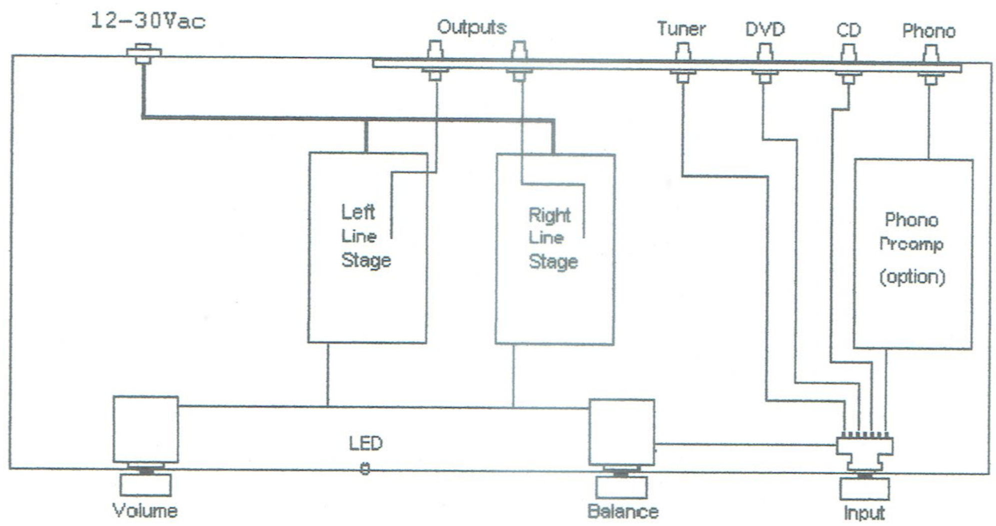


Tweaking

Some DIYers like to explore the possible sonic benefits of premium components such as Blackgate, Muse and Silvered Mica capacitors, and Bulk Foil resistors. Many of these are quite expensive and therefore it is worth knowing where these might be used to the best effect. Items outside the feedback loop are likely to respond most to change. C5, C7 should not be increased in value but may be bypassed under with a 100nF -1uF small film type. R18 and R2 can be Bulk Foil.

Other possibilities

I have attempted to make this module as versatile as possible with options for-

Unity Gain Inverter

To use as a unity gain inverting amplifier c nnect a 3K resistor on the two large hole-less solder pads on the underside fro t. This connects to the -IN and the module can now be used as a unity gain ir erting stage. The main +IN and volume pot are not used and should be lin ed to ground using a 1K resistor. DC offset should be set when connected t expected input equipment. This stage may be used in conjunction with a re jular SKpre stage to produce balanced outputs. Simply connect the -IN f the inverting stage to the output of the other SKpre before the output 47 ohm esistor. The module may be used as a DAC interface I/V stage in this way, b t DC must be blocked with a suitable capacitor.

Balanced Input

To use as a balanced in, unbalanced out u ity gain buffer, remove the volume

Setting up

The unit should have a 30Vac CT transformer connected across the input to the bridge with the CT to ground (marked E) between the large capacitors. If you have two separate secondaries make sure they are in phase by connecting the 'dotted' end of one to the 'non-dotted' end of the other – this becomes the CT (which connects to E on the PCB). Alternatively it can be sourced from supplies of +/-22V to +/-25V DC. If you know the current demand of your load then the VA rating of the transformer should be at least 3 times the 30 x I (in amps). For example a 10VA is OK for 100mA or a 300ohm load. A 20VA would be adequate for a circuit using 22 x OPA2134 chips (as each runs at 8 - 10mA) such as the Orion ASP.

The PSU should show both LEDs glowing on switch on with or without a load. Set both trimpots to centre and measure the output V+ and V- to ground across the terminal block pins shown. These should each be in the 14Vdc to 15Vdc range. Next, measure the unregulated DC supplies after rectification, Vu+ at F1 and Vu- at F2 fuse clips, to GND. These should be between 20V and 25V dc each, of the respective polarity. They should not be over +/-25V or under +/-20V.

Operation

This PSU will require some adjustment of DC voltages when operated into it's target load. It may not be possible to adjust higher than +/-15V at high current demand with low regulation or low unregulated supply voltage.

The unit should not be operated into high load capacitance as it slows the control loop. Try to **ensure direct load C is less than 50uF on each rail.** Keep wiring to the target module short for best result. The Orion ASP, for example, has 3000uF capacitors which must be removed.

If you are concerned about reliability of the trimpots, feel free to replace them with a fixed resistor once the set value is measured. The fuses can be a lower value for low current applications and can be replaced or paralleled with, say, 1ohm 1W resistors. The 500mA fuses and the 2A rated output devices are the only protections so do not accidentally short circuit the outputs.

Ratings

The PSU unit in standard form (with existing heatsinks) is rated to 250mA continuous. It has been tested at up to 500mA briefly but would require more efficient heatsinks of 10C/W not warranted for most lighter applications. Line regulation is between 90 dB at +/-16V to > 100dB at +/-12V. It is a low noise design but yet to be measured accurately.

Upgrade

The recent upgrade of VR1 and VR2 to 1K (from 20K) and Darlington pass transistor from TIP121 -> MJE270 and TIP126 -> MJE271 has resulted in a typ 15dB improvement in line regulation. Please refer to the forum thread for more detail.

Optimisation

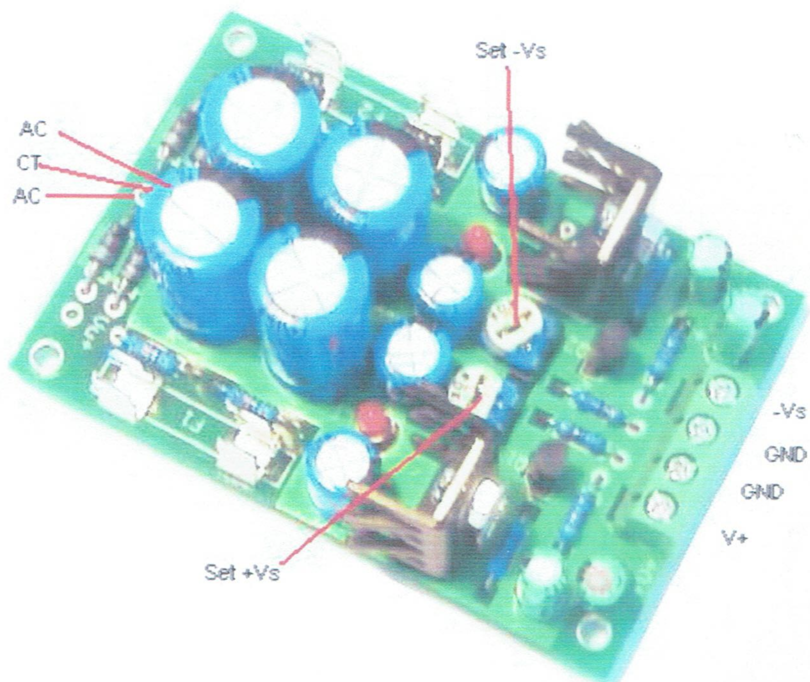
If the current being drawn from the regulators is less than 100mA from V+ and V- the regulator will run quite cool and there may be a small performance advantage in running the pass darlingtons, Q3 and Q4 without heatsinks. They will run quite warm but not overly hot. This elevates their current gain and reduces loading on the internal gain stage ensuring even better regulation. With higher currents the heatsinks are needed for good reliability.

END

L1, L2	3mm LED
Q1	BC546B
Q2	BC556B
Q3	MJE271 PNP 2A darlington
Q4	MJE270 NPN 2A darlington
F1, F2	500mA 20x5 fast blow fuse
D1, D2, D3, D4	1N4004 1A diodes
Heatsinks	as pictured 20C/W
Terminal Block	as pictured 5mm pitch 4 way screw terminal.

Upgrade dated 15/10/08

New layout is slightly different than early picture below around trimpot and resistors.



Assembly

1. Identify all resistors and insert in the locations indicated on the PCB, fold over leads and clip short for soldering.
2. Insert the fuse clips with the end retaining flange to the outside so the fuse barrel will insert.
3. Insert the 1N4004 (or 1N4007) diodes ensuring the correct polarity.
4. Insert the trimpots and LEDs (long wire is +) and solder all.
5. Insert all electrolytic capacitors with the correct polarity. Reverse = explosion at switch on.
6. Join and insert the 2 way terminal blocks (they slide together with a dovetail molding). Solder all connections under.
7. Mount Q3 and Q4 to their heatsinks (if being used) using a little thermal grease (not supplied) and insert in the PCB. Solder in place.
8. Insert the fuses.

decoupling between the two modules.Alternatively a pair of 24V zeners can be inserted in place of the diodes (same direction) and the resistor values reduced to ~ 2/3R value previously.

Wiring

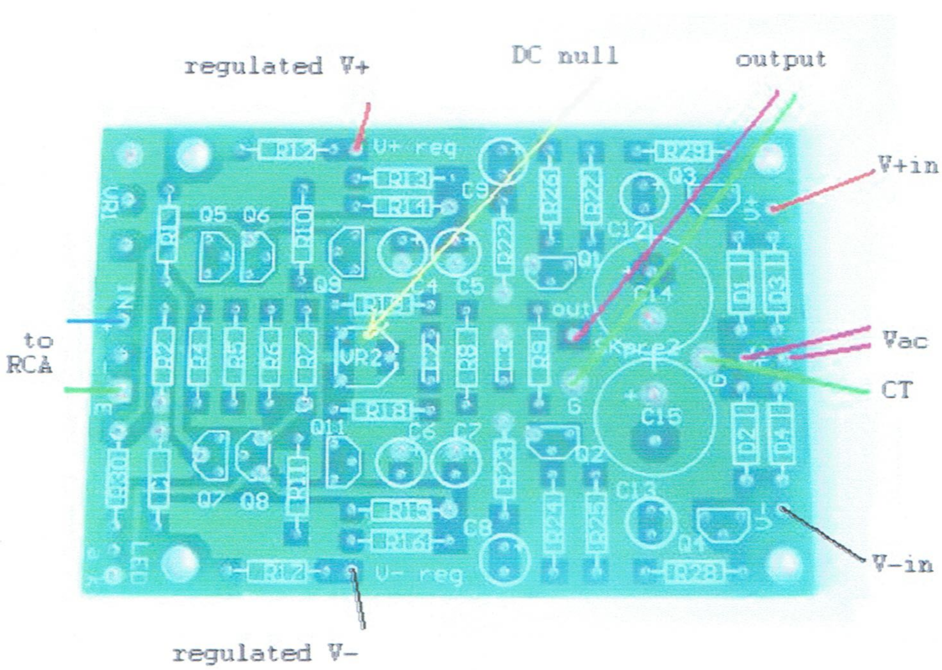
The PCB has a single input, marked "IN +" and "E", at the front edge (ignore the -ve input) and a single output marked "out" and "E" near the middle of the PCB. The E in each case is for the cable shield.

For multiple inputs the input wiring should go to an input selector switch which selects between the inputs available. The output should go directly to the output RCA through a 47 ohm at R9 location. This helps to isolate the FB loop from capacitative loads and RF pickup.

If the power transformer is to be located inside the preamp case, it should be far from the PCBs, input and output terminals and signal wiring for best hum and noise results, and preferably shielded in it's own internal steel box. Alternatively, it can be located outside the preamp box for best results.

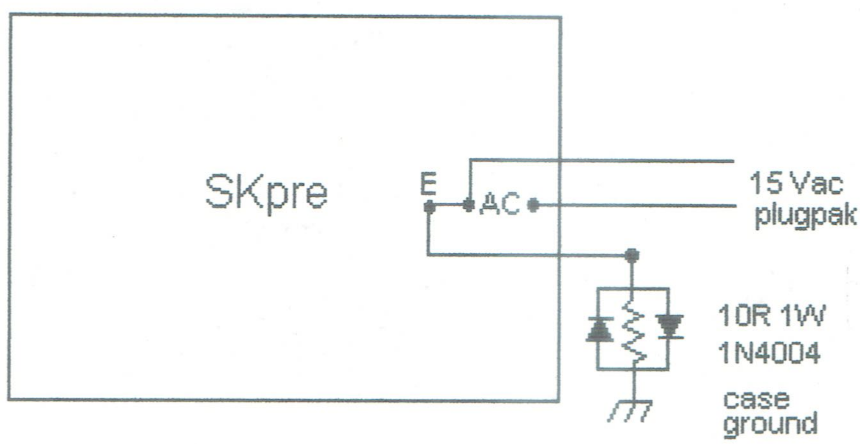
AC wires to the preamp PCB should be twisted together and kept well away from signal areas.

Connections

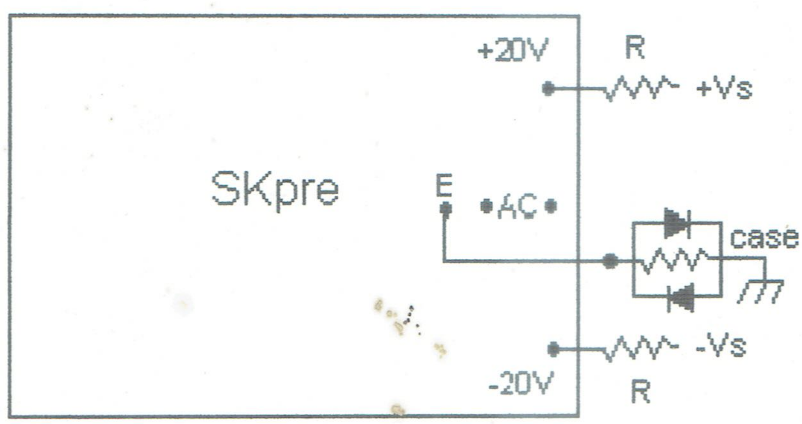


higher ripple (still negligible). Connect one wire to the AC hole nearest the board edge and the other wire to the inner AC hole but linking across underneath to the E pad next to it. Since the plugpack will not have a mains ground you can connect a ground wire from the chassis to the chassis of the power amplifier to ensure the chassis is connected to mains earth.

If the plugpack is > 15% regulation it's better to use a 12Vac one so the rectified voltage does not exceed the 25V rating of the supply capacitors. Check this by measuring the output with DMM on AC volts, nothing connected. It should be < 17.25 Vac.



3. The unit can be powered from a +/-20V upwards DC supply from a power amplifier or other available supply. To power the board from an existing DC supply of between +/-20V up to +/-Vs, the V+ and V- rails can be connected directly through the blue holes (on the stuffing guide) through a resistor of value (Vs - 20) / 0.0075 ohms [example: for 50V supplies use a 3K9 1W resistor].

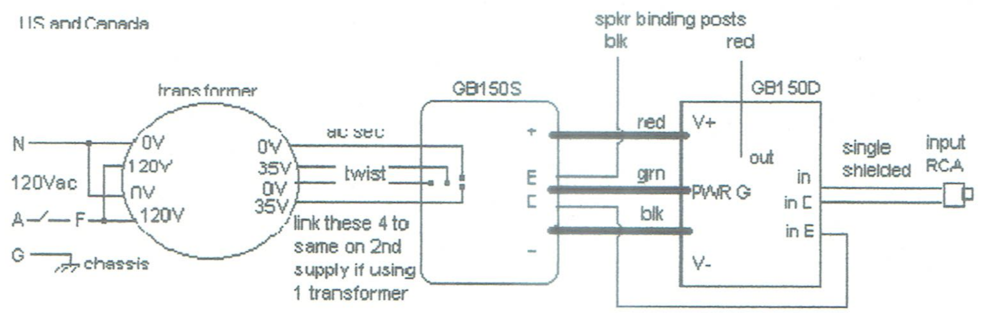


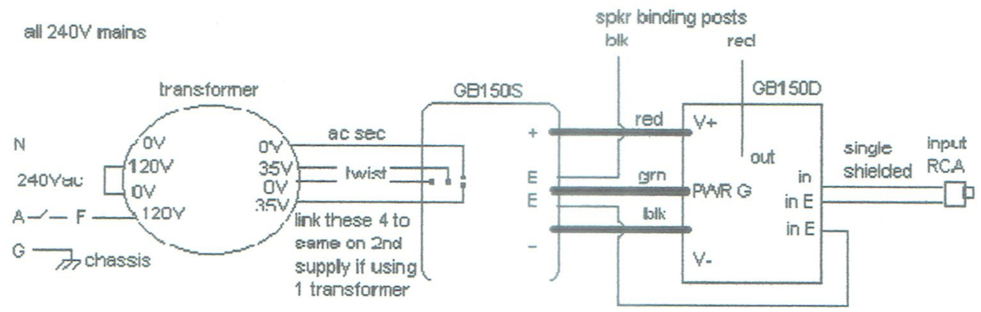
Use a pair of resistors to each module as these also provide valuable indicator of a failed fuse (they will smoke and char). Flip out fuses and recheck bias/offset settings at any time when warm or if you notice a difference in heatsink temp between the two channels.

Operation

Should any 'fuzzy or edgy' distortion occur due to unusual earthing/grounding or layout, place a quality 22nF to 100nF 100V+ film capacitor across the amplifier speaker terminals 100mm+ from the module. There is some user feedback that this may be needed with long speaker cable runs to reduce any RF pickup being returned to the amplifier. This is rarely needed, the alternative of heavier compensation would kill the amplifier dynamics.

The amplifier produces very much lower distortion into higher impedance loads (<0.001% into 100 ohms) so will produce even purer sound quality as impedance rises and particularly driving electrostatic loudspeakers, while their heavy capacitative loading at high frequencies acts to further stabilise the common source output stage.





Chassis Layout

There are many possible layouts limited only by imagination and available tools/materials. Monoblocks, shared transformers dual mono, and shared supply stereo chassis are all possible and the best performance from a given configuration will be achieved if a few simple guidelines are followed.

1. Keep the input region of the PCB and all input wiring at least 50mm from ALL power supply wiring , transformers, and power supplies including the supply to amp twisted red/green/black wires.
2. Follow proper grounding procedure.
3. Keep transformer and supply wiring well away and twisted.
4. Module to supply wiring should be twisted and leave perpendicular and not come closer than 50mm again.
5. A layout that minimises module to supply wiring is desirable to minimise supply impedance.
6. Input and outputs should be 50mm apart and well away from supply capacitors, transformers and bridges.

Extra Possibilities Holes next to R25 (LED or link) allow for wiring a normally closed thermal switch on the heatsink which can be used to open at, say, 60C and the LED will then indicate overheating, drawing the 10mA driver stage current when the switch opens (maybe a flashing LED type). The LED can be moved to the front panel on flying leads wired to the holes next to R25 and a resistor of around 270R - 470R inserted at R25 to reduce brightness (particularly if a higher efficiency blue front panel LED is used) or left out for full brightness. If the LED is unwanted on your amp simply put in an R25 of up to 270R, or a wire link.

For increased low order harmonic distortion to around 0.25% of predominantly 2HD, the bootstrap capacitors C4, 5 may be removed to provide 'bloom' - a fuller, more 'tube-like' sound. No other adjustments are necessary.

Class A build

Class A operation to 50W / 8 ohm is also possible using power supplies of +/-32V or less and very large efficient heatsinks. R10, 12 will need to be reduced to 1.1K to allow increased bias adjustment range with the reduced supplies for 50W Class A operation. R24, 26 should be changed to 3.3K 1W to restore driver stage current with the lower supply voltage. The GB50S power supply with +/-30,000uF at up to +/-35Vsubstitutes for the GB150S above for Class A. Each amplifier channel dissipation will be 110W+ continuous and a heatsink of < 0.3C/W per channel is necessary for reasonable temperature rise of 35degC (max) and reliability. An intermediate or transfer heatsink is not suitable for use in Class A and is best avoided in general. I recommend setting the unit with a bias of 500mA first (500mV across the 1R test resistors) to settle in before increasing it further. Note: 1R 1W test resistors are used for Class A setup due to the higher bias current.

As well as very large heatsinks to dissipate the 112W/channel from Class A, each channel will require a 22-0-22 Vac 300VA rated transformer for each channel and at least +/-25,000 uF 35V for each channel power supply.

Tweaking

While the GB150D has been designed using quality components to offer excellent performance and value, many DIYers like to explore the use of premium high performance (materials) components such as Blackgate, Muse or Silmic electrolytic capacitors and Bulk Foil resistors, to extract the last nuance from the design. Knowing where these may have the greatest effect for the cost is often difficult. The following is a guide:

Components within the feedback loop are considerably less likely to offer perceptible benefit. Bootstrap capacitors C4, 5 can be increased to a maximum of 22uF rated 6Vor greater but are best left at 10uF particularly if no effect is perceived. Outside the feedback loop R23 = 27K can be a bulk foil of 0.25W or higher; R2, R4 0.25W low noise types. Feedback capacitor C9 = 47uF 6V+ and can be Blackgate, Muse or Silmic; C3 = 6pF silvered mica is now standard. C6, 7 can be bypassed under the PCB with 100nF to 1uF 63V small film capacitors if desired.

If the source impedance of the input source equipment is known and is greater than 100R, the value of R2 should be reduced by this amount or a little more, to the nearest readily available value. If operating directly from a volume control it should be of 10K, no more, and R2 reduced to 47R, to optimise input stage operation at typical volume settings.

If oversize heatsinks are used or the amplifier runs very cool, bias may be increased to 1.5V across the test 10R resistors for even lower output stage odd harmonics. This will increase by 50% idle heat and power use.

Source impedance

Not well known is the fact that most amplifiers, and the SKA is no exception, have an optimum source impedance for best balanced operation of the differential input stage. This reflects in higher PSRR and CMRR of the input stage resulting in the nth degree of detail resolution. Usually an input HF filter is fitted to reject RF pickup, and to define the source impedance 'seen' by the input diff'l stage. In the SKA this is R2 = 750 and C2 = 330pF. This is fine when used with a low impedance preamp output. If used with a 10K volume pot directly, R2 can be reduced to 47 ohms. Optimum source impedance will then be attained at approx -20dB volume setting (usually about half way or 12 o'clock) due to volume pot resistance.

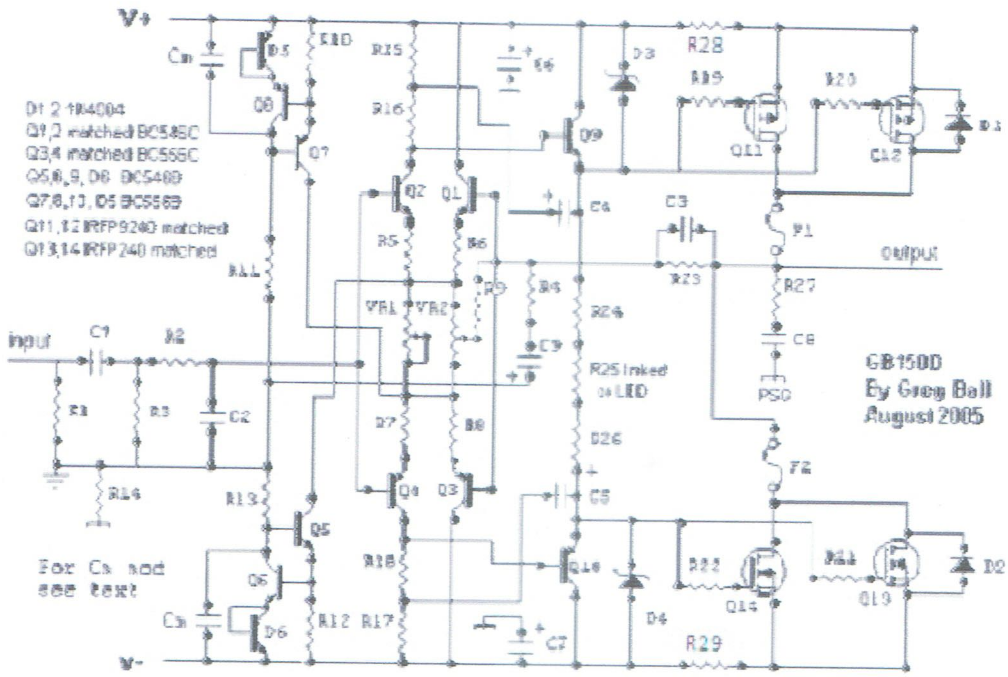
Simple mod for improved PSRR

Performance Amplifier performance is dependent on many external factors such as electromagnetic radiation from power supplies, layout, lead dress, and accurate setup/earthing. The following is provided as a guide -

Power Output	150Wrms maximum into 4 or 8 ohms (power supply dependant)*
Frequency Response	20Hz - 20KHz +0dB -0.25dB at 1W / 8 ohms.
Sensitivity	1Vrms into 27K//100pF for 100Wrms into 8 ohms [reduced from 1nF].
Slewing Rate	>15V/uS into 8ohms
THD	< 0.025% at 100Wrms into 8 ohms (typ <0.01% 2hD at 10W rms).
Damping Factor	> 500 at 50Hz for 8 ohms.
Hum and Noise	< -100dBA w.r.t 1W

* for music signal only, the amplifier is NOT designed or rated for continuous sine or square wave.

Schematic



For further information or commercial interest contact me at **gregmball@ska-audio.com**

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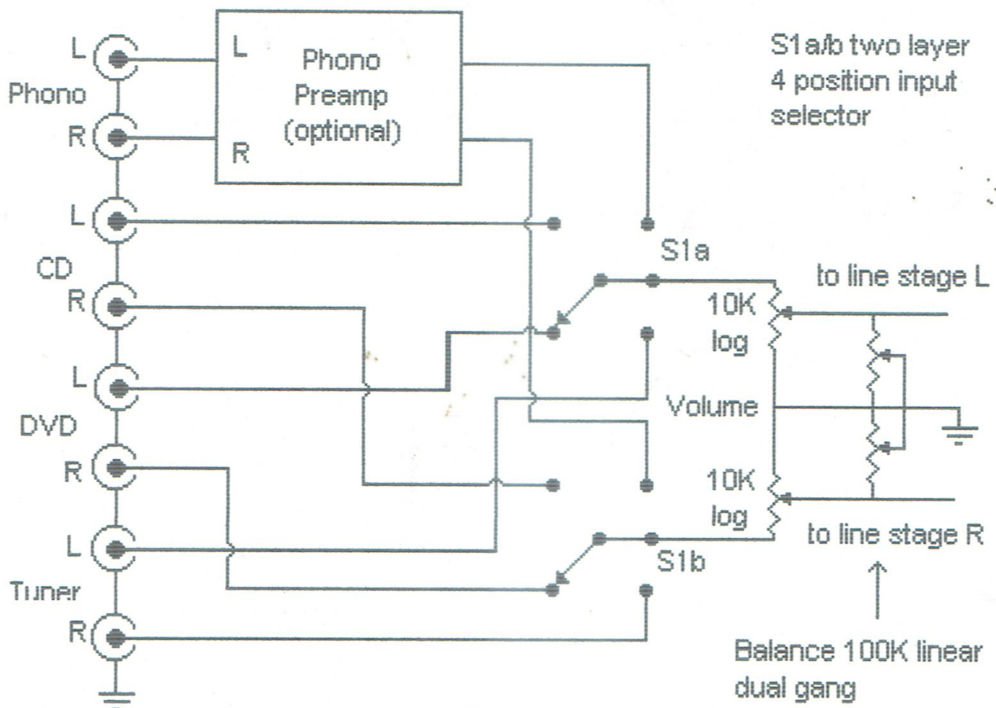
if the Alps is 50K rather than the preferred 10K.

Chassis Signal Wiring

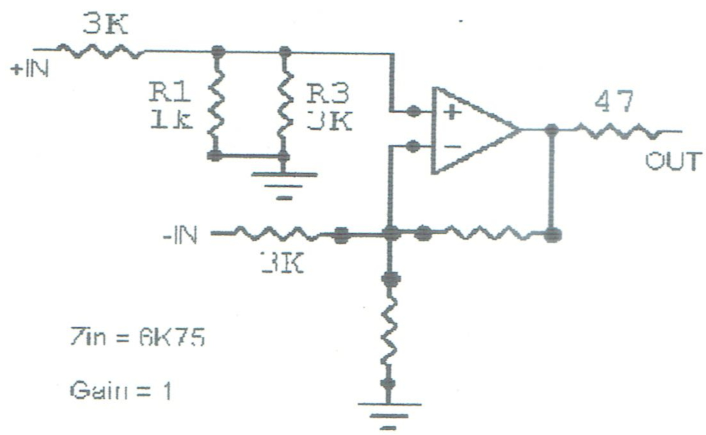
For a typical set of 1(stereo) phono and 3 stereo high level inputs, with volume and balance controls



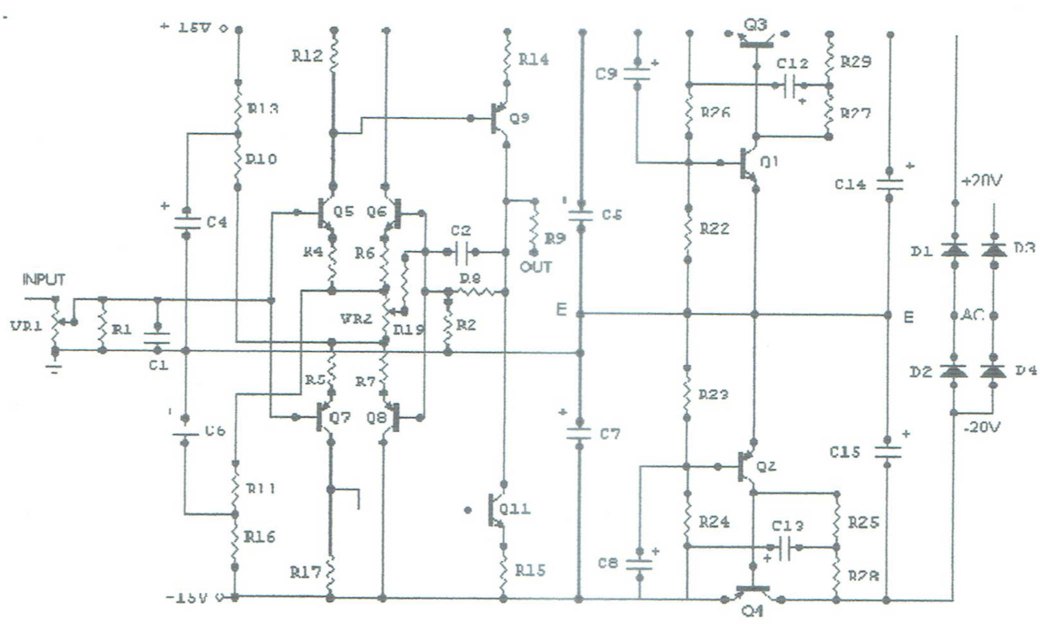
Chassis Layout

Below is one possible chassis layout. 15Vac wiring should be twisted and run against the chassis well away from signal wiring. Chassis should be mostly of steel or aluminium to shield and for grounding. RCA's should be insulated from the case.

pot and insert a 3K resistor between the wiper and input (top of pot) holes. R1 needs to become 1K and R3 is changed to 3K. A 3K resistor is soldered to the pads under as for the inverting stage above. The +IN and -IN holes can now be used for a 6K75 Zin balanced input unity gain buffer. DC offset should be set when connected to the intended source.



Schematic



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