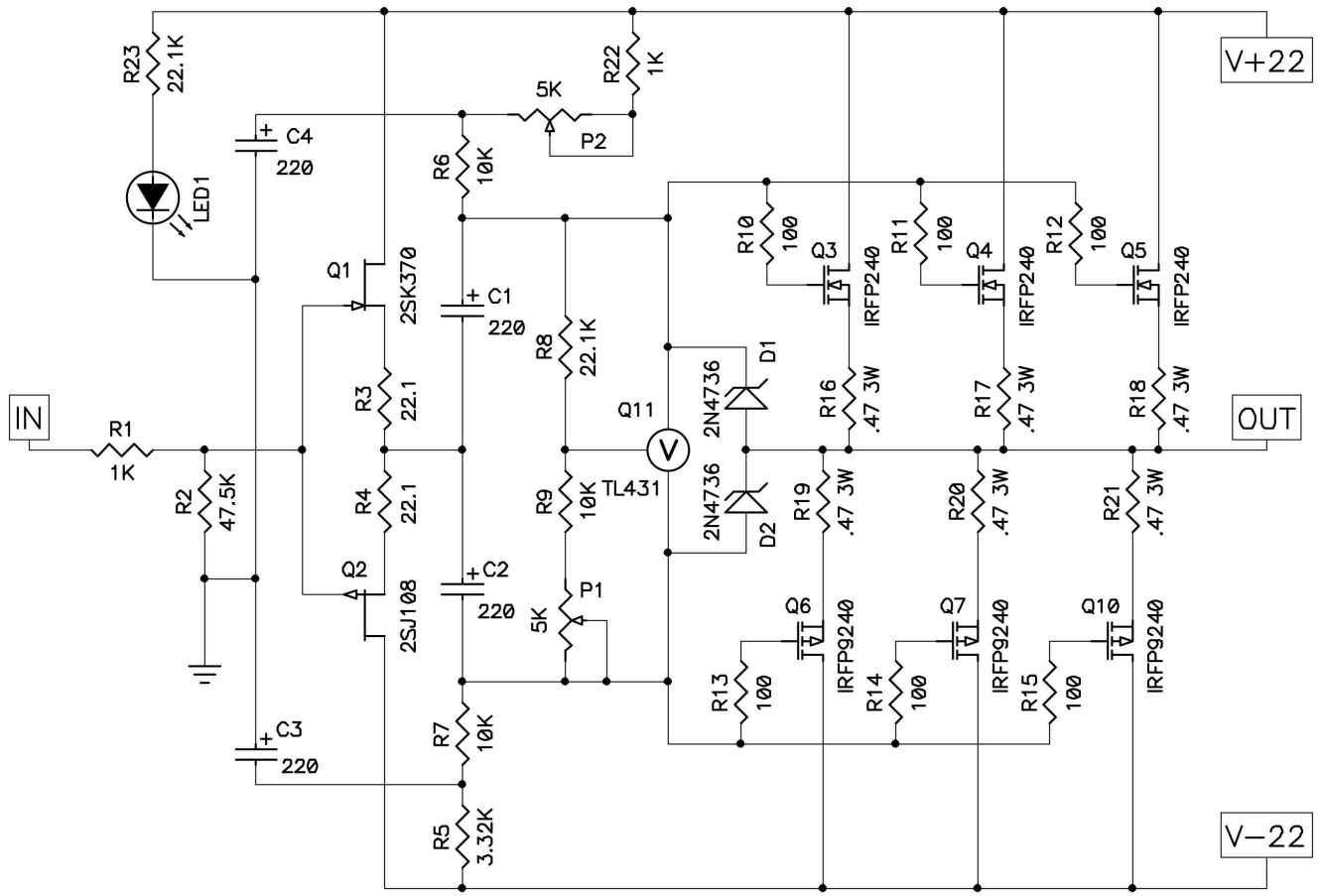
General Amplifier Inc.
PO BOX 7607
RENO NV 89510-7607



DISTORTION VS WATTS, MONO @ 8 OHMS, 1KHZ



FREQUENCY RESPONSE



FIRST WATT F4 11/8/06

CHANNEL SCHEMATIC

Notes:

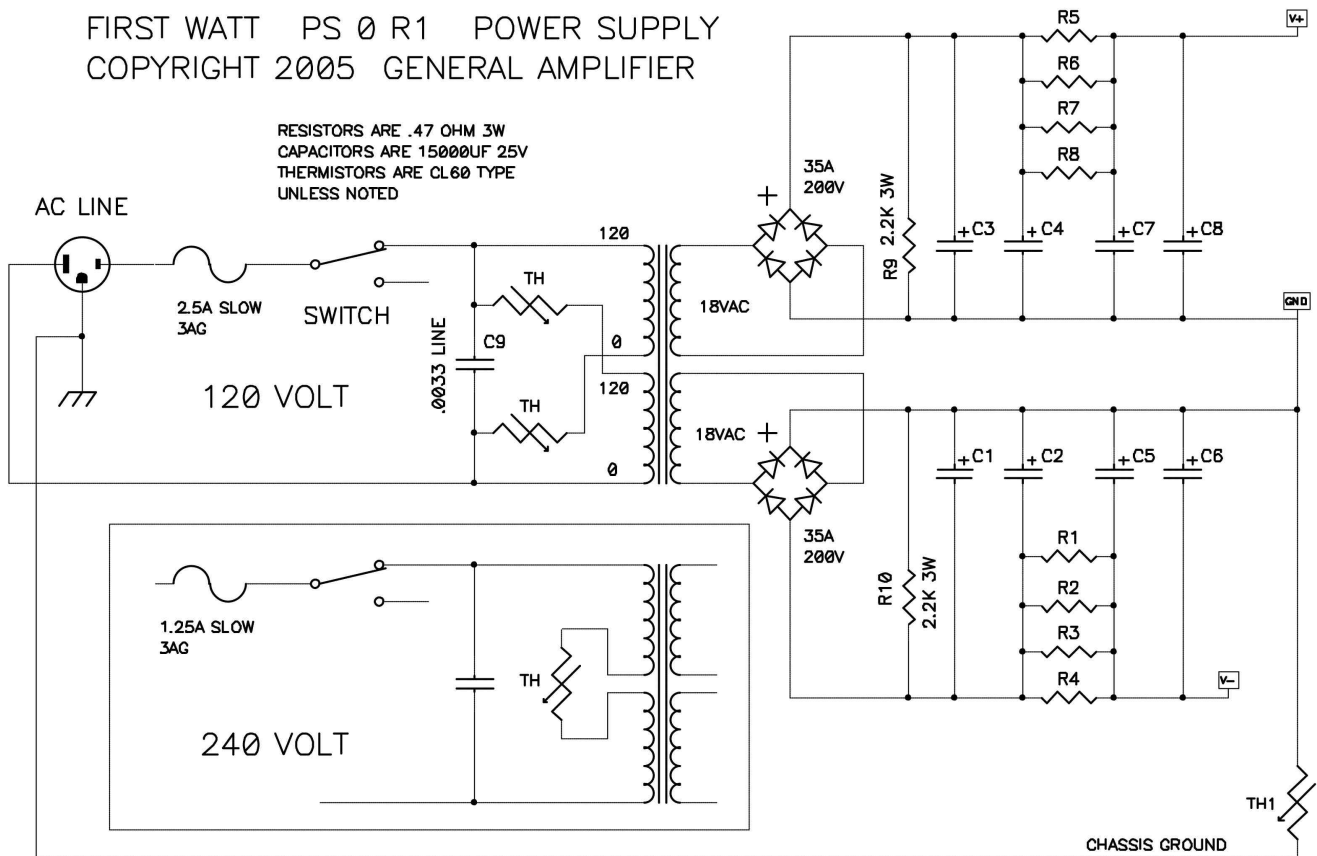
Output device bias is approximately .53 amps per device, which measures 0.25 volts across the .47 ohm source resistors.

All devices are matched for Vgs to .02V.

Bias is adjusted low and readjusted as the amplifier warms up. The proper value is achieved after 1 hour with the heat sinks at about 45-50 deg C.

P2 is adjusted for minimal DC offset at output.

FIRST WATT PS 0 R1 POWER SUPPLY
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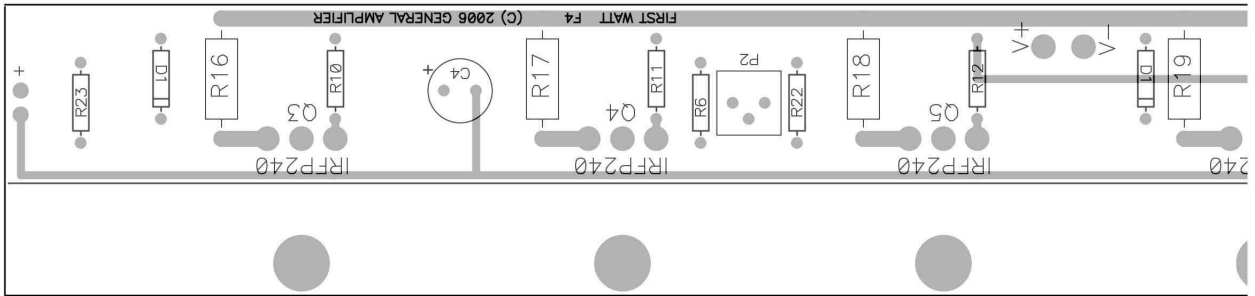
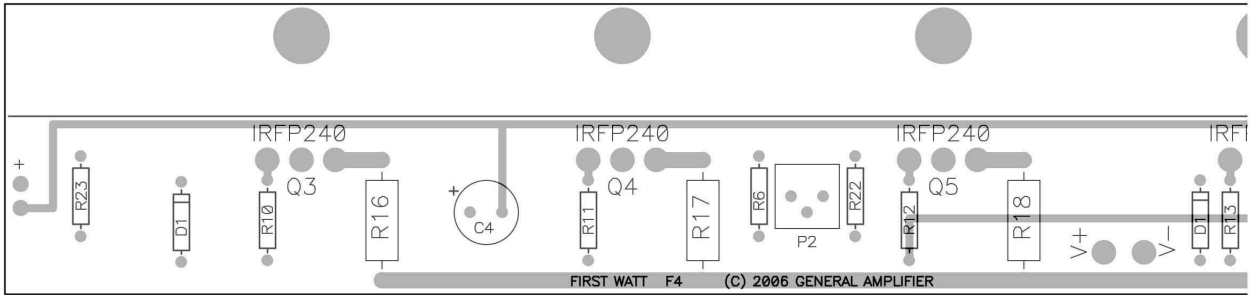


POWER SUPPLY SCHEMATIC

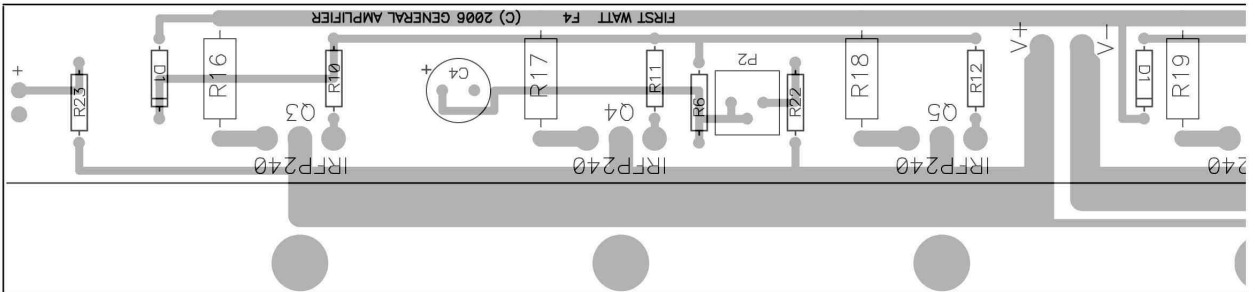
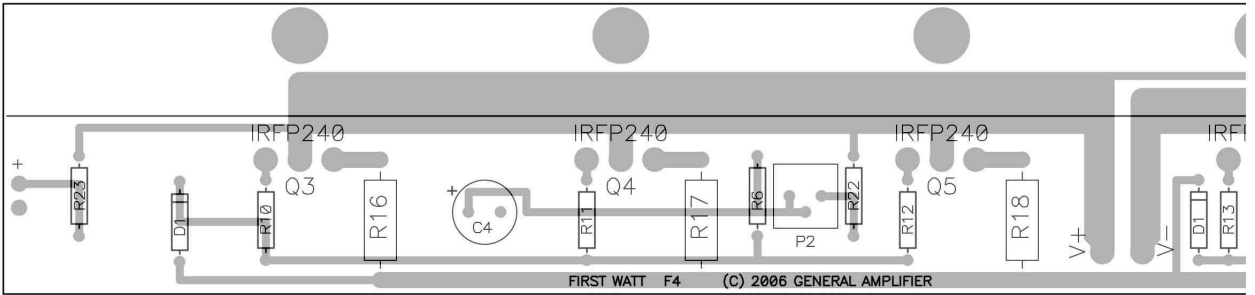
Notes:

Thermistors in series with the AC line are also used to select line voltages at 120 VAC or 240 VAC, as seen on the front edge of the PC board layout.

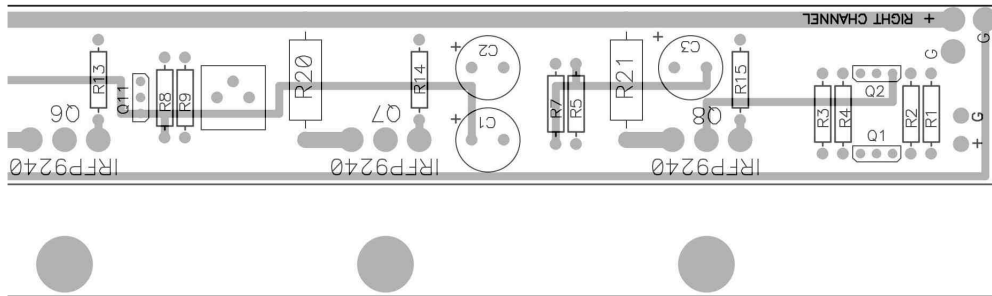
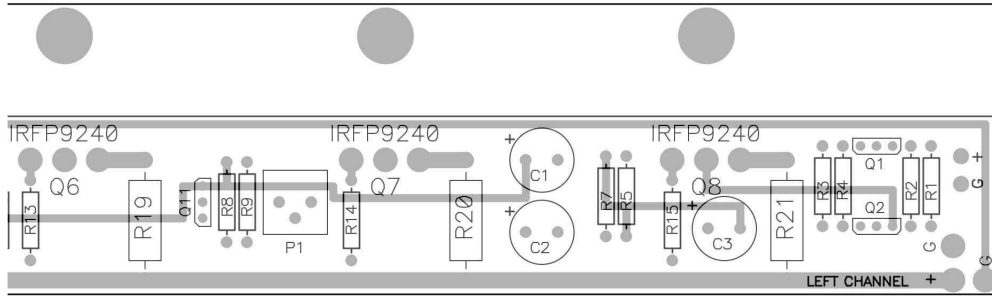
BOARD TOP



BOARD BOTTOM



BOARD TOP



BOARD BOTTOM

