

AMP-15-PS, -XP Assembly Instructions

Number of Views: 879

Related Sub-Forum: [AMP-15](#).

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Introduction



Thanks for selecting the AMP15-PS or -XP kit from 41Hz Audio. This document will help you build the kit. Rev. 1.04

This AI is in the process of adding instructions for the XP version.

Needed documents, available under the Downloads tab in your Shop account.

- The schematics
- BOM (Bill Of Materials)
- The Tripath chip datasheet for your kit

Building/Assembly instructions

IMPORTANT Components packaged in a shielded, aluminized bag should be considered ESD sensitive and should be handled with ESD care. The Tripath chips use MOSFET outputs which by nature are sensitive to ESD (Electro Static Discharge). Use ESD precautions. Preferably work on a conductive, grounded "ESD mat", and avoid touching the chip leads with your fingers. Discharge yourself before working with the components.

In general and as a rule of thumb, solder smaller components before larger.

Start at the center of the board and work outwards on similarly-sized components.

The next section will tell you to solder everything tight to the board - it should say mount everything tight apart from R41, R44, R23, R24 - these will get hot so should not be mounted near the board, lift them up a few mm.

First thing to do: read this AI the whole way through, at least TWICE.

Soldering Gotchas

- First mount the small capacitors
 - on the bottom that are directly opposite the main chip - these are harder to solder with the chip in place.
- Second, do NOT solder the big TA3020-chip in!

Mount the supplied socket, as-of Sep 1st, 2010.

- Put the chip in last, when all power supplies voltages are OK.

An unmounted chip can't be fried.

- Solder the output ready-made inductors (2 per side) *before* the output transistors/FET's. You might want to clip some pins on those inductors to PCB-thickness, the FET's will be right under them! *XP: inductors are handwound toroids using supplied Litz-wire, 1 per side.*
- Solder top-side R10 and R9 before R6+R8 and R5+R7.

Especially R10 vs R6 and R8 - the legs of R10 are directly between the quite closely spaced R6 and R8.

- Pay careful attention to the C1, C2, C3, C4 as well as the two 5-pin output transistors. *XP: four 3-pin output transistors*

All this comprises a tight three-dimensional structure. The capacitors have to be squeezed in past the transistor legs and fitting it all together can be hard. C4 is especially close to a transistor leg.

REALLY follow the links in sub-sections below. *THEN* start building.

- Do not mount the bulk capacitors until after testing.
- Remember the power bus wires, discussed below under Jumpers.

Build stages

You may want to build the amp in stages.

41Hz Forum dweller krilli's suggestion is that you FIRST build the main power input stage and the housekeeping voltages.

- Main power input

This stage connects input power to the board. The rectifier diodes convert AC to DC, and also serve to protect the amp from reverse polarity if you use a DC supply.

- 5Vdc Housekeeping voltage

The 5V stage is used internally by the Tripath chip.

- 8Vdc Preregulator

To create a stable 5V supply, power is taken from the positive rail and is preregulated to 8V above ground.

- 5Vdc stage

This stage takes the pre-regulated 8V supply and creates a clean 5V signal.

- Negative rail +10Vdc housekeeping voltage

Similar to the 5V stage, there is another housekeeping stage, feeding 10V above the negative rail to the Tripath chip.

- Negative rail +14Vdc preregulator

To create the 10V, a pre-regulated 14V rail is created above the negative rail, VNN+14V.

- Negative rail +10Vdc stage

This stage takes the preregulated VNN+14V supply and creates a clean signal 10V above the negative rail, VNN+10V.

- Power stage component lists

- Main power input.....D10 D11 C28 R13 C29 R20
- 8V Preregulator.....D8 R41 C33 R42 Q3 D4 C36
- 5V Regulator.....L5 C41 C37 IC3 R47 C38 R48
- VNN+14V Preregulator..D9 R44 C34 R45 D5 Q4 C35
- VNN+10V Regulator.....IC2 C10

Also pay attention to C43, C44. They are extra.

Read this forum thread: "<http://www.41hz.com/forums/showthread.php?2326-C43-C44>"

Mounting the Power-Parts

There are 6x TO-220 type parts on the AMP-15-PS, all on the bottom side of the PCB. *XP: 8x TO-220 parts*

The idea is that these are mounted parallel to the PCB, so the bottom plate of the amp will act as a heat sink.

- 2 FETs, 5-pin TO-220 *XP: 4 FETs, 3-pin TO-220*
- 2 Dual diodes for the rectifier
- 2 Transistors as pre-regulators for housekeeping voltages

All these should be placed with the

- Tab Parallel to the PCB
- Tab DOWN-wards
- At the same height over the PCB

There are two heights of stand-offs included:

- Long for the corner mounting screws
- Short for the plastic tab FETs, *XP: metal-tab FETs*
- Short for the transistors and diodes

For the transistors there are also bushings and isolator pads, which ensure there is no contact between the metal tabs and screws/heatsink/bottomplate.

The total height for each will be the same, within half a millimeter or so. The corner stand-offs are slightly longer than the TO-220 so you can cut the corner stand-offs by half a millimeter with a metal file or sand paper (paper flat on table).

So you will have three different standoffs-TO-220 combinations, all the same height:

- Long stand-offs for corner mountings for the PCB
- Two plastic tab TO-220 with short stand-offs *XP: none*
- Four metal tab TO-220 with bushings, isolator pads and short stand-offs, *XP: 8 metal tab....*

For some good detail pictures of build-details: [AMP-15-PS Build details](#)

Startup and testing

Even though some prefer other procedures to first power up their AMP15 the following works and may be helpful guidelines to those who are inexperienced.

- For the first power up it's very important to NOT have the large electrolytic caps C26 and C27 installed yet as their inrush current may create a false alarm to you thinking the amp draws too much current. Or even blow the test fuses/resistors you placed inline. For low listening levels these caps are not needed. Without them the amp will come alive just fine...
- Measure with your multimeter on resistance or continuity (beep) setting across the speaker output terminals to check the resistances so you know they measure alike and are not shorted. If you don't have a lab power supply then connect the transformer to the board using some 100 or 200 ohm 5W resistors in series with the AC lines (Depending on the PS voltages, 100ohm may be too high, Audiophool suggests 68ohm 2.5W for Truepath). Also measure across the (larger) electrolytic capacitor poles (especially C5,6,7,8 and C26,27) and AC input terminal (3 pins on 15-ps, 4-pins on -XP)

Jumpers

Then about connecting the jumpers: (also refer to AMP15_JUMPERS.pdf), AND check "CONNECTIONS".

- Measure 5V and if it is measuring fine connect it with a jumper to JP5 where the PCB is indicated with a stripe (or solder a wire in place there...)
- The ground jumper and BBM timing jumpers should be installed right from the start, before any testing has been done. Powering up the board without the BBM timing jumpers installed will set the timing too short by default and the fets will become HOT very quickly!! They may even be destroyed in a few seconds!!
- Also don't forget the power supply connection wires! There are some holes marked + and - which all need to be inter-connected. Otherwise the amp won't come on at all... These wires were a design consideration to enable the high current power supply voltage to be transported directly to the fets without space taking wide PCB traces.

Heat

- When you have a transformer above 2x35Vac it is wise to cool the pre-regulator transistors Q3 and Q4 with small separate TO220 heatsinks while testing). They DO carry voltage on the tabs so DON'T short them to any other parts! At least this is what I do for testing, the separate heatsinks at least are isolated so they can be bolted straight to the tabs without further insulation. Of course the insulation pads are necessary when the final installation on a larger heatsink or metal surface will take place.
- For very short "wake-up" testing at above 2x35Vac you may leave these transistors without heatsink for about 30 seconds, but do place your finger on them every few seconds to keep an eye on them!
- The dual diodes and two double-fets (*XP: 4 single fets*) shouldn't become hot at all, even when pounding loud music is created with the amp on they stay almost entirely cold. If they do get hot there's something wrong! Quickly power off and check all solders and components again. The larger resistors R23,24,41,44 do become quite hot; do-not place them too close to the board! Leave the wires at a nice length to keep the resistor bodies lifted from the board. This is to make sure they cool better and don't burn the board in time! (this may take years, but eventually they will stain the board....)

Going on

- When you fire the amp up, the LED should be ON and after closing the mute jumper it should go OFF and the current consumption goes up... The current should be about 150-200mA per rail in muted state and about 400-600mA unmuted and at idle... There's some margin for deviation from these values, it all depends much on whether there's a load connected and the kind of load. Also the rail-voltage has influence. Just make sure it isn't too far off as this would indicate something is shorted)
- Be sure not to have speakers connected yet. First adjust the trimmers R37 and R38 until the outputs measure as close to zero dc voltage as possible (DC-offset). First of all measure if there's no excessive DC voltage at the speaker outputs. If there's more than 0.3Vdc (300mV) it may already indicate a fault. Also the voltage must measure reasonably steady, if it varies this could also indicate a fault. If it is nicely adjustable and set to zero (0-25mV is OK, 0-10mV if possible) you can safely connect some speakers. It's not a bad idea to use some inexpensive speakers first to make sure the outputs are "silent". For these adjustments it isn't necessary to connect anything on the in- and outputs. Better still not to have anything on the inputs as this may cause the offset voltage to deviate. Some even short the inputs to ground to make sure. Some also place dummy load resistors on the outputs, but it should all work fine without this.

Finishing up

After all this has succeeded you may solder the big caps in place and remove the resistors between the AC lines.

You can place some 8A slow blow fuses in the DC power lines and a slow blow fuse in the mains line (the value here depends on the VA rating of the transformer, inform at the store or manufacturer)

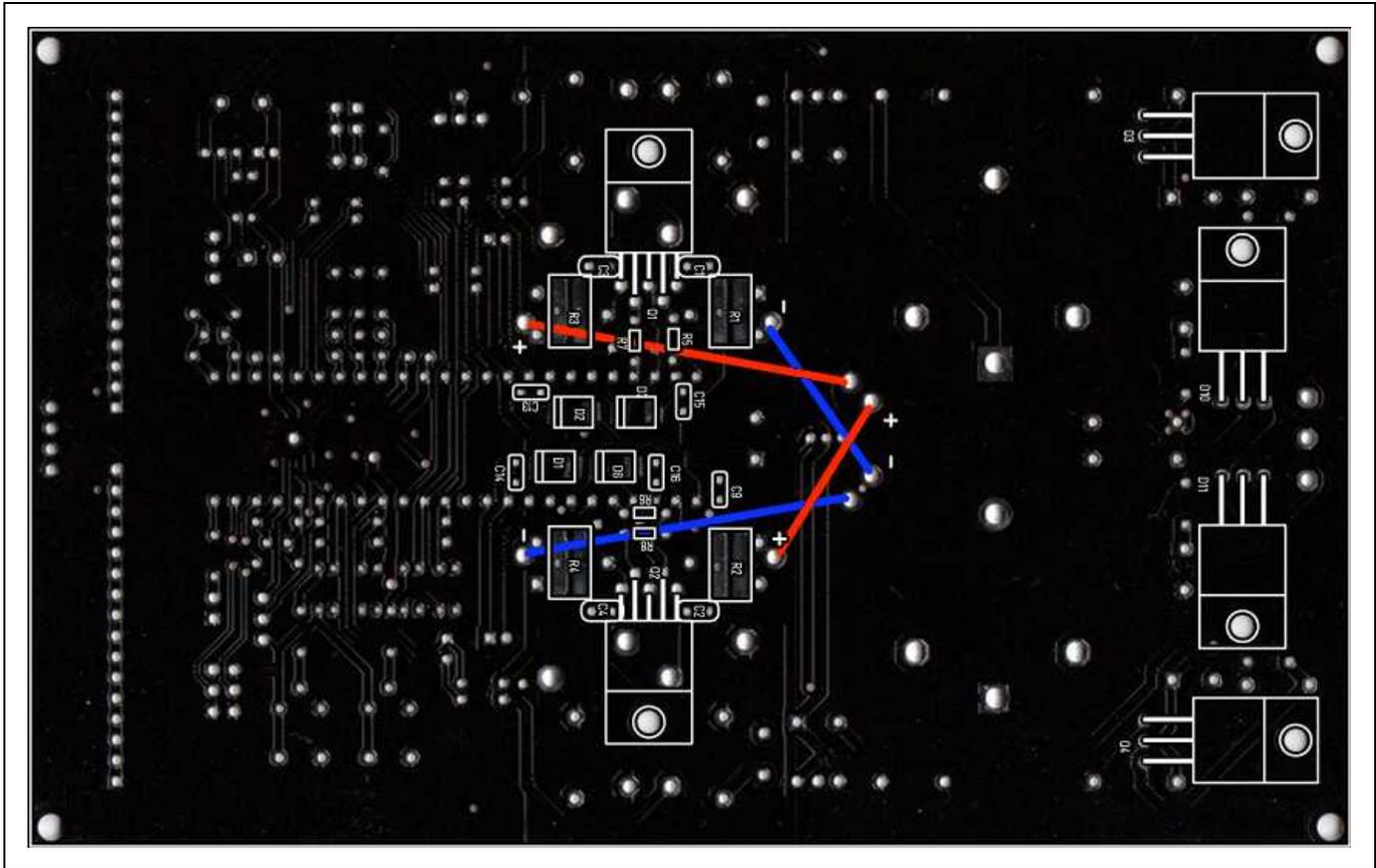
Now the time has come to connect a source and speakers up and enjoy some music!

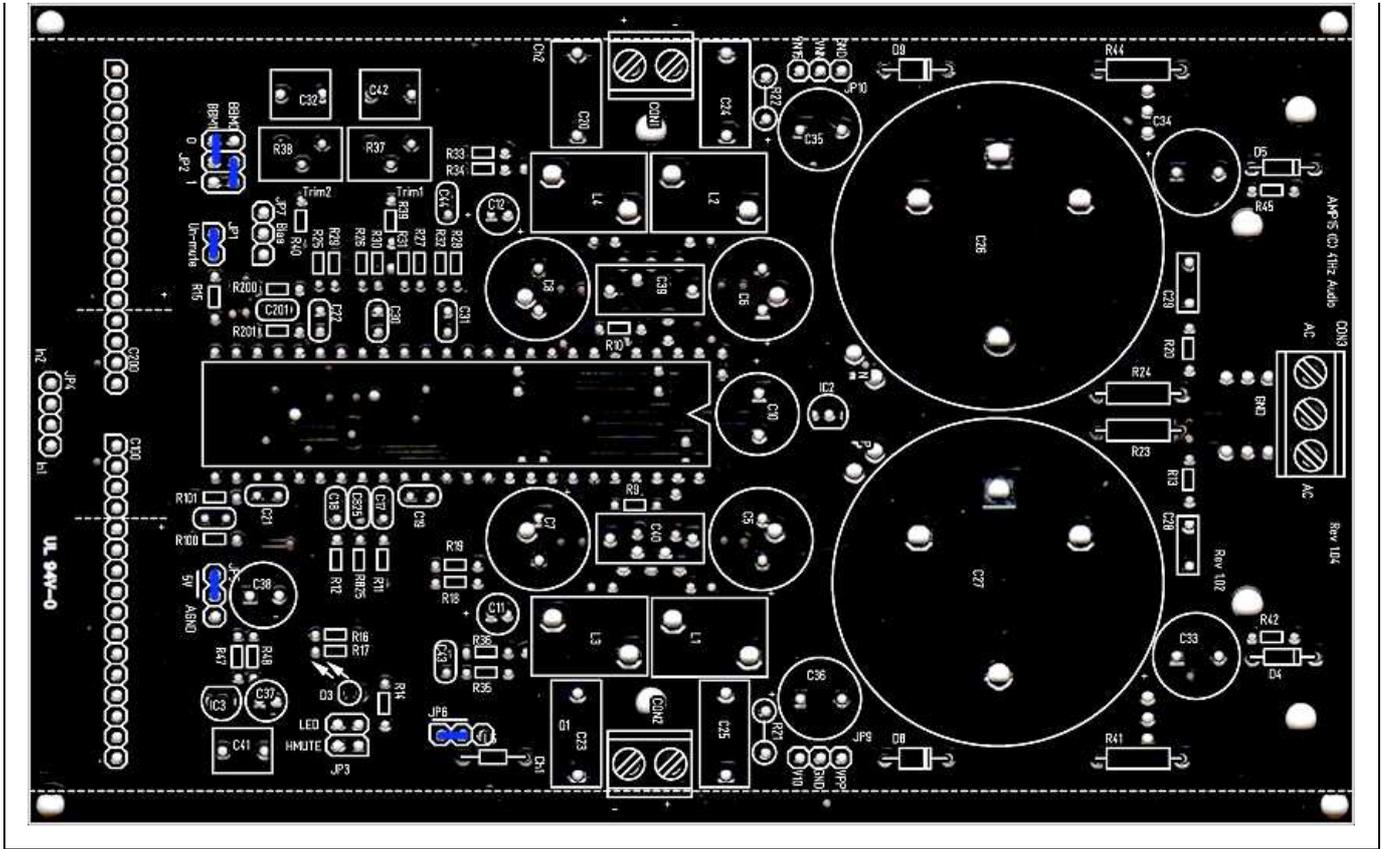
(This above section was written by V-Bro, from the forum)

Component placement

These images show how the position names overlaid on a scan of the board.

(XP: will be different because of 8x metal-tab TO-220 packages)





Connections

Pins are numbered from left to right, edge PCB is 'front' (big caps are in the 'back')

JP-1 Connector: Mute/unMute, CLOSED to un-mute

Pin 1	AGND
Pin 2	Mute input TA3020

JP-2 Connector: BBM settings. (is like on amp-15)

These settings are read on start-up, not while amp is operating.

Delay set for 0ns or 40ns is NOT recommended.

For subs (subwoofer use; 20-200Hz), one can use 120ns, but overall, 80ns is recommended.

80ns

1	3-	-	5
2-	-4		6

120ns

1-	-3	5
2-	-4	6

		120ns	80ns	40ns	0ns
Pin 1, 2 (left)	Agnd				
Pin 3 (top mid)	BBM0 input TA3020	3-1	3-5	3-1	3-5
Pin 4 (bottom mid)	BBM1 input TA3020	4-2	4-2	4-6	4-6
Pin 5, 6 (right)	V5				

Measure if pins 1+2 are Agnd, 5+6 are V5 and 3 is BBM0=pin 22 of TA3020

BBM1	BBM0	Delay:
0	0	120 ns
0	1	80 ns
1	0	40ns
1	1	0 ns

When you read this -now-, decide for 80ns or 120ns and set it NOW, preferably with a piece of wire. If you forget, the delay will probably 0ns, which can fry your MOS-Fets in seconds.

JP-3 Connector: HMUTE status output, two rows of pins, top= pin 1 . 3, bottom= pin 2 . 4

Pin 1	HMUTE output from TA3020
Pin 2	AGND
Pin 3	To connect ext. LED (don't use LED on PCB (D3) then) (on pin 3+4, anode on 3)
Pin 4	AGND

JP-4 Connector: Input signals

Pin 1	Ch.1 INput
Pin 2	AGND
Pin 3	AGND
Pin 4	Ch.2 INput

JP-5 Connector: V5 control, jumper on pin 1+2: V5 to amp, DO NOT put jumper on 2+3.

Pin 1	Provides V5
Pin 2	Output Volt.Reg.
Pin 3	AGND

JP-6 Connector: AGND to (P-)GND connect/V5 gnd ref. DO put a jumper on 1+2 OR 2+3.

Pin 1	AGND
Pin 2	From Adj. of V5 Volt.Reg. (this connects through L5 to GND=PGND)
Pin 3	AGND

JP-7 Connector: Biascap control, not jumpered, normally

Pin 1	AGND
Pin 2	BIASCAP input on TA3020
Pin 3	V5

JP-9 Connector: Voltage Testpins

Pin 1	VPP ("back" pin)
Pin 2	GND
Pin 3	V10

JP-10 Connector: Voltage Testpins

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Pin 1	GND (=PGND) ("back" pin)
Pin 2	VNN
Pin 3	V15

CON1 Connector: OUTput Ch.1

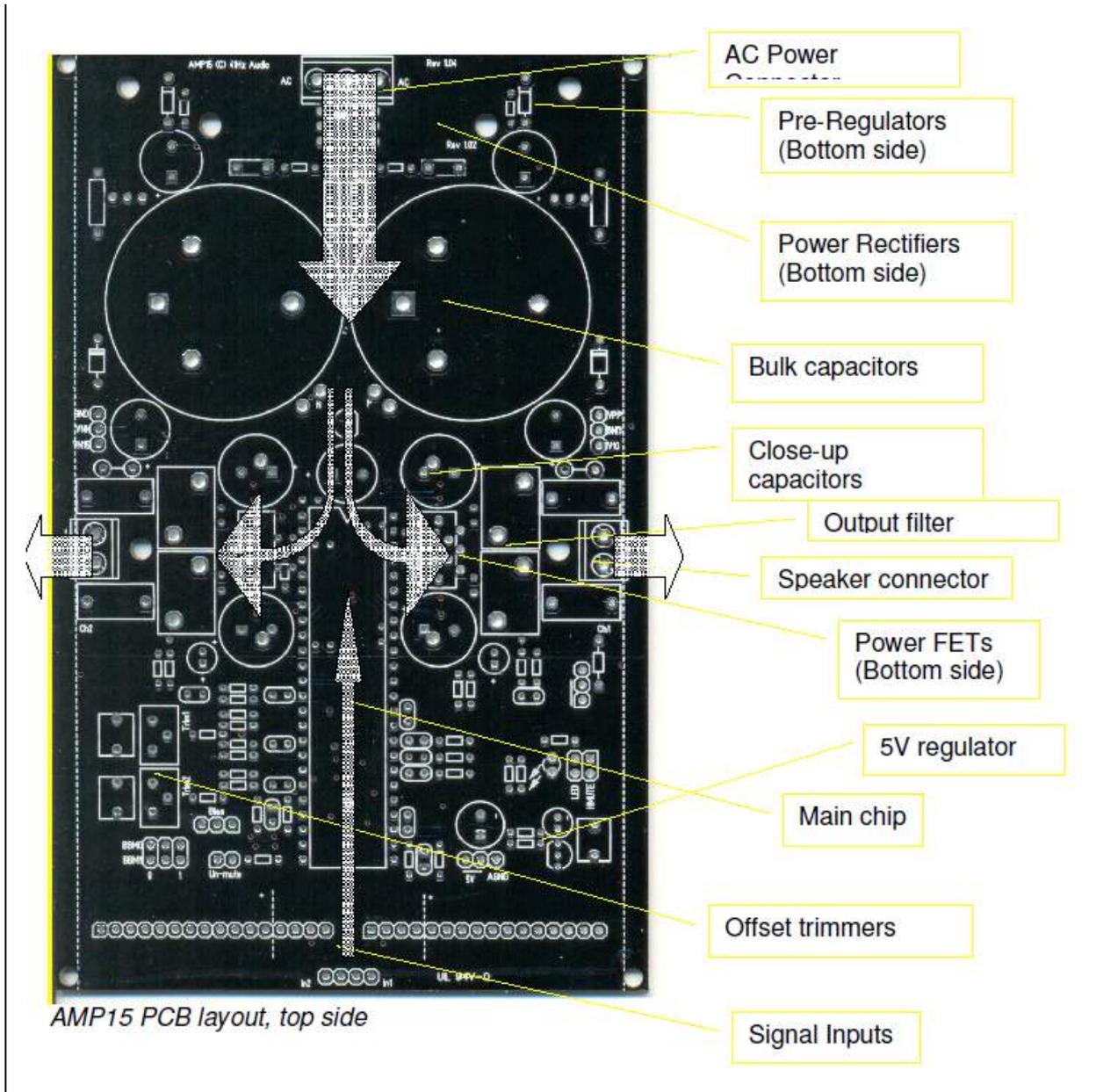
Pin 1	"Positive"
Pin 2	"Negative"

CON2 Connector: OUTput Ch.2

Pin 1	"Positive"
Pin 2	"Negative"

CON3 Connector: POWER IN

Pin 1	AC
Pin 2	(P-)GND
Pin 3	AC



Minimum requirements to build a working amplifier

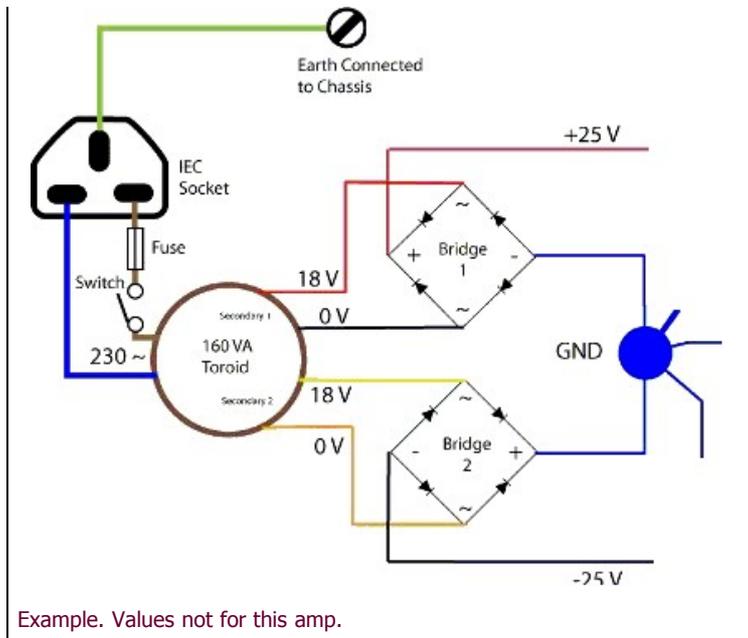
There are some essential parts needed to turn this kit into a working amplifier:

- This kit only needs a toroid transformer, no bulk-caps or rectifier, they are on the PCB already.
- Heat sink, connectors

Considerations before building

There are a few things you should consider before building, because they may influence your selection of component values:

Your power supply voltage (example PS, already on this amp, excl. transformer)



- The power supply voltage will influence the voltage sensing. The default components will work from +/-35Vdc upto +/-60Vdc.
- SO AMP15-PS *only* needs a toroid of around 2x24VAC upto 2x42Vac, 300-400VA min. (take a 500VA) *XP: 500-700 (take a 800VA)*
- REMEMBER: primary side is 110VAC or 220 VAC!! Be careful!
- SAFE DC voltage ca. 110V !!
- SAFE AC voltage ca. 42V !!
- This AMP needs AC and DC power beyond these limits: Be careful!

Your signal source

Your signal source signal level will influence the selection of the input sensitivity components. This is described elsewhere on this site.

Surface-mount bypass caps.

User V-Bro has had success with replacing the decoupling / bypass capacitors with surface-mount ones.

SMD size 0805 fits on the pads around the standard-use holes. Replace with same capacitance and voltage tolerance, size 0805, type X7R.

Should give lower noise as a surface-mount capacitor is closer to the ideal capacitor - there's no lead inductance.

Lowering BBM to 40 ns

This is an *experimental and unsupported* procedure. In theory, lowering BBM decreases distortion. mikechw]'s comment in the Amp15 picture thread:

"I tried 80ns and it is working fine, so:

I did some modification to the BBM and setting, running it at 40ns.

First I changed the gate resistor to 3.5ohm instead of 5.6ohm.

Then added a diode each parallel to the gate resistors, hopefully it should discharge a little faster.

Now it has been running for over an hour with one channel at near full volume. The mosfet is just warm."

JanF's comment

Be prepared that this may damage components.

The BBM are nano-seconds long and hard to measure and will be influenced by component temperature and component tolerances.

You should check the idle current on the rails before and after doing this modification. If possible also with heated up components. If the idle current goes up considerably, it is a sure sign of shootthrough, ie very short time short-circuits, which will destroy the FETs quite soon; can be sub-seconds.

I did not test with identical values to *mikechw's*, but with my tests (with reverse diodes and 2.8 ohms gate resistors), the idle current went up from 80mA to 200mA, and one FET fried in about two minutes. During that time, the THD+N at 1kHz went down from around 0.008% to around 0.005%.

Diodes may / may not help. Any used diodes should be schottky / ultrafast/switch type with <10 nS recovery time or they may do more damage than good.

Troubleshooting

Read article under Tech Info, Building Kits.

AMP revision history

Amp-15-PS:

- 1.25