AMP-6-Basic / -Sneaky Assembly Instructions

Related Sub-Forum: AMP-6.

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Introduction

Thanks for selecting the AMP6-BASIC kit from 41Hz Audio.
This document will help you build the kit. It has been updated for revision 1.1 boards only.
Amp6x is now at Rev. 1.2 , but is not completely covered here yet.

(If you think you cannot build it (this kit is very easy to build), then just get yourself an assembled+tested one in The Shop)

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

- The schematics
- BOM (Bill Of Materals) *for Basic or SNEAKY*
- The Tripath TA2020 chip datasheet for your kit (TA2020)

Considerations before building

- On the board there are two signal input capacitors, C14 and C15.
  These are required, as the amplifier is internally biased to about +2.5V. Two 3.3uF capacitors are provided with the kit. The board provides space for RM 2.54 (100 mil) and RM5 (200 mil) lead spacing capacitors.
  The input capacitors form a high-pass filter together with the input resistor Rin.
  The cutoff frequency is F=1/(2*π* Rin*Cin) For example, with Rin = 22kΩ (determined when you set the input-gain, below) and Cin = 3.3 uF, the cutoff frequency is F=1/(2*3.14*22*0.0033) ≈3 Hz.
  The cutoff frequency is best kept at least two octaves below the lowest frequency expected. Note that a big input capacitor may contribute to startup thumps. Smaller input capacitors can be used at the expense of low frequency damping.
  If there is a separate woofer in your system, you could use input capacitors of 1uF or even smaller (down to 100nF. ed.)
- The amplifier input stage, inside the Tripath chip
  Is of the operational amplifier type. The maximum possible voltage the input stage should handle is about +/-2V peak to peak (4Vpp=1.41

Vrms). You can set the gain of the input stage so that it matches your signal source.
The gain is calculated as for a normal inverting operational amplifier: Input Gain=-1*Rfeedback/Rin V/V. The minus sign is due to the fact that the input stage is inverting (ignore).
On the board, R2 + R4 are the Rin and R5 + R6 are the Rfeedback. With the kit, there are four 22kΩ resistors and two 56kΩ (and/or 82kΩ). With these resistor values, you can choose one of three different input sensitivities as shown in table 1 below.
If you use other input resistors, they should be of a low noise (metal film) type.

R-in, R2+R4	*R-feedback, R5+R6*	*Input-gain*	*Suitable signal source*
22 kΩ	82 kΩ	3.7	Even more sensitive input (Ipod)
22 kΩ	56 kΩ	2.5	For older type portable MP3/CD player with built in volume control.
22 kΩ	22 kΩ	1	General use
56 kΩ	22 kΩ	0.4	(Pro) preamplifier with fairly high output signal
82 kΩ	22 kΩ	0.27	Even less sensitive if needed

Table 1: *Input stage gain setting recommendations*

The total gain of the whole amplifier (volt-out/volt-in) is 12 times the input gain.
If Input gain is 1 (Ri+Rf), 'general' use, then with 0.7Vrms input, the output voltage will be ~9Vrms which results, with a 4Ωspeaker, in 20Wrms output.
With a 8Ω speaker, current will halve, so power will halve; 10Wrms.
0.7Vrms=2Vpp but input can take max. 4Vpp so gain can, if needed, be pushed up.

- Will you use a volume control/pot?
  If you have a preamplifier or sound source with its own volume control, it may be best to leave out the volume pot. If not, a volume pot of 50kΩ pot would be suitable.
  With a volume pot, there will be some signal damping so you may need to increase the gain a little. Some examples of gain settings are given in table 1.
  Note that some portable players will clip badly at full volume; that is the signal source output clips, even if the power amp does not clip. In that case increase the power amp input gain.
- Sleep/mute.
  The chip has a sleep and a mute function. Both can shut down the amplifier. You can reach both via the jumper J2. In sleep mode the chip draws less than 0.3 mA. If you use a power breaker or a power supply with an on/off switch, you may permanently close the J2 jumper (rev. 1.1: the two pins closest to the TA2020), but there may be turn on thumps. (only rev. 1.0: Therefore, using a switch for the mute function is recommended rather than using a power switch)
- The chip mute input is also hard wired to the chip error/over-temperature sensing output on the PCB.
  In case a too high temperature is reached this mutes the amp. It automatically un-mutes again when the chip has cooled down a bit. In case of over-current the amp is muted in a latched way and must then be power toggled off/on to be restarted.
- You can use the supplied terminals, screw terminals or solder hookup wire to the PCB.
  Soldering is generally the best connection from an electrical/signal point of view but may be unpractical. Note that you should avoid soldering on/off the cables, especially the power and speaker cables. As these cables are usually quite thick, they will require substantial heating.
  So repeatedly soldering these may cause the copper tracks to come off, lift, because the FRP below them is beginning to deteriorate. It is then better to unsolder/cut the "other" end of the cable or use a board connector.
- Power supply.
  For testing at moderate power any 12V supply rated 200 mA or more should work. For final use, at least 25W and for 4Ω speakers, at least 50W is recommended for high power use. The transformer/power supply would normally determine the fuse rating, if the power supply does not have built in protection.
  If the power supply has its own protection, the default 4A slow fuse is suitable. For a power supply without a fuse/protection, the fuse on the PCB should not be higher rated than recommended for the power supply.

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.

First, check the parts:

(pictures here are from PCB rev. 1.0, now PCB rev. 1.2 is sent out. SNEAKY contains fewer parts)

NOTE 1
There are two 100nF capacitors, C6, and C7, in bag 5, which should be mounted and soldered into the holes together with the TA2020 chip. These are **critical** to the function of the amplifier. The locations of these are printed on the bottom side of the PCB.
Solder these capacitors when you fit the TA2020 chip, which is the last step of mounting parts.

NOTE 2
Revision 1.1

- Has three things/components that are not visible on the photos.
  These are R3 and C21 and a jumper pair more on J2 (Mute+Sleep). They are described in the AI
- There is R1 thru R10, but **R8** does NOT exist.

Revision 1.2

- There is R1 thru R11, and new: D2.
- R8 and R11 are protection resistors to new connections for the 'overloadb' and 'fault' signals (read bottom line: Revision History)
- D2 (between C15 and L2) is for a better fault/mute circuit

NOTE 3
R5 + R6 are now delivered with extra values of 82kΩ (next to 22kΩ)

NOTE 4
The SNEAKY does NOT have connectors, fuse holder, screws/nuts/spacers, jumpers, LED plus it's R931.

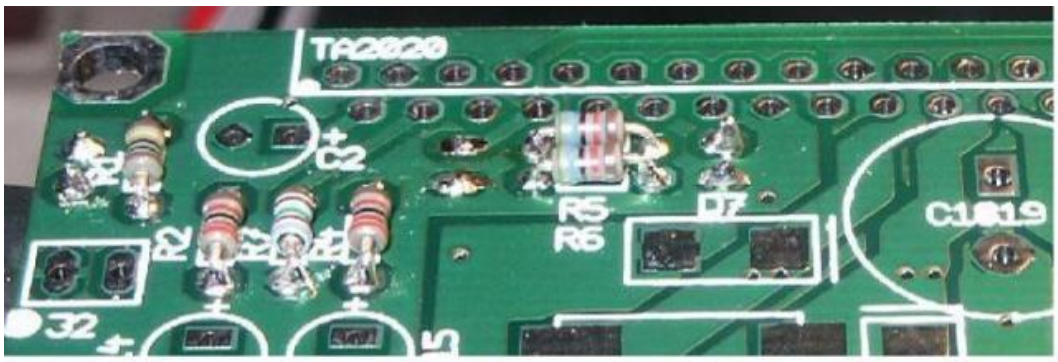
For rev. 1.2 PCB: R8, R11 and D2 can be soldered in at any time.

You might want to start (recommend by builders) to do steps 1+2 of 'BAG 5' first, then continue here.

BAG 1, So here we go with the first components.

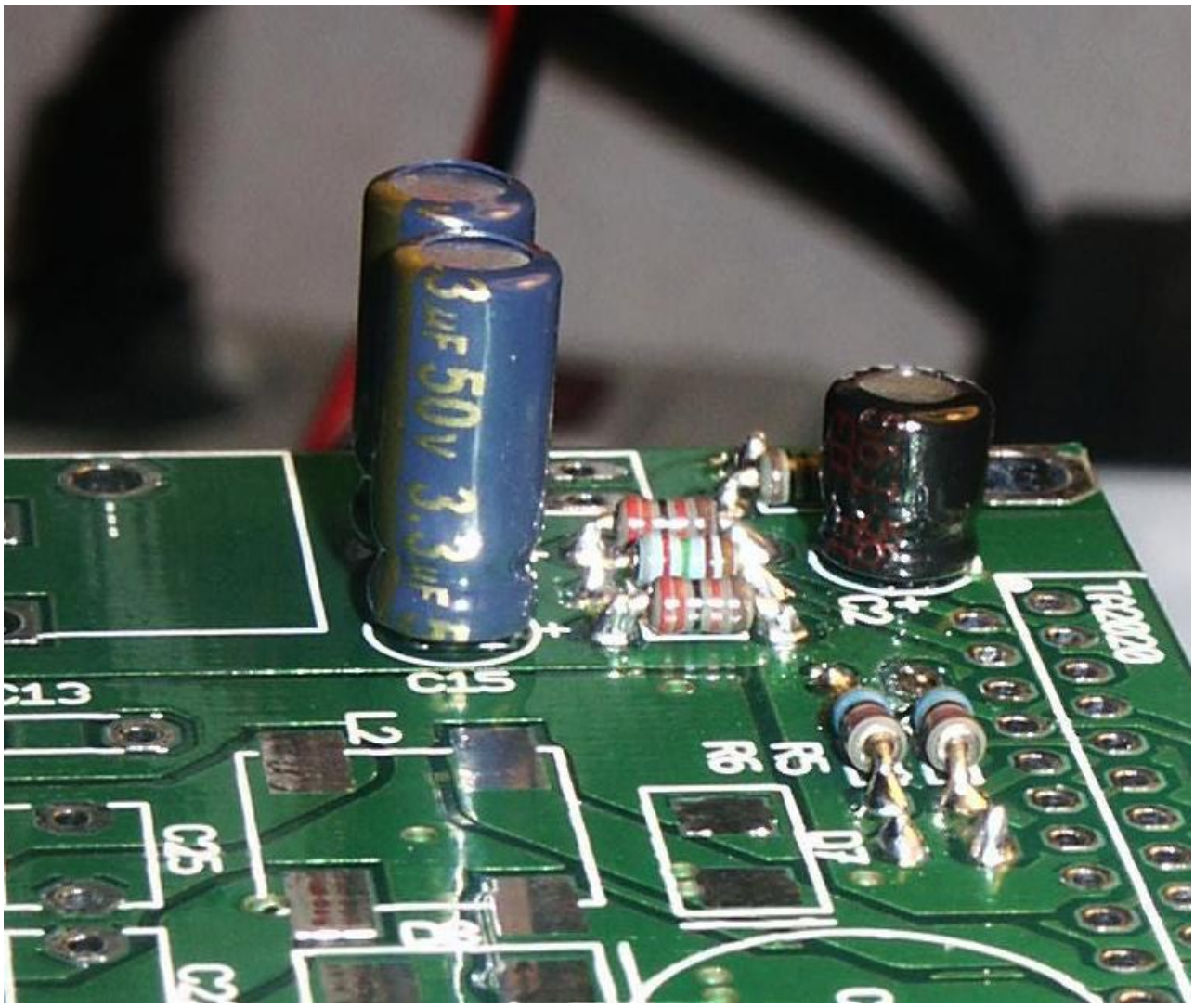
1. *(not with Sneaky)* First mount the four nylon spacers.
   One in each corner of the board, with the supplied screws. If you are working with a vice, you can leave the standoffs until later.

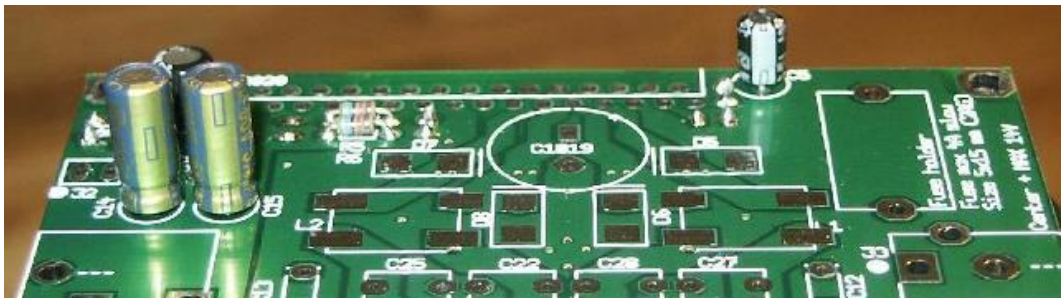
2. Solder C16, C17, C20, C21, C26, C50, small capacitors.
   On the bottom side of the board.
   A picture of how the components are placed is included under COMPONENT PLACEMENT (there it is rev. 1.1, pictures here are 1.0. ed.).
3. Solder R3, R7, 8.2kΩ in place
4. Solder R2, R4, the two input resistors 22kΩ in place



BAG 2, More components.

1. Solder R1, the Sleep pull-up resistor, 1MΩ in place
2. Solder R5, R6, the feedback resistors in place.
   These are (were) nominally 22kΩ or 56 kΩ but now 22kΩ or 82kΩ, but check!, see above Considerations on setting the input gain/sensitivity.
3. Solder C5, the charge pump capacitor well: critical.
   As with all electrolytic capacitors it is important to mount the leads the right way; the longer lead is positive, the shorter negative. Polarity is marked on the PCB with signs and with square pads for positive. C5 has the positive side towards the board edge. It may be safer to look in the component placement drawings.
4. Solder C14 and C15, they are the signal input capacitors.
   Also, these, and the other round cans, are electrolytic and have to be mounted in the right direction, like diodes, with the right polarity.
5. Solder C2,
   Cap for decoupling of the internal +5V circuit.





BAG 3, Containing all the output filter components.
These remove high frequency noise from the outputs and are all mounted near the speaker connections.

1. Solder R8, R10 resistors
2. Solder C12, C13
3. Solder C22, C25, C27, C28
4. Solder the (dual-) output-inductors L1 + L2.
   They are the ferrite cubes. Make sure they are aligned on the solder pads before soldering.

BAG 4, Contains connectors and close-up bulk capacitor.

1. *(not with Sneaky)* Mount F1, the fuse holder
   It is of USA AG2 size, 15x5 mm in Europe. This is a bit smaller than the more common size 5x20mm. Use a slow blow fuse, 4A. For testing a smaller fuse can be used.
2. *(not on Sneaky)*Solder J1, the speaker connector header

Aligned such that you can fit the cables!

3. *(not with Sneaky)* Solder J3, the power connector.
   It is of size 2.5 mm center pin and 5 or 5.5 mm sleeve. This size connector is common for more powerful external power supplies.
4. *(not with Sneaky)* Solder J5 for signal input.
   It is a stereo 3.5 mm jack type, of the same size as the headphone connectors for PCs, MP3-players, portable CDs, headphones etc.
5. *(not with Sneaky)* PCB-1.0: Solder the two pins header of J2. (long pins+plastic on top of PCB).
   PCB-1.1/1.2: Solder the four pins header of J2. (long pins+plastic on top of PCB)
6. Save C1819 for later (Bag 5, step 4).